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VOLUME 27

TONALITE *to* VESUVIUS

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J. B. M.	James Bass Mullinger, M.A. Lecturer in History, St John's College, Cambridge. Formerly University Lecturer in History and President of the Cambridge Antiquarian Society. Birkbeck Lecturer in Ecclesiastical History at Trinity College, Cambridge, 1890–1894. Author of *History of the University of Cambridge*; *The Schools of Charles the Great*; &c.	**Universities.**
✠J. C. H.	Right Rev. John Cuthbert Hedley, O.S.B., D.D. R.C. Bishop of Newport. Author of *The Holy Eucharist*; &c.	**Transubstantiation.**
J. F.-K.	James Fitzmaurice-Kelly, Litt.D., F.R.Hist.S. Gilmour Professor of Spanish Language and Literature, Liverpool University. Norman McColl Lecturer, Cambridge University. Fellow of the British Academy. Member of the Royal Spanish Academy. Knight Commander of the Order of Alphonso XII. Author of *A History of Spanish Literature*; &c.	**Translation;** **Valera y Alcalá Galiano, Juan;** **Vega Carpio** (*in part*).
J. F. W.	John Forbes White, M.A., LL.D. (d. 1904). Joint-author of the *Life and Art of G. P. Chalmers, R.S.A.*; &c.	**Velazquez** (*in part*).
J. G. H.	Joseph G. Horner, A.M.I.Mech.E. Author of *Plating and Boiler-Making*; *Practical Metal-Turning*; &c.	**Tool.**
J. G. M.	John Gray M'Kendrick, M.D., LL.D., F.R.S., F.R.S. (Edin.). Emeritus Professor of Physiology in the University of Glasgow. Professor of Physiology, 1876–1906. Author of *Life in Motion*; *Life of Helmholtz*; &c.	**Touch;** **Vascular System:** *History of Discovery.*
J. H. H.	John Henry Hessels, M.A. Author of *Gutenberg: an Historical Investigation.*	**Typography:** *History.*
J. H. M.	John Henry Middleton, M.A., Litt.D., F.S.A., D.C.L. (1846–1896). Slade Professor of Fine Art in the University of Cambridge, 1886–1895. Director of the Fitzwilliam Museum, Cambridge, 1889–1892. Art Director of the South Kensington Museum, 1892–1896. Author of *The Engraved Gems of Classical Times*; *Illuminated Manuscripts in Classical and Mediaeval Times.*	**Verona** (*in part*); **Verrocchio, Andrea del;** **Vesta** (*in part*).
J. H. R.	John Horace Round, M.A., LL.D. Balliol College, Oxford. Author of *Feudal England*; *Studies in Peerage and Family History*; *Peerage and Pedigree*,	**Vere** (*Family*).
J. J. T.	Sir Joseph John Thomson, F.Sc., LL.D., Ph.D., F.R.S. Cavendish Professor of Experimental Physics and Fellow of Trinity College, Cambridge. President of the British Association, 1909–1910. Author of *A Treatise on the Motion of Vortex Rings*; *Application of Dynamics to Physics and Chemistry*; *Recent Researches in Electricity and Magnetism*; &c.	**Vacuum Tube.**
J. L.*	Sir Joseph Larmor, M.A., D.Sc., LL.D., F.R.S. Fellow of St John's College, Cambridge, and Lucasian Professor of Mathematics in the University. Secretary of the Royal Society. Professor of Natural Philosophy, Queen's College, Galway, 1880–1885. Author of *Ether and Matter*, and various memoirs on Mathematics and Physics.	**Units, Dimensions of.**
J. L. E. D.	John Louis Emil Dreyer. Director of Armagh Observatory. Author of *Planetary Systems from Thales to Kepler*; &c.	**Transit Circle.**
J. L. W.	Jessie Laidlay Weston. Author of *Arthurian Romances unrepresented in Malory.*	**Tristan.**
J. O.	Josiah Oldfield, M.A., D.C.L., M.R.C.S., L.R.C.P. Barrister-at-law. Senior Physician of the Lady Margaret Fruitarian Hospital, Bromley. Author of *Myrrh and Amaranth*; *The Voice of Nature*; &c.	**Vegetarianism.**
J. O. B.	John Oliver Borley, M.A. Gonville and Caius College, Cambridge.	**Trawling, Seining and Netting.**
J. P.-B.	James George Joseph Penderel-Brodhurst. Editor of the *Guardian*, London.	**Vernis, Martin.**
J. P. Pe.	Rev. John Punnett Peters, Ph.D., D.D. Canon Residentiary, Protestant Episcopal Cathedral of St John the Divine in New York City. Formerly Professor of Hebrew, University of Pennsylvania. In charge of the Expedition of the University of Pennsylvania to Nippur, 1888–1895. Author of *Scriptures, Hebrew and Christian*; *Nippur, or Explorations and Adventures on the Euphrates*; &c.	**Ur.**

J. So.	John Southward. Author of *A Dictionary of Typography and its Accessory Arts*; *Practical Printing*; &c.	**Typography:** *Modern Practical Typography* (*in part*).
J. S. F.	John Smith Flett, D.Sc., F.G.S. Petrographer to the Geological Survey. Formerly Lecturer on Petrology in Edinburgh University. Neill Medallist of the Royal Society of Edinburgh. Bigsby Medallist of the Geological Society of London.	**Tonalite; Trachyte;** **Tuff; Variolites;** **Veins** (*Geology*).
J. S. N.	Joseph Shield Nicholson, M.A., Sc.D. Professor of Political Economy at Edinburgh University. Fellow of the British Academy. Author of *Principles of Political Economy*; *Money and Monetary Problems*; &c.	**Usury;** **Value.**
J. S. R.	James Smith Reid, M.A., LL.D., Litt.D. Professor of Ancient History and Fellow and Tutor of Gonville and Caius College, Cambridge. Hon. Fellow, formerly Fellow and Lecturer of Christ's College. Browne's and Chancellor's Medals. Editor of editions of Cicero's *Academia*; *De Amicitia*; &c.	**Trajan;** **Tribune;** **Varro, Marcus Terentius.**
J. T. Be.	John Thomas Bealby. Joint-author of Stanford's Europe. Formerly Editor of the *Scottish Geographical Magazine*. Translator of Sven Hedin's *Through Asia, Central Asia and Tibet*; &c.	**Transbaikalia** (*in part*); **Transcaspian Region** (*in part*); **Turgai** (*in part*); **Turkestan** (*in part*); **Ufa** (*Government*) (*in part*); **Ural Mountains** (*in part*).
J. W.	James Williams, M.A., D.C.L., LL.D. All Souls Reader in Roman Law in the University of Oxford, and Fellow of Lincoln College. Author of *Wills and Succession*; &c.	**Torture.**
J. W. He.	James Wycliffe Headlam, M.A. Staff Inspector of Secondary Schools under the Board of Education, London. Formerly Fellow of King's College, Cambridge. Professor of Greek and Ancient History at Queen's College, London. Author of *Bismarck and the Foundation of the German Empire*; &c.	**Treitschke, Heinrich von.**
J. W. J.	Jeremiah Whipple Jenks. See the biographical article: Jenks, Jeremiah Whipple.	**Trusts.**
K. S.	Kathleen Schlesinger. Editor of *The Portfolio of Musical Archaeology*. Author of *The Instruments of the Orchestra*.	**Trigonon; Tromba Marina;** **Trombone** (*in part*); **Trumpet** (*in part*); **Tuba; Valves.**
L. C.*	Louis Courtauld, M.A., M.R.C.S., L.R.C.P. Formerly Research Scholar, Middlesex Hospital Cancer Laboratories. Author of *Life-History of Pneumococcus*; &c.	**Tumour.**
L. Du.	Louis Duncan, Ph.D., M.Am.Inst.E.E. Late Associate Professor of Applied Electricity at the Johns Hopkins University, Baltimore, Md. Head of the Department of Electrical Engineering, Massachusetts Institute of Technology.	**Traction.**
L. E. H.	Leonard Erskine Hill, F.R.S., M.R.C.S., L.R.C.P. Lecturer on Physiology at the London Hospital. Formerly Demonstrator of Physiology in the University of Oxford; and Assistant Professor of Physiology, University College, London. Author of *Manual of Physiology*; &c.	**Vascular System:** *Physiology*.
L. J.*	Lionel James, F.R.G.S. *The Times* Special Correspondent in South Africa, 1899–1901. Reuter's Special Correspondent in the Chitral Campaign, 1894–1895. Author of *With the Chitral Relief Force*; *On the Heels of De Wet*; &c. &c.	**Transvaal:** *History* (*in part*).
L. J. S.	Leonard James Spencer, M.A. Assistant in the Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine*.	**Torbernite; Tremolite;** **Tridymite; Vanadinite;** **Vesuvianite.**
L. V.*	Luigi Villari. Italian Foreign Office (Emigration Department). Formerly Newspaper Correspondent in the east of Europe. Italian Vice-Consul in New Orleans, 1906; Philadelphia, 1907; and Boston, 1907–1910. Author of *Italian Life in Town and Country*; &c.	**Tuscany:** *History*; **Vespers, Sicilian.**
M. Br.	Margaret Bryant.	**Tourneur, Cyril:** *Introduction and Bibliography*.
M. G.	Moses Gaster, Ph.D. Chief Rabbi of the Sephardic Communities of England. Vice-President, Zionist Congress, 1898, 1899, 1900. Ilchester Lecturer at Oxford on Slavonic and Byzantine Literature, 1886 and 1891. Author of *A New Hebrew Fragment of Ben-Sira*; *The Hebrew Version of the Secretum Secretorum of Aristotle*.	**Vacarescu.**
M. N. T.	Marcus Niebuhr Tod, M.A. Fellow and Tutor of Oriel College, Oxford. University Lecturer in Epigraphy. Joint-author of *Catalogue of the Sparta Museum*.	**Vaphio.**
M. O. B. C.	Maximilian Otto Bismarck Caspari, M.A. Reader in Ancient History at London University. Lecturer in Greek at Birmingham University, 1905–1908.	**Trachis;** **Umbria** (*Ancient*).
N. D. M.	Newton Dennison Mereness, A.M., Ph.D. Author of *Maryland as a Proprietary Province*.	**United States:** *Fauna and Flora*.

O. Ba.	Oswald Barron, F.S.A. Editor of the *Ancestor*, 1902–1905. Hon. Genealogist to Standing Council of the Honourable Society of the Baronetage.	**Tournament;** **Tudor** (*Family*).
P. A. K.	Prince Peter Alexeivitch Kropotkin. See the biographical article: Kropotkin, Prince P. A.	**Transbaikalia** (*in part*); **Transcaspian Region** (*in part*); **Turgai** (*in part*); **Turkestan** (*in part*); **Ufa** (*Government*) (*in part*); **Ural Mountains** (*in part*).
P. C. M.	Peter Chalmers Mitchell, M.A., F.R.S., F.Z.S., D.Sc., LL.D. Secretary of the Zoological Society of London. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Author of *Outlines of Biology*; &c.	**Variation and Selection;** **Vertebrata.**
P. C. Y.	Philip Chesney Yorke, M.A. Magdalen College, Oxford. Editor of *Letters of Princess Elizabeth of England*.	**Vane, Sir H.**
P. Gi.	Peter Giles, M.A., LL.D., Litt.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology. Formerly Secretary of the Cambridge Philological Society.	**U.** **V.**
P. G. K.	Paul George Konody. Art Critic of the *Observer* and the *Daily Mail*. Formerly Editor of the *Artist*. Author of *The Art of Walter Crane*; *Velasquez: Life and Work*; &c.	**Van Dyck** (*in part*); **Velazquez** (*in part*).
P. La.	Philip Lake, M.A., F.G.S. Lecturer on Physical and Regional Geography in Cambridge University. Formerly of the Geological Survey of India. Author of *Monograph of British Cambrian Trilobites*. Translator and Editor of Kayser's *Comparative Geology*.	**Venezuela:** *Geology*.
R. A.*	Robert Anchel. Archivist of the Département de l'Eure.	**Vendée, Wars of the.**
R. A. S.	Richard Alexander Streatfeild. Assistant in the Department of Printed Books, British Museum. Musical Critic of the *Daily Graphic*. Author of *Masters of Italian Music*; *The Opera*; &c.	**Verdi, Guiseppe.**
R. C. J.	Sir Richard Claverhouse Jebb, LL.D., D.C.L., Litt.D. See the biographical article: Jebb, Sir Richard C.	**Troy and Troad** (*in part*).
R. D. S.	Rollin D. Salisbury, A.M., LL.D. Geologist in charge of Pleistocene Geology of New Jersey. Dean of Ogden (Grad.) School of Science and Head of the Department of Geography in the University of Chicago.	**United States:** *Geology* (*in part*).
R. I. P.	Reginald Innes Pocock, F.Z.S. Superintendent of the Zoological Gardens, London.	**Trilobites.**
R. J. M.	Ronald John McNeill, M.A. Christ Church, Oxford. Barrister-at-law. Formerly Editor of the *St James's Gazette* (London).	**Tone, Theobald Wolfe;** **Tyler, Wat;** **Ulster, Earls of.**
R. K. D.	Sir Robert Kennaway Douglas. Formerly Keeper of Oriental Printed Books and MSS. at the British Museum; and Professor of Chinese, King's College, London. Author of *The Language and Literature of China*; &c.	**Tsēng Kuo-fan.**
R. L.*	Richard Lydekker, M.A., F.R.S., F.G.S., F.Z.S. Member of the Staff of the Geological Survey of India, 1874–1882. Author of *Catalogues of Fossil Mammals, Reptiles and Birds in the British Museum*; *The Deer of All Lands*; *The Game Animals of Africa*; &c.	**Toxodontia;** **Tylopoda;** **Ungulata.**
R. N. B.	Robert Nisbet Bain (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613–1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*; &c.	**Torkenskjold, Peder;** **Torstensson, Count;** **Valdemar I., II. and IV. of Denmark;** **Verboczy, Istvan.**
R. P. S.	R. Phené Spiers, F.S.A., F.R.I.B.A. Formerly Master of the Architectural School, Royal Academy, London. Past President of Architectural Association. Associate and Fellow of King's College, London. Corresponding Member of the Institute of France. Editor of *Fergusson's History of Architecture*. Author of *Architecture: East and West*; &c.	**Tower;** **Tracery;** **Triumphal Arch;** **Vault.**
R. S. C.	Robert Seymour Conway, M.A., D.Litt. (Cantab.). Professor of Latin and Indo-European Philology in the University of Manchester. Formerly Professor of Latin in University College, Cardiff; and Fellow of Gonville and Caius College, Cambridge. Author of *The Italic Dialects*.	**Veneti;** **Vestini.**
R. Tr.	Roland Truslove, M.A. Fellow, Dean and Lecturer in Classics at Worcester College, Oxford.	**Troyes.**
S. A. C.	Stanley Arthur Cook, M.A. Editor for the Palestine Exploration Fund. Lecturer in Hebrew and Syriac, and formerly Fellow, Gonville and Caius College, Cambridge. Examiner in Hebrew and Aramaic, London University, 1904–1908. Author of *Glossary of Aramaic Inscriptions*; *The Laws of Moses and the Code of Hammurabi*; *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	**Tree-Worship;** **Uzziah.**

S. M. C.	Sydney Monckton Copeman, M.A., M.D., F.R.C.P., M.R.C.S., F.R.S. Medical Inspector to H.M. Local Government Board, London. Medical Lecturer on Public Health at Westminster Hospital. Lt.-Col. and Divisional Sanitary Officer, 1st London Division, Territorial Force. Milroy Lecturer, Royal College of Physicians, London, 1898. Author of *Vaccination, its Natural History and Pathology*; &c.	**Vaccination.**
S. M. E.-W.	Sir Sydney Marow Eardley-Wilmot. Rear-Admiral (retired). Commanded H.M.S. " Dolphin " in Red Sea, 1885–1886, and assisted in the defence of Suakin. Superintendent of Ordnance Stores, 1902–1909. Author of *Life of Vice-Admiral Lord Lyons*; *Our Navy for a Thousand Years*; &c.	**Torpedo.**
S. N.	Simon Newcomb, LL.D., D.Sc. See the biographical article: Newcomb, Simon.	**Uranus** (*Astronomy*); **Venus** (*Astronomy*).
T. As.	Thomas Ashby, M.A., D.Litt. Director of the British School of Archaeology at Rome. Formerly Scholar of Christ Church, Oxford. Craven Fellow, 1897. Conington Prizeman, 1906. Member of the Imperial German Archaeological Institute. Author of *The Classical Topography of the Roman Campagna.*	**Tortona; Trapani;** **Trasimene, Lake; Trebula;** **Turin; Turris Libisonis;** **Tuscany:** *Geography*; **Tusculum; Tyndaris;** **Udine; Umbria** (*Modern*); **Valeria, Via; Varia; Vasto;** **Veii; Veleia; Velia;** **Velletri; Venafrum; Venusia;** **Vercelli; Verona** (*in part*); **Vesuvius** (*in part*).
T. A. A.	Thomas Andrew Archer, M.A. Author of *The Crusade of Richard I.*; &c.	**Ursula, St** (*in part*).
T. A. I.	Thomas Allan Ingram, M.A., LL.D. Trinity College, Dublin.	**Unemployment; Vagrancy.**
T. C. C.	Thomas Chrowder Chamberlin, A.M., Ph.D., LL.D., Sc.D., F.G.S., F.A.A.S., &c. Professor and Head of Department of Geology and Director of the Walker Museum, University of Chicago. Investigator of Fundamental Problems of Geology at the Carnegie Institute. Consulting Geologist, United States and Wisconsin Geological Survey. Author of *Geology of Wisconsin*; *General Treatise on Geology* (with R. D. Salisbury); &c.	**United States:** *Geology* (*in part*).
T. E. H.	Thomas Erskine Holland, M.A., D.C.L., LL.D., K.C. Fellow of the British Academy. Fellow of All Souls College, Oxford. Professor of International Law and Diplomacy in the University of Oxford, 1874–1910. Bencher of Lincoln's Inn. Author of *Studies in International Law*; *The Elements of Jurisprudence*; *Alberici Gentilis de jure belli*; *The Laws of War on Land*; *Neutral Duties in a Maritime War*; &c.	**Treaties;** **Vacarius.**
T. F. C.	Theodore Freylinghuysen Collier, Ph.D. Assistant Professor of History, Williams College, Williamstown, Mass.	**Urban VII. and VIII.**
T. H.	Thomas Hodgkin, D.C.L., Litt.D. See the biographical article: Hodgkin, Thomas.	**Vandals** (*in part*).
T. S.	The Right Honourable Lord Shaw of Dunfermline. Lord of Appeal. M.P. for Hawick District, 1892–1909. Lord Advocate for Scotland, 1905–1909.	**Vergniaud, Pierre.**
T. Se.	Thomas Seccombe, M.A. Balliol College, Oxford. Lecturer in History, East London and Birkbeck Colleges, University of London. Stanhope Prizeman, Oxford, 1887. Assistant Editor of *Dictionary of National Biography*, 1891–1901. Author of *The Age of Johnson*; &c.	**Vanbrugh, Sir John.**
V. C.*	Sir Vincent Henry Penalver Caillard. Director of Vickers, Sons & Maxim, Ltd.; and the London, Chatham & Dover Railway. Formerly President of the Ottoman Public Debt Council, and Financial Representative of England, Holland and Belgium in Constantinople. Author of *Imperial Fiscal Reform.*	**Turkey:** *Geography and Statistics.*
V. M.	Victor Charles Mahillon. Principal of the Conservatoire Royal de Musique at Brussels. Chevalier of the Legion of Honour.	**Trombone** (*in part*); **Trumpet** (*in part*).
W. A. B. C.	Rev. William Augustus Brevoort Coolidge, M.A., F.R.G.S. Fellow of Magdalen College, Oxford. Professor of English History, St David's College, Lampeter, 1880–1881. Author of *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880–1889.	**Töpffer, Rodolphe; Trent;** **Tschudi; Unterwalden;** **Uri; Valais; Var; Vaud.**
W. A. He.	William Abbot Herdman, D.Sc., F.R.S. Professor of Natural History in the University of Liverpool. President of the Linnean Society, 1904. Author of *Report upon the Tunicata collected during the Voyage of the " Challenger "*; &c.	**Tunicata.**
W. A. P.	Walter Alison Phillips, M.A. Formerly Exhibitioner of Merton College and Senior Scholar of St John's College, Oxford. Author of *Modern Europe*; &c.	**Utrecht:** *Province* (*in part*); **Valet; Vavassor;** **Verona, Congress of;** **Vestments.**
W. Bo.	Wilhelm Bousset, D.Th. Professor of New Testament Exegesis in the University of Göttingen. Author of *Das Wesen der Religion*; *The Antichrist Legend*; &c.	**Valentinus and the Valentinians.**

W. E. G.	Sir William Edmund Garstin, G.C.M.G. Governing Director, Suez Canal Co. Formerly Inspector-General of Irrigation, Egypt, and Adviser to the Ministry of Public Works in Egypt.	**Tsana** (*in part*).
W. F. C.	William Feilden Craies, M.A. Barrister-at-Law, Inner Temple. Lecturer on Criminal Law, King's College, London. Editor of Archbold's *Criminal Pleading* (23rd edition).	**Trade Marks** (*in part*); **Treason; Trial; Venue.**
W. G.*	Walcot Gibson, D.Sc., F.G.S. Geologist on H.M. Geological Survey. Author of *The Gold-bearing Rocks of the S. Transvaal*; *Mineral Wealth of Africa*; *The Geology of Coal and Coal Mining*; &c.	**Transvaal:** *Geology.*
W. L. F.	Walter Lynwood Fleming, A.M., Ph.D. Professor of History in Louisiana State University. Editor of *Documentary History of Reconstruction*; &c.	**Union League of America, The.**
W. McD.	William McDougall, M.A. Wilde Reader in Mental Philosophy in the University of Oxford. Formerly Fellow of St John's College, Cambridge.	**Trance.**
W. MacD.*	William MacDonald, LL.D. Professor of American History in Brown University, Providence, R.I. Professor of History and Political Science at Bowdoin, 1893–1901. Author of *History and Government of Maine*; &c. Editor of *Select Documents illustrative of the History of the United States*; &c.	**Tyler, John;** **Van Buren, Martin.**
W. M. D.	William Morris Davis, D.Sc., Ph.D. Professor of Geology in Harvard University. Formerly Professor of Physical Geography. Author of *Physical Geography*; &c.	**United States:** *Physical Geography* **and** *Climate.*
W. P. C.	William Prideaux Courtney. See the biographical article: Courtney, L. H. Baron.	**Tooke, John Horne.**
W. R. M.	William Richard Morfill, M.A. (d. 1910). Formerly Professor of Russian and the other Slavonic Languages in the University of Oxford. Curator of the Taylorian Institution, Oxford. Author of *Russia*: *Slavonic Literature*; &c.	**Turgueniev, Ivan.**
W. R. S.	William Robertson Smith, LL.D. See the biographical article: Smith, William Robertson.	**Tyre** (*in part*).

PRINCIPAL UNSIGNED ARTICLES

Tonga.
Tongking.
Toronto.
Toul.
Toulouse.
Touraine.
Tours.
Townshend, Charles.
Townshend, Viscount.
Trade, Board of.
Trade Organization.
Trade Unions (*in part*).
Transylvania.
Transylvanian Mountains.
Trap.
Trenck, Franz.
Trendelenburg, Friedrich.
Trenton (N.J.).
Tresham, Francis.
Trespass.
Triazines.
Trieste.
Trinidad.
Tristan da Cunha.
Trollope, Anthony.
Tromp.
Tropine.
Troy (N.Y.).
Truffle.
Trust and Trustees.
Tschaïkovsky, Peter.
Tuareg.
Tuke (*Family*).
Tulip.
Tungsten.
Tunis.
Turgot, Anne Robert Jacques.
Turkey: *History.*
Turpentine.
Tweeddale, Marquesses of.
Tyndale, William.
Tyndall, John.
Tynemouth.
Typewriter.
Typhoid Fever.
Typhus Fever.
Tyrone.
Ulfeldt, Korfits.
Ulm.
Ulrich.
Umbelliferae.
United Kingdom of Great Britain and Ireland.
United Presbyterian Church.
United Provinces of Agra and Oudh.
United States Naval Academy.
Upsala.
Uranium.
Urbino.
Urea.
Urinary System.
Ursins, Princess des.
Urticaceae.
Uruguay.
Usher, James.
Uskoks.
Utah.
Utica (N.Y.).
Uxmal.
Valencia (*Province*).
Valencia (*City*).
Valens.
Valentinian I.-II.
Valerian.
Valla, Lorenzo.
Valladolid.
Valtellina.
Vanadium.
Vanderbilt, Cornelius.
Vane, Sir Henry.
Vanilla.
Vauban.
Vaughan, Henry.
Vauvenargues, Marquis de.
Venezuela: *History.*
Venus's Fly-trap.
Verdun.
Vermont.
Vernet (*Family*).
Verney (*Family*).
Vernon, Edward.
Versailles.
Vespasian.

THE
ENCYCLOPÆDIA BRITANNICA

VOLUME 27

TONALITE TO VESUVIUS

TONALITE, in petrology, a rock of the diorite class, first described from Monte Adamello near Tonale in the Eastern Alps. It may be described as a quartz-diorite containing biotite and hornblende in nearly equal proportions. The principal felspar is plagioclase, but orthoclase occurs also, usually in small amount. Those varieties which are rich in orthoclase, in addition to plagioclase, have been called quartz-monzonites or adamellites, but a better term is grano-diorite, which has been very generally adopted in America for rocks which are intermediate in character between the granites and the diorites. The hornblende of the diorites is green, sometimes with a tinge of brown; the biotite is always brown and strongly pleochroic. Often these two minerals are clustered together irregularly or in parallel growths. They have generally a fairly strong tendency to idiomorphism, but may sometimes enclose plagioclase felspar in ophitic manner. Both of them decompose to chlorite, epidote and carbonates. The plagioclase felspar, which may form more than one-half of the rock, is andesine or oligoclase; simple crystals are rare, the majority being complex growths with centres of felspar rich in lime, while in the external zones the proportion of soda felspar increases greatly. The inner portions have often well-defined, but very irregular, boundaries, and are sometimes sponge-like, with the cavities filled up with a later, more acid, deposit. This seems to indicate that growth has taken place in stages, alternating with periods when the crystallized felspar was eroded or partly dissolved. The orthoclase sometimes forms irregular plates enclosing individuals of plagioclase. Quartz occurs both in irregular simple grains and as micropegmatite. Occasionally pale green pyroxene is visible in the centre of crystals of dark green hornblende. The accessory minerals apatite, magnetite and zircon are always present, and very common also are orthite in coffee-coloured zonal prisms practically always encircled by yellow epidote, and reddish-brown crystals of sphene, simple or twinned.

In external appearance the tonalites are very like the granites but usually darker in colour. Tonalite-porphyrites often accompany them, having the same composition but with phenocrysts of felspar, quartz, hornblende and biotite in a fine-grained groundmass. Veins and threads of fine grey rock, mainly composed of quartz and felspar, often intersect tonalite-masses and have been called tonalite-aplites, seeing that they bear the same relations to aplites as the aplites do to the granites. They contain more soda-lime felspar than the normal aplites. Towards their margins the larger alpine masses of tonalite often assume banded or gneissic facies, due apparently to movement during intrusion.

In eastern Tirol another tonalite occurs at Rieserferner; there is also a well-known mass of this rock near Traversella. In the south of Scotland (Galloway district) tonalites accompany hornblende- and biotite-granites, hornblende- and augite-diorites. The newer granites of the Highlands of Scotland in many places pass into tonalites, especially near their margins, and similar rocks occur in Ireland in a few places. Grano-diorites have been described from California, and rocks of very similar character occur in the Andes, Patagonia and the lesser Antilles. Tonalites are also said to be frequent among the igneous rocks of Alaska. (J. S. F.)

TONAWANDA, a city of Erie county, New York, U.S.A., about 11 m. by rail N. of Buffalo on the Niagara River at the mouth of Tonawanda Creek (opposite North Tonawanda), and on the Erie Canal. Pop. (1900), 7421, of whom 1834 were foreign-born; (1910 census), 8290. Tonawanda is served by the New York Central & Hudson River and the Erie railways, and is connected with Buffalo, Niagara Falls and Lockport by electric lines. The industries depend chiefly on electric power generated by the Niagara Falls, 11 m. distant. There are rolling-mills, planing-mills, ship-yards, and blast-furnaces, and among the manufactures are wooden ware, flour and paper. The surrounding region was the scene of hostilities during the Seven Years' War, and the War of 1812. The first permanent white settlement was made about 1809, and Tonawanda was incorporated as a village in 1854 and was chartered as a city in 1903. The name of the city is an Indian word said to mean "swift water."

TONBRIDGE [Tunbridge], a market town in the Tonbridge or south-western parliamentary division of Kent, England, 29½ m. S.S.E. of London by the South Eastern & Chatham railway. Pop. of urban district (1901), 12,736. It is situated on rising ground above the river Medway, which is crossed by a stone bridge erected in 1775. The church of St Peter and St Paul, chiefly Decorated and Perpendicular, with some portions of earlier date, was completely restored in 1879. There are remains of an ancient castle, consisting chiefly of a finely preserved gateway, of the Early Decorated period, flanked by two round towers. The castle was formerly defended by three moats, one of them formed by the Medway. Tonbridge School was founded by Sir Andrew Judd, lord mayor of London in the time of Edward VI., and was rebuilt in 1865, remodelled in 1880, and extended subsequently. Ornamental articles of inlaid wood, called Tonbridge ware, chiefly sold at Tunbridge Wells, are largely manufactured. There are gunpowder mills on the banks of the Medway, and wool-stapling, brewing and tanning are carried on. There is some traffic on the Medway, which is navigable for barges.

Tonbridge owed its early importance to the castle built by Richard, earl of Clare, in the reign of Henry I. The castle was besieged by William Rufus, was taken by John in the wars with the barons, and again by Prince Edward, son of Henry III. After being in the possession of the earls of Clare and Hertford, and of the earls of Gloucester, it became the property of the Staffords, and on the attainder of the duke of Buckingham in the reign of Henry VIII. was taken by the Crown. It was dismantled during the Civil War. The lords of the castle had the right of attending the archbishops of Canterbury on state occasions as chief butlers.

TONDERN, a town of Germany, in the Prussian province of Schleswig-Holstein, on the Widane, 8 m. from the North Sea at Hoyer, opposite the island of Sylt, and 42 m. by rail N.W. from Flensburg. Pop. (1900), 4244. Tondern was in early days a seaport, but since the reclamation of the marshes and the dredging of the Widane navigation has ceased, and vessels load and unload at Hoyer, with which the place has direct railway communication. The trade consists chiefly in agricultural produce and cattle, and there is an important horse market.

In the village of Galhus, lying about 4 m. N., were discovered, in 1639 and 1734 respectively, two golden horns of the Scandinavian period; these were stolen in 1802 from the Museum of Northern Antiquities in Copenhagen, where they had been treasured, and have never been recovered.

See Karstens, *Die Stadt Tondern* (Tondern, 1861).

TONE, THEOBALD WOLFE (1763–1798), Irish rebel, the son of Peter Tone, a Dublin coachmaker, was born in Dublin on the 20th of June 1763. His grandfather was a small farmer in county Kildare, and his mother was the daughter of a captain in the merchant service. Though entered as a student at Trinity College, Dublin, Tone gave little attention to study, his inclination being for a military career; but after eloping with Matilda Witherington, a girl of sixteen, he took his degree in 1786, and read law in London at the Middle Temple and afterwards in Dublin, being called to the Irish bar in 1789. Though idle, Tone had considerable ability. Chagrined at finding no notice taken of a wild scheme for founding a military colony in the South Seas which he had submitted to Pitt, he turned to Irish politics. An able pamphlet attacking the administration of the marquess of Buckingham in 1790 brought him to the notice of the Whig club; and in September 1791 he wrote a remarkable essay over the signature "A Northern Whig," of which 10,000 copies are said to have been sold. The principles of the French Revolution were at this time being eagerly embraced in Ireland, especially among the Presbyterians of Ulster, and two months before the appearance of Tone's essay a great meeting had been held in Belfast, where republican toasts had been drunk with enthusiasm, and a resolution in favour of the abolition of religious disqualifications had given the first sign of political sympathy between the Roman Catholics and the Protestant dissenters of the north. The essay of "A Northern Whig" emphasized the growing breach between the Whig patriots like Flood and Grattan, who aimed at Catholic emancipation and parliamentary reform without disloyalty to the connexion with England, and the men who desired to establish a separate Irish republic. Tone expressed in his pamphlet unqualified contempt for the constitution which Grattan had so triumphantly extorted from the English government in 1782; and, himself a Protestant, he urged co-operation between the different religious sects in Ireland as the only means of obtaining complete redress of Irish grievances.

In October 1791 Tone converted these ideas into practical policy by founding, in conjunction with Thomas Russell (1767–1803), Napper Tandy (*q.v.*) and others, the society of the "United Irishmen." The original purpose of this society was no more than the formation of a political union between Roman Catholics and Protestants, with a view to obtaining a liberal measure of parliamentary reform; it was only when that object appeared to be unattainable by constitutional methods that the majority of the members adopted the more uncompromising opinions which Wolfe Tone held from the first, and conspired to establish an Irish republic by armed rebellion. Tone himself admitted that with him hatred of England had always been "rather an instinct than a principle," though until his views should become more generally accepted in Ireland he was prepared to work for reform as distinguished from revolution. But he desired to root out the popular respect for the names of Charlemont and Grattan, and to transfer to more violent leaders the conduct of the national movement. Grattan was a reformer and a patriot without a tincture of democratic ideas; Wolfe Tone was a revolutionary whose principles were drawn from the French Convention. Grattan's political philosophy was allied to that of Edmund Burke; Tone was a disciple of Danton and Thomas Paine.

Democratic principles were gaining ground among the Roman Catholics as well as the Presbyterians. A quarrel between the moderate and the more advanced sections of the Roman Catholic Committee led, in December 1791, to the secession of sixty-eight of the former, led by Lord Kenmare; and the direction of the committee then passed to more violent leaders, of whom the most prominent was John Keogh, a Dublin tradesman. The active participation of the Roman Catholics in the movement of the United Irishmen was strengthened by the appointment of Tone as paid secretary of the Roman Catholic Committee in the spring of 1792. When the legality of the Roman Catholic Convention in 1792 was called in question by the government, Tone drew up for the committee a statement of the case on which a favourable opinion of counsel was obtained; and a sum of £1500 with a gold medal was voted to Tone by the Convention when it dissolved itself in April 1793. Burke and Grattan were anxious that provision should be made for the education of Irish Roman Catholic priests at home, to preserve them from the contagion of Jacobinism in France; Wolfe Tone, "with an incomparably juster forecast," as Lecky observes, "advocated the same measure for exactly opposite reasons." He rejoiced that the breaking up of the French schools by the revolution had rendered necessary the foundation of Maynooth College, which he foresaw would draw the sympathies of the clergy into more democratic channels. In 1794 the United Irishmen, persuaded that their scheme of universal suffrage and equal electoral districts was not likely to be accepted by any party in the Irish parliament, began to found their hopes on a French invasion. An English clergyman named William Jackson, a man of infamous notoriety who had long lived in France, where he had imbibed revolutionary opinions, came to Ireland to negotiate between the French committee of public safety and the United Irishmen. For this emissary Tone drew up a memorandum on the state of Ireland, which he described as ripe for revolution; the paper was betrayed to the government by an attorney named Cockayne to whom Jackson had imprudently disclosed his mission; and in April 1794 Jackson was arrested on a charge of treason. Several of the leading United Irishmen, including Reynolds and Hamilton Rowan, immediately fled the country; the papers of the United Irishmen were seized; and for a time the organization was broken up. Tone, who had not attended meetings of the society since May 1793, remained in Ireland till after the trial and suicide of Jackson in April 1795. Having friends among the government party, including members of the Beresford family, he was enabled to make terms with the government, and in return for information as to what had passed between Jackson, Rowan and himself he was permitted to emigrate to America, where he arrived in May 1795. Taking up his residence at Philadelphia, he wrote a few months later to Thomas Russell expressing unqualified dislike of the American people, whom he was disappointed to find no more truly democratic in sentiment and no less attached to order and authority than the English; he described George Washington as a "high-flying aristocrat," and he found the aristocracy of money in America still less to his liking than the European aristocracy of birth.

Tone did not feel himself bound in honour by his compact with the government at home to abstain from further conspiracy; and finding himself at Philadelphia in the congenial company of Reynolds, Rowan and Napper Tandy, he undertook a mission to Paris to persuade the French government to send an expedition to invade Ireland. In February 1796 he arrived in Paris and had interviews with De La Croix and L. N. M. Carnot, who were greatly impressed by his energy, sincerity and ability. A commission was given him as adjutant-general in the French army, which he hoped might protect him from the penalty of treason in the event of capture by the English; though he himself claimed the authorship of a proclamation said to have been issued by the United Irishmen, enjoining that all Irishmen taken with arms in their hands in the British service should be instantly shot; and he supported a project for landing a thousand criminals in England, who were to be commissioned to burn Bristol and commit any other atrocity in their power. He drew up two memorials representing that the landing of a considerable French force in Ireland would be followed by a general rising of the people, and giving a detailed account of the condition of the country. The French directory, which possessed information from Lord Edward Fitzgerald (*q.v.*) and Arthur O'Connor confirming Tone, prepared to despatch an expedition under Hoche. On the 15th of December 1796 the expedition, consisting of forty-three sail and carrying about 15,000 men with a large supply of war material for distribution in Ireland, sailed from Brest. Tone, who accompanied it as "Adjutant-general Smith," had the greatest contempt for the seamanship of the French sailors, which was amply justified by the disastrous result of the invasion. Returning to France without having effected anything, Tone served for some months in the French army under Hoche; and in June 1797 he took part in preparations for a Dutch expedition to Ireland, which was to be supported by the French. But the Dutch fleet was detained in the Texel for many weeks by unfavourable weather, and before it eventually put to sea in October, only to be crushed by Duncan in the battle of Camperdown, Tone had returned to Paris; and Hoche, the chief hope of the United Irishmen, was dead. Bonaparte, with whom Tone had several interviews about this time, was much less disposed than Hoche had been to undertake in earnest an Irish expedition; and when the rebellion broke out in Ireland in 1798 he had started for Egypt. When, therefore, Tone urged the directory to send effective assistance to the Irish rebels, all that could be promised was a number of small raids to descend simultaneously on different points of the Irish coast. One of these under Humbert succeeded in landing a force in Killala Bay, and gained some success in Connaught before it was subdued by Lake and Cornwallis, Wolfe Tone's brother Matthew being captured, tried by court-martial, and hanged; a second, accompanied by Napper Tandy (*q.v.*), came to disaster on the coast of Donegal; while Wolfe Tone took part in a third, under Admiral Bompard, with General Hardy in command of a force of about 3000 men, which encountered an English squadron near Lough Swilly on the 12th of October 1798. Tone, who was on board the "Hoche," refused Bompard's offer of escape in a frigate before the action, and was taken prisoner when the "Hoche" was forced to surrender. When the prisoners were landed a fortnight later Sir George Hill recognized Tone in the French adjutant-general's uniform. At his trial by court-martial in Dublin, Tone made a manly straightforward speech, avowing his determined hostility to England and his design "by fair and open war to procure the separation of the two countries," and pleading in virtue of his status as a French officer to die by the musket instead of the rope. He was, however, sentenced to be hanged on the 12th of November; but on the 11th he cut his throat with a penknife, and on the 19th of November 1798 he died of the wound.

Although Wolfe Tone had none of the attributes of greatness, "he rises," says Lecky, "far above the dreary level of commonplace which Irish conspiracy in general presents. The tawdry and exaggerated rhetoric; the petty vanity and jealousies; the weak sentimentalism; the utter incapacity for proportioning means to ends, and for grasping the stern realities of things, which so commonly disfigure the lives and conduct even of the more honest members of his class, were wholly alien to his nature. His judgment of men and things was keen, lucid and masculine, and he was alike prompt in decision and brave in action." In his later years he overcame the drunkenness that was habitual to him in youth; he developed seriousness of character and unselfish devotion to what he believed was the cause of patriotism; and he won the respect of men of high character and capacity in France and Holland. His journals, which were written for his family and intimate friends, give a singularly interesting and vivid picture of life in Paris in the time of the directory. They were published after his death by his son, William Theobald Wolfe Tone (1791–1828), who was educated by the French government and served with some distinction in the armies of Napoleon, emigrating after Waterloo to America, where he died, in New York City, on the 10th of October 1828.

See *Life of Theobald Wolfe Tone by himself, continued by his son, with his political writings*, edited by W. T. Wolfe Tone (2 vols., Washington, 1826), another edition of which is entitled *Autobiography of Theobald Wolfe Tone*, edited with introduction by R. Barry O'Brien (2 vols., London, 1893); R. R. Madden, *Lives of the United Irishmen* (7 vols., London, 1842); Alfred Webb, *Compendium of Irish Biography* (Dublin, 1878); W. E. H. Lecky, *History of Ireland in the Eighteenth Century*, vols. iii., iv., v. (cabinet ed., 5 vols., London, 1892). (R. J. M.)

TONGA, or Friendly Islands (so called by Captain Cook), an archipelago in the South Pacific Ocean, about 350 m. S.S.W. of Samoa and 250 m. E.S.E. of Fiji. The long chain of islands, numbering about 150, though with a collective land area of only 385 sq. m., extends from 18° 5′ to 22° 29′ S. and 174° to 176° 10′ W., and is broken into three groups, viz. the Tonga to the south, Hapai (which again is divided into three clusters) in the centre and Vavau to the north. The largest island is Tongatabu (the Sacred Tonga, Tasman's Amsterdam) in the southern group, measuring about 25 by 10 m., and 165 sq. m. in area, which contains the capital, Nukualofa. The vegetation is rich and beautiful, but the scenery tame, the land seldom rising above 60 ft.; Eua (Tasman's Middelburg), 9 m. south-east and 67 sq. m. in area, is 1078 ft. in extreme height, and much more picturesque, being diversified by rocks and woods. Vavau, in the northern group, is 55 sq. m. in extent and 300 ft. high. Next to these come the coral islands Nomuka and Lifuka in the Hapai group; Tofua, 2846 ft., Late or Lette, 1800 ft. and Kao, 3020 ft. high, which are volcanic and smaller. The numerous islets of the central group are very fertile. It is along the western side of the northern half of the chain that the line of volcanic action is apparent; the islands here (of which some are active volcanoes) are lofty. To the east the whole chain is bounded by a profound trough in the ocean bed, which extends south-westward, east of the Kermadec Islands, towards New Zealand. The majority of the Tonga Islands, however, are level, averaging 40 ft. high, with hills rising to 600 ft.; their sides are generally steep. The surface is covered with a rich mould unusual in coral islands, mixed towards the sea with sand, and having a substratum of red or blue clay. The soil is thus very productive, although water is scarce and bad. Barrier reefs are rare; fringing reefs are numerous, except on the east side, which is nearly free, and there are many small isolated reefs and volcanic banks among the islands. If the reefs impede navigation they form some good harbours. The best is on the south-western side of Vavau; another is on the north of Tongatabu. Earthquakes are not infrequent. From 1845 to 1857 volcanic eruptions were very violent, and islands once fertile were devastated and nearly destroyed. A new island rose from the sea, and was at once named "Wesley," but disappeared again. In 1886 there was a serious volcanic eruption in the outlying island of Niuafoou, and at the same time Falcon Reef, normally awash at high water, discharged sufficient scoriae and pumice to form a new island 50 ft. high. In 1898 the island had been washed away, but in 1900 H.M.S. "Porpoise" found that a solid core of black rock had been extruded 6 ft. above high water. All the volcanoes in the group were then quiescent.

Geology.—The line of volcanic action extends along the western side of the northern half of the chain. Some of the islands are built of volcanic rocks alone; such are Hongu-tonga and Hongu-hapai, which appear to be fragments of a single ancient crater, Tofua, Kao, Late, Metis, Amargua and Falcon Island. The lava is a basic augite-andesite. Another group of islands consists of elevated masses of submarine volcanic deposits, upon some of which coral-reef limestone forms a more or less complete covering; such are Tonumeia and the Nomuka group (Mango, Tonua, Nomuka-iki). All the volcanic rocks of these islands are submarine stratified tuffs which are penetrated here and there by andesite or diabase dikes. The Vavau group consists entirely of coral limestone, which is occasionally crystalline, and contains stalactitic caves of great beauty.

Climate, Flora, Fauna.—The climate is healthy for Europeans, being dry and cool as compared with that of Samoa and Fiji. There are frequent alternations of temperature, which averages 75° to 77° F., though considerably higher in the wet season. Cool south-east trade winds blow, sometimes with great violence, from April to December. During the rest of the year the winds blow from west-north-west and north, with rain and occasional destructive hurricanes. A cyclone which devastated Vavau in April 1900 was the most destructive ever recorded in the group, but hurricanes are rare. The average rainfall for the year is about 80 ins. The vegetation is similar to that of Fiji, but more definitely Indo-Malayan in character; it embraces all the plants of the groups to the east with many that are absent there. Ferns abound, some of them peculiar, and tree ferns on the higher islands, and all the usual fruit trees and cultivated plants of the Pacific are found. There are several kinds of valuable timber trees. The only indigenous land mammalia are a small rat and a few curious species of bats. The dog and the pig were no doubt introduced by man. Of birds some 30 kinds are known, an owl being the only bird of prey; parrots, pigeons, kingfishers, honey-suckers, rails, ducks, and other water birds are numerous. There are snakes and small lizards, but no frogs or toads. Of insects there are relatively few kinds; but ants, beetles and mosquitoes abound. The fishes, of an Indo-Malay type, are varied and numerous. Turtle and sea-snakes abound, as do mollusca, of which a few are peculiar, and zoophytes.

Inhabitants.—The population of the archipelago is about 19,000, of whom about 370 are whites or half-castes. The natives, a branch of the Polynesian race, are the most progressive and most intellectual in the Pacific Islands, except the Hawaiians. They have exercised an influence over distant neighbours, especially in Fiji, quite out of proportion to their numbers. Their conquests have extended as far as Niué, or Savage Island, 200 m. east, and to various other islands to the north. In Captain Cook's time Poulaho, the principal chief, considered Samoa to be within his dominions. This pre-eminence may perhaps be due to an early infusion of Fijian blood: it has been observed that such crosses are always more vigorous than the pure races in these islands; and this influence seems also traceable in the Tongan dialect, and appears to have been partially transmitted thence to the Samoan. Various customs, traditions and names of places also point to a former relation with Fiji. Their prior conversion to Christianity gave the Tongans material as well as moral advantages over their neighbours. Crime is infrequent, and morality, always above the Polynesian average, has improved. The people have strict notions of etiquette and gradations of rank. In disposition they are amiable and courteous, but arrogant, lively, inquisitive and inclined to steal—their attacks in earlier days on Europeans, when not caused by misunderstandings, being due probably to their coveting property which to them was of immense value. They are brave and not unenergetic, though the soft climate and the abundance of food discourage industry. They value children, and seldom practised infanticide, and cannibalism was rare. Their women are kindly treated, and only do the lighter work. Agriculture, which is well understood, is the chief industry. They are bold and skilful sailors and fishermen; other trades, as boat and house building, carving, cooking, net and mat making, are usually hereditary. Their houses are slightly built, but the surrounding ground and roads are laid out with great care and taste.

There were formerly (till the early 18th century) two sovereigns; the higher of these, called Tui Tonga (chief of Tonga), was greatly reverenced but enjoyed little power. The real ruler and the chief officers of the state were members of the Tubou family, from which also the wife of the Tui Tonga was always chosen, whose descendants through the female line had special honours and privileges, under the title of *tamaha*, recalling the *vasu* of Fiji. The explanation of the dual kingship is probably this—the Tui Tonga were regarded as the direct descendants of the original head of the family from which the people sprang; regarded with reverence, and possessing unlimited power, they came to misuse this and discontent resulted, whereupon, to protect themselves, they appointed an executive deputy. Below these came the Eiki or chiefs, and next to them the class called Matabule. These were the hereditary counsellors and companions of the chiefs, and conveyed to the people the decisions formed at their assemblies. They also directed the national ceremonies, and preserved the popular traditions. While, under the control of Europeans, the Tongans have shown some aptitude for administration, they fail when left to themselves. They pick up superficial acquirements with astonishing ease, but seem to be incapable of mastering any subject. They write shorthand, but speak no English; they have a smattering of higher mathematics, yet are ignorant of book-keeping. Their government, effective enough when dealing with natives, breaks down in all departments concerned with Europeans, and becomes the prey of designing traders. Their ambition is to rank as a civilized state, and the flattery lavished on them by their teachers has spoiled them.

There are some ancient stone remains in Tongatabu, burial places (*feitoka*) built with great blocks, and a remarkable monument consisting of two large upright blocks morticed to carry a transverse one, on which was formerly a circular basin of stone.

Administration and Trade.—In May 1900 the group became a British protectorate under the native flag, the appointment of the consul and agent being transferred to the government of New Zealand. In 1904 the financial and legal administration was put into the hands of the British High Commissioner for the Western Pacific. The native king is assisted by a legislative assembly consisting, in equal numbers, of hereditary nobles and popular (elected) representatives. The wisdom of King George Tubou in refusing to alienate an acre of land, except upon lease, has resulted in Tonga having been the last native state in the Pacific to lose its independence. There is a revenue of about £21,000 annually derived chiefly from a poll-tax, leases and customs. The principal exports are copra, bananas, oranges and fungus, and the annual values of exports and imports are £80,000 and £70,000 respectively on an average, though both fluctuate considerably. British coin is legal tender (since 1905). There are five churches in Tonga—the Free Wesleyans, embracing the great majority of the inhabitants, Wesleyans, Roman Catholics, and Seventh Day Adventists. These last are few; a still smaller number of natives are nominally Anglicans.

History.—In 1616 the vessels of Jacob Lemaire and Willem Cornelis Schouten reached the island of Niuatobutabu, and had a hostile encounter with the natives. In 1643 Abel Tasman arrived at Tongatabu and was more fortunate. The next visit was that of Samuel Wallis in 1767, followed in 1773 by that of Captain Cook. In 1777 Cook returned, and stayed seven weeks among the islands. In 1799 a revolution, having its origin in jealousy between two natives of high rank, broke out. Civil war dragged on for many years—long after the deaths of the first leaders—but Taufaahau, who became king in 1845 under the name of George Tubou I., proved a strong ruler. In 1822 a Methodist missionary had arrived in the island, and others followed. The attempt to introduce a new faith led to renewed strife, this time between converts and pagans, but King George (who fully appreciated the value of intercourse with foreigners) supported the missionaries, and by 1852 the rebels were subdued. The missionaries, finding their position secure, presently began to take action in political affairs, and persuaded the king to grant a constitution to the Tongans, who welcomed it with a kind of childish enthusiasm, but were far from fitted to receive it. A triennial parliament, a cabinet, a privy council, and an elaborate judicial system were established, and the cumbrous machinery was placed in the hands of a "prime minister," a retired Wesleyan missionary, Mr Shirley Baker. Treaties of friendship were concluded with Germany, Great Britain, and the United States of America. Baker induced the king to break off his connexion with the Wesleyan body in Sydney, and to set up a state church. Persecution of members of the old church followed, and in 1890 the missionary-premier had to be removed from the group by the high commissioner. He afterwards returned to initiate a new sect called the "Free Church of England," which for a time created further divisions among the people.

King George Tubou died in 1893 at the age of ninety-six, and was succeeded by his great-grandson under the same title.

Mr Basil Thomson (who after Baker's deportation had carried out reforms which the natives, when left alone, were incapable of maintaining) was sent in 1900 to conclude the treaty by which the king placed his kingdom under British protection.

See Captain Cook's *Voyages* and other early narratives; Martin, *Mariner's account of the Tonga Islands* (Edinburgh, 1827); Vason, *Four Years in Tongatabu* (London, 1815); A. Monfort, *Les Tonga, ou Archipel des Amis* (Lyons, 1893); B. H. Thomson, *The Diversions of a Prime Minister* (London, 1894).

TONGKING,[1] a province of French Indo-China, and protectorate of France, situated between 20° and 23½° N. and 102° and 108½° E., and bounded N. by the Chinese provinces of Kwang-Tung, Kwang-Si and Yun-nan, W. by Laos, S. by Annam, and E. by the Gulf of Tongking. Area, about 46,000 sq. m. The population is estimated at 6,000,000, including 33,000 Chinese and about 4000 Europeans. Geographically, Tongking comprises three regions: (1) the delta of the Song-Koi (Red river), which, beginning at Son-Tay and coalescing with the delta of the Thai-Binh, widens out into the low-lying and fertile plain within which are situated the principal cities. (2) Two mountainous tracts, to the north and west of the delta, running approximately from north-west to south-east, one separating the basins of the Song-Koi and the Canton river, the other those of the Song-Koi and the Mekong. (3) A region of plateaus and low hills forming a transition between the delta and the mountains. The main geographical feature in the country is the Song-Koi, which, taking its rise near Tali Fu, in Yun-nan, enters Tongking at Lao-Kay (the Lao boundary), and flows thence in a south-easterly direction to the Gulf of Tongking. It was this river which mainly, in the first instance, attracted the French to Tongking, as it was believed by the explorers that, forming the shortest route by water to the rich province of Yun-nan, it would prove also to be the most convenient and expeditious means of transporting the tin, copper, silver and gold which are known to abound there. This belief, however, has proved fallacious. The upper course of the stream is constantly impeded by rapids, the lowest being about thirty miles above Hung-Hoa. Beyond Lao-Kay navigation is impracticable during the dry season, and at all other times of the year goods have to be there transferred into light junks. Below Lao-Kay larger junks, and in the summer months steam launches of shallow draught use the river. Within the limits of Yun-nan the navigation is still more difficult. Near Son-Tay the Song-Koi receives the waters of the Song-Bo (Black river) and the Song-Ka (Clear river), parallel affluents rising in Yun-nan, and from that point divides into a network of waterways which empty themselves by countless outlets into the sea. The Song-Cau rises in north-eastern Tongking and below the town of Sept Pagodes, where it is joined by the Song-Thuong to form the Thai-Binh, divides into numerous branches, communicating with the Song-Koi by the Canal des Rapides and the Canal des Bambous.

The coast line of Tongking from Mon-Kay on the Chinese frontier to Thanh-Hoa, near that of Annam, has a length of 375 m. From Mon-Kay as far as the estuary of the Song-Koi it is broken, rugged and fringed with islands and rocky islets. The bay of Tien-Hien, to the south of which lies the island of Ke-Bao, and the picturesque bay of Along, are the chief indentations. Beyond the island of Cac-Ba, south of the Bay of Along, the coast is low, flat and marshy, and tends to advance as the alluvial deposits of the delta accumulate.

The climate of Tongking is less trying to Europeans than that of the rest of French Indo-China. During June, July and August, the temperature ranges between 82° and 100° F., but from October to May the weather is cool. The country is subject to typhoons in August and September.

In the wooded regions of the mountains the tiger, elephant and panther are found, and wild buffalo, deer and monkeys are common. The delta is the home of ducks and many other varieties of aquatic birds. Tea, cardamom, and mulberry grow wild, and in general the flora approximate to that of southern China.

The Annamese (see ANNAM), who form the bulk of the population of Tongking, are of a somewhat better physique than those of the rest of Indo-China. Savage tribes inhabit the northern districts—the Muongs the mountains bordering the Black river, the Thôs the regions bordering the Clear river and the Thai-Binh. The Muongs are bigger and stronger than the Annamese. They have square foreheads, large faces and prominent cheek-bones, and their eyes are often almost straight.

Rice, which in some places furnishes two crops annually, is incomparably the most important product of the delta. Elsewhere there are plantations of coffee, tobacco, ramie, paper-tree (*Daphne odora*), cotton, jute, sugar-cane, pepper and mulberry. The cultivation of silkworms is of growing importance.

Gold, copper, tin, lead and other metals are found in the higher regions of Tongking, but only gold and tin are exploited, and these only to a very limited extent. There is a large output of coal of inferior quality from Hon-Gay on the bay of Along and there are coal-workings on the island of Ke-Bao.

Hanoi, Hai-phong and Nam-Dinh carry on cotton-spinning, and Hanoi and Nam-Dinh are well known for the manufacture of carved and inlaid furniture. The natives are skilful at enamelling and the chasing and ornamentation of gold and other metals. The manufacture of paper from the fibrous bark of the paper-tree is a widespread industry and there are numerous distilleries of rice-spirit.

The imports of Tongking, which in 1905 reached a value of £3,501,422, comprise railway material, cereals, flour, liquors, woven goods, petroleum, glassware, paper, prepared skins, clocks and watches, arms and ammunition, &c. Exports (valued at £1,393,674 in 1905) comprise rice, rubber, manila hemp, ramie, lacquer and badian oils, raw skins, silk-waste, coal, Chinese drugs, rattan, mats, gamboge.

The transit trade via Tongking between Hong-Kong and the province of Yun-nan in southern China is of considerable importance, reaching in 1905 a value of £1,146,000. This trade is entirely in the hands of Chinese houses, the tin of the Yun-nan mines and cotton yarns from Hong-Kong constituting its most important elements. Goods in transit enjoy a rebate of 80% of the customs duties. Goods are carried on the Song-Koi to Lao-Kay or Man-Hao, thence on mules. The waterways of the delta are lined with embankments, the causeways along which form the chief means of land communication of the region. (For railways, see INDO-CHINA, FRENCH.)

The protectorate of Tongking approaches nearer to direct administration than that of Annam, where the conditions of the protectorate are more closely observed. Till 1897 the emperor of Annam was represented in Tongking by a viceroy (*kinh-luoc*), but now the native officials are appointed by and are directly under the control of the resident-superior, who resides at Hanoi, presides over the protectorate council, and is the chief territorial representative of France. Tongking is divided into nineteen provinces, in each of which there is a resident or a vice-resident, and four military territories, the latter administered by commandants. In each province there is a council of native "notables," elected by natives and occupied with the discussion of the provincial budget and public works. There is also a deliberative council of natives (instituted 1907) for the whole of Tongking. The provincial administration, local government and educational system are analogous to those of Annam (*q.v.*). Two chambers of the court of appeal of Indo-China and a criminal court sit at Hanoi; there are tribunals of first instance and tribunals of commerce at Hanoi and Hai-Phong. When both parties to a suit are Annamese, it comes within the jurisdiction of the *An-Sat* or native judge of the province.

The following is a summary of the budgets of 1899 and 1904:—

	Receipts.	Expenditure.
	£	£
1899	461,235	427,993
1904	756,648	494,034

The chief source of revenue is the direct taxes (including especially the poll-tax and land-tax), which amounted in 1904 to £417,723, while the chief items of expenditure are the cost of the residencies and general staff, public works and the civil guard.

For the early history of Tongking, see ANNAM and INDO-CHINA, FRENCH. Tongking was loosely united to Annam until 1801, when Gia-long, king of Annam, brought it definitely under his sway. Having, by the treaty of 1862 and the annexation of Cochin China, firmly established themselves in Annamese territory, the French began to turn their attention to Tongking, attracted by the reported richness of its mineral wealth. They found a pretext for interfering in its affairs in the disturbances arising from the invasion of its northern provinces by the disbanded followers of the Taiping rebels. The Franco-German War of 1870–71 put an end to the project for a time, but the return of peace in Europe was the signal for the renewal of hostilities in the East. The appearance of Garnier's work on his expedition up the Mekong again aroused an interest in Tongking, and the reported wealth of the country added the powerful motive of self-interest to the yearnings of patriotism. Already Jean Dupuis, a trader who in the pursuit of his calling had penetrated into Yun-nan, was attempting to negotiate for the passage up the Song-Koi of himself and a cargo of military stores for the Chinese authorities in Yun-nan. Meanwhile Captain Senez appeared from Saigon, having received instructions to open the route to French commerce. But to neither the trader nor the naval officer would the Tongkingese lend a favourable ear, and in default of official permission Dupuis determined to force his way up the river. This he succeeded in doing, but arrived too late, for he found the Taiping rebellion crushed and the stores no longer wanted.

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[1] See also INDO-CHINA, FRENCH, and ANNAM.

On the return of Dupuis to Hanoi, the Tongkingese general at that place wrote to the king of Annam, begging him to induce the governor of Cochin-China to remove the intruder. An order was thereupon issued calling upon Dupuis to leave the country. This he declined to do, and, after some negotiations, Francis Garnier with a detachment was sent to Hanoi to do the best he could in the difficult circumstances. Garnier threw himself heart and soul into Dupuis's projects, and, when the Tongkingese authorities refused to treat with him except on the subject of Dupuis's expulsion, he attacked the citadel in November, 1873, and carried it by assault. Having thus secured his position, he sent to Saigon for reinforcements, and meanwhile sent small detachments against the five other important fortresses in the delta (Hung-yen, Phu-Ly, Hai-Duong, Ninh-Binh and Nam-Dinh), and captured them all. The Tongkingese now called in the help of Lu-Vinh-Phuoc, the leader of the "Black Flags,"[1] who at once marched with a large force to the scene of action. Within a few days he recaptured several villages near Hanoi, and so threatening did his attitude appear that Garnier, who had hurried back after capturing Nam-Dinh, made a sortie from the citadel. The movement proved a disastrous one, and resulted in the death of Garnier and of his second in command, Balny d'Avricourt.

Meanwhile the news of Garnier's hostilities had alarmed the governor of Saigon, who, having no desire to be plunged into a war, sent Philastre, an inspector of native affairs, to offer apologies to the king of Annam. When, however, on arriving in Tongking Philastre heard of Garnier's death, he took command of the French forces, and at once ordered the evacuation of Nam-Dinh, Ninh-Binh and Hai-Duong—a measure which, however advantageous it may have been to the French at the moment, was most disastrous to the native Christian population, the withdrawal of the French being the signal for a general massacre of the converts. In pursuance of the same policy Philastre made a convention with the authorities (March, 1874) by which he bound his countrymen to withdraw from the occupation of the country, retaining only the right to trade on the Song-Koi and at Hanoi and Hai-Phong, and agreed to put an end to Dupuis's aggressive action.

For a time affairs remained *in statu quo*, but in 1882 Le Myre de Villers, the governor of Cochin-China, sent Henri Rivière with a small force to open up the route to Yun-nan by the Song-Koi. With a curious similarity the events of Garnier's campaign were repeated. Finding the authorities intractable, Rivière stormed and carried the citadel of Hanoi, and then, with very slight loss, he captured Nam-Dinh, Hai-Duong, and other towns in the delta. And once again these victories brought the Black Flags into the neighbourhood of Hanoi. As Garnier had done, so Rivière hurried back from Nam-Dinh on news of the threatened danger. Like Garnier also he headed a sortie against his enemies, and like Garnier he fell a victim to his own impetuosity (May, 1883).

In the meantime the Annamese court had been seeking to enlist the help of the Chinese in their contest with the French. The tie which bound the tributary nation to the sovereign state had been for many generations slackened or drawn closer as circumstances determined, but it had never been entirely dissevered, and from the Annamese point of view this was one of the occasions when it was of paramount importance that it should be acknowledged and acted upon. With much more than usual regularity, therefore, the king despatched presents and letters to the court of Peking, and in 1880 he sent a special embassy, loaded with unusually costly offerings, and bearing a letter in which his position of a tributary was emphatically asserted. Far from ignoring the responsibility thrust upon him, the emperor of China ordered the publication of the letter in the *Peking Gazette*.

The death of Rivière and the defeat of his troops had placed the French in a position of extreme difficulty. M. Jules Ferry, who had become premier of France in February 1883, determined on a vigorous forward policy. But for the moment the outlying garrisons, except those of Nam-Dinh and Hai-Phong, had to be withdrawn and Hanoi itself was besieged by the Black Flags. Reinforcements brought by Admiral Courbet and General Bouet were insufficient to do more than keep them at bay. So continued was the pressure on the garrison that Bouet determined to make an advance upon Son-Tay to relieve the blockade. He attacked Vong, a fortified village, but he met with such resistance that, after suffering considerable loss, he was obliged to retreat to Hanoi. In the lower delta fortune sided with the French, and almost without a casualty Hai-Duong and Phu-Binh fell into their hands. Meanwhile, in order to put more effective pressure upon the court of Hué, Dr Harmand, commissary-general, supported by Courbet, proceeded with a naval force to the Hué river. They found that, though King Tu Duc was dead, his policy of resistance was maintained, and therefore stormed the city. After a feeble defence it was taken, and Harmand concluded a treaty with the king (August 1883) in which the French protectorate was fully recognized, the king further binding himself to recall the Annamese troops serving in Tongking, and to construct a road from Saigon to Hanoi.

Though this treaty was exacted from Annam under pressure, the French lost no time in carrying out that part of it which gave them the authority to protect Tongking, and Bouet again advanced in the direction of Son-Tay. But again the resistance he met with compelled him to retreat, after capturing the fortified post of Palan. Meanwhile, on the determination to attack Son-Tay becoming known in Paris, the Chinese ambassador warned the ministry that, since Chinese troops formed part of the garrison, he should consider it as tantamount to a declaration of war. But his protest met with no consideration. On the arrival of reinforcements an advance was again made; and on the 16th of December 1883, after some desperate fighting, Son-Tay fell.

During 1884 the French made themselves masters of the lower delta. Throughout the campaign Chinese regulars fought against the French, who thus found themselves involved in war with China. While hostilities were in progress M. Fournier, the French consul at Tientsin, had been negotiating for peace, so far as China was concerned, with Li Hung-chang, and in May 1884 had signed and sealed a memorandum by which the Chinese plenipotentiary agreed that the Chinese troops should evacuate the northern provinces of Tongking "*immédiatement.*" In the following month another treaty, signed at Hué, confirmed the French protectorate over Annam and Tongking. It was not, however, followed by a cessation of military operations. A misunderstanding arose between the French and the Chinese as to the exact date for the evacuation of their posts by the Chinese, and in June General Millot, then commander-in-chief of the French forces, dispatched Colonel Dugenne at the head of a strong force to occupy Lang-Son. The expedition was badly arranged; the baggage train was far too unwieldy; and the pace at which the men were made to march was too quick for that scorching time of the year. They advanced, however, to Bac-Le, within 25 m. of Lang-Son, when they suddenly came upon a Chinese camp. An irregular engagement began, and, in the pitched battle which ensued, the Chinese broke the French lines, and drove them away in headlong flight. This brought the military operations for the season to a close.

During the rainy season fevers of all kinds became alarmingly prevalent, and the number of deaths and of men invalided was very large. In the meantime, however, an expedition, led by Colonel Donnier, against the Chinese garrison at Chu, about 10 m. south-east from Lang-kep, was completely successful; and in a battle fought near Chu the Chinese were defeated, with a loss of 3000 killed, the French loss being only 20 killed and 90 wounded. In the skirmishes which followed the French were generally victorious, but not to such a degree as to warrant any enlargement of the campaign.

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[1] Bands of Chinese rebels who infested the mountainous region of Tongking.

In January 1885 large reinforcements arrived and Brière de l'Isle, who had succeeded Millot as commander-in-chief, ordered an advance towards Lang-Son. The difficulties of transport greatly impeded his movements, still the expedition was successful. On the 6th of February three forts at Dong-Song, with large supplies of stores and ammunition, fell into the hands of the French. Three days' heavy fighting made them masters of a defile on the road, and on the 13th Lang-Son was taken, the garrison having evacuated the town just before the entrance of the conquerors. With his usual energy General Négrier, who commanded a division under Brière de l'Isle, pressed on in pursuit to Ki-Hea, and even captured the frontier town of Cua-Ai. But Brière de l'Isle had now to hurry back to the relief of Tuyen-Kwan, which was doggedly resisting the attacks of an overwhelming Chinese force, and Négrier was left in command at Lang-Son. The withdrawal of Brière de l'Isle's division gave the Chinese greater confidence, and, though for a time Négrier was able to hold his own, on the 22nd and 23rd of March he sustained a severe check between Lang-Son and That-Ke, which was finally converted into a complete rout, his troops being obliged to retreat precipitately through Lang-Son to Than-Moi and Dong-Song. Brière de l'Isle reached Tuyen-Kwan, the garrison of which was commanded by Colonel Dominé, on the 3rd of March, and effected its relief. The disaster at Lang-Son caused the downfall of the Ferry ministry (March 30). Shortly afterwards Sir Robert Hart succeeded in negotiating peace with China. By the terms agreed on at Tientsin (June, 1885), it was stipulated that France was to take Tongking and Annam under its protection and to evacuate Formosa and the Pescadores. (For further history, see INDO-CHINA.)

See J. Dupuis, *Le Tong-kin et l'intervention française* (Paris, 1898); C. B. Norman, *Tonkin or France in the Far East* (London, 1884); Prince Henri d'Orléans, *Autour du Tonkin* (Paris, 1896); J. Ferry, *Le Tonkin et la mère-patrie* (Paris, 1890); J. Chailley, *Paul Bert au Tonkin* (Paris, 1887); E. Lunet de Lajonquière, *Ethnographie du Tonkin Septentrional* (Paris, 1906); A. Gaisman, *L'Œuvre de la France au Tonkin* (Paris, 1906); also the bibliography under INDO-CHINA, FRENCH.

TONGS (O. Eng. *tange*, M. Eng. *tonge*, cf. Du. *tang*, Ger. *Zange*, from base *tang*, to bite, cf. Gr. δάκνειν), a gripping and lifting instrument, of which there are many forms adapted to their specific use. Some are merely large pincers or nippers, but the greatest number fall into three classes: the first, as in the common fire-tongs, used for picking up pieces of coal and placing them on a fire, which have long arms terminating in small flat circular grippers and are pivoted close to the handle; the second, as in the sugar-tongs, asparagus tongs, and the like, consisting of a single band of metal bent round or of two bands joined at the head by a spring, and third, such as the blacksmith's tongs or the crucible-tongs, in which the pivot or joint is placed close to the gripping ends. A special form of tongs is that known as the "lazy-tongs," consisting of a pair of grippers at the end of a series of levers pivoted together like scissors, the whole being closed or extended by the movement of the handles communicated to the first set of levers and thence to the grippers, the whole forming an extensible pair of tongs for gripping and lifting things at a distance.

TONGUE (O. Eng. *tunge*), in anatomy, a movable organ situated in the floor of the mouth, and serving for the sensation of taste besides helping in the mastication of food, in articulate speech, and in feeling the exact position of any structure within the mouth.

The tongue is divided into a main part or body, a base which looks backward toward the pharynx, a dorsum or upper surface, a root by which it is attached to the hyoid bone and floor of the mouth, a tip which is free and an inferior free surface in contact with the front part of the floor of the mouth and with the lower incisor teeth. Owing to the large amount of muscle in its composition the shape of the tongue varies considerably from time to time. The dorsum of the tongue is covered by stratified squamous epithelium, and, when at rest, is convex both antero-posteriorly and transversely; it is thickly studded with papillae, of which four kinds are recognized.

Filiform papillae are minute conical projections covering the whole of the dorsum, by which term the true upper surface is meant, as well as the tip and borders of the tongue. They are very numerous and contain a short core of subepithelial mucous membrane covered by a thick coating of epithelial cells, which coating may divide at its tip into a number of thread-like processes.

Fungiform papillae are less numerous than the last, and somewhat resemble "button mushrooms"; they generally contain special taste buds.

Circumvallate papillae are usually from seven to ten in number and are arranged in the form of a V, the apex of which points down the throat. They lie quite at the back of the upper surface of the tongue and each consists of a little flat central mound surrounded by a deep moat, the outer wall of which is slightly raised above the surface, and it is to this that the papillae owe their name. Both sides of the moat have taste buds embedded in them, while into the bottom small serous glands open.

Foliate papillae are only vestigial in man and consist of a series of vertical ridges occupying a small oval area on each side of the tongue near its base and just in front of the attachment of the anterior pillars of the fauces. (See PHARYNX.)

The posterior surface or base of the tongue forms part of the anterior wall of the pharynx and has a quite different appearance to that of the dorsum. On it are found numerous circular or oval elevations of the mucous membrane caused by lymphoid tissue (lymphoid follicles), on the summit of the most of which is a mucous crypt or depression. The division between the superior or oral surface of the tongue and the posterior or pharyngeal is sharply marked by a V-shaped shallow groove called the *sulcus terminalis* which lies just behind and parallel to the V-shaped row of circumvallate papillae. At the apex of this V is a small blind pit, the *foramen caecum.*

At the lower part of the pharyngeal surface three folds of mucous membrane, called *glosso-epiglottic folds*, run backward; the middle one passes to the centre of the front of the epiglottis, while the two lateral ones, in modern anatomy often called pharyngo-epiglottic folds, pass backward and outward to the fossa of the tonsil.

On the inferior free surface of the tongue, that is to say, the surface which is seen when the mouth is looked into and the tongue turned up, there is a median fold of mucous membrane called the *fraenum linguae*, which is attached below to the floor of the mouth. On each side of this the blue outlines of the ranine veins are seen, while close to these a little fold on each side, known as a *plica fimbriata*, is often found. It must not, however, be confused with the plica sublingualis described in the article MOUTH AND SALIVARY GLANDS.

The substance of the tongue is composed almost entirely of striped muscle fibres which run in different directions. Some of these bundles, such as the *superficial*, *deep*, *transverse* and *oblique linguales* are confined to the tongue and are spoken of as intrinsic muscles. Other muscles, such as the hyo-glossus, stylo-glossus, &c. come from elsewhere and are extrinsic; these are noticed under the head of MUSCULAR SYSTEM. The arteries of the tongue are derived from the lingual, a branch of the external carotid (see ARTERIES), while the veins from the tongue return the blood, by one or more veins on each side, into the internal jugular vein (see VEINS).

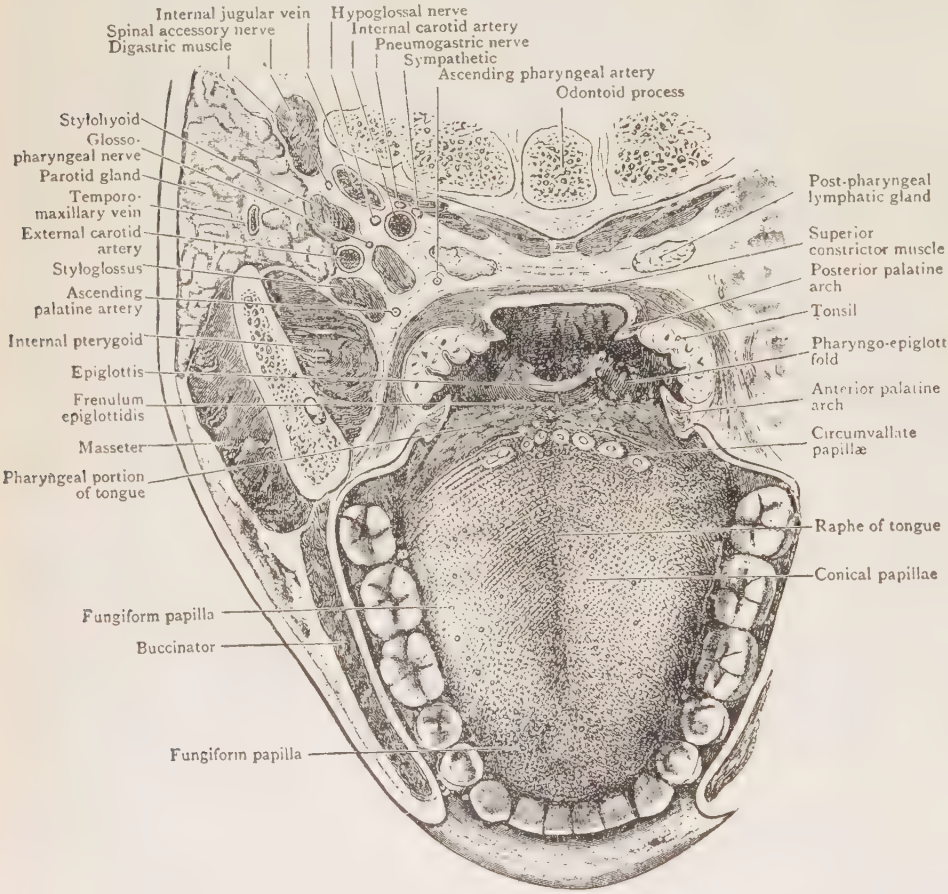
The nerves to the tongue are the (1) *lingual* or gustatory, a branch of the fifth (see NERVES: *Cranial*) which supplies the anterior two-thirds with ordinary sensation and also, by means of the chorda tymphani which is bound up with it, with taste sensation; (2) the glossopharyngeal which supplies the circumvallate papillae and posterior third of the tongue with taste and ordinary sensation; (3) a few twigs of the superior laryngeal branch of the vagus to the pharyngeal surface of the tongue; and (4) the hypoglossal which is the motor nerve to the muscles.

Embryology.

The mucous membrane covering the second and third visceral arches fuses to form the furcula (see RESPIRATORY SYSTEM). Just in front of this a rounded eminence appears at an early date in the ventral wall of the pharynx to form the *tuberculum impar* which is separated from the furcula by the depression known as the *sinus arcuatus.* This tuberculum impar gradually grows to form the central part of the tongue in front of the foramen cæcum, while the anterior part of the organ is derived from two lateral swellings which appear in the floor of the mouth and surround the tuberculum impar antero-laterally. The posterior third, or pharyngeal part, is developed from the anterior part of the furcula in the middle line, that is to say from the third visceral arch. The sinus arcuatus becomes gradually shallower as these two parts of the tongue grow together and eventually is indicated by the *sulcus terminalis;* in the mid line, however, the isthmus of the thyroid grows down from it, forming the *thyro-glossal duct* the remains of which are seen in the foramen caecum (see DUCTLESS GLANDS). It will be seen that the tongue is developed in connexion with the first, second and third visceral arches, and it is therefore to be expected that the fifth, seventh and ninth nerves which supply those arches would help to supply it, but the vagus from the fourth arch reaches it in addition, while the fact that most of the muscular substance of the tongue is supplied by the hypoglossal nerve is explained on the theory that some of the cervical skeletal musculature has grown cephalad into the tongue and has carried its nerve with it.

Comparative Anatomy.

The tongue is present in fishes but it is an immovable swelling in the floor of the mouth and is practically devoid of muscles. In the hag (*Myxine*) among the Cyclostomata, and pike (*Esox*) among the Teleostei, teeth are developed on the tongue. In the Amphibia the tailed forms (Urodela) usually have tongues like fishes, though in the genus Spelerpes the organ is very free and can be protruded for a great distance. In the majority of the Anura the tongue is usually attached close to the front of the floor of the mouth so that it can be flapped forward with great rapidity. There are, however, two closely allied families of frogs (Xenopodidae and Pipidae) which form the order of Aglossa, because in them the tongue is suppressed.



(From Ambrose Birmingham in Cunningham's *Text Book of Anatomy.*)

Horizontal Section through Mouth and Pharynx at the Level of the Tonsils.

In the reptiles the tongue is generally very movable, though this is not the case in the Crocodilia and many of the Chelonia. The forked tongues of snakes and many lizards and the highly specialized telescopic tongue of the chameleon are familiar objects.

In birds the tongue is usually covered with horny epithelium and is poorly supplied with muscles. When it is very protrusible, as in the woodpecker, the movement is due to the hyoid, with the base of the tongue attached, moving forward.

In the Mammalia the tongue is always movable by means of well-developed extrinsic and intrinsic muscles, while papillae and glands are numerous. The filiform papillae reach their maximum in the feline family of the Carnivora where they convert the tongue into a rasp by which bones can be licked clean of all flesh attached to them.

Foliate papillae are best seen in the rodents, and when they are well developed the circumvallate papillae are few, often only one on each side.

In the lemurs an under tongue or *sub lingua* is found, which is probably represented by the *plicae fimbriatae* under the human tongue, and by some morphologists is regarded as the homologue of the whole tongue of the lower vertebrates, the greater part of the mammalian tongue being then looked upon as a new formation.

For further details and literature see R. Wiedersheim's *Comparative Anatomy of Vertebrates*, translated by W. N. Parker (London, 1907); C. Gegenbaur, *Vergleich. Anat. der Wirbelthiere* (Leipzig, 1901); A. Oppel, *Lehrb. vergleich. mikroskop. Anat. der Wirbelthiere*, Teil 3 (Jena, 1900); Parker and Haswell, *Text Book of Zoology* (London, 1897). (F. G. P.)

Surgery of the Tongue.

During infancy it is sometimes noticed that the little band of membrane (*fraenum*) which binds the under part of the tongue to the middle line of the floor of the mouth is unusually short. The condition will probably right itself as the front part of the tongue takes on its natural growth. In some children the tongue is so large that it hangs out of the mouth, scratching itself upon the teeth. This condition is likely to be associated with weak intellect.

Acute inflammation of the tongue may be caused by the sting of a wasp or by the entrance of septic germs through a wound, and the trouble may end in an abscess.

Chronic inflammation of the tongue may be caused by syphilis, by the irritation of decayed teeth or of a badly-fitting plate of artificial teeth, or by excessive smoking. The condition is one of danger in that it may lead eventually to the tongue becoming the seat of cancer. The treatment demands the removal of every source of irritation. The teeth must be made sound and smooth and must be kept so. Smoking must be absolutely and entirely given up, and salt, mustard, pickles, spirits, aerated waters, and everything else which is likely to be a cause of irritation must be avoided.

Cancer of the tongue is the result of chronic irritation which produces an excessive growth of the scaly covering of the tongue and causes an invasion of the deeper parts of the tongue by the scales. It is more often found in men than women and is usually associated with a hard swelling at one side of the tongue—perhaps near a jagged tooth or at the spot where the end of the pipe-stem approaches the tongue. The nerves of the tongue being caught and compressed in the growth, pain is constant and severe, and the movements during mastication cause great distress. The swelling gradually increases in size and, spreading to the floor of the mouth, hinders the free movements of the tongue. In due course it breaks down in the middle and a hard-walled ulcer appears. All this time the small scales of the cancer are finding their way along the lymph-channels and causing a secondary enlargement in the glands just below the jaw and along the side of the neck. Enlargement of the cervical glands is a very serious complication of cancer of the tongue.

The only treatment for cancer of the tongue which is at present known in surgery is the early removal by operation. It not seldom happens that because there is a certain amount of doubt as to the exact nature of the growth in the early weeks delay in operating is reasonably permitted, but during this time there is the risk of the cells of the disease finding their way to the lymphatic system. Still, inasmuch as there may be great difficulty in determining the diagnosis from tertiary syphilitic disease, a course of treatment by iodide of potassium may well be recommended. Syphilis is often the precursor of lingual cancer, and it is impossible to say exactly when the syphilitic lesion becomes malignant. In the case of a cancerous tumour of the tongue being so deeply or so widely attached that its removal cannot be recommended, relief may be afforded by the extraction of most, or all of the teeth, by limiting the food to the most simple and unirritating kinds, and possibly by dividing the great sensory nerves of the tongue.

Cancer of the tongue is now operated on in advanced cases such as in former years would not have been dealt with by a radical operation. An incision is made beneath the jaw and through the floor of the mouth, by which the tongue is drawn out and rendered easily accessible, the arteries being leisurely secured as the tissues are cut across. The upper part of the gullet is plugged by a sponge so that no blood can enter the lungs, and unimpeded respiration is provided for by the preliminary introduction of a tube into the windpipe. Through the incision which is made below the jaw the infected lymphatic glands are removed. To Dr Kocher of Berne the profession and the public are indebted for this important advance in the treatment of this disease. (E. O*.)

TONGUES, GIFT OF, or GLOSSOLALIA (γλῶσσα, tongue, λαλεῖν, speak), a faculty of abnormal and inarticulate vocal utterance, under stress of religious excitement, which was widely developed in the early Christian circles, and has its parallels in other religions. In the New Testament such experiences are recorded in Caesarea (Acts x. 46), at Corinth (Acts xix. 6; 1 Cor. xii., xiv.), Thessalonica (1 Thess. v. 19), Ephesus (Eph. v. 18), and universally (Mark xvi. 17). From the epistles of Paul, who thanked God that he spake with tongues more than all or any of his Corinthian converts, we can gather a just idea of how he regarded this gift and of what it really was.

Firstly, then, it was a grace (*charisma*) of the spirit, yet not of the holy or pure spirit only, but of evil spirits also who on occasions had been known to take possession of the larynx of a saint and exclaim, "Jesus is Anathema." As no one could curse Jesus except under the influence of a devilish afflatus, so none could say "Jesus is Lord" except he was inspired by the Holy Spirit. But, secondly, the pneumatic utterances technically known as speaking with tongues failed to reach this level of intelligibility; for Paul compares "a tongue" to a material object which should merely make a noise, to a pipe or harp twanged or blown at random without tune or time, to a trumpet blaring idly and not according to a code of signal notes. Unless, therefore, he that has the gift of tongues also possess the gift of interpreting his exclamations, or unless some one present can do so for him, he had not better exercise it in church. He is a barbarian to others and they to him, since they cannot understand what is spoken by him. Paul discriminates between the Spirit which during these paroxysms both talks and prays to God and the *nous* or understanding which informs a believer's psalm, teaching, revelation or prophesy, and renders them intelligible, edifying and profitable to the assembly. Accordingly Paul lays down rules which he regarded as embodying the Lord's commandment. A man "that speaketh in a tongue speaketh not unto men, but unto God; for no man understandeth;" and therefore it is expedient that he keep this gift for his private chamber and there pour out the mysteries. In church it is best that he should confine himself to prophesying, for that brings to others "edification and comfort and consolation." If, however, tongues must be heard in the public assembly, then let not more than three of the saints exhibit the gift, and they only in succession. Nor let them exhibit it at all, unless there is some one present who can interpret the tongues and tell the meeting what it all means. If the whole congregation be talking with tongues all at once, and an unbeliever or one with no experience of pneumatic gifts come in, what will he think, asks Paul. Surely that "you are mad." So at Pentecost on the occasion of the first outpouring of the Spirit the saints were by the bystanders accused of being drunk (Acts ii. 15). In the church meeting, says Paul, "I had rather speak five words with my understanding, that I might instruct others also, than ten thousand words in a tongue."

The writer of Acts ii., anxious to prove that Providence from the first included the Gentiles in the Messianic Kingdom, assumes that the gift of tongues was a miraculous faculty of talking strange languages without having previously learned them. Augustine accordingly held that each of the disciples talked all languages miraculously; Chrysostom that each talked one other than his own. The Pentecostal inspiration has been construed as a providential antithesis to the confusion of tongues—an idea which Grotius expressed in the words: "Poena linguarum dispersit homines; donum linguarum dispersos in unum populum collegit." Competent critics to-day recognize that such a view is impossible; and it has been suggested with much probability that in the second chapter of Acts the words in *v.* 5: "Now there were dwelling . . . under heaven" as well as *vv.* 6–11: "because that every man . . . mighty works of God" were interpolated by Luke in the document he transcribed.[1] The faithful talking with tongues were taken by bystanders for drunken men, but intoxicated men do not talk in languages of which they are normally ignorant.[2]

Paul on the whole discouraged glossolaly. "Desire earnestly the greater gifts," he wrote to the Corinthians. The gift of tongues was suitable rather to children in the faith than to the mature. Tongues were, he felt, to cease whenever the perfect should come; and the believer who spoke with the tongues of men and of angels, if he had not love, was no better than the sounding brass and clanging cymbal of the noisy heathen mysteries. It was clearly a gift productive of much disturbance in the Church (1 Cor. xiv. 23). He would not, however, entirely forbid and quench it (1 Thess. v. 19), so long as decency and order were preserved.

It is not then surprising that we hear little of it after the apostolic age. It faded away in the great Church, and probably Celsus was describing Montanist circles (though Origen assumed that they were ordinary believers) when he wrote[3] of the many Christians of no repute who at the least provocation, whether within or without their temples, threw themselves about like inspired persons; while others did the same in cities or among armies in order to collect alms, roaming about cities or camps. They were wont to cry out, each of himself, "I am God; I am the Son of God; or I am the divine Spirit." They would indulge in prophecies of the last judgment, and back their threats with a string of strange, half-frantic and utterly unmeaning sounds, the sense of which no one with any intelligence could discover; for they were obscure gibberish, and merely furnished any fool or impostor with an occasion to twist the utterances as he chose to his own purposes.

In the above we get a glimpse both of the glossalist and of his interpreter as they appeared to the outside world; and the impression made on them is not unlike that which Paul apprehended would be left on outsiders by an indiscriminate use of the gift. Tertullian early in the 3rd century testifies that glossolaly still went on in the Montanist Church which he had joined; for we must so interpret the following passage in his *De anima*, cap. ix.: "There is among us at the present time a sister who is endowed with the charismatic gift of revelations, which she suffers through ecstasy in the spirit during the Sunday service in church. She converses with angels, sometimes even with the Lord, and both hears and see mysteries." The magical papyri teem with strings of senseless and barbaric words which probably answer to what certain of the Fathers called the language of demons. It has been suggested that we here have recorded the utterances of glossolalists.

The attitude of Paul toward glossolaly among his converts strikingly resembles Plato's opinion as expressed in the *Timaeus*, p. 72, of the enthusiastic ecstasies of the ancient μάντις (soothsayer). "God," he writes, "has given the art of divination not to the wisdom, but to the foolishness of man; for no man, when in his wits, attains prophetic truth and inspiration; but when he receives the inspired word either his intelligence is enthralled by sleep, or he is demented by some distemper or possession. And he who would understand what he remembers to have been said, whether in a dream or when he was awake, by the prophetic and enthusiastic nature, or what he has seen, must first recover his wits; and then he will be able to explain rationally what all such words and apparitions mean, and what indications they afford to this man or that, of past, present or future good and evil. But, while he continues demented, he cannot judge of the visions which he sees or the words which he utters. . . . And for this reason it is customary to appoint diviners or interpreters to be judges of the true inspiration."[1] From such passages as the above we infer that the gift of tongues and of their interpretation was not peculiar to the Christian Church, but was a repetition in it of a phase common in ancient religions. The very phrase γλώσσαις λαλεῖν, "to speak with tongues," was not invented by the New Testament writers, but borrowed from ordinary speech.

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[1] This misunderstanding of Acts ii. has influenced the official Roman doctrine of demoniacal possession. The *Sacerdotale* indicates as one of the symptoms of possession the ability of the possessed to talk other tongues than his own. Cf. the *Fustis daemonum*, cap. xi. Venetus (1606): "*Aliqui sermonem alienum a patria sua loquuntur etsi nunquam e laribus paternis recesserint.*"

[2] It is noteworthy that in Eph. v. 18 Paul contrasts the being filled with the Spirit with the foolishness of intoxication with wine, and remarks that those filled with the Spirit speak to themselves in psalms and hymns and spiritual songs and give thanks always for all things.

[3] Origen, *Contra Celsum*, vii. 9.

Virgil (*Aen.* vi. 46, 98) draws a life-like picture of the ancient prophetess "speaking with tongues." He depicts her quick changes of colour, her dishevelled hair, her panting breast, her apparent increase of stature as the god draws nigh and fills her with his divine afflatus. Then her voice loses its mortal's ring: "nec mortale sonans." The same morbid and abnormal trance utterances recur in Christian revivals in every age, *e.g.* among the mendicant friars of the 13th century, among the Jansenists, the early Quakers, the converts of Wesley and Whitefield, the persecuted protestants of the Cevennes, the Irvingites.

Oracular possession of the kind above described is also common among savages and people of lower culture; and Dr Tylor, in his *Primitive Culture*, ii. 14, gives examples of ecstatic utterance interpreted by the sane. Thus in the Sandwich Islands the god Oro gave his oracles through a priest who "ceased to act or speak as a voluntary agent, but with his limbs convulsed, his features distorted and terrific, his eyes wild and strained, he would roll on the ground foaming at the mouth, and reveal the will of the god in shrill cries and sounds violent and indistinct, which the attending priests duly interpreted to the people."

See E. B. Tylor, *Primitive Culture*; H. Weinel, *Die Wirkungen des Geistes und der Geister* (Freiburg, 1899); Shaftesbury's *Letter on Enthusiasm*; Mrs Oliphant, *Life of Irving*, vol. ii. (F. C. C.)

TONK, a native state of India, in the Rajputana agency. It consists of six isolated tracts, some of which are under the Central India agency. Total area, 2553 sq. m.; total population (1901), 273,201; estimated revenue £77,000. No tribute is payable. The chief, whose title is nawab, is a Mahommedan of Afghan descent. The founder of the family was Amir Khan, the notorious Pindari leader at the beginning of the 19th century, who received the present territory on submitting to the British in 1817. The nawab Mahommed Ibrahim Ali Khan, G.C.I.E., succeeded in 1867, and was one of the few chiefs who attended both Lord Lytton's Durbar in 1877 and the Delhi Durbar of 1903 as rulers of their states. The late minister, Sir Sahibzada Obeidullah Khan, was deputed on political duty to Peshawar during the Tirah campaign of 1897. Grain, cotton, opium and hides are the chief exports. Two of the outlying tracts of the state are served by two railways. Distress was caused by drought in 1899–1900. The town of Tonk is situated 1462 ft. above sea-level, 60 m. by road south from Jaipur, near the right bank of the river Banas. Pop. (1901), 38,759. It is surrounded by a wall, with a mud fort. It has a high school, the Walter female hospital under a lady superintendent, and a hospital for males.

There is another town in India called Tonk, or Tank, in Dera Ismail Khan district, North-West Frontier Province; pop. (1901), 4402. It is the residence of a nawab, who formerly exercised semi-independent powers. Here Sir Henry Durand, lieutenant-governor of the Punjab, was killed in 1870 when passing on an elephant under a gateway.

TONNAGE. The mode of ascertaining the tonnage of merchant ships is settled by the Merchant Shipping Acts. But before explaining the method by which this is computed, it is well to remark that there are several tonnages employed in different connexions. *Displacement tonnage* is that which is invariably used in respect of warships, and is the actual weight of water displaced by the vessel whose tonnage is being dealt with. Men-of-War are designed to carry all their weights, including coal, guns, ammunition, stores and water in tanks and in boilers, at a certain draught, and the tonnage attributed to them is the weight of water which at that designed draught they actually displace. This displacement tonnage is therefore a total made up of the actual weight of the ship's fabric and that of everything that is on board of her. It can be found by ascertaining the exact cubic space occupied by the part of her body which is immersed (including her rudder, propellers and external shafting) at the draught under consideration in cubic feet, and dividing this by 35, since 35 cubic feet of sea-water weigh one ton. Of course there is nothing to prevent displacement tonnage from being used in describing the size of merchant ships, and indeed in regard to the performances of fast steamships on trial it is usual to give their draught on the occasion when they are tested, and to state what was their actual displacement under these trial conditions. But it is obvious, from what has been said as to the components which go to make up the displacement at load draught, that this tonnage must, in respect of any individual ship, be the greatest figure which can be quoted in regard to her size. It is usual for dues to be assessed against merchant vessels in respect of their *registered tonnage*. This must therefore be fixed by authority, and at present vessels are measured by the officer of customs according to the rules laid down in the second schedule to the Merchant Shipping Act 1894. As will be seen from the explanation of the method adopted, this is a somewhat arbitrary process, and even the gross registered tonnage affords little indication of the actual size of the ship, whilst the under-deck and net tonnages are still less in accord with the extreme dimensions.

As to *length for tonnage*, the measurements start with the tonnage deck, which in vessels with less than three decks is the upper, and in vessels of three or more decks is the second from below. The length for tonnage is measured in a straight line along this deck from the inside of the inner plank at the bow to the inside of the inner plank at the stern, making allowance for the rake, if any, which the midship bow and stern timbers may have in the actual deck. When this is measured it is apparent into which of five classes the ship's tonnage-length places her. If she be under 50 ft. in length she falls into the first class, while if she be over 225 ft. in length she falls into the fifth class, the remaining three classes being intermediate to these. Vessels of the first class are measured as in four equal sections, and vessels of the larger class as in twelve equal sections, according to their length. Then at each of the points of division so marked off *transverse areas* are taken. This is done by measuring the depth in feet from a point at a distance of one-third of the round of the beam below the tonnage deck to the upper side of the floor timbers. Where the vessel has a ceiling and no water-ballast tanks at the point of measurement, 2½ in. is allowed for ceiling. But where there are such tanks the measurement is taken from the top of the tank and no allowance is made for ceiling, whether there in fact be any or not. If the midship depth so found exceeds 16 ft., each depth is divided into six equal parts, and the horizontal breadths are measured at each point of division and also at the upper and lower points of the depth, extending each measurement to the average thickness of that part of the ceiling which is between the points of measurement. They are then numbered from above, and the second, fourth and sixth multiplied by four, whilst the third and fifth are multiplied by two. The products are then added together. To the sum are added the first and the seventh breadths. This total having been multiplied by one-third the common interval between the breadths, the resultant is the transverse area. The transverse areas so obtained at each point of the vessel's length are numbered from the bow aft. Omitting the first and last, the second and every even area so obtained are multiplied by four, whilst the third and every odd area are multiplied by two. These products are added together, as are also those of the first and last areas if they yield anything, and the figure thus reached is multiplied by one-third of the common interval between the areas. This product is reckoned as the *cubical capacity of the*

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[1] Jowett's translation.

ship in feet. When divided by 100 the result is the *registered under-deck tonnage* of the ship—subject to the additions and deductions ordered by the act. Directions of a kind similar to those already set out are given whereby the tonnage in the space enclosed between the tonnage and upper decks may be ascertained, and also for the measuring of any break, poop or other permanent closed-in space on the upper deck available for stores, and the sum of the capacity of these must be added to the under-deck tonnage to arrive at the *gross registered tonnage*. But an express proviso is enacted that no addition shall be made in respect of any building erected for the shelter of deck passengers and approved by the board of trade. In the process of arriving at the *net tonnage* the main deduction allowed from the gross tonnage is that of machinery space in steamships. The method of measurement here is similar to that by which the under-deck tonnage is reached. Where the engines and boilers are fitted in separate compartments, each compartment is measured separately, as is the screw shaft tunnel in the case of steamships propelled by screws. The tonnage of these spaces is reckoned, not from the tonnage deck, but from the crown of the space; whilst, if it has previously been reckoned in the gross tonnage, there may be an allowance for the space above the crown, if enclosed for the machinery or for the admission of light and air. Allowances are only made in respect of any machinery space if it be devoted solely to machinery or to light and air. It must not be used for cargo purposes or for cabins. Further, by the act itself in the case of paddle steamships, where the machinery space is above 20% and under 30% of the gross tonnage, it is allowed to be reckoned as 37% of such gross tonnage; whilst similarly, in the case of screw steamships, where such machinery space is over 13% and under 20% of the gross tonnage, it is allowed to be reckoned as 32%. Further deductions are also made in respect of space used solely for the accommodation of the master and the crew, and for the chart-room and signal-room, as well as for the wheel-house and chain cable locker and for the donkey-engine and boiler, if connected with the main pumps of the ship, and in sailing vessels for the sail locker. The space in the double bottom and in the water-ballast tanks, if these be not available for the carriage of fuel stores or cargo, is also deducted if it has been reckoned in the gross tonnage in the first instance.

From the rules above laid down it follows that it is possible for vessels, if built with a full midship section, to have a gross registered tonnage considerably below what the actual cubical capacity of the ship would give, whilst in the case of steam tugs of high power it is not unprecedented, owing to the large allowances for machinery and crew spaces, for a vessel to have a registered net tonnage of nil.

Suez Canal dues being charged on what is practically the registered tonnage (though all deductions permitted by the British board of trade are not accepted), it is usual, at all events in the British navy, for warships to be measured for what would be their registered tonnage if they were merchant ships, so that in case they may wish to pass through the canal a scale of payment may be easily reached. But such tonnage is never spoken of in considering their size relative to other vessels.

Two other tonnages are also made use of in connexion with merchant ships, especially when specifications for vessels are being made. The first of these is *measurement capacity*. This is found by measuring out the true cubic capacity of the holds, whereby it is found what amount of light measurement goods can be carried. The second is *deadweight capacity*. This is generally given as excluding what is carried in the coal bunkers, and it is therefore the amount of deadweight which can be carried in the holds at load draught when the vessel is fully charged with coals and stores. (B. W. G.)

TONNAGE AND POUNDAGE, in England, customs duties anciently imposed upon exports and imports, the former being a duty upon all wines imported in addition to prisage and butlerage, the latter a duty imposed *ad valorem* at the rate of twelvepence in the pound on all merchandise imported or exported. The duties were levied at first by agreement with merchants (poundage in 1302, tonnage in 1347), then granted by parliament in 1373, at first for a limited period only. They were considered to be imposed for the defence of the realm. From the reign of Henry VI. until that of James I. they were usually granted for life. They were not granted to Charles I., and in 1628 that king took the unconstitutional course of levying them on his own authority, a course denounced a few years later by 16 Car. I. c. 18 (1640), when the Long Parliament granted them for two months. After the Restoration they were granted to Charles II. and his two successors for life. By acts of Anne and George I. the duties were made perpetual, and mortgaged for the public debt. In 1787 they were finally abolished, and other modes of obtaining revenue substituted, by 27 Geo. III. c. 13 (1787).

Poundage also signifies a fee paid to an officer of a court for his services, *e.g.* to a sheriff's officer, who is entitled by 29 Eliz. c. 4 (1586–1587) to a poundage of a shilling in the pound on an execution up to £100, and sixpence in the pound above that sum.

TONNERRE, a town of north-central France, capital of an arrondissement in the department of Yonne, 52 m. S.E. of Sens on the Paris-Lyon railway. Pop. (1906), 3974. It is situated on a slope of the vineclad hills on the left bank of the Armançon. At the foot of the hill rises the spring of Fosse-Dionne, enclosed in a circular basin 49 ft. in diameter. The town has two interesting churches. That of St Pierre, which crowns the hill, possesses a fine lateral portal of the Renaissance period to which the church, with the exception of the choir (1351), belongs. The church of Notre-Dame is mainly Gothic, but the façade is a fine specimen of Renaissance architecture. The Salle des Malades, a large timber-roofed apartment in the hospital, dates from the end of the 13th century and is used as a chapel. It is 330 ft. long and contains the tombs of Margaret of Burgundy, wife of Charles of Anjou, king of Sicily, and foundress of the hospital, and of François-Michel Le Tellier, marquis of Louvois, war minister of Louis XIV. The hospital itself was rebuilt in the 19th century. The Renaissance Hôtel d'Uzès was built in the 16th century. Tonnerre is the seat of a sub-prefect and has a tribunal of first instance. The vineyards of the vicinity produce well-known wines. The trade of the town is chiefly in wine, in the good building-stone found in the neighbourhood and in Portland cement. Cooperage is carried on.

Its ancient name of *Tornodorum* points to a Gallic or Gallo-Roman origin for Tonnerre. In the 6th century it became the capital of the region of Tonnerrois and in the 10th century of a countship. After passing into the possession of several noble families, it was bought from a count of Clermont-Tonnerre by Louvois, by whose descendants it was held up to the time of the Revolution.

TONQUA BEAN. The Tonqua, Tonka or Tonquin bean, also called the coumara nut, is the seed of *Dipterix odorata*, a leguminous tree growing to a height of 80 ft., native of tropical South America. The drupe-like pod contains a single seed possessed of a fine sweet "new-mown hay" odour, due to the presence of coumarin (*q.v.*). Tonqua beans are used principally for scenting snuff and as an ingredient in perfume sachets and in perfumers' "bouquets."

TÖNSBERG, a fortified seaport of Norway, in Jarlsberg-Laurvik *amt* (county), situated on a bay on the south coast, near the entrance to Christiania Fjord, 72 m. S. by W. of Christiania on the Skien railway. Pop. (1900), 8620. It is one of the most ancient towns in Norway. It is the headquarters of a sealing and whaling fleet. The principal industries are refineries for preparing whale and seal oil and saw-mills. An interesting collection of antiquities and whaling implements is preserved in the Slotstaarn on Castle Hill.

TONSILLITIS, acute inflammation of the tonsils, or quinsy, due to the invasion of the tonsil, or tonsils, by septic micro-organisms which may have gained access through the mouth or by the blood-stream. Sometimes the attack comes on as the result of direct exposure to sewer gas, and it is not at all an uncommon affection of house surgeons, nurses and others who have to spend most of their time in a hospital. The association of quinsy with rheumatism may be the result of the infection of the tonsils by the micro-organisms or the toxins of that disease. Acute tonsillitis is very apt to run on to the formation of abscess. Quinsy may begin with a feeling of chilliness or with an attack of shivering. Then comes on a swelling in the throat with pain, tenderness and difficulty in swallowing. Indeed, if both tonsils are acutely inflamed it may be impossible to swallow even fluid and the breathing may be seriously embarrassed. The temperature may be raised several degrees. There is pain about the ear and about the jaw, and there is a swelling of the glands in the neck. The breath is offensive and the tongue is thickly coated. There may be some yellowish markings on the surface of the tonsil, but these differ from the patches of "false membrane" of diphtheria in that they can be easily brushed off by a swab, but often a true diagnosis can only be made by bacteriological examination. The treatment consists in giving a purgative, and in encouraging the patient to use an inhaler containing hot carbolized water. Hot compresses also may be applied to the neck. As regards medicines, the most trustworthy are salicylic acid, iron and quinine. As soon as abscess threatens, a slender-bladed knife should be thrust from before backward deeply into the swollen mass. And if, as most likely happens, matter then escapes, the patient's distress speedily ends. Convalescence having set in, a change of air and course of tonic treatment will be advisable.

Chronic tonsillitis is often associated with adenoid vegetations at the back of the throat of tuberculous or delicate children, such children being spoken of as being "liable to sore throat." Chronic enlargement of the tonsils may seriously interfere with a child's general health and vigour and, should the condition not subside under general measures such as a stay at a bracing seaside place and the taking of cod-liver oil and iron, it will be well to treat the tonsils by operation. (E. O.*)

TONSON, the name of a family of London booksellers and publishers. Richard and Jacob Tonson (*c.* 1656–1736), sons of a London barber-surgeon, started in 1676 and 1677 independently as booksellers and publishers in London. In 1679 Jacob, the better known of the two, bought and published Dryden's *Troilus and Cressida*, and from that time was closely associated with Dryden, and published most of his works. He published the *Miscellany Poems* (1684–1708) under Dryden's editorship, the collection being known indifferently as *Dryden's* or *Tonson's Miscellany*, and also Dryden's translation of Virgil (1697). Serious disagreements over the price paid, however, arose between poet and publisher, and in his *Faction Displayed* (1705) Dryden described Tonson as having "two left legs, and Judas-coloured hair." Subsequently the relations between the two men improved. The brothers jointly published Dryden's *Spanish Friar* (1683). Jacob Tonson also published Congreve's *Double Dealer*, Sir John Vanbrugh's *The Faithful Friend* and *The Confederacy*, and the pastorals of Pope, thus justifying Wycherly's description of him as "gentleman usher to the Muses." He bought also the valuable rights of *Paradise Lost*, half in 1683 and half in 1690. This was his first profitable venture in poetry. In 1712 he became joint publisher with Samuel Buckley of the *Spectator*, and in the following year published Addison's *Cato*. He was the original secretary and a prominent member of the Kit-Cat Club. About 1720 he gave up business and retired to Herefordshire, where he died on the 2nd of April 1736. His business was carried on by his nephew, Jacob Tonson, jun. (d. 1735), and subsequently by his grand-nephew, also Jacob (d. 1767).

TONSURE (Lat. *tonsura*, from *tondere*, to shave), a religious observance in the Roman Catholic and Orthodox Eastern Churches, consisting of the shaving or cutting part of the hair of the head as a sign of dedication to special service. The reception of the tonsure in these churches is the initial ceremony which marks admission to orders and to the rights and privileges of clerical standing. It is administered by the bishop with an appropriate ritual. Candidates for the rite must have been confirmed, be adequately instructed in the elements of the Christian faith, and be able to read and write. Those who have received it are bound (unless in exceptional circumstances) to renew the mark, consisting of a bare circle on the crown of the head, at least once a month, otherwise they forfeit the privileges it carries. The practice is not a primitive one; Tertullian simply advises Christians to avoid vanity in dressing their hair, and Jerome deprecates both long and closely cropped hair. According to Prudentius (Περισ. xiii. 30) it was customary for the hair to be cut short at ordination. Paulinus of Nola (*c.* 490) alludes to the tonsure as in use among the (Western) monks; from them the practice quickly spread to the clergy. For Gaul about the year 500 we have the testimony of Sidonius Apollinaris (iv. 13), who says that Germanicus the bishop had his hair cut "in rotae speciem."

The earliest instance of an ecclesiastical precept on the subject occurs in can. 41 of the Council of Toledo (A.D. 633): "omnes clerici, detonso superius capite toto, inferius solam circuli coronam relinquant." Can. 33 of the Quinisext council (692) requires even singers and readers to be tonsured. Since the 8th century three tonsures have been more or less in use, known respectively as the Roman, the Greek and the Celtic. The first two are sometimes distinguished as the tonsure of Peter and the tonsure of Paul. The Roman or St Peter's tonsure prevailed in France, Spain and Italy. It consisted in shaving the whole head, leaving only a fringe of hair supposed to symbolize the crown of thorns. Late in the middle ages this tonsure was lessened for the clergy, but retained for monks and friars. In the Eastern or St Paul's tonsure the whole head was shaven, but when now practised in the Eastern Church this tonsure is held to be adequately shown when the hair is shorn close. In the Celtic tonsure (tonsure of St John, or, in contempt, tonsure of Simon Magus) all the hair in front of a line drawn over the top of the head from ear to ear was shaven (a fashion common among the Hindus). The question of the Roman or Celtic tonsure was one of the points in dispute in the early British Church, settled in favour of the Roman fashion at the Council of Whitby (664). The tonsure at first was never given separately, and even children when so dedicated were appointed readers, as no one could belong to the clerical state without at least a minor order. From the 7th century, however, children were tonsured without ordination, and later on adults anxious to escape secular jurisdiction were often tonsured without ordination. Till the 10th century the tonsure could be given by priests or even by laymen, but its bestowal was gradually restricted to bishops and abbots.

TONTINE, a system of life insurance owing its name to Lorenzo Tonti, an Italian banker, born at Naples early in the 17th century, who settled in France about 1650. In 1653 he proposed to Cardinal Mazarin a new scheme for promoting a public loan. A total of 1,025,000 livres was to be subscribed in ten portions of 102,500 livres each by ten classes of subscribers, the first class consisting of persons under 7, the second of persons above 7 and under 14, and so on to the tenth, which consisted of persons between 63 and 70. The annual fund of each class was to be divided among the survivors of that class, and on the death of the last individual the capital was to fall to the state. This plan of operations was authorized under the name of "tontine royale" by a royal edict, but this the parlement refused to register, and the idea remained in abeyance till 1689, when it was revived by Louis XIV., who established a tontine of 1,400,000 livres divided into fourteen classes of 100,000 each, the subscription being 300 livres. This tontine was carried on till 1726, when the last beneficiary died—a widow who at the time of her decease was drawing an annual income of 73,500 livres. Several other government tontines were afterwards set on foot; but in 1763 restrictions were introduced, and in 1770 all tontines at the time in existence were wound up. Private tontines continued to flourish in France for some years, the "tontine Lafarge," the most celebrated of the kind, being opened in 1791 and closed in 1889.

The tontine principle has often been applied in Great Britain, at one time in connexion with government life annuities. Many such tontines were set on foot between the years 1773 and 1789, those of 1773, 1775 and 1777 being commonly called the Irish tontines, as the money was borrowed under acts of the Irish parliament. The most important English tontine was that of 1789, which was created by 29 Geo. III. c. 41. Under this act over a million was raised in 10,000 shares of £100, 5s. It was also often applied to the purchase of estates or the erection of buildings. The investor staked his money on the chance of his own life or the life of his nominee enduring for a longer period than the other lives involved in the speculation, in which case he expected to win a large prize. It was occasionally introduced into life assurance, more particularly by American life offices, but newer and more ingenious forms of contract have now made the tontine principle practically a thing of the past. (See NATIONAL DEBT; INSURANCE.)

TOOKE, JOHN HORNE (1736–1812), English politician and philologist, third son of John Horne, a poulterer in Newport Market, whose business the boy when at Eton happily veiled under the title of a "Turkey merchant," was born in Newport Street, Long Acre, Westminster, on the 25th of June 1736. After passing some time at school in Soho Square, and at a Kentish village, he went from 1744 to 1746 to Westminster School and for the next five or six years was at Eton. On the 12th of January 1754 he was admitted as sizar at St John's College, Cambridge, and took his degree of B.A. in 1758, as last but one of the *senior optimes*, Richard Beadon, his lifelong friend, afterwards bishop of Bath and Wells, being a wrangler in the same year. Horne had been admitted on the 9th of November 1756, as student at the Inner Temple, making the friendship of John Dunning and Lloyd Kenyon, but his father wished him to take orders in the English Church, and he was ordained deacon on the 23rd of September 1759 and priest on the 23rd of November 1760. For a few months he was usher at a boarding school at Blackheath, but on the 26th of September 1760 he became perpetual curate of New Brentford, the incumbency of which his father had purchased for him, and he retained its scanty profits until 1773. During a part of this time (1763–1764) he was absent on a tour in France, acting as the bear-leader of a son of the miser Elwes. Under the excitement created by the actions of Wilkes, Horne plunged into politics, and in 1765 brought out a scathing pamphlet on Lords Bute and Mansfield, entitled "The Petition of an Englishman." In the autumn of 1765 he escorted to Italy the son of a Mr Taylor. In Paris he made the acquaintance of Wilkes, and from Montpellier, in January 1766, addressed a letter to him which sowed the seeds of their personal antipathy. In the summer of 1767 Horne landed again on English soil, and in 1768 secured the return of Wilkes to parliament for Middlesex. With inexhaustible energy he promoted the legal proceedings over the riot in St George's Fields, when a youth named Allen was killed, and exposed the irregularity in the judge's order for the execution of two Spitalfields weavers. His dispute with George Onslow, member for Surrey, who at first supported and then threw over Wilkes for place, culminated in a civil action, ultimately decided, after the reversal of a verdict which had been obtained through the charge of Lord Mansfield, in Horne's favour, and in the loss by his opponent of his seat in parliament. An influential association, called "The Society for Supporting the Bill of Rights," was founded, mainly through the exertions of Horne, in 1769, but the members were soon divided into two opposite camps, and in 1771 Horne and Wilkes, their respective leaders, broke out into open warfare, to the damage of their cause. On the 1st of July 1771 Horne obtained at Cambridge, though not without some opposition from members of both the political parties, his degree of M.A. Earlier in that year he claimed for the public the right of printing an account of the debates in parliament, and after a protracted struggle between the ministerial majority and the civic authorities, the right was definitely established. The energies of the indefatigable parson knew no bounds. In the same year (1771) he crossed swords with Junius, and ended in disarming his masked antagonist. Up to this time Horne's fixed income consisted of those scanty emoluments attached to a position which galled him daily. He resigned his benefice in 1773 and betook himself to the study of the law and philology. An accidental circumstance, however, occurred at this moment which largely affected his future. His friend Mr William Tooke had purchased a considerable estate, including Purley Lodge, south of the town of Croydon in Surrey. The possession of this property brought about frequent disputes with an adjoining landowner, Thomas de Grey, and, after many actions in the courts, his friends endeavoured to obtain, by a bill forced through the houses of parliament, the privileges which the law had not assigned to him (February 1774). Horne, thereupon, by a bold libel on the Speaker, drew public attention to the case, and though he himself was placed for a time in the custody of the serjeant-at-arms, the clauses which were injurious to the interest of Mr Tooke were eliminated from the bill. Mr Tooke declared his intention of making Horne the heir of his fortune, and, if the design was never carried into effect, during his lifetime he bestowed upon him large gifts of money. No sooner had this matter been happily settled than Horne found himself involved in serious trouble. For his conduct in signing the advertisement soliciting subscriptions for the relief of the relatives of the Americans "murdered by the king's troops at Lexington and Concord," he was tried at the Guildhall on the 4th of July 1777, before Lord Mansfield, found guilty, and committed to the King's Bench prison in St George's Fields, from which he only emerged after a year's durance, and after a loss in fines and costs amounting to £1200. Soon after his deliverance he applied to be called to the bar, but his application was negatived on the ground that his orders in the Church were indelible. Horne thereupon tried his fortune, but without success, on farming some land in Huntingdonshire. Two tracts about this time exercised great influence in the country. One of them, *Facts Addressed to Landholders*, &c. (1780), written by Horne in conjunction with others, criticizing the measures of Lord North's ministry, passed through numerous editions; the other, *A Letter on Parliamentary Reform* (1782), addressed by him to Dunning, set out a scheme of reform, which he afterwards withdrew in favour of that advocated by Pitt. On his return from Huntingdonshire he became once more a frequent guest at Mr Tooke's house at Purley, and in 1782 assumed the name of Horne Tooke. In 1786 Horne Tooke conferred perpetual fame upon his benefactor's country house by adopting, as a second title of his elaborate philological treatise of Ἔπεα πτερόεντα, the more popular though misleading title of *The Diversions of Purley*. The treatise at once attracted attention in England and the Continent. The first part was published in 1786, the second in 1805. The best edition is that which was published in 1829, under the editorship of Richard Taylor, with the additions written in the author's interleaved copy.

Between 1782 and 1790 Tooke gave his support to Pitt, and in the election for Westminster, in 1784, threw all his energies into opposition to Fox. With Fox he was never on terms of friendship, and Samuel Rogers, in his *Table Talk*, asserts that their antipathy was so pronounced that at a dinner party given by a prominent Whig not the slightest notice was taken by Fox of the presence of Horne Tooke. It was after the election of Westminster in 1788 that Tooke depicted the rival statesmen (Lord Chatham and Lord Holland, William Pitt and C. J. Fox) in his celebrated pamphlet of *Two Pair of Portraits*. At the general election of 1790 he came forward as a candidate for that distinguished constituency, in opposition to Fox and Lord Hood, but was defeated; and, at a second trial in 1796, he was again at the bottom of the poll. Meantime the excesses of the French republicans had provoked reaction in England, and the Tory ministry adopted a policy of repression. Horne Tooke was arrested early on the morning of the 16th of May 1794, and conveyed to the Tower. His trial for high treason lasted for six days (17th to 22nd of November) and ended in his acquittal, the jury only taking eight minutes to settle their verdict. His public life after this event was only distinguished by one act of importance. Through the influence of the second Lord Camelford, the fighting peer, he was returned to parliament in 1801 for the pocket borough of Old Sarum. Lord Temple endeavoured to secure his exclusion on the ground that he had taken orders in the Church, and one of Gilray's caricatures delineates the two politicians, Temple and Camelford, playing at battledore and shuttlecock, with Horne Tooke as the shuttlecock. The ministry of Addington would not support this suggestion, but a bill was at once introduced by them and carried into law, which rendered all persons in holy orders ineligible to sit in the House of Commons, and Horne Tooke sat for that parliament only.

The last years of Tooke's life were spent in retirement in a house on the west side of Wimbledon Common. The traditions of his Sunday parties have lasted unimpaired to this day, and the most pleasant pages penned by his biographer describe the politicians and the men of letters who gathered round his hospitable board. His conversational powers rivalled those of Dr Johnson; and, if more of his sayings have not been chronicled for the benefit of posterity, the defect is due to the absence of a Boswell. Through the liberality of his friends, his last days were freed from the pressure of poverty, and he was enabled to place his illegitimate son in a position which soon brought him wealth, and to leave a competency to his two illegitimate daughters. Illness seized him early in 1810, and for the next two years his sufferings were acute. He died in his house at Wimbledon on the 18th of March 1812, and his body was buried with that of his mother at Ealing, the tomb which he had prepared in the garden attached to his house at Wimbledon being found unsuitable for the interment. An altar-tomb still stands to his memory in Ealing churchyard. A catalogue of his library was printed in 1813.

The *Life of Horne Tooke*, by Alexander Stephens, is written in an unattractive style and was the work of an admirer only admitted to his acquaintance at the close of his days. The notice in the *Quarterly Review*, June 1812, of W. Hamilton Reid's compilation, is by J. W. Ward, Lord Dudley. The main facts of his life are set out by Mr J. E. Thorold Rogers, in his *Historical Gleanings*, 2nd series. Many of Horne Tooke's wittiest sayings are preserved in the *Table Talk* of Samuel Rogers and S. T. Coleridge. (W. P. C.)

TOOKE, THOMAS (1774–1858), English economist, was born at St Petersburg on the 29th of February 1774. Entering a large Russian house in London at an early age, he acquired sound practical experience of commercial matters and became a recognized authority on finance and banking. He was one of the earliest advocates of free trade and drew up the *Merchants' Petition* presented to the House of Commons by Alexander Baring, afterwards Lord Ashburton. He gave evidence before several parliamentary committees, notably the committee of 1821, on foreign trade, and those of 1832, 1840 and 1848 on the Bank Acts. He was elected a fellow of the Royal Society in 1821. He died in London on the 26th of February 1858.

Tooke was the author of *Thoughts and Details on the High and Low Prices of the last Thirty Years* (1823), *Considerations on the State of the Currency* (1826), in both of which he showed his hostility to the policy afterwards carried out in the Bank Act of 1844, but he is best known for his *History of Prices and of the State of the Circulation during the Years 1793–1856* (6 vols., 1838–1857). In the first four volumes he treats (*a*) of the prices of corn, and the circumstances affecting prices; (*b*) the prices of produce other than corn; and (*c*) the state of the circulation. The two final volumes, written in conjunction with W. Newmarch (*q.v.*), deal with railways, free trade, banking in Europe and the effects of new discoveries of gold.

TOOL (O. Eng. *tól*, generally referred to a root seen in the Goth. *taujan*, to make, or in the English word "taw," to work or dress leather), an implement or appliance used by a worker in the treatment of the substances used in his handicraft, whether in the preliminary operations of setting out and measuring the materials, in reducing his work to the required form by cutting or otherwise, in gauging it and testing its accuracy, or in duly securing it while thus being treated.

For the tools of prehistoric man see such articles as ARCHAEOLOGY; FLINT IMPLEMENTS; and EGYPT, § *Art and Archaeology*.

In beginning a survey of tools it is necessary to draw the distinction between hand and machine tools. The former class includes any tool which is held and operated by the unaided hands, as a chisel, plane or saw. Attach one of these to some piece of operating mechanism, and it, with the environment of which it is the central essential object, becomes a machine tool. A very simple example is the common power-driven hack saw for metal, or the small high-speed drill, or the wood-boring auger held in a frame and turned by a winch handle and bevel-gears. The difference between these and a big frame-saw cutting down a dozen boards simultaneously, or the immense machine boring the cylinders of an ocean liner, or the great gun lathe, or the hydraulic press, is so vast that the relationship is hardly apparent. Often the tool itself is absolutely dwarfed by the machine, of which nevertheless it is the central object and around which the machine is designed and built. A milling machine weighing several tons will often be seen rotating a tool of but two or three dozen pounds' weight. Yet the machine is fitted with elaborate slides and self-acting movements, and provision for taking up wear, and is worth some hundreds of pounds sterling, while the tool may not be worth two pounds. Such apparent anomalies are in constant evidence. We propose, therefore, first to take a survey of the principles that underlie the forms of tools, and then pursue the subject of their embodiment in machine tools.

Hand Tools

The most casual observation reveals the fact that tools admit of certain broad classifications. It is apparent that by far the larger number owe their value to their capacity for cutting or removing portions of material by an incisive or wedge-like action, leaving a smooth surface behind. An analysis of the essential methods of operation gives a broad grouping as follows:—

I. The chisel group .	Typified by the chisel of the woodworker.
II. The shearing group .	,, ,, scissors.
III. The scrapers . . .	,, ,, cabinet-maker's scrape.
IV. The percussive and detrusive group .	,, ,, hammer and the punch.
V. The moulding group .	,, ,, trowel.

The first three are generally all regarded as cutting tools, notwithstanding that those in II. and III. do not operate as wedges, and therefore are not true chisels. But many occupy a border-line where the results obtained are practically those due to cutting, as in some of the shears, saws, milling cutters, files and grinding wheels, where, if the action is not directly wedge-like, it is certainly more or less incisive in character.

Cutting Tools.—The cutting edge of a tool is the practical outcome of several conditions. Keenness of edge, equivalent to a small degree of angle between the tool faces, would appear at first sight to be the prime element in cutting, as indeed it is in the case of a razor, or in that of a chisel for soft wood. But that is not the prime condition in a tool for cutting iron or steel. Strength is of far greater importance, and to it some keenness of edge must be sacrificed. All cutting tools are wedges; but a razor or a chisel edge, included between angles of 15° or 20°, would be turned over at once if presented to iron or steel, for which angles of from 60° to 75° are required. Further, much greater rigidity in the latter, to resist spring and fracture, is necessary than in the former, because the resistance to cutting is much greater. A workman can operate a turning tool by hand, even on heavy pieces of metal-work. Formerly all turning, no matter how large, was done by hand-operated tools, and after great muscular exertion a few pounds of metal might be removed in an hour. But coerce a similarly formed tool in a rigid guide or rest, and drive it by the power of ten or twenty men, and it becomes possible to remove say a hundredweight of chips in an hour. Or, increase the size of the tool and its capacity for endurance, and drive by the power of 40 or 60 horses, and half a ton of chips may be removed in an hour.

All machine tools of which the chisel is the type operate by cutting; that is, they act on the same principle and by the same essential method as the knife, razor or chisel, and not by that of the grindstone. A single tool, however, may act as a cutting instrument at one time and as a scrape at another. The butcher's knife will afford a familiar illustration. It is used as a cutting tool when severing a steak, but it becomes a scrape when used to clean the block. The difference is not therefore due to the form of the knife, but to the method of its application, a distinction which holds good in reference to the tools used by engineers. There is a very old hand tool once much used in the engineer's turnery, termed a "graver." This was employed for cutting and for scraping indiscriminately, simply by varying the angle of its presentation. At that time the question of the best cutting angles was seldom raised or discussed, because the manipulative instinct of the turner settled it as the work proceeded, and as the material operated on varied in texture and degree of hardness. But since the use of the slide rest holding tools rigidly fixed has become general, the question of the most suitable tool formation has been the subject of much experiment and discussion. The almost unconscious experimenting which goes on every day in every workshop in the world proves that there may be a difference of several degrees of angle in tools doing similar work, without having any appreciable effect upon results. So long as certain broad principles and reasonable limits are observed, that is sufficient for practical purposes.

Clearly, in order that a tool shall cut, it must possess an incisive form. In fig. 1, *A* might be thrust over the surface of the plate of metal, but no cutting action could take place. It would simply grind and polish the surface. If it were formed like *B*, the grinding action would give place to scraping, by which some material would be removed. Many tools are formed thus, but there is still no incisive or knife-like action, and the tool is simply a scrape and not a cutting tool. But *C* is a cutting tool, possessing penetrative capacity. If now *B* were tilted backwards as at *D*, it would at used becomes a scraping tool. But its parallel face would rub and grind on the surface of the work, producing friction and heat, and interfering with the penetrative action of the cutting edge. On the other hand, if C were tilted forwards as at D, its action would approximate to that of a wedge for its most [illegible] cutting. But the high angle of the keener bevelled face would not afford adequate support to the cutting edge, and the tool would [illegible] because [illegible] of greater rapidity, precisely as that of a razor or wood-working tools would quickly wear away if applied to hard metals. It is therefore

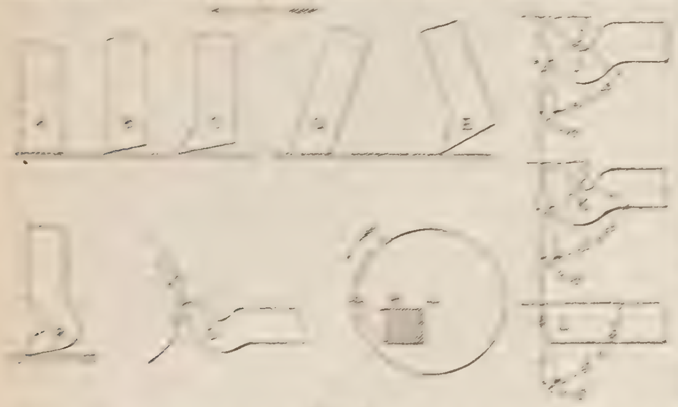


FIG. 1.

A. Tool which would become [illegible] only.
B. Scraper.
C. Keen top tool.
D. and E. [illegible] and cutting, [illegible] preserved.
F, G, H. Presentation of tools for planing, turning and boring respectively.
J, K, L. Tools to make angles of relief: a, clearance angle or bottom rake; b, front or top rake; c, tool angle.

therefore that the correct form for a cutting tool must depend upon a due balance being maintained between the angle of the front and of the bottom faces, those of top rake and clearance rake, or clearance, considered in regard to their relation to the work. Since tools used in machines are held rigidly in one position, differing in this respect from hand-operated tools, it follows that a constant angle should be given to the cutting tools which are used for operating on a given kind of metal or alloy. It does not matter whether a tool is fitted in a lathe, in a planing machine, or a shaper or a slotter; whether it is a cutting or shearing tool, it is always maintained in a fixed [illegible] to the work at the point of application as in fig. 1, F, G, H, for planing, turning and boring respectively. It is a matter of general knowledge that the softer and more fibrous the metal, the keener must be the formation of the tool, and that, conversely, the harder and more crystalline the metal, the more obtuse must be the cutting angles, as in the extremes of the razor and the tools for cutting iron and steel already instanced. The three figures J, K, L show tools suitably formed for wrought iron and mild steel, for cast iron and cast steel, and for brass respectively. Cast iron and cast steel could not be cut properly with the first, nor wrought iron and mild steel with the second, nor either with the third. The angles given are those which accord best with general practice, but they are not constant, being varied by conditions, especially by lubrication and rigidity of the machine. The profiles of the first and second tools are given mainly with the view of leaving material for grinding away without the need for frequent reforging. But there are many tools which are formed quite differently when used in tool-holders and in turrets, though the same essential principles of angle are observed.

The *angle of clearance*, or *relief*, *a*, in fig. 1, is an important detail of a cutting tool. It is of greater importance than an exact angle of top rake. But given some sufficient angle of clearance, its exact amount is not of much moment. Neither need it be uniform for a given cutting edge. It may vary from say 3° to 10°, or even 20°, and under good conditions little or no practical differences will result. Actually it need never vary much from 5° to 7°. The object in giving a clearance angle is simply to prevent friction between the non-cutting face immediately adjacent to the edge and the surface of the work. The limit to this clearance is that at which insufficient support is afforded to the cutting edge. These are the two facts which if fulfilled permit of a considerable range in clearance angle. The softer the metal being cut the greater can be the clearance; the harder the material the less clearance is permissible because the edge requires greater *support*.

The *front* or *top rake*, *b* in fig. 1, is the angle or slope of the front or top face of the tool. It is varied mainly according to the [illegible] or [illegible] of [illegible]. In the [illegible] and [illegible] metals [illegible] the more [illegible] metals and alloys the broken appearance of the chips is distinguished from the [illegible] removed from the fibrous materials. This is a feature which always distinguishes cast iron and unannealed cast steel from mild steel, high carbon steel from that low in carbon, and cast iron from wrought iron. It indicates too that [illegible] is put on the tool in breaking up the chips, [illegible] their severance, and when the comminutions are very small they indicate insufficient top rake. This is a result that turners try to avoid when possible, or at least to minimize. Now the greater the slope of the top rake the more easily will the cuttings come away, with the minimum of break in the [illegible] materials, and absolutely unbroken over lengths of many feet in the [illegible] ones. The breaking up, or the continuity, of the cuttings therefore affords an indication of the suitability of the amount of top rake to the work. But compromise often has to be made between the ideal and the actual. The amount of top rake has to be limited in the harder metals and alloys in order to secure a *strong tool angle*, without which tools would lack the endurance required to sustain them through several hours without regrinding.

The *tool angle*, *c*, is the angle included between top and bottom faces, and its amount, or thickness expressed in degrees, is a measure of the strength and endurance of any tool. At extremes it varies from about 15° to 85°. It is traceable in all kinds of tools, having very diverse forms. It is difficult to place some groups in the cutting category; they are on the border-line between cutting and scraping instruments.

Typical Tools.—A bare enumeration of the diverse forms in which tools of the chisel type occur is not even possible here. The grouped illustrations (figs. 2 to 8) show some of the types, but it will be understood that each is varied in dimensions, angles and outlines to suit all the varied kinds of metals and alloys and conditions of operation. But, as every tool has to be gripped in a holder of some kind, as a lathe-rest, tool-box, turret, tool-holder, box, cross-slide, etc., this often determines the choice of some one form in preference to another. A broad division is that into roughing and finishing

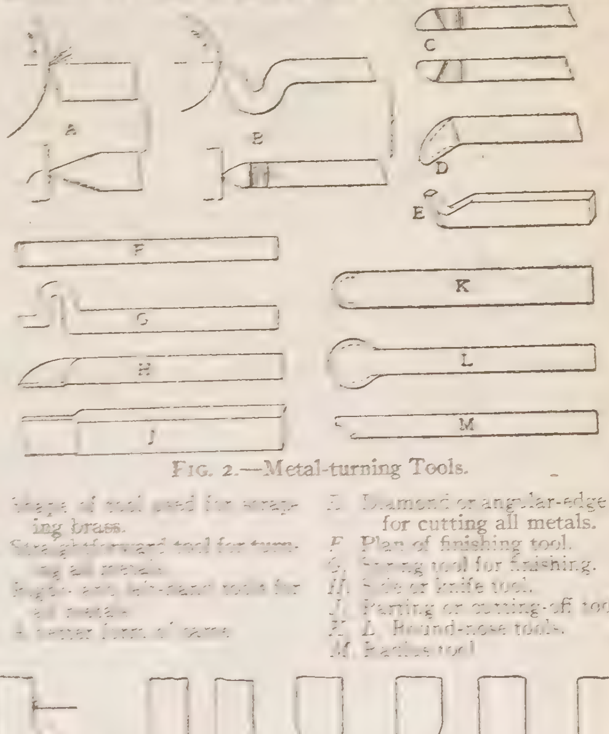


FIG. 2.—Metal-turning Tools.

A, Shape of tool used for scraping brass.
B, Straightforward tool for turning all metals.
C, Right- and left-hand tools for all metals.
D, A better form of same.
E, Diamond or angular-edge tool for cutting all metals.
F, Plan of finishing tool.
G, Spring tool for finishing.
H, Side or knife tool.
J, Parting or cutting-off tool.
K, L, Round-nose tools.
M, Radius tool.

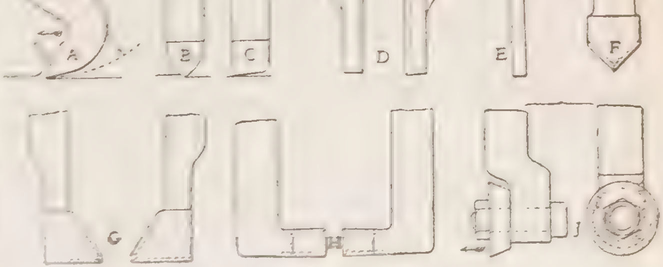


FIG. 3.—Group of Planer Tools.

A, Planer type of tool, cranked to avoid digging into the work.
B, Face view of roughing tool.
C, Face view of finishing tool.
D, Right- and left-hand knife or side tools.
E, Parting or cutting-off or grooving tool.
F, V-tool for grooves.
G, Right- and left-hand tools for V-slots.
H, Ditto for T-slots.
J, Radius tool held in holder.

(fig. 13, *E*), hence termed a "boring head." As lathe heads are fixed, the traverse cannot be imparted to the bars as in boring machines. The boring heads can be traversed, or the work can be traversed by the mechanism of the lathe saddle. The latter must be done when cutters are fixed in bars. A great deal of difference exists in the details of the fittings both of bars and heads, but they are not so arbitrary as they might seem at first sight. The principal differences are those due to the number of cutters used, their shapes, and their method of fastening. Bars receiving their cutters direct include one, two or four, cutting on opposite sides, and therefore balanced. Four give better balance than two, the cutters being set at right angles. If a rough hole runs out of truth, a single cutter is better than a double-ended one, provided a tool of the roughing shape is used. The shape of the tools varies from roughing to finishing, and their method of attachment is by screws, wedges or nuts, but we cannot illustrate the numerous differences that are met with.

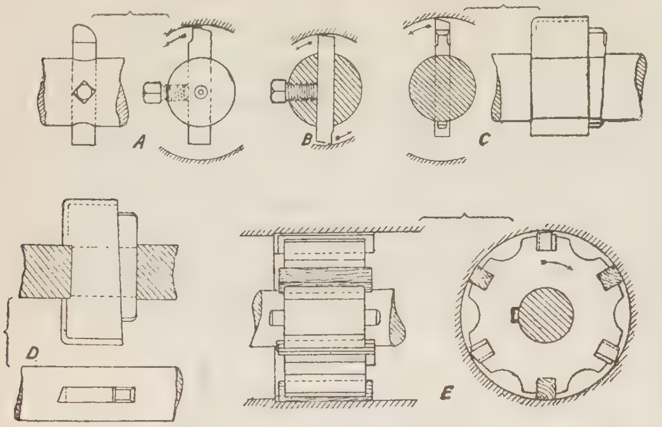


FIG. 13.—Group of Supported Boring Tools.

A, Single-ended cutter in boring bar.
B, Double-ended ditto.
C, Flat single-ended finishing cutter.
D, Flat double-ended finishing cutter.
E, Boring head with three cutters and three steady blocks.

Saws.—The saws are a natural connecting link between the chisels and the milling cutters. Saws are used for wood, metal and stone. Slabs of steel several inches in thickness are sawn through as readily as, though more slowly than, timber planks. Circular and band saws are common in the smithy and the boiler and machine shops for cutting off bars, forgings and rolled sections. But the tooth shapes are not those used for timber, nor is the cutting speed the same. In the individual saw-teeth both cutting and scraping actions are illustrated (fig. 14). Saws which cut timber continuously with the grain, as rip, hand, band, circular, have incisive teeth. For though many are destitute of front rake, the method of sharpening at an angle imparts a true shearing cut. But all cross-cutting teeth scrape only, the teeth being either of triangular or of M-form, variously modified. Teeth for metal cutting also act strictly by scraping. The pitching of the teeth is related to the nature of the material and the direction of cutting. It is coarser for timber than for metal, coarser for ripping or sawing with the grain than for cross cutting, coarser for soft than for hard woods. The *setting* of teeth, or the bending over to right and left, by which the clearance is provided for the blade of the saw, is subject to similar variations. It is greatest for soft woods and least for metals, where in fact the clearance is often secured without set, by merely thinning the blade backwards. But it is greater for cross cutting than for ripping timber. Gulleting follows similar rules. The softer the timber, the greater the gulleting, to permit the dust to escape freely.

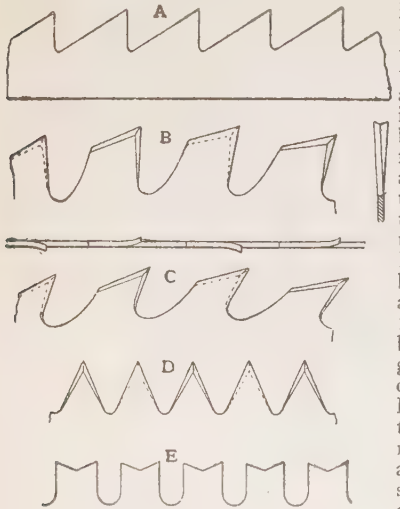


FIG. 14.—Typical Saw Teeth.

A, Teeth of band and ripping saws.
B, Teeth of circular saw for hard wood; shows *set*.
C, Ditto for soft wood.
D, Teeth of cross-cut saw.
E, M-teeth for ditto.

Milling Cutters.—Between a circular saw for cutting metal and a thin milling cutter there is no essential difference. Increase the thickness as if to produce a very wide saw, and the essential plain edge milling cutter for metal results. In its simplest form the milling cutter is a cylinder with teeth lying across its periphery, or parallel with its axis—the *edge mill* (fig. 15), or else a disk with teeth radiating on its face, or at right angles with its axis—the *end mill* (fig. 16). Each is used indifferently for producing flat faces and edges, and for cutting grooves which are rectangular in cross-section. These milling cutters invade the province of the single-edged tools of the planer, shaper and slotter. Of these two typical forms the

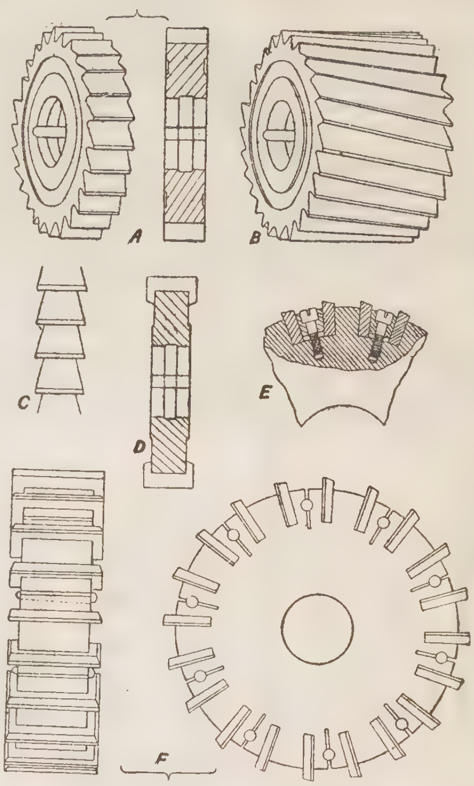


FIG. 15.—Group of Milling Cutters.

A, Narrow edge mill, with straight teeth.
B, Wide edge mill with spiral teeth.
C, Teeth on face and edges.
D, Cutter having teeth like *C*.
E, Flat teeth held in with screws and wedges.
F, Large inserted tooth mill; with taper pins secure cutters.

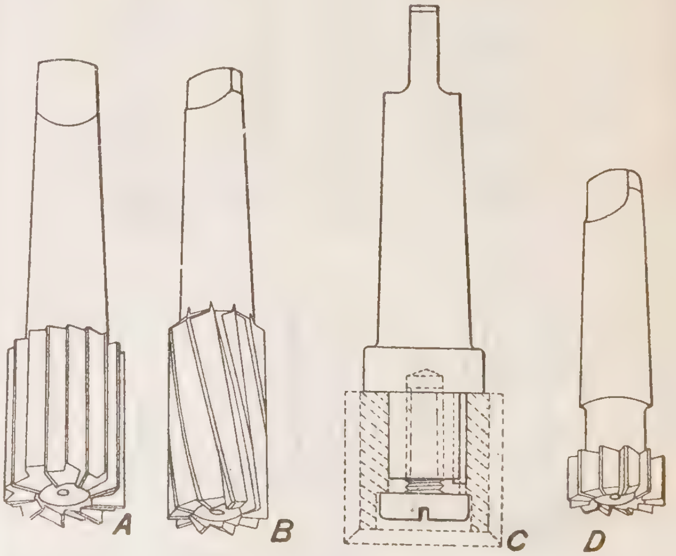


FIG. 16.—Group of End Mills.

A, End mill with straight teeth. *B*, Ditto with spiral teeth. *C*, Showing method of holding shell cutter on arbor, with screw and key. *D*, T-slot cutter.

changes are rung in great variety, ranging from the narrow slitting tools which saw off bars, to the broad cutters of 24 in. or more in width, used on plano-millers.

When more than about an inch in width, surfacing cylindrical cutters are formed with spiral teeth (fig. 15, B), a device which is

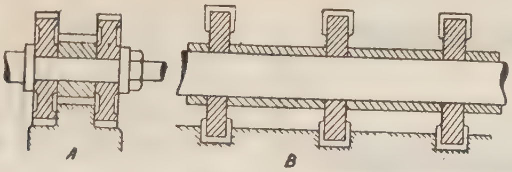


FIG. 17.

A, Straddle Mill, cutting faces and edges.
B, Set of three mills cutting grooves.

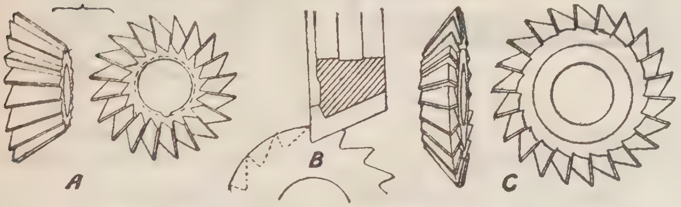


FIG. 18.—Group of Angular Mills.

A, Cutter with single slope.
B, Ditto, producing teeth in another cutter.
C, Double Slope Mill, with unequal angles.

essential to sweetness of operation, the action being that of shearing. These have their teeth cut on universal machines, using the dividing and spiral head and suitable change wheels, and after hardening they are sharpened on universal grinders. When cutters exceed about 6 in. in length the difficulties of hardening and grinding render the "gang" arrangement more suitable. Thus, two, three or more similar edge mills are set end to end on an arbor, with the spiral teeth running in reverse directions, giving a broad face with balanced endlong cutting forces. From these are built up the numerous gang mills, comprising plane faces at right angles with each other, of which the straddle mills are the best known (fig. 17, A). A common element in these combinations is the key seat type B having teeth on the periphery and on both faces as in fig. 15, C, D. By these combinations half a dozen faces or more can be tooled simultaneously, and all alike, as long as the mills retain their edge. The advantages over the work of the planer in this class of work are seen in tooling the faces and edges of machine tables, beds and slides, in shaping the faces and edges of caps to fit their bearing blocks. In a single cutter of the face type, but having teeth on back and edge also, T-slots are readily milled (fig. 16, D); this if done on the planer would require re-settings of awkwardly cranked tools, and more measurement and testing with templets than is required on a milling machine.

When angles, curves and profile sections are introduced, the capacity of the milling cutter is infinitely increased. The making of the cutters is also more difficult. Angular cutters (fig. 18) are used for producing the teeth of the mills themselves, for shaping the teeth of ratchet wheels, and, in combination with straight cutters in gangs, for angular sections. With curves, or angles and curves in combination, taps, reamers and drills can be fluted or grooved, the teeth of wheels shaped, and in fact any outlines imparted (fig. 19). Here the work of the fitter, as well as that of the planing and allied machines, is invaded, for much of this work if prepared on these machines would have to be finished laboriously by the file.

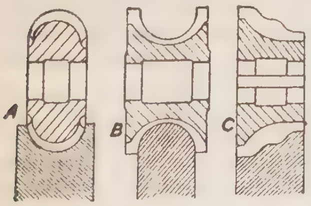


FIG. 19.

A, Convex Cutter.
B, Concave Cutter.
C, Profile Cutter.

There are two ways in which milling cutters are used, by which their value is extended; one is to transfer some of their work proper to the lathe and boring machine, the other is by duplication. A good many light circular sections, as wheel rims, hitherto done in lathes, are regularly prepared in the milling machine, gang mills being used for tooling the periphery and edges at once, and the wheel blank being rotated. Similarly, holes are bored by a rotating mill of the cylindrical type. Internal screw threads are done similarly. Duplication occurs when milling sprocket wheels in line, or side by side, in milling nuts on an arbor, in milling a number of narrow faces arranged side by side, in cutting the teeth of several spur-wheels on one arbor and in milling the teeth of racks several at a time.

One of the greatest advances in the practice of milling was that of making backed-off cutters. The sectional shape behind the tooth face is continued identical in form with the profile of the edge, the outline being carried back as a curve equal in radius to that of the cutting edge (fig. 20). The result is that the cutter may be sharpened on the front faces of the teeth without interfering with the shape which will be milled, because the periphery is always constant in outline. After repeated sharpenings the teeth would assume the form indicated by the shaded portion on two of the teeth. The limit of grinding is reached when the tooth becomes too thin and weak to stand up to its work. But such cutters will endure weeks or months of constant service before becoming useless. The

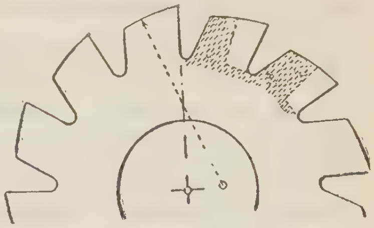


FIG. 20.—Relieved Teeth of Milling Cutter.

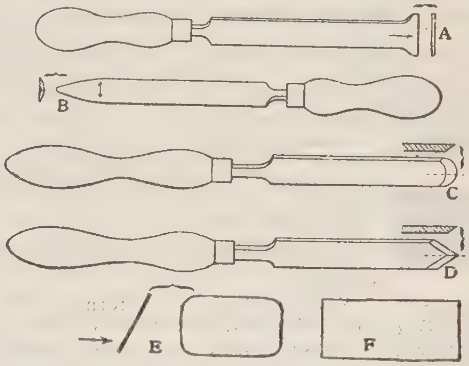


FIG. 21.—Group of Scrapes.

A, Metal-worker's scrape, pushed straightforward.
B, Ditto, operated laterally.
C, Round-nosed tool used by wood-turners.
D, Diamond point used by wood-turners.
E, *F*, Cabinet-makers' scrapes.

chief advantage of backing-off or relieving is in its application to cutters of intricate curves, which would be difficult or impossible to sharpen along their edges. Such cutters, moreover, if made with ordinary teeth would soon be worn down, and be much weaker than the strong form of teeth represented in fig. 20. The relieving is usually done in special lathes, employing a profile tool which cuts the surface

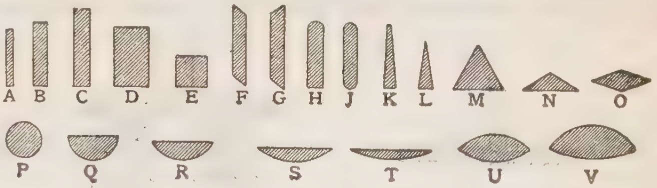


FIG. 22.—Cross-sectional Shapes of Files.

A, Warding.
B, Mill.
C, Flat.
D, Pillar.
E, Square.
F, *G*, Swaged reapers.
H, Mill.
J, Topping.
K, Reaper.
L, Knife.
M, Three-square.
N, Cant.
O, Slitting or feather-edge.
P, Round.
Q, Pit-saw or frame-saw.
R, Half-round.
S, *T*, Cabinet.
U, Tumbler.
V, Crossing.

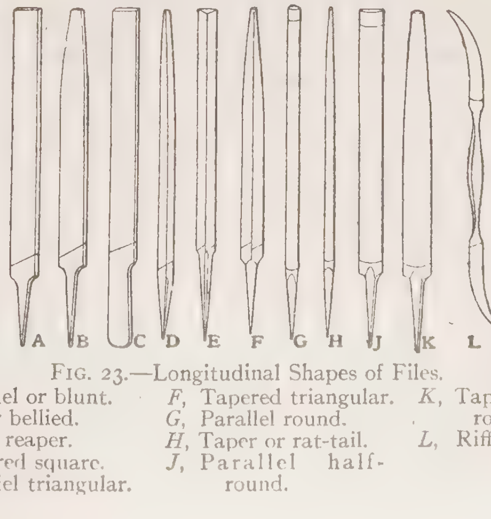


FIG. 23.—Longitudinal Shapes of Files.

A, Parallel or blunt.
B, Taper bellied.
C, Knife reaper.
D, Tapered square.
E, Parallel triangular.
F, Tapered triangular.
G, Parallel round.
H, Taper or rat-tail.
J, Parallel half-round.
K, Tapered half-round.
L, Riffler.

of the teeth back at the required radius. Relieved cutters can of course be strung together on a single arbor to form gang mills, by which very complicated profiles may be tooled, beyond the capacity of a single solid mill.

Scrapes.—The tools which operate by scraping (fig. 21) include many of the broad finishing tools of the turner in wood and metal (cf. fig. 2), and the scrape of the wood worker and the fitter. The practice of scraping surfaces true, applied to surface plates, machine slides and similar objects, was due to Sir Joseph Whitworth. It superseded the older and less accurate practice of grinding to a mutual fit. Now, with machines of precision, the practice of grinding has to a large extent displaced the more costly scraping. Scraping is, however, the only method available when the most perfect contact is desired. Its advantage lies in the fact that the efforts of the workman can be localized over the smallest areas, and nearly infinitesimal amounts removed, a mere fine dust in the last stages.

Files.—These must in strictness be classed with scrapes, for, although the points are keen, there is never any front rake. Collectively there is a shearing action because the rows of teeth are cut diagonally. The sectional forms (fig. 22) and the longitudinal forms (fig. 23) of the files are numerous, to adapt them to all classes of work. In addition, the method of cutting, and the degrees of coarseness of the teeth, vary, being single, or float cut, or double cut (fig. 24). The rasps are another group. Degrees of coarseness are designated as rough, middle cut, bastard cut, second cut, smooth, double dead smooth; the first named is the coarsest, the last the finest. The terms are relative, since the larger a file is the coarser are its teeth, though of the same name as the teeth in a shorter file, which are finer.

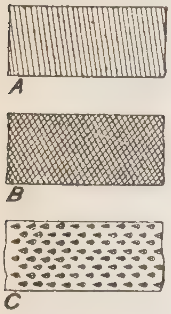


FIG. 24.—File Teeth.

A, Float cut.
B, Double cut.
C, Rasp cut.

Screwing Tools.—The forms of these will be found discussed under SCREW. They can scarcely be ranked among cutting tools, yet the best kinds remove metal with ease. This is due in great measure to the good clearance allowed, and to the narrowness of the cutting portions. Front rake is generally absent, though in some of the best screwing dies there is a slight amount.

Shears and Punches.—These may be of cutting or non-cutting types. Shears (fig. 25) have no front rake, but only a slight clearance. They generally give a slight shearing cut, because the blades do not lie parallel, but the cutting begins at one end and continues in detail to the other. But strictly the shears, like the punches, act by a severe detrusive effort; for the punch, with its bolster (fig. 26), forms a pair of cylindrical shears. Hence a shorn or punched edge is always rough, ragged, and covered with minute, shallow cracks. Both processes are therefore dangerous to iron and steel. The metal being unequally stressed, fracture starts in the annulus of metal. Hence the advantage of the practice of reamering out this annulus, which is completely removed by enlargement by about an ⅛ in. diameter, so that homogeneous metal is left throughout the entire unpunched section. The same results follow reamering both in iron and steel. Annealing, according to many experiments, has the same effect as reamering, due to the rearrangement of the molecules of metal. The perfect practice with punched plates is to punch, reamer, and finally to anneal. The effect of shearing is practically identical with that of punching, and planing and annealing shorn edges has the same influence as reamering and annealing punched holes.

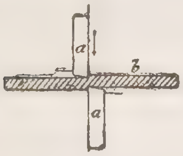


FIG. 25.—Shear Blades.
a, *a*, Blades.
b, Plate being sheared.

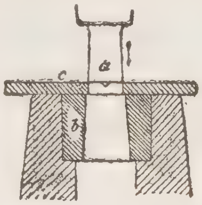


FIG. 26.—Punching.
a, Punch. *b*, Bolster.
c, Plate being punched.

Hammers.—These form an immense group, termed percussive, from the manner of their use (fig. 27). Every trade has its own peculiar shapes, the total of which number many scores, each with its own appropriate name, and ranging in size from the minute forms of the jeweler to the sledges of the smith and boiler maker and the planishing hammers of the coppersmith. Wooden hammers are termed mallets, their purpose being to avoid bruising tools or the surfaces of work. Most trades use mallets of some form or another. Hammer handles are rigid in all cases except certain percussive tools of the smithy, which are handled with withy rods, or iron rods flexibly attached to the tools, so that when struck by the sledge they shall not jar the hands. The fullering tools, and flatters, and setts, though not hammers strictly, are actuated by percussion. The dies of the die forgers are actuated percussively being closed by powerful hammers. The action of caulking too is percussive, and so is that of moulders' rammers.

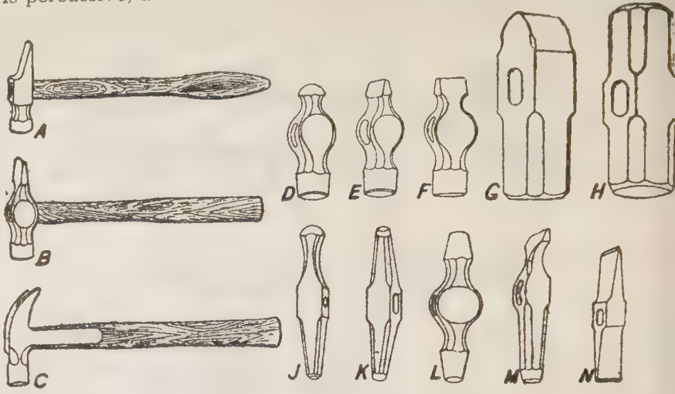


FIG. 27.—Hammers.

A, Exeter type.
B, Joiner's hammer.
C, Canterbury claw hammer (these are wood-workers' hammers).
D, Engineer's hammer, ball pane.
E, Ditto, cross-pane.
F, Ditto, straight pane.
G, Sledge hammer, straigh pane.
H, Ditto, double-faced.
J, *K*, *L*, *M*, Boiler makers' hammers.
N, Scaling hammer.

Moulding Tools.—This is a group of tools which, actuated eithe by simple pressure or percussively, mould, shape and model forms in the sand of the moulder, in the metal of the smith, and in press work. All the tools of the moulder (fig. 28) with the exception of the rammers and vent wires act by moulding the sand into shapes by pressure. Their contours correspond with the plane and curve surfaces of moulds, and with the requirements of shallow and dee work. They are made in iron and brass. The fullers, swages an flatters of the smith, and the dies used with hammer and presses all mould by percussion or by pressure, the work taking the counter part of the dies, or of some portion of them. The practice of di forging consists almost wholly of moulding processes.

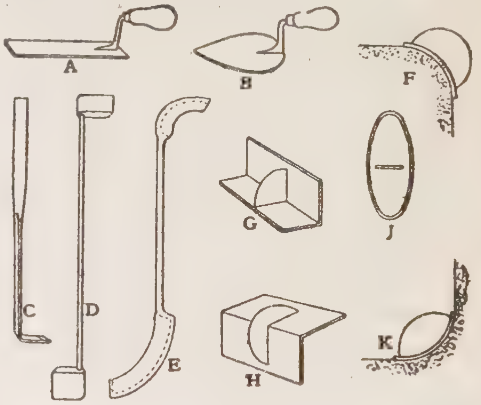


FIG. 28.—Moulding Tools.

A, Square trowel.
B, Heart trowel.
C, *D*, Cleaners.
E, Flange bead.
F, Hollow bead.
G, *H*, Square corner sleekers.
J, Button sleeker
K, Pipe smoother

Tool Steels.—These now include three kinds. The commo steel, the controlling element in which is carbon, requires to b hardened and tempered, and must not be overheated, about 500° F being the highest temperature permissible—the *critical* temperature. Actually this is seldom allowed to be reached. The disadvantage of this steel is that its capabilities are limited, because th heat generated by heavy cutting soon spoils the tools. The secon is the Mushet steel, invented by R. F. Mushet in 1868, a carbo steel, in which the controlling element is tungsten, of which it contain from about 5 to 8%. It is termed *self-hardening*, because it cooled in air instead of being quenched in water. Its value consist in its endurance at high temperatures, even at a low red hea Until the advent of the high-speed steels, Mushet steel wa reserved for all heavy cutting, and for tooling hard toug steels. It is made in six different tempers suitable for variou kinds of duty. Tools of Mushet steel must not be forged belo a red heat. It is hardened by reheating the end to a white hea and blowing cold in an air blast. The third kind of steel is terme *high-speed*, because much higher cutting speeds are practicab with these than with other steels. Tools made of them are hardene in a blast of cold air. The controlling elements are numerous an vary in the practice of different manufacturers, to render th tools adaptable to cutting various classes of metals and alloys. Tungsten is the principal controlling element, but chromium is essential, and molybdenum and vanadium are often found of value. The steels are forged at a yellow tint, equal to about 1850° F. They are raised to a white heat for hardening, and cooled in an air blast to a bright red. They are then often quenched in a bath of oil.

The first public demonstration of the capacities of high speed steels was made at the Paris Exhibition of 1900. Since that time great advances have been made. It has been found that the section of the shaving limits the practicable speeds, so that, although cutting speeds of 300 and 400 ft. a minute are practicable with light cuts, it is more economical to limit speeds to less than 100 ft. per minute with much heavier cuts. The use of water is not absolutely essential as in using tools of carbon steel. The new steels show to much greater advantage on mild steel than on cast iron. They are more useful for roughing down than for finishing. The removal of 20 lb of cuttings per minute with a single tool is common, and that amount is often exceeded, so that a lathe soon becomes half buried in turnings unless they are carted away. The horse-power absorbed is proportionately large. Ordinary heavy lathes will take from 40 to 60 h.p. to drive them, or from four to six times more than is required by lathes of the same centres using carbon steel tools. Many remarkable records have been given of the capacities of the new steels. Not only turning and planing tools but drills and milling cutters are now regularly made of them. It is a revelation to see these drills in their rapid descent through metal. A drill of 1 in. in diameter will easily go through 5 in. thickness of steel in one minute.

Machine Tools

The machine tools employed in modern engineering factories number many hundreds of well-defined and separate types. Besides these, there are hundreds more designed for special functions, and adapted only to the work of firms who handle specialities. Most of the first named and many of the latter admit of grouping in classes. The following is a natural classification:

I. *Turning Lathes.*—These, by common consent, stand as a class alone. The cardinal feature by which they are distinguished is that the work being operated on rotates against a tool which is held in a rigid fixture—the rest. The axis of rotation may be horizontal or vertical.

II. *Reciprocating Machines.*—The feature by which these are characterized is that the relative movements of tool and work take place in straight lines, to and fro. The reciprocations may occur in horizontal or vertical planes.

III. *Machines which Drill and Bore Holes.*—These have some features in common with the lathes, inasmuch as drilling and boring are often done in the lathes, and some facing and turning in the drilling and boring machines, but they have become highly differentiated. In the foregoing groups tools having either single or double cutting edges are used.

IV. *Milling Machines.*—This group uses cutters having teeth arranged equidistantly round a cylindrical body, and may therefore be likened to saws of considerable thickness. The cutters rotate over or against work, between which and the cutters a relative movement of travel takes place, and they may therefore be likened to reciprocating machines, in which a revolving cutter takes the place of a single-edged one.

V. *Machines for Cutting the Teeth of Gear-wheels.*—These comprise two sub-groups, the older type in which rotary milling cutters are used, and the later type in which reciprocating single-edged tools are employed. Sub-classes are designed for one kind of gear only, as spur-wheels, bevels, worms, racks, &c.

VI. *Grinding Machinery.*—This is a large and constantly extending group, largely the development of recent years. Though emery grinding has been practised in crude fashion for a century, the difference in the old and the new methods lies in the embodiment of the grinding wheel in machines of high precision, and in the rivalry of the wheels of corundum, carborundum and alundum, prepared in the electric furnace with those of emery.

VII. *Sawing Machines.*—In modern practice these take an important part in cutting iron, steel and brass. Few shops are without them, and they are numbered by dozens in some establishments. They include circular saws for hot and cold metal, band saws and hack saws.

VIII. *Shearing and Punching Machines.*—These occupy a border line between the cutting and non-cutting tools. Some must be classed with the first, others with the second. The detrusive action also is an important element, more especially in the punches.

IX. *Hammers and Presses.*—Here there is a percussive action in the hammers, and a purely squeezing one in the presses. Both are made capable of exerting immense pressures, but the latter are far more powerful than the former.

X. *Portable Tools.*—This large group can best be classified by the common feature of being readily removable for operation on large pieces of erection that cannot be taken to the regular machines. Hence they are all comparatively small and light. Broadly they include diverse tools, capable of performing nearly the whole of the operations summarized in the preceding paragraphs.

XI. *Appliances.*—There is a very large number of articles which are neither tools nor machine tools, but which are indispensable to the work of these; that is, they do not cut, or shape, or mould, but they hold, or grip, or control, or aid in some way or other the carrying through of the work. Thus a screw wrench, an angle plate, a wedge, a piece of packing, a bolt, are appliances. In modern practice the appliance in the form of a templet or jig is one of the principal elements in the interchangeable system.

XII. *Wood-working Machines.*—This group does for the conversion of timber what the foregoing accomplish for metal. There is therefore much underlying similarity in many machines for wood and metal, but still greater differences, due to the conditions imposed on the one hand by the very soft, and on the other by the intensely hard, materials operated on in the two great groups.

XIII. *Measurement.*—To the scientific engineer, equally with the astronomer, the need for accurate measurement is of paramount importance. Neither good fitting nor interchangeability of parts is possible without a system of measurement, at once accurate and of ready and rapid application. Great advances have been made in this direction lately.

I.—Lathes

The popular conception of a lathe, derived from the familiar machine of the wood turner, would not give a correct idea of the lathe which has been developed as the engineer's machine tool. This has become differentiated into nearly fifty well-marked types, until in some cases even the term lathe has been dropped for more precise definitions, as vertical boring machine, automatic machine, while in others prefixes are necessary, as axle lathe, chucking lathe, cutting-off lathe, wheel lathe, and so on. With regard to size and mass the height of centres may range from 3 in. in the bench lathes to 9 or 10 ft. in gun lathes, and weights will range from say 50 lb to 200 tons, or more in exceptional cases. While in some the mechanism is the simplest possible, in others it is so complicated that only the specialist is able to grasp its details.

Early Lathes.—Space will not permit us to trace the evolution of the lathe from the ancient bow and card lathe and the pole lathe, in each of which the rotary movement was alternately forward, for cutting, and backward. The curious thing is that the wheel-driven lathe was a novelty so late as the 14th and 15th centuries, and had not wholly displaced the ancient forms even in the West in the 19th century, and the cord lathe still survives in the East. Another thing is that all the old lathes were of *dead centre*, instead of *running mandrel* type; and not until 1794 did the use of metal begin to take the place of wood in lathe construction. Henry Maudslay (1771–1831) did more than any other man to develop the engineer's self-acting lathe in regard to its essential mechanism, but it was, like its immediate successors for fifty years after, a skeleton-like, inefficient weakling by comparison with the lathes of the present time.

Broad Types.—A ready appreciation of the broad differences in lathe types may be obtained by considering the differences in the great groups of work on which lathes are designed to operate. Castings and forgings that are turned in lathes vary not only in size, but also in relative dimensions. Thus a long piece of driving shafting, or a railway axle, is very differently proportioned in length and diameter from a railway wheel or a wheel tire. Further, while the shaft has to be turned only, the wheel or the tire has to be turned and bored. Here then we have the first cardinal distinction between lathes, viz. those admitting work *between centres* (fig. 29) and *face* and *boring* lathes. In the first the piece of work is pivoted and driven between the centres of head-stock and tail-stock or loose poppet; in the second, it is held and gripped only by the dogs or jaws of a face-plate, on the head-stock spindle, the loose poppet being omitted.

These, however, are broad types only, since proportions of length to diameter differ, and with them lathe designs are modified whenever there is a sufficient amount of work of one class to justify the laying down of a special machine or machines to deal with it. Then further, we have duplicate designs, in which, for example, provision is made in one lathe for turning two or three long shafts simultaneously, or for turning and boring two wheels or tires at once. Further, the position of the axis of a face lathe need not be horizontal, as is necessary when the turning of long pieces has to be done between centres. There are obvious advantages in arranging it vertically, the principal being that castings and forgings can be more easily set and secured to a horizontal chuck than to one the face of which lies vertically. The chuck is also better supported, and higher rates of turning are practicable. In recent years these *vertical lathes* or vertical turning and boring mills (fig. 30) have been greatly increasing in numbers; they also occur in several designs to suit either general or special duties, some of them being used for boring only, as *chucking lathes*. Some are of immense size, capable of boring the field magnets of electric generators 40 ft. in diameter.

Standard Lathes.—But for doing what is termed the general work of the engineer's turnery, the standard lathes (fig. 29) predominate, *i.e.* self-acting, sliding and surfacing lathes with headstock, loose poppet and slide-rest, centres, face plates and chucks, and an equipment by which long pieces are turned, either between centres or on the face chucks, and bored. One of the greatest objections to the employment of these standard types of lathes for indiscriminate duty is due to the limited height of the centres or axis of the headstock, above the face of the bed. This is met generally by providing a *gap* or deep recess in the bed next the fast headstock, deep enough to take face work of large diameter. The device is very old and very common, but when the volume of work warrants the employment of separate lathes for face-work and for that done between centres it is better to have them.

Screw-cutting.—A most important section of the work of the engineer's turnery is that of cutting screws (see SCREW). This has resulted in differentiation fully as great as that existing between centres and face-work. The slide-rest was designed with this object, though it is also used for plain turning. The standard "self-acting sliding, surfacing and screw-cutting lathe" is essentially the standard turning lathe, with the addition of the screw-cutting mechanism. This includes a master screw—the *lead* or *guide screw*, which is gripped with a *clasp nut*, fastened to the travelling carriage of the slide-rest. The lead-screw is connected to the headstock spindle by *change wheels*, which are the variables through which the relative rates of movement of the spindle and the lead-screw, and therefore of the screw-cutting tool, held and traversed in the slide-rest, are effected. By this beautiful piece of mechanism a guide screw, the pitch of which is permanent, is made to cut screw-threads of an almost infinite number of possible pitches, both in whole and fractional numbers, by virtue of rearrangements of the variables, the change wheels. The objection to this method is that the trains of change wheels have to be recalculated and rearranged as often as a screw of a different pitch has to be cut, an operation which takes some little time. To avoid this, the *nest* or *cluster system* of gears has been largely adopted, its most successful embodiment being in the Hendey-Norton lathe. Here all the change wheels are arranged in a series permanently on one shaft underneath the headstock, and any one of them is put into engagement by a sliding pinion operated by the simple movement of a lever. Thus the lead-screw is driven at different rates without removing any wheel from its spindle. This has been extensively applied to both small and large lathes. But a moment's thought will show that even this device is too cumbrous when large numbers of small screws are required. There is, for example, little in common between the screw, say of 5 or 6 ft. in length, for a massive penstock or valve, and ½-in. bolts, or the small screws required in thousands for electrical fittings. Clearly while the self-acting screw-cutting lathe is the best possible machine to use for the first, it is unsuitable for the last. So here at once, from the point of view of screw cutting only, an important divergence takes place, and one which has ultimately led to very high specialization.

Small Screws.—When small screws and bolts are cut in

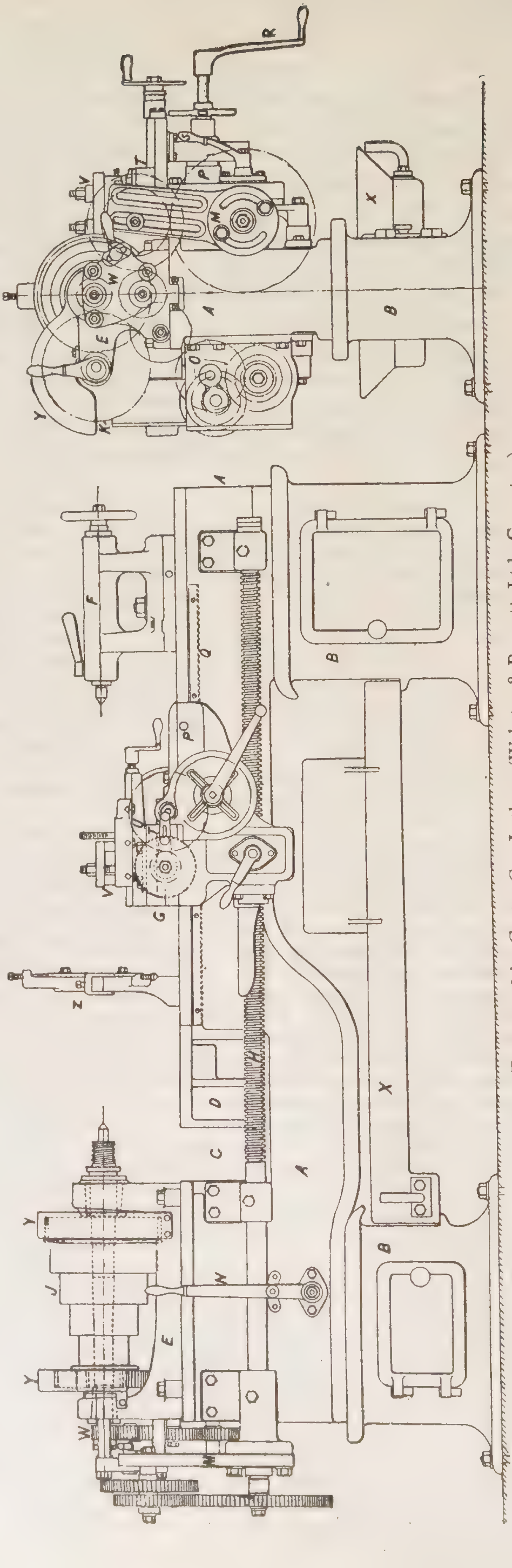


FIG. 29.—8-in. Centre Gap Lathe. (Webster & Bennett, Ltd., Coventry.)

A, Bed.
B, *B*, Cupboard legs or cabinets.
C, Gap.
D, Bridge piece.
E, Headstock.
F, Loose poppet.
G, Slide-rest.
H, Lead-screw.
J, Driving cones.
K, Back-gears.
L, Change wheels.
M, Swing plate for ditto.
N, Hand lever for changing speeds of sliding and surfacing through gears *O*.
P, Saddle or carriage.
Q, Rack.
R, Rack operating handle for sliding.
S, Clasp nut operating handle for screw cutting.
T, Cross-slide.
U, Swivel-slide.
V, Tool-holder.
W, Reversing plate.
X, Waste oil tray.
Y, Guards over gear wheels.
Z, Hinged steady to support work when boring.

large quantities, the guide-screw and change wheels give place to other devices, one of which involves the use of a separate master-screw for every different pitch, the other that of encircling cutting instruments or *dies*. The first are represented by the *chasing lathe*, the second by the *screwing lathes* and *automatics*. Though the principles of operation are thus stated in brief, the details in design are most extensive and varied.

In a chasing lathe the master-screw or *hob*, which may be either at the rear of the headstock or in front of the slide-rest, receives a hollow clasp-nut or a half-nut, or a star-nut containing several pitches, which, partaking of the traverse movement of the screw-thread, imparts the same horizontal movement to the cutting tool. The latter is sometimes carried in a hinged holder, sometimes in a common slide-rest. The attendant throws it into engagement at the beginning of a traverse, and out when completed, and also changes the hobs for threads of different sections. The screwed stays of locomotive fire-boxes are almost invariably cut on chasing lathes of this class.

In the screwing machines the thread is cut with dies, which encircle the rotating bar; or alternatively the dies rotate round a fixed pipe, and generally the angular *lead* or advance of the thread draws the dies along. These dies differ in no essentials from similar tools operated by a hand lever at the bench. There are many modifications of these lathes, because the work is so highly specialized that they are seldom used for anything except the work of cutting screws varying but little in dimensions. Such being the case they can hardly be classed as lathes, and are often termed screwing machines, because no provision exists for preliminary turning work, which is then done elsewhere, the task of turning and threading being divided between two lathes. In some cases this is an economical system, but in others not. It cannot be considered so when bolts, screws and allied forms are of small dimensions.

Hollow Mandrel Lathes.—It has been the growing practice since the last decade of the 19th century to produce short articles, required in large quantities, from a long bar. This involves making the lathe with a hollow mandrel; that is, the mandrel of the headstock has a hole drilled right through it, large enough to permit of the passage through it of the largest bar which the class of work requires. Thus, if the largest section of the finished pieces should require a bar of $1\frac{1}{2}$ in. diameter, the hole in the mandrel would be made $1\frac{5}{8}$ in. Then the bar, inserted from the rear-end, is gripped by a chuck or *collet* at the front, the operations of turning, screwing and cutting off done, and the bar then thrust farther through to the exact length for the next set of identical operations to be performed, and so on. This mechanism is termed a *wire feed*, because the first lathes which were built of this type only operated on large wires; the heavy bar lathes have been subsequently developed from it. In the more advanced types of lathes this feeding through the hollow spindle does not require the intervention of the attendant, but is performed automatically.

The amount of preliminary work which has to be done upon a portion of a bar before it is ready for screwing varies. The simplest object is a stud, which is a parallel piece screwed up from each end. A bolt is a screw with a head of hexagonal, square or circular form, and the production of this involves turning the shank and shoulder and imparting convexity to the end, as well as screwing. But screw-threads have often to be cut on objects which are not primarily bolts, but which are spindles of various kinds used on mechanisms and machine tools, and in which reductions in the form

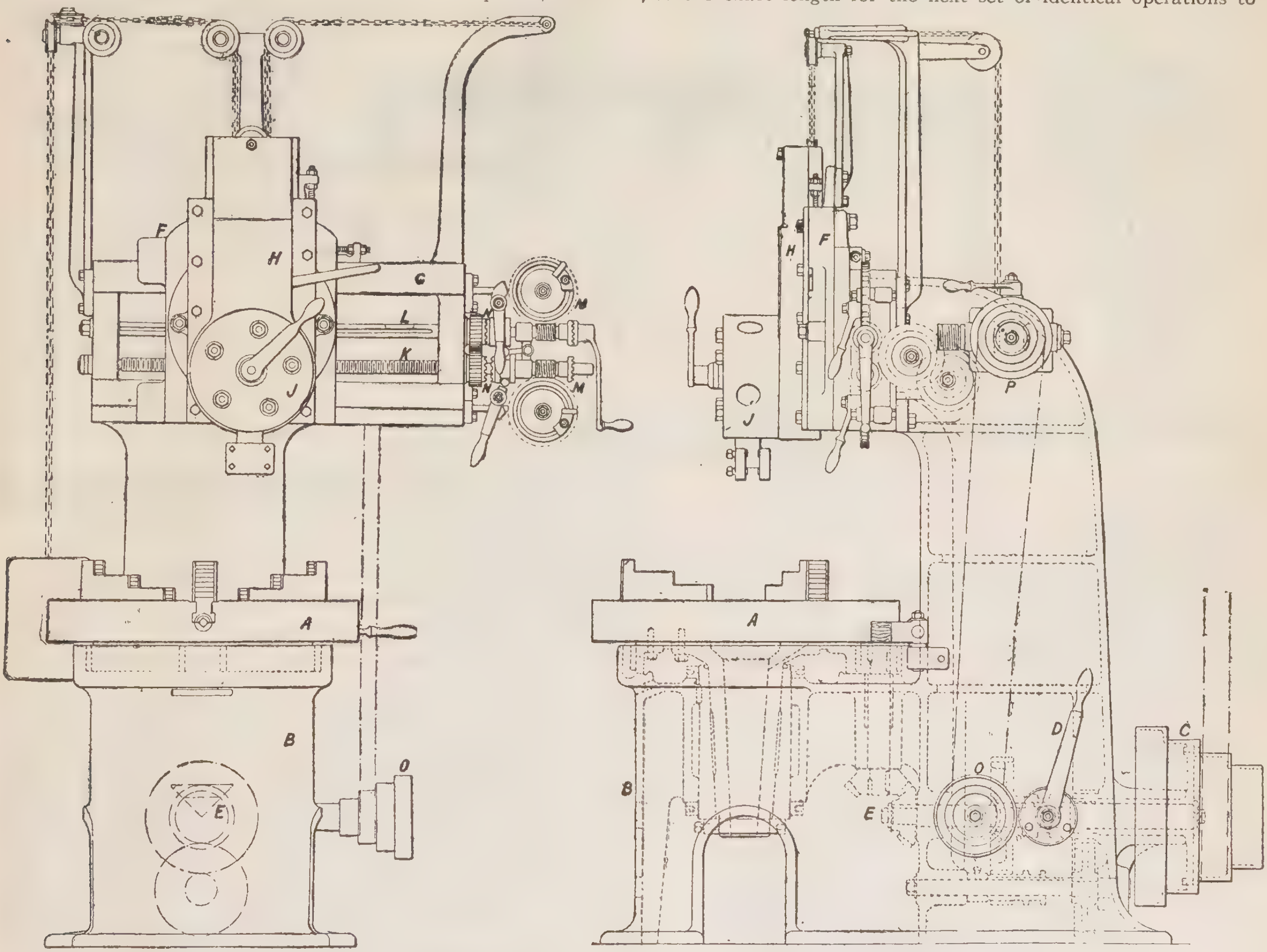


Fig. 30.—Boring and Turning Mill, vertical lathe. (Webster Bennett, Ltd., Coventry.)

A, Table, running with stem in vertical bearing.
B, Frame of machine.
C, Driving cones.
D, Handle giving the choice of two rates, through concealed sliding gears, shown dotted.
E, Bevel-gears driving up to pinion gearing with ring of teeth on the table.
F, Saddle moved on cross-rail *G*.
H, Vertical slide, carrying turret *J*.
K, Screw feeding *F* across.
L, Splined shaft connecting to *H* for feeding the latter up or down.
M, *M*, Worm-gears throwing out clutches *N*, *N* at predetermined points.
O, Cone pulley belted up to *P*, for driving the feeds of saddle and down-slide.

of steps have to be made, and recesses, or flanges, or other features produced. Out of the demands for this more complicated work, as well as for plain bolts and studs, has arisen the great group of *turret* or *capstan lathes* (fig. 31) and the automatics or *automatic screw machines* which are a high development of the turret lathes.

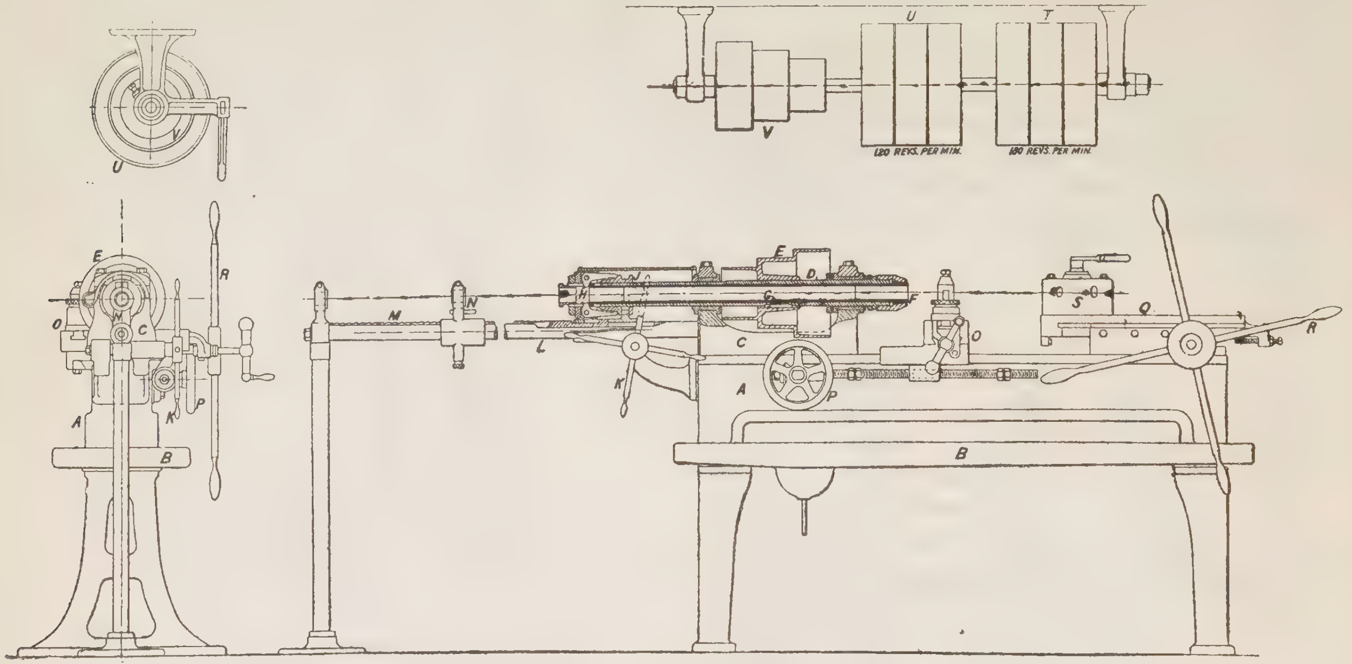


FIG. 31.—Turret Lathe. (Webster & Bennett, Ltd., Coventry.)

A, Bed.
B, Waste oil tray.
C, Headstock.
D, Hollow mandrel.
E, Cones keyed to *D*.
F, Split tapered close-in chuck, actuated by tube G.
H, Toggle dogs which push *G*.
J, Coned collar acting on *H*.
K, Handle to slide *J* through sleeve on bar *L*.
M, Rack slid on release of chuck, moving bearing *N* forward.
N, Bearing to feed the work through mandrel (constituting the *wire* or *bar feed*). A collar is clamped on the work, and is pushed by the bearing *N* at each time of feeding.
O, Cross-slide.
P, Hand-wheel operating screw to travel *O*.
Q, Turret-slide.
R, Cross-handle moving *Q* to and fro.
S, Turret or capstan.
T, *U*, Sets of fast and loose pulleys, for open and crossed belts.
V, Cone belted down to *E* on lathe.

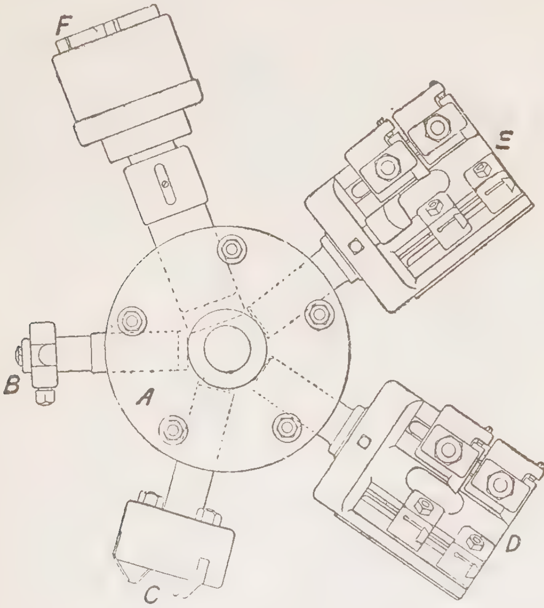


FIG. 32.—Plan of Set of Turret Tools. (A. Herbert, Ltd.)

A, Turret.
B, Tool for first operation or chucking.
C, Cutting tools for second operation, starting or pointing.
D, Box tool carrying two cutters for third operation, rough turning.
E, Similar tool for fourth operation, finish turning.
F, Screwing tools in head for final operation of screwing.

Turret Lathes.—The turret or capstan (fig. 32) is a device for gripping as many separate tools as there are distinct operations to be performed on a piece of work; the number ranges from four to as many as twenty in some highly elaborated machines, but five or six is the usual number of holes. These tools are brought round in due succession, each one doing its little share of work, until the cycle of operations required to produce the object is complete, the cycle including such operations as turning and screwing, roughing and finishing cuts, drilling and boring. Severance of the finished piece is generally done by a tool or tools held by a *cross-slide* between the headstock and turret, so termed because its movements take place at right angles with the axis of the machine. This also often performs the duty of "forming," by which is meant the shaping of the exterior portion of an object of irregular outline, by a tool the edge of which is an exact counterpart of the profile required. The exterior of a cycle hub is shaped thus, as also are numerous handles and other objects involving various curves and shoulders, &c. The tool is fed perpendicularly to the axis of the rotating work and completes outlines at once; if this were done in ordinary lathes much tedious manipulation of separate tools would be involved.

Automatics.—But the marvel of the modern automatics (fig. 33) lies in the mechanism by which the cycle of operations is rendered absolutely independent of attendance, beyond the first adjustments and the insertion of a fresh bar as often as the previous one becomes used up. The movements of the rotating turret and of the cross-slide, and the feeding of the bar through the hollow spindle, take place within a second, at the conclusion of the operation preceding. These movements are effected by a set of mechanism independent of that by which the headstock spindle is rotated, viz. by cams or cam drums on a horizontal cam shaft, or other equivalent device, differing much in arrangement, but not principle. Movements are hastened or retarded, or pauses of some moments may ensue, according to the cam arrangements devised, which of course have to be varied for pieces of different proportions and dimensions. But when the machines with their tools are once set up, they will run for days or weeks, repeating precisely the same cycle of operations; they are self-lubricating, and only require to be fed with fresh lengths of bar and to have their tools resharpened occasionally. Of these automatics alone there are something like a dozen distinct types, some with their turrets vertical, others horizontal. Not only so but the use of a single spindle is not always deemed sufficiently economical, and some of these designs now have two, three and four separate work spindles grouped in one head.

Specialized Lathes.—Outside of these main types of lathes there are a large number which do not admit of group classification. They are designed for special duties, and only a representative list can be given. Lathes for turning tapered work form a limited number, and they include the usual provisions for ordinary turning. In some designs change wheels are made use of for imparting a definite movement of cross traverse to the tool, which being compounded with the parallel sliding movements produces the taper. In others an upper bed carrying the heads and work swivels on a lower bed, which carries the slide rest. More often tapers are turned by a cross adjustment of the loose poppet, or by a taper attachment at the rear of the lathe, which coerces the movement of the top or tool-carrying slide of the rest. Or, as in short tapers, the slide-rest is set to the required angle on its carriage. Balls are sometimes turned by a spherical attachment to the slide-rest of an ordinary lathe. Copying lathes are those in which an object is reproduced from a pattern precisely like the objects required. The commonest example is that in which gun-stocks and the spokes of wheels are turned, but these are used for timber, and the engineer's copying lathe uses a form or cam and a milling cutter. The form milling machine is the copying machine for metal-work. The manufacture of boilers has given birth to two kinds of lathes, one for turning the boiler ends, the other the boiler flue flanges, the edges of which have to be caulked. Shaft pulleys have appropriated a special lathe containing provision for turning the convexity of the faces. Lathes are duplicated in two or three ways. Two, four, six or eight tools sometimes operate simultaneously on a piece of work. Two lathes are mounted on one bed. A tool will be boring a hole while another is turning the edges of the same wheel. One will be boring, another turning a wheel tire, and so on. The rolls for iron and steel mills have special lathes for trueing them up. The thin sheet metal-work produced by spinning has given rise to a special kind of spinning lathe where pressure, and not cutting, is the method adopted.

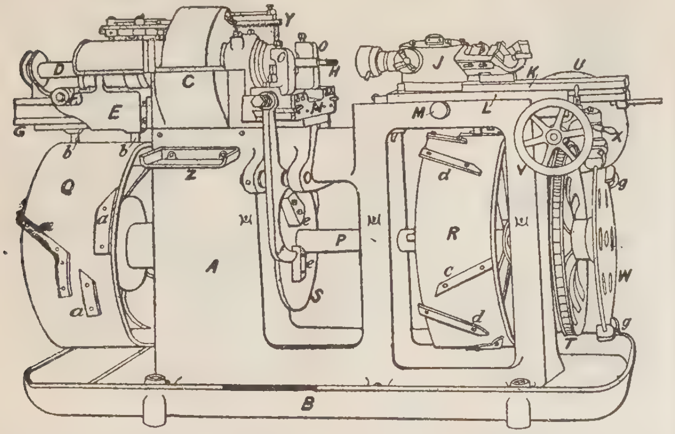


FIG. 33.—Automatic Lathe or Screw Machine. (A. Herbert, Ltd.)

A, Main body.
B, Waste oil tray.
C, Headstock.
D, Wire-feed tube.
E, Slide for closing chuck.
F, Shaft for ditto.
G, Feed-slide.
H, Piece of work.
J, Turret with box tools.
K, Turret slide.
L, Saddle for ditto, adjustable along bed.
M, Screw for locating adjustable slide.
N, Cut-off and forming cross-slide.
O, *O*, Back and front tool-holders on slide.
P, Cam shaft.
Q, Cam drum for operating chuck.
R, Cam drum for operating turret.
S, Cam disk for actuating cross-slide.
a, *a*, *a*, Cams for actuating chuck movements through pins *b*, *b*. The cam which returns *D* is adjustable but is not in view.
c, Feeding cam for turret.
d, *d*, Return cams for turret.
e, *e*, Cams on cam disk for operating the lever *f*, which actuates the cut-off and forming slide.
T, Worm-wheel which drives cam shaft by a worm on the same shaft as the feed-pulley *U*.
V, Handwheel on worm shaft for making first adjustments.
W, Change feed disk.
g, *g*, Change feed dogs adjustable round disk.
X, Change feed lever.
Y, Oil tube and spreader for lubricating tools and work.
Z, Tray for tools, &c.

Methods of Holding and Rotating Work. Chucks.—The term chuck signifies an appliance used in the lathe to hold and rotate work. As the dimensions and shapes of the latter vary extensively, so also do those of the chucks. Broadly, however, the latter correspond with the two principal classes of work done in the lathe, that *between centres*, and that held at one end only or *face work*. This of course is an extremely comprehensive classification, because chucks of the same name differ vastly when used in small and large lathes. The chucks, again, used in turret work, though they grip the work by one end only, differ entirely in design from the face chucks proper.

Chucking between Centres.—The simplest and by far the commonest method adopted is to drill countersunk centres at the ends of the work to be turned, in the centre or longitudinal axis (fig. 34, *A*), and support these on the point centres of headstock and poppet. The angle included by the centres is usually 60°, and the points may enter the work to depths ranging from as little as $\frac{1}{16}$ in. in very light pieces to $\frac{1}{2}$ in., $\frac{3}{4}$ in. or 1 in. in the heaviest. Obviously a piece centred thus cannot be rotated by the mere revolution of the lathe, but it has to be driven by some other agent making connexion between it and the mandrel. The wood turner uses a forked or prong centre to obtain the necessary leverage at the headstock end, but that would be useless in metal. A *driver* is therefore used, of which there are several forms (fig. 34), the essential element being a short stiff prong of metal set away from the centre, and rotating the work directly, or against a *carrier* which encircles and pinches the work. As this method of driving sets up an unbalanced force, the "Clement" or *double driver* (fig. 34, *D*), was invented, and is frequently made use of, though not nearly so much as the common single driver. In large and heavy work it is frequently the practice to drive in another way, by the dogs of the face-plate.

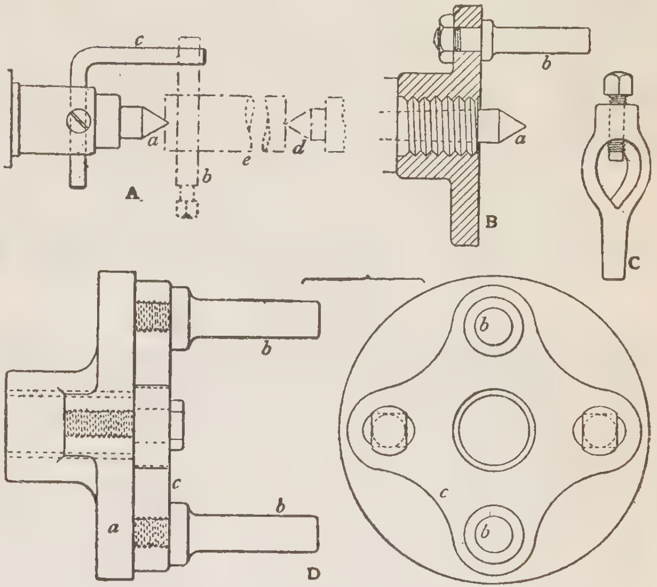


FIG. 34.

A, Centring and driving; *a*, point centre; *b*, carrier; *c*, driver fixed in slot in body of point centre; *d*, back centre; *e*, work.
B, Face-plate driver or catch-plate; *a*, centre; *b*, driver.
C, Common heart-shaped carrier.
D, Clement double driver; *a*, face-plate; *b*, *b*, drivers; *c*, loose plate carrying drivers.

Steadies.—Pieces of work which are rigid enough to withstand the stress of cutting do not require any support except the centres. But long and comparatively slender pieces have to be steadied at intermediate points (fig. 35). Of devices for this purpose there are many designs; some are *fixed* or bolted to the bed and are shifted when necessary to new positions, and others are bolted to the carriage of the slide-rest and move along with it—*travelling*

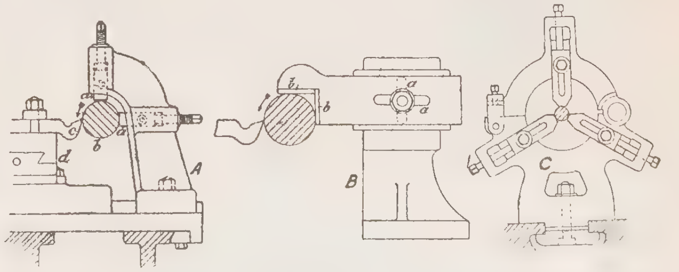


FIG. 35.

A, Travelling steady with adjustable studs *a*, *a*; *b*, work; *c*, tool; *d*, slide-rest.
B, Steady with horizontal and vertical adjustment through slotted bolt holes *a*, *a*; *b*, *b*, brass or steel facings.
C, Fixed steady with hinged top and three setting pieces.

steadies. In some the work is steadied in a vee, or a right angle, in others adjustable pins or arms are brought into contact with it. As the pressure of the cut would cause an upward as well as backward yielding of the work, these two movements are invariably provided against, no matter in what ways the details of the steadies are worked out. Before a steady can be used, a light cut has to be taken in the locality where the steady has to take its bearing, to render the work true in that place. The travelling steady follows immediately behind the tool, coming in contact therefore with finished work continually.

Mandrels.—Some kinds of work are carried between centres indirectly, upon mandrels or arbors (fig. 36). This is the method adopted when wheels, pulleys, bushes and similar articles are bored first and turned afterwards, being chucked by the bore hole, which fits on a mandrel. The latter is then driven between point centres and the bore fits the mandrel sufficiently tightly to resist the stress of turning. The large number of bores possible involves stocking a considerable number of mandrels of different diameters. As it is not usual to turn a mandrel as often as a piece of work requires chucking, economy is studied by the use of *stepped* mandrels, which comprise several diameters, say from three to a dozen. A better device is the *expanding* mandrel, of which there are several forms. The essential principle in all is the capacity for slight adjustments in diameter, amounting to from $\frac{1}{4}$ in. to $\frac{1}{2}$ in., by the utilization of a long taper. A split, springy cylinder may be moved endwise over a tapered body, or separate single keys or blades may be similarly moved.

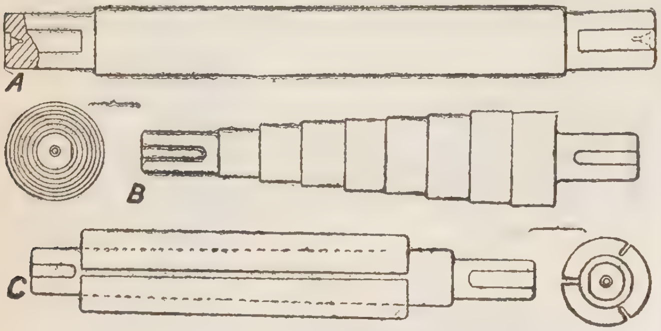


Fig. 36.—Mandrels.

A, Plain mandrel. *B*, Stepped mandrel. *C*, Expanding mandrel.

Face-Work.—That kind of work in which support is given at the headstock end only, the centre of the movable poppet not being required, is known as face-work. It includes pieces the length of which ranges from something less than the diameter to about three or four times the diameter, the essential condition being that the unsupported end shall be sufficiently steady to resist the stress of cutting. Work which has to be bored, even though long, cannot be steadied on the back centre, and if long is often supported on a *cone plate.* The typical appliance used for face-work is the common *face-plate* (fig. 37). It is a plain disk, screwed on the mandrel nose, and having slot holes in which bolts are inserted for the purpose of cramping pieces of work to its face. There are numerous forms of these clamps, and common bolts also are used. The face-plate may also serve to receive an intermediary, the *angle-plate*, against which work may be bolted when its shape is such as to render bolting directly to the plate inconvenient.

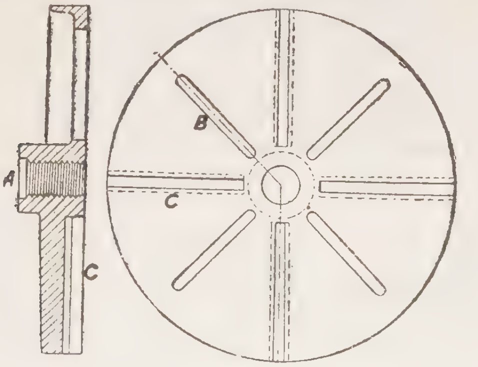


Fig. 37.—Face-plate.

A, Screwed hole to fit mandrel nose. *B*, Slots for common bolts. *C*, Tee-slots for tee-head bolts.

Jaw Chucks.—When a face-plate has fitted to it permanent *dogs* or *jaws* it is termed a dog or *jaw chuck* (fig. 38). In the commonest form the jaws are moved radially and independently, each by its own screw, to grip work either externally or internally. In some cases the dogs are loosely fitted to the holes in a plain face-plate. In all these types the radial setting is tentative, that is, the jaws being independent, there is no self-centring capacity, and thus much time is lost. A large group, therefore, are rendered self-centring by the turning of a ring which actuates a face scroll

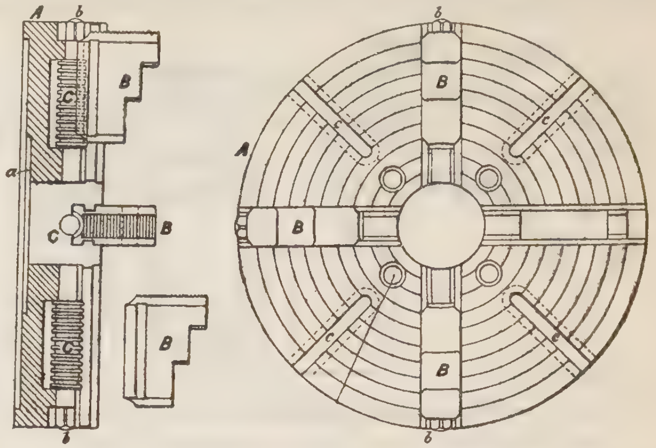


Fig. 38.—Independent Jaw Chuck.

A, Body.
a, Recess to receive face-plate.
B, Jaws or dogs.
C, Screws for operating jaws.
b, Square heads of screws for key.
c, Tee-grooves for bolts.

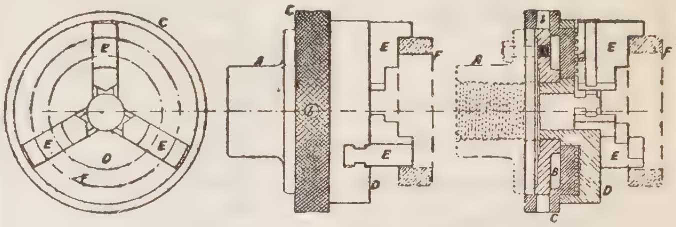


Fig. 39.—Scroll Chuck, ungeared.

A, Face-plate screwed to mandrel nose.
B, Back of chuck screwed to *A*.
C, Knurled chuck body with scroll *a* on face.
D, Chuck face.
E, Jaws in chuck face, having sectional scroll teeth engaging with scroll *a*, and moved inwards or outwards by the scroll when *C* is turned.
b, Tommy or lever hole in *C*.
F, Piece of work outlined.

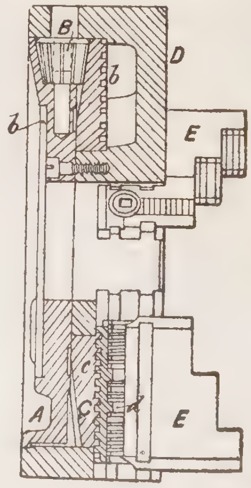


Fig. 40.—Combination Geared Scroll Chuck.

A, Back plate; *a*, recess for face-plate.
B, Pinions.
C, Circular rack with scroll *b* on face.
D, Chuck body.
E, Jaws fitting on intermediate pieces *c* that engage with the scroll *b*.
d, Screws for operating jaws independently.

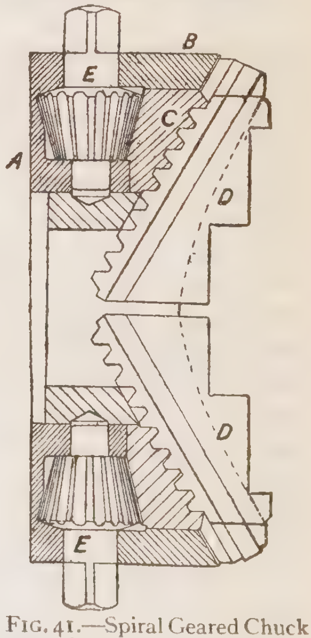


Fig. 41.—Spiral Geared Chuck, concentric movement. (C. Taylor, Birmingham.)

A, Back.
B, Body.
C, Spiral plate with teeth engaging in jaws *D*.
E, Bevel pinions gearing with teeth on back of *C*.

(fig. 39) or a circular rack with pinions (fig. 40), turned with a key which operates all the jaws simultaneously inwards or outwards. But as some classes of jobs have to be adjusted eccentrically, many chucks are of the *combination* type (fig. 40), capable of being used independently or concentrically, hence termed *universal* chucks. The change from one to the other simply means throwing the ring of teeth out of or into engagement with the pinions by means of cams or equivalent devices. Each type of chuck occurs in a large range of dimensions to suit lathes of all centres, besides which every lathe includes several chucks, large and small, in its equipment. The range of diameters which can be taken by any one chuck is limited, though the jaws are made with steps, in addition to the range afforded by the operating screws. The "Taylor" spiral chucks (fig. 41) differ essentially from the scroll types in having the actuating threads set spirally on the sloping interior of a cone. The result is that the outward pressure of each jaw is received behind the body, because the spiral rises up at the back. In the ordinary scroll chucks the pressure is taken only at the bottom of each jaw, and the tendency to tilt and pull the teeth out of shape is very noticeable. The spiral, moreover, enables a stronger form of tooth to be used, together with a finer pitch of threads, so that the wearing area can be increased.

The foregoing may be termed the standard chucks. But in addition there are large numbers for dealing with special classes of work. Brass finishers have several. Most of the hollow spindle lathes and automatics have *draw-in* or *push-out* chucks, in which the jaws are operated simultaneously by the conical bore of the encircling nose, so that their action is instantaneous and self-centring. They are either operated by hand, as in fig. 31, or automatically, as in fig. 33. There is also a large group used for drills and reamers—the *drill chucks* employed in lathes as well as in drilling machines.

II.—RECIPROCATING MACHINE TOOLS

This is the only convenient head under which to group three great classes of machine tools which possess the feature of reciprocation in common. It includes the planing, shaping and slotting machines. The feature of reciprocation is that the cutting tool is operative only in one direction; that is, it cuts during one stroke or movement and is idle during the return stroke. It is, therefore, in precisely the same condition as a hand tool such as a chisel, a carpenter's plane or a hand saw. We shall return again to this feature of an idle stroke and discuss the devices that exist to avoid it.

Planing Machines.—In the standard planer for general shop purposes (fig. 42) the piece of work to be operated on is attached to a horizontal table moving to and fro on a rigid bed, and passing underneath the fixed cutting tool. The tool is gripped in a box having certain necessary adjustments and movements, so that the tool can be carried or *fed* transversely across the work, or at right angles with the direction of its travel, to take successive cuts, and also downwards or in a vertical direction. The tool-box is carried on a cross-slide which has capacity for several feet of vertical adjustment on upright members to suit work of varying depths. These uprights or *housings* are bolted to the sides of the bed, and the whole framing is so rigidly designed that no perceptible tremor or yielding takes place under the heaviest duty imposed by the stress of cutting.

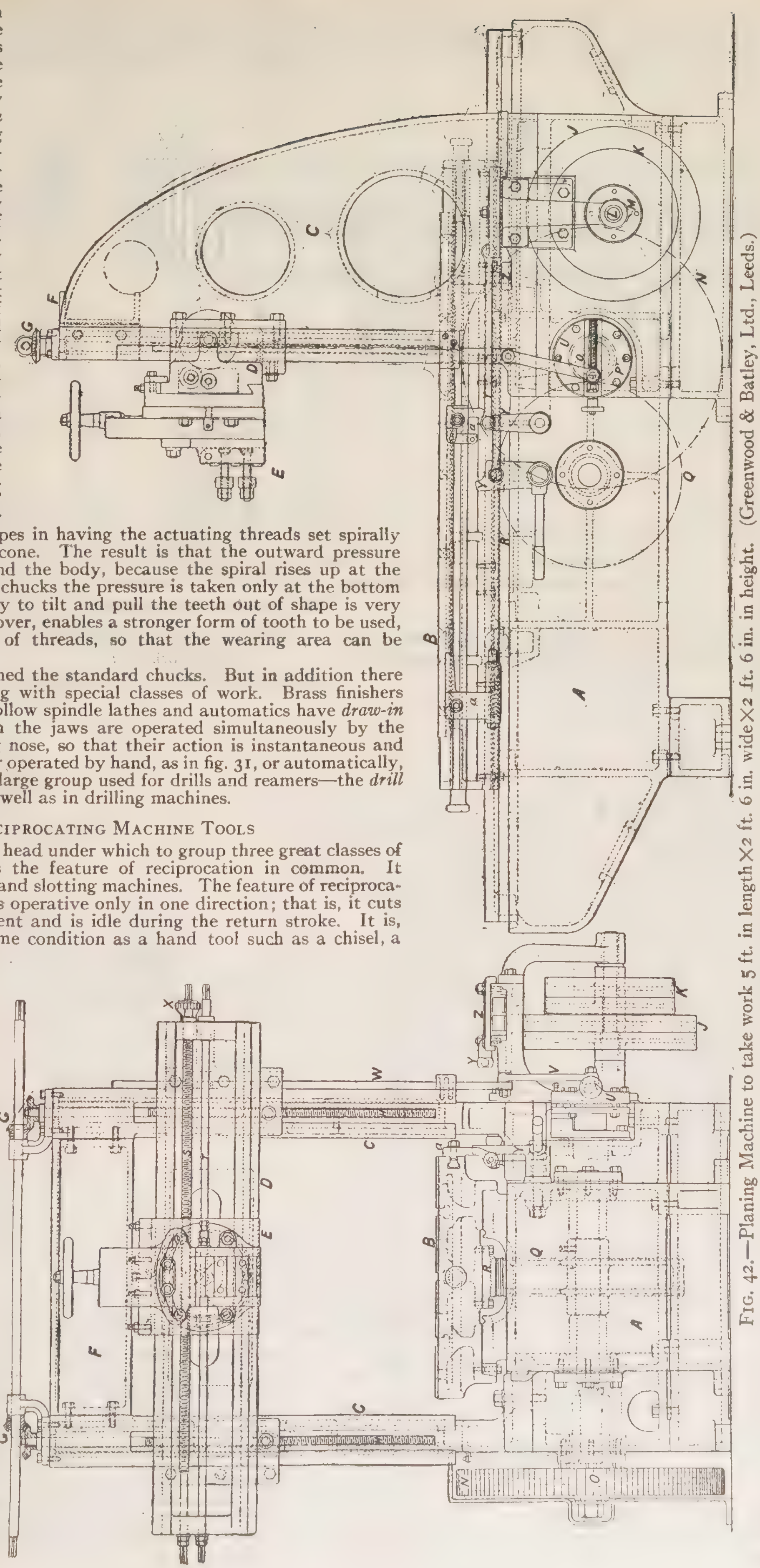


FIG. 42.—Planing Machine to take work 5 ft. in length × 2 ft. 6 in. wide × 2 ft. 6 in. in height. (Greenwood & Batley, Ltd., Leeds.)

A, Bed.
B, Table.
C, *C*, Housings.
D, Cross-rail.
E, Tool-box.
F, Stretcher.
G, *G*, Bevel-gears for elevating cross-slide by means of screws *H*, *H*.
J, Fast and loose pulleys for driving the table during the cutting stroke.
K, Pulleys for non-cutting stroke.
L, Pulley shaft.
M, Pinion on ditto, driving wheel *N*.
O, Shaft of *N* carrying pinion *P*, which drives *Q*, engaging with the rack *R* on the underside of the table *B*.
S, Traverse screw actuating linear movement of tool-box, *E*.
T, Splined rod for actuating down-feed of tool-box.
U, Slotted feed disk rotated by shaft *O*.
V, Lever adjustable across disk.
W, Toothed rack reciprocated vertically by disk and lever, and operating feed gear-wheels on shafts *S* and *T*.
X, Ratchet feed.
a, *a*, Dogs adjustable in slot at the edge of the table *B*.
Y, *Y*, Levers actuated by dogs, and operating belt-shifting forks *Z*.

Moreover, after the required adjustments have been made and the machine started, the travel and the return of the work-table and the feeding of the tool across the surface are performed by self-acting mechanism actuated by the reciprocations of the table itself, the table being driven from the belt pulleys.

To such a design there are objections, which, though their importance has often been exaggerated, are yet real. First, the cross-rail and housings make a rigid enclosure over the table, which sometimes prevents the admission of a piece that is too large to pass under the cross-rail or between the housings. Out of this

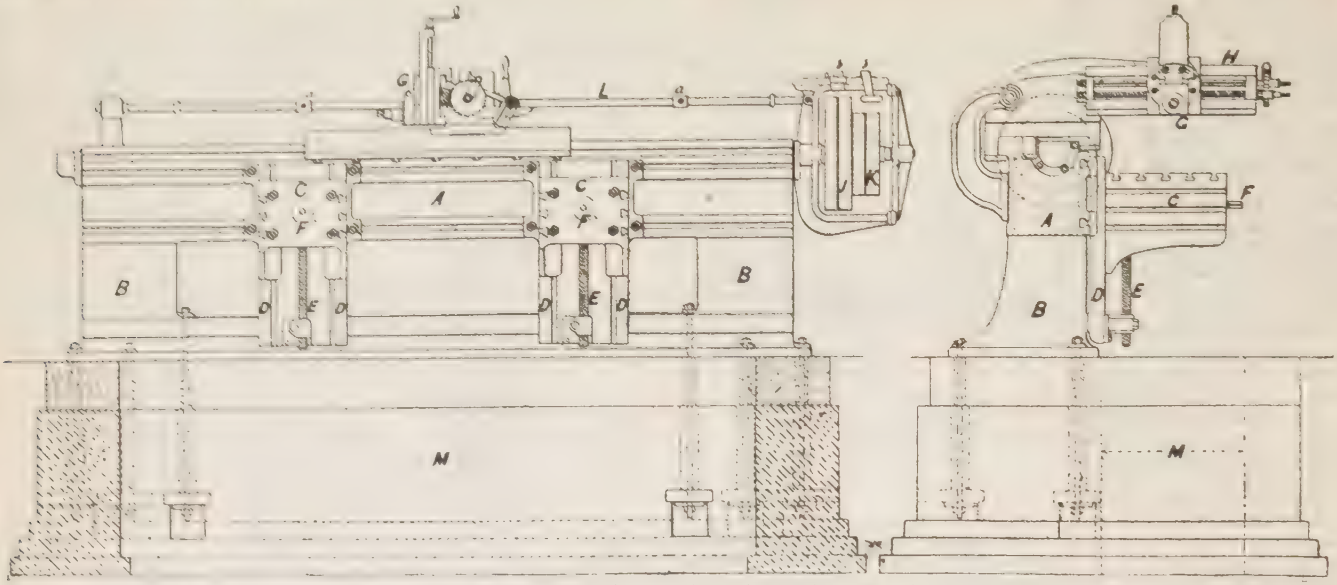


FIG. 43.—20-in. Side Planing Machine. (G. Richards & Co., Ltd., Manchester.)

A, Bed.
B, *B*, Feet.
C, *C*, Work tables adjustable vertically on the faces *D*, *D*, by means of screws *E*, *E*, from handles *F*, *F*, through bevel gears.
G, Tool-box on travelling arm *H*, travelled by fast and loose pulleys *J* for cutting, and by pulleys *K* for quick return.
L, Feed-rod with adjustable dogs *a*, *a*, for effecting reversals through the belt forks *b*, *b*.
M, Brickwork pit to receive deep objects.

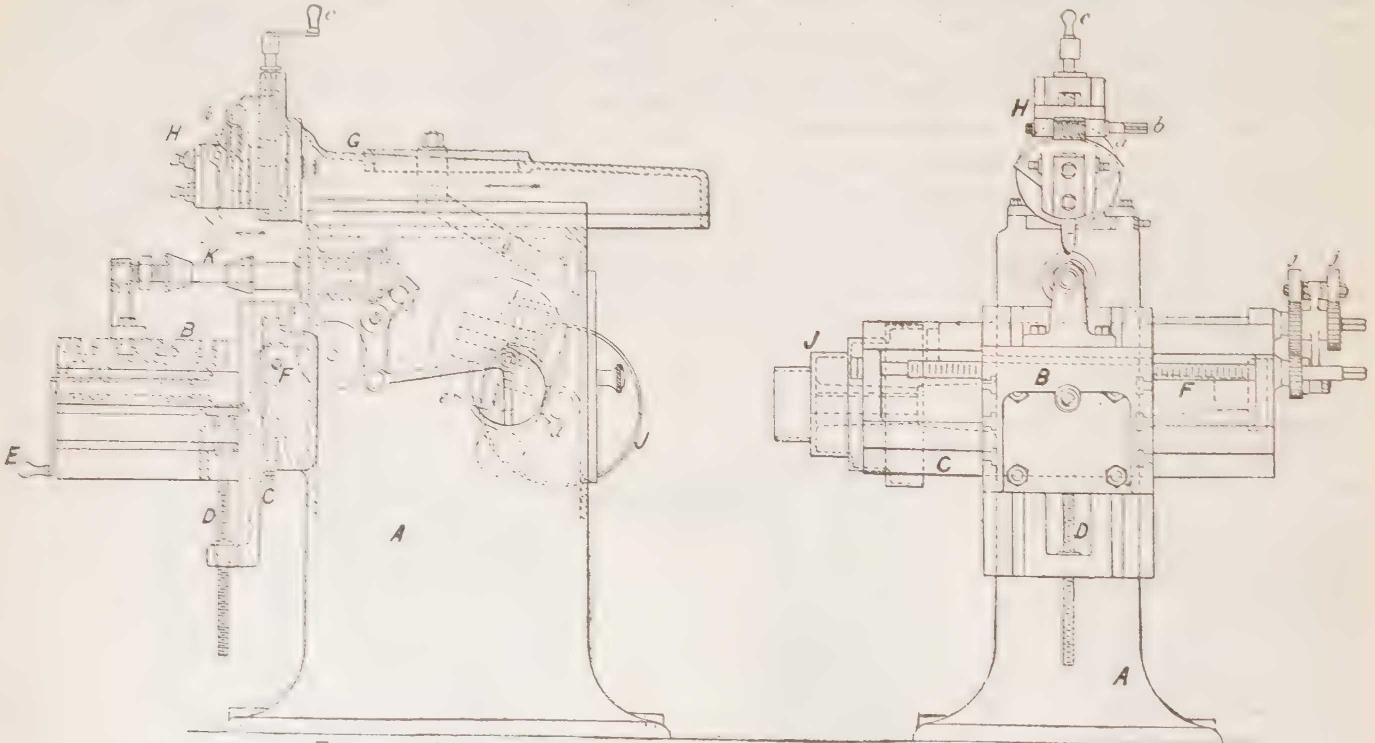


FIG. 44.—8-in. Shaping Machine. (Cunliffe & Croom, Ltd., Manchester.)

A, Base.
B, Work-table, having vertical movement on carriage *C*, which has horizontal movement along the face of *A*.
D, Screw for effecting vertical movement, by handle *E*, and bevel gears.
F, Screw for operating longitudinal movement with feed by hand or power.
G, Tool ram.
H, Tool-box.
a, Worm-gear for setting tool-holder at an angle.
b, Crank handle spindle for operating ditto.
c, Handle for actuating down feed of tool.
J, Driving cone pulley actuating pinion *d*, disk wheel *e*, with slotted disk, and adjustable nut moving in the slot of the crank *f*, which actuates the lever *g*, connected to the tool ram *G*, the motion constituting the Whitworth quick return; *g* is pivoted to a block which is adjustable along a slot in *G*, and the clamping of this block in the slot regulates the position of the ram *G*, to suit the position of the work on the table.
k, Feed disk driven by small gears from cone pulley.
j, Pawl driven from disk through levers at various rates, and controlling the amount of rotation of the feed screw *F*.
K, Conical mandrel for circular shaping, driven by worm and wheel *l*.

objection has given rise to the side planer (fig. 43), in which the tool box is carried by an arm movable along a bed or base, and overhanging the work, which is fastened to the side of the base, or on angle brackets, or on a bed-plate alongside. Here the important difference is that the work is not traversed under the tool as in the ordinary planer, but the tool moves over the work; [illegible] a cantilever supported at one end only is not so rigid when cutting as the cross-rail of the ordinary machine supported at both ends on housings. The same idea is embodied in machines built to other designs of the reciprocating table model. Sometimes one housing is omitted and the tool arm is carried on the other, being therefore unsupported at one end. Sometimes a housing is made to be removable at pleasure, to be temporarily taken away only when a piece of work of unusual dimensions has to be fixed on the table.

Another objection to the common planer is this: it seems unmechanical to cause a machine to reciprocate a heavy table and piece of work which often weighs several tons, and let the tool and its holder of a few hundredweights only remain stationary. The mere reversal of the mass absorbs much greater horse-power than the actual work of cutting. Hence a strong case is often stated for the abandonment of the common practice. But, on the other hand, the centre of gravity of the moving table and work lies low down, while when the cross-rail and housings with the cutting tool are travelled and reversed, their centre of gravity is high, and great precautions have to be taken to ensure steadiness of movement. Several planers are made thus, but they are nearly all of extremely massive type—the *pit planers*. The device is seldom applied to those of small and medium dimensions.

But there is a great group of planers in which the work is always fixed, the tools travelling. These are the *wall planers*, *vertical planers*, or *wall shapers*, used chiefly by marine engine builders. They are necessary because many of the castings and forgings are too massive to be put on the tables of the largest standard machines. They are therefore laid on the base-plate of the wall planer, and the tool-box travels up and down a tall pillar bolted to the wall or standing independently, and so makes vertical cutting strokes. In some designs horizontal strokes are provided for, or either vertical or horizontal as required. Here, as in the side planer, there is no limitation whatever to the length of the work, since it may extend to any distance beyond the bed-plate.

Shaping Machines.—The shaping machine (fig. 44) does for comparatively small pieces that which the planer does for long ones. It came later in time than the planer, being one of James Nasmyth's inventions, and beyond the fact that it has a reciprocating non-cutting return stroke it bears no resemblance to the older machine. Its design is briefly as follows. The piece of work to be shaped is attached to the top, or one of the vertical side faces, of a right-angled bracket or brackets. These are carried upon the face of a main standard and are adjustable thereon in horizontal and vertical directions. In small machines the ram or reciprocating arm (see fig. 44, C) slides in feed guides on the top of the pillar, and the operator's vice is attached to the work table B. To the top of the main standard, in other designs, a carriage is fitted with horizontal traverse across the whole breadth, within the capacity of the machine, of the work to be operated on. In the largest machines two standards support a long bed, on which the carriage, with its ram, traverses past the work. These machines are frequently made "double-headed," that is, carriages, rams and work tables are duplicated, and the operator can set one piece of work while the other is being shaped. In all cases the movement of the reciprocating arm, to the outer end of which the tool is attached, takes place in a direction transversely to the direction of movement of the carriage, and the tool receives no support beyond that which it receives from the arm which overhangs the work. Hence the shaper labours under the same disadvantages as the side planer—it cannot operate over a great breadth. A shaper with a 24-in. stroke is one of large capacity, 16 in. being an average limit. Although the non-cutting stroke exists, as in the planer, the objection due to the mass of a reciprocating table does not exist, so that the problem does not assume the same magnitude as in the planer. The weak point in the shaper is the overhang of the arm, which renders it liable to spring, and renders heavy cutting difficult. Recently a novel design has been introduced to avoid this, the *draw-cut shaper*, in which the cutting is done on the inward or return stroke, instead of on the outward one.

Slotting Machines.—In the slotting machine (fig. 45) the cutting takes place vertically and there is a fast return stroke. All the

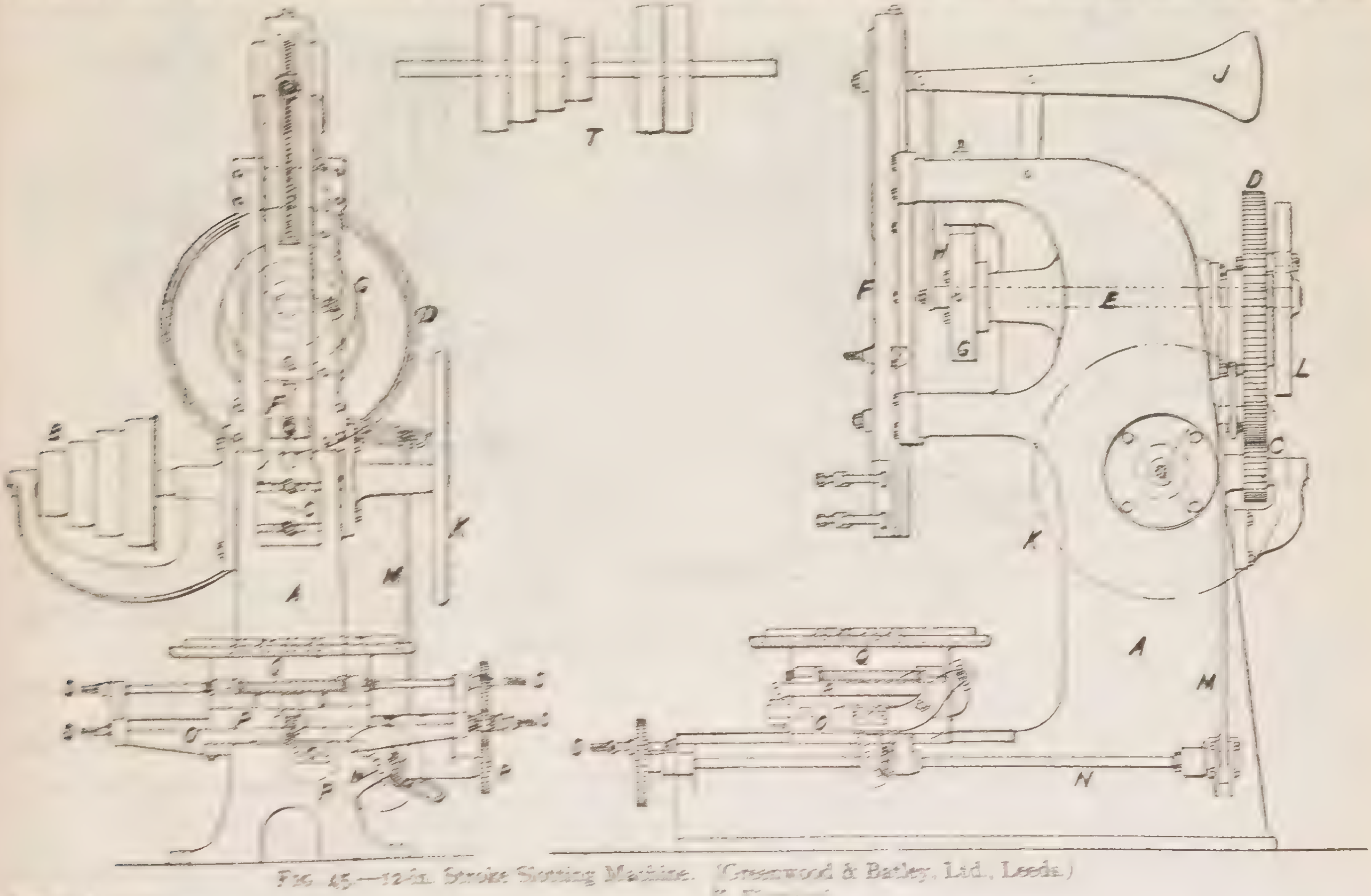


FIG. 45.—12-in. Stroke Slotting Machine. (Greenwood & Batley, Ltd., Leeds.)

A. Main framing.
B. Driving cone.
C, D. Gears driven by cone.
E. Shaft of D.
F. Tool ram driven from shaft E through disk G and rod H, with quick-return mechanism D.
J. Counter-balance lever to ram.
K. Flywheel.
L. Driving disk.
M, N. Feed levers and shaft operated from disk, actuating linear movements of slides O, P, and circular movement of table Q through gears R.
S. Hand-feed motions to table.
T. Countershaft.

necessary movements save the simple reciprocating stroke are imparted to the compound table on which the work is carried. These include two linear movements at right angles with each other and a circular motion capable of making a complete circle. Frequently a tilting adjustment is included to permit of slotting at an angle. The slotting machine has the disadvantage of an arm unsupported beyond the guides in which it moves. But the compound movements of the table permit of the production of shapes which cannot be done on planers and shapers, as circular parts and circular arcs, in combination with straight portions. Narrow key grooves in the bores of wheels are also readily cut, the wheels lying on the horizontal table, which would only be possible on planer and shaper by the use of awkward angle brackets, and of specially projecting tools.

Quick return in planers is accomplished by having two distinct sets of gearing—a slow set for cutting and a quick train for return, each operated from the same group of driving pulleys. The return travel is thus accomplished usually three, often four, times more quickly than the forward rate; sometimes even higher rates are arranged for. In the shaper and slotter such acceleration is not practicable, a rate of two to one being about the limit, and this is obtained not by gears, but by the slotted crank, the *Whitworth return*, on shapers and slotters, or by elliptical toothed wheels on slotters. The small machines are generally unprovided with this acceleration.

The double-cutting device seems at first sight the best solution, and it is adopted on a number of machines, though still in a great minority. The pioneer device of this kind, the rotating tool-box of Whitworth, simply turns the tool round through an angle of 180° at the termination of each stroke, the movement being self-acting. In some later designs, instead of the box being rotated to reverse the tool, two tools are used set back to back, and the one that is not cutting is *relieved* for the time being, that is tilted to clear the work. Neither of these tools will plane up to a shoulder as will the ordinary ones.

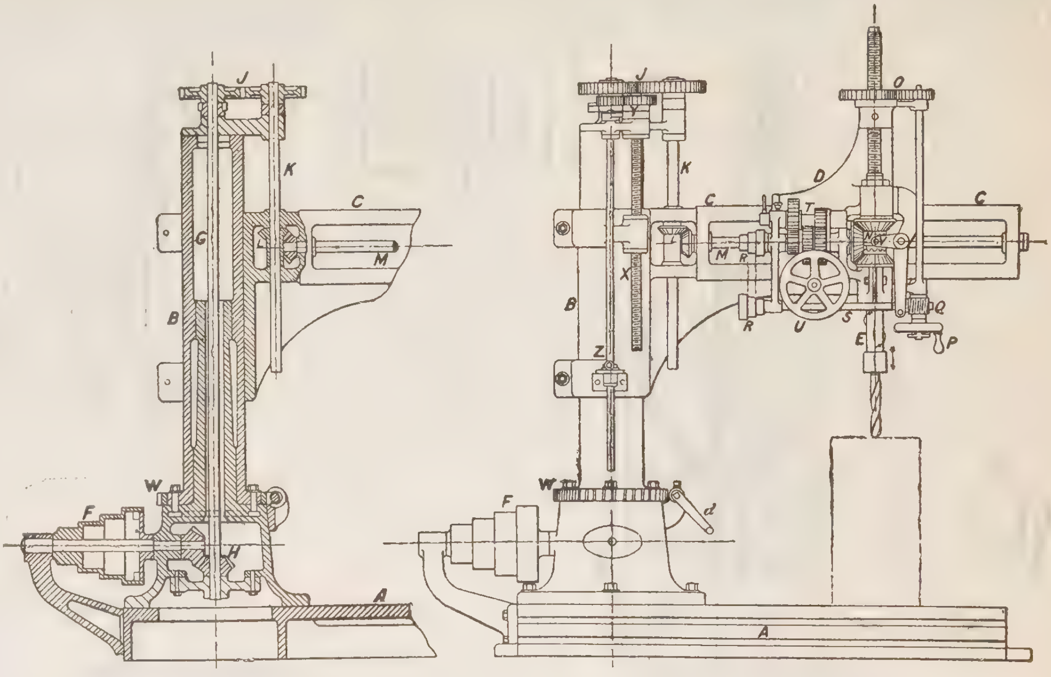


FIG. 46.—Pillar Radial Drilling Machine, 5 ft. radius.

A, Base-plate.
B, Pillar.
C, Radial arm.
D, Spindle carriage.
E, Drill spindle.
F, Main driving cones driving vertical shaft *G* through mitre-gears *H*.
J, Spur-wheels, driving from *C* to vertical shaft *K*.
L, Mitre-wheels, driving from *K* to horizontal shaft *M*, having its bearings in the radial arm.
N, Nest of mitre-wheels driving the wheel spindle *E* from *M*.
O, Feed-gears to drill spindle, actuated by hand-wheel *P* or worm-gears *Q*.
R, *R*, Feed cones driving from shaft *M* to worm-shaft *S*, for self-acting feed of drill.
T, Change-speed gears.
U, Hand-wheel for racking carriage *D* along radial arm *C*.
V, Clutch and lever for reversing direction of rotation of spindle.
W, Worm-gear for turning pillar *B*.
d, Handle for turning worm.
X, Screw for adjusting the height of the radial arm.
Y, Gears for actuating ditto from shaft *C*.
Z, Rod with handle for operating elevating gear.

Allied Machines.—The reciprocation of the tool or the work, generally the former, is adopted in several machines besides the standard types named. The plate-edge planer is used by platers and boiler makers. It is a side planer, the plates being bolted to a bed, and the tool traversing and cutting on one or both strokes. Provision is often included for planing edges at right angles. The key-seaters are a special type, designed mainly to remove the work of cutting key grooves in the bores of wheels and pulleys from the slotting machine. The work is fixed on a table and the keyway cutting tool is drawn downwards through the bore, with several resulting practical advantages. Many planing machines are portable so that they may be fixed upon very massive work. Several gear-wheel cutting machines embody the reciprocating tool.

III.—DRILLING AND BORING MACHINES

The strict distinction between the operations of drilling and boring is that the first initiates a hole, while the second enlarges one already existing. But the terms are used with some latitude. A combined drilling and boring machine is one which has provision for both functions. But when holes are of large dimensions the drilling machine is useless because the proportions and gears are unsuitable. A 6-in. drill is unusually large, but holes are bored up to 30 ft. or more in diameter.

Types of Machines.—The distinction between machines with vertical and horizontal spindles is not vital, but of convenience only. The principal controlling element in design is the mass of the work, which often determines whether it or the machine shall be adjusted relatively to each other. Also the dimensions of a hole determine the speed of the tools, and this controls the design of the driving and feeding mechanism. Another important difference is that between drilling or boring one or more holes simultaneously. With few exceptions the tool rotates and the work is stationary. The notable exceptions are the vertical boring lathes already mentioned. Obviously the demands made upon drilling machines are nearly as varied as those on lathes. There is little in common between the machines which are serviceable for the odd jobs done in the general shop and those which are required for the repetitive work of the shops which handle specialities. Provision often has to be made for drilling simultaneously several holes at certain centres or holes at various angles or to definite depths, while the mass of the spindles of the heavier machines renders counter-balancing essential.

Bench Machines are the simplest and smallest of the group. They are operated either by hand or by power. In the power machines generally, except in the smallest, the drill is also fed downwards by power, by means of toothed gears. The upper part of the drilling spindle being threaded is turned by an encircling spur-wheel, operated very slowly by a pinion and hand-wheel by the right hand of the attendant, the movement being made independent of the rotation of the spindle. A rack sleeve encircling the spindle is also common. In the power machines gears are also used, but a belt on small cone pulleys drives from the main cone shaft at variable speeds. From three to four drilling and feeding speeds are provided for by the respective cone pulleys. Work is held on or bolted to a circular table, which may have provision for vertical adjustment to suit pieces of work of different depths, and which can usually be swung aside out of the way to permit of deep pieces of work being introduced, resting on the floor or on blocking.

Wall Machines.—One group of these machines resembles the bench machines in general design, but they are made to bolt to a wall instead of on a bench. Their value lies in the facilities which they afford for drilling large pieces of work lying on the floor or on blocking, which could not go on the tables of the bench machines. Sometimes a compound work-table is fastened to the floor beneath; and several machines also are ranged in line, by means of which long plates, angles, boilers or castings may be brought under the simultaneous action of the group of machines. Another type is the radial arm machine, with or without a table beneath. In each case an advantage gained is that a supporting pillar or standard is not required, its place being taken by the wall.

Self-contained Pillar Machines include a large number having the above-named feature in common. In the older and less valuable types the framework is rigid, and the driving and feeding are by belt cones. But the machines being mostly of larger capacities than those just noted, back-gears similar to those of lathes are generally introduced. The spindles also are usually counterbalanced. The machine framing is bolted to a bed-plate. A circular work-table may or may not be included. When it is, provision is made for elevating the table by gears, and also for swinging it aside when deep work has to be put on the base-plate.

Radial Arm Machines.—In these (fig. 46) the drilling mechanism is carried on a radial arm which is pivoted to the pillar with the object of moving the drill over the work, when the latter is too massive to permit of convenient adjustment under the drill. The driving takes place through shafts at right angles, from a horizontal shaft carrying the cones and back-geared to a vertical one, thence to a horizontal one along the radial arm, whence the vertical drilling spindle is driven. The latter has its bearings in a carriage which can be traversed along the arm for adjustment of radius. The spindle is counterbalanced. Hand as well as power adjustments are included. In the work-tables of radial and rigid machines there is a great diversity, so that work can be set on top, or at the sides, or at an angle, or on compound tables, so covering all the requirements of practice.

Sensitive Machines have developed greatly and have superseded many of the older, slower designs. The occasion for their use lies in the drilling of small holes, ranging up to about an inch in diameter. They are belt-driven, without back-gears, and usually without bevel-gears to change the direction of motion. The feed is by lever moving a rack sleeve. A slender pillar with a foot supports the entire mechanism, and the work-table, with a range of vertical adjustment.

Multiple Spindle Machines.—Many of the sensitive machines are fitted with two, three or more spindles operated in unison with a belt common to all. In other machines the multiple spindles are capable of adjustment for centres, as in the machines used by boiler makers and platers. In others the spindles are adjustable in circles of varying radii, as in those employed for drilling the bolt holes in pipe flanges. In many of these the spindles are horizontal. Some very special multiple-spindle machines have the spindles at different angles, horizontal and vertical, or at angles.

Universal Machines are a particular form of the pillar type in which the spindle is horizontal, moving with its carriage on a pillar capable of traversing horizontally along a bed; the carriage has vertical adjustment on its pillar and so commands the whole of the face of a large piece of work bolted to a low bed-plate adjacent to the machine. The term "universal" signifies that the machine combines provision for drilling, boring, tapping screws and inserting screw studs, facing and in some cases milling. The power required for boring is obtained by double and treble gears. These machines are used largely in marine engine works, where very massive castings and forgings must be operated on with their faces set vertically.

Boring Machines.—Many machines are classified as suitable for drilling and boring. That simply means that provision is made on a drilling machine for boring holes of moderate size, say up to 8 or 10 in., by double and treble back-gears. But the real boring machine is of a different type. In the horizontal machines a splined bar actuated by suitable gears carries a boring head which holds the cutters, which head is both rotated with, and traversed or fed along the bar. The work to be bored is fixed on a table which has provision for vertical adjustment to suit work of different dimensions. The boring-bar is supported at both ends. In the case of the largest work the boring-bar is preferably set with its axis vertically, and the framing of the machine is arch-like. The bar is carried in a bearing at the crown of the arch and driven and fed there by suitable gears, while the other end of the bar rotates in the table which forms the base of the machine. Some boring machines for small engine cylinders and pump barrels have no bar proper, but a long boring spindle carrying cutters at the further end is supported along its entire length in a long stiff boss projecting from the headstock of the machine—the *snout* machine. The work is bolted on a carriage which slides along a bed similar to a lathe bed. Many of these machines have two bars for boring two cylinders simultaneously

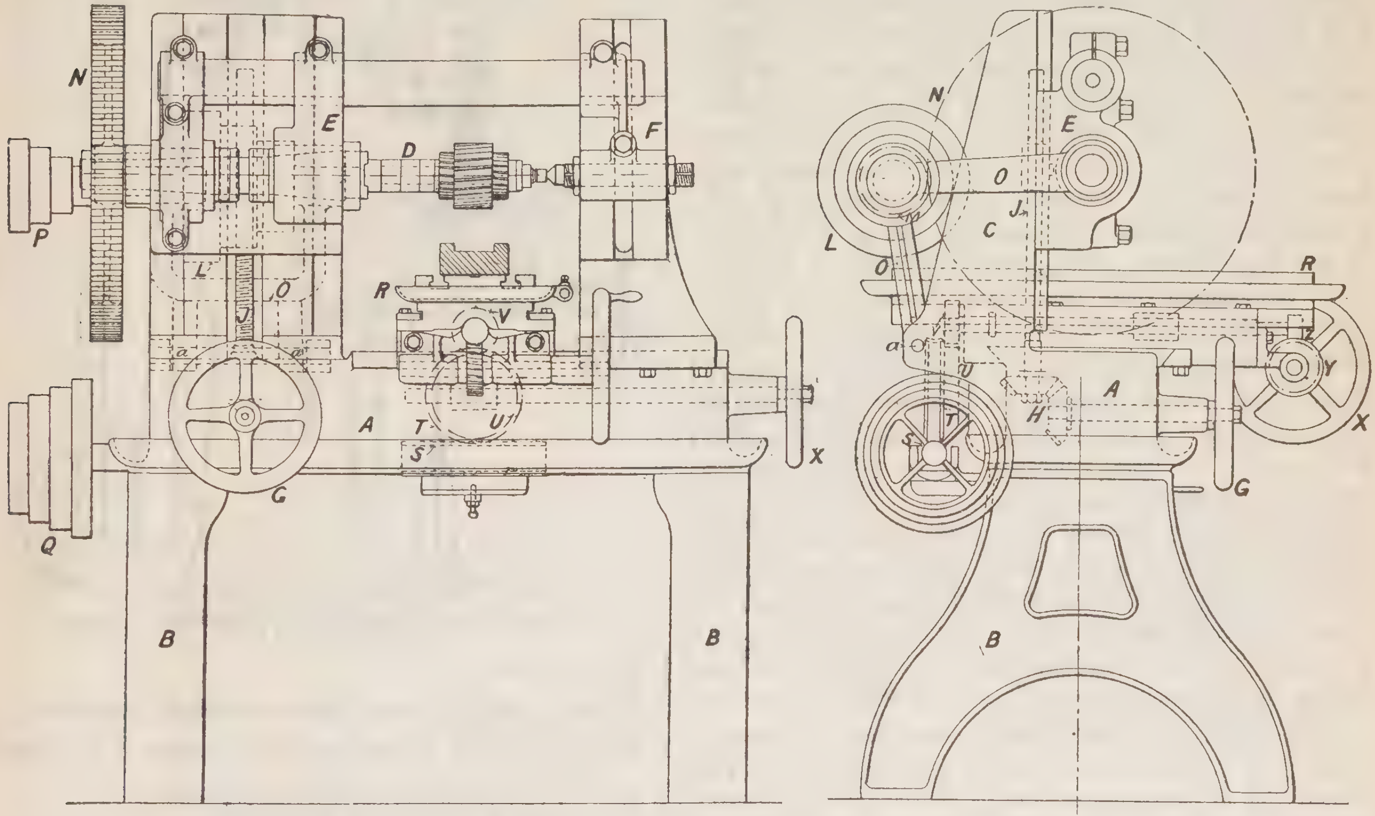


FIG. 47.—Lincoln Milling Machine. (John Holroyd & Co., Ltd., Milnrow.)

A, Bed.
B, *B*, Legs.
C, Upright.
D, Spindle or arbor.
E, Headstock, carrying bearings for spindle *D*.
F, Tailstock, carrying point centre for tail end of spindle.
G, Hand-wheel for effecting adjustment in height of headstock, through bevel-gears *H* and screw *J*.
K, Cross-bar connecting head- and tail-stocks, and ensuring equal vertical adjustment of the spindle bearings from the screw *J*.
L, Speed cones for driving spindle, through pinion *M* and wheel *N*.
O, Frame, carrying the bearings for the cone pulley *L*, and pivoted to the bed at *a*, and to the headstock *E*. This device keeps the gears *M* and *N* in engagement in all variations in the height of the spindle *D*.
P, *Q*, Cones for driving the table *R* through worm-gears *S*, *T*, and spurs *U*, *V*, to the table screw.
W, Stop for automatic knock-off to feed.
X, Hand-wheel for turning the same screw through worm-gears *Y*, *Z*.

IV.—Milling Machines

In milling machines rotary saw-like cutters are employed. To a certain extent these and some gear-cutting machines overlap because they have points in common. Many gear-wheel teeth are produced by rotary cutters on milling machines. In many machines designed for gear cutting only, rotary cutters alone are used. For this reason the two classes of machines are conveniently and naturally grouped together, notwithstanding that a large and increasing group of gear-cutting machines operate with reciprocating tools.

The French engineer, Jacques de Vaucanson (1709–1782), is credited with having made the first milling cutter. The first very crude milling machine was made in 1818 at a gun factory in Connecticut. To-day the practice of milling ranks as of equal economic value with that of any other department of the machine shop, and the varieties of milling machines made are as highly differentiated as are those of any other group. An apparent incongruity which is rather striking is the relative disproportion between the mass of these machines and the small dimensions of the cutters. The failures of many of the early machines were largely due to a lack of appreciation of the intensity of the stresses involved in milling. A single-edged cutting tool has generally a very narrow edge in operation. Milling cutters are as a rule very wide by comparison, and several teeth in deep cuts are often in simultaneous operation. The result is that the machine spindle and the arbor or tool mandrel are subjected to severe stress, the cutter tends to spring away from the surface being cut, and if the framings are of light proportions they vibrate, and inaccuracy and chatter result. Even with the very stiff machines now made it is not possible to produce such accurate results on wide surfaces as with the planer using a narrow-edged tool. Because of this great resistance and stress, cutters of over about an inch in width are always made with the teeth arranged spirally, and wide cutters which are intended for roughing down to compete with the planer always have either inserted cutters or staggered teeth. Hence the rotary cutter type of machine has not been able to displace the planing machine in wide work when great accuracy is essential. Its place lies in other spheres, in some of which its position is unassailable. Nearly all pieces of small and medium dimensions are machined as well by milling as by single-edged tools. All pieces which have more than one face to be operated on are done better in the milling machine than elsewhere. All pieces which have profiled outlines involving combinations of curves and plane faces can generally only be produced economically by milling. Nearly all work that involves equal divisions, or pitchings, as in the manufacture of the cutters themselves, or spiral cutting, or the teeth of gear-wheels when produced by rotary cutters, must be done in milling machines. Beyond these a large quantity of work lies on the border-line, where the choice between milling and planing, shaping, slotting, &c., is a matter for individual judgment and experience. It is a matter for some surprise that round the little milling cutter so many designs of machines have been built, varying from each other in the position of the tool spindles, in their number, and in the means adopted for actuating them and the tables which carry the work.

A very early type of milling machine, which remains extremely popular, was the Lincoln. It was designed, as were all the early machines, for the small arms factories in the United States. The necessity for all the similar parts of pistols and rifles being interchangeable, has had the paramount influence in the development of the milling machine. In the Lincoln machine as now made (fig. 47) the work is attached to a table, or to a vice on the table, which has horizontal and cross traverse movements on a bed, but no capacity for vertical adjustment. The cutter is held and rotated on an arbor driven from a headstock pulley, and supported on a tailstock centre at the other end, with capacity for a good range of vertical adjustment. This is necessary both to admit pieces of work of different depths or thicknesses between the table and the cutter, and to regulate the depth of cutting (vertical feed). Around this general design numerous machines small and large, with many variations in detail, are built. But the essential feature is the vertical movement of the spindle and cutter, the support of the arbor (cutter spindle) at both ends, and the rigidity afforded by the bed which supports head- and tail-stock and table.

The pillar and knee machines form another group which divides favour about equally with the Lincoln, the design being nearly of an opposite character. The vertical movements for setting and feed are imparted to the work, which in this case is carried on a bracket or knee that slides on the face of the pillar which supports the headstock. Travelling and transverse movements are imparted to the table slides. The cutter arbor may or may not be supported away from the headstock by an arched overhanging arm. None of these machines is of large dimensions. They are made in two leading designs—the plain and the universal. The first embodies rectangular relations only, the second is a marvellous instrument both in its range of movements and fine degree of precision. The first machine of this kind was exhibited at Paris in 1867. The design permits the cutting of spiral grooves, the angle of which is embodied in the adjustment of a swivelling table and of a headstock thereon (universal or spiral head). The latter embodies change-gears like a screw-cutting lathe and worm-gear for turning the head, in combination with an index or dividing plate having several circles of holes, which by the insertion of an index peg permit of the work spindle being locked during a cut. The combinations possible with the division plate and worm-gear number hundreds. The head also has angular adjustments in the vertical direction, so that tapered work can be done as well as parallel. The result is that there is nothing in the range of spiral or parallel milling, or tapered work or spur or bevel-gear cutting, or cutter making, that cannot be done on this type of machine, and the accuracy of the results of equal divisions of pitch and angle of spiral do not depend on the human element, but are embodied in the mechanism.

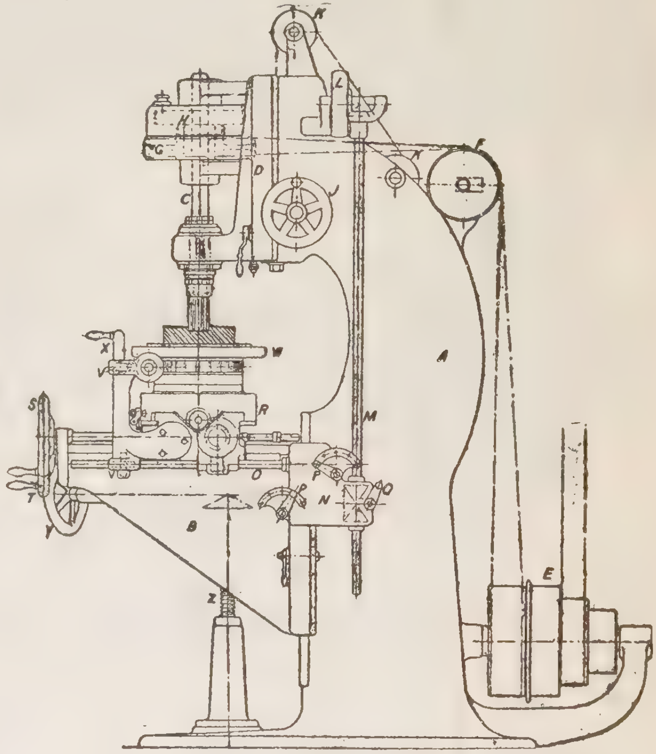


Fig. 48.—Vertical Spindle Milling Machine. (James Archdale & Co., Ltd.)

A, Main framing.
B, Knee.
C, Spindle, having its vertical position capable of adjustment by the sliding of *D* on *A*.
E, Driving cone, belt driving over guide pulleys *F* to spindle pulley *G*.
H, Enclosed gears for driving spindle by back gear.
J, Hand-wheel for adjusting spindle vertically.
K, *K*, Pulleys over which spindle is counterbalanced.
L, Feed pulley, driven from counter shaft.
M, Vertical feed shaft, driven from *L* through mitre-gears.
N, Change gear box.
O, Horizontal feed shaft, operating longitudinal and transverse feed of table through spiral and spur-gears.
P, *P*, Handles for operating changes in feed speeds, nine in number.
Q, Handle for reversing direction of motion of table *R*.
S, Hand-wheel for longitudinal movement of table.
T, Hand-wheel for effecting cross adjustments.
V, Spiral gears indicated for effecting self-acting rotation of circular table *W*.
X, Hand-wheel for rotation of table.
Y, Hand-wheel for vertical movements of knee *B* on screw *Z*.

Machines with vertical spindles (fig. 48) form another great group, the general construction of which resembles that either of the common drilling machine or of the slotting machine. In many cases the horizontal position is preferable for tooling, in others the vertical, but often the matter is indifferent. For general purposes, the heavier class of work excepted, the vertical is more convenient. But apart from the fitting of a special brace to the lower end of the spindle which carries the cutter, the spindle is unsupported there and is thus liable to spring. But a brace can only be used with a milling cutter that operates by its edges, while one advantage of the vertical spindle machine is that it permits of the use of end or face cutters. One of the greatest advantages incidental to the vertical position of the spindle is that it permits of profile milling being done. One of the most tedious operations in the machine shop is the production of outlines which are not those of the regular geometric figures, as rectangles and circles, or combinations of the same. There is only one way in which irregular forms can be produced cheaply and interchangeably, and that is by controlling the movements of the tool with an object of similar shape termed a "form" or "former," as in the well-known copying lathes, in the cam grinding machine, and in the forming adjuncts fitted to vertical spindle milling machines, so converting those into profiling machines. The principle and its application are alike simple. An object (the form) is made in hardened steel, having the same outlines as the object to be milled, and the slide which carries the cutter spindle has a hardened former pin or roller, which is pulled hard against the edges of the form by a suspended weight, so causing the tool to move and cut in the same path and in the same plane around the edges of the work. Here the milling machine holds a paramount place. No matter how many curves and straight portions may be combined in a piece, the machine reproduces them all faultlessly, and a hundred or a thousand others all precisely alike without any tentative corrections.

Plano-millers, also termed slabbing machines, form a group that grows in value and in mass and capacity. They are a comparatively late development, becoming the chief rivals to the planing machines, for all the early milling was of a very light character. In general outlines the plano-millers closely resemble the planing machines, having bed, table, housings and cross-rail. The latter in the plano-miller carries the bearings for the cutter spindle or spindles under which the work travels and reciprocates. These spindles are vertical, but in some machines horizontal ones are fitted also, as in planers, so that three faces at right or other angles can be operated on simultaneously. The slabbing operations of the plano-millers do not indicate the full or even the principal utilities of these machines. To understand these it must be remembered that the cross-sections of very many parts which have to be tooled do not lie in single planes merely, but in combinations of plane surfaces, horizontal, vertical or angular. In working these on the planing machine separate settings of tools are required, and often successive settings. But milling cutters are built up in "gangs" to deal with such cases, and in this way the entire width of profile is milled at once. Horizontal faces, and vertical and angular edges and grooves, are tooled simultaneously, with much economy in time, and the cutter profile will be accurately reproduced on numbers of separate pieces. Allied to the plano-millers are the rotary planers. They derive their name from the design of the cutters. An iron disk is pierced with holes for the insertion of a large number of separate cutters, which by the rotation of the disk produce plane surfaces. These are milling cutters, though the tools are single-edged ones, hence termed "inserted tooth mills." These are used on other machines besides the rotary planers, but the latter are massive machines built on the planer model, with but one housing or upright to carry the carriage of the cutter spindle. These machines, varied considerably in design, do good service on a class of work in which a very high degree of accuracy is not essential, as column flanges, ends of girders, feet of castings, and such like.

V.—Gear-cutting Machines

The practice of cutting the teeth of gear-wheels has grown but slowly. In the gears used by engineers, those of large dimensions are numerous, and the cost of cutting these is often prohibitive, though it is unnecessary in numbers of mechanisms for which cast wheels are as suitable as the more accurately cut ones. The smallest gears for machines of precision have long been produced by cutting, but of late years the practice has been extending to include those of medium and large dimensions, a movement which has been largely favoured by the growth of electric driving, the high speeds of which make great demands on reduction and transmission gears. Several new types of gear-cutting machines have been designed, and specialization is still growing, until the older machines, which would, after a fashion, cut all forms of gears, are being ousted from modern establishments.

The teeth of gear-wheels are produced either by rotary milling cutters or by single-edged tools (fig. 49). The advantage of the first is that the cutter used has the same sectional form as the inter-tooth space, so that the act of tooth cutting imparts the shapes without assistance from external mechanism. But this holds good only in regard to spur-wheel teeth, that is, those in which the teeth lie parallel with the axis of the wheel. The teeth of bevel-wheels, though often produced by rotary cutters, can never be formed absolutely correctly, simply because a cutter of unalterable section is employed to form the shapes which are constantly changing in dimensions along the length of the teeth (the bevel-wheel being a frustum of a cone). Hence, though fair working teeth are obtained in this way, they result from the practice of varying the relative angles of the cutters and wheel and removing the material in several successive operations or traverses, often followed by a little correction with the file. Although this practice is still commonly followed in bevel-wheels of small dimensions, and was at one time the only method available, the practice has been changing in favour of shaping the teeth by a process of planing with a single-edged reciprocating tool. As, however, such a tool embodies no formative section as do the milling cutters, either it or the wheel blank, or both, have to be coerced and controlled by mechanism outside the tool itself. Around this method a number of very ingenious machines have been designed, which may be broadly classed under two great groups—the form and the generating types.

In the form machines a pattern tooth or form-tooth is prepared in hardened steel, usually three times as large as the actual teeth to be cut, and the movement of the mechanism which carries the wheel blank is coerced by this form, so that the tool, reciprocated by its bar, produces the same shape on the reduced dimensions of the wheel teeth. The generating machines use no pattern tooth, but the principles of the tooth formation are embodied in the mechanism itself. These are very interesting designs, because they not only shape the teeth without a pattern tooth, but their movements are automatically controlled. A large number of these have been brought out in recent years, their growth being due to the demand for accurate gears for motor cars, for electric driving, and for general high-class engineers' work. These are so specialized that they can only cut the one class of gear for which they are designed—the bevel-wheels, and these in only a moderate range of dimensions on a single machine of a given size. The principal bevel-gear cutting machines using forms or formers, are the Greenwood & Batley, Le Progrès Industriel, the Bouhey (cuts helical teeth), the Oerlikon, which includes two types, the single and double cutting tools, the Gleason and the Rice. Generating machines include the Bilgram (the oldest), the Robey-Smith, the Monneret, the Warren, the Beale and the Dubosc.

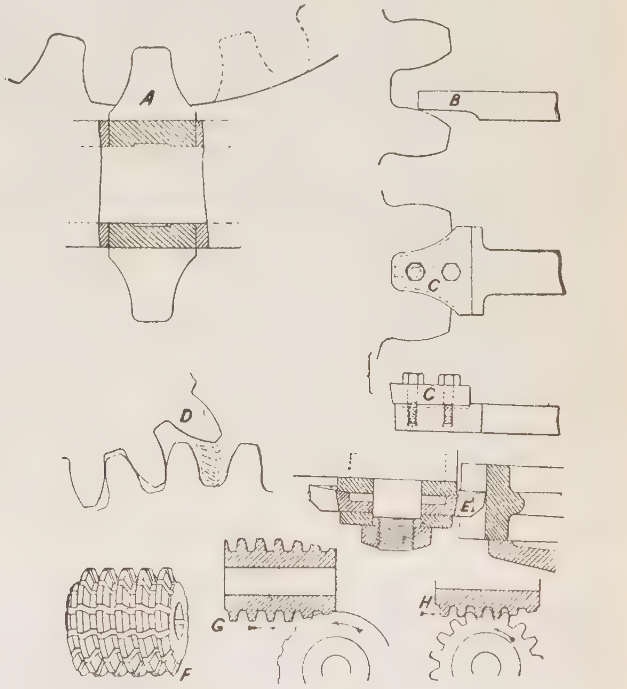


Fig. 49.—Gear Cutting.

A, Rotary milling cutter producing tooth space.
B, Planer tool operating on tooth flank.
C, Planer form-tool finishing tooth space.
D, Action of "Fellows" cutter, planing teeth.
E, Shape of "Fellows" cutter.
F, Hobbing cutter.
G, Tapered hob beginning worm-wheel.
H, Ditto finishing.

As the difficulties of cutting bevel-wheels with rotary cutters, consequent on change of section of the teeth, do not occur in spur-gears, there are no examples of form machines for spur-wheel cutting, and only one generating planing type of machine, the Fellows, which produces involute teeth by a hardened steel-cutting pinion, which shapes wheels having any number of teeth of the same pitch, the cutter and blank being partly rotated between each cut as they roll when in engagement.

The worm-gears appropriate a different group of machines, the demands on which have become more exacting since the growth of electric driving has brought these gears into a position of greater importance than they ever occupied before. With this growth the demand for nothing less than perfect gears has developed. A perfect gear is one in which the teeth of the worm-wheel are envelopes of the worm or screw, and this form can only be produced in practice in one way—by using a cutter that is practically a serrated worm (a hob), which cuts its way into the wheel just as an actual worm might be supposed to mould the teeth of a wheel made of a plastic substance. To accomplish this the relative movements of the hob and the wheel blank are arranged to be precisely those of the working worm and wheel. Very few such machines are made. A practical compromise is effected by causing the hob both to drive and cut the blank in an ordinary machine. When worms are not produced by these methods the envelope cannot be obtained, but each tooth space is cut by an involute milling cutter set at the angle of thread in a universal machine, or else in one of the general gear-cutting machines used for spur, bevel and worm gears, and only capable of yielding really accurate results in the case of spur-wheels.

The previous remarks relate only to the sectional forms of the teeth. But their pitch or distance from centre to centre requires dividing mechanism. This includes a main dividing or worm-wheel, a worm in conjunction with change gears, and a division plate for setting and locking the mechanism. The plate may have four divisions only to receive the locking lever or it may be drilled with a large number of holes in circles for an index peg. The first is adopted in the regular gear-cutters, the second on the universal milling machines which are used also for gear-cutting. In the largest number of machines this pitching has to be done by an attendant as often as one tooth is completed. But in a good number of recent machines the pitching is effected by the movements of the machine itself without human intervention. With spur-wheels the cutting proceeds until the wheel is complete, when the machine is often made to ring a bell to call attention to the fact. But in bevel-wheels only one side of the teeth all the way round can be done; the attendant must then effect the necessary settings for the other side, after which the pitchings are automatic.

As a general rule only one tooth is being operated on at one time. But economy is studied in spur-gears by setting several similar wheels in line on a mandrel and cutting through a single tooth of the series at one traverse of the tool. In toothed racks the same device is adopted. Again, there are cases in which cutters are made to operate simultaneously on two, three or more adjacent teeth.

Recently a generating machine of novel design has been manufactured, the spur-wheel hobbing machine. In appearance the hob resembles that employed for cutting worm-gears, but it also generates the teeth of spur and spiral gears. The hob is a worm cut to form teeth, backed off and hardened. The section of the worm thread is that of a rack. Though it will cut worm-wheels, spiral-wheels or spur-wheels equally correctly, the method of presentation varies. When cutting worm-wheels it is fed inwards perpendicularly to the blank; when cutting spirals it is set at a suitable angle and fed across the face of the blank. The angle of the worm thread in the hob being about 2½°, it has to be set by that amount out of parallel with the plane of the gear to be cut. It is then fed down the face of the wheel blank, which is rotated so as to synchronize with the rotation of the worm. This is effected through change gears, which are altered for wheels having different numbers of teeth. The advantage is that of the hob over single cutters; one hob serves for all wheels of the same pitch, and each wheel is cut absolutely correct. While using a set of single cutters many wheels must have their teeth only approximately correct.

VI.—GRINDING MACHINES

The practice of finishing metallic surfaces by grinding, though very old, is nevertheless with regard to its rivalry with the work of the ordinary machine tools a development of the last part of the 19th century. From being a non-precision method, grinding has become the most perfect device for producing accurate results measured precisely within thousandths of an inch. It would be rather difficult to mention any class of machine-shop work which is not now done by the grinding wheel. The most recent developments are grinding out engine cylinders and grinding the lips of twist drills by automatic movements, the drills rotating constantly.

There are five very broad divisions under which grinding machines may be classified, but the individual, well-defined groups or types might number a hundred. The main divisions are: (1) Machines for dealing with plane surfaces; (2) machines for plain cylindrical work, external and internal; (3) the universals, which embody movements rendering them capable of angular setting; (4) the tool grinders; and (5) the specialized machines. Most of these might be again classed under two heads, the non-precision and the precision types. The difference between these two classes is that the first does not embody provision for measuring the amount of material removed, while the second does. This distinction is a most important one.

The underlying resemblances and the differences in the main designs of the groups of machines just now noted will be better understood if the essential conditions of grinding as a corrective process are grasped. The cardinal point is that accurate results are produced by wheels that are themselves being abraded constantly. That is not the case in steel cutting tools, or at least in but an infinitesimal degree. A steel tool will retain its edge for several hours (often for days) without the need for regrinding, but the particles of abrasive in an emery or other grinding wheel are being incessantly torn out and removed. A wheel in traversing along a shaft say of 3 ft. in length is smaller in diameter at the termination than at the beginning of the traverse, and therefore the shaft must be theoretically larger at one end than the other. Shafts, nevertheless, are ground parallel. The explanation is, and it lies at the basis of emery grinding, that the feed or amount removed at a single traverse is extremely minute, say a thousandth or half a thousandth of an inch. The minuteness of the feed receives compensation in the repetition and rapidity of the traverse. The wear of the wheel is reduced to a minimum and true work is produced.

From this fact of the wear of grinding wheels two important results follow. One is that a traverse or lateral movement must always take place between the wheel and the piece of work being ground. This is necessary in order to prevent a mutual grooving action between the wheel and work. The other is that it is essential to provide a large range in quality of wheels, graded according to coarseness and fineness, of hardness and softness of emery to suit all the different metals and alloys. Actually about sixty grades are manufactured, but about a dozen will generally cover average shop practice. With such a choice of wheels the softest brass as well as the hardest tempered steel or case-hardened glass-like surfaces that could not possibly be cut in lathe or planer, can be ground with extreme accuracy.

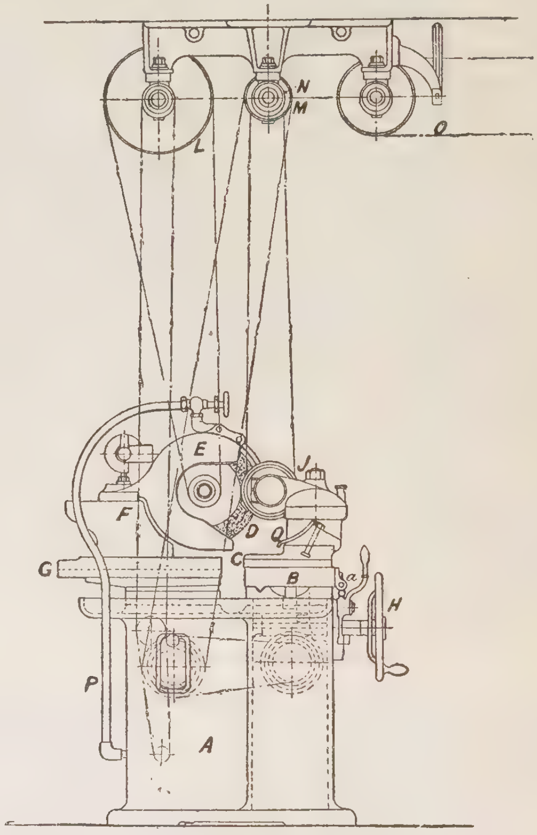


FIG. 50.—Universal Grinding Machine, 7 in. centres; 3 ft. 6 in. between centres. (H. W. Ward & Co., Ltd., Birmingham.)

A, Base or body, with waste water tray round top edge, and interior fitted as cupboards, with shelves and doors.
B, Sliding table.
C, Swivel table.
D, Grinding wheel.
E, Wheel guard.
F, Wheel headstock swivelling in a horizontal plane, and having the base graduated into degrees for angular setting.
G, Slide carrying headstock.
H, Hand-wheel for traversing table.
J, Headstock for carrying and driving work, used for chuck work or dead centre work; the base is graduated into degrees.
a, Dogs, which regulate automatic reversals. An internal grinding fixture, not shown, is fitted to wheel head.
L, Countershaft pulley driving to wheel pulley.
M, Pulley driving to cones.
N, Pulley driving to work headstock pulley.
O, Belt from line shaft.
P, Water pipe from pump.
Q, Water guards above table.

Plane surfacing machines in many cases resemble in general outlines the well-known planing machine and the vertical boring mill. The wheels traverse across the work, and they are fed vertically to precise fractional dimensions. They fill a large place in finishing plane surfaces, broad and narrow alike, and have become rivals to the planing and milling machines doing a similar class of work. For hardened surfaces they have no rival.

Cylindrical grinders include many subdivisions to embrace external and internal surfaces, either parallel or tapered, small or large. In their highest development they fulfil what are termed "universal" functions (fig. 50), that is, they are capable of grinding both external and internal cylinders, plane faces, tapers, both of low and high angle, and the teeth of various kinds of tools and cutters. These machines occur in two broad types. In one the axis of the revolving wheel is traversed past the work, which revolves but is not traversed. In the other the reverse occurs, the work traversing and the axis of the wheel with its bearings remaining stationary. Equally satisfactory results are obtained by each.

In all external cylindrical grinding, when the work can be rotated, the piece being ground rotates in an opposite direction to the rotation of the wheel (fig. 51, *A*). In all small pieces ground internally the same procedure is adopted (fig. 51, *B*). Incidentally, mention should be made of the fineness of the fitting required and attained in the construction of the spindles which carry the wheels for internal grinding. The perfection of fitting and of the means of adjustment for eliminating the effects of wear in the ordinary spindles for external and internal grinding is remarkable. The spindles for internal work have to revolve at rates ranging from about 6000 to 30,000 times in a minute, yet run so truly that the holes ground do not depart from accuracy by more than say $\frac{1}{5000}$ to $\frac{1}{10000}$ of an inch. Yet so long as the work can be revolved no special complication of mechanism is required to ensure good results. The revolution of the wheel and the work is mutually helpful. The real difficulties arise when the work, on account of its mass or awkwardness of shape, cannot be revolved. The principle embodied in machines designed to deal satisfactorily with such cases, though much diversified in detail, is the application of the planet device to the grinding wheels. That is, the wheel spindle rotating at a high speed, 6000 or 7000 revolutions per minute, is simultaneously carried round in a circular path, so that its axis makes about 25 or 30 revolutions per minute (fig. 51, *C* and *D*). The diameter of the path is capable of adjustment with minute precision within wide limits to suit bores of different diameters. The periphery of the grinding wheel which lies farthest from its axis of revolution sweeps round in a path the diameter of which equals that of the bore to be ground. These machines are now used largely for grinding out the cylinders of gas and petrol engines, valve seatings, the bushed holes of coupling rods, and similar classes of work. Many of them have their spindles set horizontally, others vertically.

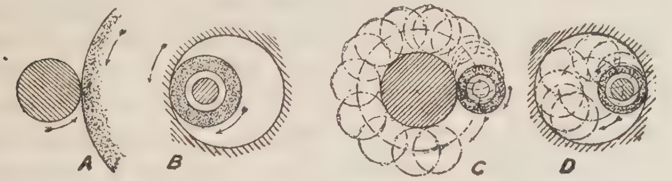


FIG. 51.

A, External cylindrical grinding. *B*, Internal ditto. *C*, External grinding when the work is fixed. *D*, Internal ditto.

Allied to these are a relatively small but important group of machines used for grinding the slot links of the slide-valve gear of locomotive and other engines. The slot is mounted on a pivoted bar adjusted to the same radius as the slot to be ground, and the slot is moved relatively to the wheel, so producing the required curves.

In another direction much development has taken place in the practice of grinding. The increasing use of the milling cutter has been the occasion for the growth and high specialization of the cutter grinding machines. It is essential to the efficiency of such cutters that regrinding shall be done without drawing the temper, and this can only be effected by the use of an abrasive. In the early days of their use the temper had to be drawn to permit of filing and rehardening effected with its inevitable distortion.

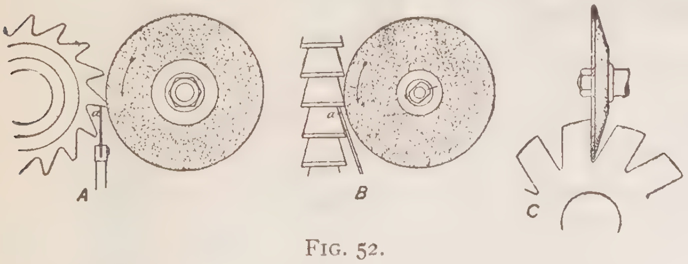


FIG. 52.

A, Grinding front edges of milling cutter. *B*, Grinding side edges of milling cutter; *a*, *a*, Tooth rests. *C*, Grinding face of formed mill.

Cutter grinding machines must possess universality of movements to deal with the numerous shapes in which milling cutters are made; hence they often resemble in general outlines the universal grinding machines. But as a rule they are built on lighter models, and with a smaller range of movements, because the dimensions of cutters are generally much smaller than those of the ordinary run of engineers' work which has to be ground. Frequently a single pillar or standard suffices to carry the mechanism. In an ordinary universal tool grinder all the teeth of any form of cutter can be ground precisely alike (fig. 52) excepting those having irregular profiled outlines, for which a special machine, or an extra attachment to an ordinary machine, is necessary. But little of this is done, because in such cases, and in many others, the faces of the teeth are ground instead of the edge. This idea, due to the firm of Brown & Sharpe, may seem a trifle, but nevertheless to it the credit is largely due for the economies of cutter grinding. The principle is that in the "formed cutter," as it is termed, the profiles of the teeth are not struck from the axis of revolution, but from another centre (fig. 20); grinding the tooth faces, therefore, has no effect on the shapes of the profiles, but only lessens the tooth thicknesses. Designed originally for the cutters for the teeth of gear-wheels, it has long been applied to profiles which involve combinations of curves. The pitching of the teeth is effected by a strip of metal, or tooth rest *a* (fig. 52), on which each successive tooth rests and is coerced during the grinding. If teeth are of special form the traverse movement of a spiral tooth along the rest ensures the required movement.

Besides the cutter grinders used for milling cutters, reamers and screwing taps, there are two other groups of tool grinders, one for twist drills only and the other for the single-edged tools used in lathe, planer, shaper and other machines. Both these in their best forms are of recent development. The machines used for grinding twist drills embody numerous designs. Hand grinding is practically abandoned, the reason being that a very minute departure from symmetry on the two cutting lips of the drill results inevitably in the production of inaccurate holes. It is essential that the two lips be alike in regard to length, angle and clearance, and these are embodied in the mechanism of the grinding machines. But formerly in all these the drill holder had to be moved by hand around its pivot, and one lip ground at a time There are now some very beautiful machines of German manufacture in which the necessary movements are all automatic, derived from the continuous rotation of a belt pulley. The drill rotates constantly, and small amounts are ground off each lip in turn until the grinding is finished. The other group for grinding single-edged tools is a very small one. The correct angles for grinding are embodied in the setting of the machine, with the great advantage that any number of similar tools can be ground all alike without skilled attendance.

Lying outside these broad types of machines there is a large and growing number designed for special service. The knife-grinding group for sharpening the planer knives used in wood-working machinery is a large one. Another is that for gulleting or deepening the teeth of circular saws as they wear. Another is designed for grinding the cups and cones for the ball races of cycle wheels, and another for grinding the hardened steel balls employed in ball bearings.

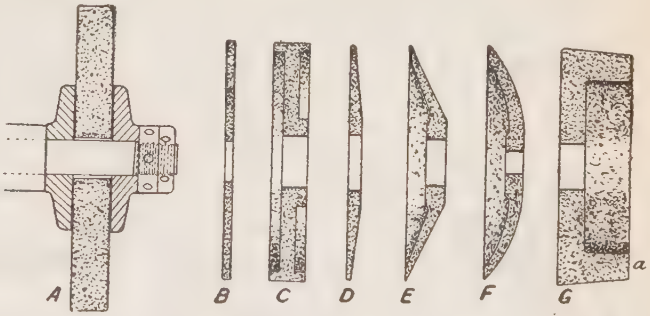


FIG. 53.—Typical Grinding Wheels.

A, Common disk held on spindle with washers and nuts.
B, Thin disk.
C, Flanged disk for grinding to shoulders.
D, Bevelled disk for cutter grinding.
E, *F*, Cupped and dished wheels for cutter grinding.
G, Cup wheel for grinding on face *a*; diameter remains constant.

Emery grinding is dependent for much of its success on a plentiful supply of water. Dry grinding, which was the original practice, is hardly employed now. The early difficulties of wet grinding were due to the want of a cementing material which would not soften under the action of water. Now wheels will run constantly without damage by water, and they are so porous that water will filter through them. Improvements in the manufacture of wheels, and the increased use of water, have concurred to render possible heavier and more rapid grinding without risk of distortion due to heating effects. In the best modern machines the provisions for water supply are a study in themselves, including a centrifugal pump, a tank, jointed piping, spraying tube, guards to protect the bearings and slides from damage, and trays to receive the waste water and conduct it back to the tank.

There are two points of view from which the modern practice of grinding is now regarded—one as a corrective, the other as a

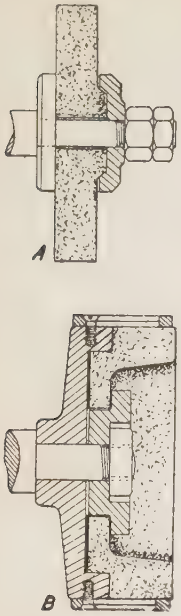


Fig. 54.—Safety Devices.

A, Grinding wheel, with coned washer to retain broken pieces in case of fracture.

B, Cup wheel with encircling ring, moved backwards as the wheel face wears.

formative process. The first is the older and is still by far the most important. The second is a later ideal towards which design and practice have been extending. As yet grinding cannot compete with the work of the single-edged tools and milling cutters when large quantities of material have to be removed. Just as some leading firms have been designing stiffer machines having fuller lubrication with a view to increase the duty of grinding wheels, the advent of the high-speed steels has given a new lease of life to the single-edged cutting tools. The rivalry now lies not with the tools of carbon temper steel, but with high-speed varieties. But as a corrective process grinding never occupied so important a position as it does to-day, and its utility continues to extend.

The commoner forms in which grinding wheels are made are shown in fig. 53. These are varied largely in dimensions, from tiny cylindrical rollers a fraction of an inch in diameter for hole grinding, to big wheels of 3 ft. or more in diameter. Safety mountings, two examples of which are shown in fig. 54, embody means of retaining the broken pieces of a wheel in case it bursts.

Sand-blast.—The well-known erosive action of sand when driven against rocks and stones by the wind is utilized industrially in the sand-blast apparatus, the invention of B. C. Tilghman. The sand is propelled by a current of steam or air, and being delivered through a nozzle is directed against the surface of the work, cutting it away by the action of the enormous number of grains striking the face, each removing a very minute quantity of material. The action is very gentle, and may be modified by varying the class of sand and its velocity. Other materials, such as emery, chilled iron globules, &c., are employed for certain classes of work. In some instances the powder is used dry, in others it is mixed with water, being then in the condition of fluid mud. The plant includes an air-compressing engine, an air reservoir and the blast nozzle through which the air passes and propels the sand in the form of a jet. The pressures range from 8 lb up to about 60 lb per sq. in., depending on the class of work which is done.

The peculiar advantage of the sandblast lies in its adaptability to the working of irregular surfaces, which could not be touched by any other class of grinding. The blast penetrates hollows and recesses, and acts over an entire surface. There are many classes of operation done with the sand-blast, including cleaning, frosting, ornamentation, engraving and sharpening. In engineers' works a large amount of cleaning is effected upon castings, forgings, sheets and other products, either preparatory to machining or to painting, enamelling, tinning, galvanizing or plating. Cycle frames are cleaned with the sand-blast after brazing. The teeth of files are sharpened by directing a stream of sand and water against their backs, with the result that the burr thrown up by the chisel when cutting is obliterated, and a strong form of tooth is produced. Worn files may also be sharpened up to equal new ones by sand-blasting them. Frosting glass is another useful application of the sand-blast, and by attaching suitable patterns or designs to the surface the sand may be caused to work ornamental figurings. It is a peculiar circumstance that the sand has little effect upon soft and yielding substances in comparison with the abrasion it produces on hard surfaces, so that the pattern will remain undamaged, while the glass or other object beneath is frosted where the sand reaches it, through the openings. Not only can designs be worked on glass, or cut in stone, but perforations may be made in glass, &c., by the continued action of the sand, without any risk of fracture occurring. Much sand-blasting is performed inside closed chambers, having panes through which the workman watches the progress of the operation. But when the blast must be used in the open, protection is necessary and is afforded to the operator by a special helmet, which keeps out the flying dust and gives a supply of pure air through a tube in a similar fashion to the diver's helmet.

VII.—Sawing Machines

Metal-sawing machines are employed extensively in engineering works for cutting off bars, shafts, rails, girders and risers on steel castings, and for getting out curved pieces which would be difficult and expensive to slot. There are three classes of these saws, circular, band and reciprocating. The first named are used for straightforward work, operating at right or other angles, the second for straight cuts and also for curves which cannot be treated with circular saws, and the third for small pieces. The circular saws embody a stiff spindle, carrying the saw disk and driven by gearing. This spindle may be mounted in a sliding bearing to carry it past the work held on a fixed table, or the spindle may be stationary and the work be moved along past the saw. The method of feeding should be sensitive, so that it will "give" and prevent damage

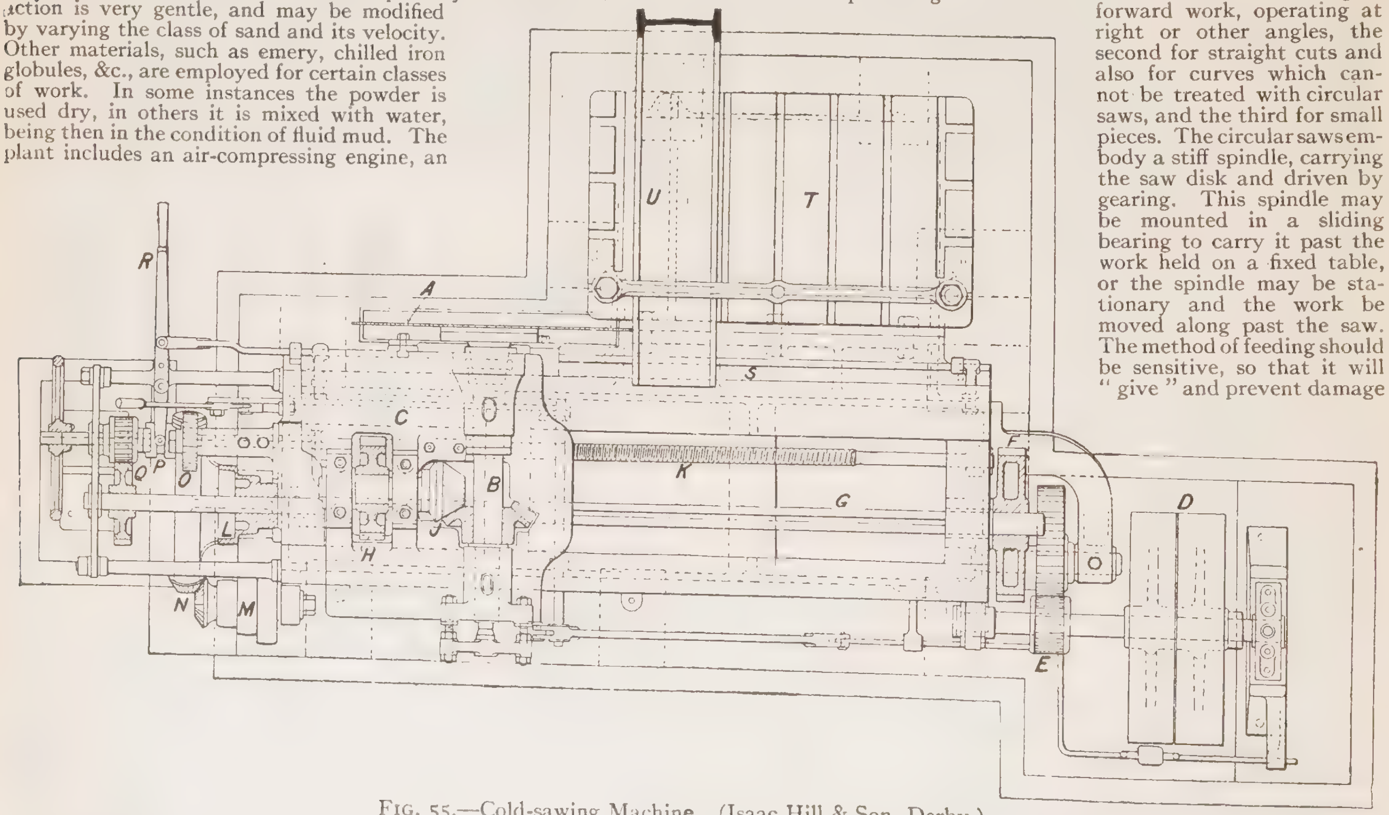


Fig. 55.—Cold-sawing Machine. (Isaac Hill & Son, Derby.)

A, Saw blade.
B, Spindle.
C, Sliding spindle carriage.
D, Driving pulleys.
E, First pinion, connecting through train of gears to wheel *F*, driving splined shaft *G*.
H, Wheel driven from sliding pinion on *G*.
J, Bevel-gears, communicating the motion to spindle *B*.
K, Screw for feeding carriage *C* along.
L, Three-step cone on shaft *G*, belted to *M*, connected by bevel-gears *N* and worm-gear *O*, to the screw *K*.
P, Clutch for throwing in *O* to drive *K*.
Q, Gears connecting shaft of *L* direct to *K*, also through clutch *P*.
R, Handle for operating clutch *P*, which thus gives slow feed when clutch is in mesh with *O*, and quick return when engaging with *P*.
S, Tappet rod, having dogs struck by carriage to stop feeding.
T, Work-table, with clamp to hold objects.
U, H-Girder being sawn off.

to the teeth, should undue stress come upon the saw. This is usually effected by the use of weights or springs, which allow a certain freedom or latitude to the driving gears. The work is held by screw clamps, V-blocks being required in the case of circular objects. A number of pieces, such as shafts, rails or girders, can be fastened down close together in a pile and cut through in one operation.

There is a very useful class of circular saw, the flush-side (fig. 55), that is valuable for cutting close up to a surface. The disk is bolted to a flange on the end of the spindle with countersunk bolts, so that the face is quite flat. Another class of saw used for dealing with girders and bars is carried in bearings upon a pivoted arm, which is pulled downwards by a weight to give the feed. The work is bolted to a table below the saw. Ample lubrication, by oil or soapy water, is essential in cutting wrought iron and steel; it is pumped on the blade, keeping it cool and washing away the cuttings.

Band-saw machines resemble in outline the familiar types employed for sawing wood, but they are necessarily stronger and stiffer, and the saws run at a much lower speed. The tables, moreover, differ in possessing compound slides for moving the work and in the provision of a series of slots on the top table, whereby the object to be sawn is secured with bolts and clamps. The tables are moved automatically or by hand. The rate of cutting must be varied according to the thickness of metal. Lubrication is effected by running the lower saw pulley in a bath of oil or soapy water, which is carried up, so keeping the blade cool and "easing" the cut.

The reciprocating class of saw has until recently been confined to small types for workshop use, termed hack saws, which have a small blade ranging from 12 to 18 in. long. This is strained between a couple of bearings in a frame which is reciprocated above the work clamped in a vice. An arrangement of weights feeds the saw downwards. The larger hack saws cut off bars and girders up to 12 in. across, and in some there is a provision introduced for giving intermittent rotation to the bar, thus presenting fresh faces to the saw. The hack saw is of great utility for comparatively light work, and, as the smallest blades are cheap enough to be thrown away when worn out, there is no trouble and expense connected with their sharpening, as in the circular and band saws. An adaptation of the reciprocating saw is that of the jig type, which has a small blade set vertically and passing up through a table on which the work is laid. It is handy for cutting out dies and various curved outlines, in the same manner that fret-sawing in wood is done.

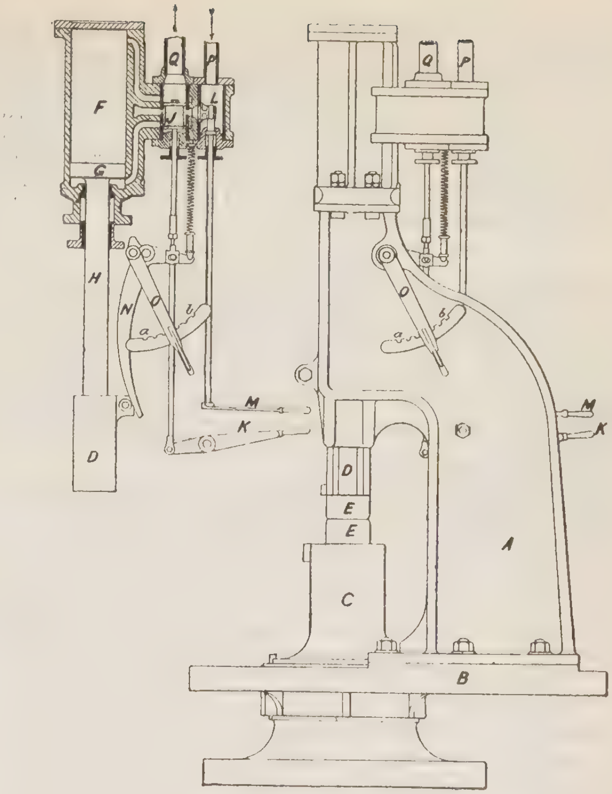


FIG. 57.—Steam Hammer, small Overhanging Type. (B. & S. Massey, Manchester).

A, Standard. *B*, Base-plate.
C, Anvil block (independent of standards).
D, Tup or hammer head.
E, *E*, Pallets, or forging blocks, attached to anvil and tup.
F, Steam cylinder.
G, Piston, solid with piston rod *H*.
J, Piston valve, regulating period of admission of steam, operated by hand by lever *K* or lever *N*.
L, Stop or throttle valve for controlling admission of steam to valve chest, operated by hand lever *M*.
N, Lever in contact with roller on tup *D*, which moves the valve *J* automatically as the tup rises and falls.
O, Lever for pre-adjusting the range of movement of *N* and *J*, according to its setting in the notches of the quadrant from *a* to *b*.
P, Steam supply pipe from boiler. *Q*, Exhaust steam pipe.

VIII.—SHEARING AND PUNCHING MACHINES

These have much in common as regards their mode of operation. They are actuated either by belt and spur gearing, by steam-engine, by electric motor, or hydraulically. The first named is only suitable where arrangements can be made for driving from a line shaft. In view of the great convenience of the other methods of driving, they are coming into greater use, especially for ship-yards and other works where shafting is undesirable or inconvenient.

For boiler makers' and platers' use the function of punching, and shearing are usually combined in one machine, the rams being placed at opposite ends and actuated from the same source of power. The last shaft in the train of gearing is set to bring its ends within the boxes containing the rams, and eccentrics on the shaft are moved within die blocks fitted to the rams, so that as the shaft revolves it causes the rams to move up and down and operate the shear blade and the punch attached to the bottom end. Another class of machines is worked by means of massive levers, pivoted in the framing, and actuated by cams on the driving shaft which cause the levers to rock and move the punches or shears up and down by the opposite ends. The punch slides are constructed to "dwell" for a short period at the top of the stroke at each revolution, thus giving the attendant time to place and adjust the plate accurately beneath the punch. The same effect is obtained in the eccentric types of machines mentioned above, by a disengaging motion, which is thrown in by touching a lever, thus stopping the punch until the operator is ready for its descent. The more complete machines have an angle shear situated centrally, with V-blades for severing angle iron. The largest forms of shears, for massive plates, usually have the blade reciprocated by crank or eccentrics on the driving shaft, coupled by connecting-rods to the slide.

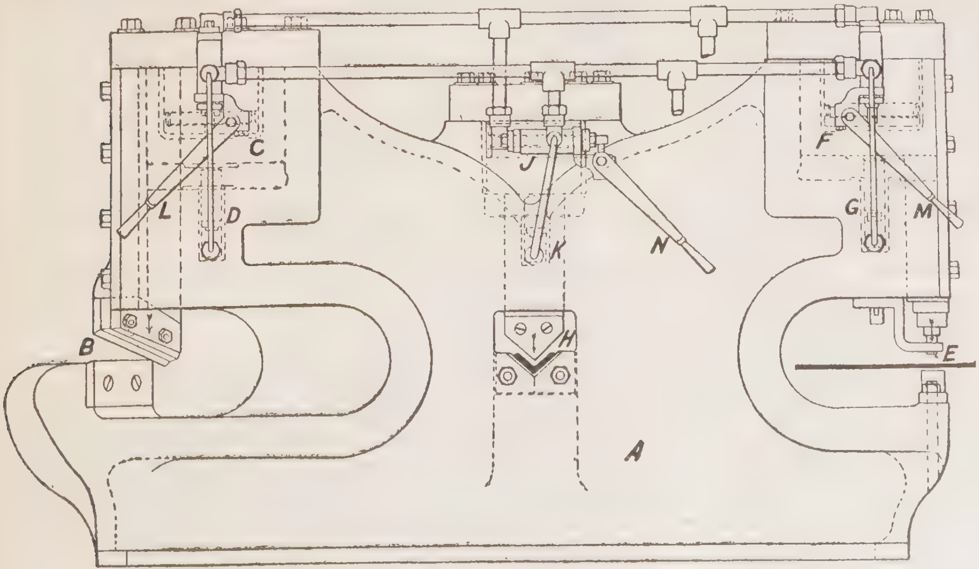


FIG. 56.—Hydraulic Punching and Shearing Machine. (Musgrave Brothers, Leeds.)

A, Frame.
B, Shear blades, set angularly.
C, Ram for operating blade.
D, Small ram for returning ditto.
E, Punch.
F & *G*, Main and return rams for punch.
H, Angle shear.
J, *K*, Main and return rams for ditto.
L, *M*, *N*, Attendant's controlling handles.

Hydraulic punching and shearing machines are used largely on account of their convenience, since they dispense with all belts, engines or motors in the vicinity, and give a very powerful stroke. The hydraulic cylinder is generally direct-connected to the slides, and the operator turns on the pressure water by a lever. The machine shown in fig. 56 is a very complete example of the hydraulic type, combining punching and shearing with angle-cutting.

Circular shears are used for the thinner plates and for sheet-metal work; they embody two circular blades placed with their axes parallel, and the sharp bevelled edges nearly in contact. The blades being rotated sever the plate as it is fed between them. Either straight or circular cuts may be made; true circles or disks are produced by mounting the plate on a fixed stud and rotating it through a complete revolution past the cutters.

IX.—HAMMERS AND PRESSES

The growth in the use of hammers actuated by steam and compressed air, and of presses worked by water power, has been remarkable. The precursors of the power hammers were the helve and the Oliver; the first named was operated by gravity, being lifted by a circle of cams, while the second was lifted by a spring pole overhead and pulled down by the foot of the workman, acting on a lever—the hammer shaft. The first was used by the ironworkers and the second by the smiths, until displaced by the Nasmyth hammer and its extensive progeny. Even now the old helve and Oliver survive in some unprogressive shops.

Steam Hammers.—The original hammer as invented by James Nasmyth was single acting, operating simply by gravity, the function of the steam being to lift the hammer for each succeeding fall. The first improvement was made by Rigby, who took the waste steam exhausted from the lower side of the piston to the upper side and so imparted some slight pressure in the descent. It was a stage between the early and the present hammers. In these, high-pressure steam is admitted above the piston to impart a more powerful blow, compounded of velocity×mass, than is obtainable by gravity; hence they are termed double-acting hammers (fig. 57). The principal difficulties which have to be surmounted in their construction are those due to the severe concussion of the blows, which very sensibly shake the ground over an area of many yards. Framings are made very rigid, and in the larger hammers double, enclosing the hammer head between them. The foundations are by far the heaviest used in any machine tools. Deep piling is often resorted to, supporting crossing timber balks; or concrete is laid in mass on which the iron anvil block is bedded. This block weighs anywhere between 100 and 1000 tons. The piston and its rod and the hammer head are generally a solid steel forging, for the piston rod is a weak element and cottered or screwed fittings are not trustworthy. Piston valves are generally used in preference to ordinary D-valves, combining simplicity of fitting with good balance. The periods of steam admission are under the control of the attendant, so that the length of stroke and the force of the blow are instantly responsive to his manipulation of the operating lever. Many hammers can be set to run automatically for any given length of stroke.

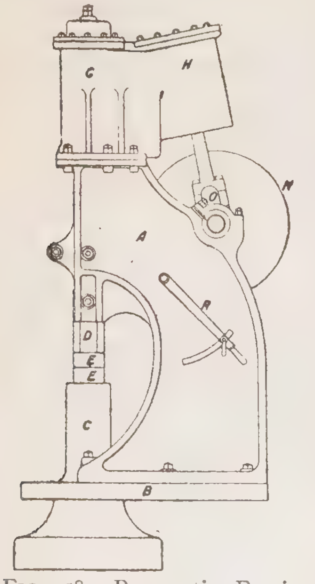


FIG. 58.—Pneumatic Forging Hammer.
(W. & J. Player, Birmingham.)

- *A*, Standards.
- *B*, Base-plate.
- *C*, Anvil block.
- *D*, Tup.
- *E*, *E*, Pallets.
- *G*, Hammer cylinder, the piston rod of which is attached to *D*.
- *H*, Air compressing cylinder.
- *N*, Belt pulleys which reciprocate by means of the crank *O*, the piston in *H*.
- *R*, Handle controlling the valve between *H* and *G*.

Pneumatic Hammers.—A successful type of hammer for the ordinary operations of the smithy is that which is actuated by compressed air. Though designs vary the principle is the same, namely, air compressed in a controlling cylinder (fig. 58), and brought into an operating or *hammer* cylinder above the piston. Cushioning, or release of the air below the piston, is under control, as is the pressure of the air above it.

Drop Hammers.—The requirements of forged work have, besides the power hammers operated by a positive down stroke, been the cause of the development of an equally large group which are gravity hammers only—the drop hammers. They are put into operation by a belt or belts, but the function of the belt is simply to lift the hammer to the height desired, at which point it is released and falls. The place of the drop hammer is in the lighter class of smith's work, as that of the steam hammer lies in the heavier, but there is much overlapping, since small steam hammers are rivals to the others in light forging. But, speaking generally, the largest volume of repetitive die forging or stamping of light articles is done under drop hammers. The small arms factories and the regular stamping shops scarcely use any other type. They may be roughly divided into three great groups; the belt, the board and the latest form—the Brett lifter. In each the hammer head or tup is lifted to any height within the range of lift, the height being controlled by the attendant at each blow. In most machines setting can be done at any constant height and the blows delivered automatically. Control is effected by hand or foot or both. Drop hammers generally have the advantage of working with greater rapidity than steam hammers.

The original drop hammers, which are believed to have originated with the locksmiths of Birmingham and district, consisted of a hammer head attached to a rope, one end of which ran up over a loose pulley suspended in the roof, and the other was pulled by a man or two men, so lifting the hammer, which was then allowed to drop. The principle is embodied in many belt hammers to-day, but the pulley is driven constantly by shafting, and when the attendant pulls at the free end of the belt the friction of the pulley draws the belt over and lifts the hammer until the attendant lets it go. The weight lifted is greater than in the old type, but the labour is nevertheless very severe, and the blows are not rapid enough for quick forging. A far better machine is the board hammer. In this (fig. 59) the place of the belt is taken by an ordinary strip of board which passes between two rollers at the top of the hammer, which rollers are belt driven. The rollers are fitted on eccentric

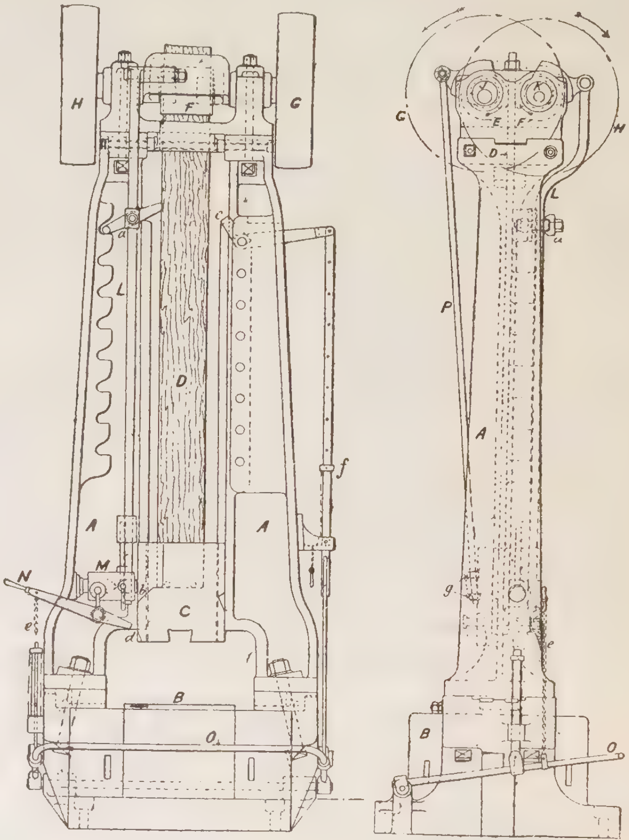


FIG. 59.—Drop Hammer—board type. (B. & S. Massey, Manchester.)

- *A*, *A*, Standards.
- *B*, Anvil, or baseblock.
- *C*, Tup.
- *D*, Board, fitting in slot in tup.
- *E*, *F*, Rollers gripping and lifting board.
- *G*, *H*, Pulleys actuating rollers through eccentrics *J*, *K*.
- *L*, Rod by which the amount of lift is regulated.
- *a*, Dog and lever adjustable on *L*, which strikes the edge *b* of the tup, releasing eccentrics and roller and allowing tup to fall.
- *c*, Catch on which tup rests previous to release, fitted into either one of the row of holes beneath, to suit various heights of drop.
- *M*, Mechanism struck by the edge *d* of the tup, which either keeps the roller *F* clear of the board *D*, allowing the tup to fall, or brings the rollers *E* and *F* into contact, and lifts the board and tup.
- *N*, Hand-lever for operating hammer.
- *O*, Foot-lever for ditto, connected by chain *e*.
- *f*, Spring for lifting levers.
- *P*, Rod with nuts *g*, to compensate for wear on the rollers by the adjustment of roller *E*.

pins, so that the movement of levers causes them to grip the board for the lift, or release it for the fall, these levers being under the control of the attendant. They can also be set to operate automically for any height of lift.

These types are all subject to much concussion and vibration, because the machines are self-contained; anvil, standards and heads being rigidly bolted together, the concussion of every blow is transmitted through the entire mechanism. The Brett hammers (fig. 60) are designed to lessen this, in some cases by making the anvil distinct from the superstructure, and in all by connecting the lifting ropes to the ends of long levers which act something like elastic springs, absorbing vibration. The driving mechanism is also original, comprising a cylinder with a wing piston, which is rotated by steam pressure through an arc of a circle only, sufficiently to operate the lifting levers. Another advantage is that the lifter cylinder need not be immediately over the hammer, but may be situated elsewhere. The hammer can be operated by hand directly for each stroke, or be set to work automatically.

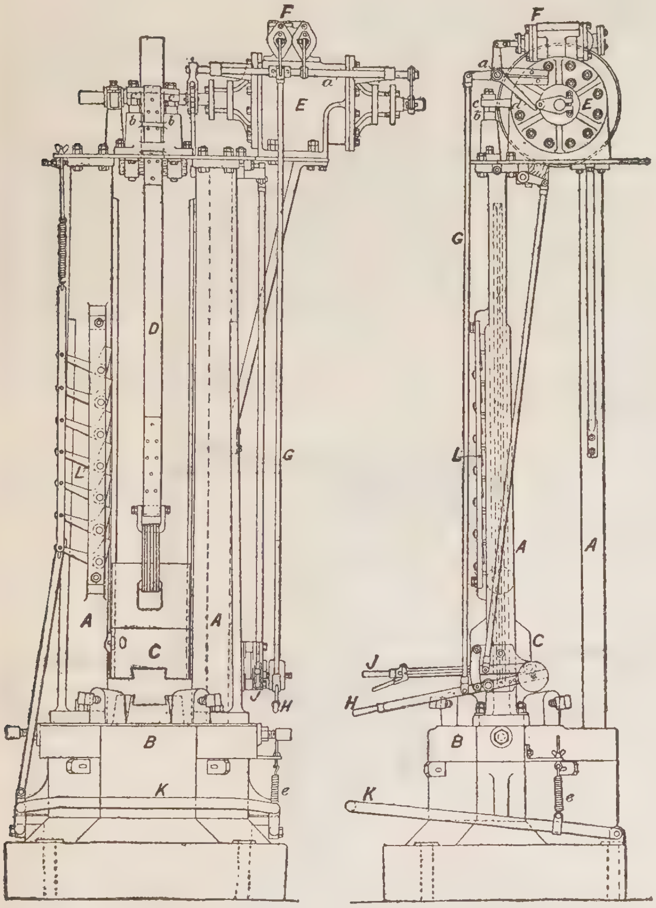


Fig. 60.—5 cwt. Belt Drop Hammer with Brett's Lifter. (Brett's Patent Lifter Co., Ltd., Coventry.)

A, *A*, Uprights.
B, Anvil.
C, Tup.
D, Belt.
E, Lifter cylinder.
F, Valve casing.
G, Rod operating valve by lever *H*.
a, Rock shaft.
b, Buffer blocks which arrest motion of lever *c*.
d, Lever for automatic regulation of valve.
J, Lever for regulating amount of opening of valve by hand.
K, Foot lever for holding tup in either of the stops *L*.
e, Spring for foot lever.

Spring Hammers are a rather smaller group than the others. In these a belt-driven pulley actuates the tup through the medium of elastic leaf springs. The length of stroke is adjustable across the face of a slotted disk on the driving shaft.

Forging Machines.—The Ryder forging machine is fitted with four or five pairs of swage tools, the lower halves being fixed and the upper ones driven by a rotating eccentric shaft. The operations imitate those on the anvil by hand forging, but from 800 to 1200 blows are delivered in a minute. The swages are arranged in succession, so that an operation is begun at one end and finished at the other, the attendant moving the bar rapidly through the successive swages or dies.

Forging Presses.—These are rivals to the hammers, especially for heavy forgings, from which hammers are being rapidly displaced (fig. 61). It is now well understood that a hammer will not effect the consolidation of a massive forging right to the centre as a press will. The force of the hammer blow is not transmitted to the centre as is that of a press, nor is the hammer so useful in work of large dimensions but of no great weight. In railway and wagon shops the presses are used far more frequently than the hammers. A great advantage of the press is that two and three rams can be brought into operation so that a forging may be pressed from above, from below and to one side, which is of great value in complicated forms and in welding, but is not practicable in the hammers. Hence the forging presses have become developed for work of average dimensions as well as for the most massive. Many are of horizontal type, termed bull-dozers.

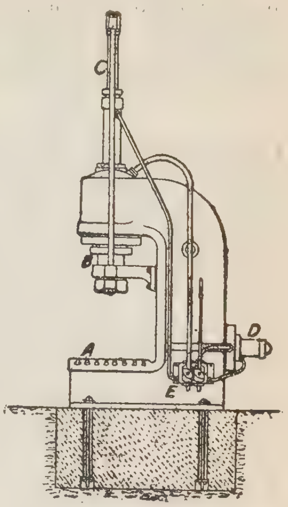
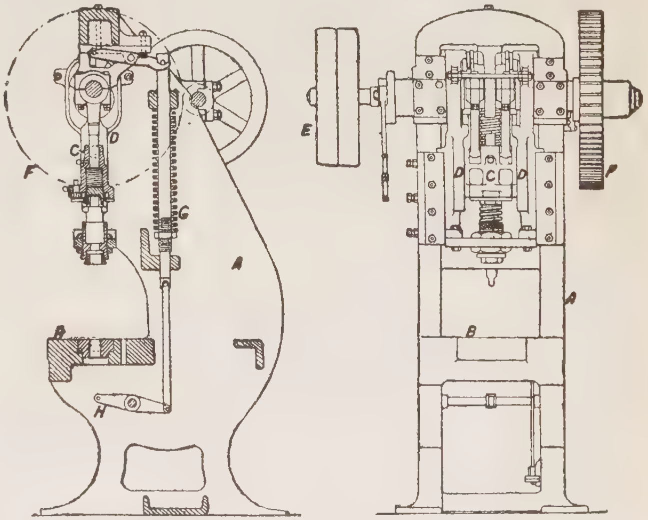


Fig. 61.—Hydraulic Forging Press. (Fielding & Platt, Ltd., Gloucester.)

A, Table.
B, Vertical ram.
C, Drawback ram for returning *B*.
D, Horizontal ram.
E, Controlling valves.

Power presses for working sheet-metal articles include those for cutting out the blanks, termed cutting-out or blanking presses, and those for cupping or drawing the flat blank into shape if desired (fig. 62). The lower dies are held upon a bed, and the upper in a sliding ram, moved up and down by a cam or crank-shaft. A clutch mechanism is fitted, by means of which this shaft is connected with or disconnected from the heavy driving-wheel at will to give a single stroke or a series of strokes to the ram. In the normal state the ram remains stationary at the top position. The lightest presses are driven direct by belt on the crank-shaft pulley, but in the heavier classes spur-gearing must be interposed between the pulley shaft and the final shaft. The operation of drawing requires an encircling die which presses on the blank as it lies on its die, the cupping of the blank being effected by the downward motion of the plunger.



Sectional Elevation. Front Elevation.

Fig. 62.—Power Press.

A, Main frame.
B, Bed for attaching dies.
C, Central slide.
D, Outer slide.
E, Belt pulleys on shaft, geared to wheel *F* thrown in by clutch to drive its shaft, which has two crank pins to reciprocate *D* and a cam disk actuating *C*.
G Extractor rocked downwards as slide rises to raise lever *H* and work an ejector rod, forcing finished article out of die.

This is why the machine shown in fig. 62 has an outer slide *D*, which is made to "dwell" with an even pressure, while the middle ram is moving down and drawing out the article. Blanking and cupping may be done as one continuous operation if the work is shallow.

Inclinable presses are employed for certain classes of work, the object being to let the stamped articles slide down the slope of the bed as rapidly as they are produced, instead of having to be removed by the operator. Much work can be placed on the dies by hand, but for producing large quantities of small articles automatic feeds are employed whenever possible. A good deal of work is produced from flat sheet, supplied in the form of a roll and fed through rollers by intermittent movements to the dies. Circular turn-tables are also used, operated by ratchet devices, which turn the tables round to bring a ring of pockets, carrying the pieces, successively under the dies; the attendant keeps the pockets supplied, but his hands do not come near the dies.

X.—PORTABLE TOOLS

The growth of portable machine tools is one of the remarkable movements of the present day. To some extent they have always been used, notably in the drilling and tapping operations of locomotive fire-boxes, but not until recently to any important extent in the ordinary fitting and erecting shops. The main reason lay in the difficulties due to transmission of power by ropes or shafts. The employment of compressed air, water, electricity and flexible shafts, by which long distances can be covered, has given new life to the portable system, which is destined to occupy a place of even greater importance than it does at present. The reason for the growing desirability of these tools is to be seen in the massive character of much engine and machine construction of the present time. Although firms that undertake the largest work can generally arrange to tool the individual parts on machines of massive sizes, that only meets a part of the difficulty. Very big work cannot be treated like that of small or even medium dimensions, done repetitively; that is, it is not practicable to drill and bore and ream and provide for the fitting of every piece by the aid of templets and jigs, while the work lies on the machine, but a great deal of adjustment and mutual fitting has to be accomplished in the course of erection. Therein lies the opportunity for the portable machine. If this is not used the alternatives are partial dismantling of the work and the transference of certain portions to machines or hand work. Another cause has been the substitution of machining for much hand work formerly done on massive constructions.

The principal operations for which portable tools are designed are the following: Drilling, screwing, cutting the seatings for keys, planing short portions of work, facings for the attachment of other pieces, as brackets and bearings, hammering operations, as in making welded joints, caulking the edges of boiler plates, chipping with hammer and chisel, riveting, ramming sand in foundry moulds, planing ships' decks, and some operations of lesser magnitude.

Portable tools are used in various ways. The first and most obvious is to attach them directly to the casting, forging or machine which is being built up. Thus a drilling machine will be clamped just where it is required to operate. Or if it has to be used on a large plane surface as a ship's deck, an electrical machine is suitable, in which magnetic attraction is set up between the foot of the machine and the deck sufficient to hold it down. A key-seating machine will be clamped on the shaft in which a keygroove has to be cut. A drilling machine may be fastened to a pipe with a chain embracing the pipe. Very many of the drills, and all the caulking and chipping hammers, are grasped in the hands and so thrust to their work. The tapping of screw holes is mostly done in this way, a common example being the holes for the stay bolts in the fire-boxes of steam boilers.

Another later method which has been introduced and practised in a few shops consists in installing a cast-iron floor-plate of large area, planed truly and provided with bolt holes and slots. On this a massive casting, forging or piece of work undergoing erection will be bolted. Then the portable tools—planers, drills, &c., as required—will be bolted to the table and brought into operation on the various sections of the work, several sometimes operating simultaneously. This method is to a certain extent coming into rivalry with the abnormal growth of machine tools, the development of which has been greatly accelerated by the massive dimensions of productions which only became possible by the substitution of steel made by the Bessemer and Siemens processes for iron.

The reciprocating motion necessary to effect hammering, chipping or caulking operations is produced by the action of a solid piston, sliding in a cylinder (fig. 63) and driven sharply against the end of the tool by the inrush of compressed air, being then returned for another stroke. The strokes range in number up to as many as 2000 per minute in some cases. For heavy riveting a "long-stroke" hammer is employed, having a longer barrel than the chipping hammer shown in fig. 63, in order to obtain a greater force of blow. The operator grasps the hammer by the handle, with his fingers or thumb on the controlling lever, and as long as this is held down the blows continue. The air-supply pipe is flexible, so that it does not impede the movements of the workman. The tools at the end of the cylinder are simply held in a socket, so that they can be changed rapidly.

Rotative motion can be produced either by electric or pneumatic motors, and both systems are in wide use. Pneumatic motors are very suitable when an air-compressing plant is already laid down for other tools, while if electricity is used in the works portable tools operated by this agent may be employed instead of the pneumatic ones. In the electric drills (fig. 64) a small motor is fitted within the body and connected by spur-gears to the spindle to effect suitable speed reduction. A switch provides for stopping and starting the motor; the current is brought through a flexible cable which, like pneumatic hose, is armoured with wire to protect it from damage. The smallest drills are simply gripped in the operator's hand and pushed up to the work; larger ones are supported by a pillar and arm, against which the thrust is taken, and the feed given by turning a screw at intervals.

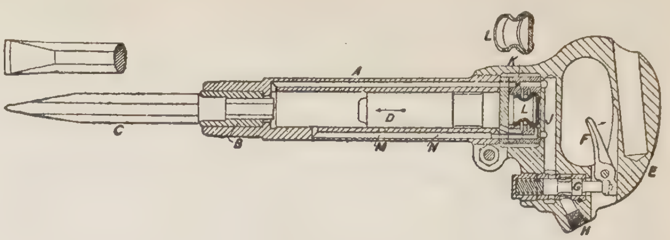


FIG. 63.—Tierney Pneumatic Chipping Hammer. (The Globe Pneumatic Engineering Co., Ltd.)

A, Cylinder.
B, Tool socket, carrying chisel *C*.
D, Piston, which strikes the back of *C*.
E, Handle, screwed and clamped to *A*.
F, Trigger or lever clasped by operator's hand and opening valve *G*, admitting compressed air through connexion *H*, up passage *J*, through valve-box *K*, past valve *L*, and so against end of *D*, moving it towards *C*. As soon as the groove in the piston *D* registers with the hole *M*, air is admitted from a small hole (not shown), passes round the groove through hole *M* and passage *N* to the rear of the valve. This acting on the back of the valve throws it forward, thus shutting off the supply to the rear of the piston and permitting a small quantity of air to flow to the forward end of the piston for driving it in a backward direction. As soon as the air pressure is relieved on the back of the valve by the uncovering of exhaust holes (not seen) by the piston *D*, the valve is returned to the original position, owing to the air constantly pressing on the small area of the valve.

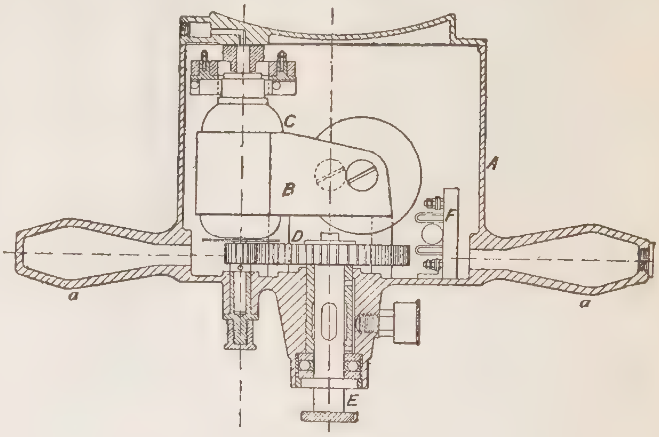


FIG. 64.—Electrically-driven Hand Drill. (Kramos Ltd., Bath.)

A, Body, cast in aluminium, with handles *a*, *a*.
B, Motor, with revolving armature *C*, connected by spur-gears *D*, to the drill spindle *E*, fitted with ball thrust bearings.
F, Switch, operated by attendant pushing in a plug; the current is brought by flexible wires through the right-hand handle *a*.

Pneumatic drills are usually worked by little motors having oscillating cylinders, by which the air and exhaust ports are covered and uncovered. They run at a high speed and are geared down to the spindle. In some cases two cylinders are used, but often four are fitted to give a powerful and equable turning moment. Grinding machines are also built with air motors directly coupled to the wheel spindle, the machines being moved about over the work by handles.

Another class of portable tools is driven, not by self-contained motors, but from an outside source of power, which is conveyed to the tools through flexible shafts built up of a series of spiral springs, or through flexible joints which form a connexion that permits the shaft to bend round corners and accommodate itself to any position in which the tool may be placed. The advantage of this is that the tool itself is much lightened, since there is no motor, and it can therefore be easily handled. Thus a drill simply contains the spindle, running in a frame which carries bevel-gears for transmitting the motion of the flexible shaft. Portable grinders also have nothing but the spindle, wheel and frame.

XI.—APPLIANCES

Appliances are vastly more numerous in a modern shop than in the older works, largely on account of the more repetitive character of the operations done and of the desire to eliminate human labour, with its greater cost and chances of inaccuracy in the finished product. On all machines there are numerous aids by which the fixing of the work is facilitated. Many of these consist of simple packing blocks, by which heights are adjusted. These reach their higher developments in wedge-shaped packings, some of which are operated by a screw, while others act directly by screws. In some cases the exact height can be ascertained by observing graduations on the packings. Circular work is held in V-blocks, which occur in numerous modified forms. Various kinds of straps, clamps and bolts are used for gripping work with sufficient security to enable it to withstand the stress of the heaviest cutting. The highest development of all is attained in the templets and jigs, which are now indispensable in all modern shops, and which increase in number and complexity as the product of the shop becomes more specialized. A templet is a piece of metal cut to a definite shape, which being laid upon the work becomes a guide for striking the same shape on the surface of the work with a pointed scriber, and by which the tooling of any number of similar pieces is done without the labour of lining out each separate piece. Obviously, in such a case the degree of accuracy of the tooling still depends on the machine hand, who may work exactly, or only approximately, to these lines. Hence a great advance is made in the jig, which may be defined generally as a templet that is clamped rigidly to the work, or a box in which the work to be tooled is held. No marking off is done, but the jig becomes the actual guide for the operation of the cutting tools. The operation most frequently performed in jigs is drilling. Then the holes in the jig receive and coerce the drills, so that the holes made cannot vary in the least degree from those already in the jig. As it will often happen that hundreds or thousands of similar pieces will have to be tooled in this manner, holes in jigs are generally bushed with hardened steel, which is capable of enduring very lengthy service, and which can be renewed when worn. This is a simple illustration, but many jigs are of an extremely elaborate character, for it is obvious that the cost of a jig, though it may run into many pounds, becomes a mere trifle when spread over some thousands of pieces of work.

XII.—Wood-working Machinery

There is a large range of various classes of tools for performing the operations on timber, from the rough log to the finished product. Division is effected by saws, planing and finishing to outlines by knives or cutters, boring by augers and smoothing by sandpaper.

The first operation is that of tree-felling, which is often effected by machine, consisting of a reciprocating blade, working horizontally in a frame and moved by a steam cylinder. The boiler is separate, so that the machine may be transported about and set to work over a considerable area, steam being conveyed to it by a flexible pipe. When the trees are brought into the saw-mills in the form of logs, *i.e.* with the branches lopped off, they are often cross-cut to reduce them to suitable lengths. This operation is effected either by a reciprocating saw, operated by a pulley and crank, or by an electric motor, or else with a circular saw, travelling on a carriage which moves the saw through the log laid in front of it. The next operation, that of division or breaking-down into smaller portions, is done by saws of various types, according to the class of work. The oldest form of machine is the frame-saw, which is still used very largely. It comprises a framing within which a saw-gate or saw-frame is reciprocated up and down by a crank; the frame holds a number of saws or webs of flat form, strained up tightly with wedges or cotters between the top and bottom of the frame, the distance between the saws being capable of variation to suit boards of all thicknesses. The log is fed longitudinally to the gang of saws upon carriages, which are of two types. In the roller-feed, which is suitable for comparatively even and straight logs, ribbed rollers in front and behind the saws obtain a bite on the top and bottom of the timber and feed it forward by their rotation. In the rack-feed the log is mounted bodily upon a long carriage that runs by rollers upon a set of rails, and the carriage is travelled along by pinions and racks, which give a positive feed regardless of the shape of the log. The carriage in the roller-feed machines is only represented by a couple of plain trolleys supporting the timber at back and front. The feed is obtained through a friction wheel of V-shape, with a smooth pawl, called the silent feed; the wheel is given a partial rotation at each down stroke of the saw-gate to turn the rollers or the pinions for carrying forward the log. The division of the timber may be either into deals or flitches, or planks or boards. In the last-named case as many as fifty saw-blades are sometimes held in a frame.

For the more valuable hardwoods a single blade reciprocating saw, operated horizontally, is used very largely, the machine being termed a board-cutter. The log is clamped to a travelling table, passing underneath the saw, which is strained in a frame sliding on a cross-rail that can be adjusted up or down on a couple of uprights like a planing machine. The saw is worked from a crank and connecting-rod. As only one board is sawn at a time the attendant is able to see the figuring of the timber and to avoid waste when bad places are encountered.

A machine much more rapid in operation is the horizontal band-saw, modelled on the lines of the above machine, but with a band-saw blade running over two pulleys, at a high speed, of about 7000 ft. per minute. The saws are very thin, so that a minimum of wood is wasted in the cut or "kerf," a very important consideration in dealing with costly woods. Vertical band-saws, having one pulley above the other so that the blade runs vertically, are very popular in America; they occupy less floor space than the horizontal types. It is necessary to present the log from the side, and it is therefore clamped by dogs upon a carriage running on rails, with provision for feeding the log laterally to the saw by sliding ways on the carriage.

The use of circular saws for breaking-down is confined chiefly to squaring up heavy balks, which need only a cut on each side, or for cutting thick slabs. The thickness of the saw entails considerable waste of wood, and a large amount of power is required for driving. The machines are termed rack-benches, and comprise a long divided table built up of thin plates and travelling past the fixed saw upon rollers, the movement being effected by a rack and pinion.

Re-sawing machines are those designed for further cutting-up deals, flitches, planks, &c., already broken out from the log, into boards and other scantlings. The deal and flitch frames are built on the model of the frame-saws first described, but with the differences that roller feed is always used, because the stuff is smooth and easily fed, and that the back of the timber is run against fences to keep it moving in a straight line. In the double equilibrium frames, which are much favoured, there are two sets of saws in separate frames connected by rods to opposite crank-shafts, so that as one frame is rising the other is going down; the forces are thus balanced and vibration is diminished, so that the machines can be speeded rather higher. Re-sawing is also done on circular and band saws of various types, fitted with fences for guiding the timber and controlling the thicknesses.

The cross-cut saws constitute another large group. They are employed for cutting-off various classes of stuff, after breaking-down or re-sawing, and are of circular saw type. The pendulum saw is a suspended form, comprising a circular saw at the bottom of a hanging arm, which can be pulled over by the attendant to draw the saw through a piece of wood laid on a bench beneath. Circular saws are also mounted in tables or benches and made to part off stuff moved laterally upon a sliding-table. When there is sufficient repetition work machines with two or more saws are used to cut one or more pieces to accurate length without the necessity for measurement.

The lighter classes of circular and band-saws, employed for sawing up comparatively small pieces of timber, embody numerous provisions for quickening output. The plain saw benches, with circular saws, are the simplest class, consisting merely of a framed table or bench carrying bearings for the saw spindle and a fence on the top to guide the wood. A mechanical feed is incorporated in the heavier machines to push the timber along. The rope-feed mechanism includes a drum driven at varying rates and giving motion to a rope, which is connected with a hook to the timber, to drag it along past the saw, roller supports on rails taking the weight at each end of the bench. Roller-feed saws propel the stuff by the contact of vertical fluted rollers placed opposite the fence. Other classes of saws for joinery work, &c., are constructed with rising and falling spindles, so that the saw may be made to project more or less from the table, this provision being necessary in grooving and tonguing with special types of saws. The same effect is obtained by making the table instead of the spindle rise and fall.

As it is necessary to use different saws for ripping (with the grain) and cross-cutting, some machines embody two saws so that work can be cut to shape on the same machine. These "dimension saws" have two spindles at the opposite ends of a pivoted arm that can be turned on a central pin to bring one or the other saw above as required. In cases where much angular and intricate sawing is done universal benches are employed, having in addition to the double saws a tilting motion to the table, which in conjunction with various special fittings enables the sawyer to produce a large range of pieces for any class of construction.

Band-saws, which have a thin narrow blade, are adapted especially for curved sawing and cutting-out work which the circular saw cannot manage. The usual design of machine (fig. 65) comprises a stiff standard supporting a lower pulley in fixed bearings, and an upper one in a sliding bearing, which by means of a weight or spring is caused to rise and maintain an even tension on the saw blade as it is driven by the lower pulley, and runs the upper one. India-rubber tires are placed around the pulley rims to prevent damage to the saw teeth. The table, placed between the pulleys, may be angled for cutting bevel work. It is necessary, in order to do true work, to guide the saw blade above and below the cut, and it is therefore run in guides consisting of flat strips, in combination with anti-friction rollers which take the backward thrust of the saw. Fret or jig saws are a small class with a vertical reciprocating blade, employed chiefly for cutting out interior portions which necessitate threading the saw first through a hole.

Planing machines, used for truing up the surfaces of wood after sawing, depend for their action upon rapidly revolving knives fastened to flat-sided cutter blocks. The simplest machines, the hand-planers, have a cutter cylinder revolving between two flat table slides adjustable for height to support the wood while it is pushed along over the knives by the hand. A fence guides it in a straight line. Exact thicknessing is done on another type of machine, the panel planer or thicknesser, in which the cutter cylinder revolves above the table and the stuff is fed through by rollers above and below. By altering the height of the table the thickness of wood can be varied. Double machines include a cutter cylinder above and below the timber, so that the upper and under sides are planed simultaneously. A combination of the hand-planer and the thicknesser is useful in cases where space or expenditure must be limited.

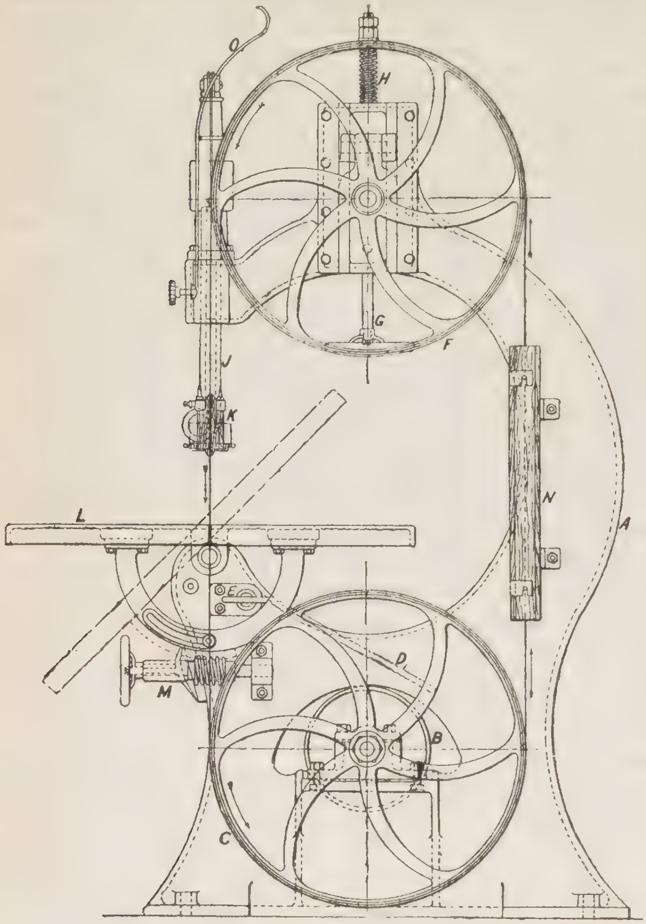


FIG. 65.—Band-sawing Machine with 30 in. pulleys.
(Thomas White & Sons, Paisley.)

A, Cast-iron cored frame.
B, Fast and loose pulleys driving pulley *C*.
D, Belt shipper operated by handle *E*.
F, Upper saw pulley, with its shaft carried in swivel bearing.
G, Screw for raising or lowering *F* to suit saw.
H, Spring to maintain even tension on saw, by raising *E*.
J, Counterbalanced guide bar, having a Jackson guide *K* at bottom; *K* has wooden strips embracing the saw and a ball-bearing roller against which the back runs, while *J* is adjusted up or down to bring *K* as near to the work as convenient.
L, Table, with slit for saw; it may be canted for bevel sawing, by means of hand worm-gear *M*.
N, Protective casing to saw.
O, Guard to prevent saw flying over in case of breakage.

When large quantities of planed stuff are wanted, such as for flooring-boards, &c., other types of machines are employed. The four-cutter planers are the most rapid in output, and the timber is passed through them at a high rate, ranging up to 150 ft. per minute. There is first a revolving cutter cylinder, which roughs off the underside of the stuff, whence it passes (being propelled by rollers) to a fixed knife which imparts a very smooth face. A little farther on in the machine two vertical cutter blocks are encountered which carry cutters to plane or tongue or mould the edges, after which another cylinder above finishes the top face. Similar types of machines are made to produce mouldings, using four cutters shaped to suit the pattern required.

Moulding is also done on the vertical spindle shapers, which carry a cutter or cutters at the top of a spindle projecting through a flat table. The work is slid over the table and controlled by touching a collar below the cutter. Any form may be given to the cutters to produce different profiles. Some special moulding machines use a cutter at the end of a spindle projecting downwards from an arm overhanging a table, an arrangement which enables recessing and carving to be performed.

Boring machines comprise rotating spindles and feeding mechanism to actuate augers. The single spindle machines are satisfactory enough for ordinary work, but when a number of differently sized holes have to be bored in a single piece of work, or in rapid succession, it is the practice to employ a machine with a number of spindles, so that a succession of augers of graduated diameters may be ready to use at will.

Mortising or cutting slots is done in vertical machines with a reciprocating spindle, operated either by hand or by crank disk and pulleys. The tool that cuts the mortise resembles a woodworker's chisel, but is of stouter form and has a suitable shank to fit in the spindle. The latter can be reversed to turn round and let the chisel face in the opposite direction for cutting at each end of a mortise. A boring spindle is often incorporated with the machine to make holes for the mortising chisel to start in (fig. 66). Another class of mortiser employs a square hollow chisel, inside of which an auger rotates and first bores a hole leaving to the chisel the duty of finishing out the corners. The chain mortiser is another type; it has an endless chain of flat links, sharpened to make cutting teeth, and is run around a bar and a roller at a high speed, so that when fed into the wood a recess or mortise is cut out.

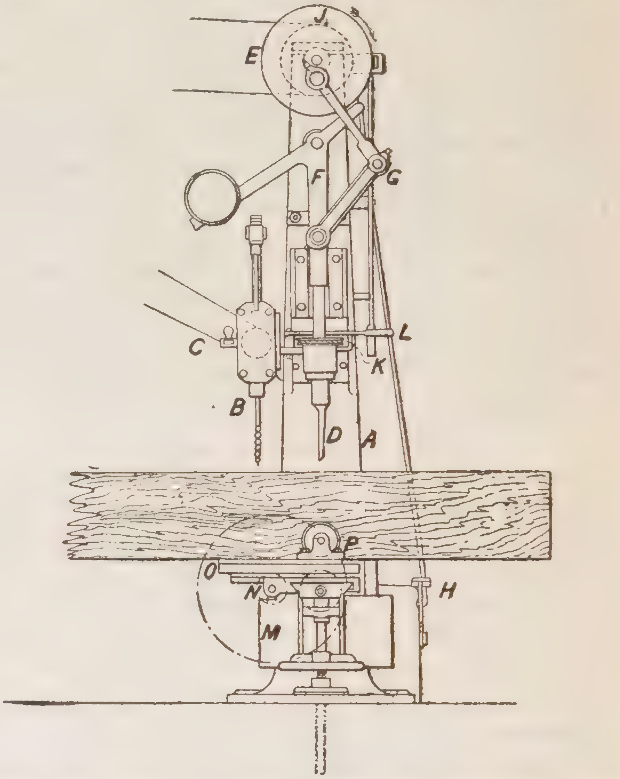


FIG. 66.—Mortising and Boring Machine with graduated stroke.
(John McDowall & Sons, Johnstone.)

A, Frame.
B, Auger head, driven by belt *C*.
D, Mortising chisel reciprocated up and down by crank-disk *E*.
F, *G*, Levers connecting crank-pin to spindle of *D*.
H, Treadle connected to *F*; a gradually increasing stroke is imparted to the chisel by depressing *H*, which brings *F*, *G* into play and continually lengthens the stroke of *D*, cutting the mortise without shock.
J, Fast and loose pulleys driving *E*.
K, Cord actuated from shaft of *J*, which reverses the chisel when the handle *L* is moved and makes it cut in the reverse position.
M, Knee raised or lowered by hand-wheel and screw.
N, Cross-slide, adjusted by hand-wheel and screw.
O, Longitudinal slide, moved by rack and pinion and hand-wheel.
P, Timber vice.

Tenoning machines, designed to cut the reduced ends or tenons to fit in mortises, perform their work by the aid of cutter blocks, revolved on horizontal spindles above and below the timber, which is fed laterally upon a sliding carriage.

Dovetailing is effected by revolving cutters in machines having mechanism for pitching out the cuts, or if the work warrants it an entire row of dovetails is made at one traverse, by fitting a row of cutters and feeding simultaneously. Corner-locking, or cutting parallel tongues and grooves in the edges of boxes, &c., is a rather more rapid operation than dovetailing, and is done with suitable cutter blocks or disks of appropriate thickness and pitching apart.

The general joiner, as its name implies, will do a large variety of operations, and is used in shops and on estates where a complete plant of machines would be out of the question. It usually has a circular saw and sometimes a band-saw also, together with planing and moulding apparatus, a moulding spindle, boring spindle and tenoning apparatus.

The lathes used in woodworking comprise the plain hand types with a simple T-rest on which the turner rests the tools to deal with the work revolving between centres, and the copying or Blanchard lathes, in which a master form or copy is rotated and caused by the contact and coercion of a roller to move the cutter rest in a corresponding fashion, so that the work is cut away until it exactly matches the shape of the copy.

Sand-papering machines, which finish the surface of wood to a high degree, deal with both flat and curved faces. Flat boards, panels, &c., can be done by contact against revolving drums or disks covered with glass-paper, being fed along over them by hand or by rotating rollers. In one class of machine a revolving disk is placed at the end of a series of jointed arms, by which the disk can be moved about over the work resting on a table underneath.

XIII.—Measurement

An advance of the greatest importance made in mechanical engineering is that of measurement. Since the beginning of the 19th century steady movement has been going on in this direction until it seems impossible that much greater refinement can now be looked for. Probably the chief advances to be expected will lie in the general extension in workshop practice of the knowledge already acquired, rather than in the acquisition of higher degrees of refinement.

Methods of measurement adopted in woodworking have but little application in high-class engineers' work. They are adopted, however, to a considerable extent in the metal trades which are allied to engineering, as sheet metal working, girder work, &c. When a carpenter or joiner sets about constructing a door, window sash, roof or box he takes a two-foot rule, a flat lead pencil, and marks off the dimensions and lines by which he intends to work. If he has to work very carefully, then instead of using a pencil he cuts a line with the edge of a keen scriber or chisel-like tool, by which to saw, plane or chisel. If outlines are curved, the compasses are brought into requisition, and these cut a fine line or lines on the surface of the wood. But in any case the eye alone judges of the coincidence of the cutting with the lines marked. Whether the tool used be saw, chisel, gouge or plane, the woodworker estimates by sight alone whether or not the lines marked are worked by.

The broad difference between his method and that of the engineer's machinist lies in this, that while the first tests his work by the eye, the second judges of its accuracy or otherwise by the sense of touch. It may seem that there cannot be very much difference in these two methods, but there is. To the first, the sixty-fourth part of an inch is a fine dimension, to the second one-thousandth of an inch is rather coarse. Now the thickness of tissue paper is about one-thousandth of an inch, and no one could possibly work so closely as that by the eye alone. Engineers' steel rules usually have one inch which is divided into one hundred parts. Tolerably keen sight is required to distinguish those divisions, and few could work by them by ocular measurement alone, that is, by placing them in direct juxtaposition with the work. A thousandth part of an inch seems by comparison a fine dimension. But it is very coarse when considered in relation to modern methods of measurement. In what are called "limit gauges" the plugs and rings are made of slightly different dimensions. If a plug is made a thousandth of an inch less than its ring it will slip through it easily with very perceptible slop. The common rule is therefore scarcely seen in modern machine shop, while the common calipers fill but a secondary place, their function having been invaded by the gauges. A minute dimension cannot be tested by lines of division on a rule, neither can a dimension which should be fixed be tested with high precision with a movable caliper of ordinary type. Yet it must not be supposed that the adoption of the system of gauging instead of the older methods of rule measurement relieves men of responsibility. The instruments of precision require delicate handling. Rough forcing of gauges will not yield correct results. A clumsy workman is as much out of place in a modern machine shop as he would be in a watch factory. Without correctness of measurement mechanical constructions would be impossible, and the older device of mutual fitting of parts is of lessening value in face of the growth of the interchangeable system, of international standards, and of automatic machine tools which are run with no intervention save that of feeding stock.

The two broad divisions of measurement by sight and by contact are represented in a vast number of instruments. To the first-named belong the numerous rules in wood and metal and with English and metric divisions, and the scales which are used for setting out dimensions on drawings smaller than those of the real objects, but strictly proportional thereto. The second include all the gauges. These are either fixed or movable, an important subdivision. The first embrace two groups—one for daily workshop service, the other for testing and correcting the wear of these, hence termed "reference gauges." They are either made to exact standard sizes, or they embody "limits of tolerance," that is, allowances for certain classes of fits, and for the minute degrees of inaccuracy which are permissible in an interchangeable system of manufacture. The movable group includes a movable portion, either corresponding with one leg of a caliper or having an adjustable rod, with provision for precise measurement in the form of a vernier or of a screw thread divided micrometrically. These may be of general character for testing internal or external diameters, or for special functions as screw threads. Subtitles indicate some particular aspect or design of the gauges, as "plug and ring," "caliper," "horseshoe," "depth," "rod," "end measure," &c. So severe are the requirements demanded of instruments of measurement that the manufacture of the finer kinds remains a speciality in the hands of a very few firms. The cost and experience necessary are so great that prices rule high for the best instruments. As these, however, are not required for ordinary workshop use, two or three grades are manufactured, the limits of inaccuracy being usually stated and a guarantee given that these are not exceeded.

Measurement by Sight. Rules and Scales.—The rules are used for marking off distances and dimensions in conjunction with other instruments, as scribers, compasses, dividers, squares; and for testing and checking dimensions when marked, and work in course of reduction or erection, directly or from calipers. They are made in boxwood and in steel, the latter being either rigid or flexible, as when required to go round curves. Rules are fitted in combination with other instruments, as sliding calipers, squares, depth gauges, &c. The scales are of boxwood, of ivory, the value of which is discounted by its shrinkage, and of paper. They are of flat section with bevelled edges, and of oval and of triangular sections, each giving a thin edge to facilitate readings. They are fully divided, or open divided; in the first case each division is alike subdivided, in the second only the end ones are thus treated.

The Gauges. Fixed Gauges.—These now embrace several kinds, the typical forms being represented by the cylindrical or plug and ring gauges and by the caliper form or snap gauges. The principle in each is that a definite dimension being embodied in the gauge, the workman has not to refer to the rule, either directly or through the medium of a caliper. This distinction, though slight, is of immense importance in modern manufacturing. Broadly it corresponds with the difference between the older heterogeneous and the present interchangeable systems.

Plug and Ring Gauges.—The principal ones and the originals of all the rest, termed Whitworth gauges after the inventor, are the plug and ring gauges (fig. 67, *A* and *B*). The principle on which they depend is that if the two gauges are made to fit with perfect accuracy, without tightness on the one hand or slop on the other, then any work which is measured or turned and bored or ground by them will also fit with equal accuracy. Bored holes are tested by the plug gauge, and spindles are tested by the ring gauge, and such spindles and holes make a close fit if the work is done carefully. Of course, in practice, there is very much variation in the character of the work done, and the finest gauges are too fine for a large proportion of engineers' work. It is possible to make these gauges within $\frac{1}{50000}$ of an inch. But they are seldom required so fine as that for shop use; $\frac{1}{5000}$ is generally fine enough. For general shop work the gauges are made to within about $\frac{1}{1000}$ of an inch. Standard gauges in which the plug and ring are of the same diameter will only fit by the application of a thin film of oil and by keeping the plug in slight movement within the ring. Without these precautions the two would "seize" so hard that they could not be separated without force and injury.

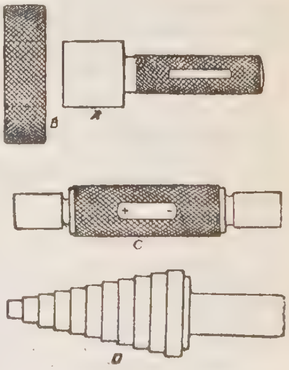


Fig. 67.

A, *B*, Plug and ring gauges.
C, Difference gauge.
D, Stepped reference gauge.

Plug and Ring v. *Horseshoe Gauges.*—The horseshoe, snap or caliper gauges (fig. 68) are often used in preference to the plug and ring types. They are preferred because the surfaces in contact are narrow. These occur in various designs, with and without handles, separately and in combination and in a much larger range of dimensions than the plug and ring. Ring gauges are not quite such delicate instruments as the fixed caliper gauges. But since they measure diameter only, and turned work is not always quite circular, the caliper gauges are not so convenient for measurement as the round gauges, which fit in the same manner as the parts have to fit to one another.

Fixed Gauges. Limit Gauges. Some fits have to be what is termed in the shops "driving fits," that is, so tight that they have to be effected by driving with a hammer or a press, while others have to be "working fits," suitable, say, for the revolution of a loose pulley on its shaft or of an axle in its bearings. The "limit" or "difference gauges" (figs. 67 and 68) are designed for producing these working fits; that is, the plug and ring gauges differ in dimensions so that the work bored will drive tightly, or slide freely over the work turned. These are variously sub-classified. The system which is generally accepted is embodied in the gauges by the Newall Engineering Co. These embrace *force fits*, which require the application of a screw or hydraulic press; *driving fits*, that require less power, as that of a hammer; *push fits*, in which a spindle can be thrust into its hole by hand; and *running fits*, such as that of shafts in bearings. Fixed gauges are made for each of these, but as this involves a heavy outlay the Newall firm have adjustable limit gauges (fig. 68, *D*) for external dimensions, the standard plug being used for holes. The setting is done by screwed plugs or anvils adjusted by reference bars. In all these gauges the "go on" and "not go on" ends respectively are stamped on the gauge, or the equivalents of + and −.

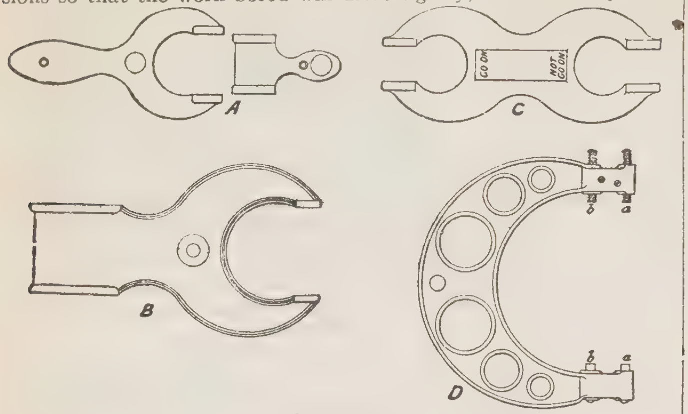


FIG. 68.

A, Separate caliper or snap gauges.
B, Combined internal and external gauges.
C, Difference gauge.
D, Newall adjustable limit gauge.
a, *b*, Plugs.

Fixed Reference Gauges. Reference Disks and End Measuring Rods.—Shop working gauges become in time so damaged by service that they fail to measure so accurately as when new. To correct these errors reference gauges are provided, by which the inaccuracy of the worn ones is brought to the test. These are never used in the shops for actual measurement of work, but are only kept for checking the truth of the working gauges. They include disk, stepped and end measurement gauges. The disk and the stepped are used for testing the ring gauges, the stepped kind comprising essentially a collection of disks in one piece (fig. 67, *D*). The end measure pieces test the external gauges. The end measure standard lengths made by the Pratt & Whitney Co. are so accurate that any sizes taken at random in any numbers from $\frac{1}{4}$ in. to 4 in., varying by sixteenths of an inch, will, when placed end to end, make up an exact length; this is a difficult test, since slight variations in the lengths of the components would add up materially when multiplied by the number of pieces. The ends are ground off with diamond dust or emery in a special machine under water, and are so true that one piece will support another by cohesive force, and this though the surfaces are less than $\frac{1}{4}$ in. square.

Movable Gauges.—This extensive group may be regarded as compounded of the common caliper and the Whitworth measuring machine. They are required when precise dimensions have to be ascertained in whole numbers and minute fractional parts. They combine the sense of touch by contact, as in the calipers, with the exact dimensions obtained by inspection of graduated scales, either the vernier or the micrometer screw. If gauges must not vary by more than $\frac{1}{10000}$ of an inch, which is the limit imposed by modern shop ideals, then instruments must be capable of measuring to finer dimensions than this. Hence, while the coarser classes of micrometers read directly to $\frac{1}{1000}$ part of an inch, the finest measure up to $\frac{1}{100000}$ of an inch, about 200 times as fine as the diameter of a human hair. They range in price correspondingly from about a sovereign to £100.

The Calipers.—Common calipers (fig. 69) are adjusted over or within work, and the dimensions are taken therefrom by a rule or a gauge. They usually have no provision for minute adjustment beyond the gentle tapping of one of the legs when setting. In some forms screw adjustment is provided, and in a few instances a vernier attachment on the side of the pivot opposite to the legs.

Vernier Calipers.—The vernier fitting, so named after its inventor, Pierre Vernier, in 1631, is fitted to numerous calipers and caliper rules. It is applied to calipers for engineers' use to read to $\frac{1}{1000}$ of an inch without requiring a magnifier. The beam of the caliper is divided into inches and tenths of the inch, and each tenth into fourths and the vernier into twenty-five parts, or the beam is divided into fiftieths of an inch (fig. 70) and the vernier has 20 divisions to 19 on the rule. The caliper jaws are adapted to take both external and internal dimensions. These "beam calipers" are also made for metric divisions. Minor variations in design by different manufacturers are numerous.

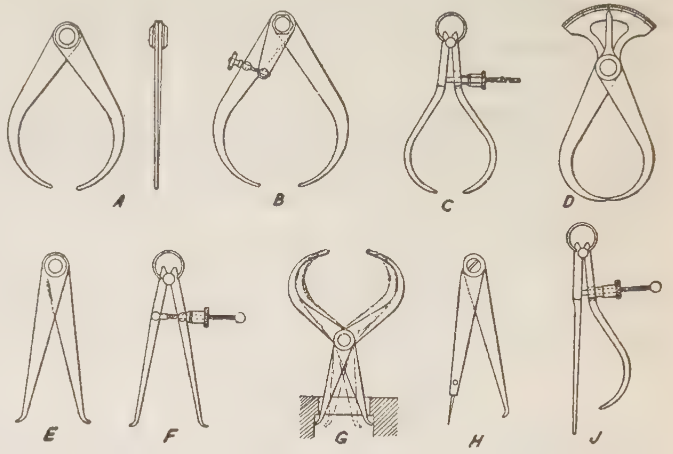


FIG. 69.—Calipers.

A, Ordinary external type, adjusted by tapping the legs.
B, Type adjusted by screw in auxiliary leg.
C, Screw calipers, opened by contraction of curved spring and closed by nut.
D, Self-registering caliper, with pointer moving over quadrant.
E, Common internal type.
F, Screw type with spring.
G, Combined internal and external for measuring chambered holes.
H, Compass caliper for finding centres.
J, Keyhole caliper for measuring from hole to outside of boss.

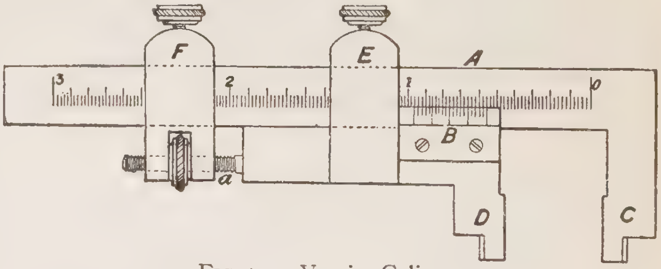


FIG. 70.—Vernier Caliper.

A, Beam; *B*, vernier; *C*, fixed jaw; *D*, movable jaw; *E*, clamping head; *F*, abutment head, with adjusting screw *a*, for fine adjustment of *D*.

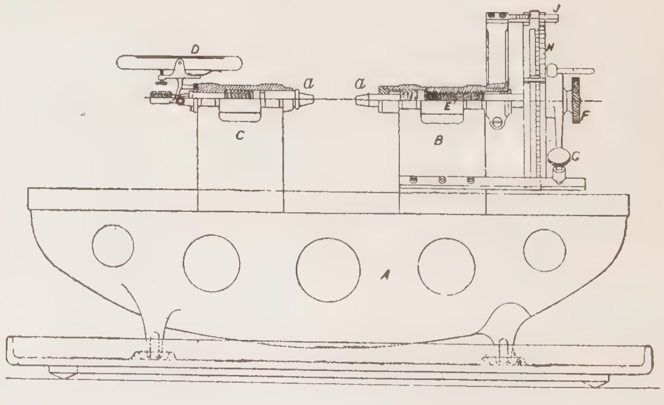


FIG. 71.—Measuring Machine. (The Newall Engineering Co.)

A, Hollow base or bed, mounted on three points.
B, Measuring or fast headstock.
C, Movable head, or tailstock.
D, Spirit-level to indicate alterations in length of piece being measured due to changes in temperature, termed the indicator or comparator.
E, Measuring screw.
F, Nut for rapid adjustment of ditto.
G, Knob of speed screw for slow movement of ditto.
H, Dividing and measuring wheel.
J, Vernier or reading bar.
a, *a*, Points between which contact is made.

Micrometer Calipers are the direct offspring of the Whitworth measuring machine. In the original form of this machine a screw of 20 threads to the inch, turned by a worm-wheel of 200 teeth and single-threaded worm, had a wheel on the axis of the worm with 250 divisions on its circumference, so that an adjustment of $\frac{1}{1000000}$ of an inch was possible. The costly measuring machines made to-day have a dividing wheel on the screw, but they combine modifications to ensure freedom from error, the fruits of prolonged experience. Good machines are made by the Whitworth, the Pratt & Whitney, the Newall (fig. 71), and the Brown & Sharpe firms. These are used for testing purposes. But there are immense numbers of small instruments, the micrometer calipers (fig. 72), made for general shop use, measuring directly to $\frac{1}{1000}$ of an inch, and in the hands of careful men easily to half and quarter thousandths; these cost from £1 to £1, 10s. only. In these the subdivision of the turns of the screw is effected by circular graduations. Usually the screw pitch is 40 to the inch, and the circular divisions number 25, so that a movement of one division indicates that the screw has been advanced $\frac{1}{25}$ of $\frac{1}{40}$ or $\frac{1}{1000}$ of an inch. Provision for correcting or taking up the effects of wear is included in these designs (*e.g.* at *a* in fig. 72), and varies with different manufacturers. A vernier is sometimes fitted in addition, in very high class instruments, to the circular divisions, so that readings of ten thousandths of an inch can be taken. Beam micrometer calipers (fig. 73) take several inches in length, the micrometer being reserved for fractional parts of the inch only.

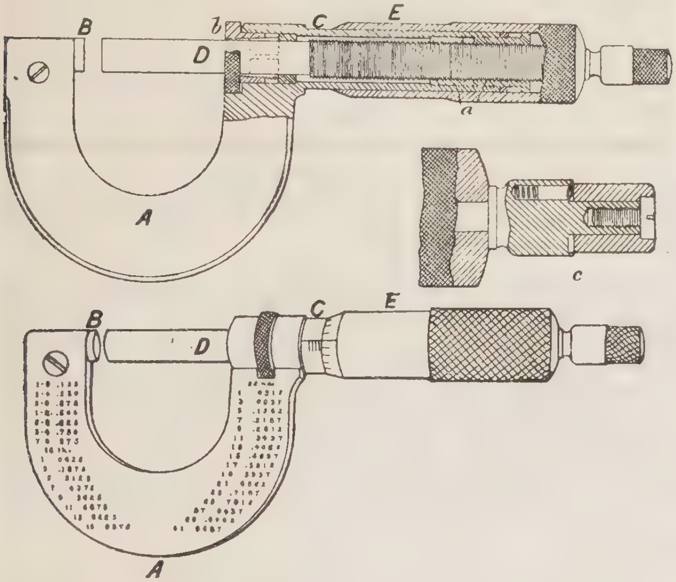


FIG. 72.—Micrometer Calipers. (Brown & Sharpe Mfg. Co.)

A, Frames.
B, Anvil or abutment.
C, Hub divided longitudinally.
D, Spindle with micrometer screw.
E, Thimble, divided circularly.
a, Adjusting nuts for taking up wear.
b, Clamping nut.
c, Ratchet stop, which slips under undue pressure to ensure uniform measurement.

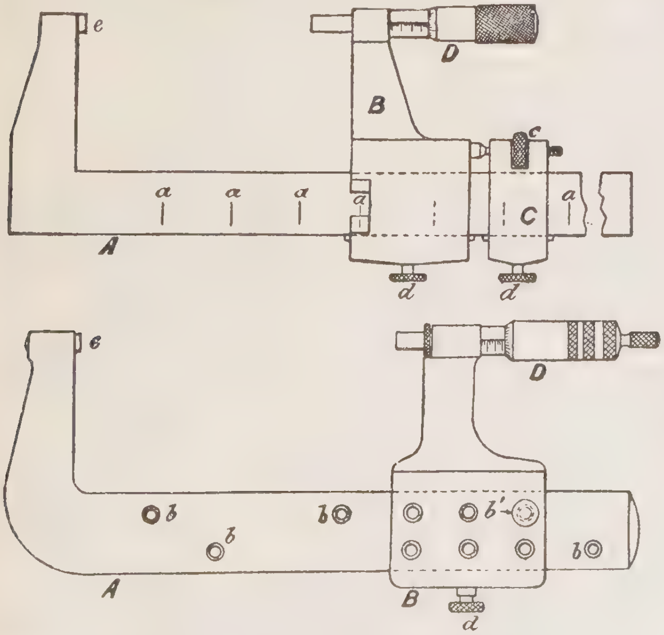


FIG. 73.—Beam Micrometer Calipers.

A, Beam.
B, Head, adjustable by equal inch divisions, by lines *a*, *a*, or holes *b*, *b*, and plug *b'* holes bushed.
C, Abutment block with screw *c* for fine adjustment.
d, Clamping screws.
D, Micrometer.
e, Anvil.

Depth Gauges.—It is often necessary to measure the depth of one portion of a piece of work below another part, or the height of one portion relatively to a lower one. To hold a rule perpendicularly and take a sight is not an accurate method, because the same objections apply to this as to rule measurement in general. There are many depth gauges made with rule divisions simply, and then these have the advantage of a shouldered face which rests upon the upper portion of the work and from which the rule measurement is taken (fig. 74). These generally have a clamping arrangement. But for very accurate work either the vernier or the micrometer fitting is applied, so that depths can be measured in thousandths of an inch, or sometimes in sixty-fourths, or in metric subdivisions.

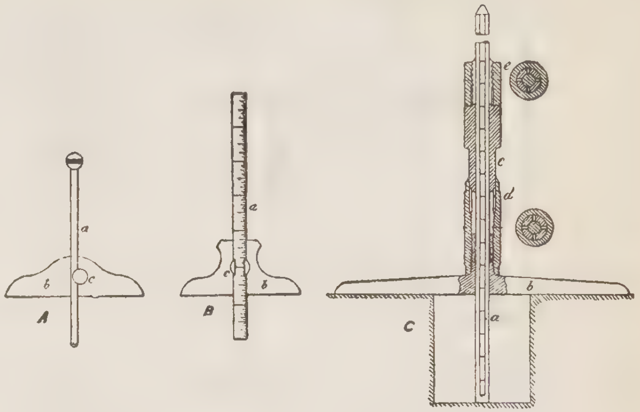


FIG. 74.—Depth Gauges.

A, Plain round rod *a*, sliding in head *b*, and pinched with screw *c*.
B, Rule *a*, graduated into inches or metric divisions, sliding on head *b*, in grooved head of clamping screw *c*.
C, Slocomb depth gauge, fitted with micrometer. *a*, Rod marked in half inches, sliding in head *b*; *c*, hub; *d*, thimble corresponding with similar divided parts in the micrometer calipers; *e*, clamping screw.

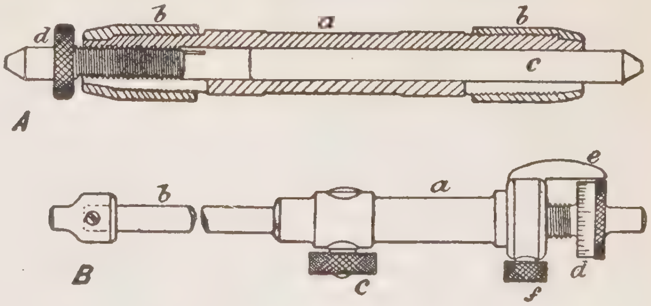


FIG. 75.—Rod Gauges.

A, Pratt & Whitney gauge. *a*, Tube split at ends; *b*, *b*, chucks clamping tube on plain rod *c*, and screwed end *d*. Rough adjustment is made on rod *c*, of which several are provided; fine adjustment is by screwed end *d*.
B, Sawyer gauge. *a*, Body; *b*, extension rods for rough adjustment, several being supplied and pinched with screw *c*; *d*, screwed end with graduated head; *e*, reading arm extending from body over graduations; *f*, clamping screw.

Rod Gauges.—When internal diameters have to be taken, too large for plug gauges or calipers to span, the usual custom is to set a rod of iron or steel across, file it till it fits the bore, and then measure its length with a rule. More accurate as well as adjustable are the rod gauges (fig. 75) to which the vernier or the micrometer are fitted. These occur in a few varied designs.

Screw Thread Gauges.—The taking of linear dimensions, though provided for so admirably by the systems of gauging just discussed, does not cover the important section of screw measurement. This is a department of the highest importance. In most English shops the only test to-day of the size of a screw or nut is the use of a standard screw or nut. That there is variation in these is evidenced by the necessity for fitting nuts to bolts when large numbers of these are being assembled, after they have been used in temporary erections or when nuts are brought from the stores to fit studs or bolts cut in the shop. This method may suffice in many classes of work, but it is utterly unsuited to an interchangeable system; and when there is a fair amount of the latter firms sometimes make thread gauges of their own, in general form like the plug and ring gauges, using a hard quality of steel for small sizes or a tough quality of cast iron for the larger. These, though not hardened, will endure for a long time if treated carefully. But though very useful and far better than none at all they lack two essentials. They are simply accommodation gauges, made to an existing tap or die, and do not therefore embody any precise absolute measurement, nor do they include any means for measuring variations from standard, nor are they hardened. To produce gauges to fulfil these requirements demands an original standard to work by, micrometric measurements, and the means of grinding after the hardening process. These requirements are fulfilled in the screw thread gauges and calipers of the Pratt & Whitney and the Brown & Sharpe companies. The essential feature of a screw gauge is that it measures the sides of the threads without risk of a possible false reading due to contact on the bottom or top of the V. This is fulfilled by flatting the top and making the bottom of the gauge keen. The Pratt & Whitney gauges are made as a plug and ring (fig. 76), the plug being solid and the ring capable of precise adjustment round it. There is a plain round end, ground and lapped exactly to the standard size of the bottom of the thread, a dimension which is obliterated in the threaded end because of the bottoms of the angles being made keen for clearance. There are three kinds of this class of gauge made; the first and most expensive is hardened and ground in the angle, while the second is hardened but not ground. The first is intended for use when a very perfect gauge is required, the second for ordinary shop usage. The third is made unhardened for purposes of reference simply, and it is not brought into contact with the work to be tested at all, but measurements are taken by calipers; in every detail it represents the standard threads. The Brown & Sharpe appliance is of quite a different character. It is a micrometer caliper having a fixed V and a movable point between which the screw to be measured is embraced. By the reading of the micrometer and the use of a constant the diameter of any thread in the middle of the thread can be estimated.

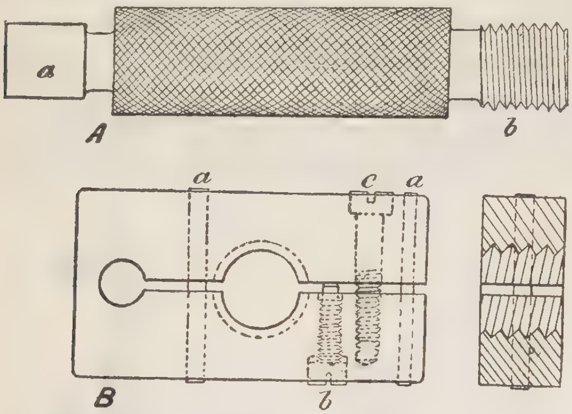


FIG. 76.—Screw Thread Gauges. (Pratt & Whitney Co.)

A, Plug gauge; *a*, size of tapping hole; *b*, thread.
B, Ring gauge; *a*, pins to prevent lateral movement; *b*, adjusting screw for opening gauge; *c*, screw for closing ditto.

Miscellaneous.—The foregoing do not exhaust the gauges. There are gauges for the sectional shapes of screw threads of all pitches, gauges for drilled holes that have to be screwed, gauges for the depth and thickness of the teeth of gear-wheels, gauges for the tapers of machine spindles, gauges for key-grooves, &c. There are also the woodworker's gauges—the marking and cutting, the panel, the mortise and the long-tooth.

Indicators are a small group of measuring instruments of a rather peculiar character. They magnify the most minute error by adaptations of long and short lever arms. The Bath, the Starrett and the Brown & Sharpe are familiar in high-class shops. Some simply magnify inaccuracy, but in one type an index reads to thousandths of an inch (fig. 77). They are used in some kinds of lathe chuck work, but their principal value is in fitting and erecting the finer mechanisms.

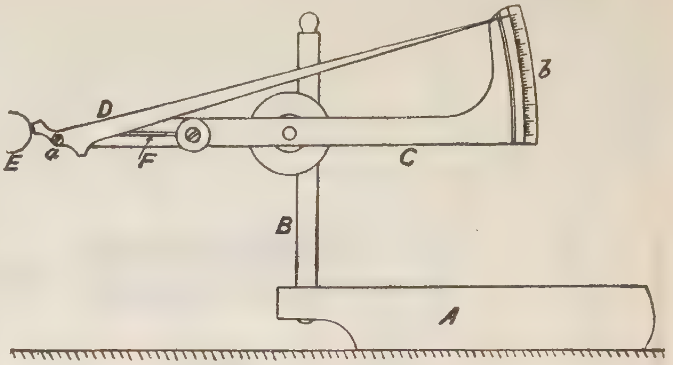


FIG. 77.—Indicator.

A, Base; *B*, stem; *C*, arm; *D*, pointer or feeler, pivoted at *a*, and magnifying movement of the work *E* upon the scale *b*; *F*, spring to return *D* to zero.

Surface Plates and Cognate Forms.—Allied to the gauges are the instruments for testing the truth of plane surfaces: the surface plates, straight-edges and winding strips. The origination of plane surfaces by scraping, until the mutual coincidence of three plates is secured, was due to Whitworth. These surface plates (fig. 78, *A*) fill an important place in workshop practice, since in the best work plane surfaces are tested on them and corrected by scraping. To a large extent the precision grinding machines have lessened the value of scraping, but it is still retained for machine slides and other work of a similar class. In the shops there are two classes of surface plates: those employed daily about the shops, the accuracy of which becomes impaired in time, and the standard plate or plates employed for test and correction. Straight-edges are derived from the surface plates, or may be originated like them. The largest are made of cast-iron, ribbed and curved on one edge, to prevent flexure, and provided with feet (fig. 78, B). But the smaller straight-edges are generally parallel, and a similar pair constitutes "winding strips," by which any twist or departure from a plane surface is detected. Squares, of which there are numerous designs (fig. 78, *C* and *D*), are straight-edges set at right angles. Bevels or bevel-squares (fig. 79), are straight-edges comprising a stock and a blade, which are adjustable for angle in relation to each other. Shop protractors often include a blade adjustable for angle, forming a bevel with graduations. Spirit-levels test the horizontal truth of surfaces. Many levels have two bubble tubes at right angles with each other, one of which tests the truth of vertical faces. Generally levels have flat feet, but some are made of V-section to fit over shafting. The common plumb-bob is in frequent use for locating the vertical position of centres not in the same horizontal plane. When a

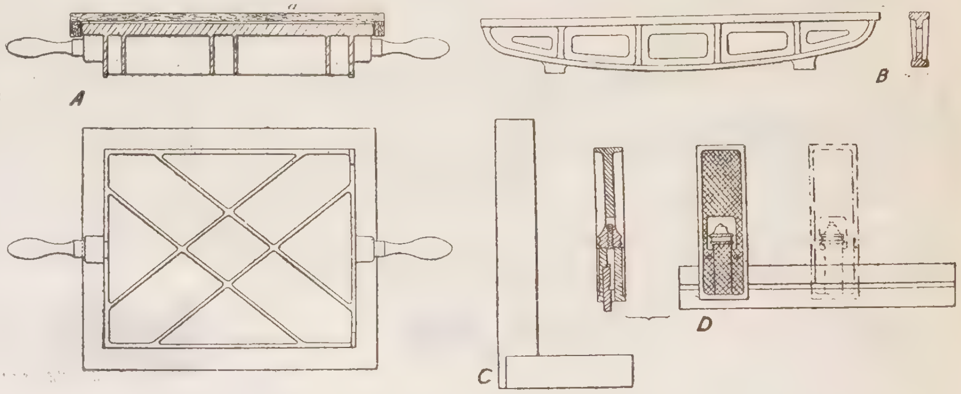


FIG. 78.

A, Surface plate; *a*, protecting cover for ditto when not in use.
B, Large ribbed straight-edge.
C, Common square.
D, Square with adjustable blade.

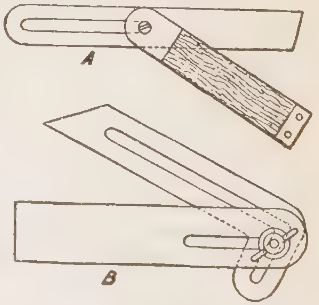


FIG. 79.

A, Common bevel.
B, Universal bevel for testing low angles.

plumb-bob is combined with a parallel straight-edge the term plumb-rule is applied. It tests the truth of vertical surface more accurately than a spirit-level. (J. G. H.)

TOOLE, JOHN LAWRENCE (1832–1906), English actor, son of an old employé of the East India Company who for many years acted as toast-master in the City of London, was born in London on the 12th of March 1832. He was educated at the City of London School, and started life in a wine merchant's office; but his natural propensity for comic acting was not to be denied, and after some practice as an amateur with the City Histrionic Club, he definitely took to the stage in 1852, appearing in Dublin as Simmons in *The Spitalfields Weaver*. He gained experience in the provinces, and in 1854 made his first professional appearance in London at the St James's theatre, acting Samuel Pepys in *The King's Rival* and Weazel in *My Friend the Major*. In 1857, having just had a great success as Paul Pry, he met Henry Irving in Edinburgh, and recommended him to go to London; and their friendship remained thenceforth of the closest kind. In 1858 Toole joined Webster at the Adelphi, and established his popularity as a comedian, among other parts creating Joe Spriggins in *Ici on parle français*. In 1868 he was engaged at the Gaiety, appearing among other pieces in *Thespis*, the first Gilbert and Sullivan collaboration. His fame was at its height in 1874, when he went on tour to the United States, but he failed to reproduce there the success he had in England. In 1879 he took the "Folly" theatre in London, which he renamed "Toole's" in 1882. He was constantly away in the provinces, but he produced here a number of plays: H. J. Byron's *Upper Crust* and *Auntie*; Pinero's *Hester's Mystery* and *Girls and Boys*; burlesques such as *Paw Claudian*, and, later, J. M. Barrie's *Walker, London*. But his appearances gradually became fewer, and after 1893 he was seen no more on the London stage, while his theatre was pulled down shortly afterwards for an extension of Charing Cross Hospital. He published his reminiscences in 1888. Toole married in 1854; and the death of his only son in 1879, and later of his wife and daughter, had distressing effects on his health; attacks of gout, from 1886 onwards, crippled him, and ultimately he retired to Brighton, where after a long illness he died on the 30th of July 1906. In his prime he was immensely popular, and also immensely funny in a way which depended a good deal on his tricks and delivery of words. He excelled in what may be called Dickens parts—combining humour and pathos. He was a good man of business, and left a considerable fortune, out of which he made a number of bequests to charity and to his friends. His genial and sympathetic nature was no less conspicuous off the stage than on it.

TOOMBS, ROBERT (1810–1885), American political leader, was born near Washington, Wilkes county, Georgia, on the 2nd of July 1810. He was educated at Franklin College (university of Georgia), at Union College, Schenectady, New York, from which he graduated in 1828, and at the law school of the university of Virginia. He was admitted to the bar in 1830, and served in the Georgia House of Representatives (1838, 1840–1841 and 1843–1844), in the Federal House of Representatives (1845–1853), and in the United States Senate (1853–1861). He opposed the annexation of Texas, the Mexican War, President Polk's Oregon policy, and the Walker Tariff of 1846. In common with Alexander H. Stephens and Howell Cobb, he supported the Compromise Measures of 1850, denounced the Nashville Convention, opposed the secessionists in Georgia, and helped to frame the famous Georgia platform (1850). His position and that of Southern Unionists during the decade 1850–1860 has often been misunderstood. They disapproved of secession, not because they considered it wrong in principle, but because they considered it inexpedient. On the dissolution of the Whig party Toombs went over to the Democrats. He favoured the Kansas-Nebraska Bill, the admission of Kansas under the Lecompton Constitution, and the English Bill (1858), and on the 24th of June 1856 introduced in the Senate the Toombs Bill, which proposed a constitutional convention in Kansas under conditions which were acknowledged by various anti-slavery leaders as fair, and which mark the greatest concessions made by the pro-slavery senators during the Kansas struggle. The bill did not provide for the submission of the constitution to popular vote, and the silence on this point of the territorial law under which the Lecompton Constitution of Kansas was framed in 1857 was the crux of the Lecompton struggle (see KANSAS). In the presidential campaign of 1860 he supported John C. Breckinridge, and on the 22nd of December, soon after the election of Lincoln, sent a telegram to Georgia which asserted that "secession by the 4th of March next should be thundered forth from the ballot-box by the united voice of Georgia." He delivered a farewell address in the Senate (Jan. 7, 1861), returned to Georgia, and with Governor Joseph E. Brown led the fight for secession against Stephens and Herschel V. Johnson (1812–1880). His influence was a most powerful factor in inducing the "old-line Whigs" to support immediate secession. After a short term as secretary of state in President Davis's cabinet, he entered the army (July 21, 1861), and served first as a brigadier-general in the Army of Northern Virginia and after 1863 as adjutant and inspector-general of General G. W. Smith's division of Georgia militia. He then spent two years in exile in Cuba, France and England, but returned to Georgia in 1867, and resumed the practice of law. Owing to his refusal to take the oath of allegiance, he was never restored to the full rights of citizenship. He died at his home in Washington, Georgia, on the 15th of December 1885.

See Pleasant A. Stovall, *Robert Toombs, Statesman, Speaker, Soldier, Sage* (New York, 1892).

TOOTHWORT, the popular name for a small British plant of curious form and growth, known botanically as *Lathraea squamaria*. It grows parasitically on roots, chiefly of hazel, in shady places such as hedge sides. It consists of a branched whitish underground stem closely covered with thick fleshy colourless leaves, which are bent over so as to hide the under surface; irregular cavities communicating with the exterior are formed in the thickness of the leaf. On the inner wall of these chambers are stalked hairs, which when stimulated by the touch of an insect send out delicate filaments by means of which the insect is killed and digested. The only portions that appear above ground are the short flower-bearing shoots, which bear a spike of two-lipped dull purple flowers. The scales which represent the leaves also secrete water, which escapes and softens the ground around the plant. *Lathraea* is closely allied to another British parasitic plant, broomrape (*Orobanche*).

TOOWOOMBA, a town of Aubigny county, Queensland, Australia, 76 m. by rail W. by N. of Ipswich, and 101 m. from Brisbane. It is situated on the summit of the Great Dividing Range, and is the centre of the rich pastoral and agricultural district of Darling Downs. The chief buildings are the town-hall, a large theatre, a school of arts and a library; the Christian Brothers College and several handsome churches. The industries are brewing, tanning, soap-boiling, flour-milling, malting, iron-founding, saw-milling and jam-making. Vineyards are cultivated by a German colony and large quantities of wine are made. The town received a municipal charter in 1860, and during the governorship of Lord Lamington (1896–1897) became the summer residence of the governor and his staff. Pop. (1901), 9137; within the five-mile radius, 14,087.

TOP (cf. Dan. *top*, Ger. *Topf*, also meaning pot), a toy consisting of a body of conical, circular or oval shape with a point or peg on which it turns or is made to whirl. The twisting or whirling motion is applied by whipping or lashing when it is a "whipping top" or "peg-top," or by the rapid unwinding of a string tightly wound round a head or handle. When the body is hollow this results in a whirring noise, whence the name "humming top." Other kinds of tops are made as supports for coloured disks which on revolving show a kaleidoscopic variation of patterns. The top is also used in certain games of chance, when it is generally known as a "teetotum." There are many references to it in ancient classical literature. The Greek terms for the toy are *βέμβιξ*, which was evidently the whipping or peg top (Arist. *Birds*, 1461), and *στρόβιλος*, a humming top, spun by a string (Plato, *Rep.* iv. 436 E.). In Homer (*Il.* xiv. 413) the word *στρόμβος* seems to point to the humming top. The Latin name for the top was *turbo*. This word and the Greek *ῥόμβος* are sometimes translated by "top" when they refer to the instrument used in the Dionysiac mysteries, which, when whirled in the air by a string, produced a booming noise. This was no doubt the equivalent of the "bull roarer" (*q.v.*). Strutt (*Games and Pastimes*, 491) says that the top was known in England as early as the 14th century. For the scientific properties of the top see GYROSCOPE and GYROSTAT.

This word must be distinguished from that signifying the highest or uppermost part of anything. It appears to have meant originally a tuft or crest of hair, cf. Ger. *Zopf*, Du. *top*, Icel. *topps*, &c.; it is allied to Eng. "tap," a spike for a cask, and "tip," point. Some etymologists have identified the two words, the toy being so called from spinning on its top or tip, but the two German forms seem to prove conclusively that the words are different.

TOPAZ, a mineral usually found in connexion with granitic rocks and used, when fine, as a gem-stone. It is believed that the topaz of modern mineralogists was unknown to the ancients, and that the stone described under the name of *τοπάζιος*, in allusion to its occurrence on an island in the Red Sea known as *τοπάζιος νῆσος*, was the mineral which is now termed chrysolite or peridot (*q.v.*). The Hebrew *pitdah*, translated "topaz" in the Old Testament, may also have been the chrysolite.

Topaz crystallizes in the orthorhombic system, usually with a prismatic habit (figs. 1 and 2). Many of the crystals, like those from Saxony and Siberia, are rich in faces, and present with the prisms a complicated combination of pyramids and domes. The faces of the prism-zone are usually striated vertically. Doubly-terminated crystals are rare, and sometimes apparently hemimorphic. The mineral presents a perfect cleavage transverse to the long axis of the prism, and the cleavage-plane often has a pearly lustre. The chemical composition of the topaz has given rise to much discussion, but it is now generally regarded as an aluminium fluo-silicate having the formula $Al_2F_2SiO_4$. It was shown by Professor S. L. Penfield and Mr J. C. Minor that the fluorine may be partially replaced by hydroxyl. When strongly heated topaz suffers considerable loss of weight. Sir D. Brewster found in topaz numerous microscopic cavities containing fluids, some of which have received the names of brewsterlinite and cryptolinite. Possibly some of the liquid inclusions may be hydrocarbons.

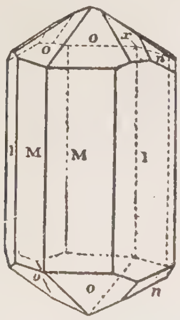


FIG. 1.

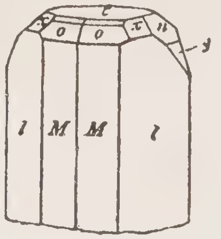


FIG. 2.

The topaz, when pure, may be colourless, and if cut as a brilliant has been mistaken for diamond. It has, too, the same specific gravity, about 3·5. It is, however, greatly inferior in hardness, the hardness of topaz being only 8; and it has lower refractivity and dispersive powers: moreover, being an orthorhombic mineral, it possesses double refraction. From phenacite and from rock-crystal, for which it may be mistaken, it is distinguished by being biaxial and by having a much higher specific gravity. The topaz becomes electric by heating, by friction or by pressure. Colourless limpid topazes are known in Brazil as *pingos d'agoa*, or "drops of water," whilst in England they pass in trade as "minas novas," from a locality in the state of Minas Geraes in Brazil.

Coloured topazes usually present various shades of yellow, blue or brown. The pleochroism is fairly marked, the colour of the sherry-yellow crystals from Brazil being generally resolved by the dichroscope into a brownish-yellow and a rose-pink. The colour in many cases is unstable, and the brown topazes of Siberia are specially liable to suffer bleaching by exposure to sunlight. In 1750 a Parisian jeweller named Dumelle discovered that the yellow Brazilian topaz becomes pink on exposure to a moderate heat, and this treatment has since been extensively applied, so that nearly all the pink topaz occurring in jewelry has been artificially heated. Such "burnt topaz" is often known as "Brazilian ruby," a name applied also to the natural red topaz, which, however, is excessively rare. "Brazilian sapphire" is the term sometimes given to blue topaz, but the colour is usually pale. The delicate green topaz has been incorrectly called aquamarine, which is a name applicable only to the sea-green beryl (*q.v.*). According to A. K. Coomáraswámy, yellow sapphire is often sold as topaz in Ceylon, where yellow topaz is unknown, whilst pink corundum is frequently called there "king topaz."

The topaz is cut on a leaden wheel, and polished with tripoli. It is generally step-cut, or table-cut, but its beauty is best developed when in the form of a brilliant. Cut topazes of large size are known, and it is said that the great "Braganza diamond" of Portugal is probably a topaz.

Topaz usually occurs in granitic and gneissose rocks, often in greisen, and is commonly associated with cassiterite, tourmaline and beryl. It seems to have been formed, in many cases, by pneumatolytic action. In the west of England it is found in Cornwall, notably at St Michael's Mount and at Cligga Head near St Agnes. It occurs also in Lundy Island. The finest British topaz is found in the Cairngorm group of mountains in the central Highlands, especially at Ben a Buird. Rolled pebbles occur in the bed of the Avon in Banffshire. Beautiful, though small, crystals occur in the drusy cavities of the granite of the Mourne Mountains in Ireland. The famous topaz-rock of the Schneckenstein, near Auerbach, in Saxony, yields pale yellow crystals, formerly cut for jewelry, and it is said that these do not become pink on heating. Fine topazes occur in Russia, at several localities in the Urals and in the Adun-chalon Mountains, near Nerchinsk, in Siberia. A very fine series from the Koksharov collection is in the British Museum. Beautiful crystals of topaz are found in Japan, especially at Takayama in the province of Mino, and at Tanokamiyama in Omi province. Ceylon and Burma occasionally yield topazes. Brazil is a famous locality, the well-known sherry-yellow crystals coming from Ouro Preto, formerly called Villa Rica, the capital of Minas Geraes, where they occur in a kaolinitic matrix, resulting from the alteration of a mica-schist, which is regarded by Professor O. A. Derby as a metamorphosed igneous rock. Topaz occurs in the tin-drifts of New South Wales, especially in the New England district; it has been discovered in the Coolgardie goldfield, West Australia; and it is found also in the tinfields of Tasmania and on Flinders Island in Bass's Strait. Fine topaz has been worked near Pike's Peak in Colorado, and in San Diego county, California. The mineral occurs in rhyolite at Nathrop in Chaffee county and Chalk Mountain in Summit county, Colorado, and in trachyte near Sevier Lake, Utah. The occurrence of topaz in these volcanic rocks is very notable, and contrasts with its common occurrence in granites. It is found in like manner in rhyolite at San Luis Potosi in Mexico; and beautiful little limpid crystals accompany stream-tin at Durango. Common topaz occurs in coarse crystals at many localities. A columnar variety from the tin-districts of Saxony and Bohemia, and from Mt Bischoff in Tasmania, is known as pycnite (*πυκνός*, dense); whilst a coarse opaque topaz from granite near Falun, in Sweden, has been termed pyrophysalite (*πῦρ*, fire; *φυσᾶω*, to blow), in allusion to its behaviour when heated.

"Oriental topaz" is the name sometimes given to yellow corundum, a mineral readily distinguished from true topaz by superior hardness and density. Yellow and smoke-tinted quartz, or cairngorm, is often known as "Scotch topaz" or "Spanish topaz," according to its locality; but these, on the contrary, are inferior in hardness and density. The chief differences between the three minerals may be seen in the following table, in which they are arranged in order of hardness, density and refractivity:—

	Scotch Topaz.	True Topaz.	Oriental Topaz.
Hardness	7	8	9
Specific gravity	2·6	3·5	4
Refractive indices	1·54, 1·55	1·61, 1·62	1·76, 1·77
Crystallization	Hexagonal	Orthorhombic	Hexagonal
Chemical composition	SiO_2	$Al_2F_2SiO_4$	Al_2O_3

(F. W. R.*)

TOPEKA, a city and the county-seat of Shawnee county, Kansas, U.S.A., the capital of the state, situated on both sides of the Kansas river, in the east part of the state, about 60 m. W. of Kansas City. Pop. (1900), 33,608, of whom 3201 were foreign-born (including 702 Germans, 575 Swedes, 512 English, 407 Russians, 320 Irish, &c.) and 4807 were negroes; (1910, census), 43,684. It is served by the Atchison, Topeka & Santa Fé, the Chicago, Rock Island & Pacific, the Union Pacific and the Missouri Pacific railways. The city is regularly laid out on a fairly level prairie bench, considerably elevated above the river and about 890 ft. above sea-level. Among its prominent buildings are the United States government building, the Capitol (erected 1866–1903 at a cost of $3,200,589 and one of the best state buildings in the country), the county court house, the public library (1882), an auditorium (with a seating capacity of about 5000), the Y.M.C.A. building, a memorial building, housing historical relics of the state, and Grace Church Cathedral (Protestant Episcopal). The city is the see of a Protestant Episcopal bishop. In the Capitol are the library (about 6000 volumes) and natural history collections of the Kansas Academy of Science, and the library (30,000 books, 94,000 pamphlets and 28,500 manuscripts) and collections of the Kansas State Historical Society, which publishes *Kansas Historical Collections* (1875 sqq.) and *Biennial Reports* (1879 sqq.). The city is the seat of Washburn (formerly Lincoln) College (1865), which took its present name in 1868 in honour of Ichabod Washburn of Worcester, Massachusetts, who gave it $25,000; in 1909 it had 783 students (424 being women). Other educational establishments are the College of the Sisters of Bethany (Protestant Episcopal, 1861), for women, and the Topeka Industrial and Educational Institute (1895), for negroes. In Topeka are the state insane asylum, Christ's Hospital (1894), the Jane C. Stormont Hospital and Training School for nurses (1895), the Santa Fé Railway Hospital, the Bethesda Hospital (1906) and the St Francis Hospital (1909). Topeka is an important manufacturing city. Its factory product was valued in 1905 at $14,448,869. Natural gas is piped from southern Kansas for manufacturing and domestic use.

The first white settlement on the site of Topeka was made in 1852, but the city really originated in 1854, when its site was chosen by a party from Lawrence. It was from the first a free-state stronghold. More than one convention was held here in Territorial days, including that which framed the Topeka Constitution of 1855; and some of the meetings of the free-state legislature chosen under that document (see KANSAS) were also held here. Topeka was made the temporary state capital under the Wyandotte Constitution, and became the permanent capital in 1861. It was first chartered by the pro-slavery Territorial legislature in 1857, but did not organize its government until 1858 (see LAWRENCE). In 1881 it was chartered as a city of the first class. The first railway outlet, the Union Pacific, reached Eugene, now North Topeka, in 1865. The construction of the Atchison, Topeka & Santa Fé was begun here in 1868, and its construction shops, of extreme importance to the city, were built here in 1878. In 1880, just after the great negro immigration to Kansas, the coloured population was 31% of the total.

See F. W. Giles, *Thirty Years in Topeka* (Topeka, 1886).

TOPELIUS, ZAKRIS [ZACHARIAS] (1818–1898), Finnish author, was born at Kuddnäs, near Nykarleby, on the 14th of January 1818. He was the son of a doctor of the same name, who was distinguished as the earliest collector of Finnish folk-songs. Topelius became a student at Helsingfors in 1833, was made professor in 1863 and received in succession all the academic distinctions open to him. Quite early in his career he began to distinguish himself as a lyric poet, with the three successive volumes of his *Heather Blossoms* (1845–1854). The earliest of his historical romances was *The Duchess of Finland*, published in 1850. He was also editor-in-chief of the *Helsingfors Gazette* from 1841 to 1860. In 1878 Topelius was allowed to withdraw from his professional duties, but this did not sever his connexion with the university; it gave him, however, more leisure for his abundant and various literary enterprises. Of all the multifarious writings of Topelius, in prose and verse, that which has enjoyed the greatest popularity is his *Tales of a Barber-Surgeon*, episodes of historical fiction from the days of Gustavus II. Adolphus to those of Gustavus III., treated in the manner of Sir Walter Scott; the five volumes of this work appeared at intervals between 1853 and 1867. Topelius attempted the drama also, with most success in his tragedy of *Regina von Emmeritz* (1854). Topelius aimed, with eminent but perhaps pathetic success, at the cultivation of a strong passion of patriotism in Finland. He died on the 13th of March 1898 at Helsingfors. Topelius was an exceptionally happy writer for children, his best-known book being *Läsning för barn.* His abundant poetry is graceful and patriotic, but does not offer any features of great originality. (E. G.)

TOPETE, JUAN BAUPTISTA (1821–1885), Spanish naval commander and politician, was born in Mexico on the 24th of May 1821. His father and grandfather were also Spanish admirals. He entered the navy at the age of seventeen, cut out a Carlist vessel in 1839, became a midshipman at twenty-two, obtained the cross of naval merit for saving the life of a sailor in 1841 and became a lieutenant in 1845. He served on the West Indian station for three years, and was engaged in repressing the slave trade before he was promoted frigate captain in 1857. He was chief of staff to the fleet during the Morocco War, 1859, after which he got the crosses of San Fernando and San Hermenegilde. Having been appointed chief of the Carrara arsenal at Cadiz, he was elected deputy and joined the Union Liberal of O'Donnell and Serrano. He was sent out to the Pacific in command of the frigate "Blanca," and was present at the bombardment of Valparaiso and Callao, where he was badly wounded, and in other engagements of the war between Chile and Peru. On his return to Spain, Topete was made port captain at Cadiz, which enabled him to take the lead of the conspiracy in the fleet against the Bourbon monarchy. He sent the steamer "Buenaventura" to the Canary Isle for Serrano and the other exiles; and when Prim and Sagasta arrived from Gibraltar, the whole fleet under the influence of Topete took such an attitude that the people, garrison and authorities of Cadiz followed suit. Topete took part in all the acts of the revolutionary government, accepted the post of marine minister, was elected a member of the Cortes of 1869, supported the pretensions of Montpensier, opposed the election of Amadeus, sat in several cabinets of that king's reign, was prosecuted by the federal republic of 1873 and again took charge of the marine under Serrano in 1874. After the Restoration Topete for some years held aloof, but finally accepted the presidency of a naval board in 1877, and sat in the Senate as a life peer until his death on the 29th of October 1885 at Madrid.

TÖPFFER, RODOLPHE (1799–1846), the inventor of pedestrian journeys in Switzerland by schoolboys, was born at Geneva on the 31st of January 1799. His grandfather, a tailor, came about 1760 from Schweinfurt (Bavaria) to settle in Geneva, while his father, Adam, was an artist. Rodolphe's literary education was rather desultory, as he intended to be an artist, like his father. But in 1819 his weak eyesight put an end to that intention, so he studied in Paris, intending to devote himself to the profession of schoolmaster. After passing some time in a private school in Geneva (1822–1824), he founded (1824) one of his own, after his marriage. It was in 1823 that he made his first foot journey in the Alps with his pupils, though this became his regular practice only from 1832 onwards. These *Voyages en zigzag* were described annually (1832–1843) in a series of lithographed volumes, with sketches by the author—the first printed edition appeared at Paris in 1844, and a second series (*Nouveaux voyages en zigzag*) also at Paris in 1854. Both series have since passed through many editions. In 1832 he was named professor of belles-lettres at the university of Geneva, and held that chair till his death, on the 8th of June 1846. As early as 1834 he published an article in the *Bibliothèque universelle* of Geneva. It was followed by a number of tales, commencing with the *Bibliothèque de mon oncle* (1832), many of which were later collected (1841) into the well-known volume which bears the title of *Nouvelles génevoises.* He took some part (on the Conservative side) in local politics, and was (1841–1843) editor of the *Courrier de Genève.* Among his other works are an edition of Demosthenes (1824), and a volume of artistic studies, the *Réflexions et menus propos d'un peintre génevois* (1848).

Lives by A. Blondel and the abbé Relave (both published at Paris, 1886), and shorter notices in E. Rambert's *Écrivains nationaux* (Geneva, 1874); and E. Javelle's *Souvenirs d'un alpiniste* (Lausanne, 1886; Eng. trans., 1899, under the title of *Alpine Memories*), and several chapters in Ste Beuve's *Causeries du lundi*, *Derniers portraits littéraires* and *Portraits contemporains*. (W. A. B. C.)

TOPHET, or TOPHETH (הַתֹּפֶת), the name given in 2 Kings xxiii. 10; Jer. vii. 31, to a spot in the valley of Ben Hinnom near Jerusalem where the Hebrews in the time of Ahab and Manasseh offered children to Molech and other heathen gods. Josiah "defiled" it as part of his reforming activity, and it became a place for the bestowal and destruction of refuse, and a synonym for Gehenna (Isa. xxx. 33; Jer. vii. 32).

The uncertain etymology of the word is discussed in the *Ency. Bib.*, *s.v.* "Molech," § 3, "Topheth."

TOPIARY, a term in gardening or horticulture for the cutting and trimming of shrubs, such as cypress, box or yew, into regular and ornamental shapes. It is usually applied to the cutting of trees into urns, vases, birds and other fantastic shapes, which were common at the end of the 17th century and through the 18th, but it also embraces the more restrained art necessary for the laying out of a formal garden. Yew and holly trees cut into fantastic objects may still be seen in old-fashioned cottage or farmhouse gardens in England. The Lat. *topiarius* meant an ornamental or landscape gardener, and was formed from *topia* (Gr. *τόπος*, place), a term specially employed for a formal kind of landscape painting used as a mural decoration in Roman houses.

TOPLADY, AUGUSTUS MONTAGUE (1740–1778), Anglican divine, was born at Farnham, Surrey, and educated at Westminster and Trinity College, Dublin. Although originally a follower of Wesley, he in 1758 adopted extreme Calvinist opinions. He was ordained in 1762 and became vicar of Harpford with Fenn-Ottery, Devonshire, in 1766. In 1768 he exchanged to the living of Broadhembury, Devonshire. He is chiefly known as a writer of hymns and poems, including "Rock of Ages," and the collections entitled *Poems on Sacred Subjects* (Dublin, 1759) and *Psalms and Hymns for Public and Private Worship* (London, 1776). His best prose work is the *Historic Proof of the Doctrinal Calvinism of the Church of England* (London, 1774). Some comments by Wesley upon Toplady's presentation of Calvinism led to a controversy which was carried on with much bitterness on both sides. Toplady wrote a venomous *Letter to Mr Wesley* (1770), and Wesley repeated his comments in *The Consequence Proved* (1771), whereupon Toplady replied with increased acridity in *More Work for Mr Wesley* (1772). From 1775 to 1778, having obtained leave of non-residence at Broadhembury, he lived in London, and ministered at a Calvinist church in Orange Street.

TOPOGRAPHY (Gr. *τόπος*, place, *γράφειν*, to write), a description of a town, district or locality, giving details of its geographical and architectural features. The term is also applied in anatomy to the mapping out of the surface of the human body, either according to a division based on the organs or parts lying below certain regions, or on a superficial plotting out of the body by anatomical boundaries and landmarks.

TORAN, the name in Hindustani (Skr. *torana*, from *tor*, pass) of a sacred or honorific gateway in Buddhist architecture. Its typical form is a projecting cross-piece resting on two uprights or posts. It is made of wood or stone, and the cross-piece is generally of three bars placed one on the top of the other; both cross-piece and posts are usually sculptured.

TORBERNITE (or cupro-uranite), a mineral which is one of the "uranium micas"; a hydrous uranium and copper phosphate, $Cu(UO_2)_2(PO_4)_2+12H_2O$. Crystals are tetragonal and have the form of square plates, which are often very thin. There is a perfect micaceous cleavage parallel to the basal plane, and on this face the lustre is pearly. The bright grass-green colour is a characteristic feature of the mineral. The hardness is 2½ and the specific gravity 3·5. The radio-activity of the mineral is greater than that of some specimens of pitchblende. It was first observed in 1772 at Johanngeorgenstadt in Saxony, but the best examples are from Gunnislake near Calstock and Redruth in Cornwall. The name torbenite is after Torbern Bergman: *chalcolite* is a synonym. (L. J. S.)

TORCELLO, an island of Venetia, Italy, in the lagoons about 6 m. to the N.W. of Venice, belonging to the commune of Burano. It was a flourishing city in the early middle ages; but now has only a few houses and two interesting churches. The former cathedral of S. Maria was founded in the 7th century. The present building, a basilica with columns, dates from 864; the nave was restored in 1008, in which year the now ruined octagonal baptistery was built. It contains large mosaics of the 12th century, strongly under Byzantine influence; those on the west wall represent the Resurrection and Last Judgment. The seats for the priests are arranged round the semicircular apse, rising in steps with the bishop's throne in the centre—an arrangement unique in Italy. Close by is S. Fosca, a church of the 12th century, octagonal outside, with colonnades on five sides and a rectangular interior intended for a dome which was never executed, beyond which is a three-apsed choir. In the local museum are four Mycenaean vases, one found in the island and another on the adjacent island of Mazzorbo, proving direct intercourse with the Aegean Sea in prehistoric times.

See R. M. Dawkins, in *Journal of Hellenic Studies* (1904), xxiv. 125.

TORCH (O. Fr. *torche*, from Med. Lat. *tortia*, derived from *tortus*, twisted, *torquere*, to twist), a light or illuminant that can be carried in the hand, made of twisted tow, hemp or other inflammable substance. Torches or "links" were, till the general introduction of street lighting, necessary adjuncts for passengers on foot or in carriages in towns at night, and many of the older houses in London and elsewhere still retain the iron stands outside their doors, in which the torches might be placed.

TORCHÈRE, a candelabrum mounted upon a tall stand of wood or metal, usually with two or three lights. When it was first introduced in France towards the end of the 17th century the torchère mounted one candle only, and when the number was doubled or tripled the improvement was regarded almost as a revolution in the lighting of large rooms.

TORDENSKJOLD, PEDER (1691–1720), eminent Danish naval hero, the tenth child of alderman Jan Wessel of Bergen, in Norway, was born at Trondhjem on the 28th of October 1691. Wessel was a wild unruly lad who gave his pious parents much trouble. Finally he ran away from them by hiding in a ship bound for Copenhagen, where the king's chaplain Dr Peder Jespersen took pity on the friendless lad, gratified his love for the sea by sending him on a voyage to the West Indies, and finally procured him a vacant cadetship. After further voyages, this time to the East Indies, Wessel was, on the 7th of July 1711, appointed 2nd lieutenant in the royal marine and shortly afterwards became the captain of a little 4-gun sloop "Ormen" (The Serpent), in which he cruised about the Swedish coast and picked up much useful information about the enemy. In June 1712 he was promoted to a 20-gun frigate, against the advice of the Danish admiralty, which pronounced him to be too flighty and unstable for such a command. His discriminating patron was the Norwegian admiral Lövendal, who was the first to recognize the young man's ability as a naval officer. At this period Wessel was already renowned for two things: the audacity with which he attacked any Swedish vessels he came across regardless of odds, and his unique seamanship, which always enabled him to escape capture. The Great Northern War had now entered upon its later stage, when Sweden, beset on every side by foes, employed her fleet principally to transport troops and stores to her distressed German provinces. The audacity of Wessel impeded her at every point. He was continually snapping up transports, dashing into the fjords where her vessels lay concealed, and holding up her detached frigates. In July 1714 he encountered a frigate which had been equipped in England for the Swedes and was on its way to Gothenburg under the command of an English captain. Wessel instantly attacked her but in the English captain he met his match. The combat lasted all day, was interrupted by nightfall, and renewed again indecisively the following morning. Wessel's free and easy ways procured him many enemies in the Danish navy. He was accused of unnecessarily endangering his majesty's war-ships in the affairs with the frigate and he was brought before a court-martial. But the spirit with which he defended himself and the contempt he poured on his less courageous comrades took the fancy of King Frederick IV., who cancelled the proceedings and raised Wessel to the rank of captain. When in the course of 1715 the return of Charles XII. from Turkey to Stralsund put a new life into the jaded and dispirited Swedish forces, Wessel distinguished himself in numerous engagements off the Pomeranian coast and did the enemy infinite damage by cutting out their frigates and destroying their transports. On returning to Denmark in the beginning of 1716 he was ennobled under the title of "Tordenskjold" (Thundershield). When in the course of 1716 Charles XII. invaded Norway and sat down before the fortress of Fredrikshald, Tordenskjold compelled him to raise the siege and retire to Sweden by pouncing upon the Swedish transport fleet laden with ammunition and other military stores which rode at anchor in the narrow and dangerous strait of Dynekil, utterly destroying the Swedish fleet with little damage to himself. For this, his greatest exploit, he was promoted to the rank of commander, but at the same time incurred the enmity of his superior officer Admiral Gabel, whom he had omitted to take into his confidence on the occasion. Tordenskjold's first important command was the squadron with which he was entrusted in the beginning of 1717 for the purpose of destroying the Swedish Gothenburg squadron which interrupted the communications between Denmark and Norway. Owing to the disloyalty of certain of his officers who resented serving under the young adventurer, Tordenskjold failed to do all that was expected of him. His enemies were not slow to take advantage of his partial failure. The old charge of criminal recklessness was revived against him at a second court-martial before which he was summoned in 1718; but his old patron Admiral U. C. Gyldenlöve again intervened energetically in his behalf and the charge was quashed. In December 1718 Tordenskjold brought to Frederick IV. the welcome news of the death of Charles XII. and was made a rear-admiral for his pains. Tordenskjold's last feat of arms was his capture of the Swedish fortress of Marstrand, when he partially destroyed and partially captured the Gothenburg squadron which had so long eluded him. He was rewarded with the rank of vice-admiral. Tordenskjold did not long survive the termination of the war. On the 20th of November 1720 he was killed in a duel with a Livonian colonel, Jakob Axel Stael von Holstein. Although, Dynekil excepted, Tordenskjold's victories were of far less importance than Sehested's at Stralsund and Gyldenlöve's at Rügen, he is certainly, after Charles XII., the most heroic figure of the Great Northern War. His courage was fully equal to the courage of "The Lion of the North," but he lacked that absolute self-command which gives to the bravery of Charles XII. its peculiar, almost superhuman, character.

See Carstensen and Lütken, *Tordenskjold* (Copenhagen, 1887).
(R. N. B.)

TOREADOR, a Spanish word derived from *torear*, to engage in a bull-fight, *toro*, a bull, Latin *taurus*, for one of the principal performers in the national sport of bull-fighting (*q.v.*).

TORELL, OTTO MARTIN (1828–1900), Swedish geologist, was born in Varberg on the 5th of June 1828. He was educated at Lund for the medical profession, but became interested in zoological and geological studies, and being of independent means he devoted himself to science. He gave his attention first especially to the invertebrate fauna and the physical changes of pleistocene and recent times. He studied the glacial phenomena of Switzerland, Spitzbergen and Greenland, making two Arctic expeditions in company with A. E. Nordenskiöld. In 1866 he became professor of zoology and geology in the University at Lund, and in 1871 he was appointed chief of the Swedish Geological Survey. In the latter capacity he laboured until 1897. His published contributions, though of much interest and importance, were not large, but his influence in promoting a knowledge of geology in Sweden was of great service. His Arctic experiences enabled him to interpret the method of origin of the drift deposits in northern Europe, and to show that they were largely of glacial or fluvio-glacial origin. In the English drifts he recognized many boulders of Scandinavian origin. He died on the 11th of September 1900.

His publications include: *Bidrag till Spitzbergens molluskfauna* (1859); and memoirs to accompany several sheets of the Geological Survey map of Sweden.

Obituary with portrait, in *Geol. Mag* (May 1902), reproduced in abridged form from memoir by L. Holmström, in *Geologiska föreningen i Stockholm's forhandlingar*, xxiii.

TORENO, JOSÉ MARIA QUIEPO DE LLANO RUIZ DE SARAVIA, Count of (1786–1843), Spanish politician and historian, was born at Oviedo on the 25th of November 1786. His family was wealthy and belonged to the most ancient nobility of Asturias. His mother, Dominga Ruiz de Saravia, had property in the province of Cuenca. The son received a better education in classics, mathematics and modern languages than was usual at that time. The young viscount of Matarrosa, the title he bore in his father's lifetime, was introduced to the writings of Voltaire and Rousseau by the abbot of the Benedictine house of Monserrat in Madrid. He was present at Madrid when the city rose against Murat on the 2nd of May 1808, and took part in the struggle which was the beginning of the Peninsular War. From Madrid he escaped to Asturias, and on the 30th of May he embarked in a Jersey privateer at Gijon, with other delegates, in order to ask for the help of England against the French. The deputation was enthusiastically received in London. By the 30th of December he was back in Asturias, his father having died in the interval. During the Peninsular War he saw some service in the first occupation of Asturias by the French, but he was mainly occupied by his duties as a member of the Cortes. In 1809 he was at Seville, where one of his uncles was a member of the central Junta. In the following year he was a leader of the party which compelled the Regency to summon the Cortes—to which he was elected by Asturias early in 1811 though he wanted some months of the legal age of twenty-five. His election was opposed by some of his own relatives who did not share his advanced opinions, but it was ratified by the Cortes. Toreno was conspicuous among the well-meaning men who framed the constitution of 1812, which was made as if it was meant for some imaginary republic and not for Catholic and monarchical Spain. When Ferdinand VII. returned from prison in France in 1814 Toreno foresaw a reaction, and put himself out of reach of the king. He was the more an object of suspicion because his brother-in-law, Porlier, perished in a wild attempt to support the constitution by force. Toreno remained in exile till the outbreak of the revolution of 1820. Between that year and 1823 he was in Spain serving in the restored Cortes, and experience had abated his radical ardour. When the French intervened in 1823 Toreno had again to go into exile, and remained abroad till the king published the amnesty of the 15th of October 1832. He returned home in July 1833, but remained on his estates till the king's death on the 29th of September. As hereditary standard bearer of Asturias (Alferez Mayor) it fell to him to proclaim the young queen, Isabella II. In 1834 his now moderate opinions pointed him out to the queen regent, Maria Christina, as a useful man for office. In June 1834 he was minister of finance, and became prime minister on the 7th of June. His tenure of the premiership lasted only till the 14th of September of the same year, when the regent's attempt to retain a practically despotic government under a thin constitutional veil broke down. The greater part of the remainder of his life was spent in voluntary exile, and he died in Paris on the 16th of September 1843. As a politician he felt the need for a revision of the worn out despotism which ruled till 1808, but he was destitute of any real political capacity. Toreno is chiefly remembered as the author of the *History of the Rising, Wa* *and Revolution of Spain*, which he began between 1823 and 1832 and published in 1836–1838 in Paris. As a work of military criticism it is not of high value, and Toreno was prejudiced in favour of his colleagues of the Cortes, whose errors and excesses he shared in and excused. The book is, however, written in excellent Castilian, and was compiled with industry. It is worth consulting as an illustration of the time in which the author lived, as a patriotic Spanish view of the war, and for the prominence it gives to the political side of the Peninsular War, which he justly treated as a revolution.

A biography by Don Antonio de Cueto is prefixed to the reprint of the *Levantamiento guerra y revolución de España*, in vol. lxiv. of the *Biblioteca de autores españoles* of Rivadeneyra (Madrid 1846–1880).

TORENO, QUEIPO DE LLANO Y GAYOSO DE, Count (1840–1890), Spanish politician, son of the preceding, was born in Madrid in 1840. He was educated at the Madrid Institute and University, entered parliament in 1864 as a Moderado, and sat in all the Cortes of Queen Isabella's reign as a deputy for his ancestral province, Asturias. Loyal to the Bourbons all through the revolution, he nevertheless became a deputy in the Cortes of 1871–1873, and founded an Alphonsist paper, *El Tiempo*, in 1873. When the Restoration took place, its first cabinet made Count de Toreno mayor of the capital, and in 1875 minister of public works, in which capacity he improved the public libraries, museums, academies and archives, and caused many important works to be published, including the *Cartas de Indias*. In 1879 he became minister for foreign affairs, in 1880 president of the House of Deputies, in 1884 again governor of Madrid, and in 1885 again president of the House of Deputies. During the reign of Alphonso XII. and the first years of the regency of Queen Christina Count de Toreno was one of the most prominent Conservative leaders, and was often consulted by the Crown. He died on the 31st of January 1890. He was a patron of the turf, and established a race-course in Madrid, where the first races took place in the reign of Alphonso XII.

TORGAU, a town of Germany, in the Prussian province of Saxony, situated on the left bank of the Elbe, 30 m. N.E. of Leipzig and 26 m. S.E. of Wittenberg by rail. Pop. (1905), 12,299. Its most conspicuous building is the Schloss Hartenfels, on an island in the Elbe, which was built, or at least was finished, by the elector of Saxony, John Frederick the Magnanimous. This castle, which is now used as a barracks, is one of the largest Renaissance buildings in Germany. It was for some time the residence of the electors of Saxony and contains a chapel consecrated by Martin Luther. The town hall, a 16th-century building, houses a collection of Saxon antiquities. Torgau has two Evangelical churches and a Roman Catholic church. One of the former, the Stadt Kirche, contains paintings by Lucas Cranach and the tomb of Catherine von Bora, the wife of Luther. The chief industries of the town are the manufacture of gloves, carriages, agricultural machinery, beer and bricks; there is a trade in grain both on the Elbe and by rail. The fortifications, begun in 1807 by order of Napoleon, were dismantled in 1889–1891. In the vicinity is the royal stud farm of Graditz.

Torgau is said to have existed as the capital of a distinct principality in the time of the German king Henry I., but early in the 14th century it was in the possession of the margraves of Meissen and later of the electors of Saxony, who frequently resided here. The town came into prominence at the time of the Reformation. In 1526 John, elector of Saxony, Philip, landgrave of Hesse, and other Protestant princes formed a league against the Roman Catholics, and the Torgau articles, drawn up here by Luther and his friends in 1530, were the basis of the confession of Augsburg. Torgau is particularly celebrated as the scene of a battle fought on the 3rd of November 1760, when Frederick the Great defeated the Austrians (see Seven Years' War). In January 1814 Torgau was taken by the Germans after a siege of three months and it was formally ceded to Prussia in 1815.

See Grulich and Bürger, *Denkwürdigkeiten der altsächsischen Residenz Torgau aus der Zeit der Reformation* (Torgau, 1855); Knabe, *Geschichte der Stadt Torgau bis zur Reformation* (Torgau, 1880); and the publications of the *Altertumverein zu Torgau* (Torgau, 1884 sqq.).

TORNADO (Span., *tornada*, a turning about, cf. "turn"), a local whirlwind of extreme violence, usually formed within a thunderstorm. In appearance it consists of a funnel-shaped cloud, depending from the mass of storm-cloud above, and when fully developed tapering downwards to the earth. Besides its whirling motion, a tornado has an advancing movement of from 20 to 40 m. an hour—and along its own narrow path it carries destruction. Its duration is usually from half an hour to an hour. Tornadoes are most common in America, especially in the Mississippi Valley and the Southern states; in Europe and elsewhere they are comparatively rare. Owing to their association with thunderstorms they generally occur in warm weather. A tornado is the result of a condition of local instability in the atmosphere, originating high above the earth. A current of air is induced to ascend with a rapid spiral motion round a central core of low pressure. The moisture in the ascending air is condensed by cooling both as it ascends and as it expands into the low-pressure core. The cloud-funnel appears to grow downwards because the moisture in the air is condensed more rapidly than the air itself, following a spiral course, ascends.

TORO, a town of Spain, in the province of Zamora, on the right bank of the river Duero (Douro), and on the Zamora-Medina del Campo railway. Pop. (1900), 8379. Toro is an ancient fortified town, with picturesque narrow streets, among which are many medieval churches, convents and palaces, besides modern schools and public buildings. A fine bridge of twenty-two arches spans the river. The cathedral church is Romanesque; it dates from the 12th century but has been partially restored. The palace of the marquesses of Santa Cruz was the meeting place of the Cortes of 1371, 1442 and 1505, which made Toro and its code of laws celebrated. Toro is first mentioned in documents of the 10th century. It played an important part in the development of the kingdoms of Leon and Castile and in the reconquest of Spain from the Moors.

TORONTO, the capital of the province of Ontario, and the second largest city in the Dominion of Canada, situated on the northern shore of Lake Ontario, almost due north from the mouth of the Niagara river. It lies on a plateau gradually ascending from the lake shore to an altitude of 220 ft., and covers an area of nearly 20 sq. m. The river Don flows through the eastern part of the city, and the river Humber forms its western limit. The fine bay in front of the city, affording a safe and commodious harbour, is formed by an island stretching along the south of it. The city is well laid out for the most part, the streets crossing each other at right angles; Yonge Street, the chief artery, running north from the bay, was constructed as a military road in 1796, and extends under the same name for upwards of 30 m. to Lake Simcoe. It constitutes the dividing line of the city, the cross streets being called east or west according to the side of it they are on.

Toronto is the seat of government for the province, and contains the parliament buildings, the lieutenant-governor's residence, the courts of law and the educational departmental buildings. The parliament buildings are situated in Queen's Park, almost in the centre of the city, and are an imposing structure of red sandstone in the neo-Greek style built at great cost. They are shortly to be enlarged, as the needs of the province have outgrown them. A little distance to the west stand the university buildings, the central one being a splendid piece of architecture in the Norman style. Stretching in a semicircle round the broad campus are the library, the medical building, the biology building and museum, the school of practical science, the geology and chemistry buildings and the convocation hall, their architecture varying very greatly, beauty having been sacrificed to more practical considerations; the magnetic observatory is also in the grounds, but is overshadowed by some of the more recent erections. It is one of the meteorological stations established by the British government on the recommendation of the Royal Society in 1840 and is now maintained by the Dominion government. The university of Toronto, for the support of which the province is responsible, includes faculties of arts, science and medicine, in the teaching of which it is strictly secular. But near at hand and in full affiliation with the university are Victoria College (Methodist), Wycliffe College (Anglican), Knox College (Presbyterian) and St Michael's College (Roman Catholic), wherein courses in divinity are given and degrees conferred. Victoria College, likewise, provides a course in arts, but none in science. Trinity College (Anglican), though some distance away, is also affiliated with the university, and her students enjoy its full advantages. Besides the university, Toronto is remarkably rich in educational institutions. Upper Canada College, founded in 1829, in many respects resembles one of the English public schools. It has over 300 students. St Andrew's College, also for boys, is a more recent establishment, and has about the same number of pupils. There are three large collegiate institutes, having some 300 to 600 pupils each, and in addition a number of schools for girls, such as Havergal College and Westminster College. Osgoode Hall, a stately structure in the heart of the city, houses the higher courts of law and appeal, and also a flourishing law school. The city hall and court-house is one of the finest civic buildings in North America. It is in the Romanesque style, and accommodates all the civic offices, the board of education, the police and county courts, &c. Many of the churches are worthy examples of good architecture.

Toronto is essentially a residential city. The houses of the better class stand separate, not in long rows, and have about them ample lawns and abundant trees. It is consequently a widespread city, the length from east to west approximating ten miles. An electric railway system provides means of communication. There are many parks, ranging in size from Carlton Park of one acre to High Park (375 acres) and Island Park (389), the latter being across the harbour and constituting the favourite resort of the people during the summer. In Exhibition Park there is held annually an industrial and agricultural exhibition that has grown to great magnitude. It lasts a fortnight in late summer. It is a municipal enterprise and the profits belong to the city.

The population in 1907, as shown by the police census, exceeded 300,000. The government of the city is vested in a council consisting of the mayor and four controllers elected annually and eighteen aldermen (three from each of the six wards into which the city is divided). The council as a whole is the legislative body, while the board of control is the executive body, and as such is responsible for the supervision of all matters of finance, the appointment of officials, the carrying on of public works, and the general administration of the affairs of the city, except the departments of education and of police, the first being under the control of the board of education, elected annually by the citizens, and the latter under the board of police commissioners, consisting of the mayor, the county judge and the police magistrate.

Toronto is one of the chief manufacturing centres of the dominion; agricultural machinery, automobiles, bicycles, cotton goods, engines, furniture, foundry products, flour, smoked meats, tobacco, jewelry, &c., are flourishing industries, and the list is constantly extending. The situation of the city is favourable to commerce, and the largest vessels on the lakes can use its harbour. It is the outlet of a rich and extensive agricultural district, and throughout the season of navigation lines of steamers ply between Toronto and the other lake ports on both the Canadian and American sides, the route of some of them extending from Montreal to Port Arthur on Lake Superior. Railway communication is complete, three great trunk lines making the city a terminal point, viz. the Grand Trunk, the Canadian Pacific and the Canadian Northern.

As a financial centre Toronto has made remarkable advance. The transactions on the stock exchange rival those of Montreal. The Bank of Commerce has its headquarters here, as have also the Bank of Nova Scotia, the Bank of Toronto, the Standard Traders, Imperial, Sovereign, Dominion, Crown, United Empire, Sterling and other banks.

The name of the city is of Indian origin, meaning "a place of meeting," the site in the days before the coming of the white man being an established rendezvous among the neighbouring Indian tribes. It first appears in history in 1749 as a centre of trade when the French built a small fort and started a trading establishment called Fort Rouille. Before long, however, British traders came up from the south and entered into active rivalry with the French, and in 1793 the fort was burned by the latter to prevent its occupation by their foes. A year later Governor Simcoe transferred the seat of government of the new province of Upper Canada from the town of Newark at the mouth of the Niagara River to Toronto, giving the new capital the name of York, in honour of the second son of George III. Under its new name it made slow progress as the surrounding country was cleared and settled. The entrance to the harbour was guarded by two blockhouses; provision was made for barracks and garrison stores; buildings were erected for the legislature; and there the members of parliament, summoned by royal proclamation to "meet us in our provincial parliament in our town of York," assembled on the 1st of June 1797. Sixteen years later the population numbered only 456. The town was twice sacked in the war of 1812. General Dearborn captured it at the head of a force of upwards of 2000. On their advance to the outworks of the garrison the magazine of the fort exploded, whether by accident or design, killing many of the invaders. The halls of legislature and other buildings were burnt and the town pillaged. On the restoration of peace the work of creating a capital for Upper Canada had wellnigh to begin anew. The organization of Upper Canada College in 1830, with a staff of teachers nearly all graduates of Cambridge, gave a great impetus to the city and province. In 1834 the population of York numbered fully 10,000; and an act of the provincial legislature conferred on it a charter of incorporation, with a mayor, aldermen and councilmen. Under this charter it was constituted a city with the name of Toronto. Since that time the progress of the city has been rapid and substantial, the population doubling every twenty years. In 1885 the total assessment was $69,000,000; in 1895 $146,000,000 and in 1906 $167,411,000, the rate of taxation being 18½ mills.

TORPEDO. In 1805 Robert Fulton demonstrated a new method of destroying ships by exploding a large charge of gunpowder against the hull under water. No doubt then remained as to the effectiveness of this form of attack when successfully applied; it was the difficulty of getting the torpedo, as it was called, to the required position which for many years retarded its progress as a practical weapon of naval warfare. Attempts were first made to bring the explosive in contact with the vessel by allowing it to drift down to her by the action of tide or current, and afterwards to fix it against her from some form of diving boat, but successive failures led to its restriction for a considerable period to the submarine mine (*q.v.*) in which the explosive is stationary and takes effect only when the ship itself moves over or strikes the charge. Used in this way, it is an excellent deterrent to hostile warships forcing a harbour.

Spar or Outrigger Torpedo.—The limitations attached to the employment of submarine mines, except for coast defence, revived the idea of taking the torpedo to the ship instead of waiting for the latter to gain some exact point which she might very possibly avoid. This first took practical shape in the spar or outrigger torpedo. This consisted of a charge of explosive at the end of a long pole projecting from the bow of a boat, the pole being run out and immersed on arriving near the object. Directly the charge came in contact with the hull of the ship it was exploded by an electric battery in the boat. If the boat was not discovered and disabled while approaching, the chances were favourable to success and escape afterwards. Against a vigilant enemy it was doubtless a forlorn hope, but to brave men the venture offered considerable attractions.

Frequent use of this spar or outrigger torpedo was made during the American Civil War. A notable instance was the destruction of the Confederate ironclad "Albemarle" at the end of October 1864. On this mission Lieut. Cushing took a steam launch equipped with an outrigger torpedo up the Roanoke River, in which lay the "Albemarle." On arriving near the ship Cushing found her surrounded by logs, but pushing his boat over them, he immersed the spar and exploded his charge in contact with the "Albemarle" under a heavy fire. Ship and launch sank together, but the gallant officer jumped overboard, swam away and escaped. Submerged boats were also used for similar service, but usually went to the bottom with their crews. During the war between France and China in 1884 the "Yang Woo" was attacked and destroyed by an outrigger torpedo.

Locomotive Torpedoes.—Though the spar torpedo had scored some successes, it was mainly because the means of defence against it at that time were inefficient. The ship trusted solely to her heavy gun and rifle fire to repel the attack. The noise, smoke, and difficulty of hitting a small object at night with a piece that could probably be discharged but once before the boat arrived, while rifle bullets would not stop its advance, favoured the attack. When a number of small guns and electric lights were added to a ship's equipment, success with an outrigger torpedo became nearly, if not entirely, impossible. Attention was then turned in the direction of giving motion to the torpedo and steering it to the required point by electric wires worked from the shore or from another vessel; or, dispensing with any such connection, of devising a torpedo which would travel under water in a given direction by means of self-contained motive power and machinery. Of the former type are the Lay, Sims-Edison and Brennan torpedoes. The first two—electrically steered by a wire which trails behind the torpedo—have insufficient speed to be of practical value, and are no longer used. The Brennan torpedo, carrying a charge of explosive, travels under water and is propelled by unwinding two drums or reels of fine steel wire within the torpedo. The rotation of these reels is communicated to the propellers, causing the torpedo to advance. The ends of the wires are connected to an engine on shore to give rapid unwinding and increased speed to the torpedo. It is steered by varying the speed of unwinding the two wires. This torpedo was adopted by the British war office for harbour defence and the protection of narrow channels.

Uncontrolled Torpedoes.—The objection of naval officers to have any form of torpedo connected by wire to their ship during an action, impeding her free movement, liable to get entangled in her propellers and perhaps exploding where not desired—disadvantages which led them to discard the Harvey towing torpedo many years ago—has hitherto prevented any navy from adopting a controlled torpedo for its sea-going fleet. The last quarter of the 19th century saw, however, great advances in the equipment of ships with locomotive torpedoes of the uncontrolled type. The Howell may be briefly described, as it has a special feature of some interest. Motive power is provided by causing a heavy steel fly-wheel inside the torpedo to revolve with great velocity. This is effected by a small special engine outside operating on the axle. When sufficiently spun up, the axle of the flywheel is connected with the propeller shafts and screws which drive the torpedo, so that on entering the water it is driven ahead and continues its course until the power stored up in the flywheel is exhausted. Now when a torpedo is discharged into the sea from a ship in motion, it has a tendency to deflect owing to the action of the passing water. The angle of deflexion will vary according to the speed of the ship, and is also affected by other causes, such as the position in the ship from which the torpedo is discharged, and its own angle with the line of keel. Hence arise inaccuracies of shooting; but these do not occur with this torpedo, for the motion of the flywheel, acting as a gyroscope—the principle of which applied to the Whitehead torpedo is described later—keeps this torpedo on a straight course. This advantage, combined with simplicity in construction, induced the American naval authorities at one time to contemplate equipping their fleet with this torpedo, for they had not, up to within a few years ago, adopted any locomotive torpedo. A great improvement in the torpedo devised by Mr Whitehead led them, however, definitely to prefer the latter and to discontinue the further development of the Howell system.

The Whitehead torpedo is a steel fish-shaped body which travels under water at a high rate of speed, being propelled by two screws driven by compressed air. It carries a large charge of explosive which is ignited on the torpedo striking any hard substance, such as the hull of a ship. The body is divided into three parts. The foremost portion or head contains the explosive—usually wet gun-cotton—with dry primer and mechanical igniting arrangement; the centre portion is the air chamber or reservoir, while the remaining part or tail carries the engines, rudders, and propellers besides the apparatus for controlling depth and direction. This portion also gives buoyancy to the torpedo.

When the torpedo is projected from a ship or boat into the water a lever is thrown back, admitting air into the engines causing the propellers to revolve and drive the torpedo ahead. It is desirable that a certain depth under water should be maintained. An explosion on the surface would be deprived of the greater part of its effect, for most of the gas generated would escape into the air. Immersed, the water above confines the liberated gas and compels it to exert all its energy against the bottom of the ship. It is also necessary to correct the tendency to rise that is due to the torpedo getting lighter as the air is used up, for compressed air has an appreciable weight. This is effected by an ingenious apparatus long maintained secret. The general principle is to utilize the pressures due to different depths of water to actuate horizontal rudders, so that the torpedo is automatically directed upwards or downwards as its tendency is to sink or rise.

The efficiency of such a torpedo compared with all previous types was clearly manifest when it was brought before the maritime states by the inventor, Whitehead, and it was almost universally adopted. The principal defect was want of speed—which at first did not exceed 10 knots an hour—but by the application of Brotherhood's 3-cylinder engine the speed was increased to 18 knots—a great advance. From that time continuous improvements have resulted in speeds of 30 knots and upwards for a short range being obtained. For some years a torpedo 14 ft. long and 14 in. in diameter was considered large enough, though it had a very limited effective range. For a longer range a larger weapon must be employed capable of carrying a greater supply of air. To obtain this, torpedoes of 18 in. diameter, involving increased length and weight, have for some time been constructed, and have taken the place of the smaller torpedo in the equipment of warships. This advance in dimensions has not only given a faster and steadier torpedo, but enabled such a heavy charge of gun-cotton to be carried that its explosion against any portion of a ship would inevitably either sink or disable her. The dimensions, shape, &c., of the 14- and 18-in. torpedoes are shown in fig. 1. A limited range was still imposed by the uncertainty of its course under water. The speed of the ship from which it was discharged, the angle with her keel at which it entered the water, and the varying velocity of impulse, tended to error of flight, such error being magnified the farther the path of the torpedo was prolonged. Hence 800 yds. was formerly considered the limit of distance within which the torpedo should be discharged at sea against an object from a ship in motion.

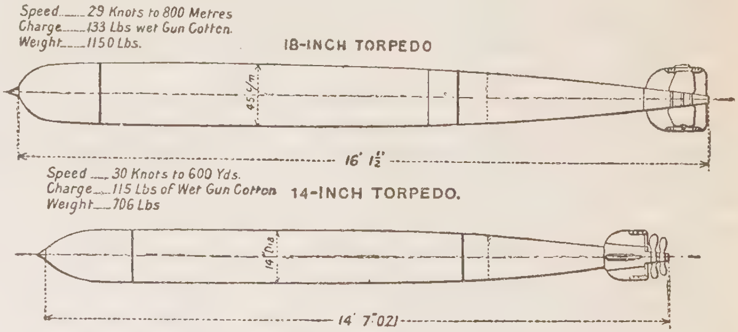

Speed......29 Knots to 800 Metres
Charge......133 Lbs wet Gun Cotton.
Weight......1150 Lbs.
18-INCH TORPEDO
45 c/m
16' 1½"
Speed ......30 Knots to 600 Yds.
Charge......115 Lbs of Wet Gun Cotton
Weight......706 Lbs
14-INCH TORPEDO.
14"018
14' 7"021

FIG. 1.—Diagrams of 14- and 18-in. Torpedoes.

In these circumstances, though improvements in the manufacture of steel and engines allowed of torpedoes of far longer range being made (the fastest torpedo up to 1898 having a speed of 29 knots for 800 yds.), it was of no advantage to make them, as they could not be depended upon to run in a straight line from a stationary point for more than 800 yds., while from a ship in motion good practice could only be ensured at a reduced range. It was obvious, therefore, that to increase the effective range of the torpedo, these errors of direction must be overcome by some automatic steering arrangement. Several inventors turned their attention to the subject, nearly all of whom proposed to utilize the principle of the gyroscope for the purpose. The first which gave any satisfactory results was an apparatus devised by Ludwig Obry—an engineer in Austria—and tried by the Italian government about 1896. These trials demonstrated the feasibility of accurately and automatically steering a torpedo in a direct line by this means. Messrs Whitehead & Co., of Fiume, then acquired the invention, and after exhaustive experiments produced the apparatus which is now fitted to every torpedo made. It is based on the principle that a body revolving on a free axis tends to preserve its plane of rotation. A gyroscope with plane of rotation parallel to the vertical axis of the torpedo will have an angular motion if the torpedo is diverted from its original course. This angular motion is employed to actuate the steering mechanism by operating an air motor connected with the rudders, and keeping the torpedo in the line of discharge. The apparatus consists of a flywheel caused to rotate by a spring, the barrel on which the latter is wound having a segmental wheel which gears into a toothed pinion spindle of the flywheel. Owing to the diameter of the segment being much greater than the pinion, a rapid rotatory motion is imparted. The spring is wound up by a key from outside the torpedo, and kept in tension until the projectile is discharged, when the spring is released by the air lever being thrown back, which admits air to the engine; the gyroscope is then freed and set in motion with its plane in the plane of the vertical axis of the torpedo as it was in the launching tube.

Assuming now that the course of the torpedo is diverted by any cause, its axis will move or perform a certain angular motion with regard to the plane of the flywheel, which will have the same result as if we consider the conditions reversed, *i.e.* as if the plane of rotation of the flywheel were altered and that of the axis of the torpedo remained the same. The axis of the flywheel performs a relative angular motion which it imparts to a crank actuating a servo-motor worked by compressed air, and connected with the rudders of the torpedo, moving them in the opposite direction to that in which the torpedo was diverted from its original course. Thus all inaccuracies of flight due to errors of adjustment, miscalculation of deflexion, or even damage to some part, are eliminated. As long as the gyroscope is in good order the torpedo is bound to run in the line it was pointing when the flywheel was started. It is placed in the after-body of the torpedo, as indicated in fig. 2.

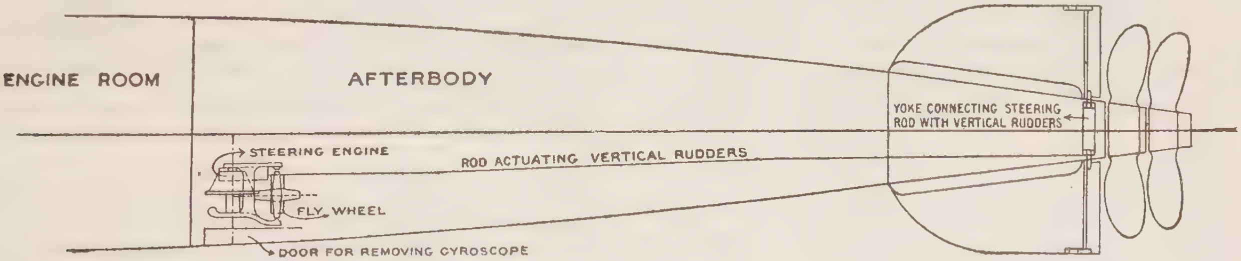

ENGINE ROOM
AFTERBODY
YOKE CONNECTING STEERING ROD WITH VERTICAL RUDDERS
STEERING ENGINE
ROD ACTUATING VERTICAL RUDDERS
FLY WHEEL
DOOR FOR REMOVING GYROSCOPE

FIG. 2.—Arrangement of Gyroscope in Torpedo.

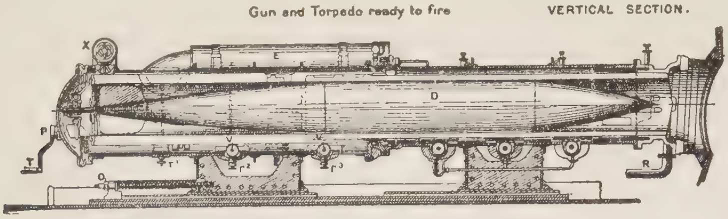
The efficiency of the Whitehead torpedo has thus been enormously increased, and more accurate practice can now be made at 2000 yds. than was formerly possible at 800 yds. This adds considerably to the chances of torpedo-boats attacking ships, even in day-time, at sea or at anchor, and will render further protection necessary against this weapon. Against a ship in motion there is still, however, the calculation as to her speed and the distance she will travel before the torpedo reaches her. Should this be miscalculated, an increased range for torpedoes will magnify the error. For instance, a 30-knot torpedo will travel 1000 yds. in a minute. If aimed at a ship on the beam assumed to be steaming 15 knots an hour, to reach her when 1000 yds. distant the torpedo must be discharged at a point 500 yds. ahead of her. But if the ship is actually steaming 12 knots, she will have travelled only 400 yds. in the minute, and the torpedo will be 100 yds. in advance of her. If discharged at a range of 500 yds., such a miscalculation causes an error of only 50 yds. or 150 ft. But if the object is 300 ft. long, and her centre was taken as the target, her bow would be just at the spot the torpedo would reach in thirty seconds. It would seem, therefore, that increased velocity of torpedo is necessary before the full advantages of the gyroscope can be realized. Now the range of the torpedo is entirely dependent upon the store of energy which can be carried; upon, therefore, the capacity of the air reservoir, the maximum pressure it can stand, and on the efficiency of the propelling engines. The speed over a given range is also dependent upon these factors; the maximum speed being limited by the strength of the engines and other parts. Improvements in steel manufacture have permitted the use of much higher pressures of air and the construction of air-chambers able to withstand the pressure of 2000 ℔ to the sq. in. with the same weight of air-chamber. This has enabled increased range without reduction in speed to be attained, or conversely, increased speed at shorter ranges. By improvement in the engines which are now of the Brotherhood 4-cylinder central crank type further gains have been effected.

Having reached the limit of pressure and endurance of air-chambers with present materials without undue increase of weight, the designer had to seek additional energy in another direction. Now the energy obtainable from a given weight of compressed air is dependent upon the volume of air available at the working pressure of the engines. At a constant pressure this volume of air is proportionate to its absolute temperature. If then the air be stored cold and highly heated before delivery to the engine the available energy from a given weight will be greatly increased. By this means we obtain the equivalent of a larger and heavier air-chamber without the increased weight such would involve.

As originally used a quantity of hydrocarbon fuel was placed in the air-vessel. Upon discharging the torpedo this fuel was automatically ignited and the contents of the air-chamber were heated. Unless, however, the combustion could be regulated there were serious risks of abnormal pressures, of overheating and weakening the air-vessel. Devices have been applied to overcome this liability, and other methods devised to obtain the same result.

By the use of heating and thereby increasing the volume of air in proportion to the rise of temperature the extra volume will allow of an increased speed for a given range or a greater range without increase of speed. The limit to the development of this system seems to be the temperature the materials will stand, but even at this early stage it has added several knots to the speed of this wonderful weapon.

Torpedo Carriages and Discharge.—As no gun which is inefficiently mounted can give good results, so the best torpedo is valueless without a good carriage or system of discharge. In the early days of the Whitehead, discredit came upon it because the importance of this was not sufficiently realized; and an erratic course under water was in nine cases out of ten due to a crude method of discharge. A delicate piece of mechanism was dropped into the water from a height of several feet, and naturally suffered internal derangement. Gun-ports were then used for the purpose, but now a special orifice is made, to which the torpedo carriage is fitted with a ball-and-socket joint—forming a water-tight aperture—so that this carriage or tube may be only 2 or 3 ft. above the water-line. The ball-and-socket joint enables it also to have a considerable angle of training. Originally the torpedo was pushed out by a rod acted upon by compressed air, in which case the carriage was a simple frame. The rod, pressing against the tail with some force, was apt to damage or disarrange the rudders, so the air-gun took the place of rod impulse. Here the torpedo fits closely in a tube or cylinder with an opening at the rear made air-tight when closed. At the desired moment compressed air is admitted to the rear part of the cylinder and blows the torpedo out. Gunpowder then superseded air for this operation; and now this has given place to a small charge of cordite, which does not leave any deposit on the inside of the cylinder. There is a double risk in the use of locomotive torpedoes from above water. (1) The charge may be exploded by hostile fire. Though mainly consisting of damp gun-cotton, which is not readily ignited, the dry primer and detonator may be struck, which would lead to a disastrous explosion. (2) The air-chamber is also a source of danger. As it contains air compressed to a high degree of tension, experiments have shown that if struck by a small shell it may burst with great violence; and as it offers a considerable mark, this is not an improbable event in an action. An instance of the danger of above-water torpedo tubes occurred in the Spanish-American War at the battle of Santiago. A shell entered the "Almirante Oquendo" and struck a 14-in. torpedo in the tube. The charge detonated, causing a fearful explosion and practically wrecking that part of the vessel. The development of moderate-sized quick-firing guns has increased this risk. Hence we find the use of above-water torpedo tubes now mainly confined to torpedo and other craft too small for submerged discharge.



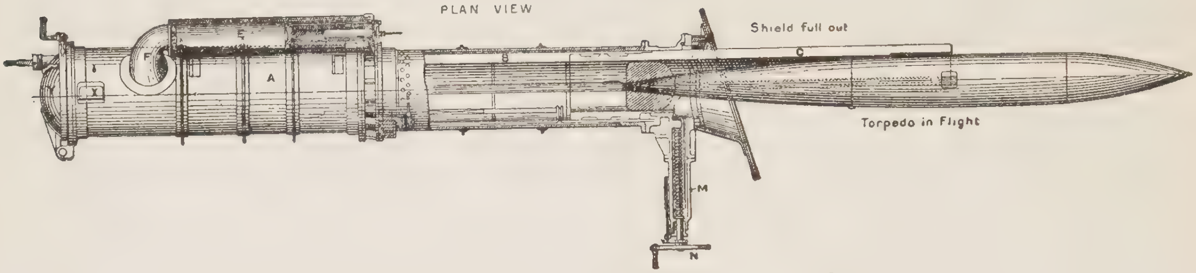


FIG. 3.—Broadside Submerged 18-in. Torpedo Tube.

Submerged Discharge.—The risk attached to having loaded torpedoes above the water-line—independently of the fact that to get the best result they should start in the element to which they belong—has given great impetus to the system of submerged discharge. From the earliest days of the weapon this has been employed to some extent. But it was principally in the direction of right-ahead fire, by having an orifice in the stem of the ship under water, to which a torpedo tube was connected. The tactical idea was thus to supplement attack with the ram, so that if the vessel endeavouring to ram saw that the object would evade this attack, she could project a torpedo ahead, which, travelling faster than the vessel, might as effectually accomplish the required service. The stem orifice had a water-tight cover, which was removed on the torpedo being placed in the tube and the inner door closed; then, sufficient impulse being imparted to eject the torpedo, and its machinery being set in motion at the same time, it darted forward towards the enemy. There is, however, some risk of the ship using a torpedo in this manner striking it before the missile has gathered the necessary impetus from its propellers to take it clear of the vessel. The system, moreover, has the disadvantage of weakening the ram, the construction of which should be of immense strength. There is the further liability of ramming with a torpedo in the bow tube, which would be as disastrous to friend as foe. This method of submerged discharge has therefore given place to ejecting the torpedo from the broadside. Considerable difficulty attached to getting the torpedo clear of the ship from this position without injury, especially when the vessel was proceeding at speed. The natural tendency of the passing water acting on the head of the torpedo as it emerged was to give a violent wrench and crush the rear end before that portion could clear the aperture. To prevent this the torpedo must be held rigid in the line of projection until the tail is clear of the ship. This is thus effected. Besides the tube with the aperture in side of the ship under water, fitted with sluice-valve, all broadside submerged discharge apparatus possess the following features: A shield is pushed out from the ship's side. In this shield there are grooves of some form. Guides on the torpedoes fit and run in these grooves. When discharged the torpedo is thus supported against the streams of passing water, and guided so that its axis continues in the line of projection until the tail is clear of the side, the shield being of such length that this occurs at the same time that the guides on the torpedo leave the grooves in the shield. An apparatus on this principle has been fitted to a number of ships of the British navy, and gives good results at high rates of speed. It has the defect that the shield must be run out previous to the torpedo being discharged, and brought back afterwards, thus involving three separate operations, each performed by compressed air.

In the broadside submerged discharge, designed, constructed and supplied to many foreign navies by Messrs Armstrong of the Elswick works, the three operations are combined in one. There is an outer tube as before, but it contains an inner tube carrying the torpedo. Fized to this tube, and prolonging it, is the shield fitted with grooves. Both tubes have a door at the rear—made air-tight when closed—by which the torpedo is entered. A charge of cordite is used for ejection instead of compressed air, the gas from which entering the outer cylinder first forces the inner tube out, and then by means of a valve in the door of the inner tube passes in and blows out water and torpedo together, the shield supporting the latter until the tail is clear of the ship. By this time the cordite gas has expanded and cooled so as to relieve the pressure in rear; this causes the pressure of the water outside to push the shield and tube into the ship again, so that practically the whole operation is one motion.

Fig. 3 will further explain this apparatus. *A* is the outer tube; *B* the inner tube; *C* the shield; *D* torpedo; *E* explosion chamber for cordite charge placed at *K*; *F* pipe for gas to pass into outer tube; *G* and *Y* doors of inner and outer tube; *J* the valve which opens automatically when inner tube arrives at position shown in fig. 2; *T* and *P* appliance for running the tube in and out by hand when desired; *O* arrangement for bringing whole apparatus back for repair, &c.; *M* and *N* sluice-valve and handle; R, r^1, r^2, r^3, for draining tubes before torpedo is put in; *X* indicator showing position of inner tube.

Torpedoes have been discharged from this apparatus with successful result from a ship steaming at 17½ knots.

The advantage of cordite over compressed air for impulse is that it requires no attention: when a charge is placed in the explosion chamber, and a torpedo is in the tube, all is in readiness for firing when desired, without further attention in the torpedo-room. The cordite is fired by electricity from the conning-tower; the officer, therefore, having ascertained that all is ready below, has only to press a button when the object is in the required position. Automatic indications are given in the conning-tower when the sluice-valve is opened and when all is in readiness for firing.

This method of discharging torpedoes from the broadside under water eliminates the principal danger of the system, which required the shield to be put into position beforehand. It was then liable to be struck and distorted by passing wreckage without the fact being apparent to those in the ship. On the discharge of a torpedo its course might thus be arrested, or possibly the charge be prematurely exploded in dangerous proximity to its own ship. There was a risk of getting the shield out too soon, and thereby exposing it unduly to injury, or leaving the operation until too late. The tendency of naval equipment being towards complication, any readjustment which makes for simplicity cannot be otherwise than beneficial, and this feature is especially desirable in all matters connected with the use of torpedoes.

The compartment containing the broadside submerged apparatus usually extends across the ship, so as to contain a tube for each side.

Use in War.—This has been mainly confined to attacks upon squadrons and single ships by torpedo craft of various types. At the battle of Yalu, between the Chinese and Japanese fleets, torpedoes were discharged by the former, but none took effect. The Japanese trusted solely to gun-fire. After the defeat of the Chinese at sea, their remaining ships took refuge in the harbour of Wei-hai-Wei. Here they were blockaded by the Japanese fleet, which, having a number of torpedo-boats, made several determined attacks upon the ships inside. After one or two attempts, foiled by the obstructions placed by the Chinese to bar the passage, the Japanese boats succeeded in torpedoing several ships, and thus expedited the reduction of the place. In the war between Spain and the United States the inferiority of Admiral Cervera's squadron to that under Admiral Sampson might at the battle of Santiago have been to some extent counterbalanced by a skilful and vigorous use of torpedoes. If, instead of striving only to escape, a bold dash had been made for the American ships, the Spanish cruisers rapidly approaching end on to the foe, enveloped in the smoke of their own guns, should—some at least—have got within torpedo range without fatal injury. Closing each other at a speed of 10 knots only they would cover an interval of 6000 yds. in 9 minutes—a short time in which to disable a ship by gun-fire under such conditions. But Cervera elected to offer a passive resistance only, and while suffering destruction wrought no material injury upon his opponents. On the other hand, there have been several instances of large warships being sunk by locomotive torpedoes discharged from small craft. During the Chilean revolutionary war of 1891, a battleship, the "Blanco Encalada," of 3500 tons, was attacked in Caldera Bay by two torpedo vessels—the "Lynch" and "Condell"—of 750 tons. They entered the bay at dawn, the "Condell" leading. This vessel fired three torpedoes which missed the ironclad; then the "Lynch," after one ineffective shot, discharged a second torpedo, which struck the "Blanco" on the side nearly amidships. The latter had opened fire with little result, and sank soon afterwards. A similar incident occurred in 1894, when the Brazilian ironclad "Aquidaban" was sunk in Catherina Bay by the "Sampaio"—a torpedo vessel of 500 tons. She entered the bay at night, and first discharged her bow torpedo at the ironclad, which missed; she then fired a broadside torpedo, which struck and exploded against the bow of the "Aquidaban." It caused a great shock on board, throwing an officer on the bridge into the water. The vessel sank soon afterwards, and the "Sampaio" escaped uninjured.

In the war (1904–5) between Russia and Japan the Whitehead torpedo did not exercise an important influence upon the naval operations. It scored a success at the beginning of the struggle when a Japanese torpedo-flotilla made an attack upon the Russian fleet lying at anchor outside Port Arthur. For some unaccountable reason, though war was imminent, little or no precautions seemed to have been taken for effectually guarding the vessels. They had no nets in position nor boats patrolling outside them. Thus taken by surprise when the Japanese torpedo-boats suddenly appeared about midnight on the 8th of February 1904, several Russian ships were struck by torpedoes before they could offer any resistance. The most damaged were the "Retvisan" and "Tsarevitch" (battleships) and "Pallada" (cruiser), but all managed to get into Port Arthur and were eventually repaired. With three ships *hors de combat* the Russian fleet was considerably weakened at an early stage. The loss of the "Petropavlovsk" in April from a mine explosion was a further discouragement, especially as with this ship went down the gallant and energetic Admiral Makarov. In these circumstances the Russian fleet could not assume the offensive nor prevent the Japanese troops being sent by sea to invest Port Arthur. In June when the injured vessels were fit for service again the fleet put to sea but returned the same evening. The incident is noteworthy only because it led to an attack by the Japanese torpedo craft on the retiring squadron after sunset. As illustrating the uncertainty of hitting a moving object at sea with the Whitehead torpedo, already mentioned, no vessels were struck on this occasion and they reached the anchorage uninjured. In the battle of Tsushima the Japanese torpedo-boats attacked the Russian fleet after its disablement by gun-fire and gave the *coup de grâce* to some of the ships, which had little power of resistance owing to the destruction of their light armament. This war, therefore, did not increase to any extent our knowledge of the actual capability of this weapon.

Effect upon Naval Tactics: Blockade.—It has often been assumed that steam and the torpedo will in future render blockade impossible as it was carried out in the old wars; that, no longer dependent upon the wind to allow egress from the blockaded port, a vessel using steam can emerge when she chooses, while the fear of torpedo attack will deter a blockading squadron from keeping such watch as to foil the attempt. As regards the power conferred by steam, it will be no less advantageous to a blockading squadron, enabling it to maintain its position, whereas sailing ships were often driven by gales to leave their station and seek a port. This gave opportunities for the blockaded vessels to escape. As regards torpedo-boats, they would no doubt be a danger to a blockading squadron unprovided with a means of defence against these craft. Such defence consists in an adequate number of small vessels interposing an in-shore squadron between the port and the main body outside. Thus they perform the twofold service of watching the enemy's movements within and frustrating a torpedo attack. As an instance of blockade under modern conditions, we have that of Admiral Sampson upon Santiago—a guard more rigidly maintained than any in the old wars. So little was he deterred by the knowledge that Admiral Cervera had two torpedo vessels in his force, that he drew his squadron closer in at night when an attack might be expected, actually illuminating the entrance of the harbour with his electric searchlights, so that no craft could come out unperceived. No attempt was made to dislodge him from that position, and we may assume that blockade, if required in any scheme of naval strategy, will be carried out, whatever the weapons of warfare.

As regards the effect of torpedoes upon tactics at sea, and in general, as well as single ship, actions, they must operate against close range and employment of the ram. If it is recognized that a vessel within 1000 yds. is liable to a fatal blow, she will endeavour in ordinary circumstances to keep outside that distance and rely upon gun-fire. The exception would be where she is overmatched in that respect, and hence might endeavour to restore the balance by the use of torpedoes. In a fleet action the danger of missing a foe and hitting a friend would restrict the discharge of torpedoes; and this risk increases as formations disappear. But the torpedo must be conceded a tactical superiority over the ram for the following reasons: A vessel to use the latter must come within torpedo range, while her adversary may successfully apply torpedoes without placing herself in any danger of being rammed. The ram can only be used in one direction, and a small miscalculation may cause disaster. If a vessel has more than one position from which torpedoes can be discharged, she is not confined as regards attack to a single bearing or direction.

In action we may consider the speed of the torpedo as double that of the ship, and since against a moving object allowance must be made for the space traversed while ram or torpedo is travelling towards it, the faster weapon is less affected in its chance of successful impact by change of direction and speed of the object at the last moment. Lastly, with machinery disabled a ship is powerless to use the ram, but can avert a ram attack with her torpedoes. The movements of squadrons or single ships on entering an action are not likely to be influenced by any contemplated immediate use of torpedoes, for the gun must remain the primary weapon, at any rate at the first onset. Commanders would hardly risk being crushed by gun-fire before getting within torpedo range. Having faith in the efficiency of their ordnance and the gunnery skill of their crew, they would first manœuvre to bring these into play. Tactics for torpedo attack in such circumstances have not therefore been laid down, and it is only necessary to consider the positions which are advantageous for the use of this weapon, and, conversely, what should be avoided when a vessel, finding herself overmatched in gunnery, seeks to redress the balance with torpedoes.

Size of Target.—This, with a ship, varies in length as the torpedo approaches end on to the vessel, or at angle to the line of keel; the greatest being when the path of both forms a right angle. Hence the object is to place your ship where it presents the former condition to the enemy, while he affords the larger target. It must be remembered that, owing to the comparatively slow velocity of the torpedo, it must be aimed not directly at a ship in motion—like a shot from a gun—but at a point ahead which the ship will reach after the torpedo has traversed the intervening distance. Thus speed of object has to be estimated, and hence the importance of adding to the velocity of the torpedo and getting a broadside shot so as to reduce as much as possible errors of calculation. The great increase of the dimensions of warships, especially in length, which now has reached 500 ft., adds to the chances of a successful hit with torpedoes, and will doubtless tend to diminish a desire in future naval tactics to close inside torpedo range for the purpose of ramming.

Range.—Though the effective range of a torpedo discharged from a ship or torpedo vessel against a single object moving at high speed may be considered as approximately within 1000 yds. this limit of distance is considerably augmented where the target consists of several vessels at sea in close order, or is that afforded by a fleet at anchor. In the first case it may be worth while to discharge torpedoes from a distance of two or three thousand yards at the centre of the line for the chance of hitting one of the vessels composing it. As regards a mass of ships at anchor, unless protected by an impenetrable guard such as a breakwater or some invulnerable defence carried by the ships themselves, the increased range and accuracy of the torpedo imparted by recent developments would give it a chance of success if discharged against such a target at even greater distance.

Finally, by improvements in construction and methods of discharge the torpedo has recovered the place it was rapidly losing a few years ago. As armour receives increased resisting power to above-water projectiles, and gets on a level again with the gun, more attention will be given to under-water attack, against which no adequate protection has yet been devised. Thus we shall probably find the torpedo taking a very prominent place in any future war between the great maritime powers. (S. M E.-W.)

TORQUAY, a municipal borough, seaport and watering place, in the Torquay parliamentary division of Devonshire, England, on Tor Bay of the English Channel, 26 m. S. of Exeter, by the Great Western railway. Pop. (1901), 33,625. Owing to the beauty of its site and the equability of its climate, and to its being screened by lofty hills on the north, east and west, and open to the sea-breezes of the south, it has a high reputation as a winter residence. The temperature seldom rises as high as 70° F. in summer or falls below freezing-point in winter. To the north lies the populous suburb of St Mary Church. There are some remains of Tor or Torre Abbey, founded for Praemonstratensians by William, Lord Brewer, in 1196. They stand north of the modern mansion, but, with the exception of a beautiful pointed arch portal, are of small importance. On the south of the gateway is a 13th-century building, known as the Spanish barn. On Chapel Hill are the remains of a chapel of the 12th century, dedicated to St Michael, and supposed to have formerly belonged to the abbey. St Saviour's parish church of Tor-Mohun, or Tormoham, an ancient stone structure, was restored in 1874. The old church at St Mary Church, north of Torquay, was rebuilt in Early Decorated style; and in 1871 a tower was erected as a memorial to Dr Phillpotts, bishop of Exeter, who with his wife is buried in the churchyard. St John's Church, by G. E. Street, is a fine example of modern Gothic. Among the principal buildings and institutions are the town-hall, museum of the natural history society, theatre and opera-house (1880), market, schools of art and science, the Torbay infirmary and dispensary, the Western hospital for consumption, Crypt House institution for invalid ladies and the Mildmay home for incurable consumptives. The control of the harbour, piers, pleasure grounds, &c., was acquired from the lord of the manor by the local board in 1886. The harbour has a depth of over 20 ft. at low water. The principal imports are coal, timber and slates, and the principal export stone of the Transition limestone or Devonshire marble. In the town are a number of marble-polishing works. Terra-cotta ware of fine quality is also manufactured from a deposit of clay at Watcombe and at Hele. The town is governed by a mayor, 9 aldermen and 27 councillors. Area, 3588 acres.

There was a village at Torre even before the foundation of the abbey, and in the neighbourhood of Torre evidence has been found of Roman occupation. The manor was granted by William the Conqueror to Richard de Bruvere or de Brewere, and was subsequently known as Tor Brewer. After the defeat of the Spanish Armada, Don Pedro's galley was brought into Torbay; and William, prince of Orange, landed at Torbay on the 5th of November 1688. Until the middle of the 19th century it was an insignificant fishing village. It was incorporated in 1892.

TORQUE, or Torc (Lat. *torquis*, *torques*, a twisted collar, *torquere*, to twist), the term given by archaeologists to the twisted collars or armlets of gold or other metal worn particularly by the ancient Gauls and other allied Celtic races. The typical torque is a circlet with twisted rope-like strands, the ends not joined together; the torque was usually worn with the opening in the front as seen in a figure of a Gaul in a sculptured sarcophagus in the Capitoline Museum at Rome. In mechanics, the term "torque" is used of the turning-moment of a system-force, as in a series dynamo.

TORQUEMADA, JUAN DE (1388–1468), or rather Johannes de Turrecremata, Spanish ecclesiastic, was born at Valladolid, in 1388, and was educated in that city. At an early age he joined the Dominican order, and soon distinguished himself for learning and devotion. In 1415 he accompanied the general of his order to the Council of Constance, whence he proceeded to Paris for study, and took his doctor's degree in 1423. After teaching for some time in Paris he became prior of the Dominican house first in Valladolid and then in Toledo. In 1431 Pope Eugenius IV. called him to Rome and made him "magister sancti palatii." At the Council of Basel he was one of the ablest supporters of the view of the Roman curia, and he was rewarded with a cardinal's hat in 1439. He died at Rome on the 26th of September 1468.

His principal works are *In Gratiani Decretum commentarii* (4 vols., Venice, 1578); *Expositio brevis et utilis super toto psalterio* (Mainz, 1474); *Quaestiones spirituales super evangelia totius anni* (Brixen, 1498); *Summa ecclesiastica* (Salamanca, 1550). The last-named work has the following topics: (1) De universa ecclesia; (2) De Ecclesia romana et pontificis primatu; (3) De universalibus conciliis; (4) De schismaticis et haereticis. His *De conceptione deiparae Mariae, libri viii.* (Rome, 1547), was edited with preface and notes by E. B. Pusey (London, 1869 seq.).

TORQUEMADA, THOMAS (1420–1498), inquisitor-general of Spain, son of Don Pedro Ferdinando, lord of Torquemada, a small town in Old Castile, was born in 1420 at Valladolid during the reign of John II. Being nephew to the well-known cardinal of the same name, he early displayed an attraction for the Dominican order; and, as soon as allowed, he joined the Friars Preachers in their convent at Valladolid. His biographers state that he showed himself from the beginning very earnest in austere life and humility; and he became a recognized example of the virtues of a Dominican. Valladolid was then the capital, and in due course eminent dignities were offered to him, but he gave signs of a determination to lead the simple life of a Friar Preacher, In the convent, his modesty was so great that he refused to accept the doctor's degree in theology, which is the highest prized honour in the order. His superiors, however, obliged him to take the priorship of the convent of Santa Cruz in Segovia, where he ruled for twenty-two years. The royal family, especially the queen and the infanta Isabella, often stayed at Segovia, and Torquemada became confessor to the infanta, who was then very young. He trained her to look on her future sovereignty as an engagement to make religion respected. Esprit Flechier, bishop of Nîmes, in this *Histoire du cardinal Jimenes* (Paris, 1693), says that Torquemada made her promise that when she became queen she would make it her principal business to chastise and destroy heretics. He then began to teach her the political advantages of religion and to prepare the way for that tremendous engine in the hands of the state, the Inquisition.

Isabella succeeded to the throne (1474) on the death of Henry IV. Torquemada had always been strong in his advice that she should marry Ferdinand of Aragon and thus consolidate the kingdoms of Spain. Hitherto he had rarely appeared at court; but now the queen entrusted him not only with the care of her conscience, but also with the benefices in the royal patronage. He also helped her in quieting Ferdinand, who was chafing under the privileges of the Castilian grandees, and succeeded so well that the king also took him as confessor. Refusing the rich see of Seville and many other preferments he accepted that of councillor of state. For a long time he had pondered over the confusion in which Spain was, which he attributed to the intimate relations allowed between Christians and infidels for the sake of commerce. He saw Jews, Saracens, heretics and apostates roaming through Spain unmolested; and in this lax toleration of religious differences he thought he saw the main obstacle to the political union of the Spains, which was the necessity of the hour. He represented to Ferdinand and Isabella that it was essential to their safety to reorganize the Inquisition, which had since the 13th century (1236) been established in Spain. The bishops, who were *ex officio* inquisitors in their own dioceses, had not succeeded in putting a stop to the evils, nor had the friars, by whom they had been practically superseded. By the middle of the 15th century there was hardly an active inquisitor left in the kingdom. In 1473 Torquemada and Gonzalez de Mendoza, archbishop of Toledo, approached the sovereigns. Isabella had been for many years prepared, and she and Ferdinand, now that the proposal for this new tribunal came before them, saw in it a means of overcoming the independence of the nobility and clergy by which the royal power had been obstructed. With the royal sanction a petition was addressed to Sixtus IV. for the establishment of this new form of Inquisition; and as the result of a long intrigue, in 1479 a papal bull authorized the appointment by the Spanish sovereigns of two inquisitors at Seville, under whom the Dominican inquisitions already established elsewhere might serve. In the persecuting activity that ensued the Dominicans, "the Dogs of the Lord" (*Domini canes*), took the lead. Commissaries of the Holy Office were sent into different provinces, and ministers of the faith were established in the various cities to take cognisance of the crimes of heresy, apostasy, sorcery, sodomy and polygamy, these three last being considered to be implicit heresy. The royal Inquisition thus started was subversive of the regular tribunals of the bishops, who much resented the innovation, which, however, had the power of the state at its back,

In 1481, three years after the Sixtine commission, a tribunal was inaugurated at Seville, where freedom of speech and licence of manner were rife. The inquisitors at once began to detect errors. In order not to confound the innocent with the guilty, Torquemada published a declaration offering grace and pardon to all who presented themselves before the tribunal and avowed their fault. Some fled the country, but many (Mariana says 17,000) offered themselves for reconciliation. The first seat of the Holy Office was in the convent of San Pablo, where the friars, however, resented the orders, on the pretext that they were not delegates of the inquisitor-general. Soon the gloomy fortress of Triana, on the opposite bank of the Guadalquivir, was prepared as the palace of the Holy Office; and the terror-stricken Sevillianos read with dismay over the portals the motto of the Inquisition: "Exsurge, Domine, Judica causam tuam, Capite nobis vulpes." Other tribunals, like that of Seville and under *La Suprema*, were speedily established in Cordova, Jaen and Toledo. The sovereigns saw that wealth was beginning to flow in to the new tribunals by means of fines and confiscations; and they obliged Torquemada to take as assessors five persons who would represent them in all matters affecting the royal prerogatives. These assessors were allowed a definite vote in temporal matters but not in spiritual, and the final decision was reserved to Torquemada himself, who in 1483 was appointed the sole inquisitor-general over all the Spanish possessions. In the next year he ceded to Diego Deza, a Dominican, his office of confessor to the sovereigns, and gave himself up to the congenial work of reducing heretics. A general assembly of his inquisitors was convoked at Seville for the 29th of November 1484; and there he promulgated a code of twenty-eight articles for the guidance of the ministers of the faith. Among these rules are the following, which will give some idea of the procedure. Heretics were allowed thirty days to declare themselves. Those who availed themselves of this grace were only fined, and their goods escaped confiscation. Absolution *in foro externo* was forbidden to be given secretly to those who made voluntary confession; they had to submit to the ignominy of the public *auto-de-fé*. The result of this harsh law was that numerous applications were made to Rome for secret absolution; and thus much money escaped the Inquisition in Spain. Those who were reconciled were deprived of all honourable employment, and were forbidden to use gold, silver, jewelry, silk or fine wool. Against this law, too, many petitions went to Rome for rehabilitation, until in 1498 the Spanish pope Alexander VI. granted leave to Torquemada to rehabilitate the condemned, and withdrew practically all concessions hitherto made and paid for at Rome. Fines were imposed by way of penance on those confessing willingly. If a heretic in the Inquisition asked for absolution, he could receive it, but subject to a life imprisonment; but if his repentance were but feigned he could be at once condemned and handed over to the civil power for execution. Should the accused, after the testimony against him had been made public, continue to deny the charge, he was to be condemned as impenitent. When serious proof existed against one who denied his crime, he could be submitted to the question by torture; and if under torture he avowed his fault and confirmed his guilt by subsequent confession he was punished as one convicted; but should he retract he was again to be submitted to the tortures or condemned to extraordinary punishment. This second questioning was afterwards forbidden; but the prohibition was got over by merely suspending and then renewing the sessions for questioning. It was forbidden to communicate to the accused the entire copy of the declaration of the witnesses. The dead even were not free from the Holy Office; but processes could be instituted against them and their remains subjected to punishment. But along with these cruel and unjust measures there must be put down to Torquemada's credit some advanced ideas as to prison life. The cells of the Inquisition were, as a rule, large, airy, clean and with good windows admitting the sun. They were, in those respects, far superior to the civil prisons of that day. The use of irons was in Torquemada's time not allowed in the Holy Office; the use of torture was in accordance with the practice of the other royal tribunals; and when these gave it up the Holy Office did so also.

Such were some of the methods that Torquemada introduced into the Spanish Inquisition, which was to have so baneful an effect upon the whole country. During the eighteen years that he was inquisitor-general it is said that he burnt 10,220 persons, condemned 6860 others to be burnt in effigy, and reconciled 97,321, thus making an average of some 6000 convictions a year. These figures are given by Llorente, who was secretary of the Holy Office from 1790 to 1792 and had access to the archives; but modern research reduces the list of those burnt by Torquemada to 2000, in itself an awful holocaust to the principle of intolerance. The constant stream of petitions to Rome opened the eyes of the pope to the effects of Torquemada's severity. On three separate occasions he had to send Fray Alfonso Badaja to defend his acts before the Holy See. The sovereigns, too, saw the stream of money, which they had hoped for, diverted to the coffers of the Holy Office, and in 1493 they made complaint to the pope; but Torquemada was powerful enough to secure most of the money for the expenses of the Inquisition. But in 1496, when the sovereigns again complained that the inquisitors were, without royal knowledge or consent, disposing of the property of the condemned and thus depriving the public revenues of considerable sums, Alexander VI. appointed Jimenes to examine into the case and make the Holy Office disgorge the plunder.

For many years Torquemada had been persuading the sovereigns to make an attempt once for all to rid the country of the hated Moors. Mariana holds that the founding of the Inquisition, by giving a new impetus to the idea of a united kingdom, made the country more capable of carrying to a satisfactory ending the traditional wars against the Moors. The taking of Zahaia in 1481 by the enemy gave occasion to reprisals. Troops were summoned to Seville and the war began by the siege of Alhama, a town eight leagues from Granada, the Moorish capital. Torquemada went with the sovereigns to Cordova, to Madrid or wherever the states-general were held, to urge on the war; and he obtained from the Holy See the same spiritual favours that had been enjoyed by the Crusaders. But he did not forget his favourite work of ferreting out heretics; and his ministers of the faith made great progress over all the kingdom, especially at Toledo, where merciless severity was shown to the Jews who had lapsed from Christianity. The Inquisition, although as a body the clergy did not mislike it, sometimes met with furious opposition from the nobles and common people. At Valentia and Lerida there were serious conflicts. At Saragossa Peter Arbuè, a canon and an ardent inquisitor, was slain in 1485 whilst praying in a church; and the threats against the hated Torquemada made him go in fear of his life, and he never went abroad without an escort of forty familiars of the Holy Office on horseback and two hundred more on foot. In 1487 he went with Ferdinand to Malaga and thence to Valladolid, where in the October of 1488 he held another general congregation of the Inquisition and promulgated new laws based on the experience already gained. He then hurried back to Andalusia where he joined the sovereigns, who were now besieging Granada, which he entered with the conquering army in January 1492 and built there a convent of his order.

The Moors being vanquished, now came the turn of the Jews. In 1490 had happened the case of El Santo niño de la Guardia—a child supposed to have been killed by the Jews. His existence had never been proved; and in the district of Guardia no child was reported as missing. The whole story was most probably the creation of imaginations stimulated by torture and despair, unless it was a deliberate fiction set forth for the purpose of provoking hostility against the Jews. For a long time Torquemada had tried to get the royal consent to a general expulsion; but the sovereigns hesitated, and, as the victims were the backbone of the commerce of the country, proposed a ransom of 300,000 ducats instead. The indignant friar would hear of no compromise: "Judas," he cried, "sold Christ for 30 pence; and your highnesses wish to sell Him again for 300,000 ducats." Unable to bear up against the Dominican's fiery denunciations, the sovereigns, three months after the fall of Granada, issued a decree ordering every Jew either to embrace Christianity or to leave the country, four months being given to make up their minds; and those who refused to become Christians to order had leave to sell their property and carry off their effects. But this was not enough for the inquisitor-general, who in the following month (April) issued orders to forbid Christians, under severe penalties, having any communication with the Jews or, after the period of grace, to supply them even with the necessaries of life. The former prohibition made it impossible for the unfortunate people to sell their goods which hence fell to the Inquisition. The numbers of Jewish families driven out of the country by Torquemada is variously stated from Mariana's 1,700,000 to the more probable 800,000 of later historians. The loss to Spain was enormous, and from this act of the Dominican the commercial decay of Spain dates.

Age was now creeping on Torquemada, who, however, never would allow his misdirected zeal to rest. At another general assembly, his fourth, he gave new and more stringent rules, which are found in the *Compilación de las instrucciones del officio de la Santa Inquisición*. He took up his residence in Avila, where he had built a convent; and here he resumed the common life of a friar, leaving his cell in October 1497 to visit, at Salamanca, the dying infante, Don Juan, and to comfort the sovereigns in their parental distress. They often used to visit him at Avila, where in 1498, still in office as inquisitor-general, he held his last general assembly to complete his life's work. Soon afterwards he died, on the 16th of September 1498, "full of years and merit" says his biographer. He was buried in the chapel of the convent of St Thomas in Avila.

The name of Torquemada stands for all that is intolerant and narrow, despotic and cruel. He was no real statesman or minister of the Gospel, but a blind fanatic, who failed to see that faith, which is the gift of God, cannot be imposed on any conscience by force. (E. Tn.)

TORRE ANNUNZIATA, a seaport of Campania, Italy, in the province of Naples, on the east of the Bay of Naples, and at the south foot of Mt Vesuvius, 14 m. S.E. of Naples by rail. Pop. (1901), 25,070 (town); 28,084 (commune). It is on the main line to Battipaglia, at the point of junction of a branch line from Cancello round the east of Vesuvius, and of the branch to Castellammare di Stabia and Gragnano. It has a royal arms factory established by Charles IV., and other ironworks, considerable manufacture of macaroni, paper, breeding of silkworms, and some fishing and shipping. The harbour is protected by moles. Remains attributed to the Roman post-station of Oplontis were discovered in making the railway between Torre del Greco and Torre Annunziata, a little west of the latter, in 1842.

TORRE DEL GRECO, a seaport of Campania, Italy, in the province of Naples, 7½ m. S.E. of that city by rail. Pop. (1901), 35,328. It lies at the south-west foot of Vesuvius, on the shore of the Bay of Naples. It is built chiefly of lava, and stands on the lava stream of 1631, which destroyed two-thirds of the older town. Great damage was done by the eruptions of 1737 and 1794; the earthquake of 1857 and the eruption of the 8th of December 1861 were even more destructive. After each disaster the people returned, the advantage of the rich volcanic land overcoming apprehensions of danger. In the outskirts are many beautiful villas and gardens. The town has shipbuilding yards and lava quarries. The inhabitants take part in the coral and sponge fishing off the African and Sicilian coasts, and coral is worked in the town. There is also fishing for tunny, sardines and oysters; hemp is woven, and the neighbourhood is famed for its fruit and wine. In June the great popular festival "Dei Quattro Altari" is annually celebrated here in commemoration of the abolition of the feudal dominion in 1700. Remains of ancient villas and baths have been found here.

TORRENS, ROBERT (1780–1864), English soldier and economist, was born in Ireland in 1780. He entered the Marines in 1797, became a captain in 1806, and major in 1811 for bravery in Anhalt during the Walcheren expedition. He fought in the Peninsula, becoming lieutenant-colonel in 1835 and retiring as colonel in 1837. After abortive attempts to enter parliament in 1818 and 1826, he was returned in 1831 as member for Ashburton. He was a prolific writer, principally on financial and commercial policy. Almost the whole of the programme which was carried out in legislation by Sir Robert Peel had been laid down in his economic writings. He was an early and earnest advocate of the repeal of the corn laws, but was not in favour of a general system of absolute free trade, maintaining that it is expedient to impose retaliatory duties to countervail similar duties imposed by foreign countries, and a lowering of import duties on the productions of countries retaining their hostile tariffs would occasion a decline in prices, profits and wages.

His principal writings of a general character were: *The Economist* [*i.e.* Physiocrat] *refuted* (1808); *Essay on the Production of Wealth* (1821); *Essay on the External Corn-trade* (eulogized by Ricardo) (1827); *The Budget, a Series of Letters on Financial, Commercial and Colonial Policy* (1841–1843); *The Principles and Practical Operations of Sir Robert Peel's Act of 1844 Explained and Defended* (1847).

TORRENS, SIR ROBERT RICHARD (1814–1884), British colonial statesman, was born at Cork, Ireland, in 1814, and educated at Trinity College, Dublin. He went to South Australia in 1840, and was appointed collector of customs. He was an official member of the first legislative council and in 1852 was treasurer and registrar-general. When responsible government was established he was elected as a representative for Adelaide and became a member of the first ministry. In 1857 he introduced his famous Real Property Act, the principle of which consists of conveyance by registration and certificate instead of deeds. The system was rapidly adopted in the other colonies and elsewhere, and was expounded by the author during a visit to the United Kingdom in 1862–1864. After leaving South Australia, Sir R. R. Torrens represented Cambridge in the House of Commons from 1868 to 1874; in 1872 he was knighted. He was the author of works on the effect of the gold discoveries on the currency, and other subjects. He died on the 31st of August 1884.

TORRENS, WILLIAM TORRENS M'CULLAGH (1813–1894), English politician and social reformer, son of James M'Cullagh (whose wife's maiden name, Torrens, he assumed in 1863), was born near Dublin on the 13th of October 1813. He was called to the bar, and in 1835 became assistant commissioner on the special commission on Irish poor-relief, which resulted in the extension of the workhouse system in Ireland in 1838. In the 'forties he joined the Anti-Corn Law League, and in 1846 published his *Industrial History of Free Nations.* In 1847 he was elected to parliament for Dundalk, and sat till 1852. In 1857 he was elected as a Liberal for Yarmouth and from 1865 to 1885 he represented Finsbury. Torrens was a well known man in political life, and devoted himself mainly to social questions in parliament. It was an amendment of his to the Education Bill of 1870 which established the London School Board, and his Artisans' Dwellings Bill in 1868 facilitated the clearing away of slums by local authorities. He published several books, and his *Twenty Years in Parliament* (1893) and *History of Cabinets* (1894) contain useful material. He died in London on the 26th of April 1894.

TORRES NAHARRO, BARTOLOMÉ DE (1480–1530), Spanish dramatist, was born towards the end of the 15th century at Torres, near Badajoz. After some years of soldiering and of captivity in Algiers, Torres Naharro took orders, settled in Rome about 1511, and there devoted himself chiefly to writing plays. Though he alludes to the future pope, Clement VII. as his protector, he left Rome to enter the household of Fabrizio Colonna at Naples where his works were printed under the title of *Propaladia* (1517). He is conjectured to have returned to his native place, and to have died there shortly after 1529. His *Diálogo del nacimiento* is written in unavowed, though obvious, imitation of Encina, but in his subsequent plays he shows a much larger conception of dramatic possibilities. He classifies his pieces as *comedias á noticia* and *comedias á fantasía*; the former, of which the *Soldatesca* and *Tinellaria* are examples, present in dramatic form incidents within his personal experience; the latter, which include such plays as *Serafina, Himenea, Calamita* and *Aquilana*, present imaginary episodes with adroitness and persuasiveness. Torres Naharro is much less dexterous in stagecraft than many inferior successors, his humour is rude and boisterous and his diction is unequal; but to a varied knowledge of human nature he adds knowledge of dramatic effect, and his rapid dialogue, his fearless realism and vivacious fancy prepared the way for the romantic drama in Spain.

TORRES NOVAS, a town of Portugal, in the district of Santarem, 19 m. N.N.E. of Santarem on the Lisbon-Entroncamento railway. Pop. (1900), 10,746. It manufactures cottons, linens, jute, paper, leather and spirits. It was probably founded by Greeks, and was held by the Romans, Goths and Moors, from whom it was conquered in 1148 by Alphonso I. of Portugal.

TORRES VEDRAS, a town of Portugal, in the district of Lisbon, 43 m. N. by W. of Lisbon, on the Lisbon-Figueira da Foz railway. Pop. (1900), 6900. Torres Vedras is built on the left bank of the river Sizandro; it has a Moorish citadel and hot sulphur baths. Roman inscriptions and other remains have been found here, but the Latin name of the town, *Turres Veteres,* is probably medieval. Here were the noted fortifications known as the "lines of Torres Vedras," constructed by Wellington in 1810 (see PENINSULAR WAR). Here also in 1846 the troops of General Saldanha defeated those of the count de Bomfin and seized the castle and town (see PORTUGAL: *History*).

TORRES Y VILLAROEL, DIEGO DE (1696–1759?), Spanish miscellaneous writer, was born in 1696 at Salamanca, where his father was bookseller to the university. In his teens Torres escaped to Portugal where he enlisted under a false name; he next moved to Madrid, living from hand to mouth as a hawker; in 1717 he was ordained subdeacon, resumed his studies at Salamanca, and in 1726 became professor of mathematics at the university. A friend of his having stabbed a priest, Torres was suspected of complicity, and once more fled to Portugal, where he remained till his innocence was proved. He then returned to his chair, which he resigned in 1751 to act as steward to two noblemen; he was certainly alive in 1758, but the date of his death is not known. Torres had so slight a smattering of mathematics that his appointment as professor was thought scandalous even in his own scandalous age; yet he quickly acquired a store of knowledge which he displayed with serene assurance. His almanacs, his verses, his farces, his devotional and pseudo-scientific writings show that he possessed the alert adaptiveness of the born adventurer; but all that remains of his fourteen volumes (1745–1752) is his autobiography, an amusing record of cynical effrontery and successful imposture.

TORREVIEJA, a seaport of south-eastern Spain, in the province of Alicante, 3 m. S.W. of Cape Cervera, and at the terminus of a railway to Albatera on the Alicante-Murcia line. Pop. (1900), 7706. The district is famous for its salt beds, which are owned and worked by the state, the Laguna Grande alone yielding more than 100,000 tons a year. The other industries are chiefly fishing, shipbuilding and the manufacture of ropes and sails. The roadstead affords safe anchorage. There is an active trade in fruit and agricultural products.

TORREY, JOHN (1796–1873), American botanist, was born at New York on the 15th of August 1796. When he was 15 or 16 years of age his father received a prison appointment at Greenwich, and there he made the acquaintance of Amos Eaton (1776–1842), a pioneer of natural history studies in America. He thus learned the elements of botany, as well as something of mineralogy and chemistry. In 1815 he began the study of medicine, qualifying in 1818. In the following year he issued his *Catalogue of Plants growing spontaneously within Thirty Miles of the City of New York,* and in 1824 he issued the first and only volume of his *Flora of the Northern and Middle States.* In the same year he obtained the chair of chemistry and geology at West Point military academy, and three years later the professorship of chemistry and botany in the College of Physicians and Surgeons, New York. In 1836 he was appointed botanist to the state of New York and produced his *Flora* of that state in 1843; while from 1838 to 1843 he carried on the publication of the earlier portions of *Flora of North America,* with the assistance of his pupil, Asa Gray. From 1853 he was chief assayer to the United States assay office, but he continued to take an interest in botanical teaching until his death at New York on the 10th of March 1873. He made over his valuable herbarium and botanical library to Columbia College in 1860, and he was the first president of the Torrey Botanical Club in 1873. His name is commemorated in the small coniferous genus *Torreya,* found in North America and in China and Japan. *T. taxifolia,* a native of Florida, is known as the Torrey tree or savin, and also as the stinking cedar.

TORREY, REUBEN ARCHER (1856–), American evangelist, was born in Hoboken, New Jersey, on the 28th of January 1856. He graduated at Yale University in 1875 and at the Yale Divinity School in 1878. He became a Congregational minister in 1878, studied theology at Leipzig and Erlanger in 1882–1883, joined D. L. Moody in his evangelistic work in Chicago in 1889, and became pastor of the Chicago Avenue Church in 1894 and afterwards superintendent of the Moody Bible Institute of Chicago. In 1902–1903 he preached in nearly every part of the English-speaking world, and with Charles McCallon Alexander (b. 1867) conducted revival services in Great Britain in 1903–1905; Torrey conducted a similar campaign in American and Canadian cities in 1906–1907.

TORRICELLI, EVANGELISTA (1608–1647), Italian physicist and mathematician, was born at Faenza on the 15th of October 1608. Left fatherless at an early age, he was educated under the care of his uncle, a Camaldolese monk, who in 1627 sent him to Rome to study science under the Benedictine Benedetto Castelli (1577–1644), professor of mathematics at the Collegio di Sapienza. The perusal of Galileo's *Dialoghi delle nuove scienze* (1638) inspired him with many developments of the mechanical principles there set forth, which he embodied in a treatise *De motu* (printed amongst his *Opera geometrica,* 1644). Its communication by Castelli to Galileo in 1641, with a proposal that Torricelli should reside with him, led to Torricelli repairing to Florence, where he met Galileo, and acted as his amanuensis during the three remaining months of his life. After Galileo's death Torricelli was nominated grand-ducal mathematician and professor of mathematics in the Florentine academy. The discovery of the principle of the barometer (*q.v.*) which has perpetuated his fame ("Torricellian tube" "Torricellian vacuum") was made in 1643.

The publication amongst Torricelli's *Opera geometrica* (Florence, 1644) of a tract on the properties of the cycloid involved him in a controversy with G. P. de Roberval, who accused him of plagiarizing his earlier solution of the problem of its quadrature. There seems, however, no room for doubt that Torricelli's was arrived at independently. The matter was still in debate when he was seized with pleurisy, and died at Florence on the 25th of October 1647. He was buried in San Lorenzo, and a commemorative statue of him erected at Faenza in 1864.

Among the new truths detected by him was the valuable mechanical principle that if any number of bodies be so connected that, by their motion, their centre of gravity can neither ascend nor descend, then those bodies are in equilibrium. He also discovered the remarkable fact that the parabolas described (in a vacuum) by indefinitely numerous projectiles discharged from the same point with equal velocities, but in all directions have a paraboloid of revolution for their envelope. His theorem that a fluid issues from a small orifice with the same velocity (friction and atmospheric resistance being neglected) which it would have acquired in falling through the depth from its surface is of fundamental importance in hydraulics. He greatly improved both the telescope and microscope. Several large object lenses, engraven with his name, are preserved at Florence. He used and developed B. Cavalieri's method of indivisibles.

A selection from Torricelli's manuscripts was published by Tommaso Bonaventura in 1715, with the title *Lezioni accademiche* (Florence). They include an address of acknowledgment on his admission to the Accademia della Crusca. His essay on the inundations of the Val di Chiana was printed in *Raccolta d'autori che trattano del moto dell' acque*, iv. 115 (Florence, 1768), and amongst *Opusculi idraulici*, iii. 347 (Bologna, 1822). For his life see Fabroni, *Vitae Italorum*, i. 345; Ghinassi, *Lettere fin qui inedite di Evangelista Torricelli* (Faenza, 1864); Tiraboschi, *Storia della lett. it.* viii. 302 (ed. 1824); Montucla, *Hist. des math.*, vol. ii.; Marie, *Hist. des sciences*, iv. 133.

TORRIDONIAN, in geology, a series of pre-Cambrian arenaceous sediments extensively developed in the north-west highlands of Scotland and particularly in the neighbourhood of upper Loch Torridon, a circumstance which suggested the name Torridon Sandstone, first applied to these rocks by J. Nicol. The rocks are mainly red and chocolate sandstones, arkoses, flagstones and shales with coarse conglomerates locally at the base. Some of the materials of these rocks were derived from the underlying Lewisian gneiss, upon the uneven surface of which they rest; but the bulk of the material was obtained from rocks that are nowhere now exposed. Upon this ancient denuded land surface the Torridonian strata rest horizontally or with gentle inclination. Their outcrop extends in a belt of variable breadth from Cape Wrath to the Point of Sleet in Skye, running in a N.N.E.–S.S.W. direction through Ross-shire and Sutherlandshire. They form the isolated mountain peaks of Canisp, Quinag and Suilven in the neighbourhood of Loch Assynt, of Slioch near Loch Maree and other hills. They attain their maximum development in the Applecross, Gairloch and Torridon districts, form the greater part of Scalpay, and occur also in Rum, Raasay, Soay and the Crowlin Islands. The Torridonian rocks have been subdivided into three groups: an upper Aultbea group, 3000–5000 ft.; a middle or Applecross group, 6000–8000 ft.; and a lower or Diabeg group, 500 ft. in Gairloch but reaching a thickness of 7200 ft. in Skye.

See "The Geological Structure of the North-West Highlands of Scotland," *Mem. Geol. Survey* (Glasgow, 1907). (J. A. H.)

TORRIGIANO, PIETRO (1472–1522), Florentine sculptor, was, according to Vasari, one of the group of talented youths who studied art under the patronage of Lorenzo the Magnificent in Florence. Benvenuto Cellini, reporting a conversation with Torrigiano, relates that he and Michelangelo, while both young, were copying the frescoes in the Carmine chapel, when some slighting remark made by Michelangelo so enraged Torrigiano that he struck him on the nose, and thus caused that disfigurement which is so conspicuous in all the portraits of Michelangelo. Soon after this Torrigiano visited Rome, and helped Pinturicchio in modelling the elaborate stucco decorations in the Apartamenti Borgia for Alexander VI. After some time spent as a hired soldier in the service of different states, Torrigiano was invited to England to execute the magnificent tomb for Henry VII. and his queen, which still exists in the lady chapel of Westminster Abbey. This appears to have been begun before the death of Henry VII. in 1509, but was not finished till 1517. The two effigies are well modelled, and have lifelike but not too realistic portraits. After this Torrigiano received the commission for the altar, retable and baldacchino which stood at the west, outside the screen of Henry VII.'s tomb. The altar had marble pilasters at the angles, two of which still exist, and below the *mensa* was a life-sized figure of the dead Christ in painted terra-cotta. The retable consisted of a large relief of the Resurrection. The baldacchino was of marble, with enrichments of gilt bronze; part of its frieze still exists, as do also a large number of fragments of the terra-cotta angels which surmounted the baldacchino and parts of the large figure of Christ. The whole of this work was destroyed by the Puritans in the 17th century.[1] Henry VIII. also commissioned Torrigiano to make him a magnificent tomb, somewhat similar to that of Henry VII., but one-fourth larger, to be placed in a chapel at Windsor; it was, however, never completed, and its rich bronze was melted by the Commonwealth, together with that of Wolsey's tomb. The indentures for these various works still exist, and are printed by Neale, *Westminster Abbey*, i. 54–59 (London, 1818). These interesting documents are written in English, and in them the Florentine is called "Peter Torrysany." For Henry VII.'s tomb he contracted to receive £1500, for the altar and its fittings £1000, and £2000 for Henry VIII.'s tomb. Other works attributed from internal evidence to Torrigiano are the tomb of Margaret of Richmond, mother of Henry VII., in the south aisle of his chapel, and a terra-cotta effigy in the chapel of the Rolls.

While these royal works were going on Torrigiano visited Florence in order to get skilled assistants. He tried to induce Benvenuto Cellini to come to England to help him, but Cellini refused partly from his dislike to the brutal and swaggering manners of Torrigiano, and also because he did not wish to live among "such beasts as the English." The latter part of Torrigiano's life was spent in Spain, especially at Seville, where, besides the painted figure of St Hieronymus in the museum, some terra-cotta sculpture by him still exists. His violent temper got him into difficulties with the authorities, and he ended his life in 1522 in the prisons of the Inquisition.

See Wilhelm Bode, *Die italienische Plastik* (Berlin, 1902).

TORRINGTON, ARTHUR HERBERT, EARL OF (1647–1716), British admiral, was the son of a judge, Sir Edward Herbert (*c.* 1591–1657). He entered the navy in 1663, and served in the Dutch wars of the reign of Charles II., as well as against the Barbary pirates. From 1680 to 1683 he commanded in the Mediterranean. His career had been honourable, and he had been wounded in action. The known Royalist sentiments of his family combined with his reputation as a naval officer to point him out to the favour of the king, and James II. appointed him rear-admiral of England and master of the robes. The king no doubt counted on his support of the repeal of the Test Acts, as the admiral was member for Dover. Herbert refused, and was dismissed from his places. He now entered into communication with the agents of the prince of Orange, and promised to use his influence with the fleet to forward a revolution. After the acquittal of the seven bishops in 1688 he carried the invitation to William of Orange. The Revolution brought him ample amends for his losses. He was named first lord, and took the command of the fleet at home. In 1689 he was at sea attempting to prevent the French admiral Château-Renault (*q.v.*) from landing the troops sent by the king of France to the aid of King James in Ireland. Though he fought an action with the French in Bantry Bay on the 10th of May he failed to baffle Château-Renault, who had a stronger force. Being discontented with the amount of force provided at sea, he resigned his place at the admiralty, but retained his command at sea. In May 1689 he was created earl of Torrington. In 1690 he was in the Channel with a fleet of English and Dutch vessels, which did not rise above 56 in all, and found himself in front of the much more powerful French fleet. In his report to the council of regency he indicated his intention of retiring to the Thames, and losing sight of the enemy, saying that they would not do any harm to the coast while they knew his fleet to be "in being." The council, which knew that the Jacobites were preparing for a rising, and only waited for the support of a body of French troops, ordered him not to lose sight of the enemy, but rather than do that to give battle "upon any advantage of the wind." On the 10th of July Torrington, after consulting with his Dutch colleagues, made a half-hearted attack on the French off Beachy Head in which his own ship was kept out of fire, and severe loss fell on his allies. Then he retired to the Thames. The French pursuit was fortunately feeble (see TOURVILLE, COMTE DE) and the loss of the allies was comparatively slight. The indignation of the country was at first great, and Torrington was brought to a court martial in December. He was acquitted, but never again employed. Although twice married, he was childless when he died on the 14th of April 1716, his earldom becoming extinct. The unfavourable account of his moral character given by Dartmouth to Pepys is confirmed by Bishop Burnet, who had seen much of him during his exile in Holland. An attempt has been made in recent years to rehabilitate the character of Torrington, and his phrase "a fleet in being" has been widely used (see *Naval Warfare*, by Vice-Admiral P. H. Colomb).

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[1] An old drawing still exists showing this elaborate work; it is engraved in the *Hierurgia anglicana*, p. 267 (London, 1848). Many hundreds of fragments of this terra-cotta sculpture were found a few years ago hidden under the floor of the triforium in the abbey; they are unfortunately too much broken and imperfect to be fitted together.

See Charnock's *Biog. Nav.*, i. 258. The best account of the battle of Beachy Head is to be found in "The Account given by Sir John Ashby Vice-Admiral and Rear-Admiral Rooke, to the Lords Commissioners" (1691).

TORRINGTON, GEORGE BYNG, VISCOUNT (1663–1733), English admiral, was born at Wrotham, Kent. His father, John Byng, was compelled by pecuniary losses to sell his property and his son entered the navy as a king's letter boy (see NAVY) in 1678. He served in a ship stationed at Tangier, and for a time left the navy to enter one of the regiments of the garrison, but in 1683 he returned to the navy as lieutenant, and went to the East Indies in the following year. During the year 1688, he had an active share in bringing the fleet over to the prince of Orange, and by the success of the revolution his fortune was made. In 1702 he was appointed to the command of the "Nassau," and was at the taking and burning of the French fleet at Vigo, and the next year he was made rear-admiral of the red. In 1704 he served in the Mediterranean under Sir Cloudesley Shovel, and reduced Gibraltar. He was in the battle of Malaga, and for his gallantry received the honour of knighthood. In 1708 as admiral of the blue he commanded the squadron which baffled the attempt of the Old Pretender to land in Scotland. In 1718 he commanded the fleet which defeated the Spaniards off Cape Passaro and compelled them to withdraw from their invasion of Sicily. This commission he executed so well that the king made him a handsome present and sent him full powers to negotiate with the princes and states of Italy. Byng procured for the emperor's troops free access into the fortresses which still held out in Sicily, sailed afterwards to Malta, and brought out the Sicilian galleys and a ship belonging to the Turkey Company. By his advice and assistance the Germans retook the city of Messina in 1719, and destroyed the ships which lay in the basin—an achievement which completed the ruin of the naval power of Spain. To his conduct it was entirely owing that Sicily was subdued and the king of Spain forced to accept the terms prescribed him by the quadruple alliance. On his return to England in 1721 he was made rear-admiral of Great Britain, a member of the privy council, Baron Byng of Southill, in the county of Bedford and Viscount Torrington in Devonshire. He was also made one of the Knights Companions of the Bath upon the revival of that order in 1725. In 1727 George II. on his accession made him first lord of the admiralty, and his administration was distinguished by the establishment of the Royal Naval College at Portsmouth. He died on the 17th of January 1733, and was buried at Southill, in Bedfordshire. Two of his eleven sons, Pattee (1699–1747) and George (1701–1750), became respectively the 2nd and 3rd viscounts. The title is still held by the descendants of the latter.

See *Memoirs relating to Lord Torrington*, Camden Soc., new series 46, and *A True Account of the Expedition of the British Fleet to Sicily 1718–1720*, published anonymously, but known to be by Thomas Corbett of the admiralty in 1739. Forbin's *Memoirs* contain the French side of the expedition to Scotland in 1708.

TORRINGTON, a borough of Litchfield county, Connecticut, U.S.A., in the township of Torrington, on the Naugatuck river, about 25 m. W. of Hartford. Pop. (1900), 8360, of whom 2565 were foreign-born; (1910) 15,483; of the township, including the borough (1900) 12,453; (1910) 16,840. It is served by the New York, New Haven & Hartford railway and by an electric line connecting with Winsted. It has a public library (1865) with 15,000 volumes in 1909. There is a state armoury in the borough. Torrington is a prosperous manufacturing centre. In 1905 the value of the factory product was $9,674,124. The township of Torrington, originally a part of the township of Windsor, was first settled in 1734, and was separately incorporated in 1740. The site was covered by pine trees, which were much used for ship-building, and for this reason it was known as Mast Swamp. In 1751 a mill was erected, but there were few, if any, residences until 1800. In 1806 the settlement was known as New Orleans village. In 1813 members of the Wolcott family of Litchfield, impressed with the water-power, bought land and built a woollen mill, and the village that soon developed was called Wolcottville. Its growth was slow until 1864. In 1881 its name was changed to Torrington, and in 1887 the borough was incorporated.

See S. Orcutt's *History of Torrington* (Albany, 1878), and an article, "The Growth of Torrington," in the *Connecticut Magazine*, vol. ix., No. 1.

TORRINGTON (GREAT TORRINGTON), a market town and municipal borough in the South Molton parliamentary division of Devonshire, England, on the Torridge, 225 m. W. by S. of London by the London & South-Western railway. Pop. (1901), 3241. It stands on a hill overlooking the richly wooded valley of the Torridge, here crossed by three bridges. Glove manufactures on a large scale, with flour and butter making and leather dressing, are the staple industries. The town is governed by a mayor, 4 aldermen and 12 councillors. Area, 3592 acres.

Torrington (*Toritone*) was the site of very early settlement, and possessed a market in Saxon times. The manor was held by Brictric in the reign of Edward the Confessor, and in 1086 formed part of the Domesday fief of Odo Fitz Gamelin, which later constituted an honour with Torrington as its caput. In 1221 it appears as a mesne borough under William de Toritone, a descendant of Odo and the supposed founder of the castle, which in 1228 was ordered to be razed to the ground, but is said to have been rebuilt in 1340 by Richard de Merton. The borough had a fair in 1221, and returned two members to parliament from 1295 until exempted from representation at its own request in 1368. The government was vested in bailiffs and a commonalty, and no charter of incorporation was granted till that of Queen Mary in 1554, which instituted a governing body of a mayor, 7 aldermen and 18 chief burgesses, with authority to hold a court of record every three weeks on Monday; law-days and view of frankpledge at Michaelmas and Easter; a weekly market on Saturday, and fairs at the feasts of St Michael and St George. This charter was confirmed by Elizabeth in 1568 and by James I. in 1617. A charter from James II. in 1686 changed the style of the corporation to a mayor, 8 aldermen and 12 chief burgesses. In the 16th century Torrington was an important centre of the clothing trade, and in 1605 the town is described as very prosperous, with three fairs, and a great market "furnished from far on every quarter, being the most convenient place for occasions of king or county in those parts." The Saturday market is still maintained, but the fairs have been altered to the third Saturday in March and the first Thursday in May. In 1643 Colonel Digby took up his position at Torrington and put to flight a contingent of parliamentary troops; but in 1646 the town was besieged by Sir Thomas Fairfax and finally forced to surrender. The borough records were destroyed by fire in 1724.

See *Victoria County History: Devonshire*; F. T. Colby, *History of Great Torrington* (1878).

TORSTENSSON, LENNART, Count (1603–1651), Swedish soldier, son of Torsten Lennartsson, commandant of Elfsborg, was born at Forstena in Vestergötland. At the age of fifteen he became one of the pages of the young Gustavus Adolphus and served during the Prussian campaigns of 1628–29. In 1629 he was set over the Swedish artillery, which under his guidance materially contributed to the victories of Breitenfeld (1631) and Lech (1632). The same year he was taken prisoner at Alte Veste and shut up for nearly a year at Ingolstadt. Under Banér he rendered distinguished service at the battle of Wittstock (1636) and during the energetic defence of Pomerania in 1637–38, as well as at the battle of Chemnitz (1638) and in the raid into Bohemia in 1639. Illness compelled him to return to Sweden in 1641, when he was made a senator. The sudden death of Banér in May 1641 recalled Torstensson to Germany as generalissimo of the Swedish forces and governor-general of Pomerania. He was at the same time promoted to the rank of field marshal. The period of his command (1641–1645) forms one of the most brilliant chapters in the military history of Sweden. In 1642 he marched through Brandenburg and Silesia into Moravia, taking all the principal fortresses on his way. On returning through Saxony he well nigh annihilated the imperialist army at the second battle of Breitenfeld (Oct. 23, 1642). In 1643 he invaded Moravia for the second time, but was suddenly recalled to invade Denmark, when his rapid and unexpected intervention paralysed the Danish defence on the land side, though Torstensson's own position in Jutland was for a time precarious owing to the skilful handling of the Danish fleet by Christian IV. In 1644 he led his army for the third time into the heart of Germany and routed the imperialists at Jüterbog (Nov. 23). At the beginning of November 1645 he broke into Bohemia, and the brilliant victory of Jankow (Feb. 24, 1645) laid open before him the road to Vienna. Yet, though one end of the Danube bridge actually fell into his hands, his exhausted army was unable to penetrate any farther and, in December the same year, Torstensson, crippled by gout, was forced to resign his command and return to Sweden. In 1647 he was created a count. From 1648 to 1651 he ruled all the western provinces of Sweden, as governor-general. On his death at Stockholm (April 7, 1651) he was buried solemnly in the Riddarholmskyrka, the Pantheon of Sweden. Torstensson was remarkable for the extraordinary and incalculable rapidity of his movements, though very frequently he had to lead the army in a litter, as his bodily infirmities would not permit him to mount his horse. He was also the most scientific artillery officer and the best and most successful engineer in the Swedish army.

His son, Senator Count Anders Torstensson (1641–1686), was from 1674 to 1681 governor-general of Esthonia. The family became extinct on the sword-side in 1727.

See J. W. de Peyster, *History of the Life of L. Torstensson* (Poughkeepsie, 1855); J. Feil, *Torstensson before Vienna* (trans. by de Peyster, New York, 1885); Gustavus III., *Eulogy of Torstensson* (trans. by de Peyster, New York, 1872). (R. N. B.)

TORT (Fr. for wrong, from Lat. *tortus*, twisted, participle of *torquere*), the technical term, in the law of England, of those dominions and possessions of the British Empire where the common law has been received or practically adopted in civil affairs, and of the United States, for a civil wrong, *i.e.* the breach of a duty imposed by law, by which breach some person becomes entitled to sue for damages. A tort must, on the one hand, be an act which violates a general duty. The rule which it breaks must be one made by the law, not, as in the case of a mere breach of contract, a rule which the law protects because the parties have made it for themselves. On the other hand, a tort is essentially the source of a private right of action. An offence which is punishable, but for which no one can bring a civil action, is not a tort. It is quite possible for one and the same act to be a tort and a breach of contract, or a tort and a crime; it is even possible in one class of cases for the plaintiff to have the option—for purposes of procedural advantage—of treating a real tort as a fictitious contract; but there is no necessary or general connexion. Again, it is not the case that pecuniary damages are always or necessarily the only remedy for a tort; but the right to bring an action in common law jurisdiction, as distinct from equity, matrimonial or admiralty jurisdiction, with the consequent right to damages, is invariably present where a tort has been committed.

This technical use of the French word *tort* (which at one time was near becoming a synonym of *wrong* in literary English) is not very ancient, and anything like systematic treatment of the subject as a whole is very modern. Since about the middle of the 19th century there has been a current assumption that all civil causes of action must be founded on either contract or tort; but there is no historical foundation for this doctrine, though modified forms of the action of trespass—actions *in consimili casu*, or "on the case" in the accustomed English phrase—did in practice largely supplant other more archaic forms of action by reason of their greater convenience. The old forms were designed as penal remedies for manifest breach of the peace or corruption of justice; and traces of the penal element remained in them long after the substance of the procedure had become private and merely civil. The transition belongs to the general history of English law.

In England the general scope of the law of torts has never been formulated by authority, the law having in fact been developed by a series of disconnected experiments with the various forms of action which seemed from time to time to promise the widest and most useful remedies. But there is no doubt that the duties enforced by the English law of torts are broadly those which the Roman institutional writers summed up in the precept *Alterum non laedere.* Every member of a civilized commonwealth is entitled to require of others a certain amount of respect for his person, reputation and property, and a certain amount of care and caution when they go about undertakings attended with risk to their neighbours. Under the modern law, it is submitted, the question arising when one man wilfully or recklessly harms another is not whether some technical form of action can be found in which he is liable, but whether he can justify or excuse himself. This view, at any rate, is countenanced by a judgment of the Supreme Court of the United States delivered in 1904. If it be right, the controverted question whether conspiracy is or is not a substantive cause of action seems to lose most of its importance. Instead of the doubtful proposition of law that some injuries become unlawful only when inflicted by concerted action, we shall have the plain proposition of fact that some kinds of injury cannot, as a rule, be inflicted by one person with such effect as to produce any damage worth suing for.

The precise amount of responsibility can be determined only by full consideration in each class of cases. It is important to observe, however, that a law of responsibility confined to a man's own personal acts and defaults would be of next to no practical use under the conditions of modern society. What makes the law of torts really effective, especially with regard to redress for harm suffered by negligence, is the universal rule of law that every one is answerable for the acts and defaults of his servants (that is, all persons acting under his direction and taking their orders from him or some one representing him) in the course of their employment. The person actually in fault is not the less answerable, but the remedy against him is very commonly not worth pursuing. But for this rule corporations could not be liable for any negligence of their servants, however disastrous to innocent persons, except so far as it might happen to constitute a breach of some express undertaking. We have spoken of the rule as universal, but, in the case of one servant of the same employer being injured by the default of another, an unfortunate aberration of the courts, which started about two generations ago from small beginnings, was pushed to extreme results, and led to great hardship. A partial remedy was applied in 1880 by the Employers' Liability Act; and in 1897 a much bolder step was taken by the Workmen's Compensation Act (superseded by a more comprehensive act in 1906). But, as the common law and the two acts (which proceed on entirely different principles) cover different fields, with a good deal of overlapping, and the acts are full of complicated provisos and exceptions, and contain very special provisions as to procedure, the improvement in substantial justice has been bought, so far, at the price of great confusion in the form of the law, and considerable difficulty in ascertaining what it is in any but the most obvious cases. The Workmen's Compensation Act includes cases of pure accident, where there is no fault at all, or none that can be proved, and therefore goes beyond the reasons of liability with which the law of torts has to do. In fact, it establishes a kind of compulsory insurance, which can be justified only on wider grounds of policy. A novel and extraordinary exception to the rule of responsibility for agents was made in the case of trade combinations by the Trade Disputes Act 1906. This has no interest for law as a science.

There are kinds of cases, on the other hand, in which the law, without aid from legislation, has imposed on occupiers and other persons in analogous positions a duty stricter than that of being answerable for themselves and their servants. Duties of this kind have been called "duties of insuring safety." Generally they extend to having the building, structure, or works in such order, having regard to the nature of the case, as not to create any danger to persons lawfully frequenting, using, or passing by them, which the exercise of reasonable care and skill could have avoided; but in some cases of "extra-hazardous" risk, even proof of all possible diligence—according to English authority, which is not unanimously accepted in America—will not suffice. There has lately been a notable tendency to extend these principles to the duties incurred towards the public by local authorities who undertake public works. Positive duties created by statute are on a similar footing, so far as the breach of them is capable of giving rise to any private right of action.

The classification of actionable wrongs is perplexing, not because it is difficult to find a scheme of division, but because it is easier to find many than to adhere to any one of them. We may start either from the character of the defendant's act or omission, with regard to his knowledge, intention and otherwise; or from the character of the harm suffered by the plaintiff. Whichever of these we take as the primary line of distinction, the results can seldom be worked out without calling in the other. Taking first the defendant's position, the widest governing principle is that, apart from various recognized grounds of immunity, a man is answerable for the "natural and probable" consequences of his acts; *i.e.* such consequences as a reasonable man in his place should have foreseen as probable. Still more is he answerable for what he did actually foresee and intend. Knowledge of particular facts may be necessary to make particular kinds of conduct wrongful. Such is the rule in the case of fraud and other allied wrongs, including what is rather unhappily called "slander of title," and what is now known as "unfair competition" in the matter of trade names and descriptions, short of actual piracy of trade-marks. But where an absolute right to security for a man's person, reputation or goods is interfered with, neither knowledge nor specific intention need be proved. In these cases we trespass altogether at our peril. It is in general the habit of the law to judge acts by their apparent tendency, and not by the actor's feelings or desires. I cannot excuse myself by good motives for infringing another man's rights, whatever other grounds of excuse may be available; and it is now settled conversely, though after much doubt, that an act not otherwise unlawful is not, as a rule, made unlawful by being done from an evil motive. This rule was known some time ago to apply to the exercise of rights of property, and such speculative doubt as remained was removed by the decision of the House of Lords in the leading case of *Allen* v. *Flood* (1898, A.C. 1). We now know that it applies to the exercise of all common rights. The exceptions are very few, and must be explained by exceptional reasons. Indeed, only two are known to the present writer—malicious prosecution, and the misuse of a "privileged occasion" which would justify the communication of defamatory matter if made in good faith. In each case the wrong lies in the deliberate perversion of a right or privilege allowed for the public good, though the precise extent of the analogy is not certain at present.[1] It must be remembered, however, that the presence or absence of personal ill will, and the behaviour of the parties generally, may have an important effect, when liability is proved or admitted, in mitigating or aggravating the amount of damages awarded by juries and allowed by the court to be reasonable. It may likewise be noted, by way of caution, that some problems of criminal law, with which we are not here concerned, require more subtle consideration. However, it is hardly ever safe to assume that the bounds of civil and criminal liability will be found coextensive. Perhaps we may go so far as to say that a man is neither civilly nor criminally liable for a mere omission (not being disobedience to a lawful command which he was bound to obey), unless he has in some way assumed a special duty of doing the act omitted.

We have already had to mention the existence of grounds of immunity for acts that would otherwise be wrongful. Such grounds there must be if the law is to be enforced and justice administered at all, and if the business of life is to be carried on with any freedom. Roughly speaking, we find in these cases one of the following conditions: Either the defendant was executing a lawful authority; or he was justified by extraordinary necessity; or he was doing something permitted by legislation for reasons of superior utility, though it may produce damage to others, and either with or without special provisions for compensating damage; or he was exercising a common right in matters open to free use and competition; or the plaintiff had, by consent or otherwise, disabled himself from having any grievance. Pure accident will hardly seem to any one who is not a lawyer to be a special ground of exemption, the question being rather how it could ever be supposed to be a ground of liability. But it was supposed so by many lawyers down to recent times; the reason lying in a history of archaic ideas too long to be traced here. Exercise of common rights is the category where most difficulty arises. Here, in fact, the point at which a man's freedom is limited by his neighbour's has to be fixed by a sense of policy not capable of formal demonstration.

As Justice Holmes of the Supreme Court of the United States has said, we allow unlimited trade competition (so long as it is without fraud) though we know that many traders must suffer, and some may be ruined by it, because we hold that free competition is worth more to society than its costs. A state with different economic foundations might have a different law on this, as on many other points. This freedom extends not only to the exercise of one's calling, but to choosing with whom and under what conditions one will exercise it. Also the law will not inquire with what motives a common right is exercised; and this applies to the ordinary rights of an owner in the use of his property as well as to the right of every man to carry on his business.[1] Owners and occupiers of immovable property are bound, indeed, to respect one another's convenience within certain limits. The maxim or precept *Sic utere tuo ut alienum non laedas* does not mean that I must not use my land in any way which can possibly diminish the profit or amenity of my neighbour's. That would be false. It is a warning that both his rights and mine extend beyond being free from actual unlawful entry, and that if either of us takes too literally the more popular but even less accurate maxim, "Every man may do as he will with his own," he will find that there is such a head of the law as nuisance.

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[1] It was formerly supposed that an action by a party to a contract against a third person for procuring the other party to break his contract was within the same class, *i.e.* that malice must be proved. But since *Allen* v. *Flood*, and the later decision of the House of Lords in *Quinn* v. *Leathem* (1901, A.C. 495), this view seems untenable. The ground of action is the intentional violation of an existing legal right; which, however, since 1906, may be practised with impunity in the United Kingdom "in contemplation or furtherance of a trade dispute": Trade Disputes Act, § 3.

From the point of view of the plaintiff, as regards the kind of damage suffered by him, actionable wrongs may be divided into four groups. We have some of a strictly personal kind; some which affect ownership and rights analogous to ownership; some which extend to the safety, convenience and profit of life generally—in short, to a man's estate in the widest sense; and some which may, according to circumstances, result in damage to person, property or estate, any or all of them. Personal wrongs touching a man's body or honour are assault, false imprisonment, seduction or "enticing away" of members of his family. Wrongs to property are trespass to land or goods, "conversion" of goods (*i.e.* wrongful assumption of dominion over them), disturbance of easements and other individual rights in property not amounting to exclusive possession. Trespass is essentially a wrong to possession; but with the aid of actions "on the case" the ground has been practically covered. Then there are infringements of incorporeal rights which, though not the subject of trespass proper, are exclusive rights of enjoyment and have many incidents of ownership. Actions, in some cases expressly given by statute, lie for the piracy of copyright, patents and trade marks. Wrongs to a man's estate in the larger sense above noted are defamation (not a strictly personal wrong, because according to English common law the temporal damage, not the insult, is, rightly or wrongly, made the ground of action); deceit, so-called "slander of title" and fraudulent trade competition, which are really varieties of deceit; malicious prosecution; and nuisance, which, though most important as affecting the enjoyment of property, is not considered in that relation only. Finally, we have the results of negligence and omission to perform special duties regarding the safety of one's neighbours or customers, or of the public, which may affect person, property, or estate generally.

The law of wrongs is made to do a great deal of work which, in a system less dependent on historical conditions, we should expect to find done by the law of property. We can claim or reclaim our movable goods only by complaining of a wrong done to our possession or our right to possess. There is no direct assertion of ownership like the Roman *vindicatio*. The law of negligence, with the refined discussions of the test and measure of liability which it has introduced, is wholly modern; and the same may be said of the present working law of nuisance, though the term is of respectable antiquity. Most recent of all is the rubric of "unfair competition," which is fast acquiring great importance.

It will be observed that the English law of torts answers approximately in its purpose and contents to the Roman law of obligations *ex delicto* and *quasi ex delicto*. When we have allowed for the peculiar treatment of rights of property in the common law, and remembered that, according to one plausible theory, the Roman law of possession itself is closely connected in its origin with the law of delicts, we shall find the correspondence at least as close as might be expected a priori. Nor is the correspondence to be explained by borrowing, for this branch of the common law seems to owe less to the classical Roman or medieval canon law than any other. Some few misunderstood Roman maxims have done considerable harm in detail, but the principles have been worked out in all but complete independence.

A list of modern books and monographs will be found at the end of the article on "Torts" by the present writer in the *Encyclopaedia of the Laws of England* (2nd ed.). Among recent editions of works on the law of torts and new publications the following may be mentioned here: Addison, by W. E. Gordon and W. H. Griffith (8th ed., 1906); Clerk and Lindsell, by Wyatt Paine (4th ed., 1906); Pollock (8th ed., 1908); Salmond, *The Law of Torts* (2nd ed., 1910). In America: Burdick, *The Law of Torts* (1905); Street, *The Foundations of Legal Liability* (1906), 3 vols. of which vol. i. is on Tort. (F. Po.)

TORTOISE. Of the three names generally used for this order of reptiles, viz. tortoise, turtle and terrapin, the first is derived from the Old French word *tortis*, *i.e.* twisted, and was probably applied first to the common European species on account of its curiously bent forelegs. Turtle is believed to be a corruption of the same word, but the origin of the name terrapin is unknown: since the time of the navigators of the 16th century it has been in general use for fresh-water species of the tropics, and especially for those of the New World. The name tortoise is now generally applied to the terrestrial members of this group of animals, and that of turtle to those which live in the sea or pass a great part of their existence in fresh water. They constitute one of the orders of reptiles, the Chelonia: toothless reptiles, with well developed limbs, with a dorsal and a ventral shell composed of numerous bony plates, large firmly fixed quadrates, a longitudinal anal opening and an unpaired copulatory organ.

The whole shell consists of the dorsal, more or less convex carapace and the ventral plastron, both portions being joined laterally by the so-called bridge. The carapace is (with the exception of *Sphargis*) formed by dermal ossifications which are arranged in regular series, viz. a median row (1 nuchal, mostly 8 neurals and 1–3 supracaudal or pygal plates), a right and left row of costal plates which surround and partly replace the ribs, and a considerable number (about 11 pairs) of marginal plates. The plastron consists of usually 9, rarely 11, dermal bones, viz. paired epi-, hyo-, hypo- and xiphi-plastral plates and the unpaired endo-plastral; the latter is homologous with the interclavicle, the epi-plastra with the clavicles, the rest with so-called abdominal ribs of other reptiles.

In most Chelonians the bony shell is covered with a hard epidermal coat, which is divided into large shields, commonly called "tortoiseshell." These horny shields or scutes do not correspond in numbers and extent with the underlying bones, although there is a general, vague resemblance in their arrangement; for instance, there is a neural, a paired costal and a paired marginal series. The terminology may be learned from the accompanying illustrations (figs. 1 and 2)

The integuments of the head, neck, tail and limbs are either soft and smooth or scaly or tubercular, frequently with small osseous nuclei.

All the bones of the skull are suturally united. The dentary portion of the mandible consists of one piece only, both halves being completely fused together. The pectoral arch remains separate in the median line; it consists of the coracoids, which slope backwards, and the scapulae, which stand upright and often abut against the inside of the first pair of costal plates. Near the glenoid cavity for the humerus arises from the scapula a long process which is directed transversely towards its fellow; it represents the acromial process of other vertebrates, although so much enlarged, and is neither the precoracoid, nor the clavicle, as stated by the thoughtless. The tail is still best developed in the Chelydridae, shortest in the Trionychoidea. Since it contains the large copulatory organ, it is less reduced in the males. No Chelonians possess the slightest traces of teeth, but their jaws are provided with horny sheaths, with hard and sharp edges, forming a beak.

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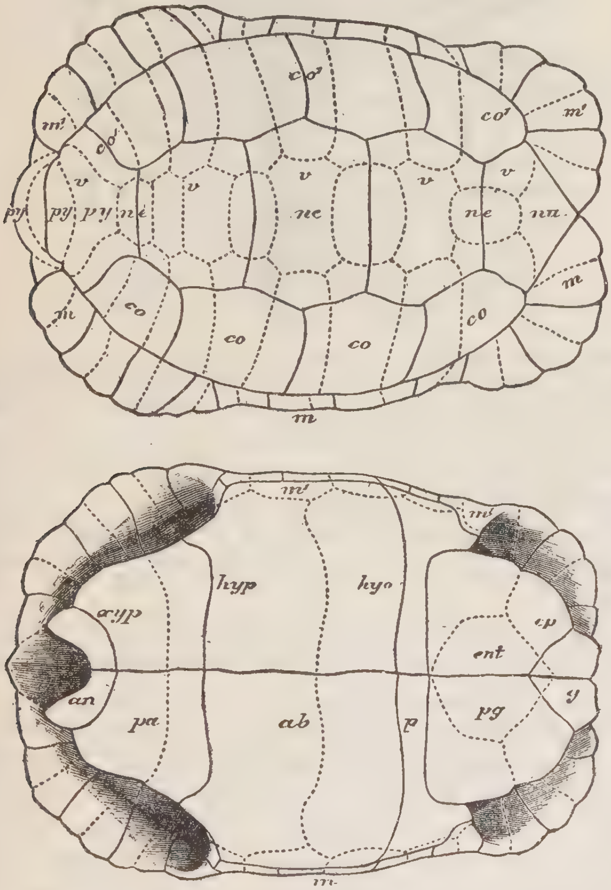
[1] The rule that a man's motives for exercising his common rights are not examinable involves the consequence that advising or procuring another, who is a free agent, to do an act of this kind can, a fortiori, not be an actionable wrong at the suit of a third person who is damnified by the act, and that whatever the adviser's motives may be. This appears to be included in the decision of the House of Lords in *Allen* v. *Flood*. That decision, though not binding in any American court, is approved and followed in most American jurisdictions. It is otherwise where a system of coercion is exercised on a man's workmen or customers in order to injure him in his business. The extension of immunity to such conduct would destroy the value of the common right which the law protects: *Quinn* v. *Leathem*. The coercion need not be physical, and the wrong as a whole may be made up of acts none of which taken alone would be a cause of action. In this point there is nothing novel, for it is so in almost every case of nuisance. Conspiracy is naturally a frequent element in such cases, but it does not appear to be necessary; if it were, millionaires and corporations might exceed the bounds of lawful competition with impunity whenever they were strong enough. The reasons given in *Quinn* v. *Leathem* are many and various. but the decision is quite consistent with *Allen* v. *Flood*. However, the Trade Disputes Act will probably have its intended effect of reducing the law on this head to relative insignificance in England.

The number of Chelonians known at present may be estimated at about 200, the fresh-water species being far the most numerous, and are abundant in well-watered districts of the tropical and sub-tropical zones. Their number and variety decrease beyond the tropics, and in the north they disappear entirely about the 50th parallel in the western and about the 56th in the eastern hemisphere, whilst in the southern hemisphere the terrestrial forms seem to advance to 36° S. only. The marine turtles, which are spread over the whole of the equatorial and sub-tropical seas, sometimes stray beyond those limits. As in other orders of reptiles, the most specialized and the largest forms are restricted to the tropics (with the exception of *Macroclemmys*); but, unlike lizards or snakes, Chelonians are unable to exist in sterile districts or at great altitudes.



FIGS. 1, 2.—Shell of *Testudo pardalis*, to show the divisions of the integument, which are marked by entire lines, and of the osseous carapace, these being marked by dotted lines. Fig. 1, Upper or dorsal aspect. Fig. 2, Lower or ventral aspect.

Epidermal shields:—	
co,	Costals.
v,	Vertebrals.
m,	Marginals.
g,	Gulars.
pg,	Postgulars or humerals.
p,	Pectorals.
ab,	Abdominals.
pa,	Preanals or femorals.
an,	Anals.

Bones of the Carapace:—	
*co*¹,	Costals.
ne,	Neurals.
nu,	Nuchal.
py,	Pygals.
*m*¹,	Marginals.
ent,	Entoplastron.
ep,	Epiplastron.
hyo,	Hyoplastron.
hyp,	Hypoplastron.
xyp,	Xiphiplastron.

They show a great divergence in their mode of life—some living constantly on land, others having partly terrestrial partly aquatic habits, others again rarely leaving the water or the sea. The first-mentioned, the land tortoises proper, have short club-shaped feet with blunt claws, and a very convex, heavy, completely ossified shell. In the fresh-water forms the joints of the limb bones are much more mobile, the digits distinct, armed with sharp claws, and united by a membrane or web; their shell is less convex, and is flattened, and more or less extensive areas may remain unossified, or transparent windows are formed with age, for instance in *Batagur*. As a rule, the degree of development of the interdigital web and of convexity of the shell indicates the prevalence of aquatic or terrestrial habits of a species of terrapin. Finally, the marine turtles have paddle-shaped limbs resembling those of Cetaceans.

Land tortoises are sufficiently protected by their carapace, and therefore have no need of any special modification of structure by means of which their appearance would be assimilated to the surroundings and thus give them additional security from their enemies. These, however, are few in number. On the other hand, among the carnivorous terrapins and fresh-water turtles instances of protective resemblance are not scarce, and may even attain to a high degree of specialization, as in *Chelys*, the matamata. The colours of land tortoises are generally plain, or in yellow and brown patterns, whilst those of many terrapins are singularly varied, bright and beautiful, especially in the very young, but all this beauty is lost in the adult of many species.

Chelonians are diurnal animals; only a few are active during the night, habitually or on special occasions, as, for instance, during oviposition. Land tortoises are slow in all their movements, but all kinds living in water can execute rapid motions, either to seize their prey or to escape from danger. All Chelonians are stationary, residing throughout the year in the same locality, with the exception of the marine turtles, which periodically migrate to their breeding-stations. Species inhabiting temperate regions hibernate.

Land tortoises, a few terrapins, and some of the marine turtles are herbivorous, the others carnivorous, their prey consisting chiefly of fish, frogs, molluscs, and other small aquatic animals; some, *e.g.* *Clemmys insculpta* and *Cistudo carolina*, have a mixed vegetable and animal diet.

All Chelonians are oviparous, and the eggs are generally covered with a hard shell, mostly elliptical, rarely quite round, as in the case of the marine turtles. The various modifications, and also the not uncommon individual variations, in the composition of the carapace plates and the number and disposition of the shields, are very significant. They show an unmistakable tendency towards reduction in numbers, a concentration and simplification of the shell and its covering shields. We can to a certain extent reconstruct a generalized ancestral tortoise and thereby narrow the wide gap which separates the Chelonia from every other reptilian order. The early Chelonians possessed most likely more than five longitudinal dorsal rows of plates. The presence of several small supramarginal shields in *Macroclemmys* may be an indication that the total number of longitudinal rows was originally at least seven. The number of transverse rows, both of plates and shields, was also greater. We can account for at least twelve median plates and as many pairs of marginals, but for only eight median and eight pairs of costal shields (individual variations observed in *Thalassochelys*). It stands to reason that originally each trunk metamere had its full complement of plates and shields; consequently that about twelve trunk metameres partook in the formation of the shell, which, with subsequent shortening and broadening of the trunk, has undergone considerable concentration and reduction, a process which has reduced the costal plates to seven pairs in the American species of *Trionyx*, has completely abolished the neural plates of some Chelydidae, and has brought down the costal shields to four pairs in the majority of recent Chelonians. In several species of *Testudo* the little nuchal shield is suppressed, thereby reducing the unpaired median shields to five. The complete absence of shields in the *Trionychidae* and in *Carettochelys* is also due to a secondary process, which, however, has proceeded in a different way.

Classification of Chelonia.

H. Stannius in 1854 clearly separated the Trionychoidea from the rest. E. D. Cope, in 1870, distinguished between Pleurodira and Cryptodira according to whether the neck, δέρη or δειρή, is bent sidewards, or hidden by being withdrawn in an S-shaped curve in a vertical plane; he also separated *Sphargis* as Athecae from all the other Chelonians, for which L. Dollo, in 1886, proposed the term Thecophora. These terms are most unfortunate, misleading. Athecae (from θήκη, shell) has reference to the absence of a horny shell-covering in the leathery turtle; but since the same character applies to Trionychoidea and to *Carettochelys*, nobody can guess that the term *Athecae* in Dollo's sense refers to the fact that the shell of the leathery turtle is not homologous with the typical shell or Θήκη of the other Chelonians. The grouping of the latter into families recognizable by chiefly internal, skeletal characters has been effected by G. A. Boulenger. For practical purposes the following "key" is preferable to those taxonomic characters which are mentioned in the descriptions of the different families. The relationships between them may be indicated as follows:—

- Chelonia
  - Athecae . . . . Sphargidae
  - Thecophora
    - Pleurodira
      - Pelomedusidae
      - Chelydidae
      - Carettochelydidae
    - Cryptodira
      - Chelydridae—Dermatemydidae-Cinosternida
      - Platysternidae
      - Testudinidae
      - Chelonidae
    - Trionychoidea

Key to the Families of Chelonia.

- Shell covered with horny shields.
  - Digits distinct, with five or four claws.
    - Pectoral shields separated from the marginals by inframarginals.
      - Tail long and crested. Plastron small and cruciform . . . . Chelydridae
      - Tail long, covered with rings of shields. Plastron large . . . . Platysternidae
      - Tail short . . . . Dermatemydidae, Cinosternidae
    - Pectoral shields in contact with the marginals.
      - Plastral shields 11 or 12, without an intergular.
        - Neck retractile in an S-shaped vertical curve . . . . Testudinidae
      - Plastral shields 13, an intergular being present.
        - Neck bending sideways under the shell Chelydidae, Pelomedusidae
  - Limbs paddle-shaped, with one or two claws . . . . Chelonidae
- Shell without horny shields, covered with soft leathery skin.
  - Digits distinct, broadly webbed, but with only three claws . . . . Trionychoidea
  - Limbs paddle-shaped.
    - Shell composed of regular series of bony plates. Two claws . . . . . . Carettochelydidae
    - Shell composed of very many small plates arranged like mosaic. No claws . . Sphargidae.

Sub-order I. Athecae.—The shell consists of a mosaic of numerous small polygonal osseous plates and is covered with leathery skin without any horny shields. The limbs are transformed into paddles, without claws. Marine. Sole representative *Sphargis* or *Dermatochelys coriacea*, the leathery turtle or luth; it is the largest of living Chelonians, surpassing 6 ft. in length, has a wide distribution over all the intertropical seas, but is very rare everywhere; a few stragglers have appeared as far north as the coasts of Long Island, and those of Great Britain, Holland and France. It is a curious fact that only adults and young, but none of intermediate size, happen to be known. This creature shows many important features. The vertebrae and ribs are not fused with, but remain free from, the carapace, and this is fundamentally different from and not homologous with that of other Chelonians. O. P. Hay has suggested that the mosaic polygonal components of the shell of *Sphargis* are, so to speak, an earlier generation of osteodermal plates than the fewer and larger plates of the Thecophora, which in them fuse with the neural arches and the ribs. *Sphargis* has, however, the later category in the plastron and in its first neural or nuchal plate. If this suggestion is correct, this turtle has either lost or perhaps never had developed the horny shields. The many mosaic plates comprise larger plates which form an unpaired median, two pairs of other dorsal, a lateral and three pairs of ventral series or ridges; thirteen, or when the inner ventral pair fuses, twelve pairs in all.

The skull, excellently studied by J. F. van Bemmelen, much resembles that of *Chelone*, but so-called epipterygoids are absent; further, the pterygoids, instead of sending lateral arms to the jugals and maxillaries, are widely separated from these bones by the palatines, and these do not at all ventrally roof over the choanae. The position of *Sphargis* in the system is still a moot question. G. A. Boulenger looks upon it as the sole remnant of a primitive group in opposition to all the other recent Chelonia; G. Baur considered it the most specialized descendant of the Chelonidae, a view which has been supported by W. Dames, E. C. Case, and to a certain extent by J. F. van Bemmelen. For literature, &c., see L. Dollo, *Bull. S. R. Bruxelles* (Février 4, 1901).

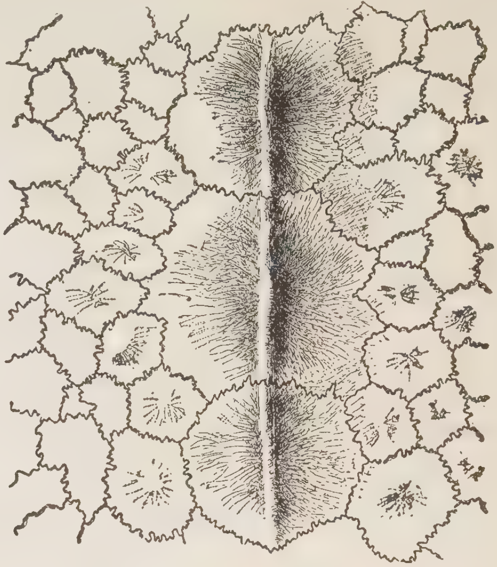


FIG. 3.—A portion of the Osseous Plates of the Carapace of *Sphargis coriacea*, showing three large keeled plates of one of the longitudinal ridges of the carapace, with a number of the small irregular plates on either side of them.

Sub-order II. Thecophora.—The bony shell is composed of several longitudinal series of plates (on the dorsal side a median or neural, a paired lateral or costal series, and marginal plates). With few exceptions this shell is covered with large horny scutes or shields.

Super-family 1. Cryptodira.—The neck, if retractile, bends in an S-shaped curve in a vertical plane. The pelvis is not fused with the shell, and this is covered with large horny shields, except in *Carettochelys*.

Family 1. Chelydridae.—The plastron is rather narrow, and cross-shaped; the bridge is very narrow and is covered by a pair of shields, the displaced abdominals, which are separated from the marginals by a few inframarginals. The limbs, neck and head are so stout that they cannot completely be withdrawn into the shell. The tail is very long. Only two genera with three species, confined to America. *Chelydra serpentina*, the "snapping turtle," ranging from the Canadian lakes through the United States east of the Rockies; closely allied is *C. rossignoni* of Central America and Ecuador. *Macroclemmys temmincki*, the "alligator turtle," is the largest known fresh-water Chelonian, its shell growing to a length of 3 ft. It is characterized by the three series of strong prominent keels along the back; it inhabits the whole basin of the Mississippi and Missouri rivers.

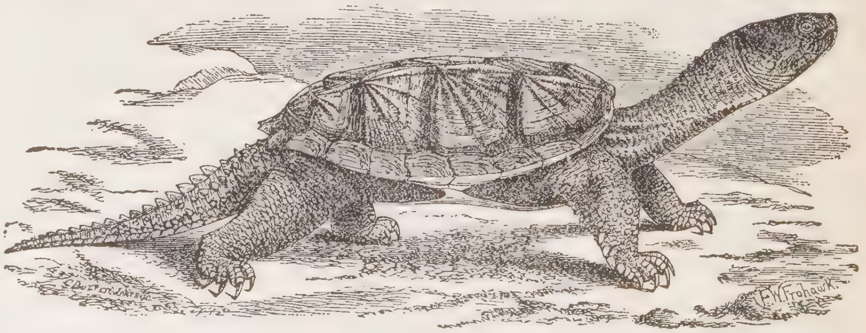


FIG. 4.—The Snapping Turtle (*Chelydra serpentina*).

Family 2. Dermatemydidae.—The pectoral shields are widely separated from the marginals by inframarginals, the gulars are small or absent, and the tail is extremely short. Only a few species, in Central America. The plastron is composed of nine plates. The nuchal plate has a pair of rib-like processes like those of the Chelydridae. One or more of the posterior costal plates meet in the middle line. The shell of these aquatic, broadly web-fingered tortoises, is very flat and the covering shields are thin. They feed upon leaves, grass and especially fruit. *Staurotypus, e.g. salvini* with 23, *Dermatemys, e.g. mawi*, with 25 marginal shields.

Family 3. Cinosternidae.—Closely allied to the two previous families from which *Cinosternum*, the only genus, differs chiefly by the absence of the endo-plastral plate. Inframarginals are present. The nuchal plate has a pair of rib-like processes. The neural plates are interrupted by the meeting of several pairs of the costal plates. Twenty-three marginal shields. In some species the skin of the legs and neck is so baggy that these parts slip in, the skin rolling off, when such a turtle withdraws into its shell. In some the plastron is hinged and the creature can shut itself up tightly, *e.g. C. leucostoma* of Mexico; in others the plastron leaves gaps, or it is narrow and without hinges, *e.g. C. odoratum*, the mud turtle or stinkpot terrapin of the eastern half of North America. About a dozen species, mostly Central American.

Family 4. Platysternidae.—*Platysternum megacephalum*, the only species, from Burma to southern China. The total length of these thick-headed, very long-tailed turtles is about 1 ft., only 5 in. belonging to the shell. The plastron is large, oblong, not cruciform, composed of nine plates. The nuchal is devoid of rib-like processes. A unique arrangement is that the jugals are completely shut off from the orbits owing to the meeting of the post-frontals with the maxillaries.

Family 5. Testudinidae.—The shell is always covered with well-developed shields; those which cover the plastral bridge are in direct contact with the marginals. The plastron is composed of nine bones. The digits have four or five claws. The neck is completely retractile.

This family contains the majority of tortoises, divided into as many as 20 genera. These, starting with *Emys* as the least specialized, can be arranged in two main diverging lines, one culminating in the thoroughly aquatic *Batagur*, the other in the exclusively terrestrial forms. *Emys*, with the plastron movably united to the carapace; with well-webbed limbs, amphibious. *E. orbicularis* or *europaea* was, towards the end of the Pleistocene period, distributed over a great part of middle Europe, remains occurring in the peat of England, Belgium, Denmark and Sweden; it is now withdrawing eastwards, being restricted in Germany to isolated localities east of Berlin, but it reoccurs in Poland and Russia, whence it extends into western Asia; it is common in south Europe. The other species, *E. blandingi*, lives in Canada and the north-eastern states of the Union. *Clemmys* with the plastron immovably united to the carapace; temperate holarctic region, *e.g. C. caspica, C. leprosa* in Spain and Morocco; *C. insculpta*, in north-east America. *Malacoclemmys* with a few species in North America, *e.g. M. terrapin*, the much prized "diamond-back." *Chrysemys* with many American species, *e.g. Ch. picta*, the "painted terrapin" and *C. concinna*, most of them very handsomely coloured and marked when still young. *Batagur* and *Kachuga* in the Indian sub-region.

Cistudo carolina, the box tortoise of North America, with the plastron divided into an anterior and a posterior movable lobe, so that the creature can shut itself up completely. Although essentially by its internal structure a water tortoise, it has become absolutely terrestrial in habits, and herewith agree the high-backed instead of depressed shell, the short webless fingers and its general coloration. It has a mixed diet. The eyes of the males are red, those of the females are brown. From Long Island to Mexico. *Cinixys, e.g. belliana* of tropical Africa, has the posterior portion of the carapace movably hinged. *Pyxis arachnoides* of Madagascar has the front-lobe of the plastron hinged.

Testudo, the main genus, with about 40 species, is cosmopolitan in tropical and sub-tropical countries, with the exception of the whole of the Australian and Malay countries; most of the species are African. *T. graeca*, in Mediterranean countries and islands. *T. marginata* in Greece with the posterior margin of the carapace much flanged or serrated, and *T. ibera* or *mauritanica* from Morocco to Persia; both differ from *T. graeca* by an unpaired supracaudal, marginal shield, and by the possession of a strong, conical, horny tubercle on the hinder surface of the thigh. With age the posterior portion of the plastron develops a transverse ligamentous hinge. *T. polyphemus*, the "gopher" of southern United States, lives in pairs in self-dug burrows. *T. tabulata* is one of the few South American terrestrial tortoises.

Of great interest are the so-called gigantic land tortoises. In former epochs truly gigantic species of the genus *Testudo* had a wide and probably more continuous distribution. There was *T. atlas*, of the Pliocene of the Sivalik hills with a skull nearly 8 in. long, but the shell probably measured not more than 6 ft. in length, the restored specimen in the Natural History Museum at South Kensington being exaggerated. *T. perpigniana* of Pliocene France was also large. Large land tortoises, with a length of shell of more than 2 ft., became restricted to two widely separated regions of the world, viz. the Galapagos Islands (called thus after the Spanish *galapago, i.e.* tortoise), and islands in the western Indian Ocean viz. the Mascarenes (Bourbon, Mauritius and Rodriguez) and Aldabra. When they became extinct in Madagascar is not known, but *T. grandidieri* was a very large kind, of apparently very recent date. At the time of their discovery those smaller islands were uninhabited by man or any predaceous mammal. It was on these peaceful islands that land tortoises lived in great numbers; with plenty of food there was nothing for them to do but to feed, to propagate, to grow and to vary. Most of the islands were or are inhabited by one or more typical, local forms. As they provided, like the equally ill-fated dodo and solitaire, a welcome provision of excellent meat, ships carried them about, to be slaughtered as occasion required, and soon almost exterminated them; some were occasionally liberated on other islands, for instance, on the Seychelles and on the Chagos, or they were left as presents, in Ceylon, Java or on Rotuma near the Fijis. Thus it has come to pass that the few survivors have been very much scattered. The small genuine stock at Aldabra is now under government protection, in a way. A large male of *T. gigantea* or *elephantina* or *hololissa* or *ponderosa*, was brought to London and weighed 870 ℔; another specimen had in 1908 been living at St Helena for more than one hundred years. A specimen of *T. daudini*, native of the South Island of Aldabra, was known for many years on Egmont Island, one of the Chagos group, then it was taken to Mauritius and then to England, where of course it soon died; its shell measures 55 in. in a straight line, and it weighed 560 ℔. The type specimen of *T. sumeirei*, supposed to have come originally from the Seychelles, was in 1908 still kept in the barrack grounds at Port Louis, Mauritius, and had been known as a large tortoise for about 150 years. *T. vosmaeri* was a very thin-shelled species in Rodriguez. Of the Galapagos species *T. ephippium* still survives on Duncan Island; *T. abingdoni* lived on Abingdon Island; of *T. elephantopus* or *vicina*, G. Baur still collected 21 specimens in 1893 on Albemarle Island. One monster of this kind is said to have measured 56 in. over the curve of the carapace, with a skull a little more than 7 in. in length. All the Galapagos species are remarkable for their comparatively small head and the very long neck, which is much larger and more slender than that of the eastern species.

Family 6. Chelonidae. Marine turtles, with only two recent genera, with three widely distributed species. The limbs are paddle-shaped, with only one or two claws, and the shell is covered with horny shields. The neck is short and incompletely retractile. The parietals, post-frontals, squamosals, quadrato-jugals, and jugals are much expanded and form an additional or false roof over the temporal region of the skull.

The Chelonidae are a highly specialized offshoot of the Cryptodira, adapted to marine life. Fundamentally they agree most with the Testudinidae, and there is nothing primitive about them except that they still possess complete series of inframarginal shields.

Chelone, with only 4 pairs of costal shields, with 5 neurals and a broad nuchal. *C. mydas* s. *viridis*, the "green or edible turtle," has, when adult, a nearly smooth shell. It attains a length of nearly 4 ft., and may then weigh more than three hundredweight. Their food consists of algae, and of *Zostera marina*. Their capture forms a regular pursuit wherever they occur in any numbers. Comparatively few are caught in the open sea, others in staked nets, but the majority are intercepted at well-known periods and localities where they go ashore to deposit their eggs. These are round, with a parchment-like shell and buried in the sand, above the high-tide mark, as many as 100 to 250 being laid by one female. They are eagerly searched for and eaten. The famous turtle-soup is made not only of the meat and the fat, but also from the thick and gelatinous layer of subcutaneous tissue which lines the inside of the shell. Only the females are eaten; the males, recognizable by the longer tail, are rejected at the London market. This species inhabits the Atlantic, Indian and Pacific Oceans.

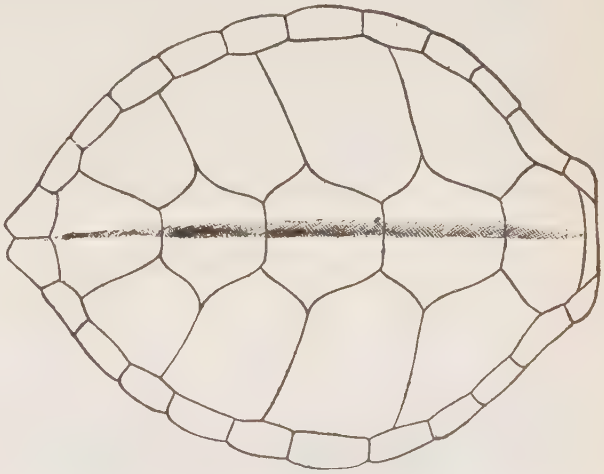


FIG. 5.—Green Turtle (*Chelone mydas*).

C. imbricata, the "hawksbill turtle." The shields are thick, strongly overlapping each other from before backwards, but in old specimens the shields lose their keel, flatten and become juxtaposed. The horny cover of the upper jaw forms a hooked beak. This species lives upon fish and molluscs and is not eaten; but is much persecuted for the horny shields which yield the "tortoise-shell," so far as this is not a fraudulent imitation. When heated in oil, or boiled, the shields (which singly are not thick enough to be manufactured into larger articles) can be welded together under pressure and be given any desired shape. The "hawksbill" ranges over all the tropical and sub-tropical seas and scarcely reaches 3 ft. in length, but such a shell yields up to 8 ℔ of tortoiseshell.

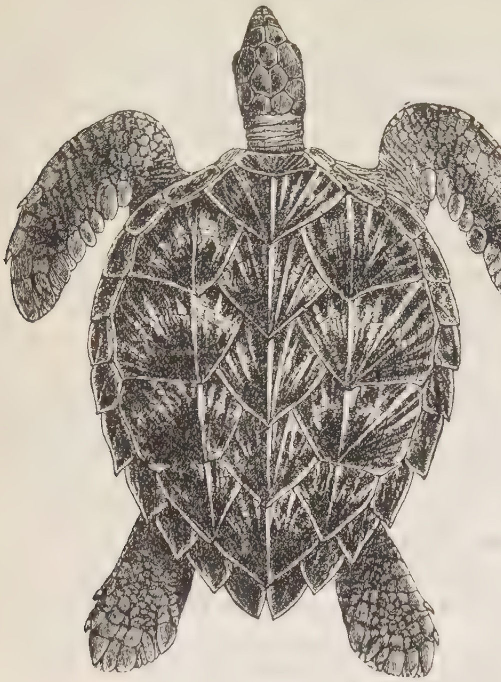


Fig. 6.—Hawksbill Turtle (*Chelone imbricata*).

Thalassochelys caretta, the "loggerhead," has normally five pairs of costal shields, but whilst the number of shields in the genus *Chelone* is very constant, that of the loggerhead varies individually to an astonishing extent. The greatest number of neurals observed, and counting the nuchal as the first, is 8, and 8 pairs of costal, in all 24; the lowest numbers are 6 neurals with 5 pairs of costals; odd costals are frequent. The most interesting facts are that some of the supernumerary shields are much smaller than the others, sometimes mere vestiges in all stages of gradual suppression, and that the abnormalities are much more common in babies and small specimens than in adults. The importance of these orthogenetic variations has been discussed by H. Gadow in A. Willey's *Zoolog. Results*, pt. iii. p. 207–222, pls. 24, 25 (Cambridge 1899).

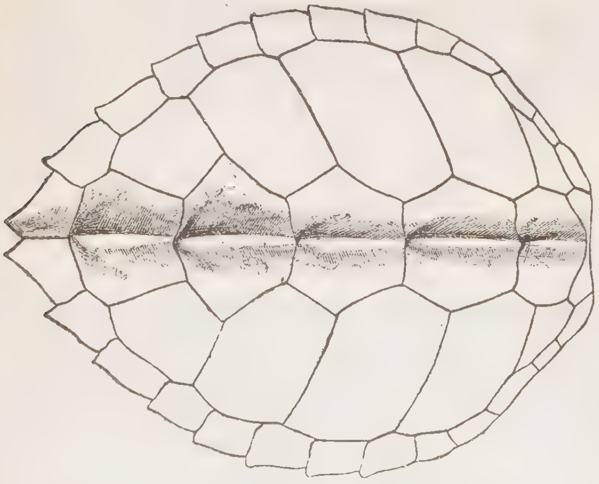


Fig. 7.—Loggerhead (*Thalassochelys caretta*).

The "loggerhead" is carnivorous, feeding on fish, molluscs and crustaceans, and is not esteemed as food. A great part of the turtle-oil which finds its way into the market is obtained from it; its tortoiseshell is of an inferior quality. Besides all the intertropical seas it inhabits the Mediterranean, and is an accidental visitor of the western coasts of Europe. The old specimen captured on the Dutch coast in 1894 contained the enormous number of 1150 eggs.

Super-family 2. Pleurodira.—The long neck bends laterally and is tucked away between the anterior portion of the carapace and the plastron. The dorsal and ventral ends of the pelvis are anchylosed to the shell. Fresh-water tortoises of South America, Australia, Africa and Madagascar.

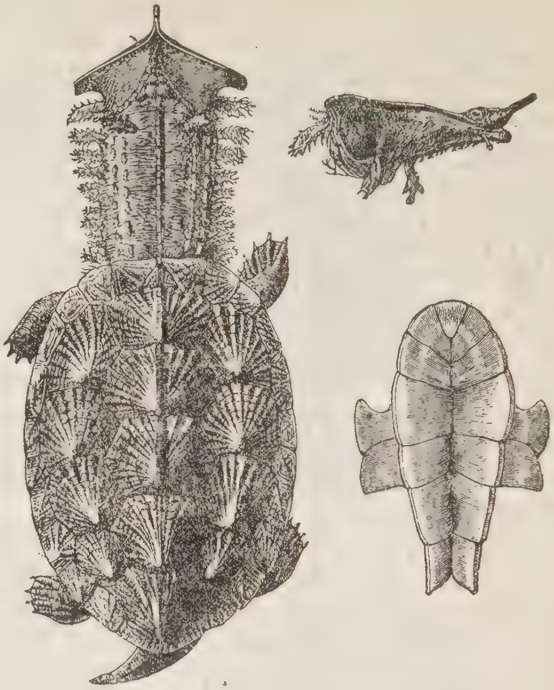


Fig. 8.—The Matamata (*Chelys fimbriata*) with side view of head, and separate view of plastron.

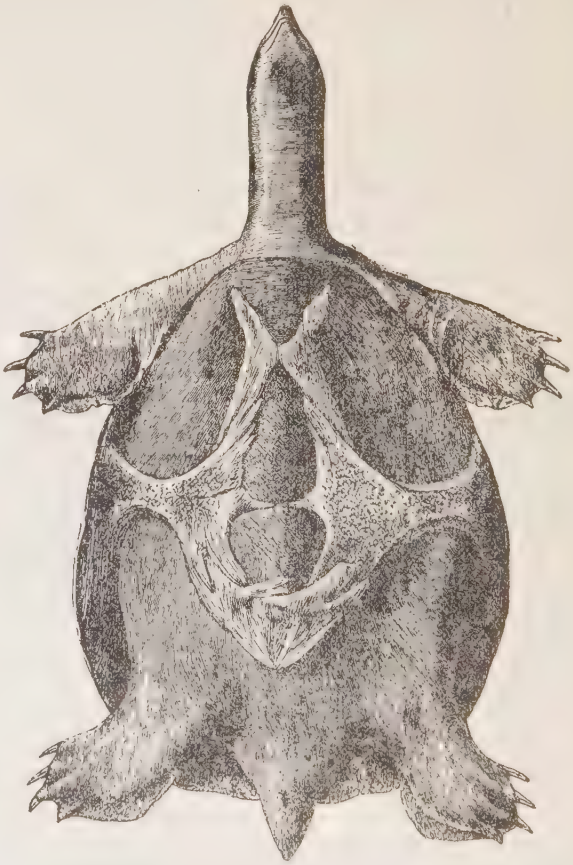


Fig. 9.—Lower view of *Trionyx euphratica.*

Family 1. Pelomedusidae.—Neck completely retractile. Carapace covered with horny shields, of which the nuchal is wanting. Plastron composed of 11 plates. With 24 marginal and 13 plastral shields, inclusive of a conspicuous intergular. *Sternothaerus* in Africa and Madagascar. *Pelomedusa galeata* in Madagascar and from the Cape to the Sinaitic peninsula. *Podocnemis* is common in tropical South America, *e.g. P. expansa* of Brazilian rivers, noteworthy for the millions of eggs which are, or were, annually collected for the sake of their oil. Bates (*The Naturalist on the River Amazon*) gives a most interesting account of these turtles, which are entirely frugivorous.

Family 2. Chelydidae.—The neck, when bent, remains partly exposed. Shell covered with shields. Plastron composed of 9 plates, but covered with 13 shields. This family, still represented by nearly 30 species, with 8 genera, is found in South America and in Australia. *Chelys fimbriata*, the "matamata" in the rivers of Guiana and North Brazil; total length about 3 ft.; with animal diet. *Hydromedusa, e.g. tectifera*, with very long neck, in Brazil, much resembling *Chelodina, e.g. longicollis* of the Australian region.

Family 3. Carettochelydidae.—*Carettochelys insculpta*, the only species, in the Fly river of New Guinea; still imperfectly known. This peculiar turtle seems to stand in the same relation to the Chelydidae and to the Trionychidae as do the Chelonidae to the Testudinidae by the transformation of the limbs into paddles with only two claws, and the complete reduction of the horny shields upon the shell, which is covered with soft skin. The plastron is composed of 9 plates; the 6 neural plates are all separated from one another by the costals. The premaxilla is single, as elsewhere only in *Chelys* and in the Trionychidae. The neck is short and non-retractile. Length of shell about 18 in.

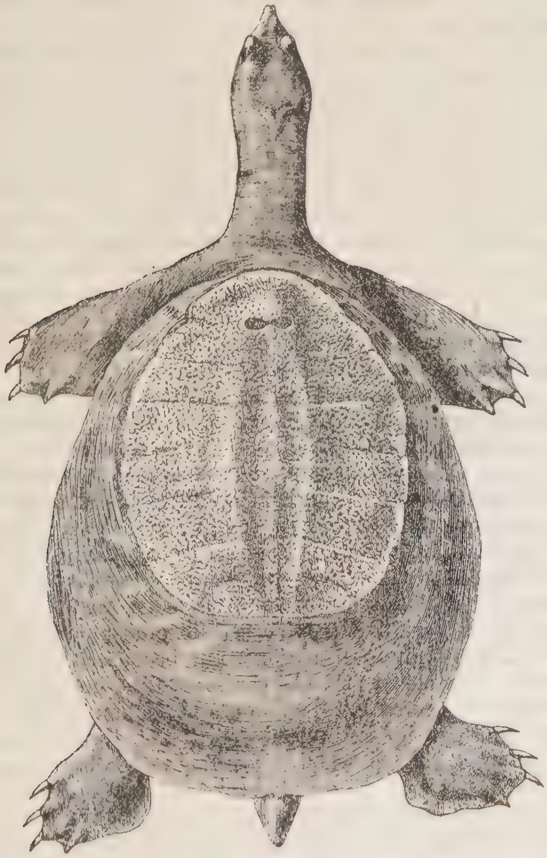


FIG. 10.—Upper view of the Turtle of the Euphrates (*Trionyx euphratica*).

Super-family 3. Trionychoidea.—The shell is very flat and much smaller than the body, and covered with soft leathery skin, but traces of horny structures are still represented, especially in the young of some species, by numerous scattered little spikes on the back of the shell and even on the soft parts of the back. The limbs are short, broadly webbed and only the three inner digits are provided with claws. Head and neck are retractile, bending in a sigmoid curve in a vertical plane. The jaws are concealed by soft lip-like flaps and the nose forms a short soft proboscis. The temporal region is not covered in by any arches; the quadrate is trumpet-shaped as in the Chelydidae, but the jugular arch is complete. The pelvis is not anchylosed to the shell. The carapace is much reduced in size, the ribs extending beyond the costal plates, and there are no marginals; except in the African *Cyclanorbis* the neural plates form a continuous series. All the nine elements of the plastron are deficient and but very loosely connected with each other. Most of these reductions in the skeletal and tegumentary armature are the result of life in muddy waters, in the bottom of which these creatures bury themselves with only the head exposed. They feed upon aquatic animals; those which are partial to hard-shelled molluscs soon wear down the sharp horny edges of the jaws, and thick horny crushing pads are developed in their stead. They only crawl upon land in order to lay their round brittle eggs. Trionyxes inhabit the rivers of Asia, Africa and North America. *Trionyx ferox*, the "soft-shelled turtle," in the whole of the Mississippi basin and in the chain of the great northern lakes. *T. triunguis* in Africa, the largest species, with a length of shell of 3 ft. *T. hurum* and *T. gangeticus* are the commonest Indian species. The young are ornamented with two or three pairs of large, round, ocellated spots on the back. (H. F. G.)

TORTOISESHELL. The tortoiseshell of commerce consists of the epidermic plates covering the bony carapace of the hawksbill turtle, *Chelonia imbricata*, the smallest of the sea turtles. The plates of the back or carapace, technically called the head, are 13 in number, 5 occupying the centre, flanked by 4 on each side. These overlap each other to the extent of one-third of their whole size, and hence they attain a large size, reaching in the largest to 8 in. by 13 in., and weighing as much as 9 oz. The carapace has also 24 marginal pieces, called hoofs or claws, forming a serrated edge round it; but these, with the plates of the plastron, or belly, are of inferior value. The plates of tortoiseshell consist of horny matter, but they are harder, more brittle, and less fibrous than ordinary horn. Their value depends on the rich mottled colours they display—a warm translucent yellow, dashed and spotted with rich brown tints—and on the high polish they take and retain. The finest tortoiseshell is obtained from the Eastern Archipelago, particularly from the east coast of Celebes to New Guinea; but the creature is found and tortoiseshell obtained from all tropical coasts, large supplies coming from the West Indian Islands and Brazil.

Tortoiseshell is worked precisely as horn; but, owing to the high value of the material, care is taken to prevent any waste in its working. The plates, as separated by heat from the bony skeleton, are keeled, curved, and irregular in form. They are first flattened by heat and pressure, and superficial inequalities are rasped away. Being harder and more brittle than horn, tortoiseshell requires careful treatment in moulding it into any form, and as high heat tends to darken and obscure the material it is treated at as low a heat as practicable. For many purposes it is necessary to increase the thickness or to add to the superficial size of tortoiseshell, and this is readily done by careful cleaning and rasping of the surfaces to be united, softening the plates in boiling water or sometimes by dry heat, and then pressing them tightly together by means of heated pincers or a vice. The heat softens and liquefies a superficial film of the horny material, and that with the pressure effects a perfect union of the surfaces brought together. Heat and pressure are also employed to mould the substance into boxes and the numerous artificial forms into which it is made up.

Tortoiseshell has been a prized ornamental material from very early times. It was one of the highly esteemed treasures of the Far East brought to ancient Rome by way of Egypt, and it was eagerly sought by wealthy Romans as a veneer for their rich furniture. In modern times it is most characteristically used in the elaborate inlaying of cabinet-work known as buhl furniture, and in combination with silver for toilet articles. It is also employed as a veneer for small boxes and frames. It is cut into combs, moulded into snuff-boxes and other small boxes, formed into knife-handles, and worked up into many other similar minor articles. The plates from certain other tortoises, known commercially as turtle-shell, possess a certain industrial value, but they are either opaque or soft and leathery, and cannot be mistaken for tortoiseshell. A close imitation of tortoiseshell can be made by staining translucent horn or by varieties of celluloid.

TORTOLÌ, a town and episcopal see of Sardinia, on the east coast, 140 m. N.N.E. of Cagliari by rail (55 m. direct). Pop. (1901), 2105. It lies 60 ft. above sea-level to the south-west of a large lagoon, which renders it unhealthy. The harbour is 2½ m. to the east, and serves for the export of the wine and agricultural produce of the Ogliastra. A little to the south of Tortolì was the station of Sulci on the Roman coast road, known to us only from the itineraries.

TORTONA (anc. *Dertoña*), a town and episcopal see of Piedmont, Italy, in the province of Alessandria, from which it is 14 m. E. by rail, on the right bank of the Scrivia, at the northern foot of the Apennines, 394 ft. above sea-level. Pop. (1901), 11,308 (town); 17,419 (commune). Tortona is on the main line from Milan to Genoa; from it a main line runs to Alessandria, a branch to Castelnuovo Scrivia, and a steam tramway to Sale. Its fortifications were destroyed by the French after Marengo (1799); the ramparts are now turned into shady promenades. The cathedral, erected by Philip II., contains a remarkably fine Roman sarcophagus of the Christian period. Silk-weaving, tanning and hat-making are the chief industries; and there is some trade in wine and grain.

Dertona, which may have become a Roman colony as early as the 2nd century B.C. and certainly did so under Augustus, is spoken of by Strabo as one of the most important towns of Liguria. It stood at the point of divergence of the Via Postumia (see Liguria) and the Via Aemilia, while a branch road ran hence to Pollentia. A number of ancient inscriptions and other objects have been found here. In the middle ages Tortona was zealously attached to the Guelphs, on which account it was twice laid waste by Frederick Barbarossa, in 1155 and 1163. (T. As.)

TORTOSA, a fortified city of north-east Spain, in the province of Tarragona; 40 m. by rail W.S.W. of the city of Tarragona, on the river Ebro 22 m. above its mouth. Pop. (1900), 24,452. Tortosa is for the most part an old walled town on the left bank of the river, with narrow, crooked and ill-paved streets, in which the houses are lofty and massively built of granite. But some parts of the old town have been rebuilt, and there is a modern suburb on the opposite side of the Ebro. The slope on which old Tortosa stands is crowned with an ancient castle, which has been restored and converted into barracks and a hospital. All the fortifications are obsolete. The cathedral occupies the site of a Moorish mosque built in 914. The present structure, which dates from 1347, has its Gothic character disguised by a classical façade with Ionic pillars and much tasteless modernization. The stalls in the choir, carved by Cristobal de Salamanca in 1588–1593, and the sculpture of the pulpits, as well as the iron-work of the choir-railing and some of the precious marbles with which the chapels are adorned, deserve notice. The other public buildings include an episcopal palace, a town-hall and numerous churches. There are manufactures of paper, hats, leather, ropes, porcelain, majolica, soap, spirits, and ornaments made of palm leaves and grasses. There is an important fishery in the river, and the harbour is accessible to vessels of 100 tons burden. Corn, wine, oil, wool, silk, fruits and liquorice (a speciality of the district) are exported. The city is connected with Barcelona and Valencia by the coast railway, and with Saragossa by the Ebro valley line; it is also the terminus of a railway to San Carlos de la Rápita on the Mediterranean. Near Tortosa are rich quarries of marble and alabaster.

Tortosa, the *Dertosa* of Strabo and the *Colonia Julia Augusta Dertosa* of numerous coins, was a city of the Ilercaones in Hispania Tarraconensis. Under the Moors it was of great importance as the key of the Ebro valley. It was taken by Louis the Pious in 811 (after an unsuccessful siege two years before), but was soon recaptured. Having become a haunt of pirates, and exceedingly injurious to Italian commerce, it was made the object of a crusade proclaimed by Pope Eugenius III. in 1148, and was captured by Ramon Berenguer IV., count of Barcelona, assisted by Templars, Pisans and Genoese. An attempt to recapture the city in 1149 was defeated by the heroism of the women, who were thenceforth empowered by the count to wear the red sash of the Order of La Hacha (The Axe), to import their clothes free of duty, and to precede their bridegrooms at weddings. Tortosa fell into the hands of the duke of Orleans in 1708; during the Peninsular War it surrendered in 1811 to the French under Suchet, who held it till 1814.

TORTURE (from Lat. *torquere*, to twist), the general name for innumerable modes of inflicting pain which have been from time to time devised by the perverted ingenuity of man, and especially for those employed in a legal aspect by the civilized nations of antiquity and of modern Europe. From this point of view torture was always inflicted for one of two purposes: (1) As a means of eliciting evidence from a witness or from an accused person either before or after condemnation; (2) as a part of the punishment. The second was the earlier use, its function as a means of evidence arising when rules were gradually formulated by the experience of legal experts.

Torture as a part of the punishment may be regarded as including every kind of bodily or mental pain beyond what is necessary for the safe custody of the offender (with or without enforced labour) or the destruction of his life—in the language of Bentham, an "afflictive" as opposed to a "simple" punishment. Thus the unnecessary sufferings endured in English prisons before the reforms of John Howard, the *peine forte et dure*, and the drawing and quartering in executions for treason, fall without any straining of terms under the category of torture.

The whole subject is now one of only historical interest as far as Europe is concerned. It was, however, up to a comparatively recent date an integral part of the law of most countries (to which England, Aragon and Sweden[1] formed honourable exceptions)—as much a commonplace of law as trial by jury in England.[2] The prevailing view, no doubt, was that truth was best obtained by confession, the *regina probationum*. Where confession was not voluntary, it must be extorted. Speaking generally, torture may be said to have succeeded the ordeal and trial by battle. Where these are found in full vigour, as in the capitularies of Charlemagne, there is no provision for torture. It was no doubt accepted reluctantly as being a *quasi judicium Dei*, but tolerated in the absence of any better means of eliciting truth, especially in cases of great gravity, on the illogical assumption that extraordinary offences must be met by extraordinary remedies. Popular feeling too, says Verri, preferred, as causes of evil, human beings who could be forced to confess, rather than natural causes which must be accepted with resignation. Confession, as *probatio probatissima* and *vox vera*, was the best of all evidence, and all the machinery of law was moved to obtain it. The trials for witchcraft remain on record as a refutation of the theory.

The opinions of the best lay authorities have been almost unanimously against the use of torture, even in a system where it was as completely established as it was in Roman law. "Tormenta," says Cicero,[3] in words which it is almost impossible to translate satisfactorily, "gubernat dolor, regit quaesitor, flectit libido, corrumpit spes, infirmat metus, ut in tot rerum angustiis nihil veritati loci relinquatur." Seneca says bitterly, "it forces even the innocent to lie." St Augustine[4] recognizes the fallacy of torture. "If," says he, "the accused be innocent, he will undergo for an uncertain crime a certain punishment, and that not for having committed a crime, but because it is unknown whether he committed it." At the same time he regards it as excused by its necessity. The words of Ulpian, in the *Digest* of Justinian,[5] are no less impressive: "The torture (*quaestio*) is not to be regarded as wholly deserving or wholly undeserving of confidence; indeed, it is untrustworthy, perilous and deceptive. For most men, by patience or the severity of the torture, come so to despise the torture that the truth cannot be elicited from them; others are so impatient that they will lie in any direction rather than suffer the torture; so it happens that they depose to contradictions and accuse not only themselves but others." Montaigne's[6] view of torture as a part of the punishment is a most just one: "All that exceeds a simple death appears to me absolute cruelty; neither can our justice expect that he whom the fear of being executed by being beheaded or hanged will not restrain should be any more awed by the imagination of a languishing fire, burning pincers, or the wheel." He continues with the curious phrase: "He whom the judge has tortured (*gehenné*) that he may not die innocent, dies innocent and tortured." Montesquieu[7] speaks of torture in a most guarded manner, condemning it, but without giving reasons, and eulogizing England for doing without it. The system was condemned by Bayle and Voltaire with less reserve. Among the Germans, Sonnenfels (1766), and, among the Italians, Beccaria,[1] Verri[2] and Manzoni[3] will be found to contain most that can be said on the subject. The influence of Beccaria in rendering the use of torture obsolete was undoubtedly greater than that of any other legal reformer. The great point that he makes is the unfair incidence of torture, as minds and bodies differ in strength. Moreover, it is, says he, to confound all relations to expect that a man should be both accuser and accused, and that pain should be the test of truth, as though truth resided in the muscles and fibres of a wretch under torture. The result of the torture is simply a matter of calculation. Given the force of the muscles and the sensibility of the nerves of an innocent person, it is required to find the degree of pain necessary to make him confess himself guilty of a given crime. Bentham's[4] objection to torture is that the effect is exactly the reverse of the intention. "Upon the face of it, and probably enough in the intention of the framers, the object of this institution was the protection of innocence; the protection of guilt and the aggravation of the pressure upon innocence was the real fruit of it." The apologists of torture are chiefly among jurists. But theoretical objections to it are often urged by the authors of books of practice, as by Damhouder, von Rosbach, von Boden, Voet, and others named below under the head of *The Netherlands*. It is worthy of note as illustrative of the feeling of the time that even Bacon[5] compares experiment in nature to torture in civil matters as the best means of eliciting truth. Muyart de Vouglans[6] derives the origin of torture from the law of God. Other apologists are Simancas, bishop of Badajoz,[7] Engel,[8] Pedro de Castro,[9] and in England Sir R. Wiseman.[10]

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[1] But even in these countries, whatever the law was, torture certainly existed in fact.

[2] Primitive systems varied. There is no trace of it in Babylonian or Mosaic law, but Egyptian and Assyrian provided for it; and the story of Regulus seems to show that it was in use at Carthage.

[3] *Pro Sulla*, c. 28.

[4] *De civ. Dei*, bk. xix. c. 6.

[5] *Dig.* xlviii. 18, 23.

[6] Essay lxv. (Cotton's trans.)

[7] *Esprit des lois*, bk. vi. c. 17.

Greece.—The opinion of Aristotle was in favour of torture as a mode of proof. "It is," he says, "a kind of evidence, and appears to carry with it absolute credibility because a kind of constraint is applied." It is classed as one of the "artless persuasions" (ἄτεχνοι πίστεις).[11] "It was the surest means of obtaining evidence, says Demosthenes.[12] At Athens slaves, and probably at times resident aliens, were tortured,[13] in the former case generally with the master's consent, but torture was seldom applied to free citizens,[14] such application being forbidden by a psephism passed in the archonship of Scamandrius. After the mutilation of the Hermae in 415 B.C. a proposition was made, but not carried, that it should be applied to two senators named by an informer. In this particular case Andocides gave up all his slaves to be tortured.[15] Torture was sometimes inflicted in open court. The rack was used as a punishment even for free citizens. Antiphon was put to death by this means.[16] The torture of Nicias by the Syracusans is alluded to by Thucydides[17] as an event likely to happen, and it was only in order to avoid the possibility of inconvenient disclosures that he was put to death without torture. Isocrates and Lysias refer to torture under the generic name of *στρέβλωσις*, but it was generally called *βάσανοι*, in the plural, like *tormenta*. As might be expected, torture was frequently inflicted by the Greek despots, and both Zeno and Anaxarchus are said to have been put to it by such irresponsible authorities. At Sparta the despot Nabis was accustomed, as we learn from Polybius,[18] to put persons to death by an instrument of torture in the form of his wife Apega, a mode of torture no doubt resembling the *Jungfernkuss* once used in Germany. At Argos, as Diodorus informs us (xv. 57), certain conspirators were put to the torture in 371 B.C.[19]

Rome.—The Roman system was the basis of all subsequent European systems which recognized torture as a part of their procedure, and the rules attained a refinement beyond anything approached at Athens. The law of torture was said by Cicero to rest originally on custom (*mores majorum*), but there is no allusion to it in the Twelve Tables. There are frequent allusions to it in the classical writers,[20] both of the republic and the empire. The law, as it existed under the later empire, is contained mainly in the titles *De quaestionibus*[21] of the *Digest* and the *Code*[22]—the former consisting largely of opinions from the *Sententiae receptae* of Paulus,[23] the latter being for the most part merely a repetition of constitutions contained in the Theodosian Code.[24] Both substantive law and procedure were dealt with by these texts of Roman law, the latter, however, not as fully as in medieval codes, a large discretion being left to the judges. Torture was used both in civil and criminal trials, but in the former only upon slaves and freedmen or infamous persons (after *Nov.* xc. 1, 1, upon *ignoti* and *obscuri* if they showed signs of corruption)—such as gladiators—and in the absence of *alia manifesta indicia*,[25] as in cases affecting the inheritance (*res hereditariae*). Its place in the case of free citizens was taken by the reference to the oath of the party. During the republic torture appears to have been confined to slaves in all cases, but with the empire a free man became liable to it if accused of a crime, though in most cases not as a witness. On an accusation of treason every one, whatever his rank, was liable to torture, for in treason the condition of all was equal.[26] The same was the case of those accused of sorcery (*magi*), who were regarded as *humani generis inimici*.[27] A wife might be tortured (but only after her slaves had been put to the torture) if accused of poisoning her husband. In accusations of crimes other than treason or sorcery, certain persons were protected by the dignity of their position or their tender age. The main exemptions were contained in a constitution of Diocletian and Maximian, and included soldiers, nobles of a particular rank, *i.e. eminentissimi* and *perfectissimi*, and their descendants to the third generation, and *decuriones* and their children to a limited extent (*tormenta moderata*)—that is to say, they were subject to the torture of the *plumbatae* in certain cases, such as fraud on the revenue and extortion. In addition to these, priests (but not clergy of a lower rank), children under fourteen and pregnant women were exempt. A free man could be tortured only where he had been inconsistent in his depositions, or where there was a suspicion that he was lying.[28] The rules as to the torture of slaves were numerous and precise. It was a maxim of Roman law that torture of slaves was the most efficacious means of obtaining truth.[29] They could be tortured either as accused or as witnesses for their masters in all cases, but against their masters only in accusations of treason, adultery, frauds on the revenue, coining, and similar offences (which were regarded as a species of treason), attempts by a husband or wife on the life of the other, and in cases where a master had bought a slave for the special reason that he should not give evidence against him. The privilege from accusations by the slave extended to the master's father, mother, wife, or tutor, and also to a former master. On the same principle a freedman could not be tortured against his patron. The privilege did not apply where the slave was joint property, and one of his masters had been murdered by the other, or where he was the property of a corporation, for in such a case he could be tortured in a charge against a member of the corporation. Slaves belonging to the inheritance could be tortured in actions concerning the inheritance. The adult slaves of a deceased person could be tortured where the deceased had been murdered. In a charge of adultery against a wife, her husband's, her own and her father's slaves could be put to the torture. A slave manumitted for the express purpose of escaping torture was regarded as still liable to it. Before putting a slave to torture without the consent of his master, security must be given to the master for his value and the oath of calumny must be taken.[30] The master of a slave tortured on a false accusation could recover double his value from the accuser. The undergoing of torture had at one time a serious effect upon the after-life of the slave, for in the time of Gaius a slave who had been tortured could on manumission obtain no higher civil rights than those of a *dediticius*.[31] The rules of procedure were conceived in a spirit of as much fairness as such rules could be. Some of the most important were these: The amount of torture was at the discretion of the judge, but it was to be so applied as not to injure life or limb. If so applied the judge was *infamis*. The examination was not to begin by torture; other proofs must be exhausted first. The evidence[1] must have advanced so far that nothing but the confession of the slave was wanting to complete it. Those of weakest frame and tenderest age were to be tortured first. Except in treason, the unsupported testimony of a single witness was not a sufficient ground for torture. The voice and manner of the accused were to be carefully observed. A spontaneous confession, or the evidence of a personal enemy, was to be received with caution. Repetition of the torture could only be ordered in case of inconsistent depositions or denial in the face of strong evidence. There was no rule limiting the number of repetitions. Leading questions were not to be asked. A judge was not liable to an action for anything done during the course of the examination. An appeal from an order to torture was competent to the accused, except in the case of slaves, when an appeal could be made only by the master.[2] The appellant was not to be tortured pending the appeal, but was to remain in prison.[3] The *quaesitor* asked the questions, the *tortores* applied the instruments. The principal forms of torture in use were the *equuleus*, or rack (mentioned as far back as Cicero),[4] the *plumbatae*, or leaden balls, the *ungulae*, or barbed hooks, the *lamina*, or hot plate, the *mala mansio*,[5] and the *fidiculae*, or cord compressing the arm. Other allusions in the *Digest* and *Code*, in addition to those already cited, may be shortly noticed. The testimony of a gladiator or infamous person (such as an accomplice) was not valid without torture.[6] This was no doubt the origin of the medieval maxims (which were, however, by no means universally recognized)—*Vilitas personae est justa causa torquendi testem*, and *Tortura purgatur infamia*. Torture could not be inflicted during the forty days of Lent.[7] Robbers and pirates might be tortured even on Easter day, the divine pardon being hoped for where the safety of society was thus assured.[8] Capital punishment was not to be suffered until after conviction or confession under torture.[9] Withdrawal from prosecution (*abolitio*) was not to be allowed as a rule after the accused had undergone the torture.[10] In charges of treason the accuser was liable to torture if he did not prove his case.[11] The infliction of torture, not judicial, but at the same time countenanced by law, was at one time allowed to creditors. They were allowed to keep their debtors in private prisons, and most cruelly ill-use them, in order to extort payment.[12] Under the empire private prisons were forbidden.[13] In the time of Juvenal the Roman ladies actually hired the public torturers to torture their domestic slaves.[14] As a part of the punishment torture was in frequent use. Crucifixion, mutilation, exposure to wild beasts in the arena and other cruel modes of destroying life were common, especially in the time of the persecution of the Christians under Nero.[15] Crucifixion as a punishment was abolished by Constantine in 315, in veneration of the memory of Him who was crucified for mankind. On the other hand, where the interests of the Church were concerned the tendency was in favour of greater severity. Thus, by the Theodosian Code, a heretic was to be flogged with lead (*contusus plumbo*) before banishment,[16] and Justinian made liable to torture and exile any one insulting a bishop or priest in a church, or saying litany, if a layman.[17]

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[1] *Dei Delitti e delle pene*, c. xvi.

[2] *Osservazioni sulla tortura.*

[3] *Storia della Colonna infame.*

[4] *Works*, vii. 525.

[5] *Nov. Org.*, bk. i. aph. 98. In the *Advancement of Learning*, bk. iv. ch. 4, Bacon collects many instances of constancy under torture.

[6] *Instituts du droit criminel* (Paris, 1757).

[7] *De catholicis institutionibus liber, ad praecavendas et extirpandas haereses admodum necessarius* (Rome, 1575).

[8] *De tortura ex foris christianis non proscribenda* (Leipzig, 1733).

[9] *Defensa de la tortura* (Madrid, 1778).

[10] *Law of Laws*, p. 122 (London, 1686).

[11] *Rhet.* i. 15, 26.

[12] *In Onetum*, i. 874.

[13] Usually by the diaetetae in the Hephaestaeum, Isocrates, *Trapez.* 361.

[14] The opinion of Cicero (*De partitionibus oratoriis*, § 34), that it was so applied at Athens and Rhodes, seems, as far as regards Athens, not to be justified by existing evidence.

[15] The demand for, or the giving up of, a slave for torture was called πρόκλησις εἰς βάσανον.

[16] In the *Ranae* of Aristophanes, v. 617, there is a list of kinds of torture, and the wheel is alluded to in *Lysistrata*, v. 846.

[17] vii. 86.

[18] xiii. 7.

[19] For the whole subject, see *Dict. Ant.*, *s.v. Tormenta.*

[20] An instance is Pliny's letter to Trajan (*Epist.* x. 97), where he mentions having put to the torture two Christian deaconesses (*ministrae*). The words are *confitentes iterum ac tertio interrogavi.* This supports Tertullian's objection to the torture of Christians, *torquemur confitentes* (*Apol.* c. 2).

[21] *Quaestio* included the whole process of which torture was a part. In the words of Cujacius, *Quaestio est interrogatio quae fit per tormenta, vel de reis, vel de testibus qui facto intervenisse dicuntur.*

[22] *Dig.* xlviii. 18; *Cod.* ix. 41.

[23] v. 14, 15, 16.

[24] ix. 35.

[25] *Cod.* ix. 8, 3.

[26] Ibid. ix. 8, 4.

[27] Ibid. ix. 18, 7.

[28] Ibid. iv. 20, 13.

[29] Ibid. i. 3, 8.

[30] Ibid. ii. 59, 1, 1. The demand of another man's slave for torture was *postulare.*

[31] Gaius i. 13.

The *Leges barbarorum* are interesting as forming the link of connexion between the Roman and the medieval systems. Through them the Roman doctrines were transmitted into the Roman law countries. The barbarian codes were based chiefly on the Theodosian Code. As compared with Roman law there seems to be a leaning towards humanity, *e.g.* the provision for redemption of a slave after confession by s. 40 of the *Lex salica*. After the edict of Gundobald in 501 the combat rather than the torture became the expression of the *judicium Dei*.

The Church.—As far as it could the Church adopted the Roman law. The Church generally secured the almost entire immunity of its clergy, at any rate of the higher ranks, from torture by civil tribunals;[18] but in general, where laymen were concerned all persons were equal. In many instances councils of the Church pronounced against torture, *e.g.* in a synod at Rome in 384.[19] Torture even of heretics seems to have been originally left to the ordinary tribunals. Thus a bull of Innocent IV., in 1282, directed the torture of heretics by the civil power, as being robbers and murderers of souls, and thieves of the sacraments of God.[20] The Church also enjoined torture for usury.[21] A characteristic division of torture, accepted by the Church, but not generally acknowledged by lay authorities, was into spiritual and corporal, the latter being simply the imposition of the oath of purgation, the only form originally in use in the ecclesiastical courts. The canon law contains little on the subject of torture, and that little of a comparatively humane nature. It laid down that it was no sin in the faithful to inflict torture,[22] but a priest might not do so with his own hands,[23] and charity was to be used in all punishments.[24] No confession was to be extracted by torture[25] and it was not to be ordered *indiciis non praecedentibus*.[26] The principal ecclesiastical tribunal by which torture was inflicted in more recent times was the Inquisition. The code of instructions issued by Torquemada in Spain in 1484 provided that an accused person might be put to the torture if *semiplena probatio* existed against the accused—that is, so much evidence as to raise a grave and not merely a light presumption of guilt, often used for the evidence of one eye or ear witness of a fact. If the accused confessed during torture, and afterwards confirmed the confession, he was punished as convicted; if he retracted, he was tortured again, or subjected to extraordinary punishment. One or two inquisitors, or a commissioner of the Holy Office, were bound to be present at every examination. Owing to the occurrence of certain cases of abuse of torture, a decree of Philip II. was issued, in 1558, forbidding the administration of torture without an order from the council. But this decree does not appear to have been fully observed. By the edict of the inquisitor-general Valdés, in 1561, torture was to be left to the prudence and equity of the judges. They must consider motives and circumstances before decreeing torture, and must declare whether it is to be employed *in caput proprium*, *i.e.* to extort a confession, or *in caput alienum*, *i.e.* to incriminate an accomplice. Torture was not to be decreed until the termination of the process and after defence heard, and the decree was subject to appeal, but only in doubtful cases, to the Council of the Supreme. It was also only in doubtful cases that the inquisitors were bound to consult the council; where the law was clear (and of this they were the judges) there need be no consultation, and no appeal was allowed. On ratification twenty-four hours afterwards of a confession made under torture, the accused might be reconciled, if the inquisitors believed him to be sincerely repentant. If convicted of bad faith he might be relaxed, *i.e.* delivered to the secular power to be burned. The inquisitors had a discretion to allow the accused to make the canonical purgation by oath instead of undergoing corporal torture, but the rule which allows this to be done at the same time discountenances it as fallacious. It is remarkable that the rules do not allow much greater efficacy to torture. They speak of it almost in the terms of Roman law as dangerous and uncertain, and depending for its effects on physical strength.[27] Torture had ceased to be inflicted before the suppression of the Inquisition, and in 1816 a papal bull decreed that torture should cease, that proceedings should be public, and that the accuser should be confronted with the accused. The rules in themselves were not so cruel as the construction put upon them by the inquisitors. For instance, by Torquemada's instructions torture could not be repeated unless in case of retractation. This led to the subtlety of calling a renewed torture a continuation, and not a repetition. The rules of Torquemada and of Valdés are those of the greatest historical importance, the latter forming the code of the Holy Office until its suppression, not only in Spain, but in other countries where the Inquisition was established. But several other manuals of procedure existed before the final perfection of the system by Valdés. The earliest is perhaps the instructions for inquisitors (*Directorium inquisitorum*) compiled a century earlier than Torquemada by Nicholas Eymerico, grand inquisitor of Aragon about 1368.[1] Rules of practice were also framed two centuries later by Simancas, whose position as an apologist has been already stated. The textbook of procedure of the Italian Inquisition was the *Sacro arsenale.*[2] In 1545 and 1550 instructions for the guidance of inquisitors were issued by Charles V. The liability of a judge for exceeding the law was not always recognized by the Inquisition to the same extent as by the lay tribunals. Llorente gives an instance of a warrant by an inquisitor to a licentiate ordering the torture of an accused person, and protesting that, in case of death or fracture of limbs, the fact is not to be imputed to the licentiate.[3]

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[1] The evidence on which the accused might be tortured was expressed in Roman law by the terms *argumentum* and *indicium* (used technically as early as Cicero, *Verres*, i. 10 and 17). The latter term, as will be seen, afterwards became one of the most important in the law of torture, but the analysis of *indicium* is later than Roman law. *Indicium* was not quite the same thing as *semiplena probatio*, though the terms appear to be occasionally used as synonyms. *Indicium* was rather the foundation or cause of *probatio*, whether *plena* or *semiplena*. An *indicium* or a concurrence of *indicia* might, according to circumstances, constitute a *plena* or *semiplena probatio*. The phrase *legitima indicia* was sometimes used. In Sir T. Smith's work, c. 24 (see below), *index* means a prisoner acting as an approver under torture. *Tormentum*, *tortura* and *quaestio* appear to be equivalent terms. The medieval jurists derived the first of these from *torquere mentem*, an etymology as false as *testamentum* from *testatio mentis* (*Inst.* ii. 10 pr.).

[2] *Dig.* xlix. i. 15.

[3] *Cod.* vii. 62, 12.

[4] *Milo*, lvii.

[5] Of doubtful meaning, but perhaps like the "Little Ease" of the Tower of London.

[6] *Dig.* xxii. 5, 21, 2.

[7] *Cod.* iii. 12, 6.

[8] Ibid. iii. 12, 10.

[9] Ibid. ix. 47, 16.

[10] Ibid. ix. 42, 3.

[11] Ibid. ix. 8, 3.

[12] See, for instance, Livy vi. 36.

[13] *Cod.* i. 4, 23; ix. 5.

[14] Ibid. vi. 480.

[15] As an example of such punishments, cf. the well-known lines of Juvenal (*Sat.* i. 155):—

"Taeda lucebis in illa,
Qua stantes ardent qui fixo gutture fumant."

For other poetical allusions, see vi. 480, xiv. 21; Lucr. iii. 1030; Propert. iv. 7, 35.

[16] xvi. 53.

[17] *Nov.* cxxiii. 31. On the subject of torture in Roman law reference may be made to Wasserscheben, *Historia quaestionum per tormenta apud Romanos* (Berlin, 1836); H. Wallon. *Histoire de l'esclavage dans l'antiquité* (Paris, 1879); Mommsen, *Römisches Strafrecht*, iii. 5 (Leipzig, 1899); Greenidge, *Legal Procedure of Cicero's Time*, p. 479 (Oxford, 1901).

[18] See Escobar, *Theol. Mor.* tract. vi. c. 2. They were to be tortured only by the clergy, where possible, and only on *indicia* of special gravity.

[19] Lea, *Superstition and Force*, p. 419 (3rd ed., Philadelphia, 1878).

[20] *Leges et constitutiones contra haereticos*, § 26.

[21] Lecky, *Rationalism in Europe*, ii. 34.

[22] *Decretum*, pt. ii. 23, 4, 45.

[23] Ibid. pt. i. 86, 25.

[24] Ibid. pt. ii. 12, 2, 11.

[25] Ibid. pt. ii. 15, 6, 1.

[26] *Decretals*, v. 41, 6.

[27] The rules will be found in H. C. Lea, *Hist. of the Inquisition of Spain* (1906). See also *Hist. of the Inquisition of the Middle Ages* (New York, 1888) by the same writer; R. Schmidt, *Die Herkunft des Inquisitionsprocesses* (Berlin, 1902).

Thus far of the law. In practice all the ingenuity of cruelty was exercised to find new modes of torment.[4] These cruelties led at times to remonstrance from the civil power. One example is the edict of Philip II. just mentioned. Another and an earlier one is an *ordonnance* of Philip the Fair, in 1302, bidding the Inquisition confine itself within the limits of the law.[5] At Venice the senate decreed that three senators should be present as inquisitors.

As the practice of torture became more systematized, it grew to be the subject of casuistical inquiry by churchmen to an extent far exceeding the scanty discussion of the question in the text of the canon law. It will be sufficient here to cite as an example the treatment of it by Liguori, who incorporates the opinions of many of the Spanish casuists. On the whole, his views appear to be more humane than the prevailing practice. The object of torture he defines very neatly as being to turn *semiplena* into *plena probatio.* For this proper *indicia* are necessary. He then proceeds to decide certain questions which had arisen, the most interesting of which deal with the nature of the sin of which the accused and the judge are guilty in particular instances. A judge sins gravely if he does not attempt all milder means of discovering truth before resorting to torture. He sins in a criminal cause, or in one of notable infamy, if he binds the accused by oath to tell the truth before there is proof against him. It is the same if without oath he uses threats, terror or exhibition of torments to confound the witness.[6] If any one, to avoid grave torments, charges himself with a capital crime, he does not sin mortally.[7] It was a doubtful question whether he sinned gravely in such a case. Escobar at an earlier date supported the morally dangerous view that an inquisitor may follow a probable opinion in ordering torture, relinquishing a more probable.[8]

England.—It is the boast of the common law of England that it never recognized torture as legal. One, perhaps the chief, reason for this position taken by the law is the difference of the nature of the procedure in criminal cases from that in general use in European countries. To use words more familiar in foreign jurisprudence, the English system is *accusatorial* as distinguished from *inquisitorial.* In the former the accuser has to prove guilt, in the latter the accused has to prove innocence. The common law of England has always shown itself averse from the inquisitorial system, and so (at least in theory) to the torture which may be regarded as an outcome of the system whose one end was to obtain a confession from the accused. The tendency of the small amount of statute law bearing on the subject is in the same direction. It was provided by Magna Carta, § 29, " that no free man . . . should be destroyed in any way unless by legal judgment of his equals or by the law of the land." On this Sir E. Coke comments, " No man destroyed, &c., that is, forejudged of life or limb, disinherited, or put to torture or death."[9] The act of 27 Hen. VIII. c. 4 enacted that, owing to the frequent escape of pirates in trials by the civil law, " the nature whereof is that before any judgment of death can be given against the offenders they must plainly confess their offence (which they will never do without torture or pains)," such persons should be tried by jury before commissioners under the Great Seal. Finally, the Bill of Rights provided that cruel and unusual punishments ought not to be inflicted. The opinions of the judges have been invariably against torture in theory, however much some of them may have been led to countenance it in practice. The strongest authority is the resolution of the judges in Felton's case (1628), " that he ought not by the law to be tortured by the rack, for no such punishment is known or allowed by our law."[10] In accordance with this are the opinions of Sir John Fortescue,[11] Sir Thomas Smith[12] and Sir E. Coke. The latter says, " As there is no law to warrant tortures in this land, nor can they be justified by any prescription, being so lately brought in."[13] In spite of all this, torture in criminal proceedings was inflicted in England with more or less frequency for some centuries, both as a means of obtaining evidence and as a part of the punishment. But it should be remarked that torture of the former kind was invariably ordered by the Crown or council, or by some tribunal of extraordinary authority, such as the Star Chamber, not professing to be bound by the rules of the common law. In only two instances was a warrant to torture issued to a common law judge.[14]

A licence to torture is found as early as the Pipe Roll of 34 Hen. II.[15] The Templars were tortured in 1310 by royal warrant addressed to the mayor and sheriffs of London.[16] In this case it is recorded that torture was unknown in England, and that no torturer was to be found in the realm.[17] A commission was issued concerning the tortures at Newgate in 1334.[18] The rack in the Tower is said to have been introduced by the duke of Exeter in the reign of Henry VI., and to have been thence called "the duke of Exeter's daughter."[19] In this reign torture seems to have taken its place as a part of what may be called extraordinary criminal procedure, claimed, and it may be said tacitly recognized, as exercisable by virtue of the prerogative, and continued in use down to 1640.[20] The infliction of torture gradually became more common under the Tudor monarchs. Under Henry VIII. it appears to have been in frequent use. Only two cases are recorded under Edward VI., and eight under Mary.[21] The reign of Elizabeth was its culminating point. In the words of Hallam, " the rack seldom stood idle in the Tower for all the latter part of Elizabeth's reign."[22] The varieties of torture used at this period are fully described by Dr Lingard,[23] and consisted of the rack, the scavenger's daughter,[24] the iron gauntlets or bilboes, and the cell called " Little Ease." The registers of the council during the Tudor and early Stuart reigns are full of entries as to the use of torture, both for state and for ordinary offences.[25] Among notable prisoners put to the torture were Anne Askew, the Jesuit Campion, Guy Fawkes[26] and Peacham (who was examined by Bacon " before torture, in torture and after torture ").[27] The prevalence of torture in Elizabeth's reign led to the well-known defence attributed to Lord Burghley, " A declaration of the favourable dealing of Her Majesty's commissioners appointed for the examination of certain traitors, and of tortures unjustly reported to be done upon them for matter of religion," 1583.[28] The use of torture in England being always of an extraordinary and extra-judicial nature, it is comparatively certain that it could hardly have been applied with that observation of forms which existed in countries where it was regulated by law. There were no rules and no responsibility beyond the will of the Crown or council. This irresponsibility is urged by Selden[1] as a strong objection to the use of torture. The main differences between the infliction of torture in England and on the continent of Europe seem to be that English lawyers made no distinction of those liable to it, never allowed torture of witnesses, and elaborated no subtle rules as to *plena* and *semiplena probatio*.

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[1] An edition was published at Rome in 1558, and a compendium at Lisbon in 1762, and by Marchena at Montpellier in 1821.

[2] It was by Father Masini, and went through numerous editions (complete or compendia) from 1558 to 1730. Among other manuals of practice were those of Carenas Caesar (1655), Morellet (1762).

[3] Llorente c. xiv.

[4] Among others were the gradual pouring of water drop by drop on a particular spot of the body, the *tormento de toca,* or pouring of water into a gauze bag in the throat, which gradually forced the gauze into the stomach, and the *péndola,* or swinging pendulum, so graphically described in one of Edgar Poe's tales.

[5] *Ordonnances des rois,* i. 346.

[6] *Theol. mor.* bk. ix. § 202.

[7] Ibid. § 274.

[8] Ibid. v. 3 and 7.

[9] 2 *Inst.* 48 b.

[10] 3 *State Trials,* 371.

[11] *De laudibus legum Angliae,* c. 22.

[12] *Commonwealth of England,* bk. ii. c. 27 (1583; ed. by L. Alston, 1906). It is curious that Sir T. Smith, with all his hatred of torture, was directed by a warrant under the queen's seal alone (not through the council) to torture the duke of Norfolk's servants in 1571. In a letter to Lord Burghley he pleaded for exemption from so hateful a task.

[13] 3 *Inst.* 35. Nevertheless, in the trials of Lord Essex and Southampton, Coke is found extolling the queen's mercy for not racking or torturing the accused (1 *State Trials,* 1338). (See further authorities in Pollock and Maitland, *Hist. of English Law,* ii. 656.)

[14] Jardine, *Reading on the Use of Torture in the Criminal Law of England* (1837), p. 52.

[15] L. O. Pike, *Hist. of Crime in England,* i. 427.

[16] Rymer, *Foedera,* iii. 228, 232.

[17] Walter of Hemingford, p. 256.

[18] Pike i. 481.

[19] 3 *Inst.* 34.

[20] This is the date of the latest warrant in Jardine's work, but it was used on three Portuguese at Plymouth during the Commonwealth (Thurloe iii. 298).

[21] It is to be noticed, as Jardine observes, that all these are cases of an ordinary nature, and afford no ground for the assertions made by Strutt and Bishop Burnet that torture was used to heretics as heretics.

[22] *Const. Hist.* i. 201.

[23] *Hist. of England,* vol. viii. app. note v.

[24] These two were exactly opposite in principle. The rack stretched the limbs of the sufferer; the scavenger's daughter compressed him into a ball.

[25] Fifty-five of these will be found in the appendix to Mr Jardine's work. An ordinary robber of plate was threatened with torture in 1567.—Froude, *Hist. of England,* viii. 386.

[26] It is not certain whether he was racked, but probably he was, in accordance with the king's letter: " If he will not otherwise confess the gentlest tortures are to be first used to him, and so on, step by step, to the most severe, and so God speed the good work."

[27] Dalrymple, *Memoirs and Letters of James I.* p. 85; Macaulay's essay on the works of Bacon.

[28] Lord Somers's *Tracts,* i. 189.

So far of what may be called torture proper, to which the common law professed itself a stranger. There were, however, cases fully recognized by the common law which differed from torture only in name. The *peine forte et dure* was a notable example of this. If a prisoner stood mute of malice instead of pleading, he was condemned to the *peine*, that is, to be stretched upon his back and to have iron laid upon him as much as he could bear, and more, and so to continue, fed upon bad bread and stagnant water through alternate days until he pleaded or died.[2] It was abolished by 12 Geo. III. c. 20. 7 and 8 Geo. IV. c. 28 enacted that a plea of "not guilty" should be entered for a prisoner so standing mute. A case of *peine* occurred as lately as 1726. At times tying the thumbs with whip-cord was used instead of the *peine*. This was said to be a common practice at the Old Bailey up to the 18th century.[3] In trials for witchcraft the legal proceedings often partook of the nature of torture, as in the throwing of the reputed witch into a pond to see whether she would sink or swim, in drawing her blood,[4] and in thrusting pins into the body to try to find the insensible spot. Confessions, too, appear to have been often extorted by actual torture, and torture of an unusual nature, as the devil was supposed to protect his votaries from the effects of ordinary torture.

Torture as a part of the punishment existed in fact, if not in name, down to a very recent period. Mutilation as a punishment appears in some of the pre-Conquest codes, such as those of Alfred, Æthelstan and Canute, in the laws attributed to William the Conqueror and in the assize of Northampton (1176). Bracton, who does not notice torture as a means of obtaining evidence, divides corporal punishment into that inflicted with and without torture.[5] Later instances are the punishment of burning to death inflicted on heretics under the Six Articles (31 Hen. VIII. c. 14) and other acts, and on women for petit treason (abolished by 30 Geo. III. c. 48), the mutilation inflicted for violence in a royal palace by 33 Hen. VIII. c. 12, the punishment for high treason, which existed nominally until 1870, the pillory (abolished by 7 Will. IV. and 1 Vict. c. 23), the stocks, branks and cucking-stool, and the burning in the hand for felony (abolished by 19 Geo. III. c. 74). Corporal punishment now exists only in the case of juvenile offenders and of robbery with violence. It was abolished in the army by the Army Act 1881.[6] Cruelty in punishment did not entirely cease in prisons even after the Bill of Rights. See such cases as *R.* v. *Huggins*, 17 *State Trials*, 298; *Castell* v. *Bambridge*, 2 *Strange's Rep.* 856.

Scotland.—Torture was long a recognized part of Scottish criminal procedure, and was acknowledged as such by many acts and warrants of the Scottish parliament and warrants of the Crown and the privy council. Numerous instances occur in the *Register of the Privy Council*.[7] Two acts in 1649 dealt with torture; one took the form of a warrant to examine witnesses against William Barton by any form of probation,[8] the other of a warrant to a committee to inquire as to the use of torture against persons suspected of witchcraft.[9] The judges in 1689 were empowered by the estates to torture Chiesly of Dalrye, charged with the murder of the lord president Lockhart, in order to discover accomplices. In the same year the use of torture without evidence or in ordinary cases was declared illegal in the Claim of Right. The careful wording of this will be noticed: it does not object to torture altogether, but reserves it for cases where a basis of evidence had already been laid, and for crimes of great gravity, thus admitting the dangerous principle, founded on Roman law, that the importance of the crime is a reason for departing from the ordinary rules of justice. However great the crime, it is no more certain than in the case of a crime of less gravity that the person accused was the person who committed it. A warrant issued in the same year to put to the torture certain persons accused of conspiring against the government, and also certain dragoons suspected of corresponding with Lord Dundee. In 1690 an act passed reciting the torture of William Carstares, a minister, in 1683, and re-establishing his competency as a witness.[10] The last warrant appears to be one in 1690 for torturing a man accused of rape and murder. In 1708 torture in Scotland was finally abolished by 7 Anne c. 21, s 5. Many details of the tortures inflicted will be found in Pitcairn's *Criminal Trials*, the introduction to J. Maclaurins' *R. Criminal Cases* and J. H. Burton's *Narratives from Criminal Trials*. Among other varieties—the nature of some of them can only be guessed—were the rack, the pilniewinkis, the boot,[11] the caschie-laws, the lang irnis, the narrow-bore, the pynebankis, and worst of all, the waking, or artificial prevention of sleep.[12] The ingenuity of torture was exercised in a special degree on charges of witchcraft, notably in the reign of James VI., an expert both in witchcraft and in torture. The act of 1649 already cited shows that the principle survived him. Under the government of the dukes of Lauderdale and York torture as a practice in charges of religious and political offences reached its height. "The privy council was accustomed to extort confessions by torture; that grim divan of bishops, lawyers and peers sucking in the groans of each undaunted enthusiast, in hope that some imperfect avowal might lead to the sacrifice of other victims, or at least warrant the execution of the present."[13] With such examples before them in the law, it is scarcely to be wondered at that persons in positions of authority, especially the nobility, sometimes exceeded the law and inflicted torture at their own will and for their own purposes. There are several instances in the *Register of the Privy Council* of suits against such persons, *e.g.* against the earl of Orkney, in 1605, for putting a son of Sir Patrick Bellenden in the boots.

Ireland seems to have enjoyed comparative immunity from torture. It was not recognized by the common or statute law, and the cases of its infliction do not appear to be numerous. In 1566 the president and council of Munster, or any three of them, were empowered to inflict torture, "in cases necessary, upon vehement presumption of any great offence in any party committed against the Queen's Majesty."[14] In 1583 Hurley, an Irish priest, was tortured in Dublin by "toasting his feet against the fire with hot boots."[15] In 1627 the lord deputy doubted whether he had authority to put a priest named O'Cullenan to the rack. An answer was returned by Lord Killultagh to the effect that "you ought to rack him if you saw cause and hang him if you found reason."[16] The latest case of *peine forte et dure* seems to have been in 1740.

British Colonies and Dependencies.—The infliction of torture in any British colony or dependency has usually been regarded as contrary to law, and ordered only by arbitrary authority. It is true that in the trial of Sir Thomas Picton in 1806, for subjecting, while governor of Trinidad, a woman named Luisa Calderon to the torture of the picquet,[17] one of the grounds of defence was that such torture was authorized by the Spanish law of the island, but the accused was convicted in spite of this defence, and the final decision of the court of king's bench, in 1812, decreeing a respite of the defendant's recognizances till further order, was perhaps not so much an affirmation of the legality in the particular instance as the practical expression of a wish to spare an eminent public servant.[18] As to India, the second charge against Warren Hastings was extortion from the begums of Oude by means of the torture of their servants.[19] In the present Indian Penal Code and Evidence Acts there are provisions intended, as Sir James Stephen says,[20] to prevent the practice of torture by the police for the purpose of extracting confessions from persons in their custody.[21] In Ceylon torture, which had been allowed under the Dutch government, was expressly abolished by royal proclamation in 1799.

In the Channel Islands confessions of persons accused of witchcraft in the 17th century were frequently obtained by torture.[22]

United States.—One instance of the *peine forte et dure* is known. It was inflicted in 1692 on Giles Cory of Salem, who refused to plead when arraigned for witchcraft.[23] The constitution of the United States provides, in the words of the Bill of Rights, that cruel and unusual punishments are not to be inflicted.[24] This is repeated in the constitutions of most states. The infliction of cruel and unusual punishment by the master or officer of an American vessel on the high seas, or within the maritime jurisdiction of the United States, is punishable with fine or imprisonment, or both.[25] There have been a good many decisions on the question of cruel and unusual punishments; *e.g. Wilkerson* v. *Utah*, 99 U.S. Rep. 130;

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[1] *Table Talk*, "Trial."

[2] Stephen, *Hist. of the Criminal Law*, i. 297.

[3] Stephen i. 300; Kelyng, *Reports*, p. 27.

[4] The superstition was that any one drawing a witch's blood was free from her power. This is alluded to in *Henry VI.* pt. i. act i. sc. 5; "Blood will I draw on thee; thou art a witch."

[5] 104*b*.

[6] 44 Vict. c. 9, s 7.

[7] *E.g.* i. 525, iv. 680, vi. 156.

[8] c. 333.

[9] c. 370.

[10] The thumbscrew with which Carstares had been tortured was afterwards presented to him as a remembrance by the privy council.

[11] Persons subjected to more than usual torture from the boot were said to be "extremely booted."

[12] This seems to have been used in one case in England. Lecky, *Rationalism in Europe*, i. 122.

[13] Hallam, *Const. Hist.* iii. 436. See Burnet, *Hist. of Own Time*, i. 583; and SCOTLAND.

[14] Froude, *Hist. of England*, viii. 386.

[15] Ibid xi. 263.

[16] Jardine, p. 54.

[17] In the picquet the sufferer was supported only on the great toe (which rested on a sharp stake), and by a rope attached to one arm.

[18] 30 *State Trials*, 449, besides many pamphlets of the period.

[19] See the *Report of the Proceedings*, vol. i.

[20] Stephen, *Indian Evidence Act*, p. 126.

[21] Sections 327–331 of code; ss. 25–27 of act.

[22] J. L. Pitts, *Witchcraft in the Channel Islands*, p. 9 (Guernsey, 1886).

[23] Bouvier, *Law Dict.*, *s.v.* "Peine forte et dure."

[24] Amendments, art. viii. (1789).

[25] *Revised Stat.* 5347.

Territory of New Mexico v. *Ketchum*, 65 Pacific Rep. 169 (death penalty for train robbery held not unconstitutional).

Continental European States.—These fall into four main groups, the Latin, Teutonic, Scandinavian and Slav states respectively. The principles of Roman law were generally adopted in the first and second groups.

Latin States.—In France torture does not seem to have existed as a recognized practice before the 13th century. From that period until the 17th century it was regulated by a series of royal *ordonnances* at first of local obligation, afterwards applying to the whole kingdom. Torture was used only by the royal courts, its place in the seigneurial courts being supplied by the judicial combat. The earliest *ordonnance* on the subject was that of Louis IX. in 1254 for the reformation of the law in Languedoc. It enacted that persons of good fame, though poor, were not to be put to the question on the evidence of one witness.[1] Numerous other provisions were made between 1254 and 1670, when an *ordonnance* was passed under Louis XIV., which regulated the infliction of torture for more than a century. Two kinds were recognized, the *question préparatoire* and the *question préalable.* The first was used where strong evidence of a capital crime—strong, but of itself insufficient for conviction—was produced against the accused. The second was used to obtain a confession of accomplices after conviction. There was also a mitigated form called the presentment, in which the accused was simply bound upon the rack *in terrorem* and there interrogated. No person was exempt on the ground of dignity, but exemption was allowed to youths, old men, sick persons and others. Counsel for the accused were usually not allowed. The *question préparatoire* was abolished by royal decree in 1780, but in 1788 the parliaments refused to register a decree abolishing the *préalable.* But torture of all kinds was abolished by an *ordonnance* in 1789. The Declaration of Right in 1791 (art. viii.) affirmed that the law ought not to establish any punishments other than such as are strictly and evidently necessary. In modern law the *code pénal* enacts that all criminals shall be punished as guilty of assassination who for the execution of their crimes employ torture.[2] The code also makes it punishable to subject a person under arrest to torture.[3] The theory of *semiplena probatio* was worked out with more refinement than in other systems. In some parts of France not only were half-proofs admitted, but quarters and eighths of proofs.[4] Among the numerous cases of historical interest were those of the Templars in 1307, Villon about 1457, Dolet in 1546, the marquise de Brinvilliers in 1676 and Jean Calas in 1762.[5]

The law as it existed in Italy is contained in a long line of authorities chiefly supplied by the school of Bologna, beginning with the *glossatores* and coming down through the *post-glossatores*, until the system attained its perfection in the vast work of Farinaccius, written early in the 17th century, where every possible question that could arise is treated with a revolting completeness. One of the earliest jurists to treat it was Cino da Pistoia, the friend of Dante.[6] He treats it at no great length. With him the theory of *indicia* exists only in embryo, as they cannot be determined by law but must be at the discretion of the judge. Differing from Bartolus, he affirms that torture cannot be repeated without fresh *indicia.* The writings of jurists were supplemented by a large body of legislative enactments in most of the Italian states, extending from the constitutions of the emperor Frederick II. down to the 18th century. It is not until Bartolus (1314–1357) that the law begins to assume a definite and complete form. In his commentary on book xlviii. of the *Digest* he follows Roman law closely, but introduces some further refinements: *e.g.* though leading questions may not be asked in the main inquiry they are admissible as subsidiary. There is a beginning of classification of *indicia.* A very full discussion of the law is contained in the work on practice of Hippolytus de Marsiliis,[7] a jurist of Bologna, notorious, on his own admission, as the inventor of the torture of keeping without sleep. He defines the question as *inquisitio veritatis per tormenta et cordis dolorem*, thus recognizing the mental as well as the physical elements in torture. It was to be used only in capital cases and atrocious crimes. The works of Farinaccius and of Julius Clarus nearly a century later were of great authority from the high official positions filled by the writers. Farinaccius was procurator-general to Pope Paul V., and his discussion of torture is one of the most complete of any.[8] It occupies 251 closely printed folio pages with double columns. The length at which the subject is treated is one of the best proofs of the science to which it had been reduced. The chief feature of the work is the minute and skilful analysis of *indicia, fama, praesumptio*, and other technical terms. Many definitions of *indicium* are suggested, the best perhaps being *conjectura ex probabilibus et non necessariis orta, a quibus potest abesse veritas sed non verisimilitudo.* For every infliction of torture a distinct *indicium* is required. A single witness or an accomplice constitutes an *indicium.* But this rule does not apply where it is inflicted for discovering accomplices or for discovering a crime other than that for which it was originally inflicted. Torture may be ordered in all criminal cases, except small offences, and in certain civil cases, such as denial of a *depositum*, bankruptcy, usury, treasure trove, and fiscal cases. It may be inflicted on all persons, unless specially exempted (clergy, minors, &c.), and even those exempted may be tortured by command of the sovereign. There are three kinds of torture, *levis, gravis* and *gravissima*, the first and second corresponding to the ordinary torture of French writers, the last to the extraordinary. The extraordinary or *gravissima* was as much as could possibly be borne without destroying life. The judge could not begin with torture; it was only a *subsidium.* If inflicted without due course of law, it was void as a proof. The judge was liable to penalties if he tortured without proper *indicia*, if a privileged person, or if to the extent that death or permanent illness was the result. An immense variety of tortures is mentioned, and the list tended to grow, for, as Farinaccius says, judges continually invented new modes of torture to please themselves. Numerous casuistical questions are treated at length, such as, what kinds of reports or how much hearsay evidence constituted fame? Were there three or five grades in torture? Julius Clarus of Alessandria was a member of the council of Philip II. To a great extent he follows Farinaccius. He puts the questions for the consideration of the judge with great clearness. They are—whether (1) a crime has been committed, (2) the charge is one in which torture is admissible, (3) the fact can be proved otherwise, (4) the crime was secret or open, (5) the object of the torture is to elicit confession of crime or discovery of accomplices. The clergy can be tortured only in charges of treason, poisoning and violation of tombs. On the great question whether there are three or five grades, he decides in favour of five, viz. threats, taking to the place of torment, stripping and binding, lifting on the rack, racking.[9] Other Italian writers of less eminence have been referred to for the purposes of this article. The burden of their writings is practically the same, but they have not attained the systematic perfection of Farinaccius. Citations from many of them are made by Manzoni (see below). Among others are Guido de Suzara, Paris de Puteo, Aegidius Bossius of Milan, Casonus of Venice, Decianus, Follerius and Tranquillus Ambrosianus, whose works cover the period from the 13th to the end of the 17th century. The law depended mainly on the writings of the jurists as interpreters of custom. At the same time in all or nearly all the Italian states and colonies[10] the customary law was limited, supplemented, or amended by legislation. That a check by legislative authority was necessary appears from the glimpses afforded by the writings of the jurists that the letter of the law was by no means always followed. The earliest legislation after the Roman law seems to be the constitutions of the emperor Frederick II. for Sicily promulgated in 1231. Torture was abolished in Tuscany in 1786, largely owing to the influence of Beccaria, whose work first appeared in 1764, and other states followed, but the *puntale* or piquet seems to have existed in practice at Naples up to 1859.

Several instances of the torture of eminent persons occur in Italian history, such as Savonarola, Machiavelli, Giordano Bruno, Campanella. Galileo appears to have only been threatened with the *esame rigoroso.* The historical case of the greatest literary interest is that of the persons accused of bringing the plague into Milan in 1630 by smearing the walls of houses with poison. An analysis of the case was undertaken by Verri[11] and Manzoni,[12] and puts in a clear light some of the abuses to which the system led in times of popular panic. Convincing arguments are urged by Manzoni, after an exhaustive review of the authorities, to prove the groundlessness of the charge on which two innocent persons underwent the torture of the *canape*, or hempen cord (the effect of which was partial or complete dislocation of the wrist), and afterwards suffered death by breaking on the wheel. The main arguments, shortly stated, are these, all based upon the evidence as recorded, and the law as laid down by jurists. (1) The unsupported evidence of an accomplice was treated as an *indicium* in a case not one of those exceptional ones in which such an *indicium* was sufficient. The evidence of two witnesses or a confession by the accused was necessary to establish a remote *indicium*, such as lying. (2) Hearsay evidence was received when primary evidence was obtainable. (3) The confession made under torture was not ratified afterwards. (4) It was made in consequence of a promise of impunity. (5) It was of an impossible crime.

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[1] *Ordonnances des rois*, i. 72. [2] s. 303. [3] s. 344.

[4] See Pollock and Maitland, ii. 658, note.

[5] On the French system generally see Imbertus, *Institutiones forenses gallicae* (Utrecht, 1649); N. Weiss, *La Chambre ardente, 1540–1550* (Paris, 1889). A large number of authorities deal mainly with the *ordonnance* of 1670; Muyart de Vouglans, *Inst. crim.* (Paris, 1767), and Jousse, *Traité de la justice crim.* (Paris, 1771), are examples. F. Siegneux de Correvon, *Essai sur l'usage, l'abus, et les inconvéniens de la torture* (Geneva, 1768), is one of the opponents of the system.

[6] Cinus Pistorensis, *Super codice, de tormentis* (Venice, 1493).

[7] *Practica criminalis quae Averolda nuncupatur* (Venice, 1532).

[8] *Praxis et theorica criminalis*, bk. ii. tit. v. quaest. 36–51 (Frankfort, 1622).

[9] *Practica criminalis finalis* (Lyons, 1637).

[10] It is obvious from the allusion at the end of *Othello* that Shakespeare regarded torture as possible in Cyprus when it was a Venetian colony.

[11] *Osservazioni sulla tortura.*

[12] *Storia della Colonna infame.* Neither writer alludes to Beccaria.

In Spain, as in Italy, the law depended partly on the writings of jurists, partly on legislation. Roman law was carried through the Visigothic Code and the *Fuero juzgo*[1] (which repeats it almost word for word) down to the *Siete partidas*.[2] This treatise, compiled by Alphonso the Wise about 1243, but not promulgated till 1256, amended the previously existing law in the direction of greater precision. Torment is defined as a manner of punishment which lovers of justice use, to scrutinize by it the truth of crimes committed secretly and not provable in any other manner. Repetition was allowed in case of grave crimes. There were the usual provisions for the infliction of torture only by a judge having jurisdiction, and for the liability of the judge for exceeding legal limits. Subsequent codes did little more than amend the *Partidas* in matters of procedure. Torture is not named in the *Ordenanzas reales* of Ferdinand and Isabella (1485). The *Nueva recopilacion* of Philip II. enacted that torture was to be applied by the *alcaldes* on due sentence of the court—even on *hidalgos* in grave crimes—without regard to alleged privilege or custom. In the *Novisima recopilacion* of 1775 the only provisions on the subject are that the *alcaldes* are not to condemn to torment without preceding sentence according to law, and that *hidalgos* are not to be tormented or suffer infamous punishment. In Aragon, while it was an independent state, torture was not in use to the same extent as in other parts of Spain. It was abolished in the 13th century by the General Privilege of 1283 except in the case of vagabonds charged with coining. A statute of 1335 made it unlawful to put any freeman to the torture.[3] On the other hand, the Aragonese nobility had a power, similar to the *peine forte et dure*, of putting a criminal to death by cold, hunger and thirst.[4] The jurists dealing with the subject are not as numerous as in Italy, no doubt because Italian opinions were received as law in all countries whose systems were based on Roman law.[5] Some of the Italian jurists too, like Clarus, were at that same time Spanish officials. The earliest Spanish secular jurist appears to be Suarez de Paz.[6] According to him the most usual tortures in Spain were the water and cord, the pulley or *strappado*, the hot brick, and the *tablillas*, or thumbscrew and boot combined. Three was the greatest number of times that any torture could be applied. It might be decreed either on demand of the accuser or at will of the judge. The Roman rule of beginning with the weakest was amplified into a series of regulations that a son was to be put to the question before a father, a woman before a man, &c. The fullest statement of Spanish law is to be found in the work of Antonio Gomez, a professor at Salamanca.[7] With him no exceptions apply in charges of *laesa majestas divina* or *humana*. A judge is liable to different punishment according as he orders torture *dolose* or *culpabiliter*. Differing from Hippolytus de Marsiliis, Gomez holds that the dying accusation of a murdered man is not an *indicium*. A confession on insufficient *indicia* is void. His division of torture into *tortura actualis* and *terror propinquus* is the same as that of the French jurists into torture and presentment. The conclusions of the ecclesiastical writers of Spain, such as Eymerico and Simancas, were accepted wholly or partially by the secular writers, such as Alvarez de Velasco,[8] and the Peruvian, Juan de Hevia Bolaños,[9] who points out differences in the ecclesiastical and secular systems, *e.g.* the former brought up the accused for ratification in three days, the latter in twenty-four hours. A good deal of the Spanish law will be found in the proceedings against Sir Thomas Picton (see above). Torture in Spain seems to have been inflicted on Jews to an extraordinary extent, as it was also in Portugal, where the latest legislation as to torture seems to be of the year 1678. In 1790 it had become obsolete,[10] and in a work on criminal procedure four years later it is only referred to for the purpose of stating that when it did exist it was *realis* or *verbalis*.[11]

Teutonic States.—Germany (including Austria) is distinguished by the possession of the most extensive literature and legislation on the subject. The principal writers are Langer, von Rosbach and von Boden. In addition may be cited the curious *Layenspiegel* of Ulrich Tengler (1544), and the works of Remus, Casonus and Carpzow.[12] Legislation was partly for the empire, partly for its component states. Imperial legislation dealt with the matter in the Golden Bull (1356), the Ordinance of Bamberg (1507), the Carolina (1532)[13] and the *Constitutio criminalis theresiana* (1768).[14] The Carolina followed the usual lines, the main difference being that the infliction must be in the presence of two *scabini* and a notary, who was to make a detailed record of the proceedings. The code of Maria Theresa defines torture as "a subsidiary means of eliciting truth." It could be applied only in cases where condemnation would have involved capital or severe corporal punishment. The illustrated edition was suppressed by Prince Kaunitz a few days after its appearance. Torture was formally abolished in the empire in 1776. In Prussia it was practically abolished by Frederick the Great in 1740, formally in 1805. Even before its abolition it was in use only to discover accomplices after conviction.[15] In some other states it existed longer, in Baden as late as 1831. It was carried to excess in Germany, as in the Netherlands and Scotland in charges of witchcraft.

The Netherlands.—The principal legislative enactment was the code of criminal procedure promulgated by Philip II. in 1570 and generally known as the *Ordonnance sur le style.*[16] One of its main objects was to assimilate the varieties of local custom, as the *Nueva recopilacion* had done in Spain three years earlier. The French *ordonnance* of 1670 is probably largely based on it. In spite of the attempt of the ordinance to introduce uniformity, certain cities of Brabant, it is said, still claimed the privilege of torturing in certain cases not permitted by the ordinance, *e.g.* where there was only one witness.[17]

The law of 1670 continued to be the basis of criminal procedure in the Austrian Netherlands until 1787. In the United Provinces it was not repealed until 1798. The principal text-writers are Damhouder,[18] van Leeuwen[19] and Voet. Van Leeuwen lays down as a fundamental principle that no one was to be condemned to death without confession, and such confession, if attainable in no other way, ought to be elicited by torture. Witnesses could be tortured only if they varied on confrontation. One of the *indicia* not always recognized by jurists was previous conviction for a similar crime. Voet's commentary *ad Pandectas*[20] is interesting for its taking the same view as St Augustine as to the uselessness of torture, and compares its effect with that of the trial by battle. At the same time he allows it to be of some value in the case of very grave crimes. The value of torture was doubted by others as well as Voet, *e.g.* by A. Nicholas[21] and by van Essen.[22] At the same time a writer was found to compose a work on the unpromising subject of the rack.[23]

Scandinavian Countries.—There is a notice of torture in the Icelandic Code known as the Grágás (about 1119). Judicial torture is said to have been introduced into Denmark by Valdemar I. in 1157.[24] In the code of Christian V. (1683) it was limited to cases of treason.[25] It was abolished by the influence of Struensee in 1771, but notwithstanding this he was threatened with it, though it was not actually inflicted, before his execution in 1772. In Sweden torture never existed as a system; and in the code of 1734 it was expressly forbidden.[26] It was however occasionally inflicted, as in England, by extrajudicial authorities, called secret committees.

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[1] vi. 4, 5.

[2] *Partida*, vii. 30. It was one of the earliest books printed in Spain, the earliest edition appearing in 1491.

[3] Cited Hallam, *Middle Ages*, iii. 76.

[4] Du Cange, *s.v. Fame necare.*

[5] In all the Latin countries the idea of torture had become a commonplace. The dramatists contain frequent allusions to it. In Lope de Vega's *El Perro del hortelano* ("The Dog in the Manger"), one of the characters says, "Here's a pretty inquisition!" to which the answer is, "The torture will be next applied." Molière and Racine both make use of it. In *L'Avare*, act iv. sc. 7, Harpagon threatens to put his whole household to the question. In *Les Plaideurs* Dandin invites Isabelle to see *la question* as a mode of passing an hour or two. In England Bacon (Essay lvi.) says, "There is no worse torture than the torture of laws." The same idea occurs again in the *Advancement of Learning*, viii. 3, 13, "It is a cruel thing to torture the laws that they may torture men."

[6] *Praxis ecclesiastica et saecularis*, vol. i. pt. v. §. 3 (Salamanca, 1583).

[7] *Variae resolutiones*, p. 412 (Antwerp, 1593).

[8] *Judex perfectus* (Lausanne, 1740).

[9] *Curia filipica* (Madrid, 1825).

[10] *Repertorio geral das leis extravagantes*, p. 381 (Coimbra, 1815).

[11] Paschal Freirus, *Inst. jur. crim. lusitani*, p. 203 (Lisbon, 1794).

[12] Extracts from these and other writers will be found in Lea, *Superstition and Force*, and in R. Quanter, *Die Folter in der deutschen Rechtspflege sonst und jetzt* (Berlin, 1900).

[13] Chs. 33–44.

[14] Art. 38 (Vienna, 1769).

[15] This statement is made on the authority of a work attributed to Frederick himself, *Dissertation sur les raisons d'établir ou d'abroger les lois* (1748).

[16] A list of the numerous commentaries on this code will be found in Nybels, *Les Ordonnances criminelles de Philippe II. de 1570*, p. 23 (Brussels, 1856).

[17] Nybels, pp. 31, 33.

[18] *Pratique judiciaire en causes criminelles* (Antwerp, 1564).

[19] *Censura forensis*, pt. ii. bk. ii. chs. 8, 9 (Leiden, 1677).

[20] On *Dig.* xlviii. 18. There are numerous editions of Voet, the sixth (generally found in libraries) is the Hague (1734).

[21] *Si la torture est un moyen sûr à vérifier les crimes* (Amsterdam, 1681). Also by an anonymous writer thirty years earlier, *De Pijnbank wedersproken en bematigt* (Rotterdam, 1651).

[22] *Jus ecclesiasticum universum* (Louvain, 1720).

[23] *Hieronymi Magii Anglarenis de equuleo liber postumus* (Amsterdam, 1664). There are several works dealing with torture in witchcraft proceedings. A large number of cases will be found in J. Scheltema, *Geschiedenis der Hexen-processen* (Haarlem, 1828). For torture in the 18th century see E. Hubert, *La Torture aux Pays Bas autrichiens pendant la xviii^e siècle* (Brussels, 1897).

[24] Baden, *Dansk juridisk Ordbog, s.v.* "Tortur" (Copenhagen, 1828).

[25] Kolderup-Rosenvinge, *Udvalg af gamle Danske-Domme*, bk. i. c. 20 (Copenhagen, 1848).

[26] *Cod. leg. svecicarum*, pp. 233, 370 (Stockholm, 1743).

The "cave of roses," where reptiles were kept for the purpose of torture, was closed by Gustavus III. in 1772.

Slav Countries.—The earliest mention of torture seems to be that of the mutilation provided for certain offences by the code of Stephen Dushan in 1349. In Russia torture does not occur in the recensions of the earlier law. It was possibly of Tatar origin, and the earliest mention of it in an official document is probably in the *Sudebnik* of Ivan the Terrible (1497). In the ordinance of 1556 there are elaborate regulations, which one learns from history were not always observed in periods of political disturbance, and torture seems to have been used even as a means of enforcing payment of debts. The reaction begins with Peter the Great and culminates with Catharine II., who was largely influenced by the opinions of Beccaria and Voltaire. In the instructions to the commission for framing a criminal code (1766), it is declared that all punishments by which the body is maimed ought to be abolished,[1] and that the torture of the rack violates the rules of equity and does not produce the end proposed by the laws.[2] It was formally abolished by Alexander I. in 1801, and in 1832 the *Svod Zakonov* subjected to penalties any judge who presumed to order it. But even as late as 1847 it seems to have been inflicted in one or two exceptional cases.[3]

Authorities.—For England Jardine's is still the standard work. Much general information and numerous authorities will be found in Lipenius, *Bibliotheca realis Juridica, s.v.* "Tortura" (Frankfort, 1679), and in the more modern work of J. Helbing, *Die Tortur* (Berlin, 1902). For those who can obtain access to it the catalogue issued at the sale of M. G. Libri (1861) is valuable. He had collected most of the books on the subject. There are several publications dealing with cases of individuals in addition to the numerous ones on witchcraft trials, *e.g.* those of William Lithgow, the Amboyna case, Dellon and Van Halen. Lithgow's story has been republished (Glasgow, 1907). (J. W.)

TORUS, a Latin word, meaning a round swelling or protuberance, applied to a convex moulding in architecture, which in section is generally a semicircle. The earliest examples are found in Egypt, where it was carried up the angles of the pylon and temple walls and horizontally across the same. Its most frequent employment is in the bases of columns; in the Roman Doric order being the lowest moulding; in the Ionic orders there are generally two torus mouldings separated by a scotia with fillets. Both in Greek and Roman bases sometimes the torus is elaborately carved. (See Moulding.)

TORZHOK, a town of Russia, in the government of Tver, on the river Tvertsa, 21 m. by rail S.W. of the Likhoslavl station of the St Petersburg & Moscow railway. Pop. (1900), 15,119. It dates from the 11th century, and the name (market-place) shows that this dependency of Novgorod was a commercial centre. It was fortified with a stone wall, which only partially protected it from the attacks of Mongols, Lithuanians and Poles. Torzhok is celebrated in Russia for its embroidered velvet and embroidered leather-work, for the manufacture of travelling bags, and for its trade in corn and flour.

TOSCANELLA (anc. *Tuscana, q.v.*), a town of the province of Rome, Italy, 15 m. N.E. of Corneto by road, 545 ft. above sea-level. Pop. (1901), 4839. The medieval walls with their towers are still preserved. On the ancient citadel hill is the Romanesque church of S. Pietro, belonging to four different periods—739, 1093 (the date of the reconstruction of the crypt), the middle of the 12th and the end of the 12th century. It has the shape of a Roman basilica, with a nave and two aisles and one apse. The elaborate façade with its rose window also belongs to the 12th century. S. Maria in the valley below dates from 1050 to 1206, and has a similar façade and a massive square campanile. In the town are two other Romanesque churches.

See G. T. Rivoira, *Origini dell' architettura Lombarda* 1. 146 (Rome 1901).

TOSTIG (d. 1066), earl of Northumbria, was a son, probably the third, of Earl Godwine, and in 1051 married Judith, sister or daughter of Baldwin V., count of Flanders. In the year of his marriage he shared the short exile of his father, returning with him to England in 1052, and became earl of Northumbria after the death of Earl Siward in 1055. He was very intimate with his brother-in-law, Edward the Confessor, and in 1061 he visited Pope Nicholas II. at Rome in the company of Aldred, archbishop of York. By stern and cruel measures Tostig introduced a certain amount of order into the wild northern district under his rule; this severity made him exceedingly unpopular, and in 1065 Northumbria broke into open revolt. Declaring Tostig an outlaw and choosing Morkere in his stead, the rebels marched southwards and were met at Oxford by Earl Harold, who, rather against the will of the king, granted their demands. Tostig sailed to Flanders and thence to Normandy, where he offered his services to Duke William, who was related to his wife and who was preparing for his invasion of England. He then harried the Isle of Wight and the Kentish and Lincolnshire coasts, and, after a stay in Scotland and possibly a visit to Norway, joined another invader, Harald III. Hardrada, king of Norway, in the Tyne. Together they sailed up the Humber and at Gate Fulford, near York, defeated Earls Morkere and Edwine and entered York. But Harold, now king, was hurrying to the north. Taking the Norwegians by surprise at Stamford Bridge he destroyed their army on the 25th of September 1066, and in this battle both Tostig and the king of Norway were slain. Tostig's two sons appear to have taken refuge in Norway, and his widow Judith married Welf, duke of Bavaria.

See E. A. Freeman, *The Norman Conquest*, vols. ii. and iii. (1870–1876).

TOTANA, a town of eastern Spain, in the province of Murcia, on the Lorca-Murcia railway. Pop. (1900), 13,703. The town, which consists of two parts, the Barrio de Sevilla and Barrio de Triana, contains several handsome public buildings, among them the church of Santiago, with its three naves. Water is conveyed to Totana from the Sierra de Espuña by an aqueduct 7 m. long. Saltpetre is obtained among the hills, and there is a thriving trade in wheat, oranges, olives, almonds, and wine from the Sangonera valley. Other industries are the manufacture of linen, leather and the earthenware jars called *tinajas*, which are used for the storage of oil and wine.

TOTEMISM. The word "totem" is used in too many varying senses by students of early society and religion. The term came into the English language in the form of "totam," through a work of 1791, by J. Long, an interpreter between the whites and the Red Indians of North America.[4] Long himself seems to have used the word to denote the protective familiar, usually an animal, which each Indian selected for himself, generally through the monition of a dream during the long fast of lads at their initiation. Such selected (or, when bestowed by medicine-men or friends, "given") totems are styled "personal totems" and have no effect in savage law, nor are they hereditary, with any legal consequences.

In stricter terminology "totem" denotes the object, generally of a natural species, animal or vegetable, but occasionally rain, cloud, star, wind, which gives its name to a *kindred* actual or supposed, among many savages and barbaric races in America, Africa, Australia and Asia and the isles. Each child, male or female, inherits this name, either from its mother ("female descent") or from its father ("male descent"). Between each person and his or her name-giving object, a certain mystic *rapport* is supposed to exist. Where descent wavers, persons occasionally have, in varying degrees, the totems of both parents.

Religious Aspect of the Totem.—As a rule, by no means invariable, the individual may not kill or eat the name-giving object of his kin, except under dire necessity; while less usually it is supposed to protect him and to send him monitory dreams. This is the "religious" or semi-religious aspect of the totem, or this aspect is, by some students, called "religious."

We also hear of customs of burying and lamenting dead animals which are regarded with reverence by this or that "family," or "clan." This custom is reported among the Samoans, and one "clan" was said to offer first-fruits to its sacred animal, the eel; while the "clan" that revered the pigeon kept and fed a tame specimen.[5] But in Samoa, though the sacred animals of "clans" or "families" are, in all probability, survivals of totemism, they are now regarded by the people as the vehicles of "clan" or "family" gods, and therefore receive honours not paid to the hereditary totems of Australia and North America, which have nothing godlike. It is to be presumed that "totem dances" in which some Australian tribes exhibit, in *ballets d'action*, the incidents of a myth concerning the totem, are, in a certain sense, "religious"; when they are not magical, and intended to foster and fertilize the species, animal or vegetable or other to which the totem belongs.

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[1] Art. 96.

[2] Ibid. 192–197.

[3] See the various histories of Russian law, such as Maceiovski, Lange and Zagoskin, under the heads of *puitka* or *muchenie*.

[4] Long, *Voyages and Travels of an Indian Interpreter* (1791), p. 86.

[5] Turner, *Samoa*, p. 71.

The magical performances for the behoof of the totem creatures may be studied in the chapters on "Intichiuma" in Messrs Spencer and Gillen's *Native Tribes of Central Australia*, and *Native Tribes of Northern Australia*. Among the many guesses at the original purpose of totemism, one has been that the primal intention of totem sets of human beings was to act as magical co-operative stores for supplying increased quantities of food to the tribe. But this opinion has gone the way of other conjectures. The "religious" status of the totem is lowest among peoples where its influence on social regulations is greatest, and vice versa, a topic to which we recur.

There are also various rites, in various tribes, connecting the dead man with his totem at his funeral; perhaps at his initiation, when a boy, into the esoteric knowledge and rules of his tribe. Men may identify themselves with their totems, or, mark themselves as of this or that totem by wearing the hide or the plumage of the bird or beast, or by putting on a mask resembling its face. The degree of "religious" regard for the revered object increases in proportion as it is taken to contain the spirit of an ancestor or to be the embodiment of a god: ideas not found among the most backward savages.

The supreme or superior being of low savage religion or mythology is never a totem. He may be able, like Zeus in Greek mythology, to assume any shape he pleases; and in the myths of some Australian tribes he ordained the institution of totemism. Byamee, among the Euahlayi tribe of north-west New South Wales, had all the totems in him, and when he went to his paradise, Bullimah, he distributed them, with the marriage rules, among his people.[1] In other legends, especially those of central and northern Australia, the original totem creatures, animal in form, with bestial aspect, were developed in a marine or lacustrine environment, and from them were evolved the human beings of each totem kin. The rule of non-intermarriage within the totem was, in some myths, of divine institution; in others, was invented by the primitive wandering totemic beings; or was laid down by the wisdom of mere men who saw some unknown evil in consanguine unions. The strict regard paid to the rule may be called "religious"; in so far as totemists are aware of no secular and social *raison d' être* of the rule it has a mysterious character. But whereas to *eat* the totem is sometimes thought to be automatically punished by sickness or death, this danger does not attach to *marriage* within the totem save in a single known case. The secular penalty alone is dreaded; so there seems to be no religious fear of offending a superior being, or the totem himself: no tabu of a mystic sort.

Social Aspect of the Totem.—The totem has almost always a strong influence on or is associated with marriage law, and except in the centre of Australia, and perhaps in the little-known West, men and women of the same totem may not intermarry, "however far apart their hunting grounds," and though there is no objection on the score of consanguinity.

This is the result, in Australia, of the custom, there almost universal, which causes each individual to belong, by birth, to one or other of the two main exogamous and intermarrying divisions of the tribe (usually called "phratries"). The phratries (often known by names of animals, as Eagle Hawk and Crow, Crow and White Cockatoo) contain each a number of totem kins, as Dog, Wild Cherry, Wombat, Frog, Owl, Emu, Kangaroo, and so on, and (except among the Arunta "nation" of five tribes in Central Australia) the same totem kin never occurs in both phratries. Thus as all persons except in the Arunta nation, marry out of their own phratry, none can marry into his or her totem kin.

In some parts of North America the same rule prevails, with this peculiarity that the phratries, or main exogamous divisions, are not always two, as in Australia, but, for example, among the Mohegans three—Wolf, Turtle, and Turkey.[2] In Wolf all the totems are quadrupeds; under Turtle they are various species of turtles and the yellow eel; and under Turkey all the totems are birds.

Clearly this ranking of the totems in the phratries is the result of purposeful design, not of accident. Design may also be observed in such phratries of Australian tribes as are named after animals of contrasted colours, such as White Cockatoo and Crow, Light Eagle Hawk and Crow. It has been supposed by Mr J. Mathew, Père Schmidt and others that these Australian phratries arose in an alliance with *connubium* between a darker and a lighter race.[3] But another hypothesis is not less probable; and as we can translate only about a third of Australian phratry names, conjecture on this subject is premature.

Both in Australia and America the animals, as Eagle Hawk and Crow, which give their names to the phratries, are almost always totem kins within their own phratries.[4]

The Moquis of Arizona are said to have ten phratries, by Captain Ulick Bourke in his *Snake Dance of the Moquis*, but possibly he did not use the term "phratry" in the sense which we attach to it.

Among the Urabunna of Southern Central Australia, and among the tribes towards the Darling River, a very peculiar rule is said to prevail. There are two phratries, and in each are many totem kins, but each totem kin may intermarry with only one totem kin which must be in the opposite phratry.[5] Thus there are as many exogamous divisions as there are totems in the tribes, which reckon descent in the female line; children inheriting the mother's totem only. Corroboration of these statements is desirable, as the tribes implicated are peculiarly "primitive," and theirs may be the oldest extant set of marriage rules.

The existence of two or more main exogamous divisions, named or unnamed, is found among peoples where there are either no totem kins, or where they have fallen into the background, as in parts of Melanesia, among the Todas and Meitchis of India and the Wanika in East Africa.[6]

An extraordinary case is reported from South Australia where people must marry in their own phratry, while their children belong to the opposite phratry.[7] This awaits corroboration.

We now see some of the numerous varieties which prevail in the marriage rules connected with the totems. Even among a tribe whose members, it is reported, may marry into their own phratries, it appears that they must not marry within their own totem kins. This is, indeed, the rule wherever totemic societies are found in anything approaching to what we deem their most archaic constitution as in south-east Australia and some tribes of North America.

Exogamy: The Arunta Abnormality.—Meanwhile, in Central Australia, in the Arunta "nation," the rule forbidding marriage within the totem kin does not exist. Totems here are not, as everywhere else, inherited from either parent, but a child is of what we may call "the local totem" of the place where its mother first became conscious of its life within her. The idea is that the spirits of a primal race, in groups each of one totem only ("Alcheringa folk"), haunt various localities; or spirits (*ratapa*) emanating from these primal beings do so; they enter into passing married women, and are incarnated and born again.[8]

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[1] Mrs Langloh Parker. *The Euahlayi Tribe.*

[2] Morgan, *Ancient Society*, p. 174.

[3] Mathew, *Eagle Hawk and Crow*; Schmidt, *Anthropos* (1909).

[4] See Lang, *The Secret of the Totem*, pp. 154, 170; and N. W. Thomas, *Kinship and Marriage in Australia*, pp. 9, 31.

[5] Howitt, *Native Tribes of South-East Australia*, pp. 93, 181, 188; Spencer and Gillen, *Native Tribes of Central Australia*, pp. 60, 61, *Northern Tribes*, p. 71; Lang, *Anthropological Essays*; Tylor's *Festschrift*, pp. 203–210.

[6] Thomas, *ut supra*, p. 10. See, for numerous examples, T. G. Frazer, *Totemism* (1910).

[7] *MS.* of Mrs Bates.

[8] It is necessary to state here the sources of our information about the central, north, north-western and south-eastern forms of

Thus if a woman, whatever her own totem, and whatever her husband's may be, becomes conscious of her child's life in a known centre of Wild Cat spirits, her child's totem is Wild Cat, and so with all the rest.

As a consequence, a totem sometimes here appears in what the people call the "wrong" (*i.e.* not the original) exogamous division; and persons may marry within their own totem name, if that totem be in the "right" exogamous division, which is not theirs. Each totem spirit is among the Arunta associated with an amulet or *churinga* of stone; these are of various shapes, and are decorated with concentric circles, spirals, *cupules*, and other archaic patterns. These amulets are only used in this sense by the Arunta nation and their neighbours the Kaitish, "and it is this idea of spirit individuals associated with *churinga* and resident in certain definite spots that lies at the root of the present totemic system of the Arunta," says Messrs Spencer and Gillen.[1] Every Arunta born incarnates a pre-existent primal spirit attached to one of the stone *churinga* dropped by primal totemic beings, all of one totem in each case, at a place called an *oknanikilla*. Each child belongs to the totem of the primal beings of the place, where the mother became aware of the child's life.

Thus the peculiar causes which have produced the unique Arunta licence of marrying within the totem are conspicuously obvious.

Contradictory Theories about the Arunta Abnormal Totemism.—At this point theories concerning the origin of totemism begin to differ irreconcilably. Mr Frazer, Mr Spencer, and, apparently Dr Rivers, hold that, in Australia at least, totemism was originally "conceptional." It began in the belief by the women that pregnancy was caused by the entrance into them of some spirit associated with a visible object, usually animal or vegetable; while the child born, in each case, was that object. Hence that class of objects was tabued to the child; was its totem, but such totems were not hereditary.

Next, for some unknown reason, the tribes were divided into two bodies or segments. The members of segment A may not intermarry; they must marry persons of segment B, and vice versa. Thus were evolved the primal forms of totemism and exogamy now represented in the law of the Arunta nation alone. Here, and here alone, marriage within the totem is permitted. The theory is, apparently, that, in all other exogamous and totemic peoples, totems had been, for various reasons, made hereditary, before exogamy was enforced by the legislator in his wisdom. Thus, all over the totemic world, except in the Arunta nation, the method of the legislator was simply to place one set of totem kins in tribal segment A, and the other in segment B, and make the segments exogamous and intermarrying. Thus it was impossible for any person to marry another of the same totem. This is the theory of Mr Frazer.

Upholders of the contradictory system maintain that the Arunta nation has passed through and out of the universal and normal system of hereditary and exogamous totemism into its present condition, by reason of the belief that children are incarnations of pre-existing animal or vegetable spirits, *plus* the unique Arunta idea of the connexion of such spirits with their stone *churinga*. Where this combination of the two beliefs does not occur, there the Arunta non-hereditary and non-exogamous totemism does not occur. It would necessarily arise in any normal tribe which adopted the two Arunta beliefs, which are not "primitive."

Arguments against Mr Frazer's Theory.—There was obviously a time, it is urged, when all totems were, as everywhere else,

totemism. About the central Arunta tribe with its neighbours, the Urabunna, we have the evidence very carefully collected by Mr Gillen, a protector of the aborigines, and Professor Baldwin Spencer (*Native Tribes of Central Australia*). Concerning the peoples north from the centre to the Gulf of Carpentaria, the same scholars furnish a copious account in their *Northern Tribes*. These two explorers had the confidence of the blacks; witnessed their most secret ceremonies, magical and initiatory; and collected their legends. Their books, however, contain no philological information as to the structure and interrelation of the dialects, information which is rarely to be found in the works of English observers in Australia. As far as appears, the observers conversed with the tribes only in "pidgin English." If this be the case that *lingua franca* is current among some eighteen central-northern tribes speaking various native dialects. We are told nothing about the languages used in each case; perhaps the Arunta men who accompanied the expedition arranged a system of interpreters.

For the Dieri tribe, neighbours of the Urabunna, we have copious evidence in *Native Tribes of South-East Australia* by the late Mr A. W. Howitt, who studied the peoples for forty years; was made free of their initiatory ceremonies; and obtained intelligence from settlers in regions which he did not visit. We have also legends with Dieri texts and translations from the Rev. Mr Siebert, a missionary among the Dieri. That tribe appears now to exist in a very dwindled condition under missionary supervision. The accounts of tribes from the centre to the south-east by Mr R. E. Mathew, are scattered in many English, Australian and American learned periodicals. Mr Mathew has given a good deal of information about some of the dialects. His statements as to the line of descent and on other points among certain tribes are at variance with those of Messrs Spencer and Gillen (see an article by Mr A. R. Brown in *Man*, March 1910). Mr Mathew, however, does not enable us to test the accuracy of his informants among the northern tribes, which is unfortunate. For the Aranda (or Arunta) of a region apparently not explored by Messrs Spencer and Gillen, and for the neighbouring Loritja tribe, we have *Die Aranda und Loritja Stämme*, two volumes by the Rev. C. Strehlow (Baer, Frankfurt am Main, 1907, 1908). Mr Strehlow is a German missionary who, after working among the Dieri and acquiring their language, served for many years among a branch of the Arunta (the Aranda), differing considerably in dialect, myths and usages from the Arunta of Messrs Spencer and Gillen. In some points, for example as to the primal ancestors and the spirits diffused by them for incarnation in human bodies, the Aranda and Loritja are more akin to the northern tribes than to Mr Spencer's Arunta. In other myths they resemble some south-eastern tribes reported on by Mr Howitt. Unlike the Arunta of Messrs Spencer and Gillen, but like the Arunta described by Mr Gillen earlier in *The Horn Expedition*, they believe in "a magnified non-natural man," Altjira, with a goose-foot, dwelling in the heavens. Unlike the self-created Atnatu of the Kaitish of Messrs Spencer and Gillen, he is not said to have created things, or to take any concern about human beings, as Atnatu does in matters of ceremonial. Mr Strehlow gives Aranda and Lortija texts in the original, with translations and philological remarks.

Mr Frazer, in his *Totemism*, makes no use of Mr Strehlow's information (save in a single instance). To us it seems worthy of study. His reason for this abstention is that, in a letter to him (Melbourne, March 10, 1908), Mr Spencer says that for at least twenty years the Lutheran Missions have taught the natives "that altjira means 'god'; have taught that their sacred ceremonies and secular dances are 'wicked'; have prohibited them, and have never seen them. Flour and tobacco, &c., are only given to natives who attend church and school. Natives have been married who, according to native customary law, belong to groups to which marriage is forbidden. For these reasons Mr Frazer cannot attempt "to filter the native liquor clear of its alien sediment," (*Totemism*, i. 186, note 2).

Against this we may urge that, as regards the goose-footed sky-dweller, Mr Strehlow reports less of his active interest in human affairs than Mr Gillen does concerning his "Great Ulthaana of the heavens" among the Arunta. Mr Strehlow's being, Altjira, has a name apparently meaning "mystic" or sacred, which is applied to other things, for example to the inherited maternal totem of each native. His names for Altjira (god) and for the totemic ancestors (totem gods), are inappropriate, but may be discounted. Many other tribes who *are* discussed by Mr Frazer have been long under missionary influence as well as the Aranda. According to Mr Frazer the Dieri tribe had enjoyed a German Lutheran mission station (since 1866) for forty-four years up to 1910. About 150 Dieri were alive in 1909 (*Totemism*, iii. 344). Nevertheless the Dieri myths published by Mr Siebert in the decadence of the tribe, and when the remnant was under missionaries, show no "alien sediment." Nor do the traditions of Mr Strehlow's Aranda. Their traditions are closely akin, now to those of the Arunta, now to those of the northern tribes, now to those of the Euahlayi of Mrs Langloh Parker (*The Euahlayi Tribe*) in New South Wales, and once more to those of Mr Howitt's south-eastern tribes. There is no trace of Christian influence in the Aranda and Loritja matter, no vestige of "alien" (that is, of European) "sediment," but the account of Atnatu among the Kaitish reported on by Messrs Spencer and Gillen reads like a savage version of Milton's "Fall of the Angels" in *Paradise Lost*. For these reasons we do not reject the information of Mr Strehlow, who is master of several tribal languages, and, of course, does not encourage wicked native rites by providing supplies of flour, tobacco, &c., during the performances, as Mr Howitt and others say that they found it necessary to do. Sceptical colonists have been heard to aver that natives will go on performing rites as long as white men will provide supplies.

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[1] *Native Tribes of Central Australia*, p. 123.

in what the Arunta call "the right" divisions; Arunta, that is, were so arrayed that no totem existed in more than one division. Obliged, as now, to marry out of their own exogamous division (one of four sub-classes among the Arunta) into one of the four sub-classes of the opposite side, no man could then find in it a woman of his own totem to marry. But when Arunta ceased to be hereditary, and came to be acquired, as now, by the local accident of the totem spirits—all, in each case, of one totem name, which haunt the supposed place of a child's conception—some totems inevitably would often get out of their original sub-class into another, and thus the same totems are in several divisions. But granting that a man of division A may legally marry a woman of division B, he is not *now* prevented from doing so because his totem (say Wild Cat) is also hers. His or hers has strayed, by accident of supposed place of conception, out of its "right" into its "wrong" division. The words "right" and "wrong" as here used by the Arunta make it certain that they still perceive the distinction, and that, before the Arunta evolved the spiritual view of conception, they had, like other people, their totems in each case confined to a single main exogamous division of their tribe, and therefore no persons could then marry into their own totems.

But when the theory of spiritual conception arose, and was combined, in the Arunta set of tribes alone (it is common enough elsewhere in northern and western Australia), with the *churinga* doctrine, which gave totems by accident, these two factors, as Messrs Spencer and Gillen say, became the causes—"lie at the root"—of the present Arunta system by which persons may marry others of "the right" division, but of "the wrong" totem. That system is strictly confined to the group of tribes (Ilpirra, Loritja, Unmaterja, Kaitish, Arunta) which constitute "the Arunta nation." Elsewhere the belief in spiritual conception widely prevails, but *not* the belief in the connexion of spirits of individuals with the stone *churinga* of individuals. Consequently the Arunta system of marriage within the totem exists nowhere, and the non-exogamous non-hereditary totem exists nowhere, except in the Arunta region. Everywhere else hereditary totems are exogamous.[1]

Thus the practice of acquiring the totem by local accident is absolutely confined to five tribes where the *churinga* doctrine coexists with it. That the *churinga* belief, coexistent with the spiritual theory of conception, is of relatively recent origin is a demonstrable fact. Had it always been present among the Arunta the inevitable result, in the course of ages, would be the scattering of the totems almost equally, as chance would scatter them among the eight exogamous divisions.

This can be tested by experiment. Take eight men, to represent the eight exogamous divisions, and set them apart in two groups of four. Take four packs of cards, 208 cards, to represent the Arunta totems, which are over 200 in number. Deal the cards round in the usual way to each of the eight men; each will receive 26 cards. It will not be found that group A has "the great majority" of spades and clubs, while group B has "the great majority" of diamonds and hearts, and neither group will have "the great majority" of court cards. Accident does not work in that way. But while accident alone *now* determines the totem to which an Arunta shall belong, nevertheless "in the Arunta, as a general rule, the great majority of the members of any one totemic group belong to one moiety of the tribe; but this is by no means universal . . ."—that is, of the totems the great majority in each case, as a rule, belongs to one or the other set of four exogamous sub-classes.[2]

The inference is obvious. While chance has now placed only the small minority of each totem in all or several of the eight exogamous divisions, the great majority of totems is in *one or another* of the divisions. This great majority cannot come by chance, as Arunta totems *now* come; consequently it is but lately that chance has determined the totem of each individual. Had chance from the first been the determining cause, each totem would not be fairly equally present in each of the two sets of four exogamous divisions. But determination by accident has only existed long enough to affect "as a general rule" a small minority of cases. "The great majority" of totems remain in what is recognized as "the right," the original divisions, as elsewhere universally. Arunta myth sometimes supports, sometimes contradicts, the belief that the totems were originally limited, in each case, to one or other division only, and, being self-contradictory, has no historic value.

A further proof of our point is that the northern neighbours of the Arunta, the Kaitish, have only partially accepted Arunta ideas, religious and social. Unlike the Arunta they have a creative being, Atnatu, from whom half of the population descend; the other half were evolved out of totemic forms.[3] In the same way the Kaitish totems "are more strictly divided between the two moieties" (main exogamous divisions) "of the tribe."[4] Consequently a man *may* marry a woman of his own totem if she be in the right exogamous division. "She is not actually forbidden to him, as a wife becomes of this identity and totem, as she would be in the Warramunga neighbouring tribe . . ." "It is a very rare thing for a man to marry a woman of the same totem as himself,"[5] naturally, for the old rule holds, in sentiment, and a totem is still very rarely in the wrong division. The Arunta system of accidental determination of the totem has as yet scarcely produced among the Kaitish any of its natural and important effects.

This view of the case seems logical: Arunta non-exogamous non-hereditary totemism is the result, as Messrs Spencer and Gillen show, of the theory of spiritual conception and the theory of the relation of the spirit part of each individual to his *churinga*. These two beliefs have already caused a minority of Arunta totems to get out of the original and into the wrong exogamous Arunta divisions. The process is not of old standing; if it were, *all* totems would now be fairly distributed among the divisions by the laws of chance. In the Kaitish tribe, on the other hand, the processes must be of very recent operation, for they have only begun to produce their necessary effects. The totemism of the Arunta is thus the reverse of "primitive," and has but slightly affected the Kaitish.

Precisely the opposite view of the facts is taken by Mr Frazer in his erudite and exhaustive work *Totemism*. In the Kaitish, he writes, "we may detect the first stage in the transition from promiscuous marriage and fortuitous descent of the totem to strict exogamy of the totem clans and strict heredity of the totems in the paternal line."[6] By "promiscuous marriage," marriage within or without the totem, at pleasure, is obviously intended, for the Arunta do not marry "promiscuously"—do not marry their nearest kin.

How, on Mr Frazer's theory, was the transition from the condition of the Arunta to that of the Kaitish made? If the Kaitish were once in the actual Arunta stage of totemism, how did their totems come now to be much more strictly divided between the two moieties, though "the division is not so *absolute* as amongst the Urabunna in the south and the tribes farther north . . ."? How did this occur? The Kaitish have not made totems hereditary by law; they are acquired by local accident. They have not made a rule that all totems should, as among the more northern neighbours of the Arunta, be regimented so that no totem occurs in more than one division: to this rule there are exceptions. A man "is not actually forbidden" to marry a woman of his own totem provided she be of "the right division," but it is clear that he "does not usually do so." This we can explain as the result of a survival in manners of the old absolute universal prohibition.

Meanwhile our view of the facts makes all the phenomena seem natural and intelligible in accordance with the statement of the observers, Messrs Spencer and Gillen, that the cause of the unique non-hereditary non-exogamous totems of the Arunta is the combination of the *churinga* spiritual belief with the belief in spiritual conception. This cause, though now present among the Kaitish, has, so far, operated but faintly. We have been explicit on these points because on them the whole problem of the original form of totemism hinges. In our view, for the reasons stated, the Arunta system of non-exogamous non-hereditary totemism is a peculiarity of comparatively recent institution. But Mr Frazer, and the chief observer of the phenomena, Mr Spencer, consider the Arunta system, non-exogamous and non-hereditary, to be the most archaic form of totemism extant.

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[1] *N.T.C.A.* p. 257; cf. Frazer, *Totemism*, i. 200–201.

[2] *Northern Tribes*, pp. 151 sqq.

[3] *Northern Tribes*, pp. 153, 154, 175.

[4] Ibid. p. 152.

[5] Ibid. p. 175.

[6] *Totemism*, i. 244.

As to non-hereditary, we find another report of the facts in *Die Aranda und Loritja Stämme*, by the Rev. Mr Strehlow, who has a colloquial and philological knowledge of the language of these tribes. As he reports, among other things, that the Aranda (Arunta) in his district *inherit* their mother's totems, in addition to their "local totems," they appear to retain an archaic feature from which their local totem system and marriage rules are a departure.[1]

The hereditary maternal totem is, in Mr Strehlow's region, the protective being (*altjira*) of each Arunta individual.

Are the Arunta "Primitive" or not?—In the whole totemic controversy the question as to whether the non-exogamous non-hereditary totemism of the Arunta or the hereditary and exogamous totemism of the rest of Australia and of totemic mankind, be the earlier, is crucial.

That Arunta totemism is a freak or "sport," it is argued, is made probable first by the fact that the Arunta inherit all things hereditable in the male line, whereas inheritance in the female descent is earlier. (To this question we return; see below, *Male and Female Lines of Descent.*) M. Van Gennep argues that tribes in contact, one set having female, the other male, descent, "like the Arunta have combined the systems."[2] But several northern tribes with male descent of the totem which are *not* in contact with tribes of female descent show much stronger traces of the "combination" than the Arunta, who intermarry freely with a tribe of female descent, the Urabunna; while the Urabunna, though intermarrying with the Arunta who inherit property and tribal office in the male line, show no traces of "combination." Thus the effects occur where the alleged causes are not present; and the alleged causes, in the case of the Urabunna and Arunta, do not produce the effects.

Next the Arunta have no names for their main exogamous divisions, these names being a very archaic feature which in many tribes with sub-classes tend to disappear. In absence of phratry names the Arunta are remote from the primitive. M. Van Gennep replies that perhaps the Arunta have not yet made the names, or have not yet borrowed them. This is also the view of Mr Frazer. As he says, the Southern Arunta lived under the rule of eight classes, but of these four were anonymous, till the names for them were borrowed from the north. The people can thus have anonymous exogamous divisions; the two main divisions, or phratries, of the Arunta may, therefore, from the first, have been anonymous.

To this the reply is that people borrow, if they can, what they need. The Arunta found names for their four hitherto anonymous classes to be convenient, so they borrowed them. But when once class-names did, as they do, all that is necessary, the Arunta had no longer any use for the names of the two primary main divisions: these were forgotten; there is nothing to be got by borrowing that; while four Arunta "sub-classes" are gaining their names, the "classes" (phratries or main divisions) have lost them. It is perfectly logical to hold that while things useful, but hitherto anonymous, are gaining names, other things, now totally useless, are losing their names. One process is as natural as the other. In all Australia tribes with two main divisions and no sub-classes, the names of the two main divisions are found, because the names are useful. In several tribes with named sub-classes, which now do the work previously thrown on the main divisions, the names of the main divisions are unknown: the main divisions being now useless, and superseded by the sub-classes. The absence of names of the two main divisions in the Arunta is merely a result, often found, of the rise of the sub-classes, which, as Mr Frazer declares, are not primitive, but the result of successive later legislative acts of division.[3]

Manifestly on this point the Arunta are at the farthest point from the earliest organization: their loss of phratry names is the consequence of this great advance from the "primitive."

All Arunta society rests on a theory of reincarnated spirits, a theory minutely elaborated. M Van Gennep asks "why should this belief not be primitive?" Surely neither the belief in spirits, nor the elaborate working out of the belief connecting spirits with manufactured stone amulets, can have been primitive. Nobody will say that peculiar stone amulets and the Arunta belief about spirits associated with them are primitive. To this M Van Gennep makes no reply.[4]

The Arunta belief that children are spirit-children (*ratapa*) incarnated is very common in the other central and northern tribes, and, according to Mrs Bates, in Western Australia; Dr Roth reports the same for parts of Queensland. It is alleged by Messrs Spencer and Gillen that the tribes holding this belief deny any connexion between sexual unions and procreation. Mr Strehlow, on the other hand, says that in his region the older Arunta men understand the part of the male in procreation; and that even the children of the Loritja and Arunta understand, in the case of animals.[5] (Here corroboration is desirable and European influence may be asserted.) Dr Roth says that the Tully River blacks of Queensland admit procreation for all other animals, which have no Koi or soul, but not for men, who have souls. (Their theory of human birth, therefore, merely aims primarily at accounting for the spiritual part of man.)[6]

According to Mrs Bates, some tribes in the north of South Australia, tribes with the same "class" names as the Arunta, hold that to have children a man must possess two spirits (*ranee*). If he has but one, he remains childless. If he has two, he can dream of an animal, or other object, which then passes into his wife, and is born as a child, the animal thus becoming the child's totem. This belief does not appear to apply to reproduction in the lower animals. It is a spiritual theory of the begetting of a soul incarnated. If a man has but one spirit, he cannot give one to a child, therefore he is childless.

It is clear that this, and all other systems in which reproduction is explained in spiritual terms, can only arise among peoples whose whole mode of thinking is intensely "animistic." It is also plain that all such myths answer two questions—(1) How does a being of flesh and spirit acquire its spiritual part?—(2) How is it that every human being is in mystical *rapport* with an animal, plant, or other object, the totem? Manifestly the second question could not arise and need answer *before mankind were actually totemists*. It may be added that in the south of Western Australia the name for the mythical "Father of All" (a being not there worshipped, though images of him are made and receive some cult at certain licentious festivals) and the name for "father-stock" is *maman*, which Mrs Bates finds to be the native term for *membrum virile*. All this appears to be proof of understanding of the male part in reproduction, though that understanding is now obscured by speculation about spirits.

The question arises then, is the ignorance of procreation, where that ignorance exists, "primitive," and is the Arunta totemism also "primitive," being conditioned, as we are told it is, by the unique belief in some *churinga*? Or is the ignorance due to attempts of native thinkers to account for the spirit in man as a pre-existing entity that has been from the beginning? The former view is that of Messrs Spencer and Gillen, and Mr Frazer. For the latter see Lang, *Anthropological Essays presented to E. B. Tylor*, pp. 210–218. We can hardly call people primitive because they have struggled with the problem "how has material man an indwelling spirit?"

Theories of the Origin of Totemic Exogamy.—Since the word "exogamy" as a name for the marriage systems connected (as a rule) with totemism was used by J. F. McLennan in his

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[1] Strehlow, ii. 57 (1908).

[2] *Mythes et légendes d'Australie*, p. xxxii.

[3] *Totemism*, i. 282, 283.

[4] Van Gennep, pp. xxiii–xxxv.

[5] *Loritja Stämme*, p. 52, note 7.

[6] Roth, *Bulletin*, No. 5, pp. 17, 22, 65, 81.

Primitive Marriage (1866), theories of the origin of exogamy have been rife and multifarious. All, without exception, are purely conjectural. One set of disputants hold that man (whatever his original condition may have been) was, when he first passed an Act of Exogamy, a member of a *tribe*. Howitt's term for this tribe was "the undivided commune." It had, according to him, its inspired medicine-man, believed to be in communication with some superior being. It had its probouleutic council of elders or "headmen" and its general assembly. Such was man's political condition.[1] It is not distinguishable from that of many modern Australian tribes. Other tribes, said by some to be the most primitive, the Arunta and their neighbours, pay no attention to the dictates of a superior being, and the Arunta of Spencer and Gillen seem to know no such entity, though as Atnatu, Tukura, Altjira, and "the Great Ulthaana of the heavens," he exists in a dwindled form among the Kaitish, Loritja and outlying portions of the Arunta tribe. In religion Howitt's early men were already in advance of Mr Spencer's Arunta. Socially, man, at this date, according to Howitt, at first left the relations of the sexes wholly unregulated; the nearest kinsfolk by blood coupled at will, though perfectly aware that they were, at least on the maternal side, actual brothers and sisters, parents and children.

Upholders of the first theory, that man lived promiscuously in a tribal state with legislative assemblies and then suddenly reformed promiscuity away, must necessarily differ in their opinion as to the origins of totems and exogamy from the friends of the second theory, who believe that man never was "promiscuous," and given to sexual union with near kin. Why man, on the first theory—familiar as he was with unions of the nearest kin—suddenly abolished them is explained in four or five different ways. Perhaps the most notable view is Mr Frazer's; he easily confutes, in thirty-five pages, the other hypotheses.[2] Man saw, or thought he saw, injurious consequences to the wedded near-related couples, and therefore he prohibited, first, unions between mothers and sons, and brothers and sisters.[3] But, in his fourth volume, Mr Frazer sees conclusive objections to this view[4] and prefers another. Some peoples, far above the estate of savagery, believe that human incest blights and sterilizes the crops, women and animals. "If any such belief were entertained by the founders of exogamy, they would clearly have been perfectly sufficient motives for instituting the system, for they would perfectly explain the horror with which incest has been regarded and the extreme severity with which it has been punished."[5] That is to say, people had a horror and hatred of incest because they supposed that it blighted the crops and other things. Mr Frazer had previously written (iv. 108) "It is important to bear steadily in mind that the dislike of certain marriages must always have existed in the minds of the people, or at least of their leaders, before that dislike, so to say, received legal sanction by being embodied in an exogamous rule."

Again (iv. 112) "There had, for some reason unknown to us, been long growing up a strong aversion to consanguineous unions"—before any legislative bar was raised against them. This is insisted on. The prohibition "must have answered to certain general sentiments of what was right and proper" (iv. 121). But here the theorist has to explain the origin of the strong aversion, the general sentiment that unions of near kin are wrong and improper. But Mr Frazer does not seem to explain the point that most needs explanation. That "strong aversion," that "general sentiment," cannot have arisen from a growing belief that unions of close kin spoiled the crops or the natural resources of the country. That superstition could only arise as a consequence of the horror and aversion with which "incest" was regarded. Now no idea corresponding to "incest" could arise before unions of near kin were deemed abominable. When once such unions were thought hateful to gods and men, and an upsetting of the cosmic balance, then, but not till then, they might be regarded as injurious to the crops. All such beliefs are sanctions of ideas already in strong force. The idea that such or such a thing is wrong begets the prohibition, followed by the sanction—the belief that the practice of the thing is injurious in a supernormal way: where that belief exists. We do not know it in Australia, for example.

A belief that close sexual unions were maleficent cosmic influences could not possibly arise previous to, and could not then cause, "the dislike of certain marriages"; "the strong aversion to consanguineous unions"—which existed already. This latest guess of Mr Frazer at the origin of the idea of "incest"—of the abomination of certain unions—is untenable. What he has to explain is the origin of the dislike, the aversion, the horror. Once that has arisen, as he himself observes, the prohibition follows, and then comes the supernormal sanction. Thus no theory of exogamous rules as the result of legislation to prevent the unions of persons closely akin, can produce, or has produced, any reason for the aversion to such unions arising among people to whom, on the theory, they were familiar. Mr Frazer has confuted the guesses of MacLennan, Morgan, Durkheim and others; but his own idea is untenable.

The Supposed Method of Reform.—On Mr Frazer's theory the reformers first placed half of the mothers of the tribe, with their children, in division A; and the rest of the mothers, with their children, in division B. The members of each division (phratry) must marry out of it into the other, and thus no man could marry his sister or mother. (The father could marry his daughter, but in tribes with no exogamous explicit rule against the union, he never does.) Later the two divisions were bisected each into a couple of pairs (classes) preventing marriage between father and daughter; and another resegmentation prohibited the unions of more distant relations. These systems, from the simplest division into two phratries, to the more complex with two "sub-classes" in each phratry, and the most elaborate of all with four sub-classes in each phratry, exist in various tribes. Environment and climate have nothing to do with the matter. The Urabunna and the Arunta live in the same climate and environment, and intermarry. The Urabunna have the most primitive, the Arunta have the most advanced of these organizations. While the rules are intended to prevent consanguineous marriages, the names of the "sub-classes" (when translatable, the names of animals) cannot perhaps be explained. They have a totemic appearance.

Totems in Relation to Exogamy.—So far, in this theory nothing has been said of totems, though it is an all but universal rule that people of the same totem may not intermarry, even if the lovers belong to tribes separated by the breadth of the continent. In fact, according to the hypothesis which has been set forth, totems, though now exogamous, played no *original* part in the evolution of exogamy. They came in by accident, not by design, and dropped into their place in a system carefully devised.

Originally, on this theory, a totem came to a child, not as is usual now, by inheritance, but by pure accident; the mother supposing that any object which caught her attention at the moment when she first felt the life of her child, or any article of food which she had recently eaten, became incarnate in her, so that the emu (say) which she saw, or had eaten of, was her child. He or she was an Emu man or woman, by totem was an Emu.

Certain localities, later, were somehow associated each with one given object—cat, kangaroo, grub, or anything else, and now "local totems" (if the phrase may be used) took the place of "conceptional totems," as among the Arunta. The child inevitably was of the *local* totem and its supposed place of conception.

Finally all tribes except the Arunta "nation" made the totem hereditary, either from mother or father; and as the mother or father, an Emu, was in division A, so was the child, and he or she must marry out of that division into the other, B.[6]

The objections taken to this theory are now to be stated:

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[1] *N.T.S.E.A.* pp. 89, 90.

[2] *Totemism*, iv. 75–120.

[3] Ibid. i. 165.

[4] Ibid. iv. 155, 156.

[5] Ibid. iv. 158.

[6] Frazer, *Totemism*, i. 157–167.

(i.) The theory can by no possibility apply to tribes with three or more main exogamous divisions or phratries, such as we find in North America. In a three-phratry tribe we are reduced to suppose that there were three sexes, or resort to some other solution not perhaps compatible with the theory. (ii.) We have no evidence that any totemic people, except the Navajoes, think the closest sexual unions injurious to the parties or their offspring. The theory is thus merely extracted from the facts—certain unions are forbidden, therefore they *must* have been deemed injurious. Now, even if they were generally thought injurious, the belief would be a mere inference from the fact that they were forbidden. (iii.) The supposed original legislative exogamous division produced a very different effect than that said to be aimed at, namely, the prohibition of marriage between brothers and sisters. It forbade to every man marriage with half the women of his tribe, most of whom were not, even in the wide native use of the term, his "tribal" sisters, that is, women in a man's phratry of the same status as his own sisters. Such relationships, of course, could not exist before they were created by the supposed Act of Division. It would have been easy to prohibit marriages of brothers with sisters directly, just as, though no exogamous rule forbids, the father, in tribes of female descent, is *directly* forbidden to marry his daughters. The natives can take a simple instead of a bewildering path. To this natural objection Mr Frazer replies:[1] "If we assume, as we have every right to do, that the founders of exogamy in Australia recognized the classificatory system of relationship, and the classificatory system of relationship only, we shall at once perceive that what they intended to prevent was not merely the marriage of a man with his sister, his mother, or his daughter in the physical sense in which we use these terms; their aim was to prevent his marriage with his sister, his mother and his daughter in the classificatory sense of these terms; that is, they intended to place bars to marriage not between individuals merely but between the whole groups of persons who designated their group, not their individual relationships, their social, not their consanguineous ties, by the names of father and mother, brother and sister, son and daughter. And in this intention the founders of exogamy succeeded perfectly." Mr Frazer's theory of the origin of exogamy appears now to waver. It was[2] that the primal bisection of the tribe was "deliberately devised and adopted as a means of preventing the marriage, at first, of brother with sisters. . . ." Here was the place to say, if it was then intended to say, that the Australians "recognized the classificatory system of relationships only." As a matter of fact they recognize both the consanguine and the classificatory systems. It is not the case that "the savage Australian, it may be said with truth, has no idea of relationships as we understand them, and does not discriminate between his actual father and mother and the men and women who belong to the group, each member of which might have lawfully been either his father or his mother, as the case may be."

This statement is made inadvertently and unfortunately by Messrs Spencer and Gillen,[3] but it is contradicted by their own observations. An Arunta can tell you, if asked, which of all the men whom he calls "father" is his very own father.[4] The Dieri have terms for "great" (actual) and "little" (tribal) father, and so for other relationships. In Arunta orgies a woman's "tribal" "fathers" and "brothers" and "sons" are admitted to her embraces; her actual father and brothers and sons are excluded.[5] Thus, if the prohibition be based on aversion to unions of persons closely akin by blood, as the actual father is excluded, the actual father, among the Arunta, is, or has been, amongst that people, regarded as near of blood to his daughters. The Arunta are ignorant, we are told, of the part of the male in procreation. Be it so, but there has been a time when they were not ignorant, and when the father was recognized as of the nearest kin by blood to his daughters. If not, and if the prohibition is based on hatred of unions of close kin, why is the father excluded? Nothing, in short, can be more certain than that Australian tribes distinguish between "social" or "tribal" relations on the one hand, and close consanguine relations on the other. Among the Arunta office is inherited by a man from his mother's husband, his father *quem nuptiae demonstrant*; not from any "tribal" father.[6]

Mr Frazer[7] apparently meant in his earlier statement that brothers and sisters consanguine, and these only, were to be excluded from intermarriage, because he went on to say that science cannot decide as to whether the closest interbreeding is injurious to the offspring of healthy parents, however near in blood; and that very low savages could not discover what is hidden from modern science. He had therefore marriages of consanguine brothers and sisters present to his mind: "the closest interbreeding." Brothers and sisters were finally forbidden, on this theory, to intermarry, not because of any dread of injury to the offspring. "The only alternative open to us seems to be to infer that these unions were forbidden because they were believed to be injurious to the persons engaged in them, even when they were both in perfect health."[8] These "incestuous unions" are between brothers and sisters, mothers and sons. Here brothers and sisters consanguine, children of the same mother in each case, certainly appear to be intended. Who else, indeed, *can* be intended? But presently[9] we are to assume that the Australians, before they made the first exogamous division of the tribe "recognized the classificatory system of relationship, and the classificatory system only." They meant, *now*, to bar marriage between "whole groups of persons," related by "social, not consanguineous ties." But this seems to be physically impossible. These "whole groups" never existed, and never could exist, as far as we can see, till they were called into being by the legislative division of the tribe into two exogamous phratries—which had not yet been made. How could a man call a whole group of women "nupa," as at present (the word being applied to his wife and to all women of the opposite phratry to his whom he might legally marry) before the new law had constituted such a group? In what sense, again, were all women of a certain status called my "sisters" (like my actual sisters) before the new law made a new group of them—in regard to marriage as sacred as my own sisters now were to me? It cannot be said that *all* women of my status were called, collectively, my "sisters" before the new division of the tribe and new rule arose, because previously, all women of my status in the tribe have been my "sisters." Who else could be collectively my "sisters"? If to marry a "sister" were reckoned dangerous to her and to me, I must have been forbidden to marry all the women of my status in the tribe. How could a law which merely halved the number of my "sisters" remove the unknown danger from half of them? If any women except my actual sisters were, before the new rule, reckoned as *socially* my sisters, all women in the tribe of a certain status must have been so reckoned. If all dangerous, I must marry none of them. But by the new rule, I may marry half of them! Why have they ceased to be dangerous?

If the theory be that originally only brothers and sisters consanguine were thought dangerous to each other in sexual relations, and the superstition was later extended so as to include all "classificatory" brothers and sisters, *who* were in these days (before the exogamous division) classificatory brothers and sisters? How and for what reason were some marriageable girls in the tribe classificatory sisters of a young man while others, equally young and marriageable, were not? The classificatory brothers and sisters must have been all the marriageable youth of both sexes in a generation, in the tribe.

But then if all the youth of a generation, of both sexes, were classificatory brothers and sisters, and if therefore their unions were dangerous to themselves, or to the crops, the danger could not be prevented by dividing them into two sets, and allowing each set of brothers to marry each set of sisters. The only way to parry the danger was to force all these brothers and sisters to marry out of the local tribe into another local tribe with the same superstition. When that was done, the two local tribes, exogamous and intermarrying, were constituted into the two phratries of one local tribe. But that is not the theory of observers on the spot: their hypothesis is that a promiscuous and communistic local tribe, for no known or conceivable reason, bisected itself into two exogamous and intermarrying "moieties."

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[1] *Totemism*, i. 288.

[2] Ibid. i. 163.

[3] *Northern Tribes*, pp. 95 seq.; *Totemism*, i. 289.

[4] *Central Tribes*, p. 57.

[5] Ibid. p. 97.

[6] See *Proceedings of British Academy*, iii. 4. Lang, "Origin of Terms of Human Relationships."

[7] *Totemism*, i. 163.

[8] Ibid. i. 165.

[9] Ibid. i. 288.

On the face of it, it is a fatal objection to the theory that when men dwelt in an undivided commune they recognized no system of relationships but the classificatory, yet were well aware of consanguineous relationships; were determined to prohibit the marriages of people in such relationships; and included in the new prohibition people in no way consanguineous, but merely of classificatory kin. The reformers, by the theory, were perfectly able to distinguish consanguineous kinsfolk, so that they might easily have forbidden them to intermarry; while if *all* the members of the tribe were not in the classificatory degrees of relationship, who were? How were persons in classificatory relationships with each other discriminated from other members of the tribe who were not? They were easily discriminated as soon as the phratries were instituted, but, we think, not before.

Term of Classificatory Relationships.—Here it is necessary to say a few words about "classificatory" terms of relationship. Among many peoples the terms or names which with us denote relationships of consanguinity or affinity, such as Father, Mother, Brother, Sister, Son, Daughter, Husband, Wife, are applied both to the individuals actually consanguineous in these degrees, and also to all the other persons in the speaker's own main exogamous division or phratry who are of the same "age-grade" and social status as the Father, Mother, Brother, Sister, Son, Daughter, Husband, Wife, and so forth. As a man thus calls all the women whom he might legally have married by the same term as he calls his wife, and calls all children of persons of his own "age-grade," class and status by the same name as he calls his own children, many theorists hold this to be a proof of the origin of the nomenclature "in a system of group marriage in which groups of men exercised marital rights over groups of women, and the limitation of one wife to one husband was unknown. Such a system would explain very simply why every man gives the name of wife to a whole group of women, and every woman gives the name of husband to a whole group of men," and so on with all such collective terms of relationship.[1]

Certainly this is a very simple explanation. But if we wished to explain why every Frenchman applies the name which he gives to his "wife" (*femme*) to every "woman" in the world, it would be rather simpler than satisfactory to say that this nomenclature arose when the French people lived in absolute sexual promiscuity. The same reasoning applies to English "wife," German *Weib*, meaning "woman," and so on in many languages. Moreover the explanation, though certainly very simple, is not "the only reasonable and probable explanation." Suppose that early man, as in a hypothesis of Darwin's, lived, not in large local tribes with the present polity of such tribes in Australia, but in "cyclopean families," where the sire controlled his female mates and offspring; and suppose that he, from motives of sexual jealousy, and love of a quiet life, forbade amours between his sons and daughters. Suppose such a society to reach the dimensions of a tribe. The rules that applied to brothers and sisters, mothers and sons, would persist, and the original names for persons in such relationships in the family would be extended, in the tribe, to all persons of the same status: new terms being adopted, or old terms extended, to cover new social relationships created by social laws in a wider society.

Another Theory of the Origin of Totemism and Exogamy.—How this would happen may be seen in studying the other hypothesis of exogamy and totemism.[2] Man was at first, as Darwin supposed, a jealous brute who expelled his sons from the neighbourhood of his women; he thus secured the internal peace of his fire circle; there were no domestic love-feuds. The sons therefore of necessity married out—were exogamous. As man became more human, a son was permitted to abide among his kin, but he had to capture a mate from another herd (exogamy). The groups received sobriquets from each other, as Emu, Frog, and so forth, a fact illustrated copiously in the practice of modern and English and ancient Hebrew villages.[3]

The rule was now that marriage must be outside of the local group-name. Frog may not marry Frog, or Emu, Emu. The usual savage superstition which places all folk in mystic *rapport* with the object from which their *names* are derived gradually gave a degree of sanctity to Emu, Frog and the rest. They became totems.

Perhaps the captured women in group Emu retained and bequeathed to their children their own group-names; the children were Grubs, Ants, Snakes, &c. in Emu group. Let two such groups, Emu and Kangaroo, tired of fighting for women, make peace with *connubium*, then we have two phratries, exogamous and intermarrying, Emu and Kangaroo, with totem kins within them. (Another hypothesis is necessary if the original rule of all was, as among the Urabunna and other tribes, that each totem kin must marry out of itself into only one other totem kin.[4] But we are not sure of the fact of one totem to one totem marriage.) In short, the existence of the two main exogamous divisions in a tribe is the result of an alliance of two groups, already exogamous and intermarrying, not of a deliberate dissection of a promiscuous horde.[5]

The first objection to this system is that it is not held by observers on the spot, such as Mr Howett and Mr Spencer. But while all the observed facts of these observers are accepted (when they do not contradict their own statements, or are not corrected by fresh observations), theorists are not bound to accept the *hypotheses* of the observers. Every possible respect is paid to facts of observation. Hypotheses as to a stage of society which no man living has observed may be accepted as freely from Darwin as from Howitt, Spencer and L. Morgan.

It is next objected that "the only ground for denying that the elaborate marriage-system" (systems?) "of the Australian aborigines has been devised by them for the purpose which it actually serves, appears to be a preconceived idea that these savages are incapable of thinking out and putting in practice a series of checks on marriage so intricate that many civilized persons lack either the patience or the ability to understand them . . . The truth is that all attempts to trace the origin and growth of human institutions without the intervention of human intelligence and will are radically vicious and foredoomed to failure."[6] But nobody is denying that the whole set of Australian systems of marriage is the result of human emotions, intelligence and will. Nobody is denying that, in course of time, the aborigines have thought out and by successive steps have elaborated their systems. The only questions are, what were the human motives and needs which, in the first instance, set human intelligence and will to work in these directions; and how, in the first instance, did they work? The answers given to these questions are purely and inevitably hypothetical, whether given by observers or by cloistered students.

It is objected, as to the origin of totemism, that too much influence is given to accident, too little to design. The answer is that "accident" plays a great part in all evolution, and that, in the opposed theory, the existence and actual exogamous function of totems is also accidental, arising from ignorance and a peculiar superstition. It is urged that no men would accept a nickname given from without by hostile groups. This is answered by many examples of cases in which tribes, clans, political parties, and, of course, individuals, have accepted sobriquets from without, and even when these were hostile and derisive.[1] It is asked, Why, on this theory, are there but two exogamous divisions in the tribe? The reply is that in America there may be three or more: that in the Urabunna there are as many exogamous divisions (dual) as there are totems, and that these, like the main exogamous divisions, go in pairs, because marriage is between two contracting parties.[2]

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[1] *Totemism*, i. 304.

[2] Lang and Atkinson, *Social Origins and Primal Law*; Lang, *Secret of the Totem.*

[3] Lang, *Social Origins* and *Secret of the Totem.*

[4] *Anthropological Essays*, pp. 206–209.

[5] This theory, already suggested by the Rev. J. Mathew, and Mr Daniel McLennan, occurred independently to M. Van Gennep, who, in *Mythes et légendes d'Australie*, suppressed his chapter on it, after reading *The Secret of the Totem.* The conclusions were almost identical with those of that work (*Op. cit.* pp. vi. xxxiv.). The details of the evolution, which are many, may be found in *Social Origins and Primal Law*, and revised in *The Secret of the Totem.*

[6] *Totemism*, i. 280, 281.

It is maintained in this theory that Australian blacks, who are reflective and by no means illogical men, have long ago observed that certain marriages are rigorously barred by their social system, for no obvious reason. Thus a man learns that he must not marry in his own main exogamous division, say Eagle Hawk. He must choose a wife from the opposite division, Crow. She must belong to a certain set of women in Crow, whose tribal status is precisely that, in Crow, of his own sisters, and his "little sisters" (the women of his sister's status) in Eagle Hawk. The reflective tribesman does not know *why* these rules exist. But he perceives that the marriageable women in his own main division bear the same title as his sisters by blood. He therefore comes to the conclusion that they are all what his own sisters manifestly are, "too near flesh," as the natives say in English; and that the purpose of the rule is to bar marriage to him with all the women who bear the name "sisters" that denotes close consanguinity. Presently he thinks that other kinsfolk, actual, or bearing the same collective title as actual kinsfolk of his, are also "too near flesh," and he goes on to bar *them* till he reaches the eight class model; or like some south-eastern tribes, drops the whole cumbrous scheme in favour of one much like our own.

The reflective savage, in short, acts exactly as the Church did when she extended to cousins the pre-existing Greek and Roman prohibitions against the marriages of very near kin; and, again, extended them still further, to exclude persons not consanguineous at all but called by the same title as real consanguines, "father," "mother" and "child" in "gossipred" —godfather, godmother, godchild.

The savage and ecclesiastical processes are parallel and illustrate each other. Probably when a tribe with two main exogamous and intermarrying divisions came into existence in the way which we have indicated, the names used in *families* for father, mother, daughter, son, husband, wife, brother, sister, were simply extended so as to include, in each case, all persons in the tribe who were now of the same status, socially, with the same rights, restrictions and duties, as had been theirs in the fire-circle before the tribe was made a tribe by the union of two exogamous and previously hostile intermarrying local groups; or two sets of such groups. The process is natural; the wide extension now given to old names of relationships saved the trouble of making new names. Thus we have found a reasonable and probable way of accounting for classificatory terminology without adopting the hypothesis that it arose out of "group-marriage" and asking "But how did group-marriage arise?"

There is no accident here, all is deliberate and reflective design, beginning with the purely selfish and peace-loving design of the jealous sire. Meanwhile the totemic prohibition, "no marriage in the same totem name," has been retained and expanded even beyond the tribe, and "however remote the hunting grounds" of two persons, they may not intermarry if their totem name be the same.

Such are the two chief opposed theories of the origins of exogamy, and of the connexions of exogamy with totemism. The second does not enjoy the benefit of notice and criticism in Mr Frazer's *Totemism.*

Relations of the Social and Religious Aspects of Totemism.—It is a curious fact (if it be accepted as a fact) that the social aspect of totemism—the prohibition to marry a person of the same hereditary totem name—is sometimes strongest where the "religious" prohibition against killing or eating the totem is weakest; while the highest regard is paid to the totem, or to the god which is supposed to inhabit the totem species, where there is no prohibition on marrying within the totem name. Thus in Australia, where (except in the centre, among the Arunta) almost all tribes prohibit marriages within the totem name, it is scarcely possible to find an instance in which irreligious treatment of the totem, killing or eating it, is (as among many other totemic peoples) thought to be automatically or "religiously" punished by illness, death or miscarriage. Religion, in these cases, does not hold that the injured majesty of the totem avenges itself on the malefactor. On the other hand the Samoans, who pay no regard to the sacred animal of each community in the matter of not marrying within his name, believe that he will inflict death if one of his species be eaten—and if no expiatory rite be performed.[3] In Samoa, we saw, the so-called totem is the vehicle of a God; in Australia no such idea is found.

Meanwhile the offence of marrying within the totem name is nowhere automatically punished in any way except among the American Navajos, where, to make certain, the totem kin also inflicts secular penalties;[4] and it is part of the magic of the *Intichiuma* rites for the behoof of the totem that his kin should eat of him sparingly, as on all occasions they may do. In all other quarters, where marriage within the totem kin is forbidden, the penalty of a breach of law has been death or tribal excommunication. The offence is secular. The Euahlayi, who never marry within the totem name, "may and do eat their hereditary totems with no ill effects to themselves."[5] This is very common in South Australia. As a rule, however, in Australia some respect is paid to the actual plant or animal, and some Northern tribes who inherit the paternal totem respect it almost as much as the maternal totem. As they also inherit property in the maternal line, it seems clear that they have passed from female to male descent, as regards the totem, but not as regards inheritance.[6]

Male and Female Descent of the Totem.—It was the almost universal opinion of anthropologists that, in the earliest totemic societies, the totem was inherited from the mother, and that inheritance from the father was a later development. But when the peculiar totemism of the Arunta was discovered, and it was desired to prove that this non-exogamous totemism was the most primitive extant, it was felt to be a difficulty that the Arunta reckon descent of everything hereditable in the male, not the female line. If then, the Arunta were not primitive but advanced, in this matter as well as in their eight sub-classes and ceremonies, how could their totemism be primitive? It would have been easy to reply that a people might be "primitive" in some details though advanced in others—the fact is notorious. But to escape from the dilemma the idea was proposed that neither male nor female descent was more primitive than the other. One tribe might begin with male, one with female descent. Nobody *can* prove that it was not so, but "whereas evidence of the passage from female to male reckoning may be observed, there is virtually none of a change in the opposite direction."[7]

Thus the Worgaia and Northern neighbours of the Arunta, with male descent, have certainly passed through a system of female descent of the totem, and actually inherit property in the female line, while Strehlow's Aranda or Arunta inherit their *mothers'* totems. Moreover Howitt shows us at least one tribe with female descent, the Dieri, actually in the process of diverging from female to male descent of the totem. "A step further is when a man gives his totem name to his son, who then has those of both father and mother. This has been done even in the Dieri tribe," which appears to mean that it is also done in other tribes.[1]

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[1] *The Secret of the Totem*, pp. 128, 134.

[2] For other arguments explaining the duality of the divisions see Van Gennep, *ut supra*, p. xxxiv. and note 1.

[3] Turner, *Samoa*, p. 31, sqq.

[4] Bourke, *Snake Dance of the Moquis*, p. 279.

[5] Mrs Langloh Parker, *The Euahlayi Tribe*, p. 279.

[6] See for Worgaia and Warramunga reverence of the mother's totem, though they inherit the father's, Spencer and Gillen, *Northern Tribes*, p. 166. That these tribes, though reckoning descent in the paternal line, inherit property in the maternal is certain, see pp. 523, 524.

[7] Thomas, *ut supra*, p. 15.

A difficult case in marriage law is explained by saying that "possibly some man, as is sometimes the case, gave his *Murdu* (totem) to his son, who was then of two *Murdus*, and so could not marry a girl of one of his two totems."[2] We thus see how the change from female to male descent of the totem is "directly led to," as Mr Howitt says,[3] by a man's mere fatherly desire to have his son made a member of his own totem kin. On the other hand, we never read that with male descent of the totem a mother gives hers to son or daughter. All these facts make it hard to doubt (though absolute proof is necessarily impossible) that female everywhere preceded male descent of the totem.

Proof of transition from female to male descent of the totem appears to be positive in some tribes of the south of South Australia. Among them each person inherits his mother's totem, and may not marry a woman of the same. But he also inherits his father's totem, which "takes precedence," and gives its name to the local group. No person, as apparently among the Dieri when a father has "given his totem" to a son, may marry into either his father's or his mother's totem kin (Mrs Bates).

Thus we have a consecutive series of evolutions: (*a*) All inherit the maternal totem only, and must not marry within it. This is the rule in tribes of south-east Australia with female descent. (*b*) Some fathers in this society give their totems to sons, who already inherit their maternal totems. Such sons can marry into neither the paternal nor maternal totems. This was a nascent rule among the Dieri. (*c*) All inherit both the paternal and the maternal totem, and may marry into neither (southern South Australia). (*d*) All inherit the religious regard for the maternal totem, but may marry within it, while they may not marry within the paternal totem (Worgaia and Warramunga of north central Australia). (*e*) The paternal totem alone is religiously regarded, and alone is exogamous (tribes of south-east Australia with male descent). (*f*) The totem is neither hereditary on either side nor exogamous (Spencer's Arunta). (*g*) The maternal totem is hereditary and sacred, but not exogamous (Strehlow's Arunta).

In this scheme we give the degrees by which inheritance of the totem from the mother shades into inheritance of the totem from both parents (Dieri), thence to inheritance of both the maternal and paternal totem while the paternal alone regulates marriage (Worgaia and Warramunga), thence to exclusive inheritance of the paternal, without any regard paid to the maternal totem (some tribes of South Australia), and so on.

Meanwhile we hear of no tribe with paternal descent of the totem in which mothers are giving their own totems also to their children. We cannot expect to find more powerful presumptions in favour of the opinion that tribes having originally only maternal have advanced by degrees to only paternal descent of the totem. Mr Frazer says, "So far as I am aware, there is no evidence that any Australian tribe has exchanged maternal for paternal descent, and until such evidence is forthcoming we are justified in assuming that those tribes which now trace descent from the father formerly traced it from the mother."[4]

We have now provided, however, the evidence for various transitional stages from maternal to paternal descent, but have found no traces of the contrary process, nor more than one way of interpreting the facts. It is admitted by Mr Frazer that in several North American tribes the change from female to male descent has to all appearance been made.[5] Among the Delawares the initial process was much akin to that of the Dieri, who, in a tribe of female descent, "gives" his own totem to his sons. "The Delawares had a practice of sometimes naming a child into its father's clan," and a son thus became a member of his father's clan. This "may very well have served to initiate a change of descent from the female to the male line."[6] Howitt says precisely the same thing about the paternal practice of the Dieri. Thus there is no reason for denying that the change from female to male descent can be made by Australian as readily as by American tribes. We have given evidence for every step in the transition. The opposite opinion arose merely in an attempt to save the primitiveness of the Arunta, some of whom actually still make the maternal totem hereditary.

The change to male descent is socially very important. The totem kin of a man, for example, takes up his blood feud. Where the descent is female a "man may probably have some (totemic) kinsmen in the same group, but equally a considerable number of members of other totem kins." But it is clear that the rule of male descent gives far greater security to the members of a local group; for they are surrounded by kinsmen, local totem groups only occurring where male descent of the totem prevails, or is predominant.[7] The change from female to male descent of the totem, or the adoption of male descent from the first (if it ever occurred) is thus a great social advantage.

The Ways out of Totemism.—While Howitt believed (though later he wavered in his opinion) that female had always preceded male descent of the totem, he also observed that with male descent came in abnormal developments. One of these is that the people of a district with male descent are often known by the name of the region, or of some noted object therein (say wild cherries).[8] They may even regard (or white observers suppose that they regard) some object as their "local totem," yet they marry within that so-called totem. But they take to marrying, not out of the hereditary totem kin, which becomes obsolescent, but out of their own region into some other given locality. Thus in the Kurnai tribe there were no inevitable hereditary totems, but *thundung* were given by the fathers to lads "when about ten years old or at initiation."[9] The animal *thundung*(elder brother) was to protect the boy, or girl (the girl's *thundung* was called *banung*). The names of the creatures, in each case, appear to have been given to their human brothers and sisters; the *thundung* name descended to a man's sons. "The names are perpetuated" (under male descent) "from generation to generation in the same locality."[10]

Thus it appears that when a Kurnai wishes to marry he goes to a locality where he finds girls of *banung* names into which he may lawfully wed. So far he seems, in fact, to practise totemic exogamy; that he has to travel to a particular locality is merely an accident. Though the *thundung* and *banung* names are not inherited at birth by the children, they are given by the father when the child is old enough to need them.[11]

On the whole, we seem to see, in tribes where male descent is of old standing, that the exogamous function of the totem becomes obsolete, but a shadow of him, as *thundung*, retains a sort of "religious" aspect and even an unappreciated influence in marriage law.

In Fiji and Samoa, in Melanesia[12] and British New Guinea, many types of contaminated and variegated survivals of totemism may be studied. In the Torres Islands[13] hero-worship blends with totemic survivals. As in parts of South Africa, where a *tribe*, not a kin, has a sacred animal, as in Fiji, he seems to be the one survivor of many totems, the totem of some dominant local totem group, before which the other totems have fled, or but dimly appear, or are vehicles of gods, or, in Africa, of ancestral spirits. (These African tribal sacred animals are called Siboko[1].) Some tribes explain that the Siboko originated in an animal sobrique, as ape, crocodile, given from without.[2] Sibokoism, the presence of a sacred animal in a *local tribe*, can hardly be called totemism, though it is probable that the totem of the leading totem kin, among several such totem kins in a tribe, has become dominant, while the others have become obsolete. On the Gold Coast of Africa as long ago as 1819, Bowdich[3] found twelve "families," as he called them, of which most were called by the name of an animal, plant or other object, more or less sacred to them. They might not marry a person of the same kindred name, and there can be little doubt that totemism, with exogamy, had been the rule. But now the rules are broken down, especially in the peoples of the coast. The survivals and other information may be found in the *Journal of the Anthropological Institute* (1906) xxxvi. 178, 188.

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[1] *N.T.S.E.A.* p. 284.
[2] Ibid. p. 167.
[3] Ibid. p. 284.
[4] *Totemism*, i. 317.
[5] Ibid. iii. 42, 58, 72, 80.

[6] *Totemism*, iii. 42.

[7] Except among the Arunta, where, though totems come by change, local groups are usual. See Spencer and Gillen, *Central Tribes*, p. 9. How this occurs we can only guess. See *Folk Lore*, vol. xx., No. 2, pp. 229–231. Here it is conjectured that adults of the totem congregate for the purpose of convenience in performing *Intichiuma*, or magical services for the propagation of the totem as an article of food. For the nature of these rites, common in the central and northern but unknown to the south-eastern tribes, see *Central Tribes*, pp. 167–212, and *Northern Tribes*, pp. 283–320. The Arunta totem aggregates are magical local societies.

[8] *Central Tribes*, pp. 8, 9.
[9] *N.T.S.E.A.* p. 146.
[10] Ibid. p. 146.
[11] Cf. Howitt, ibid. pp. 270–279.

[12] Rivers, "Totemism in Polynesia and Melanesia," *Journ. Anthrop. Inst.* vol. xxxix.

[13] Haddon, *Cambridge Expedition*, vol. v.

There are fainter traces of totemism in the Awemba between Lake Tanganyika and Lake Bangweolo.[4] A somewhat vague account of Bantu totems in British East Africa, by Mr C. W. Hobley, indicates that among exogamous "clans" a certain animal is forbidden as food to each "clan."[5] The largest collection of facts about African totemism, from fresh and original sources, is to be found in Mr Frazer's book. For totemism in British Columbia the writings of Mr Hill Tout may be consulted.[6] The Thlinkit tribes have the institution in what appears to be its earliest known form, with two exogamous phratries and female descent. Among the Salish tribes "personal" totems are much more prominent. Mr Hill Tout, with Professor F. Boas, considers the hereditary exogamous totem to have its origin in the non-exogamous personal totem, which is acquired in a variety of ways. The Salish are not exogamous, and have considerable property and marked distinctions of rank. It does not, therefore, appear probable that their system of badges or crests and personal totems is more primitive than the totemic rules of the less civilized Thlinkits, who follow the form of the south-east Australian tribes.[7]

Other very curious examples of what we take to be aberrant and decadant totemism in New Guinea are given by Mr Seligmann (*Man*, 1908, No. 89), and by Dr Rivers for Fiji (*Man*, 1908, No. 75). Mr Seligmann (*Man*, 1908, No. 100) added to the information and elucidated his previous statements. The "clans" in British south-east New Guinea usually bear geographical names, but some are named after one of the totems in the "clan." "Every individual in the clan has the same linked totems," of which a bird, in each case, and a fish seem to be predominant and may not be eaten. "The clans are exogamous . . . and descent is in the female line." It appears, then, that a man, having several totems, all the totems in his "clan," must marry a woman of another "clan" who has all the totems of her "clan."

Similar multiplicity of totems, each individual having a number of totems, is described in Western Australia (Mrs Bates). In this case the word "totem" seems to be used rather vaguely and the facts require elucidation and verification. In this part of Australia, as in Fiji[8] "pour la naissance . . . l'apparition du totem-animal avait toujours lieu." In Fiji the mother sees the animal, which does not affect conception, and "is merely an omen for the child already conceived." But in Western Australia, as we have seen, the husband dreams of an animal, which is supposed to follow him home, and to be the next child borne by his wife. If it is correctly stated that when the husband has dreamed of no animal, while nevertheless his wife has a baby, the husband spears the man whom he suspects of having dreamed of an animal, the marital jealousy takes an unusual form and human life becomes precarious. But probably the husband has some reason for the direction of his suspicions. He never suspects a woman.

"The Banks' Islanders," says Mr Frazer, "have retained the primitive system of conceptional totemism."[9] On the other hand Dr Rivers, who is here our authority, writes "totemism is absent" from "the northern New Hebrides, the Banks' and the Terres groups."[10] In a place where totemism is absent it does not prima facie seem likely that we shall discover "the primitive system of conceptional totemism." The Banks' Islanders have no totemism at all. But they have a certain superstition applying to certain cases, and that superstition resembles Arunta and Loritja beliefs, in which Mr Frazer finds the germs of totemism. The superstition, however, has not produced any kind of totemism in the Banks' group of isles, at least, no totemism is found. "There are," writes Dr Rivers, "beliefs which would seem to furnish the most natural starting-point for totemism, beliefs which Dr Frazer has been led by the Australian evidence" (by part of the Australian evidence, we must say) "to regard as the origin of the institution." Thus, in Banks' Islands we have the starting-point of the institution, without the institution itself, and in many Australian tribes we have the institution—without the facts which are "the most natural starting-point." As far as they go these circumstances look as if "the most natural" were not the actual starting-point. The facts are these: in the Isle of Mota, Banks' group, "many individuals" are under a tabu not to eat, in each case, a certain animal or fruit, or to touch certain trees, because, in each case, "the person is believed to be the animal or fruit in question."

This tabu does not, as in totemism, apply to every individual; but only to those whose mothers, before the birth of the individuals, "find an animal or fruit in their loin-cloths." This, at least, "is usually" the case. No other cases are given. The women, in each case, are informed that their child "will have the qualities of the animal" (or fruit) "or even, it appeared would be himself or herself the animal" (or fruit). A coco-nut or a crocodile, a flying fox or a brush turkey, could not get inside a loin-cloth; the animal and fruits must be of exiguous dimensions. When the animal (or fruit) disappears "it is believed that it is because the animal has at the time of its disappearance entered into the woman. It seemed quite clear that there was no belief in physical impregnation on the part of the animal nor of the entry of a material object in the form of the animal . . , but, so far as I could gather, an animal found in this way was regarded as more or less supernatural, a spirit animal and not one material, from the beginning."

"There was no ignorance of the physical rôle of the human father, and the father played the same part in conception as in cases unaccompanied by an animal appearance." The part played by the animal or fruit is limited to producing a tabu against the child eating it, in each case, and some community of nature with the animal or fruit. Nothing here is hereditary. The superstition resembles some of those of the Arunta, Loritja and Euahlayi. Among the Euahlayi the superstition has no influence; normal totemism prevails; among the Arunta nation it is considered to be, and Dr Rivers seems to think that it is, likely to have been the origin of totemism. In Mota, however, it either did not produce totemism, or it did; and, where the *germ* has survived in certain cases, the institution has disappeared —while the germinal facts have vanished in the great majority of totemic societies. Dr Rivers does not explain how a brush turkey, a sea snake or a flying fox can get into a woman's loin-cloth, yet these animals, also crabs, are among those tabued in this way. Perhaps they have struck the woman's fancy without getting into her loin-cloth.

It is scarcely correct to say that "the Banks' Islanders have retained the primitive system of conceptional totemism." They only present, in certain instances, features like those which are supposed to be the germs of a system of conceptional totemism. In the case of the Arunta we have demonstrated that hereditary and exogamous totemism of the normal type preceded the actual conceptional method of acquiring, by local accident, "personal totems." If the Banks' Islanders were ever totemists they have ceased to be so, and merely retain, in cases, a superstition analogous to that which, among the Arunta, with the aid of the stone *churinga*, has produced the present unique and abnormal state of affairs totemic.

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[1] Frazer, "Totemism, South Africa," *Man* (1901), No. iii.

[2] See *Secret of the Totem*, pp. 25, 26.

[3] *Mission to Ashanti.*

[4] *Journ. Anthrop. Inst.* (1906), xxxvi. 154.

[5] Ibid. (1903), xxxiii. 346–348.

[6] Ibid. (1903–1904).

[7] See discussion in *Secret of the Totem* for details and references.

[8] Père Schmidt, *Man* (1908), No. 84, quoting Père de Marzan, *Anthropos*, ii. 400–405.

[9] *Man*, iv. 128.

[10] "Totemism in Polynesia and Melanesia," *Journ. Anthrop. Inst.* xxxix. 173, sqq.

For totemism in India, see Dalton, *Descriptive Ethnology of Bengal*; for the north of Asia, Strahlenberg's *Description*, &c. (1738); and in all instances Mr Frazer's book.

Myths of Totem Origins.—The myths of savages about the origin of totemism are of no historical value. Not worshipping ancestral spirits, an Australian will not, like an ancestor-worshipping African, explain his totem as an ancestral spirit. But where, as in the north and centre, he has an elaborate philosophy of spirits, there the primal totems exude spirits which are incarnated in women.

In their myths as to the origin of totemism, savages vary as much as the civilized makers of modern hypotheses. Some claim descent from the totem object; others believe that an original race of animals peopled the world; animals human in character, but bestial, vegetable, astral or what not, in form. These became men, while retaining the *rapport* with their original species; or their spirits are continually reincarnated in women and are born again (Arunta of Messrs Spencer and Gillen); or spirits emanating from the primal forms, or from objects in nature, as trees or rocks, connected with them, enter women and are reincarnated (Arunta of Mr Strehlow and some Australian north-western tribes, studied by Mrs Bates). Other Australians believe that the All-Father, Baiame, gave totems and totemic laws to men.[1] There are many other explanatory myths wherever totemism, or vestiges thereof, is found in Australia, Africa, America and Asia.

All the myths of savages, except mere romantic *Märchen*, and most of the myths of peoples who, like the Greeks, later became civilized, are "aetiological," that is, are fanciful hypotheses made to account for everything, from the universe, the skies, the sun, the moon, the stars, fire, rites and ceremonies, to the habits and markings of animals. It is granted that almost all of these fables are historically valueless, but an exception has been made, by scholars who believe that society was deliberately reformed by an act bisecting a tribe into two exogamous divisions, for savage myths which hit on the same explanation. We might as well accept the savage myths which hit on other explanations, for example the theory that Sibokoism arose from animal sobriquets. Exceptions are also made for Arunta myths in which the primal ancestors are said to feed habitually if not exclusively on their own totems. But as many totems, fruit, flowers, grubs, and so on are only procurable for no longer than the season of the May-fly or the March-brown, these myths are manifestly fabulous.

Again the Arunta primal ancestors are said to have cohabited habitually with women of their own totem, though without prejudice against women of other totems whom they encountered in their wanderings. These myths are determined by the belief in *oknanikilla*, or spots haunted by spirits all of one totem, which, again, determine the totem of every Arunta. The idea being that the fabled primal ancestors male and female in each wandering group of miracle-workers were always all of one totem, it follows that, if not celibate, which these savages never are, they must have cohabited with women of their own totem, and, by the existing Arunta system, there is no reason why they should not have done so. In no other field of research is historical value attributed to savage legends about the inscrutable past that lies behind existing institutions.

We are thus confronted by an institution of great importance socially where it regulates marriages and the blood-feud, or where it is a bond of social union between kinsmen in the totem or members of a society which does magic for the behoof of its totem (central and north-western Australia), and is of some "religious" and mythical importance when, as in Samoa, the sacred animal is regarded as the vehicle of a god. Of the origin of these beliefs, which have practical effects in the evolution of society and religion, much, we saw, is conjectured, but as we know no race in the act of becoming totemic—as in all peoples which we can study totemism is an old institution, and in most is manifestly decaying or being transmuted—we can only form the guesses of which examples have been given. Others may be found in the works of Herbert Spencer and Lord Avebury, and criticisms of all of them may be read in A. Lang's *Social Origins*.

Whether or not survivals of totems are to be found in the animal worship of ancient Egypt, in the animal attendants of Greek gods, in Greek post-Homeric legends of descent from gods in various bestial disguises, and in certain ancient Irish legends, it is impossible to be certain, especially as so many gods are now explained as spirits of vegetation, to which folk-lore assigns carnal forms of birds and beasts.

Other Things called Totems.—As has been said, the name "totem" is applied by scholars to many things in nature which are not hereditary and exogamous totems. The "local totem" (so called) has been mentioned, also "linked totems."

Personal Totems.—This is the phrase for any animal or other object which has been "given" to a person as a protective familiar, whether by a sorcerer[2] or by a father, or by a congress of spaewives at birth; or whether the person selects it for himself, by the monition of a dream or by caprice. The Euahlayi call the personal totem *Yûnbeai*, the true totem they style *Dhe*. They may eat their real but not their personal totems, which answer to the hares and black cats of our witches.

Three or four other examples of tribes in which "personal totems" are "given" to lads at initiation are recorded by Howitt.[3] The custom appears to be less common in Australia than in America and Africa (except in South Australia, where people may have a number of "personal totems"). In one case the "personal totem" came to a man in a dream, as in North America.[4] Here it may be noted that the simplest and apparently the easiest theory of the origin of totemism is merely to suppose that a man, or with female descent a woman, made his or her personal totem hereditary for ever in his or her descendants. But nobody has explained how it happened that while all had evanescent personal totems those of a few individuals only become stereotyped and hereditary for ever.

Sex-Totems.—The so-called "sex totem" is only reported in Australia. Each sex is supposed by some tribes to have its patron animal, usually a bird, and to injure the creature is to injure the sex. When lovers are backward the women occasionally kill the animal patron of the men, which produces horse-play, and "a sort of jolly fight," like sky-larking and flirtation.[5] The old English "jolly kind of fight," between girls as partisans of ivy, and men as of the holly "sex-totem," is a near analogue. It need not be added that "sex-totems" are exogamous, in the nature of things.

Sub-Totems.—This is the name of what are also styled "multiplex totems," that is, numerous objects claimed for their own by totem kins in various Australian regions. The Emu totem kin, among the Euahlayi tribe, claims as its own twenty-three animals and the north-west wind.[6] The whole universe, including mankind, was apparently divided between the totem kins. Therefore the list of sub-totems might be extended indefinitely.[7] These "sub-totems" are a savage effort at universal classification.

Conclusion.—We have now covered the whole field of controversy as to the causes and origins of totemic institutions. Australia, with North America, provides the examples of those institutions which seem to be "nearest to the beginning," and in Australia the phenomena have been most carefully and elaborately observed among peoples the least sophisticated. In North America most that we know of many great tribes, Iroquois, Hurons, Delawares and others, was collected long ago, and when precision was less esteemed, while the tribes have been much contaminated by our civilization. It has been unavoidably necessary to criticize, at almost every stage, the conclusions and hypotheses of the one monumental collection of facts and theories, Mr Frazer's *Totemism* (1910). Persons who would pursue the subject further may consult the books mentioned in the text, and they will find a copious, perhaps an exhaustive bibliography in the references of Mr Frazer's most erudite volumes, with their minute descriptive account not only of the totemism, but of the environment and general culture of hundreds of human races, in Savagery and in the Lower and Higher Barbarism. (A. L.)

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[1] Mrs Langloh Parker, *The Euahlayi Tribe*.

[2] *The Euahlayi Tribe*, p. 21.

[3] *N.T.S.E.A.* pp. 144-148.

[4] Ibid. p. 154.

[5] Ibid. pp. 148-151.

[6] *The Euahlayi Tribe*, p. 15.

[7] *N.T.S.E.A.* p. 454.

TOTILA (d. 552), king of the Ostrogoths, was chosen king after the death of his uncle Ildibad in 541, his real name being, as is seen from the coinage issued by him, Baduila. The work of his life was the restoration of the Gothic kingdom in Italy and he entered upon the task at the very beginning of his reign, collecting together and inspiring the Goths and winning a victory over the troops of the emperor Justinian, near Faenza. Having gained another victory in 542, this time in the valley of Mugello, he left Tuscany for Naples, captured that city and then received the submission of the provinces of Lucania, Apulia and Calabria. Totila's conquest of Italy was marked not only by celerity but also by mercy, and Gibbon says "none were deceived, either friends or enemies, who depended on his faith or his clemency." Towards the end of 545 the Gothic king took up his station at Tivoli and prepared to starve Rome into surrender, making at the same time elaborate preparations for checking the progress of Belisarius who was advancing to its relief. The Imperial fleet, moving up the Tiber and led by the great general, only just failed to succour the city, which must then, perforce, open its gates to the Goths. It was plundered, although Totila did not carry out his threat to make it a pasture for cattle, and when the Gothic army withdrew into Apulia it was from a scene of desolation. But its walls and other fortifications were soon restored, and Totila again marching against it was defeated by Belisarius, who, however, did not follow up his advantage. Several cities were taken by the Goths, while Belisarius remained inactive and then left Italy, and in 549 Totila advanced a third time against Rome, which he captured through the treachery of some of its defenders. His next exploit was the conquest and plunder of Sicily, after which he subdued Corsica and Sardinia and sent a Gothic fleet against the coasts of Greece. By this time the emperor Justinian was taking energetic measures to check the Goths. The conduct of a new campaign was entrusted to the eunuch Narses; Totila marched against him and was defeated and killed at the battle of Tagina in July 552.

See E. Gibbon, *Decline and Fall*, edited by J. B. Bury (1898), vol. iv; T. Hodgkin, *Italy and her Invaders* (1896), vol. iv. and Kampfner, *Totila, König der Ostgoten* (1889).

TOTNES, GEORGE CAREW, or Carey, Earl of (1555-1629), English politician and writer, son of Dr George Carew, dean of Windsor, a member of a well-known Devonshire family, and Anne, daughter of Sir Nicholas Harvey, was born on the 29th of May 1555,[1] and was educated at Broadgates Hall, Oxford, where he took the degree of M.A. in 1588. He distinguished himself on the field on several occasions and filled important military commands in Ireland. In 1584 he was appointed gentleman-pensioner to Queen Elizabeth, whose favour he gained. In 1586 he was knighted in Ireland. Refusing the embassy to France, Sir George Carew was made master of the ordnance in Ireland in 1588, in 1590 Irish privy councillor; and in 1592 lieutenant-general of the ordnance in England, in which capacity he accompanied Essex in the expedition to Cadiz in 1596 and to the Azores in 1597. In 1598 he attended Sir Robert Cecil, the ambassador, to France. He was appointed treasurer at war to Essex in Ireland in March 1599, and on the latter's sudden departure in September of the same year, leaving the island in disorder, Carew was appointed a lord justice, and in 1600 president of Munster, where his vigorous measures enabled the new lord deputy, Lord Mountjoy, to suppress the rebellion. He returned to England in 1603 and was well received by James I., who appointed him vice-chamberlain to the queen the same year, master of the ordnance in 1608, and privy councillor in 1616; and on the accession of Charles I. he became treasurer to Queen Henrietta Maria in 1626. He sat for Hastings in the parliament of 1604, and on the 4th of June 1605 was created Baron Carew of Clopton, being advanced to the earldom of Totnes on the 5th of February 1626. In 1610 he revisited Ireland to report on the state of the country; and in 1618 pleaded in vain for his friend Sir Walter Raleigh. He died on the 27th of March 1629, leaving no issue. He married Joyce, daughter of William Clopton, of Clopton in Warwickshire.

Besides his fame as president of Munster, where his administration forms an important chapter in Irish history, Carew had a considerable reputation as an antiquary. He was the friend of Camden, of Cotton and of Bodley. He made large collections of materials relating to Irish history and pedigrees, which he left to his secretary, Sir Thomas Stafford, reputed on scanty evidence to be his natural son; while some portion has disappeared, 39 volumes after coming into Laud's possession are now at Lambeth, and 4 volumes in the Bodleian Library. A calendar of the former is included in the State Papers series edited by J. S. Brewer and W. Bullen. His correspondence from Munster with Sir Robert Cecil was edited in 1864 by Sir John Maclean, for the Camden Society, and his letters to Sir Thomas Roe (1615-1617) in 1860. Other letters or papers are in the Record Office; among the MSS. at the British Museum and calendared in the *Hist. MSS. Com. Series, Marquess of Salisbury's MSS.* Stafford published after Carew's death *Pacata Hibernia, or the History of the Late Wars in Ireland* (1633), the authorship of which he ascribes in his preface to Carew, but which has been attributed to Stafford himself. This was reprinted in 1810 and re-edited in 1896. *A Fragment of the History of Ireland*, a translation from a French version of an Irish original, and *King Richard II.... in Ireland* from the French, both by Carew, are printed in Walter Harris's *Hibernica* (1757). According to Wood, Carew contributed to the history of the reign of Henry V. in Speed's *Chronicle*. His opinion on the alarm of the Spanish invasion in 1596 has also been printed.

See also the *Life of Sir P. Carew*, ed. by Sir J. Maclean (1857).

TOTNES, a market town and municipal borough in the Totnes parliamentary division of Devonshire, England, on the Dart, 29 m. S.S.W. of Exeter, by the Great Western railway. Pop. (1901), 4035. It stands on the west bank of the river, and is joined by a bridge to the suburb of Bridgetown. It was formerly a walled town, and two of the four gates remain. Many old houses are also preserved, and in High Street their overhanging upper stories, supported on pillars, form a covered way for foot-passengers. The castle, founded by the Breton Juhel, lord of the manor after the Conquest, was already dismantled under Henry VIII.; but its ivy-clad keep and upper walls remain. The grounds form a public garden. Close by are the remains of St Mary's Priory, which comprise a large Perpendicular gatehouse, refectory, precinct wall, abbot's gate and still-house. A grammar school, founded 1554, occupied part of the Priory, but was removed in 1874 to new buildings. The Perpendicular church of St Mary contains a number of interesting tombs and effigies dating from the 15th century onwards, and much excellent carved work. The guildhall is formed from part of the Priory. Vessels of 200 tons can lie at the wharves near the bridge. The industries include brewing, flour milling, and the export of agricultural produce, chiefly corn and cider. Trout and salmon are plentiful in the river. The town is governed by a mayor, 4 aldermen and 12 councillors. Area 1423 acres.

Totnes (*Toteneis*, *Totton*) was a place of considerable importance in Saxon times; it possessed a mint in the reign of Æthelred, and was governed by a portreeve. In the Domesday Survey it appears as a mesne borough under Juhel of Totnes, founder of the castle and priory; it had 95 burgesses within and 15 without the borough, and rendered military service according to the custom of Exeter. In 1215 a charter from John instituted a gild merchant with freedom from toll throughout the land. A mayor is mentioned in the court roll of 1386–1387, and a charter from Henry VII. in 1505 ordered that the mayor should be elected on St Matthew's day, and should be clerk of the market. The present governing charter was granted by Elizabeth in 1596, and instituted a governing body of a mayor, fourteen masters or councillors, and an indefinite number of burgesses, including a select body called "the Twenty-men." A fresh charter of incorporation from James II. in 1689 made no alterations of importance. The borough was represented in parliament by one member in 1295, and by two members from 1298 until disfranchised by the act of 1867. A market on Saturday existed at least as early as 1255, and in 1608 is described as well stocked with provisions. The charter of Elizabeth granted a three days' fair at the feast of SS Simon and Jude (Oct. 28), and in 1608 fairs were also held on May day and at the feast of St James (July 25). The market day has been transferred to Friday, but the May and October fairs are continued. The town was formerly noted for serges, and in 1641 the inhabitants represented their distress owing to the decline of the woollen trade. The industry is now extinct. During the Civil War General Goring quartered his troops at Totnes, and Fairfax also made it his temporary station.

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[1] According to his own statement, *Archaeologia*, xii. 401. In the introduction, however, to the Calendar of Carew MSS. the date of his birth is given as 1558, and his admission into Broadgates Hall in 1572, aged 15. In the preface to Carew's Letters to Roe it is given as 1557.

See *Victoria County History; Devonshire*; *The History of Totnes, its neighbourhood and Berry Pomeroy Castle*, (Totnes, 1825); William Cotton, *A Graphic and Historical Sketch of the Antiquities of Totnes* (London, 1858).

TOTONICAPAM, or Totonicapan, the capital of the department of Totonicapam, Guatemala, on the same high plateau as Quezaltenango, the nearest railway station, from which it is 12 m. E.N.E. Pop. (1905) about 28,000. Totonicapam is inhabited mainly by Quiché Indians, employed in the making of cloth, furniture, pottery and wooden musical instruments. There are hot mineral springs in the neighbourhood. In 1838 Totonicapam was declared an independent republic, in which the adjoining departments of Sololá and Quezaltenango were included. This state existed for two years, and was then again merged in the republic of Guatemala. Totonicapam suffered greatly in the earthquake of the 18th of April 1902.

TOTTENHAM, an urban district in the Tottenham parliamentary division of Middlesex, England, forming a north suburb of London, 6½ m. north of London Bridge, adjoining Edmonton on the south. Pop. (1901), 102,541. Its full name, not now in use, was Tottenham High Cross, from the cross near the centre of the township. The origin and significance of this cross are doubtful. The present structure was erected *c.* 1600, and ornamented with stucco in 1809. In the time of Isaak Walton there stood by it a shady arbour to which the angler was wont to resort. Formerly Tottenham was noted for its "greens," in the centre of one of which stood the famous old elm trees called the "Seven Sisters"; these were removed in 1840, but the name is preserved in the Seven Sisters Road. Bruce castle, on the site of the old mansion of the Bruces, but built probably by Sir William Compton in the beginning of the 16th century, was occupied by a boarding-school founded by Mr (afterwards Sir) Rowland Hill in 1827 on the system instituted by him at Hazlewood, Birmingham. It became public property in 1892. The church of All Hallows, Tottenham, was given by David, king of Scotland (*c.* 1126) to the canons of the church of Holy Trinity, London. It retains Perpendicular portions, a south porch of brick of the 16th century and numerous ancient monuments and brasses. The grammar school was enlarged and endowed in 1686 by Sarah, dowager duchess of Somerset. The urban district formerly included Wood Green to the west, but this became a separate urban district in 1888 (pop. 34,233).

In the reign of Edward the Confessor the manor of Tottenham was possessed by Earl Waltheof. It was inherited by his daughter Maud, who was married first to Simon de St Liz and afterwards to David, son of Malcolm III., king of Scotland, who was created by Henry I. earl of Huntingdon, and received possession of all the lands formerly held by Earl Waltheof. The manor thus descended to William the Lion, king of Scotland, and was granted by him in 1184 to his brother David, earl of Angus and Galloway, the grant being confirmed in 1199 by King John of England, who created him earl of Huntingdon. He married Maud, heiress of Hugh, earl of Chester, and his son John inherited both earldoms. The son married Helen, daughter of Llewelyn, prince of Wales, by whom he was poisoned in 1237, dying without issue. She retained possession till 1254, when the manor was divided between his coheirs Robert de Brus, John de Baliol and Henry de Hastings, each division forming a distinct manor bearing the name of its owner. In 1429 they were reunited in the possession of John Gedeney, alderman of London.

William Bedwell, the Arabic scholar, was vicar of Tottenham, and published in 1632 a *Briefe Description of the Towne of Tottenham*, in which he printed for the first time the burlesque poem, the *Turnament of Tottenham.*

TOTTENVILLE, a former village of Richmond county, New York, U.S.A., and since 1898 a part of New York City. It is on the southern shore of Staten Island in New York Bay and on Staten Island Sound, about 20 m. S.W. of the south extremity of Manhattan Island, and is the terminus of the Staten Island Rapid Transit railway. Marine engines, terra-cotta and boats are manufactured here, and there are oyster fisheries. The "Billopp House" here (still standing) was the scene of the conference, on the 11th of September 1776, between Lord Howe, representing Lord North, and Benjamin Franklin, John Adams and Edward Rutledge, representing the Continental Congress, with regard to Lord North's offer of conciliation. This house, originally called the "Manor of Bentley," was built by Captain Christopher Billopp (1638–1726), who sailed from England in an armed vessel, the "Bentley," in 1667, and, by circumnavigating Staten Island in 24 hours, made it, under the ruling of the duke of York, a part of New York. From the duke of York he received 1163 acres of land, including the present site of Tottenville. The village was long known as Bentley, but in 1869 was incorporated (under a faulty charter, revised in 1894) as Tottenville, apparently in honour of Gilbert Totten, a soldier in the War of Independence.

TOUCAN, the Brazilian name of a bird,[1] long since adopted into nearly all European languages, and apparently first given currency in England (though not then used as an English word) in 1668[2] by W. Charleton (*Onomasticon*, p. 115); but the bird, with its enormous beak and feather-like tongue, was described by Oviedo in his *Sumario de la historia natural de las Indias*, first published at Toledo in 1527 (ch. 42),[3] and, to quote the translation of part of the passage in F. Willughby's *Ornithology* (p. 129), "there is no bird secures her young ones better from the *Monkeys*, which are very noisom to the young of most Birds. For when she perceives the approach of those Enemies, she so settles her self in her Nest as to put her Bill out at the hole, and gives the *Monkeys* such a welcome therewith, that they presently pack away, and glad they scape so." Indeed, so remarkable a bird must have attracted the notice of the earliest European invaders of America, the more so since its gaudy plumage was used by the natives in the decoration of their persons and weapons. In 1555 P. Belon (*Hist. nat. oyseaux*, p. 184) gave a characteristic figure of its beak, and in 1558 Thevet (*Singularitez de la France antarctique*, pp. 88–90) a long description, together with a woodcut (in some respects inaccurate, but quite unmistakable) of the whole bird, under the name of "Toucan," which he was the first to publish. In 1560 C. Gesner (*Icones avium*, p. 130) gave a far better figure (though still incorrect) from a drawing received from Ferrerius, and suggested that from the size of its beak the bird should be called *Burhynchus* or *Ramphestes*. This figure, with a copy of Thevet's and a detailed description, was repeated in the posthumous edition (1585) of his larger work (pp. 800, 801). By 1579 Ambroise Paré (*Œuvres*, ed. Malgaigne, iii. 783) had dissected a toucan that belonged to Charles IX. of France, and about the same time Léry (*Voyage fait en la terre du Brésil*, ch. xi.), whose chief object seems to have been to confute Thevet, confirmed that writer's account of this bird in most respects. In 1599 Aldrovandus (*Ornithologia*, i. 801–803), always ready to profit by Gesner's information, and generally without acknowledgment, again described and repeated the former figures of the bird; but he corrupted his predecessor's *Ramphestes* into *Ramphastos*, and in this incorrect form the name, which should certainly be *Rhamphestes* or *Rhamphastas*, was subsequently adopted by Linnaeus and has since been recognized by systematists. Into the rest of the early history of the toucan's discovery it is needless to go.[1] Additional particulars were supplied by many succeeding writers, until in 1834 J. Gould completed his *Monograph* of the family[2] (with an anatomical appendix by R. Owen), to which, in 1835, he added some supplementary plates; and in 1854 he finished a second and much improved edition. The most complete compendium on toucans is J. Cassin's "Study of the Ramphastidae," in the *Proceedings* of the Philadelphia Academy for 1867 (pp. 100–124).

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[1] Commonly believed to be so called from its cry; but Skeat (*Proc. Philolog. Society*, May 15, 1885) adduces evidence to prove that the Guarani *Tuca* is from *tĩ*, nose, and *cáng*, bone, *i.e.* nose of bone.

[2] In 1656 the beak of an "Aracari of Brazil," which was a toucan of some sort, was contained in the *Musaeum tradescantianum* (p. 2), but the word toucan does not appear there.

[3] The writer has only been able to consult the reprint of this rare work contained in the *Biblioteca de autores españoles* (xxii. 473-515), published at Madrid in 1852.

By recent systematists 5 genera and from 50 to 60 species of the family are recognized; but the characters of the former have never been satisfactorily defined, much less those of numerous subdivisions which it has pleased some writers to invent. There can be little doubt that the bird first figured and described by the earliest authors above named is the *R. toco* of nearly all ornithologists, and as such is properly regarded as the type of the genus and therefore of the family. It is one of the largest, measuring 2 ft. in length, and has a wide range throughout Guiana and a great part of Brazil. The huge beak, looking like the great claw of a lobster, more than 8 in. long and 3 high at the base, is of a deep orange colour, with a large black oval spot near the tip. The eye, with its double iris of green and yellow, has a broad blue orbit, and is surrounded by a bare space of deep orange skin. The plumage generally is black, but the throat is white, tinged with yellow and commonly edged beneath with red; the upper tail-coverts are white, and the lower scarlet. In other species of the genus, 14 to 17 in number, the bill is mostly particoloured—green, yellow, red, chestnut, blue and black variously combining so as often to form a ready diagnosis; but some of these tints are very fleeting and often leave little or no trace after death. Alternations of the brighter colours are also displayed in the feathers of the throat, breast and tail-coverts, so as to be in like manner characteristic of the species, and in several the bare space round the eye is yellow, green, blue or lilac. The sexes are alike in coloration, the males being largest. The tail is nearly square or moderately rounded. In the genus *Pteroglossus*, the "Aracaris" (pronounced Arassari), the sexes more or less differ in appearance, and the tail is graduated. The species are smaller in size, and nearly all are banded on the belly, which is generally yellow, with black and scarlet, while except in two the throat of the males at least is black. One of the most remarkable and beautiful is *P. beauharnaisi*, by some authors placed in a distinct genus and called *Beauharnaisius ulocomus*. In this the feathers of the top of the head are very singular, looking like glossy curled shavings of black horn or whalebone, the effect being due to the dilatation of the shaft and its coalescence with the consolidated barbs. Some of the feathers of the straw-coloured throat and cheeks partake of the same structure, but in a less degree, while the subterminal part of the *lamina* is of a lustrous pearly-white.[3] The beak is richly coloured, being green and crimson above and lemon below. The upper plumage generally is dark green, but the mantle and rump are crimson, as are a broad abdominal belt, the flanks and many crescentic markings on the otherwise yellow lower parts.[4] The group or genus *Selenodera*, proposed by J. Gould in 1837 (*Icones avium*, pt. 1), contains some 6 or 7 species, having the beak, which is mostly transversely striped, and tail shorter than in *Pteroglossus*. Here the sexes also differ in coloration, the males having the head and breast black, and the females the same parts chestnut; but all have a yellow nuchal crescent (whence the name of the group). The so-called hill-toucans have been separated as another genus, *Andigena*, and consist of some 5 or 6 species chiefly frequenting the slopes of the Andes and reaching an elevation of 10,000 ft., though one, often placed among them, but perhaps belonging rather to *Pteroglossus*, the *A. bailloni*, remarkable for its yellow-orange head, neck and lower parts, inhabits the lowlands of southern Brazil. Another very singular form is *A. laminirostris*, which has affixed on either side of the maxilla, near the base, a quadrangular ivory-like plate, forming a feature unique in this or almost in any family of birds. The group *Aulacorhamphus*, or "groove-bills," with a considerable but rather uncertain number of species, contains the rest of the toucans.

The monstrous serrated bill that so many toucans possess was by G. L. L. Buffon accounted a grave defect of nature, and it must be confessed that no one has given what seems to be a satisfactory explanation of its precise use, though on evolutionary principles none will now doubt its fitness to the bird's requirements. Solid as it looks, its weight is inconsiderable, and the perfect hinge by which the maxilla is articulated adds to its efficiency as an instrument of prehension. W. Swainson (*Classif. Birds*, ii. 138) imagined it merely "to contain an infinity of nerves, disposed like net-work, all of which lead immediately to the nostrils," and add to the olfactory faculty. This notion seems to be borrowed from J. W. H. Trail (*Trans. Linn. Society*, xi. 289), who admittedly had it from Waterton, and stated that it was "an admirable contrivance of nature to increase the delicacy of the organ of smell;" but R. Owen's description showed this view to be groundless, and he attributed the extraordinary development of the toucan's beak to the need of compensating, by the additional power of mastication thus given, for the absence of any of the grinding structures that are so characteristic of the intestinal tract of vegetable-eating birds—its digestive organs possessing a general simplicity of formation. The nostrils are placed so as to be in most forms invisible until sought, being obscured by the frontal feathers or the backward prolongation of the horny sheath of the beak. The wings are somewhat feeble, and the legs have the toes placed in pairs, two before and two behind. The tail is capable of free vertical motion, and controlled by strong muscles, so that, at least in the true toucans, when the bird is preparing to sleep it is reverted and lies almost flat on the back, on which also the huge bill reposes, pointing in the opposite direction.

The toucans are limited to the new world, and by far the greater number inhabit the north of South America, especially Guiana and the valley of the Amazons. Some three species occur in Mexico, and several in Central America. One, *R. vitellinus*, which has its head-quarters on the mainland, is said to be common in Trinidad, but none are found in the Antilles proper. They compose the family Ramphastidae of Coraciiform birds, and are associated with the woodpeckers (Picidae) and puff-birds and jacamars (Galbulidae); their nearest allies perhaps exist among the Capitonidae, but none of these is believed to have the long feather-like tongue which is so characteristic of the toucans, and is, so far as known, possessed besides only by the Momotidae (see MOTMOT). But of these last there is no reason to deem the toucans close relatives, and according to W. Swainson, who had opportunities of observing both, the alleged resemblance in their habits has no existence. Toucans in confinement feed mainly on fruit, but little seems amiss to them, and they swallow grubs, reptiles and small birds with avidity. They nest in hollow trees, and lay white eggs. (A. N.)

TOUCH (derived through Fr. *toucher* from a common Teutonic and Indo-Germanic root, cf. "tug," "tuck," O. H. Ger. *zucchen*, to twitch or draw), in physiology, a sense of pressure, referred usually to the surface of the body. It is often understood as a sensation of contact as distinguished from pressure, but it is evident that, however gentle be the contact, a certain amount of pressure always exists between the sensitive surface and the body touched. Mere contact in such circumstances is gentle pressure; a greater amount of force causes a feeling of resistance or of pressure referred to the skin; a still greater amount causes a feeling of muscular resistance, as when a weight is supported on the palm of the hand; whilst, finally, the pressure may be so great as to cause a feeling of pain. The force may not be exerted vertically on the sensory surface, but in the opposite direction, as when a hair on a sensory surface is pulled or twisted. Touch is therefore the sense by which mechanical force is appreciated, and it presents a strong resemblance to hearing, in which the sensation is excited by intermittent pressures on the auditory organ. In addition to feelings of contact or pressure referred to the sensory surface, contact may give rise to a sensation of temperature, according as the thing touched feels hot or cold. These sensations of contact, pressure or temperature are usually referred to the skin or integument covering the body, but they are experienced to a greater or less extent when any serous or mucous surface is touched. The skin being the chief sensory surface of touch, it is there that the sense is most highly developed both as to delicacy in detecting minute pressures and as to the character of the surface touched. Tactile impressions, properly so called, are absent from internal mucous surfaces, as has been proved in men having gastric, intestinal and urinary fistulae. In these cases, touching the mucous surface caused pain, and not a true sensation of touch.

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[1] One point of some interest may, however, be noticed. In 1705 Plot (*N.H. Oxfordshire*, p. 182) recorded a toucan found within two miles of Oxford in 1644, the body of which was given to the repository in the medical school of that university, where, he said, "it is still to be seen." Already in 1700 Leigh in his *Lancashire* (i. 195, Birds, tab. 1, fig. 2) had figured another which had been found dead on the coast of that county about two years before. The bird is easily kept in captivity, and no doubt from early times many were brought alive to Europe. Besides the one dissected by Paré, as above mentioned, Joh. Faber, in his additions to Hernandez's work on the Natural History of Mexico (1651), figures (p. 697) one seen and described by Puteus (Dal Pozzo) at Fontainebleau.

[2] Of this the brothers Sturm in 1841 published at Nuremberg a German version.

[3] This curious peculiarity naturally attracted the notice of the first discoverer of the species, Poeppig, who briefly described it in a letter published in Froriep's *Notizen* (xxxii. 146) for December 1831.

[4] Readers of F. Bates's *Naturalist on the River Amazons* will recollect the account (ii. 344) and illustration there given of his encounter with a flock of this species of toucan. His remarks on the other species with which he met are also excellent.

In the article Nerve (*Spinal*) the cutaneous distribution of the organs of touch is dealt with.

The Amphibia and Reptilia do not show any special organs of touch. The lips of tadpoles have tactile papillae. Some snakes have a pair of tentacles on the snout, but the tongue is probably the chief organ of touch in most serpents and lizards. All reptiles possessing climbing powers have the sense of touch highly developed in the feet.

Birds have epithelial papillae on the soles of the toes that are no doubt tactile. These are of great length in the capercailzie (*Tetrax urogallus*), "enabling it to grasp with more security the frosted branches of the Norwegian pine trees" (Owen). Around the root of the bill in many birds there are special tactile organs, assisting the bird to use it as a kind of sensitive probe for the detection in soft ground of the worms, grubs and slugs that constitute its food. Special bodies of this kind have been detected in the beak and tongue of the duck and goose, called the tactile corpuscles of F. S. Merkel, or the corpuscles of Grandry (fig. 1). Similar bodies have been found in the epidermis of man and mammals, in the outer root-sheath of tactile hairs or feelers. They consist of small bodies composed of a capsule enclosing two or more flattened nucleated cells, piled in a row. Each corpuscle is separated from the others by a transparent protoplasmic disk. Nerve fibres terminate either in the cells (Merkel) or in the protoplasmic intercellular matter (Ranvier, Hesse, Izquierdo). Another form of end-organ has been described by Herbst as existing in the mucous membrane of the duck's tongue. These corpuscles of Herbst are like small Pacinian corpuscles with thin and very close lamellae. Developments of integument devoid of feathers, such as the "wattles" of the cock, the "caruncles" of the vulture and turkey, are not tactile in their function.

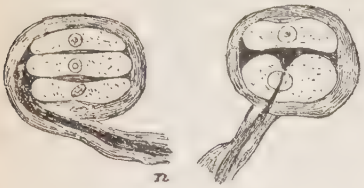


Fig. 1.—Tactile Corpuscles from duck's tongue.
n, Nerve.

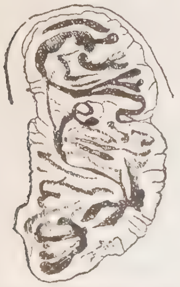


Fig. 2.—Tactile Corpuscle from the hand.

In the great majority of Mammalia the general surface of the skin shows sensitiveness, and this is developed to a high degree on certain parts, such as the lips, the end of a teat and the generative organs. Where touch is highly developed, the skin, more especially the epidermis, is thin and devoid of hair. In the monkeys tactile papillae are found in the skin of the fingers and palms, and in the skin of the prehensile tails of various species (*Ateles*). Such papillae also abound in the naked skin of the nose or snout, as in the shrew, mole, pig, tapir and elephant. In the *Ornithorhynchus* the skin covering the mandibles is tactile (Owen). In many animals certain hairs acquire great size, length and stiffness. These constitute the vibrissae or whiskers. Each large hair grows from a firm capsule sunk deep in the true skin, and the hair bulb is supplied with sensory nerve filaments. In the walrus the capsule is cartilaginous in texture. The marine Carnivora have strong vibrissae which "act as a staff, in a way analogous to that held and applied by the hand of a blind man" (Owen). Each species has hairs of this kind developed on the eyebrows, lips or cheeks, to suit a particular mode of existence, as, for example, the long fine whiskers of the night-prowling felines, and in the aye-aye, a monkey having nocturnal habits. In the Ungulata the hoofs need no delicacy of touch as regards the discrimination of minute points. Such animals, however, have broad, massive sensations of touch, enabling them to appreciate the firmness of the soil on which they tread, and under the hoof we find highly vascular and sensitive lamellae or papillae, contributing no doubt, not only to the growth of the hoof, but also to its sensitiveness. The Cetacea have numerous sensory papillae in the skin. Bats have the sense of touch strongly developed in the wings and external ears, and in some species in the flaps of skin found near the nose. There is little doubt that many special forms of tactile organs will be found in animals using the nose or feet for burrowing. A peculiar end-organ has been found in the nose of the mole, while there are "end-capsules" in the tongue of the elephant and "nerve rings" in the ears of the mouse.

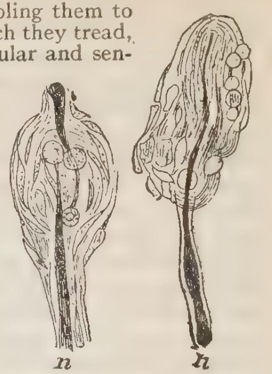


Fig. 3.—Tactile Corpuscles from clitoris of rabbit.
n, Nerve.

End-Organs of Touch in Man.—In man three special forms of tactile end-organs have been described, and can be readily demonstrated.

1. *The End-Bulbs of Krause.*—These are oval or rounded bodies, from $\frac{1}{360}$ to $\frac{1}{170}$ of an inch long. Each consists of a delicate capsule, composed of nucleated connective tissue enclosing numerous minute cells. On tracing the nerve fibre, it is found that the nerve sheath is continuous with the capsule, whilst the axis cylinder of the nerve divides into branches which lose themselves among the cells. W. Waldeyer and Longworth state that the nerve fibrils terminate in the cells, thus making these bodies similar to the cells described by F. S. Merkel (*ut supra*). (See fig. 4.) These bodies are found in the deeper layers of the conjunctiva, margins of the lips, nasal mucous membrane, epiglottis, fungiform and circumvallate papillae of the tongue, glans penis and clitoris, mucous membrane of the rectum of man, and they have also been found on the under surface of the "toes of the guinea-pig, ear and body of the mouse, and in the wing of the bat" (Landois and Stirling). In the genital organs aggregations of end-bulbs occur, known as the "genital corpuscles of Krause" (fig. 3). In the synovial membrane of the joints of the fingers there are larger end-bulbs, each connected with three four nerve-filaments.

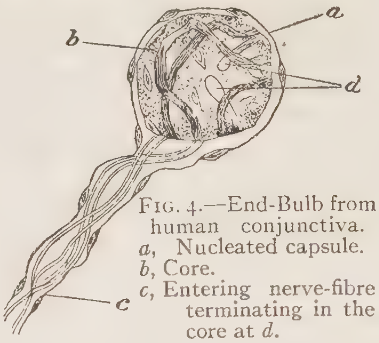


Fig. 4.—End-Bulb from human conjunctiva.
a, Nucleated capsule.
b, Core.
c, Entering nerve-fibre terminating in the core at *d*.

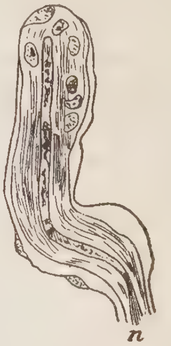
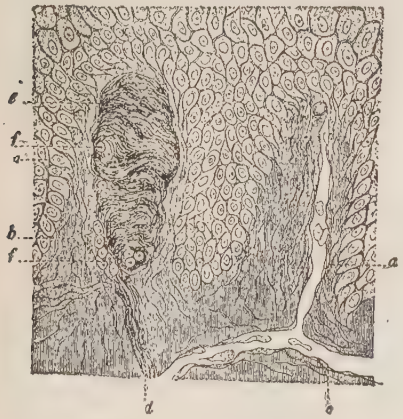


Fig. 5.—End-Bulb from conjunctiva of calf.
n, Nerve.

(2) *The Touch Corpuscles of Wagner and Meissner.*—These are oval bodies, about $\frac{1}{300}$ of an inch long by $\frac{1}{500}$ of an inch in breadth. Each consists of a series of layers of connective tissue arranged transversely, and containing in the centre granular matter with nuclei (figs. 2, 3 and 6). One, two or three nerve fibres pass to the lower end of the corpuscle, wind transversely around it, lose the white substance of Schwann, penetrate into the corpuscle, where the axis cylinders, dividing, end in some way unknown. The corpuscles do not contain any soft core, but are apparently built up of irregular septae of connective tissue, in the meshes of which the nerve fibrils end in expansions similar to Merkel's cells. Thin describes simple and compound corpuscles according to the number of nerve fibres entering them. These bodies are found abundantly

in the palm of the hand and sole of the foot, where there may be as many as 21 to every square millimetre (1 mm. = $\frac{1}{25}$ inch). They are not so numerous on the back of the hand or foot, mamma, lips and tip of the tongue, and they are rare in the genital organs.

3. *The Corpuscles of Vater or Pacini.*—These, first described by Vater so long ago as 1741, are small oval bodies, quite visible to the naked eye, from $\frac{1}{15}$ to $\frac{1}{10}$ of an inch long and $\frac{1}{25}$ to $\frac{1}{20}$ of an inch in breadth, attached to the nerves of the hands and feet. They can be readily demonstrated in the mesentery of the cat (fig. 7). Each corpuscle consists of 40 to 50 lamellae or coats, like the folds of an onion, thinner and closer together on approaching the centre. Each lamella is formed of an elastic material mixed with delicate connective-tissue fibres, and the inner surface of each is lined by a single continuous layer of endothelial cells. A double-contoured nerve fibre passes to each. The white substance of Schwann becomes continuous with the lamellae, whilst the axis cylinder passes into the body, and ends in a small knob or in a plexus. Sometimes a blood-vessel also penetrates the Pacinian body, entering along with the nerve. Such bodies are found in the subcutaneous tissue on the nerves of the fingers and toes, near joints, attached to the nerves of the abdominal plexuses of the sympathetic, on the coccygeal gland, on the dorsum of the penis and clitoris, in the meso-colon, in the course of the intercostal and periosteal nerves, and in the capsules of lymphatic glands.



(From Landois and Stirling, after Biesiadecki.)

FIG. 6.—Vertical Section of the Skin of the Palm of the Hand.

a, Blood-vessel.
b, Papilla of the cutis vera.
c, Capillary.
d, Nerve-fibre passing to a touch-corpuscle.
e, Wagner's touch-corpuscle.
f, Nerve-fibre, divided transversely.
g, Cells of the Malpighian layer of the skin.

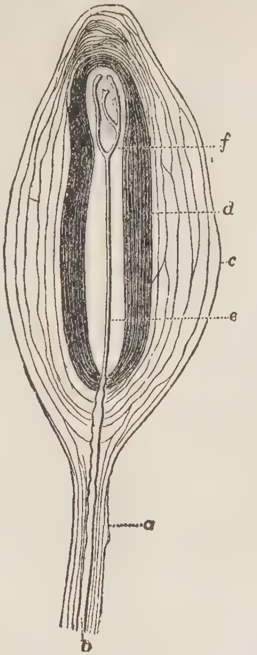


FIG. 7.—Vater's or Pacini's Corpuscle.

a, Stalk.
b, Nerve-fibre entering it.
c, *d*, Connective-tissue envelope.
e, Axis cylinder, with its end divided at *f*.

Physiology of Touch in Man.—Such are the special end-organs of touch. It has also been ascertained that many sensory nerves end in a plexus or network, the ultimate fibrils being connected with the cells of the particular tissue in which they are found. Thus they exist in the cornea of the eye, and at the junctions of tendons with muscles. In the latter situation "flattened end-flakes or plates" and "elongated oval end-bulbs" have also been found. A consideration of these various types of structure show that they facilitate intermittent pressure being made on the nerve endings. They are all, as it were, elastic cushions into which the nerve endings penetrate, so that the slight variation of pressure will be transmitted to the nerve. Probably also they serve to break the force of a sudden shock on the nerve endings.

Sensitiveness and Sense of Locality.—The degree of sensitiveness of the skin is determined by finding the smallest distance at which the two points of a pair of compasses can be felt. This method first followed by Weber, is employed by physicians in the diagnosis of nervous affections involving the sensitiveness of the skin. The following table shows the sensitiveness in millimetres for an adult.

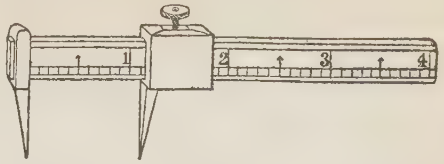


FIG. 8.—Aesthesiometer of Sieveking.

	Mm.
Tip of tongue	1·1
Third phalanx of finger, volar surface	2–2·3
Red part of the lip	4·5
Second phalanx of finger, volar surface	4–4·5
First phalanx of finger, volar surface	5–5·5
Third phalanx of finger, dorsal surface	6·8
Tip of nose	6·8
Head of metacarpal bone, volar	5–6·8
Ball of thumb	6·5–7
Ball of little finger	5·5–6
Centre of palm	8–9
Dorsum and side of tongue; white of the lips; metacarpal part of the thumb	9
Third phalanx of the great toe, plantar surface	11·3
Second phalanx of the fingers, dorsal surface	11·3
Back	11·3
Eyelid	11·3
Centre of hard palate	13·5
Lower third of the forearm, volar surface	15
In front of the zygoma	15·8
Plantar surface of the great toe	15·8
Inner surface of the lip	20·3
Behind the zygoma	22·6
Forehead	22·6
Occiput	27·1
Back of the hand	31·6
Under the chin	33·8
Vertex	33·8
Knee	36·1
Sacrum (gluteal region)	44·6
Forearm and leg	45·1
Neck	54·1
Back of the fifth dorsal vertebra; lower dorsal and lumbar region	54·1
Middle of the neck	67·7
Upper arm; thigh; centre of the back	67·7

These investigations show not only that the skin is sensitive, but that one is able with great precision to distinguish the part touched. This latter power is usually called the *sense of locality*, and it is influenced by various conditions. The greater the number of sensory nerves in a given area of skin the greater is the degree of accuracy in distinguishing different points. Contrast in this way the tip of the finger and the back of the hand. Sensitiveness increases from the joints towards the extremities, and sensitiveness is great in parts of the body that are actively moved. The sensibility of the limbs is finer in the transverse axis than in the long axis of the limb, to the extent of $\frac{1}{8}$ on the flexor surface of the upper limb and $\frac{1}{4}$ on the extensor surface. It is doubtful if exercise improves sensitiveness, as Francis Galton found that the performances of blind boys were not superior to those of other boys, and he says that "the guidance of the blind depends mainly on the multitude of collateral indications, to which they give much heed, and not their superiority to any one of them." When the skin is moistened with indifferent fluids sensibility is increased. Suslowa made the curious discovery that, if the area between two points distinctly felt be tickled or be stimulated by a weak electric current, the impressions are fused. Stretching the skin, and baths in water containing carbonic acid or common salt, increase the power of localizing tactile impressions. In experimenting with the compasses, it will be found that a smaller distance can be distinguished if one proceeds from greater to smaller distances than in the reverse direction. A smaller distance can also be detected when the points of the compasses are placed one after the other on the skin than when they are placed simultaneously. If the points of the compasses are unequally heated, the sensation of two contacts becomes confused. An anaemic condition, or a state of venous congestion, or the application of cold, or violent stretching of the skin, or the use of such substances as atropine, daturin, morphia, strychnine, alcohol, bromide of potassium, cannabin and hydrate of chloral blunt sensibility. The only active substance said to increase it is caffein.

Absolute sensitiveness, as indicated by a *sense of pressure,* has been determined by various methods. Two different weights are placed on the part, and the smallest difference in weight that can be perceived is noted. Weber placed small weights directly on the skin; Aubert and Kammler loaded small plates; Dohrn made use of a balance, having a blunt point at one end of the beam, resting on the skin, whilst weights were placed on the other end of the beam to equalize the pressure; H. Eulenberg invented an instrument like a spiral spring paper-clip or balance (the baraesthesiometer), having an index showing the pressure in grammes; F. Goltz employed an India-rubber tube filled with water, and this, to ensure a constant surface of contact, bent at one spot over a piece of cork, is touched at that spot by the cutaneous part to be examined, and, by rhythmically exerted pressure, waves analogous to those of the arterial pulse are produced in the tube; and L. Landois invented a mercurial balance, enabling him to make rapid variations in the weight without giving rise to any shock. These methods have given the following general results. (1) The greatest acuteness is on the forehead, temples and back of the hand and forearm, which detect a pressure of 0·002 gramme; fingers detect 0·005 to 0·015 gramme; the chin, abdomen and nose 0·04 to 0·05 gramme. (2) Goltz's method gives the same general results as Weber's experiment with the compasses, with the exception that the tip of the tongue has its sensation of pressure much lower in the scale than its sensation of touch. (3) Eulenberg found the following gradations in the fineness of the pressure sense: the forehead, lips, back of the cheeks, and temples appreciate differences of $\frac{1}{40}$ to $\frac{1}{30}$ (200: 205 to 300: 310 grammes). The back of the last phalanx of the fingers, the forearm, hand, first and second phalanges, the palmar surface of the hand, forearm and upper arm distinguish differences of $\frac{1}{10}$ to $\frac{1}{20}$ (200: 220 to 200: 210 grammes). The front of the leg and thigh is similar to the forearm. Then follow the back of the foot and toes, the sole of the foot, and the back of the leg and thigh. Dohrn placed a weight of 1 gramme on the skin, and then determined the least additional weight that could be detected, with this result: third phalanx of finger 0·499 gramme; back of the foot, 0·5 gramme; second phalanx, 0·771 gramme; first phalanx, 0·82 gramme; leg, 1 gramme; back of hand, 1·156 grammes; palm, 1·108 grammes; patella, 1·5 grammes; forearm, 1·99 grammes; umbilicus, 3·5 grammes; and back, 3·8 grammes. (4) In passing from light to heavier weights, the acuteness increases at once, a maximum is reached, and then with heavy weights the power of distinguishing the differences diminishes. (5) A sensation of pressure after the weights have been removed may be noticed (*after-pressure sensation*), especially if the weight be considerable. (6) Valentine noticed that, if the finger were held against a blunt-toothed wheel, and the wheel were rotated with a certain rapidity, he felt a *smooth* margin. This was experienced when the intervals of time between the contacts of successive teeth were less than from $\frac{1}{480}$ to $\frac{1}{610}$ of a second. The same experiment can be readily made by holding the finger over the holes in one of the outermost circles of a large syren rotating quickly: the sensations of individual holes become fused, so as to give rise to a feeling of touching a slit. (7) Vibrations of strings are detected even when the number is about 1500 per second; above this the sensation of vibration ceases. By attaching bristles to the prongs of tuning-forks and bringing these into contact with the lip or tongue, sensations of a very acute character are experienced, which are most intense when the forks vibrate from 600 to 1500 per second.

Information from Tactile Impressions.—These enable us to come to the following conclusions. (1) We note the existence of something touching the sensory surface. (2) From the intensity of the sensation we determine the weight, tension or intensity of the pressure. This sensation is in the first instance referred to the skin, but after the pressure has reached a certain amount muscular sensations are also experienced—the so-called muscular sense. (3) The locality of the part touched is at once determined, and from this the probable position of the touching body. Like the visual field, to which all retinal impressions are referred, point for point, there is a tactile field, to which all points on the skin surface may be referred. (4) By touching a body at various points, from the difference of pressure and from a comparison of the positions of various points in the tactile field we judge of the configuration of the body. A number of "tactile pictures" are obtained by passing the skin over the touched body, and the shape of the body is further determined by a knowledge of the muscular movements necessary to bring the cutaneous surface into contact with different portions of it. If there is abnormal displacement of position, a false conception may arise as to the shape of the body. Thus, if a small marble or a pea be placed between the index and middle finger so as to touch (with the palm downwards) the outer side of the index finger and the inner side of the middle finger, a sensation of touching *one* round body is experienced; but if the fingers be crossed, so that the marble touches the inner side of the index finger and the outer side of the middle finger, there will be a feeling of *two* round bodies, because in these circumstances there is added to the feelings of contact a feeling of distortion (or of muscular action) such as would take place if the fingers, for purposes of touch, were placed in that abnormal position. Again, as showing that our knowledge of the tactile field is precise, there is the well-known fact that when a piece of skin is transplanted from the forehead to the nose, in the operation for removing a deformity of the nose arising from lupus or other ulcerative disease, the patient feels the new nasal part as if it were his forehead, and he may have the curious sensation of a nasal instead of a frontal headache. (5) From the number of points touched we judge as to the smoothness or roughness of a body. A body having a uniformly level surface, like a billiard ball, is smooth; a body having points irregular in size and number in a given area is rough; and if the points are very close together it gives rise to a sensation, like that of the pile of velvet almost intolerable to some individuals. Again, if the pressure is so uniform as not to be felt, as when the body is immersed in water (paradoxical as this may seem, it is the case that the sensation of contact is felt only at the limit of the fluid), we experience the sensation of being in contact with a fluid. (6) Lastly, it would appear that touch is always the result of variation of pressure. No portion of the body when touching anything can be regarded as absolutely motionless, and the slight oscillations of the sensory surface, and in many cases of the body touched, produce those variations of pressure on which touch depends.

To explain the phenomenon of the tactile field, and more specially the remarkable variations of tactile sensibility above described, various theories have been advanced, but none are satisfactory. (See article "Cutaneous Sensations" by C. S. Sherrington in Schäfer's *Physiology*, ii. 920). Research shows that the sensation of touch may be referred to parts of the skin which do not contain the special end organs associated with this sense, and that filaments in the Malpighian layer (the layer immediately above the papillae of the true skin) may form the anatomical basis of the sense. The skin may be regarded, also, as an extensive surface containing nervous arrangements by which we are brought into relation with the outer world. Accordingly, touch is not the only sensation referred to the skin, but we also refer sensations of temperature (heat and cold), and often those peculiar sensations which we call pain.

Sensations of Temperature.—These depend on thermic irritation of the terminal organs, as proved by the following experiment of E. H. Weber: "If the elbow be dipped into a very cold fluid, the cold is only felt at the immersed part of the body (where the fibres terminate); pain, however, is felt in the terminal organs of the ulnar nerve, namely, in the finger points; this pain, at the same time, deadens the local sensation of cold." If the sensation of cold were due to the irritation of a specific-nerve fibre, the sensation of cold would be referred to the tips of the fingers. When any part of the skin is above its normal mean temperature, warmth is felt; in the opposite case, cold. The normal mean temperature of a given area varies according to the distribution of hot blood in it and to the activity of nutritive changes occurring in it. When the skin is brought into contact with a good conductor of heat there is a sensation of cold. A sensation of heat is experienced when heat is carried to the skin in any way. The following are the chief facts that have been ascertained regarding the temperature sense: (1) E. H. Weber found that, with a skin temperature of from 15·5° C. to 35° C., the tips of the fingers can distinguish a difference of 0·25° C. to 0·2° C. Temperatures just below that of the blood (33°–27° C.) are distinguished by the most sensitive parts, even to 0·05° C. (2) The thermal sense varies in different regions as follows: tip of tongue, eyelids, cheeks, lips, neck, belly. The "perceptible minimum" was found to be, in degrees C.: breast 0·4°; back, 0·9°; back of hand, 0·3°; palm, 0·4°; arm, 0·2°; back of foot, 0·4°; thigh, 0·5°; leg, 0·6° to 0·2°; cheek, 0·4°; temple, 0·3°. (3) If two different temperatures are applied side by side and simultaneously, the impressions often fuse, especially if the areas are close together. (4) Practice is said to improve the thermal sense. (5) Sensations of heat and cold may curiously alternate; thus when the skin is dipped first into water at 10° C. we feel cold, and if it be then dipped into water at 16° C. we have at first a feeling of warmth, but soon again of cold. (6) The same temperature applied to a large area is not appreciated in the same way as when applied to a small one; thus "the whole hand when placed in water at 29·5° C. feels warmer than when a finger is dipped into water at 32° C."

There is every reason to hold that there are different nerve fibres and different central organs for the tactile and thermal sensations, but nothing definite is known. The one sensation undoubtedly affects the other. Thus the minimum distance at which two compass points are felt is diminished when one point is warmer than the other. Again, a colder weight is felt as heavier, "so that the apparent difference of pressure becomes greater when the heavier weight is at the same time colder, and less when the lighter weight is colder, and difference of pressure is felt with equal weights of unequal temperature" (E. H. Weber). Great sensibility to differences of temperature is noticed after removal, alteration by vesicants, or destruction of the epidermis, and in the skin affection called herpes zoster. The same occurs in some cases of locomotor ataxy. Removal of the epidermis, as a rule, increases tactile sensibility and the sense of locality. Increased tactile sensibility is termed *hyperpselaphesia,* and is a rare phenomenon in nervous diseases. Paralysis of the tactile sense is called *hypopselaphesia,* whilst its entire loss is *apselaphesia.* Brown-Séquard mentions a case in which contact of two points gave rise to a sense of a third point of contact. Certain conditions of the nerve centres affect the senses both of touch and temperature. Under the influence of morphia the person may feel abnormally enlarged or diminished in size. As a rule the senses are affected simultaneously, but cases occur where one may be affected more than the other.

Sensations of heat and cold are chiefly referred to the skin, and only partially to some mucous membranes, such as those of the alimentary canal. Direct irritation of a nerve does not give rise to these sensations. The exposed pulp of a diseased tooth, when irritated by hot or cold fluids, gives rise to pain, not to sensations of temperature. It has now been ascertained that there are minute areas on the skin in which sensations of *heat* and *cold* may be more acutely felt than in adjoining areas; and, further, that there are points stimulated by addition of heat, hot spots, while others are stimulated by withdrawal of heat, cold spots.

A simple method of demonstrating this phenomenon is to use a solid cylinder of copper, 8 in. in length by $\frac{1}{2}$ in. in thickness, and sharpened at one end to a fine pencil-like point. Dip the pointed end into very hot water, close the eyes, and touch parts of the skin. When a hot spot is touched, there is an acute sensation of burning. Such a spot is often near a hair. Again, in another set of experiments, dip the copper pencil into ice-cold water and search for cold spots. When one of these is touched, a sensation of cold, as if concentrated on a point, is experienced. Thus it may be demonstrated that in a given area of skin there may be hot spots, cold spots and touch spots.

Cold spots are more abundant than hot spots. The spots are arranged in curved lines, but the curve uniting a number of cold spots does not coincide with the curve forming a chain of hot spots. By Weber's method it will be found that we can discriminate cold spots at a shorter distance from each other than hot spots. Thus on the forehead cold spots have a minimum distance of 8 mm., and hot spots 4 mm.; on the skin of the breast, cold spots 2 mm., and hot spots 5 mm.; on the back, cold spots 1·5 mm., and hot spots 4 to 6 mm.; on the back of the hand, cold spots 3 mm., and hot spots 4 mm.; on the palm, cold spots 8 mm., and hot spots 2 mm.; and on the thigh and leg, cold spots 3 mm., and hot spots 3·5 mm. Electrical and mechanical stimulation of the hot or cold spots call forth the corresponding sensation. No terminal organ for discrimination of temperature has yet been found. It will be observed that the sensation of heat or cold is excited by *change* of temperature, and that it is more acute and definite the more sudden the change. Thus discrimination of temperature is similar to discrimination of touch, which depends on more or less sudden change of pressure. The term cold means, physiologically, the sensation we experience when heat is abstracted, and the term heat, the sensation felt when heat is added to the part. Thus we are led to consider that the skin contains at least two kinds of specific terminal organs for sensations of touch and temperature, and two sets of nerve fibres which carry the nervous impulses to the brain. In all probability, also, these fibres have different central endings, and in their course to the brain run in different tracts in the spinal cord. This will explain cases of disease of the central nervous system in which, over certain areas of skin, sensations of touch have been lost while sensations of temperature and pain remain, or vice versa. Tactile and thermal impressions may influence each other. Thus a leg sent to "sleep" by pressure on the sciatic nerve will be found to be less sensitive to heat, but distinctly sensitive to cold. In some cases of disease it has been noticed that the skin is sensitive to a temperature above that of the limb, but insensitive to cold. It is highly probable that just as we found in the case of touch (pressure), the terminal organs connected with the sense of temperature are the fine nerve filaments that have been detected in the deeper strata of the Malpighian region of the epidermis, immediately above the true skin, and it is also probable that certain epidermic (epithelial) cells in that region play their part in the mechanism. Sensations of a painful character may also, in certain circumstances, be referred to the viscera, and to mucous and serous surfaces. Pain is not a sensation excited by irritating the end organs either of touch or of temperature, nor even by irritating directly the filaments of a sensory nerve. Even if sensory nerves are cut or bruised, as in surgical operations, there may be no sensations of pain; and it has been found that muscles, vessels and even the viscera, such as the heart, stomach, liver or kidneys, may be freely handled without giving rise to any feeling of pain, or indeed to any kind of sensation. These parts, in ordinary circumstances appear to be insensitive, and yet they contain afferent nerves. If the sensibility of these nerves is heightened, or possibly if the sensitiveness of the central terminations of the nerves is raised, then we may have sensations to which we give the name of pain. In like manner the skin is endowed with afferent nerves, distinct from those ministering to touch and to temperature, along which nervous impulses are constantly flowing. When these nervous impulses reach the central nervous system in ordinary circumstances they do not give rise to changes that reach the level of consciousness, but they form, as it were, the warp and woof of our mental life, and they also affect metabolisms, that is to say, nutritive changes in many parts of the body. They may also, as is well known, affect unconsciously such mechanisms as those of the action of the heart, the calibre of the blood-vessels and the movements of respiration. If, however, this plane of activity is raised, as by intermittent pressure, or by inflammatory action, or by sudden changes of temperature, as in burning, scalding, &c., such nervous impulses give rise to pain. Sometimes pain is distinctly located, and in other cases it may be irradiated in the nerve centres, and referred to areas of skin or to regions of the body which are not really the seat of the irritation. Thus irritation of the liver may cause pain in the shoulder; disease of the hip-joint often gives rise to pain in the knee; and renal colic, due to the passage of a calculus down the ureter, to severe pain even in the abdominal walls. These are often termed *reflex pains* and their interpretation is of great importance to physicians in the diagnosis of disease. Their frequent occurrence has also directed attention to the distribution in the skin and termination in the brain of the sensory nerves. It is also noticeable that a sensation of pain gives us no information as to its cause; we simply have an agonizing sensation in a part to which, hitherto, we probably referred no sensations. The acuteness or intensity of pain depends partly on the intensity of the irritation, and partly on the degree of excitability of the sensory nerves at the time.

Pain.—In addition to sensations of touch and of temperature referred to the skin, there is still a third kind of sensation, unlike either, namely, pain. This sensation cannot be supposed to be excited by irritations of the end organs of touch, or of specific thermal end organs (if there be such), but rather to irritation of ordinary sensory nerves, and there is every reason to believe that painful impressions make their way to the brain along special tracks in the spinal cord. If we consider our mental condition as regards sensation at any moment, we notice numerous sensations more or less definite, not referred directly to the surface, nor to external objects, such as a feeling of general comfort, free or impeded breathing, hunger, thirst, malaise, horror, fatigue and pain. These are all caused by the irritation of ordinary sensory nerves in different localities, and if the irritation of such nerves, by chemical, thermal, mechanical or nutritional stimuli, passes beyond a certain maximum point of intensity the result is pain. Irritation of a nerve, in accordance with the law of "peripheral reference of sensation," will cause pain. Sometimes the irritation applied to the trunk of a sensory nerve may be so intense as to destroy its normal function, and loss of sensation or anaesthesia results. If then the stimulus be increased further, pain is excited which is referred to the end of the nerve, with the result of producing what has been called *anaesthesia dolorosa.* Pains frequently cannot be distinctly located, probably owing to the fact of irradiation in the nerve centres and subsequent reference to areas of the body which are not really the seat of irritations. The intensity of pain depends on the degree of excitability of the sensory nerves, whilst its massiveness depends on the number of nerve fibres affected. The quality of the pain is probably produced by the kind of irritation of the nerve, as affected by the structure of the part and the greater or less continuance of severe pressure. Thus there are piercing, cutting, boring, burning, throbbing, pressing, gnawing, dull and acute varieties of pain. Sometimes the excitability of the cutaneous nerves is so great that a breath of air or a delicate touch may give rise to suffering. This *hyperalgia* is found in inflammatory affections of the skin. In *neuralgia* the pain is characterized by its character of shooting along the course of the nerve and by severe exacerbations. In many nervous diseases there are disordered sensations referred to the skin, such as alternations of heat and cold, burning, creeping, itching and a feeling as if insects were crawling on the surface (formication). This condition is termed *paralgia.* The term *hypalgia* is applied to a diminution and *analgia* to paralysis of pain, as is produced by anaesthetics.

Muscular Sense.—The sensory impressions considered in this article are closely related to the so-called muscular sense, or that sense or feeling by which we are aware of the state of the muscles of a limb as regards contraction or relaxation. Some have held that the muscular sense is really due to greater or less stretching of the skin and therefore to irritation of the nerves of that organ. That this is not the case is evident from the fact that disordered movements indicating perversion or loss of this sense are not affected by removal of the skin (Claude Bernard). Further, cases in the human being have been noticed where there was an entire loss of cutaneous sensibility whilst the muscular sense was unimpaired. It is also known that muscles possess sensory nerves, giving rise, in certain circumstances, to fatigue, and, when strongly irritated, to the pain of cramp. Muscular sensations are really excited by irritation of sensory nerves passing from the muscles themselves. There are specialized spindle-like bodies in many muscles, and there are organs connected with tendons which are regarded as sensory organs by which pressures are communicated to sensory nerve-filaments. We are thus made conscious of whether or not the muscles are contracted, and of the amount of contraction necessary to overcome resistance, and this knowledge enables us to judge of the amount of voluntary impulse. Loss or diminution of the muscular sense is seen in chorea and especially in locomotor ataxy. Increase of it is rare, but it is seen in the curious affection called *anxietas tibiarum*, a painful condition of unrest, which leads to a continual change in the position of the limbs (see EQUILIBRIUM).

(J. G. M.)

TOUL, a garrison town of north-eastern France, capital of an arrondissement in the department of Meurthe-et-Moselle, 21 m. W. of Nancy on the Eastern railway Pop. (1906), town 9523; commune, 13,663. Toul is situated in a plain on the left bank of the Moselle, which skirts the town on the S. and S. E., while on the N. it is bordered by the Marne-Rhine canal. It is principally important as being the centre of a great entrenched camp close to the German frontier. Immediately after the Franco-German War the whole system of frontier defence was revised, and of all the new fortresses of the Meuse and Moselle Toul is perhaps the most formidable. The works were begun in 1874 by the construction of four outlying forts north, north-east and south of the town, but these soon became merely an inner line of defence. The principal defences now lie much farther out on all sides. The west front of the new line of forts occupies a long line of high ground (the watershed of the Meuse and the Moselle), the north front, about 4 m. from Toul, is in undulating country, while facing towards Nancy and forming the chord of the arc which the Moselle describes from Fontenay below to Villey-le-Sec above, is the strong east front, the outlying works of which extend far to the east (Fort Frouard and other works about Nancy) and to the south-east (Pont St Vincent). The south front extends from the Moselle at Villey-le-Sec south-westwards till it meets the southern end of the west front on the high ground overlooking the Meuse valley. The fort at Pagny on the Meuse to the south-west may be considered an outwork of this line of defence. The perimeter of the Toul defences proper is nearly 30 m., and their mean distance from the town about 6 m. Northward, along the Meuse, Toul is connected with the fortress of Verdun by the "Meuse line" of barrier forts, the best known of which are Gironville, Liouville and Troyon. South of Toul the country was purposely left unfortified as far as Épinal (*q.v.*) and this region is known as the Trouée d'Épinal.

The town itself forms an oval within a bastioned enceinte pierced by three gateways. It has two important churches. That of St Étienne (formerly a cathedral) has a choir and transept of the 13th century; the nave and aisles are of the 14th, and the façade, the finest part of the building, of the last half of the 15th. The two western towers, which have no spires, reach a height of 246 ft. The two large lateral chapels of the nave are in the Renaissance style. The chief features of the interior are its stained glass and organ loft. South of the church there is a fine cloister of the end of the 13th century which was much damaged at the Revolution. The church of St Gengoult, which dates chiefly from the late 13th or early 14th century, has a façade of the 15th century and a cloister in the Flamboyant Gothic style of the 16th century. The hôtel-de-ville occupies a building of the 18th century, once the episcopal palace, and contains the library and museum. Toul is the seat of a sub-prefect and has a tribunal of commerce and a communal college among its public institutions. The industries include the manufacture of porcelain; trade is in wine and brandy.

Toul (*Tullum*) is one of the oldest towns of France; originally capital of the Leuci, in the Belgic Confederation, it acquired great importance under the Romans. It was evangelized by St Mansuy in the latter half of the 4th century, and became one of the leading sees of north-east Gaul. After being sacked successively by Goths, Burgundians, Vandals and Huns, Toul was conquered by the Franks in 450. Under the Merovingians it was governed by counts, assisted by elective officers. The bishops became sovereign counts in the 10th century, holding only of the emperor, and for a period of 300 years (13th to 16th centuries) the citizens maintained a long struggle against them. Together with Verdun and Metz the town and its domain formed the territory of the Trois-Evêchés. Toul was forced to yield for a time to the count of Vaudémont in the 12th century, and twice to the duke of Lorraine in the 15th, and was thrice devastated by the plague in the 16th century. Charles V. made a solemn entry into the town in 1544, but in the following year, at the instance of the cardinal of Lorraine, it placed itself under the perpetual protection of the kings of France. Henry II. took possession of the Trois-Evêchés in 1552, but the territory was not officially incorporated with France till 1648. Henry IV. was received in state in 1603, and in 1637 the parlement of Metz was transferred to Toul. In 1700 Vauban reconstructed the fortifications of the town. In 1790 the bishopric was suppressed and the diocese united to that of Nancy. Toul, which had then no modern defences, capitulated in 1870 after a bombardment of twelve days.

TOULON, a seaport and first-class fortress and naval station of France, department of Var, capital of the arrondissement of Toulon, on the Mediterranean, 42 m. E.S.E. of Marseilles. Pop. (1886), 53,941; (1901), 101,602. The bay, which opens to the east. has two divisions, the Grande Rade and the Petite Rade; it is sheltered on the north and west by high hills, closed on the south by the peninsula of capes Sicié and Cépet, and protected on the east by a huge breakwater, the entrance, 1300 ft. wide, being defensible by torpedoes. A ship coming from the open sea must first pass the forts of St Marguerite, of Cap Brun, of Lamalgue and of St Louis to the north, and the battery of the signal station to the south; before reaching the Petite Rade it must further pass under the guns of the battery of Le Salut to the east, and of the forts of Balaguier and L'Aiguillette to the west. The Bay of La Seyne lies west of the Petite Rade, and is defended by the forts of Six-Fours, Napoléon (formerly Fort Caire), and Malbousquet, and the batteries of Les Arènes and Les Gaus. To the north of Toulon rise the defensive works of Mont Faron and Fort Rouge, to the east the forts of Artigues and St Catherine, to the north-east the formidable fort of Coudon, and to the south-east that of Colle Noire, respectively dominating the highway into Italy and the valley of Hyères with the Bay of Carqueiranne. The town, enlarged to the north under the Second Empire, has on that side a fine modern quarter; but in the old town the streets are for the most part narrow, crooked and dirty, and to their insanitary state the cholera epidemic of 1884 was attributed. The chief buildings are the former cathedral of St Marie Majeure (from the 5th century Toulon was a bishop's see till 1801, when it was annexed to that of Fréjus), the church of St Louis, the naval and military hospital, with a natural history collection and an anatomical museum attached, a naval school of medicine, a school of hydrography, and large barracks. In 1883–1887 a handsome Renaissance building was erected to accommodate the picture gallery and the town library. The monument in commemoration of the centenary of the French Revolution was erected in 1890 in the Place de la Liberté, the finest in the new town. The imports are wine, corn, wood, coal, hemp, iron, sugar, coffee and fresh fish; the exports are salt, copper ore, barks for tanning and oils. The principal industries, apart from the arsenal, are shipbuilding, fishing, lace-making and wine-growing. Toulon possesses an observatory and a botanical garden. The interesting buildings and gardens of the hospital of St Mandrier stand on the peninsula of Cape Cépet, and near them is the *lazaretto*.

Toulon is the most important of the French dockyards, and is the headquarters of the Mediterranean fleet. The arsenal, which was created by Louis XIV.—Vauban being the engineer of the works—lies on the north side of the Petite Rade. This is approached from the Grande Rade by passages at the north and south ends of a long breakwater which extends from the direction of Le Mourillon towards the Cépet Peninsula. The water space within the moles amounts to about 150 acres, while the quays approach 4 m. in length. Outside in the Petite Rade is a splendid protected anchorage for a great fleet, the whole being commanded by many forts and batteries. There are four great basins approached from the Petite Rade—the Vielle Darse, to the east, on the side of Le Mourillon; the Darse Vauban, next to it; and the Darse de Castigneau and the Darse Missiessy, farther to the west. In the Darse Vauban are three dry docks, two of them 246 ft. long, with a depth of water on the sill of about 20 ft.; while the third is 283 ft. long, with a depth of over 24 ft. Three other dry docks are in the Darse de Castigneau, of which one is in two sections. The largest of the docks is 385 ft. long, and the depth of water on the sill in all these docks averages 30 ft. In the Darse Missiessy are two dry docks, 426 ft. long, with a depth on the sill of over 32 ft. There are several building slips, and the yard is supplied with a gun foundry and wharf, fitting-shops, boiler works, victualling and other establishments, rolling mills and magazines. Le Mourillon is a subsidiary yard at Toulon, devoted chiefly to ship-building, and possessing large facilities, including five covered slips.

The Roman Telo Martius is supposed to have stood near the lazaretto. The town was successively sacked by Goths, Burgundians, Franks and Saracens. During the early middle ages, and till conquered by Charles of Anjou in 1259, it was under lords of its own, and entered into alliance with the republics of Marseilles and Arles. St Louis, and especially Louis XII. and Francis I. strengthened its fortifications. It was seized by the emperor Charles V. in 1524 and 1536. Henry IV. founded a naval arsenal at Toulon, which was further strengthened by Richelieu, and Vauban made the new dock, a new enceinte, and several forts and batteries. In 1707 the town was unsuccessfully besieged by the duke of Savoy, Prince Eugene and an English fleet. In 1720 there was an outbreak of the plague. In 1792 after great and sanguinary disorder, the royalists of the town sought the support of the English and Spanish fleets cruising in the neighbourhood. The Convention having replied by putting the town "hors la loi," the inhabitants opened their harbour to the English. The army of the republic now (1793) laid siege to the town, and on this occasion Napoleon Bonaparte first made his name as a soldier. The forts commanding the town having been taken, the English ships retired after setting fire to the arsenal. The conflagration was extinguished by the prisoners, but not before 38 out of a total of 56 vessels had been destroyed. Under the Directory Toulon became the most important French military fort on the Mediterranean; here Napoleon organized the Egyptian campaign, and the expedition against Algiers set out from Toulon in 1830. The fortifications have been strengthened by Napoleon I., Louis Philippe, Napoleon III., and since 1870.

Battle of Toulon.—This naval battle took place on the 11th of February 1744, near the port of Toulon. A British fleet of thirty sail of the line under command of Thomas Mathews, who combined the offices of naval commander-in-chief in the Mediterranean and envoy to the courts of Sardinia and the Italian princes, engaged a combined force of Spaniards under Don José Navarro and French under M. de Court. They were in all twenty-seven sail. The allies left Toulon on the 9th of February. Mathews was at anchor in Hyères Bay to watch them, for though France and Great Britain were already engaged as allies on opposite sides in the War of the Austrian Succession, there had been no declaration of war between them. It was known that the allies meant to transfer Spanish troops to Italy to serve against the Austrians, and Mathews had no hesitation in attacking them, Great Britain being at war with Spain. He left Hyères in very light wind with a heavy westerly swell, and with his fleet in confusion. The British ships were straggling over a distance of ten miles, but he put himself between the enemy and Toulon. Mathews was on bad terms with his second in command, Lestock, who commanded the rear division and showed little disposition to support his superior. By the morning of the 11th the interval between the van and centre of the British fleet and its rear had increased in the light breezes, and also through the voluntary or involuntary misapprehension of Mathews's orders by Lestock. The allies were in a fairly well-formed line, heading to the south, and southward of the British. Mathews pursued, and at 1.30 p.m., when his leading ship was abreast of the centre ship of the allies, he attacked. Some hot fighting took place between Mathews and the Spaniards who formed the allied rear. The action was notable as the last occasion on which an attempt was made to use a fireship on the open sea. One was sent against the "Real" (114), the Spanish flagship, but she was reduced to a sinking state by the fire of the Spaniards, and blew up prematurely, with the loss of all on board. At about five o'clock, the French in the van turned back to support the Spaniards, and Mathews drew off. One Spanish ship, the "Poder" (60), which had surrendered was recaptured, and then set on fire by the allies. Mathews made only a feeble attempt to renew the battle on the following days, and on the 13th returned towards the coast of Italy, which he said he had to defend. The British rear division had not come into action at all.

The battle, though a miserable affair in itself, is of great importance in naval history because of the pronouncement of doctrine to which it led. Mathews, who was dissatisfied with his subordinate, Lestock, suspended him from command and sent him home for trial. Several of the captains had behaved ill, and the failure of a superior British fleet to gain a success over the allies caused extreme discontent at home. A parliamentary inquiry was opened on the 12th of March 1745, which on the 18th of April, after a confused investigation, ended in a petition to the king to order trials by court-martial of all the officers accused of misconduct. A long series of courts-martial began on the 11th of September 1745, and did not end till the 22nd of October 1746. Several captains were sentenced to be dismissed the service. Lestock was acquitted, but Mathews was condemned and sentenced to dismissal. The finding of the court, which blamed the officer who actually fought, and acquitted the other who did not, puzzled and angered public opinion. The technical points were not appreciated by laymen. The real evil done by the condemnation of Mathews was not understood even in the navy. Mathews was blamed on the ground that he had not waited to engage till his van ship was abreast of the van ship of the enemy. By this declaration of principle the court confirmed the formal system of naval tactics which rendered all sea-fighting between equal or nearly equal forces so ineffective for two generations.

See Beatson, *Naval and Military Memoirs*, i. 197 seq. (London, 1804), a full and fair narrative. (D. H.)

TOULOUSE, LOUIS ALEXANDRE DE BOURBON, Count of (1678–1737), third son of Louis XIV. and Mme de Montespan was born on the 6th of June 1678. At the age of five he was created admiral of France. He distinguished himself during the War of the Spanish Succession, and inflicted a severe defeat on Admiral Rooke near Malaga in 1704. He kept aloof from the intrigues of his sister-in-law, the duchess of Maine, and died on the 1st of December 1737. His son, Louis Jean Marie de Bourbon, duc de Penthièvre (1725–1793), succeeded his father in his posts, among others in that of grand admiral. He served under Marshal de Noailles, and fought brilliantly at Dettingen (1743) and Fontenoy (1745). He then lived in retreat at Rambouillet and Sceaux, protecting men of letters, and particularly the poet Florian, and dispensing charity. He lost his son, the prince of Lamballe, in 1768, and survived his daughter-in-law, Louise Marie Thérèse of Savoy-Carignan, the friend of Marie Antoinette, who was killed by the populace on the 3rd of September 1792. He died on the 4th of March 1793; his daughter and heiress, Louise Marie Adélaïde, married Philippe (Égalité), duke of Orleans.

TOULOUSE, a city of south-western France, capital of the department of Haute-Garonne, 443 m. S. by W. of Paris by the Orleans railway, and 159 m. S.E. of Bordeaux by the Southern railway. Pop. (1906), town, 125,856; commune, 149,438. Toulouse is situated on the right bank of the Garonne, which here changes a north-easterly for a north-westerly direction, describing a curve round which the city extends in the form of a crescent. On the left bank is the suburb of St Cyprien, which is exposed to the inundations of the river owing to its low situation. The river is spanned by three bridges—that of St Pierre to the north, that of St Michel to the south, and the Pont Neuf in the centre; the last, a fine structure of seven arches was begun in 1543 by Nicolas Bachelier, the sculptor, whose work is to be seen in many of the churches and mansions of the city. East and north of the city runs the Canal du Midi, which here joins the lateral canal of the Garonne. Between the Canal du Midi and the city proper extends a long line of boulevards leading southwards by the Allée St Étienne to the Grand Rond, a promenade whence a series of allées branch out in all directions. South-west the Allée St Michel leads towards the Garonne, and south the Grande Allée towards the Faubourg St Michel. These boulevards take the place of the old city walls. Between them and the canal lie the more modern faubourgs of St Pierre, Arnaud-Bernard, Matabiau, &c. The Place du Capitole, to which streets converge from every side, occupies the centre of the city. Two broad straight thoroughfares of modern construction, the Rue de Metz and the Rue d'Alsace-Lorraine, intersect one another to the south of this point, the first running east from the Pont Neuf, the other running north and south. The other streets are for the most part narrow and irregular.

The most interesting building in Toulouse is the church of St Sernin or Saturnin, whom legend represents as the first preacher of the gospel in Toulouse, where he was perhaps martyred about the middle of the 3rd century. The choir, the oldest part of the present building, was consecrated by Urban II. in 1096. The church is the largest Romanesque basilica in existence, being 375 ft. from east to west and 210 ft. in extreme breadth. The nave (12th and 13th centuries) has double aisles. Four pillars, supporting the central tower, are surrounded by heavy masonry, which somewhat spoils the general harmony of the interior. In the southern transept is the "portail des comtes," so named because near it lie the tombs of William Taillefer, Pons, and other early counts of Toulouse. The little chapel in which these tombs (ascribed to the 11th century) are found was restored by the capitols of Toulouse in 1648. Another chapel contains a Byzantine Christ of late 11th-century workmanship. The choir (11th and 12th centuries) ends in an apse, or rather chevet, surrounded by a range of columns, marking off an aisle, which in its turn opens into five chapels. The stalls are of 16th-century work and grotesquely carved. Against the northern wall is an ancient *table d'autel*, which an 11th-century inscription declares to have belonged to St Sernin. In the crypts are many relics, which, however, were robbed of their gold and silver shrines during the Revolution. On the south there is a fine outer porch in the Renaissance style; it is surmounted by a representation of the Ascension in Byzantine style. The central tower (13th century) consists of five storeys, of which the two highest are of later date, but harmonize with the three lower ones. A restoration of St Sernin was carried out in the 19th century by Viollet-le-Duc.

The cathedral, dedicated to St Stephen, dates from three different epochs. The walls of the nave belong to a Romanesque cathedral of the 11th century, but its roof dates from the first half of the 13th century. The choir was begun by Bishop Bertrand de l'Ile (*c.* 1272), who wished to build another church in place of the old one. This wish was unfulfilled and the original nave, the axis of which is to the south of that of the choir, remains. The choir was burned in 1690 but restored soon after. It is surrounded by seventeen chapels, finished by the cardinal d'Orléans, nephew of Louis XI., about the beginning of the 16th century, and adorned with glass dating from the 15th to the 17th century. The western gate, flanked by a huge square tower, was constructed by Peter du Moulin, archbishop of Toulouse, from 1439 to 1451. It has been greatly battered, and presents but a poor approximation to its ancient beauty. Over this gate, which was once ornamented with the statues of St Sernin, St Exuperius and the twelve apostles, as well as those of the two brother archbishops of Toulouse, Denis (1423–1439) and Peter du Moulin, there is a beautiful 13th-century rose-window, whose centre, however, is not in a perpendicular line with the point of the Gothic arch below.

Among other remarkable churches may be noticed Notre-Dame de la Daurade, near the Pont Neuf, built on the site of a 9th-century Benedictine abbey and reconstructed towards the end of the 18th century; and Notre-Dame de la Dalbade; perhaps existing in the 11th, but in its present form dating from the 16th century, with a fine Renaissance portal. The church of the Jacobins, held by Viollet-le-Duc to be "one of the most beautiful brick churches constructed in the middle ages," was built towards the end of the 13th century, and consists of a nave divided into two aisles by a range of columns. The chief exterior feature is a beautiful octagonal belfry. The church belonged to a Dominican monastery, of which part of the cloister, the refectory, the chapter-hall and the chapel also remain and are utilized by the lycée. Of the other secular buildings the most noteworthy are the capitole and the museum. The capitole has a long Ionic façade built from 1750 to 1760. The theatre is situated in the left wing. Running along almost the whole length of the first floor is the *salle des illustres* adorned with modern paintings and sculptures relating to the history of the town. The museum (opened in 1795) occupies, besides a large modern building, the church, cloisters and other buildings of an old Augustinian convent. It contains pictures and a splendid collection of antiquities, notably a series of statues and busts of Roman emperors and others and much Romanesque sculpture. There is an auxiliary museum in the old college of St Raymond. The natural history museum is in the Jardin des Plantes. The law courts stand on the site of the old Château Narbonais, once the residence of the counts of Toulouse and later the seat of the parlement of Toulouse. Near by is a statue of the jurist Jacques Cujas, born at Toulouse.

Toulouse is singularly rich in mansions of the 16th and 17th centuries. Among these may be mentioned the Hôtel Bernuy, a fine Renaissance building now used by the lycée and the Hôtel d'Assézat of the same period, now the property of the *Académie des Jeux Floraux* (see below), and of the learned societies of the city. In the court of the latter there is a statue of Clémence Isaure, a lady of Toulouse, traditionally supposed to have enriched the Académie by a bequest in the 15th century. The Maison de Pierre has an elaborate stone façade of 1612.

Toulouse is the seat of an archbishopric, of a court of appeal, a court of assizes and of a prefect. It is also the headquarters of the XVII. army corps and centre of an educational circumscription (*académie*). There are tribunals of first instance and of commerce, a board of trade-arbitration, a chamber of commerce and a branch of the Bank of France. The educational institutions include faculties of law, medicine and pharmacy, science and letters, a Catholic institute with faculties of theology and letters, higher and lower ecclesiastical seminaries, lycées and training colleges for both sexes, and schools of veterinary science, fine arts and industrial sciences and music.

Toulouse, the principal commercial and industrial centre of Languedoc, has important markets for horses, wine, grain, flowers, leather, oil and farm produce. Its pastry and other delicacies are highly esteemed. Its industrial establishments include the national tobacco factory, flour-mills, saw-mills, engineering workshops and factories for farming implements, bicycles, vehicles, artificial manures, paper, boots and shoes, and flour pastes.

Tolosa, chief town of the Volcae Tectosages, does not seem to have been a place of great importance during the early centuries of the Roman rule in Gaul, though in 106 B.C. the pillage of its temple by Q. S. Cepio, afterwards routed by the Cimbri, gave rise to the famous Latin proverb *habet aurum Tolosanum*, in allusion to ill-gotten gains. It possessed a circus and an amphitheatre, but its most remarkable remains are to be found on the heights of Old Toulouse (*vetus Tolosa*) some 6 or 7 m. to the east, where huge accumulations of broken pottery and fragments of an old earthen wall mark the site of an ancient settlement. The numerous coins that have been discovered on the same spot do not date back farther than the 2nd century B.C., and seem to indicate the position of a Roman manufacturing centre then beginning to occupy the Gallic hill-fortress that, in earlier days, had in times of peril been the stronghold of the native tribes dwelling on the river bank. Tolosa does not seem to have been a Roman colony; but its importance must have increased greatly towards the middle of the 4th century. It is to be found entered in more than one itinerary dating from about this time; and Ausonius, in his *Ordo nobilium urbium*, alludes to it in terms implying that it then had a large population. In 419 it was made the capital of his kingdom by Wallia, king of the Visigoths, under whom or whose successors it became the seat of the great Teutonic kingdom of the West-Goths—a kingdom that within fifty years had extended itself from the Loire to Gibraltar and from the Rhone to the Atlantic. On the defeat of Alaric II. (507) Toulouse fell into the hands of Clovis, who carried away the royal treasures to Angoulême. Under the Merovingian kings it seems to have remained the greatest city of southern Gaul, and is said to have been governed by dukes or counts dependent on one or other of the rival kings descended from the great founder of the Frankish monarchy. It figures prominently in the pages of Gregory of Tours and Sidonius Apollinaris. About 628 Dagobert erected South Aquitaine into a kingdom for his brother Charibert, who chose Toulouse as his capital. For the next eighty years its history is obscure, till we reach the days of Charles Martel, when it was besieged by Sema, the leader of the Saracens from Spain (*c.* 715–720), but delivered by Eudes, "princeps Aquitaniae," in whom later writers discovered the ancestor of all the later counts of Toulouse. Modern criticism, however, has discredited this genealogy; and the real history of Toulouse recommences in 780 or 781, when Charlemagne appointed his little son Louis king of Aquitaine, with Toulouse for his chief city.

During the minority of the young king his tutor Chorson ruled at Toulouse with the title of duke or count. Being deposed at the Council of Worms (790), he was succeeded by William Courtnez, the traditional hero of southern France, who in 806 retired to his newly founded monastery at Gellone, where he died in 812. In the unhappy days of the emperor Louis the Pious and his children Toulouse suffered in common with the rest of western Europe. It was besieged by Charles the Bald in 844, and taken four years later by the Normans, who in 843 had sailed up the Garonne as far as its walls. About 852 Raymond I., count of Quercy, succeeded his brother Fridolo as count of Rouergue and Toulouse; it is from this noble that all the later counts of Toulouse trace their descent. Raymond I.'s grandchildren divided their parents' estates; of these Raymond II. (d. 924) became count of Toulouse, and Ermengaud, count of Rouergue, while the hereditary titles of Gothia, Quercy and Albi were shared between them. Raymond II.'s grandson, William Taillefer (d. *c.* 1037), married Emma of Provence, and handed down part of that lordship to his younger son Bertrand.[1] William's elder son Pons left two children, of whom William IV. succeeded his father in Toulouse, Albi, Quercy, &c.; while the younger, Raymond IV. of St Gilles (*c.* 1066), made himself master of the vast possessions of the counts of Rouergue, married his cousin the heiress of Provence, and about 1085 began to rule the immense estates of his elder brother, who was still living.

From this time the counts of Toulouse were the greatest lords in southern France. Raymond IV., the hero of the first crusade, assumed the formal titles of marquis of Provence, duke of Narbonne and count of Toulouse. While Raymond was away in the Holy Land, Toulouse was seized by William IX., duke of Aquitaine, who claimed the city in right of his wife Philippa, the daughter of William IV., but was unable to hold it long (1098–1100). Raymond's son and successor Bertrand followed his father's example and set out for the Holy Land in 1109, leaving his great estates at his death to his brother Alphonse Jourdain. The rule of this prince was disturbed by the ambition of William IX. and his grand-daughter Eleanor, who urged her husband Louis VII. to support her claims to Toulouse by war. On her divorce from Louis and her marriage with Henry II., Eleanor's claims passed on to this monarch, who at last forced Raymond V. to do him homage for Toulouse in 1173. Raymond V., the patron of the troubadours, died in 1194, and was succeeded by his son Raymond VI., under whose rule Languedoc was desolated by the crusaders of Simon de Montfort, who occupied Toulouse in 1215, but lost his life in besieging it in 1218. Raymond VII., the son of Raymond VI. and Princess Joan of England, succeeded his father in 1222, and died in 1249, leaving an only daughter Joan, married to Alfonso the brother of Louis IX. On the death of Alfonso and Joan in 1271 the vast inheritance of the counts of Toulouse lapsed to the Crown.[2] From the middle years of the 12th century the people of Toulouse seem to have begun to free themselves from the most oppressive feudal dues. An act of Alphonse Jourdain (1141) exempts them from the tax on salt and wine; and in 1152 we have traces of a "commune consilium Tolosae" making police ordinances in its own name "with the advice of Lord Raymond, count of Toulouse, duke of Narbonne, and marquis of Provence." This act is witnessed by six "capitularii," four duly appointed judges (*judices constituti*), and two advocates. Twenty-three years later there are twelve capitularii or consuls, six for the city and six for its suburbs, all of them elected and sworn to do justice in whatever municipal matters were brought before them. In 1222 their number was increased to twenty-four; but they were forbidden to touch the city property, which was to remain in the charge of certain "communarii" chosen by themselves. Early in the 14th century the consuls took the name of "domini de capitulo," or, a little later, that of "capitulum nobilium." From the 13th century the consuls met in their own house, the "palatium communitatis Tolosae" or hôtel-de-ville. In the 16th century a false derivation changed the ancient consuls (*domini de capitulo*) into the modern "capitouls" (*domini capitolii tolosani*), a barbarous etymology which in its turn has, in the present century, transformed the old assembly house of Toulouse into the capitole. The parlement of Toulouse was established as a permanent court in 1443. Louis XI. transferred it to Montpellier in 1467, but restored it to Toulouse before the close of the next year. This parlement was for Languedoc and southern France what the parlement of Paris was for the north. During the religious wars of the 16th century the Protestants of the town made two unsuccessful attempts to hand it over to the prince de Condé. After St Bartholomew's Day (1572) 300 of the party were massacred. Towards the end of the 16th century, during the wars of the League, the parlement was split up into three different sections, sitting respectively at Carcassonne or Béziers, at Castle Sarrasin, and at Toulouse. The three were reunited in 1596. Under Francis I. it began to persecute heretics, and in 1619 rendered itself notorious by burning the philosopher Vanini. In 1762 Jean Calas, an old man falsely accused of murdering his eldest son to prevent him becoming a Roman Catholic, was broken on the wheel. By the exertions of Voltaire his character was afterwards rehabilitated. The university of Toulouse owes its origin to the action of Gregory IX., who in 1229 bound Raymond VII. to maintain four masters to teach theology and eight others for canon law, grammar, and the liberal arts. Civil law and medicine were taught only a few years later. The famous "Floral Games" of Toulouse, in which the poets of Languedoc contended (May 1–3) for the prize of the golden amaranth and other gold or silver flowers, given at the expense of the city, were instituted in 1323–1324. The *Académie des Jeux Floraux* still awards these prizes for compositions in poetry and prose. In 1814 the duke of Wellington defeated Marshal Soult to the north-east of the town.

See L. Ariste and L. Brand, *Histoire populaire de Toulouse depuis les origines jusqu'à ce jour* (Toulouse, 1898). This work contains an exhaustive bibliography.

TOUNGOO, or TAUNG-NGU, a town and district in the Tenasserim division of Lower Burma. The town is situated on the right bank of the river Sittang, 166 m. by rail N. from Rangoon. Pop. (1901), 15,837. From the 14th to the 16th century it was the capital of an independent kingdom. After the second Burmese War it was an important frontier station, but the troops were withdrawn in 1893. The district of Toungoo has an area of 6172 sq. m.; pop. (1901), 279,315, showing an increase of 32% in the preceding decade. Three mountain ranges traverse the district—the Pegu Yomas, the Karen, and the Nat-taung or "Great Watershed"—all of which have a north and south direction, and are covered for the most part with dense forest. The Pegu Yomas have a general elevation of from 800 to 1200 ft., while the central range averages from 2000 to 3000 ft. The rest of Toungoo forms the upper portion of the valley of the Sittang, the only large river in the district, the chief tributaries of which are the Shwa, Hkabaung, Hpyu Thank-ye-Kat and Yank-thua-wa, all navigable for a great portion of their course. Limestone appears in various places, and in the north-east a light grey marble is quarried for lime. The rivers form the chief means of communication during the rainy season. The rainfall in 1905 was 80·30 in. There are 14 railway stations in the district. Rice is the staple crop; there are promising plantations of coffee and rubber. Forests cover more than 5000 sq. m., of which 1337 sq. m. have been reserved, yielding a large revenue.

TOUP, JONATHAN [JOANNES TOUPIUS] (1713–1785), English classical scholar and critic, was born at St Ives in Cornwall, and was educated at a private school and Exeter College, Oxford. Having taken orders, he became rector of St Martin's Exeter, where he died on the 19th of January 1785. Toup established his reputation by his *Emendationes in Suidam* (1760–1766, followed in 1775 by a supplement) and his edition of *Longinus* (1778), including notes and emendations by Ruhnken. The excellence of Toup's scholarship was "known to the learned throughout Europe" (so epitaph on the tablet in the church of East Looe set up by the delegates of the Clarendon Press), but his overbearing manner and extreme self-confidence made him many enemies.

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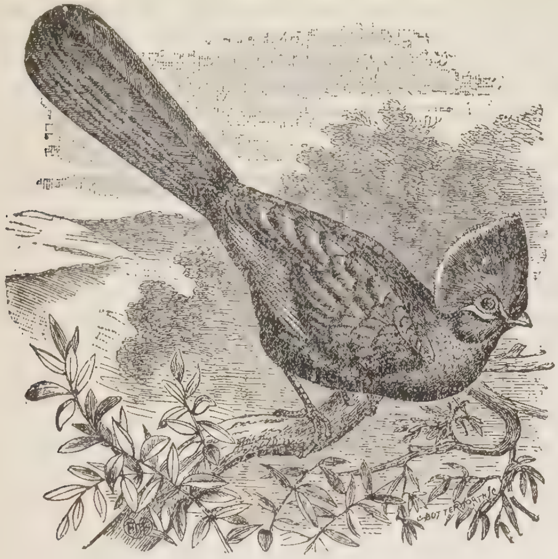
[1] About 975 there was a partition of the estates which William Taillefer and his cousin Raymond II. of Auvergne held in common,—Albi, Quercy, &c., falling to William, and Gothia, &c., to Raymond.

[2] List of the counts of Toulouse:

Chorson	778–790
William I.	790–806
Raymond Rafinel	*c.* 812–818
Berenger	818–835
Bernard I.	835–844
Warin	844–845
William II.	845–850
Fridolo	850–852
Raymond I.	852–864
Bernard	864–875
Eudo	875–918
Raymond II.	918–*c.* 924
Raymond III.	924–*c.* 950
William Taillefer	*c.* 950–*c.* 1037
Pons	1037–1060
William IV.	1060–*c.* 1093
Raymond IV.	1093–1096
Bertrand	1096–1109
Alphonse Jourdain	1109–1148
Raymond V.	1148–1194
Raymond VI.	1194–1222
Raymond VII.	1222–1249
Alfonso and Joan	1249–1271

TOURACOU, the name, evidently already in use, under which in 1743 G. Edwards figured a pretty African bird,[1] and presumably that applied to it in Guinea, whence it had been brought alive. It is the *Cuculus persa* of Linnaeus, and *Turacus* or *Corythaix persa* of later authors. Cuvier in 1799 or 1800 Latinized its native name (adopted in the meanwhile by both French and German writers) as above, for which barbarous term J. K. W. Illiger, in 1811, substituted a more classical word. In 1788 Isert described and figured (*Beobacht. Gesellsch. naturf. Freunde*, iii. 16–20, pl. 1) a bird, also from Guinea, which he called *Musophaga violacea*. Its affinity to the original Touracou was soon recognized, and both forms have been joined by modern systematists in the family Musophagidae, commonly Englished Plantain-eaters or Touracous.



(After Schlegel.)

White-Crested Touracou (*Turacus albicristatus*).

To take first the Plantain-eaters proper, or the genus *Musophaga*, of which only two species are known. One, about the size of a crow, is comparatively common in museums, and has the horny base of its yellow bill prolonged backwards over the forehead in a kind of shield. The top of the head and the primaries, except their outer edge and tip, are deep crimson; a white streak extends behind the eye; and the rest of the plumage is glossy purple. The second species, *M. rossae*, which is rare, chiefly differs by wanting the white eye-streak. Then of the Touracous—the species originally described is about the size of a jay, and has the head, crest (which is vertically compressed and tipped with red), neck and breast of grass-green, varied by two white streaks—one, from the gape to the upper part of the crimson orbit, separated by a black patch from the other, which runs beneath and behind the eye. The wing-coverts, lower part of the back, and tail are of steel-purple, the primaries deep crimson, edged and tipped with bluish black. Over a dozen other congeneric species, more or less resembling this, have been described, and all inhabit some district of Africa. One, found in the Cape Colony and Natal, where it is known as the "Lory" (cf. xv. 7, note 1), though figured by Daubenton and others, was first differentiated in 1841 by Strickland (*Ann. Nat. History*, vii. 33) as *Turacus albicristatus*—its crest having a conspicuous white border, while the steel-purple of *T. persa* is replaced by a rich and glossy bluish green of no less beauty. In nearly all the species of this genus the nostrils are almost completely hidden by the frontal feathers; but there are two others in which, though closely allied, this is not the case, and some systematists would place them in a separate genus *Gallirex*; while another species, the giant of the family, has been moved into a third genus as *Corythaeola cristata*. This differs from any of the foregoing by the absence of the crimson coloration of the primaries, and seems to lead to another group, *Schizorrhis*, in which the plumage is of a still plainer type, and, moreover, the nostrils here are not only exposed but in the form of a slit, instead of being oval as in all the rest. This genus contains about half-a-dozen species, one of which, *S. concolor*, is the Grey Touracou of the colonists in Natal, and is of an almost uniform slaty brown. A good deal has been written about these birds, which form the subject of a beautiful monograph —*De Toerako's afgebeeld en beschreven*—by Schlegel and Westerman, brought out at Amsterdam in 1860; while further information is contained in an elaborate essay by Schalow (*Journ. f. ornithologie*, 1886, pp. 1–77). Still, much remains to be made known as to their distribution throughout Africa and their habits. They seem to be all fruit-eaters, and to frequent the highest trees, seldom coming to the ground. Very little can be confidently asserted as to their nidification, but at least one species of *Schizorrhis* is said to make a rough nest and therein lay three eggs of a pale blue colour. An extraordinary peculiarity attends the crimson coloration which adorns the primaries of so many of the Musophagidae. So long ago as 1818, Jules Verreaux observed (*Proc. Zool. Society*, 1871, p. 40) that in the case of *T. albicristatus* this beautiful hue vanishes on exposure to heavy rain and reappears only after some interval of time and when the feathers are dry.[2]

The Musophagidae form a distinct family, of which the Cuculidae are the nearest allies, the two being associated to form the Cuculine as compared with the Psittacine division of Cuculiform birds (see BIRD and PARROT). T. C. Eyton pointed out (*Ann. Nat. History*, 3rd series, vol. ii. p. 458) a feature possessed in common by the latter and the Musophagidae, in the "process attached to the anterior edge of the ischium," which he likened to the so-called "marsupial" bones of Didelphian mammals. J. T. Reinhardt has also noticed (*Vidensk. meddels. naturhist. forening*, 1871, pp. 326–341) another Cuculine character offered by the *os uncinatum* affixed to the lower side of the ethmoid in the Plantain-eaters and Touracous; but too much dependence must not be placed on that, since a similar structure is presented by the frigate-bird (*q.v.*) and the petrels (*q.v.*). A corresponding process seems also to be found in Trogon (*q v.*). The bill of nearly all the species of Musophagidae is curiously serrated or denticulated along the margin and the feet have the outer toe reversible, but usually directed backwards. No member of the family is found outside of the continental portion of the Ethiopian region. (A. N.)

TOURAINE, an old province in France, which stretched along both banks of the Loire in the neighbourhood of Tours, the river dividing it into Upper and Lower Touraine. It was bounded on the N. by Orléanais, W. by Anjou and Maine, S. by Poitou and E. by Berry, and it corresponded approximately to the modern department of Indre et Loire. Touraine took its name from the Turones, the tribe by which it was inhabited at the time of Caesar's conquest of Gaul. They were unwarlike, and offered practically no resistance to the invader, though they joined in the revolt of Vercingetorix in A.D. 52. The capital city, Caesarodunum, which was built on the site of the eastern part of the present city of Tours, was made by Valentinian the metropolis of the 3rd Lyonnaise, which included roughly the later provinces of Touraine, Brittany, Maine and Anjou. Christianity seems to have been introduced into Touraine not much earlier than the beginning of the 4th century, although tradition assigns St Gatien, the first bishop of Tours, to the 3rd. The most famous of its apostles was St Martin (*fl.* 375-400), who founded the abbey of Marmoutier, near Tours, and whose tomb in the city became a celebrated shrine. Tours was besieged by the Visigoths in 428, and though it offered a successful resistance on this occasion it was included fifty years later in the territory of the Visigoths. The Tourangeans refused to adopt the Arian heresy of their conquerors, and this difference in religion materially assisted in 507 the conquest of the province by Clovis, whose orthodoxy was guaranteed by the miraculous intervention of St Martin. St Clotilda, wife of Clovis, spent the last years of her life in retreat at Tours. The possession of Touraine was constantly the subject of dispute between the Merovingian princes, and the province enjoyed no settled peace until the reign of Charlemagne. He established Alcuin as abbot of St Martin of Tours, and under his auspices the school of Tours became one of the chief seats of learning in the middle ages. In the 9th century Tours also became the ecclesiastical metropolis of Brittany, Maine and Anjou, and when the empire was divided by Louis the Pious into various districts or *missatica*, Tours was the centre of one of these, the boundaries of which corresponded roughly with those of the ecclesiastical jurisdiction of the city. Touraine suffered from the invasions of the Northmen, who massacred the monks of Marmoutier in 853, but never pillaged Tours. The administration of Touraine was entrusted, from Merovingian times onward, to counts appointed by the crown. The office became hereditary in 940 or 941 with Thibault the Old or the "Tricheur." His son Odo I. was attacked by Fulk the Black, count of Anjou, and despoiled of part of his territory. His grandson Thibault III., who refused homage to Henry I., king of France, in 1044, was entirely dispossessed by Geoffrey of Anjou, called the Hammer (d. 1060). The 7th count, Fulk (d. 1109), ruled both Anjou and Touraine, and the county of Touraine remained under the domination of the counts of Anjou (*q.v.*) until Henry II. of England deprived his brother Geoffrey of Touraine by force of arms. Henry II. carried out many improvements, but peace was destroyed by the revolt of his sons. Richard Coeur de Lion, in league with Philip Augustus, had seized Touraine, and after his death Arthur of Brittany was recognized as count. In 1204 it was united to the French crown, and its cession was formally acknowledged by King John at Chinon in 1214. Philip appointed Guillaume des Roches hereditary seneschal in 1204, but the dignity was ceded to the crown in 1312. Touraine was granted from time to time to princes of the blood as an appanage of the crown of France. In 1328 it was held by Jeanne of Burgundy, queen of France; by Philip, duke of Orleans, in 1344; and in 1360 it was made a peerage duchy on behalf of Philip the Bold, afterwards duke of Burgundy. It was the scene of dispute between Charles, afterwards Charles VII., and his mother, Isabel of Bavaria, who was helped by the Burgundians. After his expulsion from Paris by the English Charles spent much of his time in the châteaux of Touraine, although his seat of government was at Bourges. He bestowed the duchy successively on his wife Mary of Anjou, on Archibald Douglas and on Louis III. of Anjou. It was the dower of Mary Stuart as the widow of Francis II. The last duke of Touraine was Francis, duke of Alençon, who died in 1584. Plessis-les-Tours had been the favourite residence of Louis XI., who granted many privileges to the town of Tours, and increased its prosperity by the establishment of the silk-weaving industry. The reformed religion numbered many adherents in Touraine, who suffered in the massacres following on the conspiracy of Amboise; and, though in 1562 the army of Condé pillaged the city of Tours, the marshal of St André reconquered Touraine for the Catholic party. Many Huguenots emigrated after the massacre of St Bartholomew, and after the revocation of the Edict of Nantes the silk industry, which had been mainly in the hands of the Huguenots, was almost destroyed. This migration was one of the prime causes of the extreme poverty of the province in the next century. At the Revolution the nobles of Touraine made a declaration expressing their sympathy with the ideas of liberty and fraternity. Among the many famous men who were born within its boundaries are Jean le Meingre Boucicaut, marshal of France, Béroalde de Verville, author of the *Moyen de parvenir*, Rabelais, Cardinal Richelieu, C. J. Avisseau, the potter (1796–1861), the novelist Balzac and the poet Alfred de Vigny.

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[1] Apparently the first ornithologist to make the bird known was Albin, who figured it in 1738 from the life, yet badly, as "The Crown-bird of Mexico." He had doubtless been misinformed as to its proper country; but Touracous were called "Crown-birds" by the Europeans in West Africa, as witness Bosman's *Description of the Coast of Guinea* (2nd ed., 1721), p. 251, and W. Smith's *Voyage to Guinea* (1745), p. 149, though the name was also given to the crowned cranes, *Balearica*.

[2] The fact of this colouring matter being soluble in water was incidentally mentioned at a meeting of the Zoological Society of London by W. B. Tegetmeier, and brought to the notice of Professor A. H. Church, who, after experiment, published in 1868 (*Student and Intellectual Observer*, i. 161–168) an account of it as "Turacīn, a new animal pigment containing copper." Further information on the subject was given by Monteiro (*Chem. News*, xxviii. 201; *Quart. Journ. Science*, 2nd series, vol. iv. p. 132). The property is possessed by the crimson feathers of all the birds of the family.

See the quarterly publication of the *Mémoires* of the *Société archéologique de Touraine* (1842, &c.) which include a *Dictionnaire géographique, historique et biographique* (6 vols., 1878–1884), by J. X. Carré de Busserolle. There are histories of Touraine and its monuments by Chalmel (4 vols. Paris, 1828), by S. Bellanger (Paris, 1845), by Bourrassé (1858). See also Dupin de Saint André, *Hist. du protestantisme en Touraine* (Paris, 1885); T. A. Cook, *Old Touraine* (2 vols. London, 1892).

TOURCOING, a manufacturing town of northern France in the department of Nord, less than a mile from the Belgian frontier, and 8 m. N.N.E. of Lille on the railway to Ghent. Pop. (1906), 62,694 (commune, 81,671), of whom about one-third are natives of Belgium. Tourcoing is practically one with Roubaix to the south, being united thereto by a tramway and a branch of the Canal de Roubaix. The public institutions comprise a tribunal of commerce, a board of trade arbitrators, a chamber of commerce, an exchange and a conditioning house for textiles. Together with Roubaix, Tourcoing ranks as one of the chief textile centres of France. Its chief industry is the combing, spinning and twisting of wool carried on in some eighty factories employing between 10,000 and 12,000 workpeople. The spinning and twisting of cotton is also important. The weaving establishments produce woollen and mixed woollen and cotton fabrics together with silk and satin drapery, swanskins, jerseys and other fancy goods. The making of velvet pile carpets and upholstering materials is a speciality of the town. To these industries must be added those of dyeing, the manufacture of hosiery, of the machinery and other apparatus used in the textile factories and of soap.

Famed since the 12th century for its woollen manufactures, Tourcoing was fortified by the Flemings in 1477, when Louis XI. of France disputed the inheritance of Charles the Bold with Mary of Burgundy, but in the same year was taken and pillaged by the French. In 1794 the Republican army, under Generals Moreau and Souham, gained a decisive victory over the Austrians, the event being commemorated by a monument in the public garden. The inhabitants, 18,000 in 1789, were reduced by the French Revolution to 10,000.

TOURMALINE, a mineral of much interest to the physicist on account of its optical and electrical properties; it is also of some geological importance as a rock-constituent (see SCHORL), whilst certain transparent varieties have economic value as gem-stones. The name is probably a corruption of *turmali*, or *toramalli*, the native name applied to tourmaline and zircon in Ceylon, whence specimens of the former mineral were brought to Europe by the Dutch in 1703. The green tourmaline of Brazil had, however, been known here much earlier; and coarse varieties of the mineral had passed for centuries under the German name of *Schörl*, an old mining word of uncertain origin, possibly connected with the old German *Schor* (refuse), in allusion to the occurrence of the mineral with the waste of the tin-mines. The German village of Schorlau may have taken its name from the mineral. It has been suggested that the Swedish form *skörl* has possible connexion with the word *skör*, brittle.

Tourmaline crystallizes in the rhombohedral division of the hexagonal system. The crystals have generally a prismatic habit, the prisms being longitudinally striated or even channelled. Trigonal prisms are characteristic, so that a transverse section becomes triangular or often nine-sided. By combination of several prisms the crystals may become sub-cylindrical. The crystals when doubly terminated are often hemimorphic or present dissimilar forms at the opposite ends; thus the hexagonal prisms in fig. 1 are terminated at one end by rhombohedral faces, *o*, P, and at the other by the basal plane *k′*. Doubly-terminated crystals, however, are comparatively rare; the crystals being usually attached at one end to the matrix. It is notable that prismatic crystals of tourmaline have in some cases been curved and fractured transversely; the displaced fragments having been cemented together by deposition of fresh mineral matter. Tourmaline is not infrequently columnar, acicular or fibrous; and the fibres may radiate from a centre so as to form the so-called "tourmaline suns." Crystals of tourmaline present no distinct cleavage, but break with a sub-conchoidal fracture; and whilst the general lustre of the mineral is vitreous, that of the fractured surface is rather pitchy. The hardness is slightly above that of quartz (7). The specific gravity varies according to chemical composition, that of the colourless varieties being about 3, whilst in schorl it may rise to 3·2.

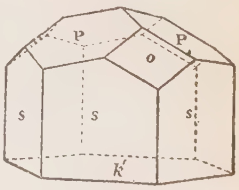


FIG. 1.

Tourmaline has a great range of colour, and in many cases the crystals are curiously parti-coloured. Occasionally, though rarely, the mineral is colourless, and is then known as achroite, a name proposed by R. Hermann in 1845, and derived from the Greek *ἄχροος* (uncoloured). Red tourmaline, which when of fine colour is the most valued of all varieties, is known as rubellite (*q.v.*). Green tourmaline is by no means uncommon, but the blue is rather rare and is distinguished by the name indigolite, generally written indicolite. Brown is a common colour, and black still more common, this being the usual colour of schorl, or common coarse tourmaline. Thin splinters of schorl may, however, be blue or brown by transmitted light.

The double refraction of tourmaline is strong. The mineral is optically negative, the ordinary index being about 1·64, and the extraordinary 1·62. Coloured tourmalines are intensely pleochroic, the ordinary ray, which vibrates perpendicular to the principal axis, being much more strongly absorbed than the extraordinary; hence a slice cut in the direction of the principal or optic axis transmits sensibly only the extraordinary ray, and may consequently be used as a polarizing medium. The brown tourmaline of Ceylon and Brazil is best adapted for this purpose, but the green is also used. Two plates properly mounted form the instrument used by opticians for testing spectacle-lenses, and are known as the "tourmaline tongs." In order to secure the best colour-effect when used as a gem-stone, the tourmaline should be cut with the table parallel to the optic axis.

It was in tourmaline that the phenomenon of pyroelectricity was first observed. On being heated in peat ashes its attractive power was observed by the Dutch, in the early part of the 18th century; and this curious character obtained for it the name of *aschtrekker*, or ash-drawer. J. R. Haüy first pointed out the relation of pyroelectricity with hemimorphism. Tourmaline is also piezoelectric, that is, it becomes electric by pressure. If a crystal be subjected to pressure along the optic axis, it behaves as though it were contracting by reduction of temperature. The mineral may also be rendered electric by friction, and retains the charge for a long time.

Tourmaline is a boro-silicate of singularly complex composition. Indeed the word tourmaline is sometimes regarded as the name of a group of isomorphous minerals rather than that of a definite species. Numerous analyses have been made, and the results discussed by a large number of authorities. In the view of S. L. Penfield and H. W. Foote all tourmaline may be derived from a boro-silicic acid of the formula $H_{20}B_2Si_4O_{21}$. It is believed that the hydrogen is present as hydroxyl, and that this may be partially replaced by fluorine. The tourmaline acid has probably the constitution $H_{18}(B{\cdot}OH)_2Si_4O_{19}$. Nine atoms of hydrogen are replaced by three of aluminium, and the remaining nine in part by other metals. Lithium is present in red tourmaline; magnesium dominates in brown; iron, manganese and sometimes chromium are found in green; and much iron occurs in the black varieties. Four groups are sometimes recognized, characterized by the presence of (1) lithium, (2) ferrous iron, (3) ferric iron and (4) magnesium.

Tourmaline occurs commonly in granite, greisen, gneiss and crystalline schists. In many cases it appears to have been formed by pneumatolysis, or the action on the rocks of heated vapours containing boron and fluorine, as in many tin-bearing districts, where tourmaline is a characteristic mineral. Near the margin of a mass of granite the rock often becomes schorlaceous or tourmaliniferous, and may pass into "tourmaline-rock," which is usually an aggregate of tourmaline and quartz. Tourmaline is an essential constituent of the west of England rocks called luxullianite (luxulyanite) and trowlesworthite. It occurs embedded in certain metamorphic limestones, where it is possibly due to fumarolic action. Microscopic crystals are common in clay-slate. By resistance to decomposition, tourmaline often survives the disintegration of the matrix, and thus passes into sands, clays, marls and other sedimentary deposits.

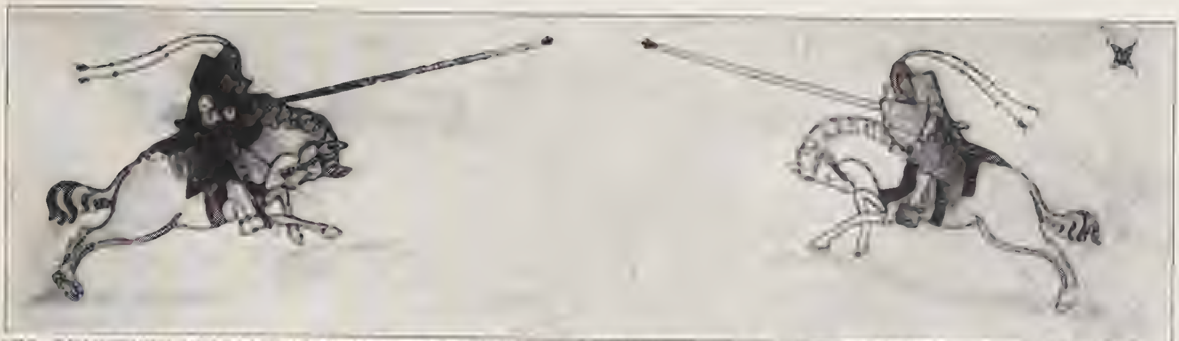
Many of the finest crystals of tourmaline occur in druses in granitic rocks, such as those of San Piero in Elba, where some of the pale pink and green prisms are tipped with black, and have consequently been called "nigger-heads." Lepidolite is a common associate of tourmaline, as at Rozena in Moravia. Tourmaline occurs, with corundum, in the dolomite of Campolongo, in canton Ticino, Switzerland. Fine black crystals, associated with apatite and quartz, were formerly found in granite at Chudleigh, near Bovey Tracey in Devonshire. The Russian localities for tourmaline are mentioned under RUBELLITE. Most of the tourmaline cut for jewelry comes from the gem-gravels of Ceylon. The green tourmaline has generally a yellowish or olive-green colour, and is known as "Ceylon chrysolite." Fine green crystals are found in Brazil, notably in the topaz-locality of Minas Novas; and when of vivid colour they have been called "Brazilian emeralds." Green tourmaline is a favourite ecclesiastical stone in South America Blue tourmaline occurs with the green; this variety is found also at Utö in Sweden (its original locality) and notably near Hazaribagh in Bengal. Certain kinds of mica occasionally contain flat crystals of tourmaline between the cleavage-planes.

Many localities in the United States are famous for tourmaline. Magnificent specimens have been obtained from Mt Mica, near Paris, Maine, where the mineral was accidentally discovered in 1820 by two students, E. L. Hamlin and E. Holmes. It occurs in granite, with lepidolite, smoky quartz, spodumene, &c.; and some of the prismatic crystals are notable for being red at one end and green at the other. Mt Rubellite at Hebron, and Mt Apatite at Auburn, are other localities in Maine which have yielded fine tourmaline. At Chesterfield, Massachusetts, remarkable crystals occur, some of which show on transverse section a triangular nucleus of red tourmaline surrounded by a shell of green. Red and green tourmalines, with lepidolite and kunzite, are found in San Diego county, California. Fine coloured tourmalines occur at Haddam Neck, Connecticut; and excellent crystals of black tourmaline are well known from Pierrepont, New York, whilst remarkable brown crystals occur in limestone at Gouverneur in the same state. Canada is rich in tourmaline, notably at Burgess in Lanark county, Ontario, and at Grand Calumet Island in the Ottawa river. Heemskirk Mountain, Tasmania, and Kangaroo Island, South Australia, have yielded fine coloured tourmaline fit for jewelry. Madagascar is a well-known locality for black tourmaline in large crystals.

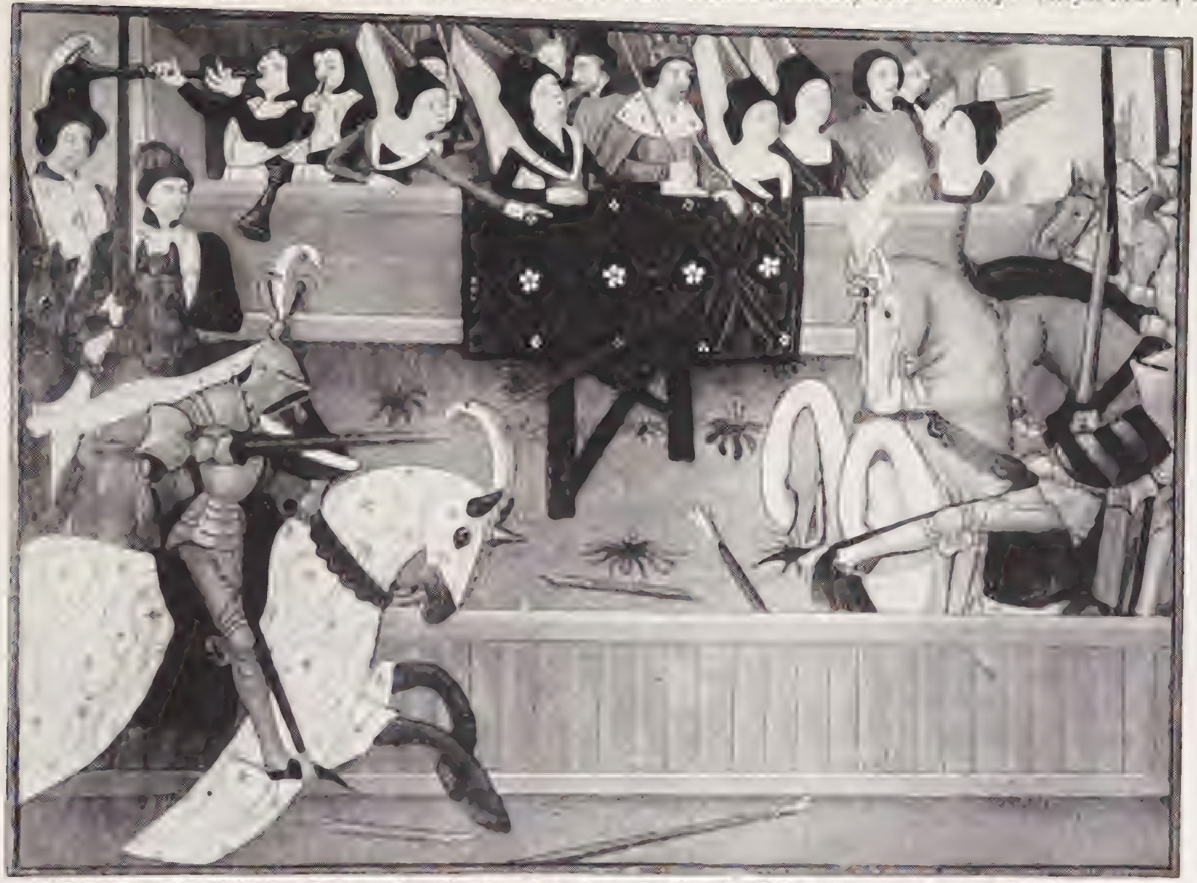
Many varieties of tourmaline have received distinctive names, some of which are noticed above. Dravite is G. Tschermak's name for a brown tourmaline, rich in magnesia but with little iron, occurring near Unter Drauburg in the Drave district in Carinthia. Taltalite was a name given by I. Domeyko to a mixture of tourmaline and copper ore from Taltal in Chile. The colourless Elba tourmaline was called apyrite by J. F. L. Hausmann, in allusion to its refractory behaviour before the blow-pipe; whilst a black iron-tourmaline from Norway was termed aphrazite by J. B. d'Andrada, in consequence of its intumescence when heated. (F. W. R.*)

TOURNAI (Flemish *Doornik*), a city of Belgium, in the province of Hainaut, situated on the Scheldt. Pop. (1904), 36,744. Although in the course of its long history it has undergone many sieges and was sacked at various epochs by the Vandals, Normans, French and Spaniards, it preserves many monuments of its ancient days. Among these is the cathedral of Notre-Dame, one of the finest and best preserved Romanesque and Gothic examples in Belgium (for plan, &c., see ARCHITECTURE: *Romanesque and Gothic in Belgium*). Its foundation dates from the year 1030, while the nave is Romanesque of the middle of the 12th century, with much pointed work. The transept was added in the 13th century. The first choir was burned down in 1213, but was rebuilt in 1242 at the same time as the transept, and is a superb specimen of pointed Gothic. There are five towers with spires, which give the outside an impressive appearance, and much has been done towards removing the squalid buildings that formerly concealed the cathedral. There are several old pictures of merit, and the shrine of St Eleuthère, the first bishop of Tournai in the 6th century, is a remarkable product of the silversmith's art. The belfry on the Grand Place was built in 1187, partly reconstructed in 1391 and finally restored and endowed with a steeple in 1852. The best view of the cathedral can be obtained from its gallery. The church of St Quentin in the same square as the belfry is almost as ancient as Notre-Dame, and the people of Tournai call it the "little cathedral." In the church of St Brice is the tomb of Childeric discovered in 1655. Among the relics were three hundred small golden models of bees. These were removed to Paris, and when Napoleon was crowned emperor a century and a half later he chose Childeric's bees for the decoration of his coronation mantle. In this manner the bee became associated with the Napoleonic legend just as the lilies were with the Bourbons. The Pont des Trous over the Scheldt, with towers at each end, was built in 1290, and among many other interesting buildings there are some old houses still in occupation which date back to the 13th century. On the Grand Place is the fine statue of Christine de Lalaing, princess d'Epinoy, who defended Tournai against Parma in 1581. Tournai carries on a large trade in carpets (called Brussels), bonnet shapes, corsets and fancy goods generally. With regard to the carpet manufactory, it is said locally to date from the time of the Crusades, and it is presumed that the Crusaders learnt the art from the Saracens.

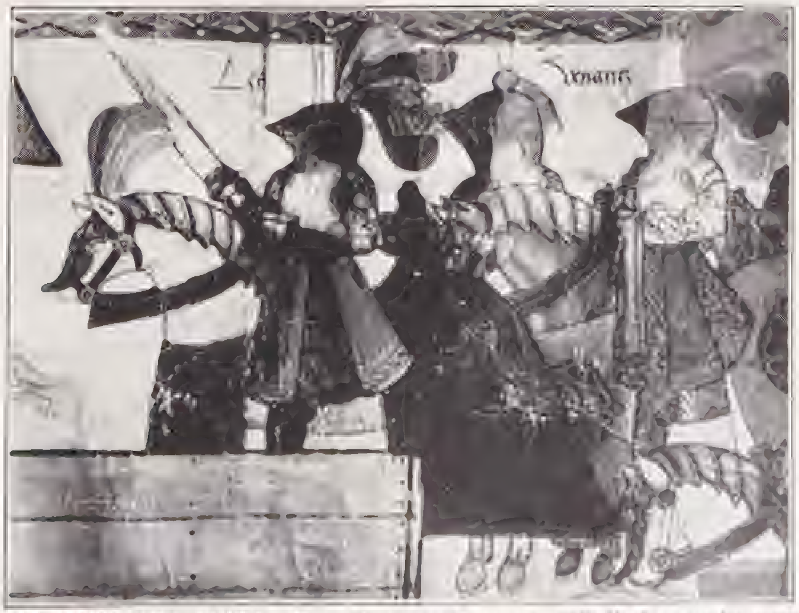
The history of Tournai dates from the time of Julius Caesar, when it was called *civitas Nerviorum* or *castrum Turnacum*. In the reign of Augustus, Agrippa fixed the newly mixed colony of Suevi and Menapii at Tournai, which continued throughout the period of Roman occupation to be of importance. In the 5th century the Franks seized Tournai, and Merovaeus made it the capital of his dynasty. This it remained until the subdivision of the Frank monarchy among the sons of Clovis. When feudal possessions, instead of being purely personal, were vested in the families of the holder after the death of Charlemagne, Tournai was specially assigned to Baldwin of the Iron Arm by Charles



KNIGHTS JOUSTING WITH CRONELLS ON THEIR LANCES. French MS. early XIV Century. (Royal MS. 14 E. iii)



KNIGHTS JOUSTING. From a French MS. of the latter half of the XV Century. (Cotton MS. Nero D. ix.)



NGLISH KNIGHTS RIDING INTO THE LISTS. From the Great Tournament Roll of 1511; by permission of the College of Arms.

the Bald, whose daughter Judith he had abducted, on receiving the hereditary title of count of Flanders. During the Burgundian period it was the residence of Margaret of York, widow of Charles the Bold; and the pretender Perkin Warbeck, whom she championed, if not born there, was the reputed son of a Jew of Tournai. In the early 16th century Tournai was an English possession for a few years and Henry VIII. sold it to Francis I. It did not long remain French, for in 1521 the count of Nassau, Charles V.'s general, took it and added it to the Spanish provinces. During the whole of the middle ages Tournai was styled the "seigneurie de Tournaisis," and possessed a charter and special privileges of its own. Near Tournai was fought, on the 11th of May 1745, the famous battle of Fontenoy. (D. C. B.)

TOURNAMENT, or TOURNEY (Fr. *tournement*, *tournoi*, Med. Lat. *torneamentum*, from *tourner*, to turn), the name popularly given in the middle ages to a species of mock fight, so called owing to the rapid *turning* of the horses (Skeat). Of the several medieval definitions of the tournament given by Du Cange (*Glossarium, s.v.* "Tourneamentum"), the best is that of Roger of Hoveden, who described tournaments as "military exercises carried out, not in the spirit of hostility (*nullo interveniente odio*), but solely for practice and the display of prowess (*pro solo exercitio, atque ostentatione virium*)." Men who carry weapons have in all ages played at the game of war in time of peace. But the tournament, properly so called, does not appear in Europe before the 11th century, in spite of those elaborate fictions of Ruexner's *Thurnierbuch* which detail the tournament laws of Henry the Fowler. More than one chronicler records the violent death, in 1066, of a French baron named Geoffroi de Preulli, who, according to the testimony of his contemporaries, "invented tournaments." In England, at least, the tournament was counted a French fashion, Matthew Paris calling it *conflictus gallicus*.

By the 12th century the tournament had grown so popular in England that Henry II. found it necessary to forbid the sport which gathered in one place so many barons and knights in arms. In that age we have the famous description by William FitzStephen of the martial games of the Londoners in Smithfield. He tells how on Sundays in Lent a noble train of young men would take the field well mounted, rushing out of the city with spear and shield to ape the feats of war. Divided into parties, one body would retreat, while another pursued striving to unhorse them. The younger lads, he says, bore javelins disarmed of their steel, by which we may know that the weapon of the elders was the headed lance. William of Newbury tells us how the young knights, balked of their favourite sport by the royal mandate, would pass over sea to win glory in foreign lists. Richard I. relaxed his father's order, granting licences for tournaments, and Jocelin of Brakelond has a long story of the great company of cavaliers who held a tournament between Thetford and Bury St Edmunds in defiance of the abbot. From that time onward unlicensed tourneying was treated as an offence against the Crown, which exacted heavy fees from all taking part in them even when a licence had been obtained. Often the licence was withheld, as in 1255, when the king's son's grave peril in Gascony is alleged as a reason for forbidding a meeting. In 1299 life and limb were declared to be forfeit in the case of those who should arrange a tourney without the royal licence, and offenders were to be seized with horse and harness. As the tournament became an occasion for pageantry and feasting, new reason was given for restraint: a simple knight might beggar himself over a sport which risked costly horses and carried him far afield. Jousters travelled from land to land, like modern cricketers on their tours, offering and accepting challenges. Thus Edward I., before coming to the throne, led eighty knights to a tournament on the Continent. Before the jousts at Windsor on St George's Day in 1344 heralds published in France, Scotland, Burgundy, Hainault, Flanders, Brabant and the domains of the emperor the king's offer of safe conduct for competitors. At the weddings of princes and magnates and at the crowning of kings the knights gathered to the joustings, which had become as much a part of such high ceremonies as the banquet and the minstrelsy. The fabled glories of the Round Table were revived by princely hosts, who would assemble a gallant company to keep open house and hold the field against all comers, as did Mortimer, the queen's lover, when, on the eve of his fall, he brought all the chivalry of the land to the place where he held his Round Table. About 1292 the "Statute of Arms for Tournaments" laid down, "at the request of the earls and barons and of the knighthood of England," new laws for the game. Swords with points were not to be used, nor pointed daggers, nor club nor mace. None was to raise up a fallen knight but his own appointed squires, clad in his device. The squire who offended was to lose horse and arms and lie three years in gaol. A northern football crowd would understand the rule that forbade those coming to see the tournament to wear harness or arm themselves with weapons. Disputes were to be settled by a court of honour of princes and earls. That such rules were needful had been shown at Rochester in 1251, where the foreign knights were beaten by the English and so roughly handled that they fled to the city for refuge. On their way the strangers were faced by another company of knights who handled them roughly and spoiled them, thrashing them with staves in revenge for the doings at a Brackley tournament. Even as early as the 13th century some of these tournaments were mere pageants of horsemen. For the Jousts of Peace held at Windsor Park in 1278 the sword-blades are of whalebone and parchment, silvered; the helms are of boiled leather and the shields of light timber. But the game could make rough sport. Many a tournament had its tale of killed and wounded in the chronicle books. We read how Roger of Lemburn struck Arnold de Montigny dead with a lance thrust under the helm. The first of the Montagu earls of Salisbury died of hurts taken at a Windsor jousting, and in those same lists at Windsor the earl's grandson Sir William Montagu was killed by his own father. William Longéspee in 1256 was so bruised that he never recovered his strength, and he is among many of whom the like is written. Blunted or "rebated" lance-points came early into use, and by the 14th century the coronall or cronell head was often fitted in place of the point. After 1400 the armourers began to devise harness with defences specially wrought for service in the lists. But the joust lost its chief perils with the invention of the tilt, which, as its name imports, was at first a cloth stretched along the length of the lists. The cloth became a stout barrier of timber, and in the early 16th century the knight ran his course at little risk. Locked up in steel harness, reinforced with the grand-guard and the other jousting pieces, he charged along one side of this barrier, seeing little more through the pierced sight-holes of the helm than the head and shoulders of his adversary. His bridle arm was on the tilt-side, and thus the blunted lance struck at an angle upon the polished plates. Mishaps might befall. Henry II. of France died from the stroke of Gabriel de Montgomeri, who failed to cast up in time the truncheon of his splintered lance. But the 16th-century tournament was, in the main, a bloodless meeting.

The 15th century had seen the mingling of the tournament and the pageant. Adventurous knights would travel far afield in time of peace to gain worship in conflicts that perilled life and limb, as when the Bastard of Burgundy met the Lord Scales in 1466 in West Smithfield under the fair and costly galleries crowded with English dames. On the first day the two ran courses with sharp spears; on the second day they tourneyed on horseback, sword in hand; on the third day they met on foot with heavy pole-axes. But the great tournament held in the market-place of Bruges, when the jousting of the Knights of the Fleece was part of the pageant of the Golden Tree, the Giant and the Dwarf, may stand as a magnificent example of many such gay gatherings. When Henry VIII. was scattering his father's treasure the pageant had become an elaborate masque. For two days after the crowning of the king at Westminster, Henry and his queen viewed from the galleries of a fantastic palace set up beside the tilt-yard a play in which deer were pulled down by greyhounds in a paled park, in which the Lady Diana and the Lady Pallas came forward, embowered in moving castles, to present the champions. Such costly shows fell out of fashion after the death of Henry VIII.; and in England the tournament remained, until the end, a martial sport. Sir Henry Lee rode as Queen Elizabeth's champion in the tilt-yard of Whitehall until his years forced him to surrender the gallant office to that earl of Cumberland who wore the Queen's glove pinned to the flap of his hat. But in France the tournament lingered on until it degenerated to the carrousel, which, originally a horseman's game in which cavaliers pelted each other with balls, became an unmartial display when the French king and his courtiers pranced in such array as the wardrobe-master of the court ballets would devise for the lords of Ind and Africk.

The tournament was, from the first, held to be a sport for men of noble birth, and on the Continent, where nobility was more exactly defined than in England, the lists were jealously closed to all combatants but those of the privileged class. In the German lands, questions as to the purity of the strain of a candidate for admission to a noble chapter are often settled by appeal to the fact that this or that ancestor had taken part in a tournament. Konrad Grünenberg's famous heraldic manuscript shows us the *Helmschau* that came before the German tournament of the 15th century—the squires carrying each his master's crested helm, and a little scutcheon of arms hanging from it, to the hall where the king of arms stands among the ladies and, wand in hand, judges each blazon. In England several of those few rolls of arms which have come down to us from the middle ages record the shields displayed at certain tournaments. Among the illustrations of the article HERALDRY will be seen a leaf of a roll of arms of French and English jousters at the Field of the Cloth of Gold, and this leaf is remarkable as illustrating also the system of "checques" for noting the points scored by the champions. (O. Ba.)

TOURNEFORT, JOSEPH PITTON DE (1656–1708), French botanist, was born at Aix, in Provence, on the 5th of June 1656. He studied in the convent of the Jesuits at Aix, and was destined for the Church, but the death of his father left him free to follow his botanical inclinations. After two years' collecting, he studied medicine at Montpellier, but was appointed professor of botany at the Jardin des Plantes in 1683. By the king's order he travelled through western Europe, where he made extensive collections, and subsequently spent three years in Greece and Asia Minor (1700–1702). Of this journey a description in a series of letters was posthumously published in 3 vols. (*Relation d'un voyage du Levant*, Lyons, 1717). His principal work is entitled *Institutiones rei herbariae* (3 vols. Paris, 1700), and upon this rests chiefly his claims to remembrance as one of the most eminent of the systematic botanists who prepared the way for Linnaeus. He died on the 28th of December 1708.

TOURNEUR, CYRIL (*c.* 1575–1626), English dramatist, was perhaps the son of Captain Richard Turner, water-bailiff and subsequently lieutenant-governor of Brill in the Netherlands. Cyril Tourneur also served in the Low Countries, for in 1613 there is a record made of payment to him for carrying letters to Brussels. He enjoyed a pension from the government of the United Provinces, possibly by way of compensation for a post held before Brill was handed over to the Dutch in 1616. In 1625 he was appointed by Sir Edward Cecil, whose father had been a former governor of Brill, to be secretary to the council of war. This appointment was cancelled by Buckingham, but Tourneur sailed in Cecil's company to Cadiz. On the return voyage from the disastrous expedition he was put ashore at Kinsale with other sick men, and died in Ireland on the 28th of February 1626. (M. Br.)

An allegorical poem, worthless as art and incomprehensible as allegory, is his earliest extant work; an elegy on the death of Prince Henry, son of James I., is the latest. The two plays on which his fame rests, and on which it will rest for ever, were published respectively in 1607 and 1611, but all students have agreed to accept the internal evidence which assures us that the later in date of publication must be the earlier in date of composition. His only other known work is an epicede on Sir Francis Vere, of no great merit as poetry, but of some value as conveying in a straightforward and masculine style the poet's ideal conception of a perfect knight or "happy warrior," comparable by those who may think fit to compare it with the more nobly realized ideals of Chaucer and of Wordsworth. But if Tourneur had left on record no more memorable evidence of his powers than might be supplied by the survival of his elegies, he could certainly have claimed no higher place among English writers than is now occupied by the Rev. Charles Fitzgeoffrey, whose voluminous and fervent elegy on Sir Francis Drake is indeed of more actual value, historic or poetic, than either or than both of Tourneur's elegiac rhapsodies. The singular power, the singular originality and the singular limitation of his genius are all equally obvious in *The Atheist's Tragedy*, a dramatic poem no less crude and puerile and violent in action and evolution than simple and noble and natural in expression and in style. The executive faculty of the author is in the metrical parts of his first play so imperfect as to suggest either incompetence or perversity in the workman; in *The Revenger's Tragedy* it is so magnificent, so simple, impeccable and sublime that the finest passages of this play can be compared only with the noblest examples of tragic dialogue or monologue now extant in English or in Greek. There is no trace of imitation or derivation from an alien source in the genius of this poet. The first editor of Webster has observed how often he imitates Shakespeare; and, in fact, essentially and radically independent as is Webster's genius also, the sovereign influence of his master may be traced not only in the general tone of his style, the general scheme of his composition, but now and then in a direct and never an unworthy or imperfect echo of Shakespeare's very phrase and accent. But the resemblance between the tragic verse of Tourneur and the tragic verse of Shakespeare is simply such as proves the natural affinity between two great dramatic poets, whose inspiration partakes now and then of the quality more proper to epic or to lyric poetry. The fiery impulse, the rolling music, the vivid illustration of thought by jets of insuppressible passion, the perpetual sustenance of passion by the implacable persistency of thought, which we recognise as the dominant and distinctive qualities of such poetry as finds vent in the utterances of Hamlet or of Timon, we recognise also in the scarcely less magnificent poetry, the scarcely less fiery sarcasm, with which Tourneur has informed the part of Vindice—a harder-headed Hamlet, a saner and more practically savage and serious Timon. He was a satirist as passionate as Juvenal or Swift, but with a finer faith in goodness, a purer hope in its ultimate security of triumph. This fervent constancy of spirit relieves the lurid gloom and widens the limited range of a tragic imagination which otherwise might be felt as oppressive rather than inspiriting. His grim and trenchant humour is as peculiar in its sardonic passion as his eloquence is original in the strenuous music of its cadences, in the roll of its rhythmic thunder. As a playwright, his method was almost crude and rude in the headlong straightforwardness of its energetic simplicity; as an artist in character, his interest was intense but narrow, his power magnificent but confined; as a dramatic poet, the force of his genius is great enough to ensure him an enduring place among the foremost of the followers of Shakespeare. (A. C. S.)

Bibliography.—The complete list of his extant works runs: *The Atheists Tragedie; or, The Honest Man's Revenge* (1611); *A Funerall Poeme Upon the Death of the Most Worthie and True Soldier, Sir Francis Vere, Knight* . . . (1609); "A Griefe on the Death of Prince Henrie, Expressed in a Broken Elegie . . .," printed with two other poems by John Webster and Thomas Haywood as *Three Elegies on the most lamented Death of Prince Henry* (1613); *The Revengers Tragaedie* (1607 and 1608); and an obscure satire, *The Transformed Metamorphosis* (1600). The only other play of Tourneur's of which we have any record is *The Nobleman*, the MS. of which was destroyed by John Warburton's cook. This was entered on the Stationers' Register (Feb. 15, 1612) as a "Tragecomedye called The Nobleman written by Cyrill Tourneur." In 1613 a letter from Robert Daborne to Henslowe states that he has commissioned Cyril Tourneur to write one act of the promised *Arraignment of*

London. "The Character of Robert, earl of Salisburye, Lord High Treasurer of England . . . written by Mr Sevill Turneur . . ." in a MS in possession of Lord Mostyn (Hist. MSS. Commission, 4th Report, appendix, p. 361) may reasonably be assigned to Tourneur. Although no external evidence is forthcoming, Mr R. Boyle names Tourneur as the collaborator of Massinger in *The Second Maid's Tragedy* (licensed 1611).

The Revenger's Tragedy was printed in Dodsley's *Old Plays* (vol. iv., 1744, 1780 and 1825), and in *Ancient British Drama* (1810, vol. ii.). The best edition of Tourneur's works is *The Plays and Poems of Cyril Tourneur, edited with Critical Introduction and Notes*, by J. Churton Collins (1878). See also the two plays printed with the masterpieces of Webster, with an introduction by J. A. Symonds, in the "Mermaid Series" (1888 and 1903). No particulars of Tourneur's life were available until the facts given above were abstracted by Mr Gordon Goodwin from the *Calendar of State Papers* ("Domestic Series," 1628–1629, 1629–1631, 1631–1633) and printed in the *Academy* (May 9, 1891). A critical study of the relation of *The Atheist's Tragedy* to *Hamlet* and other revenge-plays is given in Professor A. H. Thorndike's "Hamlet and Contemporary Revenge Plays" (*Publ. of the Mod. Lang. Assoc.*, Baltimore, 1902). For the influence of Marston on Tourneur see E. E. Stoll, *John Webster* . . . (1905, Boston, Massachusetts); pp. 105–116. (M. Br.)

TOURNEUX, JEAN MAURICE (1849–), French man of letters and bibliographer, son of the artist and author J. F. E. Tourneux, was born in Paris on the 12th of July 1849. He began his career as a bibliographer by collaborating in new editions of the *Supercheries littéraires* of Joseph Quérard and the *Dictionnaire des anonymes* of Antoine Barbier. His most important bibliographical work was the *Bibliographie de l'histoire de Paris pendant la révolution française* (3 vols. 1890–1901), which was crowned by the Academy of Inscriptions. This valuable work serves as a guide for the history of the city beyond the limits of the Revolution.

His other works include bibliographies of Prosper Mérimée (1876), of Théophile Gautier (1876), of the brothers de Goncourt (1897) and others; also editions of F. M. Grimm's *Correspondance littéraire*, of Diderot's *Neveu de Rameau* (1884), of Montesquieu's *Lettres persanes* (1886), &c.

TOURNON, a town of south-western France, capital of an arrondissement in the department of Ardèche, on the right bank of the Rhone, 58 m. S. of Lyons by rail. Pop. (1906), town, 3642; commune, 5003. Tournon preserves a gateway of the 15th century and other remains of fortifications and an old castle used as town hall, court-house and prison and containing a Gothic chapel. The church of St Julian dates chiefly from the 14th century. The lycée occupies an old college founded in the 16th century by Cardinal François de Tournon. Of the two suspension bridges which unite the town with Tain on the left bank of the river, one was built in 1825 and is the oldest in France. A statue to General Rampon (d. 1843) stands in the Place Carnot. Wood-sawing, silk-spinning, and the manufacture of chemical manures, silk goods and hosiery are carried on in the town, which has trade in the wine of the Rhone hills. Tournon had its own counts as early as the reign of Louis I. In the middle of the 17th century the title passed from them to the dukes of Ventadour.

TOURNUS, a town of east-central France, in the department of Saône-et-Loire, on the right bank of the Saône, 20 m. N. by E. of Mâcon on the Paris-Lyons railway. Pop. (1906), 3787. The church of St Philibert (early 11th century) once belonging to the Benedictine abbey of Tournus, suppressed in 1785, is in the Burgundian Romanesque style. The façade lacks one of the two flanking towers originally designed for it. The nave is roofed with barrel vaulting, supported on tall cylindrical columns. The choir beneath which is a crypt of the 11th century has a deambulatory and square chapels. In the Place de l'Hôtel de Ville stands a statue of J. B. Greuze, born in the town in 1725. There are vineyards in the surrounding district and the town and its port have considerable commerce in wine and in stone from the neighbouring quarries. Chair-making is an important industry.

TOURS, a town of central France, capital of the department of Indre-et-Loire, 145 m. S.W. of Paris by rail. Pop. (1906), town 61,507; commune, 67,601. Tours lies on the left bank of the Loire on a flat tongue of land between that river and the Cher a little above their junction. The right bank of the Loire is bordered by hills at the foot of which lie the suburbs of St Cyr and St Symphorien. The river is crossed by two suspension bridges, partly built on islands in the river, and by a stone bridge of the second half of the 18th century, the Pont de Tours. Many foreigners, especially English, live at or visit Tours, attracted by the town itself, its mild climate and situation in "the garden of France," and the historic châteaux in the vicinity. The Boulevard Béranger, with its continuation, the Boulevard Heurteloup, traverses Tours from west to east dividing it into two parts; the old town to the north, with its narrow streets and ancient houses, contains the principal buildings, the shops and the business houses, while the new town to the south, centring round a fine public garden, is almost entirely residential. The Rue Nationale, the widest and handsomest street in Tours, is a prolongation of the Pont de Tours and runs at right angles to the boulevards, continuing under the name of the Avenue de Grammont until it reaches the Cher.

St Gatien, the cathedral of Tours, though hardly among the greatest churches of France, is nevertheless of considerable interest. A cathedral of the first half of the 12th century was burnt in 1166 during the quarrel between Louis VII. of France and Henry II. of England. A new cathedral was begun about 1170 but not finished till 1547. The lower portions of the west towers belong to the 12th century, the choir to the 13th century; the transept and east bays of the nave to the 14th; the remaining bays, a cloister on the north, and the façade, profusely decorated in the Flamboyant style, to the 15th and 16th centuries, the upper part of the towers being in the Renaissance style of the 16th century. In the interior there is fine stained glass, that of the choir (13th century) being especially remarkable. The tomb of the children of Charles VIII., constructed in the first years of the 16th century and attributed to the brothers Juste is also of artistic interest.

An example of Romanesque architecture survives in the great square tower of the church of St Julien, the rest of which is in the early Gothic style of the 13th century, with the exception of two apses added in the 16th century. Two towers and a Renaissance cloister are the chief remains of the celebrated basilica of St Martin built mainly during the 12th and 13th centuries and demolished in 1802. It stood on the site of an earlier and very famous church built from 466 to 472 by bishop St Perpetuus and destroyed together with many other churches in a fire in 998. Two other churches worthy of mention are Notre-Dame la Riche, originally built in the 13th century, rebuilt in the 16th, and magnificently restored in the 19th century; and St Saturnin of the 15th century. The new basilica of St Martin and the church of St Étienne are modern. Of the old houses of Tours the hôtel Gouin and that wrongly known as the house of Tristan l'Hermite (both of the 15th century) are the best known. Tours has several learned societies and a valuable library, including among its MSS. a gospel of the 8th century on which the kings of France took oath as honorary canons of the church of St Martin. The museum contains a collection of pictures, and the museum of the Archaeological Society of Touraine has valuable antiquities; there is also a natural history museum.

The chief public monuments are the fountain of the Renaissance built by Jacques de Beaune (d. 1527), financial minister, the statues of Descartes, Rabelais and Balzac, the latter born at Tours, and a monument to the three doctors Bretonneau, Trousseau and Velpeau. Tours is the seat of an archbishop, a prefect, and a court of assizes, and headquarters of the IX. Army Corps and has tribunals of first instance and of commerce, a board of trade arbitration, a chamber of commerce and a branch of the Bank of France. Among its educational institutions are a preparatory school of medicine and pharmacy, lycées for both sexes, a training college for girls and schools of fine art and music. The industrial establishments of the town include silk factories and numerous important printing-works, steel works, iron foundries and factories for automobiles, machinery, oil, lime and cement, biscuits, portable buildings, stained glass, boots and shoes and porcelain. A considerable trade is carried on in the wine of the district and in brandy and in dried fruits, sausages and confectionery, for which the town is well known. Three-quarters of a mile to the south-west of Tours lie unimportant remains of Plessis-les-Tours, the chateau built by Louis XI., whither he retired before his death in 1483. On the right bank of the Loire 2 m. above the town are the ruins of the ancient and powerful abbey of Marmoutier. Five miles to the north-west is the large agricultural reformatory of Mettray founded in 1839.

Tours (see TOURAINE), under the Gauls the capital of the Turones or Turons, originally stood on the right bank of the Loire, a little above the present village of St Symphorien. At first called *Altionos*, the town was afterwards known as *Caesarodunum.* The Romans removed the town from the hill where it originally stood to the plain on the left bank of the river. Behind the present cathedral, remains of the amphitheatre (443 ft. in length by 394 in breadth) built towards the end of the 2nd century might formerly be seen. Tours became Christian about 250 through the preaching of Gatien, who founded the bishopric. The first cathedral was built a hundred years later by St Litorius. The bishopric became an archbishopric when Gratian made Tours the capital of Lugdunensis Tertia though the bishops did not adopt the title of archbishop till the 9th century. About the beginning of the 5th century the official name of Caesarodunum was changed for that of *Civitas Turonorum.* St Martin, the great apostle of the Gauls, was bishop of Tours in the 4th century, and he was buried in a suburb which soon became as important as the town itself from the number of pilgrims who flocked to his tomb. Towards the end of the 4th century, apprehensive of barbarian invasion, the inhabitants pulled down some of their earlier buildings in order to raise a fortified wall, the course of which can still be traced in places. Their advanced fort of Larcay still overlooks the valley of the Cher. Affiliated to the Armorican confederation in 435, the town did not fall to the Visigoths till 473, and the new masters were always hated. It became part of the Frankish dominions under Clovis, who, in consideration of the help afforded by St Martin, presented the church with rich gifts out of the spoils taken from Alaric, confirmed and extended its right of sanctuary, and accepted for himself and his successors the title of canon of St Martin. At the end of the 6th century the bishopric was held by St Gregory of Tours. Tours grew rapidly in prosperity under the Merovingians, but abuse of the right of sanctuary led to great disorder, and the church itself became a hotbed of crime. Charlemagne re-established discipline in the disorganized monastery and set over it the learned Alcuin, who established at Tours one of the oldest public schools of Christian philosophy and theology. The arts flourished at Tours in the middle ages and the town was the centre of the Poitevin Romanesque school of architecture. The abbey was made into a collegiate church in the 11th century, and was for a time affiliated to Cluny, but soon came under the direct rule of Rome, and for long had bishops of its own. The suburb in which the monastery was situated became as important as Tours itself under the name of Martinopolis. The Normans, attracted by its riches, pillaged it in 853 and 903. Strong walls were erected from 906 to 910, and the name was changed to that of Châteauneuf. Philip Augustus sanctioned the communal privileges which the inhabitants forced from the canons of St Martin and the innumerable offerings of princes, lords and pilgrims maintained the prosperity of the town all through the middle ages. A 13th-century writer speaks with enthusiasm of the wealth and luxury of the inhabitants of Châteauneuf, of the beauty and chastity of the women and of the rich shrine of the saint. In the 14th century Tours was united to Châteauneuf within a common wall, of which a round tower, the Tour de Guise, remains, and both towns were put under the same administration. The numerous and long-continued visits of Charles VII., Louis XI., who established the silk-industry, and Charles VIII. during the 15th century favoured the commerce and industry of the town, then peopled by 75,000 inhabitants. In the 15th and 16th centuries the presence of Jean Fouquet the painter of Michel Colomb and the brothers Juste the sculptors, enhanced the fame of the town in the sphere of art. In 1562 Tours suffered from the violence of both Protestants and Catholics, and enjoyed no real security till after the pact entered into at Plessis-lès-Tours between Henry III. and Henry of Navarre in 1589. In the 17th and 18th centuries Tours was the capital of the government of Touraine. Its manufactures, of which silk weaving was the chief, suffered from the revocation of the Edict of Nantes (1685). In 1772 its mint, whence were issued the "livres" of Tours (*librae Turonenses*) was suppressed. During the Revolution the town formed a base of operations of the Republicans against the Vendeans. In 1870 it was for a time the seat of the delegation of the government of national defence. In 1871 it was occupied by the Germans from the 10th of January to the 8th of March.

See P. Vitry, *Tours et les châteaux de Touraine* (Paris, 1905); E. Giraudet, *Histoire de la ville de Tours* (Tours, 1873); *Les Artistes tourangeaux* (Tours, 1885).

TOURVILLE, ANNE-HILARION DE COTENTIN (or Costantin), Comte de (1642–1701), French admiral and marshal of France, was the son of César de Cotentin, or Costantin, who held offices in the household of the king and of the prince of Condé. He is said to have been born at Tourville in Normandy, but was baptized in Paris on the 24th of November 1642, was commonly known as M. de Tourville, and was destined by his family to enter the Order of Malta. From the age of fourteen to the age of twenty-five, he served with the galleys of the Order. At that time the knights were still fighting the Barbary pirates of Algiers and Tunis. The young Anne-Hilarion is said to have been distinguished for courage. His life during these years, however, is little known. The supposed *Memoirs* bearing his name were published by the Abbé de Magron in the 18th century and belong to the large class of historical romances which professed to be biographies or autobiographies. In 1667 he was back in France, and was incorporated in the corps of officers of the French Royal navy which Louis XIV. was then raising from the prostration into which it had fallen during his minority. The positions of French naval officer and knight of Malta were not incompatible. Many men held both. The usual practice was that they did not take the full vows till they were in middle life, and had reached the age when they were entitled to hold one of the great offices. Until then they were free to marry, on condition of renouncing all claim to the chief places. As Anne-Hilarion de Cotentin married a wealthy widow, the marquise de Popelinière, in 1689 at which time he was made count of Tourville, he severed his connexion with the Order. Nor does he appear to have served with it at all after his return to France in 1667. He was at first employed in cruising against the Barbary pirates and the Turks. In the expedition sent against Crete in 1668–69 under command of the Duc de Beaufort he had command of the "Croissant" (44). The Duc de Beaufort was killed, and the expedition was a failure. When the war with Holland in which France and England acted as allies began in 1670, Tourville commanded the "Page" (50), in the squadron of the comte d'Estrées (1624–1707) sent to co-operate with the duke of York. He was present at the battle of Solebay (June 7, 1672), and in the action on the coast of Holland in the following year, when Prince Rupert commanded the English fleet. When England withdrew from the alliance, the scene of the naval war was transferred to the Mediterranean, where Holland was co-operating with the Spaniards. Tourvillle served under Abraham Duquesne in his battles with De Ruyter. He particularly distinguished himself at the battle of Palermo on the 2nd of June 1676. By this time he was known as one of the best officers in the service of King Louis XIV. Unlike many employed by the king to command his ships in the earlier part of his reign, Tourville was a seaman. He had the reputation of being able to do all the work required in a ship, and he had made a study of naval warfare. The great treatise on naval tactics afterwards published under the name of his secretary, the Jesuit Hoste or l'Hoste, was understood to have been inspired by him. In 1683 he was chef d'escadre—rear admiral—with Duquesne in operations against the Barbary pirates, and he continued on that service with D'Estrées. By 1689 he had been promoted lieutenant-général des armées navales, and was named vice-admiral du Levant or of the East. In June of that year he took up the commandership-in-chief of the French naval forces in the war against England and her continental allies which had begun in the previous year. From this time till the failure of his resources compelled King Louis XIV. to withdraw his fleets from the sea, Tourville continued to command the naval war in the Channel and the Atlantic. His conduct and example during this period were the source of the system of manœuvring to gain an advantage by some method other than plain fighting. The personal character of Tourville must be held to account largely for the timidity of the principles he established. Tourville's personal valour was of the finest quality, but like many other brave men, he was nervous under the weight of responsibility. It is no less clear that anxiety to avoid risking a disaster to his reputation was of more weight with him than the wish to win a signal success. He belonged to the type of men in whose minds the evil which may happen is always more visible than the good. In 1690 he had an opportunity which might well have tempted the most cautious, and he missed it out of sheer care to keep his fleet safe against all conceivable chances, aided perhaps by a pedantic taste for formal, orderly movement. He was opposed in the channel by the allies, who had only fifty-six ships, while his own force, though it included some vessels of no serious value, was from seventy to eighty sail strong. He was feebly attacked by Admiral Arthur Herbert, the newly created earl of Torrington, off Beachy Head on the 10th of July. The Dutch ships in the van were surrounded. The allies had to retreat in disorder, and Tourville followed in "line of battle" which limited his speed to that of his slowest ship. So his enemy escaped with comparatively little loss. In the following year he performed his famous "off shore cruise," in the Bay of Biscay. He moved to and fro in fine order avoiding being brought to battle, but also failing to inflict any harm on his opponent. In the meantime the cause of King James II. was ruined in Ireland. In 1692 the Mediterranean fleet having failed to join him, he was faced by a vastly superior force of the allies. The French king had prepared a military force to invade England, and Tourville was expected to prepare the way. Having at least a clear indication that he was expected to act with vigour, if not precise orders to fight against any odds, he made a resolute attack on the centre of the allies on the 29th of May off Cape Barfleur, and drew off before he was surrounded. This action which with the pursuit of the following days made up what is called the battle of La Hogue, from the Bay where some of the fugitive French ships were destroyed, or Barfleur, proved his readiness to face danger. But his inability to take and act on a painful decision was no less proved in the retreat. He hesitated to sacrifice his crippled flagship, and thereby detained his whole fleet. The result was that the "Soleil Royale" herself and fifteen other ships were cut off and destroyed at La Hogue. In 1693 he was again at sea with a great fleet, and had a chance to inflict extreme injury on the allies by the capture of the Smyrna convoy which included their whole Mediterranean trade for the year. He did it a great deal of harm outside the Straits of Gibraltar, but again he kept his fleet in battle order, and a large part of the convoy escaped. King Louis XIV. who had a strong personal regard for him, continued to treat him with favour. Tourville was made Marshal of France in 1693, but the growing exhaustion of the French treasury no longer allowed the maintenance of great fleets at sea. Tourville remained generally at Toulon, and had no more fighting. He died in Paris in 1701. His only son, a colonel in the army, was killed at Denain in 1712.

The English account of the battles of Beachy Head and La Hogue will be found in Ledyard's Naval History. Troude's *Batailles navales de la France* gives the French version of these and the other actions in which Tourville was concerned. Tourville is frequently mentioned in the *Life of Duquesne* by M. Jal. (D. H.)

TOUSSAINT L'OUVERTURE (or Louverture), **PIERRE-DOMINIQUE** (*c.* 1746–1803), one of the liberators of Haiti, claimed to be descended from an African chief, his father, a slave in Haiti, being the chief's second son. He was at first surnamed Breda, but this was afterwards changed to L'Ouverture in token of the results of his valour in causing a gap in the ranks of the enemy. From childhood he manifested unusual abilities and succeeded, by making the utmost use of every opportunity, in obtaining a remarkably good education. He obtained the special confidence of his master, and was made superintendent of the other negroes on the plantation. After the insurrection of 1791 he joined the insurgents, and, having acquired some knowledge of surgery and medicine, acted as physician to the forces. His rapid rise in influence aroused, however, the jealousy of Jean François, who caused his arrest on the ground of his partiality to the whites. He was liberated by the rival insurgent chief Baisson, and a partisan war ensued, but after the death of Baisson he placed himself under the orders of Jean François. Subsequently he joined the Spaniards, but, when the French government ratified the act declaring the freedom of the slaves, he came to the aid of the French. In 1796 he was named commander-in-chief of the armies of St Domingo, but, having raised and disciplined a powerful army of blacks, he made himself master of the whole country, renounced the authority of France, and announced himself "the Buonaparte of St Domingo." He was taken prisoner by treachery on the part of France, and died in the prison of Joux, near Besançon, on the 27th of April 1803.

See Toussaint l'Ouverture's own *Mémoires*, with a life by Saint Remy; (Paris, 1850); Gragnon-Laconte, *Toussaint Louverture* (Paris, 1887); Schölcher, *Vie de Toussaint Louverture* (Paris, 1889); and J. R. Beard, *Life of Toussaint Louverture* (1853).

TOW, the term given in textile manufacture to the short fibres formed during the processes of scutching and hackling, and also to the yarns which are made from these fibres. A special machine termed a carding engine or a tow card is used to form these fibres into a sliver, this sliver then passes to the drawing frames, and thereafter follows the same process as line yarns in flax spinning.

TOWANDA, a borough and the county-seat of Bradford county, Pennsylvania, U.S.A., on the west bank of the Susquehanna river, about 50 m. N.W. of Wilkes-Barré. Pop. (1890), 4169; (1900), 4663 (322 foreign-born); (1910) 4281. Towanda is served by the Lehigh Valley and the Susquehanna & New York railways. It is situated about 730 ft. above the sea, and is surrounded by high hills. Towanda contains the museum of the Bradford County Historical Society. The borough is in a farming, dairying and stock-raising region, and has various manufactures. The first settlement was made by William Means in 1786, the village was laid out in 1812, became the county-seat in the same year, was variously known for some years as Meansville, Overton, Williamson, Monmouth and Towanda, and in 1828 was incorporated as the borough of Towanda. Its name is an Indian word said to mean "where we bury the dead."

TOWCESTER, a market town in the southern parliamentary division of Northamptonshire, England, 8 m. S.S.W. of Northampton, on the East & West Junction and the Northampton & Banbury Junction railways. Pop. (1901), 2371. It is pleasantly situated on the small river Tove, a left-bank affluent of the Ouse. The church of St Lawrence is a good Early English, Decorated and Perpendicular building, with a fine western Perpendicular tower. There are a considerable agricultural trade and a manufacture of boots and shoes.

Here was a Roman town or village situated on Watling Street. The site has yielded a considerable number of relics. In the 10th century a fortress was maintained here against the invading Danes. The site of both this and the Roman station is marked by an artificial mound known as Burg Hill, not far from the church, above the river. Towcester, with the whole of this district, witnessed a large part of the operations during the Civil War of the 17th century.

TOWEL, a cloth used for the purpose of drying the hands, face or body after bathing or washing. These cloths are made of different materials, known as "towellings," the two principal kinds are "huckaback," a slightly roughened material for chamber towels for face and hands, and Turkish towelling, with a much rougher surface, for bath towels; finer towellings are made of linen or damask. The term has a particular ecclesiastical usage as applied to a linen altar cloth or to a rich cloth of embroidered silk, velvet, &c., covering the altar at all "such periods when Mass is not being celebrated."

The Mid. Eng. *towaille* comes through the O. Fr. *touaille* from the Low Lat. *toacula*, represented in other Romanic languages by Sp. *toalla*, Ital. *tovaglia*; this is to be referred to the Teutonic verb meaning "to wash," O. H. G. *twahan*, M. H. G. *dwahen*, O. Eng. *þweán*, and cf. Ger. *Zwehle*, provincial Eng. *dwile*, a dish-cloth.

TOWER (Lat. *turris*; Fr. *tour*, *clocher*; Ital. *torre*; Ger. *Thurm*), the term given to a lofty building originally designed for defence, and, as such, attached to and forming part of the fortifications of a city or castle. Towers do not seem to have existed in Egypt, but in Mesopotamia from the earliest times they form the most important feature in the city walls, and are shown in the bas-reliefs of the Assyrian palaces at Nimroud and elsewhere. The earliest representation is perhaps that engraved on the tablet in the lap of Gudea the priest king of Lagash (2700 B.C.), whose statue, found at Tello, is now in the Louvre; the drawing is that of a large fortified enclosure, with gates, bastions and towers, corresponding with remains of similar structures of the same and later periods. In the discoveries made here, at Susa and at Dom Sargoukin, the towers were about 40 ft. square, projecting from 16 to 20 ft. in front of the curtain walls which connected them, and standing about 80 ft. apart. In Roman and Byzantine times this distance was increased, owing probably to the greater speed of projectiles, and in the wall built by Theodosius at Constantinople the towers were 150 ft. apart (see also CASTLE and FORTIFICATION).

From the architectural point of view, the towers which are of chief interest are those of ecclesiastical and secular buildings, those in Italy being nearly always isolated and known as campanili (see CAMPANILE). In England the earliest known are the Anglo-Saxon towers, the best examples of which are those at Earl's Barton, Monkwearmouth, Barnack, Barton-on-Humber and Sompting; they were nearly always square on plan and situated at the west end, in an axial line with the nave, their chief characteristics being the long-and-short work of the masonry at the quoins, the decoration of the wall with thin pilaster strips, and the slight setting back of the storeys as they rose. There are a few examples of central Anglo-Saxon towers, as at St Mary's, Dover; Breamore, Hants; and Dunham Major, Norfolk; and, combined with western towers, at Ramsay and Ely; twin western towers existed at Exeter. Contemporary with these Saxon towers are many examples in France, but they are invariably central towers, as at Germigny-des-Près and at Querqueville in Normandy; in Germany the twin towers of Aix-la-Chapelle are the best known. As a rule the single western tower is almost confined to England, prior to the end of the 11th century, when there are many examples throughout Germany. In Norman times in England, central towers are more common, and the same obtains in France, where, however, they are sometimes carried to a great height, as at Périgueux, where the wall decoration consists of pilasters in the lower storeys, and semi-detached columns above, probably based on that of the Roman amphitheatre there: otherwise the design of the Romanesque church towers is extremely simple, depending for its effect on the good masonry and the enrichment of the belfry windows. In later periods flat buttresses are introduced, and these gradually assume more importance and present many varieties of design; greater apparent height is given to the tower by the string courses dividing the second storeys, and by rich blank arcading on them, the upper storey with the belfry windows forming always the most important feature of the tower. In those towers which are surmounted by spires (*q.v.*) the design of the latter possesses sometimes a greater interest both in England and France. A very large number of the towers of English cathedrals and churches have flat roofs enclosed with lofty battlemented parapets and numerous pinnacles and finials; in France such terminations are not found, and in Germany the high pitched roof is prevalent every where, so that the numerous examples in England have a special interest; sometimes the angle buttresses are grouped to carry octagonal pinnacles, and sometimes, as at Lincoln and Salisbury, octagonal turrets rise from the base of the tower.

Among the finest examples are those of Canterbury, Ely, York, Gloucester, Lincoln and Worcester cathedrals; among churches, those of the minster at Beverley; St Mary's, St Neots (Huntingdonshire); St Stephen's, Bristol, St Giles, Wrexham (Denbighshire—in many respects the most beautiful in England); St Mary Magdalene, Taunton; Magdalen College, Oxford, St Botolph, Boston, crowned with an octagonal tower; St Mary's, Ilminster (Somersetshire) and Malvern (Worcestershire); and the isolated towers at Chichester, Evesham and Bury St Edmund's.

So far reference has been made only to central and western towers, the latter not always placed, like the Anglo-Saxon towers, in the axial line of the nave, but sometimes on the north or south side of the west end; and as a rule these are only found in England. In France and Germany, however, they are greatly increased in number; thus in Reims seven towers with spires were contemplated, according to Viollet-le-Duc, but never completed; at Chartres eight towers, and at Laon seven, of which six are completed; in Germany the cathedrals of Mayence and Spires and two of the churches in Cologne have from four to seven towers; and at Tournai cathedral, in Belgium, are seven towers. In many of the churches in Norfolk and Suffolk the western tower is circular, owing probably to the fact that, being built with stone of small dimensions, the angles of the quoins would have been difficult to construct. In some of the French towns, isolated towers were built to contain bells, and were looked upon as municipal constructions; of these there are a few left, as at Béthune, Évreux, Amiens and Bordeaux, the latter being a double tower, with the bells placed in a roof between them.

The towers of secular buildings are chiefly of the town halls, of which there are numerous examples throughout France and Belgium, such as those of the hôtel de ville at St Antonin (13th century) and Compiègne, both in France; at Lübeck, Danzig and Münster in Germany; and Brussels, Bruges and Oudenarde in Belgium.

(R. P. S.)

TOWER OF LONDON, THE, an ancient fortress on the east side of the City of London, England, on the north bank of the river Thames. On a slight elevation now called the Tower Hill, well protected by the river and its marshes, and by woods to the north, there was a British stronghold. Tradition, however, pointed to Julius Caesar as the founder of the Tower (Shakespeare, *Richard III.*, III., i; and elsewhere), and remains of Roman fortifications have been found beneath the present site. The Tower contains barracks, and is the repository of the regalia. It covers an irregular hexagonal area, and is surrounded by a ditch, formerly fed by the Thames, but now dry. Gardens surround it on the north and west, and an embankment borders the river on the south. Two lines of fortifications enclose the inner bail, in which is the magnificent White Tower or Keep, flanked by four turrets. This was built by Gundulf, bishop of Rochester, *c.* 1078. Its exterior was restored by Sir Christopher Wren, but within the Norman work is little altered. Here may be seen a collection of old armour and instruments of torture, the rooms said to have been Sir Walter Raleigh's prison, and the magnificent Norman chapel of St John. Among the surrounding buildings are the barracks, and the chapel of St Peter ad Vincula, dating from the early part of the 14th century, but much altered in Tudor times. The Ballium Wall, the inner of the two lines of fortification, is coeval with the keep. Twelve towers rise from it at intervals, in one of which, the Wakefield Tower, the Regalia or crown jewels are kept. The chief entry to the fortress is through the Middle Tower on the west, across the bridge over the moat, and through the Byward Tower. The Lion Gate under the Middle Tower took name from a menagerie kept here from Norman times until 1834. On the south, giving entry from the river through St Thomas Tower and the Bloody Tower, is the famous Traitor's Gate, by which prisoners of high rank were admitted. The chief historical interest of the Tower lies in its association with such prisoners. The Beauchamp Tower was for long the place of confinement, but dungeons and other chambers in various parts of the building are also associated with prisoners of fame. Executions took place both within the Tower and on Tower Hill. Many of those executed were buried in the chapel of St Peter ad Vincula, such as Sir Thomas More, Henry VIII.'s queens, Anne Boleyn and Katharine Howard, Lady Jane Grey and her husband Dudley, Sir Walter Raleigh, and the duke of Monmouth. The Tower was not only a prison from Norman times until the 19th century, but was a royal residence at intervals from the reign of Stephen, if not before. The royal palace was demolished by order of Cromwell. The tower is under the governorship of a constable. The attendant staff, called Yeomen of the Guard or familiarly "Beefeaters," still wear their picturesque Tudor costume.

AUTHORITIES.—W. Hepworth Dixon, *Her Majesty's Tower* (London, 1869); Lord Ronald Sutherland Gower, *The Tower of London* (London, 1901).

TOWN, in its most general sense, a collection or aggregation of inhabited houses larger than a village. The O. Eng. *tun* (M. Eng. *toun*) meant originally a fence or enclosure, cf. Ger. *zaun*, hedge, hence an enclosed place. The Scottish and Northern English use of the word for a farmhouse and its buildings, a farmstead, preserves this original meaning, and is paralleled by the Icel. *tun*, homestead, dwelling-house. A cognate Celtic form meaning a fastness, a strong place, appears in Gael. and Irish *dun*, Welsh, *din*, fortress, hill-fort (cf. Welsh *dinas*, town). This is familiar from the many Latinized names of places, *e.g. Lugdunum*, *Augustodunum*, &c. In English law "town" is not a word defined by statute. For purposes of local government there are boroughs, urban districts and rural districts, but many urban districts are rural in character and the distinction is purely an administrative one (see BOROUGH; CITY; COMMUNE (MEDIEVAL); MUNICIPIUM; ENGLAND: *Local Government*, and the sections on local administration under various country headings). The meaning attached to the term "township" in the local administration of the United States is treated under UNITED STATES: *Local Government*.

TOWNELEY (or TOWNLEY), **CHARLES** (1737–1805), English archaeologist and collector of marbles, was born at Towneley, the family seat, near Burnley in Lancashire, on the 1st of October 1737. He was educated at the college of Douai, and subsequently under John Turberville Needham, the physiologist and divine. In 1758 he took up his residence at Towneley, where he lived the ordinary life of a country gentleman until about 1765, when he left England to study ancient art, chiefly at Rome. He also made several excursions to the south of Italy and Sicily. In conjunction with Gavin Hamilton, the artist, and Thomas Jenkins, a banker in Rome, he got together a splendid collection of antiquities, which was deposited in two houses bought by him for the purpose in Park Street, Westminster, where he died on the 3rd of January 1805. His solitary publication was an account of an ancient helmet found at Ribchester. His marbles, bronzes, coins, and gems were purchased by the British Museum for about £28,000, and form part of the Graeco-Roman collection.

For an account of the antiquities see Sir Henry Ellis's *The Townley Gallery* (1836), and A. T. F. Michaelis's *Ancient Marbles in Great Britain* (1882).

TOWNLEY, JAMES (1714–1778), English dramatist, second son of Charles Townley, merchant, was born in London on the 6th of May 1714. Educated at Merchant Taylors' School and at St John's College, Oxford, he took holy orders, being ordained priest on the 28th of May 1738. He was lecturer at St Dunstan's in the East, chaplain to the lord mayor, then under-master at Merchant Taylors' School until 1753, when he became grammar master at Christ's Hospital. In 1760 he became head master of Merchant Taylors' School, where in 1762 and 1763 he revived the custom of dramatic performances. He retained his headmastership until his death on the 5th of July 1778. He took a keen interest in the theatre, and it has been asserted that many of David Garrick's best productions and revivals owed much to his assistance. He was the author, although the fact was long concealed, of *High Life below Stairs*, a two-act farce presented at Drury Lane on the 31st of October 1759; also of *False Concord* (Covent Garden, March 20, 1764) and *The Tutor* (Drury Lane, Feb. 4, 1765).

TOWNSHEND, CHARLES (1725–1767), English politician, was the second son of Charles, 3rd Viscount Townshend, who married Audrey (d. 1788), daughter and heiress of Edward Harrison of Ball's Park, near Hertford, a lady who rivalled her son in brilliancy of wit and frankness of expression. Charles was born on the 29th of August 1725, and was sent for his education to Leiden and Oxford. At the Dutch university, where he matriculated on the 27th of October 1745, he associated with a small knot of English youths, afterwards well known in various circles of life, among whom were Dowdeswell, his subsequent rival in politics, Wilkes, the witty and unprincipled reformer, and Alexander Carlyle, the genial Scotchman, who devotes some of the pages of his *Autobiography* to chronicling their sayings and their doings. He represented Great Yarmouth in parliament from 1747 to 1761, when he found a seat for the treasury borough of Harwich. Public attention was first drawn to his abilities in 1753, when he delivered a lively attack, as a younger son who might hope to promote his advancement by allying himself in marriage to a wealthy heiress, against Lord Hardwicke's marriage bill. Although this measure passed into law, he attained this object in August 1755 by marrying Caroline (d. 1794), the eldest daughter of the 2nd duke of Argyll and the widow of Francis, Lord Dalkeith, the eldest son of the 2nd duke of Buccleuch. In April 1754 Townshend was transformed from the position of a member of the board of trade, which he had held from 1749, to that of a lord of the admiralty, but at the close of 1755 his passionate attack against the policy of the ministry, an attack which shared in popular estimation with the scathing denunciations of Pitt, the supreme success of Single-Speech Hamilton, and the hopeless failure of Lord Chesterfield's illegitimate son, caused his resignation. In the administration which was formed in November 1756, and which was ruled by Pitt, the lucrative office of treasurer of the chamber was given to Townshend, and in the following spring he was summoned to the privy council.

With the accession of the new monarch in 1760 this volatile politician transferred his attentions from Pitt to the young king's favourite, Bute, and when in 1761, at the latter's instance, several changes were made in the ministry, Townshend was promoted to the post of secretary-at-war. In this place he remained after the great commoner had withdrawn from the cabinet, but in December 1762 he threw it up. Bute, alarmed at the growth in numbers and in influence of his enemies, tried to buy back Townshend's co-operation by sundry tempting promises, and at last secured his object in March 1763 with the presidency of the board of trade. When Bute retired and George Grenville accepted the cares of official life, the higher post of first lord of the admiralty fell to Townshend's lot, but with his usual impetuosity he presumed to designate one of his satellites, Sir William Burrell (1732–1796), to a place under him at the board, and the refusal to accept the nomination led to his exclusion from the new administration. While in opposition his mind was swayed to and fro with conflicting emotions of dislike to the head of the ministry and of desire to share in the spoils of office. The latter feeling ultimately triumphed; he condescended to accept in the dying days of Grenville's cabinet, and to retain through the "lutestring" administration of Lord Rockingham—"pretty summer wear," as Townshend styled it, "but it will never stand the winter"—the highly paid position of paymaster-general, refusing to identify himself more closely with its fortunes as chancellor of the exchequer. The position which he refused from the hands of Lord Rockingham he accepted from Pitt in August 1766, and a few weeks later his urgent appeals to the great minister for increased power were favourably answered, and he was admitted to the inner circle of the cabinet. The new chancellor proposed the continuance of the land tax at four shillings in the pound, while he held out hopes that it might be reduced next year to three shillings, whereupon his predecessor, William Dowdeswell, by the aid of the landed gentlemen, carried a motion that the reduction should take effect at once. This defeat proved a great mortification to Lord Chatham, and in his irritation against Townshend for this blow, as well as for some acts of insubordination, he meditated the removal of his showy colleague. Before this could be accomplished Chatham's mind became impaired, and Townshend, who was the most determined and influential of his colleagues, swayed the ministry as he liked, pledging himself to find a revenue in America with which to meet the deficiency caused by the reduction in the land tax. His wife was created (August 1767) baroness of Greenwich, and his elder brother George, the 4th viscount, was made lord-lieutenant of Ireland. He himself delivered in the House of Commons many speeches unrivalled in parliamentary history for wit and recklessness; and one of them still lives in history as the "champagne speech." His last official act was to carry out his intention by passing through parliament resolutions, which even his colleagues deprecated in the cabinet, for taxing several articles, such as glass, paper and tea, on their importation into America, which he estimated would produce the insignificant sum of £40,000 for the English treasury, and which shrewder observers prophesied would lead to the loss of the American colonies. Soon after this event he died somewhat suddenly on the 4th of September 1767.

The universal tribute of Townshend's colleagues allows him the possession of boundless wit and ready eloquence, set off by perfect melody of intonation, but marred by an unexampled lack of judgment and discretion. He shifted his ground in politics with every new moon, and the world fastened on him the nickname, which he himself adopted in his "champagne" speech, of the weathercock. His official knowledge was considerable; and it would be unjust to his memory to ignore the praises of his contemporaries or his knowledge of his country's commercial interests. The House of Commons recognized in him its spoilt child, and Burke happily said that "he never thought, did or said anything" without judging its effect on his fellow members.

A *Memoir* by Percy Fitzgerald was published in 1866. See also W. E. H. Lecky, *History of England* (1892); and Horace Walpole, *Memoirs of the Reign of George III.*, edited by G. F. R. Barker (1894).

TOWNSHEND, CHARLES TOWNSHEND, 2ND VISCOUNT (1674–1738), English statesman, was the eldest son of Sir Horatio Townshend, Bart. (*c.* 1630–1687), a zealous supporter of Charles II., who was created Baron Townshend in 1661 and Viscount Townshend of Raynham in 1682. The old Norfolk family of Townshend, to which he belonged, is descended from Sir Roger Townshend (d. 1493) of Raynham, who acted as legal adviser to the Paston family, and was made a justice of the common pleas in 1484. His descendant, another Sir Roger Townshend (*c.* 1543–1590), had a son Sir John Townshend (1564–1603), a soldier, whose son, Sir Roger Townshend (1588–1637), was created a baronet in 1617. He was the father of Sir Horatio Townshend.

Charles Townshend succeeded to the peerage in December 1687, and was educated at Eton and King's College, Cambridge. He had Tory sympathies when he took his seat in the House of Lords, but his views changed, and he began to take an active part in politics as a Whig. For a few years after the accession of Queen Anne he remained without office, but in November 1708 he was appointed captain of the yeomen of the guard, having in the previous year been summoned to the privy council. He was ambassador extraordinary and plenipotentiary to the states-general from 1709 to 1711, taking part during these years in the negotiations which preceded the conclusion of the treaty of Utrecht. After his recall to England he was busily occupied in attacking the proceedings of the new Tory ministry. Townshend quickly won the favour of George I., and in September 1714, the new king selected him as secretary of state for the northern department. The policy of Townshend and his colleagues, after they had crushed the Jacobite rising of 1715, both at home and abroad, was one of peace. The secretary disliked the interference of England in the war between Sweden and Denmark, and he promoted the conclusion of defensive alliances between England and the emperor and England and France. In spite of these successes the influence of the Whigs was gradually undermined by the intrigues of Charles Spencer, earl of Sunderland, and by the discontent of the Hanoverian favourites. In October 1716, Townshend's colleague, James Stanhope, afterwards 1st Earl Stanhope, accompanied the king on his visit to Hanover, and while there he was seduced from his allegiance to his fellow ministers by Sunderland, George being led to believe that Townshend and his brother-in-law, Sir Robert Walpole, were caballing with the prince of Wales, their intention being that the prince should supplant his father on the throne. Consequently in December 1716 the secretary was dismissed and was made lord-lieutenant of Ireland, but he only retained this post until the following April.

Early in 1720 a partial reconciliation took place between the parties of Stanhope and Townshend, and in June of this year the latter became president of the council, a post which he held until February 1721, when, after the death of Stanhope and the forced retirement of Sunderland, a result of the South Sea bubble, he was again appointed secretary of state for the northern department, with Walpole as first lord of the treasury and chancellor of the exchequer. The two remained in power during the remainder of the reign of George I., the chief domestic events of the time being the impeachment of Bishop Atterbury, the pardon and partial restoration of Lord Bolingbroke, and the troubles in Ireland caused by the patent permitting Wood to coin halfpence. Townshend secured the dismissal of his rival, John Carteret, afterwards Earl Granville, but soon differences arose between himself and Walpole, and he had some difficulty in steering a course through the troubled sea of European politics. Although disliking him, George II. retained him in office, but the predominance in the ministry passed gradually but surely from him to Walpole. Townshend could not brook this. So long, to use Walpole's witty remark, as the firm was Townshend and Walpole all went well with it, but when the positions were reversed jealousies arose between the partners. Serious differences of opinion concerning the policy to be adopted towards Prussia and in foreign politics generally led to a final rupture in 1730. Failing, owing to Walpole's interference, in his efforts to procure the dismissal of a colleague and his replacement by a personal friend, Townshend retired on the 15th of May 1730. His remaining years were passed at Raynham, where he interested himself in agriculture and was responsible for introducing into England the cultivation of turnips on a large scale and for other improvements of the kind. He died at Raynham on the 21st of June 1738.

Townshend was twice married—first to Elizabeth (d. 1711), daughter of Thomas Pelham, 1st Baron Pelham of Laughton, and secondly to Dorothy (d. 1726), sister of Sir Robert Walpole. He had eight sons. The eldest son, Charles, the 3rd viscount (1700–1764), was called to the House of Lords in 1723. The second son, Thomas Townshend (1701–1780), was member of parliament for the university of Cambridge from 1727 to 1774; his only son, Thomas Townshend (1733–1800), who was created Baron Sydney in 1783 and Viscount Sydney in 1789, was a secretary of state and leader of the House of Commons from July 1782 to April 1783, and from December 1783 to June 1789 again a secretary of state, Sydney in New South Wales being named after him; his grandson, John Robert Townshend (1805–1890), the 3rd viscount, was created Earl Sydney in 1874, the titles becoming extinct at his death. Charles Townshend's eldest son by his second wife was George Townshend (1715–1769), who after serving for many years in the navy, became an admiral in 1765. The third viscount had two sons, George, 1st Marquess Townshend, and Charles Townshend, who are separately noticed.

For the 2nd viscount see W. Coxe, *Memoirs of Sir Robert Walpole* (1816); W. E. H. Lecky, *History of England in the 18th Century* (1892); and Earl Stanhope, *History of England.*

TOWNSHEND, GEORGE TOWNSHEND, 1ST MARQUESS (1724–1807), eldest son of Charles, 3rd Viscount Townshend (1700–1764), and brother of the politician Charles Townshend (*q.v.*), was born on the 28th of February 1724, his godfather being George I. Joining Cope's dragoons as a captain, he saw some service in the Netherlands in 1745, and as a member of the duke of Cumberland's staff was present at Culloden. Afterwards he accompanied the duke to the Netherlands, and was present at Lauffeld. By 1750 he had become lieutenant-colonel in the 1st Foot Guards, but differences with the duke of Cumberland led to his retirement in that year. This difference soon became hostility, and, coupled with his dread of permanent armies, caused him to give vehement support to the Militia Bill. In this matter his views and his methods of expressing them raised up a host of enemies. The retirement of the duke after the disastrous campaign in North Germany in 1757 brought Townshend back to active service as a colonel, and in 1758 he sailed for North America as one of Wolfe's three brigadiers. In the long and painful operations against Quebec he showed himself a capable officer, but his almost open dissatisfaction with Wolfe's methods sensibly added to the difficulty of the enterprise. At the battle of the Heights of Abraham the command, on the death of Wolfe and the wounding of Monckton, devolved upon Townshend, whose over-caution for a time imperilled the success of the British arms. The loss of Montcalm, however, had similarly paralyzed the French, and the crisis passed. Townshend sent home a despatch, announcing the fall of Quebec, which at once became the butt of the wits and the object of criticism of a more serious kind; and when, Monckton having taken over the command in Canada, Townshend returned to England to enjoy, as he hoped, the hero-worship of the public, he was soon involved in bitter controversies. He succeeded to the title in 1764 on his father's death, and in 1767, through his brother's influence, was made lord-lieutenant of Ireland. The story of his viceroyalty may be read in the article on him in the *Dict. Nat. Biog.*, and in Lecky's *History of England in the 18th Century* (vol. iv.). With the best will in the world, and in spite of excellent capacity, he came into continual conflict with the Irish House of Commons in his attempt to form an English party in Ireland, and he excited unmeasured abuse. In 1772 he was recalled. In 1787 he was created Marquess Townshend of Rainham. He died on the 14th of September 1807.

Townshend was twice married—first to Charlotte, Baroness de Ferrars (d. 1770) and secondly to Anne Montgomery (d. 1819). His eldest son George (1755–1811), who became the second marquess, had succeeded to the barony of de Ferrars in 1770 and had been created earl of Leicester in 1784. Although he was in turn master of the mint, joint postmaster-general and lord steward of the royal household, he did not take much part in politics, but showed a great taste for antiquarian studies. His elder son, George Ferrars Townshend, the 3rd marquess (1778–1855), was disinherited by his father for conduct which also compelled him to reside outside England. When he died at Genoa in December 1855 the earldom of Leicester became extinct. The marquessate, however, passed to a cousin, John Townshend (1798–1863), who became the 4th marquess. John James Dudley Stuart Townshend (b. 1866), who became the 6th marquess in 1899, came prominently before the public in 1906 in consequence of a judicial inquiry into his sanity, the decision being that he was not capable of managing his own affairs.

TOWNSVILLE, a town of Elphinstone county, Queensland, Australia, 870 m. direct N.W. of Brisbane. Pop. (1901), 12,717. It is the seat of the Anglican bishop of North Queensland and has a cathedral and several handsome buildings, including the supreme court and the custom-house. It is picturesquely situated partly on the slopes of Castle Hill and Melton Hill, and partly on the banks of Ross Creek, which is spanned by the Victoria Bridge, a swing bridge 550 ft. in length, worked by hydraulic power. The tidal harbour is enclosed by stone breakwaters, and large vessels enter and load frozen meat direct from the refrigerator cars. The port is an outlet for a wide area of pastoral country and for several goldfields, and has regular communication with all ports north and south by lines of steamers. The immigration barracks on Ross Island have accommodation for five hundred persons. The railway station is the terminus of the Northern line, which extends 236 m. to Hughenden. Townsville was founded in 1864 by John Medwin Black and named after his partner Captain Towns. A municipal charter was granted in 1866.

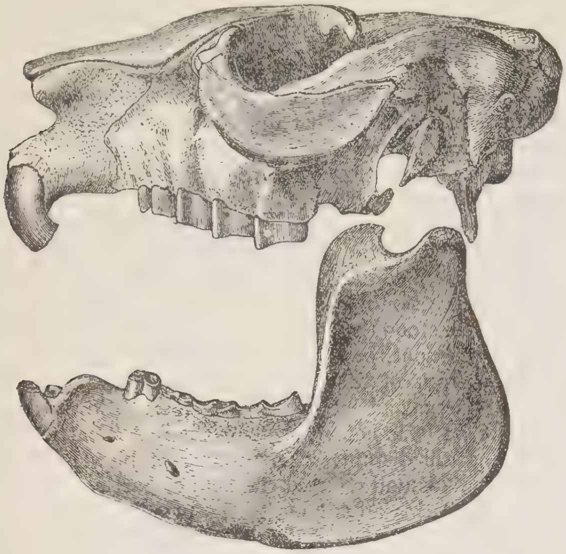
TOWTON, a village of Yorkshire, England, 2½ m. S. of Tadcaster, the scene of a battle fought on Palm Sunday, the 29th of March 1461, between the armies of York and Lancaster. The party of Lancaster had lately won the battle of St Albans, but, unable to gain admission into London, and threatened by the approach of Edward the young duke of York from the west of England, was compelled to fall back northward. York, having been proclaimed as Edward IV. on the 2nd, 3rd and 4th of March 1460/1461, followed them up into Yorkshire, and on the 27th his leading troops surprised the passage of the Aire at Ferrybridge. The Lancastrians were encamped at Towton, some miles away, covering Tadcaster and York; but a force under Lord Clifford was promptly sent out, recaptured Ferrybridge by surprise, and cut to pieces the Yorkist garrison. About the same time, however, Edward's van, under Lord Fauconberg, an experienced soldier, crossed the Aire higher up, and Clifford was compelled to retire. He was closely pressed, and at Dintingdale, within a few furlongs of his own camps, was cut off and killed with nearly all his men. Edward's main body was now close at hand, and the Lancastrians drew up on their chosen battlefield early on the 29th. This field was an elevated plateau, with steep slopes, between the present Great North Road and the river Cock, cut in two by a depression called Towton Dale. On opposite sides of this depression stood the two armies, that of York facing north, their opponents southward. Both lines of battle were very dense. On a front of little more than a thousand yards the Lancastrian party had nearly 60,000 men. Edward's force (less than 50,000) was not all present, the rear "battle" under Norfolk being still distant. Snow and sleet blew in the faces of the Lancastrians and covered the field of battle. The skilful Fauconberg used this advantage to the utmost. Aided by the wind, his archers discharged flights of arrows against the enemy, who replied blindly and feebly, hampered by snow and wind. The Yorkists withdrew until the enemy had exhausted their quivers, and then advanced afresh. Their arrows soon stung the Lancastrians into a wild and disorderly charge. Suffering severe losses the latter closed with Edward's line of battle. No quarter was given by either party, and on the narrow front the numerical superiority of the Lancastrians counted for little. The long, doubtful and sanguinary struggle was only decided by the arrival of Norfolk's corps, which charged the enemy in flank. Driven backwards and inwards, the Lancastrians were in a desperate position, for their only way of escape to Tadcaster crossed the swollen waters of the Cock by a single narrow and difficult ford, and when, after a stubborn struggle, they finally broke and fled, they were slaughtered in thousands as they tried to cross. At the close of the day the defeated army had ceased to exist. Twenty-five thousand Lancastrian and eight thousand Yorkist dead were buried in and about Towton. The neighbourhood of the battlefield contains many relics and memorials of this, the greatest battle hitherto fought on English soil. Particularly well preserved is the tomb of Lord Dacre, a prominent Lancastrian, in Saxton churchyard.

See R. Brooke, *Visits to English Battlefields* (London, 1857); C. R. B. Barrett, *Battles and Battlefields of England* (London, 1896); H. B. George, *Battles of English History* (London, 1895).

TOXICOLOGY, the name of that branch of science which deals with poisons, their effects and antidotes, &c. For the general treatment of the subject and for the law relating to the sale thereof see POISONS, and for the criminal law see MEDICAL JURISPRUDENCE. The term "toxic," meaning poisonous, is derived from Gr. τόξον, bow, owing to the custom of smearing arrows with poison.

TOXODONTIA, a sub-order of extinct South American Tertiary ungulate mammals typified by the genus *Toxodon*, so named from the bow-like curvature of the molar teeth. They all show signs of distant kinship to the Perissodactyla, as regards both limb-structure and dentition; while some exhibit resemblance to the Rodents and Hyraxes—resemblances which, however, are probably to be attributed to parallelism in development.

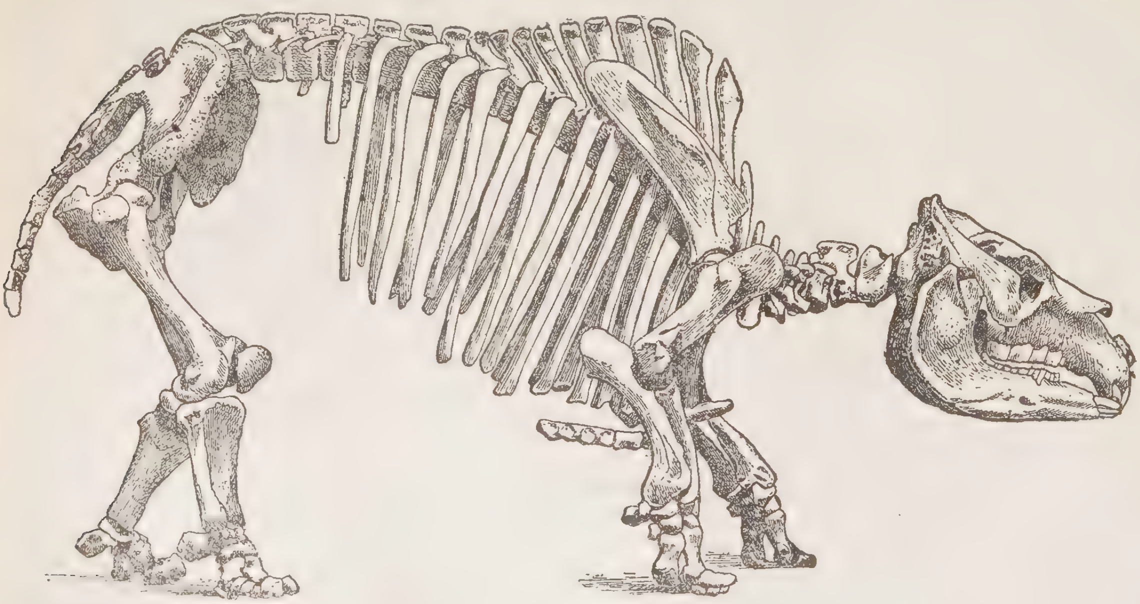
Under the sub-order Toxodontia may be included not only the typical *Toxodon*, but the more aberrant *Typotherium* (fig. 1) of the Pleistocene of Buenos Aires and the smaller *Pachyrucus* and *Hegetotherium* of the Patagonian Santa Cruz beds. All the members of the sub-order have tall-crowned and curved cheek-teeth, some or all of which generally have persistent pulps, while at least one pair of incisors in each jaw is rootless. The bodies of the cervical vertebrae have flat articular surfaces, the bones of the two rows of the carpus alternate, and in the tarsus the navicular articulates with the calcaneum, which, as in the Artiodactyla, is articulated to the fibula, while the astragalus, which is slightly grooved above, is formed on the Perissodactyle plan. The number of toes varies between three and five, of which the middle one is the largest, and the femur may or may not have a third trochanter. The Typotheriidae and Pachyrucidae are remarkable among the Ungulates for the retention of clavicles, and for their curious approximation in dentition and certain characters of the skeleton to the Rodentia. The dental formula of *Typotherium* is *i.* $\frac{1}{2}$, *c.* $\frac{0}{0}$, *p.* $\frac{2}{1}$, *m.* $\frac{3}{2}$; that of the smaller Patagonian forms differs by the larger number ($\frac{3}{3}$) of premolars. The toes were unguiculate rather than ungulate in character, except the hind ones (four in number) of *Typotherium*. Certain allied Patagonian forms, such as *Argyrohyrax*, have been supposed to be related to the Hyraxes.



(After Gervais.)

FIG. 1.—Skull of *Typotherium cristatum*, from the Pampas Formation of Buenos Aires.

The Toxodontidae differ from the preceding families by the loss of the clavicles and the reduction of the digits to three in each foot. The typical genus *Toxodon* is represented by animals the size of a rhinoceros, of which the entire skeleton is now known (fig. 2). The teeth, of which the formula is *i.* $\frac{2}{3}$, *c.* $\frac{0}{1}$ *p.* $\frac{3-4}{2-4}$, *m.* $\frac{3}{3}$, all grow from persistent pulps; those of the cheek-series are very tall, highly curved, and with a simplified crown-structure. In the older *Nesodon*, on the other hand, the cheek-teeth are shorter-crowned, and depart less widely from a generalized Perissodactyle type, the total number of teeth being forty-four, and there being scarcely any gap in the series. Very remarkable changes occur in the dentition as age advances, most of the teeth eventually developing roots, although the second pair of incisors in each jaw was rootless. The complete skeleton is not yet known, but it is ascertained that the femur differs from that of *Toxodon* in the retention of a third trochanter.



(From British Museum [Nat. His.] Guide to the Fossil Mammalia.)

FIG. 2.—Skeleton of the Toxodon (*Toxodon platensis*). From the Pampean Formation of Argentina. (About $\frac{1}{10}$ nat. size.)

Toxodon is typified by *T. platensis* from the Pampean formation of Buenos Aires. *Toxodontotherium* and *Xotodon* are allied but rather older types. *Nesodon* is from the Santa Cruz beds of Patagonia, the typical *N. imbricatus* having a skull about a foot in length, but *N. ovinus* was a smaller animal, about the size of a sheep.

(R. L.*)

TOY, CRAWFORD HOWELL (1836–   ), American Hebrew scholar, was born in Norfolk, Virginia, on the 23rd of March 1836. He graduated at the university of Virginia in 1856, and studied at the university of Berlin in 1866–1868. In 1869–1879 he was professor of Hebrew in the Southern Baptist Theological Seminary (first in Greenville, South Carolina, and after 1877 in Louisville, Kentucky), and in 1880 he became professor of Hebrew and Oriental languages in Harvard University, where until 1903 he was also Dexter lecturer on biblical literature.

He wrote *The Religion of Israel* (1882); *Quotations from the Old Testament in the New Testament* (1884); *Judaism and Christianity* (1890); and the *Book of Proverbs* (1899) in the "International Critical Commentary"; and edited a translation of Erdmann's commentary on Samuel (1877) in Lange's commentaries; Murray's *Origin of the Psalms* (1880); and, in Haupt's *Sacred Books of the Old Testament*, the Book of Ezekiel (Hebrew text and English version, 1899).

TOY (an adaptation of Du. *tuig*, tools, implements, stuff, *speltuig*, playthings, *i.e.* stuff to play with, *spelen*, to play), a child's plaything, also a trifle, a worthless, petty ornament, a gew-gaw, a bauble. Children's toys and playthings survive from the most remote periods of man's life on the earth, though many so-called diminutive objects made and used by primitive man, sometimes classified as playthings, may have been workmen's models, votive offerings or sepulchral objects. A large number of wooden, earthenware, stone or metal dolls remain with which the children of ancient Egypt once played; thus in the British Museum collection there is a flat painted wooden doll with strings of mud-beads representing the hair, a bronze woman doll bearing a pot on her head, an earthenware doll carrying and nursing a child; some have movable jointed arms. There are also many toy animals, such as a painted wooden calf, a porcelain elephant with a rider; this once had movable legs, which have disappeared. Balls are found made of leather stuffed with hair, chopped straw and other material, and also of blue porcelain or papyrus. Jointed dolls, moved by strings, were evidently favourite playthings of the Greek and Roman children, and small models of furniture, chairs, tables, sets of jugs painted with scenes of children's life survive from both Greek and Roman times. Balls, tops, rattles and the implements of numerous games, still favourites in all countries and every age, remain to show how little the amusements of children have changed.

See also DOLL; TOP; PLAY; and for the history of toys, with their varying yet unchanging fashions, see H. R. d'Allemagne, *Histoire des Jouets*, and F. N. Jackson, *Toys of other Days* (1908).

TOYNBEE, ARNOLD (1852–1883), English social reformer and economist, second son of Joseph Toynbee (1815–1866), a distinguished surgeon, was born in London on the 23rd of August 1852. He had originally intended to enter the army, but ill health and a growing love of books changed his plans, and he settled down to read for the bar. Here again the same causes produced a change of purpose, and he entered as a student at Pembroke College, Oxford. Finding himself by no means at ease in that college he migrated after two years to Balliol College. Continued ill health prevented his reading for honours, but he made so deep an impression on the authorities of his college that on taking his degree he was appointed lecturer and tutor to students preparing for the Indian civil service. He devoted himself to the study of economics and economic history. He was active also as a practical social reformer, taking part in much public work and delivering lectures in the large industrial centres on economic problems. He overtaxed his strength, and after lecturing in London in January 1883 he had a complete break-down, and died of inflammation of the brain at Wimbledon on the 9th of March.

Toynbee had a striking influence on his contemporaries, not merely through his intellectual powers, but by his strength of character. He left behind him a beautiful memory, filled as he was with the love of truth and an ardent and active zeal for the public good. He was the author of some fragmentary pieces, published after his death by his widow, under the title of *The Industrial Revolution.* This volume deserves attention both for its intrinsic merit and as indicating the first drift of a changing method in the treatment of economic problems. He, however, fluctuated considerably in his opinion of the Ricardian political economy; in one place declaring it to be a detected "intellectual imposture," whilst elsewhere, apparently under the influence of Bagehot, he speaks of it as having been in recent times "only corrected, re-stated, and put into the proper relation to the science of life," meaning apparently, by this last, general sociology. He saw that the great help in the future for the science of economics must come from the historical method, to which in his own researches he gave preponderant weight. Toynbee's interest in the poor and his anxiety to be personally acquainted with them led to his close association with the district of Whitechapel in London, where the Rev. Canon S. A. Barnett (*q.v.*) was at that time vicar—an association which was commemorated after his death by the social settlement of Toynbee Hall, the first of many similar institutions erected in the East End of London for the purpose of uplifting and brightening the lives of the poorer classes.

See F. C. Montague's *Arnold Toynbee* (Johns Hopkins University Studies, 1889); Lord Milner's *Arnold Toynbee: a Reminiscence* (1901); and L. L. Price's *Short History of Political Economy in England* for a criticism of Toynbee as an economist.

TRABEATED, the architectural term given to those styles in which the architrave or beam (Lat. *trabs*) is employed instead of the arch, in the latter case the term "arcuated" being used. The principal trabeated styles are the Egyptian, Persian, Greek, Lycian, nearly all the Indian styles, the Chinese, Japanese and South American styles, in all cases owing their origin to the timber construction, for which reason the term post-and-lintel architecture is sometimes applied to it.

TRACERY, a late coined word from "trace," track, Lat. *trahere*, to draw; the term given in architecture (French equivalents are *réseau*, *remplissage*) to the intersecting rib-work in the upper part of a Gothic window; applied also to the interlaced work of a vault, or on walls, in panels and in tabernacle work or screens. The tracery in windows is usually divided into two sections, plate tracery and rib or bar tracery, the latter rising out of the former, and entirely superseding it in the geometrical, flowing and rectilineal designs. The windows of the Early English period were comparatively narrow slits, and were sometimes grouped together under a single enclosing arch; the piercing of the tympanum of this arch with a circular light produced what is known as plate tracery, which is found in windows of the late 12th century, as in St Maurice, York, but became more common in the first half of the 13th century. In England the opening pierced in the head was comparatively small, its diameter never exceeding the width of one of the windows below, but in France it occupied the full width of the enclosing arch and was filled with cusping, and sometimes, as in Chartres, with cusping in the centre and a series of small quatrefoils round, all pierced on one plane face. In order further to enrich the mullions and arches of the window, they were moulded, as in Stowe church, Kent; the other portions were pierced; and finally, to give more importance to the principal lights, additional depth was given to their mouldings, so that they gradually developed into bar or rib tracery, of which the earliest examples in England are those in Westminster Abbey (*c.* 1250) and Netley Abbey near Southampton. Henceforth that which is described in architecture as the "element" ruled the design of the window, and led to the development of geometrical tracery, in which the bars or ribs are all about equidistant from one another. In windows of three lights the heads of the windows consisted of three circular openings, but with four lights they were grouped in two pairs, with a single circle over each and a larger one at the top in the centre. This led to increased dimensions being given to the moulding of the enclosing arches and the upper circle, forming virtually two planes in the tracery. In the great east window at Lincoln, with eight lights, there was a double subdivision and three planes, and here the upper circle was filled with semicircles, so that the openings were all about the same width. In France the upper circle always maintained its predominance, its subdivisions only retaining the scale. The next development, which would seem to have taken place in Gloucester Cathedral, was the omission of portions of the enclosing circle, so as to allow the ribs to run one into the other, forming therefore lines of double curvature, and giving rise to what is known as flowing or flamboyant tracery, of which the great window in Carlisle Cathedral is the most important example. In this window there are nine lights, the four outer ones in each rib being grouped together; these were not subdivided again, and consequently there are only two planes of tracery. The Perpendicular style which followed might perhaps be considered as a reaction against the abuse of the flowing lines in masonry, were it not that in the earlier examples it appears timidly. At Edington church in Wiltshire (1361), in a five-light window, the centre light is wider than the others and its mullions run straight up into the arch mould. In New College chapel, Oxford (1386), the head of the window is subdivided into narrow vertical lights, each half the width of those below, and this is followed in some counties, but not in all, in the east of England the flamboyant tracery being retained a century later. In St Mary's church, Oxford, with seven lights, all the mullions run straight up into the arch mould, and another feature is introduced, already found in New College chapel, and at a much earlier date in domestic work and in spire-lights, viz. the transom. In the later Perpendicular work another change takes place; the pointed arch struck from two centres is replaced by one struck from four centres, and this eventually in domestic work is superseded by the flat arch.

So far reference has been made only to that which may be called the "element" of the window. The enrichment of the lights with cusping gave additional beauty to them, took away the hard wire-drawn effect of the mouldings, and formed openings of great variety; in some of the windows of the Decorated period the ball flower and other foliage is introduced into the mouldings. In French work the geometrical style lasted till the 14th century, and then there was a lapse in building, so that the flamboyant style which followed, and from which at one time it was assumed that the English mason had derived the style, was apparently taken up by the French after its abandonment in England in favour of Perpendicular work. Germany and Spain have always followed in the wake of the French; and in Italy, where architects preferred to decorate their walls with frescoes, the light from stained glass interfered with their effect, so that there was no demand for huge windows or their subdivision with mullions. At the same time there are many beautiful examples of tracery in Italy, generally in marble, such as those of Giotto's Campanile and the cathedral at Florence, in the Ducal and other palaces at Venice, and in the triforium arcades of Pisa and Siena cathedrals; but they destroyed its effect by the insertion of small capitals to the mullions, which gave horizontal lines where they were not wanted, virtually dividing the window into two parts instead of emphasizing, as was done in the Perpendicular period, the verticality of the mullions.

Among the most glorious features in the Gothic architecture of France, England and Spain are the immense rose windows which were introduced, generally speaking, in the transepts of the cathedrals; the tracery of these follows on the lines of those of the windows, changing from geometrical to Decorated and afterwards to flamboyant. In some respects perhaps the finest examples of plate-tracery were produced in the rose windows of the 13th century.

Thus in France in the rose window of Chartres in the west front (1225), and in England in those of Barfreston in Kent (1180) and Beverley Minster in Yorkshire (1220), plate-tracery of such great beauty is found that it is unfortunate it should have been entirely superseded by rib-tracery. The rose window of Lincoln Cathedral in the north transept is a compromise between the two, as all the lights are cut out independently and in one plane, but there are mouldings round each connected with flowers; in its design and effect this window is far superior to the flamboyant circular window in the south transept. Sometimes a rose window is arranged in the upper portion of an ordinary window, as in the west front of Lichfield Cathedral, and this is constantly found in those of the transepts of the French cathedrals. In the south of Italy, at Bari, Bitonto and Troja, and at Orvieto and Assisi, farther north, there are examples of rose windows, but inferior in design to French and English work, though elaborated with carving. The revival of the 16th century was fatal so far as tracery was concerned; in the place of the flamboyant work of the last phase of Gothic in France semicircular and elliptical curves with poor mouldings were introduced, and the elaborate cusping which gave such interest to the light was omitted altogether, as in St Eustache, Paris. There is, however, one remarkable example in the church of Le Grand Andely, in Normandy, dating from the Henri II. period, in which a return was made to the tracery of the 13th century; but the introduction of Renaissance details in the place of the cusping is not altogether satisfactory, though the general design is fine.

The tracery decorating the vault of Gothic work began on the introduction of the fan vault at Gloucester (see VAULT); it was only a surface decoration, both rib and web being cut out of the same block of stone, and it received further development in the various phases which followed. In the later Perpendicular work the walls and buttresses were all panelled with blank tracery, the most complete example of which is found in Henry VII.'s chapel, Westminster Abbey.

In tabernacle work the tracery is purely of a decorative character, copied in miniature from the mullions, arch-moulds and crockets of Gothic work.

Some of the most beautiful examples of tracery are those on the rood screens of churches, either in stone as in the Jubé of the Madeleine at Troyes, or in wood as in the rood screens of the churches in East Anglia and in Somersetshire; and with this must be included that which was introduced into the panelling of church doors, choir stalls and other church fittings; this was continued, first in the early Renaissance of the 16th century, the finest examples being those of the stalls of King's College, Cambridge, and afterwards in the Jacobean style, in the church at Croxcombe near Shepton Mallet, and the church of St John at Leeds, the two latter ranking as the best work of that late period. (R. P. S.)

TRACHELIUM (Gr. τράχηλος, neck), the term in architecture given to the neck of the capital of the Doric and Ionic orders. In the Greek Doric capital it is the space between the annulets of the echinus and the grooves which marked the junction of the shaft and capital; in some early examples, as in the basilica and temple of Ceres at Paestum and the temple at Metapontum, it forms a sunk concave moulding, which by the French is called the gorge. In the Roman Doric and the Ionic orders the term is given by modern writers to the interval between the lowest moulding of the capital and the top of the astragal and fillet, which were termed the "hypotrachelium" (*q.v.*).

TRACHEOTOMY, the operation of opening the trachea or windpipe (see RESPIRATORY SYSTEM) and inserting a tube (*canula*) to provide a means of breathing when the natural air-passage is obstructed. The operation is by no means easy when performed on a small child, for the wind-pipe is deeply placed amongst important structures. The chief anxiety is in connexion with haemorrhage, for the vessels are large and generally overfull on account of the impairment of the respiration. The higher the opening is made in the trachea the easier and safer is the operation.

TRACHIS, a city of ancient Greece, situated at the head of the Malian Gulf in a small plain between the rivers Asopus and Melas, and enclosed by the mountain wall of Oeta which here extended close to the sea and by means of the Trachinian Cliffs completely commanded the main road from Thessaly. The position was well adapted as an advanced post against invaders from the north, and furthermore guarded the road up the Asopus gorge into the Cephissus valley. Strangely enough, it is not recorded what part Trachis played in the defence of Thermopylae against Xerxes. Its military importance was recognized in 427 B.C. by the Spartans, who sent a garrison to guard the Trachinian plain against the marauding highland tribes of Oeta and built a citadel close by the Asopus gorge with the new name of Heraclea. The Spartans failed to safeguard Heraclea against the Oetaeans and Thessalians, and for a short time were displaced by the Thebans (420). After a bloody defeat at the hands of the neighbouring mountaineers (409) the Spartan governor quarrelled with the native settlers, whom he expelled in 399. Four years later Thebes used her new predominance in central Greece to restore the Trachinians, who retained Heraclea until 371, when Jason of Pherae seized and dismantled it. The fortress was rebuilt, and after 280 served the Aetolians as a bulwark against Celts and Macedonians. It was captured in 191 by the Romans, but restored to the Aetolian League until 146. Henceforth the place lost its importance; in Strabo's time the original site was apparently deserted, and the citadel alone remained inhabited.

Strabo p. 428; Herodotus vii. 198–203; Thucydides iii. 92, v. 51–52; Diodorus xiv. 38, 82; Livy xxxvi. 22–24. W. Leake, *Travels in Northern Greece*, iii. 24–31 (London, 1835); G. B. Grundy, *Great Persian War*, pp. 261–264 (London, 1901). (M. O. B. C.)

TRACHOMA, the name given to a chronic destructive form of inflammation of the conjunctiva of the eye (see EYE: *Diseases*), or "granular conjunctivitis" (Egyptian ophthalmia). It is a contagious disease, associated with dirty conditions, and common in Egypt, Arabia and parts of Europe, especially among the lower class of Jews. Hence it has become important, in connexion with the alien immigration into the United Kingdom and America, and the rejection of those who are afflicted with it. It is important that all cases should be isolated, and that the spread of the infection should be prevented.

TRACHYTE (Gr. τραχύς, rough), in petrology, a group of volcanic rocks which consist mainly of sanidine (or glassy orthoclase) felspar. Very often they have minute irregular steam cavities which make the broken surfaces of specimens of these rocks rough and irregular, and from this character they have derived their name. It was first given by Haüy to certain rocks of this class from Auvergne, and was long used in a much wider sense than that defined above, in fact it included quartz-trachytes (now known as liparites and rhyolites) and oligoclase-trachytes, which are now more properly assigned to andesites. The trachytes are often described as being the volcanic equivalents of the plutonic syenites. Their dominant mineral, sanidine felspar, very commonly occurs in two generations, *i.e.* both as large well-shaped porphyritic crystals and in smaller imperfect rods or laths forming a finely crystalline groundmass. With this there is practically always a smaller amount of plagioclase, usually oligoclase; but the potash felspar (sanidine) often contains a considerable proportion of the soda felspar, and has rather the characteristics of anorthoclase or cryptoperthite than of pure sanidine.

Quartz is typically absent from the trachytes, but tridymite (which likewise consists of silica) is by no means uncommon in them. It is rarely in crystals large enough to be visible without the aid of the microscope, but in thin slides it may appear as small hexagonal plates, which overlap and form dense aggregates, like a mosaic or like the tiles on a roof. They often cover the surfaces of the larger felspars or line the steam cavities of the rock, where they may be mingled with amorphous opal or fibrous chalcedony. In the older trachytes secondary quartz is not rare, and probably sometimes results from the recrystallization of tridymite.

Of the ferromagnesian minerals present augite is the most common. It is usually of pale green colour, and its small crystals are often very perfect in form. Brown hornblende and biotite occur also, and are usually surrounded by black corrosion borders composed of magnetite and pyroxene. Sometimes the replacement is complete and no hornblende or biotite is left, though the outlines of the cluster of magnetite and augite may clearly indicate from which of these minerals it was derived. Olivine is unusual, though found in some trachytes, like those of the Arso in Ischia. Basic varieties of plagioclase, such as labradorite, are known also as phenocrysts in some Italian trachytes. Dark brown varieties of augite and rhombic pyroxene (hypersthene or bronzite) have been observed but are not common. Apatite, zircon and magnetite are practically always present as unimportant accessory minerals.

The trachytes being very rich in potash felspar, necessarily contain considerable amounts of alkalis; in this character they approach the phonolites. Occasionally minerals of the felspathoid group, such as nepheline, sodalite and leucite, occur, and rocks of this kind are known as phonolitic trachytes. The soda-bearing amphiboles and pyroxenes so characteristic of the phonolites may also be found in some trachytes; thus aegirine or aegironic augite forms outgrowths on diopside crystals, and riebeckite may be present in spongy growths among the felspars of the groundmass (as in the trachyte of Berkum on the Rhine). Trachytic rocks are typically porphyritic, and some of the best-known examples, such as the trachyte of Drachenfels on the Rhine, show this character excellently, having large sanidine crystals of tabular form an inch or two in length scattered through their fine-grained groundmass. In many trachytes, however, the phenocrysts are few and small, and the groundmass comparatively coarse. The ferromagnesian minerals rarely occur in large crystals, and are usually not conspicuous in hand specimens of these rocks. Two types of groundmass are generally recognized: the trachytic, composed mainly of long, narrow, sub-parallel rods of sanidine, and the orthophyric, consisting of small, squarish or rectangular prisms of the same mineral. Sometimes granular augite or spongy riebeckite occurs in the groundmass, but as a rule this part of the rock is highly felspathic. Glassy forms of trachyte (obsidians) occur, as in Iceland, and pumiceous varieties are known (in Teneriffe and elsewhere), but these rocks as contrasted with the rhyolites have a remarkably strong tendency to crystallize, and are rarely to any considerable extent vitreous.

Trachytes are well represented among the Tertiary and Recent volcanic rocks of Europe. In Britain they occur in Skye as lava flows and as dikes or intrusions, but they are much more common on the continent of Europe, as in the Rhine district and the Eifel, also in Auvergne, Bohemia and the Euganean Hills. In the neighbourhood of Rome, Naples and the island of Ischia trachytic lavas and tuffs are of common occurrence. In America trachytes are less frequent, being known in S. Dakota (Black Hills). In Iceland, the Azores, Teneriffe and Ascension there are Recent trachytic lavas, and rocks of this kind occur also in New South Wales (Cambewarra range), East Africa, Madagascar, Aden and in many other districts.

Among the older volcanic rocks trachytes also are not scarce, though they have often been described under the names orthophyre and orthoclase-porphyry, while "trachyte" was reserved for Tertiary and Recent rocks of similar composition. In England there are Permian trachytes in the Exeter district, and Carboniferous trachytes are found in many parts of the central valley of Scotland. The latter differ in no essential respect from their modern representatives in Italy and the Rhine valley, but their augite and biotite are often replaced by chlorite and other secondary products. Permian trachytes occur also in Thuringia and the Saar district in Germany.

Closely allied to the trachytes are the *Keratophyres*, which occur mainly in Palaeozoic strata in the Harz (Germany), in the Southern Uplands of Scotland, in Cornwall, &c. They are usually porphyritic and fluidal; and consist mainly of alkali felspar (anorthoclase principally, but also albite and orthoclase), with a small quantity of chlorite and iron oxides. Many of them are lavas, but others are probably dikes or thin intrusions. As the analyses given above will show, they differ from trachytes mainly in being richer in soda. (J. S. F.)

	SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O
Riebeckite trachyte, Hohenberg, Berkum, Rhenish Prussia	66·06	16·46	2·25	1·10	0·19	0·79	6·81	5·52	0·62
Keratophyre, Hamilton Hill, Peebles, Scotland	64·38	16·98	4·04	—	0·28	1·08	7·57	4·30	1·64
Trachyte (Orthophyre) Garleton Hill, Haddington, Scotland	61·35	16·88	0·41	5·01	0·44	2·39	5·26	6·12	1·70
Trachyte, Monte Nuovo, Phlegraean Fields, near Naples, Italy	60·33	18·74	2·84	1·29	0·38	1·15	7·15	7·30	0·56
Trachyte, Algersdorf, Bohemia	64·69	18·39	—	3·44	0·49	1·72	4·61	6·46	0·24

TRACT (from Lat. *tractare*, to treat of a matter, through Provençal *tractat* and Ital. *trattato*), in the literary signification, a work in which some particular subject, or aspect of a subject, is treated. As far as derivation is concerned, a tract is identical with a *treatise*, but by custom the latter word has come to be used for a lengthy monograph on a subject, dealing with it technically and authoritatively, whereas a tract is understood to be brief and rather argumentative than educational. There is, again, the rarer word *tractate*, which is not a tract, in the precise sense, so much as a short treatise.

The word "tract" has come to be used for brief discourses of a moral and religious character only, and in modern practice it seems to be mainly confined to serious and hortatory themes. An essay on poetry, or the description of a passage of scenery, would not be styled a tract. In the Protestant world, the tract which Luther composed in 1520, on the Babylonish captivity, has been taken more or less as the type of this species of literature, which, however, existed long before his day, both in Latin and in the vernacular tongues of western Europe. It is difficult, if not impossible, in early history, to distinguish the tract from other cognate forms of moralizing literature, but it may perhaps be said that the homilies of Ælfric (955–1025?) are the earliest specimens of this class in English literature. Four centuries later Wyclif issued a series of tracts, which were remarkable for their vigour, and exercised a strong influence on medieval theology. Bishop Reginald Pecock published many controversial tracts between 1440 and 1460. Sir Thomas More, John Fisher (d. 1535) and William Tyndale were prominent writers of controversial treatises. It was the Martin Marprelate agitation, in the reign of Elizabeth, which led from 1588 to 1591 to the most copious production of tracts in English literature; of these nearly thirty survive. On the Puritan side the principal writers were John Udall (1560–1592), Henry Barrowe (d. 1593), John Penry (1559–1593) and Job Throckmorton (1545–1601), the tracts being printed in the house of the last-mentioned; on the side of the Established Church the principal authors were Bishop Thomas Cooper (1517–1594) and the poets Lyly and Nash. An enormous collection of tracts was published between 1717 and 1720 in elucidation of what is known as the Bangorian Controversy, set in motion by a sermon of Benjamin Hoadly, bishop of Bangor, on "The Nature of the Kingdom of Christ" (1717). Convocation considered this a treatise likely to impugn and impeach the royal supremacy in religious questions. A vast number of writers took part in the dispute, and Thomas Sherlock (1678–1761) fell into disgrace through the violence of his contributions to it. Convocation was finally obliged to give way.

The most famous collection of tracts published in the course of the 19th century was that produced from 1833 onwards by Newman, Keble and E. B. Pusey, under the title of "Tracts for the Times." Among these Pusey's "Tract on Baptism" (1835) and his "On the Holy Eucharist" (1836) had a profound effect in leading directly to the foundation of the High Church party, so much so that the epithet "Tractarian" was barbarously coined to designate those who wished to oppose the spread of rationalism by a quickening of the Church of England. In 1841 Newman's "Tract No. XC." was condemned by the heads of houses in Oxford, and led to the definite organization of the High Church forces. (X.)

Tract Societies are agencies for the production and distribution, or the distribution only, of Christian literature, more especially in tract form. They vary in importance from the Society for Promoting Christian Knowledge (London), the Religious Tract Society (London) and the American Tract Society (New York)—all of which are publishing houses of recognized standing—to small and purely local organizations for distributing evangelistic and pastoral literature. It was not until the Evangelical Revival that tract work began to develop along its modern lines. Starting from the provision of simple evangelistic literature for home use, the enterprise grew into the provision of Christian literature, not only for home use, but also for the mission fields of the world. With this growth there proceeded another development, the production of books and magazines being added to that of tracts. The title "Tract Society" has, in fact, become misleading, as suggestive of limitations which had but a brief existence and are no longer recognized by the more important agencies. On the other hand it must not be supposed that because the work has gone beyond the provision of tracts, these are no longer widely employed. Probably their use in various forms at home was never wider than it is to-day; whilst in India, China and elsewhere the attack of the Christian tracts is being met by the circulation of vernacular tracts in defence of the non-Christian faiths.

The Society for Promoting Christian Knowledge, founded in 1698, though most widely known as a publishing agency, assists in a wide variety of ways the work of the Church of England. On its publication side, it is for its own Church both a Bible society and a tract society. Moreover, its publications include not only versions of the Holy Scriptures and of the Liturgy, but also theological and general literature in many forms. It has given much attention to providing good reading for children; whilst its tract catalogue is especially rich in works bearing on Christian evidences, Church seasons and the doctrines of the Anglican Church. To the foreign missions of the Church the S.P.C.K. has been a helper of the utmost value, more especially in regard to their medical missions and their use of Christian literature. In the latter case the help is given by grants of works produced either at home or by mission presses in the field. As early as 1720 it was using Arabic; but it has from time to time been of especial value in helping to found a Christian literature in languages or dialects just reduced to writing. Thus whilst recent publications for the mission field include works in Arabic, Chinese and Urdu, they also include publications in Addo, Lunyoro and Sgau Karen.

The Religious Tract Society, founded in 1799, and thus contemporary with the great missionary agencies and the Bible Society, is, like the last-named, an interdenominational organization. Its earliest publications were in English and were tracts. But it speedily undertook book publications and extended its field of operations. It began to provide tracts for China in 1813, and as early as 1817 an auxiliary tract society was founded at Bellary in India by some men of the 84th Regiment. In undertaking book publication, the society became one of the pioneers in the provision of sound and cheap literature; whilst by the issue of the *Sunday at Home*, the *Leisure Hour*, the *Boy's Own Paper*, the *Girl's Own Paper*, the *Cottager and Artisan* and other periodicals, it helped to lead the work in the provision of popular magazines. Like the S.P.C.K., the R.T.S. now produces general theological literature as well as tracts in a variety of forms, whilst it also gives especial attention to the provision of healthy reading matter for young people. Its grants of books and tracts are open to members of all Protestant denominations. The society aids Protestant communities on the Continent by maintaining depôts at Madrid, Barcelona, Lisbon, Vienna, Budapest and Warsaw; whilst it also assists, by grants, publication work in France, Italy, Russia, Turkey and Scandinavia. In the mission field it works mainly through subsidiary tract societies locally organized. The chief of these tract and book societies are in India carried on at Calcutta, Madras, Bombay, Bangalore, Allahabad and Lahore; in China at Peking, Shanghai, Hong Kong, Canton, Hankow, Chung-king and Mukden; and in Japan at Tokio. The literature produced by these organizations ranges from commentaries on the Holy Scriptures to the simplest tracts and leaflets. In 1908 the society opened a special fund in aid of its Chinese work, and by this means the provision of Christian literature in book and tract form for Chinese readers has been greatly extended. Much literature for various foreign fields is also produced in Great Britain and distributed from the society's headquarters. As with the S.P.C.K., the R.T.S. has been of great service in providing (next to the Holy Scriptures) the earliest literature for some languages. Thus it has helped to provide tracts for the Miaos of west China and for the Baganda, together with the *Pilgrim's Progress* in Bemba and in Ewé, two little-known African tongues. The languages in which works produced or aided by the society have appeared number about 300. In the distribution of its grants of tracts for home work nearly all the great evangelical organizations have a share. In the administration of a subsidiary tract society all the evangelical agencies at work in its field are as a rule represented.

In addition to the work of these societies, the production and distribution of tracts at home is carried on by *The Stirling Tract Enterprise*, which also sends grants of its publications to India, Ceylon and Africa; by *The Children's Special Service Mission*, which also issues publications in Chinese, Japanese and some Indian languages; and by *The Scripture Gift Mission*, which sends its publications into China and the East generally. In the mission field *The Christian Literature Society for India* (formerly the Christian Vernacular Educational Society), established in 1858, has its headquarters in London with auxiliary committees in India and Ceylon. It will always be associated with the name of Dr John Murdoch (d. Aug. 10, 1904), its secretary for nearly half a century. It works on similar lines to the tract societies, but includes a wider range of educational literature, in the provision of which it has been especially helpful to the mission schools of India.

The Christian Literature Society for China (formerly the Society for the Diffusion of Literature and General Knowledge among the Chinese) is incorporated (1909) in Shanghai, but has an advisory committee and an executive committee in London. It has been of great service in approaching the official and upper classes of China by its magazines and books, as well as by the diffusion of more popular literature.

The American Tract Society (New York) works, both in regard to domestic and foreign enterprises, upon similar lines to those of the Religious Tract Society. Upper Canada has its tract society also and similar organizations exist on the continent of Europe.

(A. R. B.)

TRACTION (Lat. *trahere*, to draw), the act of drawing or hauling. As used in this article the term refers to the methods of employing animal and mechanical power for transporting persons or things from place to place in wheeled vehicles.

Animal Traction.—The oldest form of motive power is that of animals, those most commonly employed for draught purposes on ordinary roads being horses, mules, donkeys and oxen. On the continent of Europe dogs are often harnessed to light carts or barrows, but in England their use in this way was prohibited by the Cruelty to Animals Act of 1854. Camels and elephants are only rarely used as draught animals in special circumstances.

When men and animals carry burdens, or draw or propel loads in certain vehicles, it is difficult, and sometimes impossible, to determine the duty performed in foot-pounds of work, because of the uncertainty of the amount in pounds of the resistance overcome. In this case, for the purpose of comparing performances of the same kind with each other, a unit is employed called a *foot-pound of horizontal transport*, meaning the conveying of a load of 1 ℔ 1 ft. horizontally. The following table, given by W. J. Macquorn Rankine, gives some examples of the daily duty of men and horses in units of horizontal transport, L denoting the load in ℔, V the velocity in feet per second, and T the number of seconds per day of working:—

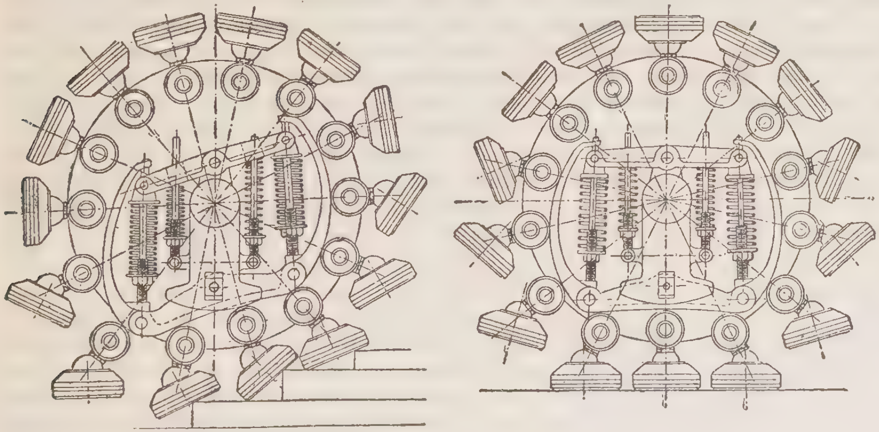
	L.	V.	$\frac{T}{3600}$	LV.	LVT.
	℔.	Feet per second.	Hours per day.	℔. conveyed 1 ft.	℔. conveyed 1 ft.
MAN—					
Walking unloaded, transport of own weight	140	5·0	10	700	25,200,000
Do. do.	140	6·0	10	840	30,240,000
Wheeling load L in two-wheeled barrow, returning empty; V = ½ velocity .	224	1·6	10	373	13,428,000
Do. one-wheeled barrow, do. . . .	135	1·6	10	225	8,100,000
Travelling with burden	90	2·5	7	225	5,670,000
Conveying burden, returning unloaded	140	1·6	6	233	5,032,800
Carrying burden for 30 seconds only	252	—	—	—	—
	126	11·7	—	1474·2	—
	—	23·1	—	—	—
HORSE—					
Walking with cart always loaded . .	1500	3·6	10	5400	194,400,000
Trotting do. do.	750	7·2	4½	5400	87,480,000
Walking with cart, going loaded, returning empty; V = ½ mean velocity	1500	2·0	10	3000	108,000,000
Carrying burden, walking	270	3·6	10	972	34,992,000
Do. trotting	180	7·2	7	1296	32,659,200

For tramway service, horse, or occasionally mule, traction was formerly employed almost universally, but on account of limited speed and high cost it has been generally abandoned, except in a few localities, where the smallness of the line, low value of livestock, labour and feed, and long headway intervals, make it still profitable.

The tractive force required on a straight and level tramway is found to vary from $\frac{1}{150}$ to $\frac{1}{50}$ of the load, according to the condition of the rails. On a tramway having grooved rails in average condition it is about $\frac{1}{100}$. The resistance is thus, at the best, nearly double that on a railway, and sometimes as much as on a good paved road. This is due to the friction of the flange of the wheel in the grooved rail, and to the fact that the latter is always more or less clogged with dirt. The clearance between the flange and the groove is necessarily small, as the former must have sufficient strength, and the latter must be narrow. The least inaccuracy of gauge, therefore, causes extra friction, which is greatly increased on curves. By removing the flanges from two of the four wheels of the tramway car H. E. Tresca (1814–1885) found that the resistance was reduced from $\frac{1}{100}$ to $\frac{1}{148}$ of the load. The resistance due to gravity is of course not lessened on a tramway; and if $\frac{1}{100}$ of the load be the tractive force required on the level, twice as much, or $\frac{1}{50}$ of the load, will be required on a gradient of 1 in 100 and three times as much on a gradient of 1 in 50. To start a tramcar, four or five times as great a pull is required as will keep it in motion afterwards, and the constant starting after stoppages, especially on inclines, is destructive to horses. Horses employed on tramways are worked only a few hours a day, a day's work being a journey of 10 or 12 m., and much less on steep gradients. In London a tramcar horse bought at the age of five years had to be sold at a low price after about four years' work. On the Edinburgh tramways, in consequence of steep gradients, the horses lasted a less time, and had to be constantly shifted from steep to easier gradients. The cost of traction by horses is generally 6d. or 7d. per mile for two horses, and more when the gradients are steep (see also TRAMWAY).

Steam Traction.—The most universally used form of motive power is the steam engine, which has been constructed to work on ordinary roads, on tramways and on railways. The road or traction engine comprises a boiler mounted on wheels, and a steam engine usually placed on top of the boiler. The front axle is pivoted so that it may be moved by means of a steering wheel geared to it, and the rear wheels are geared to the engine. The wheel rims are made wide to prevent them from sinking in loose earth or muddy roads. The whole arrangement is similar to the ordinary wheeled portable boiler and engine with the addition of the steering wheel and a gear connexion from the engine to the rear wheels. The tractive power of these engines is high, but their speed low—usually 4 to 6 m. per hour.

A peculiar form of road motor is made by equipping the axles of a traction engine with the so-called "Pedrail" invented by B. J. Diplock. This is an arrangement whereby circular pads or "feet," fastened around the periphery of a wheel, come successively in contact with the ground, the motion approximating to a smooth, even stepping or walking along. Fourteen of these feet are placed around a wheel, and each is attached at the end of a spoke, free to slide radially toward and from the hub of the wheel. Each spoke has fastened to it a helical spring which tends to draw it inwards. On each spoke there is also a roller, which bears against a cam-shaped piece placed inside the periphery of the wheel. The engine is suspended by springs from the cam and is supported by it. The lower edge of the cam is practically straight and horizontal, the length of this straight portion being great enough to subtend an angle equal to the spacing of three spokes, or about 70°. By this means three of the feet are always resting on the roadway and support the engine, which really slides along on the rollers that are at any instant underneath the flat portion of the cam. The feet take successive positions on the ground as the movement of the engine proceeds, and the engine itself rolls along on the rail portion of the cam which rests on the rollers beneath it. Ball and socket joints are used to connect the feet to the spokes so that they may rest on any conformation they may encounter. This machine has shown a remarkable ability to pass over obstacles and rough roads, and even to climb roadless hills. It gives a maximum of adhesion of the drivers, and it is claimed that it will pass over rough roads with the expenditure of less energy than will an ordinary wheeled traction engine. Its speed is necessarily low—about 4 m. per hour.



(From *The Scientific American.*)

Position of the parts in overcoming obstacles.

Position of the parts on a level road.

FIG. 1.—Principle of the Pedrail's operation.

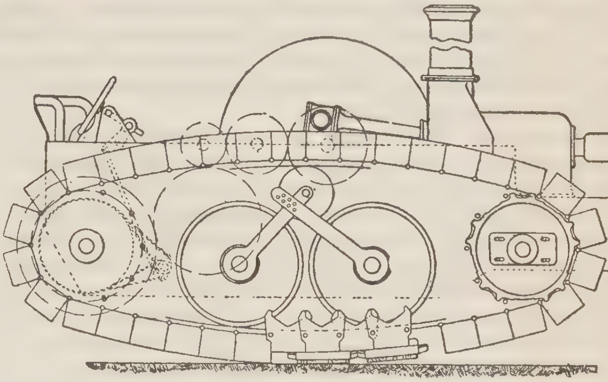


FIG. 2.—Chain Track Tractor.

The Hornsby "Chain Track Tractor" (fig. 2), patented by Mr David Roberts, is provided with two endless chains, one on each side, which constitute the track on which the machine travels. Each chain is carried on two sprocket wheels, placed at the extreme ends of the frame, and is formed of a number of links (fig. 3) so connected that it is free to bend in one direction, as required to pass round the sprocket wheels, but is locked into a rigid bar by pressure acting in the opposite direction. On their outer surfaces these links bear pads or feet, while their inner surfaces compose a track upon which roll the middle or weight-bearing wheels. Power applied to one of the sprocket wheels exerts a pull on the chain, but this being held fast by the weight of the engine pressing the feet to the ground, the effect is to roll the engine along the track, and as this happens the feet at the rear end are one by one lifted off the ground, carried round the sprocket wheels, and relaid at the front of the machine. This construction not only renders the whole weight available for adhesion, but also provides a long supporting base and thus enables the machine to pass over soft ground, loose sand, morasses, &c., in which an ordinary traction engine would certainly sink. Steering is effected by retarding or stopping the motion of the sprocket wheels on the side towards which it is desired to turn.

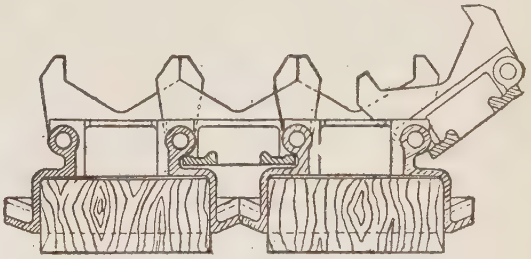


FIG. 3.—Links of Chain Track.

For tramway work steam is scarcely used at all now, though small locomotives—usually having their engines geared to the driving-wheels, instead of the connecting-rods being coupled direct to them—have been used in the past for this work. They were compactly designed and equipped with mufflers to deaden the sound of the exhaust, with other devices to decrease noise and smoke. In some instances, the engine and boiler were placed in the forward end of a car, a partition separating them from the main body of the car in which the passengers were carried.

For description of steam railway engines see RAILWAYS: *Locomotive Power*, and STEAM ENGINE.

Fireless Engines.—Fireless engines were first tried in New Orleans, and were in successful use on tramways in France and

Batavia, Java, for some years. The motive power was obtained from water heated under pressure to a very high temperature in stationary boilers and carried in a reservoir on the engine, where it gave off steam as the pressure and temperature were reduced. Two tons of water heated to give a steam-pressure of 250 ℔ to the square inch served for a run of 8 or 10 m., more than $\frac{9}{10}$ of the water and a pressure of 20 to 25 ℔ above the atmosphere being left on returning to the boiler station. Large boiler-power was required to reheat the engine reservoirs quickly, and this could be afforded for only a few engines; but, when worked on a sufficient scale, the fireless engines were claimed to be economical, the economy resulting from the generation of the steam in large stationary boilers.

Compressed Air.—Compressed air as a motive power offers the advantage of having neither steam nor the products of combustion to be got rid of. In W. D. Scott Moncrieff's engine, which was tried on the Vale of Clyde tramways in 1876, air was compressed to 310 ℔ per sq. in., and expanded in the cylinders from a uniform working pressure to that of the atmosphere. There is a considerable loss of heat during the expansion of the air which is attended with a serious loss of pressure, and in L. Mekarski's system, which was in use for the propulsion of tramcars at Nantes for a number of years, the loss of pressure was considerably lessened by heating the air during expansion. The air, at a pressure of 426 ℔ per sq. in., was stored in cylindrical reservoirs beneath the car, and before use was passed through a vessel three-quarters full of water heated to 300° F., by which it was heated and mixed with steam. The heat of the latter was absorbed by the air during its expansion, first to a working pressure which could be regulated by the driver, and then to atmospheric pressure in the cylinders. At Nantes the average cost for three years of propelling a car holding thirty-four persons was about 6d. per mile. Owing to the heat losses in compressing the air, and other considerable losses incident to its use, the compressed-air systems of traction have been found inefficient and have nearly all been replaced by the more flexible and efficient electric motor.

Cable Traction.—Moving steel cables, propelled by steam engines, have been used for traction. The street railway cars running from New York to Brooklyn, over the Brooklyn Bridge, were for many years propelled by a cable to or from which the cars could be attached or detached at will, and, though electric motors are now used on this line, the cables are still kept in place as a reserve in case of breakdown of the electrical system, and are used whenever an accident to the electrical plant occurs. Before the advent of electric traction, the tramways using cable propulsion were numerous and of great size, as at San Francisco, Chicago, Washington, Baltimore, Philadelphia and New York in America, at Highgate Hill (London) and Edinburgh in the United Kingdom, and at Melbourne in Australia. The Glasgow Subway is so equipped.

In the usual form, the motive power is transmitted from a stationary engine by a rope of steel wire running always in one direction, up one track and down the other, in a tube midway between the rails, on pulleys (fig. 4) which are arranged so as to suit curves and changes of gradient as well as straight and level lines. Over the rope is a slot $\frac{3}{4}$ in. wide, in which travels a flat arm of steel connecting the dummy car with the gripper (fig. 5) which grasps the cable. The flat arm is in three pieces, the two outer ones constituting a frame which carries the lower jaw of the gripper, with grooved rollers at each end of it, over which the cable runs when the gripper is not in action. The upper jaw is carried by the middle piece which slides within the outer frame, and can be depressed by a lever or screw, pressing the cable first on the rollers and then on the lower jaw until it is firmly held. The speed of the cable, which is generally 8 to 10 m. an hour, is thus imparted to the car gradually and without jerk. The arrangements for passing the pulleys, for changing the dummy and cars from one line to the other at the end of the road, for keeping the cable uniformly taut, and for crossings and junctions with other lines, are of considerable ingenuity. When the cars are cast off from the cable they must be stopped by hand brakes which, on steep gradients especially, must be of great power.

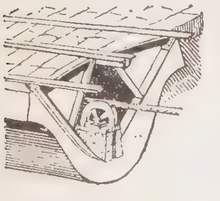


Fig. 4.—Cross-section of Cable Road.

Gasolene Engine Traction.—Explosive engines using gasolene (petrol) have been used for motive power, and this is the principal form employed in the road motor car. Certain railways in England and America have experimented with cars having a gasolene engine placed in one end to propel the car, the greater part of which is left clear for the accommodation of passengers. These cars are intended for short runs and may in effect be classed as belonging to extended tramway service. They have yielded encouraging results.

Electric Traction.—Electric traction, as treated here, will refer to the operation of vehicles for the transportation of passengers and goods upon tracks, as distinguished from what are known as telpherage systems on the one hand (see Conveyors), and automobiles intended to run on common roads on the other (see Motor Vehicles).

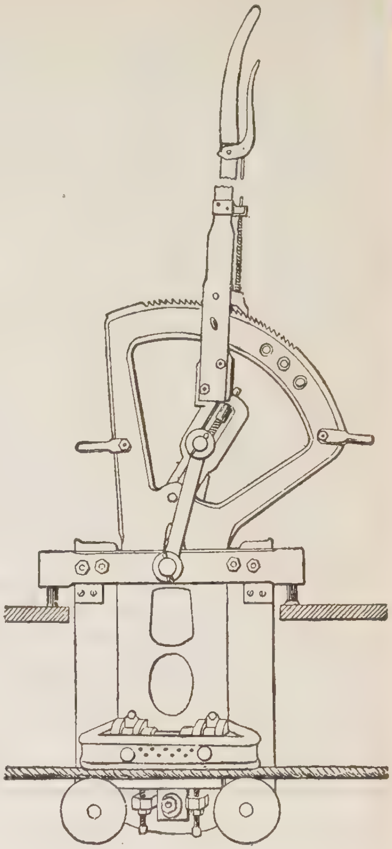


Fig. 5.—Gripper.

Possibly the first electric motor was that made by the Abbé Salvatore dal Negro in Italy in 1830. As early as 1835, Thomas Davenport, a blacksmith of Brandon, Vermont, U.S.A., constructed and exhibited an automobile electric car, operated by batteries carried upon it. Robert Davidson, of Aberdeen, Scotland, began experimenting about 1838 with the electric motor as a means of traction, and constructed a very powerful engine, weighing five tons and carrying a battery of forty cells. This locomotive made several successful trips on Scottish railways, but was finally wrecked by jealous employés of the railway while it was lying in the car sheds at Perth. In 1840 a provisional patent was granted in England to Henry Pinkus, which described a method of supplying electric energy to a moving train from fixed conductors. A little later, in 1845, French and Austrian patents granted to Major Alexander Bessolo described practically what is to-day the third-rail system. In 1847 Professor Moses G. Farmer, of Maine, U.S.A., built a model locomotive operated by electricity, which he exhibited at Dover, New Hampshire, and later at other places in New England. Shortly afterwards Professor C. G. Page, of the Smithsonian Institution in Washington, constructed an electric railway motor, which made a trip on the 29th of April 1851, from Washington, D.C., to Bladensburg, Maryland, over the Baltimore & Ohio railway. This machine carried 100 Grove's cells, and attained speeds as high as 19 m. an hour. Perhaps the beginning of modern electric traction may be said to date from 1879, when the firm of Siemens & Halske put in operation the first electric railway at the Industrial Exposition in Berlin. In America it was not until a year later that real work began and T. A. Edison built an experimental line near his laboratory in Menlo Park, New Jersey. In 1880 a locomotive driven by accumulators was constructed and operated at a linen-bleaching establishment at Breuil-en-Auge, in France; and in 1881 a similar car was worked upon the Vincennes tramway line. On the 12th of May 1881 the first commercial electric railway for regular service was opened for operations at Lichterfelde, in Germany. The first really noteworthy road was that constructed in 1883 at the Giant's Causeway at Portrush, in the north of Ireland. This line was 6 m. long, and the power was obtained from turbine wheels actuated by a cascade on the river Rush. The method of supply was, curiously enough, the third rail.

In 1883 invention in electric railways seems to have taken a decided advance in America. It was in this year that the conflicting interests of Edison and S. D. Field were consolidated; and at the same time C. J. van Depoele and Leo Daft began their experimental work, which later resulted in numerous commercial railways. Next year E. H. Bentley and Walter Knight opened to the public in Cleveland, Ohio, U.S.A., a railway operated by an open-slot conduit, and for the first time worked in competition with horse traction on regular street railway lines. For the next two years much experimental work was done, but it may be said with fairness that the first of the thoroughly modern systems, in which a large railway was equipped and operated under service conditions by electricity, was the line built in Richmond, Virginia, U.S.A., by Frank J. Sprague in 1887. This railway had 13 m. of track, and started with an equipment of forty cars. It has been in continuous and successful commercial operation ever since. The original Richmond system was in all its essential particulars the overhead trolley system now in use. Many improvements have been made in the construction of the motors, the controllers, the trolleys and the various details of car equipment and overhead construction, but the broad principles have not been departed from. The success of the Richmond line called the attention of tramway managers to the advantages of electricity as a motive power, and its substitution for other systems progressed with astonishing rapidity.

The pioneer application of electricity to heavy electric traction was that of the Baltimore & Ohio railway tunnel at Baltimore, Md., U.S.A., and the system was put into operation in 1895. This tunnel is about 1½ m. in length and passes under the city of Baltimore. Its route made the expense of ventilation prohibitive, and the smoke and gases from the locomotives made the use of the tunnel impossible without ventilation. The management therefore decided to attempt the use of electric locomotives to haul the trains through, despite the fact that there existed no prior applications of heavy electric motors for even far lighter service than that demanded by the conditions, namely, the propulsion of trains of over 2000 tons up a grade of 42 ft. to the mile. The engineering work and designing of the locomotives were undertaken by Dr Louis Duncan. The locomotives weigh 96 tons and have worked successfully since they were first put into commission. The electric service has been extended 6 m. from the mouth of the tunnel, making a total haul of nearly 8 m. for these locomotives. In 1907 many heavy electric locomotives using continuous current were constructed for the New York Central & Hudson River Railroad Company to operate a distance of about 5 m. from the New York terminus, and others for practically the same service, but using single-phase alternating currents, were put in for the New York, New Haven & Hartford Railroad Company.

It has been fully demonstrated that electricity is superior to its competitors—horses and moving cables—for tramway work. It is cheaper and more flexible. The relative cost of operation varies with the local conditions, but a fair average estimate would be that cable lines cost 25% more to operate than electric, and horse lines 100% more. The increased speed of the electric cars and the comfort rendered possible by larger vehicles always increase the receipts when horse traction is replaced by electric, while the latter, as compared with the cable, allows better and easier control of the car and a much greater possible speed variation. The installation of an overhead electric line costs less than a cable system, though the expense of a conduit electric line is about the same. By the extension of the urban tramway systems into the suburbs and the construction of inter-urban lines, electricity has come into competition with steam. Here the conditions are different. For ordinary suburban service, the electric cars, running through the city streets and on the highways, cannot, in speed, compete with steam trains operated on private rights of way. The fact that they run more frequently and can take up passengers anywhere along the line gives them an advantage, and within limited distances they have taken a large proportion of suburban traffic from steam railways. For long-distance service, in order to compete with steam a speed much greater than that used on ordinary tram-lines must be adopted, while owing to the time spent on the car more attention must be paid to the comfort of the passenger. Speed and comfort being equal, the great advantage of electricity is that, when it is used, the most economical way of transporting a given number of passengers between two points is in a larger number of small trains; with steam the converse is true. A frequent service is a great attraction to passengers.

For freight service, especially on railways having heavy grades, electricity also possesses many advantages, due principally to the peculiarity of the electric locomotive, which admits of its maintaining its tractive effort or so-called "draw-bar pull" when running at relatively high speeds. This steam locomotives cannot do. Thus a steam locomotive weighing 100 tons may exert a draw-bar pull of say 45,000 ℔ at a speed of 6 m. per hour, while at 15 m. per hour the continuous draw-bar pull will not exceed about 25,000 ℔. On the other hand, an electric locomotive weighing 75 tons and having a tractive effort of 34,000 ℔ at 6 m. per hour will exert a pull of about 27,000 ℔ at 25 m. per hour. From this it is clear that an electric locomotive may pull a heavier train at a fair speed than can a larger steam locomotive. This admits of more rapid movement of freight trains, and thus decreases the hauling cost. Another advantage the electric system has for freight service is the ability to couple several light locomotives in tandem, all under the control of one driver, and thus pull at a high speed larger trains than may now be drawn by steam locomotives of weights commercially admissible. Also, these lighter motors distribute the weight over the track instead of having it concentrated on a few wheels, and the heavy pounding due to the latter condition is obviated and the maintenance of the track and bridges reduced. Other savings arise from diminished fuel consumption, elimination of water and coal stations with their attendants, and greatly reduced repairs on motive power. The chief disadvantage is the stoppage of all trains on a section if the source of current supply should fail. With proper precautions in design and construction this should be a remote possibility, and since electric rail haulage, in any form attempted up to the present, has shown a reduced cost for a given service as compared with steam traction, it is not improbable that the future will witness great activity in the change from steam to electricity for long-distance railway work.

Systems of electric traction may be divided broadly into two classes, the one employing continuous, the other alternating currents to drive the motors. Both of these classes may be further divided with reference to the conducting system employed between the source of current and the motor. The system may also be divided according to operative units into three classes—the single car, the train pulled by one or more directly controlled locomotives or motor cars, and the train operated by two or more motor cars under a common secondary control. This last is called the "multiple unit system."

Continuous-Current Systems.—The applications of continuous current to electric traction comprise six principal varieties, with numerous modifications and combinations. In all of them the motors are operated under a constant, or approximately constant, potential difference. The system in which cars were connected in series by automatic switches, in limited use in the United States in 1888 and 1889, has now disappeared, and the parallel system of connexion, in which the cars are bridged across between the two conductors of a parallel system, maintained at a substantially constant voltage, has become practically universal.

Overhead Construction.

The overhead conductor and track-return construction is the standard for street railway work in most of the cities where electric traction is employed, though there are some notable exceptions. In its present development the system may be said to have grown out of the work of Sprague in Richmond in 1887. Over the track is suspended a bare wire, generally of hard-drawn copper, known as the trolley wire. The normal practice is to use a wire not less than 0·325 of an inch in diameter to assure permanence, since smaller wires wear out rapidly from the friction of the trolley and the burning of the surfaces of contact. The wire is usually of circular cross-section. Sometimes wires of other sections have been used, notably one having a cross-section similar to the figure 8, but the advantage of these forms is problematical, while the difficulty attending their proper installation is considerable. In some cases the working-conductor, or trolley wire, is suspended at one side of the track, connexion with it being made by a side-bearing trolley, but its usual place is directly over the track, as this arrangement leads to simpler and more efficient construction of the trolleys and their accessory parts. For certain special cases, where very large currents are employed, the overhead conductor is made of bar metal or structural shapes. In the Boston (Massachusetts) subway, where the traffic is very heavy, a bar of rectangular section is used, supported at frequent intervals from the roof. In the Baltimore & Ohio railway tunnel at Baltimore, Md., the steel working-conductor originally consisted of two Z bars forming a trough, the current being collected by an iron shoe, but this form has been replaced by a sectional third rail. But whatever the nature of the conductor, it is usually insufficient to carry the current necessary for the operation of the system without excessive loss. Recourse is therefore had to feeders or reinforcing conductors. These may be of any form, but are most frequently copper wires or cables of large section, connected at intervals of a few hundred feet to the working-conductor. They are sometimes carried on poles, but municipal ordinances frequently require their installation in underground conduits. In general, it is customary to divide the working-conductor into sections of from 1000 to 5000 ft. in length, insulated from one another and fed separately through manual or automatic cut-out switches, so that an accident causing a short-circuit or break in continuity on one section will not impair the operation of others.

In ordinary street railway construction two methods of suspending the trolley wire are in vogue. The most usual construction is to hang it from insulators attached to transverse wires running between pairs of poles set on opposite sides of the track. Bracket arms attached to poles are often used, especially on suburban lines; they are frequently double, or T-shaped, and placed between the two tracks of a double-track line. In the standard construction for either variety of suspension, the insulators are bell-shaped, and composed of some hard moulded or vitreous material. The trolley wire is supported by a clamp about 9 in. long, which embraces about three-quarters of its circumference. This clamp is usually made of bronze, and is now generally fastened to the trolley wire by a screw, causing the two parts of the clamp to close upon the wire as would the jaws of a vice, or is automatic, clamping the wire the more tightly as the strain upon it increases. It was formerly considered expedient to solder the wire into the clamp, but this practice is now generally abandoned. The insulating bell is so designed that its material is subjected only to compression stresses by the weight of the wire. It is provided at its upper part with a single catch for attachment to the transverse wire or to the bracket arm. If a span wire is used it is fastened to the poles, there being turnbuckles to tighten it, while a strain insulator on either side gives a double insulation between the trolley wire and the poles. With a bracket construction it was formerly the custom to attach the insulator directly to the bracket arm, but the blow of the trolley wheel broke great numbers of insulators, and it has therefore become the practice to adopt some more flexible method of attachment, a number of different forms being in use. The poles between which the span wires are stretched, or to which the bracket arms are attached, are of wood or iron. They are firmly set in the ground, usually with concrete.

Catenary Construction.

Another form of overhead construction for high speed service, brought out by the Westinghouse Company and known as the "Catenary" system (fig. 6), is designed to hold the contact or trolley wire in a horizontal position above the track without any dip or sag. Essentially it is made up of a supporting cable made of stranded galvanized steel wire $\frac{7}{16}$ in. in diameter which is firmly fastened to brackets attached to the supporting poles and from which the trolley wire is suspended by means of rigid iron hangers spaced about 10 ft. apart. A proper sag is given the supporting cable, and the lengths of the hangers vary so that the trolley wire is held horizontal without sag. The construction resembles a single supporting cable and suspended chord of a suspension bridge. The trolley wire, the hangers and the suspension cable are all mechanically connected together and in metallic contact, so that the whole system acts as a conductor. The supporting cable is held by insulators at the points where it is supported on the brackets at the poles. For heavy work there the currents taken by the passing cars and locomotives are great, requiring a very large trolley wire, two supporting cables are strung from pole to pole and the trolley wire suspended below and between the two.

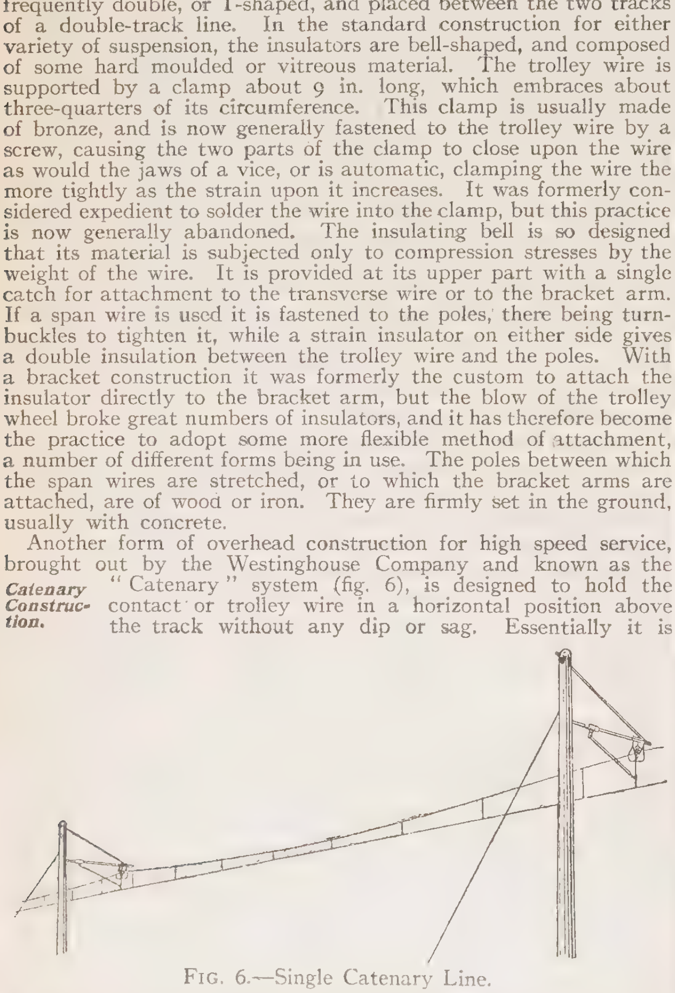


FIG. 6.—Single Catenary Line.

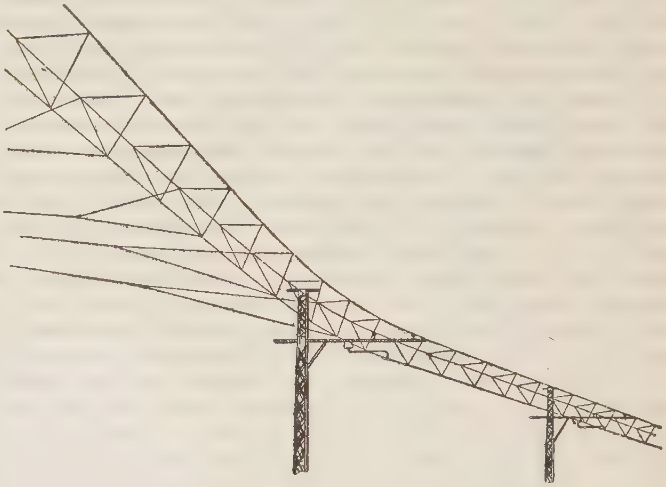


FIG. 7.—Double Catenary Line.

In this case the hangers are triangular in form and hung with the apex of the triangle downward. The two upper angles are fastened to the pair of supporting cables, while to the lower angle is attached the trolley wire. This arrangement is called the "double catenary" construction (fig. 7).

Rail Bonding.

In order to provide a proper return path for the current, the track must be made electrically continuous. This is accomplished by bonding the individual lengths of rail together in some way, or by actually welding them together to form a continuous length. There are many types of rail-bonding. In most of them holes are drilled in the ends of adjacent rails, and a copper conductor inserted between them, its ends being in some way forced against the walls of the holes. In one type the bond is in the form of a hollow cylinder, the ends of which are inserted in the holes in the rails, a tapered steel pin being driven in so as to expand the cylinder out against the rail. In another form the end of the bond is a solid cylinder, which is upset by hydraulic pressure, forcing it against the rail. A semi-plastic amalgam of mercury has been used to give a contact between the adjacent rails and the fish-plate connecting them. The most usual practice is to use a short bond covered and protected by the fish-plates. Tracks used for a return circuit are cross-bonded at intervals. If the track return has too great an electrical resistance it is reinforced by conductors connected to it at intervals and extending back to the power-house. Neglect to provide a proper return circuit has often caused a great loss of energy, and, in many places, excessive electrolytic action on iron pipes, cable sheaths and other metallic bodies buried in the earth. The lightning arresters provided on overhead lines are placed on the poles at intervals determined by the location of the line.

Double Trolley.

In a few places the municipal authorities, in order to avoid the disturbances on telephone lines due to the fluctuation of a trolley current, and the electrolysis of gas and water pipes which may arise from a grounded return, have required the erection of a double overhead system. In this each track has two trolley wires forming a complete metallic circuit. The largest system of this kind is in Cincinnati, Ohio, U.S.A., where there are over 225 m. of tram-lines. The system has the advantages to which it owes its existence, but the multiplicity of wires at crossings, right-angle turnouts and switches is so complicated that automatic switching cannot be attempted. The man in charge of the car removes the double trolley from the wires at such points, and replaces it when they are passed. The construction adopted, except in respect to the points mentioned, is practically similar to that already described for the track-return system.

Open-slot Conduit.

A number of patents have been granted in various countries for electric traction systems in which one or both of the fixed conductors are installed in a conduit underground, communication being had with them by means of an open slot, into which projects a current-taking device of some nature carried by the car as it moves along. A system of this character was installed at Blackpool, England, in 1885, and later one was very successfully operated in Budapest. The first large and important installation of this character to be made was in Washington, D.C., U.S.A., where a considerable system of street railways was changed from horse operation to this new method. The success of this system, and of experiments made on Lenox Avenue, in New York City, led to the construction of many miles of railways of the conduit type in the latter city. It is also used extensively in London. (For details of the construction of the conduits, see TRAMWAY.) This system is much more expensive to install than the overhead trolley system, but experience has shown that it can be as economically operated. Most of the troubles that have occurred have been due to lack of experience, but on the whole they have not been more serious than those experienced with overhead systems.

Closed Conduit.

The great expense of the open conduit has led numerous inventors to bring out systems of operating electric railways by means of closed conduits or sectional third rails, in which the working-conductor is laid on the surface of the ground between the rails, and is connected with the source of current only as the car passes over each section. In this way the immediate section or portion of the working-conductor under the car is electrically active, but other sections are not, and all danger to the passage of street traffic is removed. Up to 1900, nearly one thousand patents for this type of street railway construction, known also as the "surface contact" system, had been granted by the United States patent office alone. So far the system has been introduced in but few places, but its performance has been more than promising, and it is thought that it will be more extensively adopted in the future. Among the more important railways at present equipped with it may be mentioned one in Paris, using the Diatto system, and one at Monte Carlo, where the Westinghouse system is installed. In both these the current is supplied by means of "buttons" or metallic disks laid flush with the surface of the street between the tracks, and connected through switches to a working-conductor. Under the car is installed a current-taking device in the shape of a long runner or skate, which runs over the buttons and is appropriately connected with a storage battery on the car, so that when it touches one of the buttons current is sent from the battery through a system of electro-magnets operating the switches which connect that particular button to the feeding system, and thus the runners are enabled to receive current for the operation of the motors on the car. The various systems differ in the method of connecting the contact rail or button with the live conductors; in some a magnet on the car works a mechanism to make the desired contact, in others a current from batteries on the car actuates a switch located near the track. (See TRAMWAY.)

Third-rail System.

The third-rail system, which is a development of the overhead trolley and track-return system, has been applied to several large and important railway installations, especially in the United States, and in the prolongation of the Orleans railway in Paris from the Place Valhubert to the new station at the Quai d'Orsay. Its name almost sufficiently indicates its method of operation. A rail similar to the track-rails is laid upon insulators and forms the working-conductor. On the elevated railways in New York, Brooklyn, Boston and Chicago and the subway in New York, a pressure of about 600 volts is used between this rail and the track-rails which form the return circuit. Contact is made with the third rail by means of a bronze or cast-iron shoe, either resting upon the rail by its own weight, or pressed down upon it by springs. This is generally attached to some part of the truck of the car in preference to any part of the body of the car, so as to avoid any vibration or swaying due to the movement of the body upon its springs. The third-rail system has been adopted in many instances where large and powerful trains are to be operated on private rights of way, but it is nowhere in use for electric traction upon highways or in streets where there is any passing of foot passengers or vehicles. An excellent example of such construction may be found in the Albany & Hudson railroad, which connects the city of Albany with the city of Hudson, in New York state. Here the length of the road is about 32 m., the track being of standard gauge and laid with a 60-℔ T-rail. A T-rail of the same size, raised about 1 ft. above the level of the running-rails, is used for the electrical conductor, and is installed on insulators situated 5 ft. apart on the ends of the cross-ties. All these rails are well bonded with copper bonds at the joints. At road crossings, which on this railroad are at grade, the third rail is omitted for a distance nearly equal to the length of a train. Appropriate cast-iron shoes, fixed to the trucks of the front and rear cars of a train, bridge the space, so that the forward shoes are running on the rail past the break before the rear shoes leave it. Upon this railroad motors of considerable size and power are used, and both passengers and freight in their original cars, as received from connecting steam railways, are transported. Other examples of third-rail construction occur in the extension of the Baltimore & Ohio railway tunnel at Baltimore, the New York Central Railway Company's New York terminal, the underground systems of the City & South London railway, the Waterloo & City railway, and the Central London railway in London, and the Versailles division of the Western railway of France. In some cases, as on the Metropolitan, the District, and several of the "tube" railways in London, the running-rails are not used for the return circuit, which is completed by a fourth rail similar to the conductor rail, laid outside the track.

Accumulators.

One of the oldest forms of electric traction is by accumulators. In brief, its principle is that storage batteries, or accumulators, are carried on the car, which becomes a veritable automobile. It has been the usual practice to instal about 80 cells, giving a pressure of 160 to 175 volts at the motors; these are recharged after the car has run about 25 m. In general, the accumulators are not charged in place, but the car is supplied with a new set, fully charged, at the end of a run of about the length mentioned. The system has been installed in a very large number of places in Europe and America, but has never shown the gratifying commercial success which the direct-conduction systems exhibit, on account of the high cost and depreciation of storage batteries. In some places, notably in Hanover, Germany, where legislative ordinances have forbidden the overhead conducting system in city streets, a combination has been used whereby accumulator cars run in the city districts from the energy stored in their batteries, and in the suburbs operate directly as overhead trolley cars, the batteries being charged at the same time from the overhead system.

Polyphase.

Alternating Current Systems.—Alternating current systems are now being used, both single-phase and three-phase. In the former case the newly-developed single-phase motors, later to be described, are employed, while with three-phase systems induction motors are used. The polyphase current is much used as a means of distributing energy from a central power-station over extended lines of railways, but is generally converted into direct current through the agency of rotary converters, and fed to the lines as such. There are, however, a few railways working directly with induction motors upon a three-phase system of supply. Prominent among these may be mentioned the Valtellina railway in Italy and the Jungfrau railway in Switzerland. Upon these lines the rails are used as one of the three conductors, and two trolley wires are suspended above the track. The locomotive is provided with two trolleys, one running upon each wire, and consists simply of an induction motor coupled through appropriate gearing to the mechanism of the truck. For starting a large resistance is introduced into the rotor or secondary circuit of the motors by means of collecting rings placed on its shaft, upon which bear brushes. This resistance is cut out as the speed increases, until it is all withdrawn and the rotor is short-circuited, when full speed is attained. It has been found that potential differences of about 500 volts in each phase can be safely handled, and it is claimed that the few railways which use polyphase currents have shown gratifying results in practice.

Single-phase.

In the early years of the 20th century single-phase alternating current motors for electric traction were developed, and single-phase systems were extensively installed both in Europe and in America. The simplest type of single-phase motor is a series motor provided with the usual commutator and brushes, in which the current passes through both the field coils and the armature coils. The armature and field windings being traversed by the same current, the reversal of the field magnetization and that of the direction of current flow in the armature are coincident, so that the turning effort or torque, on the armature current produced by the interaction of armature and field magnetization is always in the same direction. Since the alternating current passes through both members of the motor, the armature and field cores are both laminated. In the later types of these motors the field coils are distributed and embedded in the field ring, so that the inner surface of the field ring presents a practically smooth surface to the armature. Troubles were at first experienced with commutation of the heavy alternating currents required for the operation of these motors, vicious sparking taking place at the brushes. This was overcome by the use of auxiliary or "compensating" coils, which are embedded in the field magnet ring, being placed between successive magnet coils. These compensating coils are usually connected in series with the main armature and field circuit. They may each, however, have their two ends joined together, (short-circuited), the currents in them being induced by the alternating magnetic flux of the fields.

Motors of the above types have the general characteristics of direct current series motors, and possess the same general relations between speed and torque that are such an important element in the success of direct current series motors. The efficiency of alternating current motors is not quite so good as that of direct current motors, on account of the rapid reversal of the iron magnetization in the field magnets, but their efficiency is high and their performance in practical work has been excellent (fig. 8).

There is another type of single-phase motor that has been used in Europe, but not in America, which is commonly called the repulsion motor. In these motors the armature is not directly included in the main circuit, but opposite points on the commutator are connected together through brushes. The working current is fed to the field magnets, and the rapid reversals of magnetization induce currents in the armature coils, which currents, working with the field magnetization, cause rotation. Several types of repulsion motors have been developed, and in general their characteristics are similar to those of the plain series type. They have not, however, come into extended commercial use. Single-phase motors for a given power are much larger, heavier and more expensive than the ordinary direct current motors, owing to the low magnetic densities at which the iron is worked. The power factor is between 0·75 and 0·85.

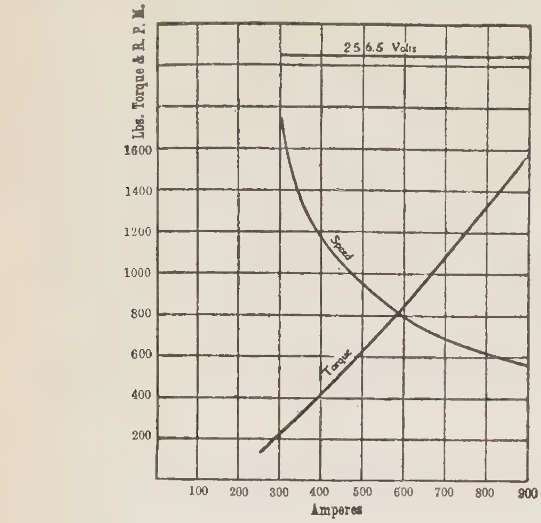


FIG. 8.—Characteristics of Series Single-phase Motor.

The advantages of the single-phase alternating system lie in the fact that it combines the simplicity of the overhead direct current construction with the possibility of exceedingly high voltage. Where heavy traffic is to be handled, and especially where that traffic is scattered, a direct current system, which up to the present has been limited in its voltage, is not commercially possible, as the amount of copper used for distribution and the excessive amount of apparatus required to convert high tension alternating current into low tension direct current, would make the cost prohibitive. In direct current systems for lines of any length, it is the custom to use alternating current of high potential and to reduce it to direct current of low potential at different points along the line. This involves rotary converters, which by their nature require attendance in the sub-stations, while if the traffic is scattered so that the load on the sub-stations may at times be zero, and at other times may be very large, the capacity of the sub-stations must be equal to handling a maximum load, so that the total capacity of each sub-station would be based on the maximum instead of on an average condition. With the single-phase alternating current system, on the contrary, only static transformers in sub-stations along the line are required, and with the high voltages available (voltages as high as 11,000 volts are used at present) the distances between these sub-stations can be greatly increased as compared with the direct current sub-stations, so that each sub-station feeding a much longer portion of the line would have a better average load than in the direct current case. The static transformers do not require attendance, and their efficiency is much higher than that of the rotary converters.

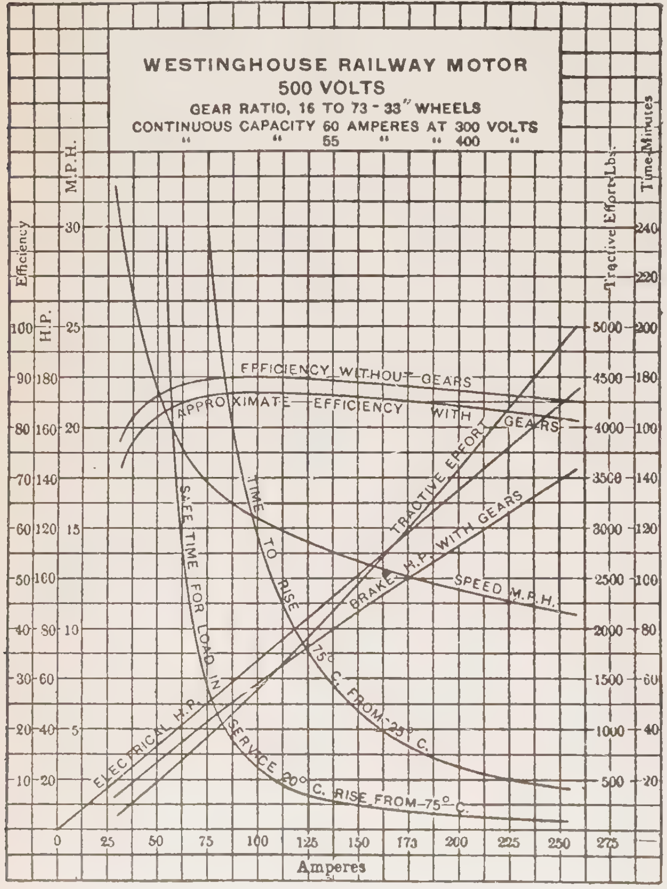


FIG. 9.

Motors. Electric motors for traction purposes have been highly elaborated and developed. At first they drove the car axles through belts or sprocket chains, the motor being sometimes attached to the car, sometimes to the truck. At Richmond, however, in 1887, the Sprague method of communicating the power from the motor axle to the car axle was put into practical operation, and this has with slight modifications been retained. It consists of sleeving one end of the motor on the axle, suspending the other flexibly from the car body or truck, and driving from the armature through spur gearing. At first the motors were too small for the work demanded of them. Their high speed required a double reduction in gearing, their overheating caused continual burn-outs, and the sparking at the commutators necessitated constant repairs. These defects were gradually eliminated. The motors were made larger, the quality of the iron and insulation was greatly improved, and finally a four-pole motor requiring only a single-speed reduction by spur-gearing was produced. Since that time further improvements in material and design have been introduced, and the present motor has been evolved. Almost all the standard modern traction motors are of the same general design. They are series wound, *i.e.* the same current passes through both the armature and the fields. This gives a strong starting torque or tractive effort, the torque diminishing as the speed increases. This characteristic is particularly suitable for traction. Fig. 9 shows the relation between speed and tractive effort of a standard railway motor of large size and power. The armature is built up of carefully tested iron disks, which are deeply slotted to make room for the coils. These are wound and insulated separately, and placed in the slots in the armature core; sometimes they are held in place by binding wire, sometimes by wedges. The commutator is put in place, the coil connexions soldered to it, and the proper end-coverings put on. The magnet frame is made in two parts, of cast steel, enclosing the entire armature. A lid in the top casting gives access to the brushes, which are of carbon. The field coils are wound on forms and properly insulated. When in operation it is practically water

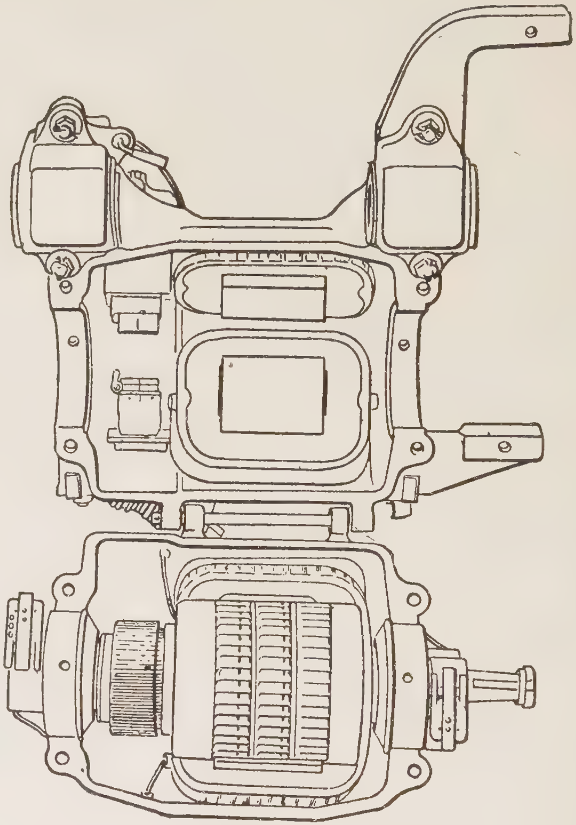


FIG. 10.—Standard Railway Motor.

and dust proof, and with proper attention is a very durable piece of machinery (fig. 10). Although the standard design of motors is at present based on a single-reduction gearing, there are in operation traction-motors which are not geared.

On the locomotives used on the New York Central, the New York, New Haven & Hartford, and the Baltimore & Ohio railways in America, the City & South London railway in England, the armatures surround the driving axles. In all the cases mentioned, except the Baltimore & Ohio railway, the armatures are set directly on and solid with the axles of the driving-wheels, while on the Baltimore & Ohio locomotives the motors are sleeved on the axles, there being a slight play between the sleeve and the axle, which allows a flexible support. The wheels are driven by arms projecting from the armature shaft.

There is no fixed method of rating the output of traction-motors. Most manufacturers, in giving a certain horse-power capacity, mean that at the given rating the motor will run an hour with a rise in temperature of a certain number of degrees, not that it can be run continuously at the power given. Another system of rating depends on the draw-bar pull which the motor can develop under normal conditions of voltage and speed. Uniformity is greatly needed.

Controllers.

One of the most important parts of the equipment of an electric car or locomotive is the controlling device. In the early days of electric traction a number of different methods of regulating the speeds of the cars were used, but they have been reduced to practically one standard method. In the old Sprague system there were at first no resistances outside of the motors themselves, but the field coils of the motors were divided into sections, and by changing the relative connexions of these sections the total resistance of the circuit could be changed; at the same time the strength of the field for a given total current was either increased or decreased. In other systems the fields and armatures of the motors were not changed in their relation to one another, but external resistances were cut out and in by the controller. Usually there are two motors on each car, and it is evident that if the speed of a car be changed within wide limits, all the other factors remaining constant, there will be a very considerable loss by either of these methods of regulating, unless the relative connexions of the motor armatures can be changed. This can be done by putting the two motors in series where low speed is desired, and in parallel where the speed is to be increased. This method was tried in the early days of electric traction at Richmond, and discarded, but it has been again taken up, and is now the standard method of regulation in ordinary tramway work. Roughly speaking, when the car is started the controller connects the two motors in series with an external resistance, then cuts out the external resistance, then breaks the circuit, then connects the two motors in parallel. The external resistance is put again in series with them, and then is gradually cut out as the car speed increases. By this method a considerable range of speed is attained at a fair efficiency. The controller (fig. 11) consists of a cylinder having on it a number of copper segments so arranged that on rotating it different connexions are made between stationary fingers that bear on these segments. In the first types much difficulty was experienced from the burning of the segments and fingers, due to the sparking on breaking the circuit, but this has been to a large extent obviated by using magnetic blow-outs at the point of break. (A magnetic blow-out is simply a magnet so arranged that the arc caused by breaking the circuit takes place in the magnetic field.) There is a reversing lever on the controllers separate from the controller handle, and interlocking with the controller so that the reverse lever may not be moved except when the controller is in the "off" position.

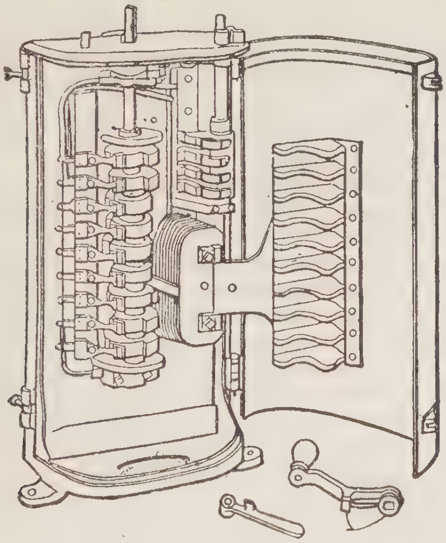


FIG. 11.—Controller (open).

When it is desired to run trains of cars and to accelerate them rapidly, it is sometimes necessary to have more than one car equipped with motors. In this case all the motors must be controlled from one point, and a number of ingenious devices have been evolved to accomplish such "multiple control." In general, each car has its own controller, and all the controllers are operated by electric power from switches on each platform of any of the motor cars.

Regenerative Control.

A motor and controlling system designed to save and utilize the power produced by a car running down an incline has been developed and is termed the "regenerative system." A car running over a line having heavy grades must have sufficient energy given to it to overcome its frictional resistance to motion and also to lift the weight of car and load from the bottom to top of each up-grade. On the return trip, the car "coasts" or runs down the grade without the consumption of current, but is restrained from attaining too high a speed by the brakes, thus wasting the energy existing by reason of the position of the car.

With the regenerative system the motors are caused to act as dynamos which are driven by the motion of the car axles when descending a grade, and, as they are connected to the line by the trolley or contacting device, the current thus generated is fed to the line and may assist other cars climbing grades at some other point on the system. The delivery of electrical energy also puts a resistance on the car axles and produces a braking effect which almost automatically fixes the car speed. If the speed be too high, the excessive current generated will tend to retard the car and reduce its velocity, while if too low the small current produced will set up but little opposition to motion and the car will accelerate.

Obviously, series motors cannot be used for this service. The motors have shunt fields, and their speed is varied by varying the field strength. Motors of this type are larger, more costly and slightly less efficient than series machines, so that a regenerative system has no place on roads that have a fairly level contour. When, however, the grades are frequent and excessive, the power saved more than counterbalances these factors, and the system may prove a valuable one for such service.

Brakes.

For tramcars of ordinary sizes hand-brakes are used, these being generally spindle brakes with leverage enough to handle the comparatively heavy cars. When the size and speed of the car increases, however, these hand-brakes do not give sufficient control, and power brakes have to be adopted. Of these there are several forms that have proved successful in practice. The one most extensively used in electric railways is the air-brake, which is similar in its mechanical operation to the air-brake used on steam railways. The compressed air required for the operation of the brake is obtained by means of an air-pump driven by an electric motor, the circuit of which is controlled by a switch actuated by the pressure of the air in the receiving tank. When this pressure rises to a predetermined value, the device acts and interrupts the supply of current to the motor, which is thus stopped. When the pressure falls below a determined minimum the device operates in the opposite direction, and the motor and pump start. Of electric brakes there are several varieties. One type consists of two iron disks, one keyed on the axle but capable of moving along it a short distance axially, and the other held firmly on the frame of the truck. By means of a coil, set in a recess of annular form turned in the face of the fixed disk, the disks are magnetized transversely, and are drawn together with greater or less pressure, dependent on the amount of current that is allowed to pass through the coil. It is customary to arrange the current connexions in this form of electric brake so that when the handle of the controller is turned beyond the stopping position the current is cut off from the source of supply, and the motor running as a dynamo furnishes the current to work the brake.

The magnetic track-brake, which is sometimes used on tramway cars, consists of a pair of steel shoes, suspended from the truck frame and hanging near and over the rail, a steel yoke connecting the two shoes together. On this yoke is wound a heavy magnetizing coil which, when energized, strongly magnetizes the two steel shoes and causes them to draw against and adhere to the track. Bracing links connect these track shoes with brake shoes on the wheel rims, and the drag of the track shoes thus applies pressure also to the wheel shoes. The downward pull of the track shoes gives a greater pressure of the wheels against the track than that due to the weight of the car, and the sliding or "skidding" of wheels, with the consequent production of flats, is avoided. A further braking effect comes from the use of the motors as dynamos, driven by the motion of the car, to supply current to the brake magnetizing coils. This therefore is one of the most effective brakes that has been devised. It has, however, not been very extensively used owing to its high cost and difficulties that arise from the track shoes running so close to the rails that any uneven places—frogs, switches, crossings and the like—may rub against them and give a braking effect at times when the car is accelerating or running. A pair of shoes is applied on both sides of the car, one pair being hung over either rail.

Another method of braking is by arranging the connexions of the two motors so that one acts as a dynamo driven by the motion of the car and supplies current to the other, which works as a motor, tending to turn the wheels in the direction opposite to that in which the car is moving. The production of current by the one motor and the reverse effort of the other give a powerful braking effect. The proper connexions are made by constructing the controllers with contacts additional to those required for motor control, which connect the machines in the desired manner when the controller handle is moved round past the "off" position.

Automatic brakes are always preferable to hand-brakes even though they cost much more, because the energy required to propel an ordinary tramcar is from 10 to 25 % more with hand than with automatic brakes. The cause is the constant pressure of the brake shoes of a hand brake against the wheel rims, the shoes being so held by the operator to avoid having too long a hand movement in applying the brake. The maximum pressure possible for any brake should be about 90 % of the weight of the car on the braked wheels. Less than this amount will give an inefficient brake; more will produce sliding or "skidding" of the wheels, producing "flats" on them, and also causing loss of retarding effect.

Accessories.

Of the numerous accessories necessary in the operation of electric railways one of the most important is the trolley. For an overhead system this consists in general of a metallic rod or tube mounted upon the top of the car and pressed upward against the trolley wire by springs. At the upper end of this trolley pole is generally placed a bronze wheel which runs along the under surface of the wire. On the continent of Europe considerable use has been made of bow-trolleys, which consist of light metallic bow-shaped structures, sustained in place by springs and running along on the under side of the wire against which they rub. The designs patented for trolleys are almost innumerable. Besides the trolleys, cars are ordinarily equipped with switches which are used to break the trolley circuit, with fuses or automatic circuit-breakers, with electric lamps, with lightning arresters, and with the necessary car wiring. The fuses or automatic circuit-breakers guard against an excess of current being passed through the motors, and when they are fitted the ordinary platform switch can be dispensed with. These automatic breakers can be set for any desired current.

Generation of Current.

The question of the generation and the distribution of the current belongs to this article only in so far as electric traction has introduced peculiarities in the type of apparatus or the methods of its use. In a continuous current station the current is generated at an approximately constant potential, varying from 500 volts to 700 volts on different systems. As the load is apt to fluctuate, except in large stations, within wide limits, the machinery must be designed to stand the most severe usage. The engines are more massive than would be necessary for constant loads, and the dynamos must be built to stand sudden overloads without destructive sparking; usually, indeed, they are considerably over-compounded, not so much for the sake of raising the voltage as to strengthen the field and prevent sparking on overload. When a number of machines are to be run in parallel—as is usually the case—they are provided with "equalizing" switches, which serve to throw the series fields in parallel. As a result, if one of the machines tends to increase its armature current beyond the proper amount, the current in the series fields does not increase with it, but retains its normal proportion. The armature reaction and resistance fall of potential, in this machine, would both tend to increase, thereby decreasing its armature potential, and therefore its current would return to its proper value. From the dynamos the current from each machine goes through an ammeter and automatic circuit-breaker to the main "omnibus" bars, then through the station ammeter to the feeder "omnibus" bars, then through ammeters and circuit-breakers to the feed-cables. As a rule, watt-meters are provided to measure the output of the station, and, if an overhead system is being supplied, lightning arresters are installed. Where continuous currents are used to operate cars at considerable distances from the generating stations, "boosters" are used. These are series-wound dynamos driven at a constant speed, through which is passed the current that is to feed the distant section of the line. Usually the characteristic of the booster is so calculated that the amount by which it raises the voltage for a given current just equals the fall of potential in the feeding-line for the same current. The result is that the potential at the end of the line will be the same as that at the station. The question of economy, as between putting in additional copper and wasting energy in the booster, is easily calculated; the advantage is more and more on the side of the latter as the distance increases and the car service becomes more infrequent. It is necessary to the satisfactory operation of a system that the variations of voltage should not be too great, so boosters sometimes become a practical necessity, irrespective of the question of economy.

Accumulators are frequently installed in power stations to prevent the heavy load fluctuations which arise from starting and stopping of cars and ascending or descending grades. The generators give an approximately unvarying amount of current. When the load demand is less than that delivered by the generators, the excess current goes into the storage battery, and when the load is greater than the power from the generators the additional current required comes from the battery. The generators, engines and boilers may thus be proportioned for the average instead of the maximum load requirements, and the sizes of these units are thereby reduced.

As traction systems have been combined and extended, the area of operation of many of the companies has grown so that a number of direct-current stations are used for a single system. The limit of distance to which electric energy can be economically supplied at the comparatively low voltages employed is not great, and the advantage of having one or two large stations to supply a system, in place of a number of smaller ones, is evident. This fact has led to the use of high-potential alternating currents for the distribution of energy, the voltage being reduced at the points of consumption, and in most cases changed to a continuous current by rotary converters. If alternating currents are used for the car motors, the economical distribution of energy is greatly simplified, the rotary converters being eliminated and their first cost and losses and expense of operation saved. The expense of operating sub-stations containing rotary converters is necessarily large, and the capital outlay required for them is often greater than for the generating station.

Cars.

As a rule, the cars used for electric traction have varied but slightly from the type of tramway car prevalent in different localities. The tendency, however, has been to increase their size. For electric railway work, as distinguished from tramway work, the cars generally follow the pattern that is standard on American steam lines. The trucks used for electric cars are made of steel, with heavy axles and suspension bars for carrying the electric motors. For smaller vehicles, a single four-wheel truck is used, the wheel base being limited by the curvature of the track, but not as a rule exceeding $7\frac{1}{2}$ ft. For the longer and heavier cars, two four-wheeled bogie trucks are employed. If two motors are used on a double-truck car, and if the grades on the road are very heavy, the trucks are made on the "maximum traction" pattern, in which one pair of wheels in each truck is of smaller diameter than the other and the greater part of the weight of the car is on the larger motor-driven wheels. For very large high-speed cars, trucks are used of practically the same type and weight as are employed on steam railways. (See also TRAMWAY.) (L. DU.)

TRACY, ANTOINE LOUIS CLAUDE DESTUTT, COMTE DE (1754–1836), French philosopher, son of a distinguished soldier, was born in Bourbonnais on the 20th of July 1754. He belonged to a noble family of Scotch descent, tracing its origin to Walter Stutt, who in 1420 accompanied the earls of Buchan and Douglas to the court of France, and whose family afterwards rose to be counts of Tracy. He was educated at home and at the university of Strassburg, where he was chiefly noted for his athletic skill. He went into the army, and when the Revolution broke took an active part in the provincial assembly of Bourbonnais. He was elected a deputy of the nobility to the states-general, where he sat alongside of his friend La Fayette. In the spring of 1792 he received the rank of *maréchal de camp* in command of the cavalry in the army of the north; but the influence of the extremists becoming predominant he took indefinite leave of absence, and settled at Auteuil, where, with Condorcet and Cabanis, he devoted himself to scientific studies. Under the Reign of Terror he was arrested and imprisoned for nearly a year, during which he studied Condillac and Locke, and abandoned the natural sciences for philosophy. On the motion of Cabanis he was named associate of the Institute in the class of the moral and political sciences. He soon began to attract attention by the *mémoires* which he read before his colleagues—papers which formed the first draft of his comprehensive work on ideology. The society of "ideologists" at Auteuil embraced, besides Cabanis and Tracy, Constantin François de Chassebœuf, Comte de Volney and Dominique Joseph Garat (1749–1833), professor in the National Institute. Under the empire he was a member of the senate, but took little part in its deliberations. Under the Restoration he became a peer of France, but protested against the reactionary spirit of the government, and remained in opposition. In 1808 he was elected a member of the French Academy in place of Cabanis, and in 1832 he was also named a member of the Academy of Moral Sciences on its reorganization. He appeared, however, only once at its conferences, owing to his age and to disappointment at the comparative failure of his work. He died at Paris on the 9th of March 1836.

Destutt de Tracy was the last eminent representative of the sensualistic school which Condillac (*q.v.*) founded in France upon a one-sided interpretation of Locke. He pushed the sensualistic principles of Condillac to their last consequences, being in full agreement with the materialistic views of Cabanis, though the attention of the latter was devoted more to the physiological, that of Tracy to the psychological or "ideological" side of man. His ideology, he frankly stated, formed "a part of zoology," or, as we should say, of biology. To think is to feel. The four faculties into which he divides the conscious life—perception, memory, judgment, will—are all varieties of sensation. Perception is sensation caused by a present affection of the external extremities of the nerves; memory is sensation caused, in the absence of present excitation, by dispositions of the nerves which are the result of past experiences; judgment is the perception of relations between sensations, and is itself a species of sensation, because if we are aware of the sensations we must be aware also of the relations between them; will he identifies with the feeling of desire, and therefore includes it as a variety of sensation. It is easy to see that such conclusions ignore important distinctions, and are, indeed, to a large extent an abuse of language. As a psychologist de Tracy deserves credit for his distinction between active and passive touch, which developed into the theory of the muscular sense. His account of the notion of external existence, as derived, not from pure sensation, but from the experience of action on the one hand and resistance on the other, may be compared with the account of Bain and later psychologists.

His chief works are *Eléments d'idéologie* (1817–1818; 2nd ed., 1824–1825), in which he presented the complete statement of his earlier monographs; *Commentaire sur l'esprit des lois de Montesquieu* (1806; 5th ed., 1828; Eng. trans., President Jefferson, 1811); *Essai sur le génie et les ouvrages de Montesquieu* (1808). See histories of philosophy, especially F. Picavet, *Les Idéologues* chs. v. and vi. (Paris, 1891), and *La Philosophie de Biran* (Académie des sci. mor. et pol., 1889); G. H. Lewes, *Hist. of Phil.*

TRACY, BENJAMIN FRANKLIN (1830–), American lawyer and soldier, was born in Owego, New York, on the 26th of April 1830. He was educated at the Owego academy, was admitted to the bar in 1851, was district-attorney of Tioga county in 1853–1859, and was a member of the state Assembly in 1862. In 1862 he organized the 109th and the 137th regiments of New York Volunteer Infantry and (Aug. 28) was made colonel of the former. In September 1864 he became colonel of the 127th United States Colored Infantry; in 1864–1865 was in command of the prison camp at Elmira, New York, and in March 1865 was breveted brigadier-general of volunteers. He received a Congressional medal of honour in 1895 for gallantry at the Wilderness in May 1864. He was United States district-attorney for the eastern district of New York in 1866–1873, and an associate judge of the New York court of appeals in 1881–1882. In 1889–1893 he was secretary of the navy in the cabinet of President Benjamin Harrison, and then resumed the practice of law in New York City. He was chairman of the commission which drafted the charter for Greater New York, and in 1897 was defeated as Republican candidate for mayor of the city. In 1899 he was counsel for Venezuela before the Anglo-Venezuelan boundary arbitration commission in Paris.

TRADE (O. Eng. *trod*, footstep, from *tredan*, to tread; in M. Eng. the forms *tred*, *trod* and *trade* appear, the last in the sense of a beaten track), originally a term meaning track or course, and so surviving in "trade-wind" (*q.v.*), a wind which always blows in one course; hence a way of life, business or occupation, and, specifically, the handicraft in which a man has been trained and which he makes his means of livelihood, or the mercantile business which he carries on for profit, as opposed to the liberal arts or professions. A further development of meaning makes the word synonymous with commerce, comprehending every species of exchange or dealing in commodities.

See COMMERCE; BALANCE OF TRADE; FREE TRADE; PROTECTION; TARIFFS; TRADE ORGANIZATION; and also the sections dealing with trade and commerce under the various countries.

TRADE, BOARD OF. The greater part of such supervision of commerce and industry as exists in the United Kingdom is exercised by the "Committee of Privy Council for Trade" or, as it is usually called, the board of trade. As early as the 14th century councils and commissions had been formed from time to time to advise parliament in matters of trade, but it was not till the middle of the 17th century, under the Commonwealth, that any department of a permanent character was attempted. Cromwell's policy in this respect was continued under the Restoration, and in 1660 a committee of the privy council was appointed for the purpose of obtaining information as to the imports and exports of the country and improving trade. A few years later another committee of the council was appointed to act as intermediaries between the crown and the colonies, or foreign plantations, as they were then called. This joint commission of trade and plantations was abolished in 1675, and it was not until twenty years later that it was revived under William III. Among the chief objects set before this board were the inquiry into trade obstacles and the employment of the poor; the state of the silver currency was also a subject on which John Locke, its secretary, lost no time in making representations to the government. Locke's retirement in 1700 removed any chance of the board of trade advocating more enlightened opinions on commercial subjects than those generally held. It had only a small share in making the constitutions of the American colonies, as only the Carolinas, Pennsylvania, Georgia and Nova Scotia were formed after the reign of Charles II.; and in 1760 a secretary of state for the colonies was appointed, to whom the control drifted away. In 1780 Burke made his celebrated attack on the public offices, which resulted in the abolition of the board. In 1786, however, another permanent committee of the privy council was formed by order in council, and with one or two small exceptions the legal constitution of the board of trade is still regulated by that order. Under it all the principal officers of state, including the first lords of the treasury and admiralty, the secretaries of state, and certain members of the privy council, among whom was the archbishop of Canterbury, obtained seats at the board *ex officio*; and ten unofficial members, including several eminent statesmen, were also placed on the committee. The duties of the revived board were made the same as they were in the beginning of the century, but the growth of commerce necessarily threw new administrative duties upon it. The board of trade thus became a mere name, the president being practically the secretary of state for trade, and the vice-president became, in 1867, a parliamentary secretary, with similar duties to those of a parliamentary under-secretary of state. At present, besides the president, who has usually a seat in the cabinet,[1] and whose salary is £5000 a year, there is a parliamentary secretary with a salary of £1200, a permanent secretary (salary £1500, rising to £1800), and four assistant secretaries (each with a salary of £1200) for the harbour, marine, commercial, labour and statistical, and railway departments. There are also other important officials in charge of different departments, as mentioned below.

1. *The Commercial, Labour and Statistical Department* is the real remains of the original board of trade, as it combines the charge of the trade statistics with the general consultative duties with which King Charles II.'s board was originally entrusted. The statistical work includes compiling abstracts, memoranda, tables and charts relating to the trade and industrial conditions of the United Kingdom, the colonies and foreign countries, the supervision of the trade accounts, the preparation of monthly and annual accounts of shipping and navigation, statistics as to labour, cotton, emigration and foreign and colonial customs, tariffs and regulations. The commercial intelligence department collects and disseminates accurate information on general commercial questions, and collects and exhibits samples of goods of foreign origin competing with similar British goods. It keeps a register of British firms who may desire to receive confidential information relative to their respective trades and supplies that information free of charge. The labour statistics published by the department are exhaustive, dealing with hours of labour, the state of the labour market, the condition of the working classes and the prices of commodities; annual reports are also

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[1] Since 1882 there have been only two occasions on which the president of the board was not included in the cabinet. Frequent suggestions were made as to raising the status and salary of the president of the board, which up to 1900 was £2000. Lord Jersey's committee in 1904 suggested that the president should be put on the same footing as a secretary of state, and be given the title of "minister of commerce and industry." In 1909 the Board of Trade Act repealed the Board of Trade (President) Act 1826, which limited the salary of the president, and enacted that the president should be paid such annual salary as parliament might determine (£5000). The increased salary came into operation in 1910, when a new president of the board came into office.

published of trade unions, of strikes and lock-outs and other important subjects. The staff comprises a controller-general (salary £1200 rising to £1500), a deputy controller-general and labour commissioner, a principal for statistics, a principal of the commercial department, an assistant labour commissioner, a chief staff officer for commercial intelligence, a chief labour correspondent, a special inquiry officer, and a staff of investigators and labour correspondents. The department also edits the *Board of Trade Journal* (started in 1886), giving items of commercial information, trade and tariff notices and various periodical returns. There are also branches which deal with the census of production, labour exchanges, &c.

2. *The Railway Department* was originally constituted in 1840, and performs multifarious duties under various railway acts, including the inspection of railways before they are open, inquiries into accidents, reports on proposed railways, approval of by-laws, appointment of arbitrators in disputes, as well as many duties under private railway acts. The inspection of tramways, their by-laws and "provisional orders" are all dealt with here, as are similar orders relating to gas and water schemes and to electric lighting. There is a special office of inspection of railways with a chief inspecting officer (salary £1400) and an assistant staff. Patents, designs and trade marks are now dealt with by the patent office under the charge of a controller-general (salary £1800), which is subordinate to the railway department, and copyright, art unions and industrial exhibitions are also among the matters dealt with by the department. Annual returns with regard to its business are published by the department.

3. *The Marine Department* was created a separate branch of the board of trade in 1850, about which time many new and important marine questions came under the board of trade, such, for example, as the survey of passenger steamers, the compulsory examination of masters and mates, the establishment of shipping offices for the engagement and discharge of seamen. Further work fell to the marine department by the act of 1853, which gave it the control of lighthouse funds, and to a certain extent of pilotage. The consolidating Merchant Shipping Act of 1854 and subsequent legislation so much increased the department that in 1866 it was divided into three, viz. the present marine department, which deals with ships and seamen, the harbour department and the finance department.

4. *The Harbour Department* was, as stated above, a branch of the marine department until 1866, so far as it is connected with the physical adjuncts of navigation, but various other matters have since been added, *e.g.* the charge of the foreshores belonging to the crown, formerly managed by the commissioners of woods and forests, and the protection of navigable harbours and channels, long under the control of the admiralty, provisional orders under the General Pier and Harbour Acts and under the Pilotage Acts, and the settlement of by-laws made by harbour authorities. Control over the lighthouse funds of the lighthouse authorities of the United Kingdom, the registry of British ships, wreck, salvage and quarantine are all among the matters dealt with by this department, which also has charge of the standards department for weights and measures.

5. *The Finance Department* was, like the harbour department, separated in 1866 from the marine department. The accounts of all the branches of the board of trade are in its charge, including the subordinate offices. It also deals with the accounts of harbours, lighthouses and mercantile marine offices, and of the merchant seamen's fund, and with the consuls' accounts for disabled seamen abroad. Savings banks and seamen's money orders are also among the accounts and payments with which it is charged, and outside these marine matters it has to prepare for parliament the life insurance companies' accounts and to take charge of the bankruptcy estate accounts.

6. *The Bankruptcy Department* was established under the 71st section of the Bankruptcy Act 1883. At its head is the inspector-general in bankruptcy (salary £1200). An account of the duties of the department will be found under BANKRUPTCY.

7. *The Fisheries Department.*—By an act of 1886 the powers of the home office over salmon and other fisheries were transferred to the board of trade, and a small department was consequently created charged with the care of those industries. But by an act of 1903 (3 Ed. VII. c. 31) the powers and duties of the board of trade under this department were transferred to the board of agriculture and fisheries.

TRADE MARKS. A "trade mark" may be defined as a symbol, consisting in general of a picture, a label or a word or words, applied or attached to the goods of a trader for the purpose of distinguishing them from the similar goods of other traders, and of identifying them as his goods, or as those of his successors, in the business in which they are produced or put forward for sale. A trade mark differs in its legal character both from a patent and from a copyright. In the case of a trade mark the property and the right to protection are in the device or symbol adopted to designate the goods to be sold, and not in the article which is manufactured and sold. The article is open to the whole world to manufacture and sell, and all that the owner of the trade mark is entitled to prevent is such use of his mark by other traders as will lead purchasers to buy, as his, goods which are not his. On the other hand, patent-right and copyright protect the substance of the article; and any unauthorized manufacture of it in the former case, or reproduction of it in the latter, while the protection lasts, is prohibited. The grounds, however, on which trade marks, patent-right and copyright obtain legal recognition, though they are to a certain extent dissimilar, have a common element. Patent-right and copyright rest upon the view that the results of the original labour of the inventor and the author ought, as a matter alike of justice and of public policy, to be secured against piracy; while, as regards the proprietor of a trade mark, the question of originality does not arise so long as the mark is sufficiently distinctive really to identify his goods and, for purposes of registration, to satisfy the Trade Marks Acts. In truth, the registration of a trade mark is rather the recognition of a fact than the grant of a privilege (Kerly and Underhay, *Trade Marks Act*, 1905, p. 3). The law as to trade marks as well as that as to patents or copyright is based on a man's rights to have guaranteed to him the profit derivable from his own property. "No man," said James (L.J.), in the case of the *Singer Manufacturing Co.* v. *Loog* (1880, 18 Ch. D., 412), "is entitled to present his goods as being the goods of another man, and no man is permitted to use any mark, sign or symbol, device or means, whereby, without making a direct false representation himself to a purchaser from him, he enables such purchaser to tell a lie or to make a false representation to somebody else who is the ultimate customer."

I. *British Trade Marks before the Registration Acts.*—The existing law in the United Kingdom cannot be properly appreciated unless the subject is approached in the first instance from the historical side. English trade-mark law practically commences with the first years of the 19th century. The use of trade marks was indeed of far earlier date, for in 1742 we find Lord Hardwicke declaring that "every particular trader had some particular mark or stamp." But in the very case in which Lord Hardwicke made that statement (*Blanchard* v. *Hill*, 2 Atkyns, 484) he refused to protect the "Great Mogul" stamp on cards, being apparently under the influence of the notion that the legal recognition of trade marks would involve the creation of a new species of monopoly; and with regard to a case decided in the reign of James I. (*Southern* v. *How*, Cro. Jac. 471), in which a clothier had applied the mark of another clothier to his own inferior goods, the reports leave it doubtful whether the action was brought by the owner of the mark, or by a defrauded customer, in which latter event it would be merely an ordinary action for deceit. But although the actual law of trade marks cannot be traced farther back than the beginning of the 19th century, Lord Eldon repeatedly granted injunctions to restrain one trader from fraudulently "passing off" his goods as those of another, and thus laid a foundation on which the present law has been built up. The stages through which its development passed possess considerable interest, and may be described quite briefly. The first reported case—apart from the doubtful one in the time of James I. above referred to—in which the infringement of a trade mark (a label on blacking) was restrained by the court of chancery was *Day* v. *Day* (Eden on *Injunctions*, ed. 1821, p. 314) in 1816. In 1824 the common law courts, in the case of *Sykes* v. *Sykes* (3 B. & C. 541), established the right of the owner of an infringed trade mark to damages. In 1833 it was held by the court of king's bench that it was not necessary for the plaintiff in an infringement action to prove that the defendant's goods were inferior to his, or that he had suffered special damage by the infringement.[1] Later this became a rule of equity as well as of law. On another point, however, the practice of the courts of common law and equity diverged for a time. It was decided by Lord Cottenham in 1838, in the leading case of *Millington* v. *Fox* (3 Mylne & Craig 338), that an injunction to restrain the infringement of a trade mark could be obtained, even although the defendant had acted without fraudulent intent. On the common law side, on the other hand, fraud was an essential ingredient in the cause of action, and remained so till the fusion of law and equity by the Judicature Acts.

The effect of Lord Cottenham's decision in the case of *Millington* v. *Fox* clearly was to recognize a right of property in trade marks, and the action for infringement became a familiar species of litigation. Under the then existing law, however, the plaintiff in such actions generally found himself in a very disadvantageous and unsatisfactory position. The basis of his action was the reputed association between his trade mark and his goods. This association the defendant—often a person of no means—would deny, and it had to be proved as a fact by witnesses at a cost to the plaintiff which there was little hope of his recovering. Moreover, even if the trade mark proprietor secured a judgment in his favour, it carried with it no immunity from the obligation of again establishing his right to the mark against any subsequent infringer who chose to dispute it. Thus—to take an interesting and pertinent illustration given in *Kerly on Trade Marks* (p. 6)—the case of *Rodgers* v. *Nowill* (22 L. J. Ch. 404) lasted five years and cost the plaintiff £2211, without giving him in the end any security that he might not have to incur equal delay and expense in proving his title to the exclusive use of the trade mark in proceeding against other defendants. To complete this statement of the shortcomings of the law before the Merchandise Marks Act 1862, it should be noted that the infringement of trade marks—except in cases where the seller of spuriously marked goods cheated the buyer—was not a criminal offence. The remedies obviously needed were the establishment of a system of registration of trade marks which would simplify the proof of a plaintiff's title, and the creation of a criminal law of false marking.[1] The first step in the accomplishment of the latter object was taken by the Merchandise Marks Act 1862.

II. *Under the Registration Acts.*—Provision was first made for the registration of trade marks by the Trade Marks Registration Act 1875. That statute made registration in the register of trade marks which it established prima facie evidence of the right of the registered proprietor to the exclusive use of the trade mark in connexion with goods of the class for which it was registered and used, and enacted that it should after the expiration of five years be conclusive proof of such right, provided that the proprietor of the mark remained the owner of the goodwill of the business in which it was used. This provision was carried as to the act of 1883 (s. 76). The act also provided that a person should not be entitled to institute any proceeding to prevent the infringement of trade mark until it was registered, or (a later statutory modification) until, in the case of a mark in use before the passing of the act of 1875, registration of the mark as a trade mark had been refused. The act of 1875 was a considerable success, but no provision was made under it for the registration of words unless they either were old marks or were registered in combination with one or more of the "essential particulars" prescribed by the act, such as a distinctive device, heading, mark, label or ticket. These limitations excluded from registration most of the trade marks ordinarily in use.

The Patents Designs and Trade Marks Act 1883 remedied this defect besides altering the law in other important respects. The act of 1883 was amended in 1888 on the recommendation of a committee presided over by Lord Herschell. Neither the act of 1875 nor those of 1883 and 1888 altered the common law definition of a trade mark, nor contained any definition of the term. The description in the acts of what was registrable as a trade mark led to much litigation, and the interpretations of the judges left commercial men dissatisfied on three points: (1) the number of good and valuable trade marks which were not registrable; (2) that on allowing registration the patent office insisted on disclaimers which hampered the owner in obtaining protection in the colonies and foreign countries; (3) that there was no effective period of limitation to attacks on registered trade marks, because though registration for five years was declared conclusive by s. 76 of the act of 1883, the powers of the court to rectify the register could be invoked even after the lapse of the five years (*re Gestetner's Trade Mark*, 1907, 2 Ch. 478). In re-enacting and enlarging the provisions of the act of 1875 the act of 1883 laid down certain essential particulars of one at least whereof a trade mark must consist to be registrable. These particulars will be considered later in dealing with the present law. The act of 1883 first provided for "word marks," and included among them "a fancy word or words not in common use" [s. 64, (1) (c)].

The expression "fancy word," used in the act of 1883, gave rise to considerable difference of opinion. It was interpreted by the court of appeal as equivalent to "obviously meaningless as applied to the article in question," or "obviously non-descriptive." In accordance with this interpretation, the words "gem" for guns, "melrose" for a hair restorer, "electric" for velveteen, and "washerine" for a soap were all held not to be registrable. On the recommendation, however, in 1887, of a committee appointed by the board of trade, and presided over by Lord Herschell, the expression "invented word" was substituted for "fancy word" by the act of 1888.

In 1905 and 1907 the legislation as to trade marks was amended and remodelled. A bill was introduced in 1905 at the instance of the London Chamber of Commerce, and after consideration by a select committee became the Trade Marks Act 1905. This act repeals the bulk of the provisions of the Patents, &c., Acts of 1883 and 1888 with respect to trade marks, and embodies them with amendments (to be noticed later) in a separate statute. The only portions of the earlier acts left standing with respect to trade marks were ss. 83 and 84 (as amended in 1885 and 1888) with reference to the administration in the patent office of the law as to trade marks (1905, s. 74); ss. 103 and 104 of the act of 1883 (as amended in 1885) relating to registration of trade marks, both as enacted in the acts of 1883 and 1885 and as applied by orders in council, are to be read as applying to trade marks registrable under the act of 1905 (s. 65). The sections of the Patents Acts of 1883, 1885 and 1888, thus preserved as to trade marks, were repealed by the Patents and Designs Act 1907. Sections 62 seq. of this act replace ss. 83 and 84 of the act of 1883, and retain the administration of trade mark law in the patent office; and s. 91 replaces ss. 103 and 104 of the act of 1883 as to international and colonial arrangements for mutual protection (*inter alia*) of trade marks. According to the rule laid down by the Interpretation Act 1889 the references in the act of 1905 to the acts of 1883, &c., are to be read as applying to the above-stated sections of the act of 1907.

The act of 1905 differs from the preceding acts in containing a definition of trade mark for the purposes of the act unless the context otherwise requires; viz. that it "shall mean a mark used or proposed to be used upon *or in connexion* with goods for the purpose of indicating that they are the goods of the proprietor of such mark by virtue of manufacture, selection, certification, dealing with or offering for sale"; and "mark" is defined as *including* "a device, brand, heading, label, name, signature, word, letter, numeral or any combination thereof" (s. 3). The act, modifying to the extent indicated in italics the acts of 1883 and 1888, prescribes (s. 9) that a trade mark to be registrable must contain or consist of at least one of the following essential particulars:—

1. The name of a *company*, individual or firm represented in a *special* or particular manner (under the act of 1883 it has been held that the name must be in the nominative case, and that ordinary printing is not representation in a particular manner).

2. The signature of the applicant for registration or some predecessor in his business. It is not clear that this includes descriptive trading styles.

3. An invented word or words.

4. A word or words having no *direct* reference to the character or quality of the goods, and not being *according to its ordinary signification* a geographical name *or a surname.*

5. *Any other distinctive mark; but a name, signature, or word or words other than such as fall within the descriptions in the above paragraphs 1, 2, 3 and 4, shall not, except by order of the board of trade or of the court, be deemed a distinctive mark.* By distinctive is meant "adapted to distinguish the goods of the proprietor of the trade mark from those of other persons": and "in determining whether a trade mark is so adapted the tribunal may in the case of a trade mark in actual use take into consideration the extent to which such

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[1] Further reference may be made, in regard to the subject of trade marks before the Registration Acts 1883–1888, to an admirable introductory chapter in *Kerly on Trade Marks*, and also to the report of the Merchandise Marks Committee 1862, and the annual reports of the commissioners and the comptroller-general of patents from 1876 to 1884 (2nd report).

user has rendered such trade mark in fact distinctive for the goods in respect of which it is registered or proposed to be registered." Where the mark is limited to specified colours, that fact may be taken into account in deciding whether the mark is distinctive (s. 10). There are certain special rules as to cotton marks.

Trade marks containing the essential particulars are not registrable if they contain any matter which would by reason of its being calculated to deceive or otherwise be disentitled to protection in a court of justice or would be contrary to law or morality, or any scandalous design (s. 11). (See *Eno* v. *Dunn*, 1890, 15 App. Cas. 293, and the "Motricine," case, 1907, 2 Ch. 435.) Registration of the same matter as a trade mark under the act of 1905 and as a design under the Patents and Designs Act (1907) is possible (*re U.S. Playing Card Co.'s Applic.*, 1907, W. N. 251).

Old marks are registrable, *i.e.* any special or distinctive word or words, letter, numeral or combination of letters or numerals, used by the applicant or his predecessors in business before the 14th of August 1875, subject to the qualification that it has "continued to be used either in its original form or with additions or alterations not substantially affecting the same down to the date of the application for registration" (s. 9). In the case of new marks, but not of old marks, a trade mark is not registrable except by order of the court in respect of any goods or description of goods which is identical with a mark already on the register with respect to such goods or description of goods, or so nearly resembles such registered mark as to be calculated to deceive (s. 19).

Invented Words.

Most controversy arose under the acts of 1883 and 1888 as to the meaning of the phrase "invented word" preserved in the act of 1905. An invented word need not be wholly meaningless, nor is it disqualified because words may have suggested it. Thus "mazawattee" was held to be an "invented word," although the latter part of it was a Sinhalese term meaning "estate," and there were estates in Ceylon having names ending with "wattee" from which tea came; and in a leading case on the construction of the clauses under consideration (*Eastman Co.'s Trade Mark*, L. Rep. 1898, A. C. 571), the word "solio" was held to be registrable as a trade mark for photographic printing paper under both clauses, although it was objected that "solio" was equivalent to "sunio." The expression "calculated to deceive" has been considered by the courts in very many cases. It is not merely or chiefly the retailer or dealer who has to be kept in view when the question of the likelihood of deception is under consideration. The courts have regard also, and mainly, to the ultimate purchaser whom the trade mark may reach, and careless or unwary persons are considered as well as those who are careful and intelligent. The judge's eye is the ultimate test as to the degree of resemblance that is calculated to deceive, although expert evidence on the point is admissible. "Savonol" for soap (*J. C. & J. Field Ltd.* v. *Wagel Syndicate Ltd.*, 1900, 17 R.P.C. 266), "tachytype" for typographical and composing machines (in *re Linotype Co.'s Application*, 1900, 17 R.P.C. 380), have been held to be invented words. But the following have been held not invented—"uneeda" (=you need a) in *re National Biscuit Co.* (1902; 1 Ch. 783); "absorbine" for an absorbent preparation (*Christy & Co.* v. *Tipper & Son*, 1905, 21 R.P.C. 97, 775); "bioscope" (*Warwick Trading Co.* v. *Urban*, 1904, 21 R.P.C. 240); "cyclostyle" (*re Gestetner's Trade Mark*, 1907, 2 Ch. 478); and cf. in *re Kodak and Trade Marks* (1903, 20 R.P.C. 337).

Subsections (3) and (4), it should be noted, are independent: the former deals with newly-coined words, the latter deals with the existing words of the English language, or of other languages likely to be known to the public. A word which is really "invented" may be registered, whether it is descriptive or not. An old word used in a new sense is not invented (*Hommel* v. *Bauer & Co.*, 1904, 21 R.P.C. 576). The exact scope of clause (5) as to other distinctive marks has not been much discussed by the courts. Registration was allowed of the word "apollinaris" as a distinctive mark for the mineral waters of the applicants, on an undertaking to apply it only to water from the Neuenahr spring or district (in *re Apollinaris Trade Mark*, 1907, 2 Ch. 178). Under prior legislation the mark had been refused registration as being a geographical name (*re Apollinaris Co.'s Trade Mark*, 1891, 2 Ch. 186).

Identical Marks.

Identical marks (except old marks) may not be registered in respect of the same goods, or goods of the same description, for two different persons (s. 19); and where several applicants make rival claims to identical marks the registrar may refuse to register until their rights have been determined by the court or settled by agreement in manner approved by the registrar, or, on appeal, by the board of trade (s. 20). In the case of honest concurrent user or of other special circumstances making it proper so to do, the court may permit the registration of the same mark or of nearly identical marks for the same goods by more than one owner, subject to such conditions or limitations, if any, as to mode or place of use or otherwise as the court may think it right to impose (s. 21).

Associated Marks.

New provisions were made in 1905 as to what are called "associated trade marks." Where registration is sought for a mark so closely resembling a mark of the applicant already on the register for the same goods as to be calculated to deceive or cause confusion if used by any one but the applicant, the registration of the new mark may be conditional on entering both marks as associated trade marks (s. 24). This section applies only to marks closely resembling one already on the register for the same goods or description of goods, and has nothing to do with identical marks (*Birmingham Small Arms Co.'s Application*, 1907, 2 Ch. 396).

In the case of combined trade marks provision is made for registering as separate trade marks the part in which the applicant has exclusive rights, and as associated marks trade marks of which the exclusive portion forms a part (s. 25).

A series of trade marks of the same owner may be registered on one registration as associated marks (s. 26).

Standardization Marks.

Provision is made for allowing the registration of marks used upon or in connexion with goods by an association (or person) which undertakes the examination of goods in respect of origin, material, mode of manufacture, quality, accuracy, or other characteristic, and certifies the result of the examination by marks used upon or in connexion with the goods. These marks cannot be registered unless the board of trade consider their registration of public advantage. Their registration is not conditional on the association or person being a trader or having goodwill in connexion with the examination or certification. The registration gives the association or person the rights of the owner of a registered trade mark, except that assignment and transmission needs permission of the board of trade (s. 62).

Cotton Marks.

In respect of cotton piece-goods, marks consisting of a line heading alone or a word alone are not registrable, and no word or line heading is treated as distinctive in respect of such goods. In respect of cotton yarn the same rule applies with respect to words, and no registration of any cotton mark gives any exclusive right to the use of a word, letter, numeral, line, heading or combination thereof [s. 64 (10)].

Use of Royal Arms, &c.

By s. 68, which is a re-enactment of s. 105 of the Patents, &c., Act, 1883, it is made illegal for any person without the authority of the king to use the royal arms in any trade in such a manner as to create the belief that he has authority so to do; a similar provision is embodied in the Merchandise Marks Act 1898 of the Isle of Man.

Registries.

The central register of trade marks is kept at the Patent Office, Southampton Buildings, London, and is under the charge of the comptroller-general of patents, designs and trade marks, who is appointed by and acts under the superintendence of the board of trade, and has a deputy—the registrar of trade marks. There is a branch registry at Manchester, whose chief officer is the keeper of cotton marks, which deals with all applications for the registration of trade marks for cotton goods falling within classes 23, 24, 25 in schedule 3 of the Trade Marks Rules 1906. The registry has been long established, but was not recognized by statute till 1905. Records are kept and are open to public inspection of all applications made since 1875, whether granted or refused.

There is a branch registry at Sheffield containing the marks for metal goods ("Sheffield marks") registered by persons carrying on business in or within six miles of Hallamshire. The care of this register is vested in the Cutlers' Company, who are substituted for the comptroller as to registration of "Sheffield marks" (s. 63). Applications made to the company are notified to the registrar, and may not be proceeded with if he objects. Any person aggrieved by the registrar's objection may appeal to the court. Applications made to the registrar for metal marks are notified to the Cutlers' Company. Persons aggrieved by the decision of the Cutlers' Company have an appeal to the courts (s. 64).

In 1906 fourteen applications were made at the head registry which were all dealt with by the Cutlers' Company. That company, by arrangement made with the sanction of the treasury, retain all fees taken at Sheffield with respect to registration up to £400, and half of the fees received in excess of that amount (*Parl. Pap.*, 1907, No. 164, p. 9).

Procedure.

A trade mark must be registered in respect of particular goods or classes of goods (s. 8), and the classification in force is scheduled to the Trade Marks Rules 1906 (R. & O., 1906, No. 233). Doubts as to the class to which the goods in question belong are settled by the registrar. The procedure for obtaining registration is regulated by the act of 1905 and the rules above mentioned. The registrar has power to refuse applications or accept them absolutely or subject to conditions, amendments and modifications (s. 12). His discretion is not absolute, but subject to the provisions of the act (*re Birmingham Small Arms Co.'s Application*, 1907, 2 Ch. 396); and he must if required state his reasons, and his decision is subject to appeal to the board of trade or the court at the option of the applicant [s. 12 (3)].

"New marks" may not be placed on the register except by order of the court for any goods or description of goods which are identical with marks already on the register with respect to the same goods, &c., or so nearly resemble a registered mark as to be calculated to deceive (s. 19). The question whether particular goods are of the same description is not determined solely by reference to the statutory classification. "The true test," says Kerly (*Trade Marks*, p. 181), "would seem to be supplied by the question: Are the two sets of goods so commonly dealt in by the same trader that his customers, knowing his mark in connexion with one set, and seeing it upon the others, would be likely to suppose that it was used upon them also to indicate that they were his goods?" Wine and spirits, beer, and even aperient drinks and baking powder, have been held to be "goods of the same description." When a trade mark contains (1) parts not separately registered as trade marks or (2) matter common to the trade or otherwise of a non-distinctive character, the registrar, or the board of trade or the court, in deciding whether the mark shall be entered or retained on the register, may impose as a condition that the owner shall disclaim all right to exclusive use of any part or parts of such trade mark or of all or any portion of such matter to the exclusive use whereof they deem him not to be entitled, or make any other disclaimer which they consider needful to define his rights under the registration (s. 15). Marks calculated to deceive are not entitled to protection (*Eno* v. *Dunn*, 1890, 15 App. Cas. 250).

Applications as accepted are advertised; the advertisements state the conditions, if any, imposed on acceptance (s. 13). Notice of opposition to the registration of a trade mark may be given under s. 14 of the act of 1905 (which replaces s. 69 of the act of 1883). The registrar after consideration decides whether the opposition is well or ill founded. His decision is subject to appeal to the High Court or by consent of the parties to the board of trade [1905, s. 14 (5)]. In 1906 there were 251 notices of opposition, of which 51 were heard. There were 4 appeals to the board of trade, all referred by the board to the court under s. 59 of the act.

There may be added to any one or more of the "essential particulars" above enumerated any letters, words or figures, or a combination of these. But the right to the exclusive use of the added matter must be disclaimed. A man is not required, however, to disclaim his own name, or trade name, or that of his place of business, if the name appears in the mark. The number of applications to register trade marks in 1884 was 7104, and the number of marks registered 4523. In 1906 the corresponding figures were 11,414 and 4731. These figures included 153 applications made to the Cutlers' Company at Sheffield (*Parl. Pap.*, 1907, 164, 24th report).

Correction and Alteration of the Register.

The register may be corrected on the request of the registered owner of a trade mark as to errors or changes of address in the name of the registered owner, or by cancelling entries of marks or by striking out classes of goods for which a mark is registered or by entering disclaimers or memoranda as to a mark, provided that they do not extend the rights given by the existing registration (s. 33).

A registered trade mark may be altered or added to in matters not substantially affecting its identity (s. 34). Thus a firm on becoming a limited company has been allowed to add the word "limited" to its name upon a registered mark, but no alteration will be permitted in regard to any "essential particular." In the above cases the corrections or alterations are made by the registrar subject to appeal to the board of trade (ss. 32, 34). A registered trade mark may be taken off by order of the court on the application of a person aggrieved, on the ground that it was registered without a bona fide intention to use it in connexion with a particular class of goods, and that there has not been any such bona fide user, or that there has been no such bona fide user during the five years preceding the application. Non-user may be excused if proved to be owing to special circumstances and not to any intention not to use or to abandon the use of the mark (s. 37). (See *re Hare's Trade Mark*, 1907, 24 R.P.C. 263).

The register may be rectified by order of the court on the application of any person aggrieved, or in the case of fraud in registration or transmission of the mark on the application of the registrar. The powers of rectification include correcting or expunging wrong entries, supplying errors and omissions and defects (s. 35).

Effect of Registration.

Registration is effective for 14 years but is renewable (s. 28). The registration if valid gives the proprietor the exclusive right to the use of the mark on or in connexion with the goods in respect of which it is registered (1905, s. 39). This rule is subject to the following qualifications. (*a*) Where two or more persons are registered owners of the same or substantially the same mark in respect of the same goods, no one of them shall as against any other of them have any right of exclusive user except so far as their respective rights have been defined by the court. (*b*) Registration of a trade mark does not entitle the proprietor to interfere with or restrain the user by any person of a similar mark upon or in connexion with goods upon or in connexion with which such person has by himself or his predecessors in business continuously used such trade mark from a date anterior to the use of the mark by the registered proprietor, or to object to the registration of the other man's similar mark for concurrent user.

In all legal proceedings relating to a registered trade mark registration is prima facie evidence of validity, and after seven years from the original registration, or seven years from the passing of the act of 1905, whichever shall last happen, the original registration shall be taken to be valid in all respects unless it was obtained by fraud, or the mark offends against s. 11 of the act. This provision as to validity limits the power which formerly existed of getting rid of long registered marks by proceedings to rectify the register.

Registered trade marks are assignable and transmissible only with the goodwill of the business concerned in the goods for which they are registered, and are determinable with the goodwill (s. 22). Associated marks are assignable and transmissible only as a whole and not separately (s. 27). The owner of a registered mark may assign the right to use his registered mark in any British possession or protectorate or foreign country in connexion with any goods for which it is registered, together with the goodwill of the business therein of such goods (s. 22). Provision is made for apportioning marks where the goodwill of a business by dissolution of partnership or otherwise does not pass to a single successor (s. 23).

The assignments, &c., on proof of title, are recorded on the register (s. 33). It is a condition precedent to an action for the infringement of a new trade mark that the plaintiff should be the registered proprietor of the mark at the time when the action comes on for hearing. This last provision does not apply to an action for "passing-off" (*vide infra*). In actions for infringement, evidence of passing off, or that the infringing mark is calculated to deceive, is not necessary. The court decides on the probability of deception by inspecting and comparing the marks (*Hennessy* v. *Keating*, 1907, 24 R.P.C. 485).

In the case of an old mark in use before the 14th of August 1875 proceedings may be taken if registration under the act of 1907 has been refused (s. 42).

The right to a trade mark lapses if the mark ceases to be distinctive and becomes *publici juris*; if it is separated from the goodwill (a trade mark can only be assigned with the goodwill); if the mark is applied by the trader to spurious goods (as where boxes of cigarettes were so labelled, in conformity with an alleged custom of the trade, as to indicate that they were of Russian manufacture, which was not the fact; or when the mark is abandoned); (temporary disuse, however, is not abandonment unless the mark has in the meantime become associated with the goods of another trader); or where, as in the "linoleum" case (7 Ch. D. 834) it has become the name of the goods, and so merely descriptive; or after fourteen years where registration is not renewed. In dealing with a claim for infringement the court must admit evidence of the usages of trade as to the get-up of the goods for which the mark is registered, and of any trade marks or get-up legitimately used with such goods by other persons (s. 43).

Appeals, &c.

The registrar has an uncontrolled discretion in the administration of the act, except in those cases in which an appeal is given from his acts or refusals to the court or the board of trade (ss. 53, 54). In cases of difficulty he consults the law officers (s. 56).

Actions or other proceedings with relation to trade marks, so far as they are for the court, may be brought in the High Court of Justice in England or Ireland and in the Court of Session in Scotland (ss. 3, 69). In the case of marks registered on application at the Manchester branch, the chancery court of Lancaster has concurrent jurisdiction with the High Court (s. 71). Actions for infringement of a trade mark are not within the jurisdiction of the county court (*Bow* v. *Hart*, 1905, 1 K.B. 592). An annual report is made by the comptroller-general of patents, &c., as to proceedings with reference to trade marks.

III. "*Passing-off*" *and Trade Name.*—A trader has generally, besides his trade mark, numerous other symbols, which he uses as *indicia* of his goods, *e.g.* the name of title under which he himself trades, the name under which his goods are known and sold, badges of property which are termed "trade name," and the distinctive "get-up" of the goods as they appear in the market. These symbols enjoy the protection of the law, under certain conditions, equally with trade marks. No trader is entitled to "pass off" his goods as those of another, and if he infringes this rule he is liable to an action for an injunction and damages, and these rights are preserved by the Trade Marks Act 1905 (s. 45). The right to be protected against "passing-off" is restricted to goods of the same description as those upon which the trader uses the "get-up," &c., imitated. Even if the "passing-off" is done innocently it will be restrained (*Millington* v. *Fox*, 1838, 3 Mylne and Craig, 338). This case is described as not one of the use of a properly descriptive name, but rather a case of the same class as those in which a fancy or invented name is used (*Cellular Clothing Co.* v. *Maxton*, 1899, App. Cas. 326, 341). Although the first purchaser is not deceived, still if the article delivered to him bears words or marks such that it is "calculated to deceive" a purchaser from him, the use of them is illegal.

To this general rule there are several exceptions:—

1. No monopoly is allowed in names that are merely descriptive. But words which prima facie are descriptive, such as "camel-hair belting," for belting made of camel-hair (*Reddaway* v. *Banham*,

1896, App. Cas. 199), or "Stone Ales" for ales brewed at Stone (*Montgomery* v. *Thompson*, 1891, App. Cas. 217), may be shown to have acquired by long use a "secondary distinctive meaning," and, in fact, to mean the goods of a particular trader. And where a defendant is not selling the genuine goods indicated by the name, as where the composition of the goods is a secret, even if the name might otherwise be taken as merely that of the goods, he cannot rely on the defence that the name is descriptive (*Birmingham Vinegar Co.* v. *Powell*, 1897, App. Cas. 710; the "Yorkshire Relish Case"). If, however, the primary meaning of the word is simple and well known, it is extremely difficult to establish a secondary meaning exclusive of the primary one (*Hommel* v. *Bauer & Co.*, 1905, 22 R.P.C. 43; "Haematogen," a preparation for forming blood, secondary meaning not established; cf. *Fells* v. *Hedley & Co.*, 1904, 21 R.P.C. 91; "Naphtha soap," secondary meaning not established; *Wurm* v. *Webster & Girling*, 1904, 21 R.P.C. 373; "White Viennese Band," secondary meaning not established; *Cellular Clothing Co.* v. *Maxton*, 1899, A.C. 326, "cellular" as applied to cloth, secondary meaning not established). But although a name may not, owing to the fact that it consists of well-known or descriptive words, be inherently entitled to protection, a distinctive scroll or device, in which it is embodied, may be so. Thus, in a case (*Weingarten Brothers* v. *Bayer & Co.*, 1905, 21 Times L.R. 418; and see 19 Times L.R. 604) which sharply divided judicial opinion in England, the defendants were restrained from selling corsets in boxes bearing the name "Erect Form Corsets" scrolled thereon by the plaintiffs in a distinctive manner. No monopoly, of course, could be claimed in the words, but it was otherwise with the scroll. The use of a fancy name "iron oxide tablets" has been restrained where it was found likely to cause deception as being used to supersede in the market certain well-known "Iron Ox" tablets (*Iron Ox Remedy Co.* v. *Co-operative Wholesale Society Ltd.*, 1907, 24 R.P.C. 425). (2) A trader cannot be prevented from trading under his own name, if he is using it honestly (bona fide); even though from its similarity to the name of another trader—even one previously well-established—it may injure the business of the latter (*Burgess* v. *Burgess*, 1853, 3 De Gex, M. & G. 896; *Turton* v. *Turton*, 1889, 42 Ch. D. 128; *Dunlop Pneumatic Tyre Co.* v. *Dunlop Motor Co.*, 1907, App. Cas. 430). This right is recognized by the Trade Marks Act 1905, s. 44, which provides that registration of a trade mark under the act shall not interfere with any bona fide use by any person of his own name or place of business or that of any of his predecessors in business. But if a trader has never carried on such a business on his own account or in partnership with others, he cannot, by promoting and registering a joint-stock company with a title of which his name forms part, confer on the company the rights which he as an individual possesses in the use of his name (*Fine Cotton Spinners, &c., Association Ltd. and John Cash & Sons Ltd.* v. *Harwood Cash & Co. Ltd.*, 1907, 2 Ch. 184). If a trader's own name has, before he entered the trade, become the trade name of some other person's goods, he would probably not be allowed to use it without taking steps to prevent deception. This rule does not debar him from using "any bona fide description of the character or quality of his goods" (1905, s. 44). A name can become universally known as referring to the goods of a particular maker, *i.e.* as having a secondary meaning. This does not give exclusive rights to use of the name, but only to prevent other firms from using the goods so as to pass off their goods as those of the person whose name is in question (*Joseph Rodgers & Sons Ltd.* v. *Hearnshaw*, 1906, 23 R.P.C. 348).

It is provided by the Companies Act 1862 (s. 20), that no company shall be registered under a name identical with that by which a subsisting company is already registered, or so nearly resembling it as to be calculated to deceive, unless the subsisting company is in process of being wound up and consents to such registration; and provision is also made for a change of the name of any company which, through inadvertence or otherwise, is registered under a name coming within the statutory prohibition. It is to be observed (cf. Buckley, *Companies Acts*, 8th ed. p. 27) that (*a*) the Companies Act 1862 applies only to the case of taking the name of a subsisting company already registered, and not to a case where a new company proposes to register in the name of, or in a name closely resembling, the name of an old-established company which is not registered, or of a firm or individual trader; (*b*) that as soon as the new company is registered the act ceases to apply; and (*c*) that the act forbids registration irrespectively of the question whether the business proposed to be carried on by the new company is the same as that of the subsisting company or not. But the provisions of the Companies Act on this subject are merely supplemental to the common law, and any company trading in the United Kingdom may restrain persons from registering a new company to carry on a rival business under a name identical with or so similar as to be calculated to deceive, and a company already registered under such a name may be restrained from carrying on a rival business under it. The right to interfere depends not upon fraud but upon the tendency of the similarity to cause confusion, deception or mistake (Fine Cotton Spinners case above cited; *Birmingham Small Arms Co.* v. *Webb*, 1907, 24 R.P.C. 27; *Star Cycle Co.* v. *Frankenburgs*, 1907, 24 R.P.C. 405; *re Reddaway & Co.*, 1907, 24 R.P.C. 203). In such proceedings evidence is admissible to show how the existing company has used the name, and what, by reason of its connecting that name with its goods, the public have come to attribute to it (*Daimler Motor Car Co.* v. *London Daimler Co.*, 1907, 24 R.P.C. 379). A new company will not be allowed to take the whole name of a subsisting company, even although that name is of a descriptive character (*Manchester Brewery Co. Ltd.* v. *North Cheshire and Manchester Brewery Co. Ltd.*, 1899, App. Cas. 83).

Rights of Assignees.

The purchaser of the goodwill of a business has the right to use the trade name under which the business is known, and to restrain others from using it or such imitations of it as may mislead the public. But he is not entitled by the use of the trade name to make the vendor liable, under the doctrine of "holding out," for debts of the business incurred after the sale. And if the vendor of the goodwill gave his name to the business, he cannot (in the absence of any restrictive condition in the agreement for sale) be prevented from beginning to trade in his own name again, unless it be shown that in so doing he is attempting to deceive the public into the belief that he is still the owner of the old business. In construing the words "calculated to deceive" (s. 20) the courts will adopt principles closely analogous to those applicable in "passing off" cases in which the question is raised whether a trade name or the description or get-up of a particular class of goods is or is not likely to deceive (*British Vacuum Cleaner Co.* v. *New Vacuum Cleaner Co.*, 1907, 2 Ch. 312; *Aerators Ltd.* v. *Tollett*, 1902, 2 Ch. 319, 324). When the names of the two companies contain terms of common ordinary meaning descriptive of an article, s. 20 will be applied less readily than where the words said to create the confusion are of the character of fancy words relating rather to the maker than the article (Vacuum Cleaner Case).

IV. *Merchandise Marks.*—The first attempt to make the falsification of trade marks a criminal offence was in the Merchandise Marks Act 1862 (25 & 26 Vict. c. 88). That statute provided that the forgery of a trade mark with intent to defraud, and the false application of a trade mark to goods with the like intent, should be misdemeanours, but left upon the prosecutor the burden of establishing the fraudulent intent. The act contained no provision for summary prosecutions, and did not provide for the seizure of falsely-marked goods on importation from abroad. The international convention for the protection of industrial property, made at Paris in 1883, to which Great Britain acceded in 1884, contains a provision that all goods illegally bearing a trade mark or trade name may be seized on importation into those states of the union where the mark or name has a right to legal protection, and that the seizure shall be effected at the request of either the proper public department or of the interested party, pursuant to the internal legislation of each country. The law had to be amended in order to carry out this article in the convention, and the Merchandise Marks Act 1887 was passed to effectuate this object and generally to make better provision for the protection of merchandise. It was subsequently amended in 1891 and 1894. The effect of the provisions of these statutes may be briefly stated. Any person is guilty of an offence, punishable on indictment or summary conviction by fine or imprisonment, who does any of the five following acts, unless he proves as regards the first four of them that he acted without intent to defraud (there is a special defence to No. v. which is noted below): (i). forges any trade mark, or makes, disposes of, or has in his possession for such purpose any die or instrument; (ii.) falsely applies any trade mark or a colourable imitation of any trade mark to goods; (iii.) applies any false trade description to goods; (iv.) causes any of the above offences to be committed; (v.) sells or exposes for sale, or has in his possession for sale, trade or manufacture, any goods or things to which any forged trade mark or false trade description is applied, or any trade mark or colourable imitation of a trade mark is falsely applied, unless *the defendant* proves that, having taken all reasonable precautions, he had no ground to suspect the genuineness of the mark, &c., and also that on demand he gave to the prosecutor all the information in his power as to the person from whom he obtained the goods, &c., or proves that he otherwise acted "innocently." (See *Thwaites & Co.* v. *McEvilly*, 1903, 20 R.P.C. 663).

"Trade description" is defined as any descriptive statement or other indication as to the measurement, quantity (not *quality*, it should be observed), or weight, place or mode of production, or the material of the goods, or as to their being subject to an existing patent, privilege or copyright; conventional or customary descriptions lawfully in use in August 1887 to indicate that the goods are of a particular class or method of manufacture are allowed to be continued; but if they contain the name of a place and are calculated to mislead as to the real place of production, the name of the latter must be added. The test of what is a trade description depends upon the understanding of the trade and not on scientific correctness (*Fowler* v. *Cripps*, 1906, 1 K.B. 16).

Trade Description.

On a prosecution for any of these offences, there is a power to forfeit the things found although no one is convicted. If the offender is indicted (it is in his option to be tried in this way) the punishment is fine and imprisonment, the latter not to exceed two years. On summary conviction the punishment is not to exceed, for a first offence, four months' imprisonment, with or without hard labour, and a fine of £20; and for any subsequent offence six months' imprisonment and a fine of £50. The importation is forbidden of goods by means of or in relation to which an offence against the acts has been committed, and also of all goods of foreign manufacture bearing any name or trade name being or purporting to be that of a manufacturer or trader within the country, unless it be accompanied by a definite indication of the country where the goods were made or produced. There are also special provisions with regard to the marking of catch-cases. The commissioners of customs have power to make general orders for carrying out the Merchandise Marks Acts. (See Regulations of the 1st of December 1887, Stat. R. & O. Revised, 1904, vol. viii. tit. Merchandise Marks.) Prosecutions may be undertaken by the board of trade in cases appearing to affect the general interests of the country or of a section of the community, or of a trade, subject to regulations made on the 21st of May 1892; and the board of agriculture and fisheries has a like power in the case of the produce of agriculture, horticulture and fisheries [act of 1894, s. 1; Board of Agriculture and Fisheries Act 1903, s. 1 (8); see the regulations of the 27th of October 1894, Stat. R. & O. Revised, vol. viii. tit. Merchandise Marks.]. Under the Sale of Food and Drugs Act 1899, and the Butter and Margarine Act 1907, the importation, except in containers showing their character, of margarine, margarine cheese, adulterated or impoverished butter, milk-blended butter or condensed, separated or skimmed milk, is penalized, and it is provided that the commissioners of customs, in accordance with directions given by the treasury after consultation with the board of agriculture, shall take such samples of consignments of imported articles of food as may be necessary for the enforcement of the law.

V. International Arrangements.—(The Trade Marks Act 1905 applies to the British Islands.) By the international convention for the protection of industrial property (see PATENTS), which was signed at Paris in 1883, the signatory states (others have since acceded) agreed that the subjects or citizens of each state should, in all the other states, enjoy as regards trade marks and trade names the advantages that their respective laws then granted, or should thereafter grant, to their own subjects or citizens. So far as Great Britain is concerned the provisions made for carrying out this convention are contained in s. 65 of the Trade Marks Act 1905 and in s. 91 of the Patents and Designs Act 1907.[1] The effect of that section is to confer on an applicant for the protection of a trade mark in one of the other contracting states a priority over other applicants for registration in the United Kingdom during the space of four months. The section does not, however, exempt the applicant from the conditions and formalities incumbent on ordinary applicants for registration in Great Britain; nor does the fact that the foreign application has been successful of itself give the applicant a right to have his mark accepted for registration. Under the Convention of Madrid of the 14th of April 1891 (to which Great Britain is not a party) a trade mark may be registered as the result of a single application in the countries of all the signatory powers. Besides the general international conventions there are also particular arrangements between many states, *e.g.* Germany and Italy (Italian law of the 24th of December 1903). Guatemala and Salvador, also signatory parties, have withdrawn from the convention.

The following is a list of the British orders in council that have been issued, applying to foreign countries, s. 103 of the Patents, &c., Act 1883:—

Foreign State.	Date of Order in Council.
Belgium	June 26, 1884.
Brazil	June 26, 1884.
Cuba	January 12, 1905.
Denmark (including the Faroe Islands)	November 20, 1894.
Dominican Republic	October 21, 1890.
Ecuador	May 16, 1893.
France	June 26, 1884.
Germany	October 9, 1903.
Greece	October 15, 1894.
Honduras	September 26,1901.
Italy	June 26, 1884.
Japan	October 7, 1899.
Mexico	May 28, 1889.
Netherlands	June 26, 1884.
,, (East Indian Colonies)	November 17, 1888.
,, (Curaçoa and Surinam)	May 17, 1890.
Norway (and Sweden)	July 9, 1885.
Paraguay	September 24, 1886.
Portugal	June 26, 1884.
Rumania	August 5, 1892.
Servia	June 26, 1884.
Spain	June 26, 1884.
Sweden (and Norway)	July 9, 1885.
Switzerland	June 26, 1884.
Tunis	June 26, 1884.
United States	July 12, 1887.[2]
Uruguay	September 24, 1886.

All these orders in council are printed in the Statutory Rules and Orders Revised (ed. 1904), vol. ix., under the title "Patents, &c." By orders in council, made under the provisions of the Foreign Jurisdiction Acts, penalties have been imposed on British subjects committing offences against the Patents, &c., Act 1883–1888 (now represented by the Trade Marks Act 1905, and the Patents and Designs Act 1907) and the orders in council issued thereunder, and the Merchandise Marks Act 1887: China and Corea (1904), Egypt (1899), Morocco (1889), Muscat (1904), Ottoman Empire (1899), Persia, Persian coast and islands (1889–1901), Siam (1906) and Zanzibar (1906).

By s. 91 of the Patents and Designs Act 1907,[3] and s. 65 of the Trade Marks Act 1905, the king is empowered by order in council to apply the provisions of s. 91 above mentioned, with such variations or additions as may seem fit, to any British possession. The following is a list of the orders in council that have been issued:—

British Possessions.	Date of Order in Council.
Ceylon	August 7, 1905.
New Zealand	February 8, 1890.
Trinidad and Tobago	August 12, 1907.
Australia (Commonwealth)	August 12, 1907.

The orders in council up to 1903 are printed in the Statutory Rules and Orders Revised (ed. 1904), vol. ix., under the title "Patents, &c."

It should be added that the protection of the Merchandise Marks Act 1887, extends to any trade mark which, either with or without registration, is protected by law in any British possession or foreign state to which the provisions of s. 103 of the act of 1883 or s. 91 of the act of 1907 are, under order in council, for the time being applicable.

A foreigner suing in the United Kingdom for infringement of a trade mark, or for "passing off," is in the same position as a subject.

VI. *Colonial and Foreign Trade Mark Laws.*—The British colonies generally follow the model of the English Trade Marks Acts (1883–1888).

Australia.—Legislation on trade marks is one of the subjects which the Commonwealth of Australia Constitution Act 1900 (s. 9, pt. v. 51, xviii.) places within the exclusive competence of the Federal Parliament. By the Commonwealth Trade Marks Act 1905, s. 20, provision is made for registration of trade marks throughout the Commonwealth, and subject to this act and other Commonwealth legislation the common law of England as to trade marks is applied throughout the Commonwealth. Prior to this act most of the states had their own trade mark law (New South Wales, No. 19 of 1900; Tasmania, No. 9 of 1893; Victoria, No. 1146, 1890; Western Australia, Nos. 7

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[1] This section supersedes ss. 103, 104 of the Patents, &c., Act 1883. The references to these sections in the Trade Marks Act 1905 must now be read as applying to s. 91 of the Patents, &c., Act 1907.

[2] A treaty was also concluded between Great Britain and the United States on the 24th of October 1877, for the protection of trade marks.

[3] This section re-enacts the provisions of ss. 103, 104 of the Patents, &c., Act 1883.

of 1884, 5 of 1886, 4 of 1894). But the state Trade Marks Acts, with certain savings, cease to apply to trade marks (1905, s. 6).

The Commonwealth act contains certain novel provisions:—

1. As to a Commonwealth trade mark to be applied to all goods included in or specified by a resolution passed by both houses, that in their opinion the conditions as to the remuneration of labour in connexion with their manufacture are fair and reasonable (s. 78). The mark consists in a device or label bearing the words "Australian Labour Conditions."

2. As to workers' trade marks intended to protect the products of any individual Australian worker or association of such workers other than primary products of agricultural or pastoral industries (s. 74). Sections 115, 116 of the act contain provisions for international and intercolonial arrangements as to protection of trade marks based on ss. 103, 104 of the act of 1883. By the Commerce Trade Descriptions Act, No. 16 of 1905, the import into and export from Australia of falsely marked goods is prohibited.

In *Canada* the law as to trade marks (*Rev. Stats.* c. 63) and merchandise marks (c. 41 of 1888) has been regulated by Dominion acts, similar to English statute law. *New Zealand* has an act of 1889. The *Hong-Kong* ordinance, No. 18 of 1898, is a typical instance of an ordinance in a Crown colony [see also Ceylon, No. 9 of 1906, Jamaica (laws 17 of 1888 and 6 of 1889)]. In the *Bahamas* a trade marks law was passed on the 29th of May 1906, based on the imperial act of 1905. In the *Straits Settlements* there is no registration of trade marks, but the common law as to "passing off" is applied.

United States.—Provision for the registration of trade marks in the United States was first made by an act of Congress of 1870; but that enactment was subsequently declared invalid by the Supreme Court (*U.S.* v. *Steffens*, 1879, 100 U.S. 82), on the ground that the constitution of the United States did not authorize legislation by Congress on the subject of trade marks, except such as had been actually used in commerce with foreign nations or with the Indian tribes. Congress legislated again on the subject in 1881 (act of the 3rd of March 1881, Revised Stats. U.S. ss. 4937–4947). The act of 1881 was repealed by an act of the 20th of February 1905 (s. 592), which, as modified by an act of the 4th of May 1906, now regulates the subject. A trade mark may be registered by the owner if he is domiciled within the United States, including all territory under the jurisdiction and control of the United States (s. 29), or resides or is located in any foreign country which by treaty, convention or law affords similar privileges to citizens of the United States (s. 1).

The right of persons domiciled in the United States was in 1906 extended to owners of trade marks who have a factory in the United States, so far as concerns the registration, &c., of trade marks used in the products of the factory (1906, s. 3). To obtain registration the owner of the mark (whether firm, corporation, association or natural person) must file in the patent office an application (*a*) specifying the name, domicile, location and citizenship of the applicant; (*b*) stating the class of merchandise and the particular description of goods in the class to which the mark is appropriated;[1] (*c*) annexing a drawing of the trade mark and as many specimens as may be required by the commissioner of patents; (*d*) giving a description of the trade mark (only when needed to express colours not shown in the drawing); and (*e*) specifying the mode in which the mark is applied and affixed to goods; (*f*) stating the time during which the mark has been used (1906, c. 2081, s. 1).

The application must be accompanied by a fee of $10, and be supported by a sworn declaration verifying the ownership and the drawing and description and stating that no one else has a right to use the mark, nor one so like it as might be calculated to deceive, and that the mark is in use in commerce among the several states or with foreign countries or with Indian tribes (1905 c. 592, s. 2).

Where the applicant resides or is located in a foreign country he must also show that the mark is registered in the foreign country, or that application has been made to register it there. Registration on behalf of foreign registrants is not made until foreign registration is proved nor unless application for United States registration is made within four months of the application abroad (1905, *c.* 592, ss. 2, 4).

The United States policy is to require registration of all trade marks unless they (*a*) consist of or comprise scandalous or immoral matter; (*b*) consist of or comprise the flag or insignia of the United States, or of any state or municipality, or of any foreign nation; (*c*) are identical with another known or registered trade mark owned and used by another and appropriated to merchandise of the same description, or so nearly resemble such other marks as to be likely to cause confusion or mistake in the mind of the public or to deceive purchasers; (*d*) consist merely in the name of an individual, firm, corporation or association, unless it is written, printed, impressed or woven in a particular or distinctive manner, or is associated with a portrait of the individual; (*e*) consist merely in words or devices descriptive of the goods with which they are used, or of the character or quality of such goods, or merely of a geographical name or term; (*f*) contain the portrait of a living individual unless his consent is evidenced by an instrument in writing.

Old marks may be registered irrespective of the above rules, no proof that they have been actually and exclusively used as a trade mark of the applicant or his predecessors from whom he derived title in such commerce as aforesaid for ten years before the 20th of April 1905. Applications made in proper form with the prescribed fee are at once examined in the patent office and if in order are gazetted to give opportunity for "interference."

Decisions of the examiners on applications or oppositions are subject to appeal to the commissioner of patents, and from him to the court of appeals for the District of Columbia (ss. 8, 9). The general jurisdiction in trade mark cases is given to the Federal courts below the Supreme Court, which has power by certiorari to review the decisions of circuit courts of appeal upon such cases (ss. 17, 18). The maximum protection given by registration is twenty years. The protection given to marks already registered in a foreign country lapses when the mark ceases to be protected in the foreign country (s. 12). Certificates of registration are issued under the seal of the patent office.

Provision is made to prevent importation of merchandise which copies or simulates the name of any domestic manufacture, manufacturer or trader, or of a manufacturer or trader located in a country affording like privileges to the United States, or which copies or simulates the trade mark registered in the United States, or which bears names or marks calculated to create the belief that it is made in the United States, or in any country other than the true country of origin. United States traders who seek protection can have their names and marks recorded and communicated to the customs department (s. 27). At any time during the six months prior to the expiry of the term of twenty years the registration may be renewed on the same terms and for a like period. The right to the use of any registered trade mark is assignable (with the goodwill of the business in which it is used) by an instrument in writing; and provision is made for recording such instruments in the patent office (s. 10).

France.—In France (laws of the 23rd of June 1857, and the 3rd of March 1890) trade marks are optional, but may be declared compulsory for certain specified articles by decrees in the form of administrative orders. The decrees regulating registration are of the 27th of February 1891 and the 17th of December 1892. The following are considered trade marks: names of a distinctive character, appellations, emblems, imprints, stamps, seals, vignettes, reliefs, letters, numbers, wrappers and every other sign serving to distinguish the products of a manufacture or the articles of a trade. A fixed fee of one franc is charged for entering the minute by registration (dépôt) of each mark, and making a copy thereof, exclusive of stamp and registration fees. By legislation of the 1st of August 1905 and the 11th of July 1906 provision is made for marking certain classes of commodities, mainly food products, to prevent falsification and the sale of foreign products as French.

Germany.—Under the German trade mark law of the 12th of May 1894 any person whatsoever can acquire protection for a trade mark, and all foreigners in Germany are placed on an exactly equal footing with Germans in the eyes of the law, so long as they have a domicile (*Niederlassung*) within the empire, *i.e.* a place of business or a residence which involves the payment of German taxes. The registration of a trade mark expires *ipso facto* after ten years from its date, but may be renewed for a similar period. Germany acceded to the international convention on the 1st of May 1903.

In the *Netherlands* (law of the 30th of September 1893) two distinct forms of registration are in force: (*a*) registration merely for the Netherlands; (*b*) international registration, available for the states of the international union.

The following other foreign trade mark laws may also be noted: *Austria-Hungary*, law of 1890 (published in Vienna on the 6th of January and in Budapest on the 6th of April 1890), and amending law of the 30th of July 1895, which enactment protects additions to trade marks. *Denmark* (law of the 11th of April 1890, and an amending law of the 19th of December 1898, which enables traders to register words or figures, provided that these are not indicative of the origin, kind, use, quality or price of the goods). *Japan* (law of the 1st of July, and regulations of the 20th of July 1899). *Russia* (law of the 26th of February [9th of March] 1896). *Switzerland* (law of the 26th of September 1890).

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[1] By the law of 1906 (s. 21) the commissioner of patents is directed to establish classes of merchandise.

AUTHORITIES.—Sebastian, *Trade Marks* (4th ed., London, 1899; in this work the American cases are fully dealt with); Kerly, *Trade Marks* (London, 3rd ed., 1908); Kerly and Underhay, *Trade Marks Act 1905* (London, 1906); Cartmell's *Digest* (London, 1876–1892); Sebastian, *Digest* (London; cases down to 1879); Gray, *Merchandise Marks Act* (London, 1888); Safford, *Merchandise Marks* (London, 1893). The reports of the Departmental Committee of 1887, and of the Select Committees of the House of Commons appointed in 1887 and 1890 to consider the law with regard to merchandise marks and false marks, and the annual Reports of the Comptroller-General, throw great light on both the history and the practical working of the law. For American law, see Browne, *Treatise on Trade Marks* (Boston, 1873); Cox, *American Trade Mark Cases* (Cincinnati, 1871); *Manual of Trade Mark Cases* (Boston, 1881); Greeley, *Foreign Patents and Trade Marks* (Washington, 1899); Paul, *Law of Trade Marks* (St. Paul, Minn., 1903); and the reports of the commissioner of patents. As to foreign trade mark laws generally, see the following: *British Parl. Papers; Reports relative to Legislation in Foreign Countries* (1879; Cd. 2284, 2420); *Reports from H.M.'s Representatives Abroad, on Trade Marks, Laws and Regulations* (1900; Cd. 104); *Summaries of Foreign and Colonial Laws as to Merchandise Marks* (1900; Cd. 358, p. 850 seq.).

(A. W. R.; W. F. C.)

TRADE ORGANIZATION. The development of commercial organization which attended the growth of trade and industry during the 19th century assumed two distinct phases. In the first we see the creation of associations of persons engaged in trade and industry for the purpose of protecting their interests and of facilitating and fostering commercial relations. In the second, governments elaborate departmental organizations for the supervision of commerial matters, and utilize their consular services as means of commercial intelligence and influence.

The associations belonging to the first category comprise three classes:—

a. Those which are themselves engaged in trade, like ordinary joint-stock companies, or which result from the combination of firms or individuals in the same or connected trades, for the purpose of facilitating or restricting production, limiting competition, regulating prices, &c.

b. Those which, without engaging in trade, aim at providing facilities for the transaction of commercial or financial operations. They chiefly take the form of exchanges, bourses, public sale rooms, &c., such as the Baltic, Lloyd's, the Stock Exchange, the Corn and Coal Exchanges, the Commercial Sale Rooms.

c. Non-trading bodies, in the nature of public institutions, whose objects are to protect the interests of trade.

British and French Systems.

When, at the close of the 18th century and early in the 19th, the power of the old trade gilds and corporations of merchants had been broken, both governments and commercial men soon realized that the ancient societies would not follow the commercial evolution, and that new organizations must be created to meet new requirements. Two systems were evolved, which, from their prototypes, are known as the British and the French systems. In the former, trade organizations were left to develop themselves in their own way, and in whatever direction they might think fit, without any official interference. In the latter, on the contrary, the government constituted itself the creator of trade organizations, which it incorporated into the administrative system of the country, and to which it gave an official status as an integral part of the machinery of the state. The former have grown chiefly into associations for the promotion and defence of commercial interests, whilst the latter have mainly become sources of commercial information and means of action at the disposal of the government. While organizations on the British system are, as regards the government, purely advisory bodies whose opinion might or might not be asked in connexion with commercial matters, and whose duties are limited to the services which they are in a position to render to their members and to commerce generally, organizations on the French system not only must be consulted, in certain specified cases, by the government, especially in connexion with the drafting of commercial legislation and of regulations affecting trade, but they have also administrative duties to perform, such as the control of public commercial institutions, of testing, standardizing and conditioning establishments, port and dock works, &c. The British system obtains in the United Kingdom and the British colonies, in the United States and in Belgium, while the French has been adopted in most European countries, and in Japan.

I.—GREAT BRITAIN AND COLONIES

A.—*Commercial Associations.*

In the United Kingdom commercial associations arose with the growth of trade, without any assistance from the state and free from all government restriction or control. The first in point of date were the "commercial societies" which were formed, chiefly during the last quarter of the 18th century, in Birmingham, Exeter, Halifax, Leeds, Liverpool and Manchester, and which exercised a not unimportant influence upon commercial developments at the close of the 18th and in the early years of the 19th centuries. The modern associations which superseded them divided themselves into four classes, viz:—

a. Chambers of commerce and associations which aim at becoming representative of general commercial interests;

b. Associations or institutes which represent particular trades or branches of trades;

c. Trade protection societies, which look after the interests of retail as well as wholesale traders, and undertake to supply them with information as to the standing and credit of firms, expose swindlers, collect debts, &c.; and

d. Non-representative associations rendering general commercial services.

a. Chambers of Commerce and General Associations.—Most of the chambers of commerce in the United Kingdom were formed during the latter half of the 19th century, although a few were in existence much earlier. The oldest British chamber is the Jersey chamber, which dates from 1768. The Glasgow chamber was founded in 1783. Dublin followed in 1785, Edinburgh in 1786, Manchester in 1794, Belfast in 1796, Birmingham in 1813, Newcastle-upon-Tyne in 1818, Liverpool in 1851, Sheffield in 1857, &c. The London chamber was the last of the chambers of importance to be established; it dates only from 1881.

The London Chamber.

The London Chamber of Commerce, which has over 3000 members, is one of the most representative associations of its kind, and the organization adopted has been very effective in securing this. The chamber has been divided into trade sections, of which there are at present forty-four, and members specify the sections to which they desire to belong. Each section has a separate organization, and is presided over by a chairman elected by itself, who may be helped by an elected committee if found advisable. The general council of the chamber confirms the election of chairmen of sections, and no action can be taken by the chamber on the recommendation of a section without authorization of the council. The chamber has placed itself in connexion with a number of mercantile associations which, whilst preserving their separate organizations and their independence of action, have found it advantageous to work in conjunction with it, either for general or for particular purposes, and to have a voice in its council. The more important of these are the Institute of Bankers, the Institute of Chartered Accountants, the Society of Accountants and Auditors, the General Ship Owners' Society, the General Produce Brokers' Association, the Federation of Grocers' Associations of the United Kingdom, the West India Committee, the Corn Trade Association, the United Planters' Association of Southern India, &c.

The Liverpool Chamber.

Particular reference should also be made to the Liverpool chamber, which, as regards division into trade sections and co-operation with independent associations, works on similar lines to those of the London chamber. The African trade section of the Liverpool chamber has been prominent in connexion with African questions, and since its foundation in 1884 has been the leading voice in all matters relating to West Africa.

Association of Chambers of Commerce.

The Association of Chambers of Commerce of the United Kingdom, which was formed in 1860, contributed much to give chambers of commerce as a whole a national importance. This association, like the chambers themselves, was of course purely voluntary, and at its foundation only sixteen chambers decided to join it. The association is maintained by an annual subscription from the constituent chambers. It has been instrumental in passing many useful acts of parliament, and in otherwise influencing legislation upon commercial topics. The general meetings, which are held annually in March, in London, and at which delegates are present from all parts of the country, have come to be considered as a kind of parliament of trade, and representatives of the Board of Trade, the general post office, and the foreign and colonial offices are generally in attendance. Special meetings take place in September, and are held in provincial towns on the invitation of the local chamber.

The association has limited its work to the United Kingdom, and has not taken advantage of the commercial development of the colonies to afford colonial interests an opportunity of voicing their needs in the metropolis. To supply this need the London Chamber of Commerce has, from time to time, organized congresses of chambers of commerce of the empire. Some of these congresses have been held in the colonies, the first being at Montreal in 1903.

British Chambers Abroad.

The home organization of chambers of commerce is supplemented by a few British chambers which have been established in foreign countries. These institutions are self-supporting, and not, as seems often to be thought, branches of, or subsidized or controlled by home chambers. The British Chamber of Commerce in Paris, which is the oldest of them, dates from 1873, and was originally established by British merchants in Paris for the defence of their own trade interests. Its scope soon extended, however, and it admitted to membership British firms trading with France although not resident in France, and in course of time became representative of general British commercial interests in the French markets. Other British chambers are to be found in Genoa, Alexandria, Barcelona, Constantinople and St Petersburg. In Brussels an Anglo-American chamber jointly represents British and American interests. Several countries are represented in London by chambers of commerce, while the American Chamber (Liverpool), the Anglo-Belgian, the Anglo-Portuguese, the Australasian, the Italian, the Norwegian and the Swedish chambers are members of the Association of Chambers of Commerce of the United Kingdom. The United States are represented in England by the American Chamber of Commerce in Liverpool.

Foreign Chambers in England.

Colonial Chambers.

Commercial organization in the colonies is very much on the same footing as it is in the United Kingdom. The most representative associations are the chambers of commerce, whose constitution and functions are similar to those of the British chambers. In *Canada* the chambers, which are also sometimes called Boards of Trade, after the American custom, number over sixty, the most important being the Montreal and Toronto Boards of Trade and the Quebec Chamber of Commerce. The Canadian chambers have no association, but hold periodical conferences. There is, in addition, the Canadian Manufacturers' Association, with headquarters in Toronto and branches in all the provinces, which incorporates all the associations of manufacturers in the Dominion. The *Australian* chambers of commerce, which number some thirty, have joined into an association called the General Council of the Chambers of Commerce of the Commonwealth of Australia. In New Zealand, South Africa, India and many British colonies there are chambers of commerce in all the more important towns.

b. Associations Representing Particular Trades.—Associations representative of particular trades are almost innumerable. The London General Shipowners' Society, the Liverpool Shipowners' Association, the North of England Shipowners' and Steamship Owners' Associations may be mentioned as representative. The chambers of shipping and shipowners' associations joined forces in 1878 in order to establish the Chamber of Shipping of the United Kingdom, which does for them what the Association of Chambers of Commerce does for chambers of commerce. The Iron and Steel Institute affords a means of communication between members of the iron and steel trades, while the British Iron Trade Association is one of the most powerful. The nature of other associations is sufficiently indicated by their titles. In addition there are the Cotton Association, the Drapers' Chamber of Trade, the Fish Trade Association, the Sugar Refiners' Committee, various tea planters' associations, the Oil Seed Association, the Petroleum Defence Committee, the Mansion House Association on Railway and Canal Traffic, &c.

c. Trade Protection Societies.—These seem to be, on the whole, more ancient bodies than chambers of commerce. In the early part of the 19th century they were already strongly organized, especially in the West Riding of Yorkshire. Outside of that district the Dublin Society was the most important. They number more than 100 throughout the United Kingdom.

The Manchester Guardian Society, which dates from 1826, occupies a position of special prominence in the Midlands, and may be taken as the model of such associations. Its objects are—the making of private inquiries as to the respectability and credit of traders, the detection and exposure of swindlers; the collection of debts; the winding-up of insolvent estates; the issue of notices of bills of sale, judgments, bankruptcies, &c.; and generally the improvement of laws and regulations affecting trade. The society has over 6000 members, and its usefulness may be gauged by the fact that it answers an average of 40,000 credit inquiries every year.

Trade protection societies formed themselves, as early as 1848, into an association, which was at first an association of secretaries, but in 1865 was transformed into an association of societies. The association issues a quarterly journal called the *Trade Protection Journal.*

B.—*State Departmental Organizations.*

Although the British government allowed commercial organizations within its jurisdiction to grow independently of official control, it does not follow that it took no interest in the protection and promotion of British trade and the dissemination of commercial intelligence. As long ago as the reign of Charles II. the body which is now the British equivalent of what is known in most countries as the ministry of commerce, viz. the board of trade, was established. The commercial jurisdiction of the Board of Trade does not extend beyond the limits of the United Kingdom, but the Foreign Office, through the negotiation of commercial treaties and by means of the consular body, came into touch with international trade. With the development of the colonies, the colonial and India offices also found themselves called upon to act, to a certain extent, as guardians of commercial rights and channels for the dissemination of commercial intelligence. But when competition began to displace British goods from foreign markets, and when the British trader noticed the efforts which were being made by foreign governments for the promotion of trade, he came to the conclusion that the British government was not doing anything for him.

Consular Service.

Complaints were especially loud against the consuls, who were accused of systematically disregarding commercial interests, whilst their American, German, French and Belgian colleagues did not consider it below their dignity to take advantage of their position, in order to promote the trade of the country they represented. British Consular Reports were also unfavourably compared with those issued by foreign consuls, notably the American. The result was that, in 1886, instructions were issued to the consular service which, for the completeness and fairness with which they deal with the subject, have frequently been quoted as models which might advantageously be followed (see Parliamentary Paper, Commercial, No. 16, 1886). The preparation of consular reports, however, continued to be most unfavourably criticised, and frequent instructions were issued by the foreign office in regard to them. The whole question was raised again in 1896, when, as the result of lengthy communications between the Foreign Office on the one hand, and the Association of Chambers of Commerce and the London chamber on the other, fresh instructions were sent to British consuls, reiterating the instructions of 1886.

The consular service has of late years been supplemented by the appointment of commercial attachés.

Commercial Intelligence Branch of the Board of Trade.

The pressure exercised by the chambers of commerce upon the government led to the appointment in 1897 of a departmental committee on the dissemination of commercial intelligence, which was charged with considering means of more adequately supplying traders with commercial information, of improving consular and colonial reports, and with reporting on the advisability of appointing commercial agents to the colonies and establishing a commercial intelligence office. The chief result of the committee's recommendations was the establishment of the commercial intelligence branch of the Board of Trade. It publishes the *Board of Trade Journal* weekly. Attached to the branch is an advisory committee, composed of representatives of the various government departments and of the Association of Chambers of Commerce.

The scope of the commercial intelligence branch was further increased, and its means of action strengthened, by the transfer of the Imperial Institute to the Board of Trade, which was effected in 1902 by the passing of a private act of parliament.

The self-governing colonies are represented in London by agents-general (*q.v.*), while the commercial interests of the crown colonies are in the hands of the crown agents for the colonies.

II.—UNITED STATES OF AMERICA

A.—*Commercial Associations.*

American trade organizations have been developed mainly on the lines of the British system. Of the associations which come within the scope of this article, the most important are the chambers of commerce, which in certain cases are called boards of trade. Theoretically there is a distinction between the two, chambers of commerce being entrusted with the protection of general commercial interests, especially in connexion with foreign trade, whilst boards of trade look after local commercial questions. But in practice the difference is of no importance, as chambers of commerce take cognisance of local as well as international trade matters, and the boards of trade in no way limit the sphere of their activity to purely American questions.

The oldest American commercial organization is the New York Chamber of Commerce, which was founded in 1768, and incorporated by royal charter in 1770. In the words of its charter, its object was "to carry into execution, encourage and promote by just and lawful ways and means such measures as will tend to promote and extend just and lawful commerce." It was the prototype of all the other chambers of commerce and boards of trade which have since been established in the United States, and which are said to exceed 1000 in number. American trade organizations are associated in a National Board of Trade, which corresponds to the Association of Chambers of Commerce of the United Kingdom. The objects of this institution are to secure unity and harmony of action in reference to commercial questions, and to obtain, through its representative character, more satisfactory consideration of the matters which it brings under the notice either of the Federal government or of the local state administrations. The expenses of the National Board of Trade are defrayed out of a fund formed by the subscriptions of the various associations belonging to it. The United States has a number of chambers of commerce established in foreign countries. The first institution of this kind was started so long ago as 1801, when the American Chamber of Commerce in Liverpool was established. This chamber is the only one representing American commercial interests in the United Kingdom, there being no association of this nature in London. The American Chamber of Commerce in Paris is one of the most active, important and representative foreign associations on the continent of Europe. In some places where neither the American nor the British element is strong enough to maintain separate associations (notably in Brussels), they have joined hands to support an Anglo-American Chamber of Commerce, which is found to work fairly satisfactorily. The American commercial museums, although of recent foundation, have attracted much notice owing to the practical and business-like manner in which they are conducted, and are considered to be among the best equipped institutions of this nature. Those in Philadelphia and at San Francisco are the best known. The Philadelphia museum, which came first and is better known, was established by an ordinance of the municipality in 1894, and is supported by subscriptions and by municipal subsidies, administered by a board of trustees, who are appointed for life and serve without remuneration. The work of the museum is supervised by an advisory board, composed of representatives of the principal commercial organizations in the United States. Its objects are to assist American manufacturers and merchants in securing wider foreign markets for their products, to aid them in forming connexions abroad, and to bring foreign buyers in touch with them. One of the chief ways in which this is done is by means of an index file of foreign customers supplied to American manufacturers, and vice versa. In addition to the regular service to members, the museum also maintains abroad, in various cities, index files covering some sixty American trades or trade divisions, containing the names of American manufacturers of standing, with full particulars of their various lines of manufacture. These files are generally entrusted to chambers of commerce, or similar commercial institutions, and are placed gratuitously at the disposal of foreign manufacturers and merchants. The Philadelphia museum has also a most valuable library and a museum of samples.

B.—*State Departmental Organization.*

The American state organization for dealing with commercial matters lacks the theoretical completeness of the organization of most European states, but is nevertheless found to give satisfaction. Official control is exercised through various bureaus placed, for the most part, under the treasury department. The most important of these are: the interstate commerce commission, which deals with matters affecting the inland trade; the industrial commission, which looks chiefly after manufacturing; and the fishery bureau. Foreign commercial matters come within the cognisance of the bureau of foreign commerce, a section of the state department which also controls the consular body, and sees to the publication of their reports and to the dissemination of foreign commercial intelligence. The state department corresponds to the British foreign office.

The Pan-American Union, until 1910 called the Bureau of American Republics, was established in 1889, as a result of the Pan-American Conference called together in that year by the late James G. Blaine, secretary of state at that time. This bureau, which had its office in Washington, is supported by a contribution from all the republics of North, Central and South America, which is fixed at the rate of 1000 dollars a year per million inhabitants. Its object is the dissemination of trustworthy commercial information concerning the republics of the American continent, and in pursuance of this object it has issued a large variety of publications.

Consular Service.

The American consular service has been frequently pointed out as a model to be followed in connexion with commercial matters. America, contrary to the European practice, has no *consuls de carrière.* Her consular representatives are appointed for a period of, as a rule, four years, and are selected in preference from commercial circles. Their work, as compared with that of British consuls, is rather limited, and they have nothing to monopolize their time like the shipping interests with which the British consular body is entrusted in most countries. Since 1898 the bureau of foreign commerce issues consular reports daily, as fast as they are received, and circulates them in advance sheets, printed on one side of the paper only, like printers' proofs. They are afterwards republished in permanent form.

The American consular body, which numbers some 400 members, and is exclusively composed of American citizens, is distributed according to the commercial importance of towns.

III.—FRANCE

A.—*Commercial Associations.*

The French government was the first to elaborate a regular system of trade organizations, which it endeavoured to make as complete as possible. This system comprises:—

a. Chambers of commerce;

b. Consultative chambers of arts and manufactures; and

c. Syndical chambers of trade and industry.

Origin.

a. Chambers of Commerce.—Chambers of commerce owe their origin to the city of Marseilles, where, in 1599, the town council, which had hitherto looked after the commercial interests of the city, found it no longer possible to combine commercial with municipal functions, and established an association which it called the "Chamber of Commerce" to take up the commercial part of its duties. This seems to be the first time that the title was used. The new chamber soon became a most important body, and in 1650, during the minority of Louis XIV., *lettres patentes* were granted to it. It settled the law merchant and the customs of the port, was entrusted with the appointment of consuls and the control of French consulates in the Levant, fitted out expeditions against corsairs, owned fleets, sent embassies to the Barbaresque countries, organized commercial missions, &c. Its ordinary budget, at one time, amounted to over one million livres. Louis XIV. conceived the idea of a system of organizations which, whilst not being allowed to become so dangerously powerful as that of Marseilles, would nevertheless be useful in other towns, and in 1700 he caused an *arrêté* to be published, ordering the creation of chambers of commerce, which were entrusted with the nomination of deputies to the Royal Council of Commerce which had just been created in Paris. Chambers were consequently established in Lyons, Rouen, Toulouse, Montpellier, Bordeaux, La Rochelle, Lille, Bayonne, Amiens, &c. These bodies, however, did not exercise much influence under the monarchy. Including the Marseilles chamber, they were suppressed, with all trade gilds and other trade associations, in 1789. Napoleon re-established the chambers by decree of the 24th of December 1802, and endowed them with a constitution similar, in essential particulars, to the one they have at present, which has served as a model for chambers of commerce on the Continent, but he submitted them to a uniform and narrow administrative jurisdiction which practically deprived them of all initiative.

Constitution.

They are now regulated by the law of the 9th of April 1898, which codified, altered and completed previous legislation on the subject. Under this law, chambers of commerce can only be established by a decree countersigned by the minister of commerce, upon the advice of the municipal council of the place where the chamber is to be, of the general council of the department, and of the existing chambers of commerce of the district. The members of chambers of commerce used to be elected by the "Notables Commerçants," who were a body of commercial electors selected by the prefects in accordance with the provisions of the Code of Commerce. They were abolished by law in 1871, but those who were then entitled to the designation still continue to use it, which explains the words "Notable Commerçant," so puzzling to foreigners in French commercial directories and on French business cards. At present, commercial houses paying *patente*—which is a special tax upon people engaged in trade—elect the members of the chamber, the number of whom is fixed for each chamber by the minister of commerce.

Functions.

Their functions, which are consultative and administrative, are set out in part ii. of the law of 1898. The government is bound to take their opinion regarding the regulation of commercial usages, the establishment of public institutions of a commercial or financial nature, and of tribunals of commerce, the improvement of transport and communications, the application of laws of a local character, the sale price of prison-made goods and the tariff for prison labour, and local public works, and loans or taxation in connexion therewith. On the other hand, they are allowed to submit observations to the government, without being asked, on proposed changes in the commercial or economic legislation of the country; on customs tariffs and regulations; on railway, canal and river rates; and on transport regulations. As regards their administrative functions, they may be authorized to establish and administer such institutions as bonded warehouses, public sale-rooms, fire-arm testing establishments, conditioning rooms for wool, silk, textiles, paper, &c., commercial, professional, or technical schools and museums, &c. They may be granted concessions for public works, and may undertake the carrying out of public services, especially in regard to the ports, docks, canals and navigable rivers in their district, and be authorized to issue loans for the purpose.

Previous to 1898 it was illegal for chambers of commerce to hold joint meetings for the discussion of matters of public interest, and they were not even allowed to correspond or consult in any way, except through the medium of the minister of commerce. The new law relaxed to a certain extent this prohibition, by authorizing direct correspondence and permitting chambers in a district to meet for the joint consideration of questions affecting their district, but for no other purpose. Such a thing as an association of chambers of commerce is still illegal in France.

French Chambers of Commerce Abroad.

When, in 1873, British merchants in Paris started a British chamber of commerce in the French capital, the French government looked rather askance at the new venture, and M. Léon Say, when minister of commerce, even threatened it with forcible dissolution unless the title "Chamber of Commerce" was dropped. This demand was not ultimately pressed, and the services rendered by the British chamber soon opened the eyes of the French government to the advantages which they might derive from the formation of similar institutions to represent French commercial interests abroad. In 1883 the minister of commerce started the organization of such chambers, which endeavoured to combine to a certain extent the French and the British systems.

Foreign Chambers of Commerce in Paris.

Foreign commercial interests are represented in Paris by seven foreign chambers of commerce, of which the British Chamber is the oldest. The others are the American, Austro-Hungarian, Belgian, Italian, Spanish and Russian chambers. In 1896 these chambers formed themselves into an Association of Foreign Chambers of Commerce, but the French government gave it to be understood that, as they did not allow associations of French chambers, they could not treat foreign bodies more favourably, and the association had to be dissolved.

Constitution.

b. Consultative Chambers of Arts and Manufactures.—These institutions, organized somewhat after the model of chambers of commerce, represent manufacturing and industrial interests. They were established by Napoleon I. in 1803, and formed part of the complete system of commercial organizations which he intended to give France. They are now regulated by decrees of 1852 and 1863, and are composed of twelve members elected for six years by merchants and manufacturers inscribed upon an electoral list specially drawn up by the prefects. These chambers, of which there are some fifty in existence, are placed under the control of the minister of commerce, but instead of being kept out of the *patentes*, like chambers of commerce, they are supported by the municipality of the town where they are situated, which has also to provide them with offices rent free, and with clerical assistance.

Functions.

In addition to giving advice in connexion with manufacturing and industrial matters, they have to look after and report upon improvements in manufactures and machinery, new industrial processes, &c. They are especially useful in the preparation of local and international exhibitions. They are also entrusted with the nomination of the Consultative Committee of Arts and Manufactures, a body whose functions are to advise the ministers of commerce and finance, as well as those of the interior and of public works, as regards the regulation of dangerous trades and industries, patents and trade marks legislation, and the interpretation of customs regulations.

c. Syndical Chambers of Trade and Industry.—By the side of the official trade organizations other associations have grown up, which, although regulated by law, are in the nature of voluntary and self-supporting bodies, viz. the syndical chambers of trade and industry. The repeal in 1884 of the law of 1791, which prohibited the formation of trade or professional association, was the signal for the formation of those chambers, which soon acquired great influence. A few syndical chambers existed before that date, the oldest, the Chamber of Master Builders, dating back as far as 1809, but they were only tolerated, and their existence, being illegal, was most precarious.

Constitution.

The syndical chambers, which are divided into chambers of employers and chambers of employed, are the official organs and representatives of the trade and professional syndicates authorized by the law of the 31st of March 1884, which was the work of M. Waldeck-Rousseau. Each syndicate has its separate chamber. They may be established without government authorization, but a copy of their rules and a list of their officials must be sent to the prefect. Membership is strictly limited to persons of French nationality. The only way in which the government can dissolve them is by application to the courts of justice for an order of dissolution on the ground of infringement of the provisions of the law. In Paris, most of the syndical chambers have formed an association called the Union Nationale du Commerce et de l'Industrie—Alliance des Chambres Syndicales. Another association, intended to take up the defence of the interests and rights of syndical chambers, has been formed under the title of Syndicat du Commerce et de l'Industrie—Syndicat des Chambres Syndicales. The syndical chambers are kept up by the subscriptions of their members, and have the right to hold real property, as have also the associations of chambers, which are kept up by subscriptions from the constituent chambers.

Functions.

According to the law which authorized their formation, the objects of the syndical chambers are exclusively "the study and defence of economic, industrial, commercial and agricultural interests," and for this purpose they have complete freedom of intercommunication and can hold congresses. They are authorized to establish for their members mutual benefit societies and pension and relief funds, to open employment agencies, to give legal advice to, and in certain cases to bring actions on behalf of their members, and to organize the settlement of disputes by arbitration. They take part in the election of judges of the tribunals of commerce and of the Conseils de Prud'hommes.

B.—*State Departmental Organization.*

Ministry of Commerce.

The state commercial departments and offices are chiefly centred round the ministry of commerce, to which is assigned the commercial part of the duties fulfilled in England by the board of trade. A ministry of commerce existed for short periods in 1811 and in 1828, but it was ultimately suppressed in 1829, and from that date until 1886, when the department received its present form and separate existence, commerce was only represented in the French government by a subsidiary bureau attached sometimes to one ministry, sometimes to another. The ministry is divided into three main bureaus—the first entrusted with all matters connected with the home trade and industry, the second with foreign and colonial relations, and the third with the compilation of statistics.

Attached to the ministry of commerce is a body called the Conseil Supérieur du Commerce et de l'Industrie, which acts as an advisory council to the minister. Its origin goes back to the council of commerce established by Louis XIV., but it is now regulated by a decree of 1882.

National Office for Foreign Trade.

The Office National du Commerce Extérieur was established by a law of the 4th of March 1898, and is carried on jointly by the ministry of commerce and the chamber of commerce of Paris, the latter having provided it with an installation at a cost of over 1,200,000 francs. The office, which has been founded for the promotion of French trade with foreign countries and the dissemination of commercial intelligence, fulfils duties similar to those of the commercial intelligence branch of the board of trade. It also publishes the weekly *Moniteur officiel du commerce.*

Office Colonial.

The Office Colonial, whose duties are especially to furnish information concerning the French colonies, to promote emigration thither, and to foster a demand in France for the produce of her colonies, was established by a decree of the 14th of March 1899. It is entrusted, in addition, with a permanent exhibition of colonial produce and a museum of samples of goods supplied by or required in the colonies. The office is also in charge of a colonial garden at Vincennes, where experiments are made for the acclimatization of colonial plants and produce in France, and the cultivation of French produce in the colonies. The office publishes a monthly bulletin of miscellaneous colonial information, and issues yearly commercial and other reports dealing with the colonies. It is a dependency of the ministry of the colonies.

Consular Service.

French consuls are instructed to transmit to their government all information which they may consider useful for the prosperity of French trade. It is also their duty to spread, in the country where they reside, a knowledge of such French commercial and financial matters as they may consider most useful in the interests of their own country. The close relations which they are recommended to cultivate with the French commercial community within their jurisdiction through the local French chamber of commerce and the councillors of foreign trade are intended to enable them to keep in better touch with commercial questions. They have had, however, to be frequently reminded of their commercial duties, and the French chambers of commerce have criticized them almost as much as the British chambers have British consuls. The most important instructions issued to consuls were contained in circulars from the minister for foreign affairs dated the 15th of March and the 24th of April 1883. French consuls have to make a return to their government every fortnight—every month if the district is not of great commercial importance—showing, upon forms specially provided, the nature, quantity, origin or destination, prices wholesale and retail, and chief trade marks of the goods imported into and exported from the district, the results of public sales of produce, the conditions of transport, contemplated public works and tenders advertised, state of the labour market, artistic enterprises, commercial failures and rumours concerning important local firms, effect of foreign competition, imitation of French trade marks, &c. These returns are mostly of a confidential nature, and are not intended for publication, but whenever the minister considers it advisable he causes information to be conveyed through the chambers of commerce, or other channels, to the parties chiefly interested. The ordinary consular reports are published in weekly instalments in the *Moniteur officiel du commerce.*

IV. Germany

A.—*Commercial Associations.*

German trade organizations are of three kinds, viz.:—

a. Official organizations established by law, and called Handelskammern, or chamber of commerce;

b. Semi-official associations; and

c. Voluntary or "free" associations.

a. Chambers of Commerce.—Contrary to the idea prevalent in England, official trade organizations in Germany are in a somewhat chaotic state. They have been established under more or less different conditions and systems in each state of the empire, and in certain districts still bear the imprint of foreign origin. They are under the control of the local state governments and lack the homogeneity and unity of direction of the French official system.

Hanseatic Organization.

Before proceeding to a general examination of the German régime, special mention must be made of the chambers of commerce of the old Hanseatic Confederacy which stand apart, and whose duties, as well as constitution, differ from those of trade organizations in the rest of Germany. The chambers of commerce in Hamburg, Bremen and Lübeck are not only the successors of, but (contrary to what happened in Germany as well as in other countries) have been evolved out of the old corporations which looked after the interests of the Hans traders in the olden days, and which, in the case of the Hamburg "Commerz-Deputation," for instance, dated as far back as 1665.

The Hamburg Chamber of Commerce, whose present constitution dates from 1860, is composed of twenty-four members elected for six years by the ancient "Versammlung eines ehrbaren Kaufmannes," that is to say, the merchants and commercial men whose names appear on the register of the "Honest Merchants" of the city. Its income is chiefly derived from special taxation, to which are added the proceeds of the sale of contract and transfer stamps, and also the amount paid every year for the re-registration of each "Honest Merchant." This latter source of income amounts to about 70,000 marks per annum. The chamber has to submit its accounts for approval to the Senate of the Republic.

In addition to the general duties of chambers of commerce in connexion with trade matters, the Hamburg chamber—the same may also be said of the other Hanseatic chambers—fulfils the combined functions of a chamber of shipping and of a port and docks board. It has the right of proposing judges and of nominating experts attached to the courts. The exchanges and public sale rooms of the city are under its control, and it publishes the official quotations, as well as a weekly price list of goods and produce at the port of Hamburg. It is entitled to elect members to the "Bürgerschaft" or lower house of representatives, who are especially competent to deal with trade and shipping questions, customs duties and emigration. The chamber must be consulted by the "Bürgerschaft" with reference to all proposals affecting trade and navigation.

In Bremen the chamber is composed of twenty-four members elected by the "Ausschuss des Kaufmanns-Konvents," which comprises all the important commercial houses of the city. Two members go out every year, and no one can remain a member for more than eighteen years. The Bremen chamber is intimately connected with the Senate of the Republic, a standing committee of both being in existence to settle questions affecting trade and navigation.

The Lübeck chamber is composed of twenty members elected for six years by the associations representing the wholesale and retail trades. The president must be approved by the senate, and is sworn in as a state official. He holds office for two years, and is not paid for his services, but when he goes out of office is presented with a sum of money subscribed by the townspeople. The Lübeck chamber is probably the wealthiest organization of its kind in Germany, and is entrusted with the administration of the property of the old corporation of the "Vorstand der Kaufmannschaft," which is very important. The senate must consult it not only in trade and navigation matters, but also with reference to all contracts entered into on behalf of the state.

Chambers of Commerce.

Chambers of commerce in other parts of the German Empire are not so important, nor are their duties so varied, as in the Hanseatic towns. The oldest ones were established by Napoleon in 1802 in Cologne, Crefeld, Aachen, Stolberg and other towns which were then under the control of France, and they were submitted to the legislation which regulated the chambers organized in France at the same time. The model set up by the French was more or less closely followed in the subsequent establishment of institutions of this nature in other German states. The Berlin chamber was only constituted on the 1st of April 1902. A trade corporation called the "Aelteste der Kaufmannschaft" previously fulfilled, to a certain extent, the duties of a chamber of commerce. The new chamber rests on a broader basis than the old corporation, which, however, remains intact, though the sphere of its action has been restricted.

Broadly speaking, the German chambers are elected by the registered tradespeople and the merchants. Throughout the whole of Germany chambers are under the strict supervision of the state minister of commerce, and cannot be established except with his permission. He fixes the number of members as well as the amount of the state allocation to the chamber. In Prussia and Bavaria the government is entitled to dissolve chambers whenever it considers it advisable to do so, and there is always a government commissioner in attendance at all meetings. In most cases the local government allows a fixed sum for the expenses of chambers of commerce, and if this amount is exceeded the electors who are on the commercial register have to make good the excess by the striking of a special rate. In some states, *e.g.* Brunswick, Württemberg and Baden, the electors cannot be called upon to pay for deficiencies more than an amount fixed by law. In Bavaria chambers get a subvention from the district and central funds.

The duties and powers of the German chambers are practically the same as those of the French chambers.

The German government did not, like the French, interfere with the liberty of association of chambers of commerce, and as a result German chambers have united, together with other trade corporations, in an association called the "Deutsche Handelstag," founded in 1861, and carried on in its present form since 1886.

German Chambers Abroad and Foreign Chambers in Germany.

The German government is understood to be opposed to the formation of German chambers of commerce abroad, and as a matter of fact there are no German chambers in Europe outside of Germany. A few have been established in South America, but they are purely voluntary associations. No foreign chambers of commerce exist in Germany.

b. Semi-Official Corporations.—Besides the chambers of commerce, there exist, chiefly in Prussia, various old-established and quasi-official corporations, whose views receive as careful consideration from the government as do those of chambers of commerce. The Berliner Aelteste der Kaufmannschaft is one of the most important of these corporations, but the Gewerbekammer of Memel, the Kaufmännische Verein of Breslau, the Vorsteher Amt der Kaufmannschaft of Koenigsberg also deserve mention. Others exist in Elbing, Stettin, Danzig, Tilsit and Magdeburg. They originated for the most part in ancient gilds or associations of commercial firms, and were organized in their present form between 1820 and 1825.

c. Voluntary Associations.—Germany possesses also a large number of influential commercial associations of a voluntary character called the "Freie Vereine," which, especially in recent years, have greatly contributed to the commercial development of the empire.

B.—*State Departmental Organization.*

The German Empire has no ministry of commerce. As in the United States, commercial matters form only a department of the ministry of state. Most of the states of the empire have, however, their own ministries of commerce, the oldest being the Prussian ministry of commerce and industry, which dates from 1848.

Prussian Council of National Economy.

In Prussia, the minister of commerce is advised by the Volkswirthschaftsrath, or council of national economy, an official body constituted in 1880 by the Emperor William I. The functions of this council, which assembles periodically under the presidency of the minister of commerce, are also similar to those fulfilled in France by the Conseil Supérieur du Commerce et de l'Industrie.

Commercial Museums.

The German government has taken steps to facilitate the dissemination of commercial intelligence by the establishment of commercial museums, which are variously called "Handelsmuseen," "Ausfuhrmusterlager" or "Exportmusterlager." The first of these, which are on the model of the Vienna Handelsmuseum, was opened in Berlin in 1883. Others followed in Munich, Karlsruhe, Frankfort, Cologne, Dresden, Leipzig, Weimar, &c. They perform, to a certain extent, much the same functions as those performed in England by the commercial intelligence branch of the board of trade.

Consular Service.

A perusal of the instructions given to German consuls with regard to commercial matters shows that the German consular body is in this respect very much in the same position as the British consular body. If German consuls as a whole have been especially active and successful in promoting German commercial interests, it is not on account of the nature of the instructions received from their government, these instructions being to all intents and purposes similar to those issued to British consuls, but because particular care was taken to select consuls from a class of men imbued with the desire of increasing the greatness of their country by the promotion of German trade.

Agricultural Attachés.

Of distinctly commercial attachés, like those of Great Britain and Russia, Germany has none; but in addition to the consular body she is represented in foreign countries by five attachés or experts, whose duties are to study the movements of agricultural produce, and interest themselves in agricultural matters generally. They cover Great Britain, France, Russia, the Danube district and the United States.

V.—BELGIUM

A.—*Commercial Associations.*

The important place which Belgium has taken in international trade has directed much attention to her commercial organization, which comes nearer to the British model than that of any other European country. Belgian chambers of commerce were on the French system until 1875, when all official ties between them and the government were broken, and full liberty was given to commercial associations to establish and govern themselves in their own way. The Belgian chambers have now no administrative functions of any kind, but the Belgian government never fails to consult them in matters likely to interest the commercial community. The most important chambers are those of Antwerp, Brussels, Ghent, Liége, Charleroi, Verviers and Namur. Mention should also be made of the federations of industrial and commercial associations at Antwerp and at Brussels, and of the syndical union of Brussels. In some places there are Liberal and Conservative chambers of commerce.

In addition to institutions representative of the general interests of commerce and industry, the principal trades have also in the larger cities separate associations or syndicates. There are a large number of associations for the promotion of colonial trade, which have grown up since the establishment of the Congo Free State. A number of Belgian chambers of commerce also exist abroad, the first of which was established in New York in 1867.

B.—*State Departmental Organization.*

The Belgian ministry of commerce, under whose control commercial matters are placed, dates only from 1895, previous to which time the department of commerce at the ministry for foreign affairs fulfilled the same functions. The ministry has established in Brussels a Commercial Museum, similar to those of Germany and Austria, to centralize commercial intelligence and facilitate its dissemination.

VI.—OTHER COUNTRIES

Austria-Hungary.—The control exercised by the government over commercial organizations in Austria and in Hungary is very close. The only institutions of this kind of any importance within the dual monarchy are the chambers of commerce. They are official bodies, regulated by the law of the 29th of June 1868, which is, as regards the functions of chambers, almost similar to the French law. But the Austrian chambers, in certain cases, have the right to elect members of parliament, which right depends upon taxation. Within the Trieste district one-third of the members of chambers of commerce may be foreigners.

Austria and Hungary have each a ministry of commerce, the former since 1853 and the latter since 1867, whose jurisdiction is strictly confined to internal trade matters in each country. Whenever important questions arise affecting common interests the Gemeinsame Zoll-Conferenz, or Common Customs Conference, is summoned. This conference is made up of representatives of the various ministries of both countries. Matters arising out of commercial relations with foreign countries are under the control of the commercial department of the imperial foreign office.

The Vienna commercial museum was the prototype of similar institutions. It was established in 1875, as a consequence of the Vienna International Exhibition of 1873, and was followed shortly afterwards by the establishment of a similar one in Budapest.

Italy.—The chambers of commerce and arts, which are regulated by the law of 1862, are official bodies. They are instituted, and may be dissolved, by royal decree, and their functions are almost similar to those performed by the French chambers. They are, however, at liberty to unite for the consideration of commercial and industrial questions of common interest, and are entitled to own property and to levy taxes for their maintenance.

An advisory council is attached to the ministry of commerce, which dates from 1878. This council is called upon to give an opinion with reference to all matters connected with trade and industry. There are also two commercial museums, one in Rome and one in Milan.

Spain.—Spanish chambers of commerce were organized by a royal decree of 1886, which places them under the control of the Ministro de Fomento. They are self-supporting bodies with unlimited membership, but have also an official standing. In order to belong to them one must be of Spanish nationality, be engaged in trade, have paid direct taxes to the state for at least five years for the business in connexion with which membership of the chamber is sought, and pay annually the amount of the subscription provided by the regulations. The government must consult chambers of commerce upon treaties of commerce and navigation, tariff changes, the creation of commercial exchanges and the organization of commercial education. Owing to the peculiarity of their constitution the Spanish chambers are much more representative of the feelings of the commercial community, and much less under the strict control of the government, than similar institutions in other continental countries. Spain has no ministry of commerce proper, the duties of this office being performed by the commercial sub-department of the Ministro de Fomento, which dates from 1847.

Portugal.—In Portugal the organizations corresponding to chambers of commerce, which are called "commercial associations," are voluntary associations kept up by the subscriptions of their members. The associations at Lisbon and Oporto are the only ones of importance.

Russia.—Attached to the department of trade and manufactures of the ministry of Finance, which in Russia does duty for the ministry of commerce, there is an official council of trade and manufactures which sits in St Petersburg, and is presided over by a representative of the ministry. A similar council is also in existence at Moscow. In addition to these there are six local bodies, called the "local committees of trade and manufactures," entrusted with the care of commercial interests in Archangel, Odessa, Rostov-on-the-Don, Tver, Tikhvin and Ivanovo-Voznesensk. At Warsaw there is a "committee of manufactures." The committees are purely consultative bodies.

Closer to what we know as chambers of commerce are the institutions called "exchange committees." They are voluntary associations, chosen by a council elected for the purpose by the commercial community; they generally consist of twelve members elected for five years, and the president is appointed by the minister of finance. Two important commercial societies, although unofficial, are recognized and frequently consulted by the government, viz. the Society for the Encouragement of Russian Trade and Industry, of St Petersburg, and the Society for the Encouragement of Navigation, of Moscow.

The Russian government is represented abroad by commercial attachés, who are known as "agents of the Russian ministry of finance." The duties of these attachés are almost similar to those of the British commercial attachés, but they are entrusted with the promotion of Russian financial as well as commercial interests.

Japan.—Commercial matters in Japan come within the cognizance of the minister of state for agriculture and commerce. The chief commercial associations are the chambers of commerce, which are under the direct control of the minister. They are official bodies, with a constitution somewhat resembling that of the French chambers. The members must be Japanese subjects.

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TRADE UNIONS, combinations for regulating the relations between workmen and masters, workmen and workmen, or masters and masters, or for imposing restrictive conditions on the conduct of any industry or business.

I.—THE UNITED KINGDOM

History of British Legislation.

By the English common law such combinations were, with certain unimportant exceptions, regarded as illegal. They were considered to be contrary to public policy, and were treated as conspiracies in restraint of trade. Those who were concerned in them were liable to be criminally prosecuted by indictment or information, and to be punished on conviction by fine and imprisonment. The offence was the same whether it was committed by masters or by workmen. But although the common law applied *mutatis mutandis* to both of them alike, it was, practically speaking, in reference rather to the latter than to the former that its effects were developed and ascertained. Although workmen, as individuals, might lawfully consent or refuse to labour for any remuneration or for any time they pleased, the hostility of the common law to combinations effected the result that when two or more of them joined together, and agreed to labour only on certain stipulated terms, their agreements were not only null and void, but were criminal offences subject to punishment. It was immaterial whether the end they had in view was to determine wages or to limit work; or whether the means they adopted for promoting its attainment was a simultaneous withdrawal from employment, an endeavour to prevent other workmen from resuming or taking employment, or an attempt to control the masters in the management of their trade, the engagement of journeymen or apprentices, or the use of machinery or industrial processes; or whether in seeking to enforce their demands they relied merely on advice and solicitation, or resorted to reproach and menace, or proceeded to actual violence. In any event their combination in itself constituted a criminal conspiracy, and rendered them amenable to prosecution and punishment.

From the reign of Edward I. to the reign of George IV. the operation of the common law was enforced and enlarged by between thirty and forty acts of parliament, all of which were more or less explicitly designed to prohibit and prevent the organization of labour. But the rise of the manufacturing system towards the end of the 18th century, and the revolution which accompanied it in the industrial arrangements of the country, were attended by a vast and unexpected extension of the movement which the legislature had for so long essayed to suppress. Among the multitudes of workmen who then began to be employed in factories, trade unions in the form of secret societies speedily became numerous and active, and to meet the situation a more summary procedure than that which had hitherto been available was provided by an act passed in 1800. By this statute it was enacted that all persons combining with others to advance their wages or decrease the quantity of their work, or in any way to affect or control those who carried on any manufacture or trade in the conduct and management thereof, might be convicted before one justice of the peace, and might be committed to the common gaol for any time not exceeding three calendar months, or be kept to hard labour in the house of correction for a term of two calendar months.

Act of 1800.

The discontent and disorder consequent upon the introduction of steam and improved appliances into British manufactures in the first quarter of the 19th century, in conjunction with a state of commercial depression and national distress, led to the nomination of a select committee by the House of Commons, to inquire into the whole question of what were comprehensively designated the "combination laws," in the session of 1824. The committee reported to the House that "those laws had not only not been efficient to prevent combinations either of masters or workmen, but on the contrary had, in the opinion of many of both parties, had a tendency to produce mutual irritation and distrust and to give a violent character to the combinations, and to render them highly dangerous to the peace of the community." They further reported that in their judgment "masters and workmen should be freed from such restrictions as regards the rate of wages and the hours of working, and be left at perfect liberty to make such agreements as they mutually think proper." They therefore recommended that "the statute laws which interfered in these particulars between masters and workmen should be repealed," and also that "the common law under which a peaceable meeting of masters or workmen might be prosecuted should be altered." In pursuance of their report, an act, 5 Geo. IV. c. 95, was at once brought in and passed. But the immediate results of the change which it effected were regarded as so inconvenient, formidable and alarming, that in the session of 1825 the House of Commons appointed another select committee to re-examine the various problems, and review and reconsider the evidence submitted to their predecessors. They reported without delay in favour of the total repeal of the act of 1824, and the restoration of those provisions of the combination laws, whether statutory or customary, which it had been more particularly intended to abrogate. The consequence was an act passed in 1825 of which the preamble declares that the act of 1824 had not been found effectual, and that combinations such as it had legalized were "injurious to trade and commerce, dangerous to the tranquillity of the country, and especially prejudicial to the interests of all who were concerned in them." The effect of this act was to leave the common law of conspiracy in full force against all combinations in restraint of trade, except such as it expressly exempted from its operation, as it had been before the act of 1824 was passed. It comprised, however, within itself the whole of the statute law relating to the subject, and under it no persons were liable to punishment for meeting together for the sole purpose of consulting upon and determining the rate of wages or prices which they, being present, would require for their work or pay to their workmen, or the hours for which they would work or require work in any trade or business, or for entering into any agreement, verbal or written, for the purpose of fixing the rate of wages or prices which the parties to it should so receive or pay. But all persons were subjected to a maximum punishment of three months' imprisonment with hard labour who should by violence, threats or intimidation, molestation, or obstruction, do, or endeavour to do, or aid, abet or assist in doing or endeavouring to do, any of a series of things inconsistent with freedom of contract which the act enumerated and defined.

Act of 1824.

Act of 1825.

In 1859, in order to remove certain doubts which had arisen as to the true import and meaning of the undefined words "molestation" and "obstruction," it was provided by an amending act that "no person, by reason merely of his endeavouring peaceably and in a reasonable manner, and without threat or intimidation, direct or indirect, to persuade others to cease or abstain from work, in order to obtain the rate of wages or the altered hours of labour agreed to by him and others, should be deemed to have been guilty of 'molestation' or 'obstruction.'"

Act of 1859.

In spite of the partial recognition which trade unions had thus received, they continued to be unlawful, although not necessarily criminal, associations. In certain cases, they were by statute exempted from penal consequences, and their members were empowered to combine for specified purposes, and to collect funds by voluntary contributions for carrying them into effect. But in the estimation of the common law the special privileges which had been accorded to them under particular circumstances did not confer any general character of legality upon them, and where their rules were held to be in restraint of trade, as in the prohibition of piece-work or the limitation of the number of apprentices, they were still regarded as conspiracies. In this condition the law was when what became notorious as the "Sheffield and Manchester outrages" suggested the appointment of the royal commission on trade unions, which investigated the subject from 1867 to 1869. The outcome was, first, a temporary measure for the more effectual protection of the funds of trade unions, passed in 1869, and, secondly, the two measures which, as amended and amending, are cited together as the "Trade Union Acts 1871 and 1876."

Acts of 1869-1876.

Under these statutes, construed with the Conspiracy and Protection of Property Act 1875, the law relating to combinations, whether of workmen or of masters, entered upon a new phase. In connexion with trade disputes no person can be prosecuted for conspiracy to commit an act which would not be criminal if committed by him singly. The purposes of a trade union are not to be deemed illegal merely because they are in restraint of trade, and the circumstance that they are in restraint of trade is not to render any member of it liable to prosecution, nor is it to avoid or make voidable any agreement or trust relating to it. No court, however, can entertain legal proceedings with the object of directly enforcing or recovering damages for the breach of an agreement between the members of a trade union as such, concerning the conditions on which the members for the time being shall or shall not sell their goods, transact their business, employ or be employed, or the payment by any person of any subscription or penalty to a trade union, or for the application of the funds of a trade union to provide benefits or to furnish contributions to any employer or workman not a member of such trade union in consideration of such employer or workman acting in conformity with the rules or resolutions of such trade union, or to discharge any fine imposed upon any person by any court of justice or any agreement made between one trade union and another, or any bond to secure such agreement. But such incapacity to sue on such agreements is not to be taken as constituting any of them illegal. Every person, however, commits a misdemeanour, and on

General Effects.

conviction is liable to a maximum fine of £20, or to a maximum imprisonment of three months with hard labour, who wilfully and maliciously breaks a contract of service or hiring, knowing or having reasonable cause to believe that the probable consequence of his so doing, either alone or in combination with others, will be to endanger human life or cause serious bodily injury, or to expose valuable property, whether real or personal, to destruction or serious injury; or, who, being employed by a municipal authority or by any company or contractor on whom is imposed by act of parliament, or who have otherwise assumed, the duty of supplying any place with gas or water, wilfully and maliciously breaks a contract of service or hiring, knowing, or having reasonable cause to believe, that the probable consequence of his so doing, alone or in combination with others, will be to deprive the inhabitants of that place, wholly or in part, of their supply of gas or water; or who, with a view to compel any other person to do or to abstain from doing any act which such other person has a right to abstain from doing or to do, wrongfully and without legal authority uses violence to or intimidates such other person or his wife or children, or injures his property, or who persistently follows such person about from place to place, or who hides any tools, clothes or other property owned or used by such other person, or deprives him of or hinders him in the use thereof, or who watches or besets the house or other place where such person resides or works or carries on business or happens to be, or the approach to such house or place, or who follows such other person with two or more other persons in a disorderly manner in or through any street or road. Attending at or near the house or place where a person resides or works or carries on business, in order merely to obtain or communicate information was not watching or besetting within the statute, but this proviso has since been repealed. In regard to registration, trade unions are placed on a similar footing with friendly and provident and industrial societies, and they enjoy all the privileges, advantages and facilities which those associations possess and command, except in so far as they differ by the fact that there is no legally enforceable contract between a trade union and its members, and that the right of a registered trade union to invest funds with the National Debt Commissioners is limited, and in a few other matters. On their side, however, they have to comply with the same conditions, are subject to the same liabilities, and are compelled to make the same periodical returns.

Later Legislation.

During the years following 1876 several important amendments of the law, other than special trade union legislation, and the decisions of the courts in various cases, led up to the important act of 1906. These affected principally the liability of trade union funds to be taken in execution for the wrongful acts of agents of the union, the statute law relating to picketing and other incidents of strikes, and the law of conspiracy as affecting trade unions.

The two latter points are dealt with in the article on STRIKES AND LOCK-OUTS, and it may suffice here to say that the clauses in the act of 1875 prescribing punishment for watching and besetting a house, &c., with the view of compelling any other person in the manner set forth, have been amended by the repeal of the proviso that "Attending at or near the house or place where a person resides, or works, or carries on business, or happens to be, or the approach to such house or place, in order merely to obtain or communicate information, shall not be deemed a watching or besetting within the meaning of this section" by the enactment in the act of 1906 that: "It shall be lawful for one or more persons, acting on their own behalf or on behalf of a trade union or of an individual employer or firm in contemplation or furtherance of a trade dispute, to attend at or near a house or place where a person resides or works or carries on business or happens to be, if they so attend merely for the purpose of peacefully obtaining or communicating information, or of peacefully persuading any person to work or abstain from working."

The object was to include the right of peaceful persuasion which had been supposed by parliament to be implied in the terms of the act of 1875. Further, the law of conspiracy has been amended by enactments in the act of 1906 that: "An act done in pursuance of an agreement or combination by two or more persons shall, if done in contemplation or furtherance of a trade dispute, not be actionable unless the act if done without any such agreement or combination would be actionable," and "An act done by a person in contemplation or furtherance of a trade dispute shall not be actionable on the ground only that it induces some other person to break a contract of employment or that it is an interference with the trade, business or employment of some other person, or with the right of some other person to dispose of his capital or his labour as he wills."

Leading Cases in the Law-courts.

The act of 1875, in the words of Lord Cairns, was framed on the principle that "the offences in relation to trade disputes should be thoroughly known and understood, and that persons should not be subjected to the indirect and deluding action of the old law of conspiracy," but no one during the discussion of the bill was thinking of the civil action. This matter became important when the dicta of various judges in the House of Lords in the case of *Quinn* v. *Leathem* showed that there might be an action for damages based on any conspiracy to injure or do harm, particularly when it is considered that the very essence of a strike is in one sense injury to those against whom it is directed, and these opinions became of the utmost import to trade unions when the Taff Vale case showed that the fact of procuring to strike might also involve trade union funds in liability, even where there had been no procuring to break contracts. This important decision arose through the amendment of general procedure under the Judicature Acts in 1881. The distinction was abolished between legal and equitable rules as regards parties to sue and be sued, and in 1883 there was issued a General Order No. xvi. of the supreme court, rule 9 of which prescribed that where there are numerous parties having the same interest in one cause or matter, one or more of such persons may sue or be sued, or may be authorized by a court or judge to defend in such cause or matter, on behalf or for the benefit of all persons so interested. It was decided in *Temperton* v. *Russell* in 1893 where three trade unions were made defendants to represent all the members, and the order did not apply in the case of a trade union, because the words of the order "numerous parties having the same interest in one cause or matter" could only be satisfied by parties who had, or claimed to have, a beneficial proprietary right which they were asserting or defending, from which it was inferred that they could not be sued at all, and in the report of the Royal Commission on Labour in 1894 the opinion was either assumed or expressly stated that they could not be sued in tort. In 1901 the House of Lords overruled *Temperton* v. *Russell* in the case of the *Duke of Bedford* v. *Ellis*, holding that the General Order No. xvi. rule 9, was universal in its application. In the same year the Taff Vale case came before the House of Lords. In the first place, expounding the Trade Union Act 1871, they held unanimously that from the provisions in that act concerning registered trade unions there is to be legally inferred an intention of parliament that a trade union might be sued in tort in its registered name, with the consequence that trade union funds would be liable for any damages that might be awarded. Secondly—apart from the Trade Union Act—Lord Macnaghten and Lord Lindley expressed an unhesitating opinion that under the General Order No. xvi. as interpreted in *Duke of Bedford* v. *Ellis*, any trade union, whether registered or not, could be sued in tort by means of a representative action. Trade unionists protested against the result as a decision of judges making a practically new law against trade unions and nullifying the settlement of their status made by the legislature in 1871, and in June 1903 a royal commission was again appointed to inquire into the subject of trade disputes and trade

Taff Vale Case.

combinations and as to the law affecting them, and to report on the law applicable to the same and the effect of any modifications thereof.

Act of 1906.

The majority of the commission reported in January 1906 in favour of an alteration in the law relating to picketing and conspiracy, but against any alteration of the law as laid down in the Taff Vale judgment. A different view was, however, expressed in the Trade Disputes Act passed in the same year, whereby it was enacted with reference to trades union funds that "an action against a trade union, whether of workmen or masters, or against any members or officials thereof on behalf of themselves and all other members of the trade union in respect of any tortious act alleged to have been committed by or on behalf of the trade union, shall not be entertained by any court," although "nothing in this section shall affect the liability of the trustees of a trade union to be sued in the events provided for by the Trades Union Act 1871, section 9, except in respect of any tortious act committed by or on behalf of the union in contemplation or in furtherance of a trade dispute." This act and the two previous acts are cited together as the Trade Union Acts 1871 to 1906, and form the present statutory enactments upon the subject.

The Osborne Judgment.

In December 1909 one of the most important judgments in connexion with trade unions was delivered in the case of *Osborne* v. *Amalgamated Society of Railway Servants*. The litigation had extended over two years, ending in the House of Lords (December 21, 1909) upholding the decision of the court of appeal (L.R. 1909, ch. 163). The plaintiff, who had been a member of the Amalgamated Society of Railway Servants since 1892, sued his trade union to have it declared that one of its current rules, which provided, amongst other things, for parliamentary representation and the enforced levy of contributions from him and other members of the society, towards the payment of salaries or maintenance allowance to members of parliament pledged to observe and fulfil the conditions imposed by the Labour Party, was *ultra vires* and void. It was decided in the King's Bench against the plaintiff, but the judgment was reversed by the court of appeal, whose decision was upheld by the House of Lords. This meant that the Labour Party in the House of Commons would have to find other ways and means than contributions from trade unionists to maintain their members in parliament. A voluntary levy was attempted, but did not meet with any success, and in 1910 agitation was set on foot by the Labour Party for the reversal of the "Osborne judgment." They also announced in September their intention of making a change in the constitution of their party by eliminating the necessity of each member signing an acceptance of certain conditions, on the ground that the party had arrived at a state when it could trust to ordinary party loyalty to keep their members' action in accordance with the policy of the party. It was also hoped that it would meet many objections raised against their agitation for the reversal of the Osborne judgment. The agitation had the result of increasing the force of the movement for payment of members, not only in the Liberal party but also among the more progressive Conservatives.

History of Organization.

Trade unions, in the sense in which the term is now understood, appear to be almost exclusively of modern growth. Though combinations among various classes of workmen to improve their position have doubtless been formed from time to time from an early period, such combinations, up to comparatively recent years, were mostly ephemeral, almost the only class among whom permanent associations of journeymen are known to have existed in the middle ages being the masons, whose confederacies were prohibited by law in 1425. With this doubtful exception, there is little or no trace of permanent combinations corresponding to the modern trade union before the 18th century. During the period when wages and conditions of employment were the subject of State regulation (*e.g.* under the Statute of Apprentices of Elizabeth), combinations to exact higher rates or other conditions than those so fixed were naturally regarded as illegal conspiracies.

The craft gilds of the middle ages have sometimes been regarded as the true predecessors of trade unions, but the analogy must not be pressed too far. The structure, constitution and functions of a gild of craftsmen, aiming at the protection and regulation of the craft as a whole, were essentially different from those of a trade union, formed to protect one class of persons engaged in an industry against another. Nor is there any trace of direct continuity between gilds and trade unions, for the claim of certain Irish trade unions to be descended from gilds will not bear scrutiny (see Webb, *History of Trade Unionism*, appendix). The only true sense in which it can be said that there is a certain indirect historical filiation between gilds and trade unions is that, as pointed out by Brentano, some of the earliest trade unions had for their original object the enforcement of the decaying Elizabethan legislation, which in its turn had taken the place of the obsolete regulation of industry by the craft gilds, so that among the rules and objects of such unions would naturally be some bearing a likeness to gild regulations.

The actual way in which trade unions first came into being probably varied very greatly. In some cases, as stated above, their origin can be definitely traced to associations for enforcing the legal regulation of industry against the opposition of employers; in others, the meetings of journeymen belonging to the same trade for such purposes as sick or burial clubs became naturally the nucleus of secret combinations to raise wages. The growth of the "capitalistic" system of industry, under which the workman no longer owned the materials or instruments with which he worked, was one of the most potent causes of the development of workmen's combinations. The efforts of trade unions to revive the enforcement of the Elizabethan legislation not only failed, but led to its repeal (1813–1814); but the laws against combinations, which had been made more stringent and more general by the acts of 1799–1800, remained unaltered until 1824. In spite of these acts, which made all combinations illegal, there is evidence that trade clubs of journeymen existed and were tolerated in many trades and districts during the first quarter of the 19th century, though they were always subject to the fear of prosecution if they took hostile action against employers; and in many cases strikes were suppressed by the conviction of their leaders under these acts or under the common law of conspiracy. The partial protection accorded to societies for the purpose of regulating wages and hours of labour by the law of 1825 led to a rapid multiplication and expansion of trade unions, and to an outburst of strikes, in which, however, partly owing to the widespread commercial depression, the workmen were mostly unsuccessful. Thus the first impetus given to trade unions by the modification of the combination laws was followed by a collapse, which in its turn was followed (in the third decade of the century) by a succession of attempts on the part of workmen to establish a federal or universal combination, to embrace members not of one but of several trades. To this new form of combination, which excited a good deal of alarm among employers, the term "trades union," as distinct from trade union, was applied. All these general movements, however, proved short-lived, and the most extensive of them, the "Grand National Consolidated Trades Union," which was formed in 1834 and claimed half a million adherents, only had an active existence for a few months, its break-up being hastened by the conviction and transportation of six Dorchester labourers for the administration of unlawful oaths. In the years of depressed trade which followed, trade unionism once more declined, and the interest of workmen was largely diverted from trade combinations to more general political movements, *e.g.* Chartism, the Anti-Corn-Law agitation and Robert Owen's schemes of co-operation.

From 1845 we trace another revival of trade unions, the characteristic tendency of this period being the amalgamation of local trade clubs to form societies, national in scope, but confined to single or kindred trades. High rates of contribution, and the provision of friendly as well as trade benefits, were among the features of the new type of union, of which the Amalgamated Society of Engineers, formed in 1851, was the most important example. The growth of unions of the new type was followed by a development of employers' associations in the 'sixties, and by a number of widespread strikes and lock-outs, and also by various efforts to promote arbitration and conciliation by the establishment of joint boards of employers and employed. (See ARBITRATION AND CONCILIATION and STRIKES AND LOCK-OUTS.)

A series of outrages at Sheffield and Manchester in 1865–1866, in which officials of some local trade societies were implicated, led to the appointment in 1867 of a Royal Commission on Trade Unions, whose report was followed by the passage of the Trade Union Act of 1871, which as amended in 1876 and 1906 now governs the legal position of trade unions. Conferences of trade union representatives held in 1866 and 1867 to determine their policy with respect to the royal commission of inquiry, led to the gatherings of the trade union congress which are still held annually.

The period of inflated trade which began in 1871 caused, as usual, another rapid growth of trade combinations, of which the most characteristic feature was their extension to agricultural and general labourers. To meet this new development of combination, the National Federation of Associated Employers of Labour was formed in 1873. The years of depression, 1875–1880, were marked by a series of unsuccessful strikes against reductions of wages, and by a general decline of trade unions, which did not again revive until nearly ten years later, when the new wave of prosperous trade brought with it an outburst of strikes, chiefly among unskilled labourers, for improved conditions, of which the most notable was the strike of the London dock labourers in 1889. These trade movements were accompanied by the formation of a large number of unions of a type more akin to those of 1830–1834 than to the more modern trade-friendly society with its high contributions and benefits. The "new unions" were chiefly among unskilled labourers; their rates of contributions were from 1d. to 3d. a week, and as a rule they only offered strike benefit. Another characteristic was the extent to which their leaders were permeated with the Socialistic doctrines which had then recently taken root in Great Britain, and which led them to advocate positive state interference with industry in the interests of the labourers (*e.g.* the legal limitation of hours of labour).

The reports of the Royal Commission on Labour, which sat from 1891 to 1894, contain much valuable information on the state of facts and on the opinions of employers and workmen at this period.

From 1892 onwards the progress of trade unionism can be traced statistically. The depression of trade, 1892–1895, brought with it, as usual, some decline in trade unionism; but though many of the "new unions" collapsed, some of the more important have survived to the present time. The revival of trade which began in 1896 was naturally accompanied by an increase in the strength of trade unions; but the most marked characteristic of this period was the extension and consolidation of employers' associations, of which perhaps the most notable is the Engineering Employers' Federation, which was originally formed on the Clyde, but gradually extended to other districts and became a national organization of great strength during its successful struggle with the Amalgamated Society of Engineers in 1897–1898. Among the other more important employers' associations and federations of a national character may be mentioned the Shipping Federation, the Federated Coal Owners, the Ship-building Federation, the Federation of Master Cotton-Spinners' Associations, the National Federation of Building Trade Employers, and the Incorporated Federated Associations of Boot and Shoe Manufacturers.

In 1899 a general federation of trade unions was established which had in 1907 a membership of 650,000 in 117 affiliated societies. This federation links the trade unions of the United Kingdom with those of other countries by its affiliation with the international federation of trade unions, which embraces the national federations of the principal European countries. During recent years there has been a noticeable tendency towards the creation of federations of trade unions, and the absorption of the smaller by the larger societies. Trade unions, both in their historical development and their present organization, present a very great variety of constitutions. The oldest type is that of the local trade club, consisting of a comparatively small number of men following the same occupation in the same locality. A large number of unions have never progressed beyond this primitive form of organization. The government is of the simplest kind, by a general assembly of all the members, while such officers as are required to carry on the necessary routine business of the society are chosen by rotation or even by lot.

Constitution.

Indisposition to concentrate power in the hands of permanent officers and a tendency to divide the business of management equally among all the members, instead of delegating authority to a few chosen representatives, are leading characteristics of trade unions in this primitive form. The organization here described, even if adequate for ordinary current requirements, is ill suited for conducting a contest with employers, and accordingly in times of strife an improvised "strike committee" often comes into existence and practically governs the conduct of the dispute. No doubt this double constitution of the old trade club as a loosely organized friendly society, converting itself at times into a more or less secret strike combination ruled by an irresponsible committee, is to be traced to the time when trade unions as such were illegal combinations and had to carry out their objects under the guise of friendly societies. The Friendly Society of Ironfounders (established in 1809), though it has to a great extent outgrown its primitive constitution, retains in its name the mark of its origin, while the government of the London Society of Bookbinders, by mass meeting of its members, offers an example of the persistence of traditional methods under wholly changed conditions. The Sheffield trade clubs, responsible for the outrages which led to the appointment of the Trade Union Commission in 1867, and subsequently to the passage of the Trade Union Acts, conformed as a rule to the primitive type. At the present time over 750 trade unions are known to exist which are purely local in character, with no branches. The next step in trade union evolution seems to have generally been an alliance or federation of two or more local clubs belonging to the same trade. This federation would make it necessary to provide some machinery for common management, the simplest and crudest expedient being for each of the allied clubs to act in rotation as the governing branch. Thus the government of the federation or "amalgamated society" was at any given time confided to the members of a single locality, and the seat of government was periodically shifted. Some federal societies (*e.g.* the Mutual Association of Journeymen Coopers) still retain this primitive form of government.

As the tendency developed for local clubs to unite, the necessity of permanent officials to cope with the growing business of the amalgamation caused the institution of a paid secretary (usually elected by the whole body of members), and this led naturally to the fixing of the seat of administration at a particular centre instead of rotating among the branches. Some continuity of policy and of office tradition was thus made possible, but the executive committee almost invariably continued to consist of the local committee of the district where the seat of government happened to be. Thus up to 1892 the business of the Amalgamated Society of Engineers, a society with hundreds of branches all over the United Kingdom and even abroad, was conducted by a committee elected by the London branches. The Boilermakers continued a somewhat similar form of government up to 1895; and many great societies, *e.g.* the Amalgamated Society of

Carpenters and Joiners, continue a somewhat similar system to the present day.

The plan of entrusting the government of a national society to a local executive has obvious conveniences, where the society consists of a body of working men scattered over a large area and with no leisure for travelling. But the control exercised by a locally-elected committee over a general secretary deriving his authority not from them but from the vote of a much wider constituency, could hardly be expected to be very effective; while the expedients of referring all important questions to a vote of the whole body of members, and of summoning at periodical intervals special delegate meetings to revise the rules, have proved in practice but clumsy substitutes for the permanent control and direction of the executive officers by a representative council. Quite as ineffective in some cases has been the authority of a mere local executive over the committees of other districts. Accordingly, some of the largest "amalgamated" unions have now adopted a representative system of government. Thus in 1892 the Engineers revised their rules so as to provide for the election of the executive council by vote of all the members divided into eight equal electoral districts. The members of council so elected are permanent paid officials, devoting all their time to the work of the society. The general secretary, however, continues to be chosen by the whole body of members, while the responsibility of the council is also weakened by the institution of "district delegates" nominally responsible to them, but chosen by direct election in the various districts. (This division of authority and consequent weakness of responsibility was one of the causes of the state of things which led to the great engineering dispute of 1897, and it also led to a deadlock in negotiations on the north-east coast in 1908, the executive being powerless to enforce its views.) The Boilermakers adopted the system of a permanent executive in 1895.

In the case of certain highly-localized industries, such as cotton and coal, the conditions have admitted of a somewhat different form of constitution from that described above. Thus the Amalgamated Association of Operative Cotton-Spinners is a federal organization, consisting of a number of local associations, all, however, situated within a comparatively small area. The governing bodies of the association are—(1) a quarterly meeting of about a hundred representatives of the districts; (2) an executive committee of thirteen chosen by the above representative meeting, of whom seven must be working spinners and the other six are usually permanent district officials; (3) a sub-council to transact the ordinary daily work of the association, consisting of the six official members referred to above. The secretary is chosen by the representative meeting, and engages his own office assistants. Here we have the familiar features of representative institutions—a large legislative body, a small executive chosen by and responsible to this body, and a still smaller group of permanent officials to transact ordinary business.

Lastly, there are some large societies constituted not by the aggregation of local clubs or the federation of neighbouring associations, but originally founded as "national societies" divided into districts and branches for administrative convenience. An example is the Amalgamated Society of Railway Servants, founded in 1872.

Besides the tendency of the national society with branches to swallow up the local trade club, there is a further tendency among the larger societies to form federations for certain common purposes. Such federations are to be distinguished from national trade unions, inasmuch as their members are societies and not individuals, and as a rule their powers over their constituent organizations are limited to certain specific objects. On the other hand, they are more than merely consultative bodies (such as local trades councils).

Some federations consist of unions in the same industry in different districts (*e.g.* the Miners' Federation). "Single trade" federations like this have usually considerable powers, including that of imposing levies.

In the cotton-spinning trade, the trade union organization has a federal character, and the Amalgamated Association of Operative Cotton-Spinners, in spite of its name, is, strictly speaking, a federation.

Other federations (*e.g.* in the building trade) are formed of allied trades in the same locality, and usually have little executive power. The Federation of Engineering and Shipbuilding Trades has among its objects the settlement of disputes between members of its constituent societies as to the limits of their work. Some federations aim at embracing societies in all kinds of industries, but as a rule such organizations have not proved long-lived. The most recent example is the "General Federation of Trade Unions," formed in 1899, referred to above.

Since 1866 a congress of delegates from trade unions has met annually for discussion, and a parliamentary committee elected by this congress watches over matters in which trade unions are interested during the ensuing year.

Objects and Methods.

The principal object of every trade union is to protect the trade interests of its members, and to strengthen their position in bargaining with their employers with regard to the conditions under which they work. The chief means by which they seek to attain these objects (apart from political methods such as the promotion of legislation or of administrative action by public authorities) are twofold: viz. the support of members when engaged in a collective dispute with employers by the payment of "dispute" benefit, and the insurance of members against loss from want of work by the payment of "unemployed" benefit, so as to enable them to refuse any terms of employment inferior to those recognized by the trade union. All trade unions in one form or another provide "dispute" benefit, but a separate "unemployed" benefit is by no means universal, though, except in certain groups of trades, it is usual among more powerful and well established societies. Thus in the mining, clothing, and even many branches of the building trade, comparatively little is spent by trade unions on "unemployed" benefit, while, on the other hand, in the metal, engineering, shipbuilding, printing and other trades a large proportion of the total expenditure is devoted to this object (see *Statistics* below). In some important societies, such as the Amalgamated Society of Engineers, "unemployed" and "dispute" benefits are mixed up together, members engaged in a dispute receiving an addition of 5s. per week (known as "contingent" benefit) to the ordinary out-of-work pay (known as "donation").

Unemployed benefit may, of course, be regarded as a "friendly" benefit, *i.e.* a provision against one class of the casualties to which a workman is exposed—the loss of employment through slackness of trade. But in practice it also operates as a method of maintaining the "standard" rate of wages, members being entitled to it who could obtain employment, but only on conditions disapproved by the society or branch.

The conditions under which the members of a union are entitled to financial support in a strike vary in different societies, and are prescribed in the rules. Usually, though the initiative may come from the localities, the central executive must approve of the strike before it takes place, and may at any time declare it to be closed, though in some societies the central authority is often unwilling to take the responsibility of curbing its members by exercising its powers in this respect.

"Dispute" and "unemployed" benefits are the only ones which are specially characteristic of trade unions, and as regards the latter benefit, it may be said that trade unions have hitherto been the only form of organization capable of meeting the difficulties arising from "malingering." Most of the more firmly established unions, however, add to their trade functions those of friendly societies, providing sick, accident, superannuation, and funeral benefits, or some of these. The position of a trade union, however, with regard to these benefits differs very materially from that of a friendly society. The trade union is under no legally enforceable contract with its members to provide the stipulated benefits: it can change their scale, or even abolish them, by vote of its members, and a member who has contributed for years in hope of receiving them has no legal redress. Again, a member excluded from the society for some "trade" reason incidentally loses all claim to friendly benefits. The funds of a trade union applicable to trade and friendly purposes are never kept distinct (in the few cases in which some distinction is attempted, the society may "borrow" from the one fund in aid of the other in case of emergency); and a prolonged strike or depression of trade may so deplete the funds as to make it impossible for the society to meet its engagements as regards sickness or superannuation. Thus the friendly society operations of trade unions have strictly no actuarial basis, and in some cases the scale of contribution and benefit have been fixed with little regard to ultimate solvency.

On the other hand, the power of levying and varying the scale of contributions adds to some extent to the financial stability of the funds, and the provision of "friendly" as well as "trade" benefits by a trade union undoubtedly gives strength and continuity to the society, and increases its power of discipline over its members. Societies that only provide "dispute" pay are exposed to violent oscillations of membership, and also to a dangerous temptation to rush into an ill-considered strike owing to the mere accumulation of funds which can be used for no other purpose.

The statistics of trade union expenditure on benefits of various classes are given below. Of the 100 principal unions, all provide dispute benefit; 79 in the year 1905 provided unemployed benefit (including in some cases travelling pay); 79, sick or accident benefit; 37, superannuation benefit; and 87, funeral benefit; 32 unions providing all four classes of benefit.

One of the most important functions of trade unions in many industries is the negotiation of agreements with employers and employers' associations for the regulation of the conditions of employment in those industries. While undoubtedly the power of withdrawing its members from employment in the last resort adds to the power of a trade union in such negotiations, many of the most important agreements by which the conditions of labour of large bodies of workmen are governed are habitually concluded, and from time to time revised, by conferences of representatives of the trade union and employers without any strike taking place. To the functions of trade unions as fighting organizations and as friendly benefit societies should therefore be added that of providing the necessary machinery and basis for the conclusion of industrial agreements between bodies of workpeople and their employers (see ARBITRATION AND CONCILIATION, and STRIKES AND LOCK-OUTS).

While the broad objects of trade union policy are generally similar, their methods and features vary greatly in detail. Among the objects most frequently met with (besides those of raising wages and shortening hours, which may be said to be universal) are the enforcement of a "minimum" wage; the limitation of overtime; the restriction of numbers in the trade through the limitation of apprentices, or the regulation of the age of entrance; the restriction or regulation of piecework (in trades accustomed to "time" work); the preservation for members of the trade of the exclusive right to perform certain classes of work claimed by other trades (leading to so-called "demarcation" disputes); resistance to the encroachment of labourers on work considered to be "skilled" (leading to disputes as to the class of persons to be employed on machines, &c.); and the securing of a monopoly of employment for members of the union by a refusal to work with non-unionists.

Year.	Number of Unions.	Membership of Unions.[1]
1897	1292	1,622,713
1898	1261	1,659,480
1899	1255	1,820,755
1900	1244	1,928,035
1901	1238	1,939,585
1902	1203	1,925,800
1903	1187	1,903,596
1904	1153	1,864,374
1905	1136	1,887,823
1906	1161	2,106,283

[1] Includes a small number of members abroad.

Statistics.

The statistics of trade unions are very complete for recent years, but for earlier years the records are so fragmentary that it is impossible to give exact figures showing the total growth of trade unions over a long period. The table at foot of preceding column, based on the statistics published by the board of trade, shows the number and membership of all trade unions in the United Kingdom making continuous returns for each of the ten years 1897 to 1906.

The fluctuations in membership correspond in the main to the oscillations of trade, membership declining in the years of depression and increasing with the revival of trade. The decline in the number of separate unions is chiefly due to the growing tendency to amalgamate into large societies.

The following table shows the distribution of trade unions among the various groups of trades in 1905:—

Groups of Unions.	Number of Unions.	Membership in 1905.	
		Number.	Percentage of Total.
Mining and quarrying	68	495,968	26
Metal engineering and shipbuilding	222	339,282	18
Textile	253	239,539	13
Building	101	205,383	11
Railway, dock and other transport	55	162,563	9
Public employment	48	72,182	4
Printing, bookbinding and paper	40	62,368	3
Clothing	35	60,407	3
Wood-working and furnishing	100	40,115	2
General labour	18	96,094	5
All other unions	196	113,922	6
Total	1136	1,887,823	100

This table shows that the strength of trade unionism lies in the five first-named groups of trades—mining; metal engineering and shipbuilding; textile; building; and railway, dock and other transport—which among them account for over three-quarters of the total membership.

In agriculture, trade unionism is at present practically non-existent, but in 1875 there were important unions of agricultural labourers, though at no time did they include any considerable proportion of the total agricultural population.

Taking the men belonging to all trade unions together, we find that their number does not amount to more than about one in five of the adult men who belong to the classes from which trade unionists are drawn. Only in a few groups do trade unionists form a high percentage of the total working population, *e.g.* coal-mining and cotton manufacture. The number of women belonging to trade unions at the end of 1906 was 162,453, distributed among 156 unions, of which, however, only 28 consisted exclusively of women. The great bulk of women trade unionists are found in the cotton trade, in which they actually outnumber the male members. Of all the women employed in factories and workshops, about one in twelve belongs to a trade union.

The available statistics with regard to the financial resources of trade unions, and their expenditure on various objects, are not so complete as those of membership, as the board of trade figures only relate to 100 of the principal unions. As, however, these unions include nearly two-thirds of the total membership, the figures showing their financial position may be accepted as being representative of the whole number of societies. In 1906 the income of these 100 societies was £2,344,157 or 36s. 9½d. per head; and their expenditure £1,958,676 or 30s. 9d. per head; and at the end of the year the funds in hand amounted to £5,198,536 or 81s. 7¼d. per head.

The actual rates of contribution per member vary greatly among the unions—from 7s. up to £4 per annum. Generally speaking, the highest income per member is found among the unions in the metal, engineering and shipbuilding group, where in 1905 it averaged £3, 5s. 7¼d., while the average in the mining unions was only £1, 4s. 1½d., and among dock labourers still lower. The metal trades and the textile unions appear to hold the highest amount of funds compared with their membership, the amounts at the end of 1905 being £6, 3s. 8¾d. and £6, 0s. 3d. per head respectively in these groups, while in the building trade unions it was only 18s. 8½d. and in some societies of unskilled labourers far less than this.

The main items of expenditure of trade unions are "dispute" benefit, "unemployed" benefit, various friendly benefits (including sick and accident, superannuation and funeral), and working expenses. The proportions of expenditure on these various objects naturally vary greatly in different groups of unions, and also in different years, some of the items being affected largely by the general state of employment, and the occurrence or absence of important disputes. On the basis, however, of an average of the ten years 1897–1906, the following analysis of the proportionate expenditure of the 100 principal unions on various classes of objects has been made: on disputes, 13·4%; on unemployed 22·1%; on friendly benefits (other than "unemployed"), 42·5%; on working expenses 22%. The 42·5% of expenditure on friendly benefits is made up of 19·1% on sick and accident, 12·4% on superannuation and 11% on funeral and other benefits.

The mining unions devoted 28·6% of their expenditure to the support of disputes (friendly benefits in this industry being largely provided by other agencies), while the unions in the printing and bookbinding trades only used 3·9% for this object, over three-quarters of their expenditure going to unemployed or friendly benefits. As illustrations of the variation in the expenditure by the same group of unions on a particular object from year to year, it may be stated that within the ten years' period referred to the annual expenditure of the metal, engineering and shipbuilding group on disputes varied from £514,637 in 1897, the year of the great engineering dispute, to £13,266 in 1899. Again, the expenditure of the same group of unions on unemployed benefit varied from £80,512 in 1899 to £303,749 in 1904. The burden of superannuation payments by the 100 unions has steadily increased during the ten years from £137,813 in 1896 to £306,089 in 1906.

At the end of 1906 there were 89 federations, including societies with a gross membership of over a million and three-quarters, but a considerable deduction must be made from this total on account of duplication. In the same year 231 "trades councils" were known to exist, with an affiliated membership of over 895,000.

The number of employers' associations and federations known to exist in the United Kingdom in 1906 was 953, including 60 federations and national associations. Of the total number of associations 398 are in the building trades.

II.—FOREIGN AND COLONIAL

Modern trade unionism has had its chief development in English-speaking countries, and especially in the United Kingdom, where the conditions necessary for its growth have been present to the fullest extent. With some exceptions, such unions as are found elsewhere are either derived or copied from English organizations, or are associations with political objects. It is therefore unnecessary to give more than a brief summary of the position of trade unions in some of the principal countries and colonies outside the United Kingdom (for *United States* see IV. below).

Germany.—In Germany the majority of trade unions are of a political character, being closely connected with the Social Democratic party. These Socialist trade unions, termed "Gewerkschaften," were started by a congress held at Berlin in 1868, under the auspices of Fritscher and Schweitzer, two followers of Lassalle. In 1878 many of them were dissolved under the law prohibiting socialistic organizations, but shortly after their place was taken by local unions termed "Fachvereine," which ostensibly abstained from politics, but which in various ways succeeded in evading the law and carrying on the work of the Gewerkschaften. In 1887 a general committee of the German Gewerkschaften was formed, and in 1890 the General Commission of Trade Unions in Germany was established. Later years of prosperous trade have been marked by a rapid growth in the strength of trade unions in Germany.

The Social Democratic (Gewerkschaften) trade unions included in 1907 a membership of 1,886,147 as compared with 743,296 in 1902 and 419,162 in 1897. Of the total number of members in 1907, 1,865,506 belonged to branches affiliated to central federations; the membership of non-federated local unions being returned as only 20,641. The income of the federated trade unions in 1907 was £2,569,839, or over 27s. per member as compared with £554,887 (or about 15s. per member) in 1902 and £204,185 (or about 10s. per member) in 1897, and the expenditure in the same years to £2,156,126, £500,276 and £177,140 respectively. Of the 61 federations in existence in 1907, 43 paid travelling benefit, 42 paid unemployed benefit, 47 paid sick benefit and 57 paid funeral, removal and special allowance.

Another group of trade unions in Germany, less important as regards number and membership than the above, are the "Gewerkvereine," or non-political trade unions, sometimes known as "Hirsch-Duncker" unions, from the names of their founders. These unions were first formed in 1868, immediately after the Berlin congress referred to above. They were directly modelled on British trade unions. Since 1876 Social Democrats have been excluded. In their earlier years these unions suffered in membership from a series of unsuccessful strikes, and of late years they have been mostly benefit societies. In 1907 the Gewerkvereine embraced 108,889 members. Their income amounted to £77,068 in 1907 and their expenditure to £71,717.

Another group of unions, the Christian trade unions (Christliche Gewerkvereine), was formed in 1894. In 1907 the membership of this group was 354,760. The income of these unions in 1907 was £225,821, and the expenditure £167,867. Besides these groups of unions there were a number of independent societies with a membership of 96,684 in 1907.

It will be seen that German trade unions of one type or another included a membership of nearly two and a half millions in 1907, their membership having more than doubled in the last five years.

France.—In France combinations of workmen as well as of employers were prohibited by the laws of the 14th of June and the 28th of September 1792, which overthrew the old gild or corporation system. They were also penalized under various articles of the Penal Code, and it was not till 1864 that the prohibition was modified by law. At present the status of trade unions in France is regulated by the law of 1884, which repealed that of 1791 and modified the articles of the Penal Code so far as regards professional syndicates of employers or workmen. Since then there has been a considerable growth of workmen's unions, which in 1906 numbered 5322 with a membership of 896,012. Of the unions in existence in 1906, 3675 with a membership of 752,362 belonged to 187 federations. There is, however, some duplication owing to the fact that some unions belong to more than one federation. In 1906 there were 260,869 members of unions in the transport, warehousing, &c., groups of trades, 103,835 in the metal, 73,126 in the mining and quarrying, 78,854 in the textile, 66,678 in the building, 51,407 in the agricultural, forestry, fishing and cattle breeding, 48,353 in the food preparation trades and the remainder in various other trades.

Austria.—Apart from the Austrian gilds, membership of which is compulsory for persons engaged in non-factory handicrafts and trades (under a law of 1883) and in mining (under a law of 1896), there are a certain number of trade unions in Austria, though freedom of combined action among workmen is less complete than in many other European countries. Such right of combination as exists rests on the law of 1870, which removed the restrictions imposed by the Penal Code on combinations for influencing the conditions of labour. The impulse given to the formation of unions by this law, and by the advantages gained for the workmen during the years of prosperous trade that immediately followed, received a severe check during the succeeding depression of trade, when these advantages were mostly lost. Trade unionism did not revive until 1888, from which time the unions formed have mostly been on a Social Democratic basis, the majority being affiliated to a central organization in Vienna.

Since 1901 statistics relating to the trade unions of Austria have been published annually by the Central Trade Union Commission (Gewerkschafts-Kommission) at Vienna. In 1907 there were 5156 trade unions in particular trades, with a membership of 501,094, affiliated to the Social Democratic trade unions (Gewerkschaften). Of the total number of unions, 49 were central unions, 77 were district unions and 5030 were local unions. Of the total number of members 454,693 were males and 46,401 were females. The greatest membership, 84,085 in 1907, is shown to have been in the metal engineering and shipbuilding group of industries, the building trades coming next with 68,543 members. The transport trades showed a membership of 61,744, and the textile trades, 51,632. The chemical, glass and pottery trades included 54,469 members and the wood-working and furnishing group included 36,502 members. Food and tobacco trades accounted for 32,679, and mining and quarrying for 30,715 members.

The total receipts of the trade unions in 1907 amounted to £338,365 and the total expenditure to £297,822, excluding receipts and expenditure for disputes. The expenditure on account of disputes, for which £136,822 was collected by special free organizations of the branch unions, amounted to £76,066 in 1907.

There are besides these unions a number of general unions not confined to one trade, and trade-clubs—educational associations discharging to a greater or less extent trade union functions. These associations have, however, been excluded from the statistics published by the Gewerkschafts Kommission as not being trade unions proper.

Hungary.—The trade union movement in Hungary is of very recent growth. The membership of unions affiliated to the Central Federation at the end of 1907 is given in the *Volkwirtschaftliche Mitteilungen aus Ungarn* as 130,192, compared with 129,332 at the end of 1906. Independent local unions had a membership of 11,838 at the end of 1907. The largest groups of organized workers are in the building trade (35,630), metal workers (27,732), railway employees (17,192) and wood-workers (14,665).

Italy.—The *Bolletino* of the bureau of labour for August 1908 states that the membership of trade unions at the beginning of 1908 numbered 191,599 (in 2550 local unions). Included in the membership of 1908 are 48,877 building trades workers, 40,000 railway employés and 17,110 metal-trade workers. The agricultural labourers' trade unions were stated to have a membership of 425,983 at the beginning of 1908 as compared with 273,698 at the beginning of 1907.

Denmark.—In 1907 there were 99,052 members of 1249 trade unions in Denmark, and of these 78,081 were in unions affiliated to the National Federation. The largest unions in the Federation are those of the general labourers with 22,660 members; blacksmiths and machinists with 8000 members; masons, 5300 members; railway employés, 4990 members; carpenters, 3855 members; textile workers, 3700 members; and cabinet-makers, 3590 members.

Sweden.—In Sweden there were, in 1906, 126,272 members of 1596 trade unions, and of these 30,645 were factory workers (trades not specified), 24,485 were in unions connected with the metal trades, 10,706 were in the transport trades, 17,862 were in the woodworking trades, 7132 were in the food, &c., trades, 6602 were in the building trades, and 6005 were in the clothing trades.

Norway.—The trade union movement in Norway dates practically from 1884. At the end of 1906 there were 25,339 members of trade unions, as compared with 16,087 at the end of 1905. Of the membership in 1905, 5277 were iron and metal workers, 4910 journeymen (factory workers), and 1117 printers.

Holland.—In 1893 a National Labour Secretariat was formed, to which, in 1899, 45 societies with 13,050 members were said to be affiliated. After a general strike in April 1903 the membership of trade unions in Holland decreased considerably, the Secretariat losing half its members and several trade unions dissolving. In 1906 it was stated in the *International Report of the Trade Union Movement* that a new national centre of unions had been formed with trade unions affiliated to it, having a membership of 26,227, while the old centre still continued with a membership of 5000. The Diamond Workers' Federation, with a membership of over 8000, was affiliated with the new national centre.

The total number of members of trade unions at the end of 1906 is given as 128,845, 33,125 of these belonging to Christian organizations, while 95,720 belonged to other organizations.

Belgium.—The status of trade unions in Belgium is regulated by the law of 1898, under which they can be incorporated, provided that their objects are non-political and are confined to the furtherance of the interests of particular trades. Belgian trade unions, nevertheless, are mostly political in character, the majority being connected either with the Socialist-Labour, Catholic or Liberal parties. The membership of the Socialist-Labour group of unions in 1905 was 94,151, of the Catholic unions 17,814, of the free trade unions 34,833 and of the Liberal unions 1685, making a grand total of 148,483.

Of the 94,000 members of the Socialist-Labour unions, 60,000 are employed in mining, 11,500 in the textile industry and 7800 in the metal industry. Of the 17,800 in the Catholic trade unions, 5300 are in the textile trades, and 3200 in the building trades. Of the 35,000 in the free trade unions, 11,000 are in the textile industry, 6000 in the glass industry, 3600 in the applied art trades and 3300 in the printing and bookbinding trades.

Several organizations, *e.g.* the diamond workers, the printers' federation of Brussels, &c., are affiliated with the trade union committee without, however, joining the political organization. The Catholic and Liberal associations also do not affiliate with the other organizations.

British Dominions and Colonies.—Trade unionism has only developed to any considerable extent in a few of the industrial centres of the self-governing dominions. A great number of the unions in Canada are branches of organizations having their headquarters in the United States or in England. In July 1907 the *Canadian Labour Gazette* stated that of the 1593 local trade unions known to be in existence, 1346 were affiliated with central organizations of an international character. Besides these 1593 local trade unions, there were 8 congresses and national associations of labour, 49 trade and labour councils and 31 federations of trade unions known to be in existence.

Between 1876 and 1890 all the principal Australian states passed statutes more or less resembling the Trade Union Acts of the United Kingdom. A similar law was passed in New Zealand in 1878, but in this dominion and in some of the Australian states trade unions can now become incorporated and acquire a special legal status by registration as industrial unions under the laws relating to industrial conciliation and arbitration. In New Zealand there were, in 1906, 261 unions of workers with a membership of 29,869 and 133 unions of employers with a membership of 3276. In the years immediately preceding 1890 certain Australian unions, especially among the shearers and the seamen and wharf labourers, acquired great strength, and their determined attempts to secure a monopoly of employment for members of their organizations led to prolonged labour disputes in 1890 and 1891 (see STRIKES AND LOCK-OUTS), which resulted in the defeat of the unions and a consequent diminution of their membership and influence. More recently the unions have revived. They are encouraged by the laws relating to arbitration and conciliation, which (*inter alia*) permit preference for employment to be awarded to members of trade unions in certain circumstances.

AUTHORITIES.—For statistics of recent progress of trade unions, see reports on trade unions published by the board of trade (from 1887 onwards). Much information respecting trade unions is contained in the reports of the royal commission on trade unions (1867) and of the royal commission on labour (1891–1894). See also report of royal commission on trade disputes and trade combinations (1903–1906). The reports of the chief registrar of friendly societies give information with regard to trade unions registered under the Trade Union Acts. On the history and constitution of trade unions the fullest information is given in Webb's *History of Trade Unionism* and *Industrial Democracy*, both of which contain valuable bibliographical appendices which may be consulted as regards other sources of information respecting British trade unions. On trade unions abroad (besides the reports on foreign countries and the colonies of the royal commission on labour), see Kulemann's *Die Gewerkschaftsbewegung* (Jena, 1900), dealing with trade unions in all countries, and the board of trade "Abstract of Foreign Labour Statistics" and *Labour Gazette*, both of which give numerous references to the foreign official sources of information on trade unions, together with a summary of the statistics which they contain.

III.—ECONOMIC EFFECTS OF TRADE UNIONISM

There is no general consensus of opinion as to the extent to which trade unions can attain success in achieving the objects which they set before themselves, or as to how far their action is beneficial or otherwise to the general community. One of the principal objects of trade unions being to maintain and increase the rates of wages paid to their members, the first question would be practically solved if statistical evidence were available to connect the course of wages with the action of combinations. Such evidence, however, is inconclusive. The period of growth of trade unionism in Great Britain has certainly been on the whole a period of rising wages. But many other causes tending to raise wages have been operative over the same period, and some of the facts might be explained as much by the tendency of rising wages to strengthen combinations as by that of combinations to raise wages.

Again, the observed fact that the rise has not been confined to industries in which organizations are strong might be explained either by the supposition that the rise brought about by trade unions has benefited a wider circle than their membership, or that the rise both within and outside the ranks of trade unions is due to causes other than their action. Perhaps the strongest statistical evidence of the power of trade unions to affect wages in particular districts is afforded by the local differences of wages in the same trade, which, it is contended, cannot be wholly explained by local differences of cost of living or industrial conditions, but which often correspond closely to differences of strength of trade union organization. This argument, however, does not touch the question of the effect of combination on the *general* level of wages.

Hardly more conclusive than the reasoning founded on statistics have been the attempts to solve the question by pure economic theory. During the prevalence of the old view of wages known as the "wage-fund" theory, combinations were usually held to be powerless to affect the general rate of wages, because they could not alter the proportion between capital and population, on which wages were thought to depend. The question however, was reöpened by the change in theory which led economists to regard wages as depending primarily on the productivity of industry, and secondarily (and within comparatively narrow limits) on the relative power of bargaining as between the labourers or groups of labourers and the organizers of labour. According to this view, the effect of combinations on the rate of wages will ultimately depend, so far as the first and most important factor in the problem is concerned, on their effect on the general productiveness of industry. Prima facie, we might expect that trade unionism would, on the whole, restrict productiveness, and this is undoubtedly a view widely held among employers. Strictly professional associations tend generally to become conservative so far as methods of work are concerned; and even trade unions which may not "officially" oppose the introduction of new processes and the use of machinery may nevertheless serve to focus and make effective the hostility felt by the artisan towards methods of business organization which seem to him likely to decrease the demand for his services or to alter the conditions of work to his detriment. In some trades also trade unions are charged with encouraging or permitting their members to restrict the amount of work performed by them in a given time, with the short-sighted object of making more work for others. Many unions have attempted also with varying degrees of success to keep up the value of their labour by creating an artificial scarcity by restricting the numbers entering the trade, and have in various ways sought to control the management of business to a degree which must restrict the freedom of experiment on which the attainment of the maximum productiveness of industry must depend. By the resort to strikes—an essentially wasteful method of settling differences with employers—they have also to some extent restricted production, though the loss directly due to this cause is often exaggerated (see STRIKES AND LOCK-OUTS). Moreover, by their insistence on the payment to all workmen of a fixed "minimum" wage they have diminished the field for the profitable employment of the old and less capable, and may to some extent have discouraged the expert workman from earning and receiving the full reward of his extra ability.

On the other hand, it is claimed that trade unions have in many cases acted in the interests of industrial peace by restraining their members from ill-considered strikes, and that, by providing a recognized channel through which the workmen's grievances may find expression, they have often assisted in adjusting differences which would otherwise have led to the interruption of production. In particular they have frequently formed a convenient basis on which to build a system of conciliation or arbitration boards by which strikes are prevented (see ARBITRATION). It is also claimed that by protecting the "standard of life" of their members through the policy of securing a "minimum" rate of wages, trade unions may tend in the long run to build up a physically and industrially superior class of workmen, and thus ultimately increase the efficiency of industry.

The comparative weight of the above considerations differs according to the point of view from which the question is regarded. At any given time an individual employer may tend to feel most strongly the disadvantages of the restrictions under which he is placed by the action of a particular trade union, and may attach but little importance to the general effects, in the long run, on the national output of the pressure which such combinations exercise—which from the point of view of the general well-being of the community is by far the most important consideration. Generally speaking, any action of trade unions tending to diminish the efficiency and industry of the individual workman is as injurious to the community as to the individual employer, except in so far as such restriction may conceivably affect the health of the working community from over-strain. But the policy of "levelling up" the standard rate of wages, which may mean loss or ruin to a particular employer, may nevertheless act quite otherwise with respect to the national well-being, in so far as it tends to eliminate the "unfit" employer and to concentrate the industry in the hands of the more capable and more enterprising of the employing class, and in the localities most suited for the purpose. The pressure of rising wages has undoubtedly acted as a stimulus to the invention of labour-saving devices and the adoption of economical methods, as is shown in America, where the highest wages are often seen concurrently with the lowest labour cost. Advocates of trade unionism sometimes lay much stress on this aspect of their operation. On the other hand, it must not be forgotten that competition, both as between different grades of employing ability and of local advantages, is now international, and that the concentration of an industry in the most suitable localities and in the hands of the most capable organizers, which is claimed as a beneficial result of trade union action, may for any particular country mean the transference of the industry abroad; and this transference, especially in the case of industries dependent on export to neutral markets, may involve a considerable national loss.

Apart from the effect of trade unions on the total amount of the "national dividend," their supporters claim that they are able to alter the mode of distribution of this dividend. It is not usually claimed that they are able to affect the proportion of the total product which is paid as rent or interest for the use of the instruments of production, but that they can alter the proportions in which the residue is shared between the organizers of labour and the manual labouring class, to the advantage of the latter. The methods by which trade unions seek to achieve this result require separate examination.

The first group of methods are those which aim at creating a scarcity of some particular kind of labour so as to alter the relation of demand and supply. The particular methods employed for this purpose have been already sufficiently described. With regard to all of them it may be remarked that they are ineffective as regards the raising of the general rate of wages throughout the country (*i.e.* the average income per head of the manual labour classes), seeing that an artificial scarcity of one sort of labour implies a redundancy of some other kind. As regards the rate of wages in particular occupations there is no doubt but that at least for a time such methods may cause a considerable rise of wages, only limited at first by the imperfection of the control exercised by the union over the number competing in the labour market and by the extent to which the rise in the cost of production so caused is checked by the competition of goods imported from abroad, or of alternative commodities, or by the loss of foreign markets, or the diminution of home demand. But as time goes on other forces of a more subtle kind tend to come into play which further limit the power of the combination to keep up wages through restricting the supply of labour. Besides the substitution of alternative commodities, alternative processes of production may be invented, diminishing the demand for the services of the members of the exclusive trade union, while the artificial rise of wages is also likely to attract labour into the trade.

Generally speaking, it may be said that while the artificial restriction of the supply of workmen in a trade may raise wages for a time, it calls into play forces tending to restore the equilibrium of demand and supply by diminishing demand, and that these forces grow progressively stronger as time goes on, while the restrictive capacity of the combination usually tends to diminish. This is apart from the fact that restriction of the supply of labour entering a trade almost always involves the narrowing of the field of ability from which the trade can be recruited, and thus a lowering of the general standard of efficiency.

The other group of trade union methods which requires examination is that which aims at strengthening the economic position of the labourer by substituting collective for individual negotiations as regards wages, supported by a common reserve fund out of which the labourer may be maintained while waiting for his terms to be accepted. Undoubtedly these methods of mutual insurance and collective bargaining afford a powerful instrument for preventing "sweating" and for enabling the whole body of workmen to exact at the earliest moment and retain to the latest moment the full amount of the wages which a given state of trade and prices will enable the industry to support. The establishment of general working rules and standards of time or piece wages throughout a trade or district may also serve to protect the better and more capable employers against their more inefficient or unscrupulous competitors, and thus tend towards the survival of the "fittest" among the employing class. It is always to be remembered that the effect of collective bargaining is not in the long run one-sided. Combinations of workmen beget counter-combinations of employers, and the conditions of important industries tend to be settled more and more by "treaties" concluded between powerful bodies of employers and employed.

Were the combinations on both sides which enter into these agreements conterminous with the entire trades which they represent, and especially if the trades were protected from foreign competition, the interests of the general unorganized mass of consumers might conceivably suffer from these agreements.

As regards the future prospects of trade unions in Great Britain it is difficult to prophesy. The hopes of those who look for a universal expansion of these organizations so as to include the whole or the majority of the members of the manual-labour classes are probably extravagant. Not less chimerical is the expectation of the opponents of trade unions that a few defeats at the hands of determined employers or employers' organizations will permanently cripple them and lead to their decay and extinction. Probably for many years trade unions will include, as now, in their membership a powerful minority of the working classes, wielding an influence out of all proportion to their actual numbers. It is to be expected that experience and the spread of education may cause them gradually to abandon the rules and methods which interfere most with the economical application of labour and capital to industry.

Lastly, it may be pointed out that trade unionism has been the result of the growth of a class of manual workmen working for wages for employers who provide the materials and instruments of industry, and into whose ranks it is relatively difficult for the average workman to rise. It remains to be proved whether the class feeling which enables powerful trade unions to flourish can permanently be fostered and maintained except among workmen who expect to remain workmen most of their lives. If these conditions should be materially altered, trade unionism in its present form must decay or undergo a profound alteration. (X.)

IV.—United States

Labour Organizations.

Trade unions in the United States are best treated from the broad standpoint of labour organizations generally, *i.e.* associations of wage-earners having for their general purpose the improvement of their members, either through a lessened working day, increased wages, or more satisfactory rules and conditions of employment. They may or may not admit employers, but as a rule they do not admit them. Sometimes they are formed for a specific purpose, like the Eight-Hours League, but generally they have platforms comprehending all the demands which labour usually makes. Labour organizations in the United States cannot be given a definite birthday. Prior to 1825 there were very few of them. In colonial days we have hints of their existence, but their purpose was partly political, and their membership often consisted of politicians. The purpose of the Caulkers' Club, in the early days of Massachusetts, was "to lay plans for introducing certain persons into places of trust and power." Tradition has it that the word "caucus" was derived from this club. It is also said that Samuel Adams's father, as early as 1724, was active in the club's work. There was probably a union of journeymen bakers in the city of New York in 1741 and of shoemakers in Philadelphia in 1792. The shipwrights of New York City were incorporated on the 3rd of April 1803, and the tailors and carpenters of that city were organized in 1806. The New York Typographical Society was in existence in 1817, and was probably organized in the early years of the 19th century. Peter Force was its president for a time, and Thurlow Weed was a member. A strike occurred in Mr Weed's office in 1821 on account of the employment of a non-union man, who was then designated a "rat." In 1823 was organized the Columbian Charitable Society of Shipwrights and Caulkers of Boston and Charlestown.

Formative Period.

The period from 1825 to 1860 may be called the formative period. About 1825, and for some years afterwards, there was a general discussion of socialistic theories, growing out of Robert Owen's experiments at New Lanark, in Scotland, and out of his communistic attempt at New Harmony, Indiana, in 1825. The wave of philosophic transcendentalism also, which swept over the country between 1825 and 1840, affected not only social but industrial life. Labour papers began to be established. The *Working Man's Advocate*, published in New York City in 1825, was probably the very first American labour journal. Soon afterwards there appeared the *Daily Sentinel* and *Young America*, projected by two Englishmen, George Henry Evans and Frederick W. Evans. The chief demands advocated by these journals were the freedom of public lands, the breaking up of monopolies, the adoption of a general bankruptcy law, a lien for the labourer upon his work for his wages, the abolition of imprisonment for debt, equal rights for women with men, and the abolition of chattel and wage slavery. These demands were endorsed by over 600 newspapers. In 1830 a Working-man's Convention was held in Syracuse, New York, the outcome of which was the nomination of Ezekiel Williams for governor. In 1832 a delegated convention which met in the state house at Boston initiated the 10-hours movement. The *Tribune* (New York), under the leadership of Horace Greeley, was opened to the advocacy of Fourierism, and so on all hands the movement towards organization was helped. In 1845 the New England Working Man's Association was organized, and such men as Charles A. Dana, George Ripley, Albert Brisbane, Wendell Phillips, William Lloyd Garrison, Theodore Parker, and others participated in its meetings. The first industrial congress of the United States was convened in the city of New York on the 12th of October 1845, but little came of it. Other and more important labour congresses were held in that city and in Chicago in 1847 and 1850 respectively. During the latter part of the formative period, that is, from 1825 to 1860, most of the great national trade unions that are now influential were projected and organized, though their great and rapid growth has been since the Civil War. The National Typographical Union was organized in 1852, its name being changed to International in 1862 in order to admit Canadian members; the National Union of Hat Finishers in 1854; the Iron Moulders' Union of North America on the 5th of July 1859; and in the same year the Machinists' and Blacksmiths' Union of North America. By 1860 the national unions already formed numbered 26.

Railway Brotherhoods.

During the next few years, among other important organizations, were instituted what are known as the group of railway brotherhoods, the oldest and largest of which is the International Brotherhood of Locomotive Engineers. The grand division was founded at Detroit, Michigan, on the 17th of August 1863, under the name of the Brotherhood of the Footboard. The society was reorganized under its present title at Indianapolis, Ind., on the 17th of August 1864. The second national association of railway employés that was organized was the Conductors' Brotherhood, formed at Mendota, Illinois, on the 6th of July 1868, by the conductors from various railways in the United States. This brotherhood was recognized, and a general governing board established, on the 15th of December of the same year. Ten years later the name of the organization was changed from the Conductors' Brotherhood to the Order of Railroad Conductors of America. The Brotherhood of Locomotive Firemen was organized at Port Jervis, N.Y., on the 1st of December 1873. The Brotherhood of Railroad Trainmen was organized at Oneonta, N.Y., on the 23rd of September 1883. It was called the Brotherhood of Railroad Brakemen until the 1st of January 1890, when the present name was adopted. The Brotherhood of Railroad Trackmen is one of the younger and smaller organizations. The first efforts to found it were made in the spring of 1887, but its permanent organization took place a year later. The Brotherhood of Railroad Carmen of America was founded on the 9th of September 1890, by the consolidation of the Carmen's Mutual Aid Association, the Brotherhood of Railroad Car Repairers, the Car Inspectors, Repairers and Oilers' Protective Association and the Brotherhood of Railroad Carmen of Canada. The Switchmen's Union of North America is the outgrowth of the Switchmen's Mutual Aid Association, the present organization dating from 1897. Several of these railway brotherhoods suffered materially in their membership and influence through the organization of the American Railway Union in 1893.

The Cigar-Makers' National Union dates from 1864, the Bricklayers' and Masons' International Union from the 17th of

National Unions.

October 1865, the United States Wool Hat Finishers' Association from 1869 and the National Union of Horseshoers of the United States from 1875. The Amalgamated Association of Iron and Steel Workers resulted, as its name signifies, from the consolidation of various other orders and societies, the present order being organized at Pittsburg in August 1876. The consolidated societies were known previously to the new order of things as the United Sons of Vulcan, the Associated Brotherhood of Iron and Steel Heaters, Rollers and Roughers of the United States, and the Iron and Steel Roll Hands' Union. The oldest was the United Sons of Vulcan, originating in Pittsburg on the 17th of April 1858, and afterwards called the Iron City Forge. The organization is now known as the Amalgamated Association of Iron, Steel and Tin Workers. The Granite Cutters' National Union was organized in 1877, the Brotherhood of Carpenters and Joiners in 1881 and the Journeymen Bakers' National Union in 1886.

The International.

There have also been attempts to organize labour on a general or universal plan. The first of these was the International Association of Working-men, known as the "International," which was organized in London in the autumn of 1864. This society sought to associate working-men wherever manufacturing has been extended. The International grew for a while, but never at any time had a membership exceeding 100,000 and probably never over 50,000. It did not extend to the United States with much force; certainly no large number of the working-men of the country were involved in it, and branches were not organized in the union until 1870 or 1871.

Knights of Labour.

The second attempt was the Noble Order of Knights of Labour of America, which was founded in Philadelphia on Thanksgiving Day 1869, through the efforts of Uriah S. Stephens and six associates, all garment-cutters. For several years the garment-cutters of Philadelphia had been organized as a trade union, but failed to maintain satisfactory rates of wages. Dissatisfaction prevailed, and resulted in the autumn of 1869 in the disbandment of the union. Stephens, who was a far-seeing man, and anticipated the disruption of his union, had prepared the outlines of a plan for an organization embracing, as he said, "all branches of honourable toil." He advocated education, co-operation and an intelligent use of the ballot as the proper means for gradually abolishing the present wage-system. The order had a varied career. Mr Stephens, himself a Mason, brought into the ritual of the new order many of the features of speculative Masonry. The obligations were in the nature of oaths, taken with much solemnity upon the Bible, and the members were sworn to the strictest secrecy. The order was known for a long time as "Five Stars," that designation being used in printing and writing. Many expressions taken from Greek literature were introduced into the ceremonies. The instructions given to every person admitted into the order are perhaps the best exponent of the nature of the ritual:—

> Labour is noble and holy. To defend it from degradation; to divest it of the evils to body, mind and estate which ignorance and greed have imposed; to rescue the toiler from the grasp of the selfish—is a work worthy of the noblest and best of our race. In all the multifarious branches of trade capital has its combinations; and, whether intended or not, they crush the manly hopes of labour and trample poor humanity in the dust. We mean no conflict with legitimate enterprise, no antagonism to necessary capital, but men, in their haste and greed, blinded by self-interests, overlook the interests of others and sometimes violate the rights of those they deem helpless. We mean to uphold the dignity of labour, to affirm the nobility of all who earn their bread by the sweat of their brows. We mean to create a healthy public opinion on the subject of labour (the only creator of values), and the justice of its receiving a full, just share of the values or capital it has created. We shall, with all our strength, support laws made to harmonize the interests of labour and capital, and also those laws which tend to lighten the exhaustiveness of toil. To pause in his toil, to devote to his own interests [*sic*], to gather a knowledge of the world's commerce, to unite, combine and co-operate in the great army of peace and industry, to nourish and cherish, build and develop, the temple he lives in, is the highest and noblest duty of man to himself, to his fellow men and to his Creator.

The ritual was neither printed nor written, and in all probability there is not now in existence a copy of it. So long as the utmost secrecy was retained the order did not grow rapidly; gradually it lost its secrecy and worked on more general plans. From the best evidence that can be secured it is probable that the first local assembly of the Knights of Labour was organized as early as 1873 in Philadelphia. Attempts at outside organization had been unsuccessful. The second assembly consisted of ship carpenters and caulkers employed in Cramp's shipyard. After this the order spread quite rapidly, 20 assemblies being organized in Philadelphia during 1873. A district assembly, consisting of delegates from local assemblies in Philadelphia, met in that city on Christmas Day 1873 and organized District Assembly No. 1. The order increased during the years following this action, and in 1877 delegates were chosen to organize a general assembly. These delegates met at Reading, Pennsylvania, on the 1st of January 1878, and organized the first general assembly, Mr Stephens, the founder, presiding as temporary chairman. Seven states were represented. General assemblies have been held each year since that time, and changes in the constitution or work of the order have been the subject of warm discussion. At the meeting of the first general assembly the membership must have been small, probably only a few thousand. It did not reach 50,000 till five years later. The general assembly of 1880, at Pittsburg, denounced strikes as injurious and not worthy of support except in extreme cases. At the fifth session, at Detroit, in 1881, the most important actions in the history of the order were taken, and from this session the rapid growth of the order may be dated. The assembly then declared that on and after the 1st of January 1882 the name and objects of the order should be made public. It also declared that women should be admitted upon an equal footing with men, and a strong committee was appointed to revise the constitution and the ritual. At the next general assembly, September 1882, in New York, the revised constitution was adopted, as well as laws and regulations for supporting strikes. After this the order began to grow rapidly. It antagonized the trade unions, the contention being that the order embraced higher and grander principles than those underlying the organization of the former. The trade unions in existence at that time struggled to preserve their organizations against what they considered the encroachment of the Knights of Labour. The high-water mark of the order was probably during 1883, 1884, 1885 and 1886, when, according to the very best information, it numbered not less than 1,000,000 members. In 1900 its membership was estimated at about 130,000.

Organization.

The order of the Knights of Labour is based on the federal plan, and has a hierarchy of assemblies—the local assembly, the district assembly, the state and the general assembly. The officers of the local assembly consist of a master workman, worthy foreman, venerable sage, recording secretary, financial secretary, treasurer, worthy inspector, almoner, statistician and some minor officers. These are elected semi-annually by ballot or by acclamation. The district assembly is composed of duly accredited delegates from at least five local assemblies, and is the highest tribunal of the Knights of Labour within its jurisdiction under the general laws of the order. It has the power to levy assessments for its maintenance upon all locals, and has also the power to establish locals in the territory governed by it. The officers and their duties are similar to those of the local assembly, except that the master workman is called the district master workman. The constitution of the general assembly is a very imposing document, containing twenty articles. The assembly consists of representatives chosen by the district assemblies, and has full and final jurisdiction, being the highest tribunal of the order. It alone possesses the power and authority to make, amend or repeal the fundamental and general laws of the order, to decide finally all controversies arising, and to issue charters to state, district and local assemblies. The officers are elected at each annual session, and their titles correspond almost completely with those of the local and district assemblies, with the exception that the word "general" takes the place of "district," as "general master workman," &c. The general master workmen have been Uriah S. Stephens (the founder of the order), Terence V. Powderly, James R. Sovereign, John N. Parsons and Henry A. Hicks. The order has a publication known as the *Journal of the Knights of Labour*, published at Washington, D.C.

American Railway Union.

The third attempt to bring into one order men employed in different vocations was the American Railway Union, organized in Chicago on the 20th of June 1893. It included all railway employés born of white parents. It was organized for the protection of members in all matters relating to wages and their rights as employés, and affirmed that such employés were entitled to a voice in fixing wages and in determining conditions of employment. The union won a great victory on the North-Western railway in April 1894, but its action in the great strikes in Chicago in 1894 cost it its life. Its membership reached at one time 150,000.

Federations of Labour.

The separate unions found that the co-operation of other unions was needed to perfect and extend their work, and attempts were made from time to time to organize a federated body. The initial steps were taken in 1866, when the trades assemblies of New York City and Baltimore called a national labour congress, the 100 delegates sent by 60 secret and open organizations from different trade unions meeting on the 20th of August. In 1867 a second convention was called to meet in Chicago, the aim being to form a Trades Union Congress like that existing in Great Britain. The National Labour Union held two conventions in 1868, the first in May and the other in September; it met again in Chicago in 1869, in Boston in 1870, in Philadelphia in 1871 and in Columbus, Ohio, in 1872. This closed the experience of the National Labour Union. During 1873, owing to the industrial depression, many of the trade unions were suspended. An industrial congress met in Rochester, N.Y., in April 1874, consisting of some of the leading trade unionists of the United States, and on the 14th of that month a convention was held representing the Sovereigns of Industry. The expectation was that the old National Labour Union should be taken up. The Industrial Brotherhood of the United States, another secret order, partaking largely of the character of the Knights of Labour, was represented in that convention. As might have been expected, the two ideas—that on which the Knights of Labour was organized and the trade union idea—immediately became antagonistic, yet a platform containing most of the principles of the Knights of Labour was adopted. The movement ended with the Rochester meeting. The years 1875 and 1876 saw other attempts; but they were chiefly political in their character and the temporary orders then organized were disbanded. Between 1876 and 1881 other attempts were made at federation. A call issued jointly by the Knights of Industry and a body known as the Amalgamated Labour Union, consisting of some dissatisfied members of the Knights of Labour, resulted in a convention held at Terre Haute, Ind., on the 2nd of August 1881. The chief purpose was to supplant the Knights of Labour by the creation of a new secret order. The membership of the convention, however, had trade union proclivities and did not believe in multiplying labour societies. The secret organization was not effected. Another convention was held in Pittsburg, on the 19th of November 1881, as the result of the following statement:—

> We have numberless trades unions, trades assemblies or councils, Knights of Labour, and various other local, national and international labour unions, all engaged in the noble task of elevating and improving the condition of the working classes. But great as has been the work done by these bodies, there is vastly more that can be done by a combination of all these organizations in a federation of trades and labour unions.

It is claimed that the 107 delegates represented 262,000 workmen. Their deliberations resulted in the Federation of Organized Trades and Labour Unions of the United States and Canada. Its platform differed but very little from that of the Knights of Labour, although it was in some respects more comprehensive. It demanded eight hours as a day's work; called for national and state incorporation of trade unions; favoured obligatory education of all children, and the prohibition of their employment under the age of fourteen; favoured the enactment of uniform apprentice laws; opposed bitterly all contract convict labour and the truck system for payment of wages; demanded laws giving to working men a first lien on property upon which their labour had been expended; insisted upon the abrogation of all so-called conspiracy laws; advocated the establishment of a national bureau of labour statistics; urged the prohibition of the importation of foreign labour; opposed government contracts on public work; favoured the adoption by states of an employers' liability act; and urged all other labour bodies to vote only for labour legislators. The second convention was held at Cleveland, O., on the 21st of November 1882.

The American Federation of Labour is the largest labour organization in the United States. It was organized at Columbus, O., on the 8th of December 1886, under the name it now bears. In 1888 it was declared that it owed its existence to the Federation of Organized Trades, &c., founded in 1881 at Pittsburg, and that the American Federation meetings or conventions should date from that year; hence it is generally stated that the Federation was founded in 1881. From the start in 1881 the Federation had a constitution, but it revised it at the convention held in Baltimore on the 16th of December 1887, under the name of the American Federation of Labour. The order is not secret, nor do individual members, through local trades unions or otherwise, owe any allegiance to it. Its object is the encouragement and formation of local trades and labour unions and the closer federation of such societies through the organization of central trades and labour unions in every state, and the combination of such bodies into state, territorial or provincial organizations for the purpose of securing general harmony not only in the interests of the working masses, but of legislation. While it is a federation, it cannot be called a federal body, like the Knights of Labour, although there are local trade unions, trade assemblies in cities and state federations; nevertheless, there is not the hierarchical character of the other body. Most of the trade unions in the United States are affiliated with the American Federation. The great railway brotherhoods are not so affiliated, except the Amalgamated Association of Railroad Employés of America, the Order of Railroad Telegraphers and the Brotherhood of Railroad Trackmen.

The federation has affiliated with it 117 international unions, 37 state federations, 574 city central bodies and 661 local trade and federal labour unions. The international unions are made up of approximately 28,500 local unions. The average membership on which dues have been paid was 264,825 in 1897, and ten years later the number was 1,538,970.

The chief officers of the federation are a president, first, second, third, fourth, fifth and sixth vice-presidents, treasurer and secretary. Samuel Gompers of New York was the first president, holding that position till 1894, when he was defeated through the endeavours of the Socialist Labour Party, and John M'Bride elected. At the next session, however, he was re-elected. The numerical strength of the American Federation of Labour is probably not far from 1,600,000. It maintains a journal called the *American Federationist*, published at Washington, D.C. The doctrine of the federation relative to strikes is that each affiliated society has its own government, distinct from the government of the national convention, which has no power to order strikes, such matters being left to the affiliated societies, but is advisory and not conclusive in its action.

Estimated Strength.

Unions are often organized for temporary purposes, their existence ceasing as soon as the purposes succeed or fail. The total number of members of all kinds of labour organizations cannot be stated. There are many local societies and associations other than those belonging to the Knights of Labour or those affiliated with the American Federation of Labour, but which are distinctly labour bodies. According to the best possible classification there are 20,000,000 wage-earners in the United States, including men, women and children. The most liberal estimate of the membership of all labour organizations places the total at 2,000,000. This would be about 10% of the whole body of wage-workers; but in some occupations, like that of the printing trade, the organization probably includes from 75 to 90%.

The law relating to trade unions varies somewhat in the different states. Both the federal legislature and several of the states (Massachusetts, New York, Pennsylvania, Michigan, Maryland, Iowa, Kansas and Louisiana) have passed laws permitting the incorporation of unions. Michigan, Wyoming and Nebraska have specially provided for incorporating assemblies of the Knights of Labour. Hardly any advantage, however, has been taken of these statutes. Some states have passed laws excepting trade unions from restrictions on combinations and conspiracies imposed by other statutes or the common law (*e.g.* New York), and especially from the operation of anti-trust laws (Michigan, Wisconsin, Nebraska, Montana, North Carolina and Texas). The Texas law, however, has been held unconstitutional. A number of states have passed laws, some of doubtful validity, prohibiting employers from making it a condition of employment that labourers should not belong to a union. Most states have adopted statutes legalizing union labels to indicate the products of members of trade unions.

By act of Congress, associations of the nature of labour organizations, having branches in several states or territories, may, on filing articles of association for record in Washington, become corporations. American legislation generally is friendly to trade unions. Their purposes are regarded as lawful by the courts, but if they use unlawful means for their accomplishments, a remedy will be applied. Injury to property, intimidation by threats, personal violence, or boycotts enforced by terrorism, are such unlawful means. The liberty of action thus secured to organizations of labour is equally the right of the employer. Therefore, a statute making it an offence for one to require those whom he employs to withdraw from a trade union is unconstitutional and void (see *Reports of American Bar Association*, xxi. 367, 372). The courts recognize that membership in trade unions is a species of property, of which no one can be deprived except through a formal procedure in conformity with the rules of the organization. Some of the states, notably New York, have a statute prohibiting trade unions from making any discrimination in connexion with their admission requirements on account of membership in the state militia or national guard.

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TRADE WINDS, the name given to the winds which blow from the tropical belts of high pressure towards the equatorial belt of low pressure, from the north-east in the northern hemisphere and from the south-east in the southern. They are exceedingly regular, especially over the oceans, where there is no disturbing influence from the great land masses. They receive their name from this feature, the term "trade" being used in the otherwise obsolete sense of "direction" or "course" (cf. "tread"). The area of their greatest influence may be taken to extend from about 3° to 35° N., and from the equator to 28° S., though these belts are actually somewhat narrower at any given season, as the whole system of surface winds over the globe moves north and south following the sun. The westerly winds prevalent in the belts respectively north of the northern tropical belt of high pressure, and south of the southern, are sometimes known as anti-trades, their direction being opposite to that of the trade winds.

TRAFALGAR, BATTLE OF. The British victory over the French off Cape Trafalgar, fought on the 21st of October 1805, was a sequel of the breakdown of Napoleon's great scheme for the invasion of the British Isles (See NAPOLEONIC CAMPAIGNS: *Naval*). When Villeneuve gave up in despair the attempt to enter the Channel, he steered for Cadiz, and anchored in that port on the 20th of August 1805. He found three British ships of the line, under the command of Vice-Admiral Cuthbert Collingwood, on the watch. Collingwood, resolved that the allies should not drive him through the Straits of Gibraltar without being compelled to follow, retired slowly, and at a short distance ahead of the ships sent to pursue him. They, not being willing to be drawn into the Mediterranean, gave up the pursuit. The British officer then resumed his watch off Cadiz. On the 22nd of August he was joined by Rear-Admiral Sir Richard Bickerton with four ships of the line, and on the 30th by Vice-Admiral Sir Robert Calder with 18. The allied fleet, consisting of 29 sail of the line which had come with Villeneuve, and five already at Cadiz, 34 in all, remained quiescent. The use to be made of it, or the measures to be taken for its destruction, were matters of urgent consideration to Napoleon and to the British government. On the 14th of September Napoleon gave orders that the French and Spanish ships at Cadiz should put to sea at the first favourable opportunity, join seven Spanish ships of the line then at Cartagena, go to Naples, and land the soldiers they carried to reinforce his troops then in that kingdom, and should fight a decisive action if they met a British fleet of inferior numbers. Two Spanish ships of the line were to be counted as equal to one French. Their final destination was to be Toulon. On the 15th he decided that Villeneuve, whose "excessive pusillanimity" rendered him incapable of vigorous action, must be replaced by Admiral Rosily. Rosily received his orders on the 17th and left for Cadiz. The British government, determined to confine the allies to Cadiz, or beat them if they came out, sent Nelson to take command and prepared to despatch reinforcements. Nelson left Portsmouth on the 15th of September, and reached Cadiz on the 28th, bringing three ships of the line with him. He gave orders that no salute should be fired for him lest the enemy should learn that reinforcements had arrived. The bulk of the fleet—23 sail—was kept well out at sea, and five ships of the line under Rear-Admiral Louis were appointed to cruise close to Cadiz as an inshore squadron. On the 5th of October Louis was sent to Gibraltar to renew his provisions and water, and the watch was left to two frigates. Between the 7th and the 13th of October Nelson was joined by six ships of the line, making a total of 34. But Admiral Calder, having been summoned home to stand a court-martial, took his flagship with him on the 14th, and on the 17th another line-of-battle ship had to be detached to renew her stores. As Admiral Louis could not return before the battle of the 21st, Nelson had at his disposal 27 ships of the line in all. Napoleon's order of the 14th of September reached Villeneuve on the 28th. He learnt also that Rosily was coming, but not that he himself was to be superseded. On the 5th of October he held a council of war of French and Spanish officers. They decided that the condition of their ships did not justify them in hoping for victory over the British fleet, but Napoleon's orders were peremptory, and they agreed that a sortie must be made. Easterly winds were needed to facilitate the sailing of a large and awkward fleet from Cadiz, and till the 14th the wind was hard from the west. Even when it fell the allies lingered. On the 18th of October Villeneuve heard that Rosily had reached Madrid, and of his own supersession. Stung by the prospect of being disgraced before the fleet, he resolved to go to sea before his successor could reach Cadiz.

The allies, aided by a light land breeze which blew from the east, though the wind at sea was westerly, began to leave Cadiz Bay on the 19th. Their movements were at once known to the British look-out frigates, and were transmitted by signal to Nelson, who was cruising some thirty miles to the west. During the period of blockade he had instructed his captains as to how he meant to fight the approaching battle. The memorandum in which his instructions were embodied was dated the 9th of October. It was drawn up in view of the circumstances which did not arise—that the enemy would come to sea with a strong easterly wind which would give him the weather gage; that he might be reinforced to a strength of over 50 ships of the line from Brest, Rochefort and Cartagena; that the British fleet might be raised by reinforcements to 40 ships. But the governing principles of the memorandum were independent of such details. They were that the order of sailing in which the fleet was when the enemy was seen was to be the order of battle; that no time was to be wasted in forming a precise line; that the attack was to be made in two bodies, of which one, to be led by the second in command, Collingwood, was to be thrown on the rear of the enemy, while the other, led by Nelson himself, was to take care that the centre and van should not come to the assistance of the ships cut off. Nelson was careful to point out that "Something must be left to chance. Nothing is sure in a sea fight beyond all others"; and he left his captains free from all hampering rules by telling them that "No captain can do very wrong if he places his ship alongside that of the enemy." In short the execution was to be as circumstances should dictate, subject to the guiding rule that the enemy's rear was to be cut off and a concentration of superior force on an inferior sought for.

The uncertainties of naval warfare in the days of sailing ships were fully shown at Trafalgar. The allies, having left Cadiz on the 20th of October, were 33 sail of the line strong, one of the fleet having been left behind. They sailed in five squadrons. Three were nearer the land than the other two. The leading squadron of the three was commanded by the Spanish admiral, Álava; Villeneuve followed; and the French admiral, Dumanoir, commanded the rear. The other two squadrons of six ships of the line each, commanded by the Spanish admiral, Gravina, and the French admiral, Magon, were parallel with, and outside of the three. All headed for the Straits of Gibraltar in the westerly breezes, which had become very light. The British fleet of 27 sail in two divisions also headed for the Mediterranean. During the night of the 20th–21st of October several movements were made to gain position, and there was an inevitable tendency to straggle among vessels which did not all sail equally well and were moving in light winds. On the early morning of the 21st the allies were some twelve miles off Cape Trafalgar. The British fleet was some ten or twelve miles out at sea to the west of them. Seeing that a battle would now be forced on him, Villeneuve ordered his whole fleet to turn so as to bring their heads on Cadiz. He was painfully aware that the incomparably more expert British fleet would not be content to attack him in the old-fashioned way, coming down in a parallel line and engaging from van to rear. He knew that they would endeavour to concentrate on a part of his line. But Villeneuve was too conscious of the inexperience of his officers and men to think it possible to make counter movements with them. It has been said that the French and Spanish ships which had taken part in the late cruise to the West Indies and back must be considered as trained in the same sense as the British. But apart from the fact that these vessels formed little more than a half of the allied fleet, the comparison is childish. It could only have occurred to writers who, wishing to exalt the glory of Trafalgar, forget that the superior quality of the British fleet, the fruit of foresight, of good sense, and the strenuous work of a people, was itself the best of all claims to honour. A hasty cruise across the Atlantic and back was no equivalent for years of training. The blockades maintained by the British fleet had made it difficult for the allies to obtain stores and their ships were ill fitted. Their crews contained a minute proportion of men bred to the sea, and as they had to be taught the elements of seamanship on the few occasions when they got to sea, their gunnery was neglected. There was valour in the allied fleet, but there was neither skill nor confidence. Moreover the very light wind then blowing rendered manœuvring all but impossible for the most expert crews. Villeneuve could do nothing more than order his fleet to turn so as to bring the ships' heads on Cadiz, to form the line, and await the enemy's attack. He, however, left his captains free to act for the best when the battle had begun, by telling them that whoever was not under fire was not at his post. The movement of conversion ordered at 6 o'clock a.m. was not executed till about 10 o'clock, and it was ill done. The three squadrons nearest the shore turned first, the rear beginning, to leave room for the others. Thus Dumanoir now led the van and Álava followed Villeneuve. The two squadrons of Gravina and Magon, which had been outside, fell in behind Álava. No accurate line was formed. The allies drifted rather than sailed into a curve of some five miles long, stretching from north to south, concave on the west side, and more pronounced at the southern than at the northern end. Their ships did not follow one another, but were in many cases two, and in some cases three, abreast in groups. To some extent this was to their advantage, as the effective range of fire of the artillery of the day was barely 1200 yds., and as the power of concentrating the fire of guns out of ports was limited, the danger to an assailant bearing down was not great during his approach. The peril was that he would be engaged with two or three enemies when he had broken into the line, and this risk was increased by the accidental group formation of the allies.

The confidence and promptitude of the British fleet presented a marked contrast to the passivity of the allies. When in the early morning the enemy was seen to the east, Nelson's fleet was in two divisions, somewhat scattered—his own of 12 sail of the line being to the westward and windward in the light breeze from W.N.W.; Collingwood's of 15 sail being to leeward and east. At 6.40 the signal was made to form the order of sailing and prepare for battle. The enemy's movement of conversion was already seen, and it was obvious that unless he were rapidly stopped he might reach Cadiz Bay in safety. A few minutes before 7 o'clock the signal to bear up, No. 76, was made by Nelson. Much discussion has arisen as to whether this was an order to bear up together, or in succession; the first if exactly executed would have caused the British ships to approach the enemy in a line abreast (side by side) since all would have turned at once; the second would have caused them to approach in a line ahead (one after the other) since they would have turned successively. The discussion is in reality futile, because the want of wind rendered it impossible to arrange exact formations, because it had been decided that no time should be wasted in dressing the line, and because Nelson's flagship, the "Victory" (100), and Collingwood's flagship, the "Royal Sovereign" (100), were quick-sailing vessels, and both admirals moved at the best attainable speed. The slow ships could not keep up with them. The two squadrons went down heading to north of east, Collingwood to the right and leeward, Nelson to the north and windward, in two bodies without exact formation, according to the speed of the ships. Collingwood headed for the centre, and the pronounced curve at the south end of the allied line caused the ships of his division to come into action in a close approach to a parallel with the enemy. The "Royal Sovereign" was the first British ship to break into the enemy's line, which she did about midday and astern of Álava's flagship the "Santa Ana." She was alone for a few minutes, but the ships of Collingwood's division, as they sailed into the curve, were mostly able, by steering to the right, to get into action very soon after their admiral. Nelson's division was headed by himself to cut through the enemy between his van and centre, and to bar his road to Cadiz. It was certainly in a nearer approach to a line ahead than Collingwood's. After making a demonstration at the allied van, he broke into their line astern of the "Bucentaure" (100), the flagship of Villeneuve.

The exact movements of all the ships engaged could only be given in a very detailed account of the battle, but the main lines of the action are already indicated. To the allies it appeared that the British fleet assailed them in two lines converging on their centre, and that it then carried out a concentration on this part of their line. Though this is too simple—or too bald—a statement of the case, it does not go far from the truth. The allied formation was broken in two, and though the rear part was kept well in play by Collingwood's division, the severest blows fell on the central sections.

The battle, which began at midday, was terminated about five. Eighteen of the allies were taken. Their van, after long remaining quiescent, made a futile demonstration, and then sailed away. The four van ships which escaped with

Admiral Dumanoir were met and captured off Cape Ortegal on the 4th of November by a British squadron of five ships under Sir Richard Strachan. The stormy weather which followed the battle gave the enemy an opportunity to retake some of the prizes, and others were lost. Four only were carried into Gibraltar by the British fleet—three French and one Spanish. Only eleven of the allied fleet succeeded in finding safety in Cadiz. The fragment of the French squadron remained there under Admiral Rosily till he was forced to surrender to the Spaniards in 1808 on the breaking out of the Peninsular War. The loss of life of the allies cannot be stated with precision. In the British fleet the reported loss in killed and wounded was 1690, of whom 1452 belonged to 14 out of the 27 ships of the line present—the inequality of loss being mainly due to the fact that it was as a rule these vessels which came earliest into action. For the circumstances of Nelson's death see the article NELSON.

AUTHORITIES.—Accounts of the battle of Trafalgar are to be found in all the naval, and most of the general, histories of the time. The most essential of the original authorities are collected by Sir N. Harris Nicolas in his *Despatches and Letters of Vice-Admiral Lord Viscount Nelson*, vol. vii. (London 1844–1846). The controversy as to the exact method on which the battle was fought, and the significance of the signal to bear down, is fully worked out with many references to authorities in *The Times* from the 14th of July to the 21st of October 1905, both in a general correspondence and in a series of articles on "Trafalgar and the Nelson Touch," 16th, 19th, 22nd, 26th, 28th and 30th of September 1905; see also J. S. Corbett, *The Campaign of Trafalgar* (1910). (D. H.)

TRAFFIC, properly the interchange or passing of goods or merchandise between persons, communities or countries, commerce or trade. The term in current usage is chiefly applied collectively to the goods, passengers, vehicles and vessels passing to and fro over the streets, roads, sea, rivers, canals, railways, &c.

The origin of the word is obscure. It occurs in Fr. *trafique*, and *trafiquer*, Ital. *traffico*, *trafficare*, Sp. *trafago*, *trafagar*. Du Cange (*Gloss. Med. et Inf. Lat.*) quotes the use of *traffigare* from a treaty between Milan and Venice of 1380, and gives other variants of the word in medieval Latin. There is a medieval Latin word *transfegator*, an explorer, spy, investigator (see Du Cange, *op. cit.*, *s.v.*) which occurs as early as 1243, and is stated to be from *transfegare*, a corruption of *transfretare*, to cross over the sea (*trans*, across, *fretum*, gulf, strait, channel). Diez (*Etymologisches Wörterbuch der romanischen Sprachen*) connects the word with Port. *trasfegar*, to decant, which he traces to Late Lat. *vicare*, to exchange, Lat. *vicis*, change, turn. A suggestion (*Athenaeum*, app. 7, 1900) has been made that it is to be referred to a late Hebrew corruption (*traffik*) of Gr. τροπαϊκός, pertaining to a trophy, applied to a silver coin with the figure of victory upon it and termed in Latin *victoriatus*.

TRAHERNE, THOMAS (1637?–1674), English writer, was, according to Anthony à Wood, a "shoemaker's son of Hereford." He entered Brasenose College, Oxford, in 1652, and after receiving his degree in 1656 took holy orders. In the following year he was appointed rector of Credenhill, near Hereford, and in 1661 received his M.A. degree. He found a good patron in Sir Orlando Bridgeman, lord keeper of the seals from 1667 to 1672. Traherne became his domestic chaplain and also "minister" of Teddington. He died at Bridgeman's house at Teddington on or about the 27th of September 1674. He led, we are told, a simple and devout life, and was well read in primitive antiquity and the fathers. His prose works are *Roman Forgeries* (1673), *Christian Ethics* (1675), and *A Serious and Patheticall Contemplation of the Mercies of God* (1699). His poems have a curious history. They were left in MS. and presumably passed with the rest of his library into the hands of his brother Philip. They then became apparently the possession of the Skipps of Ledbury, Herefordshire. When the property of this family was dispersed in 1888 the value of the MSS. was unrecognised, for in 1896 or 1897 they were discovered by Mr W. T. Brooke on a street bookstall. Dr Grosart bought them, and proposed to include them in his edition of the works of Henry Vaughan, to whom he was disposed to assign them. He left this task uncompleted, and Mr Bertram Dobell, who eventually secured the MSS., was able to establish the authorship of Thomas Traherne. The discovery included, beside the poems, four complete "Centuries of Meditation," short paragraphs embodying reflexions on religion and morals. Some of these, evidently autobiographical in character, describe a childhood from which the "glory and the dream" was slow to depart. Of the power of nature to inform the mind with beauty, and the ecstatic harmony of a child with the natural world, the earlier poems, which contain his best work, are full. In their manner, as in their matter, they remind the reader of Blake and Wordsworth. Traherne has at his best an excellence all his own, but there can be no reasonable doubt that he was familiar both with the poems of Herbert and of Vaughan. The poems on childhood may well have been inspired by Vaughan's lines entitled *The Retreat.* His poetry is essentially metaphysical and his workmanship is uneven, but the collection contains passages of great beauty.

See Bertram Dobell's editions of the *Poetical Works* (1906) and *Centuries of Meditation* (1908).

TRAILL, HENRY DUFF (1842–1900), British author and journalist, was born at Blackheath on the 14th of August 1842. He belonged to an old Caithness family, the Traills of Rattar, and his father, James Traill, was stipendiary magistrate of Greenwich and Woolwich. H. D. Traill was sent to the Merchant Taylors' School. He rose to be head of the school and obtained a scholarship at St John's College, Oxford. He was destined for the profession of medicine and took his degree in natural sciences in 1865, but then read for the bar, being called in 1869. In 1871 he received an appointment in the education office which left him leisure to cultivate his gift for literature. In 1873 he became a contributor to the *Pall Mall Gazette*, then under the editorship of Frederick Greenwood. He followed Greenwood to the *St James's Gazette* when in 1880 the *Pall Mall Gazette* took for a time the Liberal side, and he continued to contribute to that paper up to 1895. In the meantime he had also joined the staff of the *Saturday Review*, to which he sent, amongst other writings, weekly verses upon subjects of the hour. Some of the best of these he republished in 1882 in a volume called *Recaptured Rhymes*, and others in a later collection of *Saturday Songs* (1890). He was also a leader-writer on the *Daily Telegraph*, and acted for a time as editor of the (Sunday) *Observer*. In 1897 he became first editor of *Literature*, when that weekly paper (afterwards sold and incorporated with the *Academy*) was established by the proprietors of *The Times*, and directed its fortunes until his death. Traill's long connexion with journalism must not obscure the fact that he was a man of letters rather than a journalist. He wrote best when he wrote with least sense of the burden of responsibility. His playful humour and his ready wit were only given full scope when he was writing to please himself. One of his most brilliant *jeux d'esprit* was a pamphlet which was published without his name soon after he had begun to write for the newspapers. It was called *The Israelitish Question and the Comments of the Canaan Journals thereon* (1876). This told the story of the Exodus in articles which parodied very cleverly the style of all the leading journals of the day, and was at once recognized as the work of a born humorist. Traill sustained this reputation with *The New Lucian*, which appeared in 1884 (2nd ed., with several new dialogues, 1900); but for the rest his labours were upon more serious lines. He directed the production of a vast work on *Social England* in 1893–1898; he wrote, for several series of biographies, studies of Coleridge (1884), Sterne (1882), William III. (1888), Shaftesbury (1886), Strafford (1889), and Lord Salisbury (1891); he compiled a biography of Sir John Franklin, the Arctic explorer (1896); and after a visit to Egypt he published a volume on the country, and in 1897 appeared his book on Lord Cromer, the man who had done so much to bring it back to prosperity. Of these the literary studies are the best, for Traill possessed great critical insight. He published two collections of essays: *Number Twenty* (1892), and *The New Fiction* (1897). In 1865 his *Glaucus; a tale of a Fish*, was produced at the Olympic Theatre with Miss Nellie Farren in the part of Glaucus. In conjunction with Mr Robert Hichens he wrote *The Medicine Man*, produced at the Lyceum in 1898. He died in London on the 21st of February 1900.

TRAIN (M. Eng. *trayn* or *trayne*, derived through Fr. from Late Lat. *trahinare*, to drag, draw, Lat. *trahere*, cf. trail, trace, ultimately from the same source), a general term applied to that which is drawn or trailed behind or after anything else, the hind part or rear of anything. It is thus used of the portion of a skirt, robe or cloak which is lengthened behind so that when allowed to fall it trails along the ground. In ceremonial processions and other state functions the duty of keeping raised the train of the sovereign's robes, or of the robes of great officials and dignitaries, is assigned to pages or to official train-bearers. The length of the train which ladies must wear at royal courts, drawing-rooms or other state functions is fixed by regulations from the lord chamberlain's office. The chief specific uses of the term are for the trail of a gun, that portion of the carriage which rests upon the ground when it is unlimbered, the line of gunpowder or other combustible material which is used to ignite a charge of explosives, and, figuratively, to an ordered series or sequence of events, thoughts, &c. The most familiar application is to a number of carriages, wagons or trucks coupled together and drawn by a locomotive engine on a railway (see RAILWAYS). A special use of the verb "to train," in the sense of to educate, to instruct, to bring into fit and proper condition, mental, moral or physical, is developed, as in "educate" (Lat. *educare*, literally, to draw out), from the sense of drawing or bringing out the good qualities aimed at in a course of instruction; a specific use is that of training for a race or other form of athletics, *i.e.* getting into fit physical condition.

TRAJAN [MARCUS ULPIUS TRAJANUS] (A.D. 53–117), Roman emperor, was born at Italica, in Spain, on the 18th of September 52 (or 53). The family to which he belonged was probably Italian and not Iberian by blood. His father began as a common legionary soldier, and fought his way up to the consulship and the governorship of Asia. The younger Trajan was rigorously trained by him, and imbued with the same principles and tastes. He was a soldier born and bred. No better representative of the true old hardy Roman type, little softened by either luxury or education, had come to the head of affairs since the days of Marius. His training was almost exclusively military, but his experience as an officer gave him an acquaintance with almost every important province of the empire, which was of priceless value to him when he came to the throne. For ten years he held a commission as military tribune, which took him to many lands far asunder; then he filled important posts in Syria and Spain. By the year 89 he had achieved a considerable military reputation. At that time L. Antonius Saturninus headed a rebellion in Germany, which threatened seriously to bring Domitian's rule to an end. Trajan was ordered in hot haste from Further Spain to the Rhine. Although he carried his troops over that long and arduous march with almost unexampled rapidity, he only arrived after the insurrection had been put down. But his promptitude raised him higher in the favour of Domitian, and he was advanced to the consulship in 91. Of the next five years of his life we know nothing definite. It is not unlikely that they were spent at Rome or in Italy in the fulfilment of some official duties. When the revolution of 96 came, and Nerva replaced the murdered Domitian, one of the most important posts in the empire, that of consular legate of Upper Germany, was conferred upon Trajan. An officer whose nature, as the event showed, was interpenetrated with the spirit of legality was a fitting servant of a revolution whose aim it was to substitute legality for personal caprice as the dominant principle of affairs. The short reign of Nerva really did start the empire on a new career, which lasted more than three-quarters of a century. But it also demonstrated how impossible it was for any one to govern at all who had no claim, either personal or inherited, to the respect of the legions. Nerva saw that if he could not find an Augustus to control the army, the army would find another Domitian to trample the senate under foot. In his difficulties he took counsel with L. Licinius Sura, a lifelong friend of Trajan, and on the 27th of October in the year 97 he ascended the Capitol and proclaimed that he adopted Trajan as his son. The senate confirmed the choice and acknowledged the emperor's adopted son as his successor. After a little hesitation Trajan accepted the position, which was marked by the titles of imperator, Caesar and Germanicus, and by the tribunician authority. He immediately proceeded to Lower Germany, to assure himself of the fidelity of the troops in that province, and while at Cologne he received news of Nerva's death (Jan. 25, 98). The authority of the new emperor was recognized at once all over the empire. The novel fact that a master of the Romans should have been born on Spanish soil seems to have passed with little remark, and this absence of notice is significant. Trajan's first care as emperor was to write to the senate an assurance like that which had been given by Nerva, that he would neither kill nor degrade any senator. He ordered the establishment of a temple and cult in honour of his adoptive father, but he did not come to Rome. In his dealings with the mutinous praetorians the strength of the new emperor's hand was shown at once. He ordered a portion of the force to Germany. They did not venture to disobey, and were distributed among the legions there. Those who remained at Rome were easily overawed and reformed. It is still more surprising that the soldiers should have quietly submitted to a reduction in the amount of the donative or gift which it was customary for them to receive from a new emperor, though the civil population of the capital were paid their largess (*congiarium*) in full. By politic management Trajan was able to represent the diminution as a sort of discount for immediate payment, while the civilians had to wait a considerable time before their full due was handed to them.

The secret of Trajan's power lay in his close personal relations with the officers and men of the army and in the soldierly qualities which commanded their esteem. He possessed courage, justice and frankness. Having a good title to military distinction himself, he could afford, as the unwarlike emperors could not, to be generous to his officers. The common soldiers, on the other hand, were fascinated by his personal prowess and his camaraderie. His features were firm and clearly cut; his figure was tall and soldierly. His hair was already grey before he came to the throne, though he was not more than forty-five years old. When on service he used the mean fare of the common private, dining on salt pork, cheese and sour wine. Nothing pleased him better than to take part with the centurion or the soldier in fencing or other military exercise, and he would applaud any shrewd blow which fell upon his own helmet. He loved to display his acquaintance with the career of distinguished veterans, and to talk with them of their battles and their wounds. Probably he lost nothing of his popularity with the army by occasional indulgence in sensual pleasures. Yet every man felt and knew that no detail of military duty, however minute, escaped the emperor's eye, and that any relaxation of discipline would be punished rigorously, yet with unwavering justice. Trajan emphasized at once his personal control and the constitutionality of his sway by bearing on his campaigns the actual title of "proconsul," which no other emperor had done. All things considered, it is not surprising that he was able, without serious opposition from the army, entirely to remodel the military institutions of the empire, and to bring them into a shape from which there was comparatively little departure so long as the army lasted. In disciplinary matters no emperor since Augustus had been able to keep so strong a control over the troops. Pliny rightly praises Trajan as the lawgiver and the founder of discipline, and Vegetius classes Augustus, Trajan and Hadrian together as restorers of the morale of the army. The confidence which existed between Trajan and his army finds expression in some of the coins of his reign.

For nearly two years after his election Trajan did not appear in Rome. He had decided already what the great task of his reign should be—the establishment of security upon the dangerous north-eastern frontier. Before visiting the capital he determined to put affairs in train for the attainment of this object. He made a thorough inspection of the great lines of defence between the Danube and the Rhine, and framed and partly carried out a vast scheme for strengthening and securing them.

The policy of opposing uncivilized tribes by the construction of the *limes*, a raised embankment of earth or other material, intersected here and there by fortifications, was not his invention, but it owed in great measure its development to him. It is probable that the northernmost part of the great *limes Germaniae*, from the Rhine at Rheinbrohl, nearly midway between Coblenz and Bonn, to a point on the Main east of Frankfort, where that river suddenly changes its course from north to west, was begun by Domitian. The extension of this great barrier southwards to the point at which it met the *limes Raetiae* was undertaken by Trajan, though we cannot say how far he carried the work, which was not entirely completed till long after his time. We may without hesitation follow the opinion of Mommsen, who maintains that the *limes* was not intended, like Hadrian's Wall between the Tyne and the Solway, and like the great wall of China, to oppose an absolute barrier against incursions from the outside. It was useful as marking definitely the boundary of the Roman sway, and as assuring the Romans that no inroad could be made without intelligence being had of it beforehand, while the *limes* itself and the system of roads behind it enabled troops to be directed rapidly to any threatened point, and the fortified positions could be held against large numbers till reinforcements arrived. Great importance was no doubt attached to the perfection of the lines of communication bearing on the *limes*. Among a people of roadmakers, Trajan was one of the greatest, and we have definite evidence from inscriptions that some of the military roads in this region were constructed by him. The more secure control which the Romans now maintained over the territory within the *limes* tended to its rapid civilization, and the Roman influence, if not the Roman arms, soon began to affect powerfully the regions beyond.

After his careful survey of the Rhine end of the frontier defences, Trajan proceeded to strengthen them in the direction of the Danube. From the age of Tiberius onwards the Romans possessed the whole southern bank of the river from its source to the Euxine. But the precarious tenure of their possession had been deeply impressed on them by the disasters and humiliations they had undergone in these districts during the reign of Domitian. A prince had arisen among the Dacians, Decebalus by name, worthy to be placed at the head of all the great barbarian antagonists of Rome. Like Maroboduus, he was able to combine the forces of tribes commonly hostile to each other, and his military ability almost went the length of genius. Domitian attacked him but was compelled to make an ignominious peace. He agreed to pay to Decebalus an annual subsidy, and to supply him with engineers and craftsmen skilled in all kinds of construction, but particularly in the erection of fortifications and defensive works. During the nine or ten years which had elapsed since the conclusion of this remarkable treaty the Dacian prince had immensely strengthened the approaches to his kingdom from the Roman side. He had also equipped and drilled his formidable army after the Roman fashion. It was impossible for a soldier like Trajan to endure the conditions accepted by Domitian; but the conquest of Dacia had become one of the most formidable tasks that had ever confronted the empire. Trajan no doubt planned a war before he left the Danube for Rome late in 99.

The arrival of the emperor had been awaited in the capital with an impatience which is expressed by Pliny and by Martial.[1] As he entered the city and went on foot to the Capitol the plaudits of the people were unmistakably genuine. During his stay in the city he riveted more firmly still the affections both of the senate and of the people. The reconciliation of the empire with liberty, inaugurated, as Tacitus says, by Nerva, seemed now to be securely achieved. Trajan was absolutely open and simple, and lived with men at Rome as he had lived with his soldiers while on service. He realized the senate's ideal of the citizen ruler. The assurance that no senator should suffer was renewed by oath. All the old republican formalities were most punctiliously observed—even those attendant on the emperor's election to the consulate, so far as they did not involve a restoration of the old order of voting at the comitia. The veneration for republican tradition is curiously attested by the reproduction of many republican types of coin struck by senatorial officers. Trajan seized every opportunity for emphasizing his view that the *princeps* was merely the greatest of the magistrates, and so was not above but under the laws. He was determined, he said, to be to his subjects such a ruler as he had desired for himself when a subject. Real power and influence were accorded to the senate, which had now, by the incorporation of members whose origin was provincial, become in a manner representative of the whole empire. Trajan associated with the senators on equal terms, and enjoyed in their company every kind of recreation. All pomp was distasteful to him and discarded by him. There was practically no court, and no intrigues of any kind were possible. The approach to his house was free, and he loved to pass through the city unattended and to pay unexpected visits to his friends. He thirsted for no senator's blood, and used severity against the *delatores* alone. There was but one insignificant conspiracy against him during his whole reign. Though not literary himself, Trajan conciliated the literary men, who at all times had close relations with the senate. His intimate, M. Licinius, played an excellent Maecenas to his Augustus. In his efforts to win the affections of Roman society Trajan was aided by his wife Plotina, who was as simple as her husband, benevolent, pure in character, and entirely unambitious. The hold which Trajan acquired over the people was no less firm than that which he maintained upon the army and the senate. His largesses, his distributions of food, his public works, and his spectacles were all on a generous scale. The exhibitions in the arena were perhaps at their zenith during his tenure of power. Though, for some unexplained reason, he abolished the mimes, so beloved of the populace, at the outset of his reign, he availed himself of the occasion of his first triumph to restore them again. The people were delighted by the removal of the imperial *exedra* (a large chamber with open front) in the circus, whereby five thousand additional places were provided. Taxation was in many directions reduced, and the financial exactions of the imperial officers controlled by the erection of a special court. Elaborate precautions were taken to save Italy from famine; it is said that corn for seven years' consumption at the capital was retained in the granaries. Special encouragement was given to merchants to import articles of food. The corporation of bakers was organized and made more effective for the service of the public. The internal trade of Italy was powerfully stimulated by the careful maintenance and extension of the different lines of road. But the most striking evidence of Trajan's solicitude for his people's welfare is found in his institution of the *alimenta*, whereby means were provided for the rearing of poor and orphan children in Italy. The method had been sketched out by Nerva, but its great development was due to Trajan. The moneys allotted by the emperor were in many cases supplemented by private benevolence. As a soldier, Trajan realized the need of men for the maintenance of the empire against the outer barbarians, and he preferred that these men should be of Italian birth. He was only carrying a step farther the policy of Augustus, who by a system of rewards and penalties had tried to encourage marriage and the nurture of children. The actual effect of Trajan's regulations is hard to measure; they were probably more effectual for their object than those of Augustus. The foundations were confiscated by Pertinax, after they had existed less than a century.

On the 1st of September in the year 100, when Trajan was consul for the third time, Pliny, who had been designated consul for a part of the year, was appointed to deliver the "Panegyric" which has come down to us, and forms a most important source of our knowledge concerning this emperor. Pliny's eulogy of Trajan and his denunciation of Domitian are alike couched in extravagant phrases, but the former perhaps rests more uniformly on a basis of truth and justice than the latter. The tone of the "Panegyric" certainly lends itself to the supposition of some historians that Trajan was inordinately vain. That the emperor had an honest and soldierly satisfaction in his own well-doing is clear; but if he had had anything like the vanity of a Domitian, the senate, ever eager to outrun a ruler's taste for flattery, would never have kept within such moderate bounds.

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[1] It has been conjectured, not improbably, that the *Germania* of Tacitus, written at this period, had for one of its aims the enlightenment of the Romans concerning the formidable character of the Germans, so that they might at once bear more readily with the emperor's prolonged absence and be prepared for the necessity of decisive action on the frontier.

On the 25th of March in the year 101 Trajan left Rome for the Danube. Pretexts for a Dacian war were not difficult to find. Although there was no lack of hard fighting, victory in this war depended largely on the work of the engineer. The great military road connecting the posts in Upper Germany with those on the Danube, which had been begun by Tiberius, was now extended along the right bank of the river as far as the modern Orsova. The campaign of 101 was devoted mainly to road-making and fortification. In the following campaign, after desperate fighting to the north of the Danube in the mountainous region of Transylvania, Sarmizegethusa, the capital of Decebalus, was taken, and he was forced to terms. He agreed to raze all fortresses, to surrender all weapons, prisoners and Roman deserters, and to become a dependent prince under the suzerainty of Rome. Trajan came back to Italy with Dacian envoys, who in ancient style begged the senate to confirm the conditions granted by the commander in the field. The emperor now enjoyed his first Dacian triumph, and assumed the title of Dacicus. At the same time he royally entertained the people and no less royally rewarded his brave officers. But the Dacian chief could not school his high spirit to endure the conditions of the treaty, and Trajan soon found it necessary to prepare for another war. A massive stone bridge was built across the Danube, near the modern Turn Severin, by Apollodorus, the gifted architect who afterwards designed the forum of Trajan. In 105 began the new struggle, which on the side of Decebalus could now only lead to victory or to destruction. The Dacians fought their ground inch by inch, and their army as a whole may be said to have bled to death. The prince put an end to his own life. His kingdom became an imperial province; in it many colonies were founded and peopled by settlers drawn from different parts of the empire. The work done by Trajan in the Danubian regions left a lasting mark upon their history. The emperor returned to the capital in 106, laden with captured treasure. His triumph outdid in splendour all those that went before it. Games are said to have been held continuously for four months. Ten thousand gladiators are said to have perished in the arena, and eleven thousand beasts were killed in the contests. Congratulatory embassies came from all lands, even from India. The grand and enduring monument of the Dacian wars is the noble pillar which still stands on the site of Trajan's forum at Rome.

The end of the Dacian wars was followed by seven years of peace. During part of that time Pliny was imperial legate in the provinces of Bithynia and Pontus, and in constant communication with Trajan. The correspondence is extant and gives us the means of observing the principles and tendencies of the emperor as a civil governor.

The provinces (hitherto senatorial) were in considerable disorder, which Pliny was sent to cure. It is clear from the emperor's letters that in regard to nine out of ten of the matters which his anxious and deferential legate referred to him for his decision he would have been better pleased if the legate had decided them for himself. Trajan's notions of civil government were, like those of the duke of Wellington, strongly tinged with military prepossessions. He regarded the provincial ruler as a kind of officer in command, who ought to be able to discipline his province for himself and only to appeal to the commander-in-chief in a difficult case. In advising Pliny about the different free communities in the provinces, Trajan showed the same regard for traditional rights and privileges which he had exhibited in face of the senate at Rome. At the same time, these letters bring home to us his conviction that, particularly in financial affairs, it was necessary that local self-government should be carried on under the vigilant supervision of imperial officers. The control which he began in this way to exercise, both in Italy and in the provinces, over the "municipia" and "liberae civitates," by means of agents entitled (then or later) "correctores civitatium liberarum," was carried continually farther and farther by his successors, and at last ended in the complete centralization of the government. On this account the reign of Trajan constitutes a turning-point in civil as in military history. In other directions, though we find many salutary civil measures, yet there were no far-reaching schemes of reform. Many details in the administration of the law, and particularly of the criminal law, were improved. To cure corruption in the senate the ballot was introduced at elections to magistracies. The finances of the state were economically managed, and taxpayers were most carefully guarded from oppression. Trajan never lacked money to expend on great works of public utility; as a builder, he may fairly be compared with Augustus. His forum and its numerous appendages were constructed on a magnificent scale. Many regions of Italy and the provinces besides the city itself benefited by the care and munificence which the emperor bestowed on such public improvements. His attitude towards religion was, like that of Augustus, moderate and conservative. The famous letter to Pliny about the Christians is, according to Roman ideas, merciful and considerate. It was impossible, however, for a Roman magistrate of the time to rid himself of the idea that all forms of religion must do homage to the civil power. Hence the conflict which made Trajan appear in the eyes of Christians like Tertullian the most infamous of monsters. On the whole, Trajan's civil administration was sound, careful and sensible, rather than brilliant.

Late in 113 Trajan left Italy to make war in the East. The never-ending Parthian problem confronted him, and with it were more or less connected a number of minor difficulties. Already by 106 the position of Rome in the East had been materially improved by the peaceful annexation of districts bordering on the province of Syria. The region of Damascus, hitherto a dependency, and the last remaining fragment of the Jewish kingdom, were incorporated with Syria; Bostra and Petra were permanently occupied, and a great portion of the Nabataean kingdom was organized as the Roman province of Arabia. Rome thus obtained mastery of the most important positions lying on the great trade routes between East and West. These changes could not but affect the relations of the Roman with the Parthian Empire, and the affairs of Armenia became in 114 the occasion of a war. Trajan's campaigns in the East ended in complete though brilliant failure. In the retreat from Ctesiphon (117) the old emperor tasted for almost the first time the bitterness of defeat in the field. He attacked the desert city of Hatra, westward of the Tigris, whose importance is still attested by grand ruins. The want of water made it impossible to maintain a large force near the city, and the brave Arabs routed the Roman cavalry. Trajan, who narrowly escaped being killed, was forced to withdraw. A more alarming difficulty lay before him. Taking advantage of the absence of the emperor in the Far East, and possibly by an understanding with the leaders of the rising in Armenia and the annexed portions of Parthia, the Jews all over the East had taken up arms at the same moment and at a given signal. The massacres they committed were portentous. In Cyprus 240,000 men are said to have been put to death, and at Cyrene 220,000. At Alexandria, on the other hand, many Jews were killed. The Romans punished massacre by massacre, and the complete suppression of the insurrection was long delayed, but the Jews made no great stand against disciplined troops. Trajan still thought of returning to Mesopotamia and of avenging his defeat at Hatra, but he was stricken with sickness and compelled to take ship for Italy. His illness increasing, he landed in Cilicia, and died at Selinus early in August 117.

Trajan, who had no children, had continually delayed to settle the succession to the throne, though Pliny in the "Panegyric" had pointedly drawn his attention to the matter, and it must have caused the senate much anxiety. Whether Hadrian, the relative of Trajan (cousin's son), was actually adopted by him or not is impossible to determine; certainly Hadrian had not been advanced to any great honours by Trajan. Even his military service had not been distinguished. Plotina asserted the adoption, and it was readily and most fortunately accepted, if not believed, as a fact.

The senate had decreed to Trajan as many triumphs as he chose to celebrate. For the first time a dead general triumphed. When Trajan was deified, he appropriately retained, alone among the emperors, a title he had won for himself in the field, that of "Parthicus." He was a patient organizer of victory rather than a strategic genius. He laboriously perfected the military machine, which when once set in motion went on to victory. Much of the work he did was great and enduring, but the last year of his life forbade the Romans to attribute to him that *felicitas* which they regarded as an inborn quality of the highest generals. Each succeeding emperor was saluted with the wish that he might be "better than Trajan and more fortunate than Augustus." Yet the breach made in Trajan's *felicitas* by the failure in the East was no greater than that made in the *felicitas* of Augustus by his retirement from the right bank of the Rhine. The question whether Trajan's Oriental policy was wise is answered emphatically by Mommsen in the affirmative.

It was certainly wise if the means existed which were necessary to carry it out and sustain it. But succeeding history proved that those means did not exist. The assertion of Mommsen that the Tigris was a more defensible frontier than the desert line which separated the Parthian from the Roman Empire can hardly be accepted. The change would certainly have created a demand for more legions, which the resources of the Romans were not sufficient to meet without danger to their possessions on other frontiers.

The records of Trajan's reign are miserably deficient. Our best authority is the 68th book of Dio Cassius; then comes the "Panegyric" of Pliny, with his correspondence. The facts to be gathered from other ancient writers are scattered and scanty. Fortunately the inscriptions of the time are abundant and important. Of modern histories which comprise the reign of Trajan the best in English is that of Merivale; but that in German by H. Schiller (*Geschichte der römischen Kaiserzeit*, Gotha, 1883) is more on a level with recent inquiries. There are special works on Trajan by H. Francke (Güstrow, 1837), De la Berge (Paris, 1877), and Dierauer in M. Büdinger's *Untersuchungen zur römischen Kaisergeschichte*, (Leipzig, 1868). A paper by Mommsen in *Hermes*, iii. pp. 30 seq., entitled "Zur Lebensgeschichte des jüngeren Plinius," is important for the chronology of Trajan's reign. The inscriptions of the reign, and the Dacian campaigns, have been much studied in recent years, in scattered articles and monographs. (J. S. R.)

TRALEE, a market town and seaport, and the county town of Co. Kerry, Ireland, on the Ballymullen or Leigh River, about a mile from its mouth in Tralee Bay, and on the Great Southern & Western railway. Pop. (1901), 9687. A ship canal, permitting the passage of ships of 200 tons burden, connects it with Tralee Bay. Large vessels discharge at Fenit, 8 m. westward, where there is a pier connected with Tralee by rail. Coal, iron and timber are imported, and there is a considerable export of grain. There is a large trade in butter. Railways serve the neighbouring seaside watering-places of Ballybunnion and Castlegregory, and the coast scenery of this part is grand and varied. Four miles north-west of Tralee is Ardfert, with its cathedral, one of the oldest foundations in Ireland, now united to the see of Limerick. St Brendan was its original founder, and it had once a university. A neighbouring round tower fell in 1870. Seven miles north of this again is the fine round tower of Rattoo.

Tralee, anciently Traleigh, the "strand of the Leigh," owes its origin to the foundation of a Dominican monastery in 1213 by John Fitz-Thomas, of the Geraldine family. During the reign of Elizabeth it was in the possession of Earl Desmond, on whose forfeiture it came into possession of the Dennys. At the time of the rebellion in 1641 the English families in the neighbourhood asked to be placed in the castle under the charge of Sir Edward Denny, but during his absence a surrender was made. The town was incorporated by James I., and returned two members to the Irish parliament. Though disfranchised at the Union in 1800, it obtained the privilege of returning one member in 1832, but in 1885 it was merged in the county division. It is governed by an urban district council.

TRALLES (mod. *Güzel Hissar*), an ancient town of Caria, Asia Minor, situated on the Eudon, a tributary of the Maeander. It was reputed an Argive and Thracian colony, and was long under Persian rule, of which we hear in the history of Dercyllidas' raid from Ephesus in 397 B.C. Fortified and increased by the Seleucids and Pergamenians, who renamed it successively Seleucia and Antiochia, it passed to Rome in 133. Though satirized in a famous line (Juv. *Sat.* iii. 70) as a remote provincial place, it had many wealthy inhabitants in the Roman period and, to judge by objects discovered there, contained many notable works of art. Two of the best marble heads in the Constantinople museum came from Tralles; and both in the excavations conducted for that museum by Edhem Bey (1904), and by chance discoveries, fine-art products have come to light on the site. Rebuilt by Andronicus II. about 1280, it was superseded a few years later, after the Seljuk conquest, by a new town, founded by the amir Aidin in a lower situation (see AIDIN). (D. G. H.)

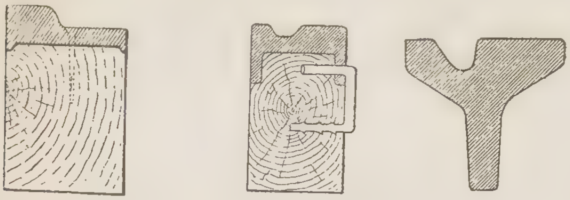
TRAMORE, a market village and seaside resort of Co. Waterford, Ireland, on the bay of the same name, 7 m. S. of the city of Waterford, and the terminus of the Waterford & Tramore railway. The situation is pleasant, and the neighbouring coast exhibits bold cliff scenery. The bay is open to the south, and is dangerous to navigators, as in foggy weather it has been frequently mistaken for the entrance to Waterford Harbour. On the cliffs to the west are three towers, one having a curious iron figure known as the "metal man," erected as a warning to sailors. The bay is divided into an outer part and an inner lagoon (the Back Strand) by a spit of sand, with a strait, crossed by a ferry at its eastern extremity. A monument commemorates the wreck of the troopship "Seahorse" in 1816. Four miles west is Dunhill Castle, well situated on a precipitous rock.

TRAMP, a vagrant, one who "tramps" or walks the roads begging from house to house or ostensibly looking for work, but with no home and habitually sleeping out or moving on from the casual ward of one workhouse to that of another (see VAGRANCY). The word is the shortened form of "tramper," one who tramps or walks with heavy tread. The term "tramp" is also used of a cargo steamer not running on a regular line but passing from port to port where freight may be picked up.

TRAMWAY, a track or line of rails laid down in the public roads or streets (hence the American equivalent "street railway"), along which wheeled vehicles are run for the conveyance of passengers (and occasionally of goods) by animal or mechanical power; also a light roughly laid railway used for transporting coals, both underground and on the surface, and for other similar purposes. The word has been connected with the name of Benjamin Outram, an engineer who, at the beginning of the 19th century, was concerned in the construction of tram roads, and has been explained as an abbreviation for "Outram way." But this is clearly wrong, since the word is found much earlier. It appears to be of Scandinavian origin and primarily to mean a beam of wood, cf. Old Swedish *tråm*, *trum*, which have that sense. In a will dated 1555 reference is made to amending a "higheway or tram" in Bernard Castle, where a log road seems to be in question. In Lowland Scottish "tram" was used both of a beam of wood and specifically of such a beam employed as the shaft of a cart, and the name is still often given in England to the wheeled vehicles used for carrying coal in mining. "Tramway," therefore, is primarily either a way made with beams of wood or one intended for the use of "trams" containing coal (see RAILWAY).

Construction.—The first tramway or street railway designed for passenger cars with flanged wheels was built in New York in 1832. The construction of this tramway does not appear to have been a success, and it was soon discontinued. In 1852 tramways were revived in New York by a French engineer named Loubat, who constructed the track of flat wrought-iron rails with a wide, deep groove in the upper surface, laid on longitudinal timbers. The groove, which was designed for wheel flanges similar to those employed on railways, proved dangerous to the light, narrow-tired vehicles of the American type. To meet this difficulty a step-rail consisting of a flat plate with a step at one side raised about ⅞ in. above the surface was designed and laid at Philadelphia in 1855. When tramways were first introduced into England by G. F. Train in 1860 a rail similar to that laid at Philadelphia was adopted. This rail (fig. 1) was made of wrought-iron and weighed 50 ℔ per yard. It was 6 in. wide and had a step ¾ in. above the sole. The rails were spiked to longitudinal timbers, which rested on transverse sleepers, and they were laid to a gauge of 4 ft. 8½ in. Tramways of this type were laid at Birkenhead in 1860, at London in 1861, and in the Potteries (North Staffordshire) in 1863. The English public, however, would not tolerate the danger and obstruction caused by the step-rail, with its large area of slippery iron surface, and the tramway laid in London had to be removed, while those at Birkenhead and the Potteries were only saved by being relaid with grooved rails. Thus, while the step-rail became the standard form used in the United States, the grooved-rail became generally adopted in Europe. From the tramway point of view the step-rail has many advantages. A groove collects ice and dirt, and on curves binds the wheel flanges, increasing the resistance to traction. A grooved rail is, however, far less of a nuisance to the ordinary vehicular traffic, and it has come to be largely used in the principal cities of America.

After the passing of the Tramways Act of 1870 the construction of tramways proceeded rapidly in England. A flat grooved rail supported on a longitudinal timber and laid on a concrete bed was generally adopted. The paving consisted of stone setts from 4 to 6 in. in depth, laid on a thin bed of sand and grouted with cement, mortar or a bituminous mixture. With the exception of the design of the rail and the manner of supporting it on the concrete foundation, which has continually changed, this method of constructing the track has varied but little to the present day.



(Figs. 2 and 3 from D. K. Clarke's *Tramways, their Construction and Working*, by permission of Crosby Lockwood & Son.)

FIG. 1. FIG. 2. FIG. 3.

Early Tramway Rails.

The flat section of rail which was wanting in vertical stiffness soon proved unsatisfactory. A fillet or flange was then added to each side, which, bedding into the supporting timber, not only increased the vertical strength but also prevented horizontal displacement of the rail. With the addition of the side flanges a greatly improved method of fixing the rail to the sleepers was adopted. The old vertical spike, which was a crude fastening, was replaced by a "dog" or double-ended side spike, one end of which was driven through a hole in the flange of the rail (fig. 2). This fastening was very strong and proved a great improvement.

The next change was the use of cast-iron chairs to support the rails, which were introduced by Kincaid in 1872. These led to a modification of the rail section, and instead of the two side flanges a rail with a central flange (fig. 3) which fitted into the cast-iron chairs was used. The chairs weighed about 75 ℔ each, and were spaced at intervals of about 3 ft. The Barker rail laid in Manchester in 1877 was somewhat similar to that shown in fig. 3, but a continuous cast-iron chair was used to support it.

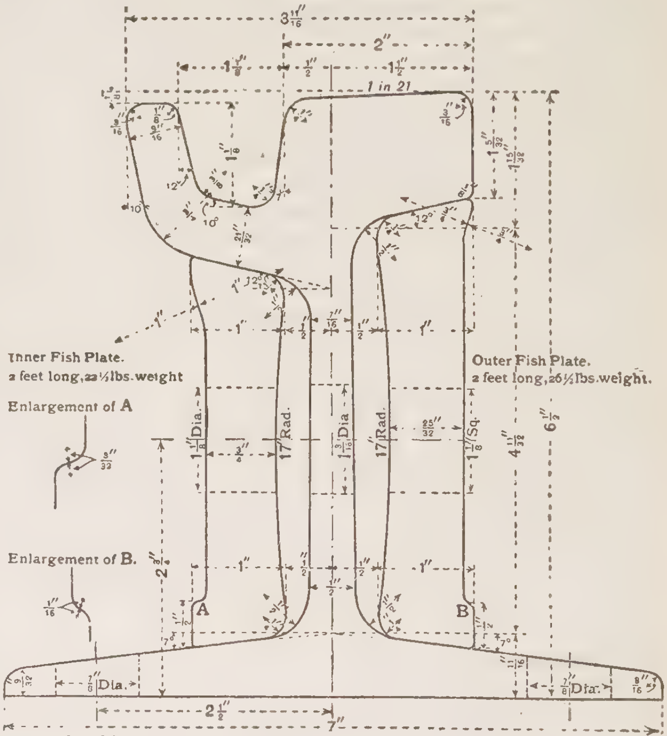
The introduction of steam traction about 1880, with its heavier axle loads and higher speeds, was a severe test of the permanent way. The flat section laid on timber sleepers and the built-up rails of the Kincaid and Barker types began to be discarded in favour of the solid girder rail rolled in one piece. The solidity and depth of this section gave it great vertical stiffness, and its introduction materially assisted in solving the problem of providing a smooth and serviceable joint.

The merits of the girder rail soon caused it to be generally adopted, and although the design has been greatly improved it remains to-day the standard form of tramway rail used throughout the world. At first difficulty was experienced in rolling the heavier sections with thin webs and wide bases, but the introduction of steel and improvements in the rolling mills overcame these troubles. The early girder rails laid about 1880 usually weighed from 70 to 80 ℔ per lineal yard, and were 6 or 6½ in. deep. The groove varied from 1 to 1⅛ in., and the tread was about 1¾ in. in width. The fish-plates were not designed to give any vertical support, and were merely used to keep the rail ends in line. The girder rails were either bedded directly on the foundation or spiked to timber sleepers which were buried in the concrete.

The form of head adopted for tramway rails in Europe has almost universally been one with the groove on one side. With this section the wheel flange forces out the dirt clear of the tread. In a few isolated cases a centre grooved rail has been used. As with railways, the adoption of many different gauges has led to much inconvenience. This want of uniformity in the gauge is in some parts of the country a great obstacle to the construction of inter-urban lines. London and the larger provincial towns adopted the standard gauge of 4 ft. 8½ in., but in many towns narrow gauges of 3 ft. or 3 ft. 6 in. were laid. Glasgow and a few other towns adopted the gauge of 4 ft. 7¾ in. with a view of making the narrow grooved rail of the tramways available for railway wagons, but without any real success.

With the introduction of electric traction the weight and speed of the cars greatly increased, and experience soon proved that only the most substantial form of permanent way was capable of withstanding the wear and tear of the traffic. The early electric lines were laid with girder rails weighing about 75 ℔ per lineal yard. These proved to be too light, and, at the present time, rails weighing from 95 to 110 ℔ per lineal yard are in general use. The large number of rail sections designed a few years ago gave considerable trouble to makers of rails. The issue in 1903 by the Engineering Standards Committee of a set of standard girder tramway rail sections was therefore generally welcomed. The sections comprise rails of five different weights. Modified sections for use on curves were also published, together with a standard form of specification. Fig. 4 shows the section of the 100 ℔. B.S. rail (No. 3).

Tramway rails are generally ordered in 45 ft. lengths. Rails 60 ft. long are sometimes used, but they are difficult to handle, especially in narrow streets. The rail joints still prove the weakest part of the track. Numerous patents have been taken out for fish-plates and sole-plates of special design, but none has proved quite satisfactory. The "Dicker" joint, in which the head of the rail on the tread side is partly cut away and the fish-plate carried up so that the wheel runs on its top edge, and the "anchor" joint, in which a short piece of inverted rail is bolted or riveted to the undersides of the abutting rails, have been largely used. The latter makes a good stiff joint, but when buried in concrete it interferes with the bedding of the rail as a whole, often causing it to work loose in the centre. Various processes have also been introduced for uniting the ends of the rails by welding. Electric welding was first tried in the United States about 1893, and has since been considerably used in that country. In this process two specially prepared fish-plates are applied, one to each side of the joint. Each fish-plate has three bosses or projections, one in the centre opposite the joint and one near each end. By passing a heavy alternating current of low voltage between the opposite bosses the fish-plates are welded to the rail. The current is obtained from the line by means of a motor-generator and static transformer. Another process which has been used considerably in the United States, and at Coventry and Norwich in England, is the cast-welded joint. To make this joint the rail ends are enclosed in an iron mould filled with molten cast-iron, which makes a more or less perfect union with the steel rails. The



(Reproduced by permission of the Engineering Standards Committee.)

FIG. 4.—British Standard Tramway Rail, No. 3.

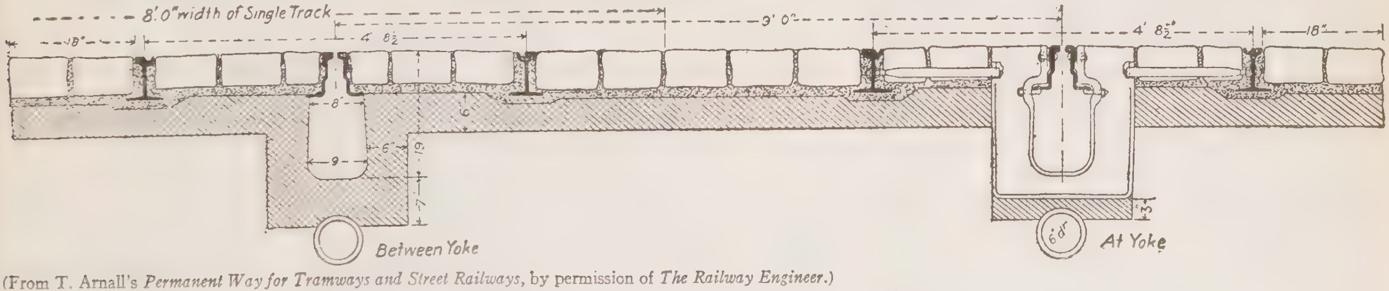
great drawback to these two processes is the costly and cumbersome apparatus required. The "thermit" process (see WELDING) does not require any large initial outlay, and has been applied to welding the joints on both old and new tracks. The cost of making each joint is about £1.

Points and crossings are used on a tramway to deflect a car from one road to another. In the days of horse traction no movable switch was used, the car being guided by making the horses pull the leading wheels in the required direction. With the introduction of mechanical traction a movable switch was fitted in one of the castings to act as a guide to the wheel flanges. On modern tramways the points consist of a pair of steel castings, one being a fixed or dummy point, and the other containing a movable switch. On a single track at passing places the cars in Great Britain always take the left-hand road, and a spring is fitted to hold the movable switch to lead in that direction. The bottom of the grooves at open points and crossings are raised so that the car wheel runs on its flange over the break in the tread of the rail. Double switch points in which the two tongues are connected are sometimes laid. In recent years the size and weight of the castings and the length of the movable switches have considerably increased. Manganese steel is very generally used for the tongues and sometimes for the whole casting. Ordinary cast steel with manganese steel inset pieces at the parts which wear most quickly are a feature of the later designs. At some junctions the points are moved by electric power.

While the form of concrete foundation remains the same as that laid at Liverpool in 1868, far greater care is now given to the bedding of the rails. After the excavation has been completed the rails are set up in the trench and carefully packed up to the finished level. The concrete is then laid and packed under the rail, generally for a depth of 6 in. When the surface is to be paved with stone setts bedded on sand the concrete may be left rough, but where wood is to be laid the surface must be floated with fine mortar and finished to a smooth surface. Both hard and soft wood blocks are used for paving. Wood should not be used unless the whole width of the carriage-way is paved. Many different qualities of stone setts have been laid. Hard granite such as that supplied from the quarries near Aberdeen is the most suitable.

In urban districts the road authorities almost always require the tramway surface, *i.e.* between the rails and for 18 in. on either side, to be paved. In country districts many tramways have been laid with only a sett edging along each rail, the remainder of the surface being completed with either ordinary or tarred macadam. This construction, however, is only suitable on roads with very light traffic. After a tramway is laid, especially in a macadamized road, the heavy vehicular traffic use the track, and the wear is very much greater than on other parts of the carriage-way.

Steam and Cable Tramways.—Horse traction, especially in hilly districts, has many limitations, and early in the history of tramways experiments were made both with steam cars and cable haulage. Although experimental steam cars were tried in England in 1873 the first tramways which regularly employed steam engines were French, though the engines were supplied by an English firm. About 1880 many improvements were made in the design of the engines employed, and this form of traction was adopted on several tramways in England. Beyond requiring a better constructed track it does not necessitate any modifications in the general design of the permanent way. The first cable tramway was constructed at San Francisco in 1873. In England the first cable system was a short length at Highgate in 1884. Cable tramways were also laid down at Edinburgh, Birmingham, Matlock and Brixton (London). Cable traction, with the expensive track construction it necessitates, and the limited speed of haulage, belongs to the past. Only gradients too severe to be worked by ordinary adhesion will in the future justify its use. The construction of the conduit or tube in which the cable runs adds very considerably to the cost of the permanent way. On the Edinburgh system the conduit was formed of concrete, with cast-iron yokes spaced at intervals of 4 ft. to support the slot beams. The conduit was 19 in. deep by 9 in. wide. The slot was $\frac{3}{4}$ in. wide. The running rails were of the ordinary girder type bedded in concrete. Fig. 5 shows a cross-section of the track at a yoke. This form of construction is very similar to that employed in forming the tube on a modern electric conduit tramway. At Edinburgh and other places where a shallow conduit is used the supporting pulleys are placed in pits sunk below the general level of the tube. On the Birmingham cable tramway, where the tube is 2 ft. 8 in. deep, pits are not required at the supporting pulleys. This reduces the difficulty of draining the conduit. The yokes in this case are made of steel T-bars spaced 4 ft. apart.



(From T. Arnall's *Permanent Way for Tramways and Street Railways*, by permission of *The Railway Engineer.*)

FIG. 5.—Section Edinburgh Cable Conduit.

Electric Tramways.—Electricity is now the standard motive power for tramway service, and is applied in three main ways: (1) the overhead or trolley system; (2) the open conduit system; and (3) the surface contact or closed conduit system. (See also TRACTION.)

Overhead Trolley.

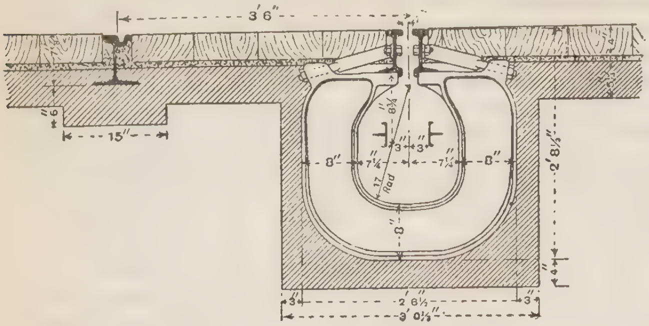
On a tramway worked on the overhead principle current is supplied to the cars by two overhead conductors or wires. Round copper wires varying in size from 0 (0·324 in.) to 0000 (0·40 in.) S.W. gauge are generally used. With feeding points at every mile, the 0 wire is electrically sufficient on most roads, but from a mechanical point of view 00 wire is the smallest it is desirable to erect. Wires having figure 8 or elliptical grooved sections have been employed, and have the advantage of allowing the use of a mechanical clip ear which is clear of the trolley wheel. The ordinary round wire is usually supported by a gun-metal or gun-metal and iron ear grooved to fit the wire, which is soldered or sweated to it. In Great Britain the overhead conductors are required by the board of trade to be divided into half-mile sections. The wires on adjoining sections are connected by section insulators. These consist of gun-metal castings in two parts, insulated from each other. The line wires are clamped to the metal ends. The continuity of the path of the trolley wheel is provided for on the underside of the insulator by fixing a hardwood strip between the ends or by the ribs on the castings with air gaps.

The trolley wires are supported by ears either from span wires which extend across the roadway between two poles or from bracket arms carried on a pole on one side only of the road. The span wires and short bracket suspension wires are also insulated, so that there is double insulation between the conductor and the pole. The overhead conductors are usually hung about 21 ft. above the rails. (For catenary suspensions see TRACTION.) The poles which carry the span wires and the bracket arms are placed not more than 40 yds. apart and are generally placed at the edge of the kerb. They are built up of three sections of steel tubes, one overlapping the other; the joints are shrunk together while hot. A cast-iron case is used to improve the appearance of the pole, and cast-iron collars hide the joints. Standard specifications for poles have been issued by the Engineering Standards Committee.

When permission can be obtained the span wires are sometimes supported by rosettes attached to the walls of the houses on either side of the street. This method has been largely adopted in Germany, and by dispensing with the poles in the roadway it improves the appearance of the street.

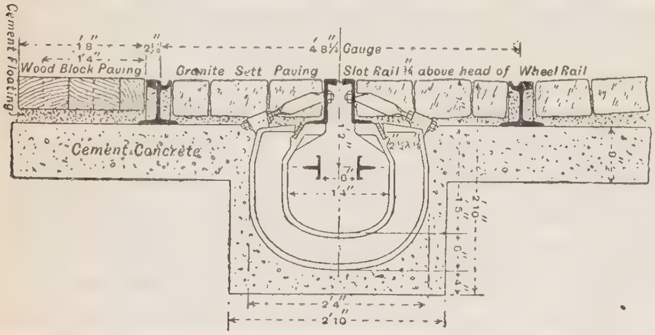
Open Conduit.

Overhead conductors will not be tolerated in some cities, and to avoid the use of them open conduit and surface contact tramways have been introduced. In the conduit system the conductors are carried in a conduit or tube beneath the surface of the track, and the electric current is picked up by means of a plough carried by the cars. Modern conduit tramways are divided into two kinds: those which have the conduit at the side under one running rail, and those which have it under the centre of the track. The only example of the former to be found in England is at Bournemouth, but it is used at Vienna, Brussels, Paris, Berlin and Budapest. Centre conduit construction has been adopted in London, Nice, Bordeaux, New York, Washington, &c. The advantages of the side slot system are the reduction in the amount of metal in the roadway, less breaking up of the pavement, and slightly cheaper cost of construction. Its chief disadvantage is the difficulty it introduces in connexion with points and crossings. It is also objected that if the side slot is made the same width as the rail groove it becomes a danger to narrow-tired vehicles. The difficulty in regard to points and crossings is overcome by bringing the slot into the centre of the track at junctions and turn-outs. Fig. 6 shows a section of the side slot track laid at Bournemouth. The width of the slot is 1 in., which is the least width possible. In London ¾ in. was first adopted as the width of the centre slot, but later this was increased to 1 in., so that in this particular there is not much to choose between the two systems. Fig. 7 shows a section of the London County Council track at one of the cast-iron yokes. These are spaced 3 ft. 9 in. apart, every second yoke being now continued out under the running rail which is fastened to it. There is no doubt that the extended yoke greatly increases the strength of the track. The slot beams weigh 60 ℔ per yard. The conductor bars are of mild steel, T-shaped. They weigh 22 ℔ per yard and are supported on insulators at intervals of 15 ft. Each insulator is covered over in the roadway with a cast-iron frame and movable lid. There are two conductor rails—positive and negative—so that the whole circuit is insulated from earth. The conduit or tube is formed of cement concrete. The track between the rails is paved with granite setts in order that there may be no trouble with wood blocks swelling and closing the slot.



(From *The Tramway and Railway World.*)

FIG. 6.—Section of Side Conduit.



(From *The Tramway and Railway World.*)

FIG. 7.—Section of Centre Conduit (London County Council type).

American practice in conduit construction has become fairly well standardized (fig. 8). The conduit is oval in shape, its major axis being vertical, and is formed of concrete. An excavation about 30 in. deep and 5 ft. wide is made, and in this are laid cast-iron yokes weighing 410 ℔ each, and spaced 5 ft. apart centre to centre. Every third yoke contains bearings for a hand-hole plate, and weighs about 600 ℔. These yokes surround the conduit proper and are provided with extensions on each side for the attachment of the rails. In the older construction the rails were laid directly upon the iron of the yokes, steel wedges and shims being used under them for the final alinement of the rails. In the more recent construction, on the Third Avenue railroad in New York City, a wooden stringer, 6 in. by 4¾ in. in size, is laid along from yoke to yoke on the bearing surfaces, and the rail laid upon this. The rail is held down on the yoke by means of two bolts at each bearing-point, these bolts having turned-up heads which embrace the foot of the rail. The slot rails, or Z bars forming the two jaws of the ⅝ in. slot, are bolted to the upper part of the yokes. The weights of the metal used per linear yard of construction of this type are: castiron, including both types of yokes, 500 ℔; track rails, 214 ℔; slot rails, 116 ℔; conductor rails, 42 ℔; and conduit plate, 16 ℔—nearly 400 ℔ of rolled steel per yard. After the rails, which are of a high girder type, are fastened in place thin plates of sheet steel are bent into the oval holes in the yokes extending from yoke to yoke, and form the inner surface of the completed conduit. Around this is carefully laid a shell, 4 in. thick, of Portland cement concrete. The yokes are furnished with lugs which serve to retain, temporarily, wooden boards forming a mould in which the concrete is rammed. Sectional wooden shapes serve to hold the thin steel lining in place while the concrete is hardening. Around this concrete tube, and on each side of it, to form a basis for the street pavement, is laid a mass of coarser concrete. In each side of the special yokes is placed an insulator of porcelain, protected by a cast-iron shell and carrying a support for the conductor rail, which is of T-shaped steel, weighing 21 ℔ per yard. It is in 30 ft. lengths and is supported every 15 ft. by the insulators, the ends of separate rails being matched at and held by an insulator support. This rail is, of course, bonded with copper bonds. Two such conductor rails are installed in the conduit 6 in. apart, the flat faces corresponding to the upper surface of the T being placed towards each other. Elaborate provisions for drainage and inspection are also provided, depending upon the situation of the tracks and nature of the street. The current is fed to the conductor rails by heavy copper conductors of from 500,000 to 1,000,000 circular mils cross-section, insulated and lead-covered, laid in ducts alongside of or between the two tracks of double-track systems. Connexion is

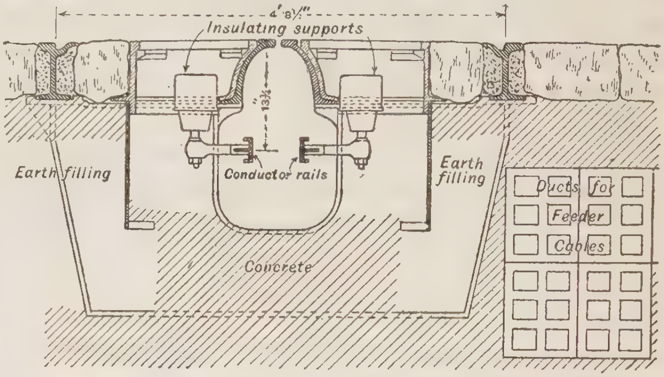
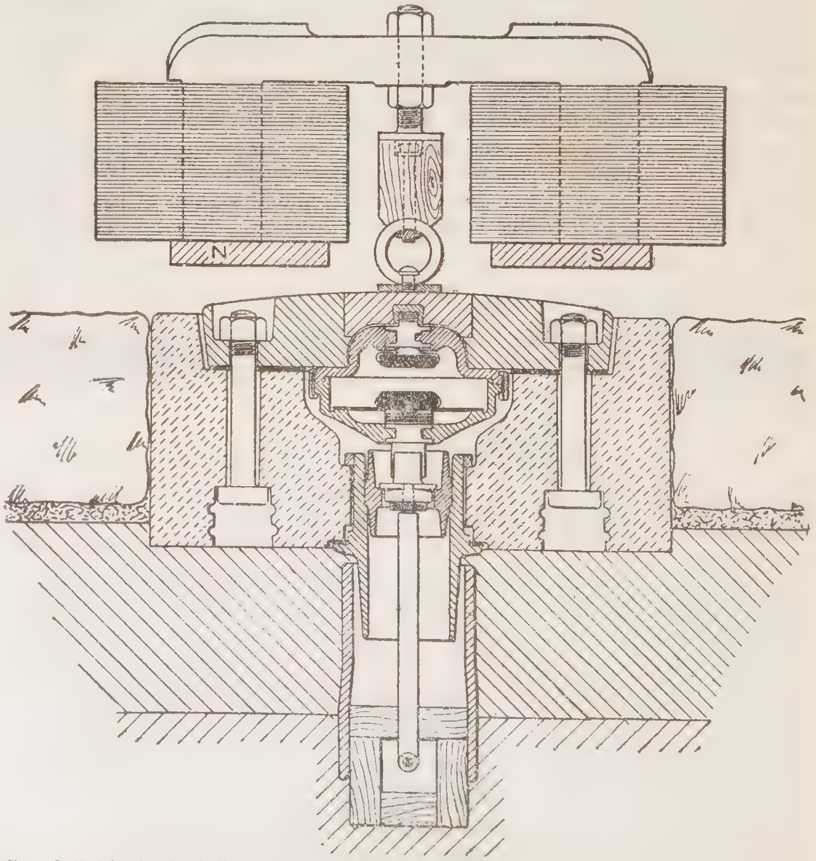


FIG. 8.—Cross-section of Open Conduit Road (American type).



(From J. H. Rider's *Electric Traction*, by permission of Whittaker & Co.)

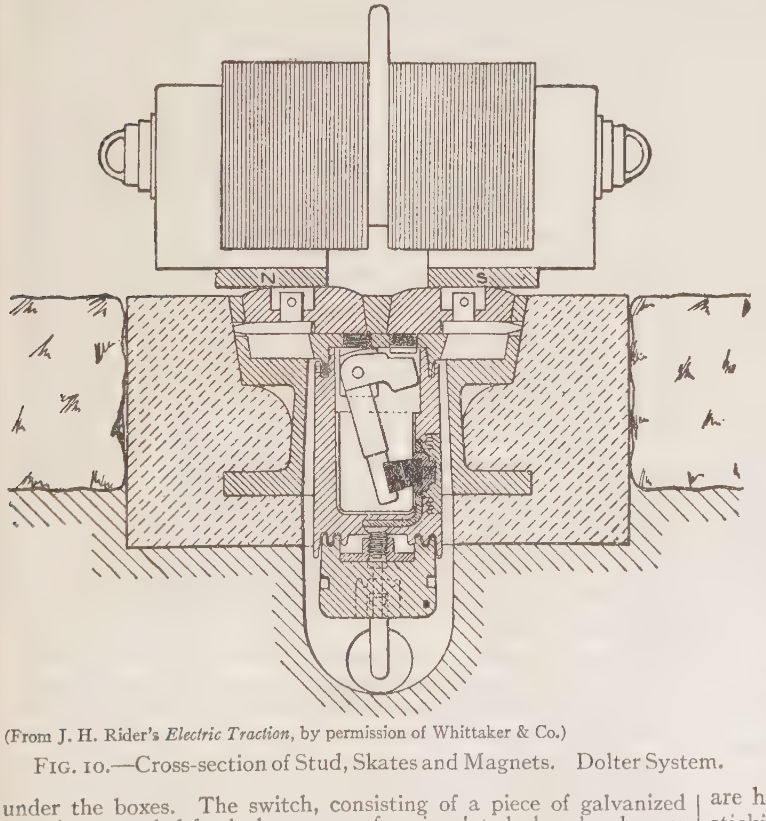
FIG. 9.—Cross-section of Stud, Skates and Magnets. Lorain System.

made between the cars and the conductor rails by means of a "plough," carried by a hard steel plate, which is channelled to receive the insulated wires leading up to the controller on the car. The plough carries two cast-iron rubbing-blocks, which are pressed outward into contact with the conductor rails by springs, the two being, of course, very carefully insulated from each other and from the other metal-work of the plough. It has been found expedient in practice to reverse the polarity of the current used on these conduit roads from time to time, since electrolytic deposits, formed by small leakage currents in the vicinity of insulators, &c., are thus dissolved before they become a source of trouble.

Great difficulty is experienced with all conduits in keeping them clean and free from water. On the London tramways a sump has been formed at intervals of about 60 yds. into which the conduit drains. These sumps are connected with the sewers. The principal objection to the conduit system is its heavy first cost. The tracks alone in London are estimated to cost about £13,000 per mile of single track against about £8000 per mile for a track to be worked on the overhead system.

Surface Contact.

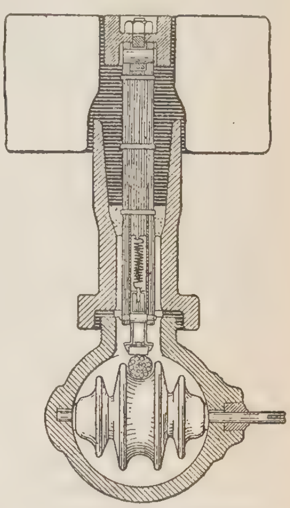
This high cost of construction has caused considerable attention to be directed by inventors to devising surface contact systems. Many of the designs which have been patented appear excellent in theory, but have been found untrustworthy under working conditions. Among those worked commercially in England are (1) the Lorain system in operation at Wolverhampton; (2) the Dolter system at Torquay, Hastings and Mexborough, and (3) the G.B. system at Lincoln. Of all these systems current is supplied from iron studs laid in the roadway between the rails of the track to a skate carried on the car. The studs are placed 10 ft. to 15 ft. apart and contain a movable switch or contact, which is operated by the influence of a magnet carried under the car. In the Lorain system (fig. 9) connexion is made to the source of power through two carbon contact pieces. The lower carbon contact is carried on a soft iron strip which is connected to the supply cable by means of a flat copper ribbon spring. When the magnet passes from over a stud the iron armature and the lower carbon contact, which has been magnetically attracted, falls vertically, assisted by the copper ribbon spring. In the Dolter system the contact box (fig. 10) contains a bell crank lever with a carbon contact at its lower end. The upper arm of this lever is of soft iron, which is attracted by the magnet carried under the car. When the lever is moved the carbon block at the lower end is brought into contact with the fixed carbon contact in the side of the box which is permanently connected to the supply cable. In the G.B. contact box (fig. 11) contact is made direct to a bare feeder cable carried in a pipe under the boxes. The switch, consisting of a piece of galvanized iron, is suspended freely by means of an insulated phosphor bronze spring. At the lower end of this moving piece a carbon contact piece is attached. When the magnet carried by the car passes over a stud, the moving piece is magnetically attracted to the cable against the pull of the spring. In the Lorain and the Dolter systems the studs are raised slightly above the road surface—which is an objectionable feature—and the current is collected by a skate, suspended under the car, touching the projecting surface. In the G.B. system the stud heads are kept flush with the pavement, and the collector consists of iron links spring suspended. As the collector passes over the box the links are magnetically attracted, and move down, making contact with the stud.



(From J. H. Rider's *Electric Traction*, by permission of Whittaker & Co.)

Fig. 10.—Cross-section of Stud, Skates and Magnets. Dolter System.

In all surface contact systems, short circuiting devices are provided to detect any studs which may remain live after the skate has passed, either by blowing a fuse or by ringing a bell, but it is questionable how much reliance can be placed on their efficiency under all conditions. The collecting skate and magnets carried by the cars on a surface contact tramway are of considerable weight, and the skate requires renewal at frequent intervals.



(From *The Tramway and Railway World.*)

Fig. 11.—G. B. Stud.

An efficient system of street traction may be defined as one which, while giving a reasonable return on the capital invested, provides the public, without disfigurement of the highway, with a quick and frequent service of comfortable cars.

Advantages of Different Systems.

When tramways were first introduced the surface of the streets was often exceedingly rough. The tramcar running on rails was therefore a great advance in comfort of travelling on the old stage carriage. Horse traction, however, limited the weight of the car and the speed of travelling. The substitution of steam traction for horse traction was a great advance. Higher speeds and quicker acceleration were obtained, and larger and more comfortable cars could be worked. The power, however, was limited, and the locomotives, built as light as possible, were expensive in first cost and maintenance. Cable traction, owing to the heavy first cost of the track, requires a great density of traffic to make it pay. The speed is limited both up and down hill to that of the cable. It has the advantage that it can be safely worked on severe gradients, and once installed the working costs are low.

Electric traction by accumulator cars was tried in Birmingham in 1890 and abandoned after some years of unsatisfactory working. The cars were costly to work and maintain. The storage batteries had to be recharged at frequent intervals, and they rapidly dropped in capacity. There was little reserve of power, and the cells added considerably to the weight of the car.

Those forms of electric traction in which the power is supplied to the cars from an outside source have many advantages. Only the weight of the motors has to be carried. These are efficient over a wide range of speed, accelerate quickly, have a large reserve of power and are clean and silent. The electric conduit and surface contact tramways do not require any disfiguring overhead wires. They have, however, troubles of their own. The construction of the electric conduit is so expensive that its choice must necessarily be limited to large cities. The conductors are easily short-circuited. Gaps in the conductors must be left at the points and crossings. The cost of keeping the conduit clean is considerable. It has the advantage, however, of having both the positive and negative conductors insulated. Surface contact systems require studs or contact boxes to be placed in the road. In most systems these project above the surface of the street. The switches which they contain are hidden away from inspection. A failure of insulation or the sticking of a switch may allow a live stud to be unprotected in the roadway. The weight of the car and consequently the power required to move it is considerably increased by the skate, magnet and battery which have to be carried.

For simplicity of working the overhead system easily comes first. The conductors are out of reach, they can easily be doubly or trebly insulated, and with their insulators are open to inspection. The poles and wiring can be erected without closing or obstructing the street. The supply of power is not interfered with by heavy rain, snow or other climatic causes. Duplicate conductors are used, and repairs can be rapidly executed. The only objection is that of unsightliness, which, however, can be greatly reduced by good design.

The cost of establishing tramways to be worked on the various systems of traction mentioned above has varied considerably. The locality and the amount of street widening have considerable influence on the total. Horse tramways in the larger cities cost in the past about £15,000[1] per track mile complete with horses, cars, &c., tramways worked by steam power about £18,000[2] per track mile including locomotives and cars. The Edinburgh Corporation cable tramways cost £23,316[3] to establish complete with power-house, cars, &c. Of this figure, the cost of the permanent way construction amounted to £14,431.[3] The construction and equipment of the South London conduit tramways cost £25,106[3] per mile of single line; the permanent way, its electrical equipment and the distributing cables cost £15,895[3] per track mile. More recent estimates appear to show that the average cost in London will be between £26,000 and £30,000 per track mile. In Glasgow the total cost of constructing and equipping the electric tramways on the overhead system, including the provision of a power station, cost £19,787[4] per track mile, and at Leeds £13,206. At Manchester, where current is provided by the lighting station, the complete cost works out at £12,498.[5] The cost of the permanent way, cables and electrical equipment per track mile varies from £6575 at Manchester to £9959 at Glasgow. The cost of laying down a surface contact electric tramway is about slightly more than that of constructing and equipping a track with overhead conductors. The cost of the permanent way and its electrical equipment together with the cables at Wolverhampton on the Lorain surface contact principle amounted to £8601 per track mile.

The working expenses of the various systems of traction are largely affected by the age of the tramway, the locality, and, in the case of electric lines, by the cost at which power is obtained. In Birmingham in 1890–1891[6] horse traction cost 9·79d. per car mile, steam traction 10·99d. per mile, cable traction 6·33d. and electric accumulator traction 9·90d. per car mile. Modern electric trolley lines generating their own current work at from 5d. to 6d. per car mile. Where current is purchased the costs vary from 6d. to 7½d. per car mile. The working costs of the London County Council conduit tramways worked on purchased current amounted to 8·02d. per car mile in the year 1905–1906.

Tramway Cars.—The modern tramway car is made up of two distinct parts, the body and the truck. The present type of double ended car with a platform at each end was first used on the American street railways about 1860. The car body was supported directly on axle-boxes through helical steel or rubber springs.

When the early pioneers were experimenting in the United States with electric traction they attached the motor to the car body. This proved unsatisfactory, and resulted in the development of the modern truck. The truck may be described as a carriage or frame supported on the axle-boxes by springs and supporting by another set of springs the car body. The truck carries the motors and in itself resists all the strains of the driving mechanism.

Modern car bodies are mounted either on a single four-wheeled truck, with a fixed or rigid wheel-base, or on two four-wheeled bogies or swivelling trucks. Four-wheeled radial trucks have been tried on several tramways, but they have not proved satisfactory. The wheel-base of the fixed or rigid truck usually varies from 6 to 7 ft. The length of the wheel-base should be determined by the radius of the sharpest curve. To obtain steady running it should be made as long as possible. Two motors are generally fitted on a car.

Of the bogie or swivelling trucks the greater number now in use are of the "maximum traction" type. This truck is used to obtain the greatest tractive effect from two motors when fitted to a car supported on eight wheels. Each bogie is a small four-wheeled truck in itself. It has one pair of its wheels driven by the single motor and of the standard size—about 30 in.—while the guiding or "pony" wheels are of small diameter. The weight of the car body is supported eccentrically on the truck, so that about 70% to 80% is available for adhesion under the driving-wheels. While this form of truck has many merits, it also has many disadvantages. The small wheels easily leave the rails, while the adhesion of the driving-wheels compared with a four-wheeled car is considerably reduced. Quick acceleration is difficult, and on a greasy rail much energy is lost in slipping. The use of equal-wheeled bogies with a motor on every axle gets over the difficulty of the loss of adhesion but at a greatly increased cost. The current consumption is increased, the first cost is greater, and there are four instead of two motors to be maintained. Steel-tired wheels have largely replaced the cast-iron chilled wheel for many years used on tramcars.

While the various forms of trucks are common both to British and American practice, car body construction differs in many points. The single-deck car is universal outside the United Kingdom, where, although many single-deck cars are worked, the greater number are of the double-deck type. It is claimed that with small single-deck cars a quicker service can be maintained, as they are easier to load and unload and generally handier. On the other hand, the double-deck car seats more than double the number of passengers, requires the same number of men to work it, and takes but little more power to drive it. Experience has proved that the 58-passenger—28 inside and 30 outside—double-deck car mounted on a four-wheeled truck is the type of rolling stock most suitable for British conditions. For heavy rush traffic or long distance travel the larger bogie cars are convenient. They are, however, slow to start and stop, and a 72-passenger car is too much for one conductor to work efficiently. Another difference is due to the width of the cars. In the United States car bodies vary from 8 ft. to 9 ft. 6 in. in width. In Great Britain the width is limited by the Tramways Act of 1870 to 11 in. beyond the outer edge of the wheels, which, on the standard gauge, allows the maximum width to be 6 ft. 10 in. This limit has governed the arrangement of the seating in the cars. Inside, the ordinary side seat is almost invariably adopted. Cross seats have been used, but they leave a very narrow gangway—a great disadvantage at times of overcrowding. On the top deck, where the available width is greater and standing is never permitted, cross seats are universally fitted.

On the old horse cars a straight type of stairway was used. The reserved stairway, brought in about 1902, gave greater protection from accident and increased the seating accommodation on the top deck. It had, however, two great disadvantages. The stairway shut out the motorman's view on the left-hand side, and the stream of passengers descending met the stream of passengers leaving the inside of the car, causing delay. The reversed type of stairway has now been abandoned and the straight type, well protected by railings, is usually fitted.

In addition to the ordinary single-deck and double-deck types of cars which are in general use many other designs are to be found. Single-deck open cars of the "toast-rack" type with transverse seats are popular on many holiday lines. They have the advantage of being quickly filled and emptied. Centre vestibule cars are now seldom seen. It is inconvenient not to have the conductor at the back of the car where he can look out for passengers, and, if necessary, "nurse" the trolley. There is also danger of a passenger being struck by the axle-boxes of the rear bogie truck when leaving the car. The Californian type of car body, with the central part closed in and one or two double-sided transverse seats at each end, has been used on routes where low bridges do not allow of the use of double-deck cars. The carrying capacity of this type in wet weather when the exposed seats cannot be used is small. A demi or one-man car has been worked in some towns. It saves the wages of one man, but the average speed of the service is reduced. Top deck covers have in recent years been largely fitted. Their use practically doubles the covered seating capacity of the car and provides accommodation for smokers, a difficult matter on a single-deck car.

In Great Britain the board of trade requires all cars to be fitted with an efficient form of lifeguard. The gate and tray pattern, in which anything striking the vertical gate drops the tray, is that principally employed. In addition to the ordinary hand-brake which operates shoes on all the wheels, and the electric reverse switch, a large number of cars are fitted with some form of electric brake (see TRACTION).

Legislative Conditions in Great Britain.—The first tramways constructed in Great Britain were promoted by private enterprise under powers conferred by private acts of parliament. Considerable opposition was offered to pioneer schemes, but after a few private acts had been passed, parliament, in 1870, passed a general act providing for the laying of rails upon roads, and specifying the procedure for tramway promotion and the main relations between tramway undertakers and local authorities. The Tramways Act 1870, which is still in force, enabled promoters to apply to the board of trade for a provisional order which, when confirmed by parliament, possesses all the force of an act of parliament. The procedure is therefore simpler and cheaper than private bill procedure. Under this act promoters are obliged to obtain, as a condition precedent to making application for a provisional order, the consent of local authorities in whose areas the proposed tramways are to run. This provision is referred to as the "veto clause." Where a line is laid in two or more districts and two-thirds of the line are in districts where the local authorities do consent, the board of trade may dispense with the consent of the remainder. When procedure by private bill is adopted a similar "veto" provision is made by Standing Order 22, which requires the consent of the local authority (and of the road authority where there is one distinct from the local authority) before the bill goes to first reading; in this case also the consent of authorities for two-thirds of a continuous line are deemed sufficient. The powers granted under the Tramways Act are in perpetuity, subject to the right of the local authorities (under the 43rd section) to purchase, at the end of twenty-one years or each septennial period following (or within three months after the promoters have discontinued working the tramway or have become insolvent), so much of the undertaking as lies within their areas, on paying the then value of the properties suitable to and used for the undertaking, exclusive of any allowance for past or future profits or compensation for compulsory sale or any other consideration whatsoever, such value to be determined by an arbitrator appointed by the board of trade. Another part of the arrangement specified between the local authorities and the undertakers is that the undertakers shall pave the tramway track between the outer rails and for 18 in. beyond each outer rail. Mr G. F. Shaw-Lefevre (afterwards Lord Eversley), when introducing the bill in 1870, said that it "would give powers to the local authorities to construct tramways, but not, of course, to work them." The idea apparently was that local authorities should retain full control of the roads by constructing the tramways, and would make arrangements with lessees on terms which would secure reasonable fares and other conditions for the benefit of the travelling public. It was not until 1896 that parliament permitted local authorities to work tramways as well as own them, except in cases where lessees could not be obtained. The precedents for municipal working were created by private acts at a time when public opinion was in favour of that policy; and after the first few bills for municipal tramway working had been successful, other municipalities found practically no difficulty in obtaining the desired powers, although parliament had never adequately discussed, as a specific reform, the departure from the principle laid down by Mr Shaw-Lefevre in 1870. The conditions in fact proved more favourable to municipal than company promoters, since the local authorities, as soon as they aspired to work tramways as well as own them, used the power of veto against the proposals of companies.

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[1] and [2] See *Tramways: Their Construction and Working*, by D. K. Clarke.

[3] *Proc. Inst. Civ. Eng.* 156, p. 179.

[4] Tramway Accounts, year ended March 31, 1906.

[5] Ibid., year ended March 31, 1905.

[6] See *Tramways: Their Construction and Working*, by D. K. Clarke.

The situation entered a more acute phase when electric traction was introduced on tramways. The Tramways Act provides, by section 34, that all carriages shall be moved by the power prescribed by the special acts or provisional order, and where no such power is prescribed, by animal power only. The mechanical power used must be by consent of the board of trade, and subject to board of trade regulations. Owing to the capital expenditure involved in electric traction, undertakings nearing the end of their twenty-one years' tenure found that it was not commercially feasible to carry out the change without an extension of tenure. The local authorities were reluctant to grant that extension, and they were also reluctant to give permission for the promotion of new lines.

The difficulties of the altered conditions created by the advent of electric traction were met to some extent by the Light Railways Act 1896. This act contains no definition of a light railway, and it has been used largely for electric tramway purposes. Lord Morley, when piloting the bill through the Lords, said that "light railway" includes "not merely all tramways but any railway which the board of trade thinks may justly be brought within the scope." It certainly includes tramways in towns, and it might include large trunk lines throughout the country." Accordingly it has been used for the construction of many miles of tram lines on the public streets and also in some cases for extensions where the track leaves the public road, and is laid on land purchased for the purpose. These tracks are generally constructed with grooved girder rails, having a wide groove and a high check, so that the shallow flanged tramcar wheels can run on them with safety at high speeds. The rails are laid on cross sleepers and ballasted in the ordinary railway fashion. Fencing is erected, but level-crossing gates are often omitted, and cattle guards only are used to prevent animals straying on the track. These sleeper tracks on private ground are cheap to maintain if well constructed in the first instance. Speeds of 20 to 25 m. an hour have been sanctioned on electric lines of this character, worked by ordinary tramway rolling stock. There is no purchase clause in the Light Railways Act, but arrangements for purchase of the undertaking were usually made with the local authorities and the terms embodied in the order. The act contains no veto clause, section 7 stating that the commissioners are to "satisfy themselves that all reasonable steps have been taken for consulting the local authorities, including road authorities, through whose areas the railway is intended to pass, and the owners and occupiers of the land it is proposed to take." The Light Railway Commissioners, however, have interpreted the act in the spirit of the Tramways Act, so that for all practical purposes the veto remains. The new act differed from the Tramways Act in providing for the compulsory purchase of land under the Lands Clauses Acts—the Tramways Act expressly stating that the promoters should not be empowered to acquire land otherwise than by agreement. The board of trade has held that the act does not apply to tramways wholly within one borough. County, borough and district councils as well as individuals and companies are empowered to promote and work light railways.

The passing of the act gave a great impetus to the construction of tramways worked by electric traction. But owing to the practical retention of the veto, there was not so much progress as was anticipated. Another cause of restriction was section 9, sub-section 3, which provides that if the board of trade considers that "by reason of the magnitude of the proposed undertaking, or of the effect thereof on the undertaking of any railway company existing at the time, or for any other special reason relating to the undertaking, the proposals of the promoters ought to be submitted to parliament," they should not confirm the order. In many cases railway companies, by pleading the competitive influence of proposed tramways promoted under the Light Railways Act, were able to force the promoters to apply to parliament or to drop the scheme. The latter alternative was frequently adopted, owing to the costs of parliamentary procedure being too heavy for the undertaking.

Commercial Results.—Interest in the commercial results of tramway enterprise is practically limited to electric traction, since other forms of traction have been almost entirely superseded owing to their economical inferiority. The main advantages of electric traction over horse traction lie in the higher speed, greater carrying capacity of cars, and the saving in power over a system in which only a small proportion of the power source is available at one time. Steam, compressed air and gas traction possess the disadvantages that each car has to carry the dead weight of power-producing machinery capable of maintaining speed up to the maximum grade. Cable traction has the disadvantages that the speed of the cars is limited by the speed of the cable, that the range and complexity of the system are restricted, and that construction is expensive. The electric system, in which power is generated at a central source and distributed to cars which take power in proportion to the work being done, possesses a higher degree of flexibility, convenience and economy than any other system. Electric tramways in Great Britain are mostly equipped on the overhead trolley system, though the conduit and the surface contact systems have been installed in a few instances. Roughly the capital expenditure required for the three systems is in proportion of 2, 1½ and 1, and both the conduit and the surface contact systems are more costly to maintain than the overhead system. A fourth system of electric traction, in which the cars are fitted with storage batteries charged at intervals, has been tried frequently and as frequently abandoned. The great weight of the batteries, the serious initial cost and high rate of deterioration prevented the attainment of financial success.

The earliest development of electric road traction on a large scale took place in America and on the continent of Europe, and the estimates for British tramways were therefore prepared from American and continental results. The following figures summarize a number of estimates made at this period; the first table gives the figures for capital cost, and the second for operating expenses. The receipts were estimated at 10d per car mile.

	Capital cost per mile of single track.
	£
Permanent way, including bonding	5050
Overhead equipment	750
Feeder cables	400
Cars at £700 each	2100
Car sheds, sundries and contingencies	1200
Total	£9500

Operating expenses per car mile.

Electrical energy	1·50d.
Wages of drivers and conductors	1·10
Car shed expenses, wages and stores	0·55
General expenses	0·90
Repairs and maintenance	1·25
Total	5·30d.

The estimates gave reason to expect that electric traction would mean cheaper fares and more frequent services at a higher speed, resulting in a considerable increase in traffic receipts per mile and a substantial reduction of working expenses. The result of pioneer undertakings in South Staffordshire, Bristol and Coventry supported this expectation. Later experience, however, showed that the estimates were too optimistic. Taking the actual figures realized for the undertakings included in the above tables, the capital expenditure per mile of single track was £12,000 and the working expenses per car mile 6·3d. The expectations as to gross revenue have been generally realized, but the increase in capital expenditure and working expenses over the estimates is typical of electric tramways in Great Britain. In the matter of wear and tear the estimates have also been too low. The reasons for the larger capital expenditure are (1) superior track construction, (2) more elaborate overhead equipment, (3) use of larger cars, (4) higher cost of road paving and other improvements imposed upon tramway undertakings.

According to the official returns of tramways and light railways for the year 1905–1906, there were 312 tramway undertakings in the United Kingdom, and 175 of these belonged to local authorities. Out of the total of 1491 m. of line owned by local authorities, 1276 m. are worked by these authorities themselves, and the remaining 215 m. by leasing companies. Local authorities working as well as owning their tramways made a net profit of £2,529,752, applying £663,336 to the reduction of tramway debt and £205,981 to the relief of rates, while carrying £623,617 to reserve and renewal funds. The following table summarizes the amounts expended by local authorities on electric traction:—

Year.	Municipalities.	£
1900	11	1,169,429
1901	18	2,748,873
1902	47	10,519,543
1903	61	14,644,126
1904	92	21,295,771
1905	115	27,876,320
1906	131	31,147,824
1907	131	35,965,920

The corresponding table for electric traction companies (including electric railways), detailing the amounts and proportions of ordinary preference and loan and debenture capital, is as follows:—

Year.	Number of undertakings.	Ordinary capital.	Percent. to total.	Preference capital.	Percent. to total.	Loan and Debenture capital.	Percent. to total.	Total.
		£		£		£		£
1896	17	5,041,375	83	412,776	7	630,521	10	6,084,672
1897	30	6,584,147	88	124,850	2	727,176	10	7,436,173
1898–1899	51	9,793,234	68	1,640,780	11	2,972,126	21	14,406,140
1899–1900	66	11,770,777	60	3,834,761	20	4,033,992	20	19,639,530
1900–1901	75	14,558,076	55	5,904,998	23	5,686,785	22	26,149,859
1901–1902	125	19,748,965	50	9,748,891	24	10,024,327	26	39,522,183
1903	126	21,600,056	49	11,170,319	25	11,296,714	26	44,067,089
1904	156	33,491,604	54	13,219,487	22	14,895,418	24	61,606,509
1905	159	36,949,069	47	22,853,948	29	19,410,384	24	79,213,401
1906	170	38,130,981	41	25,206,988	27	29,522,581	32	92,860,550
1907	173	53,034,778	45	30,642,266	26	34,372,411	29	118,049,455

The financial results achieved by electric traction companies are summarized in the next table:—

Year.	Number of companies.	Aggregate capital.	Average ordinary capital.	Average preference capital.	Average loan and debenture capital.	Total average.
		£	%	%	%	%
1899–1900	24	9,056,332	3·87	5·56	4·64	4·37
1900–1901	37	15,021,137	4·27	5·53	4·57	4·65
1901–1902	62	28,322,117	4·07	4·44	4·53	4·29
1903	64	35,479,296	4·31	5·11	4·47	4·57
1904	77	48,789,525	4·13	4·81	4·53	4·41
1905	90	61,273,986	3·79	4·92	4·39	4·33
1906	117	77,202,373	3·47	4·81	4·18	4·13
1907	118	99,315,028	2·87	4·25	4·38	3·78 [1]

The total expenditure on tramways and light railways (omitting railways—main, branch and suburban) was £15,195,993 in 1896 and £58,177,832 in 1906.

One effect of the increased cost of expenditure per mile of track is to discourage extensions of rural and inter-urban lines where the traffic is not heavy. Proposals have been made to adopt the "railless trolley" (used in some places on the continent of Europe) for such extensions. In this system the cars run on ordinary wheels and take power from overhead trolley wires. But so far no such arrangement has been put into practice in Great Britain, and outlying districts are generally dealt with by petrol or steam motor vehicles, running as feeders to the tramways and railways. The future commercial development of tramways lies more in the economics in working than in growth of track mileage. Owing to the enormous volume of traffic a very slight alteration in one of the items of expense or revenue produces a large result in the aggregate. The addition of ½d. per car mile to revenue or a corresponding reduction in expenses would, on the 240 millions of car miles run in 1905–1906, result in a gain of about £500,000 per annum, which is equal to nearly 1% on the entire capital expenditure in respect of tramways and light railways. The tables given above show that the yield upon the capital invested in electric traction is not high. The effect of increased capital expenditure has been accentuated by reductions in fares. In 1886 the average fare per passenger was 1·61d. and in 1896 it was 1·31d., falling in 1906 as low as 1·10d. Some systems carry passengers over 2½ m. for one penny, workmen being carried twice the distance for the same sum. Halfpenny fares are represented as a boon to the working man, but they have been abandoned as a failure after several years' trial on several systems, and in Glasgow it is found that halfpenny fares contribute only 20·4% of the early morning traffic, while the penny fare contributes 72·3% of that traffic. The general manager of the Birmingham Corporation tramways reported against halfpenny fares on the basis of his experience as general manager of the London County Council tramways that all the halfpenny passengers there are carried at a loss. The adjustment of fares and stages to their proper value is a question now carefully studied by tramway managers along with many problems of economy in working. The close adjustment of the service to the fluctuations in traffic is one source of economy which is being more seriously considered. Many systems have adopted top covers to cars in order to carry more passengers during wet weather. The adoption of these covers is not popular in fine weather; it adds to the weight and wind-resistance of the cars, thus increasing current consumption, and it adds to the cost of construction and maintenance. Economy in electrical energy is, in its broader aspects, secured by purchasing current from an outside source in preference to generating it at a special station. The average cost per unit of electricity for all tramway undertakings in the United Kingdom is 1·06d., but one tramway company which purchases its energy from a large power company pays only 0·85d. per unit. In its narrower aspects economy in current may be secured by reducing waste car mileage—that is to say, eliminating the running of cars at times and places where they are not required for an adequate service. Saving may also be effected by supervision of the driving of the cars, since the difference of as much as 20% has been noted between different drivers. One tramway manager secured substantial improvement by merely marking on the trolley standards the position which the controller handle should occupy in passing each point. The limitation of stops is another source of economy, the average cost per stop on a system having been found to be 0·17 d. A slight increase in the maximum speed of tramcars would also improve the net results by reducing the proportion of standing charges (wages, &c.) to the traffic capacity of the system without making the cost of maintenance or current more than slightly greater. A 15 % increase in average speed means a saving of ¼d. per car mile. The development of parcels traffic is a source of revenue, and additional receipts can be earned by the hiring-out of cars for picnics and other special purposes. An important point is the proper selection of the size of car. A small four-wheeled car is suitable to continual traffic of comparatively small volume, but when the traffic is heavy cars of larger capacity are advisable. A serious burden on tramways is the cost of insurance against accidents, although the number of serious accidents on electric tramways is exceedingly small in proportion to the number of passengers carried, the ratio of tramway accidents of all kinds being about one accident to every 15,000 passengers.

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[1] Average reduced owing to inclusion of Metropolitan and Metropolitan District railways' capital.

There are many adjoining towns having separate tramway undertakings which do not provide intercommunication. Experience has shown that a break of tramway facilities reduces the receipts by 20 to 50 % on the lines which have been severed; and the terminal half-mile, except in populous districts, is the least remunerative section of a tramway route.

Statistics.—Each year the British board of trade issues a return of street and road tramways and light railways authorized by act or order, showing the amount of capital authorized, paid up and expended; the length of line authorized and the length open for public traffic; the gross receipts, working expenditures, net receipts and appropriation of net receipts; the number of passengers conveyed; the number of miles run by cars and the quantity of electrical energy used; together with the number of horses, engines and cars in use. The return published in January 1909 deals with the figures for local authorities up to the 31st of March 1908 and for companies up to the 31st of December 1907. The following comparative table summarizes the most important general figures for the United Kingdom provided by this official return:—

	Years ended June 30.				Year ending Dec. 31 (companies) and March 31 (local authorities).
	1878.	1886.	1898.	1902.	1907–1908
Total capital authorized	£6,586,111	£17,640,488	£24,435,427	£51,677,471	£91,305,439
Total capital expended	£4,207,350	£12,573,041	£16,492,869	£31,562,267	£68,199,918
Length of route open (miles)	269	865	1,064	1,484	2,464
Number of horses	9,222	24,535	38,777	24,120	5,288
Number of locomotive engines	14	452	589	388	64
Number of cars	1,124	3,440	5,335	7,752	10,908
Total number of passengers carried	146,001,223	384,157,524	858,485,524	1,394,452,983	2,625,532,895
Quantity of electrical energy used, B.O.T. units	—	—	—	—	431,969,119
Gross receipts	£1,099,271	£2,630,338	£4,560,126	£6,679,291	£12,439,625
Working expenditure	£868,315	£2,021,556	£3,507,895	£4,817,873	£7,792,663
Net receipts	£230,956	£608,782	£1,052,231	£1,861,418	£4,646,962

The total figures at the date of the return are summarized in the following table, which is accompanied by one showing the lengths of line worked by various methods of traction:—

	Capital expenditure on lines and works open for traffic.	Total expenditure on capital account.	Length open for traffic.						No. of undertakings.
			Double.		Single.		Total.		
	£	£	M.	Ch.	M.	Ch.	M.	Ch.	
Tramways and light railways belonging to local authorities	32,978,579	44,920,317	1113	77	505	77	1619	74	177
Tramways and light railways belonging to companies and private individuals	18,641,279 [1]	23,279,601	408	58	435	46	844	24	128
Total United Kingdom	51,619,858	68,199,918	1522	55	941	43	2464	18	305

Table showing lengths worked by various methods of traction:—

Method of traction.	England and Scotland.				Ireland.		Total.	
	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.
Electric	1922	66	235	35	127	69	2286	10
Steam	22	67	—	—	29	45	52	32
Cable	4	49	22	72	—	—	27	41
Gas motors	4	2	—	—	—	—	4	2
Horse	82	60	4	28	7	5	94	13
Total.	2037	4	262	55	164	39	2461	18

The following table gives a few totals, ratios, and percentages for the last two years of what may be called a period of electric traction, in comparison with a typical "steam" period (*i.e.* a period in which the use of steam power in tramways was at its maximum) and a typical "horse" period:—

	Electric period, 1907–1908.	Steam period, 1896.	Horse period, 1879.
Length of route open	2,464·22	1009	321·27
Total number of passengers carried	2,625,532,895	759,466,047	150,881,515
Percentage of net receipts to total capital outlay	6·81	6·88	3·97
Percentage of working expenditure to gross receipts	62·64	74·79	83·81
Passengers carried per mile of route open	1,065,462	752,691	469,641
Average fare per passenger	1·09d.	1·61d.	1·84d.

From the above figures it will be noticed that the capital cost per mile has increased as a result of the adoption of electric traction, while at the same time the percentage of the return on the capital has been reduced notwithstanding that the rate of working expenditure has fallen and the number of passengers carried per mile has increased, the fares charged having been disproportionately reduced. (E. GA.)

TRANCE (through the French, from Lat. *transitus*, from *transire*, to cross, pass over), a term used very loosely in popular speech to denote any kind of sleeplike state that seems to present obvious differences from normal sleep; in medical and scientific literature the meaning is but little better defined. In its original usage the word no doubt implied that the soul of the entranced person was temporarily withdrawn or passed away from the body, in accordance with the belief almost universally held by uncultured peoples in the possibility of such withdrawal. But the word is now commonly applied to a variety of sleeplike states without the implication of this theory; ordinary sleep-walking, extreme cases of melancholic lethargy and of anergic stupor, the deeper stages of hypnosis (see HYPNOTISM), the cataleptic state, the ecstasy of religious enthusiasts, the self-induced dream-like condition of the medicine-men, wizards or priests of many savage and barbarous peoples, and the abnormal state into which many of the mediums of modern spiritualistic seances seem to fall almost at will; all these are commonly spoken of as trance, or trance-like, states. There are no well-marked and characteristic physical symptoms of the trance state, though in many cases the pulse and respiration are slowed, and the reflexes diminished or abolished. The common feature which more than any other determines the application of the name seems to be a relative or complete temporary indifference to impressions made on the sense-organs, while yet the entranced person gives evidence in one way or another, either by the expression of his features, his attitudes and movements, his speech, or by subsequent relation of his experiences, that his condition is not one of simple quiescence or arrest of mental life, such as characterizes the state of normal deep sleep and the coma produced by defective cerebral circulation by toxic substances in the blood or by mechanical violence done to the brain.

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[1] These figures include cost of buildings and equipment in respect of certain local authorities' lines worked in conjunction with other lines.

If we refuse the name trance to ordinary sleep-walking, to normal dreaming, to catalepsy, to the hypnotic state and to stupor, there remain two different states that seem to have equal claims to the name; these may be called the ecstatic trance and the trance of mediumship respectively.

The ecstatic trance is usually characterized by an outward appearance of rapt, generally joyful, contemplation; the subject seems to lose touch for the time being with the world of things and persons about him, owing to the extreme concentration of his attention upon some image or train of imagery, which in most cases seems to assume an hallucinatory character (see HALLUCINATION). In most cases, though not in all, the subject remembers in returning to his normal state the nature of his ecstatic vision or other experience, of which a curiously frequent character is the radiance or sense of brilliant luminosity.

In the mediumistic trance the subject generally seems to fall into a profound sleep and to retain, on returning to his normal condition, no memory of any experience during the period of the trance. But in spite of the seeming unconsciousness of the subject, his movements, generally of speech or writing, express, either spontaneously or in response to verbal interrogation, intelligence and sometimes even great intellectual and emotional activity. In many cases the parts of the body not directly concerned in these expressions remain in a completely lethargic condition, the eyes being closed, the muscles of neck, trunk and limbs relaxed, and the breathing stertorous.

Trances of these two types seem to have occurred sporadically (occasionally almost epidemically) amongst almost all peoples in all ages. And everywhere popular thought has interpreted them in the same ways. In the ecstatic trance the soul is held to have transcended the bounds of space or time, and to have enjoyed a vision of some earthly event distant in space or time, or of some supernatural sphere or being. The mediumistic trance, on the other hand, popular thought interprets as due to the withdrawal of the soul from the body and the taking of its place, the taking possession of the body, by some other soul or spirit; for not infrequently the speech or writing produced by the organs of the entranced subject seems to be, or actually claims to be, the expression of a personality quite other than that of the sleeper. It is noteworthy that in almost all past ages the possessing spirit has been regarded in the great majority of cases as an evil and non-human spirit; whereas in modern times the possessing spirit has usually been regarded as, and often claims to be, the soul or spirit of some deceased human being. Modern science, in accordance with its materialistic and positive tendencies, has rejected these popular interpretations. It inclines to see in the ecstatic trance a case of hallucination induced by prolonged and intense occupation with some emotionally exciting idea, the whole mind becoming so concentrated upon some image in which the idea is bodied forth as to bring all other mental functions into abeyance. The mediumistic trance it regards as a state similar to deep hypnosis, and seeks to explain it by the application of the notion of cerebral or mental dissociation in one or other of its many current forms; this assimilation finds strong support in the many points of resemblance between the deeper stages of hypnosis and the mediumistic trance, and in the fact that the artificially and deliberately induced state may be connected with the spontaneously occurring trance state by a series of states which form an insensible gradation between them. A striking feature of the mediumistic trance is the frequent occurrence of "automatic" speech and writing; and this feature especially may be regarded as warranting the application of the theory of mental dissociation for its explanation, for such automatic speech and writing are occasionally produced by a considerable number of apparently healthy persons while in a waking condition which presents little or no other symptom of abnormality. In these cases the subject hears his own words, or sees the movement of his hand and his own hand writing, as he hears or sees those of another person, having no sense of initiating or controlling the movements and no anticipatory awareness of the thoughts expressed by the movements. When, as in the majority of cases, such movements merely give fragmentary expression to ideas or facts that have been assimilated by the subject at some earlier date, though perhaps seemingly completely forgotten by him, the theory of mental dissociation affords a plausible and moderately satisfactory explanation of the movements; it regards them as due to the control of ideas or memories which somehow have become detached or loosened from the main system of ideas and tendencies that make up the normal personality, and which operate in more or less complete detachment; and the application of the theory is in many cases further justified by the fact that the "dissociated" ideas and memories seem in some cases to become taken up again by, or reincorporated with, the normal personality.

But in recent years a new interest has been given to the study of the mediumistic trance by careful investigations (made with a competence that commands respect) which tend to re-establish the old savage theory of possession, just when it seemed to have become merely an anthropological curiosity. These investigations have been conducted for the most part by members of the Society for Psychical Research, and their most striking results have been obtained by the prolonged study of the automatic speech and writing of the American medium, Mrs Piper. In this case the medium passes into a trance state apparently at will, and during the trance the organs of speech or the hand usually express what purport to be messages from the spirits of deceased relatives or friends of those who are present. A number of competent and highly critical observers have arrived at the conviction that these messages often comprise statements of facts that could not have come to the knowledge of the medium in any normal fashion; and those who are reluctant to accept the hypothesis of "possession" find that they can reject it only at the cost of assuming the operation of telepathy (*q.v.*) in an astonishing and unparalleled fashion. During 1907–1908 the investigation was directed to the obtaining of communications which should not be explicable by the most extended use of the hypothesis of telepathic communication from the minds of living persons. The plan adopted was to seek for "cross-correspondences" between the communications of the Piper "controls" and the automatic writings of several other persons which claimed to be directed by the same disembodied spirits; *i.e.* it was sought to find in the automatic writings of two or more individuals passages each of which in itself would be fragmentary and unintelligible, but which, taken in connexion with similar fragments contemporaneously produced by another and distant writer, should form a significant whole; for it is argued that such passages would constitute irrefutable evidence of the operation of a third intelligence or personality distinct from that of either medium. The results published up to 1909 seem to show that this attempt met with striking success; and they constitute a body of evidence in favour of the hypothesis of possession which no impartial and unprejudiced mind can lightly set aside. Nevertheless, so long as it is possible to believe, as so many of the most competent workers in this field believe, that dissociated fragments of a personality may become synthesized to form a secondary and as it were parasitic personality capable of assuming temporary control of the organs of expression, and so long as we can set no limits to the scope of telepathic communication between embodied minds, it would seem wellnigh impossible, even by the aid of this novel and ingenious plan of investigation, to achieve completely convincing evidence in favour of the hypothesis of "possession."

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TRANENT, a police burgh of Haddingtonshire, Scotland. Pop. (1901), 2584. It lies 9½ m. E. of Edinburgh by road and 1 m. S.E. of Prestonpans station on the North British railway. The town possesses the oldest coal-mining charter (1202–1218) in Great Britain, and the mines and quarries in the neighbourhood provide the staple industry. A fragment of a parish church, said to have been built in the 11th century, still stands. Of the palace of the Setons which stood in the parish there are no remains. It was demolished towards the close of the 18th century and a modern mansion was erected on its site.

In the neighbouring village of Ormiston, in 1885, a granite obelisk was erected in memory of Robert Moffat (1795–1883), a native, the South African missionary and father-in-law of Livingstone. At Ormiston Hall, a seat of the marquess of Linlithgow, there is a yew tree, beneath which the reformer George Wishart (1513–1546) used to preach. Hard by is the village of Pencaitland, divided into an eastern and a western portion by the Tyne. The parish church in Easter Pencaitland probably dates from the 13th century. The aisle may belong to the original building, but the rest is of the 16th century, excepting the small belfry of the 17th century. The old house of Pencaitland stands in the grounds of Winton Castle, which was erected by the 3rd earl of Winton in 1620 but forfeited by the 5th earl, who was involved in the Jacobite rising of 1715. Five miles south-east of Tranent is the village of Salton (or Saltown), where Gilbert Burnet, afterwards bishop of Salisbury, had his first charge (1665). At his death he bequeathed the parish 20,000 marks for the clothing and educating of poor children. He was tutor to Andrew Fletcher, who was born at Salton in 1655 and buried there in 1716. At Fletcher's instigation James Meikle, a neighbouring millwright, went to Holland to learn the construction of the iron-work of barley mills, and the mill which he erected at Salton after his return not only gave Salton barley a strong hold on the market, but was also for forty years the only mill of its kind in the British Isles. Meikle's son Andrew (1719–1811), inventor of the threshing machine, carried on his trade of millwright at Houston Mill near Dunbar. Andrew Fletcher, also of Salton (1692–1766), nephew of the elder Andrew, became lord justice clerk in 1735 under the style of Lord Milton. By his mother's energy the art of weaving and dressing holland linen was introduced into the village. She travelled in Holland with two skilled mechanics who contrived to learn the secrets of the craft. The British Linen Company laid down their first bleachfield at Salton under Lord Milton's patronage. Salton also lays claim to having been the birthplace of the poet William Dunbar.

TRANI, a seaport and episcopal see of Apulia, Italy, on the Adriatic, in the province of Bari, and 26 m. by rail W.N.W. of that town, 23 ft. above sea-level. Pop. (1901), 34,688. Trani has lost its old walls and bastions, but the 13th-century Gothic citadel is used as a prison. Some of the streets remain much as they were in the medieval period, and many of the houses display more or less of Norman decoration. The cathedral (dedicated to St Nicholas the Pilgrim, a Greek assassinated at Trani in 1094 and canonized by Urban II.), on a raised open site near the sea, was consecrated, before its completion, in 1143; it is a basilica with three apses, a large crypt and a lofty tower, the latter erected in 1230–1239 by the architect whose name appears on the ambo in the cathedral of Bitonto, Nicolaus Sacerdos. It has an arch under it, being supported partly on the side wall of the church, and partly on a massive pillar. The arches of the Romanesque portal are beautifully ornamented, in a manner suggestive of Arab influence; the bronze doors, executed by Barisanus of Trani in 1175, rank among the best of their period in southern Italy. The capitals of the pillars in the crypt are fine examples of the Romanesque. The interior of the cathedral has been barbarously modernized, but the crypt is fine. Near the harbour is the Gothic palace of the doges of Venice, which is now used as a seminary. The church of the Ognissanti has a Romanesque relief of the Annunciation over the door. S. Giacomo and S. Francesco also have Romanesque façades and the latter and S. Andrea have "Byzantine" domes. The vicinity of Trani produces an excellent wine (Moscato di Trani); and its figs, oil, almonds and grain are also profitable articles of trade.

Trani is the *Turenum* of the itineraries. It first became a flourishing place under the Normans and during the crusades, but attained the acme of its prosperity as a seat of trade with the East under the Angevin princes. The harbour, however, has lost its importance.

TRANQUEBAR, a town of British India, in the Tanjore district of Madras, on the sea-coast, 18 m. N. of Negapatam. Pop. (1901), 13,142. A Danish factory was opened here as early as 1620. It was taken by the British in 1801, but restored in 1814, and finally purchased, with the other Danish settlements in India, in 1845. In Danish times Tranquebar was a busy port, but it lost its importance when the railway was opened to Negapatam. It was the first settlement of Protestant missionaries in India, founded by Ziegenbalg and Plutschau (Lutherans) in 1706; and there is still a Lutheran mission high school and mission press.

TRANSBAIKALIA (sometimes also known as *Dauria*), a province of Eastern Siberia, lying E. of Lake Baikal, with the government of Irkutsk on the N.W. and N., the provinces of Amur and Manchuria on the E. and Mongolia on the S. Its area (232,846 sq. m.) is nearly as large as that of Austria-Hungary, but its population does not much exceed half a million.

Transbaikalia forms an intermediate link between Siberia, Mongolia and the northern Pacific littoral. The Yablonoi Mountains, which run north-east from the sources of the Keruleñ to the bend of the Olekma in 56° N., divide the province into two quite distinct parts; to the west, the upper terrace of the high east Asian plateau, continued from the upper Selenga and the Yenisei (4000 to 5000 ft. high) towards the plateau of the Vitim (3500 to 4000 ft.); and to the east the lower terrace of the same plateau (2800 ft.), forming a continuation of the eastern Gobi. Beginning at Lake Baikal, a valley, deep and broad, penetrates the north-western border-ridge of the plateau, and runs eastward up the river Uda, with an imperceptible gradient, like a gigantic railway cutting enclosed between two steep slopes, and it sends another branch south towards Kiakhta. After having served, through a succession of geological periods, as an outlet for the water and ice which accumulated on the plateau, it is now utilized for the two highways which lead from Lake Baikal across the plateau (3500–4000 ft.) to the Amur on the east and the Chinese depression on the south. Elsewhere the high and massive border-ridge on the north-western edge of the plateau can be crossed only by difficult footpaths. The border-ridge just mentioned, gapped by the wide opening of the Selenga, runs from south-west to north-east under different names, being known as Khamar-daban (6900 ft.) south of Lake Baikal, and as the Barguzin Mountains (7000 to 8000 ft.) along the east bank of the Barguzin river, while farther north-east it has been described under the names of the South Muya and the Chara Mountains (6000 to 7000 ft.). Resting its south-east base on the plateau, it descends steeply on the north-west to the lake and to the broad picturesque valleys of the Barguzin, Muya and Chara. Thick forests of larch, fir and cedar clothe the ridge, whose dome-shaped rounded summits (*goltsy*) rise above the limits of tree vegetation, but do not reach the snow-line (here above 10,000 ft.). The high plateau itself has the aspect of an undulating table-land, intersected by ranges, which rise some 1500 or 2000 ft. above its surface, and are separated by broad, flat, marshy valleys, traversed by sluggish meandering streams. The better drained valleys have fine meadow lands, while the hills are clothed with forests (almost exclusively of larch and birch). Numberless lakes and ponds occur along the river courses. Tunguses hunt in the forests and meadows, but permanent agricultural settlements are impossible, corn seldom ripening on account of the early frost. The lower parts of the broad, flat valley of the Jida have, however, a few Cossack settlements, and Mongolian shepherds inhabit the elevated grassy valleys about Lake Kosso-gol (5300 ft. above the sea). Quite different is the lower terrace of the plateau, occupied by the eastern Gobi and the Nerchinsk region, and separated from the upper terrace by the Yablonoi range. This last is the south-eastern border-ridge of the higher terrace. It rises to 8035 ft. in the Sokhondo peak, but elsewhere its dome-shaped summits do not exceed 5000 or 6000 ft. Numberless lakes, with flat undefined margins, feed streams which join the great north-going rivers or the Amur and the Pacific. Low hills rise above the edge of the plateau, but the slope is abrupt towards the south-east, where the foot-hills of the Yablonoi are nearly 1500 and 2000 ft. lower than on the north-west. Climate, flora and fauna change suddenly as soon as the Yablonoi has been crossed. The Siberian flora gives way to the Daurian flora, and this is in turn exchanged for the Pacific littoral flora on the Manchurian plains and lowlands.

The lower terrace has the character of a steppe, but is intersected by a number of ranges, plications of Silurian and Devonian rocks, all running south-west to north-east, and all containing silver, lead, copper and auriferous sands. Agriculture can be easily carried on in the broad prairies, the only drawbacks being droughts, and frosts in the higher closed valleys of the Nerchinsk or Gazimur Mountains. The lower terrace is in its turn fringed by a border-ridge—the Great Khingan—which occupies, with reference to the lower terrace, the same position that the Yablonoi does in relation to the upper, and separates Siberia from northern Manchuria. This important ridge does not run from south to north, as represented on the old maps, but from south-west to north-east; it is pierced by the Amur near Albazin, and joins the Okhotsk Mountains, which however do not join the Yoblonoi Mountains.

The rivers belong to three different systems—the affluents of Lake Baikal, of the Lena and of the Amur. Of the first the Selenga (800 m. long) rises in north-west Mongolia, one of its tributaries (the Egin-gol) being an emissary of Lake Kosso-gol. The Chikoi, Khilok and Uda are its chief tributaries in Transbaikalia. The Barguzin and the upper Angara enter Lake Baikal from the north-east. Of the tributaries of the Lena, the Vitim with its affluents (Karenga, Tsipa, and Muya) flows on the high plateau through uninhabited regions, as also does the Olekma. The tributaries of the Amur are much more important. The Arguñ, which at a quite recent epoch received the waters of the Dalai-nor, and thus had the Keruleñ for its source, is no longer in communication with the rapidly desiccating Mongolian lake, but has its sources in the Gan, which flows from the Great Khingan Mountains. It is not navigable, but receives the Gazimur and several other streams from the Nerchinsk mining district. The Shilka is formed by the union of the Onon and the Chita rivers, and is navigable from the town of Chita, thus being an important channel to the Amur.

Lake Baikal, with an area of 13,200 sq. m. (nearly equal to that of Switzerland), extends in a half crescent from south-west to north-east, with a length of nearly 400 m. and a width of 20 to 50 m. Its level is 1,500 ft. above the sea.[1] The wide delta of the Selenga narrows it in the middle, and renders it shallower in the east than in the west. The other lakes include the Gusinoye and Lake Ba-unt on the Vitim plateau. Many lakes yield common salt.

The high plateau is built up of granites, gneisses and syenites, overlain by Laurentian schists. Silurian and Devonian marine deposits occur only on the lower terrace. Since that epoch the region has not been under the sea, and only fresh-water Jurassic deposits and coal beds are met with in the depressions. During the Glacial period most of the high terrace and its border ridges were undoubtedly covered with vast glaciers. Volcanic rocks of more recent origin (Mesozoic?) are met with in the north-western border-ridge and on its slopes, as well as on the Vitim plateau. During the Glacial period the fauna of the lowest parts of Transbaikalia was decidedly arctic; while during the Lacustrine or post-Glacial periods this region was dotted over with numberless lakes, the shores of which were inhabited by Neolithic man. Only few traces of these survive, and they are rapidly drying up. Earthquakes are very frequent on the shores of Lake Baikal, especially at the mouth of the Selenga, and they extend as far as Irkutsk, Barguzin and Selenginsk; in 1862 an extensive area was submerged by the lake. Numerous mineral springs, some of them of high repute, exist all over Transbaikalia. The most important are the hot alkaline springs (130° F.) at Turka, at the mouth of the Barguzin, those of Pogromna on the Uda (very similar to the Seltzer springs), those of Molokova near Chita and those of Darasun in the Nerchinsk district.

The climate is, as a whole, exceedingly dry. The winter is cold and dry, the thermometer dropping as low as −58° F. But the snow is so trifling that the horses of the Buryats are able to procure food throughout the winter on the steppes, and in the very middle of the winter wheeled vehicles are used all over the west. To the east of the Yablonoi ridge the Nerchinsk district feels the influence of the North Pacific monsoons, and snow falls more thickly, especially in the valleys; but the summer is hot and dry. On the high plateau even the summer is cold, owing to the altitude and the humidity arising from the marshes, and the soil is frozen to a great depth. At Chita the daily range in summer and spring is sometimes as much as 33° to 46°. In the vicinity of Lake Baikal there is a cooler summer; in winter exceedingly deep snow covers the mountains around the lake.[2]

The estimated population in 1906 was 742,200. The Russian population is gathered around the mines of the Nerchinsk district, while the steppes are occupied by the Buryats. A string of villages has been planted along the Shilka between Chita and Stryetensk. The valleys of the Uda, the lower Selenga, and especially the Chikoi and the Khilok have been occupied since the beginning of the 19th century by Raskolniks, some of whom, living in a condition of prosperity such as is unknown in Russia proper, rank amongst the finest representatives of the Russian race. The remainder of the steppe of the Uda is occupied by Buryats, while the forests and marshes of the plateau are the hunting grounds of the nomad Tunguses. South of the Khamar-daban the only settled region is the lower valley of the Jida. On the Upper Arguñ the Cossacks are in features, character, language and manners largely Mongolian. The Russians along the Chinese frontier constitute a separate *voisko* or division of the Transbaikal Cossacks. The Buryats number about 180,000, the Tunguses over 30,000. The province is divided into five districts, the chief towns of which are Chita, the capital, Barguzin, Nerchinsk, Selenginsk and Verkhneudinsk.

Although a good deal of land has been cleared by the settlers, nearly one-half of the entire area is still covered with forests. The principal varieties are fir, larch, aspen, poplar and birch, with *Abies pectinata* in the north and the cedar in the south. Only about one-third of the surface is adaptable for cultivation, and of that only about one-tenth is actually under tillage.

Agriculture is carried on to a limited extent by the Buryats and in all the Russian settlements; but it prospers only in the valleys of West Transbaikalia, and partly in the Nerchinsk region, while in the steppes of the Arguñ and Onon even the Russians resort to pastoral pursuits and trade, or to hunting. Livestock rearing is extensively carried on, especially by the Buryats, but their herds and flocks are often destroyed in great numbers by the snowstorms of spring. Hunting is an important occupation, even with the Russians, many of whom leave their homes in October to spend six weeks in the *taiga* (forest region). The fisheries of Lake Baikal and the lower parts of its affluents are important. Enormous quantities of *Salmo omul* are taken every year; and *S. thymalus*, *S. oxyrhynchus* and *S. fluviatilis* are also taken. Mining, and especially gold mining, is important, but the production of gold has fallen off. Silver mines have only a very small output. Iron mining is gradually developing, and good coal mines are now being worked. Salt is raised from several lakes, and the extraction of Epsom salts has considerably developed. Manufactures, though insignificant, have increased. The trade is chiefly concentrated at Kiakhta. The Cossacks on the frontier traffic in brick-tea, cattle and hides with Mongolia. The export of furs is of considerable value.

Transbaikalia is crossed by the Trans-siberian railway from Mysovaya on Lake Baikal, via Chita, to Stryetensk, and from Kaidalovo, near Chita, to the Mongolian frontier; the latter section is continued across Manchuria to Vladivostok and Port Arthur. Regular steamer communication has been established along Lake Baikal, not only for the transport of passengers and goods between the two railway stations of Listvinichnoye and Mysovaya, but also with the object of developing the fishing industry, which is of great importance. Steamers ply up the Selenga river as far as Selenginsk, considerable cargoes of tea being transported along this line.

(P. A. K.; J. T. Be.)

TRANSCASPIAN REGION, a Russian territory on the E. of the Caspian, bounded S. by Khorasan and Afghanistan, N. by the Russian province of Uralsk, N.E. by Khiva and Bokhara and S.E. by Afghan Turkestan. Area, 212,545 sq. m. Some of the most interesting problems of geography, such as those relating to the changes in the course of the Jaxartes (Syr-darya) and the Oxus (Amu-darya), and the supposed periodical disappearance of Lake Aral, are connected with the Transcaspian deserts; and it is here that we must look for a clue to the physical changes which transformed the Euro-Asiatic Mediterranean—the Aral-Caspian and Pontic basin—into a series of separate seas, and desiccated them, powerfully influencing the distribution of floras and faunas, and centuries ago compelling the inhabitants of Western and Central Asia to enter upon their great migrations. But down to a comparatively recent date the arid, barren deserts, peopled only by wandering Turkomans, were almost a *terra incognita*.

A mountain chain, comparable in length to the Alps, separates the deserts of the Transcaspian from the highlands of Khorasan. It begins in the Krasnovodsk peninsula of the Caspian, under the names of Kuryanyn-kary and Great Balkans, whose masses of granite and other crystalline rock reach an altitude of some 5350 ft. Farther south-east they are continued in the Little Balkans (2000 ft.) and the Kopepet-dagh or Kopet-dagh. The latter rises steep and rugged above the flat deserts over a stretch of 600 m. In structure it is homologous with the Caucasus chain; it appears as an outer wall of the Khorasan plateau, and is separated from it by a broad valley, which, like the Rion and Kura valley of Transcaucasia, is drained by two rivers flowing in opposite directions—the Atrek, which flows north-west into the Caspian, and the Keshef-rud, which flows to the south-east and is a tributary of the Murghab. On the other side of this valley the Alla-dagh (Aladagh) and the Binalund border-ranges (9000 to 11,000 ft.) fringe the edge of the Khorasan plateau. Descending towards the steppe with steep stony slopes, the mountain barrier of the Kopet-dagh rises to heights of 6000–9000 ft. to the east of Kyzyl-arvat, while the passes which lead from the Turkoman deserts to the valleys of Khorasan are seldom as low as 3500, and usually rise to 5000, 6000 and even 8500 ft., and in most cases are very difficult. It is pierced by only one wide opening, that between the Great and Little Balkans, through which the sea, which once covered the steppe, maintained connexion with the Caspian.

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[1] There is uncertainty as to the absolute altitude (see BAIKAL).

[2] See "Das Klima von Ost-Siberien," by A. Woyeikow, in *Meteorol. Zeitschrift* (1884).

While the Alla-dagh and Binalund border-ranges are chiefly composed of crystalline rocks and metamorphic slates, overlain by Devonian deposits, a series of more recent formations—Upper and Lower Cretaceous and Miocene—crops out in the outer wall of the Kopet-dagh. Here again we find that the mountains of Asia which stretch towards the north-west continued to be uplifted at a geologically recent epoch. Quarternary deposits have an extensive development on its slopes, and its foothills are bordered by a girdle of loess.

The loess terrace, called Atok ("mountain base"), 10 to 20 m. in width, is very fertile; but it will produce nothing without irrigation, and the streams flowing from the Kopet-dagh are few and scanty. The winds which impinge upon the northern slope of the mountains have been deprived of all their moisture in crossing the Kara-kum—the Black Sands of the Turkoman desert; and even such rain as falls on the Kopet-dagh (10½ in. at Kyzyl-arvat) too often reaches the soil in the shape of light showers which do not penetrate it, so that the average relative humidity is only 56 as compared with 62 at even so dry a place as Krasnovodsk. Still, at those places where the mountain streams run closer to one another, as at Geok-tepe, Askhabad, Lutfabad and Kaaka, the villages are more populous, and the houses are surrounded by gardens, every square yard and every tree of which is nourished by irrigation.

North of this narrow strip of irrigated land begins the desert—the Kara-kum—which extends from the mountains of Khorasan to Lake Aral and the plateau of Ust-Urt, and from the Caspian to the Amu-darya, interrupted only by the oases of Merv and Tejeñ. But the terrible shifting sands, blown into *barkhans*, or elongated hills, sometimes 50 and 60 ft. in height, are accumulated chiefly in the west, where the country has more recently emerged from the sea. Farther east the barkhans are more stable. Large areas amidst the sands are occupied by *takyrs*, or flat surfaces paved with clay, which, as a rule, is hard but becomes almost impassable after heavy rains. In these takyrs the Turkomans dig ditches, draining into a kind of cistern, where the water of the spring rains can be preserved for a few months. Wells also are sunk, and the water is found in them at depths of 10 to 50, or occasionally 100 ft. and more. All is not desert in the strict sense; in spring there is for the most part a carpet of grass.

The vegetation of the Kara-kum cannot be described as poor. The typical representative of the sandy deserts of Asia, the saksaul (*Anabasis ammodendron*), has been almost destroyed within the last hundred years, and occurs only sporadically, but the borders of the spaces covered with saline clay are brightened by forests of tamarisk, which are inhabited by great numbers of the desert warbler (*Atraphornis aralensis*)—a typical inhabitant of the sands—sparrows and ground-choughs (*Podoces*); the *Houbara macqueeni*, though not abundant, is characteristic of the region. Hares and foxes, jackals and wolves, marmots, moles, hedgehogs and one species of marten live in the steppe, especially in spring. As a whole, the fauna is richer than might be supposed, while in the Atok it contains representatives of all the species known in Turkestan, intermingled with Persian and Himalayan species.

The Uzboi.—A feature distinctive of the Turkoman desert is the very numerous *shors*, or elongated depressions, the lower portion of which are mostly occupied with moist sand. They are obviously the relics of brackish lakes, and, like the lakes of the Kirghiz steppes, they often follow one another in quick succession, thus closely resembling river-beds. As the direction of the *shors* is generally from the higher terraces drained by the Amu-darya towards the lowlands of the Caspian, they were usually regarded as old beds of the Amu-darya, and were held to support the idea of its once having flowed across the Turkoman desert towards what is now the Caspian Sea. It was formerly considered almost settled, not only that that river (see Oxus) flowed into the Caspian during historical times, but that after having ceased to do so in the 7th century, its waters were again diverted to the Caspian about 1221. A chain of elongated depressions, bearing a faint resemblance to old river-beds, was traced from Urgenj to the gap between the Great and the Little Balkans; this was marked on the maps as the Uzboi, or old bed of the Oxus.[1] The idea of again diverting the Amu into the Caspian was thus set afloat, but the investigations of Russian engineers, especially A. E. Hedroitz, A. M. Konshin, I. V. Mushketov, P. M. Lessar and Svintsov,[2] went to show that the Uzboi is no river-bed at all, and that no river has ever discharged its waters in that direction. The existence of an extensive lacustrine depression, now represented by the small Sary-kamysh lakes, was proved, and it was evident that this depression, having a length of more than 130 m., a width of 70 m., and a depth of 280 ft. below the present level of Lake Aral, would have to be filled by the Amu before its waters could advance farther to the south-west. The sill of this basin being only 28 ft. below the present level of Lake Aral, this latter could not be made to disappear, nor even be notably reduced in size, by the Amu flowing south-west from Urgenj. A more careful exploration of the Uzboi has shown that, while the deposits in the Sary-kamysh depression, and the Aral shells they contain, bear unmistakable testimony to the fact of the basin having once been fed by the Amu-darya, no such traces are found along the Uzboi below the Sary-kamysh depression;[3] on the contrary, shells of molluscs still inhabiting the Caspian are found in numbers all along it, and the supposed old bed has all the characteristics of a series of lakes which continued to subsist along the foothills of the Ust-Urt plateau, while the Caspian was slowly receding westwards during the post-Pliocene period. On rare occasions only did the waters of the Sary-kamysh, when raised by inundations above the sill just mentioned, send their surplus into the Uzboi. It appears most probable that in the 16th century the Sary-kamysh was confounded with a gulf of the Caspian;[4] and this gives much plausibility to Konshin's supposition that the changes in the lower course of the Amu (which no geologist would venture to ascribe to man, if they were to mean the alternative discharge of the Amu into the Caspian and Lake Aral) merely meant that by means of appropriate dams the Amu was made to flow in the 13th–16th centuries alternately into Lake Aral and into the Sary-kamysh.

The ancient texts (of Pliny, Strabo, Ptolemy) about the Jaxartes and Oxus only become intelligible when it is admitted that, since the epoch to which they relate, the outlines of the Caspian Sea and Lake Aral have undergone notable changes, commensurate with those which are supposed to have occurred in the courses of the Central Asian rivers. The desiccation of the Aral-Caspian basin proceeded with such rapidity that the shores of the Caspian cannot possibly have maintained for some twenty centuries the outlines which they exhibit at present. When studied in detail, the general configuration of the Transcaspian region leaves no doubt that both the Jaxartes and the Oxus, with its former tributaries, the Murghab and the Tejeñ, once flowed towards the west; but the Caspian of that time was not the sea of our days; its gulfs penetrated the Turkoman steppe, and washed the base of the Ust-Urt plateau. (See Caspian and Aral.)

Kelif-Uzboi.—There is also no doubt that, instead of flowing north-westward of Kelif (on the present Bokhara-Afghan frontier), the Amu once bent south to join the Murghab and Tejeñ; the chain of depressions described by the Russian engineers as the Kelif-Uzboi[5] supports this hypothesis, which a geographer cannot avoid making when studying a map of the Transcaspian region; but the date at which the Oxus followed such a course, and the extension which the Caspian basin then had towards the east, are uncertain.

In 1897 the population numbered 377,416, of whom only 42,431 lived in towns; but, besides those of whom the census took account, there were about 25,000 strangers and troops.

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[1] On the original Russian map of the Transcaspian, drawn immediately after the survey of the Uzboi had been completed, the Uzboi has not the continuity which is given to it on subsequent maps.

[2] Their original papers are printed in the *Izvestia* of the Russian Geographical Society, 1883 to 1887, also in the *Journal* of the Russian ministry of roads and communications.

[3] According to A. E. Hedroitz and A. M. Konshin the old Tonu-darya bed of the Amu contains shells of molluscs now living in the Amu (*Cyrena fluminalis*, *Dreissensia polymorpha* and *Anodonta*). The Sary-kamysh basin is characterized by deposits containing *Neritina liturata*, *Dreissensia polymorpha* and *Limnaeus*, characteristic of this basin. Below the Sary-kamysh there are no deposits containing shells characteristic of the Amu; *Anodontae* are found quite occasionally on the surface, not in beds, in company with the Caspian *Cardium* (*Didacna*) *trigonoides*, var. *crassum*, *Cardium piramidatum. Dreissensia polymorpha*, *D. rostriformis*, *Hydrobia caspia*, *Neritina liturata* and *Dreissensia beardii*; the red clays containing these fossils extend for 130 m. east of the Caspian (*Izvestia* of Russ. Geog. Soc., 1883 and 1886).

[4] As by Jenkinson, who mentions a freshwater gulf of the Caspian within six days' march from Khwarezm (or Khiva), by which gulf he could only mean the Sary-kamysh depression.

[5] The Turkomans call this southern "old bed" Unghyuz or Onguz ("dry old bed"), and there can be no doubt that when the *Bolshoi-Chertezh* of the 16th century (speaking from anterior information) mentions a river, Ughyuz or Ugus, flowing west from the Amu towards the Caspian, it is merely describing as a river what the very name shows to have been a dry bed, supposed to have been once occupied by a river. The similarity of the names Ongus and Ugus with Ogus and Ochus possibly helped to accentuate, if not to give rise to, the confusion. Cf. N. G. Petrusevich, "The South-east Shores of the Caspian," in *Zapiski* of the Caucasian Geographical Society (1880), vol. xi.

Included in the total were some 280,000 Turkomans, 60,000 Kirghiz, 12,000 Russians, 8000 Persians, 4250 Armenians, and some Tatars. The estimated population in 1906 was 397,100. The province is divided into five districts, the chief towns of which are Askhabad, the capital; Krasnovodsk; Fort Alexandrovskiy, in the district of Manghishlak, on the Caspian Sea; Merv and Tejeñ. Until a recent date the chief occupations of the Turkomans were cattle-rearing and robbery. Even those who had settled abodes on the oases of the Atok, Tejeñ and Merv were in the habit of encamping during the spring in the steppes, the khanates of Afghan Turkestan from Balkh to Meshhed being periodically devastated by them. The aspect of the steppe has, however, greatly changed since the Russian advance and the fall (1881) of the Turkoman stronghold of Geok-tepe. Their principal oases are situated along the Atok or loess terrace, the chief settlements being Askhabad, Kyzyl-arvat and Geok-tepe. The oasis of Merv is inhabited by Akhal-tekkes (about 240,000), mostly poor. In January 1887 they submitted to Russia. The oasis of Tejeñ has sprung up where the river Tejeñ (Heri-rud) terminates in the desert.

South-west Turcomania.—The region between the Heri-rud and the Murghab has the characteristics of a plateau, reaching about 2000 ft. above the sea, with hills 500 and 600 ft. high covered with sand, the spaces between being filled with loess. The Borkhut Mountains which connect the Kopet-dagh with the Sefid-kuh in Afghanistan reach 3000 to 4000 ft., and are cleft by the Heri-rud. Thickets of poplar and willow accompany both the Murghab and the Heri-rud. Pistachio and mulberry trees grow in isolated clumps on the hills; but there are few places available for cultivation, and the Saryk Turkomans (some 60,000 in number) congregate in only two oases—Yol-otan or Yelatan, and Penjdeh. The Sarakhs oasis is occupied by the Salor Turkomans, hereditary enemies of the Tekke Turkomans; they number about 3000 tents at Old Sarakhs, and 1700 more on the Murghab, at Chardjui, at Maimene (or Meimane), and close to Herat.

The Transcaspian Region is very rich in minerals. Rock-salt, petroleum, gypsum and sulphur are extracted. Nearly 300,000 acres are irrigated by the natives, and attempts are being made by the government to increase the irrigated area; it is considered that over 5,000,000 acres of land could be rendered suitable for agriculture. Several hundred thousand trees are planted every year, and a forest guard has been established to prevent useless destruction of the saksaul trees, which grow freely in the steppes. A model garden and a mulberry plantation have been established at Askhabad in connexion with the gardening school. The land in the oases, especially those of the Atrek River, is highly cultivated. Wheat and barley are grown, in addition to sorghum (a species of millet), maize, rice, millet and sesame for oil. Raw cotton is extensively grown in the Merv district. Gardening and fruit-growing are well developed, and attempts are being made to encourage the spread of viticulture. Livestock breeding is the chief occupation of the nomad Turkomans and Kirghiz. Considerable fishing is carried on in the Caspian Sea, and seals are killed off the Manghishlak peninsula. The natives excel in domestic industries, as the making of carpets, travelling bags, felt goods and embroidered leather. The Russian population is mostly limited to the military and the towns. Wheat, flour, wool, raw cotton and dried fruit are exported; while tea, manufactured goods, timber, sugar, iron and paraffin oil are imported, as also rice and fruit from Bokhara, Turkestan and Persia. The Transcaspian railway, constructed across the province from Krasnovodsk to Merv, with a branch to Kushk, and from Merv to Bokhara and Russian Turkestan, has effected quite a revolution in the trade of Central Asia. The old caravan routes via Orenburg have lost their importance, and goods coming from India, Persia, Bokhara and even China are now carried by rail. (For the history of the region see Merv.)

See the researches of Andrusov, Bogdanovich, Konshin, Mushketov and Obruchev in the *Memoirs*, the *Bulletin* (*Izvestia*) and the *Annuals* of the Russian Geographical Society (1890–1900); P. M. Lessar, *L'Ancienne jonction de l'Oxus avec la mer Caspienne* (1889); Zarudnoi (zoology) in *Bulletin de la société des naturalistes de Moscou* (1889 seq.). (P. A. K.; J. T. Be.)

TRANSCAUCASIA, a general name given to the governments and provinces of Russian Caucasia, excluding the steppe provinces of Kuban and Terek and the steppe government of Stavropol. It thus includes the governments of Baku, Elisavetpol, Erivan, Kutais and Tiflis; the provinces of Batum, Daghestan and Kars; and the military districts of the Black Sea (Chernomorsk) and Zakataly. Its area is 95,402 sq. m., and the estimated population in 1906 was 6,114,600. (See Caucasia and Caucasus.)

TRANSCENDENTALISM (Lat. *trans*, across, *scandere*, climb, whence *transcendere*, to pass a limit), in philosophy, any system which emphasizes the limited character of that which can be perceived by the senses and is based on the view that true knowledge is intuitive, or supernatural. The term is specially applied to Kant's philosophy and its successors which hold that knowledge of the a priori is possible. It is traceable as far back as the schoolmen of whom Duns Scotus describes as "transcendental" those conceptions which have a higher degree of universality than the Aristotelian categories. Thus *ens* (being) is more universal than God or the physical universe because it can be predicated of both. Kant distinguishes as "transcendent" the world of things-in-themselves as being without the limits of experience; while "transcendental" is his term for those elements which regulate human experience, though they are themselves beyond experience; such are the categories of space, time, causality.

In general use the term is applied rather promiscuously and frequently by way of criticism to an attitude of mind which is imaginative, aloof from mundane affairs and unmoved by practical considerations. The most famous example of the pseudo-philosophic use of the term is for a movement of thought which was prominent in the New England states from about 1830 to 1850. Its use originated in the Transcendental Club (1836) founded by Emerson, Frederic Henry Hedge (1805–1890), and others. This movement had several aspects: philosophical, theological, social, economic. Its main theme was regeneration, a revolt from the formalism of both Unitarian and Calvinist theology and a widening literary outlook. It took its rise to a large extent in the study of German (and to a less extent French) philosophy and spread widely among the cultured classes. In 1840 the club began to issue an official organ, *The Dial*, and the settlement of Brook Farm (*q.v.*) followed in 1841. These enterprises themselves did not receive general support even among the Transcendentalist leaders, and the real significance of the movement was the stimulus which it gave to philanthropy, to the Abolition movement, and to a new ideal of individual character. The chief names associated with it, besides those of Emerson and Hedge, are those of A. B. Alcott (*q.v.*), Margaret Fuller (*q.v.*), George Ripley (*q.v.*), W. E. Channing (*q.v.*), and H. D. Thoreau (*q.v.*).

TRANSEPT (from Lat. *trans*, across, and *septum*, enclosure; synonymous terms in other languages are Fr. *croisée*, *nef transversée*; Ital. *crociata*; Ger. *Querbau*, *Querschiff*), in architecture, the term given to the large and lofty structure which lies at right angles to the nave and aisles of a church. The first example is that which existed in the old St Peter's at Rome, but as a rule it is not found in the early basilicas. At the present day the transept might be better defined as that portion of a cruciform church which extends from north to south across the main body of the building and usually separates the choir from the nave; but to this there are some exceptions, as in Westminster Abbey, where the choir, with its rood screen, occupies the first four bays of the nave; in Norwich two bays; in Gloucester one bay; and Winchester one bay. In some of the English cathedrals there is an eastern transept, as in Canterbury, Lincoln, Salisbury and Worcester; at Durham that which might be regarded as an eastern transept is the chapel of the Nine Altars, and the same is found in Fountains Abbey. Four of the English cathedrals have aisles on east and west sides, viz. Ely, Wells, Winchester and York, while at Chester there are aisles to the south transept only, and at Lincoln, Peterborough and Salisbury on the east side only. In some cases the transept extends to the outer walls of the aisles only, but there are many instances in which it is carried beyond, as at Lincoln (225 ft. long), Ely (180 ft.), Peterborough (180 ft.), Durham (175 ft.) and Norwich (172 ft.); in all these cases the transept is carried three bays beyond; in York (220 ft.), St Albans (170 ft.), Lichfield (145 ft.) and Canterbury, east transept (165 ft.), two bays beyond; and in Canterbury, western transept (130 ft.), Chichester (160 ft.) and Worcester (130 ft.), only one bay on each side, the dimension in all cases being taken within the north and south walls of the transept.

TRANSFER (from Lat. *transferre*, to bear across, carry over), the handing over, removal or conveyance of anything from one person or place to another; also the subject of this transference or the form or method by which it is effected. The term is particularly used in law of the conveyance of property from one person to another, especially of the conveyance of real property (see CONVEYANCING). For the simplification of this process by means of registration of title, see LAND REGISTRATION. For the transference of designs, drawings, &c., by means of transfer-paper to the surface of pottery and porcelain, see CERAMICS; for their transfer to stones for printing, see LITHOGRAPHY.

TRANSFORMERS. An electrical transformer is the name given to any device for producing by means of one electric current another of a different character. The working of such an appliance is, of course, subject to the law of conservation of energy. The resulting current represents less power than the applied current, the difference being represented by the power dissipated in the translating process. Hence an electrical transformer corresponds to a simple machine in mechanics, both transforming power from one form into another with a certain energy-dissipation depending upon frictional losses, or something equivalent to them. Electrical transformers may be divided into several classes, according to the nature of the transformation effected. The first division comprises those which change the form of the power, but keep the type of the current the same; the second those that change the type of the current as well as the form of power. The power given up electrically to any circuit is measured by the product of the *effective value* of the current, the *effective value* of the difference of potential between the ends of the circuit and a factor called the *power factor*. In dealing with periodic currents, the effective value is that called the root-mean-square value (R.M.S.), that is to say, the square root of the mean of the squares of the time equidistant instantaneous values during one complete period (see ELECTROKINETICS). In the case of continuous current, the power factor is unity, and the effective value of the current or voltage is the true mean value. As the electrical measure of a power is always a product involving current and voltage, we may transform the character of the power by increasing or diminishing the current with a corresponding decrease or increase of the voltage. A transformer which raises voltage is generally called a *step-up* transformer, and one which lowers voltage a *step-down* transformer.

Again, electric currents may be of various types, such as continuous, single-phase alternating, polyphase alternating, undirectional but pulsating, &c. Accordingly, transformers may be distinguished in another way, in accordance with the type of transformation they effect. (1) *An alternating current transformer* is an appliance for creating an alternating current of any required magnitude and electromotive force from another of different value and electromotive force, but of the same frequency. An alternating current transformer may be constructed to transform either single-phase or polyphase currents. (2) *A continuous current transformer* is an appliance which effects a similar transformation for continuous currents, with the difference that some part of the machine must revolve, whereas in the alternating current transformer all parts of the machine are stationary; hence the former is generally called a rotatory transformer, and the latter a static transformer. (3) *A rotatory or rotary transformer* may consist of one machine, or of two separate machines, adapted for converting a single-phase alternating current into a polyphase current, or a polyphase current into a continuous current, or a continuous current into an alternating current. If the portions receiving and putting out power are separate machines, the combination is called a *motor-generator*. (4) A transformer adapted for converting a single-phase alternating current into a unidirectional but pulsatory current is called a *rectifier*, and is much used in connexion with arc lighting in alternating current supply stations. (5) *A phase transformer* is an arrangement of static transformers for producing a polyphase alternating current from a single-phase alternating current. Alternating current transformers may be furthermore divided into (*a*) single-phase, (*b*) polyphase. Transformers of the first class change an alternating current of single-phase to one of single-phase identical frequency, but different power; and transformers of the second class operate in a similar manner on polyphase currents. (6) The ordinary induction or spark coil may be called an intermittent current transformer, since it transforms an intermittent low-tension primary current into an intermittent or alternating high-tension current.

Alternating Current Transformer.—The typical alternating current transformer consists essentially of two insulated electric circuits wound on an iron core constituting the magnetic circuit. They may be divided into (1) open magnetic circuit static transformers, and (2) closed magnetic circuit static transformers, according as the iron core takes the form of a terminated bar or a closed ring. A closed circuit alternating current transformer consists of an iron core built up of thin sheets of iron or steel, insulated from one another, and wound over with two insulated conducting circuits, called the primary and secondary circuits. The core must be laminated or built up of thin sheets of iron to prevent local electric currents, called eddy currents, from being established in it, which would waste energy. In practical construction, the core is either a simple ring, round or rectangular, or a double rectangular ring, that is, a core whose section is like the figure 8. To prepare the core, thin sheets of iron or very mild steel, not thicker than ·014 of an inch, are stamped out of special iron (see ELECTROMAGNETISM) and carefully annealed.

The preparation of the particular sheet steel or iron used for this purpose is now a speciality. It must possess extremely small hysteresis loss (see MAGNETISM), and various trade names, such as "stalloy," "lohys," are in use to describe certain brands. Barrett, Brown and Hadfield have shown (*Journ. Inst. Elec. Eng. Lond.*, 1902, 31, p. 713) that a silicon iron containing 2·87% of silicon has a hysteresis loss far less than that of the best Swedish soft iron. In any case the hysteresis loss should not exceed 3·0 watts per kilogram of iron measured at a frequency of 50 ~ and a flux-density of 10,000 lines per square centimetre. This is now called the "figure of merit" of the iron.

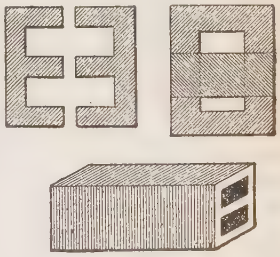

FIG. 1.

Examples of the shapes in which these stampings are supplied are shown in fig. 1. The plates when annealed are varnished or covered with thin paper on one side, and then piled up so as to make an iron core, being kept together by bolts and nuts or by pressure plates. The designer of a transformer core has in view, first, economy in metal, so that there may be no waste fragments, and second, a mode of construction that facilitates the winding of the wire circuits. These consist of coils of cotton-covered copper wire which are wound on formers and baked after being well saturated with shellac varnish. The primary and secondary circuits are sometimes formed of separate bobbins which are sandwiched in between each other; in other cases they are wound one over the other (fig. 2). In any case the primary and secondary coils must be symmetrically distributed. If they were placed on opposite sides of the iron circuit the result would be considerable magnetic leakage. It is usual to insert sheets or cylinders of micanite between the primary and secondary windings. The transformer is then well baked and placed in a cast-iron case sometimes filled in with heavy insulating oil, the ends of the primary and secondary circuits being brought out through water-tight glands. The most ordinary type of alternating current transformer is one intended to transform a small electric current produced by a large electromotive force (2000 to 10,000 volts) into a larger current of low electromotive force (100 to 200 volts). Such a step-down transformer may be obviously employed in the reverse direction for raising pressure and reducing current, in which case it is a step-up transformer. A transformer when manufactured has to be carefully tested to ascertain, first, its power of resisting breakdown, and, second, its energy-dissipating qualities. With the first object, the transformer is subjected to a series of pressure tests. If it is intended that the primary shall carry a current

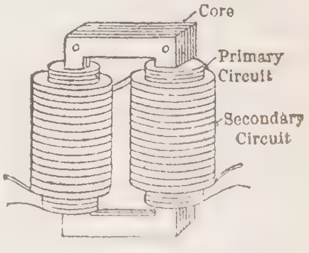

FIG. 2.—Closed Circuit Transformer.

produced by an electromotive force of 2000 volts, an insulation test must be applied with double this voltage between the primary and the secondary, the primary and the case, and the primary and the core, to ascertain whether the insulation is sufficient. To prevent electric discharges from breaking down the machine in ordinary work, this extra pressure ought to be applied for at least a quarter of an hour. In some cases three or four times the working pressure is applied for one minute between the primary and secondary circuits. When such an alternating current transformer has an alternating current passed through its primary circuit, an alternating magnetization is produced in the core, and this again induces an alternating secondary current. The secondary current has a greater or less electromotive force than the primary current according as the number of windings or turns on the secondary circuit is greater or less than those on the primary. Of the power thus imparted to the primary circuit one portion is dissipated by the heat generated in the primary and secondary circuits by the currents, and another portion by *the iron core losses* due to the energy wasted in the cyclical magnetization of the core; the latter are partly eddy current losses and partly hysteresis losses.

In open magnetic circuit transformers the core takes the form of a laminated iron bar or a bundle of iron wire. An ordinary induction coil is an instrument of this description. It has been shown, however, by careful experiments, that for alternating current transformation there are very few cases in which the closed magnetic circuit transformer has not an advantage. An immense number of designs of closed circuit transformers have been elaborated since the year 1885. The principal modern types are the Ferranti, Kapp, Mordey, Brush, Westinghouse, Berry, Thomson-Houston and Ganz. Diagrammatic representations of the arrangements of the core and circuits in some of these transformers are given in fig. 3.

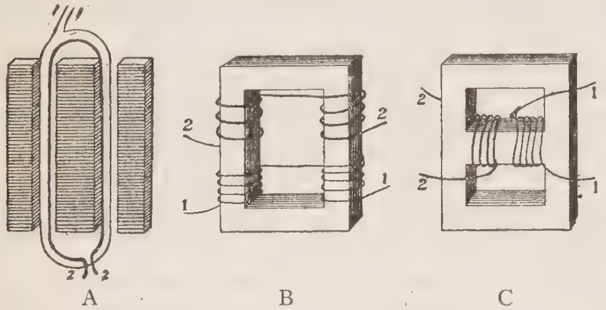

FIG. 3.—Diagrams of (A) Mordey (in section), (B) Kapp and (C) Ganz Transformers.

1, 1 Primary circuit; 2, 2 Secondary circuit.

Alternating current transformers are classified into (i.) *Core* and (ii.) *Shell* transformers, depending upon the arrangements of the iron and copper circuits. If the copper circuits are wound on the outside of what is virtually an iron ring, the transformer is a core transformer; if the iron encloses the copper circuits, it is a shell transformer. Shell transformers have the disadvantage generally of poor ventilaton for the copper circuits. Berry, however, has overcome this difficulty by making the iron circuit in the form of a number of bunches of rectangular frames which are set in radial fashion and the adjacent legs all embraced by the two copper circuits in the form of a pair of concentric cylinders. In this manner he secures good ventilation and a minimum expenditure in copper and iron, as well as the possibility of insulating the two copper circuits well from each other and from the core. An important matter is the cooling of the core. This may be effected either by ordinary radiation, or by a forced draught of air made by a fan or else by immersing the transformer in oil, the oil being kept cool by pipes through which cold water circulates immersed in it. This last method is adopted for large high-tension transformers.

Efficiency.

The ratio between the power given out by a transformer and the power taken up by it is called its *efficiency*, and is best represented by a curve, of which the ordinate is the efficiency expressed as a percentage, and the corresponding abscissae represent the fractions of the full load as decimal fractions. The output of the transformer is generally reckoned in kilowatts, and the load is conveniently expressed in decimal fractions of the full load taken as unity. The efficiency on one-tenth of full load is generally a fairly good criterion of the economy of the transformer as a transforming agency. In large transformers the one-tenth load efficiency will reach 90% or more, and in small transformers 75 to 80%.

The general form of the efficiency curve for a closed circuit transformer is shown in fig. 4. The horizontal distances represent fractions of full secondary load (represented by unity), and the vertical distances efficiency in percentages. The efficiency curve has a maximum value corresponding to that degree of load at which the copper losses in the transformer are equal to the iron losses.

In the case of modern closed magnetic circuit transformers the copper losses are proportional to the square of the secondary current (I_2) or to qI_2^2, where $q = R_1a^2 + R_2$; R_1 being the resistance of the primary and R_2 that of the secondary circuit, while a is the ratio of the number of secondary and primary windings of the transformer. Let C stand for the core loss, and V_2 for the secondary terminal potential difference (R.M.S. value). We can then write as an expression for the efficiency (η) of the transformer ($\eta = I_2V_2 / (C + qI_2^2 + I_2V_2)$). It is easy to show that if C_1, V_2 and q are constants, but I_2 is variable, the above expression for η has a maximum value when $C - qI_2^2 = O$, that is, when the iron core loss $C =$ the total copper losses qI_2^2.

Iron and Copper Losses.

The iron core energy-waste, due to the hysteresis and eddy currents, may be stated in watts, or expressed as a fraction of the full load secondary output. In small transformers of 1 to 3 kilowatts output it may amount to 2 or 3%, and in large transformers of 10 to 50 kilowatts and upwards it should be 1 or less than 1%. Thus the core loss of a 30-kilowatt transformer (one having a secondary output of 30,000 watts) should not exceed 250 watts. It has been shown that for the constant potential transformer the iron core loss is constant at all loads, but diminishes slightly as the core temperature rises. On the other hand, the copper losses due to the resistance of the copper circuits increase about 0·4% per degree C. with rise of temperature. The current taken in at the primary side of the transformer, when the secondary circuit is unclosed, is called the *magnetizing current*, and the power then absorbed by the transformer is called the *open circuit loss* or magnetizing watts. The ratio of the terminal potential difference at the primary and secondary terminals is called the *transformation ratio* of the transformer. Every transformer is designed to give a certain transformation ratio, corresponding to some particular primary voltage. In some cases transformers are designed to transform, not potential difference, but current in a constant ratio. The product of the root-mean-square (R.M.S.), effective or virtual, values of the primary current, and the primary terminal potential difference, is called the *apparent power* or apparent watts given to the transformer. The true electrical power may be numerically equal to this product, but it is never greater, and is sometimes less. The ratio of the true power to the apparent power is called the *power factor* of the transformer. The power factor approaches unity in the case of a closed circuit transformer, which is loaded non-inductively on the secondary circuit to any considerable fraction of its full load, but in the case of an open circuit transformer the power factor is always much less than unity at all loads. Power factor curves show the variation of power factor with load. Examples of these curves were first given by J. A. Fleming, who suggested the term itself (see *Jour. Inst. Elec. Eng. Lond.*, 1892, 21, p. 606). A low power factor always implies a magnetic circuit of large reluctance.

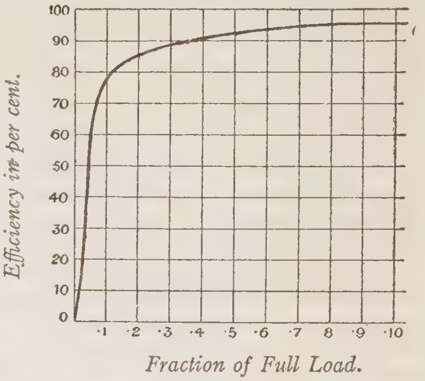

FIG. 4.—Typical Efficiency Curve of Closed Circuit Transformer.

The operation of the alternating current is then as follows: the periodic magnetizing force of the primary circuit creates a periodic magnetic flux in the core, and this being linked with the primary circuit creates by its variation what is called the back electromotive force in the primary circuit. The variation of the particular portion of this periodic flux, linked with the secondary circuit, originates in this last a periodic electromotive force. The whole of the flux linked with the primary circuit is not interlinked with the secondary circuit. The difference is called the *magnetic leakage* of the transformer. This leakage is increased with the secondary output of the transformer and with any disposition of the primary and secondary coils which tends to separate them. The leakage exhibits itself by increasing the *secondary drop.* If a transformer is worked at a constant primary potential difference, the secondary terminal potential difference at no load or on open secondary circuit is greater than it is when the secondary is closed and the transformer giving its full output. The difference between these last two differences of potential is called the secondary drop. This secondary drop should not exceed 2% of the open secondary circuit potential difference.

Appraisement.

The facts required to be known about an alternating current transformer to appraise its value are (1) its full load secondary output or the numerical value of the power it is designed to transform, on the assumption that it will not rise in temperature more than about 60° C. above the atmosphere when in normal use; (2) the primary and secondary terminal voltages and currents, accompanied by a statement whether the transformer is intended for producing a constant secondary voltage or a constant secondary current; (3) the efficiency at various fractions on secondary load from one-tenth to full load taken at a stated frequency; (4) the power factor at one-tenth of full load and at full load; (5) the secondary drop between full load and no load; (6) the iron core loss, also the magnetizing current, at the normal frequency; (7) the total copper losses at full load and at one-tenth of full load; (8) the final temperature of the transformer after being left on open secondary circuit but normal primary potential for twenty-four hours, and at full load for three hours.

The matters of most practical importance in connexion with an alternating current transformer are (1) the iron core loss, which affects the efficiency chiefly, and must be considered (*a*) as to its initial value, and (*b*) as affected by "ageing" or use; (2) the secondary drop or difference of secondary voltage between full and no load, primary voltage being constant, since this affects the service and power of the transformer to work in parallel with others; and (3) the temperature rise when in normal use, which affects the insulation and life of the transformer. The shellacked cotton, oil and other materials with which the transformer circuits are insulated suffer a deterioration in insulating power if continuously maintained at any temperature much above 80° C. to 100° C. In taking the tests for core loss and drop, the temperature of the transformer should therefore be stated. The iron losses are reduced in value as temperature rises and the copper losses are increased. The former may be 10 to 15% less and the latter 20% greater than when the transformer is cold. For the purpose of calculations we require to know the number of turns on the primary and secondary circuits, represented by N_1 and N_2; the resistances of the primary and secondary circuits, represented by R_1 and R_2; the volume (V) and weight (W) of the iron core; and the mean length (L) and section (S) of the magnetic section. The hysteresis loss of the iron reckoned in watts per lb per 100 cycles of magnetization per second and at a maximum flux density of 2500 C.G.S. units should also be determined.

Testing.

The experimental examination of a transformer involves the measurement of the efficiency, the iron core loss, and the secondary drop; also certain tests as to insulation and heating, and finally an examination of the relative phase position and graphic form of the various periodic quantities, currents and electromotive forces taking place in the transformer. The efficiency is best determined by the employment of a properly constructed wattmeter (see WATTMETER). The transformer T (fig. 5) should be so arranged that, if a constant potential transformer, it is supplied with its normal working pressure at the primary side and with a load which can be varied, and which is obtained either by incandescent lamps, L, or resistances in the secondary circuit. A wattmeter, W, should be placed with its series coil, Se, in the primary circuit of the transformer, and its shunt coil, Sh, either across the primary mains in series, with a suitable non-inductive resistance, or connected to the secondary circuit of another transformer, T^1, called an *auxiliary transformer*, having its primary terminals connected to those of the transformer under test. In the latter case one or more incandescent lamps, L, may be connected in series with the shunt coil of the wattmeter so as to regulate the current passing through it. The current through the series coil of the wattmeter is then the same as the current through the primary circuit of the transformer under test, and the current through the shunt coil of the wattmeter is in step with, and proportional to, the primary voltage of the transformer. Hence the wattmeter reading is proportional to the mean power given up to the transformer. The wattmeter can be standardized and its scale reading interpreted by replacing the transformer under test by a non-inductive resistance or series of lamps, the power absorption of which is measured by the product of the amperes and volts supplied to it. In the secondary circuit of the transformer is placed another wattmeter of a similar kind, or, if the load on the secondary circuit is non-inductive, the secondary voltage and the secondary current can be measured with a proper alternating current ammeter, A_2, and voltmeter, V_2, and the product of these readings taken as a measure of the power given out by the transformer. The ratio of the powers, namely, that given out in the external secondary circuit and that taken in by the primary circuit, is the efficiency of the transformer.

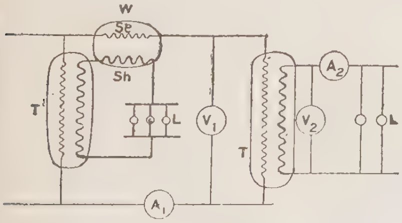

FIG. 5.—Arrangement for Testing Transformers.

In testing large transformers, when it is inconvenient to load up the secondary circuit to the full load, a close approximation to the power taken up at any assumed secondary load can be obtained by adding to the value of this secondary load, measured in watts, the iron core loss of the transformer, measured at no load, and the copper losses calculated from the measured copper resistances when the transformer is hot. Thus, if C is the iron core loss in watts, measured on open secondary circuit, that is to say, is the power given to the transformer at normal frequency and primary voltage, and if R_1 and R_2 are the primary and secondary circuit resistances when the transformer has the temperature it would have after running at full load for two or three hours, then the efficiency can be calculated as follows: Let O be the nominal value of the full secondary output of the transformer in watts, V_1 and V_2 the terminal voltages on the primary and secondary side, N_1 and N_2 the number of turns, and A_1 and A_2 the currents for the two circuits; then O/V_2 is the full load secondary current measured in amperes, and N_2N_1 multiplied by O/V_2 is to a sufficient approximation the value of the corresponding primary current. Hence O^2R_2/V_2^2 is the watts lost in the secondary circuit due to copper resistance, and $O^2R_1N_2^2/V_2^2N_1^2$ is the corresponding loss in the primary circuit. Hence the total power loss in the transformer (=L) is such that

$$L = C + \frac{O^2}{V_2^2}R_2 + \left(\frac{N_2}{N_1}\right)^2 \frac{O^2}{V_2^2}R_1 = C + (R_2 + R_1a^2)O^2/V_2^2.$$

Therefore the power given up to the transformer is O+L, and the efficiency is the fraction O/(O+L) expressed as a percentage. In this manner the efficiency can be determined with a considerable degree of accuracy in the case of large transformers without actually loading up the secondary circuit. The secondary drop, however, can only be measured by loading the transformer up to full load, and, while the primary voltage is kept constant, measuring the potential difference of the secondary terminals, and comparing it with the same difference when the transformer is not loaded. Another method of testing large transformers at full load without supplying the actual power is by W. E. Sumpner's differential method, which can be done when two equal transformers are available (see Fleming, *Handbook for the Electrical Laboratory and Testing Room*, ii. 602).

Ageing.

No test of a transformer is complete which does not comprise some investigation of the "ageing" of the core. The slow changes which take place in the hysteretic quality of iron when heated, in the case of certain brands, give rise to a time-increase in iron core loss. Hence a transformer which has a core loss, say, of 300 watts when new, may, unless the iron is well chosen, have its core loss increased from 50 to 300% by a few months' use. In some cases specifications for transformers include fines and deductions from price for any such increase; but there has in this respect been great improvement in the manufacture of iron for magnetic purposes, and makers are now able to obtain supplies of good magnetic iron or steel with non-ageing qualities. It is always desirable, however, that in the case of large sub-station transformers tests should be made at intervals to discover whether the core loss has increased by ageing. If so, it may mean a very considerable increase in the cost of magnetizing power. Consider the case of a 30-kilowatt transformer connected to the mains all the year round; the normal core loss of such a transformer should be about 300 watts, and therefore, since there are 8760 hours in the year, the total annual energy dissipated in the core should be 2628 kilowatt hours. Reckoning the value of this electric energy at only one penny per unit, the core loss costs £10, 19s. per annum. If the core loss becomes doubled, it means an additional annual expenditure of nearly £11. Since the cost of such a transformer would not exceed £100, it follows that it would be economical to replace it by a new one rather than continue to work it at its enhanced core loss.

In Great Britain the sheet steel or iron alloy used for the transformer cores is usually furnished to specifications which state the maximum hysteresis loss to be allowed in it in watts per ℔ (avoirdupois) at a frequency of 50, and at a maximum flux-density during the cycle of 4000 C.G.S. units. When plates having a thickness t mils are made up into a transformer core, the total energy loss in the core due to hysteresis and eddy current loss when worked at a frequency n and a maximum flux-density during the cycle B is given by the empirical formulae

$$T = \cdot 0032nB^{1\cdot 55}10^{-7} + (tnB)^2 10^{-16},$$

or

$$T^1 = 0\cdot 88nB_1{}^{1\cdot 55}10^{-9} + 1\cdot 4(t_1nB_1)^2 10^{-10},$$

where T stands for the loss per cubic centimetre, and T_1 for the same in watts per pound of iron core, B for the maximum flux-density in lines per square centimetre, and B_1 for the same in lines per square inch, t for the thickness of the plates in thousandths of an inch (mils), and t_1 for the same in inches. The hysteresis loss varies as some power near to 1·6 of the maximum flux-density during the cycle as shown by Steinmetz (see ELECTROMAGNETISM). Since the hysteresis loss varies as the 1·6th power of the maximum flux-density during the cycle (B max.), the advantages of a low flux-density are evident. An excessively low flux-density increases, however, the cost of the core and the copper by increasing the size of the transformer. If the form factor (f) of the primary voltage curve is known, then the maximum value of the flux-density in the core can always be calculated from the formula $B = E_1/4fnSN_1$, where E is the R.M.S. value of the primary voltage, N_1 the primary turns, S the section of the core, and n the frequency.

Curve Tracing.

The study of the processes taking place in the core and circuits of a transformer have been greatly facilitated in recent years by the improvements made in methods of observing and recording the variation of periodic currents and electromotive forces. The original method, due to Joubert, was greatly improved and employed by Ryan, Bell, Duncan and Hutchinson, Fleming, Hopkinson and Rosa, Callendar and Lyle; but the most important improvement was the introduction and invention of the oscillograph by Blondel, subsequently improved by Duddell, and also of the ondograph of Hospitalier (see OSCILLOGRAPH). This instrument enables us, as it were, to look inside a transformer, for which it, in fact, performs the same function that a steam engine indicator does for the steam cylinder.[1] Delineating in this way the curves of primary and secondary current and primary and secondary electromotive forces, we get the following result: Whatever may be the form of the curve of primary terminal potential difference, or primary voltage, that of the secondary voltage or terminal potential difference is an almost exact copy, but displaced 180° in phase. Hence the alternating current transformer reproduces on its secondary terminals all the variations of potential on the primary, but changed in scale. The curve of primary current when the transformer is an open secondary circuit is different in form and phase, lagging behind the primary voltage curve (fig. 6); but if the transformer is loaded up on its secondary side, then the primary current curve comes more into step with the primary voltage curve. The secondary current curve, if the secondary load is non-inductive, is in step with the secondary voltage curve (fig. 7). These transformer diagrams yield much information as to the nature of the operations proceeding in the transformer.

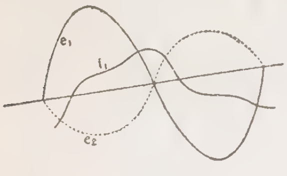

FIG. 6.—Transformer Curves at no load.

e_1, Primary voltage curve; i_1, Primary current curve; e_2, Secondary voltage curve.

The form of the curve of primary current at no secondary load is a consequence of the hysteresis of the iron, combined with the fact that the form of the core flux-density curves of the transformer is always not far removed from a simple sine curve. If e_1 is at any moment the electromotive force, i_1 the current on the primary circuit, and b_1 is the flux-density in the core, then we have the fundamental relation $e_1 = R_1i_1 + SN_1\ db_1/dt$, where R_1 is the resistance of the primary, and N_1 the number of turns, and S is the cross-section of the core. In all modern closed circuit transformers the quantity R_1i_1 is very small compared with the quantity $SNdb/dt$ except at one instant during the phase, and in taking the integral of the above equation, viz. in finding the value of $\int e_1dt$, the integral of the first term on the right-hand side may be neglected in comparison with the second. Hence we have approximately $b_1 = (SN_1)^{-1}\int e_1dt$. In other words, the value of the flux-density in the core is obtained by integrating the area of the primary voltage curve. In so doing the integration must be started from the time point through which passes the ordinate bisecting the area of the primary voltage curve. When any curve is formed such that its ordinate y is the integral of the area of another curve, viz. $y = \int y^1dx$, the first curve is always smoother and more regular in form than the second. Hence the process above described when applied to a complex periodic curve, which can by Fourier's theorem be resolved into a series of simple periodic curves, results in a relative reduction of the magnitude of the higher harmonics compared with the fundamental term, and hence a wiping out of the minor irregularities of the curve. In actual practice the curve of electromotive force of alternators can be quite sufficiently reproduced by employing three terms of the expansion, viz. the first three odd harmonics, and the resulting flux-density curve is always very nearly a simple sine curve.

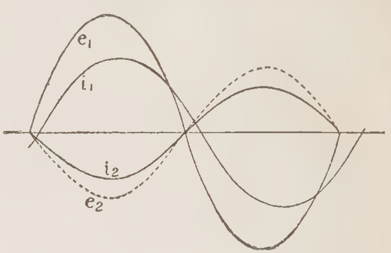

FIG. 7.—Transformer Curves at full load.

e_1, Primary voltage curve; i_1, Primary current curve; e_2, Secondary voltage curve; i_2, Secondary current curve.

We have then the following rules for predetermining the form of the current curve of the transformer at no load, assuming that the hysteresis curve of the iron is given, set out in terms of flux-density and ampere-turns per centimetre, and also the form of the curve of primary electromotive force. Let the time base line be divided up into equal small elements. Through any selected point draw a line perpendicular to the base line. Bisect the area enclosed by the curve representing the half wave of primary electromotive force and the base line by another perpendicular. Integrate the area enclosed between the electromotive force curve and these two perpendicular lines and the base. Lastly, set up a length on the last perpendicular equal to the value of this area divided by the product of the cross-section of the core and the number of primary turns. The resulting value will be the core flux-density b at the phase instant corresponding. Look out on the hysteresis loop the same flux-density value, and corresponding to it will be found two values of the magnetizing force in ampere-turns per centimetre, one the value for increasing flux-density and one for decreasing. An inspection of the position of the point of time selected on the time line will at once show which of these to select. Divide that value of the ampere-turns per centimetre by the product of the values of the primary turns and the mean length of the magnetic circuit of the core of the transformer, and the result gives the value of the primary current of the transformer. This can be set up to scale on the perpendicular through the time instant selected. Hence, given the form of the primary electromotive force curve and that of the hysteresis loop of the iron, we can draw the curves representing the changes of flux-density in the core and that of the corresponding primary current, and thus predict the root-mean-square value of the magnetizing current of the transformer. It is therefore possible, when given the primary electromotive force curve and the hysteresis curve of the iron, to predetermine the curves depicting all the other variables of the transformer, provided that the magnetic leakage is negligible.

Elementary Theory.

The elementary theory of the closed iron circuit transformer may be stated as follows: Let N_1, N_2 be the turns on the primary and secondary circuits, R_1 and R_2 the resistances, S the section of the core, and b_1 and b_2 the co-instantaneous values of the flux-density just inside the primary and secondary windings. Then, if i_1 and i_2 and e_1 and e_2 are the primary and secondary currents and potential differences at the same instant, these quantities are connected by the equations

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[1] For a useful list of references to published papers on alternating current curve tracing, see a paper by W. D. B. Duddell, read before the British Association, Toronto, 1897; also *Electrician* (1897), xxxix. 636; also *Handbook for the Electrical Laboratory and Testing Room* (J. A. Fleming), i. 407.

$$e_1 = R_1 i_1 + SN_1 \frac{db_1}{dt}, \quad e_2 = SN_2 \frac{db_2}{dt} - R_2 i_2.$$

Hence, if $b_1 = b_2$, and if $R_1 i_1$ is negligible in comparison with $SN_1 db/dt$, and $i = 0$, that is, if the secondary circuit is open, then $e_1/e_2 = N_1/N_2$, or the transformation ratio is simply the ratio of the windings. This, however, is not the case if b_1 and b_2 have not the same value; in other words, if there is magnetic leakage. If the magnetic leakage can be neglected, then the resultant magnetizing force, and therefore the iron core loss, is constant at all loads. Accordingly, the relation between the primary current (i_1), the secondary current (i_2), and the magnetizing current (i), or primary current at no load, is given by the equation $N_1 i_1 - N_2 i_2 = N_1 i$. Then, writing b for the instantaneous value of the flux-density in the core, everywhere supposed to be the same, we arrive at the identity

$$e_1 i_1 = e_2 i_2 + (R_1 i_1^2 + R_2 i^2) + S\frac{db}{dt}(N_1 i_1 - N_2 i_2).$$

This equation merely expresses the fact that the power put into the transformer at any instant is equal to the power given out on the secondary side together with the power dissipated by the copper losses and the constant iron core loss.

The efficiency of a transformer at any load is the ratio of the mean value, during the period, of the product $e_1 i_1$ to that of the product $e_2 i_2$. The efficiency of an alternating current transformer is a function of the form of the primary electromotive force curve. Experiment has shown[1] that if a transformer is tested for efficiency on various alternators having electromotive force curves of different forms, the efficiency values found at the same secondary load are not identical, those being highest which belong to the alternator with the most peaked curve of electromotive force, that is, the curve having the largest *form factor*. This is a consequence of the fact that the hysteresis loss in the iron depends upon the manner in which the magnetization (or what here comes to the same thing, the flux-density in the core) is allowed to change. If the primary electromotive force curve has the form of a high peak, or runs up suddenly to a large maximum value, the flux-density curve will be more square-shouldered than when the voltage curve has a lower form factor. The hysteresis loss in the iron is less when the magnetization changes its sign somewhat suddenly than when it does so more gradually. In other words, a diminution in the form factor of the core flux-density curve implies a diminished hysteresis loss. The variation in core loss in transformers when tested on various forms of commercial alternator may amount to as much as 10%. Hence, in recording the results of efficiency tests of alternating current transformers, it is always necessary to specify the form of the curve of primary electromotive force. The power factor of the transformer or ratio of the true power absorption at no load, to the product of the R.M.S. values of the primary current and voltage, and also the secondary drop of the transformer, vary with the form factor of the primary voltage curve, being also both increased by increasing the form factor. Hence there is a slight advantage in working alternating current transformers off an alternator giving a rather peaked or high maximum value electromotive force curve. This, however is disadvantageous in other ways, as it puts a greater strain upon the insulation of the transformer and cables. At one time a controversy arose as to the relative merits of closed and open magnetic circuit transformers. It was, however, shown by tests made by Fleming and by Ayrton on Swinburne's "Hedgehog" transformers, having a straight core of iron wires bristling out at each end, that for equal secondary outputs, as regards efficiency, open as compared with closed magnetic circuit transformers had no advantage, whilst, owing to the smaller power factor and consequent large R.M.S. value of the magnetizing current, the former type had many disadvantages (see Fleming, "Experimental Researches on Alternate Current Transformers," *Journ. Inst. Elec. Eng.*, 1892).

Magnetic Leakage.

The discussion of the theory of the transformer is not quite so simple when magnetic leakage is taken into account. In all cases a certain proportion of the magnetic flux linked with the primary circuit is not linked with the secondary circuit, and the difference is called the magnetic leakage. This magnetic leakage constitutes a wasted flux which is non-effective in producing secondary electromotive force. It increases with the secondary current, and can be delineated by a curve on the transformer diagram in the following manner. The curves of primary and secondary electromotive force, or terminal potential difference and current, are determined experimentally, and then two curves are plotted on the same diagram which represent the variation of $(e_1 - R_1 i_1)/N_1$ and $(e_2 + R_2 i_2)/N_2$; these will represent the time differentials of the total magnetic fluxes Sb_1 and Sb_2 linked respectively with the primary and secondary circuits. The above curves are then progressively integrated, starting from the time point through which passes the ordinate bisecting the area of each half wave, and the resulting curves plotted to express by their ordinates Sb_1 and Sb_2. A curve is then plotted whose ordinates are the differences $Sb_1 - Sb_2$, and this is the curve of magnetic leakage.

The existence of magnetic leakage can be proved experimentally by a method due to Mordey, by placing a pair of thermometers, one of mercury and the other of alcohol, in the centre of the core aperture. If there is a magnetic leakage, the mercury bulb is heated not only by radiant heat, but by eddy currents set up in the mercury, and its rise is therefore greater than that of the alcohol thermometer. The leakage is also determined by observing the secondary voltage drop between full load and no load, and deducting from it the part due to copper resistance; the remainder is the drop due to leakage. Thus if V_2 is the secondary voltage on open circuit, and V_2^1 that when a current A_2 is taken out of the transformer, the leakage drop v is given by the equation

$$v = (V_2 - V_2^1) - \{R_2 A_2 + R_1 A_2 (N_2/N_1)^2\}.$$

The term in the large bracket expresses the drop in secondary voltage due to the copper resistance of the primary and secondary circuits.

In drawing up a specification for an alternating current transformer, it is necessary to specify that the maximum secondary drop between full and no load to be allowed shall not exceed a certain value, say 2% of the no-load secondary voltage; also that the iron core loss as a percentage of the full secondary output shall not exceed a value, say, of 1% after six months' normal work.

Transformer Design.

In the design of large transformers one of the chief points for attention is the arrangement for dissipating the heat generated in their mass by the copper and iron losses. For every watt expended in the core and circuit, a surface of 3 to 4 sq. in. must be allowed, so that the heat may be dissipated. In large transformers it is usual to employ some means of producing a current of air through the core to ventilate it. In these, called *air-blast transformers*, apertures are left in the core by means of which the cooling air can reach the interior portions. This air is driven through the core by a fan actuated by an alternating current motor, which does not, however, take up power to a greater extent than about ¼ or $\frac{1}{10}$% of the full output of the transformer, and well repays the outlay.

In some cases transformers are *oil-insulated*, that is to say, included in a cast-iron box which is filled in with a heavy insulating oil. For this purpose an oil must be selected free from mineral acids and water: it should be heated to a high temperature before use, and tested for dielectric strength by observing the voltage required to create a spark between metal balls immersed in it at a distance of 1 millimetre apart. Oils, however, are inferior in dielectric strength or spark-resisting power to solid dielectrics, such as micanite, ebonite, &c., as shown by the above table of dielectric strengths (see T. Gray, *Phys. Rev.*, 1898, p. 199).

Material.	Dielectric strength in kilowatts per centimetre.	Material.	Dielectric strength in kilowatts per centimetre.
Glass	285	Lubricating oil . .	83
Ebonite	538	Linseed oil . . .	67
Indiarubber . . .	492	Cotton-seed oil . .	57
Mica	2000	Air film ·02 cm. thick	27
Micanite	4000	Air film 1·6 cm. thick	48
American linen paper paraffined . . .	540		

Polyphase Transformers are appliances of similar construction to the single-phase transformers already described, but modified so as to enable them to transform two or more phase-related primary alternating currents into similar secondary currents. Thus, a three-phase transformer may be constructed with a core, as shown in fig. 8. Each core leg is surrounded with a primary coil, and these are joined up either in star or delta fashion, and connected to the three or four line wires. The secondary circuits are then connected in a similar fashion to three or four secondary lines. In the case of two-phase transmission with two separate pairs of leads, single-phase transformers may be

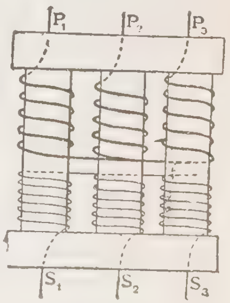

FIG. 8.—Brush Three-phase Transformer.

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[1] See Dr G. Roessler, *Electrician* (1895), xxxvi. 150; Beeton, Taylor and Barr, *Journ. Inst. Elec. Eng.* xxv. 474; also J. A. Fleming, *Electrician* (1894), xxxiii. 580.

employed in each branch, but with two-phase three-wire supply, two-phase transformers must be supplied.

Phase Transformers are arrangements of static or rotary transformers intended to transform single-phase alternating currents into polyphase currents. An important system of phase transformation has been described by C. F. Scott.[1] It is known that if two alternating electromotive forces differing in phase are connected in series, the resulting electromotive force will in general differ in phase and value from either of the components. Thus, if two alternating electromotive forces differing 90° in phase, and having magnitudes in the ratio of $1:\sqrt{3}$, are connected in series, the resulting electromotive force will have a magnitude represented by 2, and the three can be represented by the sides of a triangle which is half an equilateral triangle. If then a two-phase alternator, D (fig. 9), provides two-phase currents, and if the two circuits are connected, as shown, to a pair of single-phase transformers, T_1 and T_2, we can obtain three-phase alternating currents from the arrangement. The primaries of both transformers are the same. The secondary circuit of one transformer, T_2, has, say, 100 turns, and a connexion is made to its middle point O, and this is connected to the secondary of the other transformer which has 87 $(=50\sqrt{3})$ turns. From the points A, B, C we can then tap off three-phase alternating currents. The advantages of the Scott system are that we can transform two-phase alternating currents into three-phase for transmission, and then by a similar arrangement retransform back again into two-phase for use. In this manner an economy of 25% in copper is effected, for instead of four transmission lines we have only three. The system adapts itself for the transmission of currents both for power in driving three-phase motors and for working incandescent lamps. A somewhat similar system has been designed by C. P. Steinmetz for producing three-phase currents from single-phase (see *Electrician*, xliii. 236). When a number of alternating electromotive forces are maintained in a closed circuit, the sum of all must be zero, and may be represented by the sides of a closed polygon. The fundamental principle of Mr Steinmetz's invention consists in so choosing the number of these electromotive forces that the polygon must remain stable. Thus, if three single-phase alternators are driven independently at constant speed and excitation, and if they are joined in series, then three wires led away from the junction points will provide three-phase currents to a system from which lamps and motors may be worked.

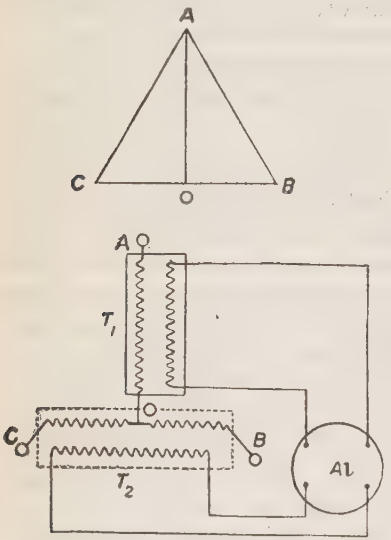

FIG. 9.—Scott's Arrangement for Transformation of Two-phase to Three-phase Currents.

Continuous Current Transformers.

Reference must be made to the continuous current transformer. The conversion of a continuous current supplied, say, at 100 volts, into one having an electromotive force of 10 volts, can of course be achieved by coupling together on the same bedplate a suitable electric motor and a dynamo. The combination is called a *motor-dynamo set*, and each machine preserves its own identity and peculiarity. The same result may, however, be accomplished by winding two separate armature circuits on one iron core, and furnishing each with its own commutator. The two circuits are interlaced or wound on together. An arrangement of this kind constitutes a *rotatory* or *rotary transformer*, or continuous current transformer. It has the advantage of greater cheapness and efficiency, because one field magnet serves for both armature windings, and there is only one armature core and one pair of bearings; moreover, no shift or lead of the brushes is required at various loads. The armature reactions of the two circuits annul each other. Machines of this description are self-starting, and can be constructed to take in primary current at high pressures, say 1000 to 2000 volts, and yield another larger current of much lower voltage, say 100 or 150 volts, for use with electric lamps. They are used in connexion with public electric supply by continuous current in many places.

Another important class of rotatory transformer is that also called a *rotatory converter*, by means of which continuous current is translated into alternating current of one-, two- or three-phase, or vice versa. The action of such an appliance may best be understood by considering the simple case of a Gramme ring armature (see DYNAMO) having, in addition to its commutator, a pair of insulated rings on its shaft connected with opposite ends of the armature winding (fig. 10). If such a ring is placed in a bipole field magnet, and if a pair of brushes make contact with the commutator C and another pair with the two rings called slip rings, S_1 S_2, and if continuous current at a constant voltage is supplied to the commutator side, then the armature will begin to revolve in the field, and from the brushes in contact with the slip rings we can draw off an alternating current. This reaches its maximum value when the points of contact of the rings with the armature circuit pass the axis of commutation, or line at right angles to the direction of the magnetic field, for it has at this moment a value which is double the steady value of the continuous current being poured into the armature. The maximum value of the electromotive force creating this alternating current is nearly equal to the electromotive force on the continuous current side. Hence if A is the maximum value of the continuous current put into the armature and V is the value of the brush potential difference on the continuous current side, then 2A is the maximum value of the outcoming alternating current and V is the maximum value of its voltage. Hence $2AV/2 = AV$ is the maximum value of the outcoming alternating current power, and if we neglect the loss in the armature for the moment, the power given out is equal to the power put in. Hence, assuming a simple harmonic law of variation, the effective value of the alternating current voltage is $V/\sqrt{2}$, and that of the alternating current is $2A\sqrt{2}$. This conclusion follows at once from the fact that the mean value of the square of a sine function is half its maximum value, and hence the R.M.S. value is $1/\sqrt{2}$ times the maximum value. The outcoming alternating current has its zero value at the instant when the ends of the diameter of the axis to which the rings are connected are in the direction of the magnetic field of the transformer. Hence the power output on the alternating current side varies from a maximum value AV to zero. The rotatory transformer thus absorbs continuous current power and emits it in a periodic form; accordingly, there is a continual storage and emission of energy by the armature, and therefore its kinetic energy is periodically varying during the phase. The armature is also creating a back-electromotive force which acts at some instants against the voltage driving the current into the armature and at others is creating an electromotive force that assists the external impressed voltage in driving a current through the alternating current side. If we put on another pair of insulated rings and connect them to points of the insulated diameter at right angles to the points of connexion of the first pair of rings, we can draw off another alternating current, the phase of which differs 90° from that of the first. Similarly, if we provide three rings connected to points removed 120° apart on the armature circuit, we can tap off a three-phase alternating current.

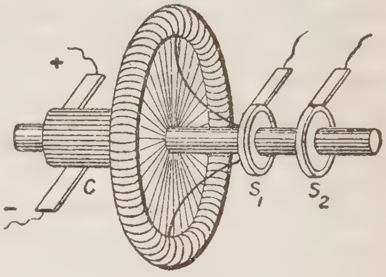

FIG. 10.—Rotary Converter, continuous to two-phase.

Returning to the case of the single-phase rotatory transformer, we may notice that at the instant when the outcoming alternating current is zero the armature is wholly engaged in absorbing power and is acting entirely as a motor. When the alternating current is a maximum, the armature on the other hand is acting as a generator and adds current to the current put into it. The ratio between the potential difference of the brushes on the continuous current side and the root-mean-square or effective value of the voltage between any pair of rings on the alternating current side is called the transformation ratio of the converter.

The following table, taken from a paper upon rotatory converters by S. P. Thompson (*Proc. Inst. Elec. Eng.*, November 1898), gives the voltage ratio or conversion ratio in the case of various forms of rotatory transformer:—

Number of slip rings.	Angle between points of connexions to armatures.	Type of current generated.	Voltage ratio.	Effective voltage on alternating current side as percentage of voltage on continuous current side.
2	180°	Single-phase	$\sqrt{2}:1$	70·71
3	120°	Three-phase	$2\sqrt{2}:\sqrt{3}$	61·23
4	90°	Two-phase	$\sqrt{2}:1$	70·71
4	90°	Four-phase	$2:1$	50
6	60°	Three-phase	$3\sqrt{3}:\sqrt{3}$	61·23
6	60°	Six-phase	$2\sqrt{2}:1$	35·35

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[1] *Proceedings of the National Electric Light Association* (Washington, U.S.A., 1894); also *Electrician* (1894), xxxii. 640.

Neglecting the energy losses in the armature, and assuming that the continuous current side of the transformer is supplied with 100 amperes, the following table, also taken from a paper by S. P. Thompson, shows the effective value of the current on the alternating side put out into each line:—

Number of slip rings.	Angle between points of connexion to armature.	Type of current generated.	Effective current put out on each line in amperes.
2	180°	Single-phase	141·4
3	120°	Three-phase	94·3
4	90°	Two-phase	70·7
6	60°	Six-phase	47·2

It is obvious that the same results of conversion can be obtained by coupling together two separate machines on the same shaft; thus we might obtain a single-phase alternating current from a continuous current by coupling together mechanically a continuous current motor and a single-phase alternator. Such a combination is generally called a *motor-dynamo*. In this case there are two field magnets and two separate armatures, and the hysteresis eddy current and copper losses are all in duplicate. If, however, the same armature winding is made to serve both purposes, the resulting machine is called a *rotatory* or *rotary converter*. In the former combination the brushes of the continuous current part require to be set with the usual lead or lag according as that part is generator or motor, but in the latter the armature reactions nearly annul each other, and lead or lag is no longer necessary.

Rectifiers.

Rectifiers are devices for transforming an alternating (generally single-phase) current into a continuous but pulsatory current. They may shortly be described as appliances for separating out each alternate current flux in an alternating current. An immense number of more or less imperfect methods of doing this have been proposed, and here we shall describe two which may be called respectively the mechanical and the electrolytic methods. Of the first class a good example is the Ferranti rectifier (fig. 11). This consists of a synchronous alternating current motor which is started up and driven in step with the alternator supplying the current. The motor drives a commutator of insulated segments, each alternate egment being connected to two insulated rings, against which press a pair of brushes. Another pair of brushes, so adjusted as to be in contact simultaneously with a pair of adjacent commutator segments, are in connexion with the alternator supplying the current to be commutated. The insulated rings are in connexion with the external circuit. It will easily be seen that when the commutator revolves at proper speed the currents delivered from the insulated rings are unidirectional. The Ferranti rectifier is much employed for rectifying alternating current for arc lighting purposes. With this object it is associated with a constant current transformer which converts alternating current supplied at constant potential to one supplied at constant current. This is achieved by taking advantage of the repulsive force existing between the primary and secondary circuits of a transformer. These are wound separately, and so balanced that any increase in the current presses them away from each other and so reduces the secondary current to normal value. Such an appliance is useful for rectifying currents up to 10 or 15 amperes.

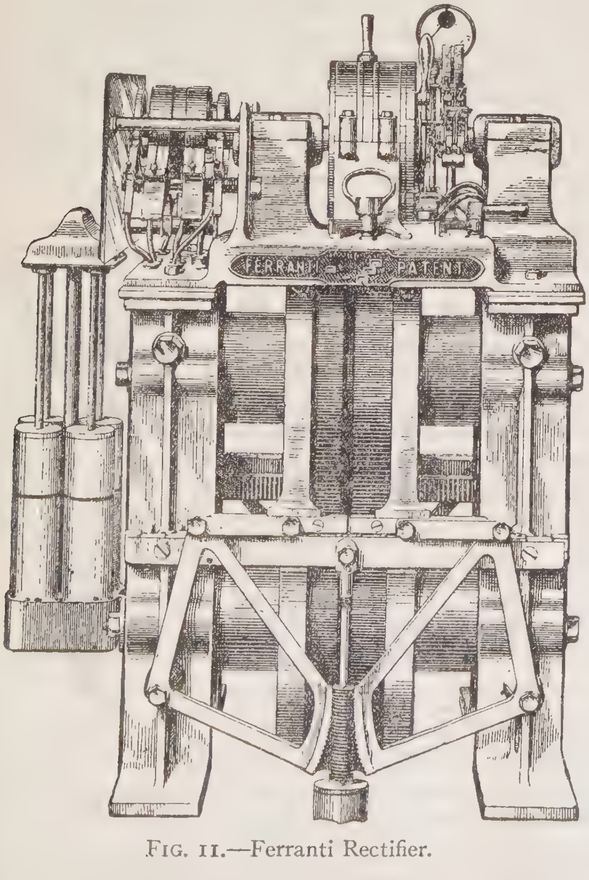


FIG. 11.—Ferranti Rectifier.

The electrolytic rectifier is based upon the fact that if plates of aluminium and carbon are placed in an electrolyte, say a solution of alum or dilute acids which yield oxygen on electrolysis, it is found that a current can be sent through the liquid from the carbon to the aluminium, but that great counter-electromotive force is created to a current in the opposite direction. Grätz and Pollak (*Elektrotechnische Zeitschrift*, 1897, 25, p. 359), taking advantage of this fact, have constructed a rectifying arrangement by arranging two series of carbon aluminium (CAl) cells with alum or hydro-potassic phosphate solution as electrolyte. In one set the order of the plates is (CAl), (CAl), &c., and in the other series (AlC), (AlC), counting from the same end. These series being connected in parallel, it follows that if an alternating current is sent through the parallel series all the currents in one direction pass through one battery and all those in the opposite direction through the other. Thus the constituents of the alternating current are separated out. By using very large cells so as to reduce the internal resistance, an efficiency of 95% is said to be obtained.

Theory of Electrolytic Rectifier.

There are many points in the operation of the electrolytic rectifier which have as yet been imperfectly explained. The action of the aluminium electrolytic rectifier, consisting as it does of an aluminium plate and a lead or carbon plate placed in an aqueous electrolyte, is to oppose a great obstruction to a current passing out of the aluminium plate, but little or no obstruction to the current passing into the aluminium plate, especially if the aluminium has been subjected to a previous treatment called *formation*. This unilateral conductivity is dependent on a certain voltage or potential difference between the plates not being exceeded, but within these limits a plate of carbon and aluminium placed in a solution, say of hydro-sodic phosphate, acts as an electrical *valve*, allowing current to pass in one direction but not in another. An examination of the aluminium plate after it has been so used shows that its appearance has changed and that its surface is covered by a thin film, the thickness of which varies with the electrolyte and the time of formation. After a certain period of use this film is seen as a grey, dull coating traversed by dark lines. It is impossible that the unilateral conductivity can be due to a true electrolytic polarization, because we know of no polarization of this latter kind which exceeds three volts, and the film can be made to resist the flow of a current under an electromotive force of 140 to 200 volts. The resistance of this film has been measured and found to be very high, so high as to be practically an insulation. Light was thrown upon the subject by F. Kohlrausch's discovery of the polarization capacity of metallic electrodes, and this discovery was applied to develop the theory of the aluminium cell by Streintz (1888), Scott (1899) and others.

This theory was expounded by K. Norden (*Electrician*, xlviii. 107). According to this view, the deposit covering the aluminium electrode forms the dielectric of a condenser. One plate of the condenser is formed by the aluminium plate and the other by an opposite layer of electrically-charged ions in the electrolyte. The dielectric film on the aluminium having been formed, the electromotive force of the circuit then charges the resulting condenser to the value of its own voltage, but immediately the impressed electromotive force is removed this condenser discharges itself. This condenser theory receives support from the behaviour of the aluminium cell when placed in the circuit of an alternating current dynamo, for it is found that in these circumstances the current through the cell is in advance in phase of the difference of potential. The question then arises, What is the nature of this insulating film? The first discoverer of the phenomenon (Buff) considered it to consist of silicon. Later Professor Beetz disproved this by experiment, and, with many others, assumed that a sub-oxide of aluminium was formed; but this has never been demonstrated in a satisfactory manner. By forming a sufficient quantity of the film Dr K. Norden was able to obtain sufficient of the material to make a chemical analysis, and this revealed the fact that it consists of normal aluminium hydroxide, $Al_2(OH)_6$.

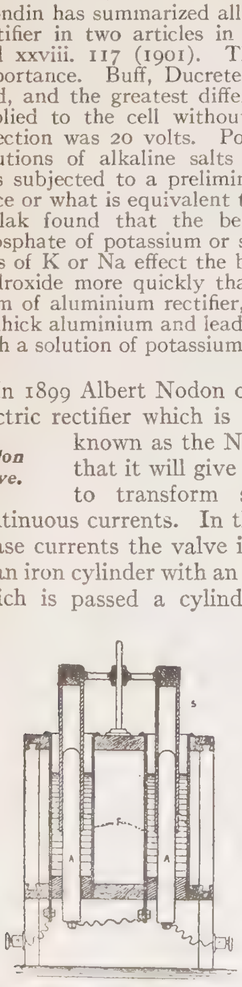
According to the facts above stated, one wave of the alternating current produces the insulating film by converting the surface of the aluminium into hydroxide, practically, therefore, blocking its own path very quickly by the creation of this film. If, then, the electromotive force reverses its direction the current immediately flows. According to Dr Norden, the rapid removal of the insulating film is due to the action of the electrolyte corroding or dissolving the weak points in the coating and thus breaking down its insulating power. The insulating film is therefore a conductor in one direction, but when the current is reversed and flows out of the aluminium plate the insulating film is renewed and is continually being repaired and kept in order. Thus different electrolytes yield aluminium valves having very different efficiencies.

Rectifying cells have been made by Pollak which will bear a voltage of over 140 volts, and which are said to have an efficiency of 75 %. The plates, however, must be removed when not in use, otherwise the film of hydroxide is destroyed by the electrolyte. One great practical difficulty in connexion with the aluminium rectifier is the tendency to heat in working.

The historical development of the discovery of this unilateral conductivity of an electrolytic cell with an aluminium electrode is as follows. The effect was first noticed by Buff in 1857, but was not applied technically until 1874, when Ducretet employed it in telegraphy. Beret in 1877 and Streintz in 1887 discussed the theory of the cell and sought for an explanation. In 1891 Hutin and Leblanc, in their study of alternating current, showed its uses in rectifying an alternating current. Pollak and Grätz laboured to give it a practically useful form. Pollak took out patents in 1895, and made a communication to the Academy of Sciences in Paris in June 1897; and Grätz presented a memoir at a meeting of the German Association of Electrochemists in Munich in 1897. M. Blondin has summarized all the work so far done on the aluminium rectifier in two articles in *L'Éclairage électrique* (1898), xiv. 293, and xxviii. 117 (1901). The choice of an electrolyte is of great importance. Buff, Ducretet and Grätz employed dilute sulphuric acid, and the greatest difference of potential which could then be applied to the cell without breaking down its insulation in one direction was 20 volts. Pollak in 1896 found that when aqueous solutions of alkaline salts were used, and when the aluminium was subjected to a preliminary formation, the back electromotive force or what is equivalent to it could be raised to 140 or 200 volts. Pollak found that the best results were given by the use of phosphate of potassium or sodium. It appears, therefore, that the ions of K or Na effect the breaking down of the film of aluminium hydroxide more quickly than the ion of hydrogen. The practical form of aluminium rectifier, according to Pollak, consists of plates of thick aluminium and lead placed in a large deep glass vessel filled with a solution of potassium hydrogen phosphate.

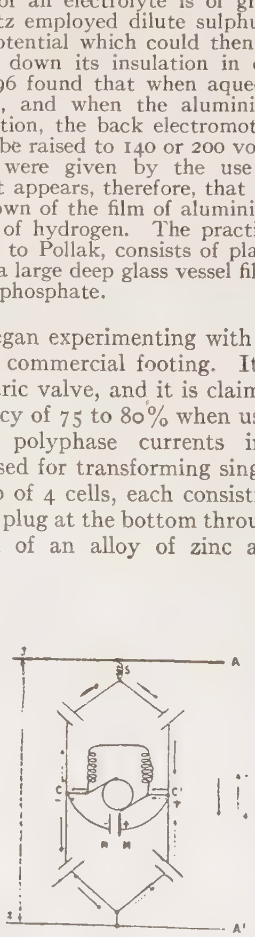
Nodon Valve.

In 1899 Albert Nodon of Paris began experimenting with an electric rectifier which is now on a commercial footing. It is known as the Nodon electric valve, and it is claimed that it will give an efficiency of 75 to 80% when used to transform single or polyphase currents into continuous currents. In the form used for transforming single-phase currents the valve is made up of 4 cells, each consisting of an iron cylinder with an insulating plug at the bottom through which is passed a cylinder formed of an alloy of zinc and aluminium. This cylinder is concentric with the iron tube and provided with a terminal at the lower end. The cell is filled with a saturated solution of ammonium phosphate, and a non-conducting shielding tube can be slid over the aluminium electrode to alter the exposed area.



(From the *Electrical Times*, by permission.)

FIG. 12.—Section through Nodon Valve.



(From the *Electrical Times*, by permission.)

FIG. 13.—Method of connecting the cells.

The valve is shown in section in fig. 12, and the 4 cells are arranged in a Wheatstone's Bridge fashion, as shown in fig. 13. A and A^1 are the terminals to which the alternating current is supplied, C and C^1 the terminals from which the continuous current is drawn off. The electrolytic actions which take place in the cells are as follows: When the alternating current passes in the positive direction from the zinc-aluminium cylinder to the iron cylinder there is formed instantly on the former a film of aluminium hydroxide; this film, presenting an enormous resistance, opposes the passage of the current. On the other hand, if the current passes in the opposite direction the film is reduced instantly and the current now flows. When used with polyphase currents the valve comprises as many times two cells as there are wires in the distribution. The cells must stand a pressure varying from 50 to 140 volts, and for higher pressures two or more valves in series are employed.

Vacuum or Vapour Rectifiers.

The aluminium-iron electrolytic rectifier is not suitable for the rectification of very high frequency currents, because the chemical actions on which it depends involve a time element. It was, however, discovered by J. A. Fleming that an oscillation valve could be constructed for rectifying electrical oscillations, as follows (see *Proc. Roy. Soc. Lond.*, 1905, 74, p. 476): In a glass bulb similar to that of an incandescent lamp a carbon filament is fixed. Around the carbon filament, but not touching it, is placed a cylinder of nickel connected to an external terminal by means of platinum wire sealed through the glass. If the carbon filament is made incandescent by an insulated battery (and for this purpose it is convenient to have the filament adjusted to be fully incandescent at a pressure of about 12 volts), then the space between the incandescent filament and the embracing cylinder possesses a unilateral conductivity such that negative electricity can pass from the incandescent filament to the cylinder but not in the opposite direction. Hence if the negative terminal of the filament and the terminal attached to the cylinder are connected to an oscillation transformer (see INDUCTION COIL) which supplies a high frequency alternating oscillatory current, the flow of electricity in one direction is cut out and the oscillatory current is therefore converted into a continuous current. Such valves have been employed by Fleming in connexion with wireless telegraphy. Wehnelt discovered that if a platinum wire was covered with oxide of barium or any of the oxides of rare earth metals, it possessed in the same manner, when used in a valve of the above type, an even greater power than incandescent carbon. The explanation of this action is to be sought for in the fact that incandescent carbon in a vacuum or incandescent earthy oxides copiously emit negative electrons.

A rectifier dependent upon the peculiar qualities of mercury vapour has been devised by Cooper-Hewitt for the transformation of polyphase currents into continuous currents. The three-phase transformer is made as follows: A large glass bulb (see fig. 14) has four iron electrodes sealed through the walls as positive electrodes and a negative electrode consisting of a pool of mercury in the bottom of the bulb connected with platinum wires sealed through the glass; the bulb is highly exhausted and contains only mercury vapour. The three iron electrodes are connected to the terminals of a star-connected polyphase transformer and one of them to the positive pole of a continuous current starting current, the connexions being shown as in fig. 15. The mercury vapour is a non-conductor for low voltages, but if a sufficiently high voltage is placed on the mercury bulb by means of the continuous current it begins to conduct and if the three-phase current is then switched on the mercury vapour will allow the components of the three-phase current to pass when the mercury electrode is negative, not when it is positive. Hence for alternate current wave of the three-phase, supply is cut down and a continuous current can be drawn by the connexions as shown in fig. 15 for the purposes of supplying secondary batteries, arc lamps, &c.

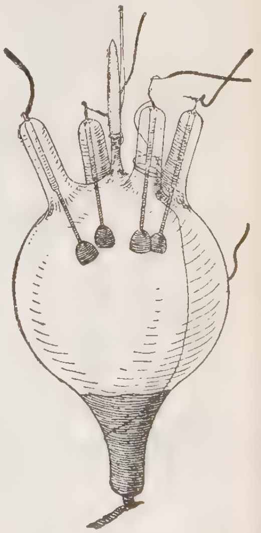


FIG. 14.
Cooper-Hewitt Rectifier.

Owing to the fact that the mercury vapour ceases to conduct when the electromotive force on it falls below a certain critical value the valve will not work with single-phase currents but will work with polyphase currents at all voltage from 100 to 1000 or more and can transform as much as 100 amperes. It is stated to have an efficiency of 88 to 89 %. (See *The Electrician*, 1903, 50, p. 510.)

A mechanical polyphase rectifier or rotary devised by Bragstad and La Cour is described in *Der Kaskadenumformer*, by E. Arnold and J. L. La Cour, Stuttgart, 1904. It consists of a three-phase induction motor coupled direct to a continuous current dynamo, the armatures of the two machines being electrically connected so that the three-phase current created in the rotor of the induction motor enters the continuous current armature and creates around it a rotary field. The connexions are such that the rotating field turns in a direction opposite to that in which the armature is turning, so that the field is stationary in space. From the continuous current armature can therefore be drawn off a continuous current and the device acts as a transformer of three-phase alternating current to a continuous current.

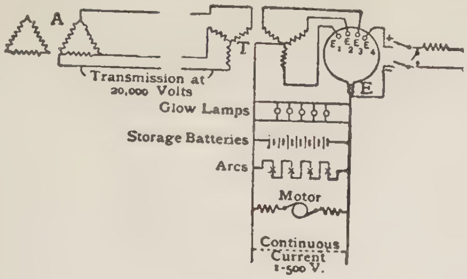


FIG. 15.

The ordinary induction coil (*q.v.*) may be regarded as the transformer for converting continuous current at low voltage into high voltage intermittent continuous current, but the difficulties of interrupting the primary current render it impossible to transform in this way more than a small amount of power. Where, however, high voltages are required, high potential transformers are used which are now built for the purpose of wireless telegraphy and the transformation of power to give secondary voltages up to 20,000, 30,000 or 60,000 volts. Transformers have even been built to give secondary voltages of half a million volts capable of giving a 14 in. spark in air. These machines, however, must be regarded as more physical laboratory instruments than appliances for technical work. For description of one such extra high potential transformer see H. B. Smith, on "Experiments on Transformers for Very High Potentials," *The Electrician* (1904), 54, p. 358. A transformer of this kind must invariably be an oil insulated transformer, as under extremely high voltage the air itself becomes a conductor and no solid insulator that can be put upon the wires is strong enough to stand the electric strain.

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TRANSIT CIRCLE, or MERIDIAN CIRCLE, an instrument for observing the time of a star's passing the meridian, at the same time measuring its angular distance from the zenith. The idea of having an instrument (quadrant) fixed in the plane of the meridian occurred even to the ancient astronomers, and is mentioned by Ptolemy, but it was not carried into practice until Tycho Brahe constructed a large meridian quadrant. This instrument enabled the observer to determine simultaneously right ascension and declination, but it does not appear to have been much used for right ascension during the 17th century, the method of equal altitudes by portable quadrants or measures of the angular distance between stars with a sextant being preferred. These methods were, however, very inconvenient, which induced Römer to invent the transit instrument about 1690. It consists of a horizontal axis in the direction east and west resting on firmly fixed supports, and having a telescope fixed at right angles to it, revolving freely in the plane of the meridian. At the same time Römer invented the altitude and azimuth instrument for measuring vertical and horizontal angles, and in 1704 he combined a vertical circle with his transit instrument, so as to determine both co-ordinates at the same time. This latter idea was, however, not adopted elsewhere, although the transit instrument soon came into universal use (the first one at Greenwich was mounted in 1721), and the mural quadrant continued till the end of the century to be employed for determining declinations. The advantage of using a whole circle, as less liable to change its figure, and not requiring reversal in order to observe stars north of the zenith, was then again recognized by Ramsden, who also improved the method of reading off angles by means of a micrometer microscope as described below. The making of circles was shortly afterwards taken up by Troughton, who in 1806 constructed the first modern transit circle for Groombridge's observatory at Blackheath, but he afterwards abandoned the idea, and designed the mural circle to take the place of the mural quadrant. In the United Kingdom the transit instrument and mural circle continued till the middle of the 19th century to be the principal instrument in observatories, the first transit circle constructed there being that at Greenwich (mounted in 1850) but on the continent the transit circle superseded them from the years 1818–1819, when two circles by Repsold and by Reichenbach were mounted at Göttingen, and one by Reichenbach at Königsberg.[1] The firm of Repsold was for a number of years eclipsed by that of Pistor and Martins in Berlin, who furnished various observatories with first-class instruments, but since the death of Martins the Repsolds have again taken the lead, and have of late years made many transit circles. The observatories of Harvard College (United States), Cambridge and Edinburgh have large circles by Troughton and Simms, who also made the Greenwich circle from the design of Airy.[2]

In the earliest transit instrument the telescope was not placed in the middle of the axis, but much nearer to one end, in order to prevent the axis from bending under the weight of the telescope. It is now always placed in the centre of the axis. The latter consists of one piece of brass or gun-metal with carefully turned cylindrical steel pivots at each end. Several recent instruments have been made entirely of steel, which is much more rigid than brass. The centre of the axis is shaped like a cube, the sides of which form the basis of two cones which end in cylindrical parts. The pivots rest on V-shaped bearings, either let into the massive stone or brick piers which support the instrument or attached to metal frameworks bolted on the tops of the piers. In order to relieve the pivots from the weight of the instrument, which would soon destroy their figure, the cylindrical part of each end of the axis is supported by a hook supplied with friction rollers, and suspended from a lever supported by the pier and counterbalanced so as to leave only about 10 ℔ pressure on each bearing. Near each end of the axis is attached a circle or wheel (generally of 3 or 3½ ft. diameter) finely divided to 2′ or 5′ on a slip of silver let into the face of the circle near the circumference. The graduation is read off by means of microscopes, generally four for each circle at 90° from each other, as by taking the mean of the four readings the eccentricity and the accidental errors of graduation are to a great extent eliminated.[3] In the earlier instruments by Pistor and Martins the microscopes were fixed in holes drilled through the pier, but afterwards they let the piers be made narrower, so that the microscopes could be at the sides of them, attached to radial arms starting from near the bearings of the axis. This is preferable, as it allows of the temporary attachment of auxiliary microscopes for the purpose of investigating the errors of graduation of the circle, but the plan of the Repsolds and of Simms, to make the piers short and to let the microscopes and supports of the axis be carried by an iron framework, is better still, as no part of the circle is exposed to radiation from the pier, which may cause strain and thereby change the angular distance between various parts of the circle. Each microscope is furnished with a micrometer screw, which moves a frame carrying a cross, or better two close parallel threads of spider's web, with which the distance of a division line from the centre of the field can be measured, the drum of the screw being divided to single seconds of arc (0·1″ being estimated), while the number of revolutions are counted by a kind of comb in the field of view. The periodic errors of the screw must be investigated and taken into account, and care must be taken that the microscopes are placed and kept at such a distance from the circle that one revolution will correspond to 1′, the excess or defect (error of run) being determined from time to time by measuring standard intervals of 2′ or 5′ on the circle.

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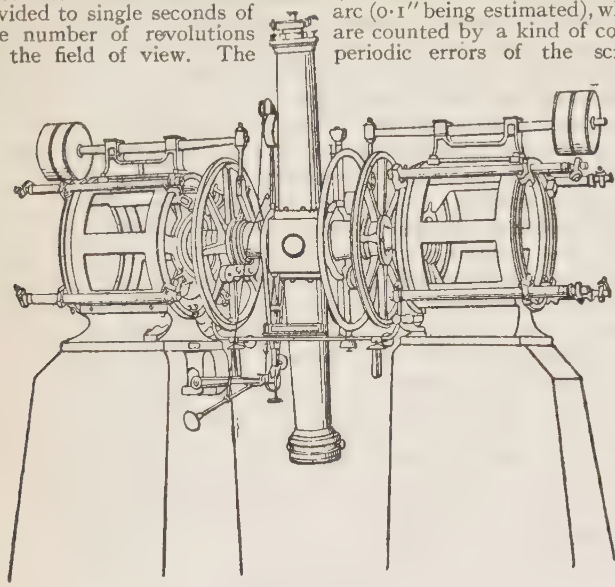
[1] The most notable exception was the transit instrument and vertical circle of the Pulkovo observatory, specially designed by the elder Struve for fundamental determinations.

[2] This instrument differs in many particulars from others: the important principle of symmetry in all the parts (scrupulously followed in all others) is quite discarded; there is only one circle; and the instrument cannot be reversed. There is a similar instrument at the Cape observatory.

[3] On Reichenbach's circles there were verniers instead of microscopes, and they were attached to an alidade circle, the immovability of which was tested by a level.



Transit Circle.

The telescope consists of two slightly conical tubes screwed to the central cube of the axis. It is of great importance that this connexion should be as firm and the tube as stiff as possible,[1] as the flexure of the tube will affect the declinations deduced from the observations. The flexure in the horizontal position of the tube may be determined by means of two collimators or telescopes placed horizontally in the meridian, north and south of the transit circle, with their object glasses towards it. If these are pointed on one another (through holes in the central tube of the telescope), so that the wire-crosses in their foci coincide, then the telescope, if pointed first to one and then to the other, will have described exactly 180°, and by reading off the circle each time the amount of flexure will be found. M. Loewy has constructed a very ingenious apparatus[2] for determining the flexure in any zenith distance, but generally the observer of standard stars endeavours to eliminate the effect of flexure in one of the following ways: either the tube is so arranged that eyepiece and object-glass can be interchanged, whereby the mean of two observations of the same star in the two positions of the object-glass will be free from the effect of flexure, or a star is not only observed directly (in zenith distance Z), but also by reflection from a mercury trough (in zenith distance $180°-Z$), as the mean result of the Z.D. of the direct and reflection observations, before and after reversing the instrument east and west, will only contain the terms of the flexure depending on $\sin 2Z$, $\sin 4Z$, &c. In order to raise the instrument a reversing carriage is provided which runs on rails between the piers, and on which the axis with circles and telescope can be raised by a kind of screw-jack, wheeled out from between the piers, turned exactly 180°, wheeled back, and gently lowered on its bearings.

The eye end of the telescope has in a plane through the focus a number of vertical and one or two horizontal wires (spider lines). The former are used for observing the transits of the stars, each wire furnishing a separate result for the time of transit over the middle wire by adding or subtracting the known interval between the latter and the wire in question. The intervals are determined by observing the time taken by a star of known declination to pass from one wire to the other, the pole star being best on account of its slow motion.[3] Instead of vertical wires, the eye end may be fitted with Repsold's self-registering micrometer with one movable wire to follow the star (see MICROMETER). The instrument is provided with a clamping apparatus, by which the observer, after having beforehand set to the approximate declination of a star, can clamp the axis so that the telescope cannot be moved except very slowly by a handle pushing the end of a fine screw against the clamp arm, which at the other side is pressed by a strong spring. By this slow motion, the star is made to run along one of the horizontal wires (or if there are two close ones, in the middle between them), after which the microscopes are read off. A movable horizontal wire or declination-micrometer is also often used. The field or the wires can be illuminated at the observer's pleasure; the lamps are placed at some distance from the piers in order not to heat the instrument, and the light passes through holes in the piers and through the hollow axis to the cube, whence it is directed to the eye-end by a system of prisms.[4]

The time of the star's transit over the middle wire is never exactly equal to the actual time of its meridian passage, as the plane in which the telescope turns never absolutely coincides with the meridian. Let the production of the west end of the axis meet the celestial sphere in a point of which the altitude above the horizon is b (the error of inclination), and of which the azimuth is $90°-a$ (the azimuth being counted from south through west), while the optical axis of the telescope makes the angle $90° + c$ with the west end of the axis of the instrument, then the correction to the observed time of transit will be $\{a \sin(\phi-\delta) + b \cos(\phi-\delta) + c\} / \cos \delta$, where ϕ is the latitude of the station and δ the declination of the star. This is called Tobias Mayer's formula, and is very convenient if only a few observations have to be reduced. Putting $b \sin \phi - a \cos \phi = n$, we get Hansen's formula, which gives the correction $= b \sec \phi + n (\tan \delta - \tan \phi) + c \sec \delta$, which is more convenient for a greater number of observations. The daily aberration is always deducted from c, as it is also multiplied by $\sec \delta$ (being $0{\cdot}31'' \cos \phi \sec \delta$). The above corrections are for upper culmination; below the pole $180° - \delta$ has to be substituted for δ, The constant c is determined by pointing the instrument on one of the collimators, measuring the distance of its wire-cross from the centre wire of the transit circle by a vertical wire movable by a micrometer screw, reversing the instrument and repeating the operation, or (without reversing) by pointing the two collimators on one another and measuring the distance of first one and then the other wire-cross from the centre wire. The inclination b is measured directly by a level which can be suspended on the pivots.[5] Having thus found b and c, the observation of two stars of known right ascension will furnish two equations from which the clock error and the azimuth can be found. For finding the azimuth it is most advantageous to use two stars differing as nearly 90° in declination as possible, such as a star near the pole and one near the equator, or better still (if the weather permits it) two successive meridian transits of a close circumpolar star (one above and one below the pole), as in this case errors in the assumed right ascension will not influence the result.

The interval of time between the culminations or meridian transits of two stars is their difference of right ascension, 24 hours corresponding to 360° or 1 hour to 15°. If once the *absolute right ascensions* of a number of *standard stars* are known, it is very simple by means of these to determine the R.A. of any number of stars. The absolute R.A. of a star is found by observing the interval of time between its culmination and that of the sun. If the inclination of the ecliptic (ϵ) is known, and the declination of the sun (δ) is observed at the time of transit, we have $\sin \alpha \tan \epsilon = \tan \delta$, which gives the R.A. of the sun, from which, together with the observed interval of time corrected for the rate of the clock, we get the R.A. of the star. Differentiation of the formula shows that observations near the equinoxes are most advantageous, and that errors in the assumed ϵ and the observed δ will have no influence if the $\Delta\alpha$ is observed at two epochs when the sun's R.A. is A and $180°-\text{A}$ or as near thereto as possible. A great number of observations of this kind will furnish materials for a standard catalogue; but the right ascensions of many important catalogues have been found by making use of the R.A.'s of a previous catalogue to determine the clock error and thus to improve the individual adopted R.A.'s of the former catalogue.

In order to determine absolute declinations or polar distances, it is first necessary to determine the co-latitude (or distance of the pole from the zenith) by observing the upper and lower culmination of a number of circumpolar stars. The difference between the circle reading after observing a star and the reading corresponding to the zenith is the zenith distance of the star, and this plus the co-latitude is the north polar distance or $90° - \delta$. In order to determine the zenith point of the circle, the telescope is directed vertically downwards and a basin of mercury is placed under it, forming an absolutely horizontal mirror. Looking through the telescope the observer sees the horizontal wire and a reflected image of the same, and if the telescope is moved so as to make these coincide, its optical axis will be perpendicular to the plane of the horizon, and the circle reading will be 180° + zenith point. In observations of stars refraction has to be taken into account as well as the errors of graduation and flexure, and, if the bisection of the star on the horizontal wire was not made in the centre of the field, allowance must be made for curvature (or the deviation of the star's path from a great circle) and for the inclination of the horizontal wire to the horizon. The amount of this inclination is found by taking repeated observations of the zenith distance of a star during the one transit, the pole star being the most suitable owing to its slow motion.

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[1] Reichenbach supplied his tubes with counterpoising levers like those on the Dorpat refractor (see TELESCOPE).

[2] *Comptes rendus*, lxxxvii. 24.

[3] The transits are either observed by "eye and ear," counting the second beats of the clock and comparing the distance of the star from the wire at the last beat before the transit over the wire with the distance at the first beat after the transit, in this way estimating the time of transit to $0{\cdot}1^s$; or the observer employs a "chronograph," and by pressing an electric key causes a mark to be made on a paper stretched over a uniformly revolving drum, on which the clock beats are at the same time also marked electrically.

[4] The idea of illuminating through the axis is due to H. Ussher, professor of astronomy in Dublin (d. 1790).

[5] To avoid the use of a very large level, the pivots of the new transit circle at Kiel are supplied with small "riders" carrying a wire-cross; these can in turn be observed through a horizontal telescope with a hanging mirror in front of its object-glass, whereby the difference in height of the two pivots above a horizontal line may be measured.

Attempts have been made in various places to record the transits of a star photographically; with most success at the Georgetown College Observatory, Washington (since 1889). A sensitive plate is placed in the focus of a transit instrument and a number of short exposures made, their length and the time they are made being registered automatically by a clock. The exposing shutter is a thin strip of steel, fixed to the armature of an electromagnet. The plate thus gives a series of dots or short lines, and the vertical wires are photographed on the plate by throwing light through the object-glass for one or two seconds. This seems to give better results than the method adopted at the Paris observatory, where the plate is moved by clock-work and the exposure is comparatively long, while the image of a fixed slit is photographed at different recorded instants.

LITERATURE.—The methods of investigating the errors of a transit circle and correcting the results of observations for them are given in Brünnow's and Chauvenet's manuals of spherical astronomy. For detailed descriptions of modern transit circles, see particularly the *Washington Observations* for 1865, the *Publications* of the Washburn Observatory (vol. ii.) and *Astronomische Beobachtungen zu Kiel* (1905). The Greenwich circle is described in an appendix to the *Greenwich Observations* for 1852. Accounts of photographic transit instruments will be found in *The Photochronograph* (Washington, 1891), *Annales de l'observatoire de Tokyo*, tome iii. and *Comptes rendus* (July 16, 1906). (J. L. E. D.)

TRANSKEI, one of the divisions of the Cape province, South Africa, east of the Kei River, being part of the country known variously as Kaffraria ((*q.v.*), "the Native Territories" (of the Cape) and the Transkeian Territories. The majority of the inhabitants are Fingo (*q.v.*).

TRANSLATION (Lat. *trans*, across, and *latus*, the participle of *ferre*, to carry), literally a carrying over or transference from one to another, and so from one medium to another. Among the more literal usages is the translation of Enoch in the Bible (Heb. xi. 5), or the ecclesiastical removal of a bishop to another see. But the commonest sense of the word is in connexion with the rendering of one language into another.

The characteristics of a good translation in the literary sense, and the history of the influence, through translations, of one literature on another, are worth more detailed notice. Dryden has prescribed the course to be followed in the execution of the ideal translation: "A translator that would write with any force or spirit of an original must never dwell on the words of his author. He ought to possess himself entirely, and perfectly comprehend the genius and sense of his author, the nature of the subject, and the terms of the art or subject treated of; and then he will express himself as justly, and with as much life, as if he wrote an original; whereas, he who copies word for word loses all the spirit in the tedious transfusion." Comparatively few translators have satisfied this canon. A writer capable of attaining the standard set up by Dryden is naturally more disposed to use his powers to express his own views than those of his foreign predecessors. No doubt at all times, and in all countries, translations have usually been produced for utilitarian purposes, and not from artistic motives. In the first instance we may assume that translations were undertaken in a spirit of educational propaganda as a means of communicating new ideas and new facts to a somewhat uninstructed and uncritical public, indifferent as to matters of form. But, though the translator's primary motive is didactic, he is insensibly led to reproduce the manner as well as the matter of his original as closely as possible. Montaigne warns aspirants of the difficulty in dealing with authors remarkable for the finish of their execution. "Il faict bon," he writes in the *Apologie de Raimond Sebonde*, "traduire les aucteurs comme celuy-là ou il n'y a guères que la matière à représenter; mais ceux qui ont donné beaucoup à la grace et à l'élégance de langage ils sont dangereux à entreprendre nommément pour les rapporter à un idiome plus foible." As it happens, however the task of translating foreign masterpieces has frequently been undertaken by writers of undisputed literary accomplishment whose renderings have had a permanent effect on the literature of their native country.

It was certainly the case when Rome, having conquered Greece, was captured by her captive. There is much point and little exaggeration in the statement that "when the Greek nation became a province of Rome, the Latin literature became a province of the Greek"; and this peaceful victory was initiated by a series of translations made by writers of exceptional ability and, in some cases, of real genius. The first translator whose name is recorded in the history of European literature is L. Livius Andronicus, a manumitted Greek slave who about 240 B.C., rendered the *Odyssey* into Saturnian verse. This translation, of which some fragments are preserved, was long in use as a school text, for Horace studied it under the formidable Orbilius; but Andronicus appears to have recognized his mistake in using the native Latin measure as a vehicle of literary expression, and is said to have rendered Greek tragedies and comedies into metres corresponding to those of his Greek originals. The decision was momentous, for it influenced the whole metrical development of Latin poetry. The example set by Andronicus was followed by Naevius and Ennius, both of whom laid the foundations of the Latin theatre by translating Greek plays—especially those of Euripides—and naturalized in Rome the hexameter, which, as practised later by Lucretius and Virgil, was destined to become "the stateliest measure ever moulded by the lips of man." The tradition of translating more or less freely was continued by Pacuvius, the nephew of Ennius, as well as by Plautus and Terence, whose comedies are skilful renderings or adaptations from the New Attic Comedy of Philemon, Diphilus and Menander. A persistent translator from the Greek was Cicero, who interpolates in his prose writings versified renderings of passages from Homer, Aeschylus, Sophocles and Euripides which prove the injustice of the popular verdict on his merits as a poet. Cicero not only translated the oration of Demosthenes *On the Crown*, but also made Latin versions of Plato's *Timaeus* (part of which survives), of Xenophon's *Oeconomicus*, and of the *Phaenomena*, an astronomical poem by Aratus of Soli, an Alexandrian imitator of Hesiod. This last performance was a tribute to the prevailing fashion of the moment, for the Alexandrian poets had supplanted the early Greek school in favour among the literary circles of Rome. To the foregoing list may be added the great name of Catullus, whose *Coma Berenices* is translated from Callimachus, and Cornelius Gallus is mentioned as a translator of Euphorion. Complete translations became less and less necessary as a knowledge of Greek spread among the educated class. But the practice of translating fragments of Greek verse continued throughout the classic period of Latin literature, and the translations of Greek originals incorporated by Virgil were duly pointed out by Octavius Avitus.

The knowledge of Greek declined with the empire, and translations were accordingly produced for the benefit of students who were curious concerning the philosophic doctrines of the Athenians and the Neoplatonists. Porphyry's introduction to Aristotle's *Categories* was translated by Victorinus about the reign of Julian the Apostate; at the end of the 5th century this introduction was once more translated by Boetius, whose translations of Aristotle's *Categories* and other logical treatises began the movement which ended in establishing the Greek philosopher as the most profound and authoritative exponent of intellectual problems during the middle ages. Plato was less fortunate, for he was known to students chiefly by the Latin version of the *Timaeus* made by Chalcidius (it is said) for Hosius, the bishop of Cordova. Cassiodorus, the contemporary of Boetius, went farther afield when he ordered a Latin translation of Josephus to be prepared; but the interest in Aristotle extended to the

East, and in the 6th century he was translated into Syriac by Sergius of Resaina. The Syrians acted as interpreters of Greek learning to the Arabs, and during the 8th and 9th centuries—chiefly through the staff of translators organized at Bagdad by Honein ibn Ishak—the works of Plato and Aristotle, as well as those of Hippocrates and Galen, were translated into Arabic. These translations are of capital importance in the history of European thought. Many of them were introduced into Spain by the Arabs, and were rendered—in some cases through the intermediary of a Castilian-speaking Jew—into Latin at the college of translators founded in 1130 (or shortly afterwards) at Toledo by Raymund, archbishop of that city. Circulating widely throughout western Europe, these Latin translations supplied the learned with a third- or fourth-hand knowledge of Greek philosophy. When Albertus Magnus, St Thomas Aquinas, or any other early light of the schools refers to Aristotle, it must be borne in mind that he often had no more exact acquaintance with the text which he expounds or confutes than could be gathered from an indirect Latin version of an Arabic rendering of a Syriac translation of a Greek original. This accounts for many misunderstandings and errors which would otherwise be incomprehensible. Among the earliest European translators who made their way to Toledo were Adelard of Bath, who rendered an Arabic version of Euclid into Latin; the Englishman known as Robert de Retines, afterwards archdeacon of Pamplona, the first translator of the Koran, which he did into Latin in 1141–1143 by order of Peter the Venerable; and Gerard of Cremona, who, towards the end of the 12th century, was responsible for over seventy translations from the Arabic, including Ptolemy's *Almagest* and many of Aristotle's treatises, as well as works by Galen, Hippocrates and Avicenna. Early in the 13th century Michael Scot, who had begun his Arabic studies at Palermo, visited Toledo and (perhaps with the help of the Jew Andreas, if we are to believe the statement of Hermann the German, repeated by Roger Bacon) translated into Latin various works of Aristotle, Avicenna, and—more especially—Averroes. These Latin translations by Michael Scot introduced Averroes to the notice of Western scholars, and the fact that they were used at the universities of Paris and Bologna gave the first impetus to the vogue of Averroistic doctrine which lasted from the time of St Thomas Aquinas to the rise of Martin Luther. At Toledo, between 1240 and 1256, Hermann the German translated into Latin the commentaries of Averroes on Aristotle's *Ethics*, together with abridgments of the *Poetic* and the *Rhetoric* made respectively by Averroes and Alfarabi. But, at the very period of Hermann the German's residence at Toledo, a more satisfactory method of translation was begun. Within half a century of the conquest of Constantinople in 1204 a visit to Spain was no longer indispensable for a would-be translator of Greek philosophical treatises. The original texts slowly became more available, and a Latin translation of Aristotle's *Ethics* seems to have been made from the Greek by order of Robert Grosseteste, bishop of Lincoln, between 1240–1244. Towards the end of the century the indefatigable William of Moerbeke (near Ghent)—mentioned as "William the Fleming" by Roger Bacon—produced, amongst numerous other Latin renderings from the Greek, versions of Aristotle's *Rhetoric* and *Politics* which have commended themselves to more exact scholars of the modern German type. The Latin renderings from the Arabic were current till a much later date; but it was henceforth accepted, at least in principle, that translations of the Greek classics should be made direct from the original text.

Meanwhile the work of translating foreign productions into the local vernacular had been begun in the north and west of Europe. Towards the end of the 9th century an illustrious English translator appeared in the person of King Alfred, who rendered St Gregory the Great's *Cura pastoralis* into West Saxon "sometimes word for word, sometimes sense for sense." Alfred is also regarded, though with less certainty, as the translator of Bede's *Historia ecclesiastica* and the *Historia adversus paganos* of Orosius. The version of St Gregory's treatise is the most literal of the three; omissions are frequent in the renderings of Bede and Orosius, and in all the diction is disfigured by latinisms. A larger conception of a translator's function is noticeable in Alfred's version of Boetius's *De consolatione philosophiae*, a famous Neoplatonic treatise which was the delight of the middle ages, and was translated later into German by Notker Labeo, into French by Jean de Meung, and twice again into English by Chaucer and by Queen Elizabeth respectively. In translating Boetius, Alfred deals more freely with his author, interpolates passages not to be found in the extant texts of the original, and yet succeeds in giving an adequate interpretation which is also an excellent specimen of English prose. If the alliterative verses found in one manuscript of Alfred's translation are accepted as his work, it is clear that he had no poetic faculty; but he has the credit of opening up a new path, of bringing England into contact with European thought, and of stimulating such writers as Werferth, bishop of Worcester—the translator of St Gregory's *Dialogues*—to proceed on the same line. Some forty years earlier John Scotus (Erigena) had won celebrity as a translator by his Latin renderings of works ascribed to the mysterious 5th century Neoplatonist who passes under the name of Dionysius the Areopagite. Towards the close of Alfred's reign some countrymen of Erigena bettered his example by producing Irish versions of Hippocrates and Galen at St Gallen. St Gallen became a centre of translation, and there, at the beginning of the 11th century, Notker Labeo presided over a committee of interpreters who issued German renderings of certain treatises by Aristotle, Terence's *Andria* and Virgil's *Eclogues*. Far greater literary importance attaches to *Syntipas*, the title given by Michael Andreopulos to a collection of ancient Oriental tales which he translated from an intermediate Syriac version into Greek at the request of the Armenian duke of Melitene about the end of the 11th century. These stories were retranslated into French verse and (by Jean de Haute-Seille) into Latin during the course of the 12th century under the respective titles of the *Sept sages de Rome* and *Dolopathos*; they were utilized in the *Cento novelle antiche*, in the *Libro dei sette savj*, and in the *Decamerone*, and were finally absorbed by every literature in Europe. Immense popularity was won by the *Liber gestorum Barlaam et Josaphat*, a Latin translation made in the 11th or 12th century from the Greek, and recast in many European languages during the 13th century. The book is in fact a legendary life of Buddha adapted to the purposes of Christianity by a monk; but it was accepted as an historical record, the undiscerning credulity of the faithful informally canonized Barlaam and Josaphat, and ultimately compelled the Latin Church to include these two fictitious beings as saints in the *Martyrologium romanum*. This is perhaps the most curious result attained by any translation. The interest in Eastern apologues and moralizing stories, which was early shown in Marie de France's translation of Aesopic fables, was further demonstrated by the Castilian translations of *Kalilah and Dimnah* and *Sindibad* made about the middle of the 13th century, by (or at the command of) Alphonso the Learned and his brother the Infante Fadrique respectively.

The enthusiasm for these Oriental stories was communicated to the rest of Europe by John of Capua's *Directorium humanae vitae* (1270), a Latin translation of *Kalilah and Dimnah*; but, in the meanwhile, as the younger European literatures grew in power and variety, the field of translation necessarily widened to such an extent that detailed description becomes impossible. Geoffrey of Monmouth's *Historia regum Britanniae*, which purports to be a free version of an unnamed Breton book, is the source of the Arthurian legends which reappeared transformed in elaborate French versions, and were transmitted to the rest of Europe during the 12th and 13th centuries. During this period of French literary supremacy instances of bilingual faculty are not wanting in the form of translations: shortly after the middle of the 13th century Brunetto Latini translated passages of Cicero into Italian, and selections from Sallust into French. A hundred years later there are unmistakable indications that the middle ages are departing, that the French suzerainty over literature is at an end, and that the advent of the New Humanism is an accomplished fact. The early Renaissance had already dawned in Italy: a renewed interest in the Latin classics (Greek was not yet generally cultivated by scholars) proved that there was a revival of learning in France. Livy was done into French by Bersuire, Seneca by Bauchant, Boccaccio by Laurent de Premier Fait, and a celebrated translator appeared in the person of Nicolas Oresme, who, however, rendered Aristotle from a Latin version. In England Chaucer executed translations of Boetius and part of the *Roman de la rose*, and succeeded equally in interpreting the philosophic treatise and the allegorical poem. A still further advance is discernible in the book of travels ascribed to Sir John Mandeville: this work, which seems to have been originally written in French, is rendered into English with an exceptional felicity which has won for the translator the loose-fitting but not altogether inappropriate title of "the father of English prose." The English version of Mandeville is assigned to the beginning of the 15th century. About 1470 Sir Thomas Malory produced from French originals his *Morte d'Arthur*, a pastiche of different texts translated with a consummate art which amounts to originality. Malory's inspired version, together with the numerous renderings from the French issued (and often made personally) by Caxton, stimulated the public taste for romantic narrative, raised the standard of execution, and invested the translator with a new air of dignity and importance.

Yet the 15th century has a fair claim to be regarded as the golden age of translation. The Gothic version of the Bible, made by Ulfilas during the 4th century almost simultaneously with St Jerome's Vulgate, is invaluable as the sole literary monument of a vanished language; the 14th century English version by Wycliffe and the 15th century English versions which bear the names of Tyndale and Coverdale are interesting in themselves, and are also interesting as having contributed to the actual Authorized Version of 1611. But they are incomparably less important than Luther's German translation of the Bible (1522–1534) which, apart from its significance as indicating the complete victory of the liberal middle class and the irremediable downfall of the feudal and ecclesiastical autocracy, supplanted minor dialects and fixed the norm of literary expression in German-speaking countries. Luther, it has been truly said, endowed Germany with a uniform literary language, a possession which she had lost for nearly three hundred years. The effect of profane literature was speedily visible in Fischart's translations of Rabelais's *Pantagruêline* (1572) and the first book of *Gargantua* (1575). But before this date France had produced a prince of translators in Jacques Amyot, bishop of Auxerre. In 1548 Nicolas de Herberay had published a French translation of *Amadis de Gaule* which enchanted the polite world at the court of Henry II., had its day, and is forgotten. But Amyot's translation of Plutarch (1559) remains an acknowledged masterpiece, surviving all changes of taste and all variations of the canon of translation. Montaigne writes: "Je donne la palme avecque raison, ce me semble, à Jacques Amyot, sur tous nos escripvains François." If "escripvain" be understood to mean "translator," this judgment is beyond appeal.

Lord Berners will not bear comparison with Amyot in achievement or influence; but, though less completely equipped and less uniformly happy in his choice of texts (for Amyot translated the *Aethiopian History* and *Daphnis and Chloe* as well as Plutarch), Lord Berners holds a distinguished place in the ranks of English translators. His renderings of Fernández de San Pedro's *Cârcel de amor* and of Guevara's *Libro aureo* are now read solely by specialists engaged in tracing English euphuism to its remoter sources, and some of his other translations—the *Boke of Duke Huon of Burdeux* and *Arthur of Little Britain*—are too poor in substance to be interesting nowadays. But Lord Berners is justly remembered by his notable translation of Froissart (1523–1525). Froissart offers fewer opportunities than Guevara for the display of that "fecundious art of rhetoric" in which the English translator thought himself deficient, and, with this temptation removed, Lord Berners is seen at his best. In his version of Froissart, apart from endless confusion of proper names, he makes few mistakes of any real importance, and, if he scarcely equals his original in *brio*, he is almost invariably adequate in reproducing the French blend of simplicity with stateliness. Such translations as Phaer's *Virgil* (1557) and Golding's *Ovid* (1561) have not the historical importance of William Painter's *Palace of Pleasure*, a miscellaneous collection of stories rendered from the Italian, nor of Jasper Heywood's version of Seneca (1581) whose plays had exercised immense influence upon the methods of Garnier and Montchrétien in France. Though Kyd translated Garnier's *Cornélie*, the Senecan system was destined to defeat in England, and Heywood's translation did not even postpone the catastrophe. On the other hand Marlowe found the subject of his *Tamburlaine* in Painter's collection, and thus began the systematic exploitation of the *Palace of Pleasure* which was continued by his successors on the stage. A translator of the rarest excellence was forthcoming in Sir Thomas North, who rendered Guevara (1557) from the French (revising his second edition from the Spanish), and *The Morall Philosophie of Doni*—"a worke first compiled in the Indian tongue"—from the Italian (1570). But, good as they are, both these versions are overshadowed by the famous translation of Plutarch which North published in 1579. He may have referred occasionally to the Greek, or perhaps to some intermediate Latin rendering; but the basis of his work is Amyot, and his English is not inferior to the French in sonority and cadence of phrase. This retranslation of a translation is a masterpiece of which fragments are incorporated with scarcely any change in *Coriolanus*, *Julius Caesar* and *Antony and Cleopatra*; and touches from North have been noted also in the *Midsummer Night's Dream* and in *Timon of Athens*. Amyot greatly influenced the development of French prose, and his translation was the source of Racine's *Mithridate*; but, if we reflect that Shakespeare not only took some of his subjects from the English Plutarch and found nothing to amend in the diction of many passages, North's triumph may be reckoned as even more signal than Amyot's. Very little below North's translation of Plutarch comes John Florio's translation of Montaigne (1603), a fantastically ingenious performance which contributed a celebrated passage to *The Tempest* and introduced the practice of the essay into England. It is impossible to cope with the activity of English translators during the last half of the 16th century and the first half of the 17th. To this period belongs Chapman's impressive and resounding translation (1598–1616) of Homer, which was to enrapture Keats two hundred years later. Adlington's version of Apuleius, Underdown's renderings of Heliodorus and Ovid, the translations of Livy, Pliny, Suetonius and Xenophon issued in quick succession by Philemon Holland are vivid and often extravagantly picturesque in their conveyance of classic authors into Elizabethan prose. With them must be named the translator of Tacitus (1591), Sir Henry Savile, who served later on the committee which prepared the Authorized Version of the Bible, and must therefore be counted amongst those who have exercised a permanent influence on English prose style. Thomas Shelton produced the earliest translation (1612) of *Don Quixote*, a version which, in spite of its inaccuracies and freakishness, preserves much of the tone and atmosphere of the original. Mabbe's translation (1622) of *Guzmán de Alfarache* was lauded by Ben Jonson, and widely read during the 17th century, and his version of the *Celestina* deserved a success which it failed to obtain. It compares most favourably with a version of Tasso (1600) by Edward Fairfax, who has been persistently overpraised. But the Puritanical instinct of the English people, powerful even when not in the ascendant, was an insuperable obstacle to the acclimatization of Spanish literature in England. The *Leviathan* has obscured Hobbes's fame as a translator, but he is known to scholars by his sound but crabbed rendering of Thucydides (1629), and by a wholly unnecessary version of Homer which he published at the very end of his career (1674). Sir Roger L'Estrange is responsible for translations of Seneca, Cicero and Josephus, which are usually lively enough to be readable and unfaithful enough to be misleading; the most popular of his renderings is a translation of Quevedo's *Sueños* (made through the French) which owes most of its vogue during the Restoration rather to its reckless indecency than to its intrinsic merit. Dryden's free translations of Juvenal (1693) and Virgil (1697) treat the original authors with a cavalier freedom, but at least they preserve the meaning, if not the conciseness and point, of the Latin.

Among the multitudinous English translations of the 18th century it is only necessary to mention Pope's versions of the *Iliad* (1715–1720) and the *Odyssey* (1725–1726), and Cowper's rendering of Homer, issued in 1791. These neat translations necessarily fail to convey any impression of Homer's epical grandeur, and they set a mischievous fashion of artificial "elegance" which has been too often adopted by their successors; but both Pope and Cowper conform faithfully to the mistaken canon of their age, and both have fugitive moments of felicity. A posthumous translation of *Don Quixote* bearing the name of Charles Jarvis appeared in 1742, has been reprinted times innumerable ever since, and has helped to make Cervantes's masterpiece known to generations of English-speaking people. Defective in point of exact scholarship, it has the merit of agreeable perspicuity, and there seems no reason to believe the remark, ascribed by Warburton to Pope, that Jarvis "translated *Don Quixote* without knowing Spanish": the available evidence is strongly against this malicious theory. The most remarkable translations of the 18th century, however, appeared in Germany: these are the versions of the *Odyssey* (1781) and *Iliad* (1793) by Voss, and A. W. von Schlegel's rendering of Shakespeare (1797–1810), which gave a powerful impulse to the romantic movement on the Continent.

Byron's version of a Spanish ballad and Shelley's renderings of Calderón are interesting exhibitions of original genius voluntarily accepting a subordinate rôle. More importance attaches to Carlyle's translation of *Wilhelm Meister* (1824), a faithful rendering free from the intolerable mannerisms and tricks which the translator developed subsequently in his original writings. William Taylor had long before translated Bürger's *Lenore*, Lessing's *Nathan* and Goethe's *Iphigenia*; but such interest as the English nation has been induced to take in German literature dates from the appearance of Carlyle's translation. If he did nothing more, he compelled recognition of the fact that Germany had at last produced an original genius of the highest class. Calderón found accomplished translators in Denis Florence MacCarthy (1848–1873) and in Edward FitzGerald (1853), who also attempted to render Sophocles into English; but these are on a much lower plane than the translation of the *Rubaiyát* (1859) of Omar Khayyam, in which, by a miracle of intrepid dexterity, a half-forgotten Persian poet is transfigured into a pessimistic English genius of the 19th century. Versions of Dante by Longfellow (whose translations of poems by minor authors are often admirable), of Latin or Greek classics by Conington, Munro, Jowett and Jebb, maintain the best traditions of the best translators. William Morris was less happy in his poetical versions of *Virgil* (1875) and the *Odyssey* (1887) than in his prose translations of *The Story of Grettir the Strong* (1869) and *The Volsunga Saga* (1870)—both made in collaboration with Magnússon—and in his rendering of *Beowulf* (1895). In his *Lays of France* (1872) Arthur O'Shaughnessy skirts the borders of translation without quite entering into the field; he elaborates, paraphrases and embroiders rather than translates the *lais* of Marie de France.

Most versions of modern foreign writers are mere hackwork carelessly executed by incompetent hands, and this is even more true of England than of France and Germany. But, with the development of literature in countries whose languages are unfamiliar, the function of the translator increases in importance, and in some few cases he has risen to his opportunity. Through translations the works of the great Russian novelists have become known to the rest of Europe, and through translations of Ibsen the dramatic methods of the modern stage have undergone a revolution. (J. F.-K.)

TRANSOM (probably a corruption of Lat. *transtrum*, a thwart, in a boat; equivalents are Fr. *traverse*, *croisillon*, Ger. *Losholz*), the architectural term given to the horizontal lintel or beam which is framed across a window, dividing it into stages or heights. In early Gothic ecclesiastical work transoms are only found in belfry unglazed windows or spire lights, where they were deemed necessary to strengthen the mullions in the absence of the iron stay bars, which in glazed windows served a similar purpose. In domestic work, on account of the opening casements, they are more frequently found. In the later Gothic, and more especially the Perpendicular period, the introduction of transoms became very general in windows of all kinds.

TRANSUBSTANTIATION, the term adopted by the Roman Catholic Church to express her teaching on the subject of the conversion of the Bread and Wine into the Body and Blood of Christ in the Eucharist. Its signification was authoritatively defined by the Council of Trent in the following words: "If any one shall say that, in the Holy Sacrament of the Eucharist there remains, together with the Body and Blood of Our Lord Jesus Christ, the substance of the Bread and Wine, and shall deny that wonderful and singular conversion of the whole substance of the Bread into (His) Body and of the Wine into (His) Blood, the species only of the Bread and Wine remaining—which conversion the Catholic Church most fittingly calls Transubstantiation—let him be anathema."[1] The word Transubstantiation is not found earlier than the 12th century. But in the Eucharistic controversies of the 9th, 10th and 11th centuries the views which the term embodies were clearly expressed; as, for example, by Radbertus Paschasius (d. 865), who wrote that "the substance of the Bread and Wine is efficaciously changed interiorly into the Flesh and Blood of Christ," and that after the consecration what is there is "nothing else but Christ the Bread of Heaven."[2] The words "substantially converted" appear in the formula which Berengarius was compelled to sign in 1079. Assuming that the *Expositio canonis missae* ascribed to St Pietro Damiani (d. 1072) is doubtful, we may take it that the first use of the word is in a passage of Hildebert de Savardin[3] (d. 1133), who brings it into an exhortation quite informally, as if it were in common use.[4] It is met with in a Decretal of Innocent III.[5] The fourth Council of Lateran fully adopted it (1215). It is clear from the treatise of Radbertus Paschasius already quoted that the word "substance" was used for *reality* as distinguished from *outward appearance*, and that the word "species" meant *outward appearance* as opposed to *reality*. The terms, therefore, were not invented by St Thomas Aquinas, and are not mere scholastic subtlety. The definition of the Council of Trent was intended both to enforce the accepted Catholic position and to exclude the teaching of Luther, who, whilst not professing to be certain whether the "substance" of the Bread and Wine could or could not be said to remain, exclaimed against the intolerance of the Roman Catholic Church in defining the question.[6]

For a full and recent exposition of the Catholic teaching on Transubstantiation the reader may consult *De ecclesiae sacramentis*, auctore Ludovico Billot, S.J. (Rome, Propaganda Press, 1896). The Abbé Pierre Batifol, in his *Études d'histoire et de théologie positive*, 2^me^ série (*Elaboration de la notion de conversion*, and *Conversion et transubstantiation*) treats it from the point of view of development (V. Lecoffre, Paris, 1905). (✠ J. C. H.)

TRANSVAAL, an inland province of the Union of South Africa between the Vaal and Limpopo rivers. It lies, roughly, between 22½° and 27½° S. and 25° and 32° E., and is bounded S. by the Orange Free State and Natal, W. by the Cape province and the Bechuanaland Protectorate, N. by Rhodesia, E. by Portuguese East Africa and Swaziland. Save on the south-west the frontiers, for the main part, are well defined natural features. From the south-west to the north-east corners of the colony is 570 m.; east to west its greatest extent is 397 m. The total area is 111,196 sq. m., a little less than the area of Great Britain and Ireland. The boundaries of the Transvaal have varied from time to time. The most important alteration was made in January 1903 when the districts of Utrecht and Vryheid, which then formed the south-eastern part of the country were annexed to Natal. The area thus lost to the Transvaal was 6970 sq. m. (For map see SOUTH AFRICA.)

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[1] *Concil trident.* Sess. XIII. Can. 2.

[2] P. L. Migne. CXX. *De corpore et sanguine Domini*, cap. viii. 2, cf. xv. 2.

[3] Sometimes called of Tours, or of Le Mans.

[4] See Batifol, *Études d'histoire et de théologie positive*, 2me série.

[5] Lib. III. *Decretalium*, tit. 41, n. 6.

[6] *De captivitate babylonica ecclesiae.* De coenâ Domini. But Luther elsewhere professed Consubstantiation; that is, in modern Lutheran phraseology, the "presence of our Lord's Body" in, with and under the bread.

Physical Features.—About five-sixths of the country lies west of the Drakensberg (*q.v.*), the mountain range which forms the inner rim of the great tableland of South Africa. For a few miles on the Natal-Transvaal frontier the Drakensberg run east and west and here is the pass of Laing's Nek. Thence the mountains sweep round to the north, with their precipitous outer slopes facing east. For some 250 m. within the province the mountains form a more or less continuous range, the highest point being the Mauchberg (8725 ft.) in 24° 20′ 10″ S. 30° 35′ E., while there are several heights of 7000 or more feet. Eastward from the foot of the Drakensberg stretches a broad belt of low land beyond which rise the Lebombo hills running north and south along the parallel of 32° E. and approaching within 35 m. of the sea at Delagoa Bay. The Lebombo hills are flat topped but with a well-defined break on their seaward side. This eastern edge forms the frontier between Transvaal and Portuguese territory.

The country west of the Drakensberg, though part of the main South African tableland, is not uniform in character, consisting of (1) elevated downs, (2) their slopes, (3) the flat "bottom" land. The downs or plateaus occupy all the southern part of the country, sloping gradually westward from the Drakensberg. That part of the plateau east of Johannesburg is from 5000 to 6400 ft. high; the western and somewhat larger half is generally below 5000 ft. and sinks to about 4000 ft. on the Bechuanaland border. This plateau land is called the high veld,[1] and covers about 34,000 sq. m. The northern edge of the plateau follows an irregular line from somewhat north of Mafeking on the west to the Mauchberg on the east. This edge is marked by ranges of hills such as the Witwatersrand, Witwatersberg and Magaliesberg; the Witwatersrand, which extends eastward to Johannesburg, forming the watershed between the rivers flowing to the Atlantic and Indian Ocean. Farther north, beyond the intervening slopes and low bush, are two elevated regions covering together over 4000 sq. m. They are the Waterberg, and, more to the east, separated from the Waterberg by the valley of the Magalakwane tributary of the Limpopo, the Zoutpansberg. The Zoutpansberg has steep slopes and is regarded as the northern termination of the Drakensberg. An eastern offshoot of the Zoutpansberg is known as the Murchison Range. The low land between the high veld and the Waterberg and Zoutpansberg is traversed by the Olifants River, an east flowing tributary of the Limpopo.

The true high veld, extending east to west 120 m. and north to south 100 m., consists of rolling grass covered downs, absolutely treeless, save where, as at Johannesburg, plantations have been made by man, the crest of the rolls being known as *builts* and the hollows as *laagtes* or *vleys*. The surface is occasionally broken by kopjes—either table-shaped or pointed—rising sometimes 100 ft. above the general level. Small springs of fresh water are frequent and there are several shallow lakes or pans—flat bottomed depressions with no outlet. The largest of these pans, Lake Chrissie, some 5 m. long by 1 m. broad, is in the south-eastern part of the high veld. The water in the pans is usually brackish. The middle veld is marked by long low stony ridges, known as rands, and these rands and the kopjes are often covered with scrub, while mimosa trees are found in the river valleys.

The banken veld, formed by the denudation of the plateau, is much broken up and is rich in romantic scenery. It covers about 27,000 sq. m., and has an average breadth of 40 m. In places, as between Mafeking and Johannesburg, the descent is in terrace-like steps, each step marked by a line of hills; in other places there is a gradual slope and elsewhere the descent is abrupt, with outlying hills and deep well-wooded valleys. The rocks at the base of the slopes are granite, the upper escarpments are of sedimentary rocks. Thence issue many streams which in their way to the ocean have forced their way through the ranges of hills which mark the steps in the plateau, forming the narrow passes or *poorts* characteristic of South African scenery.

As in the middle veld, rands and kopjes occur in the low or bush veld, but the general characteristic of this part of the country, which covers over 50,000 sq. m., is its uniformity. The low veld east of the Drakensberg begins at about 3000 ft. above the sea and slopes to 1000 ft. or less until it meets the ridge of the Lebombo hills. The lowest point is at Komati Poort, a gorge through the Lebombo hills only 476 ft. above the sea. West and north of the Drakensberg the general level of the low veld is not much below that of the lowest altitudes of the middle veld, though the climatic conditions greatly differ. North of the Zoutpansberg the ground falls rapidly, however, to the Limpopo flats which are little over 1200 ft. above the sea. Near the north-west foot of the Zoutpansberg is the large saltpan from which the mountains get their name. The low veld is everywhere covered with scrub, and water is scarce, the rivers being often dry in the winter season.

River Systems.—There are four separate river basins in the Transvaal. Of these the Komati (*q.v.*) and its affluents, and the Pongola and its affluents rise in the high veld and flowing eastward to the Indian Ocean drain but a comparatively small area of the province, of which the Pongola forms for some distance the south-eastern frontier. The rest of the country is divided between the drainage areas of the Vaal and Limpopo. The Vaal (*q.v.*) rises in the high veld in the Ermelo district not far from the source of the Komati and that of the Usuto tributary of the Pongola. The Vaal drains the greater part of the plateau, flowing westward towards the Atlantic. The waters of the northern escarpments of the plateau and of all the region farther north are carried to the Indian Ocean by the Limpopo (*q.v.*) and its tributaries the Olifants, Great Marico, Great Letaba, &c. Both the Vaal and the Limpopo in their main course have high steep banks. They carry an immense volume of water during the summer rains, but are very small streams in the winter, when several of their tributaries are completely dry.[2] None of the rivers is navigable within the limits of the province. The absence of alluvial deposits of any size is another characteristic of the Transvaal rivers. For a considerable distance the Vaal forms the frontier between the province and the Orange Free State and in similar manner the Limpopo separates the Transvaal from Bechuanaland and Rhodesia. Since the first advent of white colonists many springs and pans and small streams have dried up, this desiccation being attributed, not so much to decreased rainfall, as to the burning off of the grass every winter, so that the water, instead of soaking in, runs off the hard, baked ground into the larger rivers. (F. R. C.)

Geology.

A broad ring of crystalline rocks (Swaziland schists) encircles the Transvaal except on the south, where the Karroo formation extends over the Vaal River. Within this nearly complete circle of crystalline rocks several geological formations have been determined, of which the age cannot be more definitely fixed than that they are vastly older than the Karroo formation and newer than the Swaziland schists.

The following subdivisions have been recognized by Molengraaff: Karroo System, Transvaal System, Vaal River System, South African Primary System. Each of these systems is separated from the other by a strong unconformity.

South African Primary System.—The South African Primary System includes a complex of rocks as yet little understood. According to Molengraaff it includes the two following series:—

Witwatersrand Series.	An upper group including the auriferous conglomerates of the Rand: a lower group (Hospital Hill series) of quartzites, shales and conglomerates.
Barberton and Swaziland Series.	Crystalline schists, quartzites, conglomerates, intrusive granites.

Barberton Series.—Molengraaff considers the Barberton series to be the metamorphosed equivalent of the Hospital Hill series, while Hatch regards it to be older and to form a portion of his Archaean series (Swaziland schists) to which position it is here assigned. The chief outcrops are in the south-western Transvaal, around Zoutpansberg and in Swaziland. They show a great variety of type made up of slates, quartzites, occasional conglomerates, schists with large masses of intrusive granites and gneiss.

Witwatersrand Series.—It is now generally acknowledged that this important series consists of two main groups. Their chief occurrences are in the districts of Witwatersrand, Heidelberg, Klerksdorp and Venterskroon. The lower group (Hospital Hill slates) consists of quartzites and shales, resting on the eroded surface of the older granites and schists, and estimated to be from 10,000 to 12,000 ft. thick. There are occasional bands of conglomerates, sometimes auriferous. In the absence of fossils their age cannot be determined. The upper group consists of conglomerates, grits and quartzites with a few bands of shales. It has obtained notoriety from the conglomerates along certain bands containing gold, when they constitute the famous "banket." The thickness varies from 2300 to over 11,000 ft. The conglomerate beds occur in belts forming in descending order the Elsburg series, Kimberley series, Bird Reef series, Livingstone Reef series, Main Reef series. The richest in gold are to be found among the Main Reef series, which yields by far the greater part of the total output of gold from the Transvaal. The individual beds, seldom more than a few feet in thickness and sometimes only a few inches, are interstratified with an immense thickness of quartzites. The conglomerates consist almost entirely of pebbles of quartz set in a hard matrix consolidated by the deposition of secondary silica. The conglomerate bands and quartzites contain large quantities of iron pyrites deposited subsequent to their formation, that in the conglomerates containing the gold. Sericite in the form of scales and films characterizes those portions which have been faulted, squeezed or sheared. Sheets of diabase, apparently volcanic flows, and numerous dykes interfere with the regularity of the stratification. The theory of the subsequent infiltration of the gold is that generally accepted. No fossils have been discovered, and except that they represent some portion or portions of rocks of the Pre-Cape formation the age of the upper Witwatersrand beds, as well as that of the lower division, remains an open question. They may safely be considered to be among the oldest auriferous sediments of the world.

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[1] By the Boers the western and less elevated part of the plateau is known as the middle veld.

[2] At the Standerton gauge on the Vaal in 1905–1906, a year of extreme drought, the total flow was 8,017,000,000 cub. ft., of which 7,102,000,000 was storm water.

Vaal River System.—This consists largely of rocks of igneous origin, of which the amygdaloidal diabase of Klipriversberg forms the type. The other rocks include igneous breccias, shales, coarse conglomerates and grits. Near Reitzburg the coarse conglomerates reach a thickness of 400 ft. and about 500 ft. at Kroomdraai. This system rests unconformably on the Witwatersrand series and is unconformably overlain by the Transvaal system. It must, however, be acknowledged that these relationships are very imperfectly understood. Compared with other formations they occupy restricted areas, being only met with south of Johannesburg, around Wolmaransstad, Lichtenburg and east of Marico.

Transvaal System.—This is a very definite sequence of rocks covering immense areas in the centre of the country. The following groups are recognized: Waterberg Series, Pretoria Series, Dolomite Series, Black Reef Series.

The Black Reef Series is composed of quartzites, sandstone, slates and conglomerate. It varies in thickness from 100 ft. in the southern Transvaal to 1000 ft. at Lydenburg. Thin bands of conglomerate, sometimes auriferous, occur near the base.

The Dolomite Series, known to the Dutch as "Olifants Klip," consists of a bluish-grey magnesian limestone with bands of chert. The thickness varies from 2600 ft. in the Witwatersrand area to 5000 ft. around Pretoria; and is about 2600 ft. about Lydenburg. It is worn by solution into caves and swallow-holes (*Wondergarten*). Gold, lead, copper and iron ores occur as veins. So far it has proved to be unfossiliferous. Dykes and intrusive rocks are common.

The Pretoria Series, formerly known as the Gatsrand series, consists of repeated alternations of flagstones and quartzites, shales and sheets of diabase. These follow conformably on the Dolomite series. In the Marico district the shales become highly ferruginous and resemble the Hospital Hill slates of the Witwatersrand series. Near Pretoria duplications of the beds, due to overthrusting, are not uncommon.

The Waterberg Series lies unconformably on the Pretoria series. The colour is usually red, forcibly recalling the Old Red Sandstone and Trias of England. Sandstones, quartzites, conglomerates and breccia make up the formation. They occur to the north-east of Pretoria and occupy still wide areas in the Waterberg district.

A complex of igneous rocks of different ages covers immense areas in the central Transvaal. Various types of granite are the predominant variety. Syenites, gabbros, norites and volcanic rocks are also represented. The granite contains two varieties. One is a red granite intruded subsequently to the Waterberg sandstones; another is a grey variety considered to be older than the Black Reef series and possibly older than the Witwatersrand series.

The Karroo System attains its chief development in the south-eastern Transvaal in the districts of Ermelo, Standerton and Wakkerstroom.

The latest classification of Molengraaff subdivides the beds as follows:—

Hoogeveld Series	=	Beaufort beds of Cape Colony. Contains coal-seams.
Ecca shales.		Not present at Vereeniging.
Dwyka conglomerate.		Sandstones and conglomerates with coal-seams at Vereeniging.

The Dwyka conglomerate resembles the same bed in the Cape province. The boulders consist of very various rocks often of large size. Many of them show glacial striae. The direction of striae on the underlying quartzitic rocks, particularly well seen near the Douglas colliery, Balmoral, point to an ice movement from the north-north-west to south-south-east.

The Ecca series, as in the Cape, consists of sandstones and shales. Seams of coal lie near the base, some of them exceeding 20 ft. in thickness, but in this case layers of shaly coal are included. The overlying sandstones afford good building stones, and frequently, as at Vereeniging, yield many fossil plants. These include among others, *Glossopteris browniana*, *Gangamopteris cyclopteroides*, *Sigillaria Brardi*, *Bothrodendron Leslii*, *Noeggerathiopsis Hislopi*.

The Karroo beds lie almost horizontally, in marked contrast to the highly inclined older rocks. Their distribution, other than in the south-eastern districts, is imperfectly understood. Remnants have been found of their former existence in the neighbourhood of Pretoria; and portions of the Bushveld Sandstone have recently been relegated to the Karroo formation.

The diamond pipes probably represent some of the most recent rocks of the Transvaal. They may be of Cretaceous age or even later, and in any case belong to the same class as those of Kimberley. The recent deposits of the Transvaal may be considered to be insignificant. They include the gravels and alluviums of the present streams and the almost ubiquitous red sand of aeolian origin.[1] (W. G.*)

Climate.—Although lying on the border of and partly within the tropics, the Transvaal, owing to its high general elevation, and to the absence of extensive marshy tracts, enjoys on the whole a healthy invigorating climate, well suited to the European constitution. The climate of the high veld is indeed one of the finest in the world. The air is unusually dry, owing to the proximity of the Kalahari Desert on the west and to the interception on the east by the Drakensberg of the moisture bearing clouds from the Indian Ocean. The range of temperature is often considerable—in winter it varies from about 100° F. in the shade at 1 p.m. to freezing point at night. During summer (Oct.–April) the mean temperature is about 73°; during winter about 53°. Nov.–Jan. are the hottest and June–July the coldest months. The chief characteristic of the rainfall is its frequent intensity and short duration. During May to August there is practically no rain, and in early summer (Sept.–Dec.) the rainfall is often very light. The heaviest rain is experienced between January and April and is usually accompanied by severe thunderstorms. On the eastern escarpment of the Drakensberg the rainfall is heavy, 50 or 60 in. in the year, but it diminishes rapidly towards the centre of the plateau where it averages, at Johannesburg about 30 in.,[2] while in the extreme west as the Kalahari is approached it sinks to about 12 in. The winds in winter are uniformly dry while dust storms are frequent at all seasons—a fact which renders the country unsuitable for persons suffering from chest complaints. In the eastern part of the plateau snow occasionally falls, and frost at night is common during winter.

The banken veld district is also generally healthy though hotter than the plateaus, and malarial fever prevails in the lower valleys. Malarial fever is also prevalent throughout the low veld, but above 3000 ft. is usually of a mild type. Nearly all the country below that elevation is unsuitable for colonization by whites, while the Limpopo flats and other low tracts, including the district between the Drakensberg and the Lebombo hills are extremely unhealthy, blackwater fever being endemic. In the low veld the shade temperature in summer rises to 113° F., but the nights are generally cool, and down to 2000 ft. frost occurs in winter. The rainfall in the low country is more erratic than on the plateau, and in some districts a whole year will pass without rain.

Flora.—The general characteristic of the flora is the prevalence of herbaceous over forest growths; the high veld is covered by short sweet grasses of excellent quality for pasturage; grass is mingled with protea scrub in the middle veld; the banken veld has a richer flora, the valley levels are well wooded, scattered timber trees clothe their sides and the hills are covered with aloe, euphorbia, protea and other scrub growths. Among the timber trees of this region is the bolkenhout of terblanz (*Faurea Saligna*) which yields a fine wood resembling mahogany. The scrub which covers the low veld consists mainly of gnarled stunted thorns with flattened umbrella shaped crowns, most of the species belonging to the sub-order mimoseae. A rare species is the acacia erioloba Rameel doorn, akin to the acacia giraffae of Bechuanaland. The wild seringa (*Burkea africana*) is also characteristic of the low veld and extends up the slopes of the plateau. The meroola (*sclerocarya caffra*) a medium sized deciduous tree with a rounded spreading top is found in the low veld and up the slopes to a height of 4500 ft. It is common in the lower slopes of the rands of the low veld. Cotton and cotton-like plants and vines are also native to the low veld. Few of the low veld bushes are large or straight enough to furnish any useful wood, and timber trees are wholly absent from the level country. The forest patches are confined to the deep kloofs of the mountains, to the valleys of the larger rivers and to the sea-slopes of the Drakensberg and other ranges, where they flourish in regions exposed to the sea mists. These patches, called "woodbushes," contain many hardwood trees of great size, their flora and fauna being altogether different from that immediately outside the wood. Common species in the woodbush are three varieties of yellow wood (*Podocarpus*), often growing to an enormous size, the Cape beech (*myrsine*), several varieties of the wild pear (*Olinia*) and of stinkwood (*Oreodaphne*) ironwood and ebony. The largest forest areas are in the Pongola district and the Haenertsburg and

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[1] For geology see: F. H. Hatch and G. S. Corstorphine, *The Geology of South Africa* (London, 2nd ed., 1909); G. A. F. Molengraaff, *Géologie de la République Sud-africaine du Transvaal*, *Buli. de la Soc. Géol. de France*, 4 série, tome i., pp. 13–92 (1901). (Translation by J. H. Ronaldson, Edinburgh and Johannesburg, 1904); *Reports* and *Memoirs*, Geol. Survey (Transvaal, 1903, et seq.); H. Kynaston, *The Geology of the Transvaal and the Orange River Colony, Handbook, British Association* (Cape Town, 1905); *Trans. Geol. Soc. S. Africa* (Johannesburg).

[2] Exceptionally very heavy rain is experienced on the Rand. In January 1907 seven inches of rain fell in 24 hours.

Woodbush districts north of the Olifants river. Mimosa and the wild wilge-boom (*Salix capensis*) are the common trees on the banks and rivers, while the weeping willow is frequent round the farmsteads.

Many trees have been introduced and considerable plantations made, as for instance on the slopes between Johannesburg and Pretoria. Among the most successful of the imported trees are citrus trees, the Australian wattle and the eucalyptus. Tobacco and the vine both flourish and most European fruits and vegetables thrive. Of native fruits the misple (*Vangueria infausta*), miscalled the wild medlar, is of excellent flavour. It is common on the rands and kopjes of the bush veld. Rose and other flowering shrubs and trees grow well on the banken veld and in the valleys. A large yellow tulip (*Homerica pallida*) is one of the most abundant flowers on moist vlei lands on the high veld and is occasionally met with in the low veld; slangkop (*Urginea Burkei*) with red bulbs like a beetroot is a low bush plant apparently restricted to the Transvaal and adjacent Portuguese territory. Both these and many other plants such as gift-blaar and drouk-gras are poisonous to cattle. These poisonous plants are found chiefly in the banken and low veld.

Fauna.—When first entered by white men the Transvaal abounded in big game, the lion, leopard, elephant, giraffe, zebra and rhinoceros being very numerous, while the hippopotamus and crocodile were found in all the rivers. The indiscriminate destruction of these animals has greatly reduced their numbers and except in the Pongola district, at one or two other places on the Portuguese frontier, and along the Limpopo the hippopotamus, rhinoceros and crocodile are now extinct in the province. A few elephants, giraffes and zebras (*equus burchelli*—the true zebra is extinct) are still found in the north and north-eastern districts and in the same regions lions and leopards survive in fair numbers. Other animals fairly numerous are the spotted hyena, long-eared fox, jackal, aard wolf, red lynx, wild cat, wild dog and wart hog. Many species of antelope are found, mostly in small numbers, including the kudu, hartebeest, the sable and roan antelope, the white tailed and the brindled gnu, waterbuck, red buck, duiker, blesbok, palla, springbuck (numerous), steinbok, grysbok and klipspringer. The Africander breed of cattle is a well-marked variety, and a characteristic native domestic animal. Whether originally imported from Europe by the Portuguese or brought from the north by Africans is not certain. It is not found in a wild state and the auffalo (*bos caffer*) is almost if not quite extinct in the Transvaal. Among edentata the ant-bear, scaly ant-eater and porcupine are plentiful. The spring hare (*pedetes capensis*) abounds. Baboons and other apes are fairly common and there are several species of snakes. The ostrich is found in the Marico and Limpopo districts, and more rarely elsewhere; the great kori bustard and the koorhaan are common.

Insects abound, the greatest pest being the tsetse fly, common in the low veld. Six species of tick, including the blue tick common throughout South Africa, are found, especially in the low veld, where they are the means of the transmission of disease to cattle. Mosquitoes, locusts and ants are also common.

The baba or cat fish and the yellow fish are plentiful in the rivers and the trout has been acclimatized.

To preserve the native fauna the low country on the Portuguese frontier has been made a game reserve. It is nearly 300 m. long with an average breadth of 50 m. Other reserves have been constituted in the north of the province.

Inhabitants.—The population of the Transvaal, on the 17th of April 1904, when the first complete census of the country was taken, was 1,269,951 (including 8215 British soldiers in garrison),[1] or 11·342 persons per sq. m. Of these 20·67%, namely 297,277, were European or white. Of the coloured population 937,127 were aboriginals; and 35,547 were of mixed or other coloured races. Of the whites 178,244 (59·95%) were males. The white population is broadly divisible into the British and Dutch elements, the percentage of other whites in 1904 being but 8·6. The Dutch, as their usual designation, Boers, implies, are mainly farmers and stock-raisers and are still predominant elsewhere than in the Witwatersrand and Pretoria districts. They speak the patois of Dutch known as the *Taal*. The British element is chiefly gathered in Johannesburg and other towns on the Rand and in Pretoria. The total white population in the Witwatersrand and in Pretoria in 1904 was 135,135, and the strength of the British in these districts is shown by the fact that only 20% was Transvaal born. Of those born outside the Transvaal 24·6% came from other British possessions in Africa and 24·92% from Great Britain or British colonies other than African. Of the non-British or Boer whites Russians form 3·01%, Germans 1·62% and Dutch (of Holland) 1·14%.

The natives are found chiefly in Zoutpansberg district, where there were 314,797 at the 1904 census, and the adjoining districts of Lydenburg and Waterberg, *i.e.* in the northern and north-eastern region of the country. The natives belong to the Bantu negro race and are represented chiefly by Basuto, Bechuana, Bavenda, and Xosa-Zulu tribes. None of these peoples has any claim to be indigenous, and, save the Bavenda, all are immigrants since *c.* 1817–1820, when the greater part of the then inhabitants were exterminated by the Zulu chief Mosilikatze (see § *History*). After that event Basuto entered the country from the south, Bechuana from the west and Swazi, Zulu, Shangaan and other tribes from the east and south-east.

The Basuto, who number 410,020 and form 40% of the total population, are now found mostly in the central, northern and north-eastern districts, forming in Lydenburg about 67%, and in Zoutpansberg about 50% of the inhabitants. The Bechuana, who number 64,751, are almost confined to the western and south-western districts.

Next, numerically, to the Basuto and Bechuana peoples are the tribes known collectively as Transvaal Kaffirs, of whom there were 159,860 enumerated at the 1904 census. Altogether the Transvaal Kaffirs form 50% of the inhabitants of Waterberg district, 30% of Zoutpansberg district and 18% of Middelburg district. Zulus number 75,601 and form 54% of the population in Wakkerstroom district and 18% in Standerton district. Elsewhere they are very thinly represented. Swazis form more than half the total population of the Barberton and Ermelo districts and are also numerous in Wakkerstroom. In Barberton, Lydenburg and Zoutpansberg districts Shangaan and other east coast tribes are settled, 80,834 being returned as born in the Transvaal. The Shangaan are members of a Bantu tribe from the Delagoa Bay region who took refuge in the Transvaal between 1860 and 1862 to escape Zulu raids. They were for some time ruled by a Portuguese, Joao Albasini, who had adopted native customs. Since 1873 Swiss Protestant missionaries have lived among them and many of the Shangaans are Christians and civilized. Several other east coast tribes, such as the Bankuna, are of mixed Zulu and Shangaan blood. Among the mixed and other coloured races in the census returns figure 1592 Bushmen, 3597 Hottentots and 1147 Koranna; these people are found chiefly in the south-western regions and are remnants of the true aboriginal population.

Besides the tribes whose home is in the Transvaal considerable numbers of natives, chiefly members of east coast tribes, Cape Kaffirs and Zulus, go to the Witwatersrand to work in the gold and other mines. In all there were, in 1904, 135,042 Bantus in the country born elsewhere. Many east coast natives after working in the mines settle in the northern Transvaal. Of the aboriginal South Africans in the Transvaal, at the 1904 census, 77·69% were born in the Transvaal. Among the aborigines the number of females to males was 114 to 100. (See further KAFFIRS; BECHUANAS; ZULULAND; BUSHMEN; HOTTENTOTS; and for languages, BANTU LANGUAGES).

The number of Asiatics in the Transvaal in April 1904 was 12,320, including 904 Malays, natives of South Africa, and 9986 British Indians. They were nearly all domiciled in the Witwatersrand and in the towns of Pretoria and Barberton, where they are engaged mainly in trade.

Administrative Divisions and Chief Towns.—The province is divided into sixteen magisterial districts. Zoutpansberg, 25,654 sq. m.; Waterberg, 15,503 sq. m.; Lydenburg, 9868 sq. m., occupy the north and north-eastern parts of the country and include most of the low veld areas. Barberton district, 5106 sq. m., is east central. Piet Retief district (in the south-east), 1673 sq. m., lies between Swaziland and Natal. Along the southern border, going east to west from Piet Retief, are the districts of Wakkerstroom, 2128 sq. m.; Standerton, 1959 sq. m.; Heidelberg, 2410 sq. m.; Potchefstroom, 4805 sq. m.; Wolmaransstad, 2169 sq. m., and, occupying the south-western corner of the province, Bloemhof, 3003 sq. m. In the west are the districts of Lichtenburg, 4487 sq. m.; Marico, 3626 sq. m. and Rustenberg, 9511 sq. m. The central regions are divided into the districts of Witwatersrand, 1653 sq. m.; Pretoria, 6525 sq. m.; Middelburg, 4977 sq. m.; Carolina, 1877 sq. m.; Ermelo, 2995 sq. m. and Bethel, 1959 sq. m. It will be seen that twenty districts are enumerated, these being the divisions under the Boer government and still commonly used. In 1904 Bloemhof was officially included in Wolmaransstad; Bethel in Standerton; Piet Retief in Wakkerstroom, and Carolina in Ermelo. Each district is sub-divided into field-cornetcies, the cornetcies being themselves divided, where necessary, into urban and rural areas. For parliamentary purposes the districts are divided into single member constituencies. The capital of the province, and of the Union is Pretoria, with a population (1904) of 36,839 (of whom 21,114 were whites). Johannesburg, the centre of the gold-mining industry, had a population, within the municipal boundary, of 155,642 (83,363 whites). Other towns within the Witwatersrand district are Germiston (29,477), Boksburg (14,757) and Roodepoort-Maraisburg (19,949), virtually suburbs of Johannesburg, and Krugersdorp (20,073) and Springs (5270), respectively at the western and east ends of the district. Besides Pretoria and the towns in the Witwatersrand district, there are few urban centres of any size. Potchefstroom, in the south near the Vaal (pop. 9348), is the oldest town in the Transvaal. Klerksdorp (4276) is also near the Vaal, S.S.W. of Potchefstroom. Middelburg (5085) is the largest town on the railway between Pretoria and Delagoa Bay; Barberton (2433), the centre of the De Kaap gold-fields, lies on the slopes of the Drakensberg overlooking the De Kaap valley.

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[1] For most purposes this military element is *omitted* in the census returns.

Communications.—Before 1888 the only means of communication was by road. In that year the government sanctioned the building of a "steam tramway"—a railway in all but name—from the Boksburg collieries to the Rand gold mines. In 1890 the construction of the Transvaal section of the railway to connect Pretoria with Delagoa Bay was begun, the line from Lourenço Marques having been completed to Komati Poort in December 1887. The line to Pretoria was not opened until July 1895. Meantime, in September 1892, the Cape railway system had been extended to Johannesburg and in December 1895 the through line between Durban and Pretoria was completed. Since that date many other lines have been built. The majority of the railways are the property of and are worked by the state. With the exception of a few purely local lines they are of the standard South African gauge—3 ft. 6 in. The lines all converge on Johannesburg. The following table gives the distances from that city to other places in South Africa[1]:—

Inland Centres—

To Pretoria	46	miles.
,, Kimberley	310	,,
,, Bloemfontein	263	,,
,, Bulawayo (via Fourteen Streams)	979	,,
,, Salisbury (,, ,,)	1279	,,

Seaports—

To Cape Town (via Kimberley)	957	,,
,, ,, (via Bloemfontein)	1013	,,
,, Port Elizabeth	714	,,
,, East London	665	,,
,, Durban	483	,,
,, Lourenço Marques (via Pretoria)	396	,,

Besides the lines enumerated the other railways of importance are: (1) A line from Johannesburg eastward via Springs and Breyten to Machadodorp on the Pretoria-Delagoa Bay railway. (2) A line, 68 m. long from Witbank, a station on the Pretoria-Delagoa Bay line, to Brakpan on the Springs line. By (1) the distance between Johannesburg and Lourenço Marques is 364 m., by (2) 370 m. A continuation of the Springs-Breyten line eastward through Swaziland to Delagoa Bay will give a second independent railway from that port to the Rand, some 60 m. shorter than the route via Pretoria, while from Breyten a line (90 m. long) runs south and east to Ermelo and Piet Retief. (3) A line from Krugersdorp to Zeerust (128 m.). (4) A line from Pretoria to Rustenburg (61 m.). (5) A line from Pretoria to Pietersburg (177 m.). This line was continued (1910) north-west to effect a junction with (6) the "Selati" railway, which, starting from Komati Poort, runs north-west and was in 1910 continued to Leydsdorp. North of the junction with the Pietersburg line the railway goes towards the Limpopo. (7) A line from Belfast on the Pretoria-Delagoa Bay railway to Lydenburg (65 m.). (8) A line from Potchefstroom to Lichtenburg (70 m.).

There is an extensive telegraphic system linking the towns of the province to one another, and, through the surrounding countries, with Europe and the rest of the world. There is inland communication via Rhodesia with British Central Africa and Ujiji on Lake Tanganyika. The telegraph lines within the Transvaal have a length of about 3000 m. There is a well-organized postal service with about 400 offices. In connexion with the postal services to outlying districts there is a public passenger service by mailcarts. In the Pietersberg district zebras are occasionally employed.

Mineral Resources.—The Transvaal, the principal gold producing country in the world, is noted for the abundance and variety of its mineral resources. The minerals chiefly mined besides gold are diamonds and coal, but the country possesses also silver, iron, copper, lead, cobalt, sulphur, saltpetre and many other mineral deposits.

Gold.—The principal gold-bearing reefs are found along the Witwatersrand ("The Rand"). Probably connected with the Rand reefs are the gold-bearing rocks in the Klerksdorp, Potchefstroom and Venterskroon districts. Other auriferous reefs are found all along the eastern escarpment of the Drakensberg and are worked in the De Kaap (Barberton) district, on the Swaziland frontier, in the Lydenburg district, in the Murchison Range and in other places in the Zoutpansberg. Goldfields also exist in the Waterberg and on the western frontier in the Marico district (the Malmani fields). The total value of the gold extracted from mines in the Transvaal up to the end of 1909 was about £246,000,000.

a. The Witwatersrand and Neighbouring Mines.—The Rand reefs, first mined in 1886, cover a large area. The main reef, continuously traced, measures about 62 m. and runs in an east and west direction. The gold is found in minute particles and in the richest ores the metal is rarely in visible quantities before treatment. In many places the main reef lies at a great depth and some bore-holes are over 5500 ft. deep. The yield of the Rand mines, in 1887 but 23,000 oz., rose in 1888 to 208,000 oz. In 1892 the yield was 1,210,000 oz.: in 1896 it exceeded 2,280,000 oz. and in 1898 was 4,295,000 oz. The war that followed prevented the proper working of the mines. In 1905 when a full supply of labour was again available the output was 4,760,000 oz., in which year the sum distributed in dividends to shareholders in the Rand mines was over £4,800,000. The total output from the Rand mines up to the end of 1908 was 56,477,240 oz. (see GOLD, and JOHANNESBURG). The Klerksdorp and Potchefstroom goldfields, known also as the Western Rand, were proclaimed in 1887 and up to the close of 1908 had yielded 446,224 oz.

b. The De Kaap (Barberton) Fields.—Gold was discovered in this district of the Drakensberg in 1875, but it was not until 1884 that the fields attracted much attention. The mines are, in general, situated on the slopes of the hills and are easily opened up by adits. The reefs are narrower than those of the Rand, and the ore is usually very hard. The output, 35,000 oz. in 1889, was 121,000 oz. in 1896, but only 43,000 oz. in 1905. The total production (including the Komati and Swaziland fields) to the end of 1908 was 1,097,685 oz.

c. The Lydenburg and other Fields.—The Lydenburg fields, reported to have been worked by the Portuguese in the 17th century, and rediscovered in 1869, though lying at an elevation of 4500 to 5000 ft. are alluvial—and the only rich alluvial goldfields in South Africa. The ground containing the gold is soil which has escaped denudation. Though several large nuggets have been found (the largest weighing 215 oz.), the total production is not great, the highest output obtained by washing being worth about £300,000 in one year. Besides the alluvial deposits a little mining is carried on, gold being present in the thin veins of quartz which cross the sandstone. The chief centres of the fields are Lydenburg, Pilgrims Rest and Spitzkop. The total output of the Lydenburg fields up to the end of 1908 is estimated at 1,200,000 oz. Farther north, in the Zoutpansberg and on its spurs are the little-worked mines generally known as the Low Country goldfields. Near Pietersburg in the Zoutpansberg is the Eersteling, the first mine worked in the Transvaal. Operations began in 1873 but in 1880 the machinery was destroyed by the Boers. It was not until 1904 that prospecting in the neighbourhood was again undertaken. The fields in the Waterberg and along the Malmani river are very small producers. The total yield to the end of 1908 of the Zoutpansberg, Low Country and other minor fields was 160,535 oz.

Diamonds.—The chief diamond fields are in the Pretoria district. The ground was discovered to be diamondiferous in 1897, but it was not until 1903, when mining began on the Premier mine, situated 20 m. north-east of Pretoria, that the wealth of the fields was proved. The site of the Premier mine had been recognized as diamond-bearing in March 1898. The owner of the land, a Boer named Prinsloo, refused to allow experimental spade work, but after the conclusion of the Anglo-Boer War in 1902 sold his property for £55,000 to T. Cullinan (a Cape colonist and one of the chief contractors in the building of Johannesburg), whose faith in the richness of the ground was speedily justified. In June 1903 mining began and the diamonds found in the first five months realized over £90,000. On the 27th of January 1905, the largest diamond in the world, weighing 3025¾ carats, over 1½ ℔ avoirdupois, was found in the mine and named the Cullinan. The Premier mine is of the same character as the diamond mines at Kimberley (see DIAMOND), and is considerably larger. The area of the "pipe" containing blue ground is estimated at 350,000 sq. yds.

Besides the Pretoria fields there are diamondiferous areas (alluvial diggings) in the Bloemhof district on the Vaal river north-east of Kimberley, and in other regions. In 1898 the output for the whole of the Transvaal was valued at £44,000. The output since the opening of the Premier mine has been: 1903–1904, £685,720; 1904–1905, £1,198,530; 1905–1906, £968,229; 1906–1907, £2,203,511; 1907–1908, £1,879,551; 1908–1909, £1,295,296.

Coal and other Minerals.—There are extensive beds of good coal, including thick seams of steam coal near the Rand and other goldfields. Coal appears to have been first discovered in the neighbourhood of Bronkhorst Spruit between the Wilge and Olifants rivers, where it was so near the surface that farmers dug it up for their own use. In 1887 coal was found at Boksburg in the East Rand, and a mine was at once started. The principal collieries are those at Boksburg and at Brakpan, also on the East Rand, with a coal area of 2400 acres; at Vereeniging and Klerksdorp, near the Vaal; at Waterval, 12 m. north of Pretoria; and in the Middelburg district, between Pretoria and Lourenço Marques. Like that of Natal the Transvaal coal burns with a clear flame and leaves little ash. The mines are free from gas and fire damp and none is more than 500 ft. deep. The output in 1893, the first year in which statistics are available, was 548,534 tons (of 2000 ℔); in 1898 it was 1,907,808 tons, and for the year ending 30th of June 1909 was 3,312,413 tons, valued at £851,150.

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[1] For projected routes, shortening the journey between Europe and Johannesburg, see the *Geog. Journ.*, Dec. 1910.

Iron and copper are widely distributed. The Yzerberg near Marabastad in the Zoutpansberg consists of exceedingly rich iron ore, which has been smelted by the natives for many centuries. Silver is found in many districts, and mines near Pretoria have yielded in one year ore worth £30,000.

Salt is obtainable from the many *pans* in the plateaus, notably in the Zout(salt)pansberg, and was formerly manufactured in considerable quantities.

Agriculture.—Next to mining agriculture is the most important industry. At the census of 1904 over 500,000 persons (excluding young children), or 37% of the population, were returned as engaged in agriculture. Some 25% more women than men were so employed, this preponderance being due to the large number of Kaffir women and the few native men who work in the mealie fields. The chief occupation of the majority of the white farmers is stock-raising. The high veld is admirably adapted for the raising of stock, its grasses being of excellent quality and the climate good. Even better pasture is found in the low veld, but there stock suffers in summer from many endemic diseases, and in the more northerly regions is subject to the attack of the tsetse fly. The banken veld is also unsuited in summer for horses and sheep, though cattle thrive. Much of the stock is moved from the lower to the higher regions according to the season. Among the high veld farmers the breeding of merino sheep is very popular.

The amount of land under cultivation is very small in comparison with the area of the province. In 1904 only 951,802 acres, or 1·26% of the total acreage was under cultivation, and of the cultivated land nearly half was farmed by natives. The small proportion of land tilled is due to many causes, among which paucity of populations is not the least. Moreover while large areas on the high veld are suitable for the raising of crops of a very varied character, in other districts, including a great part of the low veld, arable farming is impossible or unprofitable. Many regions suffer permanently from deficient rainfall; in others, owing to the absence of irrigation works, the water supply is lost, while the burning of the grass at the end of summer, a practice adopted by many farmers, tends to impoverish the soil and render it arid. The country suffers also from periods of excessive heat and general drought, while locusts occasionally sweep over the land, devouring every green thing. In some seasons the locusts, both red and brown, come in enormous swarms covering an area 5 m. broad and from 40 to 60 m. long. The chief method employed for their destruction is spraying the swarms with arsenic. The districts with the greatest area under cultivation are Heidelberg, Witwatersrand, Pretoria, Standerton and Krugersdorp. The chief crops grown for grain are wheat, maize (mealie) and kaffir corn, but the harvest is inadequate to meet local demands. Maize is the staple food of the Kaffirs. Since 1906 an important trade has also arisen in the raising of mealies for export by white farmers. Oats, barley and millet are largely grown for forage. Oats are cut shortly before reaching maturity, when they are known as oat-hay. The chief vegetables grown are potatoes, pumpkins, carrots, onions and tomatoes.

Fruit farming is a thriving industry, the slopes of the plateaus and the river valleys being specially adapted for this culture. At the census of 1904 over 3,032,000 fruit trees were enumerated. There were 163,000 orange trees and nearly 60,000 other citrus trees, 430,000 grape vines, 276,000 pine plants and 78,000 banana plants. Oranges are cultivated chiefly in the Rustenburg, Waterberg, Zoutpansberg and Pretoria districts, grapes in Potchefstroom, Pretoria and Marico, as well as in the Zoutpansberg and Waterberg, to which northern regions the cultivation of the banana is confined. In the tropical district of the Limpopo valley there is some cultivation of the coffee-tree, and this region is also adapted for the growing of tea, sugar, cotton and rice. Tobacco is grown in every district, but chiefly in Rustenburg. Of the 3,032,000 ℔ of tobacco grown in 1904, Rustenburg produced 884,000 ℔.

A department of agriculture was established in 1902, and through its efforts great improvements have been made in the methods of farming. To further assist agriculture a land bank was established by the government in 1907 and an agricultural college in 1910.

Land Settlement.—The land board is a government department charged with the control of Crown lands leased to settlers on easy terms for agricultural purposes. Between 1902 and 1907 about 550 families were placed on the land, their holdings aggregating over 500,000 acres. The Crown lands cover in all about 21,500,000 acres. Large areas of these lands, especially in the northern districts, are used as native reserves.

Other Industries.—There are few manufacturing undertakings other than those connected with mining, agriculture and the development of Johannesburg. There is a large factory for the supply of dynamite to the gold mines. The building and construction trade is an important industry on the Rand, where there are also brickworks, iron and brass foundries, breweries and distilleries. There are a number of flour mills and jam factories in various centres. A promising home industry, started under English auspices after the war of 1899–1902, is the weaving by women of rugs, carpets, blankets, &c., from native wool.

Export and Import Trade.—Before the discovery of gold the trade of the Transvaal was of insignificant proportions. This may be illustrated by the duties paid on imports, which in 1880 amounted to £20,306. In 1887 when the gold-mining industry was in its infancy the duty on imports had risen to £190,792, and in 1897, when the industry was fully developed, to £1,289,039. The Anglo-Boer War completely disorganized trade, but the close of the contest was marked by feverish activity and the customs receipts in 1902–1903 rose to £2,176,658. A period of depression followed, the average annual receipts for the next three years being £1,683,159. In 1908–1909 they were £1,588,960.

The chief exports are gold and diamonds. Of the total exports in 1908, valued at £33,323,000, gold was worth £29,643,000 and diamonds £1,977,000. Next in value came wool (£226,000), horses and mules (£110,000), skins, hides and horns (£106,000), tobacco (£89,000), tin, coal, copper and lead. The gold and diamonds are sent to England via Cape Town; the other exports go chiefly to Delagoa Bay. The imports, valued at £16,196,000 in 1908, include goods of every kind. Machinery, provisions, largely in the form of tinned and otherwise preserved food, and liquors, clothing, textiles and hardware, chemicals and dynamite, iron and steel work and timber, and jewelry are the chief items in the imports. Of the imports about 50% comes from Great Britain and about 20% from British colonies (including other South African states). Half the imports reach the Transvaal through the Portuguese port of Lourenço Marques, Durban taking 25% and the Cape ports the remainder. There is free trade between the Transvaal and the other British possessions in South Africa, and for external trade they all adhere to a Customs Union which, as fixed in 1906, imposes a general *ad valorem* duty of 15% on most goods save machinery, on which the duty is 3%. A rebate of 3% is granted on imports from Great Britain.

Constitution.—The existing constitution dates from 1910. The province is represented in the Union Parliament by eight senators and thirty-six members of the House of Assembly. For parliamentary purposes the province is divided into single-member constituencies. Every adult white male British subject is entitled to the franchise, subject to a six months' residential qualification.[1] There is no property qualification. All electors are eligible to the assembly. Voters are registered biennially, and every five years there is an automatic redistribution of seats on a voters' basis.

Central Government.—At the head of the executive is a provincial administrator, appointed by the Union ministry, who holds office for five years and is assisted by an executive committee of four members elected by the provincial council. The provincial council consists of 36 members elected for the same constituencies and by the same electorate as are the members of the House of Assembly. The provincial council, which has strictly local powers, sits for a statutory period of three years. The control of elementary education was guaranteed to the provincial council for a period of five years from the establishment of the Union.

In May 1903 an inter-colonial council was established to deal with the administration of the railways in the Transvaal and Orange River Colony (known as the Central South African railways), the South African constabulary and other matters common to the Orange River and Transvaal colonies. This council was presided over by the governor of the Transvaal and formed an important part of the administrative machinery. By agreement between the two colonies the council was dissolved in 1908. In 1910 the control of the railways passed to the harbours and railway board of the Union of South Africa.

Local Government.—The unit of administration is the field cornetcy. The semi-military organization of these divisions, which existed under the South African republic, has been abolished, and field-cornets, who are nominated by the provincial government, are purely civil officials charged with the registration of voters, births and deaths, the maintenance of public roads, &c. The chief local authorities are the municipal bodies, many "municipalities" being rural areas centred round a small town. The municipal boards possess very wide powers of local government. The Witwatersrand municipalities are for certain purposes combined into one authority, and representatives of these municipalities, together with representatives of the chamber of mines, compose the Rand water board. The basis of municipal qualification is ownership of real property of the value of £100, or the tenancy of premises of the value of £300, or annual value of £24. Neither aliens nor coloured British subjects can exercise the franchise.

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[1] The number of electors at the first registration (1907) was 105,368.

Finance.—In 1883, before the Rand gold mines had been found revenue and expenditure were about £150,000; in 1887, when the mines were beginning to be developed, the receipts were £668,000 and the expenditure £721,000; in 1889 the receipts had risen to £1,577,000 and the expenditure to £1,226,000. In 1894 the receipts first exceeded two millions, the figures for that year being: revenue £2,247,000, expenditure £1,734,000. The figures for the four following years were:—

	Revenue.	Expenditure.
1895	£3,539,000	£2,679,000
1896	£4,807,000	£4,671,000
1897	£4,480,000	£4,394,000
1898	£3,983,000	£3,971,000

The public debt of the Boer government was £2,500,000. In 1899 war broke out and the finances of the country were disorganized. The accounts of the colony began, for normal purposes, with the year ending 30th of June 1903, and ended in June 1910 on the establishment of the Union. In May 1903 a loan of £35,000,000, guaranteed by the imperial government and secured on the general revenues of the Transvaal and Orange River colonies, was issued to the extent of £30,000,000, the balance being raised about the middle of 1904. This loan bears interest at 3% per annum, with a sinking fund of 1%, and as to the £30,000,000 was issued at par, the £5,000,000 being put up to tender and realizing an average price of £98, 10s. 3d. The principal head in the allocation of this loan was the purchase of the railways in the two colonies at a cost of £13,520,000, while an additional £5,958,000 was devoted to the building of new lines, purchases of rolling stock, &c. The debt of the South African Republic was paid off; £542,000 went to make good the deficit on the administration for 1901–1902; the sum of £1,561,000 was paid to burghers of the Cape Colony and Natal as compensation for war losses; £3,000,000 was devoted to land settlement schemes and £2,000,000 to public works other than railways. The railways were treated as the common property of both colonies, and to administer them and other common services the inter-colonial council was created. In addition to the charges enumerated £5,000,000 were spent out of the loan on "repatriation and compensation" of burghers who had suffered during the war.[1] In addition to the £35,000,000 guaranteed loan of 1903–1904 two small loans for land settlement and public works, together amounting to £254,800, were issued, and in 1907 an imperial guarantee was given for the raising of another loan, of £5,000,000, by the colonial government. The act authorizing the loan devoted £2,500,000 to the establishment of a land and agricultural bank, and £2,500,000 to railways, public works, irrigation and agricultural settlement and development. The loan was raised, as to £4,000,000, in January 1909, the average price obtained being £96, 3s. 7d.

The chief sources of revenue are customs, mining royalties, railways, native revenue (poll tax and passes), posts and telegraphs, stamp and transfer duties, land revenue and taxes on trades and professions. A tax of 10% is levied on the annual net produce of all gold workings (proclamation of 1902) and the government takes 60% of the profits on diamond mines. In 1907 an excise duty was, for the first time, levied on beer. The principal heads of expenditure are on railways and other public works, including posts and telegraphs, justice, education, police, land settlement and agriculture generally, mines and native affairs. Since June 1910 the control of state finance passed to the Union parliament, but the Transvaal provincial council is empowered to raise revenue for provincial purposes by direct taxation and, with the consent of the Union government, to borrow money on the sole credit of the province.

In the five years 1902–1907 the average annual receipts and expenditure amounted to £4,500,000, exclusive of the sums received and expended on account of the loans mentioned. The inter-colonial council received and spent in the four years 1903–1907 over £21,500,000, including some £3,500,000 paid in from revenue by the Transvaal and Orange River colonies to make good deficits. Fully two-thirds of the revenue and expenditure of the Council was derived from and spent upon the Transvaal, so that had the accounts of the two colonies been entirely distinct the figures of the Transvaal budget for 1903–1907 would have balanced at about £8,500,000 a year. In July 1907 when the control of the finances passed into the hands of the Transvaal legislature the credit balance on the consolidated fund was £960,000. In 1908 the inter-colonial council was dissolved, but the railways continued to be administered as a joint concern by a railway board on which the governments of both colonies were represented. This board in 1910 handed over its duties to the harbour and railway board of the Union. The Transvaal revenue (apart from railway receipts) in 1908–1909 was £5,735,000, the corresponding expenditure £4,524,000. The budget figures for 1909–1910 were: revenue £5,943,000; expenditure £5,231,000. The diamond revenue yielded £235,000 and the gold profits tax £965,000. The balance handed over to the Union government was £1,015,000.

Justice.—The laws are based on Roman-Dutch law, as modified by local acts. Courts of first instance are presided over by magistrates, the whole colony being divided into sixteen magisterial wards. There is a provincial division of the Supreme Court of South Africa sitting at Pretoria (consisting of a judge president and six puisne justices) with original and appellate jurisdiction in civil and criminal matters. A local division of the Supreme Court, formerly known as the Witwatersrand high court (consisting of one or more judges of the Supreme Court) sits permanently at Johannesburg and has civil and criminal jurisdiction throughout the Rand. Circuit courts are held as occasion requires.

Police.—Pretoria and Johannesburg have their own police forces. The rest of the province is policed by the South African constabulary, a body 3700 strong, to which is also entrusted customs preventive work, fire brigade work and such like functions.

Education.—Since 1910 education other than elementary is under the control of the Union parliament. The provincial council is responsible for elementary education. At the head of the permanent staff is a director of education. School boards and district committees are formed, but their functions are almost entirely advisory. In accordance with the terms of the Education Act of 1907 of the Transvaal colony, state schools are provided for the free instruction of all white children in elementary subjects. Attendance at school between the ages of 7 and 14 is, with certain exceptions, compulsory. The medium of instruction in the lower standards is the mother tongue of the children. Above standard III. English is the medium of instruction. No religious tests are imposed on teachers and religious teaching is confined to undenominational Bible teaching. No government grants are given to private schools. (In 1906 members of the Dutch community established a "Christian National Education" organization and opened a number of denominational schools.) Secondary education is provided in the towns and high schools are maintained at Pretoria, Johannesburg and Potchefstroom. There are University colleges at Pretoria and Johannesburg. Education of the natives is chiefly in the hands of the missionaries, but the government gives grants in aid to over 100 schools for natives. At the census of 1904 the natives able to read formed less than 1% of the population. At the same census 95% of the white population over 21 were able to read and write; of the whites between the ages of 5 and 14 59% could read and write.

State schools for white children were established by the Boer government, and in the last year (1898) before the British occupation there were 509 schools and 14,700 scholars, the education vote that year being £226,000. In 1902 the property vested in various school committees was transferred to government and control of the schools vested in a department of state. In 1909 there were 670 government elementary schools, with more than 42,000 scholars. In 1907–1908 the education vote exceeded £500,000.

Religion.—Of the total population 26·69% are Christians, and of the Christians 80% are whites. No fewer than 70% of the people, including the bulk of the natives, are officially returned as of "no religion." Of the 336,869 Christians 69,738 were natives. Nearly half of the white community, 142,540 persons, belong to one or other of the Dutch Churches in the Transvaal, but they have only 4305 native members. Of Dutch Churches the first and chief is the Nederduitsch Hervormde Kerk, founded by the Voortrekkers and originally the state Church. The others are the Nederduitsch Gereformeerde Kerk, an offshoot of the Church of the same name at the Cape, and the Gereformeerde Kerk (the "Dopper" Church) with some 15,000 members and adherents in the Transvaal. The "Dopper" Church, an offshoot of the Separatist Reformed Church of Holland, is distinguished from the other Dutch churches in being more rigidly Calvinistic and "Biblical," and in not using hymns. A "Scouts" Church was formed at the end of the war of 1899–1902 by burghers who had previously acted as "National Scouts" and were ostracized by the synods of their former Churches. After some years of friction "National Scouts" were however readmitted, on terms, to their former membership.

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[1] Besides this £5,000,000 an additional sum of £9,500,000 was spent by the imperial government in relieving the necessities of those who had suffered during the war, but of this £9,500,000 the sum of £2,500,000 was in payment for goods received.

The Anglicans number 67,882 (including 13,033 natives), and are 19 % of the European population. At the head of the community is the bishop of Pretoria. Next in numbers according to European membership among the Protestant bodies are Presbyterians, 19,821 (including 1194 natives), and Methodists 37,812 (including 20,648 natives). The Lutherans are the chief missionary body. Of a total membership of 24,175 only 5770 are European. The Protestant European community amounts altogether to 35 % of the white population. The Roman Catholics number 16,453 (including 2005 natives) and form 5 % of the European population, and the Hebrews 15,478 or 5·34 % of the European inhabitants.

Defence.—A strong garrison of the British army is maintained in the province, the headquarters of all the imperial military forces in South Africa being at Pretoria. These forces are under the command of a lieutenant-general, who, however, acts under the supreme direction of the governor-general. The Transvaal forms a distinct district command under a major-general.

A volunteer force was established in 1904, for service within the Transvaal, or wherever the interests of the country might require. The force, disciplined and organized by a permanent staff of officers and non-commissioned officers of the regular army, is about 6500 strong, and consists of a brigade of artillery, four mounted, three composite and four infantry corps, a cyclist corps, &c. There are also cadet companies some 3000 strong. (F. R. C.)

History

A. *Foundation of the Republic.*—At the beginning of the 19th century the country now known as the Transvaal was inhabited, apparently somewhat sparsely, by Bavenda and other Bantu negroes, and in the south-west by wandering Bushmen and Hottentots. About 1817 the country was invaded by the chieftain Mosilikatze and his impis, who were fleeing from the vengeance of Chaka, king of the Zulus. The inhabitants were unable to withstand the attacks of the disciplined Zulu warriors—or Matabele, as they were henceforth called—by whom large areas of central and western Transvaal were swept bare. The remnants of the Bavenda retreated north to the Waterberg and Zoutpansberg, while Mosilikatze made his chief kraal at Mosega, not far from the site of the town of Zeerust. At that time the region between the Vaal and Limpopo was scarcely known to Europeans. In 1829, however, Mosilikatze was visited at Mosega by Robert Moffat, and between that date and 1836 a few British traders and explorers visited the country and made known its principal features. Such was the situation when Boer emigrants first crossed the Vaal.

Potgieter.

The causes which led to the exodus of large numbers of Dutch farmers from Cape Colony are discussed elsewhere (see South Africa and Cape Colony). Here it is only necessary to state that the *Voortrekkers* were animated by an intense desire to be altogether rid of British control, and to be allowed to set up independent communities and govern the natives in such fashion as they saw fit. The first party to cross the Vaal consisted of 98 persons under the leadership of Louis Trichard and Jan van Rensburg. They left Cape Colony in 1835 and trekked to the Zoutpansberg. Here Rensburg's party separated from the others, but were soon afterwards murdered by natives.[1] Trichard's party determined to examine the country between the Zoutpansberg and Delagoa Bay. Fever carried off several of their number, and it was not until 1838 that the survivors reached the coast. Eventually they proceeded by boat to Natal. Meantime, in 1836, another party of farmers under Andries Hendrik Potgieter had established their headquarters on the banks of the Vet river. Potgieter and some companions followed the trail of Trichard's party as far as the Zoutpansberg, where they were shown gold workings by the natives and saw rings of gold made by native workmen. They also ascertained that a trade between the Kaffirs and the Portuguese at Delagoa Bay already existed. On returning to the Vet, Potgieter learned that a hunting party of Boers which had crossed the Vaal had been attacked by the Matabele, who had also killed Boer women and children. This act led to reprisals, and on the 17th of January 1837 a Boer commando surprised Mosilikatze's encampment at Mosega, inflicting heavy loss on the Matabele without themselves losing a man. In November of the same year Mosilikatze suffered further heavy losses at the hands of the Boers, and early in 1838 he fled north beyond the Limpopo, never to return. Potgieter, after the flight of the Matabele, issued a proclamation in which he declared the country which Mosilikatze had abandoned forfeited to the emigrant farmers. After the Matabele peril had been removed, many farmers trekked across the Vaal and occupied parts of the district left derelict. Into these depopulated areas there was also a considerable immigration of Basuto, Bechuana and other Bantu tribes.

The first permanent white settlement north of the Vaal was made by a party under Potgieter's leadership. That commandant had in March 1838 gone to Natal, and had endeavoured to avenge the massacre of Piet Retief and his comrades by the Zulus. Jealous, however, of the preference shown by the Dutch farmers in Natal to another commandant (Gert Maritz), Potgieter speedily recrossed the Drakensberg, and in November 1838 he and his followers settled by the banks of the Mooi river, founding a town named Potchefstroom in honour of Potgieter. This party instituted an elementary form of government, and in 1840 entered into a loose confederation with the Natal Boers, and also with the Boers south of the Vaal, whose headquarters were at Winburg. In 1842, however, Potgieter's party declined to go to the help of the Natal Boers, then involved in conflict with the British. Up to 1845 Potgieter continued to exercise authority over the Boer communities on both sides of the Vaal. A determination to keep clear of the British and to obtain access to the outer world through an independent channel led Potgieter and a considerable number of the Potchefstroom and Winburg burghers in 1845 to migrate towards Delagoa Bay. Potgieter settled in the Zoutpansberg, while other farmers chose as headquarters a place on the inner slopes of the Drakensberg, where they founded a village called Andries Ohrigstad. It proved fever-ridden and was abandoned, a new village being laid out on higher ground and named Lydenburg in memory of their sufferings at the abandoned settlement.

The Sand River Convention.

Meantime the southern districts abandoned by Potgieter and his comrades were occupied by other Boers. These were joined in 1848 by Andries W. J. Pretorius (*q.v.*), who became commandant of the Potchefstroom settlers. When the British government decided to recognize the independence of the Transvaal Boers it was with Pretorius that negotiations were conducted. On the 17th of January 1852 a convention was signed at a farm near the Sand river in the Orange sovereignty by assistant commissioners nominated by the British high commissioner on the one hand, and by Pretorius and other Boers on the other. The first clause was in the following terms:—

> The assistant commissioners guarantee in the fullest manner, on the part of the British government, to the emigrant farmers beyond the Vaal river, the right to manage their own affairs, and to govern themselves according to their own laws, without any interference on the part of the British government, and that no encroachment shall be made by the said government on the territory beyond to the north of the Vaal river, with the further assurance that the warmest wish of the British government is to promote peace, free trade, and friendly intercourse with the emigrant farmers now inhabiting, or who hereafter may inhabit, that country; it being understood that this system of non-interference is binding upon both parties.

At this time there were settled north of the Vaal about 5000 families of European extraction—about 40,000 persons, including young children. They had obtained independence, but they were far from being a united people. When Pretorius conducted the negotiations which led to the signing of the Sand River Convention he did so without consulting the volksraad, and Potgieter's party accused him of usurping power and aiming at domination over the whole country. However, the volksraad, at a meeting held at Rustenburg on the 16th of March 1852, ratified the convention, Potgieter and Pretorius having been publicly reconciled on the morning of the same day. Both leaders were near the end of their careers; Potgieter died in March and Pretorius in July 1853.

Whatever their internal dissensions the Boers were united in regard to what they considered their territorial rights, and in the interval between the signing of the Sand River Convention and the death of Pretorius an incident occurred significant alike of their claims to jurisdiction over enormous areas and of their manner of treating the natives. Within a few weeks of the signing of the convention Pretorius had asked the British authorities to close the "lower road" to the interior, that is the route through Bechuanaland, opened up by Moffat, Livingstone and other missionaries. Pretorius alleged that by this means the natives were obtaining firearms. At the same time the Transvaal Boers claimed that all the Bechuana country belonged to them, a claim which the British government of that day did not think it worth while to contest. No boundary westward had been indicated in the Sand River Convention. The Barolong, Bakwena and other Bechuana tribes, through whose lands the "lower road" ran, claimed however to be independent, among them Sechele (otherwise Setyeli), at whose chief kraal—Kolobeng—Livingstone was then stationed. Sechele was regarded by the Boers as owing them allegiance, and in August 1852 Pretorius sent against him a commando (in which Paul Kruger served as a field cornet), alleging that the Bakwena were harbouring a Bakatla chief who had looted cattle belonging to Boer farmers. It was in this expedition that Livingstone's house was looted. There was little fighting, but the commando carried off between two and three hundred native women and children—some of whom were redeemed by their friends, and some escaped, while many of the children were apprenticed to farmers. Sechele's power was not broken, and he appealed for British protection, which was not then granted. The incident was, however, but the first step in the struggle for the possession of that country (see BECHUANALAND). It served to strengthen the unfavourable impression formed in England of the Transvaal Boers with regard to their treatment of the natives; an impression which was deepened by tidings of terrible chastisement of tribes in the Zoutpansberg, and by the Apprentice Law passed by the volksraad in 1856—a law denounced in many quarters as practically legalizing slavery.

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[1] Two small children were spared and brought up as Kaffirs. In 1867 they were given over to the Boer government by the Swazis, who had acquired them from their captors.

Potchefstroom Assembly, 1856.

On the death of Andries Pretorius his son Marthinus W. Pretorius (*q.v.*) had been appointed his successor, and to the younger Pretorius was due the first efforts to end the discord and confusion which prevailed among the burghers—a discord heightened by ecclesiastical strife, the points at issue being questions not of faith but of church government. In 1856 a series of public meetings, summoned by Pretorius, was held at different districts in the Transvaal for the purpose of discussing and deciding whether the time had not arrived for substituting a strong central government in place of the petty district governments which had hitherto existed. The result was that a representative assembly of delegates was elected, empowered to draft a constitution. In December this assembly met at Potchefstroom, and for three weeks was engaged in modelling the constitution of the country. The name "South African Republic" was adopted as the title of the state, and the new constitution made provision for a volksraad to which members were to be elected by the people for a period of two years, and in which the legislative function was vested. The administrative authority was to be vested in a president, aided by an executive council. It was stipulated that members both of the volksraad and council should be members of the Dutch Reformed Church, and of European blood. No equality of coloured people with the white inhabitants would be tolerated either in church or state. In reviewing an incident so important in the history of the Transvaal as the appointment of the Potchefstroom assembly it is of interest to note the gist of the complaint among the Boers which led to this revolution in the government of the country as it had previously existed. In his *History of South Africa* Theal says: "The community of Lydenburg was accused of attempting to domineer over the whole country, without any other right to pre-eminence than that of being composed of the earliest inhabitants, a right which it had forfeited by its opposition to the general weal." In later years this complaint was precisely that of the Uitlanders at Johannesburg. To conciliate the Boers of Zoutpansberg the new-born assembly at Potchefstroom appointed Stephanus Schoeman, the commandant-general of the Zoutpansberg district, commandant-general of the whole country. This offer was, however, declined by Schoeman, and both Zoutpansberg and Lydenburg indignantly repudiated the new assembly and its constitution. The executive council, which had been appointed by the Potchefstroom assembly, with Pretorius as president, now took up a bolder attitude: they deposed Schoeman from all authority, declared Zoutpansberg in a state of blockade, and denounced the Boers of the two northern districts as rebels.

Presidency of Marthinus Pretorius.

Further to strengthen their position, Pretorius and his party unsuccessfully endeavoured to bring about a union with the Orange Free State. Peaceful overtures having failed, Pretorius and Paul Kruger placed themselves at the head of a commando which crossed the Vaal with the object of enforcing union, but the Free State compelled their withdrawal (see ORANGE FREE STATE). Within the Transvaal the forces making for union gained strength notwithstanding these events, and by the year 1860 Zoutpansberg and Lydenburg had become incorporated with the republic. Pretoria, newly founded, and named in honour of the elder Pretorius, was made the seat of government and capital of the country. The ecclesiastical efforts at unity had not been equally successful. The Separatist Reformed Church of Holland had sent out a young expositor of its doctrines named Postma, who, in November 1858, became minister of Rustenburg. In the following year a general church assembly endeavoured to unite all the congregations in a common government, but Postma's consistory rejected these overtures, and from that date the Separatist (or Dopper) Church has had an independent existence (see *ante*, § *Religion*). Paul Kruger, who lived near Rustenburg, became a strong adherent of the new church.

Internal Dissensions.

Pretorius, while still president of the Transvaal, had been elected, through the efforts of his partisans, president of the Orange Free State. He thereupon (in February 1860) obtained six months' leave of absence and repaired to Bloemfontein, in the hope of peacefully bringing about a union between the two republics. He had no sooner left the Transvaal than the old Lydenburg party, headed by Cornelis Potgieter, landdrost of Lydenburg, protested that the union would be much more beneficial to the Free State than to the people of Lydenburg, and followed this up with the contention that it was illegal for any one to be president of the South African Republic and the Free State at the same time. At the end of the six months Pretorius, after a stormy meeting of the volksraad, apparently in disgust at the whole situation, resigned the presidency of the Transvaal. J. H. Grobelaar, who had been appointed president during the temporary absence of Pretorius, was requested to remain in office. The immediate followers of Pretorius now became extremely incensed at the action of the Lydenburg party, and a mass meeting was held at Potchefstroom (October 1860), where it was resolved that: (*a*) the volksraad no longer enjoyed its confidence; (*b*) that Pretorius should remain president of the South African Republic, and have a year's leave of absence to bring about union with the Free State; (*c*) that Schoeman should act as president during the absence of Pretorius; (*d*) that before the return of Pretorius to resume his duties a new volksraad should be elected.

If at this stage of their existence the real ambition of the Transvaal Boers was to found a strong and compact republican state, their conduct in opposing a scheme of union with the Orange Free State was foolish to a degree. The events of the year 1860, as well as of all the years that followed down to British annexation in 1877, show that licence rather than liberty, a narrow spirit of faction rather than patriotism, were the dominant instincts of the Boer. Had the fusion of the two little republics which Pretorius sought to bring about, and from which apparently the Free State was not averse, actually been accomplished in 1860, it is more than probable that a republican state on liberal lines, with some prospect of permanence and stability, might have been formed. But a narrow, distrustful, grasping policy on the part of whatever faction might be dominant at the time invariably prevented the state from acquiring stability and security at any stage of its history.

The complications that ensued on the action of the Pretorius party subsequent to his resignation were interminable and complicated. Some of the new party were arraigned for treason and fined; and for several months there were two acting presidents and two rival governments within the Transvaal. At length Commandant Paul Kruger called out the burghers of his district and entered into the strife. Having driven Schoeman and his followers from Pretoria, Kruger invaded Potchefstroom, which, after a skirmish in which three men were killed and seven wounded, fell into his hands. He then pursued Schoeman, who doubled on his opponent and entered Potchefstroom. A temporary peace was no sooner secured than Commandant Jan Viljoen rose in revolt and engaged Kruger's forces. Viljoen's commando, with which Pretorius was in sympathy, was known as the Volksleger, or Army of the People. Kruger's force called itself the Staatsleger or Army of the State. Pretorius in 1863 resigned his Free State presidency and offering himself as mediator (not for the first time) succeeded at length in putting a period to the confused series of intestine quarrels. In January 1864 a conference, which lasted six days, was held between the parties and an agreement was reached. This was followed by a new election for president, and once more Pretorius was called upon to fill that office. Kruger was appointed commandant-general.

The Charge of Slavery against the Boers.

Civil strife for a time was at an end, but the injuries inflicted on the state were deep and lasting. The public funds were exhausted; taxes were impossible to collect; and the natives on the borders of the country and in the mountains of the north had thrown off all allegiance to the state. The prestige of the country was practically gone, not only with the world outside, but, what was of still more moment, with her neighbour the Free State, which felt that a federation with the Transvaal, which the Free State once had sought but which it now forswore, was an evil avoided and not an advantage lost. A charge frequently laid at the door of the Boers, at that time and since, was that of enslaving the black races. This charge was not without some justification. It is true that laws prohibiting slavery were in existence, but the Boer who periodically took up arms against his own appointed government was not likely to be, nor was he, restrained by laws. Natives were openly transferred from one Boer to another, and the fact that they were described as apprentices by the farmers did not in the least alter the status of the native, who to all intents and purposes became the property of his master. These apprentices, mostly bought from slave traders when little children, formed, however, a very small proportion of the native population, and after some fifteen years' servitude were usually allowed their freedom. Natives enjoying tribal government were not enslaved, but nothing could exceed in ferocity the measures taken to reduce recalcitrant tribes to submission. Education, as need hardly be said, was in the 'sixties at a very low ebb, and nothing approaching the standard of a high school existed. The private tutor was a good deal in demand, but his qualifications were of the slightest. An unsuccessful European carpenter or other mechanic, or even labourer, not infrequently occupied this position. At the various churches such elementary schools as existed were to be found, but they did not profess to teach more than a smattering of the three "R's" and the principles of Christianity.

Zoutpansberg Native Rising, 1865-8.

In 1865 an empty exchequer called for drastic measures, and the volksraad determined to endeavour to meet their liabilities and provide for further contingencies by the issue of notes. Paper money was thus introduced, and in a very short time fell to a considerable discount. In this same year the farmers of the Zoutpansberg district were driven into laagers by a native rising which they were unable to suppress. Schoemansdal, a village at the foot of the Zoutpansberg, was the most important settlement of the district, and the most advanced outpost in European occupation at that time in South Africa. It was just within the tropics, and was situated in a well-watered and beautiful country. It was used as a base by hunters and traders with the interior, and in its vicinity there gathered a number of settlers of European origin, many of them outcasts from Europe or Cape Colony. They earned the reputation of being the most lawless white inhabitants in the whole of South Africa. When called upon to go to the aid of this settlement, which in 1865–1866 was sore pressed by one of the mountain Bantu tribes known as the Baramapulana, the burghers of the southern Transvaal objected that the white inhabitants of that region were too lawless and reckless a body to merit their assistance. In 1867 Schoemansdal and a considerable portion of the district were abandoned on the advice of Commandant-general Paul Kruger, and Schoemansdal finally was burnt to ashes by a party of natives. It was not until 1869 that peace was patched up, and the settlement arrived at left the mountain tribes in practical independence. Meanwhile the public credit and finances of the Transvaal went from bad to worse. The paper notes already issued had been constituted by law legal tender for all debts, but in 1868 their power of actual purchase was only 30% compared with that of gold, and by 1870 it had fallen as low as 25%. Civil servants, who were paid in this depreciated scrip, suffered considerable distress. The revenue for 1869 was stated as £31,511; the expenditure at £30,836.

Efforts to obtain a Seaport.

The discovery of gold at Tati led President Pretorius in April 1868 to issue a proclamation extending his territories on the west and north so as to embrace the goldfield and all Bechuanaland. The same proclamation extended Transvaal territory on the east so as to include part of Delagoa Bay. The eastern extension claimed by Pretorius was the sequel to endeavours made shortly before, on the initiative of a Scotsman, to develop trade along the rivers leading to Delagoa Bay. It was also in accord with the desire of the Transvaal Boers to obtain a seaport, a desire which had led them as early as 1860 to treat with the Zulus for the possession of St Lucia Bay. That effort had, however, failed. And now the proclamation of Pretorius was followed by protests on the part of the British high commissioner, Sir Philip Wodehouse, as well as on the part of the consul-general for Portugal in South Africa. The boundary on the east was settled by a treaty with Portugal in 1869, the Boers abandoning their claim to Delagoa Bay; that on the west was dealt with in 1871.

The Keate Award.

The Sand River Convention of 1852 had not defined the western border of the state, and the discovery of gold at Tati to the north-west, together with the discovery of diamonds on the Vaal in 1867, offered Pretorius every inducement to extend his boundary. Although to-day the great diamond mines are south of the Vaal River, the early discoveries of diamonds were made chiefly on the northern bank of the Vaal, near the site of the town now known as Barkly West. This territory was claimed by the South African Republic, by Barolong and Batlapin Bechuanas, by Koranas, and also by David Arnot, on behalf of the Griqua captain, Nicholas Waterboer. To settle the boundary question an arbitration court was appointed consisting of a Transvaal landdrost, A. A. O'Reilly, on behalf of the South African Republic, and John Campbell on behalf of the other claimants, with Lieutenant-Governor Keate of Natal as referee. The judges disagreed, and the final decision, afterwards known as the Keate award, was given by the referee on the 17th of October 1871. The decision was in favour of Waterboer, who had, on the 25th of August 1870, before the appointment of the arbitration court, offered his territory to Great Britain, and it was understood by all the parties interested that that offer would be accepted. The award, admittedly just on the evidence before Keate, placed, however, outside the territory of the republic the Bloemhof district, in which district Boer farmers were settled, and over which the Pretoria government had for some years exercised jurisdiction. A few days after the publication of the Keate award Sir Henry Barkly, the British high commissioner, issued proclamations taking over Waterboer's territory under the title of Griqualand West (*q.v.*). The eastern boundary of the new territory was made to include the region between the Harts river and the Vaal, in which the diamond diggings were situated, but not the Bloemhof district. To this district Sir Henry Barkly asserted the British rights, but no steps were taken to enforce them and as a matter of fact the Bloemhof district continued to be part of the Transvaal.

The award caused a strong feeling of resentment among the Boers, and led to the resignation of President Pretorius and his executive. The Boers now cast about to find a man who should have the necessary ability, as they said, to negotiate on equal terms with the British authorities should any future dispute arise. With this view they asked Mr (afterwards Sir John) Brand, president of the Free State, to allow them to nominate him for the presidency of the South African Republic. To this President Brand would not consent. He recognized that, even at this early stage of their history, the Transvaal Boers were filled with the wildest ideas as to what steps they would take in the future to counteract the influence of Great Britain. Brand intimated to many of the leading Transvaal Boers that in his opinion they were embarking on a rash and mistaken policy. He urged that their true interests lay in friendship with, not in hostility to, Great Britain and the British. Having failed with Brand, the Boers invited the Rev. Thomas François Burgers, a member of a well-known Cape Colony family and a minister of the Dutch Reformed Church, to allow himself to be nominated. Burgers accepted the offer, and in 1872 was elected president. About this time gold reefs were discovered in the Zoutpansberg district near Marabastad, and a few gold seekers from Europe and Cape Colony began to prospect the northern portions of the Transvaal. The miners and prospectors did not, however, exceed a few hundred for several years.

Burgers becomes President, 1872.

The appointment of Burgers to the presidency in 1872 was a new departure. He was able, active and enlightened, but he was a visionary rather than a man of affairs or sound judgment. Instead of reducing chaos to order and concentrating his attention, as Brand had done in the Free State, on establishing security and promoting industry, he took up, with all its entanglements, the policy of intrigues with native chiefs beyond the border and the dream of indefinite expansion. In 1875 Burgers proceeded to Europe with the project of raising a loan for the construction of a railway to Delagoa Bay. He was empowered by the volksraad to raise £300,000, but with great difficulty he obtained in Holland the sum of £90,000 only, and that at a high rate of interest. With this inadequate sum some railway plant was obtained, and subsequently lay for ten years at Delagoa Bay, the scheme having to be abandoned for want of funds. On his return to the Transvaal in 1876 Burgers found that the conditions of affairs in the state was worse than ever. The acting-president had in his absence been granted leave by the volksraad to carry out various measures opposed to the public welfare; native lands had been indiscriminately allotted to adventurers, and a war with Sikukuni (Secocoeni), a native chief on the eastern borders of the country, was imminent. A commando was called out, which the president himself led. The expedition was an ignominious failure, and many burghers did not hesitate to assign their non-success to the fact that Burgers's views on religious questions were not sound. Burgers then proceeded to levy taxes, which were never paid; to enrol troops, which never marched; and to continue the head of a government which had neither resources, credit nor power of administration. In 1877 the Transvaal one-pound notes were valued at one shilling cash. Add to this condition of things the fact that the Zulus were threatening the Transvaal on its southern border, and the picture of utter collapse which existed in the state is complete.

B. *First Annexation by Great Britain.*—This condition of affairs coincided with the second movement in South Africa for a confederation of its various colonies and states, a movement of which the then colonial secretary, the 4th earl of Carnarvon, was a warm advocate. As to the Transvaal in particular, it was felt by Lord Carnarvon "that the safety and prosperity of the republic would be best assured by its union with the British colonies." Sir Theophilus Shepstone (*q.v.*) was given a commission, dated the 5th of October, 1876, instructing him to visit the Transvaal and empowering him, if it was desired by the inhabitants and in his judgment necessary, to annex the country to the British crown. Sir Theophilus went to Pretoria in January 1877, with an escort of twenty-five mounted police, and entered into conferences with the president and executive as to the state of the country. By this time Burgers was no longer blinded by the foolish optimism of a visionary who had woven finespun theories of what an ideal republic might be. He had lived among the Boers and attempted to lead their government. He had found their idea of liberty to be anarchy, their native policy to be slavery, and their republic to be a sham. His was a bitter awakening, and the bitterness of it found expression in some remarkable words addressed to the volksraad:

> "I would rather," said Burgers in March 1877, "be a policeman under a strong government than the president of such a state. It is you—you members of the Raad and the Boers—who have lost the country, who have sold your independence for a drink. You have ill-treated the natives, you have shot them down, you have sold them into slavery, and now you have to pay the penalty. . . . We should delude ourselves by entertaining the hope that matters would mend by-and-by. . . . Do you know what recently happened in Turkey? Because no civilized government was carried on there, the Great Powers interfered and said, 'Thus far and no farther.' And if this is done to an empire, will a little republic be excused when it misbehaves? . . If we want justice, we must be in a position to ask it with unsullied hands. . . ."

After careful investigation Shepstone satisfied himself that annexation was the only possible salvation for the Transvaal. He had gone to Pretoria hoping that the Transvaal volksraad would accept Carnarvon's federation scheme; but the federation proposals were rejected by the raad. Shepstone was willing to find some way other than simple annexation out of the difficulty, but none appeared to present itself. The treasury was empty, the Boers refused to pay their taxes, and there was no power to enforce them. A public debt of £215,000 existed, and government contractors were left unpaid. Sir Theophilus Shepstone, finding that the raad would not adopt any remedial measures, on the 12th of April 1877 issued a proclamation annexing the country. The proclamation stated (among other things): "It is the wish of Her Most Gracious Majesty that it [the state] shall enjoy the fullest legislative privileges compatible with the circumstances of the country and the intelligence of its people." The wisdom of the step taken by Shepstone has been called in question. For many years subsequently the matter was so surrounded with the sophistry of English party politics that it was difficult for Englishmen to form any impartial opinion. The history of the Transvaal is more complete and better understood to-day than it was in 1877, and no one who acquaints himself with the facts will deny that Shepstone acted with care and moderation. The best evidence in favour of the step is to be found in the publicly expressed views of the state's own president, Burgers, already quoted. Moreover, the menace of attack on the Zulu side was a serious one, however able the Boers may have been to meet a foe who fought in the open, and who had been beaten by them in previous wars. Even before annexation had occurred, Shepstone felt the danger so acutely that he sent a message to Cetywayo, the Zulu chief, warning him that British annexation was about to be proclaimed and that invasion of the Transvaal would not be tolerated. To this warning Cetywayo, who, encouraged by the defeat of the Boers at Sikukuni's hands, had already gathered his warriors together, replied: "I thank my father Somtseu [Shepstone] for his message. I am glad that he has sent it, because the Dutch have tired me out, and I intended to fight with them . . . and to drive them over the Vaal. . . ." A still further reason for Shepstone's annexation, given by Sir Bartle Frere, was that Burgers had already sought alliance with European powers, and Shepstone had no reason to doubt that if Great Britain refused to interfere, Germany would intervene. Moreover, apart from the attitude

British Annexation, 1877.

of President Burgers, which cannot be said to have been one of active opposition, a considerable number of the Boers accepted the annexation with complacency. Burgers himself left the Transvaal a disappointed, heart-broken man, and a deathbed statement published some time after his decease throws a lurid light on the intrigues which arose before and after annexation. He shows how, for purely personal ends, Kruger allied himself with the British faction who were agitating for annexation, and to undermine him and endeavour to gain the presidency, urged the Boers to pay no taxes. However this may be, Burgers was crushed; but as a consequence the British government and not Paul Kruger was, for a time at least, master of the Transvaal. In view of his attitude before annexation, it was not surprising that Kruger should be one of the first men to agitate against it afterwards. The work of destruction had gone too far. The plot had miscarried. And so Kruger and Dr Jorissen, by whom he was accompanied, were the first to approach Lord Carnarvon with an appeal for revocation of the proclamation. Lord Carnarvon's reply was that the act of annexation was an irrevocable one. Unfortunately the train of events in England favoured the intrigues of the party who wished the annexation cancelled. In 1878 Lord Carnarvon resigned, and there were other evidences of dissension in the British cabinet.

Agitation for Independence.

Kruger, who since the annexation had held a salaried appointment under the British Government, again became one of a deputation to England. His colleague was Piet Joubert. They laid their case before Sir Michael Hicks Beach (who had succeeded Lord Carnarvon) but met with no success. Sir Michael, however, in a despatch dated September the 16th 1878, reiterated the intention of the British cabinet to grant the state "to the utmost practicable extent, its individuality and powers of self-government under the sovereignty of the queen." On the occasion of Kruger's second mission to endeavour to get the annexation revoked Sir T. Shepstone determined to dispense with his further services as a government servant, and terminated the engagement. In the beginning of 1879 Shepstone was recalled and Colonel Owen Lanyon, who had served in Bechuanaland and was then administrator of Griqualand West, was appointed administrator in the Transvaal. In the meantime, the Zulu forces which threatened the Transvaal had been turned against the British, and the disaster of Isandhlwana occurred. Rumours of British defeat soon reached the Transvaal, and encouraged the disaffected party to become bolder in their agitation against British rule. Thus Sir Bartle Frere wrote at the time: "All accounts from Pretoria represent that the great body of the Boer population is still under the belief that the Zulus are more than a match for us, that our difficulties are more than we can surmount, and that the present is the favourable opportunity for demanding their independence." In April Frere visited Pretoria and conferred with the Boers. He assured them that they might look forward to complete self-government under the Crown, and at the same time urged them to sink political differences and join hands with the British against their common enemy, the Zulus. The Boers, however, continued to agitate for complete independence, and, with the honourable exception of Piet Uys, a gallant Boer leader, and a small band of followers, who assisted Colonel Evelyn Wood at Hlobani, the Boers held entirely aloof from the conflict with the Zulus, a campaign which cost Great Britain many lives and £5,000,000 before the Zulu power was finally broken. In June Sir Garnet Wolseley went to South Africa as commander of the forces against the Zulus, and as high commissioner "for a time," in the place of Sir Bartle Frere, of the Transvaal and Natal. Meantime Frere's proposals to fulfil the promises made to grant the Boers a liberal constitution were shelved. After the "settlement" of the Zulu question, Sir Garnet Wolseley proceeded to Pretoria and immediately organized an expedition against Sikukuni, who throughout the Zulu campaign had been acting under the advice of Cetywayo. Sikukuni's stronghold was captured and his forces disbanded.

Effect of Mr Gladstone's Speeches in England.

Sir Garnet Wolseley now assured the Boers at a public gathering that so long as the sun shone the British flag would fly at Pretoria. In May 1880 he returned to England, having established in the Transvaal a legislative council with powers so limited as to convince many of the Boers that there was no intention of fulfilling Shepstone's promises. Meanwhile events in Great Britain had once more taken a turn which gave encouragement to the disaffected Boers. Already in November 1879 Gladstone had conducted his Midlothian campaign. In one speech, referring to Cyprus and the Transvaal, he said: "If those acquisitions were as valuable as they are valueless, I would repudiate them, because they were obtained by means dishonourable to the character of our country." And in another speech he said that the British had insanely placed themselves in the strange predicament of the free subjects of a monarchy going to coerce the free subjects of a republic. Expressions such as these were translated into Dutch and distributed among the Boers, and they exercised a good deal of influence in fanning the agitation already going on in the Transvaal. So keenly were the Midlothian speeches appreciated by the Boers that the Boer committee wrote a letter of thanks to Gladstone, and expressed the hope that should a change in the government of Great Britain occur, "the injustice done to the Transvaal might find redress." In April 1880, this change in the British Government did occur. Gladstone became prime minister, and shortly afterwards Frere was recalled. Could events be more auspicious for the party seeking retrocession? On being directly appealed to by Kruger and Joubert, Gladstone however replied that the liberty which they sought might be "most easily and promptly conceded to the Transvaal as a member of a South African Confederation." This was not at all what was wanted, and the agitation continued. Meanwhile in the Transvaal, concurrently with the change of prime minister and high commissioner, the administrator, Colonel Lanyon, began vigorously to enforce taxation among the Boers. Men who would not pay taxes to their own appointed governments, and who were daily expecting to be allowed to return to that condition of anarchy which they had come to regard as the normal order of things, were not likely to respond willingly to the tax-gatherer's demands. That many of them refused payment in the circumstances which existed was natural.

Outbreak of War, 1880.

In November matters were brought to a head by the wagons of a farmer named Bezuidenhout being seized in respect of the non-payment of taxes, and promptly retaken from the sheriff by a party of Boers. Lanyon began to recognize that the position was becoming grave, and telegraphed to Sir George Colley, the high commissioner of South-East Africa, for military aid. This, however, was not immediately available, and on the 13th of December the Boers in public meeting at Paardekraal resolved once more to proclaim the South African Republic, and in the meantime to appoint a triumvirate, consisting of Kruger, Pretorius and Joubert, as a provisional government. Within three days of the Paardekraal meeting a letter was sent to the administrator demanding the keys of the government offices. Formal proclamation of the republic was made on the 16th of December (Dingaan's Day) at Heidelberg. Hostilities forthwith began. Meanwhile pressure was put on the British prime minister to carry out the policy he had avowed while out of office. But it was not until Great Britain was suffering from the humiliation of defeat that he was convinced that the time for granting that retrocession had arrived. The first shots fired were outside Potchefstroom, which was then occupied by a small British garrison (see POTCHEFSTROOM). On the 20th of December some 240 men under Colonel Anstruther, chiefly belonging to the 94th Regiment, while marching from Lydenburg to Pretoria, were surprised at Bronkhorst Spruit, and cut up by the Boer forces. Half the men were killed and wounded; the other half including some officers, were taken prisoners. Captain Elliot, one of the prisoners, who had been released on parole, was shot dead by Boers while crossing the Vaal, and Captain Lambert, another paroled prisoner who accompanied Elliot, was also shot, but escaped. Pretoria, Rustenberg, Lydenburg, and other smaller towns had been placed in a position of defence under the directions of Colonel Bellairs, who remained in command at Pretoria, the garrison consisting of a small number of troops and the loyal inhabitants. Sir George Colley, with about 1400 men, marched towards the Transvaal frontier, but before reaching it he found, on the 24th of January 1881, that the Boers had already invaded Natal and occupied Laing's Nek. He pitched his camp at Ingogo. Having been defeated at Laing's Nek, and suffered considerable loss in an engagement near Ingogo, Colley took a force to the top of Majuba, a mountain overlooking the Boer camp and the nek. He went up during the night, and in the morning was attacked and overwhelmed by the Boers (Feb. 27). Of the 554 men who constituted the British force on Majuba, 92 were killed and 134 wounded, Sir George Colley himself being amongst those who were slain.

Majuba Hill, 1881.

Ten days previous to the disaster at Majuba Sir Evelyn Wood had arrived at Newcastle with reinforcements. On Colley's death he assumed command. Negotiations had been opened with the Boers before the attack on Majuba and the British cabinet refused to allow that disaster to influence their action. On the 6th of March a truce was concluded and on the 21st terms of peace were arranged between the Boer triumvirate and Sir Evelyn Wood. The most important of these terms were that the Transvaal should have complete internal self-government under British suzerainty and that a British resident should be stationed at Pretoria. Another article reserved to her majesty "the control of the external relations of the said state, including the conclusion of treaties and the conduct of diplomatic intercourse with foreign powers," and the right to march troops through the Transvaal. The boundaries of the state were defined, and to them the Transvaal was strictly to adhere. These terms practically conceded all that the Boers demanded, and were never regarded as anything else than surrender either by the Boers or the loyalists in South Africa. The agreement had hardly been concluded when Sir Frederick Roberts arrived at the Cape with 10,000 troops, and after spending forty-eight hours there returned to England.

In the meantime, while the British general was making a treaty under the instructions of British ministers on the frontier, the beleaguered garrisons of Pretoria, Potchefstroom, and other smaller towns were gallantly holding their own. The news of the surrender reached Pretoria through Boer sources, and when first received there was laughed at by the garrison and inhabitants as a Boer joke. When the bitter truth was at length realized, the British flag was dragged through the dust of Pretoria streets by outraged Englishmen. Presently there assembled in Pretoria a commission to elaborate the terms of peace. On the one side were the Boer triumvirate, on the other Sir Evelyn Wood, Sir Hercules Robinson (Frere's successor in the high commissionership), and Sir J. H. de Villiers, chief justice of Cape Colony, while President Brand of the Orange Free State gave the commission the benefit of his advice. The terms agreed upon were drawn up in the form of a convention and signed (Aug. 3).

Pretoria Convention.

The preamble to the Pretoria Convention of 1881 contained in brief but explicit terms the grant of self-government to the Boers, subject to British suzerainty. In later years, when the Boers desired to regard the whole of this convention (and not merely the articles) as cancelled by the London Convention of 1884, and with it the suzerainty, which was only mentioned in the preamble, Mr Chamberlain, a member of the cabinet of 1880–1885, pointed out that if the preamble to this instrument were considered cancelled, so also would be the grant of self-government.

The government of the state was handed over to the triumvirate on the 8th of August and was continued in their name until May 1883, when Kruger was elected president.

C. *From the Retrocession to 1899.*—The retrocession of the Transvaal was a terrible blow to the loyalists. The Boers, on the other hand, found themselves in better plight than they had ever been before. Their native foes had been crushed by British forces; their liabilities were consolidated into a debt to Great Britain, to be repaid at convenience and leisure—as a matter of fact, not even interest was paid for some time. If ever a small state was well treated by a large one, the Transvaal was so in the retrocession of 1881. Unfortunately, this magnanimity was forthcoming after defeat. It appeared as though a virtue had been made of a necessity, and the Boers never regarded it in any other light.

The New Régime.

The new volksraad had scarcely been returned and the Pretoria Convention ratified (Oct. 25) before a system of government concessions to private individuals was started. These concessions, in so far as they prejudiced the commerce and general interests of the inhabitants, consisted chiefly in the granting of monopolies. Among the first monopolies which were granted in 1882 was one for the manufacture of spirituous liquor. The system continued steadily down to 1899, by which time railways, dynamite, spirits, iron, sugar, wool, bricks, jam, paper and a number of other things were all of them articles of monopoly. In 1882 also began that alteration of the franchise law which subsequently developed into positive exclusion of practically all save the original Boer burghers of the country from the franchise. In 1881, on the retrocession, full franchise rights could be obtained after two years' residence; in 1882 the period of residence was increased to five years. Meanwhile the land-hunger of the Boers became stimulated rather than checked by the regaining of the independence of their country. On the western border, where the natives were of less warlike character than those on their southern and northern frontiers, intrigues were already going on with petty tribal chiefs, and the Boers drove out a portion of the Barolongs from their lands, setting up the so-called republics of Stellaland and Goshen. This act called forth a protest from the 15th Lord Derby (now secretary of state for the colonies), stating that he could not recognize the right of Boer freebooters to set up governments of their own on the Transvaal borders. This protest had no effect upon the freebooters, who issued one proclamation after another, until in November 1883 they united the two new republics under the title of the "United States of Stellaland." Simultaneously with this "irresponsible" movement for expansion, President Kruger proceeded to London to interview Lord Derby and endeavour to induce him to dispense with the suzerainty, and to withdraw other clauses in the Pretoria Convention on foreign relations and natives, which were objectionable from the Boer point of view. Moreover, Kruger requested that the term "South African Republic" should be substituted for Transvaal State.

London Convention, 1884.

The result was the London Convention of the 27th of February 1884. In this document a fresh set of articles was substituted for those of the Pretoria Convention of 1881. In the articles of the new convention the boundaries were once more defined, concessions being made to the Transvaal on the Bechuanaland frontier, and to them the republic was bound to "strictly adhere." In what followed it must always be remembered that Lord Derby began by emphatically rejecting the first Boer draft of a treaty on the ground that no treaty was possible except between equal sovereign states. Moreover, it is undeniable that Lord Derby acted as though he was anxious to appear to be giving the Boers what they wanted. He would not formally abolish the suzerainty, but he was willing not to mention it; and though, in substituting new articles for those of the Pretoria Convention he left the preamble untouched, he avoided anything which could commit the Boer delegates to a formal recognition of that fact. On the other hand, he was most indignant when in the House of Lords he was accused by Lord Cairns of impairing British interests and relinquishing the queen's suzerainty. He declared that he had preserved the thing in its substance, if he had not actually used the word; and this view of the matter was always officially maintained in the colonial office (which, significantly enough, dealt with Transvaal affairs) whatever the political party in power. Unfortunately, the timid way in which it was done made as ineffaceable an impression on Kruger even as the surrender after Majuba. Article 4 stated:

> "The South African Republic will conclude no treaty or engagement with any state or nation, other than the Orange Free State, nor with any native tribe to the eastward or westward of the Republic, until the same has been approved by her Majesty the Queen."

The other article to which the greatest interest was subsequently attached was art. 14:

> "All persons, other than natives, conforming themselves to the laws of the South African Republic (*a*) will have full liberty, with their families, to enter, travel, or reside in any part of the South African Republic; (*b*) they will be entitled to hire or possess houses, manufactories, warehouses, shops and premises; (*c*) they may carry on their commerce either in person or by any agents whom they may think fit to employ; (*d*) they will not be subject, in respect of their persons or property, or in respect of their commerce or industry, to any taxes, whether general or local, other than those which are or may be imposed upon citizens of the said Republic."

Territorial Expansion Efforts.

Economic Developments: Gold Industry.

Notwithstanding the precise fixing of the boundaries of the republic by the London Convention, President Kruger endeavoured to maintain the Boer hold on Goshen and Stellaland, but the British government on this point proved firm, and an expedition set out in 1884 under Sir Charles Warren, broke up the freebooters' two states, and occupied the country without a shot being fired (see BECHUANALAND). The expedition cost Great Britain a million and a half, but the attempt at farther extension westwards was foiled, and a little later treaties with Lobenguela and the grant to Cecil Rhodes and his co-directors of a charter for the British South Africa Company put a check on designs the Boers held to expand northward (see RHODESIA). On the eastern border a similar policy of expansion was followed by the Boers, and in this instance with more success. Following up the downfall of the Zulu power after the British conquest in 1879, several parties of Boers began intriguing with the petty chiefs, and in May 1884, in the presence of 10,000 Zulus, they proclaimed Dinizulu, the son of Cetywayo, to be king of Zululand (see ZULULAND). As a "reward" for their services to the Zulus, the Boers then took over from them a tract of country in which they established a "New Republic." In 1886 the "New Republic" with limits considerably narrowed, was recognised by Great Britain, and the territory became incorporated with the Transvaal in 1888. Their eastern boundary, in the teeth of the spirit of the conventions, and with but scant observance of the letter, was by this means considerably extended. A similar policy eventually brought Swaziland almost entirely under their dominion (see SWAZILAND). At the same time President Kruger revived the project of obtaining a seaport for the state, one of the objects of Boer ambitions since 1860 (vide *supra*). Kruger endeavoured to acquire Kosi Bay, to the north of Zululand and only 50 m. east of the Swazi frontier. Meanwhile, events occurring within the state augured ill for the future of the country. In 1884 a concession to a number of Hollander and German capitalists of all rights to make railways led to the formation of the Netherlands Railway Company. This company, which was not actually floated till 1887, was destined to exercise a disastrous influence upon the fortunes of the state. Gold digging had hitherto enjoyed in the Transvaal but a precarious existence. In 1883 the discovery of Moodie's Reef near the Kaap Valley led to a considerable influx of diggers and prospectors from the colonies and Europe, and by 1884 the Sheba Mine had been opened up, and Barberton, with a population of 5000 inhabitants, sprung into existence. In 1886 the Rand goldfields, which had just been discovered, were proclaimed and Johannesburg was founded. From that time the gold industry made steady progress until the Rand gold mines proved the richest and most productive goldfield in the world. As the industry prospered, so did the European population increase. The revenue of the state went up by leaps and bounds. At the end of 1886 Johannesburg consisted of a few stores and some few thousand inhabitants. In October 1896 the sanitary board census estimated the population as 107,078, of whom 50,907 were Europeans. The wealth which was pouring into the Boer state coffers exceeded the wildest dreams of President Kruger and his followers. Land went up in value, and farms, many of them at comparatively remote distances from the goldfields, were sold at enormously enhanced prices. In fact, so attractive did this sale of land become to the Boers that they eventually parted with a third of the whole land area of the country to Uitlander purchasers. Yet in spite of the wealth which the industry of the Uitlanders was creating, a policy of rigid political exclusion and restriction was adopted towards them.

Relations with the rest of South Africa.

An attempt was made in 1888, after the conference held between Cape Colony, the Orange Free State and Natal, to induce the Transvaal to enter a customs union. Kruger would have none of it, although by so doing he could have obtained permission for a settlement at and railway to Kosi Bay. A convention to this effect was signed in August 1890, the Transvaal being allowed three years in which to take advantage of its provisions. Kruger's design at this time was to bring the whole of the external trade of the state, which was growing yearly as the gold industry developed, through Delagoa Bay and over the Netherlands railway. His hostility towards Great Britain and even Cape Colony led him to adopt a commercial policy both narrow and prejudicial to the interests of the gold industry. In the appointment of F. W. Reitz as president of the Orange Free State (January 1889) on the death of Sir John Brand, Kruger recognized a new opportunity of endeavouring to cajole the Free State. Brand had arranged, in the teeth of the strongest protests from Kruger, that the Cape railway should extend to Bloemfontein and subsequently to the Vaal river. Kruger now endeavoured to control the railway policy of the Free State, and induced that republic to agree to a treaty whereby each state bound itself to help the other whenever the independence of either should be threatened or assailed, unless the cause of quarrel was, in the eyes of the state called in to assist, an unjust one (see ORANGE FREE STATE).

Oligarchical Restrictions.

In 1890 a feeling of considerable irritation had grown up among the Uitlanders at the various monopolies, but particularly at the dynamite monopoly, which pressed solely and with peculiar severity upon gold miners. Requests for consideration in the matter of the franchise, and also for a more liberal commercial policy in the matter of railways, dynamite and customs dues, began to be made. In response Kruger enacted that the period of qualification for the full franchise should now be raised to ten years instead of five. He at the same time instituted what was called a second chamber, the franchise qualifications for which were easier, but which was not endowed with any real power. During this year Kruger visited Johannesburg, and what was known as "the flag incident" occurred. He had by this time rendered himself somewhat unpopular, and in the evening the Transvaal flag, which flew over the landdrost's house, was pulled down. This incensed Kruger so much that for many years he continued to quote it as a reason why no consideration could be granted to the Uitlanders.

Uitlander Grievances.

By 1892 the Uitlanders began to feel that if they were to obtain any redress for their grievances combined constitutional action was called for, and the first reform movement began. The Transvaal National Union was formed. This consisted at the outset chiefly of mercantile and professional men and artisans. The mining men, especially the heads of the larger houses, did not care at this juncture to run the risk of political agitation. The Hon. J. Tudhope, an ex-minister in the Cape government, was elected chairman of the union. The objects of this body were avowed from the outset. They desired equal rights for all citizens, the abolition of monopolies and abuses, together with the maintenance of the state's independence. In the furthering of this policy Tudhope was supported by Charles Leonard and his brother

Commandeering Incident, 1894.

German Flirtation.

James Leonard, at one time attorney-general of Cape Colony. Both the Leonards, as well as many of their followers, were South Africans by birth. They, in common with the great bulk of the Uitlanders, recognized that the state had every right to have its independence respected. But they asserted that a narrow and retrogressive policy, such as Kruger was following, was the very thing to endanger that independence. The soundness of these views and the legitimacy of Uitlander aspirations were recognized by a few Boer officials at Pretoria. Some prominent burghers even spoke at Uitlander meetings in favour of the Uitlander requests. At a later date, Chief Justice Kotze, when on circuit, warned the Boers that in its retrogressive action the government was undermining the *grondwet* or constitution of the state. It soon became evident that one course, and one only, lay open to President Kruger if he desired to avert a catastrophe. It was to meet in a friendly spirit those men who had by their industry converted a poor pastoral country into a rich industrial one, who represented more than half the inhabitants, who paid more than three-fourths of the revenue, and who were anxious to join him as citizens, with the rights of citizenship. He chose a course diametrically opposite. In an interview accorded to seven delegates from the National Union, in 1892, he told Charles Leonard to "go back and tell your people that I shall never give them anything. I shall never change my policy. And now let the storm burst." In 1894 there occurred an incident which not only incensed the Uitlanders to fury, but called for British intervention. A number of British subjects resident in the Transvaal, in spite of their having no political status, were commandeered to suppress a native rising. This led to a protest, and eventually a visit to Pretoria, from Sir Henry Loch the high commissioner. In the negotiations which followed, President Kruger at length agreed to extend "most favoured nation" privileges to British subjects in reference to compulsory military service, and five British subjects who had been sent as prisoners to the front were released. This result was not, however, achieved before President Kruger had done his utmost to induce Sir Henry Loch to promise some revision in favour of the Transvaal of the London Convention. Following this incident came a further alteration in the franchise law, making the franchise practically impossible to obtain. At a banquet given in honour of the German emperor's birthday in Pretoria in January 1895, Kruger referred in glowing terms to the friendship of Germany for the Transvaal, which in the future was to be more firmly established than ever. This speech was public evidence of what was known to be going on behind the scenes. The German consul at Pretoria at this juncture as a volatile, sanguine man, with visionary ideas of the important part Germany was to play in the future as the patron and ally of the South African Republic, and of the extent to which the Bismarckian policy might go in abetting an anti-British campaign. Whether he deceived himself or not, he led President Kruger and the Boers to believe that Germany was prepared to go to almost any length in support of the Transvaal if any opportunity occurred. His influence was an undoubted factor in the Kruger policy of that time.

Drifts Incident.

The Delagoa Bay railway being at length completed to Pretoria and Johannesburg, Kruger determined to take steps to bring the Rand traffic over it. The Netherlands railway began by putting a prohibitive tariff on goods from the Vaal river. Not to be coerced in this manner, the Rand merchants proceeded to bring their goods on from the Vaal by wagon. Kruger then closed the drifts (or fords) on the river by which the wagons crossed. He only reopened them after the receipt of what was tantamount to an ultimatum on the subject from Great Britain.

Boer Road to the Sea Blocked.

In May 1895, on the urgent representations of Sir Henry Loch, the British government annexed Tongaland, including Kosi Bay, thus making the British and Portuguese boundaries conterminous on the coast of south-east Africa. In the previous month certain native territories between Tongaland and Swaziland had been annexed by Great Britain. The Boers, who had failed to fulfil the conditions under which they might have secured Kosi Bay, nevertheless resented this action, which took away from them all chance of obtaining a seaport. Kruger telegraphed that "this annexation cannot be regarded by this government otherwise than as directed against this republic. They must therefore regard it as an unfriendly act, against which they hereby protest." The protest was unheeded, the British government having realized the international complications that might ensue had the Transvaal a port of its own.

Uitlander Reform Movement.

The "Jameson Plan."

At this time the Uitlanders formed a majority of the population, owned half the land and nine-tenths of the property, and they were at least entitled to a hearing. When in August 1895 they forwarded one of their many petitions praying for redress of their grievances and an extension of the franchise, their petition, with over 35,000 signatures, was rejected with jeers and insult. One member of the Raad, during a debate in the chamber, called upon the Uitlanders to "come on and fight" for their rights if they wanted them. The words were but the utterance of an individual Raad member, but they were only a shade less offensive than those used by Kruger in 1892, and they too accurately describe the attitude of the Boer executive. In September a meeting of the chambers of mines and commerce was held at Johannesburg, and a letter on various matters of the greatest importance to the mining industry was addressed to the Boer executive. It was never vouchsafed an answer. What the next step should be was freely discussed. Some urged an appeal to the Imperial government; but others, especially men of colonial birth and experience, objected that they would be leaning on a broken reed. That men who had still the memory of Majuba in their hearts should have felt misgiving is not to be wondered at. At this juncture (October 1895) came overtures to the leading Uitlanders from Cecil Rhodes, then prime minister of Cape Colony, and from Dr Jameson, leading to the Jameson Raid. To one or two men this scheme, subsequently known as the Jameson Plan, had been revealed in the previous June, but to the majority even of the small group of leaders it was not known till October or November 1895. The proposition came in a tempting hour. Rhodes and Jameson, after considerable deliberation, came to the conclusion that they might advantageously intervene between Kruger and the Uitlanders. They induced Alfred Beit, who was an old personal friend of Rhodes, and also largely interested in the Rand gold mines, to lend his co-operation. They then submitted their scheme to some of the Uitlander leaders. Between them it was arranged that Jameson should gather a force of 800 men on the Transvaal border; that the Uitlanders should continue their agitation; and that, should no satisfactory concession be obtained from Kruger, a combined movement of armed forces should be made against the government. The arsenal at Pretoria was to be seized; the Uitlanders in Johannesburg were to rise and hold the town. Jameson was to make a rapid march to Johannesburg. Meanwhile, in order to give Kruger a final chance of making concessions with a good grace, and for the purpose of stating the Uitlander case to the world, Charles Leonard, as chairman of the National Union, issued a historic manifesto, which concluded as follows:—

> We have now only two questions to consider: (*a*) What do we want? (*b*) How shall we get it? I have stated plainly what our grievances are, and I shall answer with equal directness the question, What do we want? We want: (1) the establishment of this republic as a true republic; (2) a *grondwet* or constitution which shall be framed by competent persons selected by representatives of the whole people and framed on lines laid down by them—a constitution which shall be safeguarded against hasty alteration; (3) an equitable franchise law, and fair representation; (4) equality of the Dutch and English languages; (5) responsibility to the heads of the great departments of the legislature; (6) removal of religious disabilities; (7) independence of the courts of justice, with adequate and secured remuneration of the judges; (8) liberal and comprehensive education;

> (9) efficient civil service, with adequate provision for pay and pension; (10) free trade in South African products. That is what we want. There now remains the question which is to be put before you at the meeting of the 6th of January, viz. How shall we get it? To this question I shall expect from you an answer in plain terms according to your deliberate judgment.

The Jameson conspiracy fared no worse and no better than the great majority of conspiracies in history. It failed in its immediate object. Jameson did not obtain more than 500 men. Johannesburg had the greatest difficulty in smuggling in and distributing the rifles with which the insurgents were to be armed. The scheme to seize the Pretoria fort had to be abandoned, as at the time fixed Pretoria was thronged with Boers. Finally, to make confusion worse confounded, Jameson, becoming impatient of delay, in spite of receiving direct messages from the leaders at Johannesburg telling him on no account to move, marched into the Transvaal.

Collapse of Jameson Raid.

The policy of delay in the execution of the plot which the Uitlander leaders found themselves compelled to adopt was determined by a variety of causes. Apart from the difficulty of obtaining arms, a serious question arose at the eleventh hour which filled some of the Uitlanders with mistrust. The reform leaders in the Transvaal, down to and including the Johannesburg rising, had always recognized as a cardinal principle the maintenance of the independence of the state. From Cape Town it was now hinted that the movement in which Jameson was to co-operate should, in Rhodes's view, be carried out under the British flag. A meeting of Uitlander leaders was hastily summoned on the 25th of December. Two messengers were that night despatched to interview Rhodes, who then gave the assurance that the flag question might be left to a plebiscite of the inhabitants of the Transvaal[1] (see Blue-book, 1897, 165, p. 21). It was determined nevertheless to postpone action; however, on the 29th of December, Jameson started, and the news of his having done so reached Johannesburg from outside sources. A number of leading citizens were at once formed into a reform committee. In the absence of Charles Leonard, who had been sent as one of the delegates to Cape Town to interview Rhodes, Lionel Phillips, a partner in Messrs Eckstein & Co., the largest mining firm on the Rand, was elected chairman. Phillips had been for three years in succession chairman of the chamber of mines, and he had persistently for several years tried to induce Kruger to take a reasonable view of the requirements of the industry. Under the supervision of the reform committee, such arms as had been smuggled in were distributed, and Colonel Frank Rhodes was given charge of the armed men. A large body of police was enrolled, and order was maintained throughout the town. On the 2nd of January 1896 Jameson, who found himself at Doornkop in a position surrounded by Boers, surrendered. Jameson and his men were conveyed to Pretoria as prisoners, and subsequently handed over to the high commissioner (Sir Hercules Robinson, who had succeeded Sir Henry Loch in June 1895).

The Kaiser's Telegram.

Significant of the attitude of Germany—whose "flirtation" with the Transvaal has been noted—was an open telegram sent by the emperor William II. the day after the surrender of Jameson congratulating Kruger that "without appealing to the help of friendly powers" he had repelled the raiders. The British government rejoined by commissioning a flying squadron and by calling attention to the London Convention, reserving the supervision of the foreign relations of the Transvaal to Great Britain. In Johannesburg meanwhile the Kruger government regained control. The whole of the reform committee (with the exception of a few who fled the country) were arrested on a charge of high treason and imprisoned in Pretoria. In April, at the trial, the four leaders—Lionel Phillips, Frank Rhodes, J. H. Hammond and George Farrar, who in conjunction with Charles Leonard had made the arrangements with Jameson—were sentenced to death, the sentence being after some months' imprisonment commuted to a fine of £25,000 each. The rest of the committee were each sentenced to two years' imprisonment, £2000 fine or another year's imprisonment, and three years' banishment. This sentence, after a month's incarceration, was also commuted. The fine was exacted, and the prisoners, with the exception of Woolls Sampson and W. D. (Karri) Davies, were liberated on undertaking to abstain from politics for three years in lieu of banishment. Messrs Sampson and Davies, refusing to appeal to the executive for a reconsideration of their sentence, were retained for over a year.

The Surrender of Johannesburg.

Sir Hercules Robinson was unfortunately in feeble health at the time, and having reached Pretoria on the 4th of January, he had to conduct negotiations under great physical disadvantage. He had no sooner learnt of the raid in Cape Town than he issued a proclamation through Sir Jacobus de Wet, the British resident at Pretoria, warning all British subjects in Johannesburg or elsewhere from aiding and abetting Jameson. This was freely distributed among the public of Johannesburg. While in Pretoria the high commissioner in the first instance addressed himself to inducing Johannesburg to lay down its arms. He telegraphed to the reform committee that Kruger had insisted "that Johannesburg must lay down arms unconditionally as a precedent to any discussions and consideration of grievances." On the following day, the 7th of January, Sir Hercules telegraphed again through the British agent, who was then at Johannesburg, saying: "That if the Uitlanders do not comply with my request they will forfeit all claims to sympathy from Her Majesty's government and from British subjects throughout the world, as the lives of Jameson and the prisoners are now practically in their hands." The two thousand odd rifles which had been distributed among the Uitlanders were then given up. With regard to the inducements to this step urged upon the reform committee by the high commissioner, it is only necessary to say with reference to the first that the grievances never were considered, and with reference to the second it subsequently appeared that one of the conditions of the surrender of Jameson's force at Doornkop was that the lives of the men should be spared. It was after the Johannesburg disarmament that Kruger had sixty-four members of the reform committee arrested, announcing at the same time that his motto would be "Forget and forgive." Sir Hercules Robinson, in response to a message from Mr Chamberlain, who had been secretary of state for the colonies since July 1895, urging him to use firm language in reference to reasonable concessions, replied that he considered the moment inopportune, and on the 15th of January he left for Cape Town. In 1897 he was succeeded in the high commissionership by Sir Alfred Milner.

After the Raid.

In the period which intervened between the Jameson raid and the outbreak of the war in October 1899 President Kruger's administration continued to be what it had been; that is to say, it was not merely bad, but it got progressively worse. His conduct immediately after Johannesburg had given up its arms, and while the reform committee were in prison, was distinctly disingenuous. Instead of discussing grievances, as before the Johannesburg disarmament he had led the high commissioner to believe was his intention, he proceeded to request the withdrawal of the London Convention, because, among other things, "it is injurious to dignity of independent republic." When Kruger found that no concession was to be wrung from the British government, he proceeded, instead of considering grievances, to add considerably to their number. The Aliens Expulsion and Aliens Immigration Laws, as well as the new Press Law, were passed in the latter part of 1896.

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[1] Jameson, speaking at Durban on the 9th of August 1910, declared that the raid was not racial in the sense usually understood, but an effort towards federation. During the raid he carried a letter containing the names of the proposed new executive, and had the raid succeeded it was proposed to make General Lukas Meyer (d. 1902) president. Jameson subsequently explained that Rhodes and he in designating "an eminent Dutchman" as president of "the new provincial republic" had had no communication with Meyer on the subject. Neither he (Jameson) nor Rhodes had any knowledge of a proposal, to which General Botha had publicly referred, that Charles Leonard should be president. (See the *Cape Times Weekly Edition*, Sept. 7, 1910, p. 15.)

Petition to the Queen.

In 1897 a decision of Chief Justice Kotze was overruled by an act of the volksraad. This led to a strong protest from the judges of the high court, and eventually led to the dismissal of the chief justice, who had held that office for over twenty years, and during the whole of that time had been a loyal and patriotic friend to his country. An industrial commission appointed during this year by President Kruger fared no better than the high court had done. The commission was deputed to inquire into and report on certain of the grievances adversely affecting the gold industry. Its constitution for this purpose was anomalous, as it consisted almost entirely of Transvaal officials whose knowledge of the requirements of the industry was scanty. In spite of this fact, however, the commission reported in favour of reform in various directions. They urged, among other things, due enforcement of the liquor law, more police protection, the abolition of the dynamite concession, and that foodstuffs should be duty free. These recommendations made by President Kruger's own nominees were practically ignored. In 1898, to strengthen his relations with foreign powers, Kruger sent the state secretary, Dr Leyds,[1] to Europe as minister plenipotentiary, his place on the Transvaal executive being taken by Mr Reitz, the ex-president of the Free State. At home Kruger continued as obdurate as ever. In January 1899 Mr Chamberlain pointed out in a despatch to President Kruger that the dynamite monopoly constituted a breach of the London Convention. To help the Transvaal government out of its difficulty, and to make one more effort towards conciliation, the financial houses of Johannesburg offered to lend the Transvaal government £600,000 wherewith to buy out the dynamite company, and so terminate the scandal and bring some relief to the industry. The offer was not accepted. Meantime Sir Alfred Milner had also endeavoured to induce the Transvaal government to grant the necessary reforms, but his efforts were equally unavailing (see MILNER, VISCOUNT). In March the Uitlanders, hopeless of ever obtaining redress from President Kruger, weary of sending petitions to the Raad only to be jeered at, determined to invoke intervention if nothing else could avail, and forwarded a petition to Queen Victoria. This petition, the outcome of the second Uitlander movement for reform, was signed by 21,000 British subjects, and stated the Uitlander position at considerable length. The following extract conveys its general tenor:—

> The condition of your Majesty's subjects in this state has become well-nigh intolerable. The acknowledged and admitted grievances, of which your Majesty's subjects complained prior to 1895, not only are not redressed, but exist to-day in an aggravated form. They are still deprived of all political rights, they are denied any voice in the government of the country, they are taxed far above the requirements of the country, the revenue of which is misapplied and devoted to objects which keep alive a continuous and well-founded feeling of irritation, without in any way advancing the general interest of the state. Maladministration and peculation of public moneys go hand in hand, without any vigorous measures being adopted to put a stop to the scandal. The education of Uitlander children is made subject to impossible conditions. The police afford no adequate protection to the lives and property of the inhabitants of Johannesburg; they are rather a source of danger to the peace and safety of the Uitlander population.

Bloemfontein Conference.

In response to this appeal, Mr Chamberlain, in a despatch dated the 10th of May, proposed a conference at Pretoria. Six days before Sir Alfred Milner had telegraphed to London a summary of the situation, comparing the position of the Uitlanders to that of helots and declaring the case for intervention to be overwhelming. Neither of these despatches was made public at the time. But on the very day Mr Chamberlain wrote his despatch the friends of the Transvaal government in Cape Colony and the Orange Free State invited Sir Alfred Milner to meet President Kruger at Bloemfontein, hoping to be able to exert pressure on both parties and to arrange a settlement as favourable as possible to the Transvaal. The conference opened on the 31st of May and closed on the 5th of June. It no sooner opened than it was evident that Kruger had come to obtain, not to grant, concessions. He offered, it is true, a seven years' franchise law in place of the five years' franchise which Sir Alfred Milner asked for. But apart from the relief suggested being entirely inadequate, it was only to be given on certain conditions, one of which was that all future disputes which might arise between the Transvaal and the Imperial government should be referred to a court of arbitration, of which the president should be a foreigner. No arrangement was possible on such terms. Meanwhile feeling was running high at Johannesburg and throughout South Africa. Meetings were held in all the large towns, at which resolutions were passed declaring that no solution of the Transvaal question would be acceptable which did not provide for equal political rights for all white men. Sir Alfred Milner urged the home government strongly to insist upon a minimum of reform, and primarily the five years' franchise; and Mr Chamberlain, backed by the cabinet, adopted the policy of the high commissioner. (A. P. H.; F. R. C.)

D. *The Crisis of 1899.*—A state of extreme diplomatic tension lasted all the summer. The British public, in whom there had always been the latent desire to retrieve the surrender to the Boers which had followed the disaster at Majuba, were at last awakened by the ministerialist press to the necessity of vindicating British influence in South Africa, and the government soon found that, in spite of a highly articulate Radical minority, the feeling of the country was overwhelmingly behind them. It was not then realized either by the public or the government how seriously, and with what considerable justification, the Boers believed in their ability, if necessary, to sweep the British "into the sea." President Kruger had every expectation of large reinforcements from the Dutch in the two British colonies; he believed that, whatever happened, Europe would not allow Boer independence to be destroyed; and he had assured himself of the adhesion of the Orange Free State, though it was not till the very last moment that President Steyn formally notified Sir Alfred Milner of this fact. The Boers profoundly despised the military power of Great Britain, and there was no reason why they, any more than Germany or France, should contemplate the possibility of the empire standing together as a whole in such a cause. In England, on the other hand, it was thought by most people that if a firm enough attitude were adopted Mr Kruger would "climb down," and the effect of this error was shown partly in the whole course of the negotiations, partly in the tone personally adopted by Mr Chamberlain. It was only later that it was seen that if Great Britain intended effectually to champion the Uitlander cause, the moment for a test of strength had inevitably arrived. Negotiations could only bring the conflict a little nearer, delay it a little longer, or supply an opportunity to either side to justify its action in the eyes of the world. The conditions of the problem were such that unless Great Britain were to accept a humiliating rebuff, any correspondence, however skilfully conducted, was bound to bring into greater prominence the standing causes of offence between the two sides. The exchange of despatches soon led to a complete *impasse.* The persistent attempt of the South African Republic to assert its full independence, culminating in a formal denial of British suzerainty, made it additionally incumbent on Great Britain to carry its point as to the Uitlander grievances, while, from Mr Kruger's point of view, the admission of the Uitlanders to real political rights meant the doom of his oligarchical régime, and appeared in the light of a direct menace to Boer supremacy. The franchise, again, was an internal affair, in which the convention gave Great Britain no right to interfere, while if Great Britain relied on certain definite breaches of the convention, satisfaction for which was sought in the first place in such a guarantee of amendment as the Uitlander franchise would involve, the Boer answer was an offer of arbitration, a course which Great Britain could not accept without admitting the South African Republic to the position of an equal. Here was material enough for an explosion, even if personal misunderstandings and aggravations, adding fuel to the fire, had not naturally occurred (or even been deliberately plotted) during the negotiations. But the truth was that the Boers thought they stood to gain by fighting, while the British, though not expecting war, and acting up till the last month or so on the assumption that serious military preparations were either unnecessary or sufficiently unlikely to be necessary to make them politically inexpedient, had with no less confidence committed themselves to a policy which was impracticable on peaceful terms.

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[1] Dr W. J. Leyds, a Hollander born in Java in 1859, went out to the Transvaal in 1884 as attorney-general and was, in 1887, made government commissioner for the Netherlands (S. A.) railway. In 1890 he became state secretary and in that position was regarded as Kruger's right-hand man.

After July the tactics of the Boer executive were simply directed towards putting off a crisis till the beginning of October, when the grass would be growing on the veld, and meanwhile towards doing all they could in their despatches to put the blame on Great Britain. At last they drafted, on the 27th of September, an ultimatum to the British government. But, although ready drafted, many circumstances conspired to delay its presentation. Meanwhile, the British war office began to act. Certain departmental details were despatched to South Africa to form a working nucleus for military bases, and early in September the cabinet sanctioned the despatch to Natal from India of a mixed force, 5600 strong, while two battalions were ordered to South Africa from the Mediterranean. Sir George White was nominated to the chief command of the forces in Natal, and sailed on the 16th of September, while active preparations were set on foot in England to prepare against the necessity of despatching an army corps to Cape Town, in which case the chief command was to be vested in Sir Redvers Buller. Fortunately, although the draft of an ultimatum was lying in the state secretary's office in Pretoria, the Boers, unprepared in departmental arrangements which are necessary in large military operations, were unable to take the field with the promptitude that the situation demanded. They consequently forfeited many of the advantages of the initiative.

The military strength of the two republics was practically an unknown quantity. It was certain that, since the troublous times of 1896, the Transvaal had greatly increased its armaments; but at their best, except by a very few,[1] the Boers were looked upon by British military experts as a disorganized rabble, which, while containing many individual first-class marksmen, would be incapable of maintaining a prolonged resistance against a disciplined army. As was to be subsequently shown, the hostilities were not confined to opposition from the fighting strength of the two little republics alone; the British had to face Dutch opposition in their own colonies. The total fighting strength of the Boer republics is difficult to ascertain exactly. General Botha stated that there were 83,000 burghers from 15 to 65 years of age on the commando lists. Lord Kitchener put the total number of combatants on the Boer side at 95,000 (Cd. 1790, p. 13). The British official *History of the War* gave the number as 87,000; another calculation, based on the number killed, taken prisoner and surrendered, made the total 90,000. In the second (1901) rebellion of the Cape Dutch about 8000 joined the burgher forces. The number of Boers in the field at any one period was probably little more than 40,000. But the fact that it was to a large extent a struggle with a nation in arms doubled the numbers of the force that the Transvaal executive was able to draw upon. The bulk of the Dutch levies were organized on the burgher system—that is, each district was furnished with a commandant, who had under him field-cornets and assistant field-cornets, who administered the fighting capacity of the district. Each field-cornet, who, with the commandant, was a paid official of the state, was responsible for the arms, equipment and attendance of his commando.

The plan of campaign which found favour with the Boers, when they determined to put their differences with Great Britain to the test by the ordeal of the sword, was to attack all the principal British towns adjacent to their own borders; at the same time to despatch a field army of the necessary dimensions to invade and reduce Natal, where the largest British garrison existed. It is not too much to suppose that the executive in Pretoria had calculated that the occupation of Durban would inspire the entire Dutch nation with a spirit of unanimity which would eventually wrest South Africa from the British. On paper the scheme had everything to recommend it as the expedient most likely to bring about the desired end. But the departmental executive could not launch the Natal invading force as early as had been anticipated, and it was not until the 9th of October that the ultimatum was presented to Sir (then Mr) Conyngham Greene, the British agent at Pretoria. The scheduled demands were as follow:—

The Ultimatum.

"*a.* That all points of mutual difference shall be regulated by the friendly course of arbitration, or by whatever amicable way may be agreed upon by the government with Her Majesty's Government.

"*b.* That the troops on the borders of this republic shall be instantly withdrawn.

"*c.* That all reinforcements of troops which have arrived in South Africa since the 1st of June 1899 shall be removed from South Africa within a reasonable time, to be agreed upon with this government, and with a mutual assurance and guarantee on the part of this government that no attack upon or hostilities against any portion of the possessions of the British Government shall be made by the republic during further negotiations within a period of time to be subsequently agreed upon between the governments, and this government will, on compliance therewith, be prepared to withdraw the armed burghers of this republic from the borders.

"*d.* That Her Majesty's troops now on the high seas shall not be landed in any part of South Africa."

To these demands the Transvaal government required an answer within 48 hours.

There could be only one reply, and on Wednesday, the 11th of October 1899, at five o'clock p.m., a state of war existed between the British government and the two Boer republics. On the following day the Boer attack on an armoured train at Kraaipan, a railway station in Cape Colony south of Mafeking and close to the western frontier of the Transvaal, witnessed the first hostile shot of a bloody war, destined to plunge South Africa into strife for two years and a half. (H. Ch.)

Stages of the War.

E. *The War of 1899–1902.*—For the purposes of history the South African War may be conveniently divided into five distinct periods. The first comprises the Boer invasion, terminating with the relief of Ladysmith on the 28th of February. The second, the period of Boer organized resistance, may be said to have finished with the occupation of Komati Poort in October 1900 (a month after Lord Roberts's formal annexation of the Transvaal) and the flight of President Kruger. The third may be characterized as a period of transition; it marks the adoption in earnest of a guerrilla policy on the part of the enemy, and an uncertain casting about on the part of the British for a definite system with which to grapple with an unforeseen development. This phase endured up to the failure of the Middelburg negotiations in March 1901. The next stage was that which saw the slow building up of the blockhouse system and the institution of small punitive columns, and may be considered to have extended until the close of 1901. The fifth, and last period—which, after all other expedients had failed, finally brought the residue of uncaptured and unsurrendered burghers to submission—was the final development of the blockhouse system, wedded to the institution of systematic "driving" of given areas, which operations were in force until the 31st of May 1902, when peace was ratified at Pretoria.

The first of these periods saw the severest fighting of the campaign. It opened with the investment of Mafeking by a Transvaal force under P. A. Cronje and the envelopment of Kimberley by Free State commandos under General Wessels. But these were minor operations. The main Boer effort was made in Natal, where their forces were commanded by P. J. Joubert, while Lieut.-General Sir George White was the British commander-in-chief. The northern part of Natal presented two faces of a triangle to the two enemies, the short base being formed by the Tugela river. Close to the head of the triangle at Dundee and Glencoe was posted a small British force under Major-General Sir W. Penn Symons. Against this force there advanced a Boer force under Lukas Meyer from the east, and, more slowly, the foremost portion of the main Boer army from the north, while at the same time other Transvaalers descended upon the railway between Glencoe and Ladysmith, and the Free Staters from the passes of the Drakensberg advanced towards Ladysmith, the British centre of operations at which the reinforcements sent from India gathered. On the 20th of October the Dundee brigade vigorously and successfully attacked Talana Hill, and drove back Lukas Meyer, but this success was dearly bought. Symons was mortally wounded, and 226 officers and men were killed and wounded. Half the mounted men lost their way in attempting to pass the enemy's flank and were taken, and the brigade, threatened to its left rear by Joubert's advance and by the force that had seized the railway, only escaped being enveloped by retreating upon Ladysmith, where it arrived in an exhausted state on the 26th of October. Meanwhile Sir George White had discovered the Boer force on the railway, and, though anxious on account of the advance of the Free Staters, on the 21st, stimulated by the news of Talana, he sent out a force of all arms under General (Sir John) French to drive the Boers from Elandslaagte and so to clear Symons's line of retreat. This was accomplished by French and his subordinate, Colonel (Sir) Ian Hamilton, in the action of Elandslaagte on the 21st of October (British losses, 258 all ranks). But on the 22nd the Free Staters' advance caused the victorious force to be recalled to Ladysmith, and the third action north of that town, Rietfontein (24th), was only a demonstration to cover the retirement of the Dundee force. By the 29th of October all the British forces at the front and their reinforcements had fallen in on Ladysmith, which the Transvaalers on the north and east and the Free Staters on the west side began to invest. Before the junction of the two allied wings was complete Sir George White attempted by a general attack to break up their line. The result of this decision was the battle of Lombard's Kop, outside Ladysmith, in which the whole of the available British force was engaged. The engagement was disastrous to the British, who had undertaken far too comprehensive an attack, and the Natal Field Force was obliged to fall back upon Ladysmith with the loss of 1500 men, including a large number of prisoners belonging to the left column under Lieut.-Colonel F.R.C. Carleton, who were cut off at Nicholson's Nek and forced to surrender by a mixed force of Transvaalers and Free Staters under Christian de Wet. From that day the rôle of the Natal Field Force was changed from that of a mobile field army into that of a garrison, and two days later it was completely isolated, but not before General French had succeeded in escaping south by train, and the naval authorities had been induced by Sir George White's urgent appeals to send into the town a naval brigade with a few guns of sufficient range and calibre to cope with the heavy position artillery which Joubert was now able to bring into action against the town.

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[1] Lord Wolseley foresaw the strength of the Boers. Writing on the 12th of September 1899 he said, "If this war comes off it will be the most serious war England has ever had" (see *Military Life of the Duke of Cambridge*, ii. 421).

Operations in Natal.

General Sir Redvers Buller, who had been appointed to the supreme command in South Africa as soon as it was perceived that war was imminent—his force being one army corps in three divisions, the divisional generals being Lord Methuen, Sir W. Gatacre and Sir C. F. Clery—arrived in Cape Town, ahead of his troops, on the day following Lombard's Kop. The situation which presented itself was delicate in the extreme. In Natal practically the whole of the available defence force was swallowed up by the steady success of the invasion; on the western frontier two British towns were isolated and besieged; and Boer commandos were on the point of invading Cape Colony, where the Dutch population seemed on the verge of rebellion. The army corps was about to arrive, practically as a whole unit, in South Africa; but it was evident that the exigencies of the situation, and the widely divided areas of invasion, would at least defer the execution of the plan which had been formed for an invasion of the Orange Free State from Cape Colony. The first duty was to effect the relief of the British forces which had been rendered immobile, and another duty imposed by political circumstances was to relieve Kimberley (where Cecil Rhodes was), while the prospect of rebellion forbade the complete denudation of the central part of the colony. Thus Sir Redvers Buller had no choice but to disintegrate the army corps. Clery and some brigades were sent to Natal; Gatacre with less than a brigade, instead of a division, was despatched to Queenstown, Cape Colony; while Lord Methuen, with a division, was sent off to relieve Kimberley. As November wore on, the situation did not improve. Cape Colony was invaded; while in Natal a flying column of Boers, pushing down from the Tugela, for a short time isolated the newly-arrived force under General (Sir) H. J. T. Hildyard, which opposed Joubert's advance on Pietermaritzburg at Estcourt. The situation in Natal seemed so serious that on the 22nd of November Sir Redvers Buller left Cape Town and sailed for Durban. In the meantime Lord Methuen had commenced his march to the relief of Kimberley. He encountered resistance at Belmont on the 23rd, but attacking resolutely he drove the Boers out of their strong positions. Two days later he won another action at Enslin. Still persevering he moved on to the Modder, where he was seriously opposed by De la Rey and P. A. Cronje, the latter having posted down from Mafeking with 2000 men and arrived on the previous night. The Boers, who held a river line, kept the British attack at bay all day, but eventually fell back, relinquishing the position after dark, as their right had been turned by General Pole-Carew's brigade. It was a long and wearing fight, in which the British lost 485 killed and wounded, and what was more serious, Lord Methuen (himself wounded) found that his force had exhausted its forward momentum, and that he would have to collect supplies and reinforcements on the Modder before fighting his next battle. The extent of the operations and the gravity of the situation now began to be felt in England; every available man was called up from the reserves, and the war office made what at the time appeared to be adequate provision for the waste which it was seen would occur. On the 30th of November the mobilization of a sixth division was ordered, offers of colonial aid were accepted, and every facility provided for local recruiting in the South African ports. Thus in the early days of December confidence was considerably restored. Buller was arranging for the relief of Ladysmith, which had already shown its spirit by two successful sorties against the besiegers' batteries. In every theatre the British strength was consolidating. But the full significance of the situation presented by these two small nations in arms had not yet been appreciated. The confidence restored by the lull during the early part of December was destined to be roughly shattered. On the 10th of December Gatacre essayed a night march and attack upon the enemy's position at Stormberg, and, misled by his guides in unknown ground, was himself surprised and forced to return with a loss of 719. On the following day Lord Methuen delivered an attack upon Cronje's position between the Upper Modder river and the Kimberley road, a line of kopjes called Spytfontein and Magersfontein. In a night attack on Magersfontein hill the Highland brigade came under heavy fire while still in assembly formation, and lost its general, A.G. Wauchope, and 750 men, and in the battle by day which followed the other brigades were unable to retrieve the failure, the total losses amounting to about 950. But even this could be suffered with equanimity, since Buller was about to bring his own force into play, and Buller, it was confidently supposed, would not fail. He had collected at Chieveley in Natal a brigade of mounted men, four brigades of infantry and six batteries of artillery, and he carried with him the trust alike of the army and the nation.

Buller's Arrival.

Failures of Methuen and Gatacre.

Buller's Failure.

Lord Roberts sent out.

On the 15th of December Buller made his effort and failed. Behind the Tugela at Colenso were Louis Botha's forces covering the siege of Ladysmith, and, imperfectly acquainted with the topography, Buller sent a force to turn Botha's left, in conjunction with a frontal attack. But the flank attack became entangled in mass in a loop of the river and suffered heavily, and two batteries that formed part of the frontal attack came into action within a few hundred yards of unsuspected Boer trenches, with the result that ten guns were lost, as well as in all some 1100 men. Buller then gave up the fight. The full nature of the failure was not realized by the British public, nor the spirit in which the general had received the finding of fortune. He lost heart, and actually suggested to White the surrender of Ladysmith, believing this to be inevitable and desiring to cover White's responsibility in that event with his own authority; but White replied that he did not propose to surrender, and the cabinet at home, aware of Buller's despondency, appointed Field Marshal Lord Roberts to the supreme command, with Major-General Lord Kitchener as his chief of staff. A wave of military enthusiasm arose throughout the empire, and as the formation of a seventh division practically drained the mother-country of trained men, a scheme for the employment of amateur soldiers was formulated, resulting in the despatch of Imperial Yeomanry and Volunteer contingents, which proved one of the most striking features of the South African campaign. Pending the arrival of Lord Roberts and reinforcements, the situation in South Africa remained at a deadlock: the three besieged towns—Mafeking, Kimberley and Ladysmith—still held their own, but no headway was made by the relief columns; all they could do was to stand on the defensive. The only bright spot, as far as the British were concerned, was to be found in northern Cape Colony, where General French, with two cavalry brigades and details, by his skilful tactics and wonderful activity kept at arm's length a superior force of the enemy in the vicinity of Colesberg, an achievement the more noteworthy since he had pitted against him both De la Rey and De Wet, two of the three men of military genius produced by the war on the Boer side. On the 6th of January the Boers in Natal made a desperate attempt to storm Ladysmith. The garrison, though already weakened by privation and sickness, made a stubborn resistance, and after one of the fiercest engagements of the war, repulsed the attack at Caesar's Camp and Wagon Hill with severe loss to the enemy, itself having 500 casualties.

Spion Kop.

When Lord Roberts arrived in Cape Town on the 10th of January 1900 the three garrisons were still invested, and the relieving forces were still maintaining their rôle of passive resistance, while at the same time restraining the Dutch in Cape Colony. The commander-in-chief's first duty was to create a field army out of the tangle of units in Cape Colony. In the meantime, Sir Redvers Buller, who had been reinforced by Sir Charles Warren and the 5th division, essayed a second attempt to cross the Tugela, by turning the Boer left. But much time was consumed and the plan underwent several modifications before its execution began in earnest on the 16th of January. Warren was placed in command of the main body, which crossed the Tugela at Trichardt's Drift on the 17th and 18th. The mounted troops engaged a Boer force north-west of the point of passage, but were brought back to take part in a general right wheel of the forces of the Tugela, pivoting on Trichardt's Drift. But meantime the mobile enemy, whose original flank had been turned, had gathered at the new centre of gravity, and the upshot of several days' fighting was the retreat of the British. They had penetrated the enemy's right centre by the seizure of Spion Kop, but the force there became the target for the concentrated attacks of the Boers, and, after suffering heavily, was withdrawn (Jan. 24, 1900), with a loss of 1700 men.

By the 1st of February Lord Roberts had matured his plans and begun to prepare for their execution. On the 3rd of February he ordered a demonstration against the right of the Boer position at Spytfontein-Magersfontein to cover the withdrawal of General French and the cavalry from before Colesberg, and the concentration of his army at Modder River, disregarding another set-back in Natal to Sir Redvers Buller, who had against his advice made a third attempt to relieve Ladysmith on the 5th of February, and failed to make good the purchase which he secured across the Tugela (Vaal Krantz).

Roberts's Advance.

Paardeberg.

Lord Roberts's plan was first to concentrate to his left, taking every measure to induce the Boers to believe that the original scheme of invasion by the centre would now be resumed, and in this purpose he succeeded so well that his field army with the necessary transport for a cross-country march was assembled between the Orange and the Modder without serious mishap. Cronje at the new centre of gravity was not reinforced, all available Boers drawing down towards Colesberg. The concentration effected, Cronje still believed that the relief of Kimberley was the object of the gathering behind Modder River, and therefore held on to his Magersfontein kopje. The relief of Kimberley was indeed urgent, for dissensions between Rhodes and the military authorities had become acute. But to this part of the task only the cavalry division assembled under French was assigned. The army itself was to force Cronje into the open and then advance on Bloemfontein from the west. Roberts began his operations on the 11th of February. French started from Ramdam (near Graspan) eastward on that day, intending to make a wide sweep round Cronje's immobile army. Skirmishing with De Wet in the first stages of their ride, the cavalry brigades crossed the Modder at Klip Drift on the 13th. Cronje sent only detachments to oppose them, but these detachments were broken through by a sword-in-hand charge of the whole division, and Kimberley was relieved on the 15th. The infantry, meeting with great difficulties in its crossing of the Riet at Waterval owing to the country and its own unwieldy transport, followed 1½ to 2 days later. But Cronje had now realized his danger, and slipped away westward behind French and in front of the leading infantry at Klip Drift. This was deflected by Kitchener westward to follow up the Boer rearguard, and after some delay the remainder of the infantry, at first fronting northwards, swerved westward likewise, while French from Kimberley, with such of his men as he could mount on serviceable horses, headed off Cronje in the north-west. The result, after one premature and costly assault on Cronje's lines had been made by Kitchener, was the surrender of 4000 Boers at Paardeberg with their leader on the 29th of February, the anniversary of Majuba. At the same moment came in news at last of the relief of Ladysmith.

Relief of Ladysmith.

It was part of Roberts's purpose to relieve the pressure in Natal by his own operations. Buller began his fourth advance on the 14th of February, and though this was checked the foothold gained was not abandoned, and a fifth and last attempt (Pieter's Hill) was successful. Ladysmith was relieved on the 28th of February. It had fared worst of all the beleaguered garrisons, and its 22,000 inhabitants were almost at their last gasp when relief came. The casualties from shell-fire had been few, but those from sickness were very heavy. Buller's operations, too, had cost at Colenso 1100 men, at Spion Kop 1700, at Vaalkrantz 400, and now in the last long-drawn effort 1600 more—over 5000 in all. But the tide of war had changed. The Natal invaders fell back to the mountains which enclose the north of the colony; Oliver and Schoeman retired from Cape Colony before the small forces of Gatacre and Clements; and the presidents of the republics, realizing that the British Empire was capable of more resistance than they had calculated upon, put forward feelers aiming at the restoration of the *status quo* before the war. These proposals were rejected by Lord Salisbury: there could be no end now but a complete destruction of the Boer power.

The surrender of Cronje and the relief of Ladysmith for the time being paralysed the Boer resistance. Two half-hearted attempts were made on the 7th and 10th of March, at Poplar Grove and Driefontein, to stem Lord Roberts's advance upon

Capture of Bloemfontein.

Bloemfontein, President Kruger himself arriving on the scene to give confidence to his burghers; but the demoralization was so great that neither the military genius of the few nor the personal influence of the president could bolster up an adequate resistance, and on the 13th of March 1900 Lord Roberts's army marched into the Free State capital. This great move was persevered in and accomplished, in spite of the fact that at the very outset of the cross-country march (February 13) the great body of transport which had been collected at Ramdam had been cut off by De Wet (who had stayed on the Riet after French had shaken him off). It was therefore only made possible at all by reducing the rations of the fighting men to a minimum and by undertaking the risks of changing the line of communication three times. Naturally and necessarily the capture of Bloemfontein was followed by a period of reaction. It was not until the 29th of March that the new railway communication recommenced to feed the army. In the meantime rebellion had broken out in the Prieska district of Cape Colony, which was promptly quelled by Lord Kitchener. The halt at Bloemfontein was marked by the publication of proclamations, offering protection to the burghers, which, however, the invaders had not yet the power to fulfil. The enforced halt was unfortunate; it not only resulted in a bad outbreak of enteric, but it gave the Boers time to recuperate, and by the beginning of April they again took the initiative. The death of their commandant-general, Piet Joubert, on the 28th of March, seemed to mark a change in the fortunes of the Republican army. Christian De Wet, who had first come into prominence as the captor of Lord Roberts's convoy at Waterval, and was now operating east and south-west of Bloemfontein in order to counteract the influence of Roberts's numerous flying columns which rode hither and thither offering peace, added to his laurels by ambushing Broadwood's mounted brigade and horse artillery at Sannah's Post, just outside Bloemfontein, on the 31st of March. Four days later he reduced a detachment at Reddersburg, and then went south and invested Colonel Dalgety and a mixed force at Wepener, which was relieved after ten days by General Hunter's Ladysmith division, brought round to Aliwal North from Natal.

Relief of Mafeking.

Capture of Pretoria.

These successes, if they retarded Roberts's progress, at least enabled him to rearrange his forces in accordance with the new situation at leisure, and to re-establish his transport, rail and wheeled, and on the 1st of May the main army moved northwards upon the Transvaal capital. The main advance was taken with one cavalry and three infantry divisions (the cavalry commanded by French, and the infantry divisions by Generals Tucker, Pole-Carew and Ian Hamilton). Rundle's division took the right of the advance; Methuen and Hunter moving from Kimberley, formed the left. Kelly Kenny, Colvile and Chermside held the communications based on Bloemfontein. A flying column detached from Hunter, under Mahon, in conjunction with Colonel H. C. O. Plumer's Rhodesian levies from the north, on the 17th of May relieved Mafeking, where Colonel (Lieut.-General Sir) R. S. S. Baden-Powell had throughout shown a bold front and by his unconventional gaiety as well as his military measures had held off the assault until the last. The same day the Natal Field Force under Buller moved up into the Biggarsberg and occupied Dundee. On the 10th of May Lord Roberts had crossed the Sand River; on the 12th of May he entered Kroonstad. After a halt of eight days at Kroonstad, the main army again moved forward, and, meeting but small resistance, marched without a halt into Johannesburg, which was occupied on the 31st of May, the Orange Free State having been formally annexed by proclamation three days earlier. On the 30th of May President Kruger fled with the state archives, taking up his residence at Waterval Boven on the Komati Poort line. The gold mines were now securely in the possession of the British, and on the 5th of June Lord Roberts's army occupied the capital of the Transvaal practically without resistance, setting free about 3000 British prisoners of war detained there.

Diamond Hill.

Prinsloo's Surrender.

It had been anticipated that the occupation of both the capitals would have brought the hostilities to a close, but this was not the case, and though after the 5th of June regular resistance was at an end, the army of occupation had still to face two years of almost unprecedented partisan warfare. On the 8th of June Sir Redvers Buller, who had made a long halt after the relief of Ladysmith and reorganized his army and its line of communication, forced his way over Alleman's Nek, and on the following day occupied Laing's Nek, the Natal gate to the Transvaal, while the field marshal fought a widespread battle against Botha, De la Rey and Kemp at Diamond Hill, 20 m. east of Pretoria. The object of this action was to push back the Boers from the neighbourhood of Pretoria, but no sooner was this done than the north-western Transvaal became active, in spite of Hunter's and Baden-Powell's advance from Mafeking through this district. As the British line of operations now extended eastward from Pretoria, the advance of these Boers to the Magaliesberg threatened their rearward communications, and as Buller had moved far more slowly than the main army there was not as yet an alternative line through Natal. Most serious of all was the pressure between Bloemfontein and the Vaal, where the Free Staters, under De Wet and other commanders, had initiated the guerrilla as soon as Botha and the Transvaalers retired over the Vaal and ceased to defend them by regular operations. Large forces had been left behind during the advance on Johannesburg for the protection of the railway and the conquered territory, and these were now reinforced from Kimberley and elsewhere as well as from detachments of the main army. These, under Sir Archibald Hunter and Sir Leslie Rundle, successfully herded Prinsloo with 4000 Free Staters into the Brandwater Basin (July 29)—a very satisfactory result, but one seriously marred by the escape of De Wet, who soon afterwards raided the Western Transvaal and again escaped between converging pursuers under Kitchener, Methuen, Smith-Dorrien, Ian Hamilton and Baden-Powell.

Flight of Kruger.

Before this Lord Roberts had initiated a movement from Pretoria to sweep down to Komati Poort on the Portuguese frontier. in which Buller, advancing across country from the south, was to co-operate. On the 26th to 27th of August the combined forces engaged and defeated Botha in the action of Belfast or Bergendal, with the result that the enemy dispersed into the bush-veld north of the Middelburg railway. On the 30th of August the remainder of the British prisoners were released at Nooitgedacht. On the 6th of September Buller, crossing the track of the main army at right angles, occupied Lydenburg in the bush-veld, and five days later the aged president of the republic took refuge in Lourenço Marques. On the 13th of September Barberton was occupied by French, and on the 25th Komati Poort by Roberts's infantry. From October the military operations were confined to attempts to reduce guerrilla commandos which had taken the field. Mr Kruger, deserting his countrymen, left for Europe in a Dutch man-of-war, and General Buller sailed for Europe. The Boer leaders definitely decided upon a guerrilla and a wearing policy, deliberately dispersed their field army, and then swelled and multiplied the innumerable local commandos. On the 25th of the month the ceremony of annexing the Transvaal was performed at Pretoria.

Kitchener takes Command.

Raids by De Wet.

In November the prevailing opinion was that the war was over, and Lord Roberts, who had been appointed commander-in-chief at home, left South Africa, handing over the command to Lord Kitchener. Then followed a long period of groping for a means to cope with the development of guerrilla tactics, which for the next six months were at their zenith. The railway communications were constantly damaged, isolated posts and convoys captured, and the raiders always seemed able to avoid contact with the columns sent in pursuit. De Wet, after escaping from Brandwater Basin, was hunted north-westward, and crossed into the Transvaal, where, joining the local guerrilla bands, he surrounded an infantry brigade at Fredrikstad. But, unable to reduce it, and threatened on all sides, he turned back. On the 6th of November he was severely handled and his guns and wagons captured at Bothaville. But this misadventure only stimulated him. His emissaries roused the Free Staters west of Bloemfontein, and disaffection broke out in

Botha's Successes.

Cape Colony to an alarming degree, while, as forerunners of the promised invasion, scattered bodies of Free Staters crossed the Orange River to swell the rebellion. From Bothaville De Wet made for Thaba Nchu, where the Bloemfontein garrison held a cordon of posts. These were traversed on the 16th of November and the raiders passed on to Bethulie capturing Dewetsdorp and 500 men *en route*. Pursued closely and finding the rivers in flood De Wet hid some of his men under Kritzinger near the Orange and himself doubled back, traversing again the line of posts east of Bloemfontein. Kritzinger, Hertzog and bodies of Cape rebels raided Cape Colony as soon as they were able to cross the Orange, and Hertzog penetrated so far that he exchanged shots on the Atlantic coast with a British warship. All that the British forces under Sir Charles Knox and others could do was to localize the raids and to prevent the spread of rebellion. So far, however, energy and vigilance made them successful. Botha meanwhile held his own in the northern Transvaal, both against forces from Pretoria, Middelburg and Lydenburg, and against the Rhodesian Field Force under Sir F. Carrington, which had been sent up from Beira (by arrangement with the Portuguese) to southern Rhodesia. At the close of 1900 the commandos under the direct influence of Louis Botha attacked the railway posts on the Middelburg railway and captured Helvetia. De la Rey operated in the western Transvaal, and in concert with Beyers, whose presence in this region was not known to the British, he inflicted a sharp reverse on General R. A. P. Clements at Nooitgedacht in the Hekpoort valley on the 13th of December. Beyers then slipped away to the east, crossing the line between Johannesburg and Pretoria with impunity. Lord Kitchener called for more men, and on the 22nd of December the war office announced that 30,000 more mounted men would be despatched to the seat of war.

Concentration Policy.

With the opening of 1901 Lord Kitchener tried new schemes. He withdrew all his detached garrisons except in the most important centres, and set himself to make his railway communications perfectly secure. He determined to make the area of operations a waste, and instituted the concentration camps, into which he intended to bring the whole of the non-combatant inhabitants of the two republics. He despatched French with a large force to clear the south-eastern districts of the Transvaal and for the rest maintained a force to watch De Wet, and organized a defence force in Cape Colony, while using the residue of his mounted men to sweep the country of stock, forage and inhabitants. Although there were no great disasters, the new policy was not prolific in success. The enemy invariably dispersed before superior forces, and the removal of the women and children from the farms did not have the effect of disheartening the burghers as had been anticipated —it rather mended their vitality by relieving them of responsibility for their families' welfare. Nor were the Boer leaders destitute of comprehensive schemes. Botha arranged to penetrate Natal, De Wet to make a second attempt on the Colony, in connexion with Hertzog and Kritzinger. On the 10th of February De Wet, with five guns and 3000 men, carried out his promised invasion of Cape Colony. Passing the Bloemfontein-Thaba Nchu line a third time, he crossed the Orange to join Hertzog and rouse the Cape Dutch. But this invasion failed. By judicious use of the railway Kitchener concentrated sufficient troops in the colony to cope with the attempt, and, after being hunted for eighteen days, De Wet escaped back into the Orange River Colony with the loss of all his guns, munitions of war and half his force. In the northern Transvaal a force under Sir Bindon Blood cleared the country, but could not prevent Viljoen from escaping eastward to join Botha. Botha's activity in the south-east caused Kitchener to despatch a large force under French thither. This swept the country up to the Swaziland border. But Botha escaped. On the 3rd of March, after various raids and adventures in company with Smuts and Kemp, De la Rey, the lion of the western Transvaal, essayed an attack upon Lichtenburg, in which he was heavily repulsed. Signs of weakness were now apparent, and as a result Louis Botha, acting with the authority of Schalk Burger, the representative of President Kruger, opened negotiations with Kitchener. A meeting took place at Middelburg, Transvaal, on the 28th of February. These negotiations, however, broke down mainly over the treatment to be awarded to Cape rebels.

Blockhouse Policy.

The hostilities now entered upon a new phase. The establishment of a line of defensive posts between Bloemfontein and Ladybrand, though De Wet had three times traversed it, had given Kitchener an idea, and he resolved upon the scheme of fencing in areas by chains of blockhouses such as those already constructed for the protection of the railways. In the meantime, while these posts were under construction, the harrying of the commandos by mobile columns was continued. In March Babington, pursuing De la Rey after the latter's Lichtenburg misadventure, captured three guns and six maxims near Ventersdorp. In April Plumer occupied Pietersburg, the last remaining seat of government open to the enemy. Rawlinson captured a laager and guns at Klerksdorp, and, though neither De Wet nor De la Rey had been brought to book, matters had so far improved in May that municipal government was given to Johannesburg, and a certain number of mines were allowed to recommence working. Kemp was defeated by Dixon at Vlakfontein, after a desperate encounter. June brought little of moment, though the Boers scored two minor successes, Kritzinger capturing the village of Jamestown in Cape Colony, and Müller reducing a force of Victorians at Wilmansrust, south of Middelburg. In July there were further evidences of weakness on the part of the Boers, and Botha applied for permission to communicate with Kruger. This was allowed, but, as Kruger advised a continuance of the struggle, the slow course of the war continued. In the meantime, the concentration camps were becoming filled to overflowing, and a steady stream of captures and surrenders were reducing the hostile power of the republics.

In August a proclamation was promulgated formally threatening the Boer leaders who should not surrender with permanent banishment from South Africa, but this proclamation had very little effect. Smuts, with a small force from the Magaliesberg, traversed Orange River Colony and stimulated the Cape rebels afresh. But September showed some slight improvement in the situation in Cape Colony, where French was in supreme command. On the 5th Scobell captured Lotter, who was subsequently executed for murder: though this was balanced a few days later by Smuts's successful attack on the 17th Lancers at Tarkastad. In the south-eastern Transvaal Botha made a new effort to invade Natal, but, although he captured 300 men and three guns in an action on the 17th of September at Blood River Poort near Vryheid, his plans were rendered abortive by his failure to reduce the posts of Mount Prospect and Fort Itala in Zululand, which he attacked on the 26th, and he only escaped with difficulty from the converging columns sent against him. Desultory fighting continued till the close of the year, the balance of success being with the British, though on the 30th of October Botha, returning from the south-east towards Pretoria, defeated Colonel Benson's column at Bakenlaagte, Benson being killed. About the same time, the force in front of De la Rey and Kemp in the west being depleted to find the troops for larger operations, the Boers made a fierce surprise attack on Colonel Kekewich's column at Moedville, in which Kekewich was wounded and his troops hard pressed for a time. De la Rey next attacked part of Methuen's column near Zeerust, but was repulsed (Oct. 24). Affairs again took an unsatisfactory turn in Cape Colony, and on the 8th of October the whole colony was placed under martial law. In November an unsuccessful attempt was made by several columns to run De Wet to earth in the Lindley district, whither, after his second raid on Cape Colony, he had returned. But in December matters improved. The reverse at Bakenlaagte was repaired by a force under Bruce Hamilton. This swept the south-eastern Transvaal as French had done, and with no better effect, for Botha escaped. But the British commander thereupon began a constant succession of night marches and raids which practically blotted out the resistance in the eastern Transvaal. The corps of National Scouts (formed of burghers who had taken the oath of allegiance) was inaugurated and the Johannesburg stock exchange reopened. By the end of the year the blockhouse system was complete, but this phase of the war was destined to close badly as De Wet on Christmas Eve captured a large force of Yeomanry at Tweefontein, west of Harrismith.

The "Drives."

With 1902 the last phase of this protracted struggle commenced. The blockhouse system was practically finished, and Kitchener determined upon a new means of harassing the enemy, who still had a total of about 25,000 men in the field. But the blockhouses had already begun to serve the purpose for which they were designed. In the past the mobile columns, of which there were over sixty in the field, had always been bound to the railway for supply; now convoys could be pushed out to them along whatever blockhouse line they touched. In January Bruce Hamilton continued his successful night marches, and late in the month General Ben Viljoen was captured in the Leydenburg district. The only set-back was the descent which Beyers made upon Pietersburg, breaking into the concentration camp and carrying off a number of able-bodied refugees. Early in February Lord Kitchener commenced his first drive, and it was so successful that it was evident that the key to the situation had been found. First the country east of the line Bloemfontein-Vereeniging was swept four times over, then the method was employed in the Transvaal, east and west, and finally against the Cape rebels. There were a few small reverses, of which De la Rey's successful rush upon Paris's column and capture of Lord Methuen was the most important, but when some initial mistakes in the composition of the driving lines, which robbed the earlier drives of part of their effect, were made good, the system worked like a machine. The Boers were at last convinced of the futility of any attempt to prolong the struggle, and on the 23rd of March the representatives of the Boer governments came into Pretoria. Six weeks were spent in negotiation, and then a meeting of delegates, under the presidency of General Kemp, was held at Vereeniging.

As a result of this conference articles of peace were signed at Pretoria on the 31st of May, and the South African war was a history of the past. The terms of peace may be condensed into the following points: (1) Surrender of all burghers in the field, with all arms and munitions of war; (2) all burghers duly declaring themselves subjects of King Edward VII. to be repatriated; (3) no burghers who should surrender to be deprived of either their liberty or property; (4) no proceedings to be taken against burghers for any legitimate acts of war during the period of hostilities; (5) the Dutch language to be taught in public schools on the request of parents, and to be allowed in courts of law; (6) sporting rifles to be allowed upon the taking out of licences; (7) the military administration to be superseded by civil administration as soon as possible, the civil administration to lead up to self-government; (8) the question of the native franchise not to be considered until after the introduction of self-government; (9) landed property not to be subjected to any special tax to defray the cost of the war; (10) a commission to be formed to facilitate the repatriation of the burghers, a grant of £3,000,000 being given as compensation for the destruction of farms.

Peace of Vereeniging.

In the whole war the British lost 5774 killed and 22,829 wounded, while the Boers lost about 4000 killed. The number of Boer prisoners in the hands of the British at the end of the war was about 40,000. (L. J.*; C. F. A.)

F. *From the Annexation to 1911.*—On the 4th of July 1900, a month after the occupation of Pretoria, a commission was issued to Lord Roberts authorizing him to annex the Transvaal. The proclamation of annexation was dated the 1st of September. Lord Roberts held the post of administrator of the colony until his departure for England in December following, when he was succeeded by Sir Alfred Milner, the high commissioner. It was not, however, until March 1901 that Milner, who resigned his governorship of Cape Colony, arrived at Pretoria to inaugurate a civil administration.[1] Hostilities were still proceeding, but in the areas under control Lord Milner (who was raised to the peerage in May) speedily set the machinery of government in motion. The civil administration of justice began in April; in October a reformed judicial system, with Sir J. Rose Innes as chief justice, was put into operation; in 1902 this was followed by the establishment of a supreme court. Besides law, the important departments of finance and mines were organized, and steps taken to remedy the grievances of the commercial and mining classes. Sir David Barbour, who had presided over a commission to inquire into the concessions granted by the late republic, presented a valuable report in June, and suggested a tax of 10% on the profits of the gold mining industry, a suggestion carried out a year later (June 1902). Meantime Johannesburg had been given a town council, and some of the gold mines permitted to restart crushing (May 1901). In November of 1901 the main body of the Uitlanders were allowed to return to the Rand. They had fled the country immediately before the outbreak of war and had been living at the seaports. While thus caring for the urban areas the administration was equally alive to the needs of the country districts. A commission which had been appointed to inquire into schemes of land settlement reported in June, and this was followed by the creation of a land board in December 1901. Lord Milner cherished the ideal of racial fusion by the establishment of British settlers on a large scale. He also recognized the necessity, if agriculture was to be developed, of an extensive system of irrigation, and Sir William Willcocks, formerly of the Egyptian Irrigation Department, was engaged to draw up a comprehensive scheme, having in view also the needs of the gold mines. Another department taken in hand was that of education; and the success which attended the opening of schools in the refugee camps was most striking. At the time the articles of peace were signed at Pretoria, more than 17,000 Boer children were being educated in these camps under the supervision of Mr E. B. Sargant.

The Work of Reconstruction.

This work of reconstruction was carried out in face of many difficulties other than those inherent to the undertaking. More than one plot on the part of Boers who had taken the oath of allegiance was hatched in Johannesburg, the most serious, perhaps, being that of Brocksma, formerly third public prosecutor under the republic. On the 15th of September 1901 Brocksma and several others were arrested as spies and conspirators. Letters to Dr Leyds and to Dr Krause of a treasonable character were found in Brocksma's possession, and being found guilty of high treason he was shot (30th of September). Krause, who was then in London, was arrested, tried and convicted for attempting to incite to murder, and sentenced to imprisonment. In November another conspiracy, to seize Johannesburg with the help of General De la Rey, was discovered and frustrated. More injurious than plots of this nature was the political agitation carried on in Cape Colony and in Great Britain. This agitation was directed with particular virulence against the high commissioner, whose recall, it was asserted, would remove the chief obstacle to peace. Mr J. X. Merriman and Mr J. W. Sauer came to England in the summer of 1901 on a mission from the Cape Africanders, and received much encouragement from Radical politicians. Nevertheless, much had been done to establish order and restart commerce by the time peace was made.

After the signature of the articles of peace the work of reconstruction was accelerated. The end of the military government was signalled by the assumption (on the 21st of June) by Lord Milner of the title of governor of the Transvaal and by the creation of an executive council. The Boer leaders unreservedly accepted British sovereignty. Generals Botha, De Wet and De la Rey, however, paid a visit to England (August–September, 1902) in an unsuccessful endeavour to get the terms of peace modified in their favour; they received little encouragement from a tour they made on the continent of Europe. On their return to South Africa the Boer generals and their colleagues aided to some extent in the work of resettlement, but the seats offered to the Boers on the executive council were declined. The work of repatriation and resettlement was carried out by commissioners acting in conjunction with a central advisory committee at Pretoria. These supplied the people with food, shelter, stock and implements. The burgher and native concentration camps were rapidly broken up; by December 1902 only 7600 out of 70,000 were left in the burgher camps.

At this period Mr Chamberlain determined to visit South Africa and use his personal influence to help forward the settlement of the country. After the almost total cessation of commerce during the war, there was in the last half of 1902 and the beginning of 1903 a great impetus to trade. When Mr Chamberlain reached the Transvaal in January 1903 the feeling among the British section of the community was optimistic. Mr Chamberlain was well received by the Boer leaders; it was, however, to the Rand magnates that he turned for financial help. That large sums were imperatively needed to accomplish the work of reconstruction was apparent. An agreement was reached whereby a loan of £35,000,000, guaranteed by the imperial government, was to be raised for the benefit of the Transvaal and the Orange River Colony; a further loan of £30,000,000 was to be issued in instalments of £10,000,000 and paid into the British exchequer as the Transvaal's contribution towards the cost of the war. The first instalment of this loan, to be issued in 1904, was guaranteed by the great mining firms of Johannesburg. With the proceeds of the first loan the debt of the South African Republic was paid off, the Transvaal and the Orange River Colony railways were bought by the state, and new railways and other public works were undertaken. The £3,000,000 granted by the articles of peace, and other considerable sums, besides £7,000,000 from the loan, were expended on repatriation and compensation.

The efforts made by the administration to restore the Boers to the land, to develop the material resources of the country,

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[1] Milner became at the same time administrator of Orange River Colony. Several of the reforms adopted for the Transvaal applied to or affected the sister colony. (See ORANGE FREE STATE.)

Economic Depression and Chinese Labour.

and to remove all barriers to the intellectual and moral development of the people, were soon, however, hampered by severe commercial depression. One of the least results of this depression was that the second war loan arranged by Mr Chamberlain was never issued, Great Britain finally (in 1906) abandoning all her claims. The commercial depression was due to many causes; of these the most apparent was the shortage of labour at the Rand mines. When work restarted after the war, the mine owners offered the Kaffir workmen little more than half the wages paid in 1898; but this effort at economy was abandoned, and the old rates of pay were restored in January 1903. Nevertheless, the labour available continued to be very much below the needs of the mines. The consequent small gold output meant a serious decrease of revenue, which was not compensated for by the heavy tax levied on the output of the Premier diamond mine, where operations began in 1903. Finally, to enable them to work their mines to their full capacity, the Rand houses asked for leave to import Chinese labourers.[1] Milner, anxious above everything else to obtain sufficient revenue to carry on his work of reconstruction, gave his consent to the experiment. The home government concurred, and during 1904–1906 over 50,000 Chinese were brought to the Rand on three-years' indentures. The objections to the introduction of the Chinese, urged in South Africa, in Great Britain and in other parts of the British Empire, are discussed under SOUTH AFRICA: *History*, § *D.*; here it need only be added that in the Transvaal the point upon which all parties were agreed was that no new racial or economic complications should be permitted; and these were guarded against by the restriction of the coolies to unskilled labour in the gold mines and by their compulsory repatriation. By the introduction of the Chinese the gold output from the mines was greatly increased, with the result that the Transvaal suffered less than any other part of South Africa from the restriction of commerce, which lasted for several years.

Position of British Indians.

The discussions in the legislative council on the Chinese coolie question had been accompanied by a demand on the part of the Boers that such an important step should not be taken "without the constitutional approval of the white people of the Transvaal"; and after the importation of the coolies had begun, the agitation for the grant of representative institutions grew in volume. The British government was also of opinion that the time was near for the setting up of such institutions, and the pending grant of a constitution to the Transvaal was announced in parliament in July 1904. Meantime the existing (nominated) legislative council was dealing with another and a vital phase of the Asiatic question. There were in the Transvaal some 10,000 British Indians, whose right to "enter, travel or reside" in the country was secured by the London convention of 1884. Under republican rule these Indians—who were mainly small shopkeepers, but included some professional men of high standing—had suffered many restrictions, and their cause had been espoused by the British government. Nevertheless, under British rule their situation was in no way improved, and a determination was shown by the European inhabitants of the Transvaal further to restrict their privileges and at the same time to stop the immigration of other Indians. In this matter the Boer and British sections of the community were in agreement, and they had the support of the Transvaal government and of the other South African colonies. The problem was both economic and racial, and on both grounds South Africans showed a determination to exclude the competition of Indians and other Asiatics. Mr Alfred Lyttelton (who had succeeded Mr Chamberlain as secretary of state for the colonies) endeavoured to meet the wishes of the Transvaal by sanctioning legislation which would greatly restrict the immigration of Indians, but he would allow no tampering with the rights of Indians already in the colony. In 1907 the royal assent was given to bills restricting the immigration of Asiatics and providing for the registration of all Asiatics in the country.

Self-Government—the Botha Ministry.

In accordance with the promise made in 1904 a constitution for the Transvaal on representative lines was promulgated by letters patent on the 31st of March 1905; but there was already an agitation for the immediate grant of full self-government, and on the accession to office of the Campbell-Bannerman administration in December 1905 it was decided to accede to it. New letters patent[2] were issued (December 12, 1906), and the first general election (February 1907) resulted in the return of a majority belonging to *Het Volk*, a Boer organization formed for political purposes. (See further, SOUTH AFRICA: *History*, § *D.*) Sir Richard Solomon,[3] it was thought, might have formed a coalition cabinet, but he was among the defeated candidates. Lord Selborne, who had during 1905 succeeded Lord Milner as high commissioner and governor of the Transvaal, entrusted General Botha with the formation of a ministry. Botha chose as his colleagues Messrs J. C. Smuts (colonial secretary), Jacob de Villiers (attorney-general), H. C. Hull (colonial treasurer), J. F. B. Rissik (minister of lands and native affairs) and E. P. Solomon (minister of public works). These were all men of progressive, in some respects democratic, views, and in thus forming his cabinet General Botha showed his determination not to be dominated by the "back veld" Boers. Botha was strengthened in his attitude by the firm action of the Progressive (*i.e.* the ex-Uitlander) party, which secured 21 seats (out of a total of 69) in the legislative chamber, entirely in the Rand and Pretoria districts, and was led by Sir George Farrar and Sir Percy Fitzpatrick.[4] The government, which obtained an imperial guarantee for a loan of £5,000,000, announced that while there would be no wholesale repatriation of Chinese, the labour ordinance under which they were recruited would not be renewed, and by February 1910 all the Chinese coolies had returned home. At the same time successful efforts were made by the ministry to increase the supply of Kaffir labour for the mines. In the re-establishment of the field cornets and in other directions a return was made to the republican forms of administration, and on the education question an agreement satisfactory to both the British and Dutch-speaking communities was reached. Ample facilities were given for the teaching of Dutch, but it was provided that no pupil should be promoted to a higher standard unless he (or she) was making satisfactory progress in the knowledge of English.

The Union Movement.

One of the first problems which confronted the Botha ministry was the attitude to be adopted towards the other British colonies in South Africa. Lord Milner, by the creation of an inter-colonial board—which administered the railways of the Transvaal and Orange River Colony and controlled the constabulary of both colonies—and in other ways (*e.g.* the inclusion of the Transvaal in the South Africa customs union), had endeavoured to pave the way for federation. Mr Chamberlain when in South Africa in 1903 had also put forward federation as the desired goal. The existence of the inter-colonial council hampered, however, the freedom of the Transvaal government, and steps were taken to determine it.

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[1] A careful summary of the facts regarding the shortage of labour and of the economic situation in the Transvaal at that time, together with the debates in the legislative council, will be found in *The Annual Register* for 1903, from the pen of Mr H. Whates.

[2] The letters patent provided, as to the Chinese coolies, that no further licences be issued for the introduction of indentured labour, and that none of the contracts be renewed.

[3] Sir Richard Solomon (b. 1850) was attorney-general of Cape Colony 1898–1900, attorney-general of the Transvaal 1902, and acting lieutenant-governor of the Transvaal 1905. He resigned office to contest a seat for the Transvaal parliament. Subsequently he was agent-general for the Transvaal in London, and (1910) agent-general for the Union of South Africa.

[4] Sir George Herbert Farrar (b. 1859) was a son of Charles Farrar, M.D., of Chatteris, England, and was a member of the Johannesburg Reform committee at the time of the Jameson Raid. He served in the war of 1899–1902, and was knighted in the last-named year. Sir James Percy Fitzpatrick (b. 1862) was a native of Cape Colony. He went to the Transvaal in 1884 and became honorary secretary to the Johannesburg Reform committee. He was the author of *The Transvaal from Within; Jock of the Bushveld*, &c.

Nevertheless, on economic as well as political grounds, the leaders of both parties in the Transvaal were prepared to consider favourably the proposals put forward by Dr Jameson at the close of 1906 for a closer union of all the self-governing colonies, and the first direct step to that end was taken at an inter-colonial conference held in May 1908. The history of this movement, which resulted in the establishment of the Union of South Africa on the 31st of May 1910, is given under SOUTH AFRICA: *History*, § *D*. Apart from this movement the most notable events in the Transvaal at this period were the development of agriculture,[1] the gradual revival of trade (the output of the gold mines in 1909 totalled £30,925,000, and at the end of the year 156,000 native labourers were employed), and the continued difficulty with regard to British Indians. Ministers declared their determination to keep the Transvaal a white man's country. With the example of Natal before them as a warning, it was (they argued) to the whites a question of life and death, and unless registration were enforced they could not prevent the surreptitious entry of new-comers. Attempts at compromise made in 1908 ended in failure. For failing to register Mr M. V. Gandhi and other leaders were imprisoned; and large numbers of Indians were deported. Notwithstanding the remonstrances of the Indian government, the imperial authorities could not effectively intervene; a self-governing colony (in which whites alone possessed the franchise) must be allowed to take its own course. By the end of 1909 it was stated that 8000 Indians—most of whom claimed the right of domicile—had been compelled to leave the country, while 2500 had been imprisoned for failure to comply with the Registration Act. The establishment of the Union of South Africa removed from the competence of the Transvaal provincial council all legislation specially or differentially affecting Asiatics. Thereupon the Union ministry was urged by the British government to effect a permanent settlement acceptable to all parties. The ministry replied (July 23, 1910) that whatever policy might be adopted regarding Indians legitimately resident in South Africa, unrestricted Indian immigration into the Transvaal would not be permitted (see Blue-book Cd. 5363).

When the Union was established General Botha became prime minister, two of his colleagues, Messrs Smuts and Hull, also joining the Union ministry. A fourth minister—Mr Rissik—was appointed first administrator of the Transvaal province, while a fifth minister, Mr E. P. Solomon, became a senator of the Union parliament. The elections to the Union House of Assembly, held in September, were notable as showing the strength of the Progressive (or Unionist) party. General Botha was defeated at Pretoria East by Sir Percy Fitzpatrick, and at Georgetown—a Rand constituency—Mr Hull was beaten by Sir George Farrar. Both ministers, however, subsequently secured seats elsewhere.

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(F. R. C.)

TRANSVERSE RIB (Fr. *arc doubleau*), the term in architecture given to the rib of a vault which is carried across the nave, dividing the same into bays. Although as a rule it was sunk in the barrel vault of the Thermae, it is found occasionally below it, as in the Piscina at Baiae and the so-called Baths of Diana (Nymphaeum) at Nîmes. In the Romanesque and Gothic styles it becomes the principal feature of the vault, so much so that Scott termed it the master rib (see VAULT).

TRANSYLVANIA[2] (Lat. *Transsilvania*; Ger. *Siebenbürgen*; Hung. *Erdély*; Rumanian, *Ardeal*), a former principality (*Grossfürstentum*) occupying the extreme eastern portion of the kingdom of Hungary. It is bounded by Hungary proper on the W. and N., by Bukovina on the N.E. and by Rumania on the E. and S., and has an area of about 21,000 sq. m.

Transylvania has the form of an irregular circle, and is a high plateau of a mean altitude of 1000–1600 ft. above sea-level, surrounded on all sides by mountains. These are known under the general name of Transylvanian Mountains (*q.v.*), which are the south-eastern continuation of the Carpathian system, and fill the interior of the country with their ramifications. On the west or Hungarian side there are comparatively easy passes into the interior, but on the east and south frontiers the lofty mountains give Transylvania the aspect of a huge natural fortress. Among the highest peaks are Negoi (8345 ft.), Bucsecs (8230 ft.), Pietrosu (7544 ft.) and Königstein (7352 ft.). There are numerous valleys, ravines and cañons in the network of mountains covering the interior of the country. The principal plains are: in the valley of the Szamos near Dés and Besztercze (Bistritz); in the middle course of the Maros the beautiful Hátszeg valley; the fertile Cibin valley around Nagy-Szeben; the valley of the Aluta near Csik-Szereda, and the one extending from Reps to the Roteturm pass; and lastly the beautiful and fertile Burzenland in the vicinity of Brassó. The altitude of the valleys generally increases towards the east of Transylvania, the lowest depression being found in the western part of the Maros valley. Almost in the centre of the country lies a fertile plain about 60 m. in length and 50 m. in breadth, called Mezöség or the Transylvania plain. The principal rivers of Transylvania, which are either tributaries of the Theiss, or flow direct into the Danube, are: the Maros, which rises in the mountains forming the eastern wall of Transylvania, and taking first a northern course flows through the country from east to west; its principal affluents are the Görgeny, the Great and Little Kokel or Nagy and Kis Küküllö, the Strell (Sztrigi) and the Cserna on the left, and on the right the Ampoly and the Aranyos, which is rich in auriferous sediments. The Aluta (Alt or Olt) rises not far from the Maros, but takes a southerly direction and pierces the Carpathians at the Roteturm pass, to enter Rumania; its principal tributaries in Transylvania are the Vargyas, the Homorod, the Cibin and the Burzen. The Szamos, formed by the junction of the Great (Nagy) and Little (Kis) Szamos, whose principal affluent is the Bistritz; the Zsil or Jiul; and the White and the Swift Körös are the other principal rivers. The largest lake of Transylvania is the Czeger or Hodosser See, 13 m. long, situated near Szamos-Ujvar, while a great number of small but beautiful mountain lakes are found. The climate of Transylvania is healthy; hot summers alternate with very cold winters, but the rainfall is not great. Transylvania abounds in mineral springs of all kinds, especially saline and chalybeate, the principal ones being found at Borszek, Elöpatak, Homorod, Rodna, Tusnád and Zaizon.

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[1] The government expended over £1,000,000 on a land and agriculture bank and in 1910 made a grant of £100,000 towards the establishment of a college of agriculture at Pretoria.

[2] The Latin name appears first after the 12th century, and signifies "beyond the woods," *i.e.* from Hungary; the Hungarian and Rumanian name both mean "forest land." The German name is usually derived from the seven principal fortified towns or "burgs," founded by the German colonists, though some authorities prefer to connect it with the Cibin Mountains on the south frontier.

The principal occupations of the inhabitants are agriculture, cattle-rearing and mining. Of the total area of Transylvania 22·6% is arable land; 16·5% meadows and gardens; 9·5% pastures and 0·5% vineyards; while 37·3% is covered by forests and 13·5% is unproductive soil. The vegetation of Transylvania is luxuriant, except of course in the higher mountain zones. Fruits abound, as apples, pears, peaches, apricots, plums, cherries, chestnuts and almonds; mulberries are also cultivated. The vine flourishes best in the valley of the Maros. The chief crop is maize; but wheat, rye and other grains, potatoes, saffron, hemp, flax and tobacco are also grown. On the boundary mountains the trees are mainly coniferous; in the interior oaks, elms, beeches and ashes are conspicuous.

Bears, wolves, foxes, boars and various varieties of game are found, and on some of the mountains the chamois. There is abundant pasturage on which excellent cattle are reared; and in some districts buffaloes are bred for draught purposes. More important is the breeding of a sturdy race of horses, thousands of which are annually exported. The mountains maintain large flocks of sheep, of which two kinds are distinguished—with a fine short-stapled and a coarse long-stapled wool respectively. Silkworms are bred, and some silk is spun; and the export of honey and wax is not inconsiderable. Transylvania possesses the richest gold mines in Europe, and this metal is also "washed" in some of the streams, chiefly by gipsies. The gold is often found in conjunction with tellurium (first discovered in Transylvania in 1782) and is extracted principally at Nagyág, Kapnik-Bánya, Zalatna and Vöröspatak. In 1900 the value of the gold extracted was £300,000. Silver, copper, lead and iron are worked to some profit, while arsenic, alum, graphite, marble, porcelain, precious and building stones are also found. Coal is mined in the valley of the Zsil, but the abundance of timber has retarded its exploitation. Some of the saline springs yield salt enough to render their evaporation profitable. The principal places where salt is extracted are at Maros-Ujvár, Dés-Akna, Kolozs, Torda and Vizakna. In 1900 the value of the mineral products, except salt, was £1,000,000.

The industry of Transylvania, although not very developed, made some progress during the last quarter of the 19th century, and is mostly in the hands of the "Saxons." The principal branches are brewing, distilling, flour-milling, sugar, leather, paper, petroleum-refineries, cloth and earthenwares. The production of linen from flax and hemp is a home industry throughout Transylvania. The commerce is fairly active, and is mainly in cattle, dairy products, wood and wooden articles, and petroleum.

The population in 1900 numbered 2,456,838. Until 1848 the chief influence and privileges, as well as the only political rights, were divided among the three "privileged nations" of the Hungarians, Szeklers and Saxons. The first are the descendants of the Magyar conquerors. The Szeklers are of disputed origin, but closely akin to the Magyars (see SZEKLERS). The Saxons are the posterity of the German immigrants brought by King Geza II. (1141–1161) from Flanders and the lower Rhine to cultivate and repeople his desolated territories. At first these were known as Teutones, Teutonici Hospites and Flandrenses, but since the beginning of the 13th century the general name of "Saxons," as tantamount to "Germans," has prevailed. They are generally the most advanced section of the population. Their literary language is High German, but their spoken language is more of the Low German character. The Hungarians and Szeklers together number 814,994, and the Saxons 233,019, but by far the most numerous element, though long excluded from power and political equality, is formed by the Rumanians, 1,397,282 in number, who are spread all over the country. The gipsies of Transylvania, who are heard of under a voivode or prince of their own in 1417, are estimated at 50,000; many of them have taken to agriculture or gold-washing. Jews, Armenians, Bulgarians, Ruthenians and Greeks are also represented in the medley of peoples. The Magyars are mostly Roman Catholics or Unitarians, the Germans Protestants, and the Rumanians adherents of the Greek Church

Transylvania, which was completely incorporated with Hungary in 1868, forms since 1876 one of the seven large administrative divisions into which Hungary was divided in that year. It was subdivided into fifteen countries, and contains the following principal towns: Kolozsvár, Brassó, Nagy-Szeben, Maros-Vásárhely, Besztercze, Fogaras, Torda, Segesvár, Gyula-Fehérvár, Dés, Szamos-Ujvár.

History.—Transylvania formed part of the Roman province of Dacia. After the withdrawal of the Romans the country became for centuries the prey of the various peoples who swept across it in their restless migrations. At the beginning of the 11th century (1004) Stephen I. of Hungary made himself master of the land, which was thenceforward governed as a Hungarian province by a voivode. As mentioned above, King Geza II. introduced German colonists, who founded Nagy-Szeben (Hermannstadt), and in 1211 King Andreas II. called in the German Teutonic orders, who settled in the Burzenland. These German colonists were granted special privileges, and founded many of the Transylvanian towns. As by the death of King Louis II. in 1526 the Hungarian crown fell to the house of Austria, the voivode John Zapolya succeeded in rendering himself independent. He and his successors, who were generally elected by the people, were supported by the Turks against the House of Austria, while the difficult nature of their country preserved them on the other hand from becoming too dependent on their powerful allies. After the defeat of the Turks at Vienna in 1683, their influence in Transylvania waned, and in 1699, by the peace of Carlowitz, the Porte acknowledged the suzerainty of Leopold I. of Austria over Transylvania. By the Leopoldine diploma of 1691 Leopold had guaranteed the ancient rights and laws of the land, and united it formally with the Hungarian crown. In 1765 Maria Theresa made it a grand principality (Grossfürstentum). The efforts of the Rumanian inhabitants to secure recognition as a fourth "nation," and the opposition of the non-Magyar population to a closer union with Hungary, led to troubles early in the 19th century, culminating in 1848. In 1849 Transylvania was divided from Hungary by an imperial decree, and became an Austrian crown-land; but in 1860 Transylvania became an autonomous province, with a separate Diet, and a high executive power of its own. The Diet assembled in Nagy-Szeben in 1863 decreed the complete separation from Hungary, the union with Austria, and the recognition of the Rumanians as the "fourth nation." But the Hungarian government did not recognize this Diet, and the Diet assembled at Kolozsvár in 1865, in which the Hungarians had the majority, decreed again the union with Hungary. By the compromise of 1867 Austria granted the union of Transylvania with Hungary, which was completed in 1868. Transylvania lost every vestige of autonomy, and was fully and completely incorporated with Hungary. Since that time the Magyarization of the principality has steadily been carried through, in spite of the bitter protests and discontent of both the Saxons and Rumanians. A Hungarian university was founded at Kolozsvár in 1872; and Hungarian is recognized as the official language.

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TRANSYLVANIAN MOUNTAINS, the general name of the mountain system which surrounds the Transylvanian highland or plateau on all four sides, and forms the south-eastern and southern continuation of the Carpathian system (*q.v.*). At the mouths of the Visó and the Golden Bistritza, where th

Eastern or Wooded Carpathians end, the range of mountains divides and sends ramifications in two directions, to the south and to the west. These chains which enclose Transylvania, giving it the general aspect of a great natural fortress, are the most eastern offshoots of the mountain system of central Europe, and guard the approach from the east to the great Hungarian plain. They slope gently towards the interior of Transylvania, but rather abruptly towards Rumania, and while the western wall possesses several large and easy passes, the eastern and southern walls are much more difficult to cross.

The eastern wall of the Transylvania quadrilateral is composed of two parallel ranges of mountains divided by the valleys of the Maros and Aluta. The outer range is composed of the following groups: the Gyergyó Mountains (including the Kelemen range) with the highest peaks Kelemenhavas (6600 ft.) and Pietrosul (6908 ft); the Csik Mountains with the highest peaks Nagy-Hagymas (5900 ft.) and the volcanic Büdös (3300 ft.); and the Bereczk Mountains with the highest peak Lakócza (5830 ft.). The inner range is composed of the following groups: the Görgény Mountains with the highest peak Mezöhavas (5826 ft.); the Hargitta Mountains with the highest peak Hargitta (5900 ft.); and the Barota Mountains with the highest peak Kukukhegy (5120 ft.). Near the mouths of the Maros and the Aluta are situated the celebrated Györgyö valley, one of the most beautiful in the whole Transylvania, and the famous Borszék valley with its mineral springs.

The southern wall of the Transylvanian highland is occupied by the Transylvanian Alps. They have a length of 230 m., and are the highest and wildest mountain range of the whole Transylvanian system, resembling the High Tatra in their bold and high peaks, their beautiful scenery, and their flora. The Transylvanian Alps rise to an altitude of 7200 ft. above the level of the Danubian (Rumanian) plain, and are divided into a considerable number of groups. From east to west these groups are: the Bodza Mountains with the highest peak Csukás (Ciucas, 6424 ft.); the Burzenland Mountains with the beautiful peaks of Bucsecs (8230 ft.), Königstein (7352 ft.) and Schuler (5910 ft.); the high Forgaras group, extending to the Roteturm pass, and containing Negoi (8345 ft.), the highest peak in the Transylvanian mountains, Butyan (8230 ft.) and Surul (7482 ft.). West of the Roteturm pass the Transylvanian Alps are also known under the name of the Hátszeg Mountains, and consist of the following groups: the Cibin Mountains with the highest peak Cindrel (7366 ft.); the Paringul Mountains with the highest peak Mandra (8260 ft.); the Vulkan Mountains, and the Hátszeg Mountains proper with the beautiful peak Retiezat (8125 ft.). The south-western part of the Transylvanian Alps is formed by the Cserna or Ruszka Mountains with the highest peak Verfu Petri (8140 ft.) whose offshoots, of a mean altitude of 3200–4700, known as the Banat Mountains, fill the Banat. The southern part of the Cserna Mountains, known as the Stretinye Mountains, extend to the Danube, and together with the Miroch Mountains, on the right side of the Danube, and belonging, therefore, to the Balkan system, form the famous gorge of the Iron Gate near Orsova.

The western and northern wall of the Transylvanian quadrilateral do not present the character of an uninterrupted chain of mountains, but possess many low and easy passes towards the Hungarian plain. Going from south to north the principal groups are: the Transylvanian Ore Mountains with the basaltic mass of the Detunata (3768 ft.) near Abrudbánya; the Bihar Mountains, with romantic scenery and numerous caverns, with the highest peak the Cucurbeta (6045 ft.); to the east of this group are the Aranyos Mountains with the highest peak, the Muntelui Mare (5970 ft.), to the south-west of Kolozsvár; then come the Meszes group and the Kraszna Mountains. The northern wall is formed by the Lápós Mountains with the highest peak Ciblesiu (6020 ft.), and the Rodna Mountains with the highest peaks Muncsel (5835 ft.), Pietrosu (7544 ft.) and Ineu (7484 ft.).

Inside this mountainous quadrilateral lies the Transylvanian highland or plateau, which has a mean elevation of 1000–1600 ft. It is improperly called a plateau, for it does not possess anywhere extensive plains, but is formed of a network of valleys of various sizes, ravines and cañons, united together by numerous small mountain ranges, which usually attain a height of 500–800 ft. above the altitude of the valley.

In the Transylvanian Mountains the principal passes are: the Rodna, the Borgo, the Tölgyes and the Békás. Then come the Gyimes, the Uz and Oitoz, the Bodza or Buzeu, the Tömös or Predeal pass, crossed by the railway from Brassó to Bucharest, the famous Roteturm pass (1115 ft.) through the narrow gorge of the Aluta, crossed by the railway from Nagy-Szeben to Bucharest, the Vulkan, the Teregova pass, and the Iron Gate pass, both crossed by the railway from Temesvár to Craiova. All those passes lead from Transylvania into Rumania. From Transylvania into Hungary are the Bánffy-Hunyad pass, crossed by the railway from Nagy-Várad to Kolozsvár, and the defile of the Maros crossed by the railway from Arad to Broos. In the interior of Transylvania are the Szent-Domokos pass near Csik-Szereda leading from the valley of the Aluta to that of the Maros (near their respective mouths), and the pass of Csik-Szereda over the Hargitta Mountains.

TRAP (O. Eng. *treppe* or *traēppe*, properly a step, as that on which an animal places its foot and is caught, cf. Ger. *Treppe*, flight of stairs), a mechanical device for the snaring or catching anything, and especially wild animals. Traps for animals are of great antiquity, and no savage people has ever been discovered, whatever its culture scale, that did not possess some variety of snare. In the most primitive form of trap no mechanism need be present, *e.g.* a cavity into which the animal walks, as the pitfall of the Arabs and Africans or the snow-hole of the Eskimos. Dr O. T. Mason has divided traps into three classes: *enclosing* traps, which imprison the victim without injury; *arresting* traps, which seize the victim without killing it, unless it be caught by the neck or round the lungs; and *killing* traps, which crush, pierce or cut to death.

Enclosing traps include the pen, cage, pit and door-traps. Pen-traps are represented by the fences built in Africa into which antelopes and other animals are driven; and by fish-seines and pound-nets. Among cage-traps may be mentioned bird-cones filled with corn and smeared with bird-lime, which adhere to the bird's head, blinding it and rendering its capture easy; the fish-trap and lobster-pot; and the coop-traps, of which the turkey-trap is an example. This consists of a roofed ditch ending in a cul-de-sac into which the bird is led by a row of corn-kernels. Over the further end a kind of coop is built; the bird, instead of endeavouring to retrace its steps, always seeks to escape upward and remains cooped. Pitfalls include not only those dug in the earth, at the bottom of which knives and spears are often fixed, but also several kinds of traps for small animals. One of these consists of a box near the top of which a platform is hung, in such a way that, when the animal leaps upon it to secure the bait, it is precipitated into the bottom of the box, while the platform swings back into place. Another kind of pitfall is formed of a sort of funnel of long poles, into which birds fall upon alighting on a perfectly balanced bar, to which a dish of corn is made fast. The door-traps form a large and varied class, ranging in size from the immense cage with sliding door in which such beasts as tigers are caught, to the common box-trap for mice or squirrels, the door of which falls when the spindle upon which the bait is fixed is moved. The box-trap with a simple ratchet door, allowing the animal or bird to push under the door or wires which fall back and imprison them, is alike an enclosing and an arresting trap. There are four general classes of arresting traps, the mesh, the set-hook, the noose and the clutch. The mesh-traps include the mesh and thong toils used of old for the capture of the lion and other large game, and the gill-net in the meshes of which fish are caught by the gills. To the set-hook division are reckoned the set-lines of the angler, several kinds of trawls and the toggle or gorge attached to a line, which the animal, bird or fish swallows only to be held prisoner. The noose-trap class is a very extensive one. The simplest examples are the common slip-noose snares of twine, wire or horsehair, set for birds or small mammals either on their feeding grounds or runways, the victim being caught by the neck, body or foot as it tries to push through the noose. When the noose is used with bait it is generally attached to a stout sapling, which is bent over and kept from springing back by some device of the "figure-4" kind. This is constructed of three pieces of wood; one of the horizontal spindle on which the bait is placed, one of the upright driven into the ground, and the third the connecting cross-piece, fitted to the others so loosely that only the strain of the elastic sapling keeps the trap together. When the victim tries to secure the bait he dislodges the cross-piece and is caught by the noose, which is spread on the ground under the bait. The Patagonians take the vicuna with one variety of this snare, and, before the moose (*Cervus alces*) was protected by law in North America, even that animal, weighing often 1200 lb, was caught in snares of wire and rope. There are two widely different types of clutch-traps: bird-lime and other tenacious substances, and jaw and clap-traps. The simplest form of the first is adhesive fly-paper. A common practice in Italy is to smear with bird-lime the branches in the neighbourhood of a captive owl, which results in the capture of numbers of birds, gathered to scold at their common enemy. Examples of the clap-trap are the clap-net, consisting of two nets laid flat on the ground and attached to cords in such a manner that they fly up and close when the draw-cord is pulled by a concealed trapper; and the various other spring-traps used by bird-catchers. The jaw-traps are the most important class of device for the capture of fur-bearing animals, and are the product of civilization. While rude specimens are known to have existed in the middle ages, the *steel-trap* as used to-day dates from the middle of the 18th century, and reached perfection in the latter half of the 19th, the "Newhouse," named from the American inventor, having been the first trap of high grade. Steel-traps consist of two jaws, with or without teeth, which are worked by powerful single or double springs and are "sprung" when the victim steps upon the "pan," which is placed between the jaws and attached to a lever. They are made in many sizes, from the smallest, designed for rats, to the "Great Bear Tamer," weighing over 40 ℔, with jaws of 16 in. in which lions, tigers and grizzly bears are trapped. The steel-trap is set and concealed in such a manner that the animal must step on its pan in passing over it to secure the bait. In trapping such wary animals as the sable, marten, mink, otter or beaver, great care is taken to obliterate all signs of the trap and of human presence, the scent of the hands being neutralized by smoking the traps or avoided by the use of gloves. In North America castoreum, musk, asafoetida, oil of anise and common fish-oil are used to entice the victims to the traps. Trails of some one of these scents are laid from different directions to the trap.

With the clutch-traps must also be reckoned the oldest form of steel-trap, now to be seen only in museums, the man-trap, which was used first about the middle of the 18th century when the systematic preservation of game rendered protection against poachers a necessity. Such a trap, from Gloucestershire, is over 6 ft. long, has 19-in. serrated jaws and weighs 88 ℔. Another form of man-trap, the spring-gun, belongs to the next category, the killing traps, which are divided into traps of weight, point and edge. The most important of the weight class is the dead-fall, of which the typical form consists of a pen over whose narrow entrance one or more logs are laid across a lighter log, which is balanced upon a spindle necessarily struck by the entering animal, causing the logs to fall upon its back. In some cases the bait is attached to the spindle itself. The dead-fall was always the favourite trap of the American Indians, and is in use among many aboriginal tribes in Africa and South America. A slab of stone is often used as a weight. The common mouse-trap which kills either by a blow or strangulation is a variety of dead-fall. Of point-traps may be mentioned those of the impaling and the missile classes. An example of the former is the stake or spear placed by Arab and African tribes at the bottom of pitfalls for big game. Another impaling trap common in Africa is the harpoon down-fall, generally used for the hippopotamus. It consists of a heavily weighted harpoon suspended in such a way that the animal, passing beneath, breaks a cord and precipitates the harpoon upon itself. Another example of impalement is the hawk-trap, consisting of a circle of stout sharp wires, in the centre of which a live fowl is placed. A bird of prey attempting to secure the fowl is impaled upon the wires. Of missile traps the most universal are the ancient springbow and its modern representative the spring-gun. This is fixed upon stakes, or against a tree, with a line attached to the trigger and stretched immediately in front of the muzzle. An animal pressing against the string pulls the trigger and discharges the piece into its own body. An arrangement of sticks holding the bait in front of the muzzle is sometimes substituted for the string. Of edge-traps a curious example is the wolf-knife of Western America, which consists of a very sharp blade embedded in frozen fat. One of the wolves, licking the fat, cuts its tongue and a flow of blood ensues, with the result that not only the wolf itself but its companions become infuriated by the smell and taste, and the wounded beast, and often many of the others, are killed and devoured. The Alaskan knife-trap for large game consists of a heavy blade attached to a lever, which, when released by the animal biting at the bait, flies over and kills the victim.

See *Shifts and Expedients of Camp Life*, by W. B. Lord (1871); *Camp Life and the Tricks of Trapping*, by W. H. Gibson (1902); O. T. Mason, "Traps of the American Indians," *Annual Report*, Smithsonian Institution, for 1901; *The Story of the Trapper*, by A. C. Laut (1903).

TRAPANI (anc. *Drepanum*), a city and episcopal see of Sicily, capital of the province of the same name, situated on the west coast, 3 m. W. of the Monte San Giuliano, which rises above it, 121 m. W. by S. of Palermo by rail, and 47 m. direct. Pop. (1906), town 47,578, commune 68,986. The ancient Drepanum (δρέπανον, a sickle, from the shape of the low spit of land on which it stands) seems originally to have been the port of Eryx, and never to have been an independent city. It is represented by Virgil in the *Aeneid* as the scene of the death of Anchises, but first appears in history as an important Carthaginian naval station in the First Punic War (about 260 B.C.), part of the inhabitants of Eryx being transferred thither. Near Drepanum the Roman fleet was defeated in 250 B.C., while the struggle to obtain possession of it ended in the decisive Roman victory off the Aegates Islands in 241, which led to the conclusion of peace (see Punic Wars). It continued to be an important harbour, but never acquired municipal rights. Under the Norman kings, at the time of the first crusade, it became a place of importance; while it was a residence of the Aragonese kings. In the 16th and 17th centuries it was strongly fortified. In 1848 it was the first Sicilian city to rise against the Bourbons.

No remains of the classical period exist except a portion of the mole. There are some fine Gothic and baroque palaces, and a few churches with interesting details. The Oratorio S. Michele contains wooden groups representing scenes from the Passion, executed in the 17th century and used for carrying in procession. On the tiled pavement of Sta Lucia is an interesting view of Trapani, showing the strong fortifications on the land side, which have been demolished to permit of the extension of the town in that direction. The Madonna dell' Annunziata, about 1½ m. east of the town, founded in 1332, is now restored to its original style. The adjacent Cappella del Cristo Risorto contains a statue of the Virgin and Child in marble said to have been brought from Cyprus, to which an immense number of valuable offerings have been made, among them two bronze candelabra and a model of the city in silver; while the statue itself is hung with jewels, necklaces, cameos, rings, watches, &c. The modern town is clean and well built, with a fine esplanade on the south. It is a harbour of considerable importance. It was entered by 144 vessels, representing a tonnage of 129,164 in 1906. The imports showed a value of £276,674, the most important items being wheat, coal and timber; while the exports amounted to £143,347, the chief items being salt, wine, salt fish and building-stone. There are also large salt-pans to the south of the city, extending along the coast as far as Marsala, which produce about 200,000 tons of salt annually, of which in 1906 121,192 tons were exported, chiefly to Norway, Sweden, Canada and the United States. The numerous windmills are used for grinding the salt. (T. As.)

TRAP-BALL, or Knur and Spell (M. Eng. *knurre*, knot; Dan. *spil*, spindle), an old English game, which can be traced back to the beginning of the 14th century, and was commonly played in northern England as late as 1825, but has since been practically confined to children (bat, trap and ball). It was played with a wooden trap, by means of which a ball (knur) of hard wood about the size of a walnut was thrown into the air, where it was struck by the player with the "trip-stick," a bat consisting of two parts: the stick, which was of ash or lancewood and about 4 ft. long, and the pommel, a piece of very hard wood about 6 in. long, 4 in. wide and 1 in. thick. This was swung in both hands, although shorter bats for one hand were sometimes used. Originally the ball was thrown into the air by striking a lever upon which it rested in the trap; but in the later development of the game, usually called knur and spell, a spell or trap furnished with a spring was used, thus ensuring regularity in the height to which the knur was tossed. The object of the game was to strike the knur the greatest possible distance, either in one or a series of strokes.

TRAPEZE, or Trapese, a form of swing, consisting of a cross-bar suspended by ropes and used for gymnastic exercises, acrobatic displays and the like. The name was so applied in French (*trapèze*) from the resemblance of the apparatus to a "trapezium" or irregular four-sided figure. The Greek *τραπέζιον* is a diminutive of *τράπεζα*, a table, literally a four-footed or four-legged object, being a shortened form of *τετράπεζα* (*τετρα-*, four, and *πέζα*, foot).

TRAPEZOPHORON, the Greek term (from *τράπεζα*, table, and *φέρειν*, to bear) given to the leg or pedestal of a small side table, generally in marble, and carved with winged lions or griffins set back to back, each with a single leg, which formed the support of the pedestal on either side. In Pompeii there was a fine example in the house of Cornelius Rufus, which stood behind the impluvium. These side tables were known as *mensae vasariae* and were used for the display of vases, lamps, &c. Sometimes they were supported on four legs, the example at Pompeii (of which the museums at Naples and Rome contain many varieties) had two supports only, one at each end of the table. The term is also applied to a single leg with lion's head, breast and forepaws, which formed the front support of a throne or chair.

TRAPPISTS, Cistercian monks of the reform instituted by Armand J. le B. de Rancé (*q.v.*), abbot of La Trappe, 1664. La Trappe was a Cistercian abbey near Soligny, in the diocese of Sées, in Normandy, founded 1140. It suffered grievously from the English wars and from commendatory abbots, so that towards 1650 the community was reduced to half a dozen monks who had long ceased to comply with the obligations of their state, and were an open scandal to the neighbourhood. Armand Jean de Rancé became commendatory abbot at the age of ten, 1636; and on his conversion from a worldly life he began to interest himself in his abbey and conceived the project of restoring the monastic life therein, 1662. With this object he visited La Trappe, but the monks were recalcitrant and threatened his life; through the intervention of Louis XIV. he was able to pension them off; they were replaced by a community of Cistercians of the strict observance, and the monastic buildings, which had fallen into ruin, were repaired at de Rancé's expense. He himself then entered the novitiate in one of the reformed Cistercian abbeys, and on his profession he came to La Trappe as regular abbot, 1664. But he desired a return to the full programme of the primitive Cistercians. His influence with Louis XIV. and with the court of Rome secured him a free hand in carrying out changes without trammel from the Cistercian superiors, who looked askance at the project; and he was able to persuade his community to adopt a manner of life beyond the original Cistercian practice, and far beyond St Benedict's rule. Thus they abstained wholly from wine and fish, and rarely ate eggs; on certain days they had only bread and water, and on two days in the year they went barefooted; and they slept in their day clothes: these practices are in contradiction to what St Benedict allowed. On the other hand manual labour occupied only 3½ hours, but the church services 7—herein reversing St Benedict's apportioning of the time. In short, the Trappist régime is probably the most penitential that has ever had any permanence in the Western Church. Yet it attracted vocations in such numbers that de Rancé had 300 monks under him. Through age and ill health he resigned his abbacy in 1695, and died five years later.

During the 18th century La Trappe continued faithful to de Rancé's ideas, but the observance spread only into two monasteries in Italy. It was the dispersal of the community at the French Revolution that turned the Trappists into a congregation in the Cistercian order and finally into a separate order. Dom Augustine de Lestrange, the novice-master at the time of the suppression in 1790, kept twenty of the monks together and obtained permission for them to settle at Val-Sainte in Fribourg, Switzerland. Here they made their life still stricter than that of La Trappe, and postulants flocked to them in such numbers that in two years' time colonies went forth to establish Trappist monasteries in England, Belgium, Piedmont, Spain and Canada; and in 1794 Dom Augustine was named by the Holy See Father Abbot of all these foundations, thus formed into a congregation. In 1817 they returned to La Trappe, many new foundations were made, and by Dom Augustine's death in 1827 there were in all some seven hundred Trappist monks. In the course of the century three or four congregations arose—a Belgian, an Italian, and two in France—each with a vicar subject to the general of the Cistercians. In 1892 these congregations were united into a single Order of Reformed Cistercians, or of Strict Observance, with an abbot-general resident in Rome and independent of the general of the Cistercians of the Common Observance. In 1898 the Trappists recovered possession of Citeaux, the mother-house of the Cistercians, secularized since the Revolution, and it was declared by Rome to be the head and mother house of the Reformed Cistercians, who thus were recognized as the authentic representatives of the primitive Cistercian movement.

The Trappists are a thriving and vigorous order. In 1905 they had 58 monasteries with 1300 professed choir monks and 1700 lay brothers. At the time of the recent expulsions (1903) they had twenty houses in France, and they have two or three in all the countries of western Europe, including England (Mount St Bernard, near Leicester) and Ireland (Mount Mellery in Waterford and Roscrea); also in the United States and in Canada. Besides they have a house in China, with over fifty Chinese monks; one each in Japan, Asia Minor, Palestine, Bosnia and Dalmatia, and four in various parts of Africa. The abbey of Mariannhill in Natal is devoted to the christianizing and civilizing of the Kaffirs; there are numerous stations with elementary schools and chapels, and at the abbey is a high school and printing-press for books in the Zulu and Basuto languages. In heathen countries the Trappists now give themselves up to missionary work and the task of civilizing the natives.

The first Trappist nunnery was the abbey of Les Clairet, near Chartres, which de Rancé persuaded to adopt his reforms. Dom Augustine de Lestrange established another in 1796, and now there are fifteen with 350 choir nuns and 500 lay sisters. One is in England at Stapehill, near Wimborne, founded in 1802. The manner of life of the nuns is almost the same as that of the monks.

See the *Lives* of de Rancé. A minute account of the observance is in de Rancé's *Règlemens de la Trappe* (1701). The beginning of the reform is told by Helyot, *Histoire des ordres religieux* (1718), vol. vi. ch. 1; the developments under Dom Augustine de Lestrange are described in the supplementary matter in Migne's *Dictionnaire des ordres religieux* (1858). The whole subject is well treated by Max Heimbucher, *Orden u. Kongregationen* (1907), vol. i. § 48; and in Wetzer und Welte, *Kirchenlexicon* (2nd ed.), and Herzog, *Realencyklopädie* (3rd ed.). A realistic and sympathetic picture of Trappist life is the redeeming feature of J. Huysman's *En route.* (E. C. B.)

TRAQUAIR, SIR JOHN STEWART, 1st Earl of (d. 1659), Scottish statesman, was the son of John Stewart, the younger, of Traquair in Peeblesshire, of a branch, originally illegitimate, of the house of Buchan, and was created Baron Stewart of Traquair in 1628 and earl of Traquair in 1633. He was appointed treasurer depute of Scotland and an extraordinary lord of session in 1630, and is said to have given the casting vote against the second Lord Balmerino at his trial in 1634, but afterwards obtained his pardon. From 1636 to 1641 he held the office of lord high treasurer of Scotland, and aided Charles I. in introducing the liturgy. He endeavoured to prevent a conflict by impressing on the king the necessity of caution and the danger of extreme measures against the rioters. He was, however, compelled to publish Charles's proclamation enforcing the use of the liturgy and forbidding hostile demonstrations on pain of treason (1638). This was followed by military measures in which Traquair assisted by secretly conveying munitions of war to Dalkeith Palace. He was, however, obliged to surrender the place with the regalia to the Covenanters (March 1639). After the treaty of Berwick he was appointed the king's commissioner to the assembly at Edinburgh (August 1639), and he assented in writing to the act abolishing episcopacy, but prevented its ratification by adjourning the opening of parliament. His apparent double-dealing made him suspected by both parties, and in 1641 the Scottish parliament issued a warrant for his arrest. In his absence he was sentenced to death, but, although the king secured the remission of this penalty, he was dismissed from his office of treasurer, and in 1644, for repairing to the court and opposing the covenant, he was declared an enemy to religion and fined 40,000 marks. His son, Lord Linton, whom he had sent to Montrose with a troop of horse, withdrew on the eve of the battle of Philiphaugh (September 1645) and it has been supposed that Traquair betrayed Montrose's plans to Leslie. He was readmitted to parliament in 1646, raised cavalry for the "engagement" between the king and the Covenanters, and was captured at Preston (1648). He was released by Cromwell in 1654, and died on the 27th of March 1659. He was succeeded by his only son John (*c.* 1622–1666), whose descendants held the title until 1861, when on the death of Charles, the 8th earl, it became dormant or extinct.

See also Spalding, *Memorialls* (Spalding Club); Sir James Balfour, *Annals* (ed. Haig, 1824); *Dict. Nat. Biog.* vol. liv.

TRASIMENE, LAKE (Lat. *Trasumenus Lacus*; Ital. *Lago Trasimeno*), a lake of Umbria, Italy, 12 m. W. from Perugia, 843 ft. above sea-level, 30 m. in circumference, and

8 m. to 14 m. across. Having no natural outlet, it was formerly subject to sudden rises, which occasioned inundations, and these in turn malaria. An artificial outlet was completed in 1898 from the south-east corner of the lake to the Caina, a small tributary of the Tiber. The work, which is about 4 m. long, cost only about £26,000. It is intended to leave about 2500 acres of land dry, and to convert another 2800 acres of marshy soil into cultivable land. The lake contains three small islands: Isola Maggiore, with a monastery, Isola Minore and Isola Polvese. Standing on a promontory jutting out into the lake is the town of Castiglione del Lago, which possesses a castle of the dukes of Cornia, built by Galeazzo Alessi, the architect of many of the Genoese palaces. Napoleon I. formed a project for draining the lake, which may ultimately be adopted. Here Hannibal disastrously defeated the consul C. Flaminius. Hannibal left his winter quarters in Cisalpine Gaul in the spring of 217 B.C. and crossed the Apennines, probably by the pass now known as the Passo dei Mandrioli (from Forlì to Bibbiena in the upper valley of the Arno). His march was much hindered by marshes (probably those in the Arno valley between Bibbiena and Arezzo). The Roman army under Flaminius was stationed at Arezzo (anc. *Arretium*), and Hannibal marched past it. Flaminius followed, and Hannibal occupied the heights on the north of the lake between Terontola and Tuoro, commanding the road from Cortona to Perugia, and also those on the east of Tuoro, so that when the Roman army (which had encamped the night before outside the entrance to the small valley of the brook now called Sanguineto, west of Tuoro), unable in the mists of early morning to see the enemy's forces, had entered the valley, it was surrounded and there was no escape except by forcing a passage. The vanguard succeeded in making their egress on the east by Passignano, but the defeat of the rest of the army was complete, the Romans losing no fewer than 15,000 men.

See T. Ashby in *Journal of Philology* (1908), and refs. (T. As.)

TRASS, the local name of a volcanic tuff occurring in the Eifel, where it is worked for hydraulic mortar. It is a grey or cream-coloured fragmental rock, largely composed of pumiceous dust, and may be regarded as a trachytic tuff. It much resembles the Italian puzzolana and is applied to like purposes. Mixed with lime and sand, or with Portland cement, it is extensively employed for hydraulic work, especially in Holland; whilst the compact varieties have been used as a building material and as a fire-stone in ovens. Trass was formerly worked extensively in the Brohl valley and is now obtained from the valley of the Nette, near Andernach.

TRAÙ (Serbo-Croatian *Trogir*; Lat. *Tragurium*), a seaport of Dalmatia, Austria. Pop. (1900) of town and commune, 17,064. Traù is situated 16 m. W. of Spalato by road, on an islet in the Traù channel, and is connected with the mainland and the adjoining island of Bua by two bridges. The city walls are intact on the north, where a 15th-century fort, the Castel Camerlengo, overlooks the sea. Above the main gateway the lion of St Mark is carved, and the general aspect of Traù is Venetian. Its streets, which are too narrow for wheeled traffic, contain many interesting churches and mediaeval houses, including the birthplace of the historian Giovanni Lucio (Lucius of Traù), author of *De regno Dalmatiae et Croatiae* (Amsterdam, 1666). The loggia, built by the Venetians, is a fine specimen of a 16th-century court of justice; and the cathedral is a basilica of rare beauty, founded in 1200 and completed about 1450. It was thus mainly built during the period of Hungarian supremacy; and, in consequence, its architecture shows clear signs of German influence. Among the treasures preserved in the sacristy are several interesting examples of ancient jewellers' work. Traù has some trade in wine and fruit. It is a steamship station, with an indifferent harbour.

Tragurium was probably colonized about 380 B.C. by Syracusan Greeks from Lissa, and its name is sometimes derived from *Troghilon* a place near Syracuse. Constantine Porphyrogenitus writing in the 10th century, regards it as a corruption of ἀγγυρίον, water melon, from a fancied similarity in shape. He states that Traù was one of the few Dalmatian cities which preserved its Roman character. In 998 it submitted to Venice; but in 1105 it acknowledged the supremacy of Hungary, while retaining its municipal freedom, and receiving, in 1108, a charter which is quoted by Lucio. After being plundered by the Saracens in 1123, it was ruled for brief periods by Byzantium, Hungary and Venice. In 1242 the Tatars pursued King Béla IV. of Hungary to Traù, but were unable to storm the island city. After 1420, when the sovereignty of Venice was finally established, Traù played no conspicuous part in Dalmatian history.

See T. G. Jackson, *Dalmatia, the Quarnero, and Istria* (Oxford, 1887); E. A. Freeman, *Sketches from the Subject and Neighbour Lands of Venice* (London, 1881); and G. Lucio, *Memorie istoriche di Tragurio, ora detto Traù* (Venice, 1673).

TRAUN, OTTO FERDINAND, COUNT VON ABENSPERG UND (1677–1748), Austrian field marshal, came of a noble family and was born on the 27th of August 1677 at Oldenburg. He was sent to Halle to complete his education, but in 1693 left the university to serve with the Prussian contingent of the allied army in the Low Countries. He saw much service in the War of the Grand Alliance, and at its close entered the imperial army. The War of the Spanish Succession soon followed, and Traun served with distinction in Italy and on the Rhine till 1709, when he became lieutenant-colonel and aide-de-camp to Field Marshal Count Guido Starhemberg (1654–1737) in Spain. A year later, for specially distinguished services, he was made colonel, and in 1712 chief of a regiment of foot. Soon after the close of the war he was again actively employed, and at the action of Francavilla in Sicily (June 20, 1719) he received a severe wound. For his services in this campaign in southern Italy he was promoted General-Feldwachtmeister in 1723. In 1727 he became governor of Messina, and in 1733 attained the rank of lieutenant field marshal. In 1734 he won a European reputation by his defence first of the pass of S. Germano and then of the half-ruined fortress of Capua, which he surrendered, marching out with the honours of war on the 30th of November. He was at once promoted Feldzeugmeister and employed in a difficult semi-political command in Hungary, after which he was made commander-in-chief in north Italy and interim governor-general of the Milanese, in which capacity he received the homage of the army and civil authorities on the accession of Maria Theresa in 1740. In the following year he was made a field-marshal. The Italian campaigns of the War of the Austrian Succession were successfully conducted by him up to 1743, when, on the death of Field-Marshal Count Khevenhüller (*q.v.*), he was made the principal military adviser of Prince Charles of Lorraine (*q.v.*), who commanded the Austrians in Bohemia and on the Danube. In this capacity he inspired the brilliant operations which led up to the passage of the Rhine (see AUSTRIAN SUCCESSION, WAR OF THE) and the skilful strategy whereby Frederick of Prussia was forced to evacuate Bohemia and Moravia (1744) without a battle. Traun's last active service was the command of an army which was sent to Frankfurt to influence the election of a new emperor to succeed Charles VII. He died at Hermannstadt on the 18th of February 1748.

See *Biographien k. k. Heerführer, herausgegeben v. d. Direktion des k. und k. Kriegsarchiv*; Thürheim, *F. M. Otto Ferdinand, Graf v. Abensperg und Traun.*

TRAUNSTEIN, a town and summer resort of Bavaria, situated, at an elevation of nearly 2000 ft., on the river Traun, 73 m. by rail S.E. of Munich. Pop. (1905), 7447. It distils salt from the brine of Reichenhall, whence (22 m. distant) it is brought in pipes. It has an historical museum, four churches (three of which are Roman Catholic), two fine fountains—a monument of the war of 1870–71 and one to King Maximilian II. There are saline baths and breweries. In the vicinity are Empfing, with baths of all kinds and a cold-water cure establishment on the Kneipp system. Traunstein received civic rights in 1375.

TRAUTENAU (Czech *Trutňov*), a town of Bohemia, 120 m. E.N.E. of Prague by rail. Pop. (1900), 14,777, mostly German. It is situated on the Aupa, a tributary of the Elbe, at the foot of the Riesengebirge, and possesses a beautiful church built in 1283 and restored in 1768. Trautenau is the centre of the Bohemian linen industry and has factories for the manufacture of paper and for the utilization of the waste products of the other mills. Trautenau was founded by German colonists invited to settle there by King Otto Kar II. of Bohemia, and received a charter as a town in 1340. It was the scene of two battles between the Prussians and Austrians on the 27th and the 28th of June 1866.

TRAVANCORE, a state of southern India, in political relation with Madras. Area, 7091 sq. m. In 1901 the population was 2,952,157, showing an increase of 15% in the preceding decade. The state stands sixteenth among the native states of India in area and third in population. Travancore extends more than 150 m. along the west coast as far as Cape Comorin, the southernmost point of the peninsula. The Western Ghats rise to an elevation of 8000 ft. and are clothed with primeval forest; they throw out spurs towards the coast, along which there is a belt of flat country of about 10 m. in width, covered with coco-nut and areca palms, which to a great extent constitute the wealth of the country. The whole surface is undulating, and presents a series of hills and valleys traversed from east to west by many rivers, the floods of which, arrested by the peculiar action of the Arabian Sea, spread themselves out into lagoons or backwaters, connected here and there by artificial canals, and forming an inland line of smooth-water communication for nearly the whole length of the coast. The chief river is the Periyar, 142 m. in length. Other important rivers are the Pambai and its tributary the Achenkoil, the Kallada, and the Western Tambraparni. Iron is abundant and plumbago is worked. Elephants are numerous, and tigers, leopards, bears, bison and various kinds of deer abound in the forests. Travancore has an abundant rainfall, with every variety of temperature. The principal ports are Alleppi, Quilon and Paravur; but there is no real harbour. The state has a fine system of roads, and the Cochin-Shoranur and the Tinnevelly-Quilon railways pass through it. The Periyar irrigation project conducts water through the ghats in a tunnel to irrigate the Madras district of Madura, for which compensation of Rs. 40,000 is annually paid to Travancore. Trade is large and increasing, the chief exports being copra, coir and other coco-nut products, pepper, tea, sugar, areca-nuts, timber, hides, coffee, &c. The capital is Trivandrum. The revenue is £670,000; tribute, £80,000; military force, 1360 infantry, 61 cavalry and 30 artillery with 6 guns. The maharaja of Travancore claims descent from Cheraman Perumal, the last Hindu monarch of united Malabar, whose date is variously given from A.D. 378 to 825. Though he is a Kshatriya, the succession follows the local custom of inheritance through females; consequently his *sanad* of adoption authorizes him to adopt sisters' sons. For some generations the rulers have been men of education and character, and the state is conspicuous for good administration and prosperity. Education, and female education in particular, is more advanced than in any other part of India. The two dominant sections of the population are the Namburi Brahmins and the Nairs or military caste. Native Christians, chiefly of the Syrian rite, form nearly one-fourth of the whole, being more numerous than in any Madras district.

See V. Nagam Aiya, *Travancore State Manual* (Trivandrum, 1906).

TRAVE, a river of north Germany, rising in the Oldenburg principality of Lübeck, between Eutin and Ahrensböck. Flowing at first southwards through small lakes and marshes, it then turns west and, confined within flat and sandy banks, enters the Prussian province of Schleswig-Holstein. It now bends due south to Oldesloe, from which point it is navigable. Hence it takes an easterly course, and, entering the territory of the free city of Lübeck, receives from the right the Stecknitz, through which and the Stecknitz canal built by the merchants of Lübeck in 1398) a direct water communication is maintained with the Elbe, and passing the city of Lübeck discharges itself into the Baltic at the port of Travemünde after a course of 58 m. Its lower course from Lübeck to the sea has been dredged to a depth of 25 ft., permitting sea-going vessels to lie alongside the wharves and quays.

TRAVELLER'S TREE, a remarkable tree, native of Madagascar and Réunion, with a straight stem reaching 30 ft. in height and bearing at the top a number of large long-stalked leaves which spread vertically like a fan. The leaf has a large sheath at the base in which water collects in such quantity as to yield a copious draught—hence the popular name. The plant is known botanically as *Rarenala Madagascariensis* and belongs to the same family as the banana (Musaceae).

TRAVEMÜNDE, a seaport of Germany, in the free state of Lübeck, situated on the Baltic, at the mouth of the Trave. Pop. (1905), 2017. It has an Evangelical church, dating from the end of the 15th century, and is a much frequented watering-place. There are extensive herring fisheries. Travemünde arose out of a stronghold placed here by Henry the Lion, duke of Saxony, in the 12th century to guard the mouth of the Trave, and the Danes subsequently strengthened it. It became a town in 1317 and in 1329 passed into the possession of the free city of Lübeck, to which it has since belonged. Its fortifications were demolished in 1807.

TRAVERSE, in fortification, a mass of earth or other material employed to protect troops against enfilade. It is constructed at right angles to the parapet manned by the defenders, and is continued sufficiently far to the rear to give the protection required by the circumstances, which, moreover, determine its height. A traverse is sometimes utilized as a casemate. Ordinary field-works, not less than those of more solid construction, require traversing, though if the trenches, instead of being continuous, are broken into short lengths, they are traversed by the unbroken earth intervening between each length. (For traversing in surveying see SURVEYING.)

TRAVERSE CITY, the county-seat of Grand Traverse county, Michigan, U.S.A., on the Boardman river, between Boardman Lake and the west arm of Grand Traverse Bay, in the N.W. part of the lower peninsula. Pop. (1900), 9407, of whom 2068 were foreign-born; (1910, census), 12,115. It is served by the Père Marquette, the Grand Rapids & Indiana and the Manistee & North-Eastern railways, and by steamboat line to Chicago and other lake ports. The climate, scenery and good fishing attract summer visitors. The city has a public library and a library owned by the Ladies' Library Association, and is the seat of the Northern Michigan Asylum for the Insane (opened 1885). There are various manufactures, and in 1904 the total value of the factory product was $2,176,903. Traverse City was settled in 1847, incorporated as a village in 1881 and chartered as a city in 1895.

TRAVESTY (Fr. *travestie*, from *travestir*, to disguise, *se travestir*, to change one's clothes; Lat. *trans*, across, and *vestire*, to clothe), a burlesque, particularly a grotesque imitation of a serious work of literature or art, in which the subject, characters, &c., are retained, but the style, language and treatment generally are exaggerated and distorted to excite ridicule (see also BURLESQUE).

TRAVNIK, the capital of a department of the same name in Bosnia; situated on the Lašva, a left-hand tributary of the Bosna, 44 m. by rail N.W. of Serajevo. Pop. (1895) about 6000. Travnik is mainly built round a steep mass of rock, crowned by an ancient citadel. Several mosques, palaces, arcades and a fine bazaar, left among its narrow lanes and wooden huts, bear witness to its former prosperity, and there are some good modern barracks and public buildings.

The old name of Travnik, *Lašva*, was last used in the 18th century. It is likely, from the number of Roman remains, that Travnik stands near the site of a Roman colony. It was a stronghold of the Bogomili during the 15th century, but its period of greatness dated from 1686, when the downfall of the Turks in Hungary caused the removal of the Bosnian government from Banjaluka, which was dangerously near the Hungarian frontier, and the Turkish governors, officially styled "valis of Hungary," ruled in Travnik from 1686 to 1850.

Several interesting villages, none containing more than a few hundred inhabitants, are grouped together, near Travnik. Prozor, with its ruined citadel, which withstood the Turkish advance until the beginning of the 16th century, when almost the whole of Bosnia had been enslaved, was then the capital of the princes of Rama, a district lying north-west of the Narenta. The thermal station of Kiseljak, where the Fojnica and Lepenica rivers meet, is a cluster of old-fashioned Turkish villas, with a casino, baths, barracks, hotels and park. In 1396, Tvrtko I. of Bosnia granted the privilege of silver-mining here to the Ragusans. Remains of old workings may still be seen. Kreševo, 5 m. N.N.E., is likewise rich in iron, cinnabar, quicksilver and the argentiferous load which was worked by the Saxons in the middle ages. The citadel of Zahor, or Gradina, now a ruin, guarded the mines. Bugojno, on the Vrbas, is a picturesque place, with a large cattle and horse trade. The Franciscan monastery of Fojnica, 18 m. east, is the largest and wealthiest foundation in Bosnia. Its Byzantine church is full of ancient ornaments and relics. The archives contain many valuable manuscripts, including a charter bestowed on the monks, in 1463 by the Sultan Mahomet II.

TRAWLING, SEINING AND NETTING. The innumerable kinds of fishing nets which may be distinguished, if all nets differing in details of structure or use be placed in separate classes, fall naturally into two main groups, namely stationary nets and nets used in motion. The former group contains the most primitive nets, though nets of great complexity are now included in it; and the simplest fixed nets, themselves derived probably from dams of rushes or stones so placed as to lead fish in to a "pound" or enclosure, may with some confidence be considered as the ancestors of the great otter trawls now shot and towed daily from powerful steamers on fishing grounds more than a thousand miles from the market they work to supply. The more primitive fixed nets are of far less importance than movable nets (except in the capture of certain particular species), owing to the fact that they are necessarily confined to very shallow water. The main types of movable nets may therefore be treated first.

All nets are constructed in accordance with what is known of the habits of the fish they are designed to capture; and as fishes may be roughly divided into those spending at least the greater part of their lives on or near the sea-bottom and those spending a great portion of their lives near the surface, two lines have been followed in the development of nets, some being designed to work on the bottom, others to work near the surface. The most important nets used in the capture of "demersal" or bottom-living fishes are trawls; the most important pelagic nets are drift-nets. The word trawling[1] was at one time applied to more than one method of fishing, but has, at all events in Europe, now become restricted to the operation of a flattened conical net or trawl, dragged along the sea-bottom. There are two trawls in common use, the beam trawl and the otter trawl. They differ in the method adopted for extending the mouth of the net. The original form is the beam trawl.

The Beam Trawl.

The beam trawl may be described as a flattened conical net whose mouth is kept open when in use by a long beam supported at the ends by iron runners, the trawl-heads. Elm is generally preferred for the beam, selected if possible from timber grown just to the proper thickness, that the natural strength of the wood may not be lessened by more trimming or chipping than is absolutely necessary. If the required length and thickness cannot be obtained in one piece, two or even three pieces are scarfed together, and the joints secured by iron bands. The trawl-heads differ somewhat in form in different countries and in different localities. The usual form is heart-shaped, the "shoe" or part actually in contact with the ground when in use being straight, the after-side straight and sloping upwards from the hindmost point or "heel," and then curving down in a single unbroken arc, which forms the front of the head, to join the shoe. In the Barking pattern the head is stirrup-shaped; but this is now unusual. A square socket is bolted to the top of the head (taking the head to be in the position of use) to receive the end of the beam, and ring-bolts are put in at the extreme front of each head, to hold the ropes or wires by which the trawl is towed, and, within the point of the heel, for the purpose of allowing the mouth of the net to be seized or lashed to the trawl-head at a point close to the ground. The shoe of the trawl-head is in the full-sized trawls made of double thickness, to resist wear.

The Net.

When the net is spread out in the position it would take up when working, the upper part or back has its straight front edge fastened to the beam, but the corresponding lower part or belly is cut away in such a manner that the front margin forms a deep curve extending from the shoe of one trawl-head to that of the other, the centre of the curve or "bosom," as it is called, being at a considerable distance behind the beam. The usual rule in English trawls is for the distance between the beam and the centre of the bosom to be about the same as the length of the beam. In French trawls this distance is generally much less; but in all cases the beam and back of the net must pass over a considerable space of ground when the trawl is at work before the fish are disturbed by much of the lower margin of the net. This lower edge of the mouth of the trawl is fastened to and protected by the "ground-rope," which is made of an old hawser "rounded" or covered with small rope to keep it from chafing, and to make it heavier. The ends of the ground-rope are fastened at each side by a few turns round the back of the trawl-heads, just above the shoe, and the rope itself rests on the ground throughout its entire curve. The fish which may be disturbed by it have therefore no chance of escape at either the sides or top of the net unless they can pass through the meshes, and as the outlet under the beam is a long way past them, and is steadily moving on, sooner or later they mostly pass over the ground-rope and find their way into the funnel-shaped end of the net, from which a small valve of netting prevents their return.

It must not be supposed, of course, that all fishes entering a trawl are retained in it. Numerous investigations have been made into the size and number of the various species of fish which get through the meshes of the trawl, by lacing small-meshed netting over the ordinary net, and examining the fish remaining in this outer net. Fish are found to escape all parts of the net, but chiefly the "batings," *i.e.* the part of the net where it is narrowing to the "cod end"; and as the chance of escape depends on the size and shape of the fish, and the mesh of the net, it is naturally found that the maximum size of the individuals which can escape in any numbers differs in different species. If small fish are on the ground, the total number escaping is, however, in all cases very large, frequently greatly exceeding the number caught. This is for the most part desirable, the fish being of a size to render them of but little value to the fishermen or to the public. It is in any case inevitable, since a full-sized trawl made entirely of small-mesh would offer so great a resistance to the water as to be unworkable.

The ground-rope bears directly on the ground, and to prevent the possibility of the fish passing under it, the rope should have some weight in it so as to "bite" well, or press the ground closely. It is, however, always made of old material, so that it may break in case of getting foul of rocks or such other chance obstruction as may be met with on the generally smooth ground where the trawl can only be worked with advantage. If in such a contingency the rope were so strong and good as not to break, there would be serious danger of the tow-rope snapping, and then the whole apparatus might be lost; but the ground-rope giving way enables the net to be cleared and hauled up with probably no more damage to it than the broken rope and perhaps some torn netting. The remaining part of the trawl, extending from the bosom to the extreme end, forms a complete bag gradually diminishing in breadth to within about the last 10 ft., which part is called the "cod or purse," and is closed by a draw-rope or "cod-line" at the extremity when the net is being used. To avoid the abrasion of the under part of the cod-end pressed by the weight of fish against the stones and shells of the sea-bottom, stout pieces of old net are laced across beneath it in parallel strips. These strips thus trail beneath the trawl and protect it. They constitute the "rubbers" or "false belly." The cod-end is the general receptacle for the various fishes which enter the net; and when the trawl is hauled up and got on board the vessel, the draw-rope is cast off and the fish all fall out on the deck.

Pockets.

It has been mentioned that the body of the net tapers away to the entrance to the purse. It is at this point the opening of the pockets are placed; and they are so arranged that the fish having passed into the purse, and then seeking to escape by returning along its sides, are pretty sure to go into the pockets, which extend for a length of about 15 or 16 ft. along the inner side of the body of the net, and there, the more they try to press forward, the more tightly they become packed, as the pockets gradually narrow away to nothing at their upper or front extremity. These pockets are not separate parts of the trawl, but are made by merely lacing together the back and belly of the net, beginning close to the margin or side nearly on a level with the bosom, and then being carried on with slowly increasing breadth backward as far as the entrance to the purse. At this point the breadth of the net is divided into three nearly equal spaces, the central one being the opening from the main body of the net into the purse, or general receptacle for the fish, which must all pass through it, and those on each side being the mouths of the pockets facing the opposite direction. The central passage has a valve or veil of netting called the "flapper," which only opens when the fish press against it on their way into the purse. To understand clearly the facilities offered to the fish to enter the pockets, it is necessary to remember that the trawl, when at work, is towed along, with just sufficient force to expand the net by the resistance of the water. But this resistance directly acts only on the interior of the body of the net between the pockets and then on the purse; it does not at first expand the pockets, but tends rather to flatten them, because they are virtually outside the general cavity of the trawl and their openings face the father end of it. The water, however, which has expanded the body of the net, then passes under or through the flapper or valve, and enters the purse, which, being with a much smaller mesh than the rest of the net, offers so much resistance that it cannot readily escape in that direction; return currents are consequently formed along the sides, and those currents open the mouths of the pockets, which, as before mentioned, are facing them; and the fish, in their endeavours to escape, and finding these openings, follow the course of the pockets until they can go no farther. The whole of the net is therefore well expanded, but it is so by the pressure of the water in one direction through the middle, and in the opposite direction at the sides or pockets.

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[1] "Trawl" is from O. Fr. *trauler*, to go hither and thither; "troll," now used of drawing a line along the surface of the water from a boat, is from the variant O. Fr. *troller*, mod. *trôler*, to lead, drag about.

Size and Mesh.

The dimensions of a full-sized beam trawl, such as has been described above are from 45 to 50 ft. along the beam and about 100 ft. in length. Trawls of practically all smaller sizes down to some 30 ft. are to be found, but except for shrimp trawls the large sizes predominate almost to the exclusion of smaller nets. The trawl-heads support the beam at about 3 or 3½ ft. above the ground. The meshes of the net behind the beam (the square) are about 5 in. from knot to knot, when drawn out taut. In the batings, the part of the net in which the narrowing mostly occurs, they decrease gradually from 4 to about 3 in.; in cod end they are 2½ in. In the hope of protecting the small fish from capture some local authorities enforce within their jurisdiction a minimum size of mesh for trawls, as for other nets. According to certain recent by-laws of the Lancashire and Western Sea Fisheries District Committee, for instance, every trawl used in their waters, except for the capture of shrimps and certain specified fish, must allow a square wooden gauge of a certain size to pass easily through its meshes when these are wet. The difficulties in the way of the efficacy of such restriction are that a mesh which would allow the escape of fish of but little value of one species might allow the escape of very valuable individuals of another kind; and that both local and national authorities alike have powers of jurisdiction over such narrow strips of coastal water, that in the absence of an international agreement on the matter, the ground affected by the regulations is exceedingly small in comparison with the ground untouched. The same remarks apply to the similar regulations as to length of beam and circumference of nets.

Working the Net.

Considerable skill is needed to work a beam trawl successfully. A knowledge of the ground and of the direction and time of the tide is essential; for the trawl is towed with the stream, a little faster than it is running, so that there may be just sufficient resistance to expand the net. The regulation of speed, seeing that beam trawls are worked only from sailing vessels, is a matter of difficulty; when, however, there is a sufficiency of wind much can be done by an adjustment of the length of tow rope. Lowering the trawl is also a matter of difficulty especially when wind and tide are contrary, as in that case the vessel tends to drift over the net: the apparatus is first got into position by paying out the rope attached to the trawl-heads in such proportions that the beam takes its proper position while close to the surface. These ropes, called "bridles," are some 15 fathoms long: they meet and are shackled to the trawl warp, a manilla rope of 6 in. circumference, of which 150 fathoms are generally carried. The trawl being in proper position, the warp is allowed to run out and the trawl lowered to the bottom, the vessel slowly moving on meanwhile; usually the length of warp which is below the surface in towing is a few fathoms over three times the depth of water. The art of shooting the trawl lies in causing it to alight on its runners or shoes, with the net freely trailing behind: should the net be twisted, or the trawl alight on its beam, the trawl has been shot "foul," and must be hauled and shot again. While towing, an experienced fisherman can tell by pressing his hand firmly on the warp outside the ship's bulwark whether the progress of the trawl over the bottom is satisfactory, any irregular progress over rough ground revealing itself in the character of the vibration of the warp.

The trawl usually remains on the bottom for a whole tide, or six hours, and will in this time have passed over some 15 m. of ground. Hauling, a most lengthy and laborious process if carried out by hand-windlass, is in practically all modern fishing smacks carried out by a small steam capstan, the "steam man" as it is frequently called, a most efficient instrument with very compact engine housed under a small iron cover on the capstan's top. When the trawl comes alongside the heavy beam is secured by its two heads, the net is hauled over the side bit by bit, by hand, until the cod end is reached, when a rope is passed round it above the bulging end which contains the catch, and then over a "tackle" or pulley, and so the cod end is hoisted inboard. The knot of the codline is untied, and the fish, mixed with various invertebrate animals, star-fish and rooted forms (confounded in the one term "scruff"), falls to the deck.

Shrimp Trawls.

A small trawl is often used from an open boat for shrimping. It closely resembles a beam trawl, but has no pockets. The usual dimensions of this net are about 15 ft. beam and 20 total length, of which about 4 ft. are taken by the cod end. The mesh is about half an inch square, but where no restrictions are enforced it decreases to a considerably smaller size as the cod end is approached. The beam when in use is about a foot and a half above the ground.

Shank Nets.

Shank nets are also similar to beam trawls in general shape, but differ in that the mouth is kept open by a rectangle of wood. Frequently the lower margin of the trawl's mouth is not in contact with the ground, being attached to a bar of wood which is fixed parallel to the bottom of the wooden rectangle and a few inches above it. A fish or prawn is thus disturbed by the bottom bar of the wood, and either jumps over it and *below* the net and so escapes, or over both bottom bar and middle bar *into* the net. The theory of the net's action is that the fish tends most frequently to take the former course, the crustacean the latter; and there is some evidence that this is partially realized in practice. Shank nets are sometimes worked from carts, when they are known as "Trollopers."

Owing to their fine netting and the very shallow water in which they work, shrimp trawls are exceedingly destructive to very small fish. Johnstone[1] has found for instance that in a two mile haul of a shrimp trawl on the Lancashire coast 567 small plaice are caught on an average, beside great numbers of whiting, dabs, soles and other fish. In most parts of the English coast regulations are in force as to the mesh, size of beam and length of haul of shrimp nets, and shrimpers working on the beach are ordered to sort their catch at the water's edge, returning as many young fish alive as possible. The proportion saved by these means is not known with accuracy; it is much greater in the case of short hauls than in longer ones. A shrimp trawl is usually kept down from half an hour to an hour, or when not subject to regulation rather longer. It is seldom towed for a longer period than 2 hours, the speed being somewhat under two miles per hour on an average, though subject to variation.

Decay of Beam Trawling and rise of other Trawling from Steamers.

The beam trawl has been described at some length because its structure is somewhat more simple than that of the trawl now in more general use; the importance of the net as an engine of capture has undoubtedly declined greatly within the past generation. Some interesting figures collected by the British Board of Agriculture and Fisheries prove this incontestably. In 1893 the number of first-class British sailing trawlers was 2037, and their average net tonnage 57·4; in 1900 they numbered 925, with a net tonnage of 41·1, and from that year up to 1906 (the last year quoted in these returns) they never again reached a thousand in number or a tonnage of 40 tons net; on the other hand, there were in no one of the years quoted as few as 800 first-class sailing trawlers registered, nor did the average tonnage sink below 37, about which figure it remained constant. It is obvious therefore that about 1894 beam trawling began to decline, and that after a time this decline lost most of its power, the number of boats and size of boats having sunk to a condition in which they fulfilled a certain function, which for some years has remained fixed. The new factors which brought about this change went hand in hand. They were the invention of the otter trawl and the increasing use of steam in fishing vessels. The otter trawl has no rigid and heavy beam, but relies on the force with which it is towed through the water to keep it open, and it is a far more efficient instrument for the capture of all but small flat fish than the beam trawl. Owing to the second of these facts its employment inevitably spread, and owing to the first a sailing vessel needing at least a moderate breeze to give it the requisite speed for keeping a large net open was unsuitable for working it. Thus the introduction of the otter trawl undoubtedly hastened the replacement of sails by steam as motive power for the great fishing fleets. That the adoption of steam would have occurred in any case is almost certain. The conversion of drift-net fishing vessels from sail to steam has gone on rapidly, though no radical change of gear has taken place, and presumably the same would have occurred in the case of trawlers had the otter trawl never have introduced. There

[1] Johnstone, *British Fisheries*, p. 283 (London, 1905).

were, for instance, nearly 200 steam fishing vessels of various descriptions working from English and Welsh ports in 1883; and the desire to exploit new and more distant grounds had undoubtedly become powerful by 1894, and accounted to some extent for the increase of steam trawling about that time. Nevertheless this increase is so sudden, that its occurrence at the time of the adoption of the otter trawl can scarcely be a coincidence. In 1893 there were 480 steam trawlers working from English and Welsh ports: in 1899 there were over a thousand.

The subsequent history of British trawling is dominated by the steamers. Garstang has calculated from a study of market statistics that a steamer (between the years 1889 and 1898) caught on the average between four and seven times as much in a year as a sailing smack. Against this competition the smacks could not succeed; if it was profitable for the steamers to fish they could gradually eliminate the smacks, as has occurred at Grimsby. The line fishery also decreased owing to the increasing transfer of the haddock and some other fisheries to the trawlers. The change from masts and sails to steam has, however, never been complete. The increased cost of building and running steamers made the handling of large catches a necessary condition of their profitable employment. A sailing trawler costs from £500 to £1200 to build: £1000 would probably be a fair average. A first-class steam trawler of the present day costs £10,000 or more, quite ten times as much, and about £5000 a year to run; and although the cost was less in the early years of steam trawling there was always an approach to these proportions. On the other hand their rapidity and independence of wind made distance between fishing ground and port of landing a matter of minor consequence. These causes, combined with a very general belief in the exhaustion of the home-grounds—there seems no doubt that at all events the catch per vessel declined—led to the growth in size and power of the steamers, which were used for distant waters and the exploitation of new grounds. Thus in 1906 there were only 200 more steam trawlers than in 1899, but the average tonnage in the same period increased from 54 to nearly 62. To this increase in power and range of action of the steamers must be attributed the great increase in the quantity of trawled fish landed, since the engine of capture, the trawl, has changed but little since 1894: but another result occurred, namely a partial division of the area trawled between sail and steam. The grounds within easy reach of the English ports were left chiefly in the hands of the "smacks," the catches never being really very great, though possessing a high proportion of "prime" (*i.e.* valuable species of) fish. The persistence of Lowestoft and Ramsgate as smack ports speak for this. The longer voyages of the smacks, on the other hand, were gradually discontinued, and the distant grounds besides a multitude of new grounds were opened up by the steamers. Grimsby, Hull, Aberdeen, Milford, increased enormously in importance, and now send vessels to the north of Russia, to the coast of Africa and far into the Atlantic. Steam trawling died at Yarmouth, the place of its birth; sailing trawlers disappeared from Grimsby, one of their greatest strongholds, but a port near cheap coal, deep water, and a market for fish from more distant grounds.

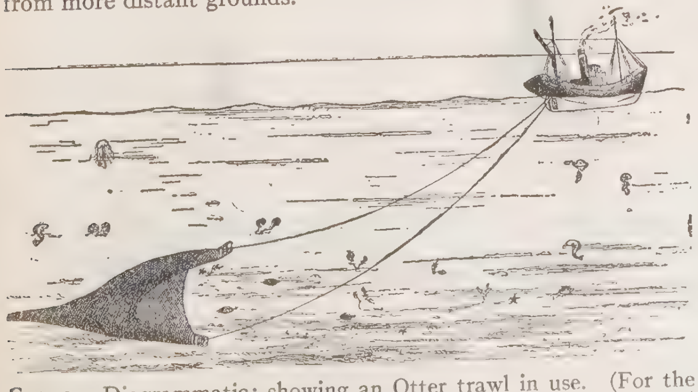


FIG. 1.—Diagrammatic; showing an Otter trawl in use. (For the sake of clearness, the size of the otter-boards is exaggerated, and the length of the warps and size of the ship diminished.)

The Otter Trawl. Principle of Action.

The essential features of the otter trawl are that the mouth is kept open by two large wooden boards, whose position when in use corresponds to that of the trawl heads in a beam trawl, no beam being used. The action of these boards resembles that of a kite. A kite dragged through still air, owing to the position of the point of attachment of the string, takes up an oblique position, in which it is acted on by forces in two directions, viz. that exerted through the string, pulling forward, and that exerted by the resistance of the air in front of the kite, which, being perpendicular to the kite's surface, acts in an upward and backward direction. The resultant of these two forces necessarily acts in a direction between them, and the kite accordingly ascends. Constrain the kite to move in a horizontal plane, and the same forces would cause it to move not upwards, but to the side. A trawl board is practically a kite made to move on its side.

The trawl boards resemble massive wooden doors strengthened by iron bands. In action they move with their short edges vertical and their long edges horizontal, one in each case in contact with the sea bottom: the front bottom corner of each board is rounded off, so that the board resembles a sleigh runner. Four strong chains, which meet in one iron ring, are attached to each board by ringbolts, and to each ring a wire warp, by which the trawl is towed, is shackled. The ringbolts are about the same distance from the centre of the board, but the two chains attached to the after-ringbolts of the board are longer than the two fore-chains. The trawl board when towed thus takes up an oblique position as regards the line in which it is towed, though remaining vertical to the ground. The force with which it is towed urges it forward; the resistance of the water urges it in a direction perpendicular to its surface, viz. backwards and to the side; it accordingly moves in an intermediate direction, going forward by tending to diverge from the line of towing. Meanwhile the other trawl-board is diverging in a similar manner but in the opposite direction, and the mouth of the net, being attached to the hinder end of the boards, is thus pulled both right and left until stretched to its utmost, and the net is thus held open. The margin of the net which forms its upper lip is lashed to a rope called the headline: and the resistance of the water to the net's progress causes this to assume an arched form, the centre of the headline being probably some 10 or 15 ft. from the ground.

It has been calculated by Fulton, who experimented on the subject, that the distance between the boards of an otter trawl of 90 ft. headline is about 60 ft., owing to this arching upwards and backwards of the upper margin of the net. The loss in the spread of the net is, however, compensated for very largely, as far as certain round fish are concerned, by the increase in height of the mouth, the fish which are swimming near but not actually on the bottom tending to "strike upward" when disturbed. Indeed, the raising of the headline is accentuated occasionally by glass spheres or other buoyant objects to its centre; corks are still used in this way, but otherwise the practice has not been generally adopted in commercial trawling.

The earliest use of the otter board appears to have been due to Hearder, an electrician and inventor who designed it about 1860. It was little used except by amateurs working by steam yachts (to whom doubtless the ease with which it could be stowed away recommended it), until the late 'eighties, when Danish fishermen used otter boards to spread their plaice seines. In 1894 a patent was taken out by Scott of Granton for an otter trawl which differed from the most modern forms chiefly in possessing rigid bars or brackets instead of chains. Chains replaced the bars in the form used by Nielsen, a Dane, in 1895. Although numerous variants have since arisen, no essential difference in the trawl has been generally adopted.

Details of Structure. The Boards.

The trawl boards, or as they are frequently called "doors," are of deal, 8 to 9 ft. long, and 4 to 5 ft. high; they are liberally shod and strengthened with iron, and are about 3 in. thick. The net is fastened to eyes placed at the top and bottom of the after-end of the board, but not to any intermediate point. This is to allow the part of the water swirling past the board to escape: the entry of the whole of the water upon which the net's mouth advances would cause too great a resistance.

The Warps.

Two warps are used, one to each trawl board. These are composed of wire rope $2\frac{1}{2}$ in. round, and when the trawl is inboard lie coiled up on the separate drums of a steam winch. As wire can be run off or wound in on either drum separately, the adjustment of the lengths is much simplified. In the larger trawlers a thousand fathoms of warp is carried on each drum, and the warp is designed to stand a breaking strain of 23 tons.

The Net.

The main form of net is that of the beam trawl. We have, as in that net, a coarse meshed netting used near the mouth, a decrease in size of mesh as the net narrows, and a bag or cod end whose end is fastened by a cod line passed through its final meshes. The only essential difference lies in the net behind the headline. This has not, as in the beam trawl, a straight margin, but a curved one, the pointed sides of the net being termed the "top wings" of the trawl, the corresponding parts of the bottom being in both trawls the bottom wings. The ground rope resembles that in the beam-trawl, but is in some cases furnished with chains or "dangles" or with "bobbins." Bobbins are heavy cylindrical wooden rollers, threaded on the wire warp which forms the core of the ground rope: they are of two sizes (the larger a foot through) placed alternately to ensure freedom of rotation. Their object is to surmount or crush obstacles which, by catching the ground rope, might capsize the trawl boards and destroy the success of the haul; they are accordingly used only on rough ground. The chains are fastened to the ground rope in loops, to give it weight, and are used on very soft ground to ensure the trawl's effectually dislodging the fish. The headline is a rope some 3 in. in circumference.

The meshes are, from knot to knot when drawn taut, from 5½ to nearly 6 in. in the square and wings, 5 to 4½ in. above, and 5 to rather over 3 in. below in the extreme back of the under batings called the "belly," about 2½ in. in the cod end.

Working the Net.

The successful shooting of the net is a matter of great skill. The paying out of the net, the lowering of the boards, the running out of unequal lengths of the two warps to square the trawl into proper position and the subsequent lowering of the whole to the bottom, resemble the corresponding operations with the beam trawl. The fore warp is then drawn close to the quarter of the vessel and shackled to the after-warp close to the vessel's side, and the vessel proceeds on her course at a speed of some 2¼ or 2½ m. per hour. The length of haul made varies enormously. On a ground where fish is very abundant, as in the early days of Iceland fishing, it may be half an hour or less: on the Eastern Grounds, off Denmark, where the great English fleets usually work, it is about 3 hours. When about to haul, the fore warp is released from the shackle and the vessel is immediately steered towards the side from which the trawl has been towed, while the warps are rapidly wound in; the warps thus speedily come to stand at right angles to the vessel. If this were not the case they might probably foul the vessel's propeller, with very serious and possibly fatal consequences to her safety. The trawl boards, having been drawn right up to their powerful iron supports or gallows, remain suspended there if the trawl is to be re-shot while the net is emptied; they are otherwise lowered between the gallows and the bulwark, and secured. The hauling in of the catch occurs as in the beam-trawl. Trawlers carry a trawl on each side of the deck, and in continuous trawling these are worked alternately. On each side of the deck a square enclosure called a pound is made for the reception of the fish falling from the cod end, by fitting planks turned on their sides into stanchions grooved for their reception. The fish is sorted into baskets in the pound, cleaned and packed in trunks in ice in the hold or fish-room.

Fleet Fishing.

A noteworthy method of trawling is the custom of 50 or 60 boats fishing together in a fleet. All these vessels will trawl as directed by an "admiral," in proximity to a "mark-boat," whose position is known to the owners from day to day, and the fish is daily fetched to market by fast "carriers." There are four such fleets of British vessels working in the North Sea. It is also worthy of mention that wireless telegraphy has recently been fitted to several German trawlers and drifters, which can thus communicate with the fishery protection cruisers, who pass on information concerning the fishery, and with the shore. The practice will doubtless spread, although as yet the distance over which a message can be sent by these vessels is very small.

Depths worked.

The use of steam has not only increased the radius of action of the vessel, but by facilitating the process of hauling enables trawling to be carried out in greater depths. The sailing vessels rarely work in greater depths than 30 fathoms. The steam vessels work frequently (*e.g.* south of Ireland) in over 200 fathoms. Commercial trawling in 500 fathoms is not unknown, and the Irish research vessel "Helga" works in as much as 800 fathoms.

Seines.

The movable nets resembling trawls are seines, from which trawls were in all probability developed. The seine is an extremely ancient net, used by Phoenicians, Greeks and other Mediterranean peoples, the word seine being derived from the Greek name (σαγήνη) for the appliance. In essence it is a long strip of netting with a buoyed headline and weighted ground rope. It is taken out in a boat some little distance from the shore, paid out during the boat's progress, and the lines attached to the ends being then brought back to the shore, the net is hauled up on the beach. From this simple form, which is still in use for the capture of smelts and other small fish, numerous developments have occurred. Before mentioning the details of a few of the chief of these it may be said that the changes mainly consist in the formation of a purse or pocket in the middle of the net, somewhat resembling the cod end of a trawl, and in the working of the net from boats or ships instead of from the sea. The boat is anchored during the hauling, the net being drawn to it. A net with a wide spread, furnished with a purse, drawn over the sea bottom to a boat, is obviously very near a trawl in its action. When in the late 'eighties Danish fishermen fastened otter boards to their plaice-seines, and allowed the boat to drift, the seine was dragged *by*, not *to* the boat, and when Petersen used a similar arrangement, presently to be described, dragged like a trawl, the evolution of a trawl from a seine was practically complete. Some such process, with the use of a beam instead of otter boards, probably occurred in the past and resulted in the beam trawl.

Pilchard Seines.

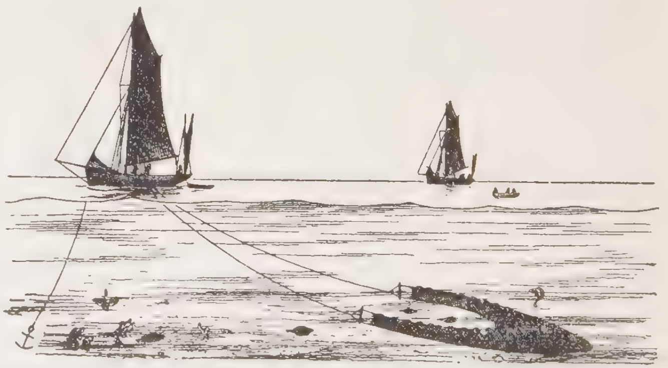
Pilchard seines, as the most elaborate forms of simple seines, may be briefly described. The pilchards approach certain parts of the Cornish coast, notably St Ives and Penzance, in shoals which are eagerly awaited; and when they are sufficiently near two boats start out on the fishery. One carries a short seine, the stop net, which has previously been joined to the large seine, and shoots this net as it rows towards shore. The other rows along the shore, shooting its net as it goes. Ultimately the boats turn to meet each other, and when they do so the ends of the long seine are joined, the stop net removed, and the circle of netting towed to the beach until its ground rope touches the bottom. The pilchards are then removed at leisure by a smaller seine called a tuck-net—seine being a word which in the west of England is confined to nets worked from the beach. This net is very deep in the middle, and as the foot rope is drawn well in in hauling, a floor is formed for it as it approaches the boat from which it is worked, a simple form of purse or bag resulting. The pilchards are dipped out in large baskets. In a good catch this process of "tucking" out the fish may be carried on for some days. The long seine used may be 200 fathoms long, and is about 6 fathoms deep at the ends and 8 fathoms in the middle. The tuck-net is about 80 fathoms long, 8 deep at the ends and 10 fathoms in the middle. The meshes are larger at the ends or wings than in the middle, as in the trawl, bringing a tuck-net from 30 down to 42 the yard.

Purse Seines.

The seine is far more used in the United States than in the British Islands, its operations being so successful that complaints have in some cases been made that local fisheries for certain species have been entirely destroyed owing to the diminution of the fish which it has brought about. It is used in water of any depth, for the purpose of catching mackerel. Rings are fastened to the ground rope, and by means of a rope passed through these rings the lower margin of the net is drawn together, converting the circle of netting into a complete basin-shaped purse. The slack of the net is then gradually drawn in, the fish collecting in the last of the net (the fullness or "bunt") to be reached. Purse seines are also used in Japan, where there is also in use a net which is a combination of seine and pound-net. A long wall of netting forms a "leader" to the fish, and ends in an oval enclosure formed by a purse seine with incompletely closed ends. Two anchored boats, to which the seine is lashed, keep it extended. On hauling, the opening is closed and the slack of the net hauled into one boat, which approaches the other, until the final portion containing the fish is brought to the surface.

"Seines with Pockets."

The pockets of seines, though answering the same purpose as those of trawls in preventing the escape of the fish, resemble not the pockets but the cod end of the latter net. In the *filets de bœuf* of the Mediterranean the pocket is a very long bag, trailing behind the arms of the seine, and constricted for some distance before joining it. It is without "flapper" or other valve.



(After Drechsel.)

FIG. 2.—Diagram of a Danish Plaice-seine at work.

Most efficient pocketed seines are used in Denmark for the capture of eels and plaice. In both these nets the depth increases rapidly as soon as the extreme wings are left, and is very great in the

Danish Seines.

middle. Thus when in action but little of the net is vertical; the ground and head ropes, though not parallel, tend to become so, and the net trails in a curve behind them. Seen from above, the whole front margin of the net is semicircular, but the net itself is shaped like the hinder part of a trawl: in fact, did the headline of a trawl lie not in front but exactly over the ground rope, the two nets would be almost identical.

Eel Drag-seine.

The eel drag-seine is worked from a boat, in shallow water. The extreme ends or wings are attached to two short spars, which in use are upright, and each of these is furnished with a line top and bottom which meet and are attached to the ropes by which the net is hauled in. The total length of the net is about 140 ft. from wing to wing, the length of the bag 30 ft., the depth at mouth is 20 ft. opening, the depth at the ends 6 or 8 ft.

Eel Drift-net.

The eel drift-net resembles the preceding, but is not drawn to an anchored boat, but drifts with the boat; it has accordingly to be made much smaller, its arms being each about 24 ft.—or a total length of 50. The wings were sometimes kept apart by the use of a floating spar, to the ends of which the seine was attached by short ropes, the spar itself being towed. A funnel-shaped valve leads into the bag.

Petersen's Trawl.

Petersen's trawl was designed by Dr Petersen for use in deep water, and for the capture of rapidly moving animals. It is essentially a drift-seine of the preceding pattern, worked with two small otter boards instead of a beam, and furnished with but a single warp, to which the otter boards are attached by shorter ropes or bridles. When used in very deep water these are prevented from twisting by attaching at the point of their junction with the warp a glass float and a leaden weight. This net is undoubtedly highly suitable for great depths. It is probably the "trawl" which it has been reported has been repeatedly used in the great depth of 2900 fathoms from the Norwegian research vessel "Michael Sars," in the course of the cruise in the Atlantic carried out in 1910 by Sir John Murray and Dr Hjort. It is practically a small otter trawl with the square cut out, leaving only wings, back part of batings and cod end, which last is entered by a funnel of netting. The meshes, in the net first constructed by Dr Petersen, were about a centimetre square in the wings and 8 millimetres square in the bag. The arms were each 24 ft. long, the bag about 16 ft. The boards were 29 in. by 32 in., and ¾ in. thick. Glass floats are frequently used with this trawl, to keep up the headline.

Danish Plaice-seine.

The Danish plaice-seine resembles the eel-seine in form, but is much larger, each arm being about 180 ft. long; the bag is 20 ft. long. The drag lines are also much longer, sometimes reaching to 1200 fathoms. These nets are worked from a very large number of boats, Esbjerg being the chief North Sea port engaged in the fishery. The vessels are yawl rigged, of the size of all but the largest smacks, and each is now furnished with a motor-boat. The boat takes the net to a considerable distance from the parent vessel, which is anchored, and shoots it in a wide curve. The drag lines are then brought back to the smack for hauling. By this method plaice are captured alive, and are kept in large floating fish-boxes until required.

Drift Nets.

Next in importance to trawling among the English fisheries is the use of drift-nets for mackerel, herrings and pilchards. It is undoubtedly the most common method of net-fishing on the coasts of the British islands, but nowhere is it so general as in Scotland. There are, however, great drift fisheries on the eastern and southern coasts of England, and an important mackerel fishery mainly at the western end of the channel, though owing to a high import duty on mackerel levied by France this is now of far less importance. The value of the mode of fishing technically known as "drifting or driving" will be understood when it is remembered that it is the only method by which such fishes as herrings, mackerel and pilchards, which generally swim at or near the surface, can be readily caught in the open sea, at any distance from land, and in any depth of water, so long as there is sufficient for the floating of the nets in the proper position. The term "**drift-net**" is derived from the manner in which the nets are worked. They are neither fixed nor towed within any precise limits of water, but are cast out or "shot" at any distance from the land where there are signs of fish, and are allowed to drift in whichever direction the tide may happen to take them, until it is thought desirable to haul them in. The essential principle of the working of the drift-net is that it forms a long wall or barrier of netting hanging for a few fathoms perpendicularly in the water, but extending for a great length horizontally, and that the fish, meeting these nets and trying to pass them, become meshed; they force their heads and gill-covers through the meshes, but can go no farther; and as the gill-covers catch in the sides of the mesh, the fish are unable to withdraw and escape. Whether it be mackerel, herring or pilchard, the manner in which the net works is the same; the variations which exist relate only to the differences in habits and size of the fish sought after.

The nets used are light cotton nets, each about 30 yards long and 10 or 12 deep, and when designed for herring have a mesh of about an inch square, pilchard nets being smaller and mackerel nets larger in mesh. These nets are laced end to end in a long row, the whole row, called a "fleet" or "train" of nets being, in the case of the large herring boats, as much as 3½ miles long. One of the long edges of the net is fastened to a rope corked at regular intervals, whose purpose is to keep that part uppermost. This edge is called the "back" of the net. The corks are, however, not sufficient to keep the whole net from sinking, and this is done by buoys called "bowls," which are attached to the back rope at intervals. It is always a matter of uncertainty at what depth the fish may be found, and a deal of judgment is needed in deciding what length of rope should be used in attaching the buoys. In the herring fishery of the English east coast the British boats usually work in somewhat shallower water than the foreign drifters, and set their nets at about 4 fathoms from the surface, the foreigners, lying outside them, using deeper-set nets. It is found convenient to colour certain of the bowls distinctively to indicate their position in the "fleet." Otherwise they are coloured to show ownership.

Drift-net fishing is with rare exceptions only carried on at night. The time for beginning is just before sunset, and the nets are then got into the water by the time it is dark. A likely place to fish is known (though there is much uncertainty in the matter) by signs recognizable only to the practised eye. An obvious one is the presence of many sea-birds, or of the fish themselves. But besides these the appearance and even the smell of the water furnishes a guide. In the case of the mackerel these signs have been shown by G. E. Bullen (*Journ. Marine Biol. Assoc.* viii. 269) to be due to the character of the microscopic organisms in the water, some of which furnish the food of the mackerel, others of which it avoids. If fish is believed to be present the vessel is sailed slowly before the wind and if possible across the tide; then the net is shot or thrown out over the vessel's quarter, the men being distributed at regular stations, some hauling up the net from below, others throwing it over and taking care that it falls so that the foot is clear of the corked back; others, again, looking after the warp which has to be paid out at the same time, and seeing that the seizings are made fast to it in their proper places. When it is all overboard, and about 15 or 20 fathoms of extra warp, called the "swing-rope," given out, the vessel is brought round head to wind by the warp being carried to the bow; the sails are then taken in, the mast lowered, a small mizen set to keep the vessel with her head to the wind, and the regulation lights are hoisted to show that she is fishing. A few of the hands remain on deck to keep a look out, and the vessel and nets are left to drift wherever the wind and tide may take them. It is very rarely that there is an absolute calm at sea; and if there is the faintest breath of air stirring the fishing boat will of course feel it more than the buoys supporting the nets; she will consequently drift faster, and being at the end of the train, extend the whole fleet of nets. In rough weather, as the strain may be greater, more rope is used. The first net in the train is often hauled after an hour to enable the men to judge whether the position is a good one. When the whole are hauled, the nets are taken in and the fish shaken out in the same orderly way as in shooting, each man having his own proper duty.

The sailing drifter is fast disappearing, giving place to the steam drifter. These vessels, though costing far more (£2500 to £3000 against £400 only) catch more fish, have a greater radius of action, reach market more quickly and are independent of weather. It has been calculated that a thousand square feet of herring netting used by a steamer catch 43½ cwt. of herring, while a sailing vessel catches 20 cwt. with the same area of netting; and the steamer-caught fish, being more quickly delivered, fetches a better price. It may be noted that of recent years herring have been caught at the bottom in considerable quantities by the trawl. The fishing of herring is thus increasing in variety of method, as well as in intensity. Such sailing boats as tend to remain are long shore boats, and such drifters as have been fitted with petrol motors.

Stationary Nets.

Stationary nets, being of very small importance relatively to the preceding, must be dismissed more shortly. They are of four main kinds, viz.: stake nets, pound and kettle nets, stow and bag nets, trammel-nets and hose nets.

Stake Nets.

Stake nets are usually set between tide-marks, or in shallow water, and, as their name implies, are kept up by stakes placed at intervals. They are generally set across the direction of the tide. They act as gill nets, and are chiefly used in America. In some cases a conical bag instead of a flat net occupies the space between every two stakes, forming a series of simple bag nets. This form is used on the German shores of the North Sea.

Pound and Kettle Nets.

In another modification the net is supported on the stakes, which is some 200 ft. long, does not act as a gill net but as a "leader," and one of its ends passes through a narrow opening into a circular enclosure surrounded by a similar wall of staked netting. The bag net and fly net for the capture of the salmon are merely elaborated forms of this type. The pound is roofed by netting, in the fly net, and in the bag net, which is floated—not staked—floored also. It is wedge-shaped, narrowing gradually from the entrance end, and divided incompletely by oblique internal walls or valves of netting into side compartments.

Stow Nets.

The bag net just described is practically a floating stake net. A simpler form is used in the Elbe, consisting of a pyramidal net whose mouth is held open by its sides being attached to spars, weighted at one end and buoyed at the other. This is the simplest form of stow net. The stow net is used in the Thames and Wash; it is specially designed for the capture of sprats, although many young herrings are sometimes caught, and it is worked most extensively at the entrance of the Thames. The stow net is a gigantic funnel-shaped bag having nearly a square mouth, 30 ft. from the upper to the lower side, and 21 ft. wide. It tapers for a length of about 90 ft. to a diameter of 5 or 6 ft., and further diminishes to about half that size for another 90 ft. to the end of the net. The whole net is therefore about 180 ft. or 60 yards long. The upper and lower sides of the square mouth are kept extended by two horizontal wooden spars called "balks," and the lower one is weighted so as to open the mouth of the net in a perpendicular direction when it is at work. The size of the meshes varies from $1\frac{3}{8}$ in. near the mouth to $\frac{1}{2}$ in. towards the end, where, however, it is again slightly enlarged to allow for the greater pressure of the water at that part. The mode of working the net is very simple. Oyster smacks are commonly used in this fishery, although shrimping boats are also employed in it in the Thames. The smack takes up a position at the first of the tide where there are signs of fish, or in such parts of the estuary as are frequented by the sprats during that part of the season; she then anchors, and at the same moment the net is put overboard and so handled that it at once takes its proper position, which is under the vessel. It is kept there by a very simple arrangement. Four ropes leading, one from each end of the two balks, and therefore from the four corners of the mouth of the net, are united at some little distance in front, forming a double bridle, and a single mooring rope leads from this point of union to the vessel's anchor; so that the same anchor holds both the vessel and the net. The net is kept at any desired distance from the bottom by means of two ropes, one from each end of the upper balk to the corresponding side of the smack, where it is made fast. The open mouth of the net is thus kept suspended below the vessel, and the long mass of netting streams away astern with the tide. The strain of this immense bag-net by the force of the tide is often very great, but if the vessel drags her anchor, the net being made fast to the same mooring, both keep their relative positions. Here they remain for several hours till the tide slackens, the vessel's sails being all taken in and only one hand being left on deck to keep watch. The way in which the fish are caught hardly requires explanation. The sprats, swimming in immense shoals, are carried by the tide into the open mouth of the net and then on to the small end, where they are collected in enormous numbers; from this there is no escape, as the crowd is constantly increasing, and they cannot stem the strong tide setting into the net. The first thing to be done in taking in the net is to close the mouth, and this is effected by means of a chain leading from the bow of the vessel through an iron loop in the middle of the upper balk down to the centre of the lower one, and by heaving in this chain the two balks are brought together and ultimately hoisted out of the water under the vessel's bowsprit. The net is then brought alongside and overhauled till the end is reached, and this is hoisted on board. The rope by which it is closed having been cast off, the sprats are then measured into the hold of the vessel by about three bushels at a time, until the net has been emptied. The quantity of sprats taken in this manner by many scores of fishing craft during the season, which lasts from November to February, is in some years simply enormous; the markets at Billingsgate and elsewhere are inundated with them, and at last in many years they can only be disposed of at a nominal price for manure; and in this way many hundreds of tons are got rid of. The stow boats do not generally take their fish on shore, but market boats come off to them and buy the fish out of the vessel's hold, and carry it away. The mode of working is the same in the Solent and the Wash as that we have described in the Thames and large quantities of sprats are landed by the Southampton boats.

"Whitebait," or young sprats, mixed with some young herring and other small fish, are caught in the Thames by a net which is practically nothing else but a very small stow net, and it is worked in essentially the same manner. An interesting form of stow net is used in the Channels of the Frisian Island, chiefly during the rush of the ebb-tide, for the capture of rays (principally *Raja clavata*, the Thornback) which are highly valued by the Dutch. It consists of a net shaped like an otter trawl, furnished with otter boards, which are attached to ropes passed to the ends of long booms which project from the sides of the vessel using the net, and also to the two anchors by which the former is anchored.

Trammel Nets.

The remaining stationary nets to be mentioned partake of the nature of traps. The trammel net consists of three nets joined together at the top, bottom and sides. The whole system of nets hangs vertical, the head line being buoyed and the ground line weighted. The two outer nets are much smaller than the inner net, but of wide-meshed netting, whereas the inner net is of very small mesh. Consequently, a fish meeting an outer net passes through it, strikes the fine-meshed net and forces it before it through one of the meshes of the farther wide-meshed net; it is thus in a small pocket from which it cannot escape.

Hose Net.

The hose net is a long cylindrical net from which trap-like pockets open. The main cavity is kept open by rigid rings. The hose nets are set between tide marks, at low water, so that the tide runs through them; and they are emptied at next low tide.

While unimportant compared with the huge quantity of fish landed from sea-going vessels, the catch of the in-shore nets described is of importance in respect of the kinds of fish taken, whitebait and pilchards, for instance, being not otherwise obtained, while salmon, though taken in rivers as well as in estuaries and along the coast, is very rarely captured at sea.

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TRAY, a flat receptacle with a raised edge used for a variety of purposes, chiefly domestic. The tray takes many forms—oblong, circular, oval, square—and is made in a vast number of materials, from papier mâché to the precious metals. Duke Charles of Lorraine had a pen-tray of rock crystal standing on golden feet; Marie Antoinette possessed a wonderful oval tray, silver gilt and enamelled, set with 144 cameos engraved with the heads of sovereigns and princes of the house of Austria, and their heraldic devices. The tea-tray is the most familiar form; next to it comes the small round tray, usually of silver or electro-plate, chiefly used for handing letters or a glass of wine. When thus employed it is usually called a "waiter." The English tea-trays of the latter part of the 18th century were usually oval in shape and sometimes had handles; mahogany and rosewood were the favourite materials. Sheraton and Shearer, among other cabinet-makers of the great English period, are credited with trays of this type. These were succeeded in the early and mid-Victorian period by trays of japanned iron, which possessed no charm but had the virtue of durability. Sheffield plate snuffer-trays of satisfying simplicity were made in large numbers, and are now much sought after.

TRAZ-OS-MONTES (*i.e.* across the Mountains), an ancient frontier province in the extreme N.E. of Portugal, bounded on the N. and E. by Spain, S. by the river Douro which separates it from Beira, and W. by the Gerez, Cabreira and Marão Mountains, which separate it from Entre-Minho-e-Douto. Pop. (1900), 427,358; area, 4,163 sq. m. For administrative purposes Traz-os-Montes was divided in 1833 into the districts of Braganza (*q.v.*) and Villa Real (*q.v.*). The surface is generally mountainous, although there are tracts of level land in the *veigas* or cultivated plains of Chaves and Miranda do Douro, and in the *cimas* or plateau region of Mogadouro. The highest peak is Marão (4642 ft.). The province belongs to the basin of the Douro and is chiefly drained by its tributaries the Tua, Tamega and Sabor. Its inhabitants belong to the old Portuguese stock, and resemble the Spaniards of Galicia in physical type, dialect and character. The Paiz do Vinho (see OPORTO) is the chief wine-growing district in Portugal; other products are silk, maize, wheat, rye, hemp, olive oil and honey. There are important mineral springs and baths at Vidago and Pedras

Salgadas. The principal towns are Braganza, Chaves and Villa Real.

TREACLE, the thick viscid syrup obtained in the early processes of refining sugar, the uncrystallizable fluid obtained in the process of procuring refined crystallized sugar being known as "golden syrup" and the drainings from the crude sugar as "molasses" (see SUGAR: *Manufacture*). The word was properly and first used for a medical compound of varying ingredients which was supposed to be a sovereign remedy against snake bites or poison generally. A well-known specific was Venice treacle, *Theriaca Andromachi*, a compound of a large number of drugs reduced to an electuary,[1] a medicinal compound prepared with honey, which dissolves in the mouth. The old French *triacle*, of which "treacle," earlier "triacle," is an adaptation, is a corruption of *theriaque*, Latin *theriaca*, Greek θηριακά (*sc.* φάρμακα), literally drugs used as an antidote against the bite of poisonous or wild animals (θήριον, dim. of θήρ, wild beast). The word "triacle" came to be used of any remedy or antidote. The composition of electuaries with honey or syrup naturally transferred the name to the most familiar syrup, that obtained from the drainings of sugar.

TREAD-MILL, a penal appliance introduced by Sir William Cubitt in 1818 and intended by him as a means of employing criminals usefully. It was a large hollow cylinder of wood on an iron frame, round the circumference of which were a series of steps about 7½ in. apart. The criminal, steadying himself by hand-rails on either side, trod on these, his weight causing the mill to revolve and compelling him to take each step in turn. In the brutalizing system formerly in vogue the necessary resistance was obtained by weights, thus condemning the offender to useless toil and defeating the inventor's object. The tread-mill, however, was subsequently utilized for grinding corn, pumping water and other prison purposes. The speed of the wheel was regulated by a brake. Usually it revolved at the rate of 32 ft. per minute. The prisoner worked for 6 hours each day, 3 hours at a time. He was on the wheel for 15 minutes and then rested for 5 minutes. Thus in the course of his day's labour he climbed 8640 ft. Isolation of prisoners at their work was obtained by screens of wood on each side of the mill, converting the working space into a separate compartment. Each prisoner was medically examined before going to the mill.

By the Prison Act 1865 every male prisoner over 16, sentenced to hard labour, had to spend three months at least of his sentence in labour of the first class. This consisted primarily of the tread-mill, or, as an alternative, the crank. The latter consisted of a small wheel, like the paddle-wheel of a steamer, and a handle turned by the prisoner made it revolve in a box partly filled with gravel. The amount of gravel regulated the hard labour; or the necessary resistance was obtained by a brake, by which a pressure, usually of 12 ℔, was applied. The prisoner had to make 8000 or 10,000 revolutions during his 6 hours' work, according to his strength, the number being registered on a dial. The crank too, however, was subsequently made to serve useful purposes. Both tread-mill and crank have gradually been abolished; in 1895 there were 39 tread-mills and 29 cranks in use in English prisons, and these had dwindled down to 13 and 5 respectively in 1901. They are now disused.

The fundamental idea of Cubitt's invention, *i.e.* procuring rotary motion for industrial purposes by the weight of men or animals, is very old. "Tread-wheels," of this type, usually consist of hollow cylinders, round the inner surface of which a horse, dog or man walks, foothold being kept by slabs of wood nailed across at short intervals.

TREASON (Fr. *trahison*, Lat. *traditio*), a general term for the crime of attacking the safety of a sovereign state or its head. The law which punishes treason is a necessary consequence of the idea of a state, and is essential to the existence of the state. Most, if not all, nations have accordingly, at an early period of their history, made provision by legislation or otherwise for its punishment. The principle is universal, though its application has led to differences of opinion. What would have been a capital crime at Rome under Tiberius may be no offence at all in England. It is to the advantage of the state and the citizen that what is treason and what is not should be clearly defined, so that as little as possible discretionary power, apt to be strained in times of popular excitement, should be left to the judicial or executive authorities. The importance of this was seen by Montesquieu. Vagueness in the crime of treason, says he, is sufficient to make the government degenerate into despotism.[2] At the same time, it may be observed that despotic governments have not always left the crime undefined. The object of Henry VIII., for instance, was rather to define it as closely as possible by making certain acts treason which would not have been so without such definition. In both ancient and modern history treason has generally been a crime prosecuted by exceptional procedure, and visited with *afflictive* as distinguished from *simple* punishments (to use the terminology of Bentham).

Roman Law.—In Roman law the offences originally falling under the head of treason were almost exclusively those committed in military service, such as in England would be dealt with under the Army Act. The very name *perduellio*, the name of the crime in the older Roman law, is a proof of this. *Perduelles* were, strictly, public enemies who bore arms against the state; and traitors were regarded as having no more rights than public enemies. The Twelve Tables made it punishable with death to communicate with the enemy or to betray a citizen to the enemy. Other kinds of *perduellio* were punished by interdiction of fire and water. The crime was tried before a special tribunal, the *duumviri perduellionis*, perhaps the earliest permanent criminal court existing at Rome. At a later period the name of *perduellio* gave place to that of *laesa majestas*, *deminuta* or *minuta majestas*, or simply *majestas*. The *lex Julia majestatis*, to which the date of 48 B.C. has been conjecturally assigned, continued to be the basis of the Roman law of treason until the latest period of the empire, and is still, with the law of *perduellio*, the basis of the law of British South Africa as to treason. The original text of the law appears to have still dealt with what were chiefly military offences, such as sending letters or messages to the enemy, giving up a standard or fortress, and desertion. With the empire the law of *majestas* received an enormous development, mainly in the reign of Tiberius, and led to the rise of a class of professional informers, called *delatores*.[3] The conception of the emperor as divine[4] had much to do with this. It became a maxim that treason was next to sacrilege[5] in gravity. The law as it existed in the time of Justinian is contained chiefly in the titles of the *Digest*[6] and *Code*[7] "*Ad legem Juliam majestatis.*" The definition given in the *Digest* (taken from Ulpian) is this: "majestatis crimen illud est quod adversus populum Romanum vel adversus securitatem ejus committitur." Of treasons other than military offences, some of the more noticeable were the raising of an army or levying war without the command of the emperor, the questioning of the emperor's choice of a successor, the murder of (or conspiracy to murder) hostages or certain magistrates of high rank, the occupation of public places, the meeting within the city of persons hostile to the state with weapons or stones, incitement to sedition or administration of unlawful oaths, release of prisoners justly confined, falsification of public documents, and failure of a provincial governor to quit his province at the expiration of his office or to deliver his army to his successor. The intention (*voluntas*) was punishable as much as an overt act (*effectus*).[8] The reported opinions as to what was not treason show the lengths to which the theory of treason was carried. It was not treason to repair a statue of the emperor which had decayed from age, to hit such a statue with a stone thrown by chance, to melt down such a statue if unconsecrated, to use mere verbal insults against the emperor, to fail in keeping an oath sworn by the emperor or to decide a case contrary to an imperial constitution. Treason was one of the *publica judicia*, *i.e.* one of those crimes in which any citizen was entitled to prosecute. The law deprived the accused in a charge of treason of his ordinary remedy for malicious prosecution, and also took from him the privilege (which those accused of other crimes generally possessed) of immunity from accusation by women or infamous persons, from liability to be put to the torture, and from having his slaves tortured to make them testify against him (see TORTURE). The punishment from the time of Tiberius was death (usually by beheading)[1] and confiscation of property, coupled with complete civil disability. A traitor could not make a will or a gift or emancipate a slave. Even the death of the accused, if guilty of treason of the gravest kind, such as levying war against the state, did not extinguish the charge, but the memory of the deceased became infamous, and his property was forfeited as though he had been convicted in his lifetime.

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[1] Electuary (Lat. *electuarium*), is probably derived from Gr. ἐκλεικτόν, used in the same sense, from ἐκλείχειν, to lick out.

[2] *Esprit des lois*, bk. xii. c. 7.

[3] See Merivale, *History of the Romans under the Empire*, iii. 467, v. 141.

[4] "Principes instar deorum esse" are the words of Tacitus.

[5] This crime was called *laesa majestas divina* in later law.

[6] xlviii. 4.

[7] ix. 8.

[8] A similar provision was contained in the Golden Bull of Charles IV. c. 24. In English law, with the one exception of a statute of 1397 (21 Ric. II. c. 3) repealed in the first year of Henry IV.,

English Law.—The law of England as to treason corresponds to a considerable extent with Roman law; in fact, treason is treated by Blackstone as the equivalent of the *crimen laesae majestatis*. The history of the crime in the two systems agrees in this that in both the law was settled by legislation at a comparatively early period, and subsequently developed by judicial construction. In both, too, there were exceptional features distinguishing this crime from other offences.[2] For instance, at common law treason was not bailable (except by the king's bench) nor clergyable, could not be cleared by sanctuary, and did not admit of accessories before or after the fact, for all were principals, nor could a married woman plead coercion by her husband. To stand mute and refuse to plead did not save the lands of the accused, as it did in felony, so that the *peine forte et dure* (see TORTURE) was unnecessary in treason. These severities were due to the conception of treason as a breach of the oath of allegiance. Other differences introduced by statute will be mentioned later. In some cases a statute simply affirmed the common law, as did the Treason Act 1351 to a great extent, and as did an act of 1534, depriving those accused of treason of the benefit of sanctuary. How far the Roman law was consciously imitated in England it is impossible to determine. It was certainly not adopted to its full extent, for many acts were *majestas* which were never high treason, even in the most despotic periods. Treason was the subject of legislation in many of the pre-Conquest codes. The laws of Alfred[3] and Æthelred[4] punished with death any one plotting against the life of the king. The *Leges Henrici Primi* "[5] put anyone slaying the king's messenger in the king's mercy. The crime was shortly defined by Glanvill,[6] and at a greater length by Britton,[7] and by Bracton,[8] who follows Roman law closely.

The offence of high treason was not precisely defined by the common law (1 Hale, 76), and until the passing of the Treason Act 1351 depended much on the opinions of the king and his judges. That statute appears to be the answer to a petition of the Commons in 1348 (1 Hale, 87), praying for a definition of the offence of accroaching royal power, a charge on which several persons—notably Gaveston and the Despensers—had suffered. The offences made high treason by the statute which still remain are these: (1) to compass or imagine[9] the death of the king,[10] the queen or their eldest son and heir; (2) to violate the king's companion, or his eldest daughter unmarried, or the wife of his eldest son and heir; (3) to levy war against the king in his realm, or be adherent to the king's enemies in his realm, giving them aid and comfort in the realm or elsewhere (*perduellio*); (4) to slay the chancellor, treasurer, or the king's justices of the one bench or the other, justices in eyre, or justices of assize, and all other justices assigned to hear and determine, being in their places doing their offices. In all cases of treason not specified in the statute the justices before whom the case came are to tarry without going to judgment until the cause has been showed and declared before the king and his parliament whether it ought to be judged treason or felony. The statute, so far as it defines the offence of high treason, is still law.

The statute also treated as high treason forgery of the great or privy seal, counterfeiting the king's coin and importing counterfeits thereof. These offences are now felonies. It also defined petty treason (now merged in wilful murder) as the slaying of a master by his servant, a husband by his wife, or a prelate by a man secular or religious owing him allegiance. The act of 1351 protects only the king's life, and its insufficiency was supplemented in periods of danger by legislation, often of a temporary nature. Under Richard II. many new offences were made treason,[11] but the acts creating these new treasons were repealed at the earliest opportunity by the parliaments of his successors. The reign most prolific in statutory additions to the law of treason was that of Henry VIII. Legislation in this reign was little more than a register of the fluctuating opinions of the monarch. Thus, by one act of 1534 it was treason not to believe Mary illegitimate and Elizabeth legitimate; by another act of 1536 it was treason to believe either legitimate; by an act of 1543 it was treason not to believe both legitimate. Another act of this reign (1545) shows that a class of men like the Roman *delatores* must have been called into existence by all the new legislation. The act made it felony to make anonymous charges of treason without daring to appear in support of them before the king or council. These acts were repealed in 1553 (1 Mar. st. 1. c. 1. s. 1.) and the act of 1351 was made the standard of the offence.

Besides the acts of 1351 and 1553 the following statutes are still in force with respect to the substantive law of treason. By an obscurely penned statute of 1495 (11 Hen. VII. c. 1. s. 1) persons serving the king for the time being in war are not to be convicted or attainted of treason; see Steph., *Dig. Cr. Law* (6th ed.), article 56. This statute has been held not to apply in British South Africa.

By an act of 1571 (13 Eliz. c. 2) as a counterblast to papal attacks on the right of Elizabeth to the English crown, it was declared that persons using in England papal bulls offering absolution and reconciliation to persons forsaking their due obedience to the English crown should be punishable as traitors. The penalties were abolished in 1846, but the acts against which the statute was aimed were declared to be still unlawful (see Steph., *Dig. Cr. Law*, 6th ed., p. 45*n*.). By an act of 1702 (1 Anne st. 2. c. 21 s. 3) it is treason to endeavour to hinder the next successor to the crown from succeeding, and by the Succession to the Crown Act 1707 it is treason maliciously, advisedly and directly by writing or printing to maintain and affirm that any person has a right to the crown otherwise than according to the Acts of Settlement and Union, or that the crown and parliament cannot pass statutes for the limitation of the succession to the crown.

By an act of 1796, made perpetual in 1817, the definition of treason is extended so as to include plots within or without Great Britain to cause the death or destruction, or any bodily harm tending to the death, destruction, maiming, or wounding, imprisonment or restraint of the king, if such plots are expressed by publishing any printing or writing, or by any overt act or deed. Since that date no new forms of treason have been created. There are many instances of offences temporarily made treason at different times. A

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an overt act has always been necessary. The difficulty of proving a mere intention is obvious. In French and German law the overt act (*Attentat* or *Unternehmen*) is as indispensable as in English.

[1] To harbour a fugitive enemy was punishable only by deportation, *Dig.*, xlviii. 19, 40.

[2] The position of treason as a special crime prosecuted by special procedure is one common to most legal systems at some period of their existence. For instance, in Germany, by a constitution of Henry VII. the procedure was to be summary, *sine strepitu et figura judicii*.

[3] c. 4.

[4] v. 30.

[5] lxxix. 2.

[6] xiv. 1.

[7] cc. 20, 21, 22.

[8] de Corona 118*b*.

[9] These words, according to Luders (*Law Tracts*, note *ad fin.*), mean to attempt or contrive.

[10] This by act of 1553 includes a queen regnant.

[11] One reason for making offences treason rather than felony was no doubt to give the Crown rather than the lord of the fee the right to the real estate of the criminal on forfeiture. Had the offences been felony the king would have had only his year, day and waste on the estate escheating to the lord, as was the case in treason before the Statute of Treasons.

few of the more interesting may be briefly noticed. It was treason to attempt to appeal or annul judgments made by parliament against certain traitors (1398); to break a truce or safe-conduct (1414–1450); to hold castles, fortresses or munitions of war against the king (1552); to adhere to the United Provinces (1665); to return without licence if an adherent of the Pretender (1696); to correspond with the Pretender (1701); and to compass or imagine the death of the prince regent (1817). In addition to these, many acts of attainder were passed at different times. One of the most severe was that against Catherine Howard (1541), which went as far as to make it treasonable for any queen to conceal her ante-nuptial incontinence. Other acts were those against Archbishop Scrope, Owen Glendower, Jack Cade, Lord Seymour, Sir John Fenwick, James Stuart and Bishop Atterbury. In one case, that of Cromwell, Ireton and Bradshaw, an act of attainder was passed after the death of those guilty of the treason (1660), and their bodies were exhumed, beheaded and exposed. Acts of indemnity were passed to relieve those who had taken part in the suppression of rebellion from any possible liability for illegal proceedings. Three such acts were passed in the reign of William III. (1689–1690). Similar acts were passed after the Irish rebellion of 1798.

Punishment.

The punishment of treason at common law was barbarous in the extreme.[1] The sentence in the case of a man was that the offender be drawn on a hurdle to the place of execution, that there he be hanged by the neck but not till he be dead, and that while yet alive he be disembowelled and that then his body be divided into four quarters, the head and quarters to be at the disposal of the Crown.[2] Until 1790 at common law a woman was drawn to the place of execution and there burned. In that year hanging was substituted for burning in the case of female traitors. In 1814 the part of the sentence relating to hanging and to disembowelling was altered to hanging until death supervened. Drawing and beheading and quartering after hanging were abolished in 1870. There is no legislation authorizing the execution of traitors within the walls of a prison as in the case of murder (see CAPITAL PUNISHMENT). The act of 1814 in the case of men enables the Crown, by warrant under the sign manual, countersigned by a secretary of state, to change the sentence to beheading. Attainder and forfeiture for treason are abolished by the Forfeitures Act 1870, except where the offender has been outlawed.[3] The maximum penalty for a felony under the act of 1848 is penal servitude for life. In every pardon of treason the offence is to be particularly specified therein (see PARDON).

Trials for treason in Great Britain and Ireland were at one time frequent and occupy a large part of the numerous volumes of the *State Trials*. Some of the more interesting may be mentioned. Before the Statute of Treasons were those of Gaveston and the Despensers in the reign of Edward II. on charges of accroaching the royal power. After the statute were those (some before the peers by trial or impeachment, most before the ordinary criminal courts) of Empson and Dudley, Fisher, More, the earl of Surrey, the duke of Somerset, Anne Boleyn, Lady Jane Grey, Sir Thomas Wyatt, Cranmer, the queen of Scots, Sir Walter Raleigh, Strafford, Laud, Sir Henry Vane and other regicides, William Lord Russell, Algernon Sydney, the duke of Monmouth, and those implicated in the Pilgrimage of Grace, the Gunpowder, Popish, Rye House and other plots. Cases where the proceeding was by bill of attainder have been already mentioned. Occasionally the result of a trial was confirmed by statute. In some of these trials, as is well known, the law was considerably strained in order to insure a conviction. Since the Revolution there have been the cases of those who took part in the risings of 1715 and 1745, Lord George Gordon in 1780, Thomas Hardy and Horne Tooke in 1794, the Cato Street conspirators in 1820, Thomas Frost in 1840, Smith O'Brien in 1848, and in 1903 Arthur Lynch, for adhering to, aiding and comforting the king's enemies in the South African war.[4] The bulk of the treason trials are reported in Howell's *State Trials* and the *New Series of State Trials*. The statute of 1351 as interpreted by the judges in these cases is still the standard by which an act is determined to be treason or not. The judicial interpretation has been sometimes strained to meet cases scarcely within the contemplation of the framers of the statute: *e.g.* it became established doctrine that a conspiracy to levy war against the king's person or to imprison or depose him might be given in evidence as an overt act of compassing his death, and that spoken words, though they could not in themselves amount to treason, might constitute an overt act, and so be evidence. Besides decisions on particular cases, the judges at different times came to general resolutions which had an appreciable effect on the law. The principal resolutions were those of 1397 (confirmed 1398), of 1557, and those agreed to in the case of the regicides at the Restoration and reported by Sir John Kelyng. The effect of this legislation, according to Sir James Stephen, is that such of the judicial constructions as extend the imagining of the king's death to imagining his death, destruction or any bodily harm tending to death or destruction, maim or wounding, imprisonment or restraint, have been adopted, while such of the constructions as make the imagining of his deposition, conspiring to levy war against him, and instigating foreigners to invade the realm, have not been abolished, but are left to rest on the authority of decided cases. The legislation in force in 1878 as to treason and kindred offences was collected by the late Mr R. S. Wright and its substance embodied in a draft consolidation bill (Parl. Pap. 1878 H. L. 178), and in 1879 the existing law was incorporated in the draft criminal codes of 1879. The code draws a distinction between treason and treasonable crimes, the former including such acts (omitting those that are obviously obsolete) as by the Treason Act 1351 and subsequent legislation are regarded as treason proper, the latter including the crimes contained in the Treason Felony Act 1848.

In the words of the draft (§ 76) "treason is (*a*) the act of killing Her Majesty, or doing her any bodily harm tending to death or destruction, maim or wounding, and the act of imprisoning or restraining her; or (*b*) the forming and manifesting by an overt act an intention to kill Her Majesty, or to do her any bodily harm tending to death or destruction, maim or wounding, or to imprison or to restrain her; or (*c*) the act of killing the eldest son and heir-apparent of Her Majesty, or the queen consort of any king of the United Kingdom of Great Britain and Ireland; or (*d*) the forming and manifesting by an overt act an intention to kill the eldest son and heir-apparent of Her Majesty, or the queen consort of any king of the United Kingdom of Great Britain and Ireland; or (*e*) conspiring with any person to kill Her Majesty, or to do her any bodily harm tending to death or destruction, maim or wounding, or conspiring with any person to imprison or restrain her; or (*f*) levying war against Her Majesty either with intent to depose Her Majesty from the style, honour and royal name of the Imperial Crown of the United Kingdom of Great Britain and Ireland or of any other of Her Majesty's dominions or countries; or in order by force or constraint to compel Her Majesty to change her measures or counsels, or in order to intimidate or overawe both Houses or either House of Parliament; or (*g*) conspiring to levy war against Her Majesty with any such intent or for any such purpose as aforesaid; or (*h*) instigating any foreigner with force to invade this realm or any other of the dominions of Her Majesty; or (*i*) assisting any public enemy at war with Her Majesty in such war by any means whatsoever; or (*j*) violating, whether with her consent or not, a queen consort, or the wife of the eldest son and heir-apparent for the time being of the king or queen regnant."

No amount of residence abroad exempts a British subject from the penalty of treason if he bears arms against the king,[5] unless he has become naturalized as the subject of a foreign state before the outbreak of the war in which he bears arms. To become naturalized as the subject of an enemy during a war is in itself an act of treason. It is well established that an alien resident within British territory owes local allegiance to the Crown and may be indicted for high treason, and there are numerous instances of prosecution of foreigners for treason. Such are the cases of Leslie, bishop of Ross, ambassador to Elizabeth from the queen of Scots (1584), the marquis de Guiscard in Queen Anne's reign and Gyllenborg, the ambassador from Sweden to George I. (1717). Proceedings against ambassadors for treason have never gone beyond imprisonment, more for safe custody than as a punishment. In 1781 La Motte, a Frenchman resident in England, was convicted of holding treasonable communications with France, and in Canada American citizens were tried for treason for aiding in the rebellion of 1837–1838 (Forsyth, 200). Assistance by a resident alien to invaders of British territory is high treason even if the territory in question is in military occupation by the forces of the foreign power.[6]

Court and Place of Trial.

Of the modes of trying high treason two are obsolete, viz. (1) by appeal in the common law courts, which ceased by the effect of statutes between 1322 and 1399 and were finally abolished in 1819; (2) before the constable and marshal. The last instance of this mode of trial was an award of battle in 1631 in the case of Lord Reay.[1] Four modes of trying high treason still remain, viz. impeachment, trial of a peer by his peers, trial by court-martial and trial by jury on indictment before the High Court or a court of assize or a special commission. The offence is not triable at quarter sessions.

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[1] The exceptional character of the punishment, like that of the procedure, may be paralleled from Germany. The punishment of traitors by Frederick II. by wrapping them in lead and throwing them into a furnace is alluded to by Dante, *Inferno*, xxiii. 66.

[2] See the sentence in full in Latin in *R.* v. *Walcot*, 1696, 1 Eng. Rep. 87.

[3] Proceedings after the death of an alleged traitor might at one time have been taken, but only to a very limited extent as compared with what was allowed in Roman and Scots law. Coke (4 *Rep.* 57) states that there might have been forfeiture of the land or goods of one slain in rebellion on view of the body by the lord chief justice of England as supreme coroner.

[4] 1903, 1 K.B. 446. He was sentenced to death. The sentence was commuted to penal servitude for life. Lynch was released on licence after one year in prison and has since been pardoned.

[5] Aeneas Macdonald's case, 18 *St. Tr.* 857; *R.* v. *Lynch* (1903) 1 K.B. 446—see Mayne, *Ind. Cr. Law* (1896), pp. 459, 460.

[6] De Jager's case (1907) App. Cas. 326.

At common law and under the Great Charter a peer, and, by an act of 1442, a peeress in right of her husband, are triable for treason before the House of Lords, or, when parliament is not sitting, in the court of the lord high steward. The last trial of a peer for treason was that of Lord Lovat in 1746–1747 (18 Howell's *St. Tr.* 529).

In the reign of Edward IV., and perhaps later, treason was at times tried by martial law. The issue of commissions of martial law in time of peace was in 1628 declared illegal by the Petition of Right. But the prerogative of the Crown to deal by martial law with traitors in time of war or open rebellion within the realm or in a British possession still exists.[2]

Treasons committed within the admiralty jurisdiction or out of the realm were originally triable only by the admiral or the constable and marshal according to the civil law, but were made triable according to the courts of the common law by the Offences at Sea Act 1536, and by acts of 1543, 1552[3] and 1797. Provision is made for the trial in British possessions of treasons committed in the admiralty jurisdiction (Offences at Sea Act 1806).

Treasons committed within the realm are tried in the High Court, the central criminal court or another court of assize, or by special commission, except in the case of peers. In two acts dealing with Ireland (of 1809 and 1833) it was provided that nothing in the acts was to take away the undoubted prerogative of the Crown for the public safety to resort to the exercise of martial law against open enemies and traitors, while actual war or insurrection is raging (see MARTIAL LAW).[4] Treason by persons subject to military law is triable by court-martial under the Army Act (1881) ss. 4, 41 (*a*), where the offence cannot with reasonable convenience be tried in a civil court, and treason by persons subject to naval discipline by court-martial under the Naval Discipline Act (1866) s. 7. The procedure in such trials is regulated by the acts.

Procedure.

In certain cases of treason the procedure on the trial is the same as upon a charge of murder. Those cases, which are statutory exceptions from the statutory procedure prescribed for the trial of high treason and misprision thereof, are: (*a*) Assassination or killing of the king, or any heir or successor of the king, or any direct attempt against his life or any direct attempt against his person whereby his life may be endangered or his person may suffer bodily harm (1800, 1814); (*b*) attempts to injure in any manner the person of the king (1842).

In all other cases of treason the procedure is regulated by acts of 1695, 1708 and 1825. A copy of the indictment must be delivered to the accused ten days at least before his arraignment, with a list of the witnesses for the prosecution (1708) and a list of the petty jury, except in the High Court, where the petty jury list is to be delivered ten days before the trial (1825).[5] The accused is entitled to be defended by counsel, and on application to the court may have two counsel assigned to him (1695), a right extended in 1746 to impeachments for treason. Witnesses for the defence have since 1702 been examinable upon oath. The accused may by the Criminal Evidence Act 1898 consent to be called as witness for the defence. It is doubtful whether the wife or husband of the accused is a compellable witness for the Crown (*Archb. Crim. Pleading*, 23rd ed., 398).

Prosecutions for treason must be begun within three years of the offence, except in cases of attempts to assassinate the king. The rules as to the indictment are stricter than in the case of felony and misdemeanour, much of the modern statutory power of amendment not extending to indictments for the graver offence. No evidence may be given of any overt act (*voie de fait*) not expressly stated in the indictment. The accused is entitled to peremptory challenge of thirty-five of the jurors summoned for the petty jury; but they need not now be freeholders. The accused can be convicted only on his own confession in open court, or by the oath of two witnesses either both to the same overt act charged, or one to one overt act and the other to another overt act of the same treason. If two or more treasons of different kinds are charged on the same indictment, one witness to prove one treason and another to prove another are not sufficient for a lawful conviction. Persons charged with treason are not admitted to bail except by order of a secretary of state or by the High Court (k.b.d.) or a judge thereof in vacation (Indictable Offences Act 1848, s. 23). Witnesses for the defence are examined on oath and their attendance is secured in the same way as that of witnesses for the Crown (1695, 170).

Misprision of Treason.

Misprision of treason consists in the concealment or keeping secret of any high treason. (*a*) This offence was in 1552 declared to be high treason (5 and 6 Edw. VI. c. 11, s. 8), but the former law was restored in 1553–1554 (1 Mary st. i. c. 1 s. 1; 1 & 2 Ph. and Mary c. 10, s. 7). The definition is vague and the exact scope of the offence uncertain, but in strictness it does not include acts which in the case of felony would constitute an accessory after the fact. In the Queensland Code of 1899 (s. 38) every person is guilty of a crime who, knowing that any person intends to commit treason, does not give information thereof with all reasonable despatch to a justice or use other reasonable endeavours to prevent the commission of that crime. The procedure for the trial of misprision of treason is the same as in the case of high treason. The punishment is imprisonment for life and forfeiture of the offender's goods and of the profits of his lands during his life. (Steph. *Dig. Cr. Law*, 6th ed., 121, 401.) The forfeitures are not abolished by the Forfeitures Act 1870. There is no case of prosecution of this offence recorded during the last century.

Offences akin to Treason.

The necessity of prosecutions for treason has been greatly lessened by a series of statutes beginning in 1744 which provide for the punishment as felonies of certain acts which might fall within the definition of treason, *e.g.* piracies (1744, 18 Geo. II. c. 30), incitement to mutiny (1797), unlawful oaths, including oaths to commit treason (1797, 1812), and aiding the escape of prisoners of war (1812). By the Treason Act 1842 it is a high misdemeanour, punishable by penal servitude for seven years, wilfully to discharge, point, aim or present at the person of the king any gun or other arms, loaded or not, or to strike at or attempt to throw anything upon the king's person, or to produce any firearms or other arms, or any explosive or dangerous matter, near his person, with intent to injure or alarm him or to commit a breach of the peace.[6] The offence is one of the few for which flogging may be awarded.

By the Treason Felony Act 1848, s. 1., it was made a felony within or without the United Kingdom to plot (*a*) to deprive or depose the king from the style, &c., of the imperial crown of the United Kingdom, (*b*) to levy war against the king in any part of the United Kingdom in order by force or constraint to change his measures or counsels or to put force or constraint on or to intimidate or overawe either or both houses of parliament, (*c*) to move or stir any foreigner with force to invade the United Kingdom or any of the king's dominions. The plot to be within the act must be expressed by publishing in printing or writing or by an overt act or deed. "Open and advised speaking," originally included as an alternative, was removed from the act in 1891. For other offences more or less nearly connected with treason reference may be made to the articles: LIBEL; OATHS; PETITION; RIOT; SEDITION.

The act of 1848 does not abrogate the Treason Act of 1351, but merely provides an alternative remedy. But with the exception of the case of Lynch in 1903, all prosecutions in England for offences of a treasonable character since 1848 have been for the felony created by the act of 1848. The trials under the act, mostly in Ireland, are collected in vols. 6, 7 and 8 of the *New Series of State Trials*. The procedure in the case of all the offences just noticed is governed by the ordinary rules as to the trial of indictable offences, and the accused may be convicted even though the evidence proves acts constituting high treason.

Scotland.—Treason included treason proper, or crimes against the Crown or the state, such as rebellion, and crimes which, though not technically treasonable, were by legislation punished as treason. Scottish procedure was as a rule less favourable to the accused than English. In one matter, however, the opposite was the case. Advocates compellable to act on behalf of the accused were allowed him by 1587, c. 57, more than a century before the concession of a similar indulgence in England. At one time trial in absence and even after death was allowed, as in Roman law. In the case of Robert Leslie, in 1540, a summons after death was held by the estates to be competent, and the bones of the deceased were exhumed and presented at the bar of the court.[7] The act of 1542, c. 13 (rep. 1906), confined this revolting procedure to certain treasons of the more heinous kind.

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[1] A case of treason out of the realm as to which alone the constable and marshal had jurisdiction (3 Howell's *St. Tr.* 1).

[2] See case of D. F. Marais (1902, App. Cas. 109).

[3] There is no trace of recourse to the act of 1552. In 1903 Arthur Lynch was tried under the act of 1543 for high treason in South Africa, and Lord Maguire in 1645 for treason in Ireland (4 *St. Tr.* 653).

[4] The decisions of courts of martial law appear not to be reviewable by ordinary civil courts (re Marais, 1907, App. Cas. 109).

[5] In these respects persons accused of treason are in a better position than those accused of felony.

[6] This act was passed in consequence of a series of assaults on Queen Victoria. See 4 *St. Tr. N. S.* 1382; 7 *St. Tr. N. S.* 1130, and 8 *St. Tr. N. S.* 1.

[7] In the one instance in England—that of Cromwell, Ireton and Bradshaw—where the bodies of alleged traitors were exhumed after death they were not brought to the bar of a court as in Scotland.

By the Treason Act 1708 trial in absence—the last instance of which had occurred in 1698—was abolished. The same act assimilates the law and practice of treason to that of England by enacting that no crime should be treason or misprision in Scotland but such as is treason or misprision in England. The act further provides for the finding of the indictment by a grand jury as in England and that the trial is to be by a jury of twelve, not fifteen as in other crimes, before the court of justiciary, or a commission of oyer and terminer containing at least three lords of justiciary. To slay a lord of justiciary or lord of session sitting in judgment, or to counterfeit the great seal, is made treason. The act also contains provisions as to forfeiture,[1] qualification of jurors and procedure, which are not affected by the Criminal Procedure (Scotland) Act 1887. The punishment is the same as it was in England before the Forfeitures Act 1870, which does not extend to Scotland; and attainder and forfeiture are still the effects of condemnation for treason in Scotland.

One or two other statutory provisions may be briefly noticed. By acts of 1706 and 1825 the trial of a peer of Great Britain or Scotland for treason committed in Scotland is to be by a commission from the Crown, on indictment found by a grand jury of twelve. Bail in treason-felony is only allowed by consent of the public prosecutor or warrant of the high or circuit court of justiciary (Treason Felony Act 1848, s. 9). The term *lese-majesty* was sometimes used for what was treason proper (*e.g.* in 1524, c. 4, making it lese-majesty to transport the king out of the realm, repealed in 1906), sometimes as a synonym of *leasing-making.* This crime (also called verbal sedition) consisted in the engendering discord between king and people by slander of the king.[2] The earliest act against leasing-making *eo nomine* was in 1524. The reign of James VI. was pre-eminently prolific in legislation against this crime. It is now of no practical interest, as prosecutions for leasing-making have long fallen into desuetude. At one time, however, the powers of the various acts were put into force with great severity, especially in the trial of the earl of Argyll in 1681. The punishment for leasing-making, once capital, is now, by acts of 1825 and 1837, fine or imprisonment or both.

Ireland.—The Treason Act 1351 was extended to Ireland by Poyning's law, but at the union there were considerable differences between the Irish and the English law. The law and practice of Ireland as to treason were assimilated to those of England by acts of 1821 (1 & 2 Geo. IV. c. 24), 1842 (5 & 6 Vict. c. 51), 1848 (11 & 12 Vict. c. 12, s. 2), and 1854 (17 & 18 Vict. c. 56).

Prior to 1854 the provisions as to procedure in the English treason acts did not apply to Ireland (Smith O'Brien's case, 1848, *7 St. Tr. N. S.* 1). A series of enactments called the "Whiteboy Acts" (passed by the Irish and the United Kingdom parliaments between 1775 and 1831) was intended to give additional facilities to the executive for the suppression of tumultuous risings, and powers for dealing with "dangerous associations" are given by the Criminal Law and Procedure (Ireland) Act 1887. Prosecutions for treason in Ireland were numerous in 1848. Since that date numerous prosecutions have taken place under the Treason Felony Act 1848.

British Possessions.—Numerous temporary acts were passed in India at the time of the Mutiny, one of the most characteristic being an act of 1858 making rebellious villages liable to confiscation. By the Indian Penal Code, s. 121, it is an offence punishable by death or transportation for life and by forfeiture of all property to wage or attempt to wage war against the king. By s. 125 it is an offence punishable by transportation for life (as a maximum) to wage or attempt to wage war against any Asiatic government in alliance or at peace with the king or to abet the waging of such war. By s. 121 A., added in 1870, it is an offence punishable by transportation for life (as a maximum) to conspire within or without British India to commit an offence against s. 121 or to deprive the king of the sovereignty of British India or of any part thereof, or to overawe by criminal force or the show of criminal force the government of India or any local government in India. Other cognate offences are included in the same chapter (vi.) of the Criminal Code.

The Penal Codes of Canada (1892, ss. 65–73) and New Zealand (1893, ss. 77–82) closely follow the provisions of the English draft code of 1879. Prosecutions for treason have been rare in Canada. Those of most note were in 1837, after the rebellion (see the Canadian Prisoners case, 1839, 9 Ad(olphus) El(les) [731]) and of Riel after the Red River rising in 1884 (see *Riel* v. *R.* 1885, 10 App. Cas. 675).

The Commonwealth parliament of Australia has not legislated on the subject of high treason, which is in Australia governed by the laws of the constituent states, *i.e.* by the law of England as it stood when they were colonized, subject to local legislation. In the codes of Queensland (1899) and West Australia (1902) the offence is defined in a form which is little more than a redrafting of the English statutes. The provisions of the Treason Felony Act 1848 have been adapted by legislation to New South Wales (1900), Queensland (1899), Western Australia (1902) and Tasmania (1868). In Victoria there is legislation as to procedure but none as to the substantive law of treason. In Mauritius the offence is regulated by the Penal Code of 1838, arts. 50–61 (*Mauritius Laws Revised*, 1903, i. 372).

In the Asiatic colonies treason is defined on the lines of the Indian Penal Code, *i.e.* Ceylon, Straits Settlements, and Hong-Kong.

In the West Indies the law of treason is defined by code in Jamaica and in British Guiana (the code superseding the Dutch Roman law).

In South Africa the law of treason is derived through Holland from the Roman law. It includes the *crimen perduellionis*, *i.e.* disturbing the security or independence of the state with hostile intent. This is spoken of as high treason, as distinct from the *crimen laesae majestatis*, in which the hostile intent need not be proved, and from *vis publica*, *i.e.* insurrection and riot involving danger to public peace and order. By a Cape law of 1853 passed during the Griqualand rebellion it is made treason to deliver arms or gunpowder to the king's enemies.

The Treason Felony Act 1848 was also adopted in Natal in 1868.

During the South African War of 1899–1902 many trials took place for treason, chiefly under martial law, including cases of British subjects who had joined the Boer forces. In some cases it was contended that the accused had been recognized by the British authorities as a belligerent (Loŭw. 1904, 21 Cape Supreme Court Reports, 36). The decisions of the ordinary courts are collected in Nathan, *Common Law of South Africa*, iv. 2425 (London, 1907). The decisions of courts-martial were not reviewable by the ordinary courts and are also protected by acts of indemnity. A striking feature of colonial legislation is the great number of such acts passed after rebellions and native risings. Instances of such acts occur in the legislation of Canada, Ceylon, the Cape of Good Hope, Natal, New Zealand, St Vincent and Jamaica. The most important in the history of law is the Jamaica Act of 1866, indemnifying Governor Eyre for any acts committed during the suppression of the rising in the previous year. It was finally held that this act protected Eyre from being civilly sued or criminally prosecuted in England for acts done during the outbreak (*Phillips* v. *Eyre*, 1871, *L. R.* 6 Q. B. 1). The validity of an act passed in 1906 after disturbances among the Kaffirs of Natal was unsuccessfully challenged in 1907 (Tilonko's case, 1907, App. Cas. 93).

United States.—The law is based upon that of England. By art. 3, s. 3 of the constitution "treason against the United States shall consist only in levying war against them, or in adhering to their enemies, giving them aid and comfort. No person shall be convicted of treason unless on the testimony of two witnesses to the same overt act, or on confession in open court. The Congress shall have power to declare the punishment of treason; but no attainder of treason shall work corruption of blood or forfeiture, except during the life of the person attainted." By art. 2, s. 4 impeachment for and conviction of treason is a ground for removing the president, vice-president and other civil officers. The punishment by an act of 1790 was declared to be death by hanging. But during the Civil War an act (July 17, 1862) was passed, providing that the punishment should be death, or, at the discretion of the court, imprisonment at hard labour for not less than five years, and a fine of not less than 10,000 dollars to be levied on the real and personal property of the offender, in addition to disability to hold any office under the United States. The act of 1862 and other acts also deal with the crimes of inciting or engaging in rebellion or insurrection, criminal correspondence with foreign governments in relation to any disputes or controversies with the United States, or to defeat the measures of the government of the United States, seditions, conspiracy, recruiting soldiers or sailors and enlistment to serve against the United States. The act of 1790 further provides for the delivery to the prisoner of a copy of the indictment and a list of the jurors, for defence by counsel, and for the finding of the indictment within three years after the commission of the treason (see Story, *Constitution of the United States*, Rev. Stat. U.S. p. 1041). Treason against the United States cannot be inquired into by any state court, but the states may, and some of them have, their own constitutions and legislation as to treasons committed against themselves, generally following the lines of the constitution and legislation of the United States. In some cases there are differences which are worth notice. Thus the constitution of Massachusetts, pt. 1, § 25, declares that no subject ought in any case or in any time to be declared guilty of treason by the legislature. The same provision is contained in the constitutions of Vermont, Connecticut, Pennsylvania, Alabama and others. In some states the crime of treason cannot be pardoned; in others, as in New York, it may be pardoned by the legislature, and the governor may suspend the sentence until the end of the session of the legislature next following conviction. In some states a person convicted of treason is disqualified for exercising the franchise. In New York conviction carries with it forfeiture of real estate for the life of the convict and of his goods and chattels.

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[1] The provisions in the act as to forfeiture (now repealed) were, according to Blackstone (*Comm.* iv. 384), the result of a compromise between the House of Lords, in favour of its continuance and the House of Commons, supported by the Scottish nation, struggling to secure a total immunity from this disability.

[2] It is called by Hallam "the old mystery of iniquity in Scots law."

France.—By the *Code Pénal* treason falls under the head of crimes against the safety of the state (bk. iii. tit. i. c. 1). It is a capital offence for a Frenchman to bear arms against France (s. 75) or to plot with a foreign power or its agents to commit hostilities or undertake war against France whether war follows or not (s. 76), or to intrigue with the enemies of the state for facilitating their entry into French territory, or to deliver to them French ships or fortresses, or to supply them with munitions of war, or aid the progress of their arms in French possessions or against French forces by sea or land (s. 78).

Germany.—The *Strafgesetzbuch* distinguishes between high treason (*Hochverrat*) and treason (*Landesverrat*). The offences denominated high treason are (1) murder or attempt to murder the emperor or a federal sovereign in his own state, or during the stay of the offender in the sovereign's state (s. 80); (2) undertaking to kill, take prisoner, or deliver into an enemy's power, or make incapable of government a federal sovereign; to change by violence the constitution of the empire or a state thereof or the successor to the throne therein; to incorporate by force the federal territory or the territory of any such state with a foreign or another federal state (s. 81). The code treats as treason, but does not punish by death, the offences included in the French code (ss. 87–89), and under certain circumstances punishes alien residents for these offences (s. 91). The code also punishes insults on the emperor and federal sovereigns (ss. 95, 97) under the name of *Majestätsbeleidigung*.

Italy.—Treason in the Penal Code 1888 (tit. i. c. 1) includes direct acts to subject Italy or any part thereof to foreign domination or to diminish its independence or break up its unity (s. 104), to bear arms against the state (s. 105)) or intrigue with foreign states with the object of their levying war against Italy or helping them in such war (s. 106), or to reveal political or military secrets affecting the national independence (s. 107).

Spain.—The Spanish code distinguishes between treason (*lesa majestad*) and rebellion (*rebelión*). Under the former are included assassination, or attempts on the life or personal liberty of the king (arts. 158, 159), or insults to the king (161, 162), and provisions are made as to attacks on the heir or consort of the sovereign (163, 164). Under rebellion are included violent attempts to dethrone the king or to interfere with the allegiance to him of his forces or any part of the realm (243). (W. F. C.)

TREASURE TROVE, the legal expression for coin, bullion, gold or silver articles, found (Fr. *trouvé*) hidden in the earth, for which no owner can be discovered. In Roman law it was called *thesaurus*, and defined as an ancient deposit of money (*vetus depositio pecuniae*) found accidentally. Under the emperors half went to the finder and half to the owner of the land, who might be the emperor, the public treasury (*fiscus*), or some other proprietor. Property found in the sea or on the earth has at no time been looked on as treasure trove. If the owner cannot be ascertained it becomes the property of the finder (see Lost Property). As the feudal system spread over Europe and the prince was looked on as the ultimate owner of all lands, his right to the treasure trove became, according to Grotius, *jus commune et quasi gentium*, in England, Germany, France, Spain and Denmark. In England for centuries the right to treasure trove has been in the Crown, who may grant it out as a franchise. It is the duty of the finder, and indeed of any one who acquires knowledge, to report the matter to the coroner, who must forthwith hold an inquest to find whether the discovery be treasure trove or no. Although the taking of the find is not larceny until this be done, the concealment is an indictable offence still punishable in practice, and formerly was held "akin both to treason and to larceny." In the statute *De officio coronatoris* 1276 (4 Edw. I. c. 2) the coroner is enjoined to inquire as to treasure trove both as to finders and suspected finders, "and that may be well perceived where one liveth riotously and have done so of long time." The Coroners Act of 1887 continues this power as heretofore. In Scotland the law is the same, but the concealment is not a criminal offence; it is there the duty of the king's and lord treasurer's remembrancer, with the aid of the local procurator fiscal, to secure any find for the Crown, whose rights in this respect have been pushed to some length. Thus in 1888 a prehistoric jet necklace and some other articles found in Forfarshire were claimed by the authorities, though they were neither gold nor silver. The matter was finally compromised by the deposit of the find in the National Museum. By a treasury order of 1886 provision is made for the preservation of suitable articles so found in the various national museums and payment to the finders of sums in respect of the same. Also if the things are not required for this purpose they are to be returned to the finder. In India the Treasure Trove Act (16 of 1878) makes elaborate provision on the subject. It defines treasure as "anything of value hidden in the soil." When treasure over Rs. 10 is discovered, the finder must inform the collector and deposit the treasure or give security for its custody. Concealment is a criminal offence. An inquiry is held upon notice; if declared ownerless the finder has three-fourths and the owner of the ground one-fourth. The government, however, has the right of pre-emption.

In the United States the common law, following English precedent, would seem to give treasure trove to the public treasury, but in practice the finder has been allowed to keep it. In Louisiana French codes have been followed, so that one-half goes to finder and one-half to owner of land. Modern French law is the same as this, as it is also in Germany, in Italy and in Spain. In the latter country formerly the state had three-quarters, whilst a quarter was given to the finder. In Austria a third goes to the finder, a third to the owner of the land, and a third to the state, and provision is made for the possible purchase of valuable antiquities by the state. In Denmark treasure trove is known as "treasure of Denmark," and is the property of the king alone. In Russia the usage varies. In one or two of the governments, in Poland and the Baltic provinces, the treasure is divided between the owner of the land and the finder, but throughout the rest of Russia it belongs exclusively to the owner of the land. This was also the law amongst the ancient Hebrews, or so Grotius infers from the parable of the treasure hid in a field (Matt. xiii. 44).

See Blackstone's *Commentaries*; Chitty's *Prerogatives of the Crown*; R. Henslowe Wellington, *The King's Coroner* (1905–1906); Rankine on *Landownership*; Murray, *Archaeological Survey of the United Kingdom* (1896), containing copious references to the literature of the subject. (F. Wa.)

TREASURY, a place for the storage of treasure (Fr. *trésor*, Lat. *thesaurus*, Gr. *θησαυρός*, store, hoard); also that department of a government which manages the public revenue. The head of the department was an important official in the early history of English institutions. He managed the king's hoard or treasury, and under the Med. Latin name of *thesaurarius*, *i.e.* treasurer, grew into increased importance in times when the main object of government seemed to be to fill the king's purse. He received the title of lord high treasurer (*q.v.*) and ranked as the third great officer of state. In course of time the English treasury grew into two departments of state (see Exchequer). Since 1714 the office of lord high treasurer has been in commission, and his duties have been administered by a board, consisting of a first lord, a chancellor and four or more junior lords. The board itself never meets, except on extraordinary occasions, although until the commencement of the 19th century it was its practice to meet almost daily to discuss matters of financial detail. There were originally separate treasury boards for England, Scotland and Ireland, but the English and Scottish were united by the act of union, and that of Ireland was joined with the English in 1816. The first lord of the treasury (see Ministry) takes practically no part in the duties of the board, the office being to all intents and purposes a sinecure; it is usually held by the prime minister of the day. Indeed from 1783 to 1885 it was invariably so held, but in the latter year there was a departure from the practice, and again in 1887, 1891 and 1895. The junior lords of the treasury are also political rather than financial officers, acting as assistant whips in the House of Commons. There are two joint secretaries to the treasury, one of whom, the patronage secretary, is merely a political officer, acting as chief whip; the other is termed financial secretary and is the chancellor of the exchequer's chief assistant. All the above officers are members of the House of Commons and of the government. The salaries of the first lord of the treasury and of the chancellor of the exchequer are £5000 per annum; of the joint secretaries £2000 per annum each; of three of the junior lords £1000 per annum each, the other junior lords being unpaid. The vast bulk of the work of the treasury department is performed by the permanent staff, at whose head is the permanent secretary and auditor of the civil list, with a salary of £2500 per annum. The chancellor of the exchequer (see MINISTRY), as finance minister of the Crown, is the officer who is responsible to parliament for the carrying out of the business of the treasury. He performs practically the ancient duties of under-treasurer and presents the annual budget of revenue and expenditure.

The treasury department of the United States is responsible for the finances of the government and the control of the currency. Its genesis was a treasury office of accounts established in 1776 for the purpose of examining and auditing accounts. In 1779 it was reorganized, but was abolished in 1781, on the election of Robert Morris as superintendent of finances, and in 1789 the present executive department of the treasury was established by act of Congress. Its scope is more varied and complex than that of any other United States government department. It is presided over by a secretary, who is a member of the cabinet and has a salary of $12,000 per annum. He is assisted by three assistant secretaries, two of them having salaries of $5000 and the third a salary of $4500. The treasury department looks after the revenue administration of the United States, and has for this purpose a customs service division and an internal revenue division. There is also the division of the treasury, in the strictest sense of the word; bureaus of auditing and accounting, of currency and of banking and certain miscellaneous bureaus, as the life-saving service, the public health and marine hospital service, the supervising architect and the bureau of engraving and printing.

TREATIES. A treaty is a contract between two or more states. The Latin term "tractatus," and its derivatives, though of occasional occurrence in this sense from the 13th century onwards, only began to be commonly so employed, in lieu of the older technical terms "conventio publica," or "foedus," from the end of the 17th century. In the language of modern diplomacy the term "treaty" is restricted to the more important international agreements, especially to those which are the work of a congress; while agreements dealing with subordinate questions are described by the more general term "convention." The present article will disregard this distinction.

The making and the observance of treaties is necessarily a very early phenomenon in the history of civilization, and the theory of treaties was one of the first departments of international law to attract attention. Treaties are recorded on the monuments of Egypt and Assyria; they occur in the Old Testament Scriptures; and questions arising under συνθῆκαι and *foedera* occupy much space in the Greek and Roman historians.[1]

Treaties have been classified on many principles, of which it will suffice to mention the more important. A "personal treaty," having reference to dynastic interests, is contrasted with a "real treaty," which binds the nation irrespectively of constitutional changes; treaties creating outstanding obligations are opposed to "transitory conventions," *e.g.* for cession of territory, recognition of independence, and the like, which operate irrevocably once for all, leaving nothing more to be done by the contracting parties; and treaties in the nature of a definite transaction (*Rechtsgeschäft*) are opposed to those which aim at establishing a general rule of conduct (*Rechtssatz*). With reference to their objects, treaties may perhaps be conveniently classified as (1) political, including treaties of peace, of alliance, of cession, of boundary, for creation of international servitudes, of neutralization, of guarantee, for the submission of a controversy to arbitration; (2) commercial, including consular and fishery conventions, and slave trade and navigation treaties; (3) confederations for special social objects, such as the Zollverein, the Latin monetary union, and the still wider unions with reference to posts, telegraphs, submarine cables and weights and measures; (4) relating to criminal justice, *e.g.* to extradition and arrest of fugitive seamen; (5) relating to civil justice, *e.g.* to the protection of trade-mark and copyright, to the execution of foreign judgments, to the reception of evidence, and to actions by and against foreigners; (6) promulgating written rules of international law, upon topics previously governed, if at all, only by unwritten custom, with reference *e.g.* to the peaceful settlement of international disputes, or to the conduct of warfare.

Classification.

It must be remarked that it is not always possible to assign a treaty wholly to one or other of the above classes, since many treaties contain in combination clauses referable to several of them.

The analogy between treaty-making and legislation is striking when a congress agrees upon general principles which are afterwards accepted by a large number of states, as, for instance, in the case of the Geneva conventions for improving the treatment of the wounded. Many political treaties containing "transitory conventions," with reference to recognition, boundary or cession, become, as it were, the title-deeds of the nations to which they relate.[2] But the closest analogy of a treaty is to a contract in private law.

Requisites.

The making of a valid treaty implies several requisites. (1) It must be made between competent parties, *i.e.* sovereign states. A "concordat," to which the pope, as a spiritual authority, is one of the parties, is therefore not a treaty, nor is a convention between a state and an individual, nor a convention between the rulers of two states with reference to their private affairs. Semi-sovereign states, such as San Marino or Egypt, may make conventions upon topics within their limited competence. It was formally alleged that an infidel state could not be a party to a treaty. The question where the treaty-making power resides in a given state is answered by the municipal law of that state. In Great Britain it resides in the executive (see the parliamentary debates upon the cession of Heligoland in 1890); sometimes, however, it is shared for all purposes, as in the United States, or for certain purposes only, as in many countries of the European continent, by the legislature, or by a branch of it. (2) There must be an expression of agreement. This is not (as in private law) rendered voidable by duress; *e.g.* the cession of a province, though extorted by overwhelming force, is nevertheless unimpeachable. Duress to the individual negotiator would, however, vitiate the effect of his signature. (3) From the nature of the case, the agreement of states, other than those the government of which is autocratic, must be signified by means of agents, whose authority is either express, as in the case of plenipotentiaries, or implied, as in the case of *e.g.* military and naval commanders, for matters, such as truces, capitulations and cartels, which are necessarily confided to their discretion. When an agent acts in excess of his implied authority, he is said to make no treaty, but a mere "sponsion," which, unless adopted by his government, does not bind it, *e.g.* the affair of the Caudine Forks

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[1] For the celebrated treaty of 509 B.C. between Rome and Carthage, see Polybius iii. 22; and, on the subject generally, Barbeyrac's full but very uncritical *Histoire des anciens traitéz*, (1739); Müller-Jochmus, *Geschichte des Völkerrechts im Alterthum* (1848); E. Egger, *Études historiques sur les traités publics chez les grecs et chez les romains* (new ed., 1866).

[2] Cf. Sir Edward Hertslet's very useful collections entitled: *The Map of Europe by Treaty* (4 vols., 1875–1891), and *The Map of Africa by Treaty* (2 vols., 1894).

(Livy ix. 5) and the convention of Closter Seven in 1757. (4) Unlike a contract in private law, a treaty, even though made in pursuance of a full power, is, according to modern views, of no effect till it is ratified. It may be remarked that ratification, though hitherto not thought to be required for "declarations," such as the Declaration of Paris of 1856, was expressly stipulated for in the case of those signed at the peace conferences of 1899 and 1907. (5) No special form is necessary for a treaty, which in theory may be made without writing. It need not even appear on the face of it to be a contract between the parties, but may take the form of a joint declaration, or of an exchange of notes. Latin was at one time the language usually employed in treaties, and it continued to be so employed to a late date by the emperor and the pope. Treaties to which several European powers of different nationalities are parties are now usually drawn up in French (the use of which became general in the time of Louis XIV.), but the treaties of Aix-la-Chapelle of 1748 and 1784 contain, as does the final act of the congress of Vienna, a protest against the use of this language being considered obligatory. French is, however, exclusively used in the treaties constituting the great "international unions"; and bilingual treaties are sometimes accompanied by a third version in French, to be decisive in case of alleged variances between the other two. A great European treaty has usually commenced "In the name of the Most Holy and Indivisible Trinity," or, when the Porte is a party, "In the name of Almighty God." (6) It is sometimes said that a treaty must have a lawful object, but the danger of accepting such a statement is apparent from the use which has been made of it by writers who deny the validity of any cession of national territory, or even go so far as to lay down, with Fiore, that "all should be regarded as void which are in any way opposed to the development of the free activity of a nation, or which hinder the exercise of its natural rights." (7) The making of a treaty is sometimes accompanied by acts intended to secure its better performance. The taking of oaths, the assigning of "conservatores pacis" and the giving of hostages are now obsolete, but revenue is mortgaged, territory is pledged, and treaties of guarantee are entered into for this purpose.

Duration.

A "transitory convention" operates at once, leaving no duties to be subsequently performed, but with reference to conventions of other kinds questions arise as to the duration of the obligation created by them; in other words, as to the moment at which those obligations come to an end. This may occur by the dissolution of one of the contracting states, by the object-matter of the agreement ceasing to exist, by full performance, by performance becoming impossible, by lapse of the time for which the agreement was made, by *contrarius consensus* or mutual release, by "denunciation" by one party under a power reserved in the treaty. By a breach on either side the treaty usually becomes, not void, but voidable. A further cause of the termination of treaty obligations is a total change of circumstances, since a clause "rebus sic stantibus" is said to be a tacit condition in every treaty.[1] Such a contention can only be very cautiously admitted. It has been put forward by Russia in justification of her repudiation of the clauses of the Treaty of Paris neutralizing the Black Sea, and of her engagements as to Batoum contained in the Treaty of Berlin. The London protocol of 1871, with a view to prevent such abuses, lays down, perhaps a little too broadly, "that it is an essential principle of the law of nations that no power can liberate itself from the engagements of a treaty, nor modify the stipulations thereof, unless with the consent of the contracting powers, by means of an amicable arrangement." Treaties are in most cases suspended, if not terminated, by the outbreak of a war between the contracting parties (though the Spanish decree of the 23rd of April 1898 went too far when it asserted that the war with the United States had terminated "all conventions that have been in force up to the present between the two countries"), and are therefore usually revived in express terms in the treaty of peace.

The rules for the interpretation of treaties are not so different from those applicable to contracts in private law as to need here a separate discussion.

Collections.

Collections of treaties are either (i.) general or (ii.) national.

i. The first to publish a general collection of treaties was Leibnitz, whose *Codex juris gentium*, containing documents from 1097 to 1497, "ea quae sola inter liberos populos legum sunt loco" appeared in 1693, and was followed in 1700 by the *Mantissa*. The *Corps universel diplomatique du droit des gens* of J. Dumont, continued by J. Barbeyrac and Rousset in thirteen folio volumes, containing treaties from A.D. 315 to 1730, was published in 1726–1739. Wenck's *Corpus juris gentium recentissimi* (3 vols. 8vo, 1781–1795) contains treaties from 1735 to 1772. The 8vo *Recueil* of G. F. de Martens, continued by C. de Martens, Saalfeld, Murhard, K. F. Samwer, K. Hopf, F. Stoerk and H. Triepel, commenced in 1791 with treaties of 1761, and is still in progress. The series in 1910 extended to eighty-eight volumes; that for 1910 being the third of the *Nouveau recueil général* (23$^{\text{me}}$ série). See also the *Recueil international des traités de xx$^{\text{e}}$ siècle* (1904, sqq.), by Descamps en Renault, and the following periodical publications: *Das Staatsarchiv, Sammlung der officiellen Actenstücke zur Geschichte der Gegenwart* (Leipzig, commencing in 1861); *Archives diplomatiques* (Stuttgart, since 1821); *Archives diplomatiques, recueil mensuel de diplomatie et d'histoire* (Paris, since 1861); and Hertslet's *British and Foreign State Papers, from the Termination of the War of 1814 to the Latest Period, compiled at the Foreign Office by the Librarian and Keeper of the Papers* (London, since 1819, and still in progress).

ii. The more important collections of national treaties are those of MM. Neumann and de Plasson from 1855, and of the commission for modern history from 1903, for Austria; Beutner for the German Empire, 1883; C. Calvo for "l'Amérique latine," 1862–1869; de Clercq for France, 1864–1908; De Garcia de la Vega for Belgium, 1850, &c., Lagemans and Breukelman for the Netherlands, 1858, &c.; Soutzo for Greece, 1858; Count Solar de la Marguerite for Sardinia, 1836–1861; Olivart for Spain, 1890, &c.; Da Castro for Portugal, 1856–1879; Rydberg for Sweden, 1877; Kaiser, 1861, and Eichmann, 1885, for Switzerland; Baron de Testa, 1864, &c., Aristarchi Bey 1873–1874, and Effendi Noradounghian, 1897–1903, for Turkey; F. de Martens for Russia (the 9 vols. published 1874–1907 contain the treaties made by Russia with Austria, Germany, Great Britain and France respectively); W. F. Mayers for China, 1877. The official publication for Italy begins in 1864 (see also the collection by Luigi Palma, 1879, &c.), for Spain in 1843, for Denmark in 1874. The treaties of Japan were published by authority in 1899. Those of the United States are contained in the *Statutes at Large* of the United States, and in the *Treaties, Conventions, etc., between the United States of America and Other Powers, 1776–1909* (Washington, 1910); also in the collections of J. Elliott (1834) and H. Minot (1844–1850); see also Mr Bancroft Davis's *Notes upon the Treaties of the United States with other Powers, preceded by a list of the Treaties and Conventions with Foreign Powers, chronologically arranged and followed by an Analytical Index and a Synoptical Index of the Treaties* (1873). In England no treaties were published before the 17th century, such matters being thought "not fit to be made vulgar." The treaty of 1604 with Spain was, however, published by authority, as were many of the treaties of the Stuart kings. Rymer's *Foedera* was published, under the orders of the government, in twenty volumes, from 1704 to 1732; but for methodical collections of the earlier British treaties we are indebted to private enterprise, which produced three volumes in 1710–1713, republished with a fourth volume in 1732. Other three volumes appeared in 1772–1781, the collection commonly known as that of C. Jenkinson (3 vols.) in 1785 and that of G. Chalmers (2 vols.) in 1795. The recent treaties made by Great Britain, previously dispersed through the numbers of the *London Gazette* or embedded in masses of diplomatic correspondence presented to parliament at irregular intervals, are now officially published as soon as ratified in a special 8vo. "Treaty Series" of parliamentary papers commenced in 1902. J. Macgregor published (1841–1844) eight volumes of commercial treaties, but the great collection of the commercial treaties of Great Britain is that of L. Hertslet, librarian of the foreign office, continued by his son, Sir Edward Hertslet, and later holders of the same office, entitled *A Complete Collection of the Treaties and Conventions and Reciprocal Regulations at present subsisting between Great Britain and Foreign Powers, and of the Laws and Orders in Council concerning the same, so far as they relate to Commerce and Navigation, the Slave Trade, Post Office, &c., and to the Privileges and Interests of the Subjects of the Contracting Parties* (24 vols., 1820–1907). Sir Edward Hertslet also commenced in 1875 a series of volumes containing *Treaties and Tariffs regulating the Trade between Britain and Foreign Nations, and Extracts of Treaties between Foreign Powers, containing the Most Favoured Nation Clauses applicable to Great Britain.* Both of these publications are still continued. He also published, in 1891, *Treaties, &c., concluded between Great Britain and Persia, and between Persia and Foreign Powers*; and, in 1896, a similar work on treaties with China The treaties affecting British India are officially set out, with historical notes, in *A Collection of Treaties,*

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[1] Cf. Bynkershoek, *Quest. sur pub.* vol. ii. ch. 10.

Engagements and Sannuds relating to India and Neighbouring Countries, by C. V. Aitchison. This work, with the index, extends to eight volumes, which appeared at Calcutta in 1862–1866. A continuation by A. C. Talbot was published in 1876, and it was brought up to date by the government of India in 1909. Useful lists of national collections of treaties will be found in the *Revue de droit international* for 1886, pp. 169–187, and in the Marquis Olivart's *Catalogue de ma bibliothèque* (1899–1910).

List of Important Treaties.

It may be worth while to add a list of some of the more important treaties, now wholly or partially in force, some of which are discussed under separate headings, especially those to which Great Britain is a party, classified according to their objects, in the order suggested above.

i. The principal treaties affecting the distribution of territory between the various states of Central Europe are those of Westphalia (Osnabrück and Münster), 1648; Utrecht, 1713; Paris and Hubertusburg, 1763; for the partition of Poland, 1772, 1793; Vienna, 1815; London, for the separation of Belgium from the Netherlands, 1831, 1839; Zürich, for the cession of a portion of Lombardy to Sardinia, 1859; Vienna, as to Schleswig-Holstein, 1864; Prague, whereby the German Confederation was dissolved, Austria recognizing the new North German Confederation, transferring to Prussia her rights over Schleswig-Holstein, and ceding the remainder of Lombardy to Italy, 1866; Frankfort, between France and the new German Empire, 1871. The disintegration of the Ottoman Empire has been regulated by the Great Powers, or some of them, in the treaties of London, 1832, 1863, 1864, and of Constantinople, 1881, with reference to Greece; and by the treaties of Paris, 1856; London, 1871; Berlin, 1878; London, 1883, with reference to Montenegro, Rumania, Servia, Bulgaria and the navigation of the Danube. The encroachments of Russia upon Turkey, previous to the Crimean War, are registered in a series of treaties beginning with that of Kuchuk-Kainarji, 1774, and ending with that of Adrianople in 1829. The independence of the United States of America was acknowledged by Great Britain in the treaty of peace signed at Paris in 1783. The boundary between the United States and the British possessions is regulated in detail by the treaties of Washington of 1842, 1846, 1871, 1903 and 1908. The territorial results of the war of 1898 between the United States and Spain are registered in the treaty of 1899, and those of the Russo-Japanese War in the treaty of Portsmouth of 1905. Various causes of possible misunderstanding between Great Britain and France were removed by the convention of 1904; and a similar treaty was concluded with Russia in 1908. The navigation of the Suez Canal is regulated by a treaty of 1888, and that of the future Panama Canal by one of 1901. The boundaries of the territories, protectorates and spheres of influence in Africa of Great Britain, Germany, France, Italy, Belgium and Portugal have been readjusted by a series of treaties, especially between the years 1885 and 1894. Switzerland, Belgium, Corfu and Paxo and Luxemburg are respectively neutralized by the treaties of Vienna, 1815, and of London, 1839, 1864, 1867. A list of treaties of guarantee supposed to be then in force, to which Great Britain is a party, beginning with a treaty made with Portugal in 1373, was presented to parliament in 1859. Treaties of alliance were made between Great Britain and Japan in 1902 and 1905.

ii. For the innumerable conventions, to which Great Britain is a party, as to commerce, consular jurisdiction, fisheries and the slave trade, it must suffice to refer to the exhaustive and skilfully devised index to vols. 1–21 of Hertslet's *Commercial Treaties*, published in 1905 as vol. 22 of the series.

iii. The social intercourse of the world is facilitated by conventions, such as those establishing the Latin monetary union, 1865; the international telegraphic union, 1865; the universal postal union, 1874; the international bureau of weights and measures, 1875; providing for the protection of submarine cables in time of peace, 1884; the railway traffic union, 1890. Such treaties, now very numerous, are somewhat misleadingly spoken of by recent writers (L. von Stein and F. de Martens) as constituting a "droit administratif international."

iv. For the now operative treaties of extradition to which Great Britain is a party, it will be sufficient to refer to the article Extradition. It may be observed that all of them, except the treaty of 1842, now, however, varied by one of 1889, with the United States, are subsequent to, and governed by, the provisions of 33 & 34 Vict. c. 52, The Extradition Act 1870. Before the passing of this general act it had been necessary to pass a special act for giving effect to each treaty of extradition. The most complete collection of treaties of extradition is that of F. J. Kirchner, *L'Extradition, Recueil, &c.* (London, 1883).

v. General conventions, to which most of the European states are parties, were signed in 1883 at Paris for the protection of industrial, and in 1886 at Bern for the protection of literary and artistic, property, and, from 1899 onwards, a series of general treaties, to none of which is Great Britain a party, have been signed at the Hague, as the result of conferences, invited by the government of the Netherlands, for solving some of the more pressing questions arising out of "the conflict of laws."

vi. Quasi-legislation by treaty has been directed mainly to encouraging the settlement of international disputes by peaceful methods, and to regulating the conduct of warfare.

The first peace conference, held at the Hague in 1899, devoted much time to producing the generally accepted "Convention for the Pacific Settlement of International Disputes." An important achievement of this convention was the establishment at the Hague of an international tribunal, always ready to arbitrate upon cases submitted to it; and the convention recommended recourse not only to arbitration, but also to good offices and mediation, and to international commissions of inquiry. This convention has now been superseded by the revised and amplified edition of it adopted by the second peace conference in 1907. The provisions of neither convention are obligatory, but merely "facultative," amounting only to recommendations. Great efforts were made, especially in 1907, but without success, to draft a generally acceptable convention, making resort to arbitration compulsory, at any rate with reference to certain classes of questions. In the meantime, however, agreements of this nature between one power and another have multiplied rapidly within the last few years (see Arbitration).

Certain bodies of rules intended to mitigate the horrors of war have received the adhesion of most civilized states. Thus the declaration of Paris, 1856 (to which, however, the United States, Venezuela and Bolivia have not yet formally acceded), prohibits the use of privateers and protects the commerce of neutrals; the Geneva conventions, 1864 and 1906, give protection to the wounded and to those in attendance upon them; the St Petersburg declaration, 1868, prohibits the employment of explosive bullets weighing less than 400 grammes; and the three Hague declarations of 1899 prohibit respectively (1) the launching of projectiles from balloons, (2) the use of projectiles for spreading harmful gases, and (3) the use of expanding bullets. The second Hague conference, of 1907, besides revising the convention made by the first conference, of 1899, as to the laws of war on land, produced new conventions, dealing respectively with the opening of hostilities; neutral rights and duties in land warfare; the status of enemy merchant ships at the outbreak of war; the conversion of merchant ships into ships of war; submarine mines; bombardment by naval forces; the application of the Geneva principles to naval warfare; the rights of maritime capture; the establishment of an international prize court; and neutral rights and duties in maritime warfare. These conventions, as well as a republication of the first Hague declaration, which had in 1907 expired by efflux of time, have been already largely ratified.

It were greatly to be wished that the official publication of treaties could be rendered more speedy and more methodical than it now is. The labours of the publicist would also be much lightened were it possible to consolidate the various general collections of diplomatic acts into a new *Corps diplomatique universel*, well furnished with cross references, and with brief annotations showing how far each treaty is supposed to be still in force.

Literature.—In addition to the works already cited in the course of this article the following are for various reasons important

Joh. Lupus, *De confederatione principum* (Strassburg, 1511, the first published monograph upon the subject); Bodinus, *Dissertatio de contractibus summarum potestatum* (Halle, 1696); Neyron, *De vi foederum inter gentes* (Göttingen, 1778); Neyron, *Essai historique et politique sur les garanties, &c.* (Göttingen, 1797); Wächter, *De modis tollendi pacta inter gentes* (Stuttgart, 1780); Dresch, *Ueber die Dauer der Völkerverträge* (Landshut, 1808); C. Bergbohm, *Staatsverträge und Gesetze als Quellen des Völkerrechts* (Dorpat, 1877); Jellinek, *Die rechtliche Natur der Statenverträge* (Vienna, 1880); D. Donati, *Trattati internazionali nel diritto costituzionale* (1907); Holzendorff, *Handbuch des Völkerrechts* (1887) vol. iii.; Fleischmann, *Völkerrechtsquellen in Auswahl herausgegeben* (1905); de Lapradelle, *Recueil des arbitrages internationaux* (1905); J. B. Moore, *History and Digest of the International Arbitrations to which the United States has been a Party* (1898) 6 vols. For a list of the principal "concordats," see Calvo, *Droit international théorique et pratique* t. i. On the history of the great European treaties generally, see the *Histoire abrégée des traités de paix entre les puissances de l'Europe*, by Koch, as recast and continued by Schöll (1817 and 1818), and again by Count de Garden in 1848–1859, as also the *Recueil manuel* of De Martens and Cussy, continued by Geffcken. For the peace of Westphalia, Pütter's *Geist des westphälischen Friedens* (1795) is useful; for the congress of Vienna Klüber's *Acten des Wiener Congresses* (1815–1819) and *Le Congrés de Vienne et les traités de 1815 précédé des conférences de Dresde, de Prague et de Chatillon, suivi des Congrés d'Aix-la-Chapelle, Troppau, Laybach et Vérone*, by Count Angeberg. The last-mentioned writer has also published collections of treaties relating to Poland, 1762–1862; to the Italian question, 1859; to the Congress of Paris, 1856 and the revision of its work by the Conference of London, 1871; and to the Franco-German War of 1870–71. For the treaties regulating the Eastern question see *The European Concert in the Eastern Question*, by T. E. Holland (1885) and *La Turquie et le Tanzimat*, by E. Engelhardt (1882–1884). (T. E. H.)

TREATISE, a written composition, dealing fully and systematically with the principles of some subject of serious importance. The M. Eng. *tretis*, O. Fr. *tretis*, or *treitis*, is a doublet of "treaty," which also meant a discourse or account. Both words are to be referred to Lat. *tractare*, to treat, handle, frequentative of *trahere*, *tractus*, to draw. "Treatise" thus would mean, by etymology, something well handled, nicely made.

TREBIA (mod. *Trebbia*), a river of Cisalpine Gaul, a tributary of the Padus (Po) into which it falls some 4 m. west of Placentia (Piacenza). It is remarkable for the victory gained on its banks by Hannibal over the Romans in 218 B.C. The latest investigations make it clear that Polybius's account, according to which the battle took place on the left bank of the river, is to be preferred to that of Livy (see W. J. Kromayer in *Anzeiger der phil. hist. Klasse der k. Akademie der Wissenschaften*, Vienna, October 14, 1908). Its valley is followed past Bobbio by the modern highroad from Piacenza to Genoa (88 m.).

TREBINJE, a town of Herzegovina, situated 9 m. N. E. of Ragusa, on the small river Trebinjčica, and on a branch of the railway from Metkovic to Castelnuovo, near Cattaro. Pop. (1895), about 1700. Trebinje is built in a low-lying oasis among the desolate limestone mountains, close to the Dalmatian and Montenegrin frontiers. Its half-ruined wall and citadel testify to its former strategic importance. Trebinje was built by the Slavs, probably on the site of a Roman town laid waste by the Saracens in 840. In the tenth century Constantine Porphyrogenitus mentions it as *Terbunia*. It commanded the road from Ragusa to Constantinople, traversed, in 1096, by Raymond of Toulouse and his crusaders. Under the name of Tribunia or Travunja (the *Trebigne* of the Ragusans), it belonged to the Servian Empire until 1355. In 1483 it was captured by the Turks.

TREBIZOND (Gr. *Trapezus*), a city of Asia Minor, situated on the Black Sea, near its south-eastern angle. From the time of its foundation as a Greek colony to the present day it has always been a considerable emporium of commerce, and it was for two centuries and a half the capital of an empire. Its importance is due to its command of the point where the chief trade route from Persia and Central Asia to Europe, over the table-land of Armenia by Bayezid and Erzerum, descends to the sea. Its safety also was secured by the barrier of rugged mountains (7000 to 8000 ft.) which separates its district from the rest of Asia Minor. So complete is the watershed that no streams pass through these ranges, and there is hardly any communication in this direction between the interior of Asia Minor and the coast. For the same reason, together with its northern aspect, the climate is humid and temperate, unlike that of the inland regions, which are exposed to great extremes of heat in summer and cold in winter. The position which was occupied by the Hellenic and medieval city is a sloping table of ground (whence the original name of the place, Trapezus, the "Table-land"), which falls in steep rocky precipices on the two sides, where two deep valleys, descending from the interior, run parallel at no great distance from one another down to the sea. The whole is still enclosed by the Byzantine walls, which follow the line of the cliffs and are carried along the sea-face; and the upper part of the level, which is separated from the lower by an inner cross wall, forms the castle; while at the highest point, where a sort of neck is formed between the two valleys, is the keep which crowns the whole. On each side, about half-way between the keep and the sea, these ravines are crossed by massive bridges, and on the farther side of the westernmost of these, away from the city, a large tower and other fortifications remain. The area of the ancient city is now called the Kaleh, and is inhabited by the Turks; eastward of this is the extensive Christian quarter, and beyond this again a low promontory juts northward into the sea, partly covered with the houses of a well-built suburb, which is the principal centre of commerce. The harbour lies on the eastern side of this promontory, but it is an unsafe roadstead, being unprotected towards the north-east and having been much silted up, so that vessels cannot approach within a considerable distance of the shore. From here the caravans start for Persia, and at certain periods of the year long trains of camels may be seen, and Persian merchants conspicuous by their high black caps and long robes. The route which these caravans follow is a *chaussée* as far as Erzerum, but this in places is too much broken to admit of the transit of wheeled vehicles. The railway by Batoum to Baku by way of Tiflis has tended greatly to turn the channel of commerce from Trebizond into Russian territory, since it helps to open the route to Erivan, Tabriz and the whole of Persia. The total population of the place amounts to about 40,000, of whom 22,000 are Moslems and 18,000 Christians. Great Britain and all the larger European states have consulates there.

The vilayet, of which Trebizond is the chief town, consists of a long irregular strip of coast country, the eastern half of which is deeply indented and mountainous.

History.—The city of Trapezus was a colony of Sinope, but it first comes into notice at the time of the Retreat of the Ten Thousand, who found repose there. Notwithstanding its commercial importance, the remoteness of its position prevented it from being much known to fame either in the Hellenic or the early medieval period; its greatness dates from the time of the fourth crusade (1204), when the Byzantine Empire was dismembered and its capital occupied by the Latins. During the confusion that followed that event Alexius Comnenus escaped into Asia, and, having collected an army of Iberian mercenaries, entered Trebizond, where he was acknowledged as the legitimate sovereign, and assumed the title of Grand Comnenus. Though only twenty-two years of age, Alexius was a man of ability and resolute will, and he succeeded without difficulty in making himself master of the greater part of the southern coast of the Black Sea. The empire thus founded continued to exist until 1461, when the city was taken by Mahommed II. The cause of this long duration, and at the same time the secret of its history, is to be found in the isolated position of Trebizond and its district, between the mountains and the sea, which has already been described. By this means it was able to defy both the Seljuks and the Ottomans, and to maintain its independence against the emperors of Nicaea and Constantinople. But for the same reason its policy was always narrow, so that it never exercised any beneficial influence on the world at large. It was chiefly in the way of matrimonial alliances that it was brought into contact with other states. The imperial family were renowned for their beauty, and the princesses of this race were sought as brides by Byzantine emperors of the dynasty of the Palaeologi, by Western nobles, and by Mahommedan princes; and the connexions thus formed originated a variety of diplomatic relations and friendly or offensive alliances. The palace of Trebizond was famed for its magnificence, the court for its luxury and elaborate ceremonial, while at the same time it was frequently a hotbed of intrigue and immorality. The Grand Comneni were also patrons of art and learning, and in consequence of this Trebizond was resorted to by many eminent men, by whose agency the library of the palace was provided with valuable manuscripts and the city was adorned with splendid buildings. The writers of the time speak with enthusiasm of its lofty towers, of the churches and monasteries in the suburbs, and especially of the gardens, orchards and olive groves. It excited the admiration of Gonzales Clavijo, the Spanish envoy, when he passed through it on his way to visit the court of Timur at Samarkand (Clavijo, *Historia del gran Tamorlan*, p. 84); and Cardinal Bessarion, who was a native of the place, in the latter part of his life, when the city had passed into the hands of the Mahommedans, and he was himself a dignitary of the Roman Church, so little forgot the impression it had made upon him that he wrote a work entitled "The Praise of Trebizond" ('Εγκώμιον Τραπεζοῦντος), which exists in manuscript at Venice. Little was known of the history of the empire of Trebizond until the subject was taken in hand by Professor Fallmerayer of Munich, who discovered the chronicle of Michael Panaretus among the books of Cardinal Bessarion, and from that work, and other sources of information which were chiefly unknown up to that time, compiled his *Geschichte des Kaiserthums von Trapezunt* (Munich, 1827). From time to time the emperors of Trebizond paid tribute to the Seljuk sultans of Iconium, to the grand khans of the Mongols, to Timur the Tatar, to the Turkoman chieftains, and to the Ottomans; but by means of skilful negotiations they were enabled practically to secure their independence. We find them also at war with many of these powers, and with the Genoese, who endeavoured to monopolize the commerce of the Black Sea. The city was several times besieged, the most formidable attack being that which occurred in the reign of Andronicus I., the second emperor, when the Seljuks, under the command of Melik, the son of the great sultan Ala-ed-din, first assaulted the northern wall in the direction of the sea, and afterwards endeavoured to storm the upper citadel by night. They failed, however, in both attempts; and in the latter, owing to the darkness, and to the occurrence of a violent storm which suddenly swelled the torrents in the ravines, their force was thrown into inextricable confusion, and they were compelled to abandon their camp and make the best of their escape from the country. So great was the strength of the fortifications that Mahommed II. might have experienced much difficulty in reducing it, had it not been for the pusillanimous conduct of David, the last emperor, who surrendered the place almost unconditionally.

Ancient Memorials.—Several interesting monuments of this period remain at Trebizond in the form of churches in the Byzantine style of architecture. One of these is within the area of the old city, viz. the church of the Panaghia Chrysokephalos, or Virgin of the Golden Head, a large and massive but excessively plain building, which is now the Orta-hissar mosque. On the farther side of the eastern ravine stands a smaller but very well proportioned structure, the church of St Eugenius, the patron saint of Trebizond, now the Yeni Djuma djami, or New Friday mosque. Still more important is the church of Haghia Sophia, which occupies a conspicuous position overlooking the sea, about 2 m. west of the city. The porches of this are handsomely ornamented, and about 100 ft. from it rises a tall campanile, the inner walls of which have been covered in parts with frescoes of religious subjects, though these are now much defaced. But the most remarkable memorial of the middle ages that exists in all this district is the monastery of Sumelas, which is situated about 25 m. from Trebizond, at the side of a rocky glen, at a height of 4000 ft. above the sea. Its position is most extraordinary, for it occupies a cavern in the middle of the face of a perpendicular cliff 1000 ft. high, where the white buildings offer a marked contrast to the brown rock which forms their setting. It is approached by a zigzag path at the side of the cliff, from which a flight of stone steps and a wooden staircase give access to the monastery. The valley below is filled with the richest vegetation, the undergrowth being largely composed of azaleas and rhododendrons. An antiquity of 1500 years is claimed for the foundation of the monastery, but it is certain that the first person who raised it to importance was the emperor Alexius Comnenus III. of Trebizond; he rebuilt it in 1360, and richly endowed it. The golden bull of that emperor, which became thenceforth the charter of its foundation, is still preserved; it is one of the finest specimens of such documents, and contains portraits of Alexius himself and his queen. The monastery also possesses the firman of Mahommed II. by which he accorded his protection to the monks when he became master of the country.

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TREBLE (a doublet of "triple," three-fold, from Lat. *triplus*, triple; cf. "double" from *duplus*), the term applied, in music, to the high or acute part of the musical system, as opposed to and distinguished from the "bass," the lower or grave part. The middle C is the practical division between the parts. The word is also used as equivalent to the "soprano" voice, the highest pitch or range of the human voice, but generally it is confined to a boy's voice of this quality, "soprano" being used of the corresponding female voice. The treble-clef is the G-clef on the second line. The origin of this application of the term "treble," *triplus*, threefold, to the highest voice or part is due to the fact that in the early plain-song the chief melody was given to the tenor, the second part to the alto (*discantus*) and where a third part (*triplum*) was added it was assigned to the highest voice, the soprano or treble.

TRÉBUCHET, a medieval siege engine, employed either to batter masonry or to throw projectiles over walls. It was developed from the post-classical Roman *onager* (wild ass), which derived its name from the kicking action of the machine. It consisted of a frame placed on the ground to which a vertical frame of solid timber was rigidly fixed at its front end; through the vertical frame ran an axle, which had a single stout spoke. On the extremity of the spoke was a cup to receive the projectile. In action the spoke was forced down, against the tension of twisted ropes or other springs, by a windlass, and then suddenly released. The spoke thus kicked the crosspiece of the vertical frame, and the projectile at its extreme end was shot forward. In the trébuchet the means of propulsion was a counter-weight. The axle which was near the top of a high strutted vertical frame served as the bridge of a balance, the shorter arm of which carried the counter-weight and the longer arm the carrier for the shot. An alternative name for the trébuchet is the mangonel (*mangonneau*).

TREBULA, the name of five ancient towns in Italy. (1) TREBULA in Samnium, a town of the Caraceni, on the left bank of the Sangro, some 20 m. below Castel di Sangro; the church of the Madonna degli Spineti near Quadri marks the site. It appears to have been a *municipium*, but we only know of its existence in Hadrian's time. (2) TREBULA in Campania, between Saticula and Suessula. The site is probably identical with the hills bearing the modern name Tripaola (about 1000 ft. above sea level) above the entrance to the valley of Maddaloni. It is possibly this Trebula the citizens of which received Latin rights in 303 B.C. Its territory extended as far as the Via Appia, and its place was taken in imperial times by the Vicus Novanensis, on the road itself, near Suessula. (3) TREBULA BALLIENSIS (mod. Treglia), also in Campania, 22 m. north of Capua, in the mountains, about 1000 ft. above sea-level. It revolted to Hannibal and was reduced to obedience by Fabius. Remains of walls, aqueduct and tombs exist. Its territory was mentioned in the projected distributions of land in Cicero's time: and its wine was well thought of under Nero. It was a *municipium*. (4) TREBULA MUTUESCA in the Sabine country, 2 m.

east of the point where the Via Caecilia diverges from the Via Salaria. It lies about 1 m. south-west of the modern Monteleone, and an amphitheatre and other remains are visible. In a dedication made there by the consul Mummius in 146 B.C. it is spoken of as a *vicus*, but when the *praefecturae* were abolished it became a *municipium*. The post station of Vicus Novus on the Via Salaria (mod. Osteria Li Massacci) belonged to its territory (see N. Persichetti in *Römische Mitteilungen*, 1898, p. 193). (5) Trebula Suffenas is generally placed 6 m. south of Reate (mod. *Rieti*) on the Via Quinctia, but is with considerable probability identified with Ciciliano, 10 m. east of Tivoli, 2030 ft. above sea-level, by O. Cuntz (*Jahreshefte des oesterr. arch. Instituts*, 1899, ii. 89), who combines the evidence of inscriptions and of the description in Martial (v. 71), with a new interpretation of the *Itineraries*. There are remains of an ancient road, with substructures in rough polygonal work ascending to it in zigzags. (T. As.)

TREDEGAR, an urban district in the western parliamentary division of Monmouthshire, England, on the Sirhowy river, 24 m. north of Cardiff, on a joint line of the London & North-Western and the Rhymney railways. Pop. (1901), 18,497. It stands at an elevation of about 1000 ft., and owes its existence to the establishment in the beginning of the 19th century of the works of the Tredegar Iron and Coal Company, which employ most of the large industrial population. The place gave the title of Baron Tredegar (*c.* 1859) to Sir Charles Morgan Robinson Morgan, Bart. (1792–1875), whose grandfather, Sir Charles Gould, Bart., married the heiress of John Morgan of Tredegar and changed his name to Morgan. He was M.P. for Brecknock in 1835–1847. He married a granddaughter of the 1st Lord Rodney. His son Godfrey (b. 1830), who succeeded to the barony, was created Viscount Tredegar in 1905; he had served in the Crimea and taken part in the famous Balaclava charge.

TREDGOLD, THOMAS (1788–1829), English engineer, was born at Brandon, near Durham, on the 22nd of August 1788, and at the age of fourteen was apprenticed to a carpenter. In 1808 he went to Scotland, and after working there as a journeyman for five years, obtained employment in London with an architect. He began to practice as a civil engineer on his own account in 1823, but much of his time was devoted to the preparation of his engineering text-books, which gained a wide reputation. They included *Elementary Principles of Carpentry* (1820), almost the first book of its kind in English; *Practical Treatise on the Strength of Cast Iron and other Metals* (1824); *Principles of Warming and Ventilating Public Buildings* (1824); *Practical Treatise on Railroads and Carriages* (1825); and *The Steam Engine* (1827). He died in London on the 28th of January 1829.

TREE, SIR HERBERT BEERBOHM (1853–), English actor and manager, was born in London, on the 17th of December 1853, the son of Julius Beerbohm, a London merchant of German parentage; his half-brother, Max Beerbohm (b. 1872), became well known as a dramatic critic, a miscellaneous writer and caricaturist. Taking the stage name of Beerbohm Tree he made his first professional appearance in London in 1876. After some years of varied experience he made a striking success in 1884 as the curate in *The Private Secretary*, but he was making himself well known meanwhile in dramatic circles as an admirable actor in many rôles. In September 1887 he became lessee and manager of the Haymarket theatre, London, where his representations of melodramatic "character" parts, as in *Jim the Penman*, *The Red Lamp*, and *A Man's Shadow*, were highly successful. His varied talents as an actor were displayed, however, not only in a number of modern dramas, such as H. A. Jones's *Dancing Girl*, but also in romantic parts such as Gringoire, and in the production of so essentially a literary play as Henley's *Beau Austin*; and in classic parts his ability as a comedian was shown in *The Merry Wives of Windsor*, in which he played Falstaff, and as a tragedian in *Hamlet*; his presentations of Shakespeare were notable too as carrying forward the methods of realistic staging inaugurated at the Lyceum under Irving. In 1897 Mr Tree moved to the new Her Majesty's (afterwards His Majesty's) theatre, opening with Gilbert Parker's *Seats of the Mighty*; but his chief successes were in Stephen Phillips's poetical dramas, and in his splendid revivals of Shakespeare (especially *Richard II.* and the *Merchant of Venice*). The magnificence of the mounting, the originality and research shown in the "business" of his productions, and his own versatility in so many different types of character, made his management memorable in the history of the London stage; and on the death of Sir Henry Irving he was generally recognized as the leader in his profession. His wife (Maud Holt), an accomplished actress, and their daughter Viola, were also prominently associated with him. In 1907 he took his company to Berlin at the invitation of the German emperor, and gave a selection from his *rêpertoire* with great success. In the same year he established a school of dramatic art, for the training of actors, in London; and in this and other ways he was prominent in forwarding the interests of the stage. He was knighted in 1909.

TREE (O. Eng. *trēo*, *treow*, cf. Dan. *trae*, Swed. *träd*, tree, *trä*, timber; allied forms are found in Russ. *drevo*, Gr. *δρῦς*, oak, and *δόρυ*, spear, Welsh *derw*, Irish *darog*, oak, and Skr. *dāru*, wood), the term, applied in a wide sense, to all plants which grow with a permanent single woody stem or trunk of some height, branching out at some distance from the ground. There is a somewhat vague dividing line, in popular nomenclature, between "shrubs" and "trees," the former term being usually applied to plants with several stems, of lower height, and bushy in growth. The various species to which the name "tree" can be given are treated under their individual titles, *e.g.* oak, ash, elm, &c.; the articles Fir and Pine treat of two large groups of conifers; general information is provided by the articles Plants and Gymnosperms; tree cultivation will be found under Forests and Forestry and Horticulture; and the various types of tree whose wood is useful for practical purposes under Timber. Apart from this general meaning of the word, the chief transferred use is that for a piece of wood used for various specific purposes, as a framework, bar, &c., such as the tree of a saddle, axle-tree, cross-tree, &c.

TREE-CREEPER, one of the smallest of British birds, and, regard being had to its requirements, one very generally distributed. It is the *Certhia familiaris* of ornithology, and is remarkable for the stiffened shafts of its long and pointed tail-feathers, aided by which, and by its comparatively large feet, it climbs the trunks or branches of trees, invariably proceeding upwards or outwards and generally in a spiral direction, as it seeks the small insects that are hidden in the bark and form its chief food. When in the course of its search it nears the end of a branch or the top of a trunk, it flits to another, always alighting lower down than the place it has left, and so continues its work. Inconspicuous in colour—for its upper plumage is mostly of various shades of brown mottled with white, buff and tawny, and beneath it is of a silvery white—the tree-creeper is far more common than the incurious suppose; but, attention once drawn to it, it can be frequently seen and at times heard, for though a shy singer its song is loud and sweet. The nest is neat, generally placed in a chink formed by a half-detached piece of bark, which secures it from observation, and a considerable mass of material is commonly used to stuff up the opening and give a sure foundation for the tiny cup, in which are laid from six to nine eggs of a translucent white, spotted or blotched with rust-colour.

The tree-creeper inhabits almost the whole of Europe as well as Algeria and has been traced across Asia to Japan. It is now recognized as an inhabitant of the greater part of North America, though for a time examples from that part of the world, which differed slightly in the tinge of the plumage, were accounted a distinct species (*C. americana*) and even those from Mexico and Guatemala (*C. mexicana*) have lately been referred to the same. It therefore occupies an area not exceeded in extent by that of many passerine birds and is one of the strongest witnesses to the close alliance of the so-called Nearctic and Palaearctic regions.

Allied to the tree-creeper, but without its lengthened and stiff tail-feathers, is the genus *Tichodroma*, the single member of which is the wall-creeper (*T. muraria*) of the Alps and some other mountainous parts of Europe and Asia. It is occasionally seen in Switzerland, fluttering like a big butterfly against the face of a rock conspicuous from the scarlet-crimson of its wing-coverts and its white spotted primaries. Its bright hue is hardly visible when the bird is at rest, and it then presents a dingy appearance of grey and black. It is a species of wide range, extending from Spain to China; and, though but seldom leaving its cliffs, it has wandered even so far as England. Merrett (*Pinax*, p. 177) in 1667 included it as a British bird, and the correspondence between Marsham and Gilbert White (*Proc. Norf. and Norw. Nat. Society*, ii. 180) proves that an example was shot in Norfolk, on the 30th of October 1792; while another is reported (*Zoologist*, 2nd series, p. 4839) to have been killed in Lancashire on the 8th of May 1872.

The passerine family Certhiidae contains a number of genera of birds to which the general name "creeper" is applied; they occur in North America, Europe and Asia, the greater part of Africa, and Australia and New Guinea. (A. N.)

TREE-FERN. In old and well-grown specimens of some of the familiar ferns of temperate climates the wide-spreading crown of fronds may be observed to rise at a distance often of a good many inches above the ground, and from a stem of considerable thickness. The common male fern *Lastraea* (*Filix-mas*) affords the commonest instance of this; higher and thicker trunks are, however, occasionally presented by the royal fern (*Osmunda regalis*), in which a height of 2 ft. may be attained, and this with very considerable apparent thickness, due, however, to the origin and descent of a new series of adventitious roots from the bases of each annual set of fronds. Some tropical members and allies of these genera become more distinctly tree-like, *e.g. Todea*; *Pteris* also has some sub-arboreal forms. *Oleandra* is branched and shrub-like, while *Angiopteris* and *Marattia* may also rise to 2 ft. or more. But the tree-ferns proper are practically included within the family Cyatheaceae. This includes seven genera (*Cyathea*, *Alsophila*, *Hemitelia*, *Dicksonia*, *Thyrsopteris*, *Cibotium* and *Balantium*) and nearly 300 species, of which a few are herbaceous, but the majority arboreal and palm-like, reaching frequently a height of 50 ft. or more, *Alsophila excelsa* of Norfolk Island having sometimes measured 60 to 80 ft. The fronds are rarely simple or simply pinnate, but usually tripinnate or decompound, and may attain a length of 20 ft., thus forming a splendid crown of foliage. The stem may occasionally branch into many crowns.

The genera are of wide geographical range, mostly within the tropics; but South Australia, New Zealand, and the southern Pacific islands all possess their tree-ferns. In Tasmania *Alsophila australis* has been found up to the snow-level, and in the humid and mountainous regions of the tropics tree-ferns are also found to range up to a considerable altitude. The fronds may either contribute to the apparent thickness of the stem by leaving more or less of their bases, which become hardened and persistent, or they may be articulated to the stem and fall off, leaving characteristic scars in spiral series upon the stem. The stem is frequently much increased in apparent thickness by the downgrowth of aerial roots, forming a black coating several inches or even a foot in thickness, but its essential structure differs little in principle from that familiar in the rhizome of the common bracken (*Pteris*). To the ring or rather netted cylinder of fibrovascular bundles characteristic of all fernstems scattered internal as well as external bundles arising from these are superadded and in a tree-fern the outer bundles give off branches to the descending roots from the region where they pass into the leaves.

Tree-ferns are cultivated for their beauty alone; a few, however, are of some economic applications, chiefly as sources of starch. Thus the beautiful *Alsophila excelsa* of Norfolk Island is said to be threatened with extinction for the sake of its sago-like pith, which is greedily eaten by hogs; *Cyathea medullaris* also furnishes a kind of sago to the natives of New Zealand, Queensland and the Pacific islands. A Javanese species of *Dicksonia* (*D. chrysotricha*) furnishes silky hairs, which have been imported as a styptic, and the long silky or rather woolly hairs, so abundant on the stem and frond-leaves in the various species of *Cibotium* have not only been put to a similar use, but in the Sandwich Islands furnish wool for stuffing mattresses and cushions, which was formerly an article of export. The "Tartarian lamb," or *Agnus scythicus* of old travellers' tales in China and Tartary, is simply the woolly stock of *Cibotium Barometz*, which, when dried and inverted, with all save four of its frond-stalks cut away, has a droll resemblance to a toy sheep.

TREE FROG. Many different groups of tailless Batrachians (see Frog) are adapted to arboreal life, which is indicated by expansions of the tips of the fingers and toes, adhesive disks which assist the animal in climbing on vertical smooth surfaces. These disks do not act as suckers, but adhere by rapid and intense pressure of the distal phalanx and special muscles upon the lower surface, which is also provided with numerous glands producing a viscous secretion.

The best-known tree frog is the little *Hyla arborea* of continental Europe, *rainette* of the French, *Laubfrosch* of the Germans, often kept in glass cylinders provided with a ladder, which the frog is supposed to ascend or descend in prevision of the weather. But recent experiments conducted on scientific principles show that not much reliance can be placed on its prophecies. This frog is one of the smallest of European Batrachians, rarely reaching 2 in. in length; its upper parts are smooth and shiny, normally of a bright grass-green, which may change rapidly to yellow, brown, olive or black; some specimens, deprived of the yellow pigment which contributes to form the green colour, are sky-blue or turquoise blue; the lower parts are granulate and white.

The family Hylidae, of which the European tree frog is the type, is closely related to the Bufonidae or true roads, being distinguished from them by the presence of teeth in the upper jaw and by the claw-like shape of the terminal phalanx of the digits. It is a large family, represented by about three hundred species, two hundred and fifty of which belong to the genus *Hyla*, distributed over Europe, temperate Asia, North Africa, North and South America, Papua and Australia. Close allies of *Hyla* are the *Nototrema* of Central and South America, in which the female develops a dorsal broad pouch in which the young undergo part or the whole of their metamorphoses. The genus *Phyllomedusa*, also from Central and South America, are quadrumanous; the inner finger and the toe being opposable to the others, and the foot being very similar to the hand. These frogs deposit their spawn between the leaves of branches overhanging water, into which the tadpoles drop and spend their larval life.

TREE KANGAROO, any individual of the diprotodont marsupial genus *Dendrolagus* (see Marsupialia). Three species are inhabitants of New Guinea and the fourth is found in North Queensland. They differ greatly from all other members of the family (Macropodidae), being chiefly arboreal in their habits, and feeding on bark, leaves and fruit. Their hinder limbs are shorter than in the true kangaroos, and their fore limbs are longer and more robust, and have very strong curved and pointed claws. The best-known species, Lumholtz' tree kangaroo (*Dendrolagus lumholtzi*), is found in North Queensland. It was named by Professor Collett in honour of its discoverer, who described it as living on the highest parts of the mountains, in the densest scrub and most inaccessible places. It is hunted by the blacks with trained dingoes; the flesh is much prized by the blacks, but the presence of a worm between the muscles and the skin renders it less inviting to Europeans.

TREE-SHREW, any of the arboreal insectivorous mammals of the genus *Tupaia*. There are about a dozen species, widely distributed over the east. There is a general resemblance to squirrels. The species differ chiefly in the size and in colour and length of the fur. Nearly all have long bushy tails. Their food consists of insects and fruit, which they usually seek for in the trees. When feeding they often sit on their haunches, holding the food, after the manner of squirrels, between their fore paws. The pen-tailed tree-shrew (*Ptilocercus lowi*), from Borneo, Sumatra and the Malay Peninsula, is the second generic representative of the family Tupaiidae. The head and body, clothed in blackish-brown fur, are about 6 in. long; the tail, still longer, is black, scaled and sparsely haired for the upper two-thirds, while the lower third is fringed on each side with long hairs, mostly white. One shrew from Borneo and a second from the Philippines have been referred to a separate genus under the name *Urogale everetti* and *U. cylindrura*, on account of their uniformly short-haired, in place of varied, tails. (See Insectivora.)

TREE-WORSHIP. Primitive man, observing the growth and death of trees, the elasticity of their branches, the sensitiveness and the annual decay and revival of their foliage, anticipated in his own way the tendency of modern science to lessen the gulf between the animal and the vegetable world. When sober Greek philosophers (Aristotle, Plutarch) thought that trees had perceptions, passions and reason, less profound thinkers may be excused for ascribing to them human conceptions and supernatural powers, and for entertaining beliefs which were entirely rational and logical from primitive points of view. These beliefs were part of a small stock of fundamental ideas into which scientific knowledge of causation did not enter, ideas which persist in one form or another over a large portion of the world, and have even found a place in the higher religions, inevitably conditioned as these positive faiths are by the soil upon which they flourish.[1] In fact, the evidence for tree-worship is almost unmanageably large, and since comparative studies do not as yet permit a concise and conclusive synopsis of the subject, this article will confine itself to some of the more prominent characteristics.

Trees and Human Life.

Numerous popular stories reflect a firmly rooted belief in an intimate connexion between a human being and a tree, plant or flower. Sometimes a man's life depends upon the tree and suffers when it withers or is injured, and we encounter the idea of the *external soul*, already found in the Egyptian "Tale of the Two Brothers" of at least 3000 years ago. Here one of the brothers leaves his heart on the top of the flower of the acacia and falls dead when it is cut down. Sometimes, however, the tree is an *index*, a mysterious token which shows its sympathy with an absent hero by weakening or dying, as the man becomes ill or loses his life. These two features very easily combine, and they agree in representing a—to us—mysterious sympathy between tree- and human-life, which, as a matter of fact, frequently manifests itself in recorded beliefs and customs of historical times.[2] Thus, sometimes the new-born child is associated with a newly planted tree with which its life is supposed to be bound up; or, on ceremonial occasions (betrothal, marriage, ascent to the throne), a personal relationship of this kind is instituted by planting trees, upon the fortunes of which the career of the individual depends. Sometimes, moreover, boughs or plants are selected and the individual draws omens of life and death from the fate of his or her choice. Again, a man will put himself into relationship with a tree by depositing upon it something which has been in the closest contact with himself (hair, clothing, &c.). This is not so unusual as might appear; there are numerous examples of the conviction that a sympathetic relationship continues to subsist between things which have once been connected (*e.g.* a man and his hair), and this may be illustrated especially in magical practices upon material objects which are supposed to affect the former owner.[3] We have to start then with the recognition that the notion of a real inter-connexion between human life and trees has never presented any difficulty to primitive minds.

The custom of transferring disease or sickness from men to trees is well known.[4] Sometimes the hair, nails, clothing, &c., of a sickly person are fixed to a tree, or they are forcibly inserted in a hole in the trunk, or the tree is split and the patient passes through the aperture. Where the tree has been thus injured, its recovery and that of the patient are often associated. Different explanations may be found of such customs which naturally take rather different forms among peoples in different grades of civilization. Much depends upon the theory of illness. In India, for example, when the patient is supposed to be tormented by a demon, ceremonies are performed to provide it with a tree where it will dwell peacefully without molesting the patient so long as the tree is left unharmed.[5] Such ideas do not enter, of course, when the rite merely removes the illness and selfishly endangers the health of those who may approach the tree.[6] Again, sometimes it is clearly felt that the man's personality has been mystically united with some healthy and sturdy tree, and in this case we may often presume that such trees already possessed some peculiar reputation. The custom finds an analogy when hair, nail-clippings, &c., are hung upon a tree for safety's sake lest they fall into the hands of an enemy who might injure the owner by means of them.

Veneration of Trees.

In almost every part of the world travellers have observed the custom of hanging objects upon trees in order to establish some sort of a relationship between the offerer and the tree. Such trees not infrequently adjoin a well or are accompanied by sacred buildings, pillars, &c. Throughout Europe, also, a mass of evidence has been collected testifying to the lengthy persistence of "superstitious" practices and beliefs concerning them. The trees are known as the scenes of pilgrimages, ritual ambulation, and the recital of (Christian) prayers. Wreaths, ribbons or rags are suspended to win favour for sick men or cattle, or merely for "good luck." Popular belief associates the sites with healing, bewitching, or mere "wishing"; and though now perhaps the tree is the object only of some vague respect, there are abundant allusions to the earlier vitality of coherent and systematic cults.[7] Decayed or fragmentary though the features may be in Europe, modern observers have found in other parts of the world more organic examples which enable us, not necessarily to reconstruct the fragments which have survived in the higher religions and civilizations, but at least to understand their earlier significance. In India, for example, the Korwas hang rags on the trees which form the shrines of the village-gods. In Nebraska the object of the custom was to propitiate the supernatural beings and to procure good weather and hunting. In South America Darwin recorded a tree honoured by numerous offerings (rags, meat, cigars, &c.); libations were made to it, and horses were sacrificed.[8] If, in this instance, the Gauchos regarded the tree, not as the embodiment or abode of Walleechu, but as the very god himself, this is a subtle but very important transference of thought, the failure to realize which has not been confined to those who have venerated trees.

Embody Spirits.

Among the Arabs the sacred trees are haunted by angels or by *jinn*; sacrifices are made, and the sick who sleep beneath them receive prescriptions in their dreams. Here, as frequently elsewhere, it is dangerous to pull a bough. This dread of damaging special trees is familiar: Cato instructed the woodman to sacrifice to the male or female deity before thinning a grove (*De re rustica*, 139), while in the Homeric poem to Aphrodite the tree nymph is wounded when the tree is injured, and dies when the trunk falls.[9] Early Buddhism decided that trees had neither mind nor feeling and might lawfully be cut; but it recognized that certain spirits might reside in them, and this the modern natives of India firmly believe. Propitiation is made before the sacrilegious axe is laid to the holy trees; loss of life or of wealth and the failure of rain are feared should they be wantonly cut; and there are even trees which it is dangerous to climb.[10] The Talein of Burma prays to the tree before he cuts it down, and the African woodman will place a fresh sprig upon the stump as a new home for the spirit. In the Gold Coast the silk-cotton and odum (poison) trees are especially sacred as the abode of the two deities, who are honoured by sacrifices—even of human victims; these indwelt trees must not be cut, and, since all trees of these species are under their protection, they can be felled only after certain purificatory ceremonies.[1] In general the evidence shows that sacred trees must not be injured unless they (*i.e.* their spirits) have been appeased, or means taken to provide the occupant with another abode. That the difference between the sacred *object* and the sacred *occupant* was not always clearly drawn is quite intelligible from those beliefs of much less rudimentary religions which confuse the unessential with the essential.

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[1] In this as in other subjects of comparative religion (see SERPENT-WORSHIP), the comparative and historical aspects of the problems should not be severed from psychology, which investigates the actual mental processes themselves. A naïve rationalism or intellectualism which would ridicule or deplore the modern retention of "primitive" ideas has to reckon with the psychology of the modern average mental constitution; a more critical and more sympathetic attitude may recognize in religious and in other forms of belief and custom the necessary consequences of a continuous development linking together the highest and the lowest conceptions of life.

[2] See the evidence collected by E. S. Hartland, *The Legend of Perseus* (1894–1896), ii.; J. G. Frazer, *The Golden Bough* (1900), iii. 351 sqq., 391; and in general, A. E. Crawley, *The Idea of the Soul* (1909).

[3] There appears to be a fundamental confusion of association, likeness and identity, which on psychological grounds is quite intelligible. It is appropriate to notice the custom of injuring an enemy by simply beating a tree-stump over which his *name* had previously been pronounced (A.B. Ellis, *The Ewe-speaking Peoples of the Slave Coast of West Africa*, 1890, p. 98). The folk-lore of the "name" is widespread and of great antiquity, and certain features of it show that a thing (individual or object) and its name were not easily disconnected, and that what affected the one affected the other. In this case, by pronouncing the name the tree-stump for all intents and purposes became the enemy.

[4] Hartland ii. 142 sqq.; Frazer, iii. 26 sqq.

[5] W. Crooke, *The Popular Religion and Folk-lore of Northern India* (1896), ii. 92 sqq.; cf. p. 96, where the demon, the cause of sterility, is removed to trees.

[6] Cf. E. B. Tylor, *Primitive Culture* (1903), ii. 149 seq., G. L. Gomme, *Ethnology in Folk-lore* (1892), 141 seq.

[7] Hartland ii. 175 sqq.; Gomme, pp. 85, 94 seq., 102 sqq., and the literature at the end of this article.

[8] Tylor ii. 223 seq.

[9] See generally Frazer i. 170 sqq., Tylor i. 475 sqq., ii. 219 seq. For the survival of the idea of modern Greece, see J. C. Lawson, *Modern Greek Folk-lore* (1910), p. 158 seq.

[10] Crooke ii. 77, 87, 90 sqq.

Again, when the jungle-races of India clear the forests, they leave behind certain trees which are carefully protected lest the sylvan gods should abandon the locality (Crooke ii. 90). These trees embody the local deities much in the same way as the north European homestead had a tree or a small grove for the guardian-spirit or "lord of the home," and they resemble the tree tutelary genius of old German villages and the Japanese trees which are the terrestrial dwelling-places of the guardian of the hamlets.[2] Such beliefs as these are more significant when trees are associated with the spirits of the dead. Trees were planted around graves in Greece, and in Roman thought groves were associated with the *manes* of the pious. The Baduyas of the central provinces of India worship the souls of their ancestors in groves of Sāj trees, and this may be supplemented by various modern burial usages where the dead are buried in trees, or where the sacred tree of the village enshrines the souls of the dead forefathers. Thus among the natives of South Nigeria each village has a big tree into which the spirits of the dead are supposed to enter; when a woman wants a child or when a man is sick, sacrifice is made to it, and if the "Big God" Osòwo who lives in the sky is favourable the request is granted.[3]

Forms of Cult.

Often the tree is famous for oracles. Best known, perhaps, is the oak of Dodona tended by priests who slept on the ground. The tall oaks of the old Prussians were inhabited by gods who gave responses, and so numerous are the examples that the old Hebrew "terebinth of the teacher" (Gen. xii. 6), and the "terebinth of the diviners" (Judg. ix. 37) may reasonably be placed in this category. Important sacred trees are also the object of pilgrimage, one of the most noteworthy being the branch of the Bo tree at Ceylon brought thither before the Christian era.[4] The tree-spirits will hold sway over the surrounding forest or district, and the animals in the locality are often sacred and must not be harmed. Thus, the pigeons at the grove of Dodona, and the beasts around the north European tree-sanctuaries, were left untouched, even as the modern Dyak would allow no interference with the snake by the side of the bush which enshrined a dead kinsman.[5] Sacred fires burned before the Lithuanian Perkuno and the Roman Jupiter; both deities were closely associated with the oak, and, indeed, the oak seems to have been very commonly used for the perpetual holy fires of the Aryans.[6] The powers of the tree-deities, though often especially connected with the elements, are not necessarily restricted, and the sacred trees can form the centre of religious, and sometimes, also, of national life. Such deities are not abstract beings, but are potent and immediate, and the cultus is primarily as utilitarian as the duties of life itself. They may have their proper ministrants· (*a*) the chief sanctuary of the old Prussians was a holy oak around which lived priests and a high priest known as "God's mouth"; (*b*) in Africa there are sacred groves into which the priest alone may enter, and (*c*) among the Kissil-Bashi (or Kizilbashes) of the Upper Tigris and Euphrates, the holy tree of the village stands in an enclosure to which only the father-priest has access.[7] The trees may be the scene of religious festivals, and—what sometimes goes with these—of periodical fairs and markets. Among the Lousiade group in British New Guinea the religious feasts are held under the sacred tree and a portion is laid aside for the spirit-occupants. That the invisible spirit naturally enjoyed only the *spiritual* part of the offerings is a belief which may have been shared by others than the African negro.[8] Human sacrifice is known on the Slave Coast and in the Punjab; it was practised among the Druids, and at Odin's grave at Upsala. It is also said that the pollution of old Prussian sacred groves and springs by the intrusion of Christians was atoned for by human victims. Indeed, to judge from later popular custom and tradition, and from the allusion in ancient writers, various grisly rites and acts of licentiousness (such as the more advanced Hebrew prophets denounced) were by no means unusual features in the cults of trees and vegetation.[9]

Forms of Development.

Although trees have played so prominent a part in the history of religions, the utmost caution is necessary in any attempt to estimate the significance of isolated evidence and its relation to the contemporary thought. Let it suffice to notice that in West Equatorial Africa the death of the sacred tree near the temples leads to the abandonment of the village, that in Rome the withering of the sacred fig-tree of Romulus in the Forum caused the greatest consternation. One can now understand in some measure why so much importance should be attached to a venerated tree, but these examples will illustrate the different historical and religious conditions which require study in any investigation of tree-worship. Unfortunately one constantly reaches the point where the ancient writer or the modern observer has failed to record the required information. Moreover, we do not encounter tree-cults at their rise: in every case we arrest the evidence at a certain stage of development. It is often impossible to determine why certain trees are sacred; sometimes it may be that the solitary tree is the survivor of a forest or grove, or it has attracted attention from its curious or uncanny form, or again it stands on a spot which has an immemorial reputation for sanctity. The persistence of sacred localities is often to be observed in the East, where more rudimentary forms of tree-cults stand by the side of or outlive higher types of religion.[10] The evolution of sacred trees and of religious beliefs and practices associated therewith have not always proceeded along parallel lines. As ideas advanced, the spirits associated with trees were represented by posts, idols, or masks; altars were added, and the trunk was roughly shaped to represent the superhuman occupant. There is reason to believe that the last-mentioned transformation has frequently happened in the development of iconography. Indeed, the natives of the Antilles suppose that certain trees instructed sorcerers to shape their trunks into idols, and to instal them in temple-huts where they could be worshipped and could inspire their priests with oracles.[11]

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[1] A. B. Ellis, *op. cit.* pp. 49 sqq.; cf. further Frazer i. 180, 182 sqq.

[2] Tylor ii. 225; H. M. Chadwick, "The Oak and the Thunder-god," *Journ. of the Anthrop. Inst.* (1900), pp. 30, 32, 43.

[3] C. Partridge, *The Cross River Natives* (1904), p. 273; cf. further Crooke ii. 85, 91; Tylor ii. 10 seq.; Frazer i. 178 sqq.; J. G. Forlong, *Faiths of Man*, iii. 446.

[4] Tylor ii. 218, and for other examples, pp. 224, 226; W. R. Smith, *Religion of the Semites* (1894), p. 185.

[5] Frazer i. 179, cf. 230.

[6] Ibid. 168; see his *Lectures on the Early History of the Kingship* (1905), pp. 209, 281.

[7] (*a*) Chadwick 32; (*b*) Tylor ii. 224; (*c*) *The Standard*, Sept. 19, 1904. For an African tree-god with priesthood and "wives," see Ellis, *op. cit.* p. 50.

[8] Tylor ii. 216 (citing Waitz, *Anthrop.* ii. 188).

[9] See *Golden Bough*, i. 171 seq.; Lucan, *Phar.* iii. 405; P. H. Mallet, *Northern Antiquities*, i. 113. Chadwick 32; and, for the survivals, *Golden Bough* iii. 345.

[10] So in Asia Minor where a tree hung with rags stands by a rock with an ancient "Hittite" representation of the god of vegetation (W. M. Ramsay, *The Expositor*, Nov., 1906, p. 461 seq.). "Hittite" religion has long passed away, but the locality preserves its sacred character and presents a form of cult older than the "Hittite" civilization itself (cf. also the persistence of the veneration of trees in Palestine in spite of some four thousand years of history). There has not been a reversion to ancient forms of cult in their organic entirety, but with the weakening and loss of the positive influences in the course of history, there has been no progression, and the communities live in simpler conditions and at a simpler stage of mental evolution and they are "childlike" rather than "senile" or "decadent."

[11] Tylor, ii. 216. Here one may observe: (*a*) the virtues of the tree as a whole will be retained—as in the case of the relic of a medieval saint—in any part of it (cf. ibid. 217; the offshoots of the oak of

The development of the beliefs relating to the spirit-occupants themselves would take us along quite another line of inquiry. When the tree-spirit was conceived to be of human shape the numerous stories which associate trees with men or deities of flesh and blood would easily arise; and just as Indian natives have gods which are supposed to dwell in trees, so in higher religions we find a Zeus or a Dionysus *Endendros*, gods, "occupants of trees," who have been identified with one or other of the leading members of a recognized pantheon.[1]

Later Vicissitudes.

The vicissitudes of the old tree-spirits are influenced by the circumstances of history. Syrian writers speak of a "king of the forest" and of a tall olive tree to the worship of which Satan seduced the people. But these "trees of the demons" were hewn down by zealous Syrian Christians. So also the caliph Omar cut down the tree at Ḥodaibaya visited by pilgrims, lest it should be worshipped, and the Council of Nantes (A.D. 895) expressly enjoined the destruction of trees which were consecrated to demons. Tradition has preserved some recollections of the overthrow of tree-cult in Europe. Bonifacius destroyed the great oak of Jupiter at Geismar in Hesse, and built of the wood a chapel to St Peter. (A similar continuity was maintained near Hebron when Constantine destroyed the idols and altars beneath the oak or terebinth of Abraham at Mamre and replaced them by a basilica.) On the Heinzenberg near Zell the Chapel of Our Lady stands where the old tree uttered its complaint as the woodman cut it down; and at Kildare (*cilldara*, church of the oak), "Saint" Brigit or Bridget built her church under an oak tree.[2] On the other hand, at Samosata, the sacred tree worshipped in Christian times, was honoured as the wood of Christ's cross, and this growth of a new tradition to justify or at least to modify an old survival recurs in Palestine where the holy trees, whether adjoining a venerated tomb or not, are often connected with the names of saints or prophets and sometimes with appropriate traditions.

It is impossible to do more than indicate the outlines of an intricate subject which concerns the course of certain fundamental ideas, their particular development so far as trees are concerned, and the more accidental factors which have influenced these two lines within historical times. Several important aspects have been inevitably ignored, *e.g.* the marriage of trees and tree-spirits, the annual festivals at the growth and decay of vegetation, and the evidence for the association of prominent deities with tree-spirits. For these features and for other general information see especially the works of J. G. Frazer (*Golden Bough*; *Lectures on Kingship*; *Adonis, Attis and Osiris*; *Totemism and Exogamy*), other literature cited in the course of this article, and the numerous works dealing with primitive religious and other customs. Among the most useful monographs are those of C. Boetticher, *Der Baumkultus d. Hellenen* (1856); W. Mannhardt, *Der Baumkultus der Germanen und ihrer Nachbarstämme* (1875), *Antike Wald- und Feldkulte* (1877), and, for introductory study, Mrs J. H. Philpot, *The Sacred Tree, or the Tree in Religion and Myth* (1897). (S. A. C.)

TREFOIL (Lat. *trifolium*, three-leaved plant, Fr. *trèfle*, Ger. *Dreiblatt* and *Dreiblattbogen*), the term in Gothic architecture given to the ornamental foliation or cusping introduced in the heads of window-lights, tracery, panellings, &c., in which the centre takes the form of a three-lobed leaf, one of the earliest examples being in the plate tracery at Winchester (1222–1235); see QUATREFOIL.

TREGELLES, SAMUEL PRIDEAUX (1813–1875), English theologian, was born at Wodehouse Place, near Falmouth, on the 30th of January 1813. His parents were Quakers, and he himself for many years was in communion with the (Darbyite) Plymouth Brethren, but afterwards became a Presbyterian. For a while he worked at the ironworks, Neath Abbey, Glamorgan, and then set up as a private tutor in Falmouth, finally devoting himself to a laborious student life, until he was incapacitated by paralysis in 1870. He received the LL.D. degree from St Andrews and a pension of £200 from the civil list. He died at Plymouth on the 24th of April 1875.

Most of his numerous publications had reference to his great critical edition of the New Testament (1857–1872; see BIBLE; *New Testament, Textual Criticism*). They include an *Account of the Printed Text of the Greek New Testament* (1854), a new edition of T. H. Horne's *Introduction* (1860), and *Canon Muratorianus: Earliest Catalogue of Books of the New Testament* (1868). As early as 1844 he published an edition of the Book of the Revelation, with the Greek text so revised as to rest almost entirely upon ancient evidence. Tregelles wrote *Heads of Hebrew Grammar* (1852), translated Gesenius's *Hebrew Lexicon*, and was the author of a little work on the *Jansenists* (1851) and of various works in exposition of his special eschatological views (*Remarks on the Prophetic Visions of Daniel*, 1852, new ed., 1864).

TRÉGUIER, a port of western France, in the department of Côtes-du-Nord, 36 m. N.W. of St Brieuc by road. Pop. (1906), 2605. The port is situated about 5½ m. from the English Channel at the confluence of two streams that form the Tréguier river; it carries on fishing and a coasting and small foreign trade. The cathedral, remarkable in having three towers over the transept, one of which is surmounted by a fine spire, dates from the 14th and 15th centuries. It contains the sumptuous modern mausoleum of St Yves (d. 1303), a canon of the cathedral, the building of which was largely due to him. To the south of the church there is a cloister (latter half of the 15th century) with graceful arcades. There is a statue of Ernest Renan, a native of the town. Saw-milling, boat-building and flax-stripping are carried on, together with trade in cereals, cloth, potatoes, &c.

Tréguier (*Trecorum*), which dates from the 6th century, grew up round a monastery founded by St Tugdual. In the 9th century it became the seat of a bishopric, suppressed in 1790.

TREILHARD, JEAN BAPTISTE (1742–1810), French revolutionist, was born at Brives (Corrèze). In Paris he gained reputation as an avocat at the parlement, and was a deputy to the states-general in 1789. In the Constituent Assembly he showed great capacity in dealing with the reorganization of the Church and the nationalization of ecclesiastical property. Ineligible, like all the members of the Constituent Assembly, for the Legislative Assembly, he became president of the criminal tribunal of Paris, but failed through lack of firmness. The department of Seine-et-Oise elected him to the Convention, where he attached himself to the group known as the Mountain (*q.v.*) and voted for the death of Louis XVI. He was a member of the committee of public safety, and became president of the Convention on the 27th of December 1792. Under the Directory he entered the Council of the Five Hundred (of which he was president during the month of Nivose, year IV.), was a member of the Tribunal of Cassation, plenipotentiary at the Congress of Rastatt, and became a director in the year VI. After the *coup d'état* of 18 Brumaire he became president of the tribunal of appeal and councillor of state. He took an important part in drafting the civil code, the criminal code, the code of civil procedure and the commercial code. He died on the 1st of December 1810, a senator and count of the empire.

See Bonnal de Ganges, "Représentants du peuple dignitaires par Napoléon . . . Treilhard," in the *Revue du monde catholique* (7th series, vol. iii., 1900); Guyot d'Amfreville, *Vie de J. B. Treilhard* (Limoges, 1879).

TREITSCHKE, HEINRICH VON (1834–1896), German historian and political writer, was born at Dresden on the 15th of September 1834. He was the son of an officer in the Saxon army who rose to be governor of Königstein and military governor of Dresden. Young Treitschke was prevented by deafness from entering the public service. After studying at Leipzig and Bonn, where he was a pupil of Dahlmann, he established himself as a *privatdozent* at Leipzig, lecturing on history and politics. He at once became very popular with the students, but his political opinions made it impossible for the Saxon government to appoint him to a professorship. He was at that

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Dodona; the sacred oak of which the Argo was built); also (*b*) it was believed that the divine essence could be made to enter—transubstantiated as it were—into an image (cf. Rameses II. and his idols; see Breasted, *Egypt. Hist. Doc.* iii. 179, note; and for analogies see *Folk-Lore*, viii. 325).

[1] Even the Hebrews knew of the good-will of "Him who dwelt in the bush" (Deut. xxxiii. 16). For ideas associating Yahweh (Jehovah) with trees, see J. G. Frazer, *Anthrop. Essays to E. B. Tylor* (1907), p. 125 seq.

[2] See Chadwick 33, 35; Frazer, *Lectures*, 225; and Hartland ii. 181, 184 (who refers to the tree-worship taken over by St Marce and St Etto). Even the temples of Dodona and of Jupiter Capitolinus stood on the sites of older tree-worship.

time a strong Liberal; he hoped to see Germany united into a single state with a parliamentary government, and that all the smaller states would be swept away. In 1863 he was appointed professor at Freiburg; in 1866, at the outbreak of war, his sympathies with Prussia were so strong that he went to Berlin, became a Prussian subject, and was appointed editor of the *Preussische Jahrbücher*. A violent article, in which he demanded the annexation of Hanover and Saxony, and attacked with great bitterness the Saxon royal house, led to an estrangement from his father, who enjoyed the warm friendship of the king. It was only equalled in its ill humour by his attacks on Bavaria in 1870. After holding appointments at Kiel and Heidelberg, he was in 1874 made professor at Berlin; he had already in 1871 become a member of the Reichstag, and from that time till his death in 1896 he was one of the most prominent figures in the city. On Sybel's death he succeeded him as editor of the *Historische Zeitschrift*. He had outgrown his early Liberalism and become the chief panegyrist of the house of Hohenzollern. He did more than any one to mould the minds of the rising generation, and he carried them with him even in his violent attacks on all opinions and all parties which appeared in any way to be injurious to the rising power of Germany. He supported the government in its attempts to subdue by legislation the Socialists, Poles and Catholics; and he was one of the few men of eminence who gave the sanction of his name to the attacks on the Jews which began in 1878. As a strong advocate of colonial expansion he was also a bitter enemy of Great Britain, and he was to a large extent responsible for the anti-British feeling of German Chauvinism during the last years of the 19th century. In the Reichstag he had originally been a member of the National Liberal party, but in 1879 he was the first to accept the new commercial policy of Bismarck, and in his later years he joined the Moderate Conservatives, but his deafness prevented him from taking a prominent part in debate. He died at Berlin on the 28th of April 1896.

As an historian Treitschke holds a very high place. He approached history as a politician and confined himself to those periods and characters in which great political problems were being worked out: above all, he was a patriotic historian, and he never wandered far from Prussia. His great achievement was the *History of Germany in the Nineteenth Century*. The first volume was published in 1879, and during the next sixteen years four more volumes appeared, but at his death he had only advanced to the year 1847. The work shows extreme diligence, and scrupulous care in the use of authorities. It is discursive and badly arranged, but it is marked by a power of style, a vigour of narrative, and a skill in delineation of character which give life to the most unattractive period of German history; notwithstanding the extreme spirit of partisanship and some faults of taste, it will remain a remarkable monument of literary ability. Besides this he wrote a number of biographical and historical essays, as well as numerous articles and papers on contemporary politics, of which some are valuable contributions to political thought.

The most important of the essays have been collected under the title *Historische und politische Aufsätze* (4 vols., Leipzig, 1896); a selection from his more controversial writings was made under the title *Zehn Jahre deutscher Kämpfe*; in 1896 a new volume appeared, called *Deutsche Kämpfe, neue Folge*. After his death his lectures on political subjects were published under the title *Politik*. He brought out also in 1856 a short volume of poems called *Vaterländische Gedichte*, and another volume in the following year. The only works translated into English are two pamphlets on the war of 1870, *What we demand from France* (London, 1870), and *The Fire-test of the North German Confederation* (1870).

See Schiemann, *Heinrich v. Treitschkes Lehr- und Wanderjahre, 1836–1866* (Munich, 1896); *Gustav Freitag und Heinrich v. Treitschke im Briefwechsel* (Leipzig, 1900); *Deutsche Rundschau* (Oct. 1896); and article by J. W. Headlam, *Hist. Rev.* (Dec. 1897). (J. W. He.)

TRELAWNY, EDWARD JOHN (1792–1881), English sailor and friend of Shelley and Byron, was born in London on the 13th of November 1792, the son of an army officer. After a short term in the navy and a naval school, he shipped for India, but deserted at Bombay. For several years he led an adventurous life in India, but about 1813 returned to England, married and settled down. In was early in 1822 that he met Shelley and Byron at Pisa and passed nearly every day with one or both of them until the drowning of Shelley (*q.v.*) and Williams on the 8th of July. He it was who superintended the recovery and cremation of the bodies, snatching Shelley's heart from the flames, and who added the lines from the *Tempest* to Leigh Hunt's "Cor Cordium"; and, finally, who supplied the funds for Mrs Shelley's return to England. In 1823 he set out with Byron for Greece, to aid in the struggle for independence. Distressed by his companion's dilatoriness, Trelawny left him and joined the insurgent chief Odysseus and afterwards married his sister Tersitza. While in charge of the former's fortress on Parnassus he was assaulted by two Englishmen and nearly killed. Returning to England, he lived for a time in Cornwall with his mother and afterwards in London, where his romantic associations, picturesque person and agreeable manners made him a great social favourite. Permission having been refused him to write the life of Shelley, he began an account of his own life in the *Adventures of a Younger Son* (1835), followed much later by a second part: *Recollections of Shelley and Byron* (1858). This gives an admirable portrait of Shelley, and a less truthful one of Byron. He married a third time, but the irregularity of his life estranged him from his wife, and he died at Sompting, near Worthing, on the 13th of August 1881. His ashes were buried in Rome by the side of those of Shelley. The old seaman in Millais's picture, "The North-West Passage," in the Tate Gallery, London, gives a portrait of him.

See the *Letters of Edward J. Trelawny*, edited with Introduction by H. Buxton Forman, C.B. (1910).

TRELAWNY, SIR JONATHAN, Bart. (1650–1721), English prelate, was a younger son of Sir Jonathan Trelawny, bart. (1624–1685), a member of a very old Cornish family, and was born at Pelynt in Cornwall on the 24th of March 1650. Educated at Westminster School and at Christ Church, Oxford, Trelawny took holy orders in 1673, and in 1685, his elder brother having died in 1680, became third baronet in succession to his father. Having rendered good service to James II. during Monmouth's rebellion, Trelawny was consecrated bishop of Bristol on the 8th of November 1685. He was loyal to King James until the first declaration of indulgence in April 1687, when, as a bishop, he used his influence with his clergy against the king, and, as a Cornish landowner, resisted the attempt to assemble a packed parliament. In May 1688 Trelawny signed the petition against the second declaration of indulgence, and in the following month was imprisoned in the Tower of London with Archbishop Sancroft and five other bishops, sharing their triumphant acquittal. In spite of Burnet's assertion, it is probable that Trelawny did not sign the invitation to William of Orange, although he certainly welcomed his army into Bristol. Before this James II., anxious to regain the bishop's support, had nominated him to the see of Exeter; but Trelawny lost nothing, as this appointment was almost at once confirmed by William III. Unlike five of his colleagues among the "seven bishops," Trelawny took the oaths of allegiance to William and Mary; but he was soon estranged from the new king and sided with the princess Anne, who showed him some favour after she became queen. In 1707 Trelawny was appointed bishop of Winchester and became prelate of the Order of the Garter, but henceforward he took very little part in politics. He died at his residence at Chelsea on the 19th of July 1721, and was buried at Pelynt. His wife was Rebecca (d. 1710), daughter of Thomas Hele of Bascombe, Devon, by whom he had a family of six sons and six daughters. His eldest son, John, the 4th baronet, died without sons in 1756, and the present baronet is descended from the bishop's brother, Henry (d. 1702). Another of his sons was Edward Trelawny (1699–1754), governor of Jamaica from 1738 to 1752. When bishop of Exeter, Trelawny, as visitor of Exeter College, Oxford, deprived the rector of his office, a sentence which was upheld on appeal by the House of Lords; and when bishop of Winchester he completed the rebuilding of Wolvesey Palace. Trelawny is the hero, or one of the heroes, of the refrain:—

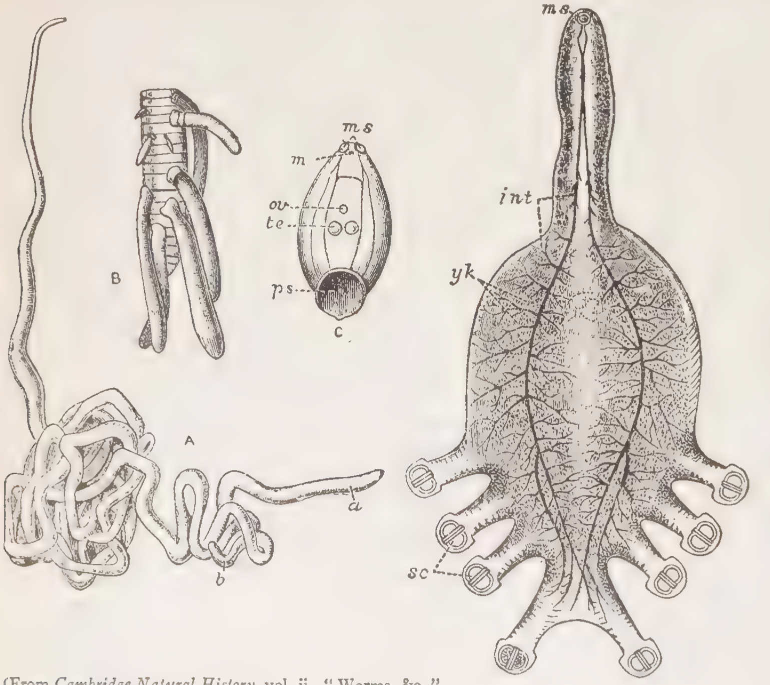
"And shall Trelawny die,
Here's twenty thousand Cornishmen
Will know the reason why."

These words were sung by the men of Cornwall, who seem to have assembled during the bishop's short imprisonment in 1688. It is probable, however, that a similar threat was heard in 1628, when John Trelawny (1592–1665), grandfather of the bishop, was imprisoned by the House of Commons for opposing the election of Sir John Eliot to parliament. The "Song of the Western Men," which contains the above refrain, was composed in 1825 by R. S. Hawker.

TREMATODES, or flukes (as they are called from their fish-like shape), one of the three classes that compose the phylum Platyelmia (*q.v.*). They are flattened organisms provided with two or more suckers, hence their name (τρηματώδης, pierced with holes), and are exclusively parasitic both in their earlier and mature stages of life. Their structure has undergone little degeneration in connexion with this habit, and may be compared organ for organ with that of the Planarians (*q.v.*). The chief peculiarities that distinguish Trematodes from their free-living allies, the Turbellaria, are the development of adhering organs for attachment to the tissues of the host; the replacement of the primitively ciliated epidermis by a thick cuticular layer and deeply sunk cells to ensure protection against the solvent action of the host; and (in one large order) a prolonged and peculiar life-history. The only organs that exhibit any sign of degeneration are those of sense, but in the ectoparasitic Trematodes simple eye-like structures are present and perhaps serve as organs of temperature. The class as a whole is linked to the Turbellaria not only by its similarity of structure, but by the intermediation of the singular class the Temnocephaloidea (see PLANARIANS), which in habit and in organization form an almost ideal annectant group.

External Characters.—The body, which varies in length from a few millimetres to a couple of feet, is usually oval and flattened. In certain genera the margins are infolded either along their whole length (the male of *Schistostomum haematobium*; fig. 9, A) or anteriorly only (Holostomidae). The anterior third of the body is attenuated and sharply marked off from the bulbous trunk in *Didymozoon.* Trematodes never exhibit segmentation, though a superficial annulation may occur, *e.g.* in *Udonella.*

The ventral surface is characterized by one or more suckers and apertures. The mouth lies usually in the centre of the anterior and sub-terminal sucker or between two adoral suckers, but in *Gasterostomum* and its allies it is mid-ventral. A second sucker of variable size and shape lies behind the oral one. In the ectoparasitic Trematodes this post-oral sucker is a complex disk placed near the hinder end and provided with suckerlets, hooks and a musculature arising from a special skeleton. In the majority of endoparasitic forms it is merely a muscular disk just behind the mouth; but in the Aspidocotylea this sucker forms a muscular ribbed sole extending over the greater part of the ventral surface (fig. 7).



(From *Cambridge Natural History*, vol. ii. "Worms, &c.," by permission of Macmillan & Co., Ltd.)

FIG. 1.—A Group of Trematodes.

A, *Nematobothrium filarina*, two specimens (*a* and *b*) from the Tunny. B, *Udonella caligorum*, attached to the ova of the copepod *Caligus*. C, *Epibdella hippoglossi* (from Halibut); *ms*, the two adoral suckers with the mouth (*m*) between them; *ps*, ventral sucker; *ov*, ovary, *te* testes. D, *Octobothrium merlangi*; *ms*, oral sucker; *int.* intestine; *sc*; posterior suckers; *yk*, yolk-glands.

The anterior and posterior ends of the body are well defined. The former is specially modified in a few genera in a manner analogous to the "proboscis" of certain Rhabdocoel Turbellaria. Thus in the recently discovered arctic genus *Prosorhynchus* the muscular and glandular extremity is protrusible, but in the allied *Gasterostomum* this organ is represented by a sucker with fimbriated or tentacular margins. Another form, *Rhopalophorus*, has two cephalic tentacles that are retractile and covered with hooks. The chief genital pore is placed anteriorly between the oral sucker and the ventral one, and is posterior only in Holostomidae, Gasterostomidae and a few Distomidae. Usually this aperture is median, but occasionally asymmetrical. Both male and female gonoducts open through a common atrium to the exterior by this pore, but in three bisexual genera the male and female ducts are developed in separate individuals (*Bilharzia, Didymozoon, Koellikeria*). A single or paired accessory gonopore is met with in many Trematodes just as in certain Turbellaria (*e.g. Cylindrostomum, Trigonoporus*). This accessory pore is not of uniform significance. In ectoparasitic Trematodes it is paired and usually ventral (fig. 4 B, *v*), but the two apertures may run into one, and may also open dorsally (*Hexacotyle*). In this group, the accessory gonopore is the opening of the "vagina," in contradistinction to the median and atrial opening of the uterus which is a "birth-pore." In most endoparasitic Trematodes the accessory gonopore is a median and dorsal structure. It is the opening of Laurer's canal and is homologous not with that of the "vagina" just mentioned, but with a totally distinct structure—the "yolk-receptacle"—which in ectoparasitic forms discharges into the gut instead of to the exterior (see fig. 3).

The excretory pore is terminal and posterior in endoparasitic forms: paired, anterior and dorsal in the ectoparasitic class.

Parasitic Habits.—The Trematodes with few exceptions select a vertebrate for their host. Speaking generally each species of parasite has a particular host, upon the blood of which it nourishes itself and matures its reproductive organs. This strange partiality is now to some extent intelligible. It has been shown in the mammals that blood-relationship, in the strict and literal sense, holds good. The blood of most species behaves differentially towards precipitants, and it is therefore conceivable that when blood is used as food and is elaborated into special compounds for the nutrition of the reproductive organs of a parasite, these specific or larger differences in the blood of animal hosts may prevent the ripening of the gonads of a widely diffused parasite and only one particular kind of blood prove suitable. It would seem that the Trematodes present various degrees of such adaptation, for whilst some—*e.g.* the common liver-fluke (*Distomum hepaticum*)—mature equally well in the bile-ducts of a man as in those of a sheep or rabbit, others and in fact the majority are restricted apparently to one host. It must, however, be borne in mind that a Trematode may develop in an "aberrant" manner in one host and "normally" in another; and unless we knew the initial stock, the two forms would be regarded as distinct species, each with its own host.

The position of the Trematode on its host is of far-reaching importance. If ectoparasitic and attached to the skin, apertures or gills, the Trematode adopts more elaborate adhesive organs and undergoes a less complex development than are required for the endoparasitic members of the class. The latter are almost invariably swallowed by their host in an immature state with its food, and from the stomach or intestine they work their way into the lungs, liver, body-cavity or blood vessels. These endoparasites have a peculiar larval development, the results of which are to increase their numbers and enhance the opportunity of their gaining the necessarily remote station in some fresh individual host. It is usual to consider the ectoparasitic habit as leading up to the endoparasitic one. From what we know of the Platyelmia, however, it is more probable that the two are quite independent and have been evolved separately.

The influence of Trematodes on their hosts is a varied one. Probably all of them secrete an active poison by the aid of their glands, but the effects of these substances are not readily perceptible. In addition to this, they constitute a drain upon the blood which may result in anaemia. If present in large numbers they may give rise to obstruction of the liver-ducts or to inflammation of other tissues. The most important of the Trematodes in its effect on man is *Schistostomum* (*Bilharzia*). This parasite is one of the plagues of Africa. In Egypt 30% of the natives are affected by haematuria which arises from congestion of the bladder consequent upon the attacks of this animal. The noxious influence of Trematodes is, moreover, not confined to their mature phase of life. The rapid multiplication that takes place in the larval stage of nearly all endoparasitic forms affects the tissues of the "intermediate" host in which they live. In most cases this is a mollusc, and the larvae bore their way into the most diverse organs, often accumulating to such an extent as to give a distinctly orange colour to an otherwise colourless tissue, and to cause the demolition of particular structures *e.g.* the liver and gonad. Perhaps the most remarkable of these effects is that produced by the larvae of *Gasterostomum.* These organisms live in cockles, oysters and other lamellibranchs and they so affect the gonads of these molluscs as to castrate and sterilize their host. A different but still more interesting result is produced by these Trematode larvae on certain lamellibranchs. The production of pearls by oysters and mussels is common knowledge, but it is only recently that the origin of pearls has been traced and admitted to be due to inflammation set up by a parasite. In the case of the pearl oyster this parasite is a cestode larva, but in the less valuable but no less genuine pearl produced by *Mytilus*, &c., the nucleus is a Trematode-larva (Jameson).

Structure.—The anatomical structure of the Trematodes is fairly uniform (Braun). The body is enveloped by a thick striated protective cuticle which is frequently raised into hooks or spines. In *Distomum acanthocephalum* the cuticle forms circlets of large and small hooks at the anterior end, somewhat as in Cestodes. The epidermis has lost its connected epithelial character and its cilia, and the isolated cells have become sunk inwards retaining their attachment to the innermost cuticular layer by slender processes. This layer also forms the attachment for the muscles, of which there are two enveloping coats, a circular and a longitudinal layer and also dorso-ventral fibres. The muscles are remarkable for two reasons. They occasionally exhibit striation and originate from large branched cells, the nucleus and unmodified part of which form conspicuous elements. The digestive system consists of a simple or bifurcated sac, opening through the mouth by means of a "pharynx bulbosus," adapted to act primarily as a sucker, and secondarily, when drawing blood, as an aspirator. Between the blind gut and the cuticle is a reticular branched tissue which forms the chief substance of the body. This is the mesenchyma. As in other Platyelmia the elements of this tissue undergo the most varied differentiation. The main mass of it forms a spongy vacuolated matrix, but some of the cells become glandular and open by pores on the surface of the cuticle, others become "flame-cells" (fig. 2, D) and canaliculi of the excretory system as in Turbellaria, others again muscle-cells. Embedded in the matrix lies the complex genital apparatus composed usually of both male and female reproductive organs (fig. 2, B). The former consist of one pair or more of vesicular testes communicating by fine ducts with a vesicula seminalis. From this point a glandular tube runs to the genital atrium and during the last part of its course is converted into an eversible hooked "cirrus" or penis. The female organs consist of distinct ovaries and yolk-glands, the ducts of which unite in the neighbourhood of a "shell-gland" or "ootype." Here the two elements, ovum and yolk-cells, are surrounded by a shell of operculate or of spindle-capped types. Coincidently, to allow of fertilization and the escape of excess of yolk, and of spermatozoa, other accessory ducts open at this point. Thus in ectoparasitic Trematodes, the paired vagina transmits spermatozoa to the egg: and a canal carries off yolk from this point of junction either to the gut for resorption or to the exterior for exudation. This duct (Laurer's canal) is sometimes rudimentary and ends blindly beneath the skin. The fertilized ova, provided with yolk and a shell, are next transferred to the "uterus" along which they travel to the exterior. In the endoparasitic trematodes the uterus is the only passage by which fertilization can be effected, and in cases of cross and self-impregnation this duct is physiologically a vagina. Lastly the nervous system is well developed and consists of a pair of well-marked and interconnected ganglia placed near the anterior end and dorsal to the oesophagus. From these ganglia, nerve-tracts provided with ganglion-cells are given off. Of these there are three on each side of the body: a large ventral tract, smaller lateral strands and dorsal ones. From these tracts a plexus of nerve-fibres is developed in connexion with the musculature and cuticle.

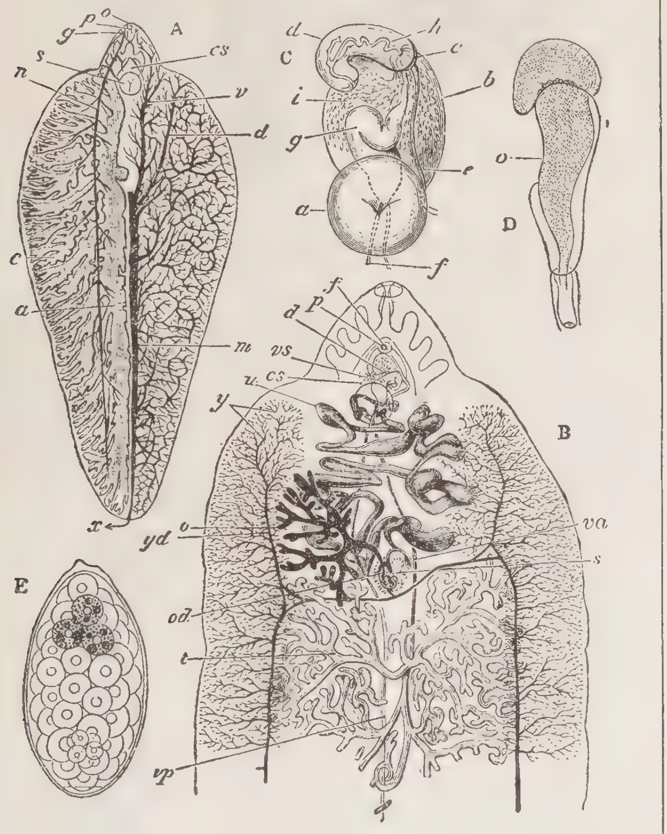


FIG. 2.

A, *Fasciola hepatica*, from the ventral surface; the alimentary and nervous systems only shown on the left side of the figure, the excretory only on the right; *a*, right main branch of the intestine; *c*, a diverticulum; *g*, lateral ganglion; *n*, lateral nerve; *o*, mouth; *p*, pharynx; *s*, ventral sucker; *cs*, cirrus sac; *d*, left anterior dorsal excretory vessel; *m*, main vessel; *v*, left anterior ventral trunk; *x*, excretory pore.

B, anterior portion more highly magnified (from Marshall and Hurst, after Sommer); *cs*, cirrus sac; *d*, ductus ejaculatorius; *f*, female aperture; *o*, ovary; *od*, oviduct; *p*, penis; *s*, shell-gland; *t*, anterior testis; *u*, uterus; *va*, *vp*, vasa deferentia; *vs*, vesicula seminalis; *y*, yolk-gland; *yd*, its duct.

C, genital sinus and neighbouring parts (from Sommer); *a*, ventral sucker; *b*, cirrus sac; *c*, genital pore; *d*, evaginated cirrus sac; *e*, end of vagina; *f*, vasa deferentia; *g*, vesicula seminalis; *h*, ductus ejaculatorius; *i*, accessory gland.

D, a flame-cell from the excretory apparatus, highly magnified (from Fraipont).

E, egg of *Fasciola hepatica*. (from Thomas).

The Trematodes are divided into three orders, primarily distinguished by the character of their suckers, viz.: Heterocotylea, Aspidocotylea and Malacocotylea.

Order 1. *Heterocotylea.*—Ectoparasitic Trematodes, in which a large posterior adhesive apparatus is present and is usually accompanied by a pair of suckers placed anteriorly in relation to the mouth. The large posterior organ of attachment is usually wheel-shaped and provided with hooks; but the ridges may become separated

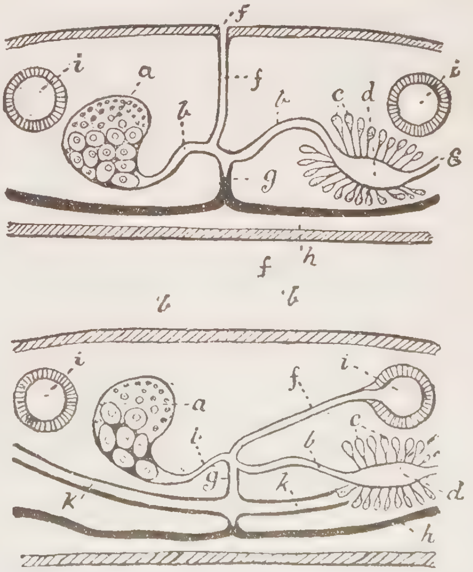
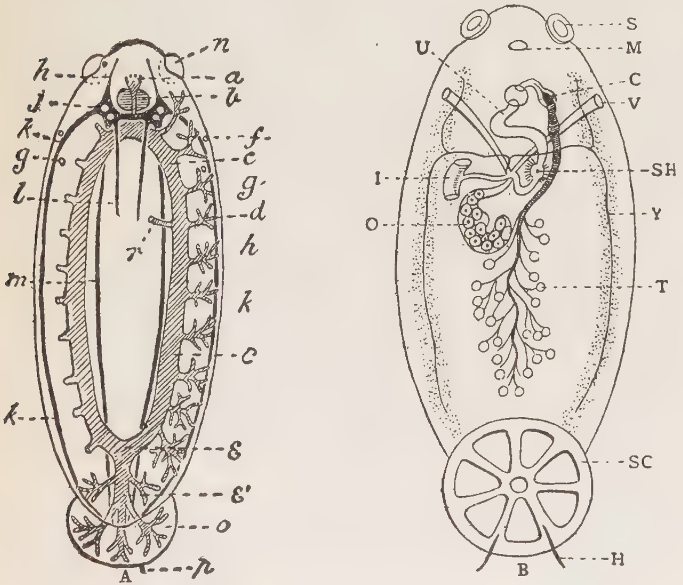


FIG. 3.—Diagrammatic projections to show the relations of the female reproductive ducts; A, in the Malacocotylea; B, in the Heterocotylea. The ovary (*a*) leads into (*bb*) the oviduct, which is joined at (*g*) by the duct of the yolk-glands (*h*). In B it is also joined by a paired vagina (*kk*) and by the "vitello-intestinal duct" (Laurer's canal), *f*. (*c*) Shell-glands; (*d*) ootype; (ε) uterus; (*g*) median-vitello-duct; (*i*, *i*) intestine.

into a number of independent suckers set on a disc or "cotylophore." Eye-spots are general and the nervous system maintains a primitive diffused condition. The excretory system opens to the exterior by a pair of dorsal pores at the level of the pharynx. The eggs are comparatively few, and development is direct, the embryo after reaching its host remaining attached to it for life.

All the members of this order are parasitic on aquatic vertebrates and in rare cases derive their food from a vertebrate host indirectly by means of another invertebrate parasite (*e.g. Udonella* occurs on parasitic Crustacea). They are transparent leaf-like organisms and may often be found attached to the skin, mouth, nostrils or gills of fish; on the skin and bladder of Amphibia; and on those of certain Reptilia. *Polystomum integerrimum* (fig. 5) occurs commonly in the "bladder" of frogs and toads; *Diplozoon* on the skin of the minnow; *Gyrodactylus* (figs. 5, 6) on the gills of various fresh-water fish; and a large number of genera occur on the skin, cloaca and gills of Elasmobranchs and other marine fish. They ingest the mucus and, to some extent, the blood of their host by the aid of a sucking pharynx through which the food passes into the bifurcated alimentary sac and its branched caeca.

The life-history of this order offers many points of interest. The eggs are stalked and provided with chitinoid often operculate shell. Each shell contains a single ovum and a mass of yolk-cells. In most cases the eggs are attached to the host, but in *Polystomum* the eggs are laid in water. The egg of *Gyrodactylus* develops in the body of the parent.



(From Lankester's *Treatise on Zoology*, pt. iv.)

FIG. 4.—Schematic figures of a Heterocotylean Trematode to illustrate its structure (after Benham).

A, Dorsal view showing the nervous system and digestive system; *a*, mouth; *b*, pharynx; *c*, *d*, *ε*, gut; *ε'*, post-genital union of two limbs of gut; *f*, excretory pore; *g*, vaginal pore; *h*, *j*, *k*, brain and nerves; *l*, dorsal nerves; *m*, ventral nerves; *n*, adoral sucker; *o*, posterior sucker; *p*, hooks on posterior sucker; *r*, vitello-intestinal duct.

B, Ventral view showing the reproductive system; C, Cirrus; H, hooks on the ventral sucker; I, small piece of the intestine to show its connexion with the reproductive organs by the narrow duct that passes from it to the union of the vaginae; M, mouth; O, ovary; S, oral sucker; SC, sucker; SH, shell-gland; T, Testis; U, uterus; V, vaginal pore; Y, yolk-gland.

The further history of the animal is only known in a few cases. *Polystomum* hatches out six weeks after ovi-position as a minute (·3 mm. long) larva capable of swimming freely for a short time by the aid of five girdles of ciliated cells. If in the course of the first twenty-four hours this larva meet with a tadpole it attaches itself at once and undergoes further development. If unsuccessful it dies. In the former case the larva creeps along the tadpole until it reaches the branchial opening into which it darts, fixes its sucker, and then throws off its cilia. Its further development takes place partly in the branchial chamber and partly in the bladder, which it reaches by travelling the whole length of the alimentary canal. In the former position the suckers are developed and growth proceeds for 8 to 10 weeks until the metamorphosis of its host. In the bladder it remains for three years before attaining maturity. Sometimes the *Polystomum*-larva attaches itself to a young tadpole, and in that case grows so rapidly as to become mature in five weeks. These *Polystomum* deposit their eggs in the branchial chamber and die at the metamorphosis of their host. They differ structurally from the normal form in being capable of self-fertilization only, and in the shape and details of their spermatozoa.

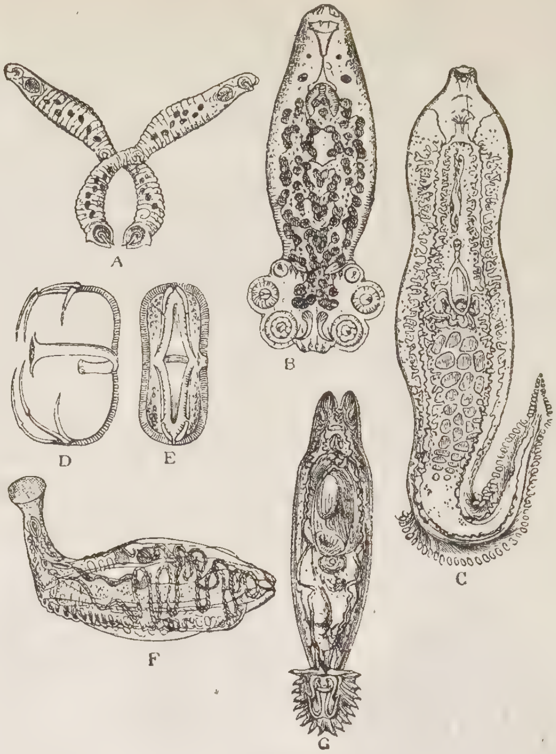


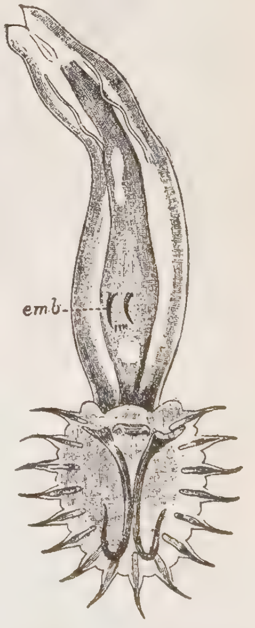
FIG. 5.

A, *Diplozoon paradoxum*; two united specimens.
B, *Polystomum integerrimum.* (×about 100; after Zeller.)
C, *Microcotyle mormyri.*
D, E, Two views of the chitinous framework of a sucker of *Axine belones*; highly magnified (after Lorenz).
F, *Aspidogaster conchicola.* (×about 25; after Aubert.)
G, *Gyrodactylus elegans.* (×about 80; after Wagener.)

The life-history of *Diplozoon* (fig. 5) is remarkable in that two larvae (the so-called *Diporpae*) unite and fuse permanently into an X-shaped organism. Unless this occurs, the development of the larvae is soon arrested. The ciliated stage is only capable of free life for five or six hours, and if at the end of that time it has not encountered and attached itself to a minnow, it dies. If successful, the larva throws off its cilia and develops a dorsal papilla, a median ventral sucker and an additional pair of lateral suckers. Then the *Diporpa* stage is attained. This stage is capable of isolated existence for two or three months but remains immature. Should it, however, encounter another *Diporpa*, the mid-ventral sucker of either is applied to the dorsal papilla of the other, and complete fusion takes place across the junction. The compound organism now develops two sets of inter-connected genitalia and becomes a *Diplozoon*.

Gyrodactylus produces only one large egg at a time and this develops *in situ* into an embryo: but within this embryo another appears before the first leaves the parent. This anomalous phenomenon is still obscure, for we do not yet know whether the second embryo is developed sexually or asexually from the first. Von Linstow has indeed suggested that *Gyrodactylus* is a larval form capable of reproduction by an asexual method.

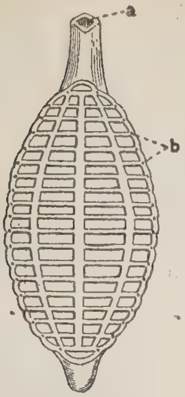
Order 2. *Aspidocotylea.*—Endoparasitic Trematodes provided with a large ventral sucker which is almost co-extensive with the lower surface of the body and is divided into rectangular compartments. The alimentary sac is simple and devoid of caeca. The development is direct.



(After v. Nordmann. From *Cambridge Natural History*, vol. ii. "Worms, &c," by permission of Macmillan & Co., Ltd.)

FIG. 6.—*Gyrodactylus elegans* from the fins of the Stickleback; *emb.* embryo.

These Trematodes occur in the alimentary canal and adjacent organs of Mollusca, the gall-bladder of *Chimaera*, and the intestine of Chelonia and of certain fish. *Aspidogaster conchicola* is a form not uncommon in *Anodon*, *Unio* and certain fresh-water Gastropods. When young it is found in the intestine, but becomes mature in "Keber's organ" and the pericardium. An allied form (*A. margaritiferae*) occurs in the pericardium of the Ceylon pearl-oyster (9).



(After Monticelli. From Lankester's *Treatise on Zoology*, part iv.)

FIG. 7.—*Aspidogaster conchicola*; ventral aspect; *a*, mouth; *b*, marginal sense organs.

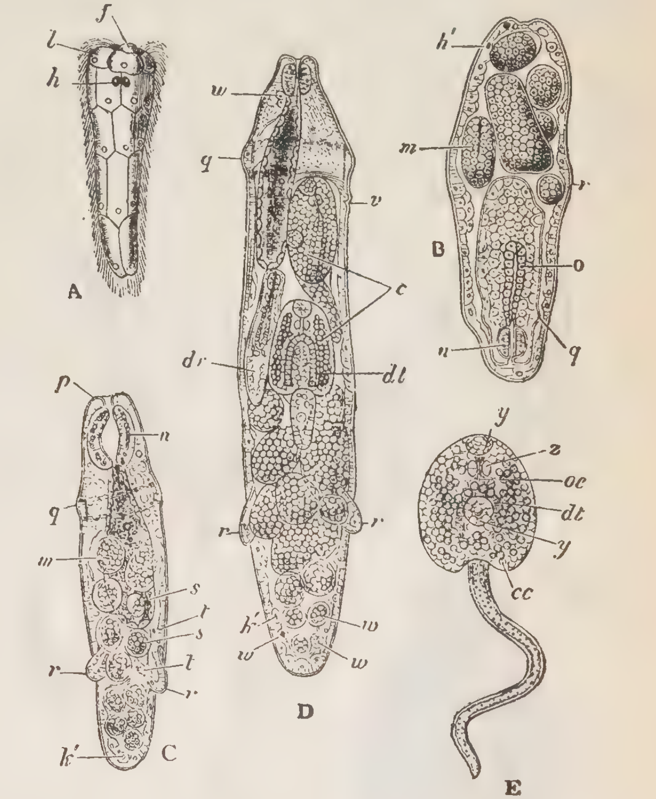
This order differs in several points from the preceding one. The excretory system is highly developed and opens at the posterior extremity by a paired muscular bladder. The testis is a single compact organ. From the oviduct a long duct full of yolk passes backwards almost to the hinder end of the body and ends blindly in a globular dilatation just below the skin. This structure is regarded as the homologue of a canal (Laurer's canal) which in the Heterocotylea opens into the intestine and so gets rid of the excess of yolk. The life-history of the order is almost unknown, but at the time of hatching the young Aspidocotylean has an oral sucker at the anterior extremity and an equally simple post-oral one at the other, thus resembling the members of the next order. Subsequently the body grows backwards and the ventral sucker comes to occupy a relatively more anterior position. Concomitantly its cavity is sub-divided by transverse ridges into a single row and later on into paired rows of compartments. A curious form (*Stichocotyle*) described in an immature condition by Cunningham from the lobster and Norway lobster probably belongs to this order.

Order 3. *Malacocotylea* (Distomae, Leuck: Digenea v. Ben.). Endoparasitic Trematodes with a variable adhesive apparatus. The oral sucker may alone be present (Monostomidae), more usually a second is developed on the under surface, but may be mid-ventral (Distomidae) or terminal. It is posterior (Amphistomidae), or anterior (Gasterostomidae). In addition to these suckers the sides of the anterior region may become infolded and give rise to an accessory adhesive organ (Holostomidae). In all these families spines and glandular papillae may be super-added. The intestinal sac has become bifid and is usually devoid of branches. The excretory system is highly developed; the larger collecting ducts are elaborately looped and open posteriorly by a single terminal aperture. A canal (Laurer's canal) leads from the oviduct or yolk-duct to the dorsal surface. The development is indirect. From the egg a larva arises. This enters a temporary host. Here it gives rise by a peculiar process to numerous individuals of a second larval form, and these usually produce a third form from which the minute immature Trematode is developed. In this manner a single egg may give rise to a large number of sexual individuals. The larvae usually live in Molluscs, the mature worm in vertebrates, and the immature but metamorphosed Trematode in either host and also in pelagic and littoral marine and fresh-water invertebrates.

The Malacocotylea occur in all classes of vertebrates. They are usually found in the alimentary canal or its appendages but occasionally work their way into the serous cavities, nervous system and blood vessels. Fourteen species belonging to five genera have been found in man, but only one [*Schistostomum* (*Bilharzia*) *haematobium*] is of serious medical importance, the others being rare and occasioned by want of cleanliness and close association with infected domestic animals. Domestic animals suffer periodically to a much greater extent. The liver-fluke (*Distomum hepaticum*) unlike most Trematodes flourishes in a wide range of hosts and infects man, horse, deer, oxen, sheep, pig, rabbit and kangaroo. Sheep, how ever, suffer most from this parasite and from the allied *D. magnum*. The former fluke is found in Europe, North Africa, Abyssinia, North Asia, South America, Australia and the Hawaiian Islands; the latter in the United States. Wet summers are followed by an acute outbreak of liver-rot amongst sheep and this, together with the effects of other diseases that accompany wet seasons, cause the death of vast numbers of sheep, the numbers from both sources being estimated in bad years at from 1½ to 3 millions in England alone. The anatomy of *Distomum hepaticum* is fully described in many accessible memoirs [Sommer (10), Marshall and Hurst, Braun (3)]. It has been shown that this parasite feeds upon the blood, not the bile of its host, though it occurs mainly in the bile ducts.

The life-histories of the Malacocotylea form the most interesting feature of the order. The majority of species are hermaphrodite and many are capable of self-impregnation. In these, the male organs ripen before the ova and spermatozoa may pass into the uterus before the external pore is formed (Looss). A few species, however, are bisexual, *e.g. Schistostomum* (*Bilharzia*) *haematobium* in which the male is larger than the female and encloses the latter in a ventral canal; *Koellikeria filicolle* Rud (*Distomum okenii*, Köll) which also occurs in pairs, a large female and a small male being found together encysted in the branchial chamber of *Brama raji*: and *Didymozoon thynni* (*Monostomum bipartitum*) which occurs in pairs fused for the greater part of their length and only free anteriorly; the larger individual is the female.

The egg consists of a fertilized ovum and a mass of yolk-cells. Segmentation takes place during its passage down the uterus. The result of this process is a minute ovoid embryo consisting of a solid mass of cells surrounded by a follicle of flattened yolk-cells. The central mass soon becomes differentiated into an outer epidermal and a dermal layer of flat-cells. Some of the central cells remain in clumps as "germ-balls," others form a mesenchyma in which "flame-cells" arise; others again give rise to muscles; and at the thicker end of the body, rudiments of the brain and digestive system are observable. A pair of "eye-spots" develops immediately over the brain. If the egg with its contained embryo falls into water with the faeces of the host the larva hatches out and swims freely for a time. In dry localities or in the absence of the intermediate host (usually a mollusc) this larva soon dies. If, however, it encounters the host the larva bores its way in, and attacks the liver, mouth or gonad in which it comes to rest. In all Malacocotylea except the Holostomidae the ensuing change is a degenerative one. The cilia are lost, the eye-spots disappear, the digestive sac vanishes and the larva becomes a sac or "sporocyst" full of germ-cells. The origin of these cells is a moot point. According to some writers (Leuckart) they are derived from undifferentiated blastomeres, other authorities (Thomas, Biehringer, Heckert) trace them to the parietal cells of the larva. These cells aggregated in masses become the bodies of another generation of larvae within the sporocyst. By a series of changes similar to those by which the primary larva arose from a segmented egg, so do these secondary larvae or "rediae" arise from the germ-cells or germ-balls within the sporocyst. The structure of a redia, however, is an advance on that of its parent. Though not possessing eyes or cilia, it has a pharynx and short straight digestive sac: and its mesenchymatous cavities are filled with germ-balls in various stages of development.



(All from Marshall and Hurst, after Thomas.)

FIG. 8.—Five stages in the life-history of *Fasciola hepatica*; all highly magnified.

A, The free-swimming embryo. B, A sporocyst containing young rediae. C, A young redia, the digestive tract shaded. D, An adult redia, containing a daughter-redia, two almost mature cercariae, and germs. E, A free cercaria. The letters have the same significance throughout.

c, Nearly ripe cercariae; *cc*, cystogenous cells; *dr*, daughter-redia; *dt*, limbs of the digestive tract; *f*, head-papilla; *h*, eye-spots; *h'*, same degenerating; *k'*, germinal cell; *l*, cells of the anterior row; *m*, embryo in optical section, gastrula stage; *n*, pharynx of redia; *o*, digestive sac; *oe*, oesophagus.

p, Lips of redia; *q*, collar; *r*, processes serving as rudimentary feet; *s*, embryos; *t*, trabecula crossing body-cavity of redia; *u*, glandular cells; *v*, birth-opening; *w*, *w'*, morulae; *y*, oral sucker; *y'*, ventral sucker; *z*, pharynx.

The movements and activity of the redia cause it to burst the wall of the sporocyst. It escapes into the adjacent tissue and there gives rise either to one or more generations of rediae or at once to a new type of organism—the cercaria. What determines the origin of the cercaria rather than a new generation of rediae is unknown. It originates from germ-balls by a differentiation similar in general to that already described, though profoundly different in detail. The cercaria is just visible to the naked eye and has an oval or discoidal body and usually a long tail of variable form. The tail may be a simple hollow muscular process or provided with stiff bristles set in transverse rows, or divided into two equally long processes, or finally it may form a large vesicular structure The body contains in miniature all the organs of the adult fluke, including the gonads and in addition "eye-spots," a stylet, rod-cells and cystogenous cells. The latter structures are only employed for an interval before the final host is entered.

The number of cercariae produced by the pullulating rediae in a single water-snail is immense, and as they are emitted at a given period or a few successive periods, the snail at these times appears enclosed in a cloud of whitish flocculent matter. The cercaria swims freely for a time and either encysts directly on grass or weeds or it enters a second host which may be another mollusc, an insect, crustacean or fish, and then encysts. In this process it is aided by the stylet with which it actively bores its way, throws off its tail and then, surrounding itself with the secretion of its cystogenous cells, comes to rest. The further development of the cercaria is dependent on the weed or animal in which it lies being eaten by the final host which is usually a predaceous fish or one of the higher vertebrates. When that occurs, the cyst is dissolved and the minute fluke works its way down the alimentary canal into some part of which it inserts its suckers and commences to feed on the blood of its host. Occasionally the fluke migrates into the blood vessels and may reach the lungs, kidneys, urethra and bladder. In the course of a few months it attains full size and maturity and probably in most cases dies in the course of a year after having given rise to another generation of larvae.

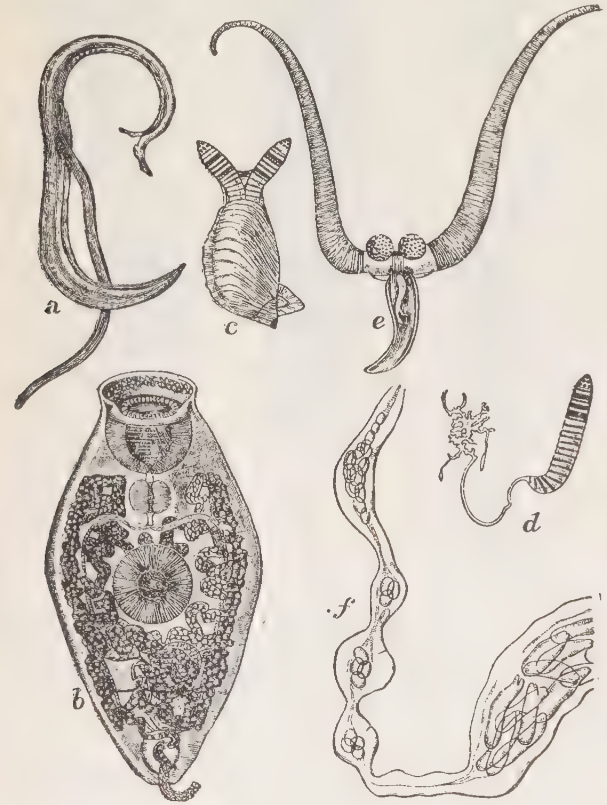


FIG. 9.

A, *Schistostomum* (*Bilharzia*) *haematobium*, the thin female in the gynaecophoric canal of the stouter male. (after Leuckart).

B, *Distomum macrostomum*, showing the digestive and the greater part of the genital apparatus with the cirrus protruded.

C, Snail (*Succinea*), the tentacles deformed by *Leucochloridium*. (Natural size.)

D, *Leucochloridium* removed from the tentacle. (Natural size; after Zeller.)

E, *Bucephalus polymorphus*. (Highly magnified; after Ziegler.)

F, Portion of a sporocyst containing *Bucephali* in process of development. (× about 50; after Lacaze-Duthiers.)

A few special cases of this general description of the life-history may be mentioned. The liver-fluke (*Distomum hepaticum*) passes through its larval stages in the water snail *Limnaea truncatula* in Europe; in *L. oahuensis* in the Hawaiian Islands; in *L. viator* in South America and in *L. humilis* in North America: and is eaten by sheep during its encysted stage attached to herbage. *Distomum macrostomum*, which occurs in various birds, produces a very curious sporocyst in the body of the snail *Succinea putris*. This sporocyst assumes a branched structure and penetrates into the tentacles of the snail (fig. 9, *c*, *d*). In this situation it becomes much swollen and banded with colours, and produces a large number of ecaudate cercariae. The attention of birds is speedily attracted to the snail by this appearance and by the peculiar movements which the worm executes, and the passage of the parasite into its final host is advantageously effected. In many cases it appears that only the brilliantly coloured tentacle is pecked off by the bird, and as the snail can easily regenerate a new one, this in turn becomes infected by a fresh branch of the sporocyst ramifying through the snail and thus a new supply of larvae is speedily provided (Heckert).

The life-history of *Schistostomum haematobium* is still unknown, but the difficulty in obtaining developmental stages in any of the numerous intermediate hosts that have been tried suggests that the ciliated larvae may develop directly in man and either gain access to him by the use of impure water for drinking or may perforate his skin when bathing. Experiments on monkeys have, however, given negative results.

The life-history of the Holostomidae differs from that of the Distomidae in an important regard. These Trematodes live chiefly in the intestine of aquatic birds or reptiles. The ciliated larva escapes from the egg into the water and enters an intermediate host (leech, mollusc, arthropod, batrachian or fish) where it undergoes a metamorphosis into a second stage in which most of the adult organs are present. In this condition they remain encysted as immature flukes until eaten by their final host.

The cycle of development taken by the Malacocotylea has been generally regarded as an alternation of one or more asexual generations with a sexual one. The question, however, is complicated by the uncertain nature of the germ-cells in the sporocysts and rediae. Some authors looking upon these as parthenogenetic ova regard the developmental cycle as one composed of an alternation of parthenogenetic and of sexual generations. Others again consider that the whole cycle is a metamorphosis which, beginning in the Heterocotylea as a direct development, has become complicated in the Holostomidae by a larval history, and finally in the Malacocotylea has acquired additional complexity by the intercalation of two larval forms, and is thus spread over several generations.

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TREMOLITE, a member of the amphibole group of rock-forming minerals (see AMPHIBOLE). It is a calcium and magnesium metasilicate, $CaMg_3(SiO_3)_4$, crystallizing in the monoclinic system with an angle of 55° 49′ between the perfect prismatic cleavages. It occurs sometimes as distinct crystals, but more usually as long bladed and fibrous forms. The colour is white or grey, but when iron is present it is green, then forming a passage to actinolite. The hardness is $5\frac{1}{2}$ and the specific gravity 3·0. Tremolite is a characteristic mineral of crystalline limestones, especially dolomitic limestones, but also occurs as an alteration-product of olivine in basic igneous rocks. Typical specimens have long been known from the white crystalline dolomite of Campolongo in the St Gotthard region, Switzerland, near to which is the Tremola Valley, after which the mineral was named in 1796. Fine crystals are found in crystalline limestone at Gouverneur, Pierrepont and other places in New York, and at several localities in Sweden. (L. J. S.)

TRENCH, RICHARD CHENEVIX (1807–1886), Anglican archbishop and poet, was born at Dublin on the 9th of September 1807. He went to school at Harrow, and graduated at Trinity College, Cambridge, in 1829. In 1830 he visited Spain. While incumbent of Curdridge Chapel near Bishops Waltham in Hampshire, he published (1835) *The Story of Justin Martyr and Other*

Poems, which was favourably received, and was followed in 1838 by *Sabbation, Honor Neale, and other Poems*, and in 1842 by *Poems from Eastern Sources*. These volumes revealed the author as the most gifted of the immediate disciples of Wordsworth, with a warmer colouring and more pronounced ecclesiastical sympathies than the master, and strong affinities to Tennyson, Keble and Monckton Milnes. In 1841 he resigned his living to become curate to Samuel Wilberforce, then rector of Alverstoke, and upon Wilberforce's promotion to the deanery of Westminster in 1845 he was presented to the rectory of Itchenstoke. In 1845 and 1846 he preached the Hulsean lecture, and in the former year was made examining chaplain to Wilberforce, now bishop of Oxford. He was shortly afterwards appointed to a theological chair at King's College, London. In 1851 he established his fame as a philologist by *The Study of Words*, originally delivered as lectures to the pupils of the Diocesan Training School, Winchester. His purpose, as stated by himself, was to show that in words, even taken singly, "there are boundless stores of moral and historic truth, and no less of passion and imagination laid up"—a truth enforced by a number of most apposite illustrations. It was followed by two little volumes of similar character—*English Past and Present* (1855) and *A Select Glossary of English Words* (1859). All have gone through numerous editions and have contributed much to promote the historical study of the English tongue. Another great service to English philology was rendered by his paper, read before the Philological Society, "On some Deficiencies in our English Dictionaries" (1857), which gave the first impulse to the great Oxford *New English Dictionary*. His advocacy of a revised translation of the New Testament (1858) aided to promote another great national undertaking. In 1856 he published a valuable essay on Calderon, with a translation of a portion of *Life is a Dream* in the original metre. In 1841 he had published his *Notes on the Parables*, and in 1846 his *Notes on the Miracles*, popular works which are treasuries of erudite and acute illustration.

In 1856 Trench was raised to the deanery of Westminster, probably the position which suited him best. Here he instituted evening nave services. In January 1864 he was advanced to the more dignified but less congenial post of archbishop of Dublin. A. P. Stanley had been named, but rejected by the Irish Church, and, according to Bishop Wilberforce's correspondence, Trench's appointment was favoured neither by the prime minister nor the lord-lieutenant. It was, moreover, unpopular in Ireland, and a blow to English literature; yet the course of events soon proved it to have been most fortunate. Trench could do nothing to prevent the disestablishment of the Irish Church, though he resisted with dignity. But, when the disestablished communion had to be reconstituted under the greatest difficulties, it was found of the highest importance that the occupant of his position should be a man of a liberal and genial spirit. This was the work of the remainder of Trench's life; it exposed him at times to considerable misconstruction and obloquy, but he came to be appreciated, and, when in November 1884 he resigned his archbishopric from infirmity, clergy and laity unanimously recorded their sense of his "wisdom, learning, diligence, and munificence." He had found time for *Lectures on Medieval Church History* (1878); his poetical works were rearranged and collected in two volumes (last edition, 1885). He died in London, after a lingering illness, on the 28th of March 1886.

See his *Letters and Memorials* (2 vols., 1886).

TRENCHARD, SIR JOHN (1640–1695), English politician, belonged to an old Dorset family, his father being Thomas Trenchard (1615–1671), of Wolverton, and his grandfather Sir Thomas Trenchard (1582–1657), also of Wolverton, who was knighted by James I. in 1613. Born at Lytchett Matravers, near Poole, on the 30th of March 1640, and educated at New College, Oxford, John Trenchard entered parliament as member for Taunton in 1679, and associated himself with those who proposed to exclude the duke of York from the throne. He attended some of the meetings held by these malcontents and was possibly concerned in the Rye House plot; at all events he was arrested in July 1683, but no definite evidence was brought against him and he was released. When Monmouth landed in the west of England in June 1685 Trenchard fled from England, but was pardoned through the good offices of William Penn and returned home two years later. Again he entered parliament, but he took no active part in the Revolution of 1688, although he managed to secure the good will of William III. He was knighted by the king and made chief justice of Chester, and in 1692 he was appointed a secretary of state. He and the government incurred much ridicule through their failure to prove the existence of a great Jacobite plot in Lancashire and Cheshire in which they had been led to believe. Sir John died on the 27th of April 1695. His wife was Philippa (d. 1743), daughter of George Speke (d. 1690) of White Lackington, Somerset.

Another member of the Trenchard family was the writer, John Trenchard (1662–1723), erroneously referred to by Macaulay as a son of Sir John Trenchard. Educated at Trinity College, Dublin, Trenchard inherited considerable wealth and was thus able to devote the greater part of his life to writing on political subjects, his point of view being that of a Whig and an opponent of the High Church party. His chief works are *A Short History of Standing Armies in England* (1698 and 1731) and *The Natural History of Superstition* (1709). With Thomas Gordon (d. 1750) he produced a weekly periodical, *The Independent Whig*, and with the same colleague he wrote a number of letters to the *London Journal* and to the *British Journal* under the pseudonym of Cato. These letters were published in four volumes in 1724 and the collection has often been reprinted. Trenchard died on the 17th of December 1723.

TRENCHER (M. Eng. *trenchour*, *trenchere*, &c., O. Fr. *trencheoir trenchoier*, a place on which to cut up food, from *trencher*, mod. *trancher*, to cut, probably from Lat. *truncare*, lop, cut off, or from *transecare*, to cut across), a platter, being a flat piece of wood, in its earliest form square, later circular, on which food was carved or cut up and served. These wooden "trenchers" took the place of earlier ones which were thick slices of coarse bread; these, after being soaked with the gravy and juices from the meat and other food were eaten or thrown to the alms basket for the poor. The wooden trencher went out of use on the introduction of pottery and later of porcelain plates. At Winchester College, the old square beechwood trenchers are still in use. The potters of the 18th century made earthenware plates very flat and with a shallow rim; these were known as "trencher plates." "Trencher salt-cellars" were the small salts placed near each person for use, as opposed to the ornamental "standing" salts.

For "trench," a ditch, and "entrenchment," see Fortification and Siegecraft.

TRENCK, FRANZ, Freiherr von der (1711–1749), Austrian soldier, was born on the 1st of January 1711, of a military family. Educated by the Jesuits at Oedenburg, he entered the Imperial army in 1728 but resigned in disgrace three years later. He then married and lived on his estates for some years. Upon the death of his wife in 1737 he offered to raise an irregular corps of "Pandours" for service against the Turks, but this offer was refused and he then entered the Russian army. But after serving against the Turks for a short time as captain and major of cavalry he was accused of bad conduct, brutality and disobedience and condemned to death, the sentence being commuted by Field Marschal Münnich to degradation and imprisonment. After a time he returned to Austria, where his father was governor of a small fortress, but there too he came into conflict with every one and actually "took sanctuary" in a convent in Vienna. But Prince Charles of Lorraine, interesting himself in this strange man, obtained for him an amnesty and a commission in a corps of irregulars. In this command, besides his usual truculence and robber manners, he displayed conspicuous personal bravery, and in spite of the general dislike into which his vices brought him his services were so valuable that he was promoted lieutenant-colonel (1743) and colonel (1744). But at the battle of Soor he and his irregulars plundered when they should have been fighting and Trenck was accused (probably falsely) of having allowed the king of Prussia himself to escape. After a time he was brought before a court-martial in Vienna, which convicted him of having sold and withdrawn commissions to his officers without the queen's leave, punished his men without heed to the military code, and drawn pay and allowance for fictitious men. Much was allowed to an irregular officer in all these respects, but Trenck had far outrun the admitted limits, and above all his brutalities and robberies had made him detested throughout Austria and Silesia. A death sentence followed, but the composition of the court-martial and its proceedings were thought to have been such as from the first forbade a fair trial, and the sentence was commuted by the queen into one of cashiering and imprisonment. The rest of his life was spent in mild captivity in the fortress of Spielberg, where he died on the 4th of October 1749.

His cousin, **Friedrich, Freiherr von der Trenck** (1726–1794), the writer of the celebrated autobiography, was born on the 16th of February 1726 at Königsberg, his father being a Prussian general. After distinguishing himself for his quickness and imagination at the university of Königsberg, he entered the Prussian army in 1742, and soon became an orderly officer on Frederick's own staff. But within a year he fell into disgrace because of a love affair—whether real or imaginary—with the king's sister Princess Amalie, and when in 1743 his Austrian cousin presented him with a horse and opened a correspondence, Frederick had him arrested, a few days after the battle of Soor, and confined in the fortress of Glatz, whence in 1746 he escaped. Making his way home and thence to Vienna, in the vain hope of finding employment under his now disgraced cousin, he finally met a Russian general, who took him into the Russian service But, receiving news that owing to his cousin's death he had become the owner of the family estates, he returned to Germany almost immediately He was made a captain of Austrian cavalry, but never served, as his time was fully taken up with litigation connected with the inherited estates. In 1754 he visited Prussia, but was there arrested and confined in Magdeburg for ten years, making frequent attempts, of incredible audacity, to escape from the harshness of his gaolers. But after the close of the Seven Years' War, Maria Theresa requested that he should, as being a captain in her service, be at once released. Trenck then spent some years in Aix-la-Chapelle, managing an agency for Hungarian wines and publishing a newspaper, and on the failure of these enterprises he returned to his Hungarian estates. Here he composed his celebrated autobiography and many other writings. He visited England and France in 1774–1777, and was afterwards employed by the government in diplomatic or secret service missions. After the death of Frederick the Great he was allowed to enter Prussia, and stayed in Berlin for two years. In 1788 he visited Paris, where he was the hero of society for a moment; next year he returned to Hungary in order to collect his writings in a uniform edition, but in 1791 he returned to Paris to be a spectator of the Revolution, and after living in safety throughout the Terror he was at last denounced as an Austrian spy and guillotined on the 25th of July 1794.

His autobiography, which has been translated into several languages, first appeared in German at Berlin and Vienna (13 vols.) in 1787. Shortly afterwards a French version, by his own hand, was published at Strassburg. His other published works are in eight volumes and appeared shortly after the autobiography at Leipzig. A reprint of the autobiography appeared in 1910 in "Reclam's Universal Series."

See Wahrmann, *Leben und Thaten des Franz, Freiherr von der Trenck* and *Friedrich Freiherrn von der Trencks Leben, Kerker und Tod* (both published at Leipzig in 1837).

TRENDELENBURG, FRIEDRICH ADOLF (1802–1872), German philosopher and philologist, was born on the 30th of November 1802 at Eutin, near Lübeck. He was educated at the universities of Kiel, Leipzig and Berlin. He became more and more attracted to the study of Plato and Aristotle, and his doctor's dissertation (1826) was an attempt to reach through Aristotle's criticisms a more accurate knowledge of the Platonic philosophy (*Platonis de ideis et numeris doctrina ex Aristotele illustrata*). He declined the offer of a classical chair at Kiel, and accepted a post as tutor to the son of an intimate friend of Altenstein, the Prussian minister of education. He held this position for seven years (1826–1833), occupying his leisure time with the preparation of a critical edition of Aristotle's *De anima* (1833; 2nd ed. by C. Belger, 1877). In 1833 Altenstein appointed Trendelenburg extraordinary professor in Berlin, and four years later he was advanced to an ordinary professorship. For nearly forty years he proved himself markedly successful as an academical teacher, during the greater part of which time he had to examine in philosophy and pedagogics all candidates for the scholastic profession in Prussia. In 1865 he became involved in an acrimonious controversy on the interpretation of Kant's doctrine of Space with Kuno Fischer, whom he attacked in *Kuno Fischer und sein Kant* (1869), which drew forth the reply *Anti-Trendelenburg* (1870). He died on the 24th of January 1872.

Trendelenburg's philosophizing is conditioned throughout by his loving study of Plato and Aristotle, whom he regards not as opponents but as building jointly on the broad basis of idealism. His own standpoint may almost be called a modern version of Aristotle thus interpreted. While denying the possibility of an absolute method and an absolute philosophy, as contended for by Hegel and others, Trendelenburg was emphatically an idealist in the ancient or Platonic sense; his whole work was devoted to the demonstration of the ideal in the real. But he maintained that the procedure of philosophy must be analytic, rising from the particular facts to the universal in which we find them explained. We divine the system of the whole from the part we know, but the process of reconstruction must remain approximative. Our position forbids the possibility of a final system. Instead, therefore, of constantly beginning afresh in speculation, it should be our duty to attach ourselves to what may be considered the permanent results of historic developments. The classical expression of these results Trendelenburg finds mainly in the Platonico-Aristotelian system. The philosophical question is stated thus: How are thought and being united in knowledge? how does thought get at being? and how does being enter into thought? Proceeding on the principle that like can only be known by like, Trendelenburg next reaches a doctrine peculiar to himself (though based upon Aristotle) which plays a central part in his speculations. Motion is the fundamental fact common to being and thought; the actual motion of the external world has its counterpart in the constructive motion which is involved in every instance of perception or thought. From motion he proceeds to deduce time, space and the categories of mechanics and natural science. These, being thus derived, are at once subjective and objective in their scope. It is true matter can never be completely resolved into motion, but the irreducible remainder may be treated like the πρώτη ὕλη of Aristotle as an abstraction which we asymptotically approach but never reach. The facts of existence, however, are not adequately explained by the mechanical categories. The ultimate interpretation of the universe can only be found in the higher category of End or final cause. Here Trendelenburg finds the dividing line between philosophical systems. On the one side stand those which acknowledge none but efficient causes—which make force prior to thought, and explain the universe, as it were, *a tergo*. This may be called, typically, Democritism. On the other side stands the "organic" or teleological view of the world, which interprets the parts through the idea of the whole, and sees in the efficient causes only the vehicle of ideal ends. This may be called in a wide sense Platonism. Systems like Spinozism, which seem to form a third class, neither sacrificing force to thought nor thought to force, yet by their denial of final causes inevitably fall back into the Democritic or essentially materialistic standpoint, leaving us with the great antagonism of the mechanical and the organic systems of philosophy. The latter view, which receives its first support in the facts of life, or organic nature as such, finds its culmination and ultimate verification in the ethical world, which essentially consists in the realization of ends. Trendelenburg's *Naturrecht* may, therefore, be taken as in a manner the completion of his system, his working out of the ideal as present in the real. The ethical end is taken to be the idea of humanity, not in the abstract as formulated by Kant, but in the context of the state and of history. Law is treated throughout as the vehicle of ethical requirements. In Trendelenburg's treatment of the state, as the ethical organism in which the individual (the potential man) may be said first to emerge into actuality, we may trace his nurture on the best ideas of Hellenic antiquity.

Trendelenburg was also the author of the following: *Elementa logices Aristotelicae* (1836; 9th ed., 1892; Eng. trans., 1881), a selection of passages from the *Organon* with Latin translation and notes, containing the substance of Aristotle's logical doctrine, supplemented by *Erläuterungen zu den Elementen der Aristotelischen Logik* (1842; 3rd ed. 1876); *Logische Untersuchungen* (1840; 3rd ed. 1870), and *Die logische Frage in Hegels System* (1843), important factors in the reaction against Hegel; *Historische Beiträge zur Philosophie*

(1846–1867), in three volumes, the first of which contains a history of the doctrine of the Categories; *Das Naturrecht auf dem Grunde der Ethik* (1860); *Lücken im Völkerrecht* (1870), a treatise on the defects of international law, occasioned by the war of 1870. A number of his papers dealing with non-philosophical, chiefly national and educational subjects, are collected in his *Kleine Schriften* (1871).

On Trendelenburg's life and work see H. Bonitz, *Zur Erinnerung an F.A.T.* (Berlin, 1872); P. Kleinert, *Grabrede* (Berlin, 1872); E. Bratuschek, *Adolf Trendelenburg* (Berlin, 1873); C. von Prantl, *Gedächtnissrede* (Munich, 1873); G. S. Morris in the *New Englander* (1874), xxxiii.

TRENT (Lat. *Tridentum*; Ital. *Trento*; Ger. *Trient*), the capital of the south or Italian-speaking portion of the Austrian province of Tirol. It stands on the left bank of the Adige where this river is joined by the Fersina, and is a station on the Brenner railway, 35 m. S. of Botzen and 56½ m. N. of Verona. It has a very picturesque appearance, especially when approached from the north, with its embattled walls and towers filling the whole breadth of the valley. A conspicuous feature in the view is the isolated rocky citadel of Doss Trento (the Roman *Verruca*), that rises on the right bank of the Adige to a height of 308 ft. above the city and is now very strongly fortified, as are various other positions near Trent giving access to Trent from the east (Val Sugana) or the west (valley of the Sarca). With its numerous palaces, substantial houses, broad streets, and spacious squares, Trent presents the aspect of a thoroughly Italian city, and its inhabitants (24,868 in 1900, including a garrison of over 2000 men) speak Italian only—it is the centre of the region called *Italia Irredenta* by fervent Italian patriots. The Duomo or cathedral church (dedicated to San Vigilio, the first bishop) was built in four instalments between the 11th and 15th centuries, and was restored in 1882–1889. More interesting historically is the church of Santa Maria Maggiore, built in 1514–1539, and the scene of the sessions of the famous Ecumenical Council (as to which, see below) which lasted, with several breaks, from 1545 to 1563; near it, in the open, a column was erected in 1845, on the occasion of the three hundredth anniversary of the opening of the Council. To the east of the city rises the Castello del Buon Consiglio, for centuries the residence of the prince-bishops, but now used as barracks. There is a huge town hall, which also houses the museum and the very extensive town library. Trent lives rather on its historical souvenirs than on its industries, which are not very extensive, viticulture, silk-spinning and the preparation of salami (a strongly spiced kind of Italian sausage) being the chief. Ecclesiastically Trent is a suffragan see of the archbishopric of Salzburg. Opposite the railway station a statue of Dante was erected in 1896, for he is believed to have visited this region about 1304.

Trent was originally the capital of the Tridentini, and is mentioned in the *Antonine Itinerary* as a station on the great road from Verona to Veldidena (Innsbruck) over the Brenner. It was later ruled by the Ostrogoths (5th century) and the Lombards (6th century) after the conquest of whom by the Franks (774) Trent became part of the kingdom of Italy. But in 1027 the emperor Conrad II. bestowed all temporal rights in the region on the bishop (the see dates from the 4th century) and transferred it to Germany, an event which fixed all its later history. The Venetian attacks were finally repulsed in 1487, and the bishop retained his temporal powers till 1803 when they passed to Austria, to which (save 1805–1814, when first the Bavarians and then Napoleon held the region) they have ever since belonged, the Trentino being annexed formally to Tirol in 1814. (W. A. B. C.)

TRENT, COUNCIL OF. The Council of Trent (1545–1563) has a long antecedent history of great significance for the fortunes of the Catholic Church. During the 15th and the earlier half of the 16th century, the conception of an "ecumenical council" remained an ideal of which the realization was expected to provide a solution for the serious ecclesiastical difficulties which were then prevalent. True, the councils of Constance and Basel had fallen short of the desired goal; but confidence in the unknown quantity persisted and took deeper root as the popes of the Renaissance showed themselves less and less inclined to undertake the reforms considered necessary in wide circles of the Church. The papacy indeed did not recognize the jurisdiction of the ecumenical council, and in 1459 Pius II. had prohibited any appeal to such a tribunal under penalty of excommunication. This, however, had no effect on public opinion, and the council continued to be invoked as the supreme court of Christianity. So in 1518, for instance, the university of Paris demanded the convocation of a general council, to which it referred its solemn protest against the papal encroachments on the privileges of the French Church. Thus, when Luther took this very step in the same year, and repeated it later, his action was not devoid of precedent. Again in 1529 the evangelical estates of Germany made a formal appeal in the Diet of Spires, and, in the preface to the Augsburg Confession of 1530, requested a "general, unfettered council of Christendom." The same demand was formulated by Charles V. The emperor indeed—though, as a statesman, he had found himself in frequent opposition to the papal policy of his day—had never entertained the slightest doubt as to the truth of Catholic doctrine, and had rendered inestimable services to the Church in the perilous years which followed the emergence of Protestantism. Still he could not blind himself to the fact that ecclesiastical life stood in urgent need of reform; and the only method of effecting an alteration in the existing régime was by means of a council. Consequently he declared himself in favour of convening a general assembly of the church—a project which he pursued with the greatest energy. True, the passive resistance of the Curia was so stubborn that the decisive step was postponed time and again. But the goal was finally attained, and this result was essentially the work of Charles. Actually, the meeting came too late: the Evangelical Church had gathered strength in the interim, and the council failed to exercise the decisive influence anticipated on the relations between Catholicism and Protestantism. In 1536 its convocation seemed imminent. Pope Paul III., who in the conclave had already admitted the necessity of a council, convened it on the 2nd of June 1536, for the 23rd of May 1537, at Mantua. He then altered the date to the 1st of November of the same year. Later it was summoned to meet at Vicenza on the 1st of May 1538, only to be postponed till the Easter of 1539. Finally, he adjourned the execution of the project *sine die.* Charles met this dilatory policy by arranging colloquies between Protestant and Catholic at Worms and Regensburg, the result being that the Curia became afraid that the emperor might take the settlement of the religious question into his own hands. This consideration forced Paul III. to compliance, and fresh writs were issued convoking the council, first for Whitsuntide, 1542, then for the 1st of November of the same year. In consequence, however, of the hostilities between Charles and the French king Francis I., the conference was so scantily attended that it was once more prorogued to the 6th of July 1543, before it had come into active existence. Not till the peace of Crespy, 1544, when the emperor showed some disposition to attempt an accommodation of the ecclesiastical feud in a German Diet, did the pope resolve to translate his numerous promises into deeds. The bull *Laetare Hierusalem* (November 19, 1544) fixed the meeting of the council for the 15th of March 1545, in Trent, and assigned it three tasks: (1) the pacification of the religious dispute by doctrinal decisions, (2) the reform of ecclesiastical abuses, (3) the discussion of a crusade against the infidels. The selection of the town of Trent, the capital of the Italian Tirol, and part of the empire had a twofold motive: on the one hand it was a token of concession to the emperor, who wished the synod to be held in his dominions; on the other, there was no occasion to fear that an assembly, meeting on the southern border of Germany, would fall under the imperial influence.

The opening of the council was deferred once again. Towards the end of May 1545, twenty bishops were collected at Trent; but there was no sign of action, and the papal legates—Del Monte, Corvinus and Reginald Pole—delayed the inauguration. The cause of this procrastinating policy was that the emperor and the pope were at cross purposes with regard to the mode of procedure. In the eyes of Paul III. the council was simply the means by which he expected to secure a condemnation of the Protestant heresy, in hopes that he would then be in a position to impose the sentence of the Church upon them by force. For him the question of ecclesiastical reform possessed no interest whatever. In contrast to this, Charles demanded that these very reforms should be given precedence, and the decisions on points of dogma postponed till he should have compelled the Protestants to send representatives to the council. The pope, however, alarmed by the threat of a colloquy in Germany, recognized the inadvisability of his dilatory tactics, and at last ordered the synod to be opened (December 13, 1545).

Since there was no definite method by which the deliberations of ecumenical councils were conducted, special regulations were necessary; and those adopted were of such a nature as to assure the predominance of the Roman chair from the first. As the voting was not to be by nations, as at Constance, but by individuals, the last word remained with the Italians, who were in the majority. In order to enhance this superiority the legates as a rule denied the suffrage to those foreign bishops who desired to be represented by procurators; and a number of Italian prelates were enabled to make their appearance at Trent, thanks to special allowances from the pope. The dispute as to the order of precedence among the subjects for deliberation was settled by a compromise, and the questions of dogma and ecclesiastical abuses were taken simultaneously, the consequence being that in the decisions of the council the doctrinal and reformatory decrees rank side by side. In pursuance of a precedent established by the last Lateran Council, the sessions were divided into two classes: those devoted to discussion (*congregationes generales*), and those in which the results of the discussion were put to the vote and formally enacted (*sessiones publicae*). To ensure a thorough consideration of every proposition, and also to facilitate the exercise of the papal influence on the proceedings, the delegates were split into three groups (*congregationes*), each group debating the same question at the same time. This arrangement, however, only endured till 1546. Since these sections were only brought into conjunction by the legates, and met under their presidency, the pontifical envoys in effect regulated the whole course of the deliberations. They claimed, moreover, the right of determining the proposals submitted, and were throughout in active and constant communication with Rome—a circumstance which provoked the *bon mot* of the French deputy (1563), that when the rivers were flooded and the Roman post delayed the Holy Ghost postponed his descent. These precautions nullified any possible disposition on the part of the council to enter on dangerous paths; and in addition the clause "under reservation of the papal authority" was affixed to all enactments dealing with ecclesiastical irregularities—thus leaving the pope a free hand with regard to the practical execution of any measures proposed. Contrary to the emperor's wish, the council began its labours in the region of dogma by defining the doctrines of the Church with reference to the most important controversial points—a procedure which frustrated all his projects for a reconciliation with the Protestants. On the 8th of April 1546 the doctrine of the Holy Scriptures and tradition (*sessio* iv.) was proclaimed; on the 17th of June 1546, the doctrine of original sin (*sessio* v.); on the 13th of January 1547, the doctrine of justification (*sessio* vi.); and on the 3rd of March 1547, the decree concerning the sacraments in general, and baptism and confirmation in particular (*sessio* vii.). On the 11th of March, however, the council was transferred to Bologna on the pretext that an epidemic was raging in Trent (*sessio* viii.), though, at the imperial command, part of the bishops remained behind. But on the 2nd of June the council of Bologna resolved (*sessio* x.) to adjourn its labours. The emperor's demands that the council should again be removed to Trent were vain, till on the 24th of April 1547, the battle of Mühlberg decided the struggle with the Schmalkaldic league, formed by the Evangelical princes of Germany, in his favour. His hands were now free, and he utilized his military successes to balance his account with the Church. At the Diet of Augsburg he secured the enactment of a *modus vivendi*, leavened by the Catholic spirit, between the adherents of either religion; and this provisory settlement—the so-called *Interim* of Augsburg—was promulgated as a law of the empire (June 3, 1548), and declared binding till the council should reassemble. The Protestants, it is true, received certain concessions—the non-celibacy of the priesthood and the lay chalice—but the Roman hierarchy, the old ceremonial, the feast-days and the fasts, were reinstated. Since the bishops who had remained in Trent abstained, at the emperor's request, from any display of activity *qua* synod, the outbreak of a schism was avoided. But the confusion of ecclesiastical affairs had grown worse confounded through the refusal of the pope to continue the council, when the death of Paul III. (November 10, 1549) gave a new turn to events.

Pope Julius III., the former legate Del Monte, could not elude the necessity of convening the council again, and, though personally he took no greater interest in the scheme than his predecessor in office, caused it to resume its labours on the 1st of May 1551 (*sessio* xi.), under the presidency of the legate, Cardinal Crescentio. The personnel of the synod was, for the most part, different; and the new members included the Jesuits, Laynez and Salmeron. More than this, the general character of the second period of the council was markedly distinct from that of its earlier stages. The French clergy had not a single delegate, while the Spanish bishops maintained an independent attitude under the aegis of the emperor, and Protestant deputies were on this occasion required to appear at Trent. The German Protestants who, in the first phase of the council, had held aloof from its proceedings, since to have sent representatives to this assemblage would have served no good purpose, had now no choice but to obey the imperial will. Charles V. was anxious to assure them not merely of a safe conduct, but also of a certain hearing. But in this he ran counter to the established facts: the Catholic Church had already defined its attitude to the dogmas above mentioned, and the Curia showed no inclination to question these results by reopening the debate. Thus the participation of the Protestants was essentially superfluous, for the object they had at heart—the discussion of these doctrines on the gound of Holy Writ—was from the Catholic standpoint an impossible aspiration. The Württemberg deputies had already submitted a creed, composed by the Swabian reformer Johann Brenz, to the council, and Melanchthon was under way with a *confessio saxonica*, when there came the revolt of the Elector Maurice of Saxony (March 20, 1552), which compelled the emperor to a speedy flight from Innsbruck, and dissolved the conclave. Its dogmatic labours were confined to doctrinal decrees on the Lord's Supper (*sessio* xiii. October 11, 1551), and on the sacraments of penance and extreme unction (November 25, 1551, *sessio* xiv.). On the 28th of April 1552, the sittings were suspended on the news of the elector's approach.

Ten years had elapsed before the council reassembled for the third time in Trent; and on this occasion the circumstances were totally changed. During the intervening period, the religious problem in Germany had received such a solution as the times admitted by the peace of Augsburg (1555); and the equality there guaranteed between the Protestant estates and the Catholic estates had left the former nothing to hope from a council. Thus the motive which till then had governed the emperor's policy was now nullified, as there was no necessity for seeking a reconciliation of the two parties by means of a conference. The incitement to continue the council came from another quarter. It was no longer anxiety with regard to Protestantism that exercised the pressure, but a growing conviction of the imperative need of more stringent reforms within the Catholic Church itself. Pope Paul IV. (1551–1559), the protector of the Inquisition, and the opponent of Philip II. of Spain as well as of the emperor Ferdinand, turned a deaf ear to all requests for a revival of the synod. The regime of Pius IV. (1559–1566) was signalized by an absolute reversal of the papal policy: and it was high time. For in France and Spain—

the very countries where the Protestant heresy had been most vigorously combated—a great mass of discontent had accumulated; and France already showed a strong inclination to attempt an independent settlement of her ecclesiastical difficulties in a national council. Pius IV. saw himself constrained to take these circumstances into account. On the 29th of November 1560 he announced the convocation of the council; and on the 18th of January 1562 it was actually reopened (*sessio* xvii.). The presidency was entrusted to Cardinal Gonzaga, assisted by Cardinals Hosius, bishop of Ermeland, Seripando, Simonetta, and Marc de Altemps, bishop of Constance. The Protestants indeed were also invited but the Evangelical princes, assembled in Naumburg, withheld their assent—a result which was only to be expected. In order to enhance the synod's freedom of action, France and the emperor Ferdinand required that it should rank as a new council, and were able to adduce in support of their claim the fact that the resolutions of the two former periods had not yet been formally recognized. Pius IV., however, designated it a continuation of the earlier meetings. Ferdinand, in addition to regulations for the amendment of the clergy and the monastic system, demanded above all the legalization of the marriage of the priesthood and the concession of the "lay chalice," as he feared further defections to Protestantism. France and Spain laid stress on the recognition of the divine right of the episcopate, and its independence with regard to the pope. These episcopal tendencies were backed by a request that the bishops should reside in their sees—a position which Pius IV. acknowledged to be *de iure divino*; though, as it would have implied the annihilation of the Roman Curia, he refused to declare it as such. In consequence of these reformatory aspirations, the position of the pope and the council was for a while full of peril. But the papal diplomacy was quite competent to shatter an opposition which at no time presented an absolutely unbroken front, and by concessions, threats and the utilization of political and politico-ecclesiastical dissensions, to break the force of the attack. In the third period of the council, which, as a result of these feuds, witnessed no session from September 1562 to July 1563, doctrinal resolutions were also passed concerning the Lord's Supper *sub utraque specie* (*sessio* xxi., July 16, 1562), the sacrifice of the Mass (*sessio* xxii., September 27, 1562), the sacrament of ordination (*sessio* xxiii., July 15, 1563), the sacrament of marriage (*sessio* xxiv., November 11, 1563), and Purgatory, the worship of saints, relics and images (December 3, 1563). On the 4th of December 1563 the synod closed.

The dogmatic decisions of the Council of Trent make no attempt at embracing the whole doctrinal system of the Roman Catholic Church, but present a selection of the most vital doctrines, partly chosen as a counterblast to Protestantism, and formulated throughout with a view to that creed and its objections. From the discussions of the council it is evident that pronounced differences of opinion existed within it even on most important subjects, and that these differences were not reconciled. Hence came the necessity for reticences, equivocations and temporizing formulae. Since, moreover, the council issued its pronouncements without any reference to the decisions of earlier councils, and omitted to emphasize its relation to these, it in fact suppressed these earlier decisions, and posed not as continuing, but as superseding them.

The reformatory enactments touch on numerous phases of ecclesiastical life—administration, discipline, appointment to spiritual offices, the marriage law (*decretum de reformatione matrimonii "Tametsi," sessio* xxiv.), the duties of the clergy, and so forth. The resolutions include many that marked an advance; but the opportunity for a comprehensive and thorough reformation of the life of the Church—the necessity of which was recognized in the Catholic Church itself—was not embraced. No alteration of the abuses which obtained in the Curia was effected, and no annulment of the customs, so lucrative to that body and deleterious to others, was attempted. The question of the annates, for instance, was not so much as broached.

The Council of Trent in fact enjoyed only a certain appearance of independence. For the freedom of speech which had been accorded was exercised under the supervision of papal legates, who maintained a decisive influence over the proceedings and could count on a certain majority in consequence of the overwhelming number of Italians. That the synod figured as the responsible author of its own decrees (*sancta oecumenica et generalis tridentina synodus in spiritu sancto legitime congregata*) proves very little, since the following clause reads *praesidentibus apostolicae sedis legatis*; while the legates and the pope expressly refused to sanction an application of the words of the Council of Constance—*universalem ecclesiam repraesentans*. The whole course of the council was determined by the presupposition that it had no autonomous standing, and that its labours were simply transacted under the commission and guidance of the pope. This was not merely a claim put forward by the Roman see at the time: it was acknowledged by the attitude of the synod throughout. The legates confined the right of discussion to the subjects propounded by the pope, and their position was that he was in no way bound by the vote of the majority. In difficult cases the synod itself left the decision to him, as in the question of clandestine marriages and the administration of the Lord's Supper *sub utraque specie*. Further, at the close of the sessions a resolution was adopted, by the terms of which all the enactments of the council *de morum reformatione atque ecclesiastica disciplina* were subject to the limitation that the papal authority should not be prejudiced thereby (*sessio* xxv. *cap.* 21). Finally, every doubt as to the papal supremacy is removed when we consider that the Tridentine Fathers sought for all their enactments and decisions the ratification (*confirmatio*) of the pope, which was conferred by Pius IV. in the bull *Benedictus Deus* (January 26, 1564). Again, in its last meeting (*sessio* xxv.), the synod transferred to the pope a number of tasks for which their own time had proved inadequate. These comprised the compilation of a catalogue of forbidden books, a catechism, and an edition of the missal and the breviary. Thus the council presented the Holy See with a further opportunity of extending its influence and diffusing its views. The ten rules *de libris prohibitis*, published by Pius IV. in the bull *Dominici gregis custodiae* (March 24, 1564), became of great importance for the whole spiritual life of the Roman Catholic Church: for they were an attempt to exclude pernicious influences, and, in practice, led to a censorship which has been more potent for evil than good. These regulations were modified by Leo XIII. in his Constitution *Officiorum ac munerum* (January 24, 1897). Acting on a suggestion of the council (*sessio* xxiv. *c.* 2; *sessio* xxv. *c.* 2), Pius IV. published a short conspectus of the articles of faith, as determined at Trent, in the bull *Injunctum nobis* (November 13, 1564). This so-called *Professio fidei tridentinae*, however, goes beyond the doctrinal resolutions of the synod, as it contains a number of clauses dealing with the Church and the position of the pope within the Church—subjects which were deliberately ignored in the discussions at Trent. In 1877 this confession—binding on every Roman Catholic priest—was supplemented by a pronouncement on the dogma of papal infallibility.

The great and increasing need of a manual for the instruction of the people gave rise in the first half of the 16th century to numerous catechisms. At the period of the council, that composed by the Jesuit Peter Canisius, father-confessor of the emperor Ferdinand, enjoyed the widest vogue. It failed, however, to receive the sanction of the synod, which preferred to undertake the task itself; and, as that body left its labours unfinished, the pope was entrusted with the compilation of a textbook. Pius V. appointed a commission (Leonardo Marini, Egidio Foscarari, Francisco Fureiro and Murio Calini) under the presidency of three cardinals, among them Charles Borromeo; and this commission discharged its duties with such rapidity that the *Catechismus a decreto concilii tridentini ad parochos* was published in Rome as early as the year 1568. The book is designed for the use of the cleric, not the layman. The *Missale romanum*, moreover, underwent revision: also the *Breviarium romanum*, the daily devotional work of the Roman priest. The necessity of still further improvements in the latter was forcibly urged in the Vatican Council.

The numerical representation of the Council of Trent was marked by considerable fluctuations. In the first session (December 13, 1545) the spiritual dignitaries present—omitting the 3 presiding cardinals—consisted of one other cardinal, 4 archbishops, 21 bishops and 5 generals of orders. On the other hand, the resolutions of the synod were signed at its close by the 4 presidents, then by 2 cardinals, 3 patriarchs, 25 archbishops, 166 bishops, 7 abbots, 7 generals of orders and 19 procurators of archbishops and bishops. In this council—as later in the Vatican—Italy was the dominant nation, sending two-thirds of the delegates; while Spain was responsible for about 30, France for about 20, and Germany for no more than 8 members. In spite of the paucity of its numbers at the opening and the unequal representation of the Church, which continued to the last, the oecumenical character of the council was never seriously questioned. On the motion of the legates, the resolutions were submitted to the ambassadors of the secular powers for signature, the French and Spanish envoys alone withholding their assent. The recognition of the council's enactments was, none the less, beset with difficulties. So far as the doctrinal decisions were concerned no obstacles existed; but the reformatory edicts—adhesion to which was equally required by the synod—stood on a different footing. In their character of resolutions claiming to rank as ecclesiastical law they came into conflict with outside interests, and their acceptance by no means implied that the rights of the sovereign, or the needs and circumstances of the respective countries, were treated with sufficient consideration. The consequence was that there arose an active and, in some cases, a tenacious opposition to an indiscriminate acquiescence in all the Tridentine decrees. Under Charles IX. and Henry IV. the situation was hotly debated in France: but these monarchs showed as little complaisance to the representations and protests of the Curia as did the French *parlement* itself; and only those regulations were recognized which came into collision neither with the rights of the king nor with the liberties of the Gallican Church. In Spain, Philip II. allowed, indeed, the publication of the *Tridentinum*, as also in the Netherlands and Naples, but always with the reservation that the privileges of the king, his vassals and his subjects, should not thereby be infringed. The empire, as such, never recognized the *Tridentinum*. Still it was published at provincial and diocesan synods in the territories of the spiritual princes, and also in the Austrian hereditary states.

In his official confirmation Pius IV. had already strictly prohibited any commentary on the enactments of the council unless undertaken with his approval, and had claimed for himself the sole right of interpretation. In order to supervise the practical working of these enactments, Pius created (1564) a special department of the Curia, the *Congregatio cardinalium concilii tridentini interpretum*; and to this body Sixtus V. entrusted the further task of determining the sense of the conciliar decisions in all dubious cases. The *resolutiones* of the congregation—on disputed points—and their *declarationes*—on legal questions—exercised a powerful influence on the subsequent development of ecclesiastical law.

The Council of Trent attained a quite extraordinary significance for the Roman Catholic Church; and its pre-eminence was unassailed till the *Vaticanum* subordinated all the labours of the Church in the past—whether in the region of doctrine or in that of law—to an infallible pope. On the theological side it fixed the results of medieval scholasticism and gleaned from it all that could be of service to the Church. Further, by pronouncing on a series of doctrinal points till then undecided it elaborated the Catholic creed; and, finally, the bold front which it offered to Protestantism in its presentation of the orthodox faith gave to its members the practical lead they so much needed in their resistance to the Evangelical assault. The regulations dealing with ecclesiastical life, in the widest sense of the words, came, for the most part, to actual fruition, so that, in this direction also, the council had not laboured in vain. For the whole Roman Catholic Church of the 16th century its consequences are of an importance which can scarcely be exaggerated: it showed that Church as a living institution, capable of work and achievement; it strengthened the confidence both of her members and herself, and it was a powerful factor in heightening her efficiency as a competitor with Protestantism and in restoring and reinforcing her imperilled unity. Indeed, its sphere of influence was still more extensive, for its labours in the field of dogma and ecclesiastical law conditioned the future evolution of the Roman Catholic Church. As regards the position of the papacy, it is of epoch-making significance—not merely in its actual pronouncements on the papal see, but also in its tacit subordination to that see, and the opportunities of increased influence accorded to it.

There were three periods of the council, separated by not inconsiderable intervals, each of an individual character, conducted by different popes, but forming a single unity—an indivisible whole, so that it is strictly correct to speak of one Council of Trent, not of three distinct synods.

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TRENT, the chief river in the midlands of England, the third in length in the country, exceeded only by the Thames and Severn. It rises in the north of Staffordshire, and discharges through the Humber into the North Sea, having a course of about 170 m., and a drainage area of 4052 sq. m. The source is on Biddulph Moor, which rises to a height of 1100 ft. The course of the river is at first southerly, and it skirts the manufacturing district of the Potteries, passing Stoke-upon-Trent. Immediately below this town the valley widens, and the fall of the river, from a point 15 m. from the source to the mouth, is only 338 ft. Passing Stone, the course becomes south-easterly, and the united waters of the Sow and the Penk are received on the right. Near Rugeley the direction becomes easterly, and near Alrewas the Trent receives the Tame on the right, and turns to the north-east. Much of the valley above this point is well wooded and picturesque, though the flanking hills are gently sloping, and of no great elevation. The river now passes

Burton-upon-Trent, in this part of its course forming the boundary between Staffordshire and Derbyshire. The fall from Burton to the mouth, a distance of 109 m., is 148 ft. The valley opens out as the stream, dividing into several channels at Burton and receiving on the left the Dove, enters Derbyshire. It then separates that county from Leicestershire and Nottinghamshire, receives in quick succession the Derwent (left), Soar (right) and Erewash (left), enters Nottinghamshire, and passes Nottingham, 81¼ m. from the mouth. The next important town is Newark, which, however, the main channel of the river passes at a considerable distance to the west; the Devon joins here on the right, and the fall from this point to the mouth, a distance of 57½ m., is only 18 ft. The valley becomes flat, though the river is rather deeply entrenched in some parts. Forming the boundary between Nottingham and Lincolnshire, the Trent passes Gainsborough (26½ m. from the mouth), receives the Idle on the left, and, entering Lincolnshire and skirting the Isle of Axholme, joins the Yorkshire Ouse near Faxfleet. The lower part of the valley resembles the Fens in character, and is drained by many artificial channels. The northward turn at Newark is of interest inasmuch as it is considered that the river from this point formerly flowed towards Lincoln, and, following a depression in the escarpment there, passed down the valley at present occupied by the Witham to the Wash. It is suggested that the waters were diverted to the Humber by a stream within that system cutting back southward and tapping the Trent in the vicinity of Newark; and in high flood the Trent has been known to send water across the low parting to the Witham (see Avebury, *Scenery of England*, ch. xi.). The highest tides are felt about 40 m. up river, and the phenomenon of an "eagre" (bore or tidal wave) is seen rising on spring tides to a height of 4 or 5 ft., 15 m. above the mouth of the river.

The Trent is navigable for a distance of 94¾ m. from its junction with the Ouse, to a point a short distance above the junction of the Derwent, the Trent Navigation Company having a general control of the navigation down to Gainsborough, the line of which passes through Nottingham by canals. On the river itself there are eight locks. Below Gainsborough the navigation is open, and vessels drawing 9 ft. can reach this point on spring tides. From the Derwent mouth the Trent and Mersey Canal follows the Trent valley upward, and gives connexion with the entire inland navigation system of the midlands and west of England. Short canals give access to Derby and the Erewash valley; the Leicester Navigation, following the Soar, connects with the Grand Junction canal; and the Grantham Canal carries a little traffic between that town and Nottingham. The Fossdyke, distinguished as the oldest navigable waterway still in use in England, as it was originally of Roman construction, connects the Trent with Lincoln and the Witham, and lower down the Sheffield and South Yorkshire canal joins the river from the west at Keadby. There is also a canal, little used, to Chesterfield.

TRENTE ET QUARANTE (called also *Rouge et Noir*), a game of French origin played with cards and a special table. It is one of the two games played in the gambling rooms at Monte Carlo, roulette being the other. The diagram illustrates one half of the table, the other half precisely corresponding to it. Two croupiers sit on each side, one of them being the dealer; behind the two on the side opposite to the dealer a supervisor of the game has his seat. Six packs of fifty-two cards each are used; these are well shuffled, and the croupier asks any of the players to cut, handing him a blank card with which to divide the mixed packs. There are only four chances at trente et quarante: *rouge* or *noir*, known as the *grand tableau*; *couleur* or *inverse*, known as the *petit tableau*. At Monte Carlo the stakes are placed on the divisions indicated on the table, the maximum being 12,000 francs and the minimum 20 francs which must be staked in gold. The dealer, who has placed all the cards before him, separates a few with the blank card, takes them in his left hand and invites the players to stake with the formula, "Messieurs, faites votre jeu!" After a pause he exclaims "Le jeu est fait, rien ne va plus!" after which no stake can be made. He then deals the cards in a row until the aggregate number of pips is something more than thirty, upon which he deals a second row, and that which comes nearest to thirty wins, the top row being always distinguished as *noir*, and the lower as *rouge*. In announcing the result the word *trente* is always omitted, the dealer merely announcing *un*, *trois*, *quatre*, as the case may be, though when forty is turned up it is described as *quarante*. The words *noir* and *inverse* are also never used, the announcement being *rouge gagne* or *rouge perd*, *couleur gagne* or *couleur perd*. Gain or loss over *couleur* and *inverse* depends upon the colour of the first card dealt. If this should be also the colour of the winning row, the player wins. Assuming, for example, that the first card dealt is red, and that the lower row of the cards dealt is nearest to thirty, the dealer will announce "Rouge gagne et le couleur." If the first card dealt is red, but the black or top row of cards is nearest to thirty, the dealer announces "Rouge perd et le couleur." It frequently happens that both rows of cards when added together give the same number. Should they both, for instance, add up to thirty-three, the dealer will announce "Trois après," and the deal goes for nothing except in the event of their adding up to thirty-one. *Un après* (*i.e.* thirty-one) is known as a *refait*; the stakes are put in prison to be left for the decision of the next deal, or if the player prefers it he can withdraw half his stake, leaving the other half for the bank. Assurance against a *refait* can be made by paying 1% on the value of the stake with a minimum of five francs. When thus insured against a *refait* the player is at liberty to withdraw his whole stake. It has been calculated that on an average a *refait* occurs once in thirty-eight coups. After each deal the cards are pushed into a metal bowl let into the table in front of the dealer. When he has not enough left to complete the two rows, he remarks "Les cartes passent"; they are taken from the bowl, reshuffled, and another deal begins.

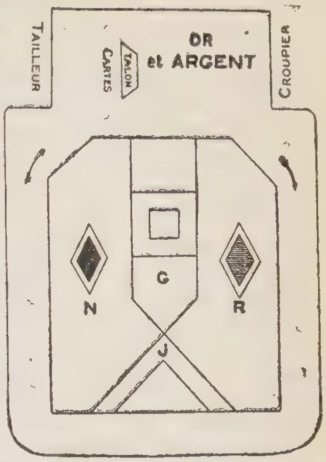

Diagram of Half of Trente et Quarante Table.
N, Noir. G, Grand tableau.
R, Rouge. J, Inverse.

TRENTON, a city and the county-seat of Grundy county, Missouri, U.S.A., on the E. fork of the Grand River, in the north central part of the state, about 100 m. N.E. of Leavenworth. Pop. (1890), 5039; (1900), 5396, including 192 foreign-born and 200 negroes; (1910), 5656. It is served by the Chicago, Rock Island & Pacific (which has repair shops here) and the Quincy, Omaha & Kansas City railways. It has a picturesque situation, and is laid out over a high uneven bluff. The city is a trading centre for a prosperous farming region, and coal is mined in the vicinity. Trenton was platted in 1841, became the county-seat in the same year, and was incorporated as a town in 1857. In 1893 it received a city charter under a general state law. In 1900–1903 it was the seat of Ruskin College, an institution founded by Walter Vrooman (b. 1869), a native of Missouri, and the organizer of the Ruskin Hall Workingmen's College, Oxford, England. The college was removed to Glen Ellyn, Illinois, in 1903 and after 1906 to Ruskin, Florida.

TRENTON, the capital of New Jersey, U.S.A., and the county-seat of Mercer county, on the eastern bank of the Delaware river, about 33 m. N.E. of Philadelphia, and about 59 m. S.W. of New York. Pop. (1890), 57,458; (1900), 73,307, of whom 16,793 were foreign-born (including 4114 Germans, 3621 English, 3292 Irish, and 1494 Hungarians), and 32,879 were of foreign parentage (both parents foreign-born), including 8873 of German parentage, 8324 of Irish parentage, 5513 of English parentage, and 2243 of Hungarian parentage; (1910 census), 96,815. Area, 9 sq. m. Trenton is served by the Pennsylvania (main line and Belvidere division) and the Philadelphia & Reading railway systems, by inter-urban electric railways, and by small freight and passenger steamers on the Delaware river; the Delaware & Raritan Canal connects with the Raritan river at New Brunswick. Trenton is at the head of navigation on the Delaware river, which falls 8 ft. here. Riverside park extends along its water front for about 3 m., and on the outskirts of the city lies Cadwalader park (100 acres), containing a zoological garden. In the centre of the city, marking the spot where Washington planted his guns at the battle of Trenton, stands the Battle monument, a Roman-Doric column of granite, 150 ft. high, hollow and fluted, its cap forming an observatory, with a statue of Washington by William R. O'Donovan (b. 1844). In Perry Street, mounted on a granite pedestal, is the "Swamp Angel," the great gun used by Federal troops in the marshes near Charleston, South Carolina, during their attack on that city in August 1863. There are many buildings in the city which are rich in historic associations. Chief among these is the barracks, erected by the colony in 1758 to mitigate the evils of billeting, and occupied by British troops during the Seven Years' War, and at different times by British, Hessian and American troops during the War of Independence. Other interesting landmarks are "Woodland" (formerly called "Bloomsbury Court"), built early in the 18th century by William Trent, and said to have sheltered, at various times, Washington, Lafayette and Rochambeau; the "Hermitage," erected some time before the War of Independence; and "Bow Hill," in the suburbs of the city, a quaint old colonial mansion which for some time before 1822 was a home of Joseph Bonaparte. Among the public buildings are the state capitol, the post office building, the county court house, the city hall, the second regiment armoury, public library (containing about 42,000 volumes in 1909), and the building (1910) given by Henry C. Kelsey to the city for the school of industrial arts (founded in 1898). Here also are the state normal and model schools (1855), the state library, housed in the capitol, the state school for deaf mutes, the state home for girls, one of the two state hospitals for the insane (opened in 1848), the state arsenal—the building being the old state prison—the state prison (1836), St Francis hospital (1874), Mercer hospital (1892), the William McKinley memorial hospital (1887), the city hospital, two children's day nurseries, the Friends' home, the Union industrial home (for destitute children), the Florence Crittenton home (1895), the indigent widows' and single women's home (1854), the Har Sinai charity society, the home for friendless children, and the society of St Vincent de Paul. Trenton is the see of Protestant Episcopal and Roman Catholic bishops.

Trenton is an important industrial centre. Its proximity to the coal fields of Pennsylvania and to the great markets of New York and Philadelphia, and its excellent transportation facilities by rail and by water, have promoted the development of its manufactures. The city is the greatest centre for the pottery industry in the United States. In 1905 there were 40 establishments for the manufacture of pottery and terra-cotta, employing 4571 labourers; and their total product was valued at $5,882,701—or 9·2% of the value of the pottery product of the United States, and 18% of the value of all the city's factory products, in this year. The chief varieties of this ware are vitrified china, belleek china, semi-porcelain, white granite and c. c. ware, vitrified porcelain for electrical supplies, porcelain bath tubs and tiles, and terra-cotta. Clay for the "saggers," or cases in which the wares are fired, is mined in the vicinity, but the raw materials for the fine grades of pottery are obtained elsewhere. Some pottery was made in Trenton by crude and primitive methods near the beginning of the 19th century, but the modern methods were not introduced until 1852, when yellow and Rockingham wares were first made here. In 1859 the manufacture of white granite and cream-coloured ware was successfully established. The fine exhibits from the Trenton potteries at the Centennial Exhibition in Philadelphia in 1876 greatly stimulated the demand for these wares and increased the competition among the manufacturers; and since that date there has been a marked development in both the quantity and the quality of the product. In Trenton, also, are manufactured iron, steel and copper wire, rope, cables and rods—the John A. Roebling's Sons Company has an immense wire and cable manufactory here—iron and steel bridge building materials and other structural work, plumbers' supplies (manufactured by the J. L. Mott Company), and machinery of almost every character, much of it being exported to foreign countries. Much rubber ware is also manufactured. In 1905 Trenton contained 312 factories, employing 14,252 labourers, and the total value of the factory products was $32,719,945.

The charter, as amended, provides for a mayor elected for two years and a common council of two members from each ward elected for two years. Other elected officers are: city clerk, comptroller, treasurer, counsel, receiver of taxes, engineer, inspector of buildings, overseer of poor, street commissioner and sealer of weights and measures. The municipality owns the water works and the sewer system; the water supply is obtained from the Delaware and is stored in a reservoir having a capacity of about 110,000,000 gallons.

The settlement of Trenton began in 1680 with the erection by Mahlon Stacy, a Quaker colonist of Burlington, of a mill at the junction of the Assanpink creek[1] with the Delaware river. By 1685 a number of colonists had settled at this point, which became known as "The Falls" on account of the rapids in the Delaware here. In 1714 Stacy sold his plantation at "The Falls" to William Trent (*c.* 1655–1724), speaker of the New Jersey Assembly (1723) and chief justice of the colony (1723–1724), in whose honour the place came to be called Trent-town or Trenton. In 1745 Trenton received a royal charter incorporating it as a borough, but in 1750 the inhabitants voluntarily surrendered this privilege, deeming it "very prejudicial to the interest and trade" of the community. In 1783 the New Jersey delegates in Congress proposed that Trenton be made the seat of the general government, but as this measure was opposed by the Southern delegates, it was agreed that Congress, pending a final decision, should sit alternately at Annapolis and Trenton. Congress accordingly met in Trenton in November 1784, but soon afterwards removed to New York, where better accommodation could be obtained. Trenton became the capital of the state in 1790, was chartered as a city in 1792, and received new charters in 1837, 1866, and 1874. The borough of South Trenton was annexed in 1850; the borough of Chambersburg and the township of Millham in 1888; the borough of Wilbur in 1898; and parts of the townships of Ewing and Hamilton in 1900.

See *The City of Trenton, N.J., a Bibliography* (1909), prepared by the Trenton Free Library; John O. Raum, *History of the City of Trenton* (Trenton, 1871); George A. Wolf, *Industrial Trenton* (Wilmington, Del., 1900); F. B. Lee, *History of Trenton* (Trenton, 1895).

TRENTON AND PRINCETON, BATTLES OF (1776–1777). These battles in the War of American Independence are noted as the first successes won by Washington in the open field. Following close upon a series of defeats, their effect upon his troops and the population at large was marked. After the capture of Fort Washington on Manhattan Island, on the 16th of November 1776, the British general, Sir William Howe, forced the Americans to retreat through New Jersey and across the Delaware into Pennsylvania. Howe then went into winter quarters, leaving the Hessian general, Rahl, at Trenton on the river with a brigade of 1200 men. Although Washington's army had dwindled to a mere handful and was discouraged by the year's disasters, it could still be trusted for a promising exploit. Ascertaining that the Hessians at Trenton were practically unsupported, the American general determined to attempt their capture. On the night of the 25th of December 1776 he recrossed the Delaware through floating ice to a point 9 m. above the enemy, whom he expected to reach at dawn of the following day, the 26th. Dividing his force of 2500 men into two divisions under Generals Sullivan and Greene, he approached the town by two roads, surprised the Hessian outposts, and then rushed upon the main body before it could form effectively. The charge of the American troops and the fire of their artillery and musketry completely disconcerted the enemy. All avenues of retreat being closed and their general mortally wounded, the latter to the number of 950 quickly surrendered and were marched back into Pennsylvania on the same day. The American loss was five or six wounded.

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[1] The name Assanpink is a corruption of an Indian word said to mean "place of stone implements." In gravel deposits in and near Trenton many stone implements, human skulls and remains of extinct animals have been found, and according to some scientists they are evidences of Glacial man, a conclusion disputed by others. (See AMERICA, vol. i. p. 817.)

Elated by this success and eager to beat up the enemy's advanced posts at other points, Washington again crossed the Delaware on the 30th of December and occupied Trenton. Hearing of this move Lord Cornwallis at Princeton, 10 m. north of Trenton, marched down with about 7000 troops upon the Americans on the 2nd of January 1777, and drove them across the Assanpink, a stream running east of the town. The Americans, who encamped on its banks that night, were placed in a precarious position, as the Delaware, with no boats at their disposal at that point, prevented their recrossing into Pennsylvania, and all other roads led towards the British lines to the northward. Washington accordingly undertook a bold manœuvre. Fearing an attack by Cornwallis on the next morning, he held a council of war, which confirmed his plan of quietly breaking camp that night and taking a by-road to Princeton, then cutting through any resistance that might be offered there and pushing on to the hills of northern New Jersey, thus placing his army on the flank of the British posts. His tactics succeeded. **At Princeton (*q.v.*)** he came upon three British regiments which for a time held him at bay. The 17th foot especially, under Colonel Mawhood, twice routed the American advanced troops, inflicting severe loss, but were eventually driven back toward Trenton. The other regiments retreated north toward New Brunswick, and Washington continued his march to Morristown, New Jersey. He had broken through Howe's lines and placed himself in an advantageous position for recruiting his army and maintaining a strong defensive in the next campaign. These two affairs of Trenton and Princeton put new life into the American cause, and established Washington in the confidence of his troops and the country at large.

See W. S. Stryker, *The Battles of Trenton and Princeton* (Boston, 1898).

TREPIDATION (from Lat. *trepidare*, to tremble), a term meaning, in general, fear or trembling, but used technically in astronomy for an imagined slow oscillation of the ecliptic, having a period of 7000 years, introduced by the Arabian astronomers to explain a supposed variation in the precession of the equinoxes. It figured in astronomical tables until the time of Copernicus, but is now known to have no foundation in fact, being based on an error in Ptolemy's determination of precession.

TRESCOT, WILLIAM HENRY (1822–1898), American diplomatist, was born in Charleston, South Carolina, on the 10th of November 1822. He graduated at Charleston College in 1840, studied law at Harvard, and was admitted to the bar in 1843. In 1852–1854 he was secretary of the U.S. legation in London. In June 1860 he was appointed assistant secretary of state, and he was acting secretary of state in June–October, during General Lewis Cass's absence from Washington, and for a few days in December after Cass's resignation. His position was important, as the only South Carolinian holding anything like official rank, because of his intimacy with President Buchanan, and his close relations with the secession leaders in South Carolina. He opposed[1] the re-enforcement of Fort Sumter, used his influence to prevent any attack on the fort by South Carolina before the meeting of the state's convention called to consider the question of secession, and became the special agent of South Carolina in Washington after his resignation from the state department in December. He returned to Charleston in February 1861; was a member of the state legislature in 1862–1866, and served as colonel on the staff of General Roswell S. Ripley during the Civil War; and later returned to Washington. He was counsel for the United States before the Halifax Fishery Commission in 1877; was commissioner for the revision of the treaty with China in 1880; was minister to Chile in 1881–1882; in 1882 with General U.S. Grant negotiated a commercial treaty with Mexico; and in 1889–1890 was a delegate to the Pan-American Congress in Washington. He died at Pendleton, South Carolina, his country place, on the 4th of May 1898.

His writings include *The Diplomacy of the Revolution* (1852), *An American View of the Eastern Question* (1854) and *The Diplomatic History of the Administrations of Washington and Adams* (1857).

TRESHAM, FRANCIS (*c.* 1567–1605), English Gunpowder Plot conspirator, eldest son of Sir Thomas Tresham of Rushton, Northamptonshire (a descendant of Sir Thomas Tresham, Speaker of the House of Commons, executed by Edward IV. in 1471), and of Muriel, daughter of Sir Thomas Throckmorton of Coughton, was born about 1567, and educated at Oxford. He was, like his father, a Roman Catholic, and his family had already suffered for their religion and politics. He is described as "a wild and unstayed man," was connected intimately with many of those afterwards known as the Gunpowder Plot conspirators, being cousin to Catesby and to the two Winters, and was implicated in a series of seditious intrigues in Elizabeth's reign. In 1596 he was arrested on suspicion together with Catesby and the two Wrights during an illness of Queen Elizabeth. In 1601 he took part in Essex's rebellion and was one of those who confined the Lord Keeper Egerton in Essex House on the 8th of February. He was imprisoned and only suffered to go free on condition of a fine of 3000 marks paid by his father. He was one of the promoters of the mission of Thomas Winter in 1602 to Madrid to persuade the king of Spain to invade England. On the death of Elizabeth, however, he, with several other Roman Catholics, joined Southampton in securing the Tower for James I.

Tresham was the last of the conspirators to be initiated into the Gunpowder Plot. According to his own account, which receives general support from Thomas Winter's confession, it was revealed to him on the 14th of October 1605. Inferior in zeal and character to the rest of the conspirators, he had lately by the death of his father, on the 11th of September 1605, inherited a large property and it was probably his financial support that was now sought. But Tresham, as the possessor of an estate, was probably less inclined than before to embark on rash and hazardous schemes. Moreover, he had two brothers-in-law, Lords Stourton and Monteagle, among the peers destined for assassination. He expressed his dislike of the plan from the first, and, according to his own account, he endeavoured to dissuade Catesby from the whole project, urging that the Romanist cause would derive no benefit, even in case of success, from the attempt. His representations were in vain and he consented to supply money, but afterwards discovered that no warning was to be given to the Roman Catholic peers. All the evidence now points to Tresham as the betrayer of the plot, and it is known that he was in London within 24 hours of the despatch of the famous letter to Lord Monteagle which revealed the plot (see Gunpowder Plot). In all probability he had betrayed the secret to Monteagle previously, and the method of discovery had been settled between them, for it bears the marks of a prearranged affair, and the whole plan was admirably conceived so as to save Monteagle's life and inform the government, at the same time allowing the conspirators, by timely warning, opportunity to escape (see Monteagle, William Parker, 4th baron). Tresham avoided meeting any of the conspirators as he had agreed to do at Barnet, on the 29th of October, but on the 31st he was visited by Winter in London, and summoned to Barnet on the following day. There he met Catesby and Winter, who were prepared to stab him for his betrayal, but were dissuaded by his protestations that he knew nothing of the letter. His entreaties that they would give up the whole project and escape to Flanders were unavailing. After the arrest of Fawkes on the night of the 4th Tresham did not fly with the rest of the conspirators, but remained at court and offered his services for apprehending them. For some days he was not suspected, but he was arrested on the 12th. On the 13th he confessed his share in the plot, and on the 29th his participation and that of Father Garnet in the mission to Spain. Shortly afterwards he fell ill with a complaint from which he had long suffered. On the 5th of December a copy of the *Treatise of Equivocation*, in which the Jesuit doctrine on that subject was treated, was found amongst his papers by Sir Edward Coke (see GARNET, HENRY). From the lessons learnt here he had evidently profited. On the 9th of December he declared he knew nothing about the book, and shortly before his death, with the desire of saving his friend, he withdrew his statement concerning Garnet's complicity in the Spanish negotiations, and denied that he had seen him or communicated with him for 16 years. His death took place on the 22nd. His last transparent falsehoods had removed any thoughts of leniency in the government. He was now classed with the other conspirators, and though he had never been convicted of any crime or received sentence, his corpse was decapitated and he was attainted by act of parliament. Tresham had married Anne, daughter of Sir John Tufton of Holtfield in Kent, by whom he had two daughters. His estates passed, notwithstanding the attainder, to his brother, afterwards Sir Lewis Tresham, Bart.

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[1] His "Narrative...concerning the Negotiations between South Carolina and President Buchanan in December 1860," written in February 1861, edited by Gaillard Hunt, appeared in the *American Historical Review*, xiii. 528–556 (1908).

TRESPASS (O. Fr. *trespas*, a crime, properly a stepping across, from Lat. *trans*, across, and *passus*, step, cf. "transgression," from *transgredi*, to step across), in law, any transgression of the law less than treason, felony or misprision of either. The term includes a great variety of torts committed to land, goods or person, distinguished generally by names drawn from the writs once used as appropriate to the particular transgression, such as *vi et armis*, *quare clausum fregit de bonis asportatis*, *de uxore abducta cum bonis viri*, *quare filium et heredem rapuit*, &c. Up to 1694 the trespasser was regarded, nominally at any rate, as a criminal, and was liable to a fine for the breach of the peace, commuted for a small sum of money, for which 5 Will. and Mar. c. 12 (1693) substituted a fee of 6s. 8d. recoverable as costs against the defendant. Trespass is not now criminal except by special statutory enactment, *e.g.* the old statutes against forcible entry, the game acts, and the private acts of many railway companies. When, however, trespass is carried sufficiently far it may become criminal, and be prosecuted as assault if to the person, as nuisance if to the land. At one time an important distinction was drawn between trespass general and trespass special or trespass on the case, for which see TORT. The difference between trespass and case was sometimes a very narrow one: the general rule was that where the injury was directly caused by the act of the defendant the proper remedy was trespass, where indirectly case. The difference is illustrated by the action for false imprisonment: if the defendant himself imprisoned the plaintiff the action was trespass; if a third person did so on the information of the defendant it was case. A close parallel is found in Roman law in the *actio directa* under the lex Aquilia for injury caused directly, the *actio utilis* for that caused indirectly. One of the reasons for the rapid extension of the action on the case, especially that form of it called *assumpsit*, was no doubt the fact that in the action on the case the defendant was not allowed to wage his law (see WAGER).

In its more restricted sense trespass is generally used for entry on land without lawful authority by either a man, his servants or his cattle. To maintain an action for such trespass the plaintiff must have possession of the premises. The quantum of possession necessary to enable him to bring the action is often a question difficult to decide. In most instances the tenant can bring trespass, the reversioner only case. Remedies for trespass are either judicial or extra-judicial. The most minute invasion of private right is trespass, though the damages may be nominal if the injury was trivial. On the other hand, they may be exemplary if circumstances of aggravation were present. Pleading in the old action of trespass was of a very technical nature, but the old-fashioned terms *alia enormia*, replication *de injuria*, new assignment, &c., once of such frequent occurrence in the reports, are of merely historical interest since the introduction of a simpler system of pleading, unless in those American states where the old pleading has not been reformed. The venue in trespass was formerly local, in case transitory. In addition to damages for trespass, an injunction may be granted by the court. The principal instances of extra-judicial remedies are distress damage feasant of cattle trespassing, and removal of a trespasser without unnecessary violence, expressed in the terms of Latin pleading by *molliter manus imposuit*.

Trespass may be justified by exercise of a legal right, as to serve the process of the law, or by invitation or license of the owner, or may be excused by accident or inevitable necessity, as deviation from a highway out of repair. Where a man abuses an authority given by the law, his wrongful act relates back to his entry, and he becomes a trespasser *ab initio*, that is, liable to be treated as a trespasser for the whole time of his being on the land. Mere breach of contract, such as refusal to pay for wine in a tavern which a person has lawfully entered, does not constitute him a trespasser *ab initio*. A trespass of a permanent nature is called a continuing trespass; such would be the permitting of one's cattle to feed on another's land without authority.

In Scots law trespass is used only for torts to land. By the Trespass (Scotland) Act 1865 trespassers are liable on summary conviction to fine and imprisonment for encamping, lighting fires, &c., on land without the consent and permission of the owner.

TRES TABERNAE (Three Taverns), an ancient village of Latium, Italy, a post station on the Via Appia, at the point where the main road was crossed by a branch from Antium. It is by some fixed some 3 m. S.E. of the modern village of Cisterna just before the Via Appia enters the Pontine marshes, at a point where the modern road to Ninfa and Norba diverges to the north-east, where a few ruins still exist (Grotte di Nottola), 33 m. from Rome. It is, however, more probable that it stood at Cisterna itself, where a branch road running from Antium by way of Satricum actually joins the Via Appia. Ulubrae, mentioned as a typical desert village by Roman writers, lay in the plain between Cisterna and Sermoneta. Tres Tabernae is best known as the point to which St Paul's friends came to meet him on his journey to Rome (Acts xxviii. 15). It became an episcopal see, but this was united with that of Velletri in 592 owing to the desertion of the place.

The name occurs twice in other parts of Italy as the name of post stations.

TRESVIRI, or TRIUMVIRI, in Roman antiquities, a board of three, either ordinary magistrates or extraordinary commissioners.

1. *Tresviri capitales*, whose duty it was to assist the higher officials in their judicial functions, especially criminal, were first appointed about 289 B.C., unless they are to be identified with the *tresviri nocturni* (Livy ix. 46, 3), who were in existence in 304. They possessed no criminal jurisdiction or *jus prensionis* (right of arrest) in their own right, but acted as the representatives of others. They kept watch over prisoners and carried out the death sentence (*e.g.* the Catilinarian conspirators were strangled by them in the *Carcer Tullianum*); took accused or suspected persons into custody; and exercised general control over the city police. They went the rounds by night to maintain order, and had to be present at outbreaks of fire. Amongst other things they assisted the aediles in burning forbidden books. It is possible that they were entrusted by the praetor with the settlement of certain civil processes of a semi-criminal nature, in which private citizens acted as prosecutors (see G. Götz in *Rheinisches Museum*, xxx. 162). They also had to collect the *sacramenta* (deposit forfeited by the losing party in a suit) and examined the plea of exemption put forward by those who refused to act as jurymen. Caesar increased their number to four, but Augustus reverted to three. In imperial times most of their functions passed into the hands of the *praefectus vigilum*.

2. *Tresviri epulones*, a priestly body (open from its first institution to the plebeians), assisted at public banquets. Their number was subsequently increased to seven, and by Caesar to ten, although they continued to be called *septemviri*, a name which was still in use at the end of the 4th century A.D. They were first created in 196 B.C. to superintend the *epulum Jovis* on the Capitol, but their services were also requisitioned on the occasion of triumphs, imperial birthdays, the dedication of temples, games given by private individuals, and so forth, when entertainments were provided for the people, while the senate dined on the Capitol.

3. *Tresviri monetales* were superintendents of the mint. Up to the Social War they were nominated from time to time, but afterwards became permanent officials. Their number was increased by Caesar to four, but again reduced by Augustus. As they acted for the senate they only coined copper money under the empire, the gold and silver coinage being under the exclusive control of the emperor. The official title was "tresviri aere argento auro flando feriundo."

4. *Tresviri reipublicae constituendae* was the title bestowed upon Octavianus, Lepidus and Antony for five years by the lex Titia, 43 B.C. The coalition of Julius Caesar, Pompey and Crassus has also been wrongly called a "triumvirate," but they never had the title *tresviri*, and held no office under that name.

See T. Mommsen, *Römisches Staatsrecht* (1888), ii. 594–601, 638, 601, 718; J. Marquardt, *Römische Staatsverwaltung* (1885), iii. 347.

TREVELYAN, SIR GEORGE OTTO, Bart. (1838–), British author and statesman, only son of Sir Charles Trevelyan, was born on the 20th of July 1838 at Rothley Temple, Leicestershire. His mother was Lord Macaulay's sister. He was educated at Harrow and at Trinity College, Cambridge, where he was second in the classical tripos. In 1861 he wrote his *Horace at the University of Athens*, a topical drama in verse, parts of which are said to have offended Whewell and lost Trevelyan a fellowship. The following year he went out as a civil servant to India, where he spent several years. During his stay he contributed "Letters of a Competition Wallah" to *Macmillan's Magazine* (republished 1864). *Cawnpore*, an account of that terrible tragedy, was published in 1865. During the same year he was elected to parliament for Tynemouth in the Liberal interest. In 1867 he wrote *The Ladies in Parliament*, a humorous political brochure in verse. At the general election of 1868 he was returned for the Hawick burghs, which he continued to represent until 1886. When the first Gladstone ministry was formed, in December 1868, Trevelyan was appointed civil lord of the Admiralty, but resigned in July 1870 on a point of conscience connected with the government Education Bill. He advocated a sweeping reform of the army, including the abolition of the purchase of commissions, and both in and out of parliament he was the foremost supporter for many years of the extension of the county franchise. In the session of 1874 he brought forward his Household Franchise (Counties) Bill, which was lost on the second reading; it was not till ten years later that the agricultural labourer was enfranchized. Among other causes which he warmly supported were women's suffrage, a thorough reform of metropolitan local government, and the drastic reform or abolition of the House of Lords. He was also in favour of the direct veto and other temperance legislation. In 1876 he published *The Life and Letters of Lord Macaulay*, one of the most admirable and most delightful of modern biographies; and in 1880 he published *The Early History of Charles James Fox*. In the latter year he was appointed parliamentary secretary to the Admiralty. This office he held until May 1882, when, after the assassination of Lord Frederick Cavendish, he became for two years chief secretary for Ireland. From November 1884 to June 1885 he was chancellor of the duchy of Lancaster. In February 1886 he became secretary for Scotland, but resigned on the 26th of March on account of his disagreement with some of Mr Gladstone's Irish Home Rule proposals. The same year he succeeded his father in the baronetcy. At the general election of 1886 Sir George Trevelyan lost his seat for Hawick. As a representative of the Unionist party he took part in the Round Table Conference, and, being satisfied with the modifications made by Mr Gladstone in his Home Rule scheme, he formally rejoined the Liberal party. In August 1887 he re-entered the House of Commons as member for the Bridgeton division of Glasgow; and from 1892 to 1895 he was secretary for Scotland. Early in 1897 he resigned his seat in parliament and retired into private life. In 1899 he published the first volume of a *History of the American Revolution*, which was completed (3 vols.) in 1905; in the latter year, as *Interludes in Prose and Verse*, he republished his early classical *jeux d'esprit* and Indian pieces. He had married in 1869 Caroline Philips, whose father was M.P. for Bury. His eldest son, Charles Philips Trevelyan (b. 1870), became Liberal M.P. for the Elland division of Yorkshire in 1899, and in 1908 was appointed parliamentary secretary to the Board of Education. The third son, George Macaulay Trevelyan (b. 1876), became well known as a brilliant historical writer, notably with two books on Garibaldi (1907 and 1909).

TREVET (or Trivet), **NICHOLAS** (*c.* 1258–*c.* 1328), English chronicler, was the son of Sir Thomas Trevet (d. 1283), a judge, and became a Dominican friar. After studying at Oxford and in Paris, he spent most of his subsequent years in writing and teaching, and died about 1328. His chief work is his *Annales sex regum Angliae*, a chronicle of English history covering the period between 1135 and 1307; this is valuable for the later part of the reign of Henry III. and especially for that of Edward I., who was the author's contemporary. A member of the same family was Sir Thomas Trivit (d. 1383), a soldier of repute, who saw a good deal of service in France, and died in October 1383.

The *Annales* were published in Paris in 1668, in Oxford in 1719, and were edited by Thomas Hog for the English Historical Society in 1845. Manuscripts are at Oxford and in the British Museum. Trevet's other historical works are *Catalogus regum anglo-saxonum durante heptarchia*, and *Les Cronicles qe frere N. Trevet escript a dame Marie* ("Marie" was Edward I.'s daughter Mary). From the latter Chaucer is believed to have obtained his *Man of Law's Tale*. Trevet also wrote a number of works of a theological and philological character.

TREVI (anc. *Trebiae*), a town of the province of Perugia, Italy, 30 m. S.E. of Perugia and 5 m. S. of Foligno by rail. Pop. (1901), 5708. The town stands on a steep hill 1355 ft. above sea-level. Several of its churches are architecturally interesting, especially the Madonna delle Lacrime (1487) outside the town, the elegant early Renaissance architecture of which resembles that of the Madonna del Calcinaio at Cortona, and most of them (and also the municipal picture gallery) contain paintings by artists of the Umbrian school—notably Lo Spagna, a pupil of Perugino. S. Emiliano has a group of three altars decorated with fine sculptures by Rocco da Vicenza (1521). The ancient town is believed to have been situated 1½ m. to the north-west, but little is known of it, and no remains save inscriptions exist.

TREVIGLIO, a town of Lombardy, Italy, in the province of Bergamo, 14 m. by rail S. by W. of that town, 410 ft. above sea-level. Pop. (1901), 5899 (town); 14,897 (commune). It has a fine church (S. Martino) containing pictures by Butinone and Zenale (1436–1526), both natives of the town, and having a lofty campanile of the 13th and 14th centuries. It has important silk works, wool-spinning, and other manufactories. It is a junction for Verona, Cremona and Bergamo, and steam tramways run to Monza, Lodi, &c.

TREVIRANUS, GOTTFRIED REINHOLD (1776–1837), German naturalist, was born at Bremen on the 4th of February 1776. He studied medicine at Göttingen, where he took his doctor's degree in 1796, and a year later he was appointed professor of medicine and mathematics in the Bremen lyceum. He died at Bremen on the 16th of February 1837.

In the first of his larger works, *Biologie; oder die Philosophie der lebenden Natur*, which appeared from 1802–1805, Treviranus gave clear expression to the theory of "descent with modification." He believed that simple forms (Protists), which he termed "zoophytes," were "the primitive types from which all the organisms of the higher classes had arisen by gradual development," and he laid down as a fundamental proposition "that all living forms are the results of physical influences which are still in operation, and vary only in degree and direction." Like many after him, he directed attention to the influence of the male elements in fertilization as a source of variation, but laid emphasis only on the intra-organismal power of adaptation to surroundings. Whatever opinion be entertained in regard to the priority and the importance of the contribution made by Treviranus to the theory of evolution, it is at least certain that he was a learned naturalist and an acute thinker. His most important later work of a synthetic nature was entitled *Erscheinungen und Gesetze des organischen Lebens* (1831).

His younger brother, LUDOLPH CHRISTIAN TREVIRANUS (1779–1864), studied medicine at Jena, and was successively professor of medicine at Bremen lyceum (1807), professor of natural history at Rostock (1812), professor of botany and director of the botanical garden at Breslau (1816), and professor of botany at Bonn (1830).

TREVISO (anc. *Tarvisium*), a town and episcopal see of Venetia, Italy, capital of the province of Treviso, 49 ft. above sea-level. Pop. (1901), 16,933 (town); 36,433 (commune). It is situated on the plain between the Gulf of Venice and the Alps, 18 m. by rail N. of Venice, at the confluence of the Sile with the Botteniga. The former flows partly round its walls, the latter through the town; and it has canal communication with the lagoons. It is an old town, with narrow irregular colonnaded streets and some interesting old frescoed houses. The cathedral of San Pietro, dating from 1141 and restored and enlarged in the 15th century by Pietro Lombardo, with a classical façade of 1836, has five domes. It contains a fine "Annunciation" by Titian (1519), an important "Adoration of the Shepherds" by Paris Bordone (born at Treviso in 1500), and frescoes by Pordenone. There are also sculptures by Lorenzo and Battista Bregno and others. The Gothic church of San Niccolò (1310–1352) contains a fine tomb by Tullio Lombardo, and a large altarpiece by Fra Marco Pensabene and others; in the church and adjoining chapter-house are frescoes by Tommaso da Modena (1352), some frescoes by whom (life of S. Ursula) are also in the Museo Civico. The Monte de Pietà contains an "Entombment" by an artist of the school of Pordenone (wrongly attributed to Giorgione). The churches of S. Leonardo, S. Andrea, S. Maria Maggiore, and S. Maria Maddalena also contain art treasures. The Piazza dei Signori contains picturesque brick battlemented palaces—the Salone del Gran Consiglio (1184) and the Palazzo del Commune (1268). Treviso is the seat of various manufactures—ironworks and pottery, macaroni, cotton-spinning and rice-husking, paper, printing, brushes, brickyards, flourmills—and is the centre of a fertile district.

The ancient Tarvisium was a *municipium*. It lay off the main roads, and is hardly mentioned by ancient writers, though Pliny speaks of the Silis as flowing "ex montibus Tarvisanis." In the 6th century it appears as an important place and was the seat of a Lombard duke. Charlemagne made it the capital of a marquisate. It joined the Lombard league, and was independent after the peace of Constance (1183) until in 1339 it came under the Venetian sway. From 1318 it was for a short time the seat of a university. In the 15th century its walls and ramparts (still extant) were renewed under the direction of Fra Giocondo, two of the gates being built by the Lombardi. Treviso was taken in 1797 by the French under Mortier (duke of Treviso). In March 1848 the Austrian garrison was driven from the town by the revolutionary party, but in the following June the town was bombarded and compelled to capitulate.

TREVITHICK, RICHARD (1771–1833), English engineer and inventor, was born on the 13th of April in the parish of Illogan, Cornwall, and was the only son of Richard Trevithick (1735–1797), manager of the Dolcoath and other important Cornish mines. He attended his first and only school at Camborne, and was in general a slow and obstinate scholar, though he showed considerable aptitude for figures. He inherited more than the average strength for which his family was famous; he stood 6 ft. 2 in. in height, and his feats in wrestling and in lifting and throwing weights were unexampled in the district. At the age of eighteen he began to assist his father, and, manifesting great fertility of mechanical invention, was soon recognized as the great rival of James Watt in improvements on the steam-engine (*q.v.*). His earliest invention of importance was his improved plunger pole pump (1797) for deep mining, and in 1798 he applied the principle of the plunger pole pump to the construction of a water-pressure engine, which he subsequently improved in various ways. Two years later he built a high-pressure non-condensing steam-engine, which became a successful rival of the low-pressure steam-vacuum engine of Watt. He was a precursor of George Stephenson in the construction of locomotive engines. On Christmas Eve 1801 his common road locomotive carried the first load of passengers ever conveyed by steam, and on the 24th of March 1802 he and Andrew Vivian applied for a patent for steam-engines in propelling carriages. In 1803 another steam vehicle made by him was run in the streets of London, from Leather Lane along Oxford Street to Paddington, the return journey being made by Islington. He next directed his attention to the construction of a steam locomotive for tramways, with such success that in February 1804 at Pen-y-darran in Wales he worked a tramroad locomotive which was able to haul twenty tons of iron; a similar engine was supplied to the Wylam colliery (Newcastle) in the following year. In 1808 he constructed a circular railway in London near Euston Square, on which the public were carried at the rate of twelve or fifteen miles an hour round curves of 50 or 100 ft. radius. Trevithick applied his high-pressure engine with great success to rock boring and breaking, as well as to dredging. In 1806 he entered into an engagement with the board of Trinity House, London, to lift ballast from the bottom of the Thames, at the rate of 500,000 tons a year, for a payment of 6d. a ton. A little later he was appointed to execute a driftway under the Thames, but the work was abandoned owing to the water breaking in. He then set up workshops at Limehouse, for the construction of iron tanks and buoys. He was the first to recognize the importance of iron in the construction of large ships, and in various ways his ideas also influenced the construction of steamboats. In the application of steam to agriculture his name occupies one of the chief places. A high-pressure steam threshing engine was erected by him in 1812 at Trewithen, while in the same year, in a letter to the Board of Agriculture, he stated his belief that every part of agriculture might be performed by steam, and that such a use of the steam-engine would "double the population of the kingdom and make our markets the cheapest in the world." In 1814 he entered on an agreement for the construction of engines for mines in Peru, and to superintend their working removed to Peru in 1816. Thence he went in 1822 to Costa Rica. He returned to England in 1827, and in 1828 petitioned parliament for a reward for his inventions, but without success. He died, penniless, at Dartford on the 22nd of April 1833.

A *Life of Richard Trevithick, with an account of his Inventions* was published in 1872 by his third son, Francis Trevithick (1812–1877).

TREVOR, SIR JOHN (1626–1672), English politician, was a son of Sir John Trevor (d. 1673) of Trevelyn, Denbighshire. His father was a member of parliament under James I. and Charles I., and sat also in the parliaments of Oliver and of Richard Cromwell, and was a member of the council of state during the Commonwealth. One of his uncles was Sir Sackvill Trevor (d. *c.* 1640), a naval officer, who was knighted in 1604; and another was Sir Thomas Trevor (1586–1656), the judge who decided in favour of the Crown in the famous case about the legality of ship-money, and was afterwards impeached and fined. Sir John Trevor was returned to parliament in 1646 as member for Flintshire. After filling several public positions under the Commonwealth and Protectorate he was a member of the council of state appointed in February 1660 and under Charles II. he rose to a high position. Having purchased the office of secretary of state he was knighted and entered upon its duties towards the end of 1668, just after he had helped to arrange an important treaty between England and France. He married Ruth, daughter of the great John Hampden, and died on the 28th of May 1672.

His second son, Thomas, Baron Trevor (1658–1730), was knighted in 1692 as solicitor-general and in 1695 became attorney-general. In 1701 he was appointed chief justice of the common pleas, and in 1712 he was created a peer as Baron Trevor of Bromham. On the accession of George I. in 1714 he was deprived of the justiceship, but from 1726 to 1730 he was lord privy seal. Three of his sons succeeded in turn to his barony, and a fourth son, Richard Trevor (1707–1771), was bishop of St Davids from 1744 to 1752, and then bishop of Durham. Robert, 4th Baron Trevor and 1st Viscount Hampden (1706–1783), represented his country at the Hague from 1739 to 1746, during which time he maintained a regular correspondence with Horace Walpole. He took the additional name of Hampden in 1754, on succeeding to the estates of that family, and in 1776, twelve years after he had become Baron Trevor, he was created Viscount Hampden. From 1759 to 1765 he was joint post-master-general. He wrote some Latin poems which were published at Parma in 1792 as *Poemata Hampdeniana*. His second son, John Hampden-Trevor (1749–1824), British minister at Munich from 1780 to 1783 and at Turin from 1783 to 1798, died only three weeks after he had succeeded his brother Thomas as 3rd Viscount Hampden, the titles becoming extinct.

Another member of this family was Sir John Trevor (1637–1717), Speaker of the House of Commons (1685). A partisan of James II., he was deprived of his office on the accession of William III., but in 1690 he was again a member of parliament, becoming Speaker for the second time in 1690 and master of the rolls in 1693. In 1695 he was found guilty of accepting a bribe and was expelled from the House of Commons, but he retained his judicial position until his death on the 20th of May 1717. Through his daughter Anne Sir John was the ancestor of the Hills, marquesses of Downshire, and of the family of Hill-Trevor, Viscounts Dungannon from 1766 to 1862.

TRÉVOUX, a town of eastern France, chief town of an arrondissement in the department of Ain, 16 m. N. of Lyons on the Paris-Lyons railway. Pop. (1906), 1934. The town is situated on the slope of the left bank of the Saône, which is here crossed by a suspension bridge and is dominated by two towers, remains of a feudal castle of the 12th century. The fortifications date from the 14th century, and the church from the same period. The law-court is a building of the 17th century, and was once the seat of the parlement of Dombes. Trévoux has a sub-prefecture and a tribunal of first instance. Gold and silver wire-drawing, introduced into the town by Jews in the 14th century, and the manufacture of apparatus for wire-drawing, are its chief industries.

Trévoux (Trevos) was hardly known before the 11th century, after which it was included in the domain of the lords of Thoire-Villars, from whom it acquired its freedom. It was bought by the Bourbons in 1402, became the capital of the Dombes, and had its own mint. In 1603 a well-known printing works was established there, from which in the 18th century the *Journal de Trévouse* and a universal dictionary known as the *Dictionnaire de Trévoux* were issued by the Jesuits.

TRIAL, in English law, the hearing by a court of first instance of the issues of fact and law involved in a civil or criminal cause. The term is inappropriate to rehearing by an appellate court. Trial follows upon the completion of the steps necessary to bring the parties before the court and to adjust the issues upon which the court is to adjudicate, which may be summed up in the term pleading (*q.v.*). In England the trial is usually in open court, and it is rare to try cases *in camera*, or to attempt to exclude the public from the hearing. The essential part of the trial is that there should be full opportunity to both sides for evidence and argument on the questions in dispute. At present in England, as distinguished from the rest of Europe, the evidence is ordinarily taken viva voce in court, and affidavits and depositions are sparingly accepted, whereas under the continental system the bulk of the proofs in civil cases are reduced to writing before the hearing.

The modes of trial have altered with legal development in English as in Roman law (see ACTION). Many forms of trial, notably those by ordeal, by wager of battle or of law (see ORDEAL and WAGER), and by grand assize, have become obsolete, and new forms have been created by legislation in order to meet altered circumstances of society. Up to a very recent date the tendency of the Roman and English systems was in opposite directions. In the former and in systems founded on it, such as the Scottish and French, trial by the judge became the rule, in the latter trial by judge and jury. In England the method of trial of issues of fact arising under the common law was by jury and a bench of judges. In truth the trials were the sittings of commissioners sent to inquire and report with the aid of the neighbourhood on questions of crime and civil wrongs in a county; the practice is summed up in the old phrase *ad quaestionem juris judices respondeant, ad quaestionem facti juratores*. In courts which administered equity or derived their law or procedure from the civil or canon law no jury was used, and the judges determined both law and fact. The system of trial before a full bench of judges even with a jury is now used on the European continent, but has been superseded in England by trial before a single judge with a jury except in the rare cases of *trial at bar*. This latter mode of trial is a survival of the mode universal in the superior courts before the writ of *nisi prius*, and is now only used in the king's bench division, when claimed by the Crown as of right or in cases of unusual importance and difficulty. Recent instances are the trial in 1904 of Arthur Lynch for treason in South Africa, and in 1905 of questions raised on a petition of right in respect of a claim to make the Crown responsible on the conquest of the Transvaal for acts of the Transvaal government before or during the war.

The necessity for trial by jury has been removed in many cases by legislation and rules of court (see JURY; SUMMARY JURISDICTION), and the present English practice is summarized in the following statement.

In the High Court of Justice in England and Ireland several modes of trial are now used:—

1. Trial by judge with a jury used in the king's bench division and in probate and matrimonial cases. There is a right to have a jury as a matter of course in actions of defamation, false imprisonment, malicious prosecution, seduction and breach of promise of marriage. In other cases, subject to exceptions to be noted, a jury can be obtained on the application of either party.

2. Trial by a judge without a jury is invariable in the chancery division and now common in the other divisions. Cases in the chancery division are not tried with a jury unless a special order is made (Ord. 36, r. 3); and the High Court in cases in which trial without jury could be ordered without consent (1875) still retains the power of so trying them, and has also acquired power to direct trial without a jury of any issue requiring prolonged examination of documents or accounts or scientific or local investigation.

3. Trial with assessors, usual in admiralty cases (the assessors being nautical) but rare in other divisions.

4. Trial by an official referee in certain cases involving much detail (R.S.C.O. 36). In the county court the ordinary mode of trial is by the judge alone, but a jury of eight is allowed in certain cases on application, and in the admiralty jurisdiction marine assessors can be called in. In other local civil courts the trial is often by jury, as in the mayor's court of London, sometimes without, as in the vice-chancellor's court of the university of Oxford. In all civil cases the parties can by a proper submission have a trial before an arbitrator selected by or for them. As regards criminal cases the right to trial by due process of law before condemnation is given by art. 29 of Magna Carta; and the trial must be by jury unless a statute otherwise provides (see COURT-MARTIAL; SUMMARY JURISDICTION).

The parties may be represented by lawyers, solicitor or counsel or both, according to the court, in county courts by accredited lay agents, or may conduct their case in person. The trial is carried on by stating to the court the pleadings if any and by opening the plaintiff's case. This is followed by the evidence of the witnesses, who are sworn and examined and cross-examined. On the completion of the plaintiff's case and evidence, the defendant's case is stated and evidence adduced in support of it. The plaintiff or his lawyer has as a rule the reply or last word, though in some courts, described as single speech courts, no reply is given. At the conclusion the judge sums up the law and facts of the case to the jury, if there is one, and their verdict is returned, or if there is no jury gives judgment, stating his conclusions on the law and facts involved.

There remain certain modes of trial not obsolete but rarely used. Such are impeachment of the House of Commons before the House of Lords; and in the case of a charge of treason or felony by a person having privilege of peerage, trial on indictment before the House of Lords, or in vacation before the court of the lord high steward. Trials by certificate, by inspection and by record, are obsolete.

The decisions on a trial at first instance are reviewed by appeal (*q.v.*), or in trial cases heard before a jury by application for a new trial, where the judge has not directed the jury correctly as to the law or has permitted them to consider inadmissible evidence, or the jurors have in their verdict acted without evidence or against the weight, *i.e.* the quality not the quantity of the evidence. Under the Criminal Appeal Act 1907 the decisions in criminal trials on indictment, whether on matters of law or of fact or on mixed questions of law or fact, are reviewable by the court of criminal appeal; but that court has no power to order a retrial of the case before a jury.

Scotland.—Jury trial was introduced into Scotland for certain classes of civil cases in the 19th century but is not much used. In criminal cases it is used where summary jurisdiction has not been conferred.

Ireland.—The law of Ireland as to trials is in substance the same as in England, except as to appeals in criminal cases.

United States.—In the United States the system of trial is that of the English common law as varied by Federal and state legislation. (W. F. C.)

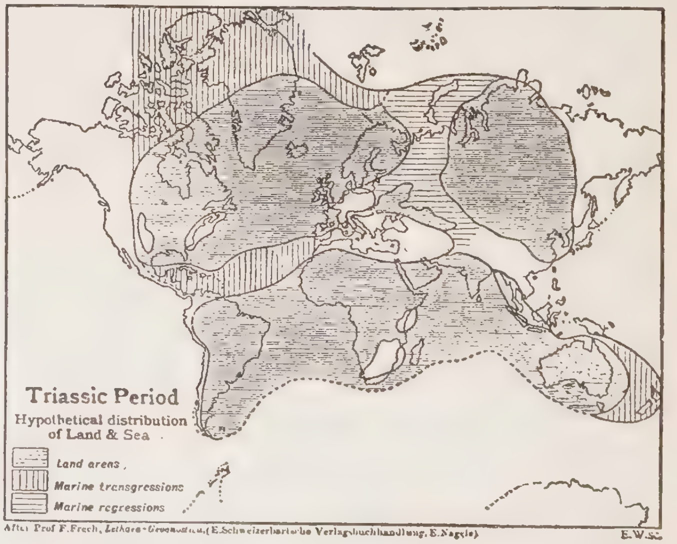
TRIANGLE, in geometry, a figure enclosed by three lines; if the lines be straight the figure is called a plane triangle; but if the figure be enclosed by lines on the surface of a sphere it is a spherical triangle. The latter are treated in TRIGONOMETRY; here we summarize the more important properties of plane triangles. In a plane triangle any one of the angular points can be regarded as the *vertex*; and the opposite side is called the *base*. The three sides and angles constitute the six elements of a triangle; it is customary to denote the angular points by capital letters and refer to the angles by these symbols; the sides are usually denoted by the lower case letter corresponding to that of the opposite angular point. Triangles can be classified according to the relative sizes of the sides or angles. An equilateral triangle has its three sides equal; an isosceles triangle has only two sides equal; whilst a scalene triangle has all its sides unequal. Also a right-angled triangle has one angle a right angle, the side opposite this angle being called the hypothenuse; an obtuse-angled triangle has one angle obtuse, or greater than a right angle; an acute-angled triangle has three acute angles, *i.e.* angles less than right angles. The triangle takes a prominent place in book i. of Euclid; whilst the relation of the triangle to certain circles is treated in book iv. (See GEOMETRY: § *Euclidean.*)

The following is a summary of the Euclidean results. The angles at the base of an isosceles triangle are equal and conversely; hence it follows that an equilateral triangle is also equiangular and conversely (i. 5, 6). If one side of a triangle be produced then the exterior angle is greater than either of the two interior opposite angles (i. 16), and equal to their sum (i. 32); hence the sum of the three interior angles equals two right angles. (In i. 17 it is shown that any two angles are less than two right angles.) The greatest angle in a triangle is opposite the greatest side (i. 18, 19). On the identical equality of triangles Euclid proves that two triangles are equal in all respects when the following parts are equal each to each (*a*) two sides, and the included angle (i. 4), three sides (i. 8, cor.), two angles and the adjacent side, and two angles and the side opposite one of them (i. 26). The mensuration is next treated. Triangles on the same base and between the same parallels, *i.e.* having the same altitude, are equal in area (i. 37); similarly triangles on equal bases and between the same parallels are equal in area (i. 38). If a parallelogram and triangle be on the same base and between the same parallels then the area of the parallelogram is double that of the triangle (i. 41). These propositions lead to the result that the area of a triangle is one half the product of the base into the altitude. The penultimate proposition (i. 47) establishes the beautiful theorem, named after Pythagoras, that in a right-angled triangle the square on the hypothenuse equals the sum of the squares on the other two sides. Two important propositions occur in book ii. viz. 12 and 13; these may be stated in the following forms: If ABC is an obtuse-angled triangle with the obtuse angle at C and a perpendicular be drawn from the angular point A cutting the base BC produced in D, then AB^2 (*i.e.* square on the side subtending the obtuse angle) $= BC^2 + CA^2 + 2BC \cdot CD$ (ii. 12); in any triangle (with the same construction but with the side AC subtending an acute angle B, we have $AC^2 = AB^2 + BC^2 - 2CB \cdot BD$ (see TRIGONOMETRY).

Book iv. deals with the circles of a triangle. To inscribe a circle in a given triangle is treated in iv. 4; to circumscribe a circle to a given triangle in iv. 5. The centre of the first circle is the intersection of the bisectors of the interior angles; if the meet of the bisectors of two exterior angles be taken, a circle can be drawn with this point as centre to touch two sides produced and the third side; three such circles are possible and are called the escribed circles. The centre of the circum circle is the intersection of the perpendiculars from the middle points of the sides. Concerning the circum circle we observe that the feet of the perpendiculars drawn from any point on its circumference to the sides are collinear, the line being called Simson's line. We may here notice that the perpendiculars from the vertices of a triangle to the opposite sides are concurrent; their meet is called the orthocentre; and the triangle obtained by joining the feet of the perpendiculars is called the pedal triangle. Also the lines joining the middle point of the sides to the opposite vertices, or medians, are concurrent in the centroid or centre of gravity of the triangle. There are several other circles, points and lines of interest in connexion with the triangle. The most important is the "nine point circle," so called because it passes through (*a*) the middle points of the sides; (*b*) the feet of the perpendiculars from the vertices to the opposite sides; and (*c*) the middle points of the lines joining the orthocentre to the angular points. This circle touches the inscribed and escribed circles. For the Brocard points and circle, Tucker's circles—with the particular forms cosine circle, triplicate ratio (T.R.) circle, Taylor's circle, McCay's circles, &c., see W. J. M'Clelland, *Geometry of the Circle*; or Casey, *Sequel to Euclid*.

TRIANGLE, in music (Fr. *triangle*, Ger. *Triangel*, Ital. *triangolo*), an instrument of percussion of indefinite musical pitch, consisting of a triangular rod of steel, open and slightly curved at one corner. The triangle, suspended by a loop, is played by means of a steel stick with a wooden handle. Varied rhythmical effects and different grades of forte and piano can be obtained. A sort of tremolo or roll can be produced by striking each end of the triangle alternately in rapid succession. When the triangle is scored for on a separate staff, the treble clef is used, but it is more often included with the bass drum on the bass stave. The tone of the triangle is clear and ringing, but it should have no definite pitch. The small triangles are the best. Beethoven, Mozart, Weber and other great masters employed the instrument.

TRIASSIC SYSTEM, in geology, the lowest or youngest system of the Mesozoic era; it occupies a position above the Permian and below the Jurassic system of rocks. The principal formations of the type region, Germany, are the Bunter, Muschelkalk and Keuper; these were for the first time grouped together under the systematic name "Trias" by F. von Alberti (1834). A description of the rocks in these formations will be found under their respective headings. For a long time this German development of the strata was regarded as typical of the period; later, however, the discovery of another more fossiliferous phase in the Alps and Mediterranean region, and subsequently in Asia and elsewhere, led geologists to take a different view of the system as a whole. It was clearly seen that there existed two distinct phases of Triassic rock-building, the one continental (terrestrial and lagoonal), the other marine (pelagic).



After Prof F. Frech, Lethaea-Geognostica, (E. Schweizerbart'sche Verlagsbuchhandlung, E. Nägele)

The original Trias of the "Germanic" area (including Great Britain) must be understood as a special local expression of the continental Trias, while the thoroughly marine type represents the normal aspect of sedimentation. Similarly, the fauna of the marine Trias is the standard for comparison with the life of other geological systems. The term Trias—indicative of the threefold grouping in Germany—thus loses its original significance when applied to the world-wide deposits of the period; its use, however, is continued by general consent.

Continental Trias.—The records of the terrestrial and lagoonal conditions during this period are to be found in the coarse conglomerates, red and mottled sandstones, marls and clays with their accompanying beds of dolomite and limestone, and layers of gypsum, anhydrite, rock-salt and coal. The coarser breccias and conglomerates appear to represent ancient screes and shore deposits, and in part at least their formation may have been due to torrential action. The remarkable oblique bedding in many of the sandstones, coupled with the fact that the sand grains are often very perfectly rounded, points to the transporting action of wind. Even the pebbles occasionally exhibit the *dreikanter* form, familiar in our modern deserts. But the marls, muds and many sandy beds were certainly deposited in sheets of water, which were evidently shallow and subject to frequent periods of desiccation. Of this we have evidence in the great abundance of reptilian foot-prints, of rain pits, ripple marks, and sun cracks upon what were once surface muds and sands. That the drying up of the water sheets repeatedly produced a highly saline condition is shown by the common occurrence of rock-salt, gypsum and anhydrite. In short, the physical conditions under which the continental Trias was formed appear to have been similar to those obtaining at the present day in the Caspian region.

In Europe the earlier deposits of the continental Trias occupy a compact area covering nearly the whole of Germany, whence they may be followed into central and northern England, Heligoland, Upper Silesia and the Vosges. Another tract lay over what are now the western Alps and south-east France; also in the Pyrenees, Balearic Islands, Sardinia, Sicily and southern Spain, and on to the north coast of Africa. In the Carpathians the same rocks appear, and they cover a large area in north-east Russia (Tartarian), and north-west Siberia. Later, the Muschelkalk limestones point to a temporary influx of the sea involving most of the above regions except Britain and Russia. Three encroachments of the sea are indicated, each followed by a period of excessive evaporation and contraction; these happened in the time of the Röth, the Lower and the Upper Muschelkalk. Finally the last influx, that of the Rhaetic Sea, not only spread much beyond the limits of the earlier incursions but remained as the forerunner of the succeeding Jurassic waters. In North America the continental Trias appears with a close resemblance to that of western Europe along the Atlantic coastal strip from Prince Edward's Island, through New Brunswick, Nova Scotia, Connecticut, New York, Pennsylvania, Virginia, to North Carolina. These are the rocks of the Newark series. Southwards it may be traced in Honduras, the Andes, Brazil, Argentina and Chile. Another large area in the western interior, Wyoming and New Mexico, is occupied by "red beds" (600–2000 ft., in part Permian) with gypsum and rock-salt. In southern Africa the upper part of the Karoo formation appears to represent Triassic time—the Stormberg beds (Permo-Trias) and the Beaufort beds (Rhaetic). In India the Panchet beds of the Gondwana system and in New South Wales the Hawkesbury series (Wianametta shales with coals and iron-stone, Hawkesbury sandstone, and at the base the Narraburra beds) belong to about the same horizon. In New Zealand the Otapiri, Wairoa and Oreti series appear to contain fossils indicating a transition from Permian to Rhaetic.

The Marine or Open-sea Trias.—This type of Triassic deposit is frequently referred to under the titles "Alpine," "Mediterranean" or "Pelagic." It first came into notice through the discovery of fossils in the neighbourhood of Recoaro and St Cassian on the southern side of the Alps, and these rocks were subsequently correlated with those at Hallstatt on the northern side. On both sides of the Alps rocks of this age flank the central core, but they are better developed, thicker and less altered towards the east than towards the west. In the western Alps Triassic beds can be only dimly recognized amongst the masses of schists called the *Schistes-lustrés* and *Bundnerschiefer*. In the eastern Alps, however, although there are sandy and conglomeratic members, such as the Werfen beds and Lunz sandstone, yet the most striking feature, in contrast with the continental Trias, is the prevalence of calcareous and dolomitic strata, to which must be added the enormously greater abundance of organic remains. The Alpine Trias varies in lithological character so rapidly from point to point, and has furthermore been subjected to so much dislocation, that great difficulty has been experienced in correlating the beds in different areas and in placing them in their proper order of sequence. The result of this difficulty has been the production of a nomenclature so unwieldy that no attempt at a detailed exposition is possible in the space here available. The principal members of the Alpine Trias will be found in their correct relative positions in the table. One of the most striking aspects of the Alpine Trias, on both the northern and southern sides, is the great development of dolomite which is so prominent a feature in the scenery of southern Tirol (Drei Zinnern, &c.). Some of these rocks contain the remains of corals, still more bear the fossils of calcareous algae, and although the view originally advanced by F. v. Richthofen that they represent Triassic coral reefs has been strongly opposed, it still seems to be the most reasonable explanation of their origin. The rocks of the marine Trias generally are argillaceous beds and dark limestones; in the Alpine regions many of the latter have been marmorized. The well-known white marble of Carrara in the Apuan Mountains is a metamorphosed Triassic limestone. The same type of Trias occurs also in south Italy (Longobardian), in Sicily, Barcelona, Balearic Islands, Crete, Bosnia, East Hungary, and the Carpathian Mountains by Bukovina and Dobrudja.

The Alpine-Mediterranean Trias sea evidently had a prolongation into Western Asia, for in Asia Minor, Armenia and Bokhara rocks with closely related fossils have been found. In Central Asia Triassic rocks are known in Afghanistan (sandstones with coal), Russian Turkestan, and in the Pamir. In India the lower Trias of the Salt Range presents the most typical example of the marine deposits of this stage. The Himalayan Trias more perfectly represents the upper portion of the system. Triassic limestones are found also in Kashmir and Hazara, and shales in Baluchistan. The marine Trias is known in Burma, Tongking, China and north-east Tibet; also in Japan, Siberia and in the arctic regions of Spitsbergen and Bear Island. In the Australasiatic region the marine Trias is found in the Sunda Islands, Sumatra, Roth and Timor and in New Caledonia.

Climate, Vulcanism.—There seems little room for doubt that the climate of Triassic times was, over large tracts of the northern continental region, dry and arid in character, certain features in the flora tending to support this view. On the other hand, the southern continental deposits, with *Glossopteris* and its allies, is more suggestive of a moist climate. There is no evidence of the glacial condition of the preceding Permian period. The Triassic period was one of rest so far as crustal movements were concerned. Volcanic activity, however, was exhibited on a large scale in the north-western part of North America, the great batholith of the Coast Range being nearly 1000 m. long; in British Columbia and Alaska large bodies of igneous rock are supposed to belong to this period. On the eastern side of the continent the diabase and dolerite lava flows, veins and sills of the famous Palisades of the Hudson valley belong to the Newark system. In Europe and Asia igneous rocks are scarce, but tuffs, porphyrites, &c., occur in the Schlern district (Upper Cassian age) and at Falzarego Strasse, Trarenanzes (Wengen horizon), in the Alpine region.

Life of the Triassic Period.—The plant life of this period exhibits on the whole a closer relationship with the Jurassic than with the preceding Palaeozoic formations. Flowering plants are unknown in the Triassic deposits and the dominant forms are all gymnosperms, the prevailing types being ferns and fern-like plants, cycadeans, conifers and equisetums. The Palaeozoic calamites, sigillarias and lepidodendrons became extinct early in this period; but in the southern hemisphere the *Glossopteris* flora still held on in considerable force. Amongst the ferns were *Lepidopteris*, *Sagenopteris*, *Danaeopteris*, with the Carboniferous genera *Sphenopteris*, *Pecopteris* and others. *Equisetites* and *Schizoneura* became common. Characteristic conifers were *Voltzia*, *Araucarites*, *Brachyphyllum*. The Cycadeans were represented by *Pterophyllum*, *Cycadites*, *Podozamites*, &c. *Baiera* was the representative of the ginkgos. Calcareous algae were important rock builders in some of the Triassic seas (*Gyroporella*, *Diplopora*). Fish remains are not generally common in the Trias; teeth and scales are crowded together in the "bone beds" in the Rhaetic and between the Keuper and Muschelkalk; in the marine Trias of the Alpine region skeletons are much more common. They are abundant also in the bituminous shales of the Connecticut Valley and in the Hawkesbury series of New South Wales. Selachians are represented by species of *Hybodus*, *Acrodus* and *Palaeobates*; dipnoids by *Ceratodus* and *Gosfordia*. The ganoids, with Palaeozoic as well as younger forms, include *Gyrolepis*, *Semionotus*, *Dictyopyge*, *Graphiurus*, *Belonorhynchus* and *Pholidopleuras*. Bony fish were very feebly represented. The amphibian labyrinthodonts (*Stegocephalia*) were numerous, their bones being found in the "bone beds" and in the Bunter and Keuper sandstones and their equivalents in North America, South Africa and India (*Labyrinthodont*, *Mastodonsaurus*, *Trematosaurus*, *Capitosaurus*). Their footprints are often very abundant, *e.g. Cheirotherium*. The reptiles of the Triassic deposits, unlike the amphibians, which are Permian in character, show a closer relationship with Jurassic forms; one of the most interesting facts in the life-history of the group is the development during this period of sea-going forms such as at a later geological period played so prominent a part. Early crocodilian reptiles are represented by *Belodon*, *Mystriosuchus*, *Stagonolepis*, *Parasuchus*; and *Rhyncocephalia* by *Telerpeton* and *Hyperodapedon*. Ichthyopterygians were represented by *Mixosaurus*, *Nothosaurus*, *Cymatosaurus*; early dinosaurs (carnivorous) by *Zanclodon*, *Anchisaurus*, *Thecodontosaurus*, *Palaeosaurus*; the remarkable theromorphs (anomodonts), by *Elginia*, *Dicynodon*, *Geikia*, *Gordonia*.

Turtles became well established during this period (*Psammochelys*, *Chelyzoon*). Of great interest is the discovery of the earliest traces of mammals in the Trias of Europe, South Africa and North America. The imperfect remains (teeth and jaw-bones) do not admit of any certainty in deciphering their relationships. *Microlestes* from the Rhaetic of England and Württemberg and *Dromatherium* from North America are perhaps the best known; *Tritylodon* from South Africa may also be added. Among the lower forms of marine life foraminifera and sponges play a subordinate part. Corals, which with the calcareous algae built considerable reefs in some regions, at this time began to assume a modern aspect, and henceforth the Hexacorallids took the place of the Palaeozoic Tetracorallid forms (*Stylophyllum*, *Pinacophyllum*, *Thecosmilia*). Crinoids were locally very numerous individually (*Encrinus liliiformis*, *Dadocrinus gracilis*). Urchins were not very common, but an important change from the Palaeozoic to the Mesozoic type of shell took place about this time. Brachiopods were important; rostrate forms like *Terebratula* and *Rhynchonella* from this time onward became more prevalent than broad hinged genera. Pelecypods were abundant, *Myophoria*, *Halobia*, *Daonella*, *Pseudomonotis*, *Avicula*, *Gervillia* and many others. Gasteropods also were numerous; at the beginning of the period, as in other groups, many Palaeozoic forms lingered on, but one of the main changes about this time was the development and expansion of siphonostomous forms with canaliculate shells. Quite the most important Mollusca were the Cephalopods. In the early Trias there still remained a few of the Palaeozoic genera, *Orthoceras*, *Hungarites*, and forms which linked up the goniatites with the ammonites, which henceforth took the lead in numbers and variety. *Prionolobus*, *Aspidites*, *Celtites*, *Meekoceras*, *Tirolites*, *Ptychites*, *Tropites*, *Ceratites*, *Arcestes*, *Psiloceras* and *Flemingites* are a few of the prominent Triassic genera. The nautiloids were fairly well represented, but they exhibit no such marked development from Palaeozoic to Mesozoic types as is shown among the ammonoids.

In the tabulated synopsis of the Triassic system given below it has been impossible to include many of the names of groups and subordinate divisions. Some of these, such as the term "Noric" (Norian), have been used in a variety of ways. A clear account of the history of the study of the Trias will be found in K. A. von Zittel's *History of Geology and Palaeontology* (Eng. trans., London 1901).

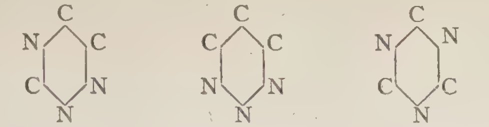
References.—The literature of the Trias is very voluminous. A full account, with full references as to date of publication, in *Lethaea Geognostica*, ed. by F. Frech, Theil II.; *Das Mesozoicum*, Bd. i. "Einleitung des Mesozoicum und der Trias" (F. Frech); "Continentale Trias" (E. Philippi and J. Wysogorski), 1903; 2nd Lieferung, "Die asiatische Trias" (F. Noetling), 1905; 3rd Lieferung, "Die Alpine Trias des Mediterran-Gebietes" (G. von Hathaber), Stuttgart, 1905. (J. A. H.)

TRIAZINES, in organic chemistry, a series of cyclic compounds, containing a ring system composed of three carbon and three nitrogen atoms. Three series are possible, the positions of

Continental Trias. Marine Trias of the Alpine and Indian Types.

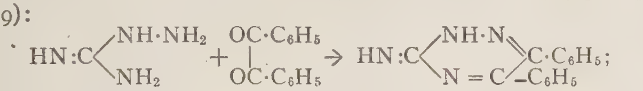
		German Trias.	England.				North Alpine Region.	South Alpine Region.	Alpine Zone Fossils.	India.		America.
Keuper	Rhaetic	Sandstones and Clays with *Avicula contorta* Bone bed	Rhaetic or Penarth beds White Lias, black paper-shales, marls Bone bed	"Newark Series" of Eastern North America and "Red beds" (in part) of western interior states, North America. Hawkesbury Series of New South Wales. Panchet Series of India. Stormberg and Beaufort beds (part) of the Karoo Series, South Africa. Tartarian group of N.E. Russia (Urals).	Upper Trias	Rhaetic	Kossen beds Lithodendron Kalk Rhaetic Dachstein Kalk and Dolomite	Kossen beds (Azzarola beds)	*Avicula contorta*	*Magalodon* limestone and "Hochgebergskalk" in part *Aulacothyris* limestone	Indian Upper Trias	Star Peak beds
	Gypskeuper	Stubensandstein Schilfsandstein	Red and mottled marls with rock-salt and gypsum Variously coloured sandstones and marls (with "Water-stones") Conglomerate and breccia			Norian	Dachstein Kalk and Coral limestones Main dolomite	Main dolomite Dachstein Kalk and Coral limestones	*Turbo* (*Worthenia*) *solitarius*	*Sagenites* beds Coral limestone *Halorites* beds		Sandstones with dinosaurs of Connecticut
	Kohlenkeuper	Grenz dolomite Lettenkohlensandstein Dolomitic limestones and marls				Carnian	Opponitz limestone and dolomite Reingrabner beds and Lunz sandstone Cardita beds	Raibl beds	*Tropites subbullatus* *Trachyceras aonides*	*Hauerites* beds Spiti dolomite *Daonella* beds		Taylorville beds of California
Muschelkalk		Haupt-Muschelkalk	Absent		Middle Trias	Ladinian	Reifling limestone and Partnach beds Wetterstein dolomite and limestone	Schlern dolomite, Esino limestone, Marmolata limestone and "Ore-bearing" dolomite Cassian beds Wengen beds Buchenstein beds Dolomite or Coral limestone Mendola dolomite	*Trachyceras aon* *Daonella lommeli* *Protrachyceras reitzi*	*Daonella* beds		Sandstones with plants, Richmond, Virginia
		Anhydrite group, dolomite and marls with rock-salt and gypsum Zellendolomit Wellenkalk and dolomite				Anisian	"Alpine Muschelkalk" (part) Guttenstein beds Ramsau (Lower) dolomite	Trinodosus beds (Prezzo limestone) (Brachiopod limestone) Recoaro limestone Virgloria limestone Tuffs of Kaltwasser near Raibl	*Ceratites trinodosus* *Rhynchonella decussata*	*Ptychites* beds Niti limestone	Indian Middle Trias	Koipato beds
Bunter		Upper division or Röth Middle division or Hauptsandstein and (Vogesensandstein) Lower division sandstones with occasional oolite (Rogenstein)	Upper mottled sandstone Pebble beds Lower mottled sandstone		Lower Trias	Scythian Wengen beds	Campil beds Seis beds	Campil beds Seis beds	*Natiria costata* *Pseudomonotis clarai*	*Hedenstroemia* beds *Prinolobus* beds *Otoceras* beds (Permian) *Ceratite* beds of Salt Range	Indian Lower Trias	*Meekoceras* beds, Idaho

the various units of the ring system being illustrated in the annexed formulae:—

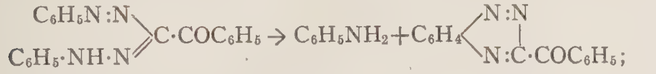


α-Triazines, β-Triazines, Cyanidines.

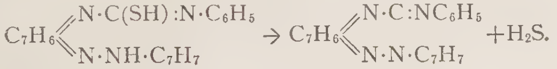
Few simple derivatives of the α-series are known, those which have been prepared result by such reactions as the condensation of aminoguanidine or a similar type of compound (*e.g.* semicarbazide) with ortho-diketones (J. Thiele, *Ann.*, 1898, 302, p. 299):



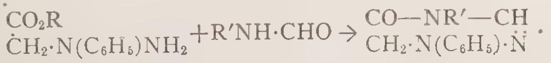
Wolff has obtained a chloro-derivative by the action of potassium cyanide on diazoacetophenone and subsequent treatment with acid. The phen-α-triazines are more numerous, and are obtained either by the action of concentrated acids on the formazyl compounds (E. Bamberger, *Ber.*, 1893, 26, p. 2786):—



by the reduction of symmetrical acyl-ortho-nitrophenyl hydrazines (*e.g.* $NO_2\cdot C_6H_4\cdot NH\cdot NH\cdot CHO$); or in the form of dihydro derivatives by the condensation of aldehydes with ortho-aminoazo compounds (H. Goldschmidt and Y. Rosell, *Ber.*, 1890, 23, p. 487), or from the aminoazo compound and a mustard oil, the resulting thiocarbanilido derivative being heated with acetic acid (M. Busch, *Ber.*, 1899, 32, p. 2960):—



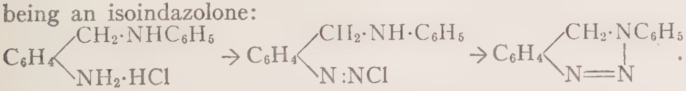
C. Harries (*Ber.*, 1895, 28, p. 1223) has also shown that *as*-phenylhydrazino-acetic esters, when heated with formamide and substituted formamides under pressure, yield dihydrotriazines:—



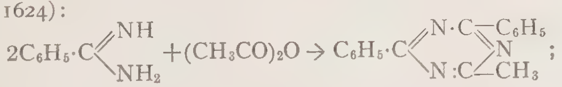
$$\begin{array}{l}CO_2R\\ \dot{C}H_2\cdot N(C_6H_5)NH_2\end{array} + R'NH\cdot CHO \rightarrow \begin{array}{l}CO-NR'-CH\\ CH_2\cdot N(C_6H_5)\cdot \ddot{N}\end{array}.$$

The phen-α-triazines are yellow-coloured crystalline compounds of a somewhat basic character.

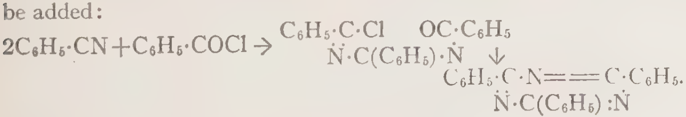
Derivatives of β-triazines are formed by the action of nitrous acid on ortho-aminobenzylamines (M. Busch, *Ber.*, 1892, 25, p. 445), or in small quantity by the action of nitrous acid on ortho-aminobenzoylphenylhydrazines (A. Konig and A. Reissert, *Ber.*, 1899, 32, p. 782), the chief product in this latter reaction being an isoindazolone:



The best drawn series of the triazines is the symmetrical or cyanidine series, members of which result from the condensation of acid anhydrides with aromatic amidines (A. Pinner, *Ber.*, 1892, 25, p. 1624):



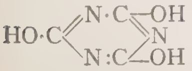
or by the condensation of aromatic nitriles with acid chlorides in the presence of aluminium chloride (Eitner and Krafft, *Ber.*, 1892, 25, p. 2263). In using benzoyl chloride in this reaction the condensation is found to proceed better if a little ammonium chloride be added:

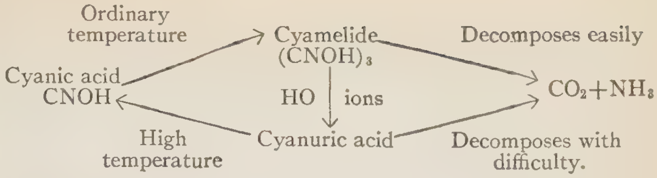


$$2C_6H_5\cdot CN + C_6H_5\cdot COCl \rightarrow \begin{array}{l}C_6H_5\cdot C\cdot Cl\qquad OC\cdot C_6H_5\\ \quad \dot{N}\cdot C(C_6H_5)\cdot N\quad \downarrow\\ \qquad\qquad C_6H_5\cdot C\cdot N{=\!=}C\cdot C_6H_5.\\ \qquad\qquad\quad \dot{N}\cdot C(C_6H_5){:}N\end{array}$$

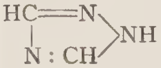
The cyanidines behave as weak bases.

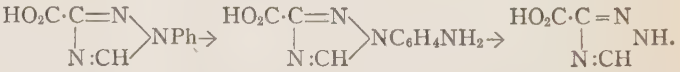
Mention may be made here of cyanuric acid, $H_3C_3N_3O_3$, which contains the same ring system as the cyanidines. It was first prepared by C. Scheele and is formed when urea is strongly heated or when cyanuric chloride is treated with water. It is usually represented by the inset formula and is closely related to cyanic acid and cyamelide, the relationships existing between the three compounds being shown in the diagram (see also A. Hantzsch, *Ber.*, 1906, 39, p. 139):





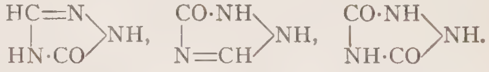
TRIAZOLES (pyrro-α and β′-diazoles), in organic chemistry, a series of heterocyclic compounds containing the ring complex (annexed formula). Derivatives were obtained by J. A. Bladin (*Ber.*, 1892, 25, p. 183) by the action of acetic anhydride on dicyanophenylhydrazine (formed from cyanogen and phenylhydrazine), the resulting acetyl derivative losing water and yielding phenylmethylcyanotriazole, which, on hydrolysis, gives the free acid. By eliminating carbon dioxide, phenylmethyltriazole results. In a similar manner, formic acid and dicyanophenylhydrazine yields a phenyl-triazole carboxylic acid, in which the phenyl group may be nitrated, the nitro group reduced to the amino group, and the product oxidized to a triazole carboxylic acid, which, by elimination of carbon dioxide, yields the free triazole:





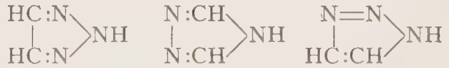
They also result when the acidylthiosemicarbazides are strongly heated, the mercapto-triazoles so formed being converted into triazoles on oxidation with hydrogen peroxide (M. Freund, *Ber.*, 1896, 29, p. 2483); by the condensation of hydrazides with acid amides; and by the distillation of the triazolones (see below) with phosphorus pentasulphide. The triazoles behave as weak bases, the imido-hydrogen being replaceable by metal.

The keto-dihydrotriazoles or triazolones are obtained by the action of hydrazines on acetyl urethane (A. Andreocci, *Ber.*, 1892, 25, p. 225). These compounds may be considered as 5-triazolones, a series of isomeric 3-triazolones resulting from the condensation of phenylsemicarbazide with aromatic aldehydes in the presence of an oxidant. The diketotetrahydrotriazoles, or urazoles, are formed by condensing urea derivatives with hydrazine salts, urazole itself resulting by the action of urea or biuret on hydrazine or its salts. It behaves as a strong acid and on treatment with phosphorus pentachloride at high temperatures gives triazole.



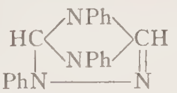
5-Triazolone. 3-Triazolone. Urazole.

Isomeric triazoles of the following constitutions are known:—



Osotriazole (αα′). Iminotriazole (ββ′). αβ-Triazole.

The osotriazoles are obtained by heating the osazones of orthodiketones with mineral acids; by the action of acetic anhydride on the hydrazoximes of orthodiketones, or by condensing diazo-methane with cyanogen derivatives (A. Peratones and E. Azzarello, *R. Acad. Lincei*, 1907 [v.], 16, pp. 237, 318). They are feeble bases which distil unchanged. The ring is very stable to most reagents. The iminobiazoles are formed by conversion of diacylhydrazines into iminochlorides which with ammonia or bases yield the required triazoles (R. Stollé, *Journ. prak. Chem.*, 1906 [ii.], 74, pp. 1, 13). M. Busch (*Ber.*, 1905, 38, pp. 856, 4049) has isolated a series of bridged ring compounds which he describes as *endo*-iminodihydrotriazoles, the triphenyl derivative (annexed formula) being prepared by condensing triphenylaminoguanidine with formic acid. The nitrate of this base (known as *nitron*) is so insoluble that nitrates may be gravimetrically estimated with its help. These bases combine with the alkyl iodides to yield quaternary ammonium salts.



Triphenyl-*endo*-iminodihydro-triazole.

TRIBALLI, in ancient geography, a Thracian people whose earliest home was near the junction of the Angrus and Brongus (the east and west Morava), and included towards the south "the Triballian plain" (Herodotus iv. 49), which corresponds to the plain of Kossovo in Turkey. In 424 B.C. they were attacked by Sitalces, king of the Odrysae, who was defeated and lost his life in the engagement. On the other hand, they were overcome by the Autariatae, an Illyrian tribe; the date of this event is uncertain (Strabo vii. 317). In 376 a large band of Triballi crossed Mt Haemus and advanced as far as Abdera; they were preparing to besiege the city, when Chabrias appeared off the coast with the Athenian fleet and compelled them to retire. In 339, when Philip II. of Macedon was returning from his expedition against the Scythians, the Triballi refused to allow him to pass the Haemus unless they received a share of the booty. Hostilities took place, in which Philip was defeated and nearly lost his life (Justin ix. 3), but the Triballi appear to have been subsequently subdued by him. After the death of Philip, the Triballi having taken up arms again, Alexander the Great in 334 crossed the Haemus and drove them to the junction of the Lyginus with the Danube. Their king Syrmus took refuge in Peuce (Peukē, an island in the Danube), whither Alexander was unable to follow him. The punishment inflicted by him upon the Getae, however, induced the Triballi to sue for peace (Arrian, *Anabasis*, i. 1, 4; 2, 2–4; 4, 6). About 280 a host of Gauls under Cerethrius defeated the Getae and Triballi (Justin xxv. 1; Pausanias x. 19, 7). Nevertheless, the latter for some fifty years (135–84) caused trouble to the Roman governors of Macedonia. In the time of Ptolemy their territory is limited to the district between the Ciabrus (Tzibritza) and Utus (Vid), in the modern Bulgaria, their chief town being Oescus (Οἶσκος Τριβαλλῶν). Under Tiberius mention is made of Treballia in Moesia, and the Emperor Maximin (235–237) had been commander of a squadron of Triballi. The name occurs for the last time during the reign of Diocletian, who dates a letter from Triballis. The Triballi are described as a wild and warlike people (Isocrates, *Panathenaicus*, 227), and in Aristophanes (*Birds*, 1565–1693) a Triballian is introduced as a specimen of an uncivilized barbarian.

See W. Tomaschek, "Die alten Thraker" in *Sitzungsberichte der k. Akad. der Wissenschaften*, cxxviii. (Vienna, 1893).

TRIBE (Lat. *tribus*, from *tres*, three), a word which is believed to have originally meant a "third part" of the people, in reference to the three patrician orders or political divisions of the people of Ancient Rome, the Ramnes, Tities and Luceres, representing the Latin, Sabine and Etruscan settlements. Its ethnological meaning has come to be any aggregate of families or small communities which are grouped together under one chief or leader, observing similar customs and social rules, and tracing their descent from one common ancestor. Examples of such "enlarged families" are the twelve tribes of Israel. In general the tribe is the earliest form of political organization, nations being gradually constituted by tribal amalgamation. (See FAMILY.)

TRIBERG, a town and health resort of Germany, in the grand duchy of Baden, in the Black Forest, pleasantly situated on the Gutach and surrounded by well-wooded hills, 2250 ft. above the sea, 35 m. by rail S.E. of Offenburg. Pop. (1905), 3717. It has four churches, one of them Anglican. Triberg is one of the chief centres of the Black Forest clock-making industry. Straw-plaiting, saw-milling, brewing, and the manufacture of wooden wares are also carried on, and the town has a permanent industrial exhibition. Triberg is what is called a *Luftkurort*, a place to which convalescents resort after a course of baths elsewhere. Near the town is the fine waterfall formed by the Gutach. Triberg came into the possession of Austria in 1654 and into that of Baden in 1806.

TRIBONIAN, the famous jurist and minister of Justinian, was born in Pamphylia in the latter part of the 5th century. Adopting the profession of an advocate, he came to Constantinople and practised in the prefectural courts there, reaching such eminence as to attract the notice of the emperor Justinian, who appointed him in 528 one of the ten commissioners directed to prepare the first *Codex* of imperial constitutions. In the edict creating this commission (known as *Haec quae*) Tribonian is named sixth, and is called "virum magnificum, magisteria dignitate inter agentes decoratum" (see *Haec quae* and *Summa reipublicae*, prefixed to the *Codex*.) When the commission of sixteen eminent lawyers was created in 530 for the far more laborious and difficult duty of compiling a collection of extracts from the writings of the great jurists of the earlier empire, Tribonian was made president and no doubt general director of this board. He had already been raised to the office of quaestor, which at that time was a sort of ministry of law and justice, its holder being the assessor of the emperor and his organ for judicial purposes, something like the English lord chancellor of the later middle ages. The instructions given to these sixteen commissioners may be found in the constitution *Deo auctore* (*Cod.* i. 17, 1), and the method in which the work was dealt with in the constitution *Tanta* (*Cod.* i. 17, 2), great praise being awarded to Tribonian, who is therein called ex-quaestor and ex-consul, and also as magister officiorum. This last constitution was issued in December 533, when the *Digest* was promulgated as a law-book. During the progress of the work, in January 532, there broke out in Constantinople a disturbance in the hippodrome, which speedily turned to a terrible insurrection, that which goes in history by the name of Nika, the watchword of the insurgents. Tribonian was accused of having prostituted his office for the purposes of gain, and the mob searched for him to put him to death (Procop. *Pers.* i. 24–26). Justinian, yielding for the moment, removed him from office, and appointed a certain Basilides in his place. After the suppression of the insurrection the work of codification was resumed. A little earlier than the publication of the *Digest*, or *Pandects*, there had been published another but much smaller law-book, the *Institutes*, prepared under Justinian's orders by Tribonian, with Theophilus and Dorotheus, professors of law (see Preface to *Institutes*). About the same time the emperor placed Tribonian at the head of a fourth commission, consisting of himself as chief and four others—Dorotheus, professor at Beyrut, and three practising advocates, who were directed to revise and re-edit the first *Codex* of imperial constitutions. The new *Codex* was published in November 534 (see constitution *Cordi nobis* prefixed to the *Codex*). With it Tribonian's work of codification was completed. But he remained Justinian's chief legal minister. He was reinstated as quaestor some time after 534 (Procop. *Pers.* i. 25; *Anecd.* 20) and seems to have held the office as long as he lived. He was evidently the prime mover in the various changes effected in the law by the novels of Justinian (*Novellae constitutiones*), which became much less frequent and less important after death had removed the great jurist. The date of his death has been variously assigned to 545, 546 and 547. Procopius says (*Anecd.* 20) that, although he left a son and many grandchildren, Justinian confiscated part of the inheritance.

The above facts, which are all that we know about Tribonian, rest on the authority of his contemporary Procopius and of the various imperial constitutions already cited. There are, however, two articles in the *Lexicon* of Suidas under the name "Tribonianos." They appear to be different articles, purporting to refer to different persons, and have been generally so received by the editors of Suidas and by modern legal historians. Some authorities, however, as for instance Gibbon, have supposed them to refer to the same person. The first article is unquestionably meant for the jurist. It is based on Procopius, whose very words are to some extent copied, and indeed it adds nothing to what the latter tells us, except the statement that Tribonian was the son of Macedonianus, was ἀπὸ δικηγόρων τῶν ὑπάρχων, and was a heathen and atheist, wholly averse to the Christian faith. The second article says that the Tribonian to whom it refers was of Side (in Pamphylia), was also ἀπὸ δικηγόρων τῶν ὑπάρχων, was a man of learning and wrote various books, among which are mentioned certain astronomical treatises, a dialogue *On Happiness*, and two addresses to Justinian. None of these books relate to law; and the better opinion seems to be that there were two Tribonians, apparently contemporaries, though possibly some of the attributes of the jurist have been, by a mistake of the compilers or transcribers of the *Lexicon* of Suidas, extended to the man of letters of the same name.

The character which Procopius gives to the jurist, even if touched by personal spite, is entitled to some credence, because it is contained in the *Histories* and not in the scandalous and secret *Anecdota*. It is as follows: "Tribonian was a man of great natural powers, and had attained as high a culture as any one of his time; but he was greedy of money, capable of selling justice for gain, and every day he repealed or enacted some law at the instance of people who purchased this from him according to their several needs. . . . He was pleasant in manner and generally agreeable, and able by the abundance of his accomplishments to cast into shade his faults of avarice" (*Pers.* i. 24, 25). In the *Anecdota* Procopius adds as an illustration of Justinian's vanity the story that he took in good faith an observation made to him by Tribonian, while sitting as assessor, that he (Tribonian) greatly feared that the emperor might some day, on account of his piety, be suddenly carried up into heaven. This agrees with the character for flattery which the minister seems to have enjoyed. The charge of heathenism we find in Suidas is probable enough; that is to say, Tribonian may well have been a crypto-pagan, like many other eminent courtiers and litterateurs of the time (including Procopius himself), a person who, while professing Christianity, was at least indifferent to its dogmas and rites, cherishing a sentimental recollection of the older and more glorious days of the empire.

In modern times Tribonian has been, as the master workman of Justinian's codification and legislation, charged with three offences —bad Latinity, a defective arrangement of the legal matter in the *Code* and *Digest*, and a too free handling of the extracts from the older jurists included in the latter compilation. The first of these charges cannot be denied; but it is hard to see why a lawyer of the 6th century, himself born in a Greek-speaking part of the empire, should be expected to write Latin as pure as that of the age of Cicero, or even of the age of Gaius and the Antonines. To the second charge also a plea of guilty must be entered. The *Code* and *Digest* are badly arranged according to our notions of scientific arrangement. These, however, are modern notions. The ancients generally cared but little for what we call a philosophic distribution of topics, and Tribonian seems to have merely followed the order of the Perpetual Edict which custom had already established, and from which custom would perhaps have refused to permit him to depart. He may more fairly be blamed for not having arranged the extracts in each title of the *Digest* according to some rational principle; for this would have been easy, and would have spared much trouble to students and practitioners ever since. As to the third complaint, that the compilers of the *Digest* altered the extracts they collected, cutting out and inserting words and sentences at their own pleasure, this was a process absolutely necessary according to the instructions given them, which were to prepare a compilation representing the existing law, and to be used for the actual administration of justice in the tribunals. The so-called *Emblemata* (insertions) of Tribonian were therefore indispensable, though, of course, we cannot say whether they were always made in the best way. Upon the whole subject of the codification and legislation in which Tribonian bore a part, see JUSTINIAN.

Tribonian, from the little we know of him, would seem to have been a remarkable man, and in the front rank of the great ones of his time. There is nothing to show that he was a profound and philosophical jurist, like Papinian or Ulpian. But he was an energetic, clear-headed man, of great practical force and skill, cultivated, accomplished, agreeable, flexible, possibly unscrupulous, just the sort of person whom a restless despot like Justinian finds useful. His interest in legal learning is proved by the fact that he had collected a vast legal library, which the compilers of the *Digest* found valuable (see const. *Tanta*).

The usual criticisms on Tribonian may be found in the *Anti-Tribonianus* (1567) of Francis Hotman, the aim of which is shown by its alternative title, *Sive discursus in quo jurisprudentiae Tribonianeae sterilitas et legum patriarum excellentia exhibetur*; and an answer to them in J. P. von Ludewig, *Vita Justiniani et Theodorae, nec non Triboniani.* (J. BR.)

TRIBUNE (Lat. *tribunus*, connected with *tribus*, tribe), a name assigned to officers of several different descriptions in the constitution of ancient Rome. The original tribunes were no doubt the commanders of the several contingents of cavalry and infantry which were supplied to the Roman army by the early gentilician tribes—the Tities, the Ramnes and the Luceres. In the historical period the infantry in each legion were commanded by six tribunes, and the number six is probably to be traced to the doubling of the three tribes by the incorporation of the new elements which received the names of *Tities secundi, Ramnes secundi, Luceres secundi.* The *tribuni celerum* or commanders of the horsemen no longer existed in the later times of the republic, having died out with the decay of the genuine Roman cavalry.[1] So long as the monarchy lasted these tribunes were doubtless nominated by the commander-in-chief, the king; and the nomination passed over on the establishment of the republic to his successors, the consuls. But, as the army increased, the popular assembly insisted on having a voice in the appointments, and from 362 B.C. six tribunes were annually nominated by popular vote, while in 311 the number was raised to sixteen, and in 207 to twenty-four, at which figure it remained. The tribunes thus elected sufficed for four legions and ranked as magistrates of the Roman people, and were designated *tribuni militum a populo*, while those who owed their office to the consuls bore the curious title of *tribuni rufuli*. The name was traced to a commander Rutilius Rufus (Liv. 7, 5; and Fest. *Ep.* 260), but was more probably derived from the dress (Mommsen, *Staatsrecht*, 1, 434). The rights of the assembly passed on to the emperors, and "the military tribunes of Augustus" were still contrasted with those nominated in the camp by the actual commanders. The obscure designation *tribunus aerarius* (tribune of the treasury) had also, in all probability, a connexion with the early organization of the army. The officer thus designated may have been the levier of the *tributum*, the original property tax, and was at any rate the paymaster of the troops. The soldier who was defrauded of his pay was allowed to exact it from this tribune by a very summary process. There was still another and important class of tribunes who owed their existence to the army. In the long struggle between the patrician and plebeian sections of the population, the first distinctions in the public service to which the plebeians forced their way were military, and the contest for admission to the consulate was, in large part, a contest for admission to the supreme command of the national forces. In 445 B.C., the year in which mixed marriages of patricians and plebeians were for the first time permitted, power was given to the senate (then wholly patrician) of determining from year to year whether consuls or military tribunes with consular authority (*tribuni militares consulari potestate* or *imperio*) should be appointed. But, even when the senate decided in favour of electing tribunes, no election was valid without the express sanction of the senate superadded to the vote of the centuriate assembly. If it happened to be too invidious for the senate openly to cancel the election, it was possible for the patricians to obtain a decision from the sacred authorities to the effect that some religious practice had not been duly observed, and that in consequence the appointment was invalid. According to tradition, recourse was had to this device at the first election, a plebeian having been successful. Forty-five years elapsed after the creation of the office before any plebeian was permitted to fill it, and it was held by very few down to the time at which it was abolished (367 B.C.) and the plebeians were fully admitted to the consulate. The number of consular tribunes elected on each occasion varied from three to six; there was no year without a patrician, and to the patrician members were probably confined the most highly esteemed duties, those relating to the administration of the law and to religion.

But by far the most important tribunes who ever existed in the Roman community were the tribunes of the commons (*tribuni plebis*). These were the most characteristic outcome of the long struggle between the two orders, the patrician and the plebeian. When in 494 B.C. the plebeian legionaries met on the Sacred Mount and bound themselves to stand by each other to the end, it was determined that the plebeians should by themselves annually appoint executive officers to stand over against the patrician officers—two tribunes (the very name commemorated the military nature of the revolt) to confront the two consuls, and two helpers called aediles to balance the two patrician helpers, the quaestors. The ancient traditions concerning the revolution are extremely confused and contradictory, and have caused endless discussions. The commonest story is that the masses assembled on the Sacred Mount bound themselves by a solemn oath to regard the persons of their tribunes and aediles as inviolable, and to treat as forfeited to Diana and Ceres, the plebeian divinities, the lives and property of those who offered them insult. That this purely plebeian oath was the real ultimate basis of the sanctity which attached to the tribunate during the whole time of its existence can hardly be believed. The revolution must have ended in something which was deemed by both the contending bodies to be a binding compact, although the lapse of time has blotted out its terms. The historian Dionysius may have been only technically wrong in supposing that peace was concluded between the two parties by the fetial priests, with the forms adopted by Rome in making treaties with a foreign state. If this were fact, the "sacrosanctity" of the tribunes would be adequately explained, because all such formal *foedera* were "sacrosanct." But, notwithstanding that the plebeians may safely be assumed to have been conscious of having to a large extent sprung from another race than the patricians and their retainers, it is not likely that the feeling was sufficiently strong to permit of the compact taking the form of a treaty between alien powers. Yet there must have been a formal acceptance by the patricians of the plebeian conditions; and most probably the oath which was first sworn by the insurgents was afterwards taken by the whole community, and the "sacrosanctity" of the plebeian officials became a part of the constitution. There must also have been some constitutional definition of the powers of the tribunes. These rested at first on an extension of the power of veto which the republic had introduced. Just as one consul could invalidate an order of his colleague, so a tribune could invalidate an order of a consul, or of any officer inferior to him. There was no doubt a vague understanding that only orders which sinned against the just and established practice of the constitution should be annulled, and then only in cases affecting definite individuals. This was technically called *auxilium*. The cases which arose most commonly concerned the administration of justice and the levying of troops.

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[1] In the legends of the foundation of the republic Brutus is represented as having exercised authority, when the king was banished, merely by virtue of holding the office of *tribunus celerum*.

Although the revolution of 494 gave the tribunes a foothold in the constitution, it left them with no very definite resources against breaches of compact by the patricians. The traditional history of the tribunate from 494 to 451 B.C. is obscure, and, so far as details are concerned, nearly worthless; but there is a thread running through it which may well be truth. We hear of attacks by patricians on the newly won privileges, even of the assassination of a tribune, and of attempts on the part of the plebeians to bring patrician offenders to justice. The assembled plebeians attempt to set up a criminal jurisdiction for their own assembly parallel to that practised by the older centuriate assembly, in which the nobles possess a preponderating influence. Nay, more, the plebs attempts something like legislation; it passes resolutions which it hopes to force the patrician body to accept as valid. As to details, only a few are worth notice. In the first place, the number of tribunes is raised to ten, how we do not know; but apparently some constitutional recognition of the increase is obtained. Then an alteration is made in the mode of election. As to the original mode, the ancient authorities are hopelessly at variance. Some of them gravely assert that the appointment lay with the assembly of the curiae—the most ancient and certainly the most patrician in Rome, even if we allow the view, which, in spite of great names, is more than doubtful, that the plebeians were members of it at any time when it still possessed political importance. The opinion of Mommsen about the method of election is more plausible than the others. It was in accordance with the Roman spirit of order that the tribunes, in summoning their assemblies, should not ask the plebeians to come *en masse* as individuals, and vote by heads, but should organize their supporters in bands. The *curia* was certainly a territorial district, and the tribunes may have originally used it as the basis of their organization. If tribunes were elected by plebeians massed *curiatim*, such a meeting would easily be mistaken in later times for the *comitia curiata*. At any rate, a change was introduced in 471 by the Publilian Law of Volero, which directed that the tribunes should be chosen in an assembly organized on the basis of the Servian or local tribe, instead of the *curia*. This assembly was the germ of the *comitia tributa*. The question by what authority the Law of Volero was sanctioned is difficult to answer. Possibly the law was a mere resolution of the plebeians with which the patricians did not interfere, because they did not consider that the mode of election was any concern of theirs. In the first period of the tribunate the tribunes almost certainly agitated to obtain for their supporters a share in the benefits of the state domain. And, whatever view may be taken of the movement which led to the decemvirate, an important element in it was of a certainty the agitation carried on by the tribunes for the reduction of the law of Rome to a written code. Until they obtained this it was impossible for them effectually to protect those who appealed against harsh treatment by the consuls in their capacity of judges.

During the decemvirate the tribunate was in abeyance. It was called into life again by the revolution of 449, which gave the tribunes a considerably stronger position. Their personal privileges and those of the aediles were renewed, while sacrosanctity was attached to a body of men called *judices decemviri*, who seem to have been the legal assistants of the tribunes. The road was opened up to valid legislation by the tribunes through an assembly summoned by them on the tribe-basis (*concilium plebis*), but in this respect they were submitted to the control of the senate. The growth of the influence of this assembly over legislation belongs rather to the history of the comitia (*q.v.*) than to that of the tribunate. After the Hortensian Law of 287 B.C. down to the end of the republic the legislation of Rome was mainly in the hands of the tribunes. The details of the history of the tribunate in its second period, from 449 to 367 B.C., are hardly less obscure than those which belong to the earlier time. There was, however, on the whole, undoubtedly an advance in dignity and importance. Gradually a right was acquired of watching and interfering with the proceedings of the senate, and even with legislation. Whether the absolute right of veto had been achieved before 367 may well be doubted. But the original *auxilium*, or right of protecting individuals, was, during this period, undergoing a very remarkable expansion. From forbidding a single act of a magistrate in relation to a single person, the tribunes advanced to forbidding by anticipation all acts of a certain class, whoever the persons affected by them might prove to be. It therefore became useless for the senate or the comitia to pass ordinances if a tribune was ready to forbid the magistrates to carry them out. Ultimately the mere announcement of such an intention by a tribune was sufficient to cause the obnoxious project to drop; that is to say, the tribunes acquired a right to stop all business alike in the deliberative assembly, the senate, and in the legislative assemblies, the comitia. The technical name for this right of veto is *intercessio*. To what extent the tribunes during the time from 449 to 367 took part in criminal prosecutions is matter of doubt. The XII. Tables had settled that offenders could only be punished in person by the centuries, but tradition speaks of prosecutions by tribunes before the tribes where the penalty sought was pecuniary. The two main objects of the tribunes, however, at the time of which we are speaking were the opening of the consulate to plebeians and the regulation of the state domain in the interests of the whole community. Both were attained by the Licinio-Sextian Laws of 367.

Then a considerable change came over the tribunate. From being an opposition weapon it became an important wheel in the regular machine of state. The senate became more and more plebeian, and a new body of nobility was evolved which comprised both orders in the state. The tribunes at first belonged to the same notable plebeian families which attained to the consulate. The old friction between senate and tribunes disappeared. It was found that the tribunate served to fill some gaps in the constitution, and its power was placed by common consent on a solid constitutional basis. From 367 to 134 B.C. (when Tiberius Gracchus became tribune) the tribunate was for the most part a mere organ of senatorial government. As the change made by the Gracchi was rather in the practice than in the theory of the tribunate, it will be convenient at this point to give a definite sketch of the conditions and privileges attaching to the office.

Even after the difference between patrician and plebeian birth had ceased to be of much practical consequence in other directions, the plebeian character was a necessity for the tribune. When the patricians P. Sulpicius Rufus and, later, P. Clodius (the antagonist of Cicero) desired to enter on a demagogic course, they were compelled to divest themselves of their patrician quality by a peculiar legal process. Even the patricians who became so by mere fiat of the emperors were excluded from the tribunate. The other necessary qualifications were for the most part such as attached to the other Roman magistracies—complete citizenship, absence of certain conditions regarded as disgraceful, fulfilment of military duties. The minimum age required for the office was, as in the case of the quaestorship, twenty-seven. The tribunate, however, stood outside the round of magistracies, the conditions of which were regulated by the Villian Law of 180 B.C. The election took place in a purely plebeian assembly, ranged by tribes, under the presidency of a tribune selected by lot. The tribune was bound by law to see a complete set of ten tribunes appointed. Technically, the tribunes were reckoned, not as magistrates of the Roman people, but as magistrates of the Roman plebs; they therefore had no special robe of office, no lictors, but only messengers (*viatores*), no official chair, like the curule seat, but only benches (*subsellia*). Their right to summon the plebs together, whether for the purpose of listening to a speech (in which case the meeting was a *contio*) or for passing ordinances (*comitia tributa*), was rendered absolute by the "laws under sacred sanction" (*leges sacratae*), which had been incorporated with the constitution on the abolition of the decemvirate. The right to summon the senate and to lay business before it was acquired soon after 367, but was seldom exercised, as the tribunes had abundant means of securing what they wanted by pressure applied to the ordinary presidents—the consuls or the praetor. When an *interregnum* came about and there were no "magistrates of the Roman people," the plebeian tribunes became the proper presidents of the senate and conductors of ordinary state business. At the end of the republic there were *interregna* of several months' duration, when the tribunes held a position of more than usual importance. A tenure of the tribunate did not, until a comparatively late period (probably about the time of the Second Punic War), confer a claim to a permanent seat in the senate. The candidates for the office were mainly young men of good family who were at the beginning of their political career, but the office was often filled by older men of ambition who were struggling upwards with few advantages. The plebeian aediles very soon after 367 became dissociated from the tribunes and associated with the curule aediles, so that in the political hierarchy they really ranked higher than those who were originally their superior officers.

The real kernel of the tribune's power consisted in his *intercessio*, or right of invalidating ordinances, whether framed by the senate or proposed by a magistrate to the *comitia*, or issued by a magistrate in pursuance of his office. From 367 B.C. down to the time of the Gracchi the power of veto in public matters was, on the whole, used in the interests of the aristocratic governing families to check opposition arising in their own ranks. A recalcitrant consul was most readily brought to obedience by an exercise of tribunician power. But, although modern readers of the ancient historians are apt to carry away the idea that the tribunate was an intensely political office, it is safe to say that the occasions on which tribunes found it possible to play a prominent part in politics were extremely few, even in the late republic. On the other hand, the tribunes found a field for constant activity in watching the administration of justice and in rendering assistance to those who had received harsh treatment from the magistrates. The tribunes were, in fact, primarily legal functionaries, and constituted in a way the only court of appeal in republican Rome. It was to this end that they were forbidden to pass a whole night away from the city, except during the Latin festival on the Alban Mount, and that they were expected to keep their doors open to suppliants by night as well as by day. They held court by day in the Forum close by the Porcian basilica, and frequently made elaborate legal inquiries into cases where their help was sought. Naturally this ordinary humdrum work of the tribunes has left little mark on the pages of the historians, but we hear of it not infrequently in Cicero's speeches and in other writings which deal with legal matters. According to the general principle of the constitution, magistrates could forbid the acts of magistrates equal to or inferior to themselves. For this purpose the tribunes were deemed superior to all other officers. If a tribune exercised his veto no other tribune could annul it, for the veto could not be itself vetoed, but it was possible for another tribune to protect a definite individual from the consequences of disobedience. The number of the tribunes (ten) made it always possible that one might balk the action of another, except at times when popular feeling was strongly roused. In any case it was of little use for a tribune to move in any important matter unless he had secured the co-operation or at least the neutrality of all his colleagues. The veto was not, however, absolute in all directions. In some it was limited by statute; thus the law passed by Gaius Gracchus about the consular provinces did not permit a tribune to veto the annual decree of the senate concerning them. When there was a dictator at the head of the state, the veto was of no avail against him. One of the important political functions of the tribunes was to conduct prosecutions of state offenders, particularly ex-magistrates. These prosecutions began with a sentence pronounced by the tribune upon the culprit, whereupon, exercising the right given him by the XII. Tables, the culprit appealed. If the tribune sought to inflict punishment on the culprit's person, the appeal was to the assembly of the centuries; if he wished for a large fine, the appeal was to the assembly of the tribes. As the tribune had no right to summon the centuries, he had to obtain the necessary meetings through the urban praetor. In the other event he himself called together the tribute assembly and proposed a bill for fining the culprit. But the forms of trial gone through were very similar in both cases.

It is commonly stated that a great change passed over the tribunate at the time of the Gracchi, and that from their day to the end of the republic it was used as an instrument for setting on foot political agitation and for inducing revolutionary changes. This view is an inversion of the facts. The tribunate did not create the agitation and the revolutions, but these found vent through the tribunate, which gave to the democratic leaders the hope that acknowledged evils might be cured by constitutional means, and in the desperate struggle to realize it the best democratic tribunes strained the theoretic powers of their office to their ruin. For the bad tribunes did not hesitate to use for bad ends the powers which had been strained in the attempt to secure what was good. But herein the tribunate only fared like all other parts of the republican constitution in its last period. The consuls and the senate were at least as guilty as the tribunes. After a severe restriction of its powers by Sulla and a restoration by Pompey, which gave a twenty years' respite, the essential force of the tribunate was merged into the imperial constitution, of which indeed it became the principal constituent on the civil side. The ten tribunes remained, with very restricted functions. The emperors did not become tribunes, but took up into their privileges the essence of the office, the "tribunician authority." This distinction between the principle of the office and the actual tenure of the office was a creation of the late republic. Pompey, for example, when he went to the East, was not made proconsul of all the Eastern provinces, but he exercised in them a "proconsular authority" which was equal to that of the actual proconsuls—an authority which was the germ of the imperial authority on its military side. Similarly the emperor, as civil governor, without being tribune, exercised powers of like quality with the powers of the tribune, though of superior force. By virtue of his tribunician authority he acquired a veto on legislation, he became the supreme court of appeal for the empire, and to his person was attached the ancient sacrosanctity. Augustus showed the highest statesmanship in founding his power upon a metamorphosed tribunate rather than upon a metamorphosed dictatorship, upon traditions which were democratic rather than upon traditions which were patrician and optimate. The tribunes continued to exist till a late period, with gradually vanishing dignity and rights; but it is not necessary here to trace their decay in detail.

The name "tribune" was once again illuminated by a passing glory when assumed by Cola di Rienzi. The movement which he headed was in many respects extremely like the early movements of the plebeians against the patricians, and his scheme for uniting Italy in one free republic was strangely parallel with the greatest dream of the Gracchi.

The history of the tribunate is interwoven with that of Rome, and must, to a large extent, be sought for in the same sources. The principles attaching to the office are profoundly analysed by Mommsen in his *Staatsrecht*, and are clearly set forth by E. Herzog in his *Geschichte u. System der römischen Staatsverfassung* (Leipzig, 1884). (J. S. R.)

TRIBUNE (med. Lat. *tribuna*, from classical Lat. *tribunal*), in architecture, the term given to the semicircular apse of the Roman basilica, with a raised platform, where the presiding magistrate sat; subsequently applied generally to any raised structure from which speeches were delivered and to the private box of the emperor at the Circus Maximus. In Christian basilicas the term is retained for the semicircular recess behind the choir, as at S. Clemente in Rome, S. Apollinare in Classe, Ravenna, S. Zeno at Verona, S. Miniato near Florence, and other churches. The term is also loosely applied to various other raised spaces in secular as well as ecclesiastical buildings, in the latter sometimes in the place of "pulpit," as in that of the refectory of St Martin des Champs at Paris. It is also given to the celebrated octagon room of the Uffizi at Florence, and sometimes to a gallery or triforium.

TRIBUTE (Lat. *tributum*, a stated payment, contribution), a sum of money or other valuable thing paid by one state or person to another state or person, either as an acknowledgment of submission, or as the price of peace or protection. Hence, in a secondary sense, an offering to mark respect or gratitude. Revenue by means of tribute was one of the most characteristic forms of the financial systems of ancient states. In imperial Athens large revenues were derived from the states of the Delian league (*q.v.*), while in both Carthage and Rome inferior or dependent districts and races were laid under contribution to a very considerable extent (see FINANCE).

The word tribute was also applied in the Roman republic to (1) certain extraordinary taxes, as opposed to the ordinary vectigalia. Such, in particular, were certain property taxes, raised to meet the expenses of war. They were levied on all citizens alike, in proportion to the extent of a man's fortune, and varied according to the total amount of revenue to be raised. (2) To the ordinary *stipendium* or tax of fixed amount paid either in money or in kind, on property, trades, or as a poll-tax, raised in the Roman provinces (see PROVINCE).

TRICHINOPOLY, a city and district of British India, in the Madras presidency. The city is on the right bank of the river Cauvery, 250 m. by rail S.W. from Madras. Pop. (1901), 104,721. The fort which forms the nucleus of the city measures about 1 m. by ½ m.; its defences have been removed. Within it rises the Rock of Trichinopoly, 273 ft. above the city, and so completely isolated as to provide a remarkable view over the surrounding plains. It is ascended by a covered stone staircase, entered by a carved gateway, and profusely ornamented. At intervals up this stair are chambers connected with the temple on the rock. Buddhist inscriptions and carvings in some of them are attributed to the 5th or 6th century. Near the foot of the rock is a fine masonry tank called the Teppakulam, and the palace of the nawab, of which the fine domed audience hall is now used as a town-hall. In Trichinopoly is St Joseph's first-grade college, maintained by the Jesuit mission and occupying, among other buildings, a house formerly the residence of Clive. Another first-grade college is maintained by the Society for the Propagation of the Gospel; it has grown out of schools founded by the missionary Schwarz. The Roman Catholics have a fine cathedral. Trichinopoly is important as a trading centre, especially as being a railway junction. It has special industries in goldsmiths' work and modelling in pith; the well-known Trichinopoly cigars are chiefly manufactured from tobacco grown outside the district at Dindigul. Trichinopoly and its neighbourhood was the scene of much hard fighting between the English and the French during the Carnatic wars between 1749 and 1761.

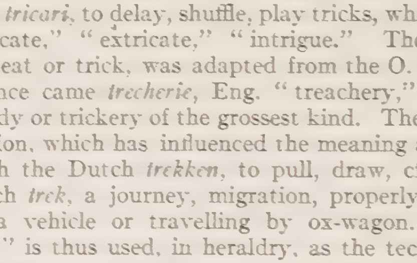
The DISTRICT OF TRICHINOPOLY has an area of 3632 sq. m. The surface is generally flat, though diversified by masses of crystalline rock, of which the Trichinopoly Rock in the fort is a well-known example. The only mountains are the Pachamalais, which rise to 2500 ft. and extend into Salem district. The Cauvery and its branch, the Coleroon, are the only rivers of any importance. The climate is very hot and not liable to great variations; the annual average rainfall is about 34 in. The principal crops are rice, millets, other food-grains and oil-seeds, with a little cotton and tobacco. The main line of the South Indian railway traverses the district, with a branch to Erode. In 1901 the population was 1,444,770, showing an increase of 5% in the decade. The district came into the hands of the British along with the rest of the Carnatic in 1801.

See *Trichinopoly District Gazetteer* (Madras, 1907).

TRICHINOSIS, or TRICHINIASIS, a disease, in man and other animals, caused by infection by the parasite *trichina* or *trichinella spiralis*. The presence of encysted trichinae in the muscles was discovered by Sir James Paget (*q.v.*) in 1835, and they were named by Sir R. Owen; but it was not until some years after that the clinical characters of the acute disease caused by the invasion of the parasite were discovered. This discovery was made in 1860 by Friedrich von Zenker (1825–1898) on examining the abdominal muscles of a patient who died at Dresden with symptoms taken to be those of typhoid fever, the case being afterwards accounted one of trichinosis on the post mortem evidence. Epidemics of this disease occur from time to time, especially in north Germany, from the eating of uncooked swine's flesh, in which trichinae are not uncommon. Out of 6320 cases in Germany during the years 1881 to 1898, 5456 occurred in states where raw pork is a common article of food. And, from the point of view of public health, the hog is the animal which is the main source of infection, others—except rats—being only rarely infested with the parasite. The greatest care is now taken to examine the carcases of swine for trichinae, a piece of the diaphragm of every animal being searched with the microscope by an inspector specially appointed, and the trichinous hogs being condemned. But it has not been found that this microscopic examination serves as an effective check, indeed it is apt to create a false feeling of security. Over [illegible] of the German cases of trichinosis between 1881 and 1898 were traced to meat so inspected and passed as free from trichinae. In America accordingly microscopic examination is not considered to give any guarantee of soundness from trichinae, in spite of a government mark "inspected and passed" (see B. H. Ransom, [illegible] of U.S. Dept. of Agriculture, [illegible]). The symptoms in man are occasioned by the presence of the free parasites in the intestine, by the development of young trichinae from the eggs, and most of all by the migration of the parasites from the intestinal canal to the muscles, where they become encysted. [illegible] from [illegible] to [illegible] [illegible] to the [illegible] [illegible] and this [illegible] When consumed in small quantity, the parasites may give rise to no marked symptoms, and they are sometimes found accidentally in muscular fibre in the bodies of those who had probably experienced no definite symptoms from their invasion. In the more acute and serious cases, sometimes ending fatally, the early symptoms are nausea, failure of appetite, diarrhoea and fever; later, when the migration to the muscles begins, there is more fever, stiffness, pain and swelling in the limbs, swelling of the eyelids, continued exhausting diarrhoea, perspirations and sometimes delirium. During convalescence there is desquamation of the cuticle. The discovery by T. R. Brown of a marked leucocytosis with an extraordinary increase of eosinophiles now enables a diagnosis to be made in cases where the symptoms are obscure. If the diagnosis be made early in the case, brisk purgatives, particularly calomel, are the best treatment; if the parasites are already on their way to the muscles, the only thing left to do is to support the patient's strength. There need, however, be no fear of infection at all if the meat be thoroughly cooked and cured before eaten. This is the only effective precaution.

TRICK, a crafty or fraudulent device, deceitful artifice or stratagem, hence an exhibition of skill, especially in sleight of hand or jugglery, the term being also used of a peculiar trait or manner of speech, character or physical habit. A specific use is that for the cards played at a single round, which are taken up and count towards the winning of the game. The origin of the word is ultimately to be found in Lat. *tricae*, trifles, hindrances, wiles, whence *tricari*, to delay, shuffle, play tricks, which has also given "intricate," "extricate," "intrigue." The M. Eng. *trichen*, to cheat or trick, was adapted from the O. Fr. *trichier*, *trechier*, whence came *trecherie*, Eng. "treachery," a betrayal of faith, perfidy or trickery of the grossest kind. There has been also a confusion, which has influenced the meaning and form of "trick," with the Dutch *trekken*, to pull, draw, cf. the South African Dutch *trek*, a journey, migration, properly the action of drawing a vehicle or travelling by ox-wagon. "Trick" or "tricking" is thus used, in heraldry, as the technical term for the drawing of a coat of arms in monochrome, giving the tinctures by the conventions of vertical, horizontal or diagonal lines, &c.

TRICLINIUM, in Roman antiquities, a set of three couches (*lecti*) arranged round a four-sided dining table, one side of which was left open to provide free access for the attendant slaves. These couches were distinguished as the highest (A, *lectus summus*), the middle (B, *lectus medius*) and the lowest (C, *lectus imus*); the guests who reclined on B had A on their left and C on their right. Each couch was usually occupied by three persons, whose left arm rested on a cushion, the right hand being thus disengaged for purposes of eating. The nine places were allotted in accordance with strict etiquette. A and B were reserved for the guests (B for the most distinguished), C for the host and his family. In A and C the chief place was 1; in B it was 3, which was consequently the place of honour at the banquet. It was called *locus consularis* (ὑπατικός), probably as being next to the host. Another explanation is that, since it was on the open and unsupported side of the couch, it was chosen in order that, if a consul happened to be present among the guests, he might be able to receive communications, sign documents or transact business with the least inconvenience. It the *locus classicus* in Horace (*Satires*, ii. 8, 20–23), which describes the banquet given by Nasidienus in honour of Maecenas, the host appears



to have resigned his place to Nomentanus, as being more capable of entertaining the guest of the evening. In later republican times, after the introduction of round tables of citrus wood, the three couches were replaced by one of crescent shape (called *sigma* from the form C of the Greek letter; also *stibadium* and *accubitum*), which as a rule was only intended to hold five persons. The two corner seats (*cornua*) were the places of honour, that on the right being considered superior. The remaining seats were reckoned from left to right, so that the least important seat was on the left side of the most important. The use of the *sigma* continued till the middle ages. The dining-room itself was also called *triclinium*, and in the houses of wealthy Romans there were several *triclinia* suited to the different seasons of the year.

See Marquardt, *Das Privatleben der Römer* (1886), p. 302.

TRICOUPIS (or Tricoupi), **CHARILAOS** (1832–1896), Greek statesman, was born at Nauplia in 1832. After studying law and literature in Athens and in Paris, he was sent to London in 1852 as an attaché of the Greek legation. By 1863 he had risen to be chargé d'affaires, but he aimed rather at a political than a diplomatic career. In 1865, therefore, after he had concluded the negotiations for the cession by Great Britain to Greece of the Ionian Islands, he entered the Greek chamber of deputies, and in the following year was made foreign minister, at the early age of thirty-four. In 1875 he became prime minister for a few months, but had no opportunity even to begin carrying out the policy which he had in mind. This policy was to develop the resources of his country so as to create an army and a fleet, and thus to give Greece the power to acquire a leading place among the nations of south-eastern Europe. It was not until 1882 that he was able to take measures to this end. In that year he became prime minister for the third time (his second period of office, two years earlier, had lasted only for a few months), and at once set about the task of putting Greek finance upon a firmer basis, and of increasing the prosperity of the country by making roads, railways and harbours. He was defeated at the general election in 1885, but in the following year he resumed office, and again took up the labour of economic and financial reform. His difficulties were now increased by the large expenditure which had been incurred for military preparations while he had been out of office as the result of the union effected between Bulgaria and eastern Rumelia. The Greeks had demanded from Turkey a compensation for this shifting of the balance of power, and had prepared to enforce their demand by an appeal to arms. The Great Powers, however, had interfered, and by blockading the Piraeus had compelled Greece to remain quiet. Tricoupis, nevertheless, believed that he could in a few years raise the value of Greek paper currency to par, and upon that assumption all his calculations were based. Unfortunately for himself and his country, he was not able to make his belief good. His dexterity in finance called forth general admiration, and his schemes for the construction of roads and railways met with a certain amount of success. But at last he was obliged to recognize that the warnings offered to him had been sound. Greece could not meet her obligations. Tricoupis tried to make terms with the creditors of his nation, but he failed in this also. The first taxation which he proposed aroused great hostility, and in January 1895 he resigned. At the general election, four months later, he and his party were defeated. He at once retired from public life, and soon afterwards the disease declared itself which eventually proved fatal. He died at Cannes on the 11th of April 1896. The faults of excessive ambition and of a far too sanguine optimism, which marked Tricoupis' character, could not prevent him from being regarded, even during his lifetime, as the foremost Greek statesman of his time. He was not a favourite with the populace, nor was he beloved so much as respected by his followers. By nature he was reserved—his nickname was "the Englishman"—and he had no sympathy with the arts of the demagogue. But, both in the ranks of his own party and by the nation at large, his abilities and his force of character were unquestioned. It was his misfortune that the circumstances of the time did not allow his wide schemes for the benefit of his country to be carried into effect. (H. H. F.)

TRICOUPIS, SPYRIDION (1788–1873), Greek author and statesman, son of the primate of Missolonghi, was born on the 20th of April 1788. After studying in Paris and London he became private secretary to the fifth earl of Guilford, who resided in the Ionian Islands. He was a friend of Lord Byron, and pronounced his funeral oration in the cathedral of Missolonghi (1824). During the Greek War of Independence he occupied several important administrative and diplomatic posts, being a member of the provisional government in 1826 and of the national convention at Troezen in 1827, and president of the council and minister of foreign affairs in 1832. He was thrice Greek minister in London (1835–1838, 1841–1843 and 1850–1861), and in 1850 envoy-extraordinary to Paris. After the Revolution he became minister of foreign affairs and of public instruction, and held portfolios in several subsequent short-lived ministries. He died on the 24th of February 1873.

A collection of his earlier religious and political orations was published in Paris in 1836. His chief work is a history of the Greek insurrection, *Ἱστορία τῆς ἑλληνικῆς ἐπαναστάσεως* (4 vols., London, 1853–1857; 2nd ed., 1862). He also wrote a martial poem, *Ὁ δῆμος. Ποίημα κλεπτικόν* (Paris, 1821).

TRICYCLE (from prefix *tri*, three, and Gr. *κύκλος*, circle, wheel). The tricycle, as a machine for pleasure riding, has steadily diminished in relative importance since the advent of the safety bicycle (see Cycling). In its modern form it is a chain-driven rear-driver. The driving axle is provided with a differential gear, which allows of both wheels being driven whether the tricycle is moving in a straight or in a curved path. There are four rows of balls, two near the middle resisting the pull of the driving chain and two near the road wheels supporting the vertical load. Two types of driving axle are in use. In one the axle is supported from a parallel frame tube by four short brackets. In the other type, the Starley-Abingdon axle, the frame tube is concentric with the axle, and the middle portion is enlarged to form a casing for the chain-wheel, with two apertures for the chain to pass through. The other mechanical details are nearly all similar to those on a bicycle.

Carrier tricycles, for tradesmen's delivery purposes, are made in two types, one with an extended wheel base and the carrier behind the rider, the other with a single rear driving wheel, the two steering wheels and the carrier being mounted in front on a transverse tube or frame which is jointed to the rear frame at the steering head. The second arrangement gives the simplest possible form of tricycle, but it is unsuited for touring purposes.

Tricars.—The tricar or motor tricycle was first made by removing the front wheel of a motor bicycle and replacing it by a frame carrying two side steering wheels and a seat. With a powerful engine this arrangement gives a light vehicle from which good performances are obtained on roads with easy gradients. On steeper gradients the power must be increased, and the belt drive with only one speed is inadequate. The modern tricar is on different lines, resembling a small motor car on three wheels. The engine is 6 to 10 h.p., preferably with two cylinders, air or water cooled, with clutch and gear-box giving two or three speeds, sometimes also a "reverse" speed. The transmission is usually by a chain from the engine shaft to the gear-box, thence by another chain to the rear road wheel. The frame or chassis is supported on the three road wheels by springs. The steering gear is on the same general lines as that of a motor car. The weight of a tricar of 7 to 10 h.p. is between 700 and 1000 lb. It is a much faster vehicle, especially uphill, than a small car of equal price. The rear tire, however, is subject to severer working conditions than the two driving wheel tires of a small car, and must be of adequate strength, or trouble will be frequent.

The tricar cannot be said to have attained to the same degree of trustworthiness and freedom from breakdown as the motor bicycle or motor car. The rear tire is difficult to remove, in case of puncture. The chain drive, direct from a small chain-wheel on the engine shaft, is faulty in principle. The engine shaft running often at 2000 revolutions per minute, the chain is necessarily noisy, and is subject to continual gradual stretching, necessitating frequent readjustment. In all respects, except speed, the tricar is inferior to the small car. (A. Sp.)

TRIDENT (Lat. *tridens*, *tri-*, *tres*, three and *dens*, tooth), a three-toothed or three-pronged fork or spear. It is and has been from primitive times the typical instrument for spearing fish, the Scottish "leister" (Norw. *ljoster*), and was thus taken as the badge or emblem of the Greek Poseidon, the god of the sea. In Homer (cf. *Il.* xii. 27; *Od.* lv. 506 seq.) Poseidon is armed with the *τρίαινα* (another word is *τριόδους*, cf. Pind. *Ol.* ix. 45). The trident as the symbol of the sovereignty of the sea is found as early as Archilochus (*c.* 700 B.C.); a more familiar example is to be found in Aristophanes (*Eq.* 839). The emblematical figure of Britannia holds the trident as mistress of the sea. In the gladiatorial shows of ancient Rome the *retiarius* was armed with a trident as a weapon.

TRIDYMITE, a mineral consisting of silicon oxide or silica, SiO_2, but differing from quartz in crystalline form. The crystals are small, thin hexagonal plates or scales, which are usually twinned together in groups of three; hence the name of the mineral, from Greek *τρίδυμος*, triplet. The apparent hexagonal plates are themselves pseudo-symmetric twins of optically biaxial material, and the exact crystalline form is doubtful. The plates are colourless and transparent and have a vitreous lustre. The hardness is 7 and the specific gravity 2·3 (that of quartz being 2·65). Unlike quartz, it is soluble in a boiling solution of sodium carbonate. Tridymite occurs in the cavities of acid volcanic rocks (rhyolite, trachyte and andesite); the best-known localities are Cerro San Cristobal near Pachuca in Mexico, the Euganean Hills near Padua, and the Siebengebirge on the Rhine. Probably identical with tridymite is the form of silica known as asmanite, found in the meteorite which fell at Breitenbach in the Erzgebirge, Bohemia. (L. J. S.)

TRIER (French *Trèves*), an ancient city of Germany, formerly the capital of an archbishopric and electorate of the empire, and now the seat of a Roman Catholic bishop and the chief town of a governmental department in the Prussian province of the Rhine. Pop. (1885) 33,019, (1905) 46,709 (86% Roman Catholics). It is situated on the right bank of the Moselle, about 6 m. from the frontier of Luxemburg and 69 m. S.W. of Coblenz, on the main lines of railway from Coblenz to Metz and from Cologne to Saarbrücken. The city lies in a fertile valley shut in by vine-clad hills, and the picturesque red sandstone buildings of the old town are interspersed with orchards and gardens. On the north, east and south boulevards with gardens follow the line of the medieval walls, which have mostly disappeared. The Roman city extended much farther south and east.

Trier contains more important Roman remains than any other place in northern Europe. Perhaps the oldest remains are some of the piers and buttresses of the bridge over the Moselle, which may date from about 28 B.C. The well-preserved amphitheatre just outside the modern town to the south-east was probably built in the reign of Trajan or Hadrian. Its eastern side is built into the hill, its longer diameter is 76 yds., and it accommodated seven or eight thousand spectators. In 306 the emperor Constantine the Great caused multitudes of Frankish prisoners to be thrown to the beasts here, and in 313 made a similar spectacle of the captive Bructeri. The most remarkable Roman building in Trier is the *Porta Nigra*, the north gate of the city, a huge fortified gateway, 115 ft. long, 75 to 93 ft. high and 29 ft. deep, built of sandstone blocks blackened with age (whence the name), and held together with iron clamps. The age of this building is very uncertain; it has been assigned to dates ranging from the 1st to the 4th century A.D. It is also called the *Simeonstor*, after a Greek hermit who inhabited it. On his death in 1035 Archbishop Poppo converted the gate into two churches, one above the other, but all the additions except the apse have now been removed. In the south-east corner of the city are the picturesque ruins of the Roman imperial palace, and near the bridge are the extensive substructures of the 4th-century Roman baths, 660 ft. in length. On the Constantinsplatz stands the magnificent brick basilica, probably of the age of Constantine, though the south and east walls are modern. Having been converted into a palace for the Frankish kings and their deputies, it passed in 1197 to the archbishops, and was restored (1846–1856) and turned into a Protestant church. The adjoining barracks were formerly the elector's palace. Another Roman basilica forms the nucleus of the cathedral. Built under the emperors Valentinian I. and Gratian as a quadrilateral hall with four huge granite columns (now removed) in the centre, it was converted into a church about the close of the 4th century, and restored by Bishop Nicetius about 550. It is the most important pre-Carolingian church in Germany. Archbishop Poppo and his successors in the 11th and 12th centuries extended the cathedral westwards and added an apse at each end. The vaulting of the nave and aisles and the beautiful cloisters were added in the 13th century. In the vaults are buried twenty-six archbishops and electors. Among the monuments are those of the electors Richard von Greiffenklau (d. 1531) and Johann von Metzenhausen (d. 1540), fine examples of German Renaissance work. The most famous of the relics preserved in the cathedral is the "Holy Coat of Trier," believed by the devout to be the seamless robe of the Saviour, and said to have been discovered and presented to the city by the empress Helena. Since 1512 it has been periodically exhibited. The exhibition of 1844, which was attended by more than a million pilgrims, aroused protests, resulting in the formation of the sect of German Catholics (*q.v.*). In 1891 nearly two million pilgrims viewed the coat, and eleven miraculous cures were claimed.

The cloisters connect the cathedral with the church of Our Lady (*Liebfrauenkirche*), a beautiful building in the form of a circle intersected by a cross, with a lofty vault, built 1127–1143, and said to be the oldest Gothic church in Germany.

The earliest churches were without the walls. Of these St Matthias in the south, now represented by a 12th-century building, has a Christian cemetery of the Roman age.

In the market-place is the market cross, said to date from 958, and a beautiful Renaissance fountain, the *Petersbrunnen*, erected in 1595. Close by are the *Steipe* or *Rotes Haus*, formerly the town hall, of the 15th century, and the *Frankenturm* or *propugnaculum*, of the 10th century, said to be the oldest stone domestic building in Germany.

The Provincial Museum (1885–1889) contains many Roman and medieval antiquities. The town library contains about 100,000 volumes, including some valuable examples of early printing. Among its most treasured MSS. are the *codex aureus*, a copy of the gospels presented to the abbey of St Maximin by Ada, a reputed sister of Charlemagne, and the *codex Egberti* of the 10th century.

At Igel near Trier is a very remarkable Roman column, 83 ft. high, adorned with sculptures. It dates from the 2nd century, and was the family monument of the Secundini. At Nennig is a fine Roman mosaic pavement.

The industries of Trier include iron-founding, dyeing and the manufacture of machinery. There is a school of viticulture and a very considerable trade in Moselle wines, especially during the annual auctions.

History.—Trier had had two periods of greatness, firstly as the favourite residence of Constantine the Great and his successors in the west, and secondly as the capital of a powerful spiritual electorate.

The Treveri or Treviri, from whom the city derived its name, were one of the most powerful tribes among the Belgae, and according to Julius Caesar, who conquered them in 56 B.C., possessed the best cavalry in Gaul. Attempts have been made to show that they were of German origin (see BELGAE), but although they were doubtless subject to Germanic influences, they spoke a Celtic language. Their chiefs, Indutiomarus, who raised a rebellion against the Romans in 54 B.C., and his successor Cingetorix have Celtic names, and St Jerome, who had lived in Trier, declares that their language in his day (*c.* 370) resembled that of the Galatians. An insurrection under Julius

Florus in A.D. 21 was soon quelled. The Roman city, Augusta Treverorum, was probably fortified by Augustus about 14 B.C., and organized as a colony about A.D. 50 in the reign of Claudius, but is not mentioned before the war of Civilis in 69 (Tacitus, *Hist.* iv.). At first the Treveri resisted the appeal of Civilis and his Batavi to join the revolt, and built a defensive wall from Trier to Andernach, but soon after the two Treverans, Tutor and Classicus, led their fellow tribesmen, aided by the Lingones (Langres), in the attempt to set up a "Gallic empire." After a brief struggle the rebels were overthrown at Trier by Cerealis, and 113 senators emigrated to Germany (70). Towards the end of the 3rd century, the inroads of the Franks having been repelled by the emperor Probus, the city rapidly acquired wealth and importance. Mainly on account of its strategic position, Diocletian on his reorganization of the empire made Trier the capital not only of *Belgica Prima*, but of the whole "diocese" of Gaul. For a century, from Maximian to Maximus (286–388), it was (except under Julian, who preferred to reside in Paris) the administrative centre from which Gaul, Britain and Spain were ruled, so that the poet Ausonius could describe it as the second metropolis of the empire, or "Rome beyond the Alps." Constantine the Great, who generally resided here from 306 to 331, and his successors also, beautified the city with public works, and villas arose upon the hill-sides.

The Church added a lustre of a different kind. Legend associated Trier with the martyrdom of part of the Theban legion (*c.* 286) and with the relics found by St Helena in the Holy Land. St Agritius (d. 332) is the first historical bishop. Four great saints of the 4th century are connected with the city. It was the scene of the first banishment of St Athanasius in 336. A baseless legend relates that he composed the *Quicunque Vult* while hiding here in a cistern. St Ambrose, one of the greatest sons of Trier, was born here about 340. St Jerome's mind was first seriously directed to religion while studying at Trier about 370, and St Martin of Tours came in 385 to plead with the tryant Maximus for the lives of the heretic Priscillian and his followers.

The Franks, who had thrice previously sacked the city, gained permanent possession of it about 455. Although some Frankish kings resided here, it gradually yielded place to Metz as a Frankish capital. The great bishop St Nicetius (528–566), who was banished for rebuking the vices of king Clotaire I. and eulogized by the poet Venantius Fortunatus, repaired the cathedral, and built a splendid castle for himself. The city passed to Lorraine in 843, and to the East Frankish kingdom in 870. It was sacked by the Northmen in 881. Hetti, who occupied the see from 814 to 847, is said to have been the first archbishop of Trier, and Radbod acquired the rights of the counts of Trier in 898, thus founding the temporal power of the see. Robert claimed in vain the right to crown the German king Otto I. in 936, on the ground of the priority of his see, and in the 10th century Archbishop Dietrich I. obtained the primacy over Gaul and Germany.

The temporal power of the archbishops was not gained without opposition. The German kings Otto IV. and Conrad IV. granted charters to the city, which however admitted the jurisdiction of its archbishop, Baldwin of Luxemburg, in 1308. This prince, a brother of the emperor Henry VII., ruled from 1307 to 1354, and was the real founder of the power of Trier. His predecessor Diether III. of Nassau had left his lands heavily encumbered with debt. Baldwin raised them to great prosperity by his energy and foresight, and chiefly as a result of the active political and military support he rendered to the emperors Henry VII., Louis the Bavarian and Charles IV. enlarged his dominions almost to their ultimate extent. He assumed the title of archchancellor of Gaul and Arles (or Burgundy), and in 1315 admitted the claim of the archbishop of Cologne to the highest place after the archbishop of Mainz among the spiritual princes of the empire. Thenceforward the elector of Trier held the third place in the electoral college. After Baldwin's death the prosperity of Trier was checked by wars and disputes between rival claimants to the see, and in 1456 the estates united for the purpose of restoring order, and secured the right of electing their archbishops.

Throughout the middle ages the *sancta civitas Trevirorum* abounded in religious foundations and was a great seat of monastic learning. The university, founded in 1473, existed until 1797. The elector Richard von Greiffenklau (1467–1531) successfully opposed the Reformation, and inaugurated the exhibitions of the holy coat, which called forth the denunciations of Luther, but have continued since his day to bring wealth and celebrity to the city. In the latter half of the 16th century the direction of education fell into the hands of the Jesuits.

During the Thirty Years' War the elector Philip Christopher von Sötern favoured France, and accepted French protection in 1631. The French in the following year expelled both Spaniards and Swedes from his territories, but in March 1635 the Spaniards recaptured Trier and took the elector prisoner. He remained in captivity for ten years, but was reinstated by the French in 1645 and confirmed in his possessions by the peace of Westphalia. The French again temporarily took Trier in 1674 and 1688.

The last elector and archbishop, Clement Wenceslaus (1768–1802), granted toleration to the Protestants in 1782, established his residence at Coblenz in 1786, and fled from the French in 1794. By the peace of Lunéville in 1801 France annexed all the territories of Trier on the left bank of the Rhine, and in 1802 the elector abdicated. A new bishopric was created for the French department of the Sarre, of which Trier was the capital. The Treveran territories on the right bank of the Rhine were secularized and given to Nassau-Weilburg in 1803, and in 1814 nearly the whole of the former electoral dominions were given to Prussia. A bishopric was again founded in 1821, with nearly the same boundaries as the old archbishopric, but it was placed under Cologne. The area of the former electoral principality was 3210 sq. m., and its population in the 18th century was from 250,000 to 300,000. Roughly speaking, it was a broad strip of territory along the lower Saar and the Moselle from its confluence with that river to the Rhine, with a district on the right bank of the Rhine behind Ehrenbreitstein. The chief towns in addition to Trier were Coblenz, Cochem, Beilstein, Oberwesel, Lahnstein and Sayn. Far more extensive was the territory under the spiritual authority of the archbishop which included the bishoprics of Metz, Toul and Verdun, and after 1777 also those of Nancy and St Dié.

See E. A. Freeman's article "Augusta Treverorum" in the *British Quarterly Review* for July 1875; Hettner, *Das römische Trier* (Trier, 1880); J. N. von Wilmowsky, *Der Dom zu Trier in seinen drei Hauptperioden* (Trier, 1874); S. Beissel, *Geschichte der trierer Kirchen* (Trier, 1888); "Gesta Treverorum" (ed. G. Waitz), in *Mon. Germ. hist.* viii., xxiv.; J. N. von Hontheim, *Historia trevirensis diplomatica et pragmatica* (3 vols., Augsburg, 1750); Marx, *Geschichte des Erzstifts Trier* (5 vols., Trier, 1858–1864); Leonardy, *Geschichte des trierischen Landes und Volkes* (Saarlouis, 1871); Woerl, *Führer durch die Stadt Trier* (8th ed., Leipzig, 1898). (A. B. Go.)

TRIESTE (Ger. *Triest*; Slav. *Trst*; the Roman *Tergeste*, *q.v.*), the principal seaport of Austria, 367 m. S.W. of Vienna by rail. Pop. (1900), 132,879, of which three-fourths are Italians, the remainder being composed of Germans, Jews, Greeks, English and French. Trieste is situated at the north-east angle of the Adriatic Sea, on the Gulf of Trieste, and is picturesquely built on terraces at the foot of the Karst hills. The aspect of the town is Italian rather than German. It is divided into the old and the new town, which are connected by the broad and handsome Via del Corso, the busiest street in the town. The old town, nestling round the Schlossberg, the hill on which the castle stands, consists of narrow, steep and irregular streets. The castle, built in 1680, is believed to occupy the site of the Roman capitol. The new town, which lies on the flat expanse adjoining the crescent-shaped bay, partly on ground that has been reclaimed from the sea, has large and regularly built streets, and several large squares adorned with artistic monuments. The cathedral of San Giusto was formed as it now stands by the union in the 14th century of three adjacent early Christian buildings of the 6th century;

the tower incorporates portions of a Roman temple. The church of Santa Maria Maggiore, built in 1627–1682, is a characteristic specimen of Jesuit architecture; the church of Sant' Antonio Nuovo, built in 1827–1849, is in the Greek style, as also the Greek Orthodox church, built in 1782, which is one of the handsomest Byzantine structures in the whole of Austria. Among the most prominent secular buildings are: the Tergesteo, a huge edifice containing a cruciform arcade roofed with glass, where the exchange is established, besides numerous shops and offices; the town-hall, rebuilt in 1874, with the handsome hall of the local Diet; the imposing old exchange, now the seat of the chamber of commerce; the palatial offices of the Austrian Lloyd, the principal shipping company; the commercial and nautical academy, with its natural history museum, containing the complete fauna of the Adriatic Sea; and finally the municipal museum, Revoltella, are all worth mentioning. The Museo Lapidario contains a collection of Roman antiquities found in or near the town. It is an open-air museum, installed in a disused burial-ground, and is situated near the castle. The Arco di Riccardo, which derives its name from a popular delusion that it was connected with Richard Coeur-de-Lion, is believed by some to be a Roman triumphal arch, but is probably an arch of a Roman aqueduct.

At the head of the industrial establishments of Trieste stand the two ship-building yards of the Austrian Lloyd and of the Stabilimento Tecnico Triestino, which are the largest of their kind in Austria. The Stabilimento Tecnico is also fitted up for the construction of war-ships. They are equipped with all the latest technical innovations, and employ over 5000 workmen. Petroleum refineries, iron-foundries, chemicals, soap-boiling, silk-spinning and the production of ships' fittings, as marine steam boilers, anchors, chains, cables, are the other principal branches of industry. Several marble quarries are worked in the neighbourhood, and there are some large cement factories. Good wine, fruit and olive oil are the most important natural products of the country round Trieste.

The great importance of Trieste lies in its trade. It is the first port of Austria, and the principal outlet for the over-sea trade of the monarchy. It may be said nearly to monopolize the trade of the Adriatic, and has long eclipsed its ancient rival Venice. It owes its development to its geographical situation in the north-east angle of the Adriatic Sea at the end of the deeply indented gulf, and to its harbour, which was more accessible to large vessels than that of Venice. Besides, it was declared a free imperial port in 1719, and was therefore released from the obstructions to trade contained in the hampering legislation of the period. It was deprived of this privilege in 1891, when only the harbour was declared to be outside the customs limit. But during the last thirty years of the 19th century the increase in its trade was the lowest in comparison with the increase in the other great European ports. This was due in the first place to the lack of adequate railway communication with the interior of Austria, to the loss of part of the Levant trade through the development of the Oriental railway system, to the diversion of traffic towards the Italian and German ports, and finally to the growing rivalry of the neighbouring port of Fiume, whose interests were vigorously promoted by the Hungarian government. But in the 20th century a more active policy was inaugurated. New and direct services were started to East Africa, Central America and Mexico; the service to India and the Far East, as well as that to the Mediterranean ports, was much improved; and lastly, Trieste was made the centre of the large emigration from Austria to America by the inauguration (June 1904) of a direct emigrant service to New York. But the most important measure, designed to give a great impetus to the trade of Trieste, and to the over-sea trade of Austria generally, was the construction of the so-called second railway connexion with Trieste, begun in 1901. This measure provided for the construction of a railway over the Tauern Mountains between Schwarzach in Salzburg and Möllbrücken in Carinthia; and of a railway over the Karawanken between Trieste and Klagenfurt, with a branch to Villach. The total length of both lines is 100 m. The Karawanken railway, a direct connexion with Bohemia and the northern industrial provinces of Austria, is calculated to counteract the gravitation of traffic towards the German ports; while the Tauern railway constitutes the shortest route to the interior of Austria and to the south of Germany. By the new line the distance between Salzburg, for instance, and Trieste, is lessened by 160 m.

In order to accommodate the increase in traffic resulting from the above improvements, important works for the extension and development of the harbour were undertaken, and part of them were completed in 1910. The capacious harbour, consisting of two parts, the old and the new, is protected by extensive moles and breakwaters. The new harbour was constructed in 1867–1883, at a cost of £1,500,000. The new additions to the harbour, which are situated at the south end, were designed to give more than double the receiving capacity of the port, and were estimated to cost £3,625,000. The bulk of the over-sea trade of Trieste is done with the Levant, Egypt, India and the Far East, Italy, Great Britain and North and South America. Its most important trade by land, besides Austria, is done with Germany, Trieste being the entrepôt for Germany's commerce with India and the Mediterranean countries. The principal articles imported are cotton and cotton goods, coffee, coal, cereals, hides, fruit and tobacco; the principal articles exported are wool and woollen goods, sugar, paper, timber, machinery and various manufactured goods.

About 4 m. north-west of Trieste on the very edge of the sea is the famous castle of Miramar, built in 1854–1856 in the Norman style, for the archduke Maximilian, the ill-fated emperor of Mexico. It belongs now to the emperor of Austria, and its beautiful gardens are open to the public. About 4 m. north-east of Trieste is the village of Opčina, which possesses an obelisk 1146 ft. high, from which a beautiful view is obtained.

The town of Trieste, with its adjoining territory of a total area of 36 sq. m., forms a separate Austrian crown land. It had in 1900 a population of 178,672, of which 77% were Italians, 18% Slovenes and 5% Germans. The municipal council of Trieste constitutes at the same time the local Diet of the crown land, and is composed of 54 members. To the Reichsrat Trieste sends five deputies. Trieste is the seat of a Roman Catholic bishop, and the seat of the administration for the Küstenland or littoral, composed of the crown lands of Trieste, Görz and Gradisca, and Istria.

History.—At the time of the foundation of Aquileia by the Romans, the district which now includes Trieste was occupied by Celtic and Illyrian tribes; and the Roman colony of Tergeste (*q.v.*) does not seem to have been established till the reign of Vespasian. After the break-up of the Roman dominion Trieste shared the general fortunes of Istria and passed through various hands. From the emperor Lothair it received an independent existence under its count-bishops, and it maintained this position down to its capture by Venice in 1203. For the next 180 years its history consists chiefly of a series of conflicts with this city, which were finally put an end to by Trieste placing itself in 1382 under the protection of Leopold III. of Austria. The overlordship thus established insensibly developed into actual possession; and except in the Napoleonic period (1797–1805 and 1809–1813) Trieste has since remained an integral part of the Austrian dominions. It was an imperial free port from 1719 until 1891. The harbour was blockaded by an Italian fleet from May until August 1848. During the Italian and Hungarian revolutions Trieste remained faithful to Austria, and received the title of *Citta Fedelissima.* In 1867 Trieste and the adjoining territory was constituted into a separate crown land. In 1888 a monument was erected in commemoration of the 500th anniversary of the connexion of the town with Austria.

Giulio Caprin, *Trieste* (Bergamo, 1906); Mainati's *Croniche ossia memorie stor.- sacro- profane di Trieste* (7 vols., Venice, 1817–1818); Löwenthal, *Gesch. der Stadt Triest* (Trieste, 1857); Della Croce, *Storia di Trieste* (ibid., 1879); Scussa, *Storia cronografica di Trieste* (ibid., new ed., 1885–1886); Neumann-Spallart, *Österreichs maritime Entwicklung und die Hebung von Triest* (Stuttgart, 1882); *Die österreich-ungarische Monarchie: Das Küstenland* (Vienna, 1891); Montanelli, *Il Movimento storico della popolazione di Trieste* (1905); Hartleben, *Führer durch Triest und Umgebung* (5th ed., Vienna, 1905).

TRIFORIUM, an architectural term, the origin of which is unknown but probably derived from "thoroughfarum," as it was used as a passage from one end of the building to the other. The derivation from Lat. *tres*, *tri*, three, and *foris*, door, entrance, does not seem appropriate. The earliest examples are those in the pagan basilicas, where it constituted an upper galley for conversation and business; in the early Christian basilicas it was usually reserved for women, and the same applied to those in the Greek Byzantine Church. In Romanesque and Gothic buildings it is either a spacious gallery over the side aisles or is reduced to a simple passage in the thickness of the walls; in either case it forms an important architectural division in the nave of the cathedral or church, and being of less height gives more importance to the ground storey or nave arcade. In consequence of its less height it was usually divided into two arches, which were again subdivided into two smaller arches and these subdivisions increased the scale. On account of the richness of its mouldings and carved ornament in the sculpture introduced in the spandrils, it became the most highly decorated feature of the interior, the triforium at Lincoln being one of the most beautiful compositions of Gothic architecture. Even when reduced to a simple passage it was always a highly enriched feature. In the 15th-century churches in England, when the roof over the aisles was comparatively flat, more height being required for the clerestory windows, the triforium was dispensed with altogether. In the great cathedrals and abbeys the triforium was often occupied by persons who came to witness various ceremonies, and in early days was probably utilized by the monks and clergy for work connected with the church.

From the constructive point of view, the triforium sometimes served very important functions, as under its roof exist arches and vaults carried from the nave to the outer wall, to which they transmitted the thrust of the nave vault; even when the flying buttress was frankly adopted by the Gothic architect and emphasized by its architectural design as an important feature, other cross arches were introduced under the roof to strengthen it.

TRIGLYPH (Gr. τρεῖς, three, and γλυφή, an incision or carving), an architectural term for the vertically channelled tablets of the Doric frieze, so called because of the angular channels in them, two perfect and one divided—the two chamfered angles or hemiglyphs being reckoned as one. The square sunk spaces between the triglyphs on a frieze are called metopes.

TRIGONOMETRY (from Gr. τρίγωνον, a triangle, μέτρον, measure), the branch of mathematics which is concerned with the measurement of plane and spherical triangles, that is, with the determination of three of the parts of such triangles when the numerical values of the other three parts are given. Since any plane triangle can be divided into right-angled triangles, the solution of all plane triangles can be reduced to that of right-angled triangles; moreover, according to the theory of similar triangles, the ratios between pairs of sides of a right-angled triangle depend only upon the magnitude of the acute angles of the triangle, and may therefore be regarded as functions of either of these angles. The primary object of trigonometry, therefore, requires a classification and numerical tabulation of these functions of an angular magnitude; the science is, however, now understood to include the complete investigation not only of such of the properties of these functions as are necessary for the theoretical and practical solution of triangles but also of all their analytical properties. It appears that the solution of spherical triangles is effected by means of the same functions as are required in the case of plane triangles. The trigonometrical functions are employed in many branches of mathematical and physical science not directly concerned with the measurement of angles, and hence arises the importance of analytical trigonometry. The solution of triangles of which the sides are geodesic lines on a spheroidal surface requires the introduction of other functions than those required for the solution of triangles on a plane or spherical surface, and therefore gives rise to a new branch of science, which is from analogy frequently called spheroidal trigonometry. Every new class of surfaces which may be considered would have in this extended sense a trigonometry of its own, which would consist in an investigation of the nature and properties of the functions necessary for the measurement of the sides and angles of triangles bounded by geodesics drawn on such surfaces.

HISTORY

Trigonometry, in its essential form of showing how to deduce the values of the angles and sides of a triangle when other angles and sides are given, is an invention of the Greeks. It found its origin in the computations demanded for the reduction of astronomical observations and in other problems connected with astronomical science; and since spherical triangles specially occur, it happened that spherical trigonometry was developed before the simpler plane trigonometry. Certain theorems were invented and utilized by Hipparchus, but material progress was not recorded until Ptolemy collated, amended and developed the work of his predecessors. In book xi. of the *Almagest* the principles of spherical trigonometry are stated in the form of a few simple and useful lemmas; plane trigonometry does not receive systematic treatment although several theorems and problems are stated incidentally. The solution of triangles necessitated the construction of tables of chords—the equivalent of our modern tables of sines; Ptolemy treats this subject in book i., stating several theorems relating to multiple angles, and by ingenious methods successfully deducing approximate results. He did not invent the idea of tables of chords, for, on the authority of Theon, the principle had been stated by Hipparchus (see PTOLEMY).

The Indians, who were much more apt calculators than the Greeks, availed themselves of the Greek geometry which came from Alexandria, and made it the basis of trigonometrical calculations. The principal improvement which they introduced consists in the formation of tables of half-chords or sines instead of chords. Like the Greeks, they divided the circumference of the circle into 360 degrees or 21,600 minutes, and they found the length in minutes of the arc which can be straightened out into the radius to be 3438. The value of the ratio of the circumference of the circle to the diameter used to make this determination is 62832:20000, or $\pi = 3{\cdot}1416$, which value was given by the astronomer Aryabhata (476–550) in a work called *Aryabhaiya*, written in verse, which was republished[1] in Sanskrit by Dr Kern at Leiden in 1874. The relations between the sines and cosines of the same and of complementary arcs were known, and the formula $\sin \frac{1}{2}a = \sqrt{\{1719(3438 - \cos a)\}}$ was applied to the determination of the sine of a half angle when the sine and cosine of the whole angle were known. In the *Sūrya-Siddhānta*, an astronomical treatise which has been translated by Ebenezer Bourgess in vol. vi. of the *Journal* of the American Oriental Society (New Haven, 1860), the sines of angles at an interval of 3° 45′ up to 90° are given; these were probably obtained from the sines of 60° and 45° by continual application of the dimidiary formula given above and by the use of the complementary angle. The values $\sin 15° = 890'$, $\sin 7°\ 30' = 449'$, $\sin 3°\ 45' = 225'$ were thus obtained. Now the angle 3° 45′ is itself 225′; thus the arc and the sine of $\frac{1}{96}$ of the circumference were found to be the same, and consequently special importance was attached to this arc, which was called the right sine. From the tables of sines of angles at intervals of 3° 45′ the law expressed by the equation

$$\sin(n + 1.225') - \sin(n.225') = \sin(n.225') - \sin(n - 1.225') - \sin\frac{(n.225')}{225}$$

was discovered empirically, and used for the purpose of recalculation. Bhaskara (*fl.* 1150) used the method, to which we have now returned, of expressing sines and cosines as fractions of the radius; he obtained the more correct values $\sin 3°\ 45' = 100/1529$, $\cos 3°\ 45' = 466/467$, and showed how to form a table, according to degrees, from the values $\sin 1° = 10/573$, $\cos 1° = 6568/6569$, which are much more accurate than Ptolemy's values. The Indians did not apply their trigonometrical knowledge to the solution of triangles; for astronomical purposes they solved right-angled plane and spherical triangles by geometry.

The Arabs were acquainted with Ptolemy's *Almagest*, and they probably learned from the Indians the use of the sine. The celebrated astronomer of Batnae, Albategnius (*q.v.*), who died in A.D. 929–930, and whose *Tables* were translated in the 12th century by Plato of Tivoli into Latin, under the title *De scientia stellarum*, employed the sine regularly, and was fully conscious of the advantage of the sine over the chord; indeed, he remarks that the continual doubling is saved by the use of the former. He was the first to calculate $\sin\phi$ from the equation $\sin\phi/\cos\phi = k$, and he also made a table of the length of shadows of a vertical object of height 12 for altitudes 1°, 2°, . . . of the sun; this is a sort of cotangent table. He was acquainted not only with the triangle formulae in the *Almagest*, but also with the formula $\cos a = \cos b \cos c + \sin b \sin c \cos A$ for a spherical triangle ABC. Abū'l-Wafā of Bagdad (b. 940) was the first to introduce the tangent as an independent function: his "umbra" is the half of the tangent of the double arc, and the secant he defines as the "diameter umbrae." He employed the umbra to find the angle from a table and not merely as an abbreviation for sin/cos; this improvement was, however, afterwards forgotten, and the tangent was reinvented in the 15th century. Ibn Yūnos of Cairo, who died in 1008, showed even more skill than Albategnius in the solution of problems in spherical trigonometry and gave improved approximate formulae for the calculation of sines. Among the West Arabs, Geber (*q.v.*), who lived at Seville in the 11th century, wrote an astronomy in nine books, which was translated into Latin in the 12th century by Gerard of Cremona and was published in 1534. The first book contains a trigonometry which is a considerable improvement on that in the *Almagest.* He gave proofs of the formulae for right-angled spherical triangles, depending on a rule of four quantities, instead of Ptolemy's rule of six quantities. The formulae $\cos B = \cos b \sin A$, $\cos c = \cot A \cot B$, in a triangle of which C is a right angle had escaped the notice of Ptolemy and were given for the first time by Geber. Strangely enough, he made no progress in plane trigonometry. Arrachel, a Spanish Arab who lived in the 12th century, wrote a work of which we have an analysis by Purbach, in which, like the Indians, he made the sine and the arc for the value 3° 45′ coincide.

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[1] See also vol. ii. of the *Asiatic Researches* (Calcutta).

Georg Purbach (1423–1461), professor of mathematics at Vienna, wrote a work entitled *Tractatus super propositiones Ptolemaei de sinubus et chordis* (Nuremberg, 1541). This treatise consists of a development of Arrachel's method of interpolation for the calculation of tables of sines, and was published by Regiomontanus at the end of one of his works. Johannes Müller (1436–1476), known as Regiomontanus, was a pupil of Purbach and taught astronomy at Padua; he wrote an exposition of the *Almagest,* and a more important work, *De triangulis planis et sphericis cum tabulis sinuum,* which was published in 1533, a later edition appearing in 1561. He reinvented the tangent and calculated a table of tangents for each degree, but did not make any practical applications of this table, and did not use formulae involving the tangent. His work was the first complete European treatise on trigonometry, and contains a number of interesting problems; but his methods were in some respects behind those of the Arabs. Copernicus (1473–1543) gave the first simple demonstration of the fundamental formula of spherical trigonometry; the *Trigonometria Copernici* was published by Rheticus in 1542. George Joachim (1514–1576), known as Rheticus, wrote *Opus palatinum de triangulis* (see TABLES, MATHEMATICAL), which contains tables of sines, tangents and secants of arcs at intervals of 10″ from 0° to 90°. His method of calculation depends upon the formulae which give $\sin n\alpha$ and $\cos n\alpha$ in terms of the sines and cosines of $(n-1)\alpha$ and $(n-2)\alpha$; thus these formulae may be regarded as due to him. Rheticus found the formulae for the sines of the half and third of an angle in terms of the sine of the whole angle. In 1599 there appeared an important work by Bartholomew Pitiscus (1561–1613), entitled *Trigonometriae seu De dimensione triangulorum*; this contained several important theorems on the trigonometrical functions of two angles, some of which had been given before by Finck, Landsberg (or Lansberghe de Meuleblecke) and Adriaan van Roomen. François Viète or Vieta (1540–1603) employed the equation $(2\cos\frac{1}{2}\phi)^3 - 3(2\cos\frac{1}{2}\phi) = 2\cos\phi$ to solve the cubic $x^3 - 3a^2x = a^2b\,(a > \frac{1}{2}b)$; he obtained, however, only one root of the cubic. In 1593 Van Roomen proposed, as a problem for all mathematicians, to solve the equation

$$45y - 3795y^3 + 95634y^5 - \dots + 945y^{41} - 45y^{43} + y^{45} = C.$$

Vieta gave $y = 2\sin\frac{1}{45}\phi$, where $C = 2\sin\phi$, as a solution, and also twenty-two of the other solutions, but he failed to obtain the negative roots. In his work *Ad angulares sectiones* Vieta gave formulae for the chords of multiples of a given arc in terms of the chord of the simple arc.

A new stage in the development of the science was commenced after John Napier's invention of logarithms in 1614. Napier also simplified the solution of spherical triangles by his well-known analogies and by his rules for the solution of right-angled triangles. The first tables of logarithmic sines and tangents were constructed by Edmund Gunter (1581–1626), professor of astronomy at Gresham College, London; he was also the first to employ the expressions cosine, cotangent and cosecant for the sine, tangent and secant of the complement of an arc. A treatise by Albert Girard (1590–1634), published at the Hague in 1626, contains the theorems which give areas of spherical triangles and polygons, and applications of the properties of the supplementary triangles to the reduction of the number of different cases in the solution of spherical triangles. He used the notation sin, tan, sec for the sine. tangent and secant of an arc. In the second half of the 17th century the theory of infinite series was developed by John Wallis, Gregory, Mercator, and afterwards by Newton and Leibnitz. In the *Analysis per aequationes numero terminorum infinitas,* which was written before 1669, Newton gave the series for the arc in powers of its sine; from this he obtained the series for the sine and cosine in powers of the arc; but these series were given in such a form that the law of the formation of the coefficients was hidden. James Gregory discovered in 1670 the series for the arc in powers of the tangent and for the tangent and secant in powers of the arc. The first of these series was also discovered independently by Leibnitz in 1673, and published without proof in the *Acta eruditorum* for 1682. The series for the sine in powers of the arc he published in 1693; this he obtained by differentiation of a series with undetermined coefficients.

In the 18th century the science began to take a more analytical form; evidence of this is given in the works of Kresa in 1720 and Mayer in 1727. Friedrich Wilhelm v. Oppel's *Analysis triangulorum* (1746) was the first complete work on analytical trigonometry. None of these mathematicians used the notation sin, cos, tan, which is the more surprising in the case of Oppel, since Leonhard Euler had in 1744 employed it in a memoir in the *Acta eruditorum.* Jean Bernoulli was the first to obtain real results by the use of the symbol $\sqrt{-1}$; he published in 1712 the general formula for $\tan n\phi$ in terms of $\tan\phi$, which he obtained by means of transformation of the arc into imaginary logarithms. The greatest advance was, however, made by Euler, who brought the science in all essential respects into the state in which it is at present. He introduced the present notation into general use, whereas until his time the trigonometrical functions had been, except by Girard, indicated by special letters, and had been regarded as certain straight lines the absolute lengths of which depended on the radius of the circle in which they were drawn. Euler's great improvement consisted in his regarding the sine, cosine, &c., as functions of the angle only, thereby giving to equations connecting these functions a purely analytical interpretation, instead of a geometrical one as heretofore. The exponential values of the sine and cosine, De Moivre's theorem, and a great number of other analytical properties of the trigonometrical functions, are due to Euler, most of whose writings are to be found in the *Memoirs* of the St Petersburg Academy.

Plane Trigonometry.

Conception of Angles of any Magnitude.

1. Imagine a straight line terminated at a fixed point O, and initially coincident with a fixed straight line OA, to revolve round O, and finally to take up any position OB. We shall suppose that, when this revolving straight line is turning in one direction, say that opposite to that in which the hands of a clock turn, it is describing a positive angle, and when it is turning in the other direction it is describing a negative angle. Before finally taking up the position OB the straight line may have passed any number of times through the position OB, making any number of complete revolutions round O in either direction. Each time that the straight line makes a complete revolution round O we consider it to have described four right angles, taken with the positive or negative sign, according to the direction in which it has revolved; thus, when it stops in the position OB, it may have revolved through any one of an infinite number of positive or negative angles any two of which differ from one another by a positive or negative multiple of four right angles, and all of which have the same bounding lines OA and OB. If OB' is the final position of the revolving line, the smallest positive angle which can have been described is that described by the revolving line making more than one-half and less than the whole of a complete revolution, so that in this case we have a positive angle greater than two and less than four right angles. We have thus shown how we may conceive an angle not restricted to be less than two right angles, but of any positive or negative magnitude, to be generated.

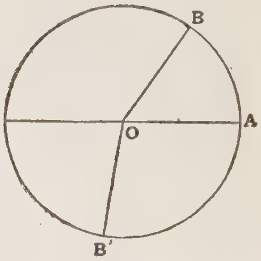

FIG. 1.

Numerical Measurement of Angular Magnitudes.

2. Two systems of numerical measurement of angular magnitudes are in ordinary use. For practical measurements the sexagesimal system is the one employed: the ninetieth part of a right angle is taken as the unit and is called a degree; the degree is divided into sixty equal parts called minutes; and the minute into sixty equal parts called seconds; angles smaller than a second are usually measured as decimals of a second, the "thirds," "fourths," &c., not being in ordinary use. In the common notation an angle, for example, of 120 degrees, 17 minutes and 14·36 seconds is written 120° 17′ 14·36″. The decimal system measurement of angles has never come into ordinary use. In analytical trigonometry the circular measure of an angle is employed. In this system the unit angle or radian is the angle subtended at the centre of a circle by an arc equal in length to the radius. The constancy of this angle follows from the geometrical propositions—(1) the circumferences of different circles vary as their radii; (2) in the same circle angles at the centre are proportional to the arcs which subtend them. It thus follows that the radian is an angle independent of the particular circle used in defining it. The constant ratio of the circumference of a circle to its diameter is a number incommensurable with unity, usually denoted by π. We shall indicate later on some of the methods which have been employed to approximate to the value of this number. Its value to 20 places is 3·14159265358979323846; its reciprocal to the same number of places is 0·31830988618379067153. In circular measure every angle is measured by the ratio which it bears to the unit angle. Two right angles are measured by the number π, and, since the same angle is 180°, we see that the number of degrees in an angle of circular measure θ is obtained from the formula $180 \times \theta/\pi$. The value of the radian has been found to 41 places of decimals by Glaisher (*Proc. London Math. Soc.* vol. iv.); the value of $1/\pi$, from which the unit can easily be calculated, is given to 140 places of decimals in *Grunerts Archiv* (1841), vol. i. To 10 decimal places the value of the unit angle is 57° 17′ 44·8062470964″. The unit of circular measure is too large to be convenient for practical purposes, but its use introduces a simplification into the series in analytical trigonometry, owing to the fact that the sine of

an angle and the angle itself in this measure, when the magnitude of the angle is indefinitely diminished, are ultimately in a ratio of equality.

Sign of Portions of an Infinite Straight Line.

3. If a point moves from a position A to another position B on a straight line, it has described a length AB of the straight line. It is convenient to have a simple mode of indicating in which direction on the straight line the length AB has been described; this may be done by supposing that a point moving in one specified direction is describing a positive length, and when moving in the opposite direction a negative length. Thus, if a point moving from A to B is moving in the positive direction, we consider the length AB as positive; and, since a point moving from B to A is moving in the negative direction, we consider the length BA as negative. Hence any portion of an infinite straight line is considered to be positive or negative according to the direction in which we suppose this portion to be described by a moving point; which direction is the positive one is, of course, a matter of convention.

Projections of Straight Lines on each other.

If perpendiculars AL, BM be drawn from two points, A, B on any straight line, not necessarily in the same plane with AB, the length LM, taken with the positive or negative sign according to the convention as stated above, is called the projection of AB on the given straight line; the projection of BA being ML has the opposite sign to the projection of AB. If two points A, B be joined by a number of lines in any manner, the algebraical sum of the projections of all these lines is LM—that is, the same as the projection of AB. Hence the sum of the projections of all the sides, taken in order, of any closed polygon, not necessarily plane, on any straight line, is zero. This principle of projections we shall apply below to obtain some of the most important propositions in trigonometry.

Definition of Trigonometrical Functions.

4. Let us now return to the conception of the generation of an angle as in fig. 1. Draw BOB' at right angles to and equal to AA'. We shall suppose that the direction from A' to A is the positive one for the straight line AOA', and that from B' to B for BOB'. Suppose OP of fixed length, equal to OA, and let PM, PN be drawn perpendicular to $A'A$, $B'B$ respectively; then OM and ON, taken with their proper signs, are the projections of OP on $A'A$ and $B'B$. The ratio of the projection of OP on $B'B$ to the absolute length of OP is dependent only on the magnitude of the angle POA, and is called the *sine* of that angle; the ratio of the projection of OP on $A'A$ to the length OP is called the *cosine* of the angle POA. The ratio of the sine of an angle to its cosine is called the *tangent* of the angle, and that of the cosine to the sine the *cotangent* of the angle; the reciprocal of the cosine is called the *secant*, and that of sine the *cosecant* of the angle. These functions of an angle of magnitude α are denoted by $\sin\alpha$, $\cos\alpha$, $\tan\alpha$, $\cot\alpha$, $\sec\alpha$, $\operatorname{cosec}\alpha$ respectively. If any straight line RS be drawn parallel to OP, the projection of RS on either of the straight lines $A'A$, $B'B$ can be easily seen to bear to RS the same ratios which the corresponding projections of OP bear to OP; thus, if α be the angle which RS makes with $A'A$, the projections of RS on $A'A$, $B'B$ are $RS\cos\alpha$ and $RS\sin\alpha$ respectively, where RS denotes the absolute length RS. It must be observed that the line SR is to be considered as parallel not to OP but to OP'', and therefore makes an angle $\pi+\alpha$ with $A'A$; this is consistent with the fact that the projections of SR are of opposite sign to those of RS. By observing the signs of the projections of OP for the positions P, P', P'', P''' of P we see that the sine and cosine of the angle POA are both positive; the sine of the angle $P'OA$ is positive and its cosine is negative; both the sine and the cosine of the angle $P''OA$ are negative; and the sine of the angle $P'''OA$ is negative and its cosine positive. If α be the numerical value of the smallest angle of which OP and OA are boundaries, we see that, since these straight lines also bound all the angles $2n\pi+\alpha$, where n is any positive or negative integer, the sines and cosines of all these angles are the same as the sine and cosine of α. Hence the sine of any angle $2n\pi+\alpha$ is positive if α is between 0 and π and negative if α is between π and 2π, and the cosine of the same angle is positive if α is between 0 and $\frac{1}{2}\pi$ or $\frac{3}{2}\pi$ and 2π and negative if α is between $\frac{1}{2}\pi$ and $\frac{3}{2}\pi$.

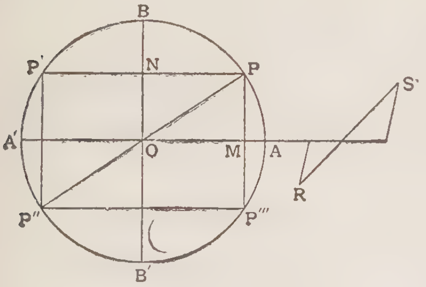

FIG. 2.

In fig. 2 the angle POA is α, the angle $P'''OA$ is $-\alpha$, $P'OA$ is $\pi-\alpha$, $P''OA$ is $\pi+\alpha$, POB is $\frac{1}{2}\pi-\alpha$. By observing the signs of the projections we see that

$$\sin(-\alpha)=-\sin\alpha,\ \sin(\pi-\alpha)=\sin\alpha,\ \sin(\pi+\alpha)=-\sin\alpha,$$
$$\cos(-\alpha)=\cos\alpha,\ \cos(\pi-\alpha)=-\cos\alpha,\ \cos(\pi+\alpha)=-\cos\alpha,$$
$$\sin(\tfrac{1}{2}\pi-\alpha)=\cos\alpha,\ \cos(\tfrac{1}{2}\pi-\alpha)=\sin\alpha.$$

Also $\sin(\frac{1}{2}\pi+\alpha)=\sin(\pi-\frac{1}{2}\pi-\alpha)=\sin(\frac{1}{2}\pi-\alpha)=\cos\alpha$,
$\cos(\frac{1}{2}\pi+\alpha)=-\cos(\pi-\frac{1}{2}\pi-\alpha)=-\cos(\frac{1}{2}\pi-\alpha)=-\sin\alpha$.

From these equations we have $\tan(-\alpha)=-\tan\alpha$, $\tan(\pi-\alpha)=-\tan\alpha$, $\tan(\pi+\alpha)=-\tan\alpha$, $\tan(\frac{1}{2}\pi-\alpha)=\cot\alpha$, $\tan(\frac{1}{2}\pi+\alpha)=-\cot\alpha$, with corresponding equations for the cotangent.

The only angles for which the projection of OP on $B'B$ is the same as for the given angle $POA(=\alpha)$ are the two sets of angles bounded by OP, OA and OP', OA; these angles are $2n\pi+\alpha$ and $2n\pi+(\pi-\alpha)$, and are all included in the formula $r\pi+(-1)^r\alpha$, where r is any integer; this therefore is the formula for all angles having the same sine as α. The only angles which have the same cosine as α are those bounded by OA, OP and OA, OP''', and these are all included in the formula $2n\pi\pm\alpha$. Similarly it can be shown that $n\pi+\alpha$ includes all the angles which have the same tangent as α.

Relations between Trigonometrical Functions.

From the Pythagorean theorem, the sum of the squares of the projections of any straight line upon two straight lines at right angles to one another is equal to the square on the projected line, we get $\sin^2\alpha+\cos^2\alpha=1$, and from this by the help of the definitions of the other functions we deduce the relations $1+\tan^2\alpha=\sec^2\alpha$, $1+\cot^2\alpha=\operatorname{cosec}^2\alpha$. We have now six relations between the six functions; these enable us to express any five of these functions in terms of the sixth. The following table shows the values of the trigonometrical functions of the angles 0, $\frac{1}{2}\pi$, π, $\frac{3}{2}\pi$, 2π, and the signs of the functions of angles between these values; I denotes numerical increase and D numerical decrease:—

Angle . .	0	$0\ldots\frac{1}{2}\pi$	$\frac{1}{2}\pi$	$\frac{1}{2}\pi\ldots\pi$	π	$\pi\ldots\frac{3}{2}\pi$	$\frac{3}{2}\pi$	$\frac{3}{2}\pi\ldots2\pi$	2π
Sine . .	0	$+I$	1	$+D$	0	$-I$	-1	$-D$	0
Cosine .	1	$+D$	0	$-I$	-1	$-D$	0	$+I$	1
Tangent .	0	$+I$	$\pm\infty$	$-D$	0	$+I$	$\pm\infty$	$-D$	0
Cotangent	$\pm\infty$	$+D$	0	$-I$	$\pm\infty$	$+D$	0	$-I$	$\pm\infty$
Secant .	1	$+I$	$\pm\infty$	$-D$	-1	$-I$	$\pm\infty$	$+D$	1
Cosecant .	$\pm\infty$	$+D$	1	$+I$	$\pm\infty$	$-D$	-1	$-I$	$\pm\infty$

The correctness of the table may be verified from the figure by considering the magnitudes of the projections of OP for different positions.

The following table shows the sine and cosine of some angles for which the values of the functions may be obtained geometrically:—

		sine	cosine		
$\frac{\pi}{12}$	15°	$\frac{\sqrt{6}-\sqrt{2}}{4}$	$\frac{\sqrt{6}+\sqrt{2}}{4}$	75°	$\frac{5}{12}\pi$
$\frac{\pi}{10}$	18°	$\frac{\sqrt{5}-1}{4}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	72°	$\frac{2}{5}\pi$
$\frac{\pi}{6}$	30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	60°	$\frac{1}{3}\pi$
$\frac{\pi}{5}$	36°	$\frac{\sqrt{10-2\sqrt{5}}}{4}$	$\frac{\sqrt{5}+1}{4}$	54°	$\frac{3}{10}\pi$
$\frac{\pi}{4}$	45°	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	45°	$\frac{1}{4}\pi$
		cosine	sine		

Values of Trigonometrical Functions for some Angles.

These are obtained as follows. (1) $\frac{1}{4}\pi$. The sine and cosine of this angle are equal to one another, since $\sin\frac{1}{4}\pi=\cos(\frac{1}{2}\pi-\frac{1}{4}\pi)$; and since the sum of the squares of the sine and cosine is unity each is $1/\sqrt{2}$. (2) $\frac{1}{6}\pi$ and $\frac{1}{3}\pi$. Consider an equilateral triangle; the projection of one side on another is obviously half a side; hence the cosine of an angle of the triangle is $\frac{1}{2}$ or $\cos\frac{1}{3}\pi=\frac{1}{2}$, and from this the sine is found. (3) $\pi/10$, $\pi/5$, $2\pi/5$, $3\pi/10$. In the triangle constructed in Euc. iv. 10 each angle at the base is $\frac{2}{5}\pi$, and the vertical angle is $\frac{1}{5}\pi$. If a be a side and b the base, we have by the construction $a(a-b)=b^2$; hence $2b=a(\sqrt{5}-1)$; the sine of $\pi/10$ is $b/2a$ or $\frac{1}{4}(\sqrt{5}-1)$, and $\cos\frac{1}{5}\pi$ is $a/2b=\frac{1}{4}(\sqrt{5}+1)$. (4) $\frac{1}{12}\pi$, $\frac{5}{12}\pi$. Consider a right-angled triangle, having an angle $\frac{1}{6}\pi$. Bisect this angle, then the opposite side is cut by the bisector in the ratio of $\sqrt{3}$ to 2; hence the length of the smaller segment is to that of the whole in the ratio of $\sqrt{3}$ to $\sqrt{3}+2$, therefore $\tan\frac{1}{12}\pi=\{\sqrt{3}/(\sqrt{3}+2)\}\tan\frac{1}{6}\pi$ or $\tan\frac{1}{12}\pi=2-\sqrt{3}$, and from this we can obtain $\sin\frac{1}{12}\pi$ and $\cos\frac{1}{12}\pi$.

Formulae for Sine and Cosine of Sum and Difference of Two Angles.

5. Draw a straight line OD making any angle A with a fixed straight line OA, and draw OF making an angle B with OD, this angle being measured positively in the same direction as A; draw FE a perpendicular on DO (produced if necessary). The projection of OF on OA is the sum of the projections of OE and EF on OA. Now OE is the projection of OF on DO, and is therefore equal to $OF\cos B$, and EF is the projection of OF

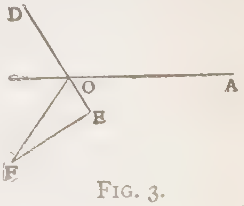

FIG. 3.

on a straight line making an angle $+\frac{1}{2}\pi$ with OD, and is therefore equal to OF sin B; hence

$$OF\cos(A+B)=OE\cos A+EF\cos(\tfrac{1}{2}\pi+A)$$
$$=OF(\cos A\cos B-\sin A\sin B),$$

or $$\cos(A+B)=\cos A\cos B-\sin A\sin B.$$

The angles A, B are absolutely unrestricted in magnitude, and thus this formula is perfectly general. We may change the sign of B, thus

$$\cos(A-B)=\cos A\cos(-B)-\sin A\sin(-B),$$

or $$\cos(A-B)=\cos A\cos B+\sin A\sin B.$$

If we projected the sides of the triangle OEF on a straight line making an angle $+\frac{1}{2}\pi$ with OA we should obtain the formulae

$$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B,$$

which are really contained in the cosine formula, since we may put $\frac{1}{2}\pi-B$ for B. The formulae

$$\tan(A\pm B)=\frac{\tan A\pm\tan B}{1\mp\tan A\tan B},\ \cot(A\pm B)=\frac{\cot A\cot B\mp 1}{\cot B\pm\cot A}$$

are immediately deducible from the above formulae. The equations

$$\sin C+\sin D=2\sin\tfrac{1}{2}(C+D)\cos\tfrac{1}{2}(C-D),$$
$$\sin C-\sin D=2\sin\tfrac{1}{2}(C-D)\cos\tfrac{1}{2}(C+D),$$
$$\cos D+\cos C=2\cos\tfrac{1}{2}(C+D)\cos\tfrac{1}{2}(C-D),$$
$$\cos D-\cos C=2\sin\tfrac{1}{2}(C+D)\sin\tfrac{1}{2}(C-D),$$

may be obtained directly by the method of projections. Take two equal straight lines OC, OD, making angles C, D, with OA, and draw OE perpendicular to CD. The angle which OE makes with OA is $\frac{1}{2}(C+D)$ and that which DC makes is $\frac{1}{2}(\pi+C+D)$; the angle COE is $\frac{1}{2}(C-D)$. The sum of the projections of OD and DE on OA is equal to that of OE, and the sum of the projections of OC and CE is equal to that of OE; hence the sum of the projections of OC and OD is twice that of OE, or $\cos C+\cos D=2\cos\frac{1}{2}(C+D)\cos\frac{1}{2}(C-D)$. The difference of the projections of OD and OC an OA is equal to twice that of ED, hence we have the formula $\cos D-\cos C=2\sin\frac{1}{2}(C+D)\sin\frac{1}{2}(C-D)$. The other two formulae will be obtained by projecting on a straight line inclined at an angle $+\frac{1}{2}\pi$ to OA.

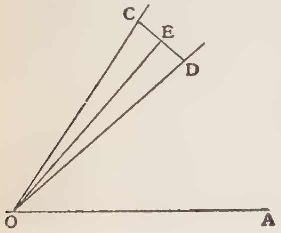

FIG. 4.

As another example of the use of projections, we will find the sum of the series $\cos\alpha+\cos(\alpha+\beta)+\cos(\alpha+2\beta)+\ .\ .\ .\ +\cos(\alpha+\overline{n-1}\beta)$.

Sum of Series of Cosines in Arithmetical Progression.

Suppose an unclosed polygon each angle of which is $\pi-\beta$ to be inscribed in a circle, and let A, A_1, A_2, A_3, . . ., A_n be $n+1$ consecutive angular points; let D be the diameter of the circle; and suppose a straight line drawn making an angle α with AA_1, then $\alpha+\beta$, $\alpha+2\beta$, . . . are the angles it makes with A_1A_2, A_2A_3, . . .; we have by projections

$$AA_n\cos(\alpha+\tfrac{1}{2}\overline{n-1}\beta)=AA_1\{\cos\alpha+\cos\overline{\alpha+\beta}+\ldots+\cos\alpha+\overline{(n-1)}\beta\},$$

also $$AA_1=D\sin\tfrac{1}{2}\beta,\ AA_n=D\sin\tfrac{1}{2}n\beta;$$

hence the sum of the series of cosines is

$$\cos(\alpha+\tfrac{1}{2}\overline{n-1}\,\beta)\sin\tfrac{1}{2}n\beta\operatorname{cosec}\tfrac{1}{2}\beta.$$

By a double application of the addition formulae we may obtain the formulae

Formulae for Sine and Cosine of Sum of Angles.

$$\sin(A_1+A_2+A_3)=\sin A_1\cos A_2\cos A_3$$
$$+\cos A_1\sin A_2\cos A_3+\cos A_1\cos A_2\sin A_3$$
$$-\sin A_1\sin A_2\sin A_3;$$
$$\cos(A_1+A_2+A_3)=\cos A_1\cos A_2\cos A_3$$
$$-\cos A_1\sin A_2\sin A_3-\sin A_1\cos A_2\sin A_3$$
$$-\sin A_1\sin A_2\cos A_3.$$

We can by induction extend these formulae to the case of n angles. Assume

$$\sin(A_1+A_2+\ .\ .\ .\ +A_n)=S_1-S_3+S_5-\ .\ .\ .$$
$$\cos(A_1+A_2+\ .\ .\ .\ +A_n)=S_0-S_2+S_4-\ .\ .\ .$$

where S_r denotes the sum of the products of the sines of r of the angles and the cosines of the remaining $n-r$ angles; then we have

$$\sin(A_1+A_2+\ .\ .\ .\ +A_n+A_{n+1})=\cos A_{n+1}(S_1-S_3+S_5-\ .\ .\ .)$$
$$+\sin A_{n+1}(S_0-S_2+S_4-\ .\ .\ .).$$

The right-hand side of this equation may be written

$$(S_1\cos A_{n+1}+S_0\sin A_{n+1})-(S_3\cos A_{n+1}+S_2\sin A_{n+1})+\ .\ .\ .,$$

or $$S'_1-S'_3+\ .\ .\ .$$

where S'_r denotes the quantity which corresponds for $n+1$ angles to S_r for n angles; similarly we may proceed with the cosine formula. The theorems are true for $n=2$ and $n=3$; thus they are true generally. The formulae

Formulae for Multiple and Sub-Multiple Angles.

$$\cos 2A=\cos^2 A-\sin^2 A=2\cos^2 A-1=1-2\sin^2 A,$$
$$\sin 2A=2\sin A\cos A,\qquad \tan 2A=\frac{2\tan A}{1-\tan^2 A}.$$
$$\sin 3A=3\sin A-4\sin^3 A,\quad \cos 3A=4\cos^3 A-3\cos A,$$
$$\sin nA=n\cos^{n-1}A\sin A-\frac{n(n-1)(n-2)}{3!}\cos^{n-3}A\sin^3 A+\ .\ .\ .$$
$$+(-1)^r\frac{n(n-1)\ .\ .\ .\ (n-2r)}{(2r+1)!}\cos^{n-2r-1}A\sin^{2r+1}A,$$
$$\cos nA=\cos^n A-\frac{n(n-1)}{2!}\cos^{n-2}A\sin^2 A+\ .\ .\ .$$
$$+(-)^r\frac{n(n-1)\ .\ .\ .\ (n-2r+1)}{2r!}\cos^{n-2r}A\sin^{2r}A+\ .\ .\ .$$

may all be deduced from the addition formulae by making the angles all equal. From the last two formulae we obtain by division

$$\tan nA=\frac{n\tan A-\frac{n(n-1)(n-2)}{3!}\tan^3 A+\ldots+(-1)^r\frac{n(n-1)\ldots(n-2r)}{(2r+1)!}\tan^{2r+1}A+\ldots}{1-\frac{n(n-1)}{2!}\tan^2 A+\ldots+(-1)^r\frac{n(n-1)\ldots(n-2r+1)}{2r!}\tan^{2r}A+\ldots}$$

In the particular case of $n=3$ we have $\tan 3A=\dfrac{3\tan A-\tan^3 A}{1-3\tan^2 A}$.

The values of $\sin\frac{1}{2}A$, $\cos\frac{1}{2}A$, $\tan\frac{1}{2}A$ are given in terms of $\cos A$ by the formulae

$$\sin\tfrac{1}{2}A=(-1)^p\left(\frac{1-\cos A}{2}\right)^{\frac{1}{2}},\ \cos\tfrac{1}{2}A=(-1)^q\left(\frac{1+\cos A}{2}\right)^{\frac{1}{2}},$$
$$\tan\tfrac{1}{2}A=(-1)^r\left(\frac{1-\cos A}{1+\cos A}\right)^{\frac{1}{2}},$$

where p is the integral part of $A/2\pi$, q the integral part of $A/2\pi+\frac{1}{2}$, and r the integral part of A/π.

Sin $\frac{1}{2}A$, cos $\frac{1}{2}A$ are given in terms of sin A by the formulae

$$2\sin\tfrac{1}{2}A=(-1)^{p'}(1+\sin A)^{\frac{1}{2}}+(-1)^{q'}(1-\sin A)^{\frac{1}{2}},$$
$$2\cos\tfrac{1}{2}A=(-1)^{p'}(1+\sin A)^{\frac{1}{2}}-(-1)^{q'}(1-\sin A)^{\frac{1}{2}},$$

where p' is the integral part of $A/2\pi+\frac{1}{4}$ and q' the integral part of $A/2\pi-\frac{1}{4}$.

Properties of Triangles.

6. In any plane triangle ABC we will denote the lengths of the sides BC, CA, AB by a, b, c respectively, and the angles BAC, ABC, ACB by A, B, C respectively. The fact that the projections of b and c on a straight line perpendicular to the side a are equal to one another is expressed by the equation $b\sin C=c\sin B$; this equation and the one obtained by projecting c and a on a straight line perpendicular to a may be written $a/\sin A=b/\sin B=c/\sin C$. The equation $a=b\cos C+c\cos B$ expresses the fact that the side a is equal to the sum of the projections of the sides b and c on itself; thus we obtain the equations

$$\left.\begin{aligned}a&=b\cos C+c\cos B\\ b&=c\cos A+a\cos C\\ c&=a\cos B+b\cos A\end{aligned}\right\}.$$

If we multiply the first of these equations by $-a$, the second by b, and the third by c, and add the resulting equations, we obtain the formula $b^2+c^2-a^2=2bc\cos A$ or $\cos A=(b^2+c^2-a^2)/2bc$, which gives the cosine of an angle in terms of the sides. From this expression for cos A the formulae

$$\sin\tfrac{1}{2}A=\left\{\frac{(s-b)(s-c)}{bc}\right\}^{\frac{1}{2}},\ \cos\tfrac{1}{2}A=\left\{\frac{s(s-a)}{bc}\right\}^{\frac{1}{2}},$$
$$\tan\tfrac{1}{2}A=\left\{\frac{(s-b)(s-c)}{s(s-a)}\right\}^{\frac{1}{2}},\ \sin A=\frac{2}{bc}\{s(s-a)(s-b)(s-c)\}^{\frac{1}{2}},$$

where s denotes $\frac{1}{2}(a+b+c)$, can be deduced by means of the dimidiary formula.

From any general relation between the sides and angles of a triangle other relations may be deduced by various methods of transformation, of which we give two examples.

α. In any general relation between the sines and cosines of the angles A, B, C of a triangle we may substitute $pA+qB+rC$, $rA+pB+qC$, $qA+rB+pC$ for A, B, C respectively, where p, q, r are any quantities such that $p+q+r+1$ is a positive or negative multiple of 6, provided that we change the signs of all the sines. Suppose $p+q+r+1=6n$, then the sum of the three angles $2n\pi-(pA+qB+rC)$, $2n\pi-(rA+pB+qC)$, $2n\pi-(qA+rB+pC)$ is π; and, since the given relation follows from the condition $A+B+C=\pi$, we may substitute for A, B, C respectively any angles of which the sum is π; thus the transformation is admissible.

β. It may easily be shown that the sides and angles of the triangle formed by joining the feet of the perpendiculars from the angular points A, B, C on the opposite sides of the triangle ABC are respectively $a\cos A$, $b\cos B$, $c\cos C$, $\pi-2A$, $\pi-2B$, $\pi-2C$; we may therefore substitute these expressions for a, b, c, A, B, C respectively in any general formula. By drawing the perpendiculars of this second triangle and joining their feet as before, we obtain a triangle of which the sides are $-a\cos A\cos 2A$, $-b\cos B\cos 2B$, $-c\cos C\cos 2C$ and the angles are $4A-\pi$, $4B-\pi$, $4C-\pi$; we may therefore substitute these expressions for the sides and angles of the original triangle; for example, we obtain thus the formula

$$\cos 4A=\frac{a^2\cos^2 A\cos^2 2A-b^2\cos^2 B\cos^2 2B-c^2\cos^2 C\cos^2 2C}{2bc\cos B\cos C\cos 2B\cos 2C}.$$

This transformation obviously admits of further extension.

Solution of Triangles.

(1) The three sides of a triangle ABC being given, the angles can be determined by the formula

$$L\tan\tfrac{1}{2}A=10+\tfrac{1}{2}\log(s-b)+\tfrac{1}{2}\log(s-c)-\tfrac{1}{2}\log s-\tfrac{1}{2}\log(s-a)$$

and two corresponding formulae for the other angles.

(2) The two sides a, b and the included angle C being given, the angles A, B can be determined from the formulae

$$A+B=\pi-C,$$

$$L\tan\tfrac{1}{2}(A-B)=\log(a-b)-\log(a+b)+L\cot\tfrac{1}{2}C,$$

and the side c is then obtained from the formula

$$\log c=\log a+L\sin C-L\sin A.$$

(3) The two sides a, b and the angle A being given, the value of $\sin B$ may be found by means of the formula

$$L\sin B=L\sin A+\log b-\log a;$$

this gives two supplementary values of the angle B, if $b\sin A<a$. If $b\sin A>a$ there is no solution, and if $b\sin A=a$ there is one solution. In the case $b\sin A<a$, both values of B give solutions provided $b>a$, but the acute value only of B is admissible if $b<a$.

The other side c can be then determined as in case (2).

(4) If two angles A, B and a side a are given, the angle C is determined from the formula $C=\pi-A-B$ and the side b from the formula $\log b=\log a+L\sin B-L\sin A$.

Areas of Triangles and Quadrilaterals.

The area of a triangle is half the product of a side into the perpendicular from the opposite angle on that side; thus we obtain the expressions $\frac{1}{2}bc\sin A$, $\{s(s-a)(s-b)(s-c)\}^{\frac{1}{2}}$ for the area of a triangle. A large collection of formulae for the area of a triangle are given in the *Annals of Mathematics* for 1885 by M. Baker.

Let a, b, c, d denote the lengths of the sides AB, BC, CD, DA respectively of any plane quadrilateral and $A+C=2\alpha$; we may obtain an expression for the area S of the quadrilateral in terms of the sides and the angle α.

We have $\qquad 2S=ad\sin A+bc\sin(2\alpha-A)$

and $\qquad \frac{1}{2}(a^2+d^2-b^2-c^2)=ad\cos A-bc\cos(2\alpha-A);$

hence $4S^2+\frac{1}{4}(a^2+d^2-b^2-c^2)^2=a^2d^2+b^2c^2-2abcd\cos 2\alpha.$

If $2s=a+b+c+d$, the value of S may be written in the form

$$S=\{s(s-a)(s-b)(s-c)(s-d)-abcd\cos^2\alpha\}^{\frac{1}{2}}.$$

Radii of Circumscribed, Inscribed and Escribed Circles of a Triangle.

Let R denote the radius of the circumscribed circle, r of the inscribed, and r_1, r_2, r_3 of the escribed circles of a triangle ABC; the values of these radii are given by the following formulae:—

$$R=abc/4S=a/2\sin A,$$

$$r=S/s=(s-a)\tan\tfrac{1}{2}A=4R\sin\tfrac{1}{2}A\sin\tfrac{1}{2}B\sin\tfrac{1}{2}C,$$

$$r_1=S/(s-a)=s\tan\tfrac{1}{2}A=4R\sin\tfrac{1}{2}A\cos\tfrac{1}{2}B\cos\tfrac{1}{2}C.$$

Spherical Trigonometry.

7. We shall throughout assume such elementary propositions in spherical geometry as are required for the purpose of the investigation of formulae given below.

Definition of Spherical Triangle.

A spherical triangle is the portion of the surface of a sphere bounded by three arcs of great circles of the sphere. If BC, CA, AB denote these arcs, the circular measure of the angles subtended by these arcs respectively at the centre of the sphere are the sides a, b, c of the spherical triangle ABC; and, if the portions of planes passing through these arcs and the centre of the sphere be drawn, the angles between the portions of planes intersecting at A, B, C respectively are the angles A, B, C of the spherical triangle. It is not necessary to consider triangles in which a side is greater than π, since we may replace such a side by the remaining arc of the great circle to which it belongs.

Associated Triangles.

Since two great circles intersect each other in two points, there are eight triangles of which the sides are arcs of the same three great circles. If we consider one of these triangles ABC as the fundamental one, then one of the others is equal in all respects to ABC, and the remaining six have each one side equal to, or common with, a side of the triangle ABC, the opposite angle equal to the corresponding angle of ABC, and the other sides and angles supplementary to the corresponding sides and angles of ABC. These triangles may be called the associated triangles of the fundamental one ABC. It follows that from any general formula containing the sides and angles of a spherical triangle we may obtain other formulae by replacing two sides and the two angles opposite to them by their supplements, the remaining side and the remaining angle being unaltered, for such formulae are obtained by applying the given formulae to the associated triangles.

If A', B', C' are those poles of the arcs BC, CA, AB respectively which lie upon the same sides of them as the opposite angles A, B, C, then the triangle $A'B'C'$ is called the polar triangle of the triangle ABC. The sides of the polar triangle are $\pi-A$, $\pi-B$, $\pi-C$, and the angles $\pi-a$, $\pi-b$, $\pi-c$. Hence from any general formula connecting the sides and angles of a spherical triangle we may obtain another formula by changing each side into the supplement of the opposite angle and each angle into the supplement of the opposite side.

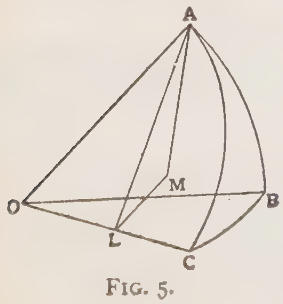

FIG. 5.

8. Let O be the centre of the sphere on which is the spherical triangle ABC. Draw AL perpendicular to OC and AM perpendicular to the plane OBC. Then the projection of OA on OB is the sum of the projections of OL, LM, MA on the same straight line. Since AM has no projection on any straight line in the plane OBC, this gives angles.

Fundamental Equations between Sides and Angles.

$$OA\cos c=OL\cos a+LM\sin a.$$

Now $OL=OA\cos b$, $LM=AL\cos C=OA\sin b\cos C$; therefore $\cos c=\cos a\cos b+\sin a\sin b\cos C$. We may obtain similar formulae by interchanging the letters a, b, c, thus

$$\left.\begin{aligned}\cos a&=\cos b\cos c+\sin b\sin c\cos A\\ \cos b&=\cos c\cos a+\sin c\sin a\cos B\\ \cos c&=\cos a\cos b+\sin a\sin b\cos C\end{aligned}\right\}\qquad(1)$$

These formulae (1) may be regarded as the fundamental equations connecting the sides and angles of a spherical triangle; all the other relations which we shall give below may be deduced analytically from them; we shall, however, in most cases give independent proofs. By using the polar triangle transformation we have the formulae

$$\left.\begin{aligned}\cos A&=-\cos B\cos C+\sin B\sin C\cos a\\ \cos B&=-\cos C\cos A+\sin C\sin A\cos b\\ \cos C&=-\cos A\cos B+\sin A\sin B\cos c\end{aligned}\right\}\qquad(2)$$

In the figures we have $AM=AL\sin C=r\sin b\sin C$, where r denotes the radius of the sphere. By drawing a perpendicular from A on OB, we may in a similar manner show that $AM=r\sin c\sin B$,

therefore $\qquad \sin B\sin c=\sin C\sin b.$

By interchanging the sides we have the equation

$$\frac{\sin A}{\sin a}=\frac{\sin B}{\sin b}=\frac{\sin C}{\sin c}=k\qquad(3)$$

we shall find below a symmetrical form for k. If we eliminate $\cos b$ between the first two formulae of (1) we have

$$\cos a\sin^2 c=\sin b\sin c\cos A+\sin c\cos c\sin a\cos B;$$

therefore $\cot a\sin c=(\sin b/\sin a)\cos A+\cos c\cos B$
$\qquad\qquad=\sin B\cot A+\cos c\cos B.$

We thus have the six equations

$$\left.\begin{aligned}\cot a\sin b&=\cot A\sin C+\cos b\cos C\\ \cot b\sin a&=\cot B\sin C+\cos a\cos C\\ \cot b\sin c&=\cot B\sin A+\cos c\cos A\\ \cot c\sin b&=\cot C\sin A+\cos b\cos A\\ \cot c\sin a&=\cot C\sin B+\cos a\cos B\\ \cot a\sin c&=\cot A\sin B+\cos c\cos B\end{aligned}\right\}\qquad(4)$$

When $C=\frac{1}{2}\pi$ formula (1) gives

$$\cos c=\cos a\cos b\qquad(\alpha)$$

and (3) gives

$$\left.\begin{aligned}\sin b&=\sin B\sin c\\ \sin a&=\sin A\sin c\end{aligned}\right\}\qquad(\beta)$$

from (4) we get

$$\left.\begin{aligned}\tan a&=\tan A\sin b=\tan c\cos B\\ \tan b&=\tan B\sin a=\tan c\cos A\end{aligned}\right\}\qquad(\gamma)$$

The formulae

$$\cos c=\cot A\cot B\qquad(\epsilon)$$

and

$$\left.\begin{aligned}\cos A&=\cos A\sin B\\ \cos B&=\cos b\sin A\end{aligned}\right\}\qquad(\zeta)$$

follow at once from (α), (β), (γ). These are the formulae which are used for the solution of right-angled triangles. Napier gave mnemonical rules for remembering them.

The following proposition follows easily from the theorem in equation (3): If AD, BE, CF are three arcs drawn through A, B, C to meet the opposite sides in D, E, F respectively, and if these arcs pass through a point, the segments of the sides satisfy the relation $\sin BD\sin CE\sin AF=\sin CD\sin AE\sin BF$; and conversely if this relation is satisfied the arcs pass through a point. From this theorem it follows that the three perpendiculars from the angles on the opposite sides, the three bisectors of the angles, and the three arcs from the angles to the middle points of the opposite sides, each pass through a point.

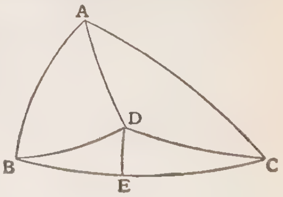

FIG. 6.

Formulæ for Sine and Cosine of Half Angles.

9. If D be the point of intersection of the three bisectors of the angles A, B, C, and if DE be drawn perpendicular to BC, it may be shown that $BE=\frac{1}{2}(a+c-b)$ and $CE=\frac{1}{2}(a+b-c)$, and that the angles BDE, ADC are supplementary. We have also $\dfrac{\sin c}{\sin BD}=\dfrac{\sin ADB}{\sin\frac{1}{2}A}$, $\dfrac{\sin b}{\sin CD}=\dfrac{\sin ADC}{\sin\frac{1}{2}A}$; therefore $\sin^2\frac{1}{2}A=\dfrac{\sin BD\sin CD\sin CDE\sin BDE}{\sin b\sin c}$. But $\sin BD\sin BDE=\sin BE=\sin\frac{1}{2}(a+c-b)$, and $\sin CD\sin CDE=\sin CE=\sin\frac{1}{2}(a+b-c)$;

therefore

$$\sin\frac{A}{2}=\left\{\frac{\sin\frac{1}{2}(a+c-b)\sin\frac{1}{2}(a+b-c)}{\sin b\sin c}\right\}^{\frac{1}{2}}\qquad(5)$$

Apply this formula to the associated triangle of which $\pi-A$, $\pi-B$, C are the angles and $\pi-a$, $\pi-b$, c are the sides; we obtain the formula

$$\cos\frac{A}{2}=\left\{\frac{\sin\frac{1}{2}(b+c-a)\sin\frac{1}{2}(a+b+c)}{\sin b\sin c}\right\}^{\frac{1}{2}}\qquad(6)$$

By division we have

$$\tan\frac{A}{2} = \left\{\frac{\sin\frac{1}{2}(a+c-b)\sin\frac{1}{2}(a+b-c)}{\sin\frac{1}{2}(b+c-a)\sin\frac{1}{2}(a+b+c)}\right\}^{\frac{1}{2}} \qquad (7)$$

and by multiplication

$\sin A = 2\{\sin(a+b+c)\sin\frac{1}{2}(b+c-a)\sin\frac{1}{2}(c+a-b)\sin\frac{1}{2}(a+b-c)\}^{\frac{1}{2}}$
$\sin b\sin c = \{1-\cos^2 a-\cos^2 b-\cos^2 c+2\cos a\cos b\cos c\}^{\frac{1}{2}}\sin b\sin c.$

Hence the quantity k in (3) is

$$\{1-\cos^2 a-\cos^2 b-\cos^2 c+2\cos a\cos b\cos c\}^{\frac{1}{2}}/\sin a\sin b\sin c. \qquad (8)$$

Of Half-sides.

Apply the polar triangle transformation to the formulae (5), (6), (7) (8) and we obtain

$$\cos\frac{a}{2} = \left\{\frac{\cos\frac{1}{2}(A+C-B)\cos\frac{1}{2}(A+B-C}{\sin B\sin C}\right\}^{\frac{1}{2}} \qquad (9)$$

$$\sin\frac{a}{2} = \left\{\frac{-\cos\frac{1}{2}(B+C-A)\cos\frac{1}{2}(A+B+C}{\sin B\sin C}\right\}^{\frac{1}{2}} \qquad (10)$$

$$\tan\frac{a}{2} = \left\{\frac{-\cos\frac{1}{2}(B+C-A)\cos\frac{1}{2}(A+B+C}{\cos\frac{1}{2}(A+C-B)\cos\frac{1}{2}(A+B-C}\right\}^{\frac{1}{2}} \qquad (11)$$

If $k' = \{1-\cos^2 A-\cos^2 B-\cos^2 C-2\cos A\cos B\cos C\}^{\frac{1}{2}}/\sin A\sin B\sin C$, we have.

$$kk' = 1 \qquad (12)$$

10. Let E be the middle point of AB; draw ED at right angles to AB to meet AC in D; then DE bisects the angle ADB. Let CF bisect the angle DCB and draw FG perpendicular to BC, then

Delambre's Formulae.

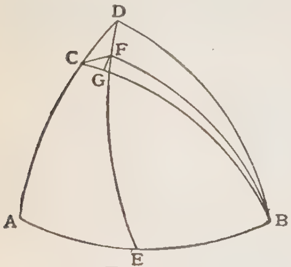

FIG. 7.

$$CG = \tfrac{1}{2}(a-b, \angle FBE = \tfrac{1}{2}(A+B),$$
$$\angle FCG = 90° - \tfrac{1}{2}C.$$

From the triangle CFG we have $\cos CFG = \cos CG\sin FCG$, and from the triangle FEB $\cos EFB = \cos EB\sin FBE$. Now the angles CFG, EFB are each supplementary to the angle DFB, therefore

$$\cos\tfrac{1}{2}(a-b)\cos\tfrac{1}{2}C = \sin\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}c. \qquad (13)$$

Also $\sin CG = \sin CF\sin CFG$ and $\sin EB = \sin BF\sin EFB$; therefore

$$\sin\tfrac{1}{2}(a-b)\cos\tfrac{1}{2}C = \sin\tfrac{1}{2}(A-B)\sin\tfrac{1}{2}c. \qquad (14)$$

Apply the formulae (13), (14) to the associated triangle of which a, $\pi-b$, $\pi-c$, A, $\pi-B$, $\pi-C$ are the sides and angles, we then have

$$\sin\tfrac{1}{2}(a+b)\sin\tfrac{1}{2}C = \cos\tfrac{1}{2}(A-B)\sin\tfrac{1}{2}c \qquad (15)$$
$$\cos\tfrac{1}{2}(a+b)\sin\tfrac{1}{2}C = \cos\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}c. \qquad (16)$$

The four formulae (13), (14), (15) (16) were first given by Delambre in the *Connaissance des Temps* for 1808. Formulae equivalent to these were given by Mollweide in Zach's *Monatliche Correspondenz* for November 1808. They were also given by Gauss (*Theoria motus*, 1809), and are usually called after him.

11. From the same figure we have

Napier's Analogies.

$$\tan FG = \tan FCG\sin CG = \tan FBG\sin BG;$$

therefore $\cot\frac{1}{2}C\sin\frac{1}{2}(a-b)\tan\frac{1}{2}(A-B)\sin\frac{1}{2}(a+b)$,

or

$$\tan\tfrac{1}{2}(A-B) = \frac{\sin\frac{1}{2}(a-b)}{\sin\frac{1}{2}(a+b)}\cot\tfrac{1}{2}C. \qquad (17)$$

Apply this formulae to the associated triangle ($\pi-a$, b, $\pi-c$, $\pi-A$, B, $\pi-C$), and we have

$$\cot\tfrac{1}{2}(A+B) = \frac{\cos\frac{1}{2}(a+b)}{\cos\frac{1}{2}(a-b)}\tan\tfrac{1}{2}C,$$

or

$$\tan\tfrac{1}{2}(A+B) = \frac{\cos\frac{1}{2}(a-b)}{\cos\frac{1}{2}(a+b)}\cot\tfrac{1}{2}C. \qquad (18)$$

If we apply these formulae (17), (18) to the polar triangle, we have

$$\tan\tfrac{1}{2}(a-b) = \frac{\sin\frac{1}{2}(A-B)}{\sin\frac{1}{2}(A+B)}\tan\tfrac{1}{2}c \qquad (19)$$

$$\tan\tfrac{1}{2}(A+B) = \frac{\cos\frac{1}{2}(A-B)}{\cos\frac{1}{2}(A+B)}\tan\tfrac{1}{2}c. \qquad (20)$$

The formulae (17), (18), (19), (20) are called Napier's "Analogies"; they were given in the *Mirif. logar. canonis descriptio.*

12. If we use the values of $\sin\frac{1}{2}a$, $\sin\frac{1}{2}b$, $\sin\frac{1}{2}c$, $\cos\frac{1}{2}a$, $\cos\frac{1}{2}b$, $\cos\frac{1}{2}c$, given by (9), (10) and the analogous formulae obtained by interchanging the letters we obtain by multiplication

Schmeisser's Formulae.

$$\left.\begin{aligned}\sin\tfrac{1}{2}a\cos\tfrac{1}{2}b\sin C &= \sin\tfrac{1}{2}c\cos\tfrac{1}{2}(B+C-A)\\ \cos\tfrac{1}{2}a\cos\tfrac{1}{2}b\sin C &= \cos\tfrac{1}{2}c\cos\tfrac{1}{2}(A+B-C)\\ \sin\tfrac{1}{2}a\sin\tfrac{1}{2}b\sin C &= \cos\tfrac{1}{2}c\cos\tfrac{1}{2}(A+B+C)\end{aligned}\right\}.$$

These formulae were given by Schmiesser in *Crelle's Journ.*, vol. x.

The relation $\sin b\sin c+\cos b\cos c\cos A = \sin B\sin C-\cos B\cos C\cos a$ was given by Cagnoli in his *Trigonometry* (1786), and was rediscovered by Cayley (*Phil. Mag.*, 1859). It follows from (1), (2) and (3) thus: the right-hand side of the equation equals $\sin B\sin C+\cos a(\cos A-\sin B\sin C\cos a) = \sin B\sin C\sin^2 a+\cos a\cos A$, and this is equal to $\sin b\sin c+\cos A(\cos a-\sin b\sin c\cos A)$ or $\sin b\sin c+\cos b\cos c\cos A$.

Cagnoli's Formulae.

13. The formulae we have given are sufficient to determine three parts of a triangle when the other three parts are given; moreover such formulae may always be chosen as are adapted to logarithmic calculation. The solutions will be unique except in the two cases (1) where two sides and the angle opposite one of them are the given parts, and (2) where two angles and the side opposite one of them are given.

Solution of Triangles.

Suppose a, b, A are the given parts. We determine B from the formula $\sin B = \sin b\sin A/\sin a$; this gives two supplementary values of B, one acute and the other obtuse. Then C and c are determined from the equations

Ambiguous Cases.

$$\tan\tfrac{1}{2}C = \frac{\sin\frac{1}{2}(a-b)}{\sin\frac{1}{2}(a+b)}\cot\tfrac{1}{2}(A-B),\ \tan\tfrac{1}{2}c = \frac{\sin\frac{1}{2}(A+B)}{\sin\frac{1}{2}(A-B)}\tan\tfrac{1}{2}(a-b).$$

Now $\tan\frac{1}{2}C$, $\tan\frac{1}{2}c$, must both be positive; hence $A-B$ and $a-b$ must have the same sign. We shall distinguish three cases. First, suppose $\sin b < \sin a$; then we have $\sin B < \sin A$. Hence A lies between the two values of B, and therefore only one of these values is admissible, the acute or the obtuse value according as a is greater or less than b; there is therefore in this case always one solution. Secondly, if $\sin b > \sin a$, there is no solution when $\sin b\sin A > \sin a$; but if $\sin b\sin A < \sin a$ there are two values of B, both greater or both less than A. If a is acute, $a-b$, and therefore $A-B$, is negative; hence there are two solutions if A is acute and none if A is obtuse. These two solutions fall together if $\sin b\sin A = \sin a$. If a is obtuse there is no solution unless A is obtuse, and in that case there are two, which coincide as before if $\sin b\sin A = \sin a$. Hence in this case there are two solutions if $\sin b\sin A \leq \sin a$ and the two parts A, a are both acute or both obtuse, these being coincident in case $\sin b\sin A = \sin a$; and there is no solution if one of the two A, a, is acute and the other obtuse, or if $\sin b\sin A > \sin a$. Thirdly, if $\sin b = \sin a$ then $B = A$ or $\pi = A$. If a is acute, $a-b$ is zero or negative, hence $A-B$ is zero or negative; thus there is no solution unless A is acute, and then there is one. Similarly, if a is obtuse, A must be so too in order that there may be a solution. If $a = b = \frac{1}{2}\pi$, there is no solution unless $A = \frac{1}{2}\pi$, and then there are an infinite number of solutions, since the values of C and c become indeterminate.

The other case of ambiguity may be discussed in a similar manner, or the different cases may be deduced from the above by the use of the polar triangle transformation. The method of classification according to the three cases $\sin b \overset{>}{\underset{<}{=}} \sin a$ was given by Professor Lloyd Tanner (*Messenger of Math.*, vol. xiv.).

14. If r is the angular radius of the small circle inscribed in the triangle ABC, we have at once $\tan r = \tan\frac{1}{2}A\sin(s-a)$, where $2s = a+b+c$; from this we can derive the formulae

Radii of Circles Related to Triangles.

$$\tan r = n\operatorname{cosec} s = \tfrac{1}{2}N\sec\tfrac{1}{2}A\sec\tfrac{1}{2}B\sec\tfrac{1}{2}C =$$
$$\sin a\sin\tfrac{1}{2}B\sin\tfrac{1}{2}C\sec\tfrac{1}{2}A \qquad (21)$$

where n, N denote the expressions

$$\{\sin s\sin(s-a)\sin(s-b)\sin(s-c)\}^{\frac{1}{2}},$$
$$\{-\cos S\cos(S-A)\cos(S-B)\cos(S-C)\}^{\frac{1}{2}}.$$

The escribed circles are the small circles inscribed in three of the associated triangles; thus, applying the above formulae to the triangle (a, $\pi-b$, $\pi-c$, A, $\pi-B$, $\pi-C$), we have for r_1, the radius of the escribed circle opposite to the angle A, the following formulae

$$\tan r_1 = \tan\tfrac{1}{2}A\sin s = n\operatorname{cosec}(s-a) = \tfrac{1}{2}N\sec\tfrac{1}{2}A\operatorname{cosec}\tfrac{1}{2}B\operatorname{cosec}\tfrac{1}{2}C$$
$$= \sin a\cos\tfrac{1}{2}B\cos\tfrac{1}{2}C\sec\tfrac{1}{2}A. \qquad (22)$$

The pole of the circle circumscribing a triangle is that of the circle inscribed in the polar triangle, and the radii of the two circles are complementary; hence, if R be the radius of the circumscribed circle of the triangle, and R_1, R_2, R the radii of the circles circumscribing the associated triangles, we have by writing $\frac{1}{2}\pi-R$ for r, $\frac{1}{2}\pi-R_1$ for r_1, $\pi-a$ for A, &c., in the above formulae

$$\cot R = \cot\tfrac{1}{2}a\cos(S-A) = \tfrac{1}{2}n\operatorname{cosec}\tfrac{1}{2}a\operatorname{cosec}\tfrac{1}{2}b\operatorname{cosec}\tfrac{1}{2}c = -N\sec S$$
$$= \sin A\cos\tfrac{1}{2}b\cos\tfrac{1}{2}c\operatorname{cosec}\tfrac{1}{2}a \qquad (23)$$

$$\cot R_1 = -\cot\tfrac{1}{2}a\cos S = \tfrac{1}{2}n\operatorname{cosec}\tfrac{1}{2}a\sec\tfrac{1}{2}b\sec\tfrac{1}{2}c = N\sec(S-A)$$
$$= \sin A\sin\tfrac{1}{2}b\sin\tfrac{1}{2}c\operatorname{cosec}\tfrac{1}{2}a. \qquad (24)$$

The following relations follow from the formulae just given:—

$$2\tan R = \cot r_1+\cot r_2+\cot r_3-\cot r,$$
$$2\tan R_1 = \cot r+\cot r_2+\cot r_3-\cot r_1,$$
$$\tan r\tan r_1\tan r_2\tan r_3 = n^2,\ \sin^2 s = \cot r\tan r_1\tan r_2\tan r_3,$$
$$\sin^2(s-a) = \tan r\cot r_1\tan r_2\tan r_3.$$

15. If $E = A+B+C-\pi$, it may be shown that E multiplied by the square of the radius is the area of the triangle. We give some of the more important expressions for the quantity E, which is called the spherical excess.

Formulae for Spherical Excess.

We have

$$\frac{\cos\frac{1}{2}(A+B)}{\sin\frac{1}{2}C} = \frac{\cos\frac{1}{2}(a+b)}{\cos\frac{1}{2}c} \text{ and } \frac{\sin\frac{1}{2}(A+B)}{\cos\frac{1}{2}C} = \frac{\cos\frac{1}{2}(a-b)}{\cos\frac{1}{2}c},$$

or

$$\frac{\sin\frac{1}{2}(C-E)}{\sin\frac{1}{2}C} = \frac{\cos\frac{1}{2}(a+b)}{\cos\frac{1}{2}c} \text{ and } \frac{\cos\frac{1}{2}(C-E)}{\cos\frac{1}{2}C} = \frac{\cos\frac{1}{2}(a-b)}{\cos\frac{1}{2}c};$$

hence

$$\frac{\sin\frac{1}{2}C-\sin\frac{1}{2}(C-E)}{\sin\frac{1}{2}C+\sin\frac{1}{2}(C-E)} = \frac{\cos\frac{1}{2}c-\cos\frac{1}{2}(a+b)}{\cos\frac{1}{2}c+\cos\frac{1}{2}(a+b)};$$

therefore
$$\frac{\tan \frac{1}{4}E}{\tan^2 \frac{1}{4}(C-E)} = \tan \tfrac{1}{2}s \tan \tfrac{1}{2}(s-c).$$
Similarly $\tan \frac{1}{4}E \tan^2 \frac{1}{4}(C-E) = \tan \frac{1}{2}(s-a) \tan \frac{1}{2}(s-b)$;
therefore
$$\tan \tfrac{1}{4}E = \{\tan \tfrac{1}{2}s \tan \tfrac{1}{2}(s-a) \tan \tfrac{1}{2}(s-b) \tan \tfrac{1}{2}(s-c)\}^{\frac{1}{2}} \tag{25}$$
This formula was given by J. Lhuilier.

Also
$$\sin \tfrac{1}{2}C \cos \tfrac{1}{2}E - \cos \tfrac{1}{2}C \sin \tfrac{1}{2}E = \frac{\cos \frac{1}{2}(a+b)}{\cos \frac{1}{2}c} \sin \tfrac{1}{2}C;$$
$$\cos \tfrac{1}{2}C \cos \tfrac{1}{2}E + \sin \tfrac{1}{2}C \sin \tfrac{1}{2}E = \frac{\cos \frac{1}{2}(a-b)}{\cos \frac{1}{2}c} \cos \tfrac{1}{2}C;$$
whence, solving for $\cos \frac{1}{2}E$, we get
$$\cos \tfrac{1}{2}E = \frac{1 + \cos a + \cos b + \cos c}{4 \cos \frac{1}{2}a \cos \frac{1}{2}b \cos \frac{1}{2}c} \tag{26}$$
This formula was given by Euler (*Nova acra*, vol. x.). If we find $\sin \frac{1}{2}E$ from this formula, we obtain after reduction
$$\sin \tfrac{1}{2}E = \frac{n}{2 \cos \frac{1}{2}a \cos \frac{1}{2}b \cos \frac{1}{2}c},$$
a formula given by Lexell (*Acta Petrop.*, 1782).

From the equations (21), (22), (23), (24) we obtain the following formulae for the spherical excess:—
$$\sin^2 \tfrac{1}{2}E = \tan R \cot R_1 \cot R_2 \cot R_3$$
$$= \frac{4(\cot r_1 + \cot r_2 + \cot r_3)}{(\cot r - \cot r_1 + \cot r_2 + \cot r_3)\ (\cot r + \cot r_1 - \cot r_2 + \cot r_3) \times (\cot r + \cot r_1 + \cot r_2 + \cot r_3)}.$$

The formula (26) may be expressed geometrically. Let M, N be the middle points of the sides AB, AC. Then we find $\cos MN$
$$= \frac{1 + \cos a + \cos b + \cos c}{4 \cos \frac{1}{2}b \cos \frac{1}{2}c}; \text{ hence } \cos \tfrac{1}{2}E = \cos MN \sec \tfrac{1}{2}a.$$

A geometrical construction has been given for E by Gudermann (in *Crelle's Journ.*, vi. and viii.). It has been shown by Cornelius Keogh that the volume of the parallelepiped of which the radii of the sphere passing through the middle points of the sides of the triangle are edges is $\sin \frac{1}{2} E$.

Properties of Spherical Quadrilateral Inscribed in Small Circle.

16. Let $ABCD$ be a spherical quadrilateral inscribed in a small circle; let a, b, c, d denote the sides AB, BC, CD, DA respectively, and x, y the diagonals AC, BD. It can easily be shown by joining the angular points of the quadrilateral to the pole of the circle that $A+C=B+D$. If we use the last expression in (23) for the radii of the circles circumscribing the triangles BAD, BCD, we have
$$\sin A \cos \tfrac{1}{2}a \cos \tfrac{1}{2}d \operatorname{cosec} \tfrac{1}{2}y = \sin C \cos \tfrac{1}{2}b \cos \tfrac{1}{2}C \operatorname{cosec} \tfrac{1}{2}y;$$
whence
$$\frac{\sin A}{\cos \frac{1}{2}b \cos \frac{1}{2}c} = \frac{\sin C}{\cos \frac{1}{2}a \cos \frac{1}{2}d}.$$
This is the proposition corresponding to the relation $A+C=\pi$ for a plane quadrilateral. Also we obtain in a similar manner the theorem
$$\frac{\sin \frac{1}{2}x}{\sin B \cos \frac{1}{2}b} = \frac{\sin \frac{1}{2}y}{\sin A \cos \frac{1}{2}d},$$
analogous to the theorem for a plane quadrilateral, that the diagonals are proportional to the sines of the angles opposite to them. Also the chords AB, BC, CD, DA are equal to $2 \sin \frac{1}{2}a$, $2 \sin \frac{1}{2}b$, $2 \sin \frac{1}{2}c$, $2 \sin \frac{1}{2}d$ respectively, and the plane quadrilateral formed by these chords is inscribed in the same circle as the spherical quadrilateral; hence by Ptolemy's theorem for a plane quadrilateral we obtain the analogous theorem for a spherical one
$$\sin \tfrac{1}{2}x \sin \tfrac{1}{2}y = \sin \tfrac{1}{2}a \sin \tfrac{1}{2}c + \sin \tfrac{1}{2}b \sin \tfrac{1}{2}d.$$

It has been shown by Remy (in *Crelle's Journ.*, vol. iii.) that for any quadrilateral, if z be the spherical distance between the middle points of the diagonals,
$$\cos a + \cos b + \cos c + \cos d = 4 \cos \tfrac{1}{2}x \cos \tfrac{1}{2}y \cos \tfrac{1}{2}z.$$
This theorem is analogous to the theorem for any plane quadrilateral, that the sum of the squares of the sides is equal to the sum of the squares of the diagonals, together with twice the square on the straight line joining the middle points of the diagonals.

A theorem for a right-angled spherical triangle, analogous to the Pythagorean theorem, has been given by Gudermann (in *Crelle's Journ.*, vol. xlii.).

Analytical Trigonometry.

Periodicity of Functions.

17. Analytical trigonometry is that branch of mathematical analysis in which the analytical properties of the trigonometrical functions are investigated. These functions derive their importance in analysis from the fact that they are the simplest singly periodic functions, and are therefore adapted to the representation of undulating magnitude. The sine, cosine, secant and cosecant have the single real period 2π; *i.e.* each is unaltered in value by the addition of 2π to the variable. The tangent and cotangent have the period π. The sine, tangent, cosecant and cotangent belong to the class of odd functions; that is, they change sign when the sign of the variable is changed. The cosine and secant are even functions, since they remain unaltered when the sign of the variable is reversed.

Connexion with Theory of Complex Quantities.

The theory of the trigonometrical functions is intimately connected with that of complex numbers—that is, of numbers of the form $x + \iota y (\iota = \sqrt{-1})$. Suppose we multiply together, by the rules of ordinary algebra, two such numbers we have
$$(x_1 + \iota y_1)(x_2 + \iota y_2) = (x_1x_2 - y_1y_2) + \iota(x_1y_2 + x_2y_1).$$
We observe that the real part and the real factor of the imaginary part of the expression on the right-hand side of this equation are similar in form to the expressions which occur in the addition formulae for the cosine and sine of the sum of two angles; in fact, if we put $x_1 = r_1 \cos \theta_1$, $y_1 = r_1 \sin \theta_1$, $x_2 = r_2 \cos \theta_2$, $y_2 = r_2 \sin \theta_2$, the above equations becomes
$$r_1(\cos \theta_1 + \iota \sin \theta_1) \times r_2(\cos \theta_2 + \iota \sin \theta_2) = r_1 r_2(\cos \overline{\theta_1 + \theta_2} + \iota \sin \overline{\theta_1 + \theta_2}).$$

We may now, in accordance with the usual mode of representing complex numbers, give a geometrical interpretation of the meaning of this equation. Let P_1 be the point whose co-ordinates referred to rectangular axes Ox, Oy are x_1, y_1; then the point P_1 is employed to represent the number $x_1 + \iota y_1$. In this mode or representation real numbers are measured along the axis of x and imaginary ones along the axis of y, additions being performed according to the parallelogram law. The points A, A_1 represent the numbers ± 1, the points a, a_1 the numbers $\pm \iota$. Let P_2 represent the expression $x_2 + \iota y_2$ and P the expression $(x_1 + \iota y_1)(x_2 + \iota y_2)$. The quantities r_1, θ_1, r_2, θ_2 are the polar coordinates of P_1 and P_2 respectively, referred to O as origin and Ox as initial line; the above equation shows that r_1 r_2 and $\theta_1 + \theta_2$ are the polar co-ordinates of P; hence $OA : OP_1 : : OP_2 \cdot OP$ and the angle POP_2 is equal to the angle P_1OA. Thus we have the following geometrical construction for the determination of the point P. On OP_2 draw a triangle similar to the triangle OAP_1 so that the sides OP_2, OP are homologous to the sides OA, OP_1, and so that the angle POP_2 is positive; then the vertex P represents the product of the numbers represented by P_1, P_2. If $x_2 + \iota y_2$ were to be divided by $x_1 + \iota y_1$ the triangle $OP'P_2$ would be drawn on the negative side of P_2, similar to the triangle OAP_1 and having the sides OP', OP_2 homologous to OA, OP_1, and P' would represent the quotient.

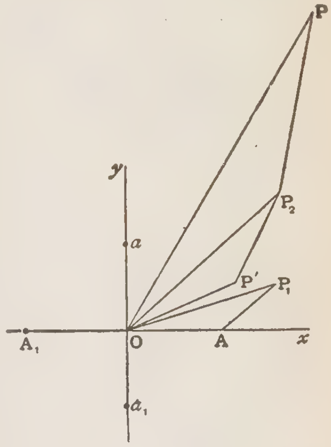

FIG. 8.

De Moivre's Theorem.

18. If we extend the above to n complex numbers by continual repetition of a similar operation, we have—
$$(\cos \theta_1 + \iota \sin \theta_1)(\cos \theta_2 + \iota \sin \theta_2) \ldots (\cos \theta_n + \iota \sin \theta_n)$$
$$= \cos (\theta_1 = \theta_2 + \ldots + \theta_n) + \iota \sin (\theta_1 + \theta_2 + \ldots + \theta_n).$$
If $\theta_1 = \theta_2 = \ldots = \theta_n = \theta_1$, this equation becomes $(\cos \theta + \iota \sin \theta)^n = \cos n\theta + \iota \sin n\theta$; this shows that $\cos \theta + \iota \sin \theta$ is a value of $(\cos n\theta + \iota \sin n\theta)^{\frac{1}{n}}$. If now we change θ into θ/n, we see that $\cos \theta/n + \iota \sin \theta/n$ is a value of $(\cos \theta + \iota \sin \theta)^{\frac{1}{n}}$; raising each of these quantities to any positive integral power m, $\cos m\theta/n + \iota \sin m\theta/n$ is one value of $(\cos \theta + \iota \sin \theta)^{\frac{m}{n}}$. Also
$$\cos(-m\theta/n) + \iota \sin(-m\theta/n) = \frac{1}{\cos m\theta/n + \iota \sin m\theta/n};$$
hence the expression of the left-hand side is one value of $(\cos \theta + \iota \sin \theta)^{-m/n}$. We have thus De Moivre's theorem that $\cos k\theta + \iota \sin k\theta$ is always one value of $(\cos \theta + \iota \sin \theta)^k$, where k is any rational number. This theorem can be extended to the case in which k is irrational, if we postulate that a value of $(\cos \theta + \iota \sin \theta)^k$ denotes the limit of a sequence of corresponding values of $(\cos \theta + \iota \sin \theta)^{k_s}$, where $k_1, k_2 \ldots k_s \ldots$ is a sequence of rational numbers of which k is the limit, and further observe that as $\cos k\theta + \iota \sin k\theta$ is the limit of $\cos k_s\theta + \iota \sin k_s\theta$.

The n Roots of a Complex Quantity.

The principal object of De Moivre's theorem is to enable us to find all the values of an expression of the form $(a + \iota b)^{m/n}$, where m and n are positive integers prime to each other. If $a = r \cos \theta$, $b = r \sin \theta$, we require the values of $r^{m/n} (\cos \theta + \iota \sin \theta)^{m/n}$. One value is immediately furnished by the theorem; but we observe that since the expression $\cos \theta + \iota \sin \theta$ is unaltered by adding any multiple of 2π to θ, the n/mth power of $r^{m/n} (\cos m.\overline{\theta + 2s\pi}/n + \iota \sin m.\overline{\theta + 2s\pi}/n)$ is $a + \iota b$, if s is any integer; hence this expression is one of the values required. Suppose that for two values s_1 and s_2 of s the values of this expression are the same; then we must have $m.\overline{\theta + 2s_1\pi}/n - m.\overline{\theta + 2s_2\pi}/n$; a multiple of 2π, or $s_1 - s_2$ must be a multiple of n. Therefore, if we give s the values 0, 1, 2, … $n-1$ successively, we shall get n different values of $(a + \iota b)^{m/n}$, and these will be repeated if we give s other values; hence all the values of

$(a+\iota b)^{m/n}$ are obtained by giving s the values 0, 1, 2, ... $n-1$ in the expression $r^{m/n}$ $(\cos\ m.\overline{\theta+2s\pi/n}+\iota\sin\ m.\overline{\theta+2s\pi/n})$, where $r=(a^2+b^2)^{\frac{1}{2}}$ and $\theta=\text{arc}\tan b/a$.

We now return to the geometrical representation of the complex numbers. If the points $B_1, B_2, B_3, \dots B_n$ represent the expression $x+\iota y$, $(x+\iota y)^2$, $(x+\iota y)^3$, ... $(x+\iota y)^n$ respectively, the triangles OAB_1, OB_1B_2, ... $OB_{n-1}B_n$ are all similar. Let $(x+\iota y)^n=a+\iota b$, then the converse problem of finding the nth root of $a+\iota b$ is equivalent to the geometrical problem of describing such a series of triangles that OA is the first side of the first triangle and OB_n the second side of the nth. Now it is obvious that this geometrical problem has more solutions than one, since any number of complete revolutions round O may be made in travelling from B_1 to B_n. The first solution is that in which the vertical angle of each triangle is B_nOA/n; the second is that in which each is $(B_nOA+2\pi)/n$, in this case one complete revolution being made round O; the third has $(B_nOA+4\pi)/n$ for the vertical angle of each triangle; and so on. There are n sets of triangles which satisfy the required conditions. For simplicity we will take the case of the determination of the values of $(\cos\theta+\iota\sin\theta)^{\frac{1}{3}}$. Suppose B to represent the expression $\cos\theta+\iota\sin\theta$. If the angle AOP_1 is $\frac{1}{3}\theta$, P_1 represent the root $\cos\frac{1}{3}\theta+\iota\sin\frac{1}{3}\theta$; the angle AOB is filled up by the angles of the three similar triangles AOP_1, P_1Op_1, p_1OB. Also, if P_2, P_3 be such that the angles P_1OP_2 P_1OP_3 are $\frac{2}{3}\pi$, $\frac{4}{3}\pi$ respectively, the two sets of triangles AOP_2, P_2Op_3, p_3OB and AOP_3, P_3Op_2, p_2OB satisfy the conditions of similarity and of having OA, OB for the bounding sides; thus P_2, P_3 represent the roots $\cos\frac{1}{3}(\theta+2\pi)+\iota\sin\frac{1}{3}(\theta+2\pi)$, $\cos\frac{1}{3}(\theta+4\pi)+\iota\sin\frac{1}{3}(\theta+4\pi)$ respectively. If B coincides with A, the problem is reduced to that of finding the three cube roots of unity. One will be represented by A and the others by the two angular points of an equilateral triangle, with A as one angular point, inscribed in the circle.

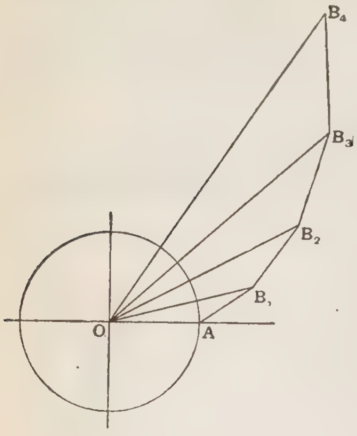

FIG. 9.

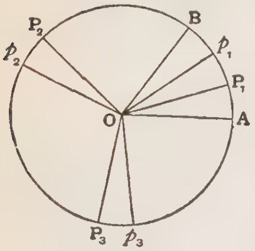

FIG. 10.

The nth Roots of Unity.

The problem of determining the values of the nth roots of unity is equivalent to the geometrical problem of inscribing a regular polygon of n sides in a circle. Gauss has shown in his *Disquisitiones arithmeticae* that this can always be done by the compass and ruler only when n is a prime of the form 2^p+1. The determination of the nth root of any complex number requires in addition, for its geometrical solution, the division of an angle into n equal parts.

Factorizations.

19. We are now in a position to factorize an expression of the form $x^n-(a+\iota b)$. Using the values which we have obtained above for $(a+\iota b)^{1/n}$, we have

$$x^n-(a+\iota b)=\overset{s=n-1}{\underset{s=0}{P}}\left[x-r^{\frac{1}{n}}\left(\cos\frac{\theta+2s\pi}{n}+\iota\sin\frac{\theta+2s\pi}{n}\right)\right]. \tag{1}$$

If $b=0$, $a=1$, this becomes

$$x^n-1=\overset{s=n-1}{\underset{s=0}{P}}\left[x-\cos\frac{2s\pi}{n}-\iota\sin\frac{2s\pi}{n}\right]$$

$$=(x-1)(x+1)\overset{s=\frac{1}{2}n-1}{\underset{s=1}{P}}\left(x-\cos\frac{2s\pi}{n}\pm\iota\sin\frac{2s\pi}{n}\right)$$

$$=(x-1)(x+1)\overset{s=\frac{1}{2}n-1}{\underset{s=1}{P}}\left(x^2-2x\cos\frac{2s\pi}{n}+1\right)\ (n\text{ even}). \tag{2}$$

$$x^n-1=(x-1)\overset{s=\frac{1}{2}(n-1)}{\underset{s=1}{P}}\left(x^2-2x\cos\frac{2s\pi}{n}+1\right)\quad(n\text{ odd}). \tag{3}$$

If in (1) we put $a=-1$, $b=0$, and therefore $\theta=\pi$, we have

$$x^n+1=\overset{s=n-1}{\underset{s=0}{P}}\left[x-\cos\frac{\overline{2s+1\pi}}{n}-\iota\sin\frac{\overline{2s+1\pi}}{n}\right]$$

$$=\overset{s=\frac{1}{2}(n-2)}{\underset{s=0}{P}}\left[x^2-2x\cos\frac{\overline{2s+1\pi}}{n}+1\right]\quad(n\text{ even}). \tag{4}$$

$$x^n+1=(x+1)\overset{s=\frac{1}{2}(n-3)}{\underset{s=0}{P}}\left[x^2-2x\cos\frac{\overline{2s+1\pi}}{n}+1\right]\quad(n\text{ odd}). \tag{5}$$

Also $x^{2n}-2x^ny^n\cos n\theta+y^{2n}$

$$=(x^n-y^n\,\overline{\cos n\theta+\iota\sin n\theta})(x^n-y^n\,\overline{\cos n\theta-\iota\sin n\theta})$$

$$=\overset{s=n-1}{\underset{s=0}{P}}\left(x-y\cos\frac{\theta+2s\pi}{n}\pm\iota\sin\frac{\theta+2s\pi}{n}\right)$$

$$=\overset{s=n-1}{\underset{s=0}{P}}\left[x^2-2xy\cos\overline{\theta+\frac{2s\pi}{n}}+y^2\right]. \tag{6}$$

Airy and Adams have given proofs of this theorem which do not involve the use of the symbol ι (see *Camb. Phil. Trans.*, vol. xi).

Example of De Moivre's Theorem.

A large number of interesting theorems may be derived from De Moivre's theorem and the factorizations which we have deduced from it; we shall notice one of them.

In equation (6) put $y=1/x$, take logarithms, and then differentiate each side with respect to x, and we get

$$\frac{2n(x^{2n-1}-x^{-2n-1})}{x^{2n}-2\cos n\theta+x^{-2n}}=\sum_{s=0}^{s=n-1}\frac{2(x-x^{-3})}{x^2-2\cos\overline{\theta+\frac{2s\pi}{n}}+x^{-2}}.$$

Put $x^2=a/b$, then we have the expression

$$\frac{n(a^{2n}-b^{2n})}{(a^2-b^2)(a^{2n}-2a^nb^n\cos n\theta+b^{2n})}$$

for the sum of the series

$$\sum_{s=0}^{s=n-1}\frac{1}{a^2-2ab\cos\overline{\theta+\frac{2s\pi}{n}}+b^2}.$$

The Exponential Series.

20. Denoting the complex number $x+iy$ by z, let us consider the series $1+z+z^2/2!+\dots+z^n/n!+\dots$ This series converges uniformly and absolutely for all values of z whose moduli do not exceed an arbitrarily chosen positive number R. Consequently the function $E(z)$, defined as the limiting sum of the above series, is continuous in every finite domain. The two series representing $E(z_1)$ and $E(z_2)$, when multiplied together give the series represented by $E(z_1+z_2)$. In accordance with a known theorem, since the series for $E(z_1)$ $E(z_2)$ are absolutely convergent, we have $E(z_1)\times E(z_2)=E(z_1+z_2)$. From this fundamental relation, we deduce at once that $\{E(z)\}^n=E(nz)$, where n is any positive integer. The number $E(1)$, the sum of the convergent series $1+1+1/2!+1/3!\dots$, is usually denoted by e; its value can be shown to be 2·718281828459.... It is known to be a transcendental number, *i.e.* it cannot be the root of any algebraical equation with rational coefficients; this was first established by Hermite. Writing $z=1$, we have $E(n)=e^n$, where n is a positive integer. If z has as a value a positive fraction p/q, we find that $\{E(p/q)\}^q=E(p)=e^p$; hence $E(p/q)$ is the real positive value of $e^{p/q}$. Again $E(-p/q)\times E(p/q)=E(0)=1$, hence $E(-p/q)$ is the real positive value of $e^{-p/q}$. It has been thus shown that for any real and rational number x, the value of $E(x)$ is the principal value of e^x. This result can be extended to irrational values of x, if we assume that e^x is for such a value of x defined as the limit of the sequence $e^{x1}, e^{x2}, \dots$, where $x_1, x_2, \dots$ is a sequence of rational numbers of which x is the limit, since $E(x_1)$, $E(x_2)\dots$, then converges to $E(x)$.

Next consider $(1+z/m)^m$, where m is a positive integer. We have by the binomial theorem,

$$\left(1+\frac{z}{m}\right)^m=1+z+\left(1-\frac{1}{m}\right)\frac{z^2}{2!}+.+\left(1-\frac{1}{m}\right)\left(1-\frac{2}{m}\right)\dots$$
$$\left(1-\frac{s-1}{m}\right)\frac{z^s}{s!}+\dots+\left(\frac{z}{m}\right)^m.$$

Also $$\left(1-\frac{1}{m}\right)\left(1-\frac{2}{m}\right)\dots\left(1-\frac{s-1}{m}\right)$$

lies between 1 and $$1+\left(\frac{1}{m}+\frac{2}{m}+\dots+\frac{s-1}{m}\right);$$

hence the product equals $1-\theta_s s.s-1/2m$ where θ_s is such that $0<\theta_s<1$.

We have now

$$\left(1+\frac{z}{m}\right)^m=1+z+\left(1-\frac{1}{m}\right)\frac{z^2}{2!}+\dots+\left[1-\theta_s\frac{s.s-1}{2m}\right]\frac{z_s}{s!}+\dots$$
$$+\left[1-\theta_m\frac{m-1}{2}\right]\frac{z^m}{m!}$$
$$=1+z+z^2/2!+\dots+z^s/s!+\text{R}_s,$$

where

$$\text{R}_s=\frac{z^{s+1}}{(s+1)!}+\dots+\frac{z^m}{m!}-\frac{z^2}{2m}\left\{1+\theta_3\frac{z}{1}+\dots\right.$$
$$\left.+\theta_s\frac{z^{s-2}}{(s-2)!}+\dots+\theta_m\frac{z^{m-2}}{(m-2)!}\right\}.$$

Since the series for $E(z)$ converges, s can be fixed so that for all values of $m>s$ the modulus of $z^{s+1}/(s+1)!+\dots+z^m/m!$ is less than an arbitrarily chosen number $\frac{1}{2}\epsilon$. Also the modulus of $1+\theta_3z/1+\dots+\theta_mz^{m-2}/(m-2)!$ is less than that of $1+1|z|/1!+|z|^2/2!+\dots$, or of $e^{\text{mod}\,z}$, hence mod $\text{R}_s<\frac{1}{2}\epsilon+(1/2m)$. mod $(z^2e^z)<\epsilon$, if m be chosen sufficiently great. It follows that $\lim_{m=\infty}(1+z/m)^m=E(z)$, where z is any complex number. To evaluate $E(z)$, write $1+x/m=\rho\cos\phi$, $y/m=\rho\sin\phi$, then

$E(z)=\lim_{m=\infty}\{\rho^m(\cos m\phi+i\sin m\phi)\}$, by De Moivre's theorem. Since $\rho^m=\left(1+\frac{x}{m}\right)^m\left\{1+\frac{y^2}{m(\sqrt{m}+x/\sqrt{m})^2}\right\}^{\frac{1}{2}m}$, we have $\lim_{m=\infty}\rho^m$ $=e^x.\lim_{m=\infty}\left\{1+\frac{y^2}{m(\sqrt{m}+x/\sqrt{m})^2}\right\}^{\frac{1}{2}m}$. Let r be a fixed number less than $\sqrt{m}+x/\sqrt{m}$, then $\lim_{m=\infty}\left\{1+\frac{y^2}{m(\sqrt{m}+x\sqrt{m})^2}\right\}^{\frac{1}{2}m}$ lies between 1 and $\lim_{m=\infty}\left\{1+\frac{y^2}{mr^2}\right\}^{\frac{1}{2}m}$, or between 1 and $e^{y^2/2r^2}$; hence since r can be taken arbitrarily large, the limit is 1. The limit of $m\phi$ or $m\tan^{-1}\{y/(x+m)\}$ is the same as that of $my/(x+m)$ which is y. Hence we have shown that $E(z)=e^x(\cos y+i\sin y)$.

Exponential Values of Trigonometrical Functions.

21. Since $E(x+iy)=i^x(\cos y+\sin y$, we have $\cos y+i\sin y=E(iy)$, and $\cos y-i\sin y=E(-iy)$. Therefore $\cos y=\frac{1}{2}\{E(iy)+E(-iy)\}$, $\sin y=\frac{1}{2}i\{E(iy)-E(-iy)\}$; and using the series defined by $E(iy)$ and $E(-iy)$, we find that $\cos y=1-y^2/2!+y^4/4!-\ldots$, $\sin y=y-y^3/3!+y^5/5!-\ldots$, where y is any real number. These are the well-known expansions of $\cos y$, $\sin y$ in powers of the circular measure y. Where z is a complex number, the symbol e^z may be defined to be such that its *principal value* is $E(z)$; thus the principal values of e^{iy}, e^{-iy} are $E(iy)$, $E(-iy)$. The above-expressions for $\cos y$, $\sin y$ may then be written $\cos y=\frac{1}{2}(e^{iy}+e^{-iy})$, $\sin y=\frac{1}{2}i(e^{iy}-e^{-iy})$. These are known as the exponential values of the cosine and sine. It can be shown that the symbol e^z as defined here satisfies the usual laws of combination for exponents.

Analytical Definitions of Trigonometrical Functions.

22. The two functions $\cos z$, $\sin z$ may be defined for all complex or real values of z by means of the equations $\cos y=\frac{1}{2}\{E(z)+E(-z)\}$, $\sin z=(\frac{1}{2i})\{E(z)-E(-z)\}$, where $E(z)$ represents the sum-function of $1+z+z^2/2!+\ldots+z^n/n!+\ldots$ For real values of z this is in accordance with the ordinary definitions, as appears from the series obtained above for $\cos y$, $\sin y$. The fundamental properties of $\cos z$, $\sin z$ can be deduced from this definition. Thus $\cos z+i\sin z=E(z)$, $\cos z-i\sin z=E(-iz)$; therefore $\cos^2 z+\sin^2 z=E(iz).E(-iz)=1$. Again $\cos(z_1+z_2)$ is given by $\frac{1}{2}\{E(iz_1+iz_2)+E(-iz_1-iz_2)\}=\frac{1}{2}\{E(iz_1)E(iz_2)+E(-iz_1)E(-iz_2)\}$ or $\frac{1}{4}\{E(iz_1)+E(-iz_1)\}\{E(iz_2)+E(-iz_2)\}+\frac{1}{4}\{E(iz_1)-E(-iz_1)\}\{E(iz_2)-E(-iz_2)\}$, whence we have $\cos(z_1+z_2)=\cos z_1\cos z_2-\sin z_1\sin z_2$. Similarly, we find that $\sin(z_1+z_2)=\sin z_1\cos z_2+\cos z_1\sin z_2$. Again the equation $E(z)=1$ has no real roots except $z=0$, for $e^y>1$, if z is real and >0. Also $E(z)=1$ has no complex root $\alpha+i\beta$, for $\alpha-i\beta$ would then also be a root, and $E(2\alpha)=E(\alpha+i\beta)E(\alpha-i\beta)=1$, which is impossible unless $\alpha=0$. The roots of $E(z)=1$ are therefore purely imaginary (except $z=0$); the smallest numerically we denote by $2i\pi$, so that $E(2i\pi)=1$. We have then $E(2i\pi r)=\{E(2i\pi)\}^r=1$, if r is any integer; therefore $2i\pi r$ is a root. It can be shown that no root lies between $2i\pi r$ and $2(r+1)i\pi$; and thus that all the roots are given by $z=\pm 2i\pi r$. Since $E(y+2i\pi)=E(z)E(2i\pi)=E(z)$, we see that $E(z)$ is periodic, of period $2i\pi$. It follows that $\cos z$, $\sin z$ are periodic, of periods 2π. The number here introduced may be identified with the ratio of the circumference to the diameter of a circle by considering the case of real values of z.

Expansion of Powers of Sines and Cosines in Series of Sines and Cosines of Multiple Arc.

23. Consider the binomial theorem

$$(a+b)^n=a^n+na^{n-1}b+\frac{n(n-1)}{2!}a^{n-2}b^2+\ldots$$
$$+\frac{n(n-1)\ldots(n-r+1)}{r!}a^{n-r}b^r+\ldots+b^n.$$

Putting $a=e^{\iota\theta}$, $b=e^{-\iota\theta}$, we obtain

$$(2\cos\theta)^n=2\cos n\theta+n2\cos\overline{n-2\theta}$$
$$+\frac{n(n-1)}{2!}2\cos\overline{n-4\theta}+\ldots$$
$$+\frac{n(n-1)\ldots(n-r+1)}{r!}2\cos(n-2r)\theta+\ldots$$

When n is odd the last term is $2\frac{n(n-1)\ldots\frac{1}{2}(n+3)}{\frac{1}{2}(n-1)!}\cos\theta$, and when n is even it is $\frac{n(n-1)\ldots(\frac{1}{2}n+1)}{\frac{1}{2}n!}$.

If we put $a=e^{\iota\theta}$, $b=-e^{-\iota\theta}$, we obtain the formula

$$(-1)^{\frac{1}{2}n}(2\sin\theta)^n=2\cos n\theta-2n\cos(n-2)\theta+\frac{n(n-1)}{1.2}2\cos(n-4)\theta-\ldots$$
$$+(-1)^{n-r}\frac{n(n-1)\ldots(n-r+1)}{r!}2\cos(n-2r)\theta\ldots$$
$$+(-1)^{\frac{n}{2}}\frac{n(n-1)\ldots(\frac{1}{2}n+1)}{\frac{1}{2}n!}$$

when n is even, and

$$(-1)^{\frac{1}{2}(n-1)}(2\sin\theta)^n=2\sin n\theta-n.2\sin(n-2)\theta+\frac{n(n-1)}{1.2}2\sin(n-4)\theta\ldots$$
$$+(-)^{\frac{n-1}{2}}\frac{n(n-1)\ldots\frac{1}{2}(n+3)}{\frac{1}{2}(n-1)!}\sin\theta$$

when n is odd. These formulae enable us to express any positive integral power of the sine or cosine in terms of sines or cosines of multiples of the argument. There are corresponding formulae when n is not a positive integer.

Expansion of Sines and Cosines of Multiple Arcs in Powers of Sines and Cosines of Arc.

Consider the identity $\log(1-px)+\log(1-qx)=\log(1-\overline{p+q}x+pqx^2)$. Expand both sides of this equation in powers of x, and equate the coefficients of x^n, we then get

$$p^n+q^n=(p+q)^n-n(p+q)^{n-2}pq$$
$$+\frac{n(n-3)}{2!}(p+q)^{n-4}p^2q^2+\ldots$$
$$+(-1)^r\frac{n(n-r-1)(n-r-2)\ldots(n-2r+1)}{r!}$$
$$(p+q)^{n-2r}p^rq^r+\ldots$$

If we write this series in the reverse order, we have

$$p^n+q^n=2(-1)^{\frac{n}{2}}\left[(pq)^{\frac{n}{2}}-\frac{n^2}{2!}(pq)^{\frac{n}{2}-1}\left(\frac{p+q}{2}\right)^2\right.$$
$$+\frac{n^2(n^2-2^2)}{4!}(pq)^{\frac{n}{2}-2}\left(\frac{p+q}{2}\right)^4$$
$$\left.-\frac{n^2(n^2-2^2)(n^2-4^2)}{6!}(pq)^{\frac{n}{2}-3}\left(\frac{p+q}{2}\right)^6+\ldots+(-1)^{\frac{n}{2}}\tfrac{1}{2}(p+q)^n\right]$$

when n is even, and

$$p^n+q^n=2(-1)^{\frac{n-1}{2}}\left[n(pq)^{\frac{n-1}{2}}\left(\frac{p+q}{2}\right)-\frac{n(n^2-1^2}{3!}(pq)^{\frac{n-3}{2}}\left(\frac{p+q}{2}\right)^3\right.$$
$$\left.+\frac{n(n^2-1^2)(n^2-3^2)}{5!}(pq)^{\frac{n-5}{2}}\left(\frac{p+q}{2}\right)^5+\ldots+(-1)^{\frac{n-1}{2}}\tfrac{1}{2}(p+q)^n\right]$$

when n is odd. If in these three formulae we put $p=e^{\iota\theta}$, $q=e^{-\iota\theta}$, we obtain the following series for $\cos n\theta$:—

$$2\cos n\theta=(2\cos\theta)^n-n(2\cos\theta)^{n-2}+\frac{n(n-3)}{2!}(2\cos\theta)^{n-4}-\ldots$$
$$+(-1)^r\frac{n(n-r-1)(n-r-2)\ldots(n-2r+1)}{r!}(2\cos\theta)^{n-2r}+\ldots\quad(7)$$

when n is any positive integer;

$$(-1)^{\frac{n}{2}}\cos u\theta=1-\frac{n^2}{2!}\cos^2\theta+\frac{n^2(n^2-2^2)}{4!}\cos^4\theta-\frac{n^2(n^2-2^2)(n^2-4^2)}{6!}\cos^6\theta$$
$$+\ldots+(-1)^{\frac{n}{2}}2^{n-1}\cos^n\theta\quad(8)$$

when n is an even positive integer;

$$(-1)^{\frac{n-1}{2}}\cos n\theta=n\cos n\theta-\frac{n(n^2-1^2)}{3!}\cos^3\theta+\frac{n(n^2-1^2)(n^2-3^2)}{5!}\cos^5\theta-$$
$$\ldots+(-1)^{\frac{n-1}{2}}2^{n-1}\cos^n\theta\quad(9)$$

when n is odd. If in the same three formulae we put $p=e^{\iota\theta}$, $q=-e^{-\iota\theta}$, we obtain the following four formulae:—

$$(-1)^{\frac{n}{2}}2\cos n\theta=(2\sin\theta)^n-n(2\sin\theta)^{n-2}+\frac{n(n-3)}{2!}(2\sin\theta)^{n-4}-\ldots$$
$$+(-1)^r\frac{n(n-r-1)\ldots(n-2r-1)}{r!}(2\sin\theta)^{n-2r}+\ldots(n\text{ even});\quad(10)$$
$$(-1)^{\frac{n-1}{2}}2\sin n\theta=\text{the same series }(n\text{ odd});\quad(11)$$
$$\cos n\theta=1-\frac{n^2}{2!}\sin^2\theta+\frac{n^2(n^2-2^2)}{4!}\sin^4\theta-\frac{n^2(n^2-2^2)(n^2-4^2)}{6!}\sin^6\theta$$
$$+\ldots+2^{n-1}\sin^n\theta\ (n\text{ even});\quad(12)$$
$$\sin n\theta=n\sin\theta-\frac{n(n^2-1^2)}{3!}\sin^3\theta+\frac{n(n^2-1^2)(n^2-3^2)}{5!}\sin^5\theta-\ldots$$
$$+(-1)^{\frac{n-1}{2}}2^{n-1}\sin^n\theta\ (n\text{ odd}).\quad(13)$$

Next consider the identity $\frac{p}{1-px}-\frac{q}{1-qx}=\frac{p-q}{1-(p+q)x+pqx^2}$.

Expand both sides of this equation in powers of x, and equate the coefficients of x^{n-1}, then we obtain the equation

$$\frac{p^n-q^n}{p-q}=(p+q)^{n-1}-(n-2)(p+q)^{n-3}pq$$
$$+\frac{(n-3)(n-4)}{2!}(p+q)^{n-5}p^2q^2-\ldots$$
$$(-1)^r\frac{(n-r-1)(n-r-2)\ldots(n-2r)}{r!}(p+q)^{n-2r-1}p^rq^r+\ldots$$

If, as before, we write this in the reverse order, we have the series

$$(-1)^{\frac{n}{2}-1}\left[n\left(\frac{p+q}{2}\right)(pq)^{\frac{n}{2}-1}-\frac{n(n^2-2^2)}{3!}\left(\frac{p+q}{2}\right)^3(pq)^{\frac{n}{2}-3}\right.$$
$$+\frac{n(n^2-2^2)(n^2-4^2)}{5!}\left(\frac{p+q}{2}\right)^5(pq)^{\frac{n}{2}-5}+\ldots+(-1)^{\frac{n}{2}-1}(p+q)^{n-1}\Big|$$

when n is even, and

$$(-1)^{\frac{n-1}{2}}\left[(pq)^{\frac{n-1}{2}}-\frac{n^2-1^2}{2!}\left(\frac{p+q}{2}\right)^2(pq)^{\frac{n-3}{2}}\right.$$
$$\left.+\frac{(n^2-1^2)(n^2-3^2)}{4!}\left(\frac{p+q}{2}\right)^4(pq)^{\frac{n-5}{2}}+\ldots+(-1)^{\frac{n-1}{2}}(p+q)^{n-1}\right]$$

when n is odd. If we put $p=e^{\iota\theta}$, $q=e-^{\iota\theta}$, we obtain the formulae

$$\sin n\theta=\sin\theta\left\{(2\cos\theta)^{n-1}-(n-2)(2\cos\theta)^{n-3}+\frac{(n-3)(n-4)}{2!}(2\cos\theta)^{n-5}\right.$$
$$\left.+(-1)^r\frac{(n-r-1)(n-r-2\ \ldots\ (n-2r)}{r!}(2\ \cos\ \theta)^{n-2r-1}+\ldots\right\}\quad(14)$$

where n is any positive integer;

$$(-1)^{\frac{n}{2}-1}\sin n\theta=\sin\theta\left\{n\cos\theta-\frac{n(n^2-2^2)}{3!}\cos^3\theta+\frac{n(n^2-2^2)(n^2-4^2)}{5!}\cos^5-\ldots\right.$$
$$\left.+(-1)^{\frac{n}{2}-1}(2\cos\theta)^{n-1}\right\}(n\text{ even});\quad(15)$$

$$(-1)^{\frac{n-1}{2}}\sin n\theta=\sin\theta\left\{1-\frac{n^2-1^2}{2!}\cos^2\theta+\frac{(n^2-1^2)\ (n^2-3^2)}{4!}\cos^4\theta-\ldots\right.$$
$$\left.+(-1)^{\frac{n}{2}-1}(2\cos\theta)^{n-1}\right\}(n\text{ odd}).\quad(16)$$

If we put in the same three formulae $p=e^{\iota\theta}$, $q=-e^{-\iota\theta}$, we obtain the series

$$(-1)^{\frac{n-2}{2}}\sin n\theta=\cos\theta\left[\sin^{n-1}\theta-(n-2)\sin^{n-3}\theta+\frac{(n-3)(n-4)}{2!}\sin^{n-5}\theta-\ldots\right.$$
$$\left.+(-1)^r\frac{(n-r-1)(n-r-2)\ldots(n-2r)}{r!}\sin^{n-2r-1}\theta+\ldots\right](n\text{ even});\quad(17)$$

$$(-1)^{\frac{n-1}{2}}\cos n\theta=\text{the same series }(n\text{ odd});\quad(18)$$

$$\sin n\theta=\cos\theta\left\{n\sin\theta-\frac{n(n^2-2^2)}{3!}\sin^3\theta+\frac{n(n^2-2^2)\ (n^2-4^2)}{5!}\sin^5\theta+\right.$$
$$\left.\ldots+(-1)^{\frac{n}{2}-1}(2\sin\theta)^{n-1}\right\}(n\text{ even});\quad(19)$$

$$\cos n\theta=\cos\theta\left\{1-\frac{n^2-1^2}{2!}\sin^2\theta+\frac{(n^2-1^2)(n^2-3^2)}{4!}\sin^4\theta-\ldots\right.$$
$$\left.+(2\sin\theta)^{n-1}\right\}(n\text{ odd}).\quad(20)$$

We have thus obtained formulae for cos $n\theta$ and sin $n\theta$ both in ascending and in descending powers of cos θ and sin θ. Vieta obtained formulae for chords of multiple arcs in powers of chords of the simple or complementary arcs equivalent to the formulae (13) and (19) above. These are contained in his work *Theoremata ad angulares sectiones*. Jacques Bernoulli found formulae equivalent to (12) and (13) (*Mém. de l' Académie des Sciences*, 1702), and transformed these series into a form equivalent to (10) and (11). Jean Bernoulli published in the *Acta eruditorum* for 1701, among other formulae already found by Vieta, one equivalent to (17). These formulae have been extended to cases in which n is fractional, negative or irrational; see a paper by D. F. Gregory in *Camb. Math. Journ.* vol. iv., in which the series for cos $n\theta$, sin $n\theta$ in ascending powers of cos θ and sin θ are extended to the case of a fractional value of n. These series have been considered by Euler in a memoir in the *Nova acta*, vol. ix., by Lagrange in his *Calcul des fonctions* (1806), and by Poinsot in *Recherches sur l'analyse des sections angulaires* (1825).

Theory of Logarithms.

24. The general definition of Napierian logarithms is that, if $e^{x+\iota y}=a+\iota b$, then $x+\iota y=\log\ (a+\iota b)$. Now we know that $e^{x+\iota y}=e^x\cos\ y+\iota e^x\ \sin\ y$; hence $e^x\cos\ y=a$, $e^x\sin\ y=b$, or $e^x=(a^2+b^2)\frac{1}{2}$, $y=\text{arc}\ \tan\ b/a\pm m\pi$, where m is an integer. If $b=0$, then m must be even or odd according as a is positive or negative; hence

$$\log_e\ (a+\iota b)=\log_e\ (a^2+b^2)\tfrac{1}{2}+\iota\ (\text{arc}\tan b/a\pm 2n\pi)$$

or $$\log_e\ (a+\iota b)=\log_e\ (a^2+b^2)\tfrac{1}{2}+\iota\ (\text{arc}\tan b/a\pm\overline{2n+\pi}),$$

according as a is positive or negative. Thus the logarithm of any complex or real quantity is a multiple-valued function, the difference between successive values being $2\pi\iota$; in particular, the most general form of the logarithm of a real positive quantity is obtained by adding positive or negative multiples of $2\pi\iota$ to the arithmetical logarithm. On this subject, see De Morgan's *Trigonometry and Double Algebra*, ch. iv., and a paper by Professor Cayley in vol. ii. of *Proc. London Math. Soc.*

Hyperbolic Trigonometry.

25. We have from the definitions given in § 21, $\cos\ \iota y=\frac{1}{2}(e^y+e^{-y})$ and $\sin\ \iota y=\frac{1}{2}i(e^y-e^{-y})$. The expressions, $\frac{1}{2}(e^y+e^{-y})$, $\frac{1}{2}(e^y-e^{-y})$ are said to define the hyperbolic cosine and sine of y and are written cosh y, sinh y; thus $\cosh\ y=\cos\ \iota y$, $\sinh\ y=-\iota\ \sin\ \iota y$. The functions cosh y, sinh y are connected with the rectangular hyperbola in a manner analogous to that in which the cosine and sine are connected with the circle. We may easily show from the definitions that

$$\cos^2(x+\iota y)+\sin^2(x+\iota y)=1,$$
$$\cosh^2 y-\sinh^2 y=1;$$
$$\cos(x+\iota y)=\cos x\cosh y-i\sin x\sinh y,$$
$$\sin(x+\iota y)=\sin x\cosh y+\iota\cos x\sinh y,$$
$$\cosh(\alpha+\beta)=\cosh\alpha\cosh\beta+\sinh\alpha\sinh\beta,$$
$$\sinh(\alpha+\beta)=\sinh\alpha\cosh\beta+\cosh\alpha\sinh\beta.$$

These formulae are the basis of a complete hyperbolic trigonometry. The connexion of these functions with the hyperbola was first pointed out by Lambert.

Expansion of an Angle in Powers of its Sine.

26. If we equate the coefficients of n on both sides of equation (13), this process requiring, however, a justification of its validity, we get

$$\theta=\sin\theta+\frac{1}{2}\ \frac{\sin^3\theta}{3}+\frac{1.3}{2.4}\ \frac{\sin^5\theta}{5}+\frac{1.3.5}{2.4.6}\ \frac{\sin^7\theta}{7}+\ldots;\quad(21)$$

θ must lie between the values $\pm\frac{1}{2}\pi$. This equation may also be written in the form

$$\text{arc}\sin x=x+\frac{1}{2}\ \frac{x^3}{3}+\frac{1.3}{2.4}\ \frac{x^5}{5}+\frac{1.3.5}{2.4.6}\ \frac{x^7}{7}+\ldots$$

when x lies between ± 1.

By equating the coefficients of n^2 on both sides of equation (12) we get

$$\theta^2=\sin^2\theta+\frac{2}{3}\ \frac{\sin^4\theta}{2}+\frac{2.4}{3.5}\ \frac{\sin^6\theta}{3}+\frac{2.4.6}{3.5.7}\ \frac{\sin^8\theta}{4}+\ldots,\quad(22)$$

which may also be written in the form

$$(\text{arc}\sin x)^2=x^2+\frac{2}{3}\ \frac{x^4}{2}+\frac{2.4}{3.5}\ \frac{x^6}{3}+\frac{2.4.6}{3.5.7}\ \frac{x^8}{4}+\ldots$$

when x is between ± 1. Differentiating this equation with regard to x, we get

$$\frac{\text{arc}\sin x}{\sqrt{1-x^2}}=x+\frac{2}{3}x^3+\frac{2.4}{3.5}x^5+\frac{2.4.6}{3.5.7}x^7+\ldots;$$

if we put arc sin $x=$ arc tan y, this equation becomes

$$\text{arc}\tan y=\frac{y}{1+y^2}\left\{1+\frac{2}{3}\frac{y^2}{1+y^2}+\frac{2.4}{3.5}\left(\frac{y^2}{1+y^2}\right)^2+\ldots\right\}.\quad(23)$$

This equation was given with two proofs by Euler in the *Nova acta* for 1793.

It can be shown that if mod $x<1$, then for any such real or complex value of x, a value of $\log_e(1+x)$ is given by the sum of the series $x^1-x^2/2+x^3/3-\ldots$

Gregory's Series.

We then have

$$\frac{1}{2}\log\frac{1+x}{1-x}=x+\frac{x^3}{3}+\frac{x^5}{5}+\frac{x^7}{7}+\ldots;$$

put ιy for x, the left side then becomes $\frac{1}{2}\{\log\ (1+\iota y)-\log\ (1-\iota y)\}$ or ι arc tan $y\pm\iota n\pi$;

hence $$\text{arc}\tan y\pm n\pi=y-\frac{y^3}{3}+\frac{y^5}{5}-\frac{y^7}{7}+\ldots$$

The series is convergent if y lies between ± 1; if we suppose arc tan y restricted to values between $\pm\frac{1}{4}\pi$, we have

$$\text{arc}\tan y=y-\frac{y^3}{3}+\frac{y^5}{5}-\ldots,\quad(24)$$

which is Gregory's series.

Series for Calculation of π.

Various series derived from (24) have been employed to calculate the value of π. At the end of the 17th century π was calculated to 72 places of decimals by Abraham Sharp, by means of the series obtained by putting arc tan $y=\pi/6$, $y=1/\sqrt{3}$ in (24). The calculation is to be found in Sherwin's *Mathematical Tables* (1742). About the same time J. Machin employed the series obtained from the equation 4 arc tan $\frac{1}{5}$ − arc tan $\frac{1}{239}=\frac{1}{4}\pi$ to calculate π to 100 decimal places. Long afterwards Euler employed the series obtained from $\frac{1}{4}\pi=$ arc tan $\frac{1}{2}+$ arc tan $\frac{1}{3}$, which, however, gives less rapidly converging series (Introd., *Anal. infin.* vol. i.). T. F. de Lagny employed the formula arc tan $1/\sqrt{3}=\pi/6$ to calculate π to 127 places; the result was communicated to the Paris Academy in 1719. G. Vega calculated π to 140 decimal places by means of the series obtained from the equation $\frac{1}{4}\pi=5$ arc tan $\frac{1}{7}+2$ arc tan $\frac{3}{79}$. The formula $\frac{1}{4}\pi=$ arc tan $\frac{1}{2}+$ arc tan $\frac{1}{5}+$ arc tan $\frac{1}{8}$ was used by J. M. Z. Dase to calculate π to 200 decimal places. W. Rutherford used the equation $\pi=4$ arc tan $\frac{1}{5}$ − arc tan $\frac{1}{70}$ + arc tan $\frac{1}{99}$.

If in (23) we put $y=\frac{1}{3}$ and $\frac{1}{7}$, we have

$$\pi=8\ \text{arc}\tan\tfrac{1}{3}+4\ \text{arc}\tan\tfrac{1}{7}=2{\cdot}4\left\{1+\frac{2}{3}\cdot\frac{1}{10}+\frac{2.4}{3.5}\ \frac{1}{10^2}+\ldots\right\}$$
$$+{\cdot}56\left\{1+\frac{2}{3}\cdot\frac{2}{100}+\frac{2.4}{3.5}\left(\frac{2}{100}\right)^2+\ldots\right\},$$

a rapidly convergent series for π which was first given by Hutton in *Phil. Trans.* for 1776, and afterwards by Euler in *Nova acta* for 1793. Euler gives an equation deduced in the same manner from the identity $\pi=20$ arc tan $\frac{1}{7}+8$ arc tan $\frac{3}{79}$. The calculation of π has been carried out to 707 places of decimals: see *Proc. Roy. Soc.* vols. xxi. and xxii.; also Circle.

Factorization of Sine and Cosine.

27. We shall now obtain expressions for sin x and cos x as infinite products of rational factors. We have

$$\sin x = 2\sin\frac{x}{2}\sin\frac{x+\pi}{2} = 2^3\sin\frac{x}{4}\sin\frac{x+\pi}{4}\sin\frac{x+2\pi}{4}\sin\frac{x+3\pi}{4};$$

proceeding continually in this way with each factor, we obtain

$$\sin x = 2^{n-1}\sin\frac{x}{n}\sin\frac{x+\pi}{n}\sin\frac{x+2\pi}{n}\ldots\sin\frac{x+\overline{n-1}\pi}{n},$$

where n is any positive integral power of 2. Now

$$\sin\frac{x+r\pi}{n}\sin\frac{x+n-r\pi}{n} = \sin\frac{x+r\pi}{n}\sin\frac{\overline{r\pi-x}}{n} = \sin^2\frac{r\pi}{n}-\sin^2\frac{x}{n},$$

and

$$\sin\frac{x+\frac{1}{2}n\pi}{n} = \cos\frac{x}{n}.$$

Hence the above may be written

$$\sin x = 2^{n-1}\sin\frac{x}{n}\left(\sin^2\frac{\pi}{n}-\sin^2\frac{x}{n}\right)\left(\sin^2\frac{2\pi}{n}-\sin^2\frac{x}{n}\right)\ldots\left(\sin^2\frac{k\pi}{n}-\sin^2\frac{x}{n}\right)\cos\frac{x}{n},$$

where $k=\frac{1}{2}n=1$. Let x be indefinitely small, then we have

$$1 = \frac{2^{n-1}}{n}\sin^2\frac{\pi}{n}\sin^2\frac{2\pi}{n}\ldots\sin^2\frac{k\pi}{n};$$

hence

$$\sin x = n\sin\frac{x}{n}\cos\frac{x}{n}\left(1-\frac{\sin^2 x/n}{\sin^2\pi/n}\right)\left(1-\frac{\sin^2 x/n}{\sin^2 2\pi/n}\right)\ldots\left(1-\frac{\sin^2 x/n}{\sin^2 k\pi/n}\right).$$

We may write this

$$\sin x = n\sin\frac{x}{n}\cos\frac{x}{n}\left(1-\frac{\sin^2 x/n}{\sin^2\pi/n}\right)\ldots\left(1-\frac{\sin^2 x/n}{\sin^2 m\pi/n}\right)R,$$

where R denotes the product

$$\left(1-\frac{\sin^2 x/n}{\sin^2\overline{m+1}\pi/n}\right)\left(1-\frac{\sin^2 x/n}{\sin^2\overline{m+2}\pi/n}\right)\ldots\left(1-\frac{\sin^2 x/n}{\sin^2 k\pi/n}\right),$$

and m is any fixed integer independent of n. It is necessary, when we make n infinite, to determine the limiting value of the quantity R; then, since the limit of $\dfrac{\sin x}{n\sin x/n\cos x/n}$ is $\dfrac{\sin x}{x}$, and that of $\dfrac{\sin m\pi/n}{m\pi/n}$ is unity, we have

$$\frac{\sin x}{x} = \left(1-\frac{x^2}{\pi^2}\right)\left(1-\frac{x^2}{2^2\pi^2}\right)\ldots\left(1-\frac{x^2}{m^2\pi^2}\right)\lim_{m=\infty}R.$$

The modulus of $R-1$ is less than

$$\left(1+\frac{\rho^2}{\sin^2\overline{m+1}\pi/n}\right)\left(1+\frac{\rho^2}{\sin^2\overline{m+2}\pi/n}\right)\ldots\left(1+\frac{\rho^2}{\sin^2 k\pi/n}\right)-1,$$

where $\rho=\text{mod. }\sin x/n$. Now $e^{A\rho^2}>1+A\rho^2$, if A is positive; hence mod. $(R-1)$ is less than exp. $\{\rho^2(\operatorname{cosec}^2\overline{m+1}\pi/n+\ldots+\operatorname{cosec}^2 k\pi/n)-1$, or than exp. $\frac{1}{4}\rho^2n^2\{1/(m+1)^2+\ldots+1/k^2\}-1$, or than exp. $\{\rho^2n^2/4m^2\}-1$. Now $\rho^2=\sin^2\alpha/n.\cosh^2\beta/n+\cos^2\alpha/n.\sinh^2\beta/n$, if $x=\alpha+i\beta$; or $\rho^2=\sin^2\alpha/n+\sinh^2\beta/n$. Hence $\lim_{n=\infty}\rho^2n^2=\alpha^2+\beta^2$, $\lim_{n=\infty}\rho n=\text{mod. }x$. It follows that $\text{mod.}_{n=\infty}(R-1)$ is between 0 and exp. $\{(\text{mod. }4)^2/xm^2\}-1$, and the latter may be made arbitrarily small by taking m large enough. It has now been shown that $\sin x=x(1-x^2/\pi^2)(1-x^2/2^2\pi^2)\ldots(1-x^2/m^2\pi^2)(1+\epsilon_m)$, where mod. ϵ_m decreases indefinitely as m is increased indefinitely. When m is indefinitely increased this becomes

$$\sin x = x\left(1-\frac{x^2}{\pi^2}\right)\left(1-\frac{x^2}{2^2\pi^2}\right)\ldots = x\mathop{P}_{n=1}^{n=\infty}\left(1-\frac{x^2}{n^2\pi^2}\right). \qquad (25)$$

This has been shown to hold for any real or complex value of x. The expression for cos x in factors may be found in a similar manner by means of the equation $\cos x=2\sin\dfrac{\pi-2x}{4}\cos\dfrac{3\pi-2x}{4}$, or may be deduced thus

$$\cos x = \frac{\sin 2x}{2\sin x} = \frac{P\left(1-\frac{4x^2}{n^2\pi^2}\right)}{P\left(1-\frac{x^2}{n^2\pi^2}\right)} = \left(1-\frac{4x^2}{\pi^2}\right)\left(1-\frac{4x^2}{3^2\pi^2}\right)\left(1-\frac{4x^2}{5^2\pi^2}\right)\ldots$$

$$= \mathop{P}_{n=0}^{n=\infty}\left(1-\frac{4x^2}{(2n+1)^2\pi^2}\right). \qquad (26)$$

If we change x into ιx, we have the formulae for sinh x, cosh x as infinite products—

$$\sinh x = x\mathop{P}_{n=0}^{n=\infty}\left(1+\frac{x^2}{n^2\pi^2}\right),\ \cosh x = \mathop{P}_{n=0}^{n=\infty}\left(1+\frac{4x^2}{(2n+1)^2\pi^2}\right).$$

In the formula for sin x as an infinite product put $x=\frac{1}{2}\pi$, we then get $1=\dfrac{\pi}{2}.\dfrac{1.3.3.5.5\ldots}{2.2.4.4.6\ldots}$; if we stop after $2n$ factors in the numerator and denominator, we obtain the approximate equation

$$1 = \frac{\pi}{2}\frac{1^2.3^2.5^2\ldots(2n-1)^2}{2^2.4^2.6^2\ldots(2n)^2}.(2n+1)$$

or $\dfrac{2.4.6\ldots2n}{1.3.5\ldots2n-1}=\sqrt{n\pi}$, where n is a large integer. This expression was obtained in a quite different manner by Wallis (*Arithmetica infinitorum*, vol. i. of *Opp.*).

Series for Cot, Cosec, Tan and Sec.

28. We have

$$\frac{\sin(x+y)}{\sin x} = \frac{(x+y)P\left(1+\frac{x+y}{n\pi}\right)}{xP\left(1+\frac{x}{n\pi}\right)},$$

or cos y+sin y cot x

$$= \left(1+\frac{y}{x}\right)\left(1+\frac{y}{x+\pi}\right)\left(1+\frac{y}{x-\pi}\right)\left(1+\frac{y}{x+2\pi}\right)\left(1+\frac{y}{x-2\pi}\right)\ldots$$

Equating the coefficients of the first power of y on both sides we obtain the series

$$\cot x = \frac{1}{x}+\frac{1}{x+\pi}+\frac{1}{x-\pi}+\frac{1}{x+2\pi}+\frac{1}{x-2\pi}+\ldots \qquad (27)$$

From this we may deduce a corresponding series for cosec x, for, since cosec x = cot $\frac{1}{2}x$ − cot x, we obtain

$$\operatorname{cosec} x = \frac{1}{x}-\frac{1}{x+\pi}-\frac{1}{x-\pi}+\frac{1}{x+2\pi}+\frac{1}{x-2\pi}-\frac{1}{x+3\pi}-\frac{1}{x-3\pi}+\ldots \qquad (28)$$

By resolving $\dfrac{\cos(x+y)}{\cos x}$ into factors we should obtain in a similar manner the series

$$\tan x = \frac{2}{\pi-2x}-\frac{2}{\pi+2x}+\frac{2}{3\pi-2x}-\frac{2}{3\pi+2x}+\frac{2}{5\pi-2x}-\frac{2}{5\pi+2x}+\ldots, \qquad (29)$$

and thence

$$\sec x = \tan\left(\frac{\pi}{4}+\frac{x}{2}\right)-\tan x = \frac{2}{\pi-2x}+\frac{2}{\pi+2x}-\frac{2}{3\pi-2x}-\frac{2}{3\pi+2x}+\ldots. \qquad (30)$$

These four formulae may also be derived from the product formulae for sin x and cos x by taking logarithms and then differentiating. Glaisher has proved them by resolving the expressions for cos x/sin x and 1/sin x … as products into partial fractions (see *Quart. Journ. Math.*, vol. xvii.). The series for cot x may also be obtained by a continued use of the equation $\cot x=\frac{1}{2}\{\cot\frac{1}{2}x+\cot\frac{1}{2}(x+\pi)\}$ (see a paper by Dr Schröter in Schlömilch's *Zeitschrift*, vol. xiii.).

Series for π derived from Series for Cot and Cosec.

Various series for π may be derived from the series (27), (28), (29), (30), and from the series obtained by differentiating them one or more times. For example, in the formulae (27) and (28), by putting $x=\pi/n$ we get

$$\pi = n\tan\frac{\pi}{n}\left\{1-\frac{1}{n-1}+\frac{1}{n+1}-\frac{1}{2n-1}+\frac{1}{2n+1}\ldots\right\},$$

$$\pi = n\sin\frac{\pi}{n}\left\{1+\frac{1}{n-1}-\frac{1}{n+1}-\frac{1}{2n-1}+\frac{1}{2n+1}\ldots\right\};$$

If we put $n=3$, these become

$$\pi = 3\sqrt{3}\left(1-\frac{1}{2}+\frac{1}{4}-\frac{1}{5}+\frac{1}{7}-\frac{1}{8}+\ldots\right),$$

$$\pi = \frac{3\sqrt{3}}{2}\left(1+\frac{1}{2}-\frac{1}{4}-\frac{1}{5}+\frac{1}{7}+\frac{1}{8}\ldots\right).$$

By differentiating (27) we get

$$\operatorname{cosec}^2 x = \frac{1}{x^2}+\frac{1}{(x+\pi)^2}+\frac{1}{(x-\pi)^2}+\frac{1}{(x+2\pi)^2}+\frac{1}{(x-2\pi)^2}+\ldots;$$

put $x=\dfrac{\pi}{6}$, and we get $\pi^2=9\left\{1+\dfrac{1}{5^2}+\dfrac{1}{7^2}+\dfrac{1}{11^2}+\ldots\right\}$.

These series, among others, were given by Glaisher (*Quart. Journ. Math.* vol. xii.).

Sums of Certain Series.

29. We have $\sinh\pi x=\pi xP\left(1+\dfrac{x^2}{n^2}\right)$, $\cosh\pi x=P\left(1+\dfrac{x^2}{(2n+1)^2}\right)$; if we differentiate these formulae after taking logarithms we obtain the series

$$\frac{\pi}{2x}\coth\pi x-\frac{1}{2x^2} = \frac{1}{1^2+x^2}+\frac{1}{2^2+x^2}+\frac{1}{3^2+x^2}+\ldots,$$

$$\frac{\pi}{2x}\tanh\pi x = \frac{1}{1^2+x^2}+\frac{1}{3^2+x^2}+\frac{1}{5^2+x^2}+\ldots$$

These series were given by Kummer (in *Crelle's Journ.* vol. xvii.) The sum of the more general series $\dfrac{1}{1^{2n}+x^{2n}}+\dfrac{1}{2^{2n}+x^{2n}}+\dfrac{1}{3^{2n}+x^{2n}}+\ldots$, has been found by Glaisher (*Proc. Lond. Math. Soc.*, vol. vii.)

If U^m denotes the sum of the series $\dfrac{1}{1^m}+\dfrac{1}{2^m}+\dfrac{1}{3^m}+\ldots$, V^m that

Sums of Powers of Reciprocals of Natural Numbers.

of the series $\frac{1}{1^m}+\frac{1}{3^m}+\frac{1}{5^m}+\ldots$, and W^m that of the series $\frac{1}{1^m}-\frac{1}{3^m}+\frac{1}{5^m}-\frac{1}{7^m}+\ldots$, we obtain by taking logarithms in the formulae (25) and (26)

$$\log\,(x \operatorname{cosec} x)=U_2\left(\frac{x}{\pi}\right)^2+\frac{1}{2}U_4\left(\frac{x}{\pi}\right)^4+\frac{1}{3}U_6\left(\frac{x}{\pi}\right)^6+\ldots,$$

$$\log\,(\sec x)=V_2\left(\frac{2x}{\pi}\right)^2+\frac{1}{2}V_4\left(\frac{2x}{\pi}\right)^4+\frac{1}{3}V_6\left(\frac{2x}{\pi}\right)^6+\ldots;$$

and differentiating these series we get

$$\frac{1}{2}\cot x=\frac{1}{2x}-\frac{U_2}{\pi^2}x-\frac{U_4}{\pi^4}x^3-\frac{U_6}{\pi^6}x^5-\ldots, \tag{31}$$

$$\frac{1}{2}\tan x=\frac{V_2}{\pi^2}2^2x+\frac{V_4}{\pi^4}2^4x^3+\frac{V^6}{\pi_6}2^6x^5+\ldots. \tag{32}$$

In (31) x must lie between $\pm\pi$ and in (32) between $\pm\frac{1}{2}\pi$. Write equation (30) in the form

$$\sec x=\Sigma(-1)^n\frac{(2n+1)\pi}{(\overline{2n+1}\cdot\frac{1}{2}\pi)^2-x^2},$$

and expand each term of this series in powers of x^2, then we get

$$\sec x=\frac{2^2W_1}{\pi}+\frac{2^4W_3x^2}{\pi^3}+\frac{2^6W_5x^4}{\pi^5}+\ldots \tag{33}$$

where x must lie between $\pm\frac{1}{2}\pi$. By comparing the series (31), (32), (33) with the expansions of cot x, tan x, sec x obtained otherwise, we can calculate the values of $U_2, U_4\ldots V_2, V_4\ldots$ and $W_1, W_3\ldots$. When U_n has been found, V_n may be obtained from the formula $2^nV^n=(2^n-1)U_n$.

Continued Factors for π.

For Lord Brounker's series of π, see CIRCLE. It can be got at once by putting $a=1$, $b=3$, $c=5\ldots$ in Euler's theorem $=\frac{1}{a}-\frac{1}{b}+\frac{1}{c}-\ldots=\frac{1}{a+}\,\frac{a^2}{b-a+}\,\frac{b^2}{c-b+}\cdots$

Sylvester gave (*Phil. Mag.*, 1869) the continued fraction

$$\frac{\pi}{2}=1+\frac{1}{1+}\,\frac{1.2}{1+}\,\frac{2.3}{1+}\,\frac{3.4}{1+}\cdots;$$

which is equivalent to Wallis's formula for π. This fraction was originally given by Euler (*Comm. Acad. Petropol.* vol. xi.); it is also given by Stern (in *Crelle's Journ.* vol. x.).

Continued Fractions for Trigonometrical Functions.

30. It may be shown by means of a transformation of the series for cos x and $\frac{\sin x}{x}$ that $\tan x=\frac{x}{1-}\,\frac{x^2}{3-}\,\frac{x^2}{5-}\,\frac{x^3}{7-}\cdots$. This may be also easily shown as follows. Let $y=\cos\sqrt{x}$, and let y', $y''\ldots$ denote the differential coefficients of y with regard to x, then by forming these we can show that $4xy''+2y'+y=0$, and thence by Leibnitz's theorem we have

$$4xy^{(n+2)}+(4n+2)y^{(n+1)}+y^{(n)}=0.$$

Therefore $\frac{y}{y'}=-2-\frac{4x}{y'/y''},\ \frac{y^{n}}{y^{(n+1)}}=-2(2n+1)-\frac{4x}{y^{(n+1)}/y^{(n+2)}};$

hence $-2\sqrt{x}\cot\sqrt{x}=-2-\frac{4x}{-6-}\,\frac{4x}{-10-}\,\frac{4x}{-14-}\cdots$

Replacing $\sqrt{x}$ by x we have $\tan x=\frac{x}{1-}\,\frac{x^2}{3-}\,\frac{x^2}{5-}\cdots$

Euler gave the continued fraction

$$\tan nx=\frac{n\tan x}{1-}\,\frac{(n^2-1)\tan^2x}{3-}\,\frac{(n^2-4)\tan^2x}{5-}\,\frac{(n^2-9)\tan^2x}{7-}\cdots;$$

this was published in *Mém. de l'acad. de St Pétersb.* vol. vi. Glaisher has remarked (*Mess. of Math.* vols. iv.) that this may be derived by forming the differential equation

$$(1-x^2)y^{(m+2)}-(2m+1)xy^{(m+1)}+(n^2-m^2)y^{(m)}=0,$$

where $y=\cos(n\arccos x)$, then replacing x by cos x, and proceeding as in the former case. If we put $n=0$, this becomes

$$x=\frac{\tan x}{1+}\,\frac{\tan^2x}{3+}\,\frac{4\tan^2x}{5+}\,\frac{9\tan^2x}{7+}\cdots;$$

whence we have

$$\arctan x=\frac{x}{1+}\,\frac{x^2}{3+}\,\frac{4x^2}{5+}\,\frac{9x^2}{7+}\cdots+\frac{n^2x^2}{2n+1+}\cdots$$

Purely Analytical Treatment of Circular Functions.

31. It is possible to make the investigation of the properties of the simple circular functions rest on a purely analytical basis other than the one indicated in § 22. The sine of x would be defined as a function such that, if $x=\int_0^y\frac{dy}{\sqrt{(1-y^2)}}$, then $y=\sin x$; the quantity $\frac{\pi}{2}$ would be defined to be the complete integral $\int_0^1\frac{dy}{\sqrt{(1-y^2)}}$. We should then have $\frac{\pi}{2}-x=\int_y^1\frac{dy}{\sqrt{(1-y^2)}}$. Now change the variable in the integral to z, where $y^2+z^2=1$, we then have $\frac{\pi}{2}-x=\int_0^z\frac{dy}{\sqrt{(1-z^2)}}$, and z must be defined as the cosine of x, and is thus equal to $\sin(\frac{1}{2}\pi-x)$, satisfying the equation $\sin^2x+\cos^2x=1$.

Next consider the differential equation

$$\frac{dy}{\sqrt{(1-y^2)}}+\frac{dz}{\sqrt{(1-z^2)}}=0.$$

This is equivalent to

$$d\{y\sqrt{(1-z^2)}+z\sqrt{(1-y^2)}\}=0;$$

hence the integral is

$$y\sqrt{(1-z^2)}+z\sqrt{(1-y^2)}=\text{ a constant.}$$

The constant will be equal to the value u of y when $z=0$; whence

$$y\sqrt{(1-z^2)}+z\sqrt{(1-y^2)}=u.$$

The integral may also be obtained in the form

$$yz-\sqrt{(1-y^2)}\sqrt{(1-z^2)}=\sqrt{(1-u^2)}.$$

Let $\alpha=\int_0^y\frac{dy}{\sqrt{(1-y^2)}},\quad \beta=\int_0^z\frac{dz}{\sqrt{(1-z^2)}},\quad \gamma=\int_0^u\frac{du}{\sqrt{(1-u^2)}};$

we have $\alpha+\beta=\gamma$, and $\sin\gamma=\sin\alpha\cos\beta+\cos\alpha\sin\beta$,

$$\cos\gamma=\cos\alpha\cos\beta-\sin\alpha\sin\beta,$$

the addition theorems. By means of the addition theorems and the values $\sin\frac{1}{2}\pi=1$, $\cos\frac{1}{2}\pi=0$ we can prove that $\sin(\frac{1}{2}\pi+x)=\cos x$, $\cos(\frac{1}{2}\pi+x)=-\sin x$; and thence, by another use of the addition theorems, that $\sin(\pi+x)=-\sin x$ $\cos(\pi+x)=-\cos x$, from which the periodicity of the functions sin x, cos x follows:—

We have also $\int\frac{dy}{\sqrt{(1-y^2)}}=-\iota\log_e\{\sqrt{(1-y^2)}+\iota y\};$

whence $\log_e\{\sqrt{(1-y^2)}+\iota y\}+\log_e\{\sqrt{(1-z^2)}+\iota z\}=$ a constant.

Therefore $\{\sqrt{(1-y^2)}\}+\iota y\{\sqrt{(1-z^2)}+\iota z\}=\sqrt{(1-u^2)}+\iota u,$

since $u=y$ when $z=0$; whence we have the equation

$$(\cos\alpha+\iota\sin\alpha)(\cos\beta+\iota\sin\beta)=\cos(\alpha+\beta)+\iota\sin(\alpha+\beta),$$

from which De Moivre's theorem follows.

REFERENCES.—Further information will be found in Hobson's *Plane Trigonometry*, and in Chrystal's *Algebra*, vol. ii. For further information on the history of the subject, see Braunmühl's *Vorlesungen über Geschichte der Trigonometrie* (Leipzig, 1900). (E. W. H.)

TRIGONON, a small triangular harp, occasionally used by the ancient Greeks and probably derived from Assyria or Egypt. The trigonon is thought to be either a variety of the sambuca or identical with it. A trigonon is represented on one of the Athenian red-figured vases from Cameiros in the island of Rhodes, dating from the 5th century B.C., which are preserved in the British Museum. The triangle is here an irregular one, consisting of a narrow base to which one end of the string was fixed, while the second side, forming a slightly obtuse angle with the base, consisted of a wide and slightly curved sound-board pierced with holes through which the other end of the strings passed, being either knotted or wound round pegs. The third side of the triangle was formed by the strings themselves, the front pillar, which in modern European harps plays such an important part, being always absent in these early Oriental instruments. A small harp of this kind having 20 strings was discovered at Thebes in 1823. (K. S.)

TRIKKALA (anc. *Trika*), a town of Greece, capital of the department of Trikkala, and the see of an archbishop, 38 m. W. of Larissa. In winter, when great numbers of Vlach herdsmen take up their quarters in the town, its population exceeds that of Larissa. It has the appearance of a Mussulman town on account of its mosques (only two of which are in use) and it is a centre of trade in wheat, maize, tobacco and cocoons. The town was in ancient times a celebrated seat of the worship of Aesculapius. Pop. (1889), 14,820; (1907) 17,809; of the department, 90,548.

TRILEMMA (Gr. τρεῖς, three, λῆμμα, something taken), in logic, an argument akin to the dilemma (*q.v.*), in which there are three possibilities. By getting rid of two, the third is proved, provided the original three exhaust the number. The terms "tetralemma" (four possibilities) and "polylemma" (many) have also been used.

TRILOBITES, extinct Arthropoda, formerly classified with the Crustacea, but of late years relegated to the Arachnida (*q.v.*), which occurred abundantly in seas of the Cambrian and Silurian periods, but disappeared entirely at the close of the Palaeozoic epoch. Both their origin and the causes which led to their extinction are quite unknown. Widely divergent forms make their appearance suddenly in the Cambrian period amongst the earliest known fossils; and the high perfection of structure to which they had at that time attained implies the antecedent existence of much simpler types, and refers the origin of life to a date immeasurably distant from that at which we have actual proof of the existence of animal and vegetable organisms.

However different in structure Trilobites may be, they all agree in possessing a head-shield usually semi-circular in shape, which results from the fusion of apparently five segments, and bears, except in some blind forms, a pair of large reniform compound eyes like those of the king-crab (*Xiphosura*). This head-shield is succeeded by a varying number of free segments, each of which consists of a medium convex tergal piece and a pair of arched lateral plates, the pleura, of which there is one on each side. The terga and pleura of each individual segment overlap those of the segment that serially succeeds it. The mid-region of the body, composed of jointed segments, is followed by a larger or smaller region consisting of fused segments and termed the *pygidium* or caudal shield, which in some cases is as large as the head-shield itself, in other cases much smaller. When the pygidium is large and composed of many segments, the number of free body segments is correspondingly reduced, and vice versa. It is with respect to this number of segments that respectively constitute the pygidium and the mid-region of the body that Trilobites differ most markedly from each other; and it is a singular fact that the extremes in structural organization in this particular to be met with in the Trilobita are found side by side in strata of Cambrian age. In *Paradoxides*, for example, there are about twenty freely movable segments followed by a very short and small pygidium, whereas in *Agnostus* the freely movable segments are reduced to two and the pygidium is as large as the cephalic shield. In this genus the number of segments composing the pygidium is obscured, as also it is in the genus *Illaenus*, which has as many as ten movable segments preceding the large semi-circular pygidium; but in such forms as *Ogygia* and *Asaphus*, which have about eight free segments, the sutural lines on the pygidium indicate that it is composed of about a dozen or more segments. Somewhat resembling *Agnostus* is *Microdiscus*, with four movable segments and a large pygidium consisting of about five fused segments, the lines of union between the latter being clearly indicated.

The tergal and pleural elements of the pygidium are generally well marked. They are also well marked on the cephalic shield, the tergal elements being represented by a median axial elevated area showing indistinct signs of segmentation, and a lateral unsegmented plate, the *gena*, which carries the eyes. The postero-lateral angles of the gena are commonly produced into spiniform processes, which may project backwards beyond the middle of the body as in *Paradoxides*, or considerably beyond its posterior termination as in *Trinucleus* or *Ampyx*. The latter is further remarkable for having the median area of the head-shield, the *flabellum*, produced into an anteriorly directed spike.

For many years only the dorsal surface of Trilobites was known, nothing having been ascertained of the ventral surface and appendages. Comparatively recently, however, specimens have been obtained with the ventral surface exposed, revealing the number and structure of the limbs. A pair of the latter was articulated to the sides of a moderately wide dorsal plate on each segment of the body, and similar limbs were attached to the ventral surface of the head-shield behind the mouth. Each of these limbs was two-branched, the external branch consisting of a slender fringed flagellum possibly respiratory in function, and the inner of a normal jointed ambulatory leg. These two branches arose from a common basal segment or coxa, the inner surface of which was produced into a strong process underlying the external area. In the region of the mouth the basal segments were armed with teeth and subserved the purpose of mastication. As in all Arachnida there is only a single pair of appendages in front of the mouth, and these were one-branched, long and filiform and acted as antennae. Under the pygidium or caudal shield the appendages were much shortened, and their main branch consisted of broader and flatter segments than those of the preceding limbs.

Such was the structure of the appendages in Trilobites belonging to the genus *Triarthrus*; but considering the great structural differences that obtain between *Triarthrus* and many other genera, it would be rash to assume that there were not corresponding differences in the structure of the limbs. It must not indeed be assumed that those of the first pair were in all cases antenniform.

It is probable that no satisfactory classification of the Trilobites will be proposed until the limbs of most of the genera have been examined. Up to the present time all attempts to arrange the genera in natural and definable groups have failed to meet with general approval; and this criticism must be extended to Beecher's subdivision of the class into three orders, named Hypoparia, Proparia and Opisthoparia, based upon the form and position of a groove, the so-called *genal suture*, which marks the lateral portion of the head-shield. In the majority of Trilobites this groove passes backwards from the anterior or anterolateral edge of this plate to its posterior or postero-lateral border, dividing it into an inner portion continuous with the flabellum and fused tergal regions, and an outer portion bearing the eye. Those genera, like *Paradoxides*, *Olenus*, *Asaphus*, *Phillipsia* and others, in which this groove cuts the posterior edge of the head-shield on the inner side of its angle are referred to the Opisthoparia; those, like *Dalmanites* and *Phacops*, in which it cuts the lateral border in front of the posterior angle, belong to the Proparia. But in certain genera, like *Conocoryphe*, *Calymmene* and *Triarthrus*, it cuts the margin of the head-shield so close to the posterior angle that the distinction between the two groups practically breaks down. To the Hypoparia belongs a comparatively small number of genera, like *Trinucleus* and *Aquastus*, in which this groove or genal suture is beneath the margin of the head-shield and does not appear upon its upper surface.

In external form Trilobites are not unlike Isopod Crustaceans, especially the terrestrial species commonly called "woodlice"; and until the nature of their appendages was known, it was thought by some authorities that the two groups might be related. Like the woodlice they were capable of rolling themselves up into a ball, many specimens having been found fossilized in this state, with the pygidium pressed tightly against the head-shield. There is very little doubt that they lived at the bottom of the sea, feeding upon worms or other soft marine organisms, crawling slowly about the sandy or muddy bottom and burying themselves beneath its surface when danger threatened. That these animals were widely distributed in former times is proved by their occurrence at the present day in palaeozoic fossiliferous strata both of the northern hemisphere and of Australia; and despite the fact that their remains have not been found in rocks of the Mesozoic or Kainozoic epochs, it was conceived to be possible that living specimens might be dredged from the sea-floor during the exploration of the ocean depths undertaken by the "Challenger" expedition. Needless to say this faint hope was not borne out by results. (R. I. P.)

TRIM, a market town and the county town of Co. Meath, Ireland, on the upper waters of the Boyne, 30 m. N.W. by W. from Dublin on a branch of the Midland Great Western railway. Pop. (1901), 1513. The county buildings are here; monthly fairs are held, and there is considerable trade in corn and flour; but the chief interest of the town lies in its historical associations and remains, enhanced by a beautiful situation. It was the seat of a very early bishopric. A Norman tower, called the Yellow Steeple, is supposed to mark the site of St Patrick's Abbey of St Mary. Two gates remain from the old town walls. King John's Castle (incorrectly so called, as this monarch only resided here on the occasion of a visit) was originally founded by Hugh de Lacy in 1173, but a later date is assignable to the greater part of the magnificent moated building, of which the keep, flanking turrets, drawbridge, portcullis and barbican, still testify to its former strength, which was augmented by its frontage to the river. Other smaller fortified buildings are Talbot's and Scurlogstown Castles; the former erected by Sir John Talbot, lord lieutenant of Ireland in 1415—afterwards earl of Shrewsbury, the latter dating from 1180. About a mile east of the town, the ruins of the abbey of St Peter and St Paul occupy both banks of the river. These include the transitional-Norman cathedral on the north bank, and a castle, guarding the crossing of the river, on the south, together with a chapel and other remains. North of the town ruins may be seen of a Dominican friary of the 13th century. The tower of the old parish church dates from 1449. In the annals of Trim many famous names have a place; Humphrey of Gloucester and Henry of Lancaster were imprisoned here by Richard II. before Henry came to the throne; and Richard, duke of York, and father of Edward IV. held court at the castle, where also several Irish parliaments met until the middle of the 15th century, and a mint was established in 1469. The residence in a house in Dublingate Street of the famous duke of Wellington is commemorated by a Corinthian column and statue. Trim is governed by an urban district council. It was incorporated by Edward III., and returned two members to the Irish parliament until the Union in 1800.

TRIMMER, JOSHUA (1795–1857), English geologist, was born at North Cray in Kent, on the 11th of July 1795. He was son of Joshua Kirby Trimmer of Brentford, and grandson of Mrs Sarah Trimmer (1741–1810), authoress of the *Story of the Robins* (1786). At the age of nineteen he was sent to North Wales to manage a copper-mine for his father; subsequently he was placed in charge of a farm in Middlesex, where he acquired a knowledge of and an interest in soils; in 1825 he became manager (for his father) of slate quarries near Bangor and Carnarvon, and in this district he remained for many years. He discovered the marine shells in the drift of Moel Tryfaen. During the years 1850–1854 he was engaged on the Geological Survey, and surveyed parts of the New Forest in Hampshire. He died in London on the 16th of September 1857.

He published memoirs on the *Origin of the Soils which cover the Chalk of Kent; On the Geology of Norfolk, as Illustrating the Laws of the Distribution of Soils* (1847); and *Proposals for a Geological Survey, specially directed to Agricultural Objects* (1850); in this respect he was a pioneer in agricultural geology. He was author also of a useful work *Practical Geology and Mineralogy* (1841). Obituary by J. E. Portlock, in *Quart. Journ. Geol. Soc.* (1858).

TRIMONTIUM, the name of a Roman fort at Newstead, near Melrose, Scotland, close under the three Eildon Hills (whence the name *trium montium*). It was an advanced post of the Romans towards Scotland both about 80 A.D. and after, and again (after an interval of evacuation) from about A.D. 140–180. Excavations during the last four years have yielded finds of almost unique importance. These include the foundations of several successive forts, one above the other, which throw much light on the character of the Roman military post; an unparalleled collection of Roman armour, including ornate helmets, and a good series of coins and datable pottery. The whole illustrate the history of the Roman army and that of Roman Scotland very remarkably and to an extent equalled by no Scottish site as yet explored.

See the report published for the Society of Antiquaries of Scotland by the excavator Mr James Curle. (F. J. H.)

TRINCOMALEE, a town and former naval station on the north-east coast of Ceylon, 100 m. N.E. by N. of Kandy. Pop. (1901), 11,295. It is built on the north side of the bay of Trincomalee, on the neck of a bold peninsula separating the inner from the outer harbour. There is a lighthouse on the extremity of Foul Point at the southern side of the bay, and another on the summit of Round Island. The inner harbour is landlocked, with a safe anchorage and deep water close to the principal wharves; the outer harbour has an area of about 4 sq. m. with a depth of about 70 fathoms. With its magnificent harbour—one of the five or six greatest natural harbours in the world—it used to be the headquarters of the admiral commanding on the East Indian station, with a garrison of infantry and British artillery. The breadth of the streets and esplanades somewhat atones for the mean appearance of the houses, but the town generally has a gloomy and impoverished aspect. Pearl oysters are found in the lagoon of Tambalagam to the west of the bay. A steamer from Colombo calls weekly with and for passengers and cargo. Average annual rainfall, 62¾ in.; average temperature, 81·2° F. Some tobacco, rice, and palm are grown in the district.

Attention was directed to the importance of Trincomalee as a naval base in 1896, when a commission of officers recommended its being turned into a modern fortress. The work was commenced in 1898 and finished in 1904. All the batteries were rebuilt and fitted with modern appliances. The whole area was connected with cable and telephone communication, and armed with the latest type of guns; and the fortress was supposed to be impregnable; but in the following year the station was abandoned, the naval yard closed, and the military garrison withdrawn. A man-of-war is still kept in Trincomalee Harbour, to work the defences.

The town was one of the first settlements of the Tamil race in Ceylon, who at a very early period erected on a height at the extremity of the peninsula, now crowned by Fort Frederick, a temple dedicated to Konatha, or Konasir, named the "temple of a thousand columns." The building was desecrated and destroyed in 1622, when the town was taken by the Portuguese, who made use of the materials for the erection of the fort. The town was successively held by the Dutch (1639), the French (1673), the Dutch (1674), the French (1782), and the Dutch (1783). After a siege of three weeks it surrendered to the British fleet in 1795, and with other Dutch possessions in Ceylon was formally ceded to Great Britain by the Treaty of Amiens in 1802.

TRING, a market town in the Watford parliamentary division of Hertfordshire, England, 31½ m. N.W. by W. from London by the London and North Western railway. Pop. of urban district (1901), 4349. It lies on the western slope of the Chiltern Hills, close to the entrance to a narrow valley which pierces them, and forms one of the highways through them to London, carrying the railway, the Grand Junction Canal, and a main road. The church of St Peter and St Paul shows fine Perpendicular work, especially in the ornate interior of the nave. Industries include straw-plaiting and the weaving of canvas and silk. The Rothschild Museum, erected in 1889, contains an extensive natural history collection. Living wild animals are also kept in a neighbouring paddock and cages. The road which passes through Tring and along the face of the hills represents the ancient Icknield Way, and there may have been a Romano-British village on the site of Tring.

TRINIDAD, the most southerly and, with the exception of Jamaica, the largest of the British West Indian Islands. Pop. (1901), 236,397. It is situated 6 m. E. of the coast of Venezuela, between 10° 3′ and 10° 50′ N. and 60° 39′ and 62° W. Its average length is 48 m., its breadth 35 m. and its area 1754 sq. m. In shape it is almost square, but it throws off two peninsulas westward from its north and south corners. Corozal Point projecting from its north-western and Icacos Point from its south-western extremity enclose the Gulf of Paria. To the west of Corozal Point lie several islands, of which Chacachacare, Huevos Monos and Monos Gaspar Grande are the most important. The surface is level or undulating, excepting in the north and south where there are ranges of hills, with eastern and western axes, prolongations of the Venezuelan coast ranges. Of these the northern is the more elevated ridge, its highest point being Tucuche Peak (3100 ft.). The southern hills attain an elevation of 600 ft. A small ridge runs east to west by south through the centre of the island, from Manzanilla Point to San Fernando, having an isolated elevation in Mt Tamana (1028). The hills of the northern and southern ranges are furrowed by innumerable ravines, and are clad to their summits with dense forests. There are numerous small streams, none navigable, and all flowing either east or west.

In its geology, as well as in its flora and fauna, Trinidad differs little from the mainland, with which it was probably at one time connected. There are four mineral springs and several mud volcanoes, but the two most striking natural features are the Maracas Falls, and the Pitch Lake. The Maracas Falls are situated at the head of a valley of the same name, to the north-east of Port of Spain, where the river leaps in a foaming torrent over a sheer wall of rock, 312 ft. high. The Pitch Lake lies some 38 m. by water south-east of the capital, in the ward of La Brea. It is circular in form, about 3 m. in circumference, and 104 acres in extent. Underground forces acting on the pitch cause it to rise in unequal masses, which are rounded off like huge mushrooms, separated from one another by narrow fissures, in which the rainwater collects and forms pools. Near the centre of the lake the pitch is always soft and can be observed bubbling up in a liquid state. When the sun is hot the lightest footfall leaves an impression and the pitch emits an unpleasant odour. The soil of the surrounding district is charged with asphalt, but is very fertile, while the road to the neighbouring port of La Brea, running on a bed of asphalt, moves slowly towards the sea like a glacier The lake is worked by a company which exports the asphalt to the United States; paying royalty to the local government on every ton exported.

The mountain range which runs along the north coast is formed of clay-slates, micaceous and talcose schists, and crystalline and compact limestones, constituting the group called the Caribbean series, the age of which is unknown. The rest of the island is composed of Cretaceous, Tertiary and Quaternary strata. The Cretaceous beds rise to the surface in the centre and are flanked to north and south by the later deposits. Owing to the rarity of satisfactory sections the relations of the various divisions of the Tertiary formation are still somewhat obscure; but they are grouped by J. B. Harrison into (1) Nariva and San Fernando beds, = Eocene and Oligocene; (2) Naparima marls=Miocene and (3) Moruga series=Pliocene and Pleistocene. The Naparima marls consist of a lower division containing *Globigerina* and an upper division with Radiolaria and diatoms and are clearly of deep-sea origin. The bitumen of the Pliocene and Pleistocene deposits appears to have been formed by the decomposition of vegetable matter. Salses or mud volcanoes occur upon the island, but there is no evidence of true volcanic action in Tertiary or recent times, except the presence of occasional bands of pumiceous earth in some of the Tertiary deposits, and the pumice in these cases was probably derived from a distance.

The presence of oil in large quantities in Trinidad had been suspected for many years, and early in the 20th century the government undertook a geological survey to determine the probabilities of an industry. This survey revealed the presence of a series of anticlines at payable depths in the southern division of the island, and experimental borings by three companies at La Brea and Point Fortin in the south-west and Guayaguayare in the south-east proved the presence of oil in large quantities. In 1910 the commercial exploitation of Trinidad oil was being rapidly pushed forward.

The soil of the island is exceedingly rich, and well adapted to the growth of tropical products, especially of sugar and cocoa, which are its staples. The planting of new lands is rapidly progressing, the greater part of the unsold crown lands (various blocks of which have been formed into forest or water reserves) being covered with forests, containing a valuable supply of timber. Poisonous and medicinal herbs grow everywhere. Owing to the variety of its resources, Trinidad has suffered less from general depression than the other islands in the British West Indies. It exports cocoa, sugar, rum, molasses, coffee, tobacco, coco-nuts, fruit, timber, dye-woods, balata gum, india-rubber and asphalt. Large quantities of tonga-beans, the produce of the mainland, are cured in bond at Port of Spain. The manufacture of bitters (Angostura and others) is an important industry, as is also the raising of stock. In addition Trinidad has a large carrying trade with the neighbouring republics, and rivals St Thomas (*q.v.*) as a centre of distribution for British and American merchandise through the West Indies and Venezuela.

Lying in the tract of the trade winds and being practically a part of the mainland, Trinidad is immune from the vicissitudes of climate to which the other Antilles are exposed. It is never visited by hurricanes and its seasons are regular, wet from May to January, with a short dry season in October known as the Indian summer and lasting usually about four weeks, and dry from end of January to middle of May. The average annual rainfall is 66·26 in. and the mean temperature is 78·6° F. A volunteer force was established in 1879, and now consists of infantry, garrison artillery and three companies of Light Horse stationed in Port of Spain, San Fernando and St Joseph. Elementary education is given chiefly in the state-aided schools of the different denominations, but there are a number of entirely secular schools managed by the government. The Presbyterian schools are conducted by a Canadian mission. Instruction is free, but in some few schools fees are paid. Agriculture is a compulsory subject in all the primary schools. Higher education is provided by the Queen's Royal College, a secular institution, to which the Presbyterian Naparima College and the Roman Catholic St Mary's College are affiliated. Attached to these colleges are four scholarships of the annual value of £150 for four years, tenable at any British university. The religious bodies, both Christian and pagan are exceedingly numerous. The Roman Catholics (with an archbishop at Port of Spain) and the Anglicans, with the bishop of Trinidad at their head, are the more powerful bodies. Of the inhabitants of the island, one-third are East Indians. Immigration from India is conducted under government control, and the prosperity of Trinidad is largely due to the contract labour obtained under this system. Of the rest the upper classes are creoles of British, French and Spanish blood, while the lower classes are of pure or mixed negro origin, with a few Chinese. English is spoken in the towns and in some of the country districts, but in the north and generally in the cocoa-growing areas a French *patois* prevails, and in several districts Spanish is still in use. English money is legal tender, as also is the United States gold currency. Accounts are kept in dollars by the general public, but in sterling by the government. There is a complete system of main and local roads constructed or under construction; there are about 90 m. of railways, and practically all the towns of any size can be reached from Port of Spain by rail. Steamers ply daily between Port of Spain and the islands at the northern entrance to the Gulf of Paria and between San Fernando (the southern terminus of the railway) and the south-western ports of the island, while two steamers of the Royal Mail Company under contract connect Port of Spain with the other parts of Trinidad and Tobago. Port of Spain is also in direct communication with Southampton.

The colony (Trinidad and Tobago) is administered by a governor assisted by an executive council and a legislative council of twenty members of whom ten are officials sitting by virtue of office and ten are unofficials nominated by the Crown. Port of Spain, the capital, is situated on the west coast on the shores of the Gulf of Paria. It is considered one of the finest towns in the West Indies, its streets are regular and well shaded, its water supply abundant, and an excellent service of tramways connects the various quarters of the town. It has two cathedrals, a fine block of public buildings containing the principal government departments, the courts of justice and the legislative council chamber, many other large government buildings, a public library, and many good shops, while one of its most beautiful features is its botanical garden, in which the residence of the governor is situated. The harbour is an open roadstead, safe and sheltered, but so shallow that large ships have to lie at anchor half a mile from the jetties. It is, nevertheless, the place of shipment not only for the produce of the entire island but also for that of the Orinoco region. The population is about 55,000. The other towns are San Fernando (pop. 7613), also on the Gulf of Paria, about 30 m. south of the capital; and Arima (pop. 4076), an inland town 16 m. by rail east of Port of Spain.

Trinidad was discovered by Columbus in 1496. It remained in Spanish possession (although its then capital, San José de Oruna, was burned by Sir Walter Raleigh in 1595) until 1797, when a British expedition from Martinique caused its capitulation. It was finally ceded to Great Britain by the Treaty of Amiens in 1802.

See F. Eversley, *The Trinidad Reviewer* (London, 1900); Stark's *Guide-book and History of Trinidad* (London); the *Journal of the Royal Colonial Institute*, passim; and for geology, G. P. Wall and J. G. Sawkins, *Report on the Geology of Trinidad* (London, 1860); J. B. Harrison and A. J. Jukes-Browne, "The Oceanic Deposits of Trinidad" (British West Indies), *Quart. Journ. Geol. Soc.* (London, 1899), lv. 177–189; R. J. L. Guppy, "The Growth of Trinidad," *Trans. Canadian Inst.* (1905), viii. 137–149, with plate. The last paper gives a list of all the more important works and papers on the geology of the island.

TRINIDAD, an uninhabited island in the South Atlantic, 680 m. E. of the coast of Espirito Santo, Brazil, in 20° 30′ S. 29° 30′ W., 4 m. long by 2 broad. It is of volcanic formation, and has springs of fresh water. As a possible coaling and telegraph station in mid-ocean, it formed a subject of contention between Brazil and Great Britain in 1895. The dispute was settled in favour of Brazil, which claimed on the ground of its discovery by Tristan da Cunha early in the 16th century, while Great Britain relied on its occupation by the astronomer Halley in the name of England in the year 1700. About 30 m. east are the three islets of Martin Vaz so named from the Portuguese mariner who discovered them about 1510.

TRINIDAD, a city and the county-seat of Las Animas county, Colorado, U.S.A., in the south part of the state, about 100 m. S. of Pueblo. Pop. (1890) 5523; (1900) 5345 (659 foreign-born); (1910) 10,204. Trinidad is served by the Denver & Rio Grande, the Colorado & Southern, the Colorado & Wyoming, and the Atchison, Topeka & Santa Fé railways and by electric railways to the neighbouring coal-mining towns. The city is regularly laid out on a hilly site, on both sides of the Purgatory (or Las Animas) river, near a picturesque canyon and mountain district, including the Stonewall Valley, and at the foot of the Raton Mountains, of which the highest peak, Fisher's (or Raton) Peak (9586 ft.), is 10 m. south of Trinidad. The city has a Carnegie library, a Federal building, an opera house, an amusement park, and the San Rafael hospital, under the charge of the Sisters of Charity. A steam heating plant pipes heat to many shops, offices and residences. Trinidad is in a coal and coke and stock-raising region, and alfalfa, frijole and sugar beets are produced in large quantities in the surrounding region, much of which is irrigated. Dry farming has been successfully carried on at an experiment farm, established in 1906, 12 m. north of the city. Trinidad has railway shops, foundry and machine shops, and coking ovens, ships large quantities of coal, has a wool-scouring mill, and various manufactures. The municipality owns and operates the waterworks. Trinidad was incorporated as a town in 1876, and in 1879 became a city of the second class.

TRINIDAD, a town near the southern coast of Cuba, in Santa Clara Province, about 45 m. south-east of Cienfuegos, and 3 m. from its seaport, Casilda, which lies due south.

Pop. (1907), 11,197. There is a small local railway, not connected (in 1909) with the central trunk line of the island. The city lies on the slope of La Vigia hill (900 ft.) amid higher mountains, and on the banks of the Jayoba (San Juan) river. The streets are narrow, broken and tortuous, and the general aspect of the town is medieval. There are some attractive buildings and a very fine market square. The fine scenery in the neighbourhood, and the climate, which is possibly the healthiest in Cuba, make the place a favourite resort for natives and foreigners. Casilda (pop. in 1907, 1246) has a landlocked, shallow harbour; but Masio Bay, a trifle farther distant, accommodates larger craft; and there are excellent deep-water anchorages among the quays off the coast. The Manati river is navigable for about 7 m. inland, and is used as an outlet for sugar and molasses crops. These and honey are the chief exports; tobacco and various vegetables and fruits are of minor importance. Trinidad is one of the seven original cities of Cuba established by Diego Velasquez. It was founded in 1514 on the coast, but after being attacked by pirates was removed inland. It was thrice sacked by English buccaneers—in 1642, 1654 and 1702; and in the following years, up to and for a time after the peace of Utrecht (1713), it maintained ships and soldiers. Indeed, throughout the first half of the 18th century it was on a continuous war footing against English corsairs, making reprisals on British ships and thriving at the same time on a large contraband trade with Jamaica and other foreign colonies. In 1818 Casilda was opened to legal commerce under the national and foreign flags.

TRINITARIANS, a religious order founded in 1198 by St John of Matha and St Felix of Valois, for the liberation of Christian prisoners and slaves from captivity under the Moors and Saracens. The two founders went to Rome and there obtained the approbation of Innocent III., 1198. The rule was the Augustinian, supplemented by regulations of an austere character. The habit was white, with a red and blue cross on the breast. The Trinitarians are canons regular, but in England they were often spoken of as friars. The first monastery and head house of the order was at Cerfroy near Soissons. Among the earliest recruits were some Englishmen, and the first to go on the special mission of the order were two Englishmen, who in 1200 went to Morocco and returned thence to France with 186 liberated Christian captives. This success excited great enthusiasm and led to the diffusion of the order all over Western Christendom. At the beginning of the 18th century there were still 250 houses, and it is stated that there had been 800; this, however, includes 43 in England, where Dugdale says he could find traces only of a dozen: so that the high figures are probably apocryphal. The first house in England was at Mottenden, in Kent, founded in 1224. The ordinary method of freeing captives was by paying their ransom and for this purpose vast sums of money were collected by the Trinitarians; but they were called upon, if other means failed, to offer themselves in exchange for Christian captives. Many thousands were liberated by their efforts. In the 17th century a reform called the Barefooted Trinitarians was initiated, which became a distinct order and is the only one that survives. There are now less than 500 members. Their headquarters are at San Crisogono in Rome. They devote themselves to the ransoming of negro slaves, especially children, and a great district in Somaliland has been since 1904 entrusted to them as a field for missionary work. There were Trinitarian nuns and a Third Order.

The chief modern book on the Trinitarians is Deslandres, *L'Ordre français des Trinitaires* (2 vols. 1903). Sufficient information will be found in Helyot, *Histoire des ordres religieux* (1714), vol. ii. chs. 45–50; and in Max Heimbucher, *Orden u. Kongregationen* (1907), ii. §57. (E. C. B.)

TRINITY HOUSE, CORPORATION OF, an association of English mariners which originally had its headquarters at Deptford in Kent. In its first charter, received from Henry VIII. in 1514, it was described as the "guild or fraternity of the most glorious and undividable Trinity of St Clement." The first master appointed was the founder of the corporation, Sir Thomas Spert, comptroller of the navy to the king, and commander of the "Harry Grace de Dieu." Deptford having been made a royal dockyard by Henry VIII., and being the station where outgoing ships were supplied with pilots, the corporation rapidly developed its influence and usefulness. By Henry VIII. it was entrusted with the direction of the new naval dockyard. From Elizabeth, who conferred on it a grant of arms in 1573, it received authority to erect beacons and other marks for the guidance of navigators along the coasts of England. In 1604 a select class, was constituted called Elder Brethren, the other members being called Younger Brethren. By the charter of 1609 the sole management of affairs was conferred on the Elder Brethren; the Younger Brethren, however, having a vote in the election of master and wardens. The practical duties of the fraternity are discharged by the acting Elder Brethren, 13 in number, of whom 2 are elected from the royal navy and 11 from the merchant service; but as a mark of honour persons of rank and eminence are admitted as honorary Elder Brethren. In 1647 the corporation was dissolved by parliament, but it was reconstructed in 1660, and the charter was renewed by James II. in 1685. In 1687 a by-law of the Trinity House for the first time required an agreement in writing between the master and crew of a ship. A new hall and almshouses were erected at Deptford in 1765; but for some time the offices of the corporation had been transferred to London, where for a while they had a house in Water Lane, Lower Thames Street, and in 1795 their headquarters were removed to Trinity House, Tower Hill, built from the designs of Samuel Wyatt. By an act of 1836 they received powers to purchase from the Crown, as well as from private proprietors, all interests in coast lights. For the maintenance of lights, buoys, &c., they had power to raise money by tolls, the surplus being devoted to the relief of old and indigent mariners or their near relatives. In 1853 the control of the funds collected by the corporation was transferred to the board of trade, and the money over which the brethren were allowed independent control was ultimately reduced to the private income derived from funded and trust property. Their practical duties in erection and maintenance of lighthouses, buoys and beacons remain as important as ever. Similar functions are carried out by the Northern Lighthouse Board and the Irish Lighthouse Board, for Scotland and Ireland respectively. They have also the care and supervision of pilots. Other Trinity Houses established under charter or act of parliament for the appointment and control of pilots are at Hull and Newcastle. The Elder Brethren of Trinity Masters also act as nautical assessors in the high court of admiralty. The corporation has a large wharf and repair shop at the mouth of the river Lea, where most of the work in connexion with buoying the Thames is carried out.

See W. H. Mayo, *Trinity House, London, Past and Present* (London, 1905); C. R. B. Barrett, *The Trinity House of Deptford Strond* (1893).

TRINITY SUNDAY, the Sunday next after Whitsunday. A festival in honour of the Trinity had been celebrated locally at various dates before Pope John XXII. in 1334 ordered its general observance on the octave of Whitsunday. According to Gervase of Canterbury, it had been introduced into England by Thomas Becket, archbishop of Canterbury, in 1162. It has, however, never been reckoned among the great festivals of the Church. From Trinity Sunday onwards all Sundays until the close of the ecclesiastical year are reckoned as "after Trinity." In the Roman Church these Sundays are also reckoned as "after Pentecost." In the latter case they are described as *dominicae trinitatis*, not to be confused with *dominicae post trinitatis*; e.g. *Dominica sexta post trinitatis* is the same as *Dominica septima trinitatis*.

TRINODA NECESSITAS, the name used by modern historians to describe the threefold obligation of serving in the host (*fyrd*), repairing and constructing bridges (*bryc-geweorc*), and the construction and maintenance of fortresses (*burhbot*), to which all freeholders were subject in Anglo-Saxon times. The obligations are usually mentioned in charters as the sole exceptions to grants of immunities; sometimes, however, a fourth obligation (*singulare praetium contra alium*) is reserved, as in the charter granted by Wiglaf of Mercia on the 28th of December 831 (*Cod. dip.* i. 294). Ceolwulf's charter of 822 to Archbishop Wilfred is remarkable, as the military service is there restricted to *expeditiones contra paganos ostes* (ibid. i. 272). The threefold obligation is first mentioned in a Latin charter (*expeditione pontis arcisue constructione*) of doubtful authenticity, which professes to have been granted by Eadbald of Kent in A.D. 616 (*Cod. dip.* v. 2), but it is not until the 8th century that it appears in documents which are generally admitted to be genuine. Although there were corresponding obligations in the Frankish Empire which were called by Charles the Bald (*antiquam et aliarum gentium consuetudinem*), Stubbs held that the arguments which refer them to a Roman origin want both congruity and continuity.

The phrase "trinoda necessitas" is not to be found in the Anglo-Saxon laws and charters; and Selden was probably the first historian of eminence who used it. "These three exceptions," he says, "are noted by the term of a three-knotted necessity in an old charter wherein King Cedwalla granted to Wilfrid, the first bishop of Shelsey in Sussex, the village of Paganham." This charter is an 11th-century copy of a lost original, but the words to which Selden referred are plainly written as *trimoda necessitas* not *trinoda necessitas*. Du Cange gives two examples of the word *trimoda* in medieval Latin, in which language it meant "triple"; but he cites no medieval example of trinoda; and in classical Latin the form is unknown, while *trinodis* (*ter-nodus*, "triple-knotted") occurs only rarely (Ovid. *Her.* iv. 115; *Fast.* i. 575).

See Du Cange, *Glossarium*; W. Stubbs, The *Constitutional History of England*, i. 86, 87; J. M. Kemble, *Codex anglo-saxonicus*, passim; Selden, *English Janus* (London, 1682), p. 43; Walter de Gray Birch, *Cartularium saxonicum*, passim; Facsimiles of Ancient Charters in the British Museum, pt. iv. Cotton MS. Augustus, ii. 86. (G. J. T.)

TRINOVANTES (commonly *Trinobantes*), a powerful British tribe about 50 B.C.–A.D. 50 dwelling north and north-east of London, rivals and neighbours of the Catuvellauni. When Caesar invaded Britain 54 B.C. they joined him against their domestic rivals and it is possible (though not certain) that half a century after Caesar's departure they succumbed to them. Certainly they were conquered by Rome in A.D. 43 and joined in Boadicea's revolt in 61. In the tribal division of Roman Britain given by Ptolemy their land included Camulodunum (Colchester), but nothing more is known of them. But their name plays a part in medieval legends and romances. There it was interpreted as Troy Novant, the "new Troy," and connected with the names of the Trojans Brutus and Corineus who were reputed to have given their names to Britain and Cornwall. (F. J. H.)

TRIOLET, one of the fixed forms of verse invented in medieval France, and preserved in the practice of many modern literatures. It consists of eight short lines on two rhymes, arranged a b a a a b a b, and in French usually begins on the masculine rhyme. The first line reappears as the fourth line, and the seventh and eighth lines repeat the opening couplet; the first line, therefore, is repeated three times, and hence the name. No more typical specimen of the triolet could be found than the following, by Jacques Ranchin (*c.* 1690):—

> "Le premier jour du mois de mai
> Fut le plus heureux de ma vie:
> Le beau dessein que je formais,
> Le premier jour du mois de mai!
> Je vous vis et je vous aimais.
> Si ce dessein vous plut, Sylvie,
> Le premier jour du mois de mai
> Fut le plus heureux de ma vie."

This poem was styled by Ménage "the king of triolets." The great art of the triolet consists in using the refrain-line with such naturalness and ease that it should seem inevitable, and yet in each repetition slightly altering its meaning, or at least its relation to the rest of the poem. The triolet seems to have been invented in the 13th century. The earliest example known occurs in the *Cléomadés* of Adenéz-le-Roi (1258–1297). The medieval triolet was usually written in lines of ten syllables, and the lightness of touch in the modern specimens was unknown to these perfectly serious examples. One of the best-known is that of Froissart, "Mon cœur s'ebât en odorant la rose." The rules are laid down in the *Art et Science de Rhéthorique* (1493) of Henry de Croi, who quotes a triolet written in words of one syllable. According to Sarrasin, who introduces the triolet as a mourner in his *Pompe funèbre de Voiture*, it was that writer who "remis en vogue" the ancient precise forms of verse, "par ses balades, ses triolets et ses rondeaux, qui par sa mort (1648) retournaient dans leur ancien décri." Boileau threw scorn upon the delicate art of these pieces, and mocked the memory of Clément Marot because he "tourna des triolets," but Marmontel recognized the neatness and charm of the form. They continued to be written in France, but not by poets of much pretension, until the middle of the 19th century, when there was a great revival of their use.

The earliest triolets in English are those of a devotional nature composed in 1651 by Patrick Carey, a Benedictine monk at Douai, where he probably had become acquainted with what Voiture had made a fashionable French pastime. In modern times, the triolet was re-introduced into English by Robert Bridges, in 1873, with his—

> "When first we met, we did not guess
> That Love would prove so hard a master;
> Of more than common friendliness
> When first we met we did not guess.
> Who could foretell the sore distress,
> This irretrievable disaster,
> When first we met?—we did not guess
> That Love would prove so hard a master."

Since then the triolet has been cultivated very widely in English, most successfully by Austin Dobson, whose "Rose kissed me to-day," "I intended an Ode" and "In the School of Coquettes" are masterpieces of ingenuity and easy grace. In later French literature, triolets are innumerable; perhaps the most graceful cycle of them is "Les Prunes," attached by Alphonse Daudet to his *Les Amoureuses* in 1858; and there are delightful examples by Théodore de Banville. In Germany the triolet has attracted much attention. Those which had been written before his day were collected by Friedrich Rassmann, in 1815 and 1817. But as early as 1795 an anthology of triolets had been published at Halberstadt, and another at Brunswick in 1796. Rassmann distinguished three species of triolet, the legitimate form (which has been described above), the loose triolet, which only approximately abides by the rules as to number of rhymes and lines, and single-strophe poems which more or less accidentally approach the true triolet in character. The true triolet was employed by W. Schlegel, Hagedorn, Rückert, Platen and other romantic poets of the early 19th century. In many languages the triolet has come into very frequent use to give point and brightness to a brief stroke of satire; the French newspapers are full of examples of this. The triolet always, or at least since medieval times, has laboured under a suspicion of frivolity, and Rivarol, in 1788, found no more cutting thing to say of Conjon de Bayeux than that he was "si recherché pour le triolet." But in the hands of a genuine poet who desires to record and to repeat a mood of graceful reverie or pathetic humour, the triolet possesses a very delicate charm.

See Friedrich Rassmann, *Sammlung triolettischer Spiele* (Leipzig, 1817). (E. G.)

TRIPHENYLMETHANE, $(C_6H_5)_3CH$, a hydrocarbon, important as being the parent substance of several series of exceedingly valuable dyestuffs, *e.g.* rosanilines and malachite greens derived from aminotriphenylmethanes, and aurins and phthaleins derived from oxytriphenylmethanes. It is obtained by condensing benzal chloride with mercury diphenyl (Kekulé and Franchimont, *Ber.*, 1872, 5, p. 907); from benzal chloride or benzotrichloride and zinc dust or aluminium chloride; from chloroform or carbon tetrachloride and benzene in the presence of aluminium chloride; and deamidating di- and tri-aminotriphenylmethane with nitrous acid and alcohol (O. and E. Fischer, *Ann.*, 1881, 206, p. 152). The last reaction is most important, for it established the connexion between this hydrocarbon and the rosanilines. Triphenylmethane is a white crystalline solid, melting at 92° and boiling at 358°. It separates from benzene and thiophene with one molecule of the "solvent of crystallization." On oxidation it gives triphenylcarbinol, $(C_6H_5)_3C{\cdot}OH$, and reduction with hydriodic acid and red phosphorus gives benzene and toluene. It combines with potassium to give $(C_6H_5)_3CK$, which with carbon dioxide gives potassium triphenylacetate, $(C_6H_5)_3C\ CO_2K$. Fuming nitric acid gives a paratrinitro substitution derivative which on reduction gives paraleucaniline; the salt of the carbinol formed on oxidizing this substance is the valuable dye rosaniline.

Considerable interest is attached to the remarkable series of hydrocarbons obtained by Gomberg (*Ber.*, 1900, 33, p. 3150, et seq.) by acting on triphenylmethane chloride (from triphenylmethane carbinol and phosphorus pentachloride, or from carbon tetrachloride and benzene in the presence of aluminium chloride) and its homologues with zinc, silver or mercury. Triphenylmethane chloride yields triphenylmethyl; ditolylphenylmethyl and tritolylmethyl have also been prepared. They behave as unsaturated compounds, combining with oxygen to form peroxides and with the halogens to form triarylmethane halides. Triphenylmethyl also combines with ethers and esters, but the compounds so formed are unsaturated. In the solid state triphenyl is colourless, crystalline and bimolecular. It was thought that it might be identical with hexaphenylethane, but the supposed synthesis of this substance by Ullmann and Borsum (*Ber.*, 1902, 35, p. 2877) appeared to disprove this, although it showed that triphenylmethyl readily isomerized into their product, under the influence of catalysts. A.E. Tschitschibabin (*Ber.*, 1908, 41, p. 2421), however, has shown that Ullmann and Borsum's preparation was para-benzhydroltetraphenylmethane $(C_6H_5)_2CH{\cdot}C_6H_4{\cdot}C(C_6H_5)_3$; and the view that solid triphenylmethyl is hexaphenylethane has much in its favour. Another remarkable fact is that these substances yield coloured solutions in organic solvents; triphenylmethyl gives a yellow solution, whilst ditolylphenyl and tritolylmethyls give orange solutions which on warming turn to a violet and to a magenta, the changes being reversed on cooling. Several views have been published to explain this fact. A summary is given by Tschitschibabin (*Journ. prak. Chem.*, 1907 (ii.), 74, p. 340). It appears probable that the solutions contain a quinonoid modification (see Gomberg and Cone, *Ann.*, 1909, 370, p. 142).

TRIPOD (Gr. τρίπους, Lat. *tripus*), in classical antiquities, any "three-footed" utensil or article of furniture. The name is specially applied to the following: (1) A seat or table with three legs. (2) A stand for holding the caldron used for boiling water or cooking meat; when caldron and stand were made in one piece, the name was given to the complete apparatus. (3) A sacrificial tripod, or altar, the most famous of which was the Delphic tripod, on which the Pythian priestess took her seat to deliver the oracles of the god, the seat being formed by a circular slab on the top, on which a branch of laurel was deposited when it was unoccupied by the priestess. Another well-known tripod was the "Plataean," made from a tenth part of the spoils taken from the Persian army after the battle of Plataea. This consisted of a golden basin, supported by a bronze serpent with three heads (or three serpents intertwined), with a list of the states that had taken part in the war inscribed on the coils of the serpent. The golden bowl was carried off by the Phocians during the Sacred War; the stand was removed by the emperor Constantine to Constantinople, where it is still to be seen in the Atmeidan (hippodrome), but in a damaged condition, the heads of the serpents having disappeared. The inscription, however, has been almost entirely restored (see Frazer on Pausanias, v. 299 seq.). Such tripods were usually of bronze and had three "ears" (rings which served as handles). They also frequently had a central upright as support in addition to the three legs. Tripods are frequently mentioned in Homer as prizes in athletic games and as complimentary gifts, and in later times, highly decorated and bearing inscriptions, they served the same purpose. They were also used as dedicatory offerings to the gods, and in the dramatic contests at the Dionysia the victorious *choregus* (a wealthy citizen who bore the expense of equipping and training the chorus) received a crown and a tripod, which he either dedicated to some god or set upon the top of a marble structure erected in the form of a small circular temple in a street in Athens, called the "street of tripods," from the large number of memorials of this kind. One of these, the "monument of Lysicrates," erected by him to commemorate his victory in a dramatic contest in 335 B.C. is still in existence (see Frazer, ii. 207).

See C. O. Müller, *De tripode delphico* (1820); F. Wieseler, *Ueber den delphischen Dreifuss* (1871); E. Reisch, *Griechische Weihgeschenke* (1890), and his article "Dreifuss" in Pauly-Wissowa, *Realencyclopädie der classischen Altertumswissenschaft*, v pt. 2 (1905).

TRIPOLI, a Turkish vilayet (regency) of North Africa. It is bounded N. by the Mediterranean (between 11° 40′ and 25° 12′ E.) and has a coast-line of over 1100 m. Tripoli comprises at least five distinct regions—Tripoli proper, the Barca plateau (*Cyrenaica*), the Aujila oases, Fezzan (*q.v.*) and the oases of Ghadames and Ghat—which with the intervening sandy and stony wastes occupy the space between Tunisia and Egypt, extend from the Mediterranean southwards to the Tropic of Cancer, and have a collective area of about 400,000 sq. m., with a population estimated at from 800,000 to 1,300,000. Towards the south and east the frontiers are undefined. But on the west side the conventional line laid down by agreement with France in 1886 was more accurately determined in 1892, when the terminal point on the Mediterranean was shifted from Borj-el-Biban to Ras Ajir, 18 m. to the south-east, in 33° 12′ N. 11° 40′ E. From this point the line passes along the Wad Magla and across the Erg (sand) dunes in such a way as to leave Ghadames to Turkey. In consequence of frontier collisions the boundary as far as Ghadames was precisely defined in 1910. South of that point the rival claims of France and Turkey remained in dispute.

Physical Features.

For some distance east of Tunisia the seaboard is low and sandy, and is often regarded as a part of the Sahara, which, however, begins only some 80 m. farther south, beyond the Jebels Nefusi, Yefren and Ghurian (Gharian). The "Jebel," as this system is locally called, terminates eastwards in the Tarhona heights of the Homs (Khoms) coast district, has a mean altitude of about 2000 ft. and culminates in the Takut (Tekuk) volcano (2800 ft.) nearly due south of the capital. It is not a true mountain range, but rather the steep scarp of the Saharan plateau, which encloses southwards the Jefara coast plains, and probably represents the original coast-line. The Ghurian section is scored in places by the beds of intermittent coast streams, and on its lower slopes is clothed with a rich sub-tropical vegetation. South of these escarpments, the vast Hammada el-Homra, the "Red Hammada," an interminable stony table-land covering some 40,000 sq. m., occupies the whole space between Tripoli proper and the Fezzan depression. The now uninhabited and waterless Hammada formerly drained through several large rivers, such as the Wadis Targelat (Uani, Kseia), Terrgurt, Sofejin, Zemzem and Bel, north-eastwards to the Gulf of Sidra (*Syrtis major*). Southwards the table-land is skirted by the Jebel Welad Hassan, the Jebel es-Suda, the Jebel Morai-Yeh, and other detached ranges, which have a normal west to east trend in the direction of the Aujila oases, rising a little above the level of the plateau, but falling precipitously towards Fezzan. The Jebel es-Suda (Black Mountains), most conspicuous of these ranges, with a mean altitude of 2800 ft., takes its name from the blackened aspect of its limestone and sandstone rocks, which have been subjected to volcanic action, giving them the appearance of basalt. Eastwards this range ramifies into the two crescent-shaped chains of the Harūj el-Aswad and Harūj el-Abiad ("Black" and "White" Harūj), which rise some 700 ft. above the Red Hammada, and enclose an extensive Cretaceous plateau. Rocks of Cretaceous age cover, indeed, an immense area of the northern part of the vilayet, recent eruptive rocks being represented by the lavas and ashes of the craters of Takut and Manterus. The later palaeozoic formations occur in Fezzan.

Beyond the barren Ghadama district in the north of the Hammada the dreary aspect of the wilderness is broken by several tracts under grass, corn and date-palms, and containing some permanent reservoirs in the beds of the Wadis Sofejin and Zemzem, where the plateau falls from a mean height of 2000 ft. to 1000 and 530 ft. respectively. But it again rises rapidly southwards to a somewhat uniform level of 1600 or 1700 ft., and here the main caravan route from Tripoli to Murzuk and Lake Chad traverses for a distance of fully 130 m. a monotonous region of sandstone, underlying clays, marls, gypsum and fossiliferous silicious deposits. In its northern section this part of the Hammada, as it is locally called in a pre-eminent sense, is relieved by a few patches of herbage, scrub and brushwood, with a little water left in the rocky cavities by the heavy showers which occasionally fall.

The Aujila Depression.

North-eastwards the Neddik pass over the Jebel Morai-Yeh leads down to the remarkable chain of low-lying oases, which, from the chief member of the group, is commonly called the Aujila depression. Collectively the oases present the aspect of a long winding valley, which is enclosed on the north side by the southern escarpments of the Barca plateau, expands at intervals into patches of perennial verdure and shallow saline basins, and extends from the Wadi el-Fareg, near the Gulf of Sidra, through the Bir Rassam, Aujila, Jalo, Faredgha, and Siwa oases, to the Natron lakes and the dried-up branch of the Nile delta known as the Bahr bilā-Mā (waterless river). The whole region presents the aspect of a silted-up marine inlet, which perhaps in Pliocene times penetrated some 300 m. south-eastwards in the direction of the Nile. Nearly all the fossil shells found in its sands belong to the fauna now living in the Mediterranean, and Siwa is 98 ft. below sea-level. This is true also of its eastern extensions, Sittra (80) and the Birket el-Kerun in the Fayum (141). But Aujila and Jalo stand 130 and 296 ft. respectively above sea-level, so that the idea entertained by the explorer Gerhard Rohlfs of transforming the chain of oases into a marine gulf, and thus converting the Barca plateau into an island or peninsula in the midst of the Mediterranean waters, and in fact flooding the Libyan desert, must share the fate of Colonel François Roudaire's equally visionary scheme in respect of the Western Sahara.

The Barca Plateau.

The Barca plateau, which consists largely of strata of tertiary formation, falls in terraces down to the Aujila depression, and presents an unbroken rampart of steep cliffs towards the Mediterranean, is by far the most favoured region of the vilayet. Its many natural advantages of climate, soil and vegetation led to the establishment of several Greek colonies, the oldest and most famous of which was that of *Cyrene* (*q.v.*), dating from about 630 B.C. From this place the whole region took the name of Cyrenaica (*q.v.*) and was also known as *Pentapolis*, from its "five cities" of Cyrene, Apollonia, Arsinoe, Berenice and Barca. The elevated plateau of Cyrenaica, which encloses the Gulf of Sidra on the west, is separated southwards by the Aujila depression from the Libyan desert, and projects northwards far into the Mediterranean, might seem, like the Atlas region in the west, to belong geologically rather to the European than to the African mainland. It has a mean altitude of considerably over 2000 ft., and in the Jebel Akhdar (Green Mountains) attains a height of nearly 3500 ft. Eastwards the Barca uplands merge gradually in the less elevated Marmarica plateau, which nowhere rises more than 1800 ft. above sea-level, and disappears altogether in the direction of the Nile delta. The most easterly spot on the coast belonging to Tripoli is the head of the Gulf of Solum; from this point the frontier line separating the regency from the Egyptian dominions runs south so as to leave the Siwa oasis on the Egyptian side of the line.

The Kufra Oases.

South of the Aujila depression the land rises steadily to a height of nearly 1200 feet in the *Kufra* oases, which lie between 21° and 24° E., north of the Tropic of Cancer and due east of Fezzan. The group consists of five distinct oases in the heart of the Libyan desert—Taizerbo, Zighen, Bu-Zeima, Erbena and Kebabo—which extend for a distance of 200 m. north-west and south-east, and have a collective area of 7000 sq. m. and a population of 6000 or 7000 Arabo-Berber nomads. Good water is obtained in abundance from the underground reservoirs, which lie within a few feet of the surface, and support over a million date-palms. Kufra, that is, "Infidels" (in reference to the now extinct pagan Tibu aborigines), is a centre of the Senūssite brotherhood, whose *zawya* (convent) at Jof, in Kebabo, ranks in importance with that of Jarabub, their chief station in Cyrenaica. This circumstance, together with the great fertility of the group and its position midway on the caravan route between Cyrenaica and Wadai, imparts exceptional importance to these oases. Formerly the Turks did not exercise authority in Kufra, the influence of the Senussi being paramount. Kufra, moreover, is outside the limits usually assigned to Tripoli. But in 1910 Ottoman troops were in occupation of the oases.

Ghat.

Ghat stands 2400 feet above the sea, on the Wadi Aghelad in the Igharghar basin, and consequently belongs, not to the Fezzan depression, but to the Saharan plateau. The Aghelad, or "Passage," trends north to the Iasawan valley along the east foot of the Tasili plateau, that is, the divide between the waters which formerly flowed north to the Mediterranean, west to the Atlantic, and south to the Niger and Chad basins. Ghat, which is skirted eastwards by the Akakus range, is a sandy plain dotted over with clumps or groves of date-palms. In the centre is an open space where is held a great annual fair, and to this, combined with its position on one of the caravan routes across the desert, the oasis owes all its importance. For several years, at the end of the 19th and beginning of the 20th centuries, the only caravan route used from the Niger countries to Tripoli was by way of Ghat, disturbances in Bornu and raids by Tuareg having closed all other routes. There is, in the oasis, a population of perhaps 10,000, nearly all Ihajenen Tuareg, about half of whom live in the town of Ghat (350 m. south of Ghadames and 250 south-west of Murzuk), which appears to be a relatively modern place, successor to *Rapsa*, a great commercial centre and military station under the Roman Empire.

Ghadames.

Ghadames, on the contrary, is ancient, being the *Cydamus* of the Garamantes, the capture of which by L. Cornelius Balbus Minor led to the overthrow of their empire. The oasis, which stands on the cretaceous Tinghert plateau 300 m. south-west of Tripoli, and 1200 ft. above the sea, is enclosed by a circular rampart over 3 m. in circumference. The town, which occupies the south-west corner of the enclosure, has a population of about 7000. Owing to its perennial springs and artesian wells, the oasis yields an abundance of dates, figs, apricots and vegetables, besides some wheat, barley and millet. It occupies a highly advantageous position at the converging-point of several caravan routes, and has extensive trading relations with the markets of Tripoli, Tunisia and the Sudan.

Climate.—The climate of Tripoli is very variable; cold nights often succeed warm days. The rainfall in the northern regions varies from 5 in. to 15 in. a year—December, January and February being the rainy season. The mean temperature on the coast lands is 68°; it is very much higher in the Hammada, where rain seldom falls.

Flora and Fauna.—The flora in the greater part of the regency is Saharan, the date-palm being the characteristic tree. The gum-yielding acacia, the tamarisk, sapan, mastic and pistachio are found in the wadis, and *shi* (wormwood) grows in clusters on the stony plateaus. In the Barca plateau and in parts of the coast belt the flora is more varied, resembling that of the Mediterranean countries generally. In these regions the laurel, myrtle and other evergreens are fairly common, and the oak, cypress, pine, carob and other trees occur, notably the olive, found also in the oases. Other fruit trees are the almond, fig, pomegranate, quince and apricot. Vines flourish in a few districts.

The larger wild animals are scarcely represented in Tripoli. The wild boar is found in Jebel Akhdar, the hyena, fox and jackal in the deserts. The mouflon, gazelle, hares, rabbits and marmots are among the commoner animals. Reptiles include the horned viper and the gecko. The characteristic animal is the camel, found only in the domesticated state. Horses and cattle are bred, but the horses are not numerous; goats and a fat-tailed variety of sheep are kept in large numbers. Birds include the ostrich, vultures, hoopoes, wood pigeons and doves. Bees are numerous and honey forms an article of export.

Inhabitants.

The explorations of Henri Duveyrier, Victor Largeau, Erwin von Bary and H. S. Cowper during the second half of the 19th century showed that Tripoli was not only inhabited by primitive man, but was the seat of a flourishing Neolithic culture, comparable to and in many respects resembling that of Iberia, Brittany and the British Isles. As in other parts of Mauretania, many now arid and uninhabitable wastes are strewn with monolithic and other remains, which occur in great variety of form and in vast numbers, as many as 10,000, chiefly of the menhir type, having been enumerated in the Mejana steppe alone. All kinds of megalithic structures are found—dolmens and circles like Stonehenge, cairns, underground cells excavated in the live rock, barrows topped with huge slabs, cup stones, mounds in the form of step pyramids, and sacrificial altars. Most remarkable are the "Senams," or trilithons of the Jebel Msīd and other districts, some still standing, some in ruins, the purpose of which has not been determined. They occur either singly or in rows, and consist of two square uprights 10 ft. high standing on a common pedestal and supporting a huge transverse beam. In the Terrgurt valley "there had been originally no less than eighteen or twenty megalithic trilithons, in a line, each with its massive altar placed before it" (Cowper). There is reason to believe that the builders of these prehistoric monuments are represented by the Berber people, who still form the substratum, and in some places the bulk, of the inhabitants of Tripoli proper. But even here the Berbers have for the most part been driven to the Ghurian and Tarhona uplands by the Arab nomads, who now occupy the Jefara flats about the capital, and are in almost exclusive possession of Cyrenaica, Marmarica, and the Aujila oases. In Fezzan the Saharan Berbers (Tinylkum Tuareg) are dominant, but are here largely intermingled with Negro or Negroid intruders from the Sudan. But even in the uplands many of the Berbers have been Arabized, and Cowper describes the people of the Tarhona heights as "pure-bred Arabs." Other early intruders are the Jews, some of whom arrived from Egypt in the time of the Ptolemies, and still lead the life of troglodytes in the limestone caves of the Ghurian escarpments. They are also numerous in the large towns, where there are also colonies of Turks, and Maltese, Italian, Cretan and other South European traders and artisans.

Tripoli and other Towns.

On the other hand, no trace can be now detected either of the Greeks who colonized Cyrenaica in the 7th century B.C., or of the Phoenicians who at a still earlier date founded the three great cities of Oea, Sabrata and Leptis Magna (*q.v.*), from which the western region projecting seawards between the two Syrtes took the name of Tripolitana. Later, when Oea, which stood between the two others, was made the capital of the province it was called Tripolis, the "Three Cities," as it were, rolled into one, and this name it has retained since Roman times, being now distinguished from the Tripolis of Syria as West Tripolis, the *Tarabulus el-Gharb* of the Turks and Arabs. Tripoli (*q.v.*), the capital of the province, is thus one of the oldest places in the world, and no doubt owes its stability in large measure to its position over against Sicily at the northern terminus of three great historic caravan routes, one of which runs due south to Lake Chad through Fezzan and Bilma, that is, across the narrowest part of the Sahara; another runs south-west through Ghadames and Ghat to Timbuktu and Kano, and the third south by east through Sokna to Wadai and Darfur. East of Tripoli are the small seaports of Homs (Khoms) and Lebda.

In Barca the largest town is Bengazi (*q.v.*), the ancient Berenice, at the southern extremity of a headland which formerly enclosed a spacious natural haven on the north-east side of the Gulf of Sidra. But the harbour has been partly filled up by the ruins of a large fortress, and is inaccessible to vessels drawing over 6 or 7 ft. East of Bengazi are Merj, the ancient Barca (*q.v.*), and the exposed roadstead of Derna (*q.v.*). Marsa-Susa, the ancient Apollonia, lies under the Ras Sem headland, and was the emporium of the neighbouring city of Cyrene (Ain Shahat-Grenna). The Turkish government displayed much activity in this fertile and healthy district in the period 1897–1903. To it were removed many of the Moslem inhabitants of Crete dissatisfied with the autonomous régime established in that island in 1898.

Agriculture and Trade.—Tripoli proper is purely an agricultural and trading country; it possesses no manufactures of importance, nor exploited mineral wealth save salt. The uncertainty of the rainfall, the apparent increasing poverty of the soil and the heavy taxation of the peasants reduced agriculture at the close of the 19th century to a lower point than theretofore recorded. The cultivation of wheat was largely supplanted by that of barley—the staple food of the peasantry, whilst esparto grass, a fibre growing wild in the rural districts within the cereal zone, acquired the chief place among local exports. The importation of foreign flour, begun in 1881, assumed large dimensions in providing for the deficiencies occasioned by ever-recurring failures of the wheat and barley harvests. Besides wheat and barley the principal products of the country are esparto grass, olives, saffron, figs and dates—these last being perhaps the finest in North Africa. Fruit also is abundant in certain parts, including oranges and lemons, and so are many kinds of vegetables. There is a lucrative sponge fishery, a monopoly of Greek traders, over 100 barques being engaged in the industry.

Trade, before the suppression of the oversea slave traffic, was largely in negroes, brought across the Sahara with other Sudan produce, for the Turkish market. It now consists chiefly in the export of esparto, barley in years of plenty, eggs, cattle, sponges, mats and henna, all articles of local production, and, from Central Africa, ivory, ostrich feathers, tanned goat-skins and a little gold dust. The cattle go mainly to Malta, the esparto, barley, eggs and ivory mostly to England, the feathers to Paris and London, and the skins to New York. The henna and mats are sent to Turkey, Egypt, Tunis and Malta. The exports of esparto grass vary with the success or failure of the cereal crops; thus in 1903 the value of barley exported was £70,800, and of esparto £76,400. In 1904 the exports of barley fell to £3,200 and those of esparto rose to £126,000. From Bengazi hundreds of thousands of sheep are exported to Egypt, Malta and Crete. With Egypt there is an overland as well as sea trade. The caravan trade, which in the forty years ending 1901 had an annual average value of £114,000, is so costly that only articles yielding considerable profit can be carried; the desert trade is, moreover, being deflected to the Niger and the Guinea coast. Tripoli imports, chiefly, food-stuffs (flour, rice, sugar, tea) cotton goods, tobacco, metals and hardware About two-thirds of the imports are from Great Britain. Exclusive of Bengazi the value of trade, imports and exports combined, was for the last thirty years of the 19th century some £770,000 per annum. The trade of Bengazi and Derna, chiefly with Great Britain and Malta, largely increased at the beginning of the 20th century. For the five years 1902–1906 the average annual value of imports was £214,000, of exports £455,700. From these ports the chief exports are sheep and goats, oxen, wool and skins, barley and camels—the last sent overland to Alexandria. Food-stuffs, tea, olive oil and cotton goods are the chief imports. There is an active contraband trade with Greece and Malta in firearms and gunpowder.

Barley is the chief food of the people both in Tripoli proper and in Bengazi. The nomad Arabs possess thousands of camels, cattle and sheep. They weave rough woollen garments, make reed matting, carpets of alternative strips of woven goat and woven camel hair, and manufacture butter. Olive and date-palm trees are cultivated in large numbers. Tea has become a favourite beverage both in the regency and with the Sudanese. Tea, sugar and cottons form the staple articles of exchange with the Sudanese for their produce.

Communications.—The town of Tripoli is connected by telegraph cable with Malta, and telegraph lines run inland from that town to Murzuk, Bengazi, Derna and other towns in the regency, and to Gabes in Tunisia. A wireless telegraphic apparatus connects Derna and Rhodes. There are regular sailings between Malta and Tripoli and between Tunis and Tripoli. Italian vessels also call regularly at Bengazi and Derna. The shipping trade is mostly in the hands of Italians—who have more than half the total tonnage—and French, British shipping coming third. Inland communication is almost entirely by camel caravans.

Administration.—The *vali* or governor-general, who exercises chief authority both civil and military, is appointed by the sultan of Turkey and holds office at his majesty's pleasure. The system of government, executive and judicial, resembles that of other Turkish provinces, but with some modifications in the direction of local autonomy. Bengazi or Barca is a separate sub-province with an administration responsible direct to Constantinople. Revenue is derived chiefly from customs, tithes and a poll tax called *verghi*. Owing to expenditure on the army, some 10,000 Turkish troops being stationed in the regency, the receipts from revenue are generally below the cost of administration. The receipts in the period 1900–1905 averaged about £150,000 a year and the expenditure £170,000, of which amount some £100,000 was on military requirements.

History.—The early history of Cyrenaica and Tripoli is distinct though similar. Cyrenaica was first colonized by Greeks, afterwards it fell under the sway of the Ptolemies and from them passed to the Romans (see CYRENAICA). Tripoli, on the other hand, was originally a Phoenician colony (*vide ante, Towns*). Later it was dependent on Carthage and followed its fortunes. From the Romans the province received its present name. In the 5th century both Tripoli and Cyrenaica were conquered by the Vandals, whose power was destroyed by the Byzantine general Belisarius in the following century. In the middle of the 7th century the whole country was overrun by the Arabs, and Christianity gave place to Islam. From this period, for many centuries, Tripoli was subject to the successive rulers of Tunisia. It was pillaged in 1146 by the Normans of Sicily. In 1321 the Beni Ammar established an independent dynasty, which lasted with an interval (1354–1369), during which two sovereigns of the Beni Mekki reigned, until 1401 when Tripoli was reconquered by the Tunisians. In 1510 Ferdinand the Catholic of Spain took Tripoli, and in 1528 it was given to the knights of St John, who were expelled in 1553 by the Turkish corsairs Dragut and Sinan. Dragut, who afterwards fell in Malta, lies buried in a much venerated *kubba* close to one of the mosques. After his decease the connexion between Tripoli and Constantinople seems to have been considerably weakened. But the Tripolitan pirates soon became the terror and scourge of the Mediterranean; half the states of Europe seem at one time or other to have sent their fleets to bombard the capital. In 1714 Ahmed Pasha Caramanli achieved practical independence and he and his descendants governed Tripoli as a regency, the claims of the Porte being recognized by the payment of tribute, or "presents." In the early part of the 19th century the regency, owing to its piratical practices, was twice involved in war with the United States. In May 1801 the pasha demanded from America an increase in the tribute ($83,000) which the government of that country had paid since 1796 for the protection of their commerce from piracy. The demand was refused and a naval force was sent from America to blockade Tripoli. The war dragged on for four years, the Americans in 1803 losing the frigate "Philadelphia," the commander (Captain William Bainbridge) and the whole crew being made prisoners. The most picturesque incident in the war was the expedition undertaken by William Eaton (*q.v.*), with the object of replacing upon the Tripolitan throne an exiled pasha, elder brother of the reigning sovereign, who had promised to accede to all the wishes of the United States. Eaton at the head of a motley assembly of 500 men marched across the desert from Alexandria, and with the aid of American ships succeeded in capturing Derna. Soon afterwards (June 3, 1805) peace was concluded, the reigning pasha relinquishing his demands but receiving $60,000 (about £12,000) as ransom for the "Philadelphia" prisoners. In 1815, in consequence of further outrages, Captains Bainbridge and Stephen Decatur, at the head of an American squadron, again visited Tripoli and forced the pasha to comply with the demands of America. In 1835 the Turks took advantage of a civil war to reassert their direct authority, and since that date Tripoli has been an integral part of the Ottoman Empire, rebellions in 1842 and 1844 being unsuccessful. After the occupation of Tunisia by the French (1881) the Turks increased their garrison in Tripoli considerably. After the Anglo-French agreement of 1889 recognizing the central Sahara as within the French sphere, various disputes arose as to the extent of the Tripolitan hinterland, which the French endeavoured to circumscribe (see TUNISIA). The French, on their part, believed that their opponents in Wadai and elsewhere in the central Sudan received support from the Turks.

The *khouan* (*ikhwân*) or semi-religious semi-political Moslem fraternities are powerful in Tripoli. The most remarkable is that of the Senussites. The explorers Rohlfs, Nachtigal and Duveyrier found their passage barred by Senussite agents. (See SENUSSI.)

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TRIPOLI (*Tarabulus el-Gharb, i.e.* Tripoli of the West), capital of the Turkish vilayet of Tripoli, North Africa, situated in 32° 53′ 40″ N. and 13° 11′ 32″ E. on a promontory stretching out into the Mediterranean and forming a small crescent-shaped bay which shelters the harbour from the north winds. Its crenellated enceinte wall has the form of an irregular pentagon. A line of small ancient forts is supposed to protect one side of the harbour, and the citadel the other. This citadel, dating from the time of the Spanish occupation, now serves as the residence of the governor. The harbour has a depth of water varying from 15 to 24 ft.; steamers drawing 21 ft. can anchor inside, but shoals render the entry difficult. At the quayside the depth of water is from 2 to 5 ft. only. The desert almost touches the western side of the city, while on the east is the verdant oasis of Meshia, where are still to be seen the tombs of the Caramanlian sultanas and the twelve-domed *ḳubba* of Sidi Hamonda. The aspect of the city is picturesque; the houses (many possessing beautiful gardens) rise in terraces from the seashore. The Turkish quarter contains numerous mosques whose minarets and cupolas break the monotony of the flat-roofed and whitewashed houses. The Grand mosque and the Pasha mosque (originally a church built by the Spaniards) both have octagonal minarets. By the harbour are several houses built in European style, but the general aspect of the city is Oriental. Many of the streets are arcaded; the *suks* or markets are the scene of much animation. Near the port stands a Roman triumphal arch. This arch, quadrifrontal in form, is made entirely of white marble, the blocks being held together with cramps, and is richly embellished with sculpture. It was begun in the reign of the emperor Antoninus, according to a still unmutilated dedicatory inscription, and finished in that of Marcus Aurelius. In the arch, now partly buried in débris, a cabaret has been installed.

A few small manufactures of carpets and silks as well as "Cordova leather" are carried on, but Tripoli is essentially a trading town, being the chief Mediterranean gateway to the Sahara. The population, about 60,000, is very mixed—Berber, Arab, Turk, Jew, Maltese, Italian and Negro. The Maltese inhabitants number about 4000, the Italians 1000 and the Jews 8000. The local trade is almost entirely in the hands of the Jews and Maltese; the shipping in the port is largely Italian.

See H. M. de Mathuisieulx, *A travers la Tripolitaine* (Paris, 1903).

TRIPOLI, or TARABULUS (anc. *Tripolis*), the chief town of a sanjak of the same name in the Beirut vilayet of Syria, situated about 2 m. inland from its port, al-Mina. The ancient Phoenician city, which we know only by its Greek name of Tripolis, was the seat in Persian times of the federal council of Sidon, Tyre and Aradus, each of which cities had its separate quarter in the "triple town." In the 2nd and 1st centuries B.C., under Seleucid and Roman influences successively, it struck autonomous coins. These are succeeded by imperial coins ranging from 32 B.C. to A.D. 221. About 450, and again in 550, it was destroyed by earthquake. The Arabs took it in 638 after a prolonged siege, the inhabitants withdrawing by sea. Moawiya recruited the population by a colony of Jews and gave it fortifications and a garrison against the naval attacks of the Greeks, who, notwithstanding, retook it for a brief space in the time of Abdalmalik. It was again taken by the Greeks in the war of 966–69 and was besieged by Basil II. in 995, after which date it was held by a garrison in the pay of the Fatimite caliphs of Egypt, who treated the city with favour and maintained in it a trading fleet. At this time, according to the description of Nāsir Khosrau, who visited it in 1047, it lay on the peninsula of Al-Mīnā, bathed on three sides by the sea, and had about 20,000 inhabitants and important industries of sugar and paper-making. Of the great sea-walls and towers there are still imposing remains. From this date till it was taken by the crusaders, after a five years' siege, in 1109, the ruling family was that of ʽAmmār, which founded a library of over 100,000 volumes. Under the crusaders Tripoli continued to flourish, exported glass to Venice, and had 4000 looms. In 1289 it was taken and destroyed by the sultan Kolāʽūn of Egypt, and a new city was begun on the present site, which rapidly rose to importance. Its medieval prosperity has obliterated most relics of remoter antiquity. Tripoli had a troubled existence during the period of Ottoman weakness (the 18th and early 19th centuries), being frequently in dispute between the pasha of Aleppo and the rebel pashas of Acre. After the Egyptian conquest of Syria it was made the capital of a province in 1834; but in 1840 it reverted to the minor position which it now holds. It is connected by a carriage road with Homs and by a steam tramway with Beirut, and is the natural outlet of the upper Orontes valley; but its inland trade has been greatly damaged by the Homs-Aleppo railway. From its own district, however, it exports silk, tobacco, oil, soap, sponges, eggs and fruit, and is a prosperous and growing place with a large Christian element in its population (about 30,000, the port-town included). It is served regularly by the Levantine lines of steamers. (D. G. H.)

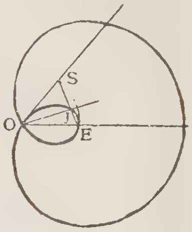
TRIPOLITSA, officially *Tripolis*, a town of Greece, capital of the nomarchy of Arcadia, and the seat of an archbishop, situated in a plain over 2,000 ft. above sea-level, 22 m. S.W. of Argos. The name has reference to the three ancient cities of Mantineia, Pallantium and Tegea, of which Tripolitsa is the modern representative. It does not stand on any ancient site. Before the war of independence it was the capital of the Morea and the seat of a pasha, with about 20,000 inhabitants; but in 1821 it was taken and sacked by the insurgents, and in 1825 its ruin was completed by Ibrahim Pasha. The town has since been rebuilt, and contains 10,789 inhabitants (1907).

TRIPTOLEMUS, in Greek mythology, the inventor of agriculture, first priest of Demeter, and founder of the Eleusinian mysteries. His name is probably connected with the "triple ploughing" (*τρὶς, πολεῖν*), recommended in Hesiod's *Works and Days* and celebrated at an annual festival. It may be noted that in some traditions he is called the son of Dysaules (possibly identical with *diaulos*, the "double furrow" traced by the ox), and that, according to the Latin poets (*e.g.* Virgil, *Georgics*, i. 19), he is the inventor of the plough.[1] Later, as the god of ploughing, he is confounded with Osiris, and on a vase-painting at St Petersburg he is represented leaving Egypt in his dragon-drawn chariot on his journey round the world. According to the best known Attic legend (Apollodorus, i. 5, 2) Triptolemus was the son of Celeus, king of Eleusis, and Metaneira. Demeter, during her search for her daughter Persephone, arrived at Eleusis in the form of an old woman. Here she was hospitably received by Celeus, and out of gratitude would have made his son Demophon immortal by anointing him with ambrosia and destroying his mortal parts by fire; but Metaneira, happening to see what was going on, screamed out and disturbed the goddess. Demophon was burnt to death, and Demeter, to console his parents, took upon herself the care of Triptolemus, instructed him in everything connected with agriculture, and presented him with a wonderful chariot, in which he travelled all over the world, spreading the knowledge of the precious art and the blessings of civilization. In another account (Hyginus, *Fab.* 147) Triptolemus is the son of Eleusinus, and takes the place of Demophon in the above narrative. Celeus endeavoured to kill him on his return, but Demeter intervened and forced him to surrender his country to Triptolemus, who named it Eleusis after his father and instituted the festival of Demeter called Thesmophoria. In the Homeric hymn to Demeter, Triptolemus is simply one of the nobles of Eleusis, who was instructed by the goddess in her rites and ceremonies. The Attic legend of Eleusis also represented him as one of the judges of the underworld. His adventures on his world-wide mission formed the subject of a play of the same name by Sophocles. In works of art Triptolemus appears mounted on a chariot (winged or drawn by dragons, symbols of the fruitfulness of the earth), with Demeter and Persephone handing him the implements of agriculture. His attributes were a sceptre of ears of corn, sometimes a drinking-cup, which is being filled by Demeter. His altar and threshing-floor were shown on the Rarian plain near Eleusis; hence he is sometimes called the son of Rarus.

See the Homeric hymn to Demeter, 153, 474; Ovid, *Metam.* v. 642–661; Virgil, *Georgics*, i. 19, and Servius *ad loc.*; Hyginus, *Astronom.* ii. 14; Dion Halic. i. 12; Preller, *Griechische Mythologie* (4th ed., 1894).

TRIPTYCH (Gr. *τρίπτυχος*, three-fold, made in three layers, *τρι-*, *τρεῖς*, three; *πτυχή*, a fold; *πτύσσειν*, to fold, double over), a painting, carving or other decorative design, executed on three compartments or panels, so constructed that the two wings may fold on hinges over the centre-piece; the backs of the wing-pieces are often also painted, carved or otherwise decorated. The subject of the side-pieces are usually appropriate and subsidiary to that of the centre. The triptych is most frequently designed as an altar-piece. An earlier use of the term is for a set of three wooden or ivory writing-tablets, hinged or otherwise fastened together, the central tablet being waxed on both sides for the impression of the *stilus* or writing implement, the outer tablets only on the inside. The three tablets thus formed a small book.

TRISECTRIX, a curve which is a variety of the limaçon (*q.v.*) of Pascal, and named from its property of trisecting an angle. The polar equation is $r=1+2\cos\theta$ and the form of the curve is shown in the figure. To trisect an angle by means of this curve, describe a circle with centre O and radius OE, and let the given angle which is to be trisected be laid off from OE and cut the circle at S; let the chord ES cut the trisectrix in J. Then OJ trisects the given angle.



TRISTAN, or TRISTRAM, one of the most famous heroes of medieval romance. In the earlier versions of his story he is the son of Rivalîn, a prince of North West Britain, and Blancheflor, sister to King Mark of Cornwall. Rivalîn is killed in battle, and Blancheflor, after giving birth to a son, dies of grief. The boy is brought up as his own by Roâld, or Rual, seneschal of the kingdom, who has him carefully trained in all chivalric and courtly arts. With the possible exception of Horn, Tristan is by far the most accomplished hero in the whole range of knightly romance; a finished musician, linguist and chess-player, no one can rival him in more knightly arts, in horsemanship or fencing. He has, besides, the whole science of "venérie" at his finger-tips; in fact Tristan is the "Admirable Crichton" of medieval romance, there is nothing he cannot do, and that superlatively well—it must be regretfully admitted that he is also a most accomplished liar! Attracted by his gifts, pirates from the North Sea kidnap the boy, but terrified by the storms which subsequently beset them, put him ashore on the coast of Cornwall, whence he finds his way to the court of his uncle King Mark. Here we have a first proof of his talent for romancing; for alike to two pilgrims who show him the road and to the huntsmen of Mark's court (whom he instructs in the rightful method of cutting up and disposing the quarry), Tristan invents different, and most detailed, fictions of his land and parentage. He becomes a great favourite at court, and when Roâld, who has sought his young lord far and wide, at last reaches Tintagel, Mark welcomes the revelation of Tristan's identity with joy. Cornwall is at this time in subjection to the king of Ireland, Gormond, and every third year must pay tribute; the Irish champion, Morôlt, brother to the queen, arrives to claim his toll of thirty youths and as many maidens. The Cornish knights (who in Arthurian romance are always represented as hopeless cowards), dare not contest his claim but Tristan challenges him to single combat, slays him and frees Cornwall from tribute. Unfortunately he himself has been wounded in the fight, and that by a poisoned weapon; and none but the queen of Ireland, Isôlt, or Iseult, possessed the secret of healing. Tristan causes himself to be placed in a boat with his harp, and committed to the waves, which carry him to the shores of Ireland. There he gives himself out for a minstrel, Tantris, and as such is tended and healed by Queen Iseult and her daughter of the same name. When recovered he makes a plausible excuse for leaving Ireland (pretending he has left a wife in his native land) and returns to Cornwall. His uncle receives him with joy, but the barons of the court are bitterly jealous and plot his destruction. They persuade Mark that he should marry, and Tristan, who has sung the praises of the princess Iseult, is despatched to Ireland to demand her hand, a most dangerous errand, as Gormond, incensed at the death of Morôlt, has sworn to slay any Cornish knight who sets foot in Ireland. Tristan undertakes the mission, though he stipulates that he shall be accompanied by twenty of the barons, greatly to their disgust. His good fortune, however, does not forsake him; he lands in Ireland just as a fierce dragon is devastating the country, and the king has promised the hand of the princess to the slayer of the monster. Tristan achieves this feat, but, overcome by the venom exhaled from the dragon's tongue, which he has cut out, falls in a swoon. The seneschal of the court, a coward who has been watching for such an opportunity, cuts off the dragon's head, and, presenting it to the king, claims the reward, much to the dismay of Iseult and her mother. Suspecting that the seneschal is not really the slayer of the dragon, mother and daughter go secretly to the scene of the combat, find Tristan, whom they recognize as the minstrel, Tantris, and bring him back to the palace. They tend him in secret, but one day, through the medium of a splinter from his sword, which had remained fixed in Morôlt's skull, and been preserved by the queen, the identity of Tantris and Tristan is made clear. The princess would slay him, but is withheld by her mother, who sees they have need of Tristan's aid to unmask the seneschal. This is done in the presence of the court; Tristan is pardoned, formally declares his errand, and receives the hand of Iseult for his uncle King Mark.

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[1] Other suggested derivations are from *τρίβω*, *αὐλαί* (*ὀλαί*), the "grain crusher," or from *πόλεμος* (= "triple fighter," see DEMETER).

Tristan and Iseult set sail for Cornwall, Iseult accompanied by her waiting-woman, Brangaene (who, in some versions, is also a kinswoman), to whose care the queen, skilled in magic arts, confides a love-potion. This is intended to be drunk by king and queen on their bridal night and will ensure their undying love for each other. Unhappily, on the voyage, by some mistake (accounted for in different ways), Tristan and Iseult drink the love drink, and are forthwith seized with a fatal passion each for the other. From this moment begins a long-drawn-out series of tricks and subterfuges, undertaken with the view of deceiving Mark, whose suspicions, excited by sundry of his courtiers, from time to time get beyond his control, and are as often laid to rest by some clever ruse on the part of his nephew, or his wife, ably seconded by Brangaene. In the poems, Mark is, as a rule, represented in a favourable light, a gentle, kindly man, deeply attached to both Tristan and Iseult, and only too ready to allow his suspicions to be dispelled by any plausible explanation they may choose to offer. At the same time the fact that the lovers are the helpless victims of the fatal force of a magic spell is insisted upon, in order that their career of falsehood and deception may not deprive them of sympathy.

One episode, in especial, has been most charmingly treated by the poets. Mark, in one of his fits of jealousy, banishes Tristan and Iseult from the court; the two fly to the woods, where they lead an idyllic life, blissfully happy in each other's company. Mark, hunting in the forest, comes upon them sleeping in a cave, and as Tristan, who knows that the king is in the neighbourhood, has placed his sword between them, is convinced of their innocence. Through a cleft in the rock a ray of light falls upon Iseult's face, Mark stops up the crevice with his glove (or with grass and flowers), and goes his way, determined to recall his wife and nephew. He does so, and the same drama of plot and counter-plot is resumed. Eventually Mark surprises the two under circumstances which leave no possible room for doubt as to their mutual relation; Tristan flies for his life and takes refuge with Hoel, duke of Britanny. After some time, hearing nothing of Queen Iseult, and believing himself forgotten, he weds the duke's daughter, Iseult of the white hand, but weds her only in name, remaining otherwise faithful to Iseult of Ireland. Later on he returns to Cornwall in disguise, and has more than one interview with his mistress. Ultimately, while assisting his brother-in-law in an intrigue with the wife of a neighbouring knight, Tristan is wounded by a poisoned arrow; unable to find healing, and being near to death, he sends a messenger to bring Queen Iseult to his aid; if successful the ship which brings her is to have a white sail, if she refuses to come, a black. Iseult of the white hand overhears this, and when the ship returns, bringing Iseult to her lover's aid, either through jealousy or by pure inadvertence (both versions are given), she tells Tristan that the sail is black, whereon, despairing of seeing his love again, the hero turns his face to the wall and dies. Iseult of Ireland lands to find the city in mourning for its lord; hastening to the bier, she lays herself down beside Tristan, and with one last embrace expires. (One dramatic version represents her as finding the wife seated by the bier, and ordering her away, "Why sit ye there, ye who have slain him? Arise, and begone!") The bodies are sent to Cornwall, and Mark, learning the truth, has a fair chapel erected and lays them in tombs, one at each side of the building, when a sapling springs from the heart of Tristan, and reaching its boughs across the chapel, makes its way into the grave of Iseult. However often the tree may be cut down it never fails to grow again. (In some versions it is respectively a vine and a rose which grow from either tomb and interlace midway.)

We need have little wonder that this beautiful love-story was extremely popular throughout the middle ages. Medieval literature abounds in references to Tristan and Iseult, and their adventures were translated into many tongues and are found depicted in carvings and tapestries. Probably the story was first told in the form of short *lais*, each recounting some special episode, such as the *lai* known as the *chêvrefeuille;* how old these may be it is impossible to say. Professor Zimmer, in his examination of the story, sees reason to believe that the main incidents may repose on a genuine historic tradition, dating back to the 9th or 10th century, the period of Viking rule in Ireland. The name of Iseult's father, Gormond, is distinctly Scandinavian; she, herself, is always noted for her golden hair, and it is quite a misrendering of the tradition to speak of her as a dark-haired Irish princess. In the German tradition she is *die lichte*, Iseult of Britanny *die schwarze* Isôlt; it is this latter who is the Celtic princess. The name Tristan is now generally admitted to be the equivalent of the Pictish Drôstan, and on the whole, the story is now very generally allowed to be of insular, probably of British, origin.

Some time in the 12th century the story was wrought into consecutive poems. The latest theory, championed with great skill by M. Bédier, is that there was one poem, and one only, at the root of the various versions preserved to us, and that that poem, composed in England, probably by an Anglo-Norman, was a work of such force and genius that it determined for all time the form of the *Tristan* story. The obvious objection to this view is that a work of such importance, composed at so comparatively late a date, is scarcely likely to have perished so completely as to leave no trace; if there were one poet held as an authority, the name of that poet would surely have been mentioned. Moreover the evidence of the author of the principal *Tristan* poem preserved to us points in another direction. This poet was an Anglo-Norman named Thomas; and, although little over 3000 lines of his poem have been preserved, we have three translations; a German, by Gottfried von Strassburg; a Scandinavian, by a certain Brother Robert; and an English, by Thomas, sometimes identified with Thomas of Ercildoune, though this is doubtful. With the help of the extant fragments and these translations we can form a very good idea of the character and content of Thomas's work, a task now rendered far more easy by M. Bédier's skilful reconstruction (cf. vol. i. of his edition of Thomas). It was certainly a work of great merit and charm. As authority Thomas cites a certain Bréri, who has now been identified with the Bleheris quoted as authority for the *Grail* and *Gawain* stories, and the Bledhericus referred to by Giraldus Cambrensis as *famosus ille fabulator*. This is what Thomas says:—

"Seignurs, cest cunte est mult divers,
E pur ço l'uni par mes vers
E di en tant cum est mester
E le surplus voil relesser.
Ne vol pas trop en uni dire!
Ici diverse la matyre.

> Entre ceus qui solent cunter
> E del cunte Tristran parler,
> Il en cuntent diversement:
> Oï en ai de plusur gent.
> Asez sai que chescun en dit
> E ço qu'il unt mis en escrit,
> Mes sulun ço que j'ai oï
> Nel dient pas sulun Bréri
> Ky solt les gestes e les cuntes
> De tuz les reis, de tuz les cuntes,
> Ki orent este en Bretaingne."
> (THOMAS, i. 377).

These are not the words of a man who is following a complete and authoritative poem; judging from the context of the other references to Bleheris he was rather a collector and versifier of short episodic tales, and it seems far more natural to understand Thomas as having wrought into one complete and consecutive form the various poems with which the name of Bréri was associated, than to hold that that, or a similar, work had already been achieved by another.

Thomas's work, fortunately, fell into the hands of a true poet in the person of Gottfried von Strassburg, whose *Tristan und Isolde* is, from a literary point of view, the gem of medieval German literature. Gottfried is a far greater master of style than Wolfram von Eschenbach, and his treatment of some of the episodes, notably the sojourn in the woods, is most exquisite. He did not live to complete his poem, but happily he carried it up to the point where the original fragments begin, so that we can judge very fairly what must have been the effect of the whole, the style of the two poets being very similar. Inspiring as the Tristan story is, it seems improbable that it should have been handled, and that within a comparatively short period, by *three* writers of genius, and that of these three the first, and greatest, should have utterly disappeared! The translators of Thomas do not fail to quote him as their source, why then has no one quoted the original poet?

Besides the version of Thomas, we have a fragment by a certain Béroul, also an Anglo-Norman, and a German poem by Eilhart von Oberge, both of which derive from a common source. There also exists in two manuscripts a short poem, *La Folie Tristan*, relating how Tristan, disguised as a fool, visits the court of King Mark. This poem is valuable, as, presuming upon the sufficiency of his disguise, Tristan audaciously gives a resumé of his feats and of his relations with Iseult, in this agreeing with the version of Thomas. The "Gerbert" continuation of the *Perceval* contains the working over of one of two short Tristan poems, called by him the *Luite Tristran*; the latter part, probably a distinct poem, shows Tristan, in the disguise of a minstrel, visiting the court of Mark. Here the tradition is more in accordance with Béroul.

Besides the poems, we possess the prose *Tristan*, an enormous compilation, akin to the prose *Lancelot*, where the original story, though still to be traced, is obscured by a mass of later Arthurian adventures. The interest here centres in the rivalry between Tristan and Lancelot, alike as knights and lovers, and in the later redaction, ascribed to Hélie de Borron, the story is spun out to an interminable length.

Certain points of difference between the poetical and the prose versions should be noted. Tristan is here the son of Meliadus, king of Loonois; his father does not die, but is decoyed away by an enchantress, and the mother, searching for her husband, gives birth to her child in the forest and dies. Meliadus marries again, and the second wife, jealous of Tristan, tries to kill him. Mark has another nephew, Andret, who is Tristan's enemy throughout the romance. Mark himself is a cowardly, treacherous and vindictive character. Some of the early printed editions follow the original version of Tristan's death, now found in one manuscript only (B.N. 103), the majority represent him as having been stabbed in the back by Mark in the presence of the queen, as we find in Malory, who drew the larger portion of his compilation from the prose *Tristan*. It should be noted that Tristan is never more than superficially connected with Arthur, an occasional visitor at his court; though in its later form ranked among the Arthurian romances, the *Tristan* is really an independent story, and does not form a part of the ordinary cyclic redaction.

The Italian prose text, *La Travola ritonda* differs from the French in adhering to the original version, and is classed by N. Bédier among the derivatives from Thomas. Like the story of Perceval that of Tristan has been made familiar to the present generation by Richard Wagner's noble music drama, *Tristan und Isolde*, founded upon the poem of Gottfried von Strassburg; though, being a drama of feeling rather than of action, the story is reduced to its simple elements; the drinking of the love-potion, the passion of the lovers, their discovery by Mark and finally their death.

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TRISTAN DA CUNHA, the general name for a group of three small volcanic islands belonging to Great Britain, situated in the South Atlantic, the summit of the largest being in 37° 5′ 50″ S., 12° 16′ 40″ W. They are about 2000 m. W. of the Cape of Good Hope and about 4000 m. N.E. of Cape Horn and lie somewhat north of a line drawn between the two capes. St Helena lies about 1500 m. N.N.E. of the group. The islands rise from the submarine elevation which runs down the centre of the Atlantic and on which are likewise situated Ascension, St Paul's Rocks and the Azores; the average depth on this ridge is from 1600 to 1700 fathoms, while depths of 3000 fathoms are found on each side of it. The depth between the islands is in some places over 1000 fathoms.

Tristan, the largest and northernmost island, has an area of 16 sq. m., is nearly circular in form, about 7 m. in diameter, and has a volcanic cone (7640 ft.), usually capped with snow, in the centre. Precipitous cliffs, 1000 to 2000 ft. in height, rise directly from the ocean on all sides, except on the north-west, where there is an irregular plain, 100 ft. above the sea, and 2½ m. in length and ½ m. in breadth. A stream crosses the northern end of the plateau, falling over the cliff edge in a fine cascade. The crater of the central cone contains a fresh-water lake about 150 yds. in diameter. This and other crater lakes are said never to be frozen over.

Inaccessible Island, the westernmost of the group, is about 20 m. from Tristan. It is quadrilateral in form, the sides being about 2 m. long, and its area is about 4 sq. m. The highest point (1840 ft.) is on the west side; all round there are perpendicular cliffs about 1000 ft. in height. At the base of the cliffs in some places are narrow fringes of beach a few feet above the sea-level.

Nightingale Island, the smallest and most southern of the group, is 10 m. from Inaccessible Island. Its area is not more than 1 sq. m. Its coasts, unlike those of the other two islands, are surrounded by low cliffs, from which there is a gentle slope up to two peaks, the one 1100 ft., the other 960 ft. high. There are two small islets—Stoltenkoff (325 ft.) and Middle (150 ft.)—and several rocks adjacent to the coast.

The rocks of Tristan da Cunha are felspathic basalt, dolerite, augite-andesite, sideromelane and palagonite; some specimens of the basalt have porphyritic augite.[1] The caves in Nightingale Island indicate that it has been elevated several feet. On almost all sides the islands are surrounded by a broad belt of kelp, the gigantic southern seaweed (*Macrocystis pyrifera*), through which a boat may approach the rocky shores even in stormy weather. There is no good anchorage in rough weather.

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[1] On the occurrence in Tristan da Cunha of rock of continental type (gneiss) see E. H. L. Schwarz of the Geological Survey, Cape Colony, in the *Transactions South African Philosoph. Soc*,. No. 16 of 1905.

The beaches and lower lands are covered with a dense growth of tussock grass (*Spartina arundinacea*), 8 to 10 ft. in height. It shelters vast numbers of penguins (*Eudyptes chrysocoma*), which there form their rookeries. There is one small tree (*Phylica nitida*), which grows in detached patches on the lower grounds. Independently of introduced plants, fifty-five species have been collected in the group, twenty-nine being flowering plants and twenty-six ferns and lycopods. A majority of the species are characteristic of the present general flora of the south temperate zone rather than any particular part of it: botanically the group is generally classed with the islands of the Southern Ocean. A finch (*Nesospiza acunhae*), a thrush (*Nesocichla eremita*), and a water-hen (*Gallinula nesiotis*) are the only land birds—the first two being peculiar to the islands. In addition to the penguins numerous other sea birds nest on the islands, as petrels, albatrosses, terns, skuas and prions. One or two land shells, a few spiders, several *Coleoptera*, a small lepidopter and a few other insects are recorded, but no *Orthoptera* or *Hymenoptera*. There appear to have been no indigenous mammals or reptiles. Seals frequent Nightingale and Inaccessible Islands, and the whale (*Balaena australis*) is found in the adjacent waters.

The prevailing winds are westerly. December to March is the fine season. The climate is mild and on the whole healthy, the temperature averaging 68° Fahr. In summer, 55° in winter—sometimes falling to 40°. Rain is frequent; hail and snow fall occasionally on the lower grounds. The sky is usually cloudy. The islands have a cold and barren appearance. The tide rises and falls about 4 ft.

History.—The islands were discovered in 1506 by the Portuguese admiral Tristan, or more correctly Tristão da Cunha,[1] after whom they are named, during a voyage to India. Thereafter the islands (which were uninhabited) were occasionally visited by outward bound ships to the Indies. Dutch vessels brought back reports on the islands in 1643, and in 1656 Van Riebeek, the founder of Cape Town, sent a ship from Table Bay to Tristan to see if it was suitable for a military station, but the absence of a harbour led to the project being abandoned. Later in the 17th century ships were sent from St Helena by the English East India Company to Tristan to report on a proposed settlement there, but that project also came to naught. A British naval officer who visited the group in 1760 gave his name to Nightingale Island. John Patten, the master of an English merchant ship, and part of his crew lived on Tristan from August 1790 to April 1791, during which time they captured 5600 seals; but the first permanent inhabitant was one Thomas Currie, who landed on the island in 1810. At this time American whalers frequented the neighbouring waters and, in the same year, an American named Lambert "late of Salem, mariner and citizen thereof" and a man named Williams made Tristan their home. Lambert declared himself sovereign and sole possessor of the group (which he renamed Islands of Refreshment) "grounding my right and claim on the rational and sure ground of absolute occupancy." Lambert's sovereignty was short lived, as he and Williams were drowned while out fishing in May 1812. Currie was joined, however, by two other men and they busied themselves in growing vegetables, wheat and oats, and in breeding pigs. War having broken out in this year between the United States and Great Britain the islands were largely used as a base by American cruisers sent to prey on British merchant ships. This and other considerations urged by Lord Charles Somerset, then governor of Cape Colony, led the British government to authorize the islands being taken possession of as dependencies of the Cape. The formal proclamation of annexation was made on the 14th of August 1816. A small garrison was maintained on Tristan until November of the following year. At their own request William Glass (d. 1853), a corporal in the Royal Artillery, with his wife and two children and two masons were left behind, and thus was begun the present settlement. From time to time additional settlers arrived or shipwrecked mariners decided to remain; in 1827 five coloured women from St Helena were induced to migrate to Tristan to become the wives of the five bachelors then on the island. Later coloured women from Cape Colony married residents in the island. Other settlers are of Dutch, Italian and Asiatic origin. Thus the inhabitants are of mixed blood, but the British strain greatly predominates. Over the little community Glass (1817–1853) ruled in patriarchal fashion. Besides raising crops, the settlers possessed numbers of cattle, sheep and pigs, but their most lucrative occupation was seal fishing. The island was still frequented by American whalers, and in 1856 out of a total population of about 100 twenty-five emigrated to the United States. The next year forty-five of the inhabitants removed to Cape Colony; whither the younger or more restless members of the community have since gone—or else taken to a seafaring life. The inhabitants had of necessity made their settlement on the plain on the north-west of Tristan; here a number of substantial stone cottages and a church were built. It is named Edinburgh in memory of a visit in 1867 by the duke of Edinburgh. In October 1873 the islands were carefully surveyed by the "Challenger," which removed to Cape Town two Germans, brothers named Stoltenhoff, who had been living on Inaccessible Island since November 1871. This was the only attempt at colonization made on any save the main island of the group.

After the death of Glass the head of the community for some time was an old man-of-war's man named Cotton, who had been for three years guard over Napoleon at St Helena; Cotton was succeeded by Peter William Green, a native of Amsterdam who settled in the island in 1836. During Green's "reign" the economic condition of Tristan was considerably affected by the desertion of the neighbouring seas by the whalers; this was largely due to the depredations of the Confederate cruisers "Alabama" and "Shenandoah" during the American Civil War, many whaling boats being captured and burnt by them. As a result the number of ships calling at Tristan considerably diminished and trade languished. In 1880 the population appears to have attained its maximum—109. In 1885 a serious disaster befell the islanders, a lifeboat which went to take provisions to a ship in the offing was lost with all hands—fifteen men—and only four adult males were left on the island. At the same time a plague of rats—survivors of a shipwrecked vessel—wrought much havoc among the crops. Plans were made for the total removal of the inhabitants to the Cape, but the majority preferred to remain. Stores and provisions were sent out to them by the British government. The ravages of the rats have rendered impossible the growing of wheat; the wealth of the islanders now consists in their cattle, sheep, potatoes and apple and peach trees. The population in 1897 was only 64; in 1901 it was 74, and in 1909, 95. They manage their own affairs without any written laws, the project once entertained of providing them with a formal constitution being deemed unnecessary. The inhabitants are described as moral, religious, hospitable to strangers, well mannered and industrious, healthy and long lived. They are without intoxicating liquors and are said to commit no crimes. They are daring sailors, and in small canvas boats of their own building voyage to Nightingale and Inaccessible islands. They knit garments from the wool of their sheep; are good carpenters and make serviceable carts. From time to time ministers of the Church of England have lived on the island and to their efforts is mainly due the education of the children. In 1906 the islanders passed through a period of distress owing to great mortality among the cattle and the almost total failure of the potato crop. The majority again refused, however, to desert the island, though offered allotments of land in Cape Colony. Similar proposals had been made and declined several times since the question was first mooted in 1886. In 1905 a lease of

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[1] Tristan da Cunha (*fl.* 1460–1540) was nominated first viceroy of Portuguese India in 1504, but was unable to serve owing to temporary blindness; in 1506 he was placed in command of a fleet which operated on the east coast of Africa and in the Indies, Alphonso d'Albuquerque (*q.v.*) having charge of a squadron under da Cunha. After discovering the islands which now bear his name, da Cunha landed in Madagascar, subsequently visiting Mozambique, Brava (where he reduced the Arab power) and Sokotra, which he conquered. He also distinguished himself in the Indies in various actions. In 1514 he was ambassador to Pope Leo X. to pay homage for the new conquests of Portugal, and was, later on, made a member of the Portuguese privy council.

Nightingale, Inaccessible and Gough islands, for the purpose of working the guano deposits, was granted by the British government.

Gough Island.—Gough Island or Diego Alvarez lies in the South Atlantic in 40° 20′ S., 9° 44′ W., and is 250 m. S.S.E. of Tristan da Cunha and some 1500 m. west by south of Cape Town. It is of volcanic origin, is rugged and mountainous, the highest peak rising to 4380 ft. The island is about 8 m. long by 4 m. broad and has an area of 40 sq. m. Precipitous cliffs, from 200 to 1000 ft. high, characterize the coast. They are divided by picturesque valleys, which, in some instances, have been cut down to sea-level and afford landing-places. Streams fall over the cliffs into the sea in fine cascades. The island is visited by vast numbers of penguins and contains valuable guano deposits. It is also the home of numerous seals. The rainfall is heavy and vegetation abundant. The island is believed to have been discovered by the Portuguese in the 16th century. Originally called Diego Alvarez, it derives its other name from a Captain Gough, the commander of a British ship which visited it in 1731. It has been claimed as a British possession since the annexation of Tristan da Cunha. In 1904 Gough Island was visited by the Antarctic exploring ship "Scotia" of the Bruce expedition, which discovered a rich marine fauna, two new buntings and three new species of plants. It has no permanent population.

A comprehensive account of Tristan da Cunha appeared in *The Cape Times* (January–March 1906), in a series of articles by W. Hammond Tooke, the commissioner sent to the islands by the Cape government in 1904. See also *Transactions of the Linnean Society* for 1819 (contains a report of an ascent of the summit by Captain Dugald Carmichael in 1817); A. Earle, *Narrative of a . . . Residence in New Zealand . . . together with a Journal of a Residence in Tristan d'Acunha* (London, 1832); Mrs K. M. Barrow, *Three Years in Tristan da Cunha* (London, 1910); H. N. Moseley, *Notes by a Naturalist on the "Challenger"* (new ed., London, 1892); F. and G. Stoltenhoff, "Two Years on Inaccessible," in *Cape Monthly Mag.* (December 1873). Among papers relating to Tristan da Cunha published by the British government, see especially reports issued in 1897, 1903, 1906—which gives a detailed account of the island and islanders—and 1907. For the discovery of Tristan see *The Commentaries of the Great Afonso Dalboquerque* (Hakluyt Society's Series, 1875, vol. 53). For Gough Island, see R. N. R. Brown of the "Scotia" expedition, "Diego Alvarez or Gough Island," in *Scottish Geog. Mag.* (August 1905); Brown and others, "The Botany of Gough Island," in *Journ. Linnean Soc.* (*Botany*) (1905), and *The Voyage of the "Scotia"* ch. xii. (London, 1906). *The Africa Pilot*, pt. ii. (5th ed., 1901), contains descriptions both of Tristan da Cunha and Gough Island.

TRISTAN L'HERMITE, FRANÇOIS (1601–1655), French dramatist, was born at the château de Soliers in the Haute Marche about 1601. His adventures began early, for he killed his enemy in a duel at the age of thirteen, and was obliged to flee to England. The story of his childhood and youth he embroiders in a burlesque novel, the *Page disgracié*. He was in succession poet to Gaston d'Orléans, to the duchesse de Chaulnes and the duke of Guise. He died on the 7th of September 1655. His first tragedy, *Mariamne* (1636), was also his best. It was followed by *Penthée* (1637), *La Mort de Sénèque* (1644), *La Mort de Crispe* (1645) and the *Parasite* (1653). He was also the author of some admirable lyrics. Three of his best plays are printed in the *Théâtre français* of 1737.

TRITHEMIUS, JOHANNES (1462–1516), German historian and divine, was born at Trittenheim on the Moselle, on the 1st of February 1462. His name was originally "von Heidenberg," but according to the fashion of the times he adopted the name of his birthplace. After an unhappy childhood, he studied at Heidelberg, and at the age of twenty entered the Benedictine monastery of Sponheim near Kreuznach, of which, in 1485, he became abbot. He established an excellent library, and through his strict discipline and consummate scholarship soon raised the monastery to an educational institution of a high order. In 1506 he resigned, and was appointed soon after abbot of the monastery of St Jakob at Würzburg; and in this city he died on the 13th of December 1516. Trithemius was, though an accomplished scholar, untrustworthy as a chronicler, and his *Annales hirsaugienses* (1514), *Annales de origine Francorum*, as well as his *Chronologia mystica* (1516) are, on this account, of doubtful value. More reliance can, however, be placed on his *De scriptoribus ecclesiasticis* (1494) and the *Catalogus illustrium virorum Germaniae* (1491). He also wrote a fanatical book against sorcery, *Antipalus maleficiorum* (1508).

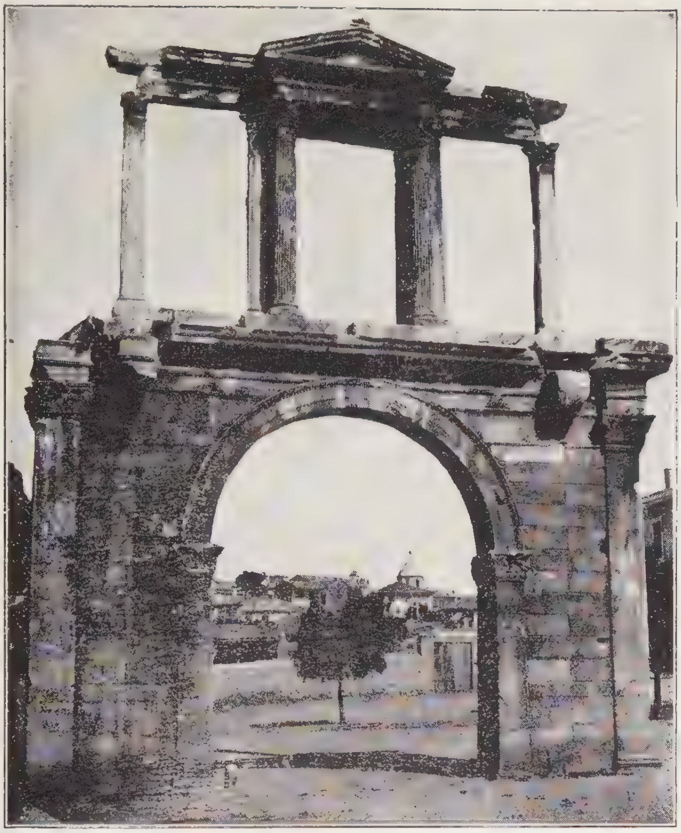
See Silbernagel, *J. Trithemius* (1868; 2nd ed., 1885); Schneegans. *Abt Joh. Trithemius und Kloster Sponheim* (1882); and F. X. Wegele, in *Allgemeine deutsche Biographie*.

TRITON, in Greek mythology, son of Poseidon and Amphitrite, the personification of the roaring waters. According to Hesiod (*Theog.* 930), he dwelt with his parents in a golden palace in the depths of the sea. The story of the Argonauts places his home on the coast of Libya. When the Argo was driven ashore on the Lesser Syrtes the crew carried the vessel to Lake Tritonis, whence Triton, the local deity, guided them across to the Mediterranean (Apollonius Rhodius iv. 1552). He was represented as human down to the waist, with the tail of a fish. His special attribute was a twisted seashell, on which he blew to calm or raise the waves. Its sound was so terrible, when loudly blown, that it put the giants to flight, who imagined it to be the roar of a mighty wild beast (Hyginus, *Poet. astronom.* ii. 23). When Misenus, the trumpeter of Aeneas, challenged him to a contest of blowing, Triton in his jealousy flung him into the sea. In course of time Triton became the name for individuals of a class, like Pan and Silenus, and Tritons (male and female) are mentioned in the plural, usually as forming the escort of marine divinities. The beings called Centauro-Tritons or Ichthyocentaurs were of a triple nature, with the forefeet of a horse in addition to the human body and fish tail. Pausanias (ix. 21) gives a detailed description of the ordinary Triton. It is probable that the idea of Triton owes its origin to the Phoenician fish-deities.

See Preller, *Griechische Mythologie* (4th ed., 1894); F. R. Dressler, *Triton und die Tritonen* (Wurzen, 1892).

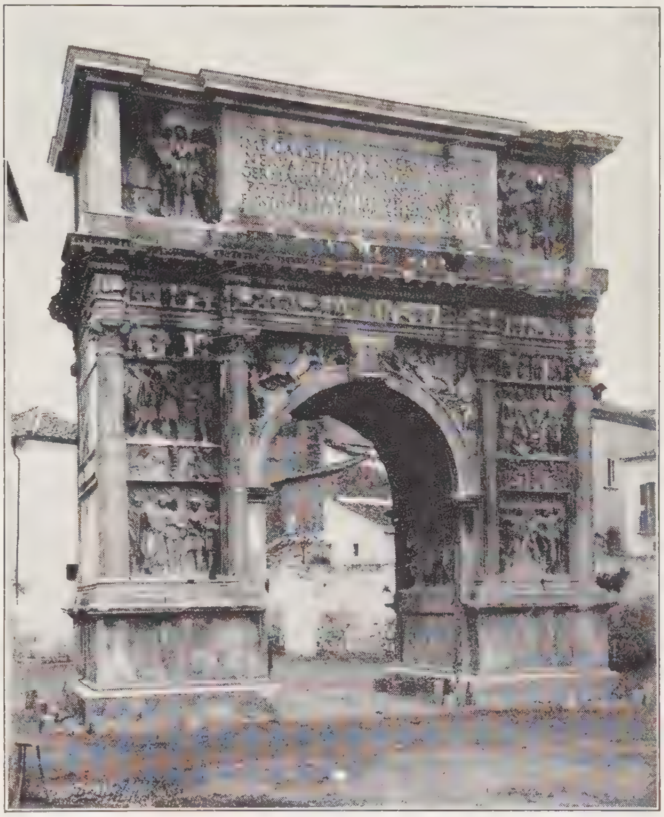
TRIUMPH (*triumphus*), amongst the ancient Romans, the highest honour bestowed upon a victorious general. Originally it was only granted on certain conditions, which were subsequently relaxed in special cases. Only those who had held the office of dictator, consul or praetor were entitled to the distinction; the war must have been brought to a definite conclusion, resulting in an extension of the boundaries of the state; at least 5000 of the enemy must have been slain; the victory must have been gained over a foreign enemy, victories in civil war or over rebels not being counted. The power of granting a triumph rested with the senate, which held a meeting outside the city walls (generally in the temple of Bellona) to consider the claims put forward by the general. If they were considered satisfactory special legislation was necessary to keep the general in possession of the *imperium* on his entry into the city. Without this, his command would have expired and he would have become a private individual the moment he was inside the city walls, and would have had no right to a triumph. Consequently he remained outside the pomoerium until the special ordinance was passed; thus Lucullus on his return from Asia waited outside Rome three years for his triumph.

The triumph consisted of a solemn procession, which, starting from the Campus Martius outside the city walls, passed through the city to the Capitol. The streets were adorned with garlands, the temples open, and the procession was greeted with shouts of *Io triumphe!* At its head were the magistrates and senate, who were followed by trumpeters and then by the spoils, which included not only arms, standards, statues, &c., but also representations of battles, and of the towns, rivers and mountains of the conquered country, models of fortresses, &c. Next came the victims destined for sacrifice, especially white oxen with gilded horns. They were followed by the prisoners who had not been sold as slaves but kept to grace the triumph; when the procession reached the Capitol they were taken off to prison and put to death. The chariot which carried the victorious general (*triumphator*) was crowned with laurel and drawn by four horses. The general was attired like the Capitoline Jupiter in robes of purple and gold borrowed from the treasury of the god; in his right hand he held a laurel branch, in his left an ivory sceptre surmounted by an eagle. Above his head the golden crown of Jupiter was held by a slave who reminded him in the midst of his glory that he was a mortal man. Last came the soldiers shouting *Io triumphe* and singing



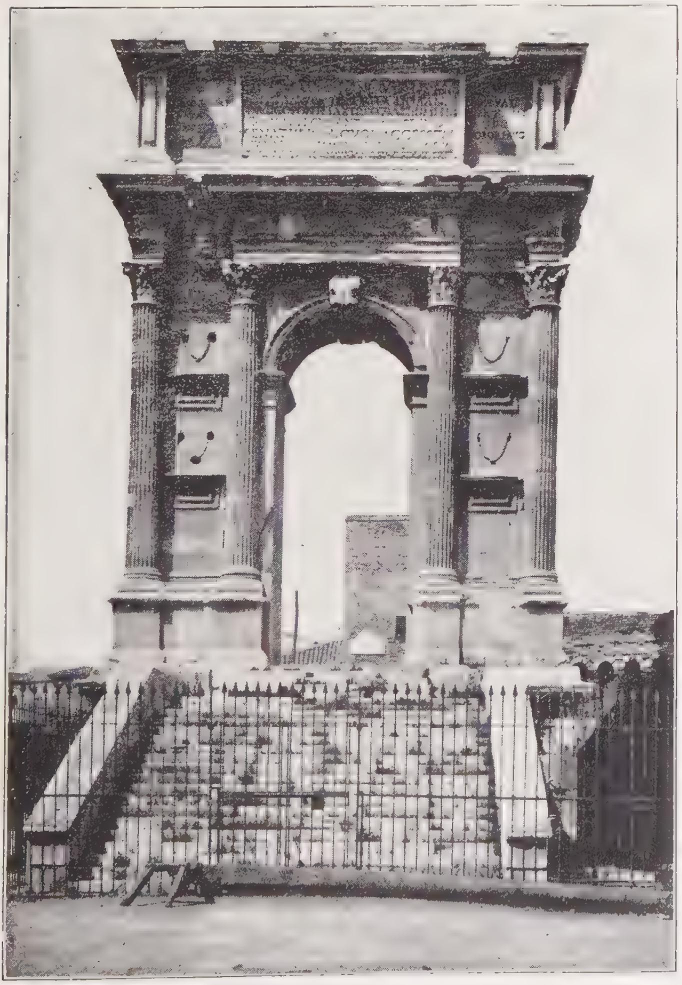
Photo, Bonfils.

FIG. 1.—ARCH OF HADRIAN, ATHENS.



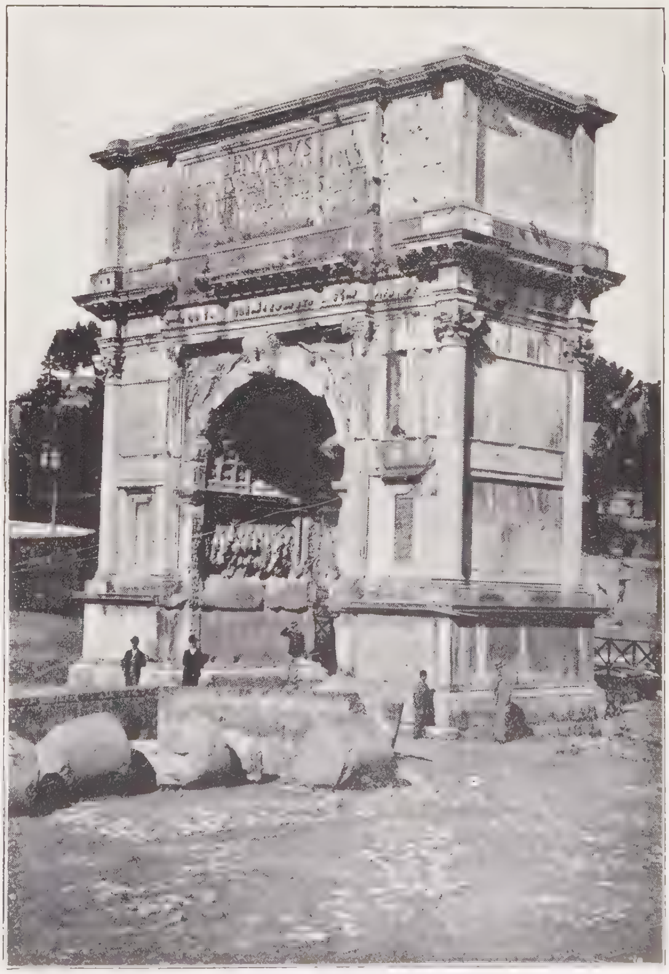
Photo, Alinari.

FIG. 2.—ARCH OF TRAJAN, BENEVENTO.



Photo, Alinari.

FIG. 3.—ARCH OF TRAJAN, ANCONA.



Photo, Anderson.

FIG. 4.—ARCH OF TITUS, ROME.

PLATE II.

TRIUMPHAL ARCH

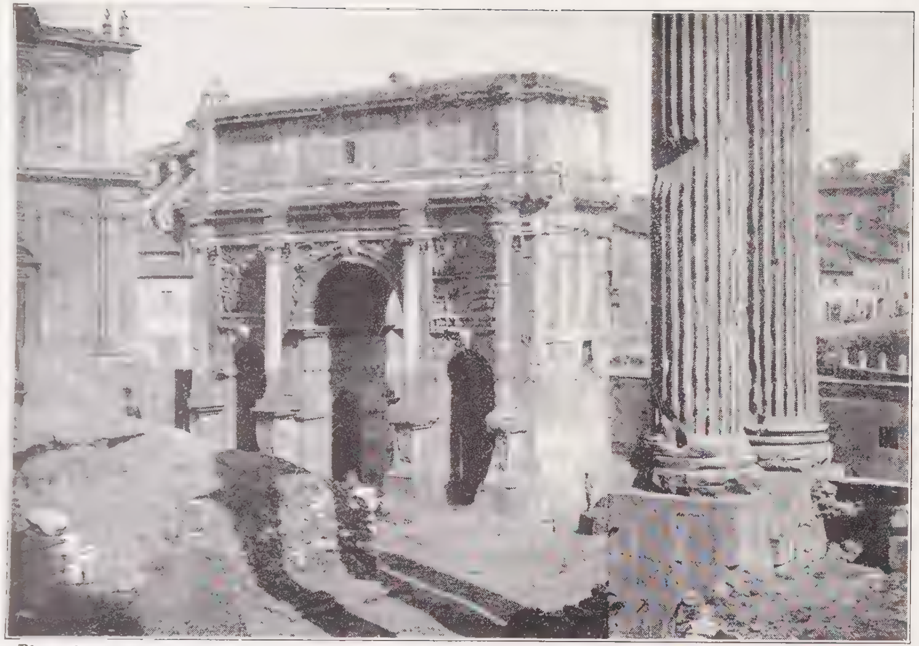

Photo, Anderson.

FIG. 5.—ARCH OF SEPTIMIUS SEVERUS, ROME.

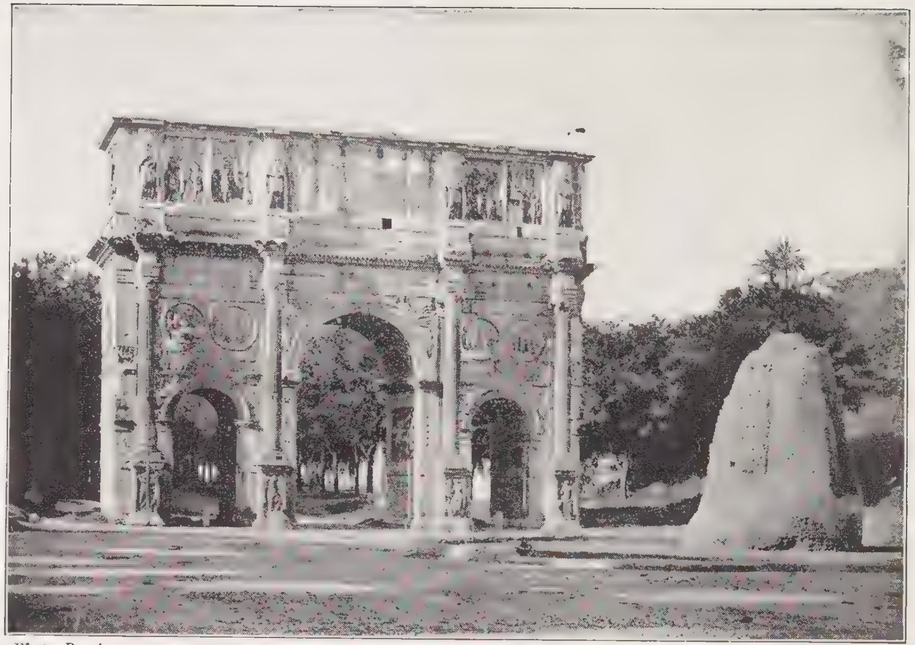

Photo, Brogi.

FIG. 6.—ARCH OF CONSTANTINE, ROME.

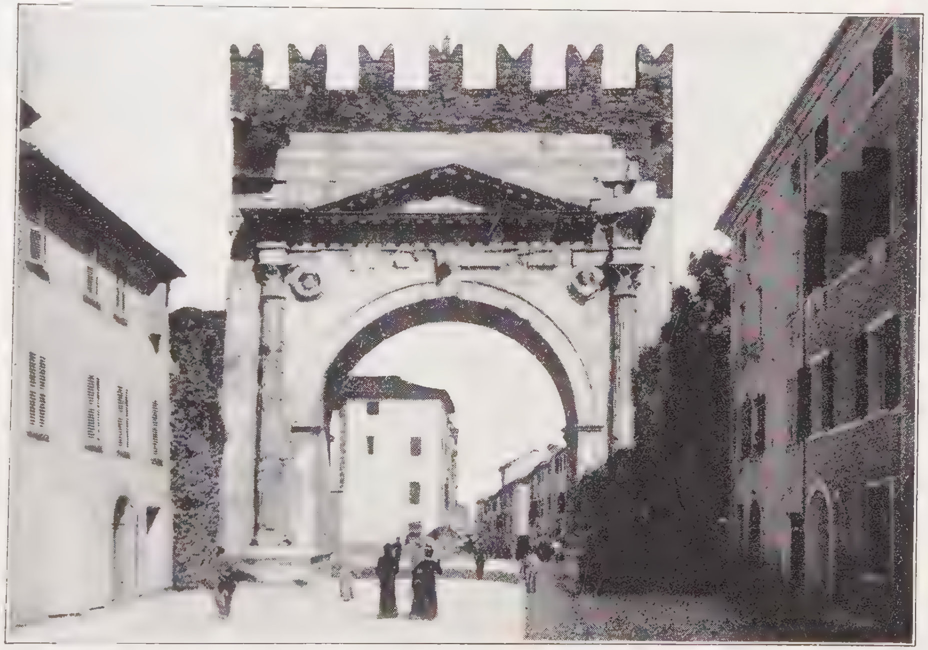

Photo, Alinari.

FIG. 7.—ARCH OF AUGUSTUS, RIMINI.

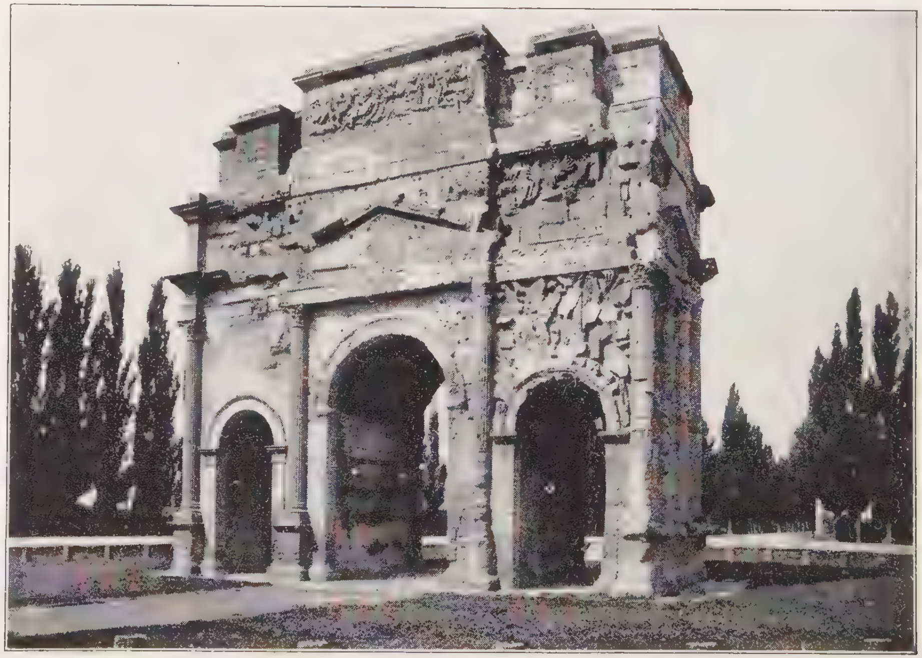

Photo, Neurdein.

FIG. 8.—ARCH AT ORANGE.

songs both of a laudatory and scurrilous kind. On reaching the temple of Jupiter on the Capitol, the general placed the laurel branch (in later times a palm branch) on the lap of the image of the god, and then offered the thank-offerings. A feast of the magistrates and senate, and sometimes of the soldiers and people, concluded the ceremony, which in earlier times lasted one day, but in later times occupied several. Generals who were not allowed a regular triumph by the senate had a right to triumph at the temple of Jupiter Latiaris on the Alban Mount. Under the empire only the emperors celebrated a triumph, because the generals commanded under the auspices of the emperors (not under their own) merely as lieutenants (*legati*); the only honour they received was the right of wearing the triumphal insignia (the robes of purple and gold and the wreath of bay leaves) on holidays. After the time of Trajan, when all consuls were allowed to wear the triumphal dress on entering office and in festal processions, the only military reward for a successful general was a statue in some public place. The last triumph recorded is that of Diocletian (A.D. 302). A naval or maritime triumph was sometimes allowed for victories at sea, the earliest being that celebrated by C. Duilius in honour of his victory over the Carthaginians in 260 B.C.

See Mommsen, *Römisches Staatsrecht* (1887), i. 126–136; Marquardt, *Römische Staatsverwaltung* (1884), ii. 582–593; H. A. Göll, *De triumphi romani origine, permissu, apparatu, via* (1854); S. Peine, "De ornamentis triumphalibus" (1885), in C. E. Ascherson's *Berliner Studien*, ii.

TRIUMPHAL ARCH, the term given to arches erected to commemorate some special victory, but here extended to include those built as memorial arches to some benefactor of the Roman Empire, such as those at Rimini, Ancona and Benevento; arches erected as monumental entrances to towns, as at Nîmes and Autun; arches on bridges, as at Chamas in France and Alcantara in Spain; and lastly those which preceded the entrance to a forum or sacred enclosure, or formed part of a colonnaded street, as in Syria. There is every reason to suppose that in early times in Greece and Etruria temporary erections, such as those of the present day, were set up on the occasion of the public entry, after a great victory, of some emperor or general; but the Romans would seem to have been the first to erect such structures in stone or marble, to enrich them with sculpture, and to raise aloft on their summit the quadriga or four-horsed chariot with statues and trophies. The time involved in the construction of such a memorial, and more especially that which would be required for its enrichment with sculpture, rendered it impossible that they should be set up on the occasion of the triumphal entry itself, and it is known that the arch of Titus was not erected till some time after his death by his successor Domitian. There is always some difficulty in deciding between triumphal and memorial arches, as they were virtually similar in design, equally enriched with sculpture, generally surmounted with a quadriga and statues, and as a rule were isolated structures. The earlier arches were pierced with a single arch and were comparatively simple in design, being decorated by pilasters or semi-detached columns only; the existence of chariots and statues on their summit is known only from coins or gems, on which such features are always shown. The arch of Titus in Rome (fig. 4), A.D. 81, is the first one enriched with bas-relief sculpture, in this case representing the triumphs of Titus with the seven-branched candlestick and the golden table brought from Jerusalem. The next sculptural arch of triumph is that built at Benevento (fig. 2) in South Italy (A.D. 112) by Trajan, recording the Dacian victories. The triumphal arch (fig. 5) of Septimius Severus (A.D. 203) has a central and two side arches, the bas-reliefs on it representing the Parthian victories; and the last important arch in Rome is that of Constantine (fig. 6), which had also three arches, and was embellished with bas-reliefs, representing the Dacian victories, which were taken from the arch of Trajan on the Via Appia and others of Constantine's time, representing the conquest of Maxentius.

Passing to other countries, we have the triumphal arches at St Remy and at Orange (fig. 8); those at Carpentras and Cavaillon, also in France, which were probably of later date, as possibly also the triple arch at Reims. The triumphal arch with three arches at Fano in Italy is said to have been commenced by Augustus, but completed by Constantine, who probably added the two side arches and decorated it with inferior sculpture. At Timgad (Thamugada) in North Africa is a triumphal arch with central and two side arches, probably of Hadrian's time, and one with triple arches at Sbeitla (Suffetula), also in North Africa, and another example at Saintes in France, built on a bridge.

Of memorial arches the earliest are the examples of Rimini (fig. 7) and Aosta, erected to Augustus, and later the arch at Ancona (fig. 3) erected to Trajan (A.D. 112) as a record of the construction of the port there. At Pola, in Istria, is an archway erected in memory of the Sergii. Of less important examples in Rome are the arches of Dolabella (A.D. 10), Drusus (A.D. 23), Gallienus (A.D. 262), the silversmith's arch (A.D. 204); in Verona, the Porta dei Borsari and the Porta de Leoni, erected by Gallienus (A.D. 265); at Aix-les-Bains in France, an arch of late 3rd century; and at Lambessa, in North Africa, the arches of Commodus (A.D. 187) and of Septimius Severus (A.D. 200). In Spain there are two monumental arches erected by Trajan at Alcantara, in the centre of the bridge built by him (A.D. 108), and the arch of Santiago at Merida; a third example exists in the Arco di Bara at Tarragona.

Quadriportal archways are those which were built in the centre of four cross roads, such as the arch of Janus in Rome, built by Constans (A.D. 350), the arch of Caracalla at Tebesse (Thevesti) in North Africa, and many examples in Syria, of which the arch at Ladikiyah (Laodicea ad Mare) is in perfect preservation.

The colonnaded streets in Syria were entered through magnificent archways, of which the finest examples are those at Palmyra and Gerasa. As entrance gateways to towns there are many examples which were sometimes built as memorial arches, but formed part of the city walls, such as the entrance gate at Susa in Italy, erected in memory of Augustus (8 B.C.), decorated with reliefs of the Suovetaurelia (sacrifices); the Porte d'Avroux and Porte St André at Autun, and the Porte d'Auguste at Nîmes, in France; the Porte d'Auguste at Perugia in Italy and the Porta Nigra at Treves in Germany; to these should be added the three entrance gateways to the palace of Spalato (A.D. 303), one of these, the Porta Aurea, or Golden Gate, showing in its enriched design certain decadent forms which led to the Byzantine and Renaissance styles; lastly there are the arched entrances to sacred or civil enclosures, such as the example at Sbeitla (Suffetula) in North Africa, the arch of Hadrian at Athens (fig. 1), built to his memory by his successors, and the archway of the Propylaea at Damascus.

The triumphal arch found no place in medieval architecture, but in Renaissance works there are many examples, of which the triumphal entrance arch of King Alfonso at Naples (A.D. 1470) comes first. Of isolated structures, there are in Paris the Porte St Martin (1647), St Denis (1684), arch of Carrousel in the Tuileries (1808), and the Arc de l'Etoile in the Champs Élysées, completed in 1830; in Berlin the Brandenburger Thor (1790); in Munich the Siegesthor (1843) and Metzger Thor (1880); in Milan the Arch of Peace, commenced by Napoleon in 1807 and completed in 1857 by the Austrians (an interesting example, as it still preserves the chariot and horses and statues which formerly crowned all triumphal arches); and in London the Marble Arch, originally built in front of Buckingham Palace, but removed to the north-east angle of Hyde Park in 1843, and the Wellington Arch at Hyde Park Corner, without the statue of the duke on horseback, afterwards set up at Aldershot. (R. P. S.)

TRIVANDRUM, or TREVANDRUM, a city of southern India, capital of the state of Travancore, situated 2 m. from the seacoast. Pop. (1901), 57,882. It is the residence of the maharaja, and contains an observatory and a museum, besides several other fine buildings. The chief fame of the place, however, centres upon the shrine of Sri Ananta Padmanabhaswami, a great resort of pilgrims, round which the city grew up. The best houses and chief public buildings stand on hilly terraces. The city contains the maharaja's college, a Sanskrit college, a high school, a school for girls, an industrial school of arts, and a hospital and medical school. There is little trade, but a speciality of wood-carving. Trivandrum has a small seaport, but the vessels that touch here have to anchor at some considerable distance from the shore, and the port itself is not fitted for any great commercial development.

TRIVET, a small metal tripod for holding cooking vessels near a fire. The word is also applied to a round, square or oval openwork plate, usually of steel or brass, fixed to the bars of a grate by a socket for keeping hot plates, dishes, or food.

TRIVIUM (Lat. for cross-road, *i.e.* where three roads meet, from *tres*, three, and *via*, road), in medieval educational systems, the curriculum which included grammar, rhetoric and logic. The trivium and the quadrivium (arithmetic, music, geometry and astronomy) together made up what are known as the seven liberal arts (see EDUCATION: *Schools*). From the word in its original sense is derived the adjective "trivial" (post-Aug. Lat. *trivialis*), that which can be seen at the cross-roads, *i.e.* unimportant, commonplace. In botany and zoology the "trivial" name is the adjectival name which follows the genus name in a binominal system of nomenclature, as *canina*, *perennis*, in *Rosa canina*, *Bellis perennis*.

TRNOVO, or TIRNOVO, an episcopal city and the capital of a department of Bulgaria; 124 m. E.N.E. of Sofia, on the river Yantra, and on the Sofia-Varna railway, at the junction of the branch line from Rustchuk. Pop. (1906), 12,171. The city consists of two divisions—the Christian quarter, situated chiefly on a high rocky plateau, and the so-called Turkish quarter, on the lower ground; but many of the Turkish inhabitants emigrated after 1878. On the Tsarevetz Hill above the city are the remains of the ancient citadel. The Husarjaini mosque is used as a military powder and dynamite factory. In the Christian quarter there are some interesting churches of the middle ages, notably that of the Forty Martyrs, in which the Bulgarian tsars were crowned. Numerous antiquarian remains have also been discovered. There are a gymnasium and a high-class girls' school. The city possesses large dye-works, and important manufactures of copper utensils.

Trnovo was the ancient capital of Bulgaria, and from 1186 until its capture by the Turks, 17th of July 1394, the residence of the Bulgarian tsars. From the beginning of the 13th century it was also the seat of the patriarchate of Bulgaria, until the suppression of the patriarchate in 1767. In 1877 it was taken from Turkey by the Russians, and in 1879 Prince Alexander of Battenberg was here elected prince of Bulgaria. On the 5th of October 1908 the independence of Bulgaria was proclaimed here by King Ferdinand, in the church of the Forty Martyrs.

TROCHAIC (from Gr. τροχαῖος, τροχαϊκός; Lat. *trochaeus*), the name of a metre very commonly used by the Greeks and Romans in their tragedies and comedies. Its characteristic foot is a trochee consisting of two syllables, one long, one short (–⏑). The usual form, in which the Greeks employed the measure, was the trochaic tetrameter catalectic, the scheme of which is as follows:—

–⏑	–⏑	–⏑	–⏑	–⏑	–⏑	–⏑	⏓
⏑⏑⏑	⏑⏑⏑	⏑⏑⏑	⏑⏑⏑	⏑⏑⏑	⏑⏑⏑	⏑⏑⏑	
	– –		– –		– –	⏑⏑–	
	⏑⏑–		⏑⏑–				
–⏑⏑	–⏑⏑	–⏑⏑	–⏑⏑	–⏑⏑	–⏑⏑	–⏑⏑	

The trochaic metre is rapid in movement and breathless, and is generally used to depict strong emotions or to tell an exciting narrative. It is, however, very closely related to the ordinary iambic metre; in fact, by subtracting the first foot and a half of the longer line, we find ourselves left with a pure iambic line as used by the tragedians.

In modern times, the trochaic measure has been adopted by the prosody of England, Germany and Scandinavia. The swift and hurrying movement of it, which we see reflected in its derivation, as the Greek name is certainly to be traced back to the verb τρέχειν, to run, has made it a favourite with our lyrical poets. In the early English writers on versification the foot is called a trocheus.

TROCHU, LOUIS JULES (1815–1896), French general, was born at Palais (Belle-Ile-en-Mer) on the 12th of March 1815. Educated at St Cyr he received a commission in the Staff Corps in 1837, was promoted lieutenant in 1840, and captain in 1843. He served as a captain in Algeria under Marshal Bugeaud, who, in recognition of his gallantry in the battles of Sidi Yussuf and Isly, made him his aide-de-camp and entrusted him with important commissions. He was promoted major in 1845, and colonel in 1853. He served with distinction throughout the Crimean campaign, first as aide-de-camp to Marshal St Arnaud, and then as general of brigade, and was made a commander of the Legion of Honour and general of division. He again distinguished himself in command of a division in the Italian campaign of 1859, where he won the grand cross of the Legion of Honour. In 1866 he was employed at the ministry of war in the preparation of army reorganization schemes, and he published anonymously in the following year *L'Armée française en 1867*, a work inspired with Orleanist sentiment, which ran through ten editions in a few months and reached a twentieth in 1870. This brochure brought him into bad odour at court, and he left the war office on half-pay, and was refused a command in the field at the outbreak of the Franco-German War. After the earlier disasters in 1870, he was appointed by the emperor first commandant of the troops of Châlons camp, and soon afterwards (Aug. 17) governor of Paris and commander-in-chief of all the forces destined for the defence of the capital, including some 120,000 regular troops, 80,000 mobiles, and 330,000 National Guards. He worked energetically to put Paris in a state of defence and throughout the siege showed himself a master of the passive defensive. At the revolution of the 4th of September he became president of the government of national defence, in addition to his other offices. His "plan" for defending the city raised expectations doomed to disappointment; the successive sorties made under pressure of public opinion were unsuccessful, and having declared in one of his proclamations that the governor of Paris would never capitulate, when capitulation became inevitable he resigned the governorship of Paris on the 22nd of January 1871 to General Vinoy, retaining the presidency of the government until after the armistice in February. He was elected to the National Assembly by eight departments, and sat for Morbihan. In October he was elected president of the council general for Morbihan. In July 1872 he retired from political life, and in 1873 from the army. He published in 1873 *Pour la vérité et pour la justice*, in justification of the government of national defence, and in 1879 *L'Armée française en 1879, par un officier en retraite*, a sort of supplement to his former work of 1867. He died at Tours on the 7th of October 1896.

TROGEN, a neat and clean little town in the Ausser Rhoden half of the Swiss canton of Appenzell. By light railway it is 6 m. from St Gall, or by carriage road 7 m. from Heiden (the chief goats' whey cure resort in the canton), or 9 m. from Altstätten in the Rhine valley. It is built on the side of a steepish hill, and in 1900 had 2496 inhabitants, mostly Protestant and German-speaking. In the square before the parish church the *Landsgemeinde* or primitive democratic assembly of Ausser Rhoden meets in the even years (in other years at Hundwil, not far from Herisau) on the last Sunday in April. Like other towns in Appenzell, Trogen is engaged in the manufacture (in the houses of the workpeople) of embroidery and muslins.

TROGLODYTES (τρωγλοδύται, from τρώγλη, hole, δύω, creep), "cave-dwellers," a name applied by ancient writers to different tribes in various parts of the world. Strabo speaks of them in Moesia, south of the Danube (vii. 318), in the Caucasus (xi. 506), but especially in various parts of Africa from Libya (xvii. 828) to the Red Sea. The troglodyte Ethiopians of Herodotus (iv. 183) in inner Africa, very swift of foot, living on lizards and creeping things, and with a speech like the screech of an owl, have been identified with the Tibbus of Fezzan.

According to Aristotle (*Hist. An* viii. 12) a dwarfish race of Troglodytes dwelt on the upper course of the Nile, who possessed horses and were in his opinion the Pygmies of fable. But the best known of these African cave-dwellers were the inhabitants of the "Troglodyte country" (Τρωγλοδυτική) on the coast of the Red Sea, as far north as the Greek port of Berenice, of whom an account has been preserved by Diodorus (iii. 31) and Photius (p. 454 Bekker) from Agatharchides of Cnidus, and by Artemidorus in Strabo (xvi. 776). They were a pastoral people, living entirely on the flesh of their herds, or, in the season of fresh pasture, on mingled milk and blood. But they killed only old or sick cattle (as indeed they killed old men who could no longer follow the flock), and the butchers were called "unclean"; nay, they gave the name of parent to no man, but only to the cattle which provided their subsistence. This last point seems to be a confused indication of totemism. They went almost naked; the women wore necklaces of shells as amulets. Marriage was unknown, except among the chiefs—a fact which agrees with the prevalence of female kinship in these regions in much later times. They practised circumcision or a mutilation of a more serious kind. Their burial rites were peculiar. The dead body, its neck and legs bound together with withies of the shrub called *paliurus*, was set up on a mound, and pelted with stones amidst the jeers of the onlookers, until its face was completely covered with them. A goat's horn was then placed above it, and the crowd dispersed with manifestations of joy. It is supposed that the Horim or Horites, the aboriginal inhabitants of Mount Seir, if their name is correctly interpreted "cave-dwellers," were a kindred people to the Troglodytes on the other side of the Red Sea.

TROGON, a word apparently first used as English[1] by G. Shaw (*Mus. Leverianum*, p. 177) in 1792, and now for many years accepted as the general name of certain birds forming the family Trogonidae of modern ornithology. The trogons are birds of moderate size: the smallest is hardly bigger than a thrush and the largest less bulky than a crow. In most of them the bill is very wide at the gape, which is invariably beset by recurved bristles. They seize most of their food, whether caterpillars or fruits, on the wing, though their alar power is not exceptionally great, their flight being described as short, rapid and spasmodic. Their feet are weak and of a unique structure, the second toe, which in most birds is the inner anterior one, being reverted, and thus the trogons stand alone, since in all other birds that have two toes before and two behind it is the outer toe that is turned backward. The plumage is very remarkable and characteristic. There is not a species which has not beauty beyond most birds, and the glory of the group culminates in the quezal (*q. v.*). But in others golden green and steely blue, rich crimson[2] and tender pink, yellow varying from primrose to amber, vie with one another in vivid coloration, or contrasted, as happens in many species, with a warm tawny or a sombre slaty grey—to say nothing of the delicate freckling of black and white, as minute as the markings of a moth's wing—the whole set off by bands of white, producing an effect hardly equalled in any group. The plumage is further remarkable for the large size of its contour-feathers, which are extremely soft and so loosely seated as to come off in scores at a touch, and there is no down. The tail is generally a very characteristic feature, the rectrices, though in some cases pointed, being often curiously squared at the tip, and when this is the case they are usually barred ladder-like with white and black.[3] According to J. Gould, they are larger and more pointed in the young than in the old, and grow squarer and have the white bands narrower at each succeeding moult. He also asserts that in the species which have the wing coverts freckled, the freckling becomes finer with age. So far as has been observed, the nidification of these birds is in holes of trees, wherein are laid without any bedding two roundish eggs, generally white, but certainly in one species (quezal) tinted with bluish green.

The trogons form a very well-marked family, belonging to the coraciiform birds, and probably to be placed in that assemblage near the colies (see MOUSE BIRD) and swifts (*q.v.*). The remains of one, *T. gallicus*, have been recognized by A. Milne-Edwards (*Ois. foss. de la France*, ii. 395, pl. 177, figs. 18-22) from the Micoene of the Allier. This fortunate discovery seems to account for the remarkable distribution of the trogons at the present day. While they chiefly abound, and have developed their climax of magnificence, in the tropical parts of the New World, they yet occur in the tropical parts of the Old. The species now inhabiting Africa, forming the group *Hapaloderma*, can hardly be separated generically from those of the Neotropical *Trogon*, and the difference between the Asiatic forms, if somewhat greater, is still comparatively slight. It is plain then that the Trogons are an exceptionally persistent type; indeed in the whole class few similar instances occur, and perhaps none that can be called parallel. The extreme development of the type in the New World just noticed also furnishes another hint. While in some of the American trogons (*Pharomacrus*, for instance) the plumage of the females is not very much less beautiful than that of the males, there are others in which the hen birds retain what may be fairly deemed a more ancient livery, while the cocks flaunt in brilliant attire. Now the plumage of both sexes in all but one[4] of the Asiatic trogons, *Harpactes*, resembles rather that of the young and of those females of the American species which are modestly clothed. The inference from this fact would seem to be that the general coloration of the Trogons prior to the establishment, by geographical estrangement, of the two types was a russet similar to that now worn by the adults of both sexes in the Indian region, and by a portion only of the females in the Neotropical. The Ethiopian type, as already said, very closely agrees with the American, and therefore would be likely to have been longer in connexion therewith. Again, while the adults of most of the American trogons (*Pharomacrus* and *Euptilotis* excepted) have the edges of the bill serrated, their young have them smooth or only with a single notch on either side near the tip, and this is observable in the Asiatic trogons at all ages. At the same time the most distinctive features of the whole group, which are easily taken in at a glance, but are difficult to express briefly in words, are equally possessed by both branches of the family, showing that they were in all likelihood—for the possibility that the peculiarities may have been evolved apart is not to be overlooked—reached before the geographical sundering of these branches (whereby they are now placed on opposite sides of the globe) was effected.

About sixty species of trogons are recognized, which J. Gould in the second edition of his *Monograph* of the family (1875) divides into seven genera. *Pharomacrus*, *Euptilotis* and *Trogon* inhabit the mainland of tropical America, no species passing to the northward of the Rio Grande nor southward of the forest district of Brazil, while none occur on the west coast of Peru or Chile. *Prionotelus and Tmetotrogon*, each with one species, are peculiar respectively to Cuba and Haiti. The African form *Hapaloderma* has two species, one found only on the west coast, the other of more general range. The Asiatic trogons, *Harpactes* (with eleven species according to the same authority), occur from Nepal to Malacca, in Ceylon, and in Sumatra, Java and Borneo, while one species is peculiar to some of the Philippine Islands. (A. N.)

TROGUS, GNAEUS POMPEIUS, Roman historian from the country of Vocontii in Gallia Narbonensis, nearly contemporary with Livy, flourished during the age of Augustus. His grandfather served in the war against Sertorius with Pompey, through whose influence be obtained the Roman citizenship; hence the name Pompeius, adopted as a token of gratitude to his benefactor. His father served under Julius Caesar in the capacity of secretary and interpreter. Trogus himself seems to have been a man of encyclopaedic knowledge. He wrote, after Aristotle and Theophrastus, books on the natural history of animals and plants, frequently quoted by the elder Pliny. But his principal work was *Historiae Philippicae* in forty-four books, so called because the Macedonian empire founded by Philip is the central theme of the narrative. This was a general history of the world, or rather of those portions of it which came under the sway of Alexander and his successors. It began with Ninus, the founder of Nineveh, and ended at about the same point as Livy (A.D. 9). The last event recorded by the epitomator Justin (*q.v.*) is the recovery of the Roman standards captured by the Parthians (20 B.C.). He left untouched Roman history up to the time when Greece and the East came into contact with Rome, possibly because Livy had sufficiently treated it. The work was based upon the writings of Greek historians, such as Theopompus (also the author of a *Philippica*), Ephorus, Timaeus, Polybius. Chiefly on the ground that such a work was beyond the powers of a Roman, it is generally agreed that Trogus did not gather together the information from the leading Greek historians for himself, but that it was already combined into a single book by some Greek (very probably Timagenes of Alexandria). His idea of history was more severe and less rhetorical than that of Sallust and Livy, whom he blamed for putting elaborate speeches into the mouths of the characters of whom they wrote. Of his great work, we possess only the epitome by Justin, the *prologi* or summaries of the 44 books, and fragments in Vopiscus, Jerome, Augustine and other writers. But even in its present mutilated state it is often an important authority for the ancient history of the East. Ethnographical and geographical excursuses are a special feature of the work.

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[1] *Trogonem* (the oblique case) occurs in Pliny (*H. N.* x. 16) as the name of a bird of which he knew nothing, save that it was mentioned by Hylas, an augur, whose work is lost; but some would read *Trygonem* (turtle-dove). In 1752 Möhring (*Av. Genera*, p. 85) applied the name to the "Curucui" (pronounced "Suruquá," *vide* Bates, *Nat. Amazons*, i. 254) of Marcgrav (*Hist. nat. Brasiliae*, p. 211), who described and figured it in 1648 recognizably. In 1760 Brisson (*Ornithologie*, iv. 164) adopted *Trogon* as a generic term, and, Linnaeus having followed his example, it has since been universally accepted.

[2] Anatole Bogdanoff determined the red pigment of the feathers of *Pharomacrus auriceps* to be a substance which he called "zooxanthine" (*Comptes rendus*, Nov. 2, 1857, xlv. 690).

[3] In the trogon of Cuba, *Prionotelus*, they are most curiously scooped out, as it were, at the extremity, and the lateral pointed ends diverge in a way almost unique among birds.

[4] Or two species if *N. macloti* be more than a local form of *H. reinwardti*.

Fragments edited by A. Bielowski (1853); see also, A. H. L. Heeren, *De Trogi P. fontibus et auctoritate* (prefixed to C. H. Frotscher's edition of Justin); A. Enmann on the authorities used by Trogus for Greek and Sicilian history (1880); A. von Gutschmid, *Über die Fragmente des Pompeius Trogus* (1857); M. Schanz, *Geschichte der römischen Litteratur* (2nd ed., 1899), ii., where all that is known of Timagenes is given; Teuffel-Schwabe, *Hist. of Roman Literature*, § 258; and article JUSTIN.

TROIA, a town and episcopal see of Apulia, Italy, in the province of Foggia, situated 1440 ft. above sea-level, 7 m. N.W. of the station of Giardinetto-Troia, which is 16 m. S.W. of Foggia. Pop. (1901), 6674. Troia occupies the site of the ancient Aecae, 12 m. S. of Luceria, on the Via Traiana, a town which fell to Hannibal after the victory of Cannae, but was won back by the Romans in 214. Under the empire it appears to have become a colony. Troia was itself founded in 1017 by the Greek prefect Basilius Bugianus. The cathedral dates from 1107, but the upper part of the façade with its curious sculptures, fine rose-window and polychromatic decoration, the choir apse and the interior were restored early in the 13th century. The latter has been somewhat spoilt by recent decorations. The bronze doors, partly in relief and partly in niello, of 1119 and 1127 respectively, were cast in Beneventum by Oderisius Berardus. The small domed church of S. Basilio has an ambo of 1158.

TROÏLUS, in Greek legend, son of Priam (or Apollo) and Hecuba. His father, when upbraiding his surviving sons for their cowardice, speaks in the *Iliad* (xxiv. 257) of Troïlus as already slain before the action of the poem commences. According to a tradition drawn from other sources and adopted by Virgil (*Aen.* i. 474), when a mere boy he fell by the hand of Achilles. In another account, he was dragged to death by his own horses. His death formed the subject of a lost tragedy by Sophocles. There is no trace in classical writers of the story of Shakespeare's *Troilus and Cressida*, the materials for which were derived from Chaucer's poem of the same name, Lydgate's *History, Sege, and Destruccion of Troy*, Caxton's *Recuyell of the Historyes of Troy* (trans. from Norman French of Raoul le Fevre), Chapman's translation of Homer, and perhaps a play on the subject by Dekker and Chattle.

TROITSK, a town of eastern Russia, in the government of Orenburg, situated in a fertile steppe, 315 m. N.E. of Orenburg, and 77 m. S. of Chelyabinsk, on the Siberian highway. Pop. (1885), 18,497; (1900), 23,293. It has grown rapidly in modern times. The Troitskiy fort, erected in 1743, became a centre for trade with the Kirghiz steppe and Turkestan, and in that trade Troitsk is now second only to Orenburg. Cotton, silk, and especially horses and cattle are imported, while leather, cotton, woollen and metal wares are exported. An active trade in corn for the Ural gold mines is carried on. The place has ironworks and tanneries.

TROLLE, HERLUF (1516–1565), Danish naval hero, was born on the 14th of January 1516 at Lillö. At the age of nineteen Trolle went to *Vor Frue Skole* at Copenhagen, subsequently completing his studies at Wittenberg, where he adopted the views of Melanchthon, with whom he was in intimate correspondence for some years. His marriage with Brigitte, the daughter of Lord Treasurer Mogens Gjöe, brought him a rich inheritance, and in 1557 he took his seat in the senate. Both Christian III. and Frederick II. had a very high opinion of Trolle's trustworthiness and ability and employed him in various diplomatic missions. Trolle was, indeed, richly endowed by nature, and his handsome face and lively manners made him popular everywhere. His one enemy was his wife's nephew Peder Oxe, the subsequently distinguished finance minister, whose narrow grasping ways, especially as the two men were near neighbours, did not contribute towards family harmony. It was Trolle whom Frederick II. appointed to investigate the charges of malversation brought against Oxe. Both Trolle and his wife were far renowned for their piety and good works, and their whole household had to conform to their example or seek service elsewhere. A man of culture, moreover, he translated David's 31st Psalm into Danish verse. He also promoted literature and learning by educating poor students both at home and abroad, endowing Latin schools and encouraging historical research. In 1559 Trolle was appointed admiral and inspector of the fleet, a task which occupied all his time and energy. In 1563 he superseded the aged Peder Skram as admiral in chief. On the 10th of May he put to sea with twenty-one ships of the line and five smaller vessels and, after uniting with a Lübeck squadron of six liners, encountered, off the isle of Öland, a superior Swedish fleet of thirty-eight ships under Jacob Bagge. Supported by two other Danish ships Trolle attacked the Swedish flagship "Makalös" (Matchless), then the largest battleship in northern waters, but was beaten off at nightfall. The fight was renewed at six o'clock the following morning, when the "Makalös" was again attacked and forced to surrender, but blew up immediately afterwards, no fewer than 300 Lübeck and Danish sailors perishing with her. But the Swedish admiral was captured and the remnant of the Swedish fleet took refuge at Stockholm. Despite the damage done to his own fleet and flagship "Fortuna" by this great victory, Trolle, on the 14th of August, fought another but indecisive action with a second Swedish fleet under the famous Swedish admiral Klas Horn, and kept the sea till the 13th of October. Trolle spent the winter partly at his castle of Herlufsholm completing his long cherished plan of establishing a school for all classes, and partly at Copenhagen equipping a new fleet for the ensuing campaign. On the 1st of June 1565 he set sail with twenty-eight liners, which were reinforced off Femern by five Lübeck vessels. Klas Horn had put to sea still earlier with a superior fleet and the two admirals encountered off Fehmarn on the 4th of June. The fight was severe but indecisive, and both commanders finally separated to repair their ships. Trolle had been severely wounded in the thigh and shoulder, but he would not let the ship's surgeon see to his injuries till every one else had been attended to. This characteristic act of unselfishness was his undoing, for he died at Copenhagen on the 25th of June, seventeen days after they had put him ashore.

TROLLHÄTTAN, a town of Sweden in the district (*län*) of Elfsborg, 45 m. by rail N. by E. of Gothenburg. Pop. 6000. It lies on the left (east) bank of the Göta at the point where that river descends 108 ft. in the course of nearly a mile by the famous falls of Trollhättan (six in number) and several rapids. The scenic setting of the falls is not striking, but the great volume of water, nearly 18,000 cub. ft. per second, renders them most imposing. The narrowed river here surrounds several islands, on either side of one of which (Toppö) are the first falls of the series, Toppö and Tjuf. These are 42 ft. in height. The water-power is used in rolling-mills, a cellulose factory and other works.

Several "giant's caldrons" are seen in the exposed bed of a former channel. Below the falls are valuable salmon fisheries. To the east of the river the Berg canal, part of the Göta canal system, ascends in a series of eleven new locks (Akersvass) completed in 1844. An old series of locks (1800) is in use for small vessels. There are also ruins of an abortive attempt made to lock the falls in 1755. (See Gota.)

TROLLOPE, ANTHONY (1815–1882), English novelist, was born in London, on the 24th of April 1815. His father, Thomas Anthony Trollope (1780–1835), a barrister who had been fellow of New College, Oxford, was reduced to poverty by unbusinesslike habits and injudicious speculation, and in 1829 Anthony's mother, Frances Milton Trollope (1780–1863), went with her husband to the United States to open a small fancy-goods shop in Cincinnati. The enterprise was a failure, but her three years' stay in that country resulted in a book on the *Domestic Manners of the Americans* (1832), of which she gave an unflattering account that aroused keen resentment. Returning to England her husband was compelled to flee the country in order to escape his creditors, and Mrs Trollope thereafter supported him in Bruges until his death by her incessant literary work. She published some books of travel, most of which are coloured by prejudice, and many novels, among the best known of which are *The Vicar of Wrexhill* (1837) and the *Widow Barnaby* (1839), studies in that vein of broad comedy in which lay her peculiar gift. She wrote steadily for more than twenty years, until her death, at Florence, on the 6th of October 1863. (See *Frances Trollope, her Life and Literary Work*, by her daughter-in-law 1895.) Her eldest son Thomas Adolphus Trollope (1810–1892), was educated at Winchester and Oxford, and spent most of his life in Italy. He wrote a number of works on Italian subjects, among them *Homes and Haunts of Italian Poets* (1881), in collaboration with his second wife, Frances Eleanor Trollope, herself a novelist of no mean ability. He was a voluminous author, and perhaps the quantity of his work has obscured its real merit. Among his novels are *La Beata* (1861) *Gemma* (1866), and *The Garstangs of Garstang Grange* (1869). (See his autobiography, *What I Remember* 1887.)

Anthony Trollope was the third son. By his own account few English men of letters have had an unhappier childhood and youth. He puts down his own misfortunes, at Harrow, at Winchester, at Harrow again, and elsewhere, to his father's pecuniary circumstances, which made his own appearance dirty and shabby, and subjected him to various humiliations. But it is permissible to suspect that this was not quite the truth, and that some peculiarities of temper, of which in after life he had many, contributed to his unpopularity. At any rate he seems to have reached the verge of manhood as ignorant as if he had had no education at all. After an experience as usher in a private school at Brussels he obtained, at the age of nineteen, by favour (for he could not pass even the ridiculous examination then usual) a position in the London post office. Even then his troubles were not over. He got into debt; he got into ridiculous entanglements of love affairs, which he has very candidly avowed; he was in constant hot water with the authorities; and he seems to have kept some very queer company, which long afterwards stood him in good stead as models for some of his novels. At last in August 1841 he obtained the appointment of clerk to one of the post office surveyors in a remote part of Ireland with a very small salary. This, however, was practically quadrupled by allowances; living was cheap; and the life suited Trollope exactly, being not office work, which he always hated, but a kind of travelling inspectorship. In the discharge of his duties he evinced a business capacity quite unsuspected by his former superiors. Here he began that habit of hunting which, after a manner hardly possible in later conditions of official work, he kept up for many years even in England. Within three years of his appointment he became engaged to Rose Heseltine, whom he had met in Ireland but who was of English birth. They were married in June 1844. His headquarters had previously been at Banagher; he was now transferred to Clonmel.

Trollope had always dreamt of novel-writing, and his Irish experiences seemed to supply him with promising subjects. With some assistance from his mother he got published his first two books, *The Macdermots of Ballycloran* (1847) and *The Kellys and the O'Kellys* (1848). Neither was in the least a success, though the second perhaps deserved to be, and a third, *La Vendée* (1850), besides being a much worse book than either, was equally a failure. Trollope made various literary attempts, but for a time ill fortune attended all of them. Meanwhile he was set on a new kind of post office work, which suited him even better than his former employment—a sort of roving commission to inspect rural deliveries and devise their extension, first in Ireland, then throughout the west of England and South Wales. That he did good work is undeniable; but his curious conception of official duty, on his discharge of which he prided himself immensely, is exhibited by his confessions that he "got his hunting out of it," and that he felt "the necessity of travelling miles enough"—he was paid by the mileage—"to keep his horses." It was during this work that he struck the vein which gave him fortune and fame. A visit to Salisbury Close inspired him with the idea of *The Warden* (1855). It brought him little immediate profit, nor was even *Barchester Towers*, which followed in 1857, very profitable, though it contains his freshest, his most original, and, with the exception of *The Last Chronicle of Barset*, his best work. The two made him a reputation, however, and in 1858 he was able for the first time to sell a novel, *The Three Clerks*, for a substantial sum, £250. A journey on post office business to the West Indies gave him material for a book of travel, *The West Indies and the Spanish Main* (1859), which he frankly and quite truly acknowledges to be much better than some subsequent work of his in the same line. From this time his production, mainly of novels, was incessant, and the sums which he received were very large, amounting in one case to as much as £3525 for a single book, and to nearly £70,000 in the twenty years between 1859 and 1879. All these particulars are given with great minuteness by himself, and are characteristic. The full high tide of his fortunes began when the *Cornhill Magazine* was established. He was asked at short notice to contribute a novel, and wrote in 1861 *Framley Parsonage*, which was extremely popular; two novels immediately preceding it, *The Bertrams* (1859) and *Castle Richmond* (1860) had been much less successful.

As it will be possible to notice few of his other works, the list of them, a sufficiently astonishing one, may be given here: *Doctor Thorne* (1858); *Tales of All Countries* (3rd series 1863); *Orley Farm*; *North America* (1862); *Rachael Ray* (1863); *The Small House at Allington, Can You Forgive Her?* (1864); *Miss Mackenzie* (1865); *The Belton Estate* (1866); *The Claverings, Nina Balatka, The Last Chronicle of Barset* (1867); *Linda Tressel* (1868); *Phineas Finn, He Knew He Was Right* (1869); *The Struggles of Brown, Jones and Robinson, the Vicar of Bullhampton, An Editor's Tales, The Commentaries of Caesar* (1870); *Sir Harry Hotspur of Humblethwaite, Ralph the Heir* (1871); *The Golden Lion of Granpere* (1872); *The Eustace Diamonds, Australia and New Zealand* (1873); *Phineas Redux, Harry Heathcote of Gangoil, Lady Anna* (1874); *The Way We Live Now* (1875); *The Prime Minister* (1876); *The American Senator* (1877); *Is He Popenjoy? South Africa* (1878); *John Caldigate, An Eye for an Eye, Cousin Henry, Thackeray* (1879); *The Duke's Children, Cicero* (1880); *Ayala's Angel, Dr Wortle's School* (1881); *Frau Frohmann, Lord Palmerston, The Fixed Period, Kept in the Dark, Marion Fay* (1882); *Mr Scarborough's Family, The Land Leaguers* (1883); and *An Old Man's Love* (1884), and several volumes of short stories.

How this enormous total was achieved in spite of official work (of which, lightly as he took it, he did a good deal, and which he did not give up for many years), of hunting three times a week in the season, of whist-playing, of not a little going into general society, he has explained with his usual curious minuteness. He reduced novel-writing to the conditions of regular mechanical work—so much so that latterly he turned out 250 words every quarter of an hour, and wrote at this rate three hours a day. He divided every book beforehand into so many days' work and checked off the amount as he wrote.

A life thus spent could not be very eventful, and its events may be summed up rapidly. In 1858 he went to Egypt on post office business, and at the end of 1859 he got himself transferred from Ireland to the eastern district of England. Here he took a house, at Waltham. He took an active part in the establishment of the *Fortnightly Review* in 1865; he was editor of *St Paul's* for some time after 1867; and at the end of that year he resigned his position in the post office. He stood as a parliamentary candidate for Beverley and was defeated; he received from his old department special missions to America and elsewhere—he had already gone to America during the Civil War. He went to Australia in 1871, and before going broke up his household at Waltham. When he returned he established himself in London, and lived there until 1880, when he removed to Harting, on the confines of Sussex and Hampshire. He had visited South Africa in 1877 and travelled elsewhere. He died of paralysis on the 6th of December 1882.

Of Trollope's personal character it is not necessary to say much. Strange as his conception of official duty may seem, it was evidently quite honest and sincere, and, though he is said to have been as an official popular neither with superiors nor inferiors, he no doubt did much good work. Privately he was much liked and much disliked—a great deal of real kindness being accompanied by a blustering and overbearing manner, and an egotism, not perhaps more deep than other men's, but more vociferous. None of his literary work except the novels is remarkable for merit. His *Caesar* and *Cicero* are curious examples of a man's undertaking work for which he was not in the least fitted. *Thackeray* exhibits, though Trollope appears to have both admired Thackeray as an artist and liked him as a man, grave faults of taste and judgment, and a complete lack of real criticism. The books of travel are not good, and of a kind not good. *Nina Balatka* and *Linda Tressel*—stories dealing with Prague and Nuremberg respectively—were published anonymously and as experiments in the romantic style. They have been better thought of by the author and by some competent judges than by the public or the publishers. *The Struggles of Brown, Jones and Robinson* was still more disliked, and is certainly very bad as a whole, but has touches of curious originality in parts. Trollope seldom creates a character of the first merit; at the same time his characters are always alive. Dr Thorne, Mr Harding, who has the courage to resign his sinecure in *The Warden*, Mr Crawley, Archdeacon Grantley, and Mrs Proudie in the same ecclesiastical series, are distinct additions to the *personae* of English fiction. After his first failures he never produced anything that was not a faithful and sometimes a very amusing transcript of the sayings and doings of possible men and women. His characters are never marionettes, much less sticks. He has some irritating mannerisms, notably a trick of repetition of the same form of words. He is sometimes absolutely vulgar—that is to say, he does not deal with low life, but shows, though always robust and pure in morality, a certain coarseness of taste. He is constantly rather trivial, and perhaps nowhere out of the Barset series (which, however, is of itself no inconsiderable work) has he produced books that will live. The very faithfulness of his representation of a certain phase of thought, of cultivation, of society, uninformed as it is by any higher spirit, in the long run damaged, as it had first helped, the popularity of his work. But, allowing for all this it may and must still be said that he held up his mirror steadily to nature, and that the mirror itself was fashioned with no inconsiderable art.

Trollope wrote an *Autobiography*, edited by his son Henry M. Trollope in 1883, explaining his literary methods with amusing frankness. See also Sir L. Stephen's *Studies of a Biographer* (1898), James Bryce's *Studies in Contemporary Biography* (1903), and Henry James's *Partial Portraits* (1888).

TROMBA MARINA, or MARINE TRUMPET (Fr. *trompette marine*; Ger. *Marine Trompete, Trompetengeige, Nonnengeige, Tympanischiza* or *Trummscheit*), a triangular bowed instrument about 6 ft. in length, which owes its characteristic timbre to the peculiar construction of the bridge. The tromba marina consists of a body and neck in the shape of a truncated cone resting on a triangular base. In the days of Michael Praetorius (1618), the length of the Trummscheit was 7 ft. 3 in. and the three sides at the base measured 7 in., tapering to 2 in. at the neck. These measurements varied considerably, as did also the shape of the body and the number of strings. In some cases the base of the body was left open, and in others there were sound-holes. The bridge, from its curiously irregular shape, was known as the "shoe"; it was thick and high at the one side on which rested the string, and low and narrow at the other which was left loose so that it vibrated against the belly with every movement of the bow, producing a trumpet-like timbre. It is to this feature, in conjunction with its general resemblance in contour to the marine speaking-trumpet of the middle ages, that the name of the instrument is doubtless due.

There was at first but one string, generally a D violoncello string, which was not stopped by the fingers in the usual way, but played only in harmonics by lightly touching it with the thumb at the nodal points. The heavy blow, similar to that of the violoncello, is used between the highest positions of the left hand at the nodal points and the nut of the head. In a Trummscheit in the collection of the Kgl. Hochschule, at Charlottenburg (No. 772 in catalogue) the frets are lettered A,D,F,A,D,F,G,A,B,C,D. Sometimes an octave string, half the length of the melody string, and even two more, respectively the twelfth and the double octave, not resting on the bridge but acting as sympathetic strings, were added to improve the timbre by strengthening the pure harmonic tones without increasing the blare due to the action of the bridge. In Germany, at the time when the trumpet was extensively used in the churches, nuns often substituted the tromba marina, whence the name *Nonnengeige*. In France, the Grande Écurie du Roi comprised five trumpets-marine and cromornes among the band in 1662, when the charge was mentioned for the first time in the accounts; and in 1666 the number was increased to six. The instrument fell into disuse during the first half of the 18th century, and was only to be seen in the hands of itinerant and street musicians. (K. S.)

TROMBONE (Fr. *trombone*, Ger. *Posaune*, Ital. *trombono*), an important member of the brass wind family of musical instruments formerly known as *sackbut*. The trombone is characterized by the *slide*, consisting of two parallel cylindrical tubes, over which two other cylindrical tubes, communicating at their lower extremities by means of a short semicircular pipe, slip without loss of air. The outer tube, therefore, slides upon the inner, and as it is drawn downwards by the right hand opens a greater length of tube proportional to the depth of pitch required. When the slide is closed the instrument is at its highest pitch. To the upper end of one of the inner tubes is fastened the cup-shaped mouthpiece and to the end of the other tube is fixed the bell-joint. This joint, on the proper proportions of which depend in a greater measure the acoustic properties of the trombone, consists of a length of tubing with conical bore widening out into a large bell and doubled back once upon itself in a plane at right angles to that of the slide. The bell-joint is strengthened by two or three stays, and the slide also has two, one between the inner immovable tubes and the other on the outer sliding tubes, by means of which the slide is drawn out and pushed in.

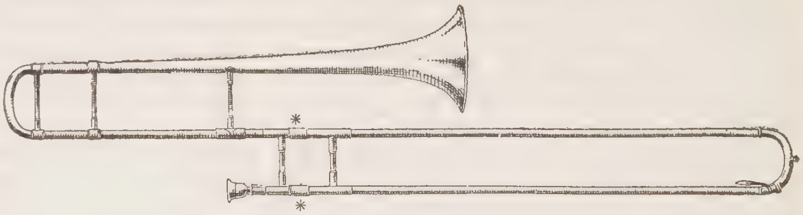
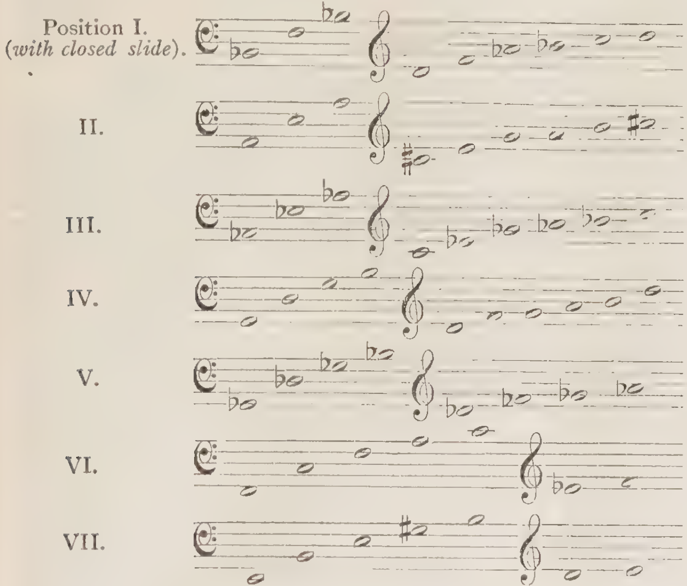


FIG. 1.—Tenor Trombone (Besson & Co.).

Sound is produced on the trombone, as on the horn, by means of the lips stretched like a vibrating reed across the cup mouthpiece from rim to rim; the acoustic principles involved are the same for both instruments. By overblowing, *i.e.* by the varying tension of the lips and pressure of breath, the harmonic series is obtained, which is effective between the second and the tenth harmonics, the fundamental being but rarely of practical use.

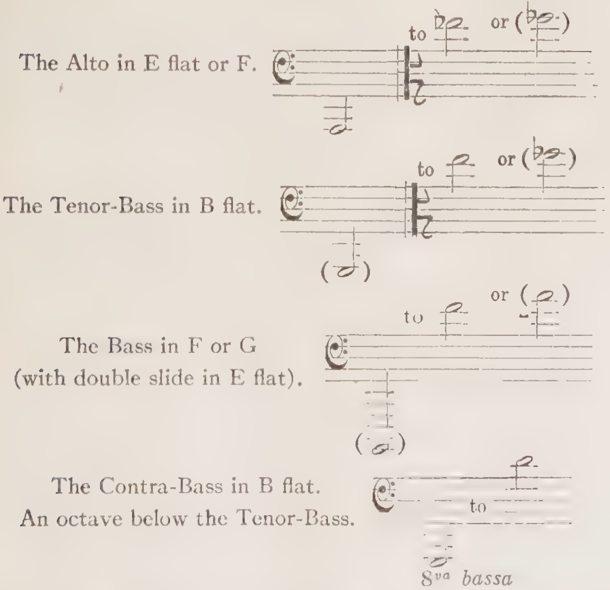
There are seven positions of the slide on the trombone, each giving a theoretical fundamental tone and its upper partials a semitone lower than the last, and corresponding to the seven shifts on the violin and to the seven positions on valve instruments. These seven positions are found by drawing out the slide a little more for each one, the first position being that in which the slide remains closed. The performer on the trombone is just as dependent on an accurate ear for finding the correct positions as a violinist.

The table of harmonics for the seven positions of the tenor trombone in B♭ is appended; they furnish a complete chromatic compass of two octaves and a sixth.



These notes represent all the notes in practical use, although it is possible to produce certain of the higher harmonics. The instrument being non-transposing, the notation represents the real sounds.

The four chief trombones used in the orchestra are the following:—


The Alto in E flat or F.
to
or
The Tenor-Bass in B flat.
to
or
The Bass in F or G
(with double slide in E flat).
to
or
The Contra-Bass in B flat.
An octave below the Tenor-Bass.
to
8va *bassa*

The compass given above is extreme and includes the notes obtained by means of the slide; the notes in brackets are very difficult; the fundamental notes, even when they can be played, are not of much practical use. The contra-bass trombone, although not much in request in the concert hall, is required for the *Nibelungen Ring*, in which Wagner has scored effectively for it.

The quality of tone varies greatly in the different instruments and registers. The alto trombone has neither power nor richness of tone, but sounds hard and has a timbre between that of a trumpet and a French horn. The tenor and bass have a full rich quality suitable for heroic, majestic music, but the tone depends greatly on the performer's method of playing; the modern tendency to produce a harsh, noisy blare is greatly to be deplored.

Besides the slide trombone, which is most largely used, there are the valve trombones, and the double-slide trombones. The former are made in the same keys as the instruments given above and are constructed in the same manner, except that the slide is replaced by three pistons, which enable the performer to obtain a greater technical execution; as the tone suffers thereby and loses its characteristic timbre, the instruments have never become popular in England.

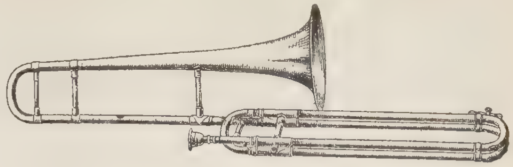


Fig. 2.

The double-slide trombone (fig. 2)—patented by Messrs Rudall Carte & Co. but said to have been originally invented by Halary in 1830—is made in B♭, G bass and E♭ contrabass. In these instruments each of the branches of the slide is made half the usual length. There are four branches instead of two and the two pairs lie one over the other, each pair being connected at the bottom by a semicircular tube and the second pair similarly at the top as well. The usual bar or stay suffices for drawing out both pairs of slides simultaneously, but as the lengthening of the air column is now doubled in proportion to the shift of the slide, the extension of arm for the lower positions is lessened by half, which increases the facility of execution but calls for greater nicety in the adjustment of the slide, more especially in the higher positions.

The history of the evolution of the trombone from the buccina is given in the article on the Sackbut (*q.v.*), the name by which the earliest *draw* or *slide* trumpets were known in England. The Germans call the trombone *Posaune*, formerly *buzaun*, *busine*, *pusin* or *pusun* in the poems and romances of the 12th and 13th century, words all clearly derived from the Latin *buccina*. The modern designation "large trumpet" comes from the Italian, in which *tromba* means not only trumpet, but also pump and elephant's trunk. It is difficult to say where or at what epoch the instrument was invented. In a psalter (No. 20) of the 11th century, preserved at Boulogne, there is a drawing of an instrument which bears a great resemblance to a trombone deprived of its bell. Sebastian Virdung, Ottmar Luscinius, and Martin Agricola say little about the trombone, but they give illustrations of it under the name of *busaun* which show that early in the 16th century it was almost the same as that employed in our day. It would not be correct to assume from this that the trombone was not well known at that date in Germany, and for the following reasons. First, the art of trombone playing was in the 15th century in Germany mostly in the hands of the members of the town bands, whose duties included playing on the watch towers, in churches, at pageants, banquets and festivals, and they, being jealous of their privileges, kept the secrets of their art closely, so that writers, such as the above, although acquainted with the appearance, tone and action of the instrument would have but little opportunity of learning much about the method of producing the sound. Secondly, German and Dutch trombone players are known to have been in request during the 15th century at the courts of Italian princes.[1] Thirdly, Hans Neuschel of Nuremberg, the most celebrated performer and maker of his day, had already won a name at the end of the 15th century for the excellence of his "Posaunen," and it is recorded that he made great improvements in the construction of the instrument in 1498,[2] a date which probably marks the transition from sackbut to trombone, by enlarging the bore and turning the bell-joint round at right angles to the slide. Finally in early German translations of Vegetius's *De re militari* (1470) the buccina is described (bk. III., 5) as the trumpet or posaun which is drawn in and out, showing that the instrument was not only well known, but that it had been identified as the descendant of the buccina.

By the 16th century the trombone had come into vogue in England, and from the name it bore at first, not *sackbut*, but *shakbusshe*, it is evident that the instrument had been introduced from Spain and not from France (where it bore the name of saquebute), as some have assumed from the more frequent use of the word sackbut. The band of musicians in the service of Henry VIII. included ten sackbut players, and under Elizabeth, in 1587, there were six English instrumentalists then enjoyed a certain reputation and were sought for by foreign courts; thus in 1604 Charles III. of Lorraine sought to recruit his sackbut players from English bands.[1] Praetorius[2] classes the trombones in a complete family, the relative tonalities of which were thus composed: 1 *Alt-Posaun*, 4 *Gemeine rechte Posaunen*, 2 *Quart-Posaunen*, 1 *Octav-Posaun*—eight in all. The Alt-posaun was in D. With the slide closed, it gave the first of the accompanying harmonics:—

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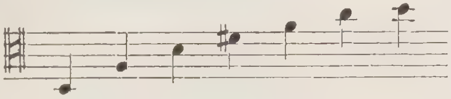
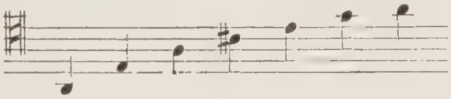
[1] E. Van der Straeten, *Les Musiciens néerlandais* p. 26.

[2] See G. von Retberg "Zur Gesch. d. Musik-instrumente" in *Anzeiger für Kunde der deutschen Vorzeit* p. 241. (Nuremberg, 1860), See also letters from Jorg Neuschell 1540–1545 in *Monatshefte f. Musikwissenschaft*, ix. p. 149 seq.



The gemeine rechte Posaunen, or ordinary trombones, were in A. Without using the slide they gave the subjoined sounds:—



The Quart-Posaun was made either in E, the fourth below the gemeine rechte Posaun, or in D, the lower fifth. In the latter case it was exactly an octave below the Alt-Posaun. The Octav-Posaun was in A. It was constructed in two different fashions: either it had a length double that of the ordinary trombone, or the slide was shortened, the length of the column of air being still maintained by the adaptation of a crook. The first system, which was invented by Hans Schreiber four years before the work of Praetorius appeared, gave the instrumentalist a slide by which he could procure in the lower octave all the sounds of the ordinary trombone. The second system, which Praetorius had known for years, was distinguished from the first, not only by modifications affecting the form, but also by a larger bore. Mersenne[3] calls the trombone *trompette harmonique*, or *tuba tractilis*. He describes carefully the seven positions and gives the diatonic scale for the first octave, but he does not, like Praetorius, mention the pitch of the trombones in use in his day. He established this fact, however, that it was customary in France, as in Germany, to lower the instrument a fourth below the pitch of the ordinary trombone by means of a *tortil*, a kind of crook with a double turn that was fitted between the bell and the slide, "in order," he said, "to make the bass to hautbois concerts." This system, so simple and rational, might have been expected always to serve for the basis of the technique of the instrument; but from the middle of the 18th century the art of playing the trombone became the object of purely empiric teaching. Owing to the decline in the popularity of the trombone during the 18th century in England, France, Germany and Italy, writers of that period are sometimes at a loss to describe the working and effect of the slide, as were the early 16th-century authors. J. J. Eisel, and after him Jacob Lotter, whose work is a *réchauffé* of Eisel's, mention four principal positions, "the others not being of much importance." The lowering of the pitch effected by means of these four positions, however, is almost equal to that of the seven positions of the modern trombone. The tenor or ordinary trombone is given as an example. It stood in the first position in A. The second position, equal to the modern third produced the harmonic series of the fundamental G one tone lower than the first position. The third position gave F again a tone lower and corresponding to our sixth position. The fourth position, which extended so far outward "that the arm could hardly reach it," gave E as fundamental. The intermediate semitones, instead of being considered as positions, are treated as accidentals, lowering or raising any note obtained in one of the positions by drawing out, or pushing in, the slide approximately an extra two-fingers breadth. It would not be correct to state without qualification that four positions only were used on the trombone in the 18th century.

Samuel Wesley, who has left notes on the scales of various instruments, in his own hand (Add MS. 35011 fol. 166 Brit. Mus.), has added under the scales of the trombones—bass, tenor and alto—the remark "sacbut or double trumpet, the scale of which is wanting."

Of all wind instruments the trombone has perhaps been least modified in form; changes have occasionally been attempted, but for the most part with only trifling success. The innovation which has had the most vogue dates from the end of the 18th century; it consisted in bending the tube of the bell in a half circle above the head of the executant, which produced a very bizarre effect. It also gave rise to very serious inconveniences: by destroying the regularity of the proportions of the bell it prejudicially affected the quality of tone and intonation of the instrument. For a long time the curved bell with its serpent's mask known as the Bucin—a term borrowed from the French in this instance—was maintained in military music, and it is not so very long since it was completely given up. By giving a half turn more to the bell tube its opening was directed to the back of the executant; but this form, in fashion for a little while about 1830, was not long adhered to, and the trombone reassumed its primitive form, which is still maintained. As appears from a patent deposited by Stölzel and Blümel at Berlin on the 12th of April 1818 the application of ventils or pistons was then made for the first time.[4] The ventils, at first two in number, effected a definite lengthening of the instrument. The first augmented the length of the tube by a tone, lowering by as much the natural harmonics. The second produced a similar effect for a semitone, and the simultaneous employment of the two pistons resulted in the depression of a tone and a half. The principle, therefore, of the employment of ventils or pistons is the same as that which governs the use of slides (see VALVES). Notwithstanding the increased facility obtained by the use of pistons, they are very far from having gained the suffrage of all players: many prefer the slide, believing that it gives a facility of emission that they cannot obtain with a piston trombone. The flat tonalities having been preferred for military music since the beginning of the 19th century the pitch of each variety of trombones has been raised a semitone. At present six trombones are more or less in use, viz. the alto trombone in F, the alto in E♭ (formerly in D), the tenor in B♭ (formerly in A), the bass in G, the bass in F (formerly in E), the bass in E♭ (formerly in D), and the contrabass in B♭. This transposition has no reference to the number of vibrations that may be officially or tacitly adopted as the standard pitch of any country or locality. A trombone an octave lower than the tenor has recently been reintroduced into the orchestra, principally by Wagner. The different varieties just cited are constructed with pistons or slides, as the case may be.

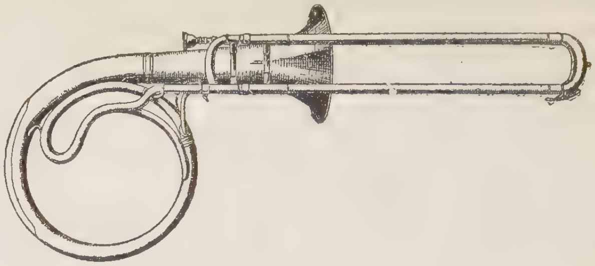


FIG. 3.—Contrabass Trombone (Boosey & Co.).

Further information on the trombone will be found in the monographs by the Rev. F. W. Galpin, "The Sackbut: its Evolution and History," *Proc. Mus. Assoc.* (1906–1907); by Victor Mahillon, *Le Trombone, son histoire, sa théorie, sa construction* (Brussels, London, 1907). Before his recent death Professor George Case had in preparation an important work on the trombone. (V. M.; K. S.)

TROMP, the name of two famous Dutch admirals.

1. MARTIN HARPERTZOON TROMP (1597–1653) was born at Brielle, South Holland, in 1597. At the age of eight he made a voyage to the East Indies in a merchantman, but was made prisoner and spent several years on board an English cruiser. On making his escape to Holland he entered the navy in 1624, and in 1637 was made lieutenant-admiral. In February 1639 he surprised, off the Flemish coast near Gravelines, a large Spanish fleet, which he completely destroyed, and in the following September he defeated the combined fleets of Spain and Portugal off the English coast—achievements which placed him in the first rank of Dutch naval commanders. On the outbreak of war with England Tromp appeared in the Downs in command of a large fleet and anchored off Dover. On the approach of Blake he weighed anchor and stood over towards France, but suddenly altered his course and bore down on the English fleet, which was much inferior to his in numbers. In the engagement which followed (May 19, 1652) he had rather the worst of it and drew off with the loss of two ships. In November he again appeared in command of eighty ships of war, and a convoy of 300 merchantmen, which he had undertaken to guard past the English coast. Blake resolved to attack him, and, the two fleets coming to close quarters near Dungeness on the 30th of November, the English, after severe losses, drew off in the darkness and anchored off Dover, retiring next day to the Downs, while Tromp anchored off Boulogne

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[1] See A. Jacquot, *La Musique en Lorraine*, p. 61.

[2] *Organographia* (Wolfenbüttel, 1619).

[3] *Harmonie universelle* (Paris, 1636).

[4] This was mentioned in the Leipzig *Allg. musik. Ztg.* (1815), the merit of the invention being assigned to Heinrich Stölzel of Pless in Silesia.

till the Dutch merchantmen had all passed beyond danger. The statement that he sailed up the Channel with a broom at his masthead in token of his ability to sweep the seas is probably mythical. In the following February (1653), while in charge of a large convoy of merchantmen, he maintained a running fight with the combined English fleets under Blake, Penn and Monk off Portland to the sands of Calais, and, though baffling to some extent the purposes of the English, had the worst of the encounter, losing nine ships of war and thirty or forty merchantmen. On the 3rd of June he fought an indecisive battle with the English fleet under Richard Dean in the Channel, but the arrival of reinforcements under Blake on the following day enabled the English to turn the scale against him and he retired to the Texel with the loss of seventeen ships. Greatly discouraged by the results of the battle, the Dutch sent commissioners to Cromwell to treat for peace, but the proposal was so coldly received that war was immediately renewed, Tromp again appearing in the Channel towards the end of July 1653. In the hotly contested conflict which followed with the English under Monk on the 29th Tromp was shot by a musket bullet through the heart. He was buried with great pomp at Delft, where there is a monument to his memory in the old church.

2. CORNELIUS VAN TROMP (1629–1691), the second son of the preceding, was born at Rotterdam on the 9th of September 1629. At the age of nineteen he commanded a small squadron charged to pursue the Barbary pirates. In 1652 and 1653 he served in Van Galen's fleet in the Mediterranean, and after the action with the English fleet off Leghorn on the 13th of March 1653, in which Van Galen was killed, Tromp was promoted to be rear-admiral. On the 13th of July 1665 his squadron was, by a hard stroke of ill-fortune, defeated by the English under the duke of York. In the following year Tromp served under De Ruyter, and on account of De Ruyter's complaints of his negligence in the action of the 5th of August he was deprived of his command. He was, however, reinstated in 1673 by the stadtholder William, afterwards king of England, and in the actions of the 7th and of the 14th of June, against the allied fleets of England and France, manifested a skill and bravery which completely justified his reappointment. In 1675 he visited England, where he was received with honour by King Charles II. In the following year he was named lieutenant-admiral of the United Provinces. He died at Amsterdam, on the 29th of May 1691, shortly after he had been appointed to the command of a fleet against France. Like his father he was buried at Delft.

See H. de Jager, *Het Geslacht Tromp* (1883).

TROMSÖ, a seaport of Norway, capital of the *amt* (county) and *stift* (diocese) of the same name on the north-western coast. Pop. (1900), 6955. It stands on the eastern shore of a low fertile islet between Kvalö and the mainland, in 69° 38′ N., 18° 55′ E. (the latitude is that of Disco, Greenland). The vegetation of the island (mountain ash and birch) is remarkably luxuriant. The buildings, mostly of wood, include the town-hall and a museum, which contains a good zoological collection. Sealskins and other furs, and whale and seal oil, are exported, and the herring fishery is very productive. Imports are coal, textiles, salt, grain and flour. Mean temperature of year 36·4° F.; February 25°; July 51·8°. Tromsö was founded in 1794. A number of Lapps usually encamp in the neighbouring Tromsdal during summer. The coast scenery, with its islands and snowy mountains, is wild and beautiful.

TRONCHET, FRANÇOIS DENIS (1726–1806), French jurist, was born in Paris on the 23rd of March 1726. He was an avocat at the parlement of Paris, and gained a great reputation in a consultative capacity. In 1789 he was elected deputy to the states-general. In the Constituent Assembly he made himself especially conspicuous by his efforts to obtain the rejection of the jurisdiction of the jury in civil cases. In the king's trial, he was chosen by Louis as counsel for the defence, and performed this difficult and dangerous task with high ability and courage. During the Directory he was deputy at the Council of the Ancients, where he unsuccessfully opposed the resolution that judges be nominated by the executive directory. Under the Consulate he was president of the tribunal of cassation, and collaborated in preparing the final scheme for the civil code. He had a marked influence on the code, and succeeded in introducing common law principles in spite of the opposition of his colleagues, who were deeply imbued with Roman law. He died on the 10th of March 1806, being the first senator of the empire to be buried in the Panthéon.

See François de Neufchâteau, *Discours sur Tronchet* (Paris, undated); Coqueret, *Essai sur Tronchet* (Caen, 1867).

TRONDHJEM, or THRONDHJEM (sometimes written in the German form *Drontheim*), a city and seaport of Norway, chief town of the *stift* (diocese) of Trondhjem and the *amt* (county) of South Trondhjem, 384 m. by rail N. of Christiania. Pop. (1900), 38,156. It lies on the south side of the broad Trondhjem Fjord on a low peninsula between the fjord and the River Nid, its situation, though picturesque, lacking the peculiar beauty of that of Christiania or Bergen. The latitude is 63° 26′ N., that of southern Iceland. In front of the town is the islet of Munkholm, formerly a monastery and now a fortress; on the high ground to the east is the small stronghold of Christiansten. The houses are principally of wood, and the streets are wide, as a precaution against the spreading of fire. The principal building is the cathedral, standing finely on a slightly elevated open site, and dating in part from the close of the 11th century, but chiefly belonging to the 12th and 13th centuries (*c.* 1161–1248). Its extreme length is 325 ft. and its extreme breadth 124 ft.; but in the 14th, 15th and 17th centuries it suffered greatly from repeated fires, and after the last of these the nave was completely abandoned and soon became a heap of ruins. The whole building, however, had been extensively and judiciously restored, and is the finest church in Norway and the scene of the coronation of the Norwegian sovereigns. It is cruciform, with a central tower, and has an eastern octagon which may have been copied from the corona of Canterbury Cathedral, as Eystein, archbishop of Trondhjem (1160–1188) and an active builder, was in England during his episcopate. The cathedral contains rich work in Norman style, and also much that is comparable with the best Early English. In the museums at Trondhjem there are interesting zoological and antiquarian collections, also exhibits illustrative of the fisheries and other industries. The port, which has regular communication with all the Norwegian coast towns—Hull, Newcastle, Hamburg, &c.—carries on an extensive trade in timber, oil, fish, copper, &c. The industries include shipbuilding, saw-milling, wood-pulp and fish-curing works and machine shops. Imports (coal, grain, salt, machinery, &c.) come chiefly from Great Britain. A considerable portion of the exports pass into Sweden by the Meraker railway.

Trondhjem, originally Nidaros, was founded by Olaf Tryggvason, who built a royal residence and a church here in 996. It was made an archbishopric in 1152. The city attained its highest development about the latter half of the 13th century, by which time it had become an important pilgrimage centre and had as many as fifteen churches. It sustained frequent sieges, as well as devastating conflagrations. Its importance declined about the time of the Reformation when it ceased to be a resort of pilgrims.

TROON, a police burgh, seaport and watering-place of Ayrshire, Scotland. Pop. (1901), 4764. It is situated 6 m. N. by W. of Ayr, and 35 m. S.W. of Glasgow by the Glasgow & South-Western railway. It has the best natural harbour in the county, with over a mile of quayage, a breakwater 3000 ft. long, and two graving docks. Shipbuilding is the leading industry, and there is a rope and sail factory. The town contains a public hall and library and reading-room. The municipality controls the waterworks and gasworks. Fullarton House, 1 m. south-east, is a seat of the duke of Portland; and at Auchans, about 3 m. west, Susannah, countess of Eglinton, in 1773 entertained Dr Johnson. Adjoining this estate stands the ruined castle of the Dundonalds.

TROOP (an adaptation of Fr. *troupe*, O. Fr. *trope*; cf. Ital. *troppa, truppa*; Med. Lat. *truppus*; the origin is doubtful; suggestions have been made that it represents a German conception of Latin *turba*, crowd, or is an adaptation of Norw. *torp*, flock), a company or assemblage of persons, the term being usually applied in the plural to a body of soldiers of varying strength and of different arms. Specifically, a "troop" is one of the smaller units into which a regiment of horse-soldiers is divided, forming a subdivision of a squadron. Roughly speaking, it consists of sixteen files, and does not exceed from 30 to 40 sabres; in some armies, however, a maximum limit of 60 sabres are found (see CAVALRY). For the military ceremony known as "trooping of the colours," see COLOURS, MILITARY.

TROPHY (Gr. τρόπαιον, from τρέπω, put to flight; Lat. *tropaeum*), in classical antiquities, in the strict sense a memorial of victory set up on the field of battle at the spot where the enemy had been routed. It consisted of captured arms and standards hung upon a tree (preferably an olive or an oak) and booty heaped up at its foot, dedicated to the god to whom the victory was attributed, especially Zeus Tropaeus. If no suitable tree was at hand, a lopped trunk was fixed in the ground on an eminence. The tree or trunk bore an inscription containing the names of the god and the combatants, a list of the booty and of the chief incidents of the battle or the entire war. In the case of a naval victory the trophy, composed of the beaks of ships (sometimes an entire ship), was generally set up on the nearest beach and consecrated to Poseidon. It was regarded as a sacrilege to destroy a trophy, since it was dedicated to a god; but, on the other hand, one that had fallen to pieces through lapse of time was not restored, to prevent feelings of resentment being kept alive. For the same reason trophies of stone or metal were forbidden by law, although this rule was not always observed. To facilitate reconciliation with their conquered foes, neither the Macedonians nor the Romans in early times erected such trophies. The usual custom was to take home the spoils, and to use them for decorating public buildings and private houses. The first example of a trophy set up after the Greek fashion occurs in 121 B.C., when Domitius Ahenobarbus celebrated his victory over the Allobroges in this manner. Although instances are not uncommon in later times, the Romans still showed a preference for setting up the memorials of victory in Rome rather than on the field of battle. These were decorated with the spoils, and were themselves called trophies; such were the trophies of Marius recording his victories over Jugurtha and the Cimbri and Teutones. In later republican and imperial times enormous columns, on which the chief incidents of a battle or war were represented in bas-relief, were frequently erected, the most famous and most perfect example being the column of Trajan (see ROME: *Archaeology*, "The Imperial Forums").

TROPIC-BIRD, so called of sailors from early times,[1] because as W. Dampier (*Voyages*, i. 53) among many others testifies, it is "never seen far without either Tropick"; hence, indulging a pretty fancy, Linnaeus bestowed on it the generic term, continued by modern writers, of *Phaethon*, in allusion to its attempt to follow the path of the sun.[2] There are certainly three well-marked species of this genus, but their respective geographical ranges have not yet been definitely laid down. All of them can be easily known by their totipalmate condition, in which the four toes of each foot are united by a web, and by the great length of the two middle tail-quills, which project beyond the rest, so as to have gained for the birds the name of "Rabijunco," "Paille-en-queue" and "Pijlstaart" among mariners of different nations. These birds fly to a great distance from land and seem to be attracted by ships, frequently hovering round or even settling on the mast-head. Their flight is performed by rapid strokes, unlike the action of other long-winged sea-fowl, and they are rarely seen on the water.

The yellow-billed tropic-bird, *P. flavirostris* or *candidus*, appears to have habitually the most northerly, as well, perhaps, as the widest range, visiting Bermuda yearly to breed there, but also occurring numerously in the southern Atlantic, the Indian, and a great part of the Pacific Ocean. In some islands of all these three it breeds, sometimes on trees, which the other species are not known to do. However, like the rest of its congeners, it lays but a single egg, and this is of a pinkish white, mottled, spotted, and smeared with brownish purple, often so closely as to conceal the ground colour. This is the smallest of the group, and hardly exceeds in size a large pigeon; but the spread of its wings and its long tail make it appear more bulky than it really is. Except some black markings on the face (common to all the species known), a large black patch partly covering the scapulars and wing-coverts, and the black shafts of its elongated rectrices its ground colour is white, glossy as satin, and often tinged with roseate. Its yellow bill readily distinguishes it from its larger congener *P. aethereus*, but that has nearly all the upper surface of the body and wings closely barred with black, while the shafts of its elongated rectrices are white. This species has a range almost equally wide as the last; but it does not seem to occur in the western part of the Indian Ocean. The third and largest species, the red-tailed tropic-bird, *P. rubricauda* or *phoenicurus*, not only has a red bill, but the elongated and very attenuated rectrices are of a bright crimson red, and when adult the whole body shows a deep roseate tinge. The young are beautifully barred above with black arrow-headed markings. This species has not been known to occur in the Atlantic, but is perhaps the most numerous in the Indian and Pacific oceans, in which last great value used to be attached to its tail-feathers to be worked into ornaments.[3]

That the tropic-birds form a distinct family, Phaethontidae, of the Steganopodes (the Dysporomorphae of Huxley), was originally maintained by Brandt, and is now generally admitted, yet it cannot be denied that they differ a good deal from the other members of the group[4]; indeed St G. Mivart in the Zoological *Transactions* (x. 364) hardly allowed *Fregata* and *Phaethon* to be steganopodous at all; and one curious difference is shown by the eggs of the latter, which are in appearance so wholly unlike those of the rest. The osteology of two species has been well described and illustrated by Alph. Milne-Edwards in A. Grandidier's fine *Oiseaux de Madagascar* (pp. 701–704, pls. 279–281*a*). (A. N.)

TROPINE, $C_8H_{15}NO$, a base formed together with tropic acid, $C_9H_{10}O_3$, in the hydrolysis of the alkaloid atropine (K. Kraut, *Ann.*, 1863, 128, p. 280; 1865, 133, p. 87). It crystallizes in plates which melt at 63° C. and boil at 233° C.; it is very hygroscopic and easily soluble in water. It is an optically inactive, strongly alkaline tertiary base. On heating with sodium in amyl alcoholic solution it it sransformed into a stereo-isomer, identical with the ψ-tropine obtained by hydrolysing tropa-cocaine with hydrochloric acid. It possesses alcoholic properties, since it forms esters, the so-called "tropeïnes." On distillation with caustic baryta or soda lime it decomposes into methylamine and tropilidine, C_7H_8 (A. Ladenburg, *Ann.* 1883, 217, p. 74), the same hydrocarbon being also obtained when it is destructively methylated, a certain amount of tropiline, $C_7H_{10}O$, being produced simultaneously When heated with fuming hydrochloric acid to 150–180° C. it yields tropidine, $C_8H_{13}N$, and with hydriodic acid similarly forms an iodo-compound, $C_8H_{15}NI_2$, which, on reduction with zinc and hydrochloric acid, is converted into hydrotropidine, $C_8H_{15}N$. It yields various oxidation products. With an alkaline solution of potassium permanganate it yields tropigenine, $C_7H_{13}NO$; with chromic acid in the presence of acetic acid it yields tropinone, $C_8H_{13}NO$; and with chromic acid in the presence of sulphuric acid it yields tropinic acid, $C_6H_{11}N(CO_2H)_2$.

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[1] More recently sailors have taken to call it "Boatswain-bird"—a name probably belonging to a very different kind. (See SKUA.)

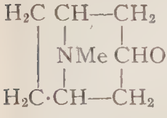
[2] Occasionally, perhaps through violent storms, tropic-birds wander very far from their proper haunts. In 1700 Leigh, in his *Nat. Hist. Lancashire* (i. 164, 195, Birds, pl. i., fig. 3), described and figured a "Tropick Bird" found dead in that county. Another is said by Mr Lees (*Zoologist*, 2nd series, p. 2666) to have been found dead at Cradley near Malvern—apparently before 1856 (J. H. Gurney, jun., *op. cit.*, p. 4766)—which, like the last, would seem (W. H. Heaton, *op. cit.*, p. 5086) to have been of the species known as *P. aethereus.* Naumann was told (*Rhea*, i. 25) of its supposed occurrence at Heligoland, and Colonel Legge (*B. Ceylon*, p. 1174) mentions one taken in India 170 m. from the sea. The case cited by Degland and Gerbe (*Ornith. européenne*, ii. 363) seems to be that of an albatross.

[3] A fourth species, *P. indicus*, has been described from the Gulf of Oman, but doubt has been expressed as to its validity (Legge, pp. 1173, 1174).

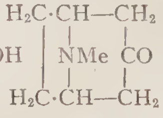
[4] Sulidae (Gannet), Pelecanidae (Pelican), Plotidae (Snake-bird). Phalacrocoracidae (Cormorant,) and Fregatidae (Frigate-bird).

Tropidine, $C_8H_{13}N$, is a liquid having an odour resembling that of conine. It is a strong tertiary base, and is an unsaturated compound, forming addition products with the halogen acids. *Hydrotropidine*, $C_8H_{15}N$, is also a liquid. Its hydrochloride on distillation loses methyl chloride and yields norhydrotropidine, $C_7H_{13}N$, a compound which is a secondary base, and whose hydrochloride when distilled over zinc dust yields α-ethylpyridine. *Tropinic acid*, $C_6H_{11}N(CO_2H)_2$, obtained as above, is inactive; it was resolved by J. Gadamer (*Arch. Pharm.*, 1901, 239, p. 663) by means of its cinchonine salt. It is a dibasic acid, and the methiodide of its dimethyl ester on fusion with caustic alkalis yields *n*-adipic acid. It is apparently a derivative of N—methyl pyrrollidine, since it may be oxidized ultimately to N—methyl succinimide. *Tropigenine*, $C_7H_{13}NO$, is a secondary base.

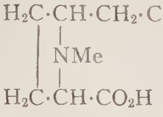
The most important of the oxidation products of tropine is *tropinone*, $C_8H_{13}NO$, which is a ketone containing the grouping $—CH_2{\cdot}CO{\cdot}CH_2—$since it yields a di-isonitroso derivative, a dibenzal derivative, and also forms mono- and di-oxalic esters. It is a strong base and has a powerful reducing action. Its constitution is determined by the above facts and also because tropinic acid on destructive methylation yields a diolefine dicarboxylic acid which on reduction is converted into *n*-pimelic acid. These data point to tropine possessing an unbranched chain of seven carbon atoms and incidentally determine the constitution of the other various oxidation products, &c. (R. Willstätter, *Ber.*, 1895–1901). These compounds may consequently be represented as



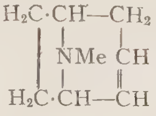
Tropine



Tropinone



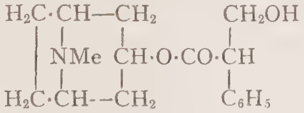
Tropinic acid



Tropidine.

On the synthesis of tropine, see R. Willstätter, *Ber.*, 1901, 34, pp. 130, 3163.

Tropic acid, $C_9H_{10}O_3$, the other decomposition product of atropine, is a saturated hydroxy-acid which is readily converted into atropic acid, $C_9H_8O_2$, by dehydrating agents. This latter acid is shown by all its reactions to be $C_6H_5C(:CH_2){\cdot}CO_2H$, a fact which is confirmed by its synthesis from acetophenone by the action of phosphorus pentachloride, followed by the decomposition of the resulting chloride with an alcoholic solution of potassium cyanide and subsequent hydrolysis of the nitrile so formed. These results show that tropic acid must be either $C_6H_5{\cdot}CH(CH_2OH){\cdot}CO_2H$ or $C_6H_5C{\cdot}(OH)(CH_3){\cdot}CO_2H$, and since the latter compound has been prepared from acetophenone by the addition of the elements of hydrocyanic acid, followed by subsequent hydrolysis and is an isomer of tropic acid, it follows that tropic acid must be represented by the former of the two formulae. Hence the alkaloid atropine, being a tropine-tropate, must have the annexed formula—



Atropine.

TROPPAU (Polish, *Oppava*; Czech, *Opava*), the capital of the Austrian duchy and crown land of Silesia, 180 m. N.E. of Vienna by rail. Pop. (1900), 26,725. It is situated on the Oppa river, close to the Prussian frontier, and is a well-built town with extensive suburbs. The industries comprise the manufacture of cloth, industrial machines, sugar-refining, jute fabrics and brewing. Troppau was founded in the 13th century; but almost its only claim to historical mention is the fact that in 1820 the monarchs of Austria, Russia and Prussia met here to deliberate on the tendencies of the Neapolitan revolution. This congress of Troppau, however, left nearly the whole matter to be considered and decided at Laibach. The former principality of Troppau is now divided between Austria and Prussia, the latter holding the lion's share.

TROPPAU, CONGRESS OF, a conference of the allied sovereigns or their representatives to discuss a concerted policy with regard to the questions raised by the revolution in Naples of July 1820. At this congress, which met on the 20th of October 1820, the emperor Alexander I. of Russia and Francis I. of Austria were present in person; King Frederick William III. of Prussia was represented by the crown prince (afterwards Frederick William IV.). The three eastern powers were further represented by the ministers responsible for their foreign policy: Austria by Prince Metternich, Russia by Count Capo d'Istria, Prussia by Prince Hardenberg. Great Britain, on the other hand, which objected on principle to the suggested concerted action against the Neapolitan Liberals, sent no plenipotentiary, but was represented by Lord Stewart, ambassador in Vienna. France, too, though her policy was less clearly defined, had given no plenary powers to her representatives. Thus from the very first was emphasized that division within the concert of the powers which the outcome of the congress was to make patent.

The characteristic note of this congress was its intimate and informal nature; the determining fact at the outset was Metternich's discovery that he had no longer anything to fear from the "Jacobinism" of the emperor Alexander. In a three hours' conversation over a cup of tea at the little inn he had heard the tsar's confession and promise of amendment: "Aujourd'hui je déplore tout ce que j'ai dit et fait entre les années 1814 et 1818 . . . Dites-moi ce que vous voulez de moi. Je le ferai" (Metternich to Esterhazy, Oct. 24, 1820, *F. O. Austria Dom. Sep.-Dec. 1820*). His failure to convert Castlereagh to his views was now of secondary importance; the "free" powers being in accord, it was safe to ignore the opinions of Great Britain and France, whose governments, whatever their goodwill, were fettered by constitutional forms.

In a series of conferences—to which the representatives of Great Britain and France were not admitted, on the excuse that they were only empowered to "report," not to "decide"—was drawn up the famous preliminary protocol signed by Austria, Russia and Prussia on the 19th of November. The main pronouncement of the "Troppau Protocol" is as follows: "States which have undergone a change of government due to revolution, the result of which threaten other states, *ipso facto* cease to be members of the European Alliance, and remain excluded from it until their situation gives guarantees for legal order and stability. If, owing to such alterations, immediate danger threatens other states the powers bind themselves, by peaceful means, or if need be, by arms, to bring back the guilty state into the bosom of the Great Alliance."

No effort was made by the powers to give immediate effect to the principles enunciated in the protocol; and after its promulgation the conferences were adjourned, it being decided to resume them at Laibach in the following January (see LAIBACH).

For authorities see the bibliography to ch. i. "The Congresses," by W. Alison Phillips, in the *Cambridge Mod. Hist.* x. 787.

TROSSACHS, THE (Gaelic, "the bristled country," a crude allusion to its physical features), a defile in the south-west of Perthshire, Scotland. It is a narrow, beautifully wooded glen, of no great depth, extending from Loch Achray to Loch Katrine, and continued thence by a strip on the north-eastern shore to a point above the now submerged Silver Strand opposite to Ellen's Isle—a total distance of 2½ m. It is situated 8 m. W. of Callander and 5 m. N. of Aberfoyle, with both of which places there is daily communication by coach during the tourist season. It lies between the steep green slopes of Ben Venue (2393 ft.) on the S.W. and the precipitous craigs of Ben A'an (1750 ft.) on the N.E. Characterized by lovely scenery, owing to its harmonious blending of wood, water, rock and hill, the region has been famous ever since the appearance of Sir Walter Scott's *The Lady of the Lake* and *Rob Roy*. Before the construction of the road that now winds through the pass, Sir Walter says that the only access to the lake was by means of a ladder formed out of the branches and roots of trees. A rustic pier has been built at the Trossachs end of Loch Katrine for the convenience of tourists, and a large hotel stands on the northern shore of Loch Achray, near the beginning of the pass.

TROTZENDORFF (or Trocedorfius), **VALENTIN FRIEDLAND** (1490–1556), German educationist, called Trotzendorff from his birthplace, near Görlitz, in Prussian Silesia, was born on the 14th of February 1490, of parents so poor that they could not keep him at school. The boy taught himself to read and write while herding cattle; he made paper from birch bark and ink from soot. When difficulties were overcome and he was sent for education to Görlitz, his mother's last words were "Stick to the school, dear son." The words determined his career: he refused all ecclesiastical promotion, and lived and died a schoolmaster. He became a distinguished student, learned Ciceronian Latin from Peter Mossellanus and Greek from Richard Croke, and after graduation was appointed assistant master in the school at Görlitz. There he also taught the rector and other teachers. When Luther began his attack on indulgences, Trotzendorff resigned his position and went to study under Luther and Melanchthon, supporting himself by private tuition. Thence he was called to be a master in the school at Goldberg in Silesia, and in 1524 became rector. There he remained three years, when he was sent to Liegnitz. He returned to Goldberg in 1531 and began that career which has made him the typical German schoolmaster of the Reformation period. His system of education and discipline speedily attracted attention. He made his best elder scholars the teachers of the younger classes, and insisted that the way to learn was to teach. He organized the school in such a way that the whole ordinary discipline was in the hands of the boys themselves. Every month a "consul," twelve "senators" and two "censors" were chosen from the pupils, and over all Trotzendorff ruled as "dictator perpetuus." One hour a day was spent in going over the lessons of the previous day. The lessons were repeatedly recalled by examinations, which were conducted on the plan of academical disputations. Every week each pupil had to write two "exercitia styli," one in prose and the other in verse, and Trotzendorff took pains to see that the subject of each exercise was something interesting. The fame of the Goldberg School extended over all Protestant Germany, and a large number of the more famous men of the following generation were taught by Trotzendorff. He died on the 20th of April 1556.

See Herrmann, *Merkwürdige Lebensgeschichte eines berühmten Schulmanns, V. F. Trotzendorffs* (1727); Frosch, *V. F. Trotzendorff, Rektor zu Goldberg* (1818); Pinzger, *V. F. Trotzendorff* (with the Goldberg portrait, and a complete list of his writings, 1825); Koehler, *V. F. Trotzendorff, ein biographischer Versuch* (1848). The biographical facts appear to be derived from a funeral or memorial oration delivered by Balthasar Rhau in the university of Wittenberg on the 15th of August 1564, and published in an edition of Trotzendorff's *Rosarium* (1565).

TROUBADOUR, the name given to the poets of southern France and of northern Spain and Italy who wrote in the *langue d'oc* from the 12th to the 14th centuries. In Provençal the word is spelt *trobaire* or *trovador*, and is derived from the verb *trobar*, to find, or to invent (Fr. *trouver*). The troubadour was one who invented, and originally improvised, poetry, who "found out" new and striking stanzaic forms for the elaborate lyrics he composed. In later times, the word has been used for romantic and sentimental persons, who dress in what is supposed to be medieval fashion, and who indite trivial verses to the sound of a lute; but this significance does less than justice to the serious artistic aims of the original and historic troubadours of Provence.

The earliest troubadour of whom anything definite is known is Guilhem IX. (b. 1071), count of Poitiers and duke of Aquitaine, whose career was typical of that of his whole class, for, according to his Provençal biographer, "he knew well how to sing and make verses, and for a long time he roamed all through the land to deceive the ladies." The high rank of this founder of the tradition was typical of its continuation; by far the largest number of the troubadours belonged to the noble class, while no fewer than twenty-three of their number were reigning princes. Among them is a king of England, Richard I., who is believed to have written in *langue d'oil* as well as in *langue d'oc*, and who has left at least one canzo, that written in prison, which is of remarkable beauty. These noble troubadours were distinguished by their wealth and independence from those who made their song their profession, and who wandered from castle to castle and from bower to bower. But whether dependent or independent, the poets exercised a social influence which was extremely remarkable, and had been paralleled by nothing before it in the history of medieval poetry. They had great privileges of speech and censure, they entered into questions of politics, and above all they created around the ladies of the court an atmosphere of cultivation and amenity which nothing had hitherto approached. The troubadour was occasionally accompanied in his travels by an apprentice or servant, called a *joglar*, whose business was to provide a musical setting for the poet's words; sometimes it was not the troubadour himself, but his *joglar*, who sang the songs. It was a matter of jealous attention to the troubadour to keep his name and fame clear of the claims of the *joglar*, who belonged to a lower caste; although it is true that some poets of very high talent rose from being *joglars* and attained the rank of troubadours. The latter were looked upon with deep admiration, and their deeds and sayings, as well as their verses, were preserved and were even embroidered with fiction.

There were recognized about four hundred troubadours, during the whole period in which they flourished, from Guilhem de Poitiers down to Guiraut Riquier (*c.* 1230–1294). Several MS. collections of biographies have been preserved, and from these we gain some idea of the careers of no fewer than 111 of the poets. In this respect, the troubadours possess an immense advantage over the trouvères of northern France, of whose private life very little is any longer known. Early in the living history of the troubadours their personal adventures came to be thought worthy of record. One of themselves, Uc of St Cyr (*c.* 1200–1240), interested himself in "the deeds and words of goodly men and women," and in the collection of lives he seems to claim to be, in several instances, the biographer. At the beginning of the 14th century it became the practice to preface the MS. works of each poet by a life of him, and even where the text seems to be quite independent, it is noticeable that there is little variation in the biography. One late troubadour, Rambaud of Orange, left a commentary on his own poems, and Guiraut Riquier one on those of a fellow troubadour, Guiraut of Calanson (1280). All this proves the poetry of Provence to have passed early into the critical stage, and to have been treated very seriously by those who were proficient in it. This is further shown by the respect with which the Provençal poets are mentioned by Dante, Petrarch and the authors of the *Novelle Critiche*.

The principal source of the lives of the troubadours is a collection, evidently written by various hands, which was made towards the middle of the 13th century. Of these we have said that Uc of Saint Cyr was certainly one of the authors. Another source of information is the *Vies des plus célèbres et anciens poètes provencaux*, published by Jehan de Notredame or Nostradamus, in 1575. This work professed to be founded on the MSS. of a learned monk, who was librarian of the monastery of St Honorat, in the island of Lérins, and died there in 1408. He was known by no other name than that of the Monk of the Golden Isles. This book, unfortunately, lies under more than a suspicion of forgery. Nostradamus no doubt possessed valuable documents, but he did not hesitate to deal with them in a highly fantastic way. His *Vies des poètes* has yet to be examined by careful and searching criticism. Even the genuine biographies, and they are numerous and above suspicion, are often embroidered with fantastic and whimsical statements which make a severe demand upon the credulity of a modern reader.

The verse form most frequently employed by the troubadours was the *sirventés*, a term which is earliest met with in the second half of the 12th century. The early critics believed this word to be derived from *servir*, and to mean that the poem was made by a servant; but Paul Meyer has contested this derivation, and holds that a *sirventés* is a poem composed by a sirvent, that is to say a *soudoyer* or paid man-at-arms. The troubadours also employed the *ballada*, which was a song with a long refrain, not much like the formal ballade of the north of France; the *pastourella*; and the *alba*. This last took its name from the circumstance that the word *alba* (dawn) was repeated in each stanza. This was a morning-song, as the *serena*, a later invention, was an evensong. The *planh* was a funeral elegy, composed by the troubadour for the obsequies of his protector, or for those of the lady of his devotion. Most interesting of all, perhaps, was the *tenson*, which was a lyrical dialogue between two persons, who discussed in it, as a rule, some point of amorous casuistry, but sometimes matters of a religious, metaphysical or satirical nature. The notion that the troubadours cultivated epic or dramatic poetry is now generally discarded; they were in their essence lyrical (see Provençal Literature).

The biographies of the troubadours, which, in spite of their imperfection and conventionality of form, throw an unparalleled light upon medieval literary life, may perhaps be most conveniently treated in connexion with the courts at which each group of them flourished. It is in Poitou that we trace them first, where Guilhem, count of Poitiers, who reigned from 1087 to 1127, was both the earliest patron and the earliest poet of the school. This prince was the type of medieval gallantry, sudden and violent in arms, brilliant and impudent in wit, with women so seductive as to be esteemed irresistible. He led an army of 300,000 men in the crusade of 1101, being then thirty years of age; he returned in dismal disarray, supported in his defeat by the arts of love and song. His levity was the wonder and delight of his contemporaries; William of Malmesbury, who speaks much of him, tells us of Guilhem's project to found a religious house at Niort for the worship of Venus. Guilhem of Poitiers was handsome, bold and of easy access; Gottfried of Vendôme says that he moved among other men as a god among mortals for the beauty of his body and the magnanimity of his soul. The surviving poems of the great count are simple in form; he does not attempt the technical subtleties of later poets; but he laboured at the art, and he was anxious to be thought a professional, not an amateur writer. His songs are highly personal and betray the author's variety, sensuality, wit and skill as a versifier.

The son of the earliest of the troubadours is known neither as a poet nor as a patron of poets, but the daughter of Guilhem IX. carried on her father's tradition. This was Eleanor of Guienne, at whose court Bernart of Ventadour rose to eminence. This poet was an exception to the rule that the troubadours belonged to the princely class. He seems to have been the son of a kitchen-scullion in the castle of Eble II., viscount of Ventadour. Eble was himself a poet, *valde gratiosus in cantilenis*, but his compositions have wholly disappeared; he was early impressed, we know not how, by the talents of his serving-boy, and he trained him to be a poet. The wife of Eble, the viscountess Agnes of Montluçon, who was extremely beautiful, encouraged the suit of the youthful Bernart; indeed, they had secretly loved one another from their childhood. The poems which this passion inspired are among the most admirable lyrics which have come down to us from the middle ages. The husband at last discovered the intrigue between his wife and the poet, and exiled Bernart from Ventadour, although, as it would seem, without violence. The troubadour took shelter with Eleanor of Guienne, who became in 1152 the queen-consort of Henry II. of England, himself a protector of poets. It has been supposed that Bernart accompanied the royal pair to London. He afterwards proceeded to the court of Raymond V. at Toulouse, where he is said to have remained until the death of that prince in 1194, when he withdrew to a cloister at Dalou in Poitou. He must at that time have been a very old man.

The son of Henry II., Henry Curtmantle, was the patron of another eminent troubadour. Bertran de Born, viscount of Hautefort in Perigord, had become a vassal of England by the marriage of Eleanor. He is the member of his class about whom we possess the most exact historical information. Dante saw Bertran de Born in hell, carrying his severed head before him like a lantern, and compared him with Achitophel, who excited the sons of David against their father. This referred to the subtle intrigues by which the troubadour had worked on the jealousy existing between the three sons of the king of England. The death of Prince Henry (1183) produced from Bertran de Born two *planhs*, which are among the most sincere and beautiful works in Provençal literature. The poet was immediately afterwards besieged in his castle of Hautefort by Richard Cœur de Lion, to whom he became reconciled and whom he accompanied to Palestine. He grew devout in his old age, and died about 1205. As a soldier and a condottiere, as the friend and enemy of kings, and as an active factor in the European politics of his time, Bertran de Born occupies an exceptional position among the troubadours.

There were poetesses in the highly refined society of Provençe, and of these by far the most eminent was Beatrix, countess of Die, whose career was inextricably interwoven with that of another eminent and noble troubadour, Rambaut III., count of Orange, who held his court at Courthézon, a few miles south of Orange. Rambaut said that since Adam ate the apple no poet had been born who could compete in skill with himself, but his existing lyrics have neither the tenderness nor the ingenuity of those of his illustrious lady-love. The poems of Beatrix are remarkable for a simplicity of form rare among the poets of her age. One of the earliest troubadours, Cercamon, was at the court of Guilhem IX. of Poitiers, and was the master of perhaps the most original of all the school, namely the illustrious Marcabrun (*c.* 1120–1195), from whose pen some forty poems survive. He was a foundling, left on the door-step of a rich man in Gascony, and no one knew anything about his descent. Marcabrun was an innovator and a reformer; to him the severity of classical Provençal style is mainly due, and he was one of the first to make use of that complexity and obscurity of form which was known as the *trobar clus*. He was also original in his attitude to love; he posed as a violent misogynist—"I never loved and I was never loved"—and he expressed, in the accents of amorous poetry, an aversion to women. "Famine, pestilence and war do less evil upon earth than the love of woman" is one of his aphorisms. He was in the service of Richard Cœur de Lion, and after 1167 in that of Alfonso II. of Aragon. Marcabrun was the object of much dislike and attack, and it is said that he was murdered by Castellane of Guian, whom he had satirized. This, however, is improbable, and it is rather believed that Marcabrun survived to a great age. For one of his contemporaries he mitigated the severities of his satiric pen; he expresses great affection for "that sweet poet," Jaufre Rudel, prince of Blaye, whose heart turned, like the disk of a sunflower, towards the Lady of Tripoli. Little else than that famous adventure is known about the career of this ultra-romantic troubadour, except that he went as a crusader to the Holy Land, and that his surviving poems, which are few in number, have so mystical a tone that Jaufre Rudel has been suspected of being a religious writer who used the amorous language of his age for sanctified purposes, and whose "Princess Far-away" was really the Church of Christ. If so, the statement that he died in the arms of the Lady of Tripoli would merely mean that he passed away, perhaps at Antioch, in the odour of sanctity. Peire d' Alveona (Peter of Auvergne), like Marcabrun, was of mean birth, son of a tradesman in Clermont-Ferrand, but he was handsome and engaging, and being the first troubadour who had appeared in the mountain district, "he was greatly honoured and fêted by the valiant barons and noble ladies of Auvergne." . . . "He was very proud and despised the other troubadours." It is believed that Peire's poems were produced between 1158 and 1180. He flourished at the court of Sancho III., king of Castile, and afterwards at that of Ermengarde, viscountess of Narbonne.

It is doubtless owing to the vehement and repeated praise which was given by Dante, in the *Inferno* and elsewhere, to Arnaut Daniel that this name remains the most famous among those of the troubadours. Yet not very much is known of the personal history of this poet. He was a knight of Riberac, in Perigord, and he attached himself as a troubadour to the court of Richard Cœur de Lion. Dante had been made acquainted with the highly complicated and obscure verse of Arnaut Daniel by Guido Guinicelli, and thus to the historian of literature a most valuable link is provided between medieval and modern poetry. Dante calls Daniel the "smith," the finished craftsman, of language, and it is evident that it was the brilliant art of the Provençal's elaborated verse which delighted the Italian. In the *De vulgari eloquentia* Dante returned to the praise of Arnaut Daniel, as the greatest of all those who have sung of love, and Petrarch was not less enthusiastic. His invention of forms of verse (see SESTINA), in particular, dazzled the great Italians. But the seventeen *sirventés* which have survived scarcely sustain the traditional idea of the supremacy of Arnaut Daniel as a poet, while their lack of historical and personal allusions deprives them of general interest. Dante was curiously anxious to defend Arnaut Daniel as being a better artist than his immediate rival, Giraut de Bornelh, whose "rectitude" Dante admits, in the sense that Giraut was a singer of gnomic verses of a high morality, but prefers the poetry of Daniel; critical posterity, however, has reversed this verdict. Giraut came from the neighbourhood of Limoges, passed over into Spain about 1180, and became famous in the courts of Pedro II. of Aragon and other Spanish monarchs. He disappears about 1230. There is a curious anecdote of his having incurred the hatred or the cupidity of the viscount of Limoges, who robbed him of his library and then burned his house to the ground. Giraut laments, in his poems, the brutality of the age and the lawlessness of princes. A troubadour of the same district of south-western France was Arnaut de Mareuil, to whom is attributed the introduction into Provençal poetry of the amatory epistle. He settled at the courts of Toulouse and Beziers, where he sang, in mystical terms, his passion for the countess Adalasia, in whose affections he had a dangerous rival in the person of Alfonso II., king of Aragon. Arnaut de Mareuil fled for his life to Montpellier, where he found a protector in Count William VIII., but he continued to address his *sirventés* to Adalasia. As that princess died in 1199, and as no *planh* to her memory is found among the works of Arnaut de Mareuil, it is conjectured that by that time he was already dead.

Peire Vidal of Toulouse was the type of the reckless and scatterbrained troubadour. His biographer says that he was "the maddest man in all the world." His early life was a series of bewildering excursions through France and Spain, but he settled down at last at Marseilles, where he made a mortal enemy of Azalaïs, the wife of Viscount Barral de Baux, from whom he stole a kiss (1180). Vidal fled to Genoa, but he continued to address the viscountess in his songs. At the entreaty of her husband, Azalaïs forgave the poet, and Peire Vidal returned to Marseilles. He committed a thousand follies; among others, being in love with a lady called Louve (she-wolf), the poet dressed himself as a wolf, and was hunted by a pack of hounds in front of the lady's castle. Starting on a crusade, he stopped at Cyprus, where a Greek girl was presented to him as being of the imperial family. He married her, assumed the title of emperor, and carried a throne about with him from camp to camp. According to a late poem, his eccentric adventures closed in Hungary about the year 1215. Folquet of Marseilles was a troubadour of Italian race, the son of a merchant of Genoa; Dante met Folquet in paradise, and gives an interesting notice of him. He was a rival with Peire Vidal for the favours of the beautiful Azalaïs; and he was one of the troubadours who gathered around the unfortunate Eudoxia, empress of Montpellier, until the close of her singular and romantic adventure (1187). He wrote a very touching *planh* on the death of the viscount Barral de Baux in 1192. Soon after this, disgusted with love, Folquet took holy orders, became the abbot of the rich Cistercian house of Torronet in Provençe, and in 1205 became bishop of Toulouse. Here he threw in his lot with Simon de Montfort and disgraced himself by his fanatic rage against the Albigenses, of whom a contemporary says that he slew 500,000 persons, acting "more like Antichrist than like an envoy of Rome." Folquet died in 1231 in the abbey of Grandselve, in his diocese. It is in the *sirventés* of Folquet that critics have seen the earliest signs of that decadence which was so rapidly to destroy Provençal poetry.

Gaucelm Faidit came from Uzerche, in the Limousin. He seems to have been a wandering minstrel of gay and reckless habits, and to have been accompanied by a light-o'-love, Guillelma Monja, who was the object of much satire and ridicule. In Gaucelm we probably see, if we can credit his story, the troubadour at his lowest social level. He made, however, Maria of Ventadour, who was probably a scion of the princely and neighbouring house of that name, the object of his songs, and he addresses her in strains of unusual pathos and delicacy. Gaucelm Faidit ultimately proceeded to Italy, to the court of the marquis Boniface of Montferrat, a prince who greatly encouraged the troubadours and who in 1201 undertook the conduct of a crusade. Gaucelm, who was still celebrating the perfections of Maria of Ventadour, accompanied him to the East. He wrote several canzones in the Holy Land and Syria, returned safely to Uzerche, and disappears about 1240. We possess sixty of his poems. Another troubadour, Raimbaut of Vaquières, passed the greater part of his life at the same court of Montferrat; he devoted himself to the Lady Beatrix, sister of the marquis. It is believed that he died in the Holy Land in 1207. The most celebrated of the Italian troubadours was Sordello, born at Mantua, at the beginning of the 13th century, who owes his fame rather to the benevolence of later poets, from Dante to Robert Browning, than to the originality of his adventures or the excellence of his verse.

We have now mentioned the troubadours who were most famous in their own time, and on the whole modern criticism has been in unison with contemporary opinion. There are, however, still one or two names to be recorded. The English historian of the troubadours, Dr Hueffer, gave great prominence to the writings of a poet who had previously been chiefly heard of in connexion with a romantic adventure, Guillem de Cabestanh (or Capestang). This was a knight of Roussillon, who made love to Seremonda, countess of Castel-Roussillon. The lady's husband, meeting the poet out hunting, slew him in a paroxysm of jealousy and, having cut out his heart, had it delicately cooked and served to his wife's dinner. When Seremonda had eaten her lover's heart, her husband told her what she had done, and she fainted away. Coming to her senses she said: "My Lord, you have served to me so excellent a dish that I will never eat of another," and she threw herself out of window and was killed. The importance of this story lies in the fact that the cruelty of the count of Castel-Roussillon was the cause of universal scandal in all good society. Feeling grew so strong that the surrounding nobles rose against the murderer, with Alfonso, king of Spain, at their head, hunted him down and killed him. The bodies of the lady and the troubadour were buried side by side, with great pomp, in the cathedral of Perpignan, and became the objects of pilgrimage. Doubt has, of course, been thrown on the veracity of this romantic story, but at all events it testifies to the fact that the troubadour enjoyed, or was expected to enjoy, all the privileges of toleration and exemption. A burlesque or satiric troubadour, who disregarded the laws of gallantry and wrote satires of great virulence against the ladies and their lovers, remains anonymous, and is spoken of as the monk or prior of Montaudon.

The classic period of the troubadours lasted until about 1210, and was contemporaneous with the magnificence of the nobles of the south of France. The wealth and cultivated tastes of the seigneurs, and the peace which had long surrounded them, led them into voluptuous extravagances and sometimes into a madness of expenditure. From this the troubadours reaped an immediate advantage, but when the inevitable reaction came they were the first to suffer. The great cause, however, of the decadence and ruin of the troubadours was the struggle between Rome and the heretics. This broke out into actual war in June 1209, when the northern barons, called to a crusade by Pope Innocent III., fell upon the Albigenses and pillaged Beziers and Carcassonne. Most of the protectors of the troubadours were, if not heretics, indulgent to the heretical party, and shared in their downfall. The poets, themselves, were not immediately injured, and no doubt their habits and their art kept them immune from the instant religious catastrophe, but the darkness began to gather round them as the ruin of Languedoc became more and more complete, culminating with the siege of Toulouse in 1218. The greatest name of this period, which was the beginning of the end, is that of Peire Cardenal, of Le Puy. He was protected by Jacme I., king of Aragon, having apparently fled from Narbonne and then from Toulouse in order to escape from the armies of Simon de Montfort. He was the inventor and the principal cultivator of the moral or ethical *sirventés*; and he was the author of singularly outspoken satires against the clergy, continuing the tradition of Marcabrun. The biographer of Cardenal certifies that he lived to be nearly one hundred years of age. Another and a still more violent troubadour of this transitional time was Guillem Figueira, the son of a Toulouse tailor, an open heretic who attacked the papacy with extraordinary vigour, supported and protected by Raimon II. Figueira was answered, strophe by strophe, by a female troubadour, Gormonda of Montpellier. The ruin of the southern courts, most of which belonged to the conquered Albigensi party, continued to depress and to exasperate the troubadours, whose system was further disintegrated by the establishment of the Inquisition and by the creation of the religious orders. The genial and cultured society of Provençe and Languedoc sank rapidly into barbarism again, and there was no welcome anywhere for secular poets.

The last of the French troubadours was Guiraut Riquier (*c.* 1230–1294), who was born at Narbonne, and addressed his earliest poems to Phillippa of Anduza, the viscountess of that city. She does not seem to have encouraged poetry, and Guiraut Riquier left Narbonne, first appealing to St Louis, without success. He then turned to Spain, and found protection at the court of Alfonso X. the Learned. This monarch, himself a great poet, welcomed the crowd of troubadours who were now flying from the troubles of southern France. It was the ambition of Alfonso to be himself a troubadour, but the Provençal pieces which bear his name are now attributed to Riquier and to Nat de Mons; the king's genuine poems are those written in Galician. Riquier remained in the court of Castile until about 1279, when he returned to France and settled in Rodez with the count of that town, Henri II. This prince was almost the last seigneur in the south or centre of France who gathered a school of poets around him, and at Rodez the troubadours enjoyed for a few years their latest gleams of success and recognition. Riquier, in a *sirventés* of about 1285, gives pathetic expression to his sense of the gathering darkness, which makes it useless and almost unbecoming for a troubadour to practise his art, while of himself he mournfully confesses: "Song should express joy, but sorrow oppresses me, and I have come into the world too late." Guiraut Riquier passed away about 1294, and left no successor behind him.

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TROUBRIDGE, SIR THOMAS, BART. (*c.* 1758–1807), English admiral, was educated at St Paul's School, London, and entered the navy in 1773. Having seen some service in the East Indies, he was taken prisoner by the French in 1794, but his captivity was only a short one and in February 1797 he commanded his ship, the "Culloden," at the battle of Cape St Vincent. In the following July he assisted Nelson in the unsuccessful attack on Santa Cruz, and in August 1798, when getting into position for the attack on the French fleet, the "Culloden" ran aground and was consequently unable to take any part in the battle of the Nile. He then served in the Mediterranean and was created a baronet in 1799; from 1801 to 1804 he was a lord of the admiralty, being made a rear-admiral just before his retirement. In 1805 Troubridge was given a command in the East and he went out in the "Blenheim." In January 1807 in this ship, an old and damaged one, he left Madras for the Cape of Good Hope, but off the coast of Madagascar the "Blenheim" foundered in a cyclone and the admiral perished. His only son, Sir Edward Thomas Troubridge, bart. (d. 1852), entered the navy in 1797 and was present at the battle of Copenhagen. From 1831 to 1847 he was member of parliament for Sandwich and from 1835 to 1841 he was a lord of the admiralty. His son, Sir Thomas St Vincent Hope Cochrane Troubridge, bart. (1815–1867), entered the army in 1834, and was severely wounded at the battle of Inkerman.

TROUGHTON, EDWARD (1753–1835), English instrument maker, was born in the parish of Corney in Cumberland in October 1753. He joined his elder brother John in carrying on the business of making mathematical instruments in Fleet Street, London, and continued it alone after his brother's death, until in 1826 he took W. Simms as a partner. He died in London on the 12th of June 1835.

Troughton was very successful in improving the mechanical part of most nautical, geodetic and astronomical instruments, but complete colour-blindness prevented him from attempting experiments in optics. The first modern transit circle was constructed by him in 1806 for Stephen Groombridge; but Troughton was dissatisfied with this form of instrument, which a few years afterwards was brought to great perfection by G. von Reichenbach and J. G. Repsold, and designed the mural circle in its place. The first instrument of this kind erected at Greenwich in 1812, and ten or twelve others were subsequently constructed for other observatories; but they were ultimately superseded by Troughton's earlier design, the transit circle, by which the two co-ordinates of an object can be determined simultaneously. He also made transit instruments, equatorials, &c.; but his failure to construct an equatorial mounting of large dimensions, and the consequent lawsuit with Sir James South, embittered the last years of his life.

TROUSERS, the name given to the article of dress worn by men, covering each leg separately and reaching from the waist to the foot. The word in its earlier forms is always found without the second *r*, *e.g. trouses*, *trouzes*, *trooze*, cf. the Lowland Scots word "trews," and is an adaptation of the French *trousses*, trunk-hose, breeches, the plural of *trousse*, a bundle, pack, truss, from *trousser*, to pack, bundle up, tuck, tie up, girth, of which the origin is doubtful. In English the word "trousers," when it first appears, was used of the leg-garments of the Irish, who wore their breeches or trunk-hose and stockings in one piece, a custom to which there are many allusions in 17th-century literature. Knee-breeches and top-boots for out-of-door wear or stockings for indoor use lasted till the beginning of the 19th century as the regular costume for men. Pantaloons, loose trousers reaching to above the ankle, were worn in Venice by the poorer classes in the 17th century (for the origin of the name see PANTALOON). The characters of the Italian comedy made the style of garment familiar in France, but it was only seen in the fantastic costumes of the ballet. During the reign of Louis XVI. loose pantaloons became fashionable for the morning deshabille of men. Their adoption by the supporters of the Revolution was the origin of the name of *sans-culottes* applied to the revolutionaries. Beau Brummel, in England, was probably the first to make the "pantaloon" popular. A striking feature of his dress were the tight-fitting black trousers reaching to the ankle, where they were buttoned. From this developed the true trousers, cut over the boot at the instep, at first open at the bottom and fastened by loops, later strapped tight under the boot. It is said that the duke of Wellington introduced this latter form after the Peninsular War. They were not recognized as correct for evening wear, and strong opposition was taken against them by the clergy and at the universities (see COSTUME).

TROUT (*Salmo trutta*), a fish closely related to the salmon. Most modern ichthyologists agree in regarding the various North European forms of trout, whether migratory or not, as varieties or races of a highly variable and plastic species, to be distinguished from the salmon by a few more or less constant characters, the most readily ascertainable of which resides in the smaller scales on the back of the caudal region of the body, these being 14 to 16 (rarely 13) in an oblique series between the posterior border of the adipose fin and the lateral line, and in the greater length of the folded anal fin as compared to the depth of the caudal peduncle. The gill-rakers are also usually fewer, 16 to 18 on the anterior branchial arch. The young may be distinguished from salmon-parr by the greater length of the upper jaw, the maxillary bone extending beyond the vertical of the centre of the eye, and in specimens 6 in. long often to below the posterior of the eye. The young are brown or olive above, silvery or golden below, with more or less numerous black and red spots in addition to the parr marks, and, contrary to what is observed in the salmon, black spots are usually present below the lateral line. Except for the gradual disappearance of the parr marks, this coloration is retained in the form known as the brook trout or brown trout (*S. fario*), which is non-migratory, and varies much in size according to the waters it inhabits, in some brooks not growing to more than 8 in., whilst in larger rivers and lakes it may attain a weight of 20 lb or more. The coloration of the young is more strongly departed from in the races known as sea trout (*S. trutta*) and sewin (*S. eriox* or *cambricus*), anadromous forms resembling the salmon in habits, and assuming in the sea a silvery coat, with, however, as a rule, more black spots on the sides below the lateral line.

The principal British races of trout are the following: the northern sea trout (*S. trutta, sensu stricto*), silvery, losing the teeth on the shaft of the vomer in the adult, and migratory like the salmon; the southern sea trout (*S. eriox* or *cambricus*), similar to the preceding, but with the hind margin of the gill-cover more or less produced, the lower bone (suboperculum) projecting beyond the end of the upper (operculum); the brown trout (*S. fario*), non-migratory, usually retaining the teeth on the shaft of the vomer, brown or olive with black and red spots, rarely more silvery, with numerous black spots; the Lochleven trout (*S. levenensis*), distinguished from the preceding by a more silvery coloration, frequent absence of red spots and a pink or red flesh; the estuary trout (*S. gillivensis* and *S. orcadensis*), large brown trout living in salt water without assuming the silvery coloration; the Gillaroo trout (*S. stomachicus*), in which the membranes of the stomach are conspicuously thicker than in the other trout, more so in adult examples than in young ones. But all these forms are ill-defined and subject to such variations when transported from one locality to another as to render their recognition a matter of insuperable difficulty. The instability of the characters on which *S. levenensis* is based has been conclusively shown by the experiments conducted by Sir James Maitland at Howietoun. Large specimens of migratory trout are often designated as bull-trout, but no definition has ever been given by which this form could be established, even as a race.

Other European varieties are the trout of the Lake of Geneva (*S. lemanus*), of the Lake of Garda (*S. carpio*), of Dalmatia (*S. dentex*), of Hungary (*S. microlepis*), of the Caspian Sea (*S. caspius*), &c. The size of trout varies much according to the waters in which they live, the anadromous forms nearly equalling the salmon in this respect, specimens of over 4 ft. and weighing up to 50 lb being on record.

The habitat of *S. trutta* extends over the whole of Europe, the Atlas of Morocco and Algeria, Transcaucasia, Asia Minor and northern Persia. By the agency of man the species has been thoroughly established in Tasmania and New Zealand, where it thrives in an extraordinary manner, and attains a very large size.

Closely allied species are found in North America, west of the Rocky Mountains, the best known being the rainbow trout (*S. irideus* or *shasta*), which has been introduced into many parts of Europe as well as the eastern states of North America, New Zealand and South Africa. It is more hardy than the English trout, and accommodates itself in almost stagnant waters, and has thus proved a success in many ponds which were regarded as fit for coarse fish only; but in many places it has caused disappointment by going down to the sea, whence it is not known ever to return. It is a handsome trout, bluish or purplish above, silvery or golden below, more or less profusely spotted with black on the body and fins, and with an orange or red lateral band. Its range extends from Alaska to North Mexico. The rainbow trout merges into a larger form, *S. gairdneri*, which resembles the British sea trout.

A remarkable European trout is the short-snouted trout, *S. obtusirostris*, a non-migratory species from Dalmatia, Herzegovina, Bosnia and Montenegro. It has a small mouth with a feeble dentition, resembling that of the grayling. A closely allied form, *S. ohridanus*, has recently been discovered in Macedonia. (G. A. B.)

TROUVÈRE, the name given to the medieval poets of northern and central France, who wrote in the *langue d'oil* or *langue d'oui*. The word is derived from the French verb *trouver*, to find or invent. The trouvères flourished abundantly in the 12th and 13th centuries. They were court-poets who devoted themselves almost exclusively to the composition and recitation of a particular kind of song, for which the highest society of that day in France had an inordinate fondness. This poetry, the usual subject of which was some refinement of the passion of love, was dialectical rather than emotional. As Jeanroy has said, the best trouvères were those who "into the smallest number of lines could put the largest number of ideas, or at least of those commonplaces which envelop thought in its most impersonal and coldest form." The trouvères were not, as used to be supposed, lovers singing to their sweethearts, but they were the pedants and attorneys of a fantastic tribunal of sentiment. This was more monotonous in the hands of the trouvères than it had been in those of the troubadours, for the latter often employed their art for purposes of satire, religion, humour and politics, which were scarcely known to the poets of the northern language.

The established idea that the poetry of the trouvères was entirely founded upon imitation of that of the troubadours, has been ably combated by Paul Meyer, who comes to the conclusion that the poetry of the north of France was essentially no less original than that of the south. The passage of Raoul Glaber, in which he says that about the year 1000 southern men began to appear in France and in Burgundy, "as odd in their ways as in their dress, and having the appearance of jongleurs," is usually quoted, but although this is valuable contemporary evidence, it proves neither what these "jongleurs" brought from the south nor what the poets of the north could borrow from them. The first appearance of trouvères seems to be much later than this, and to date from 1137, when Eléonore of Aquitaine, who was herself the granddaughter of an illustrious troubadour, arrived in the court of France as the queen of Louis VII. It is recorded that she continued to speak her native language, which would be the Poitiers dialect of the *langue d'oc*. She was queen for fifteen years (1137–1152), and this, no doubt, was the period during which the southern influence was strongest in the literature of northern France. There is not any question that the successive crusades tended to produce relations between the two sections of poetical literature. The great mass of the existing writings of the trouvères deals elaborately and artificially with the passion of love, as it had already been analysed in the *langue d'oc*. But those who are most inclined to favour the northern poets are obliged to confess that the latter rarely approach the grace and delicacy of the troubadours, while their verse shows less ingenuity and less variety. The earliest trouvères, like Cuene de Béthune and Huges de Berzé, in writing their amatory lyrics, were certainly influenced by what troubadours had written, especially when, like Bertrand de Born, these troubadours were men who wandered far and wide, under the glory of a great social prestige. We should know more exactly what the nature of the Provençal influence was if the songs of all the trouvères who flourished before the middle of the 12th century had not practically disappeared. When we become conscious of the existence of the trouvères, we find Cuene de Béthune in possession of the field, a poet of too much originality to be swept away as a mere imitator. At the same time, even Paul Meyer, who has been the great asserter of the independence of the poetry of northern France, is obliged to admit that if, at the end of the 12th century and throughout the 13th, several literary centres were formed where an amatory poetry, full of conventional grace, was held in high honour, it was because several princely courts in the south had set the example. In this sense it cannot be denied that the whole art of the trouvères was secondary and subsidiary to the art of the troubadours.

The poetical forms adopted by the trouvères bore curious and obscure names, the signification of which is still in some cases dubious. As a rule each poem belonged to one of three classes, and was either a *rotruenge*, or a *serventois*, or an *estrabot*. The rotruenge was a song with a refrain; the serventois was, in spite of its name, quite unlike the sirventes of the troubadours and had a more ribald character; the estrabot was allied to the *strambotto* of the Italians, and was a strophaic form "composed of a front part which was symmetrical, and of a tail which could be varied at will" (Gaston Paris). But scholars are still uncertain as to the positive meaning of these expressions, and as to the theory of the verse-forms themselves.

The court poetry of the trouvères particularly flourished under the protection of three royal ladies. Marie, the regent of Champagne, was the practical ruler of that country from 1181 to 1197, and she encouraged the minstrels in the highest degree. She invited Ricaut de Barbezieux to her court, rewarded the earliest songs of Gace Brulé, and discussed the art of verse with Chrétien of Troyes. Her sister, Aélis or Alice, welcomed the trouvères to Blois; she was the protector of Gautier d'Arras and of Le Châtelain de Couci. A sister of the husbands of these ladies, another Aélis, who became the second queen of Louis VII. in 1160, received Cuene de Béthune in Paris, and reproved him for the Picard accent with which he recited his poetry. At the end of the 12th century we see that the refinement and elegance of the court-poets was recognized in the north of France by those who were responsible for the education of princes. A trouvère, Gui de Ponthieu, was appointed tutor to William III. of Macon, and another, Philippe of Flanders, to Philippe Auguste. The vogue of the trouvères began during the third crusade; it rose to its greatest height during the fourth crusade and the attack upon the Albigenses. The first forty years of the 13th century was the period during which the courtly lyrical poetry was cultivated with most assiduity. At first it was a purely aristocratic pastime, and among the principal trouvères were princes such as Thibaut IV. of Navarre, Louis of Blois and John, king of Jerusalem. About 1230 the taste for court poetry spread to the wealthy bourgeoisie, especially in Picardy, Artois and Flanders. Before its final decline, and after the courts of Paris and Blois had ceased to be its patrons, the poetry of the trouvères found its centre and enjoyed its latest successes at Arras. It was here that some of the most original and the most skilful of all the trouvères, such as Jacques Bretel and Adam de la Halle, exercised their art. Another and perhaps still later school flourished at Reims.

About 1280, having existed for a century and a half, the poetical system suddenly decayed and disappeared; the very names of the court-poets were forgotten. During this time the song, *chanson*, had been treated as the most dignified and honourable form of literature, as Dante explains in his *De vulgari eloquentia*. But the song, as the trouvères understood it, was not an unstudied or emotional burst of verbal melody; it was, on the contrary, an effort of the intelligence, a piece of wilful and elaborate casuistry. The poet was invariably a lover, devoted to a married lady who was not his wife, and to whose caprices he was bound to submit blindly and patiently, in an endless and resigned humility. The progress of this conventional courtship was laid down according to certain strict rules of ceremonial; love became a science and a religion, and was practised by the laws of precise etiquette.

The curious interest of the trouvères, for us, lies in the fact that during an age when the northern world was ignorant and brutal, sunken in a rude sensuality, the trouvères advanced a theory of morals which had its absurd and immoral side, but which demanded a devotion to refinement and a close attention to what is reserved, delicate and subtle in personal conduct. They were, moreover, when the worst has been admitted about their frigidity and triviality, refiners of the race, and they did much to lay the foundation of French wit and French intelligence. The trouvères have not enjoyed the advantage of the troubadours, whose feats and adventures attracted the notice of contemporary biographers. Little is known about their lives, and they pass across the field of literary history like a troop of phantoms. Close students of this body of somewhat monotonous poetry have fancied that they detected a personal note in some of the leaders of the movement. It is certainly obvious that Cuene (or Conon) de Béthune had a violence of expression which gives life to his chansons. The delicate grace of Thibaut of Champagne, the apparent sincerity of Le Châtelain de Couci, the descriptive charm of Moniot of Arras, the irony of Richard of Fournival, have been celebrated by critics who have perhaps discovered differences where none exist. It is more certain that Adam de la Halle, the hunchback of Arras, had a superb gift of versification. The *rondel* (published in E. de Coussemaker's edition, 1872) beginning

"A Dieu courant amouretes,
Car je m'en vois
Souspirant en terre estrange!"

marks perhaps the highest point to which the delicate, frosty art of the trouvères attained. Music took a prominent place in all the performances of the trouvères, but in spite of the erudition of de Coussemaker, who devoted himself to the subject, comparatively little is known of the melodies which they used. But enough has been discovered to justify the general statement of Tiersot that "we may conclude that the musical movement of the age of the trouvères was derived directly from the most ancient form of popular French melody." A precious MS. in the Faculty of Medicine of Montpellier contains the music of no fewer than 345 part-songs attributed to trouvères, and an examination of these enables a "pitiless arranger" to divine the air, the primitive, simple and popular melody.

The principal authorities on the poetry and music of the trouvères are: H. Binet, *Le Style de la lyrique courtoise en France aux xii^{me} et xiii^{me} siècles* (Paris, 1891); Gaston Paris, *Les Origines de la poésie lyrique en France au moyen âge* (Paris, 1892); A. Jeanroy, *Les Origines de la poésie lyrique en France au moyen âge* (Paris, 1889); Julian Tiersot, *Histoire de la chanson populaire en France*; E. de Coussemaker, *Art harmonique aux xii^{me} et xiii^{me} siècles* (Paris, 1865). The works of the principal trouvères have been edited: those of Le Châtelain de Coucy by F. Michel (1830); of Adam de la Halle by E. de Coussemaker (1872); of Conon de Béthune by Wallensköld (Helsingfors, 1891); of Thibaut IV., king of Navarre, by P. Tarbé (1851). (E. G.)

TROUVILLE, a seaside town of north-western France, in the department of Calvados, on the English Channel, 34 m. N.E. of Caen by rail. Pop. (1906), 5684. Trouville is situated on the slopes of well-wooded hills at the mouth of the Touques on its right bank opposite Deauville. Its fine stretches of sand and excellent bathing, a spacious casino and beautiful villas, are among the attractions which make it the most frequented French resort on the channel. Deauville is well known for its racecourse and villas, exceeding those of Trouville in luxury, but except during the race fortnight in August (*la grande quinzaine*) it is quiet and comparatively deserted. The port shared with Deauville and formed by the Touques is entered by a channel between jetties with a depth at high tide of 18½ ft. This leads on the one side to a tidal harbour, on the other to an outer and an inner basin. Timber, coals and cement are imported. The

London & South Western Railway Company have a daily steamboat service from Havre to Trouville in connexion with their Southampton and Havre boats. Besides trawling and the provisioning of ships, in which Deauville is also engaged, Trouville carries on boat-building and has rope and briquette works.

TROVER (O. Fr. *trover*, to find, mod. *trouver*), or "trover and conversion," the name of a form of action in English law no longer in use, corresponding to the modern action of conversion. It was brought for damages for the detention of a chattel, and differed from detinue in that the latter was brought for the return of the chattel itself. The name trover is due to the action having been based on the fictitious averment in the plaintiff's declaration that he had lost the goods and that the defendant had found them. The necessity for this fictitious averment was taken away by the Common Law Procedure Act 1852. An action of trover lay (as an action of conversion still lies) in every case where the defendant was in possession of a chattel of the plaintiff and refused to deliver it up on request, such refusal being prima facie evidence of conversion. The damages recoverable are usually the value of the chattel converted. In an action for detention of a chattel (the representative of the old action of detinue), the plaintiff may have judgment and execution by writ of delivery for the chattel itself or for its value at his option. An action for conversion or detention must be brought within six years. The corresponding action in Scots law is the action of spuilzie. It must be brought within three years in order to entitle the pursuer to violent profits, otherwise it prescribes in forty years.

TROWBRIDGE, a market town in the Westbury parliamentary division of Wiltshire, England, 97½ m. W. by S. of London by the Great Western railway. Pop. of urban district (1901), 11,526. It is unevenly built on a slope at the foot of which flows the Biss or Mere, a tributary of the Avon. The parish church of St James is a fine Perpendicular building, with a lofty spire, and a beautiful open-work roof over the nave. It was rebuilt on the original plan in 1848. George Crabbe, the poet, was rector from 1813 to 1831.

Trowbridge (*Trubrig, Trobrigg, Trowbrigge*) was probably mentioned in Domesday under the name of Straburg, a manor held by one Brictric together with Staverton and Trowle, now both included within its limits. The first reference to the "town" of Trowbridge occurs early in the 16th century; previous to that date mention is made of the manor and castle only. The latter, round which the town probably grew up, is said to have been built by the de Bohuns, who obtained possession of the manor by marriage with the daughter of Edward de Sarisbury. Later it passed to William de Longespée, son of Henry II., to the Lancasters, to the protector Somerset (by grant of Henry VIII.) and then to the Rutlands, and Trowbridge is now a non-corporate town. In 1200 John granted a weekly market on Tuesday, Thursday and Saturday; also a yearly fair on the 24th, 25th and 26th of July, on which days it continued to be held until at the end of the 18th century it was changed to the 5th, 6th and 7th of August. The manufacture of woollen cloths has long been the staple trade of Trowbridge. It was introduced before the 16th century, for Leland, writing in the reign of Henry VIII., says: "The town flourisheth by drapery." In 1731 the trade was of some note, and by 1813 had attained such proportions that the whole area of the castle site was sold for the erection of dyeworks, cloth manufactories and other industrial buildings.

TROWEL (Med. Eng. *truel*, O. Fr. *truelle*, Low Lat. *truella*, a variant of *trulla*, diminutive of *trua*, stirring spoon, ladle, Gr. *τορύνη*, from the root *tar*, to turn round and round: cf. *τορεύς*, borer), a tool or implement, varying in shape according to the use to which it is put, but consisting of a blade of iron or steel fitted with a handle. The bricklayers' or plasterers' trowel, used for mixing, spreading and smoothing the mortar or plaster, has a flat, triangular, oval or rectangular blade; the gardeners' trowel, for digging plants, laying or mixing mould, &c., has a semi-cylindrical blade. Highly ornamental trowels made of, or decorated with, the precious metals are presented to royal, official or other personages who formally lay the foundation stones of buildings.

TROY, JEAN FRANÇOIS DE (1679–1752), French painter, was born at Paris in 1679. He received his first lessons from his father, himself a skilful portrait painter, who afterwards sent his son to Italy. There his amusements occupied him fully as much as his studies; but his ability was such that on his return he was at once made an official of the Academy, and obtained a large number of orders for the decoration of public and private buildings, executing at the same time a quantity of easel pictures of very unequal merit. Amongst the most considerable of his works are thirty-six compositions painted for the hotel of De Live (1729), and a series of the story of Esther, designed for the Gobelins whilst De Troy was director of the school of France at Rome (1738–1751)—a post which he resigned in a fit of irritation at court neglect. He did not expect to be taken at his word, and was about to return to France when he died on the 24th of January 1752. The life-size painting (Louvre) of the "First Chapter of the Order of the Holy Ghost held by Henry IV.," in the church of the Grands Augustins, is one of his most complete performances, and his dramatic composition, the "Plague at Marseilles," is widely known through the excellent engraving of Thomassin. The Cochins, father and son, Fessard, Galimard, Bauvarlet, Herisset, and the painters Boucher and Parrocel, have engraved and etched the works of De Troy.

TROY and **TROAD.** I. *The Troad.*—The Troad (ἡ Τρῳάς), or the land of Troy, the north-western promontory of Asia Minor. The name "Troad" is never used by Homer—who calls the land, like the city, Τροίη—but is already known to Herodotus. The Troad is bounded on the N. by the Hellespont and the westernmost part of the Propontis, on the W. by the Aegean Sea and on the S. by the Gulf of Adramyttium. The eastern limit was variously defined by ancient writers. In the widest acceptation, the Troad was identified with the whole of western and south-western Mysia, from the Aesepus, which flows into the Propontis, a little west of Cyzicus, to the Caicus, which flows into the Aegean south of Atarneus. But the true eastern boundary is undoubtedly the range of Ida, which, starting from near the south-east angle of the Adramyttian Gulf, sends its north-western spurs nearly to the coast of the Propontis, in the region west of the Aesepus and east of the Granicus. Taking Ida for the eastern limit, we have the definition which, as Strabo says, best corresponds with the actual usage of the name Troad. Ida is the key to the physical geography of the whole region; and it is the peculiar character which this mountain-system imparts to the land west of it that constitutes the real distinctness of the Troad from the rest of Mysia. Nature has here provided Asia Minor with an outwork against invaders from the north-west; and as the Troad was the scene of the struggle between Agamemnon and Priam, so it was in the Troad that Alexander won the battle which opened a path for his further advance.

Natural Divisions.—The length of the Troad from north to south—taking a straight line from the north-west point, Cape Sigeum (Yeni Shehr), to the south-west point, Cape Lectum (Babā Kale)—is roughly 40 m. The breadth, from the middle point of the west coast to the main range of Ida, is not much greater. The whole central portion of this area is drained by the Menderes (anc. *Scamander*), which rises in Ida and is by far the most important river of the Troad. The basin of the Menderes is divided by hills into two distinct parts, a southern and a northern plain. The southern—anciently called the Samonian plain—is the great central plain of the Troad, and takes its modern name from Bairamich, the chief Turkish town, which is situated in the eastern part of it near Ida. From the north end of the plain the Menderes winds in large curves through deep gorges in metamorphic rocks, and issues into the northern plain, stretching to the Hellespont. This is the plain of Troy, which is 7 or 8 m. long, and 2 or 3 m. broad on the average. The hills on the south are quite low, and towards the east the acclivities are in places so gentle as to leave the limits of the plain indefinite. Next to the basin of the Menderes, with its two plains, the best marked feature in the river-system of the Troad is the valley of the Tuzla (anc. *Satniois*). The Tuzla rises in the western part of Mt Ida, south of the plain of Bairamich, from which its valley is divided by hills; and, after flowing for many miles almost parallel with the south coast of the Troad, from which, at

Assus, it is less than a mile distant, it enters the Aegean about 10 m. north of Cape Lectum. Three alluvial plains are comprised in its course. The easternmost of these, into which the river issues from rugged mountains of considerable height, is long and narrow. The next is the broad plain round Assus, which was a fertile source of supply to that city. The third is the plain at the embouchure of the river on the west coast. This was anciently called the Halesian (‘Αλήσιον) plain, partly from the maritime salt-works at Tragasae, near the town of Hamaxitus, partly also from the hot salt-springs which exist at some distance from the sea, on the north side of the river, where large formations of rock-salt are also found. Maritime salt-works are still in operation at the mouth of the river, and its modern name (Tuzla = salt) preserves the ancient association. A striking feature of the southern Troad is the high and narrow plateau which runs parallel with the Adramyttian Gulf from east to west, forming a southern barrier to the valley of the Tuzla. This plateau seems to have been formed by a volcanic upheaval which came late in the Tertiary period, and covered the limestone of the south coast with two successive flows of trachyte. The lofty crag of Assus is like a tower standing detached from this line of mountain-wall. The western coast is of a different character. North of the Tuzla extends an undulating plain, narrow at first, but gradually widening. Much of it is covered with the valonia oak (*Quercus aegilops*), one of the most valuable products of the Troad. Towards the middle of the west coast the adjacent ground becomes higher, with steep acclivities, which sometimes rise into peaks; and north of these, again, the seaboard subsides towards Cape Sigeum into rounded hills, mostly low.

Natural Products.—The timber of the Troad is supplied chiefly by the pine forests on Mt Ida. But nearly all the plains and hills are more or less well wooded. Besides the valonia oak, the elm, willow, cypress and tamarisk shrub abound. Lotus, galingale and reeds are still plentiful, as in Homeric days, about the streams in the Trojan plain. The vine, too, is cultivated, the Turks making from it a kind of syrup and a preserve. In summer and autumn water-melons are among the abundant fruits. Cotton, wheat and Indian corn are also grown. The Troad is, indeed, a country highly favoured by nature—with its fertile plains and valleys, abundantly and continually irrigated from Ida, its numerous streams, its fine west seaboard, and the beauty of its scenery. Under Turkish rule, the natural advantages of the land suffice to mitigate the poverty of the sparse population, but have scarcely any positive result.

Early History.—In the Homeric legend, with which the story of the Troad begins, the people called Troes are ruled by a king Priam, whose realm includes all that is bounded by "Lesbos, Phrygia, and the Hellespont" (*Il.* xxiv. 544), *i.e.* the whole "Troad," with some extension of it, beyond Ida, on the north-west. According to Homer, the Achaeans under Agamemnon utterly and finally destroyed Troy, the capital of Priam, and overthrew his dynasty. But there is an Homeric prophecy that the rule over the Troes shall be continued by Aeneas and his descendants. From the "Homeric" hymn to Aphrodite, as well as from a passage in the 20th book of the *Iliad* (75–353)—a passage probably later than the bulk of the book—it is certain that in the 7th or 6th century B.C. a dynasty claiming descent from Aeneas reigned in the Troad, though the extent of their sway is unknown. The Homeric tale of Troy is a poetic creation, for which the poet is the sole witness. The geographical compactness of the Troad is itself an argument for the truth of the Homeric statement that it was once united under a strong king. How that kingdom was finally broken up is unknown. Thracian hordes, including the Treres, swept into Asia Minor from the north-west about the beginning of the 7th century B.C., and it is probable that, like the Gauls and Goths of later days, these fierce invaders made havoc in the Troad. The Ionian poet Callinus has recorded the terror which they caused farther south.

Greek Settlements.—A new period in the history of the Troad begins with the foundation of the Greek settlements. The earliest and most important of these were Aeolic. Lesbos and Cyme in Aeolis seem to have been the chief points from which the Aeolic colonists worked their way into the Troad. Commanding positions on the coast, such as Assus and Sigeum, would naturally be those first occupied; and some of them have been in the hands of Aeolians as early as the 10th century B.C. It appears from Herodotus (v. 95) that about 620 B.C. Athenians occupied Sigeum, and were resisted by the Aeolic colonists from Mytilene in Lesbos, who had already established themselves in that neighbourhood. Struggles of this kind may help to account for the fact noticed by Strabo, that the earlier colonies had often migrated from one site in the Troad to another. Such changes of seat have been, he observes, frequent causes of confusion in the topography.

The chief Greek towns in the Troad were Ilium in the north, Assus in the south and Alexandria Troas in the west. The site of the Greek Ilium is marked by the low mound of Hissarlik ("place of fortresses") in the Trojan plain, about 3 m. from the Hellespont. Exactly at what date it was founded on the top of earlier remains is uncertain (perhaps the 7th century); but it was not a place of any importance till the Hellenistic age. When Xerxes visited the Trojan plain, he "went up to the Pergamon of Priam," and afterwards sacrificed to the Ilian Athena (Herod. vii. 42). Ilion is mentioned among the towns of the Troad which yielded to Dercyllidas (399 B.C.), and as captured by Charidemus (359 B.C.). It possessed walls, but was a petty place, of little strength. In 334 B.C. Alexander, on landing in the Troad, visited Ilium. In their temple of Athena the Ilians showed him arms which had served in the Trojan War, including the shield of Achilles. Either then, or after the battle of Granicus, Alexander directed that the town should be enlarged, and should have the rank of "city," with political independence, and exemption from tribute. The battle of Ipsus (301 B.C.) added north-western Asia Minor to the dominions of Lysimachus, who executed the intentions of Alexander. He gave Ilium a wall 5 m. in circumference, incorporating with it some decayed towns of the neighbourhood, and built a handsome temple of Athena. In the 3rd century B.C. Ilium was the head of a federal league (*κοινόν*) of free Greek towns, which probably included the district from Lampsacus on the Hellespont to Gargara on the Adramyttian Gulf. Twice in that century Ilium was visited by Gauls. On the first occasion (278 B.C.) the Gauls, under Lutarius, sought to establish a stronghold at Ilium, but speedily abandoned it as being too weak. Forty years later (218 B.C.) Gauls were brought over by Attalus I. to help him in his war against Achaeus. After deserting his standard they proceeded to pillage the towns on the Hellespont, and finally besieged Ilium, from which, however, they were driven off by the troops of Alexandria Troas. At the beginning of the 2nd century B.C. Ilium was in a state of decay. As Demetrius of Scepsis tells us, the houses "had not even roofs of tiles," but merely of thatch. Such a loss of prosperity is sufficiently explained by the incursions of the Gauls and the insecure state of the Troad during the latter part of the 3rd century. The temple of the Ilian Athena, however, retained its prestige. In 192 B.C. Antiochus the Great visited it before sailing to the aid of the Aetolians. In 190 B.C., shortly before the battle of Magnesia, the Romans came into the Troad. At the moment when a Roman army was entering Asia, it was politic to recall the legend of Roman descent from Aeneas. Lucius Scipio and the Ilians were alike eager to do so. He offered sacrifice to the Ilian Athena; and after the peace with Antiochus (189 B.C.) the Romans annexed Rhoeteum and Gergis to Ilium, "not so much in reward of recent services, as in memory of the source from which their nation sprang." The later history of Ilium is little more than that of Roman benefits. A disaster befell the place in 85 B.C., when Fimbria took it, and left it in ruins; but Sulla presently caused it to be rebuilt. Augustus, while confirming its ancient privileges, gave it new territory. Caracalla (A.D. 211–217) visited Ilium, and, like Alexander, paid honours to the tomb of Achilles. In the 4th century, as some rhetorical "Letters" of that age show, the Ilians did a profitable trade in attracting tourists by their pseudo-Trojan memorials. After the 4th century the place is lost to view. But we find from Constantine Porphyrogenitus (911–959) that in his day it was one of the places in the Troad which gave names to bishoprics.

Other Ancient Sites.—Many classical sites in the Troad have been identified with more or less certainty. (For ALEXANDRIA TROAS and ASSUS, see separate articles. *Neandria* seems to be rightly fixed by F. Calvert at Mount Chigri, a hill not far from Alexandria Troas, remarkable for the fine view of the whole Troad which it commands. *Cebrene* has been conjecturally placed in the eastern part of the plain of Bairamich. *Palaeoscepsis* was farther east on the slopes of Ida, while the new *Scepsis* was near the site of Bairamich itself. At the village of Kulakli, a little south of the mouth of the Tuzla, some Corinthian columns and other fragments mark the temple of Apollo Smintheus (excavated in 1866 by Pullan) and (approximately) the site of the Homeric *Chryse*. *Colonae* was also on the west coast, opposite Tenedos. *Scamandria* occupied the site of Eneh, in the middle of the plain of Bairamich, and *Cenchreae* was probably some distance north of it. The shrine of Palamedes, mentioned by ancient writers as existing at a town called *Polymedium*, has been discovered by J. T. Clarke on a site hitherto unvisited by any modern traveller, between Assus and Cape Lectum. It proves to have been a sacred enclosure (*temenos*) on the acropolis of the town; the statue of Palamedes stood on a rock at the middle of its southern edge. Another interesting discovery has been made by Clarke, viz. the existence of very ancient town walls on Gargarus, the highest peak of Ida.

(R. C. J.; D. G. H.)

II. *The Site of Troy.*—Troy is represented now by the important ruins on and about the mound of Hissarlik which underlie those already referred to as surviving from the Hellenistic Ilion. Hissarlik is situated about 3½ m. both from the Dardanelles and from Yeni Keui, which lies on the Aegean coast north of Besika Bay. The famous academic dispute concerning the precise site, which began about A.D. 160 with Demetrius of Scepsis, may now be regarded as settled. After the full demonstration, made in 1893, that remains of a fortress exist on the mound of Hissarlik, contemporary with the great period of Mycenae, and larger than the earlier acropolis town first identified by Schliemann with Ilion, no reasonable person has continued to doubt that this last site is the local habitation of the Homeric story. The rival ruins on the Bali Dagh have been shown to be those of a small hill fort which, with another on an opposite crag, commanded the upper Menderes gorge. It is inconceivable that this fort should have been chosen by poets, generally familiar with the locality, as the scene of the great siege, while in the plain between it and the sea there had lain from time immemorial, and lay still in the Mycenaean age, a much more important settlement with massive fortified citadel.

No site in the Troad can be brought into complete accordance with all the topographical data to be ingeniously derived from the text of Homer. The hot and cold springs that lay just without the gate of "Troy" (*Il.* xxii. 147) are no more to be identified with Bunarbashi, which wells out more than a mile from the Bali Dagh ruins, than with the choked conduits, opened by Schliemann in 1882, to the south of Hissarlik. But the broader facts of geography are recognizable in the modern plain of the Menderes. The old bed of that river is the Scamander, and its little tributary, the Dumbrek Su, is the Simois. In their fork lies Hissarlik or Troy. In sight of it are, on the one side, the peak of Samothrace (xiii. 11–14); on the other, the mass of the Kaz Dagh *Ida* (viii. 52). Hissarlik lies in the plain (xx. 216) less than 4 m. both from the Hellespontine and the Aegean coasts, easily reached day by day by foes from the shore, and possible to be left and regained in a single night by a Trojan visiting the camp of the Greeks (vii. 381–421).

In summarizing what has been found to exist on the mound of Hissarlik in the excavations undertaken there since 1870, it is not advisable to observe the order of the finding, since Schliemann's want of experience and method caused much confusion and error in the earlier revelations. No certainty as to the distinction of strata or their relative ages was possible till Wilhelm Dörpfeld obtained entire control in 1891, after the original explorer's death. There are in all nine strata of ancient settlement.

1. On the virgin soil of the hillock, forming the core of the mound, scanty remains appear of a small village of the late Aegean neolithic period, at the dawn of the Bronze Age, contemporary with the upper part of the Cnossian neolithic bed. This includes what were originally supposed by Schliemann to be two successive primitive settlements. Thin walls of rough stones, bonded with mud, are preserved mainly in the west centre of the mound. No ground plan of a house is recoverable, and there is no sign of an outer fortress wall. In this stratum were found implements in obsidian and other stones, clay whorls, a little worked ivory, and much dark monochrome pottery, either of a rough grey surface or (in the finer examples) treated with resin, highly hand-polished, and showing simple geometric decoration, which was incised and often filled in with a white substance.

2. Superposed on these remains, where they still exist, but comprehending a much larger area, lies a better constructed and preserved settlement. This has been twice rebuilt. It was enclosed by a massive fortress wall of rudely squared Cyclopean character, showing different restorations, and now destroyed, except on the south side of the mound. Double gates at the south-east and south-west are well-preserved. The most complete and most important structures within the citadel lie towards the north. These are two rectangular blocks lying north-west to south-east, side by side, of which the southern and larger shows a *megaron* and vestibule of the type familiar in "Mycenaean" palaces, while the smaller seems a pendant to the larger, like the "women's quarters" at Tiryns and Phylakopi (see AEGEAN CIVILIZATION). Other blocks, whose plans are difficult to bring into inter-relation in their present state of ruin, are scattered over the area, but mainly in the south-west. This is the fortress proclaimed by Schliemann in 1873 to be the Pergamos of Troy. But we know that, while his identifications of Homeric topographical details in these ruins were fanciful, a much larger fortress succeeded to this long before the period treated of in the *Iliad*. The settlement in the second stratum belongs, in fact, to a primitive stage of that local civilization which preceded the Mycenaean; and it is this latter which is recalled by the Homeric poems. The pottery of the second stratum at Hissarlik shows the first introduction of paint, and of the slip and somewhat fantastic forms parallel to those of the pre-Mycenaean style in the Cyclades. The beaked vases, known as *schnabelkannen*, are characteristic, and rude reproductions of human features are common in this ware, which seems all to be of native fabrication. Bronze had come into use for implements, weapons and utensils; and gold and silver make up a hoarded treasure found in the calcined ruins of the fortification wall near one of the gates. But the forms are primitive and singular, and the workmanship is very rude, the pendants of the great diadems being cut out of very thin plate gold. Disks, bracelets and pendants, showing advanced spiraliform ornament, found mainly in 1878, and then ascribed to this same stratum, belong undoubtedly to a higher one, the sixth or "Mycenaean." Rough fiddle-shaped idols, whorls, a little worked ivory and some lead make up a find, of whose early period comparison of objects found elsewhere leaves no sort of doubt. This treasure is now deposited in Berlin.

3, 4, 5. This primitive "Troy" suffered cataclysmal ruin (traces of conflagration are everywhere present), and Hissarlik ceased for a time to have any considerable population. Three small village settlements, not much more than farms, were successively erected on the site, and have left their traces superposed one on another, but they yielded no finds of importance.

6. The mound, however, stood in too important a relation to the plain and the sea to remain desolate, and in due time it was covered again by a great fortress, while a city spread out below. The latter has not yet been explored. The remains of this period on the acropolis, however, have now been examined. A portion of them was first distinguished clearly by Dörpfeld in 1882, but owing to the confusion caused by Schliemann's drastic methods of trenching, the pottery and metal objects, really belonging to this stratum, had come to be confused with those of lower strata; and some grey monochrome ware, obviously of Anatolian make, was alone referred to the higher stratum. To this ware Schliemann gave the name "Lydian," and the stratum was spoken of in his *Troja* (1884) as the "Lydian city."

In 1893, however, excavations were carried out on the south of the mound in the hitherto undisturbed ground outside the limits of the earlier fortress; and here appeared a second curtain wall of massive ashlar masonry showing architectural features which characterize the "Mycenaean" fortification walls at Mycenae itself, and at Phylakopi in Melos. With this wall was associated not only the grey ware, but a mass of painted potsherds of unmistakably "Mycenaean" character; and further search in the same stratum to west and east showed that such sherds always lay on its floor level. The inevitable inference is that here we have a city, contemporary with the mass of the remains at Mycenae, which imported "Mycenaean" ware to supplement its own ruder products. The area of its citadel is larger than the citadel of the second stratum; its buildings, of which a large *megaron* on the south-west and several houses on the east remain, are of much finer construction than those which lie lower. This was the most important city yet built on the mound of Hissarlik. It belonged to the "Mycenaean" age, which precedes the composition of the Homeric poems, and is reflected by them. Therefore this is Homer's Troy.

Its remains, however, having been obliterated on the crown of Hissarlik, almost escaped recognition. When some centuries later a third important city, the Hellenistic Ilion, was built, all the accumulation on the top of the mound was cut away and a terrace made. In this process the then uppermost strata of ruins wholly vanished, their stones being taken to build the new city. The Mycenaean town, however, which had been piled stage upon stage to the summit, descended on the south side a little down the face of the mound; and the remains of its fortifications and houses at that point, lying below the level cut down to by the Hellenistic terrace-makers, were covered by the depositing of rubbish from the crown and again built over. Thus we find them now on the southern slope of the mound only, but have no difficulty in estimating their original extent. Many tombs and a large lower city of this era will doubtless be explored ere long.

7. To "Mycenaean" Troy succeeded a small unfortified settlement, which maintained itself all through the Hellenic age till the Homeric enthusiasm of Alexander the Great called a city again into being on Hissarlik.

8. The Hellenistic Ilion, however, has left comparatively little trace, having been almost completely destroyed in 85 B.C. by Fimbria. Portions of fortifications erected by Lysimachus are visible both on the acropolis (west face chiefly) and round the lower city in the plain. A small Doric temple belongs to the foundation of this city, and a larger one, probably dedicated to Athena, seems to be of the Pergamene age. Of its metopes, representing Helios and a gigantomachia, important fragments have been recovered. Coins of this city are not rare, showing Athena on both faces, and some inscriptions have been recovered proving that Hellenistic Ilion was an important municipality.

9. Lastly about the Christian era, arose a Graeco-Roman city, to which belong the theatre on the south-east slope of the hill and the ornate gateway in the same quarter, as well as a large building on the south-west and extensive remains to north-east. This seems to have sunk into decay about the 5th century A.D.

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III. *The Legend of Troy.*—According to Greek legend, the oldest town in the Troad was that founded by Teucer, who was a son of the river Scamander and the nymph Idaea. Tzetzes says that the Scamander in question was the Scamander in Crete, and that Teucer was told by an oracle to settle wherever the "earth-born ones" attacked him. So when he and his company were attacked in the Troad by mice, which gnawed their bow-strings and the handles of their shields, he settled on the spot, thinking that the oracle was fulfilled. He called the town Sminthium and built a temple to Apollo Smintheus, the Cretan word for a mouse being *sminthius*. In his reign Dardanus, son of Zeus and the nymph Electra, daughter of Atlas, in consequence of a deluge, drifted from the island of Samothrace on a raft or a skin bag to the coast of the Troad, where, having received a portion of land from Teucer and married his daughter Batea, he founded the city of Dardania or Dardanus on high ground at the foot of Mt Ida. On the death of Teucer, Dardanus succeeded to the kingdom and called the whole land Dardania after himself. He begat Erichthonius, who begat a son Tros by Astyoche, daughter of Simois. On succeeding to the throne, Tros called the country Troy and the people Trojans. By Callirrhoe, daughter of Scamander, he had three sons—Ilus, Assaracus and Ganymede. From Ilus and Assaracus sprang two separate lines of the royal house—the one being Ilus, Laomedon, Priam, Hector; the other Assaracus, Capys, Anchises, Aeneas. Ilus went to Phrygia, where, being victorious in wrestling, he received as a prize from the king of Phrygia a spotted cow, with an injunction to follow her and found a city wherever she lay down. The cow lay down on the hill of the Phrygian Atē; and here accordingly Ilus founded the city of Ilion. It is stated that Dardania, Troy and Ilion became one city. Desiring a sign at the foundation of Ilion, Ilus prayed to Zeus and as an answer he found lying before his tent the Palladium, a wooden statue of Pallas, three cubits high, with her feet joined, a spear in her right hand, and a distaff and spindle in her left. Ilus built a temple for the image and worshipped it. By Eurydice, daughter of Adrastus, he had a son Laomedon. Laomedon married Strymo, daughter of Scamander, or Placia, daughter of Atreus or of Leucippus. It was in his reign that Poseidon and Apollo, or Poseidon alone, built the walls of Troy. In his reign also Heracles besieged and took the city, slaying Laomedon and his children, except one daughter Hesione and one son Podarces. The life of Podarces was granted at the request of Hesione; but Heracles stipulated that Podarces must first be a slave and then be redeemed by Hesione; she gave her veil for him; hence his name of Priam (Gr. πρίασθαι, to buy). Priam married first Arisbe and afterwards Hecuba, and had fifty sons and twelve daughters. Among the sons were Hector and Paris, and among the daughters Polyxena and Cassandra. To recover Helen, whom Paris carried off from Sparta, the Greeks under Agamemnon besieged Troy for ten years. At last they contrived a wooden horse, in whose hollow belly many of the Greek heroes hid themselves. Their army and fleet then withdrew to Tenedos, feigning to have raised the siege. The Trojans conveyed the wooden horse into Troy; in the night the Greeks stole out, opened the gates to their friends, and Troy was taken.

See Homer, *Il.* vii. 452 seq., xx. 215 seq., xxi. 446 seq.; Apollodorus ii. 6, 4, iii. 12; Diodorus iv. 75, v. 48; Tzetzes, *Schol. on Lycophron*, 29, 72, 1302; Conon, *Narrat.* 21; Dionysius Halicarn. *Antiq. Rom.* i. 68 seq. The *Iliad* deals with a period of fifty-one days in the tenth year of the war. For the wooden horse, see Homer, *Od.* iv. 271 seq.; Virgil, *Aen.* ii. 13 seq.

The Medieval Legend.—The medieval romance of Troy, the *Roman de Troie*, exercised greater influence in its day and for centuries after its appearance than any other work of the same class. Just as the *chansons de geste* of the 10th century were the direct ancestors of the prose romances which afterwards spread throughout Europe, so, even before Heliodorus and Achilles Tatius, there were quasi-histories, which reproduced in prose, with more or less exactness, the narratives of epic poetry. Long previous to the Ἡρωϊκὸς of Flavius Philostratus (*fl.* 3rd century A.D.) the Trojan War had been the subject of many a prose fiction, dignified with the title of history; but to remodel the whole story almost in the shape of annals, and to give a minute personal description of the persons and characters of the principal actors, were ideas which belonged to an artificial stage of literature. The work of Philostratus is cast in the form of a dialogue between a Phoenician traveller and a vine-grower at Eleus, and is a discourse on twenty-six heroes of the war. A fictitious journal (*Ephemeris*), professing to give the chief incidents of the siege, and said to have been written by Dictys of Crete, a follower of Idomeneus, is mentioned by Suïdas, and was largely used by John Malalas and other Byzantine chroniclers. This was abridged in Latin prose, probably in the 4th century, under the title of *Dictys Cretensis de bello Trojano libri VI.* It is prefaced by an introductory letter from a certain L. Septimius to Q. Aradius Rufinus, in which it is stated that the diary of Dictys had been found in his tomb at Cnossus in Crete, written in the Greek language, but in Phoenician characters. The narrative begins with the rape of Helen, and includes the adventures of the Greek princes on the return voyage. With Dictys is always associated Dares, a pseudo-historian of more recent date. Old Greek writers mention an account of the destruction of the city earlier than the Homeric poems, and in the time of Aelian (2nd century A.D.) this *Iliad* of Dares, priest of Hephaestus at Troy, was believed to be still in existence. Nothing has since been heard of it; but an unknown Latin writer, living between 400 and 600, took advantage of the tradition to compile *Daretis Phrygii de excidio Trojae historia*, which begins with the voyage of the Argo. It is in prose and professes to be translated from an old Greek manuscript. Of the two works that of Dares is the later, and is inferior to Dictys. The matter-of-fact form of narration recalls the poem of Quintus Smyrnaeus. In both compilations the gods and everything supernatural are suppressed; even the heroes are degraded. The permanent success, however, of the two works distinguishes them among apocryphal writings, and through them the Troy legend was diffused throughout western Europe. The Byzantine writers from the 7th to the 12th century exalted Dictys as a first-class authority, with whom Homer was only to be contrasted as an inventor of fables. Western people preferred Dares, because his history was shorter, and because, favouring the Trojans, he flattered the vanity of those who believed that people to have been their ancestors. Many MSS. of both writers were contained in old libraries; and they were translated into nearly every language and turned into verse. In the case of both works, scholars are undecided whether a Greek original ever existed (but see DICTYS CRETENSIS). The Byzantine grammarian, Joannes Tzetzes (*fl.* 12th century), wrote a Greek hexameter poem on the subject (*Iliaca*). In 1272, a monk of Corbie translated "sans rime *L'Estoire de Troiens et de Troie* (de Dares) du Latin en Roumans mot à mot" because the *Roman de Troie* was too long. Geoffrey of Waterford put Dares into French prose; and the British Museum has three Welsh MS. translations of the same author—works, however, of a much later period.

The name of Homer never ceased to be held in honour; but he is invariably placed in company with the Latin poets. Few of those who praised him had read him, except in the Latin redaction, in 1100 verses, by the so-called Pindarus Thebanus. It supplied the chief incidents of the *Iliad* with tolerable exactness and was a textbook in schools.

For a thousand years the myth of descent from the dispersed heroes of the conquered Trojan race was a sacred literary tradition throughout western Europe. The first Franco-Latin chroniclers traced their history to the same origin as that of Rome, as told by the Latin poets of the Augustan era; and in the middle of the 7th century Fredegarius Scholasticus (*Rer. gall. script.* ii. 461) relates how one party of the Trojans settled between the Rhine, the Danube and the sea. In a charter of Dagobert occurs the statement, "ex nobilissimo et antiquo Trojanorum reliquiarum sanguine nati." This statement is repeated by chroniclers and panegyrical writers, who also considered the *History of Troy* by Dares to be the first of national books. Succeeding kings imitated their predecessors in giving official sanction to their legendary origin: Charles the Bald, in a charter, uses almost the same words as Dagobert, "ex praeclaro et antiquo trojanorum sanguine nati." In England a similar tradition had been early formulated, as appears from Nennius's *Historia britonum* and Geoffrey of Monmouth. The epic founder of Britain was Brutus, son, or in another tradition, great-grandson, of Aeneas, in any case of the royal house of Troy. The tradition, repeated in Wace's version of Geoffrey, by Matthew Paris and others, persisted to the time of Shakespeare. Brutus found Albion uninhabited except by a few giants. He founded his capital on the banks of the Thames, and called it New Troy. Otto Frisingensis (12th century) and other German chroniclers repeat similar myths, and the apocryphal hypothesis is echoed in Scandinavian sagas. About 1050 a monk named Bernard wrote *De excidio Trojae*, and in the middle of the 12th century Simon Chèvre d'Or, canon of the abbey of Saint-Victor, Paris, followed with another poem in leonine elegiacs on the fall of the city and the adventures of Aeneas, in which the Homeric and Virgilian records were blended.

We now come to a work on the same subject, which in its own day and for centuries afterwards exercised an extraordinary influence throughout Europe. About the year 1184 Benoît de Sainte-More (*q.v.*) composed a poem of 30,000 lines entitled *Roman de Troie*. It forms a true Trojan cycle and embraces the entire heroic history of Hellas. The introduction relates the story of the Argonauts, and the last 2680 verses are devoted to the return of the Greek chiefs and the wanderings of Ulysses. With no fear of chronological discrepancy before his eyes, Benoît reproduces the manners of his own times, and builds up a complete museum of the 12th century—its arts, costumes, manufactures, architecture, arms, and even religious terms. Women are repeatedly introduced in unwarranted situations; they are spectators of all combats. The idea of personal beauty is different from that of the old Greeks; by Benoît good humour, as well as health and strength, is held to be one of its chief characteristics. The love-pictures are another addition of the modern writer. The author speaks enthusiastically of Homer, but he derived his information chiefly from the pseudo-annals of Dictys and Dares, more especially the latter, augmented by his own imagination and the spirit of the age. It is to Benoît alone that the honour of poetic invention is due, and in spite of its obligation for a groundwork to Dictys and Dares we may justly consider the *Roman de Troie* as an original work. From this source subsequent writers drew their notions of Troy, mostly without naming their authority and generally without even knowing his name. This is the masterpiece of the pseudo-classical cycle of romances: and in the Latin version of Guido delle Colonne it passed through every country of Europe.

The *De bello trojano* of Joseph of Exeter, in six books, a genuine poem of no little merit, was written soon after Benoît's work or about the years 1187-1188. At first ascribed to Dares Phrygius and Cornelius Nepos, it was not published as Joseph's until 1620 at Frankfort. It was directly drawn from the pseudo-annalists, but the influence of Benoît was considerable. Of the same kind was the *Troilus* of Albert of Stade (1249), a version of Dares, in verse, characterized by the old severity and affected realism. But these Latin works can only be associated indirectly with Benoît, who had closer imitators in Germany at an early period. Herbort of Fritzlar reproduced the French text in his *Lied von Troye* (early 13th century), as did also Konrad von Würzburg (d. 1287) in his *Buch von Troye* of 40,000 verses, which he himself compared to the "boundless ocean." It was completed by an anonymous poet. To the like source may be traced a poem of 30,000 verses on the same subject by Wolfram von Eschenbach; and Jacques van Maerlant reproduced Benoît's narrative in Flemish. The Norse or Icelandic *Trojumanna saga* repeats the tale with some variations.

In Italy Guido delle Colonne, a Sicilian, began in 1270 and finished in 1287 a prose *Historia trojana*, in which he reproduced the *Roman de Troie* of Benoît, and so closely as to copy the errors of the latter and to give the name of Peleus to Pelias, Jason's uncle. As the debt was entirely unacknowledged, Benoît at last came to be considered the imitator of Guido. The original is generally abridged, and the vivacity and poetry of the Anglo-Norman trouvère disappear in a dry version. The immense popularity of Guido's work is shown by the large number of existing MSS. The French Bibliothèque Nationale possesses eighteen codices of Guido to thirteen of Benoît, while at the British Museum the proportion is ten to two. Guido's *History* was translated into German about 1392 by Hans Mair of Nördlingen. Two Italian translations were made: by Filippo Ceffi (1324) and by Matteo Beliebuoni (1333). In the 14th and the commencement of the 15th century four versions appeared in England and Scotland. The best known is the *Troy Book*, written between 1414 and 1420, of John Lydgate, who had both French and Latin texts before him. An earlier and anonymous rendering exists at Oxford (Bodleian MS. Laud Misc. 595). There is the *Gest Hystoriale of the Destruction of Troy* (Early Eng. Text Soc., 1869–1874), written in a northern dialect about 1390; a Scottish version (15th century) by a certain Barbour, not the poet, John Barbour; and *The Seege of Troy*, a version of Dares (Harl. MS. 525 Brit. Mus.). The invention of printing gave fresh impetus to the spread of Guido's work. The first book printed in English was *The Recuyell of the Hystoryes of Troye*, a translation by Caxton from the French of Raoul Lefèvre. The *Recueil des histoires de Troyes* was "composé par vénérable homme Raoul le Feure prestre chappellain de mon tres redoupté seigneur monseigneur le duc Phelippe de Bourgoingne en l'an de grace 1464," but probably printed in 1474 by Caxton or Colard Mansion at Bruges. It is in three books, of which the first deals with the story of Jupiter and Saturn, the origin of the Trojans, the feats of Perseus, and the first achievements of Hercules; the second book is wholly taken up with the "prouesses du fort Hercuiez"; the third, "traictant de la generalle destruction de Troyes qui vint a l'ocasion du rauissement de dame Helaine," is little else than a translation of that portion of Guido delle Colonne which relates to Priam and his sons. Two MSS. of the *Recueil* in the Bibliothèque Nationale wrongly attribute the work to Guillaume Fillastre, a voluminous author, and predecessor of Lefèvre as secretary to the duke. Another codex in the same library, *Histoire ancienne de Thèbes et de Troyes*, is partly taken from Orosius. The Bibliothèque Nationale possesses an unpublished *Histoire des Troyens et des Thébains jusqu'à la mort de Turnus, d'après Orose, Ovide et Raoul Lefebre* (early 16th century), and the British Museum a Latin history of Troy dated 1403. There were also translations into Italian, Spanish, High German, Low Saxon, Dutch and Danish; Guido even appeared in a Flemish and a Bohemian dress.

Thus far we have only considered works more or less closely imitated from the original. Boccaccio, passing by the earlier tales, took one original incident from Benoît, the love of Troilus and the treachery of Briseida, and composed *Filostrato*, a parable of his own relations with the Neapolitan princess who figures in his works as Fiammetta. This was borrowed by Chaucer for his *Boke of Troilus and Cresside*, and also by Shakespeare for his *Troilus and Cressida* (1609). One reason why the Round Table stories of the 12th and 13th centuries had a never-ceasing charm for readers of the two following centuries was that they were constantly being re-edited to suit the changing taste. The *Roman de Troie* experienced the same fate. By the 13th century it was translated into prose and worked up in those enormous compilations, such as the *Mer des histoires*, &c., in which the middle ages studied antiquity. It reappeared in the religious dramas called Mysteries. Jacques Millet, who produced *La Destruction de Troie la Grande* between 1452 and 1454, merely added vulgar realism to the original. Writers of chap-books borrowed the story, which is again found on the stage in Antoine de Montchrétien's tragedy of *Hector* (1603)—a last echo of the influence of Benoît.

Bibliography.—The Troy legend is dealt with in the elaborate work of A. Joly, *Benoît de Sainte-More et le Roman de Troie* (1870–1871); G. Körting, *Der altfranz. Roman de Troie* (1883); F. Settegast, *Benoît de Ste-More* (Breslau, 1876); G. C. Frommann, *Herbort v. Fritzlar u. Benoît de Ste-More* (Stuttgart, 1837); R. Jäckel, *Dares Phrygius u. Benoît de Ste-More* (Breslau, 1875); E. Juste, *Sur l'origine des poëmes attrib. à Homère et sur les cycles épiques de l'antiq. et du Moyen-Âge* (Brussels, 1849); J. A. Fuchs, *De varietate fabularum troicarum quaestiones* (Cologne, 1830); H. Dunger, *Die Sage vom trojan. Kriege* (Leipzig, 1869); G. Körting, *Dictys u. Dares* (Halle, 1874); H. Dunger, *Dictys Septimius* (Dresden, 1878); L. Havet, "Sur la date du Dictys de Septimius," *Rev. de philol.* (1878); F. Meister, "Zur Ephem. belli Troiani von Dictys," *Philologus* (1879); R. Barth, *Guido de Columna* (Leipzig, 1877); A. Mussafia, "Sulle versione Italiane della Storia Troiana," *Sitz. d. k. Akad. Wien* (1871), vol. lxvii., and "Ueber d. span. Versionen" (ibid., 1871), vol. lxix.; A. Pey, *Essai sur li romans d'Eneas* (1856). See also J. J. Jusserand, *De Josepho Exoniensi* (1877); E. Gorra, *Testi inediti di storia trojana* (Turin, 1887); A. Graf, *Roma nella memoria et nelle imaginazioni del medio evo* (Turin, 1882); *Le Roman de Troie*, ed. L. Constans (Soc. d. anc. textes fr. Paris, 1904); H. L. Ward, *Catalogue of Romances* (1883), vol. i.; W. Greif, "Die mittelälterlichen Bearbeitungen der Trojanersage," in E. Stengel's *Ausgaben und Abhandlungen aus dem Gebiete der romanischen Philologie* (Marburg, 1886); A. N. Wesselofsky, *Mat. et recherches pour servir à l'histoire du roman et de la nouvelle* (Petersburg, 1889); R. Dernedde, *Ueber die den altfranzösischen Dichtern bekannten epischen Stoffe aus dem Alterthum* (1887).

TROY, a city and the county-seat of Rensselaer county, New York, U.S.A., at the head of tidewater on the eastern bank of the Hudson river, opposite the mouth of the Mohawk, about 6 m. N. of Albany and about 148 m. N. of New York City. Pop. (1880), 56,747; (1890), 60,956; (1900), 60,651, of whom 14,384 were foreign-born (7348 being Irish, 1796 German and 1498 English) and 400 were negroes; (1910, census), 76,813. Troy is served by the Boston & Maine, the New York Central & Hudson River and the Delaware & Hudson railways, and by interurban electric lines connecting with Saratoga and Lake George on the north, Albany on the south and Schenectady and the cities of the populous Mohawk Valley on the west; it is at the head of river steamboat navigation on the Hudson, and has water communication by means of the Erie and Champlain canals with the Great Lakes and Canada. The site is a level oblong tract extending along the Hudson for 7 m. and reaching back a mile or so from the river to highlands which rise to a height of 400 ft., with Mt Ida (240 ft. above tidewater) forming a picturesque background. The older part of the city and the principal business and manufacturing district occupies the low lands; the newer part, chiefly residential, is built upon the heights. The northern part of the city was the village of Lansingburg (pop. 1900, 12,595) until 1901, when with parts of the towns of Brunswick and North Greenbush it was annexed to

Troy. Opposite Troy on the west bank of the Hudson, and connected with it by bridges, are Cohoes, Watervliet and Waterford. Industrially and commercially they virtually form a part of Troy. Troy is the seat of Rensselaer Polytechnic Institute, founded in 1824 by Stephen van Rensselaer as a "school of theoretical and practical science," incorporated in 1826, and reorganized in 1849 as a general polytechnic institute. It is the oldest school of engineering in the country, and has always maintained a high rank of efficiency. The large gifts (about $1,000,000) to the school made by Mrs Russell Sage in 1907 enabled it to add courses in mechanical and electrical engineering to its course in civil engineering. The institute had 55 instructors and 650 students in 1910. The Emma Willard School, founded as the Troy Female Seminary in 1821 by Mrs Emma Willard (1787–1870),[1] is one of the oldest schools for women in the United States. Other educational institutions include Troy Academy (1834), a non-sectarian preparatory school; La Salle Institute (conducted by the Brothers of the Christian Schools); St Joseph's Academy (Roman Catholic) and St Peter's Academy (Roman Catholic). Noteworthy buildings of a public and semi-public character include the post office, the public library, containing in 1910 43,500 volumes, the Troy Savings Bank building, the city hall, the Rensselaer county court house, a Y.M.C.A. building and St Paul's Episcopal, the Second Presbyterian and St Mary's (Roman Catholic) churches. An area of 175 acres is comprised in the city's parks, the largest of which are Prospect Park and Beman Park. In Oakwood cemetery, 400 acres, are the grave of General George H. Thomas, and a monolithic shaft to the memory of General John Ellis Wool (1784–1869), who served with distinction in the War of 1812 and in the Mexican War, and in the Civil War commanded for a time the Department of Virginia. In Washington Square there is a Soldiers' and Sailors' Monument, 93 ft. high. Altro Park, on an island a short distance down the river, is a pleasure resort in summer.

Two rapid streams, Poesten Kill and Wynants Kill, flowing into the Hudson from the east, through deep ravines, furnish good water-power, which, with that furnished by the state dam across the Hudson here, is utilized for manufacturing purposes. In 1905 the value of Troy's factory product was $31,860,829. Of this $11,271,708 was the value of collars and cuffs (89·5% of the value of the total American product), an industry which gave employment to 49·3% of the wage-earners in Troy, and paid 42·1% of the wages. Closely allied with this industry was shirt-making, with an output valued at $4,263,610. Troy is the market for a fertile agricultural region, and the principal jobbing centre for a large district in north-eastern New York and eastern Massachusetts.

The site of Troy was part of the Van Rensselaer manor grant of 1629. In 1659 it was bought from the Indians, with the consent of the patroon, by Jan Barentsen Wemp, and several families settled here. In 1707 it passed into the hands of Derick van der Heyden, who laid out a large farm. During this early period it was known variously as Ferryhook, Ashley's Ferry and Van der Heyden's Ferry. In 1777 General Philip Schuyler established his headquarters on Van Schaick's Island in the Mohawk and Hudson, then the principal rendezvous of the army which later met Burgoyne at Saratoga. After the close of the war there was an influx of settlers from Rhode Island, Connecticut, New Hampshire and Vermont; a town was laid out on the Van der Heyden farm, and in 1789 the name of Troy was selected in town meeting; and in 1791 the town of Troy was formed from part of Rensselaerwyck. The county-seat was established here in 1793, and Troy was incorporated as a village in 1794 and was chartered as a city in 1816. The first newspaper, *The Farmer's Oracle*, began publication in 1797. In 1812 a steamboat line was established between Troy and Albany. Troy benefited financially by the War of 1812, during which contracts for army beef were filled here. The opening of the Erie Canal in 1825 contributed greatly to Troy's commercial importance. During the Civil War army supplies, ammunition and cannon, and the armour-plate and parts of the machinery for the "Monitor" were made here. The first puddling works were opened in 1839, and Troy was long the centre of the New York iron and steel industry; in 1865 the second Bessemer steel works in the United States were opened here. Troy has three times been visited by severe conflagrations, that of June 1820 entailing a loss of about $1,000,000, that of August 1854 about the same, and that of May 1862, known as "the Great Fire," the destruction of over 500 buildings, and a property loss of some $3,000,000.

See Arthur J. Weise, *History of the City of Troy* (Troy, 1876), and *Troy's One Hundred Years* (Troy, 1891).

TROY, a city and the county-seat of Miami county, Ohio, U.S.A., on the west bank of the Great Miami river, about 65 m. W. of Columbus. Pop. (1890), 4494; (1900), 5881 (234 foreign-born); (1910), 6122. Troy is served by the Cleveland, Cincinnati, Chicago & St Louis and the Cincinnati, Hamilton & Dayton railways, and by the Dayton & Troy and the Springfield, Troy & Piqua electric inter-urban lines. The Miami and Erie Canal, formerly important for traffic, is now used only for power. The principal public buildings include the court house and the city hall, and there are a public library (housed in the city hall) and a children's home. Troy is situated in a good general farming region, of which tobacco is an important crop; and there are various manufactures. The municipality owns and operates the waterworks and electric-lighting plant. The first settlement was made in 1807, and Troy was first chartered as a city in 1890.

TROYES, a town of France, capital of the department of Aube, 104 m. E.S.E. of Paris on the Eastern railway to Belfort. Pop. (1906), 51,228. The town is situated in the wide alluvial plain watered by the Seine, the main stream of which skirts it on the east. It is traversed by several small arms of the river, and the Canal de la Haute-Seine divides it into an upper town, on the left bank, and a lower town on the right bank. The streets are, for the most part, narrow and crooked. It is surrounded by a belt of *boulevards*, outside which lie suburbs. The churches of the town are numerous, and especially rich in stained glass of the Renaissance period, from the hands of Jean Soudain, Jean Macadré, Linard Gonthier and other artists.

St Pierre, the cathedral, was begun in 1208, and it was not until 1640 that the north tower of the façade was completed. With a height to the vaulting of only 98 ft. it is less lofty than other important Gothic cathedrals of France. It consists of an apse with seven apse chapels, a choir with double aisles, on the right of which are the treasury and sacristy, a transept without aisles, a nave with double aisles and side chapels and a vestibule. The west façade belongs to the 16th century with the exception of the upper portion of the north tower; the south tower has never been completed. Three portals, that in the centre surmounted by a fine flamboyant rose window, open into the vestibule. The stained glass of the interior dates mainly from the 15th and 16th centuries. The treasury contains some fine enamel work and lace. The church of St Urban, begun in 1262 at the expense of Pope Urban IV., a native of the town, is a charming specimen of Gothic architecture, the lightness and delicacy of its construction rivalling that of churches built a century later. The glass windows, the profusion of which is the most remarkable feature of the church, date, for the most part, from the years 1265 to 1280. The church of La Madeleine, built at the beginning of the 13th century, and enlarged in the 16th, contains a rich rood-screen by Giovanni Gualdo (1508) and fine stained-glass windows of the 16th century. The church of St Jean, though hidden among old houses, is one of the most picturesque in Troyes. The choir is a fine example of Renaissance architecture and the church contains a high altar of the 17th century, stained glass of the 16th century and many other works of art. St Nicholas is a building of the 16th century with a beautiful vaulted gallery in the interior. The church of St Pantaléon of the 16th century and that of St Nizier, mainly of the same period, contain remarkable sculptures and paintings. St Remi (14th, 15th and 16th centuries) and St Martin-ès-Vignes (16th and 17th centuries), the latter notable for its 17th-century windows, are also of interest. The old abbey of St Loup is occupied by a museum containing numerous collections. The Hôtel Dieu of the 18th century is remarkable for the fine gilded iron railing of its courtyard. Most of the old houses of Troyes are of wood, but some of stone of the 16th century are remarkable for their beautiful and original architecture. Amongst the latter the hôtels de Vauluisant, de Mauroy and de Marisy are specially interesting. The prefecture occupies the buildings of the old abbey of Notre-Dame-aux-Nonnains; the Hôtel-de-ville dates from the 17th century; the savings bank, the theatre and the *lycée* are modern buildings. A marble monument to the Sons of Aube commemorates the war of 1870–71.

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[1] Emma Hart was born in Berlin, Connecticut, became a teacher in 1803, and in 1809 married Dr John Willard of Middlebury Vermont, where she opened a boarding school for girls in 1814. In 1819 she wrote *A Plan for Improving Female Education*, submitted to the governor of New York state; and in 1821 she removed to Troy. Her son took charge of the school in 1838. She prepared many textbooks and wrote *Journal and Letters from France and Great Britain* (1833). See the biography (1873) by John Lord.

Troyes is the seat of a bishop and a court of assize. Its public institutions include a tribunal of first instance, a tribunal of commerce, a council of trade arbitrators, a chamber of commerce and a branch of the Bank of France. A *lycée*, an ecclesiastical college, training colleges for male and female teachers, and a school of hosiery are its chief educational institutions. There are also several learned societies and a large library. The dominant industry in Troyes is the manufacture of cotton, woollen and silk hosiery, which is exported to Spain, Italy, the United States and South America; printing and dyeing of fabrics, tanning, distilling, and the manufacture of looms and iron goods are among the other industries. The market gardens and nurseries of the neighbourhood are well known. There is trade in the wines of Burgundy and Champagne, in industrial products, in snails and in the dressed pork prepared in the town.

History.—At the beginning of the Roman period Troyes (*Augustobona*) was the principal settlement of the Tricassi, from whose name its own is derived. It owed its conversion to Christianity to Saints Savinian and Potentian, and in the first half of the 4th century its bishopric was created as a suffragan of Sens. St Loup, the most illustrious bishop of Troyes, occupied the episcopal seat from 426 to 479. He is said to have persuaded Attila, chief of the Huns, to leave the town unpillaged, and is known to have exercised great influence in the Church of Gaul. The importance of the monastery of St Loup, which he founded, was overshadowed by that of the abbey of nuns known as Notre-Dame-aux-Nonnains, which possessed large schools and enjoyed great privileges in the town, in some points exercising authority even over the bishops themselves. In 892 and 898 Troyes suffered from the depredations of the Normans, who on the second occasion reduced the town to ruins. In the early middle ages the bishops were supreme in Troyes, but in the 10th century this supremacy was transferred to the counts of Troyes (see below), who from the 11th century were known as the counts of Champagne. Under their rule the city attained great prosperity. Its fairs, which had already made it a prominent commercial centre, flourished under their patronage, while the canals constructed at their expense aided its industrial development. In the 12th century both the counts and the ecclesiastics joined in the movement for the enfranchisement of their serfs, but it was not till 1230 and 1242 that Thibaut IV. granted charters to the inhabitants. A disastrous fire occurred in 1188; more disastrous still was the union of Champagne with the domains of the king of France in 1304, since one of the first measures of Louis le Hutin was to forbid the Flemish merchants to attend the fairs, which from that time declined in importance. For a short time (1419–1425), during the Hundred Years' War, the town was the seat of the royal government, and in 1420 the signing of the Treaty of Troyes was followed by the marriage of Henry V. of England with Catherine, daughter of Charles VI., in the church of St Jean. In 1429 the town capitulated to Joan of Arc. The next hundred years was a period of prosperity, marred by the destruction of half the town by the fire of 1524. In the 16th century Protestantism made some progress in Troyes but never obtained a decided hold. In 1562, after a short occupation, the Calvinist troops were forced to retire, and on the news of the massacre of St Bartholomew fifty Protestants were put to death. The revocation of the Edict of Nantes in 1685 was a severe blow to the commerce of Troyes, which was not revived by the re-establishment of the former fairs in 1697. The population fell from 40,000 to 24,000 between the beginning of the 16th century and that of the 19th century.

See T. Boutiot, *Histoire de Troyes et de la Champagne méridionale* (4 vols., Troyes, 1870–1880); R. Koechlin and J. J. Marquet de Vasselot, *La Sculpture à Troyes et dans la Champagne méridionale au seizième siècle* (Paris, 1900). (R. Tr.)

COUNTS OF TROYES. The succession of the counts of Troyes from the 9th to the 10th century can be established in the following manner. Aleran, mentioned in 837, died before the 25th of April 854. Odo (or Eudes) I. appears as count on the 25th of April 854, and seems to have been stripped of his dignities in January 859. Raoul, or Rudolph, maternal uncle of King Charles the Bald, was count of Troyes in 863 and 864, and died on the 6th of January 866. Odo I. seems to have entered again into possession of the countship of Troyes after the death of Raoul, and died himself on the 10th of August 871. Boso, afterwards king of Provence, received the countship in ward after the death of Odo I. A royal diploma was granted at his request, on the 29th of March 877, to the abbey of Montier-la-Celle in Troyes. Odo II., son of Odo I., became count of Troyes on the 25th of October 877. Robert I., brother of Odo II., was count from 879. He married Gisla, sister of kings Louis III. and Carloman, and was killed by the Northmen in 886 Aleaume, nephew of Robert I., is mentioned in 893. Richard, son of the viscount of Sens Garnier, is styled count of Troyes in a royal diploma of the 10th of December 926. He was living in 931. Herbert I., already count of Vermandois, succeeded Richard, and died in 943. Robert II., one of the five sons of Herbert of Vermandois, is called count of Troyes in an act of the 6th of August 959, and died in August 968. Herbert II. the Old, younger brother of Robert II., succeeded him and died between 980 and 983. Herbert III. the Young, nephew and successor of Herbert II., died in 995. Stephen I., son and successor of Herbert III., was alive in 1019. His successor was his cousin, Odo II., count of Blois. From the 11th century the counts of Troyes, whose domains increased remarkably, are commonly designated by the name of counts of Champagne.

See H. d'Arbois de Jubainville, *Histoire des ducs et des comtes de Champagne* (1859), vol. i.; F. Lot, *Les Derniers Carolingiens*, (1891), pp. 370–377; A. Longnon, *Documents relatifs au comté de Champagne et de Brie* (1904), ii. 9, note. (A. Lo.)

TROYON, CONSTANT (1810–1865), French painter, was born on the 28th of August 1810 at Sèvres, near Paris, where his father was connected with the famous manufactory of china. Troyon was an animal painter of the first rank, and was closely associated with the artists who painted around Barbizon. The technical qualities of his methods of painting are most masterly; his drawing is excellent, and his composition always interesting. It was only comparatively late in life that Troyon found his *métier*, but when he realized his power of painting animals he produced a fairly large number of good pictures in a few years. Troyon entered the *ateliers* very young as a decorator, and until he was twenty he laboured assiduously at the minute details of porcelain ornamentation; and this kind of work he mastered so thoroughly that it was many years before he overcame its limitations. By the time he reached twenty-one he was travelling the country as an artist, and painting landscapes so long as his finances lasted. Then when pressed for money he made friends with the first china manufacturer he met and worked steadily at his old business of decorator until he had accumulated enough funds to permit him to start again on his wanderings.

Troyon was a favourite with Roqueplan, an artist of distinction eight years his senior, and he became one of his pupils after receiving certain tuition from a painter, now quite unknown, named Riocreux. Roqueplan introduced Troyon to Rousseau, Jules Dupré, and the other Barbizon painters, and in his pictures between 1840 and 1847 he seemed to endeavour to follow in their footsteps. But as a landscapist Troyon would never have been recognized as a thorough master, although his work of the period is marked with much sincerity and met with a certain success. It may be pointed out, however, that in one or two pure landscapes of the end of his life he achieved qualities of the highest artistic kind; but this was after lengthy experience as a cattle painter, by which his talents had become thoroughly developed.

In 1846 Troyon went to the Netherlands, and at the Hague saw Paul Potter's famous "Young Bull." From the studies he made of this picture, of Cuyp's sunny landscapes, and brandt's noble masterpieces he soon evolved a new method of painting, and it is only in works produced after this time that Troyon's true individuality is revealed. When he became conscious of his power as an animal painter he developed with rapidity and success, until his works became recognized as masterpieces in Great Britain and America, as well as in all countries of the Continent. Success, however, came too late, for Troyon never quite believed in it himself, and even when he could command the market of several countries he still grumbled loudly at the way the world treated him. Yet he was decorated with the Legion of Honour, and five times received medals at the Paris Salon, while Napoleon III. was one of his patrons; and it is certain he was at least as financially successful as his Barbizon colleagues.

Troyon died, unmarried, at Paris on the 21st of February 1865, after a term of clouded intellect. All his famous pictures are of date between 1850 and 1864, his earlier work being of comparatively little value. His mother, who survived him, instituted the Troyon prize for animal pictures at the École des Beaux Arts. Troyon's work is fairly well known to the public through a number of large engravings from his pictures. In the Wallace Gallery in London are "Watering Cattle" and "Cattle in Stormy Weather"; in the Glasgow Corporation Gallery is a "Landscape with Cattle"; the Louvre contains his famous "Oxen at Work" and "Returning to the Farm"; while the Metropolitan Museum of Art and other galleries in America contain fine examples of his pictures. His "Vallée de la Toucque, Normandy," is one of his greatest pictures; and at Christie's sale-room in 1902 the single figure of a cow in a landscape of but moderate quality fetched £7350. Émile van Marcke (1827–1891) was his best-known pupil.

See H. Dumesnil, *Constant Troyon: Souvenirs intimes* (Paris, 1888); A. Hustin, "Troyon," *L'Art*, pp. 77 and 85 (Paris, 1889); Albert Wolff, "Constant Troyon," *La Capitale de l'art* (Paris, 1886); D. C. Thomson, *The Barbizon School of Painters* (London, 1890); "Constant Troyon," *The Art Journal* (1893), p. 22. (D. C. T.)

TRUCE OF GOD, an attempt of the Church in the middle ages to alleviate the evils of private warfare. Throughout the 9th and 10th centuries, as the life-benefices of the later Carolingian kings were gradually transformed into hereditary fiefs, the insecurity of life and property increased, for there was no central power to curb the warring local magnates. The two measures which were adopted by the Church to remedy these conditions—the *pax ecclesiae* or *Dei* and the *treuga* or *treva Dei*—are usually both referred to as the Truce of God, but they are distinct in character. The latter was a development of the former.

The *pax ecclesiae* is first heard of in the year 990 at three synods held in different parts of southern and central France—at Charroux, Narbonne and Puy. It enlisted the immediate support of the regular clergy, particularly the vigorous congregation of Cluny, and of William V. of Aquitaine, the most powerful lord of southern France, who urged its adoption at the Councils of Limoges (994) and Poitiers (999). The peace decrees of these various synods differed considerably in detail, but in general they were intended fully to protect non-combatants; they forbade, under pain of excommunication, every act of private warfare or violence against ecclesiastical buildings and their environs, and against certain persons, such as clerics, pilgrims, merchants, women and peasants, and against cattle and agricultural implements. With the opening of the 11th century, the *pax ecclesiae* spread over northern France and Burgundy, and diocesan leagues began to be organized for its maintenance. The bishop, or count, on whose lands the peace was violated was vested with judicial power, and was directed, in case he was himself unable to execute sentence, to summon to his assistance the laymen and even the clerics of the diocese, all of whom were required to take a solemn oath to observe and enforce the peace. At the Council of Bourges (1038), the archbishop decreed that every Christian fifteen years and over should take such an oath and enter the diocesan militia. The idea that peace is a divine institution seems to have given rise to a new name for the peace, the *pax Dei*, or peace of God.

The *treuga* or *treva Dei*, the prohibition of every act of private warfare during certain days, goes back at least to the Synod of Elne, held in the Pyrenees in 1027, which suspended all warfare from noon on Saturday till prime on Monday. Like the *pax ecclesiae* it found ardent champions in the regular clergy, especially in Odilo (962–1049), the fifth abbot of Cluny, and soon spread over all France. It penetrated Piedmont and Lombardy in 1041 and Normandy in 1042. By this time the truce extended from the Wednesday evening to the Monday morning in every week and also, in most places, lasted during the seasons of Lent and Advent, the three great vigils and feasts of the Blessed Virgin, and those of the twelve apostles and a few other saints. The *treuga Dei* was decreed for Flanders at the Synod of Thérouanne (1063) and was instituted in southern Italy in 1089, probably through Norman influence. The bishop of Liége introduced it in Germany in 1082, and three years later a synod held at Mainz in the presence of the emperor Henry IV. extended it to the whole empire. It does not appear to have secured a firm footing in England, although its general provisions were incorporated in the laws of the land (1130–1154). The popes took the direction of the matter into their own hands towards the end of the 11th century as they realized the necessity of promoting peace among Christians in order to unite them successfully in the crusades against the Mahommedans; and the first decree of the Council of Clermont (1095), at which Urban II. preached the first crusade, proclaimed a weekly truce for all Christendom, adding a guarantee of safety to all who might take refuge at a wayside cross or at the plough. The Truce of God was reaffirmed by many councils, such as that held at Reims by Calixtus II. in 1119, and the Lateran councils of 1123, 1139 and 1179. When the *treuga Dei* reached its most extended form, scarcely one-fourth of the year remained for fighting, and even then the older canons relating to the *pax ecclesiae* remained in force. The means employed for its enforcement remained practically the same: spiritual penalties, such as excommunication, special ecclesiastical tribunals, sworn leagues of peace, and assistance from the temporal power. The Council of Clermont prescribed that the oath of adherence to the truce be taken every three years by all men above the age of twelve, whether noble, burgess, villein or serf. The results of these peace efforts were perhaps surprisingly mediocre, but it must be borne in mind that not only was the military organization of the dioceses always very imperfect, but feudal society, so long as it retained political power, was inherently hostile to the principle and practice of private peace. The Truce of God was most powerful in the 12th century, but with the 13th its influence waned as the kings gradually gained control over the nobles and substituted the king's peace for that of the Church.

A few bishops, notably Gerard of Cambrai (1013–1051), seem from the first to have opposed the peace laws of the Church as encroaching on royal authority, but the lay rulers usually co-operated with the ecclesiastical authorities in encouraging and maintaining the Truce of God. In fact, the emperor Henry II. and the French king Robert the Pious discussed the subject of universal peace under church auspices at Monzon in 1023. By the 12th century, however, the ecclesiastical measures had proved ineffectual in coping with private warfare, and secular rulers sought independently to diminish the number and atrocity of private wars within their own domains. The provisions of the Truce of God were often incorporated bodily in municipal and district statutes such as the laws of Barcelona (1067). The emperor Henry IV. approved (1085) the extension of the truce to the whole land, and in 1103 royal laws entirely prohibiting private warfare in the empire replaced the Truce of God. In France royalty acquired little by little a preponderant influence over feudalism and used its increased prestige to substitute for the Truce of God the peace of the state. Louis VI., Louis VII. and Philip Augustus gradually obtained recognition not only from the petty lords of their own domain but from most of the magnates of the kingdom. Thanks to the moral support and material resources which it found in the ecclesiastical lords of central and northern France, and to the growing popular desire for the suppression of feuds, royalty was able to support its pretension to the general government of the kingdom. Confirming what was doubtless an older custom, Philip Augustus decreed the *quarantaine-le-roi*, which suspended every act of reprisal for at least forty days; and in 1257 Louis IX. absolutely forbade all private wars in the crown lands. By the beginning of the 14th century the royal authority had sufficient force to ensure the maintenance of the *Landesfriede*. In England, where the Truce of God does not seem to have acquired a firm footing, state law against private warfare obtained practically from the time of the Norman conquest. At least from Henry I. it became an axiom that the law of the king's court stood above all other law and was the same for all.

See L. Huberti, *Studien zur Rechtsgeschichte der Gottesfrieden und Landfrieden*, Bd. i. *Die Friedens-Ordnungen in Frankreich* (Ansbach, 1892); A. Luchaire, "La Paix et la trêve de Dieu," in E. Lavisse's *Histoire de France*, II. 2, pp. 133–138 (Paris, 1901); E. Sémichon, *La Paix et la trève de Dieu* (2nd ed. 1869); E. Mayer, *Deutsche und französische Verfassungsgeschichte* (1899), vol. i.; J. Fehr, *Der Gottesfriede und die katholische Kirche des Mittelalters* (Augsburg, 1861); A. Kluckhohn, *Geschichte des Gottesfriedens* (Leipzig, 1857); K. J. von Hefele, *Conciliengeschichte*, 2nd ed., vol. 4; Du Cange, *Glossarium*, *s.v. Treuga*. The principal French documents on the subject are published in Huberti's book, and those of Germany, Italy and Arles are edited by L. Weiland in the *Monumenta Germaniae historica, constitutiones* i. 596 sqq. (C. H. Ha.)

TRUCK. (1) A name for barter, or commodities used in barter or trade. The word came into English from the French *troq*, mod. *troc*; *troquer*, to barter, is borrowed from Spanish *trocar*, for which several origins have been suggested, such as a Low Latin *travicare*, the supposed original of "traffic" (*q.v.*), or some latinized form of Greek τρόπος, turn; it may, on the other hand, be connected with the Greek τροχός, wheel. "Truck," in this sense, is chiefly used now in the sense of the payment of the wages of workmen *in kind*, or in any other way than the unconditional payment of money, a practice known as the "truck system." Colloquially, "truck" is used in the general sense of "dealing," in such expressions as "to have no truck with anyone." The "truck system" has taken various forms. Sometimes the workman has been paid with "portion of that which he has helped to produce," whether he had need of it or not, but the more usual form was to give the workman the whole or part of his wages in the shape of commodities suited to his needs. There was also a practice of paying in money, but with an express or tacit understanding that the workman should resort for such goods as he required to shops or stores kept by his employer. The truck system led in many cases to grave abuses and was made illegal by the Truck Acts, under which wages must be paid in current coin of the realm, without any stipulations as to the manner in which the same shall be expended. (See LABOUR LEGISLATION.) (2) From the Late Latin *trochus*, wheel, Greek τροχός, we get "truck" in the sense of a wheeled vehicle, such as the hand-barrows used for carrying luggage at a railway station; and the word is used generally for all that portion of railway rolling-stock which is intended for the carriage of goods (see RAILWAYS: *Rolling-stock*). The term is also used of a circular disk of wood at the top of a ship's mast, generally provided with sheaves for the signal halyards.

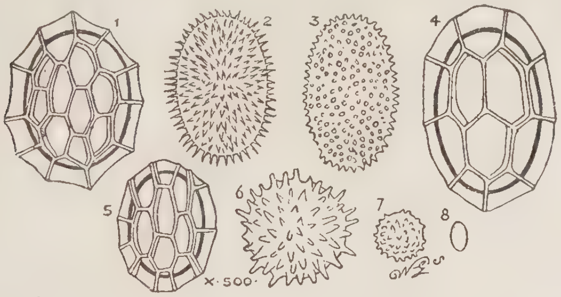
TRUCKLE, a verb meaning to submit servilely or fawningly to another's bidding, to yield in a weak, feeble or contemptible way. The origin is the "truckle bed," a small bed on wheels which could be pushed under a large one. In early times servants or children slept in such beds, placed at the foot of their masters' and parents' bed, but the name first appears as a university word, and was derived direct from Latin *trochlea*, a wheel or pulley-block, Greek τροχός, wheel (τρέχειν, to run).

TRUEBA, ANTONIO DE (1819–1889), Spanish novelist, was born on the 24th of December 1819 at Montellano (Biscay), where he was privately educated. In 1835 he was sent to learn business at Madrid; but commerce was not to his taste, and, after a long apprenticeship, he turned to journalism. In 1851 he hit the popular taste with *El Cid Campeador* and *El Libro de los cantares*; for the next eleven years he was absorbed by journalistic work, the best of his contributions being issued under the titles of *Cuentos populares* (1862), *Cuentos de color de rosa* (1864), and *Cuentos campesinos* (1865). The pleasant simplicity and idyllic sentimentalism of these collections delighted an uncritical public, and Trueba met the demand by supplying a series of stories conceived in the same ingenuous vein. In 1862 he was appointed archivist and chronicler of the Biscay provinces; he was deprived of the former post in 1870, but was reinstated after the restoration. He died at Bilbao on the 10th of March 1889.

TRUFFLE (from Med. Fr. *trufle*, a variant of *truffe*, generally taken to be for *tafie*, from Lat. *tuber*, an esculent root, a tuber, cf. Ital *tartufo*, *truffle*, from Lat. *torae tuber*; another Ital. form *tartufola* gave Ger. *Tartoffel*, dissimilated to *Kartoffel*, potato), the name of several different species of subterranean fungi which are used as food. The species sold in English markets is *Tuber aestivum*; the commonest species of French markets is *T. melanosporum*, and of Italian the garlic-scented *T. magnatum*. Of the three, the English species is the least desirable, and the French is possibly the best. The truffle used for Perigord pie (*pâté de foie gras*) is *T. melanosporum*, regarded by some as a dark variety of our British species, *T. brumale*. When, however the stock of *T. melanosporum* happens to be deficient, some manufacturers use inferior species, such as the worthless or dangerous *Choeromyces meandriformis*. Even the rank and offensive *Scleroderma vulgare* (one of the puff-ball series of fungi) is sometimes used for stuffing turkeys, sausages, &c. Indeed, good truffles, and then only *T. aestivum*, are seldom seen in English markets. The taste of *T. melanosporum* can be detected in Perigord pie of good quality. True and false truffles can easily be distinguished under the microscope.

Tuber aestivum, the English truffle, is roundish in shape, covered with coarse polygonal warts, black in colour outside and brownish and veined with white within; its average size is about that of a small apple. It grows from July till autumn or winter, and prefers beech, oak and birch woods on argillaceous or calcareous soil, and has sometimes been observed in pine woods. It grows gregariously, often in company with *T. brumale* and (in France and Italy) *T. melanosporum*, and sometimes appears in French markets with these two species as well as with *T. mesentericum*. The odour of *T. aestivum* is very strong and penetrating; it is generally esteemed powerfully fragrant, and its taste is considered agreeable. The common French truffle, *T. melanosporum*, is a winter species. It is a valuable article of commerce and is exported from France in great quantities. The tubers are globose, bright brown or black in colour, and rough with polygonal warts; the mature flesh is blackish grey, marbled within with white veins. It is gathered in autumn and winter in beech and oak woods, and is frequently seen in Italian markets. The odour of *T. melanosporum* is very pleasant, especially when the tubers are young, then somewhat resembling that of the strawberry; with age the smell gets very potent, but is never considered really unpleasant. The common Italian truffle, *T. magnatum*, is pallid ochreous or brownish buff in colour, smooth or minutely papillose, irregularly globose, and lobed; the interior is a very pale brownish liver colour veined with white. It grows towards the end of autumn in plantations of willows, poplars and oaks, on clayey soil. Sometimes it occurs in open cultivated fields. The odour of the mature fungus is very potent, and is like strong garlic, onion or decaying cheese. *T. brumale*, referred to above, grows in Britain. It is a winter truffle, and is found chiefly under oaks and abele trees from October to December. It is black in colour, globose, more or less regular in shape, and is covered with sharp polygonal warts; the mature flesh is blackish grey marbled with white veins. The odour is very strong and lasts a long time; the taste is generally esteemed agreeable. *Choeromyces meandriformis*, which occurs in Britain, is sometimes sold for *T. magnatum*, the colour of the flesh of both species being somewhat similar. *Scleroderma vulgare*, the "false truffle," is extremely common on the surface of the ground in woods, and is gathered by Italians and Frenchmen in Epping Forest for the inferior dining-rooms of London where continental dishes are served. It is a worthless, offensive, and possibly dangerous fungus. A true summer truffle, *T. mesentericum*, found in oak and birch woods on calcareous clay soil, is frequently eaten on the Continent. It is esteemed equal to *T. aestivum*, of which it is regarded as a variety and probably grows in Britain. Another edible species, *T. macrosporum*, also grows in Britain, in clayey places under young beeches and oaks, on the borders of streams and roads, and sometimes in fields; more rarely it grows in plantations of willow and poplar. It has a strong scent of onions or garlic somewhat similar to *T. aestivum*, but it is less esteemed on account of its toughness and its small size.

Terfezia leonis, a famous truffle of Italy, Algeria, Sardinia, &c., resembles externally a potato. It grows in March, April and May. Some persons eat it in a raw state, sliced and dipped in oil or egg. It is not scented, and its taste is generally considered insipid or soapy. *Melanogaster variegatus*, an ally of the puff-balls, and therefore (like *Scleroderma*) not a true truffle, is sometimes eaten in England and France. It has been, and possibly still is, occasionally sold in England under the name of "red truffle." It is a small ochreous-brown species with a strong aromatic and pleasant odour of bitter almonds. When the plant is eaten raw the taste is sweet and sugary, but when cooked it is hardly agreeable. The odour belonging to many truffles is so potent that their places of growth can be readily detected by the odour exhaled from the ground. Squirrels, hogs and other animals commonly dig up truffles and devour them, and pigs and dogs have long been trained to point out the places where they grow. Pigs will always eat truffles, and dogs will do so occasionally; it is therefore usual to give the trained pig or dog a small piece of cheese or some little reward each time it is successful. Truffles are reproduced by spores, which serve the same purpose as seeds in flowering plants; in true truffles the spores are borne in transparent sacs (*asci*), from four to eight spores in each ascus. The asci are embedded in vast numbers in the flesh of the truffle.



Spores of the Chief European Truffles.

1, *Tuber aestivum.*
2, *T. brumale.*
3, *T. melanosporum.*
4, *T. mesentericum.*
5, *T. magnatum.*
6, *Choeromyces meandriformis.*
7, *Scleroderma vulgare.*
8, *Melanogaster variegatus.*

In false truffles the spores are free and are borne on minute spicules or supports. The spores of the chief European truffles, true and false, enlarged five hundred diameters, are shown in the accompanying illustration. Many references to truffles occur in classical authors. The truffle *Elaphomyces variegatus* was till quite recent times used, under the name of Hart's nut or Lycoperdon nut, on account of its supposed aphrodisiac qualities.

TRUJILLO, or TRUXILLO, a seaport on the Atlantic coast of Honduras, in 15° 54′ N. and 86° 5′ W. Pop. (1905), about 4000. The harbour, an inlet of the Bay of Honduras, is sheltered on the north by the promontory of Cape Honduras; it is deep and spacious, but insecure in westerly winds. Mahogany, dye-woods, sarsaparilla, cattle, hides and fruit are exported; grain, flour, hardware and rum are imported. Trujillo was founded in 1524, and became one of the most prosperous ports of the new world, and the headquarters of a Spanish naval squadron. During the 17th century it was frequently and successfully raided by buccaneers, and thus lost much of its commerce. Still more has in modern times been diverted to Puerto Cortes and the Bay Islands.

TRUJILLO, or TRUXILLO, a city of northern Peru, the see of a bishopric, and capital of the department of Libertad, about 315 m. N.N.W. of Lima and 1½ m. from the Pacific coast, in lat. 8° 7′ S., long. 79° 9′ W. Pop. (1906, estimate), about 6500. The city stands on the arid, sandy plain (Mansiché, or Chimu), which skirts the coast from Paita south to Santa, a few miles north of the Moche or Chimu river, and at the northern entrance to the celebrated Chimu Valley. North and east are the ruins of an old Indian city commonly known as the Grand Chimu, together with extensive aqueducts and reservoirs. The city is partly enclosed by an old adobe wall built in 1686, and its buildings are in great part also constructed of adobe. The public institutions include a university, two national colleges, one of which is for girls, an episcopal seminary, a hospital and a theatre.

Trujillo was once an important commercial centre and the metropolis of northern Peru, but the short railways running inland from various ports have taken away its commercial importance. The port of Salaverry (with which Trujillo is connected by rail) is about 10 m. south-east, where the national government has constructed a long iron pier. Railways also extend northward to Ascope and eastward to Laredo, Galindo and Menocucho, and a short line runs from Roma, on the Ascope extension, to the port of Huanchaco. The only important manufactures of Trujillo are cigars and cigarettes.

Trujillo was founded in 1535, by Francisco Pizarro, who gave it the name of his native city in Spain. Its position on the road from Tumbez to Lima gave it considerable political and commercial importance, and some reflection of that colonial distinction still remains. It suffered little in the War of Independence, but was occupied and plundered by the Chileans in 1882.

Of the ancient aboriginal city, or group of towns, whose ruins and burial-places cover the plain on every side of Trujillo, comparatively little is definitely known. The extent of these ruins, which cover an area 12 to 15 m. long by 5 to 6 m. wide, demonstrate that it was much the largest Indian city on the southern continent. The principal ruins are 4 m. north of Trujillo, but others lie more to the eastward and still others southward of the banks of the Moche. The great aqueduct, which brought water to the several large reservoirs of the city, was 14 m. long and in some places in crossing the Chimu Valley it had an elevation of 60 ft.

The name of Grand Chimu is usually given to the ruined city, this being the title applied to the chief of the people, who were called the Chimu, or Yuncas. They were a race wholly distinct from the Incas, by whom they were finally conquered. They spoke a different language and had developed an altogether different civilization, and it is not unreasonable to presume that they were related to some earlier race of southern Mexico. Specimens of skilfully wrought ornaments of gold and silver, artistically made pottery, and finely woven fabrics of cotton and wool (alpaca), have been found in their *huacas*, or burial-places. Bronze was known to them, and from it tools and weapons were made. Their extensive irrigation works show that they were painstaking agriculturists, and that they were successful ones may be assumed from the size of the population maintained in so arid a region. Since the Spanish conquest their *huacas* have been opened and rifled, and many of the larger masses of ruins have been extensively mined in search of treasure, but enough still remains to impress upon the observer the magnitude of the city and the genius of the people who built it. Nothing is known of their history or of their political institutions, but these remains of their handiwork bear eloquent testimony that they had reached a degree of development in some respects higher even than that of the Incas.

See E. G. Squier, *Peru* (New York, 1877); and Charles Wiener, *Pérou et Bolivie* (Paris, 1882).

TRUJILLO, a town of Spain, in the province of Caceres; on a hill 25 m. east of Caceres, and on the river Tozo, a sub-tributary of the Tagus. Pop. (1900), 12,512. The surrounding country is rugged, but produces wheat, wine, oils and fruit, besides livestock of all sorts, and much phosphorite. There are valuable forests close to the town. In the oldest part of Trujillo are the remains of a castle said to be of Roman origin, but rebuilt by the Moors and restored in modern times. The Julia tower is also said to be Roman, like much of the fortifications. The Roman name for the town was Turgalium. The principal parish church, Santa Maria, is a fine Gothic structure of the 15th century. Trujillo was a town of importance in the middle ages. Pizarro, the conqueror of Peru, was born here about 1471, and built a palace, which still stands, in the main square of the town.

TRUMBALL, SIR WILLIAM (1639–1716), English politician, was a grandson of William Trumball (d. 1635), who was for sixteen years English resident at Brussels and afterwards a clerk of the privy council. Educated at St John's College, Oxford, young Trumball became a fellow of All Souls and settled down as a practising lawyer in Oxford and in London. He was made chancellor of the diocese of Rochester and was sent to Tangier on public business in 1683, one of his companions on this errand being the diarist Pepys. In 1684 Trumball was knighted by Charles II. and in 1685 he was sent as envoy to France, where he worked hard on behalf of the English Protestants there who were threatened by the Revocation of the Edict of Nantes. In 1685 he became a member of Parliament, in 1687 he went as ambassador to Constantinople, and in 1694 he was made a lord of the treasury. From May 1695 until December 1697 he was a secretary of state under William III. He died on the 14th of December 1716. His son, William Trumball (1708–1760), had an only daughter, who became the wife of the Hon. Martin Sandys. She was thus the ancestress of the later marquesses of Downshire.

Many of Trumball's letters are in the British Museum and in the Record Office, London. Trumball was on friendly terms with Pierre Bayle and with Dryden, whom he advised to translate Virgil. He was also very intimate with Pope, whom he influenced in several ways, especially in urging him to make a translation of Homer.

TRUMBULL, JAMES HAMMOND (1821–1897), American scholar, was born in Stonington, Connecticut, on the 20th of December 1821. He studied at Yale, but ill-health prevented his graduation. He was state librarian in 1854–1855, assistant-secretary of state of Connecticut in 1847–1852 and in 1858–1861, and secretary of state in 1861–1866; and was a prominent member of the Connecticut Historical Society, of which he was president in 1863–1889, the National Academy of Science, to which he was elected in 1872, and of other learned societies. He died in Hartford on the 5th of August 1897. He wrote *Historical Notes on some Provisions of the Connecticut Statutes* (1860–1861) and *The True Blue Laws of Connecticut* (1876), and edited *The Colonial Records of Connecticut* (3 vols., 1850–1859). He is better known, however, as a student of the Indian dialects of New England.

He edited Roger Williams's *Key to the Language of America* (1866), and wrote *The Composition of Indian Geographical Names* (1870), *The Best Methods of Studying the Indian Languages* (1871), *Indian Names of Places in . . . Connecticut with Interpretations* (1881) and other works on similar subjects.

TRUMBULL, JOHN (1750–1831), American poet, was born in what is now Watertown, Connecticut, where his father was a Congregational preacher, on the 24th of April 1750. At the age of seven he passed his entrance examinations at Yale, but did not enter until 1763; he graduated in 1767, studied law there, and in 1771–1773 was a tutor. In 1773 he was admitted to the bar, in 1773–1774 practised law in Boston, working in the law-office of John Adams, and after 1774 practised in New Haven. He was state attorney in 1789, a member of the Connecticut Assembly in 1792 and 1800, and a judge of the Superior Court in 1801–1819. The last six years of his life were spent in Detroit, Michigan, where he died on the 10th of May 1831. While studying at Yale he had contributed in 1769–1770 ten essays, called "The Meddler," imitating *The Spectator*, to the *Boston Chronicle*, and in 1770 similar essays, signed "The Correspondent" to the *Connecticut Journal and New Haven Post Boy*. While a tutor he wrote his first satire in verse, *The Progress of Dulness* (1772–1773), an attack in three poems on educational methods of his time. His great poem, which ranks him with Philip Freneau and Francis Hopkinson as an American political satirist of the period of the War of Independence, was *McFingal*, of which the first canto, "The Town-Meeting," appeared in 1776 (dated 1775). This canto, about 1500 lines, contains some verses from "Gage's Proclamation," published in the *Connecticut Courant* for the 7th and the 14th of August 1775; it portrays a Scotch Loyalist, McFingal, and his Whig opponent, Honorius, evidently a portrait of John Adams. This first canto was divided into two, and with a third and a fourth canto was published in 1782. After the war Trumbull was a rigid Federalist, and with the "Hartford Wits" David Humphreys, Joel Barlow and Lemuel Hopkins, wrote the *Anarchiad*, a poem directed against the enemies of a firm central government.

See the memoir in the Hartford edition of Trumbull's *Poetical Works* (2 vols., 1820); James Hammond Trumbull's *The Origin of "McFingal"* (Morrisania, New York, 1868); and the estimate in M. C. Tyler's *Literary History of the American Revolution* (New York, 1897).

TRUMBULL, JOHN (1756–1843), American artist, was born at Lebanon, Connecticut, on the 6th of June 1756, the son of Jonathan Trumbull (1710–1785), governor of Connecticut. He graduated at Harvard in 1773, served in the War of Independence, rendering a particular service at Boston by sketching plans of the British works, and was appointed second aide-de-camp to General Washington and in June 1776 deputy adjutant-general to General Gates, but resigned from the army in 1777. In 1780 he went to London to study under Benjamin West, but his work had hardly begun when the news of the arrest and execution of Major André, who was deputy adjutant-general in the English army, suggested the arrest of Trumbull as having been an officer of similar rank in the Continental army; he was imprisoned for seven months. In 1784 he was again in London working under West, in whose studio he painted his "Battle of Bunker Hill" and "Death of Montgomery," both of which are now in the Yale School of Fine Arts. In 1785 Trumbull went to Paris, where he made portrait sketches of French officers for "The Surrender of Cornwallis," and began, with the assistance of Jefferson, "The Signing of the Declaration of Independence," well-known from the engraving by Asher B. Durand. These paintings, with "The Surrender of Burgoyne," and "The Resignation of Washington," were bought by the United States government and placed in the Capitol at Washington. Trumbull's "Sortie from Gibraltar" (1787), owned by the Boston Athenaeum, is now in the Boston Museum of Fine Arts, and a series of historical paintings, the "Trumbull Gallery," by far the largest single collection of his works (more than 50 pictures), has been in the possession of Yale College since 1831, when Trumbull received from the college an annuity of $1000. His portraits include full lengths of General Washington (1790) and George Clinton (1791), in the city-hall of New York—where there are also full lengths of Hamilton and of Jay; and portraits of John Adams (1797), Jonathan Trumbull, and Rufus King (1800); of Timothy Dwight and Stephen Van Rensselaer, both at Yale; of Alexander Hamilton (in the Metropolitan Museum of Art, New York City, and in the Boston Museum of Fine Arts, both taken from Ceracchi's bust); a portrait of himself painted in 1833; a full length of Washington, at Charleston, South Carolina; a full length of Washington in military costume (1792), now at Yale; and portraits of President and Mrs Washington (1794), in the National Museum at Washington. Trumbull's own portrait was painted by Stuart and by many others. In 1794 Trumbull acted as secretary to John Jay in London during the negotiation of the treaty with Great Britain, and in 1796 he was appointed by the commissioners sent by the two countries the fifth commissioner to carry out the seventh article of the treaty. He was president of the American Academy of Fine Arts in 1816–1825. He died in New York on the 10th of November 1843.

See his *Autobiography* (New York, 1841); J. F. Weir, *John Trumbull, A brief Sketch of His Life, to which is added a Catalogue of his Works* (New York, 1901); and John Durand, "John Trumbull," *American Art Review*, vol. ii. pt. 2, pp. 181–191 (Boston, 1881).

TRUMBULL, JONATHAN (1710–1785), American political leader, was born at Lebanon, Connecticut, on the 12th of October 1710. He graduated at Harvard in 1727, and began the study of theology, but in 1731 engaged in business with his father. He next studied law, was elected to the Assembly in 1773, and held public office almost continuously afterward. He served for seven years in the Assembly, being Speaker for three years, for seventeen years as county judge of Windham county, for twenty-two years (after 1740) as governor's assistant, for two years as deputy-governor (1767–1769), and for three years (1766–1769) as chief justice of the colony. In 1769 he was elected governor and continued in office until his voluntary retirement in 1784. During the War of Independence he was a valued counsellor of Washington. The story that the term "Brother Jonathan," a sobriquet for the United States, originated in Washington's familiar form of addressing him seems to be without any foundation. After the war Trumbull was a strong Federalist. He died in Lebanon on the 17th of August 1785

His public papers have been printed in the Massachusetts Historical Society's *Collections*, 5th series, vols. ix.–x. (Boston, 1885–1888), and 7th series, vols. ii.–iii. (1902). See I. W. Stuart, *Life of Jonathan Trumbull, sen.* (Boston, 1859).

His son JONATHAN (1740–1809) graduated at Harvard in 1759, served in the War of Independence as paymaster-general of the northern department in 1775–1778 and as a military secretary of Washington in 1778–1783, and was a member of the national House of Representatives in 1789–1795, serving as Speaker in 1791–1793, and of the United States Senate in 1795–1796; he was lieutenant-governor of Connecticut in 1796–1798, and governor in 1798–1809. Another son, JOSEPH (1737–1778), was a member of the first Continental Congress (1774–1775), became commissary-general of stores of the Continental army in July 1775 and commissary-general of purchases in June 1777, resigned in August 1777, and from November 1777 to April 1778 was commissioner for the board of war. A grandson of the first Jonathan, JOSEPH (1782–1861), was a Whig representative in Congress in 1834–1835 and in 1839–1843, and was governor of Connecticut in 1849–1850.

TRUMBULL, LYMAN (1813–1896), American jurist and political leader, was born at Colchester, Connecticut, on the 12th of October 1813, and was a grandson of Benjamin Trumbull (1735–1820), a Congregational preacher and the author of a useful *Complete History of Connecticut* (2 vols., 1818). He taught in Georgia, studied law, and was admitted to the bar in 1837. Removing to Belleville, Illinois, in the same year, he was elected to the state House of Representatives as a Democrat in 1840, and in 1841–1843 was secretary of state of Illinois. In 1848–1853 he was a justice of the state Supreme Court, and in 1855–1873 was a member of the United States Senate. Elected as an Anti-Nebraska Democrat, he naturally joined the Republicans, and when this party secured control in the Senate he was made chairman of the important judiciary committee, from which he reported the Thirteenth Amendment to the Constitution of the United States abolishing slavery. Throughout the Civil War he was a trusted counsellor of the president. In the impeachment trial of President Andrew Johnson he was one of the seven Republicans who voted to acquit, and he afterwards returned to the Democratic party. After 1873 he practised law in Chicago, was the Democratic candidate for governor of Illinois in 1880, became a Populist in 1894, and defended the railway strikers in Chicago in the same year. He died in Chicago on the 25th of June 1896.

TRUMP (1) (O. Fr. *trompe*), originally the name of a musical instrument, of which "trumpet" is a diminutive; the term is now chiefly used in the sense of the sound of a trumpet, or a sound resembling it, such as is made by an elephant. It has been usually accepted that the Romanic forms (cf. Span. and Port. *trompa*) represent a corruption of Latin *tuba*, tube. On the other hand a distinct imitative or echoic origin is sometimes assigned. (2) In the sense of a playing card belonging to the suit which beats all other cards of other suits for the period during which its rank lasts, "trump" is a corruption of "triumph." The name was first used of a game of cards, also known as "ruff," which was the parent of the modern game of whist. There are traces in English of an early confusion with a term meaning to deceive or trick, cf. "trumpery," properly deceit, imposture, hence idle talk, gossip, now chiefly used as an adjective, worthless, trivial. This is an adaptation of French *tromper*, to deceive, which, according to the generally received explanation, meant "to play on the trumpet," *se tromper de quelqu'un* being equivalent to play with a person, hence to cheat.

TRUMPET (Fr. *trompette, clairon*; Ger. *Trompete, Klarino, Trummet*; Ital. *tromba, trombetta, clarino*), in music, a brass wind instrument with cup-shaped mouthpiece and a very characteristic tone. It consists of a brass or silver tube with a narrow cylindrical bore except for the bell joint, forming from ⅓ to ¼ of the whole length, which is conical and terminates in a bell of moderate diameter. The tube of the trumpet is doubled round upon itself to form a long irregular rectangle with rounded corners. A tuning slide consisting of two U-shaped cylindrical tubes fitting into each other is interpolated between the bell joint and the long cylindrical joint to which the mouthpiece is attached. The mouthpiece consists of a hemispherical cup with a rim across which the lips stretch. The shape of the cup, and more especially of the bottom, in which is pierced a hole communicating with the main bore, is of the greatest importance on account of its influence on the tone quality and on the production of the higher harmonics (see MOUTHPIECE). The shallower and smaller the cup the more easily are the higher harmonics produced; the sharper the angle at the bottom of the cup the more brilliant and incisive is the timbre, given, of course, the correct style of blowing. The diameter of the cup varies according to the pitch and to the lip-power of the player who chooses one to suit him. See HORN for the laws governing the acoustic properties of brass tubes and the production of sound by means of the lips stretched like a vibrating membrane across the mouthpiece.

There are three principal kinds of trumpets: (1) the natural trumpet, mainly used in cavalry regiments, in which the length of the tube and pitch are varied by means of crooks; (2) the slide and double-slide trumpets, in which a chromatic compass is obtained, as in the trombone, by double tubes sliding upon one another without loss of air; (3) the valve trumpet, similar in its working to all other valve instruments. The first and second of these alone give the true trumpet timbre; the tone of the valve trumpet approximates to that of the cornet, nevertheless, it is now almost universally used.

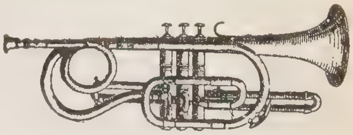
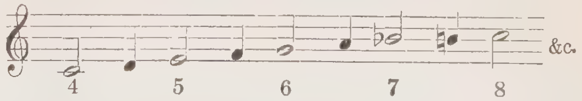
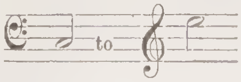


FIG. 1.—Military Trumpet in F (Besson).

In the trumpet the notes of the harmonic series from the 3rd to the 10th or 16th upper partials are produced by the varied tension of the lips and pressure of breath called overblowing. The fundamental and the second harmonic are rarely obtainable, and are therefore left out of consideration; the next octave from the 4th to the 8th harmonics contains only the 3rd, 5th and minor 7th, and is therefore mainly suitable for fanfare figures based on the common chord. The diatonic octave is the highest and its upper notes are only reached by very good players on trumpets of medium pitch. Examination of the scoring for the trumpet before any satisfactory means of bridging over the gaps in the compass had been found, shows how little the composers, and especially Bach, allowed themselves to be daunted by the limited resources at their disposal. A curious phenomenon has been observed [1] in connexion with the harmonic series of the trumpet, when the instrument is played by means of a special clarino mouthpiece (a shallow one enabling the performer to reach the higher harmonics), in which the passage at the bottom of the cup inaugurated by the sharp angle (known as the *grain* in French) is prolonged in *cylindrical* instead of conical bore for a distance of about 10 cm. (4 in.) right into the main tube. This peculiar construction of the mouthpiece, which might be considered insignificant, so upsets the acoustic properties of the tube that extra notes can be interpolated between the legitimate notes of the harmonic series thus:—



The black notes represent the extra notes, which in the next octave transform the diatonic into a chromatic scale.

This phenomenon may perhaps furnish an explanation of some peculiarities in the scoring of Bach and other composers of his day, and also in accounts of certain performances on the trumpet which have read [2] as fairy tales. It is probable that the clarino mouthpiece was one of the secrets of the gilds which has remained undiscovered till now. D. J. Blaikley writes [3]: "I had an opportunity yesterday of trying the trumpet mouthpiece as described by Mahillon with the 'grain' or 'throat,' as we would call it, extended for about 10 cm. and terminating abruptly. With such a mouthpiece, used by itself without any trumpet, I could easily get notes from  that is to say, that a continuous glide ranging over that compass can be made, the pitch at any moment being determined by the lip-pressure, rather than by the small air-column. When such a distorted mouthpiece is fitted to a trumpet, we have a resonator whose proper tones are disturbed and all the notes sounded are capable of being much modified in pitch by the lips. For instance, we may regard the 'd' as either No. 4 sharpened or No. 5 flattened, merely by lip-action, and other notes in the same way."

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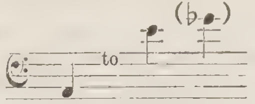
[1] See V. Mahillon, *La Trompette, son histoire, sa théorie, sa construction* (Brussels and London, 1907, pp. 29–30).

[2] See Fétis, *Biographie universelle des musiciens*, "Fantini."

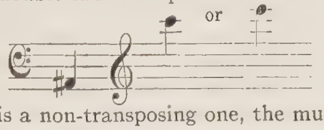
[3] Letter to the present writer, 6th of February 1909.

The compass of the three kinds of trumpets in real sounds is as follows:—

For the natural trumpet with crooks—

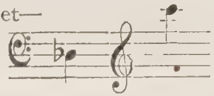


For the slide or double-slide trumpet with all chromatic semitones—



This instrument is a non-transposing one, the music being sounded as written.

For the valve trumpet—



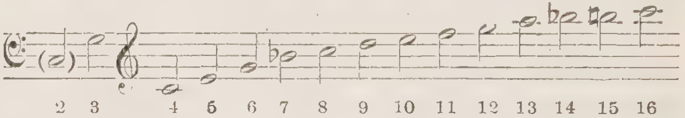
The material of which the tube is made has nothing to do with the production of that brilliant quality of tone by which the trumpet is so easily distinguished from every other mouthpiece instrument; the difference is partly due to the distinct form given to the basin of the mouthpiece, as stated above, but principally to the proportions of the column of air determined by the bore. The difference in timbre between trumpet and trombone is accounted for by the wider bore and differently shaped mouthpiece of the latter instrument.

Tonguing, both double and triple, is used with great effect on the trumpet: this device consists in the articulation with the tongue of the syllables *te-ke* or *ti-ke* repeated in rapid succession for groups of two or four notes and of *te-ke-ti* for triplets.

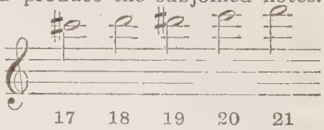
We have no precise information as to the form which the lituus, one of the ancestors of the modern trumpet, assumed during the middle ages, and it is practically unrepresented in the miniatures and other antiquities, though there is a miniature in the Bible, presented in 850 to Charles the Bald, which places the lituus in the hands of one of the companions of King David. We are not, however, warranted in concluding from this that the Etruscan instrument was in use in the 9th century. The lituus or cavalry trumpet of the Romans seems to have vanished with the fall of the Roman Empire, for although the name occasionally finds a place in Latin vocabularies, the instrument and name are both unrepresented in the development of musical instruments of western Europe: its successor, the cavalry trumpet of the 15th and succeeding centuries, was evolved from the straight *busine*, an instrument traced, by means of its name no less than by the delicate proportions of its tube and the shape of the bell, to the Roman buccina (*q.v.*). The straight busines, if we may judge from the presentments made by various artists, were not all made with bores of the same calibre, some having the wider bore of the trombone, others that of the trumpet. They abound in the illuminated MSS. of the 11th to the 14th centuries. The uses to which they are put, as the instruments of angels, of heralds, of trumpeters on horseback and on foot, at court banquets and functions of state, form additional proof of their identity. Fra Angelico (d. 1455) painted angels with trumpets having either straight or zigzag tubes, the shortest being about 5 ft. long. The perfect representation of the details, the exactness of the proportions, the natural pose of the angel players, suggest that the artist painted the instrument from real models.

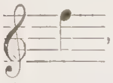
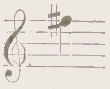
The credit of having bent the tube of the trumpet in three parallel branches, thus creating its modern form, has usually been claimed for a Frenchman named Maurin (1498–1515). But the transformation was really made much earlier, probably in the Low Countries or north Italy; in any case it had already been accomplished in the bas-reliefs of Luca della Robbia intended to ornament the organ chamber of the cathedral of Florence where a trumpet having the tube bent back as just described is very distinctly figured. From the beginning of the 16th century we have numerous sources of information. Virdung[2] cites three kinds of mouthpiece instruments—the *Felttrumet*, the *Clareta*, and the *Thurner Horn*; unfortunately he does not mention their distinctive characters, and it is impossible to make them out by examination of his engravings. Probably the Felttrumet and the Clareta closely resembled each other; but the compass of the former, destined for military signals, hardly went beyond the eighth proper tone, while the latter, reserved for high parts, was like the clarino (see below). The Thurner Horn was probably a kind of clarino or clarion used by watchmen on the towers. The *Trummet* and the *Jäger Trommet* are the only two mouthpiece instruments of the trumpet kind cited by Praetorius.[3] The first was tuned in D at the chamber pitch or "Cammerton," but with the help of a shank it could be put in C, the equivalent of the "chorton" D, the two differing about a tone. Sometimes the Trummet was lowered to B and even B♭. The Jäger Trommet, or "trompette de chasse," was composed of a tube bent several times in circles, like the posthorn, to make use of a comparison employed by Praetorius himself. His drawing does not make it clear whether the column of air was like that of the trumpet; there is therefore some doubt as to the true character of the instrument. The same author further cites a wooden trumpet (*hölzern Trommet*), which is no other than the Swiss Alpenhorn or the Norwegian luur. The shape of the trumpet, as seen in the bas-reliefs of Luca della Robbia, was retained for more than three hundred years: the first alterations destined to revolutionize the whole technique of the instrument were made about the middle of the 18th century. Notwithstanding the imperfections of the trumpet during this long period, the performers upon it acquired an astonishing dexterity.

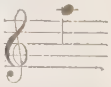
The usual scale of the typical trumpet, that in D, is



Praetorius exceeds the limits of this compass in the higher range, for he says a good trumpeter could produce the subjoined notes. This opinion is shared by Bach, who, in a trumpet solo which ends the cantata "Der Himmel lacht," wrote up to the twentieth harmonic. So considerable a compass could not be reached by one instrumentalist: the trumpet part had therefore to be divided, and each division was designated by a special name.[4] The part that was called principal went from the fifth to the tenth of these tones. The higher region, which had received the name of "clarino," was again divided into two parts: the first began at the eighth proper tone and mounted up towards the extreme high limit of the compass, according to the skill of the executant; the second, beginning at the sixth proper tone, rarely went beyond the twelfth. Each of these parts was confided to a special trumpeter, who executed it by using a larger or a smaller mouthpiece. Some of the members of the harmonic series also received special names; the fundamental or first proper note was called *Flattergrob*, the second *Grobstimme*, the third *Faulstimme*, the fourth *Mittelstimme*.



Playing the clarino differed essentially from playing the military trumpet, which corresponded in compass to that called principal. Compelled to employ very small mouthpieces to facilitate the emission of very high sounds, clarino players could not fail to alter the timbre of the instrument, and instead of getting the brilliant and energetic quality of tone of the mean register they were only able to produce more or less sonorous notes without power and splendour. Apart from this inconvenience, the clarino presented numerous deviations from just intonation. Hence the players of that time failed to obviate the bad effects inevitably resulting from the natural imperfection of the harmonic scale of the trumpet in that extreme part of its compass; in the execution, for instance, of the works of Bach, where the trumpet should give sometimes , and sometimes , the instrumentalist could only command the eleventh proper tone, which is neither the one nor the other of these. Further, the thirteenth proper tone, for which is written, is really too flat, and but little can be done to remedy this defect, since it entirely depends upon the laws of resonance affecting columns of air.



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[1] In the Bibliothèque Nationale at Paris, reproduced in facsimile by Count Auguste de Bastard (Paris, 1883).

[2] *Musica getutscht und auszgezogen* (Basel, 1511).

[3] *Organographia* (Wolfenbüttel, 1619).

[4] *Musicus αὐτοδίδακτος oder der sich selbst informirende Musicus* (Eisel, Erfurt, 1738).

Since the abandonment of the clarino (about the middle of the 18th century) our orchestras have been enriched with trumpets that permit the execution of the old clarino parts, not only with perfect justness of intonation, but with a quality of tone that is not deficient in character when compared with the mean register of the old principal instrument. The introduction of the clarinet or the so-called little clarino, although it is a wood wind instrument played with a reed, is one of the causes which led to the abandonment of the older instrument and may explain the preference given by the composers of that epoch to the mean register of the trumpet. The clarino having disappeared before Mozart's day, he had to change the trumpet parts of Handel and Bach to allow of their execution by the performers of his own time. It was now that crooks began to be frequently used. Trumpets were made in F instead of in D, furnished with a series of shanks of increasing length for the tonalities of E, E♭, D, D♭, C, B, B♭, and sometimes even A.

The first attempts to extend the limited resources of the instrument in its new employment arose out of Hampel's *Inventions-Horn*, in which, instead of fixing the shanks between the mouthpiece and the upper extremity, they were adapted to the body of the instrument itself by a double slide, upon the two branches of which tubes were inserted bent in the form of a circle and gradually lengthened as required. This system was applied to the trumpet by Michael Woegel (born at Rastatt in 1748), whose "invention trumpet" had a great success, notwithstanding the unavoidable imperfection of a too great disparity in quality of tone between the open and closed sounds. It is a curious fact that the sackbut or early trombone was merely a trumpet with a slide, or a draw trumpet, and that it was known as such in England, Scotland, Spain, Holland and Italy. Yet as soon as the powerful family of tenor and bass trombones had been created, the slide trumpet seems to have lost its identity and to have become merged in the alto trombone from which it differed mainly in the form of the bent tube. The slide trumpet appears to have been re-invented in the 18th century according to Johann Ernst Altenburg, or as some writers put it, "the slide was adapted to it from the trombone." It was mentioned in 1700 by Kuhnau.[1] Any one wishing to be convinced of this re-incarnation may compare the modern slide-trumpet with the original slide-trumpet or alto sackbut in the *Grimiani Breviary*,[2] a MS. of the 15th century, and with E. van der Straeten's reproduction[3] of an old engraving by Galle and Stradan from the *Encomium Musices* in which the forms are identical except that in the modern slide-trumpet the bell reaches the level of the U-shaped bottom of the slide.

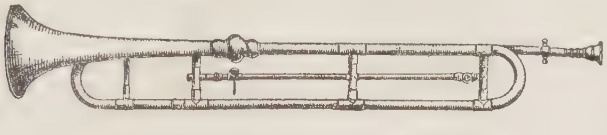
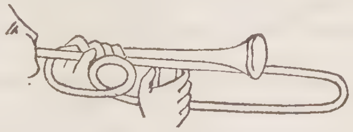


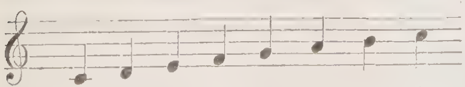
FIG. 2.—Modern Slide Trumpet F to C (Besson).



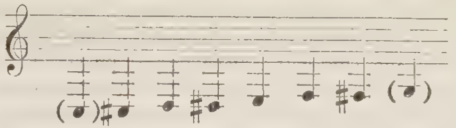
(From the *Encomium Musices.*)

FIG. 3.—Slide Trumpet 16th century.

The slide trumpet is still used in England in a somewhat modified form. The slide is a short one allowing of four positions. In 1889 a trumpet was constructed by Mr W. Wyatt with a double slide which gave the trumpet a complete chromatic compass. This instrument, which has the true brilliant trumpet tone, requires delicate manipulation, for the shifts are necessarily very short. About 1760 Kölbel, a Bohemian musician,[4] applied a key to the bugle, and soon afterwards the trumpet received a similar addition. By opening this key, which is placed near the bell, the instrument was raised a diatonic semitone, and by correcting errors of intonation by the tension of the lips in the mouthpiece the following diatonic succession was obtained.



This invention was improved in 1801 by Weidinger,[5] trumpeter to the imperial court at Vienna, who increased the number of keys and thus made the trumpet chromatic throughout its scale.[6] The instrument shown in fig. 4 is in G; the keys are five in number, and as they open one after another or in combination it is possible to connect the second proper tone with the third by chromatic steps, and thus produce the following succession:—



The number of keys was applied to fill up the gaps between the extreme sounds of the interval of a fifth; and a like result was arrived at more easily for the intervals of the fourth, the major third, &c., furnished by the proper tones of 3, 4, 5, &c. But, though the keyed trumpet was a notable improvement on the invention trumpet, the sounds obtained by means of the lateral openings of the tube did not possess the qualities which distinguish sounds caused by the resonance of the air-column vibrating in its entirety. But in 1815 Stölzel made a genuine chromatic trumpet by the invention of the Ventile or piston.[7] The natural-trumpet is now no longer employed except in cavalry regiments.[8] It is usually in E♭. The bass trumpet in E♭, which is an octave lower, is sometimes, but rarely, used. Trumpets with pistons are generally constructed in F, with crooks in E and E♭. In Germany trumpets in the high B♭ with a crook in A are very often used in the orchestra. They are easier for cornet à piston players than the trumpet in F. A quick change trumpet in B♭ with combined tuning and transposing slides, for changing into the key of A, known as the "Proteano" trumpet, has been patented by Messrs Besson & Co. The transposing slide always remains at the correct length, and change of the tuning slide does not necessitate readjustment of the former. This combination slide is fitted to the ordinary valve trumpet as well as to the trumpet with "enharmonic" valves. Mahillon constructed for the concerts of the Conservatoire at Brussels trumpets in the high D, an octave above the old trumpet in the same key. They permit the execution of the high trumpet parts of Handel and J. S. Bach. The bass trumpet with pistons used for Wagner's tetralogy is in E♭, in unison with the ordinary trumpet with crooks of D and C; but, when constructed so as to allow of the production of the second proper tone as written by this master, this instrument belongs rather to the trombones than to the trumpets.

(V. M.; K. S.)

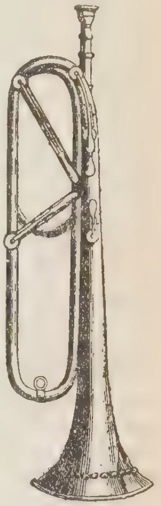


FIG. 4.—Keyed Trumpet.

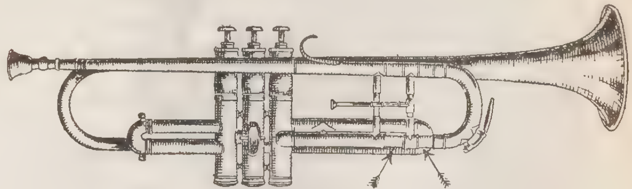


FIG. 5.—Proteano Trumpet in B♭ and A (Besson).

TRUMPET, SPEAKING AND HEARING. The speaking trumpet, though some instrument of the kind appears to have been in earlier use, is connected in its modern form with the name of Athanasius Kircher and that of Sir Samuel Morland, who in 1670 proposed to the Royal Society of London the question of the best form for a speaking trumpet. Lambert, in the *Berlin Memoirs* for 1763, seems to have been the first to give a theory of the action of this instrument, based on an altogether imaginary analogy with the behaviour of light. In this theory, which is still commonly put forward, it is assumed that sound, like light, can be propagated in rays. This, however, is possible only when the aperture through which the wave-disturbance passes into free air is large compared with the wave-length. If the fusiform mouth of the speaking trumpet were half a mile or so in radius, Lambert's theory might give an approximation to the truth. But with trumpets whose aperture is only a foot in diameter at the most the problem is one of diffraction.

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[1] *Der musikalische Quacksalber*, p. 83.

[2] Brit. Mus. Facsimile, 61, pl. 9.

[3] *La Musique aux Pays-Bas*, vi. 252.

[4] *Versuch einer Anleitung zur heroisch-musikalischen Trompeter- und Pauker-Kunst*, p. 12 (Halle, 1795).

[5] See *Allg. musikal. Ztg.* (November 1802), p. 158; (January 1803) p. 245; and E. Hanslicks, *Gesch. des Concertwesens in Wien* (1869), p. 119.

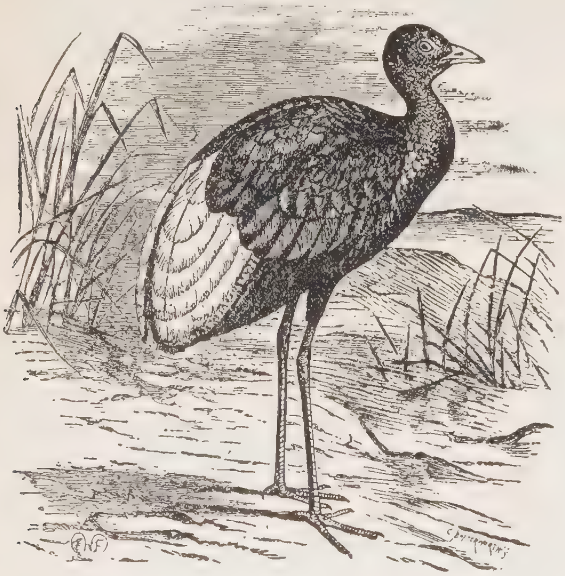
[6] Robert Eitner made a curious confusion between the keyed and valve trumpets (*Klappen- und Ventil-Trompete*). In an article entitled *Wer hat die Ventil-Trompete erfunden?* (*Monatshefte für Musikwissenschaft*, p. 41, Berlin, 1881) he deprives Stölzel of the credit of the invention of the valve in favour of Weidinger, ridiculing the notion that the keyed and the valve trumpets were not *one and the same thing*. Following up the idea in his *Tonkünstler Lexikon*, he leaves out Stölzel's name and ascribes to Weidinger the invention of the valve, with a reference to his article.

[7] For this ingenious mechanism, see VALVE; also Gottfried Weber, *Über Ventilhorn und Trompete mit 3 Ventilen*, *Caecilia* xvii. 73–104 (Mainz, 1835); and *Allg. musikal. Ztg.* xxiii. 411 (Leipzig, 1821); also A. Ung, "Verbesserung der Trompete und ähnlicher Instrumente," ibid. (1815), xviii. 633.

[8] For accounts of the early use of the trumpet as a signalling and cavalry instrument in the British army, see Sir Roger Williams, *A Brief Discourse of War*, p. 9, &c. (London, 1590); Grose, *Military Antiquities*, ii. 41; Sir S. D. Scott, *The British Army*, ii. 389–400 (London, 1868); and H. G. Farmer, *Memoirs of the Royal Artillery Band* (London, 1904).

In the hearing trumpet, the disturbance is propagated along the converging tube much in the same way as the tide-wave is propagated up the estuary of a tidal river. In speaking and hearing trumpets alike all reverberation of the instrument should be avoided by making it thick and of the least elastic materials, and by covering it externally with cloth. (See SOUND.)

TRUMPETER, or TRUMPET-BIRD, the literal rendering in 1747, by the anonymous English translator of De la Condamine's travels in South America (p. 87), of that writer's "Oiseau trompette" (*Mém. de l'Acad. des Sciences*, 1745, p. 473), a bird, which he says was called "Trompetero" by the Spaniards of Maynas on the upper Amazons, from the peculiar sound it utters. He added that it was the "Agami" of the inhabitants of Para and Cayenne,[1] wherein he was not wholly accurate, since those birds are specifically distinct, though, as they are generically united, the statement may pass. But he was also wrong, as had been P. Barrère (*France equinoxiale*, p. 132) in 1741, in identifying the "Agami" with the "Macucagua" of Marcgrav, for that is a Tinamou (*q.v.*); and both still more wrongly accounted for the origin of the peculiar sound just mentioned, whereby Barrère was soon after led (*Ornith. Spec. Novum*, pp. 62, 63) to apply to the bird the generic and vulgar names of *Psophia* and "Petteuse," the former of which, being unfortunately adopted by Linnaeus, has ever since been used, though in 1766 and 1767 Pallas (*Miscellanea*, p. 67, and *Spicilegia*, iv. 6), and in 1768 Vosmaer (*Descr. du Trompette Américain*, p. 5), showed that the notion it conveys is erroneous. Among English writers the name "Trumpeter" was carried on by Latham and others so as to be generally accepted, though an author may occasionally be found willing to resort to the native "Agami," which is that almost always used by the French.



(After Mitchell.)

White-winged Trumpeter (*Psophia leucoptera*).

P. L. Sclater and O. Salvin in their *Nomenclator* (p. 141) admit 6 species of Trumpet-Birds: (1) the original *Psophia crepitans* of Guiana; (2) *P. napensis* of eastern Ecuador (which is very likely the original "Oiseau trompette" of De la Condamine); (3) *P. ochroptera* from the right bank of the Rio Negro; (4) *P. leucoptera* from the right bank of the upper Amazons; (5) *P. viridis* from the right bank of the Madeira; and (6) *P. obscura* from the right bank of the lower Amazons near Para. And they have remarked in the Zoological *Proceedings* (1867, p. 592) on the curious fact that the range of the several species appears to be separated by rivers, a statement confirmed by A. R. Wallace (*Geogr. Distr. Animals*, ii. 358); and in connexion therewith it may be observed that these birds have short wings and seldom fly, but run, though with a peculiar gait, very quickly. A seventh species *P. cantatrix*, from Bolivia, has since been indicated by W. Blasius (*Journ. f. Ornith.*, 1884, pp. 203–210), who has given a monographic summary of the whole group very worthy of attention. The chief distinctions between the species lie in colour and size, and it will be here enough to describe briefly the best known of them, *P. crepitans*. This is about the size of a large barndoor fowl; but its neck and legs are longer, so that it is a taller bird. The head and neck are clothed with short velvety feathers; the whole plumage is black, except that on the lower front of the neck the feathers are tipped with golden green, changing according to the light into violet, and that a patch of dull rusty brown extends across the middle of the back and wing-coverts, passing into ash-colour lower down, where they hang over and conceal the tail. The legs are bright pea-green. The habits of this bird are very wonderful, and it is much to be wished that fuller accounts of them had appeared. The curious sound it utters, noticed by the earliest observers, has been already mentioned, and by them also was its singularly social disposition towards man described; but the information supplied to Buffon (*Oiseaux*, iv. 496–501) by Manoncour and De la Borde, which has been repeated in many works, is still the best we have of the curious way in which it becomes semi-domesticated by the Indians and colonists and shows strong affection for its owners as well as for their living property—poultry or sheep—though in this reclaimed condition it seems never to breed.[2] Indeed nothing can be positively asserted as to its mode of nidification; but its eggs, according to C. E. Bartlett, are of a creamy white, rather round, and about the size of bantams'. C. Waterton in his *Wanderings* (Second Journey, chap. iii.) speaks of falling in with flocks of 200 or 300 "Waracabas," as he called them, in Demerara, but added nothing to our knowledge of the species; while the contributions of Trail (*Mem. Wern. Society*, v. 523–532) and as Dr Hancock (*Mag. Nat. History*, 2nd series, vol. ii. pp. 490–492) as regards its habits only touch upon them in captivity.

To the trumpeters must undoubtedly be accorded the rank of a distinct family, *Psophiidae*; but like so many other South-American birds they seem to be the less specialized descendants of an ancient generalized group—perhaps the common ancestors of the *Rallidae* and *Gruidae*. The structure of the trachea, though different from that described in any Crane (*q.v.*), suggests an early form of the structure which in some of the *Gruidae* is so marvellously developed, for in *Psophia* the windpipe runs down the breast and belly immediately under the skin to within about an inch of the anus, whence it returns in a similar way to the front of the sternum, and then enters the thorax. Analogous instances of this formation occur in several other groups of birds not at all allied to the *Psophiidae*. (A. N.)

TRUNK (Fr. *tronc*, Lat. *truncus*, cut off, maimed), properly the main stem of a tree from which the branches spring, especially the stem when stripped of the branches; hence, in a transferred sense, the main part of a human or animal body without the head, arms or legs. It is from this last sense that the term "trunk-hose" is derived. These were part of the typical male costume of the 16th century, consisting of a pair of large puffed and slashed over-hose, reaching from the waist to the middle of the thigh, the legs clad in the long hose being thrust through them; the upper part of the body was covered by the jerkin or jacket reaching to the thigh (see COSTUME). The word "trunk" as applied to the elongated proboscis of the elephant is due to a mistaken confusion of French *trompe*, trump, with "trunk" meaning the hollow stem of a tree. A somewhat obscure meaning of French *tronc*, *i.e.* an alms-box, has given rise to the general use of "trunk" for a form of travellers' luggage.

TRURO, THOMAS WILDE, 1ST BARON (1782–1855), lord chancellor of England, was born in London on the 7th of July

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[1] Not to be confounded with the "Heron Agami" of Buffon (*Oiseaux*, ii. 382), which is the *Ardea agami* of other writers.

[2] In connexion herewith may be mentioned the singular story told by Montagu (*Orn. Dict.*, Suppl. Art. "Grosbeak, White-winged"), on the authority of the then Lord Stanley, afterwards president of the Zoological Society, of one of these birds, which, having apparently escaped from confinement, formed the habit of attending a poultry-yard. On the occasion of a pack of hounds running through the yard, the trumpeter joined and kept up with them for nearly three miles!

1782, being the second son of Thomas Wilde, an attorney. He was educated at St Paul's School and was admitted an attorney in 1805. He subsequently entered the Inner Temple and was called to the bar in 1817, having practised for two years before as a special pleader. Retained for the defence of Queen Caroline in 1820 he distinguished himself by his cross-examination and laid the foundation of an extensive common law practice. He first entered parliament in the Whig interest as member for Newark (1831–1832 and 1835–1841), afterwards representing Worcester (1841–1846). He was appointed solicitor-general in 1839, and became attorney-general in succession to Sir John (afterwards Baron) Campbell in 1841. In 1846 he was appointed chief justice of the common pleas, an office he held until 1850, when he became lord chancellor, and was created Baron Truro of Bowes, Middlesex. He held this latter office until the fall of the ministry in 1852. He died in London on the 11th of November 1855. His son Charles (1816–1891) succeeded as 2nd baron, but on the death of his nephew the 3rd baron in 1899 the title became extinct.

Lord Truro was the uncle of JAMES PLAISTED WILDE, BARON PENZANCE (1816–1899), who was appointed a baron of the court of exchequer in 1860, and was judge of the court of probate and divorce from 1863 to 1872. In 1875 he was appointed dean of the court of arches, retiring in 1899. He was created a peer in 1869, but died without issue, and the title became extinct.

TRURO, the chief town of Colchester county, Nova Scotia, on the Salmon river, near the head of Cobequid Bay, 61 m. from Halifax by rail. Pop. (1901), 5993. It is an important junction on the Intercolonial and Midland railways, and the thriving centre of a lumbering and agricultural district. There are numerous local industries, such as engine and boiler works, carriage factory and milk-condensing factory. It also contains the county buildings and the provincial normal school. The Victoria (or Joseph Howe) Park in the vicinity is of great natural beauty.

TRURO, an episcopal city and municipal borough in the Truro parliamentary division of Cornwall, England, 11 m. N. of Falmouth, on the Great Western railway. Pop. (1901), 11,562. It lies in a shallow valley at the junction of the small rivers Kenwyn and Allen in Truro river, a branch creek of the great estuary of the Fal. It is built chiefly of granite, with broad streets, through the chief of which there flows a stream of water. The episcopal see was founded in 1876, covering the former archdeaconry of Cornwall in the diocese of Exeter; the area including the whole of the county of Cornwall, with a small portion of Devonshire. The cathedral church of St Mary was begun in 1880 from the designs of John Loughborough Pearson, and is among the most important modern ecclesiastical buildings in England. The architect adopted the Early English style, making great use of the dog-tooth ornament. The form of the church is cruciform, but it is made irregular by the incorporation, on the south side of the choir, of the south aisle of the parish church, this portion retaining, by Act of Parliament of 1887, all its legal parochial rights. The design of the cathedral includes a lofty central and two western towers with spires, and a rich west front and south porch; with a cloister court and octagonal chapter-house on the north. Among other noteworthy modern institutions may be mentioned the theological library presented by Bishop Phillpotts in 1856, housed in a Gothic building (1871). The grammar school possesses exhibitions to Exeter College, Oxford. Truro has considerable trade in connexion with the tin mines of the neighbourhood. There are tin-smelting works, potteries, and manufactures of boots, biscuits, jam and clothing. Small vessels can lie at the quays, though the harbour is dry at low water; but large vessels can approach within three miles of the city. The borough is under a mayor, 6 aldermen and 18 councillors. Area, 1127 acres.

At the time of the Domesday Survey Truro (Trueret, Treurok, Treueru) was a comparatively small manor held by Jovin of Count Robert of Mortain. Its municipal charter dates from Richard Lucy the chief justiciar who held the demesne lands and under whom the free burgesses had apparently a grant of sake and soke, toll and team and infangenethef. Reginald earl of Cornwall, by an undated charter, added to these privileges exemption from the jurisdiction of the hundred and county courts and from toll throughout the county. Henry II. confirmed the grant of his uncle the said Reginald. In 1304 Truro was constituted a coinage town for tin. In 1378 the sheriff reported that the town was so impoverished by pestilence, hostile invasions and intolerable payments made to the king's progenitors that it was almost uninhabited and wholly wasted. A similar complaint was preferred in 1401 in consequence of which the fifteenth and tenth amounting to £12 was for the three years ensuing reduced to 50s. The charter of incorporation granted in 1589 provided for a mayor, recorder and steward and a council of twenty capital burgesses and four aldermen. Under it the mayor and burgesses were to enjoy the liberties of infangenethef, utfangenethef, sake, soke, toll, team, thefbote, backberindthef and ordelf; also freedom from toll passage, pontage, murage, fletage, picage, anchorage, stallage, lastage and tollage of Horngeld throughout England except in London; they were, moreover, to be entitled in respect of their markets to pontage, keyage, &c. The assize of bread and ale and wine and view of frankpledge were also granted and a court of piepowder was to regulate certain specified fairs. In 1835 the number of aldermen was increased to six. From 1295 to 1885 Truro enjoyed separate parliamentary representation, returning two members. The charter of 1589 provided that the burgesses should have power by means of the common council to elect them. Such was the procedure from 1589 to 1832 when the burgesses recovered the privilege. Under the Redistribution of Seats Act of 1885 the representation of Truro was merged in the county. No fairs or markets are mentioned prior to 1589 when two markets, on Saturdays and Wednesdays, were provided, also three fairs. Both markets and two of the three fairs are held.

See *Victoria County History: Cornwall*; Canon Donaldson, *Bishopric of Truro* (1902).

TRUSS (from O. Fr. *trusser*, *trosser*, *torser*, *trousser*, to pack, bind, gird up, Low Lat. *tortiare*, formed from *tortus*, twisted, *torquere*, to twist; cf. "torch" and "trousers," also *trousseau*, a bride's outfit, literally a small pack or bundle), a pack or bundle, applied specifically to a quantity of hay or straw tied together in a bundle. A truss of straw contains 36 ℔, of old hay 56 ℔, of new hay 60 ℔. A load contains 36 trusses. The term is also used generally of a supporting frame or structure, especially in the construction of a roof or a bridge. It is thus used as the name of a surgical appliance, a belt with an elastic spring keeping in place a pad used as a support in cases of hernia (*q.v.*).

TRUST COMPANY, the name given to a form of fiduciary corporation, originally adopted in the United States under state laws to accomplish financial objects not specially provided for under the national banking system. The function which gives a trust company its name is to execute trusts for individuals, estates and corporations. In the United States, however, these functions have been extended to include many of those of commercial banks receiving deposits payable on demand and subject to check. The relations between trust companies and their depositors are based, however, upon different principles from those between the bank and its client (see BANKS AND BANKING). The larger trust companies prefer deposit accounts which, even when subject to check, are not actively drawn upon. The fact that they pay interest on such deposits absolves them from the obligation to extend accommodation by way of loans, except upon collateral security. Hence out of the difference in their relations with depositors grows a difference in the character of their investments, which are usually in loans on stock exchange securities and not on commercial paper discounted. In New York they are prohibited from directly discounting commercial paper, but not from buying it. The rate of interest paid on demand deposits is usually

2% for small accounts, and 3% for large accounts; for time deposits it is sometimes more.

In the administration of estates for private individuals, the trust company has taken the place to a large extent of individual attorneys. The trust company has the advantage of corporate responsibility, which involves continuous life, and of proper offices, fire-proof safes, and special employees in each department devoting their time and attention exclusively to their special functions. Investments for estates are limited by law, like savings bank investments, to certain classes of securities, and a trust company has little temptation to violate such laws. It is customary, moreover, for investments of trust funds to be made by authority of the board of directors, thus protecting the estate against the uncertainties of individual judgment.

The trust company has found a special field in America as agent of railway and industrial corporations in the issue, transfer and exchange of securities. For these purposes it has an organized system, tested by experience, more perfect in its operation and less expensive than each corporation could organize for itself separately. As trustee for the bondholders under a railway mortgage, for instance, it becomes the duty of the trust company, in case of default in payment of interest on the bonds, to take steps to foreclose the mortgage and protect the bondholders. Trust companies have sometimes been named as receivers of failed banks.

The big industrial combinations in America have contributed to the business of the trust companies as registrars or transfer agents for capital stock, agents for the issue of bonds and payment of interest thereon, agents for underwriting and distributing new securities, and depositories of securities and cash under plans of reorganization or while held in escrow. In the case of the reorganization of the tobacco companies, in the autumn of 1904, securities aggregating about $600,000,000 passed through the hands of the trust company charged with the work; and while this was the largest single operation of its kind, it is typical of many similar operations resulting from the activity in the creation of new companies in America which bring business to trust companies.

The attractions offered by the trust company to the non-commercial depositor by the payment of interest on his deposit built up the deposit balances of trust companies rapidly after 1896. Their competition in this respect with national banks soon led to an effort to compel trust companies to keep cash reserves against their deposits. This demand was resisted for a while, but in 1903 a rule was made by the New York Clearing House requiring trust companies to keep certain reserves. The alternative was to withdraw from the Clearing House, and this all but a few did. The New York legislature, however, at the session of 1906, passed an act requiring trust companies in New York city to establish within fixed dates reserves of 15% of their deposits, of which only 5% was required to be currency, 5% might be on deposit in another banking institution, and 5% might be kept in certain classes of bonds.

The experience of the panic of 1907 developed several weaknesses in the position of the trust companies, and in New York led a special commission appointed by Governor Hughes to recommend much stronger reserves. The fact that the trust companies relied upon the national banks to meet the heavy demands upon them for currency doubled the strain imposed on the national banks of New York city, and the isolation of the trust companies through their withdrawal from the Clearing House in 1903 made it difficult to bring about co-operation in support of those which were subjected to severe runs. Between the 22nd of August and the 19th of December 1907 the deposits of the trust companies of New York declined by the sum of more than $275,000,000 while deposits in national banks increased about $50,000,000.

The number, resources and activities of trust companies have shown a rapid development. In New York the general law under which companies can be formed without a special act dates only from 1887, but several companies ante-date this law. The following figures[1] from reports made to the comptroller of the currency speak for themselves:—

Trust Companies of the United States.

30th June.	Number.	Capital.	Individual Deposits.
		$	$
1891	171	79,292,889	355,330,080
1897	251	106,968,253	566,922,205
1900	290	126,930,845	1,028,232,407
1901	334	137,361,704	1,271,081,174
1902	417	179,732,581	1,525,887,493
1903	531	232,807,735	1,589,398,796
1904	585	237,745,488	1,600,322,325
1905	683	243,133,622	1,980,856,737
1906	742	268,384,337	2,008,937,790
1907	794	276,146,081	2,061,623,035

Approximately half of the deposits in United States trust companies are in the state of New York, the number of such companies in New York about the 30th of June 1907, being 88, with a capital of $67,850,000, and deposits of $1,020,678,220. The next highest states in amount of deposits were Pennsylvania, with 328 companies, with capital of $103,953,067 and deposits of $381,397,305; and Massachusetts, with 46 companies, with capital of $16,677,000 and deposits of $179,278,436.

See Kirkbride and Sterrett, *The Modern Trust Company* (New York, 1905). (C. A. C.)

TRUST and **TRUSTEES,** in the law of equity. In Roman and English law alike that legal relation between two or more persons implied in the word *trust* was of comparatively late growth. The trust of English law is probably based upon a combination of the Roman conceptions of *usus* and *fideicommissum.* To *usus* is perhaps due the name as well as the idea of that right over property, co-ordinate with the right of the nominal owner, possessed by the person having the use. To *fideicommissum* appears to be due the name as well as the idea of that confidence reposed in another which is the essence of the modern trust. *Usus* was in Roman law a personal servitude, or right of one person over the land of another, confined to his personal wants and without the right to the produce and profits which *ususfructus* carried. It has little in common with the use of English law but the name and the conception of a dual ownership. The *fideicommissum* is more important (see ROMAN LAW). By the legislation of Justinian the law of *legata* was practically assimilated to that of *fideicommissa.* The only thing that distinguished the one from the other was the mode in which the gift was made: if by words of direct bequest it was a *legatum,* if by precatory words, a *fideicommissum.* It may be noticed, as an illustration of the course afterwards taken by the law in England, that *fideicommissa* in favour of the Church were so far favoured over others that if paid over by mistake they could not be recovered. In addition to *usus* and *fideicommissum,* the Roman division of ownership into quiritary and bonitary (to use words invented at a later time) may perhaps to some extent have suggested the English division into legal and equitable estate. The two kinds of ownership were amalgamated by Justinian. The gradual manner in which the beneficiary became subject to the burdens attaching to the property of which he enjoyed the benefit was a feature common to both the Roman and the English system.

Use in Early English Law.—The use or trust[2] is said to have been the invention of ecclesiastics well acquainted with Roman law, the object being to escape the provisions of the laws against Mortmain by obtaining the conveyance of an estate to a friend on the understanding that they should retain the use, *i.e.* the actual profit and enjoyment of the estate. Uses were soon extended to other purposes. They were found valuable for the defeat of creditors, the avoiding of attainder and the charging of portions. A use had also the advantage of being free from the incidents of feudal tenure: it could be alienated *inter vivos* by secret conveyance, and could be devised by will. In many cases the feoffee[3] to uses, as he was called, or the person seised to the use of another, seems to have been specially chosen on account of his rank and station, which would enable him to defy the common law and protect the estate of his *cestui que use*, or the person entitled to the beneficial enjoyment. The act of 1 Ric. II. c. 9 was directed against the choice of such persons. This alienation of land in use was looked upon with great disfavour by the common law courts, in whose eyes the cestui que use was only a tenant at will. Possibly the ground of their refusal to recognize uses was that the assizes of the king's court could only be granted to persons who stood in a feudal relation to the king. The denial of the right followed the denial of the remedy. The use was on the other hand supported by the court of chancery, and execution of the confidence reposed in the feoffee to uses was enforced by the court in virtue of the general jurisdiction which as a court of conscience it claimed to exercise over breach of faith. Jurisdiction was no doubt the more readily assumed by ecclesiastical judges in favour of a system by which the Church was generally the gainer. A double ownership of land thus gradually arose, the nominal and ostensible ownership—the only one acknowledged in the courts of common law— and the beneficial ownership protected by the court of chancery. The reign of Henry V. to a great extent corresponds with that of Augustus at Rome, as the point of time at which legal recognition was given to what had previously been binding only in honour. The means of bringing the feoffee to uses before the court was the writ of *subpoena*, said to have been invented by John de Waltham, bishop of Salisbury and master of the rolls in the reign of Richard II. By means of this writ the feoffee to uses could be compelled to answer on oath the claim on his cestui que use. The doctrine of the court of chancery as to the execution of a use varied according as there was transmutation of possession or not. In the former case it was unnecessary to prove consideration; in the latter, generally a case of bargain and sale, the court would not enforce the use unless it was executed in law—that is, unless there was a valuable consideration, even of the smallest amount. Where no consideration could be proved or implied, the use resulted to the feoffor. This theory led to the insertion in deeds (especially in the lease of the lease and release period of conveyancing) of a nominal consideration, generally five shillings. Lands either in possession, reversion or remainder could be granted in use. Most persons could be feoffees to uses. The king and corporations aggregate were, however, exceptions, and were entitled to hold the lands discharged of the use. On the accession of Richard III., who from his position of authority had been a favourite feoffee, it was necessary to pass a special act (1 Ric. III. c. 5), vesting the lands of which he had been feoffee either in his co-feoffees or, in the absence of co-feoffees, in the cestui que use. The practical convenience of uses was so obvious that it is said that by the reign of Henry VII. most of the land in the kingdom was held in use. The freedom of uses from liability to forfeiture for treason must have led to their general adoption during the Wars of the Roses.[1] The secrecy with which a use could be transferred, contrary as it was to the publicity required for livery of Seisin (*q.v.*) at common law, led to the interference of the legislature on several occasions between the reign of Richard II. and Henry VIII., the general tendency of the legislation being to make the cestui que use more and more subject to the burdens incident to the ownership of land. One of the most important statutes was the Statute of Mortmain (15 Ric. II. c. 5), forbidding evasion of the Statute *De Religiosis* of Edward I. by means of feoffments to uses. Other acts enabled the cestui que use to transfer the use without the concurrence of the feoffee to uses (1 Ric. III. c. 1), made a writ of *formedon* maintainable against him (1 Hen. VII. c. 1), rendered his heir liable to wardship and relief (4 Hen. VII. c. 17), and his lands liable to execution (19 Hen. VII. c. 15). At length in 1535 the famous Statute of Uses (27 Hen. VIII. c. 10) was passed.[2] The preamble of the statute enumerates the mischiefs which it was considered that the universal prevalence of uses had occasioned, among others that by fraudulent feoffments, fines, recoveries and other like assurances to uses, confidences and trusts lords lost their feudal aids, men their tenancies by the curtesy, women their dower, manifest perjuries in trials were committed, the king lost the profits of the lands of persons attainted or enfeoffed to the use of aliens, and the king and lords their rights of year, day and waste, and of escheats of felons' lands. To remedy this state of things it was enacted, *inter alia*, that, where any person was seised of any hereditaments to the use, confidence or trust of any other person by any means, the person having such use, confidence or trust should be seised, deemed and adjudged in lawful seisin, estate and possession of such hereditaments. Full legal remedies were given to the cestui que use by the statute. He was enabled to distrain for a rent-charge, to have action, entry, condition, &c. The effect of this enactment was to make the cestui que use the owner at law as well as in equity (as had been done once before under the exceptional circumstances which led to 1 Ric. III. c. 5), provided that the use was one which before the statute would have been enforced by the court of chancery. For some time after the passing of the statute an equitable as distinct from a legal estate did not exist. But the somewhat narrow construction of the statute by the common law courts in Tyrrel's case[3] (1557) enabled estates cognisable only in equity to be again created. In that case it was held that a use upon a use could not be executed; therefore in a feoffment to A and his heirs to the use of B and his heirs to the use of C and his heirs only the first use was executed by the statute. The use of B being executed in him, that of C was not acknowledged by the common law judges; but equity regarded C as beneficially entitled, and his interest as an equitable estate held for him in trust, corresponding to that which B would have had before the statute. The position taken by the Court of Chancery in trusts may be compared with that taken in Mortgage (*q.v.*). The Judicature Act 1873, while not going as far as the Statute of Uses and combining the legal and equitable estates, makes equitable rights cognisable in all courts. From the decision in Tyrrel's case dates the whole modern law of uses and trusts. In modern legal language use is restricted to the creation of legal estate under the Statute of Uses, trust is confined to the equitable estate of the cestui que trust or beneficiary.

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[1] The table, it may be observed, represents only the number of companies *reporting* and not the number actually in existence. Kirkbride and Sterrett, for example, give the number of trust companies in the United States on the 1st of January 1905 as 1427, or more than twice the number given here for 1905. On this point the comptroller of the Treasury in 1905 said: "In order to obtain this information [from institutions other than national banks] the comptroller is necessarily dependent upon the courtesy of officers of different states, and upon individual banks in states the laws of which states do not provide for compilation of data of this character . . Each year one or more states formerly without adequate provision for obtaining and compiling reports of banks incorporated under their laws, have through legislative enactment, placed such banks under the supervision of an official whose duty it is to receive and tabulate the reports so required, which information is placed at the disposal of the comptroller. Every year this office is thereby enabled to publish official, and hence more reliable statistics. . . ."

[2] Use seems to be an older word than trust. Its first occurrence in statute law is in 7 Ric. II. c. 12, in the form *oeps.* In Littleton "confidence" is the word employed. The Statute of Uses seems to regard use, trust and confidence as synonymous. According to Bacon, it was its permanency that distinguished the use from the trust.

[3] Feoffment, though the usual, was not the only mode of conveyance to uses. The preamble of the Statute of Uses mentions fines and recoveries, and other assurances.

Uses since 1535.—The Statute of Uses is still the basis of conveyancing. A grant in a deed is still, after the alterations in the law made by the Conveyancing Act 1881, made "to and to the use of A." The statute does not, however, apply indiscriminately to all cases, as only certain uses are executed by it. It does not apply to leaseholds or copyholds, or to cases where the grantee to uses is anything more than a mere passive instrument, *e.g.* where there is any direction to him to sell the property. The seisin, too, to be executed by the statute, must be in another than him who has the use, for where A is seised to the use of A it is a common law grant. The difference is important as far as regards the doctrine of Possession (*q.v.*). Constructive possession is given by a deed operating under the statute even before entry, but not by a common law grant, until actual receipt of rent by the grantee. The operation of the Statute of Uses was supplemented by the Statute of Inrolments and that of Wills (see WILL). The Statute of Inrolments (27 Hen. VIII. c. 16) enacted that no bargain and sale should pass a freehold unless by deed indented and enrolled within six months after its date in one of the courts at Westminster or with the *custos rotulorum* of the county. As the statute referred only to freeholds, a bargain and sale of a leasehold interest passed without enrolment. Conveyancers took advantage of this omission (whether intentional or not) in the act, and the practical effect of it was to introduce a mode of secret alienation of real property, the lease and release, which was the general form of conveyance up to 1845. (See CONVEYANCING.) Thus the publicity of transfer, which it was the special object of the Statute of Uses to effect, was almost at once defeated. In addition to the grant to uses there were other modes of conveyance under the statute which are now obsolete in practice, viz., the covenant to stand seised and the bargain and sale. Under the statute, as before it, the use has been found a valuable means of limiting a remainder to the person creating the use and of making an estate take effect in derogation of a former estate by means of a shifting or springing use. At common law a freehold could not be made to commence *in futuro*; but this end might be attained by a shifting use, such as a grant (common in marriage settlements) to A to the use of B in fee simple until a marriage, and after the celebration of the marriage to other uses. An example of a springing use would be a grant to A to such uses as B should appoint and in default of and until appointment to C in fee simple. The difficulty of deciding where the seisin was during the suspension of the use led to the invention of the old theory of *scintilla juris*, or continued possibility of seisin in the grantee to uses. This theory was abolished by 23 & 24 Vict. c. 38, which enacted that all uses should take effect by force of the estate and seisin originally vested in the person seised to the uses. The most frequent instances of a springing use are powers of appointment, usual in wills and settlements. There has been much legislation on the subject of powers, the main effect of which has been to give greater facilities for their execution, release or abandonment, to aid their defective execution, and to abolish the old doctrine of illusory appointments.

Trusts.—A trust in English law is defined in Lewin's *Law of Trusts*, adopting Coke's definition of a use, as "a confidence reposed in some other, not issuing out of the land, but as a thing collateral, annexed in privity to the estate of the land, and to the person touching the land, for which *cestui que trust* has no remedy but by *subpoena* in Chancery." The term *trust* or *trust estate* is also used to denote the beneficial interest of the cestui que trust. The term *truster* is not used, as it is in Scotland, to denote the creator of the trust. A trust has some features in common with contract (*q.v.*); but the great difference between them is that a contract can only be enforced by a party or one in the position of a party to it, while a trust can be, and generally is, enforced by one not a party to its creation. It has more resemblance to *fideicommissum*. But the latter could only be created by a testamentary instrument, whilst a trust can be created either by will or *inter vivos*; nor was there any trace in Roman law of that permanent legal relation which is suggested by the position of trustee and cestui que trust. The heir, too, in Roman law was entitled, from A.D. 70 to the reign of Justinian, to one-fourth of a *hereditas fideicommissaria* as against the beneficiary, while the very essence of the trust is its gratuitous character. Trusts may be divided in more than one way, according to the ground taken as the basis of division. One division, and perhaps the oldest, as it rests on the authority of Bacon, is into *simple* and *special*, the first being where the trust is simply vested in a trustee and the nature of the trust left to construction of law, the second where there is an act to be performed by the trustee. Another division is into *lawful* and *unlawful*, and corresponds to Bacon's division into intents or confidences and frauds, covins, or collusions. A third division is into *public* and *private*. A division often adopted in modern textbooks and recognized by parliament in the Trustee Act 1850, is into *express*, *implied* and *constructive*. An express trust is determined by the person creating it. It may be either *executed* or *executory*, the former where the limitations of the equitable interest are complete and final, the latter where such limitations are intended to serve merely as minutes for perfecting the settlement at some future period, as in the case of marriage articles drawn up as a basis of a marriage settlement to be in conformity with them. An implied trust is founded upon the intention of the person creating it; examples of it are a resulting trust, a precatory trust, and the trust held by the vendor on behalf of the purchaser of an estate after contract and before conveyance. In this case the vendor is sometimes called a trustee *sub modo* and the purchaser a cestui que trust *sub modo*. A constructive trust is judicially created from a consideration of a person's conduct in order to satisfy the demands of justice, without reference to intention. The distinction between an implied and a constructive trust is not always very consistently maintained. Thus the position of a vendor towards a purchaser after contract is sometimes called a constructive trust. The present law governing trusts rests upon the doctrines of equity as altered by legislation. The law was consolidated by the *Trustee Act* 1893 and some subsequent amending statutes. Its great importance has led to its becoming one of the most highly developed departments of equity.

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[1] The use, as in later times the trust, was, however, forfeited to the Crown on attainder of the feoffee or trustee for treason.

[2] It was adopted in Ireland exactly a century later by 10 Car. I. c. 1 (Ir.). The law of uses and trusts in Ireland is practically the same as that in England, the main differences being in procedure rather than in substantive law.

[3] Dyer's *Reports*, 155a.

Who may be a Trustee or Cestui que Trust.—The modern trust is considerably more extensive in its operation than the ancient use. Thus the Crown and corporations aggregate can be trustees, and personalty can be held in trust. Provision is made by the Municipal Corporations Act 1882, for the administration of charitable and special trusts by municipal corporations. There are certain persons who for obvious reasons, even if not legally disqualified, ought not to be appointed trustees. Such are infants, lunatics, persons domiciled abroad, felons, bankrupts and *cestuis que trustent*. The appointment of any such person, or the falling of any existing trustee into such a position, is generally ground for application to the court for appointment of a new trustee in his place. Any one may be a cestui que trust except a corporation aggregate, which cannot be a cestui que trust of real estate without a licence from the Crown. For the Public Trustee, see below.

Creation and Extinction of the Trust.—A trust may be created either by act of a party or by operation of law. Where a trust is created by act of a party, the creation at common law need not be in writing. The Statute of Frauds altered the common law by enacting that all declarations or creations of trusts or confidences of any lands, tenements or hereditaments shall be manifested and proved by some writing, signed by the party who is by law enabled to declare such trust, or by his last will in writing, or else they shall be utterly void and of none effect. Trusts arising or resulting by implication or construction of law are excepted, and it has been held that the statute applies only to real estate and chattels real, so that a trust of personal chattels may still be declared by parol. The declaration of a trust by the Crown must be by letters patent. Trusts created by will must conform to the requirements of the Will Act (see WILL). Except in the case of charitable trusts, the cestui que trust must be a definite person. A trust, for instance, merely for keeping up family tombs is void. Alteration of the trust estate by appointment of a new trustee could up to 1860 only be made where the instrument creating the trust gave a power to so appoint, or by order of the court of chancery. But now by s. 10 of the Trustee Act 1893 (superseding Lord St Leonards's Act of 1860 and the Conveyancing Act 1881), the surviving or continuing trustee or trustees, or the personal representative of the last surviving or continuing trustee, may nominate in writing a new trustee or new trustees. On such appointment the number of trustees may be increased. Existing trustees may by deed consent to the discharge of a trustee wishing to retire. Trust property may be vested in new or continuing trustees by a simple declaration to that effect. Also a separate set of trustees may be appointed for any part of the property held on distinct trusts. Trusts created by operation of law are those which are the effect of the application of rules of equity. They include resulting and constructive trusts. A resulting trust is a species of implied trust, and consists of so much of the equitable interest as is undisposed of by the instrument creating the trust, which is said to result to the creator and his representatives. An example is the purchase of an estate in the name of the purchaser and others, or of others only. Here the beneficial interest is the purchaser's. An example of a constructive trust is a renewal of a lease by a trustee in his own name, where the trustee is held to be constructively a trustee for those interested in the beneficial term. Besides being duly created, it is necessary for the validity of the trust that it should be a lawful one. An unlawful trust is one which contravenes the policy of the law in any respect. Examples of such trusts are trusts for a corporation without licence, for a perpetuity, and for purposes subversive of morality, such as trusts for illegitimate children to be hereafter born. Superstitious uses also fall under this head. There are also certain trusts which are avoided by statute under particular circumstances, such as settlements in fraud of creditors (see BANKRUPTCY). The law cannot be evaded by attempting to constitute a secret trust for an unlawful purpose. If an estate be devised by words prima facie carrying the beneficial interest, with an understanding that the devisee will hold the estate in trust for such a purpose, he may be compelled to answer as to the secret trust, and on acknowledgment or proof of it there will be a resulting trust to the heir-at-law. In the case of an advowson suspected to be held for the benefit of a Roman Catholic patron, there is a special enactment to the same effect (see QUARE IMPEDIT). The rules of equity in charitable trusts are less strict than those adopted in private trusts. Charitable trusts must be lawful, *e.g.* they must not contravene the Statutes of Mortmain; but a wider latitude of construction is allowed in order to carry out the intentions of the founder, and they will not be allowed to fail for want or uncertainty of objects to be benefited. The court, applying the doctrine of *cy près* (*q.v.*), will, on failure of the original ground of the charity, apply the funds as nearly as possible in the same manner. On this principle gifts originally made for purely charitable purposes have been extended to educational purposes. Further, trustees of a charity may act by a majority, but ordinary trustees cannot by the act of a majority (unless specially empowered so to do) bind a dissenting minority or the trust property. A trust estate is subject as far as possible to the rules of law applicable to a legal estate of a corresponding nature, in pursuance of the maxim, "Equity follows the law." Thus trust property is assets for payment of debts, may be taken in execution, passes to creditors in bankruptcy, and is subject to dower and curtesy, to the rules against perpetuities, and to the Statutes of Limitation. This assimilation of the legal and equitable estates has been produced partly by judicial decisions, partly by legislation. A trust is extinguished, as it is created, either by act of a party or by operation of law. An example of the former mode of extinction is a release by deed, the general means of discharge of a trustee when the purposes of the trust have been accomplished. Extinction by operation of law takes place when there is a failure of the objects of the trust: *e.g.* if the cestui que trust die intestate without heirs or next of kin, the property, by the Intestates Estates Act 1884, escheats in the same manner as if it were a legal estate in corporeal hereditaments. Equitable interests in real estate abroad are as a rule subject to the *lex loci rei sitae*, and an English court has no jurisdiction to enforce a trust or settle a scheme for the administration of a charity in a foreign country. An English court has, however, jurisdiction to administer the trusts of a will as to the whole real and personal estate of a testator, even though only a very small part of the estate, and that wholly personal, is in England. This was decided by the House of Lords in a well-known case in 1883 (*Ewing* v. *Orr-Ewing*, L.R. 9, A.C. 34).

Rights and Duties of the Trustee.—The principal general properties of the office of trustee are these: (1) A trustee having once accepted the trust cannot afterwards renounce. (2) He cannot delegate it, but an inconvenience which formerly attached to dealings with trustees and trust property, in consequence partly of this rule, and partly of the liability of persons dealing with trustees to see that money paid to them was properly applied, was largely obviated by s. 17 of the Trustee Act 1893 (replacing s. 2 of the Trustee Act 1888), which in effect provides that a trustee may appoint a solicitor to be his agent to receive and give a discharge for any money or valuable consideration or property receivable by the trustee under the trust, by permitting the solicitor to have the custody of and to produce a deed having in the body thereof or endorsed thereon a receipt for the consideration money or other consideration, the deed being executed or the endorsed receipt being signed by the trustee; and a trustee is not chargeable with breach of trust by reason only of his having made or concurred in making any such appointment; and the producing of any such deed by the solicitor is a sufficient authority to the person liable to pay for his paying to the solicitor without the solicitor producing any separate or other direction or authority in that behalf from the trustee. (3) In the case of co-trustees the office must be exercised by all the trustees jointly. (4) On the death of one trustee there is survivorship: that is, the trust will pass to the survivors or survivor. (5) One trustee shall not be liable for the acts of his co-trustee. (6) A trustee shall derive no personal benefit from the trusteeship. The office cannot be renounced or delegated, because it is one of personal confidence. It can, however, be resigned, and legislation has given a retiring trustee large powers of appointing a successor. The liability of one trustee for the acts or defaults of another often raises very difficult questions. A difference is made between trustees and executors. An executor is liable for joining in a receipt *pro forma*, as it is not necessary for him to do so, one executor having authority to act without his co-executor; a trustee can show that he only joined for conformity, and that another received the money. The rule of equity by which a beneficiary who consented to a breach of trust was liable to indemnify the trustees to the extent of his interest has taken definite statutory shape in s. 45 of the Trustee Act 1893 (replacing s. 6 of the Trustee Act 1888), which enacts that when a trustee commits a breach of trust at the instigation or request, or with the consent in writing of a beneficiary, the High Court may, if it thinks fit, and notwithstanding that the beneficiary is a married woman entitled for her separate use and restrained from anticipation, make such order as to the court seems just for impounding all or any part of the interest of the beneficiary in the trust estate by way of indemnity to the trustee. The rule that a trustee is not to benefit by his office is subject to some exceptions. He may do so if the instrument creating him trustee specially allows him remuneration, as is usually the case where a solicitor is appointed. The main duties of trustees are to place the trust property in a proper state of security, to keep it (if personalty) in safe custody, and to properly invest and distribute it. A trustee must be careful not to place himself in a position where his interest might clash with his duty. As a rule he cannot safely purchase from his cestui que trust while the fiduciary relation exists between them. Investments by trustees demand special notice. The Trustee Act 1893 has consolidated the law on this point, and provides, as it were, a code or charter of investment authorizing trustees, unless expressly forbidden by the instrument (if any) creating the trust, to invest trust funds in various modes, of which the more important are as follows: In any of the parliamentary stocks or public funds or government securities of the United Kingdom; on real or heritable securities in Great Britain or Ireland; in stock of the Bank of England or the Bank of Ireland; in India 3½% stock and India 3% stock; in any securities, the interest of which is for the time being guaranteed by parliament; in consolidated stock created by the London County Council; in the debenture or rent-charge or guaranteed or preference stock of any railway company in Great Britain or Ireland incorporated by special act of parliament, and having during each of the ten years last past before the date of investment paid a dividend at the rate of not less than 3% on its ordinary stock; in the debenture stock of any railway company in India, the interest on which is paid or guaranteed by the secretary of state in council of India; in the "B" annuities of the Eastern Bengal, the East Indian and the Sind, Punjab and Delhi railways; and also in deferred annuities—comprised in the register of holders of annuity Class D, and annuities comprised in the register of annuitants Class C of the East Indian Railway Company; in the stock of any railway company in India upon which a fixed or minimum dividend in sterling is paid or guaranteed by the secretary of state in council of India, or upon the capital of which the interest is so guaranteed; in the debenture or guaranteed or preference stock of any company in Great Britain or Ireland established for the supply of water for profit, and incorporated by special act of parliament or by royal charter, and having during each of the ten years last past before the date of investment paid a dividend of not less than 5% per annum on its ordinary stock; in nominal or inscribed stock issued, or to be issued, by the corporation of any municipal borough having, according to the returns of the last census prior to the date of investment, a population exceeding 50,000; or by any county council under the authority of any act of parliament or provisional order; in any of the stocks, funds or securities for the time being authorized for the investment of cash under the control or subject to the order of the High Court. Trustees may from time to time vary any such investments for others of an authorized nature. The statutory power to invest on real securities does not, of course, authorize the purchase of realty; but by s. 5 of the Trustee Act 1893 a power to invest in real securities (in the absence of express provision to the contrary) authorizes investment on mortgage of leasehold property held for an unexpired term of not less than 200 years and not subject to a greater rent than one shilling a year, or to any right of redemption or condition of re-entry except for non-payment of rent.

The position of trustees in respect of what was frequently an undue personal responsibility for the administration of their trust has been much improved by s. 8 of the Trustee Act 1888 (not repealed by the Trustee Act 1893) and s. 3 of the Judicial Trustees Act 1896. Sub-section (1) of the former enactment (with some omissions) runs as follows: "In any action or other proceeding against a trustee or any person claiming through him, except where the claim is founded upon any fraud or fraudulent breach of trust to which the trustee was party or privy, or is to recover trust property, or the proceeds thereof still retained by the trustee, or previously received by the trustee and converted to his use, the following provisions shall apply: (*a*) All rights and privileges conferred by any statute of limitations shall be enjoyed in the like manner and to the like extent as if the trustee or person claiming through him had not been a trustee or person claiming through him. (*b*) If the action or other proceeding is brought to recover money or other property, and is one to which no existing statute of limitations applies, the trustee or person claiming through him shall be entitled to the benefit of, and be at liberty to plead the lapse of time as a bar to such action or other proceeding in the like manner and to the like extent as if the claim had been against him in an action of debt for money had and received." The statutory period of limitation which trustees are thus permitted to plead is the six years fixed as the period of limitation for actions of debt by the Limitation Act 1623. It has been decided on the above section that in the case of a breach of trust consisting of an improper investment of the trust funds, time begins to run in favour of the trustee from the date of the investment. Sub-section (3) of the Judicial Trustees Act 1896 provides that "if it appears to the court that a trustee, whether appointed under that act or not, is or may be personally liable for any breach of trust, whether the transaction alleged to be a breach of trust occurred before or after the passing of that act, but has acted honestly and reasonably, and ought fairly to be excused for the breach of trust and for omitting to obtain the directions of the court in the matter in which he committed such breach, then the court may relieve the trustee either wholly or partly from personal liability for the same." Owing to the generally reduced rate of interest obtainable for money invested on trust securities, the court has in several instances, and even as against defaulting trustees, charged them with interest at 3% per annum (instead of 4%, which was formerly the recognized rate) upon sums found due from them to the trust estate.

Under the old law trustees could not safely advance on mortgage more than two-thirds of the actual value of agricultural land or one-half of the value of houses. This "two-thirds rule" is now made statutory by s. 8 of the Trustee Act 1893, which enacts that "A trustee lending money on the security of any property on which he can lawfully lend shall not be chargeable with breach of trust by reason only of the proportion borne by the amount of the loan to the value of the property at the time when the loan was made, provided that it appears to the court that in making the loan the trustee was acting upon a report as to the value of the property made by a person whom he reasonably believed to be an able practical surveyor or valuer instructed and employed independently of any owner of the property, whether such surveyor or valuer carried on business in the locality where the property is situate or elsewhere, and that the amount of the loan does not exceed two equal third parts of the value of the property as stated in the report, and that the loan was made under the advice of the surveyor or valuer expressed in the report." The same section protects trustees for not investigating the lessor's title when lending on the leasehold security, and for taking a shorter title than they might be otherwise entitled to on the purchase or mortgage of any property, if they act with prudence and caution. By s. 9 (replacing s. 5 of the Trustee Act 1888) trustees who commit a breach of trust by lending more than the proper amount on any property are excused from making good any more than the excess of the actual loan over the sum which they might have properly lent in the first instance.

Rights and Duties of the Cestui que Trust.—These may be to a great extent deduced from what has been already said as to the correlative duties and rights of the trustee. The cestui que trust has a general right to the due management of the trust property, to proper accounts and to enjoyment of the profits. He can as a rule only act with the concurrence of the trustee, unless he seeks a remedy against the trustee himself.

Judicial Trustees.—The Judicial Trustees Act 1896, inaugurated a semi-official system of trusteeship which was new in England, but had been known in Scotland for upwards of 150 years. The general scope of the act is indicated by s. 1 (1), which runs as follows: "Where application is made to the court by or on behalf of the person creating or intending to create a trust, or by or on behalf of a trustee or beneficiary, the court may, in its discretion, appoint a person (in this act called a judicial trustee) to be a trustee of that trust, either jointly with any other person or as sole trustee, and if sufficient cause is shown, in place of all or any existing trustees." The act and the rules made under it (the Judicial Trustees Rules 1897) provide that judicial trustees shall be under the control and supervision of the court as officers thereof, and may be paid for their services out of the trust property. The trust accounts are to be audited annually, and a report thereon made to the court, which has power to order inquiries into transactions connected with the administration of the trust. A judicial trustee may be required to give security, and in any case has to keep the trust account with a bank approved by the court, and deposit title-deeds and other documents of title in such custody as the court directs. Communications between judicial trustees and the court with reference to their duties are permitted to be made with little or no formality, and strict proof of facts may be waived in proper cases. The act may, in short, be described as an attempt to provide for an official check upon the administration of trusts, while avoiding the formality and expense incident to the procedure in an administration action.

Public Trustee.—A step further was taken by the Public Trustee Act 1906, which established the office of public trustee. By the act he is a corporation sole, with perpetual succession and an official seal and may sue and be sued under his official title. He may, if he thinks fit, act in the administration of estates of small value; as custodian trustee, or as an ordinary trustee; he may be appointed a judicial trustee, or administrator of a convict's property. The law of trusts generally is applicable to him and he can act either alone or jointly with other persons. He has an absolute discretion as to whether he will accept or not any trust, but cannot decline acceptance on the ground only of the small value of the trust property. He cannot accept any trust which involves the management or carrying on of a business, except in certain cases authorized under rules appended to the act. He cannot accept a trust under a deed of arrangement for the benefit of creditors, nor of an insolvent estate, nor one exclusively for religious or charitable purposes. His powers and duties are dealt with by the act under three headings: (1) *In the administration of small estates.*—On the application of any person entitled to apply to the court (*i.e.* the High Court, and as respects trusts within its jurisdiction, the county court) for an order for administration of any estate, the gross value of which is proved to the satisfaction of the public trustee to be less than £1000, he may administer the estate, and must do so if the persons beneficially entitled are persons of small means, unless he sees good reason for refusing. By declaration in writing signed and sealed by him the trust property other than stock vests in him, and the right to transfer or call for the transfer of any stock forming part of the estate, provided that he does not exercise the right of himself transferring stock without the leave of the court; this general provision also does not apply to copyhold, in respect of which he has the same powers to convey them as if he had been appointed under s. 33 of the Trustee Act 1893. Power is given to the court to order, for reasons of economy, that an estate being administered by the court be administered by the public trustee. (2) *As custodian trustee.*—The public trustee, if he consents to act, may be appointed custodian trustee on an application to the court, or by the testator, settlor or other creator of any trust or by a person having power to appoint new trustees. When he is so appointed the trust property is transferred to him as if he were the sole trustee, but the management of the trust property and any discretionary power remain vested in the other trustees. His relations with the managing trustees are further defined by the act. (3) *As an ordinary trustee.*—The public trustee may be appointed trustee, executor, &c., of any will or settlement or instrument of any date either under his official title or other sufficient designation. In a will a sentence to the following effect would be sufficient. "I appoint the Public Trustee executor and trustee of this my will." Where the public trustee has been appointed a trustee of any trust, a co-trustee may retire from the trust under s. 11 of the Public Trustee Act 1893 notwithstanding that there are not more than two trustees, and without such consents as are required by that section. The consolidated fund of the United Kingdom is liable to make good all sums required to discharge any liability which the public trustee, if he were a private trustee, would be personally liable to discharge, except where neither the public trustee nor his officers has contributed to it, and which neither he nor any of his officers could by reasonable diligence have averted. A person aggrieved by any act or omission or decision of the public trustee in relation to any trust may apply to the court, and the court may make such order in the matter as it sees fit. The act contains provisions for the investigation and audit of trust accounts, which may take place on the application of any trustee or beneficiary; if the parties do not agree upon a solicitor and public accountant for the purpose, they are appointed by the public trustee, who has entire discretion over the source from which the expenses are to be defrayed. The fees payable under the act are fixed by the Public Trustee (Fees) Order; they are of two kinds: fees on capital and fees on income. The object of the department is not to make a profit, but merely to pay expenses. Full information as to the machinery and procedure of the office and the requirements necessary to obtain the services of the public trustee are obtainable on application to the Public Trustee Office, Clement's Inn, London.

Scotland.—The history of the law differs considerably from that of England, though perhaps the position of the Scottish trustee is now not very different from that of the trustee in England. The Statute of Uses did not apply to Scotland, since neither that nor any similar legislation was necessary in a system in which law and equity were administered by the same tribunals. Trusts seem to have existed from time immemorial, and have been frequently regulated by statute. The policy of the English Statute of Frauds was no doubt intentionally imitated in the Act 1696, c. 25, enacting that no action of declarator of trust should be sustained as to any deed of trust made for thereafter, except upon a declaration or back-bond of trust lawfully subscribed by the person alleged to be trustee and against whom or his heirs or assignees the declarator should be intended, or unless the same were referred to the oath of the party *simpliciter.* The act does not apply to all cases, but only to those in which by the act of parties documents of title are in the name of a trustee, but the beneficial interest in another. The person creating the trust is called the *truster*, a term unknown in England. On the other hand the term *cestui que trust* is unknown in Scotland. The office of trustee is prima facie gratuitous, as in England, it being considered to fall under the contract of mandate. Some of the main differences between English and Scottish law are these. There is no presumption in Scotland of a resulting trust in favour of a purchaser. A trust which lapses by the failure of a beneficiary goes to the Crown as *ultimus heres.* The office of trustee is not a joint office, therefore there is no right of survivorship, and on the death of a trustee the survivors are incompetent to act, unless a certain number be declared or presumed to be a *quorum*, or the office be conferred on trustees and the accedors and survivors of them. Sometimes the concurrence of one trustee is rendered absolutely necessary by his being named *sine qua non.* The Court of Session may appoint new trustees, but generally appoints a judicial factor. There has been a considerable amount of legislation, chiefly in the direction of extending the powers of trustees and of the court in trust matters. The powers of investment given to trustees are much the same as those allowed in England.

United States.—In New York and many other States uses and trusts have been abolished (with certain exceptions), and every estate, subject to those exceptions, is deemed a legal right cognisable in courts of law. Some of these exceptions are implied trusts and express trusts to sell land for the benefit of creditors, to sell, mortgage or lease lands for the benefit of legatees, or for the purpose of satisfying any charge thereon, to receive the rents and profits of lands and apply them to the use of any person during the life of such person or any shorter term, or to receive such rents and profits, and accumulate the same within the limits allowed by the law. Some states allow the creation of trusts (other than those arising by implication or operation of law) only by means of will or deed. Where the trust is of real estate, the deed must generally be registered. Forms of deeds of trust are given in the Statutes of Virginia and other states. The English doctrine of *cy près* is being adopted in many states. A public trustee as a corporation sole exists in some states. A trustee under American law is generally entitled to compensation for his services. Spendthrift trusts, *i.e.* those under which the enjoyment of income bequeathed by will in such a way as to prevent creditors of the beneficiary from reaching it before it gets into his hands, are generally supported (*Nichols* v. *Eaton*, 91 United States Reports, 713). A "voting trust" is a concerted transfer of their shares in a corporation by a majority of the shareholders to trustees to hold and vote on them for a specified period for the purpose of securing the adoption or continuance of a certain line of corporate action. Any shareholder may recede from such an arrangement and reclaim his stock.

AUTHORITIES.—The principal authority is Lewin's *Law of Trusts*; other treatises are those of Godefroi and Underhill. For American Law see Perry *On Trusts.* The principal authority on charitable trusts is Tudor. For the history may be consulted Bacon, *Law Tracts*; Reading, *On the Statute of Uses*; Gilbert, *On Uses*; Sanders, *On Uses and Trusts*; Spence, *Equitable Jurisdiction*, i. 435; Digby, *Hist. of the Law of Real Property*, chs. vi., vii.

TRUSTS, in Economics. The word "trusts," as used here, includes all those aggregations of capital engaged in productive industry that, by virtue of their industrial strength, have or are supposed to have some monopolistic power. Legal monopolies, as such, and natural monopolies are excluded, although it is frequently true that the trusts are aided by and sometimes control natural monopolies. Trusts are here considered to be identical with the so-called "capitalistic monopolies." As "trusts" started in America, the subject will be considered here first from the point of view of American experience.

While it is probably true that trusts are a product of evolution, it is desirable to analyse and explain that conception in some detail if we are to understand their industrial significance. Competition, especially among industries managed on a great scale, often makes modern business unprofitable. Commercial men have been thus compelled in some way to modify former methods of doing business. So long as most industries were run on a small scale, the differences in the ability and the facilities of the various competitors were so great that only those at the lower end of the scale of excellence were forced out of the business—this to the general advantage of industrial society. The great mass of producers remained vigorously competing with one another, some making larger, others smaller profits, but all except a few at the lower margin making at least a living. Under modern business conditions competitors are often, relatively speaking, few in number, of substantially equal ability, and controlling substantially equal facilities for managing the business economically. Consequently, in such circumstances, modern competition differs greatly from that form which was familiar to the earlier economists. Among competitors of such great resources, the struggle may last long after the business has become unprofitable to all before any will fail. Among competitors so nearly equal in strength, the entire industry may be very seriously injured by competition before enough are forced out to affect materially the severity of the competition.

The dictum of Stephenson, that "where combination is possible, competition is impossible," has a much wider application now than in the early days of railways. The modern facilities for the transportation of goods, for the rapid transmission of intelligence by fast mail, and especially for the instantaneous exchange of information by the telegraph and telephone, have made it possible to manage easily a large business, however widely separated its different plants or establishments may be. In the middle of the 19th century or thereabouts, on account of the lack of these facilities, management of such institutions would often have been impossible. Many of the advantages of combinations are entirely dependent upon these modern facilities, and on that account these facilities may be said to be an occasion, if not a cause, of the trusts.

Two Kinds of Trust Industries.

If the product of an industry is of such a nature that its quality is substantially uniform and can be readily tested by purchasers, especially if the goods are such that they are ordinarily sold in large quantities, the competition between rival establishments must almost of necessity be a competition in price. Sugar refining, oil refining, the distilling of spirits, the manufacture of salt, are such industries. The standard quality is readily tested, and the manufacturer who can offer the standard product at the lowest price effects a sale. Industries manufacturing comparatively inexpensive articles for the retail trade, put them up in packages which become well known to customers; and those industries whose goods are sold under brands or trade-marks, or in some other form so that they are familiar to buyers, afford an example of competition of an entirely different kind. When the reputation of a certain brand of goods of this nature becomes established, consumers make no further efforts to test its quality, and the retail price often becomes a customary price. If a manufacturer of such goods finds his trade injured by a rival, his most effective means of competition will often be, not a lowering of the price, but an increase of the outlay on advertising. Soap, baking-powder, photographic cameras for general use, and of late years certain brands of coffee, patent medicine, and other drugs of similar nature, are examples of this class. Those industries in which the competition becomes a matter of cutting of prices can by combination remove rivals from the field, and then put prices up to a remunerative rate. Competitors in industries of the second class by combination can save many of the costs of selling, and thus without any increase in the price of the product may save enough of the cost to make the business profitable.

Some of the advantages of combination over competition which have led to the organization of trusts may be enumerated:—

Savings from Combination.

1. The cost of selling may be greatly lessened. As has been intimated, competition in the case of industries of the second class named above leads to very expensive advertising in order to effect sales. An examination of the pages of any of the American magazines, with a thought as to the amount charged for the use of these advertising pages (from one hundred to as high as even four hundred dollars, or from £20 to £80, per page for a single insertion in some of the magazines with the largest circulation) will convince one of the cost of such competitive advertising. The expense involved in making attractive show-windows in stores or shops, and in calling the attention of the public to popular wares by posters scattered about the country and by legends painted on rocks, on buildings along the lines of railways, &c., are other common examples.

2. The salaries of commercial travellers, together with their hotel and travelling expenses, are of a similar nature. This competitive advertising in many cases does not increase to any noteworthy extent the consumption of the products in question, but merely attracts customers from one manufacturer to another. Combination among establishments that do this costly advertising saves a large part of the expense without lessening materially the quantity of goods sold.

3. If different manufacturing establishments, scattered throughout the country, are brought under one management, it will be possible for orders for goods to be received at one central office, and then to be distributed to the federated establishments, so that goods can be despatched to customers in each case from the nearest establishment. In this way freight expenses may be very greatly lessened, cross freights over the same territory being substantially eliminated. A single establishment supplying all of its customers would often be compelled to deliver much longer distances at greatly increased expense.

4. The entire profit of an establishment frequently depends upon the skill of the manager. When many different establishments are organized into one, it is possible to select the most skilful manager of all and to put him in charge of the combination, thus securing in many cases, if the trust includes practically all of the establishments in the entire industry, the ablest manager in the country for them all. It is of course true that as an establishment increases in size, or as a combination increases the number of its branches, especially if they are widely scattered, it becomes impossible for the manager to give his personal supervision to the details of management of each institution. An executive officer of the highest skill, however, will so select his subordinates, so direct their work, and so infuse into them his own spirit, that, under careful inspection, comparatively little will be lost from his inability to be present personally in each separate establishment. In the larger combinations frequent reports, often daily, are made from each concern, giving in detail the quantity of the output, the quality of the goods, the exact cost of the different processes of manufacture; so that it is possible to compare continually each of them with all of the others; to detect the special weakness of each, and in this way to remedy any slight defects in any one establishment, and to bring all nearly up to the highest level of productive capacity.

5. Each business manager is likely to have some special excellence in his methods of management. One will be particularly skilful in the technique of manufacturing; another in the organization of the business; a third in selling goods, and so on. By combining many establishments into one, it is possible so to distribute this managerial skill that each superintendent will be given the department for which he is peculiarly fitted, and the whole establishment will thus get the benefit, not merely of the best executive ability at the head, but also of the best managing skill at the head of each separate department. In many cases it is probable that as much is saved in this way as in any other.

6. Besides this distribution of skill of the managers, it is sometimes equally beneficial to distribute the various products of the combination among the different plants. For example, in the manufacture of hoop and bar iron the products are turned out in great varieties of size, probably from seventy-five to a hundred. Wholesale dealers in sending their orders to the mills are likely to call for from ten to fifty different kinds. If these orders go to an establishment which has but one large mill, it may be necessary, in order to execute the order, to change the rolls in the mill several times, causing thus a waste of power, of time and of energy. If several establishments are combined, each can be equipped for certain sizes. When, in these circumstances, a large order is received, to each establishment will be sent that part of the order which it is especially equipped to fulfil, and thus, without any changes of rolls or stoppage of machinery, the separate sizes can be made. The same principle holds of course in nearly all lines of work, in some to a greater degree than in others; but in the manufacture of hoop and bar iron a saving from this source amounting to from a dollar to a dollar and a half, or from 4s. to 6s., per ton is sometimes made.

7. The advantage of unifying in one establishment the manufacture of products somewhat allied in nature appears also in selling goods. If customers can buy all of the various kinds of related goods in one establishment, much of their time and energy will be saved. Some of the larger combinations, therefore, in order to make this saving for their customers and thus to be sure of retaining their orders, add to their plant facilities for making products which a smaller establishment could hardly manufacture. For example, the Distilling Company of America, which controls probably 90% of the entire product of corn spirits, found it to its advantage to add to its plant several rye distilleries, and to purchase a number of the leading brands of whiskies for consumption as beverages, in order that they might supply the needs along different lines of practically all dealers in spirits and whiskies, in this way saving for themselves many customers who otherwise might have been lost.

8. The mere size of an establishment and its ability to supply at any time on short notice any order, however large, gives it also an advantage in retaining custom. A concern that controls only

from 5 to 10% of the entire output of a country in any special line of goods might at times find it impossible to supply goods promptly. Large customers who might thus be embarrassed are more ready to deal regularly with an establishment controlling 75 to 90% of the output, if they can in this way be sure of having their orders attended to promptly. It is stated that the American Sugar Refining Company on this account has been able to secure, with considerable regularity, one-sixteenth of a cent a pound more on its refined sugars than the independent refiners, the latter being frequently compelled to cut their prices to that extent in order to make sales.

9. Owing to the fact that the introduction of goods into new markets, especially into foreign markets, is a matter of time, expenditure of energy, and of money, the large establishment with great capital has in this particular also a decided advantage. The Standard Oil Company, and American Tobacco Company, and other similar establishments, have thus been able to open up new markets in Europe, in Japan, China and other portions of the Far East more readily by far than individual producers along those lines could have done. This stimulus to the foreign trade acts also beneficially to the domestic trade, inasmuch as the exportation of part of the product tends to keep prices somewhat higher at home, and as the added demand for the raw material influences its price, thus creates a demand for labour along many lines.

10. The combination also frequently saves for its stockholders considerable sums from its wiser dealing with credits, and this in a way also that is beneficial to the entire business community. When competition is very severe among different establishments, the managers, in order to increase their sales, will not infrequently grant credit somewhat unwisely. The combination controlling a large part of the market is not so tempted, and moreover has the power to bring needed pressure to bear upon delinquent debtors more readily, so that losses from bad debts are much less frequent.

Besides the special savings that serve as reasons for the formation of combinations, certain special favours at times lead to their formation.

Special Favours to Combinations.

1. The protective tariff is most frequently cited as such a favour. By the protection which a protective duty gives against foreign competition, it doubtless often furnishes the occasion for the formation of trusts. If a large amount of capital is tempted into the industry through the profits promised by the tariff, and therefore competition among the various establishments becomes fierce, it is much easier for them to form a combination with the certainty of good profits, provided the domestic competition can be overcome, if they are certain that foreign competition also is to be excluded. On the other hand, it would hardly be right to speak of the tariff as in this case the direct cause. In other industries not protected by the tariff the same fierce competition leads to the formation of combinations. The tariff is simply an encouraging condition. The removal of the tariff would not destroy the combination unless it destroyed the industry at the same time; but, on the other hand, the removal of a protective tariff might very easily prevent the abuses of exorbitant prices which might be exacted by a combination protected by the tariff.

2. It is doubtless true that combinations have a good many times been encouraged by special discriminating rates of freight granted by the railways or other transportation agencies. There is, of course, a certain economic advantage to the railways in having goods despatched in large quantities by consigners who are able to supply their own cars, loading and unloading facilities, &c. Railways on that account often prefer to deal with large firms, and, other things being equal, are willing to give them some special rates. These concerns also are likely to have rather better credit than the smaller ones, so that dealing with them ensures prompt pay and cheaper collection of accounts. The competition among the different railways also for the freights which an important customer can furnish leads to cutting of the rates in their favour. These special rates, however, whether justified from the business point of view or not, are beyond any question from the social point of view, often a very grave injury. A manufacturer who receives these special favours can build up a business substantially monopolistic in its extent, whereas his rival of equal or even of greater ability, and equally skilful as a manufacturer, would be ruined if he did not receive like rates. The injustice of such discriminations and their evil effects on the community have been recognized by legislatures and courts in America, and they are practically universally forbidden. It remains beyond question true that they are, notwithstanding, very frequently granted.

Promotion.

In recent years in the United States there can be little question that the formation of the great combinations has been much encouraged by the opportunities, which promoters were able to seize, of making for themselves large profits. The movement towards combination was so fully recognized and the advantages in many cases so palpable, that a well-informed and skilful promoter was often able to persuade a large proportion of the manufacturers in some special industry to combine. In preparing the plan for such combination, the promoter has in many cases seen to it that he himself first bought the properties which he could very shortly turn over to the combination at high rates of profit; or else he has been able to persuade the new corporation to issue large amounts of stock, of which considerable proportions were given to him in return for his services. It has been true in many cases that these securities have been speculative in nature, but nevertheless the promoter has often reaped in this way large rewards. The possibility of this profit has doubtless stimulated his activity in urging the combinations.

The Underwriter.

Associated with the promoter in the organization of these combinations have usually been bankers or other financiers who stood ready, for an amount of stock or other promised profit sufficiently large to compensate them for their risk, to furnish to the combinations cash sufficient to start the business and to provide other needed capital. Usually the form of underwriting employed has been this: A promoter engaged in the formation of a combination and needing a certain fixed sum in cash, would make an arrangement with a bank to sell to it at a price agreed upon such portions of a named amount of stock as were not disposed of to other customers before a certain fixed date. For example, the bank might agree to furnish one million dollars in cash (£200,000) in return for say four millions of stock (£800,000), or to purchase itself at a fixed price all the remainder of the $4,000,000 stock unsold at the date agreed upon, the bank itself to become the sales agent. In those circumstances the bank would naturally use its best endeavours to sell the four millions of stock to other customers at the price agreed upon, say twenty-five dollars, or £5, per share. So far as it failed of disposing of the entire amount, it would take the remainder itself. For taking these risks, naturally the bank has almost invariably asked a very high commission, and not infrequently it has been asserted that the managers of the banks have been given a special bonus for themselves privately, in addition to the rates of profits granted the bank.

The Basis of Capitalization.

These large amounts of stock that are paid to the promoter and the financier for the purpose of bringing about the organization of a large trust, lead, of course, to what is called over-capitalization. What the proper basis of capitalization for a manufacturing industry should be, is a matter that cannot perhaps easily be determined by a definite principle which shall be applicable in every case. The laws that have been most strict on the subject attempt to limit the capitalization to the "actual cash value" of the business, by that being understood at times simply the cost of the plant itself with the running cash capital needed. On the other hand, most business men think that it is a wiser plan, and on the whole equally just, to capitalize a business on the basis of its earning capacity, regardless of what the plant may have cost. When, as has been frequently the case of late years, in addition to this cash value of the plant and the cash itself which may have been paid in, large sums of stock are issued also for properties which may be in themselves highly over-valued, and for the services of the promoter, the financier and others, we can see that the capitalization must be far above what may ordinarily be considered a paying basis. On the other hand, if the element of monopoly enters into the business to any noteworthy extent, the prices of the product may be kept so high that fair dividends may be paid even on this high capitalization. That the tendency towards increasing the capital has been very strong there can be no question, and a penalty is apt to be paid for this somewhat reckless financiering. As soon as a slight depression in business comes, so that it is perfectly evident not merely that dividends cannot be paid on the common stock, but that in all probability both the deferred stock and the bonds, if any have been issued, will also have to go without interest, it may be necessary to reorganize many of these combinations and to start them anew on a much lower capitalization.

The Industrial Manager.

When the person organizing the combination is himself an active business man, and has the intention of himself directing the affairs of the combination, another element besides that of personal profit very frequently enters into the problem. Most strong men like to take responsibility and to be dominant in affairs. When, owing to the advantages of combination that have been enumerated above, the prospect of a virtual monopoly seems certain, provided due skill in management is exercised, it is natural that the manager should wish to bring about the combination in order that he may himself have the satisfaction of being in substantially absolute control of the entire industry in a country, or possibly even in the world. The ambition thus to dominate in a great industry is akin to that of a statesman, and there can be little question that this pride of power and the desire to control the destinies of others has been a more or less conscious element in the formation of many of the most successful and most skilfully managed combinations.

The Forms of Combination.

1. The form of combination which has ordinarily been first adopted has been some kind of agreement with reference to maintaining prices, or to paying wages, or to dividing the territory for the distribution of the product, or similar questions. Experience has shown that, generally speaking, such agreements are not likely to be kept in good faith for a long period.

2. In order to make the combination more permanent in its nature, the form of the trust, technically so called, was adopted. Under this form of combination, the stockholders of the various constituent companies of the trust place their stock in the hands of a small board of trustees, giving to these trustees an irrevocable power of attorney to vote the stock as they see fit, or in accordance with specific instructions given at the beginning. The title to the stock itself remains in the original holder, with the right to sell or pledge or dispose of it as he sees fit, but without the power of recalling his right to vote. In return for this stock thus deposited with the trustees, the trustees have ordinarily issued trust certificates, which are in themselves negotiable and take the place of the stock. Inasmuch as the holding of the voting power of the majority of the stock of each of the different constituent companies gave to the trustees absolute power of election of directors, and consequently the power of guiding harmoniously the affairs of all of the plant entering into the combination regardless of the will of the stockholders, the United States courts held that the corporations entering into such an agreement had gone beyond their powers, and that such a trust was illegal. Owing chiefly to these hostile decisions of the courts, this form of trust was abandoned, and new forms, which still, however, leave the power of unified direction in the hands of a few men, were adopted.

3. After the trusts were declared illegal, it was usual, when a combination was formed, to organize a new corporation which bought all of the properties of the constituent members of the trust. These constituent companies then dissolved, and the one great corporation owning all of the properties remained.

4. The form that now seems to be much in favour approaches in its general nature more closely to that of the original trust. Under this form a corporation is organized for the special purpose of buying and owning all, or a controlling share, of the stocks of each one of the constituent companies. The separate companies are then managed technically independently, the dividends of the separate corporations are all paid to the parent corporation as the stockholder owning all of the stocks, and these dividends are the source of profits of the new corporation. The officers in this parent corporation, of course, vote the stocks of the separate companies, and thus absolutely control.

The Trust and Wages.

From the savings which it is possible for the combinations to make, it would seem possible for them to pay higher rates of wages to those remaining in their employment than it was possible for the constituent companies to do. In certain instances, especially when the combination has first been made, wages have been increased. On the whole, however, it is probable that as yet the wage-earners have succeeded in getting an increase of wages in circumstances substantially similar to those under which their wages would be increased by single corporations. An increase of wages comes only through pressure on their part. Under a prosperous condition of industry it is possible, without materially lowering profits, to increase the wages.

Certain classes of employés, especially superintendents and commercial travellers, are less needed by the combinations, and consequently the total sum of wages paid to these classes by the combination is less than that formerly paid by the constituent companies. On the other hand, the number of employés of these classes being less than before, the average wage has, in certain cases at least, been increased. Owing to the fact that competitive selling is in certain cases largely done away with, it has in some, perhaps in many, cases been possible for fewer travelling salesmen, of less skill and with lower wages, to do the work than before the combination, so that not merely has the total expense been lessened, but also the average salary paid to those retained in the business.

In case of disputes arising between the combination and the operatives, the position of the combination is stronger than that of an individual corporation. It is possible to close one or two works where troubles have arisen, and to transfer orders to the other works without any material injury to the business, provided the closing of the one or two establishments is not for too long a period. Such instances have occurred. On the other hand, labour organizations are also rapidly increasing in strength, and their leaders are of the opinion that within a comparatively short time they will be so thoroughly organized in all of the chief industries that a strike can be instituted and supported not merely in one or two establishments, but throughout the entire industry. Whenever this condition of affairs shall have been reached, the employés will be substantially on an equality with their employers in such cases of conflict, so that the advantage now resting with the combination will be largely removed. In certain industries this condition seems already to have been reached.

Prices.

From the sources of savings that were enumerated before, it is evident that it would be possible for a combination either to increase the prices paid for raw materials, or to lower the prices of its finished products. Experience, however, seems to show beyond question that whenever the combinations are powerful enough to secure a monopolistic control it has usually been the policy to increase the prices above those which obtained during the period of competition preceding the formation of the combination. Inasmuch, however, as an attempt to increase prices to any great extent, so as to secure very high profits, would certainly result in tempting new capital into the field, it has been the general experience that prices have either been increased only comparatively little after the combination was formed, or else that competition entering the field has comparatively soon forced a lowering of prices to substantially the former competitive rates. It should be noted, however, that inasmuch as combinations have very frequently been formed only after a period of competition so fierce that practically all the competitors were running at a loss, it is hardly just to speak of a combination placing its prices above "competitive rates" unless one defines what is meant exactly by that expression. Whenever they have put their prices above the competitive rates existing just before the combination, it may mean that they have put their prices back to rates that will allow medium profits instead of losses, and not above rates that would be normal in the case of small competitors.

Legislative Remedies.

It will have been noted from what has been said that the excellences of the combination consist largely in the savings that have already been enumerated. The evils are: (1) The losses to investors through the acts of the promoters and financiers at the time of the organization of the combinations, and through the speculation in the stocks which is at times carried on by the directors of the combinations themselves. (2) The losses to the wage-earners from the power that sometimes exists of forcing wages rather lower than it would be possible for a single corporation or manufacturer to do, and also from the discharge of certain classes of employés whose services are no longer needed, such as commercial travellers. It should be remarked of the latter case, however, that the injury is a personal one to those men that are discharged, but that it results in a saving to the community, and, therefore, presumably to the wage-earning class as a whole in the long run. (3) A further injury at times to the consumer arises, as has been suggested, from the increase in price. Other evils come through the power that is sometimes exercised by combinations in the corruption of legislatures; in the control over industries of such a nature that it tends to destroy the spirit of individual activity and independence on the part of many persons who would otherwise enter business independently; and evils also come through the increased force of any improper or dishonourable business practices, since this added force for evil is given to any combination by virtue of its greater influence in the community. It is not intended to convey the impression that managers of combinations are less moral than other business men, but merely that whenever they are dishonourable in their practices the influence reaches more widely.

The chief remedies for these evils enumerated would seem to be more rigid laws with reference to the methods of incorporation and to the responsibility of directors to stockholders and to the public. This can perhaps best be brought about through greater publicity in both of these directions, probably under the inspection of government officials. The other line of remedies would seem to be the removal of special favours granted to these combinations either by the government or by railways or other bodies so situated that they can distribute favours to the larger combinations.

The Movement Towards Consolidation.

The movement towards consolidation of industries in the United States began to be noticeable soon after the Civil War (1861–65), but it had not reached noteworthy proportions, excepting in connection with the railways, until within the last twenty years of the 19th century. During the later years many consolidations were made, the largest number during the years 1898–1900. From what has been said earlier, it is evident that certain classes of industries, especially those that require the investment of fixed capital to large amounts, are especially adapted for combination. Very little tendency towards consolidation is found in the farming industry, and, relatively speaking, little in industries that require the investment of but small capital. It is perhaps, however, not too much to say that in nearly all lines of industry which from their nature are adapted for consolidation combinations more or less firm have been made during the last few years. It is probable that as time passes we shall have many of these combinations reorganized, and that in many lines of industry there will be further consolidation of present combinations.

Experience has shown that when combinations are made in industries that from their nature do not seem well suited for consolidation, failure follows. In many individual instances corporation lawyers, who have had much practice in forming combinations, advise their clients in lines of business especially fitted for competition not to enter a combination, but to remain independent, assuring them that an individual is able to compete in such lines of industry with any combination, however large. Such advice, of course, would not be given were the industry one which was well adapted for consolidation.

European Experience.

Great Britain.—The tendency towards consolidation has been for several years very noticeable in Great Britain, although the form has been rather that of a *pool* or *ring* than that of a trust or of a single large corporation. In the coal and milling industries there have been agreements; and, particularly in London and other distributing centres, these selling combinations have been able at times to control the market. This has also been true with reference to certain kinds of provisions, such as the bacon imported from Denmark.

Of late years there has been a marked tendency towards the formation of large corporations that buy up a very large proportion of competing manufacturing plant, and in this way secure at least a temporary monopoly of the market. The Salt Union was formed along these lines, but this has not proved successful, owing probably to the fact that new sources of supply were discovered. The dyeing industries in Bradford and in Yorkshire have been consolidated, so that in certain respects they have an absolute monopoly of the business, and in most directions of over 90% of it. The calico printers, the fine cotton spinners, the thread manufacturers, the bleachers, and others connected with the cotton manufacturing industries in Great Britain, have nearly all been brought together into large corporations which control from 90% upwards of the entire business. Similar combinations in cement, wall-paper, soap, tobacco and other trades have been formed. Most of these large corporations have been in existence for such a short time that one cannot yet judge accurately regarding their permanent success. Many of them seem to have been over-capitalized and their dividends have not always met shareholders' anticipations. There has been no active popular movement against consolidation in England, and the government has passed no laws opposed to it. Parliament, however, has passed stringent amendments to the Companies Acts, changes enforcing publicity regarding the organization of all limited liability companies and their methods of management. The amended law is expected to prevent most of the abuses of the combinations.

Germany.—Germany seems to be peculiarly the home of combinations so far as Europe is concerned. In 1897 Liefmann, writing regarding combinations in Germany, was able to mention combinations which were international in their scope in forty-one different branches of industry. Of combinations that were confined to Germany alone he mentioned 345, although many of them were in the same line of industry; for example, he found 80 combinations in different branches of the iron industry, 82 in the chemical industries, 38 in the textiles, and so on. Of that number he thought that definite information could be secured, but he was of the opinion that very many more of less importance existed, and had excluded from his reckoning all of those that were purely local, as for example those among the breweries in the different cities, as well as those among firms engaged merely in trade. The form of combination in Germany is ordinarily that merely of contracts among independent establishments (*Cartels*, *Kartells*) regulating the amount of output for each, and in certain cases also the prices. As in Austria and in France, a central selling bureau for all the members of the combination is frequently found. The most successful combinations have been those among the coal-miners in western Germany and the four or five in the leading branches of iron manufacture, also in western Germany. Others of somewhat similar rank have been organized, one, for example, in the sugar industry, which includes both refiners and producers, and another among the manufacturers of spirits. The former, following that among the Austrian sugar manufacturers, is somewhat peculiar in that the refiners guarantee to the producers of raw sugar a fixed price for their output so far as the sugar is intended for the home market, the refiners expecting to recoup themselves from the consumers through the monopolistic power which they possess. The law does not seem to be hostile to these combinations. Contracts that are immoral in their nature are, of course, non-enforceable. But the courts have, on the whole, not taken an attitude inimical to the larger combinations, and the government seems at times to have been inclined to favour them. In one or two cases where the government is itself a producer, as of soda, it is a member of a combination. Indeed, a Prussian minister in a speech in the Landtag has expressed himself favourably regarding the coal and iron combinations. The facts seem to show that the coal combination, at any rate, has used its power of fixing prices in a conservative way, and it has at times held prices somewhat lower than they probably would have been had free competition existed in that industry. So long as the combinations are managed conservatively, and so long as the government is able to secure a careful supervision over them, it is not to be expected that there will be much hostility in Germany on the part of the government.

France.—The number of combinations in France is probably much less than in Great Britain or Germany. In the penal code there has been a provision for many years against monopoly brought about by unfair means, and in one or two rather prominent instances there seem to have been convictions under this article. Consequently, the agreements that have been made, so far as they are intended to control prices, are usually kept secret. There have been, however, notably in the case of the iron industries, agreements made among the leading manufacturers, under which the proportion of output assigned to each was fixed. A single selling bureau has also in such cases been established, which receives all orders and fixes the prices for all of the different establishments concerned. So far this form of organization, although in certain localities it seems to have secured monopolistic power has not been successfully attacked in the courts. For several years it has been supposed that a similar agreement existed among the sugar refiners. They themselves, however, acknowledge only an agreement regarding the amount of the output which shall be assigned to each, and deny any agreement as to prices. Of course an agreement regarding output would be likely to have a material effect upon prices. Somewhat similar combinations exist among the petroleum refiners, the porcelain makers, and some few others. The government has taken no active steps in the matter, but popular opinion seems to be awakening somewhat.

Austria.—In Austria the development of combinations has been very marked. The most successful combination, on the whole, as well as one of the earliest, has been that of the iron industry. The sugar industry, however, including both refiners and producers of the raw sugar, and the petroleum industry, are also combinations of great power. The form of these combinations is ordinarily that of an agreement regarding both output and prices. In some instances a central selling bureau fixes the prices, in others the market is divided, while in others still other forms of agreements of many kinds which serve to secure a monopoly are found. The movement has spread very rapidly indeed, until, in the opinion of many writers in Austria, practically all branches of industry, in which agreements for the lessening of competition will prove advantageous, are now largely controlled by combinations. The courts of Austria have, on the whole, shown themselves hostile to the movement. Contracts for the division of the market, for the assignment of fixed proportions of the entire output to different establishments, the fixing of prices, &c., are declared void and will not be enforced by the courts. This adverse action, however, does not seem to have affected very materially the tendency towards combination, although it has perhaps tended somewhat to encourage the formation of large corporations which should purchase all of the separate plant in any one industry. This tendency, again, is checked by the fact that the corporation law requires publicity in business, and that the taxes are heavier on corporations than on private firms, both as regards the legal rate and the certainty of collection. A government commission has recommended recognition of the combinations by law and their careful supervision and regulation by government authority. (J. W. J.)

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TRUXTUN, THOMAS (1755–1822), American naval officer, was born at Jamaica, Long Island, on the 17th of February 1755. He went young to sea, and during the War of Independence was first persuaded to serve in a royal ship. But having been wounded in an action with a privateer manned by his countrymen, it is said that he declared he would never fight them again. Henceforth he commanded a succession of privateers sent out to cruise against British trade and transports—the "St. James," the "Mars," the "Independence." He had the reputation of being uniformly successful in all engagements with British vessels. When the independence of the United States was recognized he returned to trade with a high reputation as a seaman. He was the author of a treatise on longitude and latitude, of a "System of masting a 44-gun frigate," and was an advocate for the foundation of a national navy. When the United States navy was reconstituted in 1798 he was one of the original corps of six captains. During the last years of the 18th and first of the 19th century American commerce was subject to much intolerable interference on the part of the French as well as of the British naval officers. It was against the first that Truxtun rendered the services which have made him a prominent personage in the history of the United States navy. In February 1799 he was captain of the United States "Constellation" (36) and on the 19th of that month he captured the French "L'Insurgente" (36). In the following year, and while still in command of the "Constellation," he fought the French "Vengeance" (40), and drove her into Curaçao. The crippled state of his own ship, which had lost her mainmast, prevented him from taking possession of the enemy. In 1802 he was to have sailed in command of the squadron sent against the Barbary pirates, but a difference having occurred between him and the navy department in regard to the appointment of a captain to his flagship, his remonstrance against the official decision of the authorities was treated as a resignation, which it was apparently not meant to be, and he was not employed any further. He died at Philadelphia on the 5th of May 1822.

TRYON, DWIGHT WILLIAM (1849–), American artist, was born at Hartford, Connecticut, on the 13th of August 1849. At the age of twenty-five he left his position as a clerk in a Hartford publishing house to devote himself entirely to art, and two years afterwards went to Paris, where he became a pupil of the École des Beaux Arts, under J. de la Chevreuse, Charles Daubigny and A. Guillemet. A skilful landscape painter, New England provided his best subjects. He first exhibited at the Salon in 1881, and in the same year returned to the United States, settling first in New York City; in 1882–1886 he was director of the Hartford School of Art, and in 1886 became professor of art at Smith College. He became a member of the Society of American Artists (1882), a National Academician (1891), and a member of the American Water Color Society. He won numerous medals and prizes at important exhibitions, among his pictures being "Daybreak," "Moonlight" and "Early Spring, New England."

TRYON, SIR GEORGE (1832–1893), British admiral, a younger son of Thomas Tryon, of Bulwick Park, Northamptonshire, was born on the 4th of January 1832. He entered the navy in 1848, on board Lord Dundonald's flagship on the North American station; was subsequently in the "Vengeance" with Lord Edward Russell in the Black Sea; was landed for service with the naval brigade; and was made a lieutenant in November, but dated back to the 21st of October 1854. From 1855 to 1858 he was in the "Royal Albert" flagship of Sir Edmund Lyons; and from 1858 to 1860 in the royal yacht, which gave him his promotion to commander on the 25th of October 1860. From 1861 to 1864 he was commander of the "Warrior," the first British sea-going ironclad; from 1864 to 1866 he commanded the "Surprise" gunvessel in the Mediterranean; and was promoted to be captain on the 11th of April 1866. In 1867 he was sent out as director of transports and store ships for the Abyssinian expedition, a post which involved a great deal of hard work in a sweltering and unhealthy climate. He discharged his duties exceedingly well, but his health broke down, and he returned to England a helpless invalid. From 1871 to 1873 he was private secretary to Mr Goschen, then first lord of the admiralty; and from 1874 to 1877 commanded the "Raleigh" in India with the Prince of Wales, and later in the Mediterranean. In the years 1878–1881 he had command of the "Monarch," one of the Mediterranean fleet under Sir Geoffrey Hornby and Sir Beauchamp Seymour, afterwards Lord Alcester. He was subsequently for two years secretary of the admiralty; and for three years more, on his promotion in April 1884 to the rank of rear-admiral, commander-in-chief on the Australian station. On his return in June 1887 he was made K.C.B.; afterwards he was for three years superintendent of reserves, in which capacity it fell to him to command one of the opposing fleets during the summer manœuvres, when he showed marked ability and originality of ideas. In 1889 he was promoted to be vice-admiral; and in August 1891 was appointed to command the Mediterranean fleet, which under him—following the example of his old chief, Sir Geoffrey Hornby—became very distinctly an evolutionary and, in that sense, experimental squadron. Some of his methods were afterwards said to be dangerous; but those which were most severely criticized do not appear to have had anything to do with the lamentable accident which ended Tryon's career. On the 22nd of June 1893, the fleet being then off Tripoli on the coast of Syria, in two columns, Tryon made the signal to invert the course, the ships turning inwards in succession. By a fatal error, the psychological cause of which has never been explained, he ignored the patent fact that the two columns were so near each other that the manœuvre, as ordered, must entail the most serious risk, if not certainty, of collision. And, in fact, the two leading ships did come into collision, with the result that the "Victoria," Tryon's flagship, was cut open and sank in a few minutes. Tryon and 358 officers and men were drowned.

See the *Life*, by Rear-Admiral C. C. Penrose-FitzGerald.

TRYON, THOMAS (1634–1703), English humanitarian, was born at Bilbury near Cirencester on the 6th of September 1634. He had but little schooling, spending his youth first in spinning and carding and then as a shepherd. In 1652 he went to London, apprenticed himself to a hatter, and accepted his master's Anabaptist principles until he read the works of Jacob Behmen. He now lived a very ascetic life, though he married and became a prosperous merchant. In 1682 he began to publish his views in support of vegetarianism and abstinence from alcohol and tobacco. He detested war, and in this and his mysticism resembled the early Quakers. He died on the 21st of August 1703.

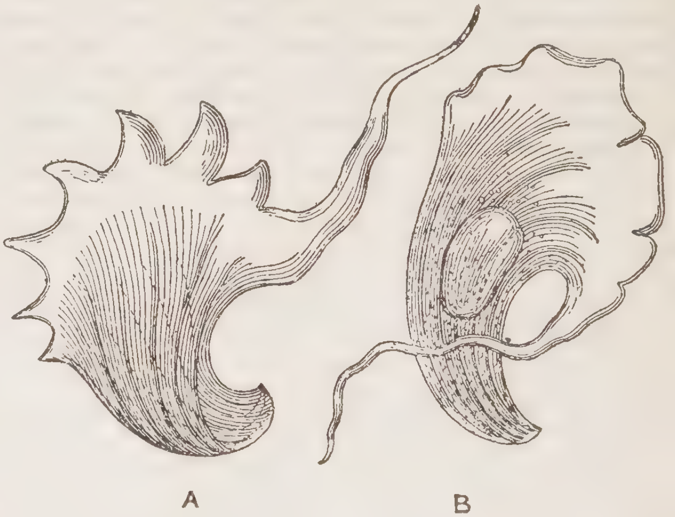
His best known book, *The Way to Health* (1691), which much impressed Benjamin Franklin, was a second edition of *Health's Grand Preservative; or, The Women's Best Doctor* (London, 1682). He wrote on many other subjects, *e.g.* the education of children, the treatment of negro slaves, the way to save wealth, and dreams and visions. Some scanty autobiographical memoirs were published in 1705.

TRYON, WILLIAM (1729–1788), American colonial governor, was born at Norbury Park, Surrey, England, in 1729. In 1757, when he was a captain of the First Foot Guards, he married a London heiress with a dower of £30,000. In 1764 he was appointed lieutenant-governor of North Carolina, upon Arthur Dobbs's death in 1765 became governor *pro tem.*, and in December of the same year received his commission as governor. Like many other pre-Revolutionary officials in America, he has generally been pictured by American writers as a tyrant. In reality, however, he seems to have been tactful and considerate, an efficient administrator, who in particular greatly improved the colonial postal service, and to have become unpopular chiefly because, through his rigid adherence to duty, he obeyed the instructions of his superiors and rigorously enforced the measures of the British government. By refusing to allow meetings of the Assembly from the 18th of May 1765 to the 3rd of November 1766, he prevented North Carolina from sending representatives to the Stamp Act Congress in 1765. To lighten the stamp tax he offered to pay the duty on all stamped paper on which he was entitled to fees. With the support of the law-abiding element he suppressed the Regulator uprising in 1768–71, caused partly by the taxation imposed to defray the cost of the governor's fine mansion at New Bern (which Tryon had made the provincial capital), and executed seven or eight of the ringleaders, pardoning six others. From 1771 nominally until the 22nd of March 1780 he was governor of New York. While he was on a visit to England the War of Independence broke out, and on the 19th of October 1775, several months after his return, he was compelled to seek refuge on the sloop of war "Halifax" in New York Harbour, but was restored to power when the British took possession of New York City in September 1776, though his actual authority did not extend beyond the British lines. In 1777, with the rank of major-general, he became commander of a corps of Loyalists, and in 1779 invaded Connecticut and burned Danbury, Fairfield and Norwalk. In 1780 he returned to England, and in 1782 was promoted to be lieutenant-general. He died in London on the 27th of January 1788.

See Marshal D. Haywood, *Governor William Tryon and his Administration in the Province of North Carolina* (Raleigh, North Carolina, 1903).

TRYPANOSOMES, or HAEMOFLAGELLATES, minute Protozoan parasites, characterized by the possession of one or two flagella and an undulating membrane, and specially adapted for life in the blood of a vertebrate.[1] Of late years considerable progress has taken place in our knowledge of these organisms, research upon them having been stimulated by the realization of their extreme importance in medical parasitology. Not only has the number of known forms been greatly multiplied, but the study of the biology and life-history of the parasites has been attended in some cases with remarkable and unexpected results.

Historical.—The first observation of a trypanosome is usually ascribed to Valentin (55), who in 1841 announced his discovery of certain amoeboid parasites in the blood of a trout. In the two or three years following several other observers recorded the occurrence of similar haematozoa in various fishes. The generic name of *Trypanosoma* was conferred by Gruby in 1843 upon the well-known parasite of frogs. E. Ray Lankester (18) subsequently described this same form (under the name of *Undulina ranarum*) and was the first to indicate the presence of a nucleus in the cell-body. To Mitrophanow (1883–1884) and Danilewsky (1885–1889) we owe the first serious attempts to study the comparative anatomy of these haematozoa. Trypanosomes were first met with in cases of disease by Griffith Evans, who in 1880 found them in the blood of horses suffering from surra in India. In 1894 (Sir) David Bruce discovered the celebrated South African parasite (*T. brucei*) in cattle and horses laid low with nagana or the tsetse-fly disease; and this worker subsequently demonstrated, in a brilliant manner, the essential part played by the tsetse-fly in transmitting the parasites. The credit for first recognizing a trypanosome in human blood, and describing it as such, must undoubtedly be assigned to G. Nepveu (1898). Trypanosomes were next seen in human blood



(From Lankester.)

Fig. 1.[2]—*Undulina ranarum*, Lankester, 1871. In B the nucleus is shown.

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[1] *Trypanophis*, although lacking (so far as is known) a haemal habitat, is included here, since it is undoubtedly closely related to *Trypanoplasma*.

[2] The illustrations in this article are from H. M. Woodcock's "Trypanosomes," in the *Quarterly Journal of Microscopical Science.*

in Senegambia in 1901, in a European suffering from intermittent fever. Forde discovered the parasites, but was uncertain of their nature; he shewed them to E. Dutton, who (11) gave this form the name of *Trypanosoma gambiense*. A year later A. Castellani (6) found the organisms (most probably the same species) in the cerebro-spinal fluid of patients suffering from sleeping-sickness in Uganda; and it has since been conclusively proved by Sir David Bruce and D. Nabarro (4) that they are the true cause of that dreadful malady.

More important, from the standpoint of protozoology, than these interesting medical discoveries have been the investigations by A. Laveran and F. Mesnil (20–24), L. Léger (30–35), S. Prowazek (47), F. Schaudinn (50) and others, upon numerous tolerated (*i.e.* non-pathogenic) forms; these researches supply, indeed, practically all the material facts on which to base an account of the Haemoflagellates at the present day.

Occurrence.

Trypanosomes are harboured by members of all the chief classes of vertebrates with the exception of cyclostomes. By far the greater number of hosts are furnished by fishes, birds and mammals. Among batrachians the parasites have been found, up till now, only in frogs; and among reptiles their occurrence has only been observed in one or two solitary instances (*T. damoniae*, fig. 3 J). Data with regard to the frequency with which individual species occur, in any kind of host, are as yet somewhat scanty; in one or two cases the parasites are fairly common, *T. lewisi*, for example, being met with in a considerable percentage of sewer-rats throughout the world.

In considering the occurrence of Trypanosomes in mammals, careful distinction must be drawn between natural or true hosts, which are tolerant of the parasites, and casual ones, which are unaccustomed and unadapted to them. A Trypanosome usually produces markedly harmful effects upon gaining an entry into animals which have never been, by their distribution, liable to its invasion previously. Such a state of affairs is produced by the march of civilization into the "hinterlands" of the various colonies, when man, together with the numerous domesticated animals which accompany him, is brought into proximity to big game, &c., and, what is equally important, into the zone of the particular blood-sucking insects which prey upon the same.

Very many of the common domestic mammals can be successfully infected (either thus accidentally or else on purpose) with different "pathogenic" Trypanosomes, to which they succumb more or less readily, but they cannot be regarded as the natural hosts of those Trypanosomes. In dealing with disease-causing forms, the more narrowly the original source of the parasite concerned is defined, the closer do we get to the true vertebrate host or hosts. In the case of the nagana-parasite, various Antilopidae (*e.g.* the gnu, bushbuck and koodoo) can certainly lay a strong claim to the honour. The capybara, again, is most probably the native host of *T. equinum* of mal de caderas of horses in South America. Similarly with regard to the many other pathogenic Trypanosomes now known, there is undoubtedly, in each case, some indigenous wild animal tolerant of that particular form, which serves as a "latent source of supply" to strange mammals.

Transmission; Alternation of Hosts.

The transmission of the parasites from one vertebrate individual to another is effected, in the great majority of cases,[1] by a blood-sucking invertebrate, and by this means alone. The "carrier" of a Trypanosome of warm-blooded vertebrates is, in all instances so far described, an insect, generally a member of the Diptera; in the case of parasites of cold-blooded vertebrates the same rôle is usually played by an ichthyobdellid leech (piscine forms), but possibly, now and again, by an *Ixodes* (amphibian or reptilian forms).

Until lately it remained quite uncertain, however, whether the invertebrate merely conveys the Trypanosomes or whether it is a true alternate host, one *i.e.* in which definite stages of the parasite's life-cycle are undergone. Schaudinn (50), who investigated certain avian Trypanosomes, considered the latter view to be correct, and believed that the carrier—in this instance a gnat—is indeed the definitive host, *i.e.* the one in which sexual conjugation occurs. Many other workers have since studied the subject and, so far as the parasites of fishes are concerned, there can be little doubt, thanks to the researches of E. Brumpt (5*a*), L. Léger (32, 33) and others, that leeches are true alternate hosts for these forms, in which certain phases of the life-cycle are normally undergone.

We cannot write quite so confidently with regard to the relation of the various pathogenic Trypanosomes to Tsetse-flies (*Glossinae*). In the first place experiment has shown that biting-flies, other in all probability than the true, natural hosts, may at times transmit the parasites—as it were—accidentally, if, after feeding on an infected animal, they are allowed to bite a fresh one within a limited time. One very helpful factor in determining which is the principal carrier of any form is the coincidence of the zone of a particular insect with that of any disease. By this means it has been ascertained with practical certainty that, among the family of Tsetse-flies (*Glossinae*) for instance, at least four species are the natural carriers of different Trypanosomes. Of these perhaps the best-known is *G. palpalis*, of Equatorial Africa, whose bite transmits the human parasite (*T. gambiense*). Nevertheless, the fact, commented upon by several observers, that even here an infected fly is only infectious for a comparatively short period suggests that this species of fly, at any rate, is not the true alternate host in which the life-cycle of that particular Trypanosome is completed. However, indications furnished by Koch (16*a*) point in this connexion to *G. fusca*. Lastly, before leaving this interesting and important subject, F. Stuhlmann's work (54*a*) on developmental phases of *T. brucii*, the nagana parasite in *G. fusca* and *G. tachinoides*, does render it probable that the pathogenic forms also have true invertebrate hosts.

Habitat: Effects on Host.

Schaudinn had fully described the relations of certain avian Trypanosomes to their invertebrate host, *Culex pipiens* (females). The distribution of the parasites in the gnat is closely connected with the process of digestion. The Trypanosomes ultimately overrun practically all parts of the body, sometimes not even the ova escaping. Thus true hereditary infection of a succeeding generation of gnats may be brought about. The life of the parasites while in the insect is characterized by an alternation of active periods, during which multiplication goes on, with resting-periods, when the Trypanosomes become attached to the epithelial cells of the host. According to S. Prowazek (47), the behaviour of *T. lewisi* in a louse (*Haematopinus*) is, in its main features, similar.

On gaining an entry into the blood of a vertebrate the organisms pass rapidly into the general circulation, and are thus carried all over. Considering them first in a tolerant host, the trend of observation is to show that they are never abundant, but on the contrary usually somewhat scarce. One reason for this scarcity is to be sought in connexion with the fact that multiplicative stages are very rarely met with, at any rate in the general circulation. The parasites are frequently more numerous in the spleen, bone-marrow, kidneys, &c., than elsewhere, and it has been found that multiplication goes on rather more actively in the capillaries of these organs.

The Trypanosomes, in the active phase, are of course always free in the blood plasma (interglobular). In the majority of cases it is very uncertain whether they actually come into relation with the blood corpuscles or not. Schaudinn has stated, however, that *Trypanomorpha* becomes, in certain phases, attached to a red blood-corpuscle (ectoglobular), and, in others, penetrates inside one and eventually destroys it (endoglobular); while his other avian parasite, *Trypanosoma ziemanni*, apparently draws up into itself the white corpuscle (leucocyte) to which it becomes attached. In addition, there are two or three obervations to hand which shew that piscine, amphibian and mammalian Trypanosomes may also become attached. Probably most forms possess a resting, attached phase at some period or other, in the invertebrate, if not in the vertebrate host.

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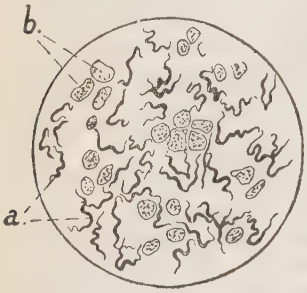
[1] *Trypanosoma equiperdum*, the cause of dourine in horses and asses, is apparently only conveyed by the act of coitus. This direct mode of transmission is most likely a secondary acquirement.

Considering now the Trypanosomes in an unaccustomed, mammalian host, they may either remain infrequent or rare (sometimes, indeed, being unnoticed until shortly before death), or, on the other hand, they may soon become numerous and go on increasing (fig. 2). In the latter case the disease is acute and rapidly fatal; in the former it is more chronic and lasts much longer, often several months. The main features of *trypanosomosis*, or illness caused by a Trypanosome, show a general agreement, whichever variety is considered; one symptom may be, of course, more marked than another in any particular case. Death is due either to weakness and emaciation (in chronic cases), or to blocking of the cerebral capillaries by the parasites (where these are abundant), or to disorganization of the nervous system (paraplegic and sleeping-sickness cases).



(After Doflein.)

FIG. 2.—*Trypanosoma equiperdum* (of dourine), in the blood of a rat eight days after inoculation.
a, Parasites.
b, Blood-corpuscles.

In post-mortem examination, the most obvious pathological lesion is hypertrophy of the spleen, which may be very pronounced; the lymphatic glands in the neck, inguinal region, &c., are also often greatly swollen. These are undoubtedly the organs which react most strongly to the parasites, and their enlarged condition is to a great extent due to their enhanced activity in elaborating blood-corpuscles and leucocytes to cope with the enemy. Ingestion and dissolution of the Trypanosomes by phagocytes has frequently been observed; and it is probable also that the haematopoietic organs secrete some substance which exerts a harmful action on the parasites, and causes them to undergo involution and assume weird-looking "amoeboid" and "plasmodial" forms.

Agglomeration.

A peculiar feature in the behaviour of the parasites, which is most probably caused by unfavourable biological conditions in the host, is that known as agglomeration. The process is readily brought about artificially by the addition of sera or chemical solutions to blood containing the parasites. Agglomeration consists in the grouping or union together of several Trypanosomes around a common centre; this leads to the formation of rosette-like clusters, or even of large masses composed of several rosettes. The end by which the parasites join is typically, in the case of *Trypanosoma*, the non-flagellate (anterior) end. If a favourable change in the surrounding medium sets in, the Trypanosomes are able to undergo the reverse process, namely disagglomeration; the parasites liberate themselves and the rosette is dissolved.

Morphology.

Trypanosomes vary greatly with regard to size; even in one and the same species this variation is often noticeable, especially under different conditions of life. The common *Trypanosoma rotatorium* of frogs (fig. 4, A and B) is, taking it all in all, one of the largest forms so far described. Its length (inclusive of the flagellum) varies from 40–60 μ, while its greatest width (including the undulating-membrane) is from 8–30 μ; in the very wide individuals breadth is gained more or less at the expense of length. Conversely, *T. gambiense*, the human parasite (fig. 3 C), is one of the smallest forms known, its average size being about 21–23 μ by 1½–2 μ.

There is equally great diversity in respect of form. Typically, the body is elongated and spindle-shaped; it is usually more or less curved or falciform (fig. 3, A–D), and tends to be slightly compressed laterally. It may be, however, anything from extremely slender or vermiform (fig. 3, H) to squat and stumpy (fig. 3, G, 4, A). Moreover, apart from the fact that a full-grown adult, ready to divide, is in many cases much plumper than a young adult (cf. *T. lewisi*, fig. 6, A and B), there can be no doubt that considerable polymorphism also sometimes occurs (*e.g. T. rotatorium*). In many cases, at any rate, this indicates a difference in sexuality; and it is particularly necessary to bear this factor in mind when considering the avian Trypanosomes, where, perhaps, the extremes of form are to be met with. That one and the same species may appear entirely different in different phases of the life-history is manifest on comparing, for instance, the chief "forms" of *Trypanosoma ziemanni* described by Schaudinn. The asexual or indifferent type (fig. 3, H) is extremely thread-like, greatly resembling, in fact, a *Spirochaete*; on the other hand, both male and female individuals have the form of a very wide spindle.

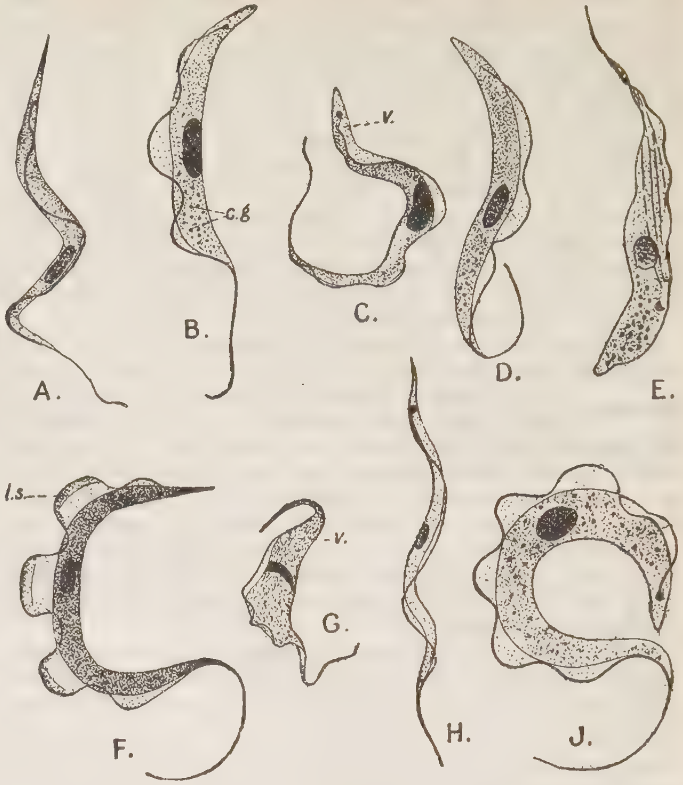


FIG. 3.—Representative Mammalian, Avian and Reptilian Trypanosomes, to illustrate the chief morphological characters.
A, *Trypanosoma lewisi*, after Bradf. and Plimmer.
B, *T. brucei*, after Lav. and Mesnil.
C, *T. gambiense* (blood, T-fever), after Bruce and Nabarro.
D, *T. equinum*, after Lav. and Mesnil.
E, *Trypanomorpha* (*Trypanosoma*) *noctuae*, after Schaud.
F, *Trypanosoma avium*, after Lav. and Mesnil.
G, Hanna's Trypanosome from Indian pigeons.
H, *T. ziemanni*, after Schaud.
J, *T. damonia*, after Lav. and Mesnil.
c.g, Chromatoid grains; *v*, vacuole; *l.s*, fold or striation.

In *Trypanoplasma* and *Trypanophis* there are two flagella, inserted into the body very close to the anterior end (fig. 4, F and G). One flagellum is entirely free and directed forwards; the other at once turns backwards and is attached to the convex or dorsal side of the body for the greater part of its length. In all other Trypanosomes there is only one flagellum, which is invariably attached to the body in the same manner as the posterior one of biflagellate forms. This flagellum, however, is most probably not to be considered homologous in all cases. (See Woodcock, *loc. cit.*)

In *Trypanomorpha* (fig. 3, E), which is to be derived from a Herpetomonadine type, the single, anterior flagellum of the ancestral parasite has been drawn backwards along one side of the body and now originates in the posterior half. Hence in this genus the end bearing the free part of the flagellum is the anterior one. The genus *Trypanosoma*, in which are included at present the great majority of Trypanosomes, is rather to be regarded as derived from a Heteromastigine ancestor, such as *Trypanoplasma*, by the loss of the anterior flagellum. Hence in this type the single flagellum represents the posteriorly-directed one of *Trypanoplasma*, and the end at which it becomes free is the hinder end. The point of origin of the flagellum in *Trypanosoma* is usually near the anterior end, but may vary considerably (cf. figs.); and its free portion may be very short or lacking.

Along the dorsal side runs the characteristic fin-like expansion of the body, the undulating-membrane, which is the organella principally concerned in locomotion. This always begins at the place where the attached flagellum emerges from the body; and its free edge is really constituted by the latter, which forms a flagellar border. The membrane is usually more or less sinuous in outline, and is sometimes thrown into broad folds (fig. 3, F and J). Distally it thins away concurrently with the body.

Minute Structure.

The body appears to be in all cases naked. A differentiation of the peripheral cytoplasm in the form of an ectoplasmic layer has been described in one or two instances, and it seems probable that in most Trypanosomes there is such a layer, although only poorly developed, as a rule, around the body generally. On the other hand, the undulating-membrane is largely if not entirely an ectoplasmic development. This is usually much clearer and more hyaline than the general cytoplasm. In many forms deep-staining grains or granules, of a chromatoid nature and of varying size, are to be seen in the cytoplasm. In most cases these granules are, if not confined to, chiefly distributed in the posterior (flagellate) half of the body (figs. 3, B, D and E, 4, E and G). In certain Trypanosomes a well-defined, usually oval vacuole is often, though not constantly, to be observed, situated at a varying distance from the anterior end (figs. 3 and C, G, 4, F). There is no reason to doubt that this vacuole is a normal cell-constituent, for it has been described in parasites in quite normal surroundings and conditions.

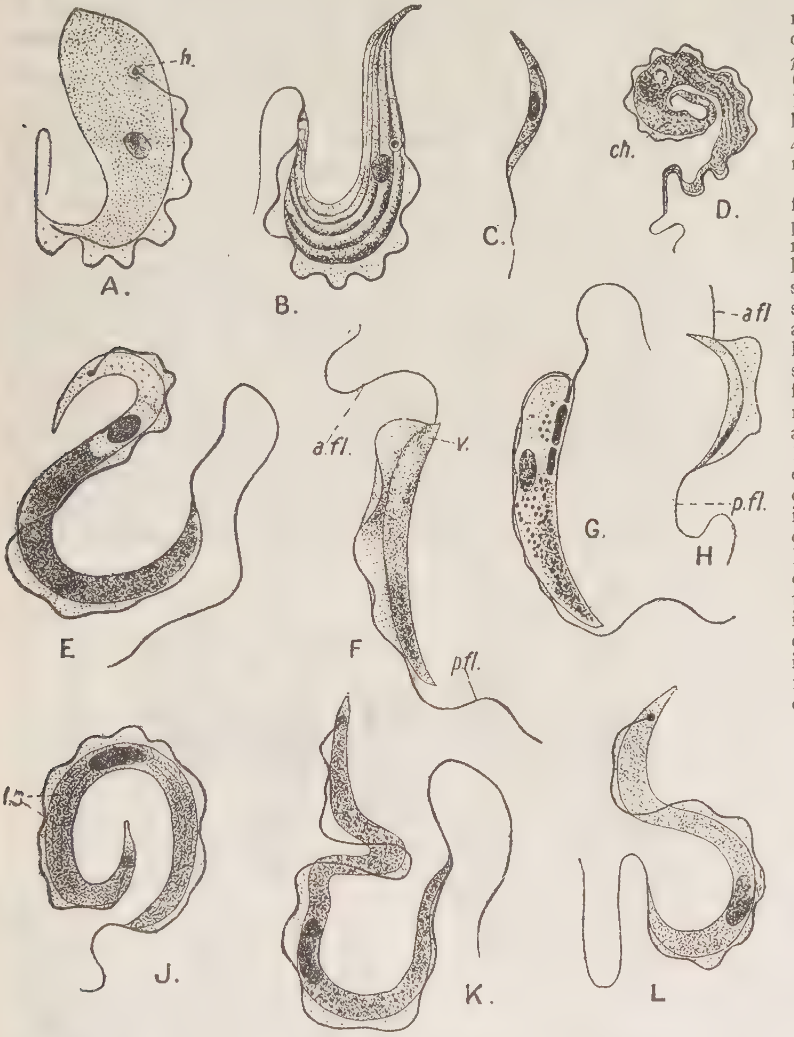


Fig. 4.—Representative Amphibian and Piscine Trypanosomes.

A, B, *Trypanosoma rotatorium*, after Lav. and Mesnil.
C, *T. inopinatum*, after Serg.
D, *T. karyozeukton*, after Dutt. and Todd.
E, *T. nelspruitense*, after Lav. and Mesnil.
F, G, *Trypanoplasma borreli* (living and stained), after Léger.
H, *T. cyprini*, after Plehn.
J, *Trypanosoma soleae*, after Lav. and Mesnil.
K, *T. granulosum*, after Lav. and Mesnil.
L, *T. remaki*, var. *magna*, after Lav. and Mesnil.

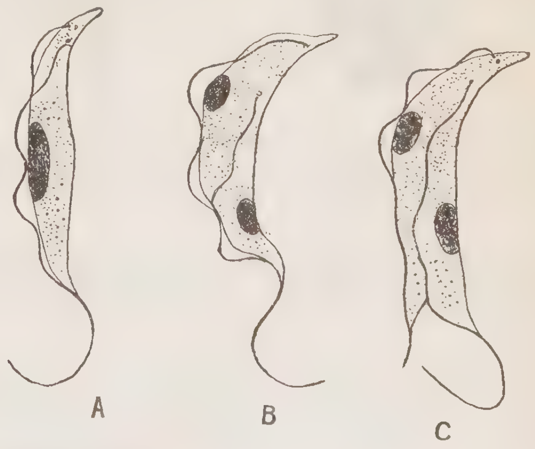
h, Clear zone or halo around kinetonucleus.
ch, Chain of chromatic rodlets running from trophonucleus to kinetonucleus.
a.fl, Anterior flagellum;
p.fl, Posterior flagellum;
l.s, Longitudinal striations (myonemes);
v, Cytoplasmic vacuole.

A Trypanosome always possesses two distinct nuclear bodies, one the *trophonucleus*, regulating the trophic life of the cell, the other, the *kinetonucleus*, directing its locomotor activities. The recent investigations of Schaudinn and Prowazek (11. c) have shown that, in some forms at any rate, the finer structure and detailed development of the nuclear apparatus is extremely complex. Not only is there an intimate correspondence in this respect between the two principal organellae, but the flagellar apparatus itself is really of nuclear origin and remains closely connected with the kinetonucleus (cf. fig. 7). In most cases, however, little beyond the position and general appearance of the nuclei has been so far made known. The trophonucleus is usually situated somewhere about the middle of the body. The kinetonucleus is typically near the anterior end; but in a few instances it lies more centrally (*e.g. T. inopinatum*, *T. rotatorium*, fig. 4, A–C); in *Trypanomorpha* it is in the posterior half of the body (fig. 3, E).

In certain forms the occurrence of prominent myonemes or muscle-fibrillae has been described, and, moreover, a nuclear origin assigned to them also. In *Trypanomorpha* they are confined to the undulating-membrane (fig. 3, E), but in other cases—*Trypanosoma ziemanni*, *T. lewisi*, *T. brucei*, and *T. soleae*—they are arranged laterally, half running down each side of the body (fig. 4, J). In *Trypanoplasma borreli* there is only a single myoneme on either side.

Multiplication.

All Trypanosomes are capable of binary longitudinal fission, and this appears to be the chief method of multiplication. The division of the nuclear apparatus is the first to take place (fig. 5, A). The kinetonucleus more often leads the way, but sometimes either kinetonucleus or trophonucleus may do so indifferently. The duplication of the flagellum begins at its proximal end, that which is in relation with the kinetonucleus. Until recently the process has been considered as an actual longitudinal splitting of the flagellum, following upon the separation of the two daughter-kinetonuclei. Both Schaudinn (in the case of *Trypanomorpha*) and Prowazek (in the case of *Trypanosoma lewisi* and *T. brucei*), have found, however, that the new flagellum is developed quite independently and laid down alongside the old one. It is at present somewhat uncertain, therefore, in what cases actual splitting occurs. The same applies equally to the formation of the undulating-membrane. If the flagellar border splits, the membrane doubtless divides also; but where the flagellum is a new formation the membrane will be too. The division of the cytoplasm in most forms is equal or sub-equal, and two approximately equal daughter-Trypanosomes result (fig. 5, C). In some instances (*e.g. T. equinum*, *T. equiperdum*) the longitudinal fission is apparently multiple, three or even four descendants being produced simultaneously.



(After Lav. and Mesnil.)

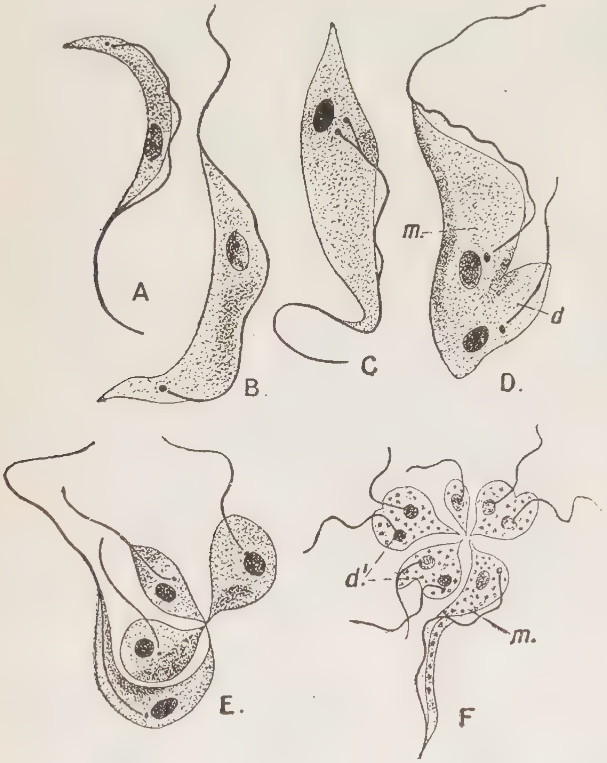
Fig. 5.—Stages in Binary Longitudinal Fission of *Trypanosoma brucei*.

T. lewisi differs from most Trypanosomes in that the cytoplasm divides in a very unequal manner (fig. 6). The process is more comparable to budding, since the larger or parent-individual may produce, successively, more than one "daughter"; moreover, the daughter-individuals may subdivide before separating, the whole family remaining attached by the non-flagellate (anterior) end (fig. 6, F). In this type of division it may be noted that the kinetonucleus comes to lie alongside the trophonucleus, or even passes to the other side of it (*i.e.* nearer the flagellar end). Easily derivable from this method is the other one characteristic of *T. lewisi*, viz. segmentation. The chief difference is that in the latter no parent-individual is distinguishable, a rosette of many equal daughter-parasites being formed.

The small Trypanosomes resulting from either of these modes of division differ from typical adults by their stumpy, pyriform shape, the position of the kinetonucleus near the flagellar end of the body, and the absence, during the first part of their youth, of an undulating-membrane. At this period they have, in fact, what may be termed a "pseudo-Herpetomonadine" aspect. These young individuals can themselves multiply by equal binary fission, giving rise to little fusiform parasites; with growth, these gradually assume the adult appearance.

Development and Life-cycle.

Comprehensive researches (1905, seq.) have made it evident that Trypanosomes have a much more varied and complex development and life-history than was previously supposed. This has now been found to be the case in widely-differing parasites, occurring in widely-different hosts. The following examples have been investigated: *Trypanosoma lewisi* (also, but much less completely, *T. brucei*),[1] among mammalian forms, described by Prowazek (47); *T. ziemanni* and *Trypanomorpha noctuae*, among avian parasites, described by Schaudinn (50); *Trypanosoma inopinatum*, among batrachian forms, described by A. Billet (1*a* and 2), *T. barbatulae* and *Trypanoplasma varium*, described by Léger (32 and 33), and *T. borreli*, by G. Keysselitz (16), from fishes; also several other piscine Trypanosomes have their development phases in leeches worked on by Brumpt (5*a*). In addition, a Trypanosome whose vertebrate host is yet unknown (*T. grayi*) has been studied in detail by Minchin (41*a*).



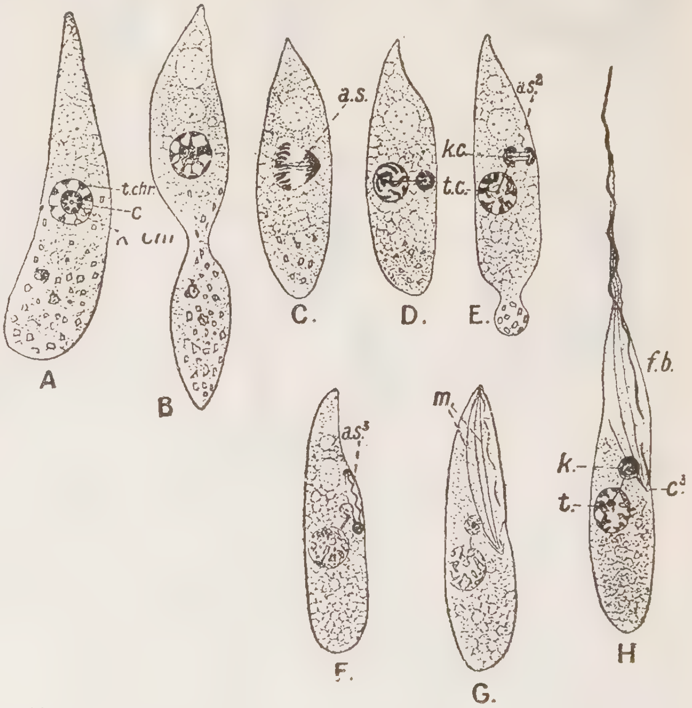
(A–E, after Lav. and Mesnil; F, after Wasiel and Senn.)

FIG. 6.—Unequal Division and "Budding" process in *T. lewisi*. *m*, Parent-individual; *d*, Daughter-individual; *d'*, Daughter-individual dividing.

It is impracticable here to consider fully all the various developmental phases and modifications of the life-cycle described as occurring in the above parasites. In view, however, of the great interest excited by Schaudinn's work on avian parasites, as well as on account of the far-reaching importance of his conclusions to the study of the Haematozoa, a brief summary of his celebrated research is necessary.

According to Schaudinn's account, he was dealing with two separate Trypanosome parasites of the Little Owl (*Athene noctua*), viz. *Trypanomorpha* (*Trypanosoma*) *noctuae* and *Trypanosoma* (*Spirochaete*) *ziemanni*. The latter organism, in certain phases, very closely resembles a *Spirochaete*. In the blood of the owl resting, intracellular phases of both parasites alternate with active trypaniform ones; and, when in the former condition, Schaudinn considers that the parasites are identical with what have been formerly regarded as distinct Haemosporidia, *Halteridium* and a *Leucocytozoon* respectively. In other words, he considers that these two Haemosporidian forms are really only phases in the life-history of particular Trypanosomes. To this life-cycle belongs the formation of sexual individuals and their conjugation on arrival in the gnat (*Culex*); the process is described as agreeing in the main, in both cases, with what has already been made known by MacCallum for another species of *Halteridium*. The male gametes, it may be noted, are said to possess the essential characters of a Trypanosome. The motile copula or ookinete formed in the gnat gives rise to one of three types of Trypanosome individual: indifferent, male or female. The development of an indifferent ookinete into an indifferent Trypanosome is shown in fig. 7, from which it will be seen that the cytological details are very complex. The indifferent parasites exhibit an alternation of resting, attached phases with active periods, during which they multiply actively and become very abundant in the insect. The male forms, which are very small and the homologues of the microgametes developed in the blood, appear to die off soon. The female Trypanosomes, on the other hand, grow to a large size, laying up a store of reserve nutriment. They are very sluggish and do not divide. They are the most resistant to unfavourable conditions of environment, and are able, by a process of parthenogenesis, to give rise to ordinary, indifferent forms again, which can repopulate the gnat.

So far as regards the remarkable connexion between Trypanosomes and Haemosporidia indicated by Schaudinn, this has met with a great deal of criticism on the part of Novy and McNeal among others, and it must be admitted that up to 1909 no definite corroboration can be said to have been brought forward. Again, the spirochaetiform *Trypanosoma* (*T. ziemanni*) described may have been really a true *Spirochaete*, *i.e.* a Bacterium. In short, it is quite possible Schaudinn did not sufficiently distinguish between the life-cycles of four distinct parasites of the Little Owl: a Trypanosome, a *Spirochaete*, a *Halteridium* and a *Leucocytozoon*; though, on the other hand, this is by no means proved. However this may be, the research of subsequent workers—*e.g.* Brumpt (5a), Léger (32, 33), Keysselitz (16), Prowazek (47), Minchin (41b) and others—has undoubtedly shown that much of Schaudinn's scheme of the life-history of a Trypanosome is well-founded. It is certain, for instance, that the three types of form which he discovered, viz. indifferent, male or female, can be recognized in many cases, often in the vertebrate, but always more sharply differentiated in the invertebrate. Moreover, it is very probable that conjugation occurs soon after the arrival of the parasites in their specific invertebrate host; and this act may perhaps give rise to an aflagellar copula, which is gregariniform and comparable to an ookinete. Different investigators, it may be noted, have described various



(After Schaudinn.)

FIG. 7.—Development of an Ookinete (of *Halteridium*) into an indifferent Trypanosome (*Trypanomorpha*).

A–D shows the formation of the two nuclear elements (trophonucleus and kinetonucleus) from the definitive nucleus (synkaryon) of the ookinete.

E–H shows the formation of the myonemes and the flagellar border (flagellum) of the undulating membrane, by means of a greatly elongated nuclear-spindle.

t.chr,	Trophonuclear chromosome.
k.chr,	Kinetonuclear do.
c,	Centrosomic granule.
a.s,	First axial spindle.
a.s^2, *a.s*^{3},	Second and third do.
t,	Trophonucleus.
k,	Kinetonucleus.
k.c,	Kinetonuclear centrosome.
t.c,	Trophonuclear centrosome.
m,	Myonemes.
f.b,	Flagellar border of undulating-membrane (3rd axial spindle).
c.^{3},	Its proximal centrosome (its distal one vanishing as such).

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[1] *T. brucei* has also been studied in a Tsetse-fly (*G. fusca*) by Stuhlmann (54*a*).

complicated nuclear changes and divisions undergone by Trypanosomes; these are considered, in many cases, to represent some kind of parthenogenesis.

A very interesting modification of the life-cycle of a Trypanosome which must be mentioned has been made known by Minchin, in his account of *T. grayi*, in a tsetse-fly (*G. palpalis*). Unfortunately the vertebrate host of this form is not yet known. Certain individuals of a particular character form definite rounded cysts in the rectum of the fly; in this condition, the only sign of Trypanosome structure is afforded by the two nuclei, which remain separate. These cysts are doubtless for dispersal by way of the anus, and the vertebrate host is in all likelihood infected by the mouth and alimentary canal. This reveals a quite novel mode by which infection with a Trypanosome may be brought about; so far, however, *T. grayi* remains the only known example.

Classification.

As remarked in the section on morphology, the Trypanosomes as a whole are preferably regarded as including two entirely distinct groups, Monadina and Heteromastigia.

SUB-ORDER MONADINA

Family: Trypanomorphidae, Woodcock.—Haemoflagellates derived from a uniflagellate, Herpetomonadine form, in which the point of insertion of the single (anterior) flagellum into the body has travelled backwards from the anterior end for a greater or less distance, the flagellum itself having become, concurrently, attached to the body for a portion of its length by means of an undulating membrane.

Genus *Trypanomorpha*, Woodcock, 1906.—With the characters of the family. The only species yet known is the type species, *T. noctuae* (Celli and San Felice). [Syn. *Trypanosoma n.* (C. & S.F.), Schaud. = *Halteridium n.* (C. & S.F.)]. See figs. 3, E, 7. Vertebrate host, *Athene noctua*, Little Owl; invertebrate host, *Culex pipiens*.

There are, in addition, other forms, which are probably to be placed in this family, but which are not yet sufficiently well known for their systematic position to be settled. It is, for instance, quite likely that certain Herpetomonadine parasites described by Léger (29, 34) from various blood-sucking insects are really only stages in the life of a Haemoflagellate. Some of these are placed by Léger in a newly discovered genus, *Crithidia*.

SUB-ORDER HETEROMASTIGINA

Family: Trypanosomatidae, Doflein.—Flagellates, in the great majority of instances haemal parasites, derived from a biflagellate, *Bodo*-like type, in which the posteriorly-directed (trailing) flagellum is always present and attached to the body by an undulating membrane, of which it constitutes the thickened edge. The other, the anterior flagellum, may or may not persist.

Genus *Trypanoplasma*, Lav. and Mesnil, 1902.—The anterior flagellum is present. Both flagella are inserted close together, near the anterior end of the body. Two sub-groups may be distinguished. In one, exemplified by *T. borreli* (fig. 4, F and G) from the rudd and minnow, the anterior flagellum is well-developed, and the free parts of both are of about equal length. In the other, exemplified by *T. cyprini* (fig. 4, H) from carp, the anterior flagellum is much shorter than the free part of the posterior one, and evidently tending to disappear. Known invertebrate hosts for different species are *Hemiclepsis* and *Piscicola*, leeches.

Genus *Trypanophis*, Keysselitz, 1904.—The body resembles that of *Trypanoplasma* in general appearance, but the locomotor apparatus does not appear to be so well-developed, especially in *T. grobbeni*. The anterior flagellum is longer than the free part of the posterior one. The species included are not, so far as is known, haemal parasites. *T. grobbeni* occurs in the coelenteric cavity of various Siphonophora.

An interesting form, "*Trypanoplasma*" *intestinalis*, which resembles both the above genera, occurs in the alimentary canal of *Box boops*. Probably this is not a haemal parasite, and lacks an alternate host.

Genus *Trypanosoma*, Gruby, 1843.—(Principal synonyms: *Undulina*, Lank., 1871; *Herpetomonas*, Kent, 1880, only in part; *Paramoecioides*, Grassi, 1881; *Haematomonas*, Mitrophan, 1883.) There is no anterior flagellum. The point of insertion of the attached (posterior) flagellum into the body, and, consequently, the commencement of the undulating membrane may be almost anywhere in the anterior half of the body, but is usually near the extremity.

Among the more important and better-known forms are the following:—

Parasitic in mammals: *T. lewisi* (Kent), the well-known natural Trypanosome of rats (figs. 3, A, 6, A); *T. brucii*, Plim. and Bradf., the cause of nagana among cattle, horses, &c., in South Africa (fig. 3, B); *T. evansi*, Steel, the cause of surra to horses in Indo-Burmah; *T. equiperdum*, Dofl., the cause of dourine in horses in Algeria and other regions of the Mediterranean littoral; *T. equinum*, Voges, causing mal de caderas or "hip-paraplegia" in South America (fig. 3, D); *T. theileri*, Lav., a very large form, the cause of galziekté or bile-sickness to cattle in the Transvaal; and *T. gambiense*, Dutton (syn. *T. ugandense*, Castellani, *T. castellanii*, Kruse), the cause of human trypanosomosis in central Africa, which becomes sleeping-sickness when the organisms penetrate into the cerebro-spinal fluid (fig. 3, C).

Parasitic in birds: *T. avium* (Danil., Lav. emend.), probably the form to which Danilewsky's original investigations related, parasitic in owls and (according to Novy and McNeal) also in other birds (fig. 3, F); *T. johnstoni*, Dutt. and Todd, a very spirochaetiform type, from little birds (*Estrelda*) in Senegambia; and Hanna's peculiar wide species from Indian birds, with a remarkably tapering anterior end (fig. 3, G). Lastly, there is *T. ziemanni*, Lav., [syn. *Spirochaete z.* (Lav.), Schaud, "*Haemamoeba*" *z.*, Lav., the "Leucocytozoon" of Danil.], from various owls, and *Culex pipiens*, whose life-history has been described by Schaudinn (fig. 3, H). (As above mentioned, this form may not be a true Trypanosome.)

Only one reptilian form is well known, *T. damoniae*, Lav. and Mesn., from a tortoise, *Damonia reevesii* (fig. 3, J). Parasitic in batrachia: *T. rotatorium*, Mayer (syn. *Amoeba r.*, Mayer, July 1843, *T. sanguinis*, Gruby, November 1843, *Undulina ranarum*, Lank., 1871), the best-known parasite of frogs, which exhibits remarkable polymorphism (fig. 4, A and B); *T. mega* and *T. karyozeukton*, Dutt. and Todd, even larger than *T. r.* (fig. 4, D), with peculiar cytological differentiation, may be only sub-species; *T. inopinatum*, Sergent, and *T. nelspruitense*, Lav., also from frogs (fig. 4, C). Parasitic in fishes: *T. remaki*, Lav. and Mesnil, from pike, a relatively small form (fig. 4, L); *T. barbatulae*, Léger, from loach; *T. granulosum*, Lav. and Mesnil, a very long vermiform parasite, from eels (fig. 4, K); *T. soleae*, Lav. and Mesnil, from soles, with a relatively small flagellum (fig. 4, J); and *T. scyllii* and *T. rajae*, from those Elasmobranchs, both very large forms, described by Lav. and Mesnil.

The Leishman-Donovan-Wright Bodies.

Undoubtedly closely allied to the Haemoflagellates, although no actual trypaniform phase has yet been observed, are the important parasites usually known as the "Leishman-Donovan" bodies, without some consideration of which an account of the Haemoflagellates would hardly be complete. These bodies are constantly found in certain tropical fevers (*e.g.* dum-dum fever, kala-azar) particularly prevalent throughout Indo-Burma, of which they are generally held to be the cause. They were discovered by W. Leishman in 1900, but before his first account of them (36) was published they were also seen quite independently by C. Donovan. Moreover, organisms very similar to these (morphologically, indeed, the two sorts appear scarcely distinguishable) are found in various sores or ulcers (*e.g.* Delhi boil, Oriental sore, "bouton d'Alep") to which people in different parts of the East are liable. These were first described by J. H. Wright (58).

The chief distinction between the parasites in the two cases is in their habitat. In the one case they are entirely restricted to the neighbourhood of the boil or ulcer, whereas in the other there is a general infection of the body, the organisms spreading to all parts and being met with in the spleen, liver, bone-marrow, &c., and (rarely) in the peripheral circulation. The parasites are either free or intracellular. In the latter case they invade cells of a leucocytic or phagocytic character as a rule; Leishman's form is particularly abundant in large macrophageal cells originating from the vascular endothelium of the spleen (fig. 8, I. *M*).

The parasites themselves are very minute and usually ovoid or pyriform in shape (fig. 8, I. *a*), the latter being, perhaps, the most typical. The splenic type is somewhat smaller than Wright's parasite; the former, when pear-shaped, is from $3\frac{1}{2}$ to $4\ \mu$ in length by $1\frac{1}{2}$ to $2\ \mu$ in width, the latter being about $4\ \mu$ by $3\ \mu$ (fig. 8, III.). The body is probably not limited by any distinct membrane. The cytoplasm is finely granular and fairly uniform in character. The most interesting point about the morphology is the fact that two chromatic bodies, of very unequal size, are almost invariably to be recognized. The larger nuclear body, which corresponds to the trophonucleus of a Trypanosome, is usually round or oval; the smaller one, representing a kinetonucleus, has the form either of a little rod or of a round grain, and is generally separate from the larger nucleus.

The parasites multiply in two ways—(*a*) by binary fission, and (*b*) by multiple division or segmentation. The principal stages in the first method are well known (fig. 8, I. *b*); they offer strong resemblance to the process in *Piroplasma*. Multiple division has not yet been so satisfactorily made out. It appears to conform more or less to the radial or rosette type of multiplication, enlarged rounded parasites, with a varying number of nuclei (up to about eight) uniformly arranged near the periphery, having been often noticed (fig. 8, I. *c* and IV. *b*). The details of the process are somewhat differently described, however, by different observers.

Laveran and Mesnil (27) gave the name *Piroplasma donovani* to

Leishman's form,[1] and there is no doubt that the parasites are closely allied to that type of organism. This does not, however, preclude in any way the supposition that they—equally with certain other Haemosporidia—represent, nevertheless, only a phase of a complete life-cycle; and this supposition has in fact been definitely proved to be true by the work of Rogers (48). Rogers cultivated the parasites obtained from cases of kala-azar in artificial media, and found that what were unmistakably flagellate stages developed in the cultures at different intervals (fig. 8, IV. *e*, *f*, *g*). These forms were elongated and spindle-like; and to one end of the body, near which the smaller nuclear element was situated, a well-developed flagellum was attached. Since then many other workers have obtained similar stages [see Leishman and Statham (38), Christophers (7)]; but however slender and Trypanosome-like the flagelliform parasites may appear, up till now no indications of an undulating membrane have been seen, and the kinetonuclear element is never far from the insertion of the flagellum.

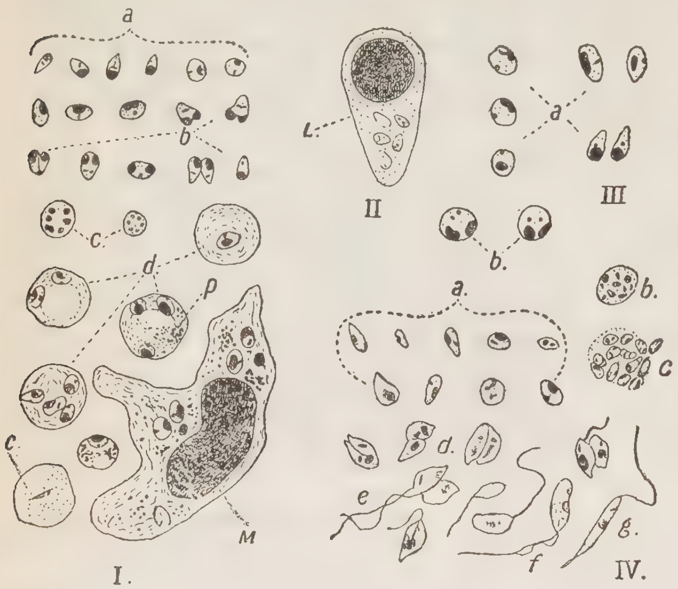

FIG. 8.

I. *Piroplasma* (*Leishmania*) *donovani*, Lav. and Mesnil.
  a, Typical pear-shaped or oval forms; *b*, various stages in longitudinal division; *c*, nuclear division preparatory to multiple fission; *d*, endoglobular forms, in red blood-corpuscles (*p*=pigment grains); *e*, bacillary form of the parasite in a corpuscle; *M*, large macrophageal cell with many parasites (after Donovan).
II. Uninuclear leucocyte (*L*) containing several parasites (after Lav. and Mesnil).
III. *P.* (*Heleosoma*) *tropicum* (Wright).
  a, Single individuals; *b*, dividing forms (from Mesnil, mostly after Wright).
IV. *P. donovani* in cultures of different ages.
  a, Ordinary forms of varying sizes; *b c*, stages in multiple division; *d*, binary fission; *e*, *f*, *g*, flagellate forms (after Rogers).

Nevertheless, the general appearance and structure of these motile forms so greatly resemble that of a Herpetomonad, or of the "pseudo-Herpetomonadine" forms of a Trypanosome which are obtained in cultures, that it cannot be doubted that the "Leishman-Donovan-Wright" bodies are closely connected with the Haemoflagellates. That being so, it is quite possible that, in normal conditions and circumstances, these parasites also possess, at some period of the life-cycle, a trypaniform phase. Nothing definite is yet known with regard to the transmission of the parasites by an alternate invertebrate host, although there is presumptive evidence in favour of this supposition.[2]

Supposed Connexion of the Spirochaetae with Trypanosomes.

A word or two must be said in conclusion with reference to the supposed connexion of the *Spirochaetae* with the Trypanosomes. In Schaudinn's great memoir he regarded *Trypanosoma ziemanni* as possessing, in certain phases, the actual characteristics of a *Spirochaete* as then known; and, further, he was inclined to think that other *Spirochaetae* (*e.g. S. obermeieri* of relapsing fever) were also only phases in the life-cycle of a particular Haemoflagellate. As a result of his more recent investigations on *S. plicatilis* (the type-species of Ehrenberg) and other forms (51), he finds, however, that this is not the case, but that the organisms exemplified by *S. plicatilis* are to be widely separated from the Trypanosomes, and placed rather with the Bacteria. In addition, it is most probable that, at any rate, certain other spirilliform parasites, *e.g. S. balbianii*, *S. refringens*, agree fundamentally in structure with the type-species.

On the other hand, evidence has lately been brought forward to show that certain parasites which greatly resemble a *Spirochaete* are really related to the Trypanosomes. This is the case with the celebrated organism first described by Schaudinn and E. Hoffmann (52) from essential syphilitic lesions, and now known as *Treponema* (*Spirochaete*) *pallida*, Schaud. F. Krzysztalowicz and M. Siedlecki have published an important account (17) of this parasite, which they consider possesses a true trypaniform phase, and for which they have proposed the name *Trypanosoma luis*. This view requires, however, corroboration. Nevertheless the resemblance between the biology of this organism in relation to syphilis (as regards mode of infection, habitat, &c.) and that of *Trypanosoma equiperdum*, the cause of dourine or "horse-syphilis," may not be without significance.

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[1] R. Ross (49), regarding the parasites as a quite different kind of Sporozoan, termed them *Leishmania*; and Wright named his variety from tropical ulcers *Helcosoma tropicum*.

[2] Patton (*Sci. Mem. India*, No. 27, 1907) has brought forward evidence to show that the bed-bug (*Cimex macrocephalus*) is the invertebrate host.

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TSAIDAM, or more correctly TSÄDUM, a depression, or self-contained shallow basin in the N.E. of Tibet, crossed by 37° N. and stretching from 92° to 97°. It is separated from the high plateau of Tibet by the Burkhan-Buddha range, and on the N.E. it is bounded by the eastward continuation of the Astin-tagh ranges, which there consist of four, namely, the lower and upper ranges, and a subsidiary chain flanking the lower range on the north and another subsidiary chain flanking the upper range on the south (see KUEN-LUN).

The valleys which divide the east ranges of the Kuen-Lun system terminate, or rather merge in, the sandy desert basin of Tsaidam; amongst them the Kakir valley between the upper Astin-tagh and the Akato-tagh and the Kum-kol valley between the Kalta-alagan and the range I. of the Arka-tagh (see KUEN-LUN). Tsaidam lies at an altitude of 11,400 ft. or about 3000 ft. lower than the Kum-kol lakes, and receives from the valley in which they lie the river Chulak-akkan or Tsagan tokhoy, which rises probably on the north slope of the Shapka-monomakha Mountain, one of the culminating summits in the region north of the Arka-tagh range. "It is very possible that the north-west of Tsaidam, which is perfectly unknown, is broken up into several separate basins. The south-east part of the same great expanse also appears to consist of several smaller basins rather than of one single great basin, each possessing its own salt lake; but then these smaller basins are undoubtedly separated from one another by remarkably low and insignificant thresholds or swellings."[1] The north-east part of the basin consists of a network of basins, which admit of being grouped in four divisions—Särtäng or Serteng, Makhai, Tsädam or Tsaidam, and Kurlyk or Tosun. The characteristic feature of each of these is that which is found in so many of the valleys of the Tibetan borderland, namely, a pair of linked lakes, one containing salt water and the other fresh water. The only inhabitants of Tsaidam are Mongols—Särtäng Mongols in the north and Tajinur Mongols in the south. The south-east part of the region is drained by the Holuzun-nor or Baïn-gol, an affluent of the upper Hwang-ho or Yellow River of China. The Särtäng basin is drained by the Khalting-gol and its tributary the Holuin-gol, which rise in the Humboldt and Ritter Mountains and empty into the lake of Sukhain-nor.

TSANA, a lake of North-East Africa, chief reservoir of the Abai or Blue Nile. Tsana lies between 11° 36′ and 12° 16′ N. and 37° 2′ and 37° 40′ E., filling a central depression in the Abyssinian highlands. It is about 5690 ft. above the sea, but from 2500 to 3000 ft. below the mountain plateau which encircles it. Its greatest length is 47 m., its greatest breadth 44 m., and it covers, approximately 1100 sq. m., having a drainage area, including the lake surface, of some 5400 sq. m. In shape it may be compared to a pear, the stem being represented by the escaping waters of the Abai. The shores of the lake are well defined, generally flat, and bordered by reeds, but at places the mountains descend somewhat abruptly into the water. Elsewhere the land rises in gentle undulations, except at the mouths of the larger tributary streams, where are alluvial plains of considerable size. At the south-east end the lake forms a bay about eleven miles long, and from three to eight miles across, and from this bay the Abai issues. The whole of the coast-line is considerably indented and many narrow promontories jut into the lake. The island of Dek (8 m. long by 4 broad) is in the south-western part of the lake. Near it is the smaller island of Dega, whilst numerous islets fringe the shores.

Lake Tsana is fed by three large rivers and by many petty streams. The chief tributary is the Abai, which enters the lake at its south-west corner through a large papyrus swamp. This river, and the Abai or Blue Nile which issues from the lake, are regarded as one and the same stream and a current is observable from the inlet to the outlet. Next in importance of the affluents are the Reb and Gumara, which run in parallel courses and enter the lake on its eastern side. The outlet of the lake is marked by openings in a rocky ledge, through which the water pours into a lagoon-like expanse. Thence it issues by two or three channels, with a fall of about 5 ft. in a succession of rapids. These channels unite within a couple of miles into one river—the Abai with a width of 650 ft. After passing a large number of rapids in the first sixteen miles of its course the Abai enters a deep gorge by a magnificent fall—the Fall of Tis Esat—the water being confined in a channel not more than 20 ft. across and falling 150 ft. in a single leap. The gorge is spanned by a stone bridge built in the 17th century. From this point the Abai makes its way through the mountains to the plains of Sennar, as described in the article NILE.

The average annual rainfall in the Tsana catchment area is estimated at $3\frac{1}{4}$ ft., and the volume of water received by the lake yearly at 6,572,000,000 of cubic metres. More than half of this amount is lost by evaporation, the amount discharged into the river being placed at 2,924,000,000 cubic metres. The seasonal alteration of the lake level is not more than 5 ft. The rainy season lasts from the beginning of June to the end of September. During this period the discharge from the lake is, it appears, little greater than in the dry season, the additional water received going to raise the lake level. Thus the rise in the Blue Nile, in its lower course, would seem to be independent of the supply it derives from its source.

Tsana has been identified with the *Coloe Palus* of the ancients, which although placed 12° too far south by Ptolemy was described by him as a chief reservoir of the Egyptian Nile and the source of the *Astapos*, which was certainly the Blue Nile. In 1625 it was visited by the Portuguese priest Jeronimo Lobo, and in 1771 by James Bruce. Dr. Anton Stecker, in 1881, made a detailed examination of the lake, enabling the cartographers to delineate it with substantial accuracy. By the Portuguese of the 17th century the lake was styled Dambia, and this name in the slightly altered form of Dembea was in use until towards the close of the 19th century. By many Abyssinians the lake is called Tana, but the correct Amharic form is Tsana.

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[1] Sven Hedin, *Scientific Results of a Journey in Central Asia, 1899–1902*, iii. 344 (Stockholm, 1905–1907).

See NILE and ABYSSINIA, and the authorities there cited. The British Blue Book, *Egypt*, No. 2, 1904, contains a special report (with maps) upon Lake Tsana by Mr C. Dupuis, of the Egyptian Irrigation Service. In the *Boll. soc. geog. italiana* for December 1908 Captain A. M. Tancredi gives the results (also with maps) of an Italian expedition to the lake. (W. E. G.; F. R. C.)

TSAR, or CZAR, the title commonly given both abroad and in Russia itself to the sovereign of Russia, whose official style is, however, "Emperor and Autocrat" (*Imperator i Samovlastityel*). In its origin the word *tsar* seems to have connoted the same as *imperator*, being identical with the German *Kaiser* in its derivation from the Latin Caesar. In the old Slavonic Scriptures the Greek *βασιλεύς* is always translated *tsar*, and this title was also given to the Roman Emperor. The old Russian title for a sovereign was *knyaz*, prince, or *veliky knyaz*, grand prince. The title *tsar* was first adopted by the Slavonic peoples settled in the Balkan peninsula, who were in close touch with the Eastern emperor; thus it was used by the medieval Bulgarian kings. It penetrated into Russia as a result of the growing intercourse between old Muscovy and Constantinople, notably of the marriage alliances contracted by Russian princes with the dynasty of Basil the Macedonian; and it was assumed by the Muscovite princes who revolted from the yoke of the Mongols. The other *tsars* were gradually ousted by those of Moscow, and the modern Russian emperors inherit their title of *tsar* from Ivan III. (1462–1505), or perhaps rather from his grandson Ivan IV. (1533–1584) who was solemnly crowned *tsar* in 1547.

Throughout, however, the title *tsar* was used, as it still is in popular parlance, indifferently of both emperors and kings, being regarded as the equivalent of the Slavonic *krol* or *kral* (Russ. *korol*, Magyar, *király*), a king, which had been adopted from the name of Charlemagne (Germ. *Karl*, Lat. *Carolus Magnus*). This use being equivocal, Peter the Great, at the peace of Nystad (November 2, 1721), assumed the style of *imperator*, an exotic word intended to symbolize his imperial dignity as the equal of the western emperor. This new style was not, however, recognized by the powers until the time of Catherine II., and then only on the express understanding that this recognition did not imply any precedency or superiority of the Russian emperor over other sovereigns. Henceforth, whatever popular usage might be, the title *tsar* was treated officially as the equivalent of that of king. Thus the Russian emperor is tsar (king) of Poland and of several other parts of his dominions. Thus, too, the prince of Bulgaria, on assuming the royal style, took the title of tsar of Bulgaria.

The title "White Tsar," applied to the Russian emperor and commonly quoted as though it had a poetic or mystic meaning, is a translation of a Mongol word meaning "independent" (cf. the feudal "blanch tenure," *i.e.* a tenure free from all obligation of personal service).

The wife of the tsar is *tsaritsa*. In former times the title *tsarevich* (king's son) was borne by every son of a tsar; but the word has now fallen out of use. The heir to the throne is known as the *tsesarevich* or *cesarevich* (*q.v.*), *i.e.* son of Caesar, the other Imperial princes bearing the old Russian title of *veliky knyaz* (grand duke; *q.v.*).

TSARITSYN, a town of Russia, in the government of Saratov, situated on the right bank of the Volga, where it suddenly turns towards the south-east, 40 m. distant from the Don. Pop. (1900), 67,650. Tsaritsyn is the terminus of a railway which begins at Riga and, running south-eastwards, intersects all the main lines which radiate from Moscow to the south. It is also connected by rail with Kalach on the Don, where merchandise from the Sea of Azov is disembarked. Corn from middle Russia for Astrakhan is transferred from the railway to boats at Tsaritsyn; timber and wooden wares from the upper Volga are unloaded here and sent by rail to Kalach; and fish, salt and fruits sent from Astrakhan by boat up the Volga are here unloaded and despatched by rail to the interior of Russia. The town has grown rapidly since the completion of the railway system, and has a large trade in petroleum from Baku. Tsaritsyn is also the centre of the trade in the mustard of Sarepta, Dubovka and the neighbourhood. The fisheries are important. The buildings of the town include a public library, and the church of St John (end of 16th century), a fine specimen of the architecture of its period. Here are iron, machinery and brick works, tanneries, distilleries, and factories for jam, mustard and mead. Market gardening is an important industry.

A fort was erected here in the 16th century to prevent the incursions of the free Cossacks and runaway serfs who gathered on the lower Volga, as also the raids of the Kalmucks and Circassians. In 1606 Tsaritsyn took part in the rising in favour of the false Demetrius, and Stenka Razin took the town in 1670. The Kalmucks and Circassians of the Kubañ attacked it repeatedly in the 17th century, so that it had to be fortified by a strong earthen and palisaded wall, traces of which are still visible.

TSARSKOYE SELO, a town of north Russia, in the government of St Petersburg, and an imperial residence, 15 m. by rail south of the capital. Pop. (1885), 15,000; (1897), 22,353. The town stands on the Duderhof Hills and consists (1) of the town proper, surrounded by villages and a German colony, which are summer resorts for the inhabitants of St Petersburg; and (2) of the imperial parks and palaces. The former is built on a regular plan, and its houses nearly all stand in gardens. The cathedral of St Catherine is a miniature copy of that at Constantinople. The imperial parks and gardens cover 1680 acres; the chief of them is the "old" garden, containing the "old palace," built (1724) by Rastrelli and gorgeously decorated with mother-of-pearl, marbles, amber, lapis lazuli, silver and gold; the gallery of Cameron adorned with fine statues and entrance gates; numerous pavilions and kiosks; and a bronze statue (1900) of the poet Pushkin. A second palace, the Alexander, was built by Catherine II. in 1792, and has in its park an historical museum and an arsenal.

When Peter the Great took possession of the mouth of the Neva, a Finnish village, Saari-mois, stood on the site now occupied by the town, and its Russified name Sarskaya was changed into Tsarskoye when Peter presented it to his wife Catherine. It was especially embellished by the tsaritsa Elizabeth. Under Catherine II., a town, Sophia, was built close by, but its inhabitants were transferred to Tsarskoye Selo under Alexander I. The railway connecting the town with St Petersburg was the first (1838) to be constructed in Russia.

TSCHAÏKOVSKY, PETER ILICH (1840–1893), Russian composer, born at Votkinsk, in the province of Vyatka, on the 7th of May 1840, was the son of a mining engineer, who shortly after the boy's birth removed to St Petersburg to assume the duties of director of the Technological Institue there. While studying in the school of jurisprudence, and later, while holding office in the ministry of justice, Tschaïkovsky picked up a smattering of musical knowledge sufficient to qualify him as an adept amateur performer. But the seriousness of his musical aspiration led him to enter the newly founded Conservatorium of St Petersburg under Zaremba, and he was induced by Anton Rubinstein, its principal, to take up music as a profession. He therefore resigned his post in the ministry of justice. On quitting the Conservatorium he was awarded a silver medal for his thesis, a cantata on Schiller's "Ode to Joy." In 1866 Tschaïkovsky became practically the first chief of the recently founded Moscow Conservatorium, since Serov, whom he succeeded, never took up his appointment. In Moscow Tschaïkovsky met Ostrovskiy, who wrote for him his first operatic libretto, *The Vojevoda*. After the Russian Musical Society had rejected a concert overture written at Rubinstein's suggestion, Tschaïkovsky in 1866 was much occupied on his *Winter Day Dreams*, a symphonic poem, which proved a failure in St Petersburg but a success at Moscow. In 1867 he made an unsuccessful début as conductor. Failure still dogged his steps, for in January 1869 his *Vojevoda* disappeared off the boards after ten performances, and subsequently Tschaïkovsky destroyed the score. The *Romeo and Juliet* overture has been much altered since its production by the Russian Musical Society in 1870, in which year the composer once more attempted unsuccessfully an operatic production, St Petersburg rejecting his *Undine*. In 1871 Tschaïkovsky was busy on his cantata for the opening of the exhibition in celebration of the bicentenary of Peter the Great, his opera *The Oprischnik*, and a textbook of harmony, which latter was adopted by the Moscow Conservatorium authorities. At Moscow in 1873 his incidental music to the *Snow Queen* failed, but some success came next year with the beautiful quartet in F. During these years Tschaïkovsky was musical critic for two journals, the *Sovremennaya Lietopis* and the *Russky Vestnik*. On the death of Serov he competed for the best setting of Polovsky's *Wakula the Smith*, and won the first two prizes. Yet on its production at St Petersburg in November 1876 this work gained only a *succès d'estime*. Since then it has been much revised, and is now known as *The Little Shoes*. Meanwhile the Second Symphony and the *Tempest* fantasia had been heard, and the pianoforte concerto in B flat minor completed. This was first played by von Bülow in Boston, Massachusetts, some time later, and was entirely revised and republished in 1889. At last something like success came to Tschaïkovsky with the production of *The Oprischnik*, in which he had incorporated much of the best of *The Vojevoda*. The Third—or Polish—Symphony, four sets of songs, the E-flat quartet (dedicated to the memory of Lamb), the ballet "The Swan Lake," and the "Francesca da Rimini" fantasia, all belong to the period of the late 'seventies—the last being made up of operatic fragments. Tschaïkovsky in 1877 first began to work on the opera of *Eugen Onegin*. With the production of this work at the Moscow Conservatorium in March 1879 real success first came to him. The story, by Pushkin, was a familiar one, and the music of Tschaïkovsky was not so extravagant in its demands as had been the music of his earlier operas.

Meanwhile the more personal side of the composer's career had been given a romantic touch by his acquaintance with his lifelong benefactress, Mme von Meck, and his deplorable fiasco of a marriage. In 1876 he had aroused the interest of Nadezhda Filaretovna von Meck (1831–1894), the wife (left a widow in 1876) of a wealthy railway engineer and contractor. She had a large fortune and she began by helping the composer financially in the shape of commissions for work, but in 1877 this took the more substantial shape of an annual allowance of £600. The romance of their association consisted in the fact that they never met, though they corresponded with one another continually. In 1890 Mme von Meck (who died two months after the composer, of progressive nervous decline), imagining herself—apparently a pure delusion—to be ruined, discontinued the allowance; and though Tschaïkovsky was then no longer really in need of it, he failed to appreciate the pathological reason underlying Mme von Meck's condition of mind, and was deeply hurt. The wound remained unhealed, and the correspondence broken, though on his death-bed her name was on his lips. Her connexion with his life was one of its dominating features. His marriage was only a brief and misguided incident. Tschaïkovsky married Antonina Ivanovna Milyukova on the 6th of July 1877, but the marriage rapidly developed into a catastrophe, through no fault of hers but simply through his own abnormality of temperament; and it resulted in separation in October. He had become taciturn to moroseness, and finally quitted Moscow and his friends for St Petersburg. There he fell ill, and an attempt to commit suicide by standing chin-high in the river in a frost (whereby he hoped to catch his death from exposure) was only frustrated by his brother's tender care.

With his brother, Tschaïkovsky went to Clarens to recuperate. He remained abroad for many months, moving restlessly from one place to another. In 1878 he accepted (but later resigned) the post of director of the Russian musical department at the Paris Exhibition, completed his Fourth Symphony and the Italian *Capriccio*, and worked hard at his "1812" overture, more songs, the second pianoforte concerto, and his "Liturgy of St Chrysostom," an interesting contribution to the music of the Eastern Church. The work was confiscated for some time by the intendant of the imperial chapel, on the ground that it had not received the imprimatur of his predecessor Bortniansky in due accordance with a ukaz of Alexander I. Bortniansky was dead, but his successor was obstinate. Finally the work was saved from destruction by an official order. Tschaïkovsky returned only for a short time to Moscow. Thence he went to Paris. In 1879 he wrote his *Maid of Orleans* (produced in 1880) and his first suite for orchestra. In 1881 died Nicholas Rubinstein—to whose memory Tschaïkovsky dedicated the trio in A minor. During the next five years Tschaïkovsky travelled, and worked at *Manfred* and *Hamlet*, the operas *Mazeppa* and *Charodaïka*, the Mozartian suite and the fine Fifth Symphony. During a great part of the time he lived in retirement at Klin, where his generosity to the poor made him beloved. His operas *The Queen of Spades* and the one-act *Iolanthe* were feeble by comparison with his earlier works; more effective, however, were the ballets *Sleeping Beauty* and *Casse-noisette*. In 1893 Tschaïkovsky sketched his Sixth Symphony, now known as the *Pathetic*, a work that has done more for his fame in foreign lands than all the rest of his works. This was the year in which the composer conducted a work of his own at Cambridge on the occasion of his receiving the honorary degree of Doctor of Music. In the same year, on the 6th of November, he died from an attack of cholera at St Petersburg.

Tschaïkovsky's work is unequal. In dramatic compositions he lacked point precisely as Anton Rubinstein lacked point. But in the invention of broad, sweeping melody Tschaïkovsky was far ahead of his compatriot. Among his songs and smaller pianoforte works, as in his symphonies and quartets, are passages of exquisite beauty. The best of Tschaïkovsky's work is more distinctly Russian than that of most of his compatriots; it is not German music in disguise, as is so much of the music by Rubinstein and Glazounow, and it is not incoherently ferocious, like so much of the music by Balakirev.

See Mrs Rosa Newmarch's *Tchaikovsky* (1900) supplemented in 1906 by her condensed English edition of the *Life and Letters*, which appeared in Russian in 1901 in three volumes, edited by Modeste Tschaïkovsky, the composer's brother.

TSCHUDI, or SCHUDY, the name of one of the most distinguished families of the land of Glarus, Switzerland. It can be traced back as a peasant, not a noble, race to 1289, while after Glarus joined the Swiss Confederation in 1352 various members of the family held high political offices at home, and were distinguished abroad as soldiers and in other ways.

In literature, its most eminent member was GILES or AEGIDIUS TSCHUDI (1505–1572), who, after having served his native land in various offices, in 1558 became the chief magistrate or *landammann*, and in 1559 was ennobled by the emperor Ferdinand, to whom he had been sent as ambassador. Originally inclined to moderation, he became later in life more and more devoted to the cause of the counter-Reformation. It is, however, as the historian of the Swiss Confederation that he is best known; by incessant wanderings and unwearied researches amongst original documents he collected material for three great works, which therefore can never wholly lose their value, though his researches have been largely corrected by those of more recent students. In 1538 his book on Rhaetia, written in 1528, was published in Latin and in German—*De prisca ac vera Alpina Rhaetia*, or *Die uralt wahrhafftig Alpisch Rhätia*. The historical reputation of Giles Tschudi has suffered very much owing to recent researches. His inventions as to the early history of the Swiss Confederation are described under TELL. His statements and documents relating to Roman times and the early history of Glarus and his own family had long roused suspicion. Detailed examination of late years has proved beyond the shadow of a doubt that he not merely claimed to have copied Roman inscriptions that never existed, and amended others in a most arbitrary fashion, but that he deliberately forged a number of documents with a view to pushing back the origin of his family to the 10th century, thus also entirely misrepresenting the early history of Glarus, which is that of a democratic community, and not (as he pretended) that of a preserve of several aristocratic families. Tschudi's historical credit is thus hopelessly ruined, and no document printed or historical statement made by him can henceforward be accepted without careful verification and examination. These discoveries have a painful interest and importance, since down to the latter part of the 19th century Swiss historical writers had largely based their works on his investigations and manuscripts.

For a summary of these discoveries see G. v. Wyss in the *Jahrbuch* of the Historical Society of Glarus (1895), vol. xxx., in No. 1 (1894), of the *Anzeiger f. schweizerische Geschichte*, and in his *Geschichte d. Historiographie in d. Schweiz* (1895), pp. 196, 201, 202. The original articles by Vögelin (Roman inscriptions) appeared in vols. xi., xiv. and xv. (1886–1890) of the *Jahrbuch f. schweizer Geschichte*, and that by Schulte (Glarus) in vol. xviii. (1893) of the same periodical. For the defence, see a weak pamphlet, *Schulte u. Tschudi* (Coire, 1898), by P. C. v. Planta.

Tschudi's chief works were not published until long after his death. The *Beschreibung Galliae Comatae* appeared under Gallati's editorship in 1758, and is mainly devoted to a topographical, historical and antiquarian description of ancient Helvetia and Rhaetia, the latter part being his early work on Rhaetia revised and greatly enlarged. This book was designed practically as an introduction to his magnum opus, the *Chronicon helveticum*, part of which (from 1001 to 1470) was published by J. R. Iselin in two stately folios (1734–1736); the rest consists only of rough materials. There exist two rather antiquated biographies of Tschudi by I. Fuchs (2 vols., St Gall, 1805) and C. Vogel (Zürich, 1856), but his extensive complete correspondence has not yet been printed.

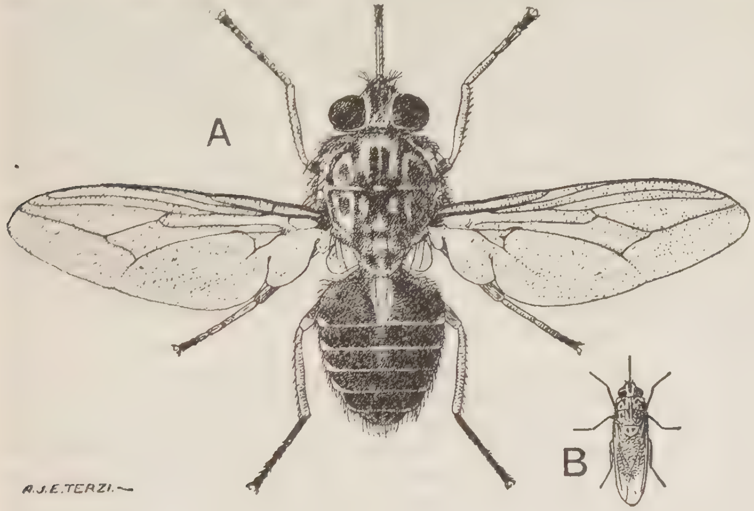
Subjoined is a list of other prominent members of the family. DOMINIC (1596–1654) was abbot of Muri and wrote a painstaking work, *Origo et genealogia gloriosissimorum comitum de Habsburg* (1651). JOSEPH, a Benedictine monk at Einsiedeln, wrote a useful history of his abbey (1823). The family, which became divided in religious matters at the Reformation, also includes several Protestant ministers: JOHN HENRY (1670–1729), who wrote *Beschreibung des Lands Glarus* (1714); JOHN THOMAS (1714–1788), who left behind him several elaborate MSS. on the local history of Glarus; and JOHN JAMES (1722–1784), who compiled an elaborate family history from 900 to 1500, and an account of other Glarus families. JOHN LOUIS BAPTIST (d. 1784), who settled in Metz and contributed to the *Encyclopédie*, and FREDERICK (1820–1886), the author of *Das Thierleben der Alpenwelt* (1853), were distinguished naturalists. Among the soldiers may be mentioned CHRISTOPHER (1571–1629), a knight of Malta and an excellent linguist, who served in the French and Spanish armies; while the brothers LOUIS LEONARD (1700–1779) and JOSEPH ANTHONY (1703–1770) were in the Neapolitan service. VALENTINE (1499–1555), the cousin of Giles, was, like the latter, a pupil of Zwingli, whom he afterwards succeeded as pastor of Glarus, and by his moderation gained so much influence that during the thirty years of his ministry his services were attended alike by Romanists and Protestants. The best-known member of the family in the 19th century was IWAN (1816–1887), author of an excellent guide-book to Switzerland, which appeared first (1855) under the name of *Schweizerführer*, but is best known under the title (given in 1872 to an entirely recast edition) of *Der Tourist in der Schweiz*. (W. A. B. C.)

TSĒNG KUO-FAN (1811–1872), Chinese statesman and general, was born in 1811 in the province of Hunan, where he took in succession the three degrees of Chinese scholarship. In 1843 he was appointed chief literary examiner in the province of Szechuen, and six years later was made junior vice-president of the board of rites. When holding the office of military examiner (1851) he was compelled by the death of his mother to retire to his native district for the regulation mourning. At this time the Taiping rebels were overrunning Hunan in their conquering career, and had possessed themselves of the cities and strongholds on both shores of the Yangtse-kiang. By a special decree Tsēng was ordered to assist the governor of the province in raising a volunteer force, and on his own initiative he built a fleet of war junks, with which he attacked the rebels. In his first engagement he was defeated, but, happily for him, his lieutenants were more successful. They recovered the capital, Chang-sha, and destroyed the rebel fleet. Following up these victories of his subordinates, Tsēng recaptured Wuchang and Hanyang, near Hankow, and was rewarded for his success by being appointed vice-president of the board of war. In 1853 other triumphs led to his being made a baturu (a Manchu order for rewarding military prowess), and to his being decorated with a yellow riding-jacket. Meanwhile, in his absence, the rebels retook Wuchang and burnt the protecting fleet. The tide quickly turned, however, and Tsēng succeeded in clearing the country round the Poyang lake, and subsequently in ridding the province of Kiangsu of the enemy. His father died in 1857, and after a brief mourning he was ordered to take supreme command in Cheh-kiang, and to co-operate with the governor of Fukien in the defence of that province. Subsequently the rebels were driven westwards, and Tsēng would have started in pursuit had he not been called on to clear the province of Ngan-hui of rebel bands. In 1860 he was appointed viceroy of the two Kiang provinces and Imperial war commissioner. At this time, and for some time previously, he had been fortunate in having the active support of Tso Tsung-t'ang, who at a later period recovered Kashgar for the emperor, and of Li Hung-Chang. Like all true leaders of men, he knew how to reward good service, and when occasion offered he appointed the former to the governorship of Cheh-kiang and the latter to that of Kiangsu. In 1862 he was appointed assistant grand secretary of state. At this time the Imperial forces, assisted by the "Ever-victorious Army," had checked the progress of the rebellion, and Tsēng was able to carry out a scheme which he had long formulated of besieging Nanking, the rebel headquarters. While Gordon, with the help of Li Hung-Chang, was clearing the cities on the lower waters of the Yangtse-kiang, Tsēng drew closer his besieging lines around the doomed city. In July 1864 the city fell into his hands, and he was rewarded with the rank and title of marquis and the right to wear the double-eyed peacock's feather. After the suppression of the Taipings the Nienfei rebellion, closely related to the former movement, broke out in Shantung, and Tsēng was sent to quell it. Success did not, however, always attend him on this campaign, and by Imperial order he was relieved of his command by Li Hung-Chang, who in the same way succeeded him in the viceroyalty of Chihli, where, after the massacre of Tientsin (1870), Tsēng failed to carry out the wishes of his Imperial master. After this rebuff he retired to his viceroyalty at Nanking, where he died in 1872.

Tsēng was a voluminous writer. His papers addressed to the throne and his literary disquisitions are held in high esteem by the scholars of China, who treasure as a memorial of a great and uncorrupt statesman the edition of his collected works in 156 books, which was edited by Li Hung-Chang in 1876. (R. K. D.)

TSETSE-FLY (*Tsetse*, an English rendering of the Bantu *nsi-nsi*, a fly), a name applied indiscriminately to any one of the eight species of *Glossina*, a genus of African blood-sucking Diptera (two-winged flies, see DIPTERA), of the family Muscidae. Tsetse-flies are of great economic and pathological importance as the disseminators of tsetse-fly disease (nagana) and sleeping sickness. These maladies are caused by minute unicellula animal parasites (*haematozoa*) of the genus *Trypanosoma* (see TRYPANOSOMES); and recent investigations have shown that, under normal conditions, the particular species of *Trypanosoma* concerned (*T. brucei*, in the case of nagana, and *T. gambiense* in that of sleeping sickness) are introduced into the blood of susceptible animals or man only by the bite of one or other of the species of tsetse. (See PARASITIC DISEASES). The names of the recognized species of tsetse-flies are as follows: *Glossina palpalis* (see fig.); *G. pallicera*; *G. morsitans*; *G. tachinoides*; *G. pallidipes*; *G. longipalpis*; *G. fusca*; and *G. longipennis*. A ninth so-called species, described in 1905 from specimens from Angola, is not really distinct from *G. palpalis* but appears to be identical with the sub-species *G. palpalis wellmani*.

In appearance tsetse are somewhat narrow-bodied flies, with a prominent proboscis, which projects horizontally in front of the head, and with the wings in the resting position closed flat one over the other like the blades of a pair of scissors (see fig., B). The latter characteristic affords an infallible means for the recognition of these insects, since it at once serves to distinguish them from any blood-sucking flies with which they might otherwise be confused. The coloration of tsetse-flies is sombre and inconspicuous; the brownish or greyish-brown thorax usually exhibits darker longitudinal markings, and when the insect is at rest the abdomen or hinder half of the body is entirely concealed by the brownish wings. In some species the abdomen is of a paler colour and marked with sharply defined, dark brown bands, which are interrupted on the middle line. The length of the body, exclusive of the proboscis, which measures about a line to a line and a half, varies according to the species from 6 or 8 millimetres in the case of *G. tachinoides*, to about 11½ millimetres in that of *G. fusca* or *longipennis*; the closed wings, however, project beyond the body and thus increase its apparent length. *G. palpalis*, the disseminator of sleeping sickness (see fig.), is about 9½ millimetres in length and is the darkest of all the tsetse-flies, though the dark brown abdomen has pale lateral triangular markings and usually at least an indication of a pale longitudinal median stripe. In all tsetse-flies the proboscis in the living insect is entirely concealed by the palpi, which are grooved in their inner sides and form a closely fitting sheath for the piercing organ; the base of the proboscis is expanded beneath into a large onion-shaped bulb, which is filled with muscles. The head of the insect contains a muscular pharynx by means of which the blood from the wound inflicted by the proboscis (labium) is pumped into the alimentary canal and the so-called sucking-stomach. The tip of the proboscis is armed with a complicated series of chitinous teeth and rasps, by means of which the fly is enabled to pierce the skin of its victim; as usual in Diptera the organ is closed on the upper side by the labrum, or upper lip, and contains the hypopharynx or common outlet of the paired salivary glands, which are situated in the abdomen. The proboscis of tsetse-flies is without the paired piercing stilets (mandibles and maxillae) possessed by other blood-sucking Diptera, such as the female horse-flies and mosquitoes.



For the anatomy of the tsetse see E. A. Minchin, *Proc. Roy. Soc.* lxxvi. 531–547.

Tsetse-flies are restricted to Africa, where they occur in suitable localities throughout the greater portion of the tropical region, although not found either in the Sahara or in the veld country of the extreme south. For practical purposes the northern limit of *Glossina*, as at present known, may be shown on the map by drawing a line from Cape Verde to the Nile a little to the south-east of El Obeid, and thence to the coast of Somaliland at 4° N.; while the southern boundary of the genus may similarly be represented by the Cunene river, in the south of Angola, and a line thence to the north-eastern end of St Lucia lake, in Zululand. Within the area thus defined tsetse-flies are not found continuously, however, but occur only in small tracts called "belts" or "patches," which, since cover and shade are necessities of life to these insects, are always situated in forest, bush or banana plantations, or among other shady vegetation. In South and Central Africa, at any rate, "fly-belts" are usually met with in damp, hot, low-lying spots on the margins of water-courses, rivers and lakes, and seldom far from water of some kind. It appears, however, that in this respect the habits of the different species show a certain amount of variation; thus, while *G. palpalis* exhibits an especial fondness for water and haunts more or less dense cover at the water's edge, recent observations in German East Africa show that *G. fusca* is in no way connected with water, but is much more frequently encountered at a distance from it. Similarly, the oft-repeated assertion that there is a definite connexion between tsetse-flies and big game, especially the buffalo (*Bubalus caffer*), in that the former are dependent upon the latter for their continued existence, is certainly not true as regards *G. palpalis*, although in South Africa there can be no question that the extermination of big game has been followed or accompanied by the disappearance of tsetse from many localities in which they formerly abounded.

As a rule tsetse-flies are most active during the warmer hours of the day, but they frequently bite at night, especially by moonlight. The blood-sucking habit is common to both sexes, and the abdomen, being capable of great expansion, is adapted for the periodical ingestion of an abundant food-supply. The act of feeding, in which the proboscis is buried in the skin of the victim nearly up to the bulb, is remarkably quick, and in thirty seconds or less the abdomen of the fly, previously flat, becomes swollen out with blood like a berry. Stuhlmann's experiments with *G. fusca* show that the insect is able to ingest considerably more than (sometimes more than twice) its own weight of blood, which would appear to be the only food, and must be drawn from the tissues of a victim. Specimens of *G. fusca*, even though fasting and kept for days in absolutely dry air, could never be induced to imbibe water, sugar-cane juice or extravasated blood. The reproduction of tsetse-flies is highly remarkable; instead of laying eggs or being ovoviviparous the females deposit at intervals of about a fortnight or three weeks a single full-grown larva, which forthwith buries itself in the ground to a depth of several centimetres, and assumes the pupal state. The practical importance of this peculiar life-history is very great, since larvae thus protected cannot easily be destroyed. It is important to note that although sleeping sickness (of which the chief foci are at present the Congo Free State and Uganda) has hitherto been associated with one particular species of *Glossina*, it has been shown experimentally both that other tsetse-flies are able to transmit the parasite of the disease, and that *G. palpalis* can convey kindred parasites which are fatal to domestic animals. Since, moreover, it is believed that at least five species of *Glossina* are carriers of nagana, it may well be that *all* tsetse-flies can disseminate both nagana and sleeping sickness. (E. E. A.)

TSHI, Tchwi, Chi, or Oji, a group of Negro peoples of the Gold Coast (*q.v.*). The chief of these are the Ashanti, Fanti, Akim and Aquapem. Their common language is the Tshi, from which they gain their family name.

TSU-SHIMA ("the island of the port"), an island belonging to Japan, situated about midway between Korea and the island of Iki, so that the two islands were used as places of call in former times by vessels plying between Japan and Korea. Tsu-shima lies about 34° 20′ N., 129° 20′ E. The nearest point of the Korean coast is 48 m. distant. It has an area of 262 sq. m. and a population of 39,000. It is divided at the waist by a deep sound (Asaji-ura), and the southern section has two hills, Yatachi-yama and Shira-dake, 2130 ft. and 1680 ft. high respectively, while the northern section has Ibeshi-yama and Mi-take, whose heights are 1128 ft. and 1598 ft. The chief town is Izu-hara. The Mongol armada visited the island in the 13th century and committed great depredations. In 1861 an attempt was made by Russia to obtain a footing on the island. The name of the battle of Tsu-shima is given to the great naval engagement of the 27th and 28th of May 1905, in which the Russian fleet under Admiral Rozhdestvensky was defeated by the Japanese under Admiral Togo.

TUAM, a market town and episcopal city of Co. Galway, Ireland, 20 m. directly N.N.E. of Galway on the Limerick & Sligo branch of the Great Southern & Western railway. Pop. (1901), 3012. An abbey was founded here towards the end of the 5th century, and in the beginning of the 6th an episcopal see by St Jarlath. The Protestant archbishopric of Tuam was lowered to a bishopric on the death of Archbishop Power Le Poer Trench in 1839, and united with that of Killala and Achonry. It is, however, a Roman Catholic archbishopric. The Protestant cathedral is also the parish church, and was to a great extent rebuilt *c.* 1861 from plans by Sir Thomas Deane. Only the chancel of the old church remains, but its red sandstone arch is a remarkably fine example of Norman work; it dates from the middle of the 12th century. The modern Roman Catholic cathedral is Perpendicular in style and cruciform in plan. The interior is elaborately decorated. The cross of Tuam, re-erected in modern times, bears inscriptions in memory of Turlogh O'Conor, king of Ireland, and O'Hoisin, successively (1128) abbot of St Jarlath's Abbey and archbishop (1152) of Tuam, when the see was raised. St Jarlath's Roman Catholic college, usually called the New College, is a seminary founded in 1814 for the education of priests. To the west are the archbishop's palace and a convent of

Presentation nuns. The town has a considerable retail trade, and is a centre for the disposal of agricultural produce. Tuam received its first charter from James I. Before the union in 1800 it returned two members to the Irish Parliament.

TUAREG, or TAWAREK (more properly Tawarik, the collective form of *tarki,* from Arabic *terek,* to give up), the name given to the western and central Saharan Berber peoples, in reference possibly to their abandonment of Christianity or their early home in Mauretania. They call themselves *Imoshagh* ("the noble people"), another form of Amazigh. They inhabit the desert from Tuat to Timbuktu and from Fezzan to Zinder. The Tuareg country covers about 1,500,000 sq. m., less than 3000 acres of which are cultivated. There are only some half-dozen commercial places in the whole Sahara to which the Tuareg resort. These are the centres from which the trade routes radiate, Wargla, Timbuktu, Ghat, Ghadames, Murzuk and Insalah.

The Tuareg, at any rate the noble class, are regarded as among the purest of the Berber stocks, but with the adoption of Islam they have become largely Arabized in manners and customs, though the nomad Tuareg preserve in singular purity the Tamashek dialect of the Berber language. Their general colour is the reddish yellow of southern Europeans, the uncovered parts of the body being, however, darker through exposure. Their hair is long, black, and silky, beards black and thin; eyes black, sometimes blue; noses small; hands delicate, but bodies muscular. They are a tall people, the chiefs being especially noted for their powerful build. They dress generally in a black tunic (some tribes wear white), trousers girt with a woollen belt, and wear as turban a cloth called *litham,* the end of which is drawn over the face, allowing nothing to be seen but the eyes and the tip of the nose. The purpose of this is to protect the throat and lungs from the sand. These cloths are dark blue or white: the former being worn most by the nobles, the latter by the common people. To this difference of colour is due the terms "black" and "white" Tuareg. The Tuareg seldom remove their masks or face-cloths. Even abroad they wear them, and have been seen so dressed in the streets of Paris. The Arabs call them "People of the Veil."

The Tuareg are divided into five main tribes or confederations of tribes: the Azgar (Asjer) about Ghat and Ghadames; the Kelui around Air; the Hoggar (Ahaggar) in the mountains of that name and in the centre of the Sahara; the Awellimiden in the desert north and east of Timbuktu; and the Arrerf Ahnet, a recent offshoot of the Hoggars living in the Adrar'n Ahnet region north-west of the Hoggar massif. Owing to their nomadic life their political organization is not so democratic as that of other Berber peoples; chiefs and the members of the popular assembly are nominally elective; practically, however, the office of chief is hereditary in a ruling family. On a chief's death the office goes, with the approval of the tribesmen, to the eldest son of his eldest sister, in no case to any of his sons. The Tuareg are nominally Mahommedans, and belong to the Malikite section of the Sunnites. The Senussite sect, however, has many adherents, but more because of the Tuareg hatred of foreigners than from devoutness. A very few perform, by way of Tripoli, the pilgrimage to Mecca. They have not many mosques, and these are merely small stone enclosures a few feet high, with a niche at one end towards Mecca. There are a number of desert monasteries, huge camps pitched in a circle. Here the marabout lives surrounded by his followers, shifting the "monastery" as the requirements of his flocks compel. In these monasteries many Tuareg children receive their education.

Socially the Tuareg are divided into five classes, viz.: *Thaggaren* or nobles; Marabouts or priests; *Imghad* or serfs; *Ireghenaten* or cross-breeds; and the slaves. The nobles are all pure-blooded, and provide the tribal chiefs. They do no manual work, but almost live in the saddle, either convoying those caravans which have paid blackmail for safe passage, or making raids on trade-routes or even outlying Arab settlements. Before the French occupation they sometimes penetrated into the very heart of Algeria and Tunisia. Among the Imghad serfdom is hereditary, and whole tribes are vassals to the nobles. They cannot be sold or freed like slaves, though they may be inherited. Most of them have practical independence and act as "squires" to the nobles on their pillaging expeditions. The cross-breeds are the descendants of mixed marriages between the nobles and serfs. These follow their mother's status. The slaves are chiefly Sudanese negroes. They are well treated and are practically members of the Tuareg family, but the Tuareg never intermarry with them. The Tuareg weapons are a straight two-edged sword about 4 ft. long, a dagger bound to the left forearm by a leather ring, and a slender iron lance some 9 ft. long barbed for about a foot. On his right arm the Tuareg warrior wears a heavy stone to give increased weight to his lance and sword-play or to parry blows. Muskets are common, no noble or freedman being without one. Besides this the Tuareg carry leathern shields. In hunting, wooden missiles like boomerangs are used. Among the low-caste hill tribes of Hoggar bows and arrows are the only weapons.

Little is known of the history of the Tuareg. The name is that given them by the Arabs. They are the descendants of those Berbers who were driven into the desert by the great Arab invasion of North Africa in the 11th century. Ibn Khaldūn in the 14th century locates them to the south and west of Tunisia. They were constantly at war with the Arabs on the north, and the Negro peoples of the Sudan on the south. For their relations with the French, with whom they came into contact after the conquest of Algeria, see SAHARA.

AUTHORITIES.—H. Duveyrier, *Les Touaregs du Nord* (Paris, 1864); Lieut. Hourst, *The Exploration of the Niger* (Eng. trans., London, 1898), pp. 199–249; W. J. Harding King, *A Search for the Masked Tuaregs* (London, 1903); M. Benhazera, *Six Mois chez les Touareg du Ahaggar* (Algiers, 1908); Lieut. C. Jean, *Les Touareg du sud-est: l'Aïr, leur rôle dans la politique saharienne* (Paris, 1909); E. Doutté, *Magie et religion dans l'Afrique du nord* (Algiers, 1909); "Essai de transcription méthodique des noms de lieux touareg" in *Bull. soc. géog. d'Alger* (1908).

TUAT, a Berber word [1] sometimes applied generally to all the oases in the western part of the Algerian Sahara, *i.e.* between 2° W. and 2½° E. 26° and 30° N., sometimes restricted to a particular group which borders the east side of Wad Mzaud between 26⅛° and 27½° N. According to the first usage Tuat includes the oases of Gurara in the north and Tidikelt in the south with the important centre of Insalah. The three groups are spoken of collectively by the French as the Tuat archipelago. The district is comparatively fertile, being formed of recent alluvium extending along the base of the Tademait plateau (Cretaceous), and produces dates and some cereals and vegetables. The wadi Saura (known in its lower course as the Messaud), formed by the junction of the wadis Zusfana and Ghir, marks the north-western boundary of the oases. After the winter rains in the Atlas it carries a considerable body of water in its upper course, but lower down its channel is choked by sand. Works were undertaken (1909) by the French to keep open the channel as it passes Tuat proper. At Gurara water is obtained from springs brought to the surface by the outcrop of impervious Devonian rocks. There is an extensive *sebkha* or salt lake at Gurara. The oases support a comparatively large population. The separate *ksurs* or hamlets, of which the district is said to contain over 300, are in Tuat proper placed close together. The political centre of Tuat is the oasis of Timmi, which has some forty ksurs. All the ksurs are strongly fortified, the walls of the citadels being of immense thickness. The whole region has been formed into an administrative unit known as *territoire des oasis sahariennes,* and comprising a native commune subdivided into the annexes of Tuat, Gurara and Tidikelt. In 1906 the commune had a population of 134 Europeans and 49,873[2] natives, of whom 112 enjoyed municipal rights. There were four places with over 2000 inhabitants: Adrar (Timmi), 2686, and Zaniet-Kunta, 3090, in Tuat; Insalah, 2837, in Tidikelt; and Timimun, 2330, in Gurara. Nine other places had between 1000 and 2000 inhabitants. By race (excluding the troops) there were 19,654 Arabs, 5470 Berbers, 4374 negroes, 191 Jews (professing Islam) and 19,412 persons of mixed blood. The district is of importance as commanding the routes southwards to Timbuktu from both Morocco and Algeria, and it is thus a great centre of trade. The oases appear to have been inhabited from a very early period. According to tradition numbers of Jews migrated thither in the 2nd century A.D. They were the predominant element in the oases when the conquests of Sidi Okba drove the Zenata south (7th century). These Berbers occupied Tuat and, to a large extent, absorbed the Jewish population. The Arabs took possession of the oases in the 10th century and imposed Islam upon the people. Thereafter the region was governed by Zenata Berbers or by Arab chieftains. In the 14th century the sultan of Morocco occupied the oases, which remained in political dependence upon Morocco. In the 17th century, however, the sovereignty of the sultan had become almost nominal and this state of quasi-independence continued. The treaty of 1845 between Morocco and France left the question of the possession of Tuat, Gurara and Tidikelt unsettled. After the murder in 1881 of the members of the Flatters mission—a French expedition sent into the Sahara—a measure concerted at Insalah, several of the Tuat headmen sought Moroccan protection, fearing the vengeance of France. A chief calling himself the Moroccan pasha established himself at Timmi, but Morocco took no active step to assert her sovereignty. In 1899 a French scientific mission, under Colonel Flamand, was despatched to the oasis of Tidikelt. The French were attacked by the natives (Dec. 28, 1899), whom they defeated, and the next day Insalah was occupied. This was the beginning of a serious campaign in which the French suffered severe losses, but by March 1901 the whole of the fortified places in the three oases had been captured. To cut off the oases from Morocco the town of Igli, 140 m. north-west of Gurara, was also annexed by the French (April 5, 1900). Igli (pop. 1057 in 1906) occupies an important position, being placed at the junction of the wadi Zusfana and the wadi Ghir. The French were not, however, left in peaceable possession of their newly acquired territory. Attacks by the nomad tribes, Moroccan and others, were made on the line of communications, and during 1903 the French troops suffered serious losses. To punish the tribes the town of Figig was bombarded by the French (June 8, 1903). On the 2nd of September following a band of nomads attacked, at a place called El Mungar, the escort of a convoy going to Taghit. After maintaining the fight 7½ hours the French were reinforced and their enemies drew off. Out of 115 combatants the French lost 38 killed and 47 wounded.

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[1] The etymology of the word is doubtful; it is used in the sense of an inhabited district—hence an oasis.

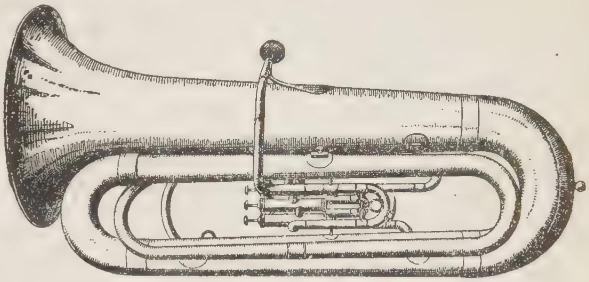
[2] By a clerical error the native population in the census returns is given as 60,497.

To consolidate their position the French authorities determined to connect the oases with the Algerian Sahara proper by carriage roads and railways. One road goes north-east to El Golea, 150 m. distant from Insalah; another north from Igli to a post called Beni Ounif, 2½ m. south of Figig, to which point the railway from Ain Sefra, in the Oranese Sahara, was carried in 1903. The continuation of this railway to Igli was begun in the following year.

Major A. G. Laing visited the Tuat territory in 1825 on his way to Timbuktu, but his papers were lost. The next European to visit Tuat was Gerhard Rohlfs, who described his explorations and investigations in *Tagebuch seiner Reise durch Marokko nach Tuat, 1864* (Gotha, 1865) and *Reise durch Marokko . . . Exploration der Oasen von Tafilet, Tuat und Tidikelt* . . . (Bremen, 1868). A. G. P. Martin's *Les Oasis sahariennes* (Algiers, 1908) gives an account of the history and economic condition of the oases. Consult also Commandant E. Laquière, *Les Reconnaissances du Général Servière dans les oasis sahariennes* (Paris, 1902), a valuable monograph by an officer who took part in the operations in 1900–1901; E. F. Gautier, *Sahara algérien* (Paris, 1908), and various contributions by G. B. M. Flamand in *La Géographie* and *Annales géographiques* for 1900, *Comptes rendus* (1902), *Bull. géog. hist. et descriptive* (1903), &c. (F. R. C.)

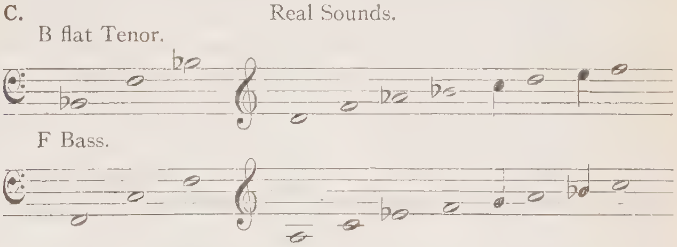
TUBA, in music. The tubas—bombardon, helicon, euphonium (Fr. *tuba, sax-tuba, bombardon*; Ger. *Tuben, Tenor-bass, Bombardon, Kontrabasstuba, Helikon*; Ital. *basstuba, bombardone*)—are a family of valved instruments of powerful tone forming the tenor and bass of the brass wind. In the orchestra these instruments are called tubas; in military bands euphonium (tenor), bombardon and helicon (bass).

The modern tubas owe their existence to the invention of valves or pistons (Ger. *Ventile*) by two Prussians, Stölzel and Blümel, in 1815. The tubas are often confounded with the baritone and bass of the saxhorns, being like them the outcome of the application of valves to the bugle family. There is, however, a radical difference in construction between the two types: given the same length of tubing, the fundamental octave of the tubas is an octave lower than that of the saxhorns, the quality of tone being besides immeasurably superior. This difference is entirely due to the proportions of the truncated cone of the bore and consequently of the column of air within. By increasing the calibre of the bore in proportion to the length of the tube it was found that the fundamental note or first sound of the harmonic series was easily obtained in a full rich quality, and by means of the valves, with this one note as a basis, a valuable pedal octave is obtained, absent in the saxhorns. Prussia has not adopted these modifications; the bass tubas with large calibre, which have long been introduced into the military bands of other countries and retained in that country, are founded on the original model invented in 1835 by Wieprecht and Moritz, a specimen of which is preserved in the museum of the Brussels Conservatoire. The name "bass tuba" was bestowed by Wieprecht upon his newly invented bass with valves, which had the narrow bore afterwards adopted by Sax for the saxhorns. The evolution of the modern tubas took place between 1835 and 1854 (see VALVES).



BB♭ Bombardon or Contrabass Tuba (Besson).

The instruments termed Wagner tubas are not included among the foregoing. The Wagner tubas are really horns designed for Wagner in order to provide for the *Nibelungen Ring* a complete quartet having the horn timbre. The tenor tuba corresponds to the tenor horn, which it outwardly resembles, having its tube bent in rectangular outline and being played by means of a funnel-shaped mouthpiece. The bore of the Wagner tenor and tenor-bass tubas, in B♭ and F, is slightly larger than in the horn, but much smaller than in the real tubas. The bell, funnel-shaped as in the German tubas, is held to the right of the performer, the valves being fingered by the left hand. There are four valves, lowering the pitch respectively 1 tone, ½ tone, 1½ tone, 2 tones (or 2½ tones). The harmonic series is the same for both instruments, the notation being as for the horn in C.



N.B.—The black notes are difficult to obtain strictly in tune as open notes.

By means of the valves the compass is extended downwards an octave for each instrument. The timbre of the tenor tuba is only slightly more metallic and less noble than that of the French horn with valves. Many motives in the *Ring* are given out by the quartet of horns and Wagner tubas.

The modern tuba finds its prototype as well as the origin of the name in the Roman tuba (the Greek *salpinx*), definite information concerning which is given by Vegetius.[1] Compared with the other military service instruments of the Romans, the *buccina* and *cornu*, the tuba was straight and was used to sound the charge and retreat, and to encourage and lead the soldiers during action; it was sounded at the changing of the guard, as the signal to begin and leave off work, &c. The tuba is represented, together with the buccina and cornu, on Trajan's column in the scenes described by Vegetius.

During the middle ages the tuba was as great a favourite as the busine (see BUCCINA and TRUMPET), from which it may readily be distinguished by its marked conical bore and absence of bell. It is recorded that King Frederick Barbarossa gave an order on the 14th of January 1240 in Arezzo for four tubas of silver and for slaves to be taught to play upon them.[2] During the middle ages the Latin word *tuba* is variously translated, and seems to have puzzled the compilers of vocabularies, who often render it by *trumba* (Fr. *trompe*). (K. S.)

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[1] *De re militari*, iii. 5 and ii. 7.

[2] Dr Alwin Schultz, *Hofisches Leben*, i. 560, note 3.

TUBE (Lat. *tuba*), a pipe or hollow cylinder. Tubes play an important part in engineering and other works for the conveyance of liquids or gases, and are made of diverse materials and dimensions according to the purpose for which they are intended, metal pipes being of the greatest consequence. According to the process of manufacture metal tubes may be divided into seamed and seamless. One of the earliest uses of seamed wrought-iron tubes was for gun-barrels, and formerly these were made by taking a strip of wrought iron, bending it so that the edges overlapped and then welding by hammering, with or without the aid of grooved swages. The development of gas lighting increased the demand for tubes, and in 1824 James Russell introduced the butt-welded tube, in which the edges of the skelp are not made to overlap, but are brought into closest possible contact and the welding is effected in a double swage, having corresponding grooves of the diameter of the tube required; this method required no mandrel as did those previously in use. The following year saw another improvement in making these pipes, when Cornelius Whitehouse effected a butt weld by drawing the bent skelp through a die. Stronger tubes are obtained by using grooved rollers instead of a die, the skelp being mounted on a mandrel. This is the method commonly adopted at the present day for making this class of tube. Seamed tubes, especially of copper and brass, are made by brazing or soldering the edges of the skelp. Another method is to bend the edges so that they interlock, the contact being perfected by rolling. Seamless tubes, which are stronger than those just described, are made by drawing a bloom of the metal perforated by an axial hole or provided with a core of some refractory material, or, in certain cases, by forcing the plastic metal by hydraulic pressure through an appropriate die. The seamless steel tube industry is now of great dimensions owing to the development of steam engineering. Another type of seamless tube is the cast-iron tube, usually of large diameter and employed for gas and water mains; these pipes are made by casting.

TUBERCULOSIS. The word "tuberculosis," as now used, signifies invasion of the body by the tubercle bacillus, and is applied generally to all morbid conditions set up by the presence of the active parasite. The name is derived from the "tubercles" or "little lumps" which are formed in tissues invaded by the bacillus; these were observed and described long before their real nature or causation was known. (For an account of the organism, which was discovered by Koch in 1882, see PARASITIC DISEASES.) The bacillus attacks every organ and tissue of the body, but some much more frequently than others. The commonest seats of tuberculous disease are the lungs, lymphatic glands, bones, serous membranes, mucous membranes, intestines and liver. Before the discovery of the bacillus its effects in different parts of the body received separate names and were classified as distinct diseases. For instance, tuberculosis of the lung was called "consumption" or "phthisis," of the bones and lymphatic glands "struma" or "scrofula," of the skin "lupus," or the intestinal glands "tabes mesenterica." Some of these names are still retained for convenience, but the diseases indicated by them are known to be really forms of tuberculosis. On the other hand, there are "tubercles" which are not caused by the tubercle bacillus, but by some other source of irritation, including various parasitic organisms, some of which closely resemble the tubercle bacillus. To these forms of disease, which are not as yet well understood, the term pseudo-tuberculosis has been given. Lastly, the word "tubercular" is still sometimes applied to mere lumpy eruptions of the skin, which have no connexion with tuberculosis or pseudo-tuberculosis.

Pathology.—The effects of tuberculosis on the structures attacked vary greatly, but the characteristic feature of the disease is a breaking-down and destruction of tissue. Hence the word "phthisis," which means "wasting away" or "decay," and was used by Hippocrates, accurately describes the morbid process in tuberculosis generally, as well as the constitutional effect on the patient in consumption. According to the most recent views, the presence and multiplication of the bacilli excite by irritation the growth of epithelioid cells from the normal fixed cells of the tissue affected, and so form the tubercle, which at first consists of a collection of these morbidly grown cells. In a typical tubercle there is usually a very large or "giant" cell in the centre, surrounded by smaller epithelioid cells, and outside these again a zone of leucocytes. The bacilli are scattered among the cells. In the earliest stages the tubercle is microscopic, but as several of them are formed close together they become visible to the naked eye and constitute the condition known as miliary tubercle, from their supposed resemblance to millet seeds. In the next stage the cells forming the tubercle undergo the degenerative change known as "caseation," which merely means that they assume in the mass an appearance something like cheese. In point of fact, they die. This degeneration is believed to be directly caused by a toxin produced by the bacilli. The further progress of the disease varies greatly, probably in accordance with the resisting power of the individual. In proportion as resistance is small and progress rapid the cheesy tubercles tend to soften and break down, forming abscesses that burst when superficial and leave ulcers, which in turn coalesce, causing extensive destruction of tissue. In proportion as progress is slow the breaking-down and destructive process is replaced by one in which the formation of fibrous tissue is the chief feature. It may be regarded as Nature's method of defence and repair. In tuberculosis of the lungs, for instance, we have at one end of the scale acute phthisis or "galloping consumption," in which a large part or even the whole of a lung is a mass of caseous tubercle, or is honeycombed with large ragged cavities formed by the rapid destruction of lung tissue. At the other end we have patches or knots of fibrous tissue wholly replacing the original tubercles or enclosing what remains of them. Such old encapsuled tubercles may undergo calcareous degeneration. Between these extremes come conditions which partake of the nature of both in all degrees, and exhibit a mixture of the destructive and the healing processes in the shape of cavities surrounded by fibrous tissue. Such intermediate conditions are far more common than either extreme; they occur in ordinary chronic phthisis. The term "fibroid phthisis" is applied to cases in which the process is very chronic but extensive, so that considerable cavities are formed with much fibrous tissue, the contraction of which draws in and flattens the chest-wall. Tuberculosis commonly attacks one organ or part more than another, but it may take the form of an acute general fever, resembling typhoid in its clinical features. "Acute miliary tuberculosis" is a term generally used to indicate disseminated infection of some particular organ—usually the lungs or one of the serous membranes—in which the disease is so severe and rapid that the tubercles have not time to get beyond the miliary state before death occurs. Tuberculosis is exceedingly apt to spread from its original seat and to invade other organs. The confusing multiplicity of terms used in connexion with this disease is due to its innumerable variations, and to attempts to classify diseases according to their symptoms or anatomical appearances. Now that the cause is known, and it has become clear that different forms of disease are caused by variations in extent, acuteness and seat of attack, the whole subject has become greatly simplified, and many old terms might be dropped with advantage.

Tuberculosis in the Lower Animals.—Most creatures, including worms and fishes, are experimentally susceptible to tuberculosis, and some contract it spontaneously. It may be called a disease of civilization. Domesticated animals are more susceptible than wild ones, and the latter are more liable in captivity than in the natural state. Captive monkeys, for instance, commonly die of it, and of birds the most susceptible are farmyard fowls, but it is practically unknown in animals in the wild state. In cattle coming chiefly from the plains (*United States Bureau of Animal Industry Reports*, 1900–1905) the number found diseased was only 0·134% in 28,000,000. Of the domesticated animals, horses and sheep are least, and cattle most, affected; pigs, dogs and cats occupy an intermediate position.

The percentage of tuberculous animals recorded at the slaughter-houses of Berlin in 1892–1893 was as follows: Cows and oxen, 15·1; swine, 1·55; calves, 0·11; sheep, 0·004. Similar records at Copenhagen in 1890–1893 give the following result: Cows and oxen, 17·7; swine, 15·3; calves, 0·2; sheep, 0·0003. The order of the animals is the same, and it is confirmed by other slaughter-house statistics; but the discrepancies between the figures indicate considerable variation in frequency, and only allow general conclusions to be drawn. A striking fact is the comparatively small amount of tubercle in calves. It shows, as Nocard has pointed out, that heredity cannot play an important part in the transmission of bovine tuberculosis. The infrequency of the disease in sheep is attributed to the open-air life they lead, and no doubt that is an important factor. The more animals and persons are herded together and breathe the same air in a confined and covered space, the more prevalent is tuberculosis among them. Stefansky found the disease in 5% of the rats caught in Odessa, and Lydia Rabinowitch obtained similar results in rats caught in Berlin. But there are evidently degrees of natural resistance also. Horses are more confined than cattle in the United Kingdom, yet they are far less affected; and on the other hand, cattle running free in the purest air may take the infection from others. Professor McEacharn of Montreal states that he has seen tuberculosis prevalent in ranch cattle, few of which were ever under a roof, ranging on the foothills of the Rocky Mountains in Montana. In cows and monkeys the lungs are chiefly affected; in horses and pigs the intestine and abdominal organs.

The relation between human and animal tuberculosis has been much debated. The bacillus in man very closely resembles that found in other mammalia, and they were considered identical until Koch threw doubt on this view at the British Congress on Tuberculosis in 1901. The British government thereupon appointed a royal commission to inquire into the relations of human and animal tuberculosis. The second interim report of the commission was issued in 1907, and the conclusions arrived at in it are: "That there seems to be no valid reason for doubting the opinion, never seriously doubted before 1901, that human and bovine bacilli belong to the same family. On this view the answer to the question, Can the bovine bacillus affect man? is obviously in the affirmative. The same answer must also be given to those who hold the theory that human and bovine tubercle bacilli are different in kind, since the 'bovine kind' are readily to be found as the causal agents of many fatal cases of human tuberculosis." The commission also found that there is an essential unity not only in the nature of the morbid processes induced by human and bovine tubercle bacilli, but also in the morphological characteristics exhibited by the tubercle bacilli which cause these processes. The conclusions of the members of the Paris Congress on Tuberculosis, held in 1905, are: "That human tuberculosis can be transferred to the bovine animal, and that what is termed the bacillus of bovine origin can be discovered in the human subject, and that there is a possibility that they may be varieties of one species."

Distribution and Mortality.

The distribution of tuberculosis is universal, and it is coincident with the existence of the human race in the habitable regions of the globe. Its comparative absence in the Arctic regions seems more due to the sparsity of population than to climatic effect. Indeed, it has been shown that climate has much less effect in its prevalence than has been formerly thought to be the case, the conclusion of Hirsch being that "the mean level of the temperature has no significance for the frequency or rarity of phthisis in any locality." The nature of the occupations and the density of population in any given area tend to its increase or otherwise, and the comparative immunity enjoyed by uncivilized races is due to their open-air life and to the sanitary advantages derived from the comparatively frequent changes of the sites of their camps and villages. Segregation of these races in fixed areas has shown an increased incidence of tuberculosis, and when living under civilized conditions they fail to exhibit any natural immunity. Altitude has an apparent influence on the frequency of phthisis, the rarity of the disease at high altitudes in Switzerland having been demonstrated, and a like protective influence is enjoyed by certain elevated districts in Mexico, notwithstanding the insanitary conditions of the towns thereon. The protection afforded by the altitude is alleged to be due to the dryness of the atmosphere, its freedom from impurities and the increased solar radiation. While no race is exempt from tuberculosis, certain races afford a greater case incidence. E. Baldwin states that the mortality from consumption in recently immigrated races in the United States is much greater than in those of longer residence. It was found that among those whose mothers were of foreign birth the rate was—in Russians 71·8, Germans 167, Scottish 172·5, French 187·7 and Irish 339·6, while in native-born Americans it was 112·8. The well-known susceptibility of the Irish has been attributed to the moisture of the climate, under-feeding, and the residual inferiority of a population drained by the emigration of a large number of able-bodied adults. That there is some added factor is shown by the fact that the above mortality of 339 in those having Irish mothers, in 1901, was greater by 31% than that of the Irish in Ireland at the same period. The Jews are said to show a relative immunity, but the matter requires further investigation. The factor which seemingly has the most constant influence on the mortality from tuberculosis is density of population. A high rate of mortality occurs in connexion with overcrowding and bad ventilation in cities, and it is proved that the death-rate from this disease is considerably lower in the country than in the towns. In addition, when we consider that it does not occur in epidemics or at certain seasons, but is constantly active, it will easily be seen that no other disease is so destructive to the human race. At the Tuberculosis Congress, held in Paris in 1905, it was stated by Kayserling that one-third of all deaths and one-half the sickness amongst adults in Germany was due to tuberculosis.

In 1908 the mortality from all forms of tuberculosis in England and Wales was, according to the registrar-general's returns, 56,080, less by 3455 than the average of the previous five years, being equal to 10·8% of the mortality from all causes, while in Ireland in 1909 14% of the total mortality was assigned to it.

The following table gives the comparative mortality from pulmonary tuberculosis for certain fixed years together with the estimated population of certain selected countries:—

	Estimated Population in Years.			Mortality from Pulmonary Tuberculosis.		
	1892.	1900.	1907.	1892.	1900.	1907.
England and Wales	29,760,842	32,249,187	34,945,600	43,323	42,987	39,839
Ireland	4,633,808	4,468,501	4,377,064	10,048	10,076	8,828
German Empire . .	47,125,446	52,624,706	61,994,743	113,720	108,827	97,555
France	38,360,000	38,900,000	39,222,000	31,080	34,357	40,304
Norway	2,010,000	2,211,300	2,305,700	3,358	4,249	4,656
Italy	30,665,662	32,346,366	33,776,087	39,715*	41,733*	41,968*
Holland	4,645,660	5,159,347	5,709,755	8,906	8,451	7,403
Belgium	6,195,355	6,693,548	7,317,561	10,491	9,117	7,377
Switzerland . . .	3,002,263	3,299,939	3,525,290	5,785	6,692	6,063

* In Italy the mortality given is for all forms of tuberculosis.

We thus see there is a general tendency to decrease in the death-rate, with the possible exception of France and Norway. In England the decrease has been most marked, having fallen from 3457 per million living in 1851–1860, or 15·6% of all deaths, to 1583 per million living, or a mortality of 10·8% of the death-rate from all causes for all ages and sexes.

Death-rate of Tuberculosis per million living in England and Wales.

	1860.	1870.	1880.	1890.	1900.	1908.
Males	3300	3300	2900	2700	2200	1800
Females	3300	3000	2500	2100	1600	1350
Both Sexes . . .	3300	3150	2700	2400	1900	1583

In English counties containing populations of 100,000 or over the highest rates were—in 1908—London, 1806; Lancashire, 1848; Northumberland, 1947; Carnarvonshire, 2025; and Carmarthenshire, 2328 per million living. Of the fifteen counties in England and Wales with the highest tuberculosis mortalities, no fewer than seven are Welsh. Cardiganshire, with 2270 for both sexes, has a rate nearly double that of England.

According to the United States census of 1900, the death-rate from tuberculosis in the area chosen for registration which embraced ten registration states, namely, Connecticut, Maine, District of Columbia, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island and Vermont, and 153 registration cities outside these states, was:—

	Number of Deaths from Tuberculosis.	Death-rate per 100,000.
1890	48,236	245·4
1900	54,898	190·5

The returns of the mortality statistics of the United States for the year 1908 cover an area of 17 states, the district of Columbia and 74 registration cities, representing an aggregate population of 45,028,767, or 51·8 % of the total estimated population of the United States.

Mortality from Tuberculosis in the United States in given areas.

Annual Average, 1901–1905.	Tuberculosis (all forms), 62,835.	Pulmonary Phthisis, 55,251.	Number Tuberculosis (all forms) per 100,000 of the population, 193·2.
1904	66,797	58,763	201·6
1905	65,352	56,770	193·6
1906	75,512	65,341	184·2
1907	176,650	66,374	183·6
1908	78,289	67,376	173·9

In the United States tuberculosis of the lungs forms from 86 to 87 % of all cases. The death-rate, as we see, is steadily decreasing. It is, however, difficult to estimate the ravages of the disease in that country owing to the fact that rather less than half the United States is still unprovided with an adequate system of registration.

The following was the death-rate from tuberculosis (all forms) per 100,000 of the population of the chief cities of the United States during 1908:—

New Orleans	298·3
Sacramento, California	294·3
Washington	264·0
Baltimore	249·9
Jersey City	241·1
New York	234·4
Philadelphia	234·1
Saratoga Springs, New York	232·2
Indianapolis	222·6
Boston, Massachusetts	219·1
St Louis	188·3
Chicago	180·7
Kansas City	172·9
Cleveland, Ohio	142·4
Pittsburg, Pennsylvania	139·2
Detroit	122·5
St Paul, Minnesota	111·8

The returns in the United States show a high rate of mortality from tuberculosis amongst the coloured population, the negro being particularly susceptible to pulmonary phthisis; the death-rate from this cause is nearly double that amongst whites.

Age and Sex.—The most complete information under this heading is derived from the English records. "In both sexes," says Dr Tatham, "the real liability to phthisis begins somewhere between the fifteenth and the twentieth year. Among males it attains its maximum at age 45–55, when it reaches 3173 per million living. Among females it attains its maximum (2096) at age 35-45. In both sexes the rate rapidly declines after the attainment of its maximum. Practically the incidence of pulmonary phthisis is upon the ages from 15 to 75 years, very old people and young children being comparatively exempt. According to recent experience, females seem to be rather *less liable* than males to death by phthisis at ages under 5 years, *more liable* at the age of 5–20, and again *less liable* at subsequent ages." These observations, it must be noted, refer only to consumption. The comparative immunity of the very young does not extend to all forms of tuberculous disease. On the contrary, tuberculosis of the bowels and mesenteric glands (tabes mesenterica), tuberculous peritonitis and tuberculous meningitis are pre-eminently diseases of childhood. The tables at foot of page show in detail the relative incidence of pulmonary phthisis at different ages, and the steady diminution of the disease in England and Wales since 1850.

Occupation has a marked influence on the prevalence of pulmonary tuberculosis. The comparative mortality figures for various occupations are taken from the supplement to the registrar-general's 65th annual Report, and show the incidence of pulmonary phthisis, agriculturists being taken at 100 for purposes of comparison.

Occupied Males: England and Wales.

Highest.		*Lowest.*	
Tin miner	816	Coal miner	89
Copper miner	574	Chemical manufacturer	98
Scissors maker	533	Carpenter, joiner	150
File maker	387	Artist	156
General shopkeeper	387	Blacksmith	158
Brush maker	325	Worsted manufacturer	159
Furrier	316	Baker	165
Printer	300	Bricklayer	194
Chimney sweep	284	Cotton manufacturer	197
Hatter	280	Tailor	248

The high incidence in the first group will be seen chiefly to affect those occupations where there is dust (scissors and file makers and furriers). The high mortality amongst general shopkeepers can only be ascribed to continuous indoor occupation. Coal miners enjoy an unexplained immunity.

Dr Von Körösy has tabulated the result of seventeen years' observation in Budapest, which is an excessively tuberculous town. His figures include both males and females above fifteen years of age, and extend to 106,944 deaths. The field of observation is evidently very different from those which furnished the statistics already given. His results are: (1) *Males*—printers 606, butlers 520, shoemakers 494, dyers 493, millers 492, joiners 485, tinkers and locksmiths 484, masons 467, labourers 433, tailors 418, bakers 398, drivers 370, servants 360, carpenters 339, officials 336, butchers 333, innkeepers 272, merchants 253, lawyers 205, physicians 118, capitalists 106; (2) *Females*—servants 353, day labourers (? char-women) 333, washerwomen 314, gardeners 269, capitalists 42. The inmates of lunatic asylums, who are classed among **the**

England and Wales

Tuberculous Phthisis.—Mortality in several Periods, 1851–1899. Annual Rate per Million Living.

Males.

Period.	Ages.										
	All Ages.	Under 5 Years.	5—	10—	15—	20—	25—	35—	45—	55—	65—
1851–1860	2579	1329	525	763	2399	4052	4031	4004	3830	3231	2389
1861–1870	2467	990	431	605	2190	3883	4094	4166	3861	3297	2024
1871–1880	2209	783	340	481	1675	3092	3699	4120	3860	3195	1924
1881–1885	1927	584	274	372	1381	2467	3246	3726	3567	2937	1800
1886–1890	1781	521	234	318	1212	2222	2842	3436	3446	2904	1845
1891–1895	1634	467	197	260	1075	2026	2548	3268	3205	2686	1572
1896–1899	1521	403	140	195	908	1841	2341	3110	3173	2627	1530
1900–1904	1479	366	149	182	799	1643	2147	2811	3130	2560	1309
1903–1907	1385	359	138	163	743	1472	2022	2573	2945	2498	1316
1908	1310	205	134	161	676	1858	2114	1964	2000	1830	1061

Females.

Period.	Ages.										
	All Ages.	Under 5 Years.	5—	10—	15—	20—	25—	35—	45—	55—	65—
1851–1860	2774	1281	620	1293	3516	4288	4575	4178	3121	2383	1635
1861–1870	2483	947	477	1045	3112	3967	4378	3900	2850	2065	1239
1871–1880	2028	750	375	846	2397	3140	3543	3401	2464	1777	1093
1881–1885	1738	553	350	749	2006	2596	3070	2927	2197	1541	995
1886–1890	1497	483	307	658	1626	2075	2552	2563	1936	1490	966
1891–1895	1303	421	260	561	1428	1740	2155	2305	1742	1294	800
1896–1899	1141	334	201	410	1165	1547	1862	2096	1597	1242	787
1900–1904	1042	316	203	417	1002	1274	1593	1807	1481	1136	670
1903–1907	975	308	194	391	959	1194	1488	1643	1382	1075	666
1908	931	229	192	441	1270	1438	1761	1407	1156	945	654

"unoccupied," suffer excessively from tubercle. According to Dr Mott, pathologist to the London County Council, tuberculous lesions are found in more than one-third of the bodies of inmates examined post mortem. The majority contract the disease in the asylums.

Heredity.

Medical opinion has undergone a great change with regard to the influence of heredity. The frequent occurrence of consumption among members of the same family used to be explained by assuming the existence of a tuberculous "diathesis" or inherent liability to consumption which "ran in families" and was handed down from one generation to another. As the real nature of the disease was not understood, the inherited diathesis was regarded as a sort of latent or potential consumption which might develop at any time and could hardly be avoided. The children of consumptive parents had the "seeds" of the disease in them, and were thought to be doomed with more or less certainty. Great importance was therefore attached to heredity as a factor in the incidence of tuberculosis. The discovery that it is caused by a specific parasitic infection placed the question in a different light, and led to a more careful examination of the facts, which has resulted in a general and increasing tendency to minimize or deny the influence of heredity. At the Berlin Congress on Tuberculosis in 1899 Virchow pronounced his disbelief in the theory on pathological grounds. "I dispute this heredity absolutely," he said. "For a course of years I have been pointing out that if we examine the bodies of infants newly born, who have had no life apart from the mother, we find no tuberculosis in them. I am convinced that what looked like tuberculosis in the newly born was none of it tuberculosis. In my opinion there is no authenticated case of tubercle having been found in a dissected newly-born infant." Observations on animals similarly tend to disprove the existence of congenital tuberculosis (Nocard). The theory that the germs may remain latent in the offspring of tuberculous parents (Baumgarten) is unsupported by evidence. The occurrence of disease in such offspring is ascribed to infection by the parents, and this view is confirmed by the fact that the incidence in consumptive families is greater on female children, who are more constantly exposed to home infection, than on the male (Squire). The statistical evidence, so far as it goes, points in the same direction. It is even denied that the children of consumptives are specially predisposed.

Density of Population and Overcrowding.

Recognition of the communicability of tuberculosis has directed attention to the influence of conditions in which people live massed together in close proximity. The prevalence of the disease in large centres of population has already been noted, and the influence of aggregation is no doubt considerable; but it does not always hold good. The distribution in England and Wales does not correspond with density of population, and some purely rural districts have a very high mortality. Broadly, however, the rural counties have a low mortality, and those containing large urban populations a high one. In France in the department of the Oise, in purely industrial villages, the mortality from pulmonary phthisis is from 56 to 61 per 10,000; in a village in which part of the population worked in the fields and part in factories the mortality was 46 per 10,000; and in purely agricultural villages it ranged from 0 to 10 per 10,000.

The following table is taken from the Supplement to the Registrar-General's 65th Report for England and Wales:—

	All occupied Males.		Occupied Males (London).		Occupied Males (industrial districts).		Occupied Males (agricultural districts).	
	1900–1902.	1890–1892.	1900–1902.	1890–1892.	1900–1902.	1890–1892.	1900–1902.	1890–1892.
All Causes	100	119	119	143	121	156	72	86
Tuberculous Phthisis.	100	122	156	183	115	147	71	90

It will be noted that the rate in the agricultural districts is low compared to the industrial districts or purely urban district chosen. There is obviously a close relation between density of population and the prevalence of phthisis. Comparing phthisis with other diseases in relation to overcrowding, the same authority found that "while associated with overcrowding is a tendency of the population to die from disease generally, this tendency is especially manifested in the case of phthisis, and is not manifested in the case of every disease."

Other Conditions.—Poverty, insufficient food and insanitary dwellings are always more or less associated with overcrowding, and it is difficult to distinguish the relative influence of these factors. An analysis of 553 deaths in Edinburgh according to rentals in 1899 gave these results: under £10, 230; from £10 to £20, 190; above £20, 106 (Littlejohn); but the corresponding population is not stated. An investigation of selected houses in Manchester gave some interesting results (Coates). The houses were divided into three classes: (1) infected and dirty; (2) infected but clean; (3) dirty but not infected; infected meaning occupied by a tuberculous person. Dust was taken from all parts of the rooms and submitted to bacteriological tests. The conclusions may be summarized thus: The effects of overcrowding were not apparent; a large cubic space was found to be of little avail if the ventilation was bad; the beneficial effects of light and fresh air were markedly shown even in the dirtiest houses; ordinary cleanliness was found not sufficient to prevent accumulation of infectious material in rooms occupied by a consumptive; no tuberculous dust was found in dirty houses in which there was no consumption. The upshot is to emphasize the importance of light and air, and to minimize that of mere dirt. This is quite in keeping with earlier investigations, and particularly those of Dr Tatham on back-to-back houses. Darkness and stuffiness are the friends of the tubercle bacillus.

So much has the question of cleanliness, and of housing in a sanitary district, to do with the prevalence of the disease, that the following table taken from the Report of the Registrar-General for Ireland for the year 1909 shows the marked class incidence in all forms of tuberculosis.

Distribution of Tuberculosis Mortality by Classes in Ireland, 1909.

	All forms of Tuberculosis.	Pulmonary Phthisis.	Other forms of Tuberculosis.
Professional and independent class	1·41	0·64	0·77
Middle class, civil service and smaller officials	1·82	1·30	0·52
Large traders, business managers	1·59	1·04	0·55
Clerks	2·92	2·33	0·59
Householders in 2nd-class localities	2·52	1·85	0·67
Artisans	2·94	2·23	0·71
Petty shopkeepers and other traders	3·85	3·00	0·85
Domestic servants	1·31	1·04	0·27
Coach and car drivers, and vanmen	4·24	3·06	1·18
Hawkers, porters and labourers	4·83	2·88	1·95

In relation to the last two classes the effect of exposure and also of alcoholic excess must be added to overcrowding and privation. The low rate noticeable for domestic servants must be ascribed to the better food and housing they enjoy while in situations. In Hamburg the mortality was 10·7 per 10,000 in those whose income rose above 3500 marks, 39·3 where the income was 900 to 1200 marks, and 60 per 10,000 where the income fell below that figure.

It is now generally accepted that tubercle bacilli may enter the body by various paths. At the International Congress on Tuberculosis held in Vienna in 1907 Weichselbaum summarized the channels of infection in pulmonary tuberculosis as follows: (1) By inhalation directly into the bronchioles and pulmonary alveoli, or by way of the bronchial glands through the blood and lymph channels into the lung. (2) Through the mucous membrane of the nose, mouth or tonsils into the neighbouring lymphatic glands, and thence through the blood or lymph into the lungs. (3) By ingestion of tubercle bacilli into the lower part of the gastro-intestinal tract in the food; thence the bacilli may pass through the lining membrane, infect the neighbouring glands and pass by the blood or lymph stream to the lungs. (4) By penetration of other mucous membranes (such as the conjunctival or urogenital) or through the skin. (5) Possible, though very rare, placental infection.

Path of Infection.

Tubercle bacilli may not produce any anatomical lesion at the point of entrance, or they may remain latent for a very long time; and it has been experimentally proved that they may pass through mucous membranes and leave no trace of their progress. As reported to the Royal Commission, the introduction of bacilli into the alimentary canal is not necessarily followed by the development of tuberculosis. The writings of Von Behring have led to renewed attention being paid to intestinal infection, particularly through the milk supply. Von Behring suggests that the bacillus itself may become modified in the human body.

Prevention.

Measures for the prevention of tuberculosis may be divided into two classes: (1) general; (2) special. Great attention has been paid to the latter since the infectious nature of the disease was established. The former include all means by which the conditions of life are improved among the mass of the people. The most important of these are probably housing and food supply. The reduction of the disease recorded in England is attributed to the great changes which have gradually taken place in such conditions since, say, 1850. Wages have been raised, food cheapened, housing improved, protection afforded in dangerous trades, air spaces provided, locomotion increased, the ground and the atmosphere have been cleaned and dried by sanitary means. In addition to these general measures is the provision of consumption hospitals, which act by segregating a certain amount of disease. Yet all these things, beneficial as they may be, do not wholly account for the reduction, for, if the records can be trusted, it was in progress before they had made any way or had even been begun. This observation, coupled with the apparently general tendency to diminution among civilized races, suggests the operation of some larger agency. The theory of acquired resistance, which has been already mentioned, would explain the diminution; and it is also in keeping with other facts, such as the great susceptibility of savage races, which have not been long exposed to tuberculosis, and the results of laboratory experiments in artificial immunity. The point is of great importance, and deserves careful attention; for if the theory be correct, the special measures for preventing tuberculosis, which are occupying so much attention, may eventually have unexpected results. Their general aim is the avoidance of infection, and they include (1) the provision of special institutions—hospitals, sanatoria and dispensaries; (2) the prevention of spitting; (3) the notification of consumption; (4) the administrative control of tuberculosis in animals; (5) the dissemination of popular knowledge concerning the nature of the disease.

The greatest stress is laid upon the prevention of spitting, because the germs are contained in the sputum of consumptive persons, and are scattered broadcast by expectoration. The sputum quickly dries, and the bacilli are blown about with the dust. There is no question that infection is so conveyed. The Manchester scientific experiments, mentioned above, are only one series out of many which prove the infectivity of dust in the proximity of consumptive persons, and they are confirmed by actual experience. Several cases are recorded of healthy persons having contracted the disease after occupying rooms in which consumptive persons had previously lived. It is a legitimate inference that spitting in public is an important means of disseminating tuberculosis, though it may be noticed that international prevalence by no means corresponds with this disgusting practice, which is a perfect curse in Great Britain, and far more common both there and in the United States than on the continent of Europe. Prohibition of spitting under a statutory penalty is attended with certain difficulties, as it is obviously impossible to make any distinction between tuberculous and other persons; but it has been applied in New York and elsewhere in America, and some local authorities in Great Britain have adopted by-laws to check the practice. Another means of controlling dangerous sputa is more practicable, and probably more effective, namely, the use of pocket spittoons by consumptive persons. Convenient patterns are available, and their use should always be insisted on, both in public and in private. The most effective way of destroying the sputa is by burning. For this purpose spittoons of papier mâché and of turf have been successfully used in the Vienna hospitals (Schrötter). When glass spittoons are used the contents can be sterilized by disinfectants and passed down the drain.

Notification is of great service as an aid to practical measures of prevention. It has been applied to that purpose with good results in several cities and states in America, and in some towns in Great Britain. New York has made the most systematic use of it. Voluntary notification was adopted there in 1894, and in 1897 it was made compulsory. The measures linked with it are the sanitary supervision of infected houses, the education of the people and the provision of hospitals. In England, Manchester has led the way. Voluntary notification was adopted there in 1899: it was at first limited to public institutions, but in 1900 private practitioners were invited to notify their cases, and they heartily responded. In Sheffield notification was made compulsory by a local act in 1904 for a limited period, and was found so valuable that the period was extended in 1910. The objects aimed at are to visit homes and instruct the household, to arrange and provide disinfection, to obtain information bearing on the modes of infection, to secure bacteriological examination of sputum, and to collect information to serve as a basis of hospital provision. Disinfection is carried out by stripping off paper, previously soaked with a solution of chlorinated lime ($1\frac{1}{2}$ oz. to the gallon), and washing the bare walls, ceiling, floor and everything washable with the same solution. This is found effective even in very dirty houses. In clean ones, where the patients have not been in the habit of spitting about the rooms, it is sufficient to rub the walls with bread-crumb and wash the rest with soap and water. Clothing, bedding, &c., are disinfected by steam. The advantages of these sanitary measures are obvious. Notification is no less important as a step towards the most advantageous use of hospitals and sanatoria by enabling a proper selection of patients to be made. It is compulsory throughout Norway, and is being adopted elsewhere, chiefly in the voluntary form. In 1908 the Prevention of Tuberculosis (Ireland) Act was passed, which conferred on local authorities the right to make notification compulsory in their districts, and provided that certain sections of the Public Health (Ireland) Act 1878 and the Infectious Diseases Prevention Act 1890 should apply to tuberculosis. By this act also the county councils were enabled to establish hospitals and dispensaries for the treatment of tuberculosis and were empowered to borrow money or levy a poor rate for the erection of sanatoria for the treatment of persons from their respective counties suffering from the disease.

The prevalence of tuberculosis in cattle is of importance from the point of view of prevention of the probability that abdominal tuberculosis, which is a very fatal form of the disease in young children, and has not diminished in prevalence like other forms, is caused by the ingestion of tuberculous milk. Whether it be so or not, it is obviously desirable that both meat and milk should not be tuberculous, if it can be prevented without undue interference with commercial interests. Preventive measures may be divided into two classes. They may deal merely with the sale of meat and milk, or they may aim at the suppression of bovine tuberculosis altogether. The former is a comparatively easy matter, and may be summed up in the words "efficient inspection." The latter is probably impracticable. If practicable, it would be excessively costly, for in many herds one half the animals or even more are believed to be tuberculous, though not necessarily the sources of tuberculous food. Unless the danger is proved to be very much greater than there is any reason to suppose, "stamping out" may be put aside. Efficient inspection involves the administrative control of slaughter-houses, cowsheds and dairies. The powers and regulations under this head vary much in different countries; but it would be useless to discuss them at length until the scientific question is settled, for if the reality of the danger remains doubtful, oppressive restrictions, such as the compulsory slaughter of tuberculous cows, will not have the support of public opinion. Whatever measures may be taken for the public protection, individuals can readily protect themselves from the most serious danger by boiling milk; and unless the source is beyond suspicion, parents are recommended, in the present state of knowledge, so to treat the milk given to young children.

A great deal has been done in most countries for the dissemination of popular knowledge by forming societies, holding conferences and meetings, issuing cheap literature, and so forth. It is an important item in the general campaign against tuberculosis, because popular intelligence and support are the most powerful levers for setting all other forces in motion. In Ireland, where an attempt had been made to deal with the question by arousing the interest of all classes, tuberculosis exhibitions have been held in nearly every county, together with lectures and demonstrations organized by the Women's National Health Association; and an organized attempt was made in the autumn of 1910 in England, by a great educational campaign, to compel the public to realize the nature of the disease and the proper precautions against it.

Diagnosis and Treatment.

The improved outlook in regard to the arrest or so-called "cure" of tuberculosis is mainly derived from the improved methods of diagnosis, thus enabling treatment to be undertaken at an earlier and therefore more favourable stage of the disease. The physical signs in early stages of the lung affection are often vague and inconclusive. A means of diagnosis has therefore been sought in the use of tuberculin. The methods are three: (1) The subcutaneous injection method of Koch; (2) the cutaneous method of Von Pirquet; (3) the conjunctival method of Wolff-Eisner and Calmette. The first method depended on the reaction occurring after an injection of "old tuberculin." It is unsuitable in febrile conditions, and has now been relegated to the treatment of cattle, where it has proved invaluable. In Von Pirquet's method a drop of old tuberculin diluted with sodium chloride is placed on a spot which has been locally scarified. The presence of tuberculosis is demonstrated by a local reaction in which a hyperaemic papule forms, surrounded by a bright red zone. Reaction occurs in tuberculosis of the bones of joints and skin. Von Pirquet in 1000 cases obtained a reaction in 88% of the tuberculous, and 10% of those clinically non-tuberculous. In the latter there may have been latent cases of tuberculosis. In the conjunctival or opthalmo-reaction of Calmette and Wolff-Eisner the instillation of a drop of a dilute solution of tuberculin into the conjunctiva is followed in the tuberculous subject by conjunctivitis. The reaction generally appears in from 3 to 12 hours, but may be delayed to 48. In a series of cases observed by Audeoud a positive reaction was obtained in 95% of 261 obviously tuberculous cases and in 8·3 % of 303 cases which presented no clinical symptoms. Very advanced cases fail to react to any of these tests, as do general miliary tuberculosis and tuberculous meningitis. As well as the three methods mentioned above the occurrence of a "negative phase" in the phagocytic power of the leucocytes following an injection of Koch's tuberculin T.R. may be said to be diagnostic of tuberculosis. Another valuable aid in diagnosis is that of the X-rays. By their help a pulmonary lesion may be demonstrated long before the physical signs can be obtained by ordinary examination.

To discuss at all fully the treatment of the various forms of tuberculosis or even of consumption alone would be quite beyond the scope of this article. It must suffice to mention the more recent points. The open-air treatment of consumption has naturally attracted much attention. Neither the curability of this disease nor the advantages of fresh air are new things. Nature's method of spontaneous healing, explained above, has long been recognized and understood. There are, indeed, few diseases involving definite lesions which exhibit a more marked tendency to spontaneous arrest. Every case, except the most acute, bears signs of Nature's effort in this direction; and complete success is not at all uncommon, even under the ordinary conditions of life. Perhaps it was not always so: the ominous character popularly attributed to consumption may once have been justified, and the power of resistance, as we see it now, may be the result of acquired immunity or of the gradual elimination of the susceptible. However this may be, the natural tendency to cure is undoubtedly much assisted by the modern system of treatment, which makes pure air its first consideration. The principle was known to Sydenham, who observed the benefit derived by consumptives from horse exercise in the open air; and about 1830 George Boddington proposed the regular treatment of patients on the lines now generally recognized. The method has been most systematically developed in Germany by the provision of special sanatoria, where patients can virtually live in the open air. The example has been followed in other countries to a certain extent, and a good many of these establishments have been provided in Great Britain and elsewhere; but they are, for the most part, of a private character for the reception of paying patients. Germany has extended these advantages to the working classes on a large scale. This has been accomplished by the united efforts of friendly and philanthropic societies, local authorities, and the state; but the most striking feature is the part played by the state insurance institutes, which are the outcome of the acts of 1889 and 1899, providing for the compulsory insurance of workpeople against sickness and old age. The sanatoria have been erected as a matter of business, in order to keep insured members off the pension list, and they are supported by the sick clubs affiliated to the institutes. They number forty-five, and can give three months' treatment to 20,000 patients in the year. The clinical and economic results are said to be very encouraging. In about 70% of the cases the disease has been so far arrested as to enable the patients to return to work.

In England, where more than 14 millions of the population belong to friendly societies, it is estimated that the sick pay of consumptive members costs three times as much as the average sick pay to members dying of other causes. An effort has been made by the National Association for the Establishment and Maintenance of Sanatoria for Workers Suffering from Tuberculosis to establish such sanatoria, together with training for suitable work during convalescence, the gradual resumption of wage-earning being resumed while in touch with the medical authorities.

The important features of the sanatorium treatment are life in the open air, independently of weather, in a healthy situation, rest and abundance of food. The last has been carried to rather extravagant lengths in some institutions, where the patients are stuffed with food whether they want it or not. The sanatorium movement on the German model is rapidly extending in all countries. For those who are able to do so advantage may be taken of the combined sanatorium and sun treatment. In certain high altitudes in Switzerland, which are favoured by a large amount of sunshine and a small percentage of moisture, much benefit has been derived from the exposure of the unclothed body to the sun's rays. The power of the sun in high altitudes is so great that the treatment can be continued even when the snow is on the ground. Not only is the sun-treatment applicable to pulmonary tuberculosis, but also to the tuberculosis of joints, even in advanced cases. The treatment has to a great extent replaced surgical procedure in tuberculosis of joints, but it requires to be persevered in over a considerable period of time. It should be remembered that the benefits of fresh air are not confined to sanatoria. If the superstitious dread of the outer air, particularly at night, could be abolished in ordinary life, more would be done for public health than by the most costly devices for eluding microbes. Not only consumption, but the other respiratory diseases, which are equally destructive, are chiefly fomented by the universal practice of breathing vitiated air in stuffy and overheated rooms. The cases most suitable for the treatment are those in an early stage. Other special institutions for dealing with consumption are hospitals, in which England is far in advance of other countries, and dispensaries; the latter find much favour in France and Belgium.

In Great Britain the pioneer work as regards the establishment of tuberculosis dispensaries was the establishment of the Victoria Dispensary for Consumption in Edinburgh in 1887, where the procedure is similar to that in Dr Calmette's dispensaries in France. In connexion with the dispensary home visits are made, patients suitable to sanatoria selected, advanced cases drafted to hospitals, bacteriological examinations made, cases notified under the voluntary system, and the families of patients instructed. There is an urgent need for the multiplication of such dispensaries throughout the United Kingdom. The recent act providing for the medical inspection of schools has done much to sort out cases of tuberculosis occurring in children, and to provide them with suitable treatment and prevent them from becoming foci for the dissemination of the disease. In Germany special open-air schools, termed forest-schools, are provided for children suffering from the disease, and an effort is being made in England to provide similar schools.

Of specific remedies it must suffice to say that a great many substances have been tried, chiefly by injection and inhalation, and good results have been claimed for some of them. The most noteworthy is the treatment by tuberculin, first introduced by Koch in 1890, which, having sunk into use as a diagnostic reagent for cattle, received a new lease of life owing to the valuable work done by Sir Almroth Wright on opsonins. The tuberculins most in use are Koch's "old" tuberculin T.O., consisting of a glycerin broth culture of the tubercle bacilli, and Koch's T.R. tuberculin, consisting of a saline solution of the triturated dead tubercle bacilli which has been centrifuged. This latter is much in use, the dosage being carefully checked by the estimation of the tuberculo-opsonic index. The injections are usually unsuitable to very advanced cases. Marmorek's serum, the serum of horses into which the filtered young cultures of tubercle bacilli have been injected, and in which a tuberculo-toxin has been set free, has proved very successful. Behring's Tulase is a tuberculin preparation formed by a process of treating tubercle bacilli with chloral, and Béreneck's tuberculin consists of a filtered bouillon culture treated with orthophosphoric acid. The variety of cases to which these treatments are suitable can only be estimated from a careful consideration of each on its own merits.

In the treatment of tuberculous lesions, the surgeon also plays his part. Tuberculosis is specially prone to attack the spongy bone-tissue, joints, skin (*lupus*) and lymphatic glands—especially those of the neck. Recognizing the infective nature of the disease, and knowing that from one focus the germs may be taken by the blood-stream to other parts of the body, and so cause a general tuberculosis, the surgeon is anxious, by removing the primary lesion, to cut short the disease and promote immediate and permanent convalescence. Thus, in the early stage of tuberculous disease of the glands of the neck, for instance, these measures may render excellent service, but when the disease has got a firm hold, nothing short of removal of the glands by surgical operation is likely to be of any avail. The results of this modern treatment of tuberculous disease of the skin and of the lymphatic glands has been highly gratifying, for not only has the infected tissue been completely removed, but the resulting scars have been far less noticeable than they would have been had less radical measures been employed. One rarely sees now a network of scars down the neck of a child, showing how a chain of tuberculous glands had been allowed to work out their own cure. A few years ago, however, such conditions were by no means unusual.

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TUBEROSE. The cultivated tuberose (*Polianthes tuberosa*) is a plant allied to the Mexican agaves, and is a native of the same country. The tuberous root-stock sends up a stem 3 ft. in height, with numerous lanceolate leaves and terminal racemes of waxy white funnel-shaped very fragrant flowers. Each flower is about 1½ in. long, with a long tube and a six-parted limb. The stamens are six in number, emerging from the upper part of the tube, and bear linear anthers. The ovary is three-celled, and the ovoid fruit is crowned by the persistent flower. The plant is largely grown in the United States and at the Cape of Good Hope for export to England, as it is found that imported bulbs succeed better than those grown in the United Kingdom. The double-flowered form is that principally grown. Cultivated plants require a rich soil, considerable heat, and, at first, abundance of water.

TÜBINGEN, a town of Germany, in the kingdom of Württemberg, picturesquely situated on the hilly and well-wooded banks of the Neckar, at its junction with the Ammer and Steinlach, 22 m. south of Stuttgart by road and 43 m. by rail. Pop. (1905), 16,809. The older town is irregularly built and unattractive, but the newer suburbs are handsome. The most conspicuous building is the old ducal castle of Hohentübingen, built in 1507–1535 on a hill overlooking the town, and now containing the university library of 460,000 volumes, the observatory, the chemical laboratory, &c. Among the other chief buildings are the quaint old *Stiftskirche* (1469–1483), a Gothic building containing the tombs of the rulers of Württemberg, the new *aula* and numerous institutes of the university, all of which are modern, and the town-hall dating from 1435 and restored in 1872. The university possesses a very important library. A monument was erected in 1873 to the poet Johann Ludwig Uhland (1787–1862), who was born and is buried here, and another, in 1881, to the poet Johann Christian Friedrich Hölderlin (1770–1843). Tübingen's chief claim to attention lies in its famous university, founded in 1477 by Duke Eberhard of Württemberg. Melanchthon was a lecturer here (1512–1518). The university adopted the reformed faith in 1534, and in 1537 a Protestant theological seminary, a residential college—the so-called Stift—was incorporated with it. In 1817 a Roman Catholic theological faculty was added, with a seminary called the *Konvikt*, and there are now also faculties of law, medicine, philosophy, political economy and natural science. The leading faculty has long been that of theology, and an advanced school of theological criticism, the founder and chief light of which was F. C. Baur, is known as the Tübingen school. The university was attended in 1908 by 1891 students and had a teaching staff of over 100. The commercial and manufacturing industries of the town are slight. Printing, book-selling, the manufacture of surgical and scientific instruments, chemicals, gloves and vinegar, and the cultivation of hops, fruit and vines are among the leading occupations of the inhabitants. The country in the neighbourhood of Tübingen is very attractive; one of the most interesting points is the former Cistercian monastery of Bebenhausen, founded in 1185, and now a royal hunting-château.

Tübingen is mentioned as a strong fortress in 1078, and was ruled from 1148 by counts palatine. In 1342 it was purchased by the count of Württemberg, whose descendants afterwards acquired the title of duke. The treaty of Tübingen is the name given in German history to an arrangement made in 1514 between Duke Ulrich and his subjects, by which the latter acquired various rights and privileges on condition of relieving the former of his debts. The town was captured by the Swabian League in 1519, by Turenne in 1647, and again in 1688 by the French, who destroyed the walls.

See Eifert, *Geschichte und Beschreibung der Stadt und Universität Tübingen* (Tübingen, 1849); Maier, *Die Musenstadt Tübingen* (Tübingen, 1904); *Tübingen und seine Umgebung* (Tübingen, 1887–1889).

TUBUAI, or AUSTRAL ISLANDS, an archipelago in the south Pacific Ocean, between 21° 49′ and 27° 41′ S., 144° 22′ and 154° 51′ W., to the south of the Society Islands, with a total land area of 110 sq. m., belonging to France. They form a curved broken chain from north-west to south-east which includes four principal islands: Tubuai (area 40 sq. m.), Vavitao or Ravaivai, Rurutu or Oheteroa, Rapa or Oparo, and Rimitara, with Maretiri or the Bass Islands, and other islets. Tubuai, Vavitao and Rapa are volcanic and reach considerable elevations (2100 ft. in Rapa). The islands are well watered and fertile, producing coco-nut palms, arrowroot and bananas; but they lie too far south for the bread fruit to flourish. The natives belong to the Polynesian race; they were once much more numerous than now, the present population not exceeding 2000. A Tahitian dialect is spoken in the western islands; in Rapa, however, which with the Bass Islands lies detached from the rest, to the south, the language is akin to that of the Rarotongans in the Cook Islands. There are remarkable ancient stone platforms and walls, massively built, on the summits of some of the peaks in Rapa; they resemble the terraces in Easter Island (Rapanui), which is believed to have been peopled from Rapa. The scattered islands of the Tubuai archipelago were discovered at different times. Captain Cook visited Rurutu in 1769 and Tubuai in 1777; Rapa was discovered by George Vancouver in 1791, Vavitao perhaps in 1772 by the Spaniards who attempted to colonize Tahiti, and certainly by Captain Broughton in 1791. The islands never attracted much attention from Europeans, and the French protection and subsequent annexation were carried out spasmodically between the middle of the 19th century and 1889.

TUCKER, ABRAHAM (1705–1774), English moralist, was born in London, of a Somerset family, on the 2nd of September 1705, son of a wealthy city merchant. His parents dying during his infancy, he was brought up by his uncle, Sir Isaac Tillard. In 1721 he entered Merton College, Oxford, as a gentleman commoner, and studied philosophy, mathematics, French, Italian and music. He afterwards studied law at the Inner Temple, but was never called to the bar. In 1727 he bought Betchworth Castle, near Dorking, where he passed the remainder of his life. He took no part in politics, and wrote a pamphlet, "The Country Gentleman's Advice to his Son on the Subject of Party Clubs" (1755), cautioning young men against its snares. In 1736 Tucker married Dorothy, the daughter of Edward Barker of East Betchworth, cursitor baron of the exchequer. On her death in 1754, he occupied himself in collecting together all the letters that had passed between them, which, we are told, he transcribed twice over under the title of "The Picture of Artless Love." From this time onward he occupied himself with the composition of his chief work, *The Light of Nature Pursued*, of which in 1763 he published a specimen under the title of "Free Will." The strictures of a critic in the *Monthly Review* of July 1763 drew from him a pamphlet called *Man in Quest of Himself, by Cuthbert Comment* (reprinted in Parr's *Metaphysical Tracts*, 1837), "a defence of the individuality of the human mind or self." In 1765 the first four volumes of his work were published under the pseudonym "Edward Search." The remaining three volumes appeared posthumously. His eyesight failed him completely in 1771, but he contrived an ingenious apparatus which enabled him to write so legibly that the result could easily be transcribed by his daughter. In this way he completed the later volumes, which were ready for publication when he died on the 20th of November 1774.

His work embraces in its scope many psychological and more strictly metaphysical discussions, but it is chiefly in connexion with ethics that Tucker's speculations are remembered. In some important points he anticipates the utilitarianism afterwards systematized by Paley, who expresses in the amplest terms his obligations to his predecessor. "Every man's own satisfaction" Tucker holds to be the ultimate end of action; and satisfaction or pleasure is one and the same in kind, however much it may vary in degree. This universal motive is further connected, as by Paley, through the will of God, with the "general good, the root where out all our rules of conduct and sentiments of honour are to branch."

The *Light of Nature* was republished with a biographical sketch by Tucker's grandson, Sir H. P. St John Mildmay (1905), 7 vols. (other editions 1834, 1836, &c.), and an abridged edition by W. Hazlitt appeared in 1807. See James Mackintosh, *Dissertation on the Progress of Ethical Philosophy* (Edinburgh, 1832); and specially Sir Leslie Stephen, *English Thought in the 18th Century*, iii. 119–130.

TUCKER, CHARLOTTE MARIA (1821–1893), English author, who wrote under the pseudonym "A.L.O.E." (a Lady of England), was born near Barnet, Middlesex, on the 8th of May 1821, the daughter of Henry St George Tucker (1771–1851), a distinguished official of the East India Company. From 1852 till her death she wrote many stories for children, most of them allegories with an obvious moral, and devoted the proceeds to charity. In 1875 she left England for India to engage in missionary work, and died at Amritsar on the 2nd of December 1893.

TUCKER, JOSIAH (1712–1799), English economist and divine, the son of a small Welsh farmer, was born at Laugharne, Carmarthenshire, in 1712. He was educated at St John's College, Oxford, and became successively a curate and rector in Bristol. This led him to take considerable interest in politics and trade, and during the greater portion of a long life he poured out a succession of pamphlets on these matters. He was appointed dean of Gloucester in 1758. He died on the 4th of November 1799, and was buried in Gloucester Cathedral. His *Important Questions on Commerce* (1755) was translated into French by Turgot.

TUCSON (possibly from Piman *styuk-son*, "dark or brown spring," pronounced *Tooson*), a city and the county-seat of Pima county, Arizona, U.S.A., on the Santa Cruz river, in the S.E. part of the state, about 130 m. S.E. of Phoenix. Pop. (1880), 7007; (1890), 5150; (1900), 7531 (2352 foreign-born, chiefly from Mexico); (1910), 13,193. It is served by the Southern Pacific and the Twin Buttes railways, the latter connecting with the mines of the Twin Buttes district, about 27 m. south by east, and with the Randolph lines in Mexico. The city lies about 2360 ft. above the sea in a broad valley sheltered by mountains 5000–9000 ft. high. Its climate, characteristic of southern Arizona, attracts many invalids and winter visitors. Tucson is the seat of the university of Arizona (1891; non-sectarian, coeducational), which is organized under the Morrill Acts; in 1909 it had 40 instructors and 201 students. At Tucson also are a desert botanical laboratory (owning a tract of some 1000 acres about 1 m. west of the city) established by the Carnegie Institution of Washington, St Joseph's Academy (Roman Catholic); a Roman Catholic cathedral; the Tucson Mission (Presbyterian), a boarding school for Indians, the San Xavier Mission for Indians (Roman Catholic) and a Carnegie library. In 1900 Tucson became the see of a Roman Catholic bishop. The surrounding country is arid and unproductive except where irrigated; but the soil is very rich, and Tucson is the centre of one of the oldest farming and ranching districts of the state. The Southern Pacific railway has division headquarters and repair shops here.

Tucson is first heard of in history in 1699, conjecturally, as an Indian rancheria or settlement; and in 1763 certainly as a *visita*, in that year temporarily abandoned, of the Jesuit mission of San Xavier del Bac, founded between 1720 and 1732, 9 m. south of what is now Tucson; in 1776 it was made a presidio (San Augustin del Tugison), or military outpost, and although a few Spaniards may possibly have lived there before, the foundation of Tucson as a Spanish town dates from this time. It was never after abandoned during the Indian wars. In 1848 it had 760 inhabitants. The abandonment by the Mexicans in 1848 of the mission towns of Tamacacori (a *visita* of Guevavi, a mission founded in the first third of the 18th century) and the presidio at Tubac (established before 1752) increased its importance. Tucson lay within the territory acquired by the United States by the Gadsden Purchase in 1853; it was occupied by the United States in 1856. Fort Lowell, 7 m. north-east of the city, was built as a protection against the Apache Indians in 1873; it was abandoned in 1891. In the earlier days of Territorial history Tucson was the political centre of Arizona. Here were held in August 1856 a convention that demanded a Territorial government from Congress, another in April 1860 that organized a provisional government independently of Congressional permission, and others in 1861 that attempted to cast in the lot of Arizona with the Confederate states. Tucson was occupied by the Confederates in February 1862 and by the Union forces in May. It was the Territorial capital from 1867 to 1877. Its prosperity fluctuated with the fortunes of the surrounding mining country. Tucson was incorporated as a town in 1877, and chartered as a city in 1883.

TUCUMAN, a northern province of Argentina, bounded N. by Salta, E. by Santiago del Estero, S. and W. by Catamarca. Area, 8926 sq. m. Pop. (1895), 215,742; (1904, estimated) 263,079. The Sierra de Aconquija is on the western frontier of the province and there is also broken country in the north, but in the east the country is flat, alluvial and very fertile. The only large river is the Salí, or Dulce, which receives a large number of small streams from the Sierra de Aconquija and flows through Santiago del Estero to the Porongos lagoons on the frontier of Cordoba. The exports are sugar, rum (*aguardiente*), timber, hides, leather, fruit and Tafi cheese made in an upland valley of the Aconquija.

TUCUMAN, or San Miguel de Tucuman, a city of Argentina, capital of the province of Tucuman, on the right bank of the Salí, or Dulce river, 780 m. by rail N.W. of Buenos Aires, in lat. 26° 50′ S., long. 64° 35′ W. Pop. (1895), 34,305; (1904, estimated) 55,000. The climate is warm and enervating, with no great seasonal variation during the year except in the rainfall, which falls almost wholly between September and April. The temperature averages about 67°, with a maximum of 104°. Malarial diseases, especially "chucho" (fever and ague), are common. Tucuman is laid out in regular squares, and still retains many of its old characteristics, low buildings enclosing large courts (*patios*), with large rooms, thick walls, and tile roofs. The more noteworthy edifices and institutions of Tucuman are the "matriz" church, Merced church, cabildo, national college, normal school, the Belgrano theatre, hospital, public library, courts of justice, post office, and sundry charitable institutions.

Tucuman was founded in 1565 by Diego Villaruel at the confluence of the Salí and Monteros rivers, but frequent inundations led to a removal to its present site in 1585. In 1680 it succeeded Santiago del Estero as the capital of the province of Tucuman, then under the government of the Spanish viceroy at Lima. The province of Tucuman then extended from Jujuy south to Cordoba. In 1776 the viceroyalty of La Plata was created and Tucuman was transferred to its jurisdiction. In 1816 a convention of delegates from the La Plata provinces met in Tucuman and signed (July 9th) an act of independence, which formally dissolved all ties with the mother country.

TUDELA, a town of northern Spain, in the province of Navarre, on the Saragossa-Logroño and Tudela-Tarazona railways, and on the right bank of the river Ebro, which is here joined by its tributary the Queiles. Pop. (1900), 9499. The Ebro is here crossed by a massive and ancient bridge of 19 arches. Most of the public buildings, such as the town-hall, bull-ring, hospitals and schools, are modern; but there is a Romanesque collegiate church, Santa Maria, which was founded in 1135 and consecrated in 1188. This church is one of the most perfect in northern Spain, the sculptured doorways and cloisters being especially fine. There are many sawmills in the town, and an active timber trade; the manufactures of cloth, linen, spirits, preserved fruit, pottery, &c., and the trade in grain, wine and oil are of less importance. Tudela, the Roman *Tutela*, was occupied by the Moors in the 8th century, and taken from them by Alphonso I. of Aragon in 1114. The town was an episcopal see from 1783 to 1851. In 1808 the Spanish forces under Generals Castaños and Palafox were twice defeated here by the French under Marshal Lannes.

TUDOR (Family). The house of Tudor, which gave five sovereigns to England, is derived by all the Welsh genealogists from Ednyfed Vychan of Tregarnedd in Anglesey, who is named in 1232 as steward of Llywelyn, prince of North Wales, and seven years later, as an arbitrator in a convention to which Davydd, the son of Llywelyn, was a party. His pedigree has been traced from Marchudd ap Cynan and beyond him, according to the veracious Lewys Dwnn, from Brutus, the great-grandson of Aeneas. Gronw, or Gronwy, one of his younger sons, had Trecastell for his portion. Tudor, son of Gronw, who lived to be called Tudor Hen or the old Tudor, founded the Carmelite friary in Bangor and was grandfather of Tudor Vychan ap Gronw of Trecastell, who is said to have assumed the style of a knight, and to have had that rank confirmed to him by Edward III.

This Tudor Vychan was the father of four sons, of whom the eldest, Gronw Vychan, was in favour with the Black Prince and with Richard II. He was forester of Snowdon and steward of the bishop of Bangor's lordship in Anglesey. He died in 1382, an infant son being heir to his lands in Penmynydd, whose sister carried them to her husband Gwylym ap Gmffydd of Penrhyn. Gronw Vychan, whom a bard calls "a pillar of the court: the ardent pursuer of France," was probably the warrior whose effigy remains in the church at Penmynydd.

Gronw's brothers Gwylym and Rhys served Richard II. as captains of archers. Their youngest brother, Meredydd ap Tudor, escheator of Anglesey in 1392 and, like Gronw, an officer of the household of the bishop of Bangor, is said to have slain a man and fled to the wild country about Snowdon. He was the father of Owen ap Meredydd, commonly called Owen Tudor, a squire who appears at the court of the infant king Henry VI. By all accounts he was a goodly young man: the chroniclers dwell upon the beauty which attracted the queen mother. She gave the handsome squire a post in her household. About 1428 or 1429, it must have been common knowledge that the presumptuous Welshman and the daughter of Charles VI. of France were living as man and wife. There is no direct evidence for their marriage. An act had but lately been passed for making it a grave offence to marry with the queen dowager without the royal consent: this act is said to have been afterwards cut out from the statute book. Richard III. denounced his rival Richmond as the son of a bastard, but it must be remembered that Richard was ready to foul the memory of his own mother in order to say the same of the young Edward V. But no one yet has found time or place of Owen Tudor's marriage with Catherine of France.

Five children were born to them, the sons being Edmund and Jasper and another son who became a monk. In 1436, a date which suggests that Bedford had been Owen's protector, the influence of Gloucester was uppermost. In that year the queen dowager was received within Bermondsey Abbey, where she died in the following January. Her children were taken from her, and Owen Tudor "the which dwelled with the said queen" was ordered to come into the king's presence. He had already seen the inside of Newgate gaol, and he would not obey without a safe conduct. When he had the safe conduct sent him he came up from Daventry and went at once to sanctuary at Westminster, whence even the temptations of the tavern would not draw him. Allowed to go back to Wales, he was retaken and lodged again in Newgate. He broke prison again, with his chaplain and his man, the sheriffs of London having a pardon in 1438 for the escape from gaol of "Owen ap Tuder, esquire," and he returned to his native Wales. When Henry VI. came of full age he made some provision for his step-father, who took the red rose and fought manfully for it. But Mortimer's Cross was his last battle (Feb. 4, 1460/1). He fell into the hands of the Yorkists, who beheaded him in Hereford market place and set up his head on the market cross. Thither, they say, came a mad woman who combed the hair and washed the face of this lover of a queen, setting lighted wax torches round about it.

His eldest son Edmund of Hadham, born about 1430 at Hadham in Herts, one of his mother's manors, was brought up with his brothers by the abbess of Barking until he was about ten years old. The king then took them into his charge. Edmund was a knight in 1449 and in 1453 he was summoned as earl of Richmond, his patent, dated the 6th of March 1452/3, giving him precedence next to the dukes. He was declared of legitimate birth, and in 1455 the royal favour found him a wife in the Lady Margaret, daughter of John Beaufort, duke of Somerset. But he died the next year, and his only child, afterwards Henry VII., was born on the 28th of January 1456/7, three months after his death.

Edmund's younger brother, Jasper Tudor, survived him many years. Jasper was knighted in 1449 and, about the date of Edmund's patent, was created earl of Pembroke. He bore the royal arms of France and England, differenced with a blue border charged with the royal martlets of the Confessor's fabulous shield, and the same was formerly to be seen upon his Garter stall-plate of 1459. He fought at St Albans in 1455 for the king who had advanced him, and two years later we find him strengthening the defences of Tenby. In 1460 he seized and took Denbigh, where the queen joined him after Northampton. He shared the defeat in 1461 at Mortimer's Cross, where his father the Welsh squire was taken and beheaded, and left the country in 1462. In 1465 he made a last descent upon Wales, to be driven off by William Herbert, who was rewarded with his earldom of Pembroke, already forfeited by attainder. But he was an obstinate and loyal partisan. He came back again with Warwick in 1470 and was hurrying to join the queen when Tewkesbury was fought and lost. After many adventures he carried off his young nephew Richmond to Brittany. The two came back together in 1485. After Bosworth, Jasper was created duke of Bedford and restored to his earldom, the earl-marshalship being given him in 1492. He lived to fight at Stoke in 1487 against Lincoln and Simnel his puppet and to be one of the leaders of the host that landed in France in 1492. He died in 1495 leaving no issue by his wife Catherine, the widow of the second duke of Buckingham and a daughter of Richard Widvile, Earl Rivers. But his bastard daughter Ellen is said to have been mother of Stephen Gardiner, bishop of Winchester. (O.BA.)

TUDOR FLOWER, or CRESTING, an architectural ornament much used in the Tudor period on the tops of the cornices of screen work, &c., instead of battlements. It consists generally of a flat, upright leaf standing on stems.

TUDOR PERIOD, in architecture, the later development of medieval architecture which followed the Perpendicular and, although superseded by the Elizabethan and the Renaissance styles, still retained its hold on English taste, portions of the additions to the various colleges of Oxford and Cambridge being still carried out in the Tudor style down to the middle of the 18th century. In church architecture the principal examples are Henry VII.'s Chapel at Westminster (1503), King's College Chapel, Cambridge, and St George's Chapel, Windsor; and the old schools at Oxford; and in domestic work, Eltham Palace, Kent; Oxburgh Hall, Norfolk; King's College, Aberdeen; Layer Marney Hall, Essex; the manor house at East Barsham, Norfolk; and Ford's Hospital, Coventry. It was a further debasement of the Perpendicular style, and the four-centred arch was its principal feature; some of the most remarkable examples of the bow-window belong to this period; the mouldings are more spread out and the foliage becomes more natural.

TUFF (Ital. *tufo*), a rock consisting of volcanic ashes, the ejectamenta of craters in a state of eruption. The products of a volcanic eruption may be classified into three groups: (*a*) steam and other gases, (*b*) lavas, (*c*) ashes. The ashes have not been burnt in any way though they resemble cinders in appearance: they are merely porous, slaggy pieces of lava which have been tossed into the air by outbursts of steam and have become vesicular by the expansion of the gases within them while they were still plastic.

Among the loose beds of ash which cover the slopes of many volcanoes, three classes of materials are represented. In addition to true ashes (*a*) of the kind above described, there are lumps of the old lavas and tuffs (*b*) forming the walls of the crater, &c., and which have been torn away by the violent outbursts of steam, pieces of sedimentary rocks (*c*) from the deeper parts of the volcano, which were dislodged by the rising lava, and are often intensely baked and recrystallized by the heat to which they have been subjected. In some great volcanic explosions nothing but materials of the second kind were emitted, as at Bandaisan in Japan in 1888. There have been many eruptions also at which the quantity of broken sedimentary rocks mingled with the ashes is very great; as instances we may cite the volcanoes of the Eifel and the Devonian tuffs, known as "Schalsteins," in Germany. In the Scotch coalfields some old volcanoes are plugged with masses consisting entirely of sedimentary débris: in such a case we must suppose that no lava was ejected, but the cause of the eruption was the sudden liberation and expansion of a large quantity of steam. These accessory or adventitious materials, however, as distinguished from the true ashes, tend to occur in angular fragments; and when they form a large part of the mass the rock is more properly a "volcanic breccia" than a tuff. The ashes vary in size from large blocks twenty feet or more in diameter to the minutest impalpable dust. The large masses are called "bombs"; they have mostly a rounded, elliptical or pear-shaped form, owing to rotation in the air while they were still viscous. Many of them have ribbed or nodular surfaces, and sometimes (at Volcano and Mont Pelé) they have a crust intersected by many cracks like the surface of a loaf of bread. Any ash in which they are very abundant is called an agglomerate (*q.v.*).

In those layers and beds of tuff which have been spread out over considerable tracts of country and which are most frequently encountered among the sedimentary rocks, smaller fragments preponderate greatly and bombs more than a few inches in diameter may be absent altogether. A tuff of recent origin is generally loose and incoherent, but the older tuffs have been, in most cases, cemented together by pressure and the action of infiltrating water, making rocks which, while not very hard, are strong enough to be extensively used for building purposes (*e.g.* in the neighbourhood of Rome). If they have accumulated subaerially, like the ash beds found on Etna or Vesuvius at the present day, tuffs consist almost wholly of volcanic materials of different degrees of fineness with pieces of wood and vegetable matter, land shells, &c. But many volcanoes stand near the sea, and the ashes cast out by them are mingled with the sediments that are gathering at the bottom of the waters. In this way ashy muds or sands or even in some cases ashy limestones are being formed. As a matter of fact most of the tuffs found in the older formations contain admixtures of clay, sand, and sometimes fossil shells, which prove that they were beds spread out under water.

During some volcanic eruptions a layer of ashes several feet in thickness is deposited over a considerable district, but such beds thin out rapidly as the distance from the crater increases, and ash deposits covering many square miles are usually very thin. The showers of ashes often follow one another after longer or shorter intervals, and hence thick masses of tuff, whether of subaerial or of marine origin, have mostly a stratified character. The coarsest materials or agglomerates show this least distinctly; in the fine beds it is often developed in great perfection.

Apart from adventitious material, such as fragments of the older rocks, pieces of trees, &c., the contents of an ash deposit may be described as consisting of more or less crystalline igneous rocks. If the lava within the crater has been at such a temperature that solidification has commenced, crystals are usually present. They may be of considerable size like the grey, rounded leucite crystals found on the sides of Vesuvius. Many of these are very perfect and rich in faces, because they grew in a medium which was liquid and not very viscous. Good crystals of augite and olivine are also to be obtained in the ash beds of Vesuvius and of many other volcanoes, ancient and modern. Blocks of these crystalline minerals (anorthite, olivine, augite and hornblende) are common objects in the tuffs of many of the West Indian volcanoes. Where crystals are very abundant the ashes are called "crystal tuffs." In St Vincent and Martinique in 1902 much of the dust was composed of minute crystals enclosed in thin films of glass, because the lava at the moment of eruption had very nearly solidified as a crystalline mass. Some basaltic volcanoes, on the other hand, have ejected great quantities of black glassy scoria which, after consolidation, weather to a red soft rock known as palagonite; tuffs of this kind occur in Iceland and Sicily. In the Lipari Islands and Hungary there are acid (rhyolitic) tuffs, of pale grey or yellow colour, largely composed of lumps and fragments of pumice. Over a large portion of the sea bottom the beds of fine mud contain small, water-worn, rounded pebbles of very spongy volcanic glass; these have been floated from the shore or cast out by submarine volcanoes, and may have travelled for hundreds of miles before sinking; it has been proved by experiment that some kinds of pumice will float on sea-water for more than a year. The deep sea-deposit known as the "red clay" is largely of volcanic origin and might be suitably described as a "submarine tuff-bed."

For petrographical purposes tuffs are generally classified according to the nature of the volcanic rock of which they consist; this is the same as the accompanying lavas if any of these were emitted during an eruption, and if there is a change in the kind of lava which is poured out, the tuffs also indicate this equally clearly. *Rhyolite tuffs* contain pumiceous, glassy fragments and small scoriae with quartz, alkali felspar, biotite, &c. In Iceland, Lipari, Hungary, Nevada, New Zealand, recent tuffs of this kind occur. The broken pumice is clear and isotropic, and when the particles are very small they have often crescentic, sickle-shaped, or biconcave outlines, showing that they are produced by the shattering of a vesicular glass; this is sometimes described as ash-structure. In the ancient rocks of Wales, Charnwood, the Pentland Hills, &c., similar tuffs are known, but in all cases they are greatly changed by silicification (which has filled them with opal, chalcedony and quartz) and by devitrification. The frequent presence of rounded corroded quartz crystals, such as occur in rhyolitic lavas, helps to demonstrate their real nature. *Trachyte tuffs* contain little or no quartz but much orthoclase and oligoclase felspar with often biotite, augite and hornblende. In weathering they often change to soft red or yellow "clay-stones," rich in kaolin with secondary quartz. Recent trachyte tuffs are found on the Rhine (at Siebengebirge), in Ischia, near Naples, Hungary, &c. *Andesitic tuffs* are exceedingly common. They occur along the whole chain of the Cordilleras and Andes, in the West Indies, New Zealand, Japan, &c. In the Lake district, North Wales, Lorne, the Pentland Hills, the Cheviots and many other districts of Britain, ancient rocks of exactly similar nature are abundant. In colour they are red or brown; their scoriae fragments are of all sizes from huge blocks down to minute granular dust. The cavities are filled up with many secondary minerals, such as calcite, chlorite, quartz, epidote, chalcedony: but in microscopic sections the nature of the original lava can nearly always be made out from the shapes and properties of the little crystals which occur in the decomposed glassy base. Even in the smallest details these ancient tuffs have a complete resemblance to the modern ash beds of Cotopaxi, Krakatoa and Mont Pelée. *Basaltic tuffs* are also of wide spread occurrence both in districts where volcanoes are now active and in lands where eruptions have long since ended. In the British Isles they are found in Skye, Mull, Antrim and other places, where there are Tertiary volcanic rocks; in Scotland, Derbyshire, Ireland among the carboniferous strata; and among the still older rocks of the lake district, southern uplands of Scotland and Wales. They are black, dark green or red in colour; vary greatly in coarseness, some being full of round spongy bombs a foot or more in diameter, and, being often submarine, may contain shale, sandstone, grit and other sedimentary material, and are occasionally fossiliferous. Recent basaltic tuffs are found in Iceland, the Faeroes, Jan Mayen, Sicily, Vesuvius, Sandwich Islands, Samoa, &c. When weathered they are filled with calcite, chlorite, serpentine and, especially where the lavas contain nepheline or leucite, are often rich in zeolites, such as analcite, prehnite, natrolite, scolecite, chabazite, heulandite, &c. *Ultra-basic* tuffs are by no means frequent; their characteristic is the abundance of olivine or serpentine and the scarcity or absence of felspar. In this class the peridotite, breccias or kimberlites of the diamond-fields of South Africa may perhaps be placed (see DIAMOND). The principal rock is a dark bluish green serpentine (blue-ground) which when thoroughly oxidized and weathered becomes a friable brown or yellow mass (the "yellow-ground"). Besides olivine and augite (chrome diopside) there occur crystals of hypersthene, brown mica, garnet (Cape ruby), magnetite, ilmenite and kyanite, together with crystalline blocks of garnet, augite and olivine (which some petrographers have called eclogites). Many lumps of shale are embedded in the breccia, and some have supposed that the diamonds are due to the ultra-basic magma dissolving carbon, which subsequently crystallized as the rock cooled down. Many of the crystals are broken, and as the rock fragments also are angular, rather than rounded, the kimberlite is more properly an ultra-basic breccia than a tuff.

In course of time other changes than weathering may overtake tuff deposits. Sometimes they are involved in folding and become sheared and cleaved. Many of the green slates of the lake district in Cumberland are fine cleaved ashes. In Charnwood forest also the tuffs are slaty and cleaved. The green colour is due to the large development of chlorite. Among the crystalline schists of many regions green beds or green schists occur, which consist of quartz, hornblende, chlorite or biotite, iron oxides, felspar, &c., and are probably recrystallized or metamorphosed tuffs. They often accompany masses of epidiorite and hornblende-schists which are the corresponding lavas and sills. Some chlorite-schists also are probably altered beds of volcanic tuff. The "Schalsteins" of Devon and Germany include many cleaved and partly recrystallized ash-beds, some of which still retain their fragmental structure though their lapilli are flattened and drawn out. Their steam cavities are usually filled with calcite, but sometimes with quartz. The more completely altered forms of these rocks are platy, green chloritic schists; in these, however, structures indicating their original volcanic nature only sparingly occur. These are intermediate stages between cleaved tuffs and crystalline schists.

Tuffs are not of much importance in an economic sense. The peperino, much used at Rome and Naples as a building stone, is a trachyte tuff. Puzzuolana also is a decomposed tuff, but of basic character, originally obtained near Naples and used as a cement, but this name is now applied to a number of substances not always of identical character. In the Eifel a trachytic, pumiceous tuff called trass (*q.v.*) has been extensively worked as a hydraulic mortar.

(J. S. F.)

TUGELA ("Startling"), a river of south-east Africa, the largest in Natal. It drains, with its tributaries, an area of about 8000 sq. m. The river valley is some 190 m. in length, the river, which has an exceedingly sinuous course is fully 300 m. long. It rises, at an altitude of nearly 11,000 ft. in the Drakensberg mountains on the eastern face of the Mont aux Sources, down which it leaps in a nearly perpendicular fall of 1800 ft.

The river, which starts its race to the ocean with a north-east course, soon bends more directly east, and, with many windings north and south, maintains this general direction across the tableland of north Natal until its junction with the Buffalo river, when it turns south. On its northern bank in its upper course are the heights of Spion Kop and Vaal Kranz, and on its southern bank, 56 m. east in a direct line from its source, is the village of Colenso, all three places being the scene of ineffectual attempts (Dec. 1899–Feb. 1900) by the British troops under General Sir Redvers Buller to dislodge the Boers who blocked the road to Ladysmith. Below Colenso are more waterfalls, and above the river is Pieter's Hill, the storming of which by the British, on the 27th of February 1900 at length led to the relief of Ladysmith. Six miles lower down the Tugela receives the Klip, which rises in the Drakensberg near Van Reenen's Pass and flows by Ladysmith. Another northern tributary is the Sunday's river, which rises in the Biggarsberg. From the south the river is increased by several affluents, the chief being the Mooi (Beautiful) river. The Tugela-Mooi confluence is 44 m. south-east of Colenso at the base of the Biggarsberg. Seven miles farther down the Tugela joins the Buffalo river, the united stream retaining, however, the name Tugela. The Buffalo has its origin in the Drakensberg near Majuba Hill and flows south with, also, a general trend to east. In its course, which is very winding, it receives numerous tributaries, one of them being the Ingogo, a small stream whose name recalls the fight on its banks on the 8th of February 1881, between British and Boers. The chief affluents are the Ingagani (from the south-west) and the Blood (from the north-east), the last-named so called after the defeat of the Zulu king Dingaan, on the 16th of December 1838, by the Boers under Andries Pretorius, when the river ran red with the blood of the Zulus. Eighteen miles in a direct line below the Blood confluence is Rorke's Drift, or ford across the river, and some 12 m. south-east of the drift is the hill of Isandhlwana, both places rendered famous in the Zulu War of 1878–79. The junction with the Tugela is 30 m. in a direct line, farther south, the Buffalo river in that distance passing through a wooded and hilly region.

Below the confluence of the two streams the Tugela flows south-east in a deep channel between lofty cliffs, or through wild, stone-strewn valleys until it reaches the narrow coast belt. Its mouth is nearly closed by a sand bar, formed by the action of the ocean. The Tugela is thus useless for navigation. About 6 m. above the mouth are two forts, Pearson and Tenedos, built by the British in 1879, during the war with the Zulus, to guard the passage of the river. Generally fordable in the winter months, the Tugela is, after the heavy rains of summer, a deep and rapid river. It is crossed, some 5 m. above the forts, by a railway bridge—the longest bridge in South Africa. From the junction of the Blood river with the Buffalo, that stream and subsequently the Tugela form the boundary between Natal and Zululand.

TUGGURT, a town in the Wadi Ghir, Algerian Sahara, 127 m. S. of Biskra. Tuggurt, which has a population (1906) of 2073, was formerly surrounded by a moat, which the French filled up. The town is entered by two gates. Just within the northern gate is the market place, which contains the chief mosque. The surrounding oasis is very fertile. It has about 9000 inhabitants and contains about 200,000 date palms. From Tuggurt a road 75 m. long leads across the desert north-east to El Wad (*q.v.*).

Some 12 m. south-west at the desert end of the Wadi Ghir is the oasis and town of Temacin (pop. 2120), one of the chief centres of the Mussulman fraternity of Tidianes.

TUG-OF-WAR, a contest between two teams composed of one or more persons, each team striving to pull the other in its own direction by means of a rope held by the hands alone. Some rules allow the "anchor-men," who hold the ends of the rope, to fasten it to their persons. A ribbon or handkerchief is tied round the middle of the rope, and others at a distance, usually, of one yard on each side of it. That team loses which allows itself to be pulled more than one yard from its original position. The British army teams are usually composed of ten men each, but the number varies in different parts of the world. The rules of the modern Olympic Games recognize teams of five. When a tug-of-war takes place out of doors the men, or at least the "anchors," are allowed to dig holes in the ground for their feet; when indoors cleats are bolted to the floor as braces.

TUGUEGARAO, a town and the capital of the province of Cagayan, Luzon, Philippine Islands, on the Grande de Cagayan River, about 60 m. from its mouth. Pop. (1903), 16,105. Many of Tuguegarao's buildings—government, religious, business and residential—are of stone or brick. There are a Dominican college for boys, a convent school for girls, and good public schools, including a high school. The river is navigable to Tuguegarao for vessels of light draught; the Cagayan Valley is the great tobacco-producing region of the Philippines; and Tuguegarao is an important shipping point for tobacco. Local business is largely in the hands of Chinese merchants; Spanish and German companies control the exportation of tobacco. The town was settled in 1774, and the old church and bell tower are still standing. The local dialects are Cagayan, and, of less importance, Ilocano and Tagalog.

TUKE, the name of an English family, several generations of which were celebrated for their efforts in the cause of philanthropy.

WILLIAM TUKE (1732–1822) was born at York on the 24th of March 1732. His name is connected with the humane treatment of the insane, for whose care he projected in 1792 the Retreat at York, which became famous as an institution in which a bold attempt was made to manage lunatics without the excessive restraints then regarded as essential. The asylum was entirely under the management of the Society of Friends. Its success led to more stringent legislation in the interests of the insane.

His son HENRY TUKE (1755–1814) co-operated with his father in the reforms at the York Retreat. He was the author of several moral and theological treatises which have been translated into German and French.

Henry's son SAMUEL TUKE (1784–1857), born at York on the 31st of July 1784, greatly advanced the cause of the amelioration of the condition of the insane, and devoted himself largely to the York Retreat, the methods of treatment pursued in which he made more widely known by his *Description of the Retreat near York*, &c. (York, 1813). He also published *Practical Hints on the Construction and Economy of Pauper Lunatic Asylums* (1815). He died at York on the 14th of October 1857.

Samuel's son JAMES HACK TUKE (1819–1896) was born at York on the 13th of September 1819. He was educated at the Friends' school there, and after working for a time in his father's wholesale tea business, became in 1852 a partner in the banking firm of Sharples and Co., and went to live at Hitchin in Hertfordshire. For eighteen years he was treasurer of the Friends' Foreign Mission Association, and for eight years chairman of the Friends' Central Education Board. But he is chiefly remembered for his philanthropic work in Ireland, which was in a great measure the result of a visit to Connaught in 1847, and of the scenes of distress which he there witnessed. In 1880, accompanied by W. E. Forster, he spent two months in the West of Ireland distributing relief which had been privately subscribed by Friends in England. Letters descriptive of the state of things he saw were published in *The Times*, and in his pamphlet, *Irish Distress and its Remedies* (1880), he pointed out that Irish distress was due to economic rather than political difficulties, and advocated state-aided land purchase, peasant proprietorship, light railways, government help for the fishing and local industries, and family emigration for the poorest peasants. From 1882 to 1884 he worked continuously in Ireland superintending the emigration of poor families to the United States and the Colonies. The failure of the potato crop in Ireland in 1885 again called forth Tuke's energy, and on the invitation of the government, aided by public subscription, he purchased and distributed seed potatoes in order to avert a famine. To his reports of this distribution and his letters to *The Times*, which were reprinted under the title *The Condition of Donegal* (1889), were due in a great measure the bill passed for the construction of light railways in 1889 and the Irish Land Act which established the Congested Districts Board in 1891. He died on the 13th of January 1896.

See *Report of the Select Committee of the House of Commons* (1815–1816); Dr Conolly, *Treatment of the Insane without Mechanical Restraints* (1856); Dr Hack Tuke, *Chapters in the History of the Insane in the British Isles* (1882).

DANIEL HACK TUKE (1827–1895), younger brother of James Hack Tuke, was born at York on the 19th of April 1827. In 1845 he entered the office of a solicitor at Bradford, but in 1847 began work at the York Retreat. Entering St Bartholomew's Hospital in London in 1850, he became a member of the Royal College of Surgeons in 1852, and graduated M.D. at Heidelberg in 1853. In 1858, in collaboration with J. C. Bucknill, he published a *Manual of Psychological Medicine*, which was for many years regarded as a standard work on lunacy. In 1853 he visited a number of foreign asylums, and later returning to York he became visiting physician to the York Retreat and the York Dispensary, lecturing also to the York School of Medicine on mental diseases. In 1859 ill health obliged him to give up his work, and for the next fourteen years he lived at Falmouth. In 1875 he settled in London as a specialist in mental diseases. In 1880 he became joint editor of the *Journal of Mental Science*. He died on the 5th of March 1895.

Among his works were *Illustrations of the Influence of the Mind on the Body* (1872); *Insanity in Ancient and Modern Life* (1878); *History of the Insane in the British Isles* (1882); *Sleepwalking and Hypnotism* (1884); *Past and Present Provision for the Insane Poor in Yorkshire* (1889); *Dictionary of Psychological Medicine* (1892).

TUKULOR (TUCULERS), the name, by some said to be the French *tout-couleur*, for the negro half-castes of Senegal, who are principally of Fula-Wolof descent. By others the word is identified with Tacurol, an old name of the country, which took the form of Tacurores in the Portuguese writers of the 16th century. The Tukulor are settled chiefly in the Damga, Futa, Toro and Dimar districts of Senegal, and are remarkable for their fanaticism as Mahommedans. An intelligent, energetic and fierce people, they offered strenuous opposition to the conquest of their country by the French in the latter half of the 19th century.

TULA, a government of central Russia, bounded by the governments of Moscow on the N., Ryazañ on the E., Tambov and Orel on the S., and Kaluga on the W. Area, 11,950 sq. m.; pop. (1906 estimate), 1,662,600. It is intersected from S.W. to N.E. by a gently undulating plateau, 950 to 1020 ft. in altitude, which separates the drainage area of the Oka from that of the Don.

The government is divided into twelve districts, the chief towns of which are Tula, Bogoroditsk, Alexin, Byelev, Epifan, Efremov, Kashira, Krapivna, Novosil, Odoyev, Chern and Venev. Only 2.4% of the aggregate area is considered as unavailable for cultivation, the remainder being distributed as follows: peasants, 48½%; nobility, 32½%; other private landowners, 11%; crown, towns, &c., 2%. Agriculture is the chief occupation. Petty trades and domestic industries (*e.g.* the making of tea-urns, brass wares, harmoniums, &c.) have always flourished. The principal factory establishments are machinery works, hardware factories, flour-mills, sugar works and distilleries. Coal is extracted, as also pyrites and iron ore. Metallurgy is a growing industry.

Before the Slav immigration the territory of Tula was inhabited by Mordvinians in the north and by Meshcheryaks in the south. The Slavs who occupied the Oka were soon compelled to pay tribute to the Khazars. Subsequently the territory on the Oka belonged to the principality of Chernigov. In the 14th century part fell under the rule of Ryazañ and

Moscow, while the rest was under Lithuanian dominion till the 15th century.

TULA, a town of Russia, capital of the government of the same name, 120 m. by rail S. of Moscow, in the broad but low, marshy and unhealthy valley of the Upa. Pop. (1882), 63,500; (1901), 109,352. It is an old town of Old Russia, but its growth began only towards the end of the 18th century after the manufacture of arms had commenced. The chief branch of industry is the making of rifles; next in importance comes the manufacture of *samovars* (tea-urns). Tula is an episcopal see of the Orthodox Greek Church. The public buildings include two cathedrals and an industrial museum.

The town is first mentioned in 1147; but its former site seems to have been higher up the Tulitsa. Its wooden fort was replaced in 1514–1521 by a stone *kreml*, or citadel, which still exists. Tsar Boris Godunov founded a gun factory here in 1595, and in 1632 a Dutchman, Winius, established an iron foundry. Tsar Michael Alexis and Peter the Great, especially the last-named, took great interest in the gun factories, and large establishments were built in 1705 and 1714.

TULCEA, or TULTCHA, the capital of the department of Tulcea, Rumania, on the right bank of the Danube, 42 m. from its mouth at Sulina. Pop. (1900), 18,800; including many Russians, Turks, Greeks and Jews. There is no railway within 20 m., and the surrounding country is barren and desolate. The principal commerce is in fish and grain. Wool is also exported to France, and hides to Turkey. Sheep-farming is carried on among the mountains.

TULIP (*Tulipa*), a genus of bulbous herbs belonging to the Liliaceae. The species are found wild along the northern shores of the Mediterranean, in the Levant, Armenia, Caucasus, Northern Africa, Persia, and sporadically across North and Central Asia to Japan. The cup-shaped flowers have six regular segments in two rows, as many free stamens, and a three-celled ovary with a sessile stigma, which ripens into a leathery many-seeded capsule. The species are numerous, and are distinguished one from another by the scales of the bulb being woolly or smooth on the inner surface, by the character of the flower-stalks, by the filaments being hairy or otherwise, and by other characters. Owing to the great beauty of the flowers they have been favourites in European gardens for two or three centuries, and have been crossed and recrossed till it has become almost impossible to refer the plants to their original types. The early flowering "Van Thol" tulips, the segments of which are mostly scarlet with yellow edges, are derived from *T. suaveolens*, a native of the Caspian region. *T. Gesneriana*, a native of Armenia and central Russia, is the origin of some of the later flowering varieties. *T. pubescens*, which is probably a hybrid between the two species just named, is the source of some of the early flowering kinds known as Pottebakker, &c. *T. oculus-solis* and *T. Clusiana* are lovely species, natives of southern Europe, and *T. silvestris*, with elegant yellow flowers, is a doubtful native of England. More recently, owing to the exertions of Russian naturalists, a large number of new species have been discovered in Turkestan, and introduced into Europe. Some of these are very beautiful, and render it probable that by intercrossing with the older species still further difficulties will be presented in the way of identification. These difficulties are further enhanced by the fact that, quite apart from any cross-breeding, the plants, when subjected to cultivation, vary so greatly in the course of two or three years from the original species from which they are directly descended that their parentage is scarcely recognizable. This innate power of variation has enabled the florist to obtain, and ultimately to "fix," so many remarkable varieties. At the present day tulips of all kinds are much more extensively grown than at any previous period. Not only are millions of bulbs cultivated in Holland for export every year, but thousands are now also grown for the same purpose in the Channel Islands, more particularly in Guernsey. Of late years tulips have become very popular in America, and an extensive trade is now done between the U.S.A. and Europe. The enormous prices once given for rare varieties of tulip bulbs no longer obtain, though, even now, two and three guineas are asked for special bulbs. It must, however, be remembered that the "tulipomania" of the 17th century was really a form of gambling, in which admiration of the flower and interest in its culture were very secondary matters. Tulips were introduced into the Low Countries in the 16th century from Constantinople and the Levant.

The florists' varieties of tulips, which have sprung from *Tulipa Gesneriana*, are arranged in separate classes named bizarres, bybloemens and roses, according to their colour and marking. Tulips are readily raised from seeds, and the seedlings when they first flower (after about 7 years cultivation) are of one colour—that is, they are self-coloured. Judged by the florists' rules, they are either good or bad in form, and pure or stained (white or yellow) at the base; the badly formed and stained flowers are thrown away, while the good and pure are grown on, these being known as "breeder" tulips. The breeder bulbs and their offsets may grow on for years producing only self-coloured flowers, but after a time, which is varied and indefinite, some of the progeny "break," that is, produce flowers with the variegation which is so much prized. The flower is then said to be "rectified"; it is a *bizarre* when it has a yellow ground marked with purple or red, a *bybloemen* when it has a white ground marked with violet or purple, or a *rose* when it has a white ground marked with rose colour. One of the most important of the properties of a fine florists' tulip is that the cup should form, when expanded, from half to a third of a hollow ball, the six divisions of the perianth being broad at the ends, and smooth at the edges, so that the divisions may scarcely show on indenture. Another is that the ground colour should be clear and distinct, whether white or yellow. The least stain at the base of the flower, technically called the "bottom," would render a tulip comparatively valueless. What are called "feathered" flowers are those which have an even close feathering, forming an unbroken edging of colour all round, "flamed" flowers being those which have a beam or bold mark down the centre, not reaching to the bottom of the cup.

Tulips flourish in any good garden soil that has been deeply dug or trenched and manured the previous season. To secure perfect drainage and greater warmth a fair quantity of sand or grit should be present. Fresh manure should be avoided, but the remains from an old hot-bed or mushroom bed may be incorporated. The best time to plant is in September and October, the bulbs being buried about 6 in. deep and the same distance apart. The best effects are produced in formal beds by planting the same variety in each, to secure the plants being of the same height and in flower simultaneously. In mixed flower borders, mixed varieties may be planted. After planting the space between the rows of tulips may be planted with such plants as forget-me-nots, wallflowers, silenes, violas, double white arabis, polyanthuses, &c., to obtain beautiful colour combinations in spring.

Propagation.—Tulips are usually increased by offsets, which most varieties produce in fairly large numbers. These are taken off and sown in drills, like seed. They are usually strong enough to flower the third year from this sowing. Some varieties produce offsets sparingly and must be increased by seed—a slow and uncertain method. New varieties are raised from seed. (The colour variation in the flowers of seedlings is discussed above.) Seeds are sown in boxes or cold frames, in light sandy soil, and the young plants are allowed to remain undisturbed until the second year. They are then lifted and treated like offsets, being sown thinly in beds out of doors. They usually flower in about the seventh year. The soil in which tulips are propagated should be sandy, free working and thoroughly drained. A warm sheltered position is a necessity.

Cultivation Out of Doors.—Planting is best effected during September, October and early November. It is usual thoroughly to dig and manure the ground in preparation. Holes 6 to 8 in. apart and 5 in. deep are then made with a dibber. Sometimes a little loose earth or sand is put in to the depth of about 1 in., and the bulbs laid singly thereon, the holes being closed by the dibber and the whole raked over. Valuable varieties are planted at about the same depth, with a trowel, a little sand being placed around them.

Unless seed is required, the young capsules should be removed as soon as the perianth has withered, to conserve the strength of the bulb. The plants should be left until the leaves begin to wither, unless it becomes necessary to lift them to make way for other plants. When lifted they should be laid thinly in a well shaded, airy spot to dry. The tops can then be removed and the bulbs sorted and stored thinly in trays in a cool dry place. Rare bulbs may be wrapped singly in tissue paper for storing.

In Pots and Forcing.—The early flowering varieties should be potted as early in September as practicable, later batches for succession being potted during October. Pots 5 and 6 in. in diameter are the most convenient. The tops should be covered with ½ in. of soil, and about half an inch left for water. The soil should be a light and fairly rich compost, comprising about 2 parts loam, 1 part decayed manure or horse droppings that have been thoroughly sweetened, 1 part leaf mould and half a part of sand. Pot firmly, and plunge the pots in several inches of ashes out of doors, to protect the bulbs from frost. As soon as growth commences at the top and a fair amount of roots are formed they may be introduced into gentle heat, in batches according to the need and the amount of stock available. For market a slightly different method is adopted. The bulbs are placed in long shallow boxes, plunged in soil or ashes in the open air, and are later introduced as required into heat in semi-darkness, and are afterwards transferred to benches in the forcing houses where they flower. Bulbs which have been forced are of no further value for that particular purpose. If planted in borders and shrubberies, however, they will continue to bear fairly good blossoms in the open air for several seasons.

Varieties.—The following varieties are among the most useful for bedding and pot culture.

Early Single Flowering Kinds:—

Name.	Colour.	Height.
Duc van Thol . . .	Various	6 in.
Adelaine	Rose Carmine	7 ,,
Artus	Dark Scarlet	8 ,,
Bacchus	Dark Crimson	7 ,,
Belle Alliance . . .	Crimson Scarlet	8 ,,
Canary Bird . . .	Yellow	10-12
Chrysolora	Yellow	9 ,,
Cottage Maid . . .	Pink and White	12 ,,
Duchess de Parma . .	Orange Crimson	10 ,,
Gold Finch	Golden Yellow	12 ,,
Joost van Vondel . .	Crimson, flaked White . . .	9 ,,
Keisers Kroon . . .	Scarlet and Yellow, superb flower	10 ,,
La Reine	White (when forced) and Pink.	9 ,,
Lac van Rhijn . . .	Rosy Violet	9 ,,
Ophir d'Or	Golden Yellow	8 ,,
Pottebakker . . .	Scarlet, White, Yellow vars. .	12 ,,
Primrose Queen . . .	Primrose.	9 ,,
Proserpine	Rosy Carmine, superb flower .	9 ,,
Rose Gris de lin . . .	White and Pink	9 ,,
Thomas Moore . . .	Terra-cotta	9 ,,
White Hawk . . .	Pure White	10 ,,
Yellow Prince . . .	Yellow	8 ,,

Early Double Flowering Kinds:—

Name.	Colour.	Height.
Duc van Thol . . .	Red, edged Yellow	6 in.
Alba Maxima . . .	Pure White	9 ,,
Couronne d'Or . . .	Yellow and Orange	9 ,,
Gloria Solis	Orange Crimson	9 ,,
Imperator rubrorum .	Crimson Scarlet	9 ,,
La Candeur	Pure White	9 ,,
Leonardo da Vinci . .	Crimson and Gold	8 ,,
Tournesol	Scarlet and Yellow	8 ,,

Late Single Flowering Kinds:—

These are tall-growing hardy kinds, suitable for herbaceous borders where they can be left undisturbed. With them may be associated what are now popularly known as "Darwin" tulips, beautiful long-stemmed kinds with self colours, and the "Cottage" or "May-flowering" tulips, all easily grown in ordinary garden soil.

Name.	Colour.	Name.	Colour.
Bouton d'Or	Golden Yellow.	Gesneriana .	Bright Scarlet.
Caledonia .	Orange Scarlet.	Gesneriana lutea	Yellow.
Columbus .	Yellow and Vermilion.	Picotee . .	White, edged Pink.
Fulgens . .	Violet Crimson.	The Fawn . .	Dove Colour.

Parrot Tulips.—This late flowering group is supposed to be derived from the curious green and yellow striped *T. viridiflora*. The flowers are mostly heavy and drooping, petals brightly coloured, the edges being curiously notched and waved.

Name.	Colour.	Name.	Colour.
Rubra Major	Dark Red.	Lutea Major .	Yellow, Crimson and Green.
Mark Graaf .	Yellow, striped Scarlet.	MonstreRouge	Crimson.
Perfecta . .	Yellow, Scarlet and Green.		

TULIP-TREE, *Liriodendron tulipifera* (Nat. Ord. Magnoliaceae), a North American tree of great beauty, with peculiarly four-lobed, truncate leaves and solitary tulip-like sweet-scented flowers, variegated with green, yellow and orange. It is hardy in England, but while young it requires protection from cold, cutting winds. In habit it resembles a somewhat stiff-growing plane tree, and becomes fully as large. It does not flourish in the atmosphere of towns. It thrives best in deep sandy loam, and is propagated by seeds.

TULL, JETHRO (1674–1741), English agricultural writer and farmer, was born at Basildon, Berkshire, in 1674, probably in March. He entered St John's College, Oxford, in 1691, and was called to the bar at Gray's Inn in 1699 but never practised. In that year he married and began farming on his father's land at Howberry, near Wallingford, and here about 1701 he invented and perfected his machine drill and began experiments in his new system of sowing in drills or rows sufficiently wide apart to allow for tillage by plough and hoe during almost the whole period of growth. In 1709 he moved to a farm near Hungerford and from 1711 to 1714 travelled in France and Italy, making careful observations of the methods of agriculture in those countries which aided and confirmed his theories as to the true use of manure and the importance of "pulverizing" the soil. He did not publish any account of his agricultural experiments or theories until 1731, when his *Horse-hoeing Husbandry* appeared. This was followed by *The Horse-hoeing Husbandry, or an Essay on the Principles of Tillage and Vegetation*, by J. T., in 1733. He was attacked in the agricultural periodical *The Practical Husbandman and Farmer* and accused of plagiarizing from such earlier writers as Sir A. Fitzherbert, Sir Hugh Plat (1552–1611?), Gabriel Plattes (*fl.* 1638) and John Worlidge (*fl.* 1669–1698). Tull answered in various smaller works forming additions to his main work. He died on the 21st of February 1741.

Many editions of his *Horse-hoeing Husbandry* were published subsequently, and in 1822 William Cobbett edited it. It was translated into French, notably by H. L. Duhamel Dumonceau (1700–1782), the naturalist and agriculturalist, in 1753–1757 (see AGRICULTURE).

TULLAMORE, a market town and the county town of King's County, Ireland, on the Grand Canal and a branch of the Great Southern & Western railway, by which it is 58 m. W. by S. of Dublin. Pop. (1901), 4639. The town is the seat of the county assizes, has a court house and other county buildings, and is governed by an urban district council. There is considerable trade in agricultural produce, and brewing and distilling are carried on. Charleville park is a fine demesne, and there are several small ruined castles in the neighbourhood, notably Shragh Castle, dating from 1588.

TULLE, a town of central France, capital of the department of Corrèze, 58 m. S.S.E. of Limoges by rail. Pop. (1906), of the town, 11,741; of the commune, 17,245. The town extends along the narrow valley of the Corrèze, its streets here and there ascending the hill-slopes on either side by means of stairways. Tulle is the seat of a bishop. Of its 12th-century cathedral, once attached to an abbey, only the porch and nave remain, the choir and transept having been destroyed in 1793, but there is a tower of the 13th century with a fine stone steeple of the 14th century. The neighbouring cloister (12th and 13th century) has been restored. The abbot's house (15th century) has a carved doorway and well-preserved windows. Other curious old houses are to be seen in the vicinity of the cathedral. The prefecture of Tulle is a sumptuous building of 1869 surrounded by gardens. The town has tribunals of first instance and of commerce, a lycée for boys, training colleges for both sexes, a chamber of commerce and a branch of the Bank of France. Its principal industry is the manufacture of small-arms, established in 1690, and now carried on by the state under the direction of the artillery authorities. At its busiest times the factory has employed 3000 hands. The well-known cascades of Gimel formed by the Montane are near Tulle.

Tulle (*Tutela*) owed its importance in the middle ages to the abbey of St Martin, founded in the 7th or 8th century. The abbacy was raised to the rank of bishopric in 1317. The town was taken by the English in 1346 and was subsequently ravaged by the Black Death. It was again conquered by the English in 1369; but, when the inhabitants succeeded in freeing themselves, they were exempted from all imposts by Charles V. The Protestants tried in vain to seize Tulle in 1577, but were successful in 1585.

TULLE, a term restricted in England to a fine bobbin-net of silk, used for veils, scarves, millinery purposes, and trimmings of ladies' dresses, &c. The French used the word to mean all machine-made lace the basis of which is the intertwisted network made on the bobbin-net machine. The word is derived from the town of Tulle in France.

TULLOCH, JOHN (1823–1886), Scottish theologian, was born at Bridge of Earn, Perthshire, in 1823, and received his university education at St Andrews and Edinburgh. In 1845 he became minister of St Paul's, Dundee, and in 1849 of Kettins, in Strathmore, where he remained for six years. In 1854 he was appointed principal of St Mary's College, St Andrews. The appointment was immediately followed by the appearance of his Burnet prize essay on *Theism*. At St Andrews, where he held also the post of professor of systematic theology and apologetics, his work as a teacher was distinguished by several features which at that time were new. He lectured on comparative religion and treated doctrine historically, as being not a fixed product but a growth. From the first he secured the attachment and admiration of his students. In 1862 he was appointed one of the clerks of the General Assembly, and from that time forward he took a leading part in the councils of the Church of Scotland. In 1878 he was chosen moderator of the Assembly. He did much to widen the national church. Two positions on which he repeatedly insisted have taken a firm hold—first, that it is of the essence of a church to be comprehensive of various views and tendencies, and that a national church especially should seek to represent all the elements of the life of the nation; secondly, that subscription to a creed can bind no one to all its details, but only to the sum and substance, or the spirit, of the symbol. For three years before his death he was convener of the church interests committee of the Church of Scotland, which had to deal with a great agitation for disestablishment. He was also deeply interested in the reorganization of education in Scotland, both in school and university, and acted as one of the temporary board which settled the primary school system under the Education Act of 1872. He died at Torquay on the 13th of February 1886.

Tulloch's best-known works are collections of biographical sketches of the leaders of great movements in church history, such as the Reformation and Puritanism. His most important book, *Rational Theology and Christian Philosophy* (1872), is one in which the Cambridge Platonists and other leaders of dispassionate thought in the 17th century are similarly treated. He delivered the second series of the Croall lectures, on the *Doctrine of Sin*, which were afterwards published. He also published a small work, *The Christ of the Gospels and the Christ of History*, in which the views of Renan on the gospel history were dealt with; a monograph on *Pascal* for Blackwood's Foreign Classics series; and a little work, *Beginning Life*, addressed to young men, written at an earlier period.

See the *Life* by Mrs Oliphant.

TULLUS HOSTILIUS, third legendary king of Rome (672–640 B.C.). His successful wars with Alba, Fidenae and Veii shadow forth the earlier conquests of Latian territory and the first extension of the Roman domain beyond the walls of Rome. It was during his reign that the combat between the Horatii and Curiatii, the representatives of Rome and Alba, took place. He is said to have been struck dead by lightning as the punishment of his pride.

Tullus Hostilius is simply the duplicate of Romulus. Both are brought up among shepherds, carry on war against Fidenae and Veii, double the number of citizens, organize the army, and disappear from earth in a storm. As Romulus and Numa represent the Ramnes and Tities, so, in order to complete the list of the four traditional elements of the nation, Tullus was made the representative of the Luceres, and Ancus the founder of the Plebs. The distinctive event of this reign is the destruction of Alba, which may be regarded as an historical fact. But when and by whom it was destroyed is uncertain—probably at a later date, by the Latins, and not by the Romans, who would have regarded as impious the destruction of their traditional mother-country.

See Livy i. 22–31; Dion. Halic. iii. 1–35; Cicero, *de Republica*, ii. 17. For a critical examination of the story see Schwegler, *Römische Geschichte*, bk. xii.; Sir G. Cornewall Lewis, *Credibility of early Roman History*, ch. 11; W. Ihne, *Hist. of Rome*, vol. i.; E. Pais, *Storia di Roma*, vol. i. (1898); O. Gilbert, *Geschichte und Topographie der Stadt Rom im Altertum*, ii. (1885); G. F. Schömann, "De Tullo Hostilio rege romano" in his *Opuscula*, i. 18-49; also ROME: *Ancient History*.

TULSA, a city (and co-extensive township) and the county-seat of Tulsa county, Oklahoma, U.S.A., on the Arkansas river, about 110 m. N.E. of Guthrie. Pop. (1900), 1390; (1907), 7298 (638 negroes); (1910) 18,182. Tulsa is served by the Atchison, Topeka & Santa Fé, the St Louis & San Francisco, the Midland Valley, the Missouri, Kansas & Texas, and the Arkansas Valley & Western railways. The city is situated on the old boundary line between Indian Territory and Oklahoma Territory, where the boundaries of the Cherokee, Creek and Osage nations intersected. It is on an elevation from the rolling prairie, which commands a fine view over the valley of the Arkansas. Tulsa is the seat of Henry Kendall College (Presbyterian, 1894), removed hither from Muskogee in 1907; it was named in honour of Henry Kendall (1815–1892), who from 1861 until his death was secretary of the board of Home Missions of the Presbyterian Church. The city is a trading centre for a rich oil, gas and coal region and a grain, cotton and live-stock country. Natural gas is used for manufacturing purposes; among the manufactures are glass and cotton-seed oil products. Tulsa was founded in 1887, was first chartered as a city in 1902, and in 1908 adopted a commission form of government.

TULSĪ DĀS (1532–1623), the greatest and most famous of Hindī poets, was a Sarwariyā Brahman, born, according to tradition, in A.D. 1532, during the reign of Humāyūn, most probably at Rājāpur in the Bāndā District south of the Jumna. His father's name was Ātmā Rām Sukal Dubē; that of his mother is said to have been Hulasī. A legend relates that, having been born under an unlucky conjunction of the stars, he was abandoned in infancy by his parents, and was adopted by a wandering *sādhū* or ascetic, with whom he visited many holy places in the length and breadth of India; and the story is in part supported by passages in his poems. He studied, apparently after having rejoined his family, at Sūkarkhēt, a place generally identified with Sōrōṅ in the Etah district of the United Provinces, but more probably the same as Varāhakshētra[1] on the Gogra River, 30 m. W. of Ajōdhyā (Ayōdhyā). He married in his father's lifetime, and begat a son. His wife's name was Ratnāwalī, daughter of Dīnabandhu Pāṭhak, and his son's Tārak. The latter died at an early age, and Tulsī's wife, who was devoted to the worship of Rāma, left her husband and returned to her father's house to occupy herself with religion. Tulsī Dās followed her, and endeavoured to induce her to return to him, but in vain; she reproached him (in verses which have been preserved) with want of faith in Rāma, and so moved him that he renounced the world, and entered upon an ascetic life, much of which was spent in wandering as a preacher of the necessity of a loving faith in Rāma. He first made Ajōdhyā (the capital of Rāma and near the modern Fyzābād) his headquarters, frequently visiting distant places of pilgrimage in different parts of India. During his residence at Ajōdhyā the Lord Rāma is said to have appeared to him in a dream, and to have commanded him to write a *Rāmāyana* in the language used by the common people. He began this work in the year 1574, and had finished the third book (*Āraṇya-kāṇḍ*), when differences with the Vairāgī Vaishnavas at Ajōdhyā, to whom he had attached himself, led him to migrate to Benares, where he settled at Asī-ghāṭ. Here he died

[1] This is the view of Baijnāth Dās, author of the best life of Tulsī Dās. At Sōrōṅ there is no tradition connecting it with the poet. Varāhakshētra and Sūkar-khēt have the same meaning (*Varāha* = *Sūkara*, a wild boar).

in 1623, during the reign of the emperor Jahāngīr, at the great age of 91.

The period of his greatest activity as an author synchronized with the latter half of the reign of Akbar (1556–1605), and the first portion of that of Jahāngīr, his dated works being as follows: commencement of the *Rāmāyan*, 1574; *Rām-satsaī*, 1584; *Pārbatī-mangal*, 1586; *Rāmāgyā*, 1598; *Kabitta Rāmāyan*, between 1612 and 1614. A deed of arbitration in his hand, dated 1612, relating to the settlement of a dispute between the sons of a land-owner named Ṭōḍar, who possessed some villages adjacent to Benares, has been preserved, and is reproduced in facsimile in Dr Grierson's *Modern Vernacular Literature of Hindustan*, p. 51. Ṭōḍar (who was not, as formerly supposed, Akbar's finance minister, the celebrated Rāja Ṭōḍar Mall) was his attached friend, and a beautiful and pathetic poem[1] by Tulsī on his death is extant. He is said to have been resorted to, as a venerated teacher, by Mahārāja Mān Singh of Jaipur (d. 1618), his brother Jagat Singh, and other powerful princes; and it appears to be certain that his great fame and influence as a religious leader, which remain pre-eminent to this day, were fully established during his lifetime.

Tulsī's great poem, popularly called *Tulsī-krit Rāmāyan*, but named by its author *Rām-charit-mānas*, "the Lake of Rāma's deeds," is perhaps better known among Hindus in upper India than the Bible among the rustic population in England. Its verses are everywhere, in this region, popular proverbs; an apt quotation from them by a stranger has an immediate effect in producing interest and confidence in the hearers. As with the Bible and Shakespeare, his phrases have passed into the common speech, and are used by every one (even in Urdū) without being conscious of their origin. Not only are his sayings proverbial: his doctrine actually forms the most powerful religious influence in present-day Hinduism; and, though he founded no school and was never known as a *guru* or master, but professed himself the humble follower of his teacher, Narhari-Dās,[2] from whom as a boy in Sūkar-khēt he heard the tale of Rāma's doings, he is everywhere accepted as an inspired and authoritative guide in religion and conduct of life.

The poem is a rehandling of the great theme of Vālmīkī, but is in no sense a translation of the Sanskrit epic. The succession of events is of course generally the same, but the treatment is entirely different. The episodes introduced in the course of the story are for the most part dissimilar. Wherever Vālmīkī has condensed, Tulsī Dās has expanded, and wherever the elder poet has lingered longest, there his successor has hastened on most rapidly. It consists of seven books, of which the first two, entitled "Childhood" (*Bāl-kāṇḍ*) and "Ayōdhyā" (*Ayōdhyā-kāṇḍ*), make up more than half the work. The second book is that most admired. The tale tells of King Dasarath's court, the birth and boyhood of Rāma and his brethren, his marriage with Sītā, daughter of Janak king of Bidēha, his voluntary exile, the result of Kaikēyī's guile and Dasarath's rash vow, the dwelling together of Rāma and Sītā in the great central Indian forest, her abduction by Rāvan, the expedition to Lankā and the overthrow of the ravisher, and the life at Ajōdhyā after the return of the reunited pair. It is written in pure Baiswārī or Eastern Hindī, in stanzas called *chaupāīs*, broken by *dōhās* or couplets, with an occasional *sōraṭhā* and *chhand*—the latter a hurrying metre of many rhymes and alliterations. Dr Grierson well describes its movement:—

> "As a work of art, it has for European readers prolixities and episodes which grate against occidental tastes, but no one can read it in the original without being impressed by it as the work of a great genius. Its style varies with each subject. There is the deep pathos of the scene in which is described Rāma's farewell to his mother: the rugged language depicting the horrors of the battle-field—a torrent of harsh sounds clashing against each other and reverberating from phrase to phrase; and, as occasion requires, a sententious, aphoristic method of narrative, teeming with similes drawn from nature herself, and not from the traditions of the schools. His characters, too, live and move with all the dignity of an heroic age. Each is a real being, with a well-defined personality. Rāma, perhaps too perfect to enlist all our sympathies; his impetuous and loving brother Lakshman; the tender, constant Bharat; Sītā, the ideal of an Indian wife and mother; Rāvan, destined to failure, and fighting with all his demon force against his destiny—the Satan of the epic—all these are characters as lifelike and distinct as any in occidental literature."

A manuscript of the *Ayōdhyā-kāṇḍ*, said to be in the poet's own hand, exists at Rājāpur in Bānda, his reputed birthplace. One of the *Bāl-kāṇḍ*, dated *Sambat* 1661, nineteen years before the poet's death, and carefully corrected, it is alleged by Tulsī Dās himself, is at Ajōdhyā. Another autograph is reported to be preserved at Malihābād in the Lucknow district, but has not, so far as known, been seen by a European. Other ancient MSS. are to be found at Benares, and the materials for a correct text of the Rāmāyan are thus available. Good editions have been published by the *Khaḍga Bilās* press at Bānkipur (with a valuable life of the poet by Baijnāth Dās), and by the *Nāgarī Prachārinī Sabhā* at Allahabad (1903). The ordinary bāzār copies of the poem, repeatedly reproduced by lithography, teem with interpolations and variations from the poet's language. An excellent translation of the whole into English was made by the late Mr F. S. Growse, of the Indian Civil Service (5th edition, Cawnpore, 1891).

Besides the "*Lake of Rāma's deeds*," Tulsī Dās was the author of five longer and six shorter works, most of them dealing with the theme of Rāma, his doings, and devotion to him. The former are (1) the *Dōhābalī*, consisting of 573 miscellaneous *dōhā* and *sōraṭhā* verses; of this there is a duplicate in the *Rām-satsaī*, an arrangement of seven centuries of verses, the great majority of which occur also in the *Dōhābalī* and in other works of Tulsī; (2) the *Kabitta Rāmāyan* or *Kabittābalī*, which is a history of Rāma in the *kabitta*, *ghanāksharī*, *chhappāī* and *sawaiyā* metres; like the *Rām-charit-mānas*, it is divided into seven *kāṇḍs* or cantos, and is devoted to setting forth the majestic side of Rāma's character; (3) the *Gīt-Rāmāyan*, or *Gītābalī*, also in seven *kāṇḍs*, aiming at the illustration of the tender aspect of the Lord's life; the metres are adapted for singing; (4) the *Krishnāwali* or *Krishna gītābalī*, a collection of 61 songs in honour of Krishna, in the Kanaujī dialect: the authenticity of this is doubtful; and (5) the *Binay Pattrikā*, or "Book of petitions," a series of hymns and prayers of which the first 43 are addressed to the lower gods, forming Rāma's court and attendants, and the remainder, Nos. 44 to 279, to Rāma himself. Of the smaller compositions the most interesting is the *Vairāgya Sandīpanī*, or "Kindling of continence," a poem describing the nature and greatness of a holy man, and the true peace to which he attains. This work has been translated by Dr Grierson in the *Indian Antiquary*, xxii. 198–201.

Tulsī's doctrine is derived from Rāmānuja through Rāmānand. Like the former, he believes in a supreme personal God, possessing all gracious qualities (*saguṇa*), not in the quality-less (*nirguṇa*) neuter impersonal *Brahman* of Sankarāchārya; this Lord Himself once took the human form, and became incarnate, for the blessing of mankind, as Rāma. The body is therefore to be honoured, not despised. The Lord is to be approached by *faith* (*bhakti*)—disinterested devotion and surrender of self in perfect love, and all actions are to be purified of self-interest in contemplation of Him. "Show love to all creatures, and thou wilt be happy; for when thou lovest all things, thou lovest the Lord, for He is all in all." The soul is from the Lord, and is submitted in this life to the bondage of works (*karma*); "Mankind, in their obstinacy, keep binding themselves in the net of actions, and though they know and hear of the bliss of those who have faith in the Lord, they attempt not the only means of release. Works are a spider's thread, up and down which she continually travels, and which is never broken; so works lead a soul downwards to the Earth, and upwards to the Lord." The bliss to which the soul attains, by the extinction of desire, in the supreme home, is not absorption in the Lord, but union with Him in abiding individuality. This is emancipation (*muktī*) from the burthen of birth and rebirth, and the highest happiness.[3]

Tulsī, as a *Smārta Vaishnava* and a Brahman, venerates the whole Hindu pantheon, and is especially careful to give Śiva or Mahādēva, the special deity of the Brahmans, his due, and to point out that there is no inconsistency between devotion to Rāma and attachment to Śiva (*Rāmāyan*, *Lankākāṇḍ*, *Dōhā* 3). But the practical end of all his writings is to inculcate *bhaktī* addressed to Rāma as the great means of salvation—emancipation from the chain of births and deaths—a salvation which is as free and open to men of the lowest caste as to Brahmans.

The best account of Tulsī Dās and his works is contained in the papers contributed by Dr Grierson to vol. xxii. of the *Indian Antiquary* (1893). In Mr Growse's translation of the *Rām-charit-Mānas* will be found the text and translation of the passages in the *Bhaktamālā* of Nābhājī and its commentary, which are the main original authority for the traditions relating to the poet. Nābhājī had himself met Tulsī Dās; but the stanza in praise of the poet gives no facts relating to his life; these are stated in the *ṭīkā* or gloss of Priyā Dās, who wrote in A.D. 1712, and much of the material is legendary and untrustworthy. Unfortunately, the biography of the poet, called *Gōsāīṅ-charitra*, by Bēnīmādhab Dās, who was a personal follower and constant companion of the Master, and died in 1642, has disappeared, and no copy of it is known to exist. In the introduction to the edition of the *Rāmāyan* by the *Nāgarī Prachārinī Sabhā* all the known facts of Tulsī's life are brought together and critically discussed. For an exposition of his religious position, and this place in the popular religion of northern India, see Dr Grierson's paper in the *Journal of the Royal Asiatic Society*, July 1903, pp. 447–466. (C. J. L.)

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[1] See *Indian Antiquary*, xxii. 272 (1893).

[2] Narhari-Dās was the sixth in spiritual descent from Rāmānand, the founder of popular Vaishnavism in northern India (see article HINDOSTANI LITERATURE).

[3] The summary given above is condensed from the translation by Dr Grierson, at pp. 229–236 of the *Indian Antiquary*, vol. xxii., of the fifth *sarga* of the *Satsaī*, in which work Tulsī unfolds his system of doctrine.

TULU, or TULUVA, a language of the Dravidian family, found chiefly in the South Kanara district of Madras. It has no literature, nor has it been adopted for official use even where it is spoken by the majority of the population. In 1901 the total number of speakers of Tulu exceeded half a million.

TUMBLER, that which "tumbles," *i.e.* falls or rolls over or down. The O. Eng. *tumbiare*, of which Mid. Eng. *tumblere* is a frequentative form, appears also in Du. *tuimelen*, Ger. *taumeln*, to stagger, tumble about; Fr. *tomber*, to fall, is Teutonic in origin. As applied to a person, "tumbler" is another word for an acrobat, one who shows his agility by turning somersaults, standing on his head, walking or dancing on his hands, &c. It is interesting to note that Herodias' daughter Salome is described as a *tumbestere* in Harl. MS., 1701, f. 8, quoted by Halliwell (*Dict. of Archaic Words*), and in the margin of Wycliffe's Bible (Matt. xiv. 6) *tumblide* is given as a variant of daunside (danced). Similarly, in early pictures of her dancing before Herod, she is represented sometimes as standing on her head. The common drinking-glass known as a "tumbler," which now is the name given to a plain cylindrical glass without a stem or foot, was originally a glass with a rounded or pointed base, which could only stand on being emptied and inverted (see DRINKING VESSELS, Plate I., fig. 3).

TUMBLE-WEED, a botanical term for a plant which breaks loose when dry, and is blown about, scattering its seeds by the way.

TUMKUR, or TOOMKOOR, a town and district of southern India, in the west of Mysore state. The town has a station on the Madras & Southern Mahratta railway, 43 m. N.W. from Bangalore. The area of the district is 4158 sq. m. It consists chiefly of elevated land intersected by river valleys. A range of hills rising to nearly 4000 feet crosses it from north to south, forming the waterparting between the systems of the Krishna and the Cauvery. The principal streams are the Jayamangala and the Shimsha. The mineral wealth of Tumkur is considerable; iron is obtained in large quantities from the hill-sides; and excellent building-stone is quarried. The slopes of the Devaray-durga hills, a tract of 18 sq. m., are clothed with forests, in which large game abounds, including tigers, leopards, bears and wild hog. The climate of Tumkur is equable and healthy; the annual rainfall averages 39 in.

The population in 1901 was 679,162, showing an increase of 17% in the decade. The cultivated products consist chiefly of millets, rice, pulses and oil seeds. The chief industries are the making of coarse cotton cloths, woollen blankets and ropes.

TUMMEL, a river of Perthshire, Scotland. Discharging from Loch Rannoch, it flows eastward to a point near the Falls of Tummel, where it bends to the S.E., a direction which it maintains until it falls into the Tay, just below Logierait, after a course of 58 m. from its source in Stob Ghabbar (3565 ft.). Its only considerable affluent is the Garry, 24 m. long, an impetuous river which issues from Loch Garry ($2\frac{1}{2}$ m. long, $\frac{1}{4}$ m. wide, and 1334 ft. above the sea). About midway in its course the Tummel expands into Loch Tummel ($2\frac{3}{4}$ m. long, $\frac{1}{2}$ m. wide, 128 ft. deep, and 500 ft. above the sea), between which and the confluence with the Garry occur the Pass and Falls of the Tummel, which are rather in the nature of rapids, the descent altogether amounting to 15 ft. The scenery throughout this reach is most picturesque, culminating at the point above the eastern extremity of the loch, known as Queen Victoria's View. The chief places of interest on the river are Kinloch Rannoch; Dunalastair, a rocky hill in well-wooded grounds, the embellishment of which was largely due to Alexander Robertson of Struan (1670–1749), the Jacobite and poet, from whom the spot takes its name ("the stronghold of Alexander"); Foss; Faskally House (beautifully situated on the left bank); Pitlochry; and Ballinluig.

TUMOUR (Lat. *tumor*, a swelling), a term applied, from the earliest period of medical literature, to any swelling of which the nature and origin were unknown. Thus used in its most literal sense, the word is of purely clinical derivation and has no pathological significance of any kind. Consequently a very heterogeneous collection of swellings have been described as tumours, including such diverse conditions as an abscess, a tubercular gland, the enlarged spleen of malaria or a cancer. With the progress of bacteriology and the improved technique of histology it has been found possible, however, to separate these various "swellings" into certain groups: (1) *Inflammatory or Infective Tumours*; (2) *Tumours due to Hypertrophy*; (3) *Cysts*; (4) *Spontaneous Tumours, or Tumours proper.* The tendency of modern convention is to restrict the use of the term "tumour" to the last group, but for the sake of completeness it is necessary to touch briefly on the distinguishing features of the first three groups.

1. *Inflammatory or Infective Tumours.*—These have certain characteristics which separate them sharply from other classes of tumour. In the first place all of them are due to the irritative action of some micro-organism (see PATHOLOGY). Inflammation due to microbial action always follows a typical course. First, a number of wandering cells derived from the blood, the lymph or the connective tissues make their way to the site of irritation, and thus produce the red, painful swelling with which every one is familiar. A struggle now ensues between these cells and the invading bacteria; if the victory rests with the former, the inflammation gradually subsides, and the swelling disappears in course of time. But if the bacteria gain the upper hand a number of the cells are killed, undergo liquefaction and are converted into pus, so that an abscess results. Thus an inflammatory swelling may be solid or fluid according to the severity of the irritant. The common inflammatory bacteria—staphylococcus and streptococcus—cause suppuration in the majority of cases, but there are a few organisms such as streptothrix, spirochaeta pallida, and in many instances the tubercle bacillus, which set up an inflammation of an extremely chronic type, rarely progressing to the formation of pus, but leading rather to the development of a hard, solid mass of very slow growth, that may persist for months or even years.

To the naked eye these solid inflammatory swellings may closely simulate the spontaneous tumours with which they have been often confused, but a microscopical examination will correct the mistake in nearly every case. For the minute structure of the infective tumours, whatever their situation, is almost identical; they consist merely of an irregular collection of inflammatory cells; and this of itself is sufficient to mark them off quite distinctly from the group of tumours proper, which, as will presently be seen, vary widely in structure according to the tissue from which they spring, and show a resemblance to the parent type at once characteristic and peculiar. To this statement there is one exception, for a form of malignant tumour, known as a sarcoma, may bear a very deceptive likeness to an inflammatory swelling.

2. *Hypertrophic Tumours.*—A tissue or organ is said to be hypertrophied when it is increased in size but remains normal in structure. The most familiar example is the hypertrophy of the skeletal muscles that follows increased use, or the hypertrophy of the heart muscle which helps to compensate the faulty action of the valves. But neither of these constitutes a hypertrophic tumour. For an instance of this we must turn to the enlargement of the spleen that occurs in malaria and certain forms of anaemia, of the thyroid gland in goitre, and of the lymphatic glands in Hodgkin's disease. In each of these conditions there is merely an increase of apparently normal tissue, and from a microscopical examination of the hypertrophied organ it would be impossible to say that it was other than healthy.

The enlargement of the spleen and of the thyroid in these cases are overshadowed by certain changes in the blood and in the nervous system which constitute a distinct disease; but in Hodgkin's disease there are no specific symptoms apart from the swelling of the glands, and it has been suggested that this may be due either to the action of some micro-organism which has hitherto escaped detection, or to a widely diffused growth of a sarcomatous type. If the former supposition be correct these glandular swellings must be classed with the infective tumours; if the latter they should be regarded as spontaneous tumours. There is, at present, no agreement on this point, and they have, therefore, been described here as hypertrophic tumours.

3. *Cysts.*—A cyst may be defined as a collection of fluid surrounded by a wall or capsule. The nature of the fluid varies according to the site and origin of the cyst; the cyst-wall is usually composed of a tough layer of fibrous tissue. Cysts arise by the dilatation of a pre-existing space with fluid; and when, as often happens, the cyst-wall is tensely stretched by the pressure of the fluid within, they may easily be mistaken for solid tumours.

The number and variety of cysts are very great, and they are only mentioned here on account of the errors in diagnosis for which they are often responsible. For further details the reader should consult the special textbooks.

4. *Spontaneous Tumours, or Tumours Proper* (*synonyms: Neoplasm, New Growth*).—The following definition of a spontaneous tumour suggested by Ziegler is perhaps the most satisfactory: "A neoplasm or tumour is a new formation of tissue, which is atypical in structure, serves no useful purpose to the whole economy, and the growth of which has no typical termination." In this definition the words "new formation of tissue" exclude the cystic swellings; the attribute "atypical in structure" excludes hypertrophies; and the final clause "the growth of which has no typical termination" excludes all swellings of an inflammatory nature which progress, however slowly, towards either suppuration or resolution and recovery.

These tumours arise by the exaggerated and abnormal proliferation of a single cell, or a group of cells. They increase in size solely by the multiplication of their own cells, and the only contribution which the surrounding tissues make to the progress is the formation of a "stroma," or supporting framework of fibrous tissue; and even that is wanting in many cases. Inasmuch as the newly-formed cells of the tumour take on the likeness of the parent from which they are sprung, it follows that the minute structure of such a tumour, whatever its situation, will be a more or less exact copy of that of the tissue whence it originated. A tumour growing from the skin will therefore imitate the cell-structure of the normal skin; the resemblance of a breast tumour to the healthy breast is often so close as to make it a hard task to distinguish the one from the other; whilst the similarity of bony and cartilaginous tumours to true bone and cartilage is evident to all.

This imitation of the parent type by the spontaneous tumours is one of their most remarkable characteristics, and provides a reliable criterion by which they may be separated from the inflammatory new growths, which are all built up on the same general plan. Consequently it is almost always possible to determine the origin of a tumour from an examination of its histological appearances; and conversely we know that an epithelial tumour will never spring from a connective tissue nor a connective tissue tumour from an epithelium.

Another outstanding feature of the neoplastic tumours is that they lead an entirely independent existence subject to none of the restraints to which the normal cell must needs submit. These normal cells are, indeed, possessed of certain limited powers of multiplication, by which they are enabled to replace the slight loss of tissue which the wear and tear of life perpetually entails; or, again, they can on occasion make good a greater loss of substance, as in the healing of an ulcer, or the regeneration of a skin wound. But these powers are confined within certain well-marked bounds, which may not be transgressed. Contrast with this the tumour cell, emancipated from all control and owning to no restraint. It is true that the simple tumours often remain stationary after attaining a certain size, but the general tendency of all tumours is towards persistent and unlimited growth, and the cancer cell continues its career unchecked by everything save death.

The spontaneous tumours are seen in every tissue and organ of the body, though in some they are relatively infrequent. Nor are they confined to man, for they have been found throughout the vertebrate kingdom. It is often stated that a higher state of civilization has inflicted on European races a greater susceptibility to tumour formation. As to this, reliable evidence is hard to obtain, but such a statement would seem to be only partially true, and the apparent immunity of certain native races is to some extent due to lack of sufficient observations.

It is usual to separate these tumours into two groups: the *Non-malignant, Innocent or Benign*, and the *Malignant or Cancerous*. Of these two groups the latter are the more familiar and have attracted much more attention and study than the former, on account of the danger to life which they involve, but in point of numbers they are greatly outweighed by the first group. Two or more non-malignant tumours, of the same or different varieties, are often found in the same individual; but with the cancers this is a rare occurrence, and such growths are usually single.

The non-malignant tumours are usually rounded in shape. In size they vary enormously; a fibroid tumour may be as small as a pea; a fatty tumour may weigh forty pounds. Often they cease growing after attaining a certain size, but there are very many exceptions to this, and it is seldom possible to predict the subsequent course of one of these growths. They possess, however, four constant characteristics by which they may be distinguished from the malignant variety.

1. A non-malignant tumour, whatever its size, remains localized to the part from which it originates. It is not an "infiltrating" growth, that is to say it does not eat its way into the surrounding tissues, but rather pushes them aside, and so may be called "expansive." Moreover, it is separated from them by a thin but usually well-marked layer of fibrous tissue known as the "capsule" of the tumour, which seems to be formed as the result of a slight inflammation that the presence of the tumour always causes among the healthy tissues surrounding it, and may be regarded as a protest on their part against the invasion of the tumour.

2. Non-malignant tumours are not of themselves dangerous to life. They may, however, cause a great deal of pain and even death, when situated in some sensitive or delicate organ. For instance, a small tumour may cause intense pain by pressing on a nerve, or dropsical swelling of a limb by obstructing a vein, or death from suffocation by blocking the larynx. Nevertheless it remains true that any evil effects are due not to the nature of the tumour, but to its situation, whereas a cancer causes death whatever its position.

3. These tumours never reproduce themselves in distant parts of the body. More than one may be present in the same individual, but each arises independently, and the widespread dissemination so typical of a cancerous growth is never seen.

4. An innocent growth never recurs after operation. The boundaries of the growth are so well defined that complete removal is usually easy, and the operation is a simple and satisfactory proceeding.

Malignant Tumours, or Cancers.—There are two varieties of malignant tumour: the *Sarcomata*, arising from the connective tissues; the *Carcinomata*, arising from epithelial tissues. It is customary to describe them both as cancers. The main features of these tumours are as follows:—

1. *The Infiltrating Nature of a Malignant Tumour.*—A cancer follows a course very different from that of an innocent tumour. Its growth has no appointed termination, but continues with unabated vigour until death; moreover, it is more rapid than that of the innocent tumours, and so does not permit of the formation of a capsule by the neighbouring tissues. In consequence such a tumour shows no well-defined boundary, but from its margin fine tendrils of cancer cells make their way in all directions into the surrounding parts, which gradually become more and more involved in the process. Thus a cancer of the breast will attack both the skin covering it and the underlying muscle and bone; a cancer of the intestine will eat its way into the liver, spleen and kidney, until these organs become to a great extent replaced by cancer cells, and can no longer perform their proper functions.

2. *Formation of Secondary Growths, or Metastases.*—In addition to this spread of growth by direct extension, another characteristic of malignant tumours is a tendency to dissemination, that is, to reproduce themselves in various parts of the body far removed from the original site; so that it is not unusual to find after death that a cancer of the breast has given rise to secondary, or metastatic, deposits in the lymphatic glands, the lungs, the ribs and other bones, the brain and the abdominal organs. These secondary deposits are due to the tumour cells making their way through the walls of the small lymph and blood vessels and becoming detached by the force of the circulation, by which they are carried to some distant part of the body, there to continue their career of uncontrolled growth.

The sarcomata and carcinomata differ somewhat as regards the path of dissemination. The former are vascular tumours, well supplied with blood-vessels; consequently dissemination usually occurs by way of the blood-stream rather than by the lymphatic circulation, and the commonest site for the secondary deposits of sarcoma is the lung. The carcinomata are less vascular, and the tendency of the growth is to invade the small lymph channels, so that the first signs of metastases are to be looked for in the lymphatic glands; at a later date these deposits may be spread throughout the body, particularly in the liver and other abdominal organs, the lungs and the bones.

The formation of metastases is of the utmost importance from a clinical point of view, as the success of an operation depends on the removal of all the secondary deposits as well as of the original growth. For instance, a few months after the first appearance of a cancer of the breast the axillary lymph glands will be found to be hard and enlarged. This means that some of the cells of the primary growth have been carried in the lymph stream to these glands, and have begun to grow there; consequently any operation for the removal of the cancer of the breast must include the removal of these glands. If the breast tumour only be taken away the growth will continue unchecked in the glands. It is a matter of great difficulty to determine by the naked eye or the touch whether a gland is infected or not. In many cases where there is no evident enlargement the microscope will show the presence of cancer cells; and a certain opinion can only be given after a microscopical examination.

In operations for cancer of the breast or tongue the modern practice is to regard the lymphatic glands of the axilla or neck respectively as infected in every case, however early it be, and to remove them accordingly. In other parts of the body where the glands are inaccessible, the only solution of the difficulty is to urge the removal of the tumour at the earliest possible moment, before lymphatic infection has had time to occur.

The frequency and rapidity of metastasis formation varies greatly. As a general rule cancer of the breast is more liable than other forms of growth to be followed by widespread secondary deposits. On the other hand, in cases of cancer of the skin secondary infection is usually confined to the neighbouring lymphatic glands, and seldom occurs in any of the internal organs.

3. *Termination of Malignant Tumours.*—In one or two well authenticated cases a malignant tumour has disappeared of its

own accord without any treatment, and a natural cure may be said to have occurred. But these form such an infinitesimal proportion of the whole that they do not affect the general truth of the statement that the universal tendency of a malignant tumour is to cause death.

Although the separation of the new growths into two groups is supported by certain fairly definite characteristics, both clinical and histological, yet it seems likely that the difference between them is one of degree rather than of kind. There is every reason to believe that the same perverted impulse may give rise either to an innocent or a cancerous growth, the issue depending in part on the intensity of the impulse, and in part on the resisting powers of the tissues in which the incipient tumour cells lie. Such a hypothesis is supported by the analogy of the microbial infections, where the final outcome of life or death depends no less on the defensive mechanism of the individual than on the virulence of the infecting organism. Again, it is beyond doubt that occasionally a tumour, which for years has been void of the least taint of malignancy, may become converted into an active cancer. Moreover, certain tumours seem to lie on the border line, for example, rodent ulcers and cancers of the parotid gland. These are malignant in that they are undoubtedly infiltrating tumours, they are innocent in that they never form metastatic deposits. Therefore it seems that malignancy or the reverse is not to be regarded as an absolute and constant attribute of any particular tumour or class of tumours, but rather as an expression of the balance struck in the conflict between the opposing forces of the tumour and its host.

Histology of Tumours.—On examining a microscopical preparation of an epithelial tumour it is found to be built up of two distinct elements. There are the epithelial cells, which form the essential part of the tumour; there is a network of fibrous connective-tissue cells, which acts as a supporting framework to the epithelial elements, and is known as the stroma of the tumour. This twofold structure is seen in all the epithelial tumours, both non-malignant and malignant, and in the case of the latter it is a general rule that the greater the proportion of epithelial to connective-tissue elements the faster will the tumour grow. On the other hand in the connective-tissue tumours (with the exception of the sarcomata) this compound structure is absent and there is only one type of cell present; thus a fatty tumour consists merely of fat cells; a bony tumour of bone cells, and so on.

To understand clearly the differences and likenesses that obtain between the malignant and the non-malignant new growths it is necessary to compare the histology of the two groups.

Figs. 1*a*, 1*b* represent an innocent tumour (adenoma) of the breast. Figs. 2*a*, 2*b* a cancer (spheroidal-celled carcinoma) of the breast. Fig. 3 an innocent tumour (papilloma) of the skin. Fig. 4 a cancer of the skin.

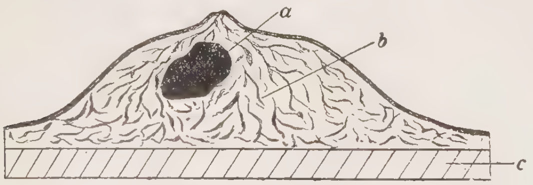

FIG. 1*a*.—Diagram to show the relations of an innocent tumour (adenoma) of the breast.

a, Tumour; *b*, normal breast tissue; *c*, underlying muscular tissue.

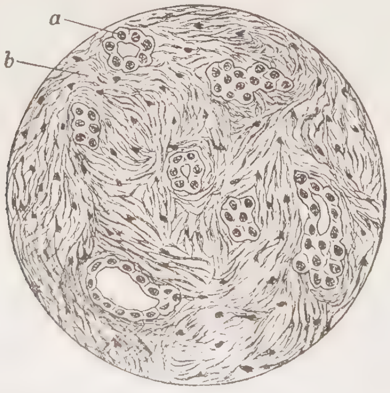

FIG. 1*b*.—Microscopical appearances of an adenoma of the breast. (Drawn from an actual specimen.)

a, Tumour cells; *b*, fibrous connective tissue.

In the adenoma the individual cells bear the closest resemblance to the glandular cells of the normal breast from which they are derived. In addition they tend to follow the normal very closely in their arrangement, so that at times it is difficult or impossible to decide which is tumour and which is healthy breast substance. Finally the growth is surrounded by a well defined capsule of fibrous tissue.

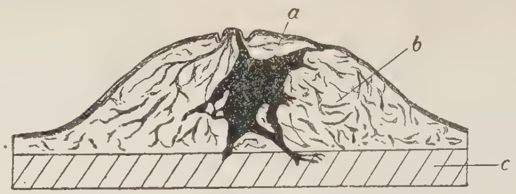

FIG. 2*a*.—Diagram to show the relations of a malignant tumour (spheroidal cell carcinoma) of the breast. Note the indrawing of the nipple by the growth and the infiltration of the underlying muscle.

a, Tumour; *b*, normal breast tissue; *c*, muscle.

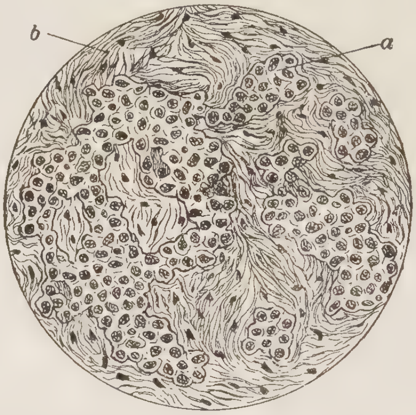

FIG. 2*b*.—Microscopical appearances of a carcinoma of the breast. (Drawn from an actual specimen.)

a, Tumour cells; *b*, stroma.

In the carcinoma, the individual resemblance is present, though less conspicuous, as many of the cells are irregular in size and shape. But the similarity of the arrangement is very hard to make out or even absent. The cells are arranged in disorderly masses; they are not enclosed by any semblance of a capsule, but tend to transgress their proper boundaries and invade the underlying muscles. Figs. 3 and 4 show analogous changes in an innocent and in a malignant tumour of the skin.

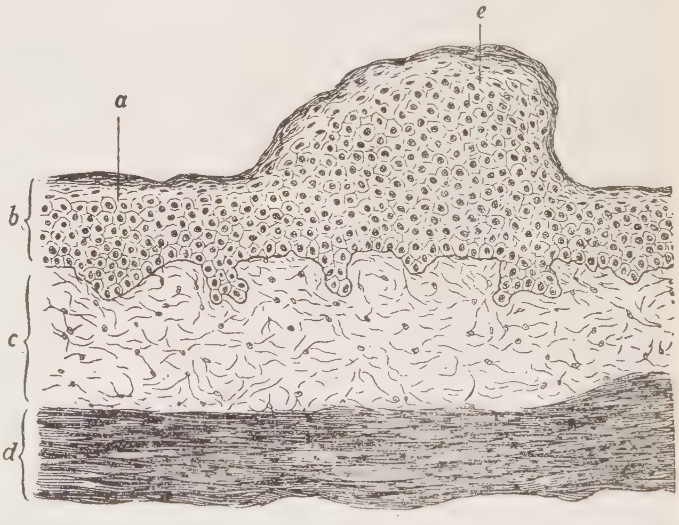

FIG. 3.—Non-malignant tumour (papilloma) of the skin. The tumour is formed by an outward proliferation of the cells of the epidermis, but these cells show no tendency to invade the underlying connective tissue or muscle. (Semidiagrammatic.)

a, Normal skin.
b, Epithelium or epidermis.
c, Connective tissue.
d, Muscular tissue.
e, Papilloma.

Speaking generally it may be said that the cells of an adenoma are fully differentiated and typical of the normal, whereas the cells of a carcinoma show less perfect differentiation, are in some degree atypical and resemble rather the actively growing cells found at an early stage of embryonic life. But it is in the cells of a sarcoma that the widest departure from type is seen. A sarcoma is a malignant growth arising from connective tissue, but the resemblance to adult connective tissue is almost non-existent and the cells are essentially of an embryonic type. These differences between the innocent and the malignant cell bear out the well-established physiological rule that the less the functional development of a cell or tissue the greater its power of growth. The primitive impulse is growth, which gives place at a later stage to the development of function.

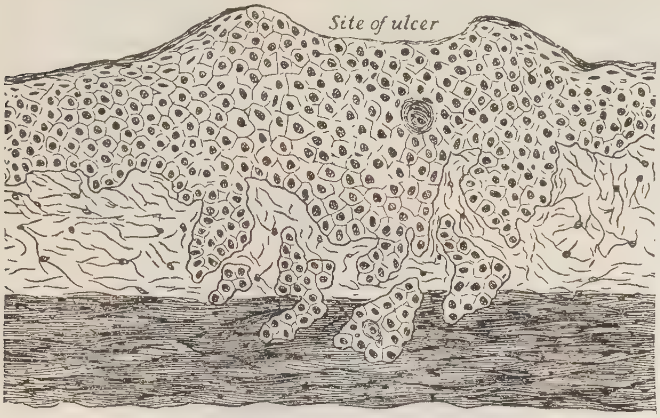

FIG. 4.—Malignant tumour (epithelioma, squamous-celled carcinoma) of the skin. The cells of the epidermis have proliferated both outwardly and inwardly and have invaded and replaced the underlying tissues. An ulcer has been formed on the surface by the necrosis of the superficial cells. (Semidiagrammatic.)

In theory it is always possible to distinguish with certainty between an innocent tumour and a cancer by means of the microscope. In practice this is, unfortunately, not the case. There are some tumours whose histological appearances seem to be on the borderline between the two conditions, and often these are the very cases in which the clinical features give no direct clue to their nature. In such circumstances it is only by taking into consideration every detail, both clinical and pathological, that an opinion can be formulated, and even then it remains to some extent a matter of guesswork.

The Causation of Tumours.—An enormous number of suggestions as to the causation of tumours have been put forward from time to time. Many of these were at the outset quite untenable, and reference can only be made here to the more important.

First in point of time came *Virchow's hypothesis* that tumours arise as the direct result of irritation or injury. Many examples of such a sequence of events are familiar to everybody. A cancer of the lip or tongue will often follow the irritation of a clay pipe or a jagged tooth; a tumour of the breast is often attributed to a blow. But, on the other hand, there must be innumerable instances in which such a cause of irritation has not been followed by a tumour; and it is necessary to discount the natural anxiety of mankind to seek a cause for every unexplained occurrence, so that a slight injury which under ordinary circumstances would be forgotten is branded as the undoubted cause of any tumour that may subsequently make its appearance. As a complete explanation Virchow's hypothesis is insufficient, but it is quite probable that irritation may have an accessory or predisposing influence in tumour formation, and that it may be enough finally to upset the balance of a group of cells, which for some other reason were already hovering on the brink of abnormal growth.

There is one peculiar form or irritation that demands special attention, that is exposure to the X rays. It is beyond doubt that exposure to these rays will cause cancerous ulceration of the skin; though what is the constituent of the rays that produces this effect is not known. Fortunately the danger can be obviated by the use of rubber gloves.

Cohnheim's Hypothesis of Embryonic Remnants.—According to Cohnheim more cells are produced in embryonic life than are required for the development of the body, and a remnant is left unappropriated. Owing to their embryonic nature, these cells possess an exaggerated power of proliferation, and if at a later period of life this should be roused into activity by some mechanical or other form of stimulus, their rate of growth will outstrip that of the adult cells and a tumour will develop. As with Virchow's so with Cohnheim's hypothesis. It is at best only a partial explanation which may be applicable to a small proportion of tumours; and it could never account for X-ray cancer, or the inoculability of mouse cancer.

The *Parasitic hypothesis* is still a matter of keen debate. In some degree cancer with its localized primary growth and widespread secondary deposits resembles certain infective diseases of microbial origin, such as pyaemia, where from a small primary site of infection the bacteria become disseminated throughout the body. From this analogy it was argued that tumour formation was due to the activity of some parasite. But if the mode of dissemination of a cancer and of a micro-organism be carefully examined this analogy is found to be false. When a micro-organism lodges in a gland or other part of the body, by its irritative action it stimulates the cells of that gland to increased activity, and any swelling that occurs is produced by the proliferation of those cells. But when a group of cancer-cells is deposited in a gland the subsequent growth arises entirely from the multiplication of those cancer-cells, and the gland cells take no part whatever in its formation.

A very large number of organisms both animal and vegetable have been described as occurring in tumours; and some of these have been cultivated on artificial media outside the body; but to none of them can any direct causal relationship with cancer be attributed. One of the best authenticated, a small coccus, known as *Micrococcus neoformans* can certainly be cultivated from many tumours malignant and innocent, and it has been suggested that it may be responsible for the slight inflammatory changes that occur in the neighbourhood of most new growths. The final and critical test of the connexion of an organism with some diseased condition is the production of a similar condition in animals by inoculation of that organism, and this experiment has signally failed with all the suggested cancer parasites. Another very cogent argument against the infective hypothesis is the fact that although tumours of identical structure are found throughout the vertebrate kingdom, it has never yet been found possible artificially to transmit these tumours from one species to another. If they were of an infective nature it is almost inconceivable that the gap between two allied species should be such an insuperable bar to transmission.

Quite recently Borrel of the Pasteur Institute has stated that certain animal parasites from the skin are often to be found buried in the cell masses of cancers of the skin and breast, and he thinks that these parasites may be the carriers of some as yet unknown cancer virus, just as the mosquito is the carrier of malaria.

Ribbert has suggested that tumour formation may be due to "alteration of tissue tension." In his opinion the various cells of the body are normally held in a state of equilibrium by some condition of mutual interdependence amongst themselves. Should this equilibrium be disturbed some of these cells may escape from the controlling influence usually exercised upon them by their neighbours, and become endowed with greatly enhanced powers of growth.

Adami considers that every cell possesses two distinct properties, a property of function and a property of growth, and he regards these as incompatible, that is to say, a cell cannot at the same time be carrying out a specific function and also undergoing active growth. He believes that on occasion some of these cells may abandon their "habit of work" and assume a "habit of growth," and this will lead to the development of a tumour.

Neither of the two latter explanations brings us very much nearer the solution of the question—they merely place the unknown factor one step farther back; but they serve to emphasize the biological aspect of the problem. At the present time the general weight of evidence seems to favour the idea that tumour formation is due to some intrinsic cause, whereby the normal processes of growth are disturbed, rather than to any extrinsic cause such as microbial infection. Therefore it is from a careful study of the laws of growth, and from research directed along broad biological lines that the best results are to be looked for in the future.

Classification of Spontaneous Tumours.—So little is known as to the nature of these tumours that a satisfactory classification on a scientific basis is not yet within reach. The following is merely suggested as convenient:—

I.—*Connective-tissue Tumours.*

Innocent.	*Malignant.*
Lipoma (fatty tumour).	
Fibroma (fibrous tumour).	Sarcoma.
Myoma (muscular tumour).	Endothelioma.
Osteoma (bony tumour).	
Chondroma (cartilaginous tumour).	
Odontoma (tumour in connexion with teeth).	
Myxoma (mucoid tumour).	
Neuroma (tumour in connexion with nerves).	
Glioma (neuroglial tumour).	
Endothelioma (endothelial tumour).	
Angioma (tumour composed of blood vessels).	

II.—*Epithelial Tumours.*

Innocent.	*Malignant.*
Papilloma.	Carcinoma.
Adenoma.	Rodent Ulcer.

I. *Connective-tissue Tumours.*[1]—*Lipoma* (fig. 5).—Of the connective-tissue group the fatty tumours are the most common. They often arise from the layer of fat beneath the skin, and a usual site for these subcutaneous lipomata is the back of the trunk, though at times they are found on the limbs and elsewhere. They are soft, painless swellings, sometimes of great size; though usually single, as many as a dozen may be present in the same individual. Lipomata are also found in the abdominal cavity, growing from the subperitoneal layer of fat.

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[1] Figs. 5, 6, 7, 8, 9, 14, 15 and 17 have been redrawn from Bland Sutton's *Tumours*, by permission; figs. 10, 11, 12 and 13 are from Rose & Carless, *Surgery*, by permission.

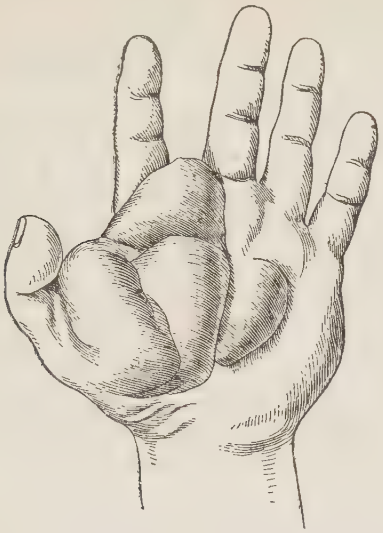


FIG. 5.—Lipoma of the palm.

What is known as a *diffuse lipoma* (fig. 6) consists of a generalized overgrowth of the subcutaneous fat of the neck, and this may be so extensive as to obliterate the outline of the jaw.

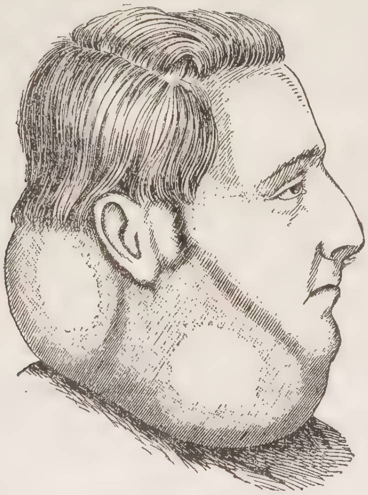


FIG. 6.—Diffuse lipoma of the neck.

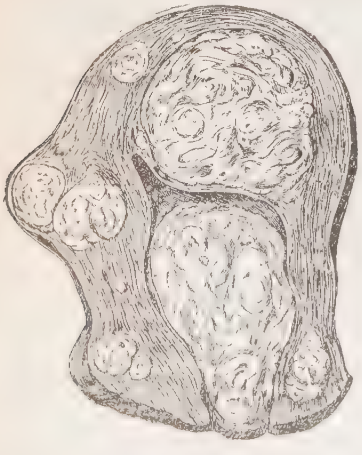


FIG. 7.—Uterus in sagittal section showing interstitial and submucous fibroids.

Fibroma (fig. 7).—Of tumours containing fibrous tissue, by far the most important are the fibroids of the uterus. A better name for these tumours would be Fibromyomata, as they always contain a varying proportion of muscle fibres. They originate in the wall of the uterus, but generally come to project either internally into the cavity of the uterus, or externally into the peritoneal cavity; and often their sole connexion with the uterine wall is a stalk or pedicle formed from the capsule of the tumour. Fibromyomata of the uterus are most common from 35 to 45 years of age; in girls under 20 they are almost unknown. They may attain a great size and are often multiple. They seem to be equally common in married and unmarried women. Not every fibroid is a source of danger or discomfort, for in the majority of cases they are discovered by chance or not until after death. On the other hand they may give rise to severe symptoms, and that in many different ways. First, they may cause haemorrhage prolonged over years so that the health is entirely ruined. Secondly, they may become inflamed and septic, and lead to severe blood-poisoning. Next, for some unknown reason, a fibroid tends to prevent conception, whilst, should pregnancy occur, labour is greatly impeded. Finally, it seems to be established that a fibroid may occasionally become converted into a sarcoma.

Examples of *pure* fibrous tissue tumours are the small multiple growths of the subcutaneous tissue, known as *Painful subcutaneous nodule*, and the irregular outgrowth from the gum known as *Epulis*.

A *Myoma* is composed of unstriped muscle fibres. It is a rare tumour sometimes found in the oesophagus, stomach and bladder.

Osteoma (fig. 8).—Bony tumours not infrequently arise from the bones of the head or face. They grow very slowly, and are so hard that surgical removal may be very difficult. They also occur as irregular outgrowths from the bones of the limbs, and are then known as *Exostoses* (fig. 9). A common site for these is the inner and lower end of the femur, at the point of attachment of the adductor muscle, and such a tumour seems to originate from an ossification of the tendon of this muscle.

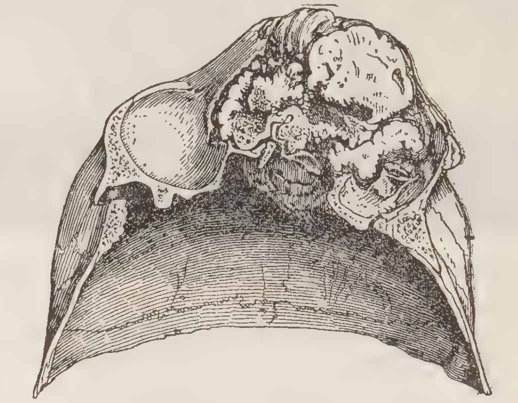


FIG. 8.—Osteoma of the left frontal sinus (seen from below).

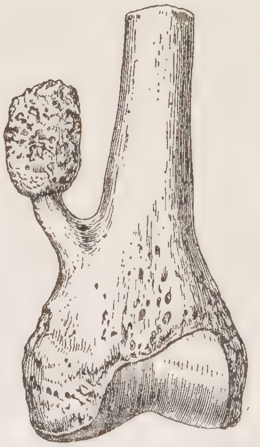


FIG. 9.—Exostosis of the femur produced by the ossification of the tendon of the adductor magnus.

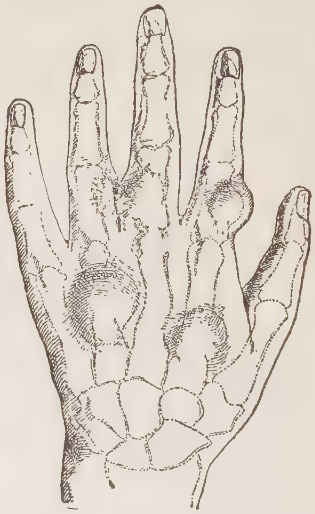


FIG. 10.—Multiple chondromata of the fingers.

Chondroma (fig. 10).—Cartilaginous tumours are often found in children and young people growing from the bones of the limbs in the neighbourhood of the joints. They are frequently multiple, especially in the hands and feet. These tumours grow slowly and are quite painless. Should removal be necessary, it is usually an easy matter.

Odontoma.—Several varieties of this tumour have been described arising in connexion with the teeth and due to delayed or faulty development. They may cause great deformity of the jaw.

A *Myxoma* is composed of loose, gelatinous connective tissue similar to that found in the umbilical cord. Some nasal polypi seem to be of this nature, but true myxomatous tumours are rare. It is, however, not uncommon for a fibroma or a sarcoma to be converted by degeneration into myxomatous-like tissue.

Neuroma.—A pure neuroma is very uncommon, but a tumour known as a *Pseudo-neuroma* (fig. 11) is often found in the course of a nerve. This is formed by a localized overgrowth of the fibrous tissue of the nerve sheath.

Glioma.—This variety of tumour arises from the neuroglia, the supporting tissue of the brain and spinal cord. Consequently gliomata are only found in these two structures.

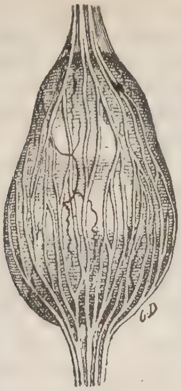


FIG. 11.—Pseudo-neuroma: fibrous tumour growing from nerve sheath, and causing the fibres to be stretched over it.

Endothelioma.—Of late years a small class of tumour has been described as originating apparently from the endothelium lining the lesser blood and lymph channels. Many of the recorded examples have been connected with the mouth, the tongue, the palate or the parotid gland. Some of these tumours are quite innocent, others are typically malignant.

An *Angeioma* consists of a meshwork of blood-vessels bound together by a small amount of fat and fibrous tissue. Two varieties are described: (*a*) The *simple naevus*, or *port-wine stain*, scarcely deserves to be called a tumour. It appears as a reddish-blue discolouration of the skin due to over growth and dilatation of the underlying blood-vessels. This condition is most commonly found on the face or scalp, and may be of congenital origin. (*b*) In the *cavernous naevus* the vascular hypertrophy is on a larger scale, and may produce a definite pulsating tumour. Here, again, the head is the usual situation.

Sarcoma.—This is the malignant type of the connective-tissue tumour. The general arrangement of a sarcoma shows a mass of atypical cells loosely bound together by a small amount of connective tissue. The cells vary greatly in size and shape in different tumours, and in accordance with the prevailing type the following varieties of sarcoma have been described: (i.) *round-cell sarcoma*, (ii.) *spindle-cell sarcoma*, (iii.) *melanotic sarcoma*, (iv.) *myeloid sarcoma*. The first two groups contain the great majority of all sarcomata, and may occur in almost any part of the body, but they are especially liable to attack the bones (fig. 12). A sarcoma of bone may be either *periosteal* when it grows from the periosteum covering the outer surface of the bone, or *endosteal* when it lies in the medullary cavity. A peculiar form of sarcoma is found in the parotid and other salivary glands. The cells are usually spindle-shaped, and among them lie scattered masses of cartilage and fibrous tissue. These tumours are seldom very malignant, and dissemination is rare (fig. 13). The *melanotic sarcoma* is of a brown or black colour owing to the presence of granules of pigment (melanin) in and among the tumour cells. A melanotic sarcoma may arise from a pigmented wart or mole, or from the pigmented layers of the retina. The primary growth is usually small, but dissemination occurs with great rapidity throughout the body. The *myeloid sarcoma*, or *myeloma* (fig. 14), is composed of very large cells like those of bone-marrow from which it is probably derived. It is only found in the interior of bones, chiefly in those of the arm and leg. The degree of malignancy is low, dissemination never occurs, and recurrence after operation is rare.

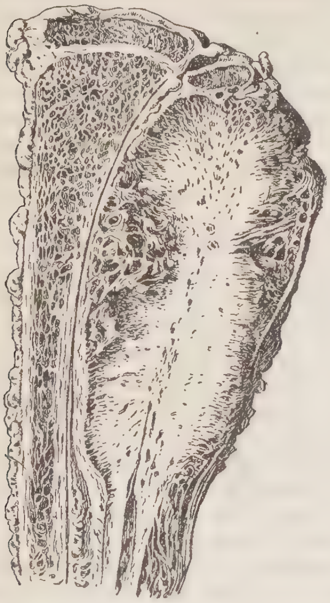


FIG. 12.—Ossifying periosteal sarcoma of fibula.

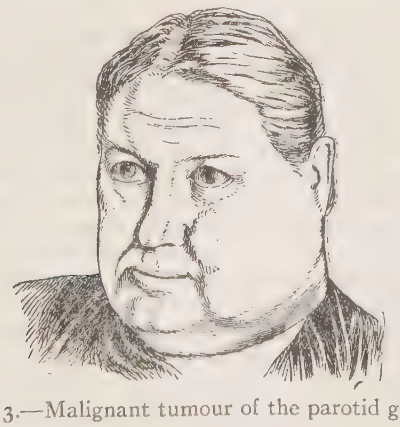


FIG. 13.—Malignant tumour of the parotid gland.

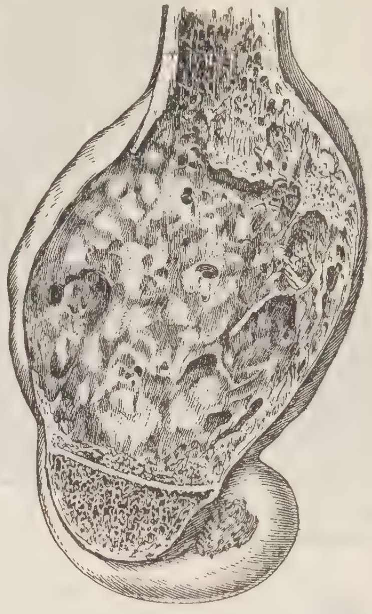


FIG. 14.—Lower end of a femur in longitudinal section, showing a myeloma.

II.—*Epithelial Tumours.*

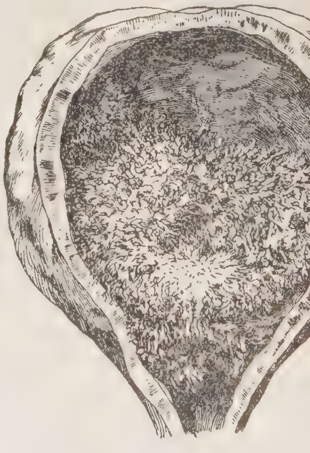


FIG. 15.—Villous papilloma of the bladder.

Papilloma.—The familiar example of a papilloma is the simple wart, which is formed by a proliferation of the squamous epithelium of the skin (fig. 3). It seems probable that some warts are of an infective nature, for instances of direct contagion are not uncommon. Occasionally warts are pigmented, and are then liable to be the seat of a melanotic sarcoma. Papillomata are also found in the bladder (fig. 15), as long delicate filaments growing from the bladder wall. These consist of a connective-tissue core covered by a thin layer of epithelium.

Adenoma.—(Figs. 1*a* and 1*b*). The glandular tumours are of very common occurrence in the breast, the ovary and the intestinal canal. The structure of an adenoma of the breast has already been described (*vide supra*), and the structure of other adenomata is on the same general plan. The main features of an innocent glandular tumour are: (*a*) the presence of a rounded, painless swelling with a well-defined margin; (*b*) the swelling is freely movable in the surrounding tissues, and if it lies close beneath the skin it is not attached thereto; (*c*) there is no enlargement of the neighbouring lymphatic glands.

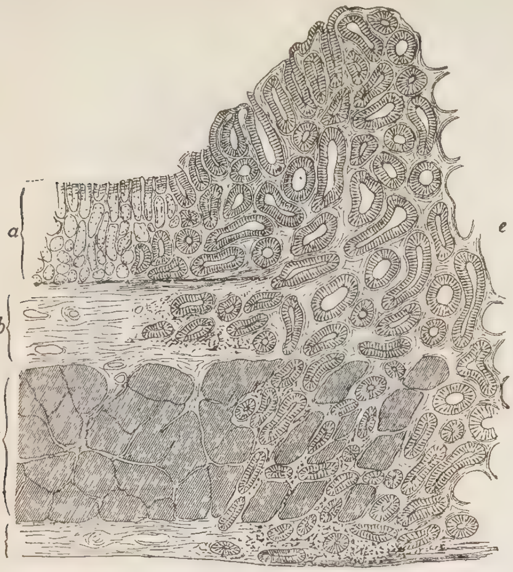
Carcinoma.—The following varieties of carcinoma are described:—

i. *Squamous-cell carcinoma* (fig. 4), arising from those parts of the body covered by squamous epithelium, namely the skin, the mouth, the pharynx, the upper part of the oesophagus and the bladder.

ii. *Spheroidal-cell carcinoma* (figs. 2*a* and 2*b*), arising from spheroidal epithelium, as in the breast, the pylorus, the pancreas, the kidney and the prostrate.

iii. *Columnar-cell carcinoma* (figs. 16 and 17), arising from columnar epithelium, as in the intestine.

The general histology of these tumours corresponds to that of a spheroidal-cell carcinoma already described (*vide supra*), the only variation between the three groups being in the shape of the cells. The clinical characteristics of a carcinoma, whatever its situation, are: (*a*) the presence of a swelling which has no well defined margin, but fades away into the surrounding tissues to which it is fixed; (*b*) when the tumour lies near the skin (*e.g.* a carcinoma of the breast) it becomes fixed to this at an early date; (*c*) the tumour is painful and tender, the degree of pain varies widely, and in the early stages there may be none; (*d*) the neighbouring lymphatic glands soon become enlarged and tender, showing that they are the seat of metastatic deposits; (*e*) in squamous carcinoma of the skin, ulceration speedily occurs.



(Redrawn from Ziegler's *Pathological Anatomy*, by permission of Macmillan & Co.)
FIG. 16.—Section through advancing margin of columnar; cancer of stomach.

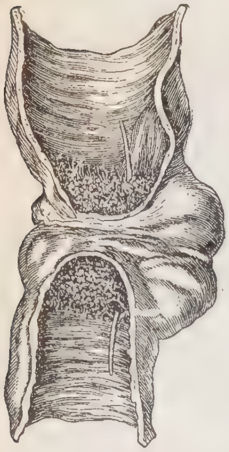


FIG. 17.—Cancer of the sigmoid flexure of the colon.

Rodent Ulcer.—This shows itself as a slowly progressing ulceration of the skin, and is especially common on the face near the eye or ear. The condition is one of purely local malignancy, and dissemination does not occur. It is believed to be a carcinoma of the sebaceous glands of the skin. (L. C.*)

TUMULUS, a Latin word meaning a heap or mound, also used in classical writings in the secondary sense of a grave. In Roman epitaphs we meet with the formula *tumulum faciendum curavit,* meaning the grave and its monument; and on the inscribed monumental stones placed over the early Christian graves of Gaul and Britain the phrase *in hoc tumulo jacet* expresses the same idea. But among archaeologists the word is usually restricted in its technical modern application to a sepulchral mound of greater or less magnitude. The mound may be of earth, or of stones with a covering of earth, or may be entirely composed of stones. In the latter case, if the tumulus of stones covers a megalithic cist or a sepulchral chamber with a passage leading into it from the outside, it is often called a dolmen. (See STONE MONUMENTS, BARROW and CAIRN.) The custom of constructing sepulchral tumuli was widely prevalent throughout the prehistoric ages and is referred to in the early literature of various races as a fitting commemoration of the illustrious dead. Prehistoric tumuli are found abundantly in almost all parts of Europe and Asia from Britain to Japan. They occur with frequency also in northern Africa, and in many parts of North and South America the aboriginal populations have practised similar customs. Sepulchral tumuli, however, vary so much in shape and size that the external appearance is no criterion of age or origin. In North America, especially in the Wisconsin region, there are numerous mounds made in shapes resembling the figures of animals, birds or even human forms. These have not been often found to be sepulchral, but they are associated with sepulchral mounds of the ordinary form, some of which are as much as 300 ft. in diameter and 90 ft. in height. Perhaps the largest tumulus on record is the tomb of Alyattes, king of Lydia, situated near Sardis, constructed in his own lifetime, before 560 B.C. It is a huge mound, 1180 ft. in diameter and 200 ft. high. In south-eastern Europe, and especially in southern Russia, the sepulchral tumuli are very numerous and often of great size, reaching occasionally to 400 ft. in circumference and over 100 ft. in height. These are mostly of the period of the Greek colonies of the Tauric Chersonese, dating from about the 5th century B.C. to about the 2nd century A.D., and their contents bear striking testimony to the wealth and culture of the people who reared them.

AUTHORITIES.—Duncan McPherson, M.D., *Antiquities of Kertch and Researches in the Cimmerian Bosphorus* (London, 1857); Cyrus Thomas, "Burial Mounds of the Northern Sections of the United States," *Fifth Annual Report of the Bureau of Ethnology to the Smithsonian Institution* (Washington, 1887); Kondakoff, Tolstoi and Reinach, *Antiquités de la Russie méridionale* (Paris, 1891). (J. AN.)

TUN, a town in the province of Khorasan, Persia, situated about 150 m. S. of Nishapur in 34° N., 58° 7′ E., at an elevation of 1200 ft. The town, which has a population of 7000, is surrounded by a wall, 20 ft. in height, raised on a high rampart of mud. It has three gates, handsome bazaars, good caravanserais and numerous large gardens and fields producing opium, tobacco and cotton. Some silk is also grown.

TUNBRIDGE WELLS, a municipal borough and inland watering-place of England, chiefly in the Tonbridge parliamentary division of Kent, but extending into the eastern division of Sussex, 34½ m. S.E. by S. of London by the South Eastern & Chatham railway, served also by a branch of the London Brighton & South Coast line. Pop. (1891), 29,296; (1901), 33,373. It owes its popularity to its chalybeate spring and its beautiful situation in a hilly wooded district. The wells are situated by the Parade (or Pantiles), a walk associated with fashion since the time of their discovery. It was paved with pantiles in the reign of Queen Anne. Reading and assembly rooms adjoin the pump-room. The town is built in a picturesquely irregular manner, and a large part of it consists of districts called "parks" occupied by villas and mansions. On Rusthall Common about a mile from the town is the curiously shaped mass of sandstone known as the Toad Rock, and a mile and a half south-west is the striking group called the High Rocks. The Tunbridge Wells sanatorium is situated in grounds sixty acres in extent. Five miles south-east of Tunbridge Wells is Bayham Abbey, founded in 1200, where ruins of a church, a gateway, and dependent buildings adjoin the modern Tudor mansion. Three miles south, in Sussex, the village of Frant stands on a hill which is perhaps the finest of the many view-points in this district, commanding a wide prospect over some of the richest woodland scenery in England. The vicinity of Tunbridge Wells is largely residential. To the north lies the urban district of SOUTHBOROUGH (pop. 6977). There is a large trade in Tunbridge ware, which includes work-tables, boxes, toys, &c., made of hard woods, such as beech, sycamore, holly, and cherry, and inlaid with mosaic. Tunbridge Wells was incorporated in 1889, and is governed by a mayor, 8 aldermen and 24 councillors. Area, 3991 acres.

The town owes its rise to the discovery of the medicinal springs by Dudley, Lord North, in 1606. Henrietta Maria, wife of Charles I., retired to drink the waters at Tunbridge Wells after the birth of her eldest son Charles. Soon after the Restoration it was visited by Charles II. and Catherine of Braganza. It was a favourite residence of the princess Anne previous to her accession to the throne, and from that time became one of the chief resorts of London fashionable society. In this respect it reached its height in the second half of the 18th century, and is specially associated with Colley Cibber, Samuel Johnson, Cumberland the dramatist, David Garrick, Samuel Richardson, Sir Joshua Reynolds, Beau Nash, Miss Chudleigh and Mrs Thrale. The Tunbridge Wells of that period is sketched with much graphic humour in Thackeray's *Virginians.*

TUNDRA (a Russian word, signifying a marshy plain), in physical geography, the name applied to the treeless and often marshy plains which border the arctic coasts of Europe, Asia and North America. The Russian tundra, apart from the arctic conditions of climate and flora, may be compared with the steppes farther south.

TUNGABHADRA, a river of southern India, the chief tributary of the Kistna. It is formed by the junction of two streams, the Tunga and the Bhadra, which both rise in Mysore in the Western Ghats. The united river for nearly all its course forms the boundary between Madras and the dominions of the nizam of Hyderabad. On its right bank stood the capital of the ancient Hindu dynasty of Vijayanagar, now a wilderness of ruins. From of old its waters have been utilized for irrigation. Near its confluence with the Kistna it supplies the Kurnool-Cuddapah Canal. A project has been recently under consideration to dam the river higher up, and there construct an artificial lake that would have an area of 160 sq. m., the cost of this scheme being roughly estimated at nearly £6,000,000.

T'UNG-CHOW, a sub-prefectural city in Chih-li, the metropolitan province of China, on the banks of the Peiho in 39° 54′ N. 116° 41′ E., 12 m. E. of Peking. Its population is estimated at about 50,000.

T'ung-Chow marks the highest point at which the Peiho is navigable, and here merchandise for Peking is transferred to a canal. The city, which is faced on its eastern side by the river, and on its other three sides is surrounded by populous suburbs, is upwards of 3 m. in circumference. The walls are about 45 ft. in height and about 24 ft. wide at the top. They are being allowed to fall into decay. Two main thoroughfares connect the north and south gates and the east and west gates. The place derives its importance from the fact that it is the port of Peking. Like most Chinese cities, T'ung-Chow has appeared in history under various names. By the founder of the Han dynasty (206 B.C.) it was called Lu-Hien; with the rise of the T'ang dynasty (618 A.D.) its name was changed to Hūan-Chow; and at the beginning of the 12th century, with the advent of the Kin dynasty to power, Hūan-Chow became T'ung-Chow. It was at T'ung-Chow that Sir Harry Parkes, Sir Henry Loch and their escort were treacherously taken prisoners by the Chinese when they were sent forward by Lord Elgin to negotiate terms of peace after the troubles of 1860. During the Boxer outbreak in 1900 T'ung-Chow was occupied by the allied armies, and a light railway connecting the city with Peking was constructed by German military engineers.

TUNGSTEN [symbol W, atomic weight 184·0 (O=16)], a metallic chemical element found in the minerals wolfram, an iron and manganese tungstate, scheelite, a calcium tungstate, stolzite, a lead tungstate, and in some rarer minerals. Its presence in scheelite was detected by Scheele and Bergman in 1781, and in 1783 Juan, José and d'Elhuyar showed the same substance occurred in wolfram; they also obtained the metal. Tungsten may be prepared from wolfram by heating the powdered ore with sodium carbonate, extracting the sodium carbonate with water, filtering and adding an acid to precipitate tungstic acid, H_2WO_4. This is washed and dried and the oxide so obtained reduced to the metal by heating with carbon to a high temperature (Hadfield, *Journ. Iron and Steel Inst.*, 1903, ii. 38). On a small scale it is obtained by reducing the trioxide in a current of hydrogen, or the chloride by sodium vapour, or the oxide with carbon in the electric furnace; in the last case the product is porous and can be welded like iron. In the form of a powder, it is obtained by reducing the oxide with zinc and extracting with soda, or by dissolving out the manganese from its alloys with tungsten. The metal may be used uncombined, but large quantities of ferrotungsten are made in the electric furnace; other alloys are prepared by acting on a mixture of the oxides with aluminium. Tungsten has been applied in the manufacture of filament electric lamps. The metal has a crystalline structure, and melts at about 2800°. The powdered metal burns at a red heat to form the trioxide; it is very slowly attacked by moist air. It combines with fluorine with incandescence at ordinary temperatures, and with chlorine at 250–300°; carbon, silicon, and boron, when heated with it in the electric furnace, give crystals harder than the ruby. It is soluble in a mixture of nitric and hydrofluoric acids, and the powdered metal, in aqua regia, but slowly attacked by sulphuric, hydrochloric and hydrofluoric acids separately; it is also soluble in boiling potash solution, giving a tunstate and hydrogen.

Tungsten dioxide, WO_2, formed on reducing the trioxide by hydrogen at a red heat or a mixture of the trioxide and hydrochloric acid with zinc, or by decomposing the tetrachloride with water, is a brown strongly pyrophoric powder, which must be cooled in hydrogen before being brought into contact with air. It is slightly soluble in hydrochloric and sulphuric acids, giving purple solutions. It dissolves in potash, giving potassium tungstate and hydrogen, and is readily oxidized to the trioxide.

Tungsten trioxide, WO_3, occurs in nature as wolframine, a yellow mineral found in Cumberland, Limoges, Connecticut and in North Carolina. It is prepared as shown above, or by other methods. It is a canary-yellow powder, which becomes a dark orange on heating; the original colour is regained on cooling. On exposure to light it assumes a greenish tinge. A crystalline form was obtained by Debray as olive-green prisms by igniting a mixture of sodium tungstate and carbonate in a current of hydrochloric acid gas, and by Nordenskjold by heating hydrated tungstic acid with borax. Partial reduction of tungsten trioxide gives blue or purple-red products which are intermediate in composition between the dioxide and trioxide. Tungsten trioxide forms two acids, tungstic acid, H_2WO_4, and metatungstic acid, $H_2W_4O_{13}$; it also gives origin to several series of salts, to which the acids corresponding are unknown. Thus we have salts of the following types $M_2O(WO_3)_n$, where $n=1, 2, 3, 4, 5, 6, 7, 8$, and also $(M_2O)_m(WO_3)_n$, where $m, n=2, 5; 3, 7; 4, 3; 5, 12$; M standing for a monovalent metal. The $(M_2O)_5(WO_3)_{12}$ or $M_{10}W_{12}O_{41}$ salts are called paratungstates. *Tungstic acid*, H_2WO_4, is obtained as $H_2WO_4{\cdot}H_2O$ by precipitating a tungstate with cold acid; this substance has a bitter taste and its aqueous solution reddens litmus. By using hot acid the yellow anhydrous tungstic acid is precipitated, which is insoluble in water and in all acids except hydrofluoric. It may be obtained in a flocculent form by exposing the hexachloride to moist air. *Metatungstic acid*, $H_2W_4O_{13}{\cdot}7H_2O$, is obtained by decomposing the barium salt with sulphuric acid or the lead salt with hydrochloric acid. It forms yellow octahedra, which become anhydrous at 100°, and are converted into the trioxide on ignition. It is readily soluble in water, and on boiling the aqueous solution a white hydrate is first deposited which after a time is converted into the trioxide. Graham obtained a colloidal tungstic acid by dialysing a dilute solution of sodium tungstate and its equivalent of hydrochloric acid; on concentrating in a vacuum a gummy product is obtained, which still remains soluble after heating to 200°, but it is converted into the trioxide on heating to redness. When moistened it becomes adhesive. The solution has a bitter taste and does not gelatinize, even under the influence of boiling acids.

Of the salts, the normal tungstates are insoluble in water with the exception of the alkaline tungstates; they are usually amorphous, but some can be obtained in the crystalline form. The metatungstates of the alkalis are obtained by boiling normal tungstates with tungstic acid until the addition of hydrochloric acid to the filtrate gives no precipitate. The most important tungstate is the so-called tungstate of soda, which is sodium paratungstate, $Na_{10}W_{12}O_{41}{\cdot}28H_2O$. This salt is obtained by roasting wolfram with sodium carbonate, lixiviating, neutralizing the boiling filtrate with hydrochloric acid and crystallizing at ordinary temperatures. The salt forms large monoclinic prisms; molecules containing 25 and 21 H_2O separate from solutions crystallized at higher temperatures. The salt is used as a mordant in dyeing and calico printing, and also for making textiles non-inflammable. Several other sodium tungstates are known, as well as potassium and ammonium tungstates. Many salts also occur in the mineral kingdom: for example, scheelite is $CaWO_4$, stolzite is $PbWO_4$, farberite is $FeWO_4$, wolfram is $(Fe,Mn)WO_4$, whilst hübnerite is $MnWO_4$.

By partial reduction of the tungstates under certain conditions products are obtained which are insoluble in acids and alkalis and present a bronze-like appearance which earned for them the name of tungsten bronzes. The sodium compound was first obtained by Wöhler on reducing sodium tungstate with hydrogen; coal-gas, zinc, iron or tin also effect the reduction. It forms golden cubes which are unattacked by alkalis or by any acid except hydrofluoric. It appears to be a mixture of which the components vary with the materials and methods used in its production (Philipp, *Ber.*, 1882, 15, p. 499). A blue bronze, $Na_2W_5O_{15}$, forming dark blue cubes with a red reflex, is obtained by electrolysing fused sodium paratungstate; a purple-red variety, $Na_2W_3O_9$, and a reddish yellow form result when sodium carbonate and sodium tungstate are heated respectively with tungsten trioxide and tinfoil. Similar potassium tungsten bronzes are known.

Tungstic acid closely resembles molybdic acid in combining with phosphoric, arsenious, arsenic, boric, vanadic and silicic acids to form highly complex acids of which a great many salts exist. Of the phosphotungstic acids the most important is phosphoduodecitungstic acid, $H_3PW_{12}O_{40}{\cdot}nH_2O$, obtained in quadratic pyramids by crystallizing mixed solutions of orthophosphoric and metatungstic acids. Two sodium salts, viz. $Na_2HPW_{12}O_{40}\cdot nH_2O$ and $Na_3PW_{12}O_{40}\cdot nH_2O$, are obtained by heating sodium hydrogen phosphate with a tungstate. The most important silicotungstic acids are silicodecitungstic acid $H_8W_{10}SiO_{36}\cdot 3H_2O$, tungstosilicic acid, $H_8W_{12}SiO_{42}\cdot 20H_2O$, and silicoduodecitungstic or silicotungstic acid, $H_8W_{12}SiO_{42}\cdot 29H_2O$. On boiling gelatinous silica with ammonium polytungstate and evaporating with the occasional addition of ammonia, ammonium silicodecitungstate is obtained as short rhombic prisms. On adding silver nitrate and decomposing the precipitated silver salt with hydrochloric acid, a solution is obtained which on evaporation in a vacuum gives the free acid as a glassy mass. If this be dissolved in water and the solution concentrated, some silicic acid separates and the filtrate deposits triclinic prisms of tungstosilicic acid. Silicotungstic acid is obtained as quadratic pyramids from its mercurous salt which is prepared from mercurous nitrate and the salt formed on boiling gelatinous silicic acid with a polytungstate of an alkali metal.

Pertungstic Acid, HWO_4.—The sodium salt, $NaWO_4\cdot H_2O$, is obtained by evaporating in a vacuum the product of boiling a solution of sodium paratungstate with hydrogen peroxide. Its solution liberates chlorine from hydrochloric acid and iodine from potassium iodide.

Halogen Compounds.—Although the trioxide is soluble in hydrofluoric acid, evaporation of the solution leads to the recovery of the oxide unchanged. A double salt of the oxyfluoride, viz. $2KF\cdot WO_2F_2\cdot H_2O$, is obtained as crystalline scales by dissolving normal potassium tungstate in hydrofluoric acid and adding potassium hydroxide till a permanent precipitate is just formed. Other oxyfluorides are known. The hexafluoride, WF_6, is a very active gaseous compound, which attacks glass and metals, obtained from tungsten hexachloride and hydrofluoric acid (Ruff and Eisner, *Ber.*, 1905, 38, p. 742). Oxyfluorides of the formulae WOF_4 and WO_2F_2 are also known. Tungsten forms four chlorides, viz. WCl_2, WCl_4, WCl_5, WCl_6. The dichloride, WCl_2, is an amorphous grey powder obtained by reducing the hexachloride at a high temperature in hydrogen, or, better, by heating the tetrachloride in a current of carbon dioxide. It changes on exposure to air and dissolves slightly in water to give a brown solution, the insoluble portion gradually being converted into an oxide with evolution of hydrogen. The tetrachloride, WCl_4, is obtained by partial reduction of the higher chlorides with hydrogen; a mixture of the penta- and hexa-chloride is distilled in a stream of hydrogen or carbon dioxide, and the pentachloride which volatilizes returned to the flask several times. This gives the tetrachloride as a greyish-brown crystalline powder. It is very hygroscopic and with cold water gives the oxide and hydrochloric acid. On heating it gives the di- and penta-chlorides. At a high temperature hydrogen reduces it to the metal partly in the form of a black pyrophoric powder. The pentachloride, WCl_5, is obtained as a product in the preparation of the tetrachloride. It forms black lustrous crystals, or when quickly condensed, a dark green crystalline powder. It melts at 248° and boils at 275·6°; the vapour density corresponds to the above formula. It is more hygroscopic than the tetrachloride; and when treated with much water the bulk is at once decomposed into the blue oxide and hydrochloric acid, but an olive-green solution is also produced. The hexachloride, WCl_6, is obtained by heating the metal in a current of dry chlorine in the absence of oxygen or moisture, otherwise some oxychloride is formed; a sublimate of dark violet crystals appear at first, but as the hexachloride increases in quantity it collects as a very dark red liquid. When perfectly pure, the hexachloride is stable even in moist air, but the presence of an oxychloride brings about energetic decomposition; similarly water has no action on the pure compound, but a trace of the oxychloride occasions sudden decomposition into a greenish oxide and hydrochloric acid. It melts at 275° and boils at 346·7° (759·5 mm.). Vapour density determinations indicate that dissociation occurs when the vapour is heated above the boiling point.

Several oxychlorides are known. The monoxychloride, $WOCl_4$, is obtained as red acicular crystals by heating the oxide or dioxychloride in a current of the vapour of the hexachloride, or from the trioxide and phosphorus pentachloride. It melts at 210·4° and boils at 227·5° forming a red vapour. Moist air brings about the immediate formation of a yellowish crust of tungstic acid. The dioxychloride, WO_2Cl_2, is obtained as a light lemon-yellow sublimate on passing chlorine over the brown oxide. It is unaffected by moist air or cold water, and even when boiled with water the decomposition is incomplete. Tungsten combines directly with bromine to give, when the bromine is in excess, the penta- and not a hexabromide. This substance forms crystals resembling iodine, which melt at 276° and boil at 333°. It slowly evolves bromine on standing, and is at once decomposed by water into the blue oxide and hydrobromic acid. The dibromide, WBr_2, is a non-volatile bluish-black powder obtained by reducing the pentabromide with hydrogen. By passing bromine vapour over red-hot tungsten dioxide a mixture of WO_2Br_2 and $WOBr_4$ is obtained, from which the latter can be removed by gently heating when it volatilizes. The dioxybromide forms light red crystals or a yellow powder; it volatilizes at a red heat. and is not acted upon by water. The monoxybromide forms brownish-black needles, which melt at 277° and boil at 327·5; it is decomposed by water. The di-iodide is obtained as green metallic scales on passing iodine over red-hot tungsten.

Tungsten disulphide, WS_2, is obtained as soft black acicular crystals by the action of sulphur, sulphuretted hydrogen or carbon bisulphide on tungsten. The trisulphide, WS_3, is obtained by dissolving the trioxide in ammonium sulphide or by passing sulphuretted hydrogen into a solution of a tungstate and precipitating by an acid in both cases. When dry it is a black mass which yields a liver-coloured powder. It is sparingly soluble in cold water, but is easily dissolved by potassium carbonate or ammonia. By dissolving it in a hydrosulphide a sulphotungstate is produced; these salts can also be obtained by passing sulphuretted hydrogen into a solution of a tungstate.

A *nitride*, W_2N_3, is obtained as a black powder by acting with ammonia on the oxytetrachloride or hexachloride; it is insoluble in sodium hydroxide, nitric and dilute sulphuric acids; strong sulphuric acid, however, gives ammonia and tungstic acids. Ammonia does not react with tungsten or the dioxide, but with trioxide at a red heat a substance of the formula $W_5H_6N_3O_5$ is obtained, which is insoluble in acids and alkalis and on ignition decomposes, evolving nitrogen, hydrogen and ammonia. Phosphorus combines directly with the metal to form W_3P_4; another phosphide, W_2P, results on igniting a mixture of phosphorus pentoxide and tungsten trioxide.

The atomic weight has been determined by many investigators; the chief methods employed being the analysis and synthesis of the trioxide and the analysis of the hexachloride. The former was employed by Pennington and Smith and Desi (*Zeit. anorg. Chem.*, 1895, 8, pp. 198, 205) who obtained the value 183·42.

TUNGUSES, a widespread Asiatic people, forming a main branch of the Mongol division of the Mongol-Tatar family. They are the *Tung-hu* of the Chinese, probably a corrupt form of *tonki* or *donki*, that is, "men" or "people." The Russian form *Tungus*, wrongly supposed to mean "lake people," appears to occur first in the Dutch writer Massa (1612); but the race has been known to the Russians ever since they reached the Yenisei. The Tungus domain, covering many hundred thousand square miles in central and east Siberia and in the Amur basin, stretches from the Yenisei eastwards to the Pacific, where it occupies most of the seaboard between Korea and Kamchatka. It also reaches the Arctic Ocean at two points, in the Nisovaya tundra, west of the Khatanga River, and in a comparatively small enclosure in the Yana basin over against the Lyakhov (New Siberia) Archipelago. But the Tunguses proper are chiefly centred in the region watered by the three large eastern tributaries of the Yenisei, which from them take their names of the Upper, Middle or Stony, and Lower Tunguska. Here the Tunguses are known to the Samoyedes by the name of *Aiya* or "younger brothers," implying a comparatively recent immigration (confirmed by other indications) from the Amur basin, which appears to be the original home both of the Tunguses and of the closely allied Manchus. The Amur is still mainly a Tungus river almost from its source to its mouth: the Oroches (Orochus), Daurians, Birars, Golds, Manegrs, Sanagirs, Ngatkons, Nigidals, and some other aboriginal tribes scattered along the main stream and its affluents—the Shilka, Sungari and Usuri—are all of Tungus stock and speech. On the Pacific the chief subdivisions of the race are the Lamuts, or "sea people," grouped in small isolated hunting communities round the west coast of the Sea of Okhotsk, and farther south the Tazi between the Amur delta and Korea. The whole race, exclusive of Manchus, numbers probably little more than 50,000, of whom some 10,000 are in the Amur basin, the rest in Siberia.

The Tungus type is essentially Mongolic, being characterized by broad flat features, small nose, wide mouth, thin lips, small black and somewhat oblique eyes, black lank hair, dark olive or bronze complexion, low stature, averaging not more than 5 ft. 4 in.; they are distinguished from other Mongolic peoples by the square shape of the skull and the slim, wiry, well-proportioned figure. This description applies more especially to the Tunguska tribes, who may be regarded as typical Tunguses, and who, unlike most other Mongols, betray no tendency to obesity. They are classed by the Russians, according to their various pursuits, as Reindeer, Horse, Cattle, Dog, Steppe and Forest Tunguses. A few have become settled agriculturists; but the great bulk of the race are still essentially forest hunters, using the reindeer both as mounts and as pack animals. Nearly all lead nomad lives in pursuit of fur-bearing animals, whose skins they supply to Russian and Yakut traders in exchange for provisions, clothing and other necessaries of life. The picturesque and even elegant national costume shows in its ornamentation and general style decided Japanese influence, due no doubt to long-continued intercourse with that nation at some period previous to the spread of the race from the Amur valley to Siberia. Many of the Tungus tribes have been baptized, and are, therefore, reckoned as "Greek Christians"; but Russian orthodoxy has not penetrated far below the surface, and most of them are still at heart Shamanists and nature-worshippers, secretly keeping the teeth and claws of wild animals as idols or amulets, and observing Christian rites only under compulsion. But, whether Christians or pagans, all alike are distinguished above other Asiatics, perhaps above all other peoples, for their truly noble moral qualities. All observers describe them as "cheerful under the most depressing circumstances, persevering, open-hearted, trustworthy, modest yet self-reliant, a fearless race of hunters, born amidst the gloom of their dense pine forests, exposed from the cradle to every danger from wild beasts, cold and hunger. Want and hardships of every kind they endure with surprising fortitude, and nothing can induce them to take service under the Russians or quit their solitary woodlands" (Keane's *Asia*, p. 479). Their numbers are steadily decreasing owing to the ravages of small-pox, scarlet fever, and especially famine, their most dreaded enemy. Their domain is also being continually encroached upon by the aggressive Yakuts from the north and east, and from the south by the Slavs, now settled in compact bodies in the province of Irkutsk about the upper course of the Yenisei. It is remarkable that, while the Russians often show a tendency to become assimilated to the Yakuts, the most vigorous and expansive of all the Siberian peoples, the Tunguses everywhere yield before the advance of their more civilized neighbours or become absorbed in the surrounding Slav communities. In the Amur valley the same fate is overtaking the kindred tribes, who are disappearing before the great waves of Chinese migration from the south and Russian encroachments both from the east and west.

See L. Adam, *Grammaire de la langue toungouse* (Paris, 1874); C. Hickisch, *Die Tungusen* (St Petersburg, 1879); L. Schrenck, *Reisen und Forschungen im Amurlande* (St Petersburg, 1881–1891); Mainov, *Niekotorya dannyia* (Irkutsk, 1898).

TUNIC (O. Eng. *tunice*, *tunical*, taken, before the Norman conquest, directly from Lat. *tunica*, of which the origin is unknown), properly the name given in Latin to the principal undergarment of men and women, answering to the chiton (χιτών) of the Greeks, and covered by the outer garment, the *palla* (Gr. ἱμάτιον), in the case of women, and by the peculiar Roman garment, the *toga*, in the case of men. The male *tunica* differed from the χιτών in usually having short sleeves (see further COSTUME: § *Ancient Greek and Roman*). The term, more often in the form "tunicle" (Lat. dim. *tunicula*), is applied, in ecclesiastical usage, to a vestment worn over the alb by the sub-deacon in the celebration of the Mass. In general current usage it is used of any loose short garment, girt at the waist and reaching from the neck to some distance above the knee. It is thus the name of the fatigue coat of a soldier of the British army. There are numerous uses of "tunic" or "tunica" in anatomy, zoology and botany in the sense of a covering or integument.

TUNICATA. This group of marine animals was formerly regarded as constituting, along with the Polyzoa and the Brachiopoda, the invertebrate class Molluscoidea. It is now known to be a degenerate branch of the Chordata, and to be more nearly related to the Vertebrata than to any group of the Invertebrata. The Tunicata are found in all seas, from the littoral zone down to abyssal depths. They occur either fixed or free, solitary, aggregated or in colonies. The fixed forms are the "simple" and "compound" Ascidians. The colonies are produced by budding and the members are conveniently known as Ascidiozooids. Some Tunicata undergo alternation of generations, and most of them show a retrograde metamorphosis in their life-history.

HISTORY[1]

More than two thousand years ago Aristotle gave a short account of a simple Ascidian under the name of *Tethyum*. Schlosser and Ellis, in a paper on *Botryllus*, published in the *Philosophical Transactions* of the Royal Society for 1756, first brought the compound Ascidians into notice; but it was not until the commencement of the 19th century, as a result of the careful anatomical investigations of G. Cuvier (1) upon the simple Ascidians and of J. C. Savigny (2) upon the compound, that the close relationship between these two groups of the Tunicata was conclusively demonstrated. Lamarck (3) in 1816 instituted the class Tunicata, which he placed between the Radiara and the Vermes in his system of classification. The Tunicata included at that time, besides the simple and the compound Ascidians, the pelagic forms *Pyrosoma*, which had been first made known by F. Péron in 1804, and *Salpa*, described by P. Forskål in 1775.

A. v. Chamisso, in 1819, made the important discovery that *Salpa* in its life-history passes through the series of changes which were afterwards more fully described by J. J. S. Steenstrup in 1842 as "alternation of generations"; and a few years later Kuhl and Van Hasselt's investigations upon the same animal resulted in the discovery of the alternation in the directions in which the wave of contraction passes along the heart and in which the blood circulates through the body. It has since been found that this observation holds good for all groups of the Tunicata. In 1826 H. Milne-Edwards and Audouin made a series of observations on living compound Ascidians, and amongst other discoveries they found the free-swimming tailed larva, and traced its development into the young Ascidian.

In 1845 Carl Schmidt (6) first announced the presence in the test of some Ascidians of "tunicine," a substance very similar to cellulose, and in the following year Löwig and A. v. Kölliker (7) confirmed the discovery and made some additional observations upon this substance and upon the structure of the test in general. T. H. Huxley (8), in an important series of papers published in the *Transactions* of the Royal and Linnean Societies of London from 1851 onwards, discussed the structure, embryology and affinities of the pelagic Tunicates *Pyrosoma*, *Salpa*, *Doliolum* and *Appendicularia*. These important forms were also investigated about the same time by C. Gegenbaur, C. Vogt, H. Müller, A. Krohn and F. S. Leuckart. The most important epoch in the history of the Tunicata is the date of the publication of A. Kowalevsky's celebrated memoir upon the development of a simple Ascidian (9). The tailed larva had been previously investigated; but its minute structure had not been sufficiently examined, and the meaning of what was known of it had not been understood. It was reserved for Kowalevsky in 1866 to demonstrate the striking similarity in structure and in development between the larval Ascidian and the vertebrate embryo. He showed that the relations between the nervous system, the notochord and the alimentary canal are the same in the two forms, and have been brought about by a very similar course of embryonic development. This discovery clearly indicated that the Tunicata are closely allied to *Amphioxus* and the Vertebrata, and that the tailed larva represents the primitive or ancestral form from which the adult Ascidian has been evolved by degeneration, and this led naturally to the view usually accepted at the present day, that the group is a degenerate side-branch from the lower end of the phylum Chordata, which includes the Tunicata (Urochorda), *Balanoglossus*, &c. (Hemichorda), *Amphioxus* (Cephalochorda) and the Vertebrata. Kowalevsky's great discovery has since been confirmed and extended to all other groups of the Tunicata by C. v. Kupffer (12), A. Giard (13 and 15), and others.

In 1872 H. Fol (14) added largely to the knowledge of the Appendiculariidae, and Giard (15) to that of the compound Ascidians. The most important additions which have been made to the latter since have been those described by Von Drasche (16) from the Adriatic and those discovered by the "Challenger" and other expeditions (17). The structure and the systematic arrangement of the simple Ascidians have been mainly discussed of recent years by J. Alder and A. Hancock (18), C. Heller (19), H. de Lacaze-Duthiers (20), M. Traustedt (21), L. Roule, R. Hartmeyer, C. P. Sluiter, W. Michaelsen and W. A. Herdman (17, 22). In 1874 Ussoff (23) investigated the minute structure of the nervous system and of the underlying gland (first discovered by Hancock), and showed that the duct communicates with the front of the branchial sac or pharynx by an aperture in the dorsal (or "olfactory") tubercle. In 1880 C. Julin (24) drew attention to the similarity in structure and relations between this gland and the *hypophysis cerebri* of the vertebrate brain, and insisted upon their homology. M. M. Metcalf has since added to our knowledge of these structures. The Thaliacea have of late years been the subject of several very important memoirs. The researches of F. Todaro, W. K. Brooks (25), W. Salensky (26), O. Seeliger, Korotneff and others have elucidated the embryology, the gemmation and the life-history of the Salpidae; and K. Grobben, Barrois (27), and more especially Uljanin (28), have elaborately worked out the structure and the details of the complicated life-history of the Doliolidae. Finally, we owe to the successive memoirs of J. Hjort, O. Seeliger, W. E. Ritter, E. van Beneden, C. Julin, C. P. Sluiter, R. Hartmeyer and others the description of many new forms and much information as to the development and life-history of the group.

The new forms described from Puget Sound and Alaska have drawn renewed attention to the similarity of the fauna in that region of the North Pacific and the fauna of north-west Europe. There is probably a common circumpolar Tunicate fauna which sends extensions downwards in both Atlantic and Pacific. As the result of the careful quantitative work of the German Plankton expedition, A. Borgert thinks that the temperature of the water has more to do with both the horizontal and the vertical distribution of pelagic

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[1] Only the more important works can be mentioned here. For a more detailed account of the history of the group and a full bibliography see (17) and (35) in the list of works at the end of this article.

Tunicata in the sea than any other factor. It is probable that the occasional phenomenal swarms of *Doliolum* which have been met with in summer in the North Atlantic are a result of the curious life-history which, in favourable circumstances, allows a small number of budding forms to produce from the numerous minute buds an enormous number of the next generation. The great increase in the number of species known from nearly all seas during the last twelve or fifteen years of the 19th century enables us now to form a truer estimate of the geographical distribution of the group than was possible when the "Challenger" collections were described, and shows that the Tunicata at least give no support to the "bi-polar theory" of the distribution of animals.

ANATOMY

As a type of the Tunicata, *Ascidia mentula*, one of the larger species of the simple Ascidians, may be taken. This species is found in most of the European seas, in shallow water. **External Characters.** It has an irregularly ovate form, of a dull grey colour, and is attached to some foreign object by one end (fig. 1). The opposite end of the body has a terminal opening surrounded by eight rounded lobes. This is the mouth or branchial aperture, and it indicates the anterior end of the animal. About half-way back from the anterior end is the atrial or cloacal aperture, surrounded by six lobes and placed upon the dorsal edge. When the Ascidian is living and undisturbed, water is being constantly drawn in through the branchial aperture and passed out through the atrial. If coloured particles be placed in the water near the apertures, they are seen to be sucked into the body through the branchial aperture, and after a short time some of them are ejected with considerable force through the atrial aperture. The current of water passing in is for respiratory purposes, and it also conveys food into the animal. The atrial current is mainly the water which has been used in respiration, but it also contains all excretions from the body, and at times the ova and spermatozoa or the embryos.

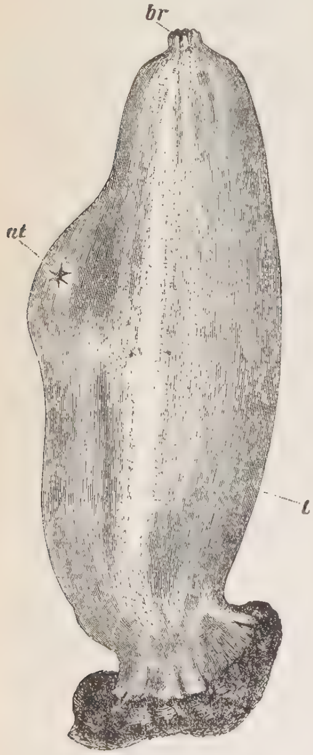
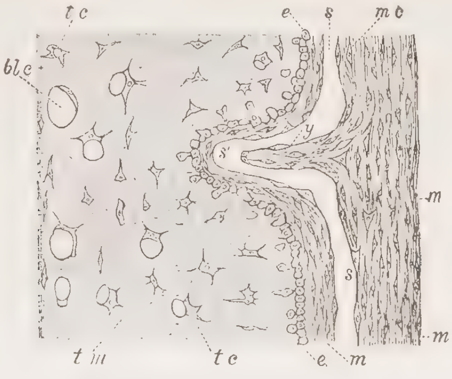


FIG. 1.—*Ascidia mentula*, from the right side.

at, Atrial aperture; *br*, branchial aperture; *t*, test.

The Test. The outer grey part of the body, which is attached at or near its posterior end and penetrated by the two apertures, is the "test." This is a firm gelatinous cuticular secretion upon the outer surface of the ectoderm, which is a layer of flat cells. Although at first produced as a cuticle, the test soon becomes organized by the migration into it of cells derived from the mesoderm. A. Kowalevsky has shown that cells of the mesenchyme of the larva make their way through the ectoderm to the exterior during the metamorphosis, and become the first cells of the young test. Some of the cells in the adult test may, however, be ectodermal in origin (see fig. 2). These test cells may remain as rounded or fusiform or stellate cells embedded in the gelatinous matrix, to which they are constantly adding by secretions on their surfaces; or they may develop vacuoles which become larger and fuse so that each cell has an ovate clear cavity (a bladder cell), surrounded by a delicate film of protoplasm with the nucleus still visible at one point; or they may form pigment granules in the protoplasm; or, lastly, they may deposit carbonate of lime, so that one or several of them together produce a calcareous spicule in the test. Only the unmodified test cells and the bladder cells are found in *Ascidia mentula* (fig. 3).



(From Herdman, "*Challenger*" *Report.*)

FIG. 2.—Diagrammatic section of part of Mantle and Test of an Ascidian, showing the formation of a vessel and the structure of the test.

m,	Mantle.	*blc*,	Bladder cell.	*mc*,	Mantle cells.
e,	Ectoderm.	*s, s'*,	Blood sinus in mantle being drawn out into test.	*y*,	Septum of vessel.
tc,	Test cell.				
tm,	Matrix.				

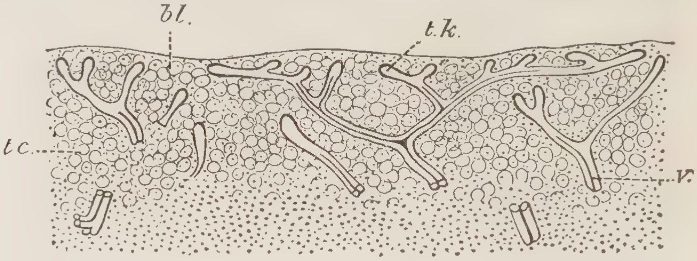


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FIG. 3.—Section through the surface layer of Test of *Ascidia mentula*.

bl, Bladder cells; *tc*, test cell; *tk*, terminal knobs of vessels; *v*, vessels of test.

Calcareous spicules are found chiefly in the Didemnidae amongst compound Ascidians; but pigmented cells may occur in the test of almost all groups of Tunicata. The matrix in which these structures are embedded is usually clear and apparently homogeneous; but in some cases it becomes finely fibrillated, especially in the family Cynthiidae. It is this matrix which contains tunicine. At one point on the left side near the posterior end a tube enters the test, and then splits up into a number of branches, which extend in all directions and finally terminate in rounded enlargements or bulbs, situated chiefly in the outer layer of the test. These tubes are known as the "vessels" of the test, and they contain blood. Each vessel is bounded by a layer of ectoderm cells lined by connective tissue (fig. 4, B), and is divided into two tubes by a septum of connective tissue. The septum does not extend into the terminal bulb, and consequently the two tubes communicate at their ends (fig. 4, A). The vessels are formed by an outgrowth of a blood sinus (derived originally from the blastocoele of the embryo) from the body wall (mantle) into the test, the wall of the sinus being formed by connective tissue and pushing out a covering of ectoderm in front of it (fig. 2, *s'*). The test is turned inwards at the branchial and atrial apertures to line two funnel-like tubes—the branchial siphon leading to the branchial sac, and the atrial siphon leading to the atrial or peribranchial cavity.

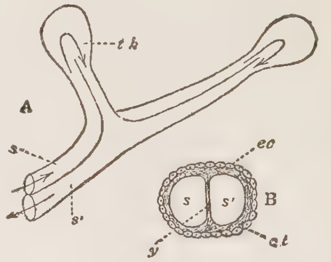

FIG. 4.

A, A vessel from the test.
B, Diagrammatic transverse section of a vessel.

ec, Ectoderm.
c t, Connective tissue.
s,s', The two tubes.
y, Septum.
t k, Terminal bulb.

Mantle, Body Wall and Body Cavities. The body wall, inside the test and the ectoderm, is formed of a layer (the somatic layer of mesoderm) of connective tissue, enclosing muscle fibres, blood sinuses, and nerves. This layer (the mantle) has very much the shape of the test outside it, but at the two apertures it is drawn out to form the branchial and atrial siphons (fig. 5). In the walls of these siphons the muscle fibres form powerful circular bands, the sphincter muscles. Throughout the rest of the mantle the bands of muscle fibres form a rude irregular network. They are numerous on the right side of the body, and almost totally absent on the left. The muscles are all formed of very long fusiform non-striped fibres. The connective tissue of the mantle is chiefly a clear gelatinous matrix, containing cells of various shapes; it is frequently pigmented, giving brilliant red or yellow colours to the body, and is penetrated by numerous lacunae, in which the blood flows. Inside the mantle, in all parts of the body, except along the ventral edge, there is a cavity—the atrial or peribranchial cavity—which opens to the exterior by the atrial aperture. This cavity is lined by a layer of cells derived originally from the ectoderm[1] and directly continuous with that layer through the atrial aperture (fig. 6); consequently the mantle is covered both externally and internally by ectodermal cells.

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[1] According to E. van Beneden and Julin (30) only the outer wall of the atrium is lined with epiblast, the inner wall being derived from the hypoblast of the primitive branchial sac.

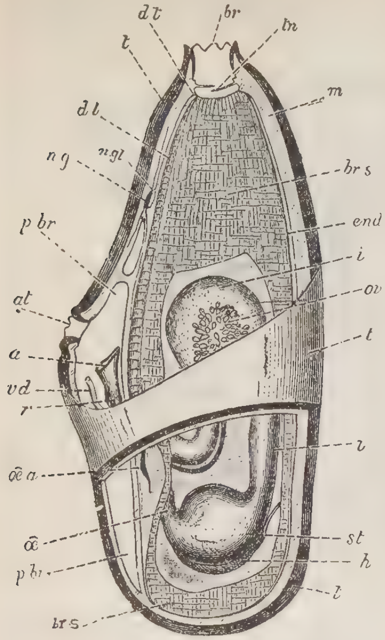

FIG. 5.—Diagrammatic dissection of *A. mentula* to show the anatomy.

at,	Atrial aperture.
br,	Branchial aperture.
a,	Anus.
brs,	Branchial sac.
dl,	Dorsal lamina.
dt,	Dorsal tubercle.
end,	Endostyle.
h,	Heart.
i,	Intestine.
m,	Mantle.
ng,	Nerve ganglion.
œ,	Oesophagus.
œa,	Oesophageal aperture.
ov,	Ovary.
pbr,	Peribranchial cavity.
r,	Rectum.
st,	Stomach.
t,	Test.
tn,	Tentacles.
vd,	Vas deferens.
ngl,	Subneural gland.

There is no true body cavity or coelom in the mesoderm; and yet the Tunicata are Coelomata in their structure and affinities, although it is very doubtful whether the enterocoele which has been described in the development is really found. In any case the coelom if formed is afterwards suppressed, and in the adult is only represented by the pericardium and its derivatives and the small cavities of the renal and reproductive organs.

Branchial Sac and Neighbouring Organs.

The branchial aperture (mouth) leads into the branchial siphon (buccal cavity or stomodaeum), and this opens into the anterior end of a very large cavity (the branchial sac) which extends nearly to the posterior end of the body (see figs. 5 and 6). This branchial sac is an enlarged and modified pharynx, and is therefore properly a part of the alimentary canal. The oesophagus opens from it far back on the dorsal edge (see below). The wall of the branchial sac is pierced by a large number of vertical slits—the stigmata—placed in numerous transverse rows (secondary or subdivided gill-slits). These slits place the branchial sac in communication with the peribranchial or atrial cavity, which lies outside it (fig. 6). Between the stigmata the wall of the branchial sac is traversed by blood-vessels, which are arranged in three regular series (fig. 7)—(1) the transverse vessels, which run horizontally round the wall and open at their dorsal and ventral ends into large longitudinal vessels, the dorsal and ventral sinuses; (2) the fine longitudinal vessels, which run vertically between adjacent transverse vessels and open into them, and which bound the stigmata; and (3) the internal longitudinal bars, which run vertically in a plane internal to that of the transverse and fine longitudinal vessels. These bars communicate with the transverse vessels by short side branches where they cross, and at these points are prolonged into the lumen of the sac in the form of hollow papillae. The edges of the stigmata are richly set with cilia, which drive the water from the branchial sac into the peribranchial cavity, and so cause the currents that flow in through the branchial aperture and out through the atrial.

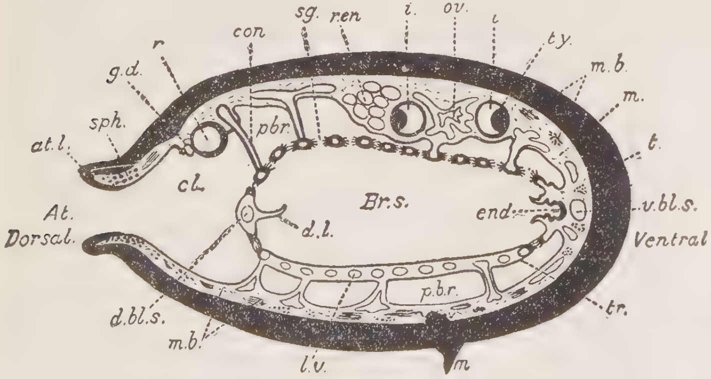

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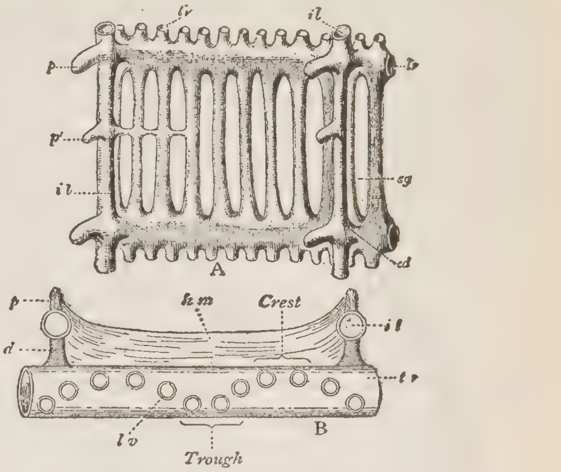
FIG. 6.—Semi-diagrammatic transverse section of *Ascidia*, passing through the atrial aperture, seen from anterior surface, left side uppermost.

At,	Atrial aperture.	*mb*,	Muscle-bundles.
atl,	Atrial lobe.	*ov*,	Ovary.
Brs,	Branchial sac.	*pbr*,	Peribranchial cavity.
cl,	Cloaca.	*r*,	Rectum.
con,	Connective.	*ren*,	Renal vesicles.
dbls,	Dorsal blood-sinus.	*sg*,	Stigmata.
dl,	Dorsal lamina.	*sph*,	Atrial sphincter.
end,	Endostyle.	*t*,	Test.
gd,	Genital ducts.	*tr*,	Transverse vessel.
ii',	Intestine.	*ty*,	Typhlosole.
lv,	Interstigmatic vessel.	*vbls*,	Ventral blood-sinus.
m,	Mantle.		



(From Herdman, "*Challenger*" *Report.*)

FIG. 7.—A, Part of branchial sac of *Ascidia* from inside. B, Transverse section of same.

tr,	Transverse vessel.	*lv*,	Fine longitudinal vessels.
cd,	Connecting duct.	*p,p'*,	Papillae.
hm,	Horizontal membrane.	*sg*,	Stigmata.
il,	Internal longitudinal bar.		

(A and B are drawn to different scales.)

Endostyle.

Along its ventral edge the wall of the branchial sac is continuous externally with the mantle (fig. 6), while internally it is thickened to form two parallel longitudinal folds bounding a groove, the "endostyle" or ventral furrow (figs. 5, 6, 8, *end.*) corresponding to the hypopharyngeal groove of *Amphioxus* and the median part of the thyroid gland of Vertebrata. The endoderm cells which line the endostyle are greatly enlarged at the bottom, where they bear very long cilia, and on parts of the sides of the furrow so as to form projecting glandular pads (fig. 8, *gl.*).

Peripharyngeal Bands.

Dorsal Lamina.

It is generally supposed that this organ is a gland for the production of the mucous secretion which is spread round the edges of the branchial sac and catches the food particles in the passing current of water. It has, however, been pointed out that there are comparatively few gland cells in the epithelium of the endostyle, and that it is possible that this furrow is merely a ciliated path along which the mucous secretion (produced in part by the subneural gland) is conveyed posteriorly along the ventral edge of the branchial sac. There are sensory bipolar cells in the lateral walls of the endostyle. At its anterior end the edges of the endostyle become continuous with the right and left halves of the posterior of two circular ciliated ridges—the peripharyngeal bands—which run parallel to one another round the front of the branchial sac. The dorsal ends of the posterior peripharyngeal band bend posteriorly (enclosing the epibranchial groove), and then join to form the anterior end of a fold which runs along the dorsal edge of the branchial sac as far as the oesophageal aperture. This fold is the dorsal lamina (figs. 5, 6, *dl*).

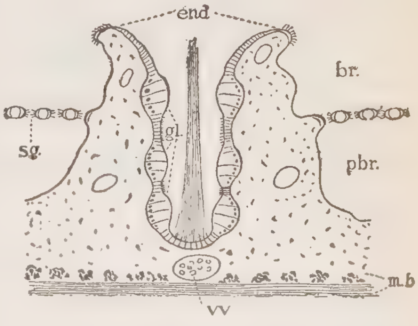


FIG. 8.—Transverse section of the endostyle of an Ascidian.

br., Branchial sac; *end.*, lips of endostyle; *gl.*, glandular tracts; *m.b.*, muscle bands; *pbr.*, peribranchial cavity; *sg.*, stigma; *v.v*, ventral vessel.

It probably serves to direct the stream of food particles entangled in a string of mucus from the anterior part of the dorsal lamina to the oesophagus.

Dorsal Languets.

In many Ascidians this organ, instead of being a continuous membranous fold as in *A. mentula*, is represented by a series of elongated triangular processes—the dorsal languets—one attached in the dorsal median line opposite to each transverse vessel of the branchial sac. The anterior peripharyngeal band is a complete circular ridge, having no connexion with either the endostyle or the dorsal lamina. In front of it lies the prebranchial zone, which separates the branchial sac behind from the branchial siphon in front. The prebranchial zone is bounded anteriorly by a muscular band—the posterior edge of the sphincter muscle—which bears a circle of long delicate processes, the tentacles (figs. 5, 9, 10, *tn*).

Tentacles.

These project inwards at right angles so as to form a network across the entrance to the branchial sac. Each tentacle consists of connective tissue covered with epithelium (endoderm), and contains two or more cavities which are continuous with blood sinuses in the mantle.

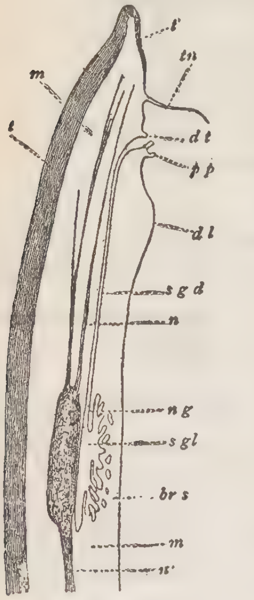


FIG. 9.—Diagrammatic section through anterior dorsal part of *A. mentula*, showing the relations of the nerve ganglion, subneural gland, &c.

n,	Nerve.
n',	Myelon.
pp,	Peripharyngeal band.
sgl,	Subneural gland.
sgd,	Its duct.
t,	Test lining branchial siphon.

Subneural Gland.

In the dorsal median line near the anterior end of the body, and embedded in the mantle on the ventral surface of the nerve ganglion, there lies a small glandular mass—the subneural gland—which, as Julin has shown (24), there is reason to regard as the homologue of the *hypophysis cerebri* of the vertebrate brain. Julin and E. van Beneden have suggested that the function of this organ may possibly be renal. The subneural gland, which was first noticed by Hancock, communicates anteriorly, as Ussoff (23) pointed out, by means of a narrow duct with the front of the branchial sac (pharynx). The opening of the duct is enlarged to form a funnel-shaped cavity, which may be folded upon itself, convoluted, or even broken up into a number of smaller openings, so as to form a complicated projection, called the dorsal tubercle, situated in the dorsal part of the prebranchial zone. (fig. 9).

Dorsal Tubercle.

The dorsal tubercle in *A mentula* is somewhat horseshoe-shaped (fig. 10); it varies in form in most Ascidians according to the genus and species, and in some cases in the individual also. The function of the neural gland must still be regarded as doubtful. The secretion is formed by the degeneration and disintegration of cells proliferated from the walls of the duct or its branches, and no concretions are found. The ciliated funnel of the dorsal tubercle is a sense-organ, innervated by a large nerve from the ganglion; it may be a sense-organ for testing the quality of the water entering the branchial sac.

The single elongated ganglion in the median dorsal line of the mantle between the branchial and atrial siphons is the only nerve-centre in *A. mentula* and most other Tunicata.

Nervous System.

It is the degenerate remains of the anterior part of the cerebro-spinal nervous system of the tailed larval Ascidian (see below). The posterior or spinal part has entirely disappeared in most Tunicata. It persists, however, in the Appendiculariidae and traces of it are found in some Ascidians (*e.g. Clavelina*). The ganglion gives off distributory nerves at both ends, which run through the mantle to the neighbourhood of the apertures, where they divide and subdivide.

Sense-Organs.

The only sense-organs are the pigment spots between the branchial and atrial lobes, the tentacles at the base of the branchial siphon, the dorsal tubercle, and possibly the languets or dorsal lamina. These are all in a lowly developed condition. Nerve-endings have also been found in the endostyle, the peripharyngeal bands and other parts of the wall of the pharynx. The larval Ascidians, on the other hand, have well-developed intracerebral optic and otic sense-organs; and in some of the pelagic Tunicata otocysts and pigment spots or eyes are found in connexion with the ganglion. Atrial tentacles (which may also be sensory) have now been found in a number of the gregarious Cynthiidae and Polystyelidae.

The mouth and the pharynx (branchial sac) have already been described.

Alimentary Canal.

The remainder of the alimentary canal is a bent tube which in *A. mentula* and most other Ascidians lies embedded in the mantle on the left side of the body, and projects into the peribranchial cavity. The oesophagus leaves the branchial sac in the dorsal middle line near the posterior end of the dorsal lamina (see fig. 5, *œa*). It is a short curved tube which leads ventrally to the large fusiform thick-walled stomach. The intestine emerges from the ventral end of the stomach, and soon turns anteriorly, then dorsally, and then posteriorly so as to form a curve—the intestinal loop—open posteriorly. The intestine now curves anteriorly again, and from this point runs nearly straight forward as the rectum, thus completing a second curve—the rectal loop—open anteriorly (see fig. 5). The wall of the intestine is thickened internally to form the typhlosole, a pad which runs along its entire length. The anus opens into the dorsal part of the peribranchial cavity near to the atrial aperture. The walls of the stomach are glandular; and a system of delicate tubules with dilated ends, which ramifies over the outer wall of the intestine and communicates with the cavity of the stomach by means of a duct, is probably a digestive gland.

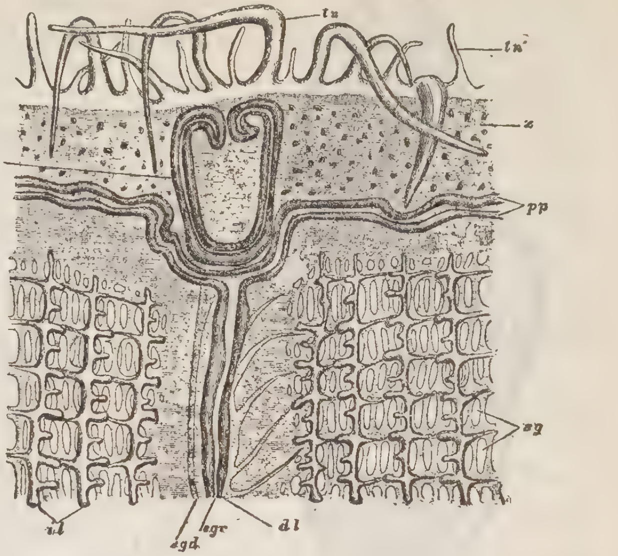


FIG. 10.—Dorsal Tubercle and neighbouring organs of *A. mentula*. Lettering as before.

egr, Epibranchial groove; *z*, prebranchial zone.

A mass of large clear vesicles which occupies the rectal loop, and may extend over the adjacent walls of the intestine, is a renal organ without a duct.

Excretory Organs.

Each vesicle is the modified remains of a part of the primitive coelom or body cavity, and is formed of cells which eliminate nitrogenous waste matters from the blood circulating in the neighbouring blood lacunae and deposit them in the cavity of the vesicle, where they form a concentrically laminated concretion of a yellowish or brown colour. These concretions contain uric acid, and in a large Ascidian are very numerous. The nitrogenous waste products are thus deposited and stored up in the renal vesicles in place of being excreted from the body. In other Ascidians the renal organ may differ from the above in its position and structure; but in no case has it an excretory duct, unless the subneural gland is to be regarded as an additional renal organ.

The heart is an elongated fusiform tube placed on the ventral and posterior edge of the stomach, in a space (the pericardium) which is part of the original coelom or body cavity, the rest of which exists merely in the form of lacunae and of the cavities of the reproductive organs and renal vesicles in the adult Ascidian.

Blood Vascular System and Coelom.

The wall of the heart is formed of a layer of epithelio-muscular cells, the inner ends of which are cross-striated; and waves of contraction pass along it from end to end, first for a certain number of beats in one direction and then in the other, so as to reverse the course of circulation periodically. At each end the heart is continued into a vessel (see fig. 11), which is merely a large sinus or lacuna lined with a delicate endothelial layer. The sinus leaving the ventral end of the heart is called the branchio-cardiac vessel,[1] and the heart itself is merely the differentiated posterior part of this sinus and is therefore a ventral vessel. The branchio-cardiac vessel, after giving off a branch which, along with a corresponding branch from the cardio-visceral vessel, goes to the test, runs along the ventral edge of the branchial sac externally to the endostyle, and communicates laterally with the ventral ends of all the transverse vessels of the branchial sac. The sinus leaving the dorsal end of the heart is called the cardio-visceral vessel, and this, after giving off to the test the branch above mentioned, breaks up into a number of sinuses, which ramify over the alimentary canal and the other viscera. These visceral lacunae finally communicate with a third great sinus, the viscero-branchial vessel, which runs forward along the dorsal edge of the branchial sac externally to the dorsal lamina and joins the dorsal ends of all the transverse vessels of the branchial sac. Besides these three chief systems, there are numerous lacunae in all parts of the body, by means of which anastomoses are established between the different currents of blood. All these blood spaces and lacunae are to be regarded as derived from the blastocoele of the embryo, and not, as has been usually supposed, from the coelom (30).

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[1] On account of the periodic reversal of the circulation none of the vessels can be called arteries or veins.

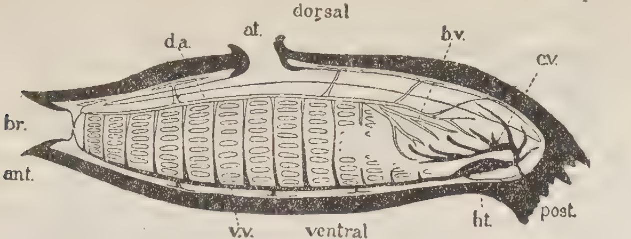


FIG. 11.—Diagram of the Blood Circulation in an Ascidian. The test is solid black.

at, Atrial aperture.
br, Branchial aperture.
bv, Branchio-visceral vessel.
cv, Cardio-visceral system.
da, Dorsal aorta.
ht, Heart.
vv, Ventral or branchio-cardiac vessel.

Course of Circulation. When the heart contracts ventro-dorsally the course of the circulation is as follows: the blood which is flowing through the vessels of the branchial sac is collected in an oxygenated condition in the branchio-cardiac vessel, and, after receiving a stream of blood from the test, enters the heart (*ht*). It is then propelled from the dorsal end of the heart into the cardio-visceral vessels, and so reaches the test and digestive and other organs; then, after circulating in the visceral lacunae, it passes into the branchio-visceral vessel in an impure condition, and is distributed to the branchial vessels (fig. 11, *da*) to be purified again. When the heart on the other hand contracts dorso-ventrally, this course of the circulation is reversed. As the test receives a branch from each end of the heart, it follows that it has afferent and efferent vessels whichever way the blood is flowing. In some Ascidians the vessels in the test become very numerous and their end branches terminate in swollen bulbs close under the outer surface of the test. In this way an accessory respiratory organ is probably formed in the superficial layer of the test. The blood corpuscles are chiefly colourless and amoeboid; but in most if not all Ascidians there are also some pigmented corpuscles in the blood. These are generally of an orange or reddish brown tint, but may be opaque white, dark indigo-blue, or even of other colours. Precisely similarly pigmented cells are found throughout the connective tissue of the mantle and other parts of the body.

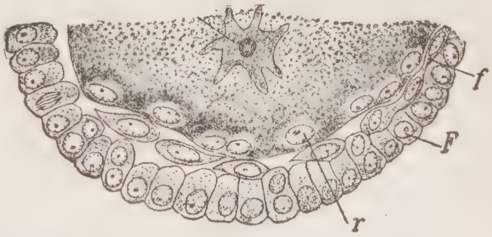
Reproductive Organs. *A. mentula* is hermaphrodite, and the reproductive organs lie, with the alimentary canal, on the left side of the body. The ovary is a ramified gland which occupies the greater part of the intestinal loop (see fig. 5). It contains a cavity which, along with the cavities of the testis, is derived from a part of the original coelom, and the ova are formed from its walls and fall when mature into the cavity. The oviduct is continuous with the cavity of the ovary and leads forwards alongside the rectum, finally opening near the anus into the peribranchial cavity. The testis is composed of a great number of delicate branched tubules, which ramify over the ovary and the adjacent parts of the intestinal wall. Those tubules terminate in ovate swellings. Near the commencement of the rectum the larger tubules unite to form the vas deferens, a tube of considerable size, which runs forwards alongside the rectum, and, like the oviduct, terminates by opening into the peribranchial cavity close to the anus. The lumen of the tubules of the testis, like the cavity of the ovary, is a part of the original coelom, and the spermatozoa are formed from the cells lining the wall. In some Ascidians reproductive organs are present on both sides of the body, and in others (*Polycarpa*) there are many complete sets of both male and female systems, attached to the inner surface of the mantle on both sides of the body and projecting into the peribranchial cavity.[1]

EMBRYOLOGY [2] AND LIFE-HISTORY

We owe to W. E. Castle (1896) the most complete account which has yet been given of the early stages of development in an Ascidian. His careful study of the cell lineage in *Ciona* has made it clear that some of the conflicting statements of his predecessors arose from incorrect orientation of the embryos. One of the most important of his conclusions is that the mesoderm of Ascidians, and probably that of the archaic Vertebrates, is derived from both primary layers, ectoderm and endoderm. Further, he finds that *Ciona* produces both ova and spermatozoa at the same time, but self-fertilization very rarely occurs. The eggs are laid just before dawn, and the larva is hatched during the following night. The test cells adhering to the young homogeneous test have, it is now well known, no connexion with the cells found later in the adult test. The larvae are free-swimming for from one to several days. They avoid the light. The spermatozoon enters at the ventral hemisphere, and that point determines the median plane and the posterior end of the embryo. The ventral is the animal pole. The cleavage is from the beginning bilateral. The first cleavage plane is vertical, and separates the right and left halves of the embryo. The four smaller dorsal cells with yolk give rise to the endodermal hemisphere; the four larger, more protoplasmic, cells form the ventral ectodermal hemisphere. The cells of the latter hemisphere divide more rapidly, and form the future aboral surface. When the dorsal hemisphere has twenty-two cells the ventral has fifty-four. The gastrulation is a combination of epiboly and invagination. The ventral ectoderm grows over, so as to envelop the dorsal hemisphere, while the latter sinks down and becomes saucer-shaped. In the centre of the dorsal surface ten cells form the future endoderm. Round these comes a ring of cells, the chordamesenchyme ring, from which the notochord and mesenchyme arise. Outside this ring is a row of cells, the neuro-muscular ring. The more anterior of these cells form the medullary plate, the more posterior the longitudinal musculature of the larva. The remainder of the cells (in the 112-cell stage) form ectoderm. By growth at the anterior end the blastopore gets pushed posteriorly, and the anterior chorda cells are covered up, and come to lie in the dorsal wall of the archenteron, sixteen cells in two rows, one over the other. The blastopore closes in the posterior part of the dorsal surface. In front of it is the medullary plate, with a continuation backwards at the sides of the blastopore. This region forms the trunk of the larva, the part posterior to it being drawn out to form the tail. The chorda cells pass back into the tail, while the mesenchyme cells shift forwards into the trunk. The muscle cells, derived from the neuro-muscular ring, lie behind the blastopore, and form the muscles of the tail. The closure of the medullary canal takes place from the blastopore forwards, and then the nerve cord is grown over by ectoderm. After closure of the blastopore the mesenchyme cells lie as lateral masses in the trunk; later they become the blood corpuscles and the mantle cells, &c.

Castle also discusses some important theoretical questions. He points out that, in *Ciona* at least, the chorda-mesenchyme ring takes part along with endoderm in the primary invagination, and so belongs to the primary endoderm; while the rest of the mesoderm, the muscle cells of the neuro muscular ring, are carried in by a secondary invagination, and belong to the outer layer of the young gastrula, or primary ectoderm. He considers that the chorda must be regarded as a mesodermal organ. He agrees with former observers in seeing no trace of enterocoele formation, and he doubts whether any Chordata are Enterocoela. He does not believe in distinguishing those Metazoa with a mesoderm from those with a "mesenchyme." He considers that embryology gives no support to the Annelid hypothesis as to the origin of Chordates.

A long-continued discussion as to the origin, nature and fate of certain cells, the "testa-zellen," which make their appearance between the young embryo and its follicle (fig. 12), has ended in practical agreement that these small cells are derived from the follicle-cells, and have nothing to do with the test. In *Salpa*, however, certain follicle-cells enter the embryo, and perform important functions in guiding the development for a time.



(After Pizon.)

FIG. 12.—Portion of Mature Ovum of Ascidian, showing F, follicle, and *f*, *r*, "test-cells."

Embryology. In most Ascidians the eggs are fertilized in the peribranchial cavity, and undergo most of their development before leaving the parent; in some cases, however, the eggs are laid, and fertilization takes place in the surrounding water. The segmentation is complete and regular (fig. 13, A) and results in the formation of a spherical blastula, which then undergoes invagination (fig. 13, B). The embryo elongates, and the blastopore or invagination opening comes to be placed on the dorsal edge near the posterior end (fig. 13, C). The hypoblast cells lining the archenteron are columnar in form, while the epiblast cells are more cubical (fig. 13, B, C, D). The dorsal surface of the embryo now becomes flattened and then depressed to form a longitudinal groove, extending forwards from the blastopore to near the front of the body This "medullary groove" now becomes converted into a closed

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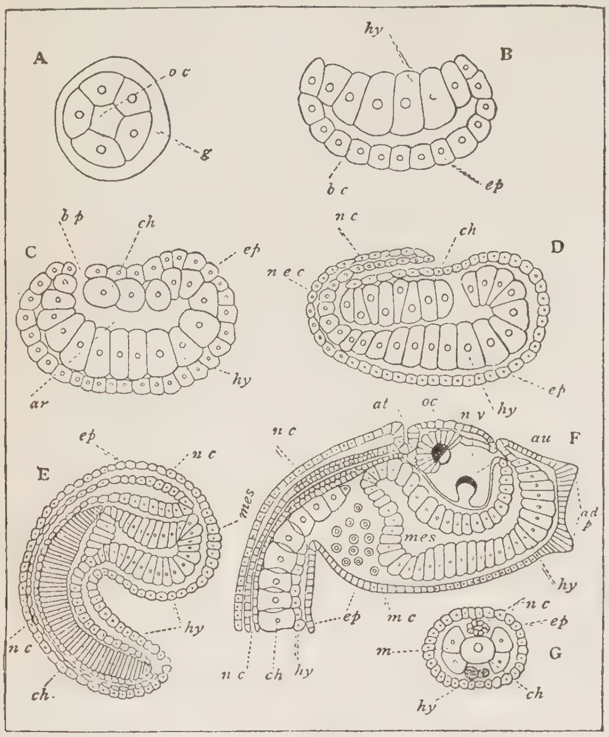
[1] For structure of other forms, see below.

[2] For reproduction by gemmation see under "Classification" below.

canal by its side walls growing up, arching over, and coalescing in the median dorsal line (fig. 13, D). This union of the *laminae dorsales* to form the neural canal commences at the posterior end behind the blastopore and gradually extends forwards. Consequently the blastopore comes to open into the posterior end of the neural canal (fig. 13, D), while the anterior end of that cavity remains open to the exterior. In this way the archenteron communicates indirectly with the exterior. The short canal leading from the neural canal to the archenteron is known as the neurenteric canal (fig. 13, D, *nec*). Previous to this stage some of the hypoblast cells at the front edge of the blastopore and forming part of the dorsal wall of the archenteron (fig. 13, C, *ch*) have become separated off, and then arranged to form an elongated band, two cells wide, underlying the posterior half of the neural canal (fig. 13, D, E, *ch*). This is the origin of the notochord. Outgrowths from the sides of the archenteron give rise to laterally placed masses of cells, which are the origin of the mesoblast. These masses show no trace of metameric segmentation. The cavities (reproductive and renal vesicles) which are formed later in the mesoblast represent the coelom. Consequently the body cavity of the Tunicata is a modified form of enterocoele. The anterior part of the embryo, in front of the notochord, now becomes enlarged to form the trunk, while the posterior part elongates to form the tail (fig. 13, E). In the trunk the anterior part of the archenteron dilates to form the mesenteron, the greater part of which becomes the branchial sac; at the same time the anterior part of the neural canal enlarges to form the cerebral vesicle, and the opening to the exterior at the front end of the canal now closes. In the tail part of the embryo the neural canal remains as a narrow tube, while the remains of the wall of the archenteron—the dorsal part of which becomes the notochord—are converted into lateral muscle bands (fig. 13, G) and a ventral cord of cells, which eventually breaks up to form blood corpuscles. As the tail grows longer, it becomes bent round the trunk of the embryo inside the egg-membrane. About this period the epiblast cells begin to form the test as a cuticular deposit upon their outer surface. The test is at first devoid of cells and forms a delicate gelatinous investment, but it shortly afterwards becomes cellular by the migration into it of test cells formed by proliferation from the epiblast.[1]



(After Kowalevsky.)

FIG. 13.—Stages in the Embryology of a Simple Ascidian.

A to F, Longitudinal vertical sections of embryos, all placed with the dorsal surface uppermost and the anterior end at the right.

A, Early blastula stage, during segmentation.

B, Early gastrula stage.

C, Stage after gastrula, showing commencement of notochord.

D, Later stage, showing formation of notochord and of neural canal.

E, Embryo showing body and tail and completely formed neural canal.

F, Larva just hatched; end of tail cut off.

G, Transverse section of tail of larva.

adp,	Adhering papillae of larva.	*nec*,	Neurenteric canal.
at,	Epiblastic (atrial) involution.	*oc*,	Ocular organ of larva.
au,	Auditory organ of larva.	*g*,	Gelatinous investment of embryo.
ar,	Archenteron.		
bc,	Blastocoele.	*m*,	Muscle cells of tail.
bp,	Blastopore.	*mes*,	Mesenteron.
ch,	Notochord.	*mc*,	Mesoderm cells.
ep,	Epiblast.	*nv*,	Cerebral vesicle at anterior end of neural canal.
hy,	Hypoblast.		
nc,	Neural canal.		

Larval Stage.

The embryo is hatched about two or three days after fertilization, in the form of a tadpole-like larva, which swims actively through the sea by vibrating its long tail. The anterior end of the body is provided with three adhering papillae (fig. 13, F, *adp.*) in the form of epiblastic thickenings. In the free-swimming tailed larva the nervous system, formed from the walls of the neural canal, becomes considerably differentiated. The anterior part of the cerebral vesicle remains thin-walled (fig. 13, F), and two unpaired sense-organs develop from its wall and project into the cavity. These are a dorsally and posteriorly placed optic organ, provided with retina, pigment layer, lens and cornea, and a ventrally placed auditory organ, consisting of a large spherical partially pigmented otolith, attached by delicate hair-like processes to the summit of a hollow *crista acoustica* (fig. 13, F, *au*). The posterior part of the cerebral vesicle thickens to form a solid ganglionic mass traversed by a narrow central canal: this becomes the ganglion of the adult Ascidian. The wall of the neural canal behind the cerebral vesicle becomes differentiated into an anterior thicker region, placed in the posterior part of the trunk and having a superficial layer of nerve fibres, and a posterior narrower part which traverses the tail, lying on the dorsal surface of the notochord, and gives off several pairs of nerves to the muscles of the tail. Just in front of the anterior end of the nervous system a dorsal involution of the epiblast breaks through into the upturned anterior end of the mesenteron and thus forms the mouth opening. Along the ventral edge of the mesenteron, which becomes the branchial sac, the endostyle is formed as a narrow groove with thickened side walls. It probably corresponds to the median portion of the thyroid body of Vertebrata. A curved outgrowth from the posterior end of the mesenteron forms the alimentary canal (oesophagus, stomach and intestine), which at first ends blindly. An anus is formed later by the intestine opening into the left of two lateral epiblastic involutions (the atria), which rapidly become larger and fuse dorsally to form the peribranchial cavity. Outgrowths from the wall of the branchial sac meet these epiblastic involutions and fuse with them to give rise to the first formed pair of stigmata, which thus come to open into the peribranchial cavity; and these alone correspond to the gill clefts of *Amphioxus* and the Vertebrata.

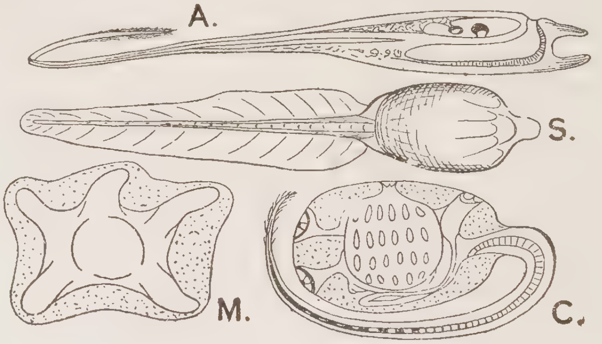


FIG. 14.—Sketches of Ascidian Larvae.
A, *Ascidia*; S, *Styela*; M, *Anurella*; C, Compound Ascidian.

Fig. 14 shows a few characteristic forms of Ascidian "tadpoles," or free-swimming larvae. A and S are typical simple Ascidians; M is the aberrant tailless form found in some *Molgulidae*; and C is the larva of a typical compound Ascidian.

Metamorphosis to Adult Form.

After a short free-swimming existence the fully developed tailed larva fixes itself by its anterior adhering papillae to some foreign object, and then undergoes a remarkable series of retrogressive changes, which convert it into the adult Ascidian. The tail atrophies, until nothing is left but some fatty cells in the posterior part of the trunk. The adhering papillae disappear and are replaced functionally by a growth of the test over neighbouring objects. The nervous system with its sense organs atrophies until it is reduced to the single small ganglion, placed on the dorsal edge of the pharynx, and a slight nerve cord running for some distance posteriorly (van Beneden and Julin). Changes in the shape of the body and a further growth and differentiation of the branchial sac, peribranchial cavity and other organs now produce gradually the structure found in the adult Ascidian.

The most important points in connexion with this process of development and metamorphosis are the following: (1) In the

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[1] Some of the first test cells are also probably derived from the epithelium of the egg follicle.

Ascidian embryo all the more important organs (*e.g.* notochord, neural canal, archenteron) are formed in essentially the same manner as they are in *Amphioxus* and other Chordata. (2) The free-swimming tailed larva possesses the essential characters of the Chordata, inasmuch as it has a longitudinal skeletal axis (the notochord) separating a dorsally placed nervous system (the neural canal) from a ventral alimentary canal (the archenteron); and therefore during this period of its life-history the animal belongs to the Chordata. (3) The Chordate larva is more highly organized than the adult Ascidian, and therefore the changes by which the latter is produced from the former may be regarded as a process of degeneration (31). The important conclusion drawn from all this is that the Tunicata are the degenerate descendants of a group of primitive Chordata (see below).

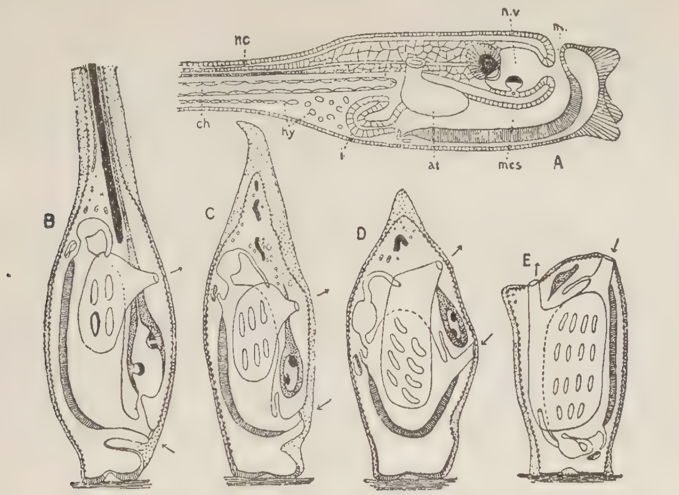

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FIG. 15.—Metamorphosis of an Ascidian (modified from Kowalevsky and others).

A, Free-swimming tailed larva. B, The metamorphosis—larva attached. C, Tail and nervous system of larva degenerating. D, Further degeneration and metamorphosis of larva into E, the young fixed Ascidian.

at, Atrial invagination.
ch, Notochord.
hy, Hypoblast cells.
i, Intestine.
m, Mouth.
mes, Mesenteron.
nc, Neural canal.
nv, Neural vesicle with sense-organs.

CLASSIFICATION AND CHARACTERS OF GROUPS

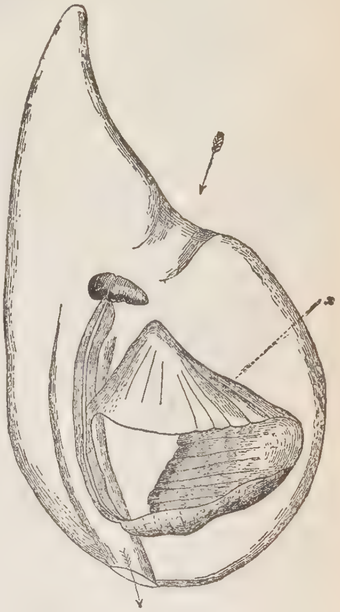
ORDER I.—LARVACEA

Characters of Larvacea.

Free-swimming pelagic forms provided with a large locomotory appendage (the tail), in which there is a skeletal axis (the urochord). A relatively large test (the "house") is formed with great rapidity as a secretion from the ectoderm; it is merely a temporary structure, which is cast off and replaced by another. The branchial sac is simply an enlarged pharynx with two ventral ciliated openings (stigmata) leading to the exterior. There is no separate peribranchial cavity. The nervous system consists of a large dorsally placed ganglion and a long nerve cord, which stretches backwards over the alimentary canal to reach the tail, along which it runs on the left side of the urochord. The anus opens ventrally on the surface of the body in front of the stigmata. No reproduction by gemmation or metamorphosis is known in the life-history.

Structure of Appendicularia.

This is one of the most interesting groups (fig. 16) of the Tunicata, as it shows more completely than any of the rest the characters of the original ancestral forms. It has undergone little or no degeneration, and consequently corresponds more nearly to the tailed-larval condition than to the adult forms of the other groups. The order includes a single family, the Appendiculariidae, all the members of which are minute and free-swimming. They occur on the surface of the sea in most parts of the world. They possess the power to form with great rapidity an enormously large investing gelatinous layer (fig. 11), which corresponds to the test of other groups. This was first described by von Mertens and by him named "Haus." It is only loosely attached to the body and is frequently thrown off soon after its formation and again reformed. H. Lohmann has made a careful study of the mode of formation of this "house" from certain large ectoderm cells, the "oikoplasts," and he considers that it probably fulfils the following functions: Its complicated apparatus of passages with partial septa form a finely perforated network, through which a relatively large volume of water is strained so as to entrap microscopic food particles; it helps in locomotion by its hydrostatic effect, and it is also a protection to the animal, which may escape from enemies by throwing off the house, which is many times its own size. The tail in the Appendiculariidae is attached to the ventral surface of the body (fig. 18), and usually points more or less anteriorly. The supposed traces of vertebration in the muscle bands and the nerve cord are probably artifacts, and do not indicate true metameric segmentation. Near the base of the tail there is a distinct elongated ganglion (fig. 18, *ng'*). The anterior (cerebral) ganglion has connected with it an otocyst, a pigment spot, and a tubular process opening into the branchial sac and representing the dorsal tubercle and associated parts of an ordinary Ascidian. The branchial aperture or mouth leads into the branchial sac or pharynx. There are no tentacles. The endostyle is short. There is no dorsal lamina, and the peripharyngeal bands run dorsally and posteriorly. The wall of the branchial sac has only two ciliated apertures (fig. 19). They are homologous with the primary stigmata of the typical Ascidians and the gill clefts of vertebrates. They are placed



(After Fol.)

FIG. 17.—*Oikopleura cophocerca* in "House," seen from right side, magnified. The arrows indicate the course of the water.

x, Lateral reticulated parts of "House."

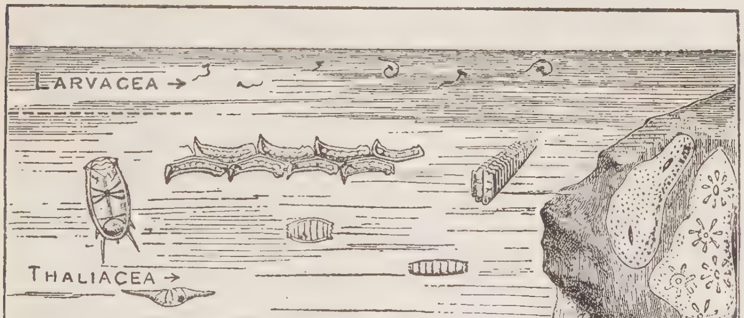


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FIG. 16.—Sketch of the chief kinds of Tunicata found in the sea.

far back on the ventral surface, one on each side of the middle line, and lead into short funnel-shaped tubes which open on the surface of the body behind the anus (fig. 18, *at*). These tubes correspond to the right and left atrial involutions which, in an ordinary Ascidian, fuse to form the peribranchial cavity. The heart, according to Lankester, is formed of two cells, which are placed at the opposite ends and connected by delicate contractile protoplasmic fibrils. The large ovary and testis are placed at the posterior end of the body. The remainder of the structural details can be made out from figs. 18 and 19.

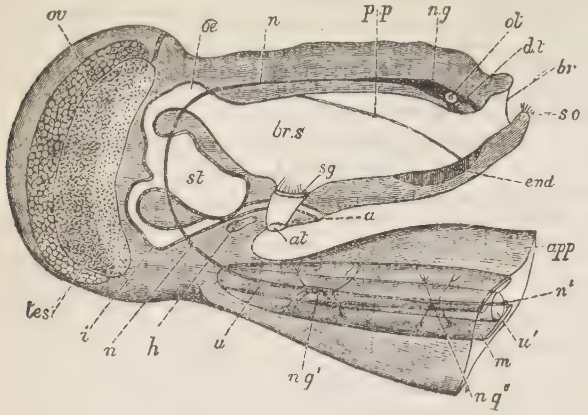

Fig. 18.—Semi-diagrammatic view of *Appendicularia* from the right.

a,	Anus.	*ov*,	Ovary.
at,	One of the atrial apertures.	*pp*,	Peripharyngeal band.
app,	Tail.	*ng*,	Cerebral ganglion.
br,	Branchial aperture.	*ng'*,	Caudal ganglion.
brs,	Branchial sac.	*ng''*,	Enlargement of nerve cord in tail.
dt,	Dorsal tubercle.		
end,	Endostyle.	*so*,	Sense-organ (tactile) on lower lip.
h,	Heart.		
i,	Intestine.	*sg*,	Ciliated aperture in pharynx.
m,	Muscle band of tail.		
n,	Nerve cord in body.	*st*,	Stomach.
n',	Nerve cord in the tail.	*tes*,	Testis.
oe,	Oesophagus.	*u*,	Urochord.
ot,	Otocyst.	*u'*,	Its cut end.

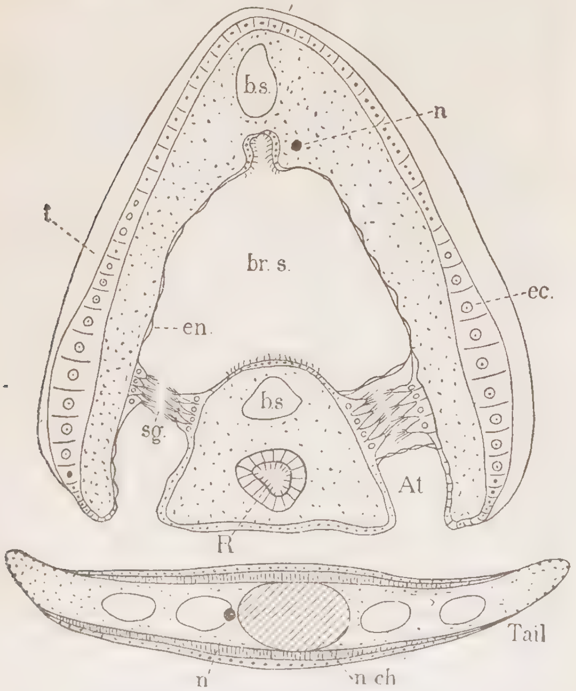

Fig. 19.—Transverse Section of *Oikopleura*; anterior part of body and tail.

At,	Atrial passage.	*n*,	Nerve.
b.s,	Blood sinus.	*n.ch*,	Notochord.
br.s,	Branchial sac (pharynx).	*R*,	Rectum.
ec,	Ectoderm.	*sg*,	Stigma.
en,	Endoderm.	*t*,	Test.

The family Appendiculariidae comprises amongst others the following genera: *Oikopleura* (Mertens), and *Appendicularia* (Cham.), in both of which the body is short and compact and the tail relatively long, while the endostyle is straight; *Megalocercus* (Chun) containing *M. abyssorum*, a huge deep-sea form from the Mediterranean (30 mm. long); *Fritillaria* (Quoy and Gaimard), in which the body is long and composed of anterior and posterior regions, the tail relatively short, the endostyle recurved, and an ectodermal hood is formed over the front of the body; and *Kowalevskia* (Fol), a remarkable form described by Fol (14), in which the heart and endostyle are said to be absent, while the branchial sac is provided with four rows of ciliated tooth-like processes.

Order II.—Thaliacea

Thaliacea.

Free-swimming pelagic forms which may be either simple or compound, and the adult of which is never provided with a tail or a notochord. The test is permanent and may be either well developed or very slight. The musculature of the mantle is in the form of more or less complete circular bands, by the contraction of which locomotion is effected. The branchial sac has either two large or many small apertures, leading to a single peribranchial cavity, into which the anus opens. Blastogenesis takes place from a ventral endostylar stolon. Alternation of generations occurs in the life-history, and may be complicated by polymorphism. The Thaliacea comprises two groups Cyclomyaria and Hemimyaria.

Sub-order 1.—Cyclomyaria.

Characters of Cyclomyaria.

Free-swimming pelagic forms which exhibit alternation of generations in their life-history but never form permanent colonies. The body is cask-shaped, with the branchial and atrial apertures at the opposite ends. The test is more or less well developed. The mantle has its musculature in the form of circular bands surrounding the body. The branchial sac is fairly large, occupying the anterior half or more of the body. Stigmata are usually present in its posterior part only. The peribranchial cavity is mainly posterior to the branchial sac. The alimentary canal is placed ventrally close to the posterior end of the branchial sac. Hermaphrodite reproductive organs are placed ventrally near the intestine.

This group forms one family, the Doliolidae, including three genera, *Doliolum* (Quoy and Gaimard), *Dolchinia* (Korotneff) and *Anchinia* (C. Vogt).

Structure of Doliolum.

Doliolum, of which about a dozen species are known from various seas, has a cask-shaped body, usually from 1 to 2 cm. in length. The terminal branchial and atrial apertures (fig. 20) are lobed and the lobes are provided with sense organs. The test is very slightly developed and contains no cells. The mantle has eight or nine circular muscle bands surrounding the body. The most anterior and posterior of these form the branchial and atrial sphincters. The wide branchial and atrial apertures lead into large branchial and peribranchial cavities, separated by the posterior wall of the branchial sac, which is pierced by stigmata; consequently there is a free passage for the water through the body along its long axis, and the animal swims by contracting its ring-like muscle bands, so as to force out the contained water posteriorly. Stigmata may also be found on the lateral walls of the branchial sac, and in that case there are corresponding anteriorly directed diverticula of the peribranchial cavity. There is a distinct endostyle on the ventral edge of the branchial sac and a peripharyngeal band surrounding its anterior end, but there is no representative of the dorsal lamina on its dorsal edge. The oesophagus commences rather on the ventral edge of the posterior end of the branchial sac, and runs backwards to open into the stomach, which is followed

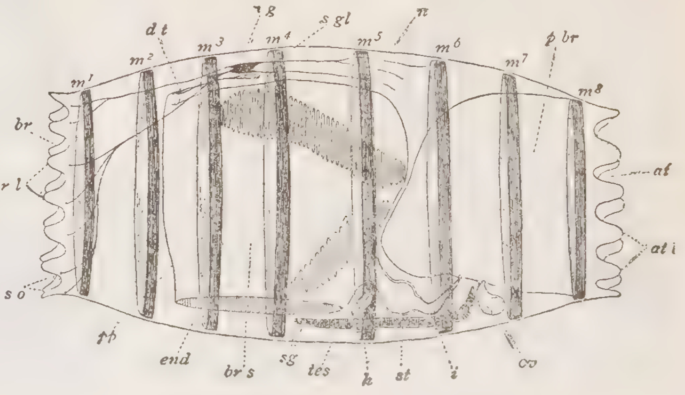

Fig. 20.—*Doliolum denticulatum*, sexual generation, from the left side. Lettering as for fig. 18.

m^1—m^8,	Muscle bands.	*pbr*,	Peribranchial cavity.
ng,	Nerve ganglion.	*atl*,	Atrial lobes.
sg,	Stigmata.	*so*,	Sense organs.
sgl,	Subneural gland.	*brl*,	Branchial lobes.

by a curved intestine opening into the peribranchial cavity. The alimentary canal as a whole is to the right of the middle line. The hermaphrodite reproductive organs are to the left of the middle line alongside the alimentary canal. They open into the peribranchial cavity. The ovary is nearly spherical, while the testis is elongated, and may be continued anteriorily for a long distance. The heart is placed in the middle line ventrally, between the posterior end of the endostyle and the oesophageal aperture. The nerve ganglion lies about the middle of the dorsal edge of the body, and gives off many nerves. Under it is placed the subneural gland, the duct of which runs forward and opens into the anterior end of the branchial sac by a simple aperture, surrounded by the spirally twisted dorsal end of the peripharyngeal band (fig. 20., *dt*).

Development of Doliolum.

The ova of the sexual generation produce tailed larvae; these develop into forms known as "nurses," which are asexual, and are characterized by the possession of nine muscle bands, an auditory sac on the left side of the body, a ventrally-placed stolon near the heart, upon which buds are produced and a dorsal outgrowth near the posterior end of the body. The nurse after producing the buds becomes a degenerate form with very wide muscle bands. The buds give rise eventually to the sexual generation, which is polymorphic, having three distinct forms, in two of which the reproductive organs remain undeveloped. The buds while still very young migrate from their place of origin on the stolon, divide by fission, and become attached to the dorsal outgrowth of the body of the nurse, where they develop. The three forms produced are as follows. (1) Nutritive forms (trophozooids), which remain permanently attached to the nurse and serve to provide it with food; they have the body elongated dorso-ventrally, and the musculature is very slightly developed. (2) Foster forms (phorozooids), which, like the preceding, do not become sexually mature, but, unlike them, are set free as cask-shaped bodies with eight muscle bands and a ventral outgrowth, which is formed of the stalk by which the body was formerly united to the nurse. On this outgrowth the (3) forms (gonozooids) which become sexually mature are attached while still young buds, and after the foster forms are set free these reproductive forms gradually attain their complete development and are eventually set free and lose all trace of their connexion with the foster forms. They resemble the foster forms in having a cask-shaped body with eight muscle bands, but differ in having no outgrowth or process, and in having the reproductive organs fully developed.[1]

Anchinia.

Anchinia, of which only one species is known, *A. rubra*, from the Mediterranean, has the sexual forms permanently attached to portions of the dorsal outgrowth from the body of the unknown nurse. The body is elongated dorso-ventrally. The test is well developed and contains branched cells. The musculature is not so well developed as in *Doliolum*. There are two circular bands at the anterior end and two at the posterior, and two on the middle of the body. The stigmata are confined to the obliquely placed posterior end of the branchial sac. The alimentary canal forms a U-shaped curve. The reproductive organs are placed on the right side of the body. The life-history is still imperfectly known. As in the case of *Doliolum* the sexual generation is polymorphic, and has three forms, two of which remain in a rudimentary condition so far as the reproductive organs are concerned. In *Anchinia*, however, the three forms do not occur together on one stolon or outgrowth, but are produced successively, the reproductive forms of the sexual generation being independent of the "foster forms" (see Barrois, 27).

Sub-order 2.—Hemimyaria.

Characters of Hemimyaria.

Free-swimming pelagic forms which exhibit alternation of generations in their life-history and in the sexual condition form colonies. The body is more or less fusiform, with the long axis antero-posterior, and the branchial and atrial apertures nearly terminal. The test is well developed. The musculature of the mantle is in the form of a series of transversely-running bands, which do not form complete independent rings as in the Cyclomyaria. These transverse muscles are probably to be regarded as branchial and atrial sphincters which have spread over the body. The branchial and peribranchial cavities form a continuous space in the interior of the body, opening externally by the branchial and atrial apertures, and traversed obliquely from the dorsal and anterior end to the ventral and posterior by a long narrow vascular band, which represents the dorsal lamina, the dorsal blood-vessel, and the neighbouring part of the dorsal edge of the branchial sac of an ordinary Ascidian. The alimentary canal is placed ventrally. It may either be stretched out (ortho-enteric) so as to extend for some distance anteriorly, or—as is more usual—be concentrated (caryo-enteric) to form along with the reproductive organs a rounded opaque mass near the posterior end of the body known as the visceral mass or "nucleus." The embryonic development is direct, no tailed larva being formed.

Salpidae.

This sub-order contains one family, the Salpidae, including the single genus *Salpa* (Forskål), which, however, may be divided into two well-marked groups of species—(1) those, such as *S. pinnata*, in which the alimentary canal is stretched out along the ventral surface of the body, and (2) those, such as *S. fusiformis* (fig. 21, A), in which the alimentary canal forms a compact globular mass, the "nucleus," near the posterior end of the body. About fifteen species altogether are known; they are all pelagic forms and are found in nearly all seas. Each species occurs in two forms—the solitary asexual (*proles solitaria*) and the aggregated sexual (*proles gregaria*)—which are usually quite unlike one another. The solitary form (fig. 21, B) gives rise by internal gemmation to a complex tubular stolon, which contains processes from all the more important organs of the parent body and which becomes segmented into a series of buds or embryos. As the stolon elongates, the embryos near the free end which have become advanced in their development are set free in groups, which remain attached together by processes of the test, each enclosing a diverticulum from the mantle so as to form "chains" (fig. 22). Each member of the chain is a *Salpa* of the sexual or aggregated form, and when mature may—either still attached to its neighbours or separated from them (fig. 21, A)—produce one or several embryos, which develop into the solitary *Salpa*. Thus the two forms alternate regularly.

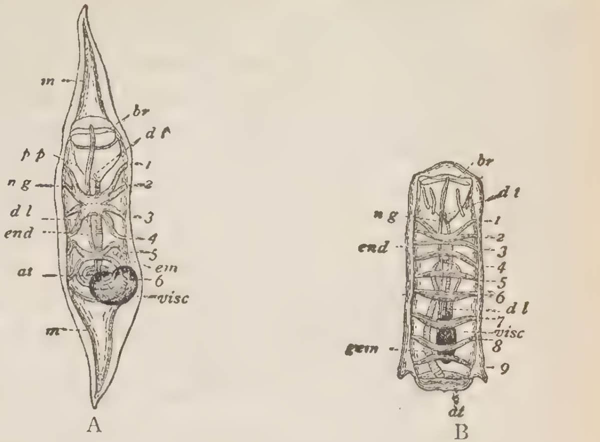

FIG. 21.—*Salpa runcinata-fusiformis.*

A, Aggregated form: *em*, Embryo; *gem*, Gemmiparous stolon; *m*, Mantle; *visc*, Visceral mass (nucleus). B, Solitary form: 1–9, Muscle bands. Lettering as before.

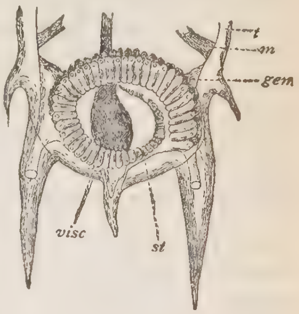

FIG. 22.—Posterior part of solitary form of *Salpa democratica-mucronata*, showing a chain of embryos nearly ready to be set free.

gem, Young aggregated *Salpae* forming the chain.
st, Stolon.
m, Muscle band of the mantle.

Structure of Salpa.

The more important points in the structure of a typical *Salpa* are shown in fig. 23. The branchial and atrial apertures are at opposite ends of the body, and each leads into a large cavity, the branchial and peribranchial sacs, which are in free communication at the sides of the obliquely-running dorsal lamina or "gill." The test is well developed and adheres closely to the surface of the mantle. The muscle bands of the mantle do not completely encircle the body. They are present dorsally and laterally, but the majority do not reach the ventral surface. In many cases neighbouring bands join in the median dorsal line (fig. 21). The anterior end of the dorsal lamina is prolonged to form a prominent tentacular organ, the languet, projecting into the branchial sac. The nerve ganglion (which represents the ganglion of the Ascidian along with the subneural gland), dorsal lamina, peripharyngeal bands and endostyle, are placed in their

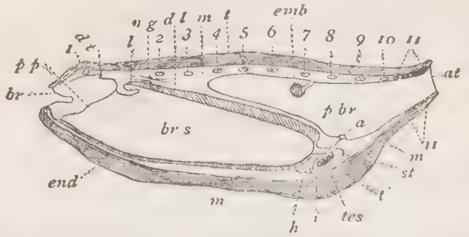

FIG. 23.—Semi-diagrammatic representation of *Salpa* from left side. Lettering as before.

emb, Embryo.
m, Mantle.
l, Languet.
t', Thickening of test over nucleus.
dl, Gill or branchia.
1–11, Muscle bands of mantle.

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[1] For further details see Uljanin (28) and Neumann, *Doliolum*, in *Deutsch. Tief-See Exped.* (Jena, 1905).

usual positions; but in place of any distinct subneural gland there are two lateral neural glandular masses first described by Metcalf. These have no connexion with the ciliated funnel, but open by lateral ducts into the branchial cavity. Median and lateral eyes are also found in connexion with the ganglion. The large spaces at the sides of the dorsal lamina (often called the gill or branchia of *Salpa*), by means of which the cavity of the branchial sac is placed in free communication with the peribranchial cavity, are to be regarded as gigantic *stigmata* formed by the suppression of the lateral walls of the branchial sac. Fig. 23 represents an aggregated or sexual *Salpa* which was once a member of a chain, since it shows a testis and a developing embryo. The ova (always few in number, usually only one) appear at a very early period in the developing chain *Salpa*, while it is still a part of the gemmiparous stolon in the body of the solitary *Salpa*. This gave rise to the view put forward by Brooks (25), that the ovary really belongs to the solitary *Salpa*, which is therefore a female producing a series of males by asexual gemmation, and depositing in each of these an ovum, which will afterwards, when fertilized, develop in the body of the male into a solitary or female *Salpa*. This idea would of course entirely destroy the view that *Salpa* is an example of alternation of generations. The sexual or chain *Salpa*, although really hermaphrodite, is always protogynous; *i.e.* the female elements or ova are produced at an earlier period than the male organ or testis. This prevents self-fertilization.

Development of Salpa.

The ovum is fertilized by the spermatozoa of an older *Salpa* belonging to another chain, and the embryo is far advanced in its development before the testis is formed. Follicular cells, known as kalymmocytes, migrate into the ovum and for a time play an important part in moulding the development and nourishing the blastomeres. At an early period in its development a part of the embryo becomes separated off, along with a part of the wall of the cavity in which it lies, to form the "placenta," in which the embryonic and the maternal blood streams circulate in close proximity (or actually coalesce during one period) and so allow of the passage of nutriment to the developing embryo. At a somewhat later stage a number of cells placed at the posterior end of the body alongside the future nucleus become filled up with oil-globules to form a mass of nutrient material—the elaeoblast—which is used up later on in the development. Many suggestions have been made as to the homology of the elaeoblast. The most probable is that it is the disappearing rudiment of the tail found in the larval condition of most Ascidians.

Addendum.

Octacnemidae.

The family Octacnemidae includes the single remarkable genus *Octacnemus*, found during the "Challenger" expedition, and first described by Moseley (29). It is now known in both a solitary and an aggregated form, and was regarded by Herdman as a deep-sea representative of the pelagic Salpidae, possibly fixed; or, better, as related to the primitive fixed forms from which Salpidae have been derived. Metcalf, however, has shown that the aggregated form of *O. patagoniensis*, which he has described, is more nearly related to the Clavelinidae amongst Ascidiacea. The body is somewhat discoid, with its margin prolonged to form eight tapering processes (fig. 24), on to which the muscle bands of the mantle are continued. The alimentary canal forms a compact nucleus (fig. 24, A); the endostyle is very short; and the dorsal lamina is also reduced. The reproduction and life-history are entirely unknown. *Octacnemus bythius* was found by the "Challenger" expedition in the South Pacific at depths of 1070 and 2160 fathoms, and Metcalf has since described a new species, *O. patagoniensis* from 1050 fathoms off the Patagonian coast, in which there is an aggregated form (fig. 24, B) consisting of individuals united by a stolon composed of test and body-walls.

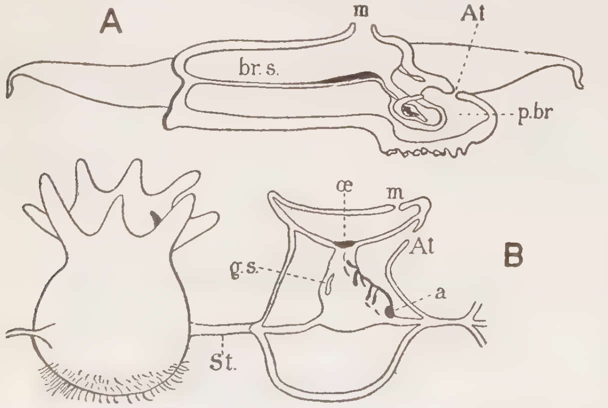


FIG. 24.—*Octacnemus*.

A, Solitary form (after Herdman). B, Aggregated form (after Metcalf).

a,	Anus.	*m,*	Mouth.
At,	Atrial aperture.	*œ,*	Oesophagus.
br.s,	Branchial sac.	*p.br,*	Peribranchial cavity.
g.s,	Gill slit.	*st,*	Stolon.

ORDER III.—ASCIDIACEA

Ascidiacea.

Fixed or free-swimming simple or compound Ascidians which in the adult are never provided with a tail and have no trace of a notochord. The free-swimming forms are colonies, the simple Ascidians being always fixed. The test is permanent and well developed; as a rule it increases with the age of the individual. The branchial sac is large and well developed. Its walls are perforated by numerous slits (stigmata) opening into the peribranchial cavity, which communicates with the exterior by the atrial aperture. Many of the forms reproduce by gemination, and in most of them the sexually-produced embryo develops into a tailed larva.

The Ascidiacea includes three groups—the simple Ascidians, the compound Ascidians and the free-swimming colonial *Pyrosoma*.

Sub-Order 1.—Ascidiae simplices.

Simple Ascidians.

Fixed Ascidians which are solitary and very rarely reproduce by gemmation; if colonies are formed, the members are not buried in a common investing mass, but each has a distinct test of its own. No strict line of demarcation can be drawn between the simple and the compound Ascidians, and one of the families of the former group, the Clavelinidae (the social Ascidians), forms a transition from the typical simple forms, which never reproduce by gemmation, to the compound forms, which always do. The Ascidiae Simplices may be divided into the following families:—

Family I., Clavelinidae.—Simple Ascidians which reproduce by gemmation to form small colonies in which each ascidiozooid has a distinct test, but all are connected by a common blood system, and by prolongations of "epicardiac tubes" from the branchial sacs. Buds formed on stolons which are vascular outgrowths from the posterior end of the body, containing prolongations from the ectoderm, mesoderm and endoderm of the ascidiozooid. Branchial sac not folded; internal longitudinal bars usually absent; stigmata straight; tentacles simple. This family contains, amongst others, the following three genera: *Ecteinascidia* (Herdman), with internal longitudinal bars in branchial sac; *Clavelina* (Savigny), with intestine extending behind branchial sac; and *Perophora* (Wiegmann), with intestine alongside branchial sac.

Family II., Ascidiidae.—Solitary fixed Ascidians with gelatinous test; branchial aperture usually eight-lobed, atrial aperture usually six-lobed. Branchial sac not folded; internal longitudinal bars usually present; stigmata straight or curved; tentacles simple. This family is divided into three sections:—

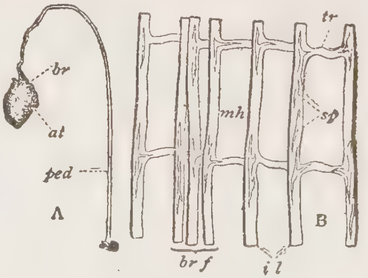
Sub-family 1, Hypobythinae.—Branchial sac with no internal longitudinal bars. One genus, *Hypobythius* (Moseley).

Sub-family 2, Ascidinae.—Stigmata straight. Many genera, of which the following are the more important: *Ciona* (Fleming), dorsal languets present; *Ascidia* (Linnaeus, = *Phallusia*, Savigny), dorsal lamina present (see figs. 1 to 10); *Rhodosoma* (Ehrenberg), anterior part of test modified to form operculum; *Abyssascidia* (Herdman), intestine on right side of branchial sac.

Sub-family 3, Corellinae.—Stigmata curved. Three chief genera: *Corella* (Alder and Hancock), test gelatinous, body sessile; *Corynascidia* (Herdman), test gelatinous, body pedunculated; *Chelyosoma* (Brod. and Sow.), test modified into horny plates.

Family III., Cynthiidae.—Solitary fixed Ascidians, usually with leathery test; branchial and atrial apertures both four-lobed. Branchial sac longitudinally folded (fig. 26); stigmata straight; tentacles simple or compound. This family is divided into three sections:—

Sub-family 1, Styelinae.—Not more than four folds on each side of branchial sac (fig. 26, S) tentacles simple. The more important genera are: *Styela* (Macleay), stigmata normal, and *Bathyoncus* (Herdman), stigmata absent or modified.



(After Herdman, "*Challenger*" *Report.*)

FIG. 25.—*Culeolus willemoesi*.

A, Entire body, natural size.

at,	Atrial aperture.
br,	Branchial aperture.
ped,	Peduncle.

B, Part of branchial sac magnified.

br f,	Slight fold of branchial sac.
i l,	Internal longitudinal bar.
mh,	Mesh.
sp,	Calcareous spicules in vessels.
tr,	Transverse vessels.

Sub-family 2, Cynthinae.—More than eight folds in branchial sac (fig. 26, C); tentacles compound; body sessile. The chief genus is *Cynthia* (Savigny), with a large number of species.

Sub-family 3, Bolteninae.—More than eight folds in branchial sac; tentacles compound; body pedunculated (fig. 25, A). The chief genera are: *Boltenia* (Savigny), branchial aperture four-lobed, stigmata normal; and *Culeolus* (Herdman), branchial aperture with less than four lobes, stigmata absent or modified (fig. 25, B). This last is a deep-sea genus discovered by the "Challenger" expedition (see 17).

Family IV., Molgulidae.—Solitary Ascidians, sometimes not fixed; branchial aperture six-lobed, atrial four-lobed. Test usually incrusted with sand. Branchial sac longitudinally folded; stigmata more or less curved, usually arranged in spirals; tentacles compound. The chief genera are: *Molgula* (Forbes), with distinct folds in the branchial sac, and *Eugyra* (Ald. and Hanc.), with no distinct folds, but merely broad internal longitudinal bars in the branchial sac. In some of the Molgulidae (genus *Anurella*, Lacaze-Duthiers, 20) the embryo (fig. 14, M) does not become converted into a tailed larva, the development being direct, without metamorphosis. The embryo when hatched assumes gradually the adult structure, and never shows the features characteristic of larval Ascidians, such as the urochord and the median sense-organs. Bourne has described an aberrant Molgulid, *Oligotrema*, from the Loyalty Islands, with a reduced branchial sac and enlarged pinnate muscular branchial lobes, apparently used for catching food!

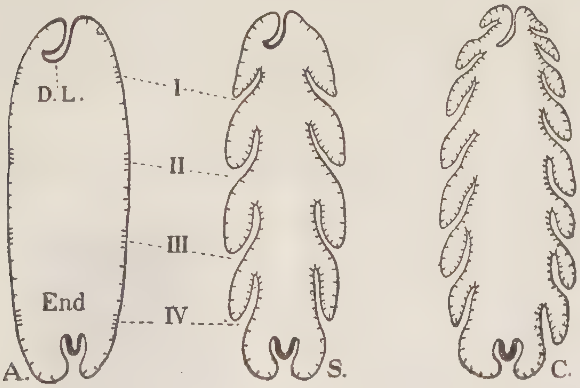


FIG. 26.—Diagrams showing Transverse Sections of Typical Branchial Sacs.

A, Unfolded type. S, *Styela*, with four folds on each side.
C, *Cynthia*, with eight folds on one side and seven on the other.
D.L., Dorsal lamina; End, endostyle; I, II, &c., folds.

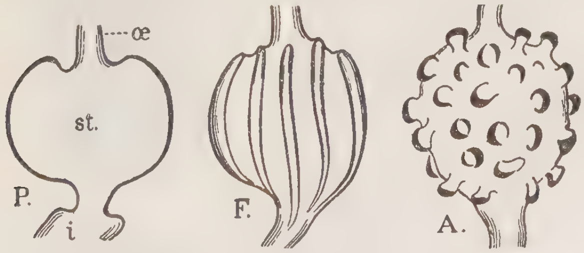


FIG. 27.—Types of Stomach amongst Compound Ascidians.
P, Plain. F, Folded. A, Areolated.
i, Intestine; *œ*, oesophagus; *st*, stomach.

Figs. 26 and 27 illustrate some details of structure of branchial sac and of stomach in various simple and compound Ascidians, which are made use of in classification, and in the definitions of genera and larger groups.

Sub-Order 2.—Ascidiae Compositae.

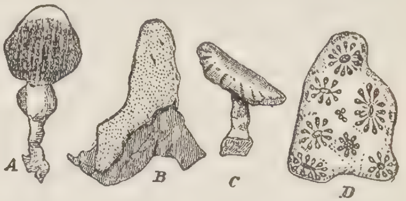
Compound Ascidians.

Fixed Ascidians which reproduce by gemmation, so as to form colonies in which the ascidiozooids are buried in a common investing mass and have no separate tests. This is probably a somewhat artificial assemblage formed of two or three groups of Ascidians which produce colonies in which the ascidiozooids are so intimately united that they possess a common test or investing mass. This is the only character which distinguishes them from the Clavelinidae, but the property of reproducing by gemmation separates them from the rest of the Ascidiae Simplices. The Ascidiae Compositae may be divided into seven families, which fall into two well-marked groups: (1) the Chalarosomata, including the first five families, with extended body, divided into two or three regions, and more nearly related to the Clavelinidae; and (2) the Pectosomata, including the Botryllidae and Polystyelidae, with a compact body, not divided into regions, and evidently related to the Cynthiidae amongst simple Ascidians.

Family I., Distomidae.—Ascidiozooids divided into two regions, thorax and abdomen; testes numerous; vas deferens not spirally coiled. The chief genera are: *Distoma* (Gaertner); *Distaplia* (Della Valle); *Colella* (Herdman), forming a pedunculated colony (see fig. 28, A) in which the ascidiozooids develop incubatory pouches, connected with the peribranchial cavity, in which the embryos undergo their development (17); and *Chondrostachys* (Macdonald).

Family II., Coelocormidae.—Colony not fixed, having a large axial cavity with a terminal aperture. Branchial apertures five-lobed. This includes one species, *Coelocormus huxleyi* (Herdman), which is, in some respects, a transition form between the ordinary compound Ascidians (*e.g.* Distomidae) and the Ascidiae Luciae (*Pyrosoma*).

Family III., Didemnidae.—Colony usually thin and incrusting test containing stellate calcareous spicules. Testis single, large; vas deferens spirally coiled. The chief genera are—*Didemnum* (Savigny), in which the colony is thick and fleshy and there are only three rows of stigmata on each side of the branchial sac; and *Leptoclinum* (Milne-Edwards), in which the colony is thin and incrusting (fig. 28, B) and there are four rows of stigmata on each side of the branchial sac.



(After Herdman, "*Challenger*" *Report.*)

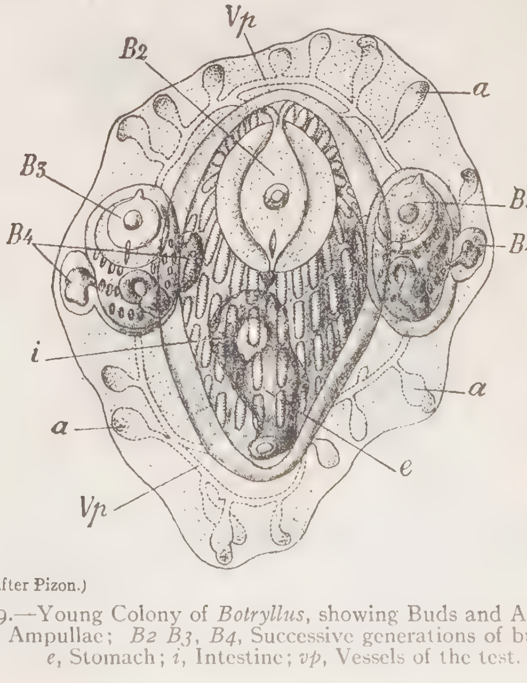
FIG. 28.—Colonies of Ascidiae Compositae. (Natural size.)

A, *Colella quoyi.*
B, *Leptoclinum neglectum.*
C, *Pharyngodictyon mirabile.*
D, *Botryllus*, showing arrangement of ascidiozooids in circular systems, each of which has a central common cloaca.

Family IV., Diplosomidae.—Test reduced in amount, rarely containing spicules. Vas deferens not spirally coiled. In *Diplosoma* (Macdonald), the most important genus, the larvȧ is gemmiparous.

Family V., Polyclinidae.—Ascidiozooids divided into three regions—thorax, abdomen and post-abdomen. Testes numerous; vas deferens not spirally coiled. The chief genera are: *Pharyngodictyon* (Herdman), with stigmata absent or modified, containing one species, *Ph. mirabile* (fig. 28, C), the only compound Ascidian known from a depth of 1000 fathoms; *Polyclinum* (Savigny), with a smooth-walled stomach; *Aplidium* (Savigny), with the stomach wall longitudinally folded (fig. 27); and *Amaroucium* (Milne-Edwards), in which the ascidiozooid has a long post-abdomen and a large atrial languet.

Family VI., Botryllidae.—Ascidiozooids having the intestine and reproductive organs alongside the branchial sac. Dorsal lamina present; internal longitudinal bars present in branchial sac. The chief genera are: *Botryllus* (Gaertn. and Pall.), with simple stellate systems (fig. 28, D), and *Botrylloides* (Milne-Edwards), with elongated or ramified systems. It is well known that in the family Botryllidae, amongst compound Ascidians, the ectodermal vessels containing



(After Pizon.)

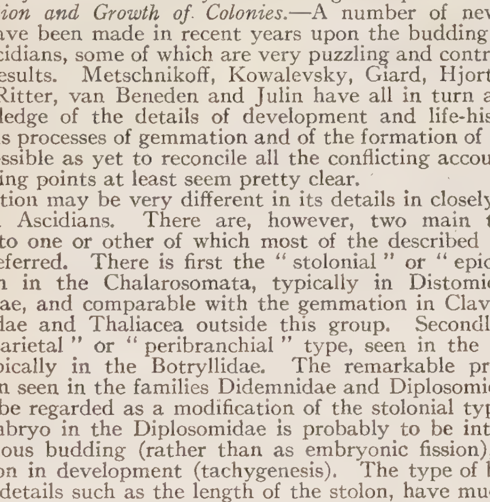
FIG. 29.—Young Colony of *Botryllus*, showing Buds and Ampullae.
a, Ampullae; *B2 B3*, *B4*, Successive generations of buds;
e, Stomach; *i*, Intestine; *vp*, Vessels of the test.

blood, which ramify through the common test and serve to connect the vascular systems of the various members of the colony, have numerous large ovate dilatations, the ampullae, upon their terminal twigs (fig. 29). Various functions have been assigned to these ampullae in the past, and Bancroft has shown that in addition to acting as storage reservoirs for blood, organs for the secretion of test matrix, and accessory organs of respiration, they are also organs for blood propulsion. The ampullae execute co-ordinated pulsations, the co-ordination being due to variations in the blood-pressure. It was actually found that the ampullae could keep up the circulation for some time in a portion of a colony independently of the hearts of the ascidiozooids. All the hearts in a colony of *Botryllus* contract simultaneously and in the same direction. The reversal of the circulation may be regarded as due to the engorgement of the ampullae in the superficial parts of the colony. These when distended overcome the resistance of the heart's action, and cause it to stop and then reverse.

Family VII., Polystyelidae.—Ascidiozooids not grouped in systems. Branchial and atrial apertures four-lobed. Branchial sac may be folded; internal longitudinal bars present. The chief genera are: *Thylacium* (Carus), with ascidiozooids projecting above general surface of colony; *Goodsiria* (Cunningham), with ascidiozooids completely imbedded in investing mass; and *Chorizocormus* (Herdman), with ascidiozooids united in little groups which are connected by stolons. Several of the species show transitions between the other Polystyelidae and the Styelinae amongst simple Ascidians.

Gemmation and Growth of Colonies.—A number of new observations have been made in recent years upon the budding of compound Ascidians, some of which are very puzzling and contradictory in their results. Metschnikoff, Kowalevsky, Giard, Hjort, Pizon, Seeliger, Ritter, van Beneden and Julin have all in turn added to our knowledge of the details of development and life-history, of the various processes of gemmation and of the formation of colonies. It is impossible as yet to reconcile all the conflicting accounts, but the following points at least seem pretty clear.

Gemmation may be very different in its details in closely related compound Ascidians. There are, however, two main types of budding, to one or other of which most of the described methods may be referred. There is first the "stolonial" or "epicardiac" type, seen in the Chalarosomata, typically in Distomidae and Polyclinidae, and comparable with the gemmation in Clavelinidae, Pyrosomidae and Thaliacea outside this group. Secondly, there is the "parietal" or "peribranchial" type, seen in the Pectosomata, typically in the Botryllidae. The remarkable process of gemmation seen in the families Didemnidae and Diplosomidae may probably be regarded as a modification of the stolonial type. The double embryo in the Diplosomidae is probably to be interpreted as precocious budding (rather than as embryonic fission), due to acceleration in development (tachygenesis). The type of budding, and even details such as the length of the stolon, have much to do with differences in the nature and appearance of the colonies produced. The stolon, which has a wall continuous with the body-wall of the parent, contains an endodermal element in the form of the so-called "epicardium," and also a prolongation of the ovary, or at least a string of migrating germ-cells, so that the reproductive elements are also handed on. Still, it is clear from recent researches that the development of the bud (blastozooid) and that of the embryo (oozooid) do not proceed along parallel lines. It is impossible to harmonize the facts of gemmation with the germ-layer theory, and attempts to explain budding in Ascidians as a process of regeneration, by which the organs of the parent or their germ-layers give rise to the corresponding organs in the bud, have signally failed.



(After Pizon.)

FIG. 30.—Young buds of *Botryllus* sectioned to show the separation of the branchial (*vb*) from the peribranchial (*cp*) cavities.

ov, Dorsal tube.
m, Mesoderm cells.
gh, Germ cells.
ect, Ectoderm.

Figs. 29 and 30 show the buds in the Botryllidae, after Pizon, who has followed day by day the changes of growth in young colonies of Botryllidae, tracing the rise of successive generations of buds and the degeneration of their parents. The buds are parietal, arising from the walls of the peribranchial cavities (fig. 29), and at an early period they acquire the structure shown in fig. 30, where there are two vesicles undergoing further subdivision and differentiation, but investigators still differ as to whether the inner, which gives rise to the branchial sac and alimentary canal, is not produced along with the outer from the ectoderm of the parent.

Reproduction by Gemmation and the Formation of Colonies.

A remarkable case of polymorphism has been found by M. Caullery in the buds of the compound Ascidian *Colella*. Some of the buds have an abundant store of reserve materials in their outer layer of cells, while others are without this supply. The former are placed deeply in the stalk, develop slowly, and probably serve to regenerate the colony when the head portion has been removed or has died down. In these cases where the ectoderm has taken on the function of storing the reserve material, it is found that all the organs of the bud are formed from the cells of the endodermic vesicle. The first ascidiozooid of the colony produced by the tailed larva does not form sexual reproductive organs, but reproduces by gemmation so as to make a colony. Thus there is alternation of generations in the life-history. In the most completely formed colonies (*e.g. Botryllus*) the ascidiozooids are arranged in groups (systems or coenobii), and in each system are placed with their atrial apertures towards one another, and all communicating with a common cloacal cavity which opens to the exterior in the centre of the system (fig. 28, D).

Sub-Order 3.—Ascidiae Luciae.

Ascidiae Luciae.

Free-swimming pelagic colonies having the form of a hollow cylinder closed at one end. The ascidiozooids forming the colony are embedded in the common test in such a manner that the branchial apertures open on the outer surface and the atrial apertures on the inner surface next to the central cavity of the colony. The ascidiozooids are produced by gemmation from a rudimentary larva (the cyathozooid) developed sexually.

Structure of Pyrosoma.

This sub-order includes a single family, the Pyrosomidae, containing one well-marked genus, *Pyrosoma* (Péron), with half a dozen species. They are found swimming near the surface of the sea, chiefly in tropical latitudes, and are brilliantly phosphorescent. A fully developed *Pyrosoma* colony may be from an inch or two to upwards of twelve feet in length. The shape of the colony is seen in fig. 31. It tapers slightly towards the closed end, which is rounded. The opening at the opposite end is reduced in size by the presence of a membranous prolongation of the common test (fig. 31, B). The branchial apertures of the ascidiozooids are placed upon short papillae projecting from the general surface, and most of the ascidiozooids have long conical processes of the test projecting outwards beyond their branchial apertures (figs. 31, 32 and 33). There is only a single layer of ascidiozooids in the *Pyrosoma* colony, as all the fully developed ascidiozooids are placed with their antero-posterior axes at right angles to the surface and communicate by their atrial apertures with the central cavity of the colony (fig. 32). Their dorsal surfaces are turned towards the open end of the colony. The more important points in the structure of the ascidiozooid of *Pyrosoma* are shown in fig. 33. A circle of tentacles, of which one, placed ventrally (fig. 33, *tn*), is larger than the rest, is found just inside the branchial aperture. From this point a wide cavity, with a few circularly placed muscle bands running round its walls, leads back to the large branchial sac, which occupies the greater part of the body. The stigmata are elongated transversely and crossed by internal longitudinal bars. The dorsal lamina is represented by a series of eight languets (*l*). The nerve ganglion (on which is placed a small pigmented sense organ), the subneural gland, the dorsal tubercle, the peripharyngeal

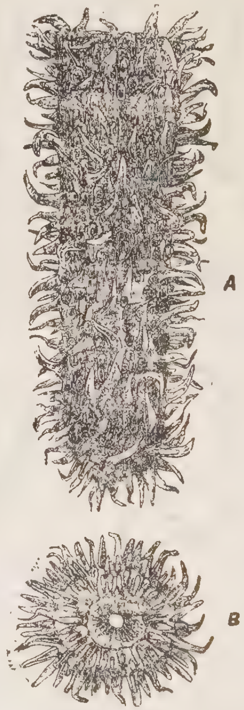
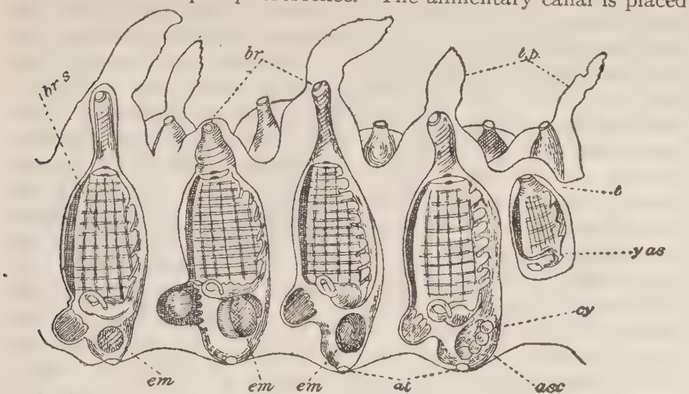


FIG. 31.—*Pyrosoma elegans.* (Natural size.)
A, Side view of entire colony.
B, End view of open extremity.

bands, and the endostyle are placed in the usual positions. On each side of the anterior end of the branchial sac, close to the peripharyngeal bands, is a mass of rounded gland cells which are the source of the phosphorescence. The alimentary canal is placed posteriorly to the branchial sac, and the anus opens into a large peribranchial (or atrial) cavity, of which only the median posterior part is shown (*p.br.*) in fig. 33. The reproductive organs are developed in a diverticulum of the peribranchial cavity, and consist of a lobed testis and a single ovum at a time. The development takes place in a part of the peribranchial cavity (fig. 32, *em*). The segmentation is meroblastic, and an elongated embryo is formed on the surface of a mass of yolk. The embryo, after the formation of an alimentary cavity, a tubular nervous system, and a pair of laterally placed atrial tubes, divides into an anterior and a posterior part. The anterior part then segments into four pieces, which afterwards develop into the first ascidiozooids of the colony, while the posterior part remains in a rudimentary condition, as the "cyathozooid"; it eventually atrophies. As the four ascidiozooids increase in size, they grow round the cyathozooid and soon encircle it (fig. 32, *asc* and *cy*). The cyathozooid absorbs the nourishing yolk upon which it lies, and distributes it to the ascidiozooids by means of a heart and system of vessels which have been meanwhile formed. When the cyathozooid atrophies and is absorbed, its original atrial aperture remains and deepens to become the central cavity of the young colony, which now consists of four ascidiozooids placed in a ring, around where the cyathozooid was, and enveloped in a common test. The colony gradually increases by the formation of buds from these four original ascidiozooids.

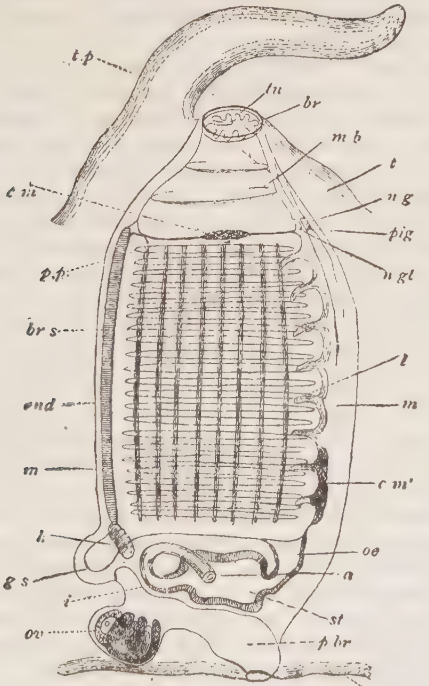
Development of Pyrosoma.



(Partly after Savigny.)

FIG. 32.—Part of a Longitudinal Section through wall of *Pyrosoma*, showing arrangement of ascidiozooids, magnified.

at,	Atrial apertures.	*em*,	Embryos in various stages.
br,	Branchial apertures.	*t*,	Test.
asc,	Young ascidiozooid of a future colony produced by budding from *cy*, cyathozooid.	*t.p*,	Processes of test.
		br.s,	Branchial sac.
		y.as,	Young ascidiozooid.



(Partly after Keferstein.)

FIG. 33.—Mature Ascidiozooid of *Pyrosoma*, from left side. Lettering as before.

c.m,	Cellular mass, the seat of phosphorescence.	*m.b*,	Muscle band.
c.m',	Posterior cellular mass.	*n.gl*,	Subneural gland.
g.s,	Gemmiparous stolon.	*pig*,	Pigment spot on ganglion.
		t.p,	Process of test.

PHYLOGENY

Phylogeny

The accompanying diagram (fig. 34) shows graphically the probable origin and course of evolution of the various groups of Tunicata, and therefore exhibits their relations to one another much more correctly than any system of linear classification can do. The ancestral Proto-Tunicata are here regarded[1] as an offshoot from the Proto-Chordata—the common ancestors of the Tunicata (Urochorda), *Amphioxus* (Cephalochorda) and the Vertebrata. The ancestral Tunicata were probably free-swimming forms, not very unlike the existing Appendiculariidae, and are represented in the life-history of nearly all sections of the Tunicata by the tailed larval stage. The Larvacea are the first offshoot from the ancestral forms which gave rise to the two lines of descendants, the Proto-Thaliacea and the Proto-Ascidiacea. The Proto-Thaliacea then split into the ancestors of the existing Cyclomyaria and Hemimyaria. The Proto-Ascidiacea gave up their pelagic mode of life and became fixed. This ancestral process is repeated at the present day when the free-swimming larva of the simple and compound Ascidians becomes attached. The Proto-Ascidiacea, after the change, are probably most nearly represented by the existing genus *Clavelina*. They have given rise directly or indirectly to the various groups of simple and compound Ascidians and the Pyrosomidae. These groups form two lines, which appear to have diverged close to the position of the family Clavelinidae. The one line leads to the more typical compound Ascidians, and includes the Polyclinidae, Distomidae, Didemnidae, Diplosomidae, Coelocormidae, and finally the Ascidiae Luciae or Salpiformes. The second line gave rise to the simple Ascidians, and to the Botryllidae and Polystyelidae, which are, therefore, not closely allied to the other compound Ascidians. The later Proto-Ascidiacea were probably colonial forms, and gemmation was retained by the Clavelinidae and by the typical compound Ascidians (Distomidae, &c.) derived from them. The power of forming colonies by budding was lost, however, by the primitive simple Ascidians, and must, therefore, have been regained independently by the ancestral forms of the Botryllidae and the Polystyelidae. If this is a correct interpretation of the course of evolution of the Tunicata, we arrive at the following important conclusions. (1) The Tunicata, as a whole, form a degenerate branch of the Proto-Chordata; (2) the Ascidiae Luciae (*Pyrosoma*) are much more closely related to the typical compound Ascidians than to the other pelagic Tunicata, viz. the Larvacea and the Thaliacea; and (3) the Ascidiae Compositae form a polyphyletic group, the sections of which have arisen at several distinct points from the ancestral simple Ascidians.

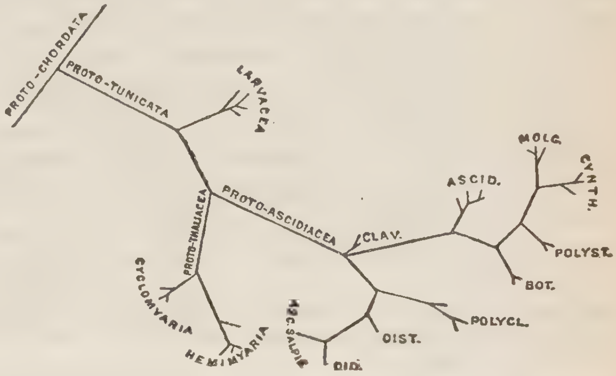


FIG. 34.

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[1] By Dohrn and others their point of origin is placed considerably farther up on the stem of the Chordata, thus causing the Tunicata to be regarded as very degenerate Vertebrata (see 31).

Müller's *Archiv* (1852); (12) Kupffer, *Arch. f. mikr. Anat.* (1869, 1872); (13) Giard, "Étude d. trav. embryolog. d. *Tun.*, &c.," in *Arch. zool. expér.* (1872), vol. i.; (14) Fol, "Études sur les appendiculaires du détroit de Messine," in *Mém. soc. phys. hist. nat. Genève*, vol. xxi.; (15) Giard, "Recherches s. l. Asc. Comp.," in *Arch. zool. expér.* (1872), vol. i.; (16) Von Drasche, *Die Synascidien der Bucht von Rovigno* (Vienna, 1883); (17) Herdman, "Report upon the *Tunicata* of the 'Challenger' Expedition," pt. i. in *Zool.* "*Chall.*" *Exp.* (1882), vol. vi.; pt. ii. in *Zool.* "*Chall.*" *Exp.* (1886), vol. xiv.; pt. iii. in *Zool.* "*Chall.*" *Exp.* (1889), vol. xxvii.; (18) Alder and Hancock, in *Ann. Mag. Nat. Hist.* (1863, 1870); (19) Heller, "Untersuch. u. d. Tunic. d. Adriat. Meeres," in *Denkschr. d. k. Akad. Wiss.* (1875–1877); (20) Lacaze-Duthiers, "Asc. simp. d. côtes d. l. Manche," in *Arch. zool. expér.* (1874, 1877); (21) Traustedt, in *Vidensk. medd. naturh. For.* (Copenhagen, 1881–1884); (22) Herdman, "Notes on British *Tunicata*, &c.," in *Journ. Linn. Soc. Zool.* (1880), vol. xv.; (23) Ussoff, in *Proc. imp. soc. nat. hist.* (Moscow, 1876), vol. xviii.; (24) Julin, "Rech. s. l'org. d. asc. simp.," in *Arch. d. biol.* (1881), vol. ii.; (25) Brooks, "Development of *Salpa*," in *Bull. Mus. Comp. Zool.* iii. 291 (Harvard); (26) Salensky, *Ztschr. f. wiss. Zool.* (1877); (27) Barrois, *Journ. d. l'anat. et phys.* (1885), vol. xxi.; (28) Uljanin, *Fauna, &c., d. Golfes von Neapel* (1884), vol. x.; (29) Moseley, "On Deep-sea Ascid," in *Trans. Linn. Soc.* (1876), 2nd series, vol. i.; (30) E. van Beneden and Julin, "Morph. d. Tuniciers," in *Arch. d. Biol.* (1886), vol. vi.; (31) Dohrn, "Studien zur Urgesch. der Wirbelth." in *Mitth. zool. Stat. Neapel*; (32) Herdman, "Revised Classification," *Journ. Linn. Soc.* (1891), vol. xxiii.; (33) Herdman, *Descriptive Catalogue of Australian Tunicata* (1899); (34) Brooks, *The Genus Salpa* (1893); (35) Seeliger, *Bronn's Thier-Reich Tunicata*. (W. A. He.)

TUNICLE (Lat. *tunicella*), a liturgical vestment of the Christian church, proper to subdeacons. It is practically the same vestment as the dalmatic (*q.v.*).

TUNING FORK, a small bar of cast steel with tolerably defined edges, bent into a fork with two prongs, with a handle of the same metal extending from the bend of the fork and serving as a sound-post to transmit the vibrations to any resonance board or body convenient for reinforcing the sound. The fork is set in vibration by striking one of the prongs against a hard substance, or pressing the prongs together if they are light ones, or if heavy drawing a bow across. The tuning fork was invented by John Shore, royal trumpeter in 1711, sergeant trumpeter at the entry of George I. in 1714, and lutanist to the Chapel Royal in 1715. It is used for determining musical pitch (see Pitch), and also in certain physical experiments (see Sound).

TUNIS, capital of Tunisia, the largest city in North Africa outside Egypt, in 36° 48′ N., 10° 12′ E. Tunis is situated on an isthmus between two salt lakes, the marshy Sebkha-el-Sejumi to the south-west, and the shallow el-Bahira (little sea), or Lake of Tunis, to the north-east. An artificially deepened channel through the Bahira into the Gulf of Tunis has converted the city into a seaport (see below). North-west and south-west the city is commanded by hills, on which are forts, that on Sidi bel Hassan to the south dating from the middle ages. The city, which was formerly strongly fortified, is built in the shape of an amphitheatre, with the kasbah, or citadel, at its highest point. The old town (Medina), the walls of which have in great part disappeared, lies between two suburbs, the Ribat-el-Sowika on the north and the Ribat Bab-el-Jezira on the south. These suburbs were also surrounded by a wall, now pulled down, leaving the gates of the city isolated. An outer wall, however, encloses the Medina and its suburbs. Beyond the Bab-el-Bahar (sea-gate), now called Porte de France, on the level ground by the Bahira, is the marine town, or Quartier Franc, built since the French occupation in 1881. No attempt has been made by the French to modernize the ancient city.

The European Quarter.—From the landing stage a short street leads into the broad Avenue Jules Ferry or de la Marine running east to west and ending in the Place de la Résidence, on the north side of which is the Roman Catholic cathedral and on the south side the palace of the French resident-general, with a large garden. The main thoroughfare is continued westwards by the Avenue de France, which leads to the Porte de France. Beyond the gate is the small Place de la Bourse, in which is the British consulate. From the Porte electric trams run to the harbour and also in a circle round the native city. From the Place de la Résidence cross-roads run north and south. The northern road, the Rue de Rome, led to the Gare du Nord, the station for Carthage, Goletta and La Marsa. This line was replaced in 1908 by an electric tramway built along the northern bank of the canal connecting Tunis and Goletta. The southern road, the Rue-es-Sadikia, leads to the Gare du Sud, the station for Susa, Kairawan, &c., and also for Algiers. The Avenue Jules Ferry is intersected by a north-to south street running in a straight line over two miles. The northern section is called the Avenue de Paris; the southern Avenue de Carthage. By these avenues, served by electric trams, access is gained to the suburbs of the city. In the Avenue de France or Avenue Jules Ferry are the chief hotels and cafés, the casino-theatre, the principal banks and the finest shops. In the Rue d'Italie, running south from the Avenue de France, are the post office, market buildings, and French Protestant church. There is an English church in the Rue d'Espagne. Behind the cathedral is a disused cemetery with a chapel, where the Christian slaves are supposed to have worshipped. The coffins in the vaults have been removed to the Chapel of St Louis at Carthage. Among them was that of M. de Lesseps, French consul-general (d. 1832), father of the maker of the Suez Canal. Next to the cemetery is the old Greek church. North of the Avenue de France is a district, inhabited chiefly by Maltese, which has obtained the name of Malta-es-Segheira (Little Malta).

The Native Town.—To the visitor from Europe the attraction of Tunis lies in the native city, where, in the Rue al Jezira, along which runs electric trams, he can see hundreds of camels in the morning bearing charcoal to market; where he may witness the motley life of the bazaars, or, by the Bab-Jedid, watch the snake-charmers and listen to the Moorish story-tellers. Christians are forbidden to enter the mosques. From various points the traveller can look over the city, with its great citadel, its many minarets and its flat-topped houses. Many of the dwellings of the richer residents are adorned with arcades, the marble columns of which were taken from the ruins of Carthage. The Porte de France is the threshold of the ancient city. Two narrow streets climb the hill towards the citadel. That to the right, the Rue de la Kasbah, opens into a small square (Suk-el-Islam or Place de la Kasbah), on the left of which is the Dar-el-Bey (palace of the bey), while beyond it rise the walls of the citadel. That to the left leads to the chief mosque of the city, the Jamaa-al-Zeituna (mosque of the Olive Tree), founded in A.D. 698. It has many domes and a spacious cloister, and its central court can be seen from the neighbouring streets. Attached to the mosque is a college attended by several hundreds of Moslem youths. The Dar-el-Bey contains numerous rooms beautifully decorated in the Moorish style of the 18th century; and the judgment hall has a domed roof adorned with the delicate arabesque plaster-work known as *Nuksh hadida*. The kasbah, which forms the western side of the Suk-el-Islam, includes within the circuit of its walls a mosque built about A.D. 1232 by Abu Zakariya the Hafsite. Of the ancient kasbah nothing but the walls remain, the old buildings having been demolished to make way for barracks for the French troops. Besides being a fortress the kasbah formerly contained a palace of the beys, barracks for janissaries and bagnios for the Christian slaves. When in July 1535 the Spaniards under Charles V. attacked Tunis, the Christians in the kasbah, said to number 10,000, rose against their keepers and helped to secure the victory of the emperor. The Spaniards during their occupancy of Tunis strengthened the kasbah and built an aqueduct to supply it with water. Immediately north of the kasbah are the buildings of the Sadiki College, and north of the college is the Palais de Justice, a building completed in 1901. It stands between the line of the ancient wall and the enceinte. Its walls are decorated with faience taken from an ancient Tunisian palace. North-east of the Palais de Justice, which like the Sadiki College is built in the Moorish style, rises the great dome, surrounded by smaller cupolas, of the largest mosque in the city, that named after Sidi Mahrez, a renowned saint of the 5th century of the Mahommedan era, whose tomb makes it a sanctuary for debtors. East of the mosque, which dates from the 17th century, and just without the inner city walls, here demolished, is the Protestant cemetery of St George, used during the 17th, 18th and the greater part of the 19th centuries. Here are buried several British consuls. Here also was the grave of John Howard Payne, author of "Home, Sweet Home" and consul for the United States, who died at Tunis in 1852. In 1883 the body was disinterred and removed to America, but a monument has been placed on the spot similar to that erected over the new tomb at Washington.

The Bazaars.—The native city to the north of the Rue de la Kasbah includes the Jewish quarter and the synagogue. The Jews of Tunis adopt a special costume, the women wearing gaily coloured vests and close-fitting white trousers. Beyond the Jewish quarter, in the Ribat-el-Soweika, is the Place el Halfa-Ouine, a favourite rendezvous of the poorer Moslem population, wherein are many native cafés. South of the Rue de la Kasbah is the bazaar quarter. Here the streets are very narrow and tortuous, some being vaulted and many covered in with planking. They are known as suks (markets), and each suk is devoted to one particular trade. Beyond paving the streets the French have made no alteration in the suks, which retain their original character unimpaired. The shops consist of small cubes, open in the front, in which the trader squats cross-legged amidst his wares. The principal suks are el-Attarin (market of the perfumers), el-Farashin (carpets and cloths), el-Serajin (saddlery) and el-Birka (jewelry). The suk el-Birka was formerly the slave market. Near by are the green-tiled domes and walls enriched with rose-coloured marbles of the mausoleum of the beys.

Public Institutions, &c.—Tunis is furnished with well-equipped hospitals and a large asylum for aged people kept by the Little Sisters of the Poor. The principal educational establishments, besides that of the mosque of the Olive Tree, are the Sadiki College, founded in 1875, for free instruction in Arabic and European subjects, the Lycée Carnot in the Avenue de Paris, formerly the College of St Charles (founded by Cardinal Lavigerie), open to Christians and Moslems alike, and the normal school, founded in 1884 by the reigning bey, for the training of teachers in the French language and European ideas. The Dames de Sion have a large establishment for the teaching of small children of both sexes, and there is a secondary school for girls. All the schools are well attended. About a mile and a half north of the centre of the European quarter, on the slopes of a hill rising 270 ft., is the Parc du Belvedère covering some 240 acres and commanding extensive views. Water is supplied to the city, with its numerous fountains, from Jebel Zaghwan (*vide infra*) by the Roman aqueduct repaired, at a cost of half a million sterling, by the bey Mahommed al-Sadik (d. 1882).

The Port.—The canal which traverses the shallow Bahira, and connects Tunis with the Mediterranean, is nearly seven miles long. By means of breakwaters it is continued beyond the coast-line and is at its mouth 328 ft. wide. It has a uniform depth of 21½ ft., but its width within the lake is reduced to 98 ft. In the centre, however, the canal is widened to 147 ft. to allow vessels to pass. There is a harbour at the entrance (see Goletta). That at the Tunis end of the canal is 1312 ft. long by 984 ft. broad, and is of the same depth as the canal. The canal was begun in 1885 and was opened to navigation in June 1893. An additional basin, south-east of the main harbour, was opened in 1905 and is used for the exportation of phosphates. Of the ships using the harbour more than half are French, and one-third Italian, British vessels coming next. British goods, however, are largely carried in French bottoms, and next to France the United Kingdom and Malta take most of the trade of the port. The exports are chiefly phosphates and other minerals, cereals, olive oil, cattle, hides, sponges and wax. The imports are cotton goods, flour, hardware, coal, sugar, tea, coffee, &c. The figures of trade and shipping are included in those of the trade of the regency (see Tunisia), of which Tunis and Goletta take about a third.

Population.—The population of the city at the census of 1906 was returned at 227,519. The "natives"—Arabs, Berbers, "Moors," Turks and negroes—were estimated at 100,000, Tunisian Jews at 50,000, French 18,000, Italians 52,000, Maltese 6000, Greeks 500 and Levantines 1000. The French language is predominant in the European quarter.

Environs: The Bardo Palace, Zaghwan, &c.—The environs of Tunis are picturesque and afford many beautiful views, the finest being from the hill on the south-east, crowned by a French fort, and from the Belvedère already mentioned. About a mile and a quarter from the Bab Bu Saadun, the north-west gate of the city, is the ancient palace called the Bardo, remarkable for the "lion court," a terrace to which access is gained by a flight of steps guarded by marble lions, and for some apartments in the Moorish style. The finest of these apartments, containing beautiful arabesque plaster work, formed the old Harem, and are now part of the Musée Alaoui, which occupies a considerable portion of the Bardo. In this museum M. Paul Gauckler, the director of the department of art and antiquities in the Tunisian government, has formed a magnificent collection of Carthaginian and Roman antiquities, especially Roman mosaics. In the Musée Arabe, which occupies an adjacent small palace built about 1830, are treasures illustrative of the Arab-Berber or Saracenic art of Tunisia.

South-east of the city, along the valley of the Wadi Melain, are hundreds of large stone arches, magnificent remains of the Roman aqueduct from Zaghwan to Carthage. At Zaghwan (38 m. by rail from Tunis), over the spot whence the spring which supplies the aqueduct issues from the hill, are the ruins of a beautiful Temple of the Waters. The spring is now diverted direct into the aqueduct and is not visible at the surface. Between Zaghwan and Tunis, and accessible by the same railway, is Wadna, the Roman Uthina, where, besides numerous other ruins, are the fairly preserved arches of a large amphitheatre. The ruins of Carthage (*q.v.*) lie a few miles north of Goletta.

History.—Tunis is probably of greater antiquity than Carthage, of which city however it became a dependency, being repeatedly mentioned in the history of the Punic Wars. Strabo speaks of its hot baths and quarries. The importance of Tunis dates from the Arab conquest, when, as Carthage sank, Tunis took its place commercially and politically. It became the usual port for those going from the sacred city of Kairawan to Spain, and was one of the residences of the Aghlabite dynasty (800–909). In the 10th century it suffered severely, being repeatedly pillaged in the wars of the Fatimite caliphs Al-Qaim and Abu Tahir Isma‘il el Mansur with the Sunnite leader Abu Yazid and the Zenata Berbers.

For its later fortunes, see Tunisia, of which regency, since the accession of the Hafsites, Tunis has been the capital.

TUNISIA (Regency of Tunis), a country of North Africa, under the protection of France, bounded N. by the Mediterranean, W. by Algeria, E. by Tripoli and S. by the Sahara. Tunisia reaches farther north than any other part of Africa, Ras-al-Abiadh (Cape Blanc)[1] being in 37° 20′ N. On the south the boundary of the Tunisian Sahara is undetermined, but it may be roughly placed at 31° N. This would give, therefore, a greatest length of something like 440 m. The country lies between 11° 40′ E. and 7° 35′ E. The average length is about 300 m., and the average breadth 150 m.; consequently the area may be estimated at 50,000 sq. m. (For map, see Algeria.)

Physical Features.—Geographically speaking, Tunisia is merely the eastern prolongation of the Mauretanian projection of northern Africa, of that strip of mountainous, fertile and fairly well-watered country north of the Sahara desert, which in its flora and its fauna, and to some extent in its human race, belongs rather to Europe than to Africa. Tunisia is divided into the following four fairly distinct regions:—

1. On the north and north-west the Aures mountains of Algeria are prolonged into Tunisia, and constitute the mountainous region of the north, which lies between the Majerda river and the sea, and also includes the vicinity of the city of Tunis and the peninsula of the Dakhelat el Mawin, which terminates in Ras Addar (Cape Bon). This first division is called by the French "the Majerda Mountains." It includes within its limits the once famous district of the "Kroumirs,"[2] a tribe whose occasional thefts of cattle across the frontier gave the French an excuse to invade Tunisia in 1881. The highest point which the mountains attain in this division of Tunisia is about 4125 ft., near Ain Draham in Kroumiria. The country, however, about Bizerta is very mountainous, though the summits do not attain a greater altitude than about 3000 ft. The district between Bizerta and the Gulf of Tunis is a most attractive country, resembling greatly the mountainous regions of South Wales. It is well watered by streams more or less perennial. The principal river, the Majerda, is formed by the junction of the Wad Malleg and the Wad Kkallad. It and its

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[1] It is possible that Ras-ben-Sekka, a little to the west of Cape Blanc, may be actually the most northerly point.

[2] The French seem systematically unable to master certain sounds foreign to their own language, or sounds which they suppose to be foreign. Thus the "w," though constantly represented in French by "ou," is continually changed by them into "v" when they transcribe foreign languages, just as the Greek χ and the German and Scottish "ch" is almost invariably rendered by the French in Algeria and Tunis as "kr." Add to this the insertion of vowel sounds where they are lacking in the Arabic and you derive from the real word *Khmir* the modern French term of Kroumir. In like manner *sebkha*, a salt lake, is constantly written by the French as *sebkra*.

tributaries rise in the Majerda and Aures mountains. Flowing north-east the Majerda forms an extensive plain in its lower course, reaching the sea near the ruins of Utica. Vegetation is abundant, and recalls that of the more fertile districts of southern Spain and of Italy. On the higher mountains the flora has a very English character, though the actual species of plants may not be the same.

2. The central plateau region, stretching between the Majerda valley and the mountains of Gafsa. The average elevation of this country is about 2000 ft. The climate, therefore, in parts is exceedingly cold and bleak in winter, and as it is very wind-swept and parched in summer by the terrible *qibli* or "sirocco" it is much less attractive in appearance than the favoured region on the northern littoral. Although it is almost always covered with some kind of vegetation, trees are relatively rare. A few of the higher mountains have the Aleppo pine and the juniper; elsewhere only an infrequent wild terebinth is to be seen. In these two regions the date palm is never met with growing naturally wild. Its presence is always due to its having been planted by man at some time or another, and therefore it is never seen far from human habitations. These central uplands of Tunisia in an uncultivated state are covered with alfa or esparto grass; but they also grow considerable amounts of cereals—wheat in the north, barley in the south. The range of the Saharan Atlas of Algeria divides (roughly speaking) into two at the Tunisian frontier. One branch extends northwards up this frontier and north-eastwards across the central Tunisian table-land, and the other continues south-eastwards between Gafsa and the salt lakes of the Jerīd. The greatest altitudes of the whole of Tunisia are attained on this central table-land, where Mt Sidi Ali bu Musin ascends to about 5700 ft. About 30 m. south of the city of Tunis is the picturesque mountain of Zaghwan, approximately 4000 ft. in altitude, and from whose perennial springs comes the water-supply of Tunis to-day as it did in the time of the Carthaginians and Romans. North-east of Zaghwan, and nearer Tunis, is the Jebel Resās, or Mountain of Lead, the height of which is just under 4000 ft.

3. The Sahel. This well-known Arab term for coast-belt (which in the plural form reappears as the familiar "Swahili" of Zanzibar) is applied to a third division of Tunisia, viz. the littoral region stretching from the Gulf of Hammamet to the south of Sfax. It is a region varying from 30 to 60 m. in breadth, fairly well watered and fertile. In a less marked way this fertile coast region is continued southwards in an ever-narrowing belt to the Tripolitan frontier. This region is relatively flat, in some districts slightly marshy, but the water oozing from the soil is often brackish, and in places large shallow salt lakes are formed. Quite close to the sea, all along the coast from Hammamet to Sfax, there are great fertility and much cultivation; but a little distance inland the country has a rather wild and desolate aspect, though it is nowhere a desert until the latitude of Sfax has been passed.

4. The Tunisian Sahara. This occupies the whole of the southern division of Tunisia, but although desert predominates, it is by no means all desert. At the south-eastern extremity of Tunisia there is a clump of mountainous country, the wind-and-water-worn fragments of an ancient plateau, which for convenience may be styled the Matmata table-land. Here altitudes of over 3000 ft. are reached in places, and in all the upper parts of this table-land there is fairly abundant vegetation, grass and herbage with low junipers, but with no pine trees. Fairly high mountains (in places verging on 4000 ft.) are found between Gafsa and the salt lakes of the Jerīd.

The Shats.

These salt lakes are a very curious feature. They stretch with only two short breaks in a line from the Mediterranean at the Gulf of Gabes to the Algerian frontier, which they penetrate for a considerable distance. They are called by the French (with their usual inaccuracy of pronunciation and spelling) "chotts"; the word should really be the Arabic *shat*, an Arab term for a broad canal, an estuary or lake. These shats however are, strictly speaking, not lakes at all at the present day. They are smooth depressed areas (in the case of the largest, the Shat el Jerīd, lying a few feet below the level of the Mediterranean), which for more than half the year are expanses of dried mud covered with a thick incrustation of white or grey salt. This salt covering gives them at a distance the appearance of big sheets of water. During the winter, however, when the effect of the rare winter rains is felt, there may actually be 3 or 4 ft. of water in these shats, which by liquefying the mud makes them perfectly impassable. Otherwise, for about seven months of the year they can be crossed on foot or on horseback. It would seem probable that at one time these shats (at any rate the Shat el Jerīd) were an inlet of the Mediterranean, which by the elevation of a narrow strip of land on the Gulf of Gabes has been cut off from them. It is, however, a region of past volcanic activity, and these salt depressions may be due to that cause. Man is probably the principal agent at the present day in causing these shats to be without water. All round these salt lakes there are numerous springs, gushing from the sandy hillocks. Almost all these springs are at a very hot temperature, often at boiling point. Some of them are charged with salt, others are perfectly fresh and sweet, though boiling hot. So abundant is their volume that in several places they form actual ever-flowing rivers. Only for the intervention of man these rivers would at all times find their way into the adjoining depressions, which they would maintain as lakes of water. But for a long period past the freshwater streams (which predominate) have been used for irrigation to such a degree that very little of the precious water is allowed to run to waste into the lake basins; so that these latter receive only a few salt streams, which deposit on their surface the salt they contain and then evaporate. This abundant supply of fresh warm water maintains oases of extraordinary luxuriance in a country where rain falls very rarely. Perennial streams of the description referred to are found between the Algerian frontier and Gabes on the coast. The town at Gabes itself is on the fringe of a splendid oasis, which is maintained by the water of an ever-running stream emptying itself into the sea at Gabes after a course of not more than 20 m.

The Jerīd.

All this region round the shats has been called the "Jerīd" from the time of the Arab occupation. "Jerīd" means in Arabic a "palm frond" and inferentially "a palm grove." The fame of this Belad-el-Jerīd, or "Country of the Date Palms," was so exaggerated during the 17th and 18th centuries that the European geographers extended the designation from this small area in the south of Tunisia to cover much of inner Africa. With this country of Jerīd may be included the island of Jerba, which lies close to the coast of Tunisia in the Gulf of Gabes. The present writer believes that the date palm was really indigenous to this district of the Jerīd, as it is to countries of similar description in southern Morocco, southern Algeria, parts of the Tripolitaine, Egypt, Mesopotamia, southern Persia and north-western India; but that north of the latitude of the Jerīd the date did not grow naturally in Mauretania, just as it was foreign to all parts of Europe, in which, as in true North Africa, its presence is due to the hand of man. To some extent it may be said that true North Africa lies to the north of the Jerīd country, which, besides its Saharan, Arabian and Persian affinities, has a touch about it of real Africa, some such touch as may be observed in the valley of the Jordan. In the oases of the Jerīd are found several species of tropical African mammals and two or three of Senegalese birds, and the vegetation seems to have as much affinity with tropical Africa as with Europe. In fact, the country between the Matmata highlands and the strait separating Jerba from the mainland is singularly African in the character and aspect of its flora. To the south of the Jerīd the country is mainly desert—vast unexplored tracts of shifting sand, with rare oases. Nevertheless, all this southern district of Tunisia bears evidence of once having been subject to a heavy rainfall, which scooped out deep valleys in the original table-land, and has justified the present existence of immense watercourses—watercourses which are still, near their origin, favoured with a little water.

Mineral Springs.

Hot and mineral springs may be almost said to constitute one of the specialities of Tunisia. They offered a singular attraction to the Romans, and their presence in remote parts of the country no doubt was often the principal cause of Roman settlement. Even at the present day their value is much appreciated by the natives, who continue to bathe in the ruined Roman baths. The principal mineral springs of medicinal value are those of Korbus and Hammam Lif (of remarkable efficacy in rheumatic and syphilitic affections and certain skin diseases), of the Jerīd and Gafsa, of El Hamma, near Gabes, and of various sites in the Kroumir country.

Climate.—The rainfall in the first geographical division is pretty constant, and may reach a yearly average of about 22 in. Over the second and third divisions the rainfall is less constant, and its yearly average may not exceed 17 in. The mean annual temperature at Sūsa is 75° F., the mean of the winter or rainy season 60° and of the hot season 97°. At Tunis the temperature rarely exceeds 90°, except with a wind from the Sahara. The prevailing winds from May to September are east and north-east and during the rest of the year north-west and east. A rainy season of about two months usually begins in January; the spring season of verdure is over in May; summer ends in October with the first rains. Violent winds are common at both equinoxes. In the Tunisian Sahara rain is most uncertain. Occasionally two or three years may pass without any rainfall; then may come floods after a heavy downfall of a few weeks. Perhaps if an average could be struck it would amount to 9 or 10 in. per annum.

[*Geology.*—The greater part of Tunisia is composed of sandstones, marls and loosely stratified deposits belonging to the Pliocene and Quaternary periods. The oldest strata, consisting of gypsiferous marls, are referred to the Muschelkalk and show an alternation of lagoon with marine conditions. The Lias and Oolite formations are well represented, but the Sequanian and Kimmeridgian subdivisions are absent. Lower Cretaceous rocks, consisting of thick limestones, shales and marls, occur in Central Tunisia. The fossils show many notable affinities with those in the Lower Cretaceous of the Pyrenees. Limestones and marls represent the stages Cenomanian to Upper Senonian. The fossils of the Cenomanian have affinities with those in the Cenomanian of Spain, Egypt, Madagascar, Mozambique and India. The Senonian consists of a central facies with *Micraster peini*; a meridional facies with *Ostrea*; and a northern facies developed round Tunisia with large forms of *Inoceramus* and echinoids. Phosphatic deposits are well developed among the Lower Eocene rocks. The Middle Eocene is characterized by the presence of *Ostrea bogharensis* and the Upper Eocene by highly fossiliferous sandstones and marls. The Oligocene and Miocene formations are present, but the Upper Miocene is confined to the coast. Quaternary deposits cover much of the desert regions.[1]]

Minerals.—Coal has been discovered in the Khmir (" Kroumir ") country, but the principal mines at present worked in Tunisia are those of copper, lead and zinc. Zinc is chiefly found in the form of calamine. Iron is worked in the Kef district. Valuable deposits of phosphates are present, chiefly in the south-west of Tunisia, in the district of Gafsa. Marble is found in the valley of the Majerda (at Shemtu), at Jebel Ust (about 35 m. south of Tunis), and at Jebel Dissa, near Gabes. The marbles of Shemtu are the finest pink Numidian marbles, which were much esteemed by the Carthaginians and Romans. It has been sought to work again the ancient quarries of Shemtu, but it was found that the marble had been spoilt by ferruginous and calcareous veins.

Flora.—The flora of Tunisia is very nearly identical with that of Algeria, though it offers a few species either peculiar to itself or not found in the last-named country. On the whole its character is less Saharan than that of parts of Algeria, for the influences of the desert do not penetrate so far north in Tunisia as they do in Algeria. There are very few patches of real forest outside the Khmir country, though it is probable that in the time of the Romans the land was a good deal more covered with trees than at the present day. Some authorities, however, dispute this, in a measure, by saying that it was not naturally forested, and that the trees growing represented orchards of olives or other fruit trees planted by the Romans or romanized Berbers. But in the Majerda Mountains there are dense primeval forests lingering to the present day, and consisting chiefly of the cork oak (*Quercus ruber*), and two other species of oak (*Quercus mirbeckii* and *Q. kermes*), the pistachio or terebinth tree, the sumach (*Rhus pentaphila*), and other species of *Rhus* which are widely spread. In the mountains of Khmiria and the central plateau there are also the alder, the poplar, the Aleppo pine, the caroub, the tamarisk, the maple, the nettle-tree, several willows and junipers. The jujube-tree (*Zizyphus*) is found at various places along the eastern littoral. The retama shrub is met with in sandy districts, especially in the Sahara, but also right up to the north of Tunisia. The wild olive, the wild cherry, two species of wild plums, the myrtle, the ivy, arbutus, and two species of holly are found in the mountains of Khmiria, at various sites at high elevation near Tunis and Bizerta, and along the mountainous belt of the south-west which forms the frontier region between Tunisia and Algeria. The present writer, riding up to these frontier mountains from the thoroughly Saharan country round Gafsa, found himself surrounded by a flora very reminiscent of Switzerland or England. On the other hand, the flora of the shat region, of the south-eastern littoral, and of the Kerkena islands opposite Sfax, is thoroughly Saharan, with a dash, as it were, in places of an African element. The date palm grows wild, as has been already related, in Jerba. The only other species of palm found wild in Tunisia is the *Chamaerops humilis*, or dwarf palm, which is found on the mountains of the north at no very great altitude. The wild flowers of the north of Tunisia are so extremely beautiful during the months of February, March and April as to constitute a distinct attraction in themselves.[2]

Fauna.—The fauna of Tunisia at the present day is much impoverished as regards mammals, birds and reptiles. In 1880 the present writer saw lions killed in the north-west of Tunisia, but by 1902 the lion was regarded as practically extinct in the regency, though occasional rumours of his appearance come from the Khmir Mountains and near Feriana. Leopards of large size are still found in the north-west of central Tunisia. The cheetah lingers in the extreme south of the Jerid; so also does the caracal lynx. The pardine lynx is found fairly abundantly in the west of Tunisia in the mountains and forest. The striped hyena is scattered over the country sparsely. The genet and the common jackal are fairly abundant. The common ichneumon is rare. The zorilla, another purely African species, is found in the south of Tunisia. The Barbary otter is present in the Majerda and in some of the salt lakes. The Tunisian hedgehog is peculiar to that country and to Algeria. There is a second species (*Erinaceus deserti*) which is common to all North Africa. In the south of Tunisia, especially about the shats, the elephant-shrew (*Macroscelides*) is found, an animal of purely African affinities. Tunisia does not appear to possess the Barbary ape, which is found in Algeria and Morocco. Natives of Morocco and of the Sahara oases occasionally bring with them young baboons which they assert are obtained in various Sahara countries to the south and south-west of Tunisia. These baboons appear to belong to the Nubian species, but they cannot be considered indigenous to any part of Tunisia. The porcupine and a large Octodont rodent (*Ctenodactylus*), the jerboa (two species), the hare, and various other rodents are met with in Tunisia. The wild boar inhabits the country, in spite of much persecution at the hands of " chasseurs." The forested regions shelter the handsome Barbary red deer, which is peculiar to this region and the adjoining districts of Algeria. In the extreme south, in the Sahara desert, the addax antelope is still found. The hartebeest appears now to be quite extinct; so also is the leucoryx, though formerly these two antelopes were found right up to the centre of Tunisia, as was also the ostrich, now entirely absent from the country. In the marshy lake near Mater (north Tunisia), round the mountain island of Jebel Ashkel, is a herd of over 50 buffaloes; these are said to resemble the domestic (Indian) buffalo of the Levant and Italy, and to have their origin in a gift of domestic buffaloes from a former king of Naples to a bey or dey of Tunis. Others again assert the buffaloes to have been there from time immemorial; in which case it is very desirable that a specimen should be submitted for examination. [An allied form with gigantic horns is found fossil in Algeria.] They are the private property of the bey, who very properly preserves them. Far down in the Sahara, to the south of Tunisia, the Arabs report the existence of a wild ass, apparently identical with that of Nubia. Roman mosaics show representations not only of this ass, but of the oryx, hartebeest, and perhaps of the addax. The dorcas gazelle is still common in the south of Tunisia; but perhaps the most interesting ruminant is the magnificent udad, or Barbary sheep, which is found in the sterile mountainous regions of south Tunisia. The birds have been ably illustrated by Mr Whitaker in the *Ibis* magazine of the British Ornithological Union. They are, as a rule, common to the south Mediterranean region. A beautiful little bird almost peculiar to the south of Tunisia and the adjoining regions of Algeria, is a species of bunting (*Fringilla*), called by the Arabs *bu-habibi*.[3] This little bird, which is about the size of the linnet, has the head and back silvery blue, and the rest of the plumage chocolate red-brown. It is of the most engaging tameness, being fortunately protected by popular sentiment from injury. It inhabits the Jerid, and extends thence across the Algerian frontier. Among reptiles the Egyptian cobra seems to be indigenous in the south, where also is found the dreaded horned viper. Some nine or ten other species of snakes are present, together with an abundance of lizards, including the *Varanus*, and most species of Mediterranean tortoises are represented. The coasts are very rich in fish, and the tunny fisheries of the north are one of the principal sources from which the world's supply of tunny is derived.

Inhabitants.—The natives of Tunisia at the present day belong mainly to two stocks, which may be roughly classified as the Berber (*q.v.*) and the Arab (*q.v.*), about two-thirds being of Berber and the remaining third of Arab descent. But the Berbers of to-day are little more than an incomplete fusion of some four earlier and once independent stocks. These four divisions taken in the order of their assumed priority of invasion or habitation are: (1) the " Neanderthal " type, which is found in the districts of the shats and the adjoining Matmata table-land in the south, and in the " Kroumir " country of the north-west;[1] (2) ordinary Berbers, dolichocephalous, and of brown complexion, found over the greater part of Tunisia, especially in the east and south centre; (3) the short-headed Berbers, found in part of the Matmata country, part of the Sahara, the island of Jerba, the Cape Bon Peninsula, and the vicinity of Susa, Kairwan, and Sfax; (4) Berbers of a blond type, that is to say, with a tendency to brown or yellow moustaches, brown beard and head hair, and grey eyes. These are met with in the west and north-west of Tunisia, and in one patch on the coast of the Cape Bon Peninsula, near Nabeul.

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[1] See L. Pervinquière, *L'Étude géologique de la Tunisie centrale* (Paris, 1903); G. Rolland, " Carte géologique du littoral nord de la Tunisie," *Bull. soc. géol. de la France* (1888), vol. xvii.; H. H. Johnston, "A Journey through the Tunisian Sahara," *Geog. Journ.* (1898), vol. xi.; *Carte géologique de la régence de Tunis*, 1:800,000 with notes (Tunis, 1892).

[2] List of Plants commonly met with in northern Tunisia:—

Adonis microcarpa, DC.
Nigella damascena, L.
Fumaria spicata, L.
Cistus halimifolius, L.
Silene rubella, L.
Oxalis cernua, Thunb.
Geranium tuberosum, L.
Malva sylvestris, L.
Tetragonolobus purpureus, Moench.
Retama retam, Webb.
Fedia cornucopiae, Gaertn.
Helichrysum Stoechas, DC.
Centaurea (*Seridia*), sp.
Urospermum Dalechampi, Desf.
Scorzonera alexandrina, Boiss.
Stachys hirta, L.
Stachys, sp. not identified.
Anagallis collina, Schousb.
Convolvulus tricolor, L.
Solenanthus lanatus, DC.
Lycium europaeum, L.
Solanum sodomaeum, L.
Celsia cretica, L.
Linaria, sp. allied to *L. reflexa*, Desf.
Linaria triphylla, L. var.
Orobanche, sp.
Trixago apula, Stev.
Cynomorium coccineum.
Plantago albicans, L.
Euphorbia serrata, L.
Ophrys fusca, Link.
Orchis papilionacea, L.
Romulea bulbocodium, Sebast. and Mauri.
Gladiolus byzantinus, Mill.
Ornithogalum umbellatum, L.
Allium roseum, L.
Asphodelus fistulosus, L.
Muscari comosum, Mill.
Echium sericeum, Vahl.
Echium maritimum, Willd.
Anchusa italica, Retz.
Arum italicum, Mill.
Lagurus ovatus, L.

To this list should also be added the common wild tulip, the Italian cyclamen, the common scarlet poppy, the fennel, wild carrot and many varieties of thistle, some of gorgeous colouring.

[3] " Father of my friend."

The Arabs of more or less unmixed descent are purely nomads. They are met with in a long strip of country south of the Majerda, between the Algerian frontier and the sea-coast north of Susa; also inland, to the south-west of Susa, and near Kef; also in another long strip between the vicinity of Sfax on the north and the Jerīd on the south. They are descended from the second Arab invasion which began in the 11th century (see *History*). The extreme south of Tunis is ranged over by Berber Tawareq[2] or Tamasheq. Berber dialects are still spoken in Tunisia in the island of Jerba, in the Matmata country, and in the Tunisian Sahara. Elsewhere to a remarkable degree the Arabic language has extinguished the Berber tongue, though no doubt in vulgar Tunisian a good many Berber words remain. Short vocabularies of the Berber spoken in the Tunisian Sahara have been published by Sir H. H. Johnston in the *Geog. Journ.* (1898), vol. xi., and by Mr G. B. Michell in the *Journ. African Soc.* (1903). The Berbers are organized in tribes with purely democratic government and laws of their own, which are not those of the Koran.

On the north-eastern littoral of Tunisia the population is very mixed. The inhabitants of the Cape Bon Peninsula show evident signs of Greek blood arising from Greek invasions, which began in prehistoric times and finished with the downfall of the Byzantine Empire in North Africa. The presence of the Romans, and the constant introduction of the Italians, first as slaves, and quite recently as colonists, has also added an Italian element to the north Tunisian population. But from the fact that the bulk of the Tunisian population belongs to the Iberian section of the Berbers, and to this being no doubt the fundamental stock of most Italian peoples, the intermixture of the Italianized Berber with his African brother has not much affected the physique of the people, though it may have slightly tinged their mental characteristics.

The Phoenicians have left no marked trace of their presence; but inasmuch as they were probably of nearly the same race as the Arabs, it would not be easy to distinguish the two types. Arab and Berber have mingled to some extent, though no considerable fusion of the two elements has taken place. In fact, it is thought by some French students of the country that the Arab element will probably be eliminated from Tunisia, as it is the most unsettled. It is considered that these nomads will be gently pushed back towards the Sahara, leaving cultivable Tunisia to the settled Berber stock, a stock fundamentally one with the peoples of Mediterranean Europe.

The inhabitants of the coast towns belong, in large part, to the class generally known as "Moors." The pure Turks and the Kuluglis (sons of Turkish fathers by Moorish women or slave girls) are no longer numerous. Among the "Moors" the descendants of the Andalusian refugees form an exclusive and aristocratic class.

The present population of Tunisia numbers approximately 2,000,000, and consists of:—

Berbers, more or less of pure race, say . . .	620,000
Arabs, ,, ,, ,, ,, . . .	500,000
Mixed Arab and Berber peoples, say	520,000
"Moors" (chiefly the population of the principal cities, of mixed Roman, Berber, Spanish, Moor and Christian races), say	110,000
Sudanese negroes and natives of Morocco, Tripoli and Turkey, say	40,000
Jews (mostly natives of Tunis, indeed, some descended from families settled at Carthage before the destruction of Jerusalem) . . .	68,000
Europeans (Christians)[3]	163,000

Towns.—Besides the capital, Tunis, the chief towns of Tunisia are Sfax, Susa and Kairwan. These places are noticed separately, as are also Goletta (formerly the port of Tunis), Bizerta (a naval port and arsenal), Kef, Porto Farina, and the ruins at Carthage and Sbeitla (Sufetula). Other towns of Tunisia are, on the east coast, Nabeul, pop. about 5000, the ancient Neapolis, noted for the mildness of its climate and its pottery manufactures; Hammamet with 3700 inhabitants; Monastir (the Ruspina of the Romans), a walled town with 5600 inhabitants and a trade in cereals and oils; Mahdiya or Mahdia (*q.v.*; in ancient chronicles called the city of Africa and sometimes the capital of the country) with 8500 inhabitants, the fallen city of the Fatimites, which since the French occupation has risen from its ruins, and has a new harbour (the ancient *Cothon* or harbour, of Phoenician origin, cut out of the rock is nearly dry but in excellent preservation); and Gabes (Tacape of the Romans, Qabis of the Arabs) on the Syrtis, a group of small villages, with an aggregate population of 16,000, the port of the Shat country and a dépôt of the esparto trade. The chief town of the Majerda basin is Beja (pop. 5000), the ancient Vaga, an important corn market. The principal mosque at Beja was originally a Christian basilica, and is still dedicated to Sidna Aissa (our Lord Jesus). Gafsa, in the south of Tunisia, is a most interesting old Roman town, with hot springs. It is in railway communication with Sfax. West of Gafsa are immense beds of phosphates. Almost all the towns of Tunisia were originally Roman or romanized Berber settlements; consequently the remains of Roman buildings form a large part of the material of which their existing structures are composed.

Antiquities and Art.—The principal Roman and other ruins in the regency are the aqueducts near the capital (Tunis) and the temple at Zaghwan, described under Tunis city; the great reservoir near Carthage (*q.v.*); the amphitheatre at El Jem (see SUSA); the temples and other ruins of Sbeitla (*q.v.*); the ruins of Dugga, near Tebursuk, in the north-west of the regency (the amphitheatre of Dugga, the ancient Thugga, is a magnificent spectacle); the baths, amphitheatre and temples of Feriana (the ancient Thelepte); the whole route between Feriana (which is in the south of Tunisia, 33 m. north-west of Gafsa) and Tebessa in Algeria is strewn on both sides with Roman ruins; the old houses and other ruins at and near Thala; the baths and other ruins of Gafsa; the baths at Tuzer, El Hamma and Gabes. There is an interesting Phoenician burial-ground near Mahdia. There are Roman ruins, scarcely known, in the vicinity of Beja and the country of the Mogods (the district behind Cape Serrat). In short, Tunisia is as much strewn with Roman remains as is Italy itself.

Saracenic art has perhaps not attained here the high degree it reached in western Algeria, Spain and Egypt; still it presents much that is beautiful to see and worthy to be studied. One of the most ancient, as it is one of the loveliest fragments, strange to say, is found at Tuzer, in the Jerīd, the *mahrab* of a ruined mosque.[4] There are some very beautiful doorways to mosques and other specimens of Moorish art at Gabes. Examples of this art found at Tunis and Kairwan have been noticed under those headings. But the visible remains of Saracenic art in Tunis and its vicinity are of relatively recent date, the few mosques which might offer earlier examples not being open to inspection by Christians. It may be noted, however, as a general condition that the native towns and villages of Tunisia, where they have not been spoiled by the shocking tastelessness of Mediterranean Europe, are exceedingly picturesque, and offer exceptional attractions to the painter.

Industries.—Agriculture is the principal industry. Oats, wheat and barley are the chief crops in the north. In the central region the olive is largely cultivated, in the south the date-palm. Viticulture is also of importance; almonds, oranges, lemons, &c., are also grown for export. The alfa and cork industries employ large numbers of persons, as do also the sardine, anchovy and tunny fisheries. The fisheries are in the hands of Italians, Maltese and Greeks. There are large herds of cattle and flocks of sheep and goats. About 60,000 acres are cultivated by French immigrants and about 15,000 acres by Italians.

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[1] In this Matmata country are the celebrated Troglodytes, people living in caves and underground dwellings now, much as they did in the days when the early Greek geographers alluded to them. See "A Journey in the Tunisian Sahara," by Sir H. H. Johnston, in the *Geog. Journ.* (June 1898).

[2] Tawareq (Tuareg) is the Arab designation of the Libyan or Desert Berbers. It is the plural form of *Targi*, "a raider." The Tawareq call themselves by some variant of the root *Masheq*—*Tamasheq, Imoshagh*, &c.

[3] Of recent introduction for the most part, consisting (census of 1906) of 81,156 Italians, 34,610 French, 10,330 Maltese, about 1000 Greeks and the remainder British, German, Austrian, &c. The French army of occupation (20,360 men) is not included in these figures.

[4] Since this was written the *mahrab* in question has been removed to Paris.

Among native industries may be mentioned the spinning and weaving of wool for clothing, carpet-weaving, the manufacture of pottery, slippers and matting, saddle-making and leather embroidery. Silk-weaving, formerly important, is declining.

In 1907 the number of mines working was 32. The export of phosphates rose from 445,000 tons in 1904 to 1,267,000 tons in 1908. The export of coal in that year was 74,000 tons, and copper ore 937 tons (*vide supra*, § *Minerals*).

Commerce.—The commerce of Tunisia has thriven under the French protectorate, having risen from an annual total of about £1,700,000 in 1881 to £8,687,000 in 1908. British trade with Tunisia has nearly tripled since the establishment of the French protectorate. It stood at over £600,000 in annual value during the year 1898. In 1908 the total trade with Great Britain and Malta amounted to £914,000. In the same year the imports from France exceeded £2,750,000 and the exports to France £1,685,000. From Algeria the imports were £656,000; to Algeria the exports were £185,000. The principal exports are olive oil, wheat, esparto grass, barley, sponges, dates, fish (especially tunny), hides, horses, wool, phosphates, copper, zinc and lead. The imports consist mainly of European manufactured goods (especially British cotton), machinery, flour, alcohol, sugar, timber, coal and petroleum. About half the shipping trade is in the hands of the French; in 1908, of the total tonnage of ships entered, 4,155,000, French vessels represented 1,905,000 tons, Italian vessels 1,422,000 tons and British vessels 299,000 tons.

Communications.—The French have made since 1882 about 2000 m. of good roads. The first railway built (1871–1872) was that between Goletta and Tunis. This line, with the extensions to La Marsa and Bardo, is 21½ m. in length. It was constructed by an English company, which in 1880 sold it to an Italian company, despite the keen competition of French rivals (see *History*, below). The conversion of Tunis into a seaport (1893) destroyed the importance of this line, which was then sold to the French Bone-Guelma Company (Bone-Guelma et Prolongements), which owns the majority of the railways in Tunisia.

The second railway connects the capital with the frontier of Algeria, where, at Suk Ahras, it joins the main line to Constantine, Algiers, &c. This line was built by the Bone-Guelma Company. The concession was obtained in 1877, and the line, 191 m. long, was finished in 1880. A branch line (8 m.) connected Beja with this railway, and another (11 m.) ran from Tunis to Hamman-el-Enf, a favourite seaside resort of the Tunisians.

For the next twelve years there was a pause in railway construction followed by the opening, in 1892, of the line between Susa and Moknine (30 m.). Then came the continuation of the line from Hamman-el-Enf to Hammamet and along the Sahel to Susa (93 m.), and the building of a line from Susa to Kairwan, 31 m. (the last-named line superseded a horse-tramway built by the French army during the campaign of 1881). A branch line to Bizerta (43½ m.) from Jedeida on the main Algeria-Tunis line was also built as well as one from Tunis to Zaghwan (44 m.). A short line, branching from the Tunis-Zaghwan line, was carried south-west to Pont du Fahs. These with a few short branch lines were built between 1892 and 1900 by the Bone-Guelma Company. In 1906 was opened a continuation of the line from Pont du Fahs to Kef and thence south-west to Kalaat-es-Senam, a place midway between Kef and Tebessa, the centre of the Algerian phosphate region. A branch from the Kef line runs to the phosphate mines of Kalaa-Jerda.

Another railway (completed by 1900) runs from Sfax, along the coast to Mahres, thence inland to Gafsa and the phosphate mines of Metalwi. This line, 151 m. long, was for some years isolated from the general Tunisian system. The total mileage of the Tunisian railways was computed to be 1060 m. by the finishing of the Susa-Sfax, Gabes-Tebessa lines in 1909. Extensions of the railway system are contemplated to Gabes and, beyond, to the Tripolitan frontier. In the south communication is maintained chiefly by camel caravans.

Posts and Telegraphs.—The whole of Tunisia is covered with a network of telegraph lines (2500 m.), and there are telephones working in most of the large towns. The telegraph system penetrates to the farthest French post in the Sahara, is connected with the Turkish system on the Tripolitan frontier and with Algeria, and by cable with Sicily, Malta, Sardinia and Marseilles. There is an efficient post office service, with about 400 post offices.

Finance.—The principal bank is the Banque de Tunisie. The coinage formerly was the caroub and piastre (the latter worth about 6d.), but in 1891 the French reformed the coinage, substituting the franc as a unit, and having the money minted at Paris. The values of the coinage are pieces of 5 and 10 centimes in bronze, of 50 centimes, 1 franc and 2 francs in silver, of 10 francs and 20 francs in gold. The inscriptions are in French and Arabic. The public debt was consolidated in 1884 into a total of £5,702,000, guaranteed by France, and bearing 4% interest. In 1888 it was converted into a loan paying 3½% interest, and in 1892 another conversion reduced the rate of interest to 3%. In 1902 a new loan of £1,800,000 was issued at 3%. At the beginning of 1907 the total Tunisian debt was £9,287,260; in that year the government was authorized to contract another loan of £5,000,000 at 3% (£3,000,000 being guaranteed by France) for railways, roads and colonization. The weights and measures are those of France. The revenue for the year 1900 was £1,456,640, and the expenditure was £1,452,597. In 1910 receipts and expenditure balanced at about £1,888,000 each. The principal sources of revenue are direct taxation, stamp and death duties, customs, port and lighthouse dues, octroi and tithes, tobacco, salt and gunpowder monopolies, postal and telegraph receipts, and revenue from the state domains (lands, fisheries, forests, mines). The civil list paid to the Bey of Tunis amounts to £36,000 per annum, and the endowment of the princes and princesses of the beylical family to £31,200 a year more.

Administration.—From a native's point of view Tunisia still appears to be governed by the Bey of Tunis, his Arab ministers and his Arab officials, the French only exercising an indirect—though a very real—control over the indigenous population (Mahommedans and Jews). But all Christians and foreigners are directly governed by the French, and the native administration is supervised by a staff of thirteen French *contrôleurs* and their French and Tunisian subordinates. Seven of the departments of state have Frenchmen at their head, the other two, Tunisians: thus the larger proportion of the Bey's ministers are French. France is directly represented in Tunisia by a minister resident-general, and by an assistant resident. The French resident-general is the virtual viceroy of Tunisia, and is minister for foreign affairs. Besides Mussulman (native) schools there were in the regency, in 1906, 158 public schools, 5 lycées and colleges and 21 private schools. At these schools were 22,000 pupils (13,000 boys), all save 3500 Mussulmans being Europeans or Jews.

The Province of "Africa."

History.—The history of Tunisia begins for us with the establishment of the Phoenician colonies (see PHOENICIA and CARTHAGE). The Punic settlers semitized the coast, but left the Berbers of the interior almost untouched. The Romans entered into the heritage of the Carthaginians and the vassal kings of Numidia, and Punic speech and civilization gave way to Latin, a change which from the time of Caesar was helped on by Italian colonization; to this region the Romans gave the name of "Africa," apparently a latinizing of the Berber term "Ifriqa," "Ifrigia" (in modern Arabic, *Ifriqiyah*).

Rich in corn, in herds, and in later times also in oil, and possessing valuable fisheries, mines and quarries, the province of Africa, of which Tunisia was the most important part, attained under the empire a prosperity to which Roman remains in all parts of the country still bear witness. Carthage was the second city of the Latin part of the empire, "after Rome the busiest and perhaps the most corrupt city of the West, and the chief centre of Latin culture and letters." In the early history of Latin Christianity Africa holds a more important place than Italy. It was here that Christian Latin literature took its rise, and to this province belong the names of Tertullian and Cyprian, of Arnobius and Lactantius, above all of Augustine. Lost to Rome by the invasion of the Vandals, who took Carthage in 439, the province was recovered by Belisarius a century later (533–34), and remained Roman till the Arab invasions of 648–69. The conqueror, 'Oqba-bin-Nafa, founded the city of Kairwan (673) which was the residence of the governors of "Ifriqiyah" under the Omayyads and thereafter the capital of the Aghlabite princes, the conquerors of Sicily, who ruled in merely nominal dependence on the Abbasids.

The Latin element in Africa and the Christian faith almost disappeared in a single generation;[1] the Berbers of the

[[1] The North African Church was not utterly swept away by the Moslem conquest, though its numbers at that time were very greatly diminished, and thereafter fell gradually to vanishing point, partly by emigration to Europe. Its episcopate in the 10th century still numbered thirty members, but in 1076 the Church could not provide three bishops to consecrate a new member of the episcopate, and for that purpose Gregory VII. named two bishops to act with the archbishop of Carthage. In the 13th century the native episcopate had disappeared. Abd ul-Mumin, the Almohade conqueror of Tunisia, compelled many of the native Christians to embrace Islam, but when Tunis was captured by Charles V. in 1535, there were still found in the city native Christians, the last remnants of the

Arab Conquest and Berber Dynasties.

mountains, who had never been latinized and never really christianized, accepted Islam without difficulty, but showed their stubborn nationality, not only in the character of their Mahommedanism, which has always been mixed up with the worship of living as well as dead saints (marabouts) and other peculiarities, but also in political movements. The empire of the Fātimites (*q.v.*) rested on Berber support, and from that time forth till the advent of the Turks the dynasties of North Africa were really native, even when they claimed descent from some illustrious Arab stock. When the seat of the Fātimite Empire was removed to Egypt, the Zīrites, a house of the Sanhaja Berbers, ruled as their lieutenants at Mahdia, and about 1050 Moʿizz the Zīrite, in connexion with a religious movement against the Shīʿites, transferred his very nominal allegiance to the Abbasid caliphs. The Fātimites in revenge let loose upon Africa about A.D. 1045 a vast horde of Beduins from Upper Egypt (Beni Hilāl and Solaim), the ancestors of the modern nomads of Barbary. All North Africa was ravaged by the invaders, who, though unable to found an empire or overthrow the settled government in the towns, forced the agricultural Berbers into the mountains, and, retaining from generation to generation their lawless and predatory habits, made order and prosperity almost impossible in the open parts of the country until its effective occupations by the French. The Zīrite dynasty was finally extinguished by Roger I. of Sicily, who took Mahdia in 1148 and established his authority over all the Tunisian coast. Even Moslem historians speak favourably of the Norman rule in Africa; but it was brought to an early end by the Almohade caliph Abd ul-Mumin, who took Mahdia in 1160.

The Hafsites.

The Almohade Empire soon began to decay, and in 1336 Abū Zakarīyā, prince of Tunis, was able to proclaim himself independent and found a dynasty, which subsisted till the advent of the Turks. The Hafsites (so called from Abū Ḥafṣ, the ancestor of Abū Zakarīyā, a Berber chieftain who had been one of the intimate disciples of the Almohade mahdi) assumed the title of Prince of the Faithful, a dignity which was acknowledged even at Mecca, when in the days of Mostanṣir, the second Hafsite, the fall of Bagdad left Islam without a titular head. In its best days the empire of the Hafsites extended from Tlemçen to Tripoli, and they received homage from the Merinids of Fez; they held their own against repeated Frankish invasions, of which the most notable were that which cost St Louis of France his life (1270), and that of the duke of Bourbon (1390), when English troops took part in the unsuccessful siege of Mahdia. They adorned Tunis with mosques, schools and other institutions, favoured letters, and in general appear to have risen above the usual level of Moslem sovereigns. But their rule was troubled by continual wars and insurrections; the support of the Beduin Arabs was imperfectly secured by pensions, which formed a heavy burden on the finances of the state;[1] and in later times the dynasty was weakened by family dissensions. Leo Africanus, writing early in the 16th century, gives a favourable picture of the "great city" of Tunis, which had a flourishing manufacture of fine cloth, a prosperous colony of Christian traders, and, including the suburbs, nine or ten thousand hearths; but he speaks also of the decay of once flourishing provincial towns, and especially of agriculture, the greater part of the open country lying waste for fear of the Arab marauders. Taxation was heavy, and the revenue very considerable: Don Juan of Austria, in a report to Philip II., states that the land revenue alone under the last Hafsite was 375,935 ducats, but of this a great part went in tribute to the Arabs.

Turkish Conquest.

The conquest of Algiers by the Turks gave a dangerous neighbour to Tunisia, and after the death of Mohammed the Hafsite in 1525 a disputed succession supplied Khair-ad-Dīn Barbarossa with a pretext for occupying the city in the name of the sultan of Constantinople. Al-Ḥasan, the son of Mahommed, sought help from the emperor, and was restored in 1535 as a Spanish vassal, by a force which Charles V. commanded in person, while Andrea Doria was admiral of the fleet. But the conquest was far from complete, and was never consolidated. The Spaniards remained at Goletta and made it a strong fortress, they also occupied the island of Jerba and some points on the south-east coast; but the interior was a prey to anarchy and civil war, until in 1570 ʿAlī-Pasha of Algiers utterly defeated Ḥāmid, the son and successor of Ḥasan, and occupied Tunis. In 1573 the Turks again retreated on the approach of Don Juan, who had dreams of making himself king of Tunis; but this success was not followed up, and in the next year Sultan Selim II. sent a strong expedition which drove the Spaniards from Tunis and Goletta, and reduced the country to a Turkish province. Nevertheless the Spanish occupation left a deep impression on the coast of Tunis, and not a few Spanish words passed into Tunisian Arabic. After the Turkish conquest, the civil administration was placed under a pasha; but in a few years a military revolution transferred the supreme power to a Dey elected by the janissaries, who formed the army of occupation. The government of the Deys lasted till 1705, but was soon narrowed or overshadowed by the authority of the Beys, whose proper function was to manage the tribes and collect tribute. From 1631 to 1702 the office of Bey was hereditary in the descendants of Murād, a Corsican renegade, and their rivalry with the Deys and internal dissensions kept the country in constant disorder. Ibrahīm, the last of the Deys (1702–1705), destroyed the house of Murād, and absorbed the beyship in his own office; but, when he fell in battle with the Algerians, Ḥussein b. ʿAlī, the son of a Cretan renegade, was proclaimed sovereign by the troops under the title of "Bey," and, being a prince of energy and ability, was able to establish the hereditary sovereignty, which has lasted without change of dynasty to the present time.[2]

Rise of the Beys.

Frequent wars with Algiers form the chief incidents in the internal history of Tunisia under the Beys. Under Deys and Beys alike Tunisia was essentially a pirate state. Occasionally acts of chastisement, of which the bombardment of Porto Farina by Blake in 1655 was the most notable, and repeated treaties, extorted by European powers, checked from time to time, but did not put an end to, the habitual piracies, on which indeed the public revenue of Tunis was mainly dependent. The powers were generally less concerned for the captives than for the acquisition of trading privileges, and the Beys took advantage of the commercial rivalry of England and France to play off the one power against the other. The release of all Christian slaves was not effected till after the bombardment of Algiers; and the definite abandonment of piracy may be dated from the presentation to the Bey in 1819 of a collective note of the powers assembled at Aix-la-Chapelle. The government had not elasticity enough to adapt itself to so profound a change in its ancient traditions; the finances became more and more hopelessly embarrassed, in spite of ruinous taxation; and attempts at European innovations in the court and army made matters only worse, so long as no attempt was made to improve

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once powerful Church. Traces of Christianity remained among the Kabyles till after the conquest of Granada (1492), when the influx of Andalusian Moors from Spain completed the conversion of those tribes. It may be added that down to the early years of the 19th century it was alleged that some of the Tuareg tribes in the Sahara professed Christianity (see *e.g.* Hornemann's *Travels*). For the North African Church after the Moslem conquest, see Migne, *Pat. lat.*; and Mas Latrie, *Afrique septentrionale*. Their information is summarized in the introduction to vol. ii. of Azurara's *Discovery and Conquest of Guinea*, Hakluyt Society's edition (1899).—ED.]

[1] In the 13th and 14th centuries the Hafsites also paid tribute to Sicily for the freedom of the sea and the right to import Sicilian corn—a clear proof of the decline of Tunisian agriculture.

[2] Muhammad VI. es Sadok, the reigning Bey at the time of the French occupation, died in October 1882, and was succeeded by his brother ʿAli IV. This prince reigned until 1902, the throne then passing to his son Muhammad VII. el Hadi, who died in 1906, when his cousin Muhammad VIII. en Nasr (b. 1855) became Bey.

the internal condition of the country. In the third quarter of the 19th century not more than a tenth part of the fertile land was under cultivation, and the yearly charge on the public debt exceeded the whole annual revenue. In these circumstances only the rivalry of the European powers that had interests in Tunisia protracted from year to year the inevitable revolution. The French began to regard the dominions of the Bey as a natural adjunct to Algeria, but after the Crimean War Turkish rights over the regency of Tunis were revived. After the Franco-German War the embarrassed Bey turned towards Great Britain for advice, and a British protectorate—suggested by the proximity of Malta—was not an impossibility under the remarkable influence of the celebrated Sir Richard Wood, British diplomatic agent at the court of Tunis from 1855 to 1879. The railways, lighthouses, gas and waterworks and other concessions and industries were placed in British hands. But in 1878, at the Congress of Berlin, Lord Salisbury agreed to allow France a "free hand" in Tunisia in return for French acquiescence in the British lease of Cyprus.

Occupation by the French.

After 1862, however, the kingdom of Italy began to take a deep interest in the future of Tunisia. When the country went bankrupt in 1869, a triple control was established over Tunisian finances, with British, French and Italian "controllers." In 1880 the Italians bought the British railway from Tunis to Goletta. This and other actions excited the French to act on the secret understanding effected with the British foreign minister at the Berlin Congress. In 1881 a French force crossed the Algerian frontier under pretext of chastising the independent Khmir or Kroumir tribes on the north-east of the regency, and, quickly dropping the mask, advanced on the capital and compelled the Bey to accept the French protectorate. The actual conquest of the country was not effected without a serious struggle with Moslem fanaticism, especially at Sfax; but all Tunisia was brought completely under French jurisdiction and administration, supported by military posts at every important point. In 1883 the new situation under the French protectorate was recognized by the British government withdrawing its consular jurisdiction in favour of the French courts, and in 1885 it ceased to be represented by a diplomatic official. The other powers followed suit, except Italy, which did not recognize the full consequences of the French protectorate until 1896. In 1884 a thorough reform of the government and administration of the country was begun under the direction of a succession of eminent French residents-general. In 1897 Great Britain surrendered her commercial treaty with Tunisia and agreed (subject to a special temporary privilege regarding cotton goods) to allow her commerce and all other relations with Tunisia to be subjected to the same conditions as those affecting all such relations between Britain and France.

Relations with Turkey.

The French protectorate over Tunisia, based on the treaty signed by the Bey at Bardo on the 12th of May 1881 and confirmed by the treaty of La Marsa (June 8, 1883), was not recognized by Turkey, which claimed the regency as part of the Ottoman dominions. The protests of the Porte were ignored by the French, and in 1892 Turkey so far recognized the actual situation as to determine the Tunisia-Tripoli frontier as far south as Ghadames. South of that point the Saharan frontiers of Algeria, Tunisia and Tripoli remained undefined. Working eastward from Tunisia and Algeria the French occupied several points to which Turkey laid claim. Thus the oasis of Janet, S.S.W. of Rhat, was occupied in 1906. The action of France led to counter-action by Turkey and to various frontier incidents. Janet was reoccupied by Ottoman troops in the summer of 1910, but in deference to French protests the troops were withdrawn pending the delimitation of the frontier. At the same time Turkey maintained the claim that Tunisians were Ottoman subjects.

Frontier troubles had however little effect on the remainder of the protectorate. In 1904–1905 there were famines and some native discontent in the south of Tunisia; but in general the country has prospered amazingly under the French protectorate. The native dynasty has been strengthened rather than weakened, and Tunisia may be pointed out as the best and wisest example of French administration over an alien land and race. Though on a smaller scale it is worthy to be set as a pendant to the British work in Egypt.

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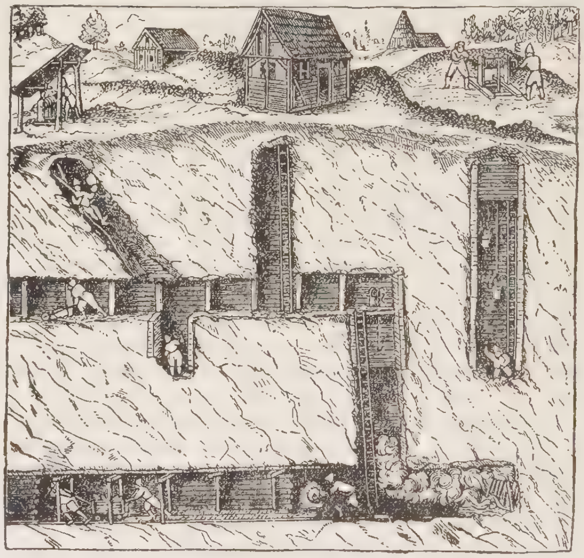
TUNNEL (Fr. *tonnel*, later *tonneau*, a diminutive from Low Lat. *tonna, tunna*, a tun, cask), a more or less horizontal underground passage made without removing the top soil. In former times any long tube-like passage, however constructed, was called a tunnel. At the present day the word is sometimes popularly applied to an underground passage constructed by trenching down from the surface to build the arching and then refilling with the top soil; but a passage so constructed, although indistinguishable from a tunnel when completed, is more correctly termed a "covered way," and the operations "cutting" and "covering," instead of tunnelling. Making a small tunnel, afterwards to be converted into a larger one, is called "driving a heading," and in mining operations small tunnels are termed "galleries," "driftways" and "adits." If the underground passage is vertical it is a shaft; if the shaft is begun at the surface the operations are known as "sinking"; and it is called a "rising" if worked upwards from a previously constructed heading or gallery.

Tunnelling has been effected by natural forces to a far greater extent than by man. In limestone districts innumerable swallow-holes, or shafts, have been sunk by the rain water following joints and dissolving the rock, and from the bottom of these shafts tunnels have been excavated to the sides of hills in a manner strictly analogous to the ordinary method of executing a tunnel by sinking shafts at intervals and driving headings therefrom. Many rivers find thus a course underground. In Asia Minor one of the rivers on the route of the Mersina railway extension pierces a hill by means of a natural tunnel, whilst a little south at Seleucia another river flows through a tunnel, 20 ft. wide and 23 ft. high, cut 1600 years ago through rock so hard that the chisel marks are still discernible. The Mammoth Cave of Kentucky and the Peak caves of Derbyshire are examples of natural tunnelling. Mineral springs bring up vast quantities of matter in solution. It has been estimated that the Old Well Spring at Bath has discharged since the beginning of the 19th century solids equivalent to the excavation of a 6 ft. by 3 ft. heading 9 m. long; and yet the water is perfectly clear and the daily flow is only the 150th part of that pumped out of the great railway tunnel under the Severn. Tunnelling is also carried on to an enormous extent by the action of the sea. Where the Atlantic rollers break on the west coast of Ireland, or on the seaboard of the western Highlands of Scotland, numberless caves and tunnels have been formed in the cliffs, beside which artificial tunnelling operations appear insignificant. The most gigantic subaqueous demolition hitherto carried out by man was the blowing up in 1885 of Flood Rock, a mass about 9 acres in extent, near Long Island Sound, New York. To effect this gigantic work by a single instantaneous blast a shaft was sunk 64 ft. below sea-level, from the bottom of which 4 m. of tunnels or galleries were driven so as to completely honeycomb the rock. The roof rock ranged from 10 ft. to 24 ft. in thickness, and was supported by 467 pillars 15 ft. square; 13,286 holes, averaging 9 ft. in length and 3 ins. in diameter, were drilled in the pillars and roof. About 80,000 cub. yds. of rock were excavated in the galleries and 275,000 remained to be blasted away. The holes were charged with 110 tons of "rackarock," a more powerful explosive than gunpowder, which was fired by electricity, when the sea was lifted 100 ft. over the whole area of the rock. Where natural forces effect analogous results, the holes are bored and the headings driven by the chemical and mechanical action of the rain and sea, and the explosive force is obtained by the expansive action of air locked up in the fissures of the rock and compressed to many tons per square foot by impact from the waves. Artificial breakwaters have often been thus tunnelled into by the sea, the compressed air blowing out the blocks and the waves carrying away the débris.

With so many examples of natural caves and tunnels in existence it is not to be wondered at that tunnelling was one of the earliest works undertaken by man, first for dwellings and tombs, then for quarrying and mining, and finally for water-supply, drainage, and other requirements of civilization. A Theban king on ascending the throne began at once to drive the tunnel which was to form his final resting-place, and persevered with the work until death. The tomb of Mineptah at Thebes was driven at a slope for a distance of 350 ft. into the hill, when a shaft was sunk and the tunnel projected a farther length of about 300 ft., and enlarged into a chamber for the sarcophagus. Tunnelling on a large scale was also carried on at the rock temples of Nubia and of India, and the architectural features of the entrances to some of these temples might be studied with advantage by the designers of modern tunnel fronts. Flinders Petrie has traced the method of underground quarrying followed by the Egyptians opposite the Pyramids. Parallel galleries about 20 ft. square were driven into the rock and cross galleries cut, so that a hall 300 to 400 ft. wide was formed, with a roof supported by rows of pillars 20 ft. square and 20 ft. apart. Blocks of stone were removed by the workmen cutting grooves all round them, and, where the stone was not required for use, but merely had to be removed to form a gallery, the grooves were wide enough for a man to stand up in. Where granite, diorite and other hard stone had to be cut the work was done by tube drills and by saws supplied with corundum, or other hard gritty material, and water—the drills leaving a core of rock exactly like that of the modern diamond drill. As instances of ancient tunnels through soft ground and requiring masonry arching, reference may be made to the vaulted drain under the south-east palace of Nimrod and to the brick arched tunnel, 12 ft. high and 15 ft. wide, under the Euphrates. In Algeria, Switzerland, and wherever the Romans went, remains of tunnels for roads, drains and water-supply are found. Pliny refers to the tunnel constructed for the drainage of Lake Fucino as the greatest public work of the time. It was by far the longest tunnel in the world, being more than 3½ m. in length, and was driven under Monte Salviano, which necessitated shafts no less than 400 ft. in depth. Forty shafts and a number of "cuniculi," or inclined galleries, were sunk, and the excavated material was drawn up in copper pails, of about ten gallons capacity, by windlasses. The tunnel was designed to be 10 ft. high by 6 ft. wide, but its actual cross-section varied. It is stated that 30,000 labourers were occupied eleven years in its construction. With modern appliances such a tunnel could be driven from the two ends without intermediate shafts in eleven months.

No practical advance was made on the tunnelling methods of the Romans until gunpowder came into use. Old engravings of mining operations early in the 17th century show that excavation was still accomplished by pickaxes or hammer and chisel, and that wood fires were lighted at the ends of the headings to split and soften the rock in advance (see fig. 1).



(From Agricola's *De re metallica*, Basel, 1621.)

FIG. 1.—Method of mining, 1621.

Crude methods of ventilation by shaking cloths in the headings and by placing inclined boards at the top of the shafts are also on record. In 1766 a tunnel 9 ft. wide, 12 ft. high and 2880 yds. long was begun on the Grand Trunk Canal, England, and completed eleven years later; and this was followed by many others. On the introduction of railways tunnelling became one of the ordinary incidents of a contractor's work; probably upwards of 4000 railway tunnels have been executed.

Tunnelling under Rivers and Harbours.—In 1825 Marc Isambard Brunel began, and in 1843 completed, the Thames tunnel between Rotherhithe and Wapping now used by the East London railway. He employed a peculiar "shield," made of timber, in several independent sections. Part of the ground penetrated was almost liquid mud, and the cost of the tunnel was about £1300 per lineal yard. In 1818 he took out a patent for a tunnelling process, which included a shield, and which mentioned cast iron as a surrounding wall. His shield foreshadowed the modern shield, which is substituted for the ordinary timber work of the tunnel, holds up the earth of excavation, affords space within its shelter for building the permanent walls, overlaps these walls in telescope fashion, and is moved forward by pushing against their front ends. The advantages of cast-iron walls are that they have great strength in small space as soon as the segments are bolted together, and they can be caulked water-tight.

In 1830 Lord Cochrane (afterwards 10th earl of Dundonald) patented the use of compressed air for shaft-sinking and tunnelling in water-bearing strata. Water under any pressure can be kept out of a subaqueous chamber or tunnel by sufficient air of a greater pressure, and men can breathe and work therein—for a time—up to a pressure exceeding four atmospheres. The shield and cast-iron lining invented by Brunel, and the compressed air of Cochrane, have with the aid of later inventors largely removed the difficulties of subaqueous tunnelling. Cochrane's process was used for the foundation of bridge piers, &c., comparatively early, but neither of these devices was employed for tunnelling until half a century after their invention. Two important subaqueous tunnels in the construction of which neither of these valuable aids was adopted are the Severn and the Mersey tunnels.

The Severn tunnel (fig. 16), 4⅓ m. in length for a double line of railway, begun in 1873 and finished in 1886, Hawkshaw, Son, Hayter & Richardson being the engineers and T. A. Walker the contractor, is made almost wholly in the Trias and Coal Measure formations, but for a short distance at its eastern end passes through gravel. At the lowest part the depth is 60 ft. at low water and 100 ft. at high water, and the thickness of sandstone over the brickwork is 45 ft. Under a depression in the bed of the river on the English side there is a cover of only 30 ft. of marl. Much water was met with throughout. In 1879 the works were flooded for months by a land spring on the Welsh side of the river, and on another occasion from a hole in the river bed at the Salmon Pool. This hole was subsequently filled with clay and the works completed beneath. Two preliminary headings were driven across the river to test the ground. "Break-ups" were made at intervals of two to five chains and the arching was carried on at each of these points. All parts of the excavation were timbered, and the greatest amount excavated in any one week was 6000 cub. yds. The total amount of water raised at all the pumping stations is about 27,000,000 gallons in twenty-four hours.

The length of the Mersey tunnel (fig. 15) between Liverpool and Birkenhead between the pumping shafts on each side of the river is one mile. From each a drainage heading was driven through the sandstone with a rising gradient towards the centre of the river. This heading was partly bored out by a Beaumont machine to a diameter of 7 ft. 4 in. and at a rate attaining occasionally 65 lineal yds. per week. All of the tunnel excavation, amounting to 320,000 cub. yds., was got out by hand labour, since heavy blasting would have shaken the rock. The minimum cover between the top of the arch and the bed of the river is 30 ft. Pumping machinery is provided for 27,000,000 gallons per day, which is more than double the usual quantity of water. Messrs Brunlees & Fox were the engineers, and Messrs Waddell the contractors for the works, which were opened in 1886, about six years after the beginning of operations.

In 1869 P. W. Barlow and J. H. Greathead built the Tower foot-way under the Thames, using for the first time a cast-iron lining and a shield which embodied the main features of Brunel's design. Barlow had patented a shield in 1864, and A. E. Beach one in 1868. The latter was used in a short masonry tunnel under Broadway, New York City, at that time. In 1874 Greathead designed and built a shield, to be used in connexion with compressed air, for a proposed Woolwich tunnel under the Thames, but it was never used. Compressed air was first used in tunnel work by Hersent, at Antwerp, in 1879, in a small drift with a cast-iron lining.

In the same year compressed air was used for the first time in any important tunnel by D. C. Haskin in the famous first Hudson River tunnel, New York City. This was to be of two tubes, each having internal dimensions of about 16 ft. wide by 18 ft. high. The excavation as fast as made was lined with thin steel plates, and inside of these with brick. In June 1880 the northerly tube had reached 360 ft. from the Hoboken shaft, but a portion near the latter, not of full size, was being enlarged. Just after a change of shifts the compressed air blew a hole through the soft silt in the roof at this spot, and the water entering drowned the twenty men who were working therein. From time to time money was raised and the work advanced. Between 1888 and 1891 the northerly tunnel was extended 2000 ft. to about three-fourths of the way across, with British capital and largely under the direction of British engineers—Sir Benjamin Baker and E. W. Moir. Compressed air and a shield were used, and the tunnel walls were made of bolted segments of cast iron. The money being exhausted, the tunnel was allowed to fill with water, and it so remained for ten years. Both tubes were completed in 1908.

The use of compressed air in the Hudson tunnel, and of annular shields and cast-iron lined tunnel in constructing the City & South London railway (1886 to 1890) by Greathead, became widely known and greatly influenced subaqueous and soft-ground tunnelling thereafter. The pair of tunnels for this railway from near the Monument to Stockwell, from 10 ft. 2 in. to 10 ft. 6 in. interior diameter, were constructed mostly in clay and without the use of compressed air, except for a comparatively short distance through water-bearing gravel. In this gravel a timber heading was made, through which the shield was pushed. The reported total cost was £840,000. Among the tunnels constructed after the City & South London work was well advanced, lined with cast-iron segments, and constructed by means of annular shields and the use of compressed air, were the St Clair (Joseph Hobson, engineer) from Sarnia to Port Huron, 1889–1890, through clay, and for a short distance through water-bearing gravel, 6000 ft., 18 ft. internal diameter; and the notable Blackwall tunnel under the Thames (Sir Alexander Binnie, engineer, and S. Pearson & Sons, contractors), through clay and 400 ft. of water-saturated gravel, 1892–1897, about 3116 ft. long, 24 ft. 3 in. in internal diameter. The shield, 19 ft. 6 in. long, contained a bulkhead with movable shutters, as foreshadowed in Baker's proposed shield (fig. 2). Numerous tunnels of small diameter have been similarly constructed under the Thames and Clyde for electric and cable ways, several for sewers in Melbourne, and two under the Seine at Paris for sewer siphons.

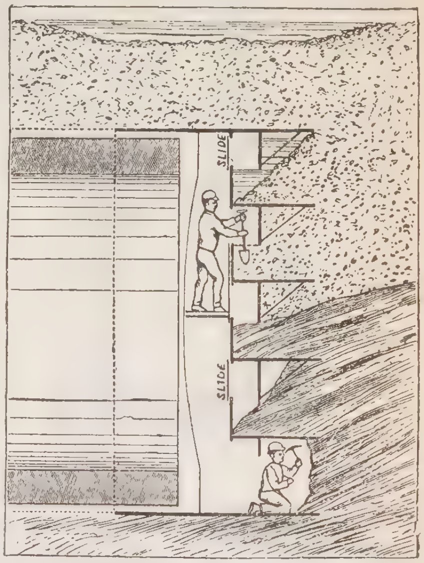


Fig. 2.—B. Baker's pneumatic shield.

The Rotherhithe tunnel, under the Thames, for a roadway, with a length of 4863 ft. between portals, of which about 1400 ft. are directly under the river, has the largest cross-section of any subaqueous tube of this type in the world (see fig. 3). It was begun in 1904 and finished in 1908, Maurice Fitzmaurice being the engineer of design and construction, and Price & Reeves the contractors. It penetrates sandy and shelly clay overlying a seam of limestone beneath which are pebbles and loamy sand. A preliminary tunnel for exploration, 12 ft. in diameter, was driven across the river, the top being within 2 ft. of the following main tunnel. The top of the main tunnel excavation in the middle of the river was only 7 ft. from the bed of the Thames, and a temporary blanket of filled earth, usually allowed in similar cases, was prohibited owing to the close proximity of the docks. The maximum progress in one day was 12·5 ft., and the average in six days 10·4 ft. The air compressors were together capable of supplying 1,000,000 cub. ft. of air per hour.

Some tunnels of marked importance of this type—to be operated solely with electric cars—have been built under the East and Hudson rivers at New York. Two tubes of 15 ft. interior diameter and 4150 ft. long penetrate gneiss and gravel directly under the East River between the Battery and Brooklyn. They were begun in 1902, with Wm. B. Parsons and George S. Rice as engineers, and were finished in December 1907, under the direction of D. L. Hough of the

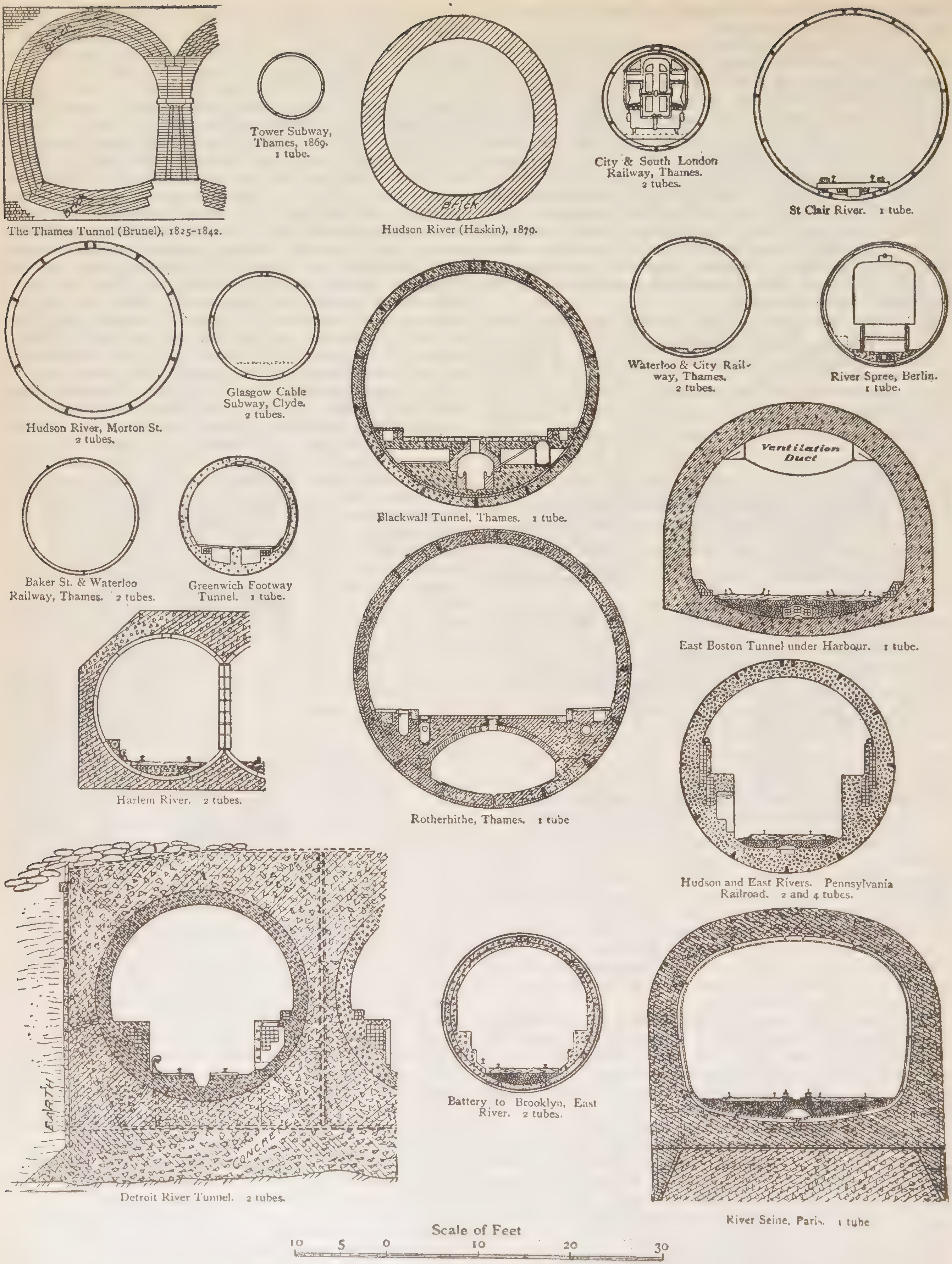

Brick
Brick
The Thames Tunnel (Brunel), 1825-1842.
Tower Subway, Thames, 1869. 1 tube.
Brick
Hudson River (Haskin), 1879.
City & South London Railway, Thames. 2 tubes.
St Clair River. 1 tube.
Hudson River, Morton St. 2 tubes.
Glasgow Cable Subway, Clyde. 2 tubes.
Blackwall Tunnel, Thames. 1 tube.
Waterloo & City Railway, Thames. 2 tubes.
River Spree, Berlin. 1 tube.
Ventilation Duct
East Boston Tunnel under Harbour. 1 tube.
Baker St. & Waterloo Railway, Thames. 2 tubes.
Greenwich Footway Tunnel. 1 tube.
Harlem River. 2 tubes.
Rotherhithe, Thames. 1 tube
Hudson and East Rivers. Pennsylvania Railroad. 2 and 4 tubes.
EARTH
CONCRETE
Detroit River Tunnel. 2 tubes.
Battery to Brooklyn, East River. 2 tubes.
River Seine, Paris. 1 tube
Scale of Feet
10 5 0 10 20 30

Fig. 3.—Cross Sections of Tunnels under Rivers and Harbours.

New York Tunnel Company. They carry subway trains. In one of the blow-outs of compressed air a workman was blown through the gravel roof into the river above. He lived until the next day. Two other tubes of the same size built also through gneiss and gravel between 1905 and 1907 by the Degnon Contracting Company, with R. A. Shailer as the contractors' engineer, go from 42nd Street to Long Island City.

Four much larger tubes (see fig. 3) built in 1904 to 1909, for the Pennsylvania railroad, with Alfred Noble as chief engineer, S. Pearson & Son as contractors, and E. W. Moir as general manager, cross from 32nd and 33rd Streets to Long Island. The maximum average progress per day (one heading) for the best month's work was: rock, 4·1 ft.; rock and earth, 3·8 ft.; earth, with full sand face, 12·8 ft. The best methods of preventing blow-outs were found to consist of employing clay blankets (sometimes 25 ft. thick) on the river bed, which could be carried up to 20 ft. depth of water, and of filling the pores of the sand and gravel with blue lias lime or cement grout. The maximum air pressure was 38 ℔ per sq. in. In the case of sand face with poor leaky cover the usual practice was to make the air pressure equal to that of water from the surface down to about a quarter the distance below the top of the shield. The average amount of free air supplied per man per hour was approximately 2300 cub. ft. On the Hudson river side two tubes of the same size as those in the East river are for the Pennsylvania trains to New Jersey. Two tubes from Morton Street to New Jersey, begun by Haskin, already referred to, are for subway trains, and so are the most southerly of all on the Hudson side, viz. the two from Cortlandt Street to under the Pennsylvania station in Jersey City.

The two tubes from Morton Street were completed under the direction of Charles M. Jacobs, who was also chief engineer of the four other Hudson River tubes. The contractors for the Hudson tubes for the Pennsylvania road were the O'Rourke Contracting Company. Skilful treatment was required to overcome the difficulties on the New York side of the Hudson in all the tubes where the face excavation was partly in rock and partly in soft earth. Most of their length, however, was through silt, and in this the tunnelling was the easiest and most rapid that has ever been carried out in subaqueous work, 50 lineal ft. per day being sometimes accomplished. A large proportion of the silt which under ordinary processes would be taken into the tunnel through the shield, carried to the shore and got rid of by expensive methods, was by the latter process merely displaced as the shield with nearly or quite closed diaphragm was pushed ahead.

The East Boston tunnel, the first important example of a shield-built monolithic concrete arch, from the Boston Subway to East Boston, is 1·4 m. long, 3400 ft. being under the harbour. One mile was excavated by tunnelling with roof shields about 29 ft. wide, through clay containing pockets of sand and gravel. The engineer was H. A. Carson, and the contractors the Boston Tunnel Construction Company and Patrick McGovern.

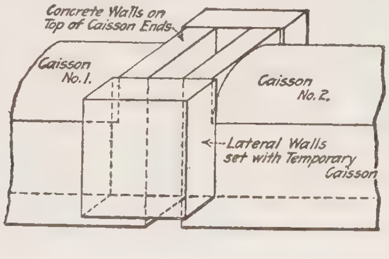
Some 25 m. of waterworks brick-lined tunnels have been built since 1864, mostly in clay, under the Great Lakes, without the use of shields, though in the later ones compressed air was utilized. A large portion of the latest Cleveland tunnel, 9 ft. interior diameter, was built at the rate of 17 ft. per day at a cost of about $18 per ft. During this work three explosions of inflammable gases occurred, in which nineteen men were killed and others were injured. Later a fire at the shaft in the lake caused the death of ten men. Work was thereafter completed under the engineering direction of G. H. Benzenberg. Less serious accidents, principally explosions of marsh gas, occurred in many of the other tunnels. In one case (at Milwaukee under Benzenberg) drift material was penetrated, with large boulders and coarse and fine gravel, and without any sand or clay filling, apparently in direct communication with the lake bottom. At times the necessary air pressure was 42 ℔ per sq. in.

Subaqueous Tunnels made by sinking Tubes, Caissons, &c.—In 1845 De la Haye, in England, doubtless having in mind the tedious and difficult work of the Thames tunnel, proposed to make tunnels under water by sinking large tubes on a previously prepared bed and connecting them together. Since then many inventors have proposed similar schemes. In 1866 Belgrand sank twin plate-iron pipes, 1 metre diameter and 156 metres long, under the Seine at Paris for a sewer siphon, and there have since been numerous examples of sunk cast-iron subaqueous water-pipes. It is believed that the first tunnel of this class, large enough for men to move upright in, was by H. A. Carson, assisted by W. Blanchard and F. D. Smith, in 1893–1894, in the outer portion of Boston harbour, for the metropolitan sewer outlet. The later tubes were about 9 ft. exterior diameter, in sections each 52 ft. long, weighing about 210,000 ℔, made of brick and concrete, with a skin of wood and water-tight bulkheads at each end. A trench was dredged in the harbour bed and saddles were accurately placed to support the tubes. The latter, made in cradles above water alongside a wharf, were lowered by long vertical screws moved by steam power, and were towed ½ to ¾ m. to their final positions. After sufficient water had been admitted they were lowered to their saddles by travelling shears on temporary piles. The temporary joints between consecutive sections were made by rubber gaskets between flanges which were bolted together by divers. The later operations were backfilling the trench over the pipes, and in each section pumping out the water, removing its bulkheads, and making good the masonry between consecutive bulkheads, this masonry being inside the flanges. This work, about 1500 ft. in length, was done without contractors, by labourers and foremen under the immediate control of the engineers, and was found perfectly tight, straight and sound.

The double-track railroad tunnel at Detroit, made in 1906–1909, under the direction of an advisory board consisting of W. J. Wilgus (chairman), H. A. Carson and W. S. Kinnear (the last-named being chief engineer), is 1½ m. long, with a portion directly under the river of ½ m. The method used under the river (proposed by Wilgus) is an important variation on the Boston scheme. A trench was dredged with a depth equal to the thickness of the tunnel below the river bed and about 70 ft. below the river surface, and grillages were accurately placed in it to support the ends of thin steel tube-forms, inside of which concrete was to be moulded and outside of which deposited. These tubes, each about 23 ft. in diameter and 262·5 ft. long, were in pairs (one tube for each track), and were connected sidewise and surrounded by thin steel diaphragms 12 ft. apart. Planking, to limit the concrete, was secured outside the diaphragms (see fig. 3). The forms were made tight, bulkheaded at their ends, floated into place, sunk by admitting water, set on the grillages, and the ends of successive pairs connected together by bolts through rubber gaskets and flanges. The succeeding pair of tubes was not lowered until concrete had been deposited through the river around the tubes of the preceding pair. The following steps were to remove the water from one pair of tubes, mould inside a lining of concrete 20 in. thick, remove the contiguous bulkheads, and repeat again and again the processes described until the subaqueous tunnel was complete.

The New York Rapid Transit tunnel under Harlem river, built 1904–1905, has two tubes, each about 15 ft. diameter and 400 ft. long, with a surrounding shell of cast iron itself surrounded by concrete. The outside width of concrete is about 33 ft. Its top is 28 ft. below high water and about 3 ft. below the bed of the river. D. D. McBean, the sub-contractor, dredged a trench in the river to within 7 or 8 ft. of the required depth. He then enclosed a space of the width of the tunnel from shore to mid-stream with 12-in. sheet piling, which was evenly cut off some 2 ft. above the determined outside top of the tunnel. On top of this piling he sank and tightly fitted a flat temporary roof of timber 3 ft. thick in sections, and covered this with about 5 ft. of dredged mud. Water was expelled from this subaqueous chamber by compressed air, after which the remaining earth was easily taken out, and the iron and concrete tunnel walls were then built in the chamber. For the remaining part of the river the foregoing process was varied by cutting off the sheet piling at mid-height of the tunnel and making the upper half of the tunnel, which was built above and lowered in sections through the water, serve as the roof of the chamber in which the lower half of the tunnel was built.

The tunnels of the Métropolitain railway of Paris (F. Bienvenüe, engineer-in-chief) under the two arms of the Seine, between Place Chatelêt and Place Saint Michel, were made by means of compressed-air caissons sunk beneath the river bed, L. Chagnaud being the contractor. They were built of plates of sheet steel and masonry, with temporary steel diaphragms in the ends, filled with concrete, making a cross wall with a level top about even with the outside top of the tunnel and about 2 ft. below the bottom of the Seine. The caissons were sunk on the line of the tunnel so that adjacent ends (and the walls just described) were nearly 5 ft. apart with—at that stage—a core of earth between them. Side walls joining the end walls and thus enclosing the earth core on four sides (fig. 4) were next made by the aid of temporary small caissons sunk through about 26 ft. of earth under the river. The tops of the side walls were made even with the end walls. A steel rectangular coffer-dam (figs. 5 and 6) was sunk to rest with rubber or clay joint on these surrounding walls. The coffer-dam had shafts reaching above the surface of the water, so that the earth core was easily taken out (after removing the water) in free air. The adjacent chambers under the caissons were then connected together. Three caissons, of a total length of 396 ft., were used under the larger arm, and two, of an aggregate length of 132 ft., under the smaller arm of the Seine. The cost of the tunnel was 7000 francs per lineal metre.


Concrete Walls on Top of Caisson Ends
Caisson No. 1.
Caisson No. 2.
Lateral Walls set with Temporary Caisson

(From *Engineering News*, New York.)

FIG. 4.—Perspective showing manner of enclosing space between tunnel caissons for the Métropolitain under the Seine at Paris.

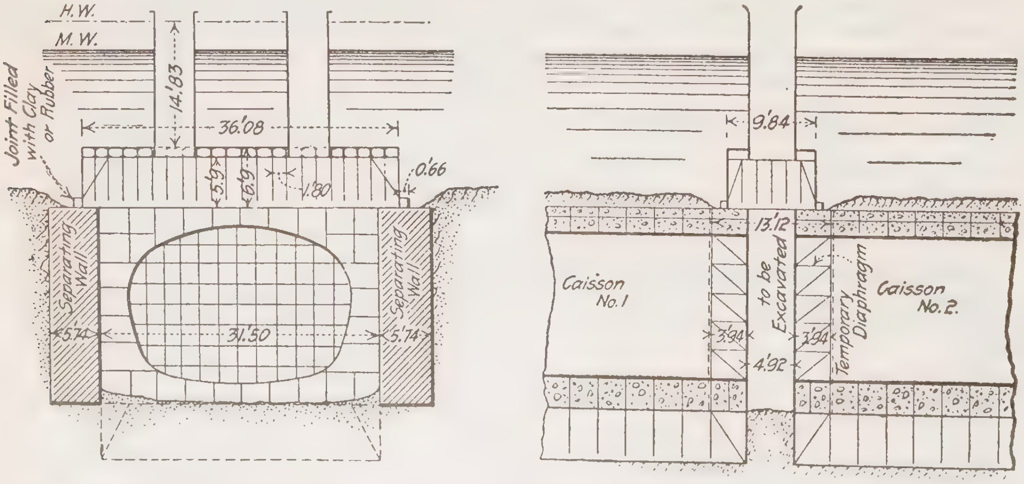
Mountain Tunnels for Railways.

Tunnel.	Location.	Length. (miles)	Internal Width and Height.	Material penetrated.	Average progress per day = 24 hrs. (lin. yds.).	Approximate cost per lin. yd.
						£
Mont Cenis (1 tunnel) .	Modane, France and Bardonecchia, Italy.	7·98	26 ft. 3 in. × 24 ft. 7 in. (horseshoe).	Granitic	2·57	226
St Gotthard (1 tunnel)	Göschenen and Airolo in Switzerland.	9·3	26 ft. 3 in. × 24 ft. 7 in. (horseshoe).	Granitic	6·01	143
Arlberg (1 tunnel) . .	Innsbruck and Bludenz in Tirol.	6·36	25 ft. 3 in. wide	—	9·07	108
Simplon (2 tunnels) .	Brigue, Switzerland and Iselle, Italy.	12·3	16 ft. 5 in. × 19 ft. 6 in. each (min.).	Gneiss, mica schist, limestone and disintegrated mica schist rock.	11·63	148

William Sooy Smith published in Chicago, in 1877, a description of a scheme for building a tunnel under the Detroit river by sinking caissons end to end, each caisson to be secured to the adjoining one by tongued and grooved guides, and a nearly water-tight connexion between the two to be made by means of an annular inflated hose.

Tunnelling through Mountains.—Where a great thickness of rock overlies a tunnel through a mountain, it may be necessary to do the work wholly from the two ends without intermediate shafts. The problem largely resolves itself into devising the most expeditious way of excavating and removing the rock. Experience has led to great advances in speed and economy, as may be seen from examples in the above table.

In 1857 the first blast was fired in connexion with the Mont Cenis works; in 1861 machine drilling was introduced; and in 1871 the tunnel was opened for traffic. With the exception of about 300 yds. the tunnel is lined throughout with brick or stone. During the first four years of hand labour the average progress was not more than 9 in. per day on each side of the Alps; but with compressed air rock-drills the rate towards the end was five times greater.



(From *Engineering News*, New York.)

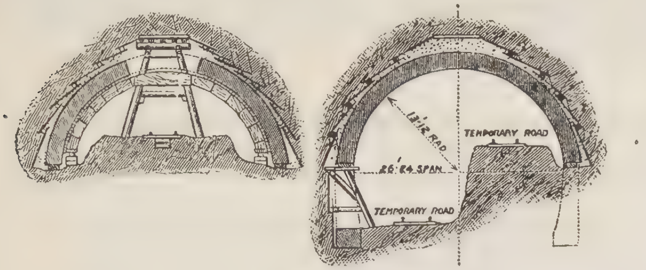
FIG. 5.—Transverse Section.

FIG. 6.—Longitudinal Section.

Coffer-dam superimposed over joints between caissons in tunnels for the Métropolitain under the Seine at Paris.

In 1872 the St Gotthard tunnel was begun, and in 1881 the first locomotive ran through it. Mechanical drills were used from the beginning. Tunnelling was carried on by driving in advance a top heading about 8 ft. square, then enlarging this sideways, and finally sinking the excavation to invert level (see figs. 7 and 8). Air for working the rock-drills was compressed to seven atmospheres by turbines of about 2000 horse-power.

The driving of the Arlberg tunnel was begun in 1880 and the work was completed in little more than three years. The main heading was driven along the bottom of the tunnel and shafts were opened up 25 to 70 yds. apart, from which smaller headings were driven right and left. The tunnel was enlarged to its full section at different points simultaneously in lengths of 8 yds., the excavation of each occupying about twenty days, and the masonry fourteen days. Ferroux percussion air-drills and Brandt rotary hydraulic drills were used, the performance of the latter being especially satisfactory. After each blast a fine spray of water was injected, which assisted the ventilation materially. In the St Gotthard tunnel the discharge of the air-drills was relied on for ventilation. In the Arlberg tunnel over 8000 cub. ft. of air per minute were thrown in by ventilators. To keep pace with the miners, 900 tons of excavated material had to be removed, and 350 tons of masonry introduced, daily at each end of the tunnel, which necessitated the transit of 450 wagons. The cost per lineal yard varied according to the thickness of masonry lining and the distance from the mouth of the tunnel. For the first thousand yards from the entrance the prices per lineal yard were £11 8s. for the lower heading; £7 12s. for the upper one; £30 10s. for the unlined tunnel; £45 for the tunnel with a thin lining of masonry; and £124 5s. with a lining 3 ft. thick at the arch, 4 ft. at the sides, and 2 ft. 8 in. at the invert.



FIGS. 7 and 8.—Method of excavation in St Gotthard Tunnel.

The Simplon tunnel was begun in 1898 and completed in 1905. It is over 30 % longer than the St Gotthard, and the greatest depth below the surface is 7005 ft. A novel method was introduced in the shape of two parallel bores (56 ft. apart, connected at intervals of 660 ft. by oblique galleries), which greatly facilitated ventilation, and resulted in increased economy and rapidity of construction, while ensuring the health of the men. One of these galleries was made large enough for a single-track railroad, and the second is to be enlarged and similarly used. The death-rate in the Simplon tunnel was decreased as compared with the St Gotthard from 800 in eight years to 60 in seven years. Had one wide tunnel been made instead of two narrow ones, it would have been difficult to maintain its integrity; even with the narrow cross-section employed the floor was forced up at points in the solid rock from the great weight above, and had to be secured by building heavy inverts of masonry. Temperatures were reduced to 89° F. by spraying devices, although the rock temperatures ranged from 129° to 130° F. At one point 4374 yds. from the portal of Iselle the "Great Spring" of cold water was struck; it yielded 10,564 gallons per minute at 600 ℔ pressure per sq. in., and reduced the temperature to 55·4° F., the lowest point recorded. A spring of hot water was met on the Italian side which discharged into the tunnel 1600 gallons per minute with a temperature of 113° F. The maximum flow of cold water was 17,081 gallons per minute, and of hot water 4330 gallons per minute. These springs often necessitated a temporary abandonment of the work. Water power from the Rhone at the Swiss and from the Diveria at the Italian end provided the power for operating all plant during the construction of most of the work. Among the able engineers connected with this work must be mentioned Alfred Brandt, a man of remarkable energy and ability, whose drills were used with much success. He died early in the work, of injuries received from falling rock.

A group of tunnels—the Tauern, Bärengraben, Wocheiner and Bosrück—was undertaken by the Austrian government in connexion with new Alpine railroads to increase the commercial territory tributary to the seaport of Trieste, which at one time was greater than Hamburg. The principal tunnel of this group is under the main body of the Tauern mountain. The bottom drifts met on the 21st of July 1907. The difficulties resulted mostly from mountain débris and springs. There are four minor tunnels between Schwarzach, St Veit, and the north portal of the Tauern, and nineteen between the south portal and the south slope at Möllbrücken.

The electric railway from the Eiger glacier to near the summit of the Jungfrau includes a tunnel 1½ m. long, 3·6 metres wide and 3·8 metres high, with a midway station, from which a large part of northern Switzerland can be seen. From the Jungfrau terminus, at an elevation of 13,428 ft., the summit, 242 ft. higher, will be reached by an elevator.

The Hoosac tunnel was the first prominent tunnel in America. It was begun in 1855 and finished in 1876, after many interruptions. It was memorable for the original use in America of air-drills and nitroglycerin. The Pennsylvania railroad tunnels crossing New York City under 32nd and 33rd Streets are of unusual size. Owing to the close proximity of large buildings and other structures special methods were adopted for mining the rock to lessen the vibrations by explosions. At 33rd Street and 4th Avenue the tunnels pass directly under two of the Rapid Transit system, above which there is another belonging to the Metropolitan Traction Company, so that there are three tunnels at different levels under the street.

Among other rock tunnels may be mentioned the Albula, through a granite ridge of the Rhaetian Alps, for a single-track narrow-gauge railroad, 3·6 m. long; tunnels on the Midland railway, near Totley in Derbyshire, over 3·5 m. long, largely in shale, and at Cowburn, over 2 m. long, in shale and harder rock, each 27 ft. wide and 20·5 ft. high inside; the Suram, on the Trans-Caucasus railway, for double track, 2·47 m. long, through soft rock; the tail-race tunnel for the Niagara Falls Water Power Company, 1·3 m. long, 19 ft. wide and 21 ft. high, through argillaceous shale and limestone, costing about $1,250,000; the Tequixquiac outlet to the drainage system for the city of Mexico, costing $6,760,000; the Cascade, Washington, part of the Great Northern railroad system, saving 9 m. in distance; and the Gunnison, irrigating 147,000 acres in Colorado.

Tunnelling in Towns.—Where tunnels have to be carried through soft soil in proximity to valuable buildings special precautions have to be taken to avoid settlement. A successful example of such work is the tunnel driven in 1886 for the Great Northern Railway Company under the Metropolitan Cattle

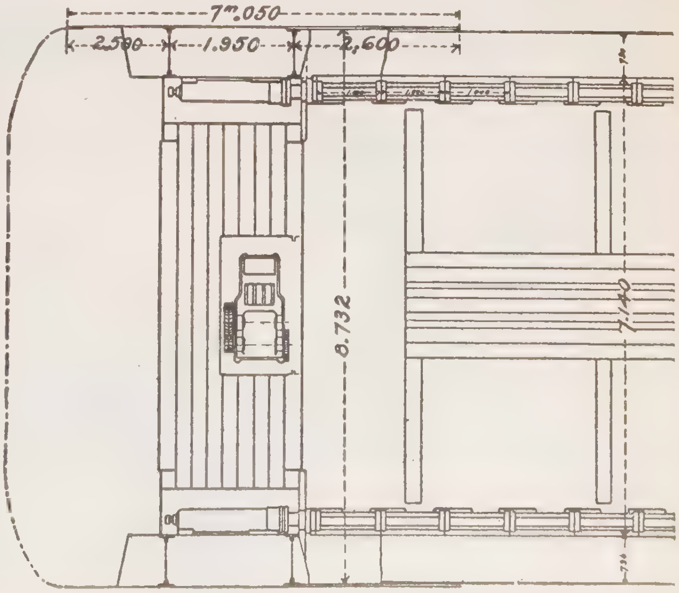


FIG. 9.—Paris Métropolitain Tunnel, longitudinal horizontal section.

Market, London. This was done by the crown-bar method, the bars being built in with solid brickwork. The subsidence in the ground was from 1 to about 3½ in. Several buildings were tunnelled under without any structural damage.

London has now some 90 m. of tunnels for railways, mostly operated by electric traction. Most of those which have been constructed since 1890 have been tunnelled by the use of cylindrical shields and walls of cast iron. Shields about 23 ft. in diameter were used in constructing the stations on the Central London railway, and one 32 ft. 4 in. in diameter and only 9 ft. 3 in. long was used for a short distance on the Clapham extension of the City and South London railway.

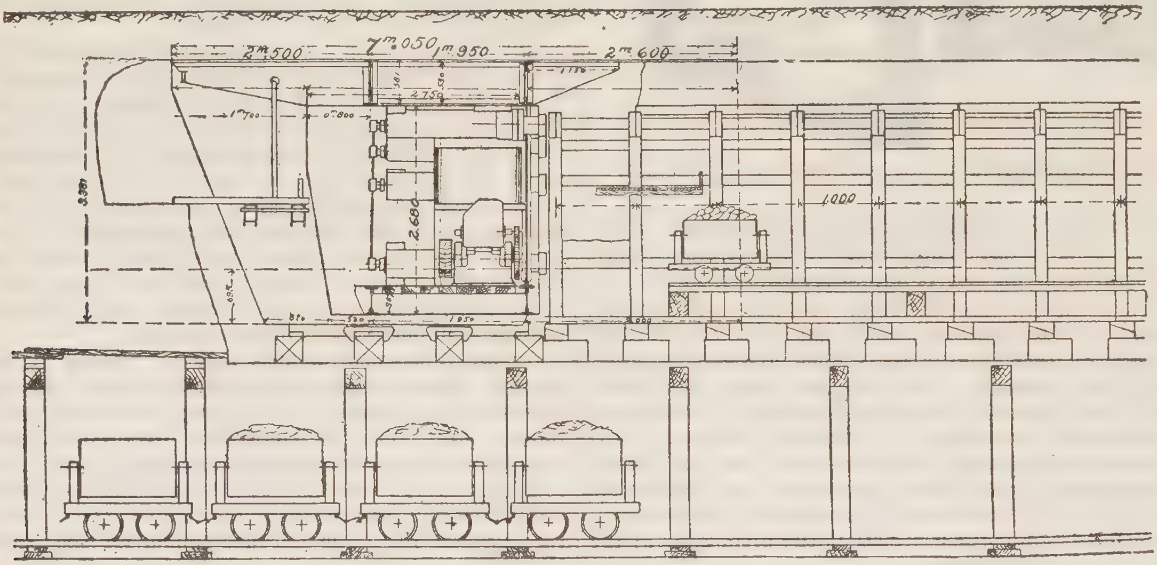


FIG. 10.—Paris Métropolitain Tunnel, longitudinal vertical section.

Paris has an elaborate plan for underground railways some 50 m. in length, a considerable number of which have been constructed since 1898 under the engineering direction of F. Bienvenüe. Instead of using completely cylindrical shields and cast-iron walls, as in London, roof-shields (*boucliers de voûte*) were employed for the construction of the upper half of the tunnel, and masonry walls were adopted throughout. In general, the upper half of the tunnel was executed first (figs. 9 and 10) and the lower part completed by underpinning.

Figs. 11, 12 and 13 illustrate a case of tunnelling near important buildings in Boston in 1896, with a roof-shield 29 ft. 4 in. in external diameter. The vertical sidewalls were first made in small drifts, the roof-shield running on top of these, and the core was taken out later and the invert or floor of the tunnel put in last. Each hydraulic press of the shield reacted against a small continuous cast-iron rod imbedded in the brick arch. In some large sewerage tunnels in Chicago the shields were pushed from a wall of oak planks, 8 in. thick, surrounding the brick walls of the sewer.

Ventilation of Tunnels.—The simplest method for ventilating a railway tunnel is to have numerous wide openings to daylight at frequent intervals. If these are the full width of the tunnel, at least 20 ft. in length, and not farther apart than 200 yds., it can be naturally ventilated. Such arrangements are, however, frequently impracticable, and then recourse must be had to mechanical means.

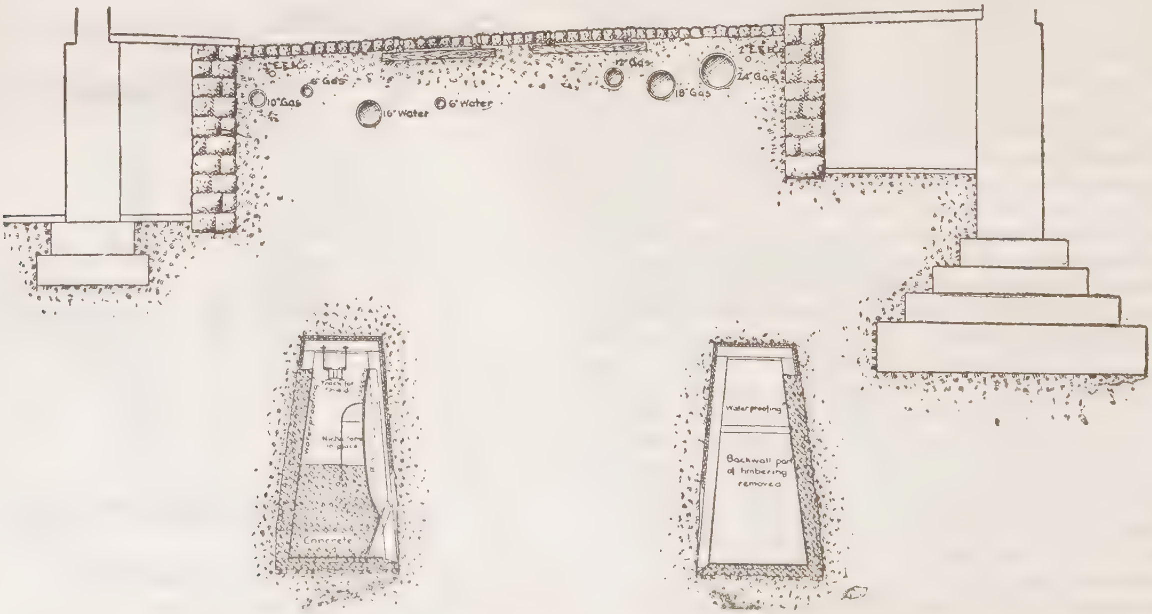


FIG. 11.—Boston Subway, first and second phases.

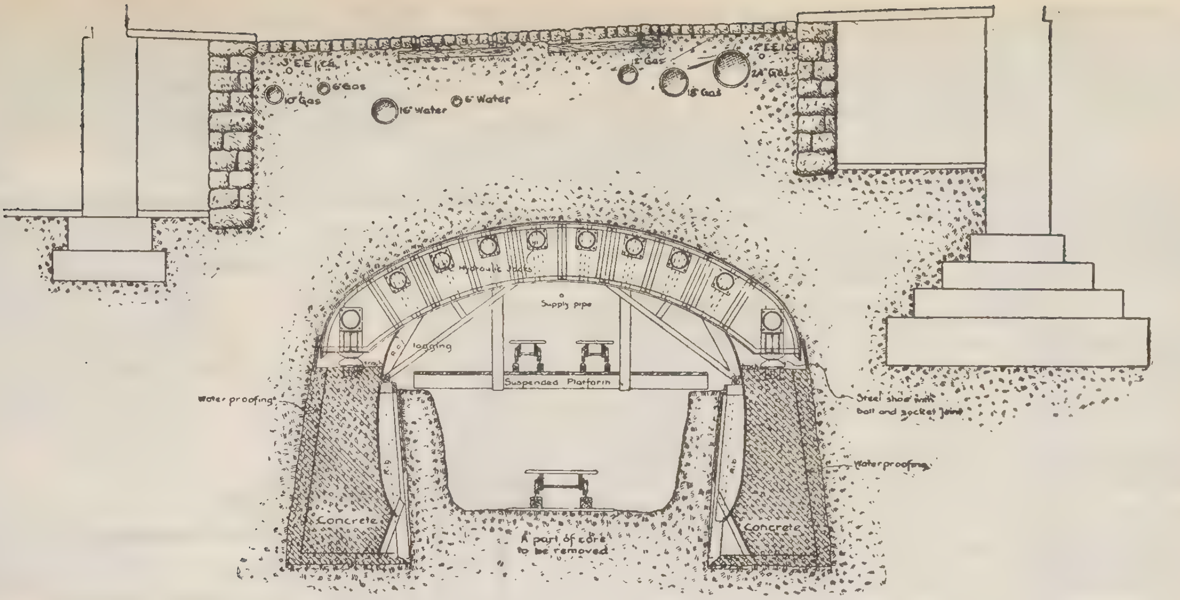

10" Gas
6" Gas
16" Water
6" Water
6" Gas
15" Gas
24" Gas
Hydraulic Jacks
Supply pipe
Jogging
Suspended Platform
Water proofing
Steel shoe with ball and socket joint
Water proofing
Concrete
Concrete
A part of core to be removed

FIG. 12.—Boston Subway, third phase.

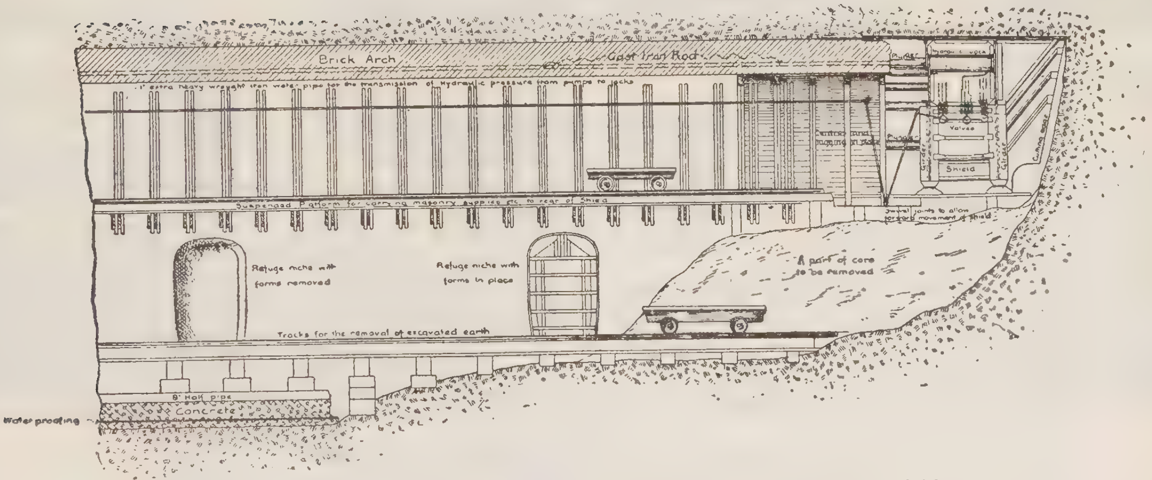
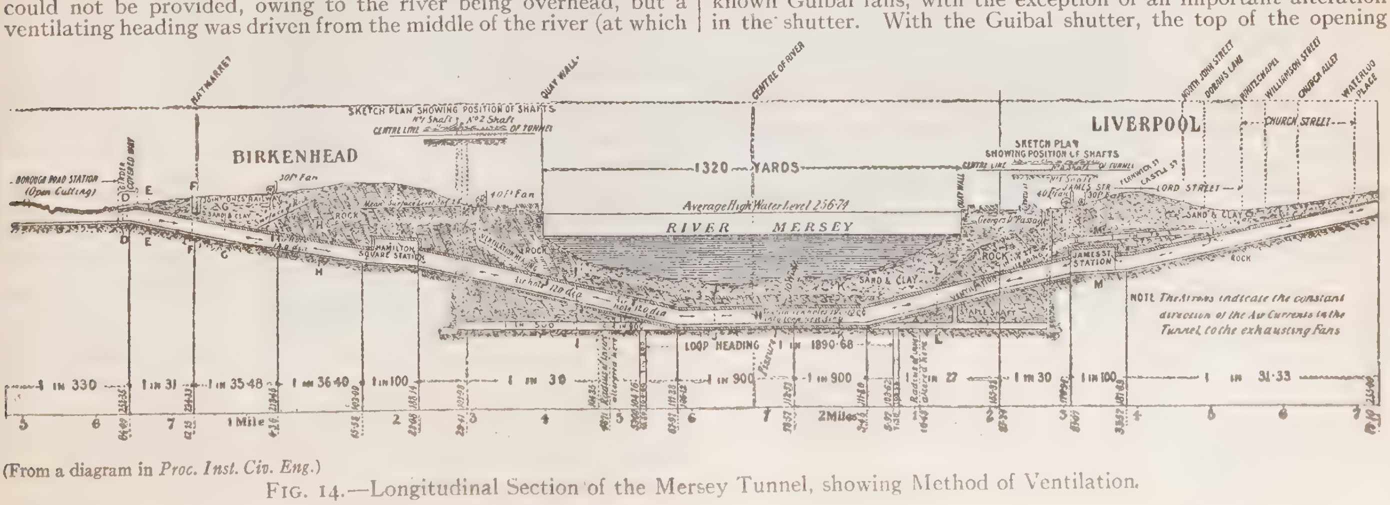

Brick Arch
Cast Iron Rod
1" extra heavy wrought iron water pipe for the transmission of hydraulic pressure from pumps to jacks
Valves
Shield
Suspended Platform for carrying masonry supplies etc. to rear of Shield
Swivel joints to allow for forward movement of shield
Refuge niche with forms removed
Refuge niche with forms in place
A part of core to be removed
Tracks for the removal of excavated earth
8" Holl pipe
Concrete
Water proofing

FIG. 13.—Boston Subway, longitudinal vertical section through shield.

The first application of mechanical or fan ventilation to railway tunnels was made in the Lime Street tunnel of the London and North-Western railway at Liverpool, which has since been replaced by an open cutting. At a later date fans were applied to the Severn and Mersey tunnels.

The principle ordinarily acted upon, where mechanical ventilation has been adopted, is to exhaust the vitiated air at a point midway between the portals of a tunnel, by means of a shaft with which is connected a ventilating fan of suitable power and dimensions. In the case of the tunnel under the river Mersey (fig. 14) such a shaft could not be provided, owing to the river being overhead, but a ventilating heading was driven from the middle of the river (at which point entry into the tunnel was effected) to each shore, where a fan 40 ft. in diameter was placed. In this way the vitiated air is drawn from the lowest point of the railway, while fresh air flows in at the stations on each side to replenish the partial vacuum, as indicated by arrows in the accompanying longitudinal section of the tunnel. The principle was that fresh air should enter at each station and "split" each way into the tunnel, and that thus the atmosphere on the station platforms should be maintained in a condition of purity.

The fans in the Mersey tunnel are somewhat similar to the well-known Guibal fans, with the exception of an important alteration in the shutter. With the Guibal shutter, the top of the opening


BIRKENHEAD
LIVERPOOL
BOROUGH ROAD STATION (Open Cutting)
HAY MARKET
QUAY WALL
CENTRE OF RIVER
SKETCH PLAN SHOWING POSITION OF SHAFTS
SKETCH PLAN SHOWING POSITION OF SHAFTS
1320 YARDS
Average High Water Level 256.74
RIVER MERSEY
30 ft Fan
40 ft Fan
40 ft Fan
30 ft Fan
HAMILTON SQUARE STATION
JAMES ST. STATION
ROCK
SAND & CLAY
LOOP HEADING 1 in 1890·68
NORTH JOHN STREET
DORANS LANE
WHITECHAPEL
WILLIAMSON STREET
CHURCH ALLEY
WATERLOO PLACE
CHURCH STREET
LORD STREET
NOTE The Arrows indicate the constant direction of the Air Currents in the Tunnel to the exhausting Fans
1 in 330
1 in 31
1 in 35·48
1 in 36·40
1 in 100
1 in 30
1 in 900
1 in 900
1 in 27
1 in 30
1 in 100
1 in 31·33
1 Mile
2 Miles
A B C D E F G H I J K L M

(From a diagram in *Proc. Inst. Civ. Eng.*)

FIG. 14.—Longitudinal Section of the Mersey Tunnel, showing Method of Ventilation.

into the chimney from the fan has a line parallel to that of the fan-shaft and of the fan-blades, and, as a consequence, as each blade passes this shutter, the stoppage of the discharge of the air is instantaneous, and the sudden change of the pressure of the air on the face of the blade whilst discharging and the reversal of the pressure, due to the vacuum inside the fan-casing, cause the vibration hitherto inseparable from this type of ventilator. As an illustration of the effect of the pulsatory action of the Guibal shutters the following figures may be given: a fan having ten arms and running, say, sixty revolutions per minute, and working twenty-four hours per day, gives (10 × 60 × 60 × 24 =) 864,000 blows per day transmitted from the tip of the fan-vanes to the fan-shaft; the shaft is thus in a constant state of tremor, and sooner or later reaches its elastic limit, and the consequent injury to the general structure of the fan is obvious. This difficulty is avoided by cutting a Λ-shaped opening in the shutter, thus gradually decreasing the aperture and allowing the air to pass into the chimney in a continuous stream instead of intermittently. The action of this regulating shutter increases the durability and efficiency of the fans in an important degree. In towns like Liverpool and Birkenhead any pulsatory action would be readily felt by the inhabitants, but with the above arrangement it is difficult to detect any sound whatever, even when standing close to the buildings containing the fans. The admission of the air on both sides is found in practice to conduce to smooth running and to the reduction of the side-thrust which occurs when the air is admitted on one side only. The fans are five in number: two are 40 ft. in diameter by 12 ft. wide, and two 30 ft. in diameter by 10 ft. wide, one of each size being erected at Liverpool and at Birkenhead respectively. In addition, there is a high-speed fan 16 ft. in diameter in Liverpool which throws 300,000 cub. ft.

The following table gives the result of experiments made with the ventilating fans of the Mersey railway:—

Fan at	Diameter of Fan in feet.	Width of Blade in feet.	Number of Revolutions per minute.	Area of Drift-way in square feet.	Water-gauge in inches.	Velocity of Air in feet per minute.	Volume of Air in cubic feet per minute.
Hamilton Street, Birkenhead .	30	10	47	113	1·30	1895	214,135
Shore Road, Birkenhead .	40	12	45	41	2·50	3288[1]	134,685
James Street, Liverpool . .	40	12	45	72	2·45	2465	178,880
James Street, Liverpool . .	30	10	60	60	2·30	2062	123,720
Bold Street, Liverpool . .	16[2]	—	—	—	—	—	300,000
						Total	951,420

The central point of the Severn tunnel (fig. 15) lies toward the Monmouthshire bank of the river, and ventilation is effected from that point by means of one fan placed on the surface at Sudbrooke, Monmouth, at the top of a shaft which is connected with a horizontal heading leading to the centre. This fan, which is 40 ft. in diameter by 12 ft. in width, removes from the tunnel some 400,000 cub. ft. per minute, and draws in an equivalent volume of fresh air from the two ends.

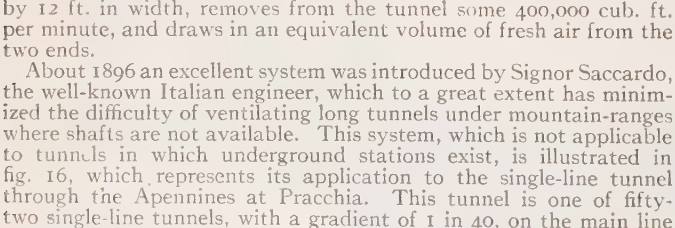
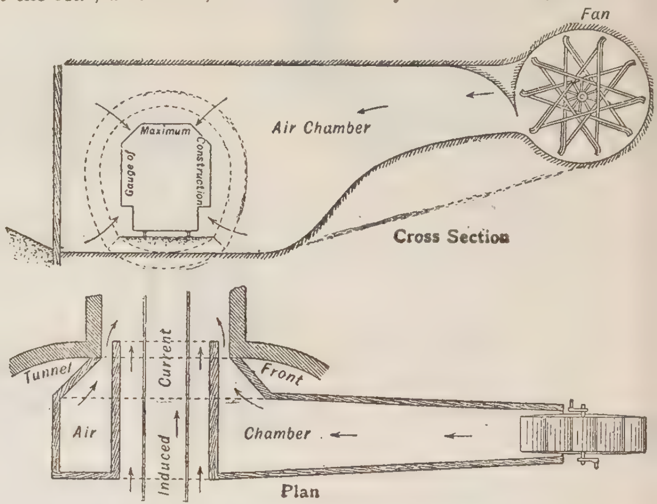


FIG. 15.—Section of Severn Tunnel (Fox).

About 1896 an excellent system was introduced by Signor Saccardo, the well-known Italian engineer, which to a great extent has minimized the difficulty of ventilating long tunnels under mountain-ranges where shafts are not available. This system, which is not applicable to tunnels in which underground stations exist, is illustrated in fig. 16, which represents its application to the single-line tunnel through the Apennines at Pracchia. This tunnel is one of fifty-two single-line tunnels, with a gradient of 1 in 40, on the main line between Florence and Bologna, built by Thomas Brassey. There is a great deal of traffic which has to be worked by heavy locomotives. Before the installation of a ventilating system under any condition of wind the state of this tunnel, about 3000 yds. in length, was bad; but when the wind was blowing in at the lower end at the same tim that a heavy goods or passenger train was ascending the gradien the condition of affairs became almost insupportable. The engines working with the regulators full open, often emitted large quantitie of both smoke and steam, which travelled concurrently with th train. The goods trains had two engines, one in front and anothe at the rear, and when, from the humidity in the tunnel, due to th steam, the wheels slipped and possibly the train stopped, the state of the air was indescribable. A heavy train with two engines conveying a royal party and their suite, arrived on one occasion at the upper exit of the tunnel with both enginemen and both firemen insensible; and on another occasion, when a heavy passenge train came to a stop in the tunnel, all the occupants were seriously affected.



(From the *Proc. Inst. Civ. Eng.*)

FIG. 16.—Diagram illustrating the Saccardo System for Ventilating Tunnels.

In applying the Saccardo system, the tunnel was extended fo 15 or 20 ft. by a structure either of timber or brickwork, the inside line of which represented the line of maximum construction, and thi was allowed to project for about 3 ft. into the tunnel. The space between this line and the exterior constituted the chamber into which air was blown by means of a fan. Considering the length of tunnel it might at first be thought there would be some tendency for the air to return through the open mouth, but nothing of the kind happened. The whole of the air blown by the fan, 164,000 cub. ft. per minute, was augmented by the induced current yielding 46,000 cub. ft. per minute, making a total of 210,000 cub. ft.; and this volume was blown down the gradient against the ascending train, so as to free the driver and men in charge of the train from the products of combustion at the earliest possible moment. Prio to the installation of this system the drivers and firemen had to b clothed in thick woollen garments, pulled on over their ordinary clothes, and wrapped round and round the neck and over the head but in spite of all these precautions they sometimes arrived at th upper end of the tunnel in a state of insensibility. The fan, however immensely improved the condition of the air, which is now pur and fresh.

In the case of the St Gotthard tunnel, which is $9\frac{1}{3}$ m. in lengt and 26 ft. wide with a sectional area of 603 sq. ft., the Saccard system was installed in 1899 with most beneficial results. Th railway is double-tracked and worked by steam locomotives, th cars being lighted by gas. The ventilating plant is situated a Göschenen at the north end of the tunnel and consists of two larg fans operated by water power. The quantity of air passed int the narrow mouth of the tunnel is 413,000 cub. ft. per minute a a velocity of 686 ft., this velocity being much reduced as the fu section of the tunnel is reached. A sample of the air taken fror a carriage contained 10·19 parts of carbonic acid gas per 10,00 volumes.

In the Simplon tunnel, where electricity is the motive powe mechanical ventilation is installed. A steel sliding door is arrange at each entrance to be raised and lowered by electric power. Afte the entrance of a train the door is lowered and fresh air forced int the tunnel at considerable pressure from the same end by fans.

The introduction of electric traction has simplified the probler of ventilating intra-urban railways laid in tunnels at a greater c less distance below the surface, since the absence of smoke an products of combustion from coal and coke renders necessary onl such a quantity of air as is required by the passengers and staf For supplying air to the shallow tunnels which form the under ground portions of the Metropolitan and District railways in London open staircases, blow-holes and sections of uncovered track ar relied on. When the lines were worked by steam locomotives the afforded notorious examples of bad ventilation, the proportion

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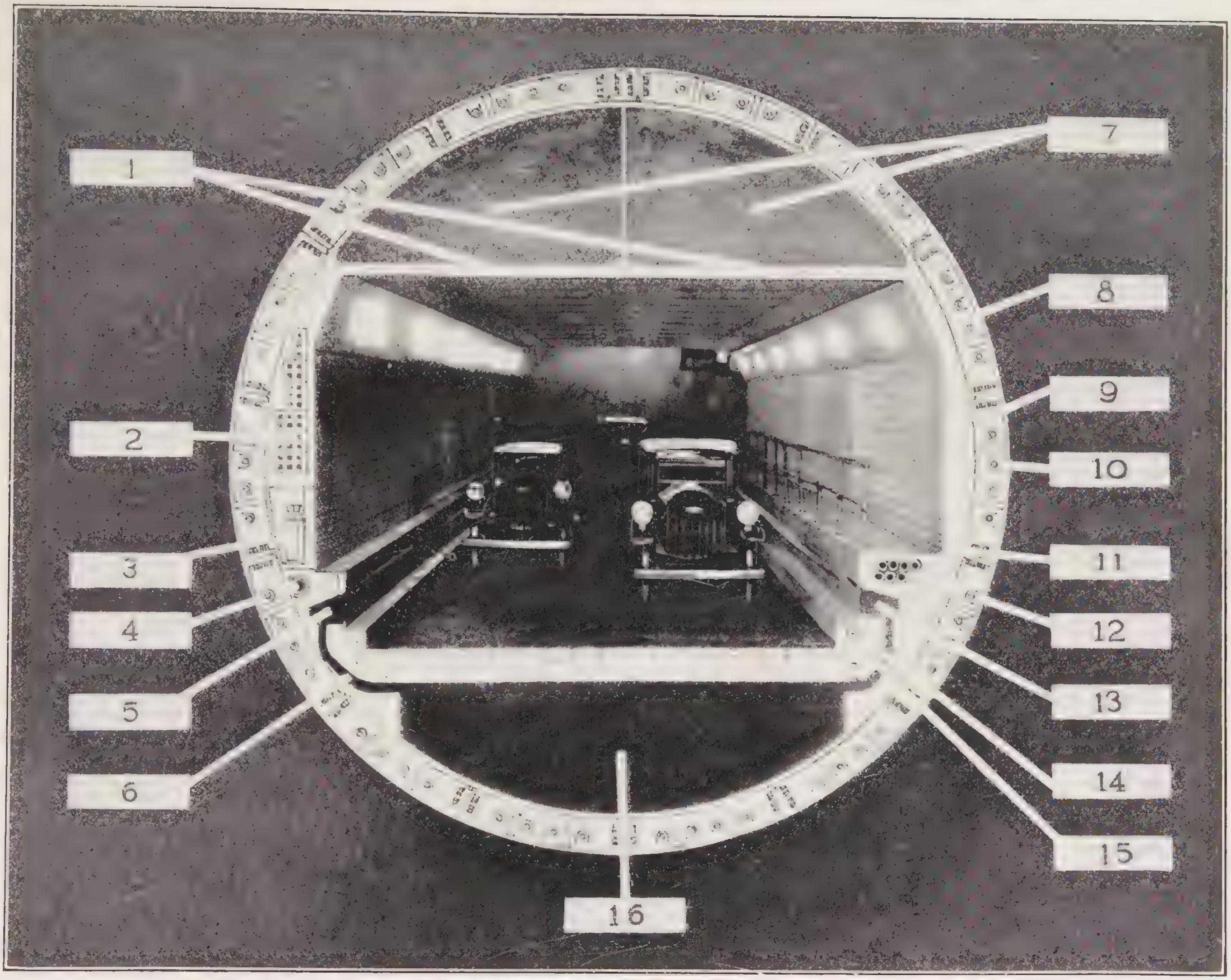
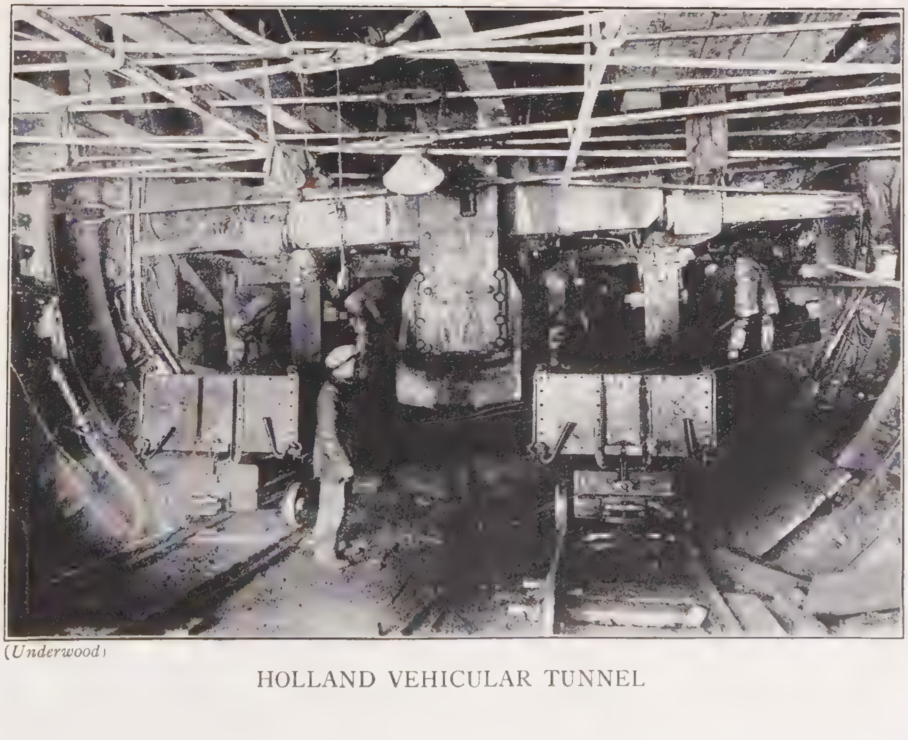
[1] In the case of this circular drift-way a velocity of 4000 ft. per minute was subsequently attained.

[2] Quick-running fan.



ABOVE. Diagram of cross section.

1. Exhaust air ports every 15 feet
2. Telephone and telegraph cables
3. Fire extinguisher
4. Water supply pipe
5. Continuous duct for fresh air supply to roadway
6. Fresh air flues every 15 feet
7. Exhaust air duct running full length of tunnel
8. Tunnel segment, weight 3,000 pounds.
9. Weight of complete ring, 21·6 tons
10. Concrete
11. Sidewalk
12. Power cables for operation of tunnel
13. Fresh air expansion chamber
14. Fresh air flues every 15 feet
15. Drainage pipe
16. Fresh air duct running entire length of tunnel



(*Underwood*)

BELOW. Interior view of tunnel during construction. The Vehicular Tunnel (for automobiles) under the Hudson River, connecting New York City with Jersey City. There are twin tubes, each one and three-quarter miles long.

Ventilating fans are run by approximately 84 electric motors, having a total of about 6,260 horse-power.

Because the gases in such a tunnel will be heated, they will tend to rise, and after prolonged experimentation, it was decided to draw the foul gases off from the top, supplying fresh air from the bottom.

HOLLAND VEHICULAR TUNNEL

carbonic acid amounting to from 15 or 20 to 60, 70 and even 89 parts in 10,000. But since the adoption of electricity as the motive power the atmosphere of the tunnels has much improved, and two samples taken from the cars in 1905 gave 11·27 and 14·07 parts of carbonic acid in 10,000.

When deep level "tube" railways were first constructed in London, it was supposed that adequate ventilation would be obtained through the lift-shafts and staircases at the stations, with the aid of the scouring action of the trains which, being of nearly the same cross-section as the tunnel, would, it was supposed, drive the air in front of them out by the openings at the stations they were approaching, while drawing fresh air in behind them at the stations they had left. This expectation, however, was disappointed, and it was found necessary to employ mechanical means. On the Central London railway, which runs from the Bank of England to Shepherd's Bush, a distance of 6 m., the ventilating plant installed in 1902 consists of a 300 h.p. electrically driven fan, which is placed at Shepherd's Bush and draws in fresh air from the Bank end of the line and at other intermediate points. The fan is 5 ft. wide and 20 ft. in diameter, and makes 145 revolutions a minute, its capacity being 100,000 cub. ft. a minute. It is operated from 1 to 4 a.m., and the openings at all the intermediate stations being closed it draws fresh air in at the Bank station. The tunnel is thus cleared out about 2¾ times each night and the air is left in the same condition as it is outside. The fan is also worked during the day from 11 a.m. to 5 p.m., the intermediate doors being open; in this way the atmosphere is improved for about half the length of the line and the cars are cleared out as they arrive at Shepherd's Bush. Samples of the air in the tunnel taken when the fan was not running contained 7·07 parts of carbonic acid in 10,000, while the air of a full car contained 10·7 parts. The outside air at the same time contained 4·4 parts. A series of tests made for the London County Council in 1902 showed that the air of the cars contained a minimum of 9·60 parts and a maximum of 14·7 parts. In some of the later tube railways in London—such as the Baker Street and Waterloo, and the Charing Cross and Hampstead lines—electrically driven exhaust fans are provided at about half-mile intervals; these each extract 18,500 cub. ft. of air per minute from the tunnels, and discharge it from the tops of the station roofs, fresh air being conveyed to the points of suction in the tunnels.

The Boston system of electrically operated subways and tunnels is ventilated by electric fans capable of completely changing the air in each section about every fifteen minutes. Air admitted at portals and stations is withdrawn midway between stations. In the case of the East Boston tunnel, the air leaving the tunnel under the middle of the harbour is carried to the shore through longitudinal ducts (fig. 3) and is there expelled through fan-chambers.

In the southerly 5 m. of the New York Rapid Transit railway, which runs in a four-track tunnel of rectangular section, having an area of 650 sq. ft., and built as close as possible to the surface of the streets, ventilation by natural means through the open staircases at the stations is mainly relied upon, with satisfactory results as regards the proportions of carbonic acid found in the air. But when intensely hot weather prevails in New York the tunnel air is sometimes 5° hotter still, due to the conversion of electrical energy into heat. This condition is aggravated by the fine diffusion through the air of oil from the motors, dust from the ballast and particles of metal ground off by the brake shoes, &c.

Volume of Air Required for Ventilation.—The consumption of coal by a locomotive during the passage through a tunnel having been ascertained, and 29 cub. ft. of poisonous gas being allowed for each pound of coal consumed, the volume of fresh air required to maintain the atmosphere of the tunnel at a standard of purity of 20 parts of carbon dioxide in 10,000 parts of air is ascertained as follows: The number of pounds of fuel consumed per mile, multiplied by 29, multiplied by 500, and divided by the interval in minutes between the trains, will give the volume of air in cubic feet which must be introduced into the tunnel per minute. As an illustration, assume that the tunnel is a mile in length, that the consumption of fuel is 32 lb per mile, and that one train passes through the tunnel every five minutes in each direction; then the volume of air required per minute will be

$$\frac{32 \text{ lb} \times 29 \text{ cub. ft.} \times 500}{2\frac{1}{2} \text{ minutes.}} = 185{,}600 \text{ cub. ft.}$$

Corrosion of Rails in Tunnels.—Careful tests made in the Box and Severn tunnels of the Great Western railway, to ascertain if possible the loss that takes place in the weight of rails owing to the presence of corrosive gases, gave the following results:—

Box Tunnel (1 m. 66 chains in length).

Percentage of Wear per annum.

	% lb per yard per annum.
Down line, gradient falling 1 in 100—	
At east mouth	0·439 = 0·377
28 chains from east mouth	1·800 = 1·540
48 chains from east mouth	2·110 = 1·810
1 m. 8 chains from east mouth	2·880 = 2.480
At west mouth	0·640 = 0·553
Up line, gradient rising 1 in 100—	
At east mouth	0·620 = 0·575
1 m. 8 chains from east mouth	1·500 = 1·380
1 m. 28 chains from east mouth	1 520 = 1·310
At west mouth	0·680 = 0·587

Severn Tunnel (4 m. 28½ chains in length).

Percentage of Wear per annum.

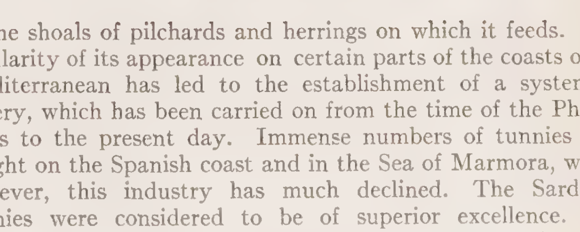
	% lb per yard per annum.
Down line, outside and quite clear of tunnel, Bristol end, gradient falling 1 in 100	0·280 = 0·240
Up line, outside and quite clear of tunnel, Newport end, gradient falling 1 in 90	0·440 = 0·390
At Bristol mouth, gradient falling 1 in 100	1·200 = 1·020
33 chains from Bristol mouth, gradient falling 1 in 100	2·160 = 1·860
3 m. 75½ chains from Bristol mouth, gradient rising 1 in 90	1·900 = 1·630
At Newport mouth	0·310 = 0·270
Down and up line under main-shaft level	3·200 = 2·750

It will be seen that the maximum wear and corrosion together reached the extraordinary weight of 2½ lb per yard of rail per year—a very serious amount that involved great expenditure The wear occurred over the whole of the rail, but the top, over which the engine and train passed, wore at a greater rate, presumably on account of the surface being kept bright and the gases being able to act on it. The Great Western Company tried the experiment in the Severn tunnel of boxing up the rails, so that the ballast approached their surface within 1 in. or 1½ in. It was found, however, that—in the case, at any rate, of the limestone ballast—the cure was almost worse than the disease, the result being a maximum wear of 2½ lb and an average wear of just under 2 lb per yard of rail per year. The average on the open line would be about 0·25 lb in the same time.

See *Proc. Inst. Civ. Eng.*; also works on tunnelling by Drinker, Simms, Stauffer and Prelini, and on tunnel shields, &c., by Copperthwaite. (H. A. C.)

TUNNEL VAULT, the term in architecture given to the semicircular or elliptical vault over underground passages, in contradistinction to the wagon or barrel vault of edifices above ground.

TUNNY (*Thunnus thynnus*), one of the largest fishes of the family of mackerels, belongs to the genus of which the bonito (*Th. pelamys*) and the albacores (*Th. albacora, Th. alalonga,* &c.) are equally well-known members. From the latter the tunny is distinguished by its much shorter pectoral fins, which reach backwards only to, or nearly to, the end of the first dorsal fin. It possesses nine short finlets behind the dorsal, and eight behind the anal fin. Its colour is dark bluish above, and greyish, tinged and spotted with silvery, below. The tunny is a pelagic fish, but periodically approaches the shore, wandering in large shoals, within well-ascertained areas along the coast. It not infrequently appears in small companies or singly in the English Channel and in the German Ocean, probably in pursuit of the shoals of pilchards and herrings on which it feeds. The regularity of its appearance on certain parts of the coasts of the Mediterranean has led to the establishment of a systematic fishery, which has been carried on from the time of the Phoenicians to the present day. Immense numbers of tunnies were caught on the Spanish coast and in the Sea of Marmora, where, however, this industry has much declined. The Sardinian tunnies were considered to be of superior excellence. The greatest number is now caught on the north coast of Sicily, the fisheries of this island supplying most of the preserved tunny which is exported to other parts of the world. In ancient times the fish were preserved in salt, and that coming from Sardinia, which was specially esteemed by the Romans, was known as



Tunny.

Salsamentum sardicum. At present preference is given to tunny preserved in oil. Many of the fishes, especially the smaller ones, are consumed fresh. The tunny occurs also in the Pacific and is much sought for by anglers on the coast of southern California, where tuna-fishing has become a fashionable sport; but several other species seem to take its place in the Indo-Pacific ocean. It is one of the largest fishes, attaining to a length of ten ft. and to a weight of more than a thousand pounds.

In connexion with the extremely active life of these fishes allusion should be made to the fact, first ascertained in 1839 by John (brother of Sir Humphry) Davy, that the temperature of the blood of a tunny may be considerably higher than that of the surrounding water, a discovery which disposed of the time-honoured division of vertebrate animals into warm-blooded and cold-blooded.

The variations and movements of the tunny and albacores were studied with special care by King Carlos of Portugal, who published in 1899 a large illustrated memoir entitled *A Pesca do atum no Algarve in 1898* (Lisbon). This memoir is accompanied by excellent figures of the different species of *Thunnus* and charts of their distribution in the Atlantic.

TUNSTALL (or Tonstall), **CUTHBERT** (1474–1559), English prelate, was an illegitimate son of Thomas Tunstall of Thurland Castle, Lancashire, his legitimate half-brother, Brian Tunstall, being killed at Flodden in 1513. Cuthbert seems to have studied at Oxford, at Cambridge and at Padua, and he became a distinguished scholar, winning favourable comment from Erasmus. Having held several livings in quick succession, he became chancellor to William Warham, archbishop of Canterbury, in 1511, and he was soon employed on diplomatic business by Henry VIII. and Wolsey, being sent to Brussels in 1515 and to Cologne in 1519, while he was at Worms during the famous Diet of 1521. In 1516 he had been made master of the rolls; in 1521 he became dean of Salisbury, in 1522 bishop of London, and in 1523 keeper of the privy seal. For Henry VIII. he negotiated with Charles V. after his victory at Pavia in 1525 and he helped to arrange the Peace of Cambrai in 1529. In 1530 he succeeded Wolsey as bishop of Durham. Tunstall's religious views now gave some anxiety. He adhered firmly to the traditional teaching of the Church, but after some slight hesitation he accepted Henry as its head and publicly defended this position. In 1537 the bishop was appointed president of the new council of the north, but although he was often engaged in treating with the Scots he found time to take part in other public business and to attend parliament, where in 1539 he participated in the discussion on the bill of six articles. Although he disliked the religious policy pursued by the advisers of Edward VI. and voted against the first act of uniformity in 1549, he continued to discharge his public duties without molestation until after the fall of the protector Somerset; then in May 1551, he was placed in custody. A bill charging him with treason was introduced, but the House of Commons refused to pass it; he was, however, deprived of his bishopric in October 1552. On the accession of Mary in 1553 he was released and was again bishop of Durham, but during this reign he showed no animus against the Protestants. When Elizabeth came to the throne he refused to take the oath of supremacy, and he would not help to consecrate Matthew Parker as archbishop of Canterbury. He was arrested, and was still a prisoner at Lambeth when he died on the 18th of November 1559.

Among Tunstall's writings are *De veritate corporis et sanguinis domini nostri Jesu Christi in eucharistia* (1554); and *De arte supputandi libri quattuor* (1522). The bishop's correspondence as president of the council of the north is in the British Museum.

TUNSTALL, a market town of Staffordshire, England, on the northern outskirts of the Potteries district, included in the parliamentary borough of Newcastle-under-Lyme, 4 m. N.W. from Stoke-upon-Trent by the North Staffordshire railway. Pop. of urban district (1901), 19,492. The town is of modern growth. The Victoria Institute (1889) includes a library and schools of art and science. The neighbourhood is full of collieries, ironworks and potteries. Kidsgrove, Chatterley and Talk-o'-th'-hill are large neighbouring villages; the mines at the last-named were the scene of a terrible explosion in 1866, by which nearly a hundred lives were lost. There are brick and tile works in Tunstall. The town is included in the large parish of Wolstanton, and in the borough of Stoke-on-Trent (*q.v.*) under the "Potteries Federation" scheme (1908).

TUPIS (Comrades), a tribe and stock of South American Indians of Brazil. They call all other peoples *Tapuyas* (foreigners). Their original home is believed to have been on the Amazon, and from its mouth they spread far southwards along the Brazilian coast. When hard pressed by the Portuguese they retreated to the Andes. Martius gives the Tupi nation a wide range, from the Atlantic to the Andes, and from Paraguay to the Amazon. Of this stock are the Omaguas, Cocomas and other Peruvian tribes. Latham makes the Tupis members of the Guarani stock. The "Lingoa Geral" or trade language between Portuguese and Amazon Indians is a corruption of the Tupi tongue.

TUPPER, SIR CHARLES, Bart. (1821–   ), British colonial statesman, son of the Rev. Charles Tupper, D.D., was born at Amherst, Nova Scotia, on the 2nd of July 1821, and was educated at Horton Academy. He afterwards studied for the medical profession at Edinburgh University, where he received the diplomas of M.D. and L.R.C.S. In 1855 he was returned to the Nova Scotia Assembly for Cumberland county. In 1862 he was appointed, by act of parliament, governor of Dalhousie College, Halifax; and from 1867 till 1870 he was president of the Canadian Medical Association. Mr Tupper was a member of the executive council and provincial secretary of Nova Scotia from 1857 to 1860, and from 1863 to 1867. He became prime minister of Nova Scotia in 1864, and held that office until the Union Act came into force on the 1st of July 1867, when his government retired. He was a delegate to Great Britain on public business from the Nova Scotia government in 1858 and 1865, and from the Dominion government in March 1868. Mr Tupper was leader of the delegation from Nova Scotia to the Union conference at Charlottetown in 1864, and to that of Quebec during the same year; and to the final colonial conference in London, which assembled to complete the terms of union, in 1866–1867. On that occasion he received a patent of rank and precedence from Queen Victoria as an executive councillor of Nova Scotia. He was sworn a member of the privy council of Canada, June 1870, and was president of that body from that date until the 1st of July 1872, when he was appointed minister of inland revenue. This office he held until February 1873, when he became minister of customs under Sir John Macdonald, resigning with the ministry at the close of 1873. On Sir John's return to power in 1878, Mr Tupper became minister of public works, and in the following year minister of railways and canals. At this time he was made K.C.M.G. Mr Tupper was the author of the Public Schools Act of Nova Scotia, and had been largely instrumental in moulding the Dominion Confederation Bill and other important measures. Sir Charles represented the county of Cumberland, Nova Scotia, for thirty-two years in succession—first in the Nova Scotia Assembly, and subsequently in the Dominion parliament until 1884, when he resigned his seat on being appointed high commissioner for Canada in London. Shortly before the Canadian Federal elections of February 1887, Sir Charles re-entered the Conservative cabinet as finance minister. By his efforts the Canadian Pacific railway was enabled to float a loan of $30,000,000, on the strength of which the line was finished several years before the expiration of the contract time. He resigned the office of finance minister in May 1888, when he was reappointed high commissioner for the Dominion of Canada in London. Sir Charles was designated one of the British plenipotentiaries to the Fisheries Convention at Washington in 1887, the result of which conference was the signing of a treaty in February 1888 (rejected by the U.S. Senate) for the settlement of the matters in dispute between Canada and the United States in connexion with the Atlantic fisheries. He was created a baronet in September 1888. When the Dominion cabinet, under Sir Mackenzie Bowell, was reconstituted in January 1896 Sir Charles Tupper accepted office, and in the following April he succeeded Bowell in the premiership. On both patriotic and commercial grounds he urged the adoption of a preferential tariff with Great Britain and the sister colonies. At the general election in the ensuing June the Conservatives were severely defeated, and Sir Charles Tupper and his colleagues resigned, Sir Wilfrid Laurier becoming premier. The Conservative party now gradually became more and more disorganized, and at the next general election, in November 1900, they were again defeated. Sir Charles Tupper, who had long been the Conservative leader, sustained in his own constituency of Cape Breton his first defeat in forty years.

TUPPER, MARTIN FARQUHAR (1810–1889), English writer, the author of *Proverbial Philosophy*, was born in London on the 17th of July 1810. He was the son of Martin Tupper, a doctor, who came of an old Huguenot family. He was educated at Charterhouse and at Christ Church, Oxford, where he gained a prize for a theological essay, Gladstone being second to him. He was called to the bar at Lincoln's Inn, but never practised. He began a long career of authorship in 1832 with *Sacra Poesis*, and in 1838 he published *Geraldine, and other Poems*, and for fifty years was fertile in producing both verse and prose; but his name is indissolubly connected with his long series of didactic moralisings in blank verse, the *Proverbial Philosophy* (1838–1867), which for about twenty-five years enjoyed an extraordinary popularity that has ever since been the cause of persistent satire. The first part was, however, a comparative failure, and N. P. Willis, the American author, took it to be a forgotten work of the 17th century. The commonplace character of Tupper's reflections is indubitable, and his blank verse is only prose cut up into suitable lengths; but the *Proverbial Philosophy* was full of a perfectly genuine moral and religious feeling, and contained many apt and striking expressions. By these qualities it appealed to a large and uncritical section of the public. A genial, warm-hearted man, Tupper's humane instincts prompted him to espouse many reforming movements; he was an early supporter of the Volunteer movement, and did much to promote good relations with America. He was also a mechanical inventor in a small way. In 1886 he published *My Life as an Author*; and on the 29th of November 1889 he died at Albury, Surrey.

TURBAN, the name of a particular form of head-dress worn by men of Mahommedan races. The earlier forms of the word in English are *turbant*, *turband*, and *tolibant* or *tulipant*, the latter showing that variant of the original which survives in the name of the flower, the tulip. All these forms represent the French adaptation of the Turkish *tulbend*, a vulgarism for *dulbend*, from Persian *dulband*, a sash or scarf wound round the head. The Moslem turban is essentially a scarf of silk, fine linen, cotton or other material folded round the head, sometimes, as in Egypt, round the tarbush or close-fitting felt cap; sometimes, as in Afghanistan, round a conical cap; or, as among certain races in India, round the skull-cap or *kullah*. Races, professions, degrees of rank, and the like vary in the style of turban worn; distinctions being made in size, methods of folding, and colour and the like (see INDIA: *Costume*). At the end of the 18th and beginning of the 19th century, a species of head-dress somewhat resembling the true turban in outward form was worn by ladies of western nations, chiefly for use indoors.

TURBERVILLE (or TURBERVILE), **GEORGE** (1540?–1610?), English poet, second son of Nicholas Turberville of Whitchurch, Dorset, belonged to an old Dorsetshire family, the D'Urbervilles of Mr Thomas Hardy's novel, *Tess*. He became a scholar of Winchester College in 1554, and in 1561 was made a fellow of New College, Oxford. In 1562 he began to study law in London, and gained a reputation, according to Anthony à Wood, as a poet and man of affairs. He accompanied Thomas Randolph in a special mission to Moscow to the court of Ivan the Terrible in 1568. Of his *Poems describing the Places and Manners of the Country and People of Russia* (1568) mentioned by Wood, only three metrical letters describing his adventures survive, and these were reprinted in Hakluyt's *Voyages* (1589). His *Epitaphs, Epigrams, Songs and Sonets* appeared "newly corrected with additions" in 1567. In the same year he published translations of the *Heroycall Epistles* of Ovid, and of the *Eglogs* of Mantuan (Gianbattista Spagnuoli, called Mantuanus), and in 1568 *A Plaine Path to Perfect Vertue* from Dominicus Mancinus. The *Book of Falconry or Hawking* and the *Noble Art of Venerie* (printed together in 1575) may both be assigned to Turberville. The title page of his *Tragical Tales* (1587), which are translations from Boccaccio and Bandello, says that the book was written at the time of the author's troubles. What these were is unknown, but Wood says he was living and in high esteem in 1594. He probably died before 1611. He is a disciple of Wyat and Surrey, whose matter he sometimes appropriated. Much of his verse is sing-song enough, but he disarms criticism by his humble estimate of his own powers.

His *Epitaphs* &c. were reprinted in Alexander Chalmers's *English Poets* (1810), and by J. P. Collier in 1867.

TURBET I HAIDARI, a district of the province of Khorasan in Persia, bounded N. by Meshed, E. by Bakharz, S. by Khaf and W. by Turshiz. It has a population of about 30,000, composed chiefly of members of the Turki Karai tribe and Beluchis. The Karais were settled here by Timur in the 14th century and now provide a battalion of infantry and 150 cavalrymen to the army. The district contains about 150 villages and hamlets, most of them situated in its more fertile eastern part, and pays a yearly revenue of £14,000. Much silk was formerly produced, now very little, but there are large crops of grain.

TURBET I HAIDARI, the capital of the district, is 76 m. nearly S. of Meshed, in 35° 17′ N., 59° 11′ E., at an elevation of 4100 ft. The town is picturesquely situated on the bank of a deep and wide ravine in the midst of lofty hills, and surrounded by clusters of villages. Its population amounts to 8000 souls. There is a well-stocked bazaar and a number of Russian traders have established themselves here since 1903, when the place was connected with Meshed on one side and with Seistan on the other side by a telegraph line which, nominally Persian, is worked and maintained by a Russian staff. A British consul has resided here since 1905, and there is also a post-office.

The place was formerly known as Zavah and derives its present name from the turbet or tomb of a holy man named Kutb ed din Haidar, the founder of the ascetic sect of dervishes known as the Haidaris. He died *c.* 1230 and is buried in a large domed building a short distance outside the town.

TURBINE (Lat. *turbo*, a whirlwind, a whirling motion or object, a top), in engineering, a machine which applies the energy of a jet of water or steam to produce the rotation of a shaft. It consists essentially of a wheel or chamber provided with a number of blades or vanes upon which the fluid jet impinges; the impelled fluid causes the blades to rotate and also the shaft to which they are attached. Water turbines are treated under HYDRAULICS, and steam turbines under STEAM ENGINE.

TURBOT[1] (*Rhombus maximus* or *Psetta maxima*), one of the largest and most valuable of the flat-fishes or *Pleuronectidae*. The turbot, which rarely exceeds a length of two feet, has great width of body, and is scaleless, but is covered with conical bony tubercles. The eyes are on the left side of the body, the lower being slightly in advance of the upper; the mouth is large and armed with teeth of uniformly minute size. The turbot is found all round the coasts of Europe (except in the extreme north), preferring a flat sandy bottom with from 10 to 50 fathoms of water. The broad banks off the Dutch coast are a favourite resort. It is a voracious fish, and feeds on other fish, crustaceans and molluscs. It seems to constantly change its abode, wandering northward during the summer, and going into deeper water in the cold season. The eggs of the turbot, like those of the majority of flat-fishes, are pelagic and buoyant. They are small and very numerous, varying from five to ten millions in fish of 18 to 21 lb weight. The young fish are symmetrical and swim

[1] The word "turbot" is of great antiquity, perhaps of Celtic origin; it is preserved in French in the same form as in English, and is composed of two words, of which the second is identical with the "but" in halibut and with the German "Butte," which signifies flat-fish. The German name for the turbot is "Steinbutte."

vertically like the young of other Pleuronectids, but they reach a much larger size before metamorphosis than species of other genera, specimens from ¾ in. to 1 in. in length being frequently taken swimming at the surface of the water and not completely converted into the adult condition. Specimens one year old are from 3 to 4½ in. long, some perhaps larger. About 1860 it was estimated that the Dutch supplied turbot to the London market to the value of £80,000 a year. In 1900 the total weight of turbot landed on English and Welsh coasts for the year was according to the Board of Trade returns 60,715 cwt. valued at £252,680. The turbot is also common, though not abundant, in the Mediterranean, and is replaced in the Black Sea by an allied species with much larger bony tubercles (*Rh. maeoticus*). Both species grow to a large size, being usually sold at from 5 to 10 ℔; but the common turbot is stated to attain to a weight of 30 ℔.

TUREEN, a deep dish or bowl, round or oval in shape, and with a cover, made to serve soup at table. The word is a corruption of the more correct "terrine," an earthenware vessel (Med. Lat. *terrineus*, made of earth, *terra*). The corruption is due to misspelling in early cookery-books, and an absurd story that the name arose from Marshal Turenne once drinking his soup from his helmet was invented to account for it.

TURENNE, HENRI DE LA TOUR D'AUVERGNE, VICOMTE DE (1611–1675), marshal of France, second son of Henri, duke of Bouillon and sovereign prince of Sedan, by his second wife Elizabeth, daughter of William the Silent, prince of Orange, was born at Sedan on the 11th of September 1611. He was educated in the doctrines of the Reformed religion and received the usual training of a young noble of the time, but physical infirmity, and particularly an impediment of speech (which he never lost), hampered his progress, though he showed a marked partiality for history and geography, and especial admiration of the exploits of Alexander the Great and Caesar. After his father's death in 1623, he devoted himself to bodily exercises and in a great measure overcame his natural weakness. At the age of fourteen he went to learn war in the camp of his uncle, Maurice of Nassau, and began his military career (as a private soldier in that prince's bodyguard) in the Dutch War of Independence. Frederick Henry of Nassau, who succeeded his brother Maurice in 1625, gave Turenne a captaincy in 1626. The young officer took his part in the siege warfare of the period, and won special commendation from his uncle, who was one of the foremost commanders of the time, for his skill and courage at the celebrated siege of Hertogenbosch (Bois-le-Duc) in 1629. In 1630 Turenne left Holland and entered the service of France. This step was dictated not only by the prospect of military advancement but also by his mother's desire to show the loyalty of the Bouillon dominions to the French crown. Cardinal Richelieu at once made him colonel of an infantry regiment. He still continued to serve at frequent intervals with the prince of Orange, who was the ally of France, and his first serious service under the French flag was at the siege of La Motte in Lorraine by Marshal de la Force (1634), where his brilliant courage at the assault won him immediate promotion to the rank of *maréchal de camp* (equivalent to the modern grade of major-general). In 1635 Turenne served under Cardinal de la Valette in Lorraine and on the Rhine. The siege of Mainz was raised but the French army had to fall back on Metz from want of provisions. In the retreat Turenne measured swords with the famous imperialist General Gallas, and distinguished himself greatly by his courage and skill. The reorganized army took the field again in 1636 and captured Saverne (Zabern), at the storming of which place Turenne was seriously wounded. In 1637 he took part in the campaign of Flanders and was present at the capture of Landrecies (July 26) and in the latter part of 1638, under Duke Bernhard of Saxe-Weimar (1608–1639), he directed the assault of Breisach (reputed the strongest fortress on the upper Rhine), which surrendered on the 17th of December. He had now gained a reputation as one of the foremost of the younger generals of France, and Richelieu next employed him in the Italian campaign of 1639–40 under "Cadet la Perle," Henri de Lorraine, count of Harcourt (1601–1666). On the 19th of November 1639 he fought in the famous rearguard action called the battle of the "Route de Quiers," and during the winter revictualled the citadel of Turin, held by the French against the forces of Prince Thomas of Savoy. In 1640 Harcourt saved Casale and besieged Prince Thomas's forces in Turin, which were besieging in their turn another French force in the citadel. The latter held out, while Prince Thomas was forced to surrender on the 17th of September 1640, a fourth army which was investing Harcourt's lines being at the same time forced to retire. The favourable result of these complicated operations was largely due to Turenne, who had by now become a lieutenant-general. He himself commanded during the campaign of 1641 and took Coni (Cuneo), Ceva and Mondovi. In 1642 he was second in command of the French troops which conquered Roussillon. At this time the conspiracy of Cinq Mars (see FRANCE: *History*) in which Turenne's elder brother, the duke of Bouillon, was implicated, was discovered.

The earlier career of Turenne was markedly influenced by the relations of the principality of Sedan to the French crown; sometimes it was necessary to advance the soldier to conciliate the ducal family, at others the machinations of the latter against Richelieu or Mazarin prevented the king's advisers from giving their full confidence to their general in the field. Moreover his steady adherence to the Protestant religion was a further element of difficulty in Turenne's relations with the ministers. Cardinal Richelieu nevertheless entrusted him with the command in Italy in 1643 under Prince Thomas (who had changed sides in the quarrel). Turenne took Trino in a few weeks, but was recalled to France towards the end of the year. He was made a marshal of France (December 19) and was soon sent to Alsace to reorganize the "Army of Weimar"—the remnant of Duke Bernhard of Saxe-Weimar's troops—which had just been severely defeated at Tüttlingen (November 24–25, 1643). He was at this time thirty-two years of age and had served under four famous commanders. The methodical prince of Orange, the fiery Bernhard, the soldierly Cardinal de la Valette and the stubborn and astute Harcourt had each contributed much to the completeness of Turenne's training, and he took the field in 1644 prepared by genius and education for the responsibilities of high command.

The work of reorganization over, Marshal Turenne began the campaign in June by crossing the Rhine at Breisach, but was almost instantly joined by an army under the duc d'Enghien (afterwards the great Condé), who, as a prince of the royal house, took the chief command of the united armies of "France" and "Weimar." The four famous campaigns which followed brought to an end the Thirty Years' War (*q.v.*). The chief event of the first of these was the desperately-fought battle of Freiburg against Count Mercy's Bavarians (August 3, 5 and 9, 1644), after which Philipsburg was successfully besieged. Before the capitulation Enghien withdrew and left Turenne in command. The marshal opened the campaign of 1645 with a strong forward movement, but was surprised and defeated by Mercy at Mergentheim (Marienthal) on the 2nd of May. Enghien was again sent to the front with the army of France and Turenne's army was greatly increased by the arrival of a Swedish force and a contingent from Hesse-Cassel. The Swedes soon departed, but Enghien was at the head of 20,000 men when he met the Bavarians in a battle even more stubbornly contested than Freiburg. Mercy was killed and his army decisively beaten at Allerheim near Nördlingen (August 3, 1645).

Ill-health forced Enghien to retire soon afterwards, and Turenne was for the third time left in command of the French army. He was again unfortunate against the larger forces of the imperialists, but the campaign ended with a gleam of success in his capture of Trier (Trèves). In the following year (1646) he obtained more decided successes, and, by separating the Austrians from the Bavarians, compelled the elector of Bavaria to make peace (signed March 14, 1647). In 1647 he proposed to attack the thus weakened army of the emperor, but was ordered into Flanders instead. Not only was the opportunity thus lost but a serious mutiny broke out amongst the Weimar troops, whose pay was many months in arrear. The marshal's tact and firmness were never more severely tried nor more conspicuously displayed than in his treatment of the disaffected regiments, among whom in the end he succeeded in restoring order with little bloodshed. He then marched into Luxemburg, but was soon recalled to the Rhine, for in 1648 Bavaria had returned to her Austrian alliance and was again in arms. Turenne and his Swedish allies made a brilliant campaign, which was decided by the action of Zusmarshausen (May 17), Bavaria being subsequently wasted with fire and sword until a second and more secure pacification was obtained. This devastation, for which many modern writers have blamed Turenne, was not a more harsh measure than was permitted by the spirit of the times and the circumstances of the case.

The peace of Westphalia (1648) was no peace for France, which was soon involved in the civil war of the Fronde (see FRANCE: *History*). Few of Turenne's actions have been more sharply criticized than his adhesion to the party of revolt. The army of Weimar refused to follow its leader and he had to flee into the Spanish Netherlands, where he remained until the treaty of Rueil put an end to the first war of the Fronde. The second war began with the arrest of Condé and others (January 1650), amongst whom Turenne was to have been included; but he escaped in time and with the duchesse de Longueville held Stenay for the cause of the "Princes"—Condé, his brother Conti, and his brother-in-law the duc de Longueville. Love for the duchess seems to have ruled Turenne's action, both in the first war, and, now, in seeking Spanish aid for the princes. In this war Turenne sustained one of his few reverses at Rethel (December 15, 1650); but the second conflict ended in the early months of the following year with the collapse of the court party and the release of the princes.

Turenne became reconciled and returned to Paris in May, but the trouble soon revived and before long Condé again raised the standard of revolt in the south of France. In this, the third war of the Fronde, Turenne and Condé were opposed to each other, the marshal commanding the royal armies, the prince that of the Frondeurs and their Spanish allies. Turenne displayed the personal bravery of a young soldier at Jargeau (March 28, 1652), the skill and wariness of a veteran general at Gien (April 7), and he practically crushed the civil war in the battle of the Faubourg St Denis (July 2) and the reoccupation of Paris (October 21). Condé and the Spaniards, however, still remained to be dealt with, and the long drawn out campaigns of the "Spanish Fronde" gave ample scope for the display of scientific generalship on the part of both the famous captains. In 1653 the advantage was with Turenne, who captured Rethel, St Menehould and Muzon, while Condé's sole prize was Rocroy. The short campaign of 1654 was again to the advantage of the French; on the 25th of July the Spanish were defeated at Arras. In 1655 more ground was gained, but in 1656 Turenne was defeated at Valenciennes in the same way as he had beaten Condé at Arras. The war was eventually concluded in 1657 by Turenne's victory at the Dunes near Dunkirk, in which a corps of English veterans sent by Cromwell played a notable part (June 3–14); a victory which, followed by another successful campaign in 1658, led to the peace of the Pyrenees in 1659.

On the death of Cardinal Mazarin in 1661 Louis XIV. took the reins of government into his own hands and one of his first acts was to appoint Turenne "marshal-general of the camps and armies of the king." He had offered to revive the office of constable of France (suppressed in 1627) in Turenne's favour if the marshal would become a Roman Catholic. Turenne declined. Born of Calvinist parents and educated a Protestant, he had refused to marry one of Richelieu's nieces in 1639 and subsequently rejected a similar proposal of Mazarin. He had later married a daughter of the Protestant Marshal de la Force, to whom he was deeply attached. But he sincerely deplored the division of the Christian church into two hostile camps. He had always distrusted the influence of many dissident and uncontrolled sects; the history of Independency in the English army and people made a deep impression on his mind, and the same fear of indiscipline which drove the English Presbyterians into royalism drew Turenne more and more towards the Roman Catholic Church. How closely both he and his wife studied such evidence as was available is shown by their correspondence, and, in the end, two years after her death, he was prevailed upon by the eloquence of Bossuet and the persuasions of his nephew, the abbé de Bouillon, to give in his adhesion to the Orthodox faith (October 1668). In 1667 he had returned to the more congenial air of the "Camps and Armies of the King," directing, nominally under Louis XIV., the famous "Promenade militaire" in which the French overran the Spanish Netherlands. Soon afterwards Condé, now reconciled with the king, rivalled Turenne's success by the rapid conquest of Franche Comté, which brought to an end the War of Devolution in February 1668.

In Louis XIV.'s Dutch War of 1672 (see DUTCH WARS) Turenne was with the army commanded by the king which overran Holland up to the gates of Amsterdam. The terms offered by Louis to the prince of Orange were such as to arouse a more bitter resistance. The dikes were opened and the country round Amsterdam flooded. This heroic measure completely checked Turenne, whom the king had left in command. Europe was aroused to action by the news of this event, and the war spread to Germany. Turenne fought a successful war of manœuvre on the middle Rhine while Condé covered Alsace. In January 1673 Turenne assumed the offensive, penetrated far into Germany, and forced the Great Elector of Brandenburg to make peace; later in the year, however, he was completely outmanœuvred by the famous imperial general Montecucculi, who evaded his opponent, joined the Dutch and took the important place of Bonn. In June 1674, however, Turenne won the battle of Sinzheim, which made him master of the Palatinate. Under orders from Paris the French wasted the country far and wide, and this devastation has usually been considered the gravest blot on Turenne's fame, though it is difficult to say that it was more unjustifiable than other similar incidents in medieval and even in modern war. In the autumn the allies again advanced, and though Turenne was again outmanœuvred, his failure on this occasion was due to the action of the neutral city of Strassburg in permitting the enemy to cross the Rhine by the bridge at that place. The battle of Enzheim followed; this was a tactical victory, but hardly affected the situation, and, at the beginning of December, the allies were still in Alsace. The old marshal now made the most daring campaign of his career. A swift and secret march in mid-winter from one end of the Vosges to the other took the allies by surprise. Sharply following up his first successes, Turenne drove the enemy to Turkheim, and there inflicted upon them a heavy defeat (January 5, 1675). In a few weeks he had completely recovered Alsace. In the summer campaign he was once more opposed to Montecucculi, and after the highest display of "strategic chess-moves" by both commanders, Turenne finally compelled his opponent to offer battle at a disadvantage at Sassbach. Here, on the 27th of July 1675, he was killed by almost the first shot fired. The news of his death was received with universal sorrow. Turenne's most eloquent countrymen wrote his *éloges*, and Montecucculi himself exclaimed: "Il est mort aujourd'hui un homme qui faisait honneur à l'homme." His body was taken to St Denis and buried with the kings of France. Even the extreme revolutionists of 1793 respected it, and, when the bones of the sovereigns were thrown to the winds, the remains of Turenne were preserved at the Jardin des Plantes until the 22nd of September 1800, when they were removed by order of Napoleon to the church of the Invalides at Paris, where they still rest.

Turenne was one of the great captains whose campaigns Napoleon recommended all soldiers to "read and re-read." His fame as a general was the highest in Europe at a period when war was studied more critically than ever before, for his military character epitomized the art of war of his time (Prince de Ligne). Strategic caution and logistic accuracy, combined with brilliant dash in small combats and constancy under all circumstances of success or failure may perhaps be considered the salient points of Turenne's genius for war. Great battles he avoided. "Few sieges and many combats" was his own maxim. And, unlike his great rival Condé, who was as brilliant in his first battle as in his last, Turenne improved day by day. Napoleon said of him that his genius grew bolder as it grew older, and a modern author, the duc d'Aumâle (*Histoire des princes de la maison de Condé*), takes the same view when he says: "Pour le connaître il faut le suivre jusqu'à Sulzbach. Chez lui chaque jour marque un progrès." In his personal character Turenne was little more than a simple and honourable soldier, endowed with much tact, but in the world of politics and intellect almost helpless in the hands of a skilful intriguer or casuist. His morals, if not beyond reproach, were at least more austere than those prevalent in the age in which he lived. He was essentially a commander of regular armies. His life was spent with the troops; he knew how to win their affection; he tempered a severe discipline with rare generosity, and his men loved him as a comrade no less than they admired him as a commander. Thus, though Condé's genius was far more versatile, it is Turenne whose career best represents the art of war in the 17th century. For the small, costly, and highly trained regular armies, and the dynastic warfare of the age of Louis XIV., Turenne was the ideal army leader.

The most notable of the numerous portraits of Turenne are those of P. de Champagne at Versailles, and of Senin (dated 1670) in the Jones collection at South Kensington, London. Of the older memoirs of Turenne the most important are those of "Du Buisson," *La Vie du vicomte de Turenne*—the author is apparently Gatien de Sandraz de Courtilz (Paris, the Hague, and Cologne, 1688–1695); Abbé Raguenet, *Histoire du vicomte de Turenne* (Paris, 1741) and especially Ramsay, *Histoire d'Henry de la Tour d'Auvergne, vicomte de Turenne* (Paris, 1735), the second volume of which contains the marshal's memoirs of 1643–1658. These memoirs, of which the Prince de Ligne wrote that "ce ne sont pas de conseils, ce sont des ordres . . . 'faites' . . . 'allez,' &c."—were written in 1665, but were first published (*Mémoires sur la guerre, tirés des originaux*, &c.) in 1738, reprinted in Michaud, *Mémoires sur l'histoire de France*, 3rd series, vol. iii., and Liskenne and Sauvan's *Bibliothèque historique et militaire*, vol. iv. (Paris, 1846). A manuscript *Maximes de M. de Turenne* (1644) exists in the Staff Archives at Vienna, and of other documentary collections may be mentioned Grimoard, *Collections de lettres et mémoires trouvés dans la portefeuille de M. de Turenne* (Paris, 1782); *Recueil de lettres écrites au vicomte de Turenne par Louis XIV. et ses ministres*, &c. (Paris, 1779); *Correspondance inédite de Turenne avec Le Tellier et Louvois*, ed. Barthélemy (Paris, 1874). See also the *Observations on the Wars of Marshal Turenne*, dictated by Napoleon at St Helena (1823); Puységur, *La Guerre par principes et règles* (Paris, 1748); Précis in *Bibliothèque internationale d'hist. milit.* (Brussels, 1883); Duruy, *Histoire de Turenne* (Paris, 1880); Roy, *Turenne, sa vie et les institutions militaires de son temps* (Paris, 1884); Hardy de Périni, *Turenne et Condé* (Paris, 1907); Neuber, *Turenne als Kriegstheoretiker und Feldherr* (Vienna, 1869); Sir E. Cust, *Lives of the Warriors of the 17th Century* (London, 1867); T. O. Cockayne, *Life of M. de Turenne* (founded on Ramsay's work; London, 1853); G. B. Malleson, *Turenne. Marshal Turenne*, by "the author of the Life of Sir Kenelm Digby" (London, 1907), is a valuable work by a civilian, and is based in the main on Ramsay's work, the memoirs of Cardinal de Retz, James, duke of York, &c., and on Napoleon's commentaries. A remarkable parallel between Turenne and Condé, in Saint-Evremont's *éloge* of the latter, will be found in Carrion-Nisas, *Essai sur l'histoire général de l'art militaire*, ii. 83 (Paris, 1824). (C. F. A.)

TURF, the top or surface of earth when covered with grass, forming a coherent mass of mould or soil in which the roots of grasses and other plants are embedded. This is capable of being cut out in solid mat-like blocks, known by the same name. Similarly "peat" (*q.v.*) when cut in pieces for fuel or other purposes is also styled "turf." The term is applied widely to any stretch or sward of trimmed grass-land, and thus by metonymy, to horse-racing and all connected with it, from the owning and running of race-horses to betting. The word "turf" is common to Teutonic languages, cf. Du. *turf*, Ger. *Torf*, Dan. *törv*, &c. It has been connected with Skt. *darbha*, grass, so called from being matted or twisted together, *darbh*, to wind. The Teutonic word was adapted in Med. Lat., as *turba* (cf. Fr. *tourbe*, Ital. *torba*), whence was formed *turbaria*, turbary, the right of digging and cutting turf in common with the owner of the land. (See COMMONS.)

TURGAI, a province of Russian Central Asia, formerly a part of the Kirghiz steppe, and now included in the governor-generalship of the Steppes, bounded by the province of Uralsk and the governments of Orenburg and Tobolsk on the W. and N., by Akmolinsk on the E., and by Syr-darya and the Sea of Aral on the S. This territory, which has an area of 176,219 sq. m.—nearly as large as that of Caucasia and Transcaucasia taken together—belongs to the Aral-Caspian depression. It has, however, the Mugojar Hills on its western border and includes a part of the southern Urals; and from Akmolinsk it is separated by a range of hills which run between the two largest rivers of the Kirghiz steppe—the Turgai and the Sary-su. In the north it includes the low belt of undulating land which stretches north-east from the Mugojar Hills and separates the rivers belonging to the Aral basin from those which flow towards the Arctic Ocean, and beyond this range it embraces the upper Tobol. The remainder is steppe land, sloping gently towards the Sea of Aral.

The Mugojar Hills consist of an undulating plateau nearly 1000 ft. in altitude, built up of Permian and Cretaceous deposits and deeply trenched by rivers. They are not the independent chain which our maps represent them to be:[1] they merely continue the Urals towards the south, and are connected with the Ust-Urt plateau by a range of hills which was formerly an island of the Aral-Caspian Sea. Their northern extremity joins the undulating plateau (400 to 600 ft.), built up of sandstones and marls, which separates the tributaries of the Tobol from those of the river Ural, and falls by a range of steep crags—probably an old shore-line of the Aral basin—towards the steppes. The steppe land of Turgai is only some 300 ft. above the sea-level, and is dotted with lakes, of which the Chalkar-teniz, which receives the Turgai and its tributary the Irgiz, is the largest. The Turgai was, at a recent epoch, a large river flowing into the Sea of Aral and receiving an extensive system of tributaries, which are now lost in the sands before joining it. Remains of aquatic plants buried in the soil of the steppe, and shells of *Mytilus* and *Cardium*, both still found in the Sea of Aral, show that during the Glacial period this region was overflowed by the waters of the Aral-Caspian Sea.

The climate of Turgai is exceedingly dry and continental. Orsk, a town of Orenburg, on its north-western border, has a January as cold as that of the west coast of Novaya Zemlya (−4° F.), while in July it is as hot as July in Morocco (73°); the corresponding figures for Irgiz, in the centre of the province, are 7° and 77°. At Irgiz and Orsk the annual rainfall is somewhat under 10 in. and 12 in. respectively (3 in. in summer). The west winds are parched before they reach the Turgai steppes, and the north-east winds, which in winter bring cold, dry snows from Siberia, raise in summer formidable clouds of sand. A climate so dry is of course incompatible with a vigorous forest growth. There is some timber on the southern Urals, the Mugojar Hills and the water-parting of the Tobol; elsewhere trees are rare. Shrubs only, such as the wild cherry (*Cerasus chamaecerasus*) and the dwarf almond (*Amygdalus nana*) grow on the hilly slopes, while the rich black-earth soil of the steppe is chiefly clothed with feather grass (*Stipa pennata*), the well-known ornament of the south Russian steppes. In spring the grass vegetation is luxuriant, and geese and cranes are attracted in vast numbers from the heart of the steppe by the fields of the Kirghiz. The jerboa (*Dipus jaculus*) and the marmot (*Spermophilus rufescens*) are characteristic of the fauna; another species of marmot (*Arctomys bobac*) and the steppe fox (*Canis corsac*) are common; and the saiga antelope of Central Asia is occasionally met with. Farther south the black earth disappears and with it the feather grass, its place being taken by its congener, *Stipa capillata*. Trees disappear, and among the bushes along the banks of the rivers willows and the pseudo-acacia or Siberian pea tree (*Caragana microphyla*) are most prevalent. In the middle parts of the province the clayey soil is completely clothed with wormwood (*Artemisia fragrans* and *A. monogyna*), with a few grassy plants on the banks of the rivers and lakes (*Lasiagrostis splendens*, *Alhagi camelorum* and *A. kirghizorum*, *Obione portulacoides*, *Halimodendrum argenteum*); while large areas consist of shifting sands, saline clays clothed with various *Salsolaceae*, and the desiccated beds of old lakes. Such lakes as still exist, notwithstanding the rapid desiccation now going on, are surrounded by thickets of reeds—the retreat of wild boars. Turgai is thus the borderland between the flora of Europe and that of Central Asia.

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[1] See P. S. Nazarov, in "Recherches zoologiques dans les steppes des Kirghizes," in *Bull. soc. des natur. de Moscow* (1886), No. 4.

The population was estimated in 1906 at 511,800, composed mainly of Kirghiz, though Russians have immigrated in large numbers. The province is divided into four districts, the chief towns of which are Turgai, the capital; Ak-tyubinsk in the district of Iletsk; Irgiz and Kustanaisk in the Nikolayevsk district, a prairie town which has grown with great rapidity. Agriculture is mainly carried on by the Russian settlers in the Nikolayevsk district, where the crops do not suffer so much from droughts as they do elsewhere. But the Kirghiz have also begun to cultivate the soil, and in 1900 there were in all 612,200 acres under cereals.

The principal crops are rye, wheat, oats, barley and potatoes. Livestock breeding is the leading occupation of the Kirghiz. Camels are bred and kept by the nomads both for their own personal use and for the transport of goods between Bokhara, Khiva and Russian Turkestan. Considerable quantities of cattle and various animal products are exported to Orenburg, Orsk and Troitsk, and to Ust-Uisk and Zverinogolovsk, where large fairs are held. The Kirghiz of the southern parts migrate in winter to the better sheltered parts of the province of Syr-darya, while in the summer some 30,000 *kibitkas* (felt tents) of nomads come from the neighbouring provinces to graze their cattle on the grassy steppes of Turgai. Salt is obtained from the lakes. There are a few oil-works, tanneries and flour-mills, and the Kirghiz are active in the making of carpets and felt goods. Education is a little more advanced than in the other steppe provinces; the system of "migratory schools" has been introduced for the Kirghiz.

See Y. Talferov, *The Turgai Province* (1896), in Russian.

(P. A. K.; J. T. Be.)

TURGOT, ANNE ROBERT JACQUES, Baron de Laune (1727–1781), French statesman and economist, was born in Paris on the 10th of May 1727. He was the youngest son of Michel Étienne Turgot, "provost of the merchants" of Paris, and Madeleine Françoise Martineau, and came of an old Norman family. He was educated for the Church, and at the Sorbonne, to which he was admitted in 1749 (being then styled abbé de Brucourt), he delivered two remarkable Latin dissertations, *On the Benefits which the Christian Religion has conferred on Mankind*, and *On the Historical Progress of the Human Mind*. The first sign we have of his interest in economics is a letter (1749) on paper money, written to his fellow student the abbé de Cicé, refuting the abbé Terrasson's defence of Law's system. He was fond of verse-making, and tried to introduce into French verse the rules of Latin prosody, his translation of the fourth book of the *Aeneid* into classical hexameters being greeted by Voltaire as "the only *prose* translation in which he had found any enthusiasm." In 1750 he decided not to take holy orders, giving as his reason, according to Dupont de Nemours, "that he could not bear to wear a mask all his life." In 1752 he became *substitut*, and later *conseiller* in the parlement of Paris, and in 1753 *maître des requêtes*. In 1754 he was a member of the *chambre royale* which sat during an exile of the parlement; in 1755 and 1756 he accompanied Gournay, then intendant of commerce, in his tours of inspection in the provinces, and in 1760, while travelling in the east of France and Switzerland, visited Voltaire, who became one of his chief friends and supporters. In Paris he frequented the salons, especially those of Mme Graffigny—whose niece, Mlle de Ligniville ("Minette"), afterwards Mme Helvétius and his lifelong friend, he is supposed at one time to have wished to marry—Mme Geoffrin, Mme du Deffand, Mlle de Lespinasse and the duchesse d'Enville. It was during this period that he met the leaders of the "physiocratic" school, Quesnay and Gournay, and with them Dupont de Nemours, the abbé Morellet and other economists. All this time he was studying various branches of science, and languages both ancient and modern. In 1753 he translated the *Questions sur la commerce* from the English of Josias Tucker, and wrote his *Lettre sur la tolérance*, and a pamphlet, *Le Conciliateur*, in support of religious tolerance. Between 1755 and 1756 he composed various articles for the *Encyclopédie*, and between 1757 and 1760 an article on *Valeurs et monnaies*, probably for the *Dictionnaire du commerce* of the abbé Morellet. In 1759 appeared his *Éloge de Gournay*.

In August 1761 Turgot was appointed intendant of the *généralité* of Limoges, which included some of the poorest and most over-taxed parts of France; here he remained for 13 years. He was already deeply imbued with the theories of Quesnay and Gournay (see Physiocratic School), and set to work to apply them as far as possible in his province. His first plan was to continue the work, already initiated by his predecessor Tourny, of making a fresh survey of the land (*cadastre*), in order to arrive at a juster assessment of the *taille*; he also obtained a large reduction in the contribution of the province. He published his *Avis sur l'assiette et la répartition de la taille* (1762–1770), and as president of the *Société d'agriculture de Limoges* offered prizes for essays on the principles of taxation. Quesnay and Mirabeau had advocated a proportional tax (*impôt de quotité*), but Turgot a distributive tax (*impôt de répartition*). Another reform was the substitution for the *corvée* of a tax in money levied on the whole province, the construction of roads being handed over to contractors, by which means Turgot was able to leave his province with a good system of roads, while distributing more justly the expense of their construction. In 1769 he wrote his *Mémoire sur les prêts à intérêt*, on the occasion of a scandalous financial crisis at Angoulême, the peculiar interest of which is that in it the question of lending money at interest was for the first time treated scientifically, and not merely from the ecclesiastical point of view. Among other works written during Turgot's intendancy were the *Mémoire sur les mines et carrières*, and the *Mémoire sur la marque des fers*, in which he protested against state regulation and interference and advocated free competition. At the same time he did much to encourage agriculture and local industries, among others establishing the manufacture of porcelain. During the famine of 1770–1771 he enforced on landowners "the obligation of relieving the poor" and especially the *métayers* dependent upon them, and organized in every province *ateliers* and *bureaux de charité* for providing work for the able-bodied and relief for the infirm, while at the same time he condemned indiscriminate charity. It may be noted that Turgot always made the *curés* the agents of his charities and reforms when possible. It was in 1770 that he wrote his famous *Lettres sur la liberté du commerce des grains*, addressed to the comptroller-general, the abbé Terray. Three of these letters have disappeared, having been sent to Louis XVI. by Turgot at a later date and never recovered, but those remaining demonstrate that free trade in corn is to the interest of landowner, farmer and consumer alike, and in too forcible terms demand the removal of all restrictions.

Turgot's best known work, *Réflexions sur la formation et la distribution des richesses*, was written early in the period of his intendancy for the benefit of two young Chinese students. Written in 1766, it appeared in 1769–1770 in Dupont's journal, the *Ephémérides du citoyen*, and was published separately in 1776. Dupont, however, made various alterations in the text, in order to bring it more into accordance with Quesnay's doctrines, which led to a coolness between him and Turgot (see G. Schelle, in *Journal des économistes*, July 1888). A more correct text is that published by L. Robineau ("Turgot," in *Petite bibliothèque économique*, 1889), and is followed by Professor W. J. Ashley in his translation (*Economic Classics*, New York, 1898), but the original MS. has never been found.

After tracing the origin of commerce, Turgot develops Quesnay's theory that the land is the only source of wealth, and divides society into three classes, the productive or agricultural, the salaried (*stipendiée*) or artisan class, and the land-owning class (*classe disponible*). After discussing the evolution of the different systems of cultivation, the nature of exchange and barter, money, and the functions of capital, he sets forth the theory of the *impôt unique*, *i.e.* that only the *produit net* of the land should be taxed. In addition he demanded the complete freedom of commerce and industry.[1]

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[1] For the controversy as to how far Adam Smith (*q.v.*) was influenced by Turgot, see S. Feilbogen, *Smith und Turgot* (1892); also E. Cannan's introduction to Smith's *Lectures on Justice*, &c. (Clarendon Press, 1896); and H. Higgs's review of the latter in the *Economic Journal*, Dec. 1896. The question may still be considered an open one. See also Neymarck, i. 332, footnote, for the French authorities. Condorcet's statement that Turgot corresponded with Smith is disproved by a letter of Smith to the duc de la Rochefoucauld, published in the *Economic Journal* (March 1896), p. 165, in which he says, "But tho' I had the happiness of his acquaintance

Turgot owed his appointment to the ministry to Maurepas, the "Mentor" of Louis XVI., to whom he was warmly recommended by the abbé Véry, a mutual friend. His appointment as minister of the marine on the 20th of July 1774 met with general approval, and was hailed with enthusiasm by the *philosophes*. A month later he was appointed comptroller-general (August 24). His first act was to submit to the king a statement of his guiding principles: "No bankruptcy, no increase of taxation, no borrowing." Turgot's policy, in face of the desperate financial position, was to enforce the most rigid economy in all departments. All departmental expenses were to be submitted for the approval of the comptroller-general, a number of sinecures were suppressed, the holders of them being compensated, and the abuse of the "acquits au comptant" was attacked, while Turgot appealed personally to the king against the lavish giving of places and pensions. He also contemplated a thorough-going reform of the *ferme générale*, but contented himself, as a beginning, with imposing certain conditions on the leases as they were renewed—such as a more efficient personnel, and the abolition for the future of the abuse of the *croupes* (the name given to a class of pensions), a reform which Terray had shirked on finding how many persons in high places were interested in them, and annulling certain leases, such as those of the manufacture of gunpowder and the administration of the *messageries*, the former of which was handed over to a company with the scientist Lavoisier as one of its advisers, and the latter superseded by a quicker and more comfortable service of diligences which were nicknamed "turgotines." He also prepared a regular budget. Turgot's measures succeeded in considerably reducing the deficit, and raised the national credit to such an extent that in 1776, just before his fall, he was able to negotiate a loan with some Dutch bankers at 4%; but the deficit was still so large as to prevent him from attempting at once to realize his favourite scheme of substituting for indirect taxation a single tax on land. He suppressed, however, a number of *octrois* and minor duties,[1] and opposed, on grounds of economy, the participation of France in the War of American Independence, though without success.

Turgot at once set to work to establish free trade in corn, but his edict, which was signed on the 13th of September 1774, met with strong opposition even in the *conseil du roi*. A striking feature was the preamble, setting forth the doctrines on which the edict was based, which won the praise of the *philosophes* and the ridicule of the wits; this Turgot rewrote three times, it is said, in order to make it "so clear that any village judge could explain it to the peasants." The opposition to the edict was strong. Turgot was hated by those who had been interested in the speculations in corn under the régime of the abbé Terray—among whom were included some of the princes of the blood. Moreover, the *commerce des blés* had been a favourite topic of the salons for some years past, and the witty Galiani, the opponent of the physiocrats, had a large following. The opposition was now continued by Linguet and Necker, who in 1775 published his treatise *Sur la législation et le commerce des grains*. But Turgot's worst enemy was the poor harvest of 1774, which led to a slight rise in the price of bread in the winter and early spring of 1774–1775. In April disturbances arose at Dijon, and early in May took place those extraordinary bread-riots known as the "guerre des farines," which may be looked upon as a first sample of the Revolution, so carefully were they organized. Turgot showed great firmness and decision in repressing the riots, and was loyally supported by the king throughout. His position was strengthened by the entry of Malesherbes into the ministry (July 1775).

All this time Turgot had been preparing his famous "Six Edicts," which were finally presented to the *conseil du roi* (Jan. 1776). Of the six edicts four were of minor importance, but the two which met with violent opposition were, firstly, the edict suppressing the *corvées*, and secondly, that suppressing the *jurandes* and *maîtrises*, the privileged trade corporations. In the preamble to the former Turgot boldly announced as his object the abolition of privilege, and the subjection of all three orders to taxation; the clergy were afterwards excepted, at the request of Maurepas. In the preamble to the edict on the *jurandes* he laid down as a principle the right of every man to work without restriction.[2] He obtained the registration of the edicts by the *lit de justice* of the 12th of March, but by that time he had nearly everybody against him. His attacks on privilege had won him the hatred of the nobles and the parlements, his attempted reforms in the royal household that of the court, his free trade legislation that of the "financiers," his views on tolerance and his agitation for the suppression of the phrase offensive to Protestants in the king's coronation oath that of the clergy, and his edict on the *jurandes* that of the rich bourgeoisie of Paris and others, such as the prince de Conti, whose interests were involved. The queen disliked him for opposing the grant of favours to her protégés, and he had offended Mme de Polignac in a similar manner (see Marquis de Ségur, *Au Couchant de la monarchie*, p. 305–306).

All might yet have gone well if Turgot could have retained the confidence of the king, but the king could not fail to see that Turgot had not the support of the other ministers. Even his friend Malesherbes thought he was too rash, and was, moreover, himself discouraged and wished to resign. The alienation of Maurepas was also increasing. Whether through jealousy of the ascendancy which Turgot had acquired over the king, or through the natural incompatibility of their characters, he was already inclined to take sides against Turgot, and the reconciliation between him and the queen, which took place about this time, meant that he was henceforth the tool of the Polignac clique and the Choiseul party. About this time, too, appeared a pamphlet, *Le Songe de M. Maurepas*, generally ascribed to the comte de Provence (Louis XVIII.), containing a bitter caricature of Turgot.

Before relating the circumstances of Turgot's fall we may briefly resume his views on the administrative system. With the physiocrats, he believed in an enlightened absolutism, and looked to the king to carry through all reforms. As to the parlements, he opposed all interference on their part in legislation, considering that they had no competency outside the sphere of justice. He recognized the danger of the recall of the old parlement, but was unable effectively to oppose it, since he had been associated with the dismissal of Maupéou and Terray, and seems to have underestimated its power. He was opposed to the summoning of the states-general advocated by Malesherbes (May 6, 1775), possibly on the ground that the two privileged orders would have too much power in them. His own plan is to be found in his *Mémoire sur les municipalités*, which was submitted informally to the king. In Turgot's proposed system landed proprietors alone were to form the electorate, no distinction being made between the three orders; the members of the town and country *municipalités* were to elect representatives for the district *municipalités*, which in turn would elect to the provincial *municipalités*, and the latter to a *grande municipalité*, which should have no legislative powers, but should concern itself entirely with the administration of taxation. With this was to be combined a whole system of education, relief of the poor, &c. Louis XVI. recoiled from this as being too great a leap in the dark, and such a fundamental difference of opinion between king and minister was bound to lead to a breach sooner or later. Turgot's only choice, however, was between "tinkering" at the existing system in detail and a complete revolution, and his attack on privilege, which might have been carried through by a popular minister and a strong king, was bound to form part of any effective scheme of reform.

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and, I flattered myself, even of his friendship and esteem, I never had that of his correspondence," but there is no doubt that Adam Smith met Turgot in Paris, and it is generally admitted that *The Wealth of Nations* owes a good deal to Turgot.

[1] For an account of Turgot's financial administration, see Ch. Gomel, *Causes financières*, vol. i.

[2] Turgot was opposed to all labour associations of employers or employed, in accordance with his belief in free competition.

The immediate cause of Turgot's fall is uncertain. Some speak of a plot, of forged letters containing attacks on the queen shown to the king as Turgot's, of a series of notes on Turgot's budget prepared, it is said, by Necker, and shown to the king to prove his incapacity. Others attribute it to the queen, and there is no doubt that she hated Turgot for supporting Vergennes in demanding the recall of the comte de Guines, the ambassador in London, whose cause she had ardently espoused at the prompting of the Choiseul clique. Others attribute it to an intrigue of Maurepas. On the resignation of Malesherbes (April 1776), whom Turgot wished to replace by the abbé Véry, Maurepas proposed to the king as his successor a nonentity named Amelot. Turgot, on hearing of this, wrote an indignant letter to the king, in which he reproached him for refusing to see him, pointed out in strong terms the dangers of a weak ministry and a weak king, and complained bitterly of Maurepas's irresolution and subjection to court intrigues; this letter the king, though asked to treat it as confidential, is said to have shown to Maurepas, whose dislike for Turgot it still further embittered. With all these enemies, Turgot's fall was certain, but he wished to stay in office long enough to finish his project for the reform of the royal household before resigning. This, however, he was not allowed to do, but on the 12th of May was ordered to send in his resignation. He at once retired to la Roche-Guyon, the château of the duchesse d'Enville, returning shortly to Paris, where he spent the rest of his life in scientific and literary studies, being made vice-president of the Académie des Inscriptions et Belles-lettres in 1777. He died on the 18th of March 1781.

In character Turgot was simple, honourable and upright, with a passion for justice and truth. He was an idealist, his enemies would say a doctrinaire, and certainly the terms "natural rights," "natural law," &c., frequently occur in his writings. His friends speak of his charm and gaiety in intimate intercourse, but among strangers he was silent and awkward, and produced the impression of being reserved and disdainful. On one point both friends and enemies agree, and that is his brusquerie and his want of tact in the management of men; Oncken points out with some reason the "schoolmasterish" tone of his letters, even to the king. As a statesman he has been very variously estimated, but it is generally agreed that a large number of the reforms and ideas of the Revolution were due to him; the ideas did not as a rule originate with him, but it was he who first gave them prominence. As to his position as an economist, opinion is also divided. Oncken, to take the extreme of condemnation, looks upon him as a bad physiocrat and a confused thinker, while Léon Say considers that he was the founder of modern political economy, and that "though he failed in the 18th century he triumphed in the 19th."

BIBLIOGRAPHY.—G. Schelle, *Turgot* (Paris, 1909); and Marquis de Ségur, *Au Couchant de la monarchie* (Paris, 1910), contain much that is based on recent research. The principal older biographies are those of Dupont de Nemours (1782, enlarged in his edition of Turgot's *Works*, 1807–1811), and Condorcet (1786); the best modern ones are those of A. Neymarck (Paris, 1885), Léon Say (Paris, 1887); and W. W. Stephens (London, 1895). See generally, Oncken, *Geschichte der Nationalökonomie*, vol. ii. ch. 1; Schelle, *Dupont de Nemours et l'école physiocratique* (1888); Henry Higgs, *The Physiocrats* (1897); R. P. Shepherd, *Turgot and the Six Edicts* (1903), in Columbia Univ. Studies, vol. xviii. No. 2.

TURGUENIEV, IVAN (1818–1883), Russian novelist, the descendant of an old Russian family, was born at Orel, in the government of the same name, in 1818. His father, the colonel of a cavalry regiment, died when our author was sixteen years of age, leaving two sons, Nicholas and Ivan, who were brought up under the care of their mother, the heiress of the Litvinovs, a lady who owned large estates and many serfs. Ivan studied for a year at the university of Moscow, then at St Petersburg, and was finally sent in 1843 to Berlin. His education at home had been conducted by German and French tutors, and was altogether foreign, his mother only speaking Russian to her servants, as became a great lady of the old school. For his first acquaintance with the literature of his country the future novelist was indebted to a serf of the family, who used to read to him verses from the *Rossiad* of Kheraskov, a once celebrated poet of the eighteenth century. Turgueniev's early attempts in literature, consisting of poems and trifling sketches, may be passed over here; they were not without indications of genius, and were favourably spoken of by Bielinski, then the leading Russian critic, for whom Turgueniev ever cherished a warm regard. Our author first made a name by his striking sketches "The Papers of a Sportsman" (*Zapiski Okhotnika*), in which the miserable condition of the peasants was described with startling realism. The work appeared in a collected form in 1852. It was read by all classes, including the emperor himself, and it undoubtedly hurried on the great work of emancipation. Turgueniev had always sympathized with the *muzhiks*; he had often been witness of the cruelties of his mother, a narrow-minded and vindictive woman. In some interesting papers recently contributed to the "European Messenger" (*Viestnik evropy*) by a lady brought up in the household of Mme Turgueniev, sad details are given illustrative of her character. Thus the dumb porter of gigantic stature, drawn with such power in *Mumu*, one of our author's later sketches, was a real person. We are, moreover, told of his mother that she could never understand how it was that her son became an author, and thought that he had degraded himself. How could a Turgueniev submit himself to be criticized?

The next production of the novelist was "A Nest of Nobles" (*Dvorianskoe gniezdo*), a singularly pathetic story, which greatly increased his reputation. This appeared in 1859, and was followed the next year by "On the Eve" (*Nakanunge*)—a tale which contains one of his most beautiful female characters, Helen. In 1862 was published "Fathers and Children" (*Otzi i Dieti*), in which the author admirably described the nihilistic doctrines then beginning to spread in Russia. According to some writers he invented the word nihilism. In 1867 appeared "Smoke" (*Dîm*), and in 1877 his last work of any length, "Virgin Soil" (*Nov*). Besides his longer stories, many shorter ones were produced, some of great beauty and full of subtle psychological analysis, such as *Rudin*, "The Diary of a Useless Man" (*Dnevnik lishnago chelovieka*), and others. These were afterwards collected into three volumes. The last works of the great novelist were "Poetry in Prose" and "Clara Milich," which appeared in the "European Messenger."

Turgueniev, during the latter part of his life, did not reside much in Russia; he lived either at Baden Baden or Paris, and chiefly with the family of the celebrated singer Viardot Garcia, to the members of which he was much attached. He occasionally visited England, and in 1879 the degree of D.C.L. was conferred upon him by the university of Oxford. He died at Bougival, near Paris, on the 4th of September 1883.

Unquestionably Turgueniev may be considered one of the great novelists, worthy to be ranked with Thackeray, Dickens and George Eliot; with the genius of the last of these he has many affinities. His studies of human nature are profound, and he has the wide sympathies which are essential to genius of the highest order. A melancholy, almost pessimist, feeling pervades his writings, a morbid self-analysis which seems natural to the Slavonic mind. The closing chapter of "A Nest of Nobles" is one of the saddest and at the same time truest pages in the whole range of existing novels.

The writings of Turgueniev have been made familiar to persons unacquainted with Russian by French translations. There are many versions in English, among which we may mention the translation of the "Nest of Nobles" under the name of "Lisa," by Ralston, and "Virgin Soil," by Ashton Dilke. There is also a complete and excellent translation by Mrs Garnett.

(W. R. M.)

TURI, a Pathan tribe on the Kohat border of the North-West Frontier Province of India. The Turis inhabit the Kurram valley, which adjoins the western end of the Miranzai valley and number nearly 12,000. Though now speaking Pushtu and ranking as Pathans, they are by origin a Turki tribe, of the Shiah sect, who subjected the Bangash Afghans some time early in the eighteenth century. They are strong, hardy, and courageous, and make first-rate horsemen. Their early dealings with the British government were inclined to turbulence, and they were concerned in the Miranzai expeditions of 1851 and 1855 (see MIRANZAI). But the only expedition specially sent against them was the Kurram expedition of 1856 (see KURRAM). Since then they have settled down and engaged in trade. During the Second Afghan War they supplied Sir Frederick Roberts with guides and provisions. In 1892 they voluntarily accepted British administration, and they now furnish a large part of the tribal militia in the Kurram Valley.

TURIN, a city of Piedmont, Italy, capital of the province of Turin, formerly of the kingdom of Sardinia until 1860, and of Italy till the removal of the seat of government to Florence in 1865. Pop. (1906), 277,121 (town), 361,720 (commune), with a garrison of 8500, the town being the headquarters of the I. army corps. The area of the city is 4155 acres, and its octroi circle measures nearly 9 m. Its geographical position is excellent; built upon alluvial soil 784 ft. above sea-level at a short distance from the Alps, it stands upon the river Po, which here runs from south to north just above the confluence of the Dora Riparia. The streets and avenues, almost all of which are straight, cut each other at right angles, forming blocks of houses, here as elsewhere called "islands." As viewed from the east the city stands out boldly against the Alps. Taken as a whole it is modern in aspect, but its regularity of form is in reality derived from the ancient Roman town of Augusta Taurinorum, which formed its nucleus. The mean temperature at Turin (1871–1900) is 53° F. (winter 35°, summer 71°), with an average maximum of 90°, and an average minimum of 17°. Mists are frequent in the winter mornings, and to a less degree in autumn. Snow falls on an average only on seven days per annum. The rainfall averages 34 in.

The cathedral of St John the Baptist is a cruciform Renaissance building dating from 1492–1498, by the Florentine Meo da Caprina. The site was first occupied by a church erected, it is said, by the Lombard duke Agilulf (7th century). Behind the high altar of the cathedral (from which it is separated by a glass screen) is the chapel of the Sudario or Sindone, built (1657–1694) by Guarini as a royal burial-place. The "sudario" from which it takes its name is asserted to be the shroud in which Joseph of Arimathea wrapped the body of Jesus. La Beata Vergine della Consolata, another of Guarini's works, has a tower which originally belonged to the church of St Andrew, founded by the monk Bruning in 1014, and attracts attention by Vincenzo Vela's beautiful kneeling statues of Queen Maria Teresa and Queen Maria Adelaide, as well as by the image of the Madonna, which has the credit of having warded off the cholera in 1835. Other churches of some note are San Filippo Neri (1672–1772), the dome of which fell in just as it was approaching completion under the hands of Guarini and was restored by Juvara, and La Gran Madre de Dio, erected to commemorate the return of the royal family in 1814. Of the secular buildings the more interesting are the Palazzo Madama, first erected by William of Montferrat at the close of the 13th century on the Roman east gate of the town, remains of the towers of which were incorporated in it, and owing its name to the widow of Charles Emmanuel II., who added the west façade and the handsome double flight of steps from Juvara's designs; and the extensive royal palace begun in the 17th century. Many of the palaces have fine pillared court-yards of the baroque period, some of which are the work of Guarini. For the Porta Palatina and other remains of the ancient city walls see below. The citadel, erected in 1565, has been almost entirely demolished. There is practically nothing of the Renaissance period except the cathedral. The Castello del Valentino is a building partly in the French style of the middle of the 16th century. The university, founded in 1400 by Lodovico di Acaja, has faculties of jurisprudence, medicine and surgery, literature and philosophy, and the mathematical, physical and natural sciences. The number of students is about 2500. The old university buildings erected in 1713 by the Genoese architect Ricca proved too small; and new buildings, fitted more especially for the medical and scientific departments, have been erected. The original building contains the valuable library (now national), many of the treasures of which were destroyed by fire in 1906, and a collection of Roman antiquities. The academy of sciences was founded in 1757. It occupies a building erected in 1687 by Guarini as a Jesuit college. The museum of antiquities and the picture gallery, of which it has the custody, are both of high interest—the former for the local antiquities of Piedmont and Sardinia (notably from Industria) and for the Egyptian treasures collected by Donati and Drovetti, and the latter for its Van Dycks and pictures by north Italian masters. There is a museum of zoology and mineralogy in Palazzo Carignano (another of Guarini's buildings), and the royal palace contains the royal armoury (a fine collection made by Charles Albert in 1833) and the royal library with its rich manuscript collection and its 20,000 drawings, among which are sketches by Raphael, Michelangelo, and Leonardo da Vinci. The civic museum has a great variety of artistic and literary curiosities, among them a remarkable collection of autographs and the Lombard missal (1490).

There are many modern public monuments—considerably more than in other Italian towns—and some of them are fine. The Mole Antonelliana, built by Alessandro Antonelli, is the most important example of modern architecture in Turin. It belongs to the municipality, and is used for the Risorgimento Museum. It is the highest brick edifice in Europe, its summit being 510 ft. above ground. It is a square edifice with a large dome and lofty spire, the dome being raised upon a hall with three galleries, one above the other, so that from the floor to the top of the dome is over 300 ft.

Among the hospitals is that called by the name of its founder, Cottolengo, a vast institution providing for more than 5000 persons; there are also the Ospedale Maggiore di San Giovanni, the Ospedale Mauriziano, and many other hospitals for special diseases, as well as asylums and charitable institutions of all kinds.

The industries comprise metallurgy, machine-making, chemicals, silk and cotton weaving, tanning and leather-working. The manufacture of motor-cars has become of great importance, and Turin is the chief seat of the industry in Italy, nearly 5000 workmen being employed. Chocolate, liqueurs and vermouth are also made here. The application of electricity is widely developed on account of the proximity of Alpine valleys rich in torrents. The supply of drinking water is furnished by three aqueducts.

The opening of the St Gothard tunnel exercised a prejudicial influence upon the traffic of the network of railways of which Turin is the centre; and Milan, owing to its nearness both to this and to the Simplon, has become the most important railway centre of Italy. Turin has, however, the advantage of being the nearest to the Mont Cenis, while the completion of the line through Cuneo over the Col di Tenda affords direct communication with the French Riviera. Main lines run also from Turin to Vercelli and thence to Novara and Milan (the direct route), to Casale Monferrato, to Alessandria (and thence to Piacenza or Genoa), to Genoa via Asti and Acqui, to Brà and Savona, and branch lines to Lanzo, Torre Pellice, Aosta, Rivoli, Rivarolo, &c., and steam tramways in various directions.

For administrative purposes the city is divided into two municipal police sections and into seven government districts or *mandamenti*. The military organization is proportionate in importance to the strategical position of Turin near the French frontier. There is a military arsenal with laboratories, a military academy for artillery and engineer officers, a war school, and a military hospital.

Among the surroundings of Turin the Hill of Superga (2300 ft. above the sea) merits special mention. Victor Amadeus II. erected there a votive basilica in memory of the liberation of Turin from the French in 1706. King Charles Albert and other kings and princes of the Savoy dynasty are buried in the crypt. Not far from Turin are also the castles of Moncalieri, Stupinigi, Rivoli, Racconigi, Aglè, Venaria, and the ancient monastery of the Sagra di San Michele (753 metres above sea-level), famous for its view of the Alps as far as the beginning of the Lombard plain.

Turin was always a place of importance and military strength, in spite of numerous vicissitudes, till at length it was made the chief town of Piedmont by Amadeus, first duke of Savoy. Under Emmanuel Philibert it became the usual residence of the ducal family, and in 1515 the bishopric was raised to metropolitan rank by Leo X. Between 1536 and 1562 Turin was occupied by the French, and in 1630 it lost 8000 of its citizens by the plague. The French were masters once more from 1640 to 1706, and again from 1798 till 1814, when Piedmont was restored to the house of Savoy. From 1860 to 1865 Turin was the capital of Italy.

The ancient *Augusta Taurinorum* was a city of Gallia Cisalpina, the chief town of the Taurini. The natural advantages of its site and its position with relation to the pass over the Alpis

Cottia (Mont Genèvre; see COTTII REGNUM) made it important in early times, though it cannot have been very strongly fortified, inasmuch as Hannibal, after crossing the Alps in 218 B.C., was able to take it after a three days' siege. It became a colony either under the triumvirs or under Augustus, and it was then no doubt that it was fortified. It was partly burned down in A.D. 69, but continued to be prosperous, as may be gathered from the remains of its fortifications and from the many inscriptions which have been discovered there. The Roman town formed a rectangle 2526 ft. by 2330; the line of the walls, which were 21 ft. high, 7 ft. thick at ground level and 3 ft. at the top, is well known, inasmuch as they were standing till about 1600; and the north gate, the Porta Palatina, still exists; it has a double opening, and two orders of arches above, and is flanked by two sixteen-sided brick towers. The east gate, similar in character, still exists in part within the Palazzo Madama. The north-west corner tower is also in part preserved, and traces of other parts of the enceinte have been found. The interior of the town was divided by seven streets from east to west and eight from north to south into 72 *insulae*; and the ancient pavement and the drains below it are frequently found under the streets of the central portion of the modern town, indicating that they follow the ancient lines (see especially *Notizie degli Scavi*, 1902, p. 277). In the great extensions which the city has undergone since 1600, the old rectangular arrangement has been followed. Remains of a theatre have been discovered beneath the Palazzo Vecchio, demolished in 1899 (A. Taramelli, in *Notizie degli Scavi*, 1900, p. 3).

See C. Promis, *Storia dell' antica Torino* (Turin, 1869); A. d'Andrade, *Relazione dell' ufficio regionale per la conservazione dei monumenti del Piemonte e della Liguria*, 7 seq. (Turin, 1899).
(T. As.)

TURKESTAN, a name conventionally employed to designate the regions of Central Asia which lie between Siberia on the N. and Tibet, India and Afghanistan on the S., the western limit being the Caspian Sea and the eastern Mongolia and the Desert of Gobi. Etymologically the term is intended to indicate the regions inhabited by Turkish races. How far this name was appropriate in the past need not be considered here; at present the regions called Turkestan not only contain races which do not belong to the Turk family, but it excludes races which do, *e.g.* the Turks of the Ottoman Empire. Nevertheless the term, in its dual application of West Turkestan and East or Chinese Turkestan, has long been established, and in default of any better designations cannot very well be dispensed with.

I.—WEST TURKESTAN

West Turkestan is very nearly, though not quite, coincident with the territories which Russia possesses and controls in Asia, Siberia excepted. Thus it includes (1) the governor-generalship of Turkestan, embracing the provinces of Ferghana, Samarkand, Semiryechensk, and Syr-darya; the provinces of Akmolinsk and Semipalatinsk, and sometimes that of Turgai belonging to the governor-generalship of the Steppes; the Transcaspian region; and the semi-independent states of Bokhara and Khiva. Its total area amounts approximately to 1,290,000 sq. m.

Physical Geography.—Physically this region is divided into two sharply contrasted parts, the mountainous and highland country in the east and the flat steppes and deserts in the west and north. The former are sufficiently described under the heading TIAN-SHAN. It will be enough to say here that the mountainous region belongs to the great orographical flange which runs from south-west to north-east along the north-western margin of the great plateau of Central Asia. Hence it consists (1) partly of ranges, mostly snow-capped, which stretch from south-west to north-east, and which in several cases terminate *en échelon* on the verge of the desert, and (2) partly of ranges which strike away from the above at various angles, but in a predominantly north-western direction. The latter, including such ranges as the Chingiz-tau, Chu-Ili Mountains, Kandyk-tau and Khan-tau, the Ferghana range, the Kara-tau and the Nura-tau, are geologically of later origin than the great border ranges of the Tian-shan proper, *e.g.* Trans-Alai, Alai, Kokshal-tau, Alexander range, Terskei Ala-tau, Kunghei Ala-tau, Trans-Ili Ala-tau and Dzungarian Ala-tau. The Tarbagatai Mountains, still farther north, are often classified as belonging to the Altai system. Generally speaking, the ranges of both categories run at 10,000 to 20,000 ft., though altitudes as high as 23,000 ft. are attained by individual peaks, such as Mt Kaufmann and Khan-tengri. Most of the loftier summits are capped with perpetual snow, and on some of them, *e.g.* Khan-tengri (Mushketov, Semenov, Inylchik) and the Kok-su Mountains (Fedchenko, Shurovsky), south of Peak Kaufmann, there are well-developed glaciers. Nearly all these border ranges rise abruptly and to great heights from the plains on the north or north-west, but have a much shorter and easier descent on the south or south-east. Hence the passes lie at great altitudes, ranging from about 9000 to 14,000 ft. On the other hand the fact of the ranges radiating outwards towards the west, and the further fact that they are in more than one place penetrated by deep depressions (*e.g.* Dzungaria, Kulja, Issyk-kul, Ferghana) for a considerable distance towards the east, greatly facilitate access to the loftier plateau lands of Central Asia, and have from time immemorial been the highways of human intercourse between East and West.

Lowland Plains.

Like the highlands of Siberia, those of Turkestan are fringed by a girdle of plains, having an altitude of 1000 to 1500 ft., and these again are skirted by an immense lowland area reaching only 400, 300 and 150 ft. above sea-level, or even sinking below the level of the ocean. Some geographers divide them into two sections—the higher plains of the Balkash (the Ala-kul and Balkash drainage areas) and the Aral-Caspian depression, which occupies nearly two-thirds of the whole and has been ably described by I. V. Mushketov under the appropriate name of Turanian basin—the Kara-tau Mountains, between the Chu and the Syr-darya rivers, being considered as the dividing line between the two. The Balkash plains, more than 1000 ft. above the sea, and covered with clay, with a girdle of loess at their foot, are well drained by the Ili and other feeders of Lake Balkash and support the numerous flocks and herds of the Kirghiz. To the south-west the clayey soil becomes saline. There is the Famine steppe (Bek-pak-dala), while in the Ak-kum steppe, which surrounds Lake Kara-kul, large areas consist of nothing but sands, partly shifting. The plains and lowlands of the Turanian basin are subdivided by a line drawn from north-east to south-west along a slight range of hills running from the sources of the Ishim towards the south-east corner of the Caspian (Bujnurd and Elburz edge of Khorasan). This low range, which most probably separated the lowlands of the Aral-Caspian region (submerged during the Post-Pliocene period) from the higher plains which had emerged by the end of the Tertiary period, now divides the Transcaspian steppes from the somewhat different higher plains. In the Turanian basin the contrast between desert and oasis is much stronger than in the Balkash region. Fertile soil, or rather soil which can be rendered fertile by irrigation, is limited to a narrow terrace of loess along the foot of the mountains, and is surrounded by barren deserts. Even where the loess stretches out over terraces at some distance from the mountains, as in the south-east of the Transcaspian region, it can be cultivated only when irrigated. Two rivers only—the Syr and the Amu—succeed in getting across the desert and reaching the Sea of Aral. But their former tributaries no longer run their full course: the glacier-fed Zarafshan dries up amid the gardens of Bokhara soon after emerging from the highlands; and the Tejeñ and the Murghab lose themselves in the recesses of the Kara-kum desert. The only tributaries which the Amu retains are those whose whole course is within the highlands. In the north such formerly important tributaries of the Syr-darya as the Chu, with its sub-tributary the Sary-su, now dry up some hundreds of miles before reaching the main stream.

Desiccation.

The whole area is now undergoing geological changes on a vast scale. Rivers have changed their courses, and lakes their outlines. Far away from their present shores the geologist finds indubitable signs of the recent presence of lakes in the shells they have left amid the sands. Traces of former rivers and channels, which were the main arteries of prosperous regions within the period of written history, have now disappeared. Of the highly developed civilizations which grew up and flourished in Bactria, Bokhara and Samarkand the last survivals are now undergoing rapid obliteration with the simultaneous desiccation of the rivers and lakes. The great "Blue Sea" of Central Asia, the Sea of Aral, which at a recent epoch (Post-Glacial) extended south-west as far as Sary-kamysh, and the shells of which are found north and east of its present shores 50 to 200 ft. above its present level (157 ft. above the ocean, and 248 above the Caspian), now occupies but a small portion of its former extent. It fills a shallow depression which is drying up with astonishing rapidity, so that the process of desiccation can be shown on surveys separated by intervals of only ten years; large parts of it, like Aibughir Gulf, have dried up since the Russians took possession of its shores. The whole country is dotted over with lakes, which are rapidly disappearing under the hot winds of the deserts.

Geology.[1]—Like the highlands of eastern Asia, those of Turkestan are mostly built up on Pre-Cambrian gneisses and metamorphic slates, resting upon granites, syenites, old orthoclase porphyries, and the like. These upheavals date from the remotest geological ages; and since the Primary epoch a triangular continent having its apex turned towards the north-east, as Africa and America have theirs pointing southward, rose in the middle of what now constitutes Asia. It is only in the outer foldings of the highlands that Palaeozoic fossiliferous deposits are found—Silurian, Devonian, Carboniferous and Permo-Carboniferous. Within that period the principal valleys were excavated, and their lower parts have been filled up subsequently with Jurassic, Cretaceous and Tertiary deposits. One of the most striking instances of this is the very thick Cretaceous and Tertiary deposits which cover the bottom of the valley of the Vakhsh (right tributary of the Amu) and are continued for about 300 m. to the north-east, as far as the Alai valley—probably along the edge of the Pamir plateau. The deposits of the Secondary period have not maintained their horizontal position. While upheavals having a north-eastern strike continued to take place after the Carboniferous epoch,[1] another series of upheavals, having a north-western strike, and occasioned by the expansion of diabases, dolerites, melaphyres and andesites, occurred later, subsequently at least to the close of the Tertiary period, if not also before it, dislocating former chains and raising rocks to the highest levels by the addition of new upheavals to the older ones. Throughout the Triassic and Jurassic periods nearly all Turkestan remained a continent indented by gulfs and lagoons of the south European Triassic and Jurassic sea. Immense fresh-water lakes, in which were deposited layers of plants (now yielding coal), filled up the depressions of the country. Cretaceous and Tertiary deposits occur extensively along the edge of the highlands. Upper and Middle Cretaceous, containing phosphates, gypsum, naphtha, sulphur and alum, attain thicknesses of 2000 and 5000 ft. in Hissar. Representatives of all the Tertiary formations are met with in Turkestan; but while in the highlands the strata are coast-deposits, they assume an open sea character in the lowlands, and their rich fossil fauna furnishes evidence of the gradual shallowing of that sea, until at last, after the Sarmathian period, it became a closed Mediterranean. During the Post-Pliocene period this sea broke up into several parts, united by narrow straits. The connexion of Lake Balkash with the Sea of Aral can hardly be doubted; but this portion of the great sea was the first to be divided. While the Sea of Aral remained in connexion with the Caspian, the desiccation of the Lake Balkash basin, and its break-up into smaller separate basins, were already going on. The Quaternary epoch is represented by vast morainic deposits in the valleys of the Tian-shan. About Khan-Tengri glaciers descended to a level of 6800 ft. above the sea,[2] and discharged into the wide open valleys or *syrts*. It is most probable that, when allowance has been made for the obliteration of glacial markings, and the region has been better explored, it will appear that the glaciation of Turkestan was on a scale at least as vast as that of the Himalayas. In the lowlands the Aral-Caspian deposits, which it is difficult to separate sharply from the later Tertiary, cover the whole of the area. They contain shells of molluscs now inhabiting the Sea of Aral, and in their petrographical features are exactly like those of the lower Volga. The limits of the Post-Pliocene Aral-Caspian sea have not yet been fully traced. It extended some 200 m. north and more than 90 m. east of the present Aral shores. A narrow strait connected it with Lake Balkash. The Ust-Urt plateau and the Mugojar Mountains prevented it from spreading north-westward, and a narrow channel connected it along the Uzboi with the Caspian, which sent a broad gulf to the east, spread up to the Volga, and was connected by the Manych with the Black Sea basin. Great interest, geological and historical, thus attaches to the recent changes undergone by this basin. Since the theory of geological cataclysms was abandoned, and that of slow modifications of the crust of the earth accepted, new data have been obtained in the Aral-Caspian region to show that the rate of modification after the close of the Glacial period, although still very slow, was faster than had been supposed from the evidence of similar changes now going on in Europe and America. The effects produced by desiccating agencies are beyond all comparison more powerful than those which result from the earthquakes that are so frequent in Turkestan. All along the base of the highlands, from Khojent to Vyernyi, earthquakes are frequent;[3] but their effects lie beyond the scope of our observational methods.

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[1] R. Pumpelly and others, *Explorations in Turkestan* (Washington, 1905), contains references to the geological literature to the date of publication.

Climate.—The climate of West Turkestan is exceedingly dry and continental. Although the country is approximately comprised within the latitudes of Sicily and Lyons, it has a south Norwegian January and a Persian summer. Temperatures of more than 100° F. in the shade are common, and the heat is rendered still more unbearable by the reflection from a soil destitute of vegetation. The winter is for the most part so cold that the average temperature of January is below the freezing point, and even reaches 0° F. Snow falls for several months on the lower Syr-darya, and, were it not blown away by the winds, sledge-communication would be possible. This river is frozen for an average of 123 days every year in its lower parts and nearly 100 days at Perovsk. At Tashkent there is snow during two months and temperatures of − 10° F. have been observed; on the other hand the maximum observation is 108°. To the south of Khojent the winter becomes more clement. Absence of rain is the distinctive feature of the climate. Although it rains and snows heavily on the mountains, only 11 in. of rain and snow fall throughout the year at Tashkent, at the base of the highlands; and the steppes of the lower Amu have less. A few showers are all that fall from the almost invariably cloudless sky above the Transcaspian steppes.

Fauna.—The fauna of Turkestan belongs to the zoo-geographical domain of northern Asia, and is only differentiated by the presence of species which have disappeared from the peripheral parts of the Old World and now find a refuge in the remotest regions of the uninhabited plateau. From the Palaeoarctic region it is distinguished by the presence of Himalayan species. The distinctive animal of the Pamir plateau is the magnificent *Ovis poli* (conjectured to be the ancestor of the common sheep). In the alpine tracts of the Tian-shan, on the borders of the Pamir, their horns and skulls are frequently met with, but there the place of the species is now taken by *Ovis karelini*. The wild horse, which occurred in Poland a few centuries ago, was discovered by Prezhevalsky in the highlands of Dzungaria. The wild camel inhabits the lonely plateaus south of the Ala-shan. The other mammals of Turkestan are mostly those which are met with elsewhere in north Asia. The Himalayan bear (*Ursus isabellinus*) has its home on the Pamir, and the smaller *Leuconyx* up to the highest levels on the Tian-shan. Antelopes, *Lepus lehmanni*, *Lagomys rutilus*, various species of *Arvicolae*, and the Himalayan long-tailed marmot (*Arctomys caudatus*), the most characteristic inhabitant of the alpine meadows, are the only mammals of the Pamir proper. In the alpine region are found the badger (*Meles taxus*), the ermine (*Putorius ermineus*) and six other Mustelidae, the wild dog (*Canis alpinus*), the common and the black-eared fox (*C. melanotis*), while the corsac fox (*C. corsac*) is met with only on the plains. Two species of lynx, the cheetah (*Felis jubata*), *F. manul*, and *F. irbis*, must be added to the above. The tiger is met with only on the lower Amu-darya, except when it wanders to the alpine region in pursuit of the maral deer (*Cervus maral*). The jackal is characteristic of the steppes; it banishes the wolves and foxes. Hares are represented by several species, *Lepus lehmanni* being the most characteristic. Both the common and the long-tailed marmot (*A. baibacinus* and *A. caudatus*) live at the foot of the mountains, as well as four species of *Spermophilus*, three of voles, two of the mouse and three of the hamster. The *Meriones* (four species) and the jerboa (five species) are only met with in the steppe region. Of ruminants, beside the sheep (*O. poli*, *O. karelini*, *O. nigrimontana*, *O. heinsii*), we find one moufflon (*Musimon vignei*), formerly known only in the Himalayas, the Chinese antelope (*Antilope subgutturosa*) and the saiga antelope in the steppes, the Siberian ibex and another goat, the yak, the zebu or Indian ox, the common ox, the camel and the dromedary. The wild boar is common in the reed thickets along the rivers and lakes, where it stays during the winter, migrating to the highlands in summer. The hedgehog and porcupine are common in the plains.

No fewer than 385 species of avifauna are recorded, most of them being middle-European and Mediterranean. A large number were formerly known only in the Himalayas, or in Persia, while others have their origin in East Asia. The commonest are mostly European acquaintances. The insect fauna is truly multitudinous. Among the Lepidoptera of the Pamir there is an interesting mixture of Tian-shan with Himalayan species. G. E. Grum-Grshimailo found on the Pamir the butterfly *Colias nastes*, a species characteristic of Labrador and Lapland; like the alpine plants which bear witness to a Glacial period flora in the Himalayas, this butterfly is a survival of the Glacial period fauna of the Pamir.[4] Of 50 species of molluscs found in Turkestan quite one half are peculiar to the region.

Flora.—As a whole the flora of Turkestan is identical with that of Central Asia, which was formerly continued by geo-botanists as far west as the steppes of Russia, but which must now be considered as a separate region subdivided into two—the Central Asian proper and that of the Gobi. It has its own habitus, notwithstanding the number of species it has in common with Siberia and south-east Russia on the one hand and with the Himalayas on the other, and this habitus is due to the dryness of the climate and the consequent changes undergone by the soil. Towards the end of the Glacial period the Tian-shan Mountains had a flora very like that of northern Caucasia, combining the characteristics of the flora of the European Alps and the flora of the Altai, while the prairies had a flora very much like that of the south Russian steppes. During the Stone Age the human inhabitants lived in forests of maple, white beech and apple trees. But the gradual desiccation of the country resulted

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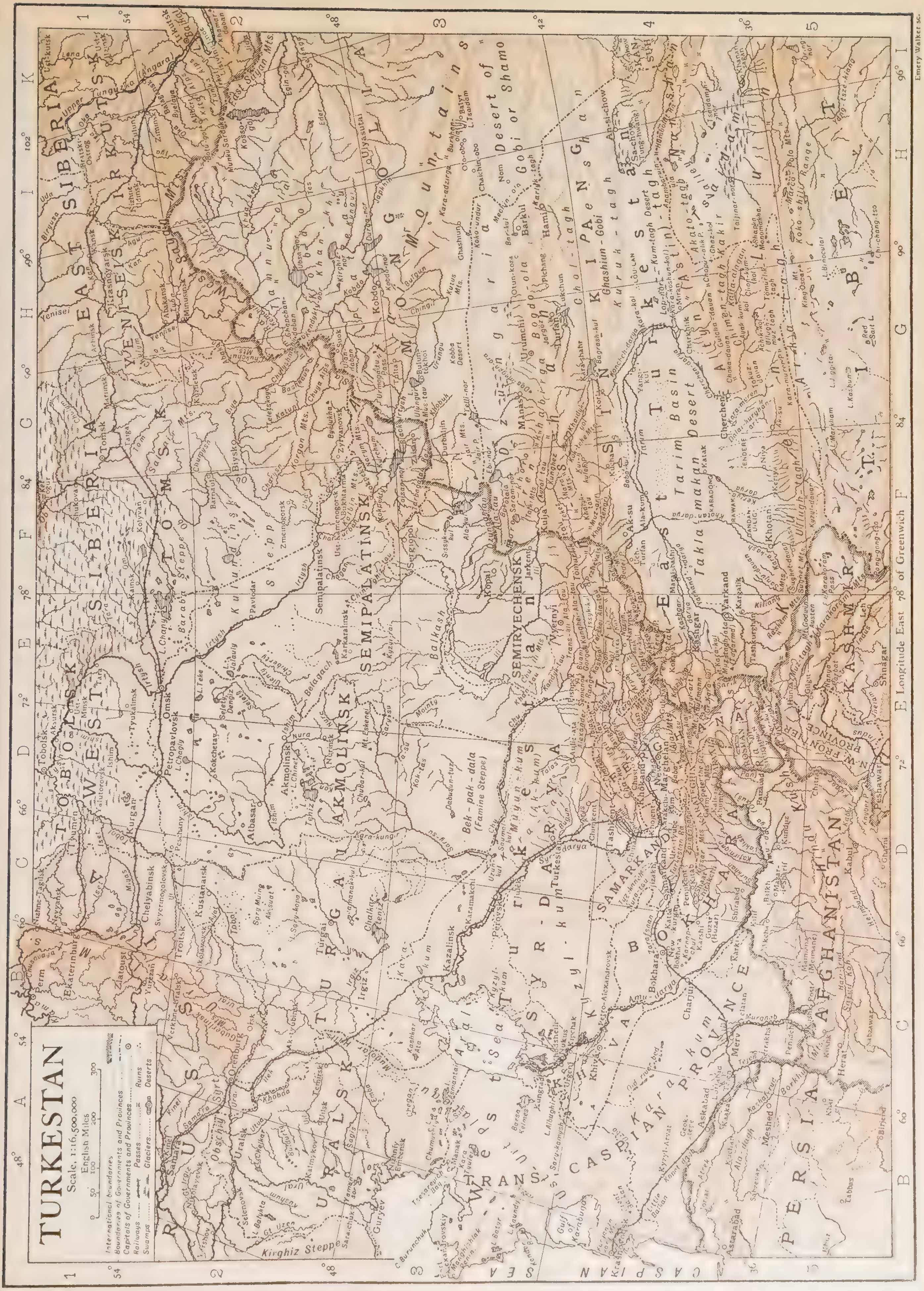
[1] I. V. Mushketov's *Turkestan* (pp. 35, 681) seems to justify this conclusion.

[2] See I. Ignatyev, in *Izvestia* of Russ. Geog. Soc. (1887), vol. xxiii.

[3] Ibid.; also Orlov in *Mem. of Kazan Naturalists* (1873), vol. iii.

[4] For ampler information, see N. A. Syevertsov's "Vertical and Horizontal Distribution of Turkestan Animals," in *Izvestia* of the Moscow Soc. of Amateurs of Nat. Science (1873); A. P. Fedchenko's "Travels in Turkestan" (vols. xi., xix., xxi., xxiv. and xxvi. of the same *Izvestia*), forming a series of monographs by specialists which deal with separate divisions of the animal and vegetable kingdom (the flora by E. A. Regel); Oshanin's *Zoo-Geographical Problems in Turkestan* (Tashkent, 1880); G. E. Grum-Grshimailo's "Flora and Fauna of Pamir," in *Izvestia* of Russ. Geog. Soc. (1886); *Works of the Aral-Caspian Expedition.*


TURKESTAN
Scale, 1:16,500,000
English Miles
0 50 100 200 300
International boundaries
Boundaries of Governments and Provinces
Capitals of Governments and Provinces
Railways
Passes
Ruins
Swamps
Glaciers
Deserts
Longitude East 78° of Greenwich
WEST SIBERIA
EAST SIBERIA
TOBOLSK
TOMSK
YENISEISK
IRKUTSK
MONGOLIA
RUSSIA
URALSK
TURGAI
AKMOLINSK
SEMIPALATINSK
SEMIRYECHENSK
SYR-DARYA
SAMARKAND
FERGHANA
BOKHARA
KHIVA
TRANS-CASPIAN PROVINCE
AFGHANISTAN
PERSIA
KASHMIR
EAST TURKESTAN
TIBET
CASPIAN SEA
Aral Sea
Kirghiz Steppe
Tarim Basin
Takla-makan Desert
Desert of Gobi or Shamo
Emery Walker sc.

in the immigration from the Central Asian plateau of such species as could adapt themselves to the dry climate and soil, in the disappearance of European and Altaic species from all the more arid parts of the region, in the survival of steppe species, and in the adaptation of many of the existing species to the needs of an arid and extreme climate and a saline soil.[1] The Pamir vegetation and that of the Aral-Caspian steppes constitute two types with numberless intermediate gradations.

There is no arboreal vegetation on the Pamir, except a few willows and tamarisks along the rivers. Mountain and valley alike are carpeted with soft grass, various species of *Festuca* predominating. In the immediate vicinity of water the sedge (*Carex physoides*) grows, and sporadic patches of *Altium*. To these may be added a few Ranunculaceae, some *Myosotis*, the common *Taraxacum*, one species of *Chamomilla*, and a few Leguminosae. In the north and west the *Stipa* of the Russian steppes supersedes *Festuca* and affords splendid pasture for the herds of the Kara-Kirghiz. In the gorges and on the better-watered slopes of the mountains the herbaceous vegetation becomes luxuriant. Besides the above-named there are many other Gramineae, such as *Lasiagrostis splendens*, the whole seas of *Scabiosae*. *Eremurus*, 6 to 7 ft. in height, forms thickets along with *Scorodosma foetida*. The northern slopes of the Alai chain are richer in trees. Up to 12,000 ft. full-grown specimens occur of the *archa* or juniper (*Juniperus pseudo-Sabina*), characteristic of the whole northern slopes of the Turkestan highlands, the poplar, spruces, cedars, a very few birches (*B. Sogdiana*), and a copious undergrowth of shrubs familiar in European gardens, such as *Rhododendron chrysanthum*, *Sorbus aucuparia* (rowan), *Berberis heteropoda* (berberry), *Lonicera Tatarica* (honeysuckle) and *Crataegus* (hawthorn). Farther east and north comes the Turkestan pine (*Picea Schrenkiana*), while at lower levels there grow willows, black and white poplars, tamarisk, *Celtis*, as well as *Elaeagnus* (wild olive), *Hippophae rhamnoides* (sallow thorn), *Rubus fructicosus* (blackberry), *Prunus spinosa* (blackthorn) and *P. Armeniaca* (apricot). The characteristic poplar, *Populus diversifolia*, and the dwarf *Acer Lobelii*—very different from the European maple—also occur.

The above applies to most of the highlands of the Tian-shan. The drier southern slopes are quite devoid of arboreal vegetation. On the northern slopes, at the higher levels, *Juniperus pseudo-Sabina* is the only tree that grows on the mountains, and luxuriant meadow grasses cover the *syrts*. Lower down, at 7500 to 8000 ft. the coniferous zone begins, characterized by the *Picea Schrenkiana*. Of course the juniper and a few other deciduous trees also occur. The richest zone is that which comes next, extending downwards to 5000 and 4500 ft. There woods of birch, several species of poplar, the maple (*Acer Semenovii*), and thick underwoods spread over the mountain slopes. Orchards of apple and apricot surround the villages. The meadows are clothed with a rich vegetation—numberless *Paeoniae*, *Scabiosae*, Convolvulaceae, Campanulae, *Eremurus*, Umbelliferae, *Gallium*, Rosaceae, *Altheae*, *Glycyrrhizae*, *Scorodosma foetida* and Gramineae. But as soon as the soil loses its fertile humus it produces only a few *Phlomis*, *Alhagi camelorum*, *Psammae*, *Salsolaceae*, *Artemisiae*, *Peganum* and some poppies and *Chamomillae*, but only in the spring. The invading steppe plants appear everywhere in patches in the Turkestan meadows.

The "culture" or "apricot" zone is followed by the prairie belt, in which black-earth plants (*Stipa* and the like) struggle for existence against invading Central Asian forms. And then come the lowlands and deserts with their moving sandy *barkhans*, *shors* and *takyrs* (see TRANSCASPIAN REGION). Two species of poplar (*P. pruinosa* and *P. diversifolia*), *Elaeagnus angustifolia*, the ash, and a few willows grow along the rivers. Large areas are wholly destitute of vegetation, and after crossing 100 m. of such a desert the traveller will occasionally come upon a forest of *saksaul* (*Anabasis Ammodendron*). Contorted stems, sometimes of considerable thickness, very hard, and covered with a grey cracked bark, rise out of the sand, bearing green plumes with small greyish leaves and pink fruit. Sometimes the tree is a mere knot peeping above the sand with a sheaf of thin branches. In spring, however, the steppe assumes quite another aspect, being clothed, except where the sands are shifting, with an abundance of vegetation. Persian species penetrate into Bokhara and the region of the upper Amu.

Vegetable Products.—As already stated the climate of Turkestan varies considerably from north to south. In Akmolinsk and Semirechensk most of the kinds of corn which characterize Middle Russia are grown. South of the Chu and the Syr-darya gardening is a considerable industry; and, although rye and wheat continue to be the chief crops, the cultivation of the apple, and especially of the apricot, acquired importance. Attempts are also made to cultivate the vine. The inhabitants of the neighbourhood of Tashkent and Samarkand, as well as those of the much more northern but better sheltered Kulja oasis, add the cultivation of the almond, pomegranate and fig. Vines are grown and cotton planted in those districts. Finally, about Khojent and in Ferghana, where the climate is milder still, the vine and the pistachio tree cover the hills, while agriculture and horticulture have reached a high degree of perfection. Successful attempts are being made to grow the tea-plant in the Transcaspian region. Large numbers of oleaginous plants are cultivated, such as sunflower.

Agriculture.—The arable land, being limited to the irrigated terraces of loess, occupies little more than 2% of the whole area of West Turkestan. The remainder is divided between pasture land (less than 44%) and desert (54%). Owing to a very equitable distribution of irrigation water in accordance with Moslem law, agriculture and gardening have reached a high stage of development in the oases. Altogether close upon 4,000,000 acres are irrigated, and the crops are usually taken every year. Wheat, barley, millet, pease, lentils, rice, sorghum, lucerne and cotton are the chief agricultural products. Carrots, melons, vegetable marrows, cucumbers and onions are extensively grown. Rye and oats are cultivated at Kazalinsk and Kopal. Corn is exported. Owing to the irrigation, total failure of crops and consequent famines are unknown, unless among the Kirghiz shepherds. The kitchen gardens of the Mahommedans are, as a rule, admirably kept. Potatoes are grown only by the Russians. The cultivation of cotton is extending rapidly—from 1300 acres in 1883 to 531,000 acres in 1902, of which 402,000 acres were in Ferghana. Sericulture, a growing industry, is chiefly carried on in Ferghana, whence silk cocoons are an important item of export, the output having doubled between 1892 and 1903 (3869 tons). Livestock breeding is extensively pursued. The flocks of sheep on the Kirghiz steppe are so large that the proprietors themselves do not know their exact numbers.

Minerals.—The mineral wealth of Turkestan is considerable. Traces of auriferous sands have been discovered at many places, but the percentage of gold is too poor to make the working remunerative. Silver, lead and iron ores occur in several localities; but the want of fuel is an obstacle to their exploitation. The vast coal-beds of Kulja and some inferior ones in Samarkand are not seriously worked. The petroleum wells of Ferghana and the beds of graphite about Zairamnor are neglected. There are abundant deposits of gypsum, alum, kaolin, marble and similar materials. Asphalt is obtained in Ferghana. Notwithstanding the salt springs of Ferghana and Syr-darya, the salt lakes of the region, and the rock-salt strata of the Alexander Mountains, salt is imported.

Industry and Trade.—Turkestan has no manufacturing industry carried on by means of machinery, except distilleries and establishments for dressing raw cotton. These last have greatly increased in number; over a score are driven by steam and about a hundred by water. But there is a great variety of artisan work, such as copper and brass, paper, knives (at Bokhara), silver filigree, shoes, caps (at Samarkand and Andijan) and carpets; but most of these have been for some time declining and now stand at a rather low level. Trade is very actively carried on. Tashkent and Bokhara are the chief commercial centres, the principal articles of export to Russia, via Orenburg and Semipalatinsk, being raw cotton and silk, cattle and their products, while manufactured wares are imported in return. There is also an import and export trade to and from Urumchi and China, via Kulja and Ak-su.

Population.—Turkestan has been the theatre of so many migrations and conquests that its present population could not fail to be very mixed. Both Aryans and Mongols have their representatives there, the former settled for the most part, the latter chiefly nomad. The Ural-Altaians are numerically the predominant element, and consist of Turkomans, Kirghiz, Uzbegs and Sarts. The Turkomans inhabit chiefly the Transcaspian region. They number less than a quarter of a million. The Kara-Kalpaks ("Black Bonnets") number about 104,000. They are supposed to be recent immigrants to Syr-darya, having come from the former Bulgarian Empire on the middle Volga. Their language and habits are the same as those of the Kirghiz; but for the last century and a half they have had some acquaintance with agrculture. Their pacific temper exposed them to the raids of the Kirghiz, who compelled them first to settle in Dzungaria, then to move their dwellings several times, and ultimately (in 1742) to recognize the sovereignty of Russia. Even since that time they have been driven by the persecution of their old enemies to cross the Aral-Caspian steppes and seek refuge near Astrakhan. The real masters of the steppes and highlands of Turkestan are the Kirghiz, of whom there are two branches—the Kazak (Cossack) Kirghiz, who number about 3,787,000, and the Kara (Black) Kirghiz or Burut, who number nearly 202,000. The Uzbegs, who played a predominant political part in Turkestan before the Russian conquest, are of Turko-Tatar origin and speak a pure Jagatai (Turkish) dialect; but they are mixed to a great extent with Persians, Kirghiz and Mongols. They are subdivided into clans, and lead a semi-nomadic life, preserving most of the attractive features of their Turkish congeners—especially their honesty and independence. They number some 726,500 in all. When settled they are mostly designated Sarts—a name which has reference more to manner of life than to anthropological classification, although a much stronger admixture of Iranian blood is evident in the Sarts, who also speak Persian at Khojent and Samarkand. Their numbers amount to very nearly 1,000,000. Taranchi or Taranji ("labourer" in Chinese) is the name given to those Sarts who were settled in the Kulja region by the Chinese government after the rising of 1758. They constitute about two-fifths of the population of Kulja. The origin of the Dzungans is somewhat problematical. They number nearly 20,000, and inhabit the valley of the Ili in Kulja and partly are settled in Russian Turkestan. They are Mahommedans, but have adopted Chinese manners of life. The Mongol branch is represented in Turkestan by Kalmucks (191,000) and Torgutes (Torgod) in the north-east and in Kulja, where they are intermingled with Solons, Sibos and Chinese. The Aryan Tajik, the aborigines of the fertile parts of Turkestan, were subdued by the Turko-Mongol invaders and partly compelled to emigrate to the mountains, where they are now known as Galchas. They number over 350,000 and constitute the intellectual element of the country and are the principal owners of the irrigated land—the Uzbegs being their labourers—merchants, and mollahs or priests. They are Sunnite Mussulmans. The other representatives of Aryan race in Turkestan are a few (8000) Persians, mostly liberated slaves; Indians (300), who carry on trade and usury in the cities; a few Gipsies (800), and the Russians. Among these last two distinct elements must be noticed—the Cossacks, who are settled on the borders of the Kirghiz steppe and have assumed many Kirghiz habits, and the peasant-settlers, who are beginning to colonize the valley of the Ili and to spread farther south. Inclusive of the military, the Russians number about 100,000. The total population numbers approximately 9,000,000.

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[1] See Krasnov's researches in *Izvestia* of Russ. Geog. Soc. (1887), vol. xxiii.

Notwithstanding immigration, the Russians still constitute a very small proportion of the population, except in the province of Semiryechensk, where the Cossacks, the peasants, and the artisans in towns number 130,000, and, with the Russian troops, constitute 14% of the aggregate population. The only other province containing any considerable number of Russians is Syr-darya, where there are about 10,000 settlers (less than 1% of the population). About 12,000 Russians are settled in Bokhara and about 4000 in Khiva. The total estimated population of Russian Turkestan in 1906 was 5,746,600.

There are several populous cities in Russian Turkestan. Its capital, Tashkent, in the Syr-darya province, had 156,414 inhabitants in 1897, and other cities of importance are Samarkand (58,194), Marghilan (42,855 in Old Marghilan, and 8977 in New Marghilan) in Ferghana, Khojent (31,881) in Syr-darya, Khokand (86,704), Namangan (61,388) and Andijan (49,682) in Ferghana.

Education.—In the way of education nearly everything has still to be done; but a technical school and an experimental agricultural station with a school have been opened at Tashkent.

Railways.—Turkestan possesses only two railway systems; the Transcaspian line and the Orenburg-Tashkent line. The former, built in 1880–1888, starts at Krasnovodsk on the Caspian and runs east-south-east between the Kara-kum desert and the Kopet-dagh Mountains until it reaches the oasis of Tejen. Then it turns north-east via Merv to Bokhara and Samarkand, the total distance being 940 m. From Samarkand it is continued east-north-east via Khojent to Andijan (330 m.), sending off on the way a branch to Tashkent (94 m.). This last city was in 1905 connected by rail via Perovsk, Kazalinsk, and Irgiz with Orenburg (1149 m.).

General Condition.—Populous cities adorned with fine monuments of Arabian architecture, numerous ruins of cities decayed, grand irrigation canals now lying dry, and written monuments of Arabian literature testify to a time when civilization in Turkestan stood at a much higher level than at present. This period was during the first centuries after its conversion to Islam. Now all is in decay. The beautiful mosques and *madrasas* (theological colleges) are dilapidated; no astronomers study the sky from the tops of their minarets; and the scholars of the *madrasas* waste their time on the most deplorably puerile scholasticism. The inspiration of early belief has disappeared; the ruling motive of the mollahs (priests) is the thirst for personal enrichment, and the people no longer follow the khojas or theologians. The agricultural labourer has preserved the uprightness, diligence and sobriety which characterize the Turkish peasant; but the richer inhabitants of the cities are grossly sensual.

It remains, however, an open question whether the Russians will be able to bring new vigour to the country and awaken intellectual life. The followers of Islam, whose common law and religion know only of a temporary possession of the land, which belongs wholly to the Prophet, cannot accept the principles of unlimited property in land which European civilization has borrowed from Roman law; to do so would put an end to all public irrigation works and to the system by which water is used according to each family's needs, and so would be fatal to agriculture. The Russians have abolished slavery; and their rule has put an end to the interminable intestine struggles which had weakened and desolated the whole region. The barbarous tortures and executions which rendered Khiva notorious in the East are no longer heard of; and the continual appeals of the khojas for "holy" war against their rivals find no response. But the Russian rule has imposed many new taxes, in return for which Turkestan only gets troops of Russian merchants and officials, who too often accept the worst features of the depraved Mussulman civilization of the higher classes of the country. Schools are being diligently built; but the wants of the natives are subordinated to the supposed necessities of Russification. A consulting hospital for Mahommedan women has been opened by women graduates in medicine at Tashkent.

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II.—EAST TURKESTAN

East or Chinese Turkestan, sometimes called Kashgaria, is a region in the heart of Asia, lying between the Tian-shan ranges on the north and the Kuen-lun ranges on the south, and stretching east from the Pamirs to the desert of Gobi and the Chinese province of Kan-su (98° E.). The country belongs to China, and to the Chinese is known as Sin-kiang; but administratively the Chinese province of Sin-kiang crosses over the Tian-shan and includes the valleys of Kulja or Ili and Dzungaria on the north.

Physical Geography.—Along with the desert of Gobi East Turkestan occupies the lower terrace of the great central Asian plateau, which projects from the Himalayas north-east towards the Bering Straits. But though it is in reality an elevated plateau, with a general altitude of 4600 down to 2675 ft., it is nevertheless a depression when compared with the girdle of mountains which surround it on every side except the east, and even on that side it is shut in by the crumbling remains of a once mighty mountain system, the Pe-shan (see GOBI). The region as a whole slopes very gently towards the Lop district, where the lake, or rather marsh, of Kara-koshun, in 39° 51′ N. and 89° 24′ E., lies at an altitude of 2675 ft. This is not, however, the absolutely lowest point in East Turkestan: that is found in the local depression of Turfan-Lukchun, south-east of Urumchi, between the Chol-tagh and the Bogdo-ola ranges of the Tian-shan. The deepest part of that depression lies 56–426 ft. *below* the level of the sea; but this remarkable pit in the surface is of very limited area, for within less than 30 m. to the north the level rises up to 250 ft. (at the town of Turfan) and to 3500 ft. in the Chol-tagh only 12 m. to the south, while at Pichang, 60 m. east, it is 3400 ft. above the sea, and immediately behind Turfan the Jargöz Mountains run up to an altitude of 10,000 ft. There are also two other depressions which lie at a lower altitude than the Kara-koshun, but they lie, one (Kulja or Ili) among the Tian-shan ranges and the other (Dzungaria) beyond them. The town of Kulja, which stands about the middle of the Chinese part of the valley of the Ili river, has an altitude of 2165 ft., but the valley of Dzungaria ranges at 900 to 3000 ft., and in the lakes (*e.g.* Ebi-nor) which dot its surface it descends to 820 ft. The mountain ranges which shut off East Turkestan from the rest of the world rank among the loftiest and most difficult in Asia, and indeed in the world. The Kuen-lun on the south rise steeply from the flat deserts of the Takla-makan and Kum-tagh by successive terraces until they reach an elevation of 19,000 to 20,000 ft. on the summit of the Tibetan plateau. The passes in them range generally at altitudes of 10,000 ft. to 18,300 ft. (*e.g.* Kyzyl-davan, 16,900 ft.; Sughet-davan, 17,825 ft.; a pass in the Arka-tagh 18,300 ft.). On the west East Turkestan is generally approached from India by the famous pass of Karakorum (18,300 ft.), from Ferghana and West (Russian) Turkestan by the passes of Kyzyl-art (14,015 ft.) and Terek (12,730 ft.), and the mountains on this side attain to altitudes of 25,780 ft. in the Muz-tagh-ata or Tagarma, of 23,000 ft. in the Kaufmann Peak, in the Trans-Alai range, and of 19,680 ft. in the Alai range. The Tian-shan Mountains skirt East Turkestan on the north-east, where the Kok-shal-tau range rises to 16,000 to 18,000 ft. and is crossed by passes (*e.g.* Bedel and Jan-art) which reach 13,000 to 14,500 ft., and on the north, where the mountain knot of Khan-tengri has an altitude of 22,800 ft. and the Bogdo-ola and Karlyk ranges run up to 15,000 to 18,000 ft., while the passes (*e.g.* Muz-art on the north-east shoulder of Khan-tengri) climb up to 8000 to 12,000 ft. But here two natural gaps or gateways, those of Urumchi at 2790 ft. and Otun-koza at 2390 ft., facilitate communication between the basins of the Tarim and the Ili (Dzungaria). The Pe-shan swelling, with its flanking ranges of the Chol-tagh and Kuruk-tagh, which, by gradually approaching the Nan-shan section of the Kuen-lun in about 98° E., narrow the desert, are a good deal lower, namely 5000 to 9000 ft.

Within this mountain girdle lies the basin of the Tarim, extending over an area of 354,000 sq. m., but of this 51·2% consists of arid and almost impassable deserts, namely the Takla-makan (*q.v.*), the desert of Lop, the Ghashiun Gobi, and the desert of Kum-tagh, which are described under GOBI. The principal stream is, of course, the Tarim, about 1000 m. in length. It is virtually composed of the Yarkand-darya, the Kashgar-darya, and the Ak-su-darya, with constant augmentation from the Koncheh-darya, which drains Lake Bagrash-kul (at the south foot of the eastern Tian-shan), and intermittent augmentation from the Khotan-darya and the Cherchen-darya from the south. The basin of the Tarim contains, indeed, numerous other streams, most of them summer torrents seaming the flanks of the encircling mountains, but once no doubt affluents of the Tarim, though now all swallowed up in the desert soon after quitting the shelter of the mountains. The Tarim, which is on the whole a sluggish, shallow, winding stream, fringes the great desert of Takla-makan on the west, north and east, and, after being extensively drawn upon for irrigation purposes in the oases (Yarkand, Kashgar, Maral-bashi, Ak-su), through which it passes, it eventually dies away in the salt reed-grown lake or marsh of Lop-nor (Kara-koshun). Along the south foot of the Tian-shan, and in the high valleys which intervene between the constituent ranges of that system, there exist numerous flourishing oases, such as Uch-turfan, Ak-su, Kucha, Korla, Kara-shahr, Hami, Barkul, Turfan, Urumchi, Manas and Kulja. A similar string of oases exist all along the north foot of the Kuen-lun, *e.g.* Kargalik, Khotan, Keriya, Niya, Cherchen, Charkhlik, Sa-chou, and An-hsi-chou, but these settlements, some of them of very great antiquity, have to maintain a constant fight against the encroachments of the desert sand. In broad, general terms the Takla-makan may be described as a tumbled sea of sand, with waves (*barkhans* or sand-accumulations) as much as 300 ft. in height, diversified by occasional patches of hard clay, mostly elongated from north-east to south-west, between the ridges of the dunes. In the deserts that lie east of the Lop-nor the sand is not piled up to such great heights, nor is it generally of such a shifting character. There are ampler expanses of hard saliferous clay (*shor*) and on the north side of the desert of Lop the surface has been carved and sculptured by the wind into innumerable flat, table-topped masses (*jardangs*) with vertical or even overhanging sides, separated from one another by deep-cut, wind-swept gullies, running from north-east to south-west. During the later Tertiary period all these desert regions would appear to have been covered by an Asian Mediterranean or, at all events, by vast fresh-water lakes, a conclusion which seems to be well warranted by the existence of salt-stained depressions of a lacustrine character; by traces of former lacustrine shore-lines, more or less parallel and concentric; by discoveries of vast quantities of fresh-water mollusc shells (*e.g. Limnaea* and *Planorbis*); the existence of belts of dead poplars, patches of dead and moribund tamarisks, and vast expanses of withered reeds, all these crowning the tops of the jardangs, never found in the wind-scooped furrows; the presence of ripple-marks of aqueous origin on the leeward side of the clay terraces and in other wind-sheltered situations; and, in fact, by the general conformation, contour lines, and shapes of the deserts as a whole. From the statements of older travellers, like the Venetian Marco Polo (13th century) and the Chinese pilgrim Hsüan Tsang (7th century), as well as from other data, it is perfectly evident, not only that this country is suffering from a progressive desiccation, but that the sands have actually swallowed up cultivated areas within the historical period.

Climate.—The climate is characterized by great extremes and a wide range of temperature, not only between summer and winter, but sometimes also in the course of twenty-four hours. In the desert of Gobi the thermometer descends as low as −19·3° F. in January, and in the desert of Cherchen as low as −26° in the same month, and snow falls in winter even in the heart of the latter desert. At Yanghi-kol (40° 52′ N. and 86° 51′ E.), beside the lower Tarim, the January mean is −1·3° F., the June mean 88°, and the lowest minimum recorded −14° (February). In both the desert of Gobi and in the desert of Lop a diurnal range of 44° has been observed. The lower Tarim begins to freeze early in November. As regards the summer temperature, as early as the 12th of March a reading of 70·5° has been obtained in the desert of Lop, and as high as 90° at Charkhlik early in May. In June beside the lower Tarim the thermometer has registered 104° before a buran, 77° during its continuance, and 48·7° at night. At Kashgar (alt. 4275 ft.) the mean temperature for the year is 55·4°, the January mean 21·2°, and the July mean 81·5°; at Yarkand (alt. 4165 ft.) the annual mean is 54·0°, the January mean 20·3°, and the July mean 81·4°. In the Lukchun depression (55 ft. below sea-level), which is situated at approximately the centre of the Asiatic continent (42° 42′ N. and 89° 42′ E.), the climate is fairly typical of Central Asia, the mean for the year being 55·5°, for January 16·7° and for July 89·6°; in other words, while the summer is as hot as in the Sahara, the winter is as cold as at St Petersburg. Minimal observations of −4·0° and −4·5° have been taken at Yarkand and Lukchun respectively, and maximal observations of 103·2° and 109·5° at the same two places. The atmosphere in the desert regions is remarkably dry, and though a little rain falls occasionally on the lower slopes of the mountains, scarcely any falls in the desert, at the most a smart shower at intervals of several years. At Kashgar the annual rainfall amounts to less than 18 in. During a large part of the year, and more especially in spring, the atmosphere is heavily charged with sand, and blinding sandstorms (*burans*) are of frequent occurrence.

Fauna.—In the more arid regions animal life is naturally not abundant. The tiger and wild boar haunt the thickets beside the Tarim, wild duck and wild geese throng its waters, and more especially the waters of its marginal and deltaic lakes. There also the wild swan is found. Antelopes, hares and occasionally the lynx, fox, deer, rats, vultures, crows, ravens, hawks, with lizards are other denizens of the borders of the deserts. The wild camel frequents the scattered oases along the margins of the desert and roams into the desert itself. Gadflies and mosquitoes are a veritable plague around the lakes of the lowlands in the hot weather. In the higher mountainous parts animal life is more abundant, the typical forms being the wild yak, the *kulan* or wild ass, the arkhari or wild sheep, the orongo and other antelopes, the marmot, wolf, hare partridge and bear. Fish are plentiful in the lower Tarim and in its lakes.

Vegetable Products.—In the desert regions vegetation is, of course, extremely scanty, being restricted almost entirely to the tamarisk, *Elaeagnus*, tussock grass, and a few *Salsolaceae*. Poplars and in some places willows grow along the river-sides, and dense reed brakes, often 6 to 10 ft. high, fill the lakes and dot the quieter reaches of the river beds. But as the slopes of the mountains are ascended the rainfall becomes more copious and grass makes its appearance, together with a few species of arboreal vegetation, such as the juniper. What cultivation there is, is confined to the oases which nestle at the foot of the mountains all round the Tarim basin. The soil in them is of great fertility wherever it is irrigated, and despite the supineness of the Chinese authorities, irrigation is very extensively practised in nearly all the oases. Excellent crops of wheat, barley, maize, sesame, millet, cotton, opium, tobacco and rice are grown, and several of the oases, *e.g.* Khotan, Kashgar, Korla, Turfan and Hami, are famous for their orchards, in which cucumbers, the mulberry, apple, pear, apricot, peach, melon, grape, pomegranate and walnut ripen to perfection.

Population.—The people who inhabit the plains and mountain slopes of East Turkestan consist partly of Aryans and partly of races of Ural-Altaic stock, and are partly of mixed blood. In Dzungaria they are Dzungans or Dungans, a Turko-Tatar tribe who nominally profess Mahommedanism, and in Kulja they are Kirghiz, Tatars, Mongols, Dungans and others. The agricultural population of the oases are principally of Turkish stock, powerfully influenced by Aryan blood. The townsmen are more distinctly Turkish, *i.e.* Sarts and Uzbegs. The language universally spoken is Jagatai Turkish. Kirghiz graze the slopes of the Tian-shan. The trade is mostly in the hands of the Chinese, natives of West Turkestan (known as Andijanis from the town of Andijan) and Hindus. The total population, excluding Kulja and Dzungaria, is estimated by A. N. Kuropatkin at 1,200,000, by M. V. Pyevtsov at 2,000,000, and by Sven Hedin at 1,800,000 to 2,000,000. The last named distributes it thus—1,500,000 rural, 200,000 urban, and 100,000 shepherds. The principal towns and their populations are Yarkand, 100,000; Khotan, 40,000; Kashgar, 33,000; Ak-su, 15,000; Keriya, 12,000; and Kulja, 20,000. The population of Dzungaria is estimated at 600,000 and of Kulja at 150,000. The prevailing religion all over East Turkestan is Mahommedanism. The country belongs politically to China, and Chinese fill all the higher administrative positions and form the garrisons in the towns. The region is divided into the administrative districts of Kashgar, Yarkand, Ak-su and Urumchi. The capital is the town of Urumchi.

Industries.—In addition to agriculture, the breeding of livestock, more especially sheep, camels, horses and asses, fishing in the waters of the lower Tarim, and the transportation of merchandise are all important means of livelihood. East Turkestan contains several minerals, such as gold, mined to a very small extent in the Kuen-lun Mountains; lead found in the country west of Kashgar and once worked in the Kuruk-tagh, and copper and petroleum near Kashgar; coal exists in abundance in the Kulja valley and is found at Ak-su, Korla, Kara-shahr, Turfan and Hami on the northern verge of the deserts. Salt is obtained from stagnant lakes and from certain parts of the desert. Jade, which is very highly valued by the Chinese for making into ornaments, vases, cups, &c., has been extracted from time immemorial, and is still extracted to-day at Khotan. In a region like East Turkestan, where the settlements are so scattered and the population so thin, the arts and crafts are prosecuted necessarily on only a local scale. Nevertheless certain of the oases are famous individually for one or more handicrafts: for instance, Khotan for its silks, white carpets and felt goods; Kashgar and Turfan for cottons, Kucha and Kara-shahr for leather and saddlery, Ak-su for felts and leather and metal goods, Yarkand for silks, carpets and felts, and Urumchi and Uch-Turfan for sulphur.

Trade and Communications.—A considerable amount of trade is done in the export of wool, hides, cotton, carpets, silks, felts, cereals (wheat, barley, maize, rice), sheep, fruit and vegetables, and in tea, silver, porcelain and opium imported from China, cloth and groceries from India, and cloth, cottons, silks, sugar, matches and leather from West Turkestan and Russia. The entire trade with India does not exceed £200,000 per annum. Traffic is carried on principally by means of caravans of camels, horses, asses and oxen. The caravan routes mostly followed between China and the more populous centres (Kashgar and Yarkand) of East Turkestan start from An-si-chow and Sa-chow respectively, converge upon Hami on the north side of the Pe-shan swelling, and continue westward along the south foot of the Tian-shan Mountains through the oases of Turfan, Kara-shahr, Korla, Kucha, Ak-su and Uch-turfan. From Hami other routes proceed to Barkul and to the main caravan road which skirts the southern edge of the Dzungarian valley and leads to Vyernyi in the Russian province of Semiryechensk. A similar branch route strikes off at Turfan and cuts through the Tian-shan ranges at Urumchi. Ak-su is an important trading town. From it three routes start for West Turkestan; the one principally used climbs over the Bedel pass (13,000 ft.) in the Kokshal-tau and makes a detour round the east and along the north side of the Issyk-kul, while the others cross over the Muz-art pass (12,000 ft.), on the north-east shoulder of Khan-tengri, and the Terek pass (12,730 ft.) respectively, the latter into Ferghana. Kashgar has connexion with Ferghana and Bokhara over the Kyzyl-art pass (14,015 ft.) and down the Alai valley. Yarkand and Khotan communicate with India over the lofty pass of Karakorum (18,300 ft.) and through Leh in Ladak, and thence over the difficult pass of Zoji-la (11,500 ft.). There is another route between Kashgar and China along the southern edge of the desert via Lop-nor, but it is not much used. A telegraph line was constructed between Lanchow in the Chinese province of Kan-su and Turfan in 1893.

History.—It appears very probable that at the dawn of history East Turkestan was inhabited by an Aryan population, the ancestors of the present Slav and Teutonic races, and that a civilization not inferior to that of Bactria had already developed at that time in the region of the Tarim.[1] Our knowledge, however, of the history of the region is very fragmentary until about the beginning of the Christian era. When the Huns (Hiung-nu) occupied west and east Mongolia in 177–165 B.C., they drove before them the Yue-chi (Yutes, Yetes or Ghetes), who divided into two hordes, one of which invaded the valley of the Indus, while the other met the Sacae in East Turkestan and drove them over the Tian-shan into the valley of the Ili. Thus by the beginning of our era the Tarim region had a mixed population of Aryans and Ural-Altaians, some being settled agriculturists and others nomads. There were also several independent cities, of which Khotan was the most important. One portion of the Aryans emigrated and settled in what is now Wakhhan (on the Pamir plateau), the present language of which seems very old, dating anterior to the separation of the Vedic and Zend languages. Between 120 and 101 B.C. the Chinese extended their rule westwards over East Turkestan as far as Kashgar. But their dominion seems to have been merely nominal, for it was soon shaken off. By the end of the 5th century the western parts fell under the sway of the "White Huns" (Ephthalites, or Tochari), while the eastern parts were under Tangut (Thygun) dominion. The Chinese, however, still retained the region about Lop-Nor. Buddhism penetrated into the country at an early date, and possessed famous monasteries there in the 5th and 7th centuries. There were also at the same time followers of Zoroastrianism, of Nestorian Christianity, and even of Manichaeism. An active trade was carried on by means of caravans, corn and silk especially being mentioned at a very early date. The civilization and political organization of the country were dominated by the Chinese, but were also influenced to some extent by Graeco-Bactrian civilization, which had probably secured a footing in the country as early as the 3rd century B.C. Our information as to the history of this region from the 2nd century to the first half of the 7th is slight, and is derived chiefly from the *Journeys* of the Chinese pilgrims, Fa-hien in 399–415, Song-yun and Hwei-seng in 518–521, and Hsüan-Tsang in 629–645. By this time Buddhism had reached its culminating point: in Khotan there were 100 monasteries and 5000 monks, and the Indian sacred literature was widely diffused. But already there were tokens of its decay; even then the eastern parts of the Tarim basin seem to have been growing less and less populous. To the east of Khotan, cities which were prosperous when visited by Song-yun had a century later fallen into ruins.

Little is known about these regions during the 7th, 8th and 9th centuries. In the 7th century the Tibetan king, Srong-btsan, with the help of the western Turks, subjugated the western part of the Tarim basin. During the following century the Mahommedans under Kotaiba ibn Moslim, after several excursions into West Turkestan, invaded (712–13) East Turkestan, penetrating as far as Turfan and even China. The Chinese supremacy was not shaken by these invasions. But, on the outbreak of internal disturbances in China, the Tibetans took possession of the western provinces of China, and intercepted the communications of the Chinese with Kashgaria, so that they had to send their troops through the lands of the Hui-khe (Hoei-ke, or Hoei-hu). In 790 the Tibetans were masters of East Turkestan; but their rule was never strong, and towards the 9th century we find the country under the Hoi-he. Who these people were is somewhat uncertain. According to Chinese documents they came from the Selenga; but most Orientalists identify them with the Uighurs. In the opinion of M. Grigoriev,[2] the Turks who succeeded the Chinese in the western parts of East Turkestan were the Karlyk Turks, who extended farther south-west up to Kashmir, while the north-eastern parts of the Tarim region were subdued by the Uighurs. Soon Mongol hordes, the Kara-Kitais, entered East Turkestan (11th century), and then penetrated into West Turkestan. During the following century the Mongol conqueror Jenghiz Khan overran China, and Turkestan and Kashgaria fell under his rule in 1220, though not without strenuous resistance followed by massacres. The Mongol rule was, however, not very heavy, the Mongols merely exacting tribute. In fact, Kashgaria flourished under them, and the fanaticism of Islam was considerably abated. Women again acquired greater independence, and the religious toleration then established permitted Christianity and Buddhism to spread freely. This state of affairs lasted until the 14th century, when Tughlak Timur, who extended his dominions to the Kuen-lun, accepted Islam. He transferred his capital from Ak-su to Kashgar, and had a summer residence on the banks of the lake Issyk-kul. His son reigned at Samarkand, but was overthrown by Timur (Tamerlane), the Mongol sovereign of Samarkand, who, to put an end to the attacks of the wild Tian-shan tribes, undertook in 1389 his renowned march to Dzungaria, which was devastated, East Turkestan also suffering severely.

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[1] Such is the conclusion reached by C. Lassen, *Indische Alterthumskunde* (4 vols., Bonn, 1844–1861), and supported by M. Grigoriev (Ritter's *Asien* in Russ. trans.; addenda to "East Turkestan"). In connexion with the objection based upon the sub-boreal character of the regions which were the cradle of the Aryans, as proved by the so-called palaeontology of the Aryan languages, it may be observed that by the end of the Glacial, and during the earlier Lacustrine (Post-Glacial) period, the vegetation of Turkestan and of Central Asia was quite different from what it is now. It was Siberian or north European. The researches by M. Krasnov (in *Izvestia* of Russ. Geog. Soc., St Petersburg, 1887, vol. xxiii.) as to the characteristics of the former flora of the Tian-shan, and the changes it has undergone in consequence of the extremely rapid desiccation of Central Asia, must be carefully borne in mind in all speculations founded upon the testimony of language as to the original home of the Aryans.

[2] See Ritter's *Asien*: "East Turkestan" (Russ. trans.), ii. 282; also A. N. Kuropatkin's *Kashgaria* (1883).

The reintroduction of Islam was of no benefit to the Tarim region. In the 14th and 15th centuries Bokhara and Samarkand became centres of Moslem scholarship, and sent great numbers of their learned doctors to Kashgaria. Rubruquis, who visited East Turkestan in 1254, Marco Polo between 1271 and 1275, and Hoïs in 1680, all bore witness to great religious tolerance; but this entirely disappeared with the invasion of the Bokharian mullahs or Mahommedan priests. They created in East Turkestan the power of the *khojas*, or "theologians," who afterwards fomented the many intestine wars that were waged between the rival factions of the White and the Black Mountaineers. In the 17th century a powerful Kalmuck confederation arose in Dzungaria, and extended its sway over the Ili and Issyk-kul basins, having its capital on the Ili. To this power or to the Kirghiz the "Whites" and "Blacks" alternately appealed in their struggles, in which Yarkand supported the latter and Kashgar the former. These struggles paved the way for a Chinese invasion, which was supported by the White khojas of Kashgar. The Chinese entered Dzungaria in 1758, and there perpetrated an appalling massacre, the victims being estimated at one million. The Kalmucks fled, and Dzungaria became a Chinese province, with a military colonization of Sibos, Solons, Dahurs, Chinese criminals and Moslem Dzungars. The Chinese next re-conquered East Turkestan, marking their progress by massacres and transporting 12,500 partisans of independence to the Ili (Kulja) valley. Hereupon the dissentient khojas fled to Khokand in West Turkestan, and there gathered armies of malcontents and fanatic followers of Islam. Several times they succeeded in overthrowing the Chinese rule—in 1825, in 1830 and in 1847—but their successes were never permanent. After the "rebellion of the seven khojas" in 1847 nearly 20,000 families from Kashgar, Yarkand and Ak-su fled to West Turkestan through the Terek-davan pass, many of them perishing on the way. In 1857 another insurrection broke out; but a few months later the Chinese again took Kashgar. In the course of the Dzungarian outbreak of 1864 the Chinese were again expelled; and Yakub Beg became master of Kashgar in 1872. But five years later he had again to sustain war with China, in which he was defeated, and East Turkestan once more became a Chinese province.

Antiquities.—In 1896 Dr Sven Hedin discovered in the desert not far from the town of Khotan, in a locality known as Borasan, objects in terra-cotta, bronze images of Buddha, engraved gems, coins and MSS.; the objects, which display artistic skill, give indications of having been wrought by craftsmen who laboured to reproduce Graeco-Indian ideals in the service of the cult of Buddha, and consequently date presumably from the 3rd century B.C., when the successors of Alexander the Great were founding their kingdoms in Persia, Khwarezm (Khiva), Merv, Bactria (Afghanistan) and northern India, and from that date to the 4th or 5th century A.D. At the same time the same explorer excavated part of the ruins of the ancient city of Takla-makan (near the Keriya-darya), which had been overwhelmed by the moving sands of the desert. There he found mural paintings, some of which represented local lake or river scenes, carved woodwork, fragments of pottery, gypsum images of Buddha, and traces of gardens. These discoveries were followed by others made by Dr M. Aurel Stein in the same part of East Turkestan, though at other localities, namely, at Yotkan, the ancient capital of the kingdom of Khotan, and at Dandan-uiliq, Endere, Karadong, Rawak and other places, all lying east and north-east of the town of Khotan. His "finds" consisted of pottery, images, statues, coins, seals, frescoes, MSS. written in Sanskrit, Brahmi and Chinese characters, wooden tablets in the Kharoshti script, furniture and various cereals. These things appear to date from the very beginning of the Christian era, and continue down to the end of the 8th century. Again, in another part of the country, namely, in the heart of the desert of Lop, in approximately 40° 40′ N. and 90° E., Dr Sven Hedin was fortunate enough to discover early in 1901 the ruins of the ancient city of Lôu-lan or Shanshan, which was destroyed, apparently by a desert storm or by an inundation, or perhaps by both, towards the end of the 3rd century A.D. Among the objects found on this site were documents testifying to the name of the locality and furnishing materials for fixing the date.

A little before the date of these last discoveries, others of a somewhat similar nature were made by D. A. Klements in the Lukchun depression already mentioned. Here in 1898 the explorer discovered the ruins of ancient monasteries, dating from the beginning of the Christian era down to the 13th and 16th centuries. Among these ruins Klements found several very interesting MSS., some of them written in the language of the Uighurs, an ancient Turkish race, and others in tongues unknown. Finally, in 1904, Dr von Le Coq, when excavating the sand-buried ruins of Kara-khoja, between Turfan and Lukchun, discovered extremely valuable MSS., some written on Chinese paper, some on white leather, and some on wood, besides Buddhistic wall-paintings. The MSS. are written in ten different alphabets, and of the languages employed two are entirely unknown. The excavators also brought to light a vast number of human corpses in the garb of Buddhist monks. Other finds were subsequently made by the same explorer, in conjunction with Professor A. Grünwedel, at Kucha and Korla, two other oases at the south foot of the Tian-shan Mountains.

In 1906–1908 Dr Stein made a second and more important journey, principally for the purpose of antiquarian research, though he also carried out important geographical investigations, with the assistance of a native surveyor, in the Eastern Pamirs (about Mustagh-ata), in the Nissa valley south of Khotan, and elsewhere. His archaeological investigations were carried on chiefly in the following localities: (i.) at and about Tashkurghan. (ii.) North-east of Khotan, where a large Buddhist temple, with relievos derived from Graeco-Buddhist models, were investigated and numerous MSS. and wooden tablets were discovered, inscribed in Sanskrit, Chinese, Tibetan and the Brahmi script of Khotan, the arid conditions, here as elsewhere, having caused these and other perishable objects to remain remarkably well preserved. (iii.) At Niya, east of Keriya, where many Kharoshti documents on wood were recovered, sometimes retaining their clay seals of Greek type and wooden covers as envelopes, together with implements, furniture, &c. (iv.) At Miran, near the western extremity of Lop-nor, where Buddhist shrines with frescoes, &c., were investigated. (v.) At Lop-nor itself, where Chinese and Kharoshti records on paper, wood and silk were recovered, and flint implements and other evidences of prehistoric occupation were discovered. (vi.) At and about the oasis of Tung-hwang, east of Lop-nor. Here the explorer traced a Chinese wall with watch-towers, guard-stations, &c., for a considerable distance, and made an important archaeological collection. Evidence of settlement back to the close of the 2nd century A.D. was obtained, and also of commercial traffic from the distant west in the shape of records in Indian, Kharoshti and Brahmi scripts and an unknown script resembling Aramaic. The sacred grottoes known as the Halls of the Thousand Buddhas, south-east of Tung-hwang, were visited, with their frescoes and cave temples, and a large number of documents and examples of early Chinese art were recovered. Dr Stein also investigated sites in the neighbourhood of Kara-shahr and others to the north-east of the great desert.

BIBLIOGRAPHY.—The best and the most exhaustive accounts of East Turkestan are contained in Sven Hedin's *Scientific Results of a Journey in Central Asia, 1899–1902* (vols. i.–ii., Stockholm, 1905–1906), *Through Asia* (2 vols., London, 1898), and *Central Asia and Tibet* (2 vols., London, 1903). See also H. H. P. Deasy, *In Tibet and Chinese Turkestan* (London, 1901); F. Grenard, in vol. ii. of J. L. Dutreuil de Rhins's *Mission Scientifique dans la Haute Asie* (1890–1895, n.p., 1897); Futterer, *Durch Asien* (Berlin, 1901); N. M. Przhevalsky, *From Kulja across the Tian-shan to Lob-nor* (Eng. trans., by Delmar Morgan, London, 1879); G. E. Grum-Grshimailo, *Opisanie Puteshestviya v Sapadniy Kitai* (St Petersburg, 1897–1899); V. I. Roborovsky and P. K. Kozlov, *Trudy Ekspeditsiy Imp. Russ. Geog.*

Obshchestva po centralnoy Asiya, 1893–1895 (St Petersburg, 1897, &c.); V. I. Roborovsky, *Trudy Tibetskoi Ekspeditsiy, 1889–1890*; K. Bogdanovich, *Geologicheskiya Isledovaniya v. Vostochnom Turkestane* and *Trudy Tibetskoy Ekspeditsiy, 1889–1890* (St Petersburg, 1891–1892); V. A. Obruchev, *Centralnaya Asiya, Severniy Kitai i Nan-schan, 1892–1894* (2 vols., St Petersburg, 1899–1901); A. N. Kuropatkin, *Kashgaria* (Eng. trans., London, 1883); and P. W. Church, *Chinese Turkestan with Caravan and Rifle* (London, 1901). For the archaeological discoveries, see the books of Sven Hedin already quoted; M. A. Stein, *The Sand-buried Cities of Khotan* (London, 1903), and *Geographical Journal* (London, July and Sept., 1909); and D. A. Klements and W. Radlov, *Nachrichten über die von der k. Akademie der Wissenschaften zu St Petersburg im Jahre 1898 ausgerüsteten Expedition* (St Petersburg, 1899). Consult also books cited under Tian-shan, Lop-nor, Gobi and Kuen-lun. (J. T. Be.; P. A. K.)

TURKESTAN, or Hazret, a town of Russian Turkestan, in the province of Syr-darya, on the railway from Orenburg to Tashkent, from which it lies 165 m. to the N.N.W. Pop. (1897), 11,592. It lies on the right bank of the Syr-darya river, 20 m. from it, at an altitude of 833 ft. It has a very old mosque of the saint Hazret-Yassavi, which attracts many pilgrims. It is an important dépôt for hides, wool and other produce of cattle-breeding. The town was captured by the Russians in 1864.

TURKEY. The Turkish or Ottoman Empire comprises Turkey in Europe, Turkey in Asia, and the vilayets of Tripoli and Barca, or Bengazi, in North Africa; and in addition to those provinces under immediate Turkish rule, it embraces also certain tributary states and certain others under foreign administration. Turkey in Europe, occupying the central portion of the Balkan Peninsula, lies between 38° 46′ and 42° 50′ N. and 19° 20′ and 29° 10′ E. It is bounded on the N.W. by Montenegro and Bosnia, on the N. by Servia and Bulgaria, on the E. by the Black Sea and the Bosporus, on the S. by the Sea of Marmora, the Dardanelles, the Aegean Sea and Greece, and on the W. by the Ionian and Adriatic Seas. Turkey in Asia, fronting Turkey in Europe to the south-east, and lying between 28° and 41° N. and 25° and 48° E., is bounded on the N. by the Black Sea, on the N.W. by the Bosporus, the Sea of Marmora and the Dardanelles, on the W. by the Aegean Sea, on the E. by Persia and Transcaucasia, and on the S. by Arabia and the Mediterranean. So far as geographical description is concerned, the separate articles on Asia Minor, Albania, Armenia, and other areas mentioned below—constituting the Turkish Empire—may be consulted. (For maps of Asiatic Turkey, see Arabia; Armenia; Asia Minor; Palestine; Syria.)

The possessions of the sultan in Europe now consist of a strip of territory stretching continuously across the Balkan Peninsula from the Bosporus to the Adriatic (29° 10′ to 19° 20′ E.), and lying in the east mainly between 40° and 42° and in the west between 39° and 43° N. It corresponded roughly to ancient Thrace, Macedonia with Chalcidice, Epirus and a large part of Illyria, constituting the present administrative divisions of Stambul (Constantinople, including a small strip of the opposite Asiatic coast), Edirne (Adrianople), Salonica with Kossovo (Macedonia), Iannina (parts of Epirus and Thessaly), Shkodra (Scutari or upper Albania). To these must be added the Turkish islands in the Aegean usually reckoned to Europe, that is, Thasos, Samothrace, Imbros and, in the extreme south, Crete or Candia. In December 1898, however, Crete was granted practical independence, under the protection of Great Britain, France, Italy and Russia (see Crete), and the suzerainty of the sultan is purely nominal.

Asiatic Turkey.—The mainstay of the Ottoman dynasty is the Asiatic portion of the empire, where the Mahommedan religion is absolutely predominant, and where the naturally vigorous and robust Turki race forms in Asia Minor a compact mass of many millions, far outnumbering any other single ethnical element and probably equalling all taken collectively. Here also, with the unimportant exception of the islands of Samos and Cyprus and the somewhat privileged district of Lebanon, all the Turkish possessions constitute vilayets directly controlled by the Porte. They comprise the geographically distinct regions of the Anatolian plateau (Asia Minor), the Armenian and Kurdish highlands, the Mesopotamian lowlands, the hilly and partly mountainous territory of Syria and Palestine and the coast lands of west and north-east Arabia. Asiatic Turkey is conterminous on the east with Russia and Persia; in the south-west it encloses on the west, north and north-east the independent part of Arabia. Towards Egypt the frontier is a line drawn from Akaba at the head of the Gulf of Akaba north-westwards to the little port of El Arish on the Mediterranean. Elsewhere Asiatic Turkey enjoys the advantage of a sea frontage, being washed in the north-west and west by the Euxine, Aegean and Mediterranean, in the south-west by the Red Sea, and in the south-east by the Persian Gulf.

Turkey's Arabian possessions comprise, besides El-Hasa on the Persian Gulf, the low-lying, hot and insalubrious Tehama and the south-western highlands (vilayets of Hejaz and Yemen) stretching continuously along the east side of the Red Sea, and including the two holy cities of Mecca and Medina.

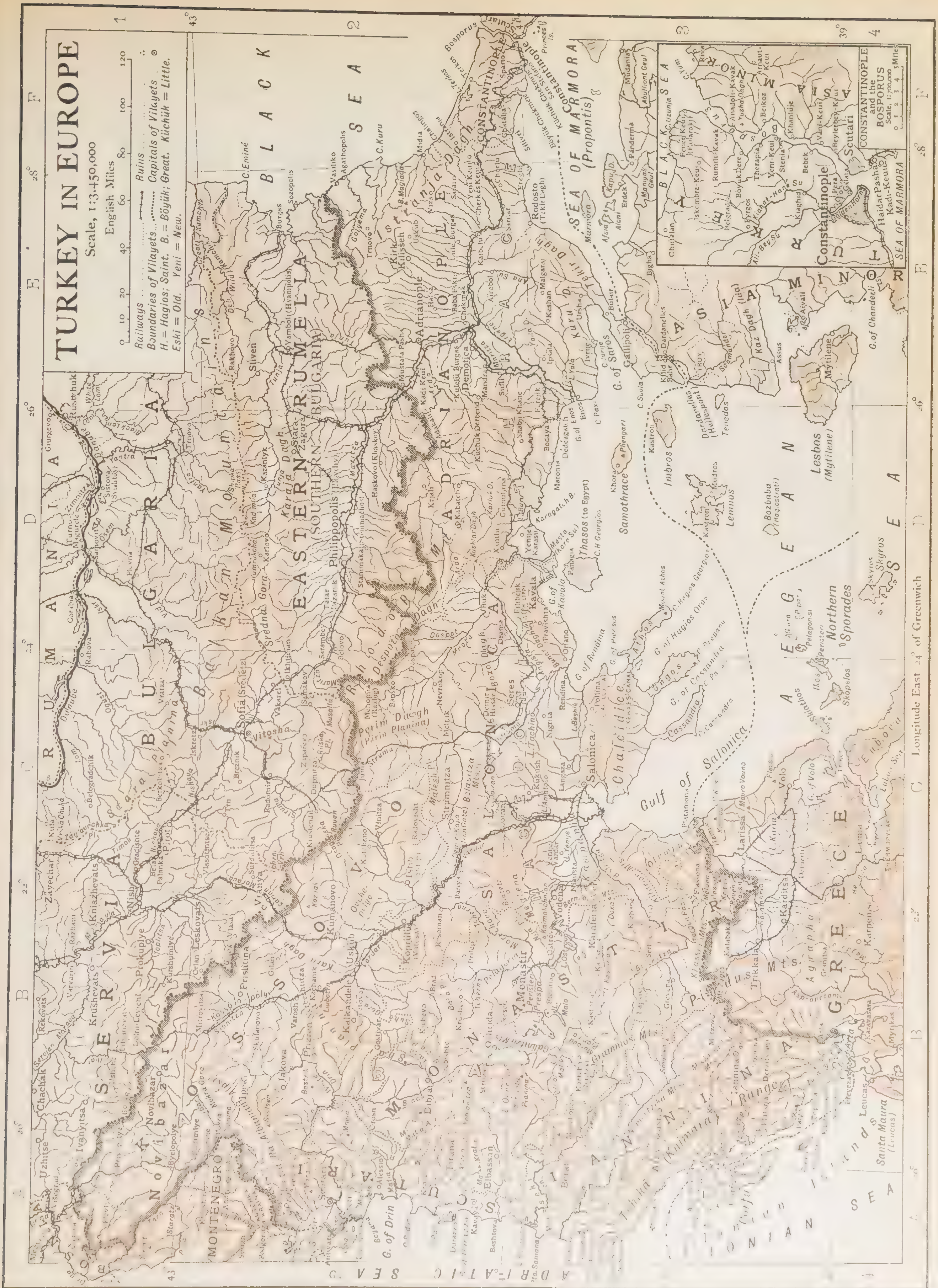
African Territories.—Turkey in Africa has gradually been reduced to Tripoli and Barca. Egypt, though nominally under Turkish suzerainty, has formed a practically independent principality since 1841, and has been *de facto* under British protection since 1881.

Population.—The total population of the Turkish Empire in 1910, including Egypt and other regions nominally under the sultan's suzerainty, was 36,323,539, averaging 25 to the square mile; in the provinces directly under Turkish government, 25,926,000.

The following towns have over 50,000 inhabitants each: Constantinople, 1,150,000; Smyrna, 250,000; Bagdad, 145,000; Damascus, 145,000; Aleppo, 122,000; Beirut, 118,000; Adrianople, 81,000; Brusa, 76,000; Jerusalem, 56,000; Caesarea Mazaca (Kaisarieh), 72,000; Kerbela, 65,000; Monastir, 53,000; Mosul, 61,000; Mecca, 60,000; Homs, 60,000; Sana, 58,000; Urfa, 55,000; and Marash, 52,000.

Race and Religion.—Exact statistics are not available as regards either race or religion. The Osmanlis or Turks (*q.v.*) are supposed to number some 10 millions, of whom 1½ million belong to Turkey in Europe. Of the Semitic races the Arabs—over whom, however, the Turkish rule is little more than nominal—number some 7 millions, and in addition to about 300,000 Jews there is a large number of Syrians. Of the Aryan races the Slavs—Serbs, Bulgarians, Pomaks and Cossacks—and the Greeks predominate, the other representatives being chiefly Albanians and Kurds. The proportion borne to one another by the different religions, as estimated in 1910, is: 50% Mussulman, 41% Orthodox, 6% Catholic, 3% all others (Jews, Druses, Nestorians, &c.). In the European provinces about two-thirds of the population are Christian and one-third Mahommedan. Full and fairly accurate statistics are available for a considerable portion of Asiatic Turkey. Out of a population of 13,241,000 (1896) in Armenia, Kurdistan and Asia Minor, 10,030,000 were returned as Mahommedans, 1,144,000 as Armenians, 1,818,000 as other Christians, and 249,000 as Jews. There are also about 300,000 Druses and about 200,000 Gipsies. The non-Mussulman population is divided into *millets*, or religious communities, which are allowed the free exercise of their religion and the control of their own monasteries, schools and hospitals. The communities now recognized are the Latin (or Catholic), Greek (or Orthodox), Armenian Catholic, Armenian Gregorians, Syrian, and United Chaldee, Maronite, Protestant and Jewish. The table on the following page, for which the writer is indebted to the kindness of Carolidi Effendi, formerly professor of history in the university of Athens, and in 1910 deputy for Smyrna in the Turkish parliament, shows the various races of the Ottoman Empire, the regions which they inhabit, and the religions which they profess.

Administration.—Until the revolution of 1908, with a very short interval at the beginning of the reign (1876) of the deposed sultan Abd-ul-Hamid, the government of Turkey had been essentially a theocratic absolute monarchy. It was subject to the direct personal control of the sultan, who was himself a temporal autocrat, which he now is not, and the most generally recognized caliph, that is, "successor," of the Prophet, and consequently the spiritual head of by far the greater portion of the Moslem world—as he still is. Owing principally to the fact that the system of the caliph Omar came to be treated as an immutable dogma which was clearly not intended by its originator, and to the peculiar relations which developed therefrom between the Mussulman Turkish conquerors and the peoples (principally Christian) which fell under their sway, no such thing as an Ottoman *nation* has ever been created. It has been a juxtaposition of separate and generally hostile peoples in territories bound under one rule by the military sway of a dominant race. Various endeavours have been made since the time of Selim III. (1789–1807), who initiated them, to break down the barriers to the formation of a homogeneous nation. The most earnest and


TURKEY IN EUROPE
Scale, 1:3,450,000
English Miles
0 10 20 40 60 80 100 120
Railways
Ruins
Boundaries of Vilayets
Capitals of Vilayets
H. = Hagios; Saint. B. = Böyük; Great. Küchük = Little.
Eski = Old. Yeni = New.
CONSTANTINOPLE and the BOSPORUS
Scale, 1:700,000
Miles
BULGARIA
EASTERN RUMELIA (SOUTHERN BULGARIA)
SERVIA
RUMANIA
MONTENEGRO
ALBANIA
MACEDONIA
SALONICA
ADRIANOPLE
CONSTANTINOPLE
GREECE
ASIA MINOR
BLACK SEA
SEA OF MARMORA (Propontis)
AEGEAN SEA
ADRIATIC SEA
IONIAN SEA
Gulf of Salonica
Longitude East 24° of Greenwich
Emery Walker sc.

Races.	Regions inhabited, or Vilayets.	Religions.
Albanians . .	Iannina, Scutari of Albania, Kossovo, Monastir	Mussulman, Orthodox, Catholic
Bulgarians . .	Salonica, Kossovo, Monastir	Orthodox (dissenting)
Servians. . .	Kossovo	Orthodox
Greeks . . .	Constantinople, Adrianople, Salonica, Monastir, Kossovo, Janina, Archipelago, Vilayets of Asiatic Turkey, (Hudavendighiar, Aidin, Konia, Angora, Kastamuni, Trebizond, Sivas, Adana Syria, Aleppo, Sanjak of Jerusalem) Crete	Orthodox and partly Greco-catholic
Kutzo-Vlachs (See MACEDONIA)	Monastir, Iannina	Orthodox
Turks . . .	The whole of European Turkey, Vilayets of Asia Minor, (Bitlis, Van, Mamuret-ul-Aziz, part of Mosul and certain islands of Vilayet of the Archipelago, of Cyprus, Crete)	Mussulman
Lazes . . .	Trebizond and throughout the whole of Eastern Asia Minor	Mussulman and Orthodox
Kurds . . .	Erzerum, Sivas, Seert, Angora, Mosul	Mussulman
Circassians . .	Spread over the whole of Asia Minor	Mussulman
Avchar . . .	Adana, Angora, Sivas	Mussulman
Arabs . . .	Adana, Aleppo, Syria, Bagdad, Sanjak of Jerusalem, Hejaz, Yemen, Beirut, Basna	Mussulman
Armenians . .	Constantinople and spread over the other Vilayets of Turkey in Europe; also Sivas, Angora, Trebizond, Adana, Erzerum, Bitlis, Mamuret-ul-Aziz, Mosul, Aleppo, Van	Gregorian and Catholic
Jews . . .	Spread through Turkey in Europe and Asia, and largely congregated in the Sanjak of Jerusalem, and in the Vilayets of Bagdad, Mosul, Syria, Beirut.	Jew
Samaritans . .	Only in the Sanjak of Napluze (Vilayet of Beirut)	Samaritan Jew
Gipsies . . .	Spread throughout the whole empire	Mussulman
Chaldaeans or Nestorians, speaking partly Syrochaldaic and partly Arabic (Syrochaldaic in their churches)	Bagdad, Mosul and partly Aleppo, Beirut and Mamuret-ul-Aziz	Nestorian Christian
Melchites, or Syrian Greco-Catholics (Greek in feeling, speaking Arabic)	Beirut, Aleppo, Syria	United Orthodox
Jacobite Syrians, speaking Arabic and partly Syrian (Syrian in their churches)	Beirut, Syria, Aleppo, Mosul, Mamuret-ul-Aziz	Monophysite and Jacobite
Monites (speaking Arabic and in their churches Syrian)	Mt Lebanon, Beirut	Monophysite (Catholic monothelite)
Druses . . .	Mt Lebanon, Sanjak of Hauran	Druse
Mendaites or Ben-i-Yahya	Basra	Sabaean: or of the sect of the son of John the Baptist (Ben-i-Yahya) whom they regard as their only prophet.
Yezzites. . .	Mosul, Bagdad, Basra	Yezzite (Mahommedan sect)

important of these attempts under Abd-ul-Mejid (1839–1861) proved, however, for various reasons abortive. So also did the "Midhat Constitution" promulgated by Abd-ul-Hamid almost immediately after his accession to the throne, owing largely to the reactionary spirit at that time of the '*Ulema* and of the sultan's immediate advisers, but almost, if not quite, in equal measure to the scornful reception of the Constitution by the European powers. The 'Ulema form a powerful corporation, whose head, the Sheik-ul-Islam, ranks as a state functionary almost co-equal with the grand vizier. Until quite recent times the conservative and fanatical spirit of the 'Ulema had been one of the greatest obstacles to progress and reform in a political system in which spiritual and temporal functions were intimately interwoven. Of late years, however, there has been a gradual assimilation of broader views by the leaders of Islam in Turkey, at any rate at Constantinople, and the revolution of 1908, and its affirmation in the spring of 1909, took place not only with their approval, but with their active assistance. The theoretical absolutism of the sultan had, indeed, always been tempered not only by traditional usage, local privilege, the juridical and spiritual precepts of the Koran and the *Sunnet*, and their 'Ulema interpreters, and the privy council, but for nearly a century by the direct or indirect pressure of the European powers, and during the reigns of Abd-ul-Aziz and of Abd-ul-Hamid by the growing force of public opinion. The enthusiastic spirit of reform which heralded the accession of the latter sultan never altogether died out, and from about the last decade of the 19th century has been rapidly and effectively growing in force and in method. The members and sympathizers of the party of reform who styled themselves "Young Turks," working largely from the European centres and from the different points in the Turkish Empire to which the sultan had exiled them for the purpose of repression—their relentless persecution by the sultan thus proving to be his own undoing—spread a powerful propaganda throughout the Turkish Empire against the old régime, in the face of that persecution and of the open and characteristic scepticism, and indeed of the hostile action, of some of the European powers. This movement came to a head in the revolution of 1908. In July of that year the sultan Abd-ul-Hamid capitulated to the Young Turks and restored by Iradé (July 24) the constitution which he had granted in December 1876 and suspended on the 14th of February 1878. A reactionary movement started in April 1909 was promptly suppressed by the Young Turks through the military occupation of Constantinople by Shevket Pasha and the dethronement of Abd-ul-Hamid, who was succeeded by his younger brother Reshad Effendi under the title of Mahommed V. A new constitution, differing from that of Abd-ul-Hamid only in some matters of detail, was promulgated by imperial Iradé of the 5th of August 1909.

In temporal matters the sultan is a constitutional monarch, advised by a cabinet formed of executive ministers who are the heads of the various departments of state, and who are responsible to the elected Turkish parliament. All Turkish subjects, of whatever race or religion, have equal juridical and political rights and obligations, and all discrimination as to military service has been abolished. The sultan remains the spiritual head of Islam, and Islam is the state religion, but it has no other distinctive or theocratic character. The grand vizier (*sadr-azam*), who is nominated by the sultan, presides *ex officio* over the privy council (*mejliss-i-khass*), which, besides the Sheikh-ul-Islam, comprises the ministers of home and foreign affairs, war, finance, marine, commerce and public works, justice, public instruction and "pious foundations" (*evkaf*), with the grand master of ordnance and the president of the council of state.

For administrative purposes the immediate possessions of the sultan are divided into vilayets (provinces), which are again subdivided into sanjaks or mutessarifliks (arrondissements), these into kazas (cantons), and the kazas into nahiés (parishes or communes). A vali or governor-general, nominated by the sultan, stands at the head of the vilayet, and on him are directly dependent the kaimakams, mutassarifs, deftardars and other administrators of the minor divisions. All these officials unite in their own persons the judicial and executive functions, under the "Law of the Vilayets," which made its appearance in 1861, and purported, and was really intended by its framers, to confer on the provinces a large measure of self-government, in which both Mussulmans and non-Mussulmans should take part. It really, however, had the effect of centralizing the whole power of the country more absolutely than ever in the sultan's hands, since the Valis were wholly in his undisputed power, while the *ex officio* official members of the local councils secured a perpetual Mussulman majority. Under such a system, and the legal protection enjoyed through it by Ottoman functionaries against evil consequences of their own misdeeds, corruption was rife throughout the empire. Foreigners settled in the country are specially protected from exactions by the so-called Capitulations (*q.v.*), in virtue of which they are exempt from the jurisdiction of the local courts and amenable for trial to tribunals presided over by their respective consuls. Cases between foreigners of different nationalities are heard in the court of the defendant, and between foreigners and Turkish subjects in the local courts, at which a consular dragoman attends to see that the trial is conducted according to law. (See further, as regards Turkish administration, the account given under *History* below, regarding the reforms instituted under the sultan Abd-ul-Mejid in 1839.)

Education.—The schools are of two classes: (1) public, under the immediate direction of the state; and (2) private, conducted either by individuals or by the religious communities with the permission of the government, the religious tenets of the non-Mussulman population being thus fully respected. State education is of three degrees: primary, secondary and superior. Primary education is gratuitous and obligatory, and superior education is gratuitous or supported by bursaries. For primary education there are three grades of schools: (1) infant schools, of which there is one in every village; (2) primary schools in the larger villages; (3) superior primary schools. Secondary education is supplied by the grammar school, of which there is one in the capital of every vilayet. For superior education there is (1) the university of Constantinople, with its four faculties of letters, science, law and medicine; and (2) special schools, including (*a*) the normal school for training teachers, (*b*) the civil imperial school, (*c*) the school of the fine arts and (*d*) the imperial schools of medicine.

Public instruction is much more widely diffused throughout the empire than is commonly supposed. This is due partly to the Christian communities, notably the Maronites and others in Syria, the Anatolian and Rumelian Greeks, and the Armenians of the eastern province and of Constantinople. Under the reformed constitution (Aug. 5, 1909) education is free, and measures have been taken largely to extend and to co-ordinate the education of all "Ottomans," without prejudice to the religious educational rights of the various religious communities. Primary education is obligatory. Among the Christians, especially the Armenians, the Greeks of Smyrna and the Syrians of Beirut, it has long embraced a considerable range of subjects, such as classical Greek, Armenian and Syriac, as well as modern French, Italian and English, modern history, geography and medicine. Large sums are freely contributed for the establishment and support of good schools, and the cause of national education is seldom forgotten in the legacies of patriotic Anatolian Greeks. Much educational work has also been done by American colleges, especially in the northern provinces of Asia Minor, in conjunction with Robert College (Constantinople).

Army.—In virtue of the enactments of May 1880, of November 1886, of February 1888 and of December 1903, military service had been obligatory on all Mussulmans, Christians having been excluded but under obligation of paying a "military exoneration tax" of £T50 for 135 males between the ages of 15 and 75. Under the new régime this system, which had greatly cramped the military strength and efficiency of the Ottoman Empire, has been changed, and all "Ottomans" are now subject to military service. Under certain conditions, however, and on payment of a certain exoneration tax, exemption may still be purchased. The revision of the whole military system was undertaken in 1910, especially as regards enrolment and promotion of officers, but, as things then stood, the term of service was twenty years (from the age of 20 to the age of 40), for all Ottoman male subjects: active service (*muasaff*) nine years. of which three with the colours (*nizam*), in the case of infantry, four in the case of cavalry and artillery; six and five respectively in the reserve (*ikhtiat*); Landwehr (*redif*) nine years; territorial (*mustahfiz*) two years. In case of supreme necessity all males up to 70 years of age can be called upon to join the colours. There are certain recognized rights to exemption from military service, such as some court officials, state officials, students in normal schools, medicine and law colleges, &c. The redifs form the principal part of the army in time of war, and are divided into two classes: *Class I.* comprises all men in the service who have completed their time with the nizam. In peace-time it is composed of weak *cadres*, on which falls the duty of guarding magazines and stores, and of carrying through musketry instruction and drill of the rank and file of the ikhtiat and the redif. *Class II.* was first established in 1898 under the name of *ilaweh*, and became "redif, class II." in 1903. This class is distributed in very weak cadres in time of peace. In time of war, it is completed by all troops not serving with the nizam, the redif class I. or the mustahfiz. As the organization proceeded, and stronger cadres were formed, the redif class II. would become completely absorbed in class I. The mustahfiz have no cadres in peace-time.

The army is divided into seven army-corps (*ordus*), each under the command of a field marshal, and the two independent commands of Tripoli (Africa) and the Hejaz. The headquarters of the ordus are I., Constantinople; II., Adrianople; III., Salonica; IV., Erzerum; V., Damascus; VI., Bagdad; VII., Yemen; 15th division, Tripoli; 16th division, Hejaz. Only the first six army-corps have, however, their proper establishment: the seventh ordu and the commands of Tripoli and the Hejaz have only garrison troops, and are fed by drafts from the first six ordus. Each ordu territory, from I. to VI., is composed of 8 redif brigade districts of 2 regimental districts of 4 battalion districts apiece, each ordu thus counting 64 battalion districts. The total strength of the Ottoman army in 1904 was returned at 1,795,350 men all told, made up as follows: (1) Active (4 years' service) 230,408 (called), reserve (ikhtiat) 251,511 (called), total 481,919; (2) nizam (class I., completely trained) 237,026 (called); (3) redif (class II., not completely trained), from 21–29 years old, 585,846; from 30–38 years old, 391,563; total 977,409 (uncalled); (4) mustahfiz, trained 53,715 (called), untrained 40,286 (uncalled), total 94,001.

The strength of the different arms is given as follows:—

Infantry.—79 nizam infantry regiments 1 to 80 (4 is missing), each regiment consisting of four battalions of four companies apiece. Allowing for certain battalions unformed, there are altogether 309 nizam battalions; 20 separate chasseur battalions, of four companies each; 4 special chasseur battalions stationed on the Bulgarian frontier—total, 333 battalions in the first line. There are 96 infantry battalions of redif class I.; each regiment composed of 4 battalions—total 384 battalions. (In 1904 the 4th battalion of the 94th regiment, and regiments 95 and 96 had not yet been formed, but, it was stated, had by 1910 been made good.) The projected strength of redif class II. was 172 regiments of 4 battalions each—total, 688 battalions. At the end of 1904 the organization of this class was stated as completed in Turkey in Europe at 40 battalions with a total of 160 regiments: how far the organization had progressed in 1910 in Asiatic Turkey was not known.

The following table shows the war strength of battalions, and the total war strength of the infantry arm:—

Class.	War Strength of Battalions.				Total War Strength of Infantry.			
	Officers.	N.C.O.'s and Men.	Draft Animals.	Rifles.	Officers.	N.C.O's and Men.	Draft Animals.	Rifles.
Special Chasseurs	26	800	200	650	520	16,000	4,000	13,000
Nizam	24	700	106	650	7,896	230,300	34,874	213,850
Redif I.	24	900	106	850	10,320	337,500	39,750	318,750
Redif II.	24	800	106	750	16,512	550,400	72,968	515,000
Mustahfiz	8–15	400–600	—	400–600	1,760	98,000	—	98,000

The troops are armed principally with Mauser repeating rifles (models 1887 and 1890) of which there are 1,120,000 issued and in store; there are also 510,000 Martini-Henry rifles in reserve.

Cavalry.—Cavalry of the Guard: 1 regiment "Ertogrul" or 5 squadrons, 2 regiments of hussars of 5 squadrons each, and 1 regiment of lancers of 5 squadrons. *Nizam Cavalry*: 38 regiments of 5 squadrons each, or 190 squadrons in all.

Redif Cavalry.—12 regiments of 4 squadrons each, or 48 squadrons in all, attached to the first three ordus. It was further proposed to appoint one regiment of redif cavalry to each redif division. On war footing the strength of a squadron of cavalry is 6 officers, 100 men, 80 horses (Ertogrul—140 men, 135 horses). The nizam cavalry is incorporated with the first six ordus. one cavalry division of 3 brigades of 2 regiments each being appointed to each ordu. The redif cavalry is not organized with large units, and in time of war would be employed as divisional troops. The total war strength of the cavalry is 54 regiments (210 squadrons); 1580 officers, 26,800 men, 21,900 horses. The cavalry is armed with repeating carbines (the N.C.O.'s with repeating revolvers) and swords.

Artillery.—From ancient times the artillery has formed a altogether independent command in the Turkish army. The grand master of ordnance is co-equal with the minister of war, and his department is classed separately in the budget; the artillery establishments, parts of the infantry and of the technical corps, and even hospitals are placed under his direct orders. The artillery is divided into (*a*) field artillery, horse artillery, mountain artillery and howitzer regiments; (*b*) fortress artillery; (*c*) artillery depôts. All artillery troops are nizam: there is no second line. On principle an ordu would have with it 30 batteries of field artillery, 3 batteries of horse artillery and 3 batteries of mountain artillery, or in all 36 batteries with 216 guns, all batteries being 6 guns strong. But the unequal strength of the ordus and political and other reasons have prevented this organization from being carried out.

On war-footing each field battery has 4 officers, 100–120 N.C. officers and men, 100–125 horses and draught animals, 3–9 ammunition wagons; each horse battery, 4 officers, 120 N.C. officers and men, 100 horses, &c., 3 ammunition wagons; each mountain battery, 3 officers, 100 N.C. officers and men, 87 horses, &c.; each howitzer battery, 4 officers, 120 N.C. officers and men, 100 horses, &c., 3 ammunition wagons.

In 1904 the total strength of the artillery was given as 198 field batteries (1188 guns), 18 horse batteries (108 guns), 40 mountain batteries (240 guns) and 12 howitzer batteries (72 guns): total 268 batteries (1608 guns). The guns are of various Krupp types. The ammunition train counts 1254 wagons. On a war-footing the strength of the artillery troops is 1032 officers and 29,380 men.

Technical Troops.—These are formed into battalions of pioneers, railway troops, telegraph troops, sappers and miners, &c.; in all 11 battalions (55 companies) numbering 245 officers and 10,470 men. Other non-combatant troops, such as military train, medical corps, &c., are undergoing reorganization. (For the history of the Turkish army, see ARMY, § 98.)

Navy.—The Turkish sea-power, already decayed owing to a variety of causes (for the effect of the revolt of the Greek islanders see GREEK INDEPENDENCE, WAR OF), was shattered by the catastrophe of Sinope (1853). Abd-ul-Aziz, however, with the aid of British naval officers, succeeded in creating an imposing fleet of ironclads constructed in English and French yards. Sultan Abd-ul-Hamid, on the other hand, pursued a settled policy of reducing the fleet to impotency, owing to his fear that it might turn against him as it had turned against Abd-ul-Aziz. He added, it is true, a few torpedo boats and destroyers, but he promptly had them dismantled on arrival at Constantinople. These now refitted, a cruiser ordered from Cramp's shipyard (America) and another from W. G. Armstrong, Whitworth & Co., and the battleship "Messudiyeh" (9100 tons displacement) reconstructed by the firm of Ansaldo (Genoa) in 1902, and re-armed by Vickers, Sons & Maxim, formed the only really effective war-ships at the disposal of Turkey in 1910, although a few armoured ships in addition might still serve for coast defence at a pinch, and a few more for training ships. Taking all into account, the available strength of the fleet might be put at 7 armour-clad ships, of which the "Messudiyeh" was one, the six others varying in displacement from 2400 to 6400 tons; two cruisers (unarmoured) of 3800 tons displacement; some 18 gunboats; 12 destroyers, 16 first-class torpedo boats and 6 second-class torpedo boats. There were also two Nordenfeldt submarine boats of doubtful efficiency.

Up to 1908 the personnel was found by yearly drafts of two to three thousand men from army recruits designated by the minister of war; the term of service was 12 years, of which 5 were in the first line, 3 in the reserve, 4 in the coastguard. The peace cadres (including 2 battalions of marines and 4 battalions of mechanics) were supposed to comprise 12,500 men on peace-footing, to be increased on declaration of war to 37,000; but these cadres were mainly on paper.

Under the "new régime" the Turkish government displayed commendable energy in reconstructing and reorganizing the sea-power of the empire. New construction to an amount of £T5,000,000, repayable over ten years at the rate of £T500,000 a year by national subscription guaranteed by the government, had by 1910 been voted by parliament. The programme of construction which this initial expenditure was to cover was fixed at two battleships of about 16,000 tons displacement, one armoured cruiser of about 12,000 tons displacement, some few auxiliary vessels (destroyers and gunboats), and a floating dock to lift about 17,000 tons. The main armament of the battleships was to be three pairs of 12-in. guns in three turrets, and three pairs of 9·2-in. in three turrets. The secondary armament was to be sixteen 4-in. Q.F. guns, and a few smaller guns (boat and field). The armoured cruiser was to carry four pairs of 9·2-in. guns in four turrets as main armament, and fourteen 4-in. Q.F. guns, and a few boat and field guns as secondary armament. British naval officers were engaged for training the personnel, and to assist in the reorganization of the fleet.

Communications.—A considerable hindrance to the development of the empire's resources has been the lack of an adequate system of communications; but although it is still deficient in good roads, much has been done of late years to develop railways, extend canals and improve river communications. From 1250 in 1885, of which 903 were in Europe and 347 in Asia, the mileage of railways had increased to some 4440 in 1909, of which 1377 are in Europe, 1810 in Asia Minor, 418 in Syria and 835 fall to the share of the Hejaz railway, including the Ed-Dera-Haifa branch. The construction of this last line is one of the most remarkable achievements of the reign of Abd-ul-Hamid. It may be said to be an absolutely autocthonous enterprise, no recourse having been had to foreign capital to find the means requisite for construction and equipment, which were provided by means of a "national subscription"—not entirely voluntary—and from other sources which, although the financial methods were not strictly orthodox, were strictly Turkish. The line was designed, surveyed and constructed by Turkish engineers—employing Ottoman navvies and labourers—in a highly efficient and economical manner, the average cost per mile having been £3230, although considerable engineering difficulties had to be overcome, especially in the construction of the Haifa branch. The line, stations, sheds and stores are all solidly built, and the rolling stock is sufficient and of the best quality (see further under *Finance*, below).

Production and Industries.—The Ottoman Empire is renowned for its productiveness, but enterprise and skill in utilizing its capabilities are still greatly lacking. For the introduction of improvements something, however, was done by the creation in 1892 of a special ministry of agriculture, to which is attached the department of mines and forests, formerly under the minister of finance. Since the year named an agricultural bank has been established, which advances money on loan to the peasants on easy terms. Schools of agriculture have been opened in the chief towns of the vilayets, and in connexion with those schools, and elsewhere throughout the empire, model farms have been instituted, where veterinary instruction can also be obtained.

To prevent the gradual destruction of the forests by unskilful management and depredations, schools of forestry have been founded, and means have been taken for regulating the cutting of wood and for replanting districts that have been partially denuded. About 21 millions of acres are under wood, of which over 3 millions are in European Turkey.

Wheat, maize, oats, barley and rye are the chief agricultural products. The culture of cotton is making rapid progress, immigrants who receive a grant of land being obliged to devote one-fourth of it to cotton culture. Tobacco is grown all over the empire, the most important market for it being Smyrna. Opium is mainly grown in Anatolia. All the more common fruit-trees flourish in most districts. In Palestine and elsewhere there is a large orange trade, and Basra, in Turkish Arabia, has the largest export of dates in the world. The vine is largely cultivated both in Europe and Asia, and much Turkish wine is exported to France and Italy for mixing purposes. The chief centres of export are Adrianople (more than half), Constantinople and Smyrna, the others being Brusa, Beirut, Ismid, Mytilene and Salonica. Under the auspices of the Ottoman public debt administration silk culture is also carried on with much success, especially in the vilayets of Brusa and Ismid. In 1888 a school of sericulture was founded by the public debt administration for the rearing of silkworms according to the Pasteur method. The production of salt is also under the direction of the public debt administration. About a fourth of the salt produced is exported to foreign countries, and of this about three-fourths goes to British India. Since 1885 great attention has been paid to the sponge fisheries of Tripoli, the annual value of which is about £30,000. With its extensive sea-coast, and its numerous bays and inlets, Turkey has many excellent fishing-grounds, and the industry, the value of which is estimated at over £200,000 a year, could be greatly developed. Its general progress may be seen in the increase of the fishery revenue—derived from duties, permits, &c.—of the public debt administration. Among other important productions of the Ottoman Empire are sesame, coleseed, castor oil, flax, hemp, aniseed, mohair, saffron, olive oil, gums, scammony and liquorice. Attar of roses is produced in large quantities both in European and Asiatic Turkey, and to aid in furthering the industry numerous rose plants are distributed gratuitously. The empire is rich in minerals, including gold, silver, lead, copper, iron, coal, mercury, borax, emery, zinc; and only capital is needed for successful exploitation. The silver, lead and copper mines are mainly worked by British capital. The more special industries of Turkey are tanning, and the manufacture of muslin, velvet, silk, carpets and ornamental weapons.

Shipping and Commerce.—The figures obtainable with respect to shipping are approximate, the statistical data not being altogether complete. In 1890–1891 the number of steamers that entered and cleared Turkish ports was 38,601, and of sailing vessels 140,726, the total tonnage of both classes of vessels being 30,509,861. In 1897–1898 the number of steamers was 39,680 of 32,446,320 tons, the number of sailing vessels being 134,059 of 2,207,137 tons, thus giving a total tonnage of 34,653,457. In 1904–1905 the number of steamers was 49,235 of 44,180,000 tons and of sailing vessels 133,706, with a tonnage of 2,506,000 tons, the total tonnage being thus 46,686,000 tons. In 1909 the total tonnage was 43,060,515. About a third of the tonnage belongs to British vessels. The number of steamships belonging to Turkey in 1899–1900 was 177 of 55,938 tons, as compared with 87 of 46,498 tons in 1897–1898, the number of sailing vessels in the same years being respectively 2205 of 141,055 tons and 1349 of 252,947 tons. The following tables show the total value of exports and imports arranged according to countries of origin or destination for 1905–1906 and 1908–1909; the same information for the year 1905–1906 with respect to the principal ports of the empire, and the tonnage of vessels cleared thereat during the year 1908–1909; and the value of the principal articles imported and exported for the year 1905–1906.

Value of Principal Articles Imported and Exported for the year 1905–1906.

Nature of Goods.	Imports.	Exports.
	£	£
Barley	—	658,462
Rice	944,950	—
Opium	—	639,630
American Cloth	1,404,803	—
Grapes	—	2,065,642
Figs	—	791,473
Cotton	—	449,628
Valonia	—	548,442
Crude Iron and Iron Bars	432,091	—
Sheepskins and Goatskins	—	528,282
Carpets, &c.	506,353	478,991
Flour	995·165	—
Cotton Thread	1,287,243	—
French Beans, Chick Peas and Beans	—	508,441
Cashmere Cloth	561,246	—
Coffee	830,325	—
Madapollam	916,715	—
Ores	—	486,037
Wool	—	439,066
Woollen Fabrics	785,622	—
Eggs	—	441,282
Cotton Print (Calico)	2,014,968	—
Tiftik (Silk-waste)	—	801,755
Cocoons	—	970,169
Petroleum	909,735	—
Sugar	2,263,928	—

Value of Goods Imported into, and Exported from, together with Number and Tonnage of Vessels cleared at, Principal Ports of Turkish Empire.

Port.	Value of the Goods imported into, or exported from, Turkey, during the year 1905–1906.		Table indicating the number of Vessels, (Steamships and Sail-Boats), and Tonnage, cleared at the following ports of the Ottoman Empire, in the year 1908–1909.	
	Imports.	Exports.	Number of Vessels	Tonnage.
	£	£		
Constantinople	8,470,095	1,381,432	17,792	16,214,947
Dependencies of Constantinople	673,699	2,453,758	—	—
Smyrna	3,724,525	5,722,273	5,888	2,989,863
Beirut	3,568,437	1,578,691	3,076	1,740,312
Salonica	3,111,957	1,650,552	2,962	1,151,273
Prevesa	358,586	259,585	—	—
Yemen	603,731	259,553	—	—
Jidda	801,927	26,154	—	—
Adrianople	587,653	585,810	—	—
Bagdad	1,510,430	777,402	—	—
Alexandretta	1,669,231	887,326	685	676,137
Tripoli in Africa	565,331	328,164	575	376,214
Trebizond	1,507,771	1,083,515	1,389	776,698
Scutari, Albania	257,397	135,850	—	—
Erzerum	103,280	96,405	—	—
Basra	—	—	—	—
Kavala	—	—	1,410	283,256
Samsun	—	—	1,064	976,803
Tripoli in Syria	—	—	1,306	919,222
Jaffa	—	—	1,241	1,210,261
Chios	—	—	2,732	915,880
Aivali	—	—	1,489	124,804
Dedeagatch [1]	—	—	404	50,469
Total	27,514,050	17,256,470		

Value of the Goods Imported from or Exported to Principal Countries during the years 1905–1906 and 1908–1909.

Country of Origin or Destination.	Imports from				Exports to			
	1905–1906		1908–1909		1905–1906		1908–1909	
	Amount	%	Amount	%	Amount	%	Amount	%
	£		£		£		£	
England	9,641,931	35·05	8,256,793	29·96	5,552,703	32·18	4,506,344	27·86
Germany	1,162,538	4·22	1,697,957	6·16	1,076,929	6·24	1,008,750	6·23
Austria-Hungary	5,715,914	20·77	3,574,724	12·96	1,874,827	10·87	2,173,453	13·43
Italy	2,145,789	7·79	2,150,064	7·79	872,641	5·06	883,358	5·46
Spain	118	—	15,588	0·06	21,827	0·13	17,332	0·10
Persia	643,641	2·34	485,887	1·77	57,443	0·33	82,530	0·51
Switzerland	63,324	0·23	105,026	0·39	640	—	3,056	0·02
United States	252,247	0·92	360,446	1·30	431,684	2·50	616,951	3·81
Belgium	865,040	3·15	762,543	2·76	427,998	2·48	152.517	0·94
Denmark	33	—	—	—	201	—	—	—
Russia	1,596,631	5·80	2,187,868	7·94	520,916	3·02	504,291	3·13
Rumania	697,631	2·54	1,107,120	4·01	350,876	2·03	336,663	2·08
Japan	1,821	—	2,374	0·01	214	—	—	—
Servia	89,329	0·33	441,050	1·60	172,220	0·99	86,602	0·53
Holland	524,116	1·91	555,972	2·01	509,688	2·96	220,489	1·36
France	2,341,086	8·51	2,956,643	10·72	4,220,006	24·46	3,187,376	19·72
Montenegro	2,928	0·01	6,633	0·02	24,686	0·15	20,228	0·12
Greece	492,037	1·79	347,287	1·26	476,829	2·76	382,484	2·37
Egypt	812,466	2·96	1,019,952	3·70	—	—	1,453,274	8·98
Bulgaria	409,727	1·49	1,188,981	4·31	663,139	3·84	498,414	3·09
Samos	1,210	0	181,965	0·66	—	—	10,319	0·08
Tunis	54,495	0·19	47,524	0·17	—	—	2,363	0·01
Other Countries			119,738	0·44	—	—	27,833	0·17
	£27,514,052	100·00	£27,572,135	100·00	£17,255,467	100·00	16,174,627	100·00

The revenues produced by the customs duties for the five years 1905–1906 to 1909–1910 are as follows:—

Year.	Export Duties.	Import Duties.	Total.
	£	£	£
1905–1906	160,037	1,928,957	3,088,994
1906–1907	151,677	2,260,382	2,412,059
1907–1908	143,210	2,704,347	2,847,557
1908–1909	143,378	3,138,534	3,281,912
1909–1910	162,252	3,533,405	3,695,657

FINANCE

Preliminary Sketch.—From the outset of their history the Osmanli Turks adapted to their own needs most of the political, economic and administrative institutions which existed before them. Primarily their system was based on the great principles enunciated by the immediate successors of the Prophet, especially by Omar, involving the absolute distinction between, and impartiality of treatment of, the Mussulman conquerors and the races which they conquered; and from this point of view a careful study of the financial history of Turkey will afford most valuable insight into the Eastern Question.

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[1] As Dedeagatch is gaining, and will gradually gain, importance, it has been included in this table.

In reward for the brilliant services rendered him by Ertoghrul (the father of Osman) and by Osman himself, Ala-ud-din, the last of the Seljuk sultans, conferred certain provinces in fief upon these two great warriors. They in their turn distributed the lands so acquired among their sons and principal emirs on strictly feudal principles, the feudatory lands being styled *ziamet* and *timar*, a system long continued by their successors in regard to the territories which they conquered. The conquered peoples fell into an inferior caste, made to work for, and to pay for the subsistence of, their conquerors, as under the Arab domination; the principal taxes exacted from them were the *kharaj*, a tax of indeterminate amount upon realty, based on the value of lands owned by unbelievers—(in contradistinction to the tithe [*ăshăr*] which was a tax of fixed amount upon lands owned by believers)—and levied in payment of the privilege of gaining means of existence in a Mussulman country, and the *jiziyé*, a compulsory payment, or poll-tax, to which believers were not subjected, in lieu of military service. The conquerors were feudatories of the reigning prince or sultan, and their payments consisted principally in providing fighting forces to make up the armies of the prince. The *kharaj*, the *jiziyé*, and the whole feudal system disappeared in theory, although its spirit, and indeed in some respects its practice, still exists in fact, during the reforming period initiated by Sultan Selim III., culminating in the Tanzimat-i-Khairiyé (1839) of Abd-ul-Mejid, and the Hatt-i-Humayun issued by the same sultan (1856). The administration of the state revenues was managed by a government department known as the Beit-ul-Mal or Maliyé, terms generally employed throughout Islamic countries since the commencement of Islam. But the entire financial authority resided in the sultan as keeper, by right, of the fortune of his subjects. The public revenues were passed under three principal denominations: (1) the public treasury; (2) the reserve, into which was paid any surplus of revenues over expenses from the treasury; (3) the private fortune (civil list) of the prince. Expenditure, as under the Seljuk sultans, was defrayed partly in cash, partly in "assignations" (*ḣavalé*).

The Osmanli sultans, as also the Mamelukes and the Seljuks, were accustomed to give *largesse* to their military forces on their accession to the throne, or on special occasions of rejoicing, a custom which still is practised in form, as for instance on the first day of the year, or the birthday of the Prophet (*mevlûd*). Largesse was especially given on the field of victory, and was, moreover, liberally distributed to stifle sedition and mutiny among the troops, the numerical strength of which was continually increased as the empire enlarged its borders. This vicious system, grafted as it was upon an inefficient administration, and added to the weight of a continually depreciated currency, debased both by ill-advised fiscal measures and by public cupidity, formed one of the principal causes of the financial embarrassments which assailed the treasury with ever increasing force in the latter part of the 16th and during the 17th and 18th centuries. The Turkish historian, Kutchi Bey, attributes the origin of the decline of the empire to the reign of Suleiman the Magnificent (1520–1566), when the conversion of many *emiriyé* lands into *vakufs* was effected, and the system of farming out revenues first introduced. Impoverished by these different causes, as well as by prodigal extravagance in interior expenditure, by shameless venality among the ruling classes, and by continual wars, of which the cost, whether they were successful or not, was enormous, the public treasury was frequently empty. So long as the reserve was available it was drawn upon to supply the void; but when that also was exhausted recourse was had to expedients, such as the borrowing, or rather seizure, of the *vakuf* revenues (1622) and the sale of crown properties; then ensued a period of barefaced confiscation, until, to restore public confidence in some measure, state budgets were published at intervals, viz. the partial budget of Ainy-Ali (in 1018 or A.D. 1609), the budget of Ali Aga (in 1064, or 1653) and that of Eyubi Effendi (in 1071, or 1660). At this time (1657–1681) the brilliant administration of the two Kuprilis restored temporary order to Ottoman finance. The budget of Eyubi Effendi is particularly interesting as giving the statement of revenue and expenditure for an average year, whereas the budget of Ainy-Ali was a budget of expenditure only, and even in this respect the budget of Eyubi Effendi is far more detailed and complete. The budget of Ali Aga is almost identical with that of Eyubi Effendi, and is worthy of special note for the conclusions which accompanied it, and which although drawn up 250 years ago, described with striking accuracy some of the very ills from which Turkish finance was suffering throughout the reign of Abd-ul-Hamid.

Apart from unimportant modifications, the form of the budget must have remained unchanged until the organic reforms of Selim III., while its complete transformation into European shape dates only from the year 1278 (1862), when Fuad Pasha attached a regular budget to his report on the financial situation of the empire. Since that time there had been no further change worth noting until the "new régime" was established in 1908. Although the publication of the budget had only taken place at very irregular intervals, it must also be observed that the published budgets were by no means accurate. From the time of Eyubi Effendi until the end of the grand vizierate of Ibrahim Pasha (1730), the empire experienced periodical relief from excessive financial distress under the series of remarkable grand viziers who directed the affairs of state during that time, but the recovery was not permanent. Ottoman arms met with almost systematic reverses; both the ordinary and the reserve treasuries were depleted; a proposal to contract a foreign loan (1783) came to nothing, and the public debt (*duyun-i-umumiyē*) was created by the capitalization of certain revenues in the form of interest bearing bonds (*sehims*) issued to Ottoman subjects against money lent by them to the state (1785). Then came forced loans and debased currency (1788), producing still more acute distress until, in 1791, at the close of the two years' war with Russia, in which the disaster which attended Ottoman arms may be largely ascribed to the penury of the Ottoman treasury, Selim III., the first of the "reforming sultans," attempted, with but little practical success, to introduce radical reforms into the administrative organization of his empire. These endeavours were continued with scarcely better result by each of the succeeding sultans up to the time of the Crimean War, and during the whole of the period the financial embarrassment of the empire was extreme. Partial relief was sought in the continual issue of debased currency (*beshlik*, *altilik* and their subdivisions), of which the excess of nominal value over intrinsic value ranged between 33 and 97%, and finally paper money (*kaimé*) which was first issued in 1839, bearing an interest of 8%, reduced in 1842 to 6%, such interest being paid on notes of 500 piastres, but not on notes of 20 or 10 piastres, which were issued simultaneously. Finally, usage of paper money was restricted to the capital only, and in 1842 this partial reform of the paper currency was followed by a reform of the metallic currency, in the shape of an issue of gold, silver and copper currency of good value. The gold coins issued were 500, 250, 100, 50, and 25 piastres in value, the weight of the 100-piastre piece (Turkish pound), 7·216 grammes, ·916⅔ fine. The silver coins were of 20, 10, 5, 2, 1 and ½ piastre in value, the 20-piastre piece weighing 24·055 grammes, ·830 fine. The copper money was in pieces of a nominal value of 40, 20, 10, 5 and 1 paras, 40 paras being equal to 1 piastre. In 1851 further attempts were made to withdraw the paper money from circulation, but these were interrupted by the Crimean War, and the government was, on the contrary, obliged to issue notes of 20 and 10 piastres. Finally, at the outbreak of the Crimean War Turkey was assisted by her allies to raise a loan of £3,000,000 in London, guaranteed by Great Britain and France; in 1855 an organic law was issued regulating the budget, and in the same year a second guaranteed loan of £5,000,000 was contracted in Great Britain. In 1857 an interior loan of 150,000 purses in bonds (*esham-i-mumtazē*), repayable in three years and bearing 8% interest, was raised; the term of repayment was, however, prolonged indefinitely. In the same year another series of bonds (*haziné tahvili*), bearing 6% interest, and repayable in 1861, was issued; in 1861 the term of reimbursement was prolonged until 1875. In 1858 a third loan was contracted in Great Britain for £5,000,000, and thereafter foreign loans followed fast on one another in 1860, 1862, 1863, 1864, 1865, 1869, 1872, 1873 and 1875, not to mention the two Egyptian tribute loans raised on Egyptian credit in 1871 and 1877. In 1859 the settlement of palace debts gave rise to the issue of 1,000,000 purses of new interior bonds (*esham-i-jedidē*) spread over a period of three years, repayable in twenty-four years, and bearing interest at 6%. Further 6% bonds, repayable in ten years, and styled *serguis*, were issued in the same year. Seeing the rapid increase of the financial burdens of the state, a commission of experts, British, French and Austrian, was charged, (1860) with setting the affairs in order, and with their assistance Fuad Pasha drew up the budget accompanying his celebrated report to the sultan in 1862. Meanwhile *kaimē* was being issued in great quantities (about 60,000 purses a month) and fell to a discount (December 1861) of 75%. In 1862 further *sehims* were issued, and these and the loan of 1862 (£8,000,000) were devoted to the withdrawal of the *kaimē*. Later, however, the *kaimē* was again issued in very large amounts, and the years succeeding 1872 up to the Russian War (1877) presented a scarcely interrupted course of extravagance and financial disorder, the result of which is described below.

The Budget was supposed to be drawn up according to an excellent set of regulations sanctioned by imperial decree, dated the 6th of July 1290 (1875), of which the first article absolutely prohibited the increase, by the smallest sum, of any of the expenses, or the abandonment of the least iota of the revenues fixed by the budget. Under these regulations the revenues were divided into two categories, viz. the direct and the indirect. The first category included the "imposts" properly so called, the fixed contributions (*redevances fixes*) to be paid by the "privileged provinces," and the military exoneration tax. In the second were comprised tithes, mine-royalties, forests and domains, customs, sheep-tax, tobacco, salt, spirits, stamps and "various." The expenses were also divided into two categories —(1) "Periodic and fixed" expenditure, which admitted of neither reduction nor delay; and (2) the credits allowed to the various departments of state, which might be increased or diminished according to circumstances. The expenditure of the first category was made up of the service of foreign loans, of the general debt, of the dotations replacing *ziamet* and *timarat* (military fiefs) and of fixed contributions such as *vakufs*. In the second category were included the imperial civil list, the departments of the Sheikh-ul-Islamāt and of religious establishments, the ministries of the interior, war, finance, public instruction, foreign affairs, marine, commerce (including mines and forests), and public works, and, finally, of the grand master of ordnance. For every province (*vilayet*) a complete budget of receipts and expenditure was drawn up by its *defterdar* (keeper of accounts) under the supervision of the *vali* (governor); this budget was forwarded to the minister of finance, while each state and ministry of department received communication of the items appertaining to it. Each ministry and department then sent in a detailed budget to the Sublime Porte before the end of November of each year. (The Turkish financial year is from the 1st of March to the 28th of February o.s.). The Sublime Porte forwarded these budgets, with its own added thereto, to the minister of finance, who thereupon drew up a general budget of receipts and expenses and addressed it to the Sublime Porte before the 15th of December. This was summarily considered by the council of ministers and then referred to the budget commission, which was to be composed not only of State functionaries, but of private persons "worthy of confidence, and well versed in financial matters," and which was invested with the fullest powers of investigation and inquiry. The report drawn up by the commission on the results of its labours was submitted to the Council of Ministers, which then finally drew up a general summary of the definitive budget and submitted it by *mazbata* (memorandum) for the imperial sanction. When this sanction had been accorded the budget was to be published. The remaining regulations set forth the manner in which extra-budgetary and extraordinary expenses were to be dealt with, and the manner in which the rectified budget, showing the actual revenues and expenditure as proved at the close of the year was to be drawn up with the assistance of the state accounts department (*divān-i-mouhassebāt*). This rectified budget, accompanied by an explanatory memorandum, was examined by the budget commission and the Council of Ministers, and submitted for the imperial sanction, after receiving which it was ordered that both be published. Special instructions and regulations determined the latitude left to each department in the distribution of the credits accorded to it among its various heads of expenditure, the degree of responsibility of the functionaries within each department and the relations regarding finance and accounts between each department and its dependencies. These regulations provide carefully and well for all contingencies, but unfortunately they were only very partially carried out. It may indeed be said that it was only the *previsionary* budget (*anglicé*, the estimates) that received any approximately proper care on the lines laid down, while the rule that both the estimates and the definite budget (at the close of each year) should be published was almost wholly honoured in the breach; until 1909, when the Constitution had been re-established the budget had only twice been published, in 1880 and 1897, since the regulations were put into force. Not only were the budgets not published, but no figures whatever were allowed to transpire in regard to the true position of the Turkish treasury—which laid the accuracy of even the limited number of budgets published open to suspicion.

All this has now been changed, and the above regulations are conscientiously carried out with the differences in procedure necessary for compliance with constitutional methods, and with the submission of the Budget to the houses of parliament. The Budget is now published in full detail and that for the year 1326 (1910–1911), with the explanatory memorandum which prefaces it, is an admirable work, mercilessly exposing the financial shortcomings and sins of the previous system, or rather want of system, while unshrinkingly facing the difficulties which the present government has inherited. The account thus presented to us of what the previous confusion was, underlines and attests the summary exposition of it given in the last edition of this work. It was there stated that, on the most favourable estimate, the normal deficit of the Turkish treasury was £T2,725,000, (upwards of £T,1,700,000 below the truth as now declared) and the following observations were appended:—

> "This budget represents the normal situation of Ottoman finance; it does not tally with the budget published in 1897, which was prepared with a special object in view, and was obviously full of inaccuracies, nor indeed does it agree with figures which could be officially obtained from the Porte. It is, however, compiled from the best sources of information, and it exaggerates nothing. The formidable deficit is met principally in three ways. (1) By leaving the salaries of state officials and the army unpaid. In many parts of the empire the soldiers rarely receive more than eight months' pay in the year, although in Constantinople the arrears are not so large. The reverse is the case with the civil officials, whose salaries in the provinces are paid more regularly than in Constantinople, owing to their being charged on the provincial budgets; the average arrears are from two to three months in Constantinople, and from one to three in the provinces. The arrears in civil and military salaries average annually about £T1,750,000. (2) By means of loans, both public and from individuals. By financial expedients of this kind payments were effected by the treasury in fifteen years (1881–1896) amounting to £T11,666,000 or at the rate of nearly £T800,000 per annum. (3) By anticipating the revenues of future years. This is the method so frankly condemned by Ali Aga, as was seen above, in 1653. Delegations (*havalē*) are granted on the provincial treasuries for one or two years in advance, sometimes for a series of years, in order to pay pressing debts too heavy to be met in a single payment. No better description of the financial distress and disorder of the empire can be given than that set forth in the official report of the budget commission of 1888. 'It has hitherto been considered necessary owing to financial embarrassment, to commence financial years with unbalanced budgets. Later, without taking into consideration the effective amounts in cash at the disposal of the vilayets, considerable sums were drawn upon them, by means of *havalēs*, out of proportion to their capacity. For these reasons, during the last two or three months of the financial year, the vilayets have not a para to remit to the central administration, and it has been considered imperatively necessary to draw on the revenues of the following year. Thus, especially during the last two years, urgent extraordinary expenses have been perforce partially covered by the proceeds of the ordinary revenues, the revenues of 1303 (1887) were already considerably anticipated in the course of 1302 (1886). The former year naturally felt the effect of this, and the tithes which should have been encashed in the last months of the year were discounted and spent several months in advance. Moreover, in order to meet to some extent the deficit arising as well from the accumulation of arrears of state departments since 1300 (1884) as, to a large degree, from gross deficiencies due to the neglect of the civil officials of the government to encash the revenues—to meet, further, the needs of the central administration, and above all, the urgent military expenses of the empire, and to provide a guarantee for bankers and merchants in business relations with the government and the treasury, part of the revenues of 1304 were perforce spent in 1303.' This commission proved the deficit of the year to be £T4,370,000. It set out also at length the very defective and disorderly condition of the state accounts. During the finance ministry of Agop Pasha (1889 to 1894) a good deal was done to set matters in order, but most of the ground then gained has since been lost."

To this may be added a short extract from the Explanatory Preface to the Finance Bill for the year 1910–1911. After pointing out the immense difficulties which he had had to encounter owing to the absence of any regular accounts, and above all of any of "those statistics which constitute the soul, indeed the very life of a public administration," and that it was therefore impossible for him to pretend that he had been able to free himself altogether from the effects of the past, the minister continues, "every time we have endeavoured to have recourse to the previous elements of appreciation, we found ourselves faced by the chaos which characterized former years. We have sometimes ascertained things so strange that we cannot forbear expressing our astonishment at the idea that a great power such as ours could maintain itself under such conditions." M. Ch. Laurent, the financial adviser to the Turkish government, stated in a lecture on Turkish Finance, delivered in Paris on the 22nd of April 1910, that the Ministry of Finance has now been largely reorganized. Officials, he says, with grand titles and no responsible duties have been abolished, and departments with responsible chiefs created. The agents of the finance ministry, instead of being mere clerks, are now employed in "the assessment and collection of taxes, the control of expenditure, the preparation and execution of the budget, the estimates of the necessary cash required at different points of the empire—all that, in fine, constitutes the real financial administration of a great empire." Laurent points out that direct taxes furnish 54% of the revenues of the empire, that agriculture is accordingly very heavily taxed, and that the tax on realty is both excessive and unfairly administered. The summary history given above of the origin of the system of taxation prevailing in Turkey explains how this came about. Reform of this system, and, further, very necessary reforms of the methods of collection of the wines and spirits revenue (which is protection turned upside down, the home-growers being far more heavily taxed than importers), and of the customs (in which almost every possible administrative sin was exemplified), were also undertaken. Three bills, moreover, were presented to parliament, the first regulating Public Accountancy, the second regulating the Central Accounts Department, and the third the service of the Treasury. By this last the centralization of receipts and expenditure and the movement of funds in the provinces were to be confided to the Imperial Ottoman Bank, which extended and perfected its own organization for the purpose.

Passing now to the examination of the budget, it should be observed that the method of estimating the revenues—a matter of great difficulty owing to the previous want of method—is described by Laurent as follows: "For every nature of receipts the total effective collections for the five last known years were set out, the averages were taken of these and the increase or decrease of the yearly average of those same years was worked out and added to or deducted from the figure previously obtained. The only exception made to this rule was in the case of revenues showing a yearly increase, such as Post Office revenue, tobacco, salt, for which were taken the figures of 1323 (1907) increased by a certain average." The expenditure was arrived at in the manner previously described—and when the general budget came to be made up the severest pruning was found necessary, the original demands of the various ministries and departments having resulted in a deficit of upwards of £T9,000,000. It is thought better here, for the sake of clearness, to reserve observations on revenues specially assigned to the international administration of the Ottoman Public Debt, and on the expenditure of that administration, and to deal with that subject separately, while, however, including the total figures of both in the general figures in order to reproduce exactly the totals shown in the budget of the empire. The principal items of revenue and expenditure are as follows, the figures being taken from the published budget above-mentioned.

Revenue. Direct Taxes.[1]—The tax on realty (*verghi*) is estimated to yield £T2,599,420. Duties on profession (*temettū*) consist (*a*) of a fixed duty leviable at rates declared in a schedule forming part of the special law (Dec. 8, 1907) regulating the tax, and (*b*) of a proportional duty at the rate of 3 % on the value of buildings occupied by companies or individuals in the prosecution of their business; of 3 % on salaries (subject to certain deductions) of employés of such companies and individuals; and on government contractors and revenue farmers, at the rate of 3 % of 10 % of the value of contracts filled and of revenues farmed. The law is defective and unfair in its incidence, and it is not applicable to foreigners. The government promised in 1910 to remedy the law with the assent of the Great Powers, and, if successful in its negotiations, to present an amended law. The duties are estimated to produce £T393,107; other professional duties £T110,887—together £T503,994. A "Military Exoneration tax" is levied on male Ottoman subjects between the ages of 15 and 75 to the amount of £T50 for 135 persons—certain exceptions such as priests, religious orders, &c., are allowed. The estimated revenue from this source is £T1, 289,612. "Prestations" are payments in lieu of services (apart from military service) to the state, such as maintenance of highways, &c.—in effect, purchase of exoneration from forced labour. These duties vary in different parts of the empire: in the vilayets of Constantinople, Bagdad and Adrianople, and in the sanjaks of Bigha and Tchatalja the day's work is calculated at 5 piastres (about 11d.); in the vilayets of Aleppo, Trebizond, Angora, Iannina, Konia, Sivas and Kastamuni at 4 piastres (about 9d.); and in most other parts of the empire at 3 piastres (about 7d.). These taxes were formerly levied either in cash or in kind: it has now been decided to levy them in cash only, although this change was expected to cause some arrears. Allowing for these, the estimated revenue is £T553,938. The "tax on sheep, camels, buffaloes and hogs" (*aghnam*, meaning literally "sheep," but for taxing purposes the other animals are included under the same name), formed originally part of the "tithe." It was transformed long since into a fixed amount per head of the animals taxed, which amount varies according to the region in which the tax is levied, the highest tariff being in the sanjak of Jerusalem (7½ piastres) and the lowest in the Yemen (1 piastre). The estimated receipts are, from sheep £T1,790,720, from camels and buffaloes £T144,520, and from hogs £T8890, or together £T1,814,152. "*Tithes*" are the direct descendant of the *kharaj* already alluded to above. It should here be noted that, from the fiscal point of view, the reforms instituted at the commencement of the 19th century may be summarized thus. In permanent remuneration of certain services to be rendered to the state, the sovereign assigned to civil or military functionaries territorial regions for the purpose, and with the power, of collecting land taxes imposed by Mussulman and Imperial law, *i.e.* the *kharaj* or tithe, and transfer and succession duties. The tithes were originally based on one-tenth of the agricultural produce of the country, but this proportion was gradually raised under the euphemistic pretence of "public instruction," but really, under financial pressure, to 12 % and again in 1900 for military "equipments" (Tejhīzāt-i-'Askeriyeh) by a further ½% to 12½%. This last surtax, which produces about £T90,000 per annum, was specially affected to a loan, known as the "Tejhīzāt-i-'Askerieh of 1905," of £T2,640,000, by virtue of a contract between the government and the Deutsche Bank (April 17, 1905). The estimated receipts from the "Tithes" (including tobacco and silk, both hypothecated to the Public Debt Administration) are £T6,731,107. The remaining taxes under the category "direct" are the forest-dues (generally speaking 15 % of the value of wood cut), estimated to produce £T130,094; the mining dues (being a fixed duty of 10 piastres per 10,000 sq. metres of the superficial area covering the mine, and a proportional duty varying from 1 % to 20 % of the gross value of metal contained in the ore, according to the kind of metal and the method of extraction of the ore), £T45,141; and tax-papers (*Tezkērēs*), £T58,434. The total "direct taxes" (inclusive of tobacco and silk tithes) are thus estimated to amount to £T13,725,892.

Section II. of the budget is composed entirely of revenues from *stamp-duties.* Of these, commercial stamps are among the revenues specifically hypothecated to the Public Debt Administration, £T460,079; the others, consisting of legal stamps of various kinds, registration and transfer-duties, &c., are estimated to produce £T653,373 forming a combined total of £T1,113,452.

Under Section III. fall the "indirect contributions" as now reclassified. The first revenue specified among these in the budget is that accruing from the wine and spirit duties, which is again among those assigned to the Public Debt, £T283,079. Licenses for sale of Tumbēki, a variety of Persian tobacco used for the *narghilē*, £T2046. By far the most important "indirect" revenue is that produced by the customs, consisting of import, export and transit duties, and various unspecified receipts. Under the old commercial treaties which lapsed about 1890—but which have been maintained "provisionally" in force until one or other of the great powers consents to set a term to the negotiation of fresh treaties—an *ad valorem* duty of 8 % was imposed on all articles imported into the Turkish empire. In 1905 financial resources had to be found for the special administration of the three European vilayets as insisted upon by the powers, and to this end the Porte initiated negotiations with the latter to increase the import duties by 3%. As is usual in Turkey, this opportunity was seized for the demand of redress of grievances by such powers as considered they had any, and the negotiations were protracted until July 1907, when France finally gave in her adhesion. Since then the import duties have been collected at the rate of 11 % *ad valorem* under the supervision of the Public Debt Administration, the bondholders having certain rights, under the decree of Muharem, described below, over any increase of revenue arising from modification of the commercial treaties. By the provisions of the "Annex Decree," also described below, three-quarters of the additional revenue is assigned to the Turkish government, and one-quarter to the Public Debt Administration to swell the sinking-fund. Fresh negotiations were also undertaken to increase the import-duties by a further 4% in order to balance the deficit shown in the budget. In the year 1910–1911 the import duties were estimated to produce £T3,980,395, the transit duties £T20,276, and the export duties (1% *ad valorem*, which it was hoped the government might soon afford to abolish) £T168,993—total customs revenue, £T4,217,752. The remaining "indirect contributions" are port and lighthouse dues, £T148,426. Sanitary taxes, £T20,519, and fisheries and sporting licenses affected to the service of the public debt, £T153,990. The revenues figuring under "indirect contributions" thus reach a total of £T4,825,812.

Monopolies form Section IV. of the budget, and include in the first place the salt revenue (£T1, 227,750), which is assigned to the Public Debt Administration, and tobacco revenues of which the larger part, £T865,737, is assigned to the same administration, the total (including share of Tumbēki profit) producing £T965,754; the remaining monopolies are: fixed payment from the Tumbēki Company, £T40,000; explosives, £T106,323; seignorage (Mint), £T10,466; and posts and telegraphs, £T912,129. The "Monopolies" thus render a total revenue of £T3,262,424.

Section V. includes receipts from commercial and industrial undertakings belonging to the state. These are the Hejaz railway, £T152,000; the Dolma-Bagtchē gas-works, £T59,130; technical school, £T8536; the Tigris and Euphrates steamships, £T62,513; and mines (Heraclea coal and other), £T120,710; forming a combined total of £T402,889.

Section VI. is composed of receipts from "State Domains" of which a large proportion was formerly included in the civil list. Under the deposed sultan the Civil List Administration had encroached in every direction not only on the revenues properly accruing to the state, but upon private and upon state property in most parts of the empire. Thus it is explained in the preface to the budget that the revenues "proceeding from the deposed sultan" are not classed together under one heading, but that they have been apportioned to the various sections under which they should fall "whether taxes on house property or property not built upon, tithes, aghnam, forests, mines, cadastre, sport, military equipment, private domains of the state, various receipts, proceeds of sales, rents"—a truly comprehensive list which by no means set a limit to the private resources of Abd-ul-Hamid II., who looked upon the customs also as a convenient reserve on which he could, and did, draw when his privy purse was short of money. Apart from the sources of revenue specified above, of which the amounts actually transferred from the civil list are not stated, Section VI. is estimated to produce £T513,651. In the previous budget there had been a special heading, "Proceeds of Domains transferred from the Civil List," estimated to produce £T620,233, which may have been intended to include all the various receipts above enumerated.

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[1] It should be noted that the classification of the revenues included respectively under the "direct" and "indirect" categories has now been quite properly changed, the sheep-tax, tithes, mining royalties and forest royalties being comprised under "direct taxes"; stamps and registration duties are placed in a special category, and salt and tobacco under "monopolies."

Section VII., formed of the tributes of dependencies of which the two principal are the Egyptian, £T765,000, and that of Cyprus, £T102,590 (assigned to the public debt) comprises a total revenue of £T871,316. Finally, various receipts of which the principal separately specified are government share of railway receipts (Oriental railways and Smyrna-Cassaba railway), £T201,710, and "subscriptions" for the Hejaz railway, £T264,600, form Section VIII.

The total revenues of the empire are thus estimated to produce £T25,848,332; and seeing the careful and moderate manner in which the estimates have been framed, this may be looked upon rather as a minimum than a maximum. The minister of finance stated in his budget speech to parliament, delivered on the 23rd of April 1910, that the revenues for the year 1909–1910, which had been estimated to produce £T25,000,000, had as a matter of fact produced £T26,500,000.

Expenditure. Ministry of Finance.—The first item of expenditure shown in the budget is the service of the public debt, amounting to £T8,288,394. The Public Debt Administration plays so considerable a part in the finances of the Ottoman Empire, and its history is of such importance that a special section of this article will be devoted to it below. Under the budgetary heading "Public Debt" is included, as it should be, all expenditure in connexion not only with the public debt proper, but also with advances from banks and others, railway guarantees, an account of which will also be found below, and all capitalized liabilities, as far as known, contracted by the state.

It is explained in the preface to the budget that one of the abuses of the previous régime had been to obtain advances from credit establishments at high rates of interest varying from 7 % to 9 %, when it was found impossible to issue a public loan. The rates on these advances have now been generally reduced to 6 % with the exception of that on the advances from the lighthouse administration, which refused to allow any reduction below 7 %. In the years 1908–1909 the advances were reduced by £T688,000, in addition to repayments allowed for in the budget, and the credit agreed for the year 1909–1910 is £T663,000, as compared with £T1,160,000 for the previous year. In the year 1910–1911 the outstanding advances were to be so far paid off that the credits to be opened under this head would be still further reduced by £T500,000.

The civil list has been reduced to the definite amount of £T443,880, which, without the consent of parliament, cannot be increased. The sultan receives an annual allocation for himself and household of £T240,000, the crown prince one of £T24,000, and a sum of £T153,000 is assigned to the Imperial princes and the sultanas. The deposed sultan was allowed £T12,000 a year, and a similar amount was set aside to provide dowries for two sultanas who were just about to be married. The debts of the former are stated in the preface to the budget to be very large, and as payments are effected fresh creditors present themselves with undeniable vouchers in their hands, causing much embarrassment to the minister of finance: no figures, however, are given. The Finance Bill provides that these debts are to be paid out of supplementary credits.

Under the reformed constitution every senator is entitled to a salary of £T100 per month, any remuneration which he may receive from the government for other services to be deducted from the senatorial allowance which, however, it may of course exceed. Deputies are allowed £T300 for each session of parliament, and £T50 per month in addition should the session exceed its legal duration. They are further allowed travelling expenses from and to their constituencies on the basis of rules governing journeys of functionaries receiving a monthly salary of £T50. The amount reserved in the budget for these purposes is £T181,871.

The ministry of finance absorbs £T2,989,600. In this are included the expenses of the administration of both the central and provincial departments of the finance ministry, the mint, charitable allowances, expenses and presents in connexion with the holy cities (£T121,410), pension funds of state officials (£T628,038), administrative allowance made to the agricultural bank (£T225,380) and various other expenses. Various administrative reforms were in hand in 1910–1911, by which it was expected considerably to reduce the credits demanded by the finance ministry—especially those in connexion with the holy cities. Special attention was called by the minister to the fact that the system of contributions of officials to the pension funds has been modified, the deduction from salaries being now 10 % instead of 5 %, and the contributions to the funds being made as to one-third by the treasury, and two-thirds by the officials, instead of the reverse as formerly: the economy effected is about £T300,000. A credit of £T17,124 is allowed for the central accounts department. The total credits for the ministry of finance are, then, as follows: Ottoman public debt, £T8,288,394; House of Osman, £T443,880; legislative corps, £T181,871; treasury, £T2,989,600; central accounts department, £T17,124; forming an aggregate of £T11,920,869.

Indirect contributions, or more familiarly "customs," are allowed a credit of £T512,670. The minister of finance points out the immense importance of the thorough reorganization of the customs administration. The services of a first-rate English expert (Mr R. F. Crawford) were obtained, and much has been done at Constantinople, but the provincial customs offices are still lamentably defective. These were immediately to be taken in hand, and considerable sums are being voted for repairs of existing customs buildings and the construction of new buildings. The reforms already accomplished have resulted in a marked increase in the customs revenues.

Posts and telegraphs, which absorbed a credit of £T782,839 in 1910–1911, have also long been in urgent need of extension and better administration. An additional credit of £T90,000 was granted, as compared with the previous year, and increased expenditure was foreshadowed for the future; on the other hand, it was confidently expected that the post office receipts would increase in far more rapid ratio than the expenditure.

The ministry of the interior was estimated to require £T1,157,230. This sum covered "immigration expenses," *i.e.* assistance given in settling Mussulmans immigrating from provinces detached from the Ottoman Empire. There can be no doubt that this expenditure is remunerative, since many rich regions of Asia Minor have long suffered from want of population.

Military expenditure, including the three departments of war, is as follows: the army (excluding artillery), £T8,280,452; ordnance, £T356,439; and gendarmerie, £T1,694,778. As regards the first of these, it is curious to observe that the budget decree of 1880 stringently limited the peace strength of the Ottoman army to 100,000 men, "including officers and generals," in order to put a stop to the rapidly increasing military expenditure; but this was merely the expression of a pious wish, at a time when European financial good will was indispensable, that expenditure might be kept down. No real attempt has ever been made to observe the decree, and indeed observance has been impossible seeing the dangers which never cease to menace the empire. To some extent the real level of military expenditure has been masked by the separation of certain payments into "extraordinary" expenditure, a course which, it is understood, has not been followed in the budgets of the "new régime," and which will not be revived. It should however, be remarked that out of an "extraordinary" budget, which will be mentioned below, sums of £T709,305 and of £T27,827 were allocated to the ministry of war and the ordnance department respectively in 1909. It is not expected that military expenditure can be much reduced, except in the direction of supply contracts, which have been the cause in the past of iniquitous waste of means.

The official budget shows a credit for admiralty expenditure of £T1,000,327, which is apparently less than that for the previous year by some £T220,000. This, however, is not a real decrease, salaries of functionaries not on the active list having been removed to the region of supplementary credits, as are those of civil departments. As a matter of fact, the marine budgets of the two years are almost identical. The vote of £T500,000 a year for ten years for the reconstruction of the Ottoman navy by "national subscription," as already mentioned, was not included in the official budget, nor was there any allusion to it in the prefatory memorandum. The minister of finance did, however, allude to it in his budget speech, (April 23, 1910), and stated that four destroyers purchased in Germany had been paid for from the national subscription only, without touching the ordinary state revenues. It should be added that the Greek War (1897) revealed to the sultan the decrepit state into which the Ottoman navy had fallen, and considerable "extraordinary" expenditure—much of which was wasted—has been incurred since (and including) 1902 to put the least out-of-date warships into a serviceable condition.

The ministry of commerce and of public works absorbed £T883,161 a reduction of some £T180,000 on the previous year. The government acknowledges the unavoidable necessity of greatly extending and improving the internal communications of the country, but cannot see its way to doing so satisfactorily out of the ordinary resources of the country. This question was being seriously studied, and it was hoped that a comprehensive scheme would be presented ere long. The Hejaz railway figures in the budget for £T550,180, and it is explained that this will not only cover working expenses, but also the final completion of the line.

Floating Debt.—This is really an accretion of undetermined liabilities which has been indefinitely, and probably alternately, advancing and receding for a great number of years, and which no previous minister of finance, or Turkish government, had the courage to face. Now and then it has been dealt with piecemeal, when some particular class of creditors has become too pressing, but it is more than probable that the piece got rid of has been more or less rapidly replaced by fresh liabilities occasioned by budgetary deficits, or by the mere accumulation of interest on debts allowed to run on.

In March 1897 the floating debt was calculated by a financial authority in the *Fortnightly Review* to amount to upwards of £T55,000,000, which might be compressed to £T25,000,000 since a large proportion was certainly composed of salaries in arrear and other items of a similar kind which the government would never, under any circumstances, make good. Laurent tells us that the present government having found it absolutely impossible to arrive at even an approximate estimate of this "occult debt," recourse was had, in order to fix it, to the creditors themselves, and a short act of parliament was passed declaring all debts prescribed which should not be claimed by a fixed date. In consequence of this 560,000 claims were received, and a first examination showed that the aggregate amount reached by these claims was not less than £T13,000,000. Considering the dilatory methods of Orientals, even when they are creditors, it is doubtful whether this sum adequately covers the whole of the claims outstanding, and it may be found difficult, even for a parliament, to refuse claims which should equitably be admitted and which may be preferred later. High authority in Constantinople put the true amount of the floating debt in 1910–1911 at the amount previously estimated, viz. £T25,000,000. No provision was then made in the budget to meet these liabilities, nor did the minister in his prefatory memorandum make any allusion to them; in his budget speech, however, he announced that a scheme for dealing with them would be presented with the budget for 1911–1912. Under the heading "Floating Debt" in the budget for 1910–1911 are placed the advances before described.

No other items in the budget call for special remark, but in order that the information given may be complete, each head of expenditure is shown separately below, and the budget for 1910–1911, as first placed before the Turkish parliament, presents the following picture, from which it may be observed that the public debt absorbs 26% of the revenue, war service 38% and civil services 36%.

Expenditure.	£T
Public debt	8,288,395
Civil list	443,880
Legislative corps	181,870
Finance	2,989,600
Accounts (central)	17,124
Customs	512,670
Posts and telegraphs	782,840
Cadastre	109,820
Grand vizierate	25,096
Council of state	33,050
Interior	1,157,230
Public security	400,405
Foreign affairs	213,400
War	8,280,453
Ordnance	356,440
Gendarmerie	1,694,778
Marine	1,000,328
Sheikh-ul-Islamāt	483,341
Justice	751,580
Public instruction	744,086
Forests, mines and agriculture	370,520
Public works and commerce	883,160
Hejaz railway	550,180
Total	£T30,270,246

Revenue. (See above for details of general headings here given.)	£T
"Direct contributions"	13,725,892
Stamps and registration duties	1,113,452
"Indirect contributions"	4,825,812
Monopolies	3,262,424
State undertakings, commercial and industrial	402,889
Domains	513,651
Tributes	871,316
Various receipts	1,132,896
Total	£T25,848,332
Deficit	£T4,421,914
Total	£T30,270,246

This deficit was increased, by the action of parliament, to £T9,678,000. Almost immediately after the budget was drawn up a change of government took place, and largely owing to this fact the parliamentary budget commission introduced various modifications on the expenditure side of the account, which increased the estimated deficit to the account just mentioned.[1] The principal increase is due to the war departments, according to the budget speech of the minister of finance (April 23, 1910), although he states that some increase is apparent in all departments. The actual figures of the increase are not, however, given. Exaggerated importance must not be attributed to the swollen deficit. The demands of the various departments of state had been much cut down, and according to the minister of finance's own statement much of the reduction was merely unavoidable expenditure deferred; the fact that some of this expenditure, which had been jealously scrutinized, was to be undertaken at once, meant that demands on future years would be relatively reduced. A loan of £T7,040,000 was arranged with a German group headed by the Deutsche Bank. This loan followed upon one of £T4,700,000 in 1908, and another of £T7,000,000 in 1909 (of which the service is provided by the revenues assigned to the Russian War indemnities amounting to £T350,000 per annum, of which payment has been deferred for forty years), the year 1909 having shown a realized deficit of about that amount—a condition of affairs which would appear alarming were it not that the Turkish Empire was passing through absolutely abnormal times, and was attempting to convert the unstable morass of disorder, ineptitude and corruption left by the previous system into a solid foundation for good and orderly constitutional government. With the two previous loans above mentioned, £T5,500,000 capital liabilities were paid off, the work of reorganization had made considerable progress, and £T2,000,000 remained in hand at the beginning of 1910–1911 to continue it. As before stated reorganization was quickly followed by a marked increase of revenue, and it seemed probable that the forecast of the minister of finance that within a comparatively short time that increase would amount to £T5,000,000 was not excessive. Negotiations were undertaken to increase the customs import duties by a further additional 4%. This measure would produce about £T1,250,000 per annum.

Further expenditure was voted in the course of 1909, to be met by an extraordinary budget. On the receipts side of this budget were comprised the Austrian indemnity for the annexation of Bosnia and Herzegovina (£T2,500,000), cash and securities belonging to the deposed sultan (£T1,600,000), sale of old guns (£T300,000), sale of lands and other property recovered from civil list encroachments (£T908,000), and finally the unexpected balance of the proceeds of the 1908 loan (£T655,000), the whole forming an aggregate total of £T5,963,000. It was intended to assign to the war department £T3,804,918, to the grand master of ordnance £T358,108, to the admiralty £T93,912, and to the ministry of finance £T2,443,202 for the payment of the war indemnities in Thessaly and other urgent liabilities, the estimated aggregate extraordinary expenditure thus amounting to £T6,700,140. Some of the assets above mentioned proved, however, not to be easily realizable. Ready buyers were not found for the state lands, and the sale of the ex-sultan's securities was disputed by the German Reichsbank with which they were deposited, while the government did not consider it good policy to sell the Anatolian railway shares, which it seized at Yildiz, so that only £T450,000 were encashed by the ministry of finance from these sources. Of the sums really received the ministry of finance expended some £T3,000,000, in payment of the Greek indemnity, in repayment of £T1,000,000 of advances to the treasury and by assigning the credit voted to the ordnance department, and it was stated that these payments exhausted the extraordinary resources so far as it has been possible to realize them.

Collection of Taxes.—The Ottoman Empire possesses a very complete system of local self-government within certain limits. Every village or town district has a kind of mayor (*mukhtar*) appointed by election and approved by the official provincial authorities, and a "council of ancients" whose members are elected directly. The taxes are collected by means of the *mukhtars*, termed for this purpose *kabz-i-mal* (receiver of treasure), and under the supervision of gendarmes specially named, termed *tahsildar* (collectors). The official authorities provide lists of all the taxes to be collected to the *tahsildars*, who hand them, against formal receipt, to the *kabz-i-mals*. The latter are bound to pay in to the local authorities all sums collected in five days in town districts, and in fifteen days in villages, if under 1500 piastres; sums of 1500 piastres and over are paid in at once. The *tahsildars* check the accounts of the *kabz-i-mals*, and, if they discover peculation, send them at once to be dealt with by the chief official authorities of the *caza* (department); all the electors of a *mukhtar* are, *ipso facto*, joint sureties for him. If the tax-payer declines to pay his due, he is brought before the proper authorities by the *tahsildar*; if he persists in his refusal, all his goods, except those indispensable for his dwelling and the pursuit of his trade, are sold by auction, without recourse to a judgment by tribunal. If he has no goods which may be seized, he may be summarily imprisoned for a term not exceeding 91 days: two imprisonments for the same debt are not permitted. The military exemption tax is not collected as above, but by the spiritual chiefs of the various religious communities. None of the above regulations apply to Constantinople, where no military exemption tax is imposed, and where separate official regulations for the collection of taxes are in force. The system of farming out the revenues is admitted, and is almost invariably followed in the case of the tithes. When this is done, the revenues to be farmed are put up to public auction and sold to the highest bidder, provided he can prove himself amply solvent and produce sufficient sureties. Elaborate regulations are in force for this method of collection to secure the state receiving its full due from the farmers, who, on the other hand, are entitled to full official assistance to enforce their rights.

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[1] On the 25th of June 1910 the chamber finally passed the budget for 1910–1911. The figures were as follows:—

Ordinary expenditure, £T32,997,000; extraordinary expenditure, £T2,696,000; revenue £T26,015,000, leaving a deficit of £T9,678,000, which was brought up to over £T10,500,000 by special credits for the pension fund, the payment of debts incurred by Abd-ul-Hamid and indemnities to officials. On the other hand, the minister of finance reckoned that the revenue would probably show an increase of £T1,500,000, while about £T2,000,000 of expenditure would remain undisbursed, which, with a reserve of £T2,000,000 from 1909, would reduce the deficit to roughly £T5,000,000.

Assessment of Taxes.—For the purposes of assessment the taxes may be divided roughly into two classes: (1) variable taxes; (2) non-variable taxes. Under the first head would be included proportional taxes dependent upon the value of the property taxed; under the second, taxes whose amount does not depend upon that value. The first class contains such revenues as the *emlak verghi-si* (duty on realty), ‘*ashār* (tithes), *temettū* (professional tax), &c. In all such cases the taxable values are fixed by a commission of experts, sometimes chosen by the tax-payers themselves, sometimes by the official authorities; in all cases both tax-payers and authorities are represented on the commissions, whose decisions may be appealed against, in last resort, to the council of state at Constantinople, whose decision is final. Revenues composing the second class such as the *tapu* (registration tax) do not vary, unless by special decree, and the assessment is automatic.

The systems, both of assessment and collection, were equitable and far from oppressive in theory. In practice they left almost everything to be desired. The officials, already too numerous and underpaid, frequently, as has been stated above, found such pay as they had far in arrear. They were therefore naturally open to bribery and corruption, with the result that, while the rich often got off almost scot free, the poor were unduly taxed, and often cruelly oppressed by the tax collectors and farmers of revenue. In all departments there ensued, thus, an alarming leakage of revenue, amounting, it was credibly estimated, to quite 40%. The new government energetically proceeded to remedy this state of affairs.

International Administration of the Ottoman Debt.—In consequence of the piling up of the exterior public debt as described above, it amounted after the issue of “general debt” in 1875 to £T190,750,000, and swallowed up annually upwards of £T10,000,000, or nearly half the revenue of the empire as it was then constituted. The revolt of various disaffected provinces brought matters to a climax; in September 1875 one-half of the service of the interest was suspended, paper certificates known as “Ramazans” (since they were issued in the Arabic month of that name) being issued for that half in lieu of cash, and in the following March it was suspended altogether. After the war with Russia, in order to obtain credit from the Imperial Ottoman Bank and local financiers, who refused any further accommodation unless their previous and further advances were amply secured, revenues known as the “six indirect contributions” were handed over to a committee of local bankers (by decree of Nov. 22, 1879), to be administered and collected directly by them. These “six indirect contributions” were the revenues from tobacco, salt, wines and spirits, stamps (commercial), certain specified fisheries, and the silk tithe in specified provinces. Two years later, partly in view of the recommendations of the Congress of Berlin, partly to overcome insuperable difficulties in obtaining any kind of credit, the sultan authorized the Sublime Porte to issue an invitation to the various bondholders’ committees in Europe to send delegates to Constantinople for the purpose of negotiating a resumption of payments. These “committees” were the “Council of Foreign Bondholders” for Great Britain, the Imperial Ottoman Bank and its “group” for France, Herr S. Bleichröder for Berlin, the Credit-Anstalt and its “group” for Austria-Hungary, and the Chamber of Commerce and of Arts of Rome for Italy. The Dutch bondholders placed their interests in the hands of the British council. Russia declined to countenance the negotiations in any way. Delegates from the various committees assembled in Constantinople in the early summer of 1881. The commission formed by them in conjunction with the delegates of the Sublime Porte is more generally known as the “Valfrey-Bourke commission,” from the leading parts played by the Right Hon. R. Bourke (Lord Connemara), the British delegate, and M. Valfrey, the French delegate. The outcome of the negotiations was the issue of an imperial decree, known as the “Decree of Muharrem,” owing to its bearing the date (Turkish style) of the 28th of Muharrem (Dec. 20) 1881. By this decree the outstanding capital of the exterior debt, to which were added the Ramazan certificates above mentioned, and all interest fallen due, making a grand total of £252,800,000, was scaled down to £106,437,234 (£T117,080,958). On this reduced capital a minimum interest of 1% was to be paid, the rate of interest to be increased by quarters per cent. as the revenues set aside for the service of the reduced debt permitted. For purposes of sinking fund the old loans were combined into four groups:[1] group i. containing the 1858 and 1862 loans, with a reduced nominal capital of £T7,902,259; group ii. the 1860, 1863, 1864 and 1872 loans, with a reduced nominal capital of £T11,265,153; group iii. the 1865, 1869 and 1873 loans, with a reduced nominal capital of £T33,915,762, and group iv. the “general debt,” of which the last issue was in 1875, with a reduced nominal capital of £T48,365,236, and the “lottery bonds” (railway loan), with a reduced nominal capital of £T15,632,548, the total of group iv. being thus £T63,997,784. As security for the service of the new reduced debt it was provided that an international council should be formed, composed of one delegate each from the bondholders of the United Kingdom, France, Germany, Austria-Hungary, Italy and Turkey, and one representing the “priority bondholders,” a term which will be explained later. On this council the Turkish government has the right of naming an imperial commissioner with “consultative voice,” *i.e.* no voting power, but the right to express his opinion on the proceedings of the council, who would make all reports he considered necessary to his government. The government was empowered also to name controllers to whom all the accounts of the administration should be open for inspection on demand. In all other respects the council, provided that it kept within the limits of the laws the administration of which was entrusted to it, was to be entirely independent of the Ottoman government, free to appoint and dismiss its own officials from highest to lowest, and to carry on its administration on such lines as it thought best. Proposals made by the council for the modification and improvement of the existing laws and regulations which concerned it were to receive an answer from the government within six months; this provision has remained a dead letter. Any difference between the government and the council, if not possible of adjustment, was to be settled by arbitration.

To this council, with these extended powers, was handed over the absolute administration, collection and control of the “six indirect contributions” above enumerated, for the benefit of the bondholders, and in addition, it was to encash for the same purpose bills on the customs, to be drawn half-yearly in its favour by the minister of finance, amounting annually to £T180,000, representing the tax on Tumbēki (£T50,000) and the surplus revenue of Cyprus (£T130,000); and the Eastern Rumelian annuity, originally fixed at £T245,000, but gradually reduced by force of circumstances, until after frequent suspensions of payment it reached in 1897 the level of £T114,000, and has, since the declaration of Bulgarian independence, been definitely stopped. In order to assist the young kingdom of Bulgaria, which could only with great difficulty and with much damage to its resources have found means to indemnify Turkey for this serious breach of treaty engagements, the Russian government intervened, and proposed as compensation to the Turkish government the deferment for forty years of the annual payment (£T350,000) of the 1877 war indemnity. This proposal was accepted by the Turkish government, which undertook to continue the annual payment of £T114,000 to the public debt administration until the extinction of the debt. The public debt council consented with good grace, although the minister of finance, by omitting to consult that council during the progress of negotiations, lost sight of the fact that a sum of £T87,823 was due to the public debt administration on account of arrears of the Eastern Rumelian annuity up to December 1887, and that a further sum of £T430,741 was due by the Bulgarian to the Turkish government itself in compensation for the Rustchuk-Varna railway under the Treaty of Berlin. As pointed out by Sir Adam Block, the representative of the British and Dutch bondholders, in his report for 1908–1909, the above arrangement would have been prejudicial to the bondholders had the public debt not been “unified” (as described below) since, however, as a result of that unification, the ceded revenues now produced a sum more than sufficient for the service of the debt, it was only the surplus of revenue reverting to the government which was affected. There were further handed over, under the Muharrem decree, to the public debt council, the tribute of Bulgaria, the amount of which has never even been fixed, but as compensation for which the tobacco tithe up to a yearly amount of £T100,000 was ceded to the council in the same conditions as the “six indirect contributions”; the proportional shares (generally known as the “contributive parts") of the Ottoman public debt to be borne by Bulgaria, Servia, Greece and Montenegro, which according to the Treaty of Berlin were to be adjudged by the representatives of the Great Powers at Constantinople, one of whom (the Russian) never succeeded in obtaining his instructions, and which therefore have never been fixed; and, finally, the excess of revenue resulting from a revision of the commercial treaties. The ceded revenues, exclusive of the "contributive parts" and the excess from commercial treaties, were estimated by Bourke, in his report to the bondholders on the decree of Muharrem, at £1,812,562 (£T1,993,818). A substantial reduction however, had to be made in favour of the 5% "priority bonds," which were bonds issued to the local banks before mentioned in satisfaction of their claims, and formed an annual first charge of £T590,000 on the whole of the revenues ceded to the bondholders; the capital amount of the "priority bonds" was £T8,169,986, which was to be extinguished by 1906. Four-fifths of the net product of the revenues, after deduction of the first charge of £T590,000, was to be applied to the service of the interest on the new reduced debt, and provided that the four-fifths were sufficient to allow the distribution of 1% interest, one-fifth was to be devoted to sinking fund; but this latter fifth was to be reduced, if necessary, by an amount sufficient to maintain the rate of interest at 1%. The interest on bonds amortized was to be added to the funds available for sinking fund. The sinking fund was to work as follows: First ¼% on the whole reduced capital was to be applied to group i.; if there were any surplus this was to be applied to group ii., until that also received the same full ¼%, and so on for group iii. and group iv., until the whole sinking fund amounted to 1% on the reduced capital. It was to be applied by redemption at the best price possible on the market, until that price stood at £T66·66, when, if the rate of interest served were 1%, it was to proceed by drawings; if the interest were anything more than 1%, and less than 3%, the limit of price for redemption was to be raised to £T75; if the interest were between 3% and 4% inclusive, the limit was to be raised to par. Any surplus of revenue beyond that necessary to provide 4% interest and 1% sinking fund was to be handed over to the government. The lottery bonds receive a special treatment both in regard to interest and sinking fund; full information as to the intricate arrangements made for these bonds will be found in the decree of Muharrem and the published reports of the council of administration of the Ottoman public debt. In 1890 the sinking fund was increased by the conversion of the "priority loan" into a 4% loan and the extension of the term of its redemption for 15 years. In this manner an annuity of £T159,500 was set free, of which £T11,000 per annum was allotted as "extraordinary sinking fund" to series A and £T49,500 per annum each to series B, C and D; the lottery bonds were originally excluded from this arrangement, and special compensation was granted to these later. Each series receives the benefit of the interest on bonds belonging to it amortized by this special annuity. Thus, in the financial year 1900–1901 the total amount of the fund had risen from £T159,500 to £T231,500.

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[1] For simplicity’s sake, the lottery bonds having a special treatment different from that of the rest of the loans, these groups, when the new bonds of the reduced debt were exchanged against the old bonds of the original loans, became “series” thus: Series A, group i.; series B, group ii.; series C, group iii.; series D, group iv. and lottery bonds.

The arrangement set forth in and sanctioned by the decree of Muharrem on the whole worked admirably. Gradually, however, it became apparent that it would be desirable to give Turkish state securities, of which those governed by the decree of Muharrem formed the principal part, a better standing in European financial markets than was possible for bonds bearing so low a rate of interest; to obliterate thus, as far as possible, the effects of the past bankruptcy; and, further, to give the Turkish government a joint interest with the bondholders in the progress of the ceded revenues. The French bondholders, who hold by far the largest proportion of Turkish securities, took the principal initiative in this matter, and, after protracted negotiations with the Turkish government and the other "syndicates" of bondholders, they succeeded, in 1903, in obtaining the following modifications of the original decree of Muharrem.

Series B, C and D (series A having already been completely redeemed by the action of the sinking fund) were replaced by the creation of new 4% bonds to a nominal amount of £T32,738,772, with a sinking fund of 0·45% per annum, bearing identical rights and privileges, and ranking immediately after, the priority bonds. The rates at which the series were respectively exchanged against the new unified bonds were £100 series B against £70 unified, £100 series C against £42 unified and £100 series C against £37, 10s. unified. Bonds of the old series not presented for exchange within a period of fifteen years are prescribed. The amortization is to proceed by purchase when the unified bonds are below par, and when at or above par, by drawings. Coupons and drawn bonds not presented within six and fifteen years respectively of their due dates of payment are prescribed. Interest on amortized bonds goes to swell the sinking fund. When the net product of the ceded revenues amounts to £T2,157,375, the surplus is divisible as to 75% to the Turkish government and 25% to the public debt administration. A variation from this was provided as soon as the priority bonds should become extinct; but these bonds having since been repaid (as mentioned below) by a further issue of unified bonds, this variation lapses. The above 25% is to be employed as additional sinking fund for the unified debt and lottery bonds, in the proportion of 60% and 40% respectively. A reserve fund was created of which the nucleus was the sum already standing to the credit of the "Reserve fund for increasing the rate of interest" (£T1,113,865), plus £T300,000 at least in cash by the issue of sufficient unified bonds to produce that amount and the sum of £T150,000 to be paid by the government to the public debt at the rate of £T15,000 per annum. It should be added that the total issue was made sufficient to reserve also £T1,460,000 for expenses, after taking into account £100,000 in cash paid by the government to the public debt administration out of the said issue. The reserve fund was created primarily to make good any deficiency in the revenues below the amount required to pay the interest due. If such drafts upon the reserve fund become necessary, they are to be made good in the following years out of the surplus above mentioned. The reserve fund is increased by the interest it may earn, but when the capital amount of the fund reaches £T2,000,000 the interest earned is merged in the general receipts of the public debt administration. As soon as the unified debt is reduced to £T16,000,000 the reserve fund is to be reduced to £T1,000,000, the surplus over this last amount being paid to the government. The unified bonds and coupons are exempt from all Turkish taxation existing or to come. Further special stipulations regarding the Turkish lottery bonds were made, but these are, as before, omitted. They will be found in art. x. of the "Annex-Decree" of September 1–14, 1903, which gave the modifications to the Muharrem decree here described force of law. Finally the Imperial Ottoman government reserved to itself the right of paying off the whole unified debt at par at any moment, and all the dispositions of the decree of Muharrem not modified by the new "Annex-Decree" were formally confirmed and maintained. In 1906 a further modification took place in the shape of the final and complete repayment of the priority bonds by the additional issue of £T9,537,000 of unified bonds for the purpose, taken firm by the Ottoman bank at 86. The rate at which the exchange was effected was par with a cash bonus of 6%. The previous annuity required for the service of these bonds having been £T430,500, and the additional charge for the service of the unified debt as a result of the operation being £T424,396, while the government received £T1,272,600 in cash for its own purposes, there was a slight immediate advantage to be found in it: as, however, the priority debt would have been completely extinguished in 1932, the financial wisdom of the change is not apparent.

The ceded revenues administered directly by the public debt council have shown remarkable expansion, and may be fairly looked upon as exemplifying what would occur in the general revenues of the empire when good and honest administration and regular payment of officials finally took the place of the carelessness, corruption and irregularity which existed up to the change of régime. The council has not limited its duties to the collection of the revenues placed under its administration, but has taken pains to develop commercially the revenues capable of such development. A large and remunerative export trade in salt to India is now established, whereas formerly not one grain found its way there; the first steps in this direction were taken in 1892 when works were begun to place the great rock-salt salines of Salif, on the coast of the Red Sea, on a commercial footing. The gross receipts from this export trade amounted in the year 1908–1909 to £T99,564, and the profits approximately to £T12,000, in spite of the contest between Liverpool and Spanish salt merchants on the Calcutta market, which led to a heavy cutting of prices. Pains, moreover, have been taken by the public debt council to develop the sale of salt within the empire. These efforts have been rewarded by the increase of the salt revenue from £T635,000 in 1881–1882, the year preceding the establishment of the council, to £T1,075,880 in 1907–1908. Again, in the early years of the administration (1885), the Pasteur system of selection of silk-worms' eggs for the rearing of silkworms was introduced, and an "Institute of Sericulture" on modern lines was erected (1888) at Brusa for gratuitous instruction in silk-rearing to students from all parts of the empire. Up to the end of 1907–1908, 919 students had received the diploma of the institute, and 465 silk-growers in addition had passed through the course of instruction. These men, returning to their various districts, impart to others the instruction they have received, and thus spread through the regions adapted to sericulture the proper methods of selection and rearing. As a result some 60,000,000 mulberry trees were planted in Turkey during 1890–1910, involving the plantation of about 130,000 acres, and new *magnaneries* and spinning factories sprang up in every direction; while the revenue (silk tithe) increased in the regions administered by the council from £T17,000 in 1881–1882 to

£T125,000 in 1906–1907, the value of the silk crop in those regions having thus advanced by over £T1,000,000. But the regions not under its administration benefited at least equally by the methods above described. Thus the total value of the silk tithe in Turkey increased in the period named from about £T20,000 to £T276,500, and the total annual value of the crop from about £T200,000 to £T2,765,000, or by nearly 2½ millions pounds sterling.

Table A gives the produce of the revenues in 1881–1882, the last year of the administration of the "Galata Bankers," the average product of the first, second, third, fourth and fifth quinquennial periods since the public council was established, and of the year 1907–1908.

Table B shows the total indebtedness of the Ottoman Empire, exclusive of tribute loans.

Tobacco Régie.—From the beginning of the year 1884 the tobacco revenue has been worked as a monopoly by a company formed under Ottoman law, styled "La Régie Impériale Cointéressée des Tabacs Ottomans." This company has the absolute monopoly of the manufacture and of the purchase and sale of tobacco throughout the Ottoman Empire, with the exception of the Lebanon and Crete, but exportation remains free. It is bound to purchase all tobacco not exported at prices to be agreed between itself and the cultivators; if no agreement can be arrived at, the price is fixed by experts. It is obliged also to form entrepôts for the storage of the crops at reasonable distances from each other, and, on certain conditions, to grant advances to cultivators to aid them in raising the leaf. The cultivators, on the other hand, may not plant tobacco without permits from the régie, although the power of refusing a permit, except to known smugglers or persons of notoriously bad conduct, seems to be doubtful; nor may they sell to any purchaser, unless for export, except to the régie, while they are bound to deposit the whole of the tobacco crops which they raise in any one year in the entrepôts of the régie before the month of August of the year following,

TABLE A.—*Showing Revenues ceded to Ottoman Public Debt Administration at Various Periods to 1907–1908.*

Heads of Revenue.	Last year of Galata Bankers, 1881–1882.	Average for First Five Years of Council of Public Debt, 1882–83, 1886–87.	Average for Second Five Years of Council of Public Debt, 1887–88, 1891–92.	Average for Third Five Years of Council of Public Debt, 1892–93, 1896–97.	Average for Fourth Five Years of Council of Public Debt. 1897–98, 1901–2.	Average for Fifth Five Years of Council of Public Debt, 1902–3, 1906–7.	1907–8.
	£T	£T	£T	£T	£T	£T	£T
Six Indirect Contributions:—*							
Tobacco	881,563	822,633	755,489	788,384	725,641	815,923	899,352
Salt	634,936	651,057	702,150	755,978	861,406	987,417	1,123,886
Stamps	129,833	146,822	185,930	212,815	221,856	321,193	366,255
Spirits	177,163	198,356	229,059	258,848	269,482	273,893	283,301
Fisheries	26,064	34,356	44,307	44,337	47,294	53,032	69,549
Silk	17,118	24,145	39,398	56,393	69,012	98,731	131,218
Extra Budgetary Receipts †	—	—	—	—	2,797	25,757	—
Total of Six Indirect Contributions	1,866,677	1,937,369	1,956,333	2,116,755	2,197,488	2,575,946	2,873,561
Tobacco Tithe	not collected	72,340	81,866	104,688	99,276	172,473	210,068
Eastern Rumelian Annuity	,,	150,040	126,688	129,222	88,682	159,628	114,020
Excess of Cyprus Revenues	,,	130,000	113,557	102,596	102,596	102,596	102,596
Tax on Tumbēki	,,	50,000	50,000	50,000	50,000	50,000	50,000
Total Gross Revenue	1,866,677	2,339,749	2,328,444	2,503,261	2,538,042	3,060,643	3,350,245‡
Expenses	378,789	388,000	392,403	346,143	418,537	522,798	572,850
Total Net Revenue	1,487,888	1,951,749	1,936,041	2,157,118	2,119,505	2,537,845	2,777,395

* Exclusive of £T50,000 representing the retrocession of the reftish (Egyptian tax, abolished in 1895) to the régie.

† Up to 1902–1903 the extra-budgetary receipts and fines had been carried to account of the respective revenues concerned; after that date they were placed under a special heading. After 1905–1906 extra-budgetary receipts relating to expenditure previously effected have been deducted from "General Expenses."

‡ The 3% customs surtax is not included in this table. It came into force on the 13th of July 1907, and produced during the remainder of the financial year £T544,987; 25% of this revenue is ceded to the public debt; the remainder reverts to the government.

TABLE B.—*Position of the Ottoman Public Debt on the 1st of March 1326 (March 14, 1910).*

Designation of Loans.		Nominal Capital issued.	Annuities.	Nominal Capital redeemed at 1st March 1326 (1910).	Nominal Capital in circulation on 1st March 1326 (1910).
		£T	£T	£T	£T
Debt controlled by the administration of the Ottoman Public Debt.	Unified Debt 4 %[1]	42,275,772	1,887,375	2,345,010	39,930,762
	Turkish Lottery Bonds[1]	15,632,548	270,000	3,599,592	12,032,956
	4 % Loan 1890	4,999,500	249,975	1,509,200	3,490,300
	5 % ,, 1896	3,272,720	180,000	289,300	2,983,420
	4 % ,, 1903 Fisheries	2,640,000	118,800	105,424	2,534,576
	4 % ,, Bagdad 1st Series	2,376,000	97,120	15,642	2,360,358
	4 % ,, ,, 2nd ,,	4,752,000	200,000	8,426	4,743,574
	4 % ,, 1904	2,750,000	123,750	57,090	2,692,910
	4 % ,, 1905 Military Equipment	2,640,000	118,800	83,556	2,556,444
	4 % ,, 1901–1905	5,306,664	238,800	123,420	5,183,244
	4 % ,, 1908	4,711,124	212,000	—	4,711,124
		91,356,328	3,696,620	8,136,660	83,219,668
Debt in the service of which the administration of the Ottoman Public Debt does not intervene.	4 % Loan 1893 Tumbēki	1,010,010	50,000	239,800	760,210
	4 % ,, 1894	1,760,000	76,560	136,202	1,623,798
	4 % ,, 1902[1]	8,600,020	390,000	367,180	8,232,840
	4 % ,, 1855	5,500,000	167,869	1,303,280	4,196,720
	4 % ,, 1891	6,948,612	308,686	777,700	6,170,912
	3½ % ,, 1894	9,033,574	362,174	852,808	8,180,766
	4 % ,, 1909	7,000,004	350,000	—	7,000,004
	Total	131,198,548	5,401,909	11,813,630	119,384,918

[1] The capital in circulation for these loans, established on the 1st of March 1326 (1910), is approximate.

and may not move any tobacco from the place where they cultivate it without the régie's express authority. In order to facilitate supervision, a minimum area of one-half of a *deunum* (a deunum = about one-fourth of an acre) is fixed for ground upon which tobacco may be cultivated; in the suburban districts of Constantinople and some other towns, and in enclosures surrounded by walls and attached to dwelling-houses, it is altogether prohibited. For its privileges the régie has to pay a rent of £T750,000 per annum to the government (assigned to bondholders), "even if it has no revenues at all," and after the payment of a dividend of 8 % to its shareholders, and certain other deductions, it has to share profits with the government and the bondholders according to a sliding scale agreed upon between the three parties. The régie did badly during the first four years of its existence, owing principally to two causes: (1) its ineffectual power to deal with contraband to which the system described above leaves the door wide open; (2) the admission of other than Turkish tobaccos into Egypt, which deprived it at once of about £T100,000 per annum. So great were its losses that in the year 1887–1888 it was obliged to write them off by reducing its capital from £2,000,000 to £1,600,000. At the same time it was granted an extension of penal powers, and the losses on *reftieh* (duty on tobacco exported to Egypt) were to be partially borne by the public debt administration. Things went better with it from that time until 1894–1895, when, owing to internal troubles in the empire, and the consequent fear of creating worse disorders, by the strict enforcement of the monopoly, the government withdrew most of its support, and contraband enormously increased. The following table shows the movement of the revenue of the régie from the year 1887–1888 to 1908–1909 inclusive:—

Average for 5 years.	Gross receipts from all sources.	Total expenses, including fixed charges.	Net revenue.
	£T	£T	£T
1887–1892	1,924,264	1,735,896	188,368
1892–1897	2,330,786	2,037,190	*293,596
1897–1902	2,098,537	1,898,646	*199,891
1902–1907	2,511,921	2,104,739	407,182
Year 1907–8	2,660,895	2,146,864	514,031
,, 1908–9	2,597,909	2,167,795	430,114

* There was a heavy fall in the receipts in the four years 1895–1896 to 1898–1899 inclusive. The climax was reached in 1897–1898 when the net revenue amounted to only £63,975 as compared with £T352,000 in 1894–1895, and it did not revert to its previous level until 1902–1903. This was the result of the Armenian massacres, the wholesale emigration of Armenians of all classes, the accompanying profound political unrest throughout the country, and the great extension of contraband which ensued from it.

Negotiations were initiated in 1910 for the prolongation of the concession of the tobacco monopoly, which reaches its term in 1913.

Railway Guarantees.—Up to 1888 the only railways existing in the Turkish Empire (exclusive of Egypt) were, in Europe, the Constantinople-Adrianople-Philippopolis line and the Salonica-Mitrovitza line (finished in 1872); and in Asia Minor, the Smyrna-Aïdin (completed in 1866), the Smyrna-Cassaba (completed in 1866), the Constantinople-Ismid (completed in 1872), the Mersina-Adana (completed in 1886). The want of railways in Asia Minor was urgently felt, but no capitalists were willing to risk their money in Turkish railways without a substantial guarantee, and a guarantee of the Turkish government alone was not considered substantial enough. In 1888 it was proposed by the public debt administration to undertake the collection of specified revenues to be set aside for the provision of railway guarantees, the principle to be followed being, generally, that such revenues should consist of the tithes of the districts through which the railways would pass, and that the public debt should hand over to guaranteed railway companies the amounts of their guarantees before transmitting to the imperial government any of the proceeds of the revenue so collected. The government adopted this proposal, and laid down as a principle that it would guarantee the gross receipts per kilometre of guaranteed railways, such gross receipts to be settled for each railway on its own merits. Considerable competition ensued for the railway concessions under this system. The first granted was for the extension of the Constantinople-Ismid railway to Angora to a group of German and British capitalists in 1888. The Germans having bought out the British rights, this concession became a purely German affair, although a certain proportion of the capital was found in London. Since that time various other concessions have been granted to French and German financial groups, principally the Imperial Ottoman Bank group of Paris and the Deutsche Bank group of Berlin.

The systems of guarantee above described are clearly faulty, since theoretically the railway company which ran no trains at all would, up to the limit of its guarantee, make the largest profits. The concessionnaire companies have, however, wisely taken the view that it is better to depend upon their own revenues than upon any government guarantee, and have done their best to develop the working value of the lines in their charge. The economic effect of the railways upon the districts through which they run is apparent from the comparative values of the tithes in the regions traversed by the Anatolian railway in 1889 and 1898 in which years it so happened that prices were almost at exactly the same level, and again in 1908–1909, when they were only slightly higher. Thus in 1889 they produced £T145,378, in 1898 £T215,470, and in 1908–1909 £T281,919.

A different system, still more uneconomic than the kilometric guarantee pure and simple, was adopted in the case of the Bagdad railway. In January 1902 the German group holding the Anatolian railway concession was granted a further concession for extending that railway from Konia, then its terminus, through the Taurus range and by way of the Euphrates, Nisibin, Mosul, the Tigris, Bagdad, Kerbela and Nejef to Basra, thus establishing railway communication between the Bosporus and the Persian Gulf. The total length, including branches to Adana, Orfa (the ancient Edessa) and other places was to exceed 1550 m.; the kilometric guarantee granted was 15,500 francs (£620). It should be noted that this concession was substituted for one negotiated by the same group, and projected to pass through Diarbekr. This raised strong objections on the part of Russia, and led to the Black Sea Basin agreement reserving to Russia the sole right to construct railways in the northern portion of Asia Minor. The Anatolian railway company, apparently unable to handle the concession above described, initiated fresh negotiations which resulted in the Bagdad railway convention (March 5, 1903). This convention caused much excitement and irritation in Great Britain, owing to the encroachment of German influence sanctioned by it on territories bordering the Persian Gulf, hitherto considered to fall solely within the sphere of British influence. Attempts were made by the German group, assisted by their government, to secure the participation of both Britain and France in the concession. These were successful in France, the Imperial Ottoman Bank group agreeing to undertake 30% of the finance without, however, any countenance from the French government—the "Glarus Syndicate" being formed for apportioning interests. The British government seemed, at one time, rather to favour a British participation, but when the terms of the convention were published, the strongest objection was taken to the constitution of the board of directors which established German control in perpetuity, while it was evident from the general tenor of the convention that a political bias informed the whole; in the end public feeling ran so high that any British participation became impossible.

The financial advantages, however, granted by the Turkish government were singularly favourable to the concessionnaires and onerous to itself. The kilometric guarantee of 15,500 francs (£620) was split into two parts, 4500 francs (£180) being granted as the fixed working expenses of the line, all receipts in excess of which amount were to be credited to the Turkish government in reduction of the remaining 11,000 francs (£440) which took the form of an annuity to be capitalized as a 4 % state loan redeemable in 99 years, that being the period fixed for the duration of the concession. The line was to be constructed in sections of 200 kilometres (125 m.) each, and as the complete plans and drawings of each were presented at the times and in the order specified in the convention, the government was to deliver to the concessionnaires government securities representing the capitalization of the annuity accruing to that section. The capital sum per section was fixed, in round figures, at 54,000,000 francs (£2,160,000), subject to adjustment when the section was completed and its actual length definitely measured up. A minimum net price of 81½ % was fixed for the realization of these securities on the market. The bonds are secured on the surplus of the revenues assigned to the guarantee of the Anatolian railway collected by the Public Debt Administration, on the excess revenue, after certain deductions, accruing to the government under the "Annex-Decree to the Decree of Muharrem" above described, on the sheep tax of the vilayets of Koniah, Adana and Aleppo, and on the railway itself. The first series (54,000,000 francs or £2,160,000), was duly handed over to the concessionaires in 1903, and was floated in Berlin at 86·4% realizing the sum of £1,868,000. The division of the line into equal sections of 200 kilometres apiece produced at once a somewhat ridiculous result. The little town of Eregli, some 190 kilometres distant from Konia, presented the only excusable locality for the terminus of the first section, and even that place is 90 kilometres distant from Karaman, the last town of any importance for some hundreds of miles on the way to the Euphrates valley, the country between the two towns being desolate and sparsely inhabited. But the Bagdad Railway Company[1] (the share capital of which is £600,000 half paid up), naturally anxious to earn the whole of the capitalized subvention, completed the construction of the entire 200 kilometres. The line was thus continued to a station taking its name from Bulgurlu, a small straggling village four miles away, between which and Eregli there is not a single habitation. But even this did not quite complete the distance, and the line was carried on for still another kilometre and there stopped, "with its pair of rails gauntly projecting from the permanent way" (Fraser, *The Short Cut to India*, 1909). The outside cost of construction of the first section, which lies entirely in the plains of Konia, is estimated to have been £625,000; the company retained, therefore, a profit of at least 1¼ millions sterling on this first part of the enterprise. In the second section the Taurus range is reached, after which the construction becomes much more difficult and costly. On the 2nd of June 1908 a fresh convention was signed between the government and the Bagdad Railway Company providing, on the same financial basis, for the extension of the line from Bulgurlu to Helif and of the construction of a branch from Tel-Habesh to Aleppo, covering a total aggregate length of approximately 840 kilometres. The principle of equal sections of 200 kilometres was thus set on one side. The payments to the company were to be made in two lump sums forming "series 2 and 3" of the "Imperial Ottoman Bagdad railway loan," series 2 amounting to £4,320,000, which was delivered to the company on the signature of the contract, and series 3 to £4,760,000. The Bagdad railway must for much time be a heavy weight on the Turkish budget, the country through which it passes—with the exception of the sections passing from Adana to Osmanieh, through the Killis-Aleppo-Euphrates district (that is, the first point at which the line crosses the Euphrates some 600 m. from Bagdad), and to a lesser extent through the plains of Seruj and Harran—being very sparsely populated, while the financial system adopted offers no inducement to the concessionaire company to work for increasing earnings. It should be mentioned that the Bagdad Railway Company has sublet the working of the line to the Anatolian Railway Company at the rate of £148 per kilometre, as against the £180 per kilometre guaranteed by the Turkish government

Ottoman Railways worked at end of 1908.

Designation of Main Lines.	Length in Miles (including branch lines).	Amount Kilometric Guarantees.
Turkey in Europe:—		£
Oriental Railways[2]	815	Nil
Salonica-Monastir	137	572
Salonica-Constantinople	317	620
Total European Turkey	1269	
Turkey in Asia:—		
Hamidie Railway of the Hejaz[3]	932	Nil.
Anatolian Railway	635	Varies from £270 to £600.
Bagdad Railway (Konia-Bulgurlu section)[4]	124	£620: Annuity £440 Working Expenses £180.
Mudania-Brusa	26	Nil.
Smyrna-Aidin	320	Nil.
Smyrna-Cassaba	322	For main-line and Burnabat and Manisa-Soma branches the government guarantees £92,400 as half the annual receipts. For the Alashehr-Karahissar extension, there is a kilometric guarantee of £755.
Damascus-Hama	361	520
Mersina-Adana[5]	42	Nil.
Jaffa-Jerusalem	54	Nil.
Total Asiatic Turkey	2816	
Grand Total	4085	

Results of 1908 according to the Nationality of the Capital.

Nationality of the Capital.	Companies or Societies.	Lengths Worked.		Gross Receipts for the Year 1908.	Guarantees paid by the State for the Year 1908.	Rents paid to the State for the Year 1908.	Totals per Companies.	Totals per Nationalities.	Average receipts per mile per Nationality.
		per Company.	per Nationality.						
		Miles.	Miles.	£	£	£	£	£	£
Ottoman	Hejaz Railway	932	932	150,435	—	—	150,435	150,435	161
German	Salonica-Monastir Railway	137	938	129,854	—	243	129,611	841,081	885
	Bagdad Railway	124		14,578	108,155	—	122,733		
	Mersina-Adana Railway	42		36,400	—	—	36,400		
	Anatolia—	635					552,337		
	Haidar Pasha-Angora			209,105	117,030				
	Eskishehr-Konia			102,570	118,755	—			
	Hamidie-Adabazar			4,877	—	—			
English	Aidin Railway	320	320	293,104	—	—	293,104	293,104	916
Austro-German	Oriental Railways	815	815	607,619	—	115,679	491,940	491,940	604
French	Salonica-Constantinople Junction	317	1,054	113,505	199,728	—	313,233	1,092,957	1,037
	Smyrna Kassaba and Extensions	322		223,643	146,980	—	—		
	Damascus-Hama and Extensions (Rayak-Aleppo)	361		269,934	94,801	—	364,735		
	Jaffa-Jerusalem	54		44,366	—	—	44,366		
Various	Mudania-Brusa	26	26	15,039	—	—	15,039	15,039	579
	Totals	4,085	4,085	2,215,029	785,449	115,922	2,884,556	2,884,556	697

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[1] Specially formed by the Anatolian railway group for the execution, which the Anatolian Railway Company guarantees under the Bagdad Railway Convention, of the Bagdad railway concession.

[2] The line from Mustafa-Pasha to Vakarel now lies in the kingdom of Bulgaria.

[3] Constructed and worked by the State.

[4] Extension of Anatolian Railway.

[5] The Anatolian Railway group (German) has obtained control of this little railway, which was originally British.

—an additional indication, if any were needed, of the thriftlessness of the latter in the matter. Moreover, the Anatolian railway receives, under the original Bagdad railway convention (1) an annuity of £14,000 per annum for thirty years as compensation for strengthening its permanent way sufficiently to permit of the running of express trains, and (2) a second annuity of £14,000 in perpetuity to compensate it for running express trains—this to begin as soon as the main Bagdad line reaches Aleppo.

It was stated in the preface to the budget of 1910 that the government would grant no more railway concessions carrying guarantees. The amount inscribed for railway guarantees in the budget of 1910 was £746,790. The tables on p. 440 show the respective lengths of the various Ottoman railways open and worked at the end of 1908 and the amount of kilometric guarantees which they carried—and the lengths, &c., of railways worked by the various companies according to the nationality of the concessionaire groups.

Banks.—At the close of the Crimean War a British bank was opened in 1856 at Constantinople under the name of the Ottoman Bank, with a capital of £500,000 fully paid up. In 1863 this was merged in an Anglo-French bank, under a concession from the Turkish government, as a state bank under the name of the *Imperial Ottoman Bank*, with a capital of £2,700,000, increased in 1865 to £4,050,000 and in 1875 to £10,000,000, one-half of which is paid up. The original concession to the year 1893 was in 1875 extended to 1913, and in 1895 to 1925. The bank acts as banker to the government, for which it has a fixed annual commission, and it is obliged to make a permanent statutory advance to the government of £T1,000,000, against the deposit by the government of marketable securities bearing interest at a rate agreed upon. The bank has the exclusive privilege of issuing bank-notes payable in gold. Its central office is in Constantinople, and it is managed by a director-general and advisory committee appointed by committees in London and Paris.

The National Bank of Turkey (a limited Ottoman Company) is a purely British concern with a capital of £1,000,000, founded by imperial firman of the 11th of April 1909, under the auspices of Sir Ernest Cassel. It is understood that it was originated at the unofficial instigation of both the British and Ottoman governments, with the idea of forming a channel for the more generous investment of British capital in Turkey under the new régime, so that British financial interests might play a more important part in the Ottoman Empire than has been the case since the state bankruptcy of 1876. This bank brought out the Constantinople municipal loan of 1909 (£1,000,000). Other banks doing business in Constantinople are the *Deutsche Bank*, the *Deutsche-Orient Bank*, the *Crédit Lyonnais*, the *Wiener Bank-Verein*, the *Russian Bank for Commerce and Industry*, the *Bank of Mitylene*, the *Bank of Salonica* and the *Bank of Athens*.

Monetary System.—The monetary system presents a spectacle of perplexing confusion, which is a remnant of the complete chaos which prevailed before the reforms initiated in 1844 by Sultan Abd-ul-Mejid. The basis of the system adopted was the double standard with a fixed relation of 1 to 15·09, and free coinage. The unit was the piastre (=2⅛d.), nominally subdivided into 40 paras. The gold pound (18s. 2d.) was equivalent to 100 piastres; the gold pieces struck were £T5, £T1, £T½ and £T¼; the standard is 0·916⅔ fine, and the weight 7·216 grammes. The silver coinage consisted of the mejidie (weight 24·055 grammes, 0·830 fine), equivalent to 20 piastres, and its subdivisions 10, 5, 2, 1, and ½ piastre pieces. The altilik, beshlik and metallik currencies struck, the first and last in the reign of Mahmud II. and Abd-ul-Mejid, and the second in the reign of Mahmud only, were not included in the reform; these were debased currencies bearing a nominal value, the altilik of 6, 3 and 1½ piastres, the beshlik of 5 and 2½ piastres, the metallik of 1, ½ and ¼ piastres; they represented the last degree of an age-long monetary depreciation, the original piastre having had a value of about 5s. 7d., which had fallen to 2⅛d. The heavy depreciation in silver causing large losses to the government, free coinage was suspended in 1880, and the nominal value of the mejidie was reduced by decree to 19 piastres (105·26 piastres thus = £T1), while in the same year the debased currencies were reduced, altilik, the 6-piastre piece to 5 piastres, the 3-piastre piece to 2½ piastres, the 1½-piastre piece to 1¼ piastre; beshlik, the 5-piastre piece to 2½ piastres, the 2½-piastre piece to 1¼-piastre; metallik, the 1-piastre piece to ½ piastre, the ½-piastre piece to ¼ piastre, the ¼-piastre piece to ⅛ piastre—these values representing approximately the intrinsic value of the silver, at mejidie standard, contained in the debased coins. The copper coinage (113,000,000 piastres) and the paper currency (kaïmë) (1,600,000,000 piastres) referred to in the above sketch were withdrawn in 1880 by repudiation. The 20-piastre mejidie currency, in spite of the further enormous depreciation of silver since 1880, has scarcely varied in the Constantinople market, but has always remained at a discount of about 3% (between 108 and 109 piastres to the pound) under government rate; this is doubtless due to the fact that the demand and supply of the coins in that market are very evenly balanced. The parity thus working out at 102·60, gold continued to be held away from the treasury, and in 1909 the government decided to accept the Turkish pound at the last named rate. The fractional mejidie coins (5, 2 and 1 piastres) are quoted at a separate rate in the market, usually at a premium over the 20-piastre piece. In the last twelve years of the 19th century the altilik currency was almost entirely withdrawn, and replaced by fractional mejidie; a large proportion of the beshlik has also been withdrawn, but the metallik has not been touched. These debased currencies are usually at a premium over gold owing to the extreme scarcity of fractional coinage. The standard of the altilik is about 0·440 fine, that of the beshlik is 0·185 to 0·225 fine, that of the metallik is 0·170 fine. Foreign gold coins, especially the pound sterling (par value 110 piastres) and the French 20-franc piece (par value 87½ piastres) have free currency. Throughout Arabia and in Tripoli (Africa) the principal money used is the silver Maria Theresa dollar tariffed by the Ottoman government at 12 piastres. The Indian rupee and the Persian kran are widely circulated through Mesopotamia; in Basra transactions are counted in krans, taking as a fixed exchange £T1 = 34·15 krans. The general monetary confusion is greatly intensified by the fact that the piastre unit varies for almost every province; thus, while the pound at Constantinople is counted at 108 piastres silver, it is at about 127 piastres for one kind of transaction and 180 for another in Smyrna, 135 piastres at Adrianople, 140 at Jerusalem, and so forth, accounts being kept in "abusive piastres," which exist no longer. In some towns, *e.g.* Adrianople, small change is often supplemented by cardboard tickets, metal discs, &c., put into circulation by private establishments or individuals of good credit.

A commission (the successor of many) was instituted at the ministry of finance in 1910, to draw up proposals for setting this confusion in order. In his 1910 budget speech the minister of finance, Javid Bey, demanded authority to create a new aluminium coinage of 5, 10, 20 and 40 para pieces, of which he would issue, in the course of three years, a nominal amount of £T1,000,000 to those provinces in which there was a great scarcity of small coins. The amounts of Turkish gold, silver and debased coinage in circulation are approximately £T16,500,000, in gold, £T8,700,000 (940,000,000 piastres at 108) in silver mejidies and fractions, and 200,000,000 piastres in beshlik and metallik.

Tenure of Property.—Real property is held in one of four various ways: either *mulk*, *emiriyē*, *vakuf* or *khaliyē*. (1) *Mulk* is the absolute property of its owner, and can be disposed of by him as he wills without restrictions, save those enumerated lower down (*General Dispositions*) as general for all the four classes. *Mulk* property is governed chiefly by the *Sheri* (sacred law). A duty of 10 per mille on its estimated value has to be paid on transfer by sale, donation or testament; 5 per mille on transfer by inheritance; and a registration duty on expenses of transfer. (2) *Emiriyē* is practically "public domains." The state may grant land of this category to private persons on payment by the latter of the value of the proprietary right—the tithes, ground-rent (should there be private buildings upon it), and the land-tax. It is administered by imperial functionaries called *arazi-mēmuru*; it is with the consent of the latter only that the proprietary rights can be sold. These rights are of simple possession, but they are transmissible in certain degrees to the heirs of the possessor. *Emiriyē* cannot be mortgaged, but can be given as security for debt on condition that it be restored when the debt has been repaid. The creditor may demand the *arazi-mēmuru* to proceed to a forced sale, but the *arazi-mēmuru* is not obliged to comply with that demand; no forced sale may take place after the decease of the debtor. *Emiriyē* is not transmissible by will, but may be transferred by donation, which returns to the donor should he outlive the beneficiary. Should a proprietor of *emiriyē* plant trees or vines, or erect buildings upon it, with the consent of the state, they are considered as *mulk*; an annual tax representing the value of the tithes on the portions of *emiriyē* thus utilized is levied. The *emiriyē* then becomes *mulk*, with certain restrictions as to transfer dues. A transfer duty of 5 % on the estimated value of *emiriyē* is paid on transmission by sale, inheritance or donation, of 2½ % on the amount of the debt in case of mortgage or release from mortgage, and of 10 % on expenses of registration. A different scale is established for *emiriyē* with *moukataa* (rent paid for *emiriyē* with *mulk* property established upon it). (3) *Vakuf* is "all property dedicated to God, of which the revenue is consecrated to His poor"; or "property of which the usufruct, such as tithe, taxes and rents, is attributed to a work of charity and of public interest." When once a property has been registered as *vakuf* it can never be withdrawn. There are two classes of *vakuf*: (*a*) Land so declared either directly by the sovereign or in virtue of imperial authority; (*b*) lands transformed by their proprietors from *mulk* into *vakuf*. The laws and regulations concerning *vakuf* are too intricate to be described; generally it may be said that they form a great obstruction to dealing with a large proportion of the most valuable property in Turkey, and therefore to the prosperity of the country. The *vakufs* are administered by a special ministerial department (*evkaf nazareti*), whose property, on behalf of the state, they theoretically are. The effect of the original system was that a *vakuf* property became the inalienable property of the state, and the original proprietor a mere tenant. All fundamental repairs thus fell to the charge of the state, which could not afford to effect them, and the *vakuf* revenues decreased so rapidly that already in the reign of Selim I. (1511–1520) a serious effort was made to deal with the difficulty. But this resulted in so heavy a burden upon the public that the law had again to be altered to extend hereditary rights, and to admit a system of mortgage which was assimilated to that for *emiriyē*; but the evils were little more than palliated. The curious gilds called *guedik* must here be mentioned. They were established at a time when industry was not free, and the government fixed the number of artisans of every kind of trade in each town, no one having the right to increase that number. The *guedik*, then, had the right to erect buildings on *vakuf* property and supply it with the tools, &c., necessary to exercise a trade. The ancient *guediks* have not been abolished, the government not daring to deprive them of their privileges; but since the Tanzimāt no new ones have been created, industry being declared free. The various special dues payable on *vakuf* form too long a list to be inserted; the highest is 30 per mille. (4) *Kkaliyē.* This property is also styled *mevad.* It consists of uncultivated or rough lands, such as mountains, stony ground, &c., which are useless without clearance, to which no possession is claimed, and which are at such a distance from the nearest dwelling that the human voice cannot be made to reach them from that dwelling. Any one can obtain a gratuitous permit to clear and cultivate such lands; the laws governing ordinary agricultural lands then apply to them. The permit is withdrawn if the clearance is not effected within three years. If the clearance is effected without the necessary permit, the land is nevertheless granted on application, and on the payment of the *tapu* or sum paid by the proprietor to the state for the value of the land.

General Dispositions.—By the "protocol of the 7th Sefer 1284 A.H." foreigners may enjoy the rights of proprietorship on the same conditions as Ottoman subjects throughout the empire, save in the Hejaz. The transmission of property from a foreigner to his heirs is therefore governed by the Ottoman laws, and not those of the country to which he belongs. The real property of a Mussulman does not pass by inheritance to non-Mussulman heirs, but may pass to his Mussulman heirs of a foreign nationality, and vice versa. Property of an individual who has abandoned Ottoman nationality without legal authority so to do does not pass to heirs, whether Ottoman or foreign, but devolves to the state; if legal authority has been granted the government under which the foreign heirs live must have accepted the protocol above cited. An heir who has voluntarily caused the death of the person from whom he should inherit loses all rights of succession. It is not proposed to trace the formalities of transfer and transmission of real property here; they will be found in vol. iii. of the *Dustur* (Ottoman Code). Minerals are worked according to the law of the 14th Sefer 1324 (March 26, 1906). Mines can only be exploited in virtue of an imperial iradē. The concessions are to be for 99 years with the exception of chrome, emery, boracite and other minerals found only in the form of deposits, which may be granted for not less than 40 years or more than 99 years. They may be disposed of under certain conditions to third parties, and they may be inherited. Immovable property, working plant, tools and fixtures, cannot be seized for payment of debts. For the discovery of mines, special permits of research, on which there is a fee of £T5 to £T15, are necessary; full details of the requisite formalities are given in the law. No researches are permitted in boroughs and villages or in forests, pasturages, &c., if it be considered that they would interfere with public convenience. Two permits are not granted for the same mineral within the same area, until the first has lapsed. Specimens may be sent to Europe for expert examination up to an aggregate weight of 2000 tons, on paying the requisite duties. Explosives are under the control of the local authorities. In order to obtain permits foreigners must first have adhered to the law of 1293 (A.H.). The original discoverer of a mine is entitled to a certain indemnity for "right of discovery" to be paid by the concessionaire of that mine, should the discoverer be unable to work it. To obtain a concession, formalities detailed in the law must be complied with, under a penalty of £T100 to £T1000. Should a different mineral from that specified in the imperial firman for a mining concession be discovered in a free state, a fresh firman is necessary to exploit it. Discovered mines not registered by the government, or not worked for a period of 99 years before the promulgation of the law of the 26th of March 1906, are considered as non-discovered. On the promulgation of the firman for the exploitation of a mine, a fee of £T50 to £T100 becomes payable. Two categories of rent, fixed and proportional, are payable to the state by mine-owners. The fixed rent is 10 piastres per *jerib* (about 10,000 square metres), to be paid whether the mine is worked or not. The proportional rent is from 1 % to 5 % on the gross products of mines of vein formation, and from 10 % to 20 % on those of mines of deposit formation; the percentages are calculated on the value of the mineral after deduction of freight, &c. to Europe and of treatment. The proportional rents are fixed by the Mines Administration according to the wealth, area and facility of working of the mine, and are inserted in the imperial firman governing the mine, and must be paid before the minerals are exported. Yearly returns, under a penalty of £T5 to £T25, of the results of working have to be rendered to the Mines Administration. If payments due to the government are not made within two months of due date, the mines may be seized by the authorities and sold to the highest bidder. The working of the mine must begin within two years of the date of the delivery of the mine to the concessionaire. Certain specified plans must be delivered annually, under penalty of £T5 to £T25, to the Mines Administration, and, under similar penalties, all information and facilities for visiting the mines in detail must be afforded to government inspectors. Should a mine-owner, in the course of developing his mine, damage the mine of a neighbouring owner, he must pay him an agreed indemnity. With the exception of the engineer and foreman, the employés must be Ottoman subjects. No part of the subterranean working of a mine may be abandoned without official permission obtained according to formalities specified in the law. Owners of the land in which a mine is located have a prior right to work such mine under imperial firman, on the obtention of which a duty of £T4 is payable; if they do not work it the concession may be granted to others, on payment of a certain compensation to the landowner. The research of a mine in no way impairs the rights of ownership of the land in which the mine is located. If a mining concession is granted within lands which are private property or which are "real *vakuf* lands" (*arazi-i-mevkufē-i-sahiha*) only one-fifth of the proportional rent is payable to the state, the other four-fifths reverting to the land-owner or the *vakufs*, as the case may be. As to ancient coins, and all kinds of treasure of which the proprietor is unknown, reference must be made to the *Dustur*, No. 4, p. 89.

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(V. C.*)

HISTORY

Legend assigns to Oghuz, son of Kara Khan, the honour of being the father of the Ottoman Turks. Their first appearance in history dates from A.D. 1227. In that year a horde, variously estimated at from two to four thousand souls, with their flocks and their slaves, driven originally from their Central Asian homes by the pressure of Mongol invasion, and who had sought in vain a refuge with the Seljukian sultan Ala-ud-din Kaikobad of Konia, were returning under their chief Suleiman Shah to their native land. They were crossing the Euphrates, not far from the castle of Jaber, when the drowning of their leader by accident threw confusion into their ranks. Those who had not yet crossed the river refused, in face of this omen, to follow their brethren; the little band, numbering 400 warriors (according to others, consisting of 2000 horsemen) decided to remain under Ertoghrul, son of the drowned leader. Ertoghrul first camped at Jessin, east of Erzerum; a second appeal to Ala-ud-din was more successful—the numbers of the immigrants had become too insignificant for their presence to be a source of danger. The lands of Karaja Dagh, near Angora, were assigned to the new settlers, who found there good pasturage and winter quarters. The help afforded by Ertoghrul to the Seljukian monarch on a critical occasion led to the addition of Sugut to his fief, with which he was now formally invested. Here Ertoghrul died in 1288 at the age of ninety, being succeeded in the leadership of the tribe by his son Osman. When, exhausted by the onslaughts of Ghazan Mahmud Khan, ruler of Tabriz, and one of Jenghiz Khan's lieutenants, the Seljukian Empire was at the point of dissolution, most of its feudatory vassals helped rather than hindered its downfall in the hope of retaining their fiefs as independent sovereigns. But Osman remained firm in his allegiance, and by repeated victories over the Greeks revived the drooping glories of his suzerain. His earliest conquest was Karaja Hissar (1295), where first the name of Osman was substituted for that of the sultan in the weekly prayer. In that year Ala-ud-din Kaikobad II. conferred on him the proprietorship of the lands he had thus conquered by the sword, and presented him at the same time with the horse-tail, drum and banner which constituted the insignia of independent command. Osman continued his victorious career against the Greeks, and by his valour and also through allying himself with Keussē Mikhal, lord of Harman Kaya, became master of Aīnēgeul, Bilejik and Yar Hissar. His marriage with Mal Khatun, the daughter of the learned sheikh Edbali, has been surrounded by poetical legend; he married his son Orkhan to the beautiful Greek Nilofer, daughter of the lord of Yar Hissar, whom he carried off from her destined bridegroom on her marriage-day; the fruits of this union were Suleiman Pasha and Murad. In 1300 the Seljukian Empire crumbled away, and many small states arose on its ruins. It was only after the death of his protector and benefactor Sultan Ala-ud-din II. that Osman declared his independence, and accordingly the Turkish historian dates the foundation of the Ottoman Empire from this event. Osman reigned as independent monarch until 1326. He pursued his conquests against the Greeks, and established good government throughout his dominions, which at the time of his death included the valleys of the Sakaria and Adranos, extending southwards to Kutaiah and northwards to the Sea of Marmora. Infirmity had compelled him towards the end of his life to depute the chief command to his younger son Orkhan, by whom in 1326 the conquest of Brusa was at last effected after a long siege.

Ertoghrul, 1230–1288.

Osman I, 1288–1326.

Orkhan, 1326–1359.

Orkhan's military prowess secured for him the succession, to the exclusion of his elder brother Ala-ud-din, who became his grand vizier. At that time a number of principalities had replaced the Seljukian state. Though Yahsha Bey, grandson of Mahommed Karaman Oghlu, had declared himself the successor of the Seljukian sultans, the princes of Aidin, Sarukhan, Menteshē, Kermian, Hamid, Tekkē and Karassi declined to recognize his authority, and considered themselves independent, each in his own dominions. Their example was followed by the Kizil Ahmedli Emir Shems-ed-din, whose family was afterwards known as the house of Isfendiar in Kastamuni. The rest of the country was split up among Turcoman tribes, such as the Zulfikar in Marash and the Al-i-Ramazan in Adana. At his accession Orkhan was practically on the same footing with these, and avoided weakening himself in the struggle for the Seljukian inheritance, preferring at first to consolidate his forces at Brusa. There he continued to wrest from the Greeks the lands which their feeble arms were no longer able to defend. He took Aīdos, Nicomedia, Hērēkē, and, after a siege, Nicaea; Tarakli and Gemlik fell to his arms, and soon the whole of the shore of the Marmora up to Kartal was conquered, and the Byzantines retained on the continent of Asia Minor only Ala Shehr and Biga. These acquisitions were made between 1328 and 1338; in the latter year Orkhan achieved his first conquest from Mussulman hands by the capture of Karassi, the pretext being the quarrel for the succession on the death of the prince, Ajlan Bey.

At this period the state of the Byzantine Empire was such as to render its powers of resistance insignificant; indeed the length of time during which it held out against the Turks is to be attributed rather to the lack of efficacious means at the disposal of its assailants than to any qualities possessed by its defenders. In Constantinople itself sedition and profligacy were rampant, the emperors were the tools of faction and cared but little for the interests of their subjects, whose lot was one of hopeless misery and depravity. On the death of the emperor Andronicus III. in 1341 he was succeeded by John Palaeologus, a minor; and Cantacuzenus, the mayor of the palace, appealed to Orkhan for assistance to supplant him, giving in marriage to the Ottoman prince his daughter Theodora. Orkhan lent the desired aid; his son Suleiman Pasha, governor of Karassi, crossed into Europe, crushed Cantacuzenus's enemies, and penetrated as far as the Balkans, returning laden with spoil. Thus the Turks learnt the country of the Greeks and their weakness. In 1355 Suleiman crossed over from Aīdinjik and captured the fortress of Gallipoli, which was at once converted into a Turkish stronghold; from this base Bulaīr, Malgara, Ipsala and Rodosto were added to the Turkish possessions. Suleiman Pasha was killed by a fall from his horse near Bulaīr in 1358; the news so affected his father Orkhan as to cause his death two months later. The institution of the Janissaries (*q.v.*) holds a prominent place among the most remarkable events of Orkhan's reign, which was notable for the encouragement of learning and the foundation of schools, the building of roads and other works of public utility.

Murad I, 1359–1389.

Orkhan was succeeded by his son Murad. After capturing Angora from a horde of Turkomans encamped there who were attacking his dominions, at first with some success, in 1361 Murad prepared for a campaign in Europe. At that time the Greek emperor's rule was confined to the shores of the Marmora, the Archipelago and Thrace. Salonica, Thessaly, Athens and the Morea were under independent Greek princes. The Bulgarians, Bosnians and Servians had at different periods invaded and conquered the territories inhabited by them; the Albanians, original natives of their land, were governed by princes of their own. When, on the death of Cantacuzenus, John Palaeologus remained sole occupant of the imperial throne, Murad declared war against him and conquered the country right up to Adrianople; the capture of this city, the second capital of the emperors, was announced in official letters to the various Mussulman rulers by Murad. Three years later, in 1364, Philippopolis fell to Lala Shahin, the Turkish commander in Europe. The states beyond the Balkan now began to dread the advance of the Turks; at the instigation of the pope an allied army of 60,000 Serbs, Hungarians, Walachians and Moldavians attacked Lala Shahin. Murad, who had returned to Brusa, crossed over to Biga, and sent on Haji Ilbeyi with 10,000 men; these fell by night on the Servians and utterly routed them at a place still known as the "Servians' coffer." In 1367 Murad made Adrianople his capital and enriched it with various new buildings. He continued to extend his territories in the north and west; the king of Servia and the rulers of Kiustendil, Nicopolis and Silistria agreed to pay tribute to the conquering Turk. Lala Shahin Pasha was appointed feudal lord of the district of Philippopolis, and Timur Tash Pasha became beylerbey of Rumelia; Monastir, Perlepē, and parts of Bosnia and Herzegovina were next taken, and the king of Servia consented to furnish to Murad a fixed contingent of auxiliary troops, besides paying a money tribute. In 1381 Murad's son Yilderim Bayezid married Devlet Shah Khatun, daughter of the prince of Kermian, who brought him in dowry Kutaiah and its six dependent provinces. In the same year Bey Shehr and other portions of the Hamid principality were acquired by purchase from their ruler Hussein Bey, as the Karamanian princes were beginning to cast covetous eyes on them; but the Karamanians were unwilling to resign their claims to be heirs of the Seljukian sultans, and not until the reign of Mahommed II. were they finally suppressed. Ali Bey, the prince at this time, took advantage of Murad's absence in Europe to declare war against him; but the Ottoman ruler returning crushed him at the battle of Konia. Meanwhile the king of Bosnia, acting in collusion with the Karamanian prince, attacked and utterly defeated Timur Tash Pasha, who lost 15,000 out of an army of 20,000 men. The princes and kings who had consented to pay tribute were by this success encouraged to rebel, and the Servian troops who had taken part in the battle of Konia became insubordinate. Indignant at the severity with which they were punished, Lazarus, king of Servia, joined the rebel princes. Murad thereupon returned to Europe with a large force, and sent Chendereli Zadē Ali Pasha northwards; the fortresses of Shumla, Pravadi, Trnovo, Nicopolis and Silistria were taken by him; Sišman III., rebel king of Bulgaria, was punished and Bulgaria once more subjugated. Ali Pasha then joined his master at Kossovo. Here Lazarus, king of Servia, had collected an army of 100,000 Serbs, Hungarians, Moldavians, Walachians and others. On the 27th of August 1389 the greatest of the battles of Kossovo was fought. A lightning charge of Yilderim Bayezid's dispelled the confidence of the enemy, scattering death and dismay in their ranks. The king of Servia was killed and his army cut to pieces, though the Turks numbered but 40,000 and had all the disadvantage of the position. After the battle, while Murad was reviewing his victorious troops on the field, he was assassinated by Milosh Kabilovich, a Servian who was allowed to approach him on the plea of submission.

Murad maintained a show of friendly relations with the emperor John Palaeologus, while capturing his cities. A review held by him in 1387 at Yeni Shehr was attended by the emperor, who, moreover, gave one of his daughters in marriage to Murad and the other two to his sons Bayezid and Yakub Chelebi. These princes were viceroys of Kermian and Karassi respectively; the youngest son, Sauji Bey, governed at Brusa during his father's absence. Led away by evil counsellors, Sauji Bey plotted with Andronicus, son of the emperor, to dethrone their respective fathers. The attempt was foiled; Andronicus was blinded by his father's orders and Sauji was put to death (1387).

Bayezid I., 1389–1403.

After being proclaimed on the field of Kossovo, Bayezid's first care was to order the execution of his brother Yakub Chelebi, and so to preclude any repetition of Sauji's plot. The young prince Andronicus, who had not been completely blinded, sent secretly to Bayezid and offered him 30,000 ducats to dethrone his father John Palaeologus and make him emperor. Bayezid consented; later on John Palaeologus offered an equivalent sum and, since he engaged to furnish an auxiliary force of 12,000 men into the bargain, Bayezid replaced him on the throne. By the aid of these auxiliaries the fort of Ala Shehr was captured (1392), Manuel Palaeologus, son of the emperor, being allowed, in common with many other princes, the privilege of serving in the Turkish army, then the best organized and disciplined force extant. The principalities of Aīdin, Menteshē, Sarukhan and Kermian were annexed to Bayezid's dominions to punish their rulers for having joined with the Karamanian prince in rebellion. The exiled princes took refuge with the Kizil Ahmedli, ruler of Kastamuni, who persuaded the Walachians to rebel against the Turks. By a brilliant march to the Danube Bayezid subjugated them; then returning to Asia he crushed the prince of Karamania, who had made head again and had defeated Timur Tash Pasha. Bayezid now consolidated his Asiatic dominions by the capture of Kaisarieh, Sivas and Tokat from Tatar invaders, the relics of Jenghiz Khan's hordes. Sinope, Kastamuni and Samsun were surrendered by the prince of Isfendiar, and the conquest of Asia Minor seemed assured.

On the death of John Palaeologus in 1391 his son Manuel, who was serving in the Turkish army, fled, without asking leave, to Constantinople, and assumed the imperial dignity. Bayezid determined to punish this insubordination: Constantinople was besieged and an army marched into Macedonia, capturing Salonica and Larissa (1395). The siege of the capital was, however, unsuccessful; the pope and the king of Hungary were able to create a diversion by rousing the Christian rulers to a sense of their danger. An army of crusaders marched upon the Turkish borders; believing Bayezid to be engaged in the siege of Constantinople, they crossed the Danube without precaution and invested Nicopolis. While the fortress held out with difficulty Bayezid fell upon the besiegers like a thunderbolt. The first onslaught of the Knights of the Cross did indeed rout the weak irregulars placed in the van of the Turkish army, but their mad pursuit was checked by the steady ranks of the Janissaries, by whom they were completely defeated (1396). King Sigismund of Hungary barely escaped in a fishing boat; his army was cut to pieces to a man; among the prisoners taken was Jean Sans Peur, brother of the king of France. To the usual letter announcing the victory the caliph in Egypt replied saluting Bayezid with the title of "Sultan of the lands of Rum."

After the victory of Nicopolis the siege of Constantinople was resumed, and the tower of Anatoli Hissar, on the Asiatic side of the Bosporus, was now built. However, by sending heavy bribes to Bayezid and his vizier, and by offering to build a mosque and a Mussulman quarter, and to allow Bayezid to be named in the weekly prayer, Manuel succeeded in inducing Bayezid to raise the siege. The mosque was destroyed later on and the Mussulman settlers driven out. Between 1397 and 1399 Bayezid overran Thessaly, while in Asia his lieutenant Timur Tash was extending his conquests. Meanwhile Timur (Tamerlane) had started from Samarkand on his victorious career. With incredible rapidity his hosts spread and plundered from Bagdad to Moscow. After devastating Georgia in 1401 he marched against the Turks. Some of the dispossessed princes of Asia Minor had repaired to Timur and begged him to reinstate them; accordingly Timur sent to Bayezid to request that this might be done. The tone of the demand offended Bayezid, who rejected it in terms equally sharp. As a result Timur's countless hordes attacked and took Sivas, plundering the town and massacring its inhabitants. Then, to avenge an insult sustained from the ruler of Egypt, Timur marched southwards and devastated Syria, thence turning to Bagdad, which shared the same fate. He then retraced his steps to the north-west. Bayezid had taken advantage of his absence to defeat the ruler of Erzingan, a protégé of Timur. All attempts to arrange a truce between the two intractable conquerors were in vain. They met in the neighbourhood of Angora. Timur's army is said to have numbered 200,000, Bayezid's force to have amounted to about half that figure, mostly seasoned veterans. The sultan's five sons were with the army, as well as all his generals; 7000 Servian auxiliaries under Stephen, son of Lazarus, took part in the battle (1402). Prodigies of valour on the part of Bayezid's troops could not make up for the defection of the newly-absorbed levies from Aīdin, Sarukhan and Menteshē who went over to their former princes in Timur's camp. The rout of the Turkish army was complete. Bayezid, with many of his generals, was taken prisoner. Though treated with some deference by his captor, who even promised to reinstate him, Bayezid's proud spirit could not endure his fall, and he died eight months later at Ak Shehr.

Interregnum, 1403–1413.

After the disaster of Angora, from which it seemed impossible that the Ottoman fortunes could ever recover, the princes fled each with as many troops as he could induce to follow him, being hotly pursued by Timur's armies. Only Mussa was captured. Timur reached Brusa, and there laid hands on the treasure of Bayezid; one after another the cities of the Turks were seized and plundered by the Tatars. Meanwhile Timur sent letters after the fugitive sons of Bayezid promising to confer on them their father's dominions, and protesting that his attack had been due merely to the insulting tone adopted towards him by Bayezid and to the entreaties of the dispossessed princes of Asia Minor. Most of the latter were reinstated, with the object of reducing the Turkish power. Timur did not cross into Europe, and contented himself with accepting some trifling presents from the Greek emperor. After capturing Smyrna he returned to Samarkand (1405). Some years of strife followed between the sons of Bayezid, in which three of them fell; Mussa, seizing Adrianople, laid siege to Constantinople, and Manuel Palaeologus, the emperor, appealed for aid to Mahommed, the other son, who had established himself at Brusa.

Mahommed I., 1413–1421.

In 1413 Mahommed defeated Mussa, and thus remained sole heir to Bayezid's throne; in seven or eight years he succeeded in regaining all the territories over which his father had ruled, whereas Timur's empire fell to pieces at the death of its founder. Two years after his accession Mahommed overcame a rebellion of the prince of Karamania and recaptured his stronghold Konia (1416), and then, turning northwards, forced Mircea, voivode of Walachia, who in the dispute as to the succession had supported Prince Mussa, to pay tribute. The Turkish dominions in Asia Minor were extended, Amasia, Samsun and Janik being captured, and an insurrection of dervishes was quelled. In 1421 the sultan died. His services in the regeneration of the Turkish power can hardly be over-estimated; all agree in recognizing his great qualities and the charm of his character; even Timur is said to have admired him so much as to offer him his daughter in marriage. The honour was declined, and Mahommed took a bride from the house of Zulfikar. Amid the cares of state he found time for works of public utility and for the support of literature and art; he is credited with having sent the first embassy to a Christian power, after the Venetian expedition to Gallipoli in 1416, and the Ottoman navy is first heard of in his reign.

Murad II., 1421–1451.

At the time of Mahommed's death his eldest son Murad was at Amasia; and, as the troops had lately shown signs of insubordination, it was deemed advisable to conceal the news of the sultan's death and to send a part of the army across to Asia. The men, however, refused to march without seeing their sultan, and the singular expedient was resorted to of propping up the dead monarch's body in a dark room and concealing behind it an attendant who raised the hands and moved the head of the corpse as the troops marched past. Shortly after Murad's accession the emperor Manuel, having applied in vain for the renewal of the annual subsidy paid him by the late sultan for retaining in safe custody Mustafa, an alleged son of Bayezid, released the pretender. Adherents flocked to him, and for a whole year Murad was engaged in suppressing his attempts to usurp the throne.

At last the armies of sultan and pretender met at Ulubad (Lopadion) on the Rhyndacus in Asia Minor; Mustafa's troops fled at the first onset; Lampsacus, where the pretender took refuge, was captured with the aid of the Genoese galleys under Adorno. Mustafa, who had crossed the strait and fled northwards, was taken, brought to Adrianople, and hanged from a tower of the serai (1422). Murad now laid siege to Constantinople to avenge himself on the emperor, and on the 24th of August the desperate valour of the defenders succeeded in driving back an assault led by a band of fanatical dervishes. The siege was raised, however, not owing to the bravery of the defence, but because the appearance of another pretender, in the person of Murad's thirteen-year-old brother Mustafa, under the protection of the revolted princes of Karamania and Kermian, called the sultan to Asia. Mustafa, delivered up by treachery, was hanged (1424); but Murad remained in Asia, restoring order in the provinces, while his lieutenants continued the war against the Greeks, Albanians and Walachians. By the treaty signed on the 22nd of February 1424, shortly before his death, the emperor Manuel II., in order to save the remnant of his empire, agreed to the payment of a heavy annual tribute and to surrender all the towns on the Black Sea, except Selymbria and Derkos, and those on the river Strymon. Peace was also made at the same time with the despot of Servia and the voivode of Walachia, on the basis of the payment of tribute. By 1426 the princes of Kermian and Karamania had submitted on honourable terms; and Murad was soon free to continue his conquests in Europe. Of these the most conspicuous was that of Salonica. Garrisoned only by 1500 Venetians, the city was carried by storm (March 1, 1428); the merciful precedent set by Mahommed I. was not followed, the greater part of the inhabitants being massacred or sold into slavery, and the principal churches converted into mosques.

The capture of Salonica had been preceded by renewed troubles with Servia and Hungary, peace being concluded with both in 1428. But these treaties, each of which marked a fresh Turkish advance, were short-lived. The story of the next few years is but a dismal record of aggression and of reprisals leading to fresh aggression. In 1432 the Turkish troops plundered in Hungary as far as Temesvár and Hermannstadt, while in Servia Semendria was captured and Belgrade invested. In Transylvania, however, the common peril evoked by the Turkish incursion and a simultaneous rising of the Vlach peasantry had knit together the jarring interests of Magyars, Saxons and Szeklers, a union which, under the national hero, the voivode János Hunyadi (*q.v.*), was destined for a while to turn the tide of war. In 1442 Hunyadi drove the Turks from Hermannstadt and, at the head of an army of Hungarians, Poles, Servians, Walachians and German crusaders, succeeded in the ensuing year in expelling them from Semendria, penetrating as far as the Balkans, where he inflicted heavy losses on the Turkish general. Meanwhile, again confronted by a rebellion of the prince of Karamania, Murad had crossed into Asia and reduced him to submission, granting him honourable terms, in view of the urgency of the peril in Europe. On the 12th of July 1444 a ten years' peace was signed with Hungary, whereby Walachia was placed under the suzerainty of that country; and, wearied by constant warfare and afflicted by the death of his eldest son, Prince Ala-ud-din, Murad abdicated in favour of his son Mahommed, then only fourteen years of age, and retired to Magnesia (1444). The pope urged the king of Hungary to take advantage of this favourable opportunity by breaking the truce solemnly agreed upon, and nineteen days after it had been concluded a coalition was formed against the Turks; a large army headed by Ladislaus I., king of Hungary, Hunyadi, voivode of Walachia, and Cardinal Cesarini crossed the Danube and reached Varna, where they hoped to be joined by the Greek emperor. In this emergency Murad was implored to return to the throne; to a second appeal he gave way, and crossing over with his Asiatic army from Anatoli Hissar he hastened to Varna. The battle was hotly contested; but, in spite of the prowess of Hunyadi, the rout of the Christians was complete; the king of Hungary and Cardinal Cesarini were among the killed. Murad is said to have abdicated a second time, and to have been again recalled to power owing to a revolt of the Janissaries. In 1446 Corinth, Patras and the north of the Morea were added to the Turkish dominions. The latter years of Murad's reign were troubled by the successful resistance offered to his arms in Albania by Scanderbeg (*q.v.*). In 1448 Hunyadi, now governor of Hungary, collected the largest army yet mustered by the Hungarians against the Turks, but he was defeated on the famous field of Kossovo and with difficulty escaped, while most of the chivalry of Hungary fell. Little more than two years later Murad died at Adrianople, being succeeded by his son Mahommed.

Mahommed II. the Conqueror, 1451–1481.

After suppressing a fresh revolt of the prince of Karamania, the new sultan gave himself up entirely to the realization of the long-cherished project of the conquest of Constantinople. He began by building on the European side of the Bosporus the fort known as Rumeli Hissar, opposite that built by his grandfather Bayezid. Tradition avers that but forty days were needed for the completion of the work, six thousand men being employed night and day; guns and troops were hurriedly put in, and all navigation of the Bosporus was stopped. After completing his preparations, which included the casting of a monster cannon and the manufacture of enormous engines of assault, Mahommed began the siege in 1453. Constantine Palaeologus, the last occupant of the imperial throne, took every measure that the courage of despair could devise for the defence of the doomed city; but his appeal to the pope for the aid of Western Christendom was frustrated through the bigoted, anti-Catholic spirit of the Greeks. The defenders were dispirited and torn by sedition and dissensions, and the emperor could rely on little more than 8000 fighting men, while the assailants, 200,000 strong, were animated by the wildest fanatical zeal. The siege had lasted fifty-three days when, on the 29th of May 1453, a tremendous assault was successful; the desperate efforts of the Greeks were unavailing, Constantine himself falling among the foremost defenders of the breach. The sultan triumphantly entered the palace of the emperors, and the next Friday's prayer was celebrated in the church of St Sofia (see ROMAN EMPIRE, LATER).

After some days' stay in Constantinople, during which he granted wide privileges to the Greeks and to their patriarch, the sultan proceeded northwards and entirely subdued the southern parts of Servia. A siege of Belgrade was unsuccessful, owing to the timely succour afforded by Hunyadi (1456). Two years later internal dissensions in Servia brought about the conquest of the whole country by the Turks, only Belgrade remaining in the hands of the Hungarians. The independent princes of Asia Minor were now completely subjugated and their territories finally absorbed into the Turkish dominions; Walachia was next reduced to the state of a tributary province. Venice having adopted a hostile attitude since Turkey's conquests in the Morea, greater attention was devoted to the fleet; Mytilene was captured and the entrance to the straits fortified. The conquest of Bosnia, rendered necessary by the war with Venice, was next completed, in spite of the reverses inflicted on the Turks by the Hungarian king Matthias Corvinus, the son of János Hunyadi. The Turks continued to press the Venetians by land and sea; Albania, which under Scanderberg had for twenty-five years resisted the Ottoman arms, was overrun; and Venice was forced to agree to a treaty by which she ceded to Turkey Scutari and Kroïa, and consented to pay an indemnity of 100,000 ducats (Jan. 25, 1478). The Crimea was next conquered and bestowed as a tributary province on the Tatar khan Mengli Girai. Mahommed now endeavoured to strike a blow at Rhodes, the stronghold of the Knights of St John, preparatory to carrying out his long-cherished plan of conquering Italy. A powerful naval expedition was fitted out, but failed, an armistice and treaty of commerce being signed with the grand master, Pierre d'Aubusson (1479). But a land attack on southern Italy at the same time was successful, Otranto being captured and held for a time by the Turks. In 1481 the sultan was believed to be projecting a campaign against the Circassian rulers of Syria and Egypt, when he died at Gebzé. He is said to have been of a merry and even jocular disposition, to have afforded a generous patronage to learning, and, strange to say for a sultan, to have been master of six languages.

Mahommed II. was the organizer of the fabric of Ottoman administration in the form which it retained practically unchanged until the reforms of Mahmud II. and Abd-ul-Mejid. He raised the regular forces of the country to a total exceeding 100,000; the pay of the Janissaries was by him increased, and their ranks were brought up to an effective of upwards of 12,000. He established the system whereby the lands conquered by the arms of his troops were divided into the different classes of fiefs, or else assigned to the maintenance of mosques, colleges, schools and charitable institutions, or converted into common and pasturage lands. Many educational and benevolent foundations were endowed by him, and it is to Mahommed II. that the organization of the ulema, or legist and ecclesiastical class, is due.

Bayezid II., 1481–1512.

Upon Bayezid II. succeeding to his father a serious revolt of the troops took place, which led to the institution of the regular payment of an accession donative to the Janissaries. At the outset of the reign Bayezid's brother, Prince Jem, made a serious attempt to claim the throne; he was defeated, and eventually took refuge with the knights of Rhodes, whom Bayezid bribed to keep him in safe custody. The unfortunate prince was led from one European stronghold to another, and, after thirteen years' wandering, died at Naples in 1494 (see BAYEZID II.). Freed from the danger of his brother's attacks, the sultan gave himself up to devotion, leaving to his ministers the conduct of affairs in peace and war. But, though of an unambitious and peace-loving temper, the very conditions of his empire made war inevitable. Even when peace was nominally in existence, war in its most horrible forms was actually being waged. On the northern frontier border raids on a large scale were frequent. Thus, in 1492 the Turks made incursions into Carinthia as far as Laibach, and into Styria as far as Cilli, committing unspeakable atrocities; in 1493 they overran both Styria and Croatia. The Hungarians retaliated in kind, burning and harrying as far as Semendria, torturing and murdering, and carrying off the saleable inhabitants as slaves. In 1494 a crushing victory of the emperor Maximilian drove the Turks out of Styria, which they did not venture again to invade during his reign. In 1496 the temporary armistice between the Poles and Turks, renewed in 1493, came to an end, and John Albert, king of Poland, seized the occasion to invade Moldavia. The efforts of Ladislaus of Hungary to mediate were vain, and the years 1497 and 1498 were marked by a terrible devastation of Poland by the Ottomans; only the bitter winter, which is said to have killed 40,000 Turks, prevented the devastation from being more complete. By the peace concluded in 1500 the sultan's dominions were again extended. Meanwhile, in June 1499, war had again broken out with Venice, mainly owing to the intervention of the pope and emperor, who, with Milan, Florence and Naples, urged the sultan to crush the republic. On the 28th of July the Turks gained over the Venetians at Sapienza their first great victory at sea; and this was followed by the capture of Lepanto, at which Bayezid was present, and by the conquest of the Morea and most of the islands of the archipelago. By the peace signed on the 24th of December 1502, however, the *status quo* was practically restored, the sultan contenting himself with receiving Santa Maura in exchange for Cephalonia.

Meanwhile in Asia also the Ottoman Empire had been consolidated and extended; but from 1501 onwards the ambitious designs of the youthful Shah Ismail in Persia grew more and more threatening to its security; and though Bayezid, intent on peace, winked at his violations of Ottoman territory and exchanged friendly embassies with him, a breach was sooner or later inevitable. This danger, together with the growing insubordination of the aged sultan's sons, caused his ministers to urge him to abdicate in favour of Selim, the younger but more valiant. This prince pushed his audacity so far as to attack his father's troops, but the action merely increased his popularity with the Janissaries, and Bayezid, after a reign of thirty-one years, was obliged to abdicate in favour of his forceful younger son; a few days later he died. This reign saw the end of the Mussulman rule in Spain, Turkey's naval power not being yet sufficient to afford aid to her co-religionists. It also saw the first intercourse between a Russian tsar and an Ottoman sultan, Ivan III. exchanging in 1492 friendly messages with Bayezid through the Tatar khan Mengli Girai; the first Russian ambassador appeared at Constantinople three years later.

Selim I., 1512–1520.

When he had ruthlessly quelled the resistance offered to his accession by his brothers, who both fell in the struggle for the throne, Selim undertook his campaign in Persia, having first extirpated the Shia heresy, the prevalent sect of Persia, in his dominions, where it threatened to extend. After an arduous march and in spite of the mutinous behaviour of his troops, Selim, crushed the Persians at Chaldiran (1515) and became master of the whole of Kurdistan. He next turned against the Mameluke rulers of Egypt, crushed them, and entering Cairo as conqueror (1517), obtained from the last of the Abbasid caliphs,[1] Motawakkil, the title of caliph (*q.v.*)

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[1] After the fall of the caliphs of Bagdad (1258), descendants of the Abbasids took refuge in Cairo and enjoyed a purely titular authority under the protection of the Egyptian rulers.

for himself and his successors (see EGYPT: *History; Mahommedan Period*). The sultan also acquired from him the sacred banner and other relics of the founder of Islam, which have since been preserved in the Seraglio at Constantinople. Egypt, Syria and the Hejaz, the former empire of the Mamelukes, were added to the Ottoman dominions. Towards the end of Selim's reign the religious revolt of a certain Jellal, who collected 200,000 adherents, was the cause of much trouble; but he was eventually routed and his force dispersed near Tokat. While preparing an expedition against Rhodes to avenge the repulse sustained forty years before by Mahommed II., the sultan died at Orashkeui, near Adrianople, at the spot where he had attacked his father's troops. His reign of eight years had almost doubled the extent of the Turkish dominions.

Suleiman I., 1520–1566.

He was succeeded by his son Suleiman "the Magnificent," in whose long and eventful reign Turkey attained the highest point of her glory. Selim's Asiatic conquests had left his successor free to enter upon a campaign in Europe, after the suppression of a revolt of the governor of Damascus, who had thought to take advantage of the new sultan's accession to restore the independent rule of the Circassian chiefs. In 1521 war was declared against the king of Hungary on the pretext that he had sent no congratulations on Suleiman's accession. Belgrade was besieged and captured, a conquest which Mahommed II. had failed to effect. In the next year an expedition was undertaken against Rhodes, the capture of which had become doubly important since the acquisition of Egypt. The siege, which was finally conducted by the sultan in person, was successful after six months' duration; the forts of Cos and Budrum were also taken. The European war was now renewed; in 1526 the sultan, marching from Belgrade, crossed the Danube and took Peterwardein and Esseg; on the field of Mohács he encountered and defeated the Hungarians under king Louis II., who was killed with the flower of the Hungarian chivalry (see HUNGARY: *History*). Budapest hereupon fell to the Turks, who appointed John Zápolya king of Hungary (1528). But the crown of Hungary was claimed by the archduke Ferdinand, brother of the emperor Charles V., as being king Louis's brother-in-law. This brought Turkey into collision with the great emperor. Moreover, Francis I. of France, who had just been defeated by Charles, sent to the sultan ambassadors and messages dwelling on the danger of allowing Charles's power to become too great, and imploring the assistance of Suleiman as the only means of preserving the balance of power in Europe. Meanwhile Ferdinand's troops captured Budapest, driving out Zápolya, who at once appealed to Suleiman for aid. Suleiman decided against Charles, and marched north (1529). Zápolya joined the Turks at Mohács, and a joint attack was made on Budapest. After five days' siege the Austrians were driven out, and Zápolya was reinstated on the throne of Hungary. The Turks then marched on Vienna, which was bombarded and closely invested, but so valiant was the resistance offered that after three weeks the siege was abandoned (Oct. 14, 1529). Suleiman now prepared for a campaign in Germany and sought to measure himself against Charles, who, however, withdrew from his approach, and little was done save to ravage Styria and Slavonia. In 1533 a truce was arranged, Hungary being divided between Zápolya and Ferdinand.

During the Hungarian campaign the Shia sectaries had been encouraged to revolt, and the Persians had overrun Azerbāijān and recaptured Tabriz. Suleiman, therefore, turned his arms against them, reaching Bagdad in 1534, and capturing the whole of Armenia. The naval exploits of Khair-ed-din Pasha (see BARBAROSSA) are among the glories of the reign, and led to hostilities with Venice. After capturing Algiers, an attack by this famous admiral on Tunis was repulsed with the aid of Spain, but in the Mediterranean he maintained a hotly-contested struggle with Charles's admiral, Andrea Doria. Venice was in alliance with Charles, and her possessions were consequently attacked by Turkey by land and by sea, many islands, including Syra and Tinos, falling before Barbarossa's assaults. Corfu was besieged, but unsuccessfully. At Preveza Barbarossa defeated the papal and Venetian fleets under Doria. In 1540 the fort of Castelnuovo, the strongest point on the Dalmatian coast, was taken by the Venetians and recaptured by Barbarossa. Peace was then made on the terms that Turkey should retain her conquests and Venice should pay an indemnity of 300,000 ducats. Friendly relations had subsisted between Suleiman and Ferdinand during the expedition to Persia; but on the death of Zápolya in 1539 Ferdinand claimed Hungary and besieged Budapest with a large force. Suleiman determined to support the claims of Zápolya's infant son, John Sigismund, and in 1541 set out in person. At the end of August he appeared before Budapest, the siege of which had already been raised by the defeat of the Austrians; the infant John Sigismund was carried into the sultan's camp, and the queen-mother, Isabella, was peremptorily ordered to evacuate the royal palace, though the sultan gave her a diploma in which he swore only to retain Budapest during the minority of her son. On the 2nd of September Suleiman entered the city, and to the ambassadors of Ferdinand, who came to offer a yearly sum if the sultan would recognize his claim to Hungary, he replied that he had taken possession of it by the sword and would negotiate only after the surrender of Gran, Tata, Visegrád and Székesfehérvár. The war now continued vigorously by sea and land. The great expedition of the emperor Charles V. against Algiers ended in failure, his fleet being destroyed by a sudden storm (Oct. 31, 1541); and his diplomatic efforts to wean Barbarossa from his allegiance to the sultan fared no better. In 1542 a formal alliance was concluded between Suleiman and Francis I.; the Ottoman fleet was placed at the disposal of the king of France, and in August 1543, the Turks under Barbarossa, and the French under the duke of Enghien, laid siege to Nice. The town surrendered; but the citadel held out until, on the 8th of September, it was relieved by Andrea Doria. Meanwhile on land Suleiman had taken full advantage of the European situation to tighten his grip on Hungary. The attempt of the imperialists, under Joachim of Brandenburg, to retake Budapest (September 1542), failed ignominiously; and in the following year Suleiman in person conducted a campaign which led to the conquest of Siklós, Gran, Székesfehérvár and Visegrád (1544). Everywhere the churches were turned into mosques; and the greater part of Hungary, divided into twelve sanjaks, became definitively a Turkish province. A truce, on the basis of *uti possidetis*, signed at Adrianople on the 19th of June 1547 for five years, between the sultan, the emperor and Ferdinand I. king of Hungary, recognized the Turkish conquests in Hungary; while, for the portion left to him, Ferdinand consented to pay an annual tribute of 30,000 ducats. John Sigismund was recognized as independent prince of Transylvania and of sixteen adjacent Hungarian counties, Queen Isabella to act as regent during his minority.

Suleiman was now free to resume operations against Persia. In the spring of 1548 he set out on his eleventh campaign, which ended in the capture of Erzerum (August 16) and the conquest of Armenia and Georgia. But the Persian War dragged on, with varying fortune, for years, till after Suleiman had ravaged Persia it was concluded by the treaty—the first between shah and sultan—signed at Amasia on the 29th of May 1555.

Meanwhile the war in Hungary had been resumed. Neither side had been careful to observe the terms of the treaty of 1547; the Turkish pashas in Hungary had raided Ferdinand's dominions, while Ferdinand had been negotiating with Frater Geörgy (see MARTINUZZI) with a view to freeing Transylvania from the Ottoman suzerainty. When the sultan discovered that Martinuzzi, who was all-powerful in Transylvania, had actually arranged to hand over the country to Ferdinand, he threw the Austrian ambassador into prison, and in September 1551 sent an army, 80,000 strong, under Mahommed Sokolli over the Danube. Several forts, and the important town of Lippa on the Marosch, fell at once, and siege was laid to Temesvár. This was raised after two months, and Martinuzzi took advantage of the retirement of the Turks to raise an army and recapture Lippa. Before the surrender of the city, however, he was murdered by Ferdinand's orders on strong suspicion of treachery. The campaign of 1552 was disastrous for the Austrians; the Turks, under the command of Ahmed Pasha, defeated them at Szegedin and captured in turn Veszprém, Temesvár, Szolnok and other places. Their victorious career was only checked, in October, by the raising of the siege of Erlau. In the spring of 1553 the victories of the Persians called for the sultan's presence in the East; a truce for six months was now concluded between the envoys of Ferdinand and the pasha of Budapest, and Austrian ambassadors were sent to Constantinople to arrange a peace. But the negotiations dragged on without result; the war continued with hideous barbarities on both sides; and it was not until the 1st of June 1562 that it was concluded by the treaty signed at Prague by Ferdinand, now emperor. Suleiman kept the possessions he had won by the sword, Temesvár, Szolnok, Tata and other places in Hungary; Transylvania was assigned to John Sigismund, the Habsburg claim to interference being categorically denied; Ferdinand bound himself to pay, not only the annual tribute of 30,000 ducats, but all the arrears that had meanwhile accumulated. Even this treaty, however, was but an apparent settlement. A year passed before the Latin and Turkish texts of the treaty were harmonized; and meanwhile irregular fighting continued on all the borders. In 1564 Ferdinand died, and was succeeded by Maximilian II. The new emperor attacked Tokaj, which was in Turkish possession; the tribute had been allowed again to fall into arrears; and to all this was added that Mahommed Sokolli, the new grand vizier (1565), pressed for new war to wipe out the disgrace of the failure of the Ottoman attack on Malta (May-September 1565). In May 1566 the war broke out, Suleiman, now seventy-two years old, again leading his army in person. In August he laid siege to Szigetvár with 100,000 men; but on the 5th of September, while preparations were being made for a final assault, the sultan died. His death was, however, kept secret, and on the 8th the fortress fell.

The reign of Suleiman the Magnificent marked the zenith of the Ottoman power. At the time of his death the Turkish Empire extended from near the frontiers of Germany to the frontiers of Persia. The Black Sea was practically a Turkish lake, only the Circassians on the east coast retaining their independence; and as a result of the wars with Persia the whole Euphrates valley, with Bagdad, had fallen into the sultan's power, now established on the Persian Gulf. The Venetians had been driven from the Morea and the islands of the Archipelago; and, except a strip of the Dalmatian coast and the little mountain state of Montenegro, the whole of the Balkan peninsula was in Turkish hands. In the Mediterranean, Crete and Malta yet survived as outposts of Christendom; but the northern coasts of Africa from Egypt to Morocco acknowledged the supremacy of the sultan, whose sea power in the Mediterranean had become a factor to be reckoned with in European politics, threatening not only the islands, but the very heart of Christendom, Italy itself, and capable—as the alliance with France against Charles V. had shown—of being thrown with decisive weight into the balance of European rivalries.

The Turkish Sea Power.

The power of the Ottomans at sea was maintained during this period by a series of notable captains, such as Khair-ed-din and his son Hassan, Pialé, Torgud, Sali Reis and Piri Reis. Of these the two first are separately noticed (see BARBAROSSA). Pialé, a Croatian who had been brought up in the imperial harem and succeeded Sinan as capudan-pasha, crowned a series of victories over the galleys of Andrea Doria by the capture of the island of Jerba, off Tripoli (July 31, 1560). For this he was rewarded with the hand of one of the sultan's grand-daughters. He later became the second vizier of the empire, and, as a supporter of Sokolli, was in power till his death in 1575. Torgud, also the son of Christian parents, was a native of the sanjak of Mentesha in Asia Minor, and began his career as a soldier in the Ottoman sea service. After spending some time as a Genoese galley-slave, he turned corsair and became the terror of the Mediterranean coasts. He seized Mahdia, a strong post on a tongue of land about 43 m. south of Susa in Tunisia, and made this the centre of his piracies till, during his absence raiding the Spanish coasts, it was bombarded and destroyed by an expedition sent by Charles V. (September 10, 1550). Torgud was now summoned to Constantinople to answer for piracies committed on the friendly galleys of Venice; but he sailed instead to Morocco, and there for two years defied the sultan's authority. But Suleiman, who needed the aid of the corsairs against Malta, pardoned him, and he was given the command of the expedition against Tripoli, which he captured. He now turned against Corsica, captured Bastia (August 1553) and on his return to Constantinople, laden with booty and slaves, chastised the insurgent Albanians. He was rewarded by Suleiman with the governorship of Tripoli, which he held till his death. He was killed during the unsuccessful attack on Malta, which he commanded (1565). Sali Reis, also by birth a Christian of Asia Minor, was likewise successful as a corsair; he distinguished himself especially at the capture of Tunis, and succeeded Hassan Barbarossa as beylerbey of Algiers.

Other captains carried the Turkish arms down the Arabian and Persian gulfs far out into the Indian Ocean. Of these the most remarkable was Piri Reis, nephew of Kamil Reis, the famous corsair who, under Bayezid II., had swept the Aegean and Mediterranean. Piri sailed into the Persian Gulf, took Muscat, and laid siege to Ormuz. But the approach of the Portuguese fleet put him to flight; some of his vessels were wrecked; and on his return by way of Egypt he was arrested at Cairo and executed. He had compiled a sea-atlas (the *Bahrije*) of the Aegean and Mediterranean seas, every nook and cranny of which he had explored, with an account of the currents, soundings, landing-places, inlets and harbours.

Another literary seaman of this period was Sidi Ali, celebrated under his poetic pseudonym of Katibi (or Katibi Rumi, to distinguish him from the Persian poet of the same name). He was no more successful than Piri or his successor Murad in fighting the elements and the Portuguese in the Persian Gulf; but he was happier in his fate. Driven, with the remnant of his ships, into the Indian Ocean, he landed with fifty companions on the coast of India and travelled back to Turkey by way of Sind, Baluchistan, Khorassan and Persia. He wrote an account of this three years' journey, for which he was rewarded by Suleiman with an office and a pension. He was the author also of a mathematical work on the use of the astrolabe and of a book (*Muhit*, "the ocean") on the navigation of the Indian seas.

Reforms of Suleiman I.

At the close of Suleiman's reign the Turkish army numbered nearly 200,000 men, including the Janissaries, whose total he almost doubled, raising them to 20,000. He improved the laws and institutions established by his predecessors and adapted them to the requirements of the age; to him are due important modifications in the feudal system, aimed at maintaining the fiefs in a really effective condition. The codes of law were by him revised and improved, and he was the first sultan to enter into relations with foreign states. In 1534 Jean de La Forêt, a knight of St John of Jerusalem, came to Constantinople as first permanent French ambassador to the Porte, and in February 1535 were signed the first Capitulations (*q.v.*) with France.

Ottoman Polity in the 16th Century.

A short sketch of the administration and state of the country at this time may find place here. Successively transferred from Brusa to Adrianople and thence to Constantinople, the seat of government was at first little more than the camp of a conqueror. After the conquest of the imperial city the sultans began to adopt the pomp and splendour of eastern sovereigns, and largely copied the system, ready to hand, of the Byzantine emperors. Affairs of state were at first discussed at the imperial divan, where the great dignitaries were convened at appointed hours. Until the reign of Mahommed the Conqueror the sultan presided in person; but a rough Anatolian peasant penetrating one day to the council and exclaiming, "Which of you might be the sultan? I've come to make a complaint!" it was thought that in future it would be more consonant with the imperial dignity for the sovereign to remain concealed behind a grating where, unseen, he could hear all that was said. Towards the middle of Suleiman's reign even this practice was abandoned, and the sultans henceforth attended the divans only on the distribution of pay to the troops or the reception of a foreign ambassador, which occasions were usually made to coincide. The divan accompanied the sultan on military expeditions.

As established by Mahommed II., the officials of the state were divided into four classes: (1) administrative; (2) ecclesiastical; (3) secretarial and (4) military. The administration of *kazas*, or cantons, was usually entrusted to the cadis and the holders of the more important fiefs; the *sanjaks*, or departments, were ruled by *alaï beys* or *mir-i-livas* (colonels or brigadiers), pashas with one horse-tail; the *vilayets*, or provinces, by *beylerbeys* or *mir-i-mirans* (lord of lords), pashas with two horse-tails; these were all originally military officers, who, in addition to their administrative functions, were charged with the duty of mustering and commanding the feudal levies in war time. Above them were the beylerbeys of Anatolia and Rumelia, who served under the orders of the commander-in-chief. The title of vizier was borne by six or seven persons simultaneously; the grand vizier was the chief of these and exercised supreme authority, being invested with the sultan's signet. He often commanded an army in person, and was then given the title of *serdar-i-ekrem* (generalissimo); one of the subordinate viziers remained behind as *kaïmmakam*, or locum tenens. The duties of the other viziers were limited to attending the divan; they were called *kubbē* or cupola viziers from the fact that the council met under a cupola; they were pashas with three horse-tails, and were attended by large retinues, having generally achieved distinction as beylerbeys. These officers were usually chosen from among the more promising of the youths selected by the *devshurmē*, or system of forced levy for manning the ranks of the Janissaries: hence so many of the statesmen of Turkey were of non-Mussulman origin. Besides these members of the secretarial class, such as *nishanjis* and *defterdars*, as well as regular army officers, and occasionally members of the ecclesiastical class, or ulema, rose to the rank of vizier.

The highest dignitaries of the ecclesiastical class were at first the *kazaskers*, or military judges, of Europe and Asia; later the office of Sheikh-ul-Islam was created as the supreme authority in matters relating to the Church and the sacred law. Promotion was regular, but was obtainable only by entering at an early age one of the *medressēs* or colleges; the student, after passing through the successive degrees of *danishmend*, *mulazim* and *muderris*, became first a molla, then a judge, rising to the higher ranks as fortune and opportunity offered. In the time of Bayezid II. the post of *nakib-ul-eshrāf*, or registrar of the *sherīfs*, or descendants of the Prophet, was created.

The secretarial class consisted of six categories: the *nishanjis*, the *defterdars*, the *reïs*, the *defter emini*, the *shakk-i-sāni* (or second class) *defterdars* and the *shakk-i-sālis* (or third class) *defterdars*. The first named were charged with the duty of revising and duly executing the decisions of the divan respecting the assignment of lands to warriors and the apportioning of conquered territories. They were men of great culture, and many historians, poets and writers belong to this class. The *defterdar* was practically the minister of finance. The *reïs* was the secretary-general of the divan, and in more modern times became minister for foreign affairs. The *defter emini* kept the registers for the *nishanji*, whose place he took on emergency, the others acted as secretaries and clerks.

The military class was divided into two categories: (1) the regular paid troops who were quartered in barracks and were known as "slaves of the palace"; (2) the feudal levies who received no pay and were called upon to serve only in war-time. The Janissaries (*q.v.*) belonged to the first category. The rigid regulations for admission to their ranks were soon relaxed: at the close of the Persian war in 1590 their total amounted to 50,000. The regular troops comprised also armourers (*jebeji*), from 6000 to 8000 men, and six squadrons of cavalry; these were recruited in the same way as the Janissaries, and their numbers were raised by Murad III. to 20,000. There were also *bostanjis*, or forest-guards, numbering about 5000, besides local troops in distant and frontier provinces, and about 20,000 *akinjis*, or light troops, in Europe, who carried out forays in the enemies' country.

The fiefs were not hereditary, and were held directly from the sultan. On the conquest of a country the lands were apportioned by the *nishanjis*, who first computed the tithe revenue of each village, its population, woods, pasturage, &c.; and divided it into the three classes of *fiefs* (*khās*, *ziamet* and *timar*), or into *vakŭf* (pious endowments) or pasturage. Any estate with a revenue exceeding 100,000 aspres was a khās, and was conferred on a prince or on a high dignitary as long as he held his post; for each 5000 aspres of revenue one armed warrior had to be furnished in war. Fiefs with a revenue of from 20,000 to 100,000 aspres were called ziamets and were conferred on similar terms on inferior officers, usually for life or during good behaviour. Fiefs with a revenue of from 3000 to 20,000 aspres were timars, furnishing one armed warrior for every 3000 aspres' revenue; the grant of a fief was conditional on obligatory residence. The peasants owning the land remained undisturbed in their proprietorship, paying to their feudal lord the tithe, as well as the fixed duties on transfer, &c. Abuses in the system first began in the time of Khosrev Pasha, Suleiman's grand vizier.

The governors of the more distant provinces enjoyed a considerable amount of independence, which in the case of the Barbary states was more or less complete; these entered into treaties with foreign powers, and by their piratical outrages frequently caused the Porte considerable embarrassment. The *sherīf* of the Hejaz, Abu-'l-berekāt, made submission to Sultan Selim I. After the subjugation of the Yemen, the absorption of the holy places was also attempted, and in Suleiman's reign judges were appointed thither from Constantinople. But it was found politic to continue the office of the grand *sherīf* of Mecca in the sherifian family.

The princes of the Crimea were invested with many of the prerogatives of independence, *e.g.* that of coining money; the ruler of Transylvania was allowed to retain the royal title, nor were Turkish troops quartered in the country. The Danubian principalities were also ruled by native princes until the Phanariote period (see PHANARIOTES).

Selim II., 1566–1574.

On the 17th of February 1568, two years after the accession of Suleiman's son Selim, peace was concluded with Austria on the basis of the former terms, the emperor Maximilian having sent ambassadors to congratulate the new sultan on his accession. A disastrous attack on Astrakhan, with the object of carrying out Sokolli's plan for uniting the Don and the Volga, first brought the Turks into collision with the Russians. Expeditions against the Yemen and Cyprus were successful, but the loss of Cyprus, accompanied as it was by the barbarous murder of the Venetian commander, Marco Antonio Bragadino, by the seraskier pasha Mustafa's orders, in violation of the terms of the capitulation of Famagusta (August 1571), roused the bitter resentment of the Venetians, previously incensed by Turkish raids on Crete. Already, on the 25th of May, had been concluded the holy league between the pope, Venice and Spain for a new crusade against the infidel, in spite of the efforts of France to prevent the adhesion of the republic. Preparations were hurried on and at the end of September the great allied fleet, under Don John of Austria, sailed into the archipelago. On the 7th of October was fought the naval battle of Lepanto, which broke for ever the tradition of the invincibility of the Turks at sea. The immediate results of the battle were not, however, as decisive as might have been expected. In June 1572 a fresh Ottoman fleet of 250 sail took the sea; and the jealousy of the allies and the incompetence of their commanders made any repetition of their former victory impossible. After a series of indecisive engagements Venice broke from the league and, under the mediation of France, concluded a treaty with the Porte practically on the basis of *uti possidetis* (March 7, 1573). With Spain the war continued, and on the 24th of August 1574 Tunis—which had been taken by Don John of Austria in 1572—was recaptured by the Turks, who from this new base proceeded, under Sinan Pasha and Kilij Ali, to ravage Sicily.[1] In the same year Selim II. died. Known in history as the "Sot," he had allowed his able grand vizier Mahommed Sokolli to rule the country.

Murad III., 1574–1595.

The character of Murad III., who succeeded his father Selim II. at the age of twenty-eight, was not calculated to arrest the progress of decay within the Ottoman Empire. He was a weakling, swayed by his favourites in the harem, especially by his Venetian wife Safiē; and, though he kept Sokolli in office, he was suspicious of the too powerful vizier, whose wise influence he allowed his minions to undermine. Thus eminent servants of the state such as Mustafa Pasha, Sokolli's nephew—who for twelve years had ruled the sanjak of Budapest with conspicuous enlightenment and success—were deposed or executed to make way for the nominees of the harem. In even weightier matters the opinion of the grand vizier was slighted. Thus it was against his advice that, at the beginning of 1578, advantage was taken of the disorders arising on the death of Shah Tahmasp of Persia to attack that country. The war lasted for twelve years, during which Tiflis, Shirvan and Daghestan were taken; finally Shah Abbas established himself on the Persian throne and in 1590 made peace with Turkey, who retained her conquests in Georgia, Azerbāijān and Shirvan. But this short-sighted policy is criticized by Turkish historians, who censure Murad III. for thus weakening the neighbouring Mussulman states such as Persia and Daghestan, thereby facilitating Russia's future expansion at their cost. Sokolli's assassination, on the 11th of October 1578, had meanwhile thrown the country into disorder. There was now no authority left to hold in check the corrupt influences of the harem. The avenues to power were through bribery and yet more unspeakable paths; the fiefs which formed the basis of the feudal array were bestowed on favourites' favourites, or sold to the highest bidder, and the sultan himself shared in the corrupt plunder. At last that final expedient of weak governments, the debasing of the coinage, led to a crisis. In 1589 mutinies of troops took place all over the empire, and in the two following years there were several risings of the Janissaries at Constantinople, the pretext being everywhere that the soldiers were being robbed of their pay. At this juncture a fresh crisis in the relations with Austria arose. The peace concluded in 1568 and thrice renewed (in 1573, 1576 and 1584) had not prevented the continuance of raids and forays, from either side of the frontier, that at times assumed the dimensions of regular campaigns. The climax came in 1593. All through the preceding year Hassan "Tilli," beylerbey of Bosnia, had raided in Croatia, taking border fortresses and driving off the inhabitants into slavery. In June 1593, with an army of 30,000 men, he laid siege to Sissek; the Austrian and Hungarian levies hurried to its relief; and on the 22nd the Turks were routed with immense slaughter on the banks of the Kulpa, Hassan himself, with many other beys and two of the imperial princes, being among the slain. Though not yet formally declared, the "long war" was now in full progress. In August, Sinan Pasha, the grand vizier—now eighty years of age—took command of the troops for the Hungarian War and left Constantinople, dragging with him the Austrian ambassador in chains. The capture of Veszprém and of Raab (1594) and the failure of the archduke Matthias to take Gran seemed to promise another rapid victory of the Ottoman arms; but Sinan was ill-supported from Constantinople, the situation was complicated by the revolt of Walachia and Moldavia, and the war was destined to last, with varying fortunes, for fourteen years. On the 16th of January 1595 Murad III. died.

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[1] It was ten years before a formal truce was signed with Spain (1584); two hundred years passed before the signature of a definitive treaty of peace and commerce (Sept. 14, 1782).

In spite of the internal corruption which, under Murad III., heralded the decay of the empire, the prestige of the Ottomans in Europe was maintained during his reign. Even the emperor had to be content to be treated by the sultan as an inferior and tributary prince; while France had to suffer, with no more than an idle protest, the insult of the conversion of Catholic churches at Constantinople into mosques. In spite of frequent causes of friction, good relations were maintained with Venice, through the influence of the sultana Safié, and the capitulations with the republic of St Mark were renewed in 1589. Those with France were also renewed (July 6, 1581); and capitulations were signed for the first time with the grand duke of Tuscany (1578) and with England (1580).[1] In the following year permanent diplomatic relations were established by England with the Porte by the despatch of William Harebone as ambassador, Queen Elizabeth urging as her special claim to the sultan's friendship their common mission to fight "idolators."

Mahommed III., 1595–1603.

The new sultan, Mahommed III., Murad's son, succeeded to the throne at a moment when the Turkish arms were suffering reverses in Hungary and in the revolted Danubian provinces; the Janissaries, too, were ill-content and mutinous, and to put an end to their murmurings Mahommed was persuaded by Sinan Pasha to lead them to the war in person. The immediate effect was good; Erlau was captured in October 1596, and a three days' battle in the plain of Keresztes (Oct. 23 to 26) ended in the disastrous rout of the allied troops under the archduke Maximilian and Sigismund, prince of Transylvania. But the Turks did not profit much by their victory. The new grand vizier, Cicala, by his severity to the soldiers, mainly Asiatics, who had shown cowardice in the battle, drove thousands to desert; and the sultan, who had himself little stomach for the perils of campaigning, returned to Constantinople, leaving the conduct of the war to his generals. The campaign of 1598 began with the loss of Raab, and continued unfavourable to the Turks, who lost Totis, Veszprém and Pápa, and were hard pressed in Budapest. In October want of supplies and a mutiny of the Janissaries compelled the commander-in-chief to retreat into winter quarters at Belgrade. In 1599 the first peace overtures were made, but came to nothing; and the confused fighting of this and the following year culminated in the capture of Kanizsa by the Turks (September 1600). The attempt of the archduke Ferdinand, at the head of 30,000 men, to retake it a year later was defeated. In August 1602 Székesfehérvár again fell into the hands of the Turks; in November the siege of Buda by the archduke Matthias, who had taken Pest by storm, was raised by the grand vizier Hassan.

Trouble had, however, meanwhile broken out in other parts of the Ottoman dominions. The deserters from Cicala's army, distributed in armed bands throughout Asia Minor, had become centres round which all the elements of discontent gathered, and formed the mainstay of the Jellali sectaries who, at this time, rose in insurrection and ravaged Anatolia. In Constantinople, early in 1603, there was, moreover, a serious rising of the spahis; and, finally, in September Shah Abbas of Persia took advantage of what is known in Turkish history as "the year of insurrections" to declare war and reconquer Tabriz. In the midst of this crisis, on the 22nd of December 1603, Sultan Mahommed III. died, and was succeeded by his elder son, Ahmed I., a boy of fourteen.

Ahmed I., 1603–1617.

Though negotiations for peace were at once begun, it was not till three years after Ahmed's accession that the peace of Sitvatorok, concluded on the 11th of November 1606, at last put an end to the war in Europe. By this treaty the annual tribute payable by Austria was abolished, but an indemnity of 200,000 florins was paid "once for all" by the emperor, who was henceforth to be given his proper imperial title (padishah) in Turkish official documents. The peace of Sitvatorok (or Zeideva, as it is also called) marks the close of Turkey's period of conquest. No longer haughtily imposed on the vanquished, as was the case with former treaties, it was submitted to the examination and discussion of both parties before being signed. It freed Austria from the humiliating tribute to which the treaty of 1547 had subjected her, and established relations between the two monarchs on a footing of equality. It was thus the first manifest sign of Turkey's decadence from the glory of Suleiman I.'s reign, when King Ferdinand stooped to call the sultan's vizier his brother. For the remainder of the reign the Persian War was continued fitfully, a treaty of peace, signed in 1611, not being observed.

Mustafa I., 1617–1618 and Osman II., 1618–1622.

In 1617 the sultan died, and was succeeded by his brother Mustafa; but the latter being declared incompetent to reign, his brother Osman took his place on the throne. The war in Persia was terminated by the renewal in 1618 of the treaty of 1611, whereby all the conquests effected by Murad III. and Mahommed III. were given up. Peace, however, left the rebellious Janissaries leisure to engage in plots against the sultan, and in order to occupy them and to remove them from the capital advantage was taken of the king of Poland having intervened in the affairs of Transylvania and the principalities to declare war against him. Osman marched against Khotin, but failed to capture it, and his unpopularity with the army was increased by rumours that he designed to collect such troops as were loyal to him, under pretence of going on pilgrimage to Mecca, in order to destroy the Janissaries and reform the country. They therefore rose and dethroned him, soon afterwards putting him to death. For a few months Mustafa was replaced on the throne; when he abdicated in favour of his nephew Murad IV. Turkey seemed to be at the point of dissolution. Profiting by the mutiny of the army, the Persians invaded Turkey, capturing Bagdad; at Constantinople and in the provinces alike anarchy was everywhere prevalent. This continued until the new sultan had acquired age and experience; but, nine years after his accession, he successfully crushed the military rebels, and thereafter ruled with a severity amounting to bloodthirsty cruelty. In 1638 he marched in person against the Persians and succeeded in recapturing Bagdad. Peace was made in 1639, leaving the Turco-Persian frontier practically as it now stands. In the next year the sultan died at the age of thirty-one, being succeeded by his brother Ibrahim. In his reign the Cossacks were driven from Azov and the expedition against Crete was begun, the immediate cause being the plunder of a Turkish vessel by Maltese corsairs who took their capture to Crete. War was therefore declared against Venice, to whom Crete belonged (1644), and continued in the island for twenty-five years.

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[1] They were renewed with England in 1593, 1603, 1606, 1622, 1624, 1641, 1662 and 1675

Mustafa I., 1622–1623, and Murad IV., 1623–1640.

Ibrahim, 1640–1648.

The anarchy and misgovernment of Turkey now reached such a pitch that Ibrahim was dethroned and murdered, and his son Mahommed IV. was proclaimed in his stead. For the first eight years of his reign successive grand viziers were unable to restore order to the country. In 1656 Mahommed Kuprili (*q.v.*) became grand vizier, and by dint of firmness and resolution repaired the falling fortunes of the country. The fleet was restored, and recaptured Lemnos and other islands which had passed into the hands of the Venetians; the revolts caused by Kuprili's severity were put down, and tranquillity was re-established in Transylvania. After five years' tenure of office the grand vizier died and was succeeded by his son, Ahmed Kuprili. In 1663 the disturbances which had broken out again in Transylvania led to war with Austria. Ahmed Kuprili attacked the Austrians, at first with success, but was routed by Montecuculi at the battle of St Gotthard Abbey and eventually consented to the treaty of Vasvár (Aug. 10, 1664), by which a twenty years' truce was agreed upon; Transylvania was evacuated by both parties, but remained tributary to Turkey. The Kuprilis, both father and son, had by their haughty and uncompromising demeanour done much to alienate the old-standing friendship with France, and at the battle of St Gotthard 6000 French, under Coligny, fought on the Austrian side. The result was that the Turks in retaliation deprived the Catholics, always under the protection of France, of some of their privileges in connexion with the holy places, which were now granted to the Orthodox Church. Meanwhile the Cretan campaign continued, and here also France lent her aid to the Venetians; this assistance could not, however, prevent the capture of Candia in 1669; on the 5th of September of that year Morosini, the Venetian commander, signed a treaty of peace with the Turks by which, after twenty-five years' warfare, they were placed in possession of the fortress of Candia, and with it of the effective rule over the whole island, Venice retaining only the fortresses of Suda, Grabusa and Spinalonga, and the islets along the coast.

Mahommed IV., 1648–1687.

Dissensions among the Cossacks led to the recognition by Turkey of Doroshenko, the hetman of the Sari Kamish, as ruler of the Ukraine; the Zaporog Cossacks, his antagonists, applied for aid to Russia. However, Michael Wiesnowiecki, king of Poland, considering the Ukraine as under his protection, sought to intervene, with the result that Turkey declared war against him (1672). The Turks captured Kamenets, Lemberg and Lublin. Hereupon the Poles sued for peace, and a treaty was signed at Buczacs (Oct. 18, 1672) whereby Podolia was ceded to Turkey, the Ukraine was left to the Cossacks, and Poland agreed to pay to Turkey an annual tribute of 22,000 sequins. But John Sobieski, who succeeded shortly afterwards to the throne of Poland, refused to abide by the terms of this treaty; the war was renewed and continued for four years, when the treaty of Buczacs was reaffirmed at Zuravno by both parties, the tribute clause alone being abrogated (Oct. 16, 1676). A few days later Ahmed Kuprili died.

Doroshenko now deserted the Turkish alliance for the Russian; in consequence an expedition was sent into the Ukraine which was both costly and useless. In 1678 the Turks succeeded in taking Cehrin, but their losses were very heavy, and on the 8th of January 1681 a treaty was signed at Radzyn whereby the territory in dispute was ceded to Russia. A revolt of the Hungarian Protestants, in consequence of the persecuting policy of the house of Habsburg, now led to a renewal of the war between Turkey and Austria, due in part to the overweening ambition of Kuprili's successor, Kara Mustafa, who desired to immortalize his tenure of office by some great exploit, and who cherished dreams of founding for himself a western Moslem Empire. The war is blamed by Turkish historians as unjustifiable and untimely, the country needing reform. A vast Turkish army marched to the walls of Vienna and closely beleaguered the imperial city, from which the emperor and his court fled. All hope seemed lost, when by a brilliant feat of arms John Sobieski, king of Poland, drove away the besiegers in hopeless confusion and saved the cause of Christianity, 1683. This was the signal for a general coalition against Turkey; Venice, Poland and the pope allied themselves with the Austrians; Russia, Tuscany and Malta joined in the attack. Turkey now sought for a *rapprochement* with France, and endeavoured to bring about her intervention in return for concessions as regards the holy places. But the French had just before bombarded Algiers and Tripoli, even menacing Chios (Scio), where some pirates had put in with French captives; and the mediation of France was not very actively exercised. One after another the Hungarian forts were captured by the Austrians; the Venetians were equally successful in Greece and the Morea; the Russians pressed on the Crimea, and Sobieski besieged Kamenets. The troops now mutinied and deposed the sultan, placing his brother Suleiman on the throne. But the disorder in the army and the administration continued, and the advance of the Austrians and the Venetians met with little opposition. In this emergency Mustafa Kuprili (*q.v.*) was appointed grand vizier (1689). His prudent measures at once re-established some degree of order in the army and the fleet, while he sought by a wise tolerance to improve the position and conciliate the sympathies of the non-Moslem subject races. At first eminently successful, he drove the Austrians across the Danube, recapturing Nish, Vidin, Semendria and Belgrade; repulses were also inflicted on the Venetians and the Russians. In the course of the campaign the sultan died, being succeeded by his brother Ahmed. The successes of the Turks were not maintained, the Austrians inflicting on them a crushing defeat at Slankamen, where Mustafa Kuprili was killed, and driving them from Hungary. After four years of disaster Ahmed died; he was succeeded by his nephew Mustafa. The tide of success now turned again in favour of the Turks, who recaptured Karansebes and Lippa, and at Lugos exterminated by the weight of overwhelming numbers an Austrian force under Field-marshal Count Friedrich von Veterani (1630–1695), the hero of many victories over the Turks, who was killed in the battle. Elsewhere, too, the Ottoman arms were victorious; in February the Venetians suffered a double defeat in the roadstead of Chios, and the island fell into the hands of the Turks. But Prince Eugene's genius restored the Austrian fortunes, and the Turks were utterly routed at Zenta on the Theiss, losing more than 15,000 men (1697). Russia, driven from Azov in 1695, succeeded in capturing it in the following year; Venice continued to press the Turks; in this condition of affairs Hussein Kuprili (*q.v.*) was called to office; England and Holland urged Turkey to

Suleiman II., 1687–1691.

Ahmed II., 1691–1695.

Mustafa II., 1695–1703.

make peace, and after long negotiations a series of treaties were concluded in January 1699 at Karlowitz, that with Poland being signed on the 16th and those with Austria and Venice on the 26th. The main provisions of these were, that Turkey retained the Banat, while Austria kept Transylvania; Poland restored the places captured in Moldavia, but retained Kamenets, Podolia and the Ukraine; Venice restored her conquests north of Corinth, but kept those in the Morea and Dalmatia. On the 4th, Russia concluded a two years' armistice, but remained in possession of Azov, which was formally ceded to her by the definitive treaty of peace signed at Constantinople on the 13th of June 1700. The peace of Karlowitz marks the definitive termination of Turkey's power of offence in Europe. Apart from the heavy losses which it imposed on her, it constitutes a fresh departure in her history, as putting an end to her splendid isolation and rendering her dependent on the changes of European politics. It is noteworthy also as being the first occasion on which representatives of the mediating powers took part in the peace negotiations. The grand vizier's efforts to take advantage of the peace to introduce order in the country were unavailing; he was driven from office, and disorders ensued which led to the sultan's abdication.

Ahmed III., 1703–1730.

The troubles were not ended by the accession of Ahmed III., and many high dignitaries of state were sacrificed to the lawlessness and insubordination of the Janissaries. Meanwhile Turkey found herself again involved with Russia. After the defeat of Charles XII. of Sweden at Poltava, this monarch took refuge in Turkey, and was allowed to reside at Bender. The Russians pursued him into Turkish territory; which led to a Turkish declaration of war (1710). The Turks succeeded in surrounding Peter the Great near the Pruth, and his army was menaced with total destruction, when the Turkish commander, the grand vizier Baltaji Mahommed Pasha, was induced by the presents and entreaties of the empress Catherine to sign the preliminary treaty of the Pruth (July 21, 1711), granting terms of peace far more favourable than were justified by the situation of the Russians. These were: the cession to Turkey of Azov with all its guns and munitions, the razing of all the forts recently built on the frontier by Russia, the renunciation by the tsar of all claim to interfere with the Tatars under the dominion of the Crimea or Poland, or to maintain a representative at Constantinople, and Russia's consent to Charles's return to Sweden.[1] It was long, however, before the latter relieved Turkey of his presence. During the campaign Peter had entered into alliance with the hospodars of Moldavia and Walachia, respectively Demetrius Cantemir and Constantine Brancovano, from whom he had received material assistance. These were naturally dismissed after the defeat of the Russians; the former made good his escape to Russia, the latter was executed. The sultan determined henceforth to appoint Greeks to the principalities as more likely to be subservient to his will than the natives hitherto appointed. This system was continued until the Greek insurrection of 1821.

Russia having thus lost all the advantage gained by the peace of Karlowitz, Venice was next taken in hand, she having invaded the Bosnian frontier and incited the Montenegrins to revolt, besides capturing Turkish ships in the Mediterranean. These acts were held to be infractions of the treaty, and war was declared (1715). The result was the stamping out of the insurrection in Montenegro and the capture of the whole of the Morea. The fleet also took Tinos and Cerigo, as well as the three forts still remaining to the Venetians in Crete. Turkey's action, and the preparations being made for the siege of Corfu, now brought about the intervention of Austria. Charles VI., weary of the war for the Spanish succession, had shortly before concluded the peace of Rastadt (1715) and was anxious that Venice should not be too hardly pressed. He therefore urged Turkey to give up to Venice certain places in Dalmatia as a compensation for the loss of the Morea. The Porte was at first disposed to comply, but the party of resistance finally prevailed. War was declared against Austria (1716); the fleet sailed for Corfu and the army crossed the Save from Belgrade to Semlin. Near Peterwardein a great battle was fought, in which the Austrians completely routed the Turks; pursuing their advantage they took Temesvàr and overran the Banat; in 1717 they captured Belgrade, the Turks retreating to Adrianople. England and Holland now urged their mediation, and after negotiations the treaty of Passarowitz (Pozharevats in Servia) was signed (July 21, 1718); Venice ceded the Morea to Turkey but kept the strongholds she had occupied in Albania and Dalmatia; Belgrade, Temesvàr and Walachia as far as the Olt were retained by Austria.

Meanwhile relations with Russia continued strained. The peace of 1712 had been concluded only for a term of years, and the neglect of the tsar to carry out its provisions had all but led to a fresh outbreak of hostilities when the intervention of the other powers led in 1713 to the renewal of the treaty; and in November 1720 it was superseded by a treaty of "perpetual peace," signed at Constantinople. But, though the questions at issue between Russia and Turkey in Poland and the northern littoral of the Black Sea were thus for the time settled, the aggressive designs of Russia in the Caucasus and in Persia soon caused a renewal of anxiety at Constantinople. Again war all but broke out; but, through the intervention of France, a treaty of partition was signed at Constantinople on the 23rd of June 1724, whereby the shores of the Caspian from the junction of the Kur and the Arras (Araxes) northwards should belong to Russia, while the western provinces of Persia should fall to the share of Turkey. These provinces had not yet been conquered by Turkey; and, when a part of them had been taken, a treaty was concluded with the Afghan Ashraf Shah, who had risen to supreme power in Persia, by which Turkey should retain them on condition of recognizing him as shah (Oct. 23, 1727). But Nadir Kuli Khan came forward as the champion of Shah Tahmasp II., the rightful ruler, and drove the Turks from these provinces, capturing Tabriz. This news caused consternation at Constantinople; the inevitable revolt of the Janissaries followed, headed this time by one Patrona Khalil, and the sultan was forced to abdicate in favour of his nephew Mahmud. With difficulty the rebellion was suppressed; in 1733 the war with Persia was resumed, and after three years of fighting Nadir succeeded in 1736 in inducing Turkey to recognize him as shah of Persia and to restore the territory captured since the reign of Murad IV.

Mahmud I., 1730–1754.

War of Polish Succession.

Russia's designs on Poland now brought about war. On the death of Augustus II., king of Poland (1733), France had put forward as candidate Stanislaus Leszczynski, Louis XV.'s father-in-law. Austria and Russia supported Augustus III., elector of Saxony, and the empress Anne marched an army into Poland and compelled the election of her candidate, though Russia had bound herself by the treaty of 1711 and again by that of 1720 to abstain from all interference with Poland. France thereupon declared war against Russia and her ally Austria, and her envoy, the marquis de Villeneuve, urged Turkey to join by representing the danger of allowing Russian influence to extend. Turkey had cause of complaint against Russia for refusing to allow the Crimean troops to march through Daghestan during the Persian campaign, and on the 28th of May 1736, war was declared, in spite of the efforts of England and Holland. The Russians had not waited for the formal declaration of war; and on the very day that this was notified by the hanging out of the horse-tails before the Seraglio at Constantinople a Russian army under Marshal Münnich stormed the ancient wall that guarded the isthmus of the Crimea. While Münnich conducted a systematic devastation of the peninsula, forces were detached under his lieutenants Leontiev and Lascy to attack Kinburn (Kilburun) and Azov. Both these places fell; and in July of the following year Münnich captured Ochakov.

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[1] The definitive treaty was signed at Constantinople on the 16th of April 1712 (renewed June 5, 1713).

Meanwhile the western sea-powers had made earnest efforts to restore peace, and in August 1737 the plenipotentiaries of the combatant powers met at Niemirov to arrange terms under their mediation. But Austria, which had made a great show of seconding their efforts, now began to unmask her real aims, which were to take advantage of Turkey's embarrassments to push her own claims in the principalities and the Balkan Peninsula. To the refusal of the sultan's representatives to concede any of her demands, Austria replied by revealing the existence of an alliance with Russia, which she threatened to make actively offensive if her terms were refused. In November the conferences broke up; in the spring of the following year Austrian divisions advanced simultaneously into Bosnia, Servia and Walachia; and in July the main army, under the prince of Lorraine, crossed the frontier and captured Nish. In spite of this initial success, however, the campaign proved disastrous to the Austrians; and France, which had meanwhile come to terms with the emperor, endeavoured to mediate a peace in conjunction with Sweden and Holland. But the Ottomans, though the negotiations continued throughout 1738, were in no hurry to come to terms; for the tide of war had turned against both Austrians and Russians; Ochakov and Kinburn were recaptured; and the victorious Turks crossed the Danube and penetrated far into the Banat. Not till the middle of 1739 would they consent to negotiate seriously for peace. The conferences were opened at the close of July in the camp of the grand vizier, who was pressing Belgrade hard and demanded the surrender of the city as a *sine qua non*. This was conceded; on the 1st of September, under the mediation of the French ambassador Villeneuve, the preliminaries were signed; on the 4th the grand vizier made his formal entrance into the city, where on the 18th the definitive treaties with Austria and Russia were signed. By the former Austria gave up Belgrade and the places on the right bank of the Save and the Danube which she had gained by the treaty of Passarowitz, together with the Austrian portions of Walachia. The treaty with Russia provided that Azov should be razed and its territory devastated to form a barrier, Russia having the right to erect a new fortress at Cherkask, an island in the Don, near Azov, and Turkey to build one on the border of Kuban near Azov. But Taganrog was not to be refortified, and Russia was to have no war-ships on the sea of Azov or the Black Sea. The Kabardias, great and little, were to remain independent, to serve as a barrier between the two empires. By the 12th article the Ottoman government agreed "amicably to discuss" the question of recognizing the tsar's claim to the imperial title, and by the 13th admitted his right to send to Constantinople representatives of whatever rank he might judge fitting (Noradounghian, *Recueil*, i. 258).

Scarcely two years after the signature of the treaty of Belgrade sinister rumours reached Constantinople from Persia, where Nadir Shah, on his return from India, was planning an attack on Mesopotamia. The war, which broke out in 1743, was waged with varying fortunes, and the peace by which it was concluded on the 5th of September 1746, beyond stipulating for a few privileges for Persian pilgrims to the holy places, altered nothing in the settlement arranged ten years before with Murad IV. In the war of the Austrian Succession, which followed the accession of Maria Theresa to the Habsburg throne, Turkey, in spite of the urgency of France, would take no share, and she maintained the same attitude in the disorders in Persia following the death of Nadir Shah.

Osman III., 1754-1757.

Mustafa III., 1757-1773.

In 1754 the Sultan Mahmud died. He was succeeded by his brother Osman, whose three years' reign was marked by no political event of special importance. Osman III. was succeeded by his cousin Mustafa. At the outset of his reign negotiations were actively pursued for the conclusion of a treaty with Prussia, to counteract the alliance between France and Austria contracted in 1756; and these resulted in the signature of Capitulations, or a treaty of friendship and commerce (March 22, 1761). The attitude of the northern powers, however, and especially of Russia, towards Poland was beginning to excite the sultan's liveliest suspicions; and these the accession, in 1762, of the masterful Catherine II. to the Russian throne was not calculated to allay. In 1763, Catherine took advantage of the death of Augustus III. of Poland to force her favourite, Stanislaus Poniatowski, on to the vacant throne. From the committee of patriots at Warsaw complaints and warnings were carried to Constantinople; and the cession of Podolia was offered as the price of a Turkish attack on Russia. The sultan, though inclined to take up the cause of the Polish dissidents, was slow to move, and contented himself for a while with protests and threats. But the aggressive policy of Russia in the direction of the Caspian and Black Seas became more and more evident; complaints reached the Porte of a violation of the neutrality of Kabardia, of a seditious propaganda in Moldavia by Russian monks, and of Russian aid given to the malcontents in Servia and Montenegro. Added to all this was the news of the continual Russian military aggressions in Poland, against which the Catholic confederation of Bar continued to appeal for aid. At last, on the 6th of October 1768, on the refusal of the Russian minister to give guarantees for the withdrawal of the Russian troops from Poland and the abandonment of Russia's claim to interfere with the liberties of the republic, war was declared and the Russian representative was imprisoned in the Seven Towers.

The war that followed marks an epoch in the decay of the Ottoman Empire and in the expansion of Russia. When, in the spring of 1769, the first serious campaign was opened by a simultaneous attack by three Russian armies on the principalities, the Crimea and the buffer state of Kabardia, the Turks, in spite of ample warning, were unprepared. They were hampered, moreover, by an insurrection in the Morea, where a Russian expedition under Orlov had stirred up the Mainotes, and by risings in Syria and Egypt. It was not, however, till September that the fall of Khotin in Bessarabia marked the first serious Russian success. The following year was more fatal. In May the Ottoman fleet was attacked and destroyed off Cheshme, and the Russian war-ships threatened to pass the Dardanelles. In June Romanzov's victory at Kartal made him master of the principalities, and by November the fortresses of Izmail and Kilia, guarding the passage of the Danube, and those of Akkerman and Bender on the Dniester had fallen into the hands of the Russians. The campaign of 1771, which opened with a gleam of success in the capture of Giurgevo, proved yet more disastrous to the Turks, the Russians passing the Danube and completing the conquest of the Crimea. Prussia and Austria now offered their mediation; and in June conferences were opened at Focshani, which led to no result. In the following year a conference, from which the Austrian and Prussian representatives were excluded, was opened at Bucharest (November 1772). In February 1773 the Russian plenipotentiary delivered his ultimatum, of which the most important demands were the cession of Kerch, Yenikale and Kinburn, the free navigation of the Black Sea and Archipelago for Russian trading and war vessels, and the recognition of the tsar's right to protect the Orthodox subjects of the sultan. These conditions were submitted to Constantinople, and rejected after a stormy debate in the divan. The conference of Bucharest now broke up, and the war continued. The successful defence of Varna and Silistria seemed to justify the stubbornness of the Porte.

Abd-ul-Hamid I., 1773-1789.

On the 24th of December 1773 Mustafa III. died, and was succeeded by his brother Abd-ul-Hamid I., a weakling, from whose character nothing could be expected to retrieve the now desperate fortunes of the war. The exhaustion of the treasury was evidenced by the absence of the usual donative to the troops; and the demoralization in both army and court made further resistance useless. At the beginning of July the Russians, under Kamenskiy, were before Shumla; and a few days later the grand vizier and his army, their communications with the capital severed, were surrounded in the fortress. Negotiations for peace were now opened and on the 21st of July—chosen by the Russian plenipotentiary as the anniversary of the humiliating convention of the Pruth—the treaty of Kuchuk Kainarji was signed. Its terms were the most onerous as yet imposed on the Ottoman sultans. The Tatars from the frontier of Poland to the shores of the Caspian, including those of the Crimea and Kuban, were declared independent under their own khan of the race of Jenghiz, saving only the religious rights of the sultan as caliph of Islam. Russia, however, retained the fortresses of Kerch, Yenikale and Kinburn, with the desert country between the Bug and the Dnieper, while Ochakov was left to the Turks. Bessarabia, with the fortresses of Akkerman, Izmail and Kilia, was restored to Turkey. Moldavia and Walachia were likewise restored, but under conditions which practically raised them to the position of semi-independent principalities under Russian protection (art. xvi.). Azov and its district were annexed to Russia, and the two Kabardias were transferred subject to the consent of the khan of the Crimea. Russia undertook to evacuate Mingrelia and Georgia. The recognition of the imperial title (*padishah*) was at last conceded to the Russian tsars.

Treaty of Kuchuk Kainarji, 1774.

Commerce and navigation in the Black Sea and the Mediterranean were free to both countries. Turkey was to pay a war indemnity of 15,000 purses, the Russian fleet was to withdraw and the islands captured by it to be restored. By article vii. of the treaty the Sublime Porte undertook "to protect the Christian religion and its churches" and conceded to the ministers of Russia the specific right to "make representations in favour of the new church" which, under article xiv. of the same treaty, the Russian government was empowered to build, in addition to the embassy chapel "in the street named Bey Oglu." This article is of great historical importance as forming the basis of the later claim of Russia to possess by treaty the right to protect the Orthodox subjects of the Porte.[1] Poland, the original cause of the war, was not even mentioned in the treaty, having been partitioned in 1772.

After yielding to these hard conditions, Turkey took advantage of her respite to strengthen the frontier defences and to put down the rebellions in Syria and Egypt; some effort was also expended on the hopeless task of reforming the Janissaries. It was not long before Russia showed that it was not the independence but the absorption of the Crimea which she desired. In 1779 a rupture on this account was only averted through the mediation of the French ambassador, coupled with the fact that Turkey was in no condition to enter upon hostilities, owing to the outbreak of plague in her army. The Porte, unable to resist, was obliged to consent to the convention of Ainali Kavak (March 10, 1779) whereby the Russian partisan, Shahin Girai, was recognized as khan of the Crimea, the admission of Russian vessels to navigate Turkish waters was reaffirmed and Russia's right of intervention in the affairs of the Danubian principalities was formally recognized. Five years later Potemkin induced the chiefs of the Crimea and Kuban to hold a meeting at which the annexation of their country to Russia was declared, Turkey giving her consent by a convention, signed at Constantinople, on the 8th of January 1784, by which the stipulations as to the liberty of the Tatars contained in the treaty of Kuchuk Kainarji and the convention of Ainali Kavak were abrogated. In 1786 Catherine made a triumphal progress through the Crimea in company with her ally, Joseph II., who had succeeded to the imperial throne on the death of his mother. These events and the friction caused by mutual complaints of infringements of the treaty stirred up public opinion in Turkey, and the British ambassador lent his support to the war party. In 1788 war was declared, but Turkey's preparations were inadequate and the moment was ill-chosen, now that Russia and Austria were in alliance, a fact of which Turkey became aware only when the horse-tails were planted for the campaign. The Turks drove back the Austrians from Mehadia and overran the Banat (1789); but in Moldavia Romanzov was successful and captured Jassy and Khotin. After a long siege Ochakov fell to Potemkin, and all its inhabitants were massacred. This news affected the sultan so deeply as to cause his death.

Selim III., 1789–1807.

Selim, the late sultan's nephew, who succeeded, made strenuous preparations for continuing the war, but his generals were incompetent and his army mutinous; expeditions for the relief of Bender and Akkerman failed, Belgrade was taken by the Austrians, Izmail was captured by Suvorov, and the fall of Anapa completed the series of Turkey's disasters. Sultan Selim was anxious to restore his country's prestige by a victory before making peace, but the condition of his troops rendered this hope unavailing; while Prussia, though on the 31st of January 1790 she had signed an offensive treaty with Turkey,[2] gave her no help during the war. Accordingly a treaty was signed with Russia at Jassy (Jan. 9, 1792) by which the Crimea and Ochakov were left to Russia, the Dniester was made the frontier in Europe, and the Asiatic frontier remained unchanged. Joseph II. had died, and his successor, Leopold II., was averse from the Russian alliance. Through the mediation of England, Holland and Prussia, Turkey and Austria concluded on the 4th of August 1791 the treaty of Sistova, by which Belgrade and the other conquests made by Austria were restored.

The War with France.

The conclusion of peace was welcomed by Selim as the opportunity for carrying out reforms, of which he thoroughly realized the necessity in every branch of the administration, and especially in the army, to whose defects the disasters of the state were due. Accordingly it was decided to form troops known as *nizam-i-jedid*, affiliated to the Janissaries so as to disarm the jealousy of the latter, properly drilled and wearing a distinctive uniform. The fleet was reorganized, military schools were established, and skilled instructors were obtained from Europe. These reforms excited much opposition, which was at first unheeded. Meanwhile Turkey came into conflict with France. Throughout all the vicissitudes of the Revolution the relations between the two states had remained unimpaired, and Turkey had been one of the first countries to recognize the republic. Bonaparte's sudden occupation of Egypt (1798) came therefore as a complete surprise. This expedition was in reality directed against English rule in India. Nelson's destruction of the French fleet at the battle of the Nile disconcerted Bonaparte's plans; he hoped to pursue his designs through Syria, and laid siege to Acre, which, however, successfully held out. Turkey now joined Great Britain and Russia against France.[3] The Russian and Turkish fleets attacked and took the Ionian Islands, which had become French by the treaty of Campo Formio, and certain towns, hitherto unconquered, on the Albanian coast. An expeditionary force was also sent against Bonaparte, now practically blockaded in Egypt. This was routed and driven into the sea at Abukir (July 15, 1799). For the subsequent operations in Egypt, which ended in its evacuation by the French after the British victory at Alexandria, see EGYPT: *History*.

Servian Rising.

Meanwhile in Turkey disorder prevailed in almost every province of the empire, and the local governors in many places became entirely independent, oppressing the people under their rule and often driving them to revolt. This was notably the case in Servia, where the temporary domination of Austria, to which the treaty of Sistova (1791) put an end, had had the effect of awakening the national spirit of the people. But no armed manifestation of revolt had taken place until the lawless and savage conduct of the Janissaries, who had made themselves masters of the country, assisted by the notorious governor of Vidin, Pasvan Oglu, and his band of outlaws, drove the peaceful rayas to rebel. The insurgents chose as their captain one George Petrovich, nicknamed Kara Georgi (*i.e.* Black George), and under his able leadership succeeded in capturing Belgrade and in breaking the power of the Janissaries. The Porte also sent an army against Pasvan Oglu, but after reducing him to submission reinstated him in his government. A serious outbreak took place at Adrianople in 1804, where 20,000 of the new troops had been sent, ostensibly to put down the revolt in Servia, but really to try to bring about the reform of the European provinces. So strong was the opposition that the troops were recalled, and the anti-reform party was greatly strengthened. The Wahhābi movement in Nejd now began to assume serious proportions. These religious sectaries attacked and plundered all Mussulmans not conforming to their peculiar tenets; they overran Kerbela and the Hejaz, sacking the holy cities and closing the pilgrim routes. Only in the reign of Mahmud II. were they put down (see WAHHABIS).

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[1] See G. F. de Martens, *Recueil des traités*, 1st series, vol. ii. p. 286, also Noradounghian, *Recueil*, p. 319.

[2] Text in Martens, *Recueil*, 2nd series, vol. iv. p. 466.

[3] The treaty of alliance with Russia was signed on the 23rd of December 1798, that with Great Britain on the 5th of January 1799.

Complications with Russia.

In 1802, by a treaty of peace signed at Paris on the 25th of June, France resumed her former terms of friendship with Turkey. Russia, desirous of deriving some return for the support which she had given the sultan during his rupture with the French, induced the Porte to address to her a note in which the right of intervention in the affairs of the principalities, conferred on her by the treaty of Kainarji and reaffirmed in the convention of Ainali Kavak, was converted into a specific stipulation that the hospodars should be appointed in future for seven years and should not be dismissed without the concurrence of the Russian ambassador at Constantinople. In pursuance of this agreement Constantine Ypsilanti was appointed to Walachia and Alexander Muruzi to Moldavia—both devoted to Russian interests. Their intrigues in favour of the Greek and other revolutionary movements induced the Porte to dismiss them in 1806, contrary to the arrangement of 1802. Russia and England hereupon used threatening language, and Turkey replaced the hospodars. But war was nevertheless declared on the 27th of December 1806, and Russia occupied the principalities. The British ambassador sought by every means in his power to induce Turkey to give way to Russia, going so far as to guarantee the withdrawal of the Russian troops from Moldo-Walachia if the Porte remained at peace, and threatening that if Turkey persisted in her opposition England would join with Russia against her. But France's influence, backed by the strong personality of her ambassador, General Sebastiani, was sufficient to enable the sultan to withstand these arguments, and the British ambassador broke off relations and withdrew to the fleet at Tenedos (February 1807). Helped by a strong south wind, the British war-ships passed up the straits and anchored off the Seven Towers. An ultimatum was presented ordering Turkey within twenty-four hours to dismiss the French ambassador, hand over the Turkish fleet, and make peace with Russia. With Sebastiani's encouragement the Porte resisted these demands; in one day a thousand guns were ranged along both sides of the Bosporus; and after a stay of ten days the British fleet was ordered to leave, and was considerably damaged by the fire of the forts while passing down.

Revolt against Selim.

Meanwhile the sultan's whole efforts were directed towards the reform of the country; the newly-instituted militia was in every respect a success; it grew in numbers, and hopes were entertained that it would gain popularity. But the Janissaries and the corrupt officials were fundamentally opposed to the scheme, and the conservatives joined with them against such reforms of European origin. The rulers of the provinces shared these views; the consequence was disquiet and confusion throughout the empire. At this difficult moment the army was obliged to march to the Danube, leaving the government in the hands of men hostile to reform. In 1807 the garrisons of the Black Sea forts at the entrance of the straits rose in rebellion, headed by one Kabakji Mustafa, and killed their officers. The sultan sought to appease them by pacific means, but the movement spread to the Janissaries, who insisted upon the abolition of the new troops. But even this concession did not satisfy them; they dethroned Selim and proclaimed his nephew Mustafa. The new sultan was obliged to abolish all the reforms, and during practically the whole of his fourteen months' reign the Janissaries were in rebellion, even while facing the Russians. All officers who were partisans of the reforms were obliged to take refuge in flight; and Turkey's position would have been desperate but for the conclusion of the peace of Tilsit (July 7, 1807) between Russia and France, to which Turkey also became a party. The army hereupon retired to Adrianople, and the powerful pasha of Rustchuk, Mustafa Baïrakdar, who had distinguished himself by his resistance to the Russians, and who thoroughly shared Selim's desire for reform, was now induced by the many officers who held similar views to march on Constantinople to restore Selim to the throne. But he arrived too late; Selim had already been killed; the unworthy Mustafa was put to death, and Mahmud, the sole survivor of the house of Osman, became sultan. Mustafa Baïrakdar, who was now raised to the dignity of grand vizier, succeeded in inspiring the Janissaries with a wholesome respect, due to their dread of the 10,000 irregulars known as *kirjalis* by whom he was accompanied. The remnants of the abolished new troops were collected and formed into regiments affiliated to the Janissaries under the name of *seymen-i-jedid*; the dignitaries of state were called upon to take an oath of fidelity and loyalty. The feast of Ramazan hereupon occurring, the grand vizier unwisely allowed his own troops to disperse. Taking advantage of this opportunity, the Janissaries rose by night and besieged the house of the grand vizier, who eventually blew himself up in the arsenal. Fighting became general and extended to the fleet, which bombarded the capital. The Janissaries slaughtered all the "new troops" whom they met, and finally extorted an amnesty from the terrified government.

Mustafa IV., 1807-1808.

Mahmud II., 1808-1839.

Treaty of Bucharest; Troubles in Servia.

After the peace of Tilsit an armistice had been agreed upon with Russia (Aug. 24, 1807). Turkey was at this time the only neutral state in Europe; it was of vital importance that she should not be absorbed into the Napoleonic system, as in that case Russia would have been exposed to a simultaneous attack from France, Austria, Turkey and Persia. Accordingly, though France made every attempt to induce Turkey to adopt her side, the young Stratford Canning succeeded in causing the resumption of the peace negotiations at Bucharest, broken off through Russia's terms being considered too onerous, and followed by the capture of Izmail and Bender. The British diplomatist secured his first triumph in the signature of the treaty of Bucharest (May 28, 1812) whereby Khotin, Bender, Kilia and Akkerman were left to Russia; the frontier was fixed at the Pruth; the Asiatic boundary was slightly modified. The treaties as to the principalities were renewed; and though Servia was restored to the direct rule of Turkey it was stipulated that clemency was to be observed in the Porte's dealings with the country, which was given the power of regulating its own affairs.

The vagueness of these latter provisions at once gave rise to disputes, and in 1813 the Turkish troops occupied the country. The new pasha of Belgrade appointed one Milosh Obrenovich headman of his own district, but a few years later Milosh raised a successful revolt, drove out the Turks, and re-established Servian semi-independence. Karageorge, who had fled to Austria in 1812, was induced to return, but Milosh caused him to be murdered, and in 1817 was by a popular vote named hereditary prince of Servia.

The affairs of Servia, however, were not the only question left unsettled by the treaty of Bucharest. In the course of the war with Persia Russia had received permission from the Ottoman government to use, for a limited time, the easy road from the Black Sea to Tiflis by way of the valley of the Rion (Phasis) for the transport of troops and supplies, and this permission had been several times renewed. Wishing to make this important privilege permanent, Russia by secret articles of the Treaty of Bucharest had secured the cession of this district, in return for an undertaking to destroy the forts of Kilia and Izmail on the Danube. But the sultan refused to ratify these articles, and the relations between Russia and Turkey were therefore determined by the patent treaty only, which positively stipulated for the evacuation by the Russians of every spot occupied by them on Turkish soil in Asia. When the Russians showed no signs of withdrawing from the valley of the Rion, the sultan threatened to renew the war, the sole result of which was to reveal the determination of the tsar not to be bullied into concessions. The dispute, at first of little importance, developed in seriousness during the next year or two, owing to the avowed intention of Russia, which by conquest or treaties with independent chiefs had acquired all the high land between the Caspian and the Black Sea, to take possession of the low lands along the coast, between Anapa and Poti, of which the sultan claimed the sovereignty.

Congress of Vienna.

Such was the situation when the question of a European guarantee of Turkey was raised at the Congress of Vienna. In view of the multiple dangers to which the Ottoman Empire was exposed, both from without and from within, and of the serious consequences to the world's peace which would result from its break-up, there was a strong feeling among the powers in favour of such a guarantee, and even the emperor Alexander was willing to agree to it in principle. But nothing could be done until the Porte should have come to terms with Russia as to the Treaty of Bucharest; for, as the British ambassador, Sir Robert Liston, was instructed to point out to the Ottoman government, "it is impossible to guarantee the possession of a territory of which the limits are not determined." With the consent of the tsar, it was proposed to submit the questions at issue to the decision of Great Britain, France and Austria; and the Porte was informed that, in the event of its accepting this arrangement, the powers would at once proceed to guarantee the integrity of the Ottoman Empire. But the sultan could not bend his pride to suffer foreign intervention in a matter that touched his honour, and the return of Napoleon from Elba threw the Eastern Question into the background. The Ottoman Empire thus remained outside the European concert; Russia maintained her claim to a special right of isolated intervention in its affairs; and the renewal of war between Russia and Turkey was only postponed by the preoccupation of Alexander with his dream of the "Confederation of Europe."

Egypt.

Meanwhile, within the Ottoman Empire there was every sign of a rapidly approaching disintegration. In Egypt Mehemet Ali had succeeded in establishing himself as quasi-independent ruler of the country. By his action during Napoleon Bonaparte's invasion, and later when the British fleet after leaving Constantinople in 1807 proceeded to Egypt, he had to some extent acquired the goodwill of the Turkish government. In 1811 he was called upon by the Porte to put down the Wahhābi insurgents (see Arabia, vol. ii. p. 268), his success in this matter, and especially in the recovery of the holy cities, adding greatly to his prestige.

Greek Revolt.

Sultan Mahmud now devoted himself to breaking the overgrown power of the local governors, which had for many years practically annihilated that of the central authority. Their extortions impoverished the whole country, yet the abolition of the system might perhaps have been carried out more gradually and with greater precaution, and Turkey more than once felt the want of their aid, questionable as its value often was. Thus Ali (*q.v.*), Pasha of Iannina, the most famous of these, though insubordinate and inclined to intrigue with foreign powers in the hope of making himself independent, had used his influence to keep the Greeks quiet; and it was only after his power had been broken in 1821 that the agitation of the *Hetairia* issued in widespread dangerous revolt. The first hope of emancipation from the Turkish yoke had been founded by the Greeks on Peter the Great, who had planned the expulsion of the Turks from Europe and had caused the inscription "Petrus I., Russo-Graecorum Monarcha" to be placed beneath his portrait engraved at Amsterdam. Catherine II. following in his footsteps, aspired to found a Greek empire, the throne of which was to be occupied by her nephew, Constantine, specially so baptized, and brought up by Greek nurses (see Constantine Pavlovich). During the war of 1770 the Greeks had risen in an abortive rebellion, promptly crushed by the Turks. But the idea of liberation continued to grow, and about 1780 the Society of Friends ('Εταιρία τῶν φιλικῶν) was founded at Bucharest by the fervent patriot and poet, Constantinos Rhigas (*q.v.*). The secret organization, temporarily checked by Rhigas's arrest and execution in 1798, was revived at Odessa in 1814; it extended throughout Turkey, and in 1820 the insurrection took shape, a favourable opportunity being afforded by the outbreak of hostilities between Ali Pasha and the Porte. (See Greek Independence, War of.)

On the 6th of March 1821 Prince Alexander Ypsilanti, son of the hospodar Constantine, and a general in the Russian service, crossed the Pruth, proclaiming the revolt of the Greeks against the sultan and the intention to restore the Greek Empire of the East. But in the principalities, where the Vlach peasants regarded the Phanariots as worse oppressors than the Turks, the movement had little chance of success; it was doomed from the moment that the emperor Alexander disavowed Ypsilanti's claim to his support (see Alexander I.). After some initial successes the Greeks were finally routed at the battle of Dragashani (June 19, 1821). It was far otherwise with the insurrection which broke out at the beginning of April in the Morea. The Mussulman population of the Morea, taken unawares, was practically exterminated during the fury of the first few days; and, most fatal of all, the defection of the Greeks of the islands crippled the Ottoman navy by depriving it of its only effective sailors. The barbarous reprisals into which Sultan Mahmud allowed himself to be carried away only accentuated the difficulty of the situation. The execution of the patriarch Gregorios, as technically responsible for the revolt, was an outrage to all Christendom; and it led at once to a breach of diplomatic relations with Russia.

To prevent this breach developing into war was now the chief study of the chanceries. Public opinion throughout Europe was violently excited in favour of the Greeks; and this Philhellenic sentiment was shared even by some of the statesmen who most strenuously deprecated any interference in their favour. For at the outset Metternich was not alone in maintaining that the war should be allowed to burn itself out "beyond the pale of civilization." The mutual slaughter of barbarians in the Levant seemed, even to George Canning, a lesser evil than a renewed Armageddon in Europe; and all the resources of diplomacy were set in motion to heal the rupture between Turkey and Russia. In spite of the emperor Alexander's engagements to the Grand Alliance and the ideal of European peace, this was no easy matter; for the murder of the patriarch was but the culmination of a whole series of grievances accumulated since the Treaty of Bucharest. Moreover, the Porte was thrown into a suspicious mood by the contrast between the friendly language of the western powers and the active sympathy of the western peoples for the Greeks, who were supported by volunteers and money drawn from all Europe. But, though the sultan remained stubborn, the emperor Alexander, who since the Congress of Laibach had been wholly under Metternich's influence, resisted the clamour of his people for war, and dismissed his Greek minister Capo d'Istria (*q.v.*). The Congress of Verona (1822) passed without any serious developments in the Eastern Question.

The stubborn persistence of the Greeks, however, dashed Metternich's hope that the question would soon settle itself, and produced a state of affairs in the Levant which necessitated some action. In the instructions drawn up, shortly before his death, for his guidance at Verona, Castlereagh had stated the possibility of the necessity for recognizing the Greeks as belligerents if the war continued. The atrophy of the Ottoman sea-power had left the archipelago at the mercy of the Greek war-brigs; piracy flourished; and it became essential in the interests of the commerce of all nations to make some power responsible for the policing of the narrow seas. On the 25th of March 1823 accordingly, Canning announced the recognition by Great Britain of the belligerent character of the Greeks.

This roused the emperor Alexander to action, since it seemed as though Great Britain was aiming at ousting Russian influence in the Levant. He suggested a joint intervention of the powers; but the conference, which met at St Petersburg in April 1824, came to nothing, since Turkey and the Greeks alike refused to be bound by its decisions, and Canning would not hear of coercion being applied to either. The sole outcome of the conference was the offer in March 1825 of the joint mediation of Austria and Russia, which the Porte rejected.

Meanwhile Mahmud, realizing the impossibility of crushing the Greek revolt unaided, had bent his pride to ask the help of Mehemet Ali, who was to receive as his reward Crete, the Morea and the pashaliks of Syria and Damascus. The Egyptian fleet and disciplined army were now thrown into the scale; and from the moment when Ibrahim Pasha landed at Modon (Feb. 24, 1825), the fate of the Greeks seemed sealed. The Morea was quickly overrun; in April 1826 Missolonghi fell, after a heroic defence; in June 1827 Athens was once more in the hands of the Turks. Crowds of Greek captives were being sent as slaves to Cairo; and, should the powers not intervene, there was every prospect of Greece being depopulated and colonized with Mussulman negroes and fellahin.

At the close of 1825 an isolated intervention of Russia had seemed probable. A great army was assembled in the south of Russia, and the emperor Alexander had gone to place himself at its head when he died (Dec 22, 1825). It was to prevent such an intervention that Canning seized the opportunity of the accession of Nicholas I. to send the duke of Wellington to St Petersburg in order to concert joint measures. The result was the protocol of St Petersburg of the 4th of April 1826, by which Great Britain was empowered to offer to the Ottoman government a settlement of the Greek question based on the establishment of Greece as a vassal and tributary state. Should the Porte refuse, the two powers were to take the earliest opportunity, either separately or in common, of establishing a reconciliation on the basis of the protocol.

Convention of Akkerman.

Russia, meanwhile, had seized the occasion to send to Constantinople an ultimatum demanding satisfaction for her own particular grievances; the Porte resented the intrusion of new demands before the others had been dealt with, and hurried on preparations for war. The reform of the army, however, involved the destruction of the Janissaries (*q.v.*), and though their massacre on the 15th of June left the sultan free to carry out his views with regard to the army, it left him too weak to resist the Russian demands. On the 7th of October, accordingly, these were conceded by the Convention of Akkerman. Its terms were: the confirmation of the Treaty of Bucharest and the opening of the navigation of the Black Sea to the Russian flag; a stipulation that the hospodars of Walachia and Moldavia should be elected by the boyars for seven years, their election being confirmed by the Porte which, however, had no power to dismiss them without the concurrence of the Russian ambassador at Constantinople; finally, Servia's autonomy was recognized, and, save in the fortresses, no Mussulman might reside there.

Agreement of the Powers as to Greece.

The Greek question was however, not yet settled. Months passed without any action being taken under the protocol of the 4th of April; and Russia suspected Great Britain of merely using the protocol to prevent her own isolated intervention. The situation was however materially altered by the end of August 1826; for the Greeks, driven to desperation, had formally invited the mediation of England, thereby removing Canning's objection to an unasked intervention. He now invited the co-operation of Russia in representations to the Porte on the basis of the protocol, and, in the event of its refusal to come to terms, suggested certain measures of coercion. The tsar consented, and proposed that the coercion should take the form of a pacific blockade of the Morea, so as to force Ibrahim, by cutting off his supplies, to evacuate the country. To this Great Britain agreed in principle; for Canning clearly saw the need for yielding on the question of a joint intervention, if the isolated intervention of Russia were to be prevented. In the conference of the five powers of the Grand Alliance opened at London in the early summer of 1827, however, a divergence of views at once became apparent. Austria and Prussia protested against any coercion of the Porte "to serve revolutionary ends" and, failing to carry their views, withdrew from the conference. France thereupon proposed to convert the protocol of the 4th of April into a treaty; Russia and Great Britain agreed; and on the 6th of July the Treaty of London was signed by the three powers.

By the patent articles of the treaty the powers agreed to secure the autonomy of Greece under the suzerainty of the sultan, but without any breach of friendly relations with Turkey. By additional secret articles it was agreed that, in the event of the Porte not accepting the offered mediation, consuls should be established in Greece, and an armistice proposed to both belligerents and enforced by all the means that should "suggest themselves to the prudence" of the high contracting powers. In general it was allowed that these means should be the "pacific blockade" proposed by the tsar. Instructions to this effect were sent to the admirals commanding in the Levant.

Navarino.

The armistice, accepted by the Greeks, was refused by Ibrahim, pending instructions from Constantinople, though he consented to keep his ships in the harbour of Navarino. The Greeks, having put themselves in the right with the powers, were free to continue the war; and the destruction of a Turkish flotilla off Salona on the 23rd of September followed. Ibrahim, taking this as a breach of the convention, set sail from Navarino northwards, but was turned back by Sir Edward Codrington, the British admiral. Then, the Russian and French squadrons having joined, it was determined to put further pressure on the Egyptian commander, and the allied fleets, on the morning of the 20th of October, stood into the bay of Navarino. A chance scuffle led to a battle, and by the evening the Turkish and Egyptian fleets had ceased to exist (see NAVARINO, BATTLE OF).

The effect on the passionate sultan of this "unparalleled outrage on a friendly power in time of peace" is easy to imagine. In spite of the weak efforts of the British government to palliate the significance of this "untoward incident," Turkey broke off diplomatic relations with the three powers concerned, and on the 20th of December Mahmud, giving full vent to his rage, issued a *hatt-i-sherīf* denouncing the cruelty and perfidy of the Christian powers, declaring the convention of Akkerman null and void, and summoning the faithful to a holy war. The struggle that followed was, however, destined once more to be a duel between Russia and Turkey. Great Britain, when Canning was no longer at the helm of state, had reverted to the traditional policy of preserving Ottoman integrity at all costs; the invitation of the tsar to accept the logical consequences of Navarino was refused; and Russia was left to settle her account with Turkey.

War with Russia.

The war that followed proved once more the wonderful resisting power of the Turks. In spite of the confusion due to the destruction of the Janissaries and army reforms as yet hardly begun, it cost the tzar two hardly fought campaigns before the audacious strategy of General Diebitsch enabled him to dictate the terms of the treaty of Adrianople (Sep. 14, 1829). Meanwhile the other powers had taken advantage of the reverses of the Russian arms to discount the effect of their ultimate victory by attempting to settle the Greek question. In July 1828 France had been commissioned to oust Ibrahim from the Morea; and though by a convention, concluded on the 9th of

August by Codrington with Mehemet Ali, the principle of evacuation by the Egyptian troops had already been settled before the arrival of the French expedition, the Morea remained for the time in French occupation. On the 16th of November a protocol of the London conference placed the Morea, with the neighbouring islands and the Cyclades, under the guarantee of the powers; and on the 22nd of March 1829 another protocol extended the frontier thus guaranteed to the line Arta-Volo and included the island of Euboea. According to this instrument Greece was to be erected into a tributary state, but autonomous, and governed by an hereditary prince chosen by the powers.

Greek Independence.

The Treaty of Adrianople, by which the Danubian principalities were erected into practically independent states, the treaty rights of Russia in the navigation of the Bosporus and Dardanelles confirmed, and the districts of Anapa and Poti in Asia ceded to the tsar, included also a settlement of the Greek question on the terms of the protocol of the 22nd of March. This fact, which threatened to give to Russia the whole prestige of the emancipation of Greece, spurred the other powers to further concessions. The acceptance of the principle of complete independence, once more warmly advocated by Metternich, seemed now essential if Greece was not to become, like the principalities, a mere dependency of Russia. On the 3rd of February 1830 was signed a protocol embodying the principle of an independent Greece under Leopold of Coburg as "sovereign prince." This was ultimately expanded, after the fall of the Wellington ministry, into the Treaty of London of the 7th of May 1832, by which Greece was made an independent kingdom under the Bavarian prince Otto. (See GREECE: *History*.)

Syria.

Before the final settlement of the Greek question a fresh crisis had arisen in the affairs of Turkey. Her lessened prestige had already received a severe blow from the bombardment and capture of Algiers by the French in 1830, and her position was further embarrassed by revolts in Bosnia and Albania, when news reached Constantinople that Mehemet Ali had invaded Syria (Nov. 1, 1831), nominally in order to punish his enemy Abdullah, pasha of Acre, really in order to take by force of arms the pashaliks of Syria and Damascus promised as a reward for his services in Greece. An account of the collapse of the Turkish power before Mehemet Ali, and of the complicated diplomatic developments that followed, is given in the article MEHEMET ALI. Here it must suffice to say that the recognition of Mehemet Ali's claims, forced on the sultan by France and Great Britain, was followed in 1833 by the signature of the Treaty of Unkiar Skelessi, which seemed to place Turkey wholly in the power of Russia, after which Sultan Mahmud concentrated his energies on creating a force strong enough to crush his rebellious vassal.

At last, in 1839, his eagerness would no longer be restrained, and without consulting his ministers, and in spite of the warnings of all the powers, he determined to renew the war. On the 21st of April the Ottoman army, which had been massed under Hafiz Pasha at Bir on the Euphrates, crossed the stream, by the sultan's orders, and advanced on Damascus. On the 23rd of June it was attacked by Ibrahim at Nezib and annihilated. As for Mahmud, the news of the disaster reached Constantinople when he was unconscious and dying. Early on the 1st of July he was dead, and his son Abd-ul-Mejid, a lad of eighteen, reigned in his stead (see MAHMUD II.).

Abd-ul-Mejid, 1839–1861.

The Eastern Question had now suddenly once more entered an acute phase. The news of Nezib was immediately followed by that of the treason of Ahmed Pasha, the Ottoman admiral, who, on the plea that the sultan's counsellors were sold to Russia, had sailed to Alexandria and handed over the fleet to Mehemet Ali. With an inexperienced boy on the throne, divided and untrustworthy counsels in the divan, and the defences of the empire shattered, the house of Osman seemed doomed and the Turkish Empire about to dissolve into its elements. If Russia was to be prevented from using the Treaty of Unkiar Skelessi for her own purposes, it was essential that the powers should concert measures to deal with the situation. The story of the diplomatic negotiations that followed is told elsewhere (see MEHEMET ALI). Here it may suffice to say that the desire of the emperor Nicholas to break the entente between Great Britain and France led him to waive his special claims under the Treaty of Unkiar Skelessi, and that in the ultimate concert by which the question was settled France, which throughout supported Mehemet Ali, had no part. The intervention of the powers, based on the convention of London of the 15th of July 1840, led to the withdrawal of Ibrahim from Syria, and the establishment by the *firman* of the 13th of February 1841 of Mehemet Ali as hereditary pasha of Egypt under conditions intended to safeguard the sovereign rights of the Ottoman sultan. On the 10th of July the four signatory powers of the convention of London signed a protocol recording the closure of the incident (*protocole de clôture*), and on the 13th France united with them in signing another protocol (*protocole des détroits*) by which the powers engaged to respect the principle proclaimed by the sultan as to the closing of the Dardanelles to foreign warships.

Reform Policy in Turkey. The Tanzimât.

The severe crisis through which the Ottoman Empire had passed accentuated the need for strengthening it by a drastic reform of its system. For such an experiment, though hampered by continual insurrections within and troubles without, Mahmud had done something to pave the way. The destruction of the Janissaries and the suppression of the quasi-independent power of the *dérêbeys* had removed the worst disturbing elements; the government had been centralized; a series of enactments had endeavoured to secure economy in the administration, to curb the abuses of official power, and ensure the impartiality of justice; and the sultan had even expressed his personal belief in the principle of the equality of all, Mussulman and non-Mussulman, before the law. It was therefore no sudden revolution when, on the 15th of November 1839 Abd-ul-Mejid signalized his accession by promulgating the Tanzimât, or Hatt-i-Sherīf of Gulhané, a decree abolishing the arbitrary and unlimited power hitherto exercised by the state and its officials, laying down the doctrine of the perfect equality of all Ottoman subjects of whatever race or creed, and providing for the regular, orderly and legal government of the country and the security of life, property and honour for all its inhabitants. Yet the feelings of dismay and even ridicule with which this proclamation was received by the Mussulmans in many parts of the country show how great a change it instituted, and how strong was the opposition which it encountered among the ruling race. The non-Mussulman subjects of the sultan had indeed early been reduced to such a condition of servitude that the idea of their being placed on a footing of equality with their Mussulman rulers seemed unthinkable. Preserved merely as taxpayers necessary to supply the funds for the maintenance of the dominant and military class, according to a foreign observer in 1571, they had been so degraded and oppressed that they dared not look a Turk in the face. Their only value was from a fiscal point of view, and in times of fanaticism or when anti-foreign sentiment ran high even this was held of little account, so that more than once they very nearly became the victims of a general and state-ordered massacre. Thus Sultan Ibrahim was dissuaded from such a step in 1644 only by the refusal of the Sheikh-ul-Islam to sanction the proceeding. The humane and tolerant measures provided for in the "nizam-i-jedīd," or new regulations for the better treatment of the Christians enacted by Mustafa Kuprili during his grand vizierate (1689–1691), did for a time improve the position of the rayas. But the wars with Russia and other Christian powers, and the different risings of the Greeks and Servians, helped to stimulate the feelings of animosity and contempt entertained towards them by the ruling race; and the promulgation of the Tanzimât undoubtedly heralded for the subject nationalities the dawn of a new era.

Remodelling of the Administration.

The reforms introduced by Sultan Mahmud and by the Tanzimāt necessitated the remodelling of nearly all the departments of state. Towards the end of Mahmud II.'s reign ministries had been instituted, and a council of ministers had been established, presided over by the grand vizier. In 1837 the "council of the Sublime Porte" and the "supreme council of legal affairs" were established: the latter was the tribunal to which were referred all complaints against officials or claims pending between the state and private individuals; the council of the Sublime Porte was in 1839 transferred to the ministry of commerce; the supreme council of legal affairs after undergoing various modifications was in 1868 absorbed in the council of state. In 1837 a "council of public works" was instituted, converted ten years later into a separate ministry. In 1835 the "ministry of administration" was formed; two years later its title was changed to ministry of the interior. Regulations prescribing the duties of the local governors and officials of all ranks were drawn up only in 1865 and 1870, but since Mahmud's time their functions were exclusively civil and administrative. A regular hierarchical order was elaborated for the official classes, both civil and military, whereby the rank of each person was clearly defined.

The military reorganization dates from the destruction of the Janissaries (June 15, 1826). On that day Aga Hussein Pasha was appointed "Seraskier (commandant) of the victorious Mahommedan troops"; at first only two divisions were established, quartered respectively at Constantinople and Scutari. In 1833 the reserves were instituted, and three years later reserve commandants were appointed in six principal provinces. In 1843 the *corps d'armée* of Constantinople, Rumelia, Anatolia and Arabia were formed, and a military council was appointed. In 1847 a recruiting law was promulgated, reducing the period of service (until then unlimited in point of time), to five years. Military schools were founded. For the reorganization carried out from 1908 to 1910 see section *Army*, above.

After the Greek revolution the system of manning the navy from the Christian natives of the archipelago and the Mediterranean littoral was abandoned, and recruits for the navy are now selected under the ordinary law. A naval school and a modern factory and arsenal were established. The direction of the police, formerly left to the Janissaries, was formed into a ministry, and a body of gendarmerie was instituted. For the financial reforms see the section *Finance*, above.

Education.

The ministry of public instruction was established in 1857; until the reign of Selim III. (when a few military schools were established) the only schools had been the colleges of the Ulema and such preparatory schools as had been founded by private munificence. In 1838 the council of education had been created and several secondary state schools were founded. In 1860 the regulations for public education were promulgated; schools were everywhere opened, and in 1882 a portion of the receipts from certain *vakufs* were appropriated to their maintenance. As all the preparatory schools founded by the state were for Mussulman children only (the various Christian communities maintaining their own schools), *idadi* or secondary schools were established in 1884 for the instruction of children of all confessions. In 1868 the Imperial Lycée of Galata Serai was founded; most of the later generation of officials received their education there. Special state schools of medicine, arts, science, crafts, &c., have been created successively, and in 1901 a university was founded. Educational affairs in the provinces are now superintended by special officials.

Justice.

After the promulgation of the reforms, the judicial duties of the Imperial Divan, which with other functions also exercised those of a kind of supreme court of appeal, were transferred to the Sheikh-ul-Islam. The codification of the civil law, which soon became necessary, was effected by the promulgation in 1859 of the *Mejellé*, or civil code. Commercial and criminal codes, as well as codes of procedure, were drawn up, largely on the basis of the Code Napoléon. The rules regulating the Ulema were amended, a school for judges was founded, and the Sheikh-ul-Islam was charged with the duty of revising all judgments. In 1865 the court of cassation was founded.

Foreign Relations.

In 1835 the Reis-ul-Kuttab, to whom the superintendence of foreign affairs was entrusted, received the designation of minister for foreign affairs. Turkey had originally maintained no representatives abroad, and appointed such only for special occasions as *e.g.* the signature of a treaty or the announcement of a new sultan's accession. Selim III. was the first sultan who entered into regular relations with foreign powers, and employed permanent ambassadors; the practice was discontinued at the time of the Greek revolution and the consequent rupture with the powers. Later, during the Egyptian negotiations, ambassadors were accredited to London, Paris and Vienna. Sultan Abd-ul-Aziz's journey to Europe and the return visits paid by foreign princes strengthened Turkey's relations with foreign states.

The ministry of the *Evkaf* or pious foundations was established in 1827 and extended ten years later. Such foundations had been created from the earliest times, and the execution of the testator's wishes was generally left to his descendants, under the supervision of some high official designated in the act of endowment. In case of failure in the line of succession an administrator was appointed by the state. But many such foundations fell into disorder, and the ministry was created to exercise the requisite supervision.

Results of Reforms.

Though the provisions of the Tanzimāt were not fully observed, they afforded convincing proof that reform was entirely practicable in Turkey. Reforms were effected in every direction; the finances and the army were reorganized, military instructors being procured from Europe; the administration was gradually centralized, and good relations were cultivated with the powers, the only serious international controversy arising in 1848–1849 over the refusal by Turkey, with the support of England, to surrender the Hungarian and Polish insurgents who had taken refuge within her borders. It cannot indeed be said that complete tranquillity prevailed throughout the country meanwhile; disturbances in the principalities and in the Lebanon gave serious trouble, while in 1842 the unsettled state of the Turco-Persian frontier nearly led to war. By the mediation of England and Russia the Treaty of Erzerum was signed (1847) and a frontier commission was appointed. But as the frontier was not definitely demarcated the door was left open for controversies which have occurred frequently up to the present day.

Russian Policy since 1829.

Turkey's progress in the path of reform was viewed with some uneasiness in Russia, the cardinal principle of whose policy since 1829 had been to maintain her own influence at Constantinople by keeping the Ottoman government weak. In favour of this view the traditional policy of Peter the Great and Catherine II. had been deliberately given up, and by the secret convention signed at Münchengrätz on the 18th of September 1833 the emperor Nicholas had agreed with his brother sovereigns of the revived "Holy Alliance" to maintain the integrity of Turkey, where Russian influence seemed to have been rendered supreme and permanent by the Treaty of Unkiar Skelessi. The crisis which ended in 1841, however, materially altered the situation from the Russian point of view. By his concert with the other powers in the affair of Mehemet Ali, the tsar had abdicated his claim to a unique influence at Constantinople, and he began to revive the idea of ending the Ottoman rule in Europe, an idea which he had only unwillingly abandoned in 1829 in response to the unanimous opinion of his advisers. In 1844 he took advantage of his visit to England to propose to British ministers a plan of partition, under which Great Britain was to receive Egypt and Crete, Constantinople was to be erected into a free city, and the Balkan states were to become autonomous under Russian protection. This proposal, as might have been expected, only served to rouse suspicions as to Russia's plans; it was politely rejected, and the whole Eastern Question slumbered, until, early in 1850, it was awakened by an incident trivial enough in itself, but pregnant with future trouble: a quarrel of Catholic and Orthodox monks about the holy places in Palestine.

The Holy Places.

By the Capitulations signed on the 28th of May 1740 on behalf of Sultan Mahmud I. and Louis XV. "emperor of France," not only French pilgrims to Jerusalem, but all members of "Christian and hostile nations" visiting the Ottoman Empire, had been placed under the protection of the French flag, and by a special article the Frank, *i.e.* Roman Catholic, ecclesiastics had been guaranteed certain rights in the holy places. These stipulations of the treaty, which were in effect a confirmation of the firman granted in 1620 by Murad IV. to Louis XIII., had fallen into oblivion during the age of Voltaire and the turmoil of the Revolution; and meanwhile, every advance of Russia had been marked by further encroachments of the Orthodox clergy in Palestine on the ancient rights of their Latin rivals. The quarrels of these monks might have been left to the contempt they deserved, had not Napoleon III. seen in the situation an opportunity at once for conciliating the clericals in France and for humiliating Russia, which had given to his title but an equivocal recognition. His ambassador, accordingly, handed in at Constantinople a formal demand for the restitution of the Catholics in all their property and rights. The Ottoman government, seeking to gain time, proposed a "mixed commission" of inquiry; and to this France agreed, on condition that no documents later than 1740 should be admitted as evidence. To this suggestion, which would have excluded the Treaty of Kuchuk Kainarji, the emperor Nicholas replied by a haughty demand that nothing should be altered in the *status quo*. It was now clear that no less an issue was involved than a contest between France and Russia for paramount influence in the East, a contest into which Great Britain would inevitably be dragged. The British government did its best to help the Porte to evolve a compromise on the questions immediately at issue, and in March 1852 a firman was issued, which to Protestants and Mahommedans might well seem to have embodied a reasonable settlement. Concessions were made to one side and the other; and the question of the right of "protection" was solved by the Turkish government itself undertaking the duty. But neither Napoleon nor Nicholas desired a settlement. The French emperor wanted a war for dynastic reasons, the tsar because he conceived his honour to be involved, and because he judged the moment opportune for expelling the infidel from Europe. France, he believed, would never come single-handed to the assistance of Turkey; Austria would be bound at least to benevolent neutrality by "gratitude" for the aid given in 1849; the king of Prussia would sympathize with a Christian crusade; Great Britain, where under the influence of John Bright and Richard Cobden the "peace at any price" spirit seemed to be in the ascendant, would never intervene. Nicholas even hoped for the active sympathy of Britain. Lord Aberdeen made no secret of his dislike for the Turks, and openly expressed his disbelief in the reality of their reforms; and in January 1853 the tsar, in conversation with Sir Hamilton Seymour, the British ambassador at St Petersburg, spoke of the Ottoman Empire as "the Sick Man," and renewed the proposals for a partition made in 1844.

Early in 1853 the Russian army was mobilized, and Prince Menshikov, a bluff soldier devoted to the interests of Orthodoxy and tsardom, was sent to present the emperor's ultimatum at Constantinople. He demanded the recognition of the *status quo* in the holy places, and of the tsar's right, under the Treaty of Kuchuk Kainarji, to the protectorate of all Orthodox Christians in the Ottoman dominions. The Porte, in alarm, turned to Great Britain for advice and assistance. Lord Stratford de Redcliffe, who reached his post at Constantinople shortly after the arrival of Menshikov, at once grasped the essential facts of the situation. The question of the holy places was insignificant in itself—it might be settled if France were granted political compensation elsewhere; that of the protectorate claimed by Russia over the Christians involved the integrity of the sultan's sovereignty. With great address he succeeded in persuading Menshikov to present the two demands separately. On the 22nd of April the French, Russian and British ministers came to an agreement on the question of the holy places; with the result that, when the question of protectorate was raised, Menshikov found himself opposed by the ambassadors of all the other powers. On the 5th of May, nevertheless, in obedience to his peremptory instructions, he presented his ultimatum to the Ottoman government, which, backed now by all the other powers, rejected it. On the 22nd Menshikov and the whole of the Russian diplomatic staff left Constantinople; and it was announced that, at the end of the month, the tsar's troops would enter the Danubian principalities. On the 22nd of June the Russian army, under Prince Gorchakov, crossed the Pruth, not—as was explained in a circular to the powers—for the purpose of attacking Turkey, but solely to obtain the material guarantees for the enjoyment of the privileges conferred upon her by the existing treaties. The news of this aggression roused intense excitement in England; but the British government still exerted itself to maintain peace. In August a conference of the four powers assembled at Vienna, but the settlement they proposed, which practically conceded everything demanded by Russia, except the claim to the protectorate, though accepted by the tsar, was rejected by the Porte, now fallen into a mood of stubborn resentment at the Russian invasion. At the beginning of October Turkey formally declared war; on the 22nd the French and British fleets passed the Dardanelles. Lord Aberdeen still hoped to secure peace, and the Russian government was informed that no *casus belli* would arise so long as Russia abstained from passing the Danube or attacking a Black Sea port. To the emperor Nicholas this was tantamount to a declaration of war; and in effect it was so. On the 30th of November the Russian fleet attacked and destroyed a Turkish squadron in the harbour of Sinope; on the 3rd of January the combined French and British fleets entered the Black Sea, commissioned to "invite" the Russians to return to their harbours.

Crimean War.

The emperor Nicholas had been singularly misled as to the state of public opinion in Europe. The news of the affair of Sinope, rather wanton slaughter than a battle, raised excitement in England to fever heat; while the excellent bearing and consistent successes of the Turkish troops during the first months of the campaign on land excited the admiration of all Europe. The belief in the rejuvenation of Turkey seemed to be justified; and when, on the 27th of March 1854, Great Britain and France declared war on Russia, the action of the governments was supported by an overwhelming public opinion. As regards Austria, too, the emperor Nicholas was no less mistaken. If she maintained neutrality, it was due to no impulse of gratitude, and it was far from "benevolent." As the Russians withdrew from the Danubian principalities, Austrian troops occupied them, and by a convention with the Porte the Austrian government undertook to resist by arms any attempt of the Russians to return. So far as the extreme claims of the tsar were concerned, neither Austria nor Prussia was willing to concede them, and both had joined with France and Great Britain in presenting, on the 12th of December 1853, an identical note at St Petersburg, drawn up at the Conference of Vienna, reaffirming the principles of the treaty of 1841. Save for the benevolent neutrality of Prussia, therefore, which enabled her to obtain supplies from the north, Russia was pitted single-handed against a coalition of Turkey, Great Britain and France, to which Sardinia was added later.

The events of the war that followed are told elsewhere (see CRIMEAN WAR). The main operations were confined to the Crimea, where the allied troops landed on the 14th of September 1854, and they were not concluded, in spite of the terrible exhaustion of Russia, till in December 1855 the threatened active intervention of Austria forced the emperor Alexander II. to come to terms. These terms were ultimately embodied in the Treaty of Paris of the 30th of March 1856. Its provisions, held by some to be so unduly favourable to Russia as to justify the question whether she had not been victorious in the war, were as follows: Russia abandoned all pretensions to exercise a protectorate over the Christians in Turkey, or to an exclusive right of interference in the Danubian principalities, to which Bessarabia was restored; the navigation of the Danube was made free and placed under the supervision of an international commission; the Black Sea was closed to warships, while open to the commercial flags of all countries; the Asiatic frontier between the two empires remained unchanged; Turkey was admitted to the concert of Europe, and all the contracting parties agreed to respect her independence and the integrity of her territory; moreover, the provisions of the Tanzimāt were reaffirmed in a fresh decree of the sultan, which was incorporated in the treaty, and further provided for a large measure of local autonomy for the Christian communities. It was stipulated that Turkey's promises of reform gave no power the right of interference on behalf of the Christians.

The New Era.

The Treaty of Paris was regarded as opening a new era in the progress of Turkey. Admitted on equal terms to the European family of nations, the Ottoman government had given a solemn guarantee of its intention to make the long-promised reforms a reality. But it soon became apparent that the time was scarcely come for liberal measures; and fanatical outbreaks at Jidda (1858) and in Syria (1860) gave proof that the various sections of the population were not yet prepared to act together in harmony. The Syrian disturbances brought about a French occupation, which Fuad Pasha, ably seconded by Ahmed Vefyk Effendi, the Turkish ambassador in Paris, contrived to restrict, and to terminate as soon as possible. The immediate local result was the institution, by a *règlement*,[1] signed at Constantinople on the 6th of September 1864, of autonomy for the Lebanon under a Christian governor appointed by the powers with the concurrence of the Porte, an arrangement which has worked satisfactorily until the present day. In 1859 the Danubian principalities, deliberately left separate by the Congress of Paris, carried out their long-cherished design of union by electing Prince Cuza both in Moldavia and in Walachia, a contingency which the powers had not taken into account, and to which in the end they gave a grudging assent (see RUMANIA).

Abd-ul-Aziz, 1861–1876.

On the 25th of June 1861 Sultan Abd-ul-Mejid died, being succeeded by his brother Abd-ul-Aziz. The new sultan's reign marked, if not the beginning, at least the high tide of that course of improvident and unrestrained expenditure, facilitated by the enthusiasm created in Europe by Turkey's admission to the ranks of the powers which loosened for her the purse-strings of the foreign investor. The viceroy of Egypt, Ismail Pasha, followed his suzerain's example in this respect, and was lavish in his bribes to his imperial overlord to obtain the extension of his own privileges and the establishment in Egypt of succession from father to son; these concessions were granted to him by the *firmans* of the 27th of May 1866 and the 8th of June 1867, in the latter of which the viceroy is addressed for the first time as "khedive." Abd-ul-Aziz is said to have yielded the more readily as being desirous of bringing about a similar alteration in the succession in Turkey, in favour of his own eldest son, Prince Yussuf Izz-ed-din; public opinion was, however, opposed to so sweeping a change, and the succession to the throne in Turkey still goes to the eldest surviving member of the house of Osman. Though the foreign relations of Turkey remained untroubled, disturbances in Servia, Montenegro and Crete continued throughout the "sixties." Servia had long resented the occupation of her fortresses by Turkish troops; frequent collisions arising from this source resulted in June 1862 in the bombardment of Belgrade; some slight concessions were then made to Servia, but it was not until 1867 that, through the mediation of England and other powers, she succeeded in obtaining the withdrawal of the Turkish garrisons. The Cretan insurrection rose to a formidable height in 1868–69, and the active support given to the movement by Greece brought about a rupture of relations between that country and Turkey. The revolt was suppressed, the Turko-Greek conflict was settled by a conference of the powers in Paris, and Crete received a charter of local self-government which for a time pacified the island.[2]

Abd-ul-Aziz had visited the Paris Exhibition of 1867 and had paid his respects to Queen Victoria, who conferred on him the order of the Garter. In 1869 the visit was returned by many sovereigns and princes on their way to the opening of the Suez Canal, among these being the empress Eugénie. An important event not to be passed over without mention is the grant on the 10th of March 1870 of the *firman* instituting the Bulgarian exarchate, thus severing the Bulgarian Church from the jurisdiction of the Greek patriarch of Constantinople. This concession, given under strong pressure from Russia, aroused the deepest resentment of the Greeks, and was the principal factor in the awakening of the Bulgarian national spirit which subsequent events have done so much to develop. Russian influence at Constantinople had been gradually increasing, and towards the end of 1870 the tsar took advantage of the temporary disabling of France to declare himself no longer bound by those clauses of the Treaty of Paris which restricted Russia's liberty of possessing warships on the Black Sea. An international conference convoked in London early in 1871 laid down the principle that treaty engagements were binding, and then proceeded to abrogate this particular engagement. Russia and Turkey thus regained full liberty as regards their naval forces and armaments in the Euxine; the passage of the straits remained interdicted to ships of war.

A reform not unworthy of notice was effected by the law promulgated on the 18th of June 1867 whereby foreigners were for the first time allowed to hold landed property throughout the Ottoman Empire (save in the Hejaz) on condition of their being assimilated to Ottoman subjects, *i.e.* divested of their right to the protection of their own authorities in every respect concerning such property.

Deposition of Abd-ul-Aziz.

Meanwhile in Turkey national bankruptcy was brought within measurable distance by the sultan's extravagance and the incompetence of his ministers; it was staved off only by loans contracted almost annually to pay the interest on their predecessors. External influences and latent fanaticism were active; a serious insurrection broke out in Bosnia and Herzegovina in 1875, and the efforts to quell it almost exhausted Turkey's resources; the example spread to Bulgaria, where abortive outbreaks in September 1875 and May 1876 led to those cruel measures of repression which were known as "the Bulgarian atrocities."[3] Mussulman public feeling was inflamed, and an attempt at Salonica to induce a Christian girl who had embraced Islam to return to her faith caused the murder of two foreign consuls by a fanatical mob. The finances of Turkey now collapsed, and the inevitable bankruptcy was declared, whereby more than through any other cause she lost such sympathies as she possessed in western Europe. Turkey's distress was Russia's opportunity; the sultan fell entirely under the influence of General Ignatiev, the tsar's ambassador, and it became evident that the country was hastening to its dissolution. A conspiracy to bring about a change was hereupon formed by certain prominent statesmen, whose leaders were Midhat Pasha, Mehemed Rushdi Pasha and Mahmud Damad Pasha, the husband of a princess of the blood, sister to Prince Murad. These succeeded in gaining over the Sheikh-ul-Islam, and in obtaining from him a *fetva* for the deposition of Abd-ul-Aziz.

In virtue of this judgment of the supreme legal authority, and with the aid of the fleet, Abd-ul-Aziz was deposed, being shortly afterwards found dead, apparently by his own hand. Murad V. reigned in his stead. But the change of sultans brought no relief to the troubled state: Servia and Montenegro declared war, and in less than three months it had become evident that Murad was incapable of governing.

Accession of Abd-ul-Hamid II., 1876.

Murad's brother Abd-ul-Hamid was accordingly proclaimed sultan on the 31st of August 1876. The diplomacy of Europe had been searching in vain since the autumn of 1875 for the means of inducing Turkey to institute effective administrative reforms and to grant to its European provinces that autonomy which now appeared essential. But the new sultan was as averse from accepting any of the formulae proposed as were his predecessors: Servia and Montenegro were with great difficulty pacified, but it was plain that Russia, whose Slavonic and Orthodox sympathies had been strongly aroused, would soon begin hostilities herself. Turkey now made a show of going even beyond the demands formulated by Europe, and the international conference which met at Constantinople during

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[1] Text in Holland, p. 212.

[2] "Correspondence . . . respecting the rupture of diplomatic relations between Turkey and Greece, &c.," in *State Papers*, lix. 584, &c., *Protocols of Conferences*, p. 813, &c.

[3] See Mr Baring's reports in *Parl. Papers* (1878), lxxxi.

Russo-Turkish War.

Treaty of San Stefano.

the last days of 1876 was startled by the salvo of artillery which heralded the promulgation of a liberal constitution, not for the European provinces only, but for the whole empire, and the institution of a Turkish parliament. The decisions of the conference, moderate though they were, in the end requiring merely the nomination of an international commission to investigate the state of the European provinces of Turkey, and the appointment by the sultan, with the approval of the powers, of governors-general for five years, were rejected by the Porte. The statesmen of Europe still continued their efforts to avert a conflict, but to no purpose. On the 24th of April 1877 Russia declared war and her troops crossed the Turkish frontiers. Hostilities were conducted both in Europe and Asia for nearly a year. Rumania joined the Russians, and in Europe no effective opposition was encountered by the invaders until the assaults on Plevna and the Shipka Pass, where the valiant resistance of the Turks won for them the admiration of Europe. By November the defence of the Turks in Asia Minor had entirely collapsed. Plevna surrendered on the 9th of December 1877 after a heroic struggle under Osman Pasha. Thereafter the Russians advanced practically unchecked (see RUSSO-TURKISH WARS). An armistice and preliminaries of peace were signed on the 31st of January 1878 at Adrianople, and a definitive treaty was concluded at San Stefano on the 3rd of March 1878. Its terms were: the creation of an autonomous tributary principality of Bulgaria extending from the Black Sea to the Aegean; the recognition by Turkey of the independence of Rumania, Servia and Montenegro, with increased territories; the payment of a war indemnity; the introduction of reforms in Bosnia and Herzegovina; the cession to Russia of Bessarabia and the Dobruja; the opening of the passage of the straits at all times to the merchant vessels of neutral states; and the razing of the fortresses on the Danube.

Congress of Berlin, 1878.

Great Britain had throughout the war preserved strict neutrality, but, while making it clear from the outset that she could not assist Turkey, had been prepared for emergencies. Turkey's severity in repressing the Bulgarian insurrection had raised up in England a storm of public opinion against her, of which the Liberal opposition had taken the fullest advantage; moreover the suspension of payments on the Ottoman debt had dealt Turkey's popularity a blow from which it had never recovered. But upon the approach of the Russians to Constantinople the British reserves were called out and the fleet was despatched to the Bosporus. Accordingly, and as her line of retreat might be threatened by Austria, Russia consented to a revision of the Treaty of San Stefano at a congress to be held at Berlin. Before the meeting of this congress, which assembled on the 13th of June 1878, the powers principally interested had arrived at an understanding as to the modifications to be introduced in the treaty, and by a convention concluded with Turkey on the 4th of June 1878 England had undertaken to defend the Asiatic dominions of the sultan by force of arms, provided that his majesty carried out all the necessary reforms, to be agreed upon later, and assigned to England the island of Cyprus, which was however to be restored if Turkey fulfilled her engagements as to reforms and if Russia gave back to her Kars, Ardahan and Batum. On the 13th of July 1878 the Treaty of Berlin was signed: the Great Bulgaria of the San Stefano Treaty was diminished to an autonomous province north of the Balkans, the south-eastern portion, no longer extending to the Aegean, was formed into a self-governing tributary province styled Eastern Rumelia; Turkey abandoned all pretension to suzerainty over Montenegro; Servia and Rumania received their independence (but the last named was made to cede Bessarabia to Russia, receiving instead the Dobruja); the Asiatic frontier was readjusted, Kars, Ardahan and Batum becoming Russian. It was further provided that Bulgaria should pay to Turkey an annual tribute, and should moreover (as well as the other Balkan states receiving accessions of territory at Turkey's expense) bear a portion of the Ottoman debt. The sums payable by the different countries were to be fixed by the powers; but no effect has so far been given to this reasonable stipulation, which may now be looked upon as null and void. Turkey undertook to pay to Russia a war indemnity of 300,000,000 roubles, and the status of the straits remained unchanged. Measures of reform in Armenia were also provided for, as also the convocation of an international commission for drawing up a reform scheme for the European provinces left to Turkey. The organic law for Crete was to be carried out, and special laws enacted for other parts of Turkey. Bosnia and Herzegovina were handed over to the administration of Austria; Montenegro and Greece received accessions of territory to which only strong pressure coupled with a naval demonstration induced Turkey to consent three years later.

The Egyptian Question.

Peace once restored, some attempt was made by Turkey in the direction of complying with her engagements to institute reform. Financial and military advisers were procured from Germany. English officers were engaged to reform the gendarmerie, and judicial inspectors of foreign nationality were to travel through the country to redress abuses. It was not long before the unsubstantial character of all these undertakings became apparent; the parliament was dissolved, the constitution was suspended and its author exiled. Egyptian affairs next threatened complications. In May 1879 the misgovernment of Ismaïl Pasha and the resulting financial crisis rendered the deposition of the khedive inevitable; in order to anticipate the action of England and France, who would otherwise have expelled the erring viceroy, the sultan deposed him himself; the succession devolved upon his son Mahommed Tewfik Pasha. (For the subsequent history of the Egyptian question see EGYPT: *History*.) The revolt of Arabi Pasha in 1881 broke up the Anglo-French condominium in Egypt and led to outrages at Alexandria followed by a bombardment on the 11th of July 1882. The occupation of the country by Great Britain gradually took a more permanent form, and though negotiations were more than once entered into with Turkey with a view to its termination, these either proved abortive or were rendered so (as *e.g.* the Drummond-Wolff convention of 1887) by the action of other powers. The Anglo-French agreement of 1904 left England in undisputed mastery.

Public Debt.

The financial straits of Turkey after the war became so acute that the sultan was compelled to consent to a measure of foreign control over the finances of the country; the administration of the public debt being established in December 1881. (See *Finance*, above.)

In 1885 the practically bloodless revolution of Philippopolis on the 18th of September united Bulgaria and Eastern Rumelia, severed by the Treaty of Berlin. A conference held at Constantinople sanctioned the union on terms which were rendered acceptable to the sultan; but Said Pasha, who had assisted the sultan in centralizing at Yildiz Kiosk the administration of the country, and who had become grand vizier, was a strong adherent of the policy of armed intervention by Turkey, and the consequence was his fall from office. His successor in the grand vizierate, Kiamil Pasha, was soon called upon to deal with Armenian unrest, consequent on the non-execution of the reforms provided for in the Treaty of Berlin and the Cyprus Convention, which first found vent about 1890. But Kiamil Pasha was not subservient enough to his imperial master's will, and his place was taken by a military man, Jevad Pasha, from whom no independence of action was to be apprehended.

German Activity in Turkey.

It is from this period that the German ascendancy in Constantinople is noticeable. Railway concessions were given to Germans over the heads of British applicants already in possession of lines from which they were expropriated, thus affording the nucleus of the Bagdad railway (of which Germany obtained the concession in November 1899). (See BAGDAD, vol. iii. p. 197.)

From 1890 Crete was frequently the scene of disturbance; the Christian communities in other parts of Turkey began to chafe under the attempted curtailing of their privileges; about Christmas 1893 the Greek patriarch caused all the Orthodox churches to be closed as a protest; and the Armenian agitation

Armenian Troubles.

entered upon a serious phase. The Kurds, the constant oppressors of that people, had received official recognition and almost complete immunity from the control of the civil law by being formed into a yeomanry frontier-guard known as the Hamidian cavalry. The troubles arising from this cause and from greater energy in the collection of taxes led the Armenians in outlying and mountainous districts to rise against the authorities. The repression of these revolts in the Sassun district in the autumn of 1894 was effected under circumstances of great severity by Turkish troops and Kurdish irregulars. A commission composed of British, French and Russian officials held an inquiry into the events which had occurred, and early in 1895 England, France and Russia entered actively into negotiations with a view to the institution of reforms. The scheme propounded by the three powers encountered great objections from the Porte, but under pressure was accepted in October 1895. Its acceptance was however the signal for a series of massacres in almost every town of importance throughout Asia Minor, which there is but too strong evidence for suspecting were committed with the connivance of the authorities, and in which upwards of 200,000 persons are computed to have perished. In 1896 Lord Salisbury induced the other powers to unite in urging the execution of the reforms, but no agreement could be come to for the use of coercion, and Europe could but look on and protest. Changes of ministry at Constantinople were powerless to bring about an improvement, and early in 1896 Cretan affairs became so serious as to call for the intervention of the powers. In September yet another Cretan charter of self-government was promulgated. Shortly before, a revolutionary attack by an Armenian band on the Ottoman bank at Constantinople brought about a general massacre of Armenians in the capital (where a widespread revolutionary organization undoubtedly existed), in which at least 3000 victims fell, and the persecution of Armenians became the order of the day.

Greek War of 1897.

The neglect of the Porte to carry out all the stipulations of the Cretan arrangement of 1896 led to a renewal of the disturbances, and Greece began to take steps for the invasion of the island; in February 1897 Colonel Vassos sailed from the Piraeus with an armed force, intending to proclaim the annexation of Crete to Greece, and Greek troops were massed on the Thessalian frontier. Diplomacy busied itself with fruitless attempts to avert hostilities; on the 17th of April 1897 war was declared by Turkey. The resistance offered by Greece was feeble in the extreme: Europe was obliged to intervene, and Turkey gained a rectification of frontier and a war indemnity of £4,000,000, besides the curtailment by the treaty eventually signed of many privileges hitherto enjoyed by Hellenic subjects in Turkey. But Europe was determined that the Cretan question should be definitely settled, at least for a period of some years, and, after an outbreak at Candia, in which the lives of British troops were sacrificed, the four powers (Germany and Austria having withdrawn from the concert) who had taken over the island *en dépôt* handed it over in October 1898 to Prince George of Greece as high commissioner (see Crete: *History*).

Revolts in Arabia.

Crete being thus removed from the scope of her action, Turkey found ample occupation in the almost constant turbulence of the Yemen, of Albania and of Macedonia. After 1892 the revolts, frequently renewed, of the so-called imam of Sana, necessitated the despatch of large and costly expeditions to Arabia, in which thousands of Turkish troops have fallen in guerrilla warfare or through the inhospitable climate; in Albania disturbance became almost endemic, owing to the resistance offered by the intractable population to successive attempts of the central authorities to subject the country to regular taxation and the operation of the laws.

Disputes with France and Britain.

Unsettled claims by French citizens led to a breaking off of relations and the occupation of Mitylene by France in November 1901; the rupture was of short duration and Turkey soon gave way, according complete satisfaction both in this matter and on certain other French demands. In 1901 and 1902 Turkish encroachments on the hinterland of Aden brought about a dangerous state of tension between Great Britain and Turkey, which had its parallel in 1906 in similar trespasses by the Ottoman authorities on the Egyptian land frontier near Akaba. In both cases Turkey eventually yielded; a similar question arose in 1906 with France over the boundaries of the African possessions of the two countries.

Macedonian Question.

But Macedonia was Turkey's chief source of anxiety. That country, left by the Treaty of Berlin with its status unaltered, was in a continued condition of disturbance. The Christian population, who in common with their Mussulman fellow subjects suffered from the defective methods of government of their rulers, had at least before them the example of their brethren—Greeks, Bulgarians or Servians—dwelling in independent kingdoms under Christian governments on the other side of the frontier. The hope of eventual emancipation was stimulated by sedulous propagandists from each of these countries; from time to time armed bands of insurgents were manned and equipped in the small neighbouring states, with or without the co-operation of the governments. So long as Stambolov, the energetic Bulgarian statesman, was alive he succeeded in keeping the Bulgarian element quiet, and the peace of the country was less liable to disturbance. But for some years the three rivals in Macedonia, to which a fourth, the Rumanian element, must be added, were in constant strife (see Macedonia). A serious Bulgarian insurrection in Macedonia in the autumn of 1903 induced Austria and Russia to combine in formulating the Mürzsteg reform programme, tardily consented to by Turkey, by which Austrian and Russian civil agents were appointed to exercise a certain degree of control and supervision over the three vilayets of Salonica, Monastir and Kossovo. It was also arranged that foreign officers should be named to reorganize the gendarmerie. An Italian officer, General De Giorgis, was appointed to the chief command in the reorganization, and the three vilayets were apportioned among the great powers into districts, in each of which was appointed a staff officer with a number of subordinate officers of his nationality under his orders. The work of reorganization was efficiently carried out, and the gendarmerie school at Salonica, under British supervision, showed excellent results. But the achievements of the two civil agents were less noteworthy; and in 1905 it was agreed that, in view of the financial necessities of the provinces, the other great powers should each appoint delegates to a financial commission with extensive powers of control in fiscal matters. The Porte opposed the project, and an international naval demonstration and the occupation of Mytilene by the powers became necessary before Turkey gave way in December 1905. Even so it proved impossible to fulfil the Mürzsteg programme, though the attempt was prolonged until 1908. The Austro-Russian *entente* had then come to an end; and after a meeting between King Edward VII. and the tsar Nicholas II. at Reval, a new scheme of reforms was announced, under the name of the "Reval programme." The enforcement of these reforms, however, was postponed *sine die* owing to the revolution which transformed the Ottoman Empire into a constitutional state; and the powers, anticipating an improvement in the administration of Macedonia by the new government, withdrew their military officers in the summer of 1908.

The Young Turks.

The Young Turkish party had long been preparing for the overthrow of the old régime. Their central organization was in Paris and their objects were known throughout Europe, but except at Yildiz Kiosk their power was almost everywhere underrated. The Porte strove by every means at its disposal to thwart their activity; but elsewhere they were regarded as a body of academic enthusiasts, more noisy than dangerous, who devoted their scanty funds to the publication of seditious matter in Paris or Geneva, and sought to achieve the impossible by importing western institutions into a country fit only to be ruled by the *sheriat* and the sword. Such was the opinion held even by experienced diplomatists and by historians. It was strengthened by the fact that the Young

Turks had deliberately abstained from violent action. They had, in fact, learned from events in Russia and Poland that sporadic outbreaks on a small scale would inevitably discredit their cause, and that a successful revolution would require the support of the army. To gain this, an extensive propaganda was carried on by secret agents, many of whom were officers. At the beginning of 1908 a favourable opportunity for action arrived. The Ottoman troops in Arabia were mutinous and unpaid; the Albanians, long the mainstay of Turkish military power in the west, had been irritated by unpopular taxes and by the repressive edicts which deprived them of schools and a printing-press; foreign interference in Crete and Macedonia was resented by patriotic Moslems throughout the empire. In these circumstances the headquarters of the Young Turks were transferred from Paris to Salonica, where a central body, known as the committee of union and progress, was established (1908) to organize the revolution. Most of its members were military officers, prominent among them being Majors Enver Bey and Niazi Bey, who directed the propaganda in Albania and Macedonia. By midsummer the Albanian leaders and the greater part of the Turkish army in Europe had sworn fidelity to the constitution.

On the 25th of May an insurrection broke out in Samos, owing to a dispute between the Samian Assembly and Kopassis Effendi, "prince," or governor of the island. After the port of Vathy had been bombarded by Ottoman war-ships the revolt was easily crushed.

The Revolution of 1908.

This affair however was of little more than local importance, and the Young Turks were not directly concerned in it. They struck their first blow on the 22nd of July 1908, when Niazi Bey and his troops raised the standard of revolt at Resna, a town on the road from Monastir to Ochrida. On the 23rd the committee of union and progress, under the presidency of Enver Bey, proclaimed the constitution in Salonica, while the second and third army corps threatened to march on Constantinople if the sultan refused to obey the proclamation. On the 24th the sultan yielded, and issued an *iradē*, restoring the constitution of 1876, and ordering the election of a chamber of deputies. Various other reforms, notably the abolition of the spy system and the censorship, were announced soon afterwards. Some of the more unpopular officials associated with the old régime were assassinated, among them Fehim Pasha, the former head of the espionage department, who had been exiled to Brusa in 1907 at the request of the British and German ambassadors. Otherwise the revolution was effected almost without bloodshed; for a time the insurgent bands disappeared in Macedonia, and the rival "nationalities"—Greek, Albanian, Turk, Armenian, Servian, Bulgarian and Jew—worked harmoniously together for the furtherance of common constitutional aims. On the 6th of August Kiamil Pasha, an advanced Liberal, became grand vizier, and a new cabinet was formed, including a Greek, Prince Mavrocordato, an Armenian, Noradounghian, and the Sheikh-ul-Islam.

Bosnia and Bulgaria.

The success of the Young Turks created a serious situation for the statesmen of Austria-Hungary and Bulgaria. A regenerated Ottoman Empire might in time be strong enough to demand the evacuation of Bosnia and Herzegovina, and to maintain or extend the nominal suzerainty over Bulgaria which the sultan had exercised since 1878. Accordingly, at the beginning of October 1908, the emperor Francis Joseph informed the powers signatory to the treaty of Berlin that the annexation of Bosnia and Herzegovina to the Dual Monarchy had become necessary, and this decision was formally announced in an imperial rescript dated the 7th of October. The independence of Bulgaria was proclaimed on the 5th. The Ottoman government protested to the powers, but it wisely limited its demands to a claim for compensation. Austria-Hungary had from the first undertaken to withdraw its garrisons from the sanjak of Novibazar—an important concession; after prolonged negotiations and a boycott of all Austrian goods exported to Turkey, it also agreed to pay £2,200,000 as compensation for the Turkish crown lands seized in Bosnia and Herzegovina. This arrangement was sanctioned by the Ottoman parliament, which assented to the annexation on the 6th of April 1909 and recognized the independence of Bulgaria on the 19th of April, the Russian government having enabled Bulgaria to pay the indemnity claimed by Turkey on account of the Eastern Rumelian tribute and railways (see BULGARIA: *History*). On the 3rd of February 1910 the Porte accepted a Bulgarian proposal for a mixed commission to delimit disputed sections of the Turco-Bulgarian frontier, and in March King Ferdinand visited Constantinople.

The Reaction in the Provinces.

Meanwhile the Young Turks were confronted with many difficulties within the empire. After the first fervour of enthusiasm had subsided the Christian nationalities in Macedonia resumed their old attitude of mutual jealousy, the insurgent bands began to reappear, and the government was in 1909–1910 forced to undertake the disarmament of the whole civil population of the three vilayets. In Albania serious discontent, resulting in an insurrection (May-September 1909), was caused by the political rivalry between Greeks and Albanians and the unwillingness of the Moslem tribesmen to pay taxes or to keep the peace with their neighbours, the Macedonian Serbs. In Asia Minor the Kurdish troops under Ibrahim Pasha revolted, and, although they were defeated with the loss of their commander, the Kurds continued to attack indiscriminately the Turks, Nestorians and Armenians; disturbances also broke out among the other reactionary Moslems of this region, culminating in a massacre of the Armenians at Adana. In Arabia Ratib Pasha, the Turkish commander-in-chief, joined the enemies of the new régime; he was defeated and captured in the autumn of 1908, but in the following year frequent raids upon the Hejaz railway were made by Bedouin tribesmen, while a Mahdist rebellion broke out and was crushed in Yemen.

The Constantinople Counter-revolution.

More serious than any of these local disturbances was the counter-revolution in Constantinople itself, which began with the revolt of Kiamil Pasha, the grand vizier, against the authority of the committee of union and progress. Kiamil Pasha was forced to resign (Feb. 14, 1909) and was succeeded by Hilmi Pasha, ex-high commissioner of Macedonia. Strife then arose between the committee and the Liberal Union, a body which mainly represented the Christian electorate, and on the 5th of April Hassan Fehmi Effendi, who edited the *Serbesti*, the official organ of the union, was assassinated. He was an Albanian, and his fellow countrymen in the Constantinople garrison at once made common cause with the opponents of the committee. Mutinous troops seized the parliament house and the telegraph offices; the grand vizier resigned and was succeeded by Tewfik Pasha (April 14); and delegates were sent by the Liberal Union, the association of Ulema and other bodies to discuss terms with the committee. But Abd-ul-Hamid had issued a free pardon to the mutineers, and the committee had now decided that the new régime would never be secure while the sovereign favoured reaction. They refused to treat with the delegates, and despatched 25,000 men under Mahmud Shevket to Constantinople.

The New Régime.

The senate and chamber met at San Stefano, and, sitting jointly as a National Assembly, issued a proclamation in favour of the committee and its army (April 22, 1909), by which Constantinople was now invested. Part of the garrison remained loyal to the sultan, but after five hours of severe fighting Shevket Pasha was able to occupy the capital (April 25). The National Assembly met in secret session two days later, voted unanimously for the deposition of Abd-ul-Hamid II., and chose his younger brother Mahommed Reshad Effendi (b. Nov. 3, 1844) as his successor, with the style of Mahommed V. Abd-ul-Hamid II. was removed to Salonica on the 28th, and on the 10th of May the new sultan was formally invested with the sword of Osman. Hilmi Pasha again became grand vizier, but resigned on the 28th of December 1909, when he was succeeded by Hakki Bey. On the 5th of August 1909 the new constitution described above was promulgated by imperial *iradē*; parliament was prorogued for three months on the 27th, and during the recess the committee of union and progress met at Salonica and modified its own rules (Oct. 23), ceasing thenceforward to be a secret association. This was regarded as an expression of confidence in the reformed parliament, which had laid the foundation of the important financial and administrative reforms already described. On the 13th of September 1909 the Macedonian international commission of finance met for the last time; its members were reappointed to a higher finance board for the whole empire, under the presidency of Djavid Bey. Ch. Laurent had already been nominated financial adviser to the empire (Sept. 16, 1908), while Sir William Willcocks became head of the irrigation department; the reorganization of the army was entrusted to the German General von der Goltz, that of the navy to Admiral Sir Douglas Gamble (resigned Feb. 1, 1910).

Crete, Greece and Rumania.

The evacuation of Crete by the four protecting powers was followed in 1909 by renewed agitation. Turkey was willing to concede the fullest local autonomy, but not to abandon its sovereign rights over the island. In July 1909, however, the Greek flag was hoisted in Canea and Candia, and it was only lowered again after the war-ships of the protecting powers had been reinforced and had landed an international force. The Cretan administrative committee swore allegiance to the king of the Hellenes in August, and again, after a change of government, at the end of December 1909. This situation had already given rise to prolonged negotiations between Greece and Turkey. It also contributed towards the conclusion of an *entente* between Turkey and Rumania in the summer of 1910. Both of these powers were interested in preventing any possible accession of territory to the Bulgarian kingdom; and Rumania (*q.v.*) had for many years been a formidable opponent of Hellenism among the Macedonian Vlachs. Greece and Crete were thus confronted with what was in effect a defensive alliance between Turkey and Rumania. The Cretans had insisted upon their demand for union with Greece and had elected three representatives to sit in the Greek national assembly. Had this act been ratified by the government at Athens, a war between Greece and the Ottoman Empire could hardly have been avoided; but a royal rescript was issued by the king of the Hellenes on the 30th of September 1910, declaring vacant the three seats to which the Cretan representatives had been elected; the immediate danger was thus averted.

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2. *Monographs*: Much information on modern Turkish history and politics will be found in the works dealing primarily with topography, finance, law and defence, which have been cited above. See also S. Lane-Poole, *Life of Lord Stratford de Redcliffe* (2 vols., London, 1888); A. Vandal, *Mémoires du marquis de Nointel* (French ambassador at Constantinople from 1670 to 1678); E. Engelhardt, *La Turquie et le Tanzimat* (Paris, 1882); E. Driault, *La Question d'orient depuis ses origines jusqu'à nos jours* (Paris, 1898); V. Bérard, *La Turquie et l'Hellénisme* (Paris, 1897); idem, *Le Sultan, l'Islam et les Puissances* (Paris, 1907); idem, *La Révolution turque* (1909).

3. *Official Publications and Collections of Treaties*: Sir E. Hertslet's *Treaties Regulating the Trade, &c., between Great Britain and Turkey* (London, 1875) presents a summary of all the principal treaties between Turkey and other states; see also Gabriel Effendi Noradounghian, *Recueil d'actes internationaux de l'empire ottoman, 1300–1789*, t. i. (Paris, 1897). Much valuable information is to be obtained from parliamentary papers. These are too numerous for detailed mention, but the following periods may be cited as the most interesting: 1833–1841 (Egyptian question); 1849–1859 (Crimean War and the events by which it was preceded and followed); 1868–1869 (Cretan insurrection); 1875–1881 (Bosnian and Herzegovinian insurrection, Russo-Turkish War, Berlin treaty and subsequent events); 1885–1887 (union of Eastern Rumelia with Bulgaria); 1889–1890 (Cretan disturbances); 1892–1899 (Armenian and Cretan affairs); 1902–1907 (Macedonia); 1908–1910 (revolution and reform). Some analysis of the unpublished documents in the record office, for the period 1815–1841, by W. Alison Phillips, will be found in the bibliographies to chs. vi. and xvii. of vol. x. of the *Cambridge Modern History*. (X.)

Literature.

Old School.

In all literary matters the Ottoman Turks have shown themselves a singularly uninventive people, the two great schools, the old and the new, into which we may divide their literature, being closely modelled, the one after the classics of Persia, the other after those of modern Europe, and more especially of France. The old or Persian school flourished from the foundation of the empire down to about 1830, and still continues to drag on a feeble existence, though it is now out of fashion and cultivated by none of the leading men of letters. These belong to the new or European school, which, in spite of the bitter opposition of the partisans of the old Oriental system, has succeeded, partly through its own inherent superiority and partly through the talents and courage of its supporters, in expelling its rival from the position of undisputed authority which it had occupied for upwards of five hundred years. For the present purpose it will be convenient to divide the old school into three periods, which may be termed respectively the pre-classical, the classical and the post-classical. Of these the first extends from the early days of the empire to the accession of Suleimān I., 1301–1520 (700–926); the second from that event to the accession of Maḥmūd I., 1520–1730 (926–1143); and the third from that date to the accession of ʿAbd-ul-ʿAzīz, 1730–1861 (1143–1277).

General Character of Ottoman Literature.

The works of the old school in all its periods are entirely Persian in tone, sentiment and form. We find in them the same beauties and the same defects that we observe in the production of the Iranian authors. The formal elegance and conventional grace, alike of thought and of expression, so characteristic of Persian classical literature, pervade the works of the best Ottoman writers, and they are likewise imbued, though in a less degree, with that spirit of mysticism which runs through so much of the poetry of Irān. But the Ottomans did not stop here: in their romantic poems they chose as subjects the favourite themes of their Persian masters, such as Leylī and Mejnūn, Khusrev and Shīrīn, Yūsuf and Zuleykhā, and so on; they constantly allude to Persian heroes whose stories occur in the *Shāh-Nāma* and other storehouses of Iranian legendary lore; and they wrote their poems in Persian metres and in Persian forms. The mesnevī, the ḳasīda and the ghazel—all of them, so far at least as the Ottomans are concerned, Persian—were the favourite verse-forms of the old poets. A mesnevī is a poem written in rhyming couplets, and is usually narrative in subject. The ḳasīda and the ghazel are both monorhythmic; the first as a rule celebrates the praises of some great man, while the second discourses of the joys and woes of love. Why Persian rather than Arabian or any other literature became the model of Ottoman writers is explained by the early history of the race (see TURKS). Some two centuries before the arrival of the Turks in Asia Minor the Seljūḳs, then a mere horde of savages, had overrun Persia, where they settled and adopted the civilization of the people they had subdued. Thus Persian became the language of their court and government, and when by-and-by they pushed their conquests into Asia Minor, and founded there the Seljūḳ Empire of Rūm, they carried with them their Persian culture, and diffused it among the peoples newly brought under their sway. It was the descendants of those Persianized Seljūḳs whom the early Ottomans found ruling in Asia Minor on their arrival there. What had happened to the Seljūḳs two centuries before happened to the Ottomans now: the less civilized race adopted the culture of the more civilized; and, as the Seljūḳ Empire fell to pieces and the Ottoman came gradually to occupy its place, the sons of men who had called themselves Seljūḳs began thenceforth to look upon themselves as Ottomans. Hence the vast majority of the people whom we are accustomed to think of as Ottomans are so only by adoption, being really the descendants of Seljūḳs or Seljūḳian subjects, who had derived from Persia whatever they possessed of civilization or of literary taste. An extraordinary love of precedent, the result apparently of conscious want of original power, was sufficient to keep their writers loyal to their early guide for centuries, till at length the allegiance, though not the fashion of it, has been changed in our own days, and Paris has replaced Shīrāz as the shrine towards which the Ottoman scholar turns. While conspicuously lacking in creative genius, the Ottomans have always shown themselves possessed of receptive and assimilative powers to a remarkable degree, the result being that the number of their writers both in prose and verse is enormous. Of course only a few of the most prominent, either through the intrinsic merit of their work or through the influence they have had on that of their contemporaries, can be mentioned in a brief review like the present. It ought to be premised that the poetry of the old school is greatly superior to the prose.

Pre-classical Period.

Ottoman literature may be said to open with a few mystic lines, the work of Sultān Veled, son of Maulānā Jelāl-ud-Dīn, the author of the great Persian poem the *Mathnawī*. Sultān Veled flourished during the reign of 'Osmān I., though he did not reside in the territory under the rule of that prince. Another mystic poet of this early time was 'Āshiḳ Pasha, who left a long poem in rhyming couplets, which is called, inappropriately enough, his *Dīvān*. The nocturnal expedition across the Hellespont by which Suleimān, the son of Orkhan, won Galipoli and therewith a foothold in Europe for his race, was shared in and celebrated in verse by a Turkish noble or chieftain named Ghāzī Fāzil. Sheikhī of Kermiyān, a contemporary of Maḥommed I. and Murād II., wrote a lengthy and still esteemed mesnevī on the ancient Persian romance of Khusrev and Shīrīn; and about the same time Yaziji-oghlu gave to the world a long versified history of the Prophet, the *Muḥammedīya*. The writers mentioned above are the most important previous to the capture of Constantinople; but there is little literature of real merit prior to that event. The most notable prose work of this period is an old collection of stories, the *History of the Forty Vezirs*, said to have been compiled by a certain Sheikh-zāda and dedicated to Murād II. A few years after Constantinople passed into the hands of the Ottomans, some ghazels, the work of the contemporary Tatar prince, Mīr 'Alī Shīr, who under the *nom de plume* of Nevāyī wrote much that shows true talent and poetic feeling, found their way to the Ottoman capital, where they were seen and copied by Aḥmed Pasha, one of the viziers of Maḥommed II. The poems of this statesman, though possessing little merit of their own, being for the most part translations from Nevāyī, form one of the landmarks in the history of Ottoman literature. They set the fashion of ghazel-writing; and their appearance was the signal for a more regular cultivation of poetry and a greater attention to literary style and to refinement of language. In Sinān Pasha (d. 1420), another minister of Maḥommed the Conqueror, Ottoman prose found its first exponent of ability; he left a religious treatise entitled *Tazarru'āt* (Supplications), which, notwithstanding a too lavish employment of the resources of Persian rhetoric, is as remarkable for its clear and lucid style as for the beauty of many of the thoughts it contains. The most noteworthy writers of the Conqueror's reign are, after Aḥmed and Sinān, the two lyric poets Nejātī and Zātī, whose verses show a considerable improvement upon those of Aḥmed Pasha, the romantic poets Jemālī and Hamdī, and the poetesses Zeyneb and Mihrī. Like most of his house, Maḥommed II. was fond of poetry and patronized men of letters. He himself tried versification, and some of his lines which have come down to us appear quite equal to the average work of his contemporaries. Twenty-one out of the thirty-four sovereigns who have occupied the throne of 'Osmān have left verses, and among these Selīm I. stands out, not merely as the greatest ruler, warrior and statesman, but also as the most gifted and most original poet. His work is unhappily for the greater part in the Persian language; the excellence of what he has done in Turkish makes us regret that he did so little. The most prominent man of letters under Selīm I. was the legist Kemāl Pasha-zāda, frequently called Ibn-Kemāl, who distinguished himself in both prose and verse. He left a romantic poem on the loves of Yūsuf and Zuleykhā, and a work entitled *Nigāristān*, which is modelled both in style and matter on the *Gulistān* of Sa'dī. His contemporary, Mesīhī, whose beautiful verses on spring are perhaps better known in Europe than any other Turkish poem, deserves a passing mention.

Classical Period.

With the accession of Selīm's son, Suleimān I., the classical period begins. Hitherto all Ottoman writing, even the most highly finished, had been somewhat rude and uncouth; but now a marked improvement becomes visible alike in the manner and the matter, and authors of greater ability begin to make their appearance. Fuzūlī (d. 1563), one of the four great poets of the old school, seems to have been a native of Bagdad or its neighbourhood, and probably became an Ottoman subject when Suleimān took possession of the old capital of the caliphs. His language, which is very peculiar, seems to be a sort of mixture of the Ottoman and Āzerbaijān dialects of Turkish, and was most probably that of the Persian Turks of those days. Fuzūlī showed far more originality than any of his predecessors; for, although his work is naturally Persian in form and in general character, it is far from being a mere echo from Shirāz or Isfahān. He struck out a new line for himself, and was indebted for his inspiration to no previous writer, whether Turk or Persian. An intense and passionate ardour breathes in his verses, and forms one of the most remarkable as well as one of the most attractive characteristics of his style; for, while few even among Turkish poets are more artificial than he, few seem to write with greater earnestness and sincerity. His influence upon his successors has scarcely been as far-reaching as might have been expected—a circumstance which is perhaps in some measure owing to the unfamiliar dialect in which he wrote. Besides his *Dīvān*, he left a beautiful mesnevī on the story of Leylī and Mejnūn, as well as some prose works little inferior to his poetry. Bāḳī (d. 1599) of Constantinople, though far from rivalling his contemporary Fuzūlī, wrote much good poetry, including one piece of great excellence, an elegy on Suleimān I. The Ottomans have as a rule been particularly successful with elegies; this one by Bāḳī has never been surpassed. Rūhi, Lāmi'ī, Nev'ī, the janissary Yahya Beg, the muftī Ebū-Su'ūd and Selīm II. all won deserved distinction as poets. During the reign of Aḥmed I. arose the second of the great poets of the old Ottoman school, Nef'ī of Erzerūm, who owes his pre-eminence to the brilliance of his ḳasīdas. But Nef'ī could revile as well as praise, and such was the bitterness of some of his satires that certain influential personages who came under his lash induced Murād IV. to permit his execution. Nef'ī, who, like Fuzūlī, formed a style of his own, had many to imitate him, of whom Ṣabrī Shākir, a contemporary, was the most successful. Nā'ilī, Jevrī and Fehīm need not detain us; but Nābī (d. 1712), who flourished under Ibrāhīm and Maḥommed IV., calls for a little more attention. This prolific author copied, and so imported into Ottoman literature, a didactic style of ghazel-writing which was then being introduced in Persia by the poet Ṣā'ib; but so closely did the pupil follow in the footsteps of his master that it is not always easy to know that his lines are intended to be Turkish. A number of poets, of whom Seyyid Vehbī, Rāghib Pasha, Raḥmī of the Crimea, Kelīm and Sāmī are the most notable, took Nābī for their model. Of these, Sāmī is remarkable for the art with which he constructed his ghazels. Among the writers of this time who did not copy Nābī are Sābit, Rāsikh and Ṭālib, each of whom endeavoured, with no great success, to open up a new path for himself. We now reach the reign of Aḥmed III., during which flourished Nedīm, the greatest of all the poets of the old school. Little appears to be known about his life further than that he resided at Constantinople and was alive in the year 1727 (A.H. 1140). Nedīm stands quite alone: he copied no one, and no one has attempted to copy him. There is in his poetry a joyousness and sprightliness which at once distinguish it from the work of any other Turkish author. His ghazels, which are written with great elegance and finish, contain many graceful and original ideas, and the words he makes use of are always chosen with a view to harmony and cadence. His ḳasīdas are almost equal to his ghazels; for, while they rival those of Nef'ī in brilliancy, they surpass them in beauty of diction, and are not so artificial and dependent on fantastic and far-fetched conceits. The classical period comes to an end with Nedīm; its brightest time is that which falls between the rise of Nef'ī and the death of Nedīm, or, more roughly, that extending from the accession of Aḥmed I. 1603 (1012), to the deposition of Aḥmed III., 1730 (1143).

Classical Prose Writers.

We will now glance at the prose writers of this period. Under the name of *Humāyūn Nāma* (Imperial Book) 'Alī Chelebi made a highly esteemed translation of the well-known Persian classic *Anvār-i Suheylī*, dedicating it to Suleimān I. Sa'd-ud-Dīn (d. 1599), the preceptor of Murād III., wrote a valuable history of the empire from the earliest times to the death of Selīm I. This work, the *Tāj-ut-Tevārīkh* (Crown of Chronicles), is reckoned, on account of its ornate yet clear style, one of the masterpieces of the old school, and forms the first of an unbroken series of annals which are written, especially the later among them, with great minuteness and detail. Of Sa'd-ud-Dīn's successors in the office of imperial historiographer the most remarkable for literary power is Na'īmā. His work, which extends from 1591 (1000) to 1659 (1070), contrasts strongly with that of the earlier historian, being written with great directness and lucidity, combined with much vigour and picturesqueness. Evliyā, who died during the reign of Maḥommed IV., is noted for the record which he has left of his travels in different countries. About this time Ṭash-köprizāda began and 'Aṭā-ullāh continued a celebrated biography of the legists and sheikhs who had flourished under the Ottoman monarchs. Ḥājī Khalīfa, frequently termed Kātib Chelebi, was one of the most famous men of letters whom Turkey has produced. He died in 1658 (1068), having written a great number of learned works on history, biography, chronology, geography and other subjects. The Persianizing tendency of this school reached its highest point in the productions of Veysī, who left a *Life* of the Prophet, and of Nergisī, a miscellaneous writer of prose and verse. Such is the intentional obscurity in many of the compositions of these two authors that every sentence becomes a puzzle, over which even a scholarly Ottoman must pause before he can be sure he has found its true meaning. The first printing-press in Turkey was established by an Hungarian who had assumed the name of Ibrāhīm, and in 1728 (1141) appeared the first book printed in that country; it was Vanḳuli's Turkish translation of Jevheri's Arabic dictionary.

Coming now to the post-classical period, we find among poets worthy of mention Belīgh, Nevres, Ḥishmet and Sunbuli-zāda Vehbī, each of whom wrote in a style peculiar to himself. Three poets of note—Pertev, Neshet and Sheikh Ghālib—flourished under Selīm III. The last-named is the fourth great poet of the old

Post-classical Period.

school. *Ḥusn u 'Ashḳ* (Beauty and Love), as his great poem is called, is an allegorical romance full of tenderness and imaginative power. Ghālib's style is as original as that of Fuzūlī, Nefī or Nedīm. The most distinguished prose writers of this period are perhaps Rāshid, the imperial historiographer, 'Āsim, who translated into Turkish two great lexicons, the Arabic *Ḳāmus* and the Persian *Burhān-i Ḳāṭi'*, and Kānī, the only humorous writer of merit belonging to the old school.

Transition Period.

When we reach the reign of Maḥmūd II., the great transition period of Ottoman history, during which the civilization of the West began to struggle in earnest with that of the East, we find the change which was coming over all things Turkish affecting literature along with the rest, and preparing the way for the appearance of the new school. The chief poets of the transition are Fāzil Bey, Wāṣif, notable for his not altogether unhappy attempt to write verses in the spoken language of the capital, 'Izzet Molla, Pertev Pasha, 'Ākif Pasha, and the poetesses Fitnet and Leylā. In the works of all of these, although we occasionally discern a hint of the new style, the old Persian manner is still supreme.

Modern School.

More intimate relations with western Europe and a pretty general study of the French language and literature, together with the steady progress of the reforming tendency fairly started under Maḥmūd II., resulted in the birth of the new or modern school, whose objects are truth and simplicity. In the political writings of Reshīd and 'Ākif Pashas we have the first clear note of change; but the man to whom more than to any other the new departure owes its success is Shināsī Effendi, who employed it (1859) for poetry as well as for prose. The European style, on its introduction, encountered the most violent opposition, but now it alone is used by living authors of repute. If any of these does write a pamphlet in the old manner, it is merely as a *tour de force*, or to prove to some faithful but clamorous partisan of the Persian style that it is not, as he supposes, lack of ability which causes the modern author to adopt the simpler and more natural fashion of the West. The whole tone, sentiment and form of Ottoman literature have been revolutionized by the new school: varieties of poetry hitherto unknown have been adopted from Europe; an altogether new branch of literature, the drama, has arisen; while the sciences are now treated and seriously studied after the system of the West. Among writers of this school who have won distinction are Ziyā Pasha, Jevdet Pasha, the statesman and historian, Ekrem Bey, the author of a beautiful series of miscellaneous poems, *Zemzema*, Ḥāmid Bey, who holds the first place among Ottoman dramatists, and Kemāl Bey (d. 1878), the leader of the modern school and one of the most illustrious men of letters whom his country has produced. He wrote with conspicuous success in almost every branch of literature—history, romance, ethics, poetry and the drama; and his influence on the Young Turk party of later days was profound. (For the Turkish language see TURKS.) (E. J. W. G.)

The *magnum opus* in English on Turkish poetry is E. J. W. Gibb's *History of Ottoman Poetry* (5 vols., 1900–8, vol. v. ed. E. G. Browne).

TURKEY, an abbreviation for Turkey-Cock or Turkey-Hen as the case may be, a well-known large domestic gallinaceous bird. How it came by this name has long been a matter of discussion, for it is certain that this valuable animal was introduced to Europe from the New World, and in its introduction had nothing to do with Turkey or with Turks, even in the old and extended sense in which that term was applied to all Mahommedans. But it is almost as unquestionable that the name was originally applied to the bird which we know as the guinea-fowl (*q.v.*), and there is no doubt that some authors in the 16th and 17th centuries curiously confounded these two species. As both birds became more common and better known, the distinction was gradually perceived, and the name "turkey" became restricted to that from the New World—possibly because of its repeated call-note—to be syllabled *turk, turk, turk*, whereby it may be almost said to have named itself (cf. *Notes and Queries*, 6th series, vol. iii. pp. 23, 369). But even Linnaeus could not clear himself of the confusion, and unhappily misapplied the name *Meleagris*, undeniably belonging to the guinea-fowl, as the generic term for what we now know as the turkey, adding thereto as its specific designation the word *gallopavo*, taken from the *Gallopava* of C. Gesner, who, though not wholly free from error, was less mistaken than some of his contemporaries and even successors.[1]

The turkey, so far as we know, was first described by Oviedo in his *Sumario de la natural historia de las Indias*[2] (cap. xxxvi.), said to have been published in 1527. He, not unnaturally, includes both curassows and turkeys in one category, calling both "Pavos" (peafowls); but he carefully distinguishes between them, pointing out among other things that the latter make a wheel (*hacen la rueda*) of their tail, though this was not so grand or so beautiful as that of the Spanish "Pavo," and he gives a faithful though short description of the turkey. The chief point of interest in his account is that he speaks of the species having been already taken from New Spain (Mexico) to the islands and to Castilla del Oro (Darien), where it bred in a domestic state among the Christians. Much labour has been given by various naturalists to ascertain the date of its introduction to Europe, to which we can at present only make an approximate attempt;[3] but after all that has been written it is plain that evidence concurs to show that the bird was established in Europe by 1530—a very short time to have elapsed since it became known to the Spaniards, which could hardly have been before 1518, when Mexico was discovered. The possibility that it had been brought to England by Cabot or some of his successors earlier in the century is not to be overlooked, and reasons will presently be assigned for supposing that one of the breeds of English turkeys may have had a northern origin;[4] but the often-quoted distich first given in Baker's *Chronicle* (p. 298), asserting that turkeys came into England in the same year—and that year by reputation 1524—as carps, pickerels and other commodities, is wholly untrustworthy, for we know that both these fishes lived in the country long before, if indeed they were not indigenous to it. The earliest documentary evidence of its existence in England is a "constitution" set forth by Cranmer in 1541, which Hearne first printed (Leland's *Collectanea*, 2nd ed., vol. vi. p. 38). This names "Turkey-cocke" as one of the "greater fowles" of which an ecclesiastic was to have "but one in a dishe," and its association with the crane and swan precludes the likelihood of any confusion with the guinea-fowl. Moreover the comparatively low price of the two turkeys and four turkey-chicks served at a feast of the serjeants-at-law in 1555 (Dugdale, *Origines*, p. 135) points to their having become by that time abundant, and indeed by 1573 Tusser bears witness to the part they had already begun to play in "Christmas husbandlie fare." In 1555 both sexes were characteristically figured by Belon (*Oyseaux*, p. 249), as was the cock by Gesner in the same year, and these are the earliest representations of the bird known to exist.

As a denizen of the poultry-yard there are at least two distinct breeds, though crosses between them are much commoner than purely-bred examples of either (see POULTRY). That known as the Norfolk breed is the smaller of the two, and is said to be the less hardy. Its plumage is black. The chicks also are black, with occasionally white patches on the head. The other breed, called the Cambridge, is much more variegated in colour, and some parts of the plumage have a bright metallic gloss, while the chicks are generally mottled with brownish grey. This has been much crossed with the American Bronze, the largest of all, which has the beautiful metallic plumage of the wild bird, with the

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[1] The French *Coq* and *Poule d'Inde* (whence *Dindon*) involve no contradiction, looking to the general idea of what India then was. One of the earliest German names for the bird, *Kalekuttisch Hün* (whence the Scandinavian *Kalkon*), must have arisen through some mistake at present inexplicable; but this does not refer, as is generally supposed, to Calcutta, but to Calicut on the Malabar coast (cf. *Notes and Queries*, 6th series, vol. x. p. 185).

[2] Purchas (*Pilgrimes*, iii. 995) in 1625 quoted both from this and from the same author's *Hystoria general*, said to have been published a few years later.

[3] The bibliography of the turkey is so large that there is here no room to name the various works that might be cited. Recent research has failed to add anything of importance to what has been said on this point by Buffon (*Oiseaux*, ii. 132–162), Pennant (*Arctic Zoology*, pp. 291–300)—an admirable summary—and Broderip (*Zoological Recreations*, pp. 120–137)—not that all their statements can be wholly accepted. Barrington's essay (*Miscellanies*, pp. 127–151), to prove that the bird was known before the discovery of America and was transported thither, is an ingenious piece of special pleading which his friend Pennant did him the real kindness of ignoring.

[4] In 1672 Josselin (*New England's Rarities*, p. 9) speaks of the settlers bringing up "great store of the wild kind" of turkeys, "which remain about their houses as tame as ours in England." The bird was evidently plentiful down to the very seaboard of Massachusetts, and it is not likely to have been domesticated by the Indian tribes there, as, according to Hernandez, it seems to have been by the Mexicans. It was probably easy to take alive, and, as we know, capable of enduring the voyage to England.

Mexican form of which it quite agrees in colour. White, pied and buff turkeys are also often seen, and if care be taken they are commonly found to "breed true." Occasionally turkeys, the cocks especially, occur with a top-knot of feathers, and one of them was figured by Albin in 1738. It has been suggested with some appearance of probability that the Norfolk breed may be descended from the northern form, *Meleagris gallopavo* or *americana*, while the Cambridge breed may spring from the southern form, the *M. mexicana* of Gould (*Proc. Zool. Society*, 1856, p. 61), which indeed it very much resembles, especially in having its tail-coverts and quills tipped with white or light ochreous—points that recent North American ornithologists rely upon as distinctive of this form. If this supposition be true, there would be reason to believe in the double introduction of the bird into England at least, as already hinted, but positive information is almost wholly wanting.[1] The northern form of wild turkey, whose habits have been described in much detail by all the chief writers on North American birds, is now extinct in the settled parts of Canada and the eastern states of the Union, where it was once so numerous; and in Mexico the southern form, which would seem to have been never abundant since the conquest, has been for many years rare. Farther to the south, on the borders of Guatemala and British Honduras, there exists a perfectly distinct species, *M. ocellata*, whose plumage almost vies with that of a peacock in splendour, while the bare skin which covers the head is of a deep blue studded with orange caruncles (*Proc. Zool. Society*, 1861, pl. xl.).

The genus *Meleagris* is considered to enter into the family Phasianidae, in which it forms a subfamily Meleagrinae, peculiar to North and Central America. The fossil remains of three species have been described by Professor Marsh—one from the Miocene of Colorado, and two, one much taller and the other smaller than the existing species, from the post-Pliocene of New Jersey. Both the last had proportionally long and slender legs. (A. N.)

TURKI, strictly speaking an Arabic or Persian adjective formed from Turk, used by European writers in two rather different senses. (1) It is applied to tribes or languages which are Turkish as opposed to Aryan, Semitic, &c. (2) It is used as the special designation of the tribes and languages of Kashgaria and Eastern Turkestan. (See TURKS.)

TURKOMAN, a name applied to certain Turkish tribes still nomad or only recently settled in Transcaspia and northern Afghanistan and Persia. (See TURKS.)

TURKS AND CAICOS ISLANDS, a group in the British West Indies. They belong geographically to the Bahamas and lie between 21° and 22° N. and 71° and 72° 37′ W. They are of coral and sand formation, their combined area being 169 sq. m. The Turks Islands, taking their name from a species of cactus having the appearance of a turbaned head, are nine in number, but Grand Turk (10 sq. m.) and Salt Cay ($5\frac{1}{2}$ sq. m.) are the only two of any size. The town of Grand Turk, on the west of the island of that name, is the seat of government and a port of registry. Salt Cay has a good harbour.

The Caicos Islands lie to the north-west of Turks Islands and are seven in number. Cockburn Harbour on South Caicos, 22 m. from Grand Turk, is the principal settlement and a port of entry. The climate, though somewhat relaxing, is healthy, but there is a scarcity of drinking water, the average annual rainfall being only $27\frac{1}{2}$ in. The mean temperature is 82° F., but owing to the sea breezes the climate is never oppressive. Salt raking is the staple industry. Sisal hemp is grown, sponges are found in some quantities off the coast and there are four sponge-curing factories on the Caicos Islands. Pink pearls are occasionally found. The exports, chiefly to the United States, include salt, sponges and sisal hemp. Grand Turk is in cable communication with Bermuda and with Kingston, Jamaica, some 420 m. to the S.W.

The islands were uninhabited when, about 1678, the Bermudians began to visit them to rake the salt found in the ponds. These visits became annual and permanent settlements were made. In 1710 the British were expelled by the Spaniards, but they returned and the salt trade (largely with the American colonies) continued to be carried on by the Bermudians despite attacks by Spaniards and French, and counter-claims to the islands by the British authorities at the Bahamas, who about 1765 made good their claim. In 1799 the islands were given representation in the Bahamas Assembly, and they remained part of that colony until 1848, when on the petition of the inhabitants they were made a separate colony under the supervision of the governor of Jamaica. This arrangement proving financially burdensome the islands were in 1873 definitely annexed to Jamaica. They are governed by a commissioner assisted by a nominated legislative board. The census of 1901 showed a total population of 5287, of whom 342 were whites, the rest being negroes or mulattoes; 1751 of the inhabitants lived in Grand Turk Island.

See J. N. Bellin, *Description géographique des débouquements au nord de St Dominique* (1768); the *Jamaica Handbook* (London, yearly) and Sir C. P. Lucas, *Historical Geography of the British Colonies*, vol. ii. (2nd ed., Oxford, 1905).

TURKS. The words "Turk" and "Turkish" are used in three senses, political, linguistic and ethnological. Politically, Turk means a Mahommedan subject of the sultan of Turkey. In the East at any rate it is not employed in speaking of Christians, and its application to Arabs, Albanians, Kurds, &c., living in Turkey, though not unusual, is hardly correct. The linguistic use of the name, by which it designates a well-marked division of the Ural-Altaic languages and their speakers, is the most satisfactory. The languages in question are easily identified and defined (see below), and there can be little doubt that they were spoken by the vast majority of the people called Turks since the 6th century of the Christian era. Ethnographically, the use of the word presents difficulties, for it is not easy to differentiate the Turks by physique or customs from allied tribes such as the Finno-Ugrians, Mongolians and Manchus. The Bashkirs, who are probably of Finno-Ugrian stock, speak a Turkish language, and the Magyars, who speak a Ugrian language, have many Turkish characteristics. At the present day there is no difficulty in making a practical distinction between Turks and Mongols. The former speak Turkish languages, are Moslems by religion, live almost entirely in the western half of Asia and fall within the Arabic, and to some extent the European, sphere of influence; the latter speak Mongolian languages, are Buddhists by religion, live in the eastern half of Asia and fall within the sphere of Chinese influence. Yet both Turkish and Mongol traditions represent the two nations as descended from two brothers: Jenghiz Khan, the founder of the Mongol power, must have had large numbers of Turks in his armies, for the chief traces left in Europe of the Mongol invasions are the settlements of Turkish-speaking Tatars in Russia; and the name of his son, Jagatai, is commonly used for a Turkish dialect and khanate in the regions of the Oxus. In Central Asia the distinctions between tribes, nations and races are unusually fluid: we are dealing with predatory nomads for ever fighting with one another or with the settled populations round them. The conquerors enslaved the men and married the women of the conquered. a successful leader attracted round his standard men of different tribes and languages. The corps of janissaries instituted by the Turks in Europe is no doubt an illustration of what happened during many centuries in Asia. The Turks after taking Constantinople claimed from the Christian population a certain number of male children, who were brought up as Turkish soldiers with few ties or principles except obedience to their officers. There was thus a large class, of Turkish speech and Turkish habits, who had absolutely no Turkish blood in their veins. In addition to this, intermarriage has taken place to so large an extent that the modern Turks are almost entirely European in physique. Similarly, no doubt, among the hordes of Central Asia the youths of conquered tribes were absorbed and assimilated by the conquerors and lost their original language. Such transformations were facilitated by the fact that there was no great difference in the manners and customs of these tribes. They were all nomadic, mostly horsemen, and rapacious. As they settled down from time to time they borrowed a good deal from their more civilized neighbours, but their natural manner of life was simple and untrammelled. The Turkish-speaking tribes were apparently the most mobile and adventurous. Starting from the confines of China they reached India, Algeria and the walls of Vienna. They probably formed a large contingent in the hordes of Jenghiz and of the Huns, and perhaps the Petchenegs, Avars and Comans all belonged to this group. In comparison with them the Mongol and Manchu-speaking tribes, though conquerors in the East on no mean scale, seem stationary and inactive, while the Finno-Ugrians are nomad hunters rather than warriors. To the honour of the Turks it must be said that, bad as is their administration when judged by European standards and especially when applied to Europeans, the empires of the Seljuks, Osmanlis and Moguls which they founded rise far above the ordinary standard of ephemeral Oriental dynasties.

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[1] For results of a comparison of the skulls of wild and domesticated turkeys, see Dr Shufeldt, in *Journ. of Comp. Medicine and Surgery* (July 1887).

The effect of Turkish invasions has been in the main destructive, but they have also played a considerable part in transporting both ideas and commodities from one end of the old world to the other. The achievement by which they are best known—the transplantation of Mahommedanism on to European soil—is a remarkable, though not successful, feat of this kind. But they are also largely responsible for the introduction of Mahommedanism into India, for carrying Nestorian Christianity and Persian fire-worship into China, and for the overland intercourse between China and India which fostered if it did not introduce Chinese Buddhism. They exported Chinese silk to Byzantium, and the most ancient Buddhist temple in Japan contains Persian objects which must have been brought across Asia by their caravans.

Divisions.—At the present day the name Turk is applied primarily to the people who have conquered Constantinople and the regions known as Turkey, but the following may be classed as Turkish in the sense of belonging to the same group linguistically and to some extent racially:—

1. *The Yakuts* are a Siberian tribe who inhabit the country near the banks of the middle and lower Lena, including Yakutsk and Verkhoyansk on the Yana. Their language is purely Turkish, though differing considerably from the more western Turkish idioms, but they have largely intermingled with the Tunguses. They are said to be industrious and skilful alike as artisans, traders and agriculturists. They are nominal Christians, but preserve much of their old nature worship.

2. *Tatar* (*q.v.*) or *Tartar* is a popular name which in its most correct sense is applied to Turkish-speaking Moslems in Russia, who number over three millions and are mostly remnants of the Mongol invasion which took place in the 13th century. But it is also extended rather loosely to various tribes in Siberia and elsewhere who speak Mongolian, Finnish or other languages.

The following classes of Tatars speak Turkish languages: (*a*) The Kazan Tatars, numbering perhaps a million. Their centre is in the government of Kazan, but they extend down both banks of the Volga as far as the government of Saratov. (*b*) The Astrakhan Tatars, numbering only about 10,000. (*c*) The Bashkirs, whose headquarters are in the government of Ufa. They appear to be a tribe of Finnish origin who have adopted a Turkish language. (*d*) The Tatars of the Crimea, sometimes called the Krim or Nogai Tatars, who occupied the Crimea in the 13th century and had a considerable empire from the 15th to the 17th century. There are also Nogai Tatars in the Caucasus and Kuban country. (*e*) There are considerable bodies of Tatars in Rumania and Bulgaria, who appear to be Nogais who have emigrated from the Crimea, Bessarabia and other parts of Russia. (*f*) The Tatars of the Caucasus seem to be for the most part Azerbaijan Turks mingled with Armenian, Georgian, Lesghian and other blood. But the name is often loosely applied to any Mahommedan Caucasian tribe.

3. *Kirghiz* (*q.v.*), nomadic tribes amounting to about three million souls who are found chiefly in Asiatic Russia. They fall into two chief divisions. (*a*) The Kazaks, who inhabit the northern and eastern parts of the Aral-Caspian basin, including the government of Orenburg. They do not call themselves Kirghiz, and apparently the name has been given them by the Russians in order not to confuse them with the Cossacks. (*b*) The Kara-Kirghiz, who are the less numerous division, live in Dzungaria, in the Altai, about lakes Balkash and Issyk-kul, and extend southwards to the Pamirs and the sources of the Oxus. Some of them inhabit Chinese territory. Both divisions live chiefly on the produce of their herds. Their chief drink is *koumiss*, or fermented mare's milk.

4. *The Kara-Kalpaks* (*q.v.*) or Black-caps, who inhabit the south-eastern shores of the sea of Aral, are sometimes classed with the Kirghiz, but seem to be a separate branch of the Turki stock. They are a feeble race, apparently in process of extinction, and now number only about 50,000.

5. *Uzbeg* is a political and not an ethnological denomination. It is derived from Uzbeg Khan of the Golden Horde (1312–1340), and was subsequently used at the beginning of the 16th century to designate the adherents of Shaibani Khan. Finally it was employed as the name of the ruling tribes in the Central Asian khanates (much like Osmanli in Turkey), in opposition to Kirghiz and Sarts, as well as to non-Turkish tribes. The Uzbegs are accordingly a mixed race, but the elements of which they are composed are mostly Turkish. Their numbers have been estimated at about two millions. They are mostly agriculturists or dwellers in cities, not nomads.

6. *Sart* is the name commonly given to the Turkish-speaking urban population of the Central Asian khanates. It is opposed to Tajik, which denotes the agricultural, Iranian-speaking population, but both words are used very loosely and have come to mean little more than town and country people. Sart and Uzbeg are also opposed in the meanings of common people and aristocracy, but many Sarts claim Uzbeg descent. The word is hardly suitable for scientific use, but is employed by Russian writers as the name of the Turkish language spoken in Bokhara, Samarkand and Ferghana.

7. The various Turkish tribes found on the eastern slopes of the Tian Shan, in Kashgar, Yarkand, Khotan, &c., are the descendants of the ancient *Uīghurs* or *Ouīghours*. These people were probably the most eastern branch of the Turks who remained behind when the first westward movements were made, but subsequently moved westward themselves. They ruled in Kashgaria from the 10th to the 12th centuries, and, like other branches of the Turks, adopted Mahommedanism. They continued, however, to use a variety of the Syriac alphabet introduced by Nestorian missionaries, and a book, the *Kudatku Bilik*, composed in their language about 1065, is extant. The Taranchis, an agricultural tribe of the Ili basin, seem also to belong to this group. The Turkish spoken in Kashgaria, &c., is often distinguished as Turki.

8. *Mogul*, *Moghul* or *Mughal*, appears to be the same word as Mongol, but is commonly restricted to the tribes who invaded northern India from Ferghana in 1526 under Baber (or Babar) and established the Mahommedan Empire of Delhi. Memoirs written by Baber in Jagatai Turkish are extant.

9. The *Koibals* and *Karagasses* of the upper Yenisei are perhaps of Finnish stock, but they speak languages akin to the Kashgarian Turki. They are sometimes called Tatars.

10. *Turkoman* or *Turkman* is the name usually given to the nomadic tribes who inhabit the country between the Caspian and the Oxus. They appear to be a branch of the Western Turks and not essentially different from the Osmanlis or Azerbaijanis, except that until the Russian occupation of Merv they remained in the condition of predatory horse-riding nomads, much feared by their neighbours as "man-stealing Turks."

They are divided into many tribes, of which the principal are (*a*) The *Chaudors* in the north-western part of the Ust-Urt and near the Kara-boghaz Gulf. (*b*) The *Yomuts* or *Yamuds* extending from Khiva across the Ust-Urt and along the shore of the Caspian to Persia. (*c*) The *Goklans* or *Göklens* settled in the Persian province of Astarabad. They are said to be the most civilized and friendly of all the Turkomans. (*d*) The *Tekkes*, who were the most important tribe when the Russians conquered Transcaspia. They are first heard of in the peninsula of Mangishlak, but were driven out by the Kalmuks in 1718, and subsequently occupied the Akhal and Merv oases. The Russians inflicted a crushing defeat on them at Geok-Tepe in 1881. (*e*) The *Sakars* inhabit the left bank of the Oxus near Charjui. (*f*) The *Sariks* are found in the neighbourhood of Panjdeh and Yulatan. (*g*) The *Salors*, an old and important tribe, suffered much in the course of fights with the Tekkes and in 1857 migrated to Zarabad in Persian territory near the Hari-rud. (*h*) The *Ersaris* are now chiefly found near Khoja Salih. They were once a very important tribe on the upper Oxus. (*i*) The *Ali-elis* live near Andkhui.

11. The Turkish nomads scattered over Persian territory are often known by the name of *Azerbaijanis* or *Adharbaijanis*, though this name is strictly applicable only to the inhabitants of the province of Azerbaijan (*q.v.*), of which Tabriz is the capital. They are the descendants of various bodies of Turks who have wandered into Persia at various times, but more particularly of the Ghuzz tribes (the *Οὔζοι* of the Greeks) who invaded it during the Seljuk period. They are also known as Ilāt or Iliyāt, meaning tribes, and each tribe has its own chieftain or Ilkhani appointed by the shah.

Among the tribes are (1) The *Kajars*, who dwelt in Transcaucasia until Abbas the Great (1585–1628) forced a portion of them to settle near Astarabad. The present dynasty of Persian Shahs comes from this tribe. (2) The *Afshars* or *Awshars* are a very numerous tribe in the province of Azerbaijan. Another division of them is found in the Anti-taurus. (3) The *Shekakis* and *Shah-seven*. The latter is a political name which has become hereditary, "those who love the shah," *i.e.* partisans of the Safawî dynasty (1499–1736), and of the Shiite faith. (4) The *Karakoyunlu* living near the town of Khoi. In the south of Persia are found (5) the *Abulwerdis*, (6) the *Kara-Gözlü*, (7) the *Baharlu*, (8) the *Inamlu* and (9) the *Kashkai*. These last perhaps include the Khalaches or Khalaj who were already settled near Herat before the arrival of the Seljuks, and from whom sprang the Indian dynasty known as Khalji (1290–1320).

12. The Turks now inhabiting the Turkish Empire fall into various categories and have entered it at various times.

a. The *Osmanlis* or *Ottomans*. This word is loosely used to mean any Mahommedan subject of the sultan, though even then it is not generally extended to Arabs and Albanians. Used more strictly it means the clan of Osman and their descendants as opposed to Seljuks and other Turks. The name is genealogical rather than ethnic; for though the exploits of the Osmanlis have given them an importance in modern history far exceeding that of all the other tribes, they are not distinguished from them in language or customs. According to tradition the clan came from Khorasan, supported the Seljuks and received in return the fief of Eskishehr. In the 14th century they took Brusa from the Byzantine Empire and established a kingdom there which withstood the shock of Timur's invasion (1402). In 1453 they captured Constantinople. Until recently Turkish Mahommedans always employed the words Osmanli and Osmanlija to describe themselves and their language, and avoided the expressions Türk and Türkche as signifying semi-civilized tribes, but in the last twenty years the older words have again come into use as national designations.

b. There must be many Turks in the Ottoman dominions who have no claim to be called Osmanlis in the strict sense. Byzantine authors mention a colony of 30,000 Turks on the river Vardar in Macedonia as early as the 9th century, and many Turks in Europe are still called Koniots or Konariots and claim to be descendants of the Seljuks. After the defeat of the emperor Romanus at Manzikert (1071) Turkomans and Turks of every description poured into Asia Minor. The Tatars of the Dobrudja also seem to be an ancient settlement.

c. The *Kizil-Bash*, or red-heads, who are found in the plains of Asia Minor about Angora, Tokat and Karahissar, differ somewhat from the surrounding Turkish population in both physique and customs. They appear to be immigrants from Persian territory, where some of them still remain. They are industrious agriculturists and their women enjoy unusual freedom. They call themselves *Eski-Türk* or old Turks, and have a secret religion in which Shiite tenets seem to be combined with elder pagan (or possibly Christian) elements.

d. In various parts of western and southern Asia Minor, particularly the plains of Cilicia, are nomadic Turkoman tribes called by the Turks *Yürük* or *Gyōchēbē*. They are even found near Smyrna. They are a peaceful race, with fair complexions and a fine physique, and are great camel breeders. Though they do not appear to have a religion of their own like the Kizil Bash, they are only nominally Mahommedans.

Besides the peoples mentioned above, a number of extinct tribes may have been Turkish-speaking, though in the absence of linguistic records no certain conclusion is possible. Such are the Huns, Ephthalites, Avars, Bulgars, Khazars, Comans and Petchenegs. The name Hun is perhaps identical with the Chinese Hiung-nu or with the Turkish word for ten, *on* or *un*, meaning the ten tribes. Of the Avars really nothing is known: they were an extremely barbarous people who made no settlements and disappeared as suddenly as they came. They have been identified with the Jwen-Jwen of the Chinese. The name of the Khazars has a Turkish sound: they were a relatively civilized people and had a kingdom in the neighbourhood of Astrakhan and the north Caspian which lasted for several centuries. The original Bulgarians were certainly not Slavs, though they acquired a Slavonic language, but it is more probable that they were Finno-Ugrians than Turks. The Petchenegs, also called Πατζινάκαι or Πατζινακίται in Greek and Bisseni in Latin, are said to have been driven into Europe from the lower Ural by the Ghuzz (Οὔζοι) at the end of the 9th century, and wandered about the northern frontiers of the Byzantine Empire for about 300 years. Perhaps some of them settled in Hungary and Bulgaria. They were, like the Avars, very barbarous and were probably Turks, for Anna Comnena says they spoke the same language as the Comans. This dialect is known by the so-called Codex Cumanicus. Coman or Kuman is a name given by Europeans to the tribes who occupied Moldavia and the adjacent regions in the middle ages. Rubruquis speaks of the Coman Kipchaks, and it is probable that the Comans were a hybrid Turkish tribe.

History.—The invasions and conquests of the later Turkish dynasties form an important part of the history of the world and are treated in such articles as TURKEY; SELJUKS; TIMUR; MOGULS. Here it is proposed to sketch the earlier wanderings and agglomerations (for they can hardly be called kingdoms) of Turkish tribes in eastern and central Asia. Much new information on this subject has been made accessible in the last twenty years by the discovery near the river Orkhon, to the south of Lake Baikal, of Turkish inscriptions dating from the 8th century A.D., and by the publication of materials furnished by Chinese writers. But authorities are still not entirely agreed as to the chronology of the events recorded or the identity of the names which appear in Turkish, Greek and Chinese forms, so that the following summary is for many periods tentative.

From 1400 B.C. onwards, but especially about 200 B.C., Chinese history contains notices of warlike nomads called Hiung-nu or Hsiung-nu, who were a danger to the empire. Their political power broke up in the early centuries of this era before the advance of the Sien-pi and Tobas, who appear to have been Tunguses, and from whom arose the Wei dynasty of northern China. In A.D. 433 a Hiung-nu clan called Asena or A-shih-na, disliking the rule of the Wei, moved eastwards and sought the protection of a people called Jeu-Jen or Jwen-Jwen, who were also a kind of Hiung-nu. They are the Geougen of Gibbon and others, and their identity with the Avars has been affirmed and disputed with equal confidence. The Asena served the Jwen-Jwen as workers in iron and lived not far from the modern city of Shan-Tan in Kan-suh. In this neighbourhood was a hill called from its shape Türkü, Dürkü or T'u-chüeh, meaning helmet, and this is said be to the origin of the national name which has become so celebrated. The name Tu-Kiue (Tou-Kiue) or Turk is first used by the Chinese in recording the events of A.D. 545, and the following years, when the Turks, or descendants of the Asena, revolted against the Jwen-Jwen. These latter were crushed and disappear from history, at least under that name. The victorious Turks advanced across their territory, came into collision with the Hephthalites or Ephthalites, whom they defeated, and are heard of on the Oxus about A.D. 560. The period 546–582 marks the first brilliant epoch of early Turkish history. The tribes were not divided and made the most astonishing advance under Tumen (who took the title of Ili-Khan), his brother Itsämi or She-ti-mi (perhaps the Stembis of Greek writers), his son Mokan and Istämi's son Tardu or Ta-t'eu. Though fifty years before only a servile clan in China, they sent an embassy in 567 to the East Roman emperor Justin II., as related by Menander Protector (C. Müller: *Fragm. hist. graec.*, vol. iv.). The object of this mission was to open up commercial relations, especially in the silk trade, with the West, and to co-operate with the Greeks against the Persians, because the latter wished to make the Persian Gulf the only outlet for the silk trade, and with that object to hamper the communications of the Turks with Western powers. The ruler who sent this embassy is called in Greek

Silziboulos or Dilziboulos, corresponding to the Sinjibu of Arab chroniclers and perhaps representing Sin-jabgu in old Turkish, the latter part being a title. He has been identified with Istämi. Justin sent as envoy to him in return a certain Zemark, who visited the khan at Ektel or Ektag (? Ak-dagh), and several subsequent embassies were exchanged. In 598 the khan Tardu wrote to the emperor Maurice, and in 620–28 the Turks assisted Heraclius in his campaigns against Persia. Meanwhile the Turks had themselves split into two divisions with separate princes. A tendency towards division, very natural in so loose and extended a community, had been visible for some time, and the rupture was precipitated in 582 by the jealousy of Ta-lo-pien or Dalobian, who was angry at not being chosen khan. For a century and a half or so we hear of two khanates: the northern Turks, living near Lake Baikal and the southern tributaries of the Yenisei, and the western[1] Turks, who appear to have had two headquarters, one near Urumchi and one near Aulieata, north of Tashkent. But their conquests, or at least their successful raids, extended very much farther to the west and south. In 630 the Chinese pilgrim Yüan Chwang (Hsüan Tsang) was well received by their khan, T'ung-she-ho, who exercised some kind of authority from Turfan to Merv. The Chinese followed a consistent policy of spreading dissension among these dangerous tribes and of supporting the factions which were weak or distant against those who were strong or near. Accordingly they were friendly to the western Turks until they had conquered the northern Turks. This western branch lasted until about 750 as a political name. From about 550 till 650 they were independent, and, as mentioned, allies of the east Roman Empire against the Persians. But about 650 the politics of the Nearer East were transformed by the conquests of the Arabs following on the preaching of Mahomet. After subduing Persia in 639 they spread to Transoxiana. At the same time dissension prevailed among the western Turks themselves: the five tribes called Nu-she-pi, who lived west of Issyk-kul, quarrelled with the five tribes called Tu-lu living to the east of it. The Chinese fomented the quarrel, and in 659 were able to declare that they annexed the whole territory of the western Turks, including at least Dzungaria, Tashkent, Ferghana, Bokhara, Khulm, Badakshan, Ghazni, Bamian, Udyana, Wakhan and Karateghin. But it would seem that neither the Turkish occupation nor the Chinese annexation of most of these countries was effective. From 650 to 750 the possession of them was disputed not only by the Turks and Chinese but by the Tibetans in the east and the Arabs in the west. In the west, the campaigns of Qotaiba b. Moslim or Kutaiba (705–14) completed the Mahommedan conquest of Transoxiana (see CALIPHATE, sect. B § 6). In the east the really effective power seems to have been exercised by a new Turkish tribe called Turgäsh, who had capitals at Tokmak and in Ili.

For the history of the northern Turks our only authorities are the Orkhon inscriptions and Chinese writers. The half-century following on the division was prosperous for the northern as well as for the western Turks, and they menaced China; but in 630 the Chinese conquered them. This is the Chinese servitude mentioned in the inscriptions. In 682 Kutluk (also called Elteres, which seems to be a title) re-established a Turkish state on the Orkhon. He was succeeded by his brother Kapagan (or Me-Chuo), who subdued the Turgäsh, or perhaps merely drove them southwards, early in the 8th century, and was succeeded by Bilgä Kagan of the inscriptions.

This northern khanate was destroyed by a coalition of the Karluk, Uighur and Basmal in 744. These peoples, like the Turgäsh, appear to have been Turkish; for though Turk was originally the name of the clan whose destinies in its northern and western branches have just been sketched, yet there is no objection to the usage by which it is extended to the descendants of similar clans with similar customs and as far as is known similar languages. A succession of these pressed forwards from the east. When first heard of, the Karluk inhabited the country on the Irtysh and the Urungu, and subsequently occupied Teles and Tokmak. The Uighurs belonged to the group of tribes known as Tölös or T'ie-le and established themselves at Balasaghun (also known by the forms Kara-Balghasun, Kara-Balgassun and Balagasun: see KARAKORUM). This brings us to the middle of the 8th century. For the next two hundred years the Turkish element in Central Asia, though it must have been numerous, does not cut any figure in history, which is filled with the chronicles of Arab and Persian dynasties (see CALIPHATE; SAMANIDS), but in the 10th century we begin to hear of it again. Turkish adventurers founded the dynasty of Ghaznevids at Ghazni, and there was a Uighur kingdom in the east comprising Kashgar and Khotan. Boghra Khan, the ruler of this kingdom, was converted to Islam at the end of the 10th century, and it continued under various branches of Uighurs until 1120. An interesting memorial of this period is the book *Kudatku Bilik* (see below). More important politically is the rise of the Seljuks. They were the princely family of the Kabaks, who were a section of the group of tribes called Ghuzz (Oghuz, Οὔζοι), and are heard of in Transoxiana about 985. Their chieftains Toghrul and Chakir drove the Ghaznevids to India and established themselves as protectors of the Abbasid caliph, who formally ceded his temporal power to them. (For the history of the dynasty see SELJUKS.) Alp Arslan, the son of Chakir, defeated the Byzantines at Manzikert (1071), and prepared the way for the Ottoman conquests. His son Malik Shah ruled over nearly all the modern Turkey in Asia, and as far as the frontiers of China. On his death in 1092 his empire broke up into several pieces. Konia became the capital of the sultanate of Asia Minor and various Seljuk dynasties established themselves in Kerman, Irak and Syria. A new Turkish power was founded by the khans of Khiva, who are known as the Khwarizm-shahs. They were originally vassals of the Seljuks, with the title of tasdar or ewer-bearer, but became independent and conquered Khorasan and Irak. They had, however, to contend with yet another new arrival from the east, the Kara-Kitais. These also were probably Turks, and were pushed westwards from China by the Kins. They conquered Kashgar, Khotan, Yarkand and later Transoxiana, pushing the Ghuzz tribes before them into Persia and Afghanistan. Their prince bore the title of gur-khan, and the Khwarizm shahs did homage to him till 1208, when they unsuccessfully revolted. But all these squabbling principalities were swept away in 1219 by the extraordinary wave of invasion which surged across Asia to Europe under Jenghiz Khan (*q.v.*). After the death of Jenghiz his conquests were divided, and Transoxiana, Kashgar, Badakshan, Balkh and Ghazni were given to his second son Chagatai or Jagatai. Jenghiz and his family must have been Mongols, but the name Jagatai passed to the population and language of the countries about the Oxus. It does not appear that they ever ceased to be Turkish in speech and customs. The hordes of Jenghiz must have comprised a considerable Turkish element; the Mongols had no inclination to settle in cities, and Jagatai himself lived near Kulja in the extreme east of his dominions. Though the cities in western Central Asia suffered severely the people were not Mongolized, and Mahommedan learning even flourished. But otherwise the whole history of the Jagatai khanate, which lasted from 1234 to 1370, is a confused record of dissensions with frequent intervals of anarchy. In 1321 it split into two khanates, Transoxiana and Dzungaria, and in 1370 collapsed before Timur. This great conqueror (1333–1404), who like Jenghiz had an extraordinary power of collecting and leading the hordes of Central Asia, was a native of the district of Samarkand and a Turk by descent. He conquered successively Dzungaria (1370), Persia and the Caucasus (1390), the Kipchaks on the Volga (1305), and Northern India (1398). He then invaded Syria and Asia Minor, where he defeated but did not annihilate the Osmanlis. The house of Timur did not retain his more distant conquests, but they ruled at

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[1] No better name seems forthcoming, but western Turks is a most inconvenient designation because it is also used (and equally correctly) to signify the Osmanlis and Seljuks as opposed to the Turks of Transoxiana and Kashgar.

Samarkand until 1499 with the usual struggles between different branches of the family. Their possessions included, at least from time to time, the northern parts of Afghanistan and Persia, as well as Transoxiana and Turkestan. They were one of the most enlightened and cultivated of Turkish dynasties. They beautified the cities of Central Asia and were patrons of literature. The literary languages were as a rule Arabic or Persian; Turkish was used more rarely and chiefly for poetry.

The Timurids were overthrown and succeeded by the Shaibani dynasty, a branch of the house of Juji, Jenghiz Khan's eldest son, to whom his father had assigned dominions in the region north of the kingdom of Jagatai. About 1465 a number of this clan migrated into the Jagatai khanate. They were given territory on the Chu River and were known as Uzbegs. About 1500 their chief, Mahommed Shaibani or Shahi Beg, made himself master of Transoxiana and founded the Uzbeg power. The chief opponent of the Uzbegs in their early days was Baber, who represented the house of Timur in the fifth generation, but he ultimately led his armies in another direction and invaded India (1526), where he founded the Mogul Empire, a far more important state than the principalities of the Oxus. The Shaibanis continued to rule in these latter till 1583, and were followed by the houses of Astrakhan and Mangit; but it is not necessary to continue here the complicated chronicles of these dynasties.

The Osmanlis, or house of Osman, the founders of the present Turkish Empire, appear to have been a clan similar to the early Seljuks or the present Turkomans of Transcaspia, who migrated into Asia Minor from Khorasan and made the neighbourhood of Brusa their headquarters. Their conspicuous position in history is mainly due to the fact that they attained pre-eminence very late and in districts very near Europe. Except for the invasion of Timur they did not suffer from the attacks of other Turks and they were able to concentrate their strength on the conquest of the decrepit Byzantine Empire.

Customs, Civilization, Religion, &c.—The Turks are imitative rather than original, and, in all their branches, have assimilated to some extent the nearest civilization whenever they have settled down. Up to the 7th century their only culture consisted of some scraps of Chinese and Indian civilization. Subsequently both the eastern and western states which they founded adopted Perso-Arabic civilization and Mahommedanism. The Osmanlis have also been affected by Byzantine and west European influences.

Chinese historians and the Turkish inscriptions of the Orkhon and Yenisei give us a good deal of information respecting the earlier condition of these tribes. We are told that the Hiung-nu lived on horseback and moved about from place to place in search of fresh pasture. They possessed horses, cattle and sheep and also camels. They had no towns or villages and no agriculture and they never stayed long in one camp, but during their halts a special piece of land was assigned to each tribe and each tent. They were ignorant of writing. The children were taught to ride and shoot, and the adults were expert archers. Their food was flesh and milk and their clothing the skins of animals. They were polygamous and a son married his deceased father's wives, except his own mother. It is expressly stated that old people were despised and neglected, but this barbarous trait disappeared from the manners of the later Turks.

Of the Turks in the 6th century the Chinese writers give a rather more flattering account. They had numerous grades of rank, and when their khan was invested with the supreme power he was carried in a carpet. When troops were levied or taxes collected, the required amount was carved on a piece of wood marked with a golden arrow as a sign of authority. Their punishments were severe. Marriage was by arrangement with the parents, not capture. The dead were kept for some time after death and the mourners gashed their faces. They sacrificed to heaven and to the spirits of their ancestors. Their amusements included singing antiphonally, playing dice and drinking *koumiss* till they were drunk. They had a written alphabet (derived from India or Syria) and a duodenary cycle in which the years were designated by the names of animals. Somewhat similar accounts are given of the Kerkur or Kirghiz and of the Kankli or Kankali. These were perhaps the ancestors of the Uighurs and moved about in carts with high wheels: they are described as a barbarous undisciplined people, but capable of concerted action.

In the Orkhon inscriptions of the early part of the 8th century a somewhat more civilized branch of the Turks gives an account of itself which tallies with the Chinese descriptions. No Turkish cities are mentioned, only tribes and localities. War is the national occupation. The sovereign or kagan fights himself, and it is interesting to see that the names of the various chargers which he mounted are carefully recorded. The spirit of tribal patriotism and desire for glory which animate these compositions are very noticeable and also the implied obligation of the rulers to see to the prosperity of the people. The existence of the tombs and of inscriptions in Chinese characters as well as in an alphabet of Aramaic origin, and the mention of gold, silver, silk and precious objects show that the builders had looted, so to speak, a certain amount of fragmentary civilization from their neighbours. The chief deity is Heaven or Tängri (still used in Osmanli Turkish as the equivalent of Allah), who gives the kingdom to the kagans and cares for the name and reputation of the Turkish people. There are also spirits of the earth and waters. All this is very like the earliest Chinese religion. Funeral ceremonies were evidently elaborate and the cycle of years named after animals was used for chronology.

The Chinese pilgrim Hüsan Tsang was entertained by She-hu (perhaps a title), kagan of the Western Turks, near Tokmak about A.D. 630. He left an account of the barbaric splendour of his reception and alludes to the number of horses, the gold embroidery of the kagan's tent, the silk robes of his retinue, and the use of wine and music. He says the Turks were fire-worshippers and would not sit on wooden seats.

It is probable that before they were converted to Islam the Turks practised in a desultory manner Buddhism, fire-worship and Nestorian Christianity, though they never wholly accepted any of them. An interesting trace of Buddhism remains in the names Shaman and Shamanism. It would appear that the Indian word Śramana or Samana was applied to the wizards and exorcizers of the older Turkish superstition. Recent investigations have discovered the existence of a considerable Buddhist civilization at Khotan, but at the time when it flourished it would appear that the mass of the population was of Iranian affinities and that the Turkish element was small.

The *Kudatku Bilik* (about 1065) gives a picture of life in Eastern Turkestan after the conversion to Islam, but still showing many traces of Chinese influence. But after this period nearly all the Turks (except a few obscure tribes like the Yakuts) adopted the Perso-Arabic civilization. Some however, such as the Kirghiz, Turkomans and Yūrūks of Asia Minor, have not yet abandoned the nomadic life. The Turks seem to be everywhere characterized by their innate sense of discipline and their submissiveness to their own authorities; councils or assemblies have rarely assumed importance among them; sovereigns and even dynasties (except the house of Osman) have often been removed by violence, but the despotic form of government has never failed to secure obedience. But equally important, as explaining their military successes, is the fact, noticed alike by ancient Chinese historians and modern European officers, that the ordinary Turkish soldier has in military matters an unusual resourcefulness and power of initiative which, without impairing discipline, renders him independent of his officers.

Language.—The Turkish or Tatar-Turkish languages belong to the Ural-Altaic family. Both nominal and verbal forms are built up solely by the addition of suffixes, and the law of vowel harmony is strictly observed. Hard and soft vowels cannot occur in the same word, and there is a tendency to assimilate the vowels of the suffix to those of the root; thus *pederiniz*, your father, but *dostunuz*, your friend. From the Mongol-Manchu languages the Turkish group is distinguished by its much more developed system of inflexion, particularly in the verbs, by its free use of pronominal suffixes, and by its more thoroughly agglutinative character. The stem with its suffixes forms a single compound word, whereas in Mongol the suffixes often seem quasi-independent. In all these features Turkish resembles the Finno-Ugric languages, but it diverges from them in having a much simpler system of cases and different phonetics, in the absence of many peculiarities such as the incorporation of the pronominal object in the verb, and in the development of some special forms, such as the expression of negation by inserting a suffix after the verbal root (*yazdim*, I wrote, *yazmadim*, I did not write). The grammatical forms are more agglutinative and less inflexional than in Finnish; though they are single words, the root does not change and the elements can be easily separated, which is not always the case in Finnish. Compare the Turkish *györdünüz*, "you saw," from the root *györ*, with the equivalent Finnish *näitte* from *näke*. The fusion between the root and suffixes is much more thorough in the latter. Turkish thus stands midway between Mongol and Finnish in its development of the agglutinative principle. Also, though compounds are not unknown in Turkish (*e.g. demiryol*, railway) they are much rarer than in Finnish or Hungarian.

Despite the apparent divergence between Turkish and Mongol, due perhaps partly to the influence of Chinese on the latter, the affinity between them seems real, though not superficial. The pronouns, case suffixes, and construction of sentences all show a general similarity, and the verb in Buriat, which differs from other Mongol languages, exhibits a development parallel to Turkish.

The want of resemblance in vocabulary between the three classes of languages is remarkable. The numerals, for instance, in Turkish, Mongol and Finno-Ugric are entirely different, and considerable changes have to be assumed before the identity of words can be proved. A comparison of Turkish words with Mongol equivalents makes it probable that the former are in many instances contractions: thus *dagh*, mountain, *yol*, road, correspond to the Mongol *dabaga*, *yabudal* and perhaps represent an earlier *tavagh* and *yavol*. The best-known Turkish languages, particularly Osmanli, have borrowed an enormous number of Arabic and Persian words which disguise the characters of the native vocabulary and to some extent affect the grammar.

Compared with the Finno-Ugric group, the Turkish languages are remarkably uniform. Indeed, allowing for the lapse of time and the importation of foreign words, it is hardly an exaggeration to say that from the Lena to Constantinople, from the Orkhon inscriptions till now, we have merely one language in different dialects. The native vocabulary and grammar remain substantially the same. The linguistic type is evidently strongly individual and persistent, and its separation from Mongol, &c., is probably very ancient.

Radlov divides the Turkish languages or dialects into four groups, according to their phonetic system. (1) Eastern: Altai, Baraba, Lebed, Tuba, Abakan, Küärik, Soyon, Karagass and Uighur. (2) Western: Kirghiz, Bashkir, Irtysh and Volga dialects. (3) Central Asiatic: Jagatai, Taranji, &c. (4) Southern: Turkmani, Azerbaijani, Krimmi, Anadoli and Osmanli. But this classification does not seem entirely satisfactory. As one passes across Asia from the Yakuts, through Kashgar, Turkestan and Azerbaijan to Constantinople, the pronunciation of the Turkish languages becomes decidedly softer, the suffixes become more intimately united with the words to which they are appended (approaching though not attaining the unity of Finnish inflexions), and the verbal forms grow more numerous and more complicated. Thus in the east we find *nin*, *ni*, *ga* as suffixes for the genitive, accusative and dative, and *man* for that of the first personal pronoun (*e.g. durman*, I stand or I am) corresponding to *-in*, *-i*, *-a* and *-im* in Osmanli, which have clearly assumed the character of inseparable terminations more completely than the older forms. Osmanli possesses more copious verbal forms than the other dialects, some of which (such as the future in *-ajak*) seem to be recent formations. On the other hand, the dialects of Turkestan use in speaking, though not in writing, forms which indicate a process of composition followed by contraction, more remarkable than any change which has taken place in the west. For instance, *wopti*, a contraction of *bolup irdi*, is said to be currently used in Khokand for "has become." Yakut (which can still be best studied in Böhtlingk's excellent grammar of 1851) is the dialect which is most distinct from the others, but does not appear always to preserve the oldest forms. Thus it has lost the genitive, which is replaced by a pronominal periphrasis (*e.g. örüs bas-a*, horse head-his, *i.e.* horse's head), and has verbal forms like *bis̱abin*, I cut, *bis̱pappin*, I do not cut, apparently standing for *bis̱arbin*, *bis̱patbin*. The negative suffix is *pa* not *ma*. The resemblance between the Turkish dialects is increased by the fact that they are nearly all written in a somewhat artificial and standardized form which imperfectly represents the variety existing in conversational speech.

Several alphabets have been employed to write Turkish. (1) Arabic characters are everywhere used by Mahommedan Turks, almost without exception; yet this alphabet is extremely ill suited to represent Turkish sounds. It cannot distinguish the hard and soft vowels, so that *oldu*, "he was" is written in the same way as *öldü*, "he died." In some cases the consonants indicate the character of the vowels which are to be supplied after them, hard consonants being followed by hard vowels and soft by soft. Thus the word spelt with the letters *kaf*, *re*, *he* is pronounced as *kara*, but that spelt with *kef*, *re*, *he* as *kerre*. Further the orthography often follows an antiquated pronunciation and the letters have many sounds. Thus the single letter *kef* can be used to express *k*, *ky*, *g*, *gy*, *y*, *v*, *w* and *n*. The result is that pure Turkish words written in Arabic letters are often hardly intelligible even to Turks and it is usual to employ Arabic synonyms as much as possible because there is no doubt as to how they should be read. Osmanli documents are often little more than a string of Arabic words with Turkish terminations.

2. The Uighurs and Eastern Turks used in the middle ages a short alphabet of fourteen letters derived from a Syriac source and probably introduced among them by Nestorian missionaries; similar characters may also have been employed by Manichaeans. The Mongol and Manchu alphabets represent further variations of this writing. Though very like the modern Nestorian, it is in some respects more nearly allied to the Estrangelo and Syro-Palestinian alphabets of the 6th and 7th centuries. The most important document in this alphabet is a MS. preserved at Vienna of the *Kudatku Bilik*, "The Blessed or Fortunate Knowledge," a poem composed at Kashgar about 1065. A colophon states that the MS. was written at Herat in 1465, and that it is a copy of one written in 1085. Inscriptions in a similar alphabet have also been found in China.

3. The most interesting forms of Turkish writing are those used on the inscriptions found in Siberia near the Yenisei and Orkhon rivers. For some time it has been known that stones bearing inscriptions as well as roughly carved figures and hunting scenes were to be found on the upper waters of the Yenisei, particularly near its tributary the Abakan in the district of Minusinsk. They are greatly venerated by the Soyotes inhabiting the region. They were first discovered by Messerschmidt in 1722, and some of them were represented in the plates of Strahlenberg's *Das nord. und östliche Theil von Europa und Asia* (1730). They were generally attributed to Scythians or Chudes. The knowledge of them did not much advance until the researches of Castrèn (1847) and the Finnish Society of Archaeology, which in 1889 published the text of thirty-two, chiefly from the Uibat, Ulukem, Altynkul and Tes. Even more interesting are the monuments discovered in 1889 and known as the Orkhon or Kosho-Tsaidam inscriptions, as they were found in Mongolia to the south of Lake Baikal, between the river Orkhon and Lake Kosho-Tsaidam. The most important are a mortuary inscription in Turkish and Chinese, bearing a date corresponding to 733, in honour of Kül-tegin, and another recounting the exploits of Bilgä Kagan. A third inscription at Kara-Balgassun probably dates from 800–805. The inscriptions were deciphered and translated by Thomsen and Radlov, and Donner examined the origin of the alphabet. He came to the conclusion that the Yenisei alphabet is rather older than that of the Orkhon inscriptions, and that both are derived from the Aramaic alphabet and most nearly allied to the variety of it used on the coins of the Assacid dynasty. In the 3rd century A.D. a section of the Kirghiz, who subsequently moved northwards, were in West Sogdiana and in touch with the Yüe-Chi, who had been for some time in contact with Persia. The old Turkish characters bear a superficial resemblance to runes; the Yenisei letters have the simplest shapes, those of Kara-Balgassun the most complicated. But they are mostly traceable to Aramaic prototypes and have no connexion with Scandinavia. The vowels are generally omitted, even at the beginning of words, and, as in the modern Turkish method of using the Arabic alphabet, their quality is often indicated by the consonants, many of which have two forms, one used with soft the other with hard vowels. Thus *bar* and *bār* are differentiated not by the vowels but by the consonants employed to write them.

4. Turkish-speaking Armenians and Greeks often write it in their own alphabets. Turkish newspapers printed in Armenian characters are published in Constantinople, and Greek characters are similarly employed in several parts of Asia Minor.

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(C. EL.)

TURLE, JAMES (1802–1882), English organist and composer, was born at Taunton, Somerset, and started as a choir boy at Wells Cathedral. In 1817 he became a pupil in London of the organist at Westminster Abbey, and after acting as deputy for some years he succeeded to this post himself in 1831 and held it till his death. He and Sir John Goss, the organist at St Paul's, had been fellow-pupils in London as boys. Turle was a great organist in his day, and composed a good deal of church music which is still well known. His son Henry Frederic Turle (1835–1883) was editor of *Notes and Queries*.

TURMERIC (from Fr. *terre mérite*, turmeric, Lat. *terra merita*, deserved, *i.e.* excellent earth; Skeat suggests that it is a barbarous corruption, perhaps of Arabic *karkam*, *kurkum*, saffron or curcuma), the tuberous root of *Curcuma longa*, L., an herbaceous perennial plant belonging to the natural order Zingiberaceae. It is a native of southern Asia, being cultivated on a large scale both on the mainland and in the islands of the Indian Ocean. Turmeric has been used from a remote period both as a condiment and as a dyestuff, and to a more limited extent as a medicine (now obsolete). In Europe it is employed chiefly as a dye, also as an ingredient in curry powder and as a chemical test for alkalies. The root is prepared by cleaning it and drying it in an oven. There are several varieties (Madras, Bengal, Gopalpur, Java, China and Cochin turmeric), differing chiefly in size and colour and to a slight degree in flavour. Some of these consist exclusively of the ovate central tubers, known as "bulbs," or "round turmeric," and others of the somewhat cylindrical lateral tubers, which are distinguished in trade as "fingers," or "long turmeric." Both are hard and tough, but break with a short resinous or waxy fracture, which varies in tint from an orange brown to a deep reddish brown. The colour is due to *curcumin*, $C_{14}H_{16}O_7$, of which the drug contains about 0·3%. When pure it forms yellow crystals having a vanilla odour and exhibiting a fine blue colour in reflected light. It is soluble in alcohol, in chloroform and in alkaline solutions, but only sparingly in water. Paper tinged with a tincture of turmeric exhibits on the addition of an alkali a reddish brown tint, which becomes violet on drying. This peculiarity was pointed out by H. A. Vogel in 1815, and since that date turmeric has been utilized as a chemical test for detecting alkalinity. It is of no therapeutic value. In Sierra Leone a kind of turmeric is obtained from a species of *Canna*.

TURNEBUS, ADRIANUS [ADRIEN TURNÈBE] (1512–1565), French classical scholar, was born at Les Andelys in Normandy. At the age of twelve he was sent to Paris to study, and attracted great notice by his remarkable abilities. After having held the post of professor of belles-lettres in the university of Toulouse, in 1547 he returned to Paris as professor (or royal reader) of Greek at the Collège Royal. In 1552 he was entrusted with the printing of the Greek books at the royal press, in which he was assisted by his friend, Guillaume Morel (*q.v.*). He died of consumption on the 12th of June 1565. His works chiefly consist of philological dissertations, commentaries (on Aeschylus, Sophocles, Theophrastus, Philo and portions of Cicero), and translations of Greek authors into Latin and French. His son, Étienne, published his complete works, in three volumes (Strassburg, 1600), and his son Adrien his *Adversaria*, containing explanations and emendations of numerous passages in classical authors.

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TURNER, CHARLES (1773–1857), English engraver, was born at Woodstock in 1773. He entered the schools of the Royal Academy in 1795; and, engraving in stipple in the manner of Bartolozzi, he was employed by Alderman Boydell. His finest plates, however, are in mezzotint, a method in which he engraved J.M.W. Turner's "Wreck" and twenty-four subjects of his *Liber studiorum*, Reynolds's "Marlborough Family," and many of Raeburn's best portraits, including those of Sir Walter Scott, Lord Newton, Dr Hamilton, Professors Dugald Stewart and John Robinson, and Dr Adam. He also worked after Lawrence, Shee and Owen. He was an admirable engraver, large, broad and masterly in touch; and he reproduced with great fidelity the characteristics of the various painters whose works he translated into black and white. In 1828 he was elected an associate of the Royal Academy. He died on the 1st of August 1857.

TURNER, SIR JAMES (1615–1686), Scottish soldier and military writer, was educated with a view to his entering the Church, but early showed his preference for the profession of arms by enlisting in the Swedish army, then the most famous training-school in Europe. He saw considerable service in the Thirty Years' War, and in 1640 returned to Scotland as a captain. It was not long before he secured employment, and as a major he accompanied the Scottish army in its invasion of England in the same year, successfully avoiding the imposition of the "Covenant" as a test. With Lord Sinclair's regiment Major Turner served in Ulster, and subsequently, after failing to join Montrose's army, accompanied the Scottish army until Naseby practically ended the Civil War. Turner was often with Charles I. during his detention at Leslie's headquarters, and continually urged him to escape. Up to this time he had served against the king, but always with some repugnance, and he welcomed the opportunity when in 1648 the cause of the king and the interests of the Scottish nation for the moment coincided. In the disastrous campaign which followed Turner was at Hamilton's headquarters, and it was owing to the neglect of his advice that the rout of Preston took place. Taken in the final surrender at Uttoxeter, he spent some time in captivity, but in 1649 was released and sent abroad. He was unable for want of means to reach Montrose in time to join in the final venture of the noblest of the Royalist commanders, but he landed in Scotland on the day before Dunbar, and in the grave crisis that followed was a welcome ally. As a colonel and adjutant-general of foot he was with Charles II. at Worcester. In that battle he was captured, but regained his liberty, and after many adventures escaped to the Continent, where for some years he was engaged in various Royalist intrigues, conspiracies and attempted insurrections. At the Restoration he was knighted, and in 1662 he became a major in the Royal Guards. Four years later, as a district commander in Scotland, he was called upon to deal severely with Covenanter disturbances. Though not, it appears, unjust, his dragooning methods eventually led to his being deprived of his command. The rest of his life was spent in retirement. A pension was granted to him by James II. in 1685. In 1683 he had published his *Pallas armata, Military Essayes of the Ancient Grecian, Roman and Modern Art of War*, one of the most valuable authorities for the history of military sciences.

TURNER, JOSEPH MALLORD WILLIAM (1775–1851), English painter, was born in London on the 23rd of April 1775. His father, William Turner, a native of Devonshire, kept a barber's shop at 26 Maiden Lane, in the parish of St Paul's, Covent Garden. Of the painter's mother, Mary Marshall or Turner, little is known; she is said to have been a person of ungovernable temper and towards the end of her life became insane. Apparently the home in which Turner spent his childhood was not a happy one, and this may account for much that was unsociable and eccentric in his character. The earliest known drawing by Turner, a view of Margate Church, dates from his ninth year. It was also about this time that he was sent to his first school at New Brentford. Of education, as the term is generally understood, he received but little. His father taught him to read, and this and a few months at New Brentford and afterwards at Margate were all the schooling he ever had; he never mastered his native tongue, nor was he able in after life to learn any foreign language. Notwithstanding this lack of scholarship, one of his strongest characteristics was a taste for associating his works with personages and places of legendary and historical interest, and certain stories of antiquity seem to have taken root in his mind very strongly.

By the time Turner had completed his thirteenth year his schooldays were over and his choice of an artist's career settled. In 1788–1789 he was receiving lessons from Palice, "a floral drawing master;" from T. Malton, a perspective draughtsman;

and from Hardwick, an architect. He also attended Paul Sandby's drawing school in St Martin's Lane. Part of his time was employed in making drawings at home, which he exhibited for sale in his father's shop window, two or three shillings being the usual price. He coloured prints for engravers, washed in backgrounds for architects, went out sketching with Girtin, and made drawings in the evenings for Dr Munro "for half a crown and his supper." When pitied in after life for the miscellaneous character of his early work, his reply was "Well! and what could be better practice?" In 1789 Turner became a student of the Royal Academy. He also worked for a short time in the house of Sir Joshua Reynolds, with the idea, apparently, of becoming a portrait painter; but, the death of Reynolds occurring shortly afterwards, this intention was abandoned. In 1790 Turner's name appears for the first time in the catalogue of the Royal Academy, the title of his solitary contribution being "View of the Archbishop's Palace, Lambeth." About 1792 he received a commission from Walker, the engraver, to make drawings for his *Copper-Plate Magazine*, and this topographical work took him to many interesting places. The natural vigour of his constitution enabled him to cover much of the ground on foot. He could walk from 20 to 25 m. a day with ease, his baggage at the end of a stick, making notes and memoranda as he went. He rose early, worked hard all day, wasted no time over his simple meals, and his homely way of living made him easily contented with such rude accommodation as he chanced to find on the road. A year or two after he accepted a similar commission to make drawings for the *Pocket Magazine*, and before his twentieth year he had travelled over many parts of England and Wales. None of these magazine drawings is remarkable for originality of treatment or for artistic feeling.

Up to this time Turner had worked in the back room above his father's shop. His love of secretiveness and solitude had already begun to show itself. An architect who often employed him to put in backgrounds to his drawings says, "he would never suffer me to see him draw, but concealed all that he did in his bedroom." On another occasion, a visitor entering unannounced, Turner instantly covered up his drawings, and, in reply to the intimation, "I've come to see the drawings for——," the answer was, "You shan't see 'em, and mind that next time you come through the shop, and not up the back way." Probably the increase in the number of his engagements induced Turner about this time to set up a studio for himself in Hand Court, not far from his father's shop, and there he continued to work till he was elected an associate of the Royal Academy (1799).

Until 1792 Turner's practice had been almost exclusively confined to water colours, and his early works show how much he was indebted to some of his contemporaries. There are few of any note whose style he did not copy or adopt. His first exhibited oil picture appeared in the Academy in 1793. In 1794–1795 Canterbury Cathedral, Malvern Abbey, Tintern Abbey, Lincoln and Peterborough Cathedrals, Shrewsbury, and King's College Chapel, Cambridge, were among the subjects exhibited, and during the next four years he contributed no less than thirty-nine works to the Academy. In the catalogue of 1798 he first began to add poetic quotations to the titles of his pictures; one of the very first of these—a passage from Milton's *Paradise Lost*—is in some respects curiously prophetic of one of the future characteristics of his art:—

"Ye mists and exhalations that now rise
From hill or steaming lake, dusky or grey
Till the sun paints your fleecy skirts with gold,
In honour of the world's great author rise."

This and several other quotations in the following years show that Turner's mind was now occupied with something more than the merely topographical element of landscape, Milton's *Paradise Lost* and Thomson's *Seasons* being laid under frequent contribution for descriptions of sunrise, sunset, twilight or thunderstorm. Turner's first visit to Yorkshire took place in 1797. It seems to have braced his powers and possibly helped to change the student into the painter. Until then his work had shown very little of the artist in the higher sense of the term: he was little more than a painstaking and tolerably accurate topographer; but even under these conditions he had begun to attract the notice of his brother artists and of the critics. England was, at the time, at a low point both in literature and art. Among the artists De Loutherbourg and Morland were almost the only men of note left. Hogarth, Wilson, Gainsborough and Reynolds had passed away. Beechey, Bourgeois, Garvey, Farington—names well-nigh forgotten now—were the Academicians who painted landscape. The only formidable rivals Turner had to contend with were De Loutherbourg and Girtin, and after the death of the latter in 1802 he was left undisputed master of the field.

It is not, therefore, surprising that the exhibition of his works in 1798 was followed by his election to the associateship of the Royal Academy. That he should have attained to this position before completing his twenty-fourth year says much for the wisdom and discernment of that body, which further showed its recognition of his talent by electing him an Academician four years later. Turner owed much to the Academy. Ruskin says, "It taught him nothing." Possibly it had little to teach that he had not already been able to learn for himself; at all events it was quick to see his genius and to confer its honours, and Turner, naturally generous and grateful, never forgot this. He enjoyed the dignity of Academician for nearly half a century, and during nearly the whole of that period he took an active share in the direction of the Academy's affairs. His speeches are described as "confused, tedious, obscure, and extremely difficult to follow"; but at council meetings he was ever anxious to allay anger and bitter controversy. His opinions on art were always listened to with respect; but on matters of business it was often difficult to know what he meant. His friend Chantrey used to say, "He has great thoughts, if only he could express them." When appointed professor of perspective to the Royal Academy in 1808, this painful lack of expression stood greatly in the way of his usefulness. Ruskin says, "The zealous care with which Turner endeavoured to do his duty is proved by a series of large drawings, exquisitely tinted, and often completely coloured, all by his own hand, of the most difficult perspective subjects, illustrating not only directions of line, but effects of light, with a care and completion which would put the work of any ordinary teacher to utter shame." In teaching he would neither waste time nor spare it With his election to the associateship of the Academy in 1799 Turner's early struggles may be considered to have ended. He had emancipated himself from hack work, had given up making topographical drawings of castles and abbeys for the engravers—drawings in which mere local fidelity was the principal object—and had taken to *composing* as he drew. Local facts had become of secondary importance compared with effects of light and colour. He had reached manhood, and with it he abandoned topographical fidelity and began to paint his dreams, the visionary faculty—the true foundation of his art—asserting itself, nature being used to supply suggestions and materials.

His pictures of 1797–1799 had shown that he was a painter of no ordinary power, one having much of the poet in him, and able to give expression to the mystery, beauty and inexhaustible fullness of nature. His work at this period is described by Ruskin as "stern in manner, reserved, quiet, grave in colour, forceful in hand."

Turner's visit to Yorkshire in 1797 was followed a year or two later by a second, and it was on this occasion that he made the acquaintance, which afterwards ripened into a long and staunch friendship, of Fawkes of Farnley Hall. From 1803 till 1820 Turner was a frequent visitor at Farnley. The large number of his drawings still preserved there—English, Swiss, German and Italian, the studies of rooms, outhouses, porches, gateways, of birds shot while he was there, and of old places in the neighbourhood—prove the frequency of his visits and his affection for the place and for its hospitable master. A caricature, made by Fawkes, and "thought by old friends to be very like," shows Turner as "a little Jewish-nosed man, in an ill-cut brown tail-coat, striped waistcoat, and enormous frilled shirt, with feet and hands notably small, sketching on a small piece of paper, held down almost level with his waist." It is evident from all the accounts given that Turner's personal appearance was not of a kind to command much attention or respect. This may have pained his sensitive nature, and led him to seek refuge in the solitude of his painting room. Had he been inclined he had abundant opportunity for social and friendly intercourse with his fellow men, but he gradually came to live more and more in a state of mental isolation. Turner could never make up his mind to visit Farnley again after his old friend's death, and his voice would falter when he spoke of the shores of the Wharfe.

Turner visited Scotland in 1800, and in 1801 or 1802 he made his first tour on the Continent. In the following year, of the seven pictures he exhibited, six were of foreign subjects, among them "Bonneville," "The Festival upon the Opening of the Vintage of Mâcon," and the well-known "Calais Pier" in the National Gallery. The last-named picture, although heavily painted and somewhat opaque in colour, is magnificently composed and full of energy.

In 1802, the year in which Turner became a Royal Academician, he took his father, who still carried on the barber business in Maiden Lane, to live with him. The old man lived in his son's house for nearly thirty years, making himself useful in various ways. It is said that he used to prepare and strain his son's canvases and varnish them when finished, which may explain a saying of Turner's that "his father used to begin and finish his pictures for him." He also attended to the gallery in Queen Anne Street, showed in visitors, and took care of the dinner, if he did not himself cook it. Turner was never the same man after his father's death in 1830, living a life of almost complete isolation.

In 1804 Turner made a second tour on the Continent, and in the following year painted the "Shipwreck" and "Fishing Boats in a Squall" (in the Ellesmere collection), seemingly in direct rivalry of Vandervelde, in 1806 the "Goddess of Discord in the Garden of the Hesperides" (in rivalry of Poussin), and in 1807 the "Sun rising through Vapour" (in rivalry of Claude).[1] The last two are notable works, especially the "Sun." In after years it was one of the works he left to the nation, on the special condition of its being hung beside the Claudes in the National Gallery. In this same year (1807) Turner commenced his most serious rivalry. Possibly it arose out of a desire to break down Claude worship—the then prevailing fashion—and to show the public that there was a living artist not unworthy of taking rank beside him. That the *Liber studiorum* was suggested by the *Liber veritatis* of Claude, and was intended as a direct challenge to that master, is beyond doubt. There is, however, a certain degree of unfairness to Claude in the way in which the challenge was given. Claude made drawings in brown of his pictures as they left the easel, not for publication, but merely to serve as private memoranda. Turner's *Liber* drawings had no such purpose, but were intended as a direct appeal to the public to judge between the two artists. The first of the *Liber* drawings was made in the autumn of 1806, the others at intervals till about 1815. They are of the same size as the plates and carefully finished in sepia. He left over fifty of these to the National Gallery. The issue of the *Liber* began in 1807 and continued at irregular intervals till 1819, when it stopped at the fourteenth number. Turner had resolved to manage the publishing business himself, but in this he was not very successful. He soon quarrelled with his engraver, F. C. Lewis, on the ground that he had raised his charges from five guineas a plate to eight. He then employed Charles Turner, who agreed to do fifty plates at the latter sum, but, after finishing twenty, he too wished to raise his price, and, as a matter of course, this led to another quarrel. Reynolds, Dunkarton, Lupton, Say, Dawe and other engravers were afterwards employed—Turner himself etching and mezzotinting some of the plates. Each part of the *Liber* contained five plates, the subjects, divided into "historical," "pastoral," "marine," &c., embracing the whole range of landscape art. Seventy-one plates in all were published (including one as a gift of the artist to his subscribers); ten other plates—more or less completed—intended for the fifteenth and sixteenth numbers were never published, the work being stopped for want of encouragement. Absence of method and business habits may account for this. Turner is said to have got up the numbers in his own house with the help of a female servant. The plates, which cost the subscribers only five shillings apiece, were so little esteemed that in the early quarter of the 19th century they were sometimes used for lighting fires. So much has fashion, or public taste, changed since then that a fine proof of a single plate has sold for £210. The merit of the plates is unequal; some—for example, "Solway Moss," "Inverary Pier," "Hind Head Hill," "Ben Arthur," "Rizpah," "Junction of the Severn and Wye" and "Peat Bog"—are of great beauty, while a few are comparatively tame and uninteresting. Among the unpublished plates "Stonehenge at Daybreak," "The Stork and Aqueduct," "The Via Mala," "Crowhurst," and "Moonlight off the Needles" take a high place. The *Liber* shows strong traces of the influence of Cozens and Girtin, and, as a matter of course, of Claude. In most of the designs the predominant feeling is serious; in not a few, gloomy, or even tragic. A good deal has been written about Turner's intention, and the "lessons" of the *Liber studiorum*. Probably his only intention in the beginning was to show what he could do, to display his art, to rival Claude, perhaps to educate public taste, and at the same time make money. If lessons were intended they might have been better conveyed by words. "Silent always with a bitter silence, disdaining to tell his meaning"—such is Ruskin's explanation; but surely Turner had little reason for either silence or contempt because the public failed to see in landscape art the means of teaching it great moral lessons. The plates of the *Liber* contain an almost complete epitome of Turner's art. It is supposed that his original intention had been that the *Liber* should consist of one hundred plates, and drawings for that number exist, but there was no public demand for them. Already in this work are seen strong indications of one of his most remarkable characteristics—a knowledge of the principles of structure in natural objects; mountains and rocks are drawn, not with topographical accuracy, but with what appears like an intuitive feeling for geological formation; and trees have also the same expression of life and growth in the drawing of stems and branches. This instinctive feeling in Turner for the principles of organic structure is treated of at considerable length in the fourth volume of *Modern Painters*, and Turner is there contrasted with Claude, Poussin, and some of the Dutch masters, greatly to their disadvantage.

After 1797 Turner was little concerned with mere topographical facts: his pictures might be like the places represented or not; much depended on the mental impression produced by the scene. He preferred to deal with the spirit, rather than with the local details of places. A curious example of the *reasonableness* accompanying his exercise of the imaginative faculty is to be found in his creations of creatures he had never seen, as, for example, the dragon[2] in the "Garden of the Hesperides" and the python in the "Apollo," exhibited in 1811. Both these monsters are imagined with such vividness and reality, and the sense of power and movement is so completely expressed, that the spectator never once thinks of them as otherwise than representations of actual facts in natural history. It needs but a little comparison to discover how far Turner surpassed all his contemporaries, as well as all who preceded him, in these respects. The imaginative faculty he possessed was of the highest order, and it was further aided by a memory of the most retentive and unerring kind. A good illustration of this may be seen at Farnley Hall in a drawing of a "Man-of-War taking in Stores." Some one, who had never seen a first-rate, expressed a wish to know what it looked like. Turner took a blank sheet of paper one morning after breakfast, outlined the ship, and finished the drawing in three hours, young Fawkes, a son of the house, sitting beside him from the first stroke to the last. The size of this drawing is about 16 in. by 11 in. Ruskin thus describes it:—

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[1] This spirit of rivalry showed itself early in his career. He began by pitting himself against his contemporaries, and afterwards, when his powers were more fully developed, against some of the old masters, notably Vandervelde and Claude. During these years, while he kept up a constant rivalry with artists living and dead, he was continuing his study of nature, and, while seemingly a mere follower of the ancients, was accumulating that store of knowledge which in after years he was to use to such purpose.

[2] "The strange unity of vertebrated action and of a true bony contour, infinitely varied in every vertebra, with this glacial outline, together with the adoption of the head of the Ganges crocodile, the fish-eater, to show his sea descent (and this in the year 1806, when hardly a single fossil saurian skeleton existed within Turner's reach), renders the whole conception one of the most curious exertions of the imaginative intellect with which I am acquainted in the arts" (Ruskin, *Mod. Painters*, v. 313).

> "The hull of a first-rate occupies nearly one half of the picture to the right, her bows toward the spectator, seen in sharp perspective from stem to stern, with all her port-holes, guns, anchors and lower rigging elaborately detailed, two other ships of the line in the middle distance drawn with equal precision, a noble breezy sea, full of delicate drawing in its waves, a store ship beneath the hull of the larger vessel and several other boats, and a complicated cloudy sky, all drawn from memory, down to the smallest rope, in a drawing-room of a mansion in the middle of Yorkshire."

About the year 1811 Turner paid his first visit to Devonshire, the county to which his family belonged, and a curious glimpse of his simple manner of life is given by Redding, who accompanied him on some of his excursions. On one occasion they spent a night together in a small road-side inn, Turner having a great desire to see the country around at sunrise.

> "Turner was content with bread and cheese and beer, tolerably good, for dinner and supper in one. In the little sanded room we conversed by the light of an attenuated candle and some aid from the moon until nearly midnight, when Turner laid his head upon the table and was soon fast asleep. Three or four hours' rest was thus obtained, and we went out as soon as the sun was up to explore the surrounding neighbourhood. It was in that early morning Turner made a sketch of the picture 'Crossing the Brook.'" In another excursion to Borough Island, "the morning was squally and the sea rolled boisterously into the Sound. Off Stakes Point it became stormy; our Dutch boat rode bravely over the furrows. Two of the party were ill. Turner was all the while quiet, watching the troubled scene. Bolt Head, to seaward, against which the waves broke with fury, seemed to absorb his entire notice, and he scarcely spoke a syllable. While the fish were getting ready Turner mounted nearly to the highest point of the island rock, and *seemed writing rather than drawing*. The wind was almost too violent for either purpose."

This and similar incidents show how careless of comfort Turner was, and how devoted to his art. The tumult and discomfort by which he was surrounded could not distract his powers of observation; and some thirty years later there is still evidence of the same kind. In the catalogue of the exhibition of 1842 one of his pictures bears the following title, "Snow-Storm: steam-boat off a harbour's mouth making signals in shallow water, and going by the lead. The author was in that storm the night the 'Ariel' left Harwich."

From 1813 till 1826, in addition to his Harley Street residence, Turner had a country house at Twickenham. He kept a boat on the river, also a pony and gig, in which he used to drive about the neighbouring country on sketching expeditions. The pony, for which Turner had a great love, appears in his well-known "Frosty Morning" in the National Gallery. He appears to have had a great affection for animals, and one instance of his tenderness of heart is given by one who often joined him in the amusement of fishing, of which Turner was very fond. "I was often with him when fishing at Petworth, and also on the banks of the Thames. His success as an angler was great, although with the worst tackle in the world. Every fish he caught he showed to me, and appealed to me to decide whether the size justified him to keep it for the table or to return it to the river; his hesitation was often almost touching, and he always gave the prisoner at the bar the benefit of the doubt."

In 1813 Turner commenced the series of drawings, forty in number, for Cooke's *Southern Coast*. This work was not completed till 1826. The price he at first received for these drawings was £7, 10s. each, afterwards raised to £13, 2s. 6d.

"Crossing the Brook" appeared in the Academy of 1815. It may be regarded as a typical example of Turner's art at this period, and marks the transition from his earlier style to that of his maturity. It represents a piece of Devonshire scenery, a view on the river Tamar. On the left is a group of tall pine-trees, beautifully designed and drawn with great skill and knowledge of structure; in the foreground a couple of children, with a dog carrying a bundle in its mouth across the brook; and beyond, a vast expanse of richly-wooded country, with glimpses of a winding river, an old bridge, a mill, and other buildings, and, in the far distance, the sea. Both in design and execution this work is founded upon Claude. Some critics consider it one of Turner's greatest works; but this is open to question.[1] It can hardly be called a work in full colour: it is limited to greys and quiet greens for the earth and pale blues for the sky. It is a sober but very admirable picture, full of diffused daylight, and in the painting of its distance better than any master who had preceded him. The fascination of the remote, afterwards so distinctive an element in Turner's pictures, shows itself here. Perhaps nothing tests the powers or tries the skill of the landscape painter more severely than the representation of distant effects. They come and go so rapidly, are often in a high key of light and colour, and so full of mystery and delicacy, that anything approaching to real imitation is impossible. Only the most retentive memory and the most sensitive and tender feeling will avail. These qualities Turner possessed to a remarkable degree, and as his powers matured there was an ever-increasing tendency in his art to desert the foreground, where things were definite and clear, in order to dream in the infinite suggestiveness and space of distances. "Dido Building Carthage" also belongs to this period. It hangs beside the Claudes in the National Gallery. It pertains to the old erroneous school of historical painting. Towering masses of Claudesque architecture piled up on either side, porticoes, vestibules, and stone pines, with the sun in a yellow sky, represent the Carthage of Turner's imagination. With all its faults it is still the finest work of the class he ever painted. Carthage and its fate had a strange fascination for him. It is said that he regarded it as a moral example to England in its agricultural decline, its increase of luxury, and its blindness to the insatiable ambition of a powerful rival. He returned again to this theme in 1817, when he exhibited his "Decline of the Carthaginian Empire: Hostages Leaving Carthage for Rome"—a picture which Ruskin describes as "little more than an accumulation of academy student's outlines coloured brown."

In 1818 Turner was in Scotland making drawings for the *Provincial Antiquities*, for which Sir Walter Scott supplied the letterpress, and in 1819 he visited Italy for the first time. One of the results of this visit was a great change in his style, and from this time his works became remarkable for their colour. Hitherto he had painted in browns, greys and blues, using red and yellow sparingly. He had gradually been advancing from the sober grey colouring of Vandervelde and Ruysdael to the mellow and richer tones of Claude. His works now begin to show a heightened scale of colour, gradually increasing in richness and splendour and reaching its culminating point in such works as the "Ulysses," "Childe Harold's Pilgrimage," "The Golden Bough," and "The Fighting Téméraire." All these works belong to the middle period of Turner's art (1829–1839), when his powers were entirely developed and entirely unabated. Much of his most beautiful work at this period is to be found in his water-colour drawings: those executed for Whitaker's *History of Richmondshire* (1819–1821), for Cooke's *Southern Coast* (1814–1826), for *The Rivers of England* (1824), for *England and Wales* (1829–1838), *Provincial Antiquities* (1826), Rogers's *Italy* (1830), Scott's *Works* (1834), and *The Rivers of France* (1833–1835) are in many instances of the greatest beauty. Of the Richmondshire drawings Ruskin says, "The foliage is rich and marvellous in composition, the rock and hill drawing insuperable, the skies exquisite in complex form."

But perhaps one of the greatest services Turner rendered to the art of England was the education of a whole school of engravers. His best qualities as a teacher came from the union of strength and delicacy in his work; subtle and delicate tonality was almost a new element for the engraver to deal with, but with Turner's teaching and careful supervision his engravers by degrees mastered it more or less successfully, and something like a new development of the art of engraving was the result. No better proof can be found of the immense advance made than by comparing the work of the landscape engravers of the pre-Turnerian period with the work of Miller, Goodall, Willmore, Cooke, Wallis, Lupton, C. Turner, Brandard, Cousen, and others who worked under his guidance. The art of steel engraving reached its highest development in England at this time. Rogers's *Italy* (1830) and his *Poems* (1834) contain perhaps the most beautiful and delicate of the many engravings executed after Turner's drawings. They are vignettes,[1] a form of art which Turner understood better than any artist ever did before—perhaps, we might add, since. "The Alps at Daybreak," "Columbus Discovering Land," and "Datur Hora Quieti" may be given as examples of the finest.

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[1] "Crossing the Brook" was a great favourite with Turner. It was painted for a patron, who, dissatisfied with it, left it on the painter's hands. The price asked (£500) seems to have been part of the objection. Turner subsequently refused an offer of £1600 for it.

In 1828 Turner paid a second visit to Italy, this time of considerable duration, on the way visiting Nîmes, Avignon, Marseilles, Genoa, Spezzia and Siena, and in the following year he exhibited the "Ulysses Deriding Polyphemus," now in the National Gallery. It marks the beginning of the central and best period of Turner's power. This work is so well known that description is hardly needed. The galley of Ulysses occupies the centre of the picture; the oars are being thrust out and the sailors flocking up the masts to unfurl sail, while Ulysses waves the blazing olive tree in defiance of the giant, whose huge form is seen high on the cliffs above; and the shadowy horses of Phoebus are traced in the slanting rays of the rising sun. The impression this picture leaves is one of great power and splendour. The painting throughout is magnificent, especially in the sky. Leslie speaks of it as "a poem of matchless splendour and beauty." From this period onward till about 1840 Turner's life was one of unceasing activity. Nothing is more astonishing than his prodigious fertility; he rose early, worked from morning till night, entirely absorbed in his art, and gradually became more and more solitary and isolated. Between 1829 and 1839 he sent fifty-five pictures to the Royal Academy, painted many others on private commission, made over four hundred drawings for engravers, besides thousands of studies and sketches from nature. His industry accounts for the immense quantity of work he left behind him. There is not the slightest evidence to show that it arose from a desire to make money, which he never cared for in comparison with his art. He has been accused, perhaps not without some cause, of avarice and meanness in his business dealings, and many stories are told to his discredit. But in private he often did generous things, although owing to his reserved disposition his virtues were known only to a few. His faults on the other hand—thanks to the malice, or jealousy, of one or two individuals—were freely talked about and, as a matter of course, greatly exaggerated. "Keep it, and send your children to school and to church," were the words with which he declined repayment of a considerable loan to a poor drawing-master's widow. On another occasion, when interrupted in his work, he roughly chid and dismissed the applicant, a poor woman; but she had hardly left his door before he followed her and slipped a £5 note into her hand. His tenants in Harley Street were in arrears for years, but he would never allow his lawyer to distrain; and if further proof of his generosity were needed his great scheme for bettering the condition of the unfortunate in his own profession should suffice. On one occasion he is known to have taken down a picture of his own from the walls of the Academy to make room for that of an unknown artist.

The first of Turner's Venetian pictures ("Bridge of Sighs, Ducal Palace and Custom House, Venice, Canaletti Painting") appeared in the Academy in 1833. Compared with the sober, prosaic work of Canaletti, Turner's pictures of Venice appear like poetic dreams. Splendour of colour and carelessness of form generally characterize them. Venice appeared to him "a city of rose and white, rising out of an emerald sea against a sky of sapphire blue." Many of these Venetian pictures belong to his later manner, and some of them, "The State Procession bearing Giovanni Bellini's Pictures to the Church of the Redeemer" (exhibited in the Royal Academy, 1841), "The Sun of Venice Going to Sea" (1843), "Approach to Venice" (1844), and "Venice, Evening, Going to the Ball" (1845), to his latest. As Turner grew older his love of brilliant colour and light became more and more a characteristic. In trying to obtain these qualities he gradually fell into an unsound method of work, treating oil as if it had been water-colour, using both indiscriminately on the same canvas, utterly regardless of the result. Many of his finest pictures are already in a ruined state, mere wrecks of what they once were.

"The Fighting Téméraire Tugged to her Last Berth to be Broken Up" was exhibited in the Academy of 1839. By many it is considered one of his finest works. Turner had all his life been half a sailor at heart: he loved the sea, and shipping, and sailors and their ways; many of his best pictures are sea pieces; and the old ships of Collingwood and Nelson were dear to him. Hence the pathetic feeling he throws around "The Fighting Téméraire." The old three-decker, looking ghostly and wan in the evening light, is slowly towed along by a black, fiery little steam tug—a contrast suggesting the passing away of the old order of things and the advent of the new; and behind the sun sets red in a thick bank of smoke or mist. "The Slave Ship," another important sea picture, was exhibited in the following year, and in 1842 "Peace: Burial at Sea," commemorative of Wilkie.

Turner had now reached his sixty-seventh year, but no very marked traces of declining power are to be seen in his work. Many of the water-colour drawings belonging to this period are of great beauty, and, although a year or two later his other powers began to fail, his faculty for colour remained unimpaired almost to the end. He paid his last visit to the Continent in 1843, wandering about from one place to another, and avoiding his own countrymen, an old and solitary man. At his house in Queen Anne Street they were often ignorant of his whereabouts for months, as he seldom took the trouble to write to any one. Two years later (1845) his health gave way and with it both mind and sight began to fail. The works of his declining period exercised the wit of the critics. Turner felt these attacks keenly. He was naturally kind-hearted and acutely sensitive to censure. "A man may be weak in his age," he once remarked, "but you should not tell him so."

After 1845 all the pictures shown by Turner belong to the period of decay—mere ghosts and shadows of what once had been. In 1850 he exhibited for the last time. He had given up attending the meetings of the Academicians; none of his friends had seen him for months; and even his old housekeeper had no idea of his whereabouts. Turner's mind had evidently given way for some time, and with that love of secrecy which in later years had grown into a passion he had gone away to hide himself in a corner of London. He had settled as a lodger in a small house in Chelsea, overlooking the river, kept by his old Margate landlady, Mrs Booth. To the children in the neighbourhood he was known as "Admiral Booth." His short, sailor-like figure may account for the idea that he was an impoverished old naval officer. He had been ill for some weeks, and when his Queen Anne Street housekeeper at last discovered his hiding-place she found him sinking, and on the following day, the 19th of December 1851, he died. He was buried in St Paul's Cathedral, in deference to a wish he had himself expressed. He left the large fortune he had amassed (about £140,000) to found a charity for the "maintenance and support of male decayed artists, being born in England, and of English parents only, and of lawful issue." His pictures he bequeathed to the nation, on condition that they were exhibited in rooms of their own, and that these rooms were to be called "Turner's Gallery." The will and its codicils were so confused that after years of litigation, during which a large part of the money was wasted in legal expenses, it was found impossible to decide what Turner really wanted. A compromise was effected in which the wishes of everybody, save those of the testator, were consulted, his next-of-kin, whom he did not mean to get a single farthing, inheriting the bulk of his property. The nation got all the pictures and drawings, and the Royal Academy £20,000.

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[1] "Of all the artists who ever lived I think it is Turner who treated the vignette most exquisitely, and, if it were necessary to find some particular reason for this, I should say that it may have been because there was nothing harsh or rigid in his genius, that forms and colours melted into each other tenderly in his dream-world, and that his sense of gradation was the most delicate ever possessed by man" (Hamerton)

If Turner had died early his reputation as an artist would have been very different from what it ultimately became. He would not have been recognized as a colourist. It was only after the year 1820 that colour began to assert itself strongly in his work. He painted for many a year in greys and greens and browns, went steadily through "the subdued golden chord," and painted yellow mists and suns rising through vapour; but as time went on that was no longer enough, and he tried to paint the sun in his strength and the full glories of sunshine. The means at the painter's disposal are, however, limited, and Turner, in his efforts after brilliancy, began to indulge in reckless experiments in colour. He could not endure even the slightest restraints which technical limitations impose, but went on trying to paint the unpaintable. As a water-colour painter Turner stands pre-eminent; he is unquestionably the greatest master in that branch of art that ever lived. If his work is compared with that of Barrett, or Varley, or Cozens, or Sandby, or any of the earlier masters, so great is Turner's superiority that the art in his hands seems to be lifted altogether into a higher region.

In 1843 a champion, in the person of John Ruskin, arose to defend Turner against the unjust and ignorant attacks of the press, and what at first was intended as a "short pamphlet, reprobating the manner and style of these critics," grew into the five volumes of *Modern Painters*. Ruskin employed all his eloquence and his great critical faculty to prove how immeasurably superior Turner was to all who had ever gone before, hardly restricting his supremacy to landscape art, and placing him among the "seven supreme colourists of the world."

Like most men of note, Turner had his enemies and detractors, and it is to be regretted that so many of the stories they set in circulation against his moral character should have been repeated by one of his biographers, who candidly admits having "spared none of his faults," and excuses himself for so doing by "what he hopes" is his "undeviating love of truth." The immense quantity of work accomplished by Turner during his lifetime, work full of the utmost delicacy and refinement, proves the singularly fine condition of his nervous system, and is perhaps the best answer that can be given to the charge of being excessively addicted to sensual gratification. In his declining years he possibly had recourse to stimulants to help his failing powers, but it by no means follows that he went habitually to excess in their use. He never lost an opportunity of doing a kindness, and under a rough and cold exterior there was more good and worth hidden than the world imagined. "During the ten years I knew him," says Ruskin, "years in which he was suffering most from the evil-speaking of the world, I never heard him say one depreciating word of any living man or man's work; I never saw him look an unkind or blameful look; I never knew him let pass, without sorrowful remonstrance, or endeavour at mitigation, a blameful word spoken by another. Of no man, but Turner, whom I have ever known could I say this." Twice during his earlier days there are circumstances leading to the belief that he had the hope of marriage, but on both occasions it ended in disappointment, and his home after his father died was cheerless and solitary.

Two biographies of Turner have been written, one by Thornbury, the other by P. G. Hamerton. The work of the latter deserves the highest commendation; it gives a clear and consistent history of the great artist, and is characterized by refined thought and critical insight. An excellent little book by W. Cosmo Monkhouse may also be noticed. Books upon Turner continue to appear, although it is scarcely to be expected that they can add to the facts already known about him. *Turner and Ruskin* an exposition of the work of Turner from the writings of Ruskin, edited with a biographical note on Turner by Frederick Wedmore, in two volumes, with ninety-one illustrations, was published by George Allen in 1900. Perhaps the most important recent work upon his art is Sir Walter Armstrong's *Turner* (1901), which deals at considerable length with the events of his life, and with his pictures in oil and his drawings in water-colour. It also gives so far as possible a list of his oil pictures, and for the first time a pretty full list of his water colours, although the great painter's works in both media are so numerous that it would be impossible to say that either is complete. See also *J. M. W. Turner*, by W. L. Wyllie, A.R.A. (1905). The great authority on the *Liber Studiorum* is W. G. Rawlinson (Turner's *Liber Studiorum*, 2nd ed., 1906). (G. Re.)

TURNER, NAT (1800–1831), the negro leader of a slave insurrection in Virginia, known as the "Southampton Insurrection," was born in Southampton county, Virginia, in 1800. From his childhood he claimed to see visions and hear voices, and he became a Baptist preacher of great influence among the negroes. In 1828 he confided to a few companions that a voice from heaven had announced that "the last shall be first," which was interpreted to mean that the slaves should control. An insurrection was planned, and a solar eclipse in February 1831 and peculiar atmospheric conditions on the 13th of August were accepted as the signal for beginning the work. On the night of the 21st of August 1831, with seven companions, he entered the home of his master, Joseph Travis, and murdered the inmates. After securing guns, horses and liquor they visited other houses, sparing no one. Recruits were added, in some cases by compulsion, until the band numbered about sixty. About noon on the 22nd they were scattered by a small force of whites, hastily gathered. Troops, marines and militia were hurried to the scene, and the negroes were hunted down. In all thirteen men, eighteen women, and twenty-four children had been butchered. After hiding for several weeks Nat was captured on the 30th of October and was tried and hanged, having made, meanwhile, a full confession. Nineteen of his associates were hanged and twelve were sent out of the state. The insurrection, which was attributed to the teachings of the abolitionists, led to the enactment of stricter slave codes.

See S. B. Weeks, "Slave Insurrections in Virginia," in *Magazine of American History*, vol. xxxi. (New York, 1891), and W. S. Drewry, *The Southampton Insurrection* (Washington, 1900).

TURNER, SHARON (1768–1847), English historian, was born in Pentonville, London, on the 24th of September 1768. His parents came from Yorkshire. He was educated at a private school kept by Dr Davis in Pentonville, and was articled to a solicitor in the Temple in 1783, and when his master died in 1789 he continued the business. He remained in business at first in the Temple, and later in Red Lion Square till 1829, when failing health compelled him to retire. He settled for a time at Winchmore Hill, but afterwards returned to London, and died in his son's house on the 13th of February 1847. In early boyhood he had been attracted by a translation of the "Death Song of Ragnar Lodbrok," and was led by this boyish interest to make a study of early English history in Anglo-Saxon and Icelandic sources. He devoted all the time he could spare from his business to the study of Anglo-Saxon documents in the British Museum. The material was abundant and had hitherto been neglected. When the first volume of his *History of England from the earliest times to the Norman Conquest* appeared in 1799, it was at once recognized as a work of equal novelty and value. The fourth volume appeared in 1805. He also published a continuation (*History of England during the Middle Ages*), a *Modern History of England*, a *Sacred History of the World*, and a volume on *Richard III.* (1845), and he was the author of pamphlets on the copyright laws (1813).

His son, Sydney Turner (1814–1879), educated at Trinity College, Cambridge, took orders, was known as a strong partisan of reformatory schools, and died rector of Hempstead in Gloucestershire.

TURNER, WILLIAM (d. 1568), English divine, botanist and physician, was born at Morpeth in Northumberland, and was educated at Pembroke Hall, Cambridge, where he was elected junior fellow in 1530. He learnt Greek from Nicholas Ridley, and, hearing Hugh Latimer preach, threw in his lot with the new faith. In 1538 he published his *Libellus de re herbaria*, and in 1540 set out to preach in different places. For doing this without a licence he suffered imprisonment, and on his release travelled in Holland, Germany, Italy and Switzerland, always increasing his knowledge of botany and medicine, collecting plants, and writing books on religion which were so popular in England that they were forbidden by proclamation in July 1546. On the accession of Edward VI. he became chaplain and physician to the duke of Somerset and in 1550 prebendary of York. In November 1550 he was made dean of Wells, but in 1553 was deprived, and during Queen Mary's reign lived at various places in Germany, mostly along the Rhine. Returning to England in 1558 he regained his deanery, and did all he could to disparage episcopacy and ceremonial, and to bring the Anglican Church into conformity with the Reformed Churches of Germany and Switzerland. On the complaint of his bishop, Gilbert Berkeley, he was suspended for Nonconformity in 1564. He passed his last days in Crutched Friars, London, and died on the 7th of July 1568. Turner was a sound and keen botanist, and introduced lucerne into England. He was a racy writer, a man of undoubted learning, and a vigorous controversialist.

TURNHOUT, a town of Belgium, in the province of Antwerp, 26 m. N.E. of that city. Pop. (1904), 22,162. It carries on an active industry in cloth and other manufactures. There is a breeding establishment for leeches. The hôtel de ville was formerly a palace of the dukes of Brabant. Two miles west of Turnhout is the curious penal or reformatory colony of Merxplas (pop. in 1904, 2827). The system of this establishment is to allow certain approved prisoners to follow their usual occupations within a defined area. The persons detained have complete liberty of movement, subject to the two conditions that they are under the supervision of guardians and are not allowed to cross the boundaries of the settlement. They also wear a distinct dress, and each prisoner bears a number.

TURNIP, *Brassica campestris*, var. *Rapa*, a hardy biennial, found in cornfields in various parts of England. It has been cultivated from a remote period for its fleshy roots. The tender growing tops are also used in spring as a green vegetable. The so-called "root" is formed by the thickening of the primary root of the seedling together with the base of the young stem (hypocotyl) immediately above it. The great mass of the "root" consists of soft "wood" developed internally by the cambium layer and composed mainly of thin-walled, unlignified, wood-parenchyma. The stem remains short during the first year, the leaves forming a rosette-like bunch at the top of the "bulb"; they are grass-green and bear rough hairs. In the second season the bud in the centre of the rosette forms a strong erect branched stem bearing somewhat glaucous smooth leaves. The stem and branches end in corymbose racemes of small, bright yellow flowers, which are succeeded by smooth, elongated, short-beaked pods.

The varieties of turnip are classified according to their shape as (1) long varieties, with a root three or more times as long as broad; (2) tankard or spindle-shaped varieties, with a root about twice as long as broad; (3) round or globe varieties with an almost spherical root; (4) flat varieties with a root broader than long; there are also many intermediate forms. Turnips are also grouped according to the colour of the upper part of the root which comes above ground, and according to the colour of the flesh, which is white or yellow. The yellow-fleshed varieties, many of which are probably hybrids between the turnip and swede, are more robust, of slower growth and superior feeding value to the white-fleshed turnips, and are less injured by frost.

The swede-turnip, *Brassica campestris*, var. *Napo-brassica*, differs from the turnip proper in having the first foliage-leaves glaucous, not grass-green, in colour, and the later leaves smooth and glaucous; the root bears a distinct neck with well-marked leaf-scars, the flesh is yellow or reddish-orange, firmer and more nutritious, and the roots keep much better during winter. The flowers are larger and buff-yellow or pale orange in colour and the seeds are usually larger and darker than in the turnip.

Turnips should be grown in a rich friable sandy loam, such as will produce medium-sized roots without much aid from the manure heap, and are better flavoured if grown in fresh soil. In light dry soils well decomposed hotbed or farmyard manure is the best that can be used, but in soils containing an excess of organic matter, bone dust, superphosphate of lime, wood-ashes or guano, mixed with light soil, and laid in the drills before sowing the seed, are beneficial by stimulating the young plants to get quickly into rough leaf, and thus to grow out of reach of the so-called turnip fly or turnip flea (*Phyllotreta*). To get rid of this pest, it has been found beneficial to dust the plants with quicklime, and also to draw over the young plants nets smeared with some sticky substance like treacle, by which large numbers will be caught and destroyed. It has been also recommended as a palliative to sow thick in order to allow for a percentage of loss from this and other causes, but this is inadvisable, as overcrowding is apt to render the plants weak. As a preventive, gas-lime may be scattered over the surface after the seed has been sown. Lime is also effective against the disease known as "finger and toe" (*q.v.*).

The first sowing should be made on a warm border, with the protection of a frame or matted hoops, in January or February; the second on a well-sheltered border in March, after which a sowing once a month will generally suffice. In May and June the plot should be in a cool moderately shaded position, lest the plants should suffer from drought. The principal autumn and winter sowings, which are the most important, should be made about the end of June in the northern districts, and in the beginning of July in warmer districts; a small sowing may be made at the end of August to come in before the spring-sown crops are ready. If the weather is showery at the time of sowing, the seed speedily germinates, and the young plants should be kept growing quickly by watering with rain or pond water and by surface stirrings. The drills for the earliest sorts need not be more than 15 in. apart, and the plants may be left moderately thick in the row; the late crops should have at least 2 ft. between the rows, and be thinned to 12 in. in the row, a free circulation of air about them being very important in winter. As a provision against prolonged periods of severe weather it has been recommended to lay the finest roots in rows, covering them well with soil, and leaving intact the whole of the foliage. The very latest sown crops of half-grown roots will prolong the supply until the earliest spring-sown crops are fit for use.

TURNPIKE, a pike or pointed bar or stake which turns or revolves, hence the name given to a form of barrier consisting of three or more horizontal bars, with one end sharpened, revolving on a pivot. Such barriers were used across roads, and, when tolls were exacted from passengers along highways to raise the money for the upkeep of the roads, the name, though not the form, was given both to the toll-gates set up at different places where the tolls were collected, and to the highways repaired under the system (see HIGHWAY).

A "turnstile," consisting of a vertical post with projecting, revolving arms, is another form of barrier, placed by the side of a gate across a road, or across a path to prevent the passage of all except foot passengers, or at the entrance to any building, park or other place as a means of controlling the admission of people, of collecting admission money and the like.

TURNSTONE, the name long given[1] to a shore-bird, from its habit of turning over with its bill such stones as it can to seek its food in the small crustaceans or other animals lurking beneath them. It is the *Tringa interpres*[2] of Linnaeus and *Strepsilas interpres* of most later writers, and is remarkable as being perhaps the most cosmopolitan of birds; for, though properly belonging to the northern hemisphere, there is scarcely a sea-coast in the world on which it may not occur: it has been obtained from Spitzbergen to the Strait of Magellan and from Point Barrow to the Cape of Good Hope and New Zealand—examples from the southern hemisphere being, however, almost invariably in a state of plumage that shows, if not immaturity, yet an ineptitude for reproduction. It also, though much less commonly, resorts to the margins of inland rivers and lakes; but it is very rarely seen except near water, and salt water for preference.

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[1] The name seems to appear first in F. Willughby's *Ornithologia* (p. 231) in 1676; but he gave as an *alias* that of Sea-Dottrel, under which name a drawing, figured by him (pl. 58), was sent to him by Sir Thomas Browne.

[2] Linnaeus (*Oel. och Gothländska Resa*, p. 217), who first met with this bird on the island of Gottland (July 1, 1741), was under the mistaken belief that it was there called Tolk (=*interpres*). But that name properly belongs to the REDSHANK (*q.v.*), from the cry of warning to other animals that it utters on the approach of danger.

The turnstone is about as big as an ordinary snipe; but, compared with most of its allies of the group Limicolae, to which it belongs, its form is somewhat heavy, and its legs are short. Still it is brisk in its movements, and its variegated plumage makes it a pleasing bird. Seen in front, its white face, striped with black, and broad black gorget attract attention as it sits, often motionless, on the rocks; while in flight the white of the lower part of the back and white band across the wings are no less conspicuous even at a distance. A nearer view will reveal the rich chestnut of the mantle and upper wing-coverts, and the combination of colours thus exhibited suggests the term "tortoise-shell" often applied to it—the quill-feathers being mostly of a dark brown and its lower parts pure white. The deeper tints are, however, peculiar to the nuptial plumage, or are only to be faintly traced at other times, so that in winter the adults—and the young always—have a much plainer appearance, ashy-grey and white being almost the only hues observable. From the fact that turnstones may be met with at almost any season in various parts of the world, and especially on islands as the Canaries, Azores, and many of those in the British seas, it has been inferred that these birds may breed in such places. In some cases this may prove to be true, but in most evidence to that effect is wanting. In America the breeding-range of this species has not been defined. In Europe there is good reason to suppose that it includes Shetland; but it is on the north-western coast of the Continent, from Jutland to the extreme north of Norway, that the greatest number are reared. The nest, contrary to the habits of most Limicolae, is generally placed under a ledge of rock which shelters the bird from observation,[1] and therein are laid four eggs, of a light olive-green, closely blotched with brown, and hardly to be mistaken for those of any other bird. A second species of turnstone is admitted by some authors and denied by others. This is the *S. melanocephalus* of the Pacific coast of North America, which is on the average larger than *S. interpres*, and never exhibits any of the chestnut colouring.

Though the genus *Strepsilas* seems to be rightly placed among the Charadriidae (see PLOVER), it occupies a somewhat abnormal position among them, and in the form of its short pointed beak and its variegated coloration has hardly any very near relative. (A. N.)

TURNU MAGURELE, the capital of the department of Teleorman, Rumania; 2½ m. N.E. of the confluence of the Olt and Danube, at the terminus of a branch railway. Pop. (1900), 8668. A ferry plies across the Danube to the Bulgarian fortress of Nicopolis. Large quantities of grain are shipped in lighters to Braila. There are some vestiges of a Roman bridge across the Danube, built (*c.* A.D. 330) by Constantine the Great.

TURNU SEVERIN, the capital of the department of Mehedintzi, Rumania, on the main Walachian railway, and on the left bank of the river Danube, below the Iron Gates cataracts. Pop. (1900), 18,628. It is a modern commercial town, having a school of arts and crafts, several churches, and large government yards for the building of river steamers, lighters and tug-boats. There is a considerable trade in livestock, preserved meat, petroleum and cereals. The town, which was originally called Drobetae by the Romans, took its later name of Turris Severi, or the "Tower of Severus," from a tower which stood on a small hill surrounded by a deep fosse. This was built to commemorate a victory over the Quadi and Marcomanni, by the Roman emperor Severus (A.D. 222–235). Near Turnu Severin are the remains of the celebrated Trajan's bridge, the largest in the Roman Empire, built in A.D. 103 by the architect Apollodorus of Damascus. The river is about 4000 ft. broad at this spot. The bridge was composed of twenty arches supported by stone pillars, several of which are still visible at low water.

TURPENTINE (in M. Eng. *turbentine*, adapted through the O. Fr. *turbentine* or *terebentine* from Lat. *terebinthina*, sc. *resina*, resin of the terebinth, Gr. *τερέβινθος* or *τέρμινθος*), the oleo-resins which exude from certain trees, especially from some conifers—such as *Pinus sylvestris*—and from the terebinth tree, *Pistacia terebinthus, L.* It was to the product of the latter, now known as Chian turpentine, that the term was first applied. The terebinth tree and its resin were well known and highly prized from the earliest times. The tree is a native of the islands and shores of the Mediterranean, passing eastward into Central Asia; but the resinous exudation found in commerce is collected in the island of Chios. Chian turpentine is a tenacious semi-fluid transparent body, yellow to dull brown in colour, with an agreeable resinous odour and little taste. On exposure to the air it becomes dry, hard and brittle. In their natural characters, turpentines are soft solids or semi-fluid bodies, consisting of resins dissolved in turpentine oil, the chief constituent of which is pinene. They are largely used in the arts, being separated by distillation into rosin or colophony (see ROSIN), and oil or spirit of turpentine.

Crude or *common turpentine* is the commercial name which embraces the oleo-resin yielded by several coniferous trees, both European and American. The principal European product, sometimes distinguished as Bordeaux turpentine, is obtained from the cluster pine, *Pinus Pinaster*, in the Landes department of France. Crude turpentine is further yielded by the Scotch fir, *P. sylvestris*, throughout northern Europe, and by the Corsican pine, *P. Laricio*, in Austria and Corsica. In the United States the turpentine-yielding pines are the swamp pine, *P. australis*, and the loblolly, *P. Taeda*, both inhabiting North and South Carolina, Georgia and Alabama. *Venice turpentine* is yielded by the larch tree, *Larix europaea*, from which it is collected principally in Tirol. *Strassburg turpentine* is obtained from the bark of the silver fir; but it is collected only in small quantities. Less known turpentines are obtained from the mountain pine, *P. Pumilio*, the stone pine, *P. Cembra*, the Aleppo pine, *P. halepensis*, &c. The so-called *Canada balsam*, from *Abies balsamea*, is also a true turpentine.

Oil of Turpentine, or *Turps*, as a commercial product is obtained from all or any of these oleo-resins, but on a large scale only from crude or common turpentine. The essential oil is rectified by redistillation with water and alkaline carbonates, and the water which the oil carries over with it is removed by a further distillation over calcium chloride. Oil of turpentine is a colourless liquid of oily consistence, with a strong characteristic odour and a hot disagreeable taste. It begins to boil at about 155° C., and its specific gravity is between 0·860 and 0·880. It rotates the plane of polarized light both to right and left in varying degrees according to its sources, the American product being dextrorotatory and the French laevorotatory. It is almost insoluble in water, is miscible with absolute alcohol and ether, and dissolves sulphur, phosphorus, resins and caoutchouc. On exposure to the air it dries to a solid resin, and absorbing oxygen gives off ozone—a reaction utilized in the disinfectant called "Sanitas." Agitated with successive quantities of sulphuric acid and distilled in a current of steam, it yields terebene, a mixture of dipentene and terpinene mainly, which is used in medicine. Chemically, oil of turpentine is a more or less complex mixture of hydrocarbons generically named terpenes (*q.v.*). Oil of turpentine is largely used in the preparation of varnishes and as a medium by painters in their "flat" colours.

Pharmacology and Therapeutics.—Oil of turpentine (*Oleum terebinthinae*) is administered internally as an anthelmintic to kill tapeworm. Applied externally it possesses, in higher degree than any of its fellows, the properties of the volatile oils. It acts as a rubefacient, an irritant and a counter-irritant. It is also an antiseptic and, in small quantities, a feeble anaesthetic. It is absorbed by the unbroken skin. The drug is largely employed as a counter-irritant, the pharmacopoeial liniments being very useful applications. Such conditions as myalgia, bronchitis, "chronic rheumatism" and pleurisy are often relieved by its use. It may also be employed as a parasiticide in ringworm and similar conditions.

In large doses oil of turpentine causes purging and may induce much haemorrhage from the bowel; it should be combined with some trustworthy aperient, such as castor oil, when given as an anthelmintic. It is readily absorbed unchanged and has a marked contractile action upon the blood vessels. This gives it the rare and valuable property of a remote haemostatic, erroneously supposed to be possessed by so many useless drugs. It must not be used to check haemorrhage from the kidneys (haematuria) owing to its irritant action on those organs, but in haemoptysis (haemorrhage from the lungs) it is often an invaluable remedy. In large doses it has a depressant action on the nervous system, leading even to coma and total abolition of reflex action. The drug is excreted partly by the bronchi—which it tends to disinfect—and partly in the urine, which it causes to smell of violets. Glycuronic acid also appears in the urine. A small portion of the drug is removed by the skin, in which it may give rise to an erythematous rash. It must not be given to the subjects of Bright's disease.

Perhaps the most valuable of all the medicinal applications of turpentine, and one which is rarely, if ever, mentioned in therapeutic textbooks—owing to the fact that gynaecology has been so extremely specialized—is in inoperable cancer of the uterus. Quite

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[1] There is little external difference between the sexes, and the brightly contrasted colours of the hen-bird seem to require some kind of concealment.

90% of these cases are seen too late for operation, and nearly all recur after operation. The exhausting pain, the serious haemorrhages, and the abdominal septicity associated with a repulsive odour and the absorption of toxic products, which are the chief and ultimately fatal symptoms of that disease, are all directly combated by the administration of oil of turpentine. So beneficial is the action that for years there prevailed the unfortunately erroneous belief that Chian turpentine is actually curative in this condition. But it undoubtedly prolongs life, lessens suffering, and by checking the growth of bacteria upon the cancer reduces the fetid odour and the symptoms of septic intoxication.

Old turpentine and French oil of turpentine are antidotes to phosphorus, forming turpentine-phosphoric acid, which is inert.

TURPIN (d. *c.* 800), archbishop of Reims, was for many years regarded as the author of the legendary *Historia de vita Caroli Magni et Rolandi*, and appears as one of the twelve peers in a number of the *chansons de geste*. He is probably identical with Tilpin, archbishop of Reims in the 8th century, who is alluded to by Hincmar, his third successor in the see. According to Flodoard, Charles Martel drove Rigobert, archbishop of Reims, from his office and replaced him by a warrior clerk named Milo, afterwards bishop of Trier. The same writer represents Milo as discharging a mission among the Vascones, or Basques, the very people to whom authentic history has ascribed the great disaster which befell the army of Charlemagne at Roncesvalles. It is thus possible that the warlike legends which have gathered around the name of Turpin are due to some confusion of his identity with that of his martial predecessor. Flodoard says that Tilpin was originally a monk at St Denis, and Hincmar tells how after his appointment to Reims he occupied himself in securing the restoration of the rights and properties of his church, the revenues and prestige of which had been impaired under Milo's rule. Tilpin was elected archbishop between 752 and 768, probably in 753; he died, if the evidence of a diploma alluded to by Mabillon may be trusted, in 794, although it has been stated that this event took place on the 2nd of September 800. Hincmar, who composed his epitaph, makes him bishop for over forty years, and from this it is evident that he was elected about 753, and Flodoard says that he died in the forty-seventh year of his archbishopric. Tilpin was present at the Council of Rome in 769, and at the request of Charlemagne Pope Adrian I. sent him the pallium and confirmed the rights of his church.

The *Historia Caroli Magni* was declared authentic in 1122 by Pope Calixtus II. It is, however, entirely legendary, being rather the crystallization of earlier Roland legends than the source of later ones, and its popularity seems to date from the latter part of the 12th century. Gaston Paris, who made a special study of the *Historia*, considers that the first five chapters were written by a monk of Compostella in the 11th century and the remainder by a monk of Vienne between 1109 and 1119. The popularity of the work is attested by the fact that there are at least five French translations of the *Historia* dating from the 13th century and one into Latin verse of about the same time. According to August Potthast there are about fifty manuscripts of the story in existence. The *Historia* was first printed in 1566 at Frankfort; perhaps the best edition is the one edited by F. Castets as *Turpini historia Karoli magni et Rotholandi* (Paris, 1880). It has been translated many times into French and also into German, Danish and English. The English translation is by T. Rodd and is in the *History of Charles the Great and Orlando, ascribed to Turpin* (London, 1812). See G. Paris, *De pseudo-Turpino* (Paris, 1865), and *Histoire poétique de Charlemagne*, new ed. by P. Meyer (1905); and V. Friedel, "Études compostellanes" in *Otia Merceiana* (Liverpool, 1899).

TURPIN, FRANÇOIS HENRI (1709–1799), French man of letters, was born at Caen. He was first a professor at the university of his native town, then went to seek his fortunes in Paris, where he made some stir in philosophical circles, and especially in that of the magnificent Helvétius; but he was only enabled with difficulty to earn a livelihood by putting his pen at the service of the booksellers. He translated, or rather adapted from the English, Edward W. Montague's *Histoire du gouvernement des anciennes républiques* (1769), and wrote a continuation of Father Pierre Joseph d'Orléans, *Histoire des révolutions d'Angleterre* (1786). His *Histoire naturelle et civile du royaume de Siam* (1771) is an interesting but faulty adaptation of the observations of a vicar-apostolic who had lived for a long time in that country, and who accused Turpin of having misrepresented his ideas. His chief work, *La France illustre, ou Le Plutarque français*, contains the biographies of generals, ministers, and eminent officers of the law (5 vols., 1777–1790), in which, however, as La Harpe said, he showed himself to be "ni Plutarque ni Français." He also wrote an *Histoire des hommes publics tirés du tiers état* (1789).

TURPIN, RICHARD [Dick] (1706–1739), English robber, was born in 1706 at Hempstead, near Saffron Walden, Essex, where his father kept an alehouse. He was apprenticed to a butcher, but, having been detected at cattle-stealing, joined a notorious gang of deer-stealers and smugglers in Essex. This gang also made a practice of robbing farmhouses, terrorizing the women in the absence of their husbands and brothers, and Turpin took the lead in this class of outrage. On the gang being broken up Turpin went into partnership with Tom King, a well-known highwayman. To avoid arrest he finally left Essex for Lincolnshire and Yorkshire, where he set up under an assumed name as a horse dealer. He was convicted at York assizes of horse-stealing and hanged on the 7th of April 1739. Harrison Ainsworth, in his romance *Rookwood*, gives a spirited account of a wonderful ride by Dick Turpin on his mare, Black Bess, from London to York, and it is in this connexion that Turpin's name has been generally remembered. But as far as Turpin is concerned the incident is pure fiction. A somewhat similar story was told about a certain John Nevison, known as "Nicks," a well-known highwayman in the time of Charles II., who to establish an alibi rode from Gad's Hill to York (some 190 m.) in about 15 hours. Both stories are possibly only different versions of an old north road myth.

TURQUOISE, a mineral much used as an ornamental stone for the sake of its blue or bluish-green colour. It is generally held that the name indicates its source as a stone from Turkey, the finest kinds having come from Persia by way of Turkey, whence it was called by the Venetians who imported it *turchesa*, and by the French *turquoise*. The old form *turkis*, used by Tennyson, agrees with the German *Türkis*. Some authorities have suggested that the word may be a corruption of the Persian name of the stone *piruzeh*. Turquoise is a crypto-crystalline mineral, occurring in small reniform nodules or as an incrustation, or in thin seams and disseminated grains. Its mode of occurrence suggests its formation by deposition from solution, and indeed it is sometimes found in stalactitic masses. The typical colour is a delicate sky-blue, but the blue passes by every transition into green. In some cases the colour deteriorates as the stone becomes dry, and may be seriously affected by exposure to sunlight; whilst with age there is often a tendency to become green, as seen in examples of ancient turquoise. The mineral is always opaque in mass, but generally translucent in thin splinters. Turquoise takes a fair polish, but the lustre is feeble, and inclines to be waxy; the hardness is nearly 6, the specific gravity between 2·6 and 2·8.

Much discussion has arisen as to the chemical composition of turquoise. It is commonly regarded as a hydrous aluminium phosphate having the composition $2Al_2O_3 \cdot P_2O_5 \cdot 5H_2O$ or rather $Al_2HPO_4(OH)_4$, coloured with a variable proportion of a copper phosphate, or perhaps partly with an iron phosphate. Professor S. L. Penfield, however, has been led by careful analysis of turquoise from Nevada to propose the general formula: $[Al(OH)_2,Fe(OH)_2,Cu(OH),H]_3PO_4$. Hence turquoise may be regarded chemically as derived from orthophosphoric acid by replacement of the hydrogen by the univalent radicles $Al(OH)_2$, &c. An ingenious counterfeit of turquoise has been formed by compressing a precipitate of cupriferous aluminium phosphate.

Turquoise is usually cut as an ornamental stone in circular or elliptical form, with a low convex surface. In the East, where it is used not only for personal ornament but for the decoration of dagger-handles, horse-trappings, &c., the pieces are not unusually of irregular shape; and when worn as amulets the turquoise is often engraved with Oriental inscriptions, generally passages from the Korān, the incised characters being gilt or inlaid with gold wire. The turquoise has always been associated with curious superstitions, the most common being the notion that it changes colour with variations in the state of the owner's health or even in sympathy with his affections. It is commonly held to be a "lucky stone."

In Persia, where the finest turquoise is found, the mines have been worked for at least eight centuries. The workings have been described by General Houtum Schindler, an Austrian, who was at one time in charge of the mines. The principal locality is north-west of the village of Madan, on the southern slopes of Mt Ali-Mirsai, a peak near Nishapur, in the province of Khorasan. Here the turquoise occurs in narrow seams in a brecciated trachyte-porphyry. It is found also in some other localities in Persia and in Turkestan. Jean Baptiste Tavernier (1605–1689) states that the best turquoise, reserved for the sole use of the shah, was obtained from the Vieille Roche, whilst inferior stones were got from the Nouvelle Roche. These terms still survive, for turquoise of fine colour is sometimes said in trade to be from the "old rock," and that of pale tint or of unstable colours is described as from the "new rock." The latter is sometimes not true Oriental turquoise, but the material called "bone-turquoise" or odontolite, and known also as "occidental turquoise." This is merely fossil bone or ivory coloured by iron phosphate (vivianite) or perhaps stained in some cases by cupriferous solutions, and is readily distinguished from true turquoise by showing organic structure under the microscope. Bone-turquoise occurs in Europe; and it may be noted that mineral turquoise also is known from certain localities in Saxony and Silesia, but the quantity is very limited and the quality poor, so that it has no commercial importance. Chrysocolla has been sometimes mistaken in various parts of the world for turquoise.

In 1849 turquoise was found by Major C. Macdonald in Wadi Maghara and Wadi Sidreh in the Sinaitic Peninsula; and a large series of the specimens was shown in the Great Exhibition of 1851. According to H. Bauerman, who described the locality geologically, the turquoise occurs in a red sandstone, in the form of embedded nodules and as an incrustation lining the joint-faces. The turquoise was worked for some time by Macdonald, and many years afterwards workings were resumed on a systematic scale by an English company, but without great success. Relics of extensive ancient mining operations for turquoise show that the rock was at one time worked with flint implements. The locality was examined by Professor Flinders Petrie in 1905.

In ancient Mexico much use was made of turquoise as an inlay for mosaic work, with obsidian, malachite, shell and iron pyrites. Such work is illustrated by fine specimens in the ethnographical gallery of the British Museum and elsewhere. Relics of extensive workings are found in the mountains of Los Cerillos near Santa Fé in New Mexico, where mining for turquoise is now actively carried on. One of the hills in which old workings occur has been called Mt Chalchihuitl, since it is believed that the turquoise was known by the name chalchihuitl, which in some places was applied also to jade. Another of the Cerillos hills in which workings have been opened up is called Turquoise Hill. The matrix at Los Cerillos is described by D. W. Johnson as an altered angite-andesite, in which the turquoise occurs in thin veins and in small nodules in patches of kaolin. It appears probable that the alumina of the turquoise was derived from the alteration of felspar, and the phosphorus from apatite in the rock, whilst the copper was brought up by heated vapours which altered the andesite. Turquoise is found also at Turquoise Mountain, Cochise county, Arizona, and at Mineral Park, Mohave county, in the same state; it occurs in the Columbus district, southern Nevada; in Fresno county, California; and near Idaho, Clay county, Alabama. Mexican turquoise is known from the state of Zacatecas. Turquoise was discovered in 1894 near Bodalla, in New South Wales; and it has also been found in Victoria.

Turquoise is sometimes termed by mineralogists callaite, since it is believed to be the *callais* of Pliny—a stone which he describes as resembling lapis lazuli, but paler, and in colour more like the shallow sea. The *callaina* of Pliny was a pale green stone from beyond India, whilst his *callaica* was a kind of turbid callaina. The name callainite was suggested by Professor J. D. Dana for a bright green mineral which was found in the form of beads, with stone hatchets, in ancient graves near Mané-er-H'roek (Rock of the Fairy), near Locmariaquer in Brittany, and which A. Damour sought to identify with Pliny's *callais*. The mineral in question seems to be identical with variscite, a hydrous aluminium phosphate named by A. Breithaupt, and occurring as a beautiful green amorphous mineral, sometimes polished as an ornamental stone; fine examples occur in Utah. Somewhat allied to turquoise is the blue mineral called lazulite (to be distinguished from lazurite, see Lapis Lazuli), which has the formula $(Fe_2Mg)Al_2(OH)(PO_4)$, and has occasionally been used as an ornamental stone. (F. W. R.*)

TURRET (from O. Fr. *tourette*, diminutive of *tour*, tower, mod. Fr. *tourelle*), a small tower, especially at the angles of larger buildings, sometimes overhanging and built on corbels, when it is often called a "bartizan" (*q.v.*), and sometimes rising from the ground.

TURRETIN, or Turretini, the name of three Swiss divines.

Benoît Turretin (1588–1631), the son of Francesco Turretini, a native of Lucca, who settled in Geneva in 1579, was born at Zürich on the 9th of November 1588. He was ordained a pastor in Geneva in 1612, and became professor of theology in 1618. In 1620 he represented the Genevan Church at the national synod of Alais, when the decrees of the synod of Dort were introduced into France; and in 1621 he was sent on a successful mission to the states-general of Holland, and to the authorities of the Hanseatic towns, with reference to the defence of Geneva against the threatened attacks of the duke of Savoy. He published in 1618–1620 (2 vols.) a defence of the Genevan translation of the Bible, *Eine Verteidigung der genfer Bibelübersetzung* (*Défense de la fidélité des traductions de la Bible faites à Genève*), against P. Cotton's *Genève plagiaire.* He died on the 4th of March 1631.

François Turretin (1623–1687), son of the preceding, was born at Geneva on the 17th of October 1623. After studying theology in Geneva, Leiden and France, he became pastor of the Italian congregation in Geneva in 1647; after a brief pastorate at Lyons he again returned to Geneva as professor of theology in 1653, having modestly declined a professorship of philosophy in 1650. He was one of the most influential supporters of the *Formula Consensus Helvetica*, drawn up chiefly by Johann Heinrich Heidegger (1633–1698), in 1675, and of the particular type of Calvinistic theology which that symbol embodied, and an opponent of the theology of Moses Amyraut and the school of Saumur. His *Institutio theologicae elencticae* (3 vols., Geneva 1680–1683) has passed through frequent editions, the last reprint having been made in Edinburgh in 1847–1848. He was also the author of volumes entitled *De satisfactione Christi disputationes* (Geneva, 1666) and *De necessaria secessione nostra ab ecclesia romana* (Geneva, 1687). He died on the 28th of September 1687.

Jean Alphonse Turretin (1671–1737), son of the preceding, was born at Geneva on the 13th of August 1671. He studied theology at Geneva under L. Tronchin, and after travelling in Holland, England and France was received into the "Vénérable Compagnie des Pasteurs" of Geneva in 1693. Here he became pastor of the Italian congregation, and in 1697 professor of church history, and later (1705) of theology. During the next forty years of his life he enjoyed great influence in Geneva as the advocate of a more liberal theology than had prevailed under the preceding generation, and it was largely through his instrumentality that the rule obliging ministers to subscribe to the *Formula Consensus Helvetica* was abolished in 1706, and the *Consensus* itself renounced in 1725. He also wrote and laboured for the promotion of union between the Reformed and Lutheran Churches, his most important work in this connexion being *Nubes testium pro moderato et pacifico de rebus theologicis judicio, et instituenda inter Protestantes concordia* (Geneva, 1729). Besides this he wrote *Cogitationes et disseriationes theologicae*, on the principles of natural and revealed religion (2 vols., Geneva, 1737; in French, *Traité de la vérité de la religion chrétienne*) and commentaries on Thessalonians and Romans. He died on the 1st of May 1737.

See E. de Budé, *François et J. Alphonse Turretini* (2 vols., 1880), and *Lettres inédites à Jean Alphonse Turretini* (3 vols., 1887–1888); F. Turretini, *Notice biographique sur Bénédict Turretini* (1871); C. Borgeaud, *Histoire de l'université de Genève* (1900).

TURRIFF, a municipal and police burgh of Aberdeenshire, Scotland. Pop. (1901), 2273. It lies near the Deveron, 38½ m. N.W. of Aberdeen by the Great North of Scotland railway, via Inveramsay. In the choir of the ancient church, now in ruins, is a fresco painting of St Ninian. On the 14th of May 1639 the national struggle for civil and religious liberty was inaugurated in the county with the skirmish known as the Trot of Turriff. Some 4 m. south are the remains of the castle of Towie Barclay, the seat of the old family of the Barclays.

TURRIS LIBISONIS (mod. Porto Torres, *q.v.*), an ancient seaport town of Sardinia, situated at the north-western extremity of the island, and connected with Carales by two roads, which diverged at Othoca, one (the more important) keeping inland and the other following the west coast. It was probably of purely Roman origin, founded apparently by Julius Caesar, as it bears the title Colonia Julia; and in Pliny's time it was the only colony in the island. It is noteworthy that it apparently belonged to one of the urban tribes, the Collina; Puteoli, which belonged to the Palatina is the only other exception to the rule that *municipia* and *coloniae* were not enrolled in the urban tribes. A Roman bridge of seven arches, somewhat restored in modern times, the ruins of a temple (now known as Il Palazzo del Re Barbaro), which an inscription found there shows to have been restored (A.D. 247–249) by the *praefectus* of the province, together with the basilica, an aqueduct, various buildings (S. Valero Usni in *Notizie degli scavi* (1882), 121, A. Taramelli, ibid. (1904), 145) and some rock tombs, still exist.

The inscriptions from Turris Libisonis are given by Th. Mommsen in *Corp. inscr. lat* x. 826; V. Dessì in *Notizie degli scavi* (1898), 260; A. Taramelli, ibid. (1904), 141. One of them (*C.I.L.* No. 7954) mentions the construction of a fountain basin, another the construction of a quay (*ripa turritana*): substructions may still be seen under water when the sea is clear. (T. As.)

TURSHIZ, a district of the province of Khorasan in Persia, lying E. of the great salt desert. It has a population of nearly 20,000 and pays a yearly revenue of about £7000. It produces and exports wool, cotton, silk and much dried fruit, of the latter particularly raisins and Alū Bukhara, "Bokhara prunes." The chief place and capital of the district is Sultanabad, generally called Turshiz, like the district, situated 225 m. south-east by east from Shahrud and 100 m. south-west from Meshed, in 35° 10′ N. 58° 34′ E., at an elevation of 2200 ft. It is surrounded by a dilapidated wall and has a population of about 8000.

TURTON, an urban district in the Westhoughton parliamentary division of Lancashire, England, 4 m. N. of Bolton, on the Lancashire & Yorkshire railway. Pop. (1901), 12,355. Its modern growth is the result of the development of the cotton trade in its various branches; and there are large stone quarries in the vicinity. There remains in the township a curious building named Turton Tower, dating principally from the 16th century, and containing some fine contemporary woodwork.

TUSCALOOSA, a city and the county-seat of Tuscaloosa county, Alabama, U.S.A., in the west-central part of the state, on the Black Warrior river, about 55 m. S.W. of Birmingham and about 100 m. N.W. of Montgomery. Pop. (1900), 5094; (local census, 1908), 7140 (3551 negroes); (1910 U.S. census), 8407. It is served by the Alabama Great Southern and the Mobile & Ohio railways. The Black Warrior river, formerly not navigable beyond Tuscaloosa, has been improved by the United States government, and there are three locks in or near the city. Tuscaloosa lies between the foothills of the Appalachians to the north-east and the low alluvial valley of the Black Warrior. It has many old-fashioned residences and gardens, and a fine Federal building. It is the seat of the university of Alabama; of the Alabama Central Female College (Baptist, 1858), which occupies the old state capitol; of the Tuscaloosa Female College (Methodist Episcopal, South, 1860); of Stillman Institute (Presbyterian, 1876; originally the Tuscaloosa Institute for the Education of Coloured Ministers; named in honour of its founder, Dr Charles A. Stillman, in 1897); and of Alabama Bryce Hospital for the Insane (1861). The university of Alabama was founded by an act of the state legislature of 1820, the United States government having donated 46,080 acres of public lands for this purpose in the preceding year; in 1831 the university was opened at Tuscaloosa, then the state capital. On the 4th of April 1865 all the buildings of the university, except the observatory, were burned by a body of Federal cavalry, and the university was closed thereafter until 1869; in 1884 the United States government gave another 46,080 acres of public lands in restitution, and in 1907 the state legislature appropriated $445,000 for new buildings. The university is a part of the public school system of the state, and is governed by a board of trustees, consisting of the governor and the superintendent of education of the state, of two members from the congressional district in which the university is situated, and of one member from each of the other congressional districts of the state. The university includes, besides a college and a graduate school, departments of engineering, law, medicine (formerly the Medical College of Alabama, established in 1859) and pharmacy (the two last in Mobile), and a summer school for teachers, and in 1908-9 had 60 instructors and 887 students. In the city there are several manufacturing establishments, principally cotton and lumber mills; and in the immediate vicinity there are important coal, coke and iron interests—there is a large iron furnace, pipe foundry and coking plant at Holt, about 4 m. north-east of the city.

Tuscaloosa derives its name from an Indian chief, who, after a desperate battle with De Soto at Mauvilla (the site of which is not definitely known) in 1540, is said to have hanged himself in order to escape capture, and is commemorated by a granite monolith in the Court House Square; the name is said to mean "black warrior." The first settlement of whites was made in 1815. The city was chartered in 1819, and in 1826–1846 it was the capital of Alabama.

TUSCANA (mod. Toscanella, *q.v.*), an ancient town of Etruria, about 15 m. N.E. of Tarquinii. It is hardly mentioned in ancient literature; it was a station on the road from Blera to Saturnia, a prolongation of the Via Clodia. On the hill of S. Pietro are remains of walling of the Roman period. A number of Etruscan tombs were found by the Campanari brothers in the 19th century, and their valuable contents are in various European museums.

TUSCANY (*Toscana*), a territorial division of Italy, consisting of the western part of the centre of the peninsula, bounded N.W by Liguria and Emilia, E. by the Marches and Umbria, S.E. by the province of Rome and W. by the Mediterranean. It consists of eight provinces, Arezzo, Firenze (Florence), Grosseto, Livorno (Leghorn), Lucca, Massa-Carrara, Pisa and Siena, and has an area of 9304 sq. m. Pop. (1901), 2,566,741. The chief railway centre is Florence, whence radiate lines to Bologna (for Milan and the north), Faenza, Lucca, Pisa and Leghorn, and Arezzo for Rome. Siena stands on a branch leaving the Florence-Pisa line at Empoli and running through the centre of Tuscany to Chiusi, where it joins the Florence-Rome railway. The line from Rome to Genoa runs along the coast throughout the entire length of Tuscany, and at Montepescali throws off a branch joining the Empoli-Chiusi line at Asciano, and at Follonica another to Massa Marittima.

Except towards the coast and around Lucca, Florence and Arezzo, where the beds of prehistoric lakes form plains, the country is hilly, being intersected with sub-Apennine spurs. The most fertile country in Tuscany is in the valley of the Arno, where the plains and slopes of the hills are highly cultivated. In strong contrast with this is the coast plain known as the Maremma, 850 sq. m. in extent, where malaria has been prevalent since the depopulation of the country in the middle ages. Here in the first half of the 19th century the grand duke Leopold II. of Tuscany began an elaborate system of drainage, which was gradually extended until it covered nearly the whole of the district. The greater part of the Maremma now affords pasture to large herds of horses and half-wild cattle, but on the drier parts corn is grown, the people coming down from the hills to sow and to reap. The hill country just inland, especially near Volterra, has poor soil, largely clayey, and subject to landslips, but is rich in minerals. But for the Maremma, Tuscany is one of the most favoured regions of Italy. The climate is temperate, and the rainfall not excessive. The Apennines shelter it from the cold north winds, and the prevailing winds in the west, blowing in from the Tyrrhenian Sea, are warm and humid, though Florence is colder and more windy than Rome in the winter and hotter in summer, owing to its being shut in among the mountains. Wheat, maize, wine (especially the red wine which takes the name of Chianti from the district S.S.W. of Florence), olive oil, tobacco, chestnuts and flowers are the chief products of Tuscany. Mules, sheep and cattle are bred, and beeswax is produced in large quantities. But the real wealth of Tuscany lies in its minerals. Iron, mercury, boracic acid, copper, salt, lignite, statuary marble, alabaster and Sienese earth are all found in considerable quantities, while mineral and hot springs abound, some of which (*e.g.* Montecatini and Bagni di Lucca) are well known as health resorts. The industries of Tuscany are exceedingly varied and carried on with great activity. There are universities at Pisa and Siena. Viareggio and Leghorn are much frequented for sea-bathing, while the latter is a prosperous port.

The main art centres of Tuscany are Florence, Pisa and Siena, the headquarters of the chief schools of painting and sculpture from the 13th century onwards. While the former city, however, bore as prominent a part as any in Italy in the Renaissance, the art of Pisa ceased, owing to the political decline of the city, to make any advance at a comparatively early period, its importance being in ecclesiastical architecture in the 12th, and in sculpture in the 13th century. Siena, too, never accepted the Renaissance to the full, and its art retained an individual character without making much progress.

The language of Tuscany is remarkable for its purity of idiom, and its adoption by Dante and Petrarch probably led to its becoming the literary language of Italy. (See ITALIAN LANGUAGE, vol. xiv. p. 895.)

See E. Repetti, *Dizionario geografico fisico storico della Toscana* (6 vols., Florence, 1834–1846). See also G. Dennis, *Cities and Cemeteries of Etruria* (2 vols., London, 1883). On medieval and Renaissance architecture and art there are innumerable works. Among those on architecture may be mentioned the great work of H. von Geymüller and A. Widmann, *Die Architektur der Renaissance in Toscana*. (T. As.)

History.—Etruria (*q.v.*) was finally annexed to Rome in 351 B.C., and constituted the seventh of the eleven regions into which Italy was, for administrative purposes, divided by Augustus. Under Constantine it was united into one province with Umbria, an arrangement which subsisted until at least 400, as the *Notitia* speaks of a "consularis Tusciae et Umbriae." In Ammianus Marcellinus there is implied a distinction between "Tuscia suburbicaria" and "Tuscia annonaria," the latter being that portion which lies to the north of the Arno. After the fall of the Western empire Tuscia, with other provinces of Italy, came successively under the sway of Herulians, Ostrogoths, and Greek and Lombard dukes. Under the last-named, "Tuscia Langobardorum," comprising the districts of Viterbo, Corneto and Bolsena, was distinguished from "Tuscia Regni," which lay more to the north. Under Charlemagne the name of Tuscia or Toscana became restricted to the latter only. One of the earliest of the Frankish marquises was Boniface, either first or second of that name, who about 828 fought with success against the Saracens in Africa. Adalbert I., who succeeded him, in 878 espoused the cause of Carloman as against his brother Louis III. of France, and suffered excommunication and imprisonment in consequence. Adalbert II. (the Rich), who married the ambitious Bertha, daughter of Lothair, king of Lorraine, took a prominent part in the politics of his day. A subsequent marquis, Hugo (the Great), became also duke of Spoleto in 989. The male line of marquises ended with Boniface II. (or III.), who was murdered in 1052. His widow, Beatrice, in 1055 married Godfrey, duke of Lorraine, and governed the country till her death in 1076, when she was succeeded by Matilda (*q.v.*), her only child by her first husband. Matilda died in 1114 without issue, bequeathing all her extensive possessions to the Church. The consequent struggle between the popes, who claimed the inheritance, and the emperors, who maintained that the countess had no right to dispose of imperial fiefs, enabled the principal cities of Tuscany gradually to assert their independence. The most important of these Tuscan republics were Florence, Pisa, Siena, Arezzo, Pistoia and Lucca.

The Return of the Medici.—After the surrender of Florence to the Imperialists in August 1530 the Medici power was re-established by the emperor Charles V. and Pope Clement VII., although certain outward forms of republicanism were preserved, and Alessandro de' Medici was made duke of Florence, the dignity to be hereditary in the family. In the reign of Cosimo III. Siena was annexed (1559); the title of grand duke of Tuscany was conferred on that ruler in 1567 by Pope Pius V. and recognized in the person of Francis I. by the emperor Maximilian II. in 1576. Under a series of degenerate Medici the history of Tuscany is certainly not a splendid record, and few events of importance occurred save court scandals. The people became more and more impoverished and degraded, a new and shoddy nobility was created and granted wide privileges, and art and letters declined. Giovan Gastone was the last Medicean grand duke; being childless, it was agreed by the treaty of Vienna that at his death Tuscany should be given to Francis, duke of Lorraine, husband of the archduchess Maria Theresa, afterwards empress. In 1737 Giovan Gastone died,[1] and Francis II., after taking possession of the grand duchy, appointed a regency under the prince of Craon and departed for Austria never to return. Tuscany was governed by a series of foreign regents and was a prey to adventurers from Lorraine and elsewhere; although the administration was not wholly inefficient and introduced some useful reforms, the people were ground by taxes to pay for the apanage of Francis in Vienna and for Austrian wars, and reduced to a state of great poverty. Francis, who had been elected emperor in 1745, died in 1765, and was succeeded on the throne of the grand duchy by his younger son, Leopold I.

The Reforms of Leopold II.

Leopold resided in Tuscany and proved one of the most capable and remarkable of the reforming princes of the 18th century. He substituted Tuscans for foreigners in government offices, introduced a system of free trade in foodstuffs (at the suggestion of the Sienese Sallustio Bandini), promoted agriculture, and reclaimed wide areas of marshland to intensive cultivation. He reorganized taxation on a basis of equality for all citizens, thereby abolishing one of the most vexatious privileges of the nobility, reformed the administration of justice and local government, suppressed torture and capital punishment, and substituted a citizen militia for the standing army. His reforms in church matters made a great stir at the time, for he curbed the power of the clergy, suppressed some religious houses, reduced the mortmain and rejected papal interference. With the aid of Scipione de' Ricci, bishop of Pistoia, he even attempted to remove abuses, reform church discipline and purify religious worship; but Ricci's action was condemned by Rome. Ricci was forced to resign, and the whole movement came to nothing. (See PISTOIA, SYNOD OF.) The grand duke also contemplated granting a form of constitution, but his Teutonic rigidity was not popular and many of his reforms were ahead of the times and not appreciated by the people. At the death of his brother, Joseph II., in 1790, Leopold became emperor, and repaired to Vienna. After a brief regency he appointed his second son, Ferdinand III., who had been born and brought up in Tuscany, grand duke.

The French Occupation.

During the French revolutionary wars Ferdinand tried to maintain neutrality so as to avoid foreign invasions, but in 1799 a French force entered Florence and was welcomed by a small number of republicans. The grand duke was forced to fly, the "tree of liberty" was set up, and a provisional government on French lines established. But the great mass of the people were horrified at the irreligious character of the new régime, and a counter-revolution, fomented by Pope Pius VII., the grand ducalists and the clergy, broke out at Arezzo. Bands of armed peasants marched through the country to the cry of "Viva Maria!" and expelled the French, not without committing many atrocities. With the assistance of the Austrians, who put an end to disorder, Florence was occupied and the grand ducalists established a government in the name of Ferdinand. But after Napoleon Bonaparte's victory at Marengo the French returned in great force, dispersed the bands, and re-entered Florence (October 1800). They too committed atrocities and sacked the churches, but they were more warmly welcomed than before by the people, who had experienced Austro-Aretine rule. Joachim Murat (afterwards king of Naples) set up a provisional government, and by the peace of Lunéville Tuscany was made a part of the Spanish dominions and erected into the kingdom of Etruria under Louis, duke of Parma (1801). The new king died in 1803, leaving an infant son, Charles Louis, under the regency of his widow, Marie Louise of Spain. Marie Louise ruled with reactionary and clerical tendencies until 1807, when the emperor Napoleon obliged Charles IV. of Spain to cede Tuscany to him, compensating Charles Louis in Portugal.

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[1] The history of Tuscany from 1530 to 1737 is given in greater detail under MEDICI.

From 1807 to 1809, when Napoleon's sister, Elisa Baciocchi, was made grand duchess, Tuscany was ruled by a French administrator-general; the French codes were introduced, and Tuscany became a French department. French ideas had gained some adherents among the Tuscans, but to the majority the new institutions, although they produced much progress, were distasteful as subversive of cherished traditions. After Napoleon's defeats in 1814 Murat seceded from the emperor and occupied Tuscany, which he afterwards handed over to Austria, and in September Ferdinand III. returned, warmly welcomed by nearly everybody, for French rule had proved oppressive, especially on account of the heavy taxes and the drain of conscription. At the Congress of Vienna he was formally reinstated with certain additions of territory and the reversion of Lucca. On Napoleon's escape from Elba Murat turned against the Austrians, and Ferdinand had again to leave Florence temporarily; but he returned after Waterloo, and reigned until his death in 1824.

The Restoration.

The restoration in Tuscany was unaccompanied by the excesses which characterized it elsewhere, and much of the French legislation was retained. Ferdinand was succeeded by his son, Leopold II., who continued his father's policy of benevolent but somewhat enervating despotism, which produced marked effects on the Tuscan character. In 1847 Lucca was incorporated in the grand duchy. When the political excitement consequent on the election of Pius IX. spread to Tuscany, Leopold made one concession after another, and in February 1848 granted the constitution. A Tuscan contingent took part in the Piedmontese campaign against Austria, but the increase of revolutionary agitation in Tuscany, culminating in the proclamation of the republic (Feb. 9, 1849), led to Leopold's departure for Gaeta to confer with the pope and the king of Naples. Disorder continuing and a large part of the population being still loyal to him, he was invited to return, and he did so, but accepted the protection of an Austrian army, by which act he forfeited his popularity (July 1849). In 1852 he formally abrogated the constitution, and three years later the Austrians departed. When in 1859 a second war between Piedmont and Austria became imminent, the revolutionary agitation, never completely quelled, broke out once more. There was a division of opinion between the moderates, who favoured a constitutional Tuscany under Leopold, but forming part of an Italian federation, and the popular party, who aimed at the expulsion of the house of Lorraine and the unity of Italy under Victor Emmanuel. At last a compromise was arrived at and the grand duke was requested to abdicate in favour of his son, grant a constitution, and take part in the war against Austria. Leopold having rejected these demands, the Florentines rose as one man and obliged him to quit Tuscany (April 27, 1859). A provisional government, led by Ubaldino Beruzzi and afterwards by Bettino Ricasoli, was established. It declared war against Austria and then handed over its authority to Boncompagni, the Sardinian royal commissioner (May 9). A few weeks later a French force under Prince Napoleon landed in Tuscany to threaten Austria's flank, but in the meanwhile the emperor Napoleon made peace with Austria and agreed to the restoration of Leopold and other Italian princes. Victor Emmanuel was obliged to recall the royal commissioners, but together with Cavour he secretly encouraged the provisional governments to resist the return of the despots, and the constituent assemblies of Tuscany, Romagna and the duchies voted for annexation to Sardinia. A Central Italian military league and a customs union were formed, and Cavour having overcome Napoleon's opposition by ceding Nice and Savoy, the king accepted the annexations and appointed his kinsman, Prince Carignano, viceroy of Central Italy with Ricasoli as governor-general (March 22, 1860). The Sardinian parliament which met in April contained deputies from Central Italy, and after the occupation of the Neapolitan provinces and Sicily the kingdom of Italy was proclaimed (Feb. 18, 1861). In 1865, in consequence of the Franco-Italian convention of September 1864, the capital was transferred from Turin to Florence, where it remained until it was removed to Rome in 1871.

Union with the Italian Kingdom.

Since the union with Italy, Tuscany has ceased to constitute a separate political entity, although the people still preserve definite regional characteristics. It has increased in wealth and education, and owing to a good system of land tenure the peasantry are among the most prosperous in Italy.

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TUSCARORA, a tribe of North American Indians of Iroquoian stock. Their former range was on the Neuse river, North Carolina. Here in 1700 they lived in fifteen villages and were estimated at 6000. In 1711, as a protest against the encroachments on their territory, they declared war on the white settlers. After two years they were defeated and fled north to the Iroquois, in whose famous league they became the sixth nation, settling on the territory of the Oneida Indians, in New York state. In the War of American Independence some of the tribe fought for the English and some against them. The remnant of them is divided between reservations in Canada and New York, and numbers about 700.

TUSCULUM, an ancient city of Latium, situated in a commanding position on the north edge of the outer crater ring of the Alban volcano, 1½ m. N.E. of the modern Frascati. The highest point is 2198 ft. above sea-level. It has a very extensive view of the Campagna, with Rome lying 15 m. distant to the north-west. Rome was approached by the Via Latina (from which a branch road ascended to Tusculum, while the main road passed through the valley to the south of it), or by the Via Tusculana (though the antiquity of the latter road is doubtful).

According to tradition, the city was founded by Telegonus, the son of Ulysses and Circe. When Tarquinius Superbus was expelled from Rome his cause was espoused by the chief of Tusculum, Octavius Mamilius, who took a leading part in the formation of the Latin League, composed of the thirty principal cities of Latium, banded together against Rome. Mamilius commanded the Latin army at the battle of Lake Regillus (497 B.C.), but was killed, and the predominance of Rome among the Latin cities was practically established. According to some accounts Tusculum became from that time an ally of Rome, and on that account frequently incurred the hostility of the other Latin cities. In 381 B.C., after an expression of complete submission to Rome, the people of Tusculum received the Roman franchise, but without the vote, and thenceforth the city continued to hold the rank of a *municipium*. Other accounts, however, speak of Tusculum as often allied with Rome's enemies —last of all with the Samnites in 323 B.C. Several of the chief Roman families were of Tusculan origin, *e.g.* the gentes Mamilia, Fulvia, Fonteia, Juventia and Porcia; to the last-named the celebrated Catos belonged. The town council kept the name of senate, but the title of dictator gave place to that of aedile. Notwithstanding this, and the fact that a special college of Roman *equites* was formed to take charge of the cults of the gods at Tusculum, and especially of the Dioscuri, the citizens resident there were neither numerous nor men of distinction. The villas of the neighbourhood had indeed acquired greater importance than the not easily accessible town itself, and by the end of the Republic, and still more during the imperial period, the territory of Tusculum was one of the favourite places of residence of the wealthy Romans. The number and extent of the remains almost defy description, and can only be made clear by a map. Even in the time of Cicero we hear of eighteen owners of villas there. Much of the territory (including Cicero's villa), but not the town itself, which lies far too high, was supplied with water by the Aqua Crabra. On the hill of Tusculum itself are remains of a small theatre (excavated in 1839), with a reservoir behind it, and an amphitheatre. Both belong probably to the imperial period, and so does a very large villa (the substructures of which are preserved), by some attributed, but wrongly, to Cicero, by others to Tiberius, near the latter. Between the amphitheatre and the theatre is the site of the Forum, of which nothing is now visible, and to the south on a projecting spur were tombs of the Roman period. There are also many remains of houses and villas. The citadel—which stood on the highest point an abrupt rock—was approached only on one side, that towards the city, and even here by a steep ascent of 150 ft. Upon it remains of the medieval castle, which stood here until 1191, alone are visible. The city walls, of which some remains still exist below the theatre, are built of blocks of the native "lapis Albanus" or peperino. They probably belong to the republican period. Below them is a well-house, with a roof formed of a pointed arch—generally held to go back to a somewhat remote antiquity, but hardly with sufficient reason.

The most interesting associations of the city are those connected with Cicero, whose favourite residence and retreat for study and literary work was at, or rather near, Tusculum. It was here that he composed his celebrated *Tusculan Disputations* and other philosophical works. Much has been written on the position of his villa, but its true site still remains doubtful. The theory, which places it at or near Grotta Ferrata, some distance farther to the west, has most evidence to support it. Although Cicero (*Pro Sestio*, 43) speaks of his own house as being insignificant in size compared to that of his neighbour Gabinius, yet we gather from other notices in various parts of his works that it was a considerable building. It comprised two gymnasia (*Div.* i. 5), with covered *porticus* for exercise and philosophical discussion (*Tusc. Disp.* ii. 3). One of these, which stood on higher ground, was called "the Lyceum," and contained a library (*Div.* ii. 3); the other, on a lower site, shaded by rows of trees, was called "the Academy." The main building contained a covered *porticus*, or cloister, with apsidal recesses (*exedrae*) containing seats (see *Ad Fam.* vii. 23). It also had bathrooms (*Ad Fam.* xiv. 20), and contained a number of works of art, both pictures and statues in bronze and marble (*Ep. ad Att.* i. 1, 8, 9, 10). The central atrium appears to have been small, as Cicero speaks of it as an *atriolum* (*Ad Quint. Fr.* iii. 1). The cost of this and the other house which he built at Pompeii led to his being burdened with debt (*Ep. ad Att.* ii. 1). Nothing now exists which can be asserted to be part of Cicero's villa with any degree of certainty. During the imperial period little is recorded about Tusculum; but soon after the transference of the seat of empire to Constantinople it became a very important stronghold, and for some centuries its counts occupied a leading position in Rome and were specially influential in the selection of the popes. During the 12th century there were constant struggles between Rome and Tusculum, and towards the close of the century (1191) the Romans, supported by the German emperor, gained the upper hand, and the walls of Tusculum, together with the whole city, were destroyed.

See L. Canina, *Descr. dell' antico Tusculo* (Rome, 1841); A. Nibby, *Dintorni di Roma*, iii. 293 (2nd ed., Rome, 1841); H. Dessau in *Corp. inscript. lat.* pp. 252 sqq. (Berlin, 1887); F. Grossi-Gondi, *Il Tuscolano nell' età classica* (Rome, 1907); T. Ashby in *Papers of the British School at Rome*, iv. 5 (London, 1907, 1909). (T. As.)

TUSKEGEE, a town and county-seat of Macon county, Alabama, U.S.A., in the east part of the state, about 40 m. E. of Montgomery. Pop. (1900) 2170; (1910) 2803. It is served by the Tuskegee railway, which connects it with Chehaw, 5 m. distant, on the Western railway of Alabama. The city manufactures cotton seed. Tuskegee is chiefly known for its educational institutions—the Tuskegee Normal and Industrial Institute and the Alabama Conference Female College (Methodist Episcopal Church, South; opened 1856). The former was founded in 1880 by an act of the state legislature as the Tuskegee State Normal School, and was opened in July 1881 by Booker T. Washington for the purpose of giving an industrial education to negroes; in 1893 it was incorporated under its present name. In 1899 the national Congress granted to the school 25,000 acres of mineral lands, of which 20,000 acres, valued at $200,000, were unsold in 1909. Andrew Carnegie gave $600,000 to the institute in 1903, and the institute has a Carnegie library (1902), with about 15,000 volumes in 1909. In 1909 the endowment was about $1,389,600, and the school property was valued at about $1,117,660. It had in 1909 a property of 2345 acres (of which 1000 were farm lands, 1145 pasture and wood lands, and 200 school campus), and 100 buildings, many of brick, and nearly all designed and constructed, even to the making of the bricks, by the teachers and students. The state of Alabama appropriated $2000 for teachers' salaries in 1880, increased the appropriation to $3000 in 1884, and for many years gave $4500 annually; the school receives $10,000 annually from the John F. Slater Fund, and the same sum from the General Education Board. The institute comprises an academic department (in which all students are enrolled) with a seven years' course, the Phelps Hall bible training school (1892), with a three years' course, and departments of mechanical industries, industries for girls, and agriculture. The department of agriculture has an experiment station, established by the state in 1896, in which important experiments in cotton breeding have been carried on. There are a farm, a large truck garden, an orchard, and a bakery and canning factory. Forty different industries are taught. Cooking schools and night schools are carried on by the institute in the town of Tuskegee. In 1908–1909 the enrolment was 1494 students, of whom about one-quarter were women, and there were 167 teachers, all negroes. Tuition in the institute is free; board and living cost $8.50 a month; day students are allowed to "work-out" $1.50–$3.00 a month of this amount, and night students may thus pay all their expenses. At Tuskegee under the auspices of the institute are held the annual negro conferences (begun in 1891) and monthly farmers' institutes (begun in 1897); and short courses in agriculture (begun in 1904) are conducted. Farmers' institutes are held throughout the South by teachers of the school. In 1905 the institute took up the work of rural school extension. A model negro village (South Greenwood) has been built west of the institute grounds on land bought by the institute in 1901. Affiliated with the institute and having its headquarters in Tuskegee is the National Negro Business League (1900). The success of the institute is due primarily to its founder and principal, Booker T. Washington, and to the efficient board of trustees, which has included such men as Robert C. Ogden and Seth Low. Tuskegee was settled about 1800.

See Booker T. Washington, *Working With the Hands* (New York, 1904); and Thrasher, *Tuskegee, Its Story and Its Work* (Boston, 1900).

TUSSAUD, MARIE (1760–1850), founder of "Madame Tussaud's Exhibition" of wax figures in London, was born in Berne in 1760, the daughter of Joseph Grosholtz (d. 1760), an army officer. Her uncle, a doctor of Berne, John Christopher Curtius, had attracted the attention of the prince de Conti by his beautiful anatomical wax models, and had been induced to move to Paris, abandon his profession, and practise wax modelling as a fine art. His house became the resort of many of the talented men of the day, and here he brought his niece at the age of six, and taught her to model in wax. She became such an adept that she early modelled many of the great people of France, and was finally sent for to stay at the palace at Versailles to instruct the sister of Louis XVI., Mme Elizabeth, in the popular craze. It was from Curtius's exhibition that the mob obtained the busts of Necker and the duke of Orleans that were carried by the procession when on the 12th of July 1789 the first blood of the French Revolution was shed. During the terrible days that followed Marie Grosholtz was called upon to model the heads of many of the prominent leaders and victims of the Revolution, and was herself for three months a prisoner, having fallen under the suspicion of the committee of public safety. In 1794 she married a Frenchman named Tussaud, from whom she was separated in 1800. Her uncle having died in the former year, after some difficulty she secured permission from Napoleon to leave France, and she took with her to London the nucleus of her collection from the *cabinet de cire* in the Palais Royal, and the idea of her "Chamber of Horrors" from Curtius's *Caverne des Grands Voleurs*, in the Boulevard du Temple. Her wax figures were successfully shown in the Strand on the site of the Lyceum theatre, and through the provinces, and finally the exhibition was established in permanent London quarters in Baker Street in 1833. Here Mme Tussaud died on the 16th of April 1850. She was succeeded by her son Francis Tussaud, he by his son Joseph, and he again by his son John Theodore Tussaud (b. 1859). The exhibition was moved in 1884 to a large building in Marylebone Road.

TUSSER, THOMAS (*c.* 1524–1580), English poet, son of William and Isabella Tusser, was born at Rivenhall, Essex, about 1524. At a very early age he became a chorister in the collegiate chapel of the castle of Wallingford, Berkshire. He appears to have been pressed for service in the King's Chapel, the choristers of which were usually afterwards placed by the king in one of the royal foundations at Oxford or Cambridge. But Tusser entered the choir of St Paul's Cathedral, and from there went to Eton College. He has left a quaint account of his privations at Wallingford, and of the severities of Nicholas Udal at Eton. He was elected to King's College, Cambridge, in 1543, a date which has fixed the earliest limit of his birth-year, as he would have been ineligible at nineteen. From King's College he moved to Trinity Hall, and on leaving Cambridge went to court in the service of William, 1st Baron Paget of Beaudesart, as a musician. After ten years of life at court, he married and settled as a farmer at Cattiwade, Suffolk, near the river Stour, where he wrote his *Hundreth Good Pointes of Husbandrie* (1557, 1561, 1562, &c.). He never remained long in one place. For his wife's health he removed to Ipswich. After her death he married again, and farmed for some time at West Dereham. He then became a singing man in Norwich Cathedral, where he found a good patron in the dean, John Salisbury. After another experiment in farming at Fairsted, Essex, he removed to London, whence he was driven by the plague of 1572–1573 to find refuge at Trinity Hall, being matriculated as a servant of the college in 1573. At the time of his death he was in possession of a small estate at Chesterton, Cambridgeshire, and his will proves that he was not, as has sometimes been stated, in poverty of any kind, but had in some measure the thrift he preached. Thomas Fuller says he "traded at large in oxen, sheep, dairies, grain of all kinds, to no profit"; that he "spread his bread with all sorts of butter, yet none would stick thereon." He died on the 3rd of May 1580. An erroneous inscription at Manningtree, Essex, asserts that he was sixty-five years old.

The *Hundreth Good Pointes* was enlarged to *A Hundreth good pointes of husbandry, lately maried unto a hundreth good poyntes of huswifery* . . . the first extant edition of which, "newly corrected and amplified," is dated 1570. In 1573 appeared *Five hundreth pointes of good husbandry* . . . (reprinted 1577, 1580, 1585, 1586, 1590, &c.). The numerous editions of this book, which contained a metrical autobiography, prove that the homely and practical wisdom of Tusser's verse was appreciated. He gives directions of what is to be done in the farm in every month of the year, and minute instructions for the regulation of domestic affairs in general. The later editions include *A dialogue of wyvynge and thryvynge* (1562). Modern editions are by William Mavor (1812), by H. M. W. (1848), and by W. Payne and Sidney J. Herrtage for the English Dialect Society (1878).

TUTBURY, a town in the Burton parliamentary division of Staffordshire, England, 4½ m. N.W. of Burton-upon-Trent, picturesquely situated on the river Dove, a western tributary of the Trent, which forms the county boundary with Derbyshire. Pop. (1901), 1971. The station of the Great Northern and North Staffordshire railways is in Derbyshire. The fine church of St Mary has a nave of rich Norman work with a remarkable western doorway; there are Early English additions, and the apsidal chancel is a modern imitation of that style. There are ruins of a large castle standing high above the valley; these include a gateway of 14th-century work, strengthened in Caroline times, a wall enclosing the broad "Tilt Yard," and portions of dwelling rooms. Glass is the staple manufacture. Alabaster is found in the neighbourhood.

The early history of Tutbury (*Toteberie, Stutesbury, Tuttebiri, Tudbury*) is very obscure. It is said to have been a seat of the Mercian kings. After the Conquest it was granted to Hugh d'Avranches, who appears to have built the first castle there. At the time of the Domesday Survey the castle was held by Henry de Ferrers, and "in the borough round it were 42 men living by their merchandize alone." Tutbury was the centre of an honour in Norman times, but the town remained small and unimportant, the castle and town continuing in the hands of the Ferrers until 1266, when, owing to Robert de Ferrers's participation in the barons' revolt, they were forfeited to the Crown and granted to Edmund Crouchback, earl of Lancaster. They are still part of the duchy of Lancaster. Tutbury Castle was partially rebuilt by John of Gaunt, whose wife, Constance of Castile, kept her court there. Later it was, for a time, the prison of Mary Queen of Scots. During the Civil War it was held for the king but surrendered to the parliamentary forces (1646), and was reduced to ruins by order of parliament (1647). Richard III. granted to the inhabitants of Tutbury two fairs, to be held respectively on St Katharine's day and the feast of the Invention of the Cross; the fair on the 15th of August was famous until the end of the 18th century for its bull coursing, said to have been originally introduced by John of Gaunt.

In 1831 a large treasure of English silver coins of the 13th and 14th centuries was discovered in the bed of the river, and a series was placed in the British Museum. This treasure was believed to have been lost by Thomas, the rebellious earl of Lancaster, who was driven from Tutbury Castle by Edward II. in 1322.

See Mosley, *History of Castle, Priory and Town of Tutbury* (1832); *Victoria County History*: *Stafford.*

TUTICORIN, a seaport of British India in the Tinnevelly district of Madras. Pop. (1901), 28,048. It is the southern terminus of the South Indian railway, 443 m. S.W. of Madras city. In connexion with this railway a daily steamer runs to Colombo, 149 m. distant by sea. Tuticorin is an old town, long in possession of the Dutch, and has a large Roman Catholic population. It used to be famous for its pearl fisheries, which extended from Cape Comorin to the Pamban Channel between India and Ceylon; but owing to the deepening of the Pamban Channel in 1895 these banks no longer produce the pearl oysters in such remunerative quantities, though conch shells are still found and exported to Bengal. As a set-off to this, Tuticorin has advanced greatly as a port since the opening of the railway in 1875, though it has only an open roadstead, where vessels must anchor two and a half miles from the shore; it is the second port in Madras and the sixth in all India. The exports are chiefly rice and livestock to Ceylon, cotton, tea, coffee and spices. There are factories for ginning and pressing cotton and a cotton mill.

TUTOR (Lat. *tutor*, guardian, *tueri*, to watch over, protect), properly a legal term, borrowed from Roman law, for a guardian of an infant (see ROMAN LAW and INFANT). Apart from this usage, which survives particularly in Scots law, the word is chiefly current in an educational sense of a teacher or instructor. It is thus specifically applied to a fellow of a college at a university with particular functions, connected especially with the supervision of the undergraduate members of the college. These functions differ in various universities. Thus, at Oxford, a fellow, who is also a tutor, besides lecturing, or taking his share of the general teaching of the college, has the supervision and responsibility for a certain number of the undergraduates during their period of residence; at Cambridge the tutor has not necessarily any teaching functions to perform, but is more concerned with the economic and social welfare of the pupils assigned to his care. In American universities the term is applied to a teacher who is subordinate to a professor, his appointment being for a year or a term of years.

TUTTLINGEN, a town of Germany, in the kingdom of Württemberg, on the left bank of the Danube, which is here crossed by a bridge, 37 m. by rail N.E. of Schaffhausen, and at the junction of lines to Stuttgart and Ulm. Pop. (1905), 14,627. The town is overlooked by the ruins of the castle of Honberg, which was destroyed during the Thirty Years' War, and has an Evangelical and a Roman Catholic church, several schools, and a monument to Max Schneckenburger (1819–1849), the author of *Die Wacht am Rhein.* Its chief manufactures are shoes, cutlery, surgical instruments and woollen goods, and it has a trade in fruit and grain.

Tuttlingen is a very ancient place, and is chiefly memorable for the victory gained here on the 24th of November 1643 by the Austrians and Bavarians over the French. It was almost totally destroyed by fire in 1803. It has belonged to Württemberg since 1404.

TUXEDO, a town of Orange county, New York, U.S.A., about 40 m. N.N.W. of New York City, near the New Jersey state line. Pop. (1890), 1678; (1900), 2277; (1905), 2865; (1910), 2858. Tuxedo is served by the Erie railway. About 1½ m. west of the railway station is Tuxedo Lake, which with 13,000 acres of surrounding country was taken for debt in 1814 by the elder Pierre Lorillard, who built a shooting-box here and sold wood from the land. The second Pierre Lorillard (1833–1901) formed the Tuxedo Park Association for the development of the tract, and on the 1st of June 1886 the Tuxedo Club and Tuxedo Park were opened; here there has grown up a remarkable collection of private establishments for the enjoyment of country life by certain wealthy families, who form a social club to whom the privileges are restricted. The area covers a variety of wild and cultivated scenery, and is beautifully laid out and utilized; there are golf links, a tennis and racket club, and game preserves, with excellent trout and bass fishing in the lake.

TUY, a city of north-western Spain, in the province of Pontevedra, on the right bank of the river Miño (Portuguese *Minho*), opposite Valença do Minho, which stands on the left bank in Portuguese territory. Pop. (1900), 11,113. Tuy is the southern terminus of the railways to Santiago de Compostela and Corunna; Valença do Minho is the northern terminus of the Portuguese railway to Oporto. Near Tuy rises the Monte San Cristobal, whose far-spreading spurs constitute the fertile and picturesque Vega del Oro. To the east is the river Louro, a right-hand tributary of the Miño abounding in salmon, trout, lamprey, eels and other fishes; and beyond the Louro, on the railway to Corunna, are the hot mineral springs of San Martin de Caldelas. Tuy is a clean and pleasant city with well-built houses, regular streets and many gardens. The cathedral, founded in the 12th century, but largely restored between the 15th and 19th, is of a massive and fortress-like architecture. Its half-ruined cloister and noble eastern façade date from the 14th century. There are several large convents and ancient parish churches, an old episcopal palace, hospitals, good schools, a theatre, and a very handsome bridge over the Miño built in 1885. The industries of Tuy include tanning, brewing, the distillation of spirits and the manufacture of soap. The city has also a brisk agricultural trade.

During part of the 7th century Tuy was the Visigothic capital. It was taken from the Moors by Alphonso VII. in the 12th century. As a frontier fortress it played an important part in the wars between Portugal and Castile.

TVER, a government of central Russia, on the upper Volga, bounded by the governments of Pskov and Novgorod on the W. and N. respectively, Yaroslavl and Vladimir on the E. and Moscow and Smolensk on the S. It has an area of 24,967 sq. m. Lying on the southern slope of the Valdai plateau, and intersected by deep valleys, it has the aspect of a hilly region, but is in reality a plateau 800 to 1000 ft. in altitude. Its highest parts are in the west, where the Volga, Southern Dvina and Msta rise in marshes and lakes. The plateau is built up chiefly of Carboniferous limestones, Lower and Upper, underlain by Devonian and Silurian deposits, which crop out only in the denudations of the lower valleys. The whole is covered by a thick sheet of boulder-clay, the bottom-moraine of the Scandinavo-Russian ice-sheet, and by subsequent Lacustrine deposits. A number of *åsar* or eskers occur on the slopes of the plateau. Ochre, brick, and pottery clays, as also limestone for building, are obtained, and there are chalybeate springs. The soil, which is clayey for the most part, is not fertile as a rule.

Nearly the whole of Tver is drained by the upper Volga and its tributaries, several of which (Vazuza, Dubna, Sestra, Tvertsa and the tributaries of the Mologa) are navigable. The Vyshnevolotsk system of canals connects the Volga (navigable some 60 m. from its source) with the Baltic, and the Tikhvin system connects the Mologa with Lake Ladoga. The Msta, which flows into Lake Ilmeñ, and its tributary the Tsna drain Tver in the north-west, and the Southern Dvina rises in Ostashkov. This network of rivers highly favours navigation: corn, linseed, spirits, flax, hemp, timber, metals and manufactured wares to the annual value of £1,500,000 are shipped from, or brought to, the river ports of the government. Lakes, ponds and marshes are numerous in the west and north-west, Lake Seliger—near the source of the Volga—and Lake Mztino being the most important. The forests—coniferous in the north and deciduous in the south—are rapidly disappearing, but still cover 32 % of the surface. The climate is continental; the average yearly temperature at Tver (41°·5 F.) is the same as that of Orel and Tambov (Jan. 11°, July 67°).

The population was estimated in 1906 as 2,053,000, almost entirely Great Russian, but including about 117,700 Karelians. The government is divided into twelve districts, the chief towns of which are Tver, Byezhetsk, Kalyazin, Kashin, Korsheva, Ostashkov, Rzhev, Staritsa, Torzhok, Vesyegonsk, Vyshniy Volochok and Zubtsov. Nearly 2,000,000 acres are under cereals. The principal crops are rye, wheat, oats, barley and potatoes. The sowing of grass is spreading, owing to the efforts of the *zemstvos* or local councils, and improved machinery is being introduced. Livestock breeding is also important, and dairy produce is exported. Manufactures have grown rapidly. Cotton-mills, flour-mills, tanneries, sugar-refineries, iron-foundries and distilleries are the chief establishments. The government of Tver is also the seat of important village industries, of which a remarkable variety is carried on, nearly every district and even every village having its own speciality. The principal of these are weaving, lace-making, boat-building, and the making of boots, saddlery, coarse pottery, sacks, nets, wooden wares, nails, locks, other hardware and agricultural implements and felt goods.

TVER, a town of Russia, capital of the government of the same name, 104 m. by rail N.W. of Moscow, on both banks of the Volga (here crossed by a floating bridge) at its confluence with the Tvertsa. The low right bank is protected from inundations by a dam. Pop. (1885), 39,280; (1900), 45,644. Tver is an archiepiscopal see of the Orthodox Greek Church. The oldest church dates from 1564, and the cathedral from 1689. A public garden occupies the site of the former fortress. The city possesses a good archaeological museum, housed in a former imperial palace. The industries have developed greatly, especially those in cotton, the chief works being cotton and flour mills, but there are also machinery works, glass works, sawmills, tanneries, railway carriage works and a steamer-building wharf. Among the domestic industries are nail-making and the manufacture of hosiery for export to Moscow and St Petersburg. The traffic of the town is considerable, Tver being an intermediate place for the trade of both capitals with the governments of the upper Volga.

Tver dates its origin from 1180, when a fort was erected at the mouth of the Tvertsa to protect the Suzdal principality against Novgorod. In the 13th century it became the capital of an independent principality, and remained so until the end of the 15th century. Michael, prince of Tver, was killed (1318) fighting against the Tatars, as also was Alexander his son. It long remained an open question whether Moscow or Tver would ultimately gain the supremacy in Great Russia, and it was only with the help of the Tatars that the princes of the former eventually succeeded in breaking down the independence of Tver. In 1486, when the city was almost entirely burned down by the Muscovites, the son of Ivan III. became prince of Tver; the final annexation to Moscow followed four years later. In 1570 Tver had to endure, for some reason now difficult to understand, the vengeance of Ivan the Terrible, who ordered the massacre of 90,000 inhabitants of the principality. In 1609–1612 the city was plundered both by the followers of the second false Demetrius and by the Poles.

TWAIN, MARK, the *nom de plume* of SAMUEL LANGHORNE CLEMENS (1835–1910), American author, who was born on the 30th of November 1835, at Florida, Missouri. His father was a country merchant from Tennessee, who moved soon after his son's birth to Hannibal, Missouri, a little town on the Mississippi. When the boy was only twelve his father died, and thereafter he had to get his education as best he could. Of actual schooling he had little. He learned how to set type, and as a journeyman printer he wandered widely, going even as far east as New York. At seventeen he went back to the Mississippi, determined to become a pilot on a river-steamboat. In his *Life on the Mississippi* he has recorded graphically his experiences while "learning the river." But in 1861 the war broke out, and the pilot's occupation was gone. After a brief period of uncertainty the young man started West with his brother, who had been appointed lieutenant-governor of Nevada. He went to the mines for a season, and there he began to write in the local newspapers, adopting the pen name of "Mark Twain," from a call used in taking soundings on the Mississippi steamboats. He drifted in time to San Francisco, and it was a newspaper of that city which in 1867 supplied the money for him to join a party going on a chartered steamboat to the Mediterranean ports. The letters which he wrote during this voyage were gathered in 1869 into a volume, *The Innocents Abroad*, and the book immediately won a wide and enduring popularity. This popularity was of service to him when he appeared on the platform with a lecture—or rather with an apparently informal talk, rich in admirably delivered anecdote. He edited a daily newspaper in Buffalo for a few months, and in 1870 he married Miss Olivia L. Langdon (d. 1904), removing a year later to Hartford, where he established his home. *Roughing It* was published in 1872, and in 1874 he collaborated with Charles Dudley Warner in *The Gilded Age*, from which he made a play, acted many hundred times with John T. Raymond as "Colonel Sellers." In 1875 he published *The Adventures of Tom Sawyer*, the sequel to which, *Huckleberry Finn*, did not appear until 1884. The result of a second visit to Europe was humorously recorded in *A Tramp Abroad* (1880), followed in 1882 by a more or less historical romance, *The Prince and the Pauper*; and a year later came *Life on the Mississippi. The Adventures of Huckleberry Finn*, the next of his books, was published (in 1884) by a New York firm in which the author was chief partner. This firm prospered for a while, and issued in 1889 Mark Twain's own comic romance, *A Connecticut Yankee at King Arthur's Court*, and in 1892 a less successful novel, *The American Claimant.* But after a severe struggle the publishing house failed, leaving the author charged with its very heavy debts. After this disaster he issued a third Mississippi Valley novel, *The Tragedy of Pudd'nhead Wilson*, in 1894, and in 1896 another historical romance, *Personal Recollections of Joan of Arc*, wherein the maid is treated with the utmost sympathy and reverence. He went on a tour round the world, partly to make money by lecturing and partly to get material for another book of travels, published in 1897, and called in America *Following the Equator*, and in England *More Tramps Abroad.* From time to time he had collected into volumes his scattered sketches; of these the first, *The Celebrated Jumping Frog of Calaveras County*, appeared in 1867, and the latest, *The Man that Corrupted Hadleyburg*, in 1900. To be recorded also is a volume of essays and literary criticisms, *How to Tell a Story* (1897). A complete edition of his works was published in twenty-two volumes in 1899–1900 by the American Publishing Company of Hartford. And in this last year, having paid off all the debts of his old firm, he returned to America. By the time he died his books had brought him a considerable fortune. In later years he published a few minor volumes of fiction, and a series of severe and also amusing criticisms of Christian Science (published as a book in 1907), and in 1906 he began an autobiography in the *North American Review.* He had a great reception in England in 1907, when he went over to receive from Oxford the degree of Doctor of Literature. He died at Redding, Connecticut, on the 21st of April 1910. Of his four daughters only one, who married the Russian pianist Gabrilowitch, survived him. Mark Twain was an outstanding figure for many years as a popular American personality in the world of letters. He is commonly considered as a humorist, and no doubt he is a humorist of a remarkable comic force and of a refreshing fertility. But the books in which his humour is broadly displayed, the travels and the sketches, are not really so significant of his power as the three novels of the Mississippi, *Tom Sawyer*, *Huckleberry Finn* and *Pudd'nhead Wilson*, wherein we have preserved a vanished civilization, peopled with typical figures, and presented with inexorable veracity. There is no lack of humour in them, and there is never a hint of affectation in the writing; indeed, the author, doing spontaneously the work nearest to his hand, was very likely unconscious that he was making a contribution to history. But such *Huckleberry Finn* is, beyond all question; it is a story of very varied interest, now comic, now almost tragic, frequently poetic, unfailingly truthful, although not always sustained at its highest level. And in these three works of fiction there are not only humour and pathos, character and truth, there is also the largeness of outlook on life such as we find only in the works of the masters. Beneath his fun-making we can discern a man who is fundamentally serious, and whose ethical standards are ever lofty. Like Cervantes at times, Mark Twain reveals a depth of melancholy beneath his playful humour, and like Molière always, he has a deep scorn and a burning detestation of all sorts of sham and pretence, a scorching hatred of humbug and hypocrisy. Like Cervantes and like Molière, he is always sincere and direct.

After Mark Twain's death, his intimate friend, W. D. Howells, published in 1910 a series of personal recollections in *Harper's Magazine.* (B. M.)

TWEED, a river in the south of Scotland. It rises in the south-west corner of Peeblesshire, not far from the Devil's Beef Tub (in Dumfriesshire) in the hill country in which the Clyde and Annan also rise. The stream flowing from Tweed's Wall, about 1500 ft. above the sea, is generally regarded as its source, though its origin has been traced to other streams at a still higher elevation. For the first 36 m. of its course the stream intersects the shire of Peebles in a north-easterly direction, and, shortly before the county town is reached, receives Lyne Water on the left and Manor Water on the right. The valley now widens, and the river, bending towards the south-east, passes Innerleithen, where it receives the Leithen (left) and the Quair (right). It then crosses Selkirkshire and, having received the Ettrick (reinforced by the Yarrow) on the right, flows northward past Abbotsford, forming for about 2 m. the boundary between the counties of Selkirk and Roxburgh. After receiving the Gala on the left, the Tweed crosses the north-western corner of Roxburghshire past Melrose and, after being joined by the Leader on the left, winds past Dryburgh Abbey round the south-western corner of Berwickshire. The remainder of its course is in a north-easterly direction through Roxburghshire past Kelso, where it receives the Teviot on the right, and then between the counties of Berwick and Northumberland, past Coldstream, to the town of Berwick, where it enters the North Sea. On the left it receives Eden Water at Edenmouth and Leet Water at Coldstream, and the Till from Northumberland between Coldstream and Norham Castle. The last 2 m. of its course before reaching Berwick are in England. The Tweed is 97 m. long and drains an area of 1870 sq. m. Its bed is pebbly and sandy, and notwithstanding discolorations from manufactures, the stream, owing to its clear and sparkling appearance, still merits the epithet of the "silver Tweed." The river, however, has no estuary, and traffic is chiefly confined to Berwick, though for a short distance above the town some navigation is carried on by barges. The Tweed is one of the best salmon streams in Scotland. From the time of Kenneth the Grim (d. 1005) to that of James VI. (1600) the Tweed uplands were the favourite hunting ground of the Scots monarchs, and, at a later date, the Covenanters found refuge in the recesses of the hills and on the banks of Talla Water, an early right-hand affluent. Close to Stobo Castle is Stobo Kirk, the mother-church of the district, founded by St Kentigern and probably the oldest ecclesiastical building in Tweeddale, a mixture of Saxon, Norman and modern Gothic.

See Sir Thomas Dick Lauder, *Scottish Rivers* (1874); Professor John Veitch, *The River Tweed* (1884); Rev. W. S. Crockett, *The Scott Country* (1892).

TWEEDDALE, MARQUESSES OF. JOHN HAY, 2ND EARL and 1ST MARQUESS OF TWEEDDALE (1626–1697), was the eldest son of John, 8th Lord Hay of Yester (*c.* 1599–1654), created earl of Tweeddale in 1646, who was the grandson of William Lord Hay of Yester (d. 1576), one of the partisans of Mary Queen of Scots, and thus a descendant of John Hay of Yester (Haddingtonshire) who was created a lord of the Scottish parliament in 1488 and died about 1500. Before succeeding to the peerage in 1654 the second earl fought for Charles I. during the Civil War, but he soon transferred his allegiance, and was in the Scottish ranks at Marston Moor. Changing sides again, he was with the royalists at Preston; but he was a member of Cromwell's parliament in 1656, and was imprisoned just after the restoration of Charles II. He was soon, however, in the king's favour, and in 1663 was appointed president of the Scottish council, and in 1664 an extraordinary lord of session. In Scotland he sought to mitigate the harshness shown by the English government to the Covenanters, and for this attitude he was dismissed from his offices in 1674; but he regained an official position in 1680 and held it during the reign of James II. A supporter of William of Orange, he was made lord high chancellor of Scotland in 1692, and two years later was created marquess of Tweeddale and earl of Gifford. He favoured the scheme for the expedition to Darien, and as lord high commissioner during William's absence he formally assented to the act establishing the trading company in 1695; for this action he was dismissed from office when the king returned to England in 1696. He died on the 11th of August 1697.

His son JOHN, 2ND MARQUESS OF TWEEDDALE (1645–1713), was prominent in Scottish politics during the stormy period which preceded the union with England. After acting for a time with the national party he became the leader of the *squadrone volante*, a band of men who at first took up an independent attitude on the question, but afterwards supported the union. For a very short time he was lord chancellor of Scotland, and he was one of the first of the Scottish representative peers. He died on the 20th of April 1713. His eldest son, CHARLES (*c.* 1670–1715), became 3rd marquess; a younger son, Lord JOHN HAY (d. 1706), commanded the famous regiment of dragoons, afterwards called the Scots Greys, at the battle of Ramillies and elsewhere.

JOHN, 4TH MARQUESS OF TWEEDDALE (*c.* 1695–1762), eldest son of the 3rd marquess, was chief secretary of state for Scotland from 1742 to 1746 and extraordinary lord of session from 1721 until his death. In six parliaments he was a representative peer for Scotland; he was for a time keeper of the king's signet, and in 1761 he was made lord-justice-general. He died on the 9th of December 1762. His brother, Lord CHARLES HAY (d. 1760), was the soldier who displayed great coolness when suddenly brought face to face with some French troops at Fontenoy, requesting the enemy, so Voltaire's account runs, to fire first.

The family of the 4th marquess became extinct when GEORGE, the 5th marquess, died on the 4th of October 1770; and GEORGE, a son of the 3rd marquess, succeeded to the title. When he died unmarried on the 16th of November 1787 the marquessate passed to a kinsman, GEORGE (1733–1804), a descendant of the 2nd marquess, who became 7th marquess.

GEORGE, 8TH MARQUESS OF TWEEDDALE (1787–1876), son of the preceding, succeeded in August 1804. He fought in the Peninsular War, being wounded at the battles of Busaco and Vittoria, and then in America; and he attained the rank of a field marshal in 1875. From 1842 to 1848 he was governor and commander-in-chief of Madras, but his later life was mainly spent at Yester, where he showed a very practical interest in agriculture. He died on the 10th of October 1876. His son, ARTHUR (1824–1878), who became 9th marquess, was an ornithologist of repute and a soldier who served in India and the Crimea. His ornithological works were published privately in 1881 by his nephew, Captain R. E. W. Ramsay, with a memoir by Dr W. H. Russell. His successor was his brother, WILLIAM MONTAGU (b. 1826), who, after sitting in the House of Commons for thirteen years, was made a peer of the United Kingdom as Baron Tweeddale in 1881.

TWEEZERS, a small instrument like a pair of tongs, used for picking up minute objects, extracting thorns or splinters from the flesh, &c. Etymologically a "tweezer" is an instrument contained in a "tweeze" or a small case containing several instruments, "tweeze" being a plural form of "twee," an adaptation of French *étui*, a sheath-case or box to put things in. Why one particular instrument out of the case should be called "tweezers" is not certain; Skeat suggests a possible connexion of ideas with the obsolete "twich," "twitch" (Ger. *zwicken*, to nip, fasten, Eng. "tweak"), or reference may be made to the M. Eng. *twisel* or *twissel*, a pair of objects (*twi-*, two).

The derivation of the French *étui* (O. Fr. *estuy*) is doubtful. Cognate forms are Span. *estuche*, Port. *estojo*, Ital. *astuccio*, formerly *stuccio* or *stucchio*, all with the same meaning of a small case for instruments such as scissors, knife, &c. Skeat supports Diez in his connexion with the modern German dialect *Stauche*, cuff, that part of the sleeve where such small objects were carried. Others connect the word with Lat. *studium*, a place where one studies, hence a place where objects of study are carried, a somewhat far-fetched sense development.

TWELVE TABLES, the tables of wood on which was engraved or painted the earliest codification of the Roman law. Originally ten in number, two others were afterwards added, containing supplemental matter, and the whole code was termed the *Lex XII. Tabularum* (Law of the Twelve Tables). (See ROMAN LAW and ROME.)

TWENTY-FOUR PARGANAS, THE, a district of British India, in the presidency division of Bengal, with an area of 4844 sq. m. It occupies part of the Gangetic delta, east of the Hugli, surrounding (but not including) the city of Calcutta. It also includes the greater part of the almost uninhabited Sundarbans (*q.v.*). The administrative headquarters are at Alipur, a southern suburb of Calcutta. The country consists for the most part of a vast alluvial plain, and is everywhere watered by numerous branches of the Ganges. In 1901 the population was 2,078,359, showing an increase of 10 % in the decade. Rice is the staple crop, followed by jute, pulses and sugar-cane. The district is traversed by three railways, two of which terminate at the ports of Diamond Harbour and Port Canning, but numerous river channels are still the chief means of communication. Apart from the suburbs of Calcutta, there is hardly a single real town. But round Calcutta all the manufactures of a great city are to be found, principally jute mills and jute presses, cotton mills and paper mills, and also government factories for rifles and ammunition.

The Twenty-four Parganas form the tract of which the *zamindari* or landlord rights were granted to the East India Company after the battle of Plassey, while the revenue arising therefrom was conferred upon Clive, upon whose death it reverted to the company.

TWICKENHAM, an urban district in the Brentford parliamentary division of Middlesex, England, 12 m. W.S.W. of St Paul's Cathedral, London, on the river Thames. Pop. (1891), 16,027; (1901), 20,991. Its situation is pleasant, and it has grown into an extensive residential district. The body of the church of St Mary was rebuilt in brick after its collapse in 1713, but the Perpendicular tower remains. Among men of eminence buried here are Alexander Pope and Sir Godfrey Kneller. The Thames in this neighbourhood forms a long deep reach in favour with fishermen, and Eel Pie Island is a resort of boating parties. There are many fine houses in the vicinity, more than one possessing historical associations. Strawberry Hill, the residence of Horace Walpole, was built to his taste in a medley of Gothic styles. Marble Hill was erected by George II. for the countess of Suffolk, and Pope, Swift and Gay took part in its equipment. Orleans House was the residence in 1800 of Louis Philippe, then duke of Orleans, and this family again acquired it in 1852, when it was occupied by the duke of Aumale. Several eminent French refugees resided at this period in the neighbourhood. In 1700 the young duke of Gloucester, son of Queen Anne, died here. York House was given to Lord Clarendon by Charles II., was probably the occasional residence of James II. when duke of York, and in 1864 was occupied by the comte de Paris, nephew of the duke of Aumale. Twickenham House was the residence of Sir John Hawkins, author of the *History of Music*, and Twickenham Park House, no longer standing, that of Lord Chancellor Bacon. Pope's Villa was replaced by another building after his death, but the tunnel which connected his garden and house beneath a road, and was ornamented by him as a grotto, remains. Other eminent residents were Turner, who occupied Sandycombe Lodge, and painted many of his famous works here, Henry Fielding the novelist, and Tennyson. Kneller Hall, the house built by Kneller (1711), was converted into a training college for masters of workhouse schools in 1847, and in 1856 became the Royal Military School of Music.

Twickenham at the Domesday survey was included in Isleworth. Anciently it was called Twittenham or Twicanham, and the first form, or a variation of it, is used by both Pope and Walpole. The manor was given in 941 by King Edmund to the monks of Christ Church, Canterbury, from whom it had been previously taken, but it was again alienated, for it was restored to the same monks by Edred in 948. In the reign of Henry VIII. it came into the possession of the Crown, and by Charles I. was assigned to Henrietta Maria as part of her jointure. It was sold during the Protectorate, but after the Restoration the queen mother resumed possession of it. In 1670 it was settled for life on Catherine of Braganza, queen of Charles II. It remains in possession of the Crown, but since the death of Catherine has been let on leases. The old manor house, now demolished, was Catherine's residence; and had been, according to tradition, the place of the retirement of Catherine of Aragon after her divorce from Henry VIII.

TWILIGHT, formerly known as Crepusculum (a Latin word meaning dusky or obscure), properly the interval during which the atmosphere is illuminated after the setting of the sun. The analogous phenomenon in the morning, *i.e.* the interval between the first appearance of light and the rising of the sun, is known as the *dawn*. These phenomena are due to the light of the sun after refraction by the atmosphere being reflected to the observer by the clouds, dust, and other adventitious matter present in the atmosphere. Even in the early infancy of astronomy, the duration of twilight was associated with the position of the sun below the horizon, and measurements were made to determine the maximum vertical depression of the sun which admitted the phenomena. This was found by Alhazen, Tycho Brahe and others, to be about 18°, and although other observers obtained somewhat different values, yet this value is now generally admitted. The duration of twilight is therefore measured by the time in which the sun traverses an arc of 18° of vertical depression, and primarily depends on the latitude of the observer and the declination of the sun. It is subject to several minor variations, occasioned by the variable amount of dust, clouds, &c. suspended in the air; and also on the temperature, which alters the altitude of the reflecting particles; thus at the same place and on the same day, the morning twilight or dawn is generally shorter than the evening twilight.

The duration and possibility of twilight may be geometrically exhibited as follows: Let O be the position of the observer (fig. 1); Z, the zenith; P, the pole of the heavens; ADB, the plane of the horizon; EDF, the path of the sun. Let the circles ADB and FDE intersect in the points D and D_1; then these points correspond to the rising and setting of the sun. Now twilight prevails from sunrise or sunset until the sun is depressed through 18°; hence if we draw arcs ZC and ZC_1 equal to 108°, and terminating on the circle FDE at C and C_1, then the arcs DC and D_1C_1 represent the distance traversed by the sun during the twilight. Also it may be observed that C_1EC represents the path of the sun during the night, and DFD_1 during the day. The arc CD is readily determined by spherical trigonometry. For, join CP by an arc of a great circle; then in the triangle ZPC we know ZP (the colatitude of O); PC (the sun's polar distance) and ZC (=108° by construction). Hence the angle ZPC, the sun's hour angle, may be found; this gives the time before or after noon when the sun passes C. The times of sunrise and sunset being known, then the arcs DC and D_1C_1 (and the duration of dawn and twilight) are determined.

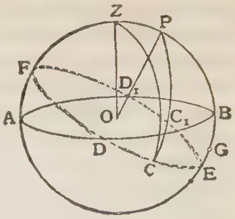

FIG. 1.

So far we have considered the case when the sun does attain a depression of 18°, but it is equally possible for this depression not to be attained. To investigate this, take ZG equal to 108°. Now if G lies beyond B and E (the maximum depression of the sun), E being also below B, then the sun will rise and set, but never descend so low as to occasion true night, and the entire interval between sunrise and sunset will be twilight.

If E be not below B but above it, the sun will never descend below the horizon, and will neither rise nor set, and we are presented with the phenomenon known as the *midnight sun*. Since PE = 90° − sun's declination, and PG = latitude of observer + 18°, then it follows that for there to be no night the latitude of the observer together with the declination of the sun must lie between 90° and 72°.

The maximum declination of the sun is about 23° 30′, and hence in latitude 48° 30′ there will be one day without a true night; in higher latitudes there will be an increasing number of such days; and in lower latitudes none. In England there is no real night from about the 22nd of May till the 22nd of July.

The phenomenon known as the *after-glow*, or second twilight, has been referred to a second reflection of the solar rays in the atmosphere.

TWILL (connected with "two"), a woven cloth in which the passage of the weft is arranged, not in regular succession as in plain weaving, but over one thread and under two or more according to the kind of twill. This gives a succession of diagonal lines to the cloth, and though in the normal type of twill this diagonal traverses from selvage to selvage at an angle of 45°, considerable variations may be made. Twills may be stout and serviceable cloths, though, theoretically, it would seem that the strain of wear on the threads that compose the cloth is necessarily irregular. The twill or diagonal may run either from left to right or vice versa. Twills are made in most kinds of cloths—silk, woollen, cotton, &c.

TWINING, THOMAS (1735–1804), English classical scholar, was born at Twickenham on the 8th of January 1734–1735. The son of Daniel Twining, tea merchant of London, he was originally intended for a commercial life, but his distaste for it and his fondness for study decided his father to send him to the university. He entered Sidney Sussex College, Cambridge (fellow, 1760), took orders, and after his marriage in 1764 spent the remainder of his life at Fordham (Essex) and Colchester, where he died on the 6th of August 1804. His reputation as a classical scholar was established by his translation, with notes, of Aristotle's *Poetics* (1789). Twining was also an accomplished musician, and assisted Charles Burney in his *History of Music*.

Selections from his correspondence will be found in *Recreations and Studies of a Country Clergyman of the Eighteenth Century* (1882) and *Selections from Papers of the Twining Family* (1887), edited by his grand-nephew (Richard Twining); see also *Gentleman's Magazine*, lxxiv. 490, and J. E. Sandys, *History of Classical Scholarship*, vol. iii. (1908).

TWISS, HORACE (1787–1849), English writer and politician, was born at Bath, being the son of Francis Twiss (1760–1827), a Shakespearian scholar who married Mrs Siddons's sister, Fanny Kemble, and whose brother Richard (1747–1821) made a name as a writer of travels. Horace Twiss had a pretty wit, and as a young man wrote light articles for the papers; and, going to the bar, he obtained a considerable practice and became a K.C. in 1827. In 1820 he was elected to parliament, where, with some interruptions, he sat till 1841, holding the office of under-secretary for war and the colonies in 1828–1830. In 1844 he was appointed vice-chancellor of the duchy of Lancaster, a well-paid post which enabled him to enjoy his popularity in London society. For some years he wrote for *The Times*, in which he first compiled the parliamentary summary, and his daughter married first Francis Bacon (d. 1840) and then J. T. Delane, both of them editors of that paper. He was the author of the *Life* (1844) of Lord Eldon, and other volumes. He died suddenly in London on the 4th of May 1849.

TWISS, SIR TRAVERS (1809–1897), English jurist, eldest son of the Rev. Robert Twiss, was born in London on the 19th of March 1809. At University College, Oxford, he obtained a first-class in mathematics and a second in classics in 1830, and was elected a fellow of his college, of which he was afterwards successively bursar, dean and tutor. During his connexion with Oxford he was, *inter alia*, a public examiner in classics and mathematics, Drummond professor of political economy (1842), and regius professor of civil law (1855). After he had forfeited his fellowship by marriage, he was elected to an honorary fellowship of University College. He published while at Oxford an epitome of Niebuhr's *History of Rome*, an annotated edition of Livy and other works, but his studies mainly lay in the direction of political economy, law, chiefly international law, and international politics. In 1840 he was called to the bar at Lincoln's Inn, and became an advocate at Doctors' Commons. In the ecclesiastical courts he enjoyed a large practice, and filled many of the appointments incidental thereto, such as commissary-general of the city and diocese of Canterbury (1849), vicar-general to the archbishop (1852) and chancellor of the diocese of London (1858). He was professor of international law at King's College, London (1852–1855). In 1858, when the Probate and Divorce Acts of 1857 came into force, and the ecclesiastical jurisdiction of Doctors' Commons had passed away, Twiss, like many other leading advocates of Doctors' Commons, became a Q.C., and in the same year he was also elected a bencher of his Inn. His successful career continued in the civil courts, and in addition to his large practice he was appointed in 1862 advocate-general to the admiralty, and in 1867 queen's advocate-general. In 1867 he was also knighted. He served during his legal career upon a great number of royal commissions, such as the Maynooth commission in 1854, and others dealing with marriage law, neutrality, naturalization and allegiance. His reputation abroad led to his being invited by the king of the Belgians in 1884 to draw up the constitution of the Congo Free State. In 1871 Twiss became involved in an unpleasant scandal, occasioned by allegations against the ante-nuptial conduct of his wife, whom he had married in 1862; and he threw up all his appointments and lived in retirement in London until his death on the 14th of January 1897, devoting himself to the study of international law and kindred topics. Among his more notable publications of this period were *The Law of Nations in Peace* and *The Law of Nations in War*, two works by which his reputation as a jurist will chiefly endure.

TWYSDEN, SIR ROGER (1597–1672), English antiquary and royalist pamphleteer, belonging to an ancient Kentish family. His mother, Anne, was the daughter of Sir Moule Finch, and his father, Sir William Twysden, was a courtier and scholar who shared in some of the voyages against the Spaniards in the reign of Queen Elizabeth and was well known at the court of King James I. He was one of the first baronets. Roger Twysden was educated at St Paul's School, London, and then at Emmanuel College, Cambridge. He entered Gray's Inn on the 2nd of February 1623. He succeeded to the baronetcy on his father's death in 1629. For some years he remained on his estate at Roydon, East Peckham, largely engaged in building and planting, but also in studying antiquities and the law of the constitution. The king's attempts to govern without a parliament, and the vexatious interference of his lawyers and clergy with the freedom of all classes of men, offended Sir Roger as they did most other country gentlemen. He showed his determination to stand on his rights by refusing to pay ship money, but, probably because the advisers of the Crown were frightened by the unpopularity of the impost, was not molested. He was chosen member of parliament for Kent in the Short Parliament of 1640, but was not elected to the Long Parliament. In common with most men of his class Sir Roger applauded the early measures of the parliament to restrict the king's prerogative, and then became alarmed when it went on to assail the Church. The attainder of Lord Strafford frightened him as a tyrannical use of power. He became in fact a very typical example of the men who formed the strength of the king's party when the sword was at last drawn. He considered himself too old to serve in the field, and therefore he did not join the king at Oxford. But he took the most prominent part in preparing the Kentish petition of March 1642 and in subsequent demonstrations on behalf of Charles. He incurred the wrath of the parliament, was arrested on the 1st of April 1642, but was soon let out on bail, and on his promise to keep quiet. But his respect for legality would not let him rest, and he was soon in trouble again for another demonstration known as "The Instruction to Mr Augustine Skinner." For this he was again arrested and for a time confined in a public-house, called "The Two Tobacco Pipes," near Charing Cross, London. He was released with a distinct intimation that he would be well advised not to go back to Roydon Hall, but to keep out of temptation in London. He took the advice and applied himself to reading. One plan for going abroad was given up, but at last he endeavoured to escape in disguise, was detected, and brought back to London. He was now subjected to all the vexations inflicted on Royalist partisans of good property, sequestrations of his rents, fines for "malignancy," and confinement in the Tower, where he consoled himself with his books. At last he compounded in 1650 and went home, where he lived quietly till the Restoration, when he resumed his position as magistrate. He died on the 27th of June 1672. He published *The Commons' Liberty* (London, 1648), demonstrating that finings and imprisonings by parliament were illegal; *Historiae anglicanae scriptores decem* (London, 1652), a work encouraged by Cromwell; and *Historical Vindication of the Church of England* (London, 1657).

TYBURN, a small left-bank tributary of the river Thames, England, now having its course entirely within London and below ground. The name, which also occurs as Aye-bourne, is of obscure derivation, though sometimes stated to signify Twy-burn, *i.e.* (the junction of) two burns or streams. The Tyburn rose at Hampstead and ran south, crossing Regent's Park, striking the head of the modern ornamental water there. Its course is marked by the windings of Marylebone Lane, the dip in Piccadilly where that thoroughfare borders the Green Park and at times by a line of mist across the park itself. It joined the Thames at Westminster (*q.v.*). But the name is more famous in its application to the Middlesex gallows, also called Tyburn Tree and Deadly Never Green, and also at an early period, the Elms, through confusion with the place of execution of that name at Smithfield. The Tyburn gallows stood not far from the modern Marble Arch. Connaught Square is said by several authorities to have been the exact site, but it appears that so long as the gallows was a permanent structure it stood at the junction of the present Edgware and Bayswater roads. The site, however, may have varied, for Tyburn was a place of execution as early as the end of the 12th century. In 1759, moreover, a movable gallows superseded the permanent erection. On some occasions its two uprights and cross-beam are said to have actually spanned Edgware Road. Round the gibbet were erected open galleries, the seats in which were let at high prices. Among those executed here were Perkin Warbeck (1449), the Holy Maid of Kent and confederates (1535), Haughton, last prior to the Charterhouse (1535), John Felton, murderer of Villiers, duke of Buckingham (1628), Jack Sheppard (1724), Earl Ferrers (1760).

In 1661 the skeletons of Cromwell, Ireton and other regicides were hung upon the gallows. The last execution took place in 1783, the scene being thereafter transferred to Newgate. The Tyburn Ticket was a certificate given to a prosecutor of a felon on conviction, the first assignee of which was exempted by a statute of William III. from all parish and ward duties within the district. The hangman's halter was colloquially known in the 16th century as the Tyburn Tippet.

See A. Marks, *Tyburn Tree, its History and Annals* (London, 1908).

TYDEUS, in Greek legend, son of Oeneus, king of Calydon, and Periboea. Having slain his uncle (or other relatives) he fled for refuge to Argos, where Adrastus received him hospitably and purified him from the guilt of blood. Tydeus took part in the expedition of the "Seven against Thebes," in which, although small of stature, he greatly distinguished himself. In the desperate battle under the walls of the city, he was severely wounded by Melanippus, but managed to slay his adversary. Athena, who held Tydeus in special favour, hastened to the field of battle, to heal him of his wound and bestow immortality upon him. But the sight of Tydeus, cleaving open the skull of his dead enemy and sucking out his brains, so disgusted her that she left him to his fate. Tydeus married Deïpylē, the daughter of Adrastus, by whom he had a son, the famous Diomedes, frequently called Tydides.

Homer, *Iliad*, xiv. 114–132; Apollodorus iii. 6, 8; Schol. on Pindar, *Nemea*, x. 12.

TYLDESLEY with SHAKERLEY, an urban district in the Leigh parliamentary division of Lancashire, England, 11 m. W.N.W. from Manchester by the London & North Western railway. Pop. (1901), 14,843. The town is of modern growth and depends upon its cotton mills and the large collieries in the neighbourhood.

TYLER, JOHN (1790–1862), tenth president of the United States, was born at Greenway, Charles City county, Virginia, on the 29th of March 1790. He was the second son of John Tyler (1747–1813), governor of Virginia in 1808–1811 and United States district judge in 1812–1813. The family was of English descent, but the claim of relationship to the famous Wat Tyler, though always stoutly maintained by President Tyler, cannot be substantiated. John Tyler the younger entered the grammar-school of the College of William and Mary, at Williamsburg, in 1802, and graduated in 1807. Two years later he was admitted to the bar. His public life began in 1811, when he was elected a member of the Virginia House of Delegates. Here he served for five years, being chosen also in 1815 a member of the council of state. In 1813 he raised a company for the defence of Richmond against the British, serving subsequently in minor operations elsewhere. From December 1816 to March 1821 he was a member of the national House of Representatives. A Republican in politics, and a firm believer in the doctrines of strict construction and state sovereignty which Thomas Jefferson had been principally instrumental in formulating, he opposed consistently the demand for internal improvements and increased tariff duties, and declined to follow Henry Clay in the proposed recognition of the independence of the Spanish colonies in South America and in the Missouri Compromise legislation. For the conduct of Jackson in Florida, in the summary execution of Arbuthnot and Ambrister, he had only strong condemnation. He declined a re-election to the House in 1821. In 1823–1825 he was again a member of the Virginia House of Delegates, and in 1825–1827 was governor of the state. In 1827 he was elected to the United States Senate to succeed John Randolph. In 1829–1830 he also served as a member of the Virginia constitutional convention. His career as senator was marked by a degree of independence which at times made his party position uncertain, notwithstanding the fact that his political ideas continued to be those of a thoroughgoing strict constructionist. Believing protective tariff duties to be unconstitutional, he voted against the "tariff of abominations" in 1828, and also against the tariff of 1832, since the latter measure, though reducing duties, showed no abandonment of the protective principle. The compromise tariff of 1833, made necessary by the hostile attitude of South Carolina, owed its inception largely to him, but he voted against the "force bill," an act for enforcing the collection of duties, being the only senator whose vote was so recorded. His hostility to a high tariff policy, however, did not prevent him from condemning the South Carolina ordinance of nullification; and in the presidential election of 1832 he supported Andrew Jackson, to whose political principles and methods, as to those of his advisers, he was invincibly opposed, as the "least objectionable" of the various candidates. The vigorous course of the president towards South Carolina, however, led him, after 1833, to act more and more with the opposition which presently became the Whig party; but he was never at heart a Whig, at least as Whig principles came later to be defined, and his place is with the Democrats of the Calhoun school. He sought to incorporate in a new code for the District of Columbia, in 1832, a prohibition of the slave trade in the district, at the same time opposing the abolition of slavery there without the consent of Maryland and Virginia, which had originally ceded the district to the United States. In the controversy over the removal of the government deposits from the Bank of the United States he sided with the bank, and voted for Clay's resolution censuring Jackson for his course in the matter. In 1833 he was again elected to the Senate, notwithstanding the criticism of his independent attitude and the wide approval of Jackson's policy in regard to the bank. In the election of 1836 he was supported as a candidate for the vice-presidency by the friends of Hugh L. White of Tennessee, the Democratic candidate opposed to Martin Van Buren, and received 47 votes, none of them from Virginia. When the legislature of Virginia voted instructions to its senators to support Senator Thomas H. Benton's resolution expunging from the journal of the Senate the resolution of censure, Tyler, though admitting the right of instruction, could not conscientiously obey the mandate, and on the 29th of February 1836 he resigned his seat. He was by this time reckoned a Whig, and his refusal to favour the Van Buren administration lent colour to that view. In 1838 he became once more a member of the Virginia House of Delegates, and in the same year was chosen president of the Virginia Colonization Society, of which he had long been a vice-president. In 1839 he made an unsuccessful contest for the United States senatorship. In December of that year the Whigs, relying upon his record in Congress as a sufficient declaration of political faith, nominated him for vice-president on the ticket with William Henry Harrison, expecting that the nomination would win support for the party in the South. Harrison and Tyler each received 234 electoral votes and were elected. On the 4th of April 1841, one month after the inauguration, Harrison died, and Tyler became president. The detailed discussion of the events of his administration, 1841–1845, belongs to the history of the United States (see UNITED STATES: *History*). He retained Harrison's cabinet until his veto of the bill for a "fiscal corporation" led to the resignation of all the members except Daniel Webster, who was bringing to a close the negotiations with Lord Ashburton for the settlement of the north-eastern boundary dispute; and he not only opposed the recognition of the spoils system in appointments and removals, but kept at their posts some of the ablest of the ministers abroad. He stood, however, as it were, midway between the two great parties, without the leadership or support of either; Van Buren, whose influence in the practical working of politics was still great, refused to recognize him as a Democrat, and the Whigs repudiated him as a Whig; while with Clay leading the majority in Congress, harmony between that body and the executive was from the first impossible. The annexation of Texas, achieved just before the close of his administration, seemed to commend him for a second term on that issue, and in May 1844 he was renominated by a convention of Democrats, irregularly chosen, at Baltimore. The majority of the annexationists, however, would not support him, and he had further to meet the opposition of Van Buren, who had failed to secure the nomination in the regular Democratic convention, and of James K. Polk, the regular Democratic nominee. Tyler accepted the Baltimore nomination, but on the 20th of August withdrew from the contest. From this time until the eve of the Civil War he held no public office, but his opinions on political questions continued to be sought, and he was much in demand as a speaker on public occasions. In December 1860, when South Carolina adopted its ordinance of secession, Tyler, though sympathizing with the state, took firm ground against disunion and exerted himself in behalf of peace. The legislature of Virginia appointed him a commissioner to confer with President Buchanan and arrange, if possible, for the maintenance of the *status quo* in the matter of Fort Sumter, in Charleston harbour; but his efforts were unavailing. He did not abate his activity, however, and the Peace Congress which assembled at Washington on the 4th of February 1861, pursuant to a resolution of the Virginia legislature, and over which he presided, was largely the result of his labours. The constitutional amendment proposed by the conference, however, did not meet with his approbation, and his action in signing and transmitting the resolution to Congress was merely formal. On the 13th of February, while absent in Washington on this mission, he was elected to the Virginia convention at Richmond, and took his seat on the 1st of March. In the convention he advocated immediate secession as the only proper course under the circumstances. He continued to serve as a member of the convention until it adjourned in December, in the meantime acting as one of the commissioners to negotiate a temporary union between Virginia and the Confederate States of America. He was also a member of the provisional Confederate Congress from May 1861, when the capital of the Confederacy was removed from Montgomery, Alabama, to Richmond. He was elected a member of the House of Representatives of the permanent Congress, but died on the 18th of January 1862, in Richmond, before that body assembled.

President Tyler was twice married, first in 1813 to Miss Letitia Christian (1790–1842), and second in 1844 to Miss Julia Gardiner (1820–1889). His son, Lyon Gardiner Tyler (b. 1853), graduated at the university of Virginia in 1875, and practised law at Richmond, Virginia, from 1882 to 1888, when he became president of the College of William and Mary. Among his publications, besides *Letters and Times of the Tylers*, are *Parties and Patronage in the United States* (1890); *Cradle of the Republic* (1900); *England in America* (1906) in the "American Nation" series, and *Williamsburg, the Old Colonial Capital* (1908).

The principal authority for the life of Tyler, aside from speeches, messages and other documents, is Lyon G. Tyler, *Letters and Times of the Tylers* (3 vols., Richmond, Va., 1884–1896). (W. Mac D.*)

TYLER, MOSES COIT (1835–1900), American author, was born in Griswold, Connecticut, on the 2nd of August 1835. At an early age he removed with his parents to Detroit, Michigan. He entered the university of Michigan in 1853, but in the next year went to Yale College, from which he graduated A.B. in 1857, and received the degree of A.M. in 1863. He studied for the Congregational ministry at the Yale Divinity School (1857–1858) and at the Andover Theological Seminary (1858–1859), and held a pastorate at Owego, New York, in 1859–1860 and at Poughkeepsie in 1860–1862. Owing to ill-health, however, and a change in his theological beliefs, he left the ministry. He became interested in physical training, and for some time (partly in England) wrote and lectured on the subject, besides other journalistic work. He became professor of English language and literature in the university of Michigan in 1867, and held that position until 1881, except in 1873–1874 when he was literary editor of the *Christian Union*; from 1881 until his death on the 28th of December 1900 at Ithaca, New York, he was professor of American history at Cornell University. In 1881 he was ordained deacon in the Protestant Episcopal Church and in 1883 priest, but he never undertook parochial work. Most important among his works are his valuable and original *History of American Literature during the Colonial Time, 1607–1765* (2 vols., 1878; revised in 1897), and *Literary History of the American Revolution, 1763–1783* (2 vols., 1897). Supplementary to these two is his *Three Men of Letters* (1895), containing biographical and critical chapters on George Berkeley, Timothy Dwight and Joel Barlow. In addition he published *The Brawnville Papers* (1869), a series of essays on physical culture; a revision of Henry Morley's *Manual of English Literature* (1879); *In Memoriam: Edgar Kelsey Apgar* (1886), privately printed; *Patrick Henry* (1887), an excellent biography, in the "American Statesmen" series; and *Glimpses of England; Social, Political, Literary* (1898), a selection from his sketches written while abroad.

See "Moses Coit Tyler," by Professor William P. Trent, in *The Forum* (Aug. 1901), and an article by Professor George L. Burr, in the *Annual Report of the American Historical Association* for 1901 (vol. i.).

TYLER, WAT [or Walter] (d. 1381), English rebel, a man of obscure origin, was a native either of Kent or of Essex. Nothing definite is known of him previous to the outbreak of the peasant revolt in 1381, but Froissart says he had served as a soldier in the French War, and a Kentishman in the retinue of Richard II. professed to identify him as a notorious rogue and robber of Kent. The name Tyler, or Teghler, is a trade designation and not a surname. The discontent of the rural labourers and of the poorer class of craftsmen in the towns, caused by the economic distress that followed the Black Death and the enactment of the Statute of Labourers in 1351, was brought to a head by the imposition of a poll tax in 1379 and again in 1381, and at the end of May in the latter year riots broke out at Brentwood in Essex; on the 4th of June similar violence occurred at Dartford; and on the 6th a mob several thousands strong seized the castle of Rochester and marched up the Medway to Maidstone. Here they chose Wat Tyler to be their leader, and in the next few days the rising spread over Kent, where much pillage and damage to property occurred. On the 10th Tyler seized Canterbury, sacked the palace of Archbishop Sudbury, the chancellor, and beheaded three citizens as "traitors." Next day he led his followers, strengthened by many Kentish recruits, on the road to London, being joined at Maidstone by John Ball (*q.v.*), whom the mob had liberated from the archbishop's prison. Reaching Blackheath on the 12th, the insurgents burnt the prisons in Southwark and pillaged the archbishop's palace at Lambeth, while another body of rebels from Essex encamped at Mile End. King Richard II. was at the Tower, but neither the king's councillors nor the municipal authorities had taken any measures to cope with the rising. The drawbridge of London Bridge having been lowered by treachery, Tyler and his followers crossed the Thames; and being joined by thousands of London apprentices, artisans and criminals, they sacked and burnt John of Gaunt's splendid palace of the Savoy, the official residence of the treasurer, Sir Robert Hales, and the prisons of Newgate and the Fleet. On the 14th Richard II., a boy of fourteen, undertook the perilous enterprise of riding out to confer with the rebels beyond the city wall. At Mile End the king met Wat Tyler; a lengthy and tumultuous conference, during which several persons were slain, took place, in which Tyler demanded the immediate abolition of serfdom and all feudal services, and the removal of all restrictions on freedom of labour and trade, as well as a general amnesty for the insurgents. Richard had no choice but to concede these demands, and charters were immediately drawn up to give effect to them. While this was in progress Tyler with a small band of followers returned to the Tower, which they entered, and dragged forth Archbishop Sudbury and Sir Robert Hales from the chapel and murdered them on Tower Hill. During the following night and day London was given over to plunder and slaughter, the victims being chiefly Flemish merchants, lawyers and personal adherents of John of Gaunt, duke of Lancaster. Meantime the people of property began to organize themselves for the restoration of order. On the 15th of June, Richard, after confession and receiving the Sacrament, rode to Smithfield for a further conference with the rebels. Close to St Bartholomew's Church he met Wat Tyler, who advanced from the ranks of the insurgents and shook the king's hand, bidding him be of good cheer. Tyler then formulated a number of fresh demands, including the confiscation of ecclesiastical estates and the institution of social equality. Richard replied that the popular desire should be satisfied "saving the regalities of the Crown." Tyler thereupon grew insolent, and in the altercation that ensued the rebel leader was killed by the mayor, Sir William Walworth (*q.v.*), and John Standwick, one of the king's squires. The rebels now handled their bows in a menacing fashion, but at the critical moment the young king with great presence of mind and courage spurred his horse into the open, crying, "Sirs, will you shoot your king? I will be your chief and captain, you shall have from me all that you seek." Richard then led the mob to a neighbouring meadow, where he kept them in parley till Walworth, who had returned within the city to summon the loyal citizens to the king's aid, returned with a sufficient following to overawe and disperse the rebels. With the death of Wat Tyler the rising in London and the home counties quickly subsided, though in East Anglia it flickered a short time longer under the leadership of John Wraw and Geoffrey Litster until suppressed by the energy of Henry Despenser, bishop of Norwich. About 110 persons were executed for the rebellion in Kent and Essex, including John Ball, and Jack Straw, Tyler's chief lieutenant.[1] The enfranchisement of villeins granted by Richard at the Mile End conference was revoked by parliament in 1382, and no permanent results were obtained for the peasants by Wat Tyler's revolt.

BIBLIOGRAPHY.—The best original account of the rebellion of Wat Tyler is the "Anonimal Chronicle of St Mary's, York," printed by G. M. Trevelyan in the *Eng. Hist. Rev.* (1898). See also Thomas Walsingham, *Chronicon Angliae* (Rolls series, 1874); Froissart, *Chronicles* (edited by G. C. Macaulay, London, 1895); André Réville, *Le Soulèvement des travailleurs d'Angleterre en 1381* (Paris, 1898); C. Oman, *The Great Revolt of 1381* (Oxford, 1906), and *The Political History of England*, vol. iv. (ed. by W. Hunt and R. L. Poole, London, 1906). (R. J. M.)

TYLER, a city and the county-seat of Smith county, Texas, U.S.A., about 115 m. E. by S. of Dallas. Pop. (1890), 6908; (1900), 8069, of whom 2693 were negroes; (1910 census), 10,400. Tyler is served by the International & Great Northern and the St Louis South-Western railways. It is the seat of the Tyler Commercial College, of the East Texas Conservatory of Music and of two institutions for negroes—Texas College (1895; Colored Methodist Episcopal) and the East Texas Normal and Industrial Academy (Baptist, 1905). The principal public buildings include the city hall, the county court-house, a Carnegie library and the post office and Federal Courts building. Sessions of the United States Circuit and District Courts, and of a state district court, as well as of the county court, are held in Tyler. Tyler is situated in a prosperous agricultural region, and has various manufactures. The St Louis South-Western railway maintains general offices and machine-shops here. Tyler, named in honour of President John Tyler, was settled in 1847, was incorporated as a town in 1870 and was chartered as a city in 1907.

TYLOPODA (Gr. for boss-footed, in reference to the cushion-like pads forming the soles of the feet), the scientific name of the section of ruminating artiodactyle ungulate mammals (see ARTIODACTYLA) now represented by the Old World camels (see CAMEL) and the South American Llamas (see LLAMA)

Characters.—In the skull there is a sagittal crest; the tympanic bulla is filled with cancellous tissue; the condyle of the lower jaw is rounded; and the premaxillae, or anterior bones of the upper jaw, have the full number of incisor teeth in the young state, the outermost of these being persistent through life as an isolated tooth. The tusk-like canines are present in both jaws, those of the lower jaw being differentiated from the long, horizontal and spatulate incisors; in form they are sub-erect and pointed. The crowns of the molars belong to the crescentic or selenodont type, and are tall-crowned or hypsodont; but one or more of the anterior premolars is usually detached from the series, and of simple pointed form. The hinder part of the body is much contracted, and the femur long and vertically placed, so that the knee-joint is lower in position, and the thigh altogether more detached from the abdomen than in most mammals. The limbs are long, but with only two digits (the third and fourth) developed on each, no traces of any of the others being present. The trapezoid and magnum of the carpus, and the cuboid and navicular of the tarsus are distinct. The two cannon-bones of each limb are confluent for the greater part of their length, though separated for a considerable distance at the lower end. Their lower articular surfaces, instead of being pulley-like, with deep ridges and grooves, as in other Artiodactyla, are simple, rounded and smooth. The first phalanges are expanded at their lower ends, and the wide, depressed middle phalanges embedded in a broad cutaneous pad, forming the sole of the foot, on which the animal rests in walking instead of on the hoofs. The terminal phalanges are small and nodular, not flattened on their inner or opposed surfaces, and not completely encased in hoofs, but bearing nails on their upper surface only. The neck is long and curved, and its vertebrae are remarkable for the position of the canal for the transmission of the vertebral artery, which does not perforate the transverse process, but passes obliquely through the anterior part of the pedicle of the arch. There are no horns or antlers. Though these animals ruminate, the stomach differs considerably in the details of its construction from that of the Pecora. The interior of the rumen or paunch has no tags or villi on its surface, and there is no distinct psalterium or manyplies. Both first and second compartments are remarkable for the presence of a number of pouches or cells in their walls, with muscular partitions, and a sphincter-like arrangement of their orifices, by which they can be shut off from the rest of the cavity, and into which the fluid portion only of the contents of the stomach is allowed to enter. The placenta is diffuse, not cotyledonary. Finally, the Tylopoda differ not only from other ungulates, but from all other mammals, in the fact that the red corpuscles of the blood, instead of being circular in outline, are oval as in the inferior vertebrate classes.

Camels.—Of the two existing generic representatives of the Camelidae (as the family in which they are both included is named), the Old World camels (*Camelus*) are characterized by their great bodily size, and the presence of one or two fleshy humps, which diminish or increase in size according to the physical condition of the animals themselves. There is a total of 34 teeth, arranged as $i. \frac{1}{3}$, $c. \frac{1}{1}$, $p. \frac{3}{2}$, $m. \frac{3}{3}$. Of these the first upper premolar is a simple tooth placed close behind the premaxilla and separated by a long gap from the two other teeth of the same series; while the lower incisors, of which the outermost is the largest, are directed partially forwards. The skull is elongated, with an overhanging occiput, complete bony rims to the orbits, and the premaxillae separated from the arched and rather long nasals. The vertebrae are C. 7. D. 12. L. 7. S. 4 and Ca. 13 to 15. The ears are short and rounded; the toes of the broad feet very imperfectly separated; the tail is well developed, with a terminal tuft; and the straight hair is not woolly.

Llamas.—Although the name llama properly applies only to one of the domesticated breeds, zoologically it is taken to include all the South American representatives of the Camelidae, which form the genus *Lama*. In this sense, llamas are characterized as follows. The dentition in the adult is $i. \frac{1}{3}$, $c. \frac{1}{1}$, $p. \frac{2}{2}$, $m. \frac{3}{3}$; total 32. In the upper jaw there is a compressed, sharp-pointed, tusk-like incisor near the hind edge of the premaxilla, followed in the male at least by a moderate-sized, pointed, curved canine in the anterior part of the maxilla. The isolated canine-like premolar which follows in the camels is not present. The teeth of the cheek-series which are in contact with each other consist of two small premolars (the first almost rudimentary) and three broad molars, constructed generally like those of *Camelus*. In the lower jaw the three incisors are long, spatulate and horizontal, with the outer one the smallest. Next to the latter is a curved, sub-erect canine, followed after an interval by an isolated minute and often deciduous simple conical premolar; then a contiguous series of one premolar and three molars, which differ from those of recent species of *Camelus* in having a small accessory column at the anterior outer edge. The skull generally resembles that of *Camelus*, the relatively larger brain-cavity and orbits and less developed cranial ridges being due to its smaller size. The nasal bones are shorter and broader, and are joined by the premaxillae. Vertebrae: C. 7, D. 12, L. 7, S. 4, Ca. 15 to 20. Ears rather long and pointed. No hump. Feet narrow, the toes being more separated than in the camels, and each with a distinct plantar pad. Tail short. Hairy covering long and woolly. Size smaller and general form lighter than in the camels. Llamas are now confined to the western and southernmost parts of South America, though fossil remains have been found in the caves of Brazil, and in the pampas of the Argentine Republic. (See also ALPACA; GUANACO; LLAMA and VICUGNA.)

Fossil History.—As regards the past history of the group, remains of fossil species of *Camelus* have been obtained from the superficial deposits of various parts of Russia, Rumania, and Siberia, and others from the Lower Pliocene of northern India; the molar teeth of these latter presenting the additional column referred to above as distinguishing those of the llamas from those of modern camels. In addition to these Dr M. Schlosser has described remains of a large camel-like animal from China, with apparently generalized affinities, for which the name of *Paracamelus* is proposed. Mme Pavlow, of Moscow, has brought to notice a fossil camel-skull of great interest, which was collected in the district Alexandrie, of the government of Kherson, Russia. Unfortunately, the precise age of the formation from which it was obtained is unknown, but it is considered probable that it dates from the later Tertiary. Although it has the deciduous dentition, Mme Pavlow considers herself justified in referring the Kherson skull to the genus *Procamelus* previously known only from the Lower Pliocene or Upper Miocene strata of North America, and differing from modern camels, among other features, by the retention of a fuller series of premolar teeth. Part of the cannon-bone of a camel from another district in Russia is provisionally assigned to the same species. Possibly this Russian camel (*Procamelus khersonensis*), as it is called, may form the connecting link between the typical *Procamelus* of North America and the fossil camel (*Camelus sivalensis*) of the Siwalik Hills of India. Be this as it may, the identification of a North American type of camel from the Tertiary strata of eastern Europe forms another connecting link between the extinct faunas of the northern half of the Old World and North America, and thus tends to show that the claim of America to be the exclusive birthplace of many Old World types may have to be reconsidered.

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[1] Mr F. W. D. Brie (*English Historical Review*, 1906) vol. xxi. advances the theory that Tyler and Straw are one and the same person.

Remains of camels (*C. thomasi*) have also been found in the Pleistocene strata of Oran and Ouen Seguen, in Algeria; and certain remains from the Isle of Samos have been assigned to the same genus, although the reference requires confirmation. The Algerian Pleistocene camel was doubtless the direct ancestor of the living African species, which it serves to connect with the extinct *C. sivalensis*.

In North America, apart from certain still older and more primitive mammals, with teeth of the tubercular type, the earliest known form which can definitely be included in the camel-series is *Protylopus*, of the Uinta or Upper Eocene. In this creature, which was not larger than a European hare, there was the full number of 44 teeth, which formed a regular series, without any long gaps, and with the canines but little taller than the incisors, while the hinder cheek-teeth, although of the crescentic type, were low-crowned. In both jaws the anterior front-teeth were of a cutting and compressed type. Unfortunately, the skull is incomplete, and the rest of the skeleton very imperfectly known; but sufficient of the former remains to show that the socket of the eye was open behind, and of the latter to indicate that in the hind-foot, at any rate, the upper bones of the two functional toes had not coalesced into a cannon-bone. The lateral hind-toes (that is to say the second and fifth of the typical series) had, however, become rudimentary; although it is probable that the corresponding digits of the fore-limb were functional, so that this foot was four-toed. In old individuals the bones of the forearm (radius and ulna) became welded together about half-way down, although they remained free above. On the other hand it appears that the smaller bone of the leg (fibula) was welded to the larger one (tibia), and that its upper portion had disappeared. Nothing is known of the neck vertebrae. It is, of course, evident that there must have been an earlier form in which all the feet were four-toed, and the bones of the forearm and lower part of the leg separate.

A stage higher in the series, viz. in the Oligocene, we meet with *Pöebrotherium*, in which a distinct increase in bodily size is noticeable, as also in the relative length of the two bones which unite in the higher types to form the cannon-bone. Moreover, the crowns of the hinder cheek-teeth are taller, and more distinctly crescentic, both feet are two-toed, the ulna and radius are fused, and the fibula is represented only by its lower part. In the vertebrae of the neck the distinctive cameloid characters had already made their appearance. On the other hand, the skull was short and rabbit-like, showing none of the characteristic features of modern camels.

In the Lower Miocene occurs *Protomeryx* or *Gomphotherium*, in which there is a considerable increase in the matter of bodily size, the two metacarpal and metatarsal bones (or those which unite in the latter forms to constitute the cannon-bones) being double the length of the corresponding elements in *Protylopus*. These bones, although separate, have their adjacent surfaces more closely applied than is the case in the latter; while in this and the earlier genera the terminal toe-bones indicate that the foot was of the normal hoofed type. In the skull the socket of the eye is surrounded by bone; while the dentition begins to approximate to the camel type—notably by the circumstance that the lower canine is either separated by a gap from the outermost incisors, or that its crown assumes a backwardly curved shape. In *Protolabis* of the Middle Miocene, while no cannon-bone is formed, the first and second pairs of incisor teeth are retained, and the limbs and feet are short and disproportionately small. In the Upper Miocene we come to a distinct type—*Procamelus*—which is entitled to be regarded as a camel, and approximates in size to a small llama. Here the metacarpals and metatarsals have partially united to form cannon-bones, the skull has assumed the elongated form characteristic of modern camels, with the loss of the first and second pairs of upper incisors, and the development of gaps in front of and behind each of the next three teeth, that is to say, the third incisor, the canine and the first cheek-tooth. The approximately contemporaneous *Pliauchenia* makes another step by the loss of the second lower cheek-tooth. Both these genera have the toe-bones of the irregular nodular form distinctive of modern camels, so that we may safely infer that the feet themselves had assumed the cushion-type.

In one species of *Procamelus* the metacarpals and metatarsals coalesced into canon-bones late in life; but when we come to the Pleistocene *Camelops* such union took place at an early stage of existence, and was thoroughly complete. In the living members of the group it occurs before birth. The species of *Camelops* were probably fully as large as llamas, and some, at any rate, resembled these animals as regards the number of teeth, the incisors being reduced to one upper and three lower pairs, and the cheek-teeth to four or five in the upper and four in the lower jaw; the total number of teeth thus being 28 or 30 in place of the 44 of *Pöebrotherium*. The sole difference between *Camelops* and *Llama* seems to consist in certain structural details of the lower cheek-teeth. An allied extinct genus (*Eschatius*) is also distinguished by certain features in the dentition.

Apart from *Procamelus* the foregoing genera are exclusively North American. A lower jaw from the Pleistocene deposits of that continent has, however, been referred to the Old World *Camelus*.

In addition to the above there is an extraordinary North American Miocene giraffe-necked camel (*Alticamelus*), a creature of the size of a giraffe, with similarly elongated neck and limbs, and evidently adapted for browsing on trees. The feet and number of teeth were generally similar to those of *Procamelus*. Unlike the giraffe, the length of the limbs is due to the elongation of their upper segments, and that of the neck to the lengthening of only the hinder vertebrae.

In caverns and superficial deposits of South America occur remains of extinct species more or less closely related to modern llamas; but previous to the Upper Pliocene the group is unknown in South America, which it reached from the north.

All the foregoing genera are included in the sub-family Camelidae. Parallel to this is, however, the North American family Leptomerychidae (Hypertragulidae), as represented by *Leptomeryx*, *Camelomeryx* and *Leptoreodon*, which presents remarkable resemblances, especially in the type genus, to the Tragulina (see CHEVROTAIN); camel-like features being, however, apparent in the two genera last mentioned. Generalized features are also displayed by the Oligocene *Hypisodus*, which in its short skull and large orbits presents a curious approximation to the African dik-dik antelopes of the genus *Madoqua* (see ANTELOPE). Again, the remarkable horned North American Oligocene genus *Protoceras*, while displaying resemblances to *Leptomeryx* and *Leptoreodon*, presents also points of similarity to the Tragulina and Pecora (*q.v.*).

The North American genus *Oreodon* typifies a second family included by Professor W. B. Scott in the Tylopoda and generally known as the Oreodontidae. As *Oreodon* is, however, antedated by *Merycoidodon*, the latter name is properly entitled to stand, in which case the family should be called Agriochoeridae. It is not easy to point out the characters in which the family approximates to the Camelidae, and only its general characteristics can be indicated. The family ranges in North America from the Upper Eocene to the Lower Miocene, but *Oreodon* (or *Merycoidodon*), which is typified by an animal of the size of a sheep, is Oligocene. In the Oreodontinae or typical section of the family, which includes several genera nearly allied to *Oreodon*, the skull is shorter and higher than in the camels, with a swollen brain-case, a preorbital gland-pit, the condyle of the lower jaw transversely elongated, the tympanic bulla hollow, and the orbit surrounded by bone. The dentition comprises the typical 44 teeth, of which the molars are short-crowned, with four crescentic cusps on those of the upper jaw (selenodont type). The most characteristic dental feature is, however, the assumption of the form and function of a canine by the first lower premolar; the lower canine being incisor-like. The tail is very long; and the feet have five functional toes, with complete but short metacarpals or metatarsals. In the Miocene *Agriochoerus*, which typifies a second sub-family (Agriochoerinae), there is no gland-pit in the skull, of which the orbit is open behind; while the upper incisors are wanting in the adult and the terminal toe-bones are claw-like rather than of the hoofed type. The molars are less completely selenodont than in the type genus. It is noteworthy that a molar from the Tertiary of India has been referred to *Agriochoerus*, a determination which if correct probably indicates the occurrence of Oreodonts in the unknown Tertiary deposits of Central Asia. It may be added that in the Oreodontidae the vertebral artery pierces the transverse processes of the cervical vertebrae in the normal manner.

The earliest representatives of the Tylopoda according to Professor Scott is the Middle Eocene genus *Homacodon*, typifying the family Homacodontidae, which is regarded as the common ancestor of both

Camelidae and Oreodontidae, with resemblances to the European Oligocene genus *Dichobune* (see ARTIODACTYLA). *Homacodon* was an animal of the size of a rabbit, with five toes (of which only five were functional to each foot) and 44 teeth, of which the molars are tuberculated (*bunodont*), with six columns on those of the upper jaw; the premolars being of a cutting type. It should be added that this generalized animal is not unfrequently classed among the ancestral pigs, but its cameline affinities are strongly emphasized by Professor Scott.

LITERATURE.—W. B. Scott, "On the Osteology of Pöebrotherium," *Journal of Morphology* (1891), vol. v.; "The Osteology of Protoceras" (1895), ibid., vol. xi.; J. L. Wortman, "On the Osteology of Agriochoerus," *Bull. Amer. Museum* (1895), vol. vii.; "The Extinct Camelidae of North America (1898), ibid., vol. x.; W. D. Matthew, "The Skull of Hypisodus (1901), ibid., vol. xvi.
(R. L.*)

TYLOR, EDWARD BURNETT (1832–), English anthropologist, was born at Camberwell, London, on the 2nd of October 1832, the son of Joseph Tylor, a brassfounder. Alfred Tylor, the geologist, was an elder brother. His parents were members of the Society of Friends, at one of whose schools, at Grove House, Tottenham, he was educated. In 1848 he entered his father's manufactory in London, but at about the age of twenty he was threatened with consumption and forced to abandon business. During 1855–1856 he travelled in the United States of America to recruit his health. Proceeding in 1856 to Cuba, he met Henry Christy the ethnologist, with whom he visited Mexico. Tylor's association with Christy greatly stimulated his awakening interest in anthropology, and his visit to Mexico, with its rich prehistoric remains, led him to make a systematic study of the science. While on a visit to Cannes he wrote a record of his observations, entitled *Anahuac; or, Mexico and the Mexicans, Ancient and Modern*, which was published in 1861. In 1865 appeared *Researches into the Early History of Mankind*, which made Tylor's reputation. It showed great research, original insight, and much constructive power in the formation of systematic views. The chapters on early myths and their geographical distribution are especially valuable. The work reached a third edition in 1878. This book was followed in 1871 by the more elaborate *Primitive Culture: Researches into the Development of Mythology, Philosophy, Religion, Language, Art and Custom*, which at once became the standard general treatise on anthropology. Tylor's treatment of animism (chs.xi.–xvii.) was particularly elaborate, and he first determined the limits of that province of anthropology intending it to include "the general doctrine of souls, and other spiritual beings." In 1881 Tylor published a smaller and more popular handbook on *Anthropology*. His work had already met with recognition. In 1871 he was elected F.R.S., and in 1875 received the honorary degree of D.C.L. from the university of Oxford. He was appointed keeper of the University Museum at Oxford in 1883, and reader in anthropology in 1884. In 1888 he was appointed first Gifford lecturer at Aberdeen University, and delivered a two years' course on "Natural Religion." In 1896 he became first professor of anthropology at Oxford. At the end of 1907 the Clarendon Press published a volume of *Anthropological Essays*, to which various representative scholars of a younger generation in the same field had contributed, the essays being dedicated and presented to Tylor as a mark of honour; and this collection includes not only a bibliography of his publications by Miss Freire-Marreco, but also an appreciation of Tylor's life-work by Andrew Lang.

TYMPANON, or TYMPANUM (Gr. *τύμπανον*, from *τύπτειν*, to strike), a name applied by the Romans to both kettledrum and tambourine, in the case of the latter sometimes qualified by *leve*. The *tympanum leve*, generally included among the *tympana*, described as being like a sieve, was the tambourine used in the rites of Bacchus and Cybele. Pliny doubtless described half pearls having one side round and the other flat, as *tympania*, on account of their resemblance to the tympanum or kettledrum, which, in its primitive form, innocent of screws or mechanism for tightening the head, exactly resembled the half pearl. During the middle ages the tympanum was generally a tambourine, the kettledrum being known as *nacaire*.

In architecture the term tympanum is given to the triangular space enclosed between the horizontal cornice of the entablature and the sloping cornice of the pediment. Though sometimes left plain, in the most celebrated Greek temples it was filled with sculpture of the highest standard ever attained. In Romanesque and Gothic work the term is applied to the space above the lintel or architrave of a door and the discharging arch over it, which was also enriched either with geometrical patterns or in later work with groups of figures; those in continental work are usually arranged in tiers. The upper portion of a gable when enclosed with a horizontal string-course, is also termed a tympanum.

TYNDALE (or TINDALE), **WILLIAM** (*c.* 1492–1536), translator of the New Testament and Pentateuch (see BIBLE, ENGLISH), was born on the Welsh border, probably in Gloucestershire, some time between 1490 and 1495. In Easter term 1510 he went to Oxford, where Foxe says he was entered of Magdalen Hall. He took his M.A. degree in 1515 and removed to Cambridge, where Erasmus had helped to establish a reputation for Greek and theology. Ordained to the priesthood, probably towards the close of 1521, he entered the household of Sir John Walsh, Old Sodbury, Gloucestershire, as chaplain and domestic tutor. Here he lived for two years, using his leisure in preaching in the villages and at Bristol, conduct which brought him into collision with the backward clergy of the district, and led to his being summoned before the chancellor of Worcester (William of Malvern) as a suspected heretic; but he was allowed to depart without receiving censure or giving any undertaking. But the persecution of the clergy led him to seek an antidote for what he regarded as the corruption of the Church, and he resolved to translate the New Testament into the vernacular. In this he hoped to get help from Cuthbert Tunstall, bishop of London, and so "with the good will of his master" he left Gloucester in the summer of 1523. Tunstall disappointed him, so he got employment as a preacher at St Dunstan's-in-the-West, and worked at his translation, living as chaplain in the house of Humphrey Monmouth, an alderman, and forming a firm friendship with John Frith; but finding publication impossible in England, he sailed for Hamburg in May 1524. After visiting Luther at Wittenberg, he settled with his amanuensis William Roy in Cologne, where he had made some progress in printing a 4to edition of his New Testament, when the work was discovered by John Cochlaeus, dean at Frankfurt, who not only got the senate of Cologne to interdict further printing, but warned Henry VIII. and Wolsey to watch the English ports. Tyndale and Roy escaped with their sheets to Worms, where the 8vo edition was completed in 1526. Copies were smuggled into England but were suppressed by the bishops, and William Warham, archbishop of Canterbury, even bought up copies on the Continent to destroy them. Attempts were made to seize Tyndale at Worms, but he found refuge at Marburg with Philip, landgrave of Hesse. There he probably met Patrick Hamilton, and was joined by John Frith. About this time he changed his views on the Eucharist and swung clean over from transubstantiation to the advanced Zwinglian position. His *Parable of the Wicked Mammon* (1528), *Obedience of a Christen Man* (1528), in which the two great principles of the English Reformation are set out, viz. the authority of Scripture in the Church and the supremacy of the king in the state, and *Practyse of Prelates* (1530), a strong indictment of the Roman Church and also of Henry VIII.'s divorce proceedings, were all printed at Marburg. In 1529 on his way to Hamburg he was wrecked on the Dutch coast, and lost his newly completed translation of Deuteronomy. Later in the year he went to Antwerp where he conducted his share of the classic controversy with Sir Thomas More. After Henry VIII.'s change of attitude towards Rome, Stephen Vaughan, the English envoy to the Netherlands, suggested Tyndale's return, but the reformer feared ecclesiastical hostility and declined. Henry then demanded his surrender from the emperor as one who was spreading sedition in England, and Tyndale left Antwerp for two years, returning in 1533 and busying himself with revising his translations. In May 1535 he was betrayed by Henry Phillips, to whom he had shown much kindness, as a professing student of the new faith. The imperial officers imprisoned him at Vilvorde Castle, the state prison, 6 m. from Brussels, where in spite of the great efforts of the English merchants and the appeal of Thomas Cromwell to Archbishop Carandolet, president of the council, and to the governor of the castle, he was tried for heresy and condemned. On the 6th of October 1536 he was strangled at the stake and his body afterwards burnt. Though long an exile from his native land, Tyndale was one of the greatest forces of the English Reformation. His writings show sound scholarship and high literary power, while they helped to shape the thought of the Puritan party in England. His translation of the Bible was so sure and happy that it formed the basis of subsequent renderings, especially that of the authorized version of 1611. Besides the New Testament, the Pentateuch and Jonah, it is believed that he finished in prison the section of the Old Testament extending from Joshua to Chronicles.

Beside the works already named Tyndale wrote *A Prologue on the Epistle to the Romans* (1526), *An Exposition of the 1st Epistle of John* (1531), *An Exposition of Matthew v.-vii.* (1532), a treatise on the sacraments (1533), and possibly another (no longer extant) on matrimony (1529).

The works of Tyndale were first published along with those of John Frith (*q.v.*) and Robert Barnes, "three worthy martyrs and principal teachers of the Church of England," by John Day, in 1573 (folio). A new edition of the works of Tyndale and Frith, by T. Russell, was published at London (1828–1831). *His Doctrinal Treatises and Introductions to Different Portions of the Holy Scripture* were published by the Parker Society in 1848. For biography, see Foxe's *Acts and Monuments*; R. Demaus, *William Tyndale* (London, 1871); also the Introduction to Mombert's critical reprint of Tyndale's Pentateuch (New York, 1884), where a bibliography is given.

TYNDALL, JOHN (1820–1893), British natural philosopher, was born in Co. Carlow, Ireland, on the 2nd of August 1820, his father being the son of a small landowner in poor circumstances, but a man of more than ordinary ability. With Darwin and Huxley his name is inseparably connected with the battle which began in the middle of the 19th century for making the new standpoint of modern science part of the accepted philosophy in general life. For many years, indeed, he came to represent to ordinary Englishmen the typical or ideal professor of physics. His strong, picturesque mode of seizing and expressing things gave him an immense living influence both in speech and writing, and disseminated a popular knowledge of physical science such as had not previously existed. But besides being a true educator, and perhaps the greatest popular teacher of natural philosophy in his generation, he was an earnest and original observer and explorer of nature.

Tyndall was to a large extent a self-made man; he had no early advantages, but with indomitable earnestness devoted himself to study, to which he was stimulated by the writings of Carlyle. He passed from a national school in Co. Carlow to a minor post (1839) in the Irish ordnance survey, thence (1842) to the English survey, attending mechanics' institute lectures at Preston in Lancashire. He then became for a time (1844) a railway engineer, and in 1847 a teacher at Queenwood College, Hants. Thence with much spirit, and in face of many difficulties, he betook himself, with his colleague Edward Frankland, to the university of Marburg (1848–1851), where, by intense application, he obtained his doctorate in two years. His inaugural dissertation was an essay on screw-surfaces.

Tyndall's first original work in physical science was in his experiments with regard to magnetism and diamagnetic polarity, on which he was chiefly occupied from 1850 to 1855. While he was still lecturing on natural philosophy at Queenwood College, his magnetic investigations made him known in the higher circles of the scientific world, and through the initiative of Sir E. Sabine, treasurer of the Royal Society, he was elected F.R.S. in June 1852. In 1850 he had made Faraday's acquaintance, and shortly before the Ipswich meeting of the British Association in 1851 he began a lasting friendship with T. H. Huxley. The two young men stood for chairs of physics and natural history respectively, first at Toronto, next at Sydney, but they were in each case unsuccessful. On the 11th of February 1853, however, Tyndall gave, by invitation, a Friday evening lecture (on "The Influence of Material Aggregation upon the Manifestations of Force") at the Royal Institution, and his public reputation was at once established. In the following May he was chosen professor of natural philosophy at the Royal Institution, a post which exactly suited his striking gifts and made him a colleague of Faraday, whom in 1866 he succeeded as scientific adviser to the Trinity House and Board of Trade, and in 1867 as superintendent of the Royal Institution. His reverent attachment to Faraday is beautifully manifested in his memorial volume called *Faraday as a Discoverer* (1868).

The more original contributions which Tyndall made to science are dealt with elsewhere, in the articles concerned with the various subjects (see HEAT, &c.). But his inquiries into glacier motion were notable alike for his association with Switzerland and for prolonged controversy with other men of science on the subject. In 1854, after the meeting of the British Association in Liverpool, a memorable visit occurred to the Penrhyn slate quarries, where the question of slaty cleavage arose in his mind, and ultimately led him, with Huxley, to Switzerland to study the phenomena of glaciers. Here the mountains seized him, and he became a constant visitor and one of the most intrepid and most resolute of explorers; among other feats of climbing he was the first to ascend the Weisshorn (1861). The strong, vigorous, healthfulness and enjoyment which permeate the record of his Alpine work are magnificent, and traces of his influence remain in Switzerland to this day. The problem of the flow of glaciers occupied his attention for years, and his views brought him into acute conflict with others, particularly J. D. Forbes and James Thomson. Every one knew that glaciers moved, but the questions were how they moved, for what reason and by what mechanism. Some thought they slid like solids; others that they flowed like liquids; others that they crawled by alternate expansion and contraction, or by alternate freezing and melting; others, again, that they broke and mended. Thus there arose a chaos of controversy, illuminated by definite measurements and observations. Tyndall's own summary of the course of research on the subject was as follows:—

> The *idea* of semi-fluid motion belongs entirely to Rendu; the *proof* of the quicker central flow belongs in part to Rendu, but almost wholly to Agassiz and Forbes; the proof of the retardation of the bed belongs to Forbes alone; while the discovery of the locus of the point of maximum motion belongs, I suppose, to me.

But while Forbes asserted that ice was viscous, Tyndall denied it, and insisted, as the result of his observations, on the flow being due to fracture and regelation. All agreed that ice flowed *as if* it were a viscous fluid; and of this apparent viscosity James Thomson offered an independent explanation by the application of pure thermodynamical theory, which Tyndall considered inefficient to account for the facts he observed. It is unnecessary here to rake among the ashes of this prolonged dispute, but it may be noted that Helmholtz, who, in his lecture on "Ice and Glaciers," adopted Thomson's theory, afterwards added in an appendix that he had come to the conclusion that Tyndall had "assigned the essential and principal cause of glacier motion in referring it to fracture and regelation" (1865).

Tyndall's investigations of the transparency and opacity of gases and vapours for radiant heat, which occupied him during many years (1859–1871), are frequently considered his chief scientific work. But his activities were essentially many-sided. He definitely established the absorptive power of clear aqueous vapour—a point of great meteorological significance. He made brilliant experiments elucidating the blue of the sky, and discovered the precipitation of organic vapours by means of light. He called attention to curious phenomena occurring in the track of a luminous beam. He examined the opacity of the air for sound in connexion with lighthouse and siren work, and he finally clinched the proof of what had been already substantially demonstrated by several others, viz. that germ-free air did not initiate putrefaction, and that accordingly "spontaneous generation" as ordinarily understood was a chimera (1875–1876). One practical outcome of these researches is the method now always adopted of sterilizing by a succession of gentle warmings, sufficient to kill the developed micro-organisms, instead of by one fierce heating attempting to attack the more refractory undeveloped germs of the same. This method of intermittent sterilization originated with Tyndall, and it was an important contribution to biological science and industrial practice.

For the substantial publication of these researches reference must be made to the *Transactions of the Royal Society*; but an account of many of them was incorporated in his best-known books, namely, the famous *Heat as a Mode of Motion* (1863; and later editions to 1880), the first popular exposition of the mechanical theory of heat, which in 1862 had not reached the text-books; *The Forms of Water*, &c. (1872); *Lectures on Light* (1873); *Floating Matter in the Air* (1881); *On Sound* (1867; revised 1875, 1883, 1893). The original memoirs themselves on radiant heat and on magnetism were collected and issued as two large volumes under the following titles: *Diamagnetism and Magne-crystallic Action* (1870); *Contributions to Molecular Physics in the Domain of Radiant Heat* (1872).

It was on the whole the personality, however, rather than the discoverer, that was greatest in Tyndall. In the pursuit of pure science for its own sake, undisturbed by sordid considerations, he shone as a beacon light to younger men—an exemplar of simple tastes, robust nature and lofty aspirations. His elevation above the common run of men was conspicuous in his treatment of the money which came to him in connexion with his successful lecturing tour in America (1872–1873). It amounted to several thousands of pounds, but he would touch none of it; he placed it in the hands of trustees for the benefit of American science—an act of lavishness which bespeaks a noble nature. Though not so prominent as Huxley in detailed controversy over theological problems, he played an important part in educating the public mind in the attitude which the development of natural philosophy entailed towards dogma and religious authority. His famous Belfast address (1874), delivered as president of the British Association, made a great stir among those who were then busy with the supposed conflict between science and religion; and in his occasional writings—*Fragments of Science*, as he called them, "for unscientific people"—he touched on current conceptions of prayer, miracles, &c., with characteristic straightforwardness and vigour.

As a public speaker he had an inborn Irish readiness and vehemence of expression; and, though a thorough Liberal, he split from Mr Gladstone on Irish home rule, and took an active part in politics in opposing it.

In 1876 Tyndall married Louisa, daughter of Lord Claud Hamilton. He built in 1877 a cottage on Bel Alp above the Rhône valley, and in 1885 a house on Hindhead, near Haslemere. At the latter place he spent most of his later years; his health was, however, no longer as vigorous as his brain, and he suffered frequently from sleeplessness. On the 4th of December 1893, having been accidentally given an overdose of chloral, he died at Hindhead.

TYNDARIS, an ancient city on the northern coast of Sicily, about 13 m. W.S.W. of Mylae (mod. Milazzo) and 5 m. E. of the modern town of Patti. It was founded by Dionysius the Elder in 395 B.C., who settled there 600 Peloponnesian Messenians on a site cut out of the territory of Abacaenum (1 m. north of the modern Tripi). It was thus almost the last Greek city founded in Sicily. It was one of the earliest allies of Timoleon. In the First Punic War it was dependent on Carthage, but expelled the garrison in 254 B.C. and joined the Romans, under whom it seems to have flourished. Cicero calls it "nobilissima civitas," though it seems to have suffered especially under Verres. It was one of the points occupied by Sextus Pompeius, but was later on taken by Agrippa, who used it as a base of operations. Augustus probably made it a *colonia*. Pliny mentions that half of it was swallowed up by the sea, though he does not give the date of this event (*Hist. nat.* ii. 206). It was probably, however, due to a fault in the limestone rock of which it is composed, and the action of the sea. The site is a remarkably fine one, and it is surprising that it was not occupied sooner. It is an isolated hill (920 ft.) with projecting spurs, rising abruptly on the seaward side, and connected by a comparatively narrow isthmus with the lower ground inland. It thus commands a magnificent view, including even the summit of Etna, while opposite to it on the north are the Lipari Islands. Considerable remains of the city walls, built of rectangular blocks of stone, exist on the south side; on the west their foundations are traceable. Remains of several towers may be seen, and the site of the main gate, which was in a recess on the south (the land) side, is clearly traceable, the walls defending it on each side being well preserved. Outside it are several tombs of the Roman period. The walls follow the upper edge of the plateau, and do not seem to have included the spurs to seaward. Their remains indicate that it was the north and north-east portion of the city that fell. This fact renders it doubtful whether the church of the Madonna di Tindari, at the east extremity, marks the site of the acropolis. Along parts of the north side, where the line of the wall should run, is a line of débris, which may belong to a reconstruction after the catastrophe described by Pliny. Within the walls are considerable remains of a building generally known (though not correctly) as the gymnasium, constructed of masonry, with three narrow halls, each about 90 ft. long, the central hall being 21 ft. wide, the other two 14 ft. Below it to the north are remains of a building with several mosaic pavements, and to the west is a small theatre, the internal diameter of which is 212 ft., and the length of the stage 80 ft. There are traces of many other buildings within the city area, including a considerable number of underground cisterns An important collection of objects found on the site is preserved in the Villa della Scala (1½ m. to the west), belonging to Baron Sciacca, the owner of the site itself.

See R. V. Scaffidi, *Tyndaris* (Palermo, 1895). (T. As.)

TYNE, a river in the north-east of England, flowing eastward to the North Sea, formed of two main branches, the North Tyne and South Tyne. The North Tyne rises in the Cheviot Hills, at their south-western extremity, near the Scottish border. The valley soon becomes beautifully wooded. At Bellingham it receives the Rede, whose wild valley, Redesdale, was one of the chief localities of border warfare, and contains the site of the battle of Otterburn (1388). The South Tyne rises in the south-eastern extremity of Cumberland, below Cross Fell in the Pennine Chain, and flows north past Alston as far as the small town of Haltwhistle, where it turns east. The valley receives from the south the picturesque Allendale, in which the lead mines were formerly important. The two branches of the Tyne join at Warden, a little above the town of Hexham, with its great abbey, and the united stream continues past Corbridge, where a Roman road crossed it, in a beautiful sylvan valley. The united course from the junction to the sea is about 30 m. The length from the source of the North Tyne is 80 m., and the drainage area is 1130 sq. m. In its last 15 m. the Tyne, here the boundary between Northumberland and Durham, is one of the most important commercial waterways in England. Sea-going vessels can navigate up to Blaydon, and collieries and large manufacturing towns line the banks—Newburn, Newcastle-upon-Tyne, Wallsend and North Shields on the Northumberland side; Gateshead, Jarrow and South Shields on the Durham side, with many lesser centres, forming continuous lines of factories and shipbuilding yards. The growth of the great shipbuilding and engineering companies, now amalgamated, of which the Armstrong firm at Elswick is the most famous, necessitated the dredging of the river so as to form a deep waterway. At high-water spring tides there are 40 ft. of water at Shields Harbour at the mouth, and 31 at Newcastle, 8 m. up river. Dangerous rocks outside the mouth have been partially removed and the remainder protected, and the Tyne forms a very safe harbour of refuge.

TYNEMOUTH, a municipal, county and parliamentary borough of Northumberland, England, including the townships of Chirton, Cullercoats, North Shields, Preston and Tynemouth. Pop. (1891), 46,588; (1901), 51,366. North Shields, Tynemouth and Cullercoats are successive stations on a branch of the North-Eastern railway. Tynemouth lies on the north bank of the Tyne, on a picturesque promontory, 8½ m. E. of Newcastle. North Shields (*q.v.*) adjoins it on the W.; Chirton is to the W. again, and Preston to the N. of North Shields, while Cullercoats is on the coast 1¼ m. N.N.W. of Tynemouth. Tynemouth is the principal watering-place on this part of the coast, and here and at Cullercoats are numerous private residences. On the point of the promontory there is a small battery called the Spanish battery, and near it is a monument to Lord Collingwood. Within the grounds, to which the gateway of the old castle gives entrance, are the ruins of the ancient priory of St Mary and St Oswin—the principal remains being those of the church, which was a magnificent example of Early English work engrafted upon Norman. The priory and castle serve as the headquarters of the Tyne Submarine Engineers. The municipal buildings are in North Shields, which is also an important seaport. The coast is rocky and dangerous, but a fine pier protects the harbour (see NORTH SHIELDS). The municipal borough is under a mayor, 6 aldermen and 18 councillors. Area, 4372 acres.

Tynemouth is supposed to have been a Roman station, from the discovery of Roman remains there, but its early history centres round the priory, supposed to have been founded by Edwin, king of Northumbria, between 617 and 633, and rebuilt by king Oswald in 634. In 651 it became famous as the burial-place of Oswin, king of Deira, afterwards patron saint of the priory. After the conquest Malcolm, king of Scotland, and Edward his son, who had been defeated and killed at Alnwick, were buried there. Earl Waltheof gave Tynemouth to the monks of Jarrow, and it became a cell to the church of Durham, but later, owing to a quarrel with the bishop, Robert de Mowbray granted it to the abbey of St Albans in Hertfordshire. The priory was probably fortified in Saxon times, and was strengthened by Robert de Mowbray so that it was able to sustain a siege of two months by William Rufus. After the Dissolution the fortifications were repaired by Henry VIII. In 1642 it was garrisoned for the king by the earl of Newcastle, but surrendered to parliament in 1644. It was converted into barracks at the end of the 18th century. Owing to their close proximity to Newcastle and to the ascendancy which the burgesses of that town had gained over the river Tyne, Tynemouth and North Shields did not become important until the 19th century; the privileges which they held before that time are contained in charters to the prior and convent, and include freedom from toll, &c., granted by King John in 1203–1204. In 1292 there were disputes between the citizens of Newcastle and the prior, who had built a quay at North Shields, but was obliged by act of parliament to destroy it. Edward IV. in 1463 confirmed the previous charters of the monks, and at the same time gave them and their tenants licence to buy necessaries from ships in the "port and river of Tyne," and to load ships with coal and salt "without hindrance from the men of Newcastle." After the Napoleonic wars the trade of North Shields rapidly increased. The borough was incorporated in 1849, and has returned one member to parliament since 1832. In 1279 the prior claimed a market at Tynemouth, but was not allowed to hold it; and in 1304 a fair, which had been granted to him in the preceding year, was withdrawn on the petition of the burgesses of Newcastle. A market and two fairs on the last Friday in April and the first Friday in November were established in 1802 by the duke of Northumberland. In the 17th century the chief industries were the salt and coal trades. The former, which has entirely disappeared, was the more important, and in 1635 the salt-makers of North and South Shields received an incorporation charter.

See *Victoria County History, Northumberland*; W. S. Gibson, *The History of the Monastery founded at Tynemouth in the Diocese of Durham* (1846–1847).

TYPEWRITER, a writing machine which produces characters resembling those of ordinary letterpress; the term is also applied to the operator who works such machines.

In 1714 a British patent was granted to Henry Mill, who claimed that he had brought his invention to perfection at great pains and expense, for "An Artificial Machine or Method for the Impressing or Transcribing Letters, Singly or Progressively one after another as in Writing, whereby all Writing whatever may be Engrossed in Paper or Parchment so Neat and Exact as not to be distinguished from Print"; but beyond the title the patent gives no indication of the nature or construction of the machine. In America a patent for a "typographer" was obtained by William A. Burt in 1829, but the records of it were destroyed by a fire at Washington in 1836. The "typographic machine or pen" patented by X. Progrin, of Marseilles, in 1833, was on the type-bar principle, and at the York meeting of the British Association in 1844 a Mr Littledale showed an apparatus for the use of the blind, by which the impression of a type selected from a series contained in a slide could be embossed on a sheet of paper. In the "chirographer," for which American patents were granted to Charles Thurber in 1843 and 1845, a horizontal wheel carried in its periphery a series of rods each bearing a letter, the wheel being rotated till the required type was over the printing point. The Great Exhibition of 1851 contained a machine patented by Pierre Foucault, of Paris, in 1849, in which a series of rods with type at their ends could be pushed down to emboss paper at the printing point to which they were arranged radially; and there was in addition the "typograph" of William Hughes, which was also intended for embossing, though it was subsequently modified to give an impression through carbon paper. Between 1847 and 1856 Alfred E. Beach in America, and between 1855 and 1860 Sir Charles Wheatstone in England, constructed several typewriters, and in 1857 Dr S. W. Francis, of New York, made one with a pianoforte keyboard and type bars arranged in a circle. In 1866 John Pratt, an American living in London, patented a machine having 36 types mounted in three rows on a type wheel, the rotation of which brought the required character opposite the printing point, when the paper with a carbon sheet intervening was pressed against it by a hammer worked by the keys. Two years later an American patent was taken out by C. L. Sholes and C. Glidden, and in 1875, after effecting various improvements, they finally placed the manufacture of their machines in the hands of Messrs E. Remington & Sons, gun-makers, of Ilion, New York. The Remington machines worked on the type-bar principle, but at first each of the 44 bars carried only a single character, so that the writing was in capitals only. But in 1878 type-bars with two types were introduced, so that a machine with 40 keys, two being change-case keys, could print 76 characters, with both capital and small letters.

The great majority of modern typewriters are worked from a keyboard; the few that are not, known as index machines, will be disregarded here, for although they are much less expensive in first cost than the others, they scarcely come into competition as practical instruments, on account of their slowness. Keyboard machines fall into two classes, according as the types which make the impressions are (*a*) carried at the end of levers or type-bars which strike the paper when the keys are depressed, or (*b*) are arranged round the circumference of a wheel, or segment, which is rotated by the action of the keys until the corresponding type is brought opposite the printing point. The former of these arrangements is the more common. Another point of difference is in the inking device; in some cases, the type is inked by means of an ink-pad before being brought down on the paper to make the impression, but more frequently an inked ribbon is drawn along by the action of the machine between the type-face and the paper. Sometimes this ribbon is inked in two colours, enabling the operator, by bringing the appropriate portion opposite the type-face, to write, say, in black and red at will. A third basis of classification may be found in the arrangement of the keyboard. In some machines there is one key for each character, in others each key does duty for two or more characters. For example, in the former class there is one key for the capital A and another for the small a, the keys being arranged in two banks corresponding to the upper and lower cases of a printer's type-case; in the latter, one key is capable of striking both the small and the capital letter, and it does one or other according as a subsidiary key is or is not brought into simultaneous use with it. In type-bar machines designed on this plan, each bar carries two or more letters (cf. fig. 1). This form of keyboard is also applied to type-wheel machines.

Though there are numberless differences in detail, all typewriters, apart from the index machines, bear a general resemblance to each other in their mechanical arrangements. The really essential operations may be reduced to two; the machine must print a letter when a key is struck, and it must have a device by which the paper may be moved a short distance to the left with each stroke in order that the letters may be printed separately, not one on top of the other. Of the many subsidiary appliances that are fitted—a bell to warn the operator that he is approaching the end of a line, a lock to prevent the machine from working after the end of the line has been passed, attachments for facilitating insertion of fresh paper, corrections, and tabulation, &c.—some are certainly of advantage, but others are more useful to the manufacturer in drawing up his advertisements than to the expert operator, whose first care often is to disconnect them from the machine. Similarly with the "visible writing," which is sometimes put forward as a recommendation of extraordinary importance; doubtless the novice who is learning the keyboard finds a natural satisfaction in being able to see at a glance that he has struck the key he was aiming at, but to the practised operator it is not a matter of great moment whether the writing is always in view or whether it is only to be seen by moving the carriage, for he should as little need to test the accuracy of his performance by constant inspection as the piano-player needs to look at the notes to discover whether he has struck the right ones. The one important desideratum, without which no typewriter can produce work of satisfactory appearance, is accuracy of alignment. For the attainment of this the use of type-bars has given wide scope to the ingenuity of inventors, who have been confronted with the problem of making a system of levers at once strong, rigid and light, and of supporting them on bearings which are steady and adjustable for wear in conditions where space is much restricted.

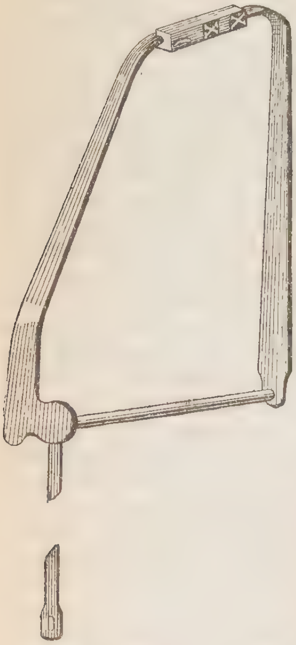

FIG. 1.—Type-bar of Oliver Machine.

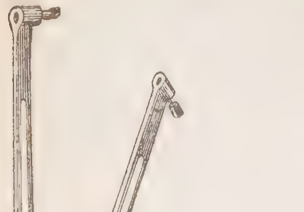

FIG. 2.—Type-bars of Bar-Lock Machine.

In the Oliver machine the type-bar is of the form shown in fig. 1, to secure stiffness and a double bearing. In the Bar-Lock, the type-bars are arranged three in one hanger, so that each has a bearing three times as wide as would be possible in the same space if each had a hanger to itself (fig. 2); in addition the wear of the pivots can be taken up by the screws seen on the right of the bearings, and as a further precaution each type-bar is locked at the printing point by falling between a pair of conical pins, which centre it exactly in the required place. In the Yost and the Empire the type-bars pass through guides. The centre guide of the former is shown at G in fig. 3, the type being just about to strike the paper. Pressure on one of the keys works the lever and pushes up the connecting-rod C, when the type leaves the ink-pad P and passes through the guide, which is slightly bevelled so as to guide it exactly to the printing point. In the Smith Premier the shafts upon which the type-bars swing are mounted tangentially on the ring (fig. 4), so that long supporting bearings are obtained, while the shortness of the type-bars themselves renders it possible to make them very stiff. The rocking-shaft mechanism (fig. 5), by which the power is transmitted from the keys to the type-bars, admits of each key having the same leverage and tends to uniformity of touch. This last quality is also aimed at by interposing an intermediate parallel bar between the key levers and the type-bar, as in the New Century Caligraph. In the Densmore the friction of the movements is minimized by the employment of ball bearings for the type-bar pivots. Electrical typewriters, in which the depression of a key does not work a type-bar directly, but merely closes a circuit that energizes an electro-magnet, have been suggested as a means of obtaining uniformity of touch combined with ease and rapidity, but have not as yet displaced the ordinary machines to any extent.

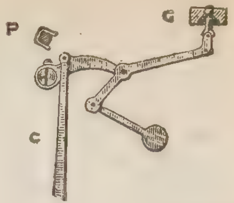

FIG. 3. — Central Guide and Type-bar of Yost Machine.

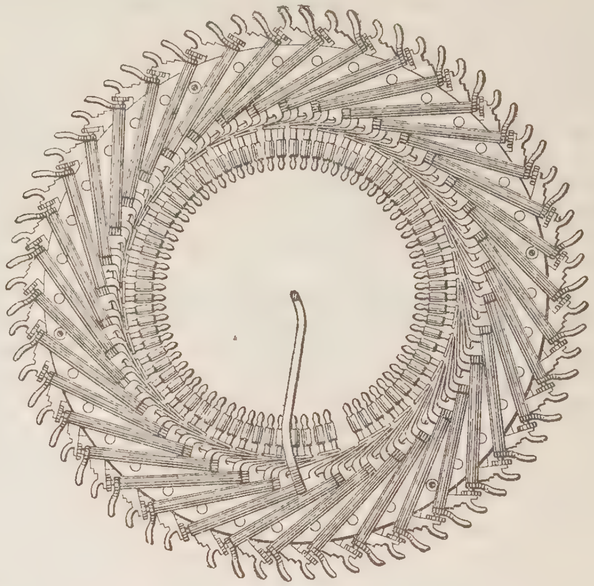

FIG. 4.—Type-bar Bearings, Smith Premier.

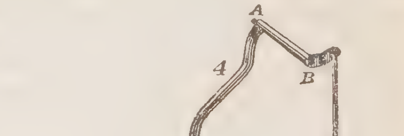

FIG. 5.—Rocking-shaft Mechanism of Smith Premier.

1, Key with stem. 2, Rocking shaft.
3, Connecting-rod. 4, Type-bar.
A and B, Conical bearings, $1\frac{5}{8}$ in. apart.

One special form of typewriter, the Elliott-Fisher, is designed to write in a book such as a ledger: One leaf is clamped between the platen and an open frame which holds the paper smoothly. The operative parts slide on this frame, and move up and down the page so as to space the lines properly, the keyboard, with the type-bars, ribbon, &c., travelling step by step across the page. An adding device may be combined with this machine.

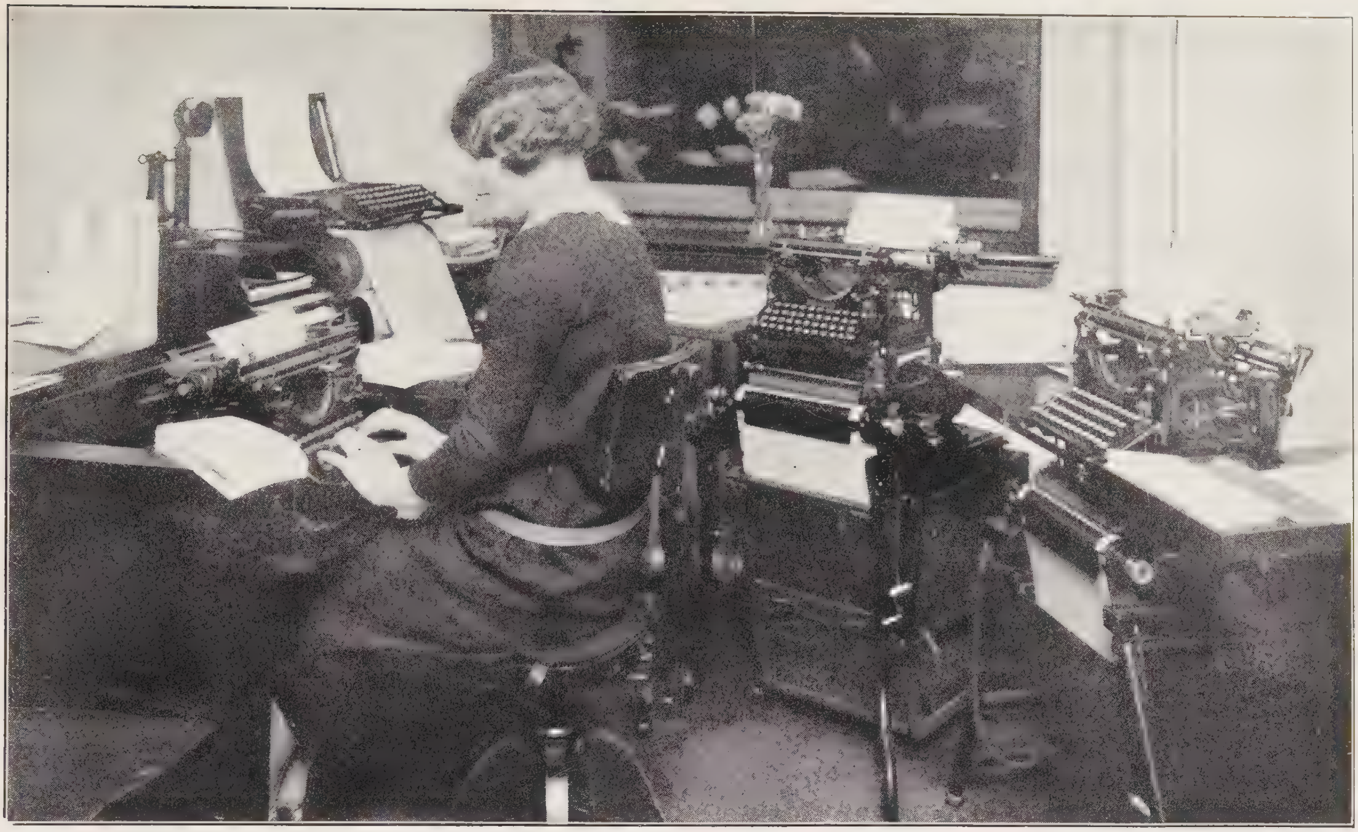

Fig. 1.

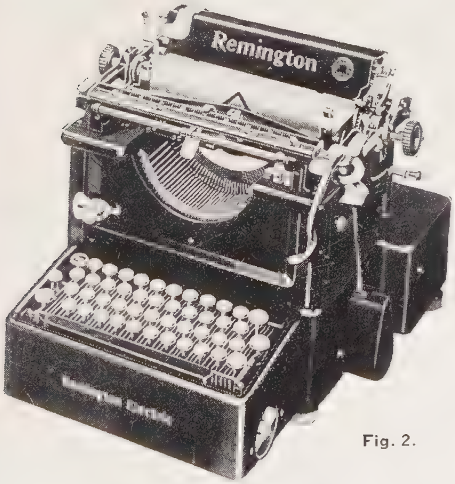
Remington
Remington Electric

Fig. 2.

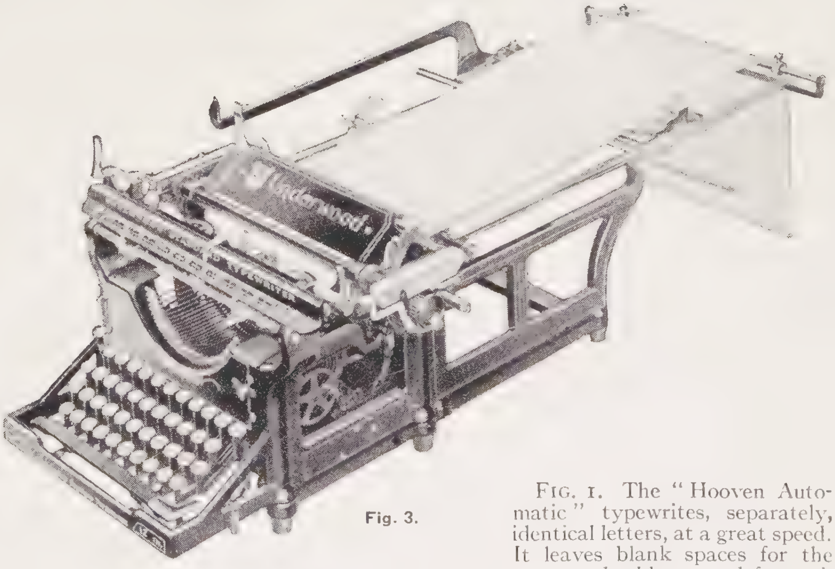

Fig. 3.

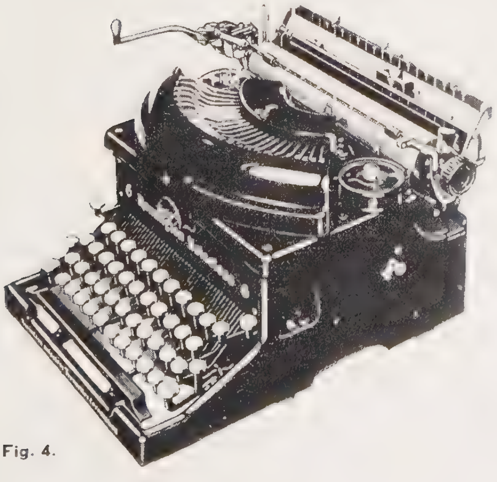

Fig. 4.

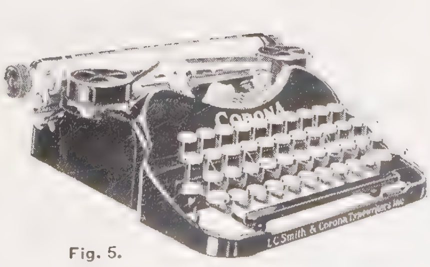
CORONA
L.C.Smith & Corona Typewriters Inc

Fig. 5.

FIG. 1. The "Hooven Automatic" typewrites, separately, identical letters, at a great speed. It leaves blank spaces for the name and address, and for such parts of the body of the letter as may need to be varied. One operator only is required to fill in these blanks on the product of several machines.

FIG. 2. The Remington electric typewriter.

FIG. 3. The Underwood fanfold typewriter saves the time and labour of putting in and taking out the paper and the carbon

FIG. 4. The Noiseless typewriter.

FIG. 5. The Corona portable typewriter.

Further discussion will be found in the article OFFICE APPLIANCES, Vol. 30.

TYPHOID FEVER. Typhoid or enteric[1] (Gr. ἔντερον, the intestine) is a specific infectious fever characterized mainly by its insidious onset, by a peculiar course of the temperature, by marked abdominal symptoms occurring in connexion with a specific lesion of the bowels, by an eruption upon the skin, by its uncertain duration, and by a liability to relapses. This fever has received various names, such as gastric fever, abdominal typhus, infantile remittent fever, slow fever, nervous fever, "pythogenic fever," &c. The name of "typhoid" was given by Louis in 1829, as a derivative from typhus. Until a comparatively recent period typhoid was not distinguished from typhus. For, although it had been noticed that the course of the disease and its morbid anatomy were different from those of ordinary cases of typhus, it was believed that they merely represented a variety of that malady. The distinction between the two diseases appears to have been first accurately made in 1836 by Messrs Gerhard and Pennock, of Philadelphia, and valuable work was done by other American doctors, particularly Elisha Bartlett (1842). The difference between typhus and typhoid was still more fully demonstrated by Dr A. P. Stewart, of Glasgow (afterwards of London). Finally, all doubt upon the subject was removed by the careful clinical and pathological observations made by Sir William Jenner at the London fever hospital (1849-1851).

The more important phenomena of typhoid fever will be better understood by a brief reference to the principal pathological changes which take place during the disease. These relate for the most part to the intestines, in which the morbid processes are highly characteristic, both as to their nature and their locality. The changes (to be presently specified) are evidently the result of the action of the contagium on the system, and they begin to show themselves from the very commencement of the fever, passing through various stages during its continuance. The portion of the bowels in which they occur most abundantly is the lower part of the small intestine (ileum), where the "solitary glands" and "Peyer's patches" on the mucous surface of the canal become affected by diseased action of a definite and progressive character, which stands in distinct relation to the symptoms exhibited by the patient in the course of the fever. (1) These glands, which in health are comparatively indistinct, become in the commencement of the fever enlarged and prominent by infiltration due to inflammatory action in their substance, and consequent cell proliferation. This change usually affects a large extent of the ileum, but is more marked in the lower portion near the ileo-caecal valve. It is generally held that this is the condition of the parts during the first eight or ten days of the fever. (2) These enlarged glands next undergo a process of sloughing, the inflammatory products being cast off either in fragments or *en masse.* This usually takes place in the second week of the fever. (3) Ulcers are thus formed varying in size according to the gland masses which have sloughed away. They may be few or many in number, and they exhibit certain characteristic appearances. They are frequently, but not always, oblong in shape, with their long axis in that of the bowel, and they have somewhat thin and ragged edges. They may extend through the thickness of the intestine to the peritoneal coat and in their progress erode blood-vessels or perforate the bowel. This stage of ulceration exists from the second week onwards during the remaining period of the fever, and even into the stage of convalescence. (4) In most instances these ulcers heal by cicatrization, leaving, however, no contraction of the calibre of the bowel. This stage of healing occupies a considerable time, since the process does not advance at an equal rate in the case of all the ulcers, some of which have been later in forming than others. Even when convalescence has been apparently completed, some unhealed ulcers may yet remain and prove, particularly in connexion with errors in diet, a cause of relapse of some of the symptoms, and even of still more serious or fatal consequences. The mesenteric glands external to, but in functional relation with, the intestine, become enlarged during the progress of the fever, but usually subside after recovery.

Besides these changes, which are well recognized, others more or less important are often present. Among these may be mentioned marked atrophy, thinning and softness of the coats of the intestines, even after the ulcers have healed—a condition which may not improbably be the cause of that long-continued impairment of the function of the bowels so often complained of by persons who have passed through an attack of typhoid fever. Other changes common to most fevers are also to be observed, such as softening of the muscular tissues generally, and particularly of the heart, and evidences of complications affecting chest or other organs, which not infrequently arise. The swelled leg of fever sometimes follows typhoid, as does also periosteal inflammation.

The symptoms characterizing the onset of typhoid fever are very much less marked than those of most other fevers. The most marked of the early symptoms are headache, lassitude and discomfort, together with sleeplessness and feverishness, particularly at night; this last symptom is that by which the disease is most readily detected in its early stages. The peculiar course of the temperature is also one of the most important diagnostic evidences of this fever. During the first week it has a morning range of moderate febrile rise, but in the evening there is a marked ascent, with a fall again towards morning, each morning and evening, however, showing respectively a higher point than that of the previous day, until about the eighth day, when in an average case the highest point is attained. This varies according to the severity of the attack; but it is no unusual thing to register 104° or 105° F. in the evening and 103° or 104° in the morning. During the second week the daily range of temperature is comparatively small, a slight morning remission being all that is observed. In the third week the same condition continues more or less; but frequently a slight tendency to lowering may be discerned, particularly in the morning temperature, and the febrile action gradually dies down as a rule between the twenty-first and the twenty-eighth days, although it is liable to recur in the form of a relapse. Although the patient may, during the earlier days of the fever, be able to move about, he feels languid and uneasy; and usually before the first week is over he has to take to bed. He is restless, hot and uncomfortable, particularly as the day advances, and his cheeks show a red flush, especially in the evening or after taking food. The aspect, however, is different from the oppressed, stupid look which is present in typhus. The pulse in an ordinary case, although more rapid than normal, is not accelerated to an extent corresponding to the height of the temperature, and is, at least in the earlier stages of the fever, rarely above 100. In severe and protracted cases, where there is evidence of extensive intestinal ulceration, the pulse becomes rapid and weak, with a dicrotic character indicative of cardiac feebleness. The tongue has at first a thin, whitish fur and is red at the tip, edges and central line. It tends, however, to become dry, brown or glazed looking, and fissured transversely, while sordes may be present about the lips and teeth. There is much thirst and in some cases vomiting. Splenic and hepatic enlargement may be made out. From an early period in the disease abdominal symptoms show themselves and are frequently of highly diagnostic significance. The abdomen is somewhat distended or tumid, and pain accompanying some gurgling sounds may be elicited on light pressure about the lower part of the right side close to the groin—the region corresponding to that portion of the intestine in which the morbid changes already referred to are progressing. Diarrhoea is a frequent but by no means constant symptom. When present it may be slight in amount, or, on the other hand, extremely profuse, and it corresponds, as a rule, to the severity of the intestinal ulceration. The discharges are highly characteristic, being of light yellow colour resembling pea soup in appearance. Should intestinal haemorrhage occur, as is not infrequently the case during some stage of the fever, they may be dark brown or composed entirely of blood. The urine is scanty and high-coloured. About the beginning, or during the course of the second week of the fever, an eruption frequently makes its appearance on the skin. It consists of isolated spots, oval or round in shape, of a pale pink or rose colour, and of about one to one and a half lines in diameter. They are seen chiefly upon the abdomen, chest and back, and they come out in crops, which continue for four or five days and then fade away. At first they are slightly elevated, and disappear on pressure. In some cases they are very few in number, and their presence is made out with difficulty; but in others they are numerous and sometimes show themselves upon the limbs as well as upon the body. They do not appear to have any relation to the severity of the attack, and in a very considerable proportion of cases (particularly in children) they are entirely absent. Besides this eruption there are not infrequently numerous very faint bluish patches or blotches about half an inch in diameter, chiefly upon the body and thighs. When present the rose-coloured spots continue to come out in crops till nearly the end of the fever, and they may reappear should a relapse subsequently occur. These various symptoms persist throughout the third week, usually, however, increasing in intensity. The patient becomes prostrate and emaciated; the tongue is dry and brown, the pulse quickened and feeble, and the abdominal symptoms more marked; while nervous disturbance is exhibited in delirium, in tremors and jerkings of the muscles (*subsultus tendinum*), in drowsiness, and occasionally in "coma vigil." In severe cases the exhaustion reaches an extreme degree, although even in such instances the condition is not to be regarded as hopeless. In favourable cases a change for the better may be anticipated between the twenty-first and twenty-eighth days, more usually the latter. It does not, however, take place as in typhus by a well-marked crisis, but rather by what is termed a "lysis" or gradual subsidence of the febrile symptoms, especially noticeable in the daily decline of both morning and evening temperature, the lessening of diarrhoea, and improvement in pulse, tongue, &c. Convalescence proceeds slowly and is apt to be interrupted by relapses. Should such relapses repeat themselves, the case may be protracted for two or three months, but this is comparatively rare.

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[1] The word "enteric" has been substituted for "typhoid" by the Royal College of Physicians in the nomenclature of diseases authorized by them, and the change was officially adopted by all departments of the British government. Its advantages are doubtful, and it has been generally ignored by those foreign countries which used the word "typhoid." "Enteric" is preferable in that it cannot be confounded with "typhus" and bears some relation to the nature of the affection, the characteristic feature of which is a specific inflammation of the small intestine; but it is not sufficiently distinctive. There are, in truth, several enteric fevers, and the appropriation of a term having a general meaning to one of them is inconvenient. Thus it is found necessary to revert to the discarded "typhoid," which has no real meaning in itself, but is convenient as a distinctive label, when speaking of the cause of the disease or some of its symptoms. We have the "typhoid bacillus," "typhoid stools," "typhoid spots", "typhoid ulcers," &c. The word "enteric" cannot well be applied to these things, because of its general meaning. Consequently both words have to be used, which is awkward and confusing.

Death in typhoid fever usually takes place from one or other of the following causes. (1) Exhaustion, in the second or third weeks, or later. Sometimes sinking is sudden, partaking of some of the characters of a collapse. (2) Haemorrhage from the intestines. The evidence of this is exhibited not only in the evacuations, but in the sudden fall of temperature and rise in pulse-rate, together with great pallor, faintness and rapid sinking. Sometimes haemorrhage, to a dangerous and even fatal extent, takes place from the nose. (3) Perforation of an intestinal ulcer. This gives rise, as a rule, to sudden and intense abdominal pain, together with vomiting and signs of collapse, viz. a rapid flickering pulse, cold clammy skin, and the marked fall of temperature. Symptoms of peritonitis quickly supervene and add to the patient's distress. Death usually takes place within 24 hours. Occasionally peritonitis, apart from perforation, is the cause of death. (4) Occasionally, but rarely, hyperpyrexia (excessive fever). (5) Complications, such as pulmonary or cerebral inflammation, bedsores, &c.

Certain sequelae are sometimes observed, the most important being the swelled leg, periostitis affecting long bones, general ill-health and anaemia, with digestive difficulties, often lasting for a long time, and sometimes issuing in pulmonary tuberculosis. Occasionally, after severe cases, mental weakness is noticed, but it is usually of comparatively short duration.

No disease has been more thoroughly studied in recent years than typhoid fever. The chief points requiring notice are (1) causation and spread, (2) prevalence, (3) treatment, (4) prevention.

Causation.—The cause is the *bacillus typhosus*, discovered by Eberth in 1880 (see Parasitic Diseases). This organism multiplies in the body of a person suffering from the disease, and is thrown off in the discharges. It enters by being swallowed and is conveyed into the intestine, where sets up the characteristic inflammation. It is found in the spleen, the mesenteric glands, the bile and the liver, not infrequently also in the bone marrow, and sometimes in the heart, lungs and kidneys, as well as in the faeces and the urine. It has also, though more rarely, been found in the blood. The illness is therefore regarded as a general toxaemia with special local lesions. The relation of the bacillus to the other numerous bacteria infesting the intestinal canal, some of which are undoubtedly capable of assuming a pathogenic character, has not been determined; but its natural history, outside the body, has been investigated with more positive results than that of any other micro-organism, though much still remains obscure. Certain conclusions may be stated on good evidence, but it is to be understood that they are all more or less tentative. (1) In crude sewage the bacillus does not multiply, but dies out in a few days. (2) In partly sterilized sewage (*i.e.* heated to 65° C.) it does not multiply, but dies out with a rapidity which varies directly with the number of other organisms present—the more organisms the quicker it dies. (3) It is said not to be found in sewer air, though Sir Charles Cameron, from a series of recent experiments, claims to have proved the contrary. (4) In ordinary water containing other organisms it dies in about a fortnight. (5) In sterilized water it lives for about a month. (6) In ordinary soil moistened by rain it has lived for 67 days, in sewage-polluted soil for at least 53 days, in soil completely dried to dust for 25 days, and in sterilized soil for upwards of 400 days. (7) Exposed to direct sunlight it dies in from four to eight hours. (8) It is killed by a temperature of 58 °C., but not by freezing or drying. (9) It multiplies at any temperature between 10° C. and 46° C., but most rapidly between 35° C and 42° C. These conclusions, which are derived from experiment, are to a considerable extent in agreement with certain observations on the behaviour of the disease on a large scale.

The susceptibility of individuals to the typhoid bacillus varies greatly. Some persons appear to be quite immune. The most susceptible age is adolescence and early adult life; the greatest incidence, both among males and females, is between the ages of 15 and 35. The aged rarely contract it. Men suffer considerably more than women, and they carry the period of marked susceptibility to a later age. Predisposing causes are believed to be debility, depression, the inhalation of sewer air by those unaccustomed to it, and anything tending to "lower the vitality," whatever that convenient phrase may mean. According to the latest theories, it probably means in this connexion a chemical change in the blood which diminishes its bactericidal power. The lower animals appear to be free from typhoid in nature; but it has been imparted to rabbits and other laboratory animals. There is no evidence that it is infectious in the sense in which small-pox and scarlet fever are infectious; and persons in attendance on the sick do not often contract it when sufficient care is taken. The recognition of these facts has led to a general tendency to underrate contagion, direct and indirect, from the sick to the healthy as a factor in the dissemination of typhoid fever; but it must be remembered that the sick, from whose persons the germs of the disease are discharged, are always an immediate source of danger to those about them. Such personal infection may become a very important means of dissemination. There is evidence that this is the case with armies in the field, *e.g.* the conclusions of the commission appointed to inquire into the origin and spread of enteric fever in the military encampments of the United States in the Cuban campaign of 1898. Out of 1608 cases most thoroughly investigated, more than half were found to be due to direct and indirect infection in and from the tents (Childs: Sanitary Congress, Manchester, 1902). A similar but perhaps less direct mode of infection was shown to account for a large number of cases under more ordinary conditions of life in the remarkable outbreak at Maidstone in 1897, which was also subjected to very thorough investigation. It was undoubtedly caused in the first instance by contaminated water, but 280 cases occurred after this cause had ceased to operate, and these were attributed to secondary infection, either direct or indirect, from the sick. A good deal of evidence to the same effect by medical officers of health in England has been collected by Dr Goodall, who has also pointed out that the attendants on typhoid patients in hospital are much more frequently attacked than is commonly supposed (*Trans. Epidem. Soc.* vol. xix.).

Recent discoveries as to the part played in the dissemination of typhoid fever by what are termed "typhoid carriers" have thrown light upon the subject of personal infection. The subject was first investigated by German hygienists in 1907, and it was found that a considerable number of persons who have recovered from typhoid fever continue to excrete typhoid bacilli in their faeces and urine (typhoid bacilluria). They found that after six weeks 4% to 5% of typhoid patients were still excreting bacilli; 23% of 65 typhoid patients at Boston City Hospital showed typhoid bacilli in their excretions ten days before their discharge. The liability of a patient to continue this excretion bears a direct relation to the severity of his illness, and it is probable that the bacilli multiply in the gall bladder, from which they are discharged into the intestine with the bile. The condition in a small number of persons may persist indefinitely. In 101 cases investigated, Kayser found three still excreting bacilli two years after the illness, and George Deane has recorded a case in which bacilli continued to be excreted 29 years afterwards.

Many outbreaks have in recent times been traced to typhoid carriers, one of the first being the Strassburg outbreak. The owner of a bakehouse had had typhoid fever ten years previously, and it was noticed that every fresh employé entering her service developed the disease. She prepared the meals of the men. On her exclusion from the kitchen the cases ceased. In Brentry reformatory, near Bristol, an outbreak numbering 28 cases was traced to a woman employed as cook and dairymaid who had had typhoid fever six years previously. Before entering the reformatory she had been cook to an institution for boarded-out girls, and during her year's residence there 25 cases had occurred. A case is reported by Huggenberger of Zürich (*Lancet*, October 1908) in which a woman carrier is said to have infected a series of cases lasting over 31 years, including her husband, son, daughter-in-law, and no less than nine different servants. Numerous cases of contamination of milk supplies by a "carrier" have been investigated, and in outbreaks traced to dairies it is wise to submit the blood of all employés to the agglutination test. A persistently high opsonic index to typhoid bacilli is notable among "carriers." Not only do persons who have had tyhpoid fever harbour bacilli, but also persons who come in contact with cases of the disease and who have no definite history of illness themselves.

The other means of dissemination are polluted soil, food and drink, particularly milk and water. The precise mode in which polluted soil acts is not understood. The result of experiments mentioned above shows that the bacillus lives and multiplies in such soil, and epidemiological investigation has repeatedly proved that typhoid persists in localities where the ground is polluted by the leakage of sewage or by the failure to get rid of excrementitious matter. In some instances, no doubt, drinking water thus becomes contaminated and conveys the germs, but there appears to be some other factor at work, for the disease occurs under the conditions mentioned where the drinking water is free from suspicion. Exhalation is not regarded as a channel of communication. The researches of Majors Firth and Horrocks prove that dust, flies and clothing may convey the germs. Another way in which food becomes the medium of conveyance is by the contamination of oysters and other shellfish with sewage containing typhoid bacilli. This has been abundantly proved by investigations in Great Britain, America and France. Uncooked vegetables, such as lettuces and celery, may convey the disease in a similar way. The most familiar and important medium, however, is water. It may operate directly as drinking water or indirectly by contaminating vessels used for holding other liquids, such as milk cans. Typhoid caused by milk or cream has generally been traced to the use of polluted water for washing out the cans, or possibly adulterating their contents. There is obviously no reason why this chain of causation should not hold good of other articles of food and drink. Outbreaks have been traced to ginger-beer and ice-creams. Water sources become contaminated directly by the inflow of drains or the deposit of excretal matter; indirectly, and more frequently, by the leakage of sewage into wells or by heavy rains which wash sewage matter and night-soil from ditches and the surface of the land into springs and watercourses. Water may further be contaminated in the mains by leakage, in domestic cisterns, and in supply pipes by suction. There is some reason to believe that the bacilli may multiply rapidly in water containing suitable nourishment in the absence of large numbers of their natural foes.

Prevalence.—Typhoid fever is more or less endemic and liable to epidemic outbreaks all over the world. It is more prevalent in temperate than in tropical climates. The following comparative death-rates show its relative prevalence in certain countries in 1890: Italy, 658; Austria, 470; U.S.A. 462; Prussia, 204; England, 179. It has undergone marked and progressive diminution in many countries coincidently with improved sanitation, particularly in regard to drainage and water-supply. Table I. gives annual death-rates in England and Wales after 1869, when typhoid was registered separately from typhus and "simple" fever.

TABLE I.—*Annual Mortality from Enteric Fever per Million Persons living—England and Wales.*

Year.	Mortality.	Year.	Mortality.
1869	390	1889	176
1870	388	1890	179
1871	371	1891	168
1872	377	1892	137
1873	376	1893	229
1874	374	1894	159
1875	371	1895	175
1876	309	1896	166
1877	279	1897	156
1878	306	1898	182
1879	231	1899	199
1880	261	1900	160
1881	212	1901	173
1882	229	1902	126
1883	228	1903	100
1884	236	1904	93
1885	175	1905	89
1886	184	1906	92
1887	185	1907	67
1888	172	1908	75

The diminution is more clearly shown if quinquennial periods are taken, as in Table II.

TABLE II.—*Average Annual Mortality per Million in England and Wales, and in London.*

	1871–75.	1876–80.	1881–85.	1886–90.	1891–95.	1896–1900.	1901–05
England and Wales. .	354	278	218	180	176	174·8	112·6
London . .	256	234	226	150	136	148	—

London shows less improvement than Great Britain as a whole, but it started with superior sanitary conditions, and though the reduction has not been maintained in the last recorded quinquennium, the mortality is still much below the mean. The disease is more prevalent in Paris, but the diminution effected has been far greater in the time, the average annual mortality per million having fallen from 1430 in 1882 and 581 in 1883–1888 to 293 in 1889–1894 and 172 in 1895–1900. Other recorded instances of diminution are Berlin, Hamburg, Munich, Copenhagen, the Netherlands, Buenos Aires (from 1060 per million in 1890 to 140 in 1899). In all these and other cases the improvement is attributed either to drainage or water-supply, or both. The case of Munich is so instructive that it deserves special mention. For many years typhoid was excessively prevalent in that city. The prevalence was continuous, but aggravated by large epidemic waves, extending over several years. These gradually decreased in magnitude, and ceased towards the end of 1880. Since then the prevalence has still further diminished, the average annual mortality per million having fallen from 2024 in 1851–1860, 1478 in 1861–1870 and 1167 in 1871–1880 to 160 in 1881–1890 and 52 in 1891–1900.

It has been forcibly argued by Dr Childs (*Trans. Epidem. Soc.* vol. xvi.) that drinking water had little, if anything, to do with the prevalence of the disease, and that its gradual reduction was due to purification of the soil by improved drainage systems and the abolition of slaughter-houses. The epidemic waves were found by von Pettenkofer to be associated with the rise and fall of the subsoil water; when the water fell the fever rose, and vice versa. He did not, however, consider that the subsoil water exercised any influence itself; he merely regarded it as an index to certain conditions of moisture which exercised a favourable or unfavourable influence on the development of the disease. His theory, which has been much misunderstood, is to some extent corroborated by some facts observed in Great Britain. One is the seasonal prevalence of typhoid, which in England is an autumnal disease. The minimum occurs in May or June; in August a marked rise begins, which continues throughout the autumn and reaches a maximum in November, after which an abrupt fall sets in. These facts are in keeping with Pettenkofer's theory, for the subsoil water reaches its maximum height at the end of spring and falls throughout the summer and a great part of the autumn. The coincidence is further emphasized by the fact that in dry years, when the subsoil water sinks lower than usual, typhoid is more prevalent, and in wet years the contrary. A glance at the mortality table for England given above will show that the progressive improvement recorded down to 1892 was suddenly interrupted in 1893, when the rate rose abruptly from 137 to 229. That was an extraordinarily dry and hot year, and it was followed by a succession of dry and hot years, culminating in 1899, with two exceptions—1894 and 1897. In both the typhoid rate fell again, but in all the others it rose. One explanation has been suggested by Mr Matthew Adams of Maidstone. He points out that organic matter deposited on or in the ground passes in normal years gradually through several layers of soil, and undergoes a process of destruction or purification before reaching the underground water; but in hot summers the ground becomes baked and cracked, and there is no such percolation; when rain comes everything is swept suddenly away without any purification, and finds its way into the sources of drinking water.

Whether this be so or not, there is no doubt that dangerous material does collect during the summer and is swept into watercourses by the autumnal rains. Perhaps this is sufficient to account for the seasonal prevalence and the annual variations noted. There is, however, a great deal of typhoid which has no connexion with water-supply. Numerous cases of persistent prevalence have been investigated by the medical officers of the local government board, in which drinking water has been exonerated and the mischief attributed to standing pollution of the soil—for instance, Mold, Middlesbrough, Southend, Swinton and Pendlebury, &c. In such places the chronic prevalence is apt to swell at times to more epidemic proportions, as at Munich; and possibly the condition of the ground may be the cause. An examination of the relative incidence of typhoid in the counties of England and Wales (Bulstrode) goes to show that its prevalence, broadly regarded, is not capricious. The areas of maximum and minimum incidence remained practically the same throughout the twenty years 1871–1890, though there was everywhere a large diminution. This fact suggests the reflection that standing conditions are more important factors than those accidental occurrences which attract public attention by causing sudden and explosive outbreaks. When these are on a small scale they may be due to milk; on a large scale they are always water-borne and caused by sudden contamination of a public supply. The classical example is Maidstone. That outbreak began towards the end of August 1897, and within six weeks some 1500 persons were attacked. The total number of cases was 1847, with 132 deaths, in a population of about 34,000. With the exception of 280 cases of secondary infection, which lingered on till the following January, they all occurred before the 18th of October, and the disease subsided almost as rapidly as it arose. A mass of evidence of different kinds left no possibility of doubt that accidental contamination of a water-supply was the cause. Perhaps the most striking point was that Maidstone is supplied with water from three different sources, known as Cossington, Boarley and Farleigh, and out of 1681 cases the respective incidence in these areas was—Cossington 29, Boarley 69, Farleigh 1583. Another great example of water-borne typhoid is furnished by Philadelphia, where 14,082 cases occurred in 1898–1899.

Treatment.—Improved knowledge of the nature and causation of typhoid fever has not led to the successful introduction of a specific treatment; nor have means been found to cut short the illness, though its fatality has been reduced. It still goes through the classical stages, which broadly coincide with first, second and third weeks. Attempts have been made to deal directly with the toxins produced by the bacilli, on the hypothesis that they are formed in the intestinal canal, by the use of internal disinfectants, such as mercury, iodine, carbolic acid, salol, &c., and these agents are sometimes beneficial; but the treatment remains essentially symptomatic, and follows the principles that were recognized before the discovery of the *bacillus typhosus*. One of the most important improvements is the regular use of sponging or bathing for the reduction of temperature. It has even been developed into a continuous bath, in which the patient is kept in water throughout the illness. Since the recent development of serum-therapy various serums have been tried in the treatment of typhoid fever, and successful reports are given of the anti-endotoxic serum devised by Dr Allen Macfadyen, while Professor Chantemesse, in the statistics of serum treatment at the Bastion Hospital, Paris, states that from July 1901 to July 1907 he so treated 1000 cases, 43 proving fatal, a mortality of 4·3%. During the same period, 5621 cases were treated in fourteen other Paris hospitals, with 960 deaths, a mortality of 17%. Chantemesse's serum was employed by Professor Brunon at Rouen in 100 cases with three deaths, and Dr Josias of Paris in 200 cases with eight deaths in typhoid fever occurring in young children. The serum is taken from a horse which has received over a long period injections of an emulsion of the *bacillus typhosus* or a soluble toxin. Sir Almroth Wright has suggested the use of an autogenous vaccine in this as in other parasitic diseases, opsonic control being exercised.

The fatality of typhoid fever varies greatly. Age exercises a marked influence, the fatality rising steadily after the period 5 to 10 years. The importance of careful and intelligent nursing is undoubtedly great, but there is a tendency, encouraged by some nurses, on the part of the public to overestimate that factor and to think that nothing more is needed. This is a grave mistake. No disease requires more vigilant attention or greater medical experience. The following table shows quinquennial figures for the London Metropolitan Asylums Board hospitals.

	Metropolitan Asylums Board Hospitals.			County of London.
	Admissions.	Deaths.	Ratio per cent. of deaths to admissions.	Mean annual mortality per 1000 living.
1874–1878	1878	379	20	0·25
1879–1883	2049	381	19	0·23
1884–1888	1937	314	16	0·17
1889–1893	2517	415	16	0·13
1894–1898	3328	578	17	0·13
1899–1903	6779	1023	15	0·13
1904–1908	3084	457	15	0·05

Prevention.—If house drainage were always perfectly carried out, sewage satisfactorily disposed of, water-supply efficiently protected or treated, patients segregated, and the typhoid material excreted by them and typhoid "carriers" effectually annihilated—if, in short, scientific cleanliness were completely attained, the disease would disappear, or be at least excessively rare. In some communities much has been done in the directions indicated; but in many others the lessons of experience are ignored, and even in the best practice lags behind theory. This is mainly due to apathy and reluctance to spend money, but there are certain real difficulties which stand in the way. To discuss them fully would involve a lengthy consideration of drainage, water-supply and other matters, which would be out of place here; but some points must be noted. The most important is undoubtedly water-supply. The substitution of public water-supplies for shallow wells and small streams liable to pollution is one of the greatest factors in the diminution of typhoid and other water-borne diseases; but it may give rise to danger on a far larger scale, for a whole community may be poisoned at one blow when such a supply becomes contaminated. Unfortunately, it is extremely difficult to prevent contamination with certainty in a populous country. Theoretically, water may be pure at its source, and may be distributed in that condition. Such is water derived from deep wells and springs, or gathered from uncultivated and uninhabited uplands. In the one case it has undergone natural filtration in the ground; in the other, it escapes all risk of pollution. These waters are generally pure, but the condition cannot be relied on. A tramp or a shepherd may pollute the most remote gathering-ground unless it be fenced in; deep wells may be similarly fouled by workmen, and sewage may find its way into them from the surface or through fissures. In an outbreak of enteritis and typhoid fever at Leavesden Asylum, investigated by Dr A. Shadwell in 1899, the source of mischief was traced to contamination of the well, which was 250 ft. deep in the chalk. The contamination did not take place from the surface, but from some underground source, and there were grounds—corroborated by subsequent observation—for believing that it occurred at irregular intervals, and was probably connected with the level of the deep underground water. At the same time the similar well of a neighbouring poor-law school was found to be dangerously polluted, and it was ascertained that two others in the same locality had been condemned and closed in the past. The deep chalk in that neighbourhood was clearly unsafe, and this was thought to be due to the practice of digging holes called "dumb wells," but in reality cess-pits, as much as 40 ft. deep, in the chalk for the reception of sewage. The same practice is common in all inhabited localities on a chalk formation, as it is an extremely convenient way of disposing of sewage, which percolates away and renders it unnecessary to empty the cess-pit. Several similar cases of deep well pollution have been recorded, notably those of Houghton-le-Spring in 1889 and Worthing in 1893. To secure purity, therefore, and prevent liability to outbreaks of typhoid and other intestinal diseases, all gathering-grounds should be fenced in, and water, even from deep wells, should be regularly examined, both chemically and bacterioscopically, in order that any change in composition may be detected. In the water-supplies of great populations such examination should be made daily. Further, all supplies which are not above suspicion should be filtered through sand or sterilized by boiling. The latter can be carried out by simple means in the case of individual domestic water, and attempts have been made to apply it by means of mechanical apparatus to supplies on a larger scale. It is not, however, applicable to the water-supply of large towns, because of the liability of such apparatus to get out of order. Sand filtration is at present the best mode of dealing with these supplies. There is no purer water than that which has been properly treated by subsidence and sand filtration, even when it is taken from an impure source. So far as the prevention of typhoid and other water-borne disease is concerned, it is certainly safer than the unfiltered water which is taken from so-called pure sources. It cannot be a mere coincidence that London, Hamburg, Berlin and other towns using well-filtered but originally impure river water should be generally freer from water-borne disease than many large towns drawing their supply from purer sources but neglecting to filter it, such as Manchester, Glasgow and the American cities. Table III., prepared by Mr Caink, engineer to the city of Worcester, illustrates this fact, which has also been noted by Professor Saltet of Amsterdam as holding good of the Netherlands.

TABLE III.—*Occurrences of Typhoid according to Sources of Water-Supply.*

Source of Water.	Town.	Annual Typhoid Case-rate per 100,000.								
		1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.
Deep wells in Red Sandstone	Wolverhampton	109	184	109	146	159	117	124	224	237
	Birkenhead	157	207	185	165	138	126	211	230	145
Deep wells in Chalk	Southampton	145	159	109	83	78	64	153	171	109
Upland surface water	Liverpool	152	275	267	190	168	160	129	149	115
	Manchester	120	120	90	96	92	90	118	78	78
	Plymouth	126	63	47	32	31	49	41	49	120
Rivers (filtered)	London	65	84	77	81	71	70	66	98	95
	Reading	30	35	28	53	30	67	32	48	41
	Worcester	155	145	110	36	43	45	31	50	26
Average of 219 towns		88	142	103	115	102	100	115	127	116

The amount of typhoid is dependent on other factors besides the water-supply, but the close connexion between the two and the influence of filtration are well attested by the experience of Worcester, where the great reduction recorded since 1894 coincided with new and improved filtration. The weak point about sand filtration is that it is apt to be imperfectly performed when the filters are frozen or newly cleaned, or when the process is too rapid. Filtration through porcelain is an efficient purifier, but it is not applicable to supplies on a large scale, and is liable to break down through clogging of the filters. Other portable filters are regarded as useless or worse. The best emergency treatment for suspected drinking water is boiling. Contamination of water in the mains is due to bad laying, and ought never to occur; that of supply pipes can be prevented by a constant service, and of domestic filters by providing them with covers.

Next to water-supply, and hardly less important, is drainage. The drying and cleansing of the soil by good household drainage and sewerage is essential to the prevention of typhoid. Cess-pits, leaking drains and privies, especially when there is only one to several houses, as in many industrial towns, are powerful allies of this disease. The drainage of all old houses is defective and dangerous. The ground about them is commonly honeycombed with cess-pits and saturated with sewage. The only way to discover and remedy such defects is to lay them bare with the pickaxe and shovel. Soil-pipes should always be trapped and ventilated. In short, no disease requires for its prevention more careful attention to house sanitation. The paving of yards and other spaces is also desirable in towns, on account of the liability of the unprotected soil to harbour moisture and filth.

Other modes by which the disease is spread—such as shellfish, milk and uncooked vegetables—suggest their own remedy. The dissemination by dust and flies is less easily prevented. All that can be done is to segregate the sick and promptly destroy all dangerous matters proceeding from them. It should be remembered that the urine may be an even greater source of danger than the faeces. The same observation applies to the prevention of infection from person to person. There is no doubt that sufficient care is often wanting, even in hospitals, in handling patients' soiled linen and clothes, and in dealing promptly and effectually with their excreta. For the effectual segregation and treatment of persons suffering from typhoid prompt recognition is necessary; and this, unfortunately, is a matter of much difficulty on account of variation in the type and severity of the illness. Bacteriological science has here come to the assistance of the clinical physician with what is called the Widal or serum reaction, which has a great diagnostic value when carefully performed. Professor Chantemesse has also introduced a cutaneous reaction similar to von Pirquet's reaction in tuberculosis. But obviously these remedies can only be applied to persons in the position of patients; it is of no use in the case of those who do not proclaim themselves ill, but go about their business when suffering from the disease. Such "ambulatory" cases have long been recognized as an important factor in spreading the disease. Many of the most memorable epidemics have probably been caused by them, and it is difficult to see how they can be guarded against. The "typhoid-carrier," however, when discovered should be interdicted from the preparation of food and should undergo a course of treatment with a view to lessening their excretion of typhoid bacilli.

The prevention of typhoid among armies in the field is a problem of special difficulty, not in principle but because of the conditions. The water is generally polluted, and soldiers are too thirsty to wait while it is boiled or filtered, even if the means are at hand. The sanitary arrangements are such as to ensure the saturation of the ground with excreta; flies and dust abound; personal cleanliness is impossible, and men feed and sleep together in the closest proximity. No doubt a great deal might be done by efficient sanitary organization, which has hitherto been lacking, and by educating the men. Dr Leigh Canney in 1901 suggested a scheme for dealing systematically with the water-supply of an army. Extraordinary results were obtained by the Japanese army medical department in the Russo-Japanese War of 1904–5 in the prevention of typhoid fever, which up to that period was responsible for the largest mortality of any disease affecting armies in the field. Handbooks on the avoidance of cholera, plague and typhoid fever were issued to the troops. Boiled water in quantities was provided for the soldiers, each battalion having its boiling outfit. Even foreign attachés and correspondents were requested to observe the regulations on this point. With this there was a systematic advance testing of wells, the wells being labelled "fit for drinking" or "for washing purposes only." It being impossible to suppress the presence of flies on food, care was taken to cover all latrines and cover and disinfect excreta, so that infection from flies was reduced to a minimum. Food was transferred from sterilized caldrons into sterilized lacquer boxes and served on sterilized plates. A crematory was attached to base hospitals, where all nightsoil, garbage and waste was burnt daily. Owing to these precautions the incidence of infectious disease, notably typhoid fever, was reduced to a figure unparalleled in any previous war, only 3·51% of the total sickness being due to infectious disease. Taking the number of men at the front in April 1905 to have been 599,617, the entire deaths from infectious and contagious diseases amounted to 1·24% of the entire army in the field.

In a table furnished by the Japanese war office at a still later date we note the small percentage of typhoid fever.

Percentage of patients in entire Army Corps at a certain date:—

Wounds received in action	45·53
Other wounds and injuries	3·71
Typhoid fever	1·61
Dysentery	1·95
All other diseases	47·20

In the statistics of General Oku's army, calculated to be at least 75,000 strong, Major-General Mori, chief medical officer, reports the typhoid cases to be 66 only between the dates of October 1904 and April 1905. Of this army 2142 were invalided home or died; 133 only being cases of typhoid fever.

The sickness incidence in the First Army under General Kuroki was as follows during the first six months of the campaign:—

Months.	Sickness: all Diseases.	Typhoid Fever.
March	3829	3
April	3545	1
May	3154	9
June	4824	9
July	5565	4
August	6006	9

The figures are interesting when we consider that during the South African War of 1899–1902 no fewer than 31,000 men were invalided home to England on account of typhoid fever.

One other point requires mention in connexion with prevention, namely, protective inoculation. This is performed with an anti-toxic substance prepared from dead cultures of bacilli, and has been tried on a fairly large scale, particularly on the British army in India and South Africa. Sir W. B. Leishman, writing on the results of anti-typhoid inoculations in the army (*Journ. of R.A.M.C.*, February 1909), gives the total number of men inoculated up to the 1st of June 1908 as 5473, amongst whom 21 cases (3·8 per 1000) with 2 deaths occurred. The number non-inoculated, 6610 men, had an incidence of 187 cases (28·3 per 1000) with 26 deaths. The case mortality of the inoculated was 9·5%, of the non-inoculated 13·8%. Several regiments however were not exposed to enteric fever. If these be excluded the incidence in the inoculated is 6·6 per 1000 against 39·5 per 1000 in the non-inoculated. Lord Kitchener, speaking at Middlesex Hospital in October 1910, bore emphatic testimony to the value of inoculation coupled with improved sanitary methods on the health of the army in India, declaring his belief that enteric would before long join cholera in total banishment from the barracks.

TYPHON (TYPHAON, TYPHOEUS), in Greek mythology, youngest son of Gaea and Tartarus. He is described as a grisly monster with a hundred dragons' heads, who was conquered and cast into Tartarus by Zeus. In other accounts, he is confined in the land of the Arimi in Cilicia (*Iliad*, ii. 783) or under Etna (Aeschylus, *P.V.* 370) or in other volcanic regions, where he is the cause of eruptions. Typhon is thus the personification of volcanic forces. Amongst his children by Echidna are Cerberus, the Lernaean hydra, and the Chimaera. He is also the father of dangerous winds (typhoons), and by later writers is identified with the Egyptian Seth.

See Eduard Meyer, *Set-Typhon* (1875), and M. Mayer, *Die Giganten und Titanen* (1887); Preller-Robert, *Griechische Mythologie* (1894), pp. 63–66; O. Gruppe, *Griechische Mythologie*, ii. 845, 1333, according to whom Typhon, the "snake-footed" earth-spirit, is the god of the destructive wind, perhaps originally of the sirocco, but early taken by the Phoenicians to denote the north wind, in which sense it was probably used by the Greeks of the 5th century in nautical language; and also in *Philologus*, ii. n.f. (1889), where he endeavours to prove the identity of Typhon with the Phoenician Zephon (Baal-Zephon, translated in Gesenius's *Thesaurus* by "locus Typhonis" or "Typhoni saar"), signifying "darkness," "the north wind," and perhaps "snake"; A. von Mess, "Der Typhonmythus bei Pindar und Aeschylus," in *Rhein. Mus.* lvi. (1901), 167.

TYPHOON (probably from the Arabic and Hindustani *tufān*, a tempest, which is perhaps derived from Typhon, *q.v.*: the Chinese *t'ai fung*, strong wind, is not used in application to typhoons), the name given to a heavy cyclonic storm in the seas fringing the eastern coast of Asia from Japan to the Philippine Islands. Typhoons generally occur in a series during the months of August, September and October, the season when the belt of equatorial calms in the Pacific Ocean reaches its most northerly extension.

TYPHUS FEVER (from Gr. τῦφος, smoke or mist, in allusion to the stupor of the disease), an acute infectious disease of highly contagious nature, lasting for about fourteen days, and characterized mainly by great prostration of strength, severe nervous symptoms, and a peculiar eruption on the skin. It has received numerous other names, such as pestilential, putrid, jail, hospital fever, exanthematic typhus, &c. It appears to have been known for many centuries as a destructive malady, frequently appearing in epidemic form, in all countries in Europe, under the conditions to be afterwards referred to. The best accounts of the disease are those given by old English writers, who narrate its ravages in towns and describe many "black assizes," in which it was communicated by prisoners brought into court to the judges, jurymen, court officials, &c., with fatal effect. Typhus fever would seem to have been observed in almost all parts of the world; but it has most frequently prevailed in temperate or cold climates.

The conditions concerned in its production include both the predisposing and the exciting. Of the former the most powerful are those influences which lower the health of a community, especially overcrowding and poverty. Hence this fever is most frequently found to affect the poor of large cities and towns, or to appear where large numbers of persons are living crowded together in unfavourable hygienic conditions, as has often been seen in prisons, workhouses, &c. Armies in the field are also liable to suffer from this disease; for instance, during the Crimean War it caused an enormous mortality among the French troops. Recently, however, an important change of view of the connexion of typhus fever has arisen. Professor Matthew Hay (*Journal of Public Health*, September 1907) attributes the spread of typhus fever to fleas. His observations are based on the epidemic in Aberdeen. He sums up his conclusions in the following manner: (1) Every case in hospital examined by Professor Hay and his assistants was flea bitten, and those of the staff who complained of flea bites were attacked. Care was exercised to distinguish between flea bites and petechiae. (2) Where a patient was apparently free from bites it was found he had been in contact with verminous families. (3) The disease did not spread in clean houses with clean inhabitants, even when a typhus patient remained in the dwelling during his entire illness. (4) All nurses or wards-maids who were attacked were in contact with the patients when they were first admitted. No nurse, wards-maid or doctor who had been in close contact with the cases when cleaned contracted the disease. (5) An ambulance driver who complained of being pestered by fleas contracted typhus fever, but when the ambulance staff were adequately protected from fleas no other cases developed.

Typhus is now regarded as certainly due to the action of some specific micro-organism (see PARASITIC DISEASES), but the bacteriology is still imperfect. In 1891 Jaroslav Hlava, of Prague, found in the blood of 20 out of 33 cases of typhus a well-defined organism which he termed the strepto-bacillus. Lewaschew in 1892 found in the blood and spleen of typhus patients small round highly refractive actively-moving bodies lying between the corpuscles. Sometimes these bodies were flagellate. Dubieff and Bruhl also found a diplococcus in the blood which they named the diplococcus exanthematicus.

The course of typhus fever is characterized by certain well-marked stages. 1. The stage of *incubation*, or the period elapsing between the reception of the fever poison into the system and the manifestation of the special evidence of the disease, is believed to vary from a week to ten days. During this time, beyond feelings of languor, no particular symptoms are exhibited.

2. The *invasion* of the fever is in general well marked and severe, in the form of a distinct rigor, or of feelings of chilliness lasting for hours, and a sense of illness and prostration, together with headache of a distressing character and sleeplessness. Feverish symptoms soon appear and the temperature of the body rises to a considerable height (103°–105° F.), at which it continues with little daily variation until about the period of the crisis. It is, however, of importance to observe certain points connected with the temperature during the progress of this fever. Thus about the seventh day the acme of the fever heat has been reached, and a slight subsidence (1° or less) of the temperature takes place in favourable cases, and no further subsequent rise beyond this lowered level occurs. When it is otherwise, the case often proves a severe one. Again, when the fever has advanced towards the end of the second week, slight falls of temperature are often observed, prior to the extensive descent which marks the attainment of the crisis. The pulse in

typhus fever is rapid (100–120 or more) and at first full, but later on feeble. Its condition as indicating the strength of the heart's action is watched with anxiety. The tongue, at first coated with a white fur, soon becomes brown and dry, while sordes (dried mucus, &c.) accumulate upon the teeth; the appetite is gone; and intense thirst prevails. The bowels are as a rule constipated, and the urine is diminished in amount and high coloured. The physician may make out distinct enlargement of the spleen.

3. The third stage is characterized by the appearance of the *eruption*, which generally shows itself about the fourth or fifth day or later, and consists of dark red (mulberry-coloured) spots or blotches varying in size from mere points to three or four lines in diameter, very slightly elevated above the skin, at first disappearing on pressure, but tending to become both darker in hue and more permanent. They appear chiefly on the abdomen, sides, back and limbs, and occasionally on the face. Besides this characteristic typhus rash, there is usually a general faint mottling all over the surface. The typhus rash is rarely absent and is a very important diagnostic of the disease. In the more severe and fatal forms of the fever the rash has all through a very dark colour, and slight subcutaneous haemorrhages (petechiae) are to be seen in abundance. After the appearance of the eruption the patient's condition seems to be easier, so far as regards the headache and discomfort which marked the outset of the symptoms; but this is also to be ascribed to the tendency to pass into the typhous stupor which supervenes about this time, and becomes more marked throughout the course of the second week. On the examination of the blood a marked leucocytosis is present. This is considered to be diagnostic in doubtful cases when the rash is badly marked. The patient now lies on his back, with a dull dusky countenance, an apathetic or stupid expression, and contracted pupils. All the febrile symptoms already mentioned are fully developed, and delirium, usually of a low muttering kind, but sometimes wild and maniacal (*delirium ferox*), is present both by night and day. The peculiar condition to which the term "coma vigil" is applied, in which the patient, though quite unconscious, lies with eyes widely open, is regarded, especially if persisting for any length of time, as an unfavourable omen. Throughout the second week the symptoms continue unabated; but there is in addition great weakness, the pulse becoming very feeble, the breathing shallow and rapid, and often accompanied with bronchial sounds.

4. A *crisis* or favourable change takes place about the end of the second or beginning of the third week (on an average the 14th day), and is marked by a more or less abrupt fall of the temperature and of the pulse, together with slight perspiration, a discharge of loaded urine, the return of moisture to the tongue, and by a change in the patient's look, which shows signs of returning intelligence. Although the sense of weakness is extreme, convalescence is in general steady and comparatively rapid.

Typhus fever may, however, prove fatal during any stage of its progress and in the early convalescence, either from sudden failure of the heart's action—a condition which is specially apt to arise—from the supervention of some nervous symptoms, such as meningitis or of deepening coma, or from some other complication, such as bronchitis. Further, a fatal result sometimes takes place before the crisis from sheer exhaustion, particularly in the case of those whose physical or nervous energies have been lowered by hard work, inadequate nourishment and sleep, or intemperance.

Occasionally troublesome sequelae remain for a greater or less length of time. Among these may be mentioned mental weakness or irritability, occasionally some form of paralysis, an inflamed condition of the lymphatic vessels of one leg (the swelled leg of fever), prolonged weakness and ill health, &c. Gradual improvement, however, may be confidently anticipated and even ultimately recovery.

The mortality from typhus fever is estimated by Charles Murchison (1830–1879) and others as averaging about 18% of the cases, but it varies much according to the severity of type (particularly in epidemics), the previous health and habits of the individual, and very specially the age—the proportion of deaths being in striking relation to the advance of life. Thus, while in children under fifteen the death-rate is only 5%, in persons over fifty it is about 46%.

Treatment.

The treatment of typhus fever includes the prophylactic measures of attention to the sanitation of the more densely populated portions of towns. Where typhus has broken out in a crowded district the prompt removal of the patients to a fever hospital and the thorough disinfection and cleansing of the infected houses are to be recommended. Where, however, a single case of accidentally caught typhus occurs in a member of a family inhabiting a well-aired house, the chance of it being communicated to others in the dwelling is small; nevertheless every precaution in the way of isolation and disinfection should be taken.

The treatment of a typhus patient is conducted upon the same general principles as in typhoid. Complete isolation should be maintained throughout the illness, and due attention given to the ventilation and cleansing of the sick chamber. Open-air treatment when practicable greatly reduces the temperature. The main element in the treatment of this fever is good nursing, and especially the regular administration of nutriment, of which the best form is milk, although light plain soup may also be given. The food should be administered at stated intervals, not, as a rule, oftener than once in one and a half or two hours, and it will frequently be necessary to rouse the patient from his stupor for this purpose. Sometimes it is impossible to administer food by the mouth, in which case recourse must be had to nutrient enemata. Alcoholic stimulants are not often required, except in the case of elderly and weakly persons who have become greatly exhausted by the attack and are threatening to collapse. When the pulse shows unsteadiness and undue rapidity, and the first sound of the heart is but indistinctly heard by the stethoscope, the prompt administration of stimulants (of which the best form is pure spirit) will often succeed in averting danger. Should their use appear to increase the restlessness or delirium they should be discontinued and the diffusible (ammoniacal or ethereal) forms tried instead.

Many other symptoms demand special treatment. The headache may be mitigated by removing the hair and applying cold to the head. The sleeplessness, with or without delirium, may be combated by quietness, by a moderately darkened room (although a distinction between day and night should be made as regards the amount of admitted light), and by soothing and gentle dealing on the part of the nurse. Opiate and sedative medicines in any form, although recommended by many high authorities, must be given with great caution, as their use is often attended with danger in this fever, where coma is apt to supervene. When resorted to, probably the safest form is a combination of the bromide of potassium or ammonium with a guarded amount of chloral. Alarming effects sometimes follow the administration of opium. Occasionally the deep stupor calls for remedies to rouse the patient, and these may be employed in the form of mustard or cantharides to the surface (calves of legs, nape of neck, over region of heart, &c.), of the cold affusion, or of enemata containing turpentine. The height of the temperature may be a serious symptom, and antipyretic remedies appear to have but a slight influence over it as compared to that which they possess in typhoid fever, acute rheumatism, &c. Hugo Wilhelm von Ziemssen (1829–1902) strongly recommends baths in hyperpyrexia, the temperature of the bath being gradually reduced by the addition of ice. Cold sponging of the hands and feet and exposed parts, or cold to the head, may often considerably lower the temperature. Throughout the progress of a case the condition of the bladder requires special attention, owing to the patient's drowsiness, and the regular use of the catheter becomes, as a rule, necessary with the advance of the symptoms.

TYPOGRAPHY (*i.e.* writing by types) is the general term for the art of printing movable (cast-metal) types on paper, vellum, &c. It is distinct from writing, and also from wood-engraving or xylography, which is the art of cutting figures, letters, words, &c., on blocks of wood and taking impressions from such blocks by means of ink, or any other fluid coloured substance, on paper or vellum.

I.—History of Typography

Although the art of writing and that of block-printing both differ widely from printing with movable metal types, yet this last process has apparently been such a gradual transition from block-printing,[1] and block-printing in its turn such a natural outcome of the many trials that were probably made to produce pictures, books, &c., in some more expeditious manner than could be done with handwriting, that a cursory glance at these two processes will not seem out of place, especially as a discussion on the origin and progress of typography could hardly be understood without knowing the state of the literary development at the time that printing appeared.

First Attempts at Printing.

The art of printing, *i.e.* of impressing (by means of certain forms and colours) figures, pictures, letters, words, lines, whole pages, &c., on other objects, as also the art of engraving, which is inseparably connected with printing, existed long before the 15th century. Not to go back to remoter essays, there is reason to suppose that medieval kings and princes (among others William the Conqueror) had their monograms cut on blocks of wood or metal in order to impress them on their charters. Such impressions from stamps are found instead of seals on charters of the 15th century. Manuscripts, even of the 12th century, show initials which, on account of their uniformity, are believed to have been impressed by means of stamps or dies.[1] Before the invention of printing, say about 1436, bookbinders are known to have impressed names or legends or other inscriptions on their bindings in two ways: (1) by means of single, insulated letters engraved reversely downwards into a stamp of brass, whereby the letters appeared en relief on the leather or parchment of the binding; (2) by letters engraved reversely en relief on the brass stamp, whereby the letters sank into the binding. For this reason the term *impressor*, applied afterwards to the "printer," was, in the first instance, applied to the binder, whereas *ligator* was the proper word for him (see F. Falk, *Der Stempeldruck*, in "Festschrift," 1900, p. 73 sqq.; Zedler, *Gutenberg-Forschungen*, 1901, p. 6). But the idea of "multiplying" representations from one engraved plate or block or stamp, or other form, was unknown to the ancients, whereas it is predominant in what we call the art of block-printing, and especially in that of typography, in which the same types can be used again and again.

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[1] We do not deal here with copperplate engraving (chalcography), nor with the question, raised by some authors, whether this art preceded that of wood-engraving (xylography), or vice versa. The earliest known date of the former is 1446 on the small engravings of "the Passion" in the Berlin Royal Print Room, whereas the earliest known date of wood-engraving is 1418 (on the Brussels Mary engraving). Both arts were naturally dependent upon MSS. for the forms of their letters, but as to the question of transition from the art of writing to that of typography, xylography alone can be regarded as the intervening and connecting link between those two arts, and there are good reasons for assuming that the inventor of printing with movable types was a xylographer (see below).

East Asiatic Printing.

Block-printing and printing with movable types seem to have been practised in China and Japan long before they were known in Europe. It is said that in the year 175 the text of the Chinese classics was cut upon tablets, and that impressions were taken of them, some of which are supposed to be still in existence. Printing from wooden blocks can be traced as far back as the 6th century, when the founder of the Suy dynasty is said to have had the remains of the classical books engraved on wood, though it was not until the 10th century that printed books became common. In Japan the earliest example of block-printing dates from the period 764–770, when the empress Shiyau-toku, in pursuance of a vow, had a million small wooden toy pagodas made for distribution among the Buddhist temples and monasteries, each of which was to contain a dhâranî out of the Buddhist Scriptures, entitled "Vimala nirbhasa Sûtra," printed on a slip of paper about 18 in. in length and 2 in. in width, which was rolled up and deposited in the body of the pagoda under the spire. In a journal of the period, under the year 987, the expression "printed book" (*suri-hoñ*) is applied to a copy of the Buddhist canon brought back from China by a Buddhist priest. This must have been a Chinese edition; but the use of the term implies that printed books were already known in Japan. It is said that the Chinese printed with movable types (of clay) from the middle of the 11th century. The authorities of the British Museum exhibit as the earliest instance of Korean books printed with movable types a work printed in 1337. To the Koreans is attributed the invention of copper types in the beginning of the 15th century; and an inspection of books bearing dates of that period seems to show that they used such types, even if they did not invent them.[2]

From such evidence as we have, it would seem that Europe is not indebted to the Chinese or Japanese for the art of block-printing, nor for that of printing with movable types.

MS. Period.

In Europe, as late as the second half of the 14th century, every book and every public and private document was written by hand; all figures and pictures, even playing cards and images of saints, were drawn with the pen or painted with a brush. In the 13th century there already existed a kind of book trade. The organization of universities as well as that of large ecclesiastical establishments was at that time incomplete, especially in Italy, France and Germany, without a staff of scribes and transcribers (*scriptores*), illuminators, lenders, sellers and custodians of books (*stationarii librorum, librarii*), and *pergamenarii, i.e.* persons who prepared and sold the vellum or parchment required for books and documents. The books supplied were for the most part theological, legal and educational, and are calculated to have amounted to above one hundred different works. As no book or document was approved unless it had some ornamented and illuminated initials or capital letters, there was no want of illuminators. The workmen scribes and transcribers were, perhaps without exception, calligraphers, and the illuminators for the most part artists. Beautifully written and richly illuminated manuscripts on vellum became objects of luxury which were treasured by princes and people of distinction. Burgundy of the 15th century, with its rich literature, its wealthy towns, its love for art and its school of painting, was in this respect the centre of Europe, and the libraries of its dukes at Brussels, Bruges, Antwerp, Ghent, &c., contained more than three thousand beautifully illuminated MSS.

Classes of Writing.

In speaking of the writing of the manuscripts of the 15th and preceding centuries it is essential to distinguish in each country between at least four different classes of writing, two of which must be again subdivided into two classes.

1. The *book hand*, that is, the ordinary writing of theological, legal and devotional books, used by the official transcribers of the universities and churches, who had received a more or less learned education, and consequently wrote or transcribed books with a certain pretence of understanding them and of being able to write with greater rapidity than the ordinary calligrapher. Hence they produced two kinds of writing: (*a*) the *current* or *cursive book hand*, of which several illustrations are given in Wilh. Schum, *Exempla Codicum Amplon. Erfurtensium*; the volumes of the (London) Palaeogr. Society, &c. Quite distinct from this current writing, and much clearer and more distinct, is (*b*) the *upright* or *set book hand*, which was employed not only by writers who worked for universities and churches, but also by persons who may be presumed to have worked in large cities and commercial towns for schools and the people in general without university connexion. (2) In the *church hand* (Gothic or black letter) were produced transcripts of the Bible, missals, psalters and other works intended for use in churches and private places of worship and devotion. This writing we may again subdivide into two classes: (*a*) the *ornamental* or *calligraphic* writing, found exclusively in books intended for use in churches or for the private use of wealthy and distinguished persons, and (*b*) the ordinary *upright* or *set church hand*, employed for less ornamental and less expensive books. (3) The *letter hand* may be said to be intermediate between the set literary book hand and the set literary church hand, and to differ but little from either. It was employed in all public documents of the nature of a letter. (4) The *court* or *charter hand* was used for charters, title-deeds, papal bulls, &c.[3]

These different kinds of writing served again, in the first instance, as models for cutting the inscriptions and explanatory texts that were intended to illustrate and explain the figures in blockbooks, and afterwards as models for the types used in the printing of books and documents.

15th-Century Books, Written.

Dypold Läber (Lauber), a teacher and transcriber at Hagenau in Germany, is known to have carried on a busy trade in manuscripts about the time of the invention of printing. His prospectuses[4] in handwriting of the middle of the 15th century announce that whatever books people wish to have, large or small, "geistlich oder weltlich, hübsch gemolt," are all to be found at Dypold Lauber's the scribe. He had in stock *Gesta Romanorum, mit den Viguren gemolt*; poetical works (*Parcival, Tristan, Freidank*); romances of chivalry (*Der Witfarn Ritter*; *Von eime Getruwen Ritter der sin eigen Hertze gab umb einer schönen Frowen willen*; *Der Ritter unter dem Zuber*); biblical and legendary works (*A Rimed Bible*; *A Psalter, Latin and German*; *Episteln und Evangelien durch das Jor*; *Vita Christy*; *Das gantzê Passional, winterteil und summerteil*; devotional books (*Bellial*; *Der Selen Trost*; *Der Rosenkrantz*; *Die zehn Gebot mit Glosen*; *Small Bette-Bücher*); and books for the people (*Gute bewehrte Artznien-Bücher*; *Gemolte Loss-Bücher*, *i.e.* fortune-telling books; *Schachtzabel gemolt*). The lower educational books consisted for the most part of the *Abecedaria*, containing the alphabet, the Lord's Prayer, the creed, and one or two prayers; the *Donatus*, a short Latin grammar extracted from the work of Aelius Donatus, a Roman grammarian of the 4th century, and distinctly mentioned in a school ordinance of Bautzen of 1418; the *Doctrinale*, a Latin grammar in *leonine* verse, compiled by Alexander Gallus (or De Villa Dei), a minorite of Brittany of the 13th century; the *Summula logica* of Petrus Hispanus (afterwards Pope John XXI.), used in the teaching of logic and dialectics; and Dionysius Cato's *Disticha de Moribus*, and its supplement called *Facetus*, with the *Floretus* of St Bernard, used in the teaching of morals. As helps to the clergy in educating the lower classes, and as a means of assisting and promoting private devotion, there were picture books accompanied with an easy explanatory text, for the most part representations of the mystic relation between the Old and New Testaments (typology). Among these books the *Biblia pauperum*[1] stands first. It represents pictorially the life and passion of Christ, and there exist MSS. of it as early as the 13th century, in some cases beautifully illuminated.[2] A richly illuminated MS. of it, executed in the Netherlands *c.* 1400, is in the British Museum (press-mark, King's 5), and also fragments of one of the 14th century (press-mark, 31,303). A remodelling and development of this work is the famous *Speculum humanae salvationis*, of which we shall speak when dealing with the blockbooks and early printed books. It was written in rhymed prose before 1324, and represents, in forty-five chapters, the Bible history of the fall and redemption of mankind interwoven with Mariolatry and legend. Of this work alone more than 200 MSS., illuminated or without pictures, are known to exist in various libraries of Europe. The National and Arsenal Libraries in Paris each possess one written some time after 1324; the British Museum has sixteen MSS. of it (eleven of which are illuminated) of the 14th and 15th centuries, written in the Netherlands, Germany, France and England, one (press-mark, 16,578) bearing the distinct date 1379 and another (press-mark, Egerton, 878) that of 1436. A work of a similar nature is the *Apocalypsis*, of which at least two recensions with illustrations may be pointed out. One gives the text as we know it, with or without commentary, for which cf. Brit. Mus. 17,333 (French), 18,633 (French, but written in England), Reg. 2 D. xiii. and 22,493 (French)—all four early 14th century. Another is more a short history or biography of St John, but the illustrations follow those of the former work very closely; cf. Brit. Mus. 19,896 (15th century, German). It is this last recension which agrees with the blockbook to be mentioned hereafter. Other devotional works are the *Ars Moriendi*, the *Antichrist* and other works which will be mentioned below among the blockbooks.

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[1] Passavant, *Le Peintre-Graveur*, i. 18 (Leipzig, 1860–1864); John Jackson, *Wood Engraving* (London, 1839); Bruno Bucher, *Gesch. der techn. Künste*, I. p. 362 seq.

[2] See Ern. Satow, "On the Early History of Printing in Japan," in *Trans. Asiat. Soc. of Japan*, x. 48 seq.; and Stan. Julien, "Documents sur l'art d'imprimer," &c., in *Journ. Asiat.*, 4^{me} ser., vol. ix. p. 505.

[3] See further PALAEOGRAPHY.

[4] An original copy of one of them is in the British Museum (Addit. MS. 28752).

Block-printing or Xylography.—When all this writing, transcribing, illustrating, &c., had reached their period of greatest development, the art of printing from wooden blocks (block-printing, xylography) on silk, cloth, vellum, paper, &c., made its appearance in Europe. This art was already a great advance on writing, in that it enabled any one with a few simple tools to multiply impressions from any block of wood with text or pictures engraved on it, and so produce a number of single (paper) leaves or sheets with text or pictures printed on them in almost the same time that a scribe produced a single copy of them.

It seems to have been practised, so far as we have evidence, on cloth, vellum and other stuffs as early as the 12th century (Weigel, *Anfänge*, i. 10); and on paper as far back as the second half of the 14th century; while it began to be largely employed in the early part of the 15th all over Germany, Flanders and Holland in the production of (1) separate leaves (called *briefs*, from *breve*, scriptum), containing either a picture (*print*, *prent*, shortened from the Fr. *emprint*, *empreinte*, and already used by Chaucer, *C.T.* 6186, six-text, D. 604, *printe*, *prente*, *preente*, and in other early English documents; also called in colloquial German *Helge*, *Helglein*, or *Halge*), or a piece of text, or both together; and of (2) whole sheets (two leaves), a number of which, arranged like the MSS. in quires or gatherings, formed what are called "blockbooks," sometimes consisting of half picture and half text, or wholly of text, or altogether of picture.

Early dated Wood-Engravings.

The earliest dated woodcut that we know of is the Mary engraving, discovered at Malines, and now preserved in the Brussels Royal Library. It bears the date mccccxviii. Some authors have asserted that an *l* has been scratched out between the fourth *c* and the *x*; that, therefore, the date is 1468. But there is no ground for such an assertion (cf. H. Hymans, *L'Estampe de 1481*, Brussels, 1903). A slightly modified reproduction of it, on a reduced scale, which could hardly be placed later than 1460, is preserved in the St Gall Library. The next date is 1423 found on the St Christopher, preserved in the John Rylands Library (Spencer collection) at Manchester. In the third place comes the woodcut of 1437 preserved in the Imperial Library at Vienna, which was discovered in 1779 in the monastery of St Blaise in the Black Forest, and represents the martyrdom of St Sebastian, with fourteen lines of text. The date, however, is said by some to refer to a concession of indulgences. A woodcut, preserved in the same library in Vienna, which represents St Nicolas de Tolentino, has the date 1440, but written in by hand; as the saint was canonized in that year it may refer to that event. Another in the Weigel collection, representing the bearing of the cross, St Dorothea and St Alexis, has the date 1443, also written in by hand, though the woodcut is considered to belong to that period. These are the only known wood-engravings with dates ranging from 1418 to 1443. But there exist a good many woodcuts which, from the style of the engraving, are presumed to be of an earlier date, and to have been printed partly in the 14th and partly in the first half of the 15th century. J. D. Passavant (*Le Peintre-Graveur*, 1860–1864, i. 27 seq.) enumerates twenty-seven of them, all of German origin and preserved in various libraries in Germany; 154 are recorded in the *Collectio Weigeliana* (vol. i., 1866), and W. L. Schreiber (*La Gravure sur bois*, vols. i. and ii., 1891 and 1892) enumerates over 2000 of them, some of which may be ascribed to the Netherlands, *exx.g.* (1) representing the Virgin Mary, with Flemish inscriptions in the museum in Berlin; (2) representing the Virgin Mary (see above) in the library at Brussels; (3) representing St Anthony and St Sebastian, in the Weigel collection (now in the Brit. Mus.); (4) a St Hubert and St Eustatius, in the royal library at Brussels; (5) representing the Child Jesus, in the library at Berlin; (6) the Mass of St Gregory, with indulgence, in the Weigel collection (cf. 1, 195), now at Nuremberg.

In these blocks, as in wood-engraving now, the lines to be printed were in relief. The block, after the picture or the text had been engraved upon it, was first thoroughly wetted with a thin, watery, pale brown material, much resembling distemper; then a sheet of damp paper was laid upon it, and the back of the paper was carefully rubbed with some kind of dabber or burnisher, usually called a *frotton*, till an impression from the ridges of the carved block had been transferred to the paper. In this fashion a leaf or sheet could only be printed on one side (anopisthographic); and in some copies of blockbooks we find the sides of the leaves on which there is no printing pasted together, so as to give the work the appearance of an ordinary book. Any one wanting to set up as a printer of briefs or books needed no apparatus but a set of woodblocks and a rubber. We know only three blockbooks which do not possess this characteristic, as the *Legend of St Servatius* in the royal library of Brussels, which may be called a xylo-chirograph (see below), in which the pictures occur on both sides of the paper (with some lines of text *written* underneath), but apparently impressed by hand from blocks without any rubbing, there being no traces of any indentures either on the rectos or the versos; *Das Zeitglöcklein* in the Bamberg Library (cf. Falkenstein, p. 49); *Das geistlich und weltlich Rom*, in the John Rylands Library (Spencer collection) and at Gotha (cf. Falkenstein, p. 46); but these belong to the end of the 15th century, and therefore to a later period than the ordinary blockbooks.

Block Printers.

Formerly it was the general opinion that playing cards had been the first products of xylography; but the earliest that have been preserved are done by hand, while the printed cards date from the 15th century, therefore from a period in which woodcuts were already used for other purposes. Some of the wood engravings and blockbooks are supposed to have been printed in monasteries. In a necrology of the Franciscan monastery at Nördlingen, which comes down to the beginning of the 15th century, this entry occurs: "VII. Id. Augusti, obiit Frater h. Luger, laycus, optimus incisor lignorum"; and on some of the engravings we find the arms of certain monasteries, which may, however, merely mean that they were printed for, not in, those monasteries. The registers of Ulm mention several wood-engravers (*formschneider*)—in 1398 a certain Ulrich; in 1441 Heinrich Peter von Erolzheim, Joerg, and another Heinrich; in 1442 Ulrich and Lienhart; in 1447 Claus (Nicolas), Stoffel (Christopher) and Johann; in 1455 Wilhelm; in 1461 Meister Ulrich, &c. In a register of taxes of Nördlingen we find from 1428 to 1452 a certain Wilhelm Kegeler mentioned as *brieftrücker*; in 1453 his widow is called *alt brieftrückerin*; and in 1461 his brother Wilhelm is registered for the same craft. At Mainz there was a printer, Henne Cruse, in 1440. At Nuremberg we find in 1449 Hans (Spoerer?), a *formschneider*, while his son Junghans exercised the same industry from 1472 to 1490. Hans von Pfedersheim printed at Frankfort in 1459; Lienhart Wolff, *priefdrucker*, is mentioned in the registers of Regensburg of 1463; Peter Schott at Strassburg in 1464. A certain George Glockendon exercised the same trade at Nuremberg till 1474, when he died and was succeeded by a son and afterwards by a grandson. In Flanders a Jan de Printere was established at Antwerp in 1417; and printers and wood engravers (*houte bildsnyters*) worked there in 1442 (*Privileges of the Corporation of St Luke* at Antwerp). At Bruges *printers* and *beeldemakers* (makers or engravers of images) were enumerated in 1454 among the members of the fraternity of St John the Evangelist. The printers of playing cards seem to have constituted a separate class.

All these entries show that long before the middle of the 15th century there were men who exercised the art of wood-engraving and printing as a trade or craft. It seems also certain that wealthy persons and religious institutions were wont to possess sets of blocks, and, when occasion arose, printed a set of sheets for presentation to a friend, or in the case of monasteries for sale to the passing pilgrim. A printer of briefs or blockbooks had no need to serve an apprenticeship;

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[1] This title is applied to at least three works: (1) the well-known blockbook, of which we speak below, (2) a treatise "in qua de vitiis et virtutibus agitur," and (3) a work in rhyme by Alexander Gallus.

[2] See Laib and Schwarz, *Biblia pauperum* (Zurich, 1867).

any neat-handed man could print for himself. We learn from the inventory of the possessions of Jean de Hinsberg, bishop of Liége (1419–1455), and his sister, a nun in the convent of Bethany, near Mechlin, that they possessed "unum instrumentum ad imprimendas scripturas et ymagines," and "novem printe lignee ad imprimendas ymagines cum quatuordecim aliis lapideis printis." These entries would seem to indicate that people purchased engraved blocks of wood or of stone from the wood-cutter rather than books from a printer.

Xylo-chirographs.

Concurrently with these single woodcuts, with or without written or xylographic text, arose a class of books, in some of which written texts were added to pictures printed from wooden blocks; in others the text was written first, and woodcuts pasted or printed in spaces reserved for them. These books, combining wood-engraving with handwriting, are now in technical language called *xylo-chirographs* (wood-handwritten books); they may also be called semi-blockbooks, and form an intervening stage between the manuscript book and the blockbook (*xylograph*) entirely printed from wooden blocks. They tend to show that xylography, after having been for some time confined to the production and multiplication of insulated pictures, was gradually applied to the printing of whole series of illustrations, to be added to written texts, or to have written texts added to them. It is not possible to assign definite dates to these xylo-chirographs; they could hardly be placed after, but may, for ought we know, be contemporaries of the blockbooks. We know nine of them; the years 1440 (which occurs in No. 5) and 1463 (found in No. 9) marking, for the present, the period within which they can be placed.

(1) *Biblia Pauperum*, in the Heidelberg University Library, German work, MS., Latin text added to engravings (cf. Schreiber, *Manuel*, iv. 90, *c.* 1460; photogr. pl. xlv.); (2) *Anti-christus*, one part of which is in the Paris Bibl. St Gen. (see Bernard, *Orig. de l'impr.* i. 102), another at Vienna, Alb. Bibl.; Bavarian work, MS., German text added to engravings (Schreiber iv. 231, pl. lv.); (3) *Vita et Passio Jesu Christi*, 48 leaves, in the Vienna Hofbibliothek, German work, the woodcuts printed on the versos, Latin prayers written on the rectos (Schreiber iv. 321, *c.* 1450, pl. lxxxx.); (4) *Septem planetae*, seven xylographically printed plates in the Berlin K. K. Library, German work, with German explanatory text written on separate leaves facing the engravings (Schreiber iv. 417, *c.* 1470, pl. cxi.); (5) *Pomerium spirituale*, by Henricus de Pomerio (or Henri Vanden Bogaert), in the Brussels Royal Library, bearing the date 1440 in two places; its twelve engravings seem to have originally been published as a blockbook, without any text (see below);[1] in this copy they are cut up, pasted on other (contemporary) leaves of paper, and a Latin MS. commentary added to them (see Alvin, *Documents iconogr.*; Schreiber iv. 317, pl. lxiv.; Conway, *Notes on the Exercitium super Pater Noster*; Holtrop, *Mon. typ.* p. 9). Some bibliographers unreasonably contend that the engravings cannot be earlier than *c.* 1470, and that the year 1440 is the date of the original, now lost, which the transcriber of this copy inadvertently repeated. (6) *Exercitium super Pater Noster* (ascribed for good reasons to the same Henri Vanden Bogaert); imperfect copy (8 leaves) in the Paris National Library (Invent. D. 1581); woodcuts printed on the recto of each leaf, and an explanatory text (in Flemish) written underneath them (Schreiber iv. 245, pl. lxxxvii.; Conway, *l. c.*); (7) the same *Exercitium*, with the same eleven engravings that were issued, some time before, as a complete blockbook (see below), a copy of which is preserved in the public library at Mons, in which the engravings are cut up and (after the Flemish verses of the blockbook had been cut away) pasted, with their versos, on the versos of other contemporary leaves, with an explanatory (Latin) text written on the recto of the leaf next to each engraving (Schreiber iv. 247, pl. lxxxviii.; Conway, *l. c.*; (8) a MS. of the *Speculum humanae salvationis*, with the written date 1461 (Munich Hof.-u. Staatsbibl. cod. lat. 21543), in which the 192 illustrations, usually found in the MSS. of the *Speculum*, have been impressed from small wooden blocks in the spaces reserved for them in the MS.; (9) another MS. of a German version of the *Speculum* in the same Munich library (Cod. Ger. 1126), with the written date 1463, in which the 192 woodcut illustrations, impressed in No. 8, are again impressed in the spaces reserved for them.

Of blockbooks of probable German origin the following are known:—

1. *The Apocalypsis*, or *Historia S. Johannis evangelistae ejusque visiones apocalypticae* (Germ. *Das Buch der haymlichen Offenbarungen Sanct Johans*).—Of this work six or seven editions are said to exist, each containing 48 (the 2nd and 3rd edition 50) illustrations, on as many anopisthographic leaves, which seem to have been divided into three quires of eight sheets each. The first edition alone is without signatures. Cf. S. L. Sotheby, *The Blockbooks*, i. 1. A copy of the 5th edition (according to W. L. Schreiber, *Manuel*, iv. 168), 48 leaves, is in the Cambridge University Library. A copy of the supposed 4th edition in the British Museum (C. 9, c. 1), and one of the 6th edition (IB. 14); also a single leaf (with signature H) of the 5th edition (IB. 16).

Blockbooks of German Origin.

2. *Ars moriendi.*—Although the origin of this work must be ascribed to the Netherlands, some authors think that there are early German editions, among others that spoken of below as the 2nd Dutch edition. Certainly German is the edition of Hans Spörer of Nuremberg (1473), in the public library at Zwickau, and a fragment of leaf 18, in the British Museum (IB. 20); another by Ludwig zu Ulm, in the Paris National Library, and the one described in *Collectio Weigel.* (ii. 16), where also other, but opisthographic, editions are described (see Sotheby i. 70; Schreiber iv. 253). A copy of one of these in the British Museum (IA. 24). A copy of an edition printed in a press and ascribed to Augsburg, in the British Museum (IB. 23).

3. *Ars memorandi quatuor evangelia*; 30 leaves, folio, printed on one side, 15 leaves being letterpress and 15 plates (Sotheby ii. 2; Schreiber iv. 135). Copy in the British Museum (IB. 17).

4. *Salve Regina*, bears the name of its engraver, Lienhart czu Regenspurck; 16 leaves; 2 leaves (signature *a*) are wanting in the only copy known of it, which was in the Weigel collection (ii. 103) and is now in the British Museum (IB. 1); Schreiber iv. 381.

5. *Vita et Passio Christi* (German); 32 leaves, small 8vo. Two copies in the Paris Library (Sotheby ii. 143; Schreiber iv. 320, who describes other issues in German and Italian).

6. *The Ten Commandments for Unlearned People* (*Die Zehn Bott für die ungelernte Leut*).—Ten leaves in the library at Heidelberg bound up with MS. No. 438; see Joh. Geffcken, *Bildercatechismus* (Leipzig, 1855), 4to; Sotheby ii. 160; W. L. Schreiber iv. 234.

7. *The Passion of our Lord*; 16 leaves in the Weigel collection (Sotheby ii. 141; Schreiber iv. 320), now in the British Museum (IA. 25).

8. *The Antichrist* (*Der Enndchrist*); 26 leaves, small folio (Sotheby ii. 38; Weigel ii. 111; Schreiber iv. 217). Copies in the Manchester Rylands Library (Spencer collection); Coll. Weig. No. 264, leaf 6 and the upper half of 7 now in the British Museum, where also a fragment of leaf 28 is preserved; four copies at Munich.

9. *The Fifteen Signs of the Last Judgment*; 12 engravings, usually bound up with the engravings of *The Antichrist* (Sotheby ii. 42; Schreiber iv. 217). Copies as of No. 8. An edition was also published at Nuremberg in 1472 by Jung hannss Priffmaler (copy at Gotha).

10. *Symbolum Apostolicum*; small 4to, 7 leaves printed on one side only, containing 12 woodcuts. Cf. Sotheby ii. 148; also Schreiber iv. 239, who describes three editions: (1) at Vienna; (2) at Heidelberg; (3) with German inscriptions, at Munich.

11. *The Legend of St Meinrad*; 48 leaves. Copies in the libraries at Munich and Einsiedeln (Sotheby ii. 150; Schreiber iv. 385).

12. The *Acht Schalkheiten*, of which 8 leaves were in the Weigel collection (i. 112; Sotheby ii. 154).

13. The *Fable of the Sick Lion*; 12 leaves. Copies in the Berlin Museum, and in the Heidelberg Library (No. 438). Cf. Sotheby ii. 159, pl. lxxxvi.; Schreiber iv. 444.

14. *Defensorium Inviolatae Virginitatis b. Mariae Virginis*; 16 leaves, folio, with the initials of the printer F(riedrich) W(althern) and the date 1470 on the first leaf (Schreiber iv. 368; Sotheby ii. 63). Copies in the British Museum (IB. 2); two at Paris; three at Munich; one at Berlin; another at Stuttgart.

15. The same work, 27 leaves, large folio, 1471, with the imprint "Johannes eysenhüt impressor (at Regensburg) Anno ab incarnacōis dnice M° quadringentesimo septuagesimo j°" (cf. Sotheby ii. 72; Schreiber iv. 374). Copies in the British Museum (IC. 4) at Berlin, Gotha, Manchester.

16. *The Dance of Death* (*Dance Macabre*; *der Doten Dantz*); 27 leaves; two editions; one in the library at Heidelberg; another at Munich (cf. Schreiber iv. 432; Sotheby ii. 156).

17. *Die Kunst Ciromantia* of Dr Johan Hartlieb (Sotheby ii. 84; Schreiber iv. 428). Ten leaves of the edition of Jorg Schapff of Augsburg *c.* 1478 in the British Museum (IB. 8).

18. *Der Beichtspiegel* or *Confessionale*; 8 engravings (Sotheby ii. 145; Schreiber iv. 252). Copy in the royal library (Mus. Meerman) at the Hague.

19. *Exercitium super Pater Noster*, only one leaf (the first) preserved at Kremsmünster, of a German edition (Schreiber iv. 247). For two xylo-chirographic issues of this Netherlandish work, see above, and below for a xylographic edition.

20. *Biblia Pauperum*, German text; copy in the British Museum (IB. 3); and a copy of another edition (40 leaves) with the device of Hans Spoerer, and the date 1471 (IC. 5).

21. *The Apostles' Creed*; 7 leaves, folio. Copy at Wolfenbüttel.

22. The *Credo*, in German; 12 leaves, 4to. Copy in the Munich Royal Library.

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[1] Dumortier testifies to having seen a copy of the engravings unaccompanied by MS. ("Notes sur l'imprimerie," in *Bull. Acad. Roy. de Belg.*, 1841, vol. viii.).

23. *Propugnacula, seu Turris sapientiae* (Sotheby ii. 164). One sheet, plano, in the British Museum (IC. 30). It may have originated in the Netherlands.

Blockbooks of Netherlandish origin are:—

Of Netherlandish Origin.

1. *Apocalypsis S. Johannis.*—Copy in the Haarlem Town Library. A copy of the 3rd (?) edition, of 50 leaves, in the British Museum (IC. 40), the leaves 36 and 38 having been supplied from another copy. Leaf 21 of another copy in the same library.

2. *Biblia Pauperum*; 40 folio leaves (each bearing a signature: *a* to *v*; *.a.* to *.v.*). As many as seven editions have been distinguished by Sotheby (i. 43), Holtrop (*Mon. typ.* p. 3), and ten by Schreiber (iv. 1), who likewise mentions a Latin edition of 50 leaves, besides the two editions with German texts of 1470 and 1471. The British Museum Catalogue of 15th-century books enumerates copies or fragments of copies of seven editions.

3. *Speculum humanae salvationis.*—Of this work a blockbook must have existed, of which only 10 sheets (= 20 leaves) with woodcuts and texts, besides 12 isolated woodcuts (used in 1483), have come down to us. We speak of it at length below when dealing with the typographic editions known of this work.

4. *Ars moriendi*; 24 leaves, small folio, 13 containing text, 11 plates. See above (German) No. 2; Sotheby i. 69; Holtrop, p. 8; Schreiber iv. 253, who enumerates thirteen editions, some of which are German.[1] The theory, started a few years ago, that the engravings of this blockbook are imitations of the sketches by the master E. S. (see M. Lehrs, *Der Kunstler der Ars moriendi*, 1890; L. H. Cust, *The Master E. S.*, 1898) is wholly inadmissible. Copy in the British Museum (IB. 18), and an imperfect one in the Haarlem Town Library.

5. A copy of another edition of 24 leaves in the British Museum (IA. 19).

6. *Canticum Canticorum*; *Historia seu Providentia B. Virginis Mariae ex Cantico Canticorum*; 16 leaves in folio, two editions (Sotheby i. 77; Holtrop, p. 6; Schreiber iv. 151). Copies in the Haarlem Town Library (wanting the leaves 3, 4, 7, 11, 13, 15, 16); the British Museum (IB. 46), which possesses also a copy of another edition (IC. 47).

7. *Liber Regum, seu Historia Davidis*; 20 leaves. folio (Sotheby i. 120^{b}; Schreiber iv. 146). Some consider this to be a German work.

8. *Exercitium super Pater Noster*, by Henricus de Pomerio or Henry Vanden Bogaert; 10 leaves, small folio (Sotheby ii. 137; Holtrop p. 10; Conway, *Notes on the Exercitium*, 1887; Schreiber iv. 245). For other editions see the two preceding sections.

9. *Pomerium Spirituale*, by the same author as No. 8; 12 leaves, having 12 woodcuts. This blockbook is now only known from a xylo-chirographic issue with the MS. date 1440 (see above), preserved in the Brussels Royal Library. See Conway, *Notes on the Exercitium.*

10. *Temptationes Demonis temptantis hominem de septem peccatis mortalibus*; a single large folio leaf printed on one side (Sotheby i. 122^{a}; Schreiber ii. 249). One copy in the British Museum (IC. 29), another in the Wolfenbüttel Library.

11. *Vita Christi*, or *The Life and Passion of Christ*; 36 cuts, originally printed in a press on six anopisthographic leaves, in 8vo. Copy in the Erlangen Library (Campbell, *Annales*, 746).

12. *Historia Sanctae Crucis*; a fragment of one leaf (with signature *g*), formerly in the Weigel Collection (ii. 92), but now in the museum at Nuremberg; it seems to be only a proof-sheet.

13. Alphabet (grotesque) in figures (Holtrop p. 11; Sotheby i. 122; Schreiber ii. 324–327).—There is one copy in the British Museum and another in the Basel Library, the latter having the date 1464 engraved on the letter A, which is mutilated in the Museum copy. A similar alphabet preserved at Dresden seems to be a copy made in Germany.

14. *Donatus* (*Aelius*) *de octo partibus orationis.* Leaf 6 of an edition *c.* 1500 of 16 leaves in the British Museum (IA. 48). For other xylographic editions of this work cf. Holtrop, *Mon. typ.*

Besides the works of Sotheby, Holtrop, Weigel, Schreiber, Lehrs, Cust, &c., quoted above, consult Sir W. M. Conway, *The Woodcutters of the Netherlands in the 15th Century* (Cambridge, 1884); Heinecken, *Idée générale* (Leipzig, 1771); J. Ph. Berjeau's *Facsimiles of the Biblia Pauperum, Canticum Canticorum, Speculum* (London, 1859–1861), and idem, *Catal. Illustré des livres xylogr.* (London, 1865); Dodgson, *Cat. of Early German and Flemish Woodcuts in the Brit. Mus.*

Invented at Haarlem.

Early Printing with movable Metal Types.—When the art of writing, and that of printing from wooden blocks (xylography), and all the subsidiary arts of illuminating, decorating and binding manuscripts, books, pictures, &c., were at their greatest height, and had long passed out of the exclusive hands of the monasteries into the hands of students and artisans, the art of printing with movable cast-metal types (typography) was invented. As to when, where and by whom this invention came about, a dispute has been waged for more than four hundred years. It will be seen below that we must attribute it, as in our former edition, to Lourens Janszoon Coster, of Haarlem, and not to Johan Gutenberg, of Mainz.

The Claims of Germany.

In saying this, we are aware that in the year 1900 (exactly four hundred years after the *Cologne Chronicle* had publicly started the dispute by saying that Gutenberg had *improved* but not *invented* the art) Germany enthusiastically celebrated the supposed 500th anniversary of his birthday. The speeches delivered on that occasion, after making faint allusions to the doubts and opposition of former times, all declared that, after the rediscovery of the Helmasperger document of 1455, which could not be found in 1880 (Hessels, *Gutenberg*, pp. 99-101), it was impossible for any unbiased person to dispute Gutenberg's claims to the honour of the invention any longer.

In the same year a Gutenberg Museum was erected at Mainz to be a repository for anything connected with Gutenberg and printing; also a Society (*Gutenberg-Gesellschaft*) founded with the view of publishing any book that related, however remotely, to Gutenberg and his invention, to which the whole civilized world was invited to subscribe, as its object was to honour the genius who had conferred such an inestimable boon on mankind by his invention. As a first result, a "Festschrift" was published containing an historical introduction by Professor Hartwig; and articles on the first steps to typography (Schreiber); stamp-printing before Gutenberg and the Psalters of 1457, 1459, &c. (Falk); 15th-century printing in France (Labande); German printers in Spain and Portugal (Häbler); German printers in Italy (Marzi); the coloured initials in Fust and Schoeffer's Psalter (Wallau); the Turkkalendar for 1455 (Wyss); the earliest spread of typography (Velke); also an elaborate pedigree of the family Gänsfleisch (Schenk zu Schweinsberg), and an equally full account (by Schorbach) of all the documents related to Gutenberg. This "Festschrift" was followed by publications of the "Gutenberg Society": I. (1902) *Die älteste Gutenberg type* (Zedler); II. (1903) *Die Donat- und Kalendar type* (Schwenke); III. (1904) *Das Mainzer Fragment vom Weltgericht* (Schröder, Zedler, Wallau); IV. (1905) *Das Mainzer Catholicon* (Zedler); V., VI., VII. (1908) *Das Mainzer Fragment vom Weltgericht* (Schröder); Die B^{42} type *im Schöfferschen Missale Mogunt. von 1493* (Zedler); *Die Missaldrucke P. Schöffers und seines Sohnes Johann* (Tronier); *Zu den Bücheranzeigen Peter Schöffers* (Velke).

We admit the great value of these learned and painstaking publications, and those who have the time and patience to study the mass of material here brought together in a somewhat bewildering fashion, will find their knowledge enriched on various subjects connected with early printing, but no proofs that Gutenberg invented it. It is clear from these books that their authors firmly believed from the outset that Gutenberg invented printing, and printed nearly every book that appeared or can be placed before his death in 1468. Under this impression they always speak of him as the "great master," the "great genius," &c., and represent him, not as inventing printing by accident, but as conceiving, somewhere about 1436 or earlier, the idea of inventing it, and meditating from that moment over the problems which he had to solve. Consequently, our authors read a good deal between the lines of their documents, which we fail to find there, and in this way the texts of the documents always show somehow that "the great master" is making or has already made his invention. For instance, the Strassburg lawsuit of 1436–1439 is to them an unimpeachable proof that Gutenberg was secretly working there at printing and trying to solve his problems; when he is paying there, during the same time, a considerable sum in duties for large quantities of wine, we are told that he was then in good circumstances; but when he borrows money in 1442, 1448, 1450 and 1452; and is summonsed in 1455 for not repaying the two last loans, and prosecuted in 1457 for not paying the interest due on his first debt, it is all owing to his difficulties in working out the problems of his invention, though the documents themselves never allude to any "invention" and may be interpreted in quite a different way.

We proceed to examine the documents. The earliest mention and description of the new art is perhaps that in the *Donatus* issued

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[1] Heinecken enumerates six editions, of which one has German inscriptions. See also an article by Guichard, in *Bull. du Bibliophile* (Paris, 1841).

Earliest Definitions of Printing.

by Peter Schoeffer at Mainz before 1456, which, according to its colophon, was finished "Arte nova imprimendi seu caracterizandi (from *character* = letter) . . . absque calami exaratione." Fust and Schoeffer said of the Mainz Psalter of 1457 that it was formed by an "adinventio artificiosa imprimendi ac caracterizandi absque calami ulla exaratione." The colophon of the *Catholicon* of 1460 says that the book was printed "non calami, stili, aut pennae suffragio, sed mira patronarum formarumque concordia, proporcione, ac modulo." In 1462 Albrecht Pfister says that he had "gedrucket" the *Four Histories*. Fust and Schoeffer say of the *Liber Sextus Decretalium*, published in 1465, that it was completed "non atramento ("atramento communi" in the Justinianus of 1468 and 1472), plumali canna neque aerea, sed artificiosa quadam adinventione imprimendi seu caracterizandi," which phrase they slightly varied in Cicero's *Officia*, issued in the same year: "non atramento, plumali canna neque aerea, sed arte quadam perpulcra." The edition of St Jerome's *Epistles* of 1470 is said to have been completed by an "ars impressoria," the *Decretum Gratiani* of 1472 by an "ars quaedam ingeniosa imprimendi," the *Dyalogus* of 1478 by an "ars magistra." We find further—"ars sancta" or "divina," "nova ars scribendi," "novum exscribendi genus prope divinum," "sculptoria archetyporum ars," "ars mirifica formandi," "ars excusoria," "nova imprimendi ratio," "ars pressurae," "chalcotypa ars," "chalcographia" (1472 and later), "chalcographia excusoria impressoriaque," "libraria impressio," "empryntynge" (Caxton, 1482), "prenterei" (Schoeffer, 1492), "truckery" (1505), "impression des livres" (1498), and "prenten."

Printers.

The early printers called themselves, or were called by others, "librorum prothocaragmatici" (*Gramm. Rhythm.*, 1468), "impressores librorum," "exsculptor librorum" (Jenson, 1471), "chalcographus" (1473; Hain 13036), "magister artis impressoriae," "boeckprinter"; and during the 16th century we find them still frequently called "chalcotypus" and "chalcographus."

Types.

The types were at first designated more by negative than positive expressions. In 1468 they were called "caragma," later on "caracter" or "character," "archetipae notae" (1473; Hain 13036), "sculptoria archetyporum ars," "chalcotypa ars," "formae," "artificiosissimae imprimendorum librorum formae." We soon hear also of the process and material by which they were produced. The *Grammatica* of 1468, published by Schoeffer, says that it was "cast" (sum fusus libellus). In 1471 "aeneae formulae" are spoken of; and Bernardus Cenninus and his son testify that they had printed the Virgil "expressis ante calibe caracteribus et deinde fusis literis" (with letters first cut into steel and then cast). In 1473 Friedrich Creusner at Nuremberg states that he had "cut" (sculpsit) the work of Diogenes (Hain 6192). Johan Zeiner of Ulm says in 1474 that he had perfected a book, not with the pen, but with letters of metal (stagneis caracteribus). In 1474 Joh. Ph. de Lignamine speaks of "metallicae formae." In 1476 Husner of Strassburg represents the Nider as being printed with "letters cut of metal (litteris sculptis artificiali certe conatu ex aere)." Nicolas Jenson printed in 1480 with letters "cut and cast" (sculptis ac conflatis).

Word "Typography."

The word *typographus* seems to occur for the first time in 1488, in the preface of P. Stephanus Dulcinius Scalae to the *Astronomicon* of Manilius, printed in that year at Milan by Antonius Zarotus;[1] in 1498 Erasmus uses it in a letter (dated Feb. 13) to Christianus, a Lübeck merchant;[2] and in 1517 Johan Schoeffer applies the word to himself in the colophon of the Aeneas Sylvius published by him. But of the use of the word *typographia* no earlier instance is known than 1520, in which year Gerardus Noviomagus (=Geldenhaurius) in his *Lucubratiuncula de Batavorum Insula* (pref. to Nicol. Buscoducensis, dated 1520) says: "inventa Germanorum . . . bombarda videlicet, typographia, pyxis chartaque nautica"; and Johan Schott, a printer of Strassburg, in the *Geogr. Ptolem.* published by him, describes his grandfather, Johan Mentelin, as "primus typographiae inventor." Gerardus, it may be added, borrowed the whole passage from Pet. Montanus (li. 1 *Adag.*, published *an.* 1504), who has chalcographia instead of typographia. Meerman indeed[3] speaks of a use of the word typographia (or at least of typographus) earlier than 1520, and refers to the preface of Bernardinus Veronensis in the edition of Tibullus, Catullus and Propertius published at Venice in 1493 by Symon Bevilaqua, "at least," Meerman adds, "as it (the preface) is read in the *Annal. typogr.* of Maittaire, i. 560, 2nd ed." But on page 560 Maittaire quotes the first two lines of Bernardinus's preface (till *dicit*) and then adds: "Graecis characteribus destitutus, typographus necesse habuit hiatus in commentario hic illic relinquere," which is evidently Maittaire's own remark, not that of Bernardinus. The present writer at least has been unable to find such a passage in the Tibullus.

When we, for the moment, leave out of sight the question as to when, where, and by whom the art was invented, and take our stand on well-authenticated dates in such printed documents as have been preserved, we find that the first printed date, 1454, occurs in two different editions of the same letter of indulgence issued in that year by Pope Nicholas V. in behalf of the kingdom of Cyprus.

Nicholas V.'s Indulgence of 1454.

These two editions bear no printer's name, nor the place of printing, but are distinguished respectively as the 31-line and the 30-line Indulgence. The one with 31 lines claims priority,[4] from a chronological point of view, over the one with 30 lines, because one of the sold copies that has been preserved was issued at Erfurt on the 22nd of October 1454 (in the possession of Herr Ernst Fischer at Weinheim, *Centralbl.*, 1909, p. 30); a second (in the Hanover Archives; *Veröffentl.* II. tab. i.) at Fritzlar on the 12th of November 1454; a third (in the Mus. Meerman, at the Hague) at Erfurt on the 15th of November 1454, &c., whereas of the 30-line Indulgence the earliest sold copy that has as yet come down to us was issued at Cologne on the 27th of February 1455, though it has the printed date mccccliiii., which was altered with the pen to mccccliiiij. In the 31-line Indulgence occur (*a*) a large church type used for the headings and commencing words of the absolutions, for the first word in the document and for the Christian name of the pope's legate; (*b*) a smaller text or brief type for the text; (*c*) a large initial V and two large initials M, which slightly differ from each other. In the 30-line Indulgence occur (*a*) a large church type, used as in the 31-line Indulgence; (*b*) a smaller text or brief type for the text; (*c*) a large initial U, and two large initials M differing from each other.

Mainz Printing.

These two different editions are usually regarded as having been printed at Mainz; and, in the absence of any evidence to the contrary, we assume that such really was the fact. But we must at the same time conclude that about October 1454 there were at least two rival printers at work there: (1) the printer of the 31-line Indulgence, who may have been Johan Gutenberg, perhaps subsidized by Johan Fust; (2) the printer of the 30-line Indulgence, who was no doubt Peter (Schoeffer) de Gernssheym, as this Indulgence is connected with one of 1489 printed by him. Four *written* copies of this 1454 Indulgence are known to exist which respectively bear the dates: Frankfurt, 10th April 1454 (in the possession of Herr Lais, Wiesbaden); Frankfurt, 11th April 1454 (Frankfurt Archives); 11th July 1454 (place unknown; Darmstadt archives); Lübeck, 6th October 1454. As their dates precede by a few weeks only the earliest known date (Oct. 22, 1454) on a printed copy, they mark, perhaps, the exact time when printing made its appearance at Mainz, in an already advanced state of perfection.

Basing ourselves on the above Indulgences with their printed date, and four different types, we subjoin two lists of the books which the German bibliographers of the present day regard as having all been printed by Johan Gutenberg at Mainz, in the types or "developments" of them, employed for these Indulgences. They are arranged in two columns (A and B) according to types, but without regard to strict or supposed chronology. For further details cf. Hessels, *Gutenberg* (1882), p. 150 sqq.; Schwenke, *Berlin Festschr.* (and in the *Veröffentl.* of the Mainz Gutenberg-Gesellsch.); Zedler (*Gutenberg-Forsch.* and in the *Veröffentl.*), &c.

A.	B.
Types: I (large church type, also called the 36-line Bible type) and II (smaller brief type), used by an unknown printer, not later than October 1454.	Types. III (large church type, somewhat smaller than Type I, also called the 42-line Bible type) and IV (a smaller brief type), used by Peter Schoeffer de Gernssheym (1454–1455).
i. 31-line Indulgence; three different issues (A, B, C), with the printed year mccccliiii., and one issue (D) with the printed year mccccl v. All printed on vellum. Of issues A and B no sold copies have yet come to light; but three unsold copies of each are preserved at Brunswick, Wolfenbüttel and Hanover (Culemann coll.). Of issue C ten sold copies are known to exist in various libraries with dates ranging from the 22nd of October 1454 to April 1455, besides three unused copies. Of issue D ten sold copies with dates from the 7th of March 1455 to the 30th of April 1455 and four unused copies are known.	i. 30-line Indulgence; one issue (A) with the printed year mccccliiii., and two issues (B, C) with the printed year mccccl-quinto. All printed on vellum. Of issue A only one copy has been discovered (now in the Rylands-Spencer Library), which was sold at Cologne on the 27th of February 1455, the printed date mccccliiii having been altered with the pen to mccccliiiij. Of issue B two sold copies, with dates April 11 and 29, 1455, are in the Berlin Library and the British Museum. Of issue C a sold copy with date April 24, 1455 is at Wolfenbüttel.

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[1] Maittaire, *Annales Typogr.* i. 508, note 1.

[2] *Opp.* iii. col. 24.

[3] *Origg. Typogr.* i. 32, note *cx*.

[1] No inferences can be drawn from this priority, as it merely rests on the date of a sold copy that has come to light.

A (*contd.*).

Type I continued; for type II. (of which no further trace is found) see below.

ii. Poem on the "Weltgericht." Fragment of one leaf (paper), discovered at Mainz about 1892, preserved in the Gutenberg Museum at Mainz; presumed to have been printed *c.* 1443–1444.

iii. *Donatus*, 27 lines. Fragments of 4 vellum leaves (4, 5, 8, 9) recently discovered in the Heiligenstadt Library, and now preserved in the Berlin Royal Library.

iv. *Donatus*, 27 lines. Two rubricated vellum leaves (5 and 10) of an edition of 14 leaves, usually called the *Donatus* of 1451, preserved in the Paris National Library.

v. *Donatus*, 27 (?) lines. Two strips of vellum leaves, containing the remains of 3 lines and about 30 mutilated letters, discovered in the Heiligenstadt Library, and now in the Berlin Royal Library.

vi. *Astronomical Kalendar*, said to be for the year 1448, therefore supposed to have been printed at the end of 1447. Fragments of two large vellum rubricated sheets, printed on one side, discovered in 1901 in the binding of a MS. belonging to the monastery of Schönau, near Mainz, now preserved in the Wiesbaden Landesbibliothek.

vii. *Donatus* of 18 leaves, 26 lines, on vellum; of which 2 rubricated sheets (4 leaves, 1, 2, 9, 10) are preserved in the Berlin Royal Library; probably issued between 1447 and 1450 (*Centralbl.* xxvii. 65 sqq.).

viii. *Manung widder die Durken.* An almanac for January 1455, in 4to, 5 paper leaves, 20 and 21 uneven lines. A unique copy, discovered at Augsburg, now in the Munich Hof Library.

ix. A German translation of the bull of Pope Calixtus III., dated XII. Kal. Julii (=Jun. 20) 1456. Fourteen rubricated leaves 4to, in the *Kalendar* type, except that two of the capital E's belong to the B^{36} type (13b and 14 blank), preserved in the Berlin Royal Library; not to be ascribed to P. Schoeffer (*Centralbl.* xxvii. 63).

x. *Conjunctiones et oppositiones solis et lunae* (now called by German bibliographers Laxier-Kalendar). A calendar for 1457, a broadside paper sheet, printed on one side, of which the upper half of the only copy known, discovered at Mainz, is in the Paris Library.

xi. *Der Cisianus* (not Cislanus) *zu Dutsche.* A broadside paper sheet, 36 lines, printed on one side, with separate headline. The Tross-copy mentioned in suppl. to Brunet's *Manuel* (1878, *sub voce* "Cislanus") was bought in 1870 for the Cambridge University Library.

xii. *Donatus*, 27 lines, 14 vellum leaves, of which the British Museum possesses the leaves 4, 10 and 11 (entire) with fragments of the leaves 2, 6–9 and 13. A fragment of 6½ lines

B (*contd.*).

Type III continued (till about 1457; of Type IV no further trace is found).

ii. *Donatus*, of 35 lines, folio, printed, according to the colophon, "per Petrum de Gernssheym. in urbe Moguntina cum suis capitalibus."

iii. Bible of 42 lines (also called Mazarine Bible and referred to below as B^{42}), printed before the 15th of August 1456, as the binder of the paper copy in the Paris Library states that he finished its rubrication on that day. Two volumes folio, 641 leaves in 2 columns of 42 lines each, though in some copies the columns of pp. 1 to 9 contain 40 lines only, while the 10th page has 2 columns of 41 lines each, the difference in the number of lines making no difference in the space which they occupy. For other copies see Hessels, *Gutenberg*, p. 170; Dziatzco, *Beitr. zur Gutenbergfrage* (Berlin, 1889); Schwenke, *Festschr.*, who has drawn up a list of all the copies known to be still in existence. The copy known as the Klemm copy, which was bought by the Saxon Government in 1886, and presented to the "Deutsches Buchgewerbemuseum" at Leipzig, has the year "1453" written in small Arabic numerals of 15th-century form at the bottom of the last leaf of the second volume. But this date is highly suspicious, for Klemm, who must have known its importance and high value, never mentioned it, though he described his copy three times, in 1883 and 1884.

iv. *Donatus* of 33 lines. Vellum fragment at Oxford, without printed initials.

v. *Donatus* of 33 lines. Vellum fragment at Paris, without printed initials; also three rubricated leaves (5, 6 and 8) in the Berlin Royal Library (*Centralbl.* xxvii. 68).

vi. *Donatus* of 33 lines. Leaf 1 (defective) on vellum, mentioned in Ludw. Rosenthal's Cat. 105, No. 3, and purchased by the Berlin Royal Library, which has also acquired the leaves 1 and 11 (*Centralbl.* xxvii. 69.). The large Psalter initials are used for the initials of chapters.

vii. *Donatus* of 33 lines. Leaf 1 (vellum) discovered in the Berlin Royal Library.

viii. *Donatus* of 33 (?) lines. Small fragment, discovered in the library at Giessen, of a vellum leaf, which Schwenke thinks may be the 10th of an edition which differs from Schoeffer's 35-line edition, and also from the Paris 33-line edition.

ix. *Donatus* of 26 lines. One defective vellum leaf, discovered in a Munich private library, and now in the Mainz Gutenberg Museum.

x. *Donatus* of 26 lines. One vellum leaf at Mainz, another at Hanover, a third in the British Museum.

xi. *Donatus* of 24 (?) lines, between 1470 and 1477 (Schwenke).

A (*contd.*).

in the Bodleian Library, and two small fragments discovered in the library at Heiligenstadt.

xiii. *Donatus*, 27 lines, which Schwenke calculates to have consisted of 14 vellum leaves, of which the leaves 6 to 9 are now in the Berlin Royal Library.

xiv. *Donatus*, 27 lines. Three strips of a rubricated vellum leaf 5 discovered in the Karlsruhe Hof-Bibliothek.

xv. *Donatus*, 27 lines. One rubricated vellum leaf (6), in the *Kalendar* type, in the Berlin Library (*Centralbl.* xxvii. 62)

xvi. *Donatus*, 27, 28 or 30 (?) lines. Fragments of two vellum leaves of an edition of 12 (?) leaves discovered in the binding of a book (printed at Milan in 1476) which formerly belonged to the Episcopal Library at Salzburg, and is now in the Munich Hof-Bibliothek.

xvii. *Donatus*, 27 (or 30?) lines. Vellum fragments of an edition of 12 (?) leaves in the British Museum (C. 18. e. 1 No. 5). Leaves 1 and 2 are in the Bodleian Library, and leaf 8 in the Mainz Town Library.

xviii. *Donatus*, 27 lines. Fragment of a vellum leaf (3?) discovered in the binding of a MS. in the Munich Hof-Bibliothek.

xix. *Donatus*, 27 lines. Two vellum fragments of the leaves 6 + 9, the upper part of which is preserved in the Bodleian Library (Auct. 2 Q infra I. 50 No. 6), the lower part in the Bamberg Royal Library (VI. F 1).

xx. *Donatus*, 28 (?) lines. One defective vellum leaf, showing 25 lines, formerly in the possession of Jacq. Rosenthal (*Incun. typ.* ii. No. 2154), afterwards in the Amherst collection (Handlist No. 5). Another leaf in the Mainz Gutenberg Museum.

xxi. Bible of 36 lines (referred to everywhere as B^{36}), 2 vols., folio, 882 leaves, with 2 columns of 36 lines each on a page. Some bibliographers, assuming that Pfister printed it, call it the Pfister Bible. A paper copy of it is in the Paris Library, and also a separate copy of the last leaf, which bears the MS. date 1461. Other copies are preserved in the Rylands-Spencer Library, in the British Museum, at Jena, Leipzig, Antwerp, &c. (Hessels, *Gutenberg*, p. 160; Bernard, *Origine*, ii. 31).

B (*contd.*).

xii. *Cantica ad Matutinas*; only known from one vellum leaf (the first) in the Paris Library, considered to be the remains of a Psalterium, for the printing of which Humery may have furnished (!) the type (Schwenke *Untersuch.* p. 72 seq.). Judging from the leaf preserved, the work corresponds in every respect to the 42-line Bible, having double columns 42 lines, &c.

Type V.—The "first stage" of Type VII., supposed by Otto Hupp (*Ein Missale Spec.*) and others to have served for printing (1) a *Missale speciale*, in the possession of Ludw. Rosenthal at Munich; (2) a *Missale abbreviatum* discovered in 1900 in the Benedict Church of St Paul in the Lavantthale.

Type VI.—The large type for the Psalter of 1457.

Type VII.—The small type for the same Psalter ("second stage" of Type V). Types VI and VII were also used for the "Canon Missae" of 1458, a copy of which is preserved in the Bodleian Library.

Type VIII used for (1) Joannis de Balbis *Catholicon* of 1460. Large folio, 373 leaves, with two columns of 66 lines each on a page; (2) Matth. de Cracovia, *Tractatus racionis*, 22 leaves with 30 lines to the page, 4to; (3) and (4) Thomas de Aquino, *Summa de articulis fidei*, two 4to editions, one of 13 leaves with 34 lines to the page; the second of 12 leaves with 36 lines to the page; (5) an Indulgence of 1461 of 15 lines (see Hessels, *Gutenberg*, p. 171 sqq.).

The above eight types and the books printed with them (besides a few others printed by Albrecht Pfister at Bamberg) are the only ones that bear, more or less closely, on the question regarding the introduction, or possible invention, of printing at Mainz.

Till recently the church type 1, of the 31-line Indulgence, had always been regarded as identical with that of B^{36}, and the church type 3, of the 30-line Indulgence, with that of B^{42}. But, as the capital P of Indulgence^{30} seems not to occur in B^{42}, and on examination minute differences show themselves in other respects, identity between the two types cannot be accepted. The use of the brief type 2 of Indulgence^{31} seems to have been limited to printing this one document, as its great resemblance to the type employed at Eltville in 1472 for printing a *Vocabularius ex quo*, and Thomas Aquinas' *Summa de articulis fidei*, amounts not to identity. Nor has any further trace been found of the brief type 4 of the Indulgence^{30}, so that the four types used for the two Indulgences were, perhaps, specially manufactured for them and discarded afterwards or melted down for other types.

Hence there is nothing to connect these two broadsides with any locality or any printing-office, except that one of the initial M's of the Indulgence^{30} re-occurs as the initial M of the second absolution of a 33-line Indulgence of 1489, which was unquestionably printed by Peter Schoeffer at Mainz, for "Raymundus Peyraudi archidiaconus Alniensis in ecclesia Xanton," who issued it at the order of Pope Innocent VIII., "pro tuicione orthodoxe fidei contra Turchos." For this reason types 3 and 4 and the books printed with them, including B^{42}, must all be ascribed to him, all the more as he printed, with the type of B^{42}, the 35-line Donatus, which bears his name in the colophon. As Schoeffer, in the colophon of this *Donatus* (ii.) which bears his name, says that it was printed "cum suis capitalibus," and as these capitals gradually disappear after 1459 and the type of the 42-line Bible is no longer found after 1456, we must presume that some of the twelve incunabula mentioned above (in col. B) were printed by Peter Schoeffer alone before he entered (in 1457) into partnership with Johan Fust (see Hessels, *Gutenberg*, p. 166 seq.).

During the last two decades, however, the two types (3 and 4) and most of the books mentioned above in column B, including B^{42}, together with the two types (1 and 2), and several of the books in column A, including B^{36}, have been attributed by German bibliographers to Gutenberg. This singular proceeding is chiefly owing to the late Dr Dziatzko's treatises (*Beiträge zur Gutenbergfrage*, 1889; *Gutenberg's früheste Druckerpraxis*, 1890) on Gutenberg's supposed work as a printer. This author, noticing that the two types of B^{36} and B^{42}, their signs of contraction, marks of punctuation, &c., though differing in size, closely resemble each other in form, concluded that they were manufactured in one and the same office, by one and the same printer, that is, Gutenberg. He thought his conclusion confirmed by the two Bibles being printed on the same kind of paper showing the same watermarks, and arranged in quires in the same way, and divided off into parts at the same place. Finally, from a misprint in B^{42} being rectified in the Stuttgart copy of B^{36} by a cancel (*Druckerpraxis*, p. 95), he concluded: (*a*) that B^{36} was a reprint of B^{42}; that the latter was printed by Gutenberg during his partnership (1450–1455) with Fust, who supplied the money and the material, while he himself superintended the manufacture of the type, instructed the compositor and printer, and therefore was its printer; and that the type came afterwards into Schoeffer's possession; (*b*) as B^{42} was Gutenberg's first work, and had been begun in 1450, B^{36}, a reprint of it, could not be dated before this year; but as its type already existed in 1454 (in the Indulgence^{31}), Gutenberg, foreseeing his quarrels with Fust, must have been preparing it since 1453, and have printed with it, first, some *Donatuses*, the Indulgence^{31}, &c., and finally B^{36}, with the technical and financial assistance of Albrecht Pfister who, shortly before 1458, acquired its type and printing-material (see further, Hessels, "A Bibliogr. Tour," in *The Library*, July 1908). Dr Dziatzko, noticing also a "resemblance" between the types and the workmanship of the two Indulgences, attributed both these broadsides likewise to Gutenberg.

His conclusions, and the method of research by which he reached them, the German bibliographers of the present day have adopted and amplified into a bibliographical and typographical "system," which professes to examine minutely the form and size of every letter, capital or small; the combined letters like *do* and *de* cast on one type; the signs of contraction above, or by the side of or through certain letters, the marks of punctuation, the habits and workmanship of the printer, the arrangement of the quires, the paper and its water-marks, &c.

The "system" divides the Gothic or Church types with which B^{36} and B^{42} and the other books mentioned above are printed into "chief" and "by-forms" (*Haupt- und Nebenformen*). The tops and bottoms of the former are ornamented with minute protruding tags, angles and points, while the "by-forms" miss most of these ornaments, their limbs being straight on the left or right, so as to be easily joined to the protruding tags, angles and points of the "chief forms," whenever the two come together. For instance, if a *u* or a *t* follows an *e*, the "by-form" of *u* with straight limbs was to be used, while the *t* was to be without its crossbar protruding on the left.

The bibliographers who deal with the incunabula enumerated above, in accordance with this "system," regard the books in which they find these chief and by-forms used in their proper places as the earliest, and therefore as the products of Gutenberg's "creative genius and skill," while they ascribe the books which bear evidence of the misuse of those forms to other printers, but their types to him. But this is an uncertain guide, as by errors in the distribution of the types after the printing of the first or second pages this misuse may already occur in the third and further pages of a book. In this way, however, the "system" arranges the books enumerated above in the following approximately chronological order:—

1443–1444. "*First* phase" of the Gutenberg type (=the *Donatus* type). The numbers ii., iii., iv. (with the suspicious date 1451) and v.

1447 (end of) till 1457(?). "*Second* phase" of the same type (=the *Kalendar* type). The numbers vi. to xiv.

1450–1453. B^{42} presumed to have been finished in or before 1453, taking this year, written in the Klemm copy, as genuine.

1453. "*Third* phase" of Gutenberg's type, B^{36} (xviii., of which the earliest known date is 1461).

1454. The two Indulgences with their types (1, 3; 2, 4).

1457. The two Psalter types.

1461, 1462 till (?). Pfister, who is said to have acquired the type of B^{36} from Gutenberg, is known to have issued a book with the date 14 February 1461, and another with the year 1462. Hence, Schwenke says that the 36-line Bible type, which he regards as a "continuation" of the *Donatus*, and the *Kalendar* types, had a life of nearly 20 years (*Veröffentl.* ii. 1). Type v. is thought to be Gutenberg's earliest (before 1443!) by the few who regard the "Missale speciale" and the "Missale abbreviatum" as his work.

The "*Donatus* type" is so called from the Paris *Donatus*, on one of whose leaves the year 1451 is written. Zedler, somewhat unreasonably, considers this date to be a forgery of Professor Bodmann, though he is known to have forged other Gutenberg documents. This type is regarded as the same as that of the *Astronomical Kalendar*, but in an earlier, more imperfect stage. As this *Kalendar* calculates the ephemerides of the sun, moon and stars, either for the year 1429 or for 1448 or 1467, it is presumed to have been printed for 1448, that is at the end of 1447, and as its type looks new and almost perfect, the Paris *Donatus* is placed considerably earlier because its type looks old. The poem on the "Weltgericht" (No. ii.) is said to show all the forms of the *Donatus* type, but as its workmanship looks primitive, it is dated back to 1443–1444. The Heiligenstadt *Donatus* (No. iii.) is placed after the "Weltgericht" (ii.), but before the Paris *Donatus* (iv.) and the other Heiligenstadt *Donatus* (v.).

Some German bibliographers do not feel sure that Gutenberg manufactured types v., vi. and vii., though they have no doubt as to the remaining. Others are of opinion that Pfister printed some of the books in the type of B^{36}, Schwenke thinks this Bible could not have been begun before 1457, but all agree that every book in the above lists must have been printed either by Gutenberg himself, or in his office, or with his type, or under his superintendence.

Though the church type 1 cannot be said to be identical with that of B^{36}, and no further trace of the brief type 2 has been found, we see no reason for separating Indulgence^{31} from Mainz printing. And assuming that it was printed there, its printer may have been Johan Gutenberg, who was at Mainz in 1454.

A peculiarity of the above-mentioned "system" is that it ascribes two types, so different in size, shape and form, as those of B^{36} and B^{42}, to one and the same printer, merely because they "resemble" each other. This shows that the "system" takes no account of the fact that the inventor of printing, and all the early printers who came after him, in manufacturing their types necessarily imitated the forms of the written characters of their time. Hence if two printers simultaneously erected their presses in one town, their types, though cut and cast independently, were apt to resemble each other, as appears from various examples. The printers of B^{36} and B^{42} are no exception to this rule; they each took a MS. as their model, and the types which they produced are simply imitations of the Gothic or Church hand, which, from its first beginnings in the 10th century, if not earlier, can clearly be traced down to, and reached its greatest development in, the 15th century.[1]

The written characters of all ages and countries resemble and yet differ from each other in various respects; and as their resemblances and differences are closely reproduced by the metal printing types of every country, we are able to ascribe MSS. as well as incunabula to definite countries, some manuscripts even to "schools," a few even to definite scribes. But when two types differ in size and form, however slightly, and there is no evidence that they belonged to one and the same printer, some of their characteristics may justify us in ascribing both to the same country or town, but not to the same printer. It is, moreover, not safe to ascribe incunabula to one and the same printer on account of their similarity of the quires and divisions into volumes, their paper or water-marks (which Dziatzko observed in the two Bibles), as these particulars are nothing but a continuance of the MSS.

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[1] The Cambridge University Library possesses two folio volumes (press-mark] Dd. 7. 1, 2), the writing of which, ascribed in the catalogue to 1490, resembles the types of B^{42} with all its chief and by-forms so much, that at first sight they might be mistaken for copies of this Bible.

Nor is his evidence for saying that B^{36} is a reprint of B^{42} conclusive. The types of B^{36} and B^{42} may be ascribed to Germany, but as both are used for the printing of a Bible and editions of *Donatus*, it is improbable that the printer of B^{42} and one set of *Donatuses* should manufacture, about the same time, another type for another Bible and another set of *Donatuses*. We have shown above that B^{42} must, on bibliographical grounds, be ascribed to Peter Schoeffer at Mainz, and as he used its type for a book which actually bears his name, all the other books in the same type must be ascribed to him. It follows that B^{36} and every other book in column A must be assigned to some other printer or printers.

Type v. is a Church type and resembles those of B^{36} and B^{42}, but it can have nothing to do with Gutenberg or the invention of printing, as it is not earlier than 1480–1490. Types vi. and vii., which are nothing but imitations of the written Psalters of the time, are employed for a work, the colophon of which distinctly mentions Fust and Schoeffer as the printers; hence they cannot be claimed for Gutenberg. Of the *Catholicon* type we speak below. Therefore the books numbered i. to xxi. in column A of the above list are the only ones about which there can be any doubt or discussion.

Here we encounter another peculiarity of the above-mentioned "system," which treats the three different types detected in these twenty-one works not as different, but as "phases" or "developments" of one and the same type, while the differences between them, and the absence or presence of certain forms of letters, are taken as guides for approximately dating the books, and for subdividing the type, hitherto known as the 36-line Bible or Gutenberg type, into three or more varieties. For instance, Schwenke (*Centralbl.*, 1908, p. 74) explains that "the types *b*, *c*, *i*, *s*, *t* enable us to distinguish the earliest from the later elements in the *Donatus* type; the 'Weltgericht' shows, at least of *i* and *s*, the old forms still unmixed. But in the Paris *Donatus*, the new forms appear by the side of the old forms, though the latter are already to a great extent superseded. The new (Heiligenstadt) *Donatus* comes between these two works; it has chiefly the old *b*, which begins to a great extent to be absent in the Paris *Donatus*."

As we cannot regard types which differ in form as "developments" of one type, we must deal with three types in column A, that is (1) the so-called *Donatus* type; (2) the *Kalendar* type; (3) the 36-line Bible type, besides the two employed for the Indulgence^{31}. Gutenberg's career, and the straightened circumstances in which he appears to have lived, so far as they are known to us, make it difficult to ascribe them all to him.

More than thirty documents have come to light which enable us to trace Johan Gutenberg from 1420 to 1468. Dr Carl Schorbach has published nearly all their texts, with elaborate explanations, in the *Festschrift zum 500 jähr. Geburtstage von J. Gutenberg* (suppl. to *Centralbl. f. Biblioth.*, 1900, p. 163 sqq.), and they are further explained by Hessels (*Gutenberg, was he the Inventor of Printing?* 1886; idem, *The so-called Gutenberg Documents*, 1911).

At least six of them are known to be forgeries, among them the "relics" of a printing-press with the date "1441" which were accidentally(!) discovered in 1856 in the "Hof zum Jungen" which had always been supposed to have been Gutenberg's first printing-office at Mainz, but which we now know not to have been the case. Assuming that the Gutenberg mentioned in the remaining documents is no other than Henne (= Hans or Johan) Gensfleisch—called Gutenberg from his mother (whose maiden name was Elsa Wyrich) having lived in the "Hof zum Gutenberg" at Mainz, where he is supposed to have been born about 1400—he appears to have lived at Strassburg from 1436 (?) till the 12th of March 1444, in easy and somewhat luxurious circumstances, at least during the first three years, as he was then paying duties for large quantities of wine (about 1924 liter). But this prosperity does not seem to have continued, for on the 17th of November 1442 he borrowed 80 pounds Strassburg denarii (=about 4800 marks) from the Strassburg St Thomas Chapter, a Strassburg citizen, Martin Brechter, being his surety. From the 12th of March 1444 till the 17th of October 1448 there is no trace of him, but on the latter day he again borrowed, this time at Mainz, 150 gold guilders. Both these loans he never redeemed, nor is it known whether he ever paid any interest on his Mainz loan. But the account books of the Thomas Chapter, still preserved in the Strassburg Public Archives, show that the interest of 4 pounds per annum on his loan of 1442 was regularly paid, by him or his surety, till 1457. The interest due in the latter year was also paid, but difficulties appear to have occurred before the Chapter received it, as there is an item in their account book for 1457–1458 of two shillings for expenses, incurred by them for arresting Gutenberg and his surety. In and after 1458 no further payments were made; the Chapter had recourse to law, and made various efforts to arrest the defaulters, but in vain; and in 1474, six years after Gutenberg's death, the debt is no longer recorded in the Chapter's accounts. He can be traced at Mainz from 1450 (when he borrowed money from Fust) till the 21st of June 1457, when he is a witness at the conveyance of property in Bodenheim near Mainz. After this date we hear no more of him until the 17th of January 1465, when the archbishop of Mainz appointed him as his servant and courtier for life on account of the "grateful and willing service which he had rendered to himself and to his Stift, and will and may render in future." The nature of this "service" is not stated. It has always been supposed that he was then residing at Eltville, the residence of the archbishop, and that he died there about or before the 26th of February 1468, on which day Dr Kunr. Humery received from the archbishop some "printing apparatus which belonged to him, and which he had lent to Gutenberg." But recent researches seem to have shown that Gutenberg remained at Mainz till his death, and was buried there.

Apart from the six forgeries, about which there is no dispute, Bockenheimer, a Mainz magistrate, explains (*Gutenberg-Feier*, Mainz, 1900) as forgeries also (1) the document of the 14th of March 1434, which represents Gutenberg as having at Strassburg arrested and released the secretary of Mainz for a debt which this city owed him; (2) a document of 1437 recording a breach of promise case between Gutenberg and a Strassburg lady; (3) the records of a Strassburg lawsuit between Gutenberg and some Strassburg citizens in 1439; (4) the Helmasperger notarial instrument of the 6th of November 1455, recording a lawsuit of Joh. Fust against Joh. Gutenberg.

The last two, and a third dated the 26th of February 1468, mentioned above, are the only documents that can be said to connect Gutenberg with the art of printing. Various external and internal circumstances throw serious doubts on the genuineness of the 1439 documents; but suppose they were genuine, they only show that Gutenberg had been engaged, with other Strassburg citizens, in "polishing stones" and "manufacturing looking-glasses," and promised to give instruction in "new arts." A "press," however, is mentioned, and a clause reports that one of Gutenberg's witnesses, Hans Dünne, a goldsmith, had testified that he had earned nearly 100 guilders from Gutenberg, "merely for that which belonged to printing" (*alleine das zu dem trucken gehöret*). The document contains nothing to connect Gutenberg with the art of printing, except this line, which has clearly been added (as an afterthought) by a different hand from the one that wrote the two first lines of this witness's testimony, a circumstance which makes the whole document more than suspicious. Several theories, however, as to Gutenberg printing at Strassburg in or before 1439 have been built upon this document, and German bibliographers are even now expressing their hope of finding some day evidence of Gutenberg having printed *Donatuses* and other works in that town.

As to the notarial instrument of 1455, Bockenheimer suggests that as it contains absurdities which are contradictory to all the legal usages of the time, it may be a forgery of the Faust family, perhaps of Joh. Fr. Faust von Aschaffenburg (who pretended to descend from Joh. Fust, whom he called "Faust"), who appears to have possessed, in or about 1600, an "original" of the instrument. From this "original" are derived all the texts published before 1741. In that year, however, J. D. Köhler (*Ehren-Rettung Joh. Guttenberg's*, Leipzig) printed the text again from an "original" which is now in the Göttingen University Library (republished by Dziatzko, *Beiträge*, Berlin, 1889), and is perhaps identical with Faust von Aschaffenburg's "original." Though an analysis of the text brings out various incongruities as to the business relations between Fust and Gutenberg, it is difficult to look upon the Göttingen document as a forgery, and we deal with it here as genuine.

It is dated the 6th of November 1455, and records some of the proceedings in the lawsuit between Johan Fust (*q.v.*) and Gutenberg, which had taken place on that day in the convent of the Barefooted Friars at Mainz, whereby the former sought to recover from Gutenberg 2026 guilders in repayment of 1600 guilders which he had advanced to him (800 about August 1450, and another 800 about December 1452), with the interest thereon. The document first relates that, on some previous day (not stated), Fust had testified (1) that by a written agreement between them, Gutenberg was to "finish the work" (line 24) with the 800 guilders to be advanced to him at 6%; Fust being unconcerned whether it cost more or less. (2) Gutenberg had not been content with these 800 guilders, and Fust, wishing to please him, advanced him another 800 guilders at 6%. (3) He had himself borrowed this money, and as Gutenberg had never paid any interest, the principal sum and the interest thereon amounted to 2026 guilders (=between 15,000 and 16,000 marks), which he now demanded from him.

(4) On the same occasion Gutenberg had replied that Fust should have furnished him with 800 guilders, wherewith to make his "tools" (or apparatus; Germ. *Geczuge*), and he should be content with this money, and might devote it to his own use. (5) Such tools should be a pledge to Fust. (6) The latter should also give him (lines 37 to 40) annually 300 guilders for maintenance and furnish workmen's wages, house-rent, parchment, paper, ink, &c. (7) If they did not agree further, he should return Fust his 800 guilders, and his tools should be free; but it was to be well understood that he should finish "such work" (line 41) with the money which Fust had lent him on his pledge, and he hoped that he had not been bound to Fust to spend such 800 guilders on "the work of the books" (line 41). (8) Fust had told him that he did not desire to take interest from him; nor had these 800 guilders all, and at once, come to him in accordance with the agreement. (9) Of the additional 800 guilders he wished to render Fust an account; hence he allowed Fust no interest, nor usury, and hopes not to be legally indebted to him.

We assume, though it is nowhere stated, that these clauses relate to the "printing of books," to be executed by Gutenberg with the money which Fust advanced to him. But as he was already in debt at Strassburg since the 17th of November 1442 (and had to pay annually interest on this debt), and at Mainz since the 17th of October 1448 (also against interest), it is not surprising that when he contracted this fresh loan in 1450, at the high rate of 6%, he (by not giving any security except tools which he had still to make) practically admitted that he was penniless, and stipulated that Fust should give him also an annual sum for maintenance, and besides furnish workmen's wages, house-rent, parchment, paper, ink, &c., in fact everything required for setting up a printing-office and keeping it going. Fust seems not to have complied with these demands, otherwise he would have mentioned them in his account and at the trial. But he advanced another 800 guilders in December 1452, barely two years after his first advance, merely to please Gutenberg, who had not been satisfied with the first 800.

It is argued that Gutenberg must have been able to show Fust some specimens of his work to induce him to lend him so much money, and we have seen above that German bibliographers attribute to him a poem on the "Weltgericht," which they date *c.* 1443–1444, and the Paris *Donatus* which they date a little later, both printed, it is said, in the "first phase" of the "Gutenberg type," but showing already some traces of wear and tear; and thirdly, an *Astronomical Kalendar* (a broadside of 4 leaves) which they ascribe to the end of 1447, and regard as a "masterpiece" printed in a new type, said to be a "development" or "second phase" of the Gutenberg type, which must have been used for several years afterwards, till a fresh or "third phase" was cast of it (for B^{36}) with the alteration of some of the letters. But if Gutenberg had printed these three works in the years ascribed to them, however small they may be, he must be supposed to have had, from 1443 to 1448, types for printing them, and patrices and matrices for making his types, besides a press and various other tools for printing. Yet the notarial instrument of 1455, if it is genuine, reveals him as borrowing money, not so early as 1443, but so late as 1450, for "preparing his tools," and as having, at the time, nothing to offer his creditor as security except the tools which he still had to make(!). But, says one theory, Gutenberg, intending to print a Bible, and finding the type in his possession too large for it, manufactured a smaller one with the aid of Fust's money, while another theory would have it that he wanted to begin with the printing of a Missal, and for this purpose casted two types, one large and the other smaller. Difficulties, however, arose which induced him to use the smaller type for B^{42}, which was finished about the beginning of 1453, and Dziatzko places the type of B^{36} also in the year 1453, while Schwenke assigns a life of nearly twenty years (1443–1462) to this type.

If, however, Gutenberg had cast all these types, and printed all these books, and sold them, straight from 1443 to 1450, and from 1450 straight on to, say, 1455, he could not have done this without Fust, his money-lender, becoming aware of it, especially as Fust, for his first advance of 800 guilders, was to have received, as security, the "tools" which Gutenberg had to make before he could begin to print. Yet in 1455, fully five years after Fust had entered into such close financial relations with Gutenberg, he claimed, in spite of what he must have known of Gutenberg's supposed activity, the whole of the money which he had advanced, with interest and compound interest on it. And Gutenberg, instead of pleading on the first day of the trial that he had from 1450 to 1455 printed two large folio Bibles and a considerable number of other books, merely refers to the initial stages of his work, to "tools" to be prepared by him as a future pledge for Fust; he tells the judges that he had expected Fust to supply him with various necessaries for printing and his own existence, without saying whether Fust had complied with his demands or not, and finally declares that he had not felt called upon to devote the first 800 guilders to the "work of the books"; that he was ready to account for the second 800, but did not feel indebted to Fust either for interest or anything else, while, on the second day of the trial, he absented himself, and merely sent two of his workmen to hear what was going on (!). This does not look as if he had performed much from 1450 to 1455, but rather the reverse. Anyhow, if the Helmasperger instrument of November 1455 is not a fabrication, it shows that Gutenberg could not have begun to print before 1450; that in this year, 1450 (about August), when he borrowed money from Fust, he had no property such as a printing-office, presses, types, patrices, matrices, &c., which he must have possessed if he had been printing since 1443, to offer his creditor as security; had not a penny to maintain himself; besides being already in debt at Strassburg since 1442, and at Mainz since 1448.

The remainder of the instrument records *the verdict* given on the first day of the trial which decided (1) when Gutenberg shall have rendered his *account* of all receipts and disbursements paid out by him on the "work for the use [or profit] of them both" (l. 49), whatever less[1] money he then has received and taken in above it, that shall be reckoned in the 800 guilders; (2) but if the account should show that Gutenberg had paid out more for Fust than 800 guilders which had not come in their common good [or use] (line 60) Gutenberg shall return it to Fust; (3) and if Fust adduces by oath or by reasonable evidence that he has borrowed the above money on interest, and not lent it of his own money, then Gutenberg shall also pay such interest according to the tenor of the schedule.

The verdict is followed by Fust's *sworn declaration* regarding the amount of his claim, which he had been ordered to make in Gutenberg's presence, but which he now made in his absence, declaring (4) that he had taken up 1550 guilders which Gutenberg had received and which also had gone on "our common work" (line 60); (5) that he had annually given interest and loss, part of which he still owed; six guilders for every 100 guilders which he had thus taken up; (6) of all that Gutenberg had received of this borrowed money, which has not gone on the "work" of them both, which is found in the account, he claimed from him the interest in accordance with the verdict.

Gutenberg appears not to have produced the account which he was expected (clause 1) to render, as Fust's allusion to an account (in clause 6) must refer to his own account. Hence we know not whether he made any "disbursements." The "receipts" seem to mean nothing more than the instalments of the first 800 guilders which he acknowledged to have received from Fust, though some authors think that allusion is made to things (printed books or broadsides?) from which he might have received money by sale or otherwise.

It is to be noticed that Fust speaks here (for the sake of accuracy?) of having taken up 1550 not 1600 guilders, as in his first account. On the whole the wording of the verdict and the sworn declaration is obscure, and open to different interpretations, but it is impossible to ascribe to Gutenberg, on the strength of this document, the manufacture of the types and the printing of all the books in column A above, especially when we have regard to his own inexplicable silence at the trial, when it was incumbent on him for his own sake to show what he had done with Fust's money, and still more when we have regard to the pecuniary difficulties in which he had been placed at least eight years before he contracted these heavy new loans with Fust. Within the space of two years after the trial he was bankrupt, unable to pay either his loans or the small interest thereon, and might have ended his days in prison if the Strassburg St Thomas Stift had been able to have him arrested.

Certain circumstances point to Albrecht Pfister of Bamberg as the printer of the numbers vii., viii., ix., xviii. and perhaps those that come between them in column A. Even in former years when the church type of the Indulgence^{31} (1454) was believed to be identical with that of B^{36}, it was the general opinion that, though Pfister could not have printed the Indulgence, he had acquired its church type from Gutenberg for printing B^{36}. Now that a closer examination has shown that the type of B^{36} need not be dated so early as 1454, the known dates of Pfister (1461, 1462) harmonize with the approximate date (1460) of B^{36}. It is admitted that the types of vii., viii. and ix. differ from that of B^{36} in the form of certain capitals. But Pfister issued on the 14th of February 1401 at Bamberg, with the B^{36} type, an edition of Boner's *Edelstein* (88 leaves fol., with wood-engravings), and at least eight other works (Hessels, *Gutenberg*, p. 161, seq.), one of which bears the date 1462, the seven others none.

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[1] The instrument says: "was er dan *men* gelts dar uber enpfangen . . . hait." Senckenberg, Köhler, Van der Linde, &c., printed *nun* for the correct reading *men*. This latter word has hitherto been interpreted as meaning *more* (see Dziatzko, *Gutenbergfrage*, p. 34, note 1; Schorbach, in *Festschr.* of 1900, p. 259). Zedler (*Gutenbergforschungen*, p. 65, note) thinks that it is a dialectic by-form of the Mid. H. German *mein* found in *mein-kouf*, *mein-rât*, *mein-swern*, *mein-tât*, and still preserved in the Mod. H. German *Meineid*; he translates it therefore as "*widerrechtlich*" (unlawfully). But *men* is the same as the Mid. Dutch *min* (see Verdam's *Middel-Nederl. Woordenb, in voce*) =New Netherl. *minder*, and means *less*, the only meaning which can give sense to this clause.

Most of the copies of the 36-line Bible now known to us were at one time or another preserved in the libraries of Bavaria, and several fragments have been found in monasteries of that country, even in a register of the year 1460 of the abbey of St Michael at Bamberg. Moreover, a transfer or sale of type from Gutenberg to Pfister is contrary to all analogy in the infancy of printing, when every printer started with a type of his own making.

The Catholicon Type.

It is alleged that, in consequence of the lawsuit between Gutenberg and Fust, the former was deprived of all tools, &c., which he had made, or is supposed to have made, with the latter's money, and that afterwards a certain Dr Homery or Humery, a syndic of Mainz, lent him fresh money to enable him to set up another printing-office.

This allegation is made on the strength of a letter of obligation (dated Feb. 26, 1468) referred to above, and given by Dr Homery to Adolph, the archbishop of Mainz, by which he acknowledges to have received from the said archbishop "several forms, letters, instruments, implements and other things belonging to the work of printing, which Johan Gutenberg had left after his death, and which had belonged and still did belong to him (Dr Homery)." It is to be observed that Homery, though willing to assist or oblige Gutenberg, had been cautious enough to reserve to himself all rights to this printing apparatus, in somewhat the same way as Fust in 1450 demanded, or was promised, to receive Gutenberg's "tools" as pledge for his advances. The Homery apparatus could hardly have been of large dimensions, seeing that it was readily passed on first from him to Gutenberg, then from the latter to the archbishop and returned again to its owner. But it is presumed that with these types, which appear in the above list as type VIII., Gutenberg had printed (1) Joannis de Balbis, *Catholicon* of 1460, copies of which exist in the Cambridge University Library, three in the British Museum, two in the Paris Library, in the Spencer collection of the Rylands Library, in the Wolfenbüttel and Mainz libraries, &c.; (2) Matthaeus de Cracovia, *Tractatus rationis*, 22 leaves, of 30 lines, 4to, three copies of which are in the British Museum, one in the Rylands, one in the Cambridge, two in the Paris Library, &c.; (3 and 4), two editions of Thomas Aquinas, *Summa de articulis fidei*, in 4to., the first of 13 leaves and 34 lines (two copies of which are in the British Museum, one in the Rylands and one in the Cambridge Library, &c.); the second of 12 leaves and 36 lines (copies in the British Museum and the Paris Library); and (5) an indulgence of 1461 of 15 lines.

We have seen above that on the 17th of January 1465 Adolph II., archbishop of Mainz, had appointed "Johan Gudenberg, his servant and courtier." It has always been inferred from this that Gutenberg had quitted Mainz and gone to Eltville (Elfeld) to reside at the archbishop's court, and that, his dignity as courtier preventing him from printing himself, he passed the *Catholicon* types on to Henry Bechtermuncze at Eltville. It seems certain that in 1467 the *Catholicon* type with some additions (already found in the Indulgence of 1461) was at Eltville near Mainz, in the hands of Henry and Nicholas Bechtermuncze and Wigandus Spyes de Orthenberg, who issued on the 4th of November of that year (vi.) *Vocabularius ex quo* (a Latin-German vocabulary) in 4to, 166 leaves, 35 lines, the only known copy of which is in the Paris Library, and (vii.) *Vocabularius ex quo*, 2nd edition, with colophon dated the 5th of June 1469, 4to, 165 leaves, 35 lines, copies of which exist in the Rylands, the Blenheim, and the Paris libraries. It is therefore asked how the Bechtermunczes could have been using the *Catholicon* type in 1467, if we assume that it was this type to which Homery refers in his letter of obligation as being in his possession. Some, therefore, conclude that the *Catholicon* and the four other works in the same type were printed at Mainz by Henry Bechtermuncze, who may afterwards have transferred his printing office to Eltville. In that case it is difficult to see what type Homery could refer to, unless it were type II, a close imitation of which, if not the actual type, was used by Nicholas Bechtermuncze at Eltville in printing (March 12, 1472) a 3rd edition of the *Vocabularius ex quo*, 166 leaves, 35 lines, copies of which are preserved in the Paris and Hamburg libraries, and an edition of Thomas Aquinas, *Summa de articulis fidei*, 12 leaves, 35 lines (Munich Library).

It would seem, however, that Fust and Schoeffer were the printers and publishers of the *Catholicon*, and the other three works mentioned above, as the latter advertised them for sale in a list which he printed and circulated in 1469–1470 (see Konr. Burger, *Buchhändleranzeigen des 15 Jahrhunderts*, Leipzig, 1907, No. 3). Schoeffer may of course have purchased the stock of these books from Gutenberg or acquired it after his death from Homery, but as nothing compels us to attribute the printing of these books to Gutenberg, there is still less reason to deny that Fust and Schoeffer printed them, as the much discussed colophon of the *Catholicon* is found, almost verbatim, in three books published by them in 1465 and 1467. Hence the numbers i. to vi. are the only ones that could be ascribed to Gutenberg.

Even this number, involving the manufacture of four different types (apart from the alterations in the forms of certain letters which involved the making of new patrices and matrices) would be large for a man who, after having lived in luxury for some years, practically subsisted from 1442 to 1455 on money which he borrowed from various parties and never repaid. But the poem on the "Weltgericht," printed on paper, could scarcely be placed at the head of a list which includes and, but for this poem, begins with vellum printed works. Moreover, as it can hardly be regarded as a specimen of primitive printing, it takes a more natural place by the side of the paper-printed *Turkkalendar*, *Cisianus* and *Conjunctiones*, which all show that printing on paper was beginning to supersede that on vellum. It is asserted that its type is the same as that of the 1451 *Donatus*, but this is doubtful.

That the *Astronomical Kalendar* calculates the ephemerides for 1448 is no evidence of its having been printed at the end of 1447, as kalendars of this kind seem to have been printed without any regard to time and circumstances. Some years ago the *Cisianus* was ascribed to Gutenberg and to the year 1444, because some of the saints and movable feasts mentioned in it were thought to relate to that year. But as the same saints and feasts occur in the same way in *Cisianus* editions printed long after 1500, this notion was abandoned. The *Astronomical Kalendar* in question lays down rules for blood-letting at certain times of the year, and was evidently intended to be hung up in houses as guides for this purpose. It is admitted that it contains mistakes if we apply its calculations to 1448, and it has not yet been proved that these rules required a special kalendar for each year in particular. Removing, therefore, Nos. ii. and vi. to somewhat later dates in the list, the *Donatus* No. iii. and that of 1451 (No. iv.) with another edition (No. v.) of the same school-book remain at the head of the column A, together with the Indulgence^{31}, as the only works that could be ascribed to Gutenberg. They bring us down to the time (*c.* 1451) when he, according to the Helmasperger document, may be supposed to have been in a position to exercise the new art of printing.

It is necessary to point out that eight books—(1) *Prognostication* or *Calendar*; (2) Hermann de Saldis, *Speculum sacerdotum*; (3) *Tractatus de celebratione missarum*; (4) a work in German treating of the necessity of councils; (5) *Dialogus inter Hugonem Cathonem et Oliverium super libertate ecclesiastica*; (6) Sifridus de Arena, *Determinatio duarum quaestionum*; (7) idem, *Responsio ad quatuor quaestiones*; (8) *Klagspiegel*, or *New geteutscht Rechtbuch*—have been ascribed to Gutenberg on the strength (*a*) of the date 1460, which was said to be found in a *Prognostication* in the Darmstadt library, and (*b*) of a so-called rubrication alleged to be in a copy of the *Tractatus de celebratione missarum*, in which "Johannes dictus a bono monte" and Johannes Numeister are represented as offering this work on the 19th of June 1463 to the Carthusians at Mainz. But the date in the *Prognostication* has been falsified from 1482 into 1460, and the rubrication in the *Tractatus* is a forgery (Hessels, *Gutenberg*, pp. 107–114). The eight books are now considered to have been printed by Erhard Reuwich.

Apart from these disputed points there is no further difficulty as regards the history of Mainz printing. Fust and Schoeffer worked together from 1457 to 1466, starting in August 1457 with an edition of the *Psalterium*, printed in large missal types, which, as far as we know, is the first printed book which bears a date, besides the place where it was printed and the name of the printers. It was reprinted with the same types in 1459 (the second printed book with date, place and name of printer), in 1490, and in 1502 (the last work of Schoeffer, who had manufactured its types). In 1459 Fust and Schoeffer also published Gul. Durantus, *Rationale divinorum officiorum*, with the small type (usually called *Durandus* type) with which they continued to print long afterwards. In 1460 they published the *Constitutiones* of Pope Clement V., the text printed in a type (Clement type) about a third larger than the *Durandus*. This type was, however, in existence in 1459, as the colophon of the *Durandus* is printed with it.[1]

The Invention Controversy.—Now that we have traced the art of printing from the moment (1454) that it made its appearance in a perfect state at Mainz, and have seen that none of the particulars known to us of the life and career of Johan Gutenberg, who is alleged to have invented it, nor any of the books said to have been printed by him, afford us any basis for ascribing that honour to him, we will examine what has been said during a period of more than four hundred years on the question of the invention. For this purpose we will gather up into a chronological sequence (*a*) a few of the most important expressions used by the earliest printers in their colophons, (*b*) whatever documentary evidence there may be on the subject, and (*c*) some accounts of the earliest authors on the question. The Roman numerals i., ii., &c., are for the sake of convenient reference.

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[1] See further Bernard, *Origine*, i. 216 seq.

Early Testimonies.

The earliest[1] testimony (**i.**) is the notarial instrument, dated the 6th of November 1455, of the lawsuit between Fust and Gutenberg, already mentioned above, which records transactions between the two men from August 1450 to November 1455, Fust speaking of "the work" and of "our common work"; Gutenberg of "tools" which he wanted to prepare, of "workmen's wages, house-rent, vellum, paper, ink, &c.," of "such work" and of "the work of the books," whereas the judges speak of "the work to the profit of both" and "their common use."

From Book Colophons, &c.

(**ii.**) In the first[2] book published with a date (the Mainz Psalter, issued the 14th of August 1457 by Fust and Peter Schoeffer) it is said that it was perfected at Mainz by an "adinventio artificiosa imprimendi ac caracterizandi absque calami ulla exaratione," repeated and varied later, by the same printers in their colophons of the years 1459 to at least 1470. (**iii.**) In 1460 the colophon of the *Catholicon* published at Mainz without the printer's name, after stating that "the book was printed at Mainz, the genial city of the renowned German nation, which town God's mercy had deigned to prefer and adorn above the other nations of the earth by such an exalted light of genius and spontaneous gift," adds that the book was printed and completed "non calami, stili, aut pennae suffragio, sed mira patronarum formarumque concordia, proporcione, et modulo." This work (which is to be ascribed to Peter Schoeffer) is considered to have been printed by Gutenberg, and the mention of God's mercy, &c., is regarded as an allusion to the invention of printing. The phrase is, however, also found, with some variations, in the *Liber sextus Decretalium*, in the *Summa* of Thomas Aquinas, and in the *Clementinae*, published respectively on the 17th of December 1465, the 6th of March and the 8th of October 1467, by Fust and Schoeffer. (**iv.**) On the 17th of January 1465 Adolph II., archbishop of Mainz, by a public decree, appointed Gutenberg as his servant in reward for "his services," but he does not say what kind of "services" he had rendered, nor does he speak of him as the inventor of printing, nor as a printer. (**v.**) In the *Grammatica rhythmica*, published in 1466 by Fust and Schoeffer, the third line of the colophon runs: "Hinc Nazareni sonet oda per ora Johannis," which was formerly regarded as an allusion to Johann Fust or Johann Gutenberg, but which more probably refers to Johann Brunnen or Fons, the author of the grammar. (**vi.**) On the 26th of February 1468 Dr Homery wrote to the archbishop of Mainz the letter quoted above, from which it may be inferred that Gutenberg had been a printer, though nothing is said as to his being the inventor of printing. (**vii.**) In 1468 Schoeffer reprinted Fons's *Grammatica*, in the colophon of which it is said: "At Moguntina sum fusus in urbe libellus meque (the book) domus genuit unde caragma venit." (**viii.**) Schoeffer published on the 24th of May 1468 the 1st edition of *Justiniani Imper. Institutionum juris libri VI., cum glossa*. To this were added by way of colophon some verses commencing: "Scema tabernaculi," &c., in which it is said that (the ornament of the church) Jesus "hos dedit eximios sculpendi in arte magistros . . . Quos genuit ambos urbs Moguntina Johannes, librorum insignes prothocaragmaticos," which is regarded as an allusion to Johann Gutenberg and Johann Fust as first or chief printers. (**ix.**) In the same year (1468) Johannes Andreae, bishop of Aleria, says, in the dedication of his edition of St Jerome's *Epistles*, published in that year (Dec. 13,) at Rome, to Pope Paul II., that "Germany is to be honoured for ever as having been the inventress of the greatest utilities. Cardinal Cusa wished that the sacred art of printing, which then (under Cardinal Cusa, who died on the 11th of August 1464) seemed to have arisen in Germany, were brought to Rome." (**x.**) In 1470 Guil. Fichet, in an octastichon inserted in the Paris edition of 1470 of the *Letters* of Gasparinus of Bergamo, exhorts Paris to take up the almost divine art of writing (printing) which Germany is acquainted with (see below No. xiii.). In the same year Erhard Windsberg writes to the same effect in an epigram inserted in the *Epistolae Phalaridis* published at Paris about 1470. (**xi.**) In 1471 Ludov. Carbo, in the dedication of the *Letters* of Pliny to Borso, duke of Modena, speaks of the Germans having invented printing; Nicolaus Gupalatinus (Venice, 1471) of a German being the inventor of printing, and Nicolaus Perottus of the art which had lately come from Germany. (**xii.**) On the 21st of May 1471 Nicolas Jenson published an edition of Quintilian, edited and revised by Ognibene de Lonigo (Omnibonus Leonicenus), who in the preface speaks of its printer as "librariae artis mirabilis inventor, non ut scribantur calamo libri, sed veluti gemma imprimantur, ac prope sigillo, primus omnium ingeniose demonstravit." (**xiii.**) About 1472 the first three printers of Paris published Gasparinus Pergamensis's *Orthographiae liber*, to which is prefixed (in the copy of the university library of Basel) a letter, dated the 1st of January, from Guillaume Fichet (see above No. x.), prior of the Sorbonne, to Robert Gaguin, in which he says that "it is rumoured that in Germany, 'not far from the city of Mainz,' a certain Johann Gutenberg (Johannes, cui cognomen Bonemontano) first of all invented the art of printing (impressoriam artem), by means of which books are made with letters of metal, not with a reed (as the ancients did), nor with the pen (as is done at present)." (**xiv.**) On the 14th of July 1474 Joh. Philippus de Lignamine published at Rome *Chronica summorum pontificum imperatorumque*, in which, between two entries, relating one to the 14th of July 1459 and the other to the 1st of October 1459, an undated paragraph is found saying that Jacobus with the surname of Gutenberg of Strassburg and a certain other one named Fustus, "imprimendarum litterarum in membranis cum metallicis formis periti, trecentas cartas quisque eorum per diem facere innotescunt apud Moguntiam Germanie civitatem." It says the same of Mentelin, and (under 1464) of Conrad Sweynheym, Arnold Pannarts, and Udalricus Gallus. (**xv.**) On the 23rd of May 1476 Peter Schoeffer issued the 3rd edition of the *Institutiones* of Justinian, with the same imprint as in the edition of 1468 (see testimony viii.), but with the addition that Mainz is the "impressoriae artis inventrix elimatrixque prima." (**xvi.**) In the *Fasciculus temporum*, issued at Cologne in 1478, it is stated under the year 1457 that the printers of books were multiplied on earth, deriving the origin of their art from Mainz. The earlier editions merely stated that the printers of books were multiplied on earth. (**xvii.**) In 1483 Matthias Palmer of Pisa, in the *Chron. Euseb.* published at Venice, stated under the year 1457 that students owe a great debt to Germany, where Johannes Gutenberg zum Jungen, knight of Mainz, invented the art of printing in 1440. (**xviii.**) In the same year, 1483, Jac. Phil. Foresta of Bergamo, in the *Supplementum chronicorum*, says under the year 1458 that the art of printing books was first discovered in Germany, according to some by Guthimberg of Strassburg, according to others by Faust (see xiv.), according to others by Nicolas Jenson (see xii.). (**xix.**) On the 6th of March 1492 Peter Schoeffer published the *Niedersächsische Chronik* of Conrad Botho, saying in the colophon that it was "geprent . . . in . . . Mentz, die eyn anefangk is der prentery." (**xx.**) At the end of 1494 two Heidelberg professors, Adam Wernher and Joh. Herbst, composed some Latin verses in honour of Johannes Gensfleisch (Gutenberg's family name turned into the Latin Ansicarus), whom they called "primus librorum impressor" and "impressoriae artis inventor primus."[3] (**xxi.**) In 1499 Jacob Wimpheling (born at Schlettstadt 1450, died 1528) published (at Mainz, by P. Friedberg [?]) an *Oratio in Memoriam Marsilii ab Inghen* (d. 1396), in which he, on leaf 22 a, praises Joannes Ansicarus in Latin verse for his invention at Mainz. (**xxii.**) These verses are preceded by a Latin epitaph on Johann Gensfleisch, "artis impressoriae inventor" and "repertor," written by Adam Gelthus, a relative of Gutenberg, adding that his remains rest in the Franciscan Church at Mainz. (**xxiii.**) In the same year (1499) Polydore Vergil (*De inventoribus rerum, Venice*, lib. ii. cap. 7) says that a certain Peter [Schoeffer ?], a German, invented in 1442 the art of printing at Mainz in Germany, as he had heard from the latter's countrymen; this statement was repeated in a Venice edition of 1503. In later editions "Peter" was altered to "Joh. Gutenberg." (**xxiv.**) In the same year Koelhoff, printer at Cologne, published *Cronica van der hilliger Stat van Coellen*, in which on fol. 311 b, the following statements occur: (1) The art of printing was found first of all in Germany at Mainz about the year 1440; (2) from that time till 1450 the art and what belonged to it were investigated; (3) and in 1450, when it was a golden year (jubilee), they began to print, and the first book that they printed was the Bible in Latin, in a large letter, resembling that with which at present missals are printed. (4) Although the art was found at Mainz, as aforesaid, in the manner in which it is generally employed now, yet the first prefiguration was found in Holland from out the *Donatuses* which were printed there before that time, and from and out of them was taken the beginning of the aforesaid art, and it was found much more masterly and exact (*subtilis*) than that other manner was, and has become more and more artistic. (5) Omnibonus wrote in a preface to Quintilian, and in some other books, too, that a Walloon

From Documentary Evidence.

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[1] The earliest would be the records of the Strassburg lawsuit of 1439, in which the word "trucken" is used, but we cannot accept them as genuine.

Earlier is perhaps the *Donatus* issued by Peter Schoeffer, possibly before 1456, the colophon of which says that it was finished Arte nova imprimendi seu caracterizandi . . . absque calami exaratione (by a new art of printing or making letters . . . without the writing of a pen).

[3] These verses were not published at the time, but in the 19th century by F. J. Mone, *Quellensamml. der bad. Landesgesch.* iii. 163, from the contemporary MS. of Adam Wernher, preserved in the archives of Carlsruhe.---We pass over here a few books which merely say that the invention was made at Mainz: a *Chronyk der landen van Overmaas*, written by an inhabitant of Beek, near Maastricht, in the 15th century; the *Chronycke van Hollandt* (Leiden, 1517), &c.

from France, named Nicol. Jenson (see xii.), discovered this art; but that is untrue, for there are those still alive who testify that books were printed at Venice before Nicol. Jenson came there and began to cut and make letters. (6) But the first inventor of printing was a citizen of Mainz, named Junker Johan Gudenburch. (7) From Mainz the art was introduced first of all into Cologne, then into Strassburg, and afterwards into Venice. (8) The origin and progress of the art were told to the writer verbally by Ulrich Zell of Hanau, still printer at Cologne (*anno* 1499), through whom the said art came to Cologne. **(xxv.)** In 1501 Jacob Wimpheling (see xxi.), who stated in his *Oratio querulosa contra Invasores Sacerdotum*, &c. (published at Delft, *c.* 1495) that chalcography had been invented at Mainz, says on p. 43 of his *Germania* (Strassburg, Joh, Prüss, 1501), that the invention was made at Strassburg by Johann Gutenberg of Strassburg, and that it was perfected at Mainz. **(xxvi.)** In 1503 Johann Schoeffer (the son of Peter Schoeffer and the grandson of Johann Fust) published an edition of *Hermes Trismegistus*, in which he represents himself as one of the most distinguished citizens of Mainz (nobili vrbe maguntina artis impressoriae inventrice illuminatriceque prima), descended from the most fortunate race who invented the art of printing. **(xxvii.)** In 1504 Ivo Wittig, a canon and the keeper of the seal of the St Victor Cathedral near Mainz (of which Gutenberg had been a lay member), erected in the house "Zum Gutenberg" a memorial stone and an epitaph (missing already in 1700) to Joh. Gutenberg of Mainz, "qui primus omnium litteras aere imprimendas invenit." **(xxviii.)** In 1505, in the German translation of Livy published by Johann Schoeffer (see xxxii.) the dedication to the emperor Maximilian, probably written by Ivo Wittig (see xxvii.), speaks of Johan Güttenbergk as inventor of printing (1450) and Johan Faust and Peter Schoeffer as improvers and perpetuators of the art. This work was reprinted at least eight times (in 1514, 1523, 1529, 1530, 1533, 1551, 1553, 1557) with the same dedication; but in 1509 the *Breviarium Moguntinum* says that it was printed at the expense and labour of Johann Schoeffer, whose grandfather (*i.e.* Johann Fust) was the first inventor and author of the art of printing (see xxvi.). **(xxix.)** In 1505 Jacob Wimpheling, in his *Epithoma Germanorum* (Strassburg, 1505), asserts (on leaf xxxviii. b and xxxix. a) that in 1440 Johann Gutenberg of Strassburg invented there the art of printing. And in 1507, in his *Catal. episcoporum Argent.* (Strassburg, 1507), he says that the art was invented, though in an imperfect manner, by a certain Strassburger, who afterwards went to Mainz and joined others working and trying the same art, where it was, under the guidance of Johann Gensfleisch, perfected in the house "boni montis" (Gutenberg). This he repeated in 1515. **(xxx.)** About 1506–1511 Johannes Trithemius wrote his *Chronikon* of Spanheim, published at Frankfort in 1601, in which he says (p. 366), under the year 1450, that the art of printing books was discovered afresh (*à novo*) at Mainz by a certain citizen said to be Johan Gutenberg, who, after having spent all his property in accomplishing the new invention, perfected it by the advice and assistance of Johan Fust and others. The first propagator of the new art was, after the inventor, Peter Schoeffer. **(xxxi.)** In 1515 Johann Schoeffer published Joh. Trithemius's *Compendium sive Breviarium historiae Francorum*, and said in the colophon that the book was published at Mainz (the *first* inventress of the art of printing), by him, the grandson of the late Johann Fust, the *first* author of the said art, who finally from his own genius commenced to excogitate and to investigate the art in 1450, and in 1452 perfected it and commenced printing, assisted by many necessary inventions of Peter Schoeffer von Gernsheim, his servant and adopted son. Johann Fust and Peter Schoeffer kept this art secret, binding all their servants and domestics by oath never to reveal it; but in 1462 it was spread by the same domestics into divers countries. The same statements were repeated in the *Breviar. eccles. Mindensis* of 1516. **(xxxii.)** On the 9th of December 1518 the emperor Maximilian accorded to Johann Schoeffer the privilege of printing Livy (1518–1519), saying that "he has learnt and been advised on the faith of worthy testimonies that the ingenious invention of chalcography was effected by the printer's grandfather." Erasmus, in his preface to this book, says that great praise is due to the inventors of the almost divine art of printing, the chief among whom is rumoured or said to be Joan Faust, the grandfather of Joan Scheffer; and Nicolaus Carbachius, in a final notice of the edition, speaks of "Joan Scheffer Chalcographus," whose grandfather first invented and exercised this art in Mainz. **(xxxiii.)** In 1519 Joh. Thurmayer Aventinus (1474–1534) wrote that "in 1450 Joannes Faustus, a German, a citizen of Mainz, invented a new kind of writing, called chalcography, and completed it in two years; it was kept secret by him and Peter Schoeffer, his son-in-law, but divulged in Germany ten years afterwards by Faust's servant, Johannes Guttenberger, a Strasburger." **(xxxiv.)** In a pedigree of Lourens Janssoen Coster of Haarlem and his descendants, preserved in the Haarlem Town Library, it is asserted that "he brought the first print into the world 1446." It would seem that an attempt was made, at some time or other, to alter the date 1446 of this document into 1440, otherwise its genuineness is beyond doubt; in its present state it was probably first drawn up about 1559, but its first four divisions including the above statement were evidently copied from some earlier document, as they are all written by one hand, in Roman or Karoline minuscules, and, of course, this earlier document may be assumed to have existed long before 1502–1560, the period usually assigned to this pedigree, and to go back to the time of L. J. Coster himself. There is some doubt as to whether the year 1446 refers to Coster's bringing the first print into the world, or to the marriage of his daughter. In the latter case the "first print" must be earlier. **(xxxv.)** In 1520 Johan Schott, a printer at Strassburg and grandson of Johan Mentelin, the first printer of that town, published an edition of Ptolemy, and printed at the end the arms of his grandfather with the following inscription: "insigne Schottorum Familiae ab Friderico Rom. Imp. III. Joan. Mentelio primo Typographiae Inventori ac suis concessum: Anno Christi 1466." Apart from the assertion that Mentelin was the inventor of printing, we may remark that the emperor Frederick III. raised Mentelin to the rank of a nobleman in 1466 and granted him new arms. **(xxxvi.)** In 1524 Johan Schoeffer speaks again (at the end of S. Prosperi *libellus*) of his maternal grandfather Joan "Faust" and his father Peter Schoeffer, citizens of Mainz, who first of all invented and practised metal printing. **(xxxvii.)** in 1531 Ivo Schoeffer, the son of Johan Schoeffer, speaks of his great grandfather Johan "Faust" having invented chalcography, and "Faust" continues for many years afterwards to be spoken of as the inventor, sometimes in connexion with Peter, once or twice even with Ivo Schoeffer. **(xxxviii.)** About 1533 the Neapolitan Mariangelo Accorso, who had resided at the court of Charles V., wrote on the first leaf of a vellum *Donatus* (in the possession of Aldus Manutius, jun.) that "Joh. Faust of Mainz first discovered the art of printing with metal types which afterwards he made of lead; his son Peter Schoeffer added much afterwards to polish the said art. This *Donatus* and *Confessionalia* were printed first of all in 1450. Faust derived the suggestion from a *Donatus* printed before in Holland from an engraved block." This statement is found on p. 411 of the *Biblioth. Apost. Vaticana* of Angelo Roccha (Rome, 1591), who saw the leaf. Some consider its latter part to have been derived from the *Cologne Chronicle* (xxiv.) and it seems probable that it was a mixture of some of the above testimonies. **(xxxix.)** In 1536 Johan Schott (see xxxv.) published *Historien Handt-Buchlein* (Strassburg, 1536), in which on leaf b^1 and b^2 he says that "Hans Mentlin of Strassburg invented the art, which, through infidelity, was brought to Mainz." On the strength of this and other statements (xxv., xxix., xxxv.) the bicentenary of the Strassburg invention was celebrated there in 1640. **(xl.)** In 1541 Joh. Arnold (Bergel or) Bergellanus, who had settled as press-reader at Mainz two years previously, published his *Encomium chalcographiae* (Mainz, in the St Victor Stift, Fr. Behem, 1541, 4to), in which the lawsuit between Fust and Gutenberg (i.) is alluded to for the first time. Bergel had read Tritheim's books (xxx.), in which the invention is ascribed to Johan Gutenberg with two coadjutors, Johann Faust and Peter Schoeffer, which he (Bergel) had heard confirmed in conversations with Mainz citizens; he had also seen some old tools prepared for the work by the originators which were still in existence. Gutenberg invented it in 1450. **(xli.)** About 1561 Jan van Zuren (born at Haarlem in 1517) and Dirk Volkerts Coornhert (born at Amsterdam in 1522) established a printing-office at Haarlem. Of the former it is alleged that he had compiled a work on the invention of printing, which is presumed to have been lost during the siege of Haarlem in 1573. This work was not publicly mentioned before 1628, when Peter Scriverius published his *Laurecranz voor Laurens Coster*, in which he says that he had only found the title, preface and introduction, in which Van Zuren contended that the first foundations of the art were laid at Haarlem, and that it afterwards accompanied a foreigner to Mainz. In this introduction he does not mention the name of the inventor, nor a date, but points in indefinite terms to the house of the inventor as still existing. **(xlii.)** In the same year (1561) Van Zuren and Coornhert published an edition of the *Officia Ciceronis*, in which the latter, in a dedication to the magistracy of Haarlem, refers to the rumour that the art of printing books was invented first of all at Haarlem, and was brought to Mainz by an unfaithful servant and much improved there. He adds that very old and dignified persons had often told him, not only the family of the inventor, but also his name and surname, and had explained the first crude way of printing, and pointed out to him the house of the first printer. **(xliii.)** In 1566 Luigi Guicciardini, a Florentine nobleman, who had visited the Netherlands and had resided many years at Antwerp, finished a description of the Netherlands (published in 1567), in which, alluding to Haarlem, he speaks of the invention there according to the assertions of the inhabitants, the evidence of some authors, and other remembrances; the inventor died before the perfection of his art; his servant went to Mainz, where he perfected the art, and hence the report that it was invented there. **(xliv.)** About 1568 (it is calculated) Hadrianus Junius wrote his *Batavia*, published at Leiden in 1588, with two prefaces, dated, the one from Leiden, the 6th of January 1575, the other from Delft *ad annum salutis* 1575. On p. 253 he says: (*a*) the opinion that the forms of the letters whereby books are printed were first discovered at Mainz is very inveterate, but old and eminent inhabitants of Haarlem had assured him that they had heard from their ancestors (*b*) that there lived at Haarlem, more than 128 years before, in a decent house then existing, near the market-place, opposite the royal palace, Lourens (son of) Jan, surnamed Coster, who, while walking in the wood near Haarlem, began to shape beechen bark first into figures of letters, by which, reversely impressed one by one on paper, he composed one or two lines to serve as an example for the children of his son-in-law. (*c*) When this succeeded, he began to contemplate greater things, and first of all invented, assisted by his son-in-law Thomas (son of) Peter, a more gluey and substantial kind of ink (as the ordinary ink was found to blot), with which he printed whole tablets with pictures, with the letters added. (*d*) Junius had seen books of this kind printed by Coster (the beginnings of his labours) on the rectos of the leaves only, not on both sides; the book was written (in Dutch) by an anonymous author, and entitled *Speculum nostrae salutis*, in which care was taken that the blank versos could be pasted together, so that the blank pages should not present any unsightliness. (*e*) Afterwards (Coster) changed the beechen characters into leaden, and the latter again into tin ones. Very ancient wine-pots cast of the remains of these types were still to be seen in the house of Lourens, which was afterwards inhabited by his great-grandson Gerard (son of) Thomas, who had died an old man a few years before. (*f*) When the new merchandise attracted purchasers everywhere, workmen were added to (Lourens') household, among whom was a certain John (whether, as was suspected, Faust, or another of the same name, Junius did not inquire), who was bound to the work of printing by oath. But, when he thought he knew the art of joining the letters and of casting the types, &c., he stole away, when everybody had gone to church, the whole apparatus of the types and the tools prepared by his master, and hastened to Amsterdam, thence to Cologne, until he arrived at Mainz, where he could remain in safety, and, having opened a work-office, issued within the space of one year, about 1442, the *Doctrinale* of Alexander Gallus and the *Tracts* of Petrus Hispanus, printed with the same types which Lourens had used at Haarlem. (*g*) Junius recollects that Nicolaas Gaal, his tutor, a man of firm memory and venerable old age, had told him that as a boy he had often heard a certain bookbinder, Cornelis (a man of more than eighty years of age, who had been an under-workman in the same office) narrating the story of the invention (as he had heard it from his master), the polishing and increase of the crude art, &c., and cursing those nights which he had passed, during some months, with the culprit in one bed. (*h*) The burgomaster Quirinus Talesius admitted to Junius that he had formerly heard nearly the same from the mouth of the same bookbinder.

(xlv.) Natalis Comes, in his *Universa historia sui temporis* (Venice 1581; the edition of 1572 contains only books 1 to 10), lib. xxiv. 521, says that Haarlem is memorable on account of the almost divine invention of printing books first contrived by John Cutenberg in the year 1453; who, when he had invented the rudiments of it, had a rather cunning servant, observant of his master's art, who, after the death (see xliii., xlvi., xlvii.) of Johan went to Mainz and there perfected the art, and hence the report that it was invented in that city. **(xlvi.)** Geo. Braunius, in the second volume of his *Civitates orbis terrarum* (Cöln, 1575?), says of Haarlem, that in this town and the whole province of Holland, there was a fixed tradition that the art of typography was first invented there. But before it was perfected and brought to light, the inventor died (see xliii., xlv.) and his servant went to Mainz, and made it known there. **(xlvii.)** Mich. Eyzinger on p. 75 of his *Niederländsche Beschreibung* (Cöln, 1584) says that the art of printing, as it was then done, with letters and characters on paper or otherwise, was invented by some one at Haarlem, but, on the death of his master (see xliii., xlv., xlvi.), was brought to light in perfection by his servant. (Repeated by Matthias Quadus Pictor Juliacus in *Compendium Universi, sive Geographicae narrationes*, lib. iii. c. 38, Colon. 1600.) **(xlviii.)** *Chronicon Sublacense*, per P. D. *Cherubinum Mirtium Trevirensem monachum Sublacensem laboratum anno . . . 1629*. A MS. in 4to, on p. 150 of which is read: Non egre ferat, quaeso lector, si inseruero ratione temporis rem non plane ab instituto nostro alienam, nempe laudabile studium monachorum Sublacensium teutonicorum . . . Nempe, quod nobilissima librorum typographia paucis ante annis in inferiori Germania enata est et in lucem producta (with a note by Mirtius: Hollandia A.D. 1453 in civitate Haarlem per Joannem Cutenbergam, quae tamen ars, postea Moguntiae per dicti inventoris famulum in meliorem redacta fuit excudendi formam). It is supposed that xlv. to xlvii. are derived from Test. xliii., but this seems impossible as regards xlviii.

(xlix.) In 1628 Scriverius in his *Laurecranz* (see xli.) placed the date of the Haarlem invention as far back as 1428, and mentioned as its inventor Lourens Janszoon, sheriff of Haarlem. He asserts that the art of printing appeared, "not in the manner as it is used now, with letters cast of lead and tin, but a book was cut leaf for leaf on wooden blocks," and the Haarlem inventor was robbed in 1440 by Johan Gutenberg. Scriverius based the date 1428 upon a Hebrew *Chronicle* compiled by Joseph ben Meir (1496–1575?), and published in 1554 at Sabionetta by Cornelius Adelkind, where, under the year of the Jewish era 5188 (=1428), the author mentions a book (without giving the title) printed at Venice and seen by him. Scriverius, being convinced that this could only refer to a book printed at Haarlem, applied the entry to a xylographic *Biblia pauperum*, of which he gave a description, together with several other blockbooks and early printed books.

(l.) In 1639 Boxhorn pushed the date of the Haarlem invention back to 1420, referring, as his authority, to the same *Chronicle* of Rabbi Joseph. Since that time the date of the Haarlem invention has been variously placed between 1420 and 1430.

Later testimonies are mere repetitions of earlier statements.[1]

We need not discuss the story of Antonio Cambruzzi, who asserted that Pamfilo Castaldi invented printing at Feltre, in Italy, in 1456, and that Fausto Comesburgo, who lived in his house in order to learn the Italian language, learnt the art from him, and brought it to Mainz; the story, however, found so much credence that in 1868 a statue was erected at Feltre in honour of Castaldi. Nor need we speak of Kuttenberg in Bohemia, where John Gutenberg is asserted to have been born and to have found the art of printing. Nor is it necessary to speak of Jean Brito, who printed at Bruges *c.* 1477–1488, and is asserted to have invented printing there. We may also pass over Johann Fust, later on called Faust (testimonies xiv., xviii., xxvi., xxviii., xxxi., xxxii., xxxiii., xxxviii.), as we know from the Mainz lawsuit of 1455 that he had simply assisted Gutenberg with loans of money. We may also pass over Johann Mentelin of Strassburg (testimonies xxxv., xxxix.), only remarking here that he had already printed a Bible in 1460, and that he is mentioned in Strassburg registers as a chrysographer or gold-writer from 1447 to 1450; but of his whereabouts between 1450 and 1460 there is no record. That he had gone, or had been called, after 1450 by Gutenberg to Mainz has been asserted but not proved, though there is no reason why he should not be one of the two Johannes alluded to as the *prothocaragmatici* of Mainz in the Justinian of 1468 (testimony viii.). That Nicolas Jenson came to be regarded in certain circles and for a time as the inventor of printing is owing to testimony xii. being misunderstood.

There remain, therefore, to be considered the testimonies which bear on the rival claims of Haarlem and Mainz. So far as we know, the controversy between Germany and Holland was publicly started as early as 1499 by the *Cologne Chronicle* (testimony xxiv.), that between the two towns mentioned not publicly before 1561 (testimony xli.); while the name of the Haarlem inventor was not mentioned publicly in print earlier than 1588 (testimony xliv.).

The claims of Germany and Mainz, as centred in the person of Johann Gutenberg, have been discussed above while treating of the early printing at Mainz. A few more words about these claims are necessary. Though some of the documents relating to him connect him with the art of printing, they say nothing of him as the inventor of it; nor do any of the books ascribed to him.

The first document that connects him with the art of printing, the notarial instrument of the 6th of November 1455 (testimony i.), says nothing of an invention or a new mode of printing. And yet the occasion was such as to make it almost imperative on Gutenberg to speak of his invention, if he had made any, for he had spent 1600 guilders of Fust's money for making "tools," apparently without printing anything,[2] and was on the point of being robbed by the latter and having taken away from him all that he is supposed to have made and done to give effect to his idea or invention. The next testimony (ii.) *i.e.* the earliest Mainz books with printed dates (1457 to 1467), shows that the art of printing was not treated as a secret at Mainz; it is openly proclaimed; its importance fully realized and appreciated, but it is distinctly advertised as a "by-invention of printing," and still more distinctly as a "*new art* of printing"; the public were informed that books were now no longer produced by means of the pen, but by a new art of forming characters and printing. Such advertisements are natural and appropriate if we assume that the new art of printing had recently (say about 1450 to 1455) become known at Mainz, but not when we assume that Gutenberg had been printing there devotional and school books and folio Bibles since 1443. But, though the new art is so distinctly described and advertised, in none of these advertisements is there one word of a "Mainz invention" or an "inventor." In testimony iii. (the *Catholicon* of 1460) there is an allusion to Mainz being favoured by God, but again not one word about an invention or an inventor. If Gutenberg had printed the *Catholicon*, it would be incredible that he, who had been wronged and robbed by his two rivals (Fust and Schoeffer), should join in with them in defining and proclaiming the new art, but never with one word assert his claim to the honour and profit of the invention, if he had made any, and should even omit his name, whereas he saw his two rivals never neglect to print their names in full on every book which they published. Those who believe that Gutenberg was the inventor of printing suggest that he kept silent, as otherwise his creditors would have seized his copies and his printing-office. But this explanation cannot be accepted, as we have seen that Gutenberg was practically bankrupt at that time, and prosecuted as a defaulter; and the verbose colophon at the end of a gigantic folio book like the *Catholicon*, published at a time when there were perhaps not more than three printing offices in the world, would be calculated to draw attention to its printer and his residence, not to conceal him. Testimony v. (1466) can no longer be regarded as having any reference to Gutenberg or the invention of printing; vii. (1468) was formerly thought to mean: "I, the book, am cast (*i.e.* its types are cast) in the Mainz city, and the house whence the type came (=where the type was invented) produced me." But of late years it has been shown that the author of the book, Johann Fons, was Peter Schoeffer's press-corrector. And, as he no doubt resided in Schoeffer's house, the two lines evidently mean: "I am a little book cast in Mainz, and I was born (=written) in the same house whence the type comes[1] (=where I am printed)." Testimony viii. (also of 1468) speaks of two Johannes (Gutenberg and Fust) as the "prothocaragmatici librorum quos genuit urbs Moguntina." But this means, not that the first printers of books were born at Mainz, but that the two Johannes (born) produced at Mainz were the chief printers of books.

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[1] Over a hundred of them have been collected by Ger. Meerman, *Origines typogr.* ii. 58 seq.

[2] In line 42 Gutenberg distinctly declares that "he hoped he was under no obligation to Fust to devote the first 800 guilders to the work of the books"; and, as Fust, by advancing the second 800 guilders in 1452, had practically become Gutenberg's partner, it seems clear that the former claimed in October or November 1455, when the trial may be said to have commenced, his money and interest because Gutenberg had as yet not printed anything.

Mainz Testimonies, 1454-1468. When we now place together the clear documentary testimonies (i. to viii.) of the first fourteen years of printing (1454 to 1468) at Mainz, we see that they all come from Mainz itself. Everybody connected with the art when speaking of it does so in the most public and unreserved manner; its importance was as fully realized and advertised then as it is now; the German nation is even congratulated on possessing it; there is never any secrecy about it; but from the moment that it begins to be mentioned there (say about 1456) it is called a *new* art. In the midst of all this publicity, however, the *new* art which Mainz and Germany possess is never spoken of as having been *invented* at Mainz or anywhere else in Germany. The supposed Mainz inventor (Gutenberg) even speaks himself on two occasions (certainly in the lawsuit of 1455, and presumably in the *Catholicon* of 1460) but never says that he made an invention. The archbishop of Mainz, too, speaks publicly of Gutenberg in 1465 (testimony iv.), and rewards him for services, but does not speak of him as the inventor of printing, nor even as a printer. Nor does Dr Homery, in his letter to the archbishop (testimony vi. of 1468), in which he refers to Gutenberg's printing apparatus, call him the inventor of printing.

In 1468 we enter on a new phase in the history of the invention. Even if we set aside testimony viii. as being merely local, testimony ix. (1468) speaks of the art of printing as having arisen in Germany. This testimony, however, does not come from Germany, nor from Mainz, but from Italy, and is supposed to have been inspired by the two German printers who had established a printing-office at Subiaco in 1465, and in 1467 at Rome, and who most likely learned their craft at Mainz.

As the two printers are mentioned in the testimony, and as it does not speak of Gutenberg, nor of Mainz, it is far more likely that it was merely derived from the colophons of Fust and Schoeffer, or from something that Cardinal Cusa had heard during his embassies in Germany. To the Mainz colophons we must also ascribe (*a*) the two testimonies of 1470 (x.) and (*b*) the three of 1471 (xi.), all five of which come from France and Italy. At last, in 1472 (testimony xiii.), the invention of printing is ascribed to Gutenberg of Mainz, but as a rumour, and the testimony comes from France. Guil. Fichet of Paris, who gives it, is supposed to have heard the rumour from the three German printers who commenced printing at Paris in 1470. And as two of them had resided, immediately before they came to Paris, in the university of Basel, and are supposed to have learnt their art there, the rumour is traced to "Bertolff von Hanauwe," who appears in the lawsuit of 1455 as Gutenberg's servant and who was printing at Basel in 1468. But it came more likely from information which Fichet obtained from the St Victor Cathedral, near Mainz (of which Gutenberg had been a lay member), as he speaks of the art having been invented "not far from that town." Testimony xiv. (1474) again comes from Italy, from Rome, and was perhaps derived from one of the German printers settled there at that time. It merely speaks of Gutenberg, Fust and Mentelin as printers, but says not a word which even touches upon the invention of the art. In testimony xv. (1476) we have the first definite mention of Mainz as the inventress of the art; it is given as an addition to the Mainz colophon of 1468 (see viii.). In 1478 Mainz is again mentioned in a Cologne testimony (xvi.) which gives evidence of research, as it is an amplification of an earlier one in which Mainz was not mentioned. Germany, Gutenberg and Mainz are again mentioned in the Venetian testimony xvii. (1483), which gives (under the year 1457) for the first time 1440 as the date of the invention. In the same year we have two earlier testimonies (xiv. and xii.) worked into one (xviii.), to the effect that printing was invented either by Gutenberg or by Fust or by Jenson. Testimony xix. (1492), which states that printing commenced at Mainz, is practically equivalent to xv. In 1494 and 1499 we have three German testimonies (xx., xxi., xxii.) as to Gutenberg being the inventor of printing; these, however, come, not from Mainz, but from Heidelberg; xxii. is given by a relative of Gutenberg, Adam Gelthus, and, as the latter resided at Heidelberg, it is clear that he was the real source of the other two Heidelberg testimonies (xx. and xxi.). Two years later, when Wimpheling, the author of testimony xxi., had left Heidelberg, he ascribed (xxv.) the invention of printing to Strassburg, though stating that Gutenberg was the inventor. Testimony xxiii. is recorded above to show the confusion that reigned in people's minds about 1500 regarding the invention. We must add to these testimonies those of 1504 (xxvii.) and 1505 (xxviii.), which are owing to Ivo Wittig, a canon and the keeper of the seals of the St Victor Cathedral, near Mainz, of which, according to its *liber fraternitatis*, Gutenberg had been a lay member.

Thus the Helmasperger document, the two Indulgences of 1454 and the 42-line Bible tell us, that in the period from August 1450 to 1456 the art of printing had commenced and been perfected at Mainz; but not a word is heard as to how it arose, or what its nature was. In the period from 1456 (if we place Schoeffer's 35-line *Donatus* in this year) to 1468 various books were printed at Mainz with colophons in which the art of printing is proclaimed as a by-invention of printing; more especially as a *new* art; its mechanism is fully described and said to be quite different from the mode of producing books by means of the pen; but, no one says that it was *invented* at Mainz, or mentions the name of a Mainz *inventor*.

In the period from 1468 to 1505, however, we have (1) several vague statements made in Italy and France as to the art of printing being known or practised or invented in Germany, statements which arose from the books and colophons published at Mainz; (2) one item of rumour in 1472 that Gutenberg invented it *near* that town; (3) two Mainz statements, of 1476 and 1492, and one Cologne statement, of 1478, that it was invented at Mainz; (4) three German statements, of 1492, 1494 and 1499, that Gutenberg had invented it; and (5) two Mainz statements, of 1504 and 1505, to the same effect. But it is to be particularly noticed that the statements (2, 4, 5), which speak distinctly of Gutenberg being the inventor, can be clearly traced to the St Victor Cathedral, that is, to Gutenberg himself and one of his relatives.

Contradiction of Gutenberg's Claims. Seeing then how slender the basis is for the assertion that printing was invented by Gutenberg at Mainz, that even this slender basis was not laid till fourteen years after the art had been fully established and proclaimed in that city, and that it may be traced to Gutenberg himself, we cannot be surprised to find it promptly contradicted, not in Holland, but in Germany itself.

This contradiction was made in 1499 (testimony xxiv.) in a *Chronicle* published at Cologne. To facilitate the understanding of this testimony it is divided above into eight sections. The first (taken from Hartmann Schedel's *Chronicle*, 1493), second, sixth, seventh and eighth are no doubt due to the compiler of the *Chronicle*, and must not be connected with the third, fourth and fifth, which, according to the compiler, are due to Ulrich Zell, a printer at Cologne, who had probably settled there about 1463, and had most likely learnt his art at Mainz, as he called himself "clericus moguntinus." As Zell's testimony leaves to Gutenberg nothing but the honour of having *perfected* the art, various attempts have been made to explain away this account. As long as no typographically printed *Donatus* had been found that could be fitted into Zell's account it was argued that he meant a *Donatus* printed from wooden blocks; and this argument is brought forward even at the present time. But a practical printer like Zell must have been able to express himself to that effect if he had really meant to say so; and, as block-printing was not less practised in Germany than in Holland, we could hardly assume that blockbooks printed in Holland would have inspired the German inventor rather than the same books printed in Germany. That testimony xxxviii. speaks of a *Donatus* printed from wooden blocks may be ascribed to the notion arising at that time (*c.* 1533) that block-printing had given rise to typography. It has also been remarked that unless we take Zell to refer to a *Donatus* xylographically printed in Holland, the passage in the *Chronicle* would be contradictory, as it says in its first and sixth section that the art of printing was found first of all at Mainz about 1440, by a Mainz citizen, Junker Johan Gudenburch, and then in its fourth that the art had already been found before that time in another place. But if the fourth section is read in accordance with its punctuation in the *Chronicle* itself, it says clearly that the art was found at Mainz, *as aforesaid* in the manner in which it is generally employed *now*, that is, more masterly, more artistic than in the *Donatuses* printed in Holland. It has further been asserted that Holland in the *Chronicle* means Flanders; but the *Chronicle* is usually correct in geographical matters, and is therefore not likely to have gone astray in this particular case. It has also been suggested that Zell most likely learnt his art in Fust and Schoeffer's office and invented the passage to injure the reputation of Gutenberg, who had been their enemy. Finally it has been said that Zell did not suggest or write the passage at all; but it is hard to see how this can be maintained in face of the compiler's own statement to that effect.

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[1] Venit (comes), the present not the perfect tense (has come).

Lourens Coster's Claims.

As, therefore, all these suggestions do not weaken or invalidate Zell's testimony, we must see how far it harmonizes with other circumstances and the testimonies xxxiv., xli. to xlix., which claim the honour of the invention for Haarlem in Holland

Testimony xxxiv. (the Pedigree) is sufficiently clear as to the invention of printing at Haarlem, the supposed date and the name of its inventor. Testimonies xli. and xlii., though coming from Haarlem, do not mention the name of the inventor. But xli. is a mere introduction destined for a complete book that seems to have been lost during the siege of Haarlem in 1573 before it was printed; we are, therefore, not justified in saying that Van Zuren did not know the name; xlii. may have omitted the name, because the publication of Van Zuren's work was in contemplation at the time that it was written. That Guicciardini (testimony xliii.) in 1566 did not mention the name of the reputed Haarlem inventor cannot be considered as an indication that it was not known or had not yet been "invented" when he wrote, as his accounts of the cities of the northern Netherlands are all rather meagre and for the most part derived from correspondence. He and other authors coming after him (testimonies xiv.–xlvii.) state that the Haarlem inventor had died before the art was perfected, and that thereupon his servant had brought it to perfection at Mainz. We do not find any such statement in Junius. The latter's account (xliv.), however, gives various particulars as regards the inventor and his invention. He begins by referring to the difficulty of vindicating the honour of the invention for Haarlem on account of the deep-rooted and general opinion that it took place at Mainz. He then mentions that Lourens (son of Jan) surnamed Coster resided at Haarlem "more than 128 years ago," and gives us to understand that in the year indicated by that phrase he invented the art of printing. Junius's book was not published till after his death, in 1588, but its two prefaces are dated 1575 (he died June 16, 1575), hence the number 128 is supposed to go back from the date when he actually wrote his account, which he is calculated to have done about 1568. Thus we get the year 1440 as the supposed date of the Haarlem invention, though, if we based our calculation upon the date of the preface, the year 1446 or 1447 would have to be assumed. But, as Junius adds that Coster's types were stolen by one of his servants, who fled with them to Mainz, and, establishing there a printing-office, printed within a year's time, in 1442, two books, he must, if this latter date is correct, have meant 1440. By testimonies xlix. and l. we see that in the 17th century the date of the Haarlem invention was first put back as far as 1428, then to 1420; and since then it has usually been regarded as 1420–1423, especially after it was discovered that the Haarlem wood where Coster is said to have cut his wooden letters was destroyed during a siege in 1426.

The researches regarding the reputed Haarlem inventor have hitherto been made in an inadequately scientific manner, and it appears that, after Scriverius (1628) had pushed back, in spite of Junius, the date of the invention to 1420–1428, he and later Dutch authors on the subject mixed up two Haarlem citizens (*a*) Lourens Janszoon, who never bore the surname Coster: he is proved to have been sheriff, wine merchant and innkeeper from 1404 to 1439, and to have died in the latter year; (*b*) Lourens Janszoon Coster, authenticated by official documents as a chandler and innkeeper from 1436 to 1483, leaving Haarlem in the latter year. The name of this person and some genealogical particulars known of him seemed to agree with Junius's account and the Coster pedigree.

But recent investigations at Haarlem and elsewhere tend to show that there have been two, if not three, persons of this name living at Haarlem about the same time. Though this superabundance of namesakes shows that van der Linde and those who accepted his conclusions were rather hasty in declaring L. J. Coster to be a myth, it is somewhat perplexing to the historian, and it would seem that the Dutch people prefer to make speculations and guesses on this point, rather than search in some systematic way the original documents and registers from which they draw haphazard extracts. The result of the latest inquiries (so far as they may be called inquiries) is that L. J. Coster, who would agree with Junius's account and the Haarlem Coster pedigree, was a member of a Christmas-gild in 1436, is mentioned in the Haarlem registers as a dealer in candles and oil till 1454, and seems to have died before 1460 (see Fruin, *De huidige stand van het Costervraagstuk*, 1906; Enschedé, *Laurens Jansz. Coster*, 1904); so that his business as printer was probably continued by one of his relatives, and finally broken up about 1481, when the *Speculum* cuts are in the hands of Veldener.

Junius's account of the Haarlem invention is based on three books: (1) a Dutch edition of the *Speculum humanae salvationis*; (2) the *Doctrinale* of Alexander Gallus; and (3) the *Tracts* of Petrus Hispanus (Pope John XXI.). The first work, he said, was printed by Coster as a first specimen of his art, and it would seem from his words that the tradition believed it to be printed with wooden types; the second and third books, he declares, were printed at Mainz with Coster's types, stolen from him by his workman. Of the Hispanus *Tracts* no edition answering to Junius's description has as yet come to light. Of the *Doctrinale* and the *Speculum* we possess editions which fit into his account, though, of course, it will be impossible to say whether any of the *Doctrinale* editions were printed at Haarlem or at Mainz. Various editions of the Latin grammar of Aelius Donatus, printed in the same types, link Junius's independent testimony regarding Haarlem and Coster on to that of Ulrich Zell, who declares in the *Cologne Chronicle* of 1499 that editions of this school book printed in Holland were the models (prefiguration) for the printing at Mainz, which commenced about 1450.

Costeriana.

As the evidence for Haarlem's claims has been obscured by various adverse and not always intelligent criticisms, and no less by imperfect and incorrect descriptions of the books on which they rest, we describe here, from autopsy, the types and books that have always been and still may be, on solid grounds, attributed to Coster, and which, for this reason, we continue to call Costeriana.

The Costeriana. Xylographic Printing.

Of the *Speculum humanae salvationis*, a folio Latin blockbook (that is, an edition printed entirely from wooden blocks) must have been printed several years before 1471, consisting, like the later type-printed Latin editions, of at least 32 sheets=64 leaves, all printed on one side of the leaf only, alternately on the versos or rectos (therefore 64 printed pages). The sheets were, no doubt, arranged in the same number of quires (a^3 for the preface; bcd^7, e^8=29 sheets for the text) as in the later editions; the first leaf was perhaps blank, the preface occupied the leaves 2 to 6, and 58 leaves remained for the 29 chapters of text, each occupying two opposite pages of two columns each. We may further assume that the upper part of each printed page of the text was occupied by one of the woodcuts, which we know from the later editions, and which are divided each into two compartments or scenes by a pillar, with a line or legend below each compartment explaining, in Latin, the subject of the engraving; and that underneath the woodcut was the text, in two columns, corresponding to the two divisions of the engraving above.

This blockbook has already been alluded to above among the Netherlandish blockbooks, but we give here further details, as various circumstances make it clear that it was the work of the same (Haarlem) printer who issued the other editions of the *Speculum*, together with the several incunabula described below, and to whom a Haarlem tradition ascribes the invention of printing.

All the *Speculum* editions which concern us contain, so far as we know, 29 chapters. But previous to the above blockbook another one of more than 29 chapters (may be 45, like most of the MSS.) must have existed, as may be inferred from Johan Veldener's 4to edition of a Dutch version of the *Speculum*, published in 1483, in which all the 58 blocks of the old folio editions reappear cut up into 116 halves to suit this smaller edition, besides twelve additional woodcuts for three additional chapters (the 25th, 28th and 29th) not found in any of the old folio editions. As these additional woodcuts appear to be also cut-up halves of six larger blocks, they point to the existence, at some earlier period, of a folio edition (xylochirographic or xylographic?) of at least 32 chapters, at present unknown to us.

Of the blockbook as is here assumed we know now only 10 sheets or 20 leaves, which, in combination with 22 sheets or 44 typographically printed leaves, make up an edition, called, on account of this mixture of xylography and typography, the *mixed* Latin edition. These twenty xylographic leaves are (counting the 6 leaves of the type-printed preface) 7+20, 8+19, 10+17, 11+16, 12+15, 13+14 (in quire *b*); 22+33, 23+32, 27+28 (in quire *c*); 52+61 (in quire *e*).

Copies of this *mixed* Latin edition still existing: (1) Bodleian Library, Oxford (Douce collection, 205), perfect; (2 and 3) Paris National Library, 2 copies, one perfect, the other wanting the first (blank) leaf; (4) John Rylands Library at Manchester (Spencer collection), wanting the first (blank) leaf; (5) Colonel Geo. Lindsay Holford, London, wanting the first (blank) leaf; (6) British Museum (Grenville collection), wanting the leaves 1 (blank) and 21 (this being supplied in facsimile); (7) Royal Public Library at Hanover, wanting the leaves 19 (xylogr.) and 24 (typ.), but having duplicates of the (xylogr.) leaves 15 and 28; (8) Museum Meerman-Westreenen, the Hague, wanting the leaves 1 to 36, and portions of the text of leaves 37 and 38; (9) Berlin Royal Library, wanting the leaves 1 (blank), 58, 59, 62, 63, 64, while in place of the (xylogr.) leaves 52 and 61 it has the same (type-printed) leaves of the second Latin edition; several of the other leaves are bound in a wrong order; (10) Pembroke library at Wilton House, wanting the leaves 1 to 7 and 64, while the leaves 9 + 18 have been supplied from the second (type-printed) Latin edition; (11) Copy, represented now by the leaves 15 + 28, which appear as duplicates in the Hanover copy (above, No. 7); (12) Ottley (*Invention of Printing*, p. 287) mentions another copy as having belonged to Mr Singer, which wanted three or four leaves, but has since been taken to pieces and dispersed. See further Holtrop, *Cat. bibl. reg. Hag.* 560; idem, *Mon. typ.* p. 22 and facs. pls. 20, 21; Bernard, *Orig.* i. 13 sqq.; Sotheby i. pl. xxxii.; Campbell, *Ann.* No. 1570 (who wrongly states that the two copies in the Paris National Library belong to the *unmixed* Latin edition).

Efforts have from time to time been made to account for the unusual mixture of xylography and typography in this one book, and to assign a date to it and the other editions, with the further view of ascertaining the date of their printer, as for him the honour of the invention of printing is claimed.

Bernard.

Bernard (1853) was uncertain as to the chronological order to be assigned to the various editions, but, without stating his reasons, concluded that at least six or seven must have been issued, and that the *xylographic* leaves of the *mixed Latin* (his edition A), are the remains of a *first* complete, entirely *xylographic* edition.

Ottley.

As there is a close resemblance between the letters of the xylographic and typographic texts, and both texts agree, with a few exceptions, word for word with the corresponding texts of the other Latin edition (which, being wholly typographical, is called the *unmixed Latin*), Ottley in 1816 concluded that the xylographic pages were facsimiles from those of the typographically printed *unmixed* Latin edition, which the publisher caused to be made after having lost, through some accident in his office, not only those sheets already typographically printed, but also his types. In support of this theory he pointed to some defects or breakages in the pillars, dresses, &c., of the woodcuts of the xylographic pages which he did not find in the same woodcuts in the *unmixed* Latin edition; so that he thought the latter must be the first edition. Secondly, as the scrolls in the last vignette (Daniel interpreting the handwriting on the wall) are black in the Inglis copy of the *unmixed* Latin edition, but white in all the copies of the *mixed* Latin and the other editions, he concluded that the former must have been printed before the woodcutter had cut away the piece of wood which produced the black scroll, which was to him an additional proof that the *unmixed* Latin edition was the first. These theories were adopted by Sotheby in 1858 and again by Schreiber in two treatises on xylography (in *Centralbl.*, 1895, p. 20 sqq.; in the Gutenberg-Festschrift, *Centralbl.*, 1900, p. 46 sqq.; and in his *Manuel de la gravure sur bois*, 1902, iv. 114 sqq., vii. pls. 48, 49, viii. pls. 79, 80). The latter author is of opinion that xylography was not employed for the multiplication of books till about 1468–1470, and that about that time printing with movable metal types was almost unknown in the Netherlands. Hence he thinks that the woodcut illustrations in the various editions of the *Speculum* were printed somewhere in the Netherlands, and the sheets afterwards sent to Germany, most likely to Cologne, for the purpose of having the texts added by typography. These proceedings, he fancies, were successful twice, once with what he calls the first (*unmixed*) Latin, secondly with the first Dutch edition, but on the third return journey a part of the material of the second (*mixed*) Latin edition, that is the ten sheets in question, all packed in one parcel, were lost, and the publisher, in a hurry to sell his copies, had these sheets replaced by xylography.

As a careful examination of the *mixed* Latin and other editions clearly shows their real condition and the order of their issue, we do not discuss Schreiber's improbable theories. As to those of Ottley and Sotheby, some of the lines which they regarded as broken in the copy or copies of the *mixed* Latin edition which they examined, are intact in other copies of the same edition, so that no reliance can be placed on these defects and breakages, which are clearly due to printing from wooden blocks, a process which admittedly causes more defects in the impressions than printing from types. Of the black and white scrolls we speak below.

It is to be noticed first of all that the legends underneath the woodcuts are in Latin, so that they were no doubt engraved for a *Latin edition*. But, unless we take the twenty xylographic leaves as remains of a complete xylographic edition issued (at Haarlem) before the invention of printing, there would be no Latin edition to connect the woodcuts with in the first instance, as the primitive types and workmanship of one, if not two, of the Dutch editions described below show that these must have been printed before the 44 type-printed leaves of the *mixed* Latin edition, and also before the wholly type-printed *unmixed* Latin edition, the types of which are new and far better cast.

Incidentally, this fact that the types of the *mixed* Latin edition are *later* than those of the Dutch editions disposes also of another theory favoured by some authors, viz. that during the progress of the xylographic edition its printer invented the movable type, and thereupon stopped his xylographic work to complete the book by means of type, so that in this *mixed* Latin edition we were to see the transition from xylography to typography.

The priority of the xylographic over the typographic leaves is proved by the Pembroke (No. 10) and Berlin (No. 9) copies. In the former the third sheet of quire *b* (= the leaves 9 + 18 with the figures 5, 6 and 23, 24), the only type-printed sheet in this quire in the other copies (1 to 7 and 9), is not the same as in the other copies, but belongs to the *unmixed* or second Latin edition.[1]

A somewhat similar but still more important manipulation we observe in the Berlin copy, in which the *fourth* sheet of quire *e* (= the leaves 52 and 61), the only xylographic sheet in this quire in the other copies, is replaced by the corresponding type-printed sheet of the *unmixed* or second Latin edition.

All this makes it clear that the printer of the *Speculum*, some time after having become a type-printer instead of a block-printer, replaced gradually (or by one operation), forty-four xylographically printed leaves of his first edition by type-printed leaves, for the purpose of issuing the Latin edition, now known as the *mixed* Latin edition; then, at a later stage, prepared a new Latin edition, wholly printed in movable type (now known as the *unmixed* Latin edition), and afterwards used sheets of this latest edition, not only to replace more of his old xylographic sheets (as in the Berlin copy), but even (as in the Pembroke copy) some of the forty-four sheets which he had printed (evidently for no more copies than he calculated to have left of the old xylographic stock), in the first instance, for issuing the *mixed* Latin edition. We shall see below that he proceeded in a somewhat similar way in completing copies of his Dutch editions.

Hence the sequence of the Latin editions was thus: (1) The *xylographic* edition of 64 (?) or more leaves in 29 (?) or more chapters, of which we have only 20 leaves remaining, which was issued before the invention of printing with movable types, and was probably preceded in its turn by a *xylographic* or *xylo-chirographic* edition of at least 32 or more chapters; (2) another issue of 20 leaves of the preceding edition, in combination with 44 typographic leaves (the *mixed* Latin edition) printed for the purpose of replacing the corresponding xylographic leaves of the preceding edition, considered unfit for further publication, or discarded for other reasons; (3) the wholly typographically printed edition known as the *unmixed* Latin edition.

This clear sequence of the Latin makes it easy to explain that of the other editions of the *Speculum*.

Typographic Printing.

(*Speculum* type 1).—First edition of a Dutch translation of the *Speculum*, with the title *Spieghel der menschliker behoudenisse*, hitherto called the *first*, or the *unmixed*, Dutch edition, or the Dutch edition in one fount of type. *First issue* entirely printed in type 1.

Judging by this and the third, the editions of the Dutch version of the *Speculum* must have had the same number of sheets, arranged (woodcuts and text) in the same way, as the *mixed* and *unmixed* Latin editions, with the exception of the preface, which required only 2 sheets (= 4 leaves). Hence complete copies consist of the quires a^2 (prefatory matter), bcd^7, e^8 = 31 sheets or 62 leaves.

Holtrop, who gives a facsimile of one of its pages (*Mon.* pl. 22), regarded this edition as the last of all the *Speculum* editions, because he thought the type to be identical with that employed for the other editions, only here more used up. Bernard, however, saw that it was a different fount, and there can be no doubt that it is; it differs in form and size from *Speculum* type 2 as well as from type 3, though it has all the characteristics and the family likeness of the two. Most of the letters might even be regarded as identical with those of type 3, if they were not slightly smaller. That it looks old and battered seems to be owing to bad ink having been used for the printing; it was, however, badly engraved and badly cast, for not one line in the book runs straight. For this reason alone this edition is to be placed before the next two, which are printed with a better type, especially the third. There are, however, more reasons for doing this. First of all, leaf 46 (with the figures 83: *Semey*, and 84: *Rex amon*) of Lord Pembroke's copy belongs to the 3rd edition (in *Speculum* type 3), so that the present edition, to which the Pembroke copy belongs, must have existed earlier. It appears from Holtrop's facsimile (*Mon.* pl. 22) that leaf 46 was duly printed in type 1 like the other leaves of this edition. But the leaf 46, from which he took his facsimile, is an isolated one which found its way into the Meerman Museum at the Hague, but is wanting in the copy of the Communal Library at Lille. Hence this particular leaf is, perhaps, a cancel meant to be replaced (in the Lille copy) by another one of the 3rd edition, as in the Pembroke copy. The corresponding leaf of this sheet (33, with the figures 57: *Cristus fleuit*, and 58: Jeremias) is wanting in the Pembroke copy, so that we can obtain no further information. Another reason for placing this edition before the 3rd is found in the Haarlem copy (No. 5), the leaves 24 + 27, 25 + 26 of which also belong to the (3rd) edition, and were apparently meant to replace in that copy the corresponding leaves of this edition, which may have been lost, or the stock of which had become exhausted. Similar manipulations we have noticed above, type-printed leaves having been used to replace earlier xylographic leaves, and again below in the 3rd edition leaves of another edition are found.

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[1] The Pembroke copy has this additional peculiarity that these leaves 9 + 18 consist each of two separate slips, one having the engraving, the other the text, the latter being pasted on to the bottom part of the former slip.

Hence we must distinguish between at least three issues of this edition; the *first*, with the whole text printed in *Speculum* type 1; the *second*, with sheet 46 of the 3rd Dutch edition, the *third*, with the leaves 24 to 27 of the 3rd Dutch edition. Copies of the first issue: (1) Communal Library at Lille, wanting the leaves 33 and 46 (which latter are probably now in the Meerman Museum at the Hague), and showing several peculiarities;[1] (2) Haarlem Town Library (No. 4), wanting the leaves 2 and 3, besides the woodcuts (figures 7, 8 and 21, 22) belonging to the leaves 8 and 15. The sheets of this copy have all been cut up into halves, mounted on other larger sheets, and so bound in one volume, together with a copy of the *Liber Alexandri Magni*, printed at Utrecht by Ketelaer and De Leempt, and of Pet. Scriverius' *Laurecrans*, both mounted in the same way. There is no rubrication. *Second* issue: (3) Lord Pembroke's copy, which was completed by leaf 46 of the 3rd Dutch edition. Besides wanting the original leaf 46 in type 2, this copy also wants the leaves 32, 33, 54 and 55. It shows, moreover, these peculiarities, that on the recto of leaf 7 and the verso of the corresponding leaf 16 (therefore, on the verso of the third sheet of quire *b*) are illegible sets-off of the texts of two other pages, or, perhaps, they are faulty impressions of the leaves 8 and 15, which, in the Haarlem copies, seem to be reprints. *Third* issue: (4) Haarlem Town Library (No. 5), wanting the leaves 20 + 31, 21 + 30, 22 + 29, 23 + 28, while its leaves 24 + 27, 25 + 26 belong to the *third* (formerly called *second*) Dutch edition (in *Speculum* type 3). It has, moreover, this peculiarity that the fourth sheet of quire *b* (=the leaves 8 + 15, with the figures 7, 8 and 21, 22), consists of two separate slips of paper, one containing the impression of the engravings, the other that of the text, the latter slip being pasted on the former, while underneath the figures 7 and 8 are still visible the blind impressions of the two top lines (on the corresponding leaf even 3 lines) of the old discarded letterpress. Seeing that the other copy at Haarlem has the text of these leaves, but not their engravings, it would seem that the letterpress had failed, that is, it had been impressed on the paper without its having been inked.

It is clear from all these manipulations in the copies of this edition, that its printer was inexperienced; moreover, considering its defective type, &c., it is necessary to give it precedence to all the other types and to place this edition immediately after the xylographic edition.

(*Speculum* type 2).—Second (?) edition of the Dutch version of the *Speculum*, at present only known from one sheet (the 26th) = the two leaves 49 (with the figures 89: *Xpūs crucifixus* and 90: *Inventores artis*) and 60 (with the figures 111: *Exitus ione* and 112: *Lapis reprobatus*), that is, the third sheet of quire *e*, found in all the existing copies of the Dutch edition (in the *Speculum* type 3), called the *mixed Dutch* edition, on account of its having these two leaves, printed in a different type, bound up with the others.

The type (on which see Holtrop, *Mon.* pl. 19, and Ottley, *Inquiry*, i. 249) used for these two leaves is slightly smaller than the *Speculum* type 3, and differs from it and from *Speculum* type 1 in several respects, though there is a great family likeness between all three. We place it before type 3 because the letters ba, be, ha, he, hē, ho, pè, pē, ve, &c., are cast in pairs on one body of type, which combinations appear no longer in type 3. Moreover it looks so primitive, uneven and used up that its proper place would almost seem to be before *Speculum* type 1, although the latter's uneven, wobbling condition suggests its priority. Further, its look and "ductus litterarum" bear such a singular likeness to the *Valla* type (mentioned below) that it seems reasonable to place it as near to that type as possible. Under ordinary circumstances these two leaves might be regarded as *later impressions* for completing the edition in which they occur. Ottley and others regarded them as replacing earlier leaves which, by some accident in the printing-office, had got lost or spoiled. But why should a printer use an old, quaint-looking type for printing and reprinting, with differences, one sheet for a book which he had printed entirely with a new and better type employed for many other works? We rather assume that the leaves are the remains of a complete (the second Dutch?) edition in *Speculum* type 2 and were used on this occasion as substitutes for the two corresponding leaves of the third edition, which had become defective or momentarily unavailable.

Differences in the text of the second column of leaf 60 between Meerman's copy and the Spencer Rylands and (Enschedé) Crawford copies (see Meerman, *Origg. typ.* i. 121, note cl., and facs. on pl. vi. 3rd div.; also Holtrop *Mon.* pl. 19, sec. col.) point to another edition printed in this same type. We therefore distinguish between one edition represented by the Meerman-Westreenen copy, and another represented by the two other copies, without being able to say which of the two is the earlier.

No other trace of this type has hitherto been found, but as it looks old and used up, it seems reasonable to suggest that it must have been employed not only for printing one or more editions of the *Speculum*, but for other books not yet known to us. It bears a singular likeness to the *Valla* type mentioned below, and some of the capitals seem almost identical.

(*Speculum* type 3). (1) The (*second*, or *third*, but) *first type-printed Latin* edition of the *Speculum*, or rather of 22 of its sheets (=44 leaves), printed on one side only, in a type which is newer, and therefore later than the above types 1 and 2, and, for that reason, here called *Speculum* type 3. It has hitherto been called *the Speculum* type, as it was thought that all the editions of the *Speculum* were printed in one and the same type; type 1 being considered identical with 3, while of type 2, regarded as a stray one, no account was taken. The 22 type-printed sheets of this edition are only found in combination with the 10 sheets (20 leaves) printed entirely (figures and text) from wooden blocks, described above; and the edition so made up is, on account of this mixture of xylography and typography, called the *mixed* Latin edition. The type-printed leaves are 1 (blank) + 6, 2 + 5, 3 + 4 (quire *a*, preface); 9 + 18 (of quire *b*); 21 + 34, 24 + 31, 25 + 30, 26 + 29 (of quire *c*); the whole quire *d* (leaves 35 + 48, 36 + 47, 37 + 46, 38 + 45, 39 + 44, 40 + 43, 41 + 42); and the leaves 49 + 64, 50 + 63, 51 + 62, 53 + 60, 54 + 59, 55 + 58, 56 + 57 of quire *e*. The copies of this edition, still in existence, with all the particulars related to them, have been enumerated above.

(2) The *third* (hitherto called the *second*) *Dutch* edition; also called the *mixed Dutch* edition, or the *Dutch edition in two types*, two of its leaves (49 and 60) being printed in a different type (see above, *Speculum* type 2). This edition is arranged in the same way as the first and second, and consists therefore of 62 leaves. Copies: 1. John Rylands Library, Manchester (Spencer collection), perfect; (2) Lord Crawford's library, perfect; (3), Museum Meerman, the Hague, perfect; (4) Geneva Public Library.

(3) The (*third*, or *fourth*, but) *second type-printed Latin* edition, usually called the *unmixed* Latin edition, it being printed throughout in one type (3). It contains 64 leaves, printed on one side and arranged in the same number of quires as the *mixed* Latin edition. But under figure 100 (column 100) it has a line (5th) which is wanting in the first (*mixed*) Latin edition, and the final word of line 4 is correctly printed *corporali*, not *spirituali* as in the *mixed* Latin. Moreover, line 10 in col. 104 has the final word *egipti*, which is wanting in the mixed Latin, and line 6 in col. 62 has the correct final word *terrestris* instead of *celestis* as in the mixed Latin. (See also Holtrop, BRH. 561; Sotheby, i. 145; Bernard, i. 17; Facs. in Holtrop, *Mon.* pls. 17, 19; Sotheby, i. pls. xxix. and xxx.). Copies: (1) The Hague, Museum Meerman-Westreenen, wanting the first six leaves of the preface. A separate impression of the engraving (*Semey maledicit + Rex amon*) of leaf 48 is pasted on the lower part of the same cut, which had been printed with the text in the first instance, but defectively (Holtrop, *Mon.* p. 20, and pl. 17); (2) Florence, Royal National Library, formerly in the Pitti Palace, wanting the first (blank) leaf and having also a separate impression of the engraving of leaf 48, but here the text seems to have failed and is pasted on the engraving; (3) Stuttgart, Landesbibliothek, wanting the first (blank) leaf; (4) Munich, Hofbibliothek (pressmark Xyl. 4to No. 37) wanting the first (blank) leaf; (5) Vienna, Hofbibliothek (pressmark Inc. 2 D 19) wanting the first (blank) leaf; (6) [John B. Inglis, bought by Mr Quaritch, and now in] the Lennox library; (7) Haarlem, Town Library (No. 8), wanting the preface (leaves 1 to 6); (8) Brussels, Royal Library, wanting, besides the first (blank) leaf, the second and third sheet of quire *b* (leaves 8 + 19, 9 + 18), and the second half of the fourth sheet (leaf 31) of quire *c*; (9) Hanover, Royal Library, wanting 18 leaves, that is, the first four, and the whole quire *d* (leaves 34 to 48); (10) Munich, University Library (pressmark Xyl. 10), wanting the four leaves 1 (blank), 54, 55 and 59. In this copy Schreiber (*Centralbl.* 1895, p. 208) discovered the date 1471, in old arabic numerals in rubrics, underneath the blind impression of some line after the last line of the Prohemium. The date is repeated by a hand of the 18th century, in modern arabic numerals, underneath the old date, by way of

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[1] The fourth sheet of quire *b* (leaves 8 and 15) consists of two separate slips of paper, one containing the engravings, the other the text, the latter being pasted on the former. The fifth sheet of quire *c* (=leaves 23 and 28) is in the same condition. But these slips are not, like the former, pasted one on the other, but the pieces of leaf 23 are pasted on a small, apparently old, slip of paper, another newer piece of paper having been pasted on to the outer margin to strengthen the old piece. The slips of leaf 28 are pasted together by a slip of modern paper on the back, from which it would appear that they had been left loose when the volume was issued. Further the 7th or centre sheet of this same quire *c* (leaves 25 and 26) is bound wrongly in the place of the first sheet of quire *d* (leaves 33 and 46), which is wanting in this copy, so that leaf 25 follows after leaf 32, taking the place of the missing leaf 33, while leaf 26 follows after leaf 45, taking the place of the missing leaf 46 (now at the Hague). But on leaf 25^a, which should be blank, is an impression of the text belonging to leaf 62^a, but not of the figures (115, 116), while on leaf 26, which should also be blank, is now the text belonging to leaf 47, but without its figures (85 and 86). Hence the text of these pages (62^a and 47^b) occurs twice in this copy, first on the leaves 25^a and 26^b, and secondly in their proper place. These peculiarities seem to show that the letterpress was printed first, and that in this case a mistake was made in the first instance, but discovered when the figures were printed.

explanation; (11) Library of the Royal Gymnasium at Freiberg in Sachsen. where the 14 leaves of quire *c* are said to be preserved, but which in June 1908 could not be found

In the Florence, Munich (University Library), Vienna and (Inglis) Lennox copies, all four belonging to this (*unmixed*) Latin edition, the three scrolls on the last vignette of the book (over col. 116), representing Daniel before Belshazzar, and the "handwriting on the wall," appear *black* (see Sotheby, *Principia typogr.* i. pl. xxx., xxxvii., xxxviii.), but blank in all other copies of this and the other editions. From this fact some authors have concluded that the *unmixed* Latin edition, here called the *last*, was, in reality, the *first*, as the black scrolls show that the pieces of wood which caused these black impressions had not yet been cut away when the copies were printed off. But as its type and other circumstances connected with this *unmixed* Latin edition make it impossible to regard it as the first, we have to look for another explanation of these black scrolls. First of all, scrolls, especially scrolls proceeding from the mouth of some individual, were already common in the pictures or illustrations of the manuscript- and block-printing periods, just as they are now. They were then, as they are now, intended in all cases to convey to the reader some memorable saying, quotation, inscription or motto. As black scrolls, therefore, could have had no object, we should have to assume that the practised engraver of the *Speculum* had prepared this last engraving carelessly and only saw his mistake after some copies had been printed off, which yet he allowed to pass into circulation. In some copies the Bible words *Mane thecel phares* have been written in the blank scrolls, as was to be expected; other copies vary this by adding the Latin interpretations, *numerus, appensio, divisio*. But in one of the Haarlem copies the scrolls have been coloured yellow with a brush, and it would seem that to some such operation the black scrolls are due; the colour in none of the impressions looks exactly like that of the vignette. It is, however, more than probable that, for some purpose or another, some of these scrolls were intended to be black, and that, while they were printed, something was placed in the block in the hollow of the scrolls to produce a black impression.

Sotheby, in his *Principia typogr.* p. 178 sqq., calls attention to an imitation of this *Speculum* vignette by Jacobus de Breda, who began printing at Deventer about 1483. This imitation (having one scroll which proceeds from the mouth of a figure supposed to represent Jacobus himself) he used for the first (?) time in Matthaei Bossi *Sermo*, *c.* 1491, the *scroll* being blank. But when he uses the engraving for the second (?) time, in *P. Ovidi Naso. metamor. Liber Secundus*, *c.* 1493 (copy in the Cambridge University Library), his name, "Jacob' de Breda" appears in the scroll (upside down when reading from right to left). A *third* time the vignette appears in his edition of *Pub. Ov. Nas. Metamorphoseos lib. tertius* (copy in the Cambridge Library) with his name in the ordinary way. A *fourth* time it is on the title-page of *Seneca de quattuor virtutibus*, *c.* 1495 (also in the Cambridge Library), with the name "Seneca" in the scroll. Sotheby shows that it occurs a fifth time on the title-page of a *Donatus* published by J. de Breda, again with his name in the scroll. A sixth time (says Sotheby) the engraving occurs on the title-page of a tract *Dominus que Pars*, again with his name in the scroll. And finally (says Sotheby) it is on the title-page of *Secunda Pars Doctrinalis Alexandri*, with the date 1511 and the name "Joãnes Bergis" in the scroll. Seeing then the use made of this imitation till 1511, Sotheby, not unreasonably, suggests that the original scroll in the *Speculum* was from the beginning meant to contain the name of the printer (the inventor of printing). See also Dibdin, *Bibliographical Decameron*, ii. 285–296. One thing seems certain, the scrolls in the *Speculum* were not intended to be black in all cases, but to contain something or other, and not always the words *Mene, &c.*, as in that case it would have been as easy for the engraver to cut them on the block as any other words or figures, pillars, &c. The printer probably wished to leave the choice to his purchasers. Incidentally the use made by Jacobus de Breda of his scroll points to his having been aware of the use for which the original scroll, which he imitated, was intended; and as the printer of the *Speculum* was undoubtedly the first printer of Holland, it is not improbable that Jacobus learnt his craft from him.

The above descriptions and explanations, based on bibliographical and typographical *facts*, deal exclusively with the editions and issues of editions of the *Speculum* now known to us. They by themselves make it clear (1) that their printer began as a *xylographer* and *block-printer*; (2) that the *six* editions which he published of this one work cannot be placed later than 1471, as this date is written in a copy of the latest of them; (3) that, for the printing of his *five* type-printed editions (Dutch and Latin), he manufactured no less than *three* different types.

When round these editions and types we now group the various other incunabula which must be ascribed to him, as being printed with the same types or others related to them by a striking family likeness and other circumstances, we obtain the following sequence for this printer's work.

A.—*The Xylographic Period.*

1. One or two folio editions of the *Speculum* in Latin, printed (pictures and text) from wooden blocks, and consisting most likely of 32 if not more chapters, but of which only ten sheets (twenty leaves), and six separate woodcuts (cut up into twelve halves, for the Veldener 4to edition of 1483) have come down to us. Of one of these xylographic editions, at least of ten sheets of it, three issues are known to have been made in combination with type-printed leaves (see below).

2. As various circumstances compel us to regard the printer of the *Speculum* as having been a xylographer before he invented printing with movable types, it is necessary to mention here a small block of wood which is known to have been preserved for nearly 300 years at Haarlem as a remnant of Coster's printing-office. On it is engraved part of an Horarium; its first lines beginning with *Servu[m] tuum in pace Quia viderunt oculi mei Salutare*, &c., of the hymn of Simeon. About 1628 it was in the possession of Adriaen Rooman, printer to the Haarlem Corporation, who had obtained it from one of Coster's descendants, a man of great age. Rooman gave it to Dr Johan Vlasveld, of Haarlem, at whose death, in 1684, it came into the hands of his children; in 1734 it was bought by Jan Maas of Haarlem, who left it at his death to his son-in-law the Rev. Jacobus Mandt, a pastor at Gorinchem; at whose death it was bought by Jacobus Koning, the well known author on the invention of printing, and after his death it was acquired by the Haarlem Town Library where it now is (see A. de Vries, *de Uitvinding der Boekdrukkunst*, 1862, p. 35).

B.—*Printing with movable Metal Types.*

Type I., also called the *Abecedarium* type, with which were printed: (1) The *Abecedarium*, 4 leaves, 16mo, on *vellum*, now preserved at Haarlem (Town Library), where M. Joh. Enschedé discovered it in 1751, in a MS. *Breviarium* of the 15th century; (2) An edition of *Donatus*, 31 lines, 4to, two *vellum* leaves, printed on one side, discovered in 1844, in the ancient binding of a Dutch Book of Hours, printed at Delft in 1484; it is now preserved in the Hague Royal Library.

Type II. (*Speculum* type 1; see p. 525; hitherto erroneously regarded as identical with *Speculum* type 3): (1) *First Dutch* edition of the *Speculum*, of 31 paper sheets (62 leaves) printed on one side, folio, hitherto known as the first or *unmixed* Dutch edition. Two issues: (*a*), printed entirely in this type, represented by copies at Lille and Haarlem (No. 4); (*b*), having some of its leaves replaced by leaves of the *third* Dutch edition, represented by the Pembroke and Haarlem (No. 5) copies. (2)[1] An edition of *Donatus*, 28 lines, 4to; two vellum leaves in the Haarlem Town Library, found pasted in the original binding of an account book of 1474 of the cathedral of that town, in which an entry testifies that this account-book was bound by Cornelis the bookbinder, whom Junius asserts to have been the servant of Lourens Janszoon Coster (Meerman, *Orig. typ.* Tab. VI.*). (3) Another *Donatus* of 28 lines, two leaves of which are in the Haarlem Town Library, and were discovered in the original bindings of account-books of the Haarlem Cathedral Church of 1476, also bound by "Cornelis the bookbinder." Fragments of this same edition are also in the Paris National Library, and in various other public and private collections. (4) *Donatus*, 28 lines, 4to, one vellum leaf, in the Hague Royal Library (BRH. 2; Ca. 612; Holtrop, *Mon.* pl. 13), discovered in the binding of a book belonging formerly to the Sion Convent at Cologne containing several treatises printed by Ulrich Zell, one being dated 1467. (5) *Donatus*, 30 lines, 4to. Two unrubricated *vellum* leaves in the Cambridge University Library (Inc. 4. E. 1.1), discovered in the binding of a copy of J. Mile's *Repertorium*, Louvain, 1475, now also in the same library. The first leaf contains the chapters xiv. 11 to xvi. 4, the second chapter xxvi. 6 to xxix. 10. The text is abridged, having *amabamus, batis, bant*, &c., where other editions have *amabamus, amabatis, amabant*, &c. (6) *Donatus*, 30 lines, abridged edition, 4to, one unrubricated vellum leaf, cut into halves. Wrongly described by Holtrop (BRH5) and Campbell (614) as part of No. 7 (below). (7) *Donatus*, 30 lines, 4to; two rubricated vellum leaves, in the Paris National Library (Van Praet, Velins, No. 8; now 1040). (8) *Donatus*, 30 uneven lines, 4to. Two rubricated vellum leaves, in the Hague Royal Library (BRH 5; Ca. 614). (9) *Donatus*, 30 lines 4to. Two vellum leaves in the Haarlem Town Library, discovered in 1750 by M. Joh. Enschedé at Haarlem in the binding of a MS. (*Handvesten . . . van Kennemerland*, 1330 to 1477). (10) A liturgical book, containing rules for saying Mass, in 16mo (12 lines to a page [Holtrop, *Mon.* pl. 14] 2 vellum leaves, pp. 3–6), in the Brussels Royal Library. (11) Alex. Galli *Doctrinale*, on vellum, 32 lines,

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[1] The present writer is certain that *Speculum* type 1 differs from *Speculum* type 3 in size, and somewhat in form too. But he is still uncertain whether the *Donatuses* (2 to 7) here enumerated are in the same type as the first Dutch *Speculum*, though he travelled twice to the places where they are preserved to examine them. It would seem that the *Donatuses* are in a different type, more compact, regular and better cast than that used for this edition of the *Speculum*. But if there is any difference between the types it is so minute that it is well nigh impossible to detect it.

4to; one leaf and fragment of a second, in the Ghent University Library (Res. 1409). (12) Alex. Galli *Doctrinale*, on vellum, 32 lines, 4to. Two leaves (forming one sheet) in the Cologne Town Library.[1]

Type III. (*Speculum* type 2): (1) *Second Dutch* edition of the *Speculum*, which probably consisted of 31 paper sheets (62 leaves) printed on one side in folio, like the first and third. Only known from one sheet (leaves 49 and 60) which forms part of all the copies of the *mixed* or *third* Dutch edition preserved to us. (2) On account of differences in the setting up of the second column of leaf 60, another edition in this type may be supposed to have existed. There is no further trace of this type,[2] which greatly resembles type IV.

Type IV., also called the *Valla* type: (1) Laur. Vallae *Facetiae morales et Franc. Petrarcha de salibus virorum illustrium ac faceciis tractatus*, 24 paper leaves, small 4to. No other books printed in this type[2] are known to exist. But four of its capitals (B, H, L, and M) have been used in printing the edition of the *Singularia* of Ludovicus (Pontanus) de Roma, which otherwise is entirely printed in type VI.

Type V. (*Speculum* type 3, hitherto wrongly called *The Speculum* type): (1) The [*second* or *third*, but] *first type-printed Latin* edition of the *Speculum*, for which only 22 paper sheets (44 leaves) seem to have been printed to replace the same sheets of the earlier *xylographic* edition A, and to make up, in combination with the ten remaining xylographic leaves, a folio Latin edition of 64 anopisthographic leaves, called, on account of this mixture of xylography and typography, the *mixed* Latin edition. Some copies (the Berlin and Pembroke) of this mixed edition were still further mixed with sheets of the *second* type-printed Latin edition. (2) *Third Dutch* edition of the *Speculum*, hitherto known as the *mixed* Dutch edition, as having two leaves, (49 and 60) printed in a different type (*Speculum* type 2); 31 paper sheets (62 leaves) printed on one side, folio. (3) A Dutch version of the *Seven Penitential Psalms*, one *vellum* sheet (= 2 leaves), 4 pages 16mo, 11 lines to the page, printed on one side; copies in the Royal Library of Brussels (where it was discovered) and the Hague. (4) An edition of *Donatus*, of 27 lines, fragments of which are in the British Museum and the Bodleian Library. (5, 6, 7) Three editions of *Donatus*, of 30 lines, all on *vellum* (Holtrop, *Mon.* pl 14^{b}; Meerman, *Origg.* iv.). (8) A *French* translation of *Donatus*, on vellum, 29 or 30 lines to a page; four leaves, now in the Utrecht University Library, discovered by Dr Samuel Muller, the Archivist of Utrecht, in a Utrecht MS. Cartulary of the first half of the 16th century. (9, 10) Two different editions of Alexandri Galli *Doctrinale* on vellum, 32 lines to a page (Holtrop, *Mon.* pl. 15). (11) Catonis *Disticha*, imperfect copy of four vellum leaves, 8vo, 21 lines to a page (Holtrop, *Mon.* pl. 16) in the John Rylands Library (Spencer Collection). (12) The [*third* or *fourth*, but] *second* type-printed *Latin* edition of 32 sheets (64 leaves), printed entirely in this *Speculum* type (3), and therefore known as the *unmixed* Latin edition (Holtrop, *Mon.*, pl. 17). For the use of sheets of this edition to complete copies of the earlier edition, see above V.1. The Munich University Library copy has the rubricator's date 1471.

Type VI., also called the *Pontanus* type: (1) Ludov. (Pontani) de Roma *Singularia juris* (in type VI.) and Pii Secundi *Tractatus de mulieribus pravis et ejusdem Epitaphia* (in type VII.), 60 paper leaves, folio, of which the Pontanus occupies the leaves 1 (blank) to 45 recto, and the Pius, the leaves 45 verso to the end. Various differences are found in the copies of the Pontanus known to us, and we may assume two if not three issues. This type VI., therefore, is linked on to type VII. by the two being used in one and the same book, while it is inseparably connected with type IV. by the capitals B, H, L and M of this latter type being employed in printing the *Singularia*. Copies in the British Museum, Cambridge University Library, John Rylands Library (Spencer Collection), Hague Royal Library. (2, 3, 4, 5) Four different editions of *Donatus*, each of 24 lines, fragments of which are preserved in the Hague Royal Library, Haarlem Town Library, Paris National Library, Cologne Town Library, &c.

Type VII., also called the *Saliceto*, or the *Pii Secundi Tractatus* type. (1) *Pii Secundi Tractatus et Epitaphia*, mentioned above under type VI. as being printed with the *Pontanus* in one volume. (2) Guil. de Saliceto *De salute corporis*. Fragments of two *vellum* leaves of this edition, discovered in the binding of a copy of the *Formulae Noviciorum*, printed at Haarlem by Joh. Andreae, in 1486, are now in the British Museum. The fragments are printed on one side only, and their texts correspond to the leaves 3 and 5 of another edition (see below) in the same type, to which treatises of Turrecremata, Pius Secundus, &c. have been added. It is not clear why these fragments were printed on one side only; the *versos* have not been scraped as was asserted by Holtrop and Campbell, nor are they printer's waste, as they are rubricated. It is not known whether the treatises added to the other edition formed also part of this one. (3) An edition of *Donatus minor*, or *abbreviatus*, 26 lines. (4, 5, 6, 7, 8) Five different editions of *Donatus* of 27 lines. (9) An edition of the *Doctrinale*, of 26 lines. (10) A *Doctrinale* of 28 lines. (11) *Doctrinale* of 29 lines. (12) *Doctrinale* of 32 lines. (13) *Catonis disticha*, 21 lines. (14) [Incerti auctoris, vulgo Pindari Thebani] *Iliados Homericae Epitome abbreviatum* (metrice), cum praefatione Pii II. in laudem Homeri, in folio, 10 leaves (first blank), 35 lines; first edition having, on fol. 9a, as last line 35: "intēcio homeri in precedēti poemate est describere," as in the copy in the Cambridge University Library (Inc. 3 E. 1. 1). (15) Guil. de Saliceto *De salute corporis*; De Turrecremata *De salute corporis*; Pii II. *Tractatus de amore*; (Pindari) *Iliados Homericae epitome* abbreviatum, cum praefatione Pii II.; added are three additional pages, the first contains "Hectoris . . . Epitaphium"; the second "Homonee . . . Epitaph."; the third is blank. In folio, 24 leaves (first blank), divided into two quires of six sheets each; 34, 35 and 36 lines (second edition of the *Saliceto*, and of the *Yliada*; but *first* of the *Turrecremata*, and the *Tract. de amore* of Pius II.). This edition is represented by the copy in the Hague Museum Meerman, in which a MS. note records that it was bought between 1471 and 1474 (Campbell *Ann.* 1493), which still has in the *Yliada*: "in precedēti poemate est describere." (16) *Second* edition of the *Yliada*, having as last line (35) on folio 9a a more correct reading: "intēcio homeri in hoc opere est describere troianā." This edition is represented by the British Museum copy (pressm. 8814) and the three additional pages (3rd blank already found in No. 15) "Hectoris . . . Epitaphium" and "Homonee . . . Epitaph." (17) Another edition of No. 15 (that is *third* edition of the *Saliceto*, second of the *Turrecremata* and *Tract. de amore* of Pius II., *third* of the *Yliada* and *third* of the additional pages), but with the line in the *Yliada* (on 22a): "intēcio . . . troianā." This edition is represented by the British Museum copy (C. 14. b 10). (18) Another issue of the *Saliceto*; *Turrecremata*; Pii *Tract. de amore* et *epitaphia*, 26 leaves, with various additions or omissions and differences in the setting up not in the former editions. Copy in the Darmstadt Hof-Bibliothek (S 4705), which has the rubricator's date *1472* written in two places. (19) Another issue of the *Yliada* with the Pii *Tract. de amore et epitaphia*, again with additions, omissions and differences in the setting up, not in the Darmstadt copy or in the earlier editions. Represented by 17 loose leaves in the Museum Meerman at the Hague (see Holtrop, *Mon. typ.*, pp. 32, 33).

An *eighth* type, hitherto regarded as a Costerian, is type VI. in Hessels's List of Costeriana (*Haarlem not Mentz*, p. 31 seq.), where two editions of *Donatus* in this type are mentioned, one of 26 lines, four leaves of which are in the Catholic Gymnasium at Cologne (Campbell, 629), another of 27 lines, of which leaf 11 is in the Museum Meerman at the Hague, some fragments in the Haarlem Town Library and two leaves (formerly in the Weigel Collection) in the British Museum (IA 47028). Holtrop (*Mon. typ.* pl. 21) and Meerman (*Opp.* pl. II.) give a facsimile of the type. Campbell, in his *Annales* (No. 629, 631), referring to pl. 31 of Holtrop's *Mon.* for a facsimile of both these editions, says that they are printed with the types of the Pii II. Tractatus (the *Saliceto* type), but that, by the size and form of the P, this edition is distinguished from the other books in this type. Hessels (*l. c.* p. 24) repeated this; but Campbell's assertion proves to be an error, as the two types differ, in spite of a great likeness between them (the C, F, I and V being almost identical). That of the two *Donatuses* is an early Gothic, and has some of the characteristics of the Costerian types, as the *t* with perpendicular stroke to its cross-bar, the marks of contraction connected with the letters above which they appear, but only a few pairs of letters cast on one body, and no *r* with a curl; so that it seems somewhat later than those mentioned above.

A *ninth* type (facsimile in Holtrop's *Mon.* pl. 32a), hitherto regarded as a Costerian, is No. VII. in Hessels's List (*l.c.*). It resembles much that of the *Saliceto*, and has served for a *Donatus* of 27 lines, fragments of which representing two copies, were found in the binding of a Durandi *Rationale*, printed at Strassburg, 1493, belonging to the Convent of the Holy Cross, at Uden in North Brabant. This type again bears a great likeness to the *Saliceto* and also to the above type 8, but it differs from both.

Setting aside for the moment the types viii. and ix. as doubtful Costerians, we must also point out that there is no direct evidence that type i. is connected with the other seven, or that it is the first of them. But it is a primitive one; it has all the characteristics of the *Speculum* and other Costerian types, and could hardly be placed later than the earliest of them; the *Donatus* printed with it is printed on one side of the leaf only; it shows, moreover, in other respects that it must be dated before 1470. The *Abecedarium* printed with the same type, and discovered at Haarlem in a 15th century manuscript belonging to a Haarlem family, looks as the work of an inexperienced printer. The types II., III. and V. (the *Speculum* types 1, 2 and 3) are inseparably connected with each other; they must have been in one and the same office; their workmanship shows that their founder step by step simplified and improved his work, and in what order they are to be placed; the most perfect of them (V.) was in existence not later than 1471 (see above), and the three, together with the xylographic leaves in the mixed Latin *Speculum* (from which they cannot be separated) take us back to a period which could not possibly be extended beyond 1470, but which may reasonably be said to have begun as early as, say 1440.

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[1] It may be that some of the works enumerated under type v. are really printed in the first *Speculum* type, but it is almost impossible to come to some certainty as to the difference between types 1 and 3, unless the books are together.

[2] The present writer has recently purchased from Herr Jaques Rosenthal, of Munich, two leaves of a *Donatus*, which were said (in Herr Rosenthal's catalogue) to be printed in the *Valla* type (IV.). On examination this proves not to be the case. At first sight it seemed to him to be type III (*Speculum* type 2). But this is not the case either. It has, however, the peculiarities of both these types combined, so that he does not hesitate to call these fragments a *unicum*, and its type provisionally type III.*

Therefore these three types, and the books printed with them in combination with the xylographic leaves, and various circumstances pointing to Haarlem as their birthplace, would alone suffice to support and vindicate the Haarlem claims to the honour of the invention of printing. It could, however, serve no useful purpose to separate the types I., IV., VI. and VII. from those of the *Speculum*, as they have all a great family likeness and three distinctive peculiarities common among them: (1) a perpendicular stroke to the cross-bar of the *t*; (2) a small curl attached to the top of the *r* found in no other Netherlandish type; it goes backward in types 1 and 3; and in type 2 another curl is added to the first, bending to the right again; (3) a minute perpendicular link connecting the marks of contraction with the letters above which they appear (a peculiarity common also in the Dutch MSS. of the time). A copy of the latest issue of the *Saliceto*, preserved at Darmstadt, printed in type VII., has the rubricator's date 1472 in two places; another book in the same type (in the Meerman Museum) was bought between 1471–1474, and as this type is used for a tract printed together with the Pontanus treatise printed in type VI., and the Pontanus type is supplemented with capitals of type IV. (the *Valla* type), it follows that these three types (IV., VI. and VII.) must have been in use in one and the same office, and that the latest of them (VII.) cannot be placed later than 1472. Again, it must be said that there is no direct evidence that these three types were used by the printer of the *Speculum*, but as fragments of *Donatuses* in the Saliceto type have been found in account-books of the Great Church at Haarlem, all presumably bound by the same Cornelis the bookbinder (the reputed servant of the Haarlem inventor), who also used fragments of *Donatuses* in the *Speculum* types, Haarlem may be regarded as their common birthplace.[1] Hence these seven types may be grouped thus: (*a*) the *Abecedarium* type; (*b*) the three *Speculum* types; (*c*) the *Valla*, *Pontanus* and *Saliceto* or *Pius* types; the (*a*) group cannot be dated later than 1470; (*b*) (three types) not later than 1471; (*c*) (three types) not later than 1472 and perhaps not before 1458.

Here then we have a printer who, before 1472, had manufactured and extensively used at least seven (if not eight or nine) different and primitive looking types; three of the seven must have existed long before 1471, as with them he had printed before that year no less than five folio editions of one book (the *Speculum*), besides several editions of *Donatus* and the *Doctrinale* of Alex. Gallus and other smaller books. This work may be supposed to have extended over a number of years, and before he printed any of these type-printed books he had already engraved, printed and issued at least one large folio blockbook (the *Speculum*).

And yet the catalogues of the present day, which profess to arrange the incunabula *chronologically*, under their respective countries, towns, printers, types and dates—according to some "historical" or "natural history method" suggested in 1870 by an eminent bibliographer, and intended to show the "development of printing"—assign this primitive Dutch printer, and his primitive types and books, to what is presumed to be their "chronological" place, *after* the productions of Germany, Italy, Switzerland and France; that is, they are placed in a period when printing presses had been established in nearly every large town of Europe, and the art of printing was already so fully developed and vulgarized, that the books of that period show, on comparison with the Costeriana, that the latter must have preceded them by at least two or three decades.

Apart from this anachronism, the same catalogues assign this printer and his books no longer to Haarlem in North Holland, to which they had always been attributed in conformity with the tradition that printing had been invented in that town and the *Speculum* and other books printed there; but they locate them at Utrecht, the capital of the province of the same name, although the types of the Costeriana show that they are imitations of the handwritings indigenous to the province of Holland, not to those of Utrecht.

This bibliographical calamity dates from the year 1870, when Dr Anton Van der Linde published his book *The Haarlem Coster Legend*. After it had become known to him that for years past the "Lourens Janszoon Coster" mentioned by Junius as the inventor of printing had been confused by some authors with another inhabitant of Haarlem, whose name was "Lourens Janszoon," but who had never borne the surname "Coster," he, after an inadequate investigation in the Haarlem archives and elsewhere, professed to prove from documents (1) that the Haarlem tradition was nothing but a "legend," the kernel of which was "Jacob Bellaert," who published in 1483 the first Haarlem book with a date; (2) Lourens Janszoon Coster was a "myth"; (3) Cornelis the bookbinder, Junius's chief witness for the Haarlem tradition, had been Bellaert's servant, and telling his story in his second childhood, magnified the first Haarlem printer of 1483 into the first printer of the world; (4) the "Spiegel" and the Donatuses could not have been printed before 1470–1474, &c. As Van der Linde's book was apparently based on documents, it was generally thought to have put an end to the Haarlem claims. It seems to have struck nobody at the time that this Haarlem tradition or legend, if it had originated in or after 1483, could not have been so strangely distorted and altered that, within a few decades, "Jacob Bellaert" its hero, according to Van der Linde, was forgotten, while his "servant," in his second childhood, substituted for him another person of an entirely different name and of a much earlier period; whose descendants all appear in Haarlem's history, and one of whom records him in a genealogy; who is himself mentioned again and again in the Haarlem registers of the time, but who is finally, in 1870, declared to be a "myth." Nor did it strike anybody at the time that if Cornelis the bookbinder had been Bellaert's servant or binder, and his story of the inventor related to him, and to no other printer, this bookbinder must have used fragments of Bellaert's productions for strengthening his bindings, instead of which he employed fragments of the Costeriana, which are admittedly not printed by Bellaert.

These are two of the many points which might have arrested Van der Linde in his sweeping denunciation of the Haarlem tradition if he had given more attention to the subject. As no reply invalidating the main part of his criticism emanated from Haarlem, Henry Bradshaw, the librarian at Cambridge, who had been studying the Dutch incunabula for some years, accepted Van der Linde's conclusions, and published, in 1871, his *List of the founts of type used by printers in Holland in the 15th century*, in which he explained that he was compelled to place the printer of the *Speculum* at Utrecht because "it is there that the cuts of the old folio editions first appear cut up into pieces in a book (*Epistelen ende Evangelien*) printed by Veldener at that place in 1481. Without further information he would have found it necessary to place the printer of the *Speculum* last among the Utrecht presses and to affix as his date (before 1481). But as the types of the *Yliada* (VII.) and of the Ludovicus de Roma (VI.) bear a close resemblance to those of the *Speculum*, they could not be separated from the latter, and a note in the Hague copy of the *Tractatus de salute corporis* in the same type VII. makes it clear that it was bought between 1471 and 1474, this was the only date which he could accept, and it compelled him to place the printer of the *Speculum* at the head of the Dutch printers, just as the *Speculum* compelled him to place him at Utrecht."

It is clear that Bradshaw's system of classifying the incunabula, so inflexible as regards dates and places of printing, that he would admit any stray statement on these points if it be found in the books themselves, rather than go outside the books for further information, is yet elastic enough to ascribe the *Yliada* and the *Pontanus* to the printer of the *Speculum*, merely on account of a close resemblance between the types of these books. As he knew that the early printers shaped their types according to the handwritings indigenous to the places where they settled, it must have escaped him that in locating the printer of the *Speculum* at Utrecht, he placed him among printers whose types bore no resemblance to those of the Costeriana. This system, therefore, so rigorous on the one hand and so flexible on the other, can only be applied with safety to books whose country, printer and date are known, not to such as the *Costeriana*, which have neither date nor printer's name, nor place of printing, and might, therefore, be ascribed to France, Italy, Germany or any other European country, if it were not that some of them were printed in the Dutch vernacular.

As to the *Speculum* cuts being in Veldener's hands in 1481 (and 1483), various circumstances show (see Holtrop, *Mon.* p. 110 sqq.) that he could not have possessed them, nor acquired them from other printers at Utrecht, until he used them cut up into halves and already considerably worn out. It is also known that ten years at least before he employed them, the cuts had been used intact as illustrations in a book which could not be ascribed to him. In such cases bibliography is bound to inquire where they could have been so used before ascribing them to the place where they are used in 1481. The statements of the *Cologne Chronicle* (1499) and of Junius (1568) when examined together with the types and workmanship of the *Costeriana* give satisfactory answers on this point. The fact that fragments of a French translation of *Donatus*, printed in *Speculum* type 3, and of a treatise of Ludov. Pontanus on Canonical Law in the *Pontanus* type, were discovered at Utrecht, cannot be set against the finding of many more fragments of Donatuses, &c. at Haarlem.

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[1] The Cambridge University Library possesses two sheets of two different editions of *Donatus*, one (unrubricated) printed in *Speculum* type 1, the other (rubricated) in the *Saliceto* type, both found pasted by the binder on the wooden boards of a copy of J. Mile's *Reportorium*, printed at Louvain in 1475, which is also in the same library.

Bradshaw lived to see some result of his system in Campbell's *Annales*, published in 1874, where all the Costeriana are ascribed to a *Prototypographie neerlandaise à Utrecht*, and he regretted it. Unhappily, his untimely death prevented him from testing his system more closely; those who adopted it were unable, or considered it unnecessary, to repeat his explanations and reservations, so that the Costeriana are now, in almost every catalogue, placed at Utrecht,[1] without any sign of doubt or hesitation, though all the particulars connected with them prove that they could not have originated there.

Date of Haarlem Invention.

To ascertain the probable date of the Haarlem invention, we have at our disposal: (A) some historic statements and documents, namely (*a*) two entries of 1446 and 1451 in the Diary of Jean Le Robert (Abbat of Cambray); (*b*) the Helmasperger Instrument of 1455; (*c*) Ulrich Zell's account of the invention of printing in the *Cologne Chronicle* of 1499; (*d*) the Coster pedigree; and (*e*) Junius's narrative of the Haarlem tradition; (B) a collection of nearly, if not more than, fifty incunabula, known as Costeriana, the printing of which must have involved the manufacture of *seven* types, four of which (the *Abecedarium*, and three *Speculum* types) cannot be placed later than 1471, the other three (the *Valla*, *Pontanus* and *Saliceto* types) not later than 1472. With these types were printed five folio editions of the *Speculum*, twenty-three of *Donatus*, eight of the *Doctrinale*, besides several other important books.

Mainz date, 1450.

A. Historic Statements.—Junius, saying that Coster invented printing in 1440, and that Johan, who stole his types, printed with them at Mainz in 1442, probably knew, or had heard, nothing more definite about a date than that Coster's types were used at Mainz within a year after the theft. The year 1440 as that of the invention was first mentioned, it seems, in 1483, in testimony xvii.; a second time by the *Cologne Chronicle* in 1499 (but only as the year in which the art began to be "investigated," whatever that may mean), and again in 1505 and later (testimonies xxix., xxxix.). Junius, therefore, may have derived 1440 not from the Haarlem tradition, nor from the Coster pedigree (which gives 1446, and may imply a still earlier date), but from other sources, and hence fixed the commencement of printing at Mainz in 1442 (first mentioned, it seems, in 1499 by Polyd. Vergil, testimony xxiii.). Be this as it may, the Helmasperger instrument of 1455, if it is genuine, shows that Gutenberg could not have begun printing before the end of 1450, if so early, as in that year, about the middle of August, he borrowed money for "making his tools," and was then, moreover, destitute of everything necessary for printing, as parchment, paper, even ink. This year 1450 agrees with the date (1451) written in the Paris *Donatus*, which, on insufficient grounds is considered to be a forgery. It also agrees with Ulr. Zell's statement in the *Cologne Chronicle* that printing and all that belonged to it were "investigated" from 1440 to 1450, and that in the latter year they began to print. And it likewise agrees with the testimonies xxviii., xxx., xxxi., xxxiii., xxxviii. and xl. quoted above, which all come from persons who may be supposed to have known something about the date of early Mainz printing, namely, Johan Schoeffer, the son of Peter Schoeffer, Joh. Trithemius (who was personally acquainted with both Peter and Johan Schoeffer), Joh. Thurmayer Aventinus (who lived from 1474 to 1534), Mariangelo Accorso (who wrote *c.* 1533), while No. xl. is that of Joh. Bergellanus, the first author, so far as we know, who mentioned the lawsuit of 1455, in his *Encomium*, printed and published in the very St Victor Stift of which Gutenberg had been for some years a lay-brother till his death, so that this testimony points to Gutenberg's own version of the "beginning" of Mainz printing.

Therefore the Mainz date 1450, derived from documents and testimonies which cannot be lightly set aside, is much later than the latest date (1446) of the Haarlem claims, and those who accept the Haarlem tradition, as we do, may reasonably conclude that Fust was induced to advance money to Gutenberg about August 1450, not by seeing anything printed by the latter, but by having some of Coster's types and tools, and a type-printed *Donatus*, shown and explained to him.

We are, however, now asked to disregard this date 1450 and all documents that indicate, and have hitherto always been relied on as fixing, the beginning of printing at Mainz in that year, and to believe that the *Astronomical Kalendar*, said to be for 1448, was printed at Mainz in 1447. If this year could be accepted for the printing of this Kalendar, its value would of course be greater than any written or printed statement. It is, however, far from certain, and its assumed date, though not interfering with the Haarlem dates, as it falls after 1446 of the Coster pedigree, is incompatible with the Helmasperger instrument, which shows that so late as August 1450 Gutenberg had not printed anything, and had not even made his apparatus for printing. There remains the Poem on the "Weltgericht," also ascribed to Gutenberg and said to be printed in the same type as the *Donatus* of 1451, with the exception of certain letters the form of which represents, it is thought, a still earlier stage. Hence the Poem is dated back, apparently for no tangible reason, to 1443–1444, and the *Donatus* placed between it and the *Kalendar*, the type of which is said to be a "development" of the *Donatus* type. This date, which is even more speculative than that assigned to the *Kalendar*, militates entirely against the Helmasperger instrument; it can hardly be said to go against the Coster pedigree, while it does not interfere with, but rather favours, Junius' dates.

Among the historic statements also come the two entries of the Abbot of Cambray, on folio 161^{a} of his *Diary*, preserved in the Archives at Lille, in which he records having bought in January (1445, o.s. =) 1446 and in 1451, at Bruges and Valenciennes, printed[2] *Doctrinalia* (on vellum[3] and on paper). Even if printing could be said to have begun at Mainz in 1450 or earlier, no *Doctrinalia* printed there have ever come to light, unless we accept the Haarlem tradition, that those printed with Coster's types were printed there. Hence these entries can only be applied to the *Doctrinalia* printed in Holland in the same types as the *Speculum* (on which Junius based the tradition of the Haarlem invention) and the *Donatuses* which fit into Zell's historic statement (in the *Cologne Chronicle* of 1499), that the *Donatuses* printed in Holland were the models for the Mainz printing. Therefore there is no certainty as to any Mainz printing having been done before 1450, and, if the Helmasperger instrument has any value, it is certain that it could not have begun there before that year; Ulrich Zell unreservedly places the printing done in Holland before that of Mainz; Jean Le Robert's statements make it certain that printing was exercised before January 1446; the Coster pedigree fixes no later date than 1446 for the invention at Haarlem; Junius' years (1440–1442) are, perhaps, his own guess. Anyhow, if historic statements and documents have any value, the invention must have been accomplished within the six years from 1440 to 1446 (also indicated by Zell).

B. *The Costeriana.*—It has been pointed out above that we have nearly 50 Costeriana, for which *seven* types have been employed, four of which cannot be placed later than 1471, the remaining three not later than 1472; and that with these types five folio editions of the *Speculum* were printed, 23 of *Donatus*, 8 of the *Doctrinale*, besides several other important books. With such an abundance of material, for the greatest part of which we have the year 1471–1472 as an undoubted *terminus ad quem*, we need not inquire too anxiously whether Junius placed the invention in 1440, or whether the Haarlem Coster pedigree fixes it at 1446 or earlier. For, by placing intervals either between the seven types or between the several editions of the *Speculum*, *Donatus*, *Doctrinale*, &c., we can easily reach any *terminus a quo* which may be found to agree with the historic statements explained above. Such intervals, however natural and necessary they may be to arrange the Costeriana in some chronological order, must always be more or less arbitrary, as it is impossible to say whether the editions followed each other within two months or within two or more years, or whether the types became used up within six months or within six, seven or more years. Therefore, only such intervals need be suggested as may show that the Costeriana, or some of them, may reasonably be placed before Mainz dates which are certain (that is *c.* 1450, derived from the Helmasperger instrument, and 1454, the date of the Indulgences), or speculative (as 1443–1444 for the "Weltgericht," and 1447 for the *Astronomical Kalendar*). The first products of the art of printing were intended to be faithful imitations of the manuscripts, and no material deviations from the general plan become observable till about 1473–1477. Nowhere are the features of the MSS. of the 15th century so faithfully imitated as in the productions of the three earliest printing-offices of Coster, Gutenberg (?) and Schoeffer. They are all without signatures, without printed initial directors,[1] without printed catchwords; in short, without any of those characteristics which we see gradually, one after the other, come into almost general use when printing becomes more developed, that is from 1473 (if not earlier) to 1480. Hence a comparison of the *Speculum*, *Donatus* and *Doctrinale* editions, printed in the *Speculum* and other types, with the Gutenberg and Schoeffer *Donatuses* and their other books enumerated above, shows that the types, mode of printing and workmanship of all these books stand on nearly the same primitive stage. Yet there is a considerable difference between the productions of the three offices, those of the Haarlem office being more primitive than any of the other two. First of all the types of the Costeriana (which have nothing in common with any of those used in the Netherlands after 1471), show by their *t* with the perpendicular stroke attached to its cross-bar, the *r* with a curl, and the signs of contraction connected by a fine link to the tops of the letters over which they stand, that they were manufactured during the MS. and block-printing periods of Holland. Secondly, none of the Costeriana have any hyphens, which, in the Gutenberg and Schoeffer incunabula appear already from the beginning. Thirdly, the five editions of the *Speculum* are all printed anopisthographically (that is, on one side), the woodcuts at the top of the pages as well as the explanatory text underneath, which would hardly be the case if they had been printed after 1471, when the printing of woodcuts, together with text in movable types, on both sides of the leaf, was no longer a novelty. None of them have any colophon (except such a word as *explicit*), which would, for a collection of nearly 50 books, be incompatible with a period after 1471, but not with the earlier period of the blockbooks and MSS. Moreover, of the 50 no less than 38 are printed on vellum, which is incompatible with a period after 1471 and even earlier, when printing on paper had become universal, but not with the earlier period of the MSS. Therefore, those who wish to date the *Donatuses*, ascribed to Gutenberg, before 1450, or before 1447, must not forget that the more primitive editions of the *Speculum*, *Donatus* and *Doctrinale* printed in types I. and II. &c. can also be dated before 1450 or 1447; and when once so much is admitted, there is no reason to reject Zell's statement that the *Donatuses* printed in Holland served as models to Mainz printing.

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[1] It is pleasant to be able to record some exceptions. Voulliéme and Günther in their *Catalogues* still mention Haarlem.

[2] The abbot speaks of *Doctrinalia* "gette" or "jettez en molle," and the phrase is, as Bernard (*Origine*, i. 97 seq.) shows by eight examples from 1474 (the year when printing is first officially spoken of in France) to 1593, and down to the present day, applied to typographically printed books only; see also Fred. Godefroy, *Dictionaire*, in voce *mole* (which he interprets as *caractère d'imprimerie*, where he gives six quotations showing the same meaning.

[3] The abbot does not mention the word *vellum*, but states that the *Doctrinale* which he had bought at Valenciennes was full of mistakes wherefore he had bought one *on paper*.

In addition to the above considerations, there is the remarkable fact that the chief productions of the three earliest printing-offices are editions of *Donatus*, all printed on vellum. This fact has become more conspicuous by the discovery in recent years, in various parts of Holland and Germany, of a multitude of fragments of different editions of this schoolbook. Of the Haarlem office we know 23 editions; 13 are ascribed to Gutenberg; 9 we have in the Schoeffer or B^{42} type. The production of so many editions, all about the same time in the infancy of printing and in two different places, so widely apart from each other as Haarlem and Mainz, cannot have been an accident or coincidence, but suggests some connexion, some links[2] between the three or more offices that produced them. One link we find in Ulrich Zell's statement that the *Donatuses* printed in Holland were the models for Mainz printing, another in the Haarlem tradition, as narrated by Junius, that one of Coster's workmen, taking his master's types and tools, went with them to Mainz and settled there as a printer. These two statements go far to explain not only how the art of printing was transferred from Haarlem to Mainz, but how, at the latter place, it was thought expedient to continue the printing of *Donatuses* begun at Haarlem. Bearing this obvious connexion between the three earliest offices in mind, and also that the books of the printer of the *Speculum* show that he could not have learnt his art at Mainz or any other place, the only question really is: Can the Costeriana, or some of them, by placing an interval between them, be dated so far back that they may be placed before the certain or speculative dates now attributed to books or broadsides printed at, or ascribed to Mainz. In our former edition, when only 20 Costerian editions of *Donatus* were known, and no earlier final date than 1474, we suggested an interval of 18 months between each of them, giving about 30 years, from 1474 back to 1445, for the issue of all the *Donatuses*. We now know 23 editions, and 1472 as final date for the existence of all the types, though, of course, some of the editions may have appeared after this year. Therefore, our interval need not be longer than about 15 months, which makes a stretch of nearly 29 years from 1472 back to 1443. As to an interval between the types, an eminent type-founder, Dr Ch. Enschedé of Haarlem, when dealing with Coster's types (in his treatise *Laurens Jansz. Coster de uitvinder van de boekdrukkunst*, Haarlem, 1904, p. 28), reminds us of three printers (Eckert van Homberch of Delft, Govaert Bac and Willem Vorsterman, of Antwerp), who used one type all the time that they were printing (which means 23 years for the first and 19 for the second), and declares that we could not possibly put a shorter interval than 6 years between each type. As there are seven Costerian types, such an interval would mean a period of 42 years, from 1472 back to 1430, hence only four and a half years (=31½ years) between each type would suffice to reach the year 1440.

These calculations, however, include the *Abecedarium* (i.), *Valla* (v.), *Pontanus* (vi.) and *Saliceto* (vii.) types, and, as has been pointed out above there is no absolute proof that these four also belonged to the printer of the *Speculum*. Types v., vi., and vii. cannot be separated, and two circumstances, mentioned above, make it more than probable that they did belong to him. But the *Abecedarium* type can be ascribed to the *Speculum* printer on no other grounds than that it has all the characteristics of the Costerian types; that it is too primitive to be attributed to any later Dutch printer, so far as we know them, and that the *Abecedarium* printed with it, was discovered at Haarlem in a Dutch MS. which belonged to a Haarlem family.

Hence a computation based on the five *Speculum* editions (all printed and issued at least before 1471), the 12 editions of *Donatus* and four editions of the *Doctrinale* printed in the same types might be more convincing to the opponents of Haarlem's claims. Apart from the final date (1471) for them there is also evidence that the *Speculum* type I existed a considerable time before 1474, as in that year the bookbinder Cornelis used fragments of a *Donatus* printed in that type in the binding of an account book of the cathedral church at Haarlem. Their types and workmanship, moreover, compel us to place them before the *Valla*, *Pontanus* and *Saliceto* (or *Pius*) types. The last two, employed together in one book, cannot have been used for this book before 1458, as it bears the name of Pope Pius II., who was not elected till that year, but it is certain that it cannot have been printed after 1472. The *Valla* type, however, existed before the *Pontanus* and *Saliceto* types, as four capitals of the former were used to supply the want of such capitals in the *Pontanus* type.

If then, as suggested by Enschedé, the type-founder, an interval of six years is placed between the three *Speculum* types, it would mean 18 years, or a period from 1471 back to 1453. A similar number of years we obtain by intervals of 18 months between each of the 12 editions of *Donatus* printed in type I. Even this moderate calculation makes it plain that the printer of the *Speculum* must have begun printing at least about the same time that printing began at Mainz. But we have seen above that this printer did not hesitate to make up complete copies of his books by mixing sheets of a later edition, printed in a different type, with those of an earlier edition, and even mixed type-printed with xylographically printed sheets. A printer so carefully and economically husbanding his stock of sheets is not likely to have printed new editions of his books before the old ones were fully sold off, or to have manufactured new types till his old ones were used up. Moreover, Haarlem, a quiet provincial town, could not have been a favourable market for a rapid sale of books, especially not for books in the vernacular, like the Dutch versions of the *Speculum*. Hence we should not put too short an interval either between his editions or his types.

As (*e.g.*) Gerard Leeu[3] printed at Gouda, during the six years 1477 to 1482, 17, mostly bulky, volumes, together consisting of 2968 leaves, or nearly 6000 folio pages, all in *one* type, we need not hesitate to place at least eight or nine years between each of the three *Speculum* types, that is together 24 or 27 years from 1471 back to 1447 or 1444. It is true, the types manufactured after, say 1477, may have been more enduring than the earlier types, as being, perhaps, cast of better material and by a more perfect process than those of Coster, but the number of pages printed by the latter with the three *Speculum* types, barely amounts, so far as we know, to a tenth part (600 pages) of Gerard Leeu's work. Our calculations are, of course, liable to modification or alteration; earlier dates may yet be discovered in the Costeriana or in other documents; more editions of *Donatus* in the same types may be found, which would shorten the intervals. But we have shown that, without straining chronology, bibliography or typology, the Costeriana can be dated back so as to harmonize with any historical date, Dutch (1440, 1446) or German (1450), known at the present time, or so as to precede even the speculative dates (1447 or 1444) assigned to some Gutenberg products.

Necessity of an Earlier Printer before Mainz.

There is therefore no reason to discredit Zell's statement in the *Cologne Chronicle* of 1499, that the *Donatuses* printed in Holland were anterior to, and the models for, the art of printing at Mainz, or that of Hadrianus Junius in his *Batavia*, that printing was invented at Haarlem by Lourens Janszoon Coster, and that the *Speculum* was one of his first productions. The two statements were made independently of each other. But even without them, the existence of a group of nearly fifty primitively printed books of undoubtedly Dutch origin, the printing of which must have taken a number of years before 1471, would suggest serious doubts as to the priority of Mainz printing. Zell's statement is all the more weighty, as it is not one made at random but meant to be a direct *contradiction* of the vague rumours and statements about an invention of printing at Mainz by Gutenberg, which had gradually crept into print since 1468 in Italy and France, and had found their way back into Germany about 1476, after Mainz and Germany had given the greatest publicity, during twenty-two years, to the existence of the new art in their midst; while all those who might, and would and could, have told the public that the invention had been made at Mainz, if it had come about there, preserved a profound silence on this particular point, even the supposed inventor himself. And, though Zell accords to Mainz and Gutenberg the honour of having "improved" the art and having made it more artistic, he denies to them the honour of having "invented" or "begun" it, and this latter honour was never claimed by that town before 1476. Junius's account, on the other hand, is the embodiment of a local tradition at Haarlem, the first written traces of which we have in a pedigree (testimony xxxiv) of the family of the reputed Haarlem inventor, which, as regards its central part, may have existed at least as early as 1520, whereas its first part may be dated much earlier. His account is indirectly confirmed by the finding of several fragments at Haarlem, all belonging to the groups of books mentioned above, but still more by the discovery of several fragments of the *Donatuses* printed in the *Speculum* type 1 and 3, some of which had been used as binder's waste by Cornelis, the bookbinder, the very man whom Junius alleges to have been the servant of Coster.

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[1] An exception is to be noticed in the Costerian *Yliada* (see above type VII., no. 14–17) in which on the recto of the second leaf the initial director *i* is printed.

[2] Schwenke has, to some extent, observed this connexion, and suggested that the texts of the *Donatuses* should be studied, as the differences between them might show whether those of Mainz were printed from the Haarlem editions or vice versa. Such a study may be useful, but could hardly lead to a definite result, as the types of these schoolbooks, like those of other incunabula, were imitations of the respective handwritings of the places where they were printed, and the texts were no doubt taken from the same MSS. in the first instance, though it is possible that the types were cast for other books and used afterwards for the *Donatuses*.

[3] These examples might easily be multiplied. Ulr. Zell, for instance, printed more than 80 books in his first type.

As the case stands at present, therefore, we have, after careful and impartial examination, no choice but to repeat that the invention of printing with movable metal types took place at Haarlem between the years 1440 and 1446 by Lourens Janszoon Coster.

That the Haarlem inventor of printing was, as we have shown, a block-printer before he printed with movable types, helps us to understand what the tradition, as chronicled by Junius, says of him (Testimony xliv. *b*): that he, while walking in the wood near Haarlem, cut some letters in the bark of a tree, and with them, reversely impressed one by one on paper, he composed one or two lines as an example for the children of his son-in-law. Junius does not say it, but clearly implies that, in this way, Coster came to the idea of the movability (the first step in the invention of typography) of the characters which, hitherto, he had been cutting together on one block. He perceived the advantage and utility of such insulated characters, and so the invention of printing with movable types was made. The questions as to whether he continued to print with movable "wooden" types, or even printed books with them, cannot be answered, because no such books or fragments of them have come down to us. Junius's words (Test. xliv. § *d*) on this point are ambiguous, and no Dutch edition of the *Speculum* printed, figures and text, from wooden blocks or movable wooden types, is known.

By the middle of the 19th century the claims of Coster and Haarlem had steadily gained ground, owing to the researches of Joh. Enschedé (1751), Meerman (1765), Koning (1815), Young Ottley (1816), Bernard (1853), Sotheby (1858) and others. But in 1870 they were wellnigh destroyed by a criticism which afterwards proved to be partly groundless, partly a distortion of facts. At the time, however, it was, without further research, accepted as decisive; the claims were regarded to be a fiction, and a system of classifying the incunabula started with the unfortunate result that Utrecht came to be adopted as the birthplace of the Costeriana and Coster and Haarlem almost obliterated from all our catalogues. Since then many things have come to light, all tending to confirm Haarlem's claims, and showing how unjustifiably they were attacked in 1870. An examination of the incunabula on which they rest is far from easy or inexpensive, as the books are scattered not only over Europe but now also over America, and therefore not easy of access. We have, however, made it, sufficiently to be able to prove that the claims are based on good grounds. Our evidence, though still circumstantial, is not based on guesses; we assert nothing except on bibliographical or historical grounds; nor do we accept one statement unless it is corroborated by other statements, or by the rules of bibliography and history. Hence we should not accept Zell's evidence or that of Junius, or of any one else, if the books to which they refer did not corroborate them to the fullest extent, or if the claims of Mainz to the honour of the invention could be said to have any substance of fact. The great efforts made in Germany since 1882 to strengthen the case for Gutenberg, which culminated in the celebrations of 1900 and the publication of valuable and learned books, have enriched our knowledge of early Mainz and German printing, but at the same time conclusively shown that it requires great courage to maintain that Gutenberg was the inventor of printing.

How long Coster or his successors continued the first printing-office at Haarlem we cannot say; it seems to have come to an end in or before 1481, as the cuts of the *Speculum* had evidently then passed into John Veldener's hands, and the Haarlem tradition says that wine-pots had been cast of the remains of the types. In 1483 Jacob Bellaert was printing at Haarlem, and Jan Andrieszn in 1485; their types are imitations of the writing of their time, but already differ from those of the *Speculum* and the other Costeriana in various respects, and show many features of a later period. The question as to whether they learnt their craft from the first Haarlem printer, or from other masters, has been asked but not yet answered.

Spread of Typography.—Having explained the early printing of Haarlem and Mainz, in so far as it bears upon the controversy as to where and by whom the art of printing was invented, and shown that the testimony of Ulrich Zell (in the *Cologne Chronicle* of 1499) as to Mainz having learnt the art of printing from Holland through the *Donatuses* printed there, and that of Hadrianus Junius, as to the tradition of its Haarlem origin, are confirmed by bibliographical and historical facts, we can follow its spread from Haarlem to Mainz, and from the latter place to other towns and countries.

1460; Strassburg.—First printers: Johann Mentelin, who completed a Latin Bible in that year, according to a rubrication in a copy at Freiburg in the Breisgau; Adolph Rusch de Inguilen, who is presumed to be the printer of the undated books with a singularly shaped R,[1] *c.* 1464; Henricus Eggestein, 1471; George Husner, &c.

1461; Bamberg.—First printers: Albrecht Pfister, who in 1461 published Boner's *Edelstein*, though it is still doubtful whether he did not print earlier, while he has always been regarded as the printer of B^{36} (see above); Joh. Sensenschmidt, *c.* 1480.

1465; Subiaco.—First and only printers: Conrad Sweynheym and Arnold Pannarts, who completed in that year an edition of Cicero, *De Oratore*, and Lactantius, and removed to Rome in 1467.

1466; Cologne.—Earliest printers: (1) Ulrich Zell, who published in that year Chrysostom, *Super Psalmo quinquagesimo liber primus*, though it is presumed that he printed already in 1463; (2) Arnold Ther Hoernen, 1470; (3) Johannes Koelhoff of Lübeck, 1470, who printed the *Cologne Chronicle* in 1499; (4) Nicolaus Götz, 1474; (5) Goiswinus Gops, 1475; (6) Petrus de Olpe, 1476 (not 1470); (7) Conradus Winter of Homburg, 1476; (8) Joh. Guldenschaaf, 1477; (9) Henricus Quentel, 1479, &c.[2]

1467; Eltville.—First printers: Nicolas and Henry Bechtermuncze and Wygandus Spyes de Orthenberg, who completed in that year a *Vocabularius ex quo*.

1467; Rome.—First printers: Conrad Sweynheym and Arnold Pannarts from Subiaco, who published an edition of Cicero's *Epistolae ad familiares*; Ulrich Hahn or Udalricus Gallus, who issued on the 31st of December 1467 Turrecremata's *Meditationes*.

1468; Augsburg.—First printer: Günther Zainer or Zeyner. Same year at Basel (first printer Berthold Rot of Hanau) and at Marienthal (Brothers of the Common Life).

1469; Venice.—Printers: (1) Johannes of Spires; (2) his brother Vindelinus of Spires; (3) Christopher Valdarfer; (4) Nicolas Jenson, &c.

The further spread of typography is indicated by the following dates: 1470 at Nüremberg (Johan Sensenschmidt, Friedr. Creusner, Anton Koberger, &c.), Berona or Beromünster in Switzerland (Helyas Helye *alias* De Llouffen), Foligno (Emilianus de Orfinis and Johannes Numeister), Trevi (Johann Reynard), Paris (first printers the three partners Ulrich Gering, Michael Friburger, Martin Krantz); 1471 at Spires, Bologna, Ferrara, Florence, Milan, Naples, Pavia, Treviso, Savigliano (Hans Glim?); 1472 at Esslingen, Cremona, Mantua, Padua, Brescia, Parma, Monreale (Mondovi), Fivizzano, Verona, Iesi, St Ursino (?); 1473 at Lauingen, Ulm (perhaps as early as 1469), Merseburg, Alost, Utrecht, Lyons, Messina, Buda-Pest, Santorso; 1474 at Louvain, Genoa, Como, Savona, Turin, Vicenza, Modena, Valencia; 1475 at Lübeck, Breslau, Blaubeuren, Burgdorf, Trent, Cracow (?), Reggio (in Calabria), Cagli,

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[1] M. Philippe, *Origine de l'imprimerie à Paris*, p. 219, mentions two books printed in this type, which contain manuscript notes, to the effect that they were purchased in 1464 and 1467, so that Inguilen is to be placed before Eggestein.

[2] Johann Veldener, who is said to have printed at Cologne, was never established there, but at Louvain (1473–1477), Utrecht (1478–1481), and Culenborg or Kuilenburg (1483–1484); see Holtrop, *Mon. typ.*, pp. 42, 47, 109.

Caselle or Casale, Pieve (Piove) di Sacco, Perugia, Piacenza, Saragossa; 1476 at Rostock, Bruges, Brussels, Angers, Toulouse, Polliano (Pogliano), Pilsen; 1477 at Reichenstein, Deventer, Gouda, Delft, Westminster, Lucca, Ascoli, Bergamo, Tortosa, Palermo, Seville; 1478 at Oxford, St Maartensdijk, Colle, Schussenried (in Würtemberg), Eichstädt, Geneva, Vienne, Trogen (?), Chablis, Cosenza, Prague, Barcelona; 1479 at Erfurt, Würzburg, Nijmegen, Zwolle, Poitiers, Toscolano, Pinerolo, Novi, Lerida, Segorbe, Saluzzo; 1480 at London, St Albans (or in 1479), Oudenarde, Hasselt, Reggio (in Modena), Salamanca, Toledo, Nonantola, Friuli (?), Caen; 1481 at Passau, Leipzig, Magdeburg, Treves, Urach, Casale di San Vaso, Saluzzo, Albi, Antwerp, Rougemont; 1482 at Reutlingen, Memmingen, Metz, Pisa, Aquila, Promentoux, Zamora, Odense, Chartres, Wien, Guadalajara, München, Erfurt; 1483 at Leiden, Kuilenburg (Culenborg), Ghent, Chalons-sur-Marne (?), Gerona, Stockholm, Siena, Soncino, Salins; 1484 at Bois-le-Duc, Eichstätt, Novi, Sangermano, Chambéry, Udine, Winterberg, Klosterneuburg, Rennes, Loudéac, Tarragona; 1485 at Heidelberg, Ratisbon, Pescia, Vercelli, Tréguier or Lantreguet, Brünn, Salins, Burgos, Mallorca, Hijar, Palma, Xeres; 1486 at Münster, Stuttgart, Chiavasco, Voghera, Casal Maggiore, Abbeville, Schleswig, Toledo; 1487 at Ingolstadt, Gaeta, Rouen, Murcia, Besançon; 1488 at Stendal, Viterbo, Gradisca, Faro, Constantinople, Lantenac; 1489 at Hagenau, Kuttenberg, San Cucufat (near Barcelona), Portesio, Coria, Pamplona, Tolosa, Lisbon; 1490 at Embrun, Orleans, Grenoble, Döle; 1491 at Hamburg, Kirchheim, Norzano, Goupillières, Angoulême, Dijon, Narbonne; 1492 at Marienburg, Cluni, Zinna, Valladolid, Leiria; 1493 at Lüneburg, Freiburg (in Breisgau), Urbino, Cagliari, Lausanne, Nantes, Copenhagen, Rieka; 1494 at Oppenheim, Tours, Mâcon, Monterey, Braga; 1495 at Freisingen, Freiberg (near Leipzig), Scandiano, Forli, Limoges, Schoonhoven (monastery Den Hem), Pamplona, Wadstena, Cettinje; 1496 at Offenburg, Provins, Barco, Valence, Granada; 1497 at Carmagnola, Avignon; 1498 at Tübingen, Périgueux, Schiedam, Gripsholm; 1499 at Danzig, Olmütz, Montserrat, Madrid; 1500 at Pforzheim, Sursee, Perpignan, Valenciennes, Jaen.

Printing seems to have begun in Scotland after September 1507, when King James IV. granted a patent to Walter Chepman and Andrew Myllar (also printed Millar) for the establishment of a printing press at Edinburgh. Their first book (*The Maying or disport of Chaucer*) appeared on the 4th of April 1508. Myllar, however, appeared to have been established there as a bookseller already in 1503 and to have published there his first book, Joh. de Garlandia *Interpr. vocabulorum equivocorum* (printed for him abroad) in 1505, his second *Expositio Sequentiarum* (also printed abroad) in 1506. (See Rob. Dickson and John Ph. Edmond, *Annals of Scottish Printing from 1507 to the 17th century*, Cambridge, 1890; Harry G. Aldis, *List of Books printed in Scotland before 1700*, Edinburgh 1904). Printing was introduced into Ireland at Dublin in 1551 by Humfrey Powell, who published in that year a verbal reprint of Whitchurch's edition of the Common Prayerbook of 1549. Printing in *Irish types* was brought into the kingdom in 1571 by N. Walsh and John Kearney, the first book printed in that type being *A Catechism*, written by Kearney.

Question of Date at Avignon.

Above we have stated that printing was established at Avignon in the year 1497. But during the last two decades various treatises have been published endeavouring to show that printing had already been exercised there more than half a century earlier.

In 1890 the Abbat Requin discovered at Avignon, in three notarial registers, five Latin notarial Protocols of the years 1444 and 1446, which, though they mention only the arts of "writing artistically," and painting different colours on stuffs, he and others interpreted as showing that, during those years, certain artisans had exercised the art of printing with movable types at Avignon; so that, if the art was not invented there, one of those artisans must have learnt the secret from Gutenberg, said to have been engaged in printing at Strassburg from 1436 to 1439. And hence Avignon, hitherto regarded as the 60th town where printing was introduced, was to take the second place, if not the first, in the history of the invention of printing, between Strassburg and Mainz (Requin, *L'Imprimerie à Avignon en* 1444, Paris, 1890; id., *Origines de l'imprimerie en France, Avignon*, 1444, Paris, 1891).

From Requin's first document (dated July 4, 1444) it appears that a silversmith, Procopius Waldfoghel, of Prague, residing at Avignon, had received from a magister Manaudus (also called Menaldus Vitalis, born at Dax, in the Département des Landes, *baccalaureus in decretis*, and student at Avignon) two alphabets of steel, two iron forms (frames?), one steel screw, 48 forms of tin, and divers other forms belonging to the art of *writing* (*duo abecedaria calibis et duas formas ferreas, unum instrumentum calibis vocatum vitis, quadraginta octo formas stangni necnon diversas alias formas ad artem* scribendi *pertinentes*), and promised to return these instruments (*ad usum* scribendi *pertinencia*) the moment Manaudus asked for them. The second document (dated August 27, 1444) makes no mention of tools or instruments, but is Procopius's bond for two sums of money (10 to 27 florins) which he had borrowed from Georgius de la Jardina; for the first he promised to instruct the said George in the art of *writing* well and seemly, and to do the necessary and suitable things for one month (*pro quibus promisit instruere dictum Georgium in arte* scribendi *bene et condecenter, et administrare necessaria et opportuna, hinc ad unum mensem*), on condition that neither of them should instruct anyone else in the said art of *writing*, without the consent of the other (*fuit tamen de pacto quod nullus non debeat instruere aliquem in dicta arte* scribendi, *nisi de licentia alterius*). The third document (March 10, 1446) is an agreement between Procopius and a Jew of Avignon named Davinus de Codarossia, who had advanced money to him and held property from him as security. The Jew had promised to teach Procopius to paint stuffs in different colours, and the latter had promised the Jew to make for him and to deliver to him "twenty-seven prepared Hebrew letters, well and properly cut in iron according to the science and practice of *writing*, which, two years ago, the said Procopius had shown and taught the Jew, together with instruments of wood, tin and iron (*Procopius promisit . . . judeo facere et factas reddere et restituere viginti septem litteras ebreaycas formatas, scisas in ferro bene et debite juxta scientiam et practicam* scribendi, *sunt duo anni elapsi ipsi judeo per dictum Procopium ostensam et doctam, ut dixit, una cum ingeniis de fuste, de stagno et de ferro*). It was also agreed that the Jew should pay for the tin and wood for the instruments of the Hebrew writing (*fuit de pacto quod idem judeus solvet stagnam et fustes artificiorum sive ingeniorum scripture ebrayce*). And Procopius further promised to give the Jew, the following week, ten florins to recover certain pledges or utensils which the Jew had in pawn from him, the latter binding himself not to reveal the science or teach the art to any one as long as Procopius should remain at Avignon or in the neighbourhood (*promisit eidem judeo dare decem florenos per totam hebdomadam proxime futuram et restituere sibi certa pignora sive ustensilia que ipse judeus habet in pignora a dicto Procopio*). The fourth document (April 5, 1446) shows that Procopius had made for the above-named Menaldus Vitalis and Arnaldus de Coselhaco (and Girardus Ferrosis?) and delivered to them several instruments or tools of iron, steel, copper, latten, lead, tin and wood for writing artistically; he had instructed them in the said art of *writing* artistically, and all the tools belonged to them in common. But Menaldus, wishing to sell his share in the said tools to the others and to retire from the association, twelve florins were paid to him in two instalments, but at the request of Procopius he testifies under oath that the said art of writing, taught him artistically by the said Procopius, was real and most proper, and also easy, practicable and useful to any one wishing and choosing to work it (*Cum dictus Procopius super* arte scribendi artificialiter *fecerit venerabilibus viris . . . Menaldo Vitalis et Arnaldo de Coselhaco . . . nonnulla instrumenta sive artificia causa* artificialiter scribendi *tam ferro de callibe, de cupro, de lethono, de plumbo, de stagno, et de fuste . . . dictamque artem scribendi artificialiter eos docuerit, instrumentaque ipsa omnia et singula sint . . . communia inter eosdem studentes . . . Cumque dictus . . . Vitalis cupiat . . . partem suam dictorum instrumentorum sive artificiorum . . . vendere et a communione eorum recedere . . . vendidit dicto Procopio et Girardo presentibus . . . partem suam . . . precio duodecim florenorum . . . Ibidem Vitalis . . . medio suo juramento . . . dixit . . . dictam artem scribendi per dictum Procopium artificialiter eidem doctam, esse veram et verissimam, esseque facilem, possibilem et utilem laborare volenti et diligenti eam*). The fifth document (April 26, 1446) shows that Procopius had recovered from Davinus all the pledges which he had pawned with him, except one mantle and 48 letters engraved in iron, that Davinus had not yet carried out his part of the agreement as to teaching Procopius the painting of different colours on stuffs, whereas Procopius had delivered to the Jew all the arts, tools and instruments pertaining to writing artistically in Latin letters, as he had promised to do on the 10th of March last. (*Procopius confessus fuit se ab eodem judeo recepisse . . . omnia pignora sua per eum penes dictum judeum impignorata, excepto uno mantello et quadraginta octo litteris gravatis in ferro. Et . . . dictus judeus confessus fuit . . . recepisse a dicto Procopio . . . omnia artificia, ingenia et instrumenta ad scribendum artificialiter in litera latina*, &c.) Again the compact is that Davinus shall not reveal the science to anyone, at least so long as Procopius should reside at Avignon or within 30 m. in the neighbourhood. (*nemini mundi dicere, notificare nec quovismodo revelare, per se nec per alium ullomodo, presentem scientiam in teorica nec pratica, et nulli mundi eam docere neque revelare eam fuisse ostensam per quemvis*).

It is difficult to find the art of printing with movable types, or the art of casting types in these documents. The Abbat, however, says they prove the establishment of a printing-office at Avignon in 1444, and he reads "*matrices*," "*caractères d'imprimerie*," *une* "*imprimerie*," and "*tout un matériel d'imprimerie*" in them, although the documents themselves do not mention such things; they only allude to the "art of *writing*," the "practice" or "exercise of *writing*"; the "art of *writing* well and seemly"; the "science and practice of *writing*"; the "art of *writing* artistically." And there is, apparently, no reason to think that these precise documents, while speaking exclusively of this art, should always mean another art which they do not mention. Procopius, indeed, seemed to have known an art of *writing*, in which he instructed others (second document) and which he and his associates wished to keep secret, while the "letters," tools, &c. of which they speak were no doubt "movable."

But Procopius himself appears to have possessed neither letters nor tools nor instruments or forms at the beginning of these proceedings; it was Menaldus Vitalis, a bachelor of law and student at Avignon, who entrusted to him the "two steel alphabets, two iron forms, one steel screw, and forty-eight tin and other forms," mentioned in the first document of 1444. Procopius, however, appears to have seen no permanent value in these letters, forms, &c. as he, of his own accord, promised to return them at the first request of Menaldus, who had handed them to Procopius without asking for a receipt. The third document, however, makes it plain that Procopius engraved for Davinus the Jew, not for himself, twenty-seven Hebrew letters (therefore a complete alphabet, including the five final letters) in iron, in accordance with the art of writing which he had taught Davinus two years ago, together with tools of wood, tin and iron, in return for which the Jew would teach Procopius the art of painting stuffs. The fourth document shows that Procopius had made tools of iron, steel and other metals for *writing* artistically, but again not for himself but for two other men one of whom was Menaldus who, two years ago, had entrusted him with two alphabets and some tools; Procopius, however, had this time reserved to himself a share in these tools, and Menaldus sold his share in the tools for twelve florins to the other associates, so that the value of all these tools cannot have amounted to more than about 36 florins of Avignon currency.

Therefore, the precise descriptions in the documents of the letters, tools and instruments required for Procopius's art of *writing* artistically, and the absence of all allusions to paper, ink and other things necessary for *printing* with movable types, show that there is no reference to this art, even in its infancy. That art means the multiplication of books or documents by means of an adequate quantity of single types for composing a whole page of text, and capable of being taken asunder and used again for a second, a third and a multitude of other pages, and so produce a number of copies of a book in the same or a shorter time than a scribe with his pen could produce one copy. But two Latin alphabets (of steel) and one Hebrew alphabet (of iron) would not suffice for composing and printing more than two or three words on any one page at a time, so that a person with such a small quantity of letters at his command would, in several respects, be worse off than a scribe. Hence the documents which only refer to the art of writing, mean nothing more serious than an art of taking impressions of certain letters (perhaps initials or capitals) in a more regular and steady fashion than even trained scribes could produce them by hand. For pressing in such (ornamental) initials or capitals here and there in MSS., after the scribes had done their ordinary work of writing, the insulated alphabets of Menaldus and Davinus would be a great help and save a deal of time and labour, but useless for the art of printing with movable types. If the two steel alphabets, and the one Hebrew alphabet of iron, and the 48 letters engraved in iron had been *patrices*, and the 48 forms of tin had been *matrices*, the documents, no doubt, would contain some expressions to show this, in spite of the endeavour not to divulge this art of writing. What the nature of this writing was, and why all these forms and instruments, even a screw, were required, we cannot say. It has been pointed out that the art of *printing* was also described as an art of *writing*, which is true; but when it is so described we learn at the same time that typography is meant. But we must bear in mind that Davinus the Jew was engaged on the painting of colours on stuffs and that Procopius desired to become acquainted with this industry. No doubt tools were much more required for this work than for writing. However, this writing association seems to have come to an end in 1446, and the parties departed from Avignon, without leaving there or anywhere else any trace of themselves and their interesting operations. See also Zedler, *Gutenberg-Forsch.*, p. 10 sqq.

As for non-European countries and towns, printing was established in Mexico in 1544, at Goa about 1550, at Tranquebar in 1569, Terceira in the Azores 1583, Lima 1585, Manila and Macao (China) 1590, in Haiti in the beginning of the 17th century, at Puebla in 1612, Cambridge (Mass.) 1638, Batavia 1668, Tiflis 1701, German-town 1735, Ceylon 1737, Halifax (Nova Scotia) 1766, Madras 1772, Calcutta 1778, Buenos Aires 1789, Bombay 1792, in Egypt (at Alexandria, Cairo, and Gizeh) in 1798, at Sydney 1802, Cape Town 1806, Montevideo 1807, Sarepta 1808, Valparaiso 1810, Astrakhan 1815, in Sumatra and at Hobart Town and Santiago (in Chile) in 1818, in Persia (at Teheran) in 1820, and at Chios about 1821.[1]

Customs of Early Printers.

Till the moment (say 1477) that printing was practised in almost all the chief towns of the Netherlands, Germany, Italy, Switzerland, France, Spain, England, not a single printer carried away with him a set of types or a set of punches or moulds from the master who had taught him, but, in setting up his printing office, each man cast a set of types for his own use, always imitating as closely as possible the handwriting indigenous to his locality, or of some particular manuscript which he or his patron desired to publish. When we compare Schoeffer's 30-line Indulgence of 1454 with a manuscript copy of the same Indulgence dated the 10th of April 1454, now in the hands of a private collector at Wiesbaden, we see that the types used in printing that document were specially cast for the purpose after the model of the handwriting employed for the written copies. We know also that the types of the 36-line and 42-line Bibles and those of the Psalter of 1457 are the closest possible imitations of the ornamental church handwriting customary at the time of their production. Also, when we compare the 31-line Indulgence of 1454 with the German blockbook called the *Enndtchrist*, and both in their turn with the German MSS. of that period (especially the manuscript portions in the printed copies of the Indulgences), we see that the cutter of the text-type of the Indulgence, as well as the engraver of the blockbook, formed his characters according to some German handwriting (book hand) of the period. This imitation extended, not only to the shape of the individual letters of the alphabet, but likewise to all those combinations of letters (double *p*, double *f*, double *s*, *st*, *ti*, *tu*, *re*, *cu*, *ct*, *si*, *de*, *co*, *ci*, *te*, *ce*, *or*, *ve*, *po*, *fa*, *he*, *be*, &c.) and contractions (for *pro*, *-um*, *-em*, *-en*, *the-*, *uer*, *-bus*, *-bis*, *sed*, *am*, *tur*, *qui*, *quae*, *quod*, *secundum*, &c.) which were then, and had been for many centuries, in use by scribes. In most, if not all cases, the MSS. which the printers imitated were, as has been remarked above, indigenous to the place where they settled. Thus the first printers of Subiaco, though they were Germans and had most probably learnt the art of casting types and printing at Mainz, yet cut their types after the model of some Italian MS. which was free from any Gothic influence, but written in a pure Caroline minuscule hand, differing but slightly from the Caroline minuscules which the same printers adopted two years afterwards at Rome. The first Paris printers started in 1470 with a type cast entirely on the model of the Caroline minuscule handwriting then in vogue at Paris. John de Westphalia, who introduced printing into Belgium, used from the beginning a type which he calls Venetian. Therefore a great similarity (without absolute identity) between the types of two printers (*e.g.* Schoeffer and Ulr. Zell), should be attributed to the similarity of the handwritings which the printers followed, not to any attempt on their part to imitate each other's types. To this universal system (clearly discernible in the first twenty-five years of printing) of each printer setting up business with a new type cast by himself, there would be, according to the conjectures of some bibliographers, only two exceptions; one is Albrecht Pfister (see above); the other is the Bechtermunczes of Eltville (see above).[2]

Unevenness of Lines.

Another important feature in the earliest books is that the printers imitated, not only the handwriting, with all its contractions, combined letters, &c., but all the other peculiarities of the MSS. they copied. There is in the first place the unevenness of the lines, which often serves as a guide to the approximate date of an early printed book, especially when we deal with the works of the same printer, since each commenced with uneven lines, and gradually made them less uneven, and finally even. The unevenness was unavoidable in manuscripts as well as in blockbooks; but in the earliest printed books it is regarded as evidence of the inability of the printers to space out their lines. If this theory be correct, this inability was perhaps owing to the types being perforated and connected with each other by a thread, or to some other cause which has not yet been clearly ascertained. In some incunabula we find some pages with uneven lines, and others quite straight in the same book. It is not impossible, however, that the unevenness was simply part and parcel of the system of imitating MSS., and that only gradually (about 1473 or 1474, but in some cases later) printers began to see that even lines looked better than uneven. This seems clear when we observe that the imitation of MSS. was carried so far that sometimes things which deviated from the work of the scribe, but had accidentally been printed in, were afterwards erased and altered in conformity with the MS. The Paris Library, for instance, possesses two copies of the *Liber Epistolarum* of Gasparinus Pergamensis (printed at Paris in 1470), in both of which the initial G of the first line and the initial M of the fourth line were printed in, and, whilst they have been allowed to remain in one of the copies, in the other they were regarded as a fault and replaced by a rubricated L and M.

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[1] On the introduction of printing in various towns, consult Henry Cotton, *A Typog. Gazet.*, 8vo, Oxford, 1831 and (second series, 8vo, Oxford, 1866); (P. Deschamps) *Dict. de géogr. à l'usage du libraire*, (8vo, Paris, 1870); R. C. Hawkins, *Titles of the First Books from the Earliest Presses Established in Different Cities in Europe*, (4to, New York, 1884); Rob. Proctor, *Early Printed Books in the British Museum*, (1898), &c.

[2] In recent years Dr Dziatzko, overlooking the relation between MSS. and typography in its infancy, has attempted to show that the types of the 36-line Bible were imitations of those of the 42-line Bible.

Initials.

In the second place the initials of books or the chapters of books in MSS., and again in blockbooks and the earliest products of printing, were always, or at least in most cases (they are printed in the Indulgences of 1454), omitted by the scribe and the printer and afterwards filled in by the rubricator. As the latter artists were sometimes illiterate and very often filled up the gap by a wrong initial, we find in many MSS. as well as early printed books small letters written either in the margin or in the blank left for the initial, to guide the rubricator. In most cases where these letters (now called initial directors) were written in the margin, they were placed as much as possible on the edges of the pages in order that they might be cut away by the binder as unsightly; but in many incunabula they have remained till the present day.[1] Later on these initial directors were in many books printed in (in lower-case type) with the text. In all cases, whether written or printed, they were meant to be covered by the illuminated initial; but, as a matter of fact, the latter very seldom covers the initial-director so completely as to make it invisible, and in various cases the intended illumination was never carried into effect.

Hyphens.

With respect to the hyphens, which were used in the 1454 Indulgences and the 36-line and 42-line Bibles, always outside the printed margin, some of the earliest printers did not employ them at the moment that they started their presses, and in the case of some printers the non-use or use of hyphens, and their position outside or inside the printed margin, serve as a guide to the dating of their products. After about 1472 they become more uniform in their shape and more generally used.

Signatures.

The use of signatures was confined in MSS. mostly to mark the quires (with a numeral or a letter of the alphabet), sometimes also the leaves; in many cases they were written close to the bottom of the leaf, so that they might be cut off by the binder, which has happened in many cases, wholly or in part, as may be seen in many MSS.; in blockbooks they are usually printed with the picture on each sheet or page; they are not printed in incunabula close to the bottom line of the page before 1472 (at least in no earlier book with a date), when they appear in Joh. Nider's *Praeceptorium Divinae Legis*, published by Johan Koelhoff at Cologne. Caxton did not adopt them till 1480. In the books printed before 1472 they were written by the rubricator or the binder, in the same way as in the MSS.

Catchwords.

Catchwords (custodes) were used for the first time about 1469 by Johannes of Spires, at Venice, in the first edition of Tacitus.

Pagination.

Pagination or rather foliation was first used by Arn. Ther Hoernen, at Cologne in 1471, in Adrianus's *Liber de remediis fortuitorum casuum*, having each leaf (not page) numbered by figures placed in the end of the line on the middle of each right-hand page.

Slowness of Progress at First.

The practice among early printers of imitating and reproducing MSS. was not abandoned till many years after the first dated document (1454) made its appearance; and, looking at the books printed, say from 1454 to 1477, from our present standpoint, the printing of that period may be said to have been almost wholly stagnant, without any improvement or modification. If some printers (for instance, Sweynheym and Pannarts at Subiaco and Rome, and Nicolas Jenson at Venice) produced handsomer books than others, this is to be attributed to the beauty of the MSS. imitated and the paper used rather than to any superior skill. Generally speaking, therefore, we shall not be far wrong in saying that the workmanship of Ketelaer and De Leempt's first book, published at Utrecht *c.* 1473, and that of Caxton's first book issued at Westminster in 1477, exhibit almost the same stage of the art of printing as the 1454 Indulgences. If, therefore, any evidence were found that Ketelaer and De Leempt and Caxton had really printed their first books in 1454, there would hardly be anything in the workmanship of these books to prevent us from placing them in that year. And conversely, if the Indulgences of 1454 had been issued without a date or without any names to indicate their approximate date, their workmanship might induce bibliographers to ascribe them to *c.* 1470, if not somewhat later. Even after 1477 alterations in the mode of printing books came about slowly and almost imperceptibly. It was no longer a universal system for printers to begin business by casting a type for themselves, but some received their types from one of their colleagues. And, though there were still many varieties of types, one sort began to make its appearance in two or three different places. The combinations of letters were the first to disappear; but the contractions remain in a good many books even of the 17th century.

Some theories have been based on, and others have been considered to be upset by, the supposition that the early printers always required as much type as printers of the present day, or at any rate so much as would enable them to set up, not only a whole quire of 4 or 5 sheets (=8 or 10 leaves=16 or 20 pages), but even two quires (=40 pages). Consequently calculations have been made that, for instance, the printer of the 42-line Bible required a fount of at least 120,000 characters. See Bernard, *Orig. de l'impr.* i. 164, who was a printer himself and speaks very strongly on this point. But there are numerous proofs that many early books were printed page by page; even when in small 4to. For instance, in some books it has been observed that portions of the types with which the text of the first, second or third pages of a quire had been printed, were used to "lock up" the types employed for the later pages of the same quire, as is evident from the blank impressions of such portions being found on these later pages. Again, in some small books, two, three or four blank leaves are found at the end, showing a miscalculation of the printer at the commencement. Moreover, numerous itinerant printers of the 15th century established a press for a short time wherever they went, which proves that the furniture of the earliest printing-offices cannot have been of any great extent.

Early Types and their Fabrication.—We must now take notice of two theories or traditions which have been current for a long time as to some intervening stage between the art of block-printing and the art of printing with movable cast metal types.[2] One theory or tradition would have it that the inventor of printing, after the idea of single, individual, movable types had arisen in his mind, practised his new invention for some time with wooden types, and that he came only gradually to the idea of movable types cast of metal.

Wooden Types.

Junius gives us to understand that the Dutch *Speculum* was printed with such wooden types. Of Johann Gutenberg it was asserted that he printed his first Bible with wooden types. The Mainz psalter, printed in 1457 by Joh. Fust and Peter Schoeffer, was alleged to have been printed with wooden types, in which case the 4th edition, published in 1502, and even the 5th edition of 1516, would be printed with wooden types, the same being used for them as for the editions of 1457 and 1459. Theod. Bibliander was the first to speak (in 1548) of such types and to describe them: first they cut their letters, he says, on wood blocks the size of an entire page; but, because the labour and cost of that way was so great, they devised movable wooden types, perforated and joined one to the other by a thread.[3] Bibliander does not say that he had ever seen such types himself, but Dan. Speckle or Specklin (d. 1589), who ascribed the invention to Mentelin, asserts that he saw some of these wooden types at Strassburg.[4] Angelo Roccha asserted in 1591 that he had seen at Venice types perforated and joined one to the other by a thread, but he does not say whether they were of wood or of metal.[5] In 1710 Paulus Pater asserted that he had seen wooden types made of the trunk of a box-tree, and perforated in the centre to enable them to be joined together by a thread, originating from the office of Fust at Mainz.[6] Bodman, as late as 1781, saw the same types in a worm-eaten condition at Mainz; and Fischer stated in 1802 that these relics were used as a sort of token of honour to be bestowed on worthy apprentices on the occasion of their finishing their term.

Besides those who believed in these wooden types from the fact that the letters (especially in the *Speculum*) vary among themselves in a manner which would not be the case had they been cast from a matrix in a mould, there were authors and practical printers who attempted to cut themselves, or to have cut for them, some such wooden types as were alleged to have been used by the early printers. Some of them came to the conclusion that such a process would be quite practicable; others found by experiment that it would, in the case of small types, be wholly impossible. Nearly all the experiments, however, were made with the idea that the inventor of printing, or the earliest printers, started, or had to start, with as large a supply of type as a modern printer. This idea is erroneous, as it is known that, for a good many years after the first appearance of the art, printers printed their books (large or small) not by quires (quaternions or quinternions) but page by page.[7] Therefore, all considerations of the experimenters as to the impracticability of such wooden types, on account of the trouble and length of time required for the cutting of thousands of types, fall to the ground in face of the fact that the earliest printers required only a very small quantity of type, in spite of the peculiar forms (combined letters, letters with contractions, &c.) which were then in vogue. Up to the present time no book or document has come to light which can be asserted to have been printed from single, movable, wooden types. But we have seen above that the Haarlem tradition, as told by Junius, distinctly points to such types having been used for, among other things, the first edition of the Dutch Spiegel, and no one examining this edition (of which two copies are preserved at Haarlem) would deny that there are grounds for this belief; the dancing condition of the lines and letters making it almost impossible to think that they are metal types. For how long and to what extent such types were employed, if at all, we cannot say.

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[1] The university library of Basel possesses a collection of the earliest Paris books still bound in their original binding, in which these initial directors are written not only on the outer edges, but on the inner sides of the pages, and so close to the back that they can only be seen by stretching the books wide open.

[2] We do not allude to Tritheim's assertion that the *Catholicon* of 1460 was printed from wooden blocks; for this story, which he declares he had heard from Peter Schoeffer, if it were true, would belong to the history of block-printing. Nor need we speak of Bergellanus's verses (1541), in which he distinctly alludes to carved blocks.

[3] *Commentatio de ratione communi omnium linguarum et literarum*, p. 80 (Zurich, 1548).

[4] *Chron. Argent.* MS. ed. Jo. Schilterus, p. 442.

[5] *De Bibliotheca Vaticana*, p. 412 (Rome, 1591).

[6] *De Germaniae miraculo*, p. 10 (Leipzig, 1710).

[7] See, for instance, W. Blades, *Life of Caxton*, i. 39.

Sculpto-fusi Types.

The other theory would have it that between block-printing and printing with movable cast types there was an intermediate stage of printing with "sculpto-fusi" types, that is, types of which the shanks had been cast in a quadrilateral mould, and the "faces," *i.e.* the characters or letters engraved by hand afterwards. This theory was suggested by some who could not believe in wooden types and yet wished to account for the marked irregularities in the types of the earliest printed books.

Gerardus Meerman, the chief champion of this theory, based it, not only on the words of Celtes (*Amores*, iii. 3), who in 1502 described Mainz as the city "quae prima sculpsit solidos aere characteres," but on the frequent recurrence of the word *sculptus* in the colophons of the early printers (for Jenson and Husner of Strassburg, see p. 514 above). Sensenschmid in 1475 said that the *Codex Justinianus* was "cut" (*insculptus*), and that he had "cut" (*sculpsit*) the work of Lombardus, *In Psalterium*. Meerman also interpreted the account of the invention of printing by Trithemius[1] as meaning that, after the rejection of the first wooden types, the inventors discovered a method of casting the bodies only of all the letters of the Latin alphabet from what they called matrices, on which they cut the face of each letter; and from the same kind of matrices a method was in time discovered of casting the complete letters of sufficient hardness for the pressure they had to bear, which letters they were before—that is, when the bodies only were cast—obliged to cut.[2] In this way Meerman explained that the *Speculum* was printed in sculpto-fusi types, although in the one page of which he gives a facsimile there are nearly 1700 separate types, of which 250 alone are e's. Schoepflin claimed the same invention for Strassburg, and believed that all the earliest books printed there were produced by this means. Meerman and Schoepflin agreed that engraved metal types (*literae in aere sculptae*) were in use for many years after the invention of the punch and matrix, mentioning among others so printed the Mainz psalter, the *Catholicon* of 1460, the Eggestein *Bible* of 1468, and even the *Praeceptorium* of Nider, printed at Strassburg in 1476. But the difficulty connected with the process of first casting the shanks and afterwards engraving the faces of the types has become apparent to those who have made experiments; and it seems more probable that the terms *sculpere, exsculpere, insculpere*, are only a figurative allusion to the first process towards producing the types, namely, the cutting of the punch, which is artistically more important to the fabrication of types than the mechanical casting—all the more as Schoeffer in 1468 makes his *Grammatica vetus rhythmica* say, "I am cast at Mainz," an expression which could hardly be anything but a figurative allusion to the casting of the types.

Types Cast in Sand.

Granting that all the earlier works of typography preserved to us are impressions of cast-metal types, there are still differences of opinion, especially among practical printers and type-founders, as to the probable methods employed to cast them. It is considered unlikely that the inventor of printing passed all at once to the perfect typography of the punch, the matrix and the mould. Bernard[3] thought that the types of the *Speculum* were cast in sand, as that art was certainly known to the silversmiths and trinket-makers of the 15th century; and he accounts for the varieties observable in the shapes of various letters on the ground that several models would probably be made of each letter, and that the types, when cast by this imperfect mode, would require some touching up or finishing by hand. He exhibits a specimen of a word cast for him by this process which not only proves the possibility of casting types in this manner, but also shows the same kind of irregularities as those observable in the types of the *Speculum*.

But here again it is argued that in types cast by this or any other primitive method there would be an absence of uniformity in what founders term "height to paper." Some types would stand higher than others, and the low ones, unless raised, would miss the ink and not appear in the impression. The comparative rarity of faults of this kind in the *Speculum* leads one to suppose that, if a process of sand-casting had been adopted, the difficulty of uneven heights had been surmounted either by locking up the forme face downwards, or by perforating the types, either at the time of casting or afterwards, and holding them in their places by means of a thread or wire. To this cause Ottley attributed the numerous misprints in the *Speculum*, to correct which would have involved the unthreading of every line in which an error occurred. And, as a still more striking proof that the lines were put into the forme one by one, in a piece, he shows a printer's blunder at the end of page 42 in the unmixed Dutch edition, where the whole of the last reference-line is put in upside down, thus:—

Noe vuas bespot slapende ende niet vuetende.
Genesis ix capitel.

A "turn" of this magnitude could hardly have occurred if the letters had been set in the forme type by type.

Types Cast in Clay Moulds.

A second suggested mode is that of casting in clay moulds, by a method very similar to that used in the sand process, and resulting in similar peculiarities and variations in the types.

Ottley, who was the chief exponent of this theory, suggested that the types were made by pouring melted lead or other soft metal into moulds of earth or plaster, after the ordinary manner used from time immemorial in casting statues of bronze and other articles of metal. But the mould thus formed could hardly avail for a second casting, as it would be scarcely possible to extract the type after casting without breaking the clay, and, even if that could be done, the shrinking of the metal in cooling would be apt to warp the mould beyond the possibility of further use. Ottley therefore suggests that the constant renewal of the moulds could be effected by using old types cast out of them, after being touched up by the graver, as models—a process which he thinks will account for the varieties observable in the different letters, but which would really cause such a gradual deterioration and attenuation in the type, as the work of casting progressed, that in the end it would leave the face of the letter unrecognizable as that with which it began. It would, therefore, be more reasonable to suppose that one set of models would be used for the preparation of all the moulds necessary for the casting of a sufficient number of types to compose a page, and for the periodical renewal of the moulds all through the work, and that the variations in the types would be due, not to the gradual paring of the faces of the models, but to the different skill and exactness with which the successive moulds would be taken.

It is evident that the sand and clay methods of casting types above described would be slow. The time occupied after the first engraving of the models in forming, drying and clearing the moulds, in casting, extracting, touching up and possibly perforating the types required for one page, would exceed the time required by a practised xylographer for the cutting of a page of text upon a block. But he that has gone through the trouble of casting separate movable types has a clear gain over the wood-block printer in having a fount of movable types, which, even if the metal in which they were cast were only soft lead or pewter, might be used again and again in the production of any other page of text, while the wood block can only produce the one page which it contains. Moreover, only one hand could labour on the xylographic block; but many hands could be employed in the moulding and casting of types, however rude they might be. Bernard states that the artist who produced for him the few sand-cast types shown in his work assured him that a workman could easily produce a thousand such letters a day. He also states that, though each letter required squaring after casting, there was no need to touch up the faces.

Polytype.

A third suggestion was made as to the method in which the types of the rude school may have been produced. This may be described as a system of what the founders of about 1800 called polytype, which is a cast or facsimile copy of an engraved block, matter in type, &c.

Lambinet,[4] who is responsible for the suggestion, based upon a new translation of Trithemius's narrative, explains that this process really means an early adoption of stereotype. He thinks that the first printers may have discovered a way of moulding a page of some work—an *Abecedarium*—in cooling metal, so as to get a matrix-plate impression of the whole page. Upon this matrix they would pour a liquid metal, and by the aid of a roller or cylinder press the fused matter evenly, so as to make it penetrate into all the hollows and corners of the letters. This tablet of tin or lead, being easily lifted and detached from the matrix, would then appear as a surface of metal in which the letters of the alphabet stood out reversed and in relief. These letters could easily be detached and rendered mobile by a knife or other sharp instrument, and the operation could be repeated a hundred times a day. The metal faces so produced would be fixed on wooden shanks, type high, and the fount would then be complete. Lambinet's hypothesis was endorsed by Firmin-Didot, the renowned type-founder and printer of Lambinet's day. But it is impossible to suppose that the Mainz psalter of 1457, which these writers point to as a specimen of this mode of execution, is the impression, not of type at all, but of a collection of "casts" mounted on wood.

Yet another theory has been proposed by Dr Ch. Enschedé, head of the celebrated type foundry of the same name at Haarlem, who says (pp. 15 sqq. of his *Technisch onderzoek naar de uitvinding van de Boekdrukkunst*, 1901), that the principle of a printing surface

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[1] *Annales Hirsaugienses*, ii. 421: "Post haec inventis successerunt subtiliora, inveneruntque modum fundendi formas omnium Latini alphabeti literarum, quas ipsi matrices nominabant, ex quibus rursum aeneos sive stanneos characteres fundebant, ad omnem pressuram sufficientes, quos prius manibus sculpebant."

[2] *Origines typographicae*, app. p. 47 (The Hague, 1765).

[3] *Origine de l'imprimerie*, i. 40.

[4] *Orig. de l'imprimerie* i. 97 (2 vols. 8vo., Paris, 1810).

Enschedé Theory.

composed of separate pieces was known to the block-printer, but he would have found it impossible to use small insulated blocks of wood for printing, or to manufacture them for that purpose with the necessary mathematical precision. Hence the idea of separate movable characters was not the invention of printing, but the art of casting them, and this was a work not for the block-printer, but for another industry, for a foundry.

From the types of B^{36} and B^{42} Enschedé concludes that Gutenberg's punches (patrices) were made, like the bookbinders' stamps, of yellow copper (brass, Germ. *Messing*). With such patrices only leaden matrices could be made, but the latter could be produced in two ways: the lead can be poured over the patrix, or the patrix be pressed into cold lead. The first mode is somewhat complex, but the matrix would have a smooth surface, and need no further adjustment. The second mode is more simple, but requires great force, although lead is a soft metal. Moreover, the surface of the matrix has to be trimmed, as the impression forces the lead downwards and sidewards, which makes the surface uneven, though by this pressure the lead becomes firmer and more compact, to the advantage of the type-founder. Enschedé thinks that Gutenberg's letters must have been sharp, and that he obtained his matrices by the second mode; he had each letter engraved on a brass plate, 2mm. thick, therefore a mere letter without anything underneath it. This letter (patrix) was pressed, by means of a small flat plate, so far into the metal that its back formed one surface with the top part of the lead, and then removed. After the patrix and matrix had been made in this way, the letter was to be cast, and Enschedé believes that for this work Gutenberg used what in Germany is called the *Abklatsch*-method, which, after having been gradually improved, was at last superseded by more perfect machinery. By this method the letter was cast in two tempos. First the letter itself on a small plate; then the plate placed underneath a casting-form, to fix it to a small shank, which was to be cast into the form and would make, with the plate, the exact height of the letter. The letter on the plate was made not by pouring the metal into the matrix, but by beating the latter into the molten metal. When lead is heated so as to be a soft mass it easily assumes the form of any object which falls on or in it, therefore also of the matrix, which is the image of the engraved type. When the metal is not overheated it will immediately cool down by contact with the cold matrix, so that the latter will not be injured, although it consists of the same substance as the molten metal. In this way a great many letters can be cast from one matrix. Enschedé describes various difficulties connected with this method, and tells us that only large letters, like those of B^{36} and B^{42}, could be made by it, as the operation of adding the shank to the letter becomes impossible in the case of smaller letters. Hence Gutenberg, having conceived the idea of printing from seeing (!) the Dutch *Donatuses*, chose this large size of type for his work; for the smaller types of the 1454 Indulgences a copper matrix was required, which, in its turn, necessitated the use of a steel patrix, the introduction of which he ascribes, as others have done before him (*e.g.* Bergellanus), to Peter Schoeffer.

As to the Costerian types, their bad and irregular condition shows, he thinks, that they were produced from leaden matrices, and the latter from brass patrices, though wooden patrices are also possible, but not probable. All the tools, however, were imperfect, and the workmen inexperienced, and therefore bound to produce such imperfections as he finds in the *Abecedarium* and *Donatus* types. But the types were cast in one tempo; the *Abklatsch*-method would have been out of the question for them on account of their small size. In this way Enschedé thinks Coster, not having learnt his art from anybody, invented the type cast with the staff, in one tempo, while Gutenberg, having had a Costerian *Donatus* as his model, cast his large types in two tempos by the *Abklatsch* system till Peter Schoeffer, by means of his steel patrices, was able to cast smaller types such as those of the 1454 Indulgences, with staff and all.

Enschedé warns us that he is merely making suggestions as a type-founder, that he is not a bibliographer, and leaves the interpretation of documents to others. We quote his theories as coming from such a qualified type-founder, and because they have made some impression in certain quarters, but they lead us away from the real points connected with the invention of printing. First of all the "casting of metal types" is not, as he thinks, the *first* stage in the invention; its beginning, its essence is, and has always been thought to be, the *movability* of the characters. This movability, and the accidental way in which it was discovered, form together the pith of the Haarlem tradition as told by Junius. He indicates it, without using the word "movable," by saying that Coster, while walking in the Haarlem wood, cut some letters in the bark of a tree, and with them, "reversely impressed *one by one* on paper," composed one or two lines. Nothing seems more natural than that a block-printer (as the printer of the xylographically printed *Speculum* must have been) should cut such separate letters, and thereupon perceive that they could be used over and over again for a variety of words, on different pages, while those which he used to cut in a block only served him for one page and for one purpose. It is equally clear from the Haarlem tradition that the art of *casting metal* types was the *second* stage in the invention, a development or outcome of the primary idea of "movable letters," and the realization of their advantage, for Junius says that Coster "afterwards changed the beechen characters into leaden, and the latter again into tin ones." This also shows that the discoverer of the insulated movable wooden letters—after realizing, perhaps, that they could not endure much pressure, or missed (as Enschedé says) the mathematical precision necessary for his purpose—transformed himself from a woodcutter into a letter-founder, and had no recourse (as Enschedé would have it) for casting his types to a foundry apart from his own. As this transformation is possible and probable there seems to be no reason for departing from the simple but clear Haarlem tradition as we read it in Junius.

In the infancy of printing every printer, in different countries and different towns, starts with his own types; hence we may conclude that he had learnt the art of engraving and casting them himself, and so combined the art of type-founding with that of printing. This points back to a combination of the two or three arts in the first printing-office. It would be strange if the inventor of the movable letters, whom we have shown to have been a block-printer, and therefore acquainted with the art of engraving letters, and other mechanical contrivances connected with printing, had lacked the ability, which his immediate followers possessed, of imparting to his movable characters, by some means or another, that firmness and precision which he required for the realization of his invention. How long Coster had been a block-printer before he invented, and how long and to what extent he continued to use, the movable wooden letters, we cannot tell.

That Enschedé ascribes to Coster the invention of casting metal types with a shank (as they have been manufactured for centuries afterwards), and that of another mode of manufacturing types (the *Abklatsch*-method) to Gutenberg, suggested to the latter by *seeing* (!) the *Donatuses* printed at Haarlem, looks like an amiable attempt to get over the unpleasant tradition of the theft of Coster's types, but his theories are irreconcilable with the Haarlem tradition, with Zell's account of the relation between Dutch and Mainz printing and with bibliography in general.

It is not surprising that Enschedé's theories called forth others from Zedler (*Veröffentl.* i. 34), who argues as follows: Enschedé says rightly that the type of the Hague Dutch *Donatus* is more defective than that of any other 15th-century book, more than even that of the Paris *Donatus*. Such types could not have been cast from a copper matrix. But a printer who had derived his art of casting types from Gutenberg or one of his pupils, would hardly, after the introduction of the steel stamp and the copper matrix (necessary for manufacturing the small types of the 1454 Indulgences), have returned to the casting of a small type from a leaden matrix, and used, moreover, a process which remained, in its consequences, behind that of Gutenberg. Zedler then points to a peculiarity of the earliest Dutch incunabula already mentioned above, namely, the sign of contraction connected with some letters by a fine stroke, which he says is not (!) found in the Dutch block-books, or in the Dutch MSS. He thinks, therefore, that this stroke was required by the method of casting this type. The stamp for making the matrix cannot have been *a staff*, on the lower end of which the *reversed* letter was cut, but a mere letter without any footing. Consequently, it must have consisted of lead not wood, and have been manufactured in the same way as Gutenberg's type was made, according to Enschedé. Every sign of contraction had to be one whole with the letters to which they belonged to prevent their being shifted during the process of printing. The letters cast from the matrix made in this way had as foot a thin square plate which enclosed the letter but no staff, owing to the mode of making the stamp and the matrix. If the Dutch printer had intended to cast a type with a staff by means of a casting tool, however primitive, he would not have required the thin plate. But his letters, with a thin plate as their foot, required to be pasted on a sheet of strong paper, so as to be firmly connected in words and sentences for the purpose of printing. Hence the printer could regulate the spaces between the words, without using, like Gutenberg, spaces of a definite width for this purpose, so that he had no trouble in making the lines end evenly. From such a printing-surface with a firm footing, it was possible, after the ground had become hard, to obtain impressions just as from movable types enclosed in the forme. Zedler was told by an expert that, technically, there was nothing against such an explanation, but, he says, if it were correct, it would not solve the question, not yet satisfactorily answered, as to what we have to understand by the printed Dutch *Donatuses*. The "doctrinal jetté en molle" of Jean le Robert and the *libri impressi*, mentioned under the year 1450 in the *Memorial* of the monastery Weidenbach in Cologne would then be books printed from such printing plates with separately cast letters. In this way Zells' account in the *Cologne Chronicle* would be confirmed (!). We should also understand why the Dutch, though knowing the art of casting types, only printed *Donatuses* and similar small schoolbooks, for which there was much demand, for in the present day, stereotype-printing is likewise used for books which, when editions follow each other rapidly, have to be printed unaltered. In this case Gutenberg would not be the inventor of the cast letter. But the Dutch could not claim, with Enschedé, the honour of the invention of movable metal types. They invented the casting of letters, but it would be Gutenberg's merit to have invented the *movable* cast types. At any rate he would be the inventor of the casting instrument whereby the letter with the staff became independent, that is movable. The early Dutch printing letter, which could only be used by being firmly footed on a plate, would have missed its real value for printing, its free movability.

Zedler, for want of data, cannot say where and when Gutenberg learnt the technics of early Dutch printing, though the *Cologne Chronicle* tells us that from this printing his work began. But he thinks that the secret arts which occupied Gutenberg at Strassburg, and which, when the documents are impartially (!) considered, can be regarded as nothing but experiments in the printing of books, are earlier than 1440. He will not decide whether Gutenberg has been in Holland, or whether this historical kernel is the foundation of the Coster legend (!) of Adrianus Junius which is independent of the *Cologne Chronicle*. Anyhow, Gutenberg still required ten years of hard work and troublesome experiments, before he, basing himself on the early Dutch printing, whatever this may have been, could become the inventor of the present mode of printing books.

We here see how Enschedé's theories give rise to Zedler's structure of theories. When the former says that Gutenberg chose for his first work the large letters of B^{36} and B^{42}, because the Abklatsch-method (invented [?] by him) was only fit for large letters, he forgets that the printers of these Bibles, wishing to apply their new art to the production of copies of the Bible in a speedier way than the scribes of their time were able to do, had, of necessity, to design their types from the large ornamental church-hand then in vogue for Bibles, Psalters, Missals, &c. For the same reason they prepared different, much smaller, types for the Indulgences of 1454, as the manuscript copies of these Indulgences, handed to them as "copy," were written in the bastard Roman book-hand, used for such documents. When the arts of casting types and of printing with them found their way to Mainz they were new in that city, but they came there already well-developed, and the printers, whoever they were, knew how to prepare themselves for any book or document which it was thought desirable to print. But of these questions Enschedé takes no account. He ascribes the two Bibles to Gutenberg, because Dziatzko has done so, without inquiring whether Gutenberg (not Pfister) had, after all, anything to do with B^{36}.

Zedler's theories, partly developments, partly corrections of those of Enschedé's, are based on the misapprehension that a peculiarity in the Costerian types, *i.e.* the connexion of the signs of contractions by a fine stroke with the letters over which they stand, does not occur either in the Dutch blockbooks or in the Dutch MSS. This connexion, however, far from being not found, is a conspicuous feature, in the Dutch blockbooks and MSS., and being faithfully reproduced in the Costerian types, shows how near these types stand to the block-printing and MS. periods. Zedler does not explain how he would print with the plate-footed types, pasted on strong paper, which he ascribes to Coster. Nor does he say whether he ever examined the Costerian editions of the *Speculum*, *Donatuses*, &c., to see whether they showed any traces of such awkward contrivances.

After having done justice, we hope, to these latest theories, which, in spite of their great length, leave many things unexplained, it is a pleasure to read once more Junius's unvarnished account of the Haarlem tradition, which contains no intricate theories, but a simple explanation of the rise and progress of printing with movable (metal) types in that city. The reading of it shows that real facts can be explained in a few words, while theories require long explanations, first for explaining away the real facts, and then for explaining the theories, which after all lead us astray.

Shape of Earliest Type.

The shape and manufacture of the types used as early as *c.* 1470 do not seem to have differed materially from those of the present types. This is evident (1) from the shape of the old types which were discovered in 1878 in the bed of the river Saône, near Lyons, opposite the site of one of the 15th-century printing-houses of that city, and which there is reason to believe belonged once to one of those presses, and were used by the early printers of Lyons; (2) from a page in Joh. Nider's *Lepra moralis*, printed by Conrad Homburch at Cologne in 1476, which shows the accidental impression of a type, pulled up from its place in the course of printing by the ink-ball, and laid at length upon the face of the forme, thus leaving its exact profile indented upon the page; (3) from an entirely similar page (fol. 4^{b}) in *Liber de laudibus ac festis gloriosae Virginis* (Cologne, *c.* 1468). From the small circle appearing in the two last-mentioned types, it is presumed that the letters were pierced laterally by a circular hole, which did not penetrate the whole thickness of the letter, and served, like the nick of modern types, to enable the compositor to tell by touch which way to set the letter in his stick. The fact that in these two cases the letter was pulled up from the forme seems to show that the line could not have been threaded.

Vinc. Fineschi, *Notizie Storiche sopra la stamperia di Ripoli*, p. 49 (Florence, 1781), gives an extract from the cost-book of the Ripoli press, about 1480, which shows that steel, brass, copper, tin. lead and iron wire were all used in the manufacture of types at that period.[1]

History of the Earliest Types.—The history and nomenclature of the earliest types are practically a continuation of the history and nomenclature of the characters figured in the earliest blockbooks, wood-engravings and MSS. For instance, Gothic type was first used, say, about the year 1445; but Gothic writing, of which that type was an imitation, was already known and used about the second half of the 12th century and can be traced still farther back (see above). Again, the pure Roman type, which appeared about 1464, is nothing but an imitation of what in palaeography is called the Caroline minuscule, a handwriting which was already fully developed towards the end of the 8th century (see PALAEOGRAPHY).

The broad outlines of the history of the earliest types are as follows:—

Gothic.

Gothic type, of the angular or pointed kind, was first used by the Haarlem printer of the *Speculum*, *Donatus*, &c. (see specimen No. 1, taken from the British Museum copy of the *Speculum humanae salvationis*, mixed Latin edition), presumably *c.* 1445. An entirely similar but larger type (No. 2, taken from the British Museum copy of Ludovicus [Pontanus] de Roma, *Singularia*) was used, presumably by the same printer, *c.* 1465–1470. Gothic type appeared in Germany as a church type in 1454, in the 31-line Indulgence, presumably printed by Johan Gutenberg at Mainz (No. 3, from the Göttingen copy), and in the 30-line Indulgence (No. 4, taken from the British Museum copy), printed by Peter Schoeffer at Mainz. Type No. 3 was also used about the same time for the 36-line Bible, and type No. 4 for the 42-line Bible. Two much larger Gothic types appeared in the Psalter of 1457, published by Fust and Schoeffer (see Bernard, *Origine*, pl. vii.). In Italy Gothic type appears in 1468 (No. 5, taken from the British Museum copy of Cicero, *De oratore*, published at Rome by Ulr. Hahn, the 15th of December 1468, in small Roman type, with imprint in Gothic), but in a more rounded form; it is practically the ordinary Italian writing influenced by the Gothic. In France Gothic began to be used in 1473; in England it appears first in Caxton's type about the year 1480.[2] It was employed extensively in a great many of the earliest presses all over Europe, and continued to be used largely at all times, especially for Bibles, law books, royal proclamations, &c., and even to this day it is the national character of Germany. It is now usually called *lettre de forme*, *black letter* or *English* in English-speaking countries, *lettre flamand* in Holland, and *fractur* in Germany.

Bastard Italian or Roman.

Bastard Italian or bastard Roman was introduced in 1454 at Mainz in the 31-line (No. 6) and 30-line (No. 7) Indulgences. It is also called *lettre de somme*, some think from the *Summa* of Thomas Aquinas, printed in the type of the Bible of 1462 by Fust and Schoeffer. Varieties of this kind of type were, like the Gothic, much used by the earliest printers, as, for instance, the printer of the 1460 *Catholicon*, Mentelin of Strassburg, *c.* 1460, and Ulrich Zell at Cologne, *c.* 1466, &c. In England it appeared in the first three books printed (1478, 1479) at Oxford (No. 8, taken from the British Museum copy of Jerome's *Expositio in Simbolum Apostolorum* wrongly dated 1468 for 1478).

Roman.

Roman type, the Caroline minuscule of palaeography, was first used in Germany about 1464, Strassburg, by the printer whose fount of type is known by a peculiarly shaped R, and who on that account is usually called "the R printer" (No. 9, taken from the British Museum copy of Durandus, *Rationale*, of which the Basel library possesses a copy which was bought in 1464).[3] In Italy it appears in 1465 at Subiaco (see Bernard pl. xii. No. 19), at Rome in 1467 (*op. cit.* pl. xii. No. 20), but in all its purity at Venice in 1469, used by Johannes of Spires (*op. cit.* pl. xii. No. 25), and at Paris in 1470 (*op. cit.* pl. xiii. No. 25). In England it was not used before 1518, when Richard Pynson printed Pace's *Oratio in Pace nuperrima* (see facsimile in Reed's *Type Foundries*, p. 92).

Burgundian.

Burgundian type, or *gros batarde* or *secretary*, was first used about 1470–1472 by Colard Mansion at Bruges (No. 10, taken from the British Museum copy of *La Controversie de Noblesse*, *c.* 1471–1472). With a somewhat similar type (No. 11, taken from the British Museum copy of the *Recuyell*) William Caxton is presumed to have printed, likewise at Bruges, a set of five books, of which the *Recuyell of the History of Troye*, a translation of a work by Raoul le Fèvre, is the best known and was probably printed *c.* 1471.[4] To this same class belong the first type (No. 12, from the British Museum copy of the *Dictes*) used in England by William Caxton for the printing of *Dictes and Sayings of the Philosophers* (Nov. 18, 1477), and that used by the printer of St Albans (No. 13, taken from the Cambridge University Library copy of Aug. Dactus, *Elegancie*). It was an imitation of the manuscript hand of the English and Burgundian scribes of the 15th century, and, after having figured for a long time in several of the early London and provincial presses, was about 1534 entirely superseded by the English black letter. To this class of type belong also the later *lettre de civilité* (*c.* 1570), the *script* (*lettre coulée*, *lettre de finance*, Dutch, *geschreven schrift*), *set court*, *base secretary*, and *running secretary* types.

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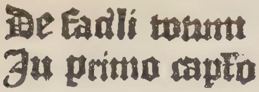
[1] On the above theories and types consult T. B. Reed, *Old English Letter Foundries*, pp. 3–26.

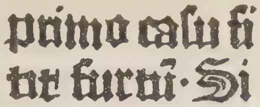
[2] See Blades, *Life of Caxton*, pl. xvii.

[3] See Jules Philippe, *L'Imprimerie à Paris*, p. 219.

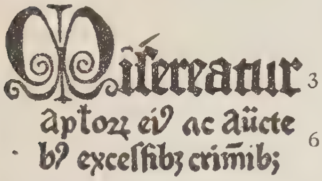
[4] Cf. Blades, *Life of Caxton*.

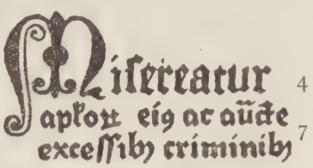

De facili totum
Ju primo capſo

No. 1.—*Speculum* type *c.* 1445 (?).


primo caſu ſi
tur furni·Si

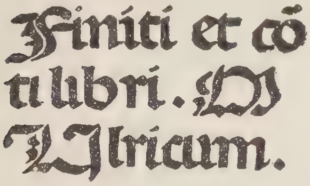
No. 2.—Pontanus type, *c.* 1470 (?).


Miſereatur
aptoꝝ eiꝰ ac aūcte
bꝫ exceſſibꝫ crimibꝫ;

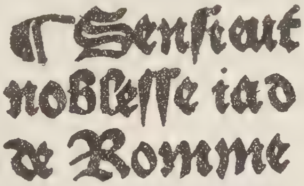

Miſereatur
aptoꝝ eiꝫ ac aūcte
exceſſibꝫ criminibꝫ

Nos. 3 and 6.—Mainz 31-line Indulgence, 1454.

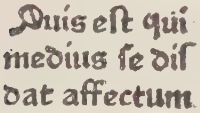
Nos. 4 and 7.—Mainz 30-line Indulgence, 1454.


Finiti et cō
ti libri. M
Tulliam.

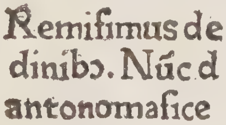
No. 5.—Cicero, *De oratore*, 1468.


Senſcaut
nobleſſe iad
de Romme

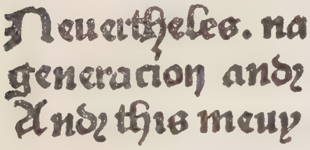
No. 10.—*Controversie de Noblesse*, *c.* 1471–1472.


Quis eſt qui
medius ſe diſ
dat affectum

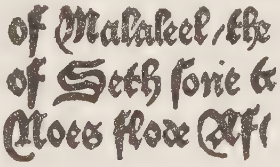
No. 8.—Jerome's *Expositio* (1468), 1478.


Remiſimus de
dinibꝫ. Nūc d
antonomaſice

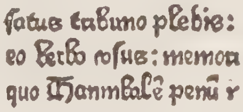
No. 9.—Durandus, *c.* 1464.


Neuertheles. na
generacion and
And this meuy

No. 11.—*Recuyell of the Hist. of Troye*, *c.* 1471.


of Malaleel / the
of Seth ſone &
Cloes floxe Af

No. 12.—*Dictes and Sayings*, 1477.


ſatus tabuno plebis:
eo verbo roſus: memori
quo Hannibal' penū r

No. 13.—Aug. Dactus, *Elegancie*, 1479.

On the types, illustrations, initials, &c., before 1500, consult also the facsimiles in Holtrop's *Mon. typ. des Pays-Bas* (the Hague, 1868); R. C. Hawkins, *First Books and Printers of the Fifteenth Century* (New York, 1884); William Blades, *The Life of Caxton* (London, 1861–1863); Bernard, *Origine de l'imprimerie*, vol. i. pls. iii.–xiii. (Paris, 1853); Placidus Braun, *Notitia de libris ab artis typogr. inventione usque ad annum 1479 impressis* (Augsburg, 1788); H. Noel Humphreys, *Hist. of the Art of Printing*, fol. (London, 1867); *Veröffentlichungen der Gesellsch. für Typenkunde des 15. Jahrhunderts.* Edd. Isak Collyn, Rud. Haupt, H. O. Lange, K. Haebler, V. Madsen, E. Voullième, vol. i, &c. (220 facs. published, Leipzig, 1907–); *The Woolley* [Geo. Dunn], *Photographs of Early Types* (400), designed to supplement published examples with references to the British Museum Index 1899–1904, 5 pts., folio; K. Burger, *Deutsche und italienische Inkunabeln, in getreuen Nachbildungen herausgeg.*, pts. 1–8 (200 pls.), folio (Berlin, 1892–); E. Gordon Duff, *Early English Printing*, a series of facs., folio (London, 1896); Ch. Enschedé, *Fonderies de caractères et leur matériel dans les Pays-Bas du 15me au 19me siècle*, fol. (Haarlem, 1908); Horace Hart, *Notes on a Century of Typography at the University Press, Oxford, 1693–1794*, folio (Oxford, 1900); Olgar Thierry-Poux, *Premiers monuments de l'imprimerie en France au 15me siècle*, fol. (Paris, 1890); *British Museum* (*Facsimiles from early printed books in the*), (1897), 32 pls. folio; *Type Facsimile Society*, folio (Oxford, 1900–).

The types after 1500 can best be learned from the catalogues of type-founders, among which those of Messrs Enschedé of Haarlem occupy a foremost place. Of others we may mention: *Indice dei caratteri nella stampa Vaticana*, 4to (Rome, 1628); *Épreuves des caractères qui se trouvent chez Claude Lameste*, 4to (Paris, 1742); *Épreuves des car. de la fonderie de Claude Mozet*, 8vo (Nantes, 1754); *Les Car. de l'imprimerie par Fournier le Jeune*, 8vo (Paris, 1764); *Proef van Letteren, Bloemen, &c., van Ploos van Amstel*, 8vo (Amsterdam, 1767); *Épreuve de car. de Jacques François Rosart*, 8vo (Brussels, 1771); *Schriften . . . bey J. H. Prentzler*, 4to (Frankfort-on-Main, 1774); *Épreuves des car. de la fond. de J. L. Joannis*, 8vo (Paris, 1776); *Épreuves des car. de la fond. de J. L. de Boubers*, 8vo (Brussels, 1777); *Proeve van Letteren welke gegooten worden door J. de Groot*, 8vo (the Hague, 1787); *Pantographie*, by Edmund Fry, 8vo (London, 1799); and *Manuale typographico*, by G. Bodoni, 4to (Parma, 1818).

Printers after 1500.—Though the *Cologne Chronicle* of 1499 denies to Mainz the honour of the invention of the art of printing, it was right in asserting that, after it had been brought there from Holland, it became more masterly and exact, and more and more artistic. During the first half-century of printing a good many printers distinguished themselves by the beauty, excellence and literary value of their productions. We may mention as such: Johan Fust and Peter Schoeffer at Mainz; Johan Mentelin and Heinrich Eggestein at Strassburg; Ulrich Zell at Cologne; Sweynheym and Pannarts at Subiaco and at Rome; Nicolas Jenson at Venice; Anton Koberger at Nuremberg; Ketelaer and De Leempt at Utrecht; Johan Veldener at Louvain, Utrecht and Kuilenburg; Gerard Leeu at Gouda; Johan of Westphalia at Louvain; and William Caxton (*q.v.*) at Westminster.

Very soon the demand for books increased, and with it came a reduction in their prices. This caused a decline in the execution of printing, which begins to be appreciable about 1480 in some localities, and may be said to have become general towards the end of the 15th century. At all times, however, we find some printers raise their art to a great height by the beauty of their types and the literary excellence of their productions. Among the later printers we may mention the Aldi of Venice (1490 to 1597); G. B. Bodoni of Parma (1768–1813); John Amerbach at Basel (1492–1516); John Froben at Basel (1496–1527); John Baskerville at Birmingham (1750–1775); the house of Weichel, first at Paris (*c.* 1530–1572), afterwards at Frankfort; Christopher Plantin at Antwerp (1554–1589); the Elzevirs, first at Leiden, afterwards at Amsterdam (1580–1680); Antoine Verard at Paris (1485–1513); Josse Bade or Badius at Paris (1495–1535); and the Estiennes at Paris (1502–1598).

Italic.

The Italic type[1] is said to be an imitation of the handwriting of Petrarch, and was introduced by Aldus Manutius of Venice for the purpose of printing his projected small editions of the classics. The cutting of it was entrusted to Francesco da Bologna, an artist who is presumed to be identical with the painter Francesco Francia or Raibolini. The fount is a "lower case" only, the capitals being Roman in form. It contains a large number of tied letters, to imitate handwriting, but is quite free from contractions and ligatures. It was first used in the *Virgil* of 1500. Aldus produced six different sizes between 1501 and 1558. It was counterfeited almost immediately in Italy, at Lyons and elsewhere. Originally it was called Venetian or Aldine, but subsequently Italic type, except in Germany and Holland, where it is called "cursive." The Italians also adopted the Latin name "characteres cursivi seu cancellarii." In England it was first used by Wynkyn de Worde in Wakefield's *Oratio* in 1524. The character was at first intended and used for the entire text of classical works. When it became more general, it was employed to distinguish portions of a book not properly belonging to the work, such as introductions, prefaces, indexes, notes, the text itself being in Roman. Later it was used in the text for quotations, and finally served the double part of emphasizing certain words in some works, and in others, chiefly translations of the Bible, of marking words not rightly forming a part of the text.

Greek.

Greek type (*minuscules*) first occurs in Cicero, *De officiis* printed at Mainz in 1465 by Fust and Schoeffer. The fount used is rude and imperfect, many of the letters being ordinary Latin. In the same year Sweynheym and Pannarts used a good Greek letter for some of the quotations in their edition of *Lactantius* (see, for instance, leaves 11a, 19a, 36a, 139, 140); but the supply was evidently short at first, as some of the larger quotations in the first part of the book were left blank to be filled in by hand. The first book wholly printed in Greek minuscules was the *Grammar* of Lascaris, by Paravisinus, at Milan in 1476, in types stated to have been cut and cast by Demetrius of Crete. The fount contains breathings, accents and some ligatures. The headings to the chapters are wholly in capitals. The *Anthologia graeca* of Lascaris was printed at Florence in 1494 wholly in Greek capitals (*litterae majusculae*), and it is stated in the preface that they were designed after the genuine models of antiquity to be found in the inscriptions on medals, marbles, &c. But as late as 1493 Greek type was not common, for in that year the Venice printer Symon Bevilaqua issued *Tibullus*, *Catullus* and *Propertius* with blanks left in the commentary for the Greek quotations. In England Greek letters appeared for the first time in 1519 in W. de Worde's edition of Rob. Whittington's *Grammatica*, where a few words are introduced cut in wood. Cast types were used at Cambridge in Galen's *De temperamentis*, translated by Linacre, and printed by Siberch in 1521, who styles himself the first Greek printer in England; but the quotations in the Galen are very sparse, and Siberch is not known to have printed any entire book in Greek. The first printer who possessed Greek types in any quantity was Reginald Wolfe, who held a royal patent as printer in Greek, Latin and Hebrew, and printed in 1543 two *Homilies* of Chrysostom, edited by Sir John Cheke, the first Greek lecturer at Cambridge. In Edinburgh, in 1563, and as late as 1579, the space for Greek words was left blank in printing, to be filled in by hand.

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[1] These paragraphs on the various types are for the most part taken from T. B. Reed's *History of the Old English Letter Foundries*, p. 50 seq. (London, 1887).

The Oxford University Press, re-established in 1585, was well supplied with Greek types, which were used in the Chrysostom of 1586. About 1607 Sir Henry Savile introduced Greek types (vulgarly called on account of their beauty "the silver letter") into Eton College, for printing his edition of St Chrysostom (8 vols., 1610–1613, John Norton), and other Greek authors. He afterwards presented this type to the university of Oxford. In 1632 Cambridge applied to Oxford for the loan of a Greek fount to print a Greek Testament, and the same university made an offer in 1700 for the purchase of a fount of the king's Greek at Paris, but withdrew on the French Academy insisting as a condition that every work printed should bear the imprint "characteribus Graecis e typographeo regio Parisiensi." It should not be forgotten that the large number of ligatures in the Greek of that day made the production of a fount a serious business. The Oxford Augustin Greek comprised no fewer than 354 matrices, the great primer 456, and Fournier's fount showed even 776 different sorts. The Dutch founders effected a gradual reduction of the Greek typographical ligatures. Early in the 19th century a new fashion of Greek, for which Porson was sponsor and furnished the drawings, was introduced, and has remained the prevailing form to this day. Cf. Rob. Proctor, *The Printing of Greek in the XVth Century*, folio (Oxford, 1900).

Hebrew.

The first Hebrew types are generally supposed to have appeared in 1475 in Petrus Niger's *Tractatus contra perfidos Judaeos* (leaf 10), printed by Conrad Fyner at Esslingen. De Rossi states that a Hebrew work in four folio volumes entitled *Arba Turim*, of Rabbi Jacob ben Asher, was printed in 1475 at Pieve di Sacco in Austrian Italy, while in the same year, a few months earlier, Salomon Jarchi's *Comment. on the Pentateuch* appeared at Reggio in Italy, printed in the Rabbinical character. Numerous other Hebrew works followed before 1488, in which year the first entire Hebrew Bible was printed, with points, at Soncino, by a family of German Jews. The first English book in which any quantity of Hebrew type was used was Dr Rhys's *Cambro-Brytannicae Cymraecaeve linguae institutiones*, printed by Thomas Orwin in 1592, though already in 1524 Hebrew characters, but cut on small blocks of wood, were used by W. de Worde in Rob. Wakefield's *Oratio*. The Hebrew fount made use of in Walton's *Polyglott* in 1657 was probably the first important fount cut and cast in England, though there were as yet no matrices there for Rabbinical Hebrew. In the beginning of the 18th century Amsterdam was the centre of the best Hebrew printing in Europe.

Arabic.

The first book printed in Arabic types is said to be a *Diurnale Graecorum Arabum*, printed at Fano in Italy in 1514.[1] Two years later P. P. Porrus's *Polyglott Psalter*, comprising the Arabic version, was printed at Genoa; and two years later a *Koran* in Arabic is said to have been printed at Venice. In 1505 an *Arabic Vocabulary* at Granada had the words printed in Gothic letters with the Arabic points placed over them; and in other presses where there were no Arabic types the language was expressed in Hebrew letters or cut in wood. De Guignes and others mention a fount of Arabic used by Gromors in Paris in 1539–1540 to print Postel's *Grammar*. In England some Arabic words were introduced in Wakefield's *Oratio* of 1524, but apparently cut on small blocks of wood. In Minsheu's *Ductor in linguas*, 1617, the Arabic words are printed in Italic characters. Laud's gift of Oriental MSS. to Oxford in 1635, and the appointment of an Arabic lecturer, were the first real incentives to the cultivation of the language by English scholars. Previous to this it is stated that the Raphelengius Arabic Press at Leiden had been purchased by the English Orientalist, William Bedwell; but, if it was brought to England, it does not appear to have been immediately made use of. The Arabic words in Thomas Greave's *Oratio de linguae Arabicae utilitate*, printed at Oxford in 1639, were written in by hand.

Syriac.

Syriac type, probably cut in wood, first appeared in Postel's *Linguarum XII. Alphabeta*, printed in Paris in 1538; but the characters are so rude in form and execution as to be scarcely legible. In 1555, however, Postel assisted in cutting the punches for the Syriac Peshito New Testament, printed at Vienna in 4to, the first portion of the Scriptures, and apparently the first book, printed in that language. In 1569–1572 Plantin at Antwerp included the Syriac New Testament in his *Polyglott*, and reissued it in a separate form in 1574. In England Syriac was usually expressed in the earlier works in Hebrew characters. But in 1652, when the prospectus and preliminary specimen of Walton's *Polyglott* were issued, we find Syriac type in use.

Armenian.

Of the Armenian character the press of the Vatican possessed a good fount in 1591, when Angelo Roccha showed a specimen in his *Bibliotheca Apostolica Vaticana*. A psalter is said to have been printed at Rome in 1565, and Rowe Mores mentions doubtfully a liturgy printed at Cracow in 1549. Armenian printing was practised in Paris in 1633; but the Armenian bishops, on applying to France for assistance in printing an Armenian Bible, in 1662, were refused, and went to Rome, where, as early as 1636, the press of the Propaganda had published a specimen of its Armenian matrices. The patriarch, after fifteen months' residence in Rome, removed to Amsterdam, where he established an Armenian press, and printed the Bible in 1666, which was followed in 1668 by a separate edition of the New Testament. In 1669 the press was set up at Marseilles, where it continued for a time, and was ultimately removed to Constantinople. In England the first Armenian type was that presented by Dr Fell to Oxford in 1667. The alphabet given in the prolegomena of Walton's *Polyglott* was cut in wood.

Ethiopic.

Of Ethiopic the earliest type appeared in Potken's *Psalter and Song of Solomon*, printed at Rome in 1513. The work was reprinted at Cologne, in 1518, in Potken's *Polyglott Psalter*. In 1548 the New Testament was printed at Rome by some Abyssinian priests. The press of the Propaganda issued a specimen of its fount in 1631, and again in Kircher's *Prodromus Coptus* in 1636. Erpenius at Leiden had an Ethiopic fount, which in 1626 was acquired by the Elzevirs. Usher attempted to procure the fount for England; but, his attempt failing, punches were cut and matrices prepared by the London founders for the London *Polyglott*, which showed the Psalms, Canticles and New Testament in the Ethiopic version.

Coptic.

Of Coptic the press of the Propaganda possessed a fount, and a specimen was issued in 1636, in which year also Kircher's *Prodromus Coptus* appeared from the same press. In England David Wilkins's edition of the New Testament was printed in 1716 from Coptic types cast with matrices which Dr Fell had presented to Oxford in 1667. The alphabets shown in the introduction and prolegomena to the London *Polyglott* of 1655 and 1657 were cut in wood.

Samaritan.

Of Samaritan the press of the Propaganda had a fount in 1636, and the Paris *Polyglott*, completed in 1645, contained the entire Pentateuch in type, the punches and matrices of which had been specially prepared under Le Jay's direction. The fount used for the London *Polyglott* in 1657 is admitted to have been an English production, and was probably cut under the supervision of Usher.

Slavonic.

Russian.

With Slavonic type a psalter was printed at Cracow as early as 1491, and reprinted in Montenegro in 1495. The only Slavonic fount in England was that given by Dr Fell to Oxford, and this, Mores states, was replaced in 1695 by a fount of the more modern Russian character, purchased probably at Amsterdam. The *Oratio Dominica* in 1700 gives a specimen of this fount, but renders the Hieronymian version in copper-plate. Modern Slavonic, better known as Russian, is said to have appeared first in portions of the Old Testament, printed at Prague in 1517–1519. Ten years later there was Russian type in Venice. A Russian press was established at Stockholm in 1625, and in 1696 there were matrices in Amsterdam, from which came the types used in Ludolph's *Grammatica Russica*, printed at Oxford in that year, and whence also, it is said, the types were procured which furnished the first St Petersburg press, established in 1711 by Peter the Great. Mores notes that in 1778 there was no Russian type in England, but that Cottrell was at that time engaged in preparing a fount. It does not appear that this project was carried out, and the earliest Russian in England was cut by Dr Fry from alphabets in the *Vocabularia*, collected and published for the empress of Russia in 1786–1789. This fount appeared in the *Pantographia* in 1799.

Etruscan.

A fount of the Etruscan character cut by William Caslon about 1733 for Swinton of Oxford was apparently the first produced. Fournier in 1766 showed an alphabet engraved in metal or wood. In 1771 the Propaganda published a specimen of their fount, and Bodoni of Parma in 1806 exhibited a third in his *Oratio Dominica*.

Runic.

Runic types were first used at Stockholm in a Runic and Swedish *Alphabetarium*, printed in 1611. The fount, which was cast at the expense of the king, was afterwards acquired by the university. About the same time Runic type was used at Upsala and at Copenhagen. Voskens of Amsterdam had matrices about the end of that century, and it was from Holland that Francis Junius is supposed to have procured the matrices which, in 1677, he presented to Oxford. This fount appears in the

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[1] See Panzer vii. 2.

Oratio Dominica of 1700, and in Hickes's *Thesaurus* (1703–1705), and it remained the only one in England.

Gothic.

Matrices of Gothic type were presented to Oxford by Francis Junius in 1677, and a fount of them was used for the *Oratio Dominica* of 1700 and in Hickes's *Thesaurus*. A different fount was used for Chamberlayne's *Oratio Dominica*, printed at Amsterdam in 1715. Caslon cut a fount which appeared in his first specimen in 1734. This and the Oxford fount were the only two in England in 1820.

Scandinavian.

Founts of Icelandic, Swedish and Danish were included in Junius's gift to Oxford in 1677, and were, perhaps, specially prepared in Holland. The first-named is shown in the *Oratio Dominica* of 1700 and in Hickes's *Thesaurus*. Printing had been practised in Iceland since 1531, when a *Breviary* was printed at Hoolum, in types rudely cut, it is alleged, in wood. In 1574, however, metal types were provided and several works produced. After a period of decline, printing was revived in 1773, and in 1810 Sir George M'Kenzie reported that the Hoolum press possessed eight founts of type, of which two were Roman, and the remainder of the common Icelandic character, which, like the Danish and Swedish, bears a close resemblance to the German.

Anglo-Saxon.

For the Anglo-Saxon language the first type was cut by John Day in 1567, under the direction of Archbishop Parker, and appeared in Ælfric's *Paschal Homily* in that year and in the *Ælfredi res gestæ* of Asser Menevensis in 1574. Anglo-Saxon type was used by Browne in 1617, in Minsheu's *Ductor in linguas*; and Haviland, who printed the second edition of that work in 1626, had in 1623 made use of the character in Lisle's edition of Ælfric's *Homily*.

Irish.

The first fount of Irish character was that presented by Queen Elizabeth to O'Kearney in 1571, and used to print the Catechism which appeared in that year in Dublin, from the press of Franckton. But the fount is only partially Irish, many of the letters being ordinary Roman or Italic. It was used in several works during the early years of the 17th century, and as late as 1652 in Godfrey Daniel's *Christian Doctrine*, printed in Dublin. The Irish seminaries abroad were better supplied with Irish type. A new type was cut by Moxon, and appeared in 1681 in Boyle's New Testament, printed by Robert Everingham.

Music.

The earliest specimen of music type occurs in Higden's *Polychronicon*, printed by De Worde at Westminster in 1495. The square notes appear to have been formed of ordinary quadrats, and the staff-lines of metal rules imperfectly joined. In Caxton's edition of the same work in 1482 the space had been left to be filled up by hand. The plain chant in the Mainz psalter of 1490, printed in two colours, was probably cut in wood. Hans Froschauer of Augsburg printed music from wooden blocks in 1473, and the notes in Burtius's *Opusculum Musices*, printed at Bologna in 1487, appear to have been produced in the same manner; while at Lyons the missal printed by Matthias Hus in 1485 had the staff only printed, the notes being intended to be filled in by hand. About 1500 a musical press was established at Venice by Ottavio Petrucci, at which were produced a series of mass-books with lozenge-shaped notes, each being cast complete with a staff-line. In 1513 he removed to Fossombrone, and obtained a patent from Leo X. for his invention of types for the sole printing of figurative song (*cantus figuratus*). Before 1550 several European presses followed Petrucci's example, and music type was used, among other places, at Augsburg in 1506 and 1511, Parma in 1526, Lyons in 1532 and Nuremberg in 1549. In 1525 Pierre Hautin cut punches of lozenge-shaped music at Paris. Round notes were used at Avignon in 1532. In England, after its first use, music-printing did not become general till 1550, when Grafton printed Marbecke's Book of Common Prayer, "noted" in movable type, the four staff-lines being printed in red and the notes in black. There are only four different sorts of notes used—three square and one lozenge. About 1660 the detached notes hitherto employed began to give place to the "new tyed note," by which the heads of sets of quavers could be joined. But at the close of the 17th century music-printing from type became less common, on account of the introduction of stamping and engraving plates for the purpose. Cf. Rob. Steele, *The Earliest English Music Printing*, folio (London, 1903); Andr. Deakin, *Mus. Bibliogr.*, 8vo. (Birmingham, 1893).

Printing for the Blind.

Printing for the blind was first introduced in 1784 by Valentin Haüy, the founder of the asylum for blind children in Paris. He made use of a large script character, from which impressions were taken on a prepared paper, the impressions being so deeply sunk as to leave their marks in strong relief and legible to the touch. Haüy's pupils not only read in this way, but executed their own typography, and in 1786 printed an account of their institution and labours as a specimen of their press. The first school for the blind in England was opened in Liverpool in 1791, but printing in raised characters was not successfully accomplished till 1827, when Gall of the Edinburgh asylum printed the Gospel of St John from angular types. Alston, the treasurer of the Glasgow asylum, introduced the ordinary Roman capitals in relief, and this system was subsequently improved upon by the addition of the lower-case letters by Dr Fry, the type-founder, whose specimen gained the prize of the Edinburgh Society of Arts in 1837. Several rival systems have competed in England for adoption, of which the most important are those of Lucas, Frere, Moon, Braille, Carton and Alston (see BLINDNESS).

Initials.

The trouble and cost involved in the use of the initial director early suggested the use of woodcut initials, and Erhard Ratdolt of Venice, about 1475, is generally supposed to have been the first printer to introduce the *literae florenies*, called also *lettres tourneures*, or *typi tornatissimi*, which eventually superseded the hand-painted initials. Caxton introduced one or two kinds in 1484. Among the earliest to be used are the so-called Lombardic initials or capitals. The more elaborate initials, such as those used in the Mainz indulgences and psalter, by Aldus at Venice, by Johann Schoeffer at Mainz in 1518, by Tory and the Estiennes at Paris, by Froben at Basel, and by the other great printers of their day, were known as *lettres grises*. Besides these, the ordinary "two-line letters" or large plain capitals came into use; and these were generally cast, whilst the ornamental letters were for the most part engraved on wood or metal.

Ornaments and Flowers.

Type ornaments and flowers began, like the initials, with the illuminators, and were afterwards cut on wood or metal. The first printed ornament or vignette is supposed to be the scutum or arms of Fust and Schoeffer in some copies of their 1457 Psalter, and of their edition of the Bible of 1462. There is no vignette in the Subiaco *Lactantius* of 1465 (as stated by Mr Reed, *Letter Foundries*, p. 82). In Holtrop's *Monum. typogr. des Pays-Bas* may be seen borders used by some of the earliest printers of Holland (1475–1490), which would not look bad even in the present time. Caxton in 1490 used ornamental pieces to form the border for his *Fifteen O's*. At the same time the Paris printers engraved still more elaborate border pieces. At Venice entire frames were engraved in one piece, while Aldus as early as 1495 used tasteful head-pieces cut in artistic harmony with his *lettres grises*. Early in the 16th century we observe detached ornaments and flourishes which have evidently been cast from a matrix.

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(J. H. H.)

II.—MODERN PRACTICAL TYPOGRAPHY

The printing surfaces used in the production of books and newspapers, apart from wood- or process-blocks and casts, and apart also from such surfaces as are obtained by means of the Linotype and kindred machines, are made up primarily of an aggregation of separate types, each representing a letter, mark or sign, though the actual surface employed on the printing press is frequently a duplicate copy made by a process of stereotyping or electrotyping.

Material Characteristics of Type.—A *fount* consists of a proportioned quantity of each of these letters and signs of any one particular body and face. It therefore contains single letters, both capitals ("upper case") and small letters ("lower case"), diphthongs, ligatures, such as ff, fl, accents, points, figures, fractions, commercial signs such as @, £, "peculiars" such as *, † and leaders (. . .), together with quads (pieces of metal which do not print, but are used to compensate for the shortness of occasional lines, as at the end of a paragraph), and spaces which separate words. A fount may thus have about 275 characters or *sorts*, about 100 of them consisting of italic letters, points and figures.

The numbers of the different sorts vary with different languages, and even with the style of different writers, the works of Charles Dickens, for instance, making unusually heavy demands on the vowels, while the writings of Lord Macaulay run with like persistence on the consonants. Type-founders determine the proportions of the different sorts according to a *bill of type*, or *scheme*, either numerically, when the basis of the computation is the number of lower case m's (or of A's, in the case of display type used for headings) or by weight. In the second method a fount of 125 ℔ of Roman type includes, on one scheme, 8 oz. of E, M, C; 9 oz. of T; 8 ℔ of e; 5 ℔ each of a, b, n, o, t; and so on down to 3 oz. of z. A fount of body-letters, that is those used for the reading matter of books and newspapers, as made up by one British type-founder, contains capitals 9% by weight, small capitals 4%, figures 6%, lower case letters, points and leaders 56%, spaces 15% and quads 10%; rules, accents and fractions not being supplied except in new complete founts or when specially asked for. A rule for estimating the quantity of type required for a page is to divide the number of square inches it contains by 4, when the quotient represents approximately the weight of type in ℔. But for large founts 25% and for small ones 40% should be allowed in addition, on account of unused type in the cases which cannot be completely set.

Logotypes.

For many years it was a favourite idea with inventors, especially those who were not practical printers, that great economy might be gained in composition by the use of word characters, or "logotypes," instead of single letters. The constant recurrence of certain words such as "the," "and," "is," suggested that they, as well as affixes and suffixes like ad-, ac-, -ing, -ment, should be cast in single pieces instead of being set up with their component letters. Such logotypic printing was used in 1785 in the *London Daily Universal Register*, which three years later became *The Times*, but it has never found general favour. The chief practical objection is that it involves the use of cases with an inconveniently large number of boxes. The greater the variety of characters the more "travel" of the compositor's hand over the cases is necessary for picking them up, and by so much is the speed of his work retarded.

Parts of a Type.

Each of the parts of a type has a technical name. In fig. 1, representing the capital letter M, the darkest space *a*, *a*, *a*, *a*, is called the *face*; and only that part of the type touches the paper in printing. The face is divided into the *stem*, marked 1, which comprises the whole outline of the type M; the *serifs*, or the horizontal lines marked 2, which complete the outline of the letter; the *beard*, consisting of the bevel or sloping part marked *b*, *b*, and the *shoulder* or flat portion below *b*. The shank is the entire body of the letter *d*, the front part (that shown) being known as the *belly* and the corresponding part behind as the *back*. The spaces at *h* and *h* are the *counters*, which regulate the distances apart of the stems in a line of type. The hollow groove extending across the shank at *e*, *e* is the *nick*, which enables the workman to recognize the direction of the type and to distinguish different founts of the same body. The absence of this simple expedient would retard the operation of hand-setting up by fully one-half. The earliest type-founders did not know the use of the nick. If a part of the face overhangs the shank, this part is called the *kern*, but kerned letters are avoided as much as possible. The groove *g* divides the bottom of the type into two parts called the *feet*. An impression from that part of a type on which it stands would be as =. Types must be perfectly rectangular, the minutest deviation rendering them useless. Any roughness at the sides is called *burr*, and any injury to the faces a *batter*.

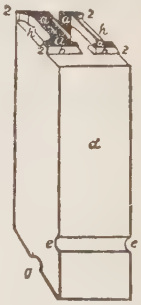

FIG. 1.—Finished Type.

Species of Letter.

Types which have the face cast in the middle of the shank, as a, c, e, m, &c., and thus leave an open space above them corresponding to that below, caused by the beard, are known as *short letters*. Those whose stem extends to the top of the shank, as b, d, f, &c., are called *ascending letters*. Those that have a stem extending over the shoulder, as g, p, &c., are called *descending letters*. Those that are both ascending and descending, and extend over the whole of the shank, as Q and j, are *long letters*. Small letters and figures cast upon the upper part of the shank, as 1^{a}, are called *superiors*; those very low down on the shank are *inferiors*, as H_3. Types that are very heavy and massive in appearance are called *fat-faced*; those that are fine and delicate, *lean-faced*. A type whose face is not in proportion to the depth of the shank (*e.g.* a small pica cast on a pica body) is a *bastard type*.

Sizes of Type.

Types of are various sizes, from those used for the smallest pocket bibles to those used for large placards, and the sizes are classified according to the dimensions of their ends or *bodies*. In a given fount the length of the end of the type which bears the face is the same for all characters, but the width varies, an i for example being narrower than a w. Each body has a distinctive name, but it used to be a confusing and inconvenient anomaly that types made by different founders, though called by the same name, were not of precisely the same size. The long primer of one maker, for example, was 89 lines to the foot, of another 89½, and of a third 92. This inconvenience was remedied in America by the founders agreeing to adopt a uniform *point-system*; the pica of 0·16604 in. was taken as a standard, six picas being 0·996 in., and was divided into twelve parts or points of 0·013837 in., other types being cast as multiples of one of these points, and specified according to the number of them they contained. This system, with the same basic unit, has been adopted by British typefounders, though not to the exclusion of older sizes, and it has been extended to regulate the thickness or *set* of types, and also the position of the faces on the bodies as regards alignment. The Didot point-system, used in France, is based on a point of 0·376 mm., the English point being 0·35145 mm. The following are specimens of the principal bodies of ordinary British and American types, with their corresponding appellations on the point-system, the first five being now mainly for display purposes:—

		Points.
The Encyclo	2-line small pica	22
The Encyclopaed	Great primer	18
The Encyclopaedia	English	14
The Encyclopaedia Brit	Pica	12
The Encyclopaedia Britan	Small pica	11
The Encyclopaedia Britannica,	Long primer	10
The Encyclopaedia Britannica,	Bourgeois	9
The Encyclopaedia Britannica, 11th	Brevier	8
The Encyclopaedia Britannica, 11th	Minion	7
The Encyclopaedia Britannica, 11th edition	Nonpareil	6
The Encyclopaedia Britannica, 11th edition	Ruby	5½
The Encyclopaedia Britannica, 11th edition	Pearl	5

[The larger type used in the body of this work is 10-point, and the smaller 8-point.]

The height of types is $\frac{11}{12}$ in. Those lower than the standard dimensions are said to be "low to paper," and if surrounded by higher types will not give perfect impressions. Spaces and quads are $\frac{3}{4}$-in. high for direct printing, but for stereotyping are cut rather higher (0·83 in.).

Varieties of Face.

According to the purpose for which they are used, types are divided into two classes—book type, including Roman and Italic; and job type, including a multitude of fanciful forms of letters, chiefly founded on the shape of the Roman and Italic letters, and intended to be more prominent, delicate, elegant, &c. It is impossible to enumerate all the varieties of the latter class, as additions are being constantly made and once popular styles always going out of fashion. The leading varieties are the antiques, which are Roman letters with strokes of nearly uniform thickness, as **M**; sanserifs or grotesques, which have no serifs, as **M**; blacks, as 𝔐; and scripts, which represent the modern cursive or Italian handwriting, as ℳ. Black letter is now only a jobbing type in English-speaking countries, although it was the first character used in printing. It is still used in Germany, with certain modifications, as the principal text-letter for books and newspapers. A comparison of the numerous reproductions that have been issued of Caxton's works with any modern line of black letter will show how greatly the form and style have been altered. The present style of Roman type dates only from about the first quarter of the 18th century. Previously the approved shape was as follows:—

Printing has been defined to be the act, art, or practice

The use of this type was revived by Charles Whittingham, nephew of the founder of the Chiswick Press, about 1843, and it has since become a favourite form, under the name of old style. Some of the punches cut by the first notable English type-founder, William Caslon (1692–1766), have been preserved, and types are being constantly cast from them. Nearly all founders now produce modernized old style.

In this connexion reference may be made to the modern revival of artistic book printing in England by William Morris and others influenced by him. This development took definite form in the founts and books of the Kelmscott Press, which is distinguished by the use of three founts designed by Morris. The Troye and Chaucer founts, both Gothic, are best fitted for ornamented medieval works, while the Golden or Roman fount is without the exaggerated contraction of form laterally, the exaggerated use of thick and thin strokes, and the vicious stroke-terminations common to modern founts. It is a type of full body, designed in careful relation to the up and down strokes, and resting upon solid serifs, as with Jenson's fount, for instance, but in detail more allied to fine penmanship or black letter. The *Vale* books, often classed with the Kelmscott, may be counted with them so far as they also are controlled by one designer, from the important matter of type, decoration and illustration, to that of "build" and press work. The first Vale book in which these conditions were achieved is *Milton's Minor Poems* (1896). In this is employed the Roman type, known as the Vale fount, designed by Charles Ricketts, which differs from the Kelmscott fount in a greater roundness or fullness of body, and in a modification of details by the conditions of type-making. The second fount used in the Vale issues, first employed in *The Plays of Shakespeare* (1896), is less round in body, more traditional in detail and lighter in effect.

Manufacture of Type.—Type is made of an alloy, known as type-metal, which consists chiefly of lead, with smaller amounts of antimony and tin. The exact proportions vary in different countries and foundries and with the size and quality of the type, but in general more than 60% is lead and the antimony predominates over the tin. Sometimes small quantities of other metals, such as copper and iron, are added. Large letters, such as are used for bills and posters do not come within the province of the type-founder; they are made of wood, chiefly rock maple, sycamore, pine and lime, planed to the right size and engraved by special machinery.

Matrices for Type.

The earliest printers made their own types, and the books printed from them can now be distinguished with almost as much certainty as handwriting can be identified. The modern printer has recourse to the type-founder. The first step in the making of type, according to the old method, is the production of a *matrix*. The letter is cut on the end of a piece of fine steel, forming the punch (fig. 2), which is afterwards hardened. A separate punch is required for each character in every fount of type, and the making of them requires great care and delicacy in order that the various sorts in a fount may be exactly uniform in width, height and general proportions. During the process of its manufacture, the punch is frequently tested or measured by delicate gauges to insure its accuracy, and from time to time it is examined by means of a *smoke-proof*, that is, an impression obtained by holding it in a flame and stamping it on paper. When the letter is perfect, it is driven into a piece of polished copper, called the *drive* or *strike* (fig. 3). This passes to the justifier, who makes the width and depth of the faces uniform throughout the fount. They must then be made to line exactly with each other. When completed, the strike becomes the matrix (fig. 4), wherein the face of the type is made. But matrices are now commonly produced by the aid of an engraving engine which copies a standard drawing of each letter on any desired scale, and they may be obtained from existing founts by electrotyping.

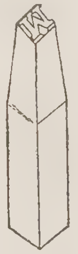
FIG. 2.—Punch.

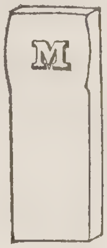

FIG. 3.—Drive.

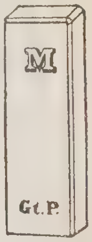

FIG. 4.—Matrix.

Type Casting.

Until well into the 19th century types were cast from the matrices in small hand-moulds, the output from which with a skilful worker was about 400 letters an hour. The mould consisted of two portions fitting closely to each other and containing the matrix with a space to receive the metal for the shank; holding it in his left hand the operator poured in the metal with his right, and after jerking it at arm's length, to bring the metal well up against the matrix, opened the two halves and threw out the type. In 1838 David Bruce, Junr., of New York, a Scotsman, who had migrated to America, invented a machine to perform substantially the same operations; this increased the rate of production to about 100 a minute for ordinary sizes, and with improvements and modifications remained a standard appliance for 40 years after its introduction. The metal, kept molten by a small furnace, was injected by a pump into the mould, which at every revolution of the axle came up to the spout of the pump, received a charge of metal, receded, opened, and discharged the type. But neither the hand mould nor the Bruce machine produced finished type. To the bottom of each there was attached a wedge-shaped *jet* (fig. 5), somewhat similar to that on a bullet cast in a hand mould. This had to be picked off by hand; the burr on the shoulder of the types had also to be rubbed off, and a groove had to be cut in the bottom to form the feet. Many efforts were made to devise machines which should perform these operations and produce finished type, one of the most satisfactory being that patented by Henry Barth, of Cincinnati, in 1888, but the principle of the divided mould which opened to discharge the type was generally retained. A new principle, however, was adopted by Frederick Wicks (1840–1910) in his rotary type casting machine, which was developed into a practical apparatus in London just at the end of the 19th century, and which is able to produce finished types, ready to be despatched to the printer without any inspection or treatment beyond packing, at a

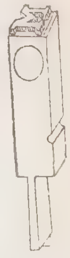
FIG. 5.—Type with jet.

continuous rate of 60,000 an hour. It consists of a horizontal mould wheel, 20 in. in diameter, contained in the casing D (fig. 6), in which are cut 100 radial slots, each having a matrix at its inner end. These slots thus form moulds, and are of varying width according to the letter each has to cast. Each wheel can only produce type of the particular body for which it has been cut, but by changing the matrices the moulds can be made to cast any description of face capable of being received upon the body. The wheel is rotated once in every six seconds, so that the slots are successively presented to a jet of molten type-metal, which is pumped from the metal reservoir A by a pump B of special construction, and forced out at high pressure through a nozzle under the shield C. As soon as any particular slot has passed the jet and been filled with metal, a cam-action comes into play and gradually pushes out the formed type. This operation is completed in half a revolution, the ejected type being taken up by carriers mounted on a continuous chain E, which is moved along exactly in step with the wheel. The carriers, which are of different sizes according to the particular letters they have to hold, are raised by a cam-action as they come opposite the slots to receive the types, but fall again at the point F, depositing the letters at the end of the race G. Each successive type thus dropped pushes its predecessors farther along the race until when the row contains 200 types—the product of two revolutions of the wheel—an attendant lifts the whole series off and places them on the plate H, one row below the other. Since the sequence of the letters is of course the same in each revolution, the result is that each vertical line on the plate consists of the same character, and each sort can be easily removed and packed in any required form for despatch to the printer. As soon as each slot has been emptied of its type, another cam begins to draw in the matrix towards the centre of the wheel, so that it is in as far as it can go by the time the slot is again opposite the jet. To prevent a type from being drawn back with the matrix, the bead-cam K engages with the nicks which have already been formed on the front of the type-bodies by the operation of the machine. To ensure trueness and accuracy in the product, the conditions under which casting is conducted are maintained as uniform as possible. The composition of the type-metal alloy is kept constant; the temperature of the molten metal is carefully regulated by the aid of a pyrometer to about 800° F., so as not to volatilize the antimony it contains; the pumps work up to a pressure of 900 lb to the square inch, and by the interposition of a reducing valve deliver the metal at the nozzle at a constant pressure of 200 lb; and the moulding slots are maintained at an equably cool temperature by an elaborate system of water circulation.

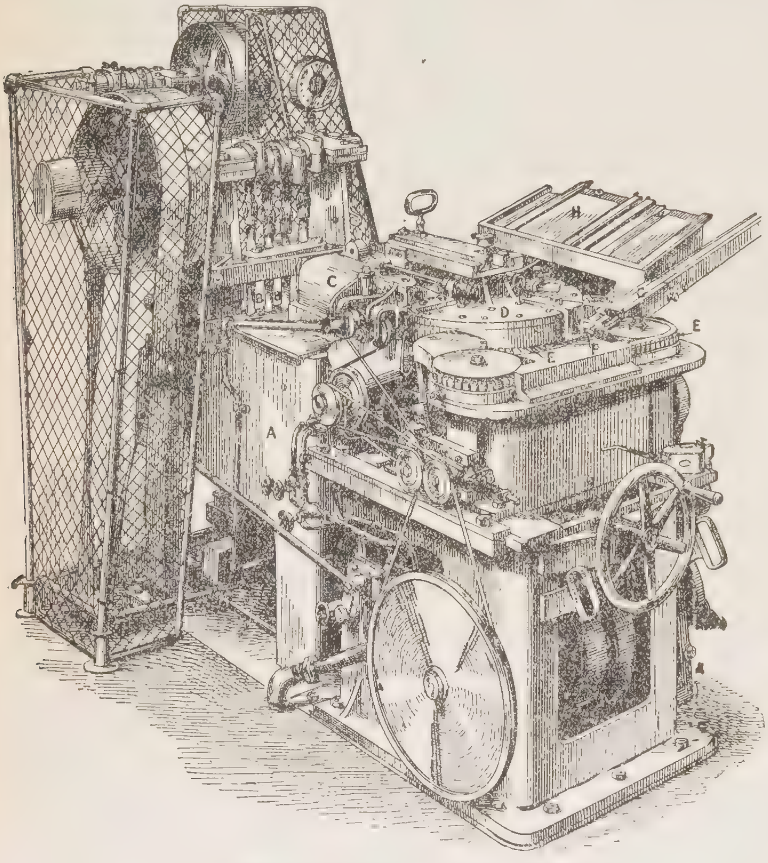

Fig. 6.—Wicks Rotary Type-casting Machine.

Type-case.

Type-setting by Hand.—The types, received from the foundry in the packages called pages, containing about 8 lb, are placed in shallow trays called *cases*. These contain compartments or *boxes*, each of which is appropriated to some particular *sort* or character. The cases when in use stand on *frames* or sloping desks. The case at the top is the *upper case*, and that below the *lower case*. The former contains 98 equal-sized boxes, appropriated principally to the capital and small capital letters; the latter has 53 boxes of various sizes, appropriated to the lower case sorts. The difference in the size of the boxes corresponds to the difference of quantity of letters in a fount, the lower-case *e*, for instance, having the largest box. As a man picks out from the boxes seldom less than 1500 letters an hour and distributes or replaces on the average about 5000 an hour, it is necessary that the most economical allocation of the boxes should be adopted. The system of allocating the various types is called the *lay* of the case; one plan is illustrated in fig. 7.

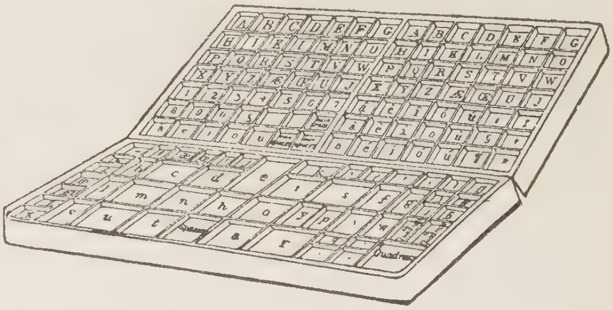

Fig. 7.—Type-case.

Composing.

The types when taken from the cases are arranged in lines (*composed* or *set up*) in an instrument called a *composing stick*, made of iron, brass or gun metal. The slide in the middle is movable so as to accommodate varying lengths of lines. The compositor fixes the "copy" or document which he has to repeat in type, in a convenient place before his eye. In his left hand he holds the composing stick, and with the thumb and first finger of the right hand lifts the letters from the boxes, and arranges them in the composing stick, every letter, point or sign being picked out separately. In this operation he is much assisted by the use of a *setting-rule*, a thin brass or steel plate which, being removed as successive lines are completed, keeps the type in place. When so many words and parts of words as will nearly fill the line have been composed, it is made the exact length required by increasing or diminishing the space between the several words. This is called *justifying* the line and is effected by means of the spaces already mentioned. If the work is not "solid"—that is, if the lines are not close together—the strips of metal called *leads* or *brasses* are inserted between each. When the composing stick is filled, the type is lifted upon a *galley*, a shallow tray of wood or metal, two or three sides of which are flanged, for the purpose of supporting the type when the galley is slightly inclined. Stickful after stickful of type is placed on the galley until it is full. The matter is then fastened up, a *proof* taken at the proof press, and the work of the *reader* or corrector of the press begins (see Proof-reading). The proof, marked with the necessary corrections, is given back to the compositor, in order that he may make the required alterations in the type.

Imposing.

The type, being duly corrected, is made up into pages of the required length (unless the author has desired to see proof in *slip*). It is then *imposed*, that is, the pages are arranged in such a manner that, when printed and the sheet folded, they will fall in due numerical sequence. The impression from any arrangement of pages will be the reverse of that in which they are laid down. If a four-page newspaper be opened and spread out with the first page uppermost, it will be found that on this side the order of pages is 4, 1, when turned the pages are 2, 3. The type pages must be ranged in the reverse way, as 1, 4; 3, 2. Thus the fourth page is placed alongside the first, because both must be printed together on the outside; the third page is to the left, and the second to the right, because in books the odd page—the verso—is always to the right. For a quarto a sheet of paper is folded twice, that is once across its breadth and then once in a perpendicular direction down the middle. It contains four leaves, and if these are printed on both sides eight pages. The two sides of a sheet are called the outer and inner formes respectively. A sheet of octavo is folded three times, making 8 leaves or 16 pages. The size of a book depends not only upon the number of times the sheet has been folded, and described accordingly as 4to, 8vo, 12mo, &c., but upon the size of the sheets. The dimensions of the papers commonly used in book-printing are: imperial, 22×30 in.; super royal, $20\frac{1}{2}\times27\frac{1}{2}$; royal, 20 × 25; medium, 19 × 24; demy, 17½ × 22½; double crown, 20 × 30; double foolscap, 17 × 27; post, 15¾ × 19½. Hence to say merely that a book is a quarto gives no precise indication of its dimensions, as a quarto of one size of paper may be smaller than an octavo of another; it is also necessary to know the size of the sheets of which it is composed.

Signatures. When a printed book is opened, it will be found that at the foot of certain pages there is usually a letter and at the foot of another a letter and a figure, as B, B 2; farther on another letter and another letter and figure. On going through the book it will be seen that the letters are in regular alphabetical order, and occur at regular intervals of eight, twelve, sixteen, &c., pages. These designate the several sheets of which the book is composed and are called *signatures*, so that a sheet may be designated B, and the pages of which it consists are thereby sufficiently indicated. (Occasionally, numbers are used instead of letters.) These signatures assist the binder in folding, as they occupy a certain specified place in each sheet; hence to ascertain if the sheet has been folded properly it is only necessary to examine the position of the signature. The binder also is thus assisted in *gathering* or collating together the sheets of a volume in proper order. Signature A is omitted, because it would be on the title or first page, and would be both unnecessary and unsightly. By old custom J, V and W are discarded, I and J, U and V being originally used indiscriminately, by printers, while W was written UU or VV. When the alphabet is exhausted, a new one is begun, distinguished by a figure precedent, as 2 B, 2 C, &c.

Forme. The pages of types are arranged in proper order on a flat table, covered with stone or metal, called the *imposing stone*, and are then ready to be made into a *forme*, that is, into such a state that they can be securely fastened up and moved about. The forme is enclosed in an iron frame or *chase*, sub-divided by a cross bar. The portions of the type are separated by *furniture*, which may be of metal or wood or both. It is of the same height as the chase, but lower than the type, and therefore does not print, but forms the margin of the printed pages. As the sides of the two sections of the formes are pieces of furniture of a tapering shape, called *side-sticks*, and at the top and bottom corresponding pieces, called *foot-sticks*. Small wedges, called *quoins*, are inserted and driven forward by a mallet and a *shooting-stick*, so that they gradually exert increasing pressure upon the type. Other mechanical means for locking up are also occasionally adopted. When sufficiently locked up, the whole is quite as firm and portable, however many thousands of pieces of metal it may consist of, as if it were a single plate, and is ready for use on the printing press, either directly or in the form of a stereotyped or electrotyped copy.

Distributing. After use the type undergoes the operation of *distributing*, which is the converse of composing; it is de-composing the forme and returning the several letters to their proper boxes in the case. The forme is first washed over with an alkali or other detergent to remove the ink from its surface, and then laid down on the imposing surface, unlocked and damped; this assists the cohesion of the type, after the chase, furniture, side-sticks, &c., are removed. The compositor then takes in his left hand, supported by a setting rule, a portion of type in lines, and with the right hand takes a word or so between the finger and thumb, letting each letter drop separately into its proper box. The types are held upside down, that is, with the nicks uppermost; hence the letters of each word are read from left to right like ordinary matter when printed, but the words are of course dealt with in the inverse order.

Type-setting by Machine.—The above method of producing a printing surface depends entirely upon hand labour, but it has long been an object of inventors in connexion with printing to perfect a mechanical system by which hand-work may be done away with both in setting type and in distributing it after use. The first step in this direction was the construction of composing machines in which the compositor put together types in the required order, not by lifting them one after another from his "boxes" and placing them by hand in his "stick," but by operating a keyboard which liberated them from magazines and assembled them in the order in which the keys had been struck. Such machines were followed as a natural correlative by distributing machines which performed the converse operation. Then the idea occurred of avoiding distribution altogether, by returning the printing surface to the melting-pot and using the metal over again to produce an entirely new printing surface as required, instead of sorting the types into their various kinds to be set up again either by hand or by machine. There are two main solutions of this problem. One is to manufacture ordinary movable types at a cost that is less than that of distribution, when it obviously becomes advantageous to treat the formes, after use, as old metal and return them directly to the melting pot without distribution. In 1900 *The Times* began to adopt this method, thus securing the advantage of fresh new type for each issue. In its offices for several years type made by the Wicks casting machine was set up by composing machines, and after being used in making the necessary stereotype plates was returned to the foundry to be melted and recast. The other solution depends upon the employment of apparatus which are in effect combinations of type-setting and type-casting machines, and may be divided into two broad classes: (*a*) those in which, by the operation of a keyboard, letters are translated into metal types which appear as a product for use in the printing-press, not singly, but cast into complete bars or lines of type; and (*b*) those in which the final product is separate types, delivered made up into lines of the required length. The former class is exemplified by the Linotype, the Typograph, and the Monoline machines, the latter by the Lanston Monotype, the Tachytype and the Goodson. In machines of the Linotype class, which have come into extensive use, especially for newspaper printing, it is impossible to make corrections or alterations in the line of type after it has been cast. The smallest change, such as the addition of a comma, involves the resetting and recasting of a whole line, while, if two or three words have to be added or removed, the compositor may have to recast a considerable number of lines, perhaps a whole paragraph. Machines of the second class, like the Monotype, which has been employed for setting up the present edition of the *Encyclopaedia Britannica*, appeal rather to the book printer, though the Monotype is used by such newspapers as *The Times* (London) and the *Sun* (New York). They have the advantage that corrections can be made as with hand-set type; but for newspaper work the fact that the manipulation of the keyboard does not, as with the Linotype, directly produce a printing surface but merely a punched strip of paper, which has then to be passed through a separate casting machine, inevitably introduces some delay. This is a matter that must be taken into account in the hurried conditions under which a daily paper is produced, when the shortest possible interval must elapse between the time when the latest news is received and the actual printing is begun. A machine invented by Mr H. Gilbert-Stringer is designed to combine the advantages of the Linotype and Monotype machines by casting at a single operation separate types properly arranged in lines and uniformly spaced. Up to the point where the matrices are ranged in a line ready for the bar of type to be cast, the mechanism may be identical with that of the Linotype; from that point each matrix is separately pushed into a mould which is automatically varied in size to suit the size of the particular letter it is casting, and also casts the spaces between the words (determined by the use of a modified Schuckers wedge-space), so that when all the individual types and spaces in the line are assembled after casting they exactly fill the line. The machine requires only one operator, and while one line is being cast the matrices which have formed the preceding one are being distributed to the magazine, as in the Linotype, and the following one is being set up. The matrices differ from those of the Linotype in that the face is impressed on their broad flat surface, not on the thin edge.

Composing Machines.—An early attempt to make a machine for setting up ordinary foundry type was patented in England by Dr William Church in 1822. In the machine of Young and Delcambre, which was used in London for composing the *Family Herald* in 1842, and was the forerunner of the Kastenbein machine adopted in *The Times* office in 1869, the types were arranged in tubes placed either vertically or horizontally, and the lowest or endmost letter was, when wanted, ejected from the tube by a pusher actuated by a finger-key. It then passed down the channels of a guide-plate to a common point, whence it was pushed forward by a reciprocating motion to the line of previously composed matter and divided into lines of the required length. To the same group belong the Fraser machine, the Hattersley and the Empire, also known in America as the Burr. Another group of machines developed from the rotary composer was invented by Alexander Mackie of Warrington in 1871, and used in the office of the *Warrington Guardian*. In this the types were arranged in vertical tubes round a rotating disk, and the letters were automatically selected by a strip of paper previously punched with holes through which feelers passed and caused the desired type to be ejected upon a travelling band. This device of using a paper strip perforated in different positions to correspond to different letters was patented by Felt in 1860 (*U.S. Patent Spec.* No. 28,463), and he also utilized it for effecting distribution, the "dead" or used type being dealt with by another machine through which the paper strip was run in the reverse direction. This quality, however, was not so valuable as it might appear at first sight, since any correction, however simple, of necessity made the perforated paper ineffectual as a guide in distribution. The Thorne machine, exhibited in the Paris Exhibition of 1878, was a development of the principle of a rotating disk, but the types, which were contained in a vertical cylinder, were selected by touching keys in the ordinary manner. When liberated they fell upon a rotating table, whence they were deflected by a finger upon a travelling band and delivered into the composing race. The American Simplex machine resembles the Thorne very closely. The Wicks composing machine, again, adopts a different principle from both the above groups. The types are ejected upon a straight race set at an angle of 45°. Thus each has to travel a different distance from the other—a result which the inventors of the Delcambre group of machines were at pains to avoid; and when several keys are struck together so as to give a combination like "and," the several types delivered to the race follow each other in proper succession to the point of assembly, the letter whose key is nearest to the left side of the keyboard preceding those whose keys are more to the right.

The Paige composing, justifying and distributing machine—an American invention—is one of the most remarkable pieces of mechanism ever put together. It contains 18,000 parts, and the patent specifications form an imposing volume. It is operated by keys in the ordinary way, but automatic mechanism advances the ejected letters in words, spaces them and inserts the lines in the "galley" with "leads" if desired; at the same time other mechanism automatically distributes dead matter and refills the tubes which contain the supplies of types. Two machines were made, and are said to have done good work, but the cost of construction and the complicated nature of the mechanism made the apparatus impracticable commercially, and the two that were made are now on view as mechanical curiosities, the one in the Columbia Institute and the other in Cornell University. The Paige machine dispensed with the guide-plate of the Delcambre group, the letters being ejected on a plane along which a driver passed at intervals and swept the type into a receiving race on the left of the machine. The Dow composing and justifying machine, a later American invention, adopts this characteristic of the Paige, but has two drivers meeting at the centre of the plane which receives the letters. The types having been swept to the centre by these, a vertical driver forces them downwards into a vertical receiver. When a line has been set a justifying key is touched, the vertical line passes to a horizontal position, and is driven forwards to a point where apparatus measures it, and having removed temporary brass spaces replaces them with others selected from a series of ten different thicknesses.

Distributing Machines.—There are two main classes of distributing machines. One, which is exemplified by the Delcambre or the Fraser machine, is operated by a keyboard; the compositor strikes the keys corresponding to the letters of the printed matter he wishes to distribute, and thus opens gates through which the types pass and find their way down a guide-plate to their proper tubes. The other comprises a number of machines which agree in requiring the type to be specially nicked for their use. Each type has its own particular combination of nicks, and the receptacles in which the type is collated are provided at their entrances with wards corresponding to these nicks, so that each type can only enter the one receptacle for which its nicks are arranged (fig. 8). In some cases, as in the Empire and the Dow, the distributor is a separate machine; in others, as the Thorne and the Simplex, it is combined with the composing machine in such a way that the two work simultaneously.

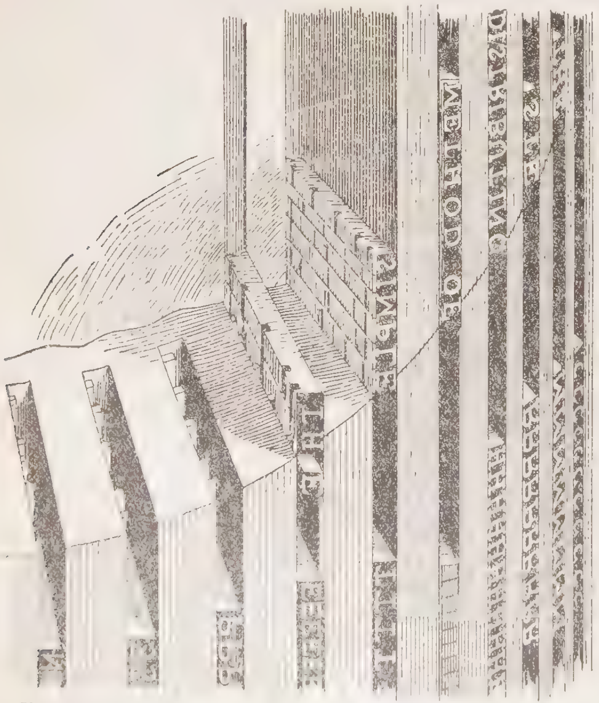

Fig. 8.—Nick System of Distribution (Simplex Machine).

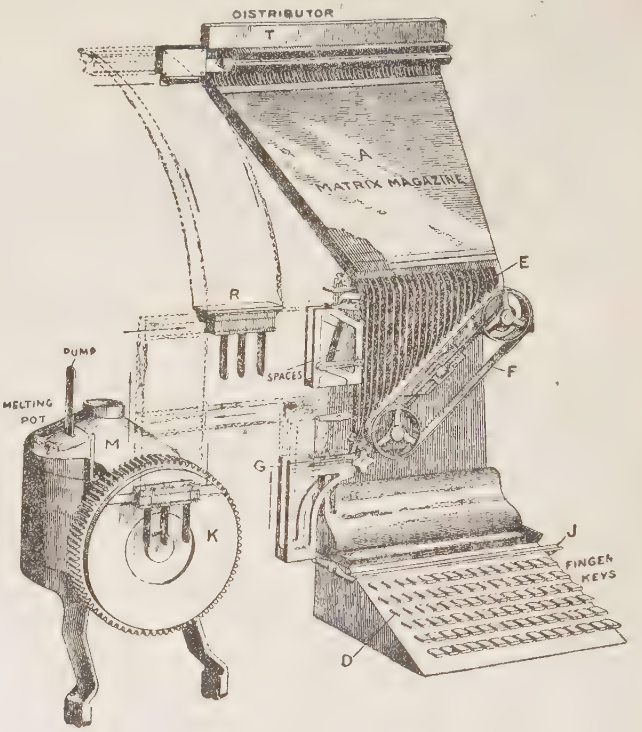

Fig. 9.—Diagram of Linotype Machine.

Linotype.—An enormous amount of ingenuity has been expended on the Linotype, which was developed into a practical machine by Ottmar Mergenthaler, of Baltimore, though two of its elements—the solid bar of type and the wedge space—were invented by others, the former by T. W. Smith, of the Caslon Foundry, and the latter by Jacob W. Schuckers, of Washington. The following will give a general idea of its working: In the magazine A (fig. 9) are a series of matrices, formed with the characters in intaglio on one edge, which are discharged by gates, operated from the keyboard D into the chutes E, and thence upon the travelling belt F; this delivers them upon a revolving pusher wheel by which they are set up in proper order in the assembler block G. Above the assembler block is a space magazine, and from this the space key J releases a space bar, when desired, which drops into place in the line. As the matrices are forced into the assembler block they move to the left against the resistance of a sliding abutment, thus being held compactly in place in the line. As soon as a complete line is set up, the compositor operates a hand lever by which the assembler block and matrices are raised to the level of a horizontal slide, where the line is grasped between two jaws and carried to the left, and lowered into position opposite the mouth of the mould wheel K. Here the justification of the line is effected by means of an upwardly moving plunger which drives the wedge-shaped spaces, seen in fig. 10, into the line, and thus expands it to the exact length required. The matrices are then locked firmly in a vice with the characters opposite the mouth of the mould. At this time the pump plunger in the melting pot M (fig. 9) is forced downwards by mechanism actuated by suitable cams on the driving shaft, and a jet of molten type metal is ejected into the mould and against the characters on the matrices, thus casting the bar or "slug." The cast bar is next forced, by a revolution of the wheel K, between a pair of knives, by which it is trimmed, and into a galley, where it is pushed along by a packer arm and placed beside its fellows in a column ready for use.

It is next necessary to distribute the matrices to the magazines, in order that the operation of the machine may be carried on continuously. The matrices and spaces are raised from the vice and brought opposite a bar R, which carries on its under side a series of undercut ribs corresponding to the teeth which are shown at the edges of the V-shaped notch in the top of the matrices (fig. 10) and the matrices are pushed on to this bar so as to be suspended by the ribs. They are next pushed still farther towards the right of the machine into a box having ribs engaging the notches in the side of the matrices, but with downwardly inclined grooves crossing these ribs, by which the shoulders at the upper end of the space bars are allowed to descend, and the spaces are thus dropped out of line and fall through a chute into the space-box from which they originally came. The matrices are pushed still farther to the right, where their teeth slide along the distributor bar T, being carried by two screws which engage opposite sides of the matrices and keep them separated so that they hang loosely from the distributor bar. The ribs of the distributor bar are so arranged as to support each matrix by one or more pairs of teeth until it arrives opposite the mouth of its own magazine channel, where they are interrupted in such a manner that the matrix is unsupported and drops into the magazine for further use. It will thus be apparent that there is a constant circulation of the matrices through the machine, and the composing of one line, the casting of another and the distribution of a third are all carried on at the same time, which adds greatly to the speed of the operation. The machine may be fitted with double magazine, which with double-letter matrices gives 360 characters or four faces ready for use, or even with three magazines, which provide for 540 characters or six faces, the movement of a hand lever bringing the desired magazine into use.

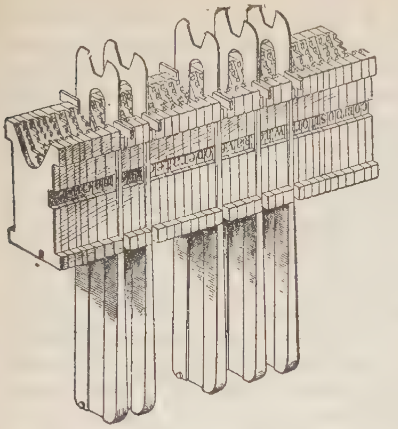

FIG. 10.—Line of Matrices with Spaces.

Lanston Monotype.—In the Lanston apparatus there are two distinct machines, a ribbon-punching machine and a type-casting and composing machine. The first of these is a small device resembling a typewriter, having a number of keys, 257 in all, corresponding to all the characters used in a fount of type, with some additions representing certain movements to be performed by the composing machine. These keys, when depressed, admit compressed air to a plunger or combination of two plungers working punches, whereby perforations are made in a strip of paper fed step by step through the machine. Most of the keys make two perforations, though some a single one only. These perforations stand in a transverse line across the strip, as shown in fig. 11, and their relative position in the line varies with the particular key operated. At the end of each word a spacing key is struck, and suitable perforations are made in the strip, and as the end of a line is neared, a bell rings to warn the operator, who, by looking at a line scale facing him on the machine, is enabled to see how many units of space remain to be filled, and can then determine whether another word or syllable can be set up. If not, it then becomes necessary to provide proper space-type to justify or fill out the line, which is done by increasing the width of the normal space-types already provided for in the proportion which the number of units of space still vacant in the line bears to the number of space-types which the line contains. For example, if there are ten space-types and $\frac{1}{10}$ of an inch of space remains to be filled, each space-type must be increased in thickness just $\frac{1}{100}$ of an inch completely to fill the line. It is not necessary, however, for the operator to make this calculation, for he has only to consult the scale provided for this purpose, and is referred at once to the proper keys to punch the justifying perforations in the strip. Each time the space key is depressed a pointer rises one step against a cylindrical scale placed vertically in front of the machine, and when the operator has finished setting a line he presses a special key which causes the cylinder to rotate until it automatically stops with the required number at the end of the pointer. This number is in the form $\frac{3}{4}$, and to complete the justification of the line the operator has only to depress the appropriate keys in the top two rows of the keyboard, in this case No. 3 of the top row and No. 4 of the second.

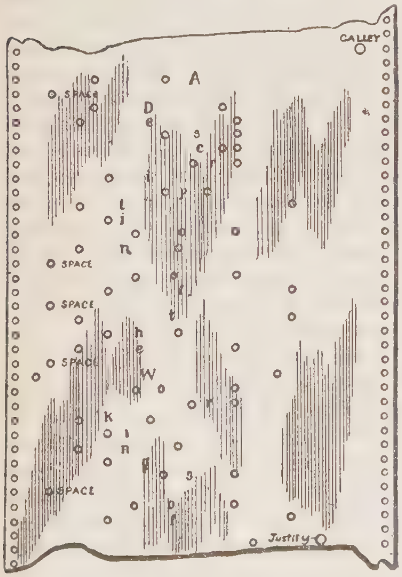

FIG. 11.—Perforated Strip.

The ribbon thus prepared in the punching machine is used to control all the movements of the casting or composing machine. The matrices for making the type faces are formed in a plate about 3 in. square, and any character is brought opposite the casting point by the movement of the matrix-carrier in two directions, or rather by the resultant of two such independent movements. As the perforations for controlling the galley movements and those for justifying the line are necessarily made after the others in the perforating machine, and these operations must be provided for in the composing machine before the line is set up, the latter machine is so organized that the ribbon is passed through and the types are set in the reverse order to that in which the strip was punched. The perforated ribbon is wound from one wheel off to another, passing over the edge of a tracker board in which there are a number of holes corresponding to those which may occur in the ribbon, and each of these holes communicates by a tube with a small piston which controls some device for performing one of the various operations of the machine. As the ribbon passes over the tracker board, a jet of compressed air passes to the appropriate operating device whenever a ribbon perforation or any combination of them coincides with the proper holes. The two perforations on each transverse line control two stop pins which limit the movements of the matrix-carrier to bringing the proper matrix to the casting-point, while the justifying perforations set in motion devices which open the space mould to cast space type of the exact size to effect the proper justification of the line, and the galley perforation starts the feeding device which moves the galley for the next line of type. The matrix-carrier may be readily removed and another carrying a different style or size of type substituted therefor.

In modern printing it is often the case that the printing surface actually used in the press (see PRINTING) is not the original forme of type, whether consisting of separate type set up by machine or by hand, or of Linotype slugs, but a reproduction of it made by electrotyping or by stereotyping. Of these two processes the former is the slower and the more costly, but it produces the better results, since electrotyped plates are capable of yielding a larger number of sharp impressions than are stereotypes.

Electrotyping.—In making an electrotype, a moulding composition consisting mainly of wax with a little blacklead, is poured when molten into a shallow metal tray, and, when it has set, its surface is brushed over with blacklead and polished. An impression of the forme, which is also blackleaded, is next taken in the wax while it is still warm, often by the aid of a hydraulic press, and the mould thus obtained, after being separated from the forme, undergoes a process of *building up*, which consists of dropping heated wax upon those portions which require to be more deeply sunk in the finished type, that is, upon those places where " whites " are to appear in the print. The face of the finished mould is then carefully covered with blacklead, which is a conductor of electricity, and the whole is immersed in an electrotyping bath, where copper is deposited on the blackleaded portions by means of the current from a Smee's battery or a dynamo machine. When the deposit, or *shell*, is sufficiently thick, it is disengaged from the wax mould, backed with a metal which resembles type-metal but contains a larger proportion of lead, and trimmed and planed. For use in rotary presses curved electrotypes may be produced.

Stereotyping.—The great advantage of stereotyping is in connexion with the production of newspapers, where the desideratum is the printing off of a large number of copies in a short time. For this purpose, in the first place, rotary machines must be employed, and stereotyping affords a ready means of obtaining curved printing surfaces to fit their cylinders. It is true that stereotyping is not absolutely necessary for rotary printing, since it has been found possible to print from movable type clamped on the cylinders in curved frames known as " turtles." But to set up duplicate formes of type is impracticable, and, therefore, this device does not permit the utilization of more than one press. Herein lies the second great advantage of stereotyping, for it enables the printer to obtain as many replicas of each forme as he desires, and thus not only to employ a number of machines simultaneously, but also to " dress " each of them with several duplicates of the same forme, as is required in the later developments of high-speed presses.

The first attempt at making stereotypes was by means of moist clay into which, after it had been impressed with the type and baked, molten type metal was poured; but this method did not yield a curved plate. Later the clay was replaced by papier-mâché, which being flexible can be bent to the required shape. This papier-mâché, known as *flong* and composed of several sheets of paper united by a paste capable of withstanding a high temperature without burning, is moistened and laid over the forme of type, into which it is well pressed either by beating with a long-handled brush or, according to the more modern and expeditious method, by being passed through a moulding press. The flong is next dried for which purpose it is either placed with the type in a heated chamber covered with blankets which absorb the moisture, or is removed from the type and heated separately. Sometimes these two methods are used in combination; processes have also been devised for pressing the flong dry upon the type, when subsequent drying becomes unnecessary. For casting a plate the matrix thus prepared is fastened in a casting mould or *box* curved to the circumference of the cylinder of the press, and molten stereo-metal (a softer form of type-metal) is poured upon it. During this process the box stands upright, but while the matrix is being placed in position it lies horizontally, a swivel mounting enabling it to be readily turned. After time has been allowed for solidification, the cast is taken out, stripped from the matrix and adjusted on a "finishing saddle," where a machine cuts off the superfluous metal from its upper end and forms a bevel by which it can be clamped on the press. It is then placed face downwards in another machine which shaves out and smooths its interior surface, and finally it is set face upwards, while men with chisels remove protruding pieces of metal that might take ink and print.

Up to the end of the 19th century the general method of stereotyping was as outlined above, though of course there were variations in different establishments. The time required to produce a plate, as distinct from making the matrix, was about 1 or $1\frac{1}{2}$ minute, and the process was expensive in labour since it required the employment of half-a-dozen men. This time may seem short enough, but when plates are needed by the score, as may be the case with a paper having a large circulation, the delay entailed by the preparation of the whole number by this method becomes of serious importance. Means were therefore sought to reduce it by the adoption of automatic mechanism. In the Autoplate machine, invented in America by Henry A. Wise Wood, and first used by the *New York Herald* in 1900, the operation of casting is performed automatically from the time the matrix is put in position until the finished plate is ready to be placed on the printing press, and from a single matrix four plates $\frac{1}{2}$ in. thick, or seven or eight $\frac{1}{4}$ in. thick, can be produced every minute, by the aid of three men only. The casting is done against a horizontal cylinder or core, the interior of which is cooled by water. Below it is a frame or "back" carrying the matrix. This back has an up and down movement of about six inches, and when it is in its topmost position there is a semicircular space between it and the core equal in length, breadth and thickness to the plate which has to be cast. Molten metal having been injected into this space by a pump, there is a pause of a few seconds to permit of solidification, and then the back falls, bringing away the matrix with it. Immediately afterwards the cylinder makes a half turn, and presents what was previously its upper half to the matrix for another cast. The first cast is taken with it as it turns, and is then pushed along from the top of the core against two rotating saws which trim its edges. Next it comes under a shaving arch, where it pauses while its interior surface is smoothed to proper thickness, and finally water is directed against its back, to cool it without wetting its printing face. The Junior Autoplate is a simpler machine which does not perform so many operations. In it the casting core is vertical, not horizontal, but the matrix is still automatically stripped from the plate, the casts are made alternately on the two halves of the cylinder, and as one plate is being removed another is being cast. The machine also automatically cuts off the sprue which is left on the top of the plate as it stands in the casting box. About three plates a minute are produced, but they are not delivered completely finished, and have to undergo several further operations before they are ready to be placed on the press. The Double Junior consists of two Junior Autoplates served from a common melting-pot, and its capacity is six plates a minute, with two matrices; and another machine, the Autoshaver, has been devised which can shave, cool and deliver that number of plates automatically, no labour being required except to take the plate from the casting machine and place it on the Autoshaver.

See *Practical Printing*, by John Southward and Arthur Powell (5th ed., London, 1900); *Modern Printing*, by John Southward (London, 1898); *The American Handbook of Printing*, by Edmund G. Gress (New York, 1907); *History of Composing Machines*, by John S. Thompson (Chicago, 1904); *Traité de la typographie*, by Henri Fournier (4th ed., Paris, 1904); "Type Casting and Composing Machines," by L. A. Legros, *Proc. Inst. Mech. Eng.* (London, 1908); "Modern Stereotypy and the Mechanics of the Newspaper," by Henry A. Wise Wood, *Journ. Franklin Inst.* (Philadelphia, 1910). (J. So.; H. M. R.)

TÝR, the Scandinavian god of battle. He is not a prominent figure in Northern mythology, for even in this special capacity he is overshadowed by Odin, and there are hardly any traces of worship being paid to him. Among other Teutonic peoples, however, he seems at one time to have been a deity of considerable importance. In Anglo-Saxon he was called Tī (*Ti*, *Tiig*, gen. *Tiwes*, whence "Tuesday") and equated with the Roman Mars. He is also identified with the German god mentioned more than once by Tacitus, as well as in inscriptions, by the name Mars. His Teutonic name is the same as the word for "god" in several other Indo-European languages (*e.g.* Lat. *dīuus*, Lith. *dēvas*, Skr. *devas*), and even in Old Norse the plural (*tívar*) was still used in the same sense. (See TEUTONIC PEOPLES, § *Religion, ad fin.*) (H. M. C.)

TYRANT (Gr. τύραννος, master, ruler), a term applied in modern times to a ruler of a cruel and oppressive character. This use is, however, based on a complete misapprehension of the application of the Greek word, which implied nothing more than unconditional sovereignty. Such rulers are not, as is often supposed, confined to a single period, the 7th and 6th centuries B.C. (the so-called "Age of the Tyrants") of Greek history, but appear sporadically at all times, and are frequent in the later city-states of the Greek world. The use of the term "tyrant" in the bad sense is due largely to the ultra-constitutionalists of the 4th century in Athens, to whom the democracy of Pericles was the ideal of government. Thus the government which Lysander set up in Athens at the close of the Peloponnesian War is called that of the "Thirty Tyrants" (see CRITIAS). The same term is applied to those Roman generals (really 18) who usurped authority locally under Gallienus.

TYRAS, a colony of Miletus, probably founded about 600 B.C., situated some 10 m. from the mouth of the Tyras River (Dniester). Of no great importance in early times, in the 2nd century B.C. it fell under the dominion of native kings whose names appear on its coins, and it was destroyed by the Getae about 50 B.C. In A.D. 56 it seems to have been restored by the Romans and henceforth formed part of the province of Lower Moesia. There exists a series of its coins with heads of emperors from Domitian to Alexander Severus. Soon after the time of the latter it was destroyed by the Goths. Its government was in the hands of five archons, a senate, a popular assembly and a registrar. The types of its coins suggest a trade in wheat, wine and fish. The few inscriptions are also mostly concerned with trade. Its remains are scanty, as its site has been covered by the great medieval fortress of Monocastro or Akkerman (*q.v.*).

See E. H. Minns, *Scythians and Greeks* (Cambridge, 1909); V. V. Latyshev, *Inscriptiones Orae Septentrionalis Ponti Euxini*, vol. i. (E. H. M.)

TYRCONNELL, RICHARD TALBOT, EARL [TITULAR DUKE] OF (1630–1691), Irish Jacobite, came of an ancient Anglo-Norman family, the Talbots of Malahide. His father, Sir William Talbot (d. 1633), was a Roman Catholic lawyer and politician of note. His brother Peter was Roman Catholic archbishop of Dublin. Richard Talbot served as a royalist during the Great Rebellion. He was present in Drogheda (Tredah) when it was stormed by Cromwell on the 3rd of September 1647, and was one of the few members of the garrison who escaped from the massacre; he fled to Spain. He then lived like many other royalist refugees, partly by casual military service, but also by acting as a subordinate agent in plots to upset the Commonwealth and murder Cromwell. He was arrested in London in November 1655 and was examined by Cromwell. Once more he escaped, but it was said by his enemies that he was bribed by the Protector, with whom one of his brothers was certainly in correspondence. After the Restoration he had a place in the household of the duke of York (James II.). He was actively engaged in an infamous intrigue to ruin the character of Anne Hyde, the duke's wife, but continued in James's employment and saw some service at sea in the naval wars with the Dutch. He accumulated money by acting as agent for Irish Roman Catholics who sought to recover their confiscated property. He was arrested in connexion with the Popish Plot agitation in 1678, but was allowed to go into exile. He returned just before the death of Charles II., and during the reign of James II. he was the chief agent of the king's policy in Ireland. He was appointed commander-in-chief and created earl of Tyrconnell in 1685. The duty assigned him was to create a Roman Catholic army which might be used to coerce England. In February 1687 he was appointed lord deputy, and became the civil as well as the military governor of Ireland. Tyrconnell, who foresaw the revolution in England, entered into intrigues for handing Ireland over to the king of France in order to secure the interest of his fellow Roman Catholics. For a time he made a pretence of protecting the Protestants, but when the revolution of 1688 occurred in England he threw himself, after some hesitation, into the struggle against William III., and when James fled to France Tyrconnell was left as his representative. When William raised the siege of Limerick, Tyrconnell went over to France to seek help, and after his return (January 1691) he was little more than a spectator of the military operations. When he did act it was to thwart the French General St Ruth and his own countryman Sarsfield. He became so unpopular that he was compelled to retire to Limerick, where he died of apoplexy on the 14th of August 1691. In 1689 King James created him duke of Tyrconnell, but the title was recognized only by the Jacobites.

TYRCONNELL (*Tir-Conaill*), an ancient kingdom of Ireland. Conall Gulban, a son of Niall of the Nine Hostages, king of Ireland, acquired the wild territory in the north-west of Ulster (the modern Co. Donegal, &c.), and founded the kingdom about the middle of the 5th century. Of the several branches of his family, the O'Connells, O'Cannanans and O'Dohertys may be mentioned. The kings of Tyrconnell maintained their position until 1071.

TYRE (Phoen. and Hebr. צר, צור = "rock," Assyr. *Ṣurru*, Egypt. *Dara*, Early Lat. *Sarra*), the most famous city of Phoenicia. It is now represented by the petty town of Sur (about 5,000 inhabitants), built round the harbour at the north end of a peninsula, which till the time of Alexander's siege was an island, without water or vegetation. The mole which he constructed has been widened by deposits of sand, so that the ancient island is now connected with the mainland by a tongue of land a quarter of a mile broad. The greatest length of the former island, from north to south, is about $\frac{5}{8}$ m. and its area about 142 acres. The researches of Renan have refuted the once popular idea that a great part of the original island has disappeared by natural convulsions, though he believes that the remains of a submerged wall at the south end indicate that about 15 additional acres were once reclaimed and have been again lost. On this narrow site Tyre was built; its 25,000 inhabitants were crowded into many-storeyed houses loftier than those of Rome; and yet place was found not only for the great temple of Melqarth with its courts, but for docks and warehouses, and for the purple factories, which in Roman times made the town an unpleasant place of residence (Strabo xvi. 2, 23). In the Roman period the population occupied a strip of the opposite mainland, including Palaetyrus. Pliny (*Nat. Hist.* v. 19) gives to the whole city, continental and insular, a compass of 19 Roman miles; but this account must be received with caution. In Strabo's time the island was still the city, and Palaetyrus on the mainland was distant 30 stadia; modern research, however, indicates an extensive line of suburbs rather than one mainland city that can be identified with Palaetyrus. This name was given by the Greeks to the settlement on the coast under the mistaken impression that it was more ancient than that on the island; the Assyr. *Ushu*, frequently mentioned in the Amarna letters, makes it probable that Usu or Uzu was the native name. Owing to the paucity of Phoenician remains the topography of the town and its surroundings is still obscure. The present harbour is certainly the Sidonian port, though it is not so large as it once was; the other ancient harbour, the Egyptian port, has disappeared, and is supposed by Renan to have lain on the south side of the island, and to be now absorbed in the isthmus. The most important ruins are those of the cathedral, with its magnificent columns of rose-coloured granite, now prostrate. The present building is assigned by De Vogüé to the second half of the 12th century, but the columns may have belonged to the 4th-century church of Paulinus (Euseb. *H.E.* x. 4). The water-supply of ancient Tyre came from the powerful springs of Ras-al 'Ain (see AQUEDUCT) on the mainland, one hour south of the city, where there are still remarkable reservoirs, in connexion with which curious survivals of Adonis worship have been observed by travellers. Tyre was still an important city and an almost impregnable fortress under the Arab Empire. From 1124 to 1291 it was a stronghold of the crusaders, and Saladin himself besieged it in vain. After the fall of Acre the Christians deserted the place, which was then destroyed by the Moslems. The present town has arisen since the Motāwila (Metāwila or Mutāwileh) occupied the district in 1766.

The most important references to Tyre in the Bible are 1 Kings v., vii., ix.; Is. xxiii.; Am. i. 9 seq.; Ezek. xxvi.–xxviii.; 2 Macc. iv. 18 sqq.; Mark iii. 8, vii. 24 sqq.; Matt. xi. 21 seq. (and parallels); Acts xii. 20. Cf. also Joshua xix. 29; 2 Sam. xxiv. 7; Ezra iii. 7; Neh. xiii. 16; Ps. xlv. 12, lxxxiii. 7, lxxxvii. 4. For the history of Tyre see PHOENICIA. See also Renan, *Mission de Phénicie* (1864); Pietschmann, *Gesch. der Phönizier* (1889), 61–72; F. Jeremias, *Tyrus bis zur Zeit Nebukadnesars* (1891); H. Winckler, *Altor. Forschungen*, ii. 65 sqq.; A. Socin in Baedeker, *Pal. u. Syrien.*

(W. R. S.; G. A. C.*)

TYREE, an island of the Inner Hebrides, Argyllshire, Scotland. Pop. (1901), 2192. It is situated fully 2 m. S.W. of Coll, the isle of Gunna lying in the channel between the two islands, and has an extreme length from north-east to south-west of nearly 12 m. and a breadth varying from $\frac{3}{4}$ m. to $4\frac{1}{4}$ m. Carnan Mor (460 ft.) is the highest point; there are several lakes. On the south-western point of Balephuill Bay are ruins of St Patrick's temple, besides duns and ancient chapels. Steamers call from Oban regularly at the small harbour of Scarinish. SKERRYVORE, a lonely rock in the Atlantic, 14 m. south-west, belongs to the parish of Tyree. The massive lighthouse, which Alan Stevenson erected in 1833–1843, was constructed of granite from the quarries of Hynish at the south-eastern extremity of Tyree.

TYRONE, EARLS OF. The earldom of Tyrone was first conferred by Henry VIII. in 1542 on Conn Bacach O'Neill, and was forfeited in 1614 when an act of attainder was passed against his grandson Hugh, 2nd earl (more strictly 3rd earl, for his brother Brien was for some years *de jure* holder of the title though never recognized as such), the famous rebel who fled from Ireland with the earl of Tyrconnell in 1607 (see O'NEILL). Descendants of the 1st earl in Spain continued to style themselves earls of Tyrone till the death early in the 18th century of Owen O'Neill, grandson of Owen Roe O'Neill. In 1673 Richard Power, 6th Baron Le Power and Coroghmore, governor of Waterford, was created viscount of Decies and earl of Tyrone, being succeeded in these titles by his two sons successively, on the death of the younger of whom in 1704 they became extinct. A daughter of this last earl married Sir Marcus Beresford, Bart., of Coleraine, Co. Derry, in 1717; and in 1720 Beresford was created Baron Beresford and Viscount of Tyrone. In 1746 he was further created earl of Tyrone, and after his death in 1763 his widow became in 1767 Baroness La Poer in her own right. The only surviving son of this marriage inherited the titles of both his parents, all of which were in the peerage of Ireland, and in 1786 he was created a peer of Great Britain as Baron Tyrone of Haverfordwest in the county of Pembroke; three years later he was created marquess of Waterford, with which dignity the earldom of Tyrone has remained conjoined.

TYRONE, a county of Ireland in the province of Ulster, bounded N. and W. by Donegal, N.E. by Londonderry, E. by Lough Neagh and Armagh and S. by Monaghan and Fermanagh. The area is 806,658 acres or about 1260 sq. m. The surface is for the most part hilly, rising into mountains towards the north and south, but eastward towards Lough Neagh it declines into a level plain. Running along the north-eastern boundary with Londonderry are the ridges of the Sperrin Mountains (Sawel, 2240 ft., and Meenard, 2061 ft.). Farther south there is a range of lower hills, and Mullaghearn, north-east of Omagh, reaches 1778 ft. South of Clogher a range of hills, reaching 1255 ft. in Slieve Beagh, forms the boundary between Tyrone and Monaghan. On each side of the Mourne River near Omagh rise the two picturesque hills Bessy Bell and Mary Gray. The Foyle forms a small portion of the western boundary of the county, and receives the Mourne, which flows northward by Newton Stewart. The principal tributaries of the Mourne are the Strule (constituting its upper waters), the Derg from

Lough Derg, and the Owenkillew, flowing westward from Fir Mountain. The Blackwater rises near Fivemiletown and forms part of the south-eastern boundary of the county with Monaghan and Armagh. With the exception of Lough Neagh, bounding the county on the east, the lakes are small, also few in number. Lough Fea is picturesquely situated in the north-west, and there are several small lakes near Newtown Stewart.

Geology.—The Sperrin Mountains in the north consist of ordinary "Dalradian" mica schists, covered mostly with grass. Lower Carboniferous Sandstone occurs as an outlier between the mountains and Strabane. The relation of the northern schists to the gneissic and "green rock" axis that forms the central moorland of Tyrone is obscure; intrusions of granite have evidently coarsened the structure of this axis. Ancient perlitic rhyolites occur among the "green rocks" on its northern flank. Omagh lies on Lower Carboniferous Sandstone, which, fringed by Old Red Sandstone, stretches west from the town to the county boundary; but the Dalradian schists appear continuously south of this from Omagh to Lack in Co. Fermanagh. A great mass of Old Red Sandstone, rising in long ranges of hills, occupies most of the south of the county, resting on Silurian shales at Pomeroy. Lower Carboniferous sandstone and limestone occur on the south flank of this upland, and extend over its east end to Cookstown. At Slieve Beagh in the extreme south Upper Carboniferous sandstones and shales are reached, and from Coalisland to Dungannon true Coal Measures appear. This coalfield includes one fine seam 9 ft. thick at Coalisland; less important coals occur in the Millstone Grit series at Dungannon. Though much denuded before Triassic times, the field doubtless continues eastward under the Triassic sandstone that stretches towards Lough Neagh. The pale clays, probably Pliocene, of the southern shore of the lake cover the flat land east of Coalisland, and are several hundred feet thick. North of Stewartstown, near Tullaghoge, a very small patch of Magnesian limestone contains Permian marine fossils; and, farther north, the county includes part of the basaltic plateaus, protecting Chalk, which extend away into Co. Londonderry. The Glacial epoch has left immense deposits of gravel and long eskers throughout the county. These are especially conspicuous north of Pomeroy. Fire-clay is raised from the collieries at Coalisland; but coal-mining here awaits exploration on the east.

Industries.—The hilly districts are unsuitable for tillage; but in the lower regions the soil is remarkably fertile, and agriculture is generally practised after improved methods, the county in this respect being in advance of most parts of Ireland. The excellent pasturage of the hilly districts supports a large number of young cattle. The proportion of tillage to pasture is roughly as 1 to 1½. Oats, potatoes and turnips are the principal crops. The cultivation of flax, formerly an important industry, has greatly deteriorated. Poultry-keeping is a growing industry. There are manufactures of linens and coarse woollens (including blankets); brown earthenware, chemicals, whisky, soap and candles are also made. There are a few breweries and distilleries, and several flour and meal mills. But for the lack of enterprise the coal and iron might aid in the development of a considerable manufacturing industry.

Branches of the Great Northern railway from Portadown (Co. Armagh) and Dungannon in the south-east, and from Enniskillen (Co. Fermanagh) and Fintona, unite at Omagh, whence a line proceeds north by Newtown Stewart and Strabane to Londonderry. From Dungannon a branch runs north to Cookstown, where it joins a branch of the Northern Counties (Midland) railway. From Victoria Bridge on the Londonderry line the Castlederg light railway serves that town. The south of the county is served by the Clogher Valley light railway. Water communication includes Lough Neagh, and the Blackwater entering it, and navigable to Moy, whence the Ulster canal skirts the boundary of the county with Co. Armagh to Caledon. The Foyle is navigable to Strabane.

Population.—The population (150,567 in 1901) shows a decrease among the most serious of Irish county populations, and emigration is heavy. About 55% of the inhabitants are Roman Catholics, 22% Protestant Episcopalians and 19% Presbyterians; about 90% constitute the rural population The chief towns are Strabane (pop. 5033), Omagh (the county town, 4789), Dungannon (3694), Cookstown (3531) and Newtown Stewart (1062). The county comprises 8 baronies. Two county members and 2 for each of the boroughs of Augher, Clogher, Dungannon and Strabane were returned to the Irish parliament; after the Union the county returned 2 members to parliament, the borough of Dungannon also returning 1; but in 1885 Dungannon was disfranchised and the county arranged in four divisions—east, mid, north and south—each returning one member. Assizes are held at Omagh and quarter-sessions at Clogher, Cookstown, Dungannon, Omagh and Strabane.

History.—Tyrone became a principality of one of the sons of Niall of the Nine Hostages in the 5th century, and from his name—Eogan—was called Tir Eogan, gradually altered to Tyrone. From Eogan were descended the O'Neals or O'Neills and their numerous septs. The family had their chief seat at Dungannon until the reign of Elizabeth, when it was burned by Hugh O'Neill to prevent it falling into the hands of Lord Mountjoy. The earldom of Tyrone had been conferred by Henry VIII. on Conn O'Neill, but on his death, when the earldom should have descended to his heir Matthew, baron of Dungannon, another son, Shane, was proclaimed chief with the consent of the people. Shane maintained a contest with English authority, but his last-remaining forces were completely defeated near the river Foyle in May 1567, and shortly afterwards he was himself killed. Tyrone was one of the counties formed at Sir John Perrot's shiring of the unreformed parts of Ulster; but his work was interrupted by the rising of Hugh O'Neill in 1596. During the insurrection of 1641 Charlemont Fort and Dungannon were captured by Sir Phelim O'Neill, and in 1645 the parliamentary forces under General Munro were signally defeated by Owen Roe O'Neill at Benburb. At the Revolution the county was for a long time in the possession of the forces of James II.

Raths are scattered over every district of the county. There is a large cromlech near Newtown Stewart, another at Tarnlaght near Coagh and another a mile above Castlederg. At Kilmeillie near Dungannon are two stone circles. There are some ruins of the ancient castle of the O'Neills, near Benburb; mention may also be made of the ruins of the castles of Newtown Stewart, Dungannon, Strabane and Ballygawley.

TYRONE, a borough of Blair county, Pennsylvania, U.S.A., about 15 m. N.E. of Altoona, on the Little Juniata river, a small tributary of the Juniata river. Pop. (1910) 7176. Tyrone is served by the main line and three short branches of the Pennsylvania railway (which has repair shops here), and is connected with Altoona by an electric line. The borough is situated about 910 ft. above sea-level, in an agricultural and lumbering region, and there are deposits of limestone in the vicinity. It is a distributing point for the Clearfield coal region to the northward. At the village of Birmingham, 3 m. east, is a school for girls (founded 1853; incorporated 1907). Tyrone was laid out as a village in 1851, and was incorporated as a borough in 1857.

TYRRELL, GEORGE (1861–1909), Irish divine, was born in Dublin on the 6th of February 1861, and came of a family noted for its intellectual distinction. He was educated under Dr Benson at Rathmines School and entered Trinity College in 1878. He was greatly influenced by the writings of Cardinal Newman, and early in 1879 entered the Roman Catholic Church. In 1880 he joined the Society of Jesus and passed his novitiate at Manresa and other houses of the order, becoming teacher of philosophy at Stonyhurst. He had a keen sympathy with the difficulties experienced by the ordinary lay mind in trying to reconcile the conservative element in Catholicism with the principle of development and growth, and in *The Faith of the Millions*, *Hard Sayings* and *Nova et vetera* he attempted to clear them away. His writings have been described as "apologetic in intention, meditative in method and mystical in substance," and Tyrrell himself certainly combined in a wonderful way the judicial and the enthusiastic types of character. Besides the influence of Newman, the friendship and work of Robert Dolling made a great impression on him, and as he admitted, saved him from being contented with a merely academic and ecclesiastical type of religion. Tyrrell privately circulated among his friends writings in which he drew a clear line of distinction between religion as a life and theology as the incomplete interpretation of that life. One of these, the *Letter to a Professor of Anthropology*, was translated without his knowledge into Italian, and extracts from it were published in the *Corriere della Sera* of Milan in January 1906. For at least eight years before this he had been more or less in conflict with the authorities of his order, through his sympathy with "modernist" views, but the publication of this letter (afterwards issued by Tyrrell as *A Much Abused Letter*) brought about his expulsion from the order in February 1906. "The conflict," he wrote, "such as it is, is one of opinion and tendencies, not of persons; it is the result of mental and moral necessities created by the antitheses with which the Church is wrestling in this period of transition." Tyrrell found no bishop to give him an ecclesiastical status and a *celebret*, and he never regained these privileges. In July 1907 the Holy Office published its decree condemning certain modernist propositions, and in September the pope issued his encyclical *Pascendi Gregis*. Tyrrell's criticism of this document appeared in *The Times* on the 30th of September and the 1st of October, and led to his virtual excommunication from the Church. In the few years that remained to him he gave himself with patience and dignity to the work of his life. He had already published *Lex orandi*, insisting that the true interpretation of the creed is determined by its prayer value, and in 1906 he wrote *Lex credendi*. This was followed by *Through Scylla and Charybdis*, in which he developed his favourite view of revelation as experience; *Mediaevalism*, a vigorous apologia in reply to a Lenten pastoral of Cardinal Mercier, archbishop of Malines, who had attacked him as the chief exponent of Modernism; and *Christianity at the Cross Roads*, which emphasizes the distinction between his own position and that of the Liberal Protestants, and is of special interest for its treatment of the eschatological problems of the Gospels. On the 6th of July 1909 he was suddenly taken ill, on the 10th he received conditional absolution from a priest of the diocese of Southwark, and on the 12th extreme unction from the prior of Storrington. His intimate friend, the Abbé Bremond, gave him the last absolution and remained with him until his death on the 15th of July 1909. Such appear to be the facts, but Tyrrell's relations with Rome were such that a good deal of mystery was made as to whether he really received the last rites of his Church in any authorized manner. About his own saintly and sympathetic character, and his essential religiousness, there was no doubt.

See the estimates by Baron F. von Hügel and Rev. C. E. Osborne in *The Hibbert Journal* for January 1910; also the obituary in *The Times* (July 16, 1909), and the *Life*, by Miss M. D. Petre.

TYRRELL, SIR JAMES (d. 1502), the supposed murderer of the English king Edward V., and of his brother Richard, duke of York, was a son of William Tyrrell and a grandson of Sir John Tyrrell (d. *c.* 1437), who was treasurer of the royal household and was on three occasions Speaker of the House of Commons. The family is said to descend from Walter Tirel, the murderer of William Rufus. During the Wars of the Roses James Tyrrell fought for the Yorkists; in 1471 he was knighted; and in 1477 he was member of parliament for Cornwall. With regard to his share in the murder of the prince in 1483 he appears to have been selected by Richard III. and sent to the Tower of London, where he supervised the crime which was carried out by his subordinates. Afterwards he received several appointments from Richard and was sent to Flanders. He was also employed by Henry VII. and was made governor of Guisnes, but he seems to have incurred the king's displeasure through his friendship with Edmund de la Pole, earl of Suffolk. Having been treacherously seized he was conveyed to England and was executed on the 6th of May 1502. Just before his death he made a confession about the murder of the princes.

Members of the same family were Sir Thomas Tyrrell (1594–1672), justice of the common pleas under Charles II., and Anthony Tyrrell (1552–*c.* 1610), a Roman Catholic priest and spy, who afterwards became a clergyman of the Church of England.

TYRTAEUS, Greek elegiac poet, lived at Sparta about the middle of the 7th century B.C. According to the older tradition he was a native of the Attic deme of Aphidnae, and was invited to Sparta at the suggestion of the Delphic oracle to assist the Spartans in the second Messenian war. According to a later version, he was a lame schoolmaster, sent by the Athenians as likely to be of the least assistance to the Spartans (Justin iii. 5; Themistius, *Orat.* xv. 242; Diod. Sic. xv. 67). A fanciful explanation of his lameness is that it alludes to the elegiac couplet, one verse of which is shorter than the other. According to Plato (*Laws*, p. 629 A), the citizenship of Sparta was conferred upon Tyrtaeus, although Herodotus (ix. 35) makes no mention of him among the foreigners so honoured. Basing his inference on the ground that Tyrtaeus speaks of himself as a citizen of Sparta (*Fr.* 2), Strabo (viii. 362) is inclined to reject the story of his Athenian origin. Suïdas speaks of him as "Laconian or Milesian"; possibly he visited Miletus in his youth, where he became familiar with the Ionic elegy. Busolt, who suggests that Tyrtaeus was a native of Aphidnae in Laconia, conjectures that the entire legend may have been concocted in connexion with the expedition sent to the assistance of Sparta in her struggle with the revolted Helots at Ithome (464). However this may be, it is generally admitted that Tyrtaeus flourished during the second Messenian war (*c.* 650 B.C.)—a period of remarkable musical and poetical activity at Sparta, when poets like Terpander and Thaletas were welcomed—that he not only wrote poetry but served in the field, and that he endeavoured to compose the internal dissensions of Sparta (Aristotle, *Politics*, v. 6) by inspiring the citizens with a patriotic love for their fatherland. About twelve fragments (three of them complete poems) are preserved in Strabo, Lycurgus, Stobaeus and others. They are mainly elegiac and in the Ionic dialect, written partly in praise of the Spartan constitution and King Theopompus (Εὐνομία), partly to stimulate the Spartan soldiers to deeds of heroism in the field (Ὑποθῆκαι—the title is, however, later than Tyrtaeus). The interest of the fragments preserved from the Εὐνομία is mainly historical, and connected with the first Messenian war. The Ὑποθῆκαι, which are of considerable merit, contain exhortations to bravery and a warning against the disgrace of cowardice. The popularity of these elegies in the Spartan army was such that, according to Athenaeus (xiv. 630 F), it became the custom for the soldiers to sing them round the camp fires at night, the polemarch rewarding the best singer with a piece of flesh. Of the marching songs (Ἐμβατήρια), written in the anapaestic measure and the Doric dialect, only scanty fragments remain (Lycurgus, *In Leocratem*, p. 211, § 107; Pausanias iv. 14, 5. 15, 2; fragments in T. Bergk, *Poetae lyrici graeci*, ii.).

Verrall (*Classical Review*, July 1896, May 1897) definitely places the lifetime of Tyrtaeus in the middle of the 5th century B.C., while Schwartz (*Hermes*, 1899, xxxiv.) disputes the existence of the poet altogether; see also Macan in *Classical Review* (February 1897); H. Weil, *Études sur l'antiquité grecque* (1900), and C. Giarratani, *Tirteo e i suoi carmi* (1905). There are English verse translations by R. Polwhele (1792) and imitations by H. J. Pye, poet laureate (1795), and an Italian version by F. Cavallotti, with text, introduction and notes (1898). The fragment beginning Τεθνάμεναι γὰρ καλόν has been translated by Thomas Campbell, the poet. The edition by C. A. Klotz (1827) contains a dissertation on the war-songs of different countries.

TYRWHITT, THOMAS (1730–1786), English classical scholar and critic, was born in London on the 27th of March 1730, where he died on the 15th of August 1786. He was educated at Eton and Queen's College, Oxford (fellow of Merton, 1755). In 1756 he was appointed under-secretary at war, in 1762 clerk of the House of Commons. In 1768 he resigned his post, and spent the remainder of his life in learned retirement. In 1784 he was elected a trustee of the British Museum, to which he bequeathed a portion of his valuable library.

His principal classical works are: *Fragmenta Plutarchi II. inedita* (1773), from a Harleian MS.; *Dissertatio de Babrio* (1776), containing some fables of Aesop, hitherto unedited, from a Bodleian MS.; the pseudo-Orphic *De lapidibus* (1781), which he assigned to the age of Constantius; *Conjecturae in Strabonem* (1783); Isaeus *De Meneclis hereditate* (1785); Aristotle's *Poetica*, his most important work, published after his death under the superintendence of Dr Burgess, bishop of Salisbury, in 1794. Special mention is due of his editions of Chaucer's *Canterbury Tales* (1775–1778); and of *Poems, supposed to have been written at Bristol by Thomas Rowley* *and others in the Fifteenth Century* (1777–1778), with an appendix to prove that the poems were all the work of Chatterton. In 1782 he published a *Vindication of the Appendix* in reply to the arguments of those who maintained the genuineness of the poems. While clerk of the House of Commons he edited *Proceedings and Debates of the House of Commons*, 1620–1621 from the original MS. in the library of Queen's College, Oxford, and Henry Elsynge's (1598–1654) *The Manner of holding Parliaments in England*.

TYTLER, WILLIAM (1711–1792), of Woodhouselee, Scottish historian and antiquarian, son of Alexander Tytler of Edinburgh, was born in that city on the 12th of October 1711. He was educated at the High School and the University, and was in 1744 admitted into the society of Writers to the Signet. In 1759 he published an *Inquiry, Historical and Critical*, defending the character of Mary, Queen of Scots, and in 1783 the *Poetical Remains of James the First, King of Scotland*. He died at Woodhouselee on the 12th of September 1792. His life, written by Henry Mackenzie, was published in 1796.

His son ALEXANDER FRASER TYTLER, Lord Woodhouselee (1747–1813), Scottish judge, was born at Edinburgh on the 15th of October 1747. He was called to the Edinburgh bar in 1770. His first work, a supplement to Lord Kames's *Dictionary of Decisions*, entitled *The Decisions of the Court of Session*, was published in 1778, and a continuation appeared in 1796. In 1780 he was appointed conjoint professor of universal history in the university of Edinburgh, becoming sole professor in 1786. In 1783 he published *Outlines* of his course of lectures, extended and republished in 1801 under the title of *Elements of General History*. In 1790 he was appointed judge-advocate of Scotland, and while holding this office he wrote a *Treatise on the Law of Courts-Martial*. In 1801 he was raised to the bench, taking his seat (1802) in the court of session as Lord Woodhouselee. He died at Edinburgh on the 5th of January 1813.

Besides the works already mentioned, he wrote *Life and Writings of Dr John Gregory* (1788); *Essay on the Principles of Translation* (1790); a dissertation on *Final Causes*, prefixed to his edition of Derham's *Physico-Theology* (1799); a political pamphlet entitled *Ireland profiting by Example* (1799); an *Essay* on Laura and Petrarch (1801); and *Memoirs of the Life and Writings of Henry Home of Kames* (1807).

PATRICK FRASER TYTLER (1791–1849) Scottish historian, son of Lord Woodhouselee, was born at Edinburgh on the 30th of August 1791. He was called to the bar in 1813; in 1816 he became king's counsel in the exchequer, and practised as an advocate until 1832. He contributed to Allison's *Travels in France* (1815); his first independent essays were papers in *Blackwood's Magazine*. His great work, the *History of Scotland* (1828–1843) covered the period between 1249 and 1603. While occupied on this work Tytler removed to London, and it was largely owing to his efforts that a scheme for publishing state papers was carried out. Tytler was one of the founders of the Bannatyne Club and of the English Historical Society. He died at Great Malvern on the 14th of December 1849. His life (1859) was written by his friend, John W. Burgon, dean of Chichester.

His other works include: contributions to Thomson's *Select Melodies of Scotland* (1824); *Life of James Crichton of Cluny, commonly called the Admirable Crichton* (1819; 2nd ed., 1823); a *Memoir of Sir Thomas Craig of Riccarton* (1823); an *Essay on the Revival of Greek Literature in Italy*, and a *Life of John Wickliff*, published anonymously (1826); *Lives of Scottish Worthies*, for Murray's *Family Library* (1831–1833); *Historical View of the Progress of Discovery in America* (1832); *Life of Sir Walter Raleigh* (1833); *Life of Henry VIII.* (1837); *England under the Reigns of Edward VI. and Mary*, from original letters (1839); *Notes on the Darnley Jewel* (1843), and on the *Portraits of Mary Queen of Scots* (1845).

TYUMEÑ, a town in West Siberia, in the government of Tobolsk, situated where the chief highway from Russia across the Urals touches the first navigable river (the Tura) of Siberia. Pop. (1900), 29,651. A railway passing through Ekaterinburg (202 m west by rail) and the principal ironworks on the eastern slopes of the middle Urals connects Tyumeñ with Perm, the terminus of steamboat traffic on the Kama and Volga. Tyumeñ has regular steam communication with Omsk and Semipalatinsk Irtysh (steamers penetrating as far as Lake Zaisan in Dzungaria), with Tomsk, and other places in the Altai, and with the Arctic Ocean and the fisheries of the lower Ob. The town is well built, and stands on both banks of the Tura, here spanned by a bridge. The inhabitants have always been renowned for their industrial skill. Woollen cloth, linen, belts, barges, paper, and especially boots and gloves, are manufactured to a large amount; and Tyumeñ carpets have a great reputation in Russia and Siberia.

TZETZES, JOHN, Byzantine poet and grammarian, flourished at Constantinople during the 12th century A.D. Tzetzes has been described as a perfect specimen of the Byzantine pedant. Excessively vain, he resented any attempt at rivalry, and violently attacked his fellow grammarians. Owing to want of books, he was obliged to trust to his memory; hence he is to be used with caution. But he was a learned man, and deserves gratitude for his efforts to keep up the study of ancient Greek literature. Of his numerous works the most important is the *Book of Histories*, usually called *Chiliades* ("thousands") from the arbitrary division by its first editor (N. Gerbel, 1546) into books each containing 1000 lines (it actually consists of 12,674 lines in "political" verse). It is a collection of literary, historical, theological and antiquarian miscellanies, whose chief value consists in the fact that it to some extent makes up for the loss of works which were accessible to Tzetzes. The whole production suffers from an unnecessary display of learning, the total number of authors quoted being more than 400 (H. Spelthahn, *Studien zu den Chiliaden des Johannes Tzetzes*, diss., Munich, 1904). The author subsequently brought out a revised edition with marginal notes in prose and verse (ed. T. Kiessling, 1826; on the sources see C. Harder, *De J. T. historiarum fontibus quaestiones selectae*, diss., Kiel, 1886). The *Chiliades* is based upon a collection of *Letters* (ed. T. Pressel, 1851), which has been called an index to the larger work, itself described as a versified commentary on the letters. These letters (107 in number) are addressed partly to fictitious personages, and partly to the great men and women of the writer's time. They contain a considerable amount of biographical details. The *Iliaca*, an abridgment of and supplement to the *Iliad*, is divided into three parts—*Antehomerica*, *Homerica*, *Posthomerica*—containing the narrative from the birth of Paris to the return of the Greeks after the fall of Troy, in 1676 hexameters (ed. C. Lehrs and F. Dübner, 1868, in the Didot series, with Hesiod, &c.) The Homeric *Allegories*, dedicated to the empress Irene, in "political" verse, are two didactic poems in which Homer and the Homeric theology are explained on euphemistic principles (ed. P. Matranga, in his *Anecdota graeca*, i. 1850). Tzetzes also wrote commentaries on a number of Greek authors, the most important of which is that on the *Cassandra* or *Alexandra* of Lycophron (ed. C. G. Müller, 1811), in the production of which his brother Isaac is generally associated with him. Mention may also be made of a dramatic sketch in iambic verse, in which the caprices of fortune and the wretched lot of the learned are described; and of an iambic poem on the death of the emperor Manuel, noticeable for introducing at the beginning of each line the last word of the line preceding it[1] (both in Matranga, *An. gr.* ii.).

For the other works of Tzetzes see J. A. Fabricius, *Bibliotheca graeca* (ed. Harles), xi. 228, and C. Krumbacher, *Geschichte der byz. Litt.* (2nd ed., 1897); monograph by G. Hart, "De Tzetzarum nomine, vitis, scriptis," in Jahn's *Jahrbücher für classische Philologie*. Supplementband xii. (Leipzig, 1881).

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[1] This versification is called κλιμακωτός (κλῖμαξ, ladder), a term more commonly applied to a verse in which each word contains one letter more than the one which precedes it.

U The twenty-first letter of the English alphabet. It is a modification made in manuscript writing of the Latin inscriptional V, and is itself found on the inscriptions of Rome as early as the latter part of the 2nd century A.D. The symbols U, V, Y are all of the same origin, but what the origin is has been much disputed. In the Phoenician alphabet T is the last symbol, but there can be little doubt that when the Greeks introduced symbols for vowels, which had not been indicated in the alphabet they had borrowed, they took the sixth symbol of the Phoenician alphabet (see F) in its ordinary form Y and placed it at the end of the alphabet with the value of a vowel. This vowel was apparently *u* (English *oo* in *moon*), though Ionic and Attic Greek at a very early period changed it to the sound of the French *u*. In other dialects the earlier value long persisted, and in modern Tzakonian, the representative of the ancient Laconian, it still survives. In some places, *e.g.* Boeotia, the sound seems to have changed, in connexion with dental consonants, in the same way as the English sound, in certain cases i̯ (*y*) being inserted in front of it. This seems to be the only feasible explanation of such spellings as *τιούχα* (*τύχη*), *πολιούξενος* (*πολύξενος*), which appear after the Boeotians adopted the Ionic alphabet. A similar change must have existed in very early Attic and Ionic to account for the change of *t* before *υ* into *s* in *σύ*, "thou" for *τύ*; some authorities think it was universal in the earliest Greek. Greek nowhere shows the symbol in the bowl shape that it has in the Semitic alphabet. From the 7th century B.C. both Y and V are found, sometimes both in the same area. Another form somewhat later has the upper strokes curved outwards ϒ, while the angle is much less deep than in the other forms. It is noticeable that the symbol for *u* in the syllabary which was used to write Greek in Cyprus has this form amongst others. The name of the sixth symbol in the Phoenician alphabet was *Wāw* (*Vau*), but though U has taken its form, in Greek its name was ῦ (*i.e.* English *oo*, as in moon, except in Attic and Ionic, where it was like the French *u* in *lune*), not *upsilon*, as is frequently stated. In Sweet's terminology *u* (*oo*), as pronounced in English "put" or "too," is a high back wide round, while the sound in the French *sou* or the Scotch pronunciation of "book" is a high back narrow round. The high front corresponding sound is found in the French *lune*. With this the German "modified u" (*ü*) is often equated, but it is not really identical, being a mid front narrow round vowel. The pitch of the vowel *u* is among the lowest of the vowel sounds; the rounding and protrusion of the lips make the breath passage longer than it is for other vowels, and so its production may be compared to that of a sound made upon a flute when all the finger-holes are covered. In modern English *ū* preceded by i̯ (*y*) arises from three different sounds in middle English: (*a*) the long French *u* (*ü*) brought in with borrowed words from French (duke), (*b*) *ēu* (Early English *ēow*) as in "new," (*c*) a more open sound *ēu* (Early English *ēaw*) as in "dew" (Sweet, *New English Grammar*, § 806). The *y*-sound was dropped after *r*, *ch* and *dzh*, as in "true," "choose," "juice" (ibid., § 857). In the literary dialect also it generally disappears after *l*, as in "lurid," "lute." In some provincial and American pronunciations it is dropped everywhere except initially, so that "Tuesday" is pronounced *Toosday*, "new" *noo*. (P. Gi.)

UAKARI (*Ouakari*), the native name of certain tropical American monkeys, distinguished from all other New World monkeys by their short tails. The three known species constitute the genus *Uacaria* (or *Cothurus*) of zoologists, and are confined to the forests of Amazonia and the neighbourhood. One of them (*U. calva*) is remarkable for its long, silky, pale chestnut fur and brilliant scarlet face, which is naked (see PRIMATES).

UBANGI, a river of Equatorial Africa, the chief northern affluent of the Congo (*q.v.*). The Ubangi (otherwise Mubangi or Mobangi) enters the Congo by various mouths between 0° 22′ and 0° 37′ S. and 17° 40′ and 17° 50′ E. The main channel, fully 1 m. wide, joins the Congo in 0° 31′ S. The Ubangi is formed by the junction of the Mbomu and the Welle, both of which rise on the north-eastern rim of the Congo basin.

The water-parting between the Bahr-el-Ghazal affluents (Nile system) and the Mbomu headstreams is not very clearly marked, but high hills running parallel with the Nile between Albert Nyanza and Dufile sharply separate the valley of the Welle and other west-flowing streams from that of the Mountain Nile. The chief of the headstreams of the Welle (known in its upper course as the Kibali) rises on the western slope of a hill about 40 m. west of Wadelai. It is joined by several small streams, the main river flowing in a W.N.W. direction. After a course of over 700 m. (during which it receives one large southern tributary—the Bomokandi—and other considerable affluents) the Welle joins the Mbomu in 4° 10′ N. 22° 37′ E. The Mbomu, which has two large northern tributaries, the Shinko and the Bali, rises in 4° 50′ N. 27° 12′ E. For some distance it runs parallel to and about 100 m. north of the lower course of the Welle. About 23° 12′ E. it turns sharply south until its junction with the Welle. In its lower course the Mbomu is interrupted by many falls and rapids. A short distance below the junction of the Mbomu and Welle the Kotto, coming from beyond 8° N., on the borders of Darfur, and forming the most northerly extension of the Congo basin, enters the united stream, now known as the Ubangi, on the right bank. The remaining tributaries, mostly on the right bank, are smaller, but the Kemo, which joins the Ubangi near its most northern point (5° 8′ N.), is of some importance as offering water communication to within a short distance of the Shari basin. Below the Kemo confluence the Ubangi, which has hitherto continued to flow W.N.W., makes a great bend south and runs into the Congo after a southerly course of 400 m. Shortly after receiving the Kemo the river forces its way through a line of hills whose tops rise 600 to 800 ft. above the banks of the stream. Here are the Zongo or Grenfell rapids, which are a barrier to navigation save for small boats at flood season. Above the Zongo rapids the river is navigable up to the confluence of the Welle and Mbomu, and the Welle is navigable at high flood up to the Bomokandi confluence in 26° 8′, though the stream is much interrupted by rapids.

From the Mbomu-Welle confluence to the junction of the Ubangi with the Congo the river has a course of fully 700 m., while the Ubangi-Welle combined exceeds 1400 m. From its mouth to Zongo rapids, a distance of 350 m., the stream is navigable by steamers drawing 3 ft. of water. In general the Ubangi flows through a fertile and forested region.

The Welle was discovered from the north by G. A. Schweinfurth in 1870; *i.e.* seven years before the discovery of the course of the Congo by H. M. Stanley. By Schweinfurth the Welle was believed to belong to the Chad system, but W. Junker, who (1882–1883) followed the river to near its confluence with the Mbomu, made it clear that the Welle belonged to the Congo system. In 1885 the Rev. George Grenfell, of the Baptist Missionary Society (who had discovered the mouth of the river in 1884), ascended the Ubangi as far as the Zongo rapids. He was followed in 1886–1889 by the Belgian A. van Gèle, who in the last-named year finally established the identity of the Ubangi with Schweinfurth's Welle. The Mbomu was discovered from the north in 1877 by a Greek, Dr P. Potagos, and its upper course was followed for some distance by Junker. The Ubangi and the Mbomu form the frontier between Belgian Congo and French Congo, the northern banks of both streams belonging to France.

See, besides the works of Schweinfurth, Junker and other travellers, A. J. Wauters, *Les Bassins de l'Ubangi* (*inférieur*) *et de la Sanga*, with map (Brussels, 1902); Dr Cureau's map (1 : 1,000,000) of the upper Ubangi in *La Géographie* (October 1900); the CONGO and works there cited.

ÚBEDA, a town of southern Spain, in the province of Jaen; 2000 ft. above sea-level, in the Loma de Úbeda, a range on the right bank of the Guadalquivir. Pop. (1900), 19,913. The surrounding country produces wheat, wine, olives and fruit. Úbeda has a station 6 m. south on the Madrid-Almeria railway. Portions of the old walls, with towers and gates, still remain, and there are three late Gothic churches, the oldest of which, San Salvador, dates from 1540 to 1556, and contains some interesting paintings. An important fair is held from the 29th of September to the 5th of October. Oil, soap, esparto and linen fabrics are manufactured. Úbeda was an important town under Moorish rule.

UDAD, Aoudad or Audad, the Moorish name of the Barbary sheep, or arui, *Ovis* (*Ammotragus*) *lervia*, the only wild sheep found in Africa, where it inhabits all the mountain ranges of the north, descending to the eastward far into the heart of the Sudan. The udad is distinguished by the abundant hair on the throat and fore-quarters of the rams, and the length of the tail. In the absence of face-glands and in the structure of the horns the species approximates to the goats. The "lion-coloured" coat approximates to the hue of the limestone rocks on which these sheep dwell.

UDAIPUR, Oodeypore or Mewar, a native state of India, in the Rajputana agency. Area, 12,691 sq. m. Pop. (1901), 1,030,212. Estimated revenue £200,000; tribute £17,000. The greater part of the country is level plain. A section of the Aravalli Mountains extends over the south-western and southern portions, and is rich in minerals, but the mines have been long closed. The general inclination of the country is from south-west to north-east, the Banas and its numerous feeders flowing from the base of the Aravalli range. There are many lakes and tanks in the state, the finest of which is the Debar or Jaisamand, with an area of nearly 21 sq. m.; it is considered to be the largest artificial sheet of water in the world. A portion of the state is traversed by the Malwa line of the Rajputana railway. A branch from Chitor towards Udaipur was taken over by the state in 1898, and was extended nearer to the capital. Like the rest of Rajputana the state suffered severely from famine in 1900. The ancient coinage is of the Sasanian or Persian type, copper issues of this type being still in circulation. Modern coins bear on the reverse the words "Friend of London."

The chief, whose title is maharana, is the head of the Sisodhyia clan of Rajputs, and claims to be the direct representative of Rama, the mythical king of Ajodhya. He is universally recognized as the highest in rank of all the Rajput princes. The dynasty offered a heroic resistance to the Mahommedans, and boast that they never gave a daughter to a Mogul emperor. They are said to have come from Gujarat and settled at Chitor in the 8th century. After the capture of Chitor by Akbar in 1568 the capital was removed to Udaipur by Maharana Udai Singh. During the 18th century the state suffered greatly from internal dissension and from the inroads of the Mahrattas. It came under British protection in 1817. The Maharana Fateh Singh, G.C.S.I. (b. 1848), succeeded by adoption in 1884.

The name of *Mewar* is derived from the Meos, or Minas, a tribe of mixed Rajput origin, who have likewise given their name to a different tract in northern Rajputana, called Mewat, where they are now all Mahommedans. About 1400 a sub-division of the Mewatis, called Khanzadas, made themselves the dominant power in this tract; and at the end of the 18th century, and again during the Mutiny, they were notorious for their ravages in the Upper Doab, around Agra and Delhi. In 1901 the total number of Mewatis in Rajputana was 168,596, forming 13% of the population in the state of Alwar. Down to 1906 the Mewar residency was the title of a political agency in Rajputana, comprising the four states of Udaipur, Banswara, Dungarpur and Partabgarh; area, 16,970 sq. m.; pop. (1901), 1,336,283. But in that year the three last states were separated from Udaipur, and formed into the Southern Rajputana States agency. The Mewar Bhil Corps, raised as a local battalion in 1840, which was conspicuously loyal during the Mutiny, was in 1897 attached to the Indian army, with its headquarters at Kherwara.

The city of Udaipur is 2469 ft. above sea-level. Pop. (1901), 45,976. It is situated in a valley amid wooded hills, on the bank of a large lake (Pichola), with palaces built of granite and marble. The maharana's palace, which crowns the ridge on which the city stands, dates originally from about 1570, but has had additions made to it till it has become a conglomeration of various architectural styles. On Lake Pichola are two islands, on which are palaces dating respectively from the middle of the 17th and of the 18th centuries. In one of these the European residents were sheltered during the Indian Mutiny. In the neighbourhood are Eklingji (with a magnificent temple of the 15th century), and Nagda, the seat of the ancestors of the chiefs of Udaipur, with a number of temples, two of which are said to date from the 11th century.

There is another Udaipur State in the Central Provinces (till 1905 one of the Chota Nagpur states of Bengal). Area, 1052 sq. m.; pop. (1901), 45,391. Its capital is Dharmjaygarh.

UDAL, NICHOLAS (1504–1556), English schoolmaster, translator and playwright, author of the earliest extant English comedy, *Roister Doister*, came of the family of Uvedale, who in the 14th century became lords of Wykeham, Hants, by marriage with the heiress of the Scures. The name was probably pronounced Oovedale, as it appears as Yevedale, Owdall, Woodall, with other variants. He latinized it as Udallus, and thence anglicized it as Udall. He is described as Owdall of the parish of St Cross, Southampton, 12 years old at Christmas 1516, when admitted a scholar of Winchester College in 1517 (*Win. Schol. Reg.*). He was therefore not 14 (as Anthony Wood says) but 16½ years of age when admitted a scholar of Corpus Christi College, Oxford, in June 1520; he is called Wodall as a lecturer at that college in 1526 to 1528 (T. Fowler, *Hist. C. C. C.*).

With John Leland he produced "dites" (ditties) "and interludes" (B.M. MS. 18A lxiv.) at Anne Boleyn's coronation on the 31st of May 1533. Leland's contributions are all in Latin; those of "Udallus," which form the chief part, are mostly in English, the speeches being each spoken by a "child," at Cornhill beside Leadenhall," "at the Conducte in Cornhill" and "at the little Conducte in Cheepe." His *Floures for Latine Spekynge, selected and gathered out of Terence and the same translated into Englysshe*, published by Bartlet (*in aedibus Bertheleti*), were dedicated "to my most sweet flock of pupils, from the monastery of the monks of the order of Augustine," on the 28th of February 1533–1534. There were no monks of that order, and whether Austin Friars or Augustinian canons were meant is open to doubt. The book was prefaced with laudatory Latin verses by Leland and by Edmund Jonson. The latter was a Winchester and Oxford contemporary of Udal's, in 1528 lower master (*hostiarius*) at Eton, a post which he left to become master of the school of St Anthony's Hospital, then the most flourishing school in London. From the dedication we may infer that Udal was usher under Jonson and "the sweet flock" was at St Anthony's school next door to Austin Friars. At Midsummer 1534 he became head master of Eton (*informator puerorum* or *ludi grammaticalis*; *Eton Audit Book*. 25–26 Hen. VIII.). It has been suggested (*Dic. Nat. Biog.*) that the *Floures* was dedicated to Eton boys in advance; but this is unlikely, as in those days schools never got their masters till the place was vacant, or on the verge of vacancy. At Eton Udal's salary was £10 and £1 for livery, with "petty receipts" of 8s. 4d. for *obits*, 2s. 8d. for laundress, 2s. for candles for his chamber, and 23s. 4d. "for ink, candles and other things given to the grammar school by Dr Lupton, provost." One of his school books, *Commentaries on the Tusculan questions of Cicero* (ed. Berouldus, 1509), with the inscription "sum Nicolai Udalli 1536," is in the King's Library at the British Museum.

There was a yearly play, 3s. being paid for the repair of the dresses of the players at Christmas, and 1s. 4d. to a servant of the dean of Windsor for bringing his master's clothes for the players. A payment for repair of the players' dresses recurs every year. Udal has been credited (E. K. Chambers, *Mediaeval Stage*, ii. 144, 192) with producing a play at Braintree while vicar there, recorded in the churchwardens' accounts for 1534 as "Placidas *alias* Sir Eustace." The play is actually called in the accounts (only extant in 17th-century extracts) "Placy Dacy *alias* St Ewastacy," and is the old play of Placidas, mentioned in the 9th century. Udal did not become vicar of Braintree till the 27th of September 1537 (Newcourt's *Repert.* ii. 89). At Michaelmas he resigned the mastership of Eton to reside at Braintree, being called "late schole-master wose roome nowe enjoyeth and occupieth Mr Tindall" in a letter from the provost to Thomas Cromwell, then privy seal, on the 7th October 1537 (*Lett. and Pa. Hen. VIII.*, 1537). He returned to Eton, however, or rather to Hedgeley, the school being removed there on account of the plague, at Midsummer 1537, being paid for the third and fourth terms of the school year

(*Eton Audit Book*, 29–30 Hen. VIII.). In October 1538 "Nicholas Uvedale, professor of the liberal arts, *informator* and schoolmaster of Eton," was licensed to hold the vicarage of Braintree, "with other benefices," without personal residence. The accounts of Cromwell for 1538 include "Woodall, the scholemaster of Eton, to playing before my lord, £5." Presumably he brought a troupe of Eton boys with him. In that year he published a second edition of his *Floures of Terence* for the benefit of Eton boys. The often-questioned account of Thomas Tusser (*Five Hundred Pointes of Good Husbandrie*) is typical of Eton at the time, as Udal's predecessor Cox is said in Ascham's *Scholemaster* to have been "the best scholemaster and greatest beater of our time":—

> "From Powles[1] I went to Aeton sent,
> To learn straightwaies the Latin phraise;
> Where fifty-three stripes given to me at once I had;
> For fault but small or none at all
> It came to pass thus beat I was;
> See, Udall, see, the mercie of thee to mee, poor lad."

Udal's rule of the rod at Eton was brought to an abrupt conclusion by his being brought up before the privy council on the 14th of March 1540/1541 for being "counsail" with two of the boys, Thomas Cheney, a relation of the lord treasurer of the household, and Thomas Hoorde, for stealing some silver images and chapel ornaments. He denied the theft, but confessed to a much more scandalous offence with Cheney, and was sent to the Marshalsea prison. He tried, but failed, to get restored to Eton. Attempts have been made to whitewash him. But his own confession, and an abject letter of repentance with promises of amendment, addressed (probably) to Wriothesley, a Hampshire man and a family friend, cannot be got over. It shows that he was a bad schoolmaster as well as an immoral one, since he pleads "myn honest chaunge from vice to vertue, from prodigalitee to frugall lyving, from negligence of teachyng to assiduitee, from play to studie, from lightness to gravitee." In 1542–1543, after the bursar of Eton had ridden up to London to the provost, Udal was paid "53s. 4d. in full satisfaction of his salary in arrears and other things due to him while he was teaching the children"; but on the other side of the account appears an item of "60s. received from Dr Coxe for Udal's debts." So no money passed to Udal.

He seems to have maintained himself by translating into English, in 1542, Erasmus's *Apophthegms* and other works. In 1544 he published a new edition of the *Floures of Terence*. He seems to have taken a schoolmastership in Northumberland or Durham, as Leland in one of his *Encomia* speaks of him, probably at this time, as translated to the Brigantes. He seems to have been made to resign his living at Braintree, a successor being appointed on the 14th of December 1544. He purged himself, however, by composing the *Answer to the Articles of the Commoners of Devonshire and Cornwall* (Pocock, *Troubles of the Prayer Book of 1549*, Camd. Soc., new series, 37, 141, 193), when they rose in rebellion in the summer of 1549 against the First Prayer Book of Edward VI. In 1551 he received a patent for printing his translation of Peter Martyr's two works on the Eucharist and the Great Bible in English (Pat. 4 Edw. VI. pt. 5, m. 5, Shakespeare Soc. iii. xxx.). He was rewarded by being made a canon of Windsor on the 14th of December 1551. On the 5th of January "after the common reckoning 1552" (*i.e.* 1551/2) he edited a translation of Erasmus's *Paraphrases* of the Gospels, himself translating the first three, while that on St John was being translated by the princess Mary, till she fell sick and handed her work over to Dr Malet. The work was done at the suggestion and expense of the dowager queen Katharine, in whose charge Mary was. A translation by Udal of Geminus's *Anatomie* or *Compendiosa totius anatomiae delineatio*, a huge volume with gruesome plates, was published in 1553." Udal's preface is dated the 20th of July 1552 "at Windesore. In June and September 1553 (*Trevelyan Pap.* Camd. Soc. 84, ii. 31, 33) "Mr Nicholas Uvedale" was paid at the rate of £13, 6s. 8d. a year as "scholemaster to Mr Edward Courtney, beinge within the Tower of London, by virtue of the King's Majesty's Warrant"—the young earl of Devon, who had been in prison ever since he was twelve years old.

Queen Mary on the 3rd of December 1554 issued a warrant on Udal's behalf reciting that he had "at soundrie seasons convenient heretofore shewed and myndeth hereafter to shewe his diligence in setting forth Dialogues and Enterludes before us for our royal disporte and recreacion," and directing "the maister and yeomen of the office of the Revells" to deliver whatever Udal should think necessary for setting forth such devices, while the exchequer was ordered to provide the money to buy them (Loseley MSS. Kempe 63, and *Hist. MSS. Com. Rep.* vii. 612). One of these interludes was probably *Roister Doister*; for it was in January 1553, *i.e.* 1554, that Thomas Wilson, master of St Katharine's Hospital by the Tower, produced the third edition of *The Rule of Reason*, the first text-book on logic written in English, which contains, while the two earlier editions, published in 1551 and 1552 respectively, do not contain, a long quotation from *Roister Doister*. It gives under the heading of "ambiguitie," as "an example of such doubtful writing whiche, by reason of poincting, maie have double sense and contrarie meaning . . . taken out of an intrelude made by Nicholas Udal," the letter which Ralph Roister procured a scrivener to compose for him, asking Christian Constance, the heroine, to marry him. Roister's emissary read it—

> "Sweete mistresse, where as I love you nothing at all,
> Regarding your substance and richnesse chiefe of all,"

and so on; whereas it was meant to read—

> "Sweete mistresse, whereas I love you (nothing at all
> Regarding your substance and richnesse) chiefe of all,
> For your personage, beautie, demeanour and wit."

The play was entered at Stationers' Hall, when printed in 1566. Only one copy is known, which was given to Eton by an old Etonian, the Rev. Th. Briggs, in 1818, who privately printed thirty copies of it. As the title-page is gone the only evidence of its authorship is Wilson's quotation. Wilson being an Etonian, it has been argued that his quotation was a reminiscence of his Eton days, and that the play was written for and first performed by Eton boys. But the occurrence of the quotation first in the edition of 1554, and its absence in the previous editions of 1551 and 1552, coupled with the absence of anything in the play to suggest any connexion with a school, while the scene is laid in London and among London citizens and is essentially a London play, furnish a strong argument that *Roister Doister* first appeared in 1553, and therefore could not have been written at Eton or for Eton boys.

Nor could it have been written at Westminster School or for Westminster boys, as argued by Professor Hales in *Eng. Studien* (1893) xviii. 408. For though Udal did become head master of Westminster, he only became so nearly two years after Wilson's quotation from *Roister Doister* appeared. He was at Winchester in the interval, for Stephen Gardiner, bishop of Winchester and chancellor, by will of the 8th of November 1555 (P.C.C. 3 Noodes), gave 40 marks (£26, 13s. 4d.) to "Nicholas Udale, my scholemaister." In what sense he was Gardiner's schoolmaster it is hard to guess. He was not head master or usher of Winchester College; but he may have been master of the old City Grammar or High School, to which the bishop appointed (A. F. Leach, *Hist. Winch. Coll.* 32, 48). The schoolhouse had been leased out for 41 years in 1544 but it is possible Gardiner had revived the school or kept a school at his palace of Wolvesey. At Westminster "Mr Udale was admitted to be scholemaster 16 Dec. anno 1555" (*Chapter Act-Book*).

The last act of the secular canons, substituted by Henry VIII. for the monks, was the grant of a lease on the 24th of September 1556. When the monks re-entered, on Mary's restoration of the abbey (Nov. 21, 1556), the school did not, as commonly alleged, cease, nor had Udal ceased to be master (Shakespeare Soc. iii. xxxiv.) when he died a month later. The parish register of St Margaret's, Westminster, under "Burials in December A.D. 1556" records "11 die Katerine Woddall," "23 die Nicholas

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[1] Tusser was a chorister of St Paul's.

Yevedale," *i.e.* Udal. Katharine was perhaps a sister or other relation, as Elizabeth Udall was buried there on the 8th of July 1559. The abbey cellarer's accounts ending Michaelmas 1557 contain a payment "to Thomas Notte, usher of the boys, £6, 10s., and to the scholars (*scolasticis vocatis le grammer childern*), £63, 6s. 8d.," showing that the usher carried on the school after Udal's death. Next year (1557–1558) the abbey receiver accounted for £20 paid to John Passey, (the new) schoolmaster, to Richard Spenser, usher, £15, and £133, 6s. 8d. for 40 grammar boys. So it is clear that the school never stopped. Udal therefore was master of Westminster for just over two years. He died at the age of 52.

Roister Doister well deserves its fame as the first English comedy. It is infinitely superior to any of its predecessors in form and substance. It has sometimes been described as a mere adaptation of Plautus's *Miles Gloriosus*. Though the central idea of the play—that of a braggart soldier (with an impecunious parasite to flatter him) who thinks every woman he sees falls in love with him and is finally shown to be an arrant coward—is undoubtedly taken from Plautus, yet the plot and incidents, and above all the dialogue, are absolutely original, and infinitely superior to those of Plautus. Even the final incident, in which the hero is routed, is made more humorous by the male slaves being represented by maid-servants with mops and pails.

The play was printed by F. Marshall in 1821; in Thomas White's *Old English Dramas* (3 vols., 1830); by the Shakespeare Society, vol. iii., the introduction to which contains the fullest and most accurate account of his life; in Edward Arber's reprints in 1869; and Dodsley's *Old Plays* (1894), vol. iii. (A. F. L.)

UDAL (Dan. *odel*), a kind of right still existing in Orkney and Shetland, and supposed to be a relic of the old allodial mode of landholding existing antecedently to the growth of feudalism in Scotland (see ALLODIUM). The udal tenant holds without charter by uninterrupted possession on payment to the Crown, the kirk, or a grantee from the Crown of a tribute called scat (Dan. *skat*), or without such payment, the latter right being more strictly the udal right. Udal lands descend to all the children equally. They are convertible into feus at the option of the udallers.

UDINE, a town and archiepiscopal see of Venetia, Italy, capital of the province of Udine, situated between the Gulf of Venice and the Alps, 84 m. by rail N.E. of Venice, 450 ft. above sea-level. Pop. (1906), 25,217 (town); 40,627 (commune). The town walls were in the main demolished towards the end of the 19th century. The old castle, at one time the residence of the patriarchs of Aquileia, and now used as a prison, was erected by Giovanni Fontana in 1517 in place of the older one destroyed by an earthquake in 1511. The Romanesque cathedral contains some interesting examples of native art (by Giovanni Martini da Udine, a pupil of Raphael, and others). The church of S. Maria della Purità has frescoes by Giovanni Battista and Domenico Tiepolo. In the principal square stands the town hall, built in 1448–1457 in the Venetian-Gothic style, and skilfully restored after a fire in 1876; opposite is a clock tower resembling that of the Piazza di San Marco at Venice. In the square is a statue of Peace, erected in commemoration of the peace of Campo Formio (1796), which lies 5 m. to the W.S.W. The archiepiscopal palace and Museo Civico, as well as the municipal buildings, have some valuable paintings. The leading industry of Udine is silk-spinning, but it also possesses manufactures of linen, cotton, hats and paper, tanneries and sugar refineries, and has a considerable trade in flax, hemp, &c. Branch railways lead to Cividale del Friuli and S. Giorgio di Nogaro, and a steam tramway to S. Daniele del Friuli.

The origin of Udine is uncertain; though it lay on the line of the Via Iulia Augusta, there is no proof of its existence in Roman times. In the middle ages it became a flourishing and populous city; in 1222 or 1238 the patriarch Berthold made it the capital of Friuli, and in 1420 it became Venetian. In 1752 it became an archbishopric. (T. As.)

UEBERWEG, FRIEDRICH (1826–1871), German historian of philosophy, was born on the 22nd of January 1826 at Leichlingen, in Rhenish Prussia, where his father was Lutheran pastor. Educated at Göttingen and Berlin, he qualified himself at Bonn as *Privatdozent* in philosophy (1852). In 1862 he was called to Königsberg as extraordinary professor, and in 1867 he was advanced to the ordinary grade. He married in 1863, and died on the 9th of June 1871. His compendious *History of Philosophy* is remarkable for fullness of information, conciseness, accuracy and impartiality. At first he followed Beneke's empiricism, and strongly opposed the subjectivistic tendency of the Kantian system, maintaining in particular the objectivity of space and time, which involved him in a somewhat violent controversy. His own mode of thought he preferred later to describe as an ideal realism, which refused to reduce reality to thought, but asserted a parallelism between the forms of existence and the forms of knowledge. Beneke and Schleiermacher exercised most influence upon the development of his thought.

WORKS.—*System der Logik* (1857; 5th ed., 1882; Eng. trans. of 3rd ed. by T. M. Lindsay, 1871); *Grundriss der Gesch. der Phil.* (1863–1866, 8th ed., M. Heinze, 1894–1898; Eng. trans., G. S. Morris, 1872; 4th ed., 1885); an essay (1861) on the authenticity and order of Plato's writings, crowned by the Imperial Academy of Vienna; *Schiller als. Hist. und Phil.* (published by Brasch from his papers, Leipzig, 1884). See F. A. Lange, *Friedrich Ueberweg* (Berlin, 1871); M. Brasch, *Die Welt- und Lebensanschauung Friedrich Ueberwegs* (Leipzig, 1889).

UELZEN, a town of Germany, in the Prussian province of Hanover, on the Ilmenau, east of the famous Lüneburger Heide, at the junction of the railway connecting Hamburg, Hanover, Bremen and Stendal, 52 m. S.E. of Hamburg. Pop. (1905), 9329. The town has four Evangelical churches, one of which, dedicated to the Holy Ghost, has a valuable altar-piece dating from the 14th century. The principal industries are flax, sugar, tobacco and machinery, and there is a trade in cattle and horses. In the vicinity are some interesting Slavonic remains and the former Benedictine monastery of Ullesheim.

Founded in the 10th century as Löwenwold, Uelzen became in the middle ages an active member of the Hanseatic League.

See Jaenicke, *Geschichte der Stadt Uelzen* (Hanover, 1889).

UFA, a government of south-eastern Russia, on the western slope of the Ural Mountains. It has the governments of Vyatka and Perm on the N., Orenburg on the E. and S., Samara and Kazañ on the W., and comprises an area of 47,094 sq. m. Several craggy and densely wooded ranges, running from S.W. to N.E. parallel to the main chain of the southern Urals, occupy its eastern part. They rise to altitudes of 2500 to 3500 ft.; their highest peaks—Iremel (5230 ft.), Urenga (4115 ft.) and Taganai (3935 ft.)—ascend above the limits of arboreal vegetation, but in no case reach those of perpetual snow. Southward Ufa extends over the slopes of the Obshchiy Syrt plateau, the angular space between the latter and the Urals being occupied by elevated plains (1000 to 1500 ft.), deeply grooved by the river valleys, and sometimes described as the "Ufa plateau." Towards the Kama the fertility of the soil increases, and the black-earth regions of Menzelinsk and Birsk are granaries for that part of Russia.

The geological structure of Ufa is very varied. The main range of the Urals consists of gneisses and various crystalline slates resting upon granites and syenites; next comes a broad strip of limestones and sandstones, the fossil fauna of which is intermediate between the Upper Silurian and the Lower Devonian. These form the highest elevations in the government. Farther west the Devonian deposits are followed by Lower and Upper Carboniferous and Artinsk schists, which, together with Permian deposits, cover western Ufa. Quaternary deposits are extensively developed in all the valleys, most of which were occupied by lakes during the Lacustrine period. There is great wealth in iron (Devonian) and copper (Permian). The district of Zlatoust is celebrated for its granite, epidote, nephrite and a variety of decorative stones and minerals. Coal is found over a wide area.

Ufa belongs almost entirely to the drainage area of the Byelaya, a tributary of the Kama which rises in Orenburg and flows north and north-west through Ufa, receiving a number of tributaries, among which the Syun, the Tanyp and the Ufa are also navigable. The Byelaya is an important channel for trade; but it sometimes drops to so low an ebb in summer that steamers cannot proceed beyond Birsk. The Kama flows for 120 m. along the western border of the government.

The average temperature at the city of Ufa is 37° F., and the winter is extremely cold (January 5·5° F., July 68° F.); at the Zlatoust observatory the average temperature is only 32·2° (January 2°; July 61·8°). Even in the hilly tracts of Zlatoust the annual rainfall is not more than 19 in. The rivers are frozen 158 days at Ufa and 202 at Zlatoust.

The estimated population in 1900 was 2,620,600. The government is divided into six districts, the chief towns of which are Ufa, Belebey, Birsk, Menzelinsk, Sterlitamak and Zlatoust. Towns have sprung up around the ironworks at Zatkinsk, Yurezañ and Katav-Ivanovsk. The Russian element in the population has rapidly increased (in 1897, 45%; in 1865, 36%), the other ethnographical elements being mainly Bashkirs, Tatars and Meshcheryaks, together with Chuvashes and Cheremisses, Votyaks and Mordvinians. Since the wholesale plundering of the Bashkir lands, which took place under Alexander II., the land has been sold by the nobles, and bought chiefly by the merchant class. Large estates are common, though it is the peasants and the peasants' co-operative societies that cultivate most of the area under crops. Agriculture has greatly developed, owing partly to the Russian immigration and partly to the educational efforts of the local councils; in 1900 there were 4,860,000 acres (16%) under crops and 9,780,000 acres (32½%) under cultivation. The principal crops are rye, wheat, oats, barley, millet, buckwheat and potatoes.

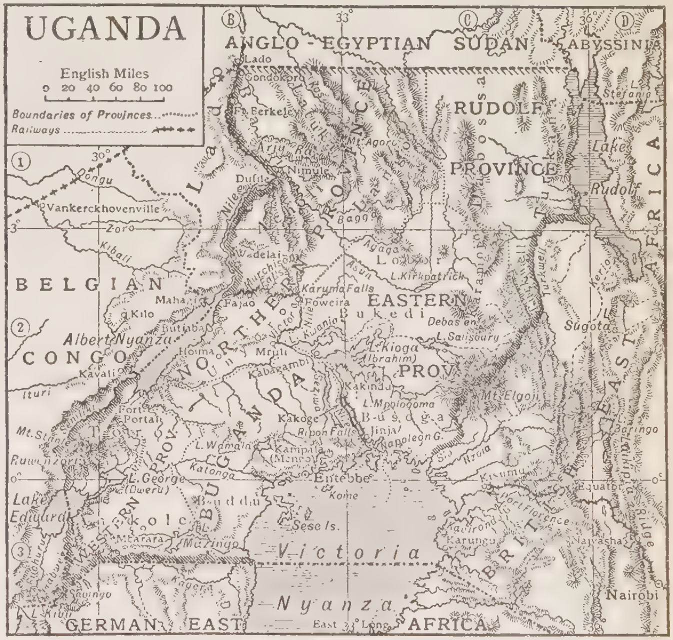
The government is rich in antiquities belonging to three different periods—the Finnish or Chud period, the period of the Bulgarian empire, and the period of the Nogai Tatar domination. The burial-mounds of the Chudes contain brass implements and decorations, and in one of them near Ufa a coffin sheeted with silver was found. Remains from the Bulgarian epoch have been discovered at Menzelinsk. But it is the ruins of the Mongol period which are of greatest value; the remains of a large town, with a mausoleum and a palace, have been found near Ufa and extend several miles along the Byelaya River. (P. A. K.; J. T. Be.)

UFA, a town and river-port of Russia, capital of the government of the same name, situated 326 m. by rail N.E. of Samara, on the main line from Moscow to Siberia, at the confluence of the Ufa with the Byelaya. Pop., 49,275. The better part of the town contains two cathedrals and a few churches; the remainder is a scattered aggregation of small wooden houses. There are a museum, a public library and a theological seminary; and the industries include iron and copper works, machinery works and saw-mills.

Ufa was founded in 1574. The wooden kreml, or fort, protected by wooden towers and an outer earthen wall, had to sustain the attacks of the revolted Bashkirs and Russian serfs in 1662 and at later dates; and in 1773 Chika, one of the chiefs of the Pugachev revolt, besieged it for four months.

UGANDA, a British protectorate in Eastern Equatorial Africa, lying between Lakes Victoria and Albert and between the Mountain Nile and Lake Rudolf. The same name was originally applied to the Bantu kingdom of Buganda, which is now one of the five provinces of the protectorate, but which is now styled officially by the correct native name of "Buganda." The Swahili followers of the first explorers always pronounced the territorial prefix, Bu, as a simple vowel, U; hence the incorrect rendering "Uganda" of the more primitive Bantu designation. It was first applied to the kingdom of Mutesa, discovered by J. H. Speke in 1862, and in time came to include the large protectorate which grew out of the extension of British influence over Buganda.

Boundaries and Area.—On the north the frontier of the protectorate is an undetermined line running between Lado (which lies a little north of 5° N.) on the Mountain Nile and the watershed of Lake Rudolf. This northern boundary is in any case conterminous with the southern boundary of the Anglo-Egyptian Sudan. On the east the limit of the Uganda Protectorate in 1901 was the *thalweg* of Lake Rudolf and a line drawn from the south-eastern coast of that lake south along the edge of the Laikipia and Kikuyu escarpments to the frontier of German East Africa. The southern frontier of Uganda was the 1st degree of S. lat.; the western was the 30th meridian of E. long., from the German frontier on the south, across Albert Edward Nyanza and the Semliki River to the line of waterparting between the systems of the Congo and the Nile (in the country of Mboga); thence northwards this western boundary descended to the north coast of Albert Nyanza at Mahagi, and then followed the main stream of the Nile to about 5° N. In 1904, however, it was found that the 30th meridian had been placed some 25 m. west of its true position in the maps used when the frontier was agreed upon, and that if it was maintained as the dividing line it would cut off the Uganda Protectorate from access to Albert Edward Nyanza while giving a corner of the Congo forest to Uganda. A survey commission was subsequently despatched, and in 1910 British, Belgian and German delegates met in Brussels to draw up a new frontier line. Germany was interested in the dispute, inasmuch as the southern frontier of the Uganda Protectorate coincided with the northern frontier of German East Africa. Moreover Germany, Great Britain and Belgium (as inheritor of the Congo State) had conflicting claims in the region N.E. of Lake Kivu. On the 14th of May 1910 a protocol was signed defining the new frontier as follows: From the north end of Lake Kivu the Congo-German frontier turns east by north, traversing the volcanic region of Mfumbiro, and crosses the summit of Mt Karissimbi to the summit of Mt Sabyino, where the British, Belgian and German frontiers meet. From Mt Sabyino the frontier between Belgian Congo and the Uganda Protectorate goes in a direct line north to Mt Nkabwe, and thence along the Ishasha River, to its mouth on the S.E. shores of Albert Edward Nyanza. Thence it crosses that lake in a straight line and afterwards the Ruwenzori to its highest point, Margherita peak, whence it follows the Lamia River to its junction with the Semliki. From that point the frontier is formed by the Semliki to its mouth and the middle of Albert Nyanza to a point opposite Mahagi, where it meets the Congo-Sudan frontier.



Emery Walker sc.

Meantime in 1903 the then Eastern province of the Uganda Protectorate had been transferred to the adjoining East Africa Protectorate, the new eastern boundary being the west coast of Lake Rudolf, the river Turkwel, the eastern flanks of Mt Elgon, the Sio River, and a line running south from the mouth of the Sio across Victoria Nyanza to 1° S. The area of the protectorate, approximately 150,000 sq. m. in 1901, has been reduced by these changes to about 110,000 sq. m.

Climate.

Physical Features.—The protectorate, with a singularly diversified surface of lofty plateaus, snow-capped mountains, vast swamps, dense forests and regions of desolate aridity (valley of Lake Rudolf), offers a remarkable variety of climates. The Rudolf province lies low—an average altitude of not more than 2000 ft.—is extremely hot, and has a very poor rainfall. In some of its districts no rain falls for two years at a time, elsewhere scarcely as much as 10 in. per annum. The Eastern province is abundantly watered near Victoria Nyanza and around Mt Elgon and the noble Debasien mountain (about 50 in. to 100 in. annually); elsewhere, in Karamojo and the northern regions, the rainfall lessens to about 20 in. Busoga and the western part of the Elgon district in this province have a regular West African climate—hot, moist and not over-healthy. These are the conditions of Buganda, a country with an annual rainfall of from 60 to 80 in., a regular West African climate, and severe and frequent thunderstorms. Much the same may be said about the Western province, except for the cooling influence of the Ruwenzori snow range, which pleasantly affects Toro and northern Ankole. The rainfall on Ruwenzori and the central Semliki valley is quite 100 in. per annum. Along the Ruwenzori range are glaciers and snowfields nearly 15 m. in continuous length and some 5 m. in breadth. The Northern (formerly called the Nile) province is perhaps the hottest part of Uganda. Like the districts round Lake Rudolf, the average altitude (near the Nile) is not more than 2000 ft., but the rainfall is more abundant than in the terrible Rudolf region, being an average of 30 in. per annum.

Mountains, Lakes and Rivers.

The surface of the protectorate is diversified. Mount Elgon (*q.v.*) just outside the Eastern province is one of the leading physical features of the Uganda and East Africa protectorates. It consists of the vast crater—some 10 m. in diameter—of an extinct volcano, the rim of which rises in several places to over 14,000 ft. Terraces and buttresses extend and ramify in all directions from the central crater, so that the giant volcano and its surrounding heights form a mountain country (notable for its innumerable cascades and dense forests) the size of Montenegro. The mass of Elgon can be seen from the north-east coast of Victoria Nyanza, from near the main Nile stream, from the heights overlooking Lake Rudolf and from the Kikuyu escarpment. The Eastern province consists of well-forested, undulating land (Busoga) on the coast of the lake, a vast extent of marsh round the lake-like backwaters of the Victoria Nile (Lakes Ibrahim or Kioga, Kwania, &c.) and a more stony, open, grain-growing country (Bukedi, Lobor, Karamojo). The Turkana country west of Lake Rudolf has been of late years terribly arid. A little vegetation is met with in the stream valleys, but most of the rivers marked on the map have ceased to show running water in their lower courses. A good deal of high land—rising in some peaks to near 10,000 ft.—is found in the eastern part of the Northern province, and these heights attract moisture and nourish permanent streams flowing Nilewards. But much of the lower ground is stony and poor in vegetation, while the lowland near the main Nile is exceedingly marshy.

The Ripon Falls, in the centre of the northern coast of the Victoria Nyanza, at the head of the exquisitely beautiful Napoleon Gulf, mark the exit of the fully born Nile from the great lake. The Victoria Nile tumbles over 50 m. of cascades and rapids (descending some 700 ft. in that distance) between Ripon Falls and Kakoge. Here it broadens into Lake Ibrahim (Kioga) (in reality a vast backwater of the Nile discovered by Colonel Chaillé Long in 1874), and continues navigable (save for sudd obstacles at times) right through Lake Ibrahim and thence northwards for 100 m. to Foweira and Karuma Falls. Between Karuma and Murchison Falls the Victoria Nile is unnavigable. At Fajao the navigation can be resumed into Lake Albert. The main Nile stream when it quits Lake Albert continues navigable as far north as Nimule (3° 40′ N.). Between Nimule and Fort Berkeley the river flows through a deep gorge and falls nearly 1000 ft. Navigability really only begins again at Gondokoro on the Sudan frontier, from which point steamers ply to Khartum (see NILE).

The geography of the Western province includes many interesting features, the in many ways peculiar Albert Nyanza (*q.v.*), the great snowy range of Ruwenzori (*q.v.*), the dense Semliki, Budonga, Mpanga and Bunyaraguru forests, the salt lakes and salt springs of Unyoro and western Toro, the innumerable and singularly beautiful crater lakes of Toro and Ankole, the volcanic region of Mfumbiro (where active and extinct volcanoes rise in great cones to altitudes of from 11,000 to nearly 15,000 ft.), and the healthy plateaus of Ankole, which are in a lesser degree analogous in climate and position, and the Nandi plateau on the east of Victoria Nyanza. Ruwenzori is a snowy range, and not a single mountain. Its greatest altitude—the Duke of the Abruzzi's Mt Stanley (Margherita Peak)—is 16,816 ft., and therefore the third highest point on the African continent. The Uganda Protectorate is a land of great lakes, and includes partially or wholly the water areas of Victoria Nyanza (about 27,000 sq. m.), Lake Rudolf (about 3500 sq. m.), Lake Ibrahim-Kioga-Kwania (800 sq. m.), Albert Nyanza (2700 sq. m.), and Lakes Albert Edward and Dweru[1] (1500 sq. m.), besides the small crater lakes of Toro and Ankole (singularly beautiful), the lake-swamps Salisbury and Kirkpatrick in the Eastern province, Lakes Wamala in Buganda, and Kachera in Ankole. The water of Lake Victoria is perfectly fresh. This is the case with all the other lakes except Rudolf, Albert Nyanza and Albert Edward, in which the water ranges from salt to slightly brackish.

Geology.—Wide tracts remain geologically unexplored. Archean rocks—gneiss, schist and granite—cover large areas through which the Nile cuts its way in alternate narrow gorges and open reaches. In Ankole and Koki rocks consisting of granular quartzite, schistose sandstone, red and brown sandstone, and shales with cleaved killas rest on the Archean platform and possibly represent the Lower Witwatersrand beds of the Transvaal. No traces of the Karroo formation have been detected. Volcanic rocks occur in Usoga and elsewhere. The Nile at the Ripon Falls leaps over a basalt dike. The rocks on the verge of the Kisumu province of East Africa are mainly volcanic (basalt, tuff, lava, kenyte). West of the volcanic region, nearer to Lake Victoria and the Eastern province, ironstone, granite, gneiss and schistose formations predominate, with phonolite in places.

Petrology and Mineralogy.

Iron ore (haematite) is abundant. In the Eastern province the rocks are mainly quartz, gneiss and granite, with sandstone in Busoga, basalt round Mt Elgon, slate (Busoga) and ironstone (Busoga and Bukedi). In the Rudolf province there are the basalt, lava, tuff and kenyte of the volcanic Rift valley, overlying a formation of granite, gneiss and quartz. Gold—in some cases alluvial—is found in the mountainous country to the north-west of Lake Rudolf. Gneiss, granite and quartz—the decomposed granite giving the red "African" clay—are the leading features in the formations of the Northern province, of Buganda, and of the Western province, with some sandstone in the littoral districts of Buganda and in Ankole, and eruptive rocks and lava in south-western Ankole and on the eastern flanks of Ruwenzori. There are indications of copper in Busoga, of gold in Unyoro. Iron is found nearly everywhere. Graphite is present in Buganda and Unyoro.

Flora.—The vegetation is luxuriant except in the Rudolf region, which has the sparse flora of Somaliland. In the Western province, Busoga and the Elgon district the flora is very West African in character. The swampy regions of the Nile and of the Eastern province are characterized by an extravagant growth of papyrus and other rushes, of reeds and coarse grass. There are luxuriant tropical forests in the coast region of Buganda, in Busoga, west Elgon, western Unyoro, eastern Toro, the central Semliki valley and north-west Ankole. The upper regions of Mt Elgon, Mt Debasien and Mt Agoro are clothed with forests of conifers—juniper and yew—and witch-hazels (*Trichocladus*). There are also giant yew-trees (*Podocarpus*) on the flanks of Ruwenzori and the Mfumbiro volcanoes between 7000 and 9000 ft., but no junipers. The alpine vegetation on all these lofty mountains is of a mixed Cape and Abyssinian character—witch-hazels, senecios, lobelias, kniphofias, everlasting flowers, tree heaths and hypericums. The really tropical vegetation of Buganda is nearly identical with that of West Africa, but there is no oil-palm.

Fauna.—The fauna also has many West African affinities in the hot, forested regions. In the Kisumu province of East Africa even, there are several West African mammals such as the broad-horned tragelaph and the forest pig. These are also found in part of the Semliki forests. As a rule, however, the fauna of the Upper Semliki valley, of parts of Ankole, Buganda and Unyoro, of the Northern, Rudolf and Eastern provinces, is of that "East African," "Ethiopic" character which is specially the feature of South and East Africa and of the Sudan right across from Abyssinia to the river Senegal. Among notable mammals the chimpanzee is found in Unyoro, Toro and north-west Ankole, and has only recently become extinct in Buganda; the okapi inhabits the Semliki forests on the Congo frontier; the giraffe (the male sometimes developing five horn cores) is common in the Northern, Eastern and Rudolf provinces; there are three types of buffalo—the Cape, the Congo and the Abyssinian; two species of zebra (one of them Grévy's), the African wild ass, the square-lipped ("white") and pointed-lipped ("black") rhinoceroses, the elephant, hippopotamus, water tragelaph ("Speke's antelope"), Cape ant-bear, aard-wolf (*Proteles*), hunting-dog, and nearly every genus and most of the species of African antelopes. The birds are more West African than the mammals, and include the grey parrot, all the genera of the splendidly-coloured turacoes, the unique "whale-headed stork," and the ostrich.

Inhabitants.—The inhabitants in 1909 numbered about 3,500,000 natives, 3000 British Indians and Arabs, and 507 Europeans (British, French, Germans, Italians and Maltese). Of these last 119 were women. The races indigenous to the protectorate are mainly of the Negro species (with slight Caucasian intermixture), and may be divided into the following categories: (1) *Pigmy-prognathous* (so-called "Congo" pigmies of Semliki forest, of Kiagwe in Buganda, and of the western flanks of Mt Elgon and the types of Forest Negroes); (2) *Bantu negroes* (Banyoro, Bairu, Basese, Basoga, Bakonjo, Baganda, Masaba and Kavirondo); (3) *Nile negroes* (Aluru, Bari, Madi, Acholi, Gang, Lango, Latuka, Tesi, Sabei (Nandi), Turkana and Karamojo); (4) *Hamitic* (some tribes on islands and the north coast of Lake Rudolf; and the remarkable "Hima" or "Huma" aristocracy in Unyoro, Buganda, Toro and Ankole). The pigmies are generally known as Bambute or Bakwa in the Semliki forests. They are both reddish yellow and brownish black (according to individual variation) in skin colour, with head hair often tending to russet, and body hair of two kinds—black and bristly on the upper lip, chin, chest, axillae and pubes; and yellowish and fleecy on the cheeks, back and limbs. Their faces are remarkable for the long upper lip and the depressed broad nose with enormous alae. Associated with these pigmies is the "Forest Negro" type (Lendu, Lega, Baamba, Banande) of normal human stature, but short-legged and unusually prognathous. The Bantu negroes represent the future ruling race of the protectorate, and include the remarkable Baganda people. These last, prior to the arrival of Arabs and Europeans, displayed a nearer approach to civilization than has as yet been attained by an unaided Negro people. Their dynasty of monarchs can be traced back with tolerable certainty to a period coincident with the reign of Henry IV. of England (A.D. 1400). The first Buganda king was probably a Hamite of the Hima stock (from Unyoro). Until recent years the Baganda and most of the other Bantu peoples of the protectorate worshipped ancestral and nature spirits who had become elevated to the rank of gods and goddesses. The Baganda are now mainly Christian. There is also a "totem" system still in vogue. All the Baganda belong to one or other of twenty-nine clans, or "Biká," which are named after and have as totem familiar beasts, birds, fish or vegetables. The Baganda are not a very moral people, but they have an extreme regard for decency, and are always scrupulously clothed (formerly in bark-cloth, now in calico). As a general rule, it may be said that all the Bantu tribes in the western half of the protectorate, including the Basoga, are careful to consider decency in their clothing, while the Nilotic negroes are often completely nude in both sexes. More or less, absolute nudity among men is characteristic even of the Bahima (Hamites). But in this aristocratic caste the women are scrupulously clothed.

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[1] In 1909 Albert Edward Nyanza was renamed by British geographers (with the consent of Edward VII) Lake Edward, and Lake Dweru Lake George, in honour of George V.

The Nile negroes and Hima are tall people. The former are seldom handsome, owing to their flat faces and projecting cheek-bones. The Bahima are often markedly handsome, even to European eyes. In the Bahima the proportion of Caucasian blood is about one-fourth; in the Nile negroes and Bantu from one-sixteenth to none at all. The aboriginal stock of the Uganda Protectorate is undoubtedly the pigmy-prognathous, which has gradually been absorbed, overlaid or exterminated by better developed specimens of the Negro sub-species, or by Negro-Caucasian hybrids from the north and north-east.

The languages spoken in the Uganda Protectorate belong to the following stocks: (1) *Hamitic* (Murle and Rendile of Lake Rudolf); (2) *Masai* (Bari, Elgumi, Turkana, Sūk, &c.); (2*a*) Sabei, on the northern slopes of Elgon and on Mt Debasien; (2*b*) *Nilotic* (Acholi, Aluru, Gang, &c.); (3) *Madi* (spoken on the Nile between Aluru and Bari, really of West African affinities); (4) Bantu (Lu-ganda, Runyoro, Lu-konjo, Kuamba, Lihuku, the Masaba languages of west Elgon and Kavirondo, &c.); and lastly, the unclassified, isolated *Lendu* and *Mbuba* spoken by some of the pigmy-prognathous peoples.

Towns.—The seat of the British administration is Entebbe ("a throne") on the south shores of a peninsula projecting into the Victoria Nyanza in 0° 4′ 2″ N. 32° 27′ 45″ E. It contains a number of commodious official residences, churches, hospitals, a laboratory, covered market, &c. The port is protected by a breakwater and provided with a pier on which is the customs-house. The native capital of Buganda is Mengo (pop. about 70,000), situated some 20 m. N. by E. of Entebbe. It is a straggling town built on seven steep hills: on one hill is the royal residence; on another (Namirembe = the hill of peace) was the cathedral of St Paul, destroyed by lightning in September 1910, and other buildings of the Anglican mission. St Paul's was a fine Gothic church of brick, built by the Baganda in 1901–1904. After its destruction steps were at once taken to rebuild the cathedral. On a third hill are the cathedral and mission buildings of the Roman Catholics. On still another hill, Kampala, the British fort and government and European quarters are situated. Some 7½ m. S. by E. of Kampala, and connected with it by monorail, is Kampala Port, on Victoria Nyanza. The capital of the Eastern province is Jinja, on the Victoria Nyanza, immediately above and east of the Ripon Falls. It is a thriving trading centre and port. Hoima is the administrative headquarters in Unyoro; Butiaba is a trading port of some importance on Lake Albert; Mbarara is the capital of Ankole. Kakindu, Mruli, Fowera and Fajao are government stations and trading posts on the Victoria Nile; Wadelai (*q.v.*), Nimule and Gondokoro (*q.v.*) are similar stations on the Mountain Nile. Bululu is a port on Lake Ibrahim.

Agriculture and Trade.—A few plantations are owned and managed by Europeans. Otherwise agriculture is in the hands of the natives. Some Baganda chiefs have started cotton, rubber and cocoa plantations, the botanic department assisting in this enterprise. Pará and *Funtumia* rubber trees are also cultivated by the department. (For the work of the botanic, forestry and scientific department, the government plantations, &c., see the *Colonial Report* [Miscellaneous], No. 64.) A forest area of 150 sq. m. has been leased to a European company. Trade is mainly conducted by native (*i.e.* Arab, Somali and Negro) traders, by British Indians and by Germans. The value of the trade during 1901–1902 was approximately £400,000 in imports (largely railway material) and £50,000 in exports. The articles exported were ivory, rubber, skins and hides, and livestock (for consumption in East Africa). These, except livestock, continue to be the main items of export. For the six years 1903–1904 to 1908–1909 the imports increased from £147,000 to £419,000, and the exports—produce of the protectorate—from £43,000 to £127,000. The imports included the transit trade (with the Belgian Congo and German East Africa), which grew from £8460 in 1903–1904 to £82,615 in 1908–1909. The transit trade in the last-named year included bullion valued at £33,000, being raw gold from the Kilo mines, Belgian Congo. Among the new industries are sugar and coffee plantations, while cotton, ground-nuts and rubber figure increasingly among the exports, cotton and cotton-seed being of special importance. Cotton goods, chiefly "Americani," are the chief imports, machinery, hardware and provisions ranking next. Large quantities of rice are imported from German East Africa. About 50% of the imports are from the United Kingdom and British possessions.

Communications.—In connexion with the railway from Mombasa to Victoria Nyanza a steamship service is maintained on the lake between Port Florence, Entebbe and other ports, including those in German territory. Government boats also ply on the Victoria Nile and Lake Kioga (Ibrahim) and on Albert Nyanza and the Mountain Nile. A railway (begun in 1910), some 50 m. long, runs from Jinja to Kakindu, *i.e.* along the Victoria Nile from its point of issue from the Nyanza to where it becomes navigable above Lake Kioga. Good roads connect Entebbe and Butiaba (the steamboat terminus on Albert Nyanza) and other districts. There is a direct telegraphic service to Gondokoro and Khartum and to Mombasa. The postal service is well organized.

Administrative Divisions and Government.—The protectorate is divided into five provinces—Rudolf, Eastern (formerly central), kingdom of Buganda, Western, and Northern (formerly Nile)—and these again into a number of administrative districts. The kingdom of Buganda, which has a thoroughly efficient and recognized native government, is subdivided into no fewer than nineteen "counties" or districts, but the other provinces have as a rule only three or four subdivisions.

The protectorate is administered by a governor and commander-in-chief, under the colonial office, residing at Entebbe, on the north-western coast of the Victoria Nyanza. He is assisted by a staff of officials similar to the functionaries of a Crown colony, but there is at present no legislative council. The natives are ordinarily under the direct rule of their own recognized chiefs, but in all the organized districts the governor alone has the power of life or death, of levying taxes, of carrying on war, of controlling waste lands and forests, and of administering justice to non-natives. In the case of Buganda special terms were accorded to the native king and people in the settlement dated the 10th of March 1900. The king was secured a minimum civil list of £1500 a year out of the native revenues; pensions were accorded to other members of the Buganda royal family; the salaries of ministers and governing chiefs were guaranteed; compensation in money was paid for removing the king's control over waste lands; definite estates were allotted to the king, royal family, nobility and native landowners; the native parliament or "Lukiko" was reorganized and its powers were defined; and many other points in dispute were settled. The king was accorded the title of "His Highness the Kabaka of Buganda," and his special salute was fixed at eleven guns. By this agreement the king and his people pledged themselves to pay hut and gun taxes to the administration of the protectorate. Somewhat similar arrangements on a lesser scale were made with the king of Ankole, the kings of Toro and Unyoro, and with the much less important chieftains or tribes of other districts. The territories north and north-east of these Bantu kingdoms are inhabited by Nilotic negroes and up to 1909 were left almost unadministered, except in close vicinity to the Nile banks.

The education of the natives is confined to the schools maintained by the missionaries, who are doing an excellent work. Manual technical and higher education is provided. In 1909–1910 there were in the Anglican schools over 36,000 scholars, of whom 17,000 were girls. Of the total number of scholars over 26,000 were in the kingdom of Buganda. The Roman Catholic schools had in 1909 over 11,000 scholars. (See the *Col. Off. Report on Uganda*, No. 686.)

Expenditure and Revenue.

The expenditure for 1902–1903 was fixed at £210,000, of which about £170,000 was furnished by an imperial grant-in-aid and the balance from local revenue. Between 1903 and 1909 the revenue increased from £51,000 to £102,000. Revenue is chiefly derived from hut and poll taxes, customs, wharfage dues, game licences and land tax. The hut and poll taxes yield about £62,000 a year. The expenditure increased from £186,000 in 1903 to £256,000 in 1909. Deficiencies are made good by parliamentary grants. The rupee (1s. 4d.) is the standard coin, with a subsidiary decimal coinage.

History.—The countries grouped under this protectorate were invaded at some relatively remote period—say, three to four thousand years ago—by Hamitic races from the north-east (akin to the ancestors of the ancient Egyptians, Gallas, Somalis), who mingled extensively with the Nile negroes first, and then with the aboriginal inhabitants of Buganda, Unyoro and Nandi. These Hamites brought with them a measure of Egyptian civilization, cattle, and the arts of metallurgy, pottery and other adjuncts to neolithic civilization. There was probably no direct intercourse with Egypt by way of the Nile, owing to the lake-like marshes between Bôr and Fashoda, but instead an overland traffic with Ethiopia (the Land of Punt) via Mt Elgon and the Rudolf regions. In time even this intercourse with the non-negro world died away, and powerful kingdoms with an aristocracy of Galla descent grew up in Buganda, Unyoro and Ankole.

The kingdom of Buganda especially dominated the lands of Victoria Nyanza in the 19th century. In the 'forties and 'fifties Egyptian officials, Austrian missionaries, and British, Dutch, Italian, and German explorers had carried our knowledge of the Nile beyond Khartum as far south as Gondokoro. In the same period of time the Zanzibar Arab traders were advancing from the south on the Bahima kingdoms of the western Victoria Nyanza and on Buganda. King Suna of Buganda first heard of the outer world of white men in 1850 from a runaway Baluch soldier of Zanzibar. Captains Burton and Speke, on their Tanganyika expedition, heard of Buganda from the Arab traders in 1857. Captain Speke in 1862 reached Buganda, the first of all Europeans to enter that country. In the early 'seventies Sir Samuel Baker (who had discovered Albert Nyanza) extended the rule of the Egyptian Sudan as far south as the Victoria Nile. General Gordon, who succeeded Baker, and who had Dr Emin Bey (afterwards Emin Pasha) as lieutenant, attempted through Colonel Charles Chaillé Long, in 1874, not only to annex Unyoro but also Buganda to the Egyptian dominions, and thoroughly established Egyptian control on Albert Nyanza. But owing to the indirect influence of the British government, exercised through Sir John Kirk at Zanzibar, the Egyptian dominions were prevented from coming south of the Victoria Nile.

Suna, the powerful king or emperor of Buganda, who was the first to hear of a world beyond Negroland, had been succeeded in 1857 by his still more celebrated son, Mutesa (*Mutesa* means the measurer). Mutesa had received Speke and Grant in a most friendly manner. Subsequent to their departure he had opened up relations with the British agent at Zanzibar. In 1875 he received an epoch-making visit from Sir H. M. Stanley. Stanley, in response to Mutesa's questions about religion, obtained from that king an invitation to Anglican missionaries, which he transmitted to London through the *Daily Telegraph*.[1] Having made the first survey of Victoria Nyanza and confirmed Speke's guesses as to its shape and area, Stanley passed on (half discovering Ruwenzori on the way) to the Congo.

Christian Missions, 1877–1879.

Meanwhile the Zanzibar Arabs had reached Buganda in ever-increasing numbers as traders; but many of them were earnest propagandists of Islam, and strove hard (with some success) to convert to that religion the king and chiefs of Buganda and adjoining countries. In 1877 the Rev. C. T. Wilson, one of a party of missionaries sent in answer to Stanley's appeal by the Church Missionary Society of England, arrived in Uganda, and towards the end of 1878 was joined by Alexander Mackay. In 1879 another party arrived by the Nile route; and Wilson, after thirteen months' actual residence, left for England with Dr R. W. Felkin, who had arrived only three months before, taking with him envoys from Mutesa. In the same year the French Roman Catholic mission of the White Fathers of Algeria was inaugurated, and thus from 1879 dates the triangular rivalry of the creeds of Anglican and Roman Christianity and of Islam.

Mutesa succeeded by Mwanga, 1884.

In 1882 Islam gained an ascendancy, and the French withdrew for a time. In the autumn of 1884 Mutesa died. A great change had been wrought in Uganda during the latter years of his reign. Calico, fire-arms and swords had replaced the primitive bark-cloth and spear, while under the teaching of the missionary-engineer Mackay the native artisans had learnt to repair arms and use European tools. Mutesa was a clever man of restless energy, but regardless of human life and suffering, and consumed by vanity. He was succeeded by Mwanga, a cruel, weak and vicious youth. The intrigues of the Arabs led him to suspect the designs of the missionaries. He was alarmed at their influence over numbers of his people and resolved to stamp out Christianity.

In the early 'eighties the aspirations of several European powers turned towards Africa as a field for commercial and colonial expansion. The restless Arabs of Zanzibar had since 1857 steadily advanced Zanzibar influence to Tanganyika, Nyasa, and even through the Masai countries to the north-east coast of Victoria Nyanza and the "back door" of Uganda. In 1882 the Royal Geographical Society despatched Joseph Thomson to discover through Masailand the direct route to Victoria Nyanza. Thomson succeeded (he also discovered Lake Baringo and Mt Elgon), but turned back from the frontier of Busoga in order not to provoke Mutesa to hostilities. Mr H. H. Johnston was despatched on a scientific mission to Kilimanjaro, and concluded treaties on which the British East Africa Company was subsequently based. The vague stir of these movements had perturbed Mutesa, and they were regarded with deep suspicion by his successor, Mwanga.

Murder of Bishop Hannington. 1885.

The annexations of Emin on Albert Nyanza, the visit of Thomson to the closed door of Busoga, the opposition of the Europeans to the slave trade, and, lastly, the identification of the missionaries with political embassies and their letters of introduction from secular authorities, added to Mwanga's fears, and early in 1885, simultaneously with the return of the French Fathers, the long smouldering hostility broke out, and the Christian converts were seized and burnt at the stake. Bishop Hannington, who attempted to enter Buganda by the forbidden route from the east, was murdered, and the Rev. R. P. Ashe and Mackay only redeemed their lives by presents. The Buganda Christians showed heroism, and in spite of tortures and death the religion spread rapidly. Mwanga now determined to rid himself of Christians and Mahommedans alike by inducing them to proceed to an island in the lake, where he meant to leave them to starve. The plot was discovered, and Mwanga fled to the south of the lake, and Kiwewa, his eldest brother, was made king. The chiefs of the rival creeds—British (Anglicans), French (Catholics), and Ba-Islamu, as they were called—divided the chiefships. The Mahommedans now formed a plot to oust the Christians, and treacherously massacred a number of their chiefs and then defeated their unprepared adherents. Kiwewa, refusing to submit to circumcision, was (after reigning three or four months) expelled by the Ba-Islamu, who placed another brother, Kalema, on the throne and began a fanatical propaganda, forcing the peasantry to submit to the hated circumcision. The British and French

Religious Feuds.

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[1] The letter was entrusted to Linant de Bellefonds, a Belgian in the Egyptian service, who had been sent to Buganda by Gordon. On his return journey Bellefonds was murdered by the Bari. When his body was recovered Stanley's letter was found concealed in one of his boots and was forwarded to England.

French and British Factions.

factions, who had taken refuge in Ankole, could not agree even in their common exile, and nearly came to blows, but on the spur of threatened famine they agreed to combine and to take back Mwanga as their king and strike a blow for supremacy in Buganda. In May 1889 Mwanga, aided by the trader Charles Stokes, approached Buganda by water, and after several bloody battles captured the capital, but shortly afterwards was again defeated, and Kalema and the Ba-Islamu reoccupied Mengo (the native capital). Appeals for help were sent to Frederick John Jackson (subsequently lieutenant-governor of British East Africa), who had arrived on the east of the lake with a caravan of some 500 rifles, sent by the newly-formed East African Chartered Company. He replied saying he would come if all the expenses were guaranteed and the British flag accepted. Père Lourdel, who was Mwanga's chief adviser at this time, counselled acceptance of these terms, but Jackson at first marched in a different direction northwards. Returning three months later, he found that Dr Karl Peters, a German in command of an "Emin Pasha Relief" expedition, had passed through his camp, read his letters, and, acting on the information thus obtained, had marched to Buganda, arriving in February 1890, where with the aid of Lourdel he concluded a treaty which was kept secret from the British party, who repudiated it. The Baganda Christians, before the arrival of Peters, had again engaged the Mahommedans and driven them to the frontier of Unyoro, where King Kabarega gave them an asylum and aid. Kalema died later in the same year—1890—and was succeeded by Mbogo, a half brother of King Mutesa. The posts of honour had been divided between the rival factions. Peters's treaty had given fresh offence and added to the disputes arising in the division of the offices of state, and the factions were on the point of fighting. Jackson arrived in April with 180 gun-men (a portion of his caravan having mutinied), and presented a new treaty, which was refused by the French. Feeling ran high, and Jackson withdrew his treaty, and, taking a couple of envoys who should bring back word whether Uganda was to be French or British, he left the country, Mr Ernest Gedge remaining in charge of his expedition.

Lugard's Arrival, 1890.

While these events were happening in Uganda the Anglo-German treaty of July 1890 had assigned Uganda to Great Britain, and in October 1890 Captain F. D. Lugard, then at Kikuyu, halfway between the coast and the lake, received instructions to go to Uganda. He had with him Messrs De Winton and W. Grant, some 50 Sudanese soldiers, and about 250 porters, armed with Snider carbines. Marching with unprecedented rapidity, he entered Mengo on the 18th of December. Lugard, by introducing the names "Protestant" and "Catholic"—till then unknown—and by insisting that all religion was free, endeavoured to dissociate it from politics, and urged that as Uganda was now under Great Britain there could be no hostile "French" faction. This attitude was welcome to neither faction, and for some days the position of the new arrivals on the little knoll of Kampala was very precarious. Lugard's first object was to obtain a treaty which would give him a right to intervene in the internal affairs of the country. The hostile French faction was much the stronger, since at this time the king (whom the whole of the pagan party followed) was of that faction; but after some critical episodes the treaty was signed on the 26th of December. Lugard then endeavoured to settle some of the burning disputes relative to the division of lands and chiefships, &c., and to gain the confidence of both parties. In this he was to some extent successful, and his position was strengthened by the arrival in January 1891 of Captain (subsequently Colonel) W. H. Williams, R.A., with a small force of Sudanese and a maxim. In April Lugard, hoping to achieve better results away from the capital, led the combined factions against the Mahommedans, then raiding the frontier, whom he defeated. Seeing that the situation in Buganda was impossible unless they had a strong central force, which the company could not provide, Lugard and Williams had formed the idea of enlisting the Sudanese who had been left by Emin and Stanley at the south end of the Albert Lake. Taking with him Kasagama, the rightful king of Toro, he traversed the north of Ankole, with which country he made a treaty, and passing thence through Unyoro, along the northern slopes of Ruwenzori, reached Kavali at the south end of Lake Albert, defeating the armies of Unyoro who opposed his progress. He brought away with him 8000 Sudanese men, women, children and slaves, under Selim Bey (an Egyptian officer). Some of these he left at the posts he established along southern Unyoro. After an absence of six months from Buganda, Lugard reached the capital at the end of the year (1891) with 200 or 300 Sudanese soldiers and two or three times that number of followers. Lugard little thought that in bringing these Sudanese, already (some of them) infected with the sleeping-sickness of the Congo forests, he was to introduce a disease which would kill off some 250,000 natives of Uganda in eight years. Meanwhile Williams, amid endless difficulties, with a mere handful of men, had managed to keep the two factions from civil war, though fighting had actually occurred in Buddu and in the Sese Islands.

Civil War, 1891.

After Lugard's return a lull occurred till the coast caravan left, when lawlessness again broke out and several murders were committed. On the 22nd of January the killing of a Protestant at the capital (Mengo) produced a crisis. Lugard appealed to the king to do justice, but he himself was treated with scant courtesy, and his envoy was told that the French party would sack Kampala if Lugard interfered on behalf of the murdered man. In spite of strenuous efforts on the part of the British administrator to avert war the French party determined to fight, and finally attacked the British, who had assembled round Kampala. The king and French party were defeated and fled to the Sese Islands. The king and chiefs (except two ringleaders) were offered reinstatement, and they appeared anxious to accept these terms, but the French bishop joined them in the islands, and from that day all hopes of peace vanished. Fighting was recommenced by a "French" attack on "British" canoes, and Williams thereupon attacked the island and routed the hostile faction. After this the "French" slowly concentrated in Buddu in the south, the Protestants migrating thence. Williams then led a successful expedition against the Sese islanders and went on to the south of the lake to obtain one of the young princes—heirs to the throne—who were at the French mission there. But the Fathers were hostile, and though Mwanga was eager to accept Lugard's offers of reinstatement, he was a prisoner in the hands of his party. He succeeded eventually in escaping, and arrived in Mengo on the 30th of March (1892). A new treaty was made, and the British flag flew over the capital, while the French party were given a proportion of chiefships and assigned the province of Buddu. These conditions they themselves said were liberal, nor could they have ventured to assume their old positions throughout Uganda.

The Mahommedans had all this time refrained from attacking the capital as had been expected. They now clamoured for recognition, and Lugard went to meet them, and after a somewhat precarious and very difficult interview he succeeded in bringing back their king Mbogo to Kampala, and in assigning them three minor provinces in Uganda.[1]

The Question of Evacuation, 1892.

Lugard on his return to Uganda at the end of 1891 had received orders to evacuate the country with his whole force, as the company could no longer maintain their position. A reprieve till the end of 1892 followed, funds having been raised through the efforts of Bishop Tucker by the Church Missionary Society and friends. The lives of many Europeans were at stake, for anarchy must follow the withdrawal, and it seemed impossible to repudiate the pledges to Toro, or to abandon the Baganda who had fought for the British. In June 1892, therefore, Lugard determined to leave for England to appeal against the decision for abandonment. Williams remained in Uganda, where the outlook was now fairly promising, and every effort was made to reduce expenses. On arrival in England Lugard found that the British Government had decided not to come to the help of the company, and Uganda was to be left to its fate. A strong movement was set on foot for the "retention of Uganda," and on the 10th of December Lord Rosebery despatched Sir Gerald Portal to report on the best means of dealing with the country, and a subsidy was given to the company to enable them to retain their troops there till the 31st of March 1893. Captain (afterwards General Sir) J. R. L. Macdonald, who had been in charge of a railway survey to Uganda, was directed to inquire into the claims put forward by France for compensation for the priests. His report was set aside by the government, which, without admitting liability, but to close the controversy with France, agreed to pay £10,000 to the French priests, and the foreign office published a categorical reply by Lugard to the accusations made. Portal and his staff reached Uganda in March, and Williams left soon afterwards with the original troops of the company, leaving Selim Bey and the Sudanese and Portal's large escort in Uganda. The country on Portal's arrival bore every mark of prosperity and revival. By increasing the territory of the Roman Catholics, and giving them estates on the road from Buddu to the capital, Portal gave effect to projects which the Protestants had violently opposed. He added also to their chiefships, and on the 1st of April hoisted the British flag, made a new treaty with Mwanga, and sent Major Roderick Owen to enlist 400 Sudanese from the Toro colonies. He recommended to the imperial government the retention of Uganda (*i.e.* Buganda), the abandonment of Unyoro and Toro, and the construction of a railway half-way only to the lake. He departed after two and a half months' residence, leaving Macdonald in charge. During Macdonald's administration the Sudanese under Selim Bey began to conspire against the British control. The movement was checked and Selim Bey was deported to the coast.

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[1] Since reduced to one.

Portal's Mission.

Colvile's Occupation of Unyoro.

In November 1893 Colonel (Sir Henry) Colvile arrived to take charge, and at once led the whole of the Baganda army against King Kabarega of Unyoro. Major R. Owen defeated the hostile army, first in the south and later in the north, and the Baganda chiefs scattered the main body, while Colvile occupied the capital and built a line of forts from Buganda to Lake Albert, of which he left Major A. B. Thruston in command. This officer fought a number of brilliant actions, and aided by Major (later Colonel) G. G. Cunningham, Captain Seymour Vandeleur, William Grant and others, he overran Unyoro and broke down all resistance. In June 1894 Uganda (*i.e.* the kingdom of Buganda) was declared a protectorate, and at the end of the year Sir Henry Colvile was invalided. Mr F. J. Jackson now took temporary charge, pending the arrival in June 1895 of Mr E. J. L. Berkeley, the first administrator.

At this time also it was decided to construct a railway to Uganda, but work was not begun till December 1896. Peace seemed assured in Uganda; territorial limits to religious teaching were abolished, English Roman Catholic priests were added to the French Fathers, and the material progress of the country was very marked. European traders settled in the country, good permanent houses were built, roads were made and kept in repair, and many new industries introduced, chief among which were the expression of oil from various oilseeds and the cultivation of coffee. Trees were imported and land set aside for planting forests. The success of these efforts at progress was largely due to Mr G. Wilson, C.B., who had been sent to Uganda from East Africa as an assistant administrator in 1896. In this year also the protectorate was extended over Unyoro and Busoga.[1]

Rebellion of 1897.

In the middle of 1897 this era of peace was rudely interrupted. Colonel Trevor Ternan was acting commissioner, and Macdonald had returned to East Africa in command of an exploring expedition, for which Ternan had been ordered to supply 300 Sudanese. In June Wilson discovered a plot to revolt, and in July Mwanga fled to the south of Buddu and raised the standard of rebellion. The rebels were defeated, while Mwanga was made a prisoner by the Germans. Ternan, unaware of the disaffection of his men, now sent three companies to Macdonald, selecting those who had been continuously fighting in Unyoro, Nandi and Buddu. This caused great discontent, which was increased by the fact that their pay was six months in arrears and their clothing long overdue. The men, too, resented the fact that their pay was but a fifth of that given to Zanzibari porters and to those of their own body enlisted in the adjoining protectorate. They were sore at again being sent on service without their wives, and complained of harsh treatment from their officers. Necessaries had been delayed in the attempt to import steamers from the coast before the railway was made.

Sudanese Mutiny.

After Colonel Ternan's departure on leave the three companies who had joined Macdonald broke out into revolt in the Nandi district (East Africa) and set off to Uganda, looting the countries they passed through. Macdonald and Jackson followed with a force of Zanzibaris. Meanwhile Major Thruston—a man justly loved by his soldiers, in whom he had complete confidence—hurried to the garrison at Luba's, near the Ripon Falls, relying on his personal influence to control the men, and risking his life in the heroic attempt. He and two other Europeans were seized and made prisoners. On the 19th of October a battle was fought between the mutineers and Macdonald's force, in which the former were defeated. The same night the Sudanese leaders, fearful lest their men might submit, murdered Thruston and his companions and sent letters to Uganda to incite their comrades to mutiny. Wilson, however, had already disarmed the troops in Kampala, who remained loyal, as also did Mbogo, the ex-king of the Baganda Mahommedans. A large Protestant army now went to the assistance of Macdonald, and from the 19th of October to the 9th of January the siege of Luba's continued, with constant skirmishes, among the killed being the Rev. G. Pilkington. Early in January Mwanga escaped from the Germans, and, declaring himself a Mahommedan, reached Buddu with a large force, which Major Macdonald defeated with the aid of the Baganda army. He then disarmed the Sudanese garrisons in Buddu. The garrisons in Unyoro (about 500) and in Toro remained loyal. Meanwhile the Sudanese at Luba's (numbering 600, with 200 Mahommedan Baganda) escaped, proceeded up the east bank of the Nile and crossed the river, making their way to Mruli. It appeared probable that if they reached that point the Sudanese garrisons in Unyoro would revolt as well as the Baganda Mahommedans, and the last hope of the Europeans would be lost. Leaving a small column to deal with Mwanga's force in the south, and another with Kabarega, Macdonald pursued the mutineers, overtook them in the swamps of Lake Kioga, and after a couple of successful skirmishes returned to Kampala, leaving Captain (afterwards Colonel) E. G. Harrison in command. That officer, crossing a swamp supposed to be impassable, attacked the rebel stockade at Kabagambi, and carried it with great gallantry. Captain Maloney was killed and Lieut. Osborne wounded, but the crisis was past. A large number of Indian troops arrived early in 1899, and in May Colonel C. G. Martyr inflicted another heavy defeat on the mutineers at Mruli. Mwanga, however, managed to get through and join Kabarega and the rebels in the north. These were dealt with in a series of engagements, but it was not till June 1899 that Colonel J. T. Evatt had the good fortune to capture Kings Mwanga and Kabarega, who were deported to the coast and subsequently removed to the Seychelles, where Mwanga died in 1903. Colonel Martyr at the close of the year (1899) undertook an expedition up the Nile, and extended the limits of the protectorate in that direction. Major H. H. Austin, who had come up to Uganda in 1897 with Macdonald and had fought through the mutiny operations, revealed the regions north of Mt Elgon. Colonel C. Delmé-Radcliffe finally subdued the last remnant of the Sudanese mutineers in 1900–1901. The year 1899 had been a costly one, £329,000 being voted in aid. In the autumn of 1899 Sir Harry Johnston was sent out as special commissioner to Uganda, being also given the rank of commander-in-chief. By extensive reorganizations, and in spite of having to cope with a rising in Nandi, his commission resulted in the reduction of expenditure and increase of local revenue. He gave the kingdom of Buganda a definite constitution, settled the land question in the provinces of Buganda, Busoga, Unyoro, Toro and Ankole, and also the question of native taxation. By the treaty of Mengo, signed in March 1900, the young king of Buganda, Daudi Chwa, a son of Mwanga, born in 1896, was accorded the title of his Highness the Kabaka. During his minority the kingdom of Buganda was governed by regents. In 1900, the Uganda Protectorate was divided into six provinces, but in 1903 the Eastern and part of the Central provinces were transferred to the British East Africa Protectorate.

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[1] Toro, Ankole, Bukedi and the other countries now included in the protectorate were added by Sir Harry Johnston in 1899–1901.

In 1902 the Uganda railway, begun in 1896, was finished. Its terminus is at Kisumu (Port Florence) on Kavirondo Gulf, Victoria Nyanza. It is some 580 m. long, ascends in places to altitudes of 7000 and 8000 ft. (highest point 8300 ft.), but has only one tunnel. Its cost was about £5,300,000. (See British East Africa.)

Colonel Sir James H. Sadler succeeded Sir Harry Johnston in 1902 and was transferred to East Africa in 1905. His place in Uganda was taken by Sir Henry Hesketh Bell, who was made the first governor of Uganda in 1906. The ravages of sleeping-sickness between 1901 and 1909 destroyed upwards of a quarter of a million people, and the whole of the native population had to be removed from the lake shores and the Sese Islands; but nevertheless the protectorate continued to make steady progress in civilization and in the development of its material resources. Its transit trade, especially with the Belgian Congo, became of great importance. To facilitate commerce with the Congo and with the Anglo-Egyptian Sudan and to open up the Busoga region the British government in 1910 voted money to build a railway from Jinja to Kakindu. The work was carried out under the superintendence of Captain H. E. S. Cordeaux, who became governor of the protectorate in 1910.

Authorities.—J. H. Speke, *Discovery of the Source of the Nile* (1863); Sir H. M. Stanley, *Through the Dark Continent* (1878) and *In Darkest Africa* (1890); Sir Richard Burton, *Lake Regions of Central Africa* (1860); Sir Samuel Baker, *Albert Nyanza* (1866); Emin Pasha, *Journals* (1886 edition); C. Chaillé Long, *Central Africa. Naked Truths of Naked People* (1876); *Colonel Gordon in Central Africa* (1881), edited by G. B. Hill; C. T. Wilson and R. W. Felkin, *Uganda and the Egyptian Sudan* (1882); R. P. Ashe, *Two Kings of Uganda* (1889) and *Chronicles of Uganda* (1894), Sir H. Colvile, *The Land of the Nile Springs* (1895); P. Kollmann, *The Victoria Nyanza* (1899); Sir F. D. Lugard, *The Rise of Our East African Empire* (1893); G. F. Scott-Elliot, *A Naturalist in Mid Africa* (1896); Joseph Thomson, *Through Masai Land* (1885); J. Ansorge, *Under the African Sun* (1899); Count Teleki and Lieut. Höhnel, *Discoveries of Lakes Rudolf and Stéphanie* (1894); F. Stuhlmann, *Mit Emin Pascha ins Herz von Afrika* (1894); Sir Harry Johnston, *The Uganda Protectorate* (1902); and *The Nile Quest* (1903); A. B. Thruston, *African Incidents* (1900); J. F. Cunningham, *Uganda and its Peoples* (1905); H. H. Austin, *With Macdonald in Uganda* (1903) and *Among Swamps and Giants in Equatorial Africa* (1902); Winston Churchill, *My African Journey* (1908); Bishop Tucker, *Eighteen Years in Uganda and East Africa* (1908); articles on ethnology by the Rev. H. Roscoe in the *Journal* of the Royal Anthropological Institute between 1900 and 1908; the duke of the Abruzzi, "The Snows of the Nile," in *The Geographical Journal* (February 1907); De Filippi, *Ruwenzori* (1908); J. E. S. Moore, *The Tanganyika Problem* (1903), and *To the Mountains of the Moon* (1901); A. F. R. Wollaston, *From Ruwenzori to the Congo* (1908); Seymour Vandeleur, *Campaigning on the Upper Nile and Niger* (1898).

(H. H. J.)

UGLICH, a town of Russia, in the government of Yaroslavl, on the upper Volga, 63 m. W. by S. of the city of Yaroslavl. Pop., 9698. Its historical remains are mostly associated with Prince Dmitri, son of Ivan the Terrible, who was believed to have been murdered (1591) here by Boris Godunov. The wooden house (built in 1481, restored in 1892) which the prince occupied, a church of St Demetrius, erected at the spot where he was killed, and a kiosk on the site of a convent where his mother was forcibly consecrated a nun, are the principal memorials of this incident. The cathedral was erected in the 13th century, but subsequently restored, and contains the grave of Prince Roman. The industries include paper-mills, flour-mills, distilleries, copper works, and linen factories; and the samovars (tea-urns) and sausages made here are famous.

The local annals go as far back as the 9th century. Until the 14th century Uglich was a separate principality, which extended over eastern Tver. In 1329 the sons of Prince Roman the Saint renounced their independence in favour of Moscow, and fifty years later the Uglich princes sold their rights to the great prince of Moscow. The Tatars plundered the town in 1237, 1293 and 1408, and the Lithuanians did the same at a later date.

UHDE, FRITZ KARL HERMANN VON (1848–   ), German painter, was born at Wolkenburg in Saxony. His artistic career, for which he studied first in Dresden, was interrupted for nearly ten years by military service, which included the two years of the Franco-German War, but in 1877 he again turned his attention to art, studying under Munkacsy in Paris and afterwards independently in Holland. His inclination was from the first directed towards religious subjects. He revived the practice of treating Biblical episodes realistically by transferring them to modern days. Thus in the "Come, Lord Jesus, be our Guest," of the Berlin National Gallery, Christ appears among the peasant family assembled for their meal in a modern German farmhouse "parlour," and in "The Sermon on the Mount" (Berlin, private collection) addresses a crowd of 19th century harvesters. Similar in conception are "Suffer Little Children to come unto Me" (Leipzig Museum), "The Holy Night" (Dresden Gallery), "The Last Supper," "The Journey to Bethlehem" (Munich Pinakothek) and "The Miraculous Draught of Fishes." Other works of his in public collections are: "Saying Grace," at the Luxembourg in Paris; "Christ at Emmaus," at the Staedel Institute, Frankfort; "The Farewell of Tobias," at the Liechtenstein Gallery, Vienna; and a portrait of the actor Wohlmuth, at the Christiania Museum. Von Uhde became professor and honorary member of the academies of Munich, Dresden and Berlin.

UHLAND, JOHANN LUDWIG (1787–1862), German poet, was born at Tübingen on the 26th of April 1787. He studied jurisprudence at the university of his native place, but also devoted much time to medieval literature. Having graduated as a doctor of laws in 1810, he went for some months to Paris; and from 1812 to 1814 he worked at his profession in Stuttgart, in the bureau of the minister of justice. He had begun his career as a poet in 1807 and 1808 by contributing ballads and lyrics to L. von Seckendorff's *Musenalmanach*; and in 1812 and 1813 he wrote poems for J. Kerner's *Poetischer Almanach* and *Deutscher Dichterwald*. In 1815 he collected his poems in a volume entitled *Gedichte*, which almost immediately secured a wide circle of readers. To almost every new edition he added some fresh poems. He wrote two dramatic works—*Ernst, Herzog von Schwaben* and *Ludwig der Baier*—the former published in 1818, the latter in 1819. These, however, are unimportant in comparison with his *Gedichte*. As a lyric poet, Uhland must be classed with the writers of the romantic school, for, like them, he found in the middle ages the subjects which appealed most strongly to his imagination. But his style has a precision, suppleness and grace which sharply distinguish his most characteristic writings from those of the romantic poets. Uhland wrote manly poems in defence of freedom, and in the states assembly of Württemberg he played a distinguished part as one of the most vigorous and consistent of the liberal members. In 1829 he was made extraordinary professor of German literature at the university of Tübingen, but he resigned this appointment in 1833, when it was found to be incompatible with his political views. In 1848 he became a member of the Frankfort parliament.

Uhland was not only a poet and politician; he was also an ardent student of the history of literature. In 1812 he published an interesting essay on *Das altfranzösische Epos*; and ten years afterwards this was followed by an admirable work on Walther von der Vogelweide. He was also the author of an elaborate study of *Der Mythus von Thôr nach nordischen Quellen* (1836), and he formed a valuable collection of *Alte hoch- und niederdeutsche Volkslieder*, which appeared in 1844–1845. He died at Tübingen on the 13th of November 1862.

Uhland's *Gesammelte Werke*, edited by H. Fischer, were published in 1892 in 6 vols.; also by L. Fränkel (2 vols., 1893) and L. Holthof (1901). His *Gedichte* passed through nearly fifty editions in the poet's lifetime; jubilee edition of the *Gedichte und Dramen* (1886). A critical edition by E. Schmidt and J. Hartmann appeared in 1898 (2 vols.). Uhland's *Schriften zur Geschichte der Dichtung und Sage* were published in 8 vols. (1865–1873); his *Tagebuch von 1810–1820* by J. Hartmann (1893). See F. Notter, *L. Uhland, sein Leben und seine Dichtungen* (1863); K. Mayer, *L. Uhland, seine Freunde und Zeitgenossen* (2 vols., 1867); *L. Uhlands Leben* (with *Nachlass*), by his widow (1874); A. von Keller, *Uhland als Dramatiker* (1877); H. Dederich, *L. Uhland als Dichter und Patriot* (1886); W. L. Holland, *Zu Uhlands Gedächtnis* (1886); H. Fischer, *L. Uhland* (1887); H. Maync, *Uhlands Jugenddichtung* (1899).

UIGHUR, or Ouighour, the name of a Turkish tribe and dynasty who came from the East and ruled in Kashgaria from the 10th to the 12th centuries. They used a variety of the Syriac alphabet. (See Turks.)

UIST, NORTH AND SOUTH, islands of the outer Hebrides, Inverness-shire, Scotland. North Uist lies S.W. of Harris (Long Island), from which it is separated about 8 m. by the Sound of Harris. The island measures 14 m. in length by 16 m. in greatest width, but the coasts are extremely indented. The highest point is Mt Eaval (1138 ft.). The principal sea-lochs are Loch Maddy and Loch Eport, both on the east. On the east coast the surface is mostly swampy moorland, but on the west there is some fertile soil. The inhabitants are chiefly engaged in crofting, fishing and cattle-rearing. The principal village, Loch Maddy, is the centre of a large trade, and is a favourite resort of anglers, being a regular calling station for the steamers from Oban and Portree. The islands belonging to the parish of North Uist comprise—to the south-west Balleshare and Illeray (pop., 383), Kirkibost, Heisker (98), and the Monach group, with a lighthouse on Shillay; to the south, Grimisay (290) and Ronay; to the north-east, Levera; to the north, Boreray (118) and Vallay.

South Uist has a population (1901) of 3541, an extreme length of 22 m. and an extreme width of 8 m. Towards the north-east it becomes mountainous, the highest points being Buail'a Choill (2034), Ben More (1994) and Hecla (1988). The chief sea-lochs are Loch Boisdale, largely frequented by anglers, Loch Eynort and Loch Skiport on the east coast. On the east side the surface is mainly alluvial peat, broken by hills, but on the west there is a belt of productive land. Besides crofting, the inhabitants are engaged in the fisheries and cattle-raising. Steamers from Oban call regularly at the village of Loch Boisdale. The islands attached to the parish of South Uist include, to the south, Eriskay (pop., 3478), where Prince Charles landed on the 2nd of August 1745; to the north-east, Wiay; to the north, Grimisay, Fladda, just off the north-east shore of Benbecula, and Benbecula (pop., 1417), with an area of 40 sq. m., from which there is at low tide a ford to North and South Uist.

UITENHAGE, a town of the Cape province, South Africa, in the valley of the Zwartkops river, 270 ft. above the sea, 21 m. by rail N.N.W. of Port Elizabeth. Pop. (1904), 12,193, of whom 6680 were whites. It was founded in 1804 by De Mist, the Batavian commissioner, who took over Cape Colony from the British in 1803. Many natives find employment in the mills along the Zwartkops, where vast quantities of wool from the sheep farms of the eastern part of the province are cleansed and forwarded for shipment at Port Elizabeth. Extensive railway works are established here. There are in addition large flower and fruit nurseries. The town is laid out in rectangular blocks, and contains a handsome town-hall, court-house and public offices.

UJEST (Polish, *Viast*), a small town on the Klodnitz in Prussia, which gives the title of duke to the head of the family of Hohenlohe-Öhringen, a branch (1823) of that of Hohenlohe-Ingelfingen (see Hohenlohe). Prince Hugo of Hohenlohe-Öhringen was created duke of Ujest in 1861, and in 1807 was succeeded by his son Christian Kraft (b. 1848). The duke is an hereditary member of the upper houses of Württemberg and Prussia.

UJIJI, a town in German East Africa, also known as Kavele, situated on the eastern shores of Lake Tanganyika, in 4° 55′ S., 29° 40′ E. It is connected with Cape Town by an overland telegraph line. The population (about 14,000) is composed of Arabs and members of numerous Central African tribes. Ujiji is the meeting-point of merchants from all parts of Tanganyika, and the terminus of the caravan route from Dar-es-Salaam. Arabs from Zanzibar made Ujiji their headquarters during the first half of the 19th century, and it became a great slave and ivory mart. In 1858 Richard Burton and J. H. Speke reached Ujiji from Zanzibar, being the first Europeans to see Lake Tanganyika. In 1869 David Livingstone, coming from the south, arrived at Ujiji, and it was here that H. M. Stanley found him on the 28th of October 1871. In 1890 it came within the German sphere of influence. (See Tanganyika and German East Africa.)

UJJAIN, or Ujain, a city of central India, in the state of Gwalior, on the right bank of the river Sipra, with a station on the branch of the Rajputana railway from Ratlam to Bhopal. Pop. (1901) 39,892. Ujjain, known as Avanti in the Buddhist period and as Ozene to the Greeks, is one of the seven sacred cities of the Hindus and the traditional capital of King Vikramaditya, at whose court the "nine gems" of Sanskirt literature are said to have flourished. It marks the first meridian of longitude in Hindu geography. It is heard of first as the residence of Asoka (afterwards emperor), when viceroy of the western provinces. It was sacked by the Mahommedans in 1235. Under Akbar it became the capital of Malwa, and during the last half of the 18th century it was the headquarters of Sindhia. It contains few old buildings, though relics of antiquity are often found on the abandoned site of the old city. It is now a centre of the trade in Malwa opium, with a wealthy colony of Bohra merchants. The principal institutions are the Madhava College (called after the present Maharaja), two state hospitals, and a dispensary belonging to the Canadian Presbyterian mission. A great religious festival is held here every twelfth year.

UJVIDÉK (German, *Neusatz*), a town of Hungary in the county of Bács-Bodrog, 171 m. S.S.E. of Budapest by rail. Pop. (1900), 28,763. It is situated on the left bank of the Danube near the terminus of the Franz-Josef canal. It is the seat of a Greek Orthodox bishop, and has become the literary and religious centre of the Servians in Hungary, especially since the foundation in 1864 of the *Matica Srbska*, or Servian Literary Society. The town was founded in the middle of the 18th century, and was almost totally destroyed during the revolution of 1848–49. On the opposite bank of the Danube, connected with Ujvidék by a railway bridge, lies Pétervárad or Peterwardein.

UKAZ, or Ukase (Russ., from *ukazat*, a shortened form of *ukazlivat*, to show, announce, prescribe), a term applied in Russia to an edict or ordinance, legislative or administrative, having the force of law. A ukaz proceeds either from the emperor or from the senate, which has the power of issuing such ordinances for the purpose of carrying out existing decrees. All such decrees are promulgated by the senate. A difference is drawn between the ukaz signed by the emperor's hand and his verbal ukaz, or order, made upon a report submitted to him. (See Russia: *Constitution and Government*.)

UKRAINE ("frontier"), the name formerly given to a district of European Russia, now comprising the governments of Kharkov, Kiev, Podolia and Poltava. The portion east of the Dnieper became Russian in 1686 and the portion west of that river in 1793.

ULAN (formerly spelt Uhlan), originally a Polish cavalry soldier armed with a lance. These troops were light cavalry, and wore the national dress and *czapka* (or lancer cap). They were introduced into the Prussian service in 1740, but failed to distinguish themselves in the first Silesian War, and it was only after the treaty of Tilsit (1807) that Ulan regiments were again formed in the Prussian army. In the Austrian army a "Uhlanpulk" of Poles was formed in 1784 and ordinary Ulan regiments of Austrian cavalry in 1791. The Austrian Ulans no longer carry the lance. In the German army of to-day Ulans are classed as heavy cavalry and wear the distinctive lancer dress inherited from the original Polish light horse. (See CAVALRY and LANCE.)

ULBACH, LOUIS (1822–1889), French writer, was born at Troyes (Aube) on the 7th of March 1822. He was encouraged to take up a literary career by Victor Hugo. He became dramatic critic of the *Temps*, and attracted attention by a series of satirical letters addressed to the *Figaro* over the signature of "Ferragus," and published separately in 1868. He edited the *Revue de Paris* until its suppression in 1858, and in 1868 he founded a paper, *La Cloche*, which was suppressed in 1869 for its hostility to the empire. Ulbach was imprisoned for six months, and when on his release he revived the paper he got into trouble both with the commune and the government, and was again imprisoned in 1871–1872. In 1878 he was made librarian of the arsenal, and died in Paris on the 16th of April 1889.

Among his works are: *Voyage autour de mon clocher* (1864), *Nos contemporains* (1869–1871), *Aventures de trois grandes dames de la cour de Vienne* (3 vols., 1876); *Les Buveurs de poisons: la fée verte* (1879), *La Vie de Victor Hugo* (1886), &c.

ULCER, an open sore (derived through the French from Lat. *ulcus*, Gr. ἕλκος). When a portion of animal tissue dies in consequence of an infection or injury, the death of that tissue taking place by gradual breaking down or disintegration, the process is termed *ulceration* and the result an ulcer. When the ulcer is spreading the place is painful and the surrounding parts are flushed with extra blood, but under appropriate treatment the destructive process ceases and the ulcer gradually heals. The bright surface of the ulcer becomes glazed over, and those changes take place in it which occur in an open wound. The ulcer gradually contracts, and round its edges cicatrization, or scarring, occurs. Ulcers may arise from various causes in different parts of the body, and in association with certain specific diseases, such as syphilis, tubercle, cancer and typhoid fever. (For GASTRIC ULCER see the separate article.) (E. O.*)

ULEÅBORG (Finnish, *Oulu*), a province in the grand duchy of Finland, including a wide territory to the north of Kuopio and nearly reaching Varangerfjord, taking in the high dreary plateau of Laponia (16,000 sq. m.) and the fertile plains of Österbotten. It has a total area of 63,970 sq. m., with a population, chiefly agricultural in Österbotten and nomadic in Laponia, of (1904) 295,187. The bulk of the inhabitants (99%) are Finnish. There are immense forests, and only 0·4% of the area is under culture. The capital of the government is Uleåborg, a seaport on the Gulf of Bothnia, now connected by railway with Helsingfors (498 m.); pop. (1904), 17,737.

ULEMA (Arab. *ʿulamā*, sing. *ʿālim*, literally "knowers," in the sense of *scientes*), the learned of Islām, theologians, canon-lawyers, professors, judges, muftīs, &c., all who, whether in office or not, are versed theoretically and practically in Muslim science in general. By "science" in this case is especially meant what is learned from tradition, books or men, and through the intellect. In a narrower sense, Ulema is used, in a Muslim state, of a council of such learned men, holding government appointments. If all conception of intermediary priesthood be eliminated, the Ulema may be said to be equivalent to the secular clergy of Roman Christendom (see DERVISH). Opposed to them, again, are the *ʿārifs* ("knowers," "perceivers," *sentientes*, as opposed to *scientes*), to whom religious knowledge comes in the vision of the mystic, not by tradition or reason (see ṢŪFĪISM).

On the training of the ulema see SUNNITES. (D. B. MA.)

ULFELDT, KORFITS (1606–1664), Danish statesman, was the son of the chancellor Jacob Ulfeldt. After a careful education abroad he returned to Denmark in 1629 and quickly won the favour of Christian IV. In 1634 he was made a Knight of the Elephant, in 1636 became councillor of state, in 1637 governor of Copenhagen, and in 1643 lord treasurer. In 1637 he married the king's daughter Leonora Christina, who had been betrothed to him from her ninth year. Ulfeldt was the most striking personality at the Danish court in all superficial accomplishments, but his character was marked by ambition, avarice and absolute lack of honour or conscience. He was largely responsible for the disasters of the Swedish war of 1643–45, and when the treaty of Brömsebro was signed there was a violent scene between him and the king, though Ulfeldt's resignation was not accepted. In December 1646 he was sent as ambassador extraordinary to the Hague, but the results of his embassy by no means corresponded to its costliness, and when he returned to Denmark in July 1647 he found the king profoundly irritated. Ulfeldt, supported by the Raad and the nobility, who objected to Christian's fiscal policy, resisted his father-in-law, and triumphed completely. As lord high steward he was the virtual ruler of Denmark during the two months which elapsed between the death of Christian IV. and the election of Frederick III. (July 6, 1648); but the new king was by no means disposed to tolerate the outrageous usurpations of Ulfeldt and his wife, and this antagonism was still further complicated by allegations of a plot (ultimately proved to be false, but believed at the time to be true) on the part of Dina Winhavers, a former mistress of Ulfeldt, to poison the royal family. Dina was convicted of perjury and executed, but Ulfeldt no longer felt secure at Copenhagen, and on the day after the execution he secretly quitted Denmark (July 14, 1651), with his family. After living for a time in concealment at Amsterdam, he migrated to Barth in Swedish Pomerania, and began the intrigues which have branded his name with infamy. In July 1657 he eagerly responded to the invitation of Charles X. of Sweden, when he invaded Denmark, and entered the service of his country's deadliest foe, for the express purpose of humiliating his sovereign and enriching himself. He persuaded the commandant of Nakskov, the one fortress of Laaland, to surrender to Charles X., and did his best to convince his countrymen that resistance was useless. Finally, as one of the Swedish negotiators at the congress of Taastrup, he was instrumental in humiliating his native land as she had never been humiliated before. Ulfeldt's treason was rewarded by Charles X. of Sweden with the countship of Solvitsburg in Blekinge; but the discontented renegade began intriguing against his new master, and in May 1659 was condemned to death. The Swedish regents, on the 7th of July, amnestied him, and he returned to Copenhagen to try to make his peace with his lawful sovereign, who promptly imprisoned him and his wife. In the summer of 1660 they were conveyed to Hammershus in Bornholm, as prisoners of state. Their captivity was severe to brutality; and they were only released (in September 1661) on the most degrading conditions. The fallen magnate henceforth dreamed of nothing but revenge, and in the course of 1662, during his residence at Bruges, he offered the Danish crown to the elector of Brandenburg, proposing to raise a rebellion in Denmark for that purpose. Frederick William betrayed Ulfeldt's treason to Frederick III., and the Danish government at once impeached the traitor; on the 24th of July 1663 he and his children were degraded, his property was confiscated, and he was condemned to be beheaded and quartered. He escaped from the country, but the sentence was actually carried out on his effigy; and a pillory was erected on the ruins of his mansion at Copenhagen. He died at Basel, in February 1664.

See Julius Albert Fridericia, *Adelsvaeldens sidste dage* (Copenhagen, 1894); *Danmarks riges historie*, vol. iv. (Copenhagen, 1897–1905); Robert Nisbet Bain, *Scandinavia*, chs. vii., ix., x. (Cambridge, 1905).

ULFILAS (*c.* 311–383), the apostle of Christianity to the Gothic race, and, through his translation of the Scriptures into Gothic, the father of Teutonic literature, was born among the Goths of the trans-Danubian provinces about the year 311.[1] The Arian historian Philostorgius (*Hist. eccl.* ii. 5) says that his grand-parents were Christian captives from Sadagolthina in Cappadocia, who had been carried off to the lands beyond the Danube in the Gothic raid of 264, and became so naturalized that the boy received a Gothic name, *Wulfila* (Little Wolf).

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[1] Krafft gives 313 as the date; Waitz, 318.

An authoritative record of the outlines of his life was only discovered early in the 19th century in a writing of Auxentius of Milan, his pupil and companion. At an early age Ulfilas was sent, either as an envoy or as a hostage for his tribe, to Constantinople, probably on the occasion of the treaty arranged in 332. During the preceding century Christianity had been planted sporadically among the Goths beyond the Danube, through the agency in part of Christian captives, many of whom belonged to the order of clergy, and in part of merchants and traders. Ulfilas may therefore have been a convert to Christianity when he reached Constantinople. But it was here probably that he came into contact with the Arian doctrines which gave the form to his later teaching, and here that he acquired his command over Greek and Latin. For some time before 341 he worked as a lector (reader of the Scriptures), probably among his own countrymen in Constantinople, or among those attached as *foederati* to the Imperial armies in Asia Minor. From this work he was called to return as missionary bishop to his own country, being ordained by Eusebius of Nicomedia and "the bishops who were with him," probably at Antioch, in 341. This ordination of Ulfilas by the chiefs of the semi-Arian party is at once an indication of their determination to extend their influence by active missionary enterprise, and evidence that Ulfilas was now a declared adherent of the Arian or semi-Arian party. He was now thirty years of age, and his work as "bishop among the Goths" covered the remaining forty years of his life. For seven of these years he wrought among the Visigoths beyond the Danube, till the success which attended his labours drew down the persecution of the still pagan chief of the tribe. This "sacrilegus judex" has been identified with Athanaric, a later persecutor, but the identification is not beyond question. To save his flock from extinction or dispersion, Ulfilas decided to withdraw both himself and his people. With the consent of the emperor Constantius he led them across the Danube, "a great body of the faithful," and settled in Moesia at the foot of the range of Haemus and near the site of the modern Tirnova (349). Here they developed into a peace-loving pastoral people.

The life of Ulfilas during the following thirty-three years is marked by only one recorded incident (Sozomen iv. 24), his visit to Constantinople in January 360, to attend the council convened by the Arian or Homoean party. His work and influence were not confined to his own immediate flock, but radiated by means of his homilies and treatises, and through the disciples he despatched as missionaries, among all the Gothic tribes beyond the Danube. Thus the Church beyond the Danube, which had not been extinguished on Ulfilas's withdrawal, began to grow once more, and once more had to undergo the fires of persecution. Catholic missionaries had not been wanting in the meanwhile, and in the indiscriminate persecution by Athanaric, between 370 and 375, Catholics and Arians stood and fell side by side. The religious quarrel either accentuated, or was accentuated by, political differences, and the rival chiefs, Athanaric and Frithigern, appeared as champions of Paganism and Christianity respectively. Then followed the negotiations with the emperor Valens, the general adhesion of the Visigoths under Frithigern to Arian Christianity, the crossing of the Danube by himself and a host of his followers, and the troubles which culminated in the battle of Adrianople and the death of Valens (378). The part played by Ulfilas in these troublous times cannot be ascertained with certainty. It may have been he who, as a "presbyter christiani ritus," conducted negotiations with Valens before the battle of Adrianople; but that he headed a previous embassy asking for leave for the Visigoths to settle on Roman soil, and that he then, for political motives, professed himself a convert to the Arian creed, favoured by the emperor, and drew with him the whole body of his countrymen—these and other similar stories of the orthodox church historians appear to be without foundation. The death of Valens, followed by the succession and the early conversion to Catholicism of Theodosius, dealt a fatal blow to the Arian party within the empire. Ulfilas lived long enough to see what the end must be. Hardships as well as years must have combined to make him an old man, when in 383 he was sent for to Constantinople by the emperor. A split seems to have taken place among the Arians at Constantinople. Ulfilas was summoned to meet the innovators, and to induce them to surrender the opinion which caused the dispute. His pupil Auxentius describes how, "in the name of God," he set out upon his way, hoping to prevent the teaching of these new heretics from reaching "the churches of Christ by Christ committed to his charge." No sooner had he reached Constantinople than he fell sick, "having pondered much about the council," and before he had put his hand to the task which had brought him he died, probably in January 383. A few days later there died, also in Constantinople, his old enemy and persecutor, Athanaric.

The Arianism of Ulfilas was a fact of pregnant consequence for his people, and indirectly for the empire. It had been his lifelong faith, as we learn from the opening words of his own confession—"Ego Ulfilas semper sic credidi." If, as seems probable from the circumstances of his ordination, he was a semi-Arian and a follower of Eusebius in 341, at a later period of his life he departed from this position, and vigorously opposed the teaching of his former leader. He appears to have joined the Homoean party, which took shape and acquired influence before the council of Constantinople in 360, where he adhered with the rest of the council to the creed of Ariminum, with the addendum that in future the terms ὑπόστασις and οὐσία should be excluded from Christological definitions. Thus we learn from Auxentius that he condemned Homoousians and Homoiousians alike, adopting for himself the Homoean formula, "filium similem esse patri suo." This Arian form of Christianity was imparted by Ulfilas and his disciples to most of the tribes of the Gothic stock, and persisted among them, in spite of persecution, for two centuries.

The other legacy bequeathed by Ulfilas was of less questionable value. His version of the Scriptures is his greatest monument. By it he became the first to raise a barbarian tongue to the dignity of a literary language; and the skill, knowledge and adaptive ability it displays make it the crowning testimony of his powers as well as of his devotion to his work.

The personal qualities of the man may be inferred from his pupil's description of him as "of most upright conversation, truly a confessor of Christ, a teacher of piety, and a preacher of truth—a man whom I am not competent to praise according to his merit, yet altogether keep silent I dare not."

See Waitz, *Das Leben des Ulfilas* (1840); W. L. Krafft, *Kirchengeschichte der deutschen Völker* (Abth. i., 1854); H. Böhmer in Herzog-Hauck, *Realencyklopädie*,^{3} vol. xxi.; W. Bessell, *Das Leben des Ulfilas* (1860); C. A. Scott, *Ulfilas, Apostle of the Goths* (1885).
(C. A. S.)

ULLATHORNE, WILLIAM BERNARD (1806–1889), English Roman Catholic bishop, was born at Pocklington, Yorkshire, on the 7th of May 1806, of an old Roman Catholic family. At fifteen he went to sea, and made several voyages to the Baltic and Mediterranean. In 1823 he entered the Benedictine monastery of Downside, near Bath, taking the vows in 1825. He was ordained priest in 1831, and in 1833 went to New South Wales, as vicar-general to Bishop William Morris (1794–1872), whose jurisdiction extended over the Australian missions. It was mainly Ullathorne who caused Gregory XVI. to establish the hierarchy in Australia. He returned to England in 1836, and, after another visit to Australia, settled in England in 1841, taking charge of the Roman Catholic mission at Coventry. He was consecrated bishop in 1847 as vicar-apostolic of the western district, in succession to Bishop C. M. Baggs (1806–1845), but was transferred to the central district in the following year. On the re-establishment of the hierarchy in England Ullathorne became the first Roman Catholic bishop of Birmingham. During his thirty-eight years tenure of the see 67 new churches, 32 convents and nearly 200 mission schools were built. In 1888 he retired and received from Leo XIII. the honorary title of archbishop of Cabasa. He died at Oscott College on the 21st of March 1889.

Of his theological and philosophical works the best known are: *The Endowments of Man* (1882); *The Groundwork of the Christian Virtues* (1883); *Christian Patience* (1886). For an account of his life see his *Autobiography*, edited by A. T. Drane (London, 1891).

ULLMANN, KARL (1796–1865), German Protestant theologian, was born at Epfenbach, near Heidelberg, on the 15th of

March 1796. He studied at Heidelberg and Tübingen, and in 1820 delivered exegetical and historical lectures at Heidelberg. In 1829 he went to Halle as professor to teach church history, dogmatics and symbolics, but in 1836 he accepted a chair at Heidelberg. A lifelong exponent of the mediating theology (*Vermittelungs-Theologie*), in 1828, with the help of Umbreit (1795–1860), he founded and edited the *Theologische Studien und Kritiken* in its interests. When Wegscheider and Gesenius were denounced by Hengstenberg as rationalists, he pleaded for freedom in theological teaching (cf. his *Theol. Bedenken*, 1830). On the other hand, he vigorously attacked David Strauss. His *Historisch oder mythisch* (1838; 2nd ed. 1866) was a reply to Strauss's *Life of Jesus*, and his criticism resulted in Strauss making numerous concessions in later works. Ullmann died on the 12th of January 1865.

In *Das Wesen des Christenthums* (1845; 5th ed., 1865; Eng. trans., 1860) Ullmann explains that Christianity is independent of the orthodox formulas, and contends that a distinction should be made between faith and dogmatics. His principal historical works are *Gregor von Nazianz* (1825; 2nd ed., 1867) and *Die Reformatoren vor der Reformation* (2 vols., 1841; 2nd ed., 1866; Eng. trans., 1854). Another well-known work is *Die Sündlosigkeit Jesu* (1854; Eng. trans., 1858 and 1870). See O. Pfleiderer, *Development of Theology* (1890); and cf. W. Beyschlag, *Karl Ullmann* (1867), and Adolf Hausrath in *Kleine Schriften religionsgeschichtlichen Inhalts* (1883).

ULM, a fortress-city of Germany, in the kingdom of Württemberg, situated on the left bank of the Danube, in a fertile plain at the foot of the Swabian Alps, 58 m. by rail S.E. of Stuttgart and 63 m. N.W. of Munich. Pop. (1905), 51,680. Ulm still preserves the dignified and old-fashioned appearance of a free imperial town, and contains many medieval buildings of historic and of artistic interest. Among these are the town hall, of the 16th century, in the Transition style from late Gothic to Renaissance, restored in recent years; the Kornhaus; the Ehingerhaus or Neubronnerhaus, now containing the industrial museum; and the commandery of the Teutonic order, built in 1712–1718 on the site of a habitation of the order dating from the 13th century, and now used as barracks. The magnificent early Gothic cathedral is capable of containing 30,000 people. Begun in 1377, and carried on at intervals till the 16th century, the building was long left unfinished; but in 1844 the work of restoration and completion was begun, being completed in 1890. Ulm cathedral has double aisles and a pentagonal apsidal choir, but no transepts. Its length (outside measurement) is 464 ft., its breadth 159 ft.; the nave is 136 ft. high and 47½ wide; the aisles, which are covered with rich net-vaulting, are 68 ft. in height. The massive and richly decorated square tower in the centre of the west façade, which for centuries terminated in a temporary spire, was completed in 1890, according to the original plans, by the addition of an octagonal storey and a tall open spire (528 ft.), the loftiest ecclesiastical erection in the world, outstripping the twin spires of Cologne cathedral by 21 ft. The towers of the choir, rebuilt in the course of the restoration, are 282 ft. high. The cathedral contains some fine stained glass, the largest organ in Germany (1856), and a number of interesting old paintings and carvings by Jörg Syrlin the elder, Jörg Syrlin the younger, Burkhard Engelberger, and other masters of the Swabian school. It belongs to the Protestant Church. Trinity church dates from 1617–1621, and there are also four Roman Catholic churches and a synagogue.

The Danube, joined by the Iller just above the town and by the Blau just below, here becomes navigable, so that Ulm occupies the important commercial position of a terminal river-port. Hence there is water communication with the Neckar, and so to the Rhine and into the interior of France. The market for leather and cloth is important, and Ulm is famous for its vegetables (especially asparagus), barley, beer, pipe-bowls and sweet cakes (Ulmer Zuckerbrot). Bleaching, brewing and brass-founding are carried on, as well as a large miscellany of manufactures.

Ulm has long been a fortress of the first rank. In 1844–1859 the German Confederation carefully fortified it, and in 1876 the new German Empire added a comprehensive outer girdle of detached forts, culminating in the powerful citadel of Wilhelmsburg. The long straight lines of works which stretched to the plateau of the Michelsberg and formed the outworks of the main fortress on the left bank of the Danube were purchased in 1900 by the municipal authorities, in order to be levelled and laid out in streets for the extension of the town in this direction. The fortifications also of Neu-Ulm, on the Bavarian side of the Danube, were ordered to be razed and devoted to municipal purposes. The citadel of Wilhelmsburg remains, and also the defences on the left bank of the Danube, further extended and strengthened. Ulm is the basis of operations for the German army behind the Black Forest, and can easily shelter a force of 100,000 men; its peace garrison is 5600.

Ulm is mentioned as early as 854, and under the Carolingian sovereigns it was the scene of several assemblies. It became a town in 1027, and was soon the principal place in the duchy of Swabia. Although burned down by Henry the Lion, it soon recovered from this disaster and became a free imperial town in 1155. Towards the close of the middle ages it appears several times at the head of leagues of the Swabian towns. Its trade and commerce prospered and in the 15th century it attained the summit of its prosperity, ruling over a district about 300 sq. m. in extent, and having a population of about 60,000. In 1803 it lost its freedom and passed to Bavaria, being ceded to Württemberg in 1809. In October 1805 General Mack with 23,000 Austrians capitulated here to Napoleon. Ulm is remarkable in the history of German literature as the spot where the Meistersinger lingered longest, preserving without text and without notes the traditional lore of their craft. In 1830 there were twelve Meistersinger alive in Ulm, but in 1839 the four survivors formally made over their insignia and gild property to a modern singing society and closed the record of the *Meistergesang* in Germany.

See E. Nübling, *Ulms Handel und Gewerbe im Mittelalter* (Ulm, 1892–1900); G. Fischer, *Geschichte der Stadt Ulm* (Stuttgart, 1863); Pressel, *Ulmisches Urkundenbuch* (Stuttgart, 1873); and *Ulm und sein Münster* (Ulm, 1877); Schultes, *Chronik von Ulm* (Stuttgart, 1881 and 1886); Hassler, *Ulms Kunstgeschichte im Mittelalter* (Stuttgart, 1872); and *Das rote Buch der Stadt Ulm*, edited by C. Mollvo (1904).

ULPIAN (Domitius Ulpianus), Roman jurist, was of Tyrian ancestry. The time and place of his birth are unknown, but the period of his literary activity was between A.D. 211 and 222. He made his first appearance in public life as assessor in the *auditorium* of Papinian and member of the council of Septimius Severus; under Caracalla he was master of the requests (*magister libellorum*). Heliogabalus banished him from Rome, but on the accession of Alexander (222) he was reinstated, and finally became the emperor's chief adviser and *praefectus praetorio*. His curtailment of the privileges granted to the praetorian guard by Heliogabalus provoked their enmity, and he narrowly escaped their vengeance; ultimately, in 228, he was murdered in the palace, in the course of a riot between the soldiers and the mob.

His works include *Ad Sabinum*, a commentary on the *jus civile*, in over 50 books; *Ad edictum*, a commentary on the Edict, in 83 books; collections of opinions, responses and disputations; books of rules and institutions; treatises on the functions of the different magistrates—one of them, the *De officio proconsulis libri x.*, being a comprehensive exposition of the criminal law; monographs on various statutes, on testamentary trusts, and a variety of other works. His writings altogether have supplied to Justinian's *Digest* about a third of its contents, and his commentary on the Edict alone about a fifth. As an author he is characterized by doctrinal exposition of a high order, judiciousness of criticism, and lucidity of arrangement, style and language.

Domitii Ulpiani fragmenta, consisting of 29 titles, were first edited by Tilius (Paris, 1549). Other editions are by Hugo (Berlin, 1834), Böcking (Bonn, 1836), containing fragments of the first book of the *Institutiones* discovered by Endlicher at Vienna in 1835, and in Girard's *Textes de droit romain* (Paris, 1890).

ULRICH, duke of Württemberg (1487–1550), was a son of Henry, count of Montbéliard (d. 1519), younger son of Ulrich V., count of Württemberg. He succeeded his kinsman Eberhard II. as duke of Württemberg in 1498, being declared of age in 1503. He served the German king, Maximilian I., in the war over the succession to the duchy of Bavaria-Landshut in 1504, receiving some additions to Württemberg as a reward; he accompanied Maximilian on his unfinished journey to Rome in 1508; and he marched with the imperial army into France in 1513. Meanwhile in Württemberg Ulrich had become very unpopular. His extravagance had led to a large accumulation of debt, and his subjects were irritated by his oppressive methods of raising money. In 1514 a rising under the name of "poor Conrad" broke out, and was only suppressed after Ulrich had made important concessions to the estates in return for financial aid. The duke's relations with the Swabian league, moreover, were very bad, and trouble soon came from another quarter also. In 1511 Ulrich had married Sabina, a daughter of Albert III., duke of Bavaria-Munich, and niece of the emperor Maximilian. The marriage was a very unhappy one, and having formed an affection for the wife of a knight named Hans von Hutten, a kinsman of Ulrich von Hutten, the duke killed Hans in 1515 during an altercation. Hutten's friends now joined the other elements of discontent. Fleeing from her husband, Sabina won the support of the emperor and of her brother William IV., duke of Bavaria, and Ulrich was twice placed under the imperial ban. After the death of Maximilian in January 1519 the Swabian league interfered in the struggle, and Ulrich was driven from Württemberg, which was afterwards sold by the league to the emperor Charles V.

Ulrich passed some time in Switzerland, France and Germany, occupied with brigand exploits and in service under Francis I. of France; but he never lost sight of the possibility of recovering Württemberg, and about 1523 he announced his conversion to the reformed faith. His opportunity came with the outbreak of the Peasants' War. Posing as the friend of the lower orders and signing himself "Ulrich the peasant," his former oppressions were forgotten and his return was anticipated with joy. Collecting men and money, mainly in France and Switzerland, he invaded Württemberg in February 1525, but the Swiss in his service were recalled owing to the defeat of Francis I. of France at Pavia; the peasantry were unable to give him any serious support, and in a few weeks he was again a fugitive. During his exile Ulrich had formed a friendship with Philip, landgrave of Hesse; and his restoration, undertaken by Philip, is an event of some importance in the political history of the Reformation. In 1526 Philip had declared he was anxious to restore the exiled duke, and about the same time Francis I. and Zwingli had intimated their willingness to assist in a general attack upon the Habsburgs. Many difficulties, however, barred the way, and it was 1534 before Philip was prepared to strike. In January of that year Francis I. had definitely promised assistance; the Swabian league had just been dissolved; and, after a manifesto had been issued by Ulrich and Philip justifying the proposed undertaking, Württemberg was invaded in April 1534. Charles V. and his brother, the German king, Ferdinand I., could send but little assistance to their lieutenants, and on the 13th of May the troops of the Habsburgs were completely defeated at Lauffen. In a few weeks Ulrich was restored, and in June 1534 a treaty was negotiated at Kaaden by which he was recognized as duke by Ferdinand, but was to hold Württemberg under Austrian suzerainty. After some hesitation Ulrich yielded to the solicitations of Philip, and signed the treaty in February 1535.

The duke now lost no time in pressing on the teaching of the reformed doctrines of Luther and Zwingli. Many convents and monasteries were destroyed, and extensive seizures of church property formed a welcome addition to his impoverished exchequer. Taxation, however, was so heavy that he soon lost his temporary popularity. In April 1536 he joined the league of Schmalkalden, though he did not assent to some of the schemes of Philip of Hesse for attacking Charles V. In 1546 his troops fought against the emperor during the war of the league of Schmalkalden, but with disastrous results for Württemberg. The duchy was quickly overrun, and the duke compelled to agree to the treaty of Heilbronn in January 1547. By this treaty Charles, ignoring the desire of Ferdinand to depose Ulrich again, allowed him to retain his duchy, but stipulated that he should pay a large sum of money, surrender certain fortresses, and appear as a suppliant before the emperor at Ulm. Having submitted under compulsion to the *Interim* issued from Augsburg in May 1548, Ulrich died on the 6th of November 1550 at Tübingen, where he was buried. He left a son, Christopher (1515–1568), who succeeded him.

Bibliography.—L. F. Heyd, *Ulrich, Herzog zu Württemberg* (Tübingen, 1841–1844); B. Kugler, *Ulrich, Herzog zu Wirtemberg* (Stuttgart, 1865); H. Ulmann, *Fünf Jahre württembergischer Geschichte 1515–1519* (Leipzig, 1867); J. Janssen, *Geschichte des deutschen Volks seit dem Ausgang des Mittelalters* (Freiburg, 1890), Eng. trans. by A. M. Christie and M. A. Mitchell (London, 1900 seq.); C. F. von Stälin, *Wirtembergische Geschichte*, Bd. iv. (Stuttgart, 1873); and J. Wille, *Philipp der Grossmüthige von Hessen und die Restitution Ulrichs von Wirtemberg* (Tübingen, 1882).

ULRICI, HERMANN (1806–1884), German philosopher, was born at Pförten, Prussia, on the 23rd of March 1806. He was educated for the law, but gave up his profession on the death of his father, and devoted four years to the study of literature, philosophy and science. In 1834 he was called to a professorship at Halle, where he remained till his death, on the 11th of January 1884. His philosophical standpoint may be characterized as a reaction from the pantheistic tendency of Hegel's idealistic rationalism towards a more pronouncedly theistic position. The Hegelian identity of being and thought is also abandoned and the truth of realism acknowledged, an attempt being made to exhibit idealism and realism as respectively incomplete but mutually complementary systems. Ulrici's later works, while expressing the same views, are largely occupied in proving the existence of God and the soul from the basis of scientific conceptions, and in opposition to the materialistic current of thought then popular in Germany.

His first works were in the sphere of literary criticism; of his treatise *On Shakespeare's Dramatic Art* (1839; editions, 1847, 1868, 1874), the 3rd ed. was translated into English by L. D. Schmitz in 1876. In 1841 he published *Über Princip u. Methode der Hegelschen Philosophie*, a severe criticism of the Hegelian system. This was continued in the *Grundprincip der Philosophie* (1845–1846), which also gives his speculative position. Complementary to this is his *System der Logik* (1852). His later works on the relation of philosophy to science and to the thought of his time were more popular in character. These are *Glauben u. Wissen* (1858), *Gott u. die Natur* (1862; 3rd ed., 1875), *Gott und der Mensch* (2 vols., 1866–1873; 2nd ed., 1874). From 1847 onward Ulrici edited, jointly with the younger Fichte, the *Zeitschrift für Philosophie u. phil. Kritik*. See Fränkel's art. in *Allgemeine deutsche Biog.* (1895) and works there quoted.

ULSTER, EARLS OF. The earldom of Ulster was the first title of honour in Ireland of English creation, and for more than a century was the only one. By many authorities John de Courci (*q.v.*), the conqueror of Ulster, is held to have been the first earl of Ulster; "it is, however, certain," says J.H. Round, "that this title was the invention of a late chronicler, and that it first appears in the *Book of Howth*, where we read of "Sir John Courcey, earl and president of Ulster." The confusion probably arose from the words of a charter, dated the 29th of May 1205, by which King John confirmed to Hugh de Lacy, whom he then created earl of Ulster, a grant of Ulster "as John de Courci held it on the day when Hugh conquered and took him prisoner in the field"; these words referring not to the earldom but to the lands held by de Courci, and possibly also to the authority which he had exercised in the king's name. The earldom therefore dates from this grant to de Lacy in 1205.

Hugh de Lacy, 1st Earl of Ulster (d. 1242 ?), was descended from Walter de Lacy (d. 1085), who fought for William the Conqueror at Hastings. The family came from Lassy in Normandy, and after the Conquest Walter de Lacy obtained extensive grants of land on the Welsh marches. He was the first baron Lacy by tenure, and was probably a brother, certainly a kinsman, of Ilbert de Lacy, from whom were descended Roger de Lacy, justiciar in the reign of King John, and the earls of Lincoln (*q.v.*) of the de Lacy family. Although Walter had three sons, one of whom founded Llanthony Abbey, none of them left heirs; but his daughter's son Gilbert took the name of de Lacy and became the fourth baron. Gilbert's son Hugh de Lacy (d. 1186) was one of the barons who accompanied Henry II. to Ireland in 1171; he obtained a grant of Meath, and governed Ireland as vicegerent for the king. By his wife Rose of Monmouth Hugh was father of Walter de Lacy (d. 1241), who succeeded his father as lord of Meath and took a leading part in the conflict of his family with John de Courci in Ireland, and also of Hugh de Lacy, 1st earl of Ulster. The latter was for a time a coadjutor of de Courci in Leinster and Munster, but after 1200 the rivalry between the two developed into war, and in 1203 de Lacy drove de Courci out of Down, and in the following year took him prisoner. He was rewarded by the king with grants of land in Ulster and Connaught, which were confirmed by the charter of the 29th of May 1205, when Hugh was created earl. He returned to Ireland with quasi-viceregal authority, and endeavoured without much success to reduce the O'Neill of Tyrone to submission. In 1207 war broke out between the earl of Ulster and FitzHenry, the justiciar. This brought King John in person to Ireland, where he expelled the earl's brother, Walter de Lacy, from Meath, and compelled the earl himself to fly from Carrickfergus to Scotland. For several years Ulster took part in the wars in France, and he did not return to Ireland till 1221, when he allied himself with O'Neill against the English. In 1226 his lands in Ulster were handed over to his brother Walter, but were restored to him in the following year, after which date he appears to have loyally served the king, being more than once summoned to England to give advice about Irish affairs. He died at Carrickfergus in 1242 or 1243. He left no surviving legitimate children, and on his death the earldom of Ulster reverted to the Crown.

In 1254 the lordship of Ireland was granted by Henry III. to Prince Edward (afterwards Edward I.), who about 1255 transferred "the county of Ulster" to Walter de Burgh, lord of Connaught, in exchange for the rich domain of Kilsilan. De Burgh was henceforth, or at all events within a short time afterwards, styled earl of Ulster, to which title he may have advanced some hereditary claim of a loose order through his mother Egidia, daughter of Walter de Lacy, the first earl of Ulster's brother. The earldom remained in the family of De Burgh until the death of William, 3rd earl of this line, in 1333, when it passed to his daughter Elizabeth, who married Lionel Plantagenet, son of Edward III. Lionel, having inherited in right of his wife the great estates of the family of de Clare as well as those of de Burgh, was created duke of Clarence in 1362. Leaving no male heirs, Lionel was succeeded in the earldom of Ulster by his daughter Philippa, who married Edmund Mortimer, earl of March. The third Mortimer, earl of Ulster, died unmarried in 1425, when his titles were inherited by his sister's son, Richard Plantagenet, duke of York, whose son Edward ascended the throne as Edward IV. in 1461.

Since that date the earldom of Ulster, which then merged in the Crown, has only been held by members of the royal family. It was granted in 1659 to James, duke of York, second son of Charles I., on whose accession as James II. it again merged in the Crown. The next prince to bear the title (1716) was Ernest Augustus, duke of Brunswick-Lüneburg, son of the elector of Hanover, and youngest brother of George I. The title became extinct at his death without heirs in 1728. It was next conferred on Edward Augustus, brother of George III., in 1760, again becoming extinct at his death seven years later. In 1784 Prince Frederick, second son of George III., was created earl of Ulster, and died leaving no children in 1827. Each of these last four earls of Ulster, all being of separate creations, held the title in conjunction with the dukedoms of York and Albany. On the next occasion of its revival it was united with the dukedom of Edinburgh, Prince Alfred Ernest Albert, second son of Queen Victoria, being created duke of Edinburgh, earl of Kent and earl of Ulster in 1866. On the death of the duke of Edinburgh in 1900 the earldom became extinct.

See, for the de Lacy and de Burgh earls of Ulster, *The Chronicle of Florence of Worcester*, edited by T. Forester (London, 1854); *Annals of Ireland by the Four Masters*, edited by J. O'Donovan (7 vols., Dublin, 1851); The *Annals of Loch Cé*, edited by W. M. Hennessy, "Rolls Series" (2 vols., London, 1871); *Calendar of Documents Relating to Ireland*, edited by H. S. Sweetman (5 vols., London, 1875–1886); W. W. Shirley, *Royal and Historical Letters of the Reign of Henry III.*, "Rolls Series" (2 vols., London, 1862–1866); Sir J. T. Gilbert, *History of the Viceroys of Ireland* (Dublin, 1865). For the later history of the earldom see G. E. C., *Complete Peerage*, vol. viii. (London, 1898). (R. J. M.)

ULSTER, a province of Ireland occupying the northern part of the island. It includes the counties Donegal, Londonderry, Antrim, Fermanagh, Tyrone, Cavan, Monaghan, Armagh and Down. Ulster (*Uladh*) was one of the early provincial kingdoms of Ireland, formed, according to the legendary chronicles, at the Milesian conquest of the island ten centuries before Christ, and given to the descendants of Ir, one of the sons of Mileadh. Interprovincial wars frequently altered its boundaries, notably in 332 when the three Collas, sons of Eochaidh Doimhlein, conquered the land between the river Boyne and Lough Neagh, which became a separate kingdom under the name of Uriel (Oriel or Orgial). Its princes maintained themselves until the close of the 16th century. In 1177 John de Courci, with the countenance of Henry II., set out to the conquest of Ulster. His operations were gradually successful, and he became lord deputy of Ireland in 1186 (see above). The nominal reign of the last king of Ulster closed in 1200. In 1585 Lord Deputy Sir John Perrot undertook the shiring of Ulster (excluding the counties Antrim and Down, which had already taken shape); and his work, though of little immediate effect owing to the rising of Hugh O'Neill, served as a basis for the division of the territory at the plantation of Ulster in the reign of James I.

ULTIMATUM (from Lat. *ultimus*, last), a word used in diplomacy to signify the final terms submitted by one of the parties in negotiation for settlement of any subject of disagreement. It is accompanied by an intimation as to how refusal will be regarded. English diplomacy has devised the adroit reservation that refusal will be regarded as an "unfriendly act," a phrase which serves as a warning that the consequences of the rupture of negotiations will be considered from the point of view of forcing a settlement. This opens up a variety of possibilities, such as good offices, mediation, the appointment of a commission of inquiry, arbitration, reprisals, pacific blockade and war.[1]

As regards the alternative of war, the Hague convention relative to the Opening of Hostilities of the 18th of October 1907, provides as follows:—

> "Considering that it is important, in order to ensure the maintenances of pacific relations, that hostilities should not commence without previous warning," it is agreed by the Contracting Powers to "recognize that hostilities between them must not commence without a previous and explicit warning in the form of either a declaration of war, giving reasons, or an ultimatum with a conditional declaration of war."

As reasons for a declaration of war are necessarily in the nature of an ultimatum, the ultimatum may now be regarded as an indispensable formality precedent to the outbreak of hostilities.

Another Hague convention of the same date respecting the limitation of the employment of force for the recovery of contract debts provides as follows:—

> "Being desirous of preventing between nations armed conflicts originating in a pecuniary dispute respecting contract debts claimed from the government of one country by the government of another country as due to its subjects or citizens," the Contracting Powers agree "not to have recourse to armed force for the recovery of contract debts claimed from the government of one country by the government of another country as being due to its subjects or citizens."

This undertaking, however, is not applicable when the debtor state refuses or neglects to reply to an offer of arbitration or, "after accepting the offer, renders the settlement of the *compromis* impossible, or, after the arbitration, fails to comply with the award."

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[1] To these may be added a new unofficial method devised by the Turks in connexion with the Austro-Turkish difficulty over the annexation of Bosnia-Herzegovina, viz. the boycotting of the goods and ships of the natives of the state against which the grievance exists. This is a method open to weaker as against more powerful states, which can have serious coercive and even complicated consequences under the influence of democratic institutions.

Under this convention, in the cases to which it relates, the alternative of the ultimatum is *ipso facto* arbitration, and it is only when the conditions of the convention have been set at naught that other measures may be employed.

ULTRAMARINE, a blue pigment, consisting essentially of a double silicate of aluminium and sodium with some sulphides or sulphates, and occurring in nature as a proximate component of lapis lazuli (*q.v.*). As early at least as the 11th century the art of extracting a blue pigment from lapis lazuli was practised, and from the beginning of the 16th century this pigment began to be imported into Europe from "over the sea," as *azurrum ultramarinum.* As the mineral only yields from 2 to 3% of the pigment, it is not surprising to learn that the pigment used to be weighed up with gold. It was valued chiefly on account of its brilliancy of tone and its inertness in opposition to sunlight, oil, and slaked lime (in fresco-painting). In 1814 Tassaert observed the spontaneous formation of a blue compound, very similar to ultramarine, if not identical with it, in a soda-furnace at St Gobain, which caused the *Société pour l'Encouragement d'Industrie* to offer, in 1824, a prize for the artificial production of the precious colour. Processes were devised by Guimet (1826) and by Christian Gmelin (1828), then professor of chemistry in Tübingen; but while Guimet kept his process a secret Gmelin published his, and thus became the originator of the "artificial ultramarine" industry.

The details of the commercial processes are trade secrets. The raw materials used in the manufacture are: (1) iron-free kaolin, or some other kind of pure clay, which should contain its silica and alumina as nearly as possible in the proportion of $2SiO_2 : Al_2O_3$ demanded by the formula assigned to ideal kaolin (a deficit of silica, however, it appears can be made up for by addition of the calculated weight of finely divided silica); (2) anhydrous sulphate of soda; (3) anhydrous carbonate of soda; (4) sulphur (in the state of powder); and (5) powdered charcoal or relatively ash-free coal, or colophony in lumps. "Ultramarine poor in silica" is obtained by fusing a mixture of soft clay, sodium sulphate, charcoal, soda and sulphur. The product is at first white, but soon turns green ("green ultramarine") when it is mixed with sulphur and heated. The sulphur fires, and a fine blue pigment is obtained. "Ultramarine rich in silica" is generally obtained by heating a mixture of pure clay, very fine white sand, sulphur and charcoal in a muffle-furnace. A blue product is obtained at once, but a red tinge often results. The different ultramarines—green, blue, red and violet—are finely ground and washed with water.

Artificial, like natural, ultramarine has a magnificent blue colour, which is not affected by light nor by contact with oil or lime as used in painting. Hydrochloric acid at once bleaches it with liberation of sulphuretted hydrogen and milk of sulphur. It is remarkable that even a small addition of zinc-white (oxide of zinc) to the reddish varieties especially causes a considerable diminution in the intensity of the colour, while dilution with artificial precipitated sulphate of lime ("annalin") or sulphate of baryta ("blanc fix") acts pretty much as one would expect. Ultramarine being very cheap, it is largely used for wall painting, the printing of paperhangings and calico, &c., and also as a corrective for the yellowish tinge often present in things meant to be white, such as linen, paper, &c. Large quantities are used in the manufacture of paper, and especially for producing that kind of pale blue writing paper which is so popular in Great Britain. The composition of the pigment is quite similar to that of lapis lazuli; but the constitution of both is uncertain.

By treating blue ultramarine with silver nitrate solution, "silver-ultramarine" is obtained as a yellow powder. This compound gives a blue potassium- and lithium-ultramarine when treated with the corresponding chloride, and an ethyl-ultramarine when treated with ethyl iodide. Selenium- and tellurium-ultramarine, in which these elements replace the sulphur, have also been prepared. It has been suggested that ultramarine is a compound of a sodium aluminium silicate and sodium sulphide. Another view is that the colour is due to some comparatively simple substance suspended in a colourless medium.

ULTRAMONTANISM (Lat. *ultra*, beyond, *montes*, the mountains), the name given to a certain school of opinion in the Roman Catholic Church. The expression *ultramontane* was originally no more than a term of locality, characterizing the persons so described as living—or derived from—"beyond the mountains." The "mountains" in this case are the Alps, so that, from the Italian standpoint, Germans and French for instance were "ultramontane." In this sense the word was applied in the later middle ages to the Germans studying at Italian universities and—to take a particular example—to the French cardinals at the election of Clement V. (1305). North of the Alps, however, the term seems never to have been restricted to the sense implying locality; for from the very beginning we find it used as a party appellation to describe those who looked "beyond the mountains" in order to obtain a lead from Rome, who represented the papal point of view and supported the papal policy. Thus, as early as the 11th century, the partisans of Gregory VII. were styled ultramontanes, and from the 15th century onwards the same name was given to the opponents of the Gallican movement in France.

It was not until the 19th century that "ultramontane" and "ultramontanism" came into general use as broad designations covering the characteristics of particular personalities, measures and phenomena within the Roman Catholic Church. At the present time they are applied to a tendency representing a definite form of Catholicism within that Church; and this tendency, in spite of the individual forms it has assumed in different countries, everywhere displays the same essential features and pursues the same ends. It follows, to be sure, from the very nature of Ultramontanism, and from the important position to which it has attained, that the official organs of the Church and all the people interested in the continuance of the actual state of affairs deny that it exists at all as an independent tendency, and seek to identify it with any proper interpretation of Roman Catholicism. Numerous Catholics, on the other hand, well qualified to form a judgment, themselves protest against this obliteration of the dividing line. It is indisputably legitimate to speak of Ultramontanism as a distinct policy, but it is very difficult to define its essential character. For, true to its nature, it has itself drawn up no complete programme of its objects, and, in addition to its avowed aims, its subsidiary effects claim attention. There is something chameleon-like in its appearances; its genuine views are kept in the background from tactical considerations, and first one aspect, then another, comes into prominence. It is evident, therefore, that the request for a definition of Ultramontanism cannot be answered with a concise formula, but that the varied character of its manifestations necessitates a more detailed examination of its peculiar objects.

The indications given by the late Franz Xaver Kraus—himself a Catholic—may well serve for a guide (*Spectator*, ep. 2). He classes as Ultramontane: (1) Whoever places the idea of the Church above that of religion; (2) whoever confounds the pope with the Church; (3) whoever believes that the kingdom of Heaven is of this world, and maintains, with medieval Catholicism, that the power of the keys, conferred on Peter, includes secular jurisdiction over princes and nations; (4) whoever holds that religious conviction can be imposed by material force, or may legitimately be crushed by it; (5) whoever is always ready to sacrifice a clear injunction of his own conscience to the claims of an alien authority.

The first and fundamental characteristic of Ultramontanism is its championship of a logical carrying out of the so-called "papalistic system," the concentration, that is, of all ecclesiastical power in the person of the Roman bishop. This tendency among occupants of the Roman see to exalt themselves above other bishops, and to usurp the part of a superior authority as compared with them, may be traced even in antiquity. No later than the end of the 2nd century Bishop Victor made an attempt to establish this position during the discussions regarding the date of the Easter festival. But he met with a sharp rebuff, and Bishop Stephen fared no better when, in the middle of the 3rd century, he came into collision with Cyprian of Carthage and Firmilian of Caesarea in the dispute concerning heretical baptism. How the Roman bishopric rose in status till it became the papacy, how the individual popes—in spite of these and similar repulses—advanced steadily on their path, how they succeeded in founding their primacy within the Church, and in re-establishing and maintaining that primacy notwithstanding severe defeats and long periods in which their prestige sank to the vanishing point, is told elsewhere (see Papacy). A characteristic peculiarity of the process is that the claims of the Roman see were always in advance of the actual facts and always encountered opposition; though there were many periods—at the height of the middle ages, for instance—when the voices raised in protest were only timid and hesitating. To the curial system, so evolved, and continually fortifying its position in the domains of theology, ecclesiastical law and politics, the episcopal system stands in diametrical opposition. This system admits that the pope represents the unity of the Church, and acknowledges his primacy, but only in the sense that he is *primus inter pares*; while at the same time it claims on behalf of the bishops that, in virtue of the divine ordinance, they possess an inalienable right to a share in the government of the Church (see Episcopacy). This theory of the independence of the episcopate with regard to the Roman bishop was first propounded by Cyprian, in his treatise *De unitate ecclesiae*. In the 15th century it received its classical expression in the resolutions of the ecumenical council at Constance; its principles were developed and amplified by Gallicanism, and, finally, in the 18th century, was restored in a modernized form by "Febronius" (Nikolaus von Hontheim, *q.v.*) and in the Punctation of Ems (see Febronianism). The struggle between these two systems continued well into the 19th century; and, though episcopalism was not infrequently proscribed by the curia, it still survived, and till the year 1870 could boast that no ecumenical council had ventured to condemn it. This was done for the first time, in 1870, at the Vatican Council (*q.v.*), whose decrees, recognizing the universal episcopate and the infallibility of the pope, marked the triumph of that ultramontane doctrine by which they had been long anticipated.

In 1865 Döllinger wrote: "The Ultramontane view can be summarized in a single, concise, and luminous proposition; but out of this proposition are evolved a doctrine and a view that embrace not merely religion and the Church, but science and the state, politics, morals and the social order—in a word, the whole intellectual life of men and nations. The proposition runs: The pope is the supreme, the infallible, and consequently the sole authority in all that concerns religion, the Church, and morality, and each of his utterances on these topics demands unconditional submission—internal no less than external." History, since the Vatican Council, has shown this judgment to have been correct. The Roman Catholic Church, in all countries, has become more and more dependent on the Curia: the bishops have lost their autonomous standing, and their position is little more than that of papal delegates, while all important questions are referred to Rome or settled by the nuncios.

A second peculiarity of Ultramontanism is its confusion of religion with politics; it claims for the Roman Catholic Church the functions of a political power, and asserts that it is the duty of the secular state to carry out its instructions and wishes. Ultramontanism regards the state, not as a divinely established order but, like its ancient prototype, as a profane institution and, for that reason, not co-ordinate with, but subordinate to the Church.

Since the conditions of the age no longer allow the pope to depose a temporal sovereign, the practical application of this conception of the relationship between the spiritual and temporal powers has taken other forms, all of which, however, clearly show that the superiority of the Church over the state is assumed. This may be seen in the attitude of Ultramontanism towards secular law. It assumes that God has conferred on the individual and on society certain rights and competences as inalienable possessions. This "natural law" ranks above all secular law, and all state legislation is binding only in so far as it is in harmony with that law. As to the provisions of this natural law, and the consequences they entail in individual cases, these can be decided only by the Church, *i.e.* the last resort, by the pope. This is to assert the principle of the invalidity of all legislation conflicting with ecclesiastical interests and rules. This was the attitude of Innocent III. when he annulled the English Magna Charta; of Innocent X. when he pronounced the treaty of Westphalia null and void; of Pius IX. when he condemned the Austrian constitution (1868) and the ecclesiastical laws of Prussia so far as they affected the circumstances of the Roman Catholic Church (1875). Thus, too, even at the present time, the opinion is very clearly expressed in Ultramontane quarters that, in the event of the state issuing laws contravening those of nature or of the Church, obedience must be refused. The attitude of Ultramontanism, for instance, towards the right claimed and exercised by the state to make laws concerning marriage is wholly negative; for it recognizes no marriage laws except those of the Church, the Church alone being regarded as competent to decide what impediments are a bar to marriage, and to exercise jurisdiction over such cases. Thus Ultramontanism disclaims any moral subjection to secular authority or law, and will recognize the state only in so far as it conforms its rules to those of the Church. An instance of this interference with the duties of the individual citizen towards the state may be found in the fact that, till the year 1904, the Catholics of Italy were prohibited by the pope from taking part in any parliamentary election.

Since Ultramontanism cannot hope to realise its political ambitions unless it succeeds in controlling the intellectual and religious life of Catholic Christendom, it attempts to extend its sphere of influence in all directions over culture, science, education, literature and the forms taken by devotion. This endeavour is the third great characteristic of Ultramontanism. Wherever its operations can be traced, they are dominated by the conviction that all stirrings of independence must be repressed, and any advance beyond the stage of immaturity and nonage checked at the outset. That science must be left free to determine the aims of her investigation, to select and apply her own methods, and to publish the results of her researches without restraint, is a postulate which Ultramontanism either cannot understand or treats with indifference, for it regards as strange and incredible the fundamental law governing all scientific research—that there is for it no higher aim than the discovery of the truth. This ignorance of the very nature of science leads to under-estimation of the elemental force which science possesses; for only thus can we explain the pertinacity with which Ultramontanism, even at the present day, strives to subject her work to its own censorship and control. Nor are its criticisms limited to theology alone: its care extends to philosophy, history and the natural sciences. Even medicine has not escaped its vigilance, as is proved by the prohibition of certain surgical operations. The development of these efforts may be easily traced from decisions of the Congregation of the Index and the Holy Office in Rome. Ultramontanism, too, labours systematically to bring the whole educational organization under ecclesiastical supervision and guidance; and it manifests the greatest repugnance to allowing the future priest to come into touch with the modern spirit. Hence the attempts to train its growing manhood in clerically regulated boarding-schools and to keep it shut out from the external world in clerical seminaries, even in places where there are universities. Again, it works zealously to bring the elementary schools under the sway of the Church. Since it regards the training and instruction of childhood as inseparable, and holds that the former is essentially the work of the Church, it contests the right of the state to compel parents to send their children to the state schools and only to the state schools. In logical sequence to these tenets it seeks to divorce the school from the state—a proceeding which it terms educational freedom, though the underlying motive is to subordinate the school to the Church. In the domain of religion, Ultramontanism tends to foster popular superstitions and to emphasize outward forms as the essence of religious life, for it can only maintain its dominion so long as the common people remain at a low spiritual level. If any one desires to appreciate the intellectual plane—

and the power—of this Ultramontane habit of thought, he will find ample material in the performances of the notorious swindler Leo Taxil under Leo XIII., and in the acceptance of his blasphemous effusions by the highest ranks of the clergy.

In the fourth place, Ultramontanism is the embodiment of intolerance towards other creeds. The general presupposition involved is that a man cannot be saved except within the Catholic Church. Since, however, on the one hand—in virtue of a theory advanced by Pius IX. against the emperor William I. of Germany, in a letter which has since become famous—every Christian, whether he will or no, belongs to that Church by baptism, and is consequently pledged to obey her, and, on the other hand, since the state lies under the obligation to place the "secular arm" at her disposal whenever one of her members wishes to secede, the most far-reaching consequences result. In the past this principle led to the erection of the Inquisition (*q.v.*) and, even at the present day, there exists in the Curia a special congregation charged with its application (see CURIA ROMANA). On the Roman Catholic side the employment of compulsion against heretics has never been acknowledged as a blunder; and this method of silencing opposition has found champions in the bosom of the Church down to the most recent years. But the development of modern culture has rendered these exploits of an unbridled fanaticism impossible, and no government would consent to enforce the once obligatory sentences of ecclesiastical courts. As a result of this situation, the Catholic condemnation of heresy—though as stringent as ever in principle—has assumed less dangerous forms for the heretic. Nevertheless, it proved capable, even in the 19th century, of imposing onerous restrictions on the heterodox, and practical exemplifications of this hostile attitude persist to the present day. The embittering influence of Ultramontanism may be further traced in its attitude towards the baptism of non-Catholics, for it seeks to establish the rule that baptism conferred by Protestants is invalid through defect of form or matter, or even of intention, and that, consequently, the rite must be readministered, at least conditionally, to proselytes joining the Roman Church. Finally, ample scope for the display of tolerance—or intolerance—is found in the mixed marriages between Protestants and Catholics, which, as a result of the modern facilities for intercommunication and the consequent greater mobility of the population, have shown a large increase during the last few decades—in Germany, for instance. Here, again, Ultramontanism has done much to aggravate the pernicious feud between the two creeds, by exacting a promise before marriage from the Roman Catholic party that all the children shall be brought up as members of the Roman Catholic Church (see MARRIAGE: *Canon Law*). A like result has been produced when, in response to Ultramontane agitation, interdicts have been placed on churchyards in which non-Catholics have found their last resting-place.

Lastly, Ultramontanism is the foe of the nationalization of Catholicism. This peculiarity is connected, though not identical, with the above-mentioned tendency towards the Romanization of the Church. Just as in Protestant countries there has often been an amalgamation of evangelical belief with national feeling, to the great gain of both, Catholics demand that Catholicism shall enter into the sphere of their national interests, and that the activities of the Catholic Church should rest on a national basis. These aspirations have been proclaimed with especial emphasis in France, in Germany (*Reformkatholizismus*) and in the United States (*Americanism*; see HECKER, I. T.) but are everywhere met with a blank refusal from the Ultramontane side. For Ultramontanism fears that any infusion of a national element into ecclesiastical life would entail the eventual independence of the people in question from papal control, and lead to developments opposed to its papalistic mode of thought. It endeavours, therefore, to undermine all aspirations of this nature and, its own tendency being essentially international, strives to ensure that national sentiment and national interests shall not find over-zealous champions among the clergy.

The relationship of Ultramontanism to Catholicism is a much-disputed problem. The Ultramontane, indeed, maintains that there is no justification for distinguishing between the two: but the motives underlying this attitude are obvious. For, by representing the prosecution of its party-political objects as a championship of the Catholic Church, Ultramontanism seeks to acquire the support of the official organs of that Church, and the good will of all circles interested in her welfare; while at the same time it strives to discredit any attempt at opposition by branding it as an assault on the orthodox faith. But, even within the pale of the Roman Church, this identification provokes emphatic dissent, and is repudiated by all who are shocked by the effects of a one-sided accentuation of political Catholicism on the inner life of the church, and are reluctant to see the priest playing the part of a political agitator. It was on these grounds that Count May, in January 1904, proposed in the chamber of the Bavarian Reichsrath that the clergy should be deprived of the suffrage. In Germany, again, the last few years have witnessed a growing aversion from Ultramontanism on the part of those Catholics who cannot reconcile its tenets with their patriotic sentiments, and are disinclined to submit to a limitation of their share in the intellectual life of the times, particularly in art, science and literature. It may be admitted that, in many cases, the distinction between Ultramontanism and Catholicism cannot be clearly traced; and it is impossible to draw a sharp line of severance between the two, which could be absolutely valid under all circumstances and in relation to all questions. For there are many almost imperceptible stages of transition from the one to the other; and, for all the principal contentions of Ultramontanism, analogies may be found in the past history of the Catholic Church. Thus, in the middle ages, we find extremely bold pronouncements with respect to the position of the papacy in the universal Church; while political Catholicism had its beginnings in antiquity and found very definite expression, for instance, in the bull *Unam sanctam* of Boniface VIII. Again, the attempt to subordinate all intellectual life to ecclesiastical control was a feature of the medieval Church, and the fundamental attitude of that Church towards heresy was fixed during the same period. But since then much has been altered both in the Church and her secular environment. The state has become independent of the Church, legislates on its own sole authority, and has recognized as falling within its own proper sphere the civilizing agencies and social questions formerly reserved for the Church. Again, education, science, art and literature have been secularized: the printing-press carries knowledge into every house, the number of illiterates diminishes from year to year in every civilized country, and the clergy are no longer the exclusive propagators of culture, but merely one factor among a hundred others. Finally, the Roman Catholic Church has long forfeited the privileged position formerly accorded as her due. The days when she was *the* Christian Church are past: and now the civic rights of a man in a modern state are not curtailed, though he may neglect his duty to the Church or flatly refuse to acknowledge the existence of any such duty. The struggle for religious freedom has suffered no intermission since the beginning of the Reformation; and the result is that to-day its recognition is considered one of the most precious trophies won in the evolution of modern civilization; nor can these changes be reversed, for they stand in the closest connexion and reciprocity one with another, and represent the fruits of centuries of co-operation on the part of the European peoples. But Ultramontanism ignores this latest page of history and treats it as non-existent, aspiring to the erection of a new order of society, similar to that which Rome created—or, at least, endeavoured to create—in the halcyon days of medievalism. For the justification of this enterprise, it is considered sufficient to point out that the several elements of its programme once enjoyed validity within the Church. But Cyprian of Carthage said long ago, *Consuetudo sine veritate vetustas erroris est*; and the bare fact of previous existence is no argument for the re-introduction of obsolete and antiquated institutions and theories. But, under the guise of a restoration on conservative lines, Ultramontanism—notwithstanding the totally different conditions which now obtain—girds itself to work for an ideal of religion and culture in vogue during the middle ages, and at the same time holds itself justified in adopting the extreme point of view with respect to all questions which we have mentioned. Thus Ultramontanism is not to be conceived as a theological movement, but as the programme of a party whose principles are in fundamental opposition to modern culture, modern education, modern tolerance and the modern state—a party which seeks to carry out its campaign against the society of to-day, not by bridging the gulf betwixt creed and creed, but by widening it, by awakening religious fanaticism, and by closing the way to a peaceful co-operation of Catholics and non-Catholics in the highest tasks of culture and human civilization. The hierophants of this Ultramontane system are to be found in the Society of Jesus (See JESUITS). In fact, the terms *jesuitical* and *ultramontane* may, in numerous cases, be regarded as equivalent.

The origin of modern Ultramontanism is preceded and conditioned by the collapse of Catholicism in the period of the French Revolution. Pius VI. and Pius VII. were expelled from Rome, deprived of the papal states, and banished to France. In that country the Church almost completely lost her possessions; in Germany they were at least considerably curtailed; in both the hierarchical organization was shattered, while the Catholic laity surveyed the catastrophe in complete passivity. But from this severe fall the Roman Church recovered with comparative readiness, and the upward movement is contemporaneous with the rise of Ultramontanism. The birth of that system, however, cannot be fixed as a definite event by the day and the hour; nor was it created by any single personality. Rather it was the product of the first post-revolutionary generation. Neither is it merely fortuitous that the reaction proceeded from France itself. For in no other country had hostility to religion attained such a pitch or assumed such grotesque forms; and consequently in no other country did the yearning for religion manifest itself so unequivocally, when bitter experience had demonstrated the necessity of a return to law and order. And in the other states of Europe there existed, more or less, a similar desire for peace and an equal dread of a fresh outbreak of revolutionary violence. In contrast to the struggle for an ideal freedom, which was at first hailed with tempestuous delight only to reveal itself as a dangerous tyranny, men became conscious of the need for a firmly established authority in the reconstruction of society. After the violent upheaval in the political world during the last few decades, the existent—as such—increased in value, and the high estimation in which the old régime was now held led to a policy of restoration. At the same time, the repression of idealism and sentiment during the period of "illumination" was amply revenged, and the barren age of reason gave place to Romanticism. These tendencies in contemporary opinion favoured the renovation of the Roman Catholic Church. But the papacy signalized its reinstation by restoring the Society of Jesus (1814) and re-establishing the index. Even before this, the earliest germs can be traced back into the revolutionary period itself—the movement characterized above had begun working in France on the same lines; and, as it showed great zeal for the increase of the papal authority, it received the support of the Curia. True, the principles of Bonald, Lemaître, Lamennais and Lacordaire, were not carried through in the French Church without opposition; but, about the year 1850, they had become predominant there. In Germany Ultramontanism had to contend with great difficulties; for here ecclesiastical affairs were not in so desperate a case that the most drastic remedies possessed the most powerful attraction; while, in addition, the clergy were too highly educated to be willing to renounce all scientific work. The result was that a series of violent struggles took place between the old Catholicism and the new Ultramontane species (Hermes, Baader, Döllinger, &c.). But even here Ultramontanism gained ground and derived inestimable assistance from the blunders of government after government—witness the conflict of the Prussian administration with Archbishop Droste-Vischering (*q.v.*) of Cologne, 1837. Additional impetus was also lent by the revolution of 1848.

The growth of the Jesuitical influence at Rome—more especially after the return of Pius IX. from exile—implied a more definite protection of Ultramontanism by the papacy. The proclamation of the dogma of the immaculate conception in 1854 was more than the decision of an old and vexed theological problem; it was an act of conformity to a pietistic type especially represented by the Jesuits. The Syllabus of 1864, however, carried with it a recognition of the Ultramontane condemnation of all modern culture (see the articles PIUS IX., and SYLLABUS). Finally, in the Vatican Council, the Jesuits saw another of their favourite theories—that of papal infallibility—elevated to the status of a dogma of the Church (see VATICAN COUNCIL and INFALLIBILITY).

Ultramontanism, again, though essentially averse from all forms of progress, had displayed great dexterity in utilizing the opportunities presented to it by modern life. Where it appeared advisable, it has formed itself into a political party, as for instance, the Centre Party in Germany. It has shown extreme activity in the creation of a press devoted to its interests, and has consolidated its influence by the formation of an extensive league-system. In the episcopacy it has numerous adherents; it has made progress in the universities, and most of the learned and theological reviews are conducted in its spirit.

Whether the powerful position of this movement within the Roman Catholic Church be an advantage for that Church itself cannot be discussed here. The answer to the problem will mainly depend on the estimate which we form of the Society of Jesus and its whole activity. The outstanding event in the latest history of Ultramontanism is the separation between Church and state in France (1904), by which the republic has endeavoured to break the influence of this party. Similarly, the dissolution of the German Reichstag in December 1906 was a weapon directed against Ultramontanism; and, though the elections of 1907 failed to diminish the numbers of the Centre, they rendered possible the formation of a majority, in face of which that system forfeited the influence it had previously possessed.

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A collection of the further literature will be found in Benrath's article "Ultramontanism" in the *Realencyclopädie für protestantische Theologie und Kirche* (3rd ed., 1908, vol. xx. p. 213 seq.). Also, for the history of the rise of Ultramontanism in Germany, see C. Mirbt, *Die katholisch-theologische Fakultät zu Marburg. Ein Beitrag zur Geschichte der katholischen Kirche in Kurhessen und Nassau* (Marburg, 1905).

(C. M.)

ULUGH BEG, MIRZA MAHOMMED BEN SHAH ROK (1394–1449), Persian astronomer, son of the shah Rok and grandson of Timur, succeeded his father as prince of Samarkand in 1447, after having for years taken part in the government, and was murdered in 1449 by his eldest son. He erected an observatory at Samarkand, from which were issued tables of the sun, moon and planets, with an interesting introduction, which throws much light on the trigonometry and astronomical methods then in use (*Prolégomènes des tables astronomiques d'Oouloug Beg*, ed. by Sédillot, Paris, 1847, and translated by the same, 1853). The serious errors which he found in the Arabian star catalogues (which were simply copied from Ptolemy, adding the effect of precession to the longitudes) induced him to redetermine the positions of 992 fixed stars, to which he added 27 stars from Al Sûfi's catalogue, which were too far south to be observed at Samarkand.

This catalogue, the first original one since Ptolemy, was edited by Th. Hyde at Oxford in 1665 (*Tabulae longitudinis et latitudinis stellarum fixarum ex observatione Ulugbeighi*), by G. Sharpe in 1767, and in 1843 by F. Baily in vol. xiii. of the *Memoirs* of the Royal Astronomical Society.

See Delambre, *Histoire de l'astronomie du moyen âge*; Poggendorff, *Biographisch-litterarisches.*

ULUNDI (Zulu for "high place"), the royal kraal of Cetywayo, situated in the Mahlabatini district of Zululand, about 3 m. north of the White Umfolosi River, and 115 m. N.N.E. of Durban. The valley of the White Umfolosi here forms an extensive basin called the Emhlabatini, and from the time of Chaka to the overthrow of Cetywayo in 1883 was the exclusive place of residence of the Zulu kings. The basin on the south side of the river is regarded as the cradle of the Zulu race; here all their early chiefs are buried, hence the term Emakosini (*i.e.* at the grave of the chiefs) applied to the district (see Blue Book C. 5143). During Cetywayo's reign a garrison of 3000 was kept at Ulundi. About a mile from the kraal on the 4th of July 1879 a Zulu army some 20,000 strong was totally defeated by Lord Chelmsford. The British force, consisting of the second division and Wood's column, numbered in all 4200 Europeans and some 1000 natives. On the morning of the battle they formed a square, with the mounted troops (about 300) inside. The Zulus attacked with great gallantry but were received with so deadly a fire that they could not come within thirty yards of the rifles. After twenty minutes they broke and fled, and the cavalry followed them till broken ground rendered further pursuit impossible. The British loss was about 100, that of the Zulus 1500. After the fight the royal kraal was burned. On the 1st of September following, at the site of the ruined kraal, Sir Garnet (afterwards Lord) Wolseley announced the partition of Zululand into thirteen petty chieftainships. But on the 29th of January 1883 Cetywayo was reinstalled by the British at Ulundi as chief over two-thirds of his old dominions. Attacked at Ulundi in July 1883 by the rival chief Usibepu, Cetywayo and his 5000 followers fled to the Nkandhla bush. The royal kraal was again destroyed and Ulundi ceased to be a rallying point. The magistracy for the district is situated 5 m. north of the site of Ulundi. (See ZULULAND.)

ULVERSTON, a market town in the North Lonsdale parliamentary division of Lancashire, England, in the Furness district, 9½ m. N.E. from Barrow-in-Furness and 256 m. N.W. by N. from London, on the Furness railway. Pop. of urban district (1901), 10,064. The church of St Mary, founded in 1111, retains the south door of the original building in the Transition style, but the greater portion of the structure is Perpendicular, of the time of Henry VIII. It contains an altar-tomb with recumbent figure of Walter Sandys of Conishead, dated 1588. After the destruction of Furness Abbey, Ulverston succeeded Dalton as the most important town in Furness, but the rapid rise of Barrow surpassed it in modern times. A monument on Hoad Hill commemorates Sir John Barrow, secretary of the admiralty and a native of the town. Conishead Priory, 2 m. south-east, a mansion on the site of a priory founded in the reign of Henry II., is used as a hydropathic establishment. Formerly Ulverston had a considerable trade in linens, checks and ginghams, but it is now dependent on large iron and steel works, chemical works, breweries, tan-yards, and hardware, paper, and wooden hoop manufactories. Through its connexion with Morecambe Bay by a ship canal of 1 m. in length, owned by the Furness railway, it has a shipping trade in iron and slates.

Ulverston, otherwise Vlureston, Olvestonum, occurs in Domesday Book, where Vlurestun is named as a manor in possession of Turulf, who was probably the original Saxon owner. Early in the 12th century the manor passed to Stephen, count of Boulogne, and was given by him to Furness Abbey. In 1196 the abbot granted the vill of Ulverstone with the inhabitants to Gilbert Fitz-Reinfred, who granted it a charter by which he raised it to the rank of a free borough. The lordship became divided, and one-half passed to the Harringtons and finally to Henry Grey, duke of Suffolk, on whose attainder in 1553 it was forfeited to the Crown. The other moiety returned to the abbey about the end of the 14th century, and at the dissolution was surrendered to the Crown. Early in the 17th century the Crown alienated the manor, which is now in the family of Buccleuch. The yearly court-leet and court-baron are still held in October. In 1280 Roger de Lancaster obtained a charter from Edward I. for a weekly market on Thursday and an annual fair of three days beginning on the eve of the nativity (Sept. 7).

UMAÑ, a town of Russia, in the government of Kiev, 120 m. S. of the city of Kiev. Pop. 28,628, many of whom are Jews, and carry on the export of corn, spirits, &c. It has a park (290 acres), planted in 1793 by Count Potocki, and now containing a gardening school. Umañ was founded early in the 17th century as a fort against the Tatar raiders. The Cossacks of the Ukraine, who kept it, revolted against their Polish rulers about 1665, and sustained a fierce siege. In 1674 it was plundered and most of its inhabitants murdered by the Ukrainians and Turks. In 1712 its last occupants were transferred by Peter the Great to the left bank of the Dnieper. But by the end of the 18th century, when it again became the property of the Potockis, it was repeopled and became one of the busiest trading towns of Little Russia. In 1768, when the Cossacks revolted anew against the Poles, they took Umañ and murdered most of its inhabitants.

UMARKOT, a town in Sind, India, 7 m. from a station on the North-Western railway; pop. (1901), 4924. It is the headquarters of the Thar and Parkar district. The Mogul emperor Akbar was born here in 1542, when his father, Humayun, was fleeing to Afghanistan.

UMBALLA, or AMBALA, a city and district of British India, in the Delhi division of the Punjab. The city is 3 m. E. of the river Ghaggar, 902 ft. above the sea. Pop. (1901), 78,638. It has a station on the North-Western railway (1077 m. N.W. of Calcutta), with a branch line to Kalka at the foot of the hills (39 m.), which was continued up to Simla in 1903. Umballa owes its importance to a large military cantonment which was first established in 1843, and is the headquarters of a cavalry brigade belonging to the Northern army. The cantonment, which lies 4 m. south-east of the native town, is well laid out with broad roads shaded by trees. It contains a church, a club-house, several hotels and English shops.

The DISTRICT OF UMBALLA has an area of 1851 sq. m. With one small exception it consists of a level alluvial plain, sloping away gradually from the foot of the Himalayas, and lying between the rivers Jumna and Sutlej. These rivers do not materially affect the district, which has a drainage system consisting of the numerous torrents which pour down from the hills. In the south these torrents run in broad sandy beds scarcely below the surface of the country, and vary from 200 yds. to 1 m. in width, until, at a distance of 20 or 30 m. from the hills, they become comparatively docile streams, with well-defined clay banks. Towards the north the torrents run in deep beds from the point where they debouch from the hills; they also differ from the streams of the south in being free from sand. The principal of these northern streams is the Ghaggar, into which the minor streams empty themselves, some within and some beyond the limits of the district. Whatever surplus water of this river is not swallowed up by irrigation passes on through Patiala state and Sirsa, and is finally lost in the sands of Rajputana. The Ghaggar is the only perennial stream within the district, but dwindles to a tiny rivulet in the dry season, and disappears altogether beyond the border of the district. In 1901 the population was 815,880, showing a decrease of 5·6% in the decade. The principal crops are wheat, maize, pulse, millets, rice, cotton and some sugar-cane. There are factories for ginning and pressing cotton, and also for grinding wheat. Two opposite corners of the district are watered by the Sirhind and the Eastern Jumna canals. A portion is crossed by the main line of the North-Western railway and by the Delhi-Umballa-Kalka railway, which have their junction at Umballa city. Umballa is one of the territories previously held by numerous Sikh sirdars, which were attacked by Ranjit Singh during one of his marauding expeditions. This caused the movement of British troops in 1809 which resulted in the treaty with Ranjit Singh, by which he was required to withdraw his army from the left bank of the Sutlej and to relinquish his recent conquests in Sirhind. In June 1849, after the second Sikh War had brought the Punjab under British rule, the chiefs were deprived of all sovereign power and the district took practically its modern form. In March 1869 a grand durbar was held at Umballa on the occasion of the visit of the amir Shere Ali.

UMBELLIFERAE, in botany, an order of polypetalous Dicotyledons belonging to the series Umbelliflorae, which includes also the orders Araliaceae (ivy family) and Cornaceae (dogwood family). It contains 180 genera with about 1400 species, occurring in all parts of the world but chiefly in north temperate regions. It is well represented in the British flora by 35 genera. The plants are annual or perennial herbs, rarely shrubby as sometimes in *Bupleurum*, with generally a very characteristic habit, namely stout erect stems with hollow internodes, alternate pinnately compound exstipulate sheathing leaves and compound umbels of small, generally white, flowers.

An example of an annual is the common fool's parsley, *Aethusa Cynapium*; carrot (*Daucus Carota*) is a biennial; others are perennial, persisting by means of tubers or rhizomes—such are hogweed (*Heracleum*), *Angelica*, *Peucedanum*, and others. Some genera have a creeping stem as in *Hydrocotyle* (pennywort), a small herb with a creeping filiform stem and, in the British species, entire leaves. *Bupleurum* has simple, entire, often perfoliate leaves (fig. 1). *Azorella*, a large genus in south temperate regions, has a peculiar caespitose habit, forming dense cushions often several feet in diameter and persisting for many years. *Eryngium*, represented in Britain by sea-holly (*E. maritimum*), is a large genus of rigid often glaucous herbs with spiny-toothed leaves, which in some South American species with narrow parallel-veined blade and broadly sheathing base recall those of a Monocotyledon such as *Agave* or *Bromelia*. In sanicle (*Sanicula*), *Astrantia* and others the leaves are palmately divided; and there is a great variety in the degree of division in the characteristic pinnate leaf, which varies from simply pinnate to a branching of the blade to the fifth or sixth order.

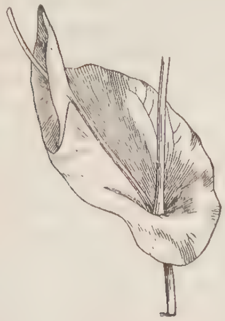


FIG. 1.—Perfoliate leaf of a species of hare's-ear (*Bupleurum rotundifolium*). The two lobes at the base of the leaf are united, so that the stalk appears to come through the leaf.

There is also considerable variety in the development of the umbel, which is usually compound but sometimes simple, as generally in *Hydrocotyle* and *Astrantia*, rarely reduced to a single flower as in species of *Hydrocotyle*. In *Eryngium* the flowers are crowded into dense heads subtended by a whorl of rigid bracts. A terminal flower is sometimes present as in carrot, where it is distinguished by its form and dark colour. The presence or absence of bracts and their form when present afford useful diagnostic characters. When present at the base of the primary rays of the umbel they form the *involucre*, and the *involucel* when at the base of a partial umbel. In *Astrantia* the simple umbel is enveloped by a large, often coloured, involucre.

The small epigynous flowers are usually hermaphrodite and regular, with parts in fives. The sepals are usually very small, often represented only by teeth on the upper edge of the ovary; the petals are usually obovate or obcordate in shape, often with the tip inflexed; the stamens have long slender filaments bent inwards in the bud but ultimately spreading; the two carpels are in the median plane; the two-celled ovary is surmounted by an epigynous glandular disk—the stylopodium—which bears the two styles. Each ovary-cell contains a single pendulous anatropous ovule with a ventral raphe and a single integument. In the development of the flower the stamens appear first, followed by the petals, the sepals and the rudiments of the carpels in succession. The flowers are rendered conspicuous by being massed into more or less dense flat-topped inflorescences. A resemblance to the rayed heads of Compositae is suggested in the frequently larger size of the flowers on the circumference of the umbel which are often sterile and zygomorphic from the larger size of the outer petals. This arrangement allows a large number of flowers to be visited in a short time. The flowers are generally white, sometimes pink or yellow, very rarely blue; they are generally scented, but the whole plant has an odour from the general presence in the tissues of an ethereal oil or resin. The flower is widely open, the petals and stamens radiating from the central disk (fig. 3, *d*), on which honey is secreted, and is thus accessible to quite short-lipped flies. Cross-pollination is rendered necessary by the flowers being generally markedly proterandrous; the stamens throughout the umbel have generally shed their pollen before the stigmas have begun to be functional even in the outer flowers.

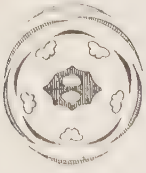
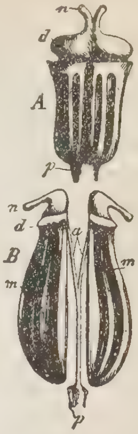


FIG. 2.—Diagram of flower of Umbelliferae.



(From Vines's *Student's Text Book of Botany*, by permission of Swan, Sonnenschein & Co.)

FIG. 3.—*A*, Pistil; *B*, Fruit of the Caraway (*Carum Carui*); enlarged. *d*, epigynous disk; *f*, ovary; *n*, stigma; *p*, pedicel. In *B* the two carpels have separated so as to form two mericarps (*m*). Part of the septum constitutes the carpophore (*a*).

The fruit is again very characteristic; a schizocarp which splits down the septum to form two dry one-seeded mericarps which are at first attached to, or pendulous from, an entire or split central axis or *carpophore* (fig. 3). The form of the mericarp affords valuable characters for distinguishing genera. On the outer surface of each are generally 5 ridges (primary ridges), between which are sometimes 4 secondary ridges; oil-cavities, *vittae*, are often present in the intervening furrows. The fruits are variously adapted for distribution; they are sometimes thin and flat as in *Heracleum*, when they are easily carried by the wind, or, as in carrot, provided with hooks. The seed contains a small embryo embedded in oily endosperm, which is usually cartilaginous in texture.

The order is divided into 9 tribes depending on the form of the fruit, whether compressed, angled, grooved, constricted, &c., and the presence or absence of *vittae*. The 35 British genera include representatives of 7 of the tribes. The following may be mentioned: *Hydrocotyle* (pennywort), *Eryngium* (sea-holly), *Sanicula* (sanicle), *Conium* (hemlock, *q.v.*), *Smyrnium* (Alexanders), *Bupleurum* (hare's-ear), *Apium* (celery, *q.v.*), *Carum* (caraway, *q.v.*), *Conopodium* or *Bunium* (earth-nut, *q.v.*), *Myrrhis* (Cicely), *Chaerophyllum* (chervil), *Foeniculum* (fennel, *q.v.*), *Crithmum* (samphire), *Oenanthe* (water dropwort), *Aethusa* (fool's parsley, *q.v.*), *Angelica* (*q.v.*), *Peucedanum* (hog's fennel, parsnip, *q.v.*), *Heracleum* (hogweed), *Daucus* (carrot). *Petroselinum sativum* is common parsley (*q.v.*).

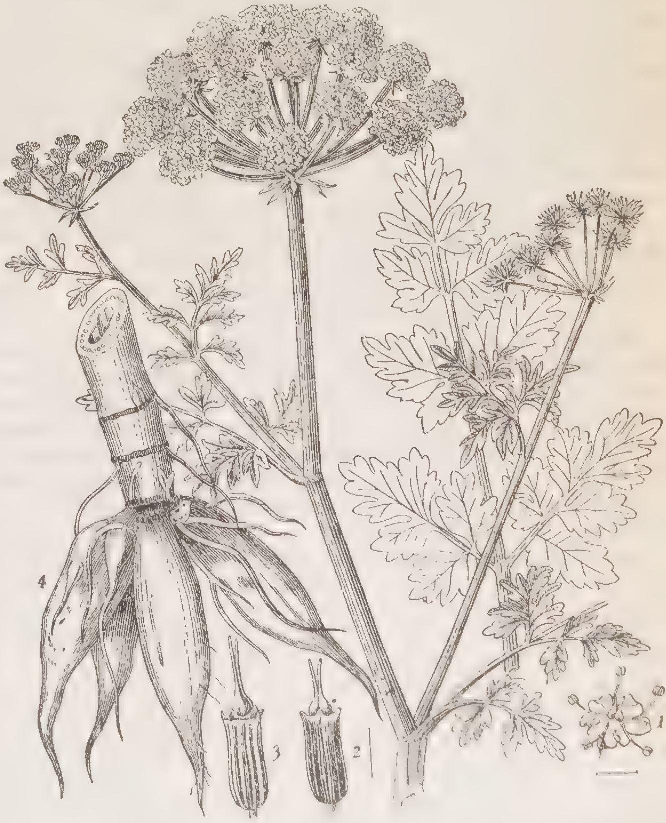


FIG. 4.—Water Dropwort, *Oenanthe crocata*, with thickened root fibres, about half nat. size.

1, Flower; 2 and 3, Side and front view of fruit; enlarged.

UMBER, a brown mineral pigment consisting of hydrated iron and manganese oxides. The finely-powdered mineral is known as *raw umber*; when calcined the beauty of the colour increases and the pigment is known as *burnt umber*. It was probably first obtained from Umbria in Italy, but it occurs in many localities, notably in Cyprus (*Turkey umber*); large quantities of *English umber* are mined in Devonshire and Cornwall. (See PIGMENTS.)

UMBRA (Lat. for shade or shadow), in astronomy, the completely dark portion of the shadow of a heavenly body, filling the space within which the sun is entirely hidden. The body being supposed spherical, the umbra is a cone circumscribing both the sun and the body that casts the shadow. The term is also given to the interior and darkest part of a sunspot. (See SUN; ECLIPSE.)

UMBRELLA, a portable folding protector from rain (Fr. *parapluie*), the name parasol being given to the smaller and more fanciful article carried by ladies as a sunshade, and the *en-tout-cas* being available for both purposes. Primarily the umbrella (*ombrella*, Ital. dim. from Lat. *umbra*, shade) was a sunshade alone—its original home having been in hot, brilliant climates. In Eastern countries from the earliest times the umbrella was one of the insignia of royalty and power. On the sculptured remains of ancient Nineveh and Egypt there are representations of kings and sometimes of lesser potentates going in procession with an umbrella carried over their heads; and throughout Asia the umbrella had, and still has, something of the same significance. The Mahratta princes of India had among their titles "lord of the umbrella." In 1855 the king of Burma in addressing the governor-general of India termed himself "the monarch who reigns over the great umbrella-wearing chiefs of the Eastern countries." The baldachins erected over ecclesiastical chairs, altars and portals, and the canopies of thrones and pulpits, &c., are in their origin closely related to umbrellas, and have the same symbolic significance. In each of the basilican churches of Rome there still hangs a large umbrella.

Among the Greeks and Romans the umbrella (σκιάς, σκιάδειον, *umbraculum*, *umbella*) was used by ladies, while the carrying of it by men was regarded as a sign of effeminacy. Probably in these southern climes it never went out of use, and allusions by Montaigne show that in his day its employment as a sunshade was quite common in Italy. The umbrella was not unknown in England in the 17th century, and was already used as a rain protector. Michael Drayton, writing about the beginning of the 17th century, says, speaking of doves:—

> "And, like umbrellas, with their feathers
> Shield you in all sorts of weathers."

Although it was the practice to keep an umbrella in the coffee-houses early in the 18th century, its use cannot have been very familiar, for in 1752 Colonel Wolfe, writing from Paris, mentions the carrying of them there as a defence against both rain and sun, and wonders that they are not introduced into England. The traveller Jonas Hanway, who died in 1786, is credited with having been the first Englishman who habitually carried an umbrella.

The umbrella, as at first used, was based on its Eastern prototype, and was a heavy, ungainly article which did not hold well together. It had a long handle, with ribs of whalebone or cane, very rarely of metal, and stretchers of cane. The jointing of the ribs and stretchers to the stick and to each other was very rough and imperfect. The covering material consisted of oiled silk or cotton, heavy in substance, and liable to stick together in the folds. Gingham soon came to be substituted for the oiled cloth, and in 1848 William Sangster patented the use of alpaca as an umbrella covering material. One of the most notable inventions for combining lightness, strength and elasticity in the ribs of umbrellas was the "Paragon" rib patented by Samuel Fox in 1852. It is formed of a thin strip of steel rolled into a U or trough section, a form which gives great strength for the weight of metal. Umbrella silk is chiefly made at Lyons and Crefeld; much of it is so loaded that it cuts readily at the folds. Textures of pure silk or of silk and alpaca mixed have better wear-resisting properties.

UMBRIA (Ὀμβρική), the name of an ancient and a modern district of Italy.

1. The ancient district was bounded in the period of the Roman supremacy by the Ager Gallicus (in a line with Ravenna) on the N., by Etruria (the Tiber) on the W., by the Sabine territory on the S. and by Picenum on the E. The Via Flaminia passed up through it from Ocriculum to Ariminum; along it lay the important towns of Narnia (Narni) Carsulae, Mevania (Bevagna), Forum Flaminii, Nuceria Camellaria (Nocera) and Forum Sempronii; and on the Adriatic coast Fanum Fortunae (Fano) and Pisaurum (Pesaro). To the east lay Interamna (Terni), Spoletium (Spoleto), Fulginium (Foligno—on a branch of the Via Flaminia which left the main road at Varina and rejoined it at Forum Flaminii) and the important town of Camerinum on the side of the Apennines towards Picenum. On the side towards Etruria lay Ameria (Amelia) and Tuder (Todi), both on the direct road from Rome to Perusia,[1] Iguvium, which occupied a very advantageous position close to the main pass through the Apennines, and Hispellum (Spello). Not far off was Assisium (Assisi), whilst far to the north in the mountains lay Sarsina. Under the empire it formed the sixth region of Italy. In earlier times it embraced a far larger area. Herodotus (iv. 49) describes it as extending to the Alps, and the περίοδος ascribed to Scylax (a treatise which embodies material of the 4th century B.C. or earlier) makes Umbria conterminous with Samnium. Furthermore, place-names of undoubted Umbrian origin abound in Etruria and are also found in the Po valley. Thus in the early days of Italian history Umbria may be taken as having extended over the greater part of northern and central Italy.

The name Umbria is derived from the Umbri, one of the chief constituent stocks of the Italian nation. The origin and ethnic affinities of the Umbrians are still in some degree a matter of dispute, but their language proves them to have been an Aryan people closely allied with the Oscans and in a remoter degree with the Latins. Archaeological considerations further show with approximate certainty that the Umbri are to be identified with the creators of the Terramara (*q.v.*), and probably also of the Villanova (*q.v.*), culture in northern and central Italy, who at the beginning of the Bronze Age displaced the original Ligurian population by an invasion from the north-east. From the time and starting-point of their migrations, as well as from their type of culture, it may be provisionally inferred that the Umbrians were cognate with the Achaeans of prehistoric Greece. Pliny's statement (iii. 13, 19) that they were the most ancient race of Italy may certainly be rejected.

The process by which the Umbrians were deprived of their predominance in upper and central Italy and restricted to their confines of historic times cannot be traced in any detail. A tradition declares that their easternmost territory in the region of Ancona was wrested from them by the Picentes, a branch of the Sabine stock. It may also be conjectured that they were partly displaced in the valley of the Po by the Gaulish tribes which began to pour across the Alps from about 500 B.C. But their chief enemies were undoubtedly the Etruscans. These invaders, whose encroachments can be determined by archaeological evidence as proceeding from the western seaboard towards the north and east, and as lasting from about 700 to 500 B.C., eventually drove the Umbrians into that upland tract athwart the Apennines to which the name of Umbria belonged in historical times. In the course of this struggle the Etruscans are said to have captured 300 Umbrian towns. Nevertheless the Umbrian element of population does not seem to have been eradicated in the conquered districts. Strabo records a tradition that the Umbrians recovered their ground in the plain of the Po at the expense of the Etruscans, and states that the colonies subsequently founded in this region by the Romans contained large Umbrian contingents. In Etruria proper the persistence of the Umbrian stock is indicated by the survival of numerous Umbrian place-names, and by the record of Umbrian soldiers taking part in Etruscan enterprises, *e.g.* the attack on Cumae in 524 B.C. Indeed it is not unlikely that the bulk of the population in Etruria continued to be of Umbrian origin, and that the Romanization of this country was facilitated by the partial absorption of the Etruscan conquerors into the Umbrian multitude.

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[1] The geographers make this road go round by Vettona (mod. Bettona) between Tuder and Perusia, instead of following the more direct modern line.

Against the Romans the Umbrians never fought any wars of importance, a fact which may be explained partly by the remoteness of their position, but chiefly by the common hostility of the two nations to the Etruscans. After the downfall of the Etruscan power they made a belated attempt to aid their Samnite kinsmen in their decisive struggle against Rome (308 B.C.); but their communications with Samnium were impeded by the foundation of a Roman fortress at Narnia (298 B.C.), and at the great battle of Sentinum (295 B.C.), which was fought in their own territory, the Umbrians are not reported to have lent the Samnites any substantial help. It is perhaps on account of this defection that in 200 B.C. they received from the Romans a portion of the Ager Gallicus reconquered from the Senonian Gauls. They offered no opposition to the construction of the Via Flaminia through the heart of their country, and in the Second Punic War withheld all assistance from Hannibal. In the Social War (90–89 B.C.), they joined the rebels tardily and were among the first to make their peace with Rome. Henceforth the Umbrians no longer played an independent part in Italian history.

The material prosperity of Umbria, in spite of its unfavourable position for commercial intercourse, was relatively great, owing to the fertility of the numerous small valleys which intersect the Apennine system in this region. The chief products of the soil were olives, vines and spelt; the uplands harboured the choicest boars of Italy. In Pliny's time there still existed in Umbria 49 independent communities, and the abundance of inscriptions and the high proportion of recruits furnished to the imperial army attest its continued populousness. Among its most famous natives were the poets Plautus (b. at Sarsina) and Propertius (b. at Assisi).

Of the Umbrians' political and municipal organization little is known. In addition to the city (*tota*) they seem to have had a larger territorial division in the *tribus* (*trifu*, acc.) as we gather from Livy (xxxi. 2, "per Umbriam quam tribum Sapiniam vocant"; cf. xxxiii. 37) and from the Eugubine Tables ("trifor Tarsinates," vi. B. 54). Ancient authors describe the Umbrians as leading effeminate lives, and as closely resembling their Etruscan enemics in their habits (Theopompus, *Fragm.* 142; Pseudo-Scymnus, 366–368). It is almost certain that each race influenced and modified the other to a large extent. There is conclusive proof of strong Etruscan influences in Umbria. For instance, they undoubtedly borrowed their alphabet and the art of writing from the Etruscans. Their writing ran from right to left. The alphabet consisted of nineteen letters. It had no separate symbols for O, G, Q; the aspirates and X were wanting; on the other hand, it possessed forms for Z and V, and had likewise the Etruscan *f* (8). It also had a symbol peculiar to itself for expressing the sound of palatal *k* when followed by either *e* or *i*. The fact that it is only in towns on the side next Etruria, *e.g.* Tuder and Iguvium, that a coinage is found indicates that they borrowed the art of minting from that quarter. The Umbrians counted their day from noon to noon. But whether they borrowed this likewise from the Etruscans we do not know (Pliny ii. 77). In their measuring of land they employed the *vorsus*, a measure common to them and the Oscans (Frontinus, *De Limit.* p. 30), $3\frac{1}{3}$ of which went to the Roman *jugerum*.

See Strabo bk. v.; T. E. Peet, *The Stone and Bronze Ages of Italy and Sicily* (Oxford, 1909), pp. 492–510; B. V. Head, *Historia numorum* (Oxford, 1887); B. Nissen, *Italische Landeskunde*; Bücheler, *Umbrica* (1883); R. S. Conway, *Italic Dialects*. (M. O. B. C.)

2. The modern territorial division is situated in the middle of the peninsula, between Tuscany and the Marches on the N. and E., and Rome and the Abruzzi on the S. and W., and comprising the one province of Perugia, with an area of 3748 sq. m.; pop. (1901), 675,352. Umbria and the two provinces of Ancona and Pesaro and Urbino taken together form an area slightly more extensive than that of the sixth region of Augustus. The surface is mountainous, but affords good pasture, and there are numerous fertile valleys. Many treasures of art and architecture are preserved, and Umbria is in this respect one of the most interesting regions of Italy (see PERUGIA). Modern Umbria formed down to 1860 a part of the States of the Church.

Two main lines of railway run through the territory. That from Florence to Rome skirts the borders of the province on the west, running north and south, while the Rome-Ancona runs across the province from north-east to south-west. The cross communication is given by three branch lines. In the north a narrow gauge line from Arezzo to Fossato passes through Gubbio. Perugia, the capital of the province, stands on the line from Terontola to Foligno, while on the extreme south a line passing through Rieti and Aquila, and ultimately reaching Sulmona, starts from Terni on the Rome-Ancona line. (T. As.)

UMFRAVILLE, the name of an English baronial family, derived from Amfreville in Normandy. Members of this family obtained lands in Northumberland, including Redesdale and Prudhoe, from the Norman kings, and a later member, Gilbert de Umfraville (d. 1245), married Matilda, daughter of Malcolm, earl of Angus, and obtained this Scottish earldom. Gilbert's son, Gilbert, earl of Angus (*c.* 1244–1307), took part in the fighting between Henry III. and his barons, and in the Scottish expeditions of Edward I. His son, Robert, earl of Angus (1277–1325), was taken prisoner by the Scots at Bannockburn, but was soon released, though he was deprived of the earldom of Angus and of his Scottish estates. His son and heir, Gilbert de Umfraville (1310–1381), claimed the earldom, which he hoped to gain by helping Edward Baliol to win the Scottish crown, but he failed, and on his death without issue the greater part of his English estates passed to his niece, Eleanor, the wife of Sir Henry Talboys (d. 1370), while others, including Redesdale, Harbottle and Otterbourne, came to his half-brother, Sir Thomas de Umfraville (d. 1386). Sir Thomas's son, another Sir Thomas de Umfraville (1362–1391), left a son, Gilbert de Umfraville (1390–1421), who fought on the Scottish border and in France under his warlike uncle, Sir Robert de Umfraville (d. 1436). Although not related in blood he appears to have inherited the estates in Lincolnshire of the Kyme family, and he was generally known as the earl of Kyme, though the title was never properly conferred upon him. In 1415 he fought at Agincourt; he was afterwards sent as an ambassador to Charles VI. of France, and arranged an alliance between the English and the Burgundians. He was killed at the battle of Baugé on the 22nd of March 1421. His heir was his uncle Sir Robert, who died on the 29th of January 1436, when the male line of the Umfraville family became extinct. The chronicler John Hardyng was for many years in the service of Sir Robert, and in his *Chronicle* he eulogizes various members of the family.

UMPIRE, the term used, like "referee," for a person appointed by consent to settle disputes arising between opposing parties, and particularly one chosen to see that the rules of a game are obeyed. The word itself stands for the Middle English *nompere* or *noumpere*, "a numpere" becoming "an umpire." The earlier form represents the Old French *nompere*, *nonpair*, *i.e.* not equal, odd. The Latin *impar*, unequal, was similarly used in the sense of "arbitrator."

UMRA KHAN, of Jandol (*c.* 1860–1903), a Pathan chief on the north-western frontier of India, who was chiefly responsible for the Chitral Campaign of 1895. He was the younger son of the khan of Jandol; but he killed his elder brother, seized the throne, and made himself a power on the frontier. In 1894 he held undisputed sway over almost the whole of Bajour, when his restless ambition caused him to interfere in the internal affairs of Chitral. He instigated Amir-ul-Mulk, a half-witted brother of the Chitral chief, to murder his brother Nizam-ul-Mulk, and then threw over the fratricide and supported the claims of his uncle Sher Afzul to the throne. The government of India intervened and ordered Umra Khan to leave Chitral. When he refused, the Chitral Expedition was despatched (see CHITRAL); Umra Khan was driven into exile in Afghanistan, and died there in 1903.

UNAO, a town and district of British India, in the Lucknow division of the United Provinces. The town is 10 m. N.E. of Cawnpore, on the Oudh and Rohilkhand railway. Pop. (1901), 13,109.

The DISTRICT OF UNAO has an area of 1792 sq. m. It consists of a flat alluvial plain, lying north of the Ganges. Rich and fertile tracts, studded with groves, alternate with stretches of waste land and plains of barren *usar*, the whole being intersected by small streams, used for irrigation. The Ganges is the only navigable river in the district, while the Sai forms its north-eastern boundary. The temperature varies from about 75° to 103° in the hot season and from 46° to 79° in the cold season. The annual rainfall averages about 35 in. Pop. (1901), 976,639, showing an increase of 2·4% in the decade. The principal crops are barley, wheat, pulses, rice and millets, with some cotton, sugar-cane and poppy. The district is crossed by the main line of the Oudh & Rohilkhand railway.

During the Mutiny of 1857–58 Unao was the scene of several severe engagements between General Havelock's little army and the rebels on his march to relieve Lucknow. On the death of Raja Jasa Singh, one of the leading rebels, and the capture of his two sons, the family estates were confiscated, and the villages either restored to their former owners or given to other landholders for their loyalty.

See *Unao District Gazetteer* (Allahabad, 1903).

UNCLE, the brother of a person's father or mother, also the husband of one's aunt (*i.e.* the sister of a father or mother). The French *oncle*, which appears in Anglo-French as *uncle*, comes from a Late Latin *unculus*, a shortened form of the Latin *avunculus*, a maternal uncle, the brother of one's mother. The word is a diminutive of *avus*, grandfather. The Latin for a paternal uncle is *patruus*. "Aunt" comes through the Old French *aunte*, *ante*, corrupted into the modern *tante*, from Latin *amita*, a father's sister, a paternal aunt, the maternal aunt being called *matertera*.

UNCTION (Lat. *unctio*, anointing, *ungere*, *unguere*, to smear with ointment, to anoint; cf. "ointment," O.Fr. *oignement*, from *oigner*, mod. *oindre*, to anoint), the act of pouring, or rubbing oil, ointment or salve over or on to a person or object. The term is particularly used of the ceremonial practice of anointing with oil or unguents (see ANOINTING). The sacrament of the anointing of the sick in the Roman church is treated under EXTREME UNCTION. The use of the term for religious fervour in speech has degenerated into its common meaning of exaggerated sentiment.

UNDER-CROFT, in architecture, a synonym for crypt (*q.v.*), a vaulted chamber under ground.

UNDERWRITER, one who insures ships and their cargoes from loss and damage, so called from his writing his name under the document or policy of insurance. A request to an underwriter to insure is termed the offering of a "risk," and the word risk in marine insurance is equivalent to the liability of an underwriter under a contract. When the risk is divided up among several underwriters, each signs his name individually, putting opposite thereto the amount for which he accepts liability. Each signature has the effect of making a separate contract, in the terms of the policy, for the amount set opposite the name of the underwriter. (See INSURANCE: *Marine*.)

UNEMPLOYMENT, a modern term for the state of being unemployed among the working-classes. The social question involved is intimately bound up with that of relief of the poor, and its earlier history is outlined in the article CHARITY AND CHARITIES. It is more particularly within the 20th century that the problem of unemployment has become specially insistent, not by reason of its greater intensity—for it is open to considerable doubt whether, comparatively speaking, there was not more unemployment in the organized industrial communities of the early middle ages—but because the greater facilities for publicity, the growth of industrial democracy, the more scientific methods applied to the solution of economic questions, the larger humanitarian spirit of the times all demand that remedies differing considerably from those of the past should at least be tried. In most civilized countries attempts have been made to solve this or that particular phase of the problem by improved methods. There is, however, always a great difficulty in knowing the extent of unemployment even in any one particular country. No census has ever been taken in any country of those of the whole population who were employed and unemployed on any particular day, and even if it were possible to take such a census modern conditions of industry might render its results valueless almost immediately after. It would be complicated, too, by having of necessity to include the shiftless and unemployable sections of the population, as well as those on the borderland of employment (those who are worth some sort of wage in times of pressure), while at the same time it would be necessary, to make the census of practical value, to obtain returns of the demand for labour, in order to value the true character of the supply. Such statistics are obtainable possibly only in theory, but every country makes an endeavour to obtain statistics of a sort. In England the Board of Trade, for example, has compiled valuable memoranda on the percentages of unemployment in the more important trade union groups of trades, which may be taken as a measure of unemployment in the more highly organized industries; while other memoranda throwing light on the subject deal with the amount of time lost by workpeople through want of employment and other causes; with cyclical trade depressions; the extent to which female labour has displaced adult male labour of late years; seasonal industries and industries carried on by casual labour; emigration and immigration, &c., all intimately bound up with the study of the problem. The statistics issued by the Labour Bureaus of many of the states in the United States are of considerable value, in particular, those of Massachusetts, New Jersey, New York, Connecticut and Wisconsin. Germany, France and Belgium also publish statistics, but like the figures of other countries, they far from represent the actual state of unemployment.

Causes of Unemployment.

The actual causes of unemployment in any one country will always remain to a certain extent controversial, as will the comparative weight to be assigned to each cause. Putting aside the much disputed theories of economists as to the causes of cyclical depressions of trade, there are certain well-observed facts which present themselves in connexion with the question of unemployment, and to each one of them some contributory portion of blame may be assigned. These facts may be classified as (*a*) those over which the worker has no control, and (*b*) those which may be said to lie in the worker himself. Some of those under (*a*), of which it is impossible to give more than the more obvious examples, have, of course, been operating, especially in the United Kingdom, sometimes potently, sometimes slowly and almost unnoticed, over a long range of years. They are seasonal industries and industries carried on by casual labour. There are many industries affected by certain states of the weather or by the changes of the seasons, as the building and allied trades, the furriers' trade, confectionery trades, &c. But more important are those industries which depend largely in times of pressure on casual and unskilled labour, such as port and riverside work of all kinds, construction works and to a certain extent the iron and steel industries. Then there are a number of skilled trades which have about them continually a fringe of casual labour, for which employment is very intermittent.

To quote from the report of the British Royal Commission on the Poor Laws (1909):—

> "The class of under-employed includes not merely the whole of the men in such occupations as dock and wharf labour and market porters, and a waxing and waning share of the lower grades of the building operations, but also a very extensive fringe of men more or less attached to particular industries, and working at them only by way of brief and casual jobs. "To go in" for one half-day, one day, two, three, four or five days out of the five and a half is common to bootmaking, coopering, galvanizing, tank-making, oil pressing, sugar boiling, piano-making, as it is to dock-labouring, stevedoring, crane-lifting, building. Some trades, like that of the London bakers, regularly employ more men on one or two days of the week than on others. In London a large body of men is always required for the Friday night baking when the work in preparation for Saturday and Sunday is we are told, exceedingly heavy. The usual hours of

working are fifteen or sixteen instead of the ten of other nights and twice as many men are required. These Friday night men, many hundreds in number, pick up odd jobs the rest of the week. At the factory gates every night during the week, a number of men are always hanging about ready to be taken on in an emergency, or to fill the place of any man who, according to a very common custom, has "taken a night off." In busy marketing neighbourhoods, a whole class of butchers' assistants are engaged only for Fridays and Saturdays. Analogous arrangements exist in many other trades. Moreover, in every trade there are men whom the employer takes on only when he has a sudden and temporary press of business. They may be the "glut men" of the customs department or the Christmas hands of the post office. Every tramway undertaking, municipal or commercial, has its reserve of extra drivers, conductors, yard-men, washers, &c., who get a day's work now and then when they are wanted. At Liverpool, and indeed in all large towns, there is a whole class of casual carmen, who are taken on for the job as required."

Then there are the accidental circumstances which incidentally produce unemployment, such as the displacement of labour by the progress of invention and improvement. The example of the distress brought upon the hand-loom weavers by the invention of the power-loom is only one of many, but the process is continually going on. The change, for example, from horse carriages to motor cars has brought much unemployment in its train. Then there is the unemployment due to decaying or declining trades, brought about through a persistent falling off of the demand, or through some change of process or of fashion; the removal of an industry from one place to another, the displacement of adult labour by that of women and boys, the continuous migration of unskilled labour from the country to the towns, and the depression in general trade caused by the occurrence of something unforeseen, as war. Then too, there are to be added the numberless frictions of industrial life, all contributing their quota to unemployment, such as the bankruptcy of an employer, changes in management, the arbitrariness of a foreman, &c. There are also what may be termed the political causes of unemployment, which depend on the commercial policy of the nation, in so far as it adopts Free Trade or Protection.

Remedies for Unemployment.

Labour Exchanges.

Recognizing the existence of the problem of unemployment, and putting aside the possibility of knowing exactly its extent, we have to consider the remedies which have been advanced for its solution. These may be classified as temporary and permanent. Temporary expedients, whether in the nature of voluntary relief by individuals or organized societies, or on the larger scale of municipal or state organized relief works, more properly fall under the description of charity (see CHARITY AND CHARITIES). Two particular methods of permanent remedy, however, are especially favoured. The first of these is the establishment of a system of labour exchanges, national in character if possible, by which it is claimed that machinery would at once be set in motion for assisting that mobility which is so effective for the proper utilization of labour and which, even with the modern facilities for travel, labour so lacks at the present time. Labour exchanges would also, it is argued, facilitate the collection of data for the enumeration and classification of the unemployed. Labour exchanges have been long established in Germany. "There is a network of labour exchanges of various types. The most important . . . are the public and municipal exchanges. There are over 200 such, among the 700 odd exchanges, filling now 150,000 places a month, which report regularly to the imperial statistical officer. Practically there is a public general exchange in every town of over 50,000 inhabitants, and in a very large proportion of the smaller towns. Most of the public labour exchanges date from 1894 to 1896 or received a fresh impulse then" (Report of Commission on Poor Laws, 1909). The causes of the success of the German system of labour exchanges[1] are attributed by the Poor Law Commissioners to (*a*) the high standing given to the movement by the advocacy and practical assistance of all public authorities, town councils, state governments, imperial government, &c.; (*b*) the association through combined committees of employers and employees in the management of the exchanges; (*c*) the unequivocal character of the exchanges as industrial and not relief institutions; (*d*) the excellent arrangements for the use of telephonic, telegraphic and postal facilities by the exchanges, and (*e*) the preferential railway fares for men sent to a situation.

An attempt was made in England to start labour exchanges by the Labour Bureaux (London) Act 1902, which gave metropolitan boroughs power to establish and maintain bureaux, to be paid for out of the general rate. Before this act, however, certain municipalities here and there had made experiments in the way of exchanges, but they were never very successful, for they had no knowledge of what they intended to do; they were not properly staffed; they were hampered by bad rules; they were nearly all started in times of depression, exactly the wrong time to start a labour exchange, the time to start it being when trade is going up. The act of 1902 was a failure because it merely permitted, and did not compel borough councils to establish bureaux, and consequently only a very small part of the metropolis was covered, and there was no interchange of ideas amongst those established. However, a fresh attempt was made to establish exchanges over a greater part of the United Kingdom by the Labour Exchanges Act 1909. The Labour Exchanges Act defines a labour exchange as any office or place used for the purpose of collecting and furnishing information, either by the keeping of registers or otherwise, respecting employers who desire to engage workpeople and workpeople who seek engagement or employment. The act gave the Board of Trade power to establish and maintain labour exchanges in such places as they might think fit, and to collect and furnish information to employers and workpeople. An important provision of the act was the authorization of advances by way of loan towards meeting the expenses of workpeople travelling to places where employment is found for them through a labour exchange. The regulations of the exchanges provide that no person shall suffer any disqualification or be otherwise prejudiced on account of refusing to accept employment found for him through a labour exchange where the ground of refusal is that a trade dispute which affects his trade exists, or that the wages offered are lower than those current in the trade in the district where the employment is found. The act also empowers the Board of Trade to establish advisory committees in connexion with the exchanges and imposes penalties for making false statements for the purpose of obtaining employment or procuring workpeople. For the carrying out of the act the whole of the United Kingdom was mapped out into divisions, with a divisional inspector at the head of each. In all the more important towns of each division exchanges were established, classified according to the population of the town. All the exchanges are in telephonic communication either with each other or with a divisional clearing-house, the divisional clearing-house in turn being in communication with a central clearing-house in London. The advantage of the English system of labour exchanges will be found in the fact that it is a national system, with the support of the state behind it. Unless, as has been proposed, it is made compulsory in all large trades, much of its success will depend on the patronage extended to it by employers, which in its turn must be justified by the efficiency of the service rendered. Patronage by government and municipal authorities, while making an imposing addition to the returns of situations found, will not necessarily be an effective guarantee that the true objects of the exchanges are being fulfilled.

The German labour registries are of seven principal types: the private registry office, maintained by ordinary agents for purposes of gain, and occupying itself chiefly with the placing of domestic servants; the travellers' homes and relief stations, which endeavour to find situations for their inmates—their success is not great, as the better elements of the labouring classes avoid them; trade union registries maintained by trade unions to assist their members in obtaining employment; gild labour registries or associations of employers (mainly small employers) for the promotion of the interests of the trade in which they are engaged; agricultural labour registries maintained in different parts of Germany by the chambers of agriculture; employers' labour registries, established as a countermove against the trade union registries—they are chiefly in industries employing large capital, particularly the metal industries; and public labour registries, established either by voluntary associations or by municipalities. These latter have been very successful and have provided the model for the English registries. In Austria labour registries have also been established on the German model by many district and municipal authorities, those of Vienna and Prague being especially successful. Switzerland has a few registries established by public authorities, notably those at Basel, Bern, Schaffhausen and Zurich. In Belgium there are a considerable number of public registries, some established by associations, some philanthropic, some political, some organized by employers, some by employees, some jointly by employers and employed. Some of these registries are in receipt of subventions granted by municipalities, while in a few cases the municipalities themselves have started registries. In France labour registries are of many types. There are the ordinary registry offices, carried on for gain, and requiring a licence from the municipal authorities. They are very numerous and according to returns to the French Labour Department fill over 1,000,000 situations yearly in various occupations. There are also registries maintained by trade gilds, by individual trade unions, by a number of trade unions jointly, by joint associations of employers and employed, by associations of employers, by friendly societies, by philanthropic institutions and by municipalities. These last are being rapidly increased, and will without doubt eventually supersede all the others. In the United States the states of Colorado, Connecticut, Illinois, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Ohio, West Virginia and Wisconsin have established free public employment offices, and in many of the other states the private registries are under strict supervision and licensing.

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[1] The German system of labour exchanges is exhaustively dealt with in *Report to the Board of Trade on Agencies and Methods for Dealing with the Unemployed in certain Foreign Countries*, by D. F. Schloss (1904).

Insurance against Unemployment.

The second permanent remedy is that of insurance against unemployment. Certain schemes have been tried in Switzerland, notably the voluntary municipal scheme of Berne, the compulsory municipal scheme of St Gall and a trade union scheme at Basel,[1] while there is in Germany a system of insurance against sickness, accident and incapacity (see GERMANY). Much attention has been devoted in England to the possibilities of insurance against unemployment, and in 1910 a scheme was being worked out by the government with a view to its discussion by parliament in 1911. The lines on which such a scheme must work were clearly laid down by Sir H. Llewellyn Smith, the permanent secretary to the Board of Trade, in his presidential address to the Economic Science and Statistics section of the British Association at Sheffield in September 1910.

"The crucial question from a practical point of view," said Sir H. Llewellyn Smith, "is whether it is possible to devise a scheme of insurance which, while nominally covering unemployment due to all causes other than those which can be definitely excluded, shall automatically discriminate as between the classes of unemployment for which insurance is or is not an appropriate remedy. We can advance a step towards answering this crucial question by enumerating some of the essential characteristics of any unemployment insurance scheme which seem to follow directly or by necessary implication from the conditions of the problem as here laid down.

"1. The scheme must be compulsory; otherwise the bad personal risks against which we must always be on our guard would be certain to predominate.

"2. The scheme must be contributory, for only by exacting rigorously as a necessary qualification for benefit that a sufficient number of weeks' contribution shall have been paid by each recipient can we possibly hope to put limits on the exceptionally bad risks.

"3. With the same object in view there must be a maximum limit to the amount of benefit which can be drawn, both absolutely and in relation to the amount of contribution paid; or, in other words, we must in some way or other secure that the number of weeks for which a workman contributes should bear some relation to his claim upon the fund. Armed with this double weapon of a maximum limit to benefit and of a minimum contribution, the operation of the scheme itself will automatically exclude the loafer.

"4. The scheme must avoid encouraging unemployment, and for this purpose it is essential that the rate of unemployment benefit payable shall be relatively low. It would be fatal to any scheme to offer compensation for unemployment at a rate approximating to that of ordinary wages.

"5. For the same reason it is essential to enlist the interest of all those engaged in the insured trades, whether as employers or as workmen, in reducing unemployment, by associating them with the scheme both as regards contribution and management.

"6. As it appears on examination that some trades are more suitable to be dealt with by insurance than others, either because the unemployment in these trades contains a large insurable element, or because it takes the form of total discharge rather than short time, or for other reasons, it follows that, for the scheme to have the best chance of success, it should be based upon the trade group, and should at the outset be partial in operation.

"7. The group of trades to which the scheme is to be applied must, however, be a large one, and must extend throughout the United Kingdom, as it is essential that industrial mobility as between occupations and districts should not be unduly checked.

"8. A state subvention and guarantee will be necessary, in addition to contributions from the trades affected, in order to give the necessary stability and security, and also in order to justify the amount of state control that will be necessary.

"9. The scheme must aim at encouraging the regular employer and workman, and discriminating against casual engagements. Otherwise it will be subject to the criticism of placing an undue burden on the regular for the benefit of the irregular members of the trade.

"10. The scheme must not act as a discouragement to voluntary provision for unemployment, and for that purpose some well-devised plan of co-operation is essential between the state organization and the voluntary associations which at present provide unemployed benefit for their members. Our analysis, therefore, leads us step by step to the contemplation of a national contributory scheme of insurance, universal in its operation within the limits of a large group of trades—a group so far as possible self-contained and carefully selected as favourable for the experiment, the funds being derived from compulsory contributions from all those engaged in these trades, with a subsidy and guarantee from the state, and the rules relating to benefit being so devised as to discriminate effectively against unemployment which is mainly due to personal defects, while giving a substantial allowance to those whose unemployment results from industrial causes beyond the control of the individual. Is such a scheme practicable? This is a question partly actuarial, partly administrative, and partly political. I may say that so far as can be judged from such data as exist (and those data are admittedly imperfect and rest on a somewhat narrow basis) a scheme framed on the lines I have indicated is actuarially possible, at least for such a group of trades as building, engineering and shipbuilding."

In addition to insurance against unemployment by the state, there are various voluntary associations, such as friendly societies and trade unions, which make a feature of grants to their members when out of employment.

In September 1910 the first International Conference on Unemployment was convened in Paris, the subjects of statistics of unemployment, labour registries and state insurance being the chief topics. The outcome of the conference was the formation of a society to study all phases of the problem, and to keep in touch with public and private bodies and the various governments.

AUTHORITIES.—*Report* of Royal Commission on Labour (1894); *Report* of House of Commons Committee on Distress from Want of Employment (1895); *Report* of Royal Commission on Poor Laws (1909); *Report* of the Massachusetts Board to Investigate the Subject of the Unemployed. The following recent books will be found useful: P. Alden, *The Unemployed* (1905); W. H. Beveridge, *Unemployment: A Problem of Industry* (1909); N. B. Dearle, *Problems of Unemployment in the London Building Trades* (1909); J. A. Hobson, *The Problem of the Unemployed* (1904); F. W. Lewis, *State Insurance a Social and Industrial Need* (1909); D. F. Schloss, *Insurance Against Unemployment* (1909); F. I. Taylor, *A Bibliography of Unemployment and the Unemployed* (1909). (T. A. I.)

UNGAVA, an unorganized territory of the Dominion of Canada, including the north-western side of the peninsula of Labrador (*q.v.*), bounded by Hudson Bay on the W. as far S. as East Main River; Hudson Strait and Ungava Bay on the N.; and with indefinite boundaries toward Quebec on the S., and the coast strip of Labrador belonging to Newfoundland on the E. The area is estimated at 354,961 sq. m. Ungava includes much of the lower portion of Labrador, with a rim of recent marine deposits along its western coast, but the interior has the usual character of low rocky hills of Archean rocks, especially granite and gneiss, with a long band of little disturbed iron-bearing rocks, resembling the Animikie, or Upper Huronian of the Lake Superior region, near its eastern side. Along Hudson Bay shore there is a strip of similar rocks, and a long row of small islands of the same age, with great sheets of trap or diabase forming the tops of the hills. The iron formation is widely spread. There is evidence that Ungava, like the rest of Labrador, has risen several hundred feet since the Ice Age, marine beaches being found up to 700 ft. on the Hudson Bay side; and it is interesting to find seals like those of the adjoining seacoasts in the Seal Lakes 100 m. inland and 800 ft. above the present sea-level. Owing to its northerly position a large part of Ungava is treeless, and belongs to the barren grounds where caribou roam and feed on the so-called caribou moss, a greyish lichen.

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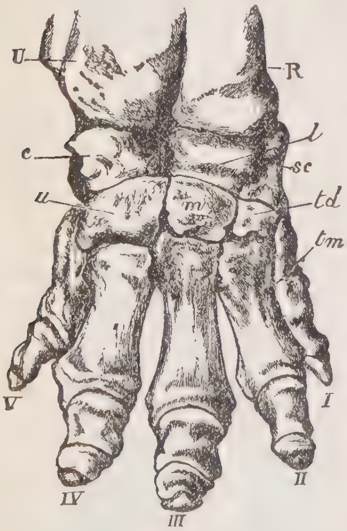
[1] For a detailed description of these schemes see G. Schanz, *Zur Frage der Arbeitsloser Versicherung* (Bamberg, 1895); *Neue Beitrage zur Frage der Arbeitslosen Versicherung* (Berlin, 1897); and *Dritter Beitrag zur Frage der Arbeitslosen-Versicherung und der Bekampfung der Arbeitslosigkeit* (Berlin, 1901).

UNGULATA, the name of an order of placental mammals in which the terminal joints of the toes are usually encased in solid hoofs or covered with broad hoof-like nails, while the molar (and not unfrequently some or all of the premolar) teeth have broad tuberculated crowns adapted for crushing vegetable substances. The teeth (when all are present) are differentiated into the usual four series; and milk-teeth, not completely discarded till the full stature is attained, are invariably developed. All the existing members of the group are eminently adapted for a terrestrial life, and in the main for a vegetable diet. Though a few may in some circumstances kill living creatures smaller than themselves for food, none are habitually predaceous. In none of the existing, and in but few of the extinct types, are collar-bones, or clavicles, developed; and the scaphoid and lunar bones of the carpus are separate. The typical ungulates are the members of the suborders Artiodactyla and Perissodactyla (*q.v.*), in both of which the bones of the foot articulate with each other by means of groove-and-tongue joints, whence the name of Diplarthra (equivalent to Ungulata Vera), which has been proposed for these two groups collectively, as distinct from the other representatives of the order. The remaining and less typical subordinal groups—sometimes ranked as orders by themselves—include among living animals the Proboscidea, or elephants, and the Hyracoidea, or hyraxes, and among extinct groups the Amblypoda, Ancylopoda, Barypoda, Condylarthra, Litopterna and Toxodontia. The characteristics of these groups will be found under their respective headings, with the exception of the Barypoda and Condylarthra, for which see Arsinoitherium and Phenacodus.



Right Fore Foot of Indian Elephant.

U, ulna; *R*, radius; *c*, cuneiform; *l*, lunar; *sc*, scaphoid; *u*, unciform; *m*, magnum; *td*, trapezoid; *tm*, trapezium; *I* to *V*, first to fifth digit.

In the great majority of the Subungulata the bones of the upper and lower rows of the wrist-joint, or carpus, retain the primitive or more typical relation to each other (see fig., and contrast with Perissodactyla, fig. 1); the os magnum of the second row articulating mainly with the lunar of the first, or with the cuneiform, but not with the scaphoid. On the other hand in the Diplarthra, the group to which the vast majority of modern Ungulates belong, the second or lower row has been shifted altogether towards the inner side of the limb, so that the magnum is brought considerably into relation with the scaphoid, and is entirely removed from the cuneiform, as in most existing mammals.

In the typical Ungulata or Diplarthra, the feet are never plantigrade, and the functional toes do not exceed four—the inner digit being suppressed, at all events in all forms which have existed since the Early Eocene period. The os magnum of the carpus articulates freely with the scaphoid. The allantois is largely developed, and the placenta, so far as known, is nondeciduate, the chorionic villi being either evenly diffused or collected in groups or cotyledons (in Pecora). The testes descend into a scrotum. There is never an os penis. The uterus is bicornuate. The teats are usually few, and inguinal, but may be numerous and abdominal (as in Suina), although they are never solely pectoral. The cerebral hemispheres in existing Ungulates are well convoluted. (R. L.*)

UNICORN (Lat. *unicornis*, for Gr. μονόκερως, having one horn; Fr. *licorne*; Ital. *alicorno*), a fabulous beast, usually having the head and body of a horse, the hind legs of an antelope, the tail of a lion (sometimes horse's tail), sometimes the beard of a goat, and as its chief feature a long, sharp, twisted horn, similar to the narwhal's tusk, set in the middle of its forehead. The earliest description is that of Ctesias, who (*Indica opera*, ed. Baehr, p. 254) states that there were in India white wild asses celebrated for their fleetness of foot, having on the forehead a horn a cubit and a half in length, coloured white, red and black; from the horn were made drinking cups which were a preventive of poisoning. Aristotle mentions (*Hist. anim.* ii. 1; *De part. anim.* iii. 2) two one-horned animals, the oryx, a kind of antelope, and "the so-called Indian ass." In Roman times Pliny (*N.H.* viii. 30; xi. 106) mentions the oryx, the Indian ass, and an Indian ox as one-horned; Aelian (*De nat. anim.* iii. 41; iv. 52), quoting Ctesias, adds that India produces also a one-horned horse, and says (xvi. 20) that the *Monoceros* was sometimes called *Carcazonon*, which may be a form of the Arabic *Carcadān*, meaning rhinoceros (see Rev. W. Haughton, "On the Unicorn of the Ancients," in *Annals and Mag. of Natural History* for 1862, p. 363). Strabo (*lib.* xv.) says that in India there were one-horned horses with stag-like heads. The origin of all these statements is probably to be found partly in the rhinoceros, which was well known to the ancients, and partly in the narwhal, specimens of the long tusk of which were probably brought home by travellers. The theory of a one-horned oryx would probably be drawn from the remembrance of a passing glimpse of an antelope in silhouette, or even of one which had broken one horn off short in fighting, and E. Schrader (*Sitzungsberichte d. kgl. preuss. Akad. zu Berlin*, 1892, pp. 573–581, and pl. 5) traces the idea of a one-horned ox to the sculptures of Persepolis and other places, which Ctesias would probably have seen, in which the ox, represented in silhouette, has apparently only one horn. As India became better known, and it was realized that the unicorn was not found there, its place of abode was changed to Africa.

The medieval conception of the unicorn as possessing great strength and fierceness may have been partly due to the fact that in certain passages of the Old Testament (*e.g.* Num. xxiii. 22; Deut. xxxiii. 17; Job xxxix. 9–10) the Hebrew word *R'ēm*, now translated in the Revised Version "wild ox," was translated in the Septuagint μονόκερως, in the Vulgate *unicornis* or *rhinoceros*, and in the Authorised Version "unicorn," though in Deut. xxxiii. 17 it obviously refers to a two-horned animal. The early commentators applied to this beast the classical attributes of the μονόκερως (*e.g.* Isidore xii. 2, 12 tells how the unicorn has been known to worst the elephant in combat). There is also the passage in Aelian xvi. 20 which says that though as a rule savage and quarrelsome, even with females, the unicorn at mating time becomes very gentle to his mate, which is supposed to have given rise to the medieval idea that the unicorn is subdued to gentleness at the sight of a virgin, and will come and lay his head in her lap, which is the only means by which he can be caught on account of his swiftness and ferocity. This story is illustrated in the tapestry figured in Plate II. Fig. 10 of Embroidery, also on Pisanello's medal of Cecilia Gonzaga (see J. de Foville, *Pisanello et les médailleurs italiens*, 1909, p. 40), on the reverse of which is a young girl with a unicorn lying by her side, the unicorn here being represented as a beautiful long-haired goat, with the long horn in the middle of his brow. The idea was widely spread in the middle ages, and Lauchert (*Geschichte des Physiologus*, 1889) gives instances of its allegorical use, as typical not only of Christ and the Virgin, but also of the softening influence of love upon the fiercest of men, and a symbol of purity. As a decoration of drinking cups it symbolized the ancient belief in the efficacy of the unicorn's horn against poison, which in England remained even in the time of Charles II., though Sir E. Ray Lankester (*Science from an Easy Chair*, London, 1910, p. 127) mentions that a cup made of rhinoceros horn was then handed over to the Royal Society for experiment, with the result of entirely disproving the superstition. In the court ceremonial of France as late as 1789 instruments of "unicorn's" horn were still used for testing the royal food for poison. So-called unicorns' horns, or articles made of unicorn's horn, have always been sought after as "curiosities"; some of them, like the cup mentioned above, were of rhinoceros horn; others, like the horn seen at Windsor by Heutzner, a German traveller, in 1598 (see E. Phipson, *Animal-lore of Shakespeare's Time*, p. 456), were probably narwhals' tusks. Another medieval legend about the unicorn is that when it stooped to drink from a pool its horn, dipping into the water, purified and rendered it sweet. The traditional rivalry of the lion and the unicorn, which is generally considered to date at earliest from the Union of England and Scotland, when the lion and the unicorn appeared as the supporters of the royal arms, is referred to, curiously enough, in Spenser's *Faery Queene*, ii. 5.

In heraldry the unicorn was sometimes used as a device (see HERALDRY, where two English families are enumerated who used the unicorn on their arms), but more frequently as a supporter, and subsists to the present day as the left-hand supporter of the royal arms. This position it assumed at the Union, the Scottish royal arms having previously been supported by two unicorns. The origin of these is uncertain. The unicorn first appears (*c.* 1480), as a single supporter, on two gold coins of James III. of Scotland, hence known as "unicorns" and "half-unicorns" (see Lindsay, *Coinage of Scotland*, pp. 135–137 and plate xiii. figs. 22–27). It is represented in a sitting posture, having round its neck a crown, to which is attached a chain and ring, and holding the shield between its front feet. Seton (*Law and Practice of Heraldry in Scotland*, Edinburgh, 1863, p. 274, foot-note) suggests that the unicorn as a supporter may have been introduced into Scotland by the marriage of James I. with Jane Beaufort, the Beauforts as dukes of Somerset having used it as such.[1] However this may be, the unicorn became established by the end of the 15th century. J. A. Smith in "Notes on Melrose Abbey" (*Proceedings of Society of Antiquaries of Scotland*, ii. 257) describes a table dated 1505 on which are sculptured the royal arms supported by two unicorns. The royal arms are also supported by unicorns on the Great Seals of Scotland from the time of Queen Mary onwards (see Anderson, *Diplomata Scotiae*, plate lxxxviii. xc. xci.). At the Union, when the unicorn became a supporter of the royal arms both of England and Scotland, a royal crown was added on the head of the unicorn, in addition to the crown with chain and ring round its neck (see Great Seal of James I. and VI. in Anderson, pl. xciii.), but this crown was removed after the Hanoverian succession. In England after the Union the unicorn became the left-hand supporter, but in Scotland, as late as 1766, it was still put on the right (Seton, p. 442), and Scotland displayed great reluctance to alter this, or to remove the crown from the head of the unicorn. Seton tells us how in 1853 a petition was made in favour, among other things, of retaining the crown on the unicorn, but without success. The rule, however, that the unicorn is to be the left-hand supporter, uncrowned, is still sometimes ignored, and Seton states (1863) that in the case of seals, such as that of the Board of Manufactures, which bear the Scottish arms alone, the two unicorns are still kept as supporters.

AUTHORITIES.—There are many treatises on the unicorn and other fabulous beasts, from the 16th century onwards. Of these, good bibliographies are given by Drexler, *s.v. Monokeros*, in Roscher's *Lexicon*, and by Rev. W. Haughton in *Annals and Magazine of Natural History* for 1862, p. 363, "On the Unicorn of the Ancients." (C. B. P.)

UNIFORMS. The word "uniform" (Lat. *unus*, one, and *forma*, form), meaning adjectively homogeneous, is specifically used as a substantive for the distinctive naval and military dress, which serves, in its various styles, to give homogeneity to the several services, regiments and ranks. Although in ancient history we occasionally meet with uniformed soldiers, such as the white and crimson Spanish regiments of Hannibal, it was not until the beginning of large standing armies that uniforms were introduced in modern times. Before this, armed bodies were of two sorts, retainers and mercenaries, and while the former often wore their master's livery, the latter were dressed each according to his own taste or means. The absence of uniforms accounts very largely for the significance attached to the colours and standards, which alone formed rallying points for the soldier and his comrades, and thus acquired the sacred character which they have since possessed. A man who left the colours wandered into the terrifying unknown, for there was nothing to distinguish friend and foe. Even if the generals had ordered the men to wear some improvised badge such as a sprig of leaves, or the shirt outside the coat, such badges as these were easily lost or taken off. The next step in advance was a scarf of uniform colour, such as it is supposed was worn by the "green," "yellow" and other similarly-named brigades of the Swedish army under Gustavus Adolphus. This too was easily removed, as in the example of the squire who at Edgehill put on the orange scarf of the parliamentarians and with no more elaborate disguise succeeded in recapturing the lost royal standard from the hands of Essex's own secretary. By this time, in France at least, the general character of the clothes and accoutrements to be worn on various occasions was strictly regulated by orders. But uniformity of clothing was not to be expected so long as the "enlistment" system prevailed and soldiers came and went, were taken in and dismissed, at the beginning and end of every campaign. The beginnings of uniform are therefore to be found in truly national armies, in the *Indelta* of Gustavus, and the English armies of the Great Rebellion. In the earlier years of the latter, though the richer colonels uniformed their men (as, for instance, the marquess of Newcastle's "Whitecoats" and the king's own "Bluecoats"), the rustics and the citizens turned out for war in their ordinary rough clothes, donning armour and sword-belt. But in 1645 the parliament raised an army "all its own" for permanent service, and the colonels became officials rather than proprietors. The "new model" was clothed in the civilian costume of the date—ample coat, waistcoat, breeches, stockings and shoes (in the case of cavalry, boots)—but with the distinctive colour throughout the army of red and with regimental facings of various colours. The breeches were grey. Soon afterwards the helmet disappeared, and its place was taken by a grey broad-brimmed hat. From the coat was evolved the tunic of to-day, and the hat became the cocked hat of a later generation, which has never altogether disappeared, and has indeed reverted to its original form in the now familiar "slouch-hat."

For service in Ireland the red coat was exchanged for one of russet colour, just as scarlet gave way to khaki for Indian service in the 19th century. The cavalry, however, wore buff leather coats and armour long after the infantry had abandoned them; the Austrians (see Plate I., line 1, No. 2), on account of their Turkish wars, retained them longer than any.

Thus the principle ever since followed—uniform coat and variegated facings—was established. Little or nothing of sentiment led to this. By choice or convenience the majority of the corps out of which the new model was formed had come to be dressed in red, with facings according to the colonel's taste, and it is a curious fact that in Austria sixty years afterwards events took the same course. The colonels there uniforming their men as they saw fit, had by tacit consent, probably to obtain "wholesale" prices, agreed upon a serviceable colour (pearl grey), and when in 1707 Prince Eugene procured the issue of uniform regulations, few line regiments had to be reclothed. The preferences of the colonel were exhibited in the colour of the facings (Plate I., line 1, fig. 3). In France, as in England and Austria, the cavalry, as yet rather led by the wealthy classes than officered by the professional, was not uniformed upon an army system until after the infantry. But in 1688 six-sevenths of the French cavalry was uniformed in light grey with red facings; and about half the dragoon regiments had red uniforms and blue facings. Louvois, in creating a standing army, had introduced an infantry uniform as a necessary consequence. The native French regiments had light grey coats, the Swiss red, the German black and the Italian blue, with various facings. The French grey was probably decided upon, like the Austrian grey, as being a good "service" colour, which could be cheaply manufactured (Plate I.,

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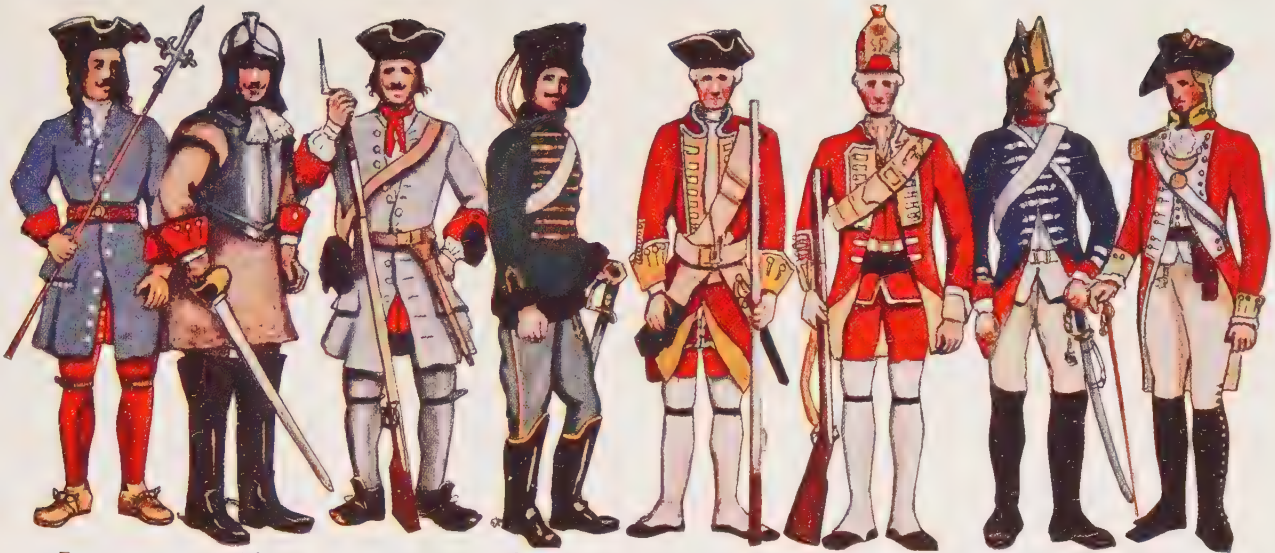
[1] Willement, *Regal Heraldry*, p. 70, says that it was also so used by Anne Boleyn and by the earls of Hertford.

UNIFORMS.

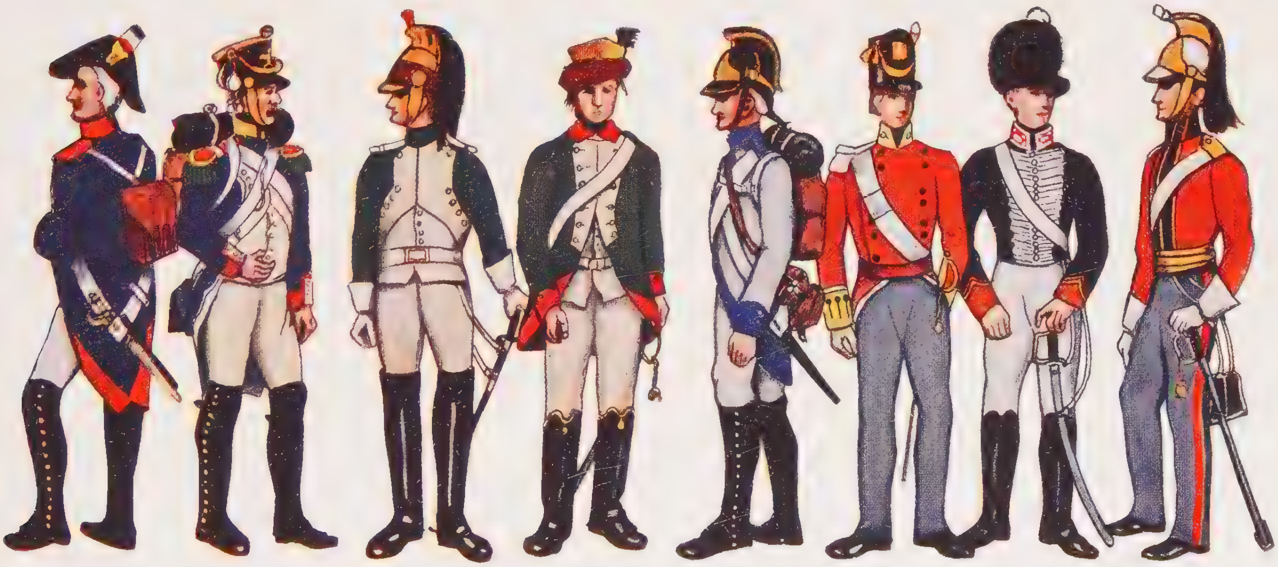
PLATE I.

1690-1790.



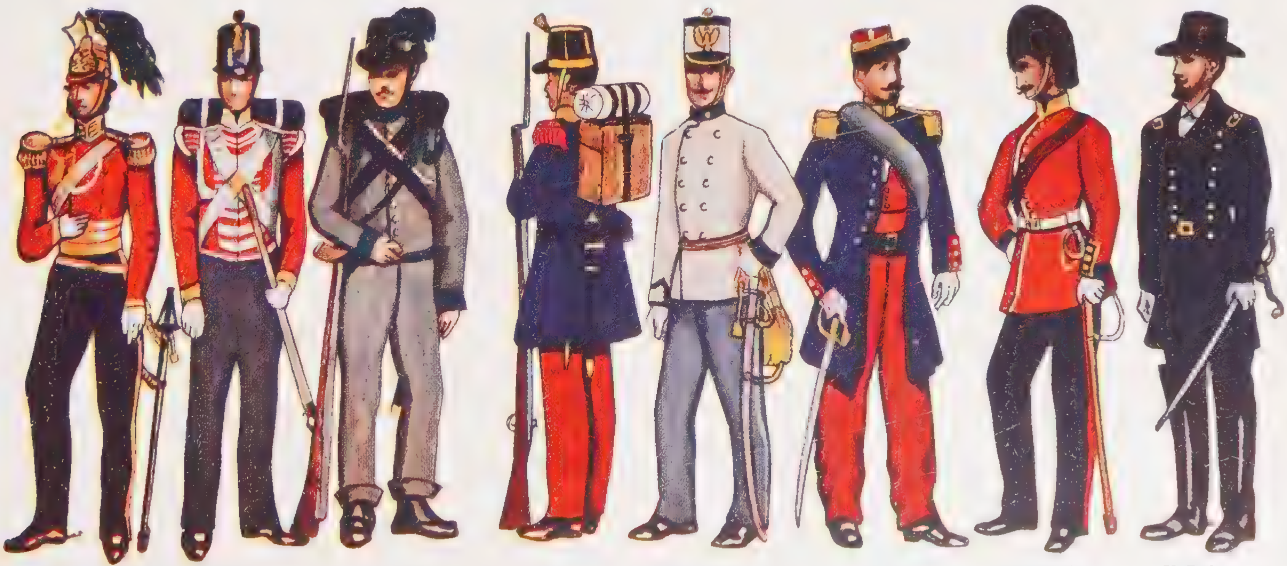
France: Sergeant, Alsace Regt., 1690.
Austria: Cuirassier, 1705.
Austria: Württemberg Regt., 1710.
Hungary: Nádasdy Hussars, 1762.
England: 34th Foot, 1742.
England: Grenadier, 4th Foot, 1751.
Prussia: Hesse-Cassel Regt., 1756.
England: 40th Foot, 1790.

1792-1815.



France: Revolutionary Infantry, 1795.
France: Voltigeur, 51st Regt., 1806.
France: Guard Dragoon, 1806.
Austria: Uhlan, 1800.
Austria: Deutschmeister Regt., 1805.
England: 9th Foot, 1812.
England: Royal Horse Artillery, 1815.
England: 1st Royal Dragoons, 1815.

1815-1865.



England: 17th Lancers, Officer, 1845.
England: 90th Light Infantry, 1845.
Austria: Jäger, 1848.
France: Line Infantry, 1852.
Austria-Hungary: Gyulai Regt., 1856.
France: Infantry Officer, 1859.
England: Scots Fusilier Guards, Officer, 1865.
U. S. A.: General Officer, 1864.

line 1, fig. 1). Both these greys, however, refined themselves in course of time into white.

The hat and the long coat and breeches remained the uniform of line infantry almost everywhere up to the advent of the shako and the coatee about 1790–1820. The gradual evolution of these two garments, from the comfortable civilian clothes of 1690 to the stiff, precise military garments of 1790, can be traced in a few words. The brim of the felt hat was first looped up on one side for convenience, then, for appearance' sake, on the other, and so became the three-cornered cocked hat, fringed with feathers, lace or braid, of Marlborough's wars.[1] Then came the fashion of looping up before and behind, which produced the hat called the "Khevenhüller," or the broadside-on cocked hat. Lastly, came the purely decorative, lace-looped "fore-and-aft" pattern, as worn in many states to-day. But before this came into vogue the cocked hat had practically disappeared from the ordinary ranks of all armies. It may be said that so long as the cocked hat survived in its simple, rank-and-file form, uniforms retained much of their looseness. Though the long skirts that rendered great coats unnecessary were looped back, and the ample cuffs of Marlborough's time were becoming narrower until they were at last sewn down to the sleeve, yet the military costume was in all essentials the civil costume of the time—long coat, hat, sleeved waistcoat, breeches and gaiters.

But other influences were at work. The principal was the introduction into armies of Slavonic irregulars, which tended to restrict line infantry and cavalry to parade drill and to pitched battles in parade order. This, and their complete separation from the civil population, stiffened their costume until it became "soldierly." Frederick the Great, indeed, could not have developed the infantry fire power that he needed if his soldiers had had tight sleeves, but in his old age the evil of sacrificing comfort to smartness attained a height which, except in the 1820–1840 period, was never surpassed. The figure of a Prussian fusilier, Plate I. line 1, No. 7 (in which by mistake a slung sword is shown) shows this process beginning. The stock has made its appearance, soon to stiffen into a cloth collar, under which, as if it were not already tight enough, another stock in due course came to be worn. The flapped cuffs, shown in the British figure No. 5, have become plain round cuffs, above which are embroidery stripes and buttons which at one time laced the flaps of the cuff together and now survive as the "guard-stripe." This may be called the first instance of the dummy adornments, which are so marked in modern full-dress uniforms. Similarly the former cloth turnback on the front of the coat has even in 1756 been cut off, the buttons and embroidered loops that retained it being kept as decorations.

Many of these specially military adornments were borrowed from the national costumes of the irregulars themselves. Their head-gear in particular drove out the cocked hat. The grenadier cap, now a towering bearskin, was its first successful rival, the shako the next. The grenadier cap was, in the first instance, a limp conical cap (identical with the hussar cap), edged with fur and having a tassel at the end. Soon the fur became more prominent in the front, and the tail disappeared. Then the cloth mitre-cap (Plate I., line 1, fig. 6) appeared. This was originally a field-service cap, with ear-flaps and sunshade. But it stiffened about 1775 into a fur cap of the same shape (with which sometimes the old cloth tail is found), and this in turn evolved, through the fuller but still narrow and forward-pointing bearskin of Peninsular days, into the great fur cap of grenadiers and fusiliers of the present time. The mitre-shaped cloth cap survives in a few Russian and Prussian regiments. As early as 1755, as the Prussian figure shows, a conical leather cap with a large brass plate in front had come into existence. This held its ground for some time, and the grenadier cap of to-day in Russia and Prussia is a metal copy of the mitre field-service cap itself. A curious derivative of the low fur cap with a peak in front and a bag-tail behind worn by some 17th- and 18th-century grenadiers is the head-dress of the Russian horse-grenadiers. The peak has become the helmet, the fur a "sausage" across the cap from ear to ear, and the back part of the helmet is covered by the bag-tail.

The Hungarian hussars introduced the jacket and the busby. The latter was originally a conical cap with fur edge, but the fur became higher until there was nothing left of the cap but the ornamental "busby-bag" of to-day. It would appear also as if the hussars brought the shako to western Europe. This is a conical, bell-topped, or cylindrical head-dress of stiff material, commonly leather. Its prototype, the tall cylindrical cap of the 18th-century hussars, was tilted on one side and wound round with a very narrow bag-tail, the last few inches of which, adorned with a tassel, hung down. But the shako itself succeeded, as nothing else succeeded, in being accepted by line infantry and cavalry, and after passing through numerous forms it remains in every army to-day, either as a low rigid cap (Germany, England and Austria), a stiffened or limp képi (France and Italy), or the flat-topped peaked cap which is the most common military head-dress of modern Europe.

All these adjuncts came in the first place from the national costume of imported auxiliaries. So also did the lancer cap, which, originally the Polish czapka, was a cylindrical cap, the upper part of which could be pushed up or down after the fashion of a bellows or accordion, with a square top. The original form is seen in Plate I., line 2, fig. 4, and the stiffened development of it in Plate I., line 3, fig. 1. The British lancer cap (Plate II., line 1, No. 2) has still a full middle portion, but in Austria and Germany this has dwindled to a very narrow neck (Plate II., line 3, No. 6; Plate IV., line 1, No. 7). The line infantry and cavalry coat, full-skirted in the first instance, retained its original length until about 1780, but from that time onwards (probably in most cases in the interests of the colonel's pocket) it becomes, little by little, shorter and scantier (Plate I., line 2, Nos. 2, 3, and 5), until at last it is a "coatee," not as long as the present-day tunic (Plate I., line 2, Nos. 6 and 8), or a swallow-tailed coat (Plate I., line 3, figs. 1–3). This, of course, did away with the protection afforded by the full skirt, and necessitated the introduction of the great coat, which even to-day in some cases is worn, without the tunic, over the "vest" that represents the sleeved waistcoat (Plate II., line 2, No. 3), formerly worn under the long skirted coat. The white breeches and gaiters, retained to the last, gradually gave way to trousers and ankle boots in 1800–1820.

Meanwhile another form of head-dress, which was purely military and owed nothing to Poland or Hungary, came into vogue. This was the helmet, which had disappeared from the infantry about 1650–1670, and the cavalry thirty years afterwards. It took two forms, both of which possessed some of the characteristics of ancient Greek and Roman helmets. These were a small helmet with sausage-shaped ornament from front to back, worn chiefly by British light dragoons and artillery (Plate I., line 2, fig. 7), and the towering crested helmet worn by the French, British and Austrians. The French cuirassiers and dragoons (Plate I., line 2, No. 3) had, and still have, long horse-hair tails dependent from the crest. The Austrian infantry helmet, worn with the white coat, similar to, but smaller than, that shown in Plate II., line 2, No. 5, had no ornament, but the British heavy cavalry helmet (Plate I., line 2, No. 8) resembled that of the French. To-day, besides the French, the Austrian dragoons and Italian heavy cavalry have this form of helmet (Plate II., line 3, No. 1, and Plate IV., line 2, No. 8).

It has been said above that the coatee and the shako are the principal novelties in European military costumes of Napoleon's time. To these should be added the replacement of the gaitered breeches by trousers, and the adoption of hussar and lancer uniforms of ever-growing sumptuousness, in which the comfort that had originally belonged to these national irregular costumes was entirely sacrificed. After Waterloo, indeed, all traces of the old-fashioned coat disappeared, and, except for the doubtful gain of tight-fitting "overalls," the soldier was more showy and worse off in comfort and convenience than ever before or since. One or two examples may be quoted. In George IV.'s time the coatees of the lifeguards were so tight that the men were unable to perform their sword exercise, and their crested helmet, surmounted by a "sausage" ornament, was so high that the sword could not be raised for a downward blow. The total height of the lancer cap with its plume (Plate I., line 3, No. 1) was about an arm's length, and prints exist showing British lancers in a cap of which the square top is very nearly as broad as the wearer's shoulders. The hussar furred pelisse, originally worn over a jacket (Plate I., line 1, fig. 4), and so worn by the Austrians to-day, had become a magnificently embroidered and laced garment, always slung and never worn, and the old plain under-jacket had been loaded with buttons and lace, and differed from the pelisse only in the absence of fur. It was the Restoration era, too, that delighted to decorate uniforms with sewn-down imitations of the skirt pockets, turn-back cuffs, &c., of the old coat. This was, in short, the epoch of pure dandyism, and although some of its wilder extravagances were abolished between 1830 and 1850, enough still remained when the British army took the field in the Crimea to bring about a sudden and violent reaction, in which the slovenliest dress was accounted the best. The dress regulations of 1855 introduced the low "Albert" shako and the tunic, abolished the epaulette—an ornament which had grown in the 18th century out of a shoulder cord that kept the belts in place and was decorated at the outer end with a few loose strands or tassels of embroidery—and made other changes which, without bringing back uniform to its original roominess and comfort, destroyed not only the dandyism of George IV.'s time, but also the chastened finery of the Early Victorian uniforms (Plate I., line 3, No. 7).

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[1] In the cavalry an iron-framed skull-cap was often worn under the cocked hat.

The tunic, accompanied by a spiked helmet of burgonet shape, had been introduced in Prussia and Russia about 1835. Russia was too poor to allow extravagance in dress, and Russians, clothed as they generally were in their great coats, had little incentive to aim at futile splendour. Both countries, however, and France and Austria likewise, passed through a period of tight, if unadorned, uniforms, before Algeria, Italy, and similar experiences brought about the abandonment of the swallow-tailed coatee. The French adopted the tunic in 1853, the Austrians in 1856, and in both countries the shako became smaller and lighter. From about 1880, when the spiked helmet replaced the low shako in England, no radical changes were made in full dress uniforms, except that the Russian army, abandoning the German pattern uniforms formerly in vogue, adopted a national uniform which is simple, roomy, and exceedingly plain, even in full dress. In 1906–1909, however, this attempt to combine handsomeness and comfort was given up, full dresses being made more decorative, and light green-grey service dresses being introduced. Lastly, since the South African War and the development of infantry fire, the attempt to wear full dress uniform on active service has been practically given up. Great Britain first of all adopted the Indian khaki, and then a drab mixture for "service dress" and returned, after 150 years, to the civilian style of field dress, adopting the "Norfolk jacket" or shooting coat with spinal pleat and roomy pockets. Germany, Italy, the United States and other countries have followed suit, though each has chosen its own shade, and the shades vary from light grey blue in Italy to deep olive drab in the United States. The details of the present-day uniforms in the principal states are given below. It might be stated, as a summary of modern uniforms, that Great Britain has most completely divorced service and full dress, and that in consequence her full dress is handsomer and her service dress plainer than those of any other country. Whether, for European war at any rate, the obliteration of regimental distinctions has not been carried too far, is open to question. The method adopted for the Italian infantry would seem to give enough means of identification, without increasing visibility, and as this method was used by the British in the South African War, it will probably be revived in future wars.

GREAT BRITAIN

The full dress uniforms of the British service in 1910 had not undergone any radical change since the army reorganization of 1881. Many regiments had, however, resumed their original facings instead of the white common to all non-royal English regiments in the last twenty years of the 19th century. But the Scottish regiments maintained their yellow or yellow-buff facings, and the single Irish regiment which is not "royal" (the Connaught Rangers) its green. Rifle regiments had astrakhan busbies, resembling in shape enlarged "glengarry" caps, with plume and lines. Details in all corps have been changed, rendering the uniforms more handsome. In September 1910 it was announced that the cloth helmet would be replaced by a shako.

Cavalry.—Household cavalry and dragoons wear single-breasted tunics with gold buttons, cuffs pointed with Austrian knot collars and shoulder-straps of the facings colour and white piping on the front and the skirt-flaps. The household cavalry wear steel cuirasses in review order, and in undress tight-fitting jackets and blue red-striped overalls. All wear steel or brass helmets, with drooping horsehair plumes, except the Scots Greys (2nd Dragoons), who have a grenadier bearskin with feather plume. All wear blue pantaloons and jack boots, except the household cavalry, who in full dress wear white leather breeches and high jack boots reaching above the knee. The stripes on the pantaloons are yellow, (white in 2nd and 6th Dragoon Guards), white belts[1] and slings. See Plate II., line 1, figs. 4 and 9.

Lancers (Plate II., line 1, No. 2) wear double-breasted tunics with gold buttons, and the front or "plastron," the peculiar mark of the lancer, varies in colour with the facings of the regiment. Lancers wear lancer caps (the Polish czapka) with drooping plumes. Pantaloons are blue, with yellow stripes (white in 17th), boots as in the dragoons. Round the waist is a girdle of yellow and red, and the cap is secured to the collar of the tunic by yellow lines.

	Tunic.	Facings.	Helmet.	Plume.
1st Life Guards	Scarlet	Blue	Steel	White
2nd ,, ,, ...	,,	,,	,,	,,
Royal Horse Guards (Blues) . .	Blue	Red	,,	Red
1st Dragoon Guards (King's) . .	Scarlet	Black	Brass	,,
2nd ,, ,, ...	,,	White	,,	Black
3rd ,, ,, ...	,,	Yellow	,,	Black and red
4th ,, ,, ...	,,	Blue	,,	White
5th ,, ,, ...	,,	Dark green	,,	Red and white
6th ,, ,, (Carabineers).	Blue	White	,,	White
7th ,, ,, ...	Scarlet	Black	,,	Black and white
1st Royal Dragoons	,,	Blue	Steel	Black
2nd Dragoons (Scots Greys) . .	,,	,,	(Bearskin cap)	White
6th Inniskilling Dragoons . . .	,,	Primrose	Steel	,,
			Czapka top.	
5th Lancers	Blue	Scarlet	Scarlet	Green
9th ,, ...	,,	,,	Black	Black and white
12th ,, ...	,,	,,	Scarlet	Scarlet
16th ,, ...	Scarlet	Blue	Blue	Black
17th ,, ...	Blue	White	White	White
21st ,, ...	,,	Light blue	Light blue	,,
			Busby-bag.	
3rd Hussars	Blue	Nil	Garter blue	White
4th ,, ...	,,	,,	Yellow	Scarlet
7th ,, ...	,,	,,	Scarlet	White
8th ,, ...	,,	,,	,,	White over red
10th ,, ...	,,	,,	,,	White over black
11th ,, ...	,,	,,	Crimson	White over crimson
13th ,, ...	,,	,,	White	White
14th ,, ...	,,	,,	Yellow	,,
15th ,, ...	,,	,,	Scarlet	Scarlet
18th ,, ...	,,	,,	Blue	White over red
19th ,, ...	,,	,,	White	White
20th ,, ...	,,	,,	Crimson	Yellow

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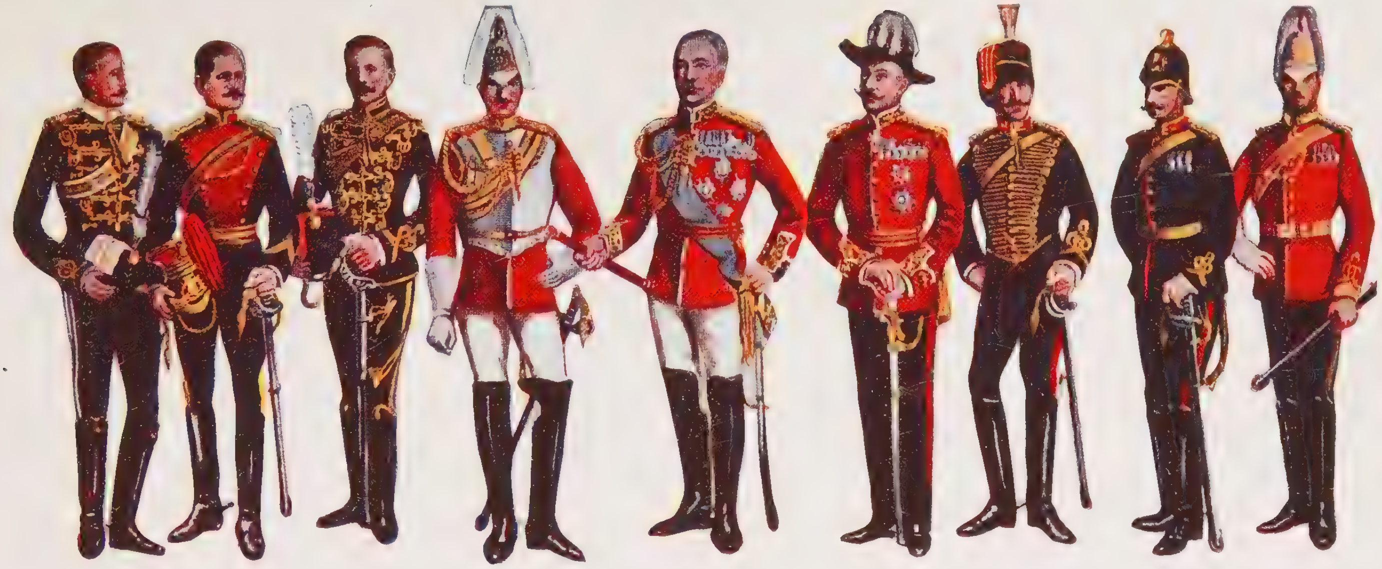
[1] The 1st Life Guards have a red line, the 2nd a blue line, in the pouch belt.

GREAT BRITAIN

UNIFORMS.

PLATE II.



13th Hussars, Officer.

12th Lancers, Officer.

10th Hussars, Officer.

2nd Life Guards, Officer.

Field Marshal.

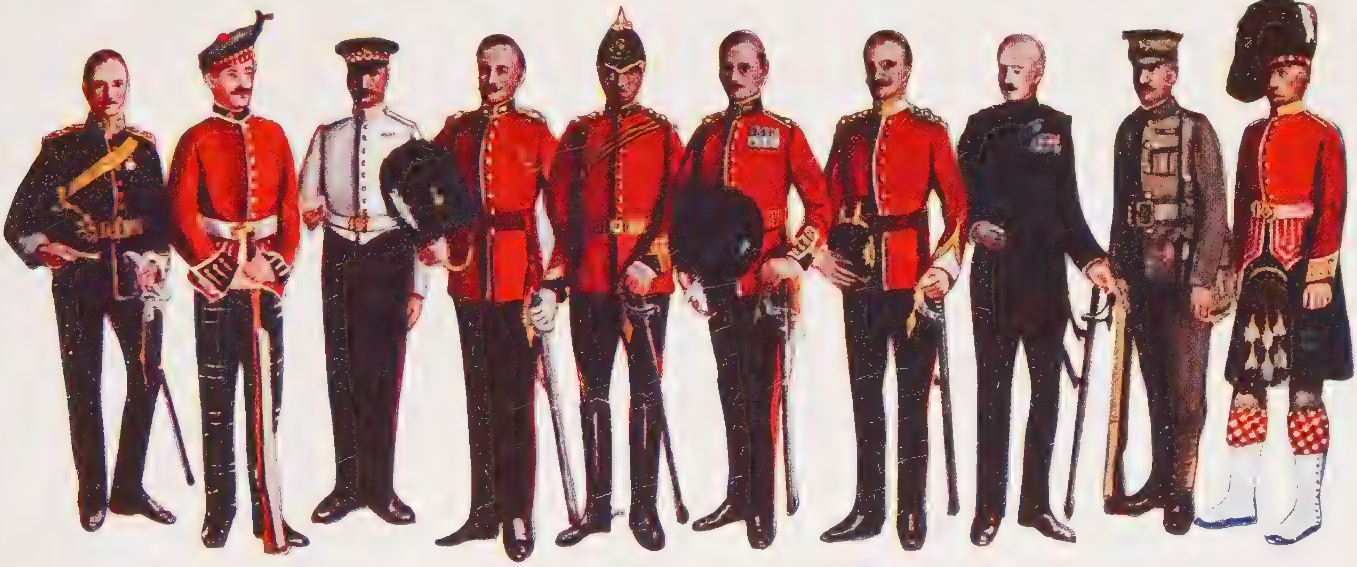
Major-General.

Royal Horse Artillery, Officer.

Royal Field Artillery, Officer.

6th Inniskilling Dragoons, Officer.

GREAT BRITAIN



Army Service Corps, Officer.

King's Own Scottish Borderers.

Scots Guards, Undress.

Royal Fusiliers, Officer.

Royal Engineers, Officer.

Grenadier Guards, Officer.

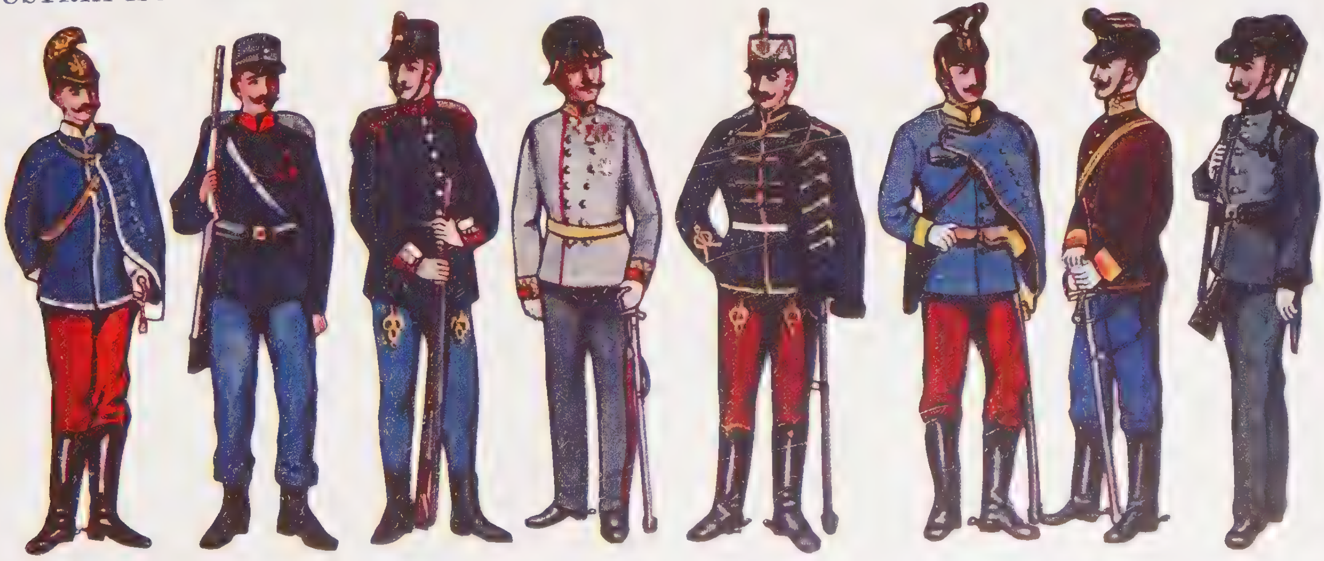
Welsh Regiment, Officer.

Rifle Brigade, Officer.

King's Own (Royal Lancaster) Service Dress.

Argyll and Sutherland Highlanders.

AUSTRIA-HUNGARY



15th Dragoons, Officer.

Austrian 18th Infantry.

Hungarian 82nd Infantry.

General.

9th Hussars.

1st Uhlans.

Artillery, Colonel.

Jager

The undress cap is in all the above blue, with bands of various colours, amongst which the most noticeable is the white zigzag on a black background of the Scots Greys.

Hussars (Plate I., line 1, figs. 1 and 3) wear a blue jacket, shorter than the ordinary tunic, braided with yellow or gold in front, along the back seams and on the collars and cuffs. They have no shoulder-straps, facings or waist-belt. The 3rd Hussars wear, however, scarlet and the 13th white, collars. The distinctive head-dress is the cylindrical busby with an upright feather plume, lines, and a busby-bag on the right side. The pantaloons are blue, except for the 11th Hussars, who wear crimson. Double stripes on the trousers, yellow (white, 13th). The undress cap is a red peaked cap. Officers' Hessian boots have gold edging and boss.

Infantry.—The uniforms of the four Foot Guard regiments are distinguished by the cuffs, which have slashed flaps and buttons, by the blue shoulder-straps and by the embroidery patches on the collar, cuff-flaps and skirts, which are analogous to the *Garde-Litzen* of continental armies. The only uniform which could be mistaken for it is the Royal Marine Light Infantry's (Plate IV. line 3, No. 1), which has also slashed flaps, but it has fewer and smaller embroidery patches and plain collars. All the Guard regiments wear scarlet tunics with blue collars, shoulder-straps and cuffs, bearskin caps, blue trousers with red piping (officers, red stripe). The regimental distinctions (Plate II., line 2, Nos. 3 and 6) are: Grenadiers—Buttons equally spaced, white plume, red cap-band. Coldstream—Buttons spaced in twos. red plume, white cap-band. Scots—Buttons in threes, no plume, diced red and white cap-band. Irish—Buttons in fours, green plume, green cap-band. All wear in undress the white jacket, which is the old sleeved waistcoat, and peaked cap.

The uniforms of the line infantry may be classed as Line, Light, Fusilier, Rifle, Lowland and Highland Scottish. The tunic in the first three is red, with pointed cuffs and collars of the facings colour (blue in Royal regiments, white in English and Welsh, yellow in Scottish, green in Irish, except where the older colours have been revived), red shoulder-straps, gold buttons and white piping, blue trousers with red piping. On the shoulder-strap in the case of the rank and file is the regimental title, on the collar the regimental badge. The line infantry have a dark blue helmet (Plate II., line 2, No. 7), with brass spike and ornaments; the light infantry a dark green helmet of the same pattern;[1] the fusiliers (Plate II., line 2, fig. 4) bear or racoon skin cap with hackle plume. In undress all ranks have a blue (green for light infantry) peaked cap, with a black (royal regiments, scarlet, non-royal Irish, green) band. The rifle regiments (Plate II., line 2, No. 8) wear very dark green tunics and trousers without coloured cuffs or collars. In the King's Royal Rifles the scarlet piping and collar form a conspicuous distinction. The head-dress of the rifle regiments is an astrakhan cap with plume (red and black, K.R.R.; dark green and black, K.I.R.; black, Rifle Brigade), in undress a dark green peaked cap.

The Lowland and Highland Scottish regiments wear a scarlet (Scottish Rifles, green) "doublet" with gauntlet cuffs (Plate II., line 2, Nos. 2 and 10.) In undress Highland regiments wear the white jacket. Highland regiments wear tartan kilt and plaid and sporran (varying with the regiments), diced hose-tops and white spats, Lowland regiments (also Scottish Rifles, Highland Light Infantry, and all mounted officers) tartan trews. The head-dress of Highland regiments is a "feather bonnet"—a loose fur cap of peculiar shape with hackle. The Highland Light Infantry wear a small shako with a red and white diced band and ball. Lowland regiments (except the Royal Scots Fusiliers) wear the Kilmarnock bonnet (Plate II., line 2, No. 2). The Scottish Rifles have a shako with black drooping plume. The undress cap of all Scottish infantry is the "glengarry."

The full dress of officers is similar to that of the men, but it is more ornamented (see below for badges of rank). In all English and Irish regiments clothed in scarlet a crimson waist-sash is worn by officers. Guards officers on ceremonial occasions wear a gold and crimson sash. On the collar and cuffs there are broad edgings of lace terminating in the case of the cuffs in a small Austrian knot. The rifle Jacket is of hussar pattern with black embroidery and a black pouch belt (Plate II., line 2, fig. 8.) The Highland officer has a special pattern of sword; in full dress the basket-hilted claymore (so-called) or a plainer sword decorated with ribbon, on service a plain cross-hilted sword. He has also a richly decorated dirk, a broad white baldric, and a very full sash over the left shoulder. Lowland officers have also the shoulder belt and claymore, &c.

Royal Artillery.—The Royal Horse Artillery (Plate II., line 1, fig. 7) wears an old-fashioned hussar uniform, consisting of busby with red bag and white plume, a blue jacket with 18 rows of gold braid and scarlet collar. Trousers blue with red stripe. The Royal Field and Royal Garrison Artillery (Plate II., line 1, No. 8) wear a blue tunic with red collar and gold lace (Austrian knot on the sleeve), blue trousers with red stripe, helmet with brass plate and ball ornament, waist-belt and pouch-belt (white for men, gold for officers). The badge is either a grenade or a device of a field gun on its carriage.

	Facings.	Corresponding Corps and their facings in 1815. (S = silver lace.)
Line Infantry, English and Welsh.		
Queen's (R. West Surrey)	Blue	2nd, blue (S).
Buffs (East Kent)	Buff yellow	3rd, buff (S).
King's Own (R. Lancaster)	Blue	4th, blue.
Royal Warwickshire	,,	6th, yellow (S).
King's Liverpool	,,	8th, blue.
Norfolk	Yellow	9th, yellow (S).
Lincolnshire	White	10th, yellow (S).
Devonshire	Lincoln green	11th, green.
Suffolk	Yellow	12th, yellow.
Prince of Wales's Own (West Yorks)	Buff yellow	14th, buff (S).
East Yorkshire	White	15th, yellow (S).
Bedfordshire	,,	16th, yellow (S).
Leicestershire	,,	17th, white (S).
Princess of Wales's Own (Yorkshire Regt.)	Grass green	19th, grass green.
Cheshire	Buff yellow	22nd, buff yellow.
South Wales Borderers	Grass green	24th, grass green (S).
Gloucestershire	White	28th, yellow (S). 61st, yellow (S).
Worcestershire	,,	29th, yellow (S). 36th, gosling green.
East Lancashire	,,	30th, pale yellow (S). 59th, white (S).
East Surrey	,,	31st, buffs (S). 70th, black.
West Riding (Duke of Wellington's)	Scarlet	33rd, red (S); 76th, red (S).
Border	White	34th, yellow (S). 55th, green.
Royal Sussex	Blue	35th, orange (S). 107th, (?).
Hampshire	Yellow	37th, yellow (S). 67th, yellow (S).
South Staffordshire	White	38th, yellow (S). 80th, yellow.
Dorsetshire	Grass green	39th, grass green. 54th, green (S).
Prince of Wales's Volunteers (S. Lancashire)	White	40th, buff yellow. 82nd, yellow (S).
Welsh	,,	41st, red (S). 69th, green.
Essex	,,	44th, yellow (S). 56th, purple (S).
Sherwood Foresters (Notts and Derby)	,,	45th, dark green (S).
Loyal North Lancashire	,,	47th, white (S). 81st, buff (S).
Northamptonshire	,,	48th, buff. 58th, black.
Princess Charlotte of Wales's Royal Berkshire	Blue	49th, green. 66th, gosling grn. (S).
Queen's Own R. West Kent	,,	50th, black (S). 97th, blue (S).
Duke of Cambridge's Own Middlesex	Lemon yellow	57th, yellow. 77th, yellow (S).
Wiltshire (Duke of Edinburgh's Own)	Buff yellow	62nd, buff (S). 99th, pale yellow.
Manchester	White	63rd, dark green (S). 96th, buff (S).
Prince of Wales's North Staffordshire	,,	64th, black. 98th, buff.
York and Lancashire	,,	65th, white; 84th, yellow (S).
Line Infantry, Irish.		
Royal Irish Regt.	Blue	18th, blue.
Connaught Rangers	Green	88th, yellow (S). 94th, green.
Leinster Regt. (R. Canadian)	Blue	(100th and 109th late H.East India Co.'s troops).
Light Infantry.		
Prince Albert's Somersetshire	Blue	13th, yellow (S).
Duke of Cornwall's	White	32nd, white; 42nd, pale yellow (S).
Oxfordshire and Bucks	,,	43rd, white (S). 52nd, buff (S).

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[1] To be replaced by a shako.

	Facings.	Corresponding Corps and their facings in 1815. (S = silver lace.)
Light Infantry—continued.		
Yorkshire (King's Own)	Blue	51st, grass green (105th H.E. India Co.'s troops).
Shropshire (the King's)	,,	53rd, red; 85th, yellow (S).
Durham	Dark green	68th, bottle green (S) (106th H.E. India Co.'s troops).
Highland	Buff yellow	71st, buff (S); 74th, white.
Fusiliers.		
Northumberland	Gosling green	5th, gosling green (S).
Royal (City of London)	Blue	7th, blue.
Lancashire	White	20th, yellow (S).
Royal Scots	Blue	21st, blue.
Royal Welsh	,,	23rd, blue.
Royal Irish	,,	27th, buff (108th lateH.East India Co.'s troops).
Royal Inniskilling	,,	87th, green; 89th black.
Royal Munster	,,	(101st and 104th late H. East India Co.'s troops).
Royal Dublin	,,	(102nd and 103rd, late H.East India Co.'s troops).
Rifles.		
Cameronians (Scottish Rifles)	Dark green	(Formerly 26th and 90th line).
King's Royal	Red	60th Rifles, red.
Royal Irish	Dark green	(Formerly 83rd and 86th line).
Rifle Brigade	Black	95th Rifles, black.
Line Infantry, Lowland Scottish.		
Royal Scots Lothian	Blue	1st, blue.
King's Own Scottish Borderers	,,	25th, blue.
Highlanders.		
Black Watch (Royal Hrs.)	,,	42nd, blue; 73rd, dark green.
Seaforth	Buff yellow	72nd, yellow (S).
Gordon	Yellow	75th, yellow; 92nd yellow (S).
Queen's Own Cameron Hrs.	Blue	79th, dark green.
Princess Louise's (Argyll and Sutherland Hrs.)	Yellow	91st, yellow (S). 93rd, yellow (S).

Royal Engineers (Plate II., line 2, No. 5).—Scarlet tunic with garter, blue cuffs and collar, yellow shoulder-cords and piping, blue trousers with red stripe, helmet with royal arms on plate, and spike. Waist-belt white for men, gold-laced russia leather for officers, who wear also a pouch-belt of russia leather with a wavy gold lion in the centre.

Army Service Corps (Plate II., line 2, No. 1).—Blue tunic with white facings and white piping. Helmet with ball and plate, trousers blue with double white stripe. Officers, gold belts. *Royal Army Medical Corps*, blue uniform with magenta facings; *Army Veterinary Corps*, blue with maroon facings; *Army Pay Corps*, blue with yellow facings; *Army Ordnance Corps*, blue with red facings. *The West India Regiment* (negroes) wear a red sleeveless jacket over a white smock, baggy dark blue trousers, and a round cap with white puggaree.

The distinguishing mark of the *staff* officer in full dress is the aiguillette and the cocked hat with upright or drooping plume; in undress and service dress the red gorget patches on the collar. The full-dress uniforms of a *field marshal* and a *general officer* are shown in Plate II., line 1, Nos. 5 and 6.

Badges of Rank.—All officers have twisted gold shoulder-cords (except Foot Guards, who wear a blue cloth shoulder-strap with lace edges); on these cords badges of rank are worn as follows: 2nd lieutenant, lieutenant and captain, 1, 2 and 3 stars; major, crown; lieutenant-colonel, crown and star; colonel, crown and 2 stars; brigadier-general, crossed swords; generals, sword and baton crossed, and (major-general) star; (lieutenant-general), crown; (general), crown and star; field marshal, crossed batons in a laurel wreath with crown above. In service dress (khaki), however, the badges are worn in worsted on a slashed flap of the sleeve, coupled with rings of braid (1 for a 2nd lieutenant or lieutenant, 2 for a captain, &c.). Non-commissioned officers wear chevrons (point downwards) on the upper right arm; lance-corporal or acting bombardier, 1; corporal, 2; sergeant, 3; colour-sergeant, 3 chevrons and crossed colours; staff-sergeant, 4 chevrons. On the lower part of the left arm chevrons (point up) are worn as "good conduct" badges. A sergeant-major is dressed as an officer, except that he has a crown on the lower part of the right sleeve). There are also badges of proficiency such as crossed rifles for marksmen, a spur for rough-riders, a fleur-de-lys for scouts, &c.

Regimental Badges.—The grenade in various forms is worn by the Royal Artillery, the Grenadier Guards and the Fusilier regiments. The figure of Britannia was awarded to the (9th) Norfolk regiment for gallantry at Almanza, 1707. The White Horse of Hanover was given to some regiments for service against the Jacobites. The Lion of England was awarded by William III. to the King's Own (Royal Lancaster) Regiment for services against the troops of James II. The Queen's (Royal West Surrey) Regiment wear a Paschal Lamb, the badge of Catherine of Braganza, queen of Charles II. The Dragon of Wales figures among the badges of all the Welsh regiments. Several regiments wear a castle and key in memory of services at Gibraltar, others have a tiger for services in India and still more a sphinx for Egyptian campaigns. The most general of all badges—though not the most generally worn—is the "stripped" rose. Nearly all corps possess several badges, which are combined in various ways.

The special interest of these badges is that they are peculiar to the British army. Although a badge of the branch (infantry, cavalry, &c.) is common, no other army wears distinctive regimental devices.

A few details of general practice may be added. All cavalry wear a pouch-belt over the left shoulder. The crimson infantry sash is worn by officers round the waist and by sergeants across the body and over the right shoulder. All officers and sergeants who do not wear the sash, to whatever branch they belong, have a pouch-belt, the pattern of course varying. Ankle boots (and sometimes leggings with them) are worn by dismounted men. Swords, except in the case of Scottish infantry, are worn suspended by slings from a belt (the belt in infantry, rifles and hussars being worn under the tunic or sash). On foreign service the uniform is varied according to circumstances, the most usual change being from the full dress head-dress to the white helmet.

The full dress of the territorial army varies greatly, sometimes conforming exactly to the uniform of the corresponding regular units, sometimes keeping to its original "Rifle" character in grey or green of various shades. The latter conform to the rules of the dress of "Rifles" (*e.g* wear pouch-belts instead of sashes), and the former, though in many cases the silver lace and ornaments of the old volunteer force are retained, to those for the regulars, the distinguishing mark in all cases being the letter "T" on the shoulder or collar. The yeomanry cavalry is variously attired, some old regiments possessing rich old-fashioned hussar uniforms, others of recent formation wearing "service" colours only. Some regiments are dressed as dragoons, but the great majority are hussars. The infantry and artillery of the Honourable Artillery Company of London are dressed somewhat after the fashion of the Grenadier Guards and the Royal Horse Artillery.

Undress Uniforms.—In "walking-out" order most troops wear the tunic, Household Cavalry and Dragoons with waist-belts and sword-slings, lancers with girdle (R.F.A. and Army Service Corps also wear girdles in walking-out order), infantry and all other branches except hussars with waist-belt. Sergeants of infantry wear the sash and side-arms, the latter privilege being accorded also to corporals of the guards regiments. White gloves are worn by sergeants. Since the general introduction of khaki service dress, undress uniforms of red, blue, &c., have mostly disappeared, but the blue serge "jumper" is still retained. Officers of infantry (except in hussars and Rifles) have undress frock coats of various patterns. With these the "Sam Browne" equipment brown leather waist-belt, frog and the sash and slings are worn, but with the jumper and service frock, braces. Field officers have an edging of braid on the peak of the undress caps, staff and general officers an oak-leaf design.

Service Dress.—This, since the conclusion of the Boer War, is universally khaki serge, of shooting-coat pattern, with a spinal pleat and four large pockets; all buttons and badges are in bronze. It has a double collar. A peaked cap, breeches or trousers, and puttees of the same colour are worn with it. The universal pattern greatcoat and macintosh are also khaki coloured. The guards and staff officers, however, wear a light grey overcoat.

Mess Dress, for officers, after undergoing various modifications, now almost universally consists of a jacket with roll collar, waistcoat, and overalls and patent leather Wellington boots, the colours following in the main those of the full dress.

It remains to mention a few of the many regimental distinctions, trifling in themselves yet of the greatest importance as fostering regimental pride and as recalling specially gallant services in the old wars. The officers of the 7th Hussars and the Oxfordshire and Buckinghamshire Light Infantry wear linen collars with their undress uniforms. The Royal Welsh Fusiliers have a bow of black velvet (called a "flash," this being an obsolete slang word for "wig") sewn to the back of the collar—a survival of the old-fashioned method of tying the hair in a club queue. The officers of certain regiments, in memory of severe losses, wear a black line in their gold lace. To commemorate Culloden the sergeants of the Somersetshire Light Infantry wear their sashes over the left shoulder as officers used to do. Until after the South African War the only fusilier regiment that wore plumed busbies was the Northumberland Fusiliers; now, however, all fusiliers wear a hackle (in the order of regiments shown in the table: red and white; white; primrose; white; white; grey; green; white and green; blue and green). The (28th) Gloucestershire regiment wears two badges on the helmet, to commemorate its having fought facing both ways, ranks back to back, at Alexandria in 1801.

Indian Native Army.—The uniforms of the Indian army vary infinitely in details, owing to the different methods of tying the turban, &c., practised by different castes and tribes, and to the strictly regimental system of clothing and equipping the soldier. But the infantry, except the Gurkha Rifles, have tunics of similar pattern, viz. long skirted, without collars, and (if scarlet) with round cuffs, flaps and broad edgings on the front of the tunic of the facings colour. The trousers are dark blue and wide, and spats are worn with them (Plate III., line 3, No. 4). Gurkhas (Plate III., line 3, No. 5) are dressed as Rifles, except that their head-dress is a round cap. The pattern of cavalry uniform, which is generally followed whatever the colours and regimental distinctions, is shown on Plate III., line 3, No. 3.

In the main the dress of the native cavalry is dark blue. Five of the regiments wear red, the three Madras corps French grey, the Hyderabad and one other green, and only three drab. One regiment, the 1st, wears a yellow uniform, being perhaps the only one so clothed in the world.

Native artillery units wear blue with red facings, native engineer units, red with blue facings. The Queen's Own Corps of Guides wears drab with red facings.

The greater part of the infantry wears, in full dress, scarlet, the various facings following no discoverable system, although certain groups of regiments have a regular colour scheme.

A large number of regiments are clothed in drab, and there are Gurkha and other rifles in green; the remarkable Baluchi uniforms (green and drab with baggy red trousers) are unique in the British Empire.

The regiments of the *Australian Commonwealth*, with certain exceptions, wear khaki or drab with white facings and emu plume in the cavalry and green facings in the infantry. The same principle is carried out in other services, the intelligence corps having pale blue, the signal corps royal purple, the medical chocolate and the veterinary maroon facings. The artillery, engineers and army service corps are dressed as the corresponding branches of the home army. All the *Canadian* forces are uniformed very similarly to the British army. The 6th Dragoon Guards and the 13th Hussars are the models for the cavalry, and line, rifle, highland and fusilier uniforms are all represented, the dark rifle uniform predominating. In *South Africa*, as in Australia, khaki has become almost universal.

FRANCE

The Revolutionary simplification of the varied uniforms of the *Ancien Régime* has endured to the present day. Even in the various waves of flamboyant military fashions they have remained simple in the sense that all troops of an arm or branch were dressed practically alike, with none of the regimental differences that England, deferring to tradition, and Germany, systematizing the *ordre de bataille* to the last detail, preserved and introduced.

The line infantry wears a single-breasted blue tunic with red collar, a small red flap on the cuff, red epaulettes and gold buttons. The number of the regiment appears on a blue collar patch. The cap is a madder-red képi, with blue band, brass grenade, tricolour cockade and a ball. The trousers are loose, madder-red, and worn either with shoes and gaiters or with high ankle boots. The men usually march in the blue double-breasted greatcoat, under which is worn the plain *veste* (Plate III., line 2, No. 1). With this is worn a képi without ornaments and having the number in front. The officers wear a tunic of a different blue, almost black; otherwise, except for rank badges, it is similar to the men's; epaulettes and braid, gold. The officers' full dress képi has a golden ball and the trousers have a black stripe (Plate III., line 1, No. 1).

The chasseur battalions (Plate III., line 2, No. 2) wear the same pattern of tunic as the line, but the collar and cuffs are self-coloured, the epaulettes green, the trousers grey-blue with yellow piping, képi dark blue with yellow edgings and green ball, buttons, &c., silver. Chasseur officers are dressed as the men (with the usual officer's blue-black tunic), but have a drooping green plume. The Alpine battalions wear a plain dark blue jumper and soft cap (*béret*) or tam-o'-shanter. Under the jumper, which is usually half-open, they wear a light blue shawl round the waist. The trousers are wide, dark blue knickerbockers, and puttees are worn with them.

The Zouaves (Plate III., line 1, No. 8) wear dark blue red-trimmed jackets and waistcoats, with a light blue cummerbund, baggy red trousers with blue piping and dark blue or white spats. The head-dress is a red tasselled cap (*chéchia*). The "false pockets" round which the braid circles on the front of the jacket are red for the 1st, white for the 2nd, yellow for the 3rd and blue for the 4th Zouaves. Zouave officers have the ordinary officer's tunic, with blue-black collar and gold ornaments, but wear it unbuttoned (showing a red cummerbund) and without epaulettes. The cuff is pointed and slit almost to the elbow, the edges of the slit being gold laced according to rank and having a scarlet lining. Only the service képi is worn. The red trousers have the usual black stripe, and are cut very wide.

The Turcos are dressed similarly to the Zouaves, but with light blue jackets and waistcoats, light blue or white trousers, red cummerbund and yellow braid; the four regiments are distinguished among themselves in the same way as the four Zouave units. Their officers have a light blue tunic with yellow collar, Zouave cuff, red trousers with light blue stripe; képi red, with light blue band.

The Foreign Legion is dressed as line infantry, with certain minor distinctions. The colonial (formerly marine) infantry wears a double-breasted tunic with gold buttons, blue grey trousers and dark blue képi with red piping, plain collar and cuffs. The full dress cap badge is an anchor.

Cavalry.—Cuirassiers (Plate III., line 1, No. 3) wear dark blue tunics with red collars and cuff-flaps, silver ornaments and steel cuirasses, steel helmet with brass ornaments, black horsehair tail, red "shaving-brush" at the front of this tail and another shaving-brush, of colour varying with the squadron, &c., on the left side of the helmet. The trousers are red (officers with dark blue stripes, men with blue piping). The number is borne on a blue collar patch. The officers wear silver, the men red, epaulettes. Undress cap as infantry, silver-laced for officers.

Dragoons wear blue tunics (the black-braided "dolman," shown on Plate III., line 1, No. 6, is gradually passing out of the service) with white collars and cuff-flaps, silver buttons, &c., helmet as for cuirassiers, but without the "shaving-brush" at the front of the horsehair tail, trousers red with dark blue stripe. The men wear shoulder-cords instead of epaulettes, and the officers only wear their silver epaulettes on ceremonial duties. The number appears on a blue collar patch. Undress cap as for cuirassiers.

Chasseurs à cheval (Plate III., line 1, No. 7) wear a light blue tunic or dolman (the latter black-braided) with silver buttons, red collars and cuff-flaps. The trousers are red with light blue piping (two broad and one narrow light blue stripes between for officers). The full dress head-dress is a light blue shako, with dark green plume in full dress, coloured ball in other orders. The badge on the shako is a brass bugle. The képi is red with light blue band and piping (silver braid for officers). Number on the collar.

Hussars are dressed as *chasseurs à cheval*, but with white braiding on the dolman instead of black, and self-coloured collar. The badge on the shako is an Austrian knot.

The *Chasseurs d' Afrique* wear the half-open *veste*, which is light blue with yellow collar and edgings. The cuff is slit in the Zouave style, the visible lining being yellow. A red cummerbund is worn. The shako is almost invariably worn with a white cover and neck curtain. The trousers are red. Officers as the corresponding chasseur officers in France, but with yellow instead of red collars, &c.

The native Algerian cavalry, the *Spahis*, wear national costume—red jacket with black braiding, red cummerbund, light blue wide trousers, and red morocco boots. Above this they wear a flowing red mantle of thick cloth, and over this mantle the ample white burnous, which covers the head and shoulders. Their French officers wear a red tunic, with self-coloured collar and cuffs, gold buttons and epaulettes, number with crescent in gold on the collar, gold rings on cuff according to rank, trousers as for the hussars, &c., in France.

Artillery.—The rank and file wear blue tunics or dolmans (more usually, however, the *veste*). The dolman has black braiding but a red shoulder-cord, and has red collar, with black patch and number, and red pointed cuffs; buttons, &c., gold. The trousers are dark blue, with two broad and one narrow red stripe. The képi is dark blue, with dark blue band and red ornaments, the full dress cap having a badge, in red, of crossed guns and grenade. Artillery officers wear a black-braided dolman (blue-black) with gold shoulder-cord and Austrian knot. Their képi has the artillery badge in brass, gold braid, and a red plume. Plate III., line 1, No. 5 shows an artillery officer serving on the general staff.

Engineers, dark blue tunic with gold buttons, black red-edged collar patches bearing the number in red, black red-edged flap on cuffs; red epaulettes, trousers and képi as for artillery. Engineer officers have the same tunic as infantry, without facings, and the engineer badge (a cuirass and helmet) on the full dress képi.

Train (Army Service Corps), blue-grey dolman, black-braided, with red collar, black braid on the cuff, and red shoulder-cord; infantry képi, officers as officers of the *chasseurs à cheval* but with (silver) Austrian knot on the sleeve, and red plume. Medical officers have dark blue dolman, red trousers with black stripe, and red collars and cuffs. Their distinctive marks are a whole red képi (with gold braid), a white armlet with the red cross, Aesculapius' staff on the collar, gold-laced shoulder-strap, and a curious pouch-belt which is entirely wrapped in a red cloth cover that buttons over it.

Generals wear in full dress the uniform shown in Plate III., line 1, No. 4, with some distinctions of rank. In undress they wear a dark blue jacket with black braiding, the black Austrian knot on the sleeve carrying the silver stars of rank; trousers red with black stripe; képi red, with a blue band covered by gold, oak leaf lace. General staff officers (see Plate III., line 1, No. 5) wear their regimental uniform, with gold or silver aiguillettes, and on the collar, instead of the regimental number, the thunderbolt badge of the staff, the badge or number being removed also from the képi. Their special distinctions are the armlet and the plume, which vary according to the staff to which the officer belongs.

Badges of Rank.—General officers (on the epaulette or on the Austrian knot), one silver star for general of brigade, two for general of division. Other officers (rings on the cuff and képi band, or strands of braid on the Austrian knot), 1 for sub-lieutenant, 2 for lieutenant, 3 for captain, 4 for commandant, 5 (3 gold and 2 silver) for lieutenant-colonel, 5 for colonel (Plate III., line 1, figs. 1 and 5). Epaulettes: sub-lieutenant, 1 with fringe on right shoulder and 1 scale on left; lieutenant, fringed on left and scale on right shoulder; captain, both fringed; commandant, as sub-lieutenant but with thicker fringe; lieutenant-colonel and colonel, both with thick fringes (in the case of the lieutenant-colonel the body is silver). The vertical braids of the képi also vary according to rank. Field officers as a rule wear in full dress "shaving brush" plumes instead of a ball.

Under-Officers.—The badge is a stripe crossing the lower half of the sleeve diagonally; lance-corporals 1, corporals 2 worsted stripes; sergeants 1, sergeant-majors 2 gold or silver stripes. The "adjutant," who corresponds to the British sergeant-major, has a ring of lace, like an officer's, but narrower.

GERMANY

The infantry of the Prussian Guard wear single-breasted dark Prussian blue tunics with red piping on front and skirt flaps, or gold buttons (1st and 5th Foot Guards and Guard Fusiliers silver), white belts (3rd or "Fusilier" battalions and the Guard Fusiliers black), red collars and cuffs, spiked helmets with, in full dress, white plumes (Guard Fusiliers black). Guard distinctions throughout Germany take the form of "guard-stripes," collar stripes of embroidery, and similar stripes forming false buttonholes round the buttons on the cuff, whether these are of the "Brandenburg" (plain flap with 3 buttons), "French" (slashed flap with 3 buttons), or "Swedish" (round cuff with buttons along the top edge) pattern.

The 1st to 4th Foot Guards have two guard-stripes on the collar, Swedish cuff with stripes, and white, red, yellow and light blue (the ordinary German indicative sequence) shoulder-straps. The Guard Fusiliers have the same uniform with yellow shoulder-straps and plume and belt as stated above. The 1st to 4th Grenadier Guards have double guard-stripes, red "Brandenburg" cuffs with blue flaps and embroidered stripes, shoulder-straps coloured in the same order as the Foot Guards. The 5th Foot Guards and 5th Grenadier Guards (of later formation) wear only a single guard-stripe; these return to white shoulder-straps in the sequence, and both have the blue flap and stripes. Service cap as in the line. For gala wear the 3rd battalion of the 1st Foot Guards, and all battalions of the 1st Grenadier Guards, wear the old mitre cap, once of cloth, but now become rigid and consisting of a metal front plate and a stiff red cap behind it.

The line infantry (other than Bavarians, Saxons, Württembergers, &c.) wear blue tunic with gold buttons, red piping, and red collar. The cuffs, also red, are of the "Brandenburg" pattern, plain round with a small red flap. The shoulder straps bear the number, or cipher. The head-dress is a small black leather helmet with brass Prussian eagle badge and spike. The trousers are dark grey with red piping, the equipment of black leather, the boots of Wellington pattern (the trousers being tucked into them). The greatcoat is grey with shoulder-straps as on tunic and a collar patch of the cuff-flap colour. The service cap is a round cap without peak, dark blue with red band and piping, and two cockades, "national" and "imperial." Exceptions to these rules are: Prussian grenadiers (Nos. 1 to 12) wear black horsehair plumes and white belts, Mecklenburg grenadiers No. 89, Queen's Fusiliers No. 86, Brunswick regiment No. 92, 145th Prussian regiment, black plumes.

The Prussian and quasi-Prussian portions of the army follow a clear rule as to the badge of the army corps. The infantry of each corps has shoulder-straps of uniform colour, and when a regiment changes its corps it changes its shoulder-strap. There is a further distinguishing mark on the cuff-flap:—

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Shoulder-strap	White	White	Red	Red	Yellow	Yellow	Lt. blue	Lt. blue
Cuff-flap piping . . .	White	Nil	White	Nil	White	Nil	White	Nil
	IX.	X.	XI.	XV.	XVI.	XVII.	XVIII.	XX.[1]
Shoulder-strap	White	White	Red	Red	Yellow	Yellow	Lt. blue	Lt. blue
Cuff-flap piping . . .	Yellow	Lt. blue	Yellow	Lt. blue	Yellow	Lt. blue	Yellow	Lt. blue

Except in regiments (such as the guards of the smaller states now numbered in the line of the army, and a few others) where the blue flap and guard-stripes are worn, the greater part of the Prussian regiments wear the historic red flap; but there came a time when the system of indicating regimental variations had to be expanded, and thereafter (from No. 145 inclusive onwards) red and white flaps were given alternately to new regiments, in such a way that there was one "white" regiment in each corps. The I. corps on the Russian frontier, being further reinforced, received one regiment with a yellow (150th) and one with a light blue flap (151st). "Guard" distinctions are worn by the Mecklenburg Grenadiers, No. 89, double guard-stripe on collar, blue cuff-flap with red piping and embroidery; by the 7th Prussian Grenadiers, single guard-stripe and blue flap with embroidery (edged with V. corps colour); by the 1st, 2nd, 3rd and 8th Prussian Grenadiers and by the 80th Fusiliers (formerly the elector of Hesse's bodyguard), single guard-stripe and embroidery on the ordinary red cuff-flap.

The infantry of Hesse-Darmstadt, Württemberg and Baden are similarly uniformed to those of Prussia, the distinctions being easily described. The five "Grand Ducal Hessian" regiments (115–118 and 168) have not the corps (XVIII.) distinction, and have both shoulder-straps and cuff-flap of the same colour (red, white, light blue, yellow and red), the senior regiment, 115 (bodyguard regiment), having double guard-stripe on the collar and guard patches on the flap. A very marked distinction is in the buttons, which are invariably silver, and in the helmet badge, which is a lion rampant. The first three regiments wear a black plume.

Of the Württemberg infantry (XIII. corps), the 119th and 123rd regiments (guards) wear the double guard-stripe, and the "Swedish" cuff, also plumed helmets. The remainder have red shoulder-straps and red cuff-flaps edged with light blue, like the XV. army corps, and the only conspicuous distinction is the royal arms instead of the eagle on the helmet. The 120th also wears the grenadier plume.

Of the Baden regiments, the 109th and 110th (guards and grenadiers) have white plumes and white shoulder-straps, the 109th having the Swedish cuff with patches, the double guard stripe, and silver buttons. The remainder have yellow, red, light blue and green shoulder-straps; there is no edging to the flap. The only distinguishing mark for these is the Baden device (a griffin and a shield) on the helmet.

The Saxon infantry, though assimilated to the Prussian in most respects, is distinguished by various well-marked peculiarities. All shoulder-straps are self-coloured and edged with red. All Saxon regiments have either the "Swedish" or more usually the so-called "German" plain round cuff (red), with two buttons on back seam. The guard and grenadier regiments, 100th and 101st, have black plumes, double guard-stripes and "Swedish" cuffs. The helmet has an eight-pointed brass star. The 108th is a rifle regiment, and wears a green tunic with black red-edged collar and cuffs, dark grey trousers and a shako with black plume looped to one side in the Austrian fashion. The service cap of this corps is green with black piping and band. A peculiarity of the Saxons is that the bottom edges of the tunics are edged with red, as well as the front, and the skirt flaps are very short.

The Bavarian infantry has retained its historic light blue uniform, though in most details the Prussian model has been accepted. Tunic and trousers are light blue with red piping, red cuffs, collars and shoulder-straps. The Bavarian bodyguard regiment has red collar with double guard-stripe, red Swedish cuff with stripes, red shoulder-straps and silver buttons, but no plume. The line has gold buttons and appointments and "Brandenburg" cuffs, flaps edged according to the usual sequence (I. corps white, II. none, III. yellow). The service cap is light blue with red band and piping. Belts black.

Jägers and *Schützen.*—The Jäger uniform is bright green, with red collars, piping and Swedish cuffs (Prussian Guard, double guard-stripe and cuff-stripes), gold buttons, trousers as for line, and a small shako with drooping black plume. The Mecklenburg battalion No. 14, however, has light green collars, cuffs and shoulder-straps edged with red, and double guard-stripe and cuff-stripes. The Guard Schützen battalion (originally a French-speaking corps from Neuchâtel) has black collars and cuffs, edged with red shoulder-straps, double guard-stripe and green red-edged "French" (*i.e.* slashed) cuff-flaps with stripes; and the Jäger battalions of the XII. and XVIII. corps have exactly the same uniform as the Saxon Schützen regiment already mentioned, silver buttons being substituted for gold. The Bavarian Jäger battalions have light blue uniforms with green facings, Swedish cuff, and shako. In all these the field cap is of the colour of the uniform, the band of the colour of the collar, the piping as on the tunic.

Cavalry.—The heavy cavalry consists of the Prussian *Gardes du Corps* and Guard Cuirassiers, the eight line cuirassier regiments, and the Saxon and Bavarian "heavy cavalry." In most of these cuirasses of black or bright iron or of brass (with or without breast decorations), and even cuirass-shaped remnants of the old buff coat, in richly decorated leather, are worn on ceremonial occasions. The head-dress is a helmet of burgonet shape. The ordinary full dress of Prussian cuirassiers is a white long-skirted tunic (called a *Koller*) with white shoulder-straps and collars, edged along the collar and down the front (which is hooked, not buttoned) with broad braid (white, with lines of the regimental colour). The Swedish cuffs, edged with similar braid, are of the regimental colour, of which colour there is also a patch on the collar and piping round the shoulder-straps and back seams. In full dress white trousers, otherwise dark grey trousers with red piping, are worn. The undress tunic is dark blue of the ordinary buttoned pattern, but with braided cuffs, white shoulder-strap and collar-patch and braid as in full dress. The field cap is of the tunic colour with band of the regimental colour. The belts are white. High jack-boots are worn. The guard regiments have double guard-stripe and cuff-stripes.

The Saxon heavy cavalry wears light blue braided cuirassier tunics, with brass scales instead of shoulder-straps, white piping, brass helmets with the Saxon star device, Swedish cuffs cut gauntlet-wise, white or light blue trousers, light blue cap, and white belts. In the 1st Guard regiment the collar and cuffs are white, the braid light blue and white, the helmet ornament a silver lion, the cap-

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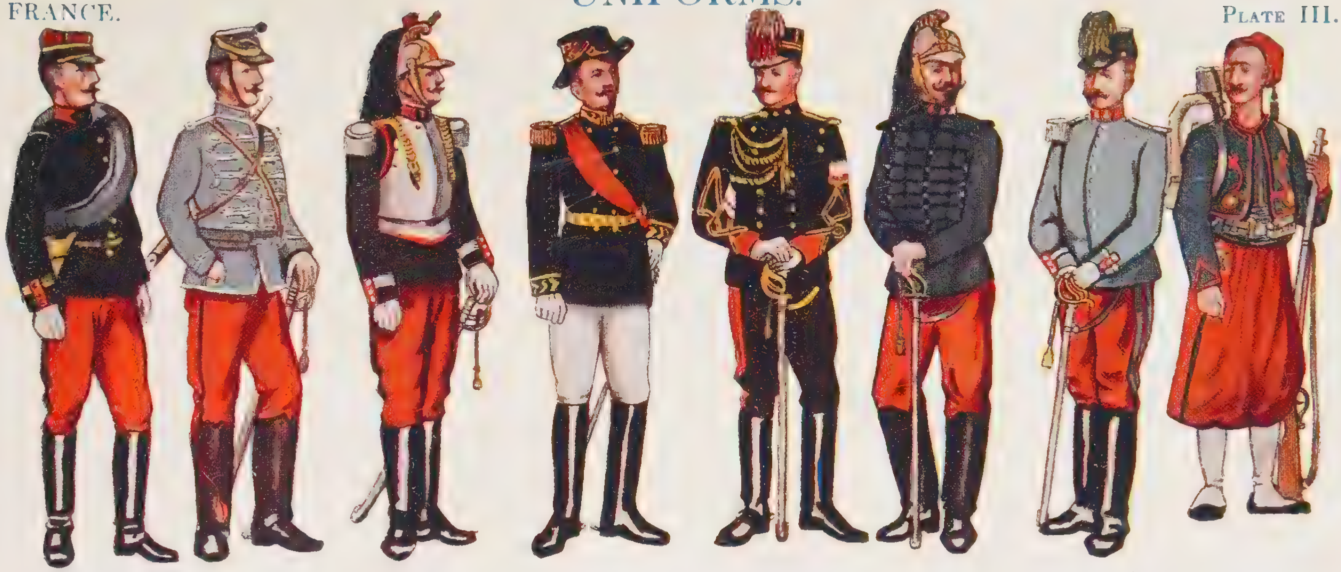
[1] Not yet formed.

UNIFORMS.

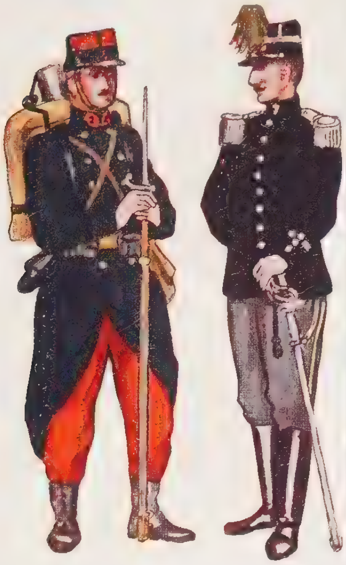
PLATE III.

FRANCE.



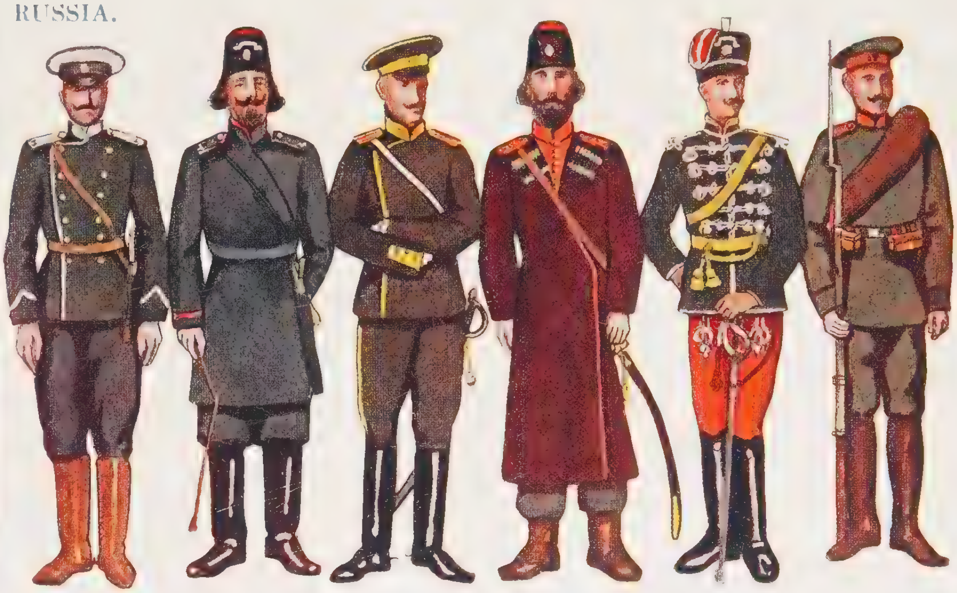
Infantry of the Line Lieutenant. Hussar. Cuirassiers. Captain. General of Brigade Full Dress. Artillery (Lieut. on General Staff). Dragoons. Chasseurs à Cheval Sub-Lieut. 3rd Zouaves.

FRANCE.



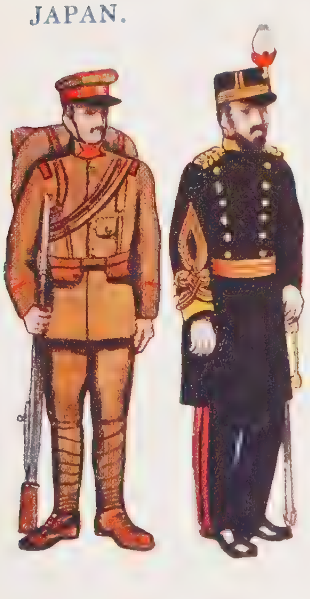
Line Infantry. Marching order. Chasseurs à Pied, Lieutenant.

RUSSIA.



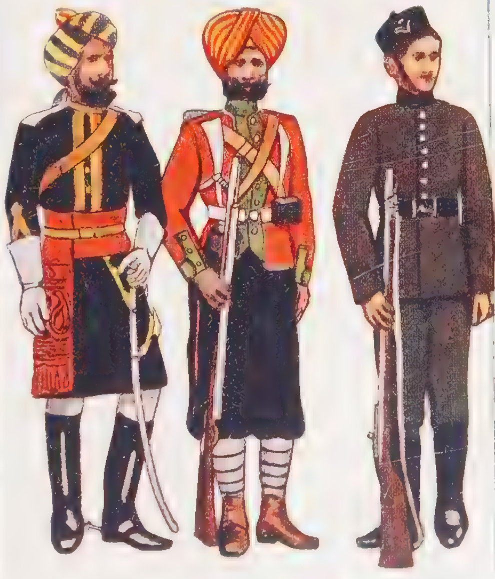
21st Dragoons, Officer. Don Cossack. Lithuanian Guards, Officer. Kuban Cossack. Grodno Hussars, Officer. 17th Infantry of the Line.

JAPAN.



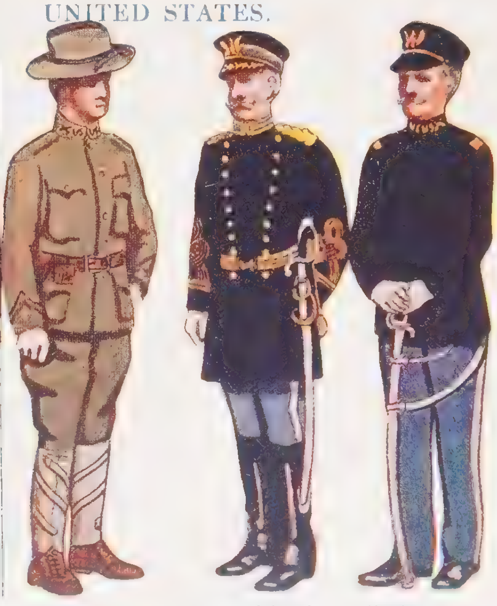
Infantry, Service dress. General Officer, Full dress.

INDIA.



16th Cavalry. Ludhiana Sikhs. nd Gurkhas.

UNITED STATES.



Infantry, Service dress. Lieut. Colonel, Infantry, Full dress. Captain Infantry Undress

band white; in the 2nd Carabineers collar and cuffs black, braid black and white, helmet ornament a brass spike, cap-band black. The Bavarian heavy cavalry is dressed in dragoon fashion—light blue tunic, red facings, light blue collar edging, light blue trousers with red stripe, helmet with white plume. 1st regiment has silver buttons, the 2nd gold.

	Helmet.	Facings.	Blue Tunic Facings.	Buttons.
G. du Corps	Brass with silver eagle (or spike)	Red	Red	Silver
G. Cuirassiers	,,	Blue	Blue	,,
1 ,,	Steel with brass spike	Black	Black	,,
2 ,,	,,	Dark red	Dark red	,,
3 ,,	,,	Light blue	Light blue	,,
4 ,,	,,	Red	Red	,,
5 ,,	,,	Pink	Pink	Gold
6 ,,	Brass with silver spike	Dark blue	Poppy-red	,,
7 ,,	Steel with brass spike	Yellow	Yellow	,,
8 ,,	,,	Green	Green	,,

The line dragoon regiments, other than those of Oldenburg, Mecklenburg, Baden, Württemberg, and Grand Ducal Hesse (Saxony and Bavaria have no dragoons) wear light blue tunics with collars, shoulder-straps (with number), piping and cuffs of the regimental colour. The cuffs are Swedish. The trousers are blue-black without stripe. The helmet is black leather, very similar to the infantry helmet, with black horsehair plume. The regimental distinctions follow a regular scheme thus:—

Regiment.	1	2	3	4	5	6	7	8
Facing . . .	Scarlet	Black	Pink	Yellow	Scarlet	Black	Pink	Yellow
Collar edging	Lt. blue	Lt. blue	Lt. blue	Lt. blue	Lt. blue	Lt. blue	Lt. blue	Lt. blue
Buttons and ornaments.	Gold	Gold	Silver	Silver	Silver	Silver	Gold	Gold
Regiment.	9	10	11	12	13	14	15	16
Facing . . .	White	White	Crimson	Crimson	Scarlet	Black	Pink	Yellow
Collar edging	Lt. blue	Lt. blue	Lt. blue	Lt. blue	White	White	White	White
Buttons and ornaments.	Gold	Silver	Gold	Silver	Gold	Gold	Silver	Silver

The 17th and 18th (Mecklenburg) have respectively scarlet facings and gold buttons, and black facings with silver buttons. They have the double guard-stripe and cuff stripes. The 19th (Oldenburg) have the ordinary uniform with black facings and silver buttons, but white shoulder-straps.

The Baden regiments (20, 21 and 22) have light blue uniforms with scarlet, yellow and black facings, light blue, light blue and red edgings, and silver buttons. They have white plumes instead of black, and the Baden device on the helmet. The Hessian regiments (23 and 24) have dark green tunics; the 23rd have double guard-stripe, cuff stripes and scarlet facings; the 24th the ordinary tunic with white facings, and both silver buttons. The Württembergers (25 and 26) have white and yellow facings respectively, collar edging light blue, buttons gold and silver respectively; the 25th regiment has double guard-stripe and cuff stripes, and white plume. Belts are white throughout, except in the Hessian units, which have black.

The Prussian Guard Dragoons have light blue uniforms and red facings, double guard-stripes, and cuff stripes. Buttons gold in the 1st, silver in the 2nd. White plumes.

The uniforms of the eight Bavarian regiments of *Chevaulegers* resemble those of dragoons. They wear the black dragoon helmet and white plumes, dark green tunics, trousers and undress cap, and white belts. They also have the dragoon cuffs. But they have the double-breasted lancer tunic with front and piping of the regimental colour; crimson 1st and 2nd; pink 3rd and 6th; scarlet 4th and 5th; white 7th and 8th; the first of each pair having gold, the second silver ornaments.

The Lancers (*Ulanen*) wear the usual lancer uniform of czapka, double-breasted tunic with plastron, and girdle. The trousers are dark grey, the plume white. The girdle is of the uniform colour edged with the facings colour. The cuff is the so-called "Polish," a round, slightly pointed cuff with a button (and where appropriate a guard-stripe) in the middle of the pointed portion. The collar is edged with the uniform colour. Regimental distinctions in the line are as shown in table at the top of next column.

Guard Ulans: dark blue tunic with double guard-stripe and cuff stripes, and dark grey trousers; 1st, red facings, and piping, white turnback (piped red), white czapka; 2nd, scarlet facings and czapka; 3rd, yellow facings and czapka.

17th, 18th and 21st (Saxon), light blue tunics and trousers, crimson facings, double guard-stripes and cuff stripes, brass scales, white piping. Czapkas white, crimson, light blue. Undress caps white. 19th and 20th (Württemberg), dark blue uniforms, dark grey trousers, facings and czapkas scarlet in 19th, yellow in 20th. 19th double guard-stripe and cuff stripe. Ornaments silver. 1st and 2nd Bavarian Ulans, dark green tunics and trousers, crimson facings and czapkas, white belts instead of girdles; 1st gold, 2nd silver ornaments.

	1	2	3	4	5	6	7	8
Facings and piping . .	Scarlet	Scarlet	Scarlet	Scarlet	Scarlet	Scarlet	Scarlet	Scarlet
Czapka and ground of scale . . .	White	Scarlet	Yellow	Lt. blue	White	Scarlet	Yellow	Lt. blue
Ornaments .	Gold	Gold	Gold	Gold	Silver	Silver	Silver	Silver
	9	10	11	12	13	14	15	16
Facings and piping . .	White	Crimson	Yellow	Lt.blue*	White	Crimson	Yellow	Lt.blue*
Czapka and ground of scale . . .	White	Crimson	Yellow	Lt. blue	White	Crimson	Yellow	Lt. blue
Ornaments .	Gold	Gold	Gold	Gold	Silver	Silver	Silver	Silver

* These two regiments have white piping.

The Hussars are very richly dressed, many having the slung pelisse. The front cuffs, back seams and collar are braided. The busby is low and slightly conical, the busby-bag hanging over towards the back on the left side. On the front of the busby are various decorations. Round the waist is a white girdle intertwined with the colours of the state to which the regiment belongs. A plain shoulder cord is worn. The trousers are dark grey with lace stripe. The Hessian boots have embroidered top and boss. The five senior regiments preserve the unusual colours indicative of their irregular origin. The remainder are clothed in dark and light blue, or green. All wear a white (gold or silver officers) pouch-belt, white plumes. The undress cap is of the colour of the tunic, with various bands.

	Uniform.	Busby-bag.	Lace and Braid.	Pelisse.
Guard	Scarlet	Scarlet	Gold	Dark blue
1	Black	Red	Silver	Black
2	,,	White	,,	,,
3	Dull vermilion	Vermilion	,,	Dark blue
4	Brown	Yellow	Gold	—
5	Dark red	Dark red	Silver	—
7	Dark blue	Red	Gold	—
8	,,	Light blue	Silver	Dark blue
14	,,	Red	,,	—
15	,,	Yellow	,,	Dark blue
9	Light blue	Light blue	Gold	—
12	,,	White	Silver	Light blue
13	,,	Red	,,	—
16	,,	Yellow	,,	Light blue
6	Dark green	Red	Gold	—
19	,,	Pink	,,	—
11	,,	Red	Silver	—

The 17th Brunswick Hussars, preserving the memory of the Black Brunswickers of the Napoleonic wars, have black uniforms (no pelisse), with gold lace and red busby-bag. The 18th and 19th (Saxon) Hussars have light blue tunics and trousers (no pelisse), with gold and silver lace and red and crimson busby-bags respectively. No information is available as to the 20th Hussars, formed in November 1910.

The *Jägers zu Pferd* (mounted rifles) have a green-grey tunic and trousers of cuirassier cut, with green collars, Swedish cuffs, shoulder-straps, and piping, green-grey cap, brown belts and a black helmet of cuirassier pattern. The buttons are silver. The broad cuirassier braid on collar, front and cuffs is green, with white lines in the 1st, red in the 2nd, yellow 3rd, light blue 4th (the normal sequence), black 5th. The edgings of the shoulder-straps are similarly white, red, &c. The "staff orderlies" wear the same uniform, with certain deviations, in particular yellow and green braid, gold buttons, and white undress cap.

The machine gun detachments wear a grey uniform with red Swedish cuffs (guard-stripes and cuff stripes in the Guard corps), collar, shoulder-strap and piping. The head-dress is the Jäger shako, and the whole uniform is of Jäger type, so much so that the 2nd Guard detachment has the black collar and "French" cuff of the *Gardeschützen*.

The field artillery has the dark blue tunic with red piping, black collar and Swedish cuffs, gold appointments, and dark grey trousers without stripe. The helmet has a ball ornament. The cap is blue with black band. The Guard regiments have double guard-stripes and cuff stripes and a white plume—shoulder-straps, white for 1st, red for 2nd, yellow for 3rd, light blue for 4th regiment. In the field artillery at large the shoulder-straps are of the corps colour.

The Bavarian, two Württemberg, one Baden and two Hessian regiments have white or black (Bavarians red) plumes, otherwise as for a "red" Prussian corps. The Mecklenburg artillery has silver buttons. The Saxon field artillery uniform is altogether different, consisting of green tunics with red collars and Swedish cuffs, gold appointments, red edgings, and black plume (horse artillery have a brass scale). Prussian and Bavarian field artillery have white belts, others black.

The foot artillery, which has white shoulder-straps, is distinguished from the field by the black Brandenburg cuff with plain blue flap (Guard Swedish cuff, guard-stripes, &c.) and by a red trouser piping. The Saxon foot artillery is distinguished from the field by the ball ornament instead of plume, and the "German" cuff. Belts black (Guard and Bavarians white). Bavarian foot artillery as Prussian, but with a spiked helmet and black cuff-flap, red-edged.

The pioneers have the same uniform as artillery, but with silver buttons and appointments. The shoulder-straps are red, the helmet is spiked (Guards, black plume). The cuffs are black, red-edged, Swedish. Saxon pioneers as field artillery, but with "German" cuff. The "communication troops" wear similar uniforms with special badges, some having the Jäger shako. The *Train* (army service corps) has dark blue dragoon uniforms with light blue facings and black plumes; Saxons, however, have light blue with black facings. Medical officers and hospital corps wear blue uniforms with blue collars and cuffs and red edgings; stretcher bearers, &c., blue with magenta facings and silver buttons, &c.

Rank Badges (*a*).—Non-commissioned officers: lance-corporal a button on each side of the collar. Corporals and sergeants gold or silver lace on the collar and cuffs, small patches of the national colours on the collar patches of the greatcoat. Sergeants are distinguished from corporals by a button to the collar. There are numerous minor distinctions on the sword knots, lance pennons, hussar girdles, &c. Sergeant-majors have a narrow ring of lace on the cuff in addition to the broad under-officer's ring; and on the greatcoat patch two small national patches. Aspirant officers wear the uniform of their non-commissioned rank with some of the officer's distinctions. (*b*) Officers: The distinctive mark of the commissioned officer is the shoulder-piece (epaulette or cord). The epaulette is almost always silver and is worn as a "scale," *i.e.* without fringe, by captains and subalterns, with a fine fringe by field officers and with a thick fringe by general officers. The ranks within each class are distinguished by small stars on the circle of the epaulette, lieutenant, major, and major-general, no star; first lieutenant, lieutenant-colonel and lieutenant-general, one star; captain, colonel and general, two stars. A colonel-general has three stars and a field-marshal crossed batons. The number or cipher is also worn by all regimental officers. The body of the epaulette is usually of the same colour as the shoulder-strap of the rank and file. The shoulder cord for captains and subalterns is made up of straight strips of silver lace, that for field officers is of twisted silver cords, that of general officers is composed of two gold cords and one of silver and colours intertwined. In all these, lines of the national colours are interwoven with the silver. Badges, numbers, &c., as on the epaulette. A silver waist-sash (staff officers and adjutants shoulder-sash) is worn by all combatant officers (except hussars, who have girdles). An interesting survival of earlier uniforms is found in the full dress of general officers. The tunic buttons below the waist, and while on the left shoulder there is only a narrow silver cord, on the right the thick cord of gold, silver and coloured silks is extended to form an aiguillette. The aiguillette is also worn on the right shoulder by staff officers and some others. A universal custom, which is also a survival, is for all ranks to wear sword-knots, even with the bayonet.

The new service dress is a loose-fitting "field-grey" uniform, except in *Jägers*, machine-gun detachments and *Jägers zu Pferd*, who wear grey-green field dress.

Austria-Hungary

The infantry uniforms, since the abandonment of the historic white after 1866, have been of a very quiet shade of dark blue, and the facings colours are more varied than those of any other army. The "German," that is Austrian, infantry wears in full dress a dark blue single-breasted tunic, light blue trousers, and a black leather shako with double eagle and a metal ball ornament. The equipment is black. On the shoulders are straps terminating in rolls or "wings," all of the regimental colour, as are the collar and the ("German") cuffs. In marching or service dress the tunic is replaced by a hooked jacket or blouse with plain cuffs, no shoulder-straps, and only collar patches of the regimental colour. The trousers are turned up over or tucked into a high ankle boot. The field cap is of cloth, cylindrical, with flaps buttoning in front. Hungarian infantry wears the same tunic but has a silver or white embroidered device in front of the cuff. The trousers are tight pantaloons, with a yellow piping and "Austrian"—really Hungarian—knots. Officers of infantry have no shoulder cords or straps. The full dress shako and the collar are ornamented with braid or lace according to rank. A yellow waist-sash is worn. Hungarian officers are dressed as Austrian except for the tunic cuff ornament. In other respects both the tunic and the blouse are similar to the men's. Jägers wear a broad-brimmed felt hat with cock's feather plume on the left. The tunic, trousers and cap are green-grey; the buttons gold; cuffs, collar, shoulder ornament and piping in full dress, and collar patch and piping in undress, green. Officers wear the waist-sash and double green stripes on the trousers. All officers in undress wear plain dark grey trousers and dark grey cylindrical cloth cap, both in the line and the Jägers.

	Austrian.		Hungarian.	
Facings.	White or silver buttons, &c.	Gold or brass buttons, &c.	White buttons, &c.	Gold buttons, &c.
Black . . .	58th	14th	38th	26th
Dark brown	17th	55th	78th	68th
Maroon . .	7th	93rd	83rd	12th
Dark red .	18th	1st	53rd	52nd
Amaranth red	95th	90th	—	86th
Bordeaux red	88th	89th	—	—
Cherry red .	77th	73rd	23rd	43rd
Madder red	74th	15th	34th	44th
Crimson . .	81st	84th	82nd	96th
Scarlet . .	80th	45th	9th	37th
Vermilion .	20th	35th	67th	71st
Pink . . .	36th	57th	66th	65th
Rose . . .	97th	13th	6th	5th
White . .	92nd	94th	—	—
Sea green . .	87th	21st	25th	70th
Apple green	54th	9th	79th	85th
Bright green	10th	91st	50th	46th
Grass green .	28th	8th	62nd	61st
Seaweed green	—	102nd	—	—
Grey green .	47th	56th	60th	48th
Pike grey .	49th	30th	69th	76th
Ash grey . .	24th	11th	33rd	51st
Orange . .	42nd	59th	63rd	64th
Imperial yellow . .	22nd	27th	31st	2nd
Sulphur . .	41st	99th	101st	16th
Sky blue . .	8th	4th	19th	32nd
Pale blue . .	75th	40th	29th	72nd
Pearl . . .	98th	100th	—	—

Dragoons wear light blue jackets with collar and cuffs of regimental colour and narrow white or gold shoulder cord, red trousers, black crested helmets (gilded crests for officers), and slung pelisse exactly similar to the jacket except that the collar and cuffs are of black fur. The jacket is not merely an ornament, but is frequently worn, serving as a tunic. The field cap of the rank and file is red, shaped as for infantry, but without peak. Belts brown. The facings are—dark red 1st and 3rd, black 2nd and 6th, grass green 4th and 9th, imperial yellow 5th and 12th, sulphur yellow 7th and 10th, scarlet 8th and 11th, madder red 13th and 14th, white 15th. Silver buttons 1, 2, 4, 5, 6, 7, 11, 13; gold 3, 8, 9, 10, 14, 15.

Hussars wear dark or light blue jackets and pelisses, the former braided, the latter braided and edged with black fur. The trousers are red with gold "Austrian" knots and piping (all hussars are Hungarian) and the boots have the usual hussar braid. The headdress is a shako with black "shaving-brush" plume. Regimental distinctions are as follows:—

	Shako.	Silver.	Gold.		Shako.	Silver.	Gold.
Uniform Dk. blue	White	9th	3rd	Uniform Lt. blue	White	12th	2nd
	Dark blue	13th	1st		Light blue	7th	10th
	Madder red	5th	8th		Madder red	4th	14th
	Ash grey	11th	15th		Ash grey	16th	6th

Lancers (*Uhlans*, who do not carry lances) wear the lancer cap (*czapka*) with black plume looped back, and old ornaments, light blue double-breasted lancer tunics (slung on the shoulder as pelisses) with madder red cuffs and piping—but no "plastron"—black for collar and gold shoulder cord. The jacket is plain, light blue, with breast and skirt pockets and flaps edged red, red collar and cuffs, no shoulder cord. The trousers are red. Regimental distinctions—top of the *czapka*, imperial yellow 1st and 6th, dark green 2nd and 7th, madder 3rd and 8th, white 4th, light blue 5th, cherry 11th, dark blue 12th and 13th. Gold buttons 1st, 2nd, 3rd, 4th, 5th and 12th; silver 6th, 7th, 8th, 11th and 13th.

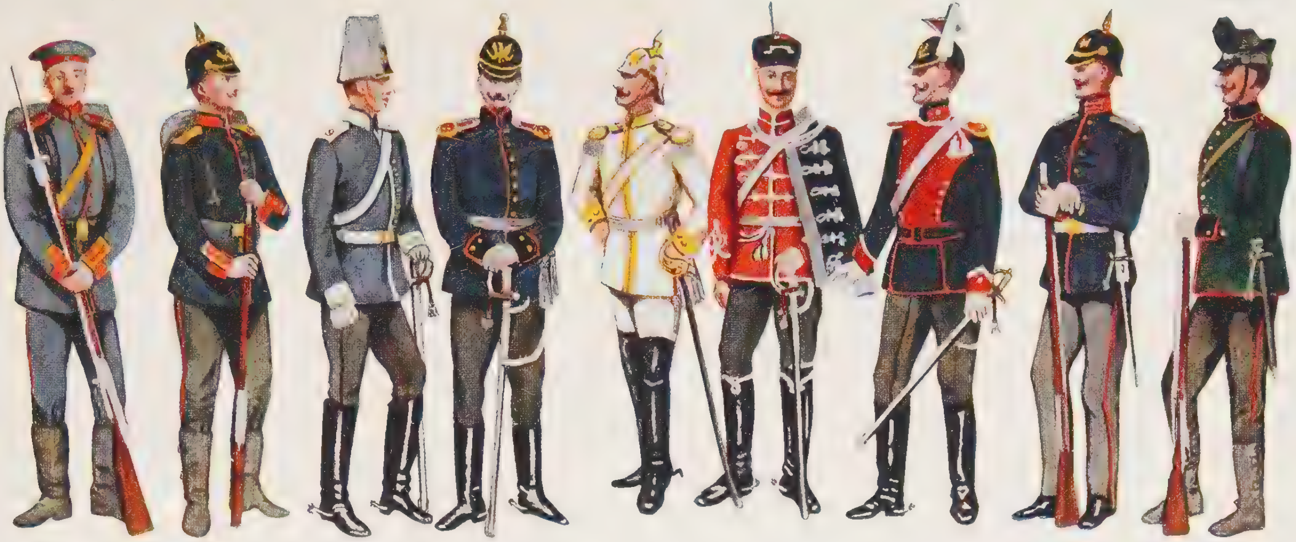
All cavalry officers wear gold or silver pouch-belts; in undress dark grey trousers and cap are worn. Men's undress cap as for dragoons. All cavalry men carry the carbine slung and have brown belts.

Artillery wear maroon tunics, light blue trousers, red collars, cuffs, shoulder-straps and wings, light blue cap, shako with black plume looped back. Fortress artillery have a red stripe in the trousers, technical artillery are dressed as field, but with dark grey trousers and cap and without plume. Buttons gold. On the jacket the whole collar is red. Officers wear pouch-belts as cavalry, and in undress the usual grey trousers and cap.

Engineers have an infantry uniform, but in the Jäger colours, grey and green. Train (A.S.C.) as artillery, but with light blue facings and red trousers with cap. Their shako has no plume.

UNIFORMS.

GERMANY.



Bavaria: Infantry (III. Corps).

Prussia: Infantry (V. Corps).

Prussia: 9th Dragoons.

Prussia: Captain, Field Artillery.

Prussia: Major, 7th Cuirassiers.

Prussia: Officer, 3rd Zieten Hussars.

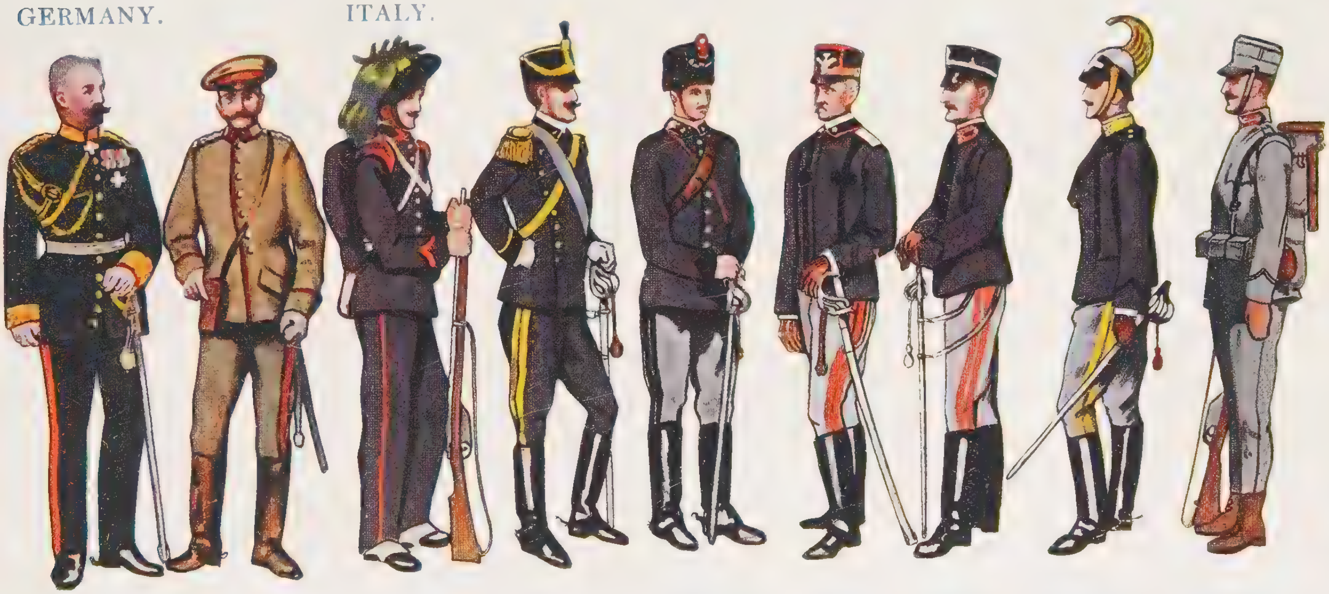
Prussia: 14th Uhlans.

Prussia: 4th Grenadier Guards

Saxony: Jäger

GERMANY.

ITALY.



Prussia: General.

General Staff, Service dress.

Bersaglieri: Marching order.

Field Artillery Officer.

Cavallegieri (12th Regt.).

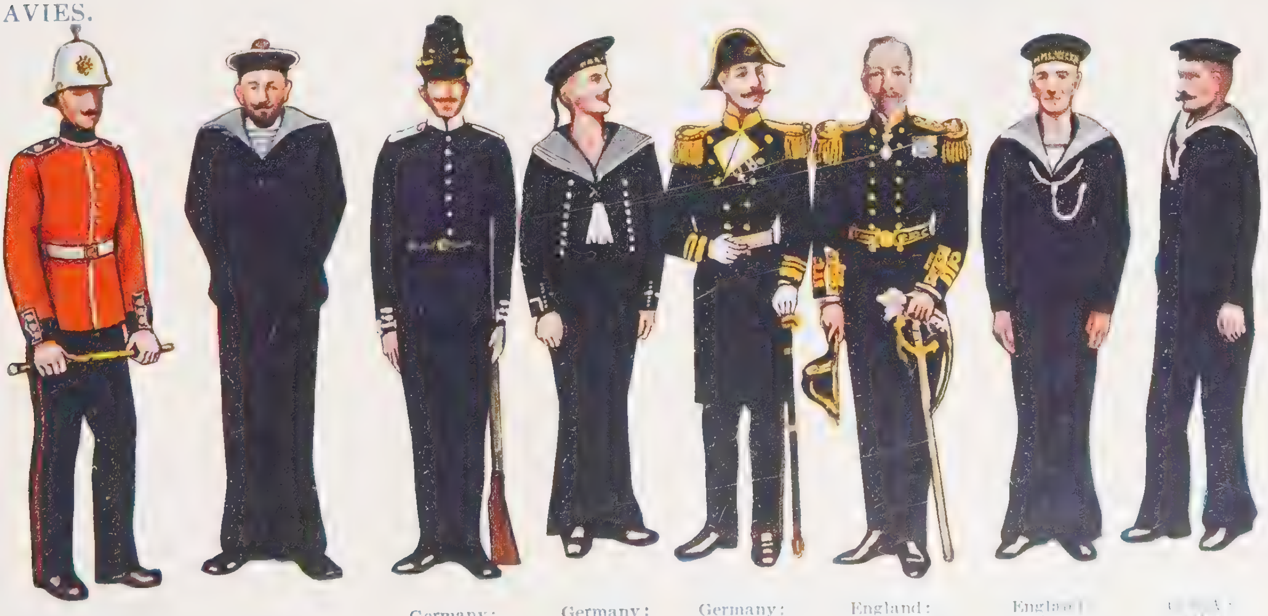
Major-General.

Infantry Officer, Undress (Pistoia Brigade).

Line Cavalry, Officer Undress (4th Genoa Regt.).

Infantry, Service dress (Aosta Brigade).

NAVIES.



England: Marine Light Infantry.

France: Sailor.

Germany: Marine.

Germany: Sailor.

Germany: Vice-Admiral.

England: Vice Admiral.

England: Sailor.

U.S.A.: Sailor.

The staff wears a dark green tunic, short-waisted, double-breasted and piped all round with red. The collar and cuffs are red (cuffs black for general staff), buttons and lace usually gold. The trousers are dark grey, piped red (in some cases with stripes of yellow and red). The general staff wears the waist-sash; the adjutant-general's branch, aides-de-camp, &c., the same sash over the shoulder (as indeed all adjutants wear it in Germany and Austria). The cocked hat is small and has a green feather plume. General officers ordinarily wear dark grey trousers with double red stripe, pearl-grey tunics, cocked hats and waist-sash; their collars and cuffs are red. Inspector-generals of artillery and engineers wear the colours of their arm (brown and Jäger grey). In court dress, however, Austrian generals wear the old white tunic and red, gold-laced trousers; Hungarian generals an elaborate red hussar dress, with a white pelisse.

Rank is shown by stars and lace on the collar. Lance-corporal, corporal and sergeant have 1, 2 and 3 worsted stars; second lieutenant, first lieutenant and captain 1, 2, and 3 gold or silver stars; major, lieutenant-colonel and colonel 1, 2 and 3 stars on a gold-laced collar; major-general, lieutenant field-marshal and general (or *Feldzeugmeister*) 1, 2 or 3 stars on laced collar.

Russia

The figures in Plate III. represent the uniforms of 1905. Since that time the attempt to combine bright colours with the looseness and comfort of service dress has been abandoned, and the troops have received a more handsome full dress and a grey-green field dress. Little information as to the details of the new uniforms has been published. The ordinary infantry uniform was a double-breasted hooked tunic of dark green cloth, dark green trousers and cap (in full dress a round fur cap). With a few exceptions, details of facings, &c., followed well-marked rules. The number of the regiment appeared on the cap, that of the division on the shoulder-strap. The two regiments of the 1st brigade in each division wore red shoulder-straps, the two of the 2nd brigade blue. The 1st regiment had a red cap band and red collar patches, the 2nd blue, the 3rd white and the 4th green. It is not known how far this has been modified of late years. Regiments with royal colonels-in-chief wear ciphers on the shoulder-strap, and some have double guard-stripes on the collar. In winter a heavy grey-brown greatcoat is worn, usually with a loose sheepskin lining and a fur-lined hood. The grenadiers are distinguished by yellow shoulder-straps (with a narrow edging of red, blue, white and yellow, according to the division). The Guards wear closely fitting tunics, with guard-stripes on the collars and cuff-flaps. In the 1st Guard division the shoulder-straps and piping are red and white, in the 2nd red and red, in the 3rd yellow and yellow respectively. The cuff-flaps are red in 1st, and 2nd, yellow in 3rd division. The colour of the collars and cuffs varies according to the order of regiment within the division. The Pavlovsky regiment wears, instead of the fur cap, the old mitre-cap in brass and stiff red cloth.

Rifles wear the universal pattern uniform with plain cap-band and collar and crimson shoulder-straps. The Finland rifles have light blue instead of crimson, and the Guard rifles have double guard-stripes and stripes on the cuff-flap (or Swedish cuff).

Line dragoons wear a dark green silver or gold buttoned tunic, double-breasted, grey-blue trousers and knee boots. The cap, which was peaked, and had a dark green band, was, in 1905, red for the 1st, blue for the 2nd, and white for the 3rd regiment of each division, the same colours appearing on the collar patches, piping and shoulder-straps. The regimental number (or colonel-in-chief's cipher) appears on the shoulder-strap. The fur cap is in shape a truncated cone, the body of the cap being of the colour of the facings and the sides of fur. A few regiments had special distinctions.

The cuirassiers (guards) wear in full dress white cuirassier uniforms with brass helmets and eagles, and in field order dark green tunics and white caps. The trousers are grey-blue with red stripe. The Horse Grenadiers wear dark green lancer tunic with red facings, double guard-stripe and cuff-stripe, red girdles and dark grey trousers with red stripes. They wear epaulettes and the curious grenadier cap mentioned above. The Guard Dragoons are dressed as the Horse Grenadiers, but with the dragoon busby and red shoulder-straps. The Guard Lancers wear a lancer uniform resembling the German, blue with scarlet facings, lancer caps and grey-blue trousers. The top of the czapka is scarlet and yellow for the respective regiments. The Emperor's Hussars wear scarlet tunics and blue trousers, and the Grodno Hussars dark green tunics and crimson trousers (see Plate III., line 2, No. 7), with busby, red busby-bag and white plume; girdles scarlet and blue and green and white, and braid yellow and white respectively.

The artillery tunic, trousers and cap are dark green, the piping and shoulder-strap red. The Guard Artillery has black collar and cuffs, red-edged. The engineers are distinguished from artillery by their having silver buttons and appointments instead of gold.

The greater part of the Cossacks wear a long, loose caftan. This, in the Don, Ural and Astrakhan contingents is dark blue, in the rest, except as mentioned below, dark green. Cossacks wear no spurs, but use a whip. As for the facings, the Don regiments have plain, and the other blue regiments crimson and yellow shoulder-straps respectively, and the green regiments have red, yellow or light blue. The head-dress is a conical lambskin cap, with cloth top, or a blue or green cap with band of the regimental colour. The Caucasus regiments, however, wear a more distinctly national uniform, consisting of a dark brown, collarless caftan, cut away below the throat to show a waistcoat, scarlet for Kuban and blue for Terek regiments (Plate III., line 2, No. 6). The shoulder-straps are of the colour of this waistcoat. The Caucasus regiments always wear the full head-dress and never the field cap. The Guard Cossacks have short tunics (scarlet, light blue and dark red) with guard-stripes on collar and cuffs, and caps of the same colours. These wear spurs besides carrying whips. The Cossacks of the tsar's escort wear a scarlet caftan edged with gold braid, white waistcoat and dark blue trousers. The Cossack artillery wears green uniforms of Cossack cut, with red facings.

Badges of rank are as follows: Non-commissioned officers, one, two or three stripes of braid across the shoulder-strap; sergeant-major, a stripe of gold lace across the shoulder-strap. In and above the rank of corporal, gold lace is worn on the collar and cuffs as in Germany. Officers wear broad cloth (red, blue, &c.) shoulder-straps nearly covered by strips of silver or gold lace; on these appear the number or cipher and stars of rank—subalterns one, two and three, second captains four and senior captains none. In these ranks the cloth of the shoulder-strap shows in one narrow strip through the lace. In the field ranks, the cloth, covered by three bars of lace, shows two strips and the same sequence is followed: lieutenant-colonel, three stars; colonel, none. In general officers' uniforms the lace entirely covers the cloth, and the stars number two for a major-general, three for lieutenant-general and none for a full general.

Italy

The universal colour in full dress and undress coats is a dark, flat blue, faintly tinged with purple. Generals, cavalry and infantry (except *Bersaglieri*) wear blue-grey trousers and silver ornaments; staff officers, artillery and engineers dark blue trousers and gold ornaments.

The coat, whether tunic or frock, has a stand and fall collar, on the corners of which invariably figures a five-pointed silver or white star. The cuffs are slightly pointed, except for cavalry. The full-dress head-dress is a low cloth shako, the undress throughout a képi. Generals wear only the képi. The tunic, double-breasted for officers and single-breasted for rank and file, is cut very short, and has little piping. Officers have plain blue shoulder-straps with stars showing rank. A white collar is worn under the coat collar by all ranks. Officers have a blue frock, with black braid and plain cuffs.

Infantry have silver buttons and (rank and file) red-edged shoulder-straps and shoulder wings, blue-grey trousers with red piping (officers, silver braid), silver device and cockade; the képi (in the rank and file pointed back and front and pressed down at the sides) is similar in colour, &c., to the men's shako. The belts are black. The Grenadier brigade alone has red collars and cuffs, all others are self-coloured (red edge to cuff). The greatcoat is light blue-grey, single-breasted and unadorned except for shoulder wings. White or holland gaiters are worn with the blue uniform. The brigades are distinguished by gorget patches of the brigade colours, upon which the star is worn. Officers wear a shoulder sash of light blue, and in full dress silver epaulettes.

Cavalry.—Line cavalry have light coloured collars, cuffs and shoulder-strap edges, silver buttons, and blue-grey trousers with double back stripe (officers, of the facings colour). Regimental distinctions are given in the table. The full head-dress is a singularly handsome helmet, partly black, partly bright steel, with a tall swan-neck crest (see Plate IV., line 2, fig. 8) and on the front a broad white cross. The undress cap is a képi with piping as in table. On the men's shoulder-straps is a silver grenade. The lancers (*Lanzieri*) have coat and trousers as line cavalry with regimental distinctions given below. On the men's shoulder-straps are crossed lances. The head-dress is a fur cap, adorned with crossed lances and chain in silver. It has also a cockade and a small upright plume. The crossed lances appear also on the képi. The light horse (*Cavallegieri*) have a similar coat and trousers, except that the collar has a flame-shaped patch. Shoulder-strap, full head-dress and képi as for lancers, with a bugle instead of lances. All cavalry have brown bandoliers over the left shoulder.

Artillery, gold buttons, dark blue trousers, with yellow piping (officers, double yellow stripe). Officers' tunics have black yellow-edged collars and cuffs, men's a black yellow-edged collar patch, and yellow edgings on the collars, shoulder-straps and cuff. The badge of the field artillery on shako, képi and men's shoulder-straps is gold crossed guns; that of the horse and mountain, a gold grenade; fortress artillery are dressed practically as field. The shako has gold badge and short upright plume (horse artillery long black plume, looped back on the right side); the képi piping is yellow. Gold epaulettes and light blue sash are worn by officers, and in the horse artillery a pouch-belt as well. *Engineers* have the artillery uniform, but with red piping, &c. instead of yellow, and badge of crossed axes. The departmental corps wear, as a rule, black facings with light blue piping, differing amongst themselves in details.

The famous *Bersaglieri* (light infantry) have the infantry tunic and frock with gold buttons, &c. (officers in full dress, epaulettes), dark blue trousers with crimson stripe. Officers have crimson cuffs, all ranks a blue red-edged collar, with crimson flame patch. The distinctive feature is the dark, wide-brimmed, slouch hat with a large drooping cock's feather plume. The Alpine infantry (*Alpini*) have a black felt hat with silver device and eagle feather, tunic, trousers and képi with green instead of red piping throughout. Officers wear black collar with green flame patch and green cuffs.

	Collar.	Cuff.	Piping.
Line.			
1 Nice	Crimson	Crimson	Crimson
2 Piedmont	Red	Red	Red
3 Savoy	Black, red edged	Black	,,
4 Genoa	Yellow	Yellow	Yellow
Lancers.			
5 Novara	White	Black	As collar
6 Aosta	Red		
7 Milan	Crimson		
8 Montebello	Green		
9 Florence	Orange		
10 Victor Emmanuel II.	Yellow		

	Collar.	Flame patch.	Cuff.	Piping.
Light Horse.				
11 Foggia	Red	Black	Red	Red
12 Saluzzo	Yellow	,,	Black	Yellow
13 Monferrato	Black	Crimson	,,	Crimson
14 Alessandria	,,	Orange	,,	Orange
15 Lodi	Red	Black	,,	Red
16 Lucca	White	,,	,,	White
17 Caserta	Black	Red	Red	Red
18 Piacenza	Green	Black	Black	Green
19 Guides	Lt. blue	White	Lt. blue	White
20 Rome	Black	,,	Black	,,
21 Padua	Crimson	Black	,,	Crimson
22 Catania	Orange	,,	,,	Orange
23 Humbert I.	White	Lt. blue	White	White
24 Vicenza	,,	Red	,,	Red

General officers have a single-breasted tunic with black velvet collar and cuffs laced with silver, red piping, silver shoulder-straps, and silver buttons. Frock, trousers, &c., as shown on Plate IV., line 2, No. 6. Staff officers wear light blue collar and cuffs, dark blue trousers with gold stripe and shako somewhat as for artillery officers. They wear the usual light blue shoulder sash, but over the left, instead of, as in the army at large, over the right shoulder.

The new service dress is blue-grey, regimental distinctions as on the officer's frock and képi in all arms. Infantry equipment is shown on Plate IV., line 2, No. 9. The cavalry head-dress is a round grey helmet.

Rank Badges.—Non-commissioned officers: Red or silver chevrons above the cuff, and small distinctions on the shako. Officers: On the shoulder-strap, 1, 2 and 3 silver stars for subalterns and captains, the same with narrow silver edging round the strap for field officers, 1, 2 or 3 gold stars on a silver shoulder-strap for general officers; on the shako, silver or gold rings round the upper part, on the képi rings round the lower part of the cap, 1, 2 or 3 for company officers, 1 broader ring and 1, 2 or 3 for field officers. On the general's képi there is a red, silver-embroidered band with 1, 2 or 3 rings above.

UNITED STATES

The uniforms, though recent changes have largely deprived them of their character, still in some respects follow the French fashion upon which they were originally modelled. The helmet, worn until 1899, indeed showed no trace of French influence—it was simply a mere showy parade head-dress. The French képi, worn during and after the Civil War, has been abolished and replaced by a cap which, like the full-dress cap now worn, bears some resemblance to the Japanese cap. But the long-skirted blue tunic, the general's "chapeau," the sergeant's and corporal's long pointed chevrons still survive to recall the old uniforms, and one or two of the innovations, the rank badges on the sleeve, are also French.

Infantry Officers.—Full dress: universal pattern tunic (dark blue, double-breasted with thick gold shoulder cord) with light blue, gold-laced collar, light blue trousers with white stripe, badges of rank and branch on sleeve. Universal pattern full-dress peaked cap (stiff blue cloth, gold-edged band, and eagle badge, with light blue band). Undress: universal pattern frock (dark blue, single-breasted, braided black and hooked; across the shoulder, flat loops edged with gold lace and bearing rank badges); shoulder loop light blue; plain collar with U.S. and branch badge in gold; trousers as in full dress. Sword belt under the frock, slings brown leather. Cap, of the same shape as full-dress cap but with plain black braid band. A white undress of similar pattern is worn in hot climates. Service dress (olive drab or light khaki). Coat, single-breasted, four pockets, stand and fall collar, bronze buttons and ornaments. Brown waistbelt and braces, somewhat similar to British "Sam Browne," but with sword slings. Peaked cap, plain olive drab or khaki, with bronze eagle badge. Slouch hat, grey, with gold and black twisted cord.

Evening dress and mess dress: blue, with shoulder cords and rank-marks as in full dress, blue trousers. Greatcoat, universal pattern, khaki with horn buttons; rank-marks in black braid on the sleeve, branch badge in bronze.

Cavalry officers as infantry, but with yellow collar, cap-band and trousers stripes as full dress and branch badge.

Artillery officers as infantry, but with red collar, cap-band and trousers stripes, and branch badge.

Engineer officers as infantry, but branch badge, red ground with white edges on full-dress collar and cap. Full-dress trousers, dark blue with red, white-edged stripe; undress, light blue with red stripe. In full dress engineer officers have the special distinction of wearing red skirt-flaps with white line and gold edge. *Signal Corps*, as infantry, but with branch badge and salmon collar, cap-band, &c. Signal officers, alone in the army, wear a pouch-belt: this is of black leather—crimson leather for the chief of the corps—with gold appointments. *Ordnance Corps*, as infantry, but dark blue red-edged trousers stripes, &c., and branch badge. *Medical*, as infantry, but with magenta stripes, &c., and branch badge.

Generals and Staff Officers.—Major-generals (and with a third star lieutenant-generals), dark blue double-breasted tunic with buttons in threes, and cuffs and collar of black velvet ornamented with oak-leaf gold embroidery, above the cuffs two silver stars; gold epaulettes and aiguillette, wide yellow waist-sash; dark blue trousers with two gold stripes: slings, and waist-belt if worn, crimson leather with gold stripes. "Chapeau" or cocked hat (French pattern) black felt with black feather edging and gold ornament; full-dress cap, universal pattern, with black velvet band, embroidered on band and peak as on full-dress cuffs. Undress: blue frock, double-breasted, with buttons in threes, "stand and fall" collar with U.S. in gold; rank marks on shoulder loops; plain dark blue trousers, universal pattern undress caps with oak-leaves on the peak only. White undress uniform is similar. Brigadier-generals, as major-generals with the following distinctions: one star on the sleeve or shoulder-loop, narrow yellow sash, buttons in pairs, plain black strap instead of crimson waist-belt (with, however, crimson and gold slings). Service dress and overcoats (all general officers) universal pattern: on the slouch hat a gold cord instead of black and gold. Evening and mess dress, universal pattern, with cuffs, collar and epaulettes as in full dress. Certain general officers who are chiefs of departments wear some of the distinctions of their branch; thus the adjutant-general, the quartermaster-general, &c., wear the branch badge below the stars, the chief of engineers the scarlet engineer skirt flap, the chief of artillery a crimson waist-sash instead of yellow. In undress these officers have a ground of their branch colour instead of dark blue on the shoulder loops. *Staff officers* are in the main uniformed in the same way as those of infantry, but wear dark blue trousers (in full dress a gold stripe), black and gold belts and slings, branch badge on sleeve, and full-dress collars, full-dress cap-bands and undress shoulder loops of the branch colour.

Branch and Line Badges.—General staff, a silver star, decorated with eagle device; inspector-general's department, sword and "fasces" crossed in wreath, gold; adjutant-general's department, gold shield with U.S. arms; quartermaster-general's department, sword and key crossed, surmounted by eagle, over a wheel, gold; ordnance, grenade; commissary or subsistence, silver crescent; infantry, gold crossed rifles; cavalry, gold crossed swords; artillery, gold crossed guns; engineers, silver castle; signal corps, crossed flags and torch; medical, winged Aesculapius staff. Aides-de-camp wear a shield like the adjutant-general's but in red, white and blue enamel and surmounted by an eagle; adjutants, quartermasters, commissaries, &c., of the combatant arms wear a shield, sword and key, crescent, &c., under the guns, swords, &c., of the regiment or corps.

Branch and Arm Colours.—Infantry, light blue; cavalry, yellow; artillery, red; engineers, red with white edge; signal corps, salmon with white edge; quartermaster's department, yellow ochre; ordnance, blue with crimson edge; other staffs and departments, light blue; medical, magenta; general staff, dark blue.

Badges of Rank.—Officers: general, lieutenant-general, major-general, brigadier-general, stars 4, 3, 2, and 1 respectively, in all orders of dress. Other officers, in undress, silver on a shoulder loop of coloured cloth according to branch; colonel, spread eagle; lieutenant-colonel, pair of oak-leaf sprigs; major as lieutenant-colonel but in gold; captain, two pairs of bars; 1st lieutenant, one pair of bars; 2nd lieutenant, no badge: in full dress, evening dress and greatcoat, colonel fivefold, lieutenant-colonel fourfold, major threefold, captain twofold, 1st lieutenant single Austrian knot of narrow gold braid, 2nd lieutenant no Austrian knot. Field officers have black leather waist-belt and slings completely covered with gold braid, and also oak-leaf embroidery on the peak of the full-dress cap. Captains and lieutenants have similar belts, but with four gold braids only; in the infantry, cavalry, artillery and engineers the intervening spaces ("lights") are coloured light blue, yellow, &c., while in other cases the black leather is allowed to appear.

Enlisted men are dressed similarly to officers, with the following differences: tunic with dark blue cuffs, collar and shoulder-straps. The collar is edged top and bottom, the shoulder-straps all round and the cuffs along the top edge wth yellow for cavalry, light blue for infantry, &c. The badge of the branch in brass is on the collar. Lines are worn (aiguillette fashion) as an additional decoration; these are of the branch colours. The trousers are light blue, with, in full dress, stripes of branch colours. The white undress, service dress and greatcoat are similar to those for officers, with certain distinctions in detail. The full-dress cap is of the officers' pattern, but the band is dark blue, edged with the branch or arm colour above and below, and the badge is brass in a white metal wreath. The slouch hat has a cord of the branch colours. Rank marks of non-commissioned officers are long, graceful chevrons (inherited from France) pointing upwards, 1, 2 and 3 for lance-corporals, corporals and sergeants, 3 with diamond star, &c., for "first sergeants" and corresponding ranks, 3 with the lower ends connected by bars or arcs of the chevron material for sergeant-majors and staff-sergeants. In full dress these chevrons are of the colour of the branch facings, in service dress of khaki embroidery.

Naval Uniforms.—The full-dress coat of British naval officers is a dark blue double-breasted swallow-tailed coat with gold buttons, lace and epaulettes, a white gold-edged slashed-flap on the sleeve with rings of lace showing rank. Dark blue trousers with gold stripes, and black silk cocked hat. The undress coats are frock coat, which may be worn with epaulettes, and double-breasted jumper, both having plain cuffs with rings of gold lace. The undress cap is a peaked cap with gold badge. Certain petty officers wear blue jumpers, the rest and the sailors wear sailors' dress (Plate IV., line 3, No. 7). White is worn in the tropics, with white pith helmets in the case of officers and broad-brimmed straw hats in that of the sailors. Royal Marine Artillery and Royal Marine Light Infantry are dressed as artillery and infantry of the army, with certain distinctions; they may always be recognized by the badge of a globe within a laurel wreath. (Plate IV., line 3, No. 1.)

Officers' Rank Marks.—(*a*) On the epaulette: Batons in laurel wreath and crown, admiral of the fleet; crown, sword and baton crossed, and 1, 2, 3 stars, rear-admiral, vice-admiral, admiral; anchor and crown, with 0, 1, 2, stars, commander, junior captain, senior captain; anchor and star, senior lieutenant; anchor, junior lieutenant; anchor on fringeless epaulette, sub-lieutenant. (*b*) On the sleeve (in all orders of dress except white, and greatcoat): flag officers, broad gold ring with 1, 2, 3, 4 narrow rings (the uppermost with a curl) for rear-admiral, vice-admiral, &c.; other officers, 1, 2, 2 with narrower ring between, 3 and 4 for sub-lieutenant, junior lieutenant, senior lieutenant, commander and captain. (*c*) Shoulder straps in greatcoat and white undress, blue strap with bars and curl as on sleeve in other orders, except flag officers, who have gold-laced shoulder-strap with rank marks as on epaulette. Non-combatant branches have not the "curl," and between the gold bars or rings there are "lights" or stripes of various colours according to branch. The Royal Naval Reserve officers have similar rank mark, but, instead of bars of plain lace, a thin twist of gold embroidery, and an oval badge surrounding the anchor on the epaulettes.

The uniforms of other navies are very similar to those of the British. The old-fashioned jacket worn over the sailor blouse, and the conspicuous white lapels of the full-dress coat, are the principal peculiarities of the German navy. The Spanish naval officer has red lapels. A very marked peculiarity of the Austrian navy is that the officers, dressed in all other respects similarly to the naval officers of other countries, have the military tunic. The marines, where they exist, conform to the infantry of the respective land forces in most respects; the German marines, however, wear the Jäger shako, and navy-blue uniforms with white collars and cuffs. (Plate IV., line 3, No. 3.)

See Colonel C. Walton, *British Army*; and British regimental histories; Ottenfeld and Teuber, *Oesterreichs Armee*; Richard Knötel, *Uniformen-Kunde*; R. Nevill, *British Military Prints*; Lienhardt and Humbert, *Les Uniformes de l'Armée Française*; British Dress Regulations, 1822, 1834, 1846, 1855–64, 1874, 1883, 1891 and 1904; Lavisse, *Sac au Dos*, and Moritz Ruhl's handbooks of the German, Austrian, Russian, Italian and French army uniforms of the present day. The particulars given of the United States army uniforms have been obtained, by the kind permission of the United States Embassy, from official plates. (C. F. A.)

UNION (known locally as Union Hill and officially as Town of Union), a town of Hudson county, New Jersey, U.S.A., on the Hudson river, adjoining West Hoboken and Weehawken, and opposite New York City. Pop. (1900), 15,187, of whom 5179 were foreign-born; (1910 U.S. census) 21,023. In the foreign element Germans predominate. The town is served by the railways passing through Weehawken and Hoboken. The principal manufactures are silk goods, shirts and malt liquors. In 1905 the factory products were valued at $3,512,451. Originally a part of the township of North Bergen, Union was incorporated as a separated township in 1861, and as a town, under the name Town of Union, in 1864. Town of Union must not be confused with Union township (pop. in 1910, 3419), Union county, incorporated in 1808; Union township (1910, 2756), Bergen county, incorporated in 1852; Union township (1910, 982), Ocean county, incorporated in 1846; and Union township (1910, 930), Hunterdon county, incorporated in 1853. Union township, Camden county, became Gloucester City in 1868, and Union township, Hudson county, became West New York in 1898.

UNION, a town and the county-seat of Union county, South Carolina, U.S.A., about 66 m. N.W. of Columbia. Pop. (1900) 5400, of whom 1701 were negroes; (U.S. census 1910) 5623. Union is served by the Southern and the Union & Glenn Springs railways; the latter connects at Pride, 16 m. distant, with the Seaboard Air Line. The city is situated in the Piedmont region near the foot of the Blue Ridge Mountains. It is the seat of Clifford Seminary for Young Women (opened, 1881; chartered, 1883), and has a Carnegie library. Union is in a rich cotton-growing, farming and fruit-growing region, and deposits of gold, magnetic iron ore, marble and granite are found. The town has several large cotton mills and a large knitting mill. Union was settled about 1755 and was incorporated as a town in 1872.

UNION LEAGUE OF AMERICA, THE, sometimes called the Loyal League, an organization for political purposes of Northern whites, later of Southern blacks, which originated in Ohio in 1862 when the Confederate military successes and political disaffection in the Northern states made the outlook for the North seem doubtful. Within one year it had spread over eighteen Northern states and among the Unionists of the South. The order raised troops, paid their expenses, sent supplies to the field and distributed political literature. At the close of the war it worked for radical reconstruction of the Southern states, punishment of the Southern leaders, confiscation of property and negro suffrage. The Southern Unionists hoped to make it the nucleus of a new political party, but this was frustrated by the admission of the blacks for political purposes, after which the Southern whites generally deserted the League. After the Freedmen's Bureau agents and other Northern whites obtained command of the League in the South it became simply a machine to control the votes of the blacks. The League ceased to be important in the North, though headquarters were in New York City. Each Southern state had its grand council and each county one or more councils. A constitution and an elaborate ritual were adopted, making it an oath-bound secret order, whose members were sworn to support one another on all occasions, to vote in elections only for negroes or Northern men, and to overthrow the Southern "white oligarchy." No ex-Confederate and few Southern Unionists were permitted to join. At each meeting the members were taught from a catechism prepared by Radical members of Congress that they must beware of their white neighbours as their worst enemies, that the Democratic party, to which the Southern whites belonged, had opposed emancipation and was still opposed to any rights for the negro. In order to prevent moral control of the negroes by former masters, the League, by an "exodus order," required all negroes who were still living with their former masters to find other homes. The negroes were taught the equality of men and the right of the negro to his master's property. The votes of blacks, during reconstruction, were controlled by the few white Radical leaders. No negro could safely break away and vote independently. Negroes who voted with the mass of the Southern whites were persecuted, beaten or (as in a few cases) killed. The League died out about 1870, but not before it had succeeded, with the Freedmen's Bureau and other forces, in permanently arraying the blacks and whites into opposing political parties. (W. L. F.)

UNIONTOWN, a borough and the county-seat of Fayette county, Pennsylvania, U.S.A., about 40 m. S. by E. of Pittsburg. Pop. (1900) 7344 (449 foreign-born); (1910) 13,344. Uniontown is served by the Pennsylvania and the Baltimore & Ohio railways. Coal, iron and natural gas are found in the neighbouring region. The manufactures include glass products, iron, steel, enamel, radiators, coke, flour and bricks.

The original village was surveyed and laid out in 1776 on land owned by Henry Beeson, and the borough was incorporated in 1796. From 1827 to 1832 Uniontown was the seat of Madison College, formed from Union Academy (founded 1808); in 1832 the college was merged with Allegheny College, of Meadville, Pa. In 1866 the buildings were turned over to the Soldiers' Orphans' School (now at Jumonville, a suburb), which occupied them until 1875. In the south-eastern part of the county is the district known as Great Meadows; here George Washington built Fort Necessity in 1754, and General Edward Braddock died and was buried here after his defeat by the French and Indians in 1755.

UNITARIANISM, a system of Christian thought and religious observance, based, as opposed to orthodox Trinitarianism, on the unipersonality of the Godhead, *i.e.* that the Godhead exists in the person of the Father alone. Unitarians carry their history up to the Apostolic age, claim for their doctrine a prevalence during the ante-Nicene period, and by help of Arian communities and individual thinkers trace a continuity of their views to the present time. However this may be, it is certain that the Reformation of the 16th century was in every European country attended by an outbreak more or less serious of anti-Trinitarian opinion. Suppressed as a rule in individual cases, this type of doctrine ultimately became the badge of separate religious communities, in Poland (extinct), in Hungary (still flourishing), and at a much later date in England. Along with the fundamental doctrine, certain characteristics have always marked its professors; namely, a large degree of toleration, a minimizing of essentials, a repugnance to formulated creed, an historical study of Scripture. Martin Cellarius (1499–1564) a friend of Luther, is usually regarded as the first literary pioneer (1527) of the movement; the anti-Trinitarian position of Ludwig Haetzer (*q.v.*) was not disclosed till after his execution (1529) for anabaptism. Both by his writings (from 1531) and by his fate (1553) Servetus (*q.v.*) stimulated thought in this direction. The *Dialogues* (1563) of Bernardino Ochino, while defending the Trinity, stated objections and difficulties with a force which captivated many. In his 27th Dialogue Ochino points to Hungary as a possible home of religious liberty. It was in Poland and Hungary that religious communities, definitely anti-Trinitarian, were first formed and tolerated.

Poland.—Scattered expressions of anti-Trinitarian opinion appear here early. At the age of 80, Catherine, wife of Melchior Vogel or Weygel, was burned at Cracow (1539) for apostasy; whether her views embraced more than deism is not clear. The first synod of the Reformed Church was held in 1555; at the second (1556), Gregory Pauli and Peter Gonesius avowed anti-Trinitarian and anabaptist views. The arrival of Blandrata (*q.v.*) in 1558 furnished the party with a leader. In 1565 the diet of Piotrkow excluded anti-Trinitarians from the existing synod; henceforward they held their own synods as the Minor Church. Known by various other names (of which Arian was the most common), at no time in its history did this body adopt for itself any designation save Christian. Originally Arian (though excluding any worship of Christ) and anabaptist, the Minor Church was (by 1588) brought round to his own views by Fausto Sozzini, who had settled in Poland in 1579 (see Socinus). In 1602 James Sienynski established at Raków a college and a printing-press, from which the *Racovian Catechism* was issued in 1605. In 1610 a Catholic reaction began, led by Jesuits. The establishment at Raków was suppressed in 1638, two lads having pelted a crucifix outside the town. Twenty years later the Polish Diet gave anti-Trinitarians the option of conformity or exile. The Minor Church included many Polish magnates, but their adoption of the views of Sozzini, which precluded Christians from magisterial office, rendered them politically powerless. The execution of the decree, hastened by a year, took place in 1660. Some conformed; a large number made their way to Holland (where the Remonstrants admitted them to membership on the basis of the Apostles' Creed); others to the German frontier; a contingent settled in Transylvania, not joining the Unitarian Church, but maintaining a distinct organization at Kolozsvár till 1793. At Amsterdam was published (1665–1669) the *Bibliotheca fratrum polonorum*, embracing the works of Hans Krell, their leading theologian, of Jonas Schlichting, their chief commentator, of Sozzini and of Johann Ludwig Wolzogen; the title-page of this collection, bearing the words *quos Unitarios vocant*, introduced this term to Western Europe.

Transylvania and Hungary.—No distinct trace of anti-Trinitarian opinion precedes the appearance of Blandrata at the Transylvanian court in 1563. His influence was exerted on Francis Dávid (1510–1579), who was successively Catholic, Lutheran, Calvinist and anti-Trinitarian. In 1564 Dávid was elected by the Calvinists as "bishop of the Hungarian churches in Transylvania," and appointed court preacher to John Sigismund, prince of Transylvania. His discussion of the Trinity began (1565) with doubts of the personality of the Holy Ghost. His antagonist in public disputations was the Calvinist leader, Peter Juhász (Melius); his supporter was Blandrata. John Sigismund, adopting his court-preacher's views, issued (1568) an edict of religious liberty at the Torda Diet, which allowed Dávid (retaining his existing title) to transfer his episcopate from the Calvinists to the anti-Trinitarians, Kolozsvár being evacuated by all but his followers. In 1571, John Sigismund was succeeded by Stephen Báthory, a Catholic, and trouble began. Under the influence of John Sommer, rector of the Kolozsvár gymnasium, Dávid (about 1572) abandoned the worship of Christ. The attempted accommodation by Sozzini only precipitated matters; tried as an innovator, Dávid died in prison at Déva (1579). The cultus of Christ became an established usage of the Church; it is recognized in the 1837 edition of the official hymnal, but removed in the edition of 1865. On the other hand, in 1621 a new sect arose, the *Sabbatarii*, with strong Judaic tendencies; though excluded from toleration they maintained an existence till 1848. The term *unitarius* (said to have been introduced by Melius, in discussions of 1569–1571) makes its first documentary appearance in a decree of the Lécsfalva Diet (1600); it was not officially adopted by the Church till 1638. Of the line of twenty-three bishops the most distinguished were George Enyedi (1592–1597), whose *Explicationes* obtained European vogue, and Michael Lombard Szentabrahámi (1737–1758), who rallied the forces of his Church, broken by persecution and deprivation of property, and gave them their existing constitution. His *Summa universae theologiae secundum Unitarios* (1787), Socinian with Arminian modifications, was accepted by Joseph II. as the official manifesto of doctrine, and so remains, though no subscription to it has ever been required. The official title is the Hungarian Unitarian Church, with a membership of over 60,000, most of them in Transylvania, especially among the Szekler population, a few in Hungary; their bishop has a seat in the Hungarian parliament. At Kolozsvár, the seat of the consistory, is the principal college; others are at Torda and at Székely-Keresztúr. Till 1818 the continued existence of this body was unknown to English Unitarians; relations have since become intimate; since 1860 a succession of students have finished their theological education at Manchester College, Oxford; others at the Unitarian Home Missionary College.

England.—Between 1548 (John Assheton) and 1612 we have a thin line of anti-Trinitarians, either executed or saved by recantation. Those burned were George van Parris (1551), Flemish surgeon; Patrick Pakingham (1555), fellmonger; Matthew Hamont (1579), ploughwright; John Lewes (1583); Peter Cole (1587), tanner; Francis Kett (1589), physician and author; Bartholomew Legate (1612), cloth-dealer, last of the Smithfield victims; and the twice-burned fanatic Edward Wightman (1612). In all these cases the virus seems to have come from Holland; the last two executions followed the rash dedication to James I. of the Latin version of the *Racovian Catechism* (1609). The vogue of Socinian views, which for a time affected men like Falkland and Chillingworth, led to the abortive fourth canon of 1640 against Socinian books. The ordinance of 1648 made denial of the Trinity capital, but it was a dead letter, Cromwell intervening in the cases of Paul Best (1590–1657) and John Biddle (1616–1662). In 1650 John Knowles was an Arian lay-preacher at Chester. In 1652–1654 and 1658–1662 Biddle held a Socinian conventicle in London; in addition to his own writings he reprinted (1651) and translated (1652) the *Racovian Catechism*, and the *Life of Socinus* (1653). His disciple Thomas Firmin (1632–1697), mercer and philanthropist, and friend of Tillotson, was weaned to Sabellian views by Stephen Nye (1648–1719), a clergyman. Firmin promoted a remarkable series of controversial tracts (1690–1699).

The term "Unitarian" first emerges in 1682, and appears in the title of the *Brief History* (1687). It was construed in a broad sense to cover all who, with whatever differences, held the unipersonality of the Divine Being. Firmin had later a project of Unitarian societies "within the Church"; the first preacher to describe himself as Unitarian was Thomas Emlyn (1663–1741) who gathered a London congregation in 1705. This was contrary to the Toleration Act of 1689, which excluded all who should preach or write against the Trinity. It is noteworthy that in England the Socinian controversy, initiated by Biddle, preceded the Arian controversy initiated by Samuel Clarke's *Scripture Doctrine* of the Trinity (1712). Arian or semi-Arian views had much vogue during the 18th century, both in the Church and in dissent. The free atmosphere of dissenting academies (colleges) favoured new ideas. The effect of the Salters' Hall conference (1719), called for by the alleged heresy of James Peirce (1673–1726) of Exeter, was to leave dissenting congregations to determine their own orthodoxy; the General Baptists had already (1700) condoned defections from the common doctrine. In 1689 Presbyterians and Independents had coalesced, agreeing to drop both names and to support a common fund. The union in the London fund was ruptured in 1693; in course of time differences in the administration of the two funds led to the attaching of the Presbyterian name to theological liberals, though many of the older Unitarian chapels were Independent foundations, and at least half of the Presbyterian chapels (of 1690–1710) are now in the hands of Congregationalists. Leaders in the advocacy of a purely humanitarian christology came largely from the Independents, *e.g.* Nathaniel Lardner (1684–1768), Caleb Fleming (1698–1779), Joseph Priestley (1733–1804), Thomas Belsham (1750–1829).

The formation of a distinct Unitarian denomination dates from the secession (1773) of Theophilus Lindsey (1723–1808) from the Anglican Church, on the failure of the Feathers petition to parliament (1772) for relief from subscription. Lindsey's secession had been preceded in Ireland by that of William Robertson, D. D. (1705–1783), who has been called "the father of Unitarian nonconformity." It was followed by other clerical secessions, mostly of men who left the ministry, and Lindsey's hope of a Unitarian movement from the Anglican Church was disappointed. By degrees his type of theology superseded Arianism in a considerable number of dissenting congregations. The Toleration Act was amended (1779) by substituting belief in Scripture for belief in the Anglican (doctrinal) articles; in 1813 the penal acts against deniers of the Trinity were repealed. In 1825 the British and Foreign Unitarian Association was formed as an amalgamation of three older societies, for literature (1791), mission work (1806) and civil rights (1818). Attacks were made on properties held by Unitarians, but created prior to 1813. The Wolverhampton Chapel case began in 1817, the more important Hewley Fund case in 1830; both were decided against the Unitarians in 1842. Appeal to parliament resulted in the Dissenters' Chapels Act (1844), which secures that, so far as trusts do not specify doctrines, twenty-five years tenure legitimates existing usage.

The drier Priestley-Belsham type of Unitarianism, bound up with a determinist philosophy, was gradually modified by the influence of Channing (see below), whose works were reprinted in numerous editions and owed a wide circulation to the efforts of Robert Spears (1825–1899). Another American influence, potent in reducing the rigid though limited supernaturalism of Belsham and his successors, was that of Theodore Parker (1810–1860). At home the teaching of James Martineau (1805–1900), resisted at first, was at length powerfully felt, seconded as it was by the influence of John James Tayler (1797–1869) and John Hamilton Thom (1808–1894). The body has produced some remarkable scholars, *e.g.* John Kenrick (1788–1877), James Yates (1789–1871), Samuel Sharpe (1799–1881), but few very popular preachers, though George Harris (1794—1859) is an exception. Its year-book specifies 406 congregations in England and Wales. For the education of its ministry it supports Manchester College at Oxford (which deduces its ancestry from the academy of Richard Frankland, begun 1670), the Unitarian Home Missionary College (founded in Manchester in 1854 by John Relly Beard, D.D., and William Gaskell), and the Presbyterian College, Carmarthen.

English Unitarian periodical literature begins with Priestley's *Theological Repository* (1769–1788), and includes the *Monthly Repository* (1806–1838), The *Christian Reformer* (1834–1863), the *Prospective Review* (1845–1854), the *National Review* (1855–1864), the *Theological Review* (1864–1879), and now the *Hibbert Journal*, one of the enterprises of the Hibbert Trust, founded by Robert Hibbert (1770–1849) and originally designated the Anti-Trinitarian Fund. This came into operation in 1853, awards scholarships and fellowships, supported (1878–1894) an annual lectureship, and has maintained (from 1894) a chair of ecclesiastical history at Manchester College. The general activities of the body are conducted partly by its association (Essex Street, Strand), partly by its (triennial) National Conference, established 1882. It has two weekly papers, the *Inquirer* and the *Christian Life.*

Scotland.—Much has been made of the execution (1697) at Edinburgh of the student Thomas Aikenhead, convicted of blaspheming the Trinity. The works of John Taylor, D.D. (1694–1761) on original sin and atonement had much influence in the east of Scotland, as we learn from Robert Burns; and such men as William Dalrymple, D.D. (1723–1814) and William M'Gill, D.D. (1732–1807), along with other "moderates," were under suspicion of similar heresies. Overt Unitarianism has never had much vogue in Scotland. The only congregation of old foundation is at Edinburgh, founded in 1776 by a secession from one of the "fellowship societies" formed by James Fraser, of Brea (1639–1699). The mission enterprises of Richard Wright (1764–1836) and George Harris (1794–1859) produced results of no great permanence. There are now seven congregations. The Scottish Unitarian Association was founded in 1813, mainly by Thomas Southwood Smith, M.D., the sanitary reformer. The McQuaker Trust was founded (1889) for propagandist purposes.

Ireland.—Controversy respecting the Trinity was excited in Ireland by the prosecution at Dublin (1703) of Thomas Emlyn (see above), resulting in fine and imprisonment, for rejecting the deity of Christ. In 1705 the Belfast Society was founded for theological discussion by Presbyterian ministers in the north, with the result of creating a body of opinion adverse to subscription to the Westminster standards. Toleration of dissent, withheld in Ireland till 1719, was then granted without the requirement of any doctrinal subscription. Next year a movement against subscription was begun in the General Synod of Ulster, culminating (1725) in the placing of the advocates of non-subscription, headed by John Abernethy, D.D., of Antrim, into a presbytery by themselves. This Antrim presbytery was excluded (1726) from jurisdiction, though not from communion. During the next hundred years its members exercised great influence on their brethren of the synod; but the counter-influence of the mission of the Scottish Seceders (from 1742) produced a reaction. The Antrim Presbytery gradually became Arian; the same type of theology affected more or less the Southern Association, known since 1806 as the Synod of Munster. From 1783 ten of the fourteen presbyteries in the General Synod had made subscription optional; the synod's code of 1824 left "soundness in the faith" to be ascertained by subscription or by examination. Against this compromise Henry Cooke, D.D. (1788–1868), directed all his powers, and was ultimately (1829) successful in defeating his Arian opponent, Henry Montgomery, LL.D. (1788–1865). Montgomery led a secession which formed (1830) the Remonstrant Synod, comprising three presbyteries. In 1910 the Antrim Presbytery, Remonstrant Synod and Synod of Munster were united as the General Synod of the non-subscribing Presbyterian Church of Ireland. They have 38 congregations and some mission stations. Till 1889 they maintained two theological chairs in Belfast, where John Scott Porter (1801–1880) was a pioneer in biblical criticism; they now send their students to England for their theological education, though in certain respects their views and practices are more conservative than those of their English brethren.

Irish Unitarian periodical literature began in 1832 with the *Bible Christian*, followed by the *Irish Unitarian Magazine*, the *Christian Unitarian*, the *Disciple* and now the *Non-subscribing Presbyterian*. See generally R. Wallace's *Antitrinitarian Biog.* (1850); G. Bonet-Maury's *Early Sources of Eng. Unit. Christianity*, trans. E. P. Hall (1884); A. Gordon's *Heads of Eng. Unit. Hist.* (1895). (A. Go.*)

United States.—Unitarianism in the United States followed essentially the same development as in England, and passed through the stages of Arminianism, Arianism, anti-tritheism, to rationalism and a modernism based on a large-minded acceptance of the results of the comparative study of all religions. In the early 18th century Arminianism presented itself in New England, and sporadically elsewhere; this tendency was largely accelerated by the reaction from the excesses of the "Great Awakening" under Jonathan Edwards and George Whitefield. Before the War of Independence Arianism showed itself in individual instances, and French influences were widespread in the direction of deism, though they were not organized into any definite utterance by religious bodies.

As early as the middle of the 18th century Harvard College represented the most advanced thought of the time, and a score or more of clergymen in New England were preaching what was essentially Unitarianism. The most prominent of these men was Jonathan Mayhew (1720–1766), pastor of the West Church in Boston from 1747 to 1766. He preached the strict unity of God, the subordinate nature of Christ, and salvation by character. Charles Chauncy (1705–1787), pastor of the First Church from 1727 until his death, the chief opponent of Edwards in the great revival, was both a Unitarian and a Universalist. Ebenezer Gay (1696–1787) of Hingham, Samuel West (1730–1807) of New Bedford, Thomas Barnard (1748–1814) of Newbury, John Prince (1751–1836) and William Bentley (1758–1819) of Salem, Aaron Bancroft (1755–1836) of Worcester, and several others, were Unitarians.

The first official acceptance of the Unitarian faith on the part of a congregation was by King's Chapel in Boston, which settled James Freeman (1759–1853) in 1782, and revised the Prayer Book into a mild Unitarian liturgy, in 1785. The Rev. William Hazlitt (father of the essayist and critic), visiting the United States in 1783–1785, published the fact that there were Unitarians in Philadelphia, Boston, Charleston, Pittsburg, Hallowell, on Cape Cod and elsewhere. Unitarian congregations were organized at Portland and Saco in 1792 by Thomas Oxnard; in 1800 the First Church in Plymouth accepted the more liberal faith. Joseph Priestley came to the United States in 1794, and organized a Unitarian Church at Northumberland, Pennsylvania, the same year, and one at Philadelphia in 1796. His writings had a considerable influence.

Thus from 1725 to 1825 a more tolerant and rational belief was developing in New England, and to some extent elsewhere. The first distinctive manifestation of the change was the inauguration of Henry Ware (1764–1845) as professor of divinity at Harvard College, in 1805. In the same year appeared Unitarian books by John Sherman (1772–1828) and Hosea Ballou (1771–1852), and another in 1810 by Noah Worcester (1758–1837). At the opening of the 19th century, with one exception, all the churches of Boston were occupied by Unitarian preachers, and various periodicals and organizations expressed their opinions. Churches were established in New York, Baltimore, Washington, Charleston and elsewhere during this period.

William Ellery Channing was settled over the Federal Street Congregational Church, Boston, 1803; and in a few years he became the leader of the Unitarian movement. At first mystical rather than rationalistic in his theology, he took part with the "Catholic Christians," as they called themselves, who aimed at bringing Christianity into harmony with the progressive spirit of the time. His essays on *The System of Exclusion and Denunciation in Religion* (1815), and *Objections to Unitarian Christianity Considered* (1819), made him a defender of Unitarianism. His sermon on "Unitarian Christianity," preached at Baltimore in 1819, at the ordination of Jared Sparks, and that at New York in 1821, on "Unitarian Christianity most favourable to Piety," made him its interpreter. The result was a growing division in the Congregational churches, which was emphasized in 1825 by the formation of the American Unitarian Association at Boston. It was organized "to diffuse the knowledge and promote the interests of pure Christianity"; and it published tracts and books, supported poor churches, sent out missionaries into every part of the country, and established new churches in nearly all the states. Essentially non-sectarian, with little missionary zeal, the Unitarian movement has grown slowly; and its influence has been chiefly exercised through general culture and the better literature of the country. Many of its clergymen have been trained in other denominations; but the Harvard Divinity School was distinctly Unitarian from its formation, in 1816, to 1870, when it became an unsectarian department of the university. The Meadville (Pa.) Theological School was founded in 1844; and the Unitarian Theological School at Berkeley, California, in 1904.

Unitarian thought in the United States has passed through three periods. The first, from 1800 to 1835, was formative, mainly influenced by English philosophy, semi-supernatural, imperfectly rationalistic, devoted to philanthropy and practical Christianity. Dr Channing was its distinguished exponent. The second, from 1835 to 1885, profoundly influenced by German idealism, was increasingly rationalistic, though its theology was largely flavoured by mysticism. In 1865 the National Unitarian Conference was organized, and adopted a distinctly Christian platform, affirming that its members were "disciples of the Lord Jesus Christ." The more rationalistic minority thereupon formed the Free Religious Association, "to encourage the scientific study of theology and to increase fellowship in the spirit." The Western Unitarian Association accepted the same position, and based its "fellowship on no dogmatic tests," but affirmed a desire "to establish truth, righteousness and love in the world." This period of controversy, and of vigorous theological development, practically came to an end soon after 1885; and its cessation was assured by the action of the national conference at Saratoga in 1894, when it was affirmed by a nearly unanimous vote: "These churches accept the religion of Jesus, holding, in accordance with his teaching, that practical religion is summed up in love to God and love to man. The conference recognizes the fact that its constituency is Congregational in tradition and polity. Therefore it declares that nothing in this constitution is to be construed as an authoritative test; and we cordially invite to our working fellowship any who, while differing from us in belief, are in general sympathy with our spirit and our practical aims." The leaders of this period were Emerson, with his idealism, and Theodore Parker, with his acceptance of Christianity as absolute religion.

The third period, beginning about 1885, has been one of rationalism, recognition of universal religion, large acceptance of the scientific method and ideas and an ethical attempt to realize the higher affirmations of Christianity. It has been marked by harmony and unity to a degree perhaps found in no other religious body, by steady growth in the number of churches and by a widening fellowship with all other progressive phases of modern religion. This last phase has been shown in the organization of "The International Council of Unitarian and other Liberal Religious Thinkers and Workers," at Boston on the 25th of May 1900, "to open communication with those in all lands who are striving to unite pure religion and perfect liberty, and to increase fellowship and co-operation among them." This council has held biennial sessions in London, Amsterdam, Geneva and Boston. During the period since 1885 the influence of Emerson has become predominant, modified by the more scientific preaching of Minot J. Savage, who has found his guides in Darwin and Spencer.

Beyond its own borders the body has obtained recognition through the public work of such men as Henry Whitney Bellows and Edward Everett Hale, the remarkable influence of James Freeman Clarke and the popular power of Robert Collyer. The number of Unitarian churches in the United States in 1909 was 461, with 541 ministers. The church membership, really nominal, may be estimated at 100,000. The periodicals are *The Christian Register*, weekly, Boston; *Unity*, weekly, Chicago; *The Unitarian*, monthly, New York; *Old and New*, monthly, Des Moines; *Pacific Unitarian*, San Francisco.

See Joseph Henry Allen, *Our Liberal Movement in Theology* (Boston, 1882), and *Sequel to our Liberal Movement* (Boston, 1897); John White Chadwick, *Old and New Unitarian Belief* (Boston, 1894), and specially *William Ellery Channing* (1903); *Unitarianism: its Origin and History, a course of Sixteen Lectures* (Boston, 1895); George Willis Cooke, *Unitarianism in America: a History of its Origin and Development* (Boston, 1902); and *Unitarian Year Book* (Boston). (G. W. C.*)

UNITED BRETHREN IN CHRIST,[1] an American religious sect which originated in the last part of the 18th century under the leadership of Philip William Otterbein (1726–1813), pastor of the Second Reformed Church in Baltimore, and Martin Boehm (1725–1812), a Pennsylvanian Mennonite of Swiss descent. Otterbein and Boehm licensed some of their followers to preach and did a great work, especially through class-meetings of a Wesleyan type;[2] in 1789 they held a formal conference at Baltimore, and in 1800, at a conference near Frederick City, Maryland, the Church was organized under its present name, and Otterbein and Boehm were chosen its first bishops or superintendents. The ecclesiastical polity of the Church is Wesleyan and its theology is Arminian: there is no hard-and-fast rule about baptism. Bishops are elected for four years. The first delegated general conference met at Mount Pleasant, Pennsylvania, in 1815, and adopted a confession of faith, rules of order and a book of discipline, which were revised in 1885–1889, when women were first admitted to ordination, and when the Conservatives, protesting against the new constitution, withdrew and formed the body now commonly known as the United Brethren in Christ "of the Old Constitution."

The Liberal branch had 3732 organizations in 1906 with a total membership of 274,649. This body carries on missions in West Africa (since 1855), Japan, China, the Philippines and Porto Rico. It has a publishing house (1834) and Bonebrake Theological Seminary (1871) at Dayton, Ohio; and supports Otterbein University (1847) at Westerville, O.; Westfield College (1865) at Westfield, Illinois; Leander Clark College (1857) at Toledo, Iowa; York College (1890) at York, Nebraska; Philomath College (1867) at Philomath, Oregon; Lebanon Valley College (1867) at Annville, Pa.; Campbell College (1864) at Holton, Kansas, and Central University (1907) at Indianapolis, Indiana.

The "Old Constitution" body had 572 organizations in 1906 with a total membership of 21,401. It has a publishing house at Huntington, Indiana.

See D. Berger, *History of the Church of the United Brethren* (1897), and his sketch (1894) in vol xii. of the "American Church History Series"; E. L. Shuey, *Handbook of the United Brethren in Christ* (1893); W. J. Shuey, *Year-Book of the United Brethren in Christ* (from 1867); and A. W. Drury, *Life of Philip William Otterbein* (1884).

UNITED FREE CHURCH OF SCOTLAND, a religious organization, representing the union made in 1900 between the Free Church of Scotland (except a dissentient section who separated off and retained the name of Free Church) and the United Presbyterian Church. (See FREE CHURCH OF SCOTLAND and UNITED PRESBYTERIAN CHURCH.)

The first moderator was Dr Rainy (*q.v.*). The Free Church brought into the union 1077 congregations, the United Presbyterians 599; the revenue of the former amounted to £706,546, of the latter to £361,743. The missionaries of both churches joined the union, and the United Church was then equipped with missions in various parts of India, in Manchuria, in Africa (Lovedale, Livingstonia, &c.), in Melanesia and in the West Indies. The formula which was adopted allowed for development of doctrine, the candidate stating that he believes "in the doctrine of this Church, set forth in the Confession of Faith," the Church being thus set above the confession. The Church has three divinity halls, at Glasgow, Edinburgh and Aberdeen, served by seventeen professors and five lecturers.

The minority of the Free Church who had refused to join the union lost no time in testing the legality of the act of the majority in entering it. Their summons, dated the 14th of December 1900, claimed that in uniting with the United Presbyterian Church, which did not hold the principles of the Free Church, the majority had forfeited the right to the property of the Free Church, which must be judged to belong to the minority who remained faithful to the principles of the Free Church and were that Church. In the Scottish courts the case was decided in favour of the union by Lord Low on the 9th of August 1901, and by the second division of the Court of Session on the 4th of July 1902, it being held in both trials that the old Free Church had a right within limits to change its views and to do by its Assembly what had been done. The proceedings before the House of Lords on appeal were protracted by the death of one of the judges, which involved the necessity of a second hearing, and it was not till the 1st of August 1904 that the verdict was pronounced. By a majority of five to two the House of Lords reversed the decision of the Court of Session, allowed the appeal, and found the minority entitled to the funds and property of the Free Church. It was held that the majority of an independent church, adopting new standards of doctrine or ceasing to hold essential or fundamental doctrines of the church, forfeit the right to the property, which remains with the minority holding the church's original doctrine: also that the establishment principle was a fundamental doctrine of the Free Church, and that by entering a union on terms leaving that doctrine an open question, the majority had violated the conditions on which the property of the Free Church was held. On the plea that by the Declaratory Act of 1892 the Free Church had abandoned its doctrinal position, argument was heard, but the House of Lords did not decide.

Few legal decisions have occasioned so great consternation or such serious practical difficulties. At first sight it deprived the Free Church section of the United Church of all its material goods—churches, manses, colleges and missions, even of the provision for the old age of the clergy. It appeared to divert large amounts of church property from the uses for which it had been provided, and to hand it over to a body with which the United Church was deeply out of sympathy and which could have little prospect of making effective use of it. A conference held in September between representatives of the United Free and of the (now distinct) Free Church, in order to come to some working arrangement in view of the decision, found that no basis for such an agreement could be arrived at. Nothing remained but to invoke the intervention of parliament to put an end to an impossible situation. A convocation of ministers and elders of the United Free Church, held on the 15th of December, decided that the union should go on, and resolved to "take every lawful means of appealing to the nation and to parliament to rescue the funds and buildings of the Church for the sacred purposes for which they had been provided." The Free Church could not refuse to consent to this, and in December a commission was appointed, consisting of Lord Elgin, Lord Kinnear and Sir Ralph Anstruther, to inquire into matters connected with the two churches, while the question of interim possession was referred to Sir John Cheyne, as commissioner, for inquiry and action. The commission sat in public, and after hearing evidence on both sides, issued their report in April 1905. They reported that the state of feeling on one side and on the other had made their work difficult. They had concluded however that the Free Church was unable in many respects to carry out the purposes of the trusts, which, under the verdict of the House of Lords, was a condition of their holding the property, and that there was a case for parliamentary interference. They recommended that an executive commission should be set up by act of parliament, in which the whole property of the Free Church, as at the date of the union, should be vested, and which should allocate it to the United Free Church, where the Free Church was unable to carry out the trust purposes. The commission was to entertain suggestions which might be made to them for friendly arrangements.

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[1] The sect is not to be confused with the Moravian Brethren (*q.v.*), whose official name, *Unitas Fratrum*, is commonly rendered in English "United Brethren."

[2] Otterbein was an intimate friend of Francis Asbury and was greatly influenced by him.

The Churches (Scotland) Act, which gave effect to these recommendations, was passed on the 11th of August 1905. It contained (see SCOTLAND, CHURCH OF) a clause (No. 5) providing for the relaxation of subscription in the Established Church, parliament thus interesting itself in the affairs of all Presbyterian churches. The commissioners were those on whose report the act was formed, with the addition of two others. In October 1906 the commission intimated that the Assembly Hall, with the New College Buildings and the High Church, were to be the property of the United Free Church, the Free Church receiving the offices in Edinburgh, and a tenement to be converted into a college, while the library was to be vested in the United Free Church, but open to members of both churches. After having occupied class-rooms in the university for two sessions, and held an assembly (1905) in another hall, the United Free Church in 1906 again occupied in its own right the historic buildings of the Free Church. All the foreign missions and all the continental stations were adjudged to the United Free Church. The allocation of churches and manses was a slow business, but in 1908 over 100 churches had been assigned to the Free Church. Some of the dispossessed United Free Church congregations, most of them in the Highlands, found shelter for a time in the parish churches; but it was early decided that in spite of the objection against the erection of more church buildings in districts where many were now standing empty, 60 new churches and manses should at once be built at a cost of about £150,000. (A. M.*)

UNITED KINGDOM OF GREAT BRITAIN AND IRELAND,[1] the official title, since the 1st of January 1801, of the political unity composed of England and Wales, Scotland and Ireland. "Great Britain" was employed as a formal designation from the time of the union of the kingdoms of England and Scotland in 1707. Although the name (which apparently had its origin in Britannia Major, the name given to the island to distinguish it from Britannia Minor or Brittany) had, in earlier times, been often used both by English and by foreign writers, especially for rhetorical and poetical purposes, it was not till after the accession of James I. that it became a recognized part of the royal style. Its adoption was due to the king himself, who was anxious to give expression to the fact that he was sovereign of the undivided island, and not only of England or Scotland. As early as 1559 the Scottish congregation had formally proposed the union of the two crowns, and the adoption of the name of Great Britain for the common country (Teulet, *Mém. Caille à M. de la Mothe*, Dec. 20). But in England the innovation at first met with great opposition. Various objections, sentimental and practical, were urged against it in parliament; and the judges, when appealed to by the king, declared that the adoption of the title would invalidate all legal processes. At length, on the 20th of October 1604, the king, weary of the discussion, cut the knot by assuming the title by royal proclamation, and in due course the inscription "J. D. G. Mag. Brit. F. et H. Rex" appeared on his coins. In November 1604 we find the king instructing the lords commissioners of the Gunpowder Plot to try and discover if the prisoner was the author of a most "cruel pasquil" against him for assuming the name of Britain.

For further details see *Calendar of State Papers, Domestic Series*; and J. Spedding, *Letters and Life of Lord Bacon*, vol iii. (London, 1861–1874).

England and Wales, Scotland and Ireland are politically united under a parliament (*q.v.*), consisting of the king, the House of Lords[2] and the House of Commons,[3] the prerogatives of the Crown being exercised through responsible ministers. The executive government is carried on under the supervision of the ministers of state (see MINISTRY), the more important of whom are united in the cabinet (*q.v.*). The first minister of the Crown or prime minister (*q.v.*) is appointed by the king, and having made choice of his colleagues, recommends them for appointment. (See the separate articles on the various offices. For the judiciary system, see COURT; APPEAL; &c.)

The table at the foot of this column shows the imperial revenue and expenditure, with the amount of revenue per head of population of the United Kingdom for various years. The financial year now ends on the 31st of March of the year following that quoted. The figures before 1907 did not include the revenue assigned to local purposes. The deficit in 1909 was due to delay in passing the Finance Act.

Year ending March 31st.

	1891.	1896.	1901.	1906.	1910.
	£	£	£	£	£
Funded debt	579,472,082	589,146,878	551,182,153	634,047,429	614,868,547
Terminable annuities	66,550,579	49,183,748	60,154,800	43,459,548	35,876,861
Unfunded debt	36,140,079	9,975,800	78,133,000	65,713,000	62,500,000
Other capital liabilities*	1,317,719	3,979,940	14,464,396	45,770,210	49,218,217
Total gross liabilities of the state	683,480,459	652,286,366	703,934,349	788,990,187	762,463,625
Assets—					
Suez Canal shares	3,532,040†	22,627,000‡	25,806,000‡	31,080,000‡	35,295,000
Other assets	1,740,397	939,354	712,760	2,586,799	4,118,352
Exchequer balances at banks of England and Ireland	6,370,897	8,975,201	5,596,918	10,451,487	2,831,248

* These are in respect of sums borrowed under certain acts. † Nominal value.
‡ Estimated market value on the 31st of March each year.

Year.	Total Revenue.	Total Expenditure.	Proportion of Revenue per head.		
	£	£	£	s.	d.
1861	70,283,674	72,792,059	2	8	10
1871	69,945,220	69,548,539	2	4	5
1881	81,872,354	80,938,990	2	7	1
1891	89,489,112	87,732,855	2	6	2
1901	130,384,684	183,592,264	3	2	10
1902	142,997,999	195,522,213	3	12	11
1903	151,551,698	184,483,708	3	11	6
1904	141,545,597	146,961,136	3	6	2
1905	143,370,404	141,956,497	3	6	4
1906	143,977,575	140,511,955	3	5	11
1907	156,537,690	151,812,094	3	6	5
1908	151,578,295	152,292,395	3	5	0
1909	131,696,456	157,944,611	2	18	5

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[1] See also BRITAIN; BRITISH EMPIRE; ENGLAND; IRELAND; SCOTLAND; WALES; &c.

[2] See PEERAGE.

[3] See REPRESENTATION and PARLIAMENT.

In separate articles throughout this Encyclopaedia the main subjects of interest in connexion with British institutions are fully dealt with; and it is only necessary here to give such details as are needed to supplement those given under the subject-heading. See Agriculture; Navy (also Ship and Ship-Building); Education; English Finance; English History; Civil Service; National Debt; Police; Poor Law; &c. A separate section, however, is devoted to the army, the constitution of which in 1910 is described; the history is given under Army.

National Debt (*q.v.*).—The table on the preceding page shows the position of the national debt at quinquennial intervals during 1891–1910.

Area and Population.—The United Kingdom has an area of 120,651 sq. m., and at the census of 1891 had a population of 37,732,922 and in 1901 of 41,458,721. If the islands in British seas are included, the area is increased to 120,953 sq. m., and the population to 41,609,091. The main divisions are as follows:—

	Area sq. m.	Population.	
		1891.	1901.
England and Wales	58,324	29,002,525	32,527,843
Scotland	29,796	4,025,647	4,472,103
Ireland	32,531	4,704,750	4,458,775
Islands in the British seas	302	147,842	150,370

Vital Statistics.—The following table institutes a comparison between the birth-rates per thousand of the population in the United Kingdom and certain other countries, at intervals (so far as possible) of five years, adding the figures for other years in specific years when there was a marked fluctuation:—

	1881.	1886.	1891.	1896.	1901.	1905,	1906.
Russia in Europe *	47·8 (1882, 50·4)	46·5	48·8	49·7	47·9	—	—
Hungary	42·9	45·6	42·3	40·5	37·8	—	36·0
Austria	37·5 (1882, 38·9)	38·1	38·3	38·0	36·6	33·7	—
Germany	37·0	37·0	37·0	36·3	35·7	33·0	—
Japan	25·6	27·3 (1889, 30·2)	26·7	30·0	32·7	30·6	—
Holland	35·0	34·6	33·7	32·7	32·3	—	30·4
Denmark	32·2	32·4	31·0 (1892, 29·6)	30·5	29·7	—	28·5
Switzerland	29·8	27·8	28·2	28·1	29·1	27·4	—
United Kingdom	32·5	31·5 (1890, 29·2)	30·4	29·0	28·0	—	26·8
England	33·9	32·8 (1890, 30·2)	31·4	29·6	28·5	—	27·1
Scotland	33·7	32·9 (1890, 30·4)	31·2 (1894, 29·9)	30·4	29·5	—	27·9
Ireland	24·5	23·2 (1890, 22·3)	23·1 (1892, 22·5)	23·7	22·7	—	23·6
Norway	30·6	31·2	30·9	30·2	29·6	—	26·5
Sweden	29·1	29·8	28·3	27·2	27·0	—	25·7
Belgium	31·8	29·9	30·0	29·0	29·4	—	25·7
France	24·9	23·9	22·6	22·5	22·0	—	20·6

The number of births in the United Kingdom in 1909 was 1,146,118, giving a rate per thousand of 25·5.

* Not including Finland.

The death-rate is similarly treated:—

	1881.	1886.	1891.	1896.	1901.	1905,	1906.
Denmark	18·3	18·1	20·0	15·7	15·8	—	13·5
Norway	17·0	16·2	17·5	15·1	14·9	—	13·7
Sweden	17·7	16·6	16·8	15·6	16·1	—	14·4
Holland	21·5	21·8	20·7	17·2	17·2	—	14·8
United Kingdom.	18·7	19·2	20·0	16·9	17·1	—	15·6
England	18·9	19·5	20·2	17·1	16·9	—	15·4
Scotland	19·3	18·9	20·7	16·6	17·9	—	16·0
Ireland	17·5	17·8	18·4	16·7	17·8	—	17·0
Belgium	21·2	21·3	21·2	17·5	17·2	—	16·4
Switzerland	22·4	20·7	20·6	17·8	18·0	17·9	—
Germany	25·5	26·2	23·4	20·8	20·7	19·8	—
France	22·0	22·5	22·9	20·0	20·1	—	19·9
Japan	18·7	24·4	21·0	21·4	20·4	22·0	—
Hungary	34·4	31·7	33·1	28·9	25·4	—	24·8
Austria	30·5	29·5	28·1	26·3	24·0	25·0	—
Russia in Europe*.	33·2	31·2	34·6	32·8	32·1	—	—

* Not including Finland.

The deaths in the United Kingdom in 1909 numbered 667,765, the rate per thousand being 14·8.

The number of marriages (*a*) and the proportion of persons married per thousand of the population (*b*) are thus shown:—

Year.	England and Wales.		Scotland.		Ireland.		United Kingdom.	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
1896	242,764	15·7	30,270	14·2	23,055	10·2	296,089	15·0
1901	259,400	15·9	31,387	14·0	22,564	10·2	313,351	15·1
1906	269,734	15·6	33,123	14·0	22,557	10·3	325,414	14·9
1909	260,259	14·6	30,092	12·3	22,769	10·4	313,120	13·9

Emigration.—The following table shows the number of passengers, distinguishing English and Welsh, Scottish and Irish, who left the United Kingdom for extra-European countries in 1895, 1900 and 1905, and the total for 1909, and in certain other years in which the numbers show marked fluctuations:—

Year.	English and Welsh.	Scottish.	Irish.	Total.
1895	112,538	18,294	54,349	185,181
1898	90,679	15,570	34,395	140,644
1900	102,448	20,472	45,905	168,825
1904	175,733	37,445	58,285	271,435
1905	170,408	41,510	50,159	262,077
1906	219,765	53,162	52,210	325,137

In 1909 the total number to British dominions was 163,594 and the total number to other extra-European countries was 125,167.

Occupations.—The following table shows the occupations of the people (excluding children under ten years of age) as distinguished in five great orders, according to the census of 1901:—

	England and Wales.	Scotland.	Ireland.
Professional	804,427	101,061	131,035
Domestic	1,994,197	201,230	219,418
Commercial	1,858,454	245,715	97,889
Agricultural	1,152,495	237,311	876,062
Industrial	7,534,994	1,197,495	639,413

Agriculture.—The following table illustrates broadly the difference in the position of agriculture in Great Britain and in Ireland:—

Percentage to total area of area—	Great Britain.		Ireland.	
	1890.	1909.	1890.	1909.
Cultivated	57·7	56·6	73·1	70·3
Under grain crops	14·1	12·4	7·3	6·1
Under green crops	5·8	5·4	5·8	5·0
Under grasses and other crops	8·5	7·9	5·9	11·2
In permanent pasture	28·2	30·2	53·4	43·1

Minerals and Mining.—The mineral production of the United Kingdom reached a total value in 1890 of £100,802,657 and in 1909 of £119,394,486, with a maximum during that period of £160,605,154 in 1900 and a minimum of £73,024,066 in 1893. These figures include pig-iron produced from foreign ores. About 73 % represents the value of the coal output. The figures for the more important minerals are as follows:—

Description of Minerals.	1900.	1909.	Value, 1909.
	Tons.	Tons.	£
Coal	225,181,300	263,774,312	106,274,900
Iron ore	14,025,208	14,979,979	3,689,777
Clay and shale . . .	14,049,694	14,067,810	1,718,056
Sandstone	5,019,874	4,600,084	1,339,106
Slate	585,859	402,184	1,007,013
Limestone (not chalk) .	11,905,477	11,811,122	1,226,967
Igneous rocks . . .	4,634,301	6,283,297	1,235,046
Oil shale	2,282,221	2,967,057	815,937
Tin ore (dressed) . .	6,800	8,289	617,376
Salt	1,861,347	1,822,744	548,896

Gold ore, manganese ore and uranium ore are produced in small quantities, and the list of minerals worked in the United Kingdom also includes chalk, lead, alum, phosphate of lime, chert and flint, gravel and sand, zinc ore, gypsum, arsenic, copper, barytes, wolfram and strontium sulphate.

Metals were obtained from the ores as follows:—

Description of Metal.	1900.	1909.	
	Quantity.	Quantity.	Value (average market price).
			£
Iron	4,666,942 tons	4,802,163 tons	15,559,253
Tin	4,268 ,,	5,199 ,,	695,546
Lead	24,364 ,,	22,463 ,,	298,945
Zinc	9,066 ,,	3,818 ,,	87,146
Copper . . .	765 ,,	435 ,,	27,162
Gold	14,004 oz.	1,210 oz.	4,400
Silver . . .	190,850 ,,	142,146 ,,	14,030

The total number of persons employed in and about all the mines of the United Kingdom in 1901 was 839,178, and in 1909 1,126,372.

The workers were thus distributed between the three kingdoms and the principality in 1905:—

	Coal Mines, &c.	Metalliferous Mines (*a*).	Quarries (*b*).
England . .	606,206	19,561	60,725
Wales . .	137,124	7,333	17,277
Scotland .	114,294	974	12,187
Ireland . .	749	733	4,464

The total figures given above include (*a*) 550 and (*b*) 166 workers in the Isle of Man; and the figures quoted for production include that of the isle.

Coal.

The production of coal in Great Britain, though marked by fluctuation, has, on the whole, largely increased, and in 1901 the output was 42 % greater than that of 1881. The maximum quantity extracted in any one year between 1890 and 1910 was 267,830,962 tons in 1907, and the minimum 164,325,795 in 1893. The maximum estimated value, however, was £121,652,596 for the 225,181,300 tons raised in 1900; the value in 1907 being £120,527,378.

	1900.	1909.
England.	Tons.	Tons.
Cumberland	2,022,327	2,309,370
Derby	15,243,031	16,869,347
Durham	34,800,719	41,240,612
Gloucester	1,578,386	1,486,526
Lancashire	24,842,208	23,705,387
Leicester	2,106,343	2,661,606
Monmouth	9,818,829	13,204,357
Northumberland	11,514,521	14,013,135
Nottingham	8,626,177	11,106,702
Somerset	1,046,792	1,140,818
Stafford	14,222,743	13,517,101
Warwick	2,957,490	4,447,978
York	28,247,249	35,896,623
Wales.		
Carmarthen	1,333,880	1,950,429
Denbigh	2,447,092	2,556,612
Glamorgan	27,686,758	34,461,631

In the chief coal-producing counties of England and Wales the quantity raised in 1900 and in 1909 will be found in the table at the foot of preceding column.

Thus it appears that of the coal raised in England the county of Durham contributes about 22 %, Yorkshire 17 %, Lancashire 16 %, Stafford and Derbyshire each about 9 %, and Northumberland 7 %; while of the coal raised in Wales 85 % is contributed by the county of Glamorgan; and that the coal production of England and Wales together constitutes, in quantity and value, 85 % of the whole production of the United Kingdom.

The export of coal greatly increased on the whole during the period 1890–1909. The following table shows this; the figures for 1893 are given as the lowest during the period. The tonnage of coke and patent fuel is included in the totals:—

Year.	Tons.	Year.	Tons.
1890	30,442,839	1900	46,098,228
1893	29,031,955	1905	49,359,272
1895	33,101,452	1909	65,694,267

The chief receiving countries are, in order, Germany, France, Italy, Sweden, Spain, Russian Empire, Denmark, Egypt, Holland, Argentina, Norway and Brazil.

Iron.

The annual output of iron ore in the United Kingdom has on the whole decreased since 1882. In that year it reached a maximum of 18,031,957 tons; it then fell off to 13,098,341 tons in 1887, rose in the two years following to nearly 15,000,000, fell to little over 11,000,000 in 1892–1893, rose fairly steadily to 14,461,330 in 1899, stood in 1900 at 14,028,208 tons of a value of £4,224,400, and then showed a further fall and rise, until in 1905 the tonnage was 14,590,703, and the value £3,482,184.

The iron ore raised in the various countries, and in the most productive counties, is here shown:—

	1900.	1909.
	Tons.	Tons.
England	13,072,118	14,176,658
Cumberland [1]	1,103,430	1,246,228
Lancashire [1]	630,361	312,367
Leicester	750,708	514,896
Lincoln	1,924,898	2,037,363
Northampton	1,622,539	2,875,659
Stafford [2]	1,084,797	902,565
York	5,550,677	6,234,589
Wales	7,418	38,043
Scotland [2]	849,031	697,276
Ireland	99,641	68,002

The number of furnaces in blast (fractions showing the proportion of the year furnaces were in blast) was: in England $298\frac{6}{12}$, Wales $19\frac{4}{12}$; Scotland $85\frac{5}{12}$, total $403\frac{3}{12}$. The total number of existing furnaces in 1900 was: in England 456, Wales 42, Scotland 106; total 604; so that 33 % of the number stood unused. In 1905 furnaces in blast numbered: England $244\frac{1}{12}$, Wales $13\frac{8}{12}$, Scotland $87\frac{9}{12}$; total $345\frac{6}{12}$; and those existing: in England 412, Wales 31, Scotland 101; total 544; and the percentage unused was thus 36.

In 1888 the imports of iron ore amounted to 3,562,071 tons, in 1898 to 5,468,396 tons, in 1899 to 7,054,578 tons, in 1900 to 6,297,953 tons, in 1901 to 5,548,888 tons and in 1909 to 6,361,571 tons, of which the bulk was imported from Spain. The amount of pig-iron obtained found its minimum, during the period 1890–1910, of 6,976,990 tons in 1893, and its maximum of 10,183,860 in 1906, and in 1905 the quantity produced from foreign ores (4,847,899 tons) for the first time exceeded that produced from British ores (4,760,187).

Lead.

The quantity of lead ore produced within the United Kingdom has decreased. It is now less than one-half of the output of about 1877, and the value has decreased more than proportionately. In the period 1890–1908 the maximum annual production of metallic lead from British ore was 33,590 tons in 1890, valued at £449,826; the production fluctuated somewhat, but generally fell, to the minimum of 17,704 tons in 1902 (value £198,875). The most productive counties are Flint, Durham and Derby; the ore obtained in the Isle of Man is increased in value by the silver it contains.

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[1] These counties supply the richest ore in the United Kingdom.

[2] In these cases the greater proportion of ore is from mines also producing coal.

Tin.

The annual output of tin ore, which in 1878 amounted to 15,045 tons, valued at £530,737, fell to 12,898 tons in 1881, though the value in that year rose to £697,444. During the years 1882–1892 the average output was over 14,000 tons, and its average value about £770,000, but in 1893 a decline began in the output (not however accompanied closely by a decline in the value), slightly relieved about 1905.

Year.	Tin Ore.	Value.
	Tons.	£
1893	13,689	637,053
1900	6,800	523,604
1905	7,201	574,183
1909	5,193	617,376

Tin ore is obtained almost exclusively in Cornwall.

Copper.

Like others of the less important mining industries, copper mining in the United Kingdom has declined. In 1881 the output of ore amounted to 52,556 tons, in 1891 to 9158 tons, in 1893 to 5576 tons, in 1905 to 7153 tons, valued at £32,696 and yielding 716 tons of metal by smelting. The total tonnage of ore included 5757 tons from England (chiefly from Cornwall) and 1146 from Ireland (Wicklow, &c.). Copper precipitate is taken from water pumped up from old copper mines on Parys Mountain in Anglesey.

Zinc.

Zinc ore is obtained chiefly from mines in Cumberland, Wales and the Isle of Man. In 1881 the output reached 35,527 tons, valued at £110,043; in 1891 the output was only 22,216 tons, but its value was £113,445. In 1897 the quantity was 19,278 tons, and the value £69,134; but in 1898 the price had risen so that the output of 23,552 tons was worth £117,784. In 1900 the output of 24,675 tons was worth £97,606; and in 1905 that of 23,909 tons was worth £139,806.

Gold.

During the period 1890–1905 gold mines were worked continuously in Merionethshire. Notices of the discovery of gold elsewhere (as in the Forest of Dean, Argyllshire and Ireland) have appeared from time to time.

The principal fluctuations in production were as follows:—

Year.	Ore.	Gold.	Value.
	Tons.	Oz.	£
1890	575	206	675
1891	14,117	4,008	13,700
1893	4,489	2,309	8,691
1895	13,266	6,600	18,520
1898	703	395	1,229
1900	20,802	14,004	52,147
1902	29,953	4,181	14,570
1904	23,203	19,655	73,925
1905	15,981	5,797	21,222
1908	—	915	3,311

It should be noted also that from imported cupreous iron pyrites, copper, gold and silver are extracted at some fifteen metal extraction works in Great Britain. From 386,858 tons of burnt ore in 1900 there were obtained 13,925 tons of copper, 1777 oz. of gold and 309,486 oz. of silver; and in 1905 the figures were: ore, 402,863 tons; copper, 14,502 tons; gold, 1850 oz.; silver, 322,291 oz.

Cotton.

Textile Industries.—The most important of the textile industries of Great Britain is cotton manufacture. The quantities of raw cotton imported, exported and retained for consumption for various years during the period 1890–1910 were as follows:—

Year.	Imported.	Exported.	Retained.
	℔	℔	℔
1890	1,793,495,200	214,641,840	1,578,853,360
1893	1,416,780,064	224,621,488	1,192,158,576
1895	1,757,042,672	203,284,592	1,553,758,080
1898	2,128,548,352	203,072,464	1,925,475,888
1900	1,760,206,672	215,747,168	1,544,459,504
1905	2,203,595,520	283,177,888	1,920,417,632
1907	2,386,901,104	330,352,064	2,056,549,040
1909	2,188,761,456	268,633,456	1,920,128,000

During the same period the minimum and maximum amount of raw cotton (in ℔) imported into the United Kingdom from the principal countries whence it is exported was as follows: United States of America (1893), 1,055,855,360; (1898), 1,805,353,424; Egypt (1890), 181,266,176; (1907), 423,052,448; British possessions in the East Indies (1898), 27,349,728; (1890), 238,746,704; (1909), 75,621,168; Brazil (1899), 5,464,592; (1906), 54,362,000; Peru (1891), 6,175,344; (1909), 24,413,648. In 1905 there were imported 7,941,920 ℔ from Chile (only 195,328 in 1909); 6,033,104 ℔ from Canada (this also fluctuates greatly; 1,801,072 in 1909); 1,241,408 ℔ from British West Africa (4,985,232 in 1909); 1,126,720 ℔ from the British West Indies and Guiana (3,022,208 in 1908).

According to the census returns of 1901 there were 546,065 persons employed in cotton factories, 199,920 male and 346,145 female. Of the total number of workpeople, 529,131 were employed in England and Wales, 14,805 in Scotland and 212 in Ireland. In 1907 the total had risen to 576,820 (217,742 males and 359,078 females).

Wool.

The extent of the woollen and worsted manufactures of the United Kingdom is indicated by the following table showing the imports and exports of wool and the quantity retained for use in various years (1890–1905):—

Year.	Imports.	Exports of imported Wool.	Retained.
	℔	℔	℔
1890	633,028,131	340,712,303	292,315,828
1895	775,379,063	404,935,226	370,443,837
1898	699,555,048	283,317,748	416,237,300
1900	558,950,528	196,207,261	362,743,267
1905	620,350,885	277,864,215	342,486,670
1907	764,286,625	313,519,282	450,767,343
1909	808,710,087	390,695,182	418,014,905

During the same period the minimum and maximum amount of wool (in ℔) imported into the United Kingdom was as follows: Australia (1904), 220,483,961; (1895), 417,163,078; New Zealand (1890), 95,632,598; (1909), 176,457,150; British possessions in South Africa (1900), 32,219,369; (1909), 115,896,598; South America (1890), 11,173,692; (1908), 78,938,157; British possessions in the East Indies (1901), 24,069,571; (1909), 56,238,633; France (1890), 10,873,788; (1902), 27,770,790; Turkish Empire (1908), 5,705,671; (1897), 25,727,462.

In the woollen and worsted industries 239,954 persons were employed according to the census of 1901, of whom 99,425 were males and 140,529 females. Of the total number 209,700 were employed in England and Wales, 24,906 in Scotland and 5348 in Ireland.

The numbers of persons employed in the other principal textile industries in 1901 was as follows:—

	England and Wales.	Scotland.	Ireland.	United Kingdom.		Total.
				Males.	Females.	
Flax . .	4,493	23,570	71,464	29,226	70,301	99,527
Hemp, jute, &c. . .	2,750	39,200	639	11,618	30,971	42,589
Silk . .	34,847	2,424	209	11,058	26,422	37,480
Hosiery .	48,374	11,957	611	15,067	45,875	60,942

Commerce.—British commerce received an enormous development after the first quarter of the 19th century. In 1826 the aggregate value of the imports into and exports from the United Kingdom amounted to no more than £88,758,678; while the total rose to £110,559,538 in 1836 and to £205,625,831 in 1846. In 1856 the aggregate of imports and exports had risen to £311,764,507, in 1866 to £534,195,956 and in 1876 to £631,931,305. Thus the commercial transactions of the United Kingdom with foreign states and British colonies increased more than sevenfold in the course of fifty years.

An important fact in connexion with the foreign commerce of the United Kingdom is that there has been a steady increase in imports, but there has been no corresponding steady increase in exports of British produce and manufactures. Many industries, which formerly were mainly in British hands, have been developed on the continent of Europe, in America, and to some extent in the East. The movement began in 1872. Up to that time the exports of British home produce had kept on increasing with the imports, although at a lesser rate, and far inferior in aggregate value; but a change took place in the latter year. While the imports continued their upward course, gradually rising from £354,693,624 in 1872 to £375,154,703 in 1876, the exports of British produce fell from £256,257,347 in 1872 to £200,639,204 in 1876. The decline in exports, regular and steady throughout the period, and with a tendency to become more pronounced every year, affected all the principal articles of British

Country.		1890.	1895.	1900.	1905.	1909.
		£	£	£	£	£
I.—BRITISH POSSESSIONS—						
India and Ceylon	Imports	37,856,598	31,076,761	32,861,217	40,540,341	40,995,633
	Exports	38,254,769	27,519,909	32,885,147	45,796,432	46,617,909
Straits Settlements, Malaysia and Hong Kong	Imports	6,412,865	5,404,887	8,092,057	7,222,215	8,948,582
	Exports	5,766,059	4,077,436	6,162,526	7,162,908	7,455,726
Africa	Imports	11,290,022	12,522,366	9,703,086	14,755,353	13,130,724
	Exports	10,744,904	13,325,089	16,725,092	21,338,292	20,181,408
Canada and Newfoundland	Imports	12,444,489	13,400,570	22,240,325	26,204,205	27,674,340
	Exports	8,272,743	6,594,903	9,659,138	14,267,967	18,750,970
West Indies, Bermudas, Honduras and Guiana	Imports	2,992,472	2,831,343	2,483,648	2,717,318	2,969,772
	Exports	4,262,669	3,230,189	2,954,477	3,324,665	3,777,244
Australia	Imports	20,992,185	24,954,779	23,800,820	26,968,977	32,655,709
	Exports	21,750,705	15,867,979	23,545,565	19,476,463	27,207,430
New Zealand	Imports	8,347,430	8,383,058	11,615,881	13,391,222	17,730,556
	Exports	3,705,428	3,443,688	5,899,292	6,994,806	8,081,422
Other	Imports	1,720,583	1,952,431	2,287,537	3,731,132	2,800,939
	Exports	3,826,012	3,095,184	4,252,072	4,351,367	4,246,362
II. FOREIGN COUNTRIES—						
France	Imports	44,828,148	47,470,583	53,618,656	53,072,900	50,690,785
	Exports	24,710,803	20,324,998	25,877,453	23,232,663	31,515,320
Germany	Imports	26,073,331	26,992,559	31,181,667	35,799,758	40,115,450
	Exports	30,516,281	32,736,651	38,542,790	42,742,300	47,168,852
Belgium	Imports	17,383,776	17,545,169	23,502,603	27,751,288	29,217,560
	Exports	13,594,966	11,934,653	14,846,307	14,818,923	19,284,791
Holland	Imports	25,900,924	28,419,944	31,381,023	35,481,059	37,371,702
	Exports	16,445,992	11,272,258	14,931,090	14,516,887	16,303,884
Denmark, Faeroe, Iceland, Greenland	Imports	7,753,389	9,799,328	13,187,757	15,606,991	19,427,483
	Exports	2,928,006	3,135,122	4,724,121	4,609,671	5,705,415
Norway	Imports	—	3,831,727	5,756,018	5,954,870	6,574,319
	Exports	—	2,532,050	3,910,982	3,712,532	3,835,436
Sweden	Imports	—	8,784,256	10,635,060	9,827,993	9,245,303
	Exports	—	4,036,729	6,495,223	6,016,332	7,114,071
Austria-Hungary	Imports	1,728,337	1,221,783	1,375,245	1,488,604	1,208,499
	Exports	1,694,318	2,149,552	3,157,716	2,603,223	4,333,269
Rumania	Imports	4,447,159	2,118,505	1,396,639	1,689,513	3,395,474
	Exports	1,350,497	944,034	616,287	1,305,658	1,749,996
Greece	Imports	1,962,798	1,241,406	2,227,212	1,328,234	1,613,174
	Exports	1,235,126	860,193	1,104,196	1,251,642	1,513,744
Italy	Imports	3,093,918	3,132,720	3,417,790	3,324,595	3,634,073
	Exports	8,523,209	6,211,337	9,444,498	9,787,306	13,274,764
Spain	Imports	12,508,533	11,314,518	15,882,346	13,858,631	13,362,959
	Exports	5,702,804	4,052,806	6,333,857	4,841,774	5,352,017
Portugal	Imports	2,942,194	2,491,926	3,241,367	2,929,634	2,912,994
	Exports	2,612,638	1,865,973	2,529,305	2,826,257	2,777,201
Russian Empire	Imports	23,750,868	24,736,919	21,983,952	33,366,234	36,897,746
	Exports	8,846,054	10,686,333	16,360,475	14,884,050	18,325,844
Turkey	Imports	8,368,851 [1]	5,630,240	5,657,627	5,491,443	5,085,435
	Exports	7,340,868 [1]	5,566,187	5,372,956	6,979,147	7,789,432
Japan	Imports	1,024,993	1,143,382	1,540,526	1,860,313	4,232,716
	Exports	4,187,373	4,772,829	9,933,925	9,796,900	8,618,821
China	Imports	4,830,850 [2]	3,343,865 [2]	2,359,821	2,340,346 [3]	3,725,502
	Exports	6,763,221 [2]	5,363,536 [2]	5,634,313	13,298,828 [3]	8,558,275
Netherlands—India	Imports	1,223,037	874,313	287,454	2,129,479	2,436,518
	Exports	1,675,054	1,988,479	2,881,601	3,558,562	3,768,264
Egypt	Imports	8,368,851	9,524,507	12,585,578	14,976,188	19,872,288
	Exports	3,459,991	3,414,556	6,159,468	8,069,668	8,142,325
U.S.A.	Imports	97,283,349	86,548,860	138,789,261	115,573,051	118,269,777
	Exports	46,340,012	44,067,703	37,343,955	47,282,088	59,254,166
Mexico and Central American States	Imports	1,863,284	1,443,345	1,144,590	2,138,574	2,595,356
	Exports	3,050,051	3,035,097	3,149,652	3,022,074	3,179,577
Brazil	Imports	4,350,675	3,614,155	5,946,547	8,109,208	11,271,890
	Exports	7,795,073	7,643,739	6,156,600	6,916,617	8,809,226
Argentina	Imports	4,129,802	9,084,497	13,080,466	25,034,325	32,528,446
	Exports	8,530,427	5,480,848	7,438,238	13,383,835	19,202,496
Chile	Imports	3,473,348	3,436,142	4,828,371	6,068,031	6,607,415
	Exports	3,365,824	3,454,332	3,535,736	4,782,382	5,054,144
Other countries in Asia	Imports	376,969	344,895	373,344	611,096	1,043,280
	Exports	516,846	720,350	684,440	699,556	1,214,041
Africa	Imports	2,345,843	1,683,319	2,503,823	2,901,281	4,538,518
	Exports	3,262,462	3,052,023	4,686,727	6,063,114	7,783,508
South America	Imports	2,080,466	2,437,294	2,355,801	3,897,595	5,657,201
	Exports	5,674,325	4,489,592	4,088,731	5,129,351	6,137,748
Other countries	Imports	3,206,713	3,447,034	3,190,888	6,289,947	4,260,790
	Exports	6,605,220	3,901,551	6,370,943	8,352,264	7,440,065
Total for British possessions	Imports	100,279,852	100,405,592	113,074,557	134,530,683	146,908,244
	Exports	94,522,469	76,138,896	102,083,109	122,712,920	136,318,471
Total for foreign countries	Imports	324,530,783	321,038,151	413,434,242	437,151,191	477,796,713
	Exports	233,729,649	209,693,511	252,290,645	284,883,607	333,206,695
Grand total	Imports	420,691,997	416,689,658	523,075,163	565,019,917	624,704,957
	Exports	328,252,118	285,832,407	354,373,754	407,596,527	469,525,166

[1] Including Cyprus in this year.

[2] Including Korea.

[3] Excluding Wei-hai-wei.

home produce just enumerated. The value of the cotton manufactures exported sank from £80,164,155 in 1872 to £67,641,268 in 1876; woollen fabrics from £38,493,411 to £23,020,719; iron and steel from £35,996,167 to £20,737,410; coals from £10,442,321 to £8,904,463; machinery from £8,201,112 to £7,210,426; and linen manufactures from £10,956,761 to £7,070,149. The decline during the four years, it will be seen, was greatest in all textile manufactures, and least in coal and machinery.

The table[1] on p. 602 shows the subsequent movement in value of imports from other countries to the United Kingdom, and of exports to other countries from the United Kingdom, at quinquennial intervals; bullion and specie being excluded.

As regards fluctuations not revealed by the above figures, it may be mentioned that the highest total figures for any one year during the period covered are those for 1907, viz. imports £645,807,942; exports £517,977,167. As to minima within the period, the lowest totals for British possessions were: imports £91,851,534 in 1893, and exports, the figure quoted for 1895; for foreign countries, imports £312,836,644 in 1893, and exports £195,133,239 in 1894; grand totals, imports £404,688,178 in 1893, and exports £273,785,867 in 1894. It may be added that the maximal import figures for France within the period are those of 1906 (£53,871,661), for Germany those of 1909, and for the United States those of 1901 (£141,015,465). For exports to the United States the figures for 1909 were highest, to France those of 1907 (£33,507,544) and to Germany those of 1907 (£56,729,988).

The following table presents the value of the chief groups and articles of importation into the United Kingdom:—

	1895.	1900.	1905.	1909.
	£	£	£	£
Grain and flour	53,077,981	62,992,082	70,057,290	83,107,421
Meat	33,334,171	46,782,579	49,431,748	47,623,428
Other principal articles of food and drink—				
Butter	14,235,230	17,450,435	21,586,622	22,424,962
Sugar	17,684,413	19,256,439	19,471,811	21,691,894
Tea	10,242,999	10,686,910	9,302,713	11,617,031
Wine	5,448,088	5,192,909	4,072,199	3,746,489
Coffee	3,778,305	2,544,726	2,578,327	2,075,516
Fish (preserved)	2,289,260	2,895,330	2,493,876	2,509,573
Cocoa and chocolate	1,610,483	2,398,248	2,227,141	903,464
Principal fruits—				
Apples	960,273	1,224,657	2,065,193	2,007,911
Oranges	1,925,415	2,120,790	1,949,496	2,522,491
Bananas	—	548,956	1,770,256	1,752,190
Tobacco	3,353,916	4,799,417	3,721,920	4,986,663
Raw materials—				
Cotton	30,522,016	41,117,308	52,370,878	60,295,049
Wool	28,494,249	24,073,917	26,648,737	35,041,766
Oils, &c.	18,497,573	23,564,644	23,600,927	31,039,883
Wood and timber	16,372,181	27,875,913	23,274,020	23,591,579
Textile materials excluding cotton and wool	11,378,608	11,553,114	14,511,978	12,127,707
Caoutchouc	3,760,178	6,986,133	9,643,153	14,138,204
Hides and skins	7,360,070	8,465,660	8,084,793	11,617,756
Metallic ores excluding iron	4,575,929	5,575,272	7,610,990	8,327,193
Iron ore, &c.	3,027,196	5,750,947	5,525,575	5,076,131
Manufactured articles—				
Yarns and textile fabrics	—	—	39,688,418	29,651,658
Metal, excluding iron and steel	11,196,315	21,844,683	21,840,696	24,346,328
Leather	11,035,870	11,823,132	11,037,983	11,617,130
Chemicals	8,714,360	8,628,279	9,624,638	10,596,593
Iron and steel (not machinery)	—	7,314,696	8,589,405	7,971,594
Paper	2,845,730	4,412,440	5,256,065	5,647,437
Machinery	—	3,475,887	4,537,871	4,438,336

Certain omissions are necessary in this table owing to alterations in classification of the returns.

The value of the chief articles and groups of export of home produce are similarly shown:—

	1895.	1900.	1905.	1909.
	£	£	£	£
Cotton yarn and manufactures	63,746,463	69,750,279	92,010,985	93,444,799
Iron and steel and manufactures	19,428,383 [2]	31,623,353 [2]	31,826.438	38,192,142
Woollen yarn and manufactures	29,094,568	24 259,766	29,916,807	30,917,807
Coal	14,600,326	36,409,614	24,859 129	37,129,978
Machinery	15,150,522	19 619 784	23,260.326	28,057,643
Chemicals	11,463,304	13 154,344	14,536,857	16,783,019
Textiles (not cotton or wool)	11,986,718	12,191,069	13,204,899	12,441,525
Metal manufactures (not iron)	5,048,588	6.473,197	8,920,533	8,708,945
Clothing	5,615,594	6,499,086	6,021,242	9,824,125
Leather and leather goods	3,833,980	3,875,683	5,660,494	4,242,356
Ships	—	8,587,710	5,431,298	5,927,114

The proportion of imports and exports per head of population of the United Kingdom was:—

Year.	Total Imports.			Exports of British Produce.		
	£	s.	d.	£	s.	d.
1890	11	4	6	7	0	7
1895	10	12	6	5	15	4
1900	12	14	3	7	1	6
1905	13	1	5	7	12	7
1906	13	18	5	8	12	0
1907	14	12	6	9	13	3
1908	13	6	3	8	9	4
1909	13	17	7	8	8	1

The tables on p. 604 show the value of unregistered imports of gold and silver bullion and specie from British possessions and from foreign countries into the United Kingdom, specifying the most important countries individually.

Shipping.—The table at foot of p. 604 shows the tonnage of vessels entered from and cleared to British possessions and foreign countries at the principal ports of the United Kingdom.

For the purpose of showing the relative importance of British and Irish ports falling below the list, the following figures may be quoted for 1909 only: Methil, entered 824,375 tons, cleared 1,105,048 tons; Harwich, entered 792,980, cleared 776,595; Grangemouth, entered 988,007, cleared 1,064,217; Burntisland, entered 609,722, cleared 815,507; Bristol, entered 858,933, cleared 615,266; Goole, entered 815,177, cleared 817,226; Hartlepool, entered 934,836, cleared 730,141; Newhaven, entered 385,313, cleared 376,083; Folkestone, entered 364,524, cleared 359,697; Belfast, entered 490,513, cleared 165,670; Borrowstounness (Bo'ness), entered 301,549, cleared 292,194; Dublin, entered 219,081, cleared 80,868; Cork, entered 146,724, cleared 7413; Maryport and Workington, entered 118,388, cleared 67,494. The figures for Plymouth have included vessels which call "off" the port to embark passengers, &c., by tender only since 1907; for 1909 they were: entered, 1,455,605; cleared, 1,292,244.

The table at the commencement of page 605 shows the total tonnage of vessels entered from and cleared to British possessions and foreign countries at ports in the United Kingdom, and also the nationality of vessels under British and the principal foreign flags.

Out of the following totals steam vessels had an aggregate tonnage of 30,604,578 entered and 31,080,481 cleared in 1890, and 64,327,508 entered and 64,968,655 cleared in 1909. The total tonnage of vessels entered and cleared coastwise was as follows: (1890), 47,738,612 entered,

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[1] Adapted from the *Statistical Abstract for the United Kingdom*, where it is specified that the value of new ships and boats, with their machinery, was not included in exports before 1899.

[2] Owing to an alteration in classification these figures are not strictly comparable with those for 1905.

GOLD.

	1890.	1895.	1900.	1905.	1909.
	£	£	£	£	£
From British possessions	5,368,424	17,618,466	11,350,591	38,567,895	40,464,212
South Africa	1,876,677	8,353,913	378,626	21,286,374	32,912,428
India	443,079	1,929,590	3,637,978	6,850,360	2,170,957
Australia	1,398,627	5,324,498	6,182,718	3,440,037	2,613,002
Foreign countries	18,199,625	18,390,863	14,840,282	4,949,335	14,227,617
Total	23,568,049	36,009,329	26,190,873	43,517,230	54,691,829

SILVER.

	1890.	1895.	1900.	1905.	1909.
	£	£	£	£	£
From British possessions	350,094	282,269	264,676	412,756	667,619
Foreign countries	10,035,565	10,384,063	13,057,624	12,579,258	11,147,270
United States of America	4,057,709	8,082,925	11,459,612	9,784,828	9,971,396
Total	10,385,659	10,666,332	13,322,300	12,992,014	11,814,889

42,317,876, cleared; (1895), 54,304,703 entered, 47,263,791 cleared; (1900), 55,828,569 entered, 54,425,666 cleared; (1905), 60,066,919 entered, 58,670,971 cleared; (1909), 60,566,043 entered, 60,060,979 cleared.

The number and gross tonnage of the registered sailing and steam vessels belonging to the United Kingdom were as follows at the end of each of the years named:—

Year.	Sailing Vessels.		Steam Vessels.	
	Number.	Gross Tonnage.	Number.	Gross Tonnage.
1890	14,181	3,055,136	7,410	8,095,370
1895	12,617	3,040,194	8,386	9,952,211
1900	10,773	2,247,228	9,209	11,816,324
1905	10,059	1,796,826	10,552	14,883,594
1909	9,392	1,407,469	11,797	16,994 732

These figures show not only that steamers have been rapidly taking the place of sailing vessels, but also that large steamers are preferred to small, their average tonnage having increased from 1092 tons in 1895 to 1440 in 1909.

Railways.—The first ordinary roads deserving the name of highways were made about 1660, and canal-building began in the middle of the following century; but though roads and canals aided materially in raising the commercial and industrial activity of the nation, their fostering agency was very slight compared with that of railways, of which England is the birthplace. The first line of railway for regular passenger service, that from Stockton to Darlington, 14 m. in length, was opened on the 27th of September 1825. The first really important railway was the line from Manchester to Liverpool, opened on the 15th of September 1830, when William Huskisson, M.P., was accidentally killed. It took three years to get the bill for the London-Birmingham railway, which was passed at last in the session of 1833, obtaining the royal assent on the 8th of May. The first sod of the great line was cut at Chalk Farm, London, on the 1st of June 1834. Enormous engineering difficulties had to be overcome, originating not so much from the nature of the ground as from intense public prejudice against the new mode of locomotion. It took over four years to construct the railway from London to Birmingham, at a cost exceeding £4,000,000. Even friends of the railway presaged that such outlay could not by any possibility be remunerative; but the contrary became evident from the moment the line was opened on the 17th of September 1838. All the great railway systems of England sprang into existence within less than ten years after the opening of the London-Birmingham line. Out of this railway grew one of the largest companies, the London & North-Western; while the most extensive system as regards mileage, the Great Western, originated in a line from Paddington, London, to Bristol, for which an act of parliament was obtained in 1835, and which was opened in 1841. In 1836 a bill passed the legislature erecting the "Great North of England" Railway Company, from which was developed the North-Eastern system. A few years later other acts were passed, sanctioning the "Midland Counties" and the "North Midland" lines, from which the present Midland system grew.

The total length of railways conveying passengers in the United Kingdom at the end of the year 1825 was 40 m., constructed at a cost of £120,000. Five years later, at the end of 1830, there were not more than 95 m., built at a cost of £840,925, but at the end of 1835 there were 293 m., costing £5,648,531. Thus, in the first five years of railway construction, from 1825 to 1830, the mileage doubled; while in the second five years, from 1830 to 1835, it trebled. It quintupled in the next five-yearly period, till the end of 1840, when the total length of miles of railway in the kingdom had come to be 1435, built at a cost of £41,391,634, as represented by the paid-up capital of the various companies. The next five years saw nearly another doubling of length of lines, for at the end of 1845 there were 2441 m. of railway created by a paid-up capital of £88,481,376.

		1890.	1895.	1900.	1905.	1909.
		Tons.	Tons.	Tons.	Tons.	Tons.
London	Entered	7,708,705	8,435,676	9,580,854	10,814,115	11,605,698
	Cleared	5,772,062	6,110,325	7,479,008	7,913,115	8,622,316
Liverpool and Birkenhead	Entered	5,782,351	5,598,341	6,001,563	7,806,844	7,747,994
	Cleared	5,159,450	4,883,199	5,778,114	6,932,687	6,593,094
Cardiff	Entered	3,173,699	3,739,856	5,132,523	4,337,720	5,771,476
	Cleared	5,641,511	6,500,510	7,636,717	7,476,879	8,888,756
Tyne Ports [1] & [2]	Entered	3,401,216	3,292,624	3,897,142	4,058,618	5,700,405
	Cleared	5,010,098	4,822,648	4,894,157	5,158,899	6,899,023
Southampton	Entered	888,352	1,420,531	1,613,913	2,087,277	4,279,052
	Cleared	813,133	1,328,393	1,395,486	1,888,030	4,108,063
Hull	Entered	1,997,138	2,150,654	2,666,598	2,546,064	3,517,953
	Cleared	1,655,996	1,612,385	2,274,137	2,102,160	3,164,156
Glasgow	Entered	1,121,700	1,184,537	1,454,860	1,635,609	1,917,144
	Cleared	1,697,662	1,911,739	2,229,574	2,836,462	3,160,916
Newport	Entered	920,560	871,886	1,092,068	1,250,192	1,548,258
	Cleared	1,316,430	1,374,237	1,511,383	1,773,161	2,105,509
Dover	Entered	789,846	742,940	973,074	2,928,741	1,636,530
	Cleared	767,724	734,334	964,476	2,944,774	1,631,751
Middlesbrough	Entered	833,562	953,985	1,096,130	1,227,017	1,728,385
	Cleared	623,967	875,059	882,156	1,092,958	1,586,148
Blyth [2]	Entered	—	—	974,285	1,094,168	1,292,353
	Cleared	—	—	1,525,727	1,623,003	1,836,503
Sunderland	Entered	725,859	730,396	800,027	981,606	1,357,201
	Cleared	956,266	1,002,552	1,163,310	1,344,999	1,676,777
Swansea [3]	Entered	565,644	580,481	1,018,148	635,458	1,020,480
	Cleared	858,215	931,588	1,427,903	1,335,134	1,719,654
Leith	Entered	706,491	887,842	1,055,291	1,124,281	1,344,898
	Cleared	626,573	750,257	982,309	1,085,734	1,314,361
Grimsby	Entered	663,513	763,892	931,238	1,094,531	1,289,476
	Cleared	689,165	829,837	960,236	1,074,495	1,334,566
Manchester	Entered	—	317,625	787,497	1,133,003	1,275,937
	Cleared	—	288,001	595,757	970,620	1,067,835

[1] Newcastle, North Shields, South Shields.
[2] Blyth was included with North Shields till 1897.
[3] Swansea included Port Talbot till 1904.

		1890.	1895.	1900.	1905.	1909.
		Tons.	Tons.	Tons.	Tons.	Tons.
Total	Entered	36,835,712	40,001,691	49,913,223	55,623,974	66,309,519
	Cleared	37,448,157	40,537,483	50,182,439	56,416,760	66,958,163
British	Entered	26,777,955	29,175,282	32,135,745	35,200,869	39,661,660
	Cleared	27,195,157	29,516,644	32,147,060	35,762,218	40.102,311
German	Entered	2,161,536	1,940,358	2,966,426	4,298,769	6,766,591
	Cleared	2,230,419	1,948,284	3,060,782	4,346,284	6,754,026
Norwegian	Entered	2,477,936	2,604,049	3,839,602	3,392,216	4,315,870
	Cleared	2,522,865	2,660,795	3,821,969	3,387,152	4,308,221
Swedish	Entered	783,045	990,728	1,788,844	2,114,028	2,456,144
	Cleared	792,767	1,003,634	1,808,354	2,117,717	2,478,534
Danish	Entered	901,819	961,730	1,735,288	2,106,717	2,889,986
	Cleared	952,183	990,006	1,759,509	2,123,830	2,886,731
Dutch	Entered	952,695	1,150,098	1,600,317	1,949,161	2,272,075
	Cleared	948,196	1,156,936	1,613,450	1,957,107	2,294,584
French	Entered	834,039	929,250	1,417,128	1,574,395	1,640,466
	Cleared	852,935	909,493	1,405,247	1,587,762	1,663,197
Spanish	Entered	631,629	645,210	1,309,915	1,462,488	1,477,199
	Cleared	644,431	682,184	1,399,332	1,471,300	1,499,319
Belgian	Entered	449,470	551,513	804,472	936,918	1,355,135
	Cleared	423,639	537,969	797,134	920,597	1,357,668
U.S.A.	Entered	146,721	323,700	282,152	664,360	274,241
	Cleared	145,212	332,825	277,400	675,096	280,464

Not far from a fresh trebling took place in the course of the next quinquennial period, and at the end of 1850 there were 6621 m. of railways, constructed at the cost of £240,270,745.

The construction of railways (especially in England) was undertaken originally by a vast number of small companies, each under separate acts of parliament. But it was soon discovered that there could be neither harmonious nor profitable working of a great many systems, and this led to a series of amalgamations (see under **England**; **Ireland**; **Scotland**).

The number of passengers carried per mile in 1832 was 4860, but before ten more years were past the number of passengers had not only increased in proportion with the opening of new lines, but more than doubled per mile, and, instead of being under 5000, had in 1842 come to be near 12,000. In 1861 the number of passengers carried per mile of railway was 15,988; in 1876 it was 31,928; and in 1900 it was over 52,000.

The two following tables illustrate the further development of railways in the United Kingdom:—

Year.	Mileage.	Paid-up Capital.	Number of Passengers.*	Traffic Receipts.		Percentage of Working Expenses to Receipts.
				Total.	Per Mile.	
		£		£	£	
1860	10,433	348,130,127	163,435,678	27,766,622	2,661	47
1865	13,298	455,478,143	251,862,715	35,890,116	2,701	48
1870	15,537	529,908,673	336,545,397	43,417,070	2,794	48
1875	16,658	630,223,494	506,975,234	58,982,753	3,541	54
1880	17,933	728,316,848	603,885,025	62,961,767	3,511	51
1885	19,169	815,858,055	697,213,031	66,644,967	3,477	53
1890	20,073	897,472,026	817,744,046	76,548,347	3,813	54
1895	21,174	1,001,110,221	929,770,909	81,396,047	3,844	56
1900	21,855	1,176,001,890	1,142,276,686	98,854,552	4,523	62
1905	22,847	1,272,601,000	1,199,022,102	105,131,709	4,601	62
1909	23,280	1,314,406,000	1,265,081,000	110,682,266	4,754	62

* Excluding season-ticket holders, whose number in 1880 was 502,174; in 1900, 1,749,804; and in England and Wales alone, in 1880, 449,823; in 1900, 1,610,754.

In the next table further details are given for 1909:—

		1909.		
		England and Wales.	Scotland.	Ireland.
Mileage of	Double or more lines	10,746	1,580	670
	Single lines	5,299	2,264	2,721
		£	£	£
Traffic Receipts	Passenger traffic	43,919,702	5,080,603	2,204,756
	Total goods traffic	50,647,426	6,836,920	1,992,859
	Including—			
	Minerals	24,837,682	3,286,074	281,634
	General merchandise	24,885,494	3,299,588	1,392,600
Working expenditure		65,169,619	7,200,173	2,667,796
Net receipts		37,979.313	5,489,579	1,667,572

In 1909 the percentage of working expenses to total receipts was 63 in England and Wales, 57 in Scotland and 62 in Ireland.

Tramways.—An act passed in 1870 to facilitate the construction of tramways throughout the country marks the beginning of their modern development. It led to the laying down of "street railways" in many large towns. According to a return laid before the House of Commons in the session of 1878, the total length of tramways authorized by parliament up to the 30th of June 1877 was 363 m., and the total length opened for traffic 213 m., comprising 125 m. of double lines and 88 m. of single lines. On the 30th of June 1900 there were in the United Kingdom 70 tramway undertakings with 585 m. of line belonging to local authorities, while 107 with 592 m. of line belonged to other than local authorities. The capital expenditure on the former amounted to £10,203,604, on the latter to £11,532,384.

The development of tramway enterprise in the United Kingdom, as shown by the mileage open, the paid-up capital, gross receipts, working expenses and number of passengers carried, has been as follows:—

Years ending June 30.	Miles open.	Paid-up Capital.	Gross Receipts.	Working Expenses.	Passengers carried during year.
		£	£	£	
1890	948	13,502,026	3,214,743	2,402,800	526,369,328
1895	982	14,111,521	3,733,690	2,878,490	661,760,461
1900	1177	20,582,692	5,445,629	4,075,352	1,065,374,347
1905	2117	51,501,410	9,917,026	6,565,049	2,068,913,226
1909	2526	70,345,155	12,641,437	8,045,658	2,659,981,136

Authorities.—The following publications relating to the United Kingdom are issued annually in London (unless otherwise stated): *Finance Accounts*; *Financial Estimates*; *Return showing Revenue and Expenditure (England, Scotland and Ireland)*; *National Debt Accounts*; *National Debt during 60 Years*; *Local Taxation Returns*; *Army Estimates*; *Army Accounts*; *Army List* (quarterly); *Navy Estimates*; *Navy List* (quarterly); *Royal Commission on Agriculture, Reports* (1896); *Mineral Statistics*; *Reports of Inspectors of Mines*; *Reports on Factories and Workshops*; *Reports of Inspectors of Fisheries*; *Return of Fish conveyed inland by rail*; *Statement of the Trade of the United Kingdom*; *Statement of the Shipping and Navigation of the United Kingdom*; *Report of the Postmaster-General*. Vital statistics: *Reports* of the registrars-general respectively for England, for Scotland (Edinburgh), for Ireland (Dublin); *Census Reports* (decennial, 1901, &c.), ditto; Education: *Reports of the Board of Education for England and Wales*; *Report of the Commissioners of National Education in Ireland*; *Report of the Committee of Council on Education in Scotland*; *Electoral Statistics* (London, 1905); *Statistical Tables relating to Emigration and Immigration*; *Judicial Statistics* of England and Wales, of Scotland, of Ireland; *Local Government Reports*, ditto; *Statistical Abstract for the United Kingdom*, in which the most important statistics are summarized for each of the fifteen years preceding the year of issue. Among books may be mentioned the following: Sir W. R. Anson, *The Law and Custom of the Constitution* (2 vols., 2nd ed., Oxford, 1892–1896); W. J. Ashley (edited by), *British Industries* (London, 1902); E. G. Boutmy, *Le Développement de la constitution et de la société politique en Angleterre* (2nd ed., Paris, 1897). Of this there is an English translation (from 1st ed.)

by I. M. Eaden (London, 1891); *Études de droit constitutionel, France, Angleterre, États-Unis* (Paris, 1885; Eng. trans. by E. M. Dicey, London, 1891); Brassey, *The Naval Annual* (Portsmouth, 1886 onwards); Cassell's *Gazetteer of Great Britain and Ireland* (London, 1899); W. L. Clowes and other writers, *History of the Royal Navy* (London, 1896–1901); W. Cunningham, *Growth of English Industry and Commerce* (4th ed., London, 1904); A. V. Dicey, *Introduction to the Study of the Law of the Constitution* (5th ed., London, 1897); R. Donald (edited by) *Municipal Year-book* (London, annual); S. Eardley-Wilmot, *Our Fleet To-day and its Development during the Last Half Century* (London, 1900); Hon. J. W. Fortescue, *History of the British Army* (London, 1906); R. Giffen, *Essays in Finance* (London, 1880 and 1886); R. von Gneist, *Das englische Parlament in tausendjährigen Wandelungen* (Berlin, 1885; translated into English by A. H. Keane, *History of the English Parliament*, London, 1889); *Englische Verfassungsgeschichte* (Berlin, 1882; Eng. trans. by P. A. Ashworth, London, 1891); E. Hull, *The Coalfields of Great Britain* (London, 1905); J. E. T. Rogers, *Industrial and Commercial History of England* (London, 1892); J. Holt Schooling, *The British Trade Book* (London, 1908); Sir J. R. Seeley, *The Growth of British Policy* (2 vols., London, 1895); H. Taylor, *The Origin and Growth of the English Constitution* (2 vols., London, 1889–1899); A. Todd, *Parliamentary Government in England* (new ed., revised by S. Walpole, 2 vols., London, 1892).

British Military Forces.

The forces of the British Crown may be classed as (*a*) the regular, or general service, army, together with the Indian army; and (*b*) the home territorial force; while there are also certain forces controlled by the governments of the various self-governing dominions. The home government raises, pays and controls the regular army, its reserves, the territorial force, and some few details such as the militia of the smaller possessions, Indian native battalions employed on imperial service out of India, &c. But the cost of that portion of the regular army which is in India is borne by the Indian government, which is not the case with the regulars serving in other colonies or in the dominions. Consequently the Indian government, unlike the colonial governments, can within limits dispose of the British paid regulars within its sphere.

Regular Army.—The duties of the regular army are to garrison India and overseas colonies, to garrison Great Britain and Ireland, and to find expeditionary forces of greater or less strength for war in Europe or elsewhere. The principles upon which the reorganization of 1905–1908 was based are: (*a*) that in peace the army at home must be maintained at such an effective standard that all necessary drafts for the army abroad shall be forthcoming, without undue depletion of the army at home; (*b*) the home army on mobilization for service should be brought up to war strength by the recall of reservists in sufficient, but not too great, numbers; (*c*) the wastage of a campaign shall be made good by drafts partly from the remaining army reserve, but above all from the militia, now converted into the special reserve; and (*d*) the volunteers and yeomanry, reorganized into the territorial force, shall be responsible, with little regular help, for the defence of the home country, thus freeing the regular army at home for general service. The first of these conditions entirely, the second largely, and even indirectly the third and fourth depend upon the recruiting, establishments and terms of service of the regular army. These last are a compromise between the opposite needs of short service, producing large reserves, and long service, which minimizes the sea-transport of drafts; they are also influenced by the state of the labour market at any given moment, as recruiting is voluntary. To enable the authorities to deal with these conditions, the secretary of state for war may without special legislation vary the terms of enlistment, not only in general but also for the various arms and branches.

After the South African War, several different terms were tried for the line infantry and cavalry, but these experiments proved that the terms formerly prevailing, viz. 7 years with the colours and 5 in the reserve, were the most convenient. In the Horse and Field Artillery the term is 6 and 6, in the Household Cavalry and the Garrison Artillery 8 and 4, and in the Foot Guards 3 and 9. Engineers and other specialists are recruited on various terms. A certain number, again varying from year to year, almost from month to month, are allowed to engage for the full 12 years with the colours (long service). Thus in 1907–1908, 1551 men were serving on a 12-year colour engagement, 24,856 on a term of 7 years colours and 5 reserve, 3589 on a 6 and 6 term, 3449 on 3 and 9 engagement, 4529 for other terms, out of a total of 37,974 recruits or soldiers signing fresh engagements.

The following figures show the inflow of recruits:—

Year.	Recruits offering.	Recruits approved.	Percentage approved.	Percentage of Recruits to Strength of Army.
Oct. 1903–Oct. 1904	89,824	42,041	46·8	14·6
Oct. 1904–Oct. 1905	81,045	35,551	43·9	13·05
Oct. 1905–Oct. 1906	83,155	36,380	43·5	14
Oct. 1906–Oct. 1907	72,855	34,710	47·6	14·25
Oct. 1907–Oct. 1908	77,526	37,222	47·9	14·05
Oct. 1908–Oct. 1909	75,630	33,766	44·7	13·6

The army consists of about 250,000 officers and men of the regular forces on full pay, distributed (October 1909) as follows:—

	Strength.	Establishment.
Staff and departments, &c.	3,293	3,392
On regimental strength:—		
Home	128,412	130,714
India	77,866	76,009
Colonies	47,127	44,981
Total	253,004	253,405

By units, it is composed of 3 regiments of Household Cavalry, 7 regiments of Dragoon Guards, 3 of Dragoons, 6 of Lancers and 12 of Hussars (total cavalry, 31 regiments); 4 regiments of Foot Guards of 9 battalions, 51 English and Welsh, 10 Scottish and 8 Irish line infantry and rifle regiments (total infantry, 149 battalions); the Royal Regiment of Artillery, divided into Royal Horse and Field Artillery, and Royal Garrison Artillery—the R.H.A. consisting of 28 batteries, the R.F.A. of 150 batteries, the R.G.A. of 100 companies (told off to garrisons, siege train and heavy field batteries) and 8 batteries mountain guns; the Corps of Royal Engineers, organized into mounted field troops, field companies, fortress, telegraph, railway, searchlight, balloon, wireless companies and bridging train; the Army Service Corps, divided into transport, supply, mechanical-transport and other companies and sections; the Royal Army Medical Corps of 35 companies; the Army Ordnance Corps; the Army Veterinary Corps; Army Post Office Corps (formed on mobilization only) and Army Pay Corps.

In addition, there are the following colonial troops under the home government:—West India Regiment, 2 battalions; Royal Malta Artillery, 2 garrison companies; West African Frontier Force, 2 batteries, 1 garrison company, 1 battalion M.I., 6 battalions infantry; and King's African Rifles (East Africa), 5 battalions, besides the Indian troops in imperial services.

The army reserve, formed of men who have served with the colours, consists of four classes. Sections A, B and C consist of men who are fulfilling the reserve portion of their original twelve years' liability. Section A, which receives extra allowances, is liable to be called up in a minor emergency; section B is the general reserve; section C, also part of the general reserve, consists of men who have been sent to the reserve prematurely; section D (which is often suspended) consists of men who at the expiry of their twelve years' engagement undertake a further four years' reserve liability.

Strength and Ages of the Army Reserve (Oct. 1, 1909).

Section.	A.	B & C.	D.	Total.
Infantry	4,051	70,998	9,608	84,657
Cavalry	—	8,894	1,229	10,123
R.H. & F.A.	604	13,849	1,571	16,024
R.G.A.	—	7,748	642	8,189
R.E.	415	4,200	406	5,021
Others	427	9,356	558	10,341
	5,497	115,045	14,014	134,556
Under 30.	98,146		201	98,347
30–35	21,730		10,758	32,488
Over 35	666		3,055	3,721
	120,542		14,014	134,556

The special reserve, converted from the militia, consists of infantry, field and garrison artillery, the Irish Horse (late Yeomanry), engineers, and a few A.S.C. and R.A.M.C. Its object is to make good on mobilization deficiencies (so far as they may exist after the calling in of the army reserve) in the expeditionary or regular forces, and to repair the losses of a campaign. It also acts as a feeder to the regular army. Its establishment and strength on the 1st of October 1909 were 90,664 and 69,954 respectively, without counting in the latter figure 6172 militia and militia reserve men not then absorbed into the new organization.

The war organization of the home establishment, with its general and special reserves, aimed at the mobilization and despatch overseas of 6 army divisions, each of 12 battalions in 3 brigades; 9 field batteries in 3 brigades, a brigade of 3 field howitzer batteries, and a heavy battery, each with the appropriate ammunition columns; 2 field companies and 1 telegraph company R.E.; 2 companies mounted infantry; and ambulances, columns and parks. In addition to these 6 divisions, there are "army troops" at the disposal of the commander-in-chief, consisting of two mixed "mounted brigades" (cavalry, mounted infantry, and horse artillery) serving as the "protective cavalry," and of various technical troops, such as balloon companies and bridging train. The "strategical" cavalry is a division of 4 brigades (12 regiments or 36 squadrons), with 2 brigades (4 batteries) of horse artillery, 4 "field troops" and wireless company R.E., and ambulances and supply columns. The peace organization of the regular forces at home conforms to the prospective war organization. In addition to the field army itself, various lines of communication troops are sent abroad on mobilization. These number some 20,000 men, the field army about 135,000, with 492 field guns, 7561 other vehicles and 60,769 horses and mules.

But the first condition of employing all the home regulars abroad is perfect security at home. Thus the pivot of the Haldane system is the organization of the *Territorial Force* as a completely self-contained army. The higher organization—which the volunteers (*q.v.*) and yeomanry (*q.v.*) never possessed—varies only slightly from that in vogue in the regular army. The second line army consists of 14 mixed mounted brigades as protective cavalry and 14 army divisions of much the same combatant strength as the regular divisions, the only important variation being that the artillery consists of 4-gun instead of 6-gun batteries. In addition to the divisions and mounted brigades there are "army troops," of which the most important component is the cyclist battalions, recruited in the different coast counties and specially organized as a first line of opposition to an invader. Affiliated to the territorial force are officers' training corps, cadets, "veteran reserves," and some of the other organizations mentioned below, the Haldane scheme having as its express object the utilization of every sort of contribution to national defence, whether combatant or non-combatant, on a voluntary basis.

The conditions of enlistment and reserve in the territorial force are a four years' engagement (former yeomen and volunteers being however allowed to extend for one year at a time if they desire to do so), within each year a consecutive training in camp of 14-18 days and a number of "drills" (attendances at company and battalion parades) that varies with the branch and the year of service. The minimum is practically always exceeded, and trebled or quadrupled in the case of the more enthusiastic men, and the chief difficulty with which the officers responsible for training have to contend is the fact that no man can be compelled to attend on any particular occasion. Attendance at the camp training, in so far as the claims of men's civil employment do not infringe upon it, is compulsory, and takes place at one time for all—generally the first half of August.

The army troops, divisions and mounted brigades consist of 56 regiments of yeomanry; 14 batteries and 14 ammunition columns R.H.A., 151 batteries and 55 ammunition columns R.F.A., 3 mountain batteries and ammunition column, and 14 heavy batteries and ammunition columns R.G.A.; 28 field companies, 29 telegraph companies, railway battalion, &c., R.E.; 204 battalions infantry (including 10 of cyclists, the Honourable Artillery Company, and certain corps of the Officers' Training Corps training as territorials); 60 units A.S.C.; 56 field ambulances, 23 general hospitals and 2 sanitary companies R.A.M.C. Told off to the defended seaports are 16 groups of garrison artillery companies and 58 fortress and electric light companies R.E.

Establishment and Strength (April 1, 1910)

Arm or Branch.	Establishment.		Strength.	
	Officers.	Men.	Officers.	Men.
Yeomanry	1,345	24,766	1,193	24,219
R.H. & F.A.	1,211	32,945	1,015	29,658
R.G.A.	450	11,455	406	9,356
R.E.	571	14,660	525	12,896
Infantry	5,679	195,297	5,064	173,670
A.S.C.	322	8,562	277	7,577
R.A.M.C.	1,438	13,664	1,151	11,849
A.V.C.	198	14	95	—
Total	11,214	301,363	9,726[1]	269,225

The Territorial Force is enlisted to serve at home, but individuals and whole corps may volunteer for service abroad in war if called upon. A register is kept of those who accept this liability beforehand, and about 6000 officers and men had joined it in April 1910.

The force is trained, commanded and inspected exclusively by the military authorities, the regular army finding the higher commanders and staffs. But in accordance both with the growing tendency to separate command and administration and with the desire to enlist local sympathies and utilize local resources, "associations," partly of civilian, partly of military members, were formed in every county and charged by statute with all matters relating to the enlistment, service and discharge of the county's quota in the force, finance (other than pay, &c. in camp), buildings, ownership of regimental property, &c. To these duties of county associations are added that of supervising and administering cadet corps of all sorts (other than officers' training corps), and that of providing the extra horses required on mobilization, not only by the territorial force, but by the expeditionary force as well.

There are several groups of more or less military character which are for various reasons outside war office control. These are: (*a*) boys' brigades—the Church Lads' Brigade, the London Diocesan Brigade, the Jewish Lads' Brigade, &c.; (*b*) the Legion of Frontiersmen, an organization intended to enroll for "irregular" service men with colonial or frontier experience; (*c*) rifle clubs, which exist solely for rifle practice, and have no military liabilities; (*d*) boy scouts, an organization founded in 1908 by Lieut.-General Sir R. S. S. Baden-Powell.

Command and Administration.—The secretary of state for war is the head of the army council, which comprises the heads of departments and is the chief executive authority. These departments (see STAFF) are: the general staff; the adjutant-general's department; the quartermaster-general's department; the department of the master-general of the ordnance; the civil member's department; and the finance member's department. In addition to these departments, whose heads form the army council itself, there is the very important department of the inspector-general of the forces, whose duties are to ensure by inspection the maintenance of military efficiency and an adequate standard of instruction, &c. This department is thus in the main a complement of the general staff branch. In 1910 the commander-in-chief in the Mediterranean was appointed inspector-general of the overseas forces other than those in India, and the inspector-general in London supervises therefore only the forces in the home establishment. There are, therefore, three single authorities of high rank for the great divisions of the army—the two inspectors-general and the commander-in-chief in India.

The United Kingdom is subdivided into 7 commands and 12 districts, the commands under a lieutenant-general or general as commander-in-chief and the districts under brigadier-generals. The commands are the eastern, southern, western, northern, Scottish, Irish and the Aldershot. London is organized as a separate district under a major-general. In the colonial establishment the principal commands are the Mediterranean (including Egypt) and the South African. Except in South Africa, there are no imperial troops quartered in the self-governing colonies.

Since 1904–1905 command and administration have been separated and general officers commanding in chief relieved of administrative details by the appointment to their staffs of major-generals in charge of administration (see STAFF and OFFICERS).

Finance.—The army estimates for 1910–1911 show a total sum of £27,760,000 required for the home and colonial establishments, made up as follows (after deducting appropriations in aid):—

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[1] Does not include unattached list of officers, 853, or 736 R.A.M.C. officers not available until mobilization.

Regular Army, Pay and Allowances	£8,733,000
Special Reserve	833,000
Territorial Force	2,660,000
Medical Services	452,000
Educational Establishments	147,000
Quartering, Transport, Remounts	1,589,000
Supplies, Clothing	4,397,000
Stores and Ordnance Establishment	533,000
Armament and Engineer Stores	1,482,000
Works, Buildings and Land, &c.	2,598,000
War Office and Miscellaneous	503,000
Pensions, &c.	3,833,000
	£27,760,000

The pay of the soldiers has increased since the South African War. Without allowances of any kind, it was in 1910 as follows: Warrant officer, 5s. to 6s. per day; quartermaster-sergeants, colour-sergeants, &c., 3s. 4d. to 4s. 6d.; sergeants, 2s. 4d. to 3s. 4d.; corporals, 1s. 8d. to 2s. 8d.; lance-corporals, 1s. 3d. to 1s. 9d.; privates 1s. 1d. to 1s. 9d.; boys, 8d. In addition, all receive a messing allowance of 3d. per day, 2d. for upkeep of kit, and most receive "service" or "proficiency" pay at 3d.–6d a day; and engineers, A.S.C. and R.A.M.C. specialist pay at various rates. Officers' pay, without allowances, is for second lieutenants 5s. 3d. to 7s. 8d.; lieutenants, 6s. 5d. to 8s. 10d.; captains, 11s. 7d. to 15s.; majors, 13s. 7d. to 18s. 6d.; and lieutenant-colonels, 18s. to 24s. 9d.

Indian Army.—The forces in India consist of the British army on the Indian establishment and the Indian native army with its dependent local militias, feudatories, contingents, &c. In addition there is a force of European and Eurasian volunteers, drawn largely from railway employés. The Indian army consists of 138 battalions of infantry, 10 regiments of cavalry, 16 mountain batteries, 1 garrison artillery company, 32 sapper and miner companies (2 railways companies included). The proportion between British and Indian troops observed since the Mutiny is roughly one British to two native, the Indian army being about 162,000 men. In addition the native army includes supply and transport corps, the medical service, and the veterinary service, officered in the higher ranks by officers of the A.S.C., R.A.M.C. and A.V.C. respectively.

The Indian army is recruited from Mahommedans and Hindus of various tribes and sects, and with some exceptions (chiefly in the Madras infantry) companies, sometimes regiments, are composed exclusively of men of one class. The official *F.S. Pocket Book* 1908 gives the following particulars: *Mahommedans* (Pathans of the frontier tribes, Hazaras Baluchis, Moplahs, Punjabi Mahommedans, &c.), 350 infantry companies, 76 squadrons (35% of the army). *Hindus* (Sikhs, Gurkhas, Rajputs, Jats, Dogras, Mahrattas, Tamils, Brahmans, Bhils, Garhwalis, &c.), 727 companies, 79 squadrons (63·3%).

Enlistment is entirely voluntary, and the army enjoys the highest prestige. Service is for three years, but in practice the native soldier makes the army his career and he is allowed to extend up to 32 years. The native cavalry is almost entirely *Silahdar*, in which the trooper mounts and clothes himself, and practically serves without pay. In the infantry, too, the old system of paying men and requiring them to equip, clothe and feed themselves, is in vogue to some extent. There is a reserve of the native army, numbering some 35,000 men. But it is rather a draft to replace wastage than a means of bringing the army up to a war footing in the European way. Indeed, a cardinal principle of the Indian forces, British and native alike, is that the units are maintained in peace at full war effective, often a little above their field strength. Part of the army, nearest the north-west frontier, has even its transport practically in readiness to move at once. The command is in the hands of British officers assisted by native officers, promoted from the ranks. The number of native officers in a unit is equal to that of the British officers.

Besides the regular native army there are: (*a*) various frontier and other levies, such as the Khyber Rifles and the Waziristan Militia; (*b*) selected contingents from the armies of the native princes, inspected by British officers, numbering about 20,000 and styled "imperial service troops"; (*c*) the volunteers, about 32,000 strong; and (*d*) the military police.

The general organization of the forces is into two armies, the northern and the southern, with headquarters at Rawal Pindi and Poona respectively.

Administration.—Under the governor-general in council the commander-in-chief (himself a member of the council) is the executive authority. Under him in the army department, now divided into higher committees and the headquarter staff, the latter comprising (since the abolition of the military staff department under Lord Kitchener's reorganization) the divisions of the chief of the general staff, the adjutant-general and the quartermaster-general. India has her own staff college at Quetta, and can manufacture rifles, ammunition and field artillery equipment except the actual guns.

The cost of the Indian army, and of the British forces on the Indian establishment, borne by the Indian government in 1909 was £20,558,000.

Regulars only.	Northern Army.	Southern Army.	Total.
British	40,608	34,143	74,751
Indian Army, white	1,534	1,512	3,046
,, ,, native	85,189	76,772	161,961
Total	86,723	78,284	165,007
Total	127,331	112,427	239,758

Forces of the Dominions and Colonies.—Lord Kitchener and Sir John French in 1909–1910 paid visits of inspection to Australia and Canada in connexion with the reorganization by the local governments of their military forces, and a beginning was made of a common organization of the forces of the empire in the colonial military conference of 1909. Without infringement of local autonomy and local conditions, a common system of drill, equipment, training and staff administration was agreed on as essential, and to that end the general staff in London was to evolve into an "imperial general staff." The object to be attained as laid down was twofold; (*a*) complete organization of the territorial forces of each dominion or colony; (*b*) evolution of contingents of colonial general-service troops with which the dominion governments might assist the army of Great Britain in wars outside the immediate borders of each dominion. (See BRITISH EMPIRE; AUSTRALIA; CANADA.)

UNITED METHODIST CHURCH, or UNITED METHODISTS, and English Nonconformist community formed in 1907 by the union of the Methodist New Connexion (1797), the Bible Christians (1815), and the United Methodist Free Churches (1857). The act of parliament which enabled this amalgamation received the royal assent on the 26th of July 1907, and authorized the union "to deal with real and personal property belonging to the said three churches or denominations, to provide for the vesting of the said property in trust for the United Church so formed and for the assimilation of the trusts thereof, and for other purposes." The union was completed on the 16th of September 1907 in Wesley's Chapel, City Road, London. The Church gives power of speech and vote in its meetings to every member of 18 years of age and upwards. Its principal courts are constituted of an equal number of ministers and laymen. The Church had theological colleges at Manchester and Sheffield, boys' schools at Shebbear, in Devonshire, and at Harrogate, and a girls' school at Bideford. It issues a weekly and two monthly journals. In 1908 its statistics showed 2343 chapels with accommodation for 714,793 persons, 848 ministers and 5621 local preachers, 165,463 church members and 332,756 Sunday scholars; there were 55 foreign missionaries, and about 30,000 church members and probationers in the foreign field.

UNITED METHODIST FREE CHURCHES, an English Nonconformist community merged since 1907 in the United Methodist Church (*q.v.*). The organization was itself formed in 1857 by the amalgamation of the "Wesleyan Association" (which had in 1836 largely absorbed the Protestant Methodists of 1828) and the "Wesleyan Reformers" (dating from 1849, when a number of Wesleyan Methodist ministers were expelled on a charge of insubordination).

UNITED PRESBYTERIAN CHURCH (of Scotland). This Presbyterian organization, merged since 1900 in the United Free Church of Scotland (see above), was formed in 1847 by the union of the United Secession and Relief Churches.

United Secession Church.

The general causes which led to the first great secession from the Church of Scotland, as by law established in 1688, are indicated in the article SCOTLAND, CHURCH OF. Its immediate occasion rose out of an act of assembly of 1732, which abolished the last remnant of popular election by enacting that, in cases where patrons might neglect or decline to exercise their right of presentation the minister was to be chosen, not by the congregation, but only by the elders and Protestant heritors. The act itself had been passed by the assembly, although the presbyteries to which it had been previously submitted as an overture had disapproved of it by a large majority; and in accordance with a previous act (1730), which had taken away even the right of complaint, the protests of the dissentient majority were refused. In the following October Ebenezer Erskine (*q.v.*), minister of Stirling, preached a synod sermon, in the course of which he took occasion to refer to the act in question as in his opinion unscriptural and unconstitutional.[1] Some of his expressions were objected to by members of synod, and it was resolved that he should be censured for them. This judgment, on appeal, was affirmed by the assembly in May 1733, whereupon Erskine protested to the effect that he held himself still at liberty to teach the same truths and to testify against the same or similar evils on every proper occasion. This protest, in which he was joined by William Wilson (1690–1741), Alexander Moncrieff (1695–1761) and James Fisher (1697–1775), ministers at Perth, Abernethy and Kinclaven respectively, was regarded by the assembly as contumacious, and the commission of assembly was ordered to procure its retractation or to proceed to higher censures. In November accordingly the protesting ministers were severed from their charges, their churches declared vacant, and all ministers of the Church prohibited from employing them in any ministerial function. They replied by protesting that they still adhered to the principles of the Church, though now obliged to "make a secession from the prevailing party in ecclesiastical courts."

In December 1733 they constituted themselves into a presbytery, but for some time their meetings were devoted almost entirely to prayer and religious conferences. In 1734 they published their first "testimony," with a statement of the grounds of their secession, which made prominent reference to the doctrinal laxity of previous general assemblies. In 1736 they proceeded to exercise "judicial powers" as a church court, published a "judicial testimony," and began to organize churches in various parts of the country. Having been joined by four other ministers, including the well-known Ralph Erskine, they appointed Wilson professor of divinity. For these acts proceedings were again instituted against them in the assembly, with the result that, having disowned the authority of that body in an "act of declinature," there were in 1740 all deposed and ordered to be ejected from their churches. Meanwhile the members of the "Associate Presbytery" and its adherents steadily increased, until in 1745 there were forty-five congregations under its jurisdiction, and it was reconstituted into an "Associate Synod." A violent controversy arose the same year respecting the religious clause of the oath taken by burgesses in Edinburgh, Glasgow and Perth ("I profess and allow with my heart the true religion presently professed within this realm and authorized by the laws thereof"), and resulted in April 1747 in a "breach," when two bodies were formed, each claiming to be the "Associate Synod"; those who condemned the swearing of the burgess oath as sinful came to be popularly known as "Antiburghers," while the other party, who contended that abstinence from it should not be made a term of communion, were designated "Burghers." The Antiburghers not only refused to hold further friendly conference with the others, but ultimately went so far as to pass sentences of deposition and the greater excommunication on the Erskines and other ministers who held the opposing view. The Associate (Antiburgher) Synod held its first meeting in Edinburgh in the house of Adam Gib (*q.v.*) on the 10th of April 1747. It grew with considerable rapidity, and in 1788 had ninety-four settled charges in Great Britain and nineteen in Ireland, besides a presbytery in America. For purposes of organization it was formed in that year into four provincial synods, and took the name of "The General Associate Synod." The "new light" controversies as to the province of the civil magistrate in matters of religion led to the publication of a revised testimony in the "voluntary" sense in 1804, and in consequence Thomas M'Crie (1772–1835), with three other brethren, withdrew to form the Constitutional Associate Presbytery. The Associate (Burgher) Synod held its first meeting at Stirling on the 16th of June 1747. The number of congregations under its charge rapidly increased, and within thirty years there were presbyteries in connexion with it in Ireland and North America, as well as throughout Scotland. In 1782 the American presbyteries took the designation of the Associate Reformed Church in America. About the year 1795 the "voluntary" controversy respecting the power of the civil magistrate in matters of religion arose within this synod also, and a large majority was found to have adopted "new light" views. This led in 1799 to the secession of the "Associate Presbytery," which in 1805 took the designation of the Associate Synod or Original Burgher Synod.[2] In 1820 the General Associate or Antiburgher Synod (to the number of 129 congregations[3]) united with the 154 congregations of the Associate or Burgher Synod. The body thus constituted, "The United Secession Church," had increased by 1847 to 400 congregations.

Relief Church.

The Presbytery of Relief was constituted in 1761 by three ministers of the Church of Scotland, one of whom was Thomas Gillespie (*q.v.*), who had been deposed by the assembly in 1752 for refusing to take part in the intrusion of unacceptable ministers. The number of congregations under its charge increased with considerable rapidity, and a Relief Synod was formed in 1773, which in 1847 had under its jurisdiction 136 congregations. The Relief Church issued no distinctive "testimonies," and a certain breadth of view was shown in the formal declaration of their terms of communion, first made in 1773, which allowed occasional communion with those of the Episcopal and Independent persuasion who are "visible saints." A Relief theological hall was instituted in 1824.

United Presbyterian Church.

In 1847 a union was formed between all the congregations of the United Secession Church and 118 out of 136 of the Relief Churches, in what now became the United Presbyterian Church. It was the first Presbyterian body to relax the stringency of subscription, the Synod passing a declaratory act on the subject in 1879. On such points as that of the six days' creation it was made clear that freedom was allowed; but when Mr David Macrae of Gourock claimed that it should also be allowed on the question of eternal punishment, he was at once declared to be no longer a minister of the church. He left behind him many who sympathized with his position, and in the remaining part of the 19th century the United Presbyterian Church came fully to share the forward movement of thought of the other Scottish churches. Doctrinally there was little difference between the United Presbyterian Church and the Free Church of Scotland, and between 1863 and 1873 negotiations were carried on for a union, which however were fruitless. But in 1896 the United Presbyterian Church again made advances, which were promptly met, and on the 31st of October 1900 the United Free Church of Scotland came into existence.

UNITED PROVINCES OF AGRA AND OUDH (formerly known as the North-Western Provinces and Oudh), a province of British India, lying between 23° 52′ and 31° 18′ N., and between 77° 3′ and 84° 39′ E. The province, including native states, has a total area of 112,243 sq. m. It is bounded N. by Tibet; N.E. by Nepal; E. by Bengal; S. by Chota Nagpur, Rewa, the Bundelkhand states, and the Central Provinces; and on the W. by Gwalior, Rajputana and the Punjab.

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[1] The passing of the act was certainly unconstitutional; it was rescinded in 1734, "because not made according to former acts."

[2] The majority of this synod joined the Church of Scotland in 1839. The small minority which still retained the name joined the Original Seceders in 1842, the resultant body assuming the designation of United Original Seceders. A small majority (twenty-seven ministers in all) of the Synod of United Original Seceders joined the Free Church in 1852.

[3] A dissentient remnant (eight congregations) of the General Associate Synod united with the Constitutional Associate Presbytery in 1827, the resultant body being called the Associate Synod of Original Seceders.

Physical Aspects.—The province occupies, roughly speaking, the upper basin of the Ganges and the Jumna, corresponding to the Hindostan proper of the Mahommedan chroniclers. A large semi-circular tract, comprising the valleys of the Gogra and the Gumti, has long been separated from the remainder of the great plain as the kingdom of Oudh; and though since 877 it has been under the administrative charge of a lieutenant-governor, it retains certain features of its former status as a chief-commissionership. The province includes the whole upper portion of the wide Gangetic basin, from the Himalayas and the Punjab plain to the Vindhyan plateau, and the low-lying ricefields of Behar. Taken as a whole, the lieutenant-governorship consists of the richest wheat-bearing country in India, irrigated both naturally by the rivers which take their rise in the northern mountains, and artificially by the magnificent system of canals which owe their origin to British enterprise. It is studded with villages, interspersed at greater distances with commercial towns. Except during the hot season, when the crops are off the fields, the general aspect in normal years is that of a verdant and well-tilled but very monotonous plain, only merging into hilly or mountainous country at the extreme edges of the basin on the south and north. The course of the great rivers marks the prevailing slope of the land, which falls away from the Himalayas, the Rajputana uplands, and the Vindhyan plateau south-eastwards towards the Bay of Bengal. The chief natural features of the province are thus determined by the main streams, whose alluvial deposits first formed the central portion of the United Provinces; while the currents afterwards cut deep channels through the detritus they brought down from the ring of hills or uplands.

The extreme or north-western Himalayan region comprises the native state of Garhwal, with the British districts of Dehra Dun, Naini Tal, Almora and Garhwal. The economic value of this mountainous tract is almost confined to the export of forest produce. South of the Himalayas, from which it is separated by valleys or *duns*, is the Siwalik range, which slopes down to the fruitful plain of the Doab (two rivers), a large irregular horn-shaped tongue of land enclosed between the Ganges and Jumna. The great boundary rivers flow through low-lying valleys fertilized by their overflow or percolation, while a high bank leads up to the central upland, which, though naturally dry and unproductive except where irrigated by wells, has been transformed by various canal systems. This favoured region may be regarded as the granary of upper India. North of the Ganges, and enclosed between that river and the Himalayas and Oudh, lies the triangular plain of Rohilkhand. This tract presents the same general features as the Gangetic valley, varied by the damp and pestilential submontane region of the *tarai* on the north-east, at the foot of the Kumaon hills. South of the Jumna is the poor and backward region of Bundelkhand, comprising the districts of Jalaun, Jhansi, Hamirpur and Banda. The soil is generally rocky and unfertile, and the population impoverished, scanty and ignorant. The southernmost portion of Bundelkhand is much cut up by spurs of sandstone and granite hills, running down from the Vindhyan system; but the northern half near the Jumna has a somewhat richer soil, and comes nearer in character to the plain of Doab. Below the junction of the Ganges and the Jumna at Allahabad the country begins to assume the appearance of the Bengal plains, and once more expands northwards to the foot of the Nepal Himalayas. This tract consists of three portions, separated by the Ganges and the Gogra. The division south of the Ganges comprises portions of Allahabad, Benares and Ghazipur, together with the whole of Mirzapur, and in general features somewhat resembles Bundelkhand, but the lowlands along the river bank are more fertile. The triangular tract between the Ganges and the Gogra and the boundary of Oudh is the most fertile corner of the Gangetic plain, and contains the densest population. The trans-Gogra region presents a wilder, submontane appearance.

Oudh forms the central portion of the great Gangetic plain, sloping downwards from the Nepal Himalayas in the north-east to the Ganges on the south-west. For 60 m. along the northern border of Gonda and Bahraich districts the boundary extends close up to the lower slopes of the Himalayas, embracing the damp and unhealthy submontane region known as the *tarai*. To the westward of this the northern boundary recedes a little from the mountain tract, and the *tarai* in this portion of the range has been for the most part ceded to Nepal. With the exception of a belt of government forest along the northern frontier, the rest of the province consists of a fertile and densely peopled plain. The greatest elevation (600 ft.) is attained in the jungle-clad plateau of Khairagarh in Kheri district, while the extreme south-east frontier is only 230 ft. above sea level. Four great rivers traverse or skirt the plain of Oudh in converging courses the Ganges, the Gumti, the Gogra and the Rapti. Numerous smaller channels seam the whole face of the country carrying off the surplus drainage in the rains, but drying up in the hot season. All the larger rivers, except the Gumti, as well as most of the smaller streams, have beds hardly sunk below the general level; and in time of floods they burst through their banks and carve out new channels. Numerous shallow ponds or *jhils* mark the former beds of the shifting rivers. These *jhils* have great value, not only as preservatives against inundation, but also as reservoirs for irrigation. The soil of Oudh consists of a rich alluvial deposit, the detritus of the Himalayan system washed down into the Ganges valley. Usually a light loam, it passes here and there into pure clay, or degenerates occasionally into barren sand. The uncultivable land consists chiefly of extensive *usar* plains, found in the southern and western districts, and covered by the deleterious saline efflorescence known as *reh*. Oudh possesses no valuable minerals. Salt was extensively manufactured during native rule, but the British government has prohibited this industry for fiscal reasons. Nodular limestone (*kankar*) occurs in considerable deposits, and is used as road metal.

The villages lie thickly scattered, consisting of low thatched cottages, and surrounded by patches of garden land, or groves of banyan, *pipal* and *pakar* trees. The dense foliage of the mango marks the site of almost every little homestead, no less an area than 1000 sq. m. being covered by these valuable fruit-trees. Tamarinds overhang the huts of the poorer classes, while the seat of a wealthy family may be recognized by clumps of bamboo. Plantains, guavas, jack-fruit, limes and oranges add further beauty to the village plots. The flora of the government reserved forests is rich and varied. The *sal* tree yields the most important timber; the finest logs are cut in the Khairagarh jungles and floated down the Gogra to Bahramghat, where they are sawn. The hard wood of the *shisham* is also valuable; and several other timber-trees afford materials for furniture or roofing shingle. Among the scattered jungles in various parts of the province, the *mahua* tree is prized alike for its edible flowers, its fruits and its timber. The *jhils* supply the villages with wild rice, the roots and seeds of the lotus, and the *singhara* water-nut. The fauna comprises most of the animals and birds common to the Gangetic plain; but the wild elephant is now practically unknown, except when a stray specimen loses its way at the foot of the hills. Tigers are now only found in any numbers in the wilds of Khairagarh. Leopards still haunt the cane-brakes and thickets along the banks of the rivers; and *nilgai* and antelopes abound. Game birds consist of teal and wild duck, snipe, jungle fowl and peacock.

Rivers.—The Ganges and its affluents, the Jumna, the Ramganga and the Gogra, rise in the Himalayas, and meet within the province. In addition there are the following secondary streams: the Kalinadi and the Hindan flow through the Doab; the Chambal intersects the trans-Jumna tract; in Bundelkhand the principal streams are the Betwa and the Ken; the Ramgana, rising in Garhwal, pursues a tortuous course through Rohilkhand; the Gumti flows past Lucknow and Jaunpur to join the Ganges; the trans-Gogra region is divided into two nearly equal parts by the Rapti. These rivers are constantly modifying the adjacent lands. A small obstruction may divert the stream from one side to the other. The deep stream corrodes and cuts down the high ground; but meanwhile alluvial flats are gradually piled up in the shallows. The tributary streams get choked at the mouth and assist the process of deposition. The deposit is greatest when the floods of the rainy season are subsiding.

Climate.—The climate as a whole is hot and dry. The Himalayan districts of course are cool, and have a much greater rainfall than the plains. They are succeeded by a broad submontane belt, the *tarai*, which is rendered moist by the mountain torrents, and is covered by forest from end to end. This region bears the reputation of being the most unhealthy in all India, and in many parts only the acclimatized aborigines can withstand its deadly malaria. The plain country is generally warm and dry, the heat becoming more oppressive as the general level of the country sinks towards Allahabad and Benares, or among the hills of Bundelkhand. There are three seasons. The cold changes gradually to the hot; the hot season gives way abruptly to the rains; and the rains again change gradually into the cold season. In point of humidity and temperature the province lies half-way between Bengal and the Punjab. The rainfall varies from 30 to 44 in. in the plains, increasing gradually towards the Himalaya. The temperature in the hot season ranges from 86° to 115° F., and even higher, in the shade.

Minerals.—Owing to the loamy nature of the soil, few minerals of any kind are found. Iron and coal exist in the southern hills. A little coal was extracted from Mirzapur in 1896, but the enterprise was dropped. Iron, copper, sapphires, &c., are said to be obtainable in the Himalaya. It has been suggested that the oily water known as *telya pani* indicates the presence of petroleum.

Agriculture.—Out of a total area of 104,075 sq. m. in the British districts of the province, over 54,000 sq. m. are under cultivation. The course of tillage comprises two principal harvests: the *kharif*, or autumn crops, sown in June and reaped in October or November; and the *rabi*, or spring crops, sown in October or November, and reaped in March or April. The great agricultural staple is wheat, but millets and rice are also largely cultivated. Speaking broadly, rice and oilseeds predominate in the eastern and sub-Himalayan districts, millets and cotton in Bundelkhand and wheat in the greater part of the Gangetic plain. The pulses *mung*, *urd* and *moth* are grown generally in the autumn alone, or in combination with millets; and gram, alone or in combination with wheat and barley, is an important spring crop. Sugar-cane, indigo, poppy and tobacco are locally important; and a little tea is grown in the submontane districts of Almora Garhwal and Dehra Dun.

Land Tenure.—Owing to historical reasons, the system of land tenure is not uniform. In the Benares division, which was the first portion to come under British administration, the land revenue was permanently fixed in 1795, on the same principles that had been previously adopted in Bengal; and there a special class of tenants, as well as the landlords, enjoy a privileged status. Throughout the rest of the province of Agra, almost all of which was acquired between 1801 and 1803, temporary settlements are in force, usually for a term of thirty years, the revenue being assessed at one-half of the "assets" or estimated rental value. The settlement is made with the landholders or *zamindars*, who are frequently a group of persons holding distinct shares in the land, and may be themselves petty cultivators. No proprietary rights superior to those of the actual landowners are recognized. The only privileged class of tenants are those possessing "occupancy" rights, as defined by statute. These rights, which are heritable but not transferable, protect the tenant against eviction, except for default in payment of rent, while the rent may not be enhanced except by mutual agreement or by order of a revenue court. "Occupancy" rights are acquired by continuous cultivation for ten years, but the cultivation need not be of the same holding. All other tenants are merely tenants-at-will. In Oudh, after the convulsion of the Mutiny, all rights in land were confiscated at a stroke, and the new system adopted was in the nature of a treaty between the state and the *talukdars*, or great landlords. These *talukdars* had not all the same origin. Many were Rajput chiefs, ruling over their tribesmen by ancient hereditary right; while others were officials or court favourites, who had acquired power and property during the long period of native misrule. On all the same status was now conferred—a status that has no analogy in the rest of India. By *sanad* (or patent) and by legislation the *talukdars* were declared to possess permanent, heritable and transferable rights, with the special privilege of alienation, either in lifetime or by will, notwithstanding the limits imposed by Hindu or Mahommedan law. In addition most of them follow the rule of primogeniture, while a power of entail has recently been granted. The estates of *talukdars* extend over more than half the total area of Oudh. No "occupancy" rights based on continuous cultivation are recognized in Oudh, but similar rights, here known as "sub-proprietary," were granted to all those who had possessed them within thirty years before annexation. On the other hand, there are no tenants-at-right in Oudh. Any person admitted to the cultivation of land is entitled to hold it for seven years at the same rent, which may not be advanced by more than 6¼% at the end of the term.

Manufactures.—The principal manufactures are those of sugar, indigo and coarse cotton cloth. Ornamental metal-work is made at Benares. Among the factories on the English model are the Elgin and Muir cotton mills at Cawnpore, the Cawnpore tanneries and leather factories, the Shahjahanpur rum distillery, and breweries at Mussoorie and Naini Tal. There are also woollen and jute mills, iron and brass foundries, lac factories and oil-mills. The manufacture of synthetic indigo by German chemists has greatly affected the growth and manufacture of indigo, the indigo factories decreasing in 1904–1905 from 402 to 252.

Trade.—The export trade is chiefly confined to agricultural produce. The principal staples include wheat, oilseeds, raw cotton, indigo, sugar, molasses, timber and forest produce, dry-stuffs, ghee, opium and tobacco. The imports consist mainly of English piece-goods, metal-work, manufactured wares, salt and European goods. The chief centres of trade are Cawnpore, Allahabad, Mirzapur, Benares, Meerut and Moradabad.

Irrigation.—The Doab is intersected by canals drawn from the great rivers. The major productive works are the upper and lower Ganges, the eastern Jumna, and the Agra canals. The greatest work in the province, and one of the greatest irrigation works in the world, is the upper Ganges canal, which is taken from the river where it leaves the hills, some 2 m. above Hardwar. In the first 20 m. of its course this gigantic canal crosses four great torrents, which bring down immense volumes of water in the rainy season. The first two are carried in massive aqueducts over the canal, the third is passed through the canal by a level-crossing, regulated by drop-gates, and the canal is taken over the fourth by an aqueduct. The total length of the main canal is 213 m., navigable throughout, and designed to irrigate 1,500,000 acres. The lower Ganges canal is taken from the river at Narora, 149 m. below Hardwar. After crossing in 55 m. four great drainage lines, it cuts into the Cawnpore, and 7 m. lower down into the Etawah, branches of the upper Ganges canal. These branches are now below the point of intersection, part of the lower Ganges canal system. The irrigating capacity of this canal is 1,250,000 acres.

Railways.—The province is well supplied with railways. The main line of the East Indian runs throughout south of the Ganges, which is bridged at Benares and Cawnpore. North of the river the Oudh & Rohilkhand system connects with Bengal and with the Punjab. From Allahabad, Cawnpore and Agra trade finds an outlet to the sea at Bombay as well as at Calcutta.

Administration.—The administration is conducted by a lieutenant-governor, with five secretaries and five under-secretaries. There is no executive council; but the board of revenue, consisting of two members, exercises important executive duties, and is also the highest court of appeal in revenue and rent cases. For legislative purposes the lieutenant-governor has a council, first constituted in 1886, and enlarged in 1909. It now consists of 48 members, of whom 28 are nominated, and the remainder are elected by local bodies, landholders, Mahommedans, &c. In Agra the chartered high court sitting at Allahabad, and in Oudh the court of the judicial commissioner, sitting at Lucknow, have final jurisdiction in both civil and criminal cases, subject to appeal to the privy council. The former is composed of a chief justice and six puisne judges appointed by the Crown; the latter of a judicial commissioner and two additional judicial commissioners. For ordinary purposes of administration the provinces are divided into nine divisions, each under a commissioner, and into 48 districts, each under a collector or deputy commissioner. Two native states are attached to the United Provinces—Rampur and Garhwal.

Population.—Out of a total population in 1901 of 47,691,782 no fewer than 40,691,818, or over 85% were Hindus, and 6,731,034 or 14% Mahommedans. The total number of persons belonging to all the other religions—Sikhs, Jains, Buddhists, Parsees, Christians, Jews, Aryas and Brahmos—was only 268,930, or less than 0·6%. While nearly fifty languages in all are spoken in the provinces, out of every 10,000 people 4527 speak Western Hindi, 3125 Eastern Hindi, 2109 Bihari and 211 Central Pahari.

History.—If the present limits be slightly extended in either direction so as to include Delhi and Patna, the United Provinces would contain the area on which almost the whole drama of Indian history has been played. Here lay the scene, known as *Madhya Desa* or "middle country," of the second period of Aryan colonization, when the two great epics, the *Mahabhārata* and *Ramayana*, were probably composed, and when the religion of Brahmanism took form. Here Buddha was born, preached and died. Here arose the successive dynasties of Asoka, of the Guptas, and of Harshavardhana, which for a thousand years exercised imperial sway over the greater part of India. Here is Ajodhya, the home of Rama, the most popular of Hindu demigods; and also Benares and Muttra, the most sacred of Hindu shrines. Here too were the Mahommedan capitals—Delhi, Agra, Allahabad, Jaunpur and Lucknow. Here finally, at the crisis of the Mutiny, British dominion was permanently established in India.

The political vicissitudes through which this tract of country passed in earlier times are described under INDIA: *History*. It will be sufficient here to trace the steps by which it passed under British rule. In 1765, after the battle of Buxar, when the nawab of Oudh had been decisively defeated and Shah Alam, the Mogul emperor, was a suppliant in the British camp, Lord Clive was content to claim no acquisition of territory. The whole of Oudh was restored to the Nawab, and Shah Alam received as an imperial apanage the province of Allahabad and Kora in the lower Doab, with a British garrison in the fort of Allahabad. Warren Hastings augmented the territory of Oudh by lending the nawab a British army to conquer Rohilkhand, and by making over to him Allahabad and Kora on the ground that Shah Alam had placed himself in the power of the Mahrattas. At the same time he received from Oudh the sovereignty over the province of Benares. Subsequently no great change took place until the arrival of Lord Wellesley, who acquired a very large accession of territory in two instalments. In 1801 he obtained from the nawab of Oudh the cession of Rohilkhand, the lower Doab, and the Gorakhpur division, thus enclosing Oudh on all sides except the north. In 1804, as the result of Lord Lake's victories in the Mahratta War, the rest of the Doab and part of Bundelkhand, together with

Agra and the guardianship of the old and blind emperor, Shah Alam, at Delhi, were obtained from Sindia. In 1815 the Kumaon division was acquired after the Gurkha War, and a further portion of Bundelkhand from the peshwa in 1817. These new acquisitions, known as the ceded and conquered provinces, continued to be administered by the governor-general as part of Bengal. In 1833 an act of parliament was passed to constitute a new presidency, with its capital at Agra. But this scheme was never fully carried out, and in 1835 another statute authorized the appointment of a lieutenant-governor for the North-Western Provinces, as they were then styled. They included the Delhi territory, transferred after the Mutiny to the Punjab; and also (after 1853) the Saugor and Nerbudda territories, which in 1861 became part of the Central Provinces. Meanwhile Oudh remained under its nawab, who was permitted to assume the title of king in 1819. All protests against gross misgovernment during many years having proved useless, Oudh was annexed in 1856 and constituted a separate chief commissionership. Then followed the Mutiny, when all signs of British rule were for a time swept away throughout the greater part of the two provinces. The lieutenant-governor died when shut up in the fort at Agra, and Oudh was only reconquered after several campaigns lasting for eighteen months.

In 1877 the offices of lieutenant-governor of the North-Western Provinces and chief commissioner of Oudh were combined in the same person; and in 1902, when the new name of United Provinces was introduced, the title of chief commissioner was dropped, though Oudh still retains some marks of its former independence.

See *Gazetteer of the United Provinces* (2 vols., Calcutta, 1908); and Theodore Morison, *The Industrial Organization of an Indian Province* (1906).

UNITED STATES, THE, the short title usually given to the great federal republic which had its origin in the revolt of the British colonies in North America, when, in the Declaration of Independence, they described themselves as "The Thirteen United States of America." Officially the name is "The United States of America," but "The United States" (used as a singular and not a plural) has become accepted as the name of the country; and pre-eminent usage has now made its citizens "Americans," in distinction from the other inhabitants of North and South America.

Boundaries and Area.

The area of the United States, as here considered, exclusive of Alaska and outlying possessions, occupies a belt nearly twenty degrees of middle latitude in width, and crosses North America from the Atlantic to the Pacific. The southern boundary is naturally defined on the east by the Gulf of Mexico; its western extension crosses obliquely over the western highlands, along an irregular line determined by aggressive Americans of Anglo-Saxon stock against Americans of Spanish stock. The northern boundary, after an arbitrary beginning, finds a natural extension along the Great Lakes, and thence continues along the 49th parallel of north latitude to the Pacific (see *Bulletin* 171, U.S. Geological Survey). The area thus included is 3,026,789 sq. m.[1]

I.—Physical Geography

Coast.—The Atlantic coast of the United States is, with minor exceptions, low; the Pacific coast is, with as few exceptions, hilly or mountainous. The Atlantic coast owes its oblique N.E.–S.W. trend to crustal deformations which in very early geological time gave a beginning to what later came to be the Appalachian mountain system; but this system had its climax of deformation so long ago (probably in Permian time) that it has since then been very generally reduced to moderate or low relief, and owes its present altitude either to renewed elevations along the earlier lines or to the survival of the most resistant rocks as residual mountains. The oblique trend of the coast would be even more pronounced but for a comparatively modern crustal movement, causing a depression in the north-east, with a resulting encroachment of the sea upon the land, and an elevation in the south-west, with a resulting advance of the land upon the sea. The Pacific coast has been defined chiefly by relatively recent crustal deformations, and hence still preserves a greater relief than that of the Atlantic. The minor features of each coast will be mentioned in connexion with the land districts of which the coast-line is only the border.

General Topography and Drainage.—The low Atlantic coast and the hilly or mountainous Pacific coast foreshadow the leading features in the distribution of mountains within the United States. The Appalachian system, originally forest-covered, on the eastern side of the continent, is relatively low and narrow; it is bordered on the south-east and south by an important coastal plain. The Cordilleran system on the western side of the continent is lofty, broad and complicated, with heavy forests near the north-west coast, but elsewhere with trees only on the higher ranges below the Alpine region, and with treeless or desert intermont valleys, plateaus and basins, very arid in the south-west. Between the two mountain systems extends a great central area of plains, stretching from the Gulf of Mexico northward, far beyond the national boundary, to the Arctic Ocean. The rivers that drain the Atlantic slope of the Appalachians are comparatively short; those that drain the Pacific slope include only two, the Columbia and the Colorado, which rise far inland, near the easternmost members of the Cordilleran system, and flow through plateaus and intermont basins to the ocean. The central plains are divided by a hardly perceptible height of land into a Canadian and a United States portion; from the latter the great Mississippi system discharges southward to the Gulf of Mexico. The upper Mississippi and some of the Ohio basin is the prairie region, with trees originally only along the watercourses; the uplands towards the Appalachians were included in the great eastern forested area; the western part of the plains has so dry a climate that its herbage is scanty, and in the south it is barren. The lacustrine system of the St Lawrence flows eastward from a relatively narrow drainage area.

Relation of General Topography to Settlement.—The aboriginal occupants of the greater part of North America were comparatively few in number, and except in Mexico were not advanced beyond the savage state. The geological processes that placed a much narrower ocean between North America and western Europe than between North America and eastern Asia secured to the New World the good fortune of being colonized by the leading peoples of the occidental Old World, instead of by the less developed races of the Orient. The transoceanic invasion progressed slowly through the 17th and 18th centuries, delayed by the head winds of a rough ocean which was crossed only in slow sailing vessels, and by the rough "backwoods" of the Appalachians, which retarded the penetration of wagon roads and canals into the interior. The invasion was wonderfully accelerated through the 19th century, when the vast area of the treeless prairies beyond the Appalachians was offered to the settler, and when steam transportation on sea and land replaced sailing vessels and wagons. The frontier was then swiftly carried across the eastern half of the central plains, but found a second delay in its advance occasioned by the dry climate of the western plains. It was chiefly the mineral wealth of the Cordilleran region, first developed on the far Pacific slope, and later in many parts of the inner mountain ranges, that urged pioneers across the dry plains into the apparently inhospitable mountain region; there the adventurous new-comers rapidly worked out one mining district after another, exhausting and abandoning the smaller "camps" to early decay and rushing in feverish excitement to new-found river fields, but establishing important centres of varied industries in the more important mining districts. It was not until the settlers learned to adapt themselves to the methods of wide-range cattle raising and of farming by irrigation that the greater value of the far western interior was recognized as a permanent home for an agricultural population.

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[1] The following are the states of the Union (recognized abbreviations being given in brackets): Alabama (Ala.), Arizona (Ariz.), Arkansas (Ark.), California (Cal.), Colorado (Col.), Connecticut (Conn.), Delaware (Del.), Florida (Fla.), Georgia (Ga.), Idaho, Illinois (Ill.), Indiana (Ind.), Iowa (Ia.), Kansas (Kan.), Kentucky (Ky.), Louisiana (La.), Maine (Me.), Maryland (Md.), Massachusetts (Mass.), Michigan (Mich.), Minnesota (Minn.), Mississippi (Miss.), Missouri (Mo.), Montana (Mont.), Nebraska (Neb.), Nevada (Nev.), New Hampshire (N.H.), New Jersey (N.J.), New Mexico (N. Mex.), New York (N.Y.), North Carolina (N.C.), North Dakota (N. Dak.), Ohio (O.), Oklahoma (Okla.), Oregon (Oreg.), Pennsylvania (Pa.), Rhode Island (R.I.), South Carolina (S.C.), South Dakota (S. Dak.), Tennessee (Tenn.), Texas (Tex.), Utah, Vermont (Vt.), Virginia (Va.), West Virginia (W. Va.), Washington (Wash.), Wisconsin (Wis.), Wyoming (Wyo.); together with the District of Columbia (D.C.).

The purchase of "Louisiana"—a great area west of the Mississippi river—from the French in 1803 has sometimes been said to be the cause of the westward expansion of the United States, but the Louisiana purchase has been better interpreted as the occasion for the expansion rather than its cause; for, as Lewis Evans of Philadelphia long ago recognized (1749), whoever gained possession of the Ohio Valley—the chief eastern part of the central plains—would inevitably become the masters of the continent.

Physiographic Subdivisions.—The area of the United States may be roughly divided into the Appalachian belt, the Cordilleras and the central plains, as already indicated. These large divisions need physiographic subdivision, which will now be made, following the guide of "structure, process and stage"; that is, each subdivision or province will be defined as part of the earth's crust in which some similarity of geological structure prevails, and upon which some process or processes of surface sculpture have worked long enough to reach a certain stage in the cycle of physiographic development.

The Appalachians.—The physiographic description of the Appalachian mountain system offers an especially good opportunity for the application of the genetic method based on "structure, process and stage." This mountain system consists essentially of two belts: one on the south-east, chiefly of ancient and greatly deformed crystalline rocks, the other on the north-west, a heavy series of folded Palaeozoic strata; and with these it will be convenient to associate a third belt, farther north-west, consisting of the same Palaeozoic strata lying essentially horizontal and constituting the Appalachian plateau. The crystalline belt represents, at least in part, the ancient highlands from whose ruins the sandstones, shales and limestones of the stratified series were formed, partly as marine, partly as fluviatile deposits. The deformation of the Appalachians was accomplished in two chief periods of compressive deformation, one in early Palaeozoic, the other about the close of Palaeozoic time, and both undoubtedly of long duration; the second one extended its effects farther northwest than the first. These were followed by a period of minor tilting and faulting in early Mesozoic, by a moderate upwarping in Tertiary, and by a moderate uplift in post-Tertiary time. The later small movements are of importance because they are related to the existing topography with which we are here concerned. Each of the disturbances altered the attitude of the mass with respect to the general base-level of the ocean surface; each movement therefore introduced a new cycle of erosion, which was interrupted by a later movement and the beginning of a later cycle.

Thus interpreted, the Appalachian forms of to-day may be ascribed to three cycles of erosion: a nearly complete Mesozoic cycle, in which most of the previously folded and faulted mountain masses were reduced in Cretaceous time to a peneplain or lowland of small relief, surmounted, however, in the north-east and in the south-west by monadnocks of the most resistant rocks, standing singly or in groups; an incomplete Tertiary cycle, initiated by the moderate Tertiary upwarping of the Mesozoic peneplain, and of sufficient length to develop mature valleys in the more resistant rocks of the crystalline belt or in the horizontal strata of the plateau, and to develop late mature or old valleys in the weaker rocks of the stratified belt, where the harder strata were left standing up in ridges; and a brief post-Tertiary cycle, initiated by an uplift of moderate amount and in progress long enough only to erode narrow and relatively immature valleys. Glacial action complicated the work of the latest cycle in the northern part of the system. In view of all this it is possible to refer nearly every element of Appalachian form to its appropriate cycle and stage of development. The more resistant rocks, even though dissected by Tertiary erosion, retain in their summit uplands an indication of the widespread peneplain of Cretaceous time, now standing at the altitude given to it by the Tertiary upwarping and post-Tertiary uplift; and the most resistant rocks surmount the Cretaceous peneplain as unconsumed monadnocks of the Mesozoic cycle. On the other hand, the weaker rocks are more or less completely reduced to lowlands by Tertiary erosion, and are now trenched by the narrow and shallow valleys of the short post-Tertiary cycle. Evidently, therefore, the Appalachians as we now see them are not the still surviving remnants of the mountains of late Palaeozoic deformation; they owe their present height chiefly to the Tertiary upwarping and uplifting, and their form to the normal processes of sculpture which, having become nearly quiescent at the close of the Mesozoic cycle, became active again in Tertiary and later times.

The belts of structure and the cycles of erosion thus briefly described are recognizable with more or less continuity from the Gulf of St Lawrence 1500 m. south-westward to Alabama, where the deformed mountain structures pass out of sight under nearly horizontal strata of the Gulf coastal plain. But the dimensions of the several belts and the strength of the relief developed by their later erosion varies greatly along the system. In a north-eastern section, practically all of New England is occupied by the older crystalline belt; the corresponding northern part of the stratified belt in the St Lawrence and Champlain-Hudson valleys on the inland side of New England is comparatively free from the ridge-making rocks which abound farther south; and here the plateau member is wanting, being replaced, as it were, by the Adirondacks, an outlier of the Laurentian highlands of Canada which immediately succeeds the deformed stratified belt west of Lake Champlain. In a middle section of the system, from the Hudson river in southern New York to the James river in southern Virginia, the crystalline belt is narrowed, as if by the depression of its south-eastern part beneath the Atlantic Ocean or beneath the strata of the Atlantic coastal plain which now represents the ocean; but the stratified belt is here broadly developed in a remarkable series of ridges and valleys determined by the action of erosion on the many alternations of strong and weak folded strata; and the plateau assumes full strength southward from the monoclinal Mohawk valley which separates it from the Adirondacks. The linear ridges of this middle section are often called the Alleghany Mountains. In a south-western section the crystalline belt again assumes importance in breadth and height, and the plateau member maintains the strength that it had in the middle section, but the intermediate stratified belt again has fewer ridges, because of the infrequence here of ridge-making strata as compared to their frequency in the middle section.

The Middle Appalachians.

The middle section of the Appalachians, rather arbitrarily limited by the Hudson and the James rivers, may be described first because it contains the best representation of the three longitudinal belts of which the mountain system as a whole is composed. The mountain-making compression of the heavy series of Palaeozoic strata has here produced a marvellous series of rock folds with gently undulating axes, trending north-east and south-west through a belt 70 or 80 m. wide; no less wonderful is the form that has been produced by the processes of sculpture. The peculiar configuration of the ridges may be apprehended as follows: The pattern of the folded strata on the low-lying Cretaceous peneplain must have resembled the pattern of the curved grain of wood on a planed board. When the peneplain was uplifted the weaker strata were worn down almost to a lowland of a second generation, while the resistant sandstones, of which there are three chief members, retained a great part of their new-gained altitude in the form of long, narrow, even-crested ridges, well deserving of the name of Endless Mountains given them by the Indians, but here and there bending sharply in peculiar zigzags which give this Alleghany section of the mountains an unusual individuality. The post-Tertiary uplift, giving the present altitude of 1000 or 1500 ft. in Pennsylvania, and of 2500 or 3500 ft. in Virginia, has not significantly altered the forms thus produced; it has only incited the rivers to intrench themselves 100 or more feet beneath the lowlands of Tertiary erosion. The watercourses to-day are, as a rule, longitudinal, following the strike of the weaker strata in paths that they appear to have gained by spontaneous adjustment during the long Mesozoic cycle; but now and again they cross from one longitudinal valley to another by a transverse course, and there they have cut down sharp notches or "water-gaps" in the hard strata that elsewhere stand up in the long even-crested ridges.

The transition from the strongly folded structure of the Alleghany ridges and valleys to the nearly horizontal structure of the Appalachian plateau is promptly made; and with the change of structure comes an appropriate change of form. The horizontal strata of the plateau present equal ease or difficulty of erosion in any direction; the streams and the submature valleys of the plateau therefore ramify in every direction, thus presenting a pattern that has been called insequent, because it follows no apparent control. Further mention of the plateau is made in a later section.

The crystalline belt of the middle Appalachians, 60 or 80 m. wide, is to-day of moderate height because the Tertiary upwarping was there of moderate amount. The height is greatest along the inner or north-western border of the belt, and here a sub-mountainous topography has been produced by normal dissection, chiefly in the Tertiary cycle; the valleys being narrow because the rocks are resistant. The relief is strong enough to make occupation difficult; the slopes are forested; the uplands are cleared and well occupied by farms and villages, but many of the valleys are wooded glens. With continued decrease of altitude south-eastward, the crystalline belt dips under the coastal plain, near a line marked by the Delaware river from Trenton to Philadelphia in Pennsylvania, and thence south-south-westward through Maryland and Virginia past the cities of Baltimore, Washington and Richmond.

The Pennsylvania portion of the crystalline belt is narrow, as has been said, because of encroachment upon it by the inward overlap of the coastal plain; it is low because of small Tertiary uplift; but, still more, it is discontinuous, because of the inclusion of certain belts of weak non-crystalline rock; here the rolling uplands are worn down to lowland belts, the longest of which reaches from the southern corner of New York, across New Jersey, Pennsylvania and Maryland, into central Virginia.

Drainage.

The middle section of the Appalachians is further distinguished from the north-eastern and south-western sections by the arrangement of its drainage: its chief rivers rise in the plateau belt and flow across the ridges and valleys of the stratified belt and through the uplands of the crystalline belt to the sea. The rivers which most perfectly exemplify this habit are the Delaware, Susquehanna and Potomac; the Hudson, the north-eastern boundary of the middle section, is peculiar in having headwaters in the Adirondacks as well as in the Catskills (northern part of the plateau); the James, forming the south-western boundary of the section, rises in the inner valleys of the stratified belt, instead of in the plateau. The generally transverse course of these rivers has given rise to the suggestion that they are of antecedent origin; but there are many objections to this over-simple, Gordian explanation. The south-east course of the middle-section rivers is the result of many changes from the initial drainage; the Mesozoic and Tertiary upwarpings were probably very influential in determining the present general courses.

For the most part the rivers follow open valleys along belts of weak strata; but they frequently pass through sharp-cut notches in the narrow ridges of the stratified belt—the Delaware water-gap is one of the deepest of these notches; and in the harder rocks of the crystalline belt they have eroded steep-walled gorges, of which the finest is that of the Hudson, because of the greater height and breadth of the crystalline highlands there than at points where the other rivers cross it. The rivers are shallow and more or less broken by rapids in the notches; rapids occur also near the outer border of the crystalline belt, as if the rivers there had been lately incited to downward erosion by an uplift of the region, and had not yet had time to regrade their courses. This is well shown in the falls of the Potomac a few miles above Washington; in the rapids of the lower Susquehanna; and in the falls of the Schuylkill, a branch which joins the Delaware at Philadelphia, where the water-power has long been used in extensive factories. Hence rivers in the Appalachians are not navigable; it is only farther down-stream, where the rivers have been converted into estuaries and bays—such as Chesapeake and Delaware bays—by a slight depression of the coastal plain belt, that they serve the purposes of navigation. But the Hudson is strikingly exceptional in this respect; it possesses a deep and navigable tide-water channel all through its gorge in the highlands, a feature which has usually been explained as the result of depression of the land, but may also be explained by glacial erosion without change of land-level; a feature which, in connexion with the Mohawk Valley, has been absolutely determinative of the metropolitan rank reached by New York City at the Hudson mouth.

The North-eastern Appalachians.

The community of characteristics that is suggested by the association of six north-eastern states under the name "New England" is in large measure warranted by the inclusion of all these states within the broadened crystalline belt of the north-eastern Appalachians, which is here 150 m. wide. The uplands which prevail through the centre of this area at altitudes of about 1000 ft. rise to 1500 or 2000 ft. in the north-west, before descent is made to the lowlands of the stratified belt (St Lawrence-Champlain-Hudson valleys, described later on as part of the Great Appalachian valley), and at the same time the rising uplands are diversified with monadnocks of increasing number and height and by mature valleys cut to greater and greater depths; thus the interior of New England is moderately mountainous. When the central uplands are followed south-east or south to the coast, their altitude and their relief over the valleys gradually decrease; and thus the surface gradually passes under the sea. The lower coastal parts, from their accessibility and their smaller relief, are more densely populated; the higher and more rugged interior is still largely forested and thinly settled; there are large tracts of unbroken forest in northern Maine, hardly 150 m. from the coast. In spite of these contrasts, no physiographic line can be drawn between the higher and more rugged interior and the lower coastal border; one merges into the other. New England is a unit, though a diversified unit.

The Appalachian trends (N.E.–S.W.) that are so prominent in the stratified belt of the middle Appalachians, and are fairly well marked in the crystalline belt of New Jersey and Pennsylvania, are prevailingly absent in New England. They may be seen on the western border, in the Hoosac range along the boundary of Massachusetts and New York; in the linear series of the Green Mountain summits (Mt Mansfield, 4364 ft., Killington Peak, 4241 ft.) and their (west) piedmont ridges farther north in Vermont; and in the ridges of northern Maine: these are all in sympathy with Appalachian structure; so also are certain open valleys, as the Berkshire (limestone) Valley in western Massachusetts and the corresponding Rutland (limestone and marble) Valley in western Vermont; and more particularly the long Connecticut Valley from northern New Hampshire across Massachusetts to the sea at the southern border of Connecticut, the populous southern third of which is broadly eroded along a belt of red Triassic sandstones with trap ridges. But in general the dissection of the New England upland is as irregular as is the distribution of the surmounting monadnocks. The type of this class of forms is Mt Monadnock in south-western New Hampshire, a fine example of an isolated residual mass rising from an upland some 1500 ft. in altitude and reaching a summit height of 3186 ft. A still larger example is seen in Mt Katahdin (5200 ft.) in north-central Maine, the greatest of several similar isolated mountains that are scattered over the interior uplands without apparent system. The White Mountains of northern New Hampshire may be treated as a complex group of monadnocks, all of subdued forms, except for a few cliffs at the head of cirque-like valleys, with Mt Washington, the highest of the dome-like or low pyramidal summits, reaching 6293 ft., and thirteen other summits over 5000 ft. The absence of range-like continuity is here emphasized by the occurrence of several low passes or "notches" leading directly through the group; the best-known being Crawford's Notch (1900 ft.).

Drainage.

In consequence of the general south-eastward slope of the highlands and uplands of New England, the divide between the Atlantic rivers and those which flow northward and westward into the lowland of the stratified belt in Canada and New York is generally close to the boundary of these two physiographic districts. The chief rivers all flow south or south-east: they are the Connecticut, Merrimack, Kennebec, Penobscot and St John, the last being shared with the province of New Brunswick.

The drainage of New England is unlike that of the middle and south-western Appalachians in the occurrence of numerous lakes and falls. These irregular features are wanting south of the limits of Pleistocene glaciation; there the rivers have had time, in the latest cycle of erosion into which they have entered, to establish themselves in a continuous flow, and as a rule to wear down their courses to a smoothly graded slope. In New England also a well-established drainage undoubtedly prevailed in preglacial times; but partly in consequence of the irregular scouring of the rock floor, and even more because of the very irregular deposition of unstratified and stratified drift in the valleys, the drainage is now in great disorder. Many lakes of moderate size and irregular outline have been formed where drift deposits formed barriers across former river courses; the lake outlets are more or less displaced from former river paths. Smaller lakes were formed by the deposition of washed drift around the longest-lasting ice remnants; when the ice finally melted away, the hollows that it left came to be occupied by ponds and lakes. In Maine lakes of both classes are numerous; the largest is Moosehead Lake, about 35 m. long and of a very irregular shore line.

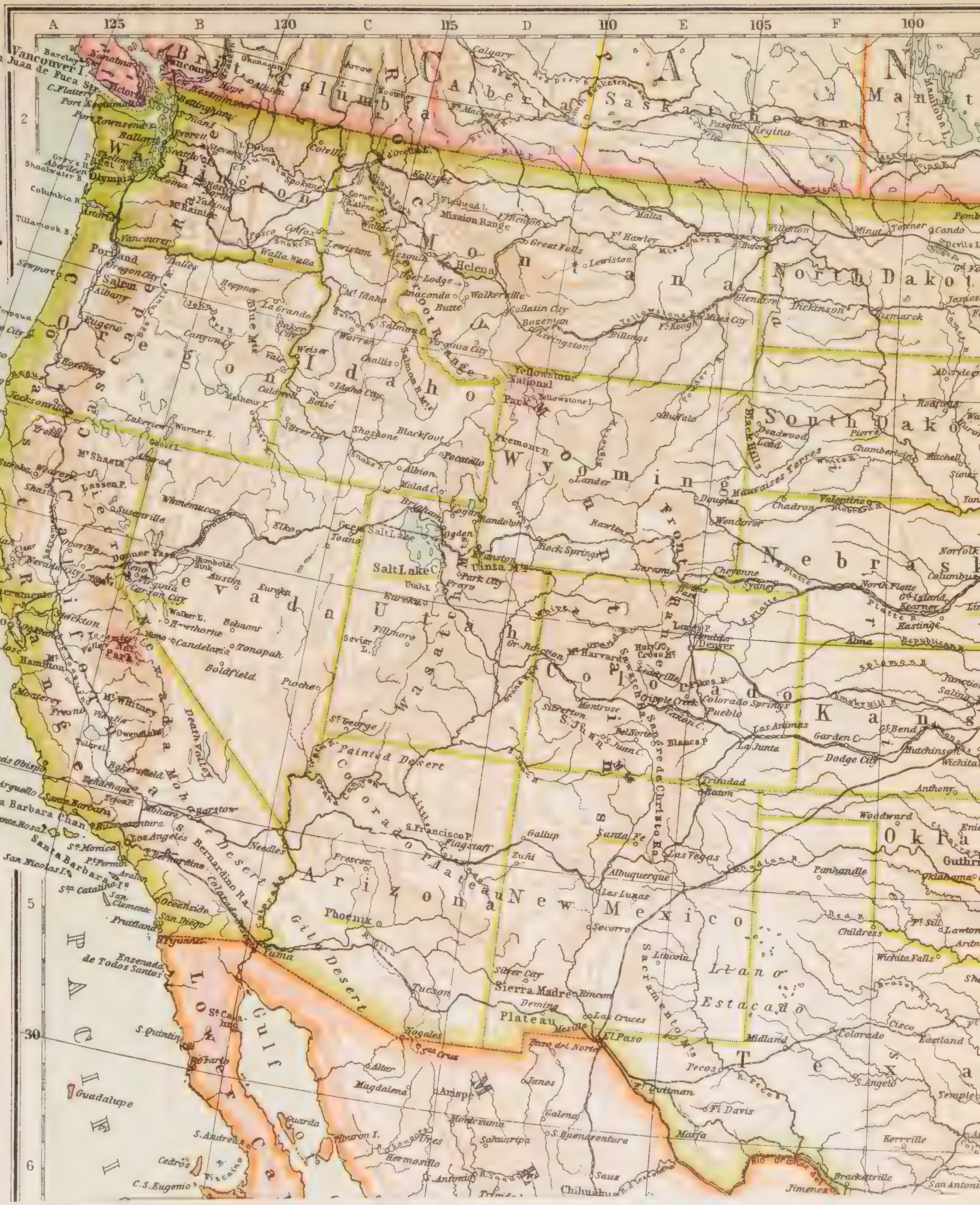
Coast.

The features of a coast can be appreciated only when it is perceived that they result from the descent of the land surface beneath the sea and from the work of the sea upon the shore line thus determined; and it is for this reason that throughout this article the coastal features are described in connexion with the districts of which they are the border. The maturely dissected and recently glaciated uplands of New England are now somewhat depressed with respect to sea-level, so that the sea enters the valleys, forming bays and estuaries, while the interfluve uplands and hills stand forth in headlands and islands. Narragansett Bay, with the associated headlands and islands on the south coast, is one of the best examples. Where drift deposits border the sea, the shore line has been cut back or built forward in beaches of submature expression, often enclosing extensive tidal marshes; but the great part of the shore line is rocky, and there the change from initial pattern due to submergence is as yet small. Hence the coast as a whole is irregular, with numerous embayments, peninsulas and islands; and in Maine this irregularity reaches a disadvantageous climax.

The South-western Appalachians.

As in the north-east, so in the south-west, the crystalline belt widens and gains in height; but while New England is an indivisible unit, the southern crystalline belt must be subdivided into a higher mountain belt on the north-west, 60 m. wide where broadest, and a lower piedmont belt on the south-east, 100 m. wide, from southern Virginia to South Carolina. This subdivision is already necessary in Maryland, where the mountain belt is represented by the Blue Ridge, which is rather a narrow upland belt than a ridge proper where the Potomac cuts across it; while the piedmont belt, relieved by occasional monadnocks, stretches from the eastern base of the Blue Ridge to the coastal plain, into which it merges. Farther south, the mountain belt widens and attains its greatest development, a true highland district in North Carolina, where it includes several strong mountain groups. Here Mt Mitchell rises to 6711 ft., the highest of the Appalachians, and about thirty other summits exceed 6000 ft., while the valleys are usually at altitudes of about 2000 ft. Although the relief is strong, the mountain forms are rounded rather than rugged; few of the summits deserve or receive the name of peaks; some are called domes, from their broadly rounded tops, others are known as balds, because the widespread forest cover is replaced over their heads by a grassy cap.

The height and massiveness of the mountains decrease to the south-west, where the piedmont belt sweeps westward around them in western Georgia and eastern Alabama. Some of the residual mountains hereabouts are reduced to a mere skeleton or framework by the retrogressive penetration of widening valleys between wasting spurs; the very type of vanishing forms. Certain districts within



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Salem
Oregon
Eugene
Roseburg
Jacksonville
Idaho
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Lewiston
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Pierre
Deadwood
Wyoming
Yellowstone National Park
Cheyenne
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Rock Springs
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Tonopah
Goldfield
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Colorado Springs
Leadville
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Sacramento
S. Francisco
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Monterey
Los Angeles
San Diego
Santa Barbara
Mt Whitney
Death Valley
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Phoenix
Tucson
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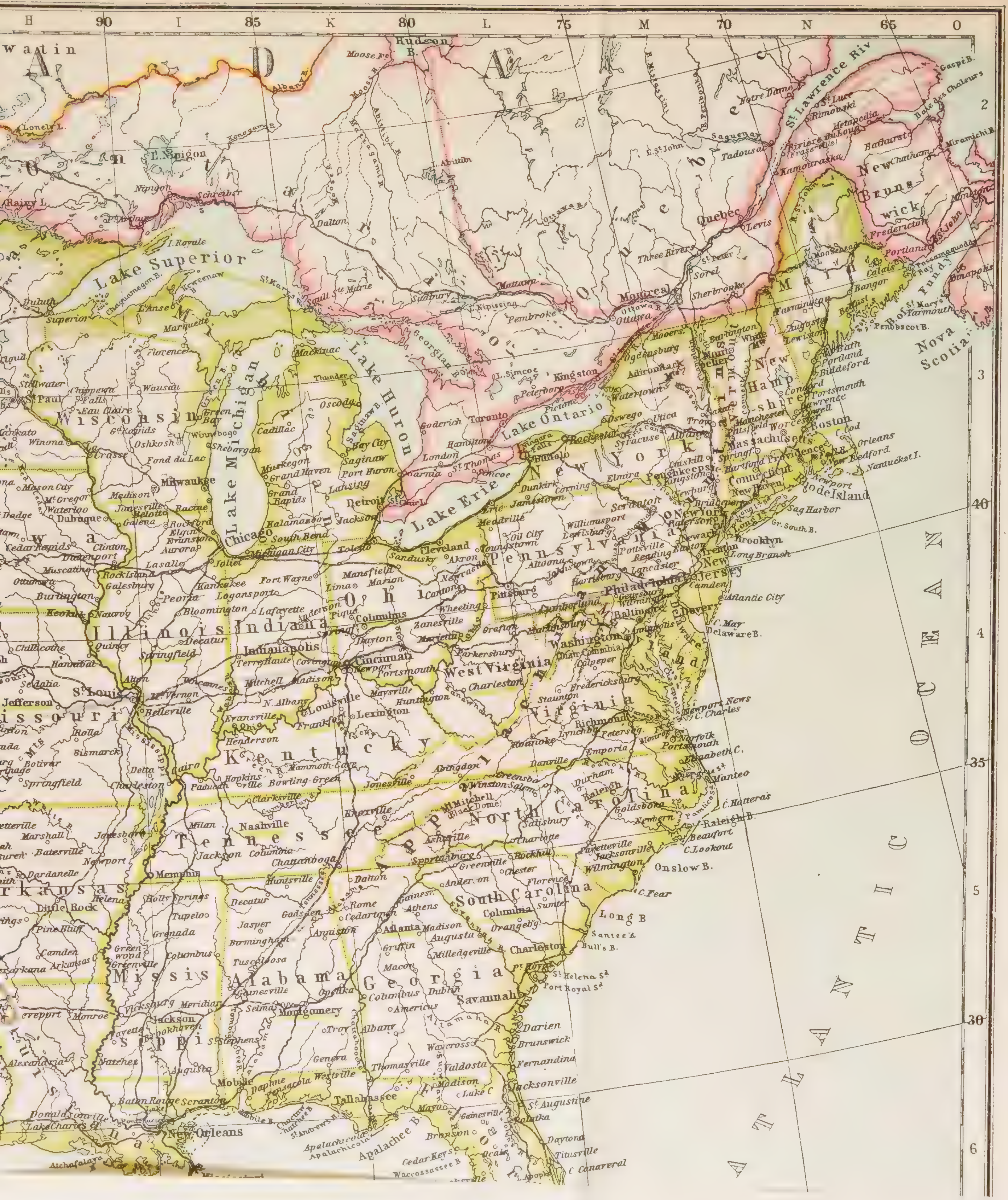
Prescott
Flagstaff
Painted Desert
Colorado Plateau
Gila Desert
New Mexico
Santa Fe
Albuquerque
Las Vegas
Socorro
Las Cruces
El Paso
Llano Estacado
Texas
Midland
San Angelo
Pecos
Lower California
Gulf of California
Guadalupe
Cedros
PACIFIC
Hermosillo
Chihuahua
Nogales
Sierra Madre Plateau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L. Abitibi
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Mattawa
Sudbury
L. Nipissing
Pembroke
Ottawa
Montreal
Three Rivers
Sorel
Sherbrooke
Quebec
Levis
Tadousac
Saguenay
Notre Dame
St. Lawrence Riv.
Rimouski
Riviere du Loup
Kamouraska
Metapedia
Gaspe B.
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Bathurst
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Miramichi B.
New Brunswick
Fredericton
St. John
Passamaquoddy Bay
B. of Fundy
Annapolis
Yarmouth
Nova Scotia
Penobscot B.
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Duluth
Superior
Sault Ste Marie
Marquette
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Georgian B.
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Thunder B.
Oscoda
Cadillac
Bay City
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Port Huron
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Detroit
Grand Rapids
Grand Haven
Muskegon
Kalamazoo
Jackson
Wisconsin
St. Paul
Stillwater
Chippewa Falls
Eau Claire
Wausau
Green Bay
Oshkosh
Sheboygan
Fond du Lac
Milwaukee
Madison
Racine
Winona
La Crosse
Mankato
Mason City
Mc. Gregor
Waterloo
Dubuque
Cedar Rapids
Clinton
Davenport
Muscatine
Burlington
Keokuk
Iowa
Chicago
Elgin
Evanston
Aurora
Rockford
Joliet
Rock Island
Galesburg
Peoria
Bloomington
Illinois
Quincy
Springfield
Alton
St. Louis
Belleville
Mt. Vernon
Cairo
Indiana
South Bend
Michigan City
Fort Wayne
Logansport
Lafayette
Indianapolis
Terre Haute
Vincennes
Evansville
New Albany
Louisville
Frankfort
Lexington
Kentucky
Paducah
Hopkinsville
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Martinsburg
Virginia
Fredericksburg
Richmond
Petersburg
Lynchburg
Staunton
Roanoke
Danville
Norfolk
Portsmouth
Newport News
C. Charles
C. Henry
New York
Buffalo
Niagara Falls
Rochester
Oswego
Syracuse
Utica
Watertown
Ogdensburg
Adirondack Mts.
Albany
Troy
Elmira
Corning
Dunkirk
Jamestown
Catskill
Kingston
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Newburgh
New York
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Long Island
Sag Harbor
Long Branch
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Newark
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Trenton
Camden
Atlantic City
C. May
Delaware B.
Connecticut
Hartford
New Haven
Bridgeport
Rhode Island
Providence
Newport
Massachusetts
Boston
Worcester
Springfield
Pittsfield
Lowell
Lawrence
Fall R.
New Bedford
C. Cod
Orleans
Nantucket I.
Vermont
Burlington
New Hampshire
Concord
Manchester
Portsmouth
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Portland
Biddeford
Bath
Augusta
Lewiston
Bangor
Belfast
Calais
Farmington
Moosehead L.
North Carolina
Raleigh
Durham
Greensboro
Winston-Salem
Salisbury
Charlotte
Asheville
Goldsboro
Newbern
Wilmington
Beaufort
Elizabeth C.
Manteo
C. Hatteras
Raleigh B.
C. Lookout
Onslow B.
C. Fear
Tennessee
Nashville
Knoxville
Chattanooga
Memphis
Jackson
Clarksville
Mitchell (Black Dome)
South Carolina
Columbia
Spartanburg
Greenville
Charleston
Orangeburg
Sumter
Florence
Long B.
Georgia
Atlanta
Athens
Augusta
Macon
Milledgeville
Savannah
Columbus
Americus
Albany
Thomasville
Valdosta
Waycross
Brunswick
Darien
Alabama
Birmingham
Montgomery
Mobile
Tuscaloosa
Selma
Huntsville
Decatur
Mississippi
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Baton Rouge
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Pensacola
Jacksonville
St. Augustine
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Cedar Keys
Apalachee B.
Apalachicola
Appalachian Mts.
ATLANTIC OCEAN

the mountains, apparently consisting of less resistant crystalline rocks, have been reduced to basin-like peneplains in the same time that served only to grade the slopes and subdue the summits of the neighbouring mountains of more resistant rocks; the best example of this kind is the Asheville peneplain in North Carolina, measuring about 40 by 20 m. across; but in consequence of later elevation, its general surface, now standing at an altitude of 2500 ft., is maturely dissected by the French Broad river and its many branches in valleys 300 ft. deep; the basin floor is no longer a plain, but a hilly district in the midst of the mountains; Asheville on its southern border is a noted health resort.

The rivers of the mountain belt, normally dividing and subdividing in apparently insequent fashion between the hills and spurs, generally follow open valleys; there are few waterfalls, the streams being as a rule fairly well graded, though their current is rapid and their channels are set with coarse waste. The valley floors always join at accordant levels, as is the habit among normally subdued mountains; they thus contrast with glaciated mountains such as the Alps and the Canadian Rockies, where the laterals habitually open as "hanging valleys" in the side slope of the main valleys. It is a peculiar feature of the drainage in North Carolina that the headwaters lie to the east of the highest mountains, and that the chief rivers flow north-westward through the mountains to the broad valley lowland of the stratified belt and then through the plateau, as the members of the Mississippi system. It is probable that these rivers follow in a general way courses of much more ancient origin than those of the Atlantic rivers in the middle Appalachians.

The piedmont belt may be described as a maturely dissected peneplain over much of its extent; it is indeed one of the best examples of that class of forms. Its uplands are of fairly accordant altitude, which gradually decreases from 500 to 1000 ft. near the mountain belt to half that height along the coastal plain border. The uplands are here and there surmounted by residual monadnocks in the form of low domes and knobs; these increase in height and number towards the mountain belt, and decrease towards the coastal plain: Stone Mountain, near Atlanta, Georgia, a dome of granite surmounting the schists of the uplands, is a striking example of this class of forms. The chief rivers flow south-eastward in rather irregular courses through valleys from 200 to 500 ft. deep; the small branches ramify indefinitely in typical insequent arrangement; the streams are nearly everywhere well graded; rapids are rare and lakes are unknown.

The boundary between the mountains and the piedmont belt is called the Blue Ridge all along its length; and although the name is fairly appropriate in northern Virginia, it is not deserved in the Carolinas, where the "ridge" is only an escarpment descending abruptly 1000 or 1500 ft. from the valleys of the mountain belt to the rolling uplands of the piedmont belt; and as such it is a form of unusual occurrence. It is not defined by rock structure, but appears to result from the retrogressive erosion of the shorter Atlantic rivers, whereby the highlands, drained by much longer rivers, are undercut. The piedmont belt merges south-eastward into the coastal plain, the altitudes of the piedmont uplands and of the coastal plain hills being about the same along their line of junction. Many of the rivers, elsewhere well graded, have rapids as they pass from the harder rocks of the piedmont to the semi-consolidated strata of the coastal plain.

The Great Valley.

There is one feature of the Appalachians that has greater continuity than any other; this is the Great Valley. It is determined structurally by a belt of topographically weak limestones and shales (or slates) next inland from the crystalline uplands; hence, whatever the direction of the rivers which drain the belt, it has been worn down by Tertiary erosion to a continuous lowland from the Gulf of St Lawrence to central Alabama. Through all this distance of 1500 m. the lowland is nowhere interrupted by a transverse ridge, although longitudinal ridges of moderate height occasionally diversify its surface. In the middle section, as already stated, the Great Valley is somewhat open on the east, by reason of the small height and broad interruptions of the narrow crystalline belt; on the west it is limited by the complex series of Alleghany ridges and valleys; in the north-east section the valley is strongly enclosed on the east by the New England uplands, and on the west by the Adirondacks and Catskills (see below); in the south-west section the valley broadens from the North Carolina highlands on the south-east almost to the Cumberland plateau on the north-west, for here also the ridge-making formations weaken, although they do not entirely disappear.

The Atlantic Coastal Plain.

A striking contrast between New England and the rest of the Appalachians is found in the descent of the New England uplands to an immediate frontage on the sea; while to the south of New York harbour the remainder of the Appalachians are set back from the sea by the interposition of a coastal plain, one of the most characteristic examples of this class of forms anywhere to be found. As in all such cases, the plain consists of marine (with some estuarine and fluviatile) stratified deposits, more or less indurated, which were laid down when the land stood lower and the sea had its shore line farther inland than to-day. An uplift, increasing to the south, revealed part of the shallow sea bottom in the widening coastal plain, from its narrow beginning at New York harbour to its greatest breadth of 110 or 120 m. in Georgia: there it turns westward and is continued in the Gulf coastal plain, described farther on. The coastal plain, however, is the result, not of a single recent uplift, but of movements dating back to Tertiary time and continued with many oscillations to the present; nor is its surface smooth and unbroken, for erosion began upon the inner part of the plain long before the outer border was revealed. Indeed, the original interior border of the plain has been well stripped from its inland overlap; the higher-standing inner part of the plain is now maturely dissected, with a relief of 200 to 500 ft., by rivers extended seaward from the older land and by their innumerable branches, which are often of insequent arrangement; while the seaward border, latest uplifted, is prevailingly low and smooth, with a hardly perceptible seaward slope of but a few feet in a mile; and the shallow sea deepens very gradually for many miles off shore.

South Carolina and Georgia furnish the broadest and most typical section of this important physiographic province: here the more sandy and hilly interior parts are largely occupied by pine forests, which furnish much hard or yellow pine lumber, tar and turpentine. Farther seaward, where the relief is less and the soils are richer, the surface is cleared and cotton is an important crop.

A section of the coastal plain, from North Carolina to southern New Jersey, resembles the plain farther south in general form and quality of soils, but besides being narrower, it is further characterized by several embayments or arms of the sea, caused by a slight depression of the land after mature valleys had been eroded in the plain. The coastal lowland between the sea arms is so flat that, although distinctly above sea-level, vegetation hinders drainage and extensive swamps or "pocossins" occur. Dismal Swamp, on the border of North Carolina and Virginia, is the largest example.

The small triangular section of the coastal plain in New Jersey north of Delaware Bay deserves separate treatment because of the development there of a peculiar topographic feature, which throws light on the occurrence of the islands off the New England coast, described in the next paragraph. The feature referred to results from the occurrence here of a weak basal formation of clay overlaid by more resistant sandy strata; the clay belt has been stripped for a score or more of miles from its original inland overlap, and worn down in a longitudinal inner lowland, while the sandy belt retains a significant altitude of 200 or 300 ft. overlooking the inner lowland in a well-defined slope dissected by many inland-flowing streams, and descending from its broad crest very gently seaward, thus giving rise to what has been called a "belted coastal plain," in which the relief is arranged longitudinally and the upland member, with its very unsymmetrical slopes, has sometimes been called a "cuesta." This is a form of relief frequently occurring elsewhere, as in the Niagara cuesta of the Great Lake district of the northern United States and in the Cotswold and Chiltern hills of England, typical examples of the cuesta class. The Delaware river, unlike its southern analogues, which pursue a relatively direct course to the sea, turns south-westward along the inner lowland for some 50 m.

There is good reason for believing that at least along the southern border of New England a narrow coastal plain was for a time added to the continental border; and that, as in the New Jersey section, the plain was here stripped from a significant breadth of inland overlap and worn down so as to form an inner lowland enclosed by a longitudinal upland or cuesta; and that when this stage was reached a submergence, of the kind which has produced the many embayments of the New England coast, drowned the outer part of the plain and the inner lowland, leaving only the higher parts of the cuesta as islands. Thus Long Island (fronting Connecticut, but belonging to New York state), Block Island (part of the small state of Rhode Island), Martha's Vineyard and Nantucket (parts of Massachusetts) may be best explained. Heavy terminal moraines and outwashed fluviatile plains have been laid on the cuesta remnants, increasing their height as much as 100 ft. and burying their seaward slope with gravel and sand. Moreover, the sea has worked on the shore line thus originated, reducing the size of the more exposed islands farther east, and even consuming some islands which are now represented by the Nantucket shoals.

The Appalachian Plateau.

The same Palaeozoic formations that are folded in the belt of the Alleghany ridges lie nearly horizontal in the plateau district next north-west. The exposed strata are in large part resistant sandstones. While they have suffered active dissection by streams during the later cycles of erosion, the hilltops have retained so considerable an altitude that the district is known as a plateau; it might be better described as a dissected plateau, inasmuch as its uplands are not continuous but are nearly everywhere interrupted by ramifying insequent valleys. The unity and continuity of the district, expressed in the name Appalachian plateau, is seldom recognized in local usage. Its north-eastern part in eastern New York is known as the Catskill Mountains; here it reaches truly mountainous heights in great dome-like masses of full-bodied form, with two summits rising a little over 4000 ft. The border of this part of the plateau descends eastward by a single strong escarpment to the Hudson valley, from which the mountains present a fine appearance, and northward by two escarpments (the second being called the "Helderberg Mountains") to the Mohawk Valley, north of which rise the

Adirondacks; but to the south west the dissected highland continues into Pennsylvania and Virginia, where it is commonly known as the Alleghany plateau. A curious feature appears in northern Pennsylvania: here the lateral pressure of the Palaeozoic mountain-making forces extended its effects through a belt about fifty miles wider than the folded belt of the Hudson Valley, thus compressing into great rock waves a part of the heavy stratified series which in New York lies horizontal and forms the Catskills; hence one sees, in passing south-west from the horizontal to the folded strata, a beautiful illustration of the manner in which land sculpture is controlled by land structure. Altitudes of 1200 ft. prevail in Pennsylvania and increase in Virginia; then the altitude falls to about 1000 ft. in Kentucky and Tennessee, where the name Cumberland plateau is used for the highest portion, and to still less in northern Alabama, where the plateau, like the mountain belt, disappears under the Gulf coastal plain. Through all this distance of 1000 m. the border of the plateau on the south-east is an abrupt escarpment, eroded where the folded structure of the mountain belt reveals a series of weaker strata; but in the north-west the plateau suffers only a gradual decrease of height and of relief, until the prairie plains are reached in central Ohio and southern Indiana and Illinois, about 150 m. inland from the escarpment. Two qualifications must, however, be added. In certain parts of the plateau there are narrow anticlinal uplifts, an outlying effect of mountain-making compression; here a ridge rises if the exposed strata are resistant, as in Chestnut ridge of western Pennsylvania; but here a valley is excavated if the exposed strata are weak, as in Sequatchie Valley, a long narrow trough which cuts off a strip of the plateau from its greater body in Tennessee. Again, in Kentucky and Tennessee, there is a double alternation of sandstone and limestone in the plateau-making strata; and as the skyline of the plateau bevels across these formations, there are west-facing escarpments, made ragged by mature dissection, as one passes from the topographically strong sandstone to the topographically weak limestone.

In the north-east (New York and Pennsylvania) the higher parts of the plateau are drained by the Delaware and Susquehanna rivers directly to the Atlantic; farther west and south-west, the plateau is drained to the Ohio river and its branches. The submature or mature dissection of the plateau by its branching insequent streams results in giving it an excess of sloping surface, usually too steep for farming, and hence left for tree growth.

The Superior Oldland.—An outlying upland of the Laurentian highlands of Canada projects into the United States west and south of Lake Superior. Although composed chiefly of crystalline rocks, which are commonly associated with a rugged landscape, and although possessing a greatly deformed structure, which must at some ancient period have been associated with strong relief, the upland as a whole is gently rolling, and the inter-stream surfaces are prevailing plateau-like in their evenness, with altitudes of 1400 to 1600 ft. in their higher areas. In this province, therefore, we find a part of one of those ancient mountain regions, initiated by crustal deformation, but reduced by long continued erosion to a peneplain of modern relief, with occasional surmounting monadnocks of moderate height not completely consumed during the peneplanation of the rest of the surface. The erosion of the region must have been far advanced, perhaps practically completed, in very ancient times, for the even surface of the peneplain is overlapped by fossiliferous marine strata of early geological date (Cambrian); and this shows that a depression of the region beneath an ancient sea took place after a long existence as dry land. The extent of the submergence and the area over which the Palaeozoic strata were deposited are unknown; for in consequence of renewed elevation without deformation, erosion in later periods has stripped off an undetermined amount of the covering strata. The valleys by which the uplands are here and there trenched to moderate depth appear to be, in part at least, the work of streams that have been superposed upon the peneplain through the now removed cover of stratified rocks. Glaciation has strongly scoured away the deeply-weathered soils that presumably existed here in preglacial time, revealing firm and rugged ledges in the low hills and swells of the ground, and spreading an irregular drift cover over the lower parts, whereby the drainage is often much disordered; here being detained in lakes and swamps (" muskegs ") and there rushing down rocky rapids. The region is therefore generally unattractive to the farmer, but it is inviting to the lumberman and the miner.

The Adirondack Mountains.—This rugged district of northern New York may be treated as an outlier in the United States of the Laurentian highlands of Canada, from which it is separated by the St Lawrence Valley. It is of greater altitude (Mt Marcy 5344 ft.) and of much greater relief than the Superior Oldland; its heights decrease gradually to the north, west and south, where it is unconformably overlapped by Palaeozoic strata like those of Minnesota and Wisconsin; it is of more broken structure and form on the east, where the disturbances of the Appalachian system have developed ridges and valleys of linear trends, which are wanting or but faintly seen elsewhere. (See ADIRONDACKS.)

Region of the Great Lakes.—The Palaeozoic strata, already mentioned as lapping on the southern slope of the Superior Oldland and around the western side of the Adirondacks are but parts of a great area of similar strata, hundreds of feet in thickness, which decline gently southward from the great oldland of the Laurentian highlands of eastern Canada. The strata are the deposits of an ancient sea, which in the earlier stage of geological investigation was thought to be part of the primeval ocean, while the Laurentian highlands were taken to be the first land that rose from the primeval waters. Inasmuch, however, as the floor on which the overlapping strata rest is, like the rest of the Laurentian and Superior Oldland, a worn-down mountain region, and as the lowest member of the sedimentary series usually contains pebbles of the oldland rocks, the better interpretation of the relation between the two is that the visible oldland area of to-day is but a small part of the primeval continent, the remainder of which is still buried under the Palaeozoic cover; and that the visible oldland, far from being the first part of the continent to rise from the primeval ocean, was the last part of the primeval continent to sink under the advancing Palaeozoic seas. When the oldland and its overlap of stratified deposits were elevated again, the overlapping strata must have had the appearance of a coastal plain; but that was long ago; the strata have since then been much eroded, and to-day possess neither the area nor the smooth form of their initial extent. Hence this district may be placed in the class of ancient coastal plains. As is always the case in the broad denudation of the gently inclined strata of such plains, the weaker layers are worn down in sub-parallel belts of lower land between the oldland and the belts of more resistant strata, which rise in uplands.

Few better illustrations of this class of forms are to be found than that presented in the district of the Great Lakes. The chief upland belt or cuesta is formed by the firm Niagara limestone, which takes its name from the gorge and falls cut through the upland by the Niagara river. As in all such forms, the Niagara cuesta has a relatively strong slope or infacing escarpment on the side towards the oldland, and a long gentle slope on the other side. Its relief is seldom more than 200 or 300 ft., and is commonly of small measure, but its continuity and its contrast with the associated lowlands worn on the underlying and overlying weak strata suffice to make it a feature of importance. The cuesta would be straight from east and west if the slant of the strata were uniformly to the south; but the strata are somewhat warped, and hence the course of the cuesta is strongly convex to the north in the middle, gently convex to the south at either end. The cuesta begins where its determining limestone begins, in west-central New York; there it separates the lowlands that contain the basins of lakes Ontario and Erie; thence it curves to the north-west through the province of Ontario to the belt of islands that divides Georgian Bay from Lake Huron; then westward through the land-arm between lakes Superior and Michigan, and south-westward into the narrow points that divide Green Bay from Lake Michigan, and at last westward to fade away again with the thinning out of the limestone; it is hardly traceable across the Mississippi river. The arrangement of the Great Lakes is thus seen to be closely sympathetic with the course of the lowlands worn on the two belts of weaker strata on either side of the Niagara cuesta; Ontario, Georgian Bay and Green Bay occupy depressions in the lowland on the inner side of the cuesta; Erie, Huron and Michigan lie in depressions in the lowland on the outer side. When the two lowlands are traced eastward they become confluent after the Niagara limestone has faded away in central New York, and the single lowland is continued under the name of Mohawk Valley, an east-west longitudinal depression that has been eroded on a belt of relatively weak strata between the resistant crystalline rocks of the Adirondacks on the north and the northern escarpment of the Appalachian plateau (Catskills-Helderbergs) on the south; forming a pathway of great historic and economic importance between the Atlantic seaports and the interior.

In Wisconsin the inner lowland presents an interesting feature in a knob of resistant quartzites, known as Baraboo Ridge, rising from the buried oldland floor through the partly denuded cover of lower Palaeozoic strata. This knob or ridge may be appropriately regarded as an ancient physiographic fossil, inasmuch as, being a monadnock of very remote origin, it has long been preserved from the destructive attack of the weather by burial under sea-floor deposits, and recently laid bare, like ordinary organic fossils of much smaller size, by the removal of part of its cover by normal erosion.

The occurrence of the lake basins in the lowland belts on either side of the Niagara cuesta is an abnormal feature, not to be explained by ordinary erosion, which can produce only valleys. The basins have been variously ascribed to glacial erosion, to obstruction of normal outlet valleys by barriers of glacial drift, and to crustal warping in connexion with or independent of the presence of the glacial sheet. No satisfactory solution of this problem has been reached; but the association of the Great Lakes and other large lakes farther north in Canada with the great North American area of strong and repeated glaciation is highly suggestive.

Lake Superior is unlike the other lakes; the greater part of its basin occupies a depression in the oldland area, independent of the overlap of Palaeozoic strata. The western half of the basin occupies a trough of synclinal structure; but the making of this syncline is so ancient that it cannot be directly connected with the occurrence of the lake to-day. A more reasonable explanation ascribes the lake basin to a geologically modern depression within the Superior oldland area; but there is at present no direct evidence in favour of this hypothesis. The Great Lakes are peculiar in receiving the drainage of but a small peripheral land area, enclosed by an ill-defined water-parting from the rivers that run to Hudson Bay or the Gulf of St Lawrence on the north and to the Gulf of Mexico on the south.

Large canals and locks on both sides of the Sault (pronounced *Soo*) Ste Marie in the outlet of Lake Superior are actively used except during three or four winter months. The three lakes of the middle group stand at practically the same level: Michigan and Huron are connected by the Strait of Mackinac (pronounced Mackinaw); Huron and Erie by the St Clair and Detroit rivers, with the small Lake St Clair between them. The navigable depth of these two short rivers is believed to be the result of a slow elevation of the land in the north-east, still in progress, whereby the waters have risen on their former shores near Detroit. Niagara river, connecting lakes Erie and Ontario, with a fall of 326 ft. (160 ft. at the cataract) in 30 m., is manifestly a watercourse of very modern origin; for a large river would now have a thoroughly matured valley had it long followed its present course; the same is true of the St Lawrence, which in its several rapids and in its subdivision into many channels at the Thousand Islands, presents every sign of youth. Canals on the Canadian side of these unnavigable stretches admit vessels of a considerable size to lakes Ontario and Erie.

The Prairie States.—The originally treeless prairies of the upper Mississippi basin began in Indiana and extended westward and north-westward until they merged with the drier region described beyond as the Great Plains. An eastward extension of the same region, originally tree-covered, extended to central Ohio. Thus the prairies may be described as lying in a general way between the Ohio and Missouri rivers on the south and the Great Lakes on the north. Under the older-fashioned methods of treating physical geography, the prairies were empirically described as "level prairies," "rolling prairies," and so on. The great advance in the interpretation of land forms now makes it possible to introduce as thoroughly explanatory a description of these fertile plains as of forms earlier familiar, such as sand dunes, deltas and sea cliffs. The prairies are, in brief, a contribution of the glacial period; they consist for the most part of glacial drift, deposited unconformably on an underlying rock surface of moderate or small relief. The rocks here concerned are the extension of the same stratified Palaeozoic formations already described as occurring in the Appalachian region and around the Great Lakes. They are usually fine-textured limestones and shales, lying horizontal; the moderate or small relief that they were given by mature preglacial erosion is now buried under the drift, but is known by numerous borings for oil, gas and water.

The greatest area of the prairies, from Indiana to North Dakota, consists of till plains, that is, sheets of unstratified drift, 30, 50 or even 100 ft. thick, which cover the underlying rock surface for thousands of square miles (except where postglacial stream erosion has locally laid it bare), and present an extraordinarily even surface. The till is presumably made in part of preglacial soils, but it is more largely composed of rock waste mechanically comminuted by the creeping ice sheets; although the crystalline rocks from Canada and some of the more resistant stratified rocks south of the Great Lakes occur as boulders and stones, a great part of the till has been crushed and ground to a clayey texture. The till plains, although sweeping in broad swells of slowly changing altitude, are often level to the eye, and the view across them stretches to the horizon, unless interrupted by groves of trees along the watercourses, or by belts of low morainic hills. Here and there faint depressions occur, occupied by marshy "sloughs," or floored with a rich black soil of postglacial origin. It is thus by sub-glacial aggradation that the prairies have been levelled up to a smooth surface, in contrast to the higher and non-glaciated hilly country next south.

The great ice sheets formed terminal moraines around their border at various halting stages; but the morainic belts are of small relief in comparison to the great area of the ice; they rise gently from the till plains to a height of 50, 100 or more feet; they may be one, two or three miles wide; and their hilly surface, dotted over with boulders, contains many small lakes in basins or hollows, instead of streams in valleys. The morainic belts are arranged in groups of concentric loops, convex southward, because the ice sheets advanced in lobes along the lowlands of the Great Lakes; neighbouring morainic loops join each other in re-entrants (north-pointing cusps), where two adjacent glacial lobes came together and formed their moraines in largest volume. The discovery of this significant looped arrangement of the morainic belts is the greatest advance in interpretation of glacial phenomena since the first suggestion of a glacial period; it is also the strongest proof that the ice here concerned was a continuous sheet of creeping land ice, and not a discontinuous series of floating icebergs, as had been supposed. The moraines are of too small relief to be shown on any maps but those of the largest scale; yet small as they are, they are the chief relief of the prairie states, and, in association with the nearly imperceptible slopes of the till plains, they determine the course of many streams and rivers, which as a whole are consequent upon the surface form of the glacial deposits.

The complexity of the glacial period and its subdivision into several glacial epochs, separated by interglacial epochs of considerable length (certainly longer than the postglacial epoch) has a structural consequence in the superposition of successive till sheets, alternating with non-glacial deposits, and also a physiographic consequence in the very different amount of normal postglacial erosion suffered by the different parts of the glacial deposits. The southernmost drift sheets, as in southern Iowa and northern Missouri, have lost their initially plain surface and are now maturely dissected into gracefully rolling forms; here the valleys of even the small streams are well opened and graded, and marshes and lakes are wanting: hence these sheets are of early Pleistocene origin. Nearer the Great Lakes the till sheets are trenched only by the narrow valleys of the large streams; marshy sloughs still occupy the faint depressions in the till plains, and the associated moraines have abundant small lakes in their undrained hollows: hence these drift sheets are of late Pleistocene origin.

When the ice sheets fronted on land sloping southward to the Ohio, Mississippi and Missouri rivers, the drift-laden streams flowed freely away from the ice border; and as the streams, escaping from their subglacial channels, spread in broader channels, they ordinarily could not carry forward all their load; hence they acted not as destructive but as constructive agents, and aggraded their courses. Thus local sheets or "aprons" of gravel and sand are spread more or less abundantly along the outer side of the morainic belts; and long trains of gravel and sands clog the valleys that lead southward from the glaciated to the non-glaciated area. Later when the ice retreated farther and the unloaded streams returned to their earlier degrading habit, they more or less completely scoured out the valley deposits, the remains of which are now seen in terraces on either side of the present flood plains.

When the ice of the last glacial epoch had retreated so far that its front lay on a northward slope, belonging to the drainage area of the Great Lakes, bodies of water accumulated in front of the ice margin, forming glacio-marginal lakes. The lakes were small at first, and each had its own outlet at the lowest depression in the height of land to the south; but as the ice melted back, neighbouring lakes became confluent at the level of the lowest outlet of the group; the outflowing streams grew in the same proportion and eroded a broad channel across the height of land and far down stream, while the lake waters built sand reefs or carved shore cliffs along their margin, and laid down sheets of clay on their floors. All of these features are easily recognized in the prairie region. The present site of Chicago was determined by an Indian *portage* or "carry" across the low divide between Lake Michigan and the headwaters of the Illinois river; and this divide lies on the floor of the former outlet channel of the glacial Lake Michigan. Corresponding outlets are known for the glacial lakes Erie, Huron and Superior, and for a very large sheet of water, named Lake Agassiz, which once overspread a broad till plain in northern Minnesota and North Dakota. The outlet of this glacial lake, called river Warren, eroded a large channel in which the Minnesota river of to-day is an evident "misfit."

Certain extraordinary features were produced when the retreat of the ice sheet had progressed so far as to open an eastward outlet for the marginal lakes along the depression between the northward slope of the Appalachian plateau in west-central New York and the southward slope of the melting ice sheet; for when this eastward outlet came to be lower than the south-westward outlet across the height of land to the Ohio or Mississippi river, the discharge of the marginal lakes was changed from the Mississippi system to the Hudson system. Many well-defined channels, cutting across the north-sloping spurs of the plateau in the neighbourhood of Syracuse, N.Y., mark the temporary paths of the ice-bordered outlet river. Successive channels are found at lower and lower levels on the plateau slope, thus indicating the successive courses taken by the lake outlet as the ice melted farther and farther back. On some of these channels deep gorges were eroded heading in temporary cataracts which exceeded Niagara in height but not in breadth; the pools excavated by the plunging waters at the head of the gorges are now occupied by little lakes. The most significant stage in this series of changes occurred when the glacio-marginal lake waters were lowered so that the long cuesta of Niagara limestone was laid bare in western New York; the previously confluent waters were then divided into two lakes; the higher one, Erie, supplying the outflowing Niagara river, which poured its waters down the escarpment of the cuesta to the lower lake, Ontario, whose outlet for a time ran down the Mohawk Valley to the Hudson: thus Niagara falls began. (See NIAGARA.)

Many additional features associated with the glacial period might be described, but space can be given to four only. In certain districts the subglacial till was not spread out in a smooth plain, but accumulated in elliptical mounds, 100 or 200 ft. high, half a mile or a mile long, with axes parallel to the direction of the ice motion as indicated by striae on the underlying rock floor; these hills are known by the Irish name, drumlins, used for similar hills in north-western Ireland. The most remarkable groups of drumlins occur in western New York, where their number is estimated at over 6000, and in southern Wisconsin, where it is placed at 5000. They completely dominate the topography of their districts.

A curious deposit of an impalpably fine and unstratified silt, known by the German name *loess*, lies on the older drift sheets near the larger river courses of the upper Mississippi basin. It attains a thickness of 20 ft. or more near the rivers and gradually fades away at a distance of ten or more miles on either side. It is of inexhaustible fertility, being in this as well as in other respects closely like the loess in China and other parts of Asia, as well as in Germany. It contains land shells, and hence cannot be attributed to marine or lacustrine submergence. The best explanation suggested for loess is that, during certain phases of the glacial period, it was carried as dust by the winds from the flood plains of aggrading rivers, and slowly deposited on the neighbouring grass-covered plains.

South-western Wisconsin and parts of the adjacent states of Illinois, Iowa and Minnesota are known as the "driftless area," because, although bordered by drift sheets and moraines, it is free from glacial deposits. It must therefore have been a sort of oasis, when the ice sheets from the north advanced past it on the east and west and joined around its southern border. The reason for this exemption from glaciation is the converse of that for the southward convexity of the morainic loops; for while they mark the paths of greatest glacial advance along lowland troughs (lake basins), the driftless area is a district protected from ice invasion by reason of the obstruction which the highlands of northern Wisconsin and Michigan (part of the Superior oldland) offered to glacial advance.

The course of the upper Mississippi river is largely consequent upon glacial deposits. Its sources are in the morainic lakes in northern Minnesota; Lake Itasca being only one of many glacial lakes which supply the headwater branches of the great river. The drift deposits thereabouts are so heavy that the present divides between the drainage basins of Hudson Bay, Lake Superior and the Gulf of Mexico evidently stand in no very definite relation to the preglacial divides. The course of the Mississippi through Minnesota is largely guided by the form of the drift cover. Several rapids and the Falls of St Anthony (determining the site of Minneapolis) are signs of immaturity, resulting from superposition through the drift on the under rock. Farther south, as far as the entrance of the Ohio, the Mississippi follows a rock-walled valley 300 to 400 ft. deep, with a flood-plain 2 to 4 m. wide; this valley seems to represent the path of an enlarged early-glacial Mississippi, when much precipitation that is to-day discharged to Hudson Bay and the Gulf of St Lawrence was delivered to the Gulf of Mexico, for the curves of the present river are of distinctly smaller radius than the curves of the valley. Lake Pepin (30 m. below St Paul), a picturesque expansion of the river across its flood-plain, is due to the aggradation of the valley floor where the Chippewa river, coming from the north-east, brought an overload of fluvio-glacial drift. Hence even the "father of waters," like so many other rivers in the Northern states, owes many of its features more or less directly to glacial action.

The fertility of the prairies is a natural consequence of their origin. During the mechanical comminution of the till no vegetation was present to remove the minerals essential to plant growth, as is the case in the soils of normally weathered and dissected peneplains, such as the Appalachian piedmont, where the soils, though not exhausted by the primeval forest cover, are by no means so rich as the till sheets of the prairies. Moreover, whatever the rocky understructure, the till soil has been averaged by a thorough mechanical mixture of rock grindings; hence the prairies are continuously fertile for scores of miles together.

The true prairies, when first explored, were covered with a rich growth of natural grass and annual flowering plants. To-day they are covered with farms. The cause of the treelessness has been much discussed. It does not seem to lie in peculiarities of temperature or of precipitation; for trees thrive where they are properly planted on the prairies; every town and farm to-day has its avenues and groves of trees; but it should be noted that west of the Mississippi river increasing aridity becomes an important factor, and is the chief cause of the treelessness of the Great Plains (see below). The treelessness of the prairies cannot be due to insufficient time for tree invasion since glacial evacuation; for forests cover the rocky uplands of Canada, which were occupied by ice for ages after the prairies were laid bare. A more probable cause is found in the fineness of the prairie soil, which is inimical to the growth of young trees in competition with the grasses and annual plants. Prairie fires, both of natural and artificial origin, are also a contributive cause; for young trees are exterminated by fires, but annual plants soon reappear.

The Gulf Coastal Plain.—The westward extension of the Atlantic coastal plain around the Gulf of Mexico carries with it a repetition of certain features already described, and the addition of several new ones. As in the Atlantic coastal plain, it is only the lower, seaward part of this region that deserves the name of plain, for there alone is the surface unbroken by hills or valleys; the inner part, initially a plain by reason of its essentially horizontal (gently seaward-sloping) structure, has been converted by mature dissection into an elaborate complex of hills and valleys, usually of increasing altitude and relief as one passes inland.

The special features of the Gulf Plain are the peninsular extension of the plain in Florida, the belted arrangement of relief and soils in Alabama and in Texas, and the Mississippi embayment or inland extension of the plain half-way up the course of the Mississippi river, with the Mississippi flood plain there included.

Florida.

A broad, low crustal arch extends southward at the junction of the Atlantic and Gulf coastal plains; the emerged half of the arch constitutes the visible lowland peninsula of Florida; the submerged half extends westward under the shallow overlapping waters of the Gulf of Mexico. The northern part of the peninsula is composed largely of a weak limestone; here much of the lowland drainage is underground, forming many sink-holes (swallow-holes). Many small lakes in the lowland appear to owe their basins to the solution of the limestones. Valuable phosphate deposits occur in certain districts. The southern part of the state includes the "Everglades" (*q.v.*), a large area of low, flat, marshy land, overgrown with tall reedy grass, a veritable wilderness; thus giving Florida an unenvied first rank among the states in marsh area. The eastern coast is fringed by long-stretching sand reefs, enclosing lagoons so narrow and continuous that they are popularly called "rivers." At the southern end of the peninsula is a series of coral islands, known as "keys"; they appear to be due to the forward growth of corals and other lime-secreting organisms towards the strong current of the Gulf Stream, by which their food is supplied: the part of the peninsula composed of coral reefs is less than has been formerly supposed. The western coast has fewer and shorter off-shore reefs; much of it is of minutely irregular outline, which seems to be determined less by the work of the sea than by the forward growth of mangrove swamps in the shallow salt water.

Alabama.

A typical example of a belted coastal plain is found in Alabama and the adjacent part of Mississippi. The plain is here about 150 m. wide. The basal formation is chiefly a weak limestone, which has been stripped from its original innermost extension and worn down to a flat inner lowland of rich black soil, thus gaining the name of the "black belt." The lowland is enclosed by an upland or cuesta, known as Chunnenugga Ridge, sustained by partly consolidated sandy strata; the upland, however, is not continuous, and hence should be described as a "maturely dissected cuesta." It has a relatively rapid descent toward the inner lowland, and a very gradual descent to the coast prairies, which become very low, flat and marshy before dipping under the Gulf waters, where they are generally fringed by off-shore reefs.

The coastal plain extends 500 m. inland on the axis of the Mississippi embayment. Its inner border affords admirable examples of topographical discordance where it sweeps north-westward square

The Mississippi Embayment.

across the trend of the piedmont belt, the ridges and valleys, and the plateau of the Appalachians, which are all terminated by dipping gently beneath the unconformable cover of the coastal plain strata. In the same way the western side of the embayment, trending south and south-west, passes along the lower south-eastern side of the dissected Ozark plateau of southern Missouri and northern Arkansas, which in many ways resembles the Appalachian plateau, and along the eastern end of the Massern ranges of the Ouachita mountain system in central Arkansas, which in geological history and topographical form present many analogies with the ridges and valleys of the Appalachians; and as the coastal plain turns westward to Texas it borders the Arbuckle hills in Oklahoma, a small analogue of the crystalline Appalachian belt. In the embayment of the coastal plain some low cuesta-like belts of hills with associated strips of lowlands suggest the features of a belted coastal plain; the hilly belt or dissected cuesta determined by the Grand Gulf formation in western Mississippi is the most distinct. Important salt deposits occur in the coastal plain strata near the coast. The most striking feature of the embayment is the broad valley which the Mississippi has eroded across it.

The lower Mississippi is the trunk in which three large rivers join; the chief figures (approximate only) regarding them are as follows:—

	Drainage Area (square miles).	Percentage of Total Discharge.
Upper Mississippi . . .	170,000	18
Ohio	210,000	31
Missouri	530,000	14

The Lower Mississippi River.

The small proportion of total water volume supplied from the great Missouri basin is due to the light precipitation in that region. The lower Mississippi receives no large tributary from the east, but two important ones come from the west; the Arkansas drainage area being a little less than that of the Ohio, and the basin of the Red River of Louisiana being about half as large. The great river thus constituted drains an area of about 1,250,000 sq. m., or about one-third of the United States; and discharges 75,000 cub. yds. of water per second, or 785,190,000,000 cubic yds. per annum, which corresponds roughly to one quarter of the total precipitation on its drainage basin. Its load of land waste (see I. C. Russell, *Rivers of North America*) is as follows:—

In suspension . .	6,718,694,400	cub. ft. or	241	ft. deep over	1 sq. m.
Swept along bottom	750,000,000	,, ,,	26	,, ,,	1 ,,
In solution . . .	1,350,000,000	,, ,,	45	,, ,,	1 ,,

Average annual removal of waste from entire basin, $\frac{1}{330}$ in. or 1 ft. in 4000 years.

The head of the coastal plain embayment is near the junction of the Ohio and the Mississippi. Thence southward for 560 m. the great river flows through the semi-consolidated strata of the plain, in which it has eroded a valley, 40 or 50 m. wide, and 29,700 sq. m. in area, enclosed by bluffs one or two hundred feet high in the northern part, generally decreasing to the southward, but with local increase of height associated with a decrease in flood plain breadth on the eastern side where the Grand Gulf cuesta is traversed. This valley in the coastal plain, with the much narrower rock-walled valley of the upper river in the prairie states, is the true valley of the Mississippi river; but in popular phrase the "Mississippi Valley" is taken to include a large central part of the Mississippi drainage basin. The valley floor is covered with a flood plain of fine silt, having a southward slope of only half a foot to a mile. The length of the river itself, from the Ohio mouth to the Gulf, is, owing to its windings, about 1060 m.; its mean fall is about 3 in. in a mile. On account of the rapid deposition of sediment near the main channel at times of overflow, the flood plain, as is normally the case on mature valley floors, has a lateral slope of as much as 5, 10, or even 12 ft. in the first mile from the river; but this soon decreases to a less amount. Hence at a short distance from the river the flood plain is often swampy, unless its surface is there aggraded by the tributary streams: for this reason Louisiana, Arkansas and Mississippi rank next after Florida in swamp area.

The great river receives an abundant load of silt from its tributaries, and takes up and lays down silt from its own bed and banks with every change of velocity. The swiftest current tends, by reason of centrifugal force, to follow the outer side of every significant curve in the channel; hence the concave bank, against which the rapid current sweeps, is worn away; thus any chance irregularity is exaggerated, and in time a series of large serpentines or meanders is developed, the most symmetrical examples at present being those near Greenville, Miss. The growth of the meanders tends to give the river continually increasing length; but this tendency is counteracted by the sudden occurrence of cut-offs from time to time, so that a fairly constant length is maintained.

The floods of the Mississippi usually occur in spring or summer. Owing to the great size of the drainage basin, it seldom happens that the three upper tributaries are in flood at the same time; the coincident occurrence of floods in only two tributaries is of serious import in the lower river, which rises 30, 40, or occasionally 50 ft. The abundant records by the Mississippi River Commission and the United States Weather Bureau (by which accurate and extremely useful predictions of floods in the lower river course are made, on the basis of the observed rise in the tributaries) demonstrate a number of interesting features, of which the chief are as follows: the fall of the river is significantly steepened and its velocity is accelerated down stream from the point of highest rise; conversely, the fall and the velocity are both diminished up stream from the same point.

The load of silt borne down stream by the river finally, after many halts on the way, reaches the waters of the Gulf, where the decrease of velocity, aided by the salinity of the sea water, causes the formation of a remarkable delta, leaving less aggraded areas as shallow lakes (Lake Pontchartrain on the east, and Grand Lake on the west of the river). The ordinary triangular form of deltas, due to the smoothing of the delta front by sea action, is here wanting, because of the weakness of sea action in comparison with the strength of the current in each of the four distributaries or "passes" into which the river divides near its mouth. (See MISSISSIPPI RIVER.)

The Texas Coastal Plain.

After constriction from the Mississippi embayment to 250 m. in western Louisiana, the coastal plain continues south-westward with this breadth until it narrows to about 130 m. in southern Texas near the crossing of the Colorado river, (of Texas); but it again widens to 300 m. at the national boundary as a joint effect of embayment up the valley of the Rio Grande and of the seaward advance of this river's rounded delta front: these several changes take place in a distance of about 500 m., and hence include a region of over 100,000 sq. m.—less than half of the large state of Texas. A belted arrangement of reliefs and soils, resulting from differential erosion on strata of unlike composition and resistance, characterizes almost the entire area of the coastal plain. Most of the plain is treeless prairie, but the sandier belts are forested; two of them are known as "cross timbers," because their trend is transverse to the general course of the main consequent rivers. An inland extension from the coastal plain in north-central Texas leads to a large cuesta known as Grand Prairie (not structurally included in the coastal plain), upheld at altitudes of 1200 or 1300 ft. by a resistant Cretaceous limestone, which dips gently seaward; its scalloped inland-facing escarpment overlooks a denuded central prairie region of irregular structure and form; its gentle coastward slope (16 ft. to a mile) is dissected by many branching consequent streams; in its southern part, as it approaches the Colorado river the cuesta is dissected into a belt of discontinuous hills. The western cross timbers follow a sandy belt along the inner base of the ragged escarpment of Grand Prairie; the eastern cross timbers follow another sandy belt in the lowland between the eastern slope of Grand Prairie and the pale western escarpment of the next eastward and lower Black Prairie cuesta. This cuesta is supported at an altitude of 700 ft. or less by a chalk formation, which gives an infacing slope some 200 ft. in height, while its gently undulating or "rolling" seaward slope (2 or 3 ft. in a mile), covered with marly strata and rich black soil, determines an important cotton district. Then comes the East Texas timber belt, broad in the north-east, narrowing to a point before reaching the Rio Grande, a low and thoroughly dissected cuesta of sandy Eocene strata; and this is followed by the Coast Prairie, a very young plain, with a seaward slope of less than 2 ft. in a mile, its smooth surface interrupted only by the still more nearly level flood plains of the shallow, consequent river valleys. Near the Colorado river the dissected cuesta of the Grand Prairie passes southward, by a change to a more nearly horizontal structure, into the dissected Edwards plateau (to be referred to again as part of the Great Plains), which terminates in a maturely dissected fault scarp, 300 or 400 ft. in height, the northern boundary of the Rio Grande embayment. From the Colorado to the Rio Grande, the Black Prairie, the timber belt and the Coast Prairie merge in a vast plain, little differentiated, overgrown with "chaparral" (shrub-like trees, often thorny), widening eastward in the Rio Grande delta, and extending southward into Mexico.

Although the Coast Prairie is a sea bottom of very modern uplift, it appears already to have suffered a slight movement of depression, for its small rivers all enter embayments; the larger rivers, however, seem to have counteracted the encroachment of the sea on the land by a sufficiently active delta building, with a resulting forward growth of the land into the sea. The Mississippi has already been mentioned as rapidly building forward its digitate delta; the Rio Grande, next in size, has built its delta about 50 m. forward from the general coast-line, but this river being much smaller than the Mississippi, its delta front is rounded by seashore agencies. In front of the Brazos and the Colorado, the largest of the Texan rivers, the coast-line is very gently bowed forward, as if by delta growth, and the sea touches the mainland in a nearly straight shore line. Nearly all the rest of the coast is fringed by off-shore reefs, built up by waves from the very shallow sea bottom; in virtue of weak tides, the reefs continue in long unbroken stretches between the few inlets.

The Great Plains.—A broad stretch of country underlaid by nearly horizontal strata extends westward from the 97th meridian to the base of the Rocky Mountains, a distance of from 300 to 500 m., and northward from the Mexican boundary far into Canada. This is the province of the Great Plains. Although the altitude of plains increases gradually from 600 or 1200 ft. on the east to 4000, 5000 or 6000 ft. near the mountains, the local relief is generally small; the sub-arid climate excludes tree growth and opens far-reaching views. The plains are by no means a simple unit; they are of diverse structure and of various stages of erosional development; they are occasionally interrupted by buttes and escarpments; they are frequently broken by valleys: yet on the whole a broadly extended surface of moderate relief so often prevails that the name, Great Plains, for the region as a whole is well deserved. The western boundary of the plains is usually well defined by the abrupt ascent of the mountains. The eastern boundary of the plains is more climatic than topographic. The line of 20 in. of annual rainfall trends a little east of northward near the 97th meridian, and if a boundary must be drawn where nature presents only a gradual transition, this rainfall line may be taken to divide the drier plains from the moister prairies. The plains may be described in northern, intermediate, central and southern sections, in relation to certain peculiar features.

The northern section of the Great Plains, north of latitude 44°, including eastern Montana, north-eastern Wyoming and most of the Dakotas, is a moderately dissected peneplain, one of the best examples of its class. The strata here are Cretaceous or early Tertiary, lying nearly horizontal. The surface is shown to be a plain of degradation by a gradual ascent here and there to the crest of a ragged escarpment, the cuesta-remnant of a resistant stratum; and by the presence of lava-capped mesas and dike-ridges, surmounting the general level by 500 ft. or more and manifestly demonstrating the widespread erosion of the surrounding plains. All these reliefs are more plentiful towards the mountains in central Montana. The peneplain is no longer in the cycle of erosion that witnessed its production; it appears to have suffered a regional elevation, for the rivers—the upper Missouri and its branches—no longer flow on the surface of the plain, but in well graded, maturely opened valleys, several hundred feet below the general level. A significant exception to the rule of mature valleys occurs, however, in the case of the Missouri, the largest river, which is broken by several falls on hard sandstones about 50 m. east of the mountains. This peculiar feature is explained as the result of displacement of the river from a better graded preglacial valley by the Pleistocene ice-sheet, which here overspread the plains from the moderately elevated Canadian highlands far on the north-east, instead of from the much higher mountains near by on the west. The present altitude of the plains near the mountain base is 4000 ft.

The northern plains are interrupted by several small mountain areas. The Black Hills, chiefly in western South Dakota, are the largest group: they rise like a large island from the sea, occupying an oval area of about 100 m. north-south by 50 m. east-west, reaching an altitude in Harney Peak of 7216 ft., and an effective relief over the plains of 2000 or 3000 ft. This mountain mass is of flat-arched, dome-like structure, now well dissected by radiating consequent streams, so that the weaker uppermost strata have been eroded down to the level of the plains where their upturned edges are evenly truncated, and the next following harder strata have been sufficiently eroded to disclose the core of underlying crystalline rocks in about half of the domed area.

In the intermediate section of the plains, between latitudes 44° and 42°, including southern South Dakota and northern Nebraska, the erosion of certain large districts is peculiarly elaborate, giving rise to a minutely dissected form, known as "bad lands," with a relief of a few hundred feet. This is due to several causes: first, the dry climate, which prevents the growth of a grassy turf; next, the fine texture of the Tertiary strata in the bad land districts; and consequently the success with which every little rill, at times of rain, carves its own little valley. Travel across the bad lands is very fatiguing because of the many small ascents and descents; and it is from this that their name, "mauvaises terres pour traverser," was given by the early French *voyageurs*.

The central section of the Great Plains, between latitudes 42° and 36°, occupying eastern Colorado and western Kansas, is, briefly stated, for the most part a dissected fluviatile plain; that is, this section was once smoothly covered with a gently sloping plain of gravel and sand that had been spread far forward on a broad denuded area as a piedmont deposit by the rivers which issued from the mountains; and since then it has been more or less dissected by the erosion of valleys. The central section of the plains thus presents a marked contrast to the northern section; for while the northern section owes its smoothness to the removal of local gravels and sands from a formerly uneven surface by the action of degrading rivers and their inflowing tributaries, the southern section owes its smoothness to the deposition of imported gravels and sands upon a previously uneven surface by the action of aggrading rivers and their outgoing distributaries. The two sections are also unlike in that residual eminences still here and there surmount the peneplain of the northern section, while the fluviatile plain of the central section completely buried the pre-existent relief. Exception to this statement must be made in the south-west, close to the mountains in southern Colorado, where some lava-capped mesas (Mesa de Maya, Raton Mesa) stand several thousand feet above the general plain level, and thus testify to the widespread erosion of this region before it was aggraded.

The southern section of the Great Plains, between latitudes 35½° and 29½°, lies in eastern Texas and eastern New Mexico; like the central section it is for the most part a dissected fluviatile plain, but the lower lands which surround it on all sides place it in so strong relief that it stands up as a table-land, known from the time of Mexican occupation as the Llano Estacado. It measures roughly 150 m. east-west and 400 m. north-south, but it is of very irregular outline, narrowing to the south. Its altitude is 5500 ft. at the highest western point, nearest the mountains whence its gravels were supplied; and thence it slopes south-eastward at a decreasing rate, first about 12 ft., then about 7 ft. in a mile, to its eastern and southern borders, where it is 2000 ft. in altitude: like the High Plains farther north, it is extraordinarily smooth; it is very dry, except for occasional shallow and temporary water sheets after rains. The Llano is separated from the plains on the north by the mature consequent valley of the Canadian river, and from the mountains on the west by the broad and probably mature valley of the Pecos river. On the east it is strongly undercut by the retrogressive erosion of the headwaters of the Red, Brazos and Colorado rivers of Texas, and presents a ragged escarpment, 500 to 800 ft. high, overlooking the central denuded area of that state; and there, between the Brazos and Colorado rivers, occurs a series of isolated outliers capped by a limestone which underlies both the Llano on the west and the Grand Prairies cuesta on the east. The southern and narrow part of the table-land, called the Edwards Plateau, is more dissected than the rest, and falls off to the south in a frayed-out fault scarp, as already mentioned, overlooking the coastal plain of the Rio Grande embayment. The central denuded area, east of the Llano, resembles the east-central section of the plains in exposing older rocks; between these two similar areas, in the space limited by the Canadian and Red rivers, rise the subdued forms of the Wichita Mountains in Oklahoma, the westernmost member of the Ouachita system.

The Cordilleran Region.—From the western border of the Great Plains to the Pacific coast, there is a vast elevated area, occupied by mountains, plateaus and intermont plains. The intermont plains are at all altitudes from sea-level to 4000 ft.; the plateaus from 5000 to 10,000 ft.; and the mountains from 8000 to 14,000 ft. The higher mountains are barren from the cold of altitude; the timber line in Colorado stands at 11,000 to 12,000 ft.

The chief provinces of the Cordilleran region are: The Rocky Mountain system and its basins, from northern New Mexico northward, including all the mountains from the front ranges bordering on the plains to the Uinta and Wasatch ranges in Utah; the Pacific ranges including the Sierra Nevada of California, the Cascade range of Oregon and Washington, and the Coast range along the Pacific nearly to the southern end of California; and a great intermediate area, including in the north the Columbian lava plains and in the south the large province of the Basin ranges, which extends into Mexico and widens from the centre southward, so as to meet the Great Plains in eastern New Mexico, and to extend to the Pacific coast in southern California. There is also a province of plateaus between the central part of the Basin ranges and the southern part of the Rocky Mountains. An important geological characteristic of most of the Cordilleran region is that the Carboniferous strata, which in western Europe and the eastern United States contain many coal seams, are represented in the western United States by a marine limestone; and that the important unconformity which in Europe and the eastern United States separates the Palaeozoic and Mesozoic eras does not occur in the western United States, where the formations over a great area follow in conformable sequence from early Palaeozoic through the Mesozoic.

The Rocky Mountains.

The Rocky Mountains begin in northern Mexico, where the axial crystalline rocks rise to 12,000 ft. between the horizontal structures of the plains on the east and the plateaus on the west. The upturned stratified formations wrap around the flanks of the range, with ridges and valleys formed on their eroded edges and drained southward by the Pecos river to the Rio Grande and the Gulf of Mexico. The mountains rapidly grow wider and higher northward, by taking on new complications of structure and by including large basins between the axes of uplift, until in northern Colorado and Utah a complex of ranges has a breadth of 300 m., and in Colorado alone there are 40 summits over 14,000 ft. in altitude, though none rises to 14,500. Then turning more to the north-west through Wyoming, the ranges decrease in breadth and height; in Montana their breadth is not more than 150 m., and only seven summits exceed 11,000 ft. (one reaching 12,834).

As far north as the gorge of the Missouri river in Montana, the Front range, facing the Great Plains, is a rather simple uplift, usually formed by upturning the flanking strata, less often by a fracture. Along the eastern side of the Front Range in Colorado most of the upturned stratified formations have been so well worn down that, except for a few low piedmont ridges, their even surface may now be included with that of the plains, and the crystalline core of the range is exposed almost to the mountain base. Here the streams that drain the higher areas descend to the plains through narrow canyons in the mountain border, impassable for ordinary roads and difficult of entrance even by railways; a well-known example is the gorge of Clear Creek east of the Georgetown mining district. The crystalline highlands thereabouts, at altitudes of 8000 to 10,000 ft., are of so moderate a relief as to suggest that the mass had stood much lower in a former cycle of erosion and had then been worn down to rounded hills; and that since uplift to the present altitude the revived streams of the current cycle of erosion have not entrenched themselves deep enough to develop strong relief. This idea is confirmed 80 m. farther south, where Pike's Peak (14,108 ft.), a conspicuous landmark far out on the plains, has every appearance of being a huge monadnock, surmounting a rough peneplain of 10,000 ft. in general elevation. The idea is still better confirmed farther north in Wyoming, where the Laramie Range, flanked with upturned strata on the east and west, is for the most part a broad upland at altitudes of 7000 or 8000 ft., with no strong surmounting summits and as yet no deep carved valleys. Here the first of the Pacific railways chose its pass. When the summit is reached, the traveller is tempted to ask, "Where are the mountains?" so small is the relief of the upland surface. This low range turns westward in a curve through the Rattlesnake Mountains towards the high Wind River Mountains (Gannett Peak, 13,775 ft.), an anticlinal range within the body of the mountain system, with flanking strata rising well on the slopes. Flanking strata are even better exhibited in the Bighorn Mountains, the front range of northern Wyoming, crescentic in outline and convex to the north-east, like the Laramie Range, but much higher; here heavy sheets of limestone arch far up towards the range crest, and are deeply notched where consequent streams have cut down their gorges.

Farther north in Montana, beyond the gorge of the Missouri river, the structure of the Front Range is altogether different; it is here the carved residual of a great mass of moderately bent Palaeozoic strata, overthrust eastward upon the Mesozoic strata of the plains; instead of exposing the oldest rocks along the axis and the youngest rocks low down on the flanks, the younger rocks of the northern range follow its axis, and the oldest rocks outcrop along its eastern flanks, where they override the much younger strata of the plains; the harder strata, instead of lapping on the mountain flanks in great slab-like masses, as in the Bighorns, form out-facing scarps, which retreat into the mountain interior where they are cut down by outflowing streams.

The structure of the inner ranges is so variable as to elude simple description; but mention should be made of the Uinta range of broad anticlinal structure in north-east Utah, with east-west trend, as if corresponding to the east-west Rattlesnake Mountains, already named. The Wasatch Range, trending north-south in central Utah, is peculiar in possessing large east-west folds, which are seen in cross-section in the dissected western face of the range, because the whole mass is there squarely cut off by a great north-south fault with down-throw to the Basin Range province, the fault face being elaborately carved.

Volcanic action has been restricted in the Rocky Mountains proper. West Spanish Peak (13,620 ft.), in the Front Range of southern Colorado, may be mentioned as a fine example of a deeply dissected volcano, originally of greater height, with many unusually strong radiating dike-ridges near its denuded flanks. In north-western Wyoming there are extensive and heavy lava sheets, uplifted and dissected, and crowned with a few dissected volcanoes. It is in association with this field of extinct volcanic activity that a remarkable group of geysers and hot springs has been developed, from which the Yellowstone river, a branch of the Missouri, flows north-eastward, and the Snake river, a branch of the Columbia, flows south-westward. The geyser district is held as a national domain, the Yellowstone Park.

Travellers whose idea of picturesqueness is based upon the abnormally sharpened peaks of the ice-sculptured Alps are disappointed with the scenery of the central and southern ranges of the Rocky Mountains. It is true that many of these ranges are characterized by the rounded tops and the rather evenly slanting, waste-covered slopes which normally result from the long-continued action of the ordinary agencies of erosion; that they bear little snow in summer and are practically wanting in glaciers; that forests are often scanty on the middle and lower slopes, the more so because of devastation by fires; and that the general impression of great altitude is much weakened because the mountains are seen from a base which itself is 5000 or 6000 ft. above sea-level. Nevertheless the mountains are of especial interest to the physiographer who wishes to make a comparative study of land forms as affected by normal and by glacial sculpture, in order to give due attention to "process" as well as to "structure and stage" in the analysis and description of mountain topography. A journey along the range from south to north reveals most strikingly a gradual increase in the share of sculpture due to Pleistocene glaciers. In New Mexico, if glaciers were formed at all in the high valleys, they were so small as not greatly to modify the more normal forms. In central Colorado and Wyoming, where the mountains are higher and the Pleistocene glaciers were larger, the valley heads were hollowed out in well-formed cirques, often holding small lakes; and the mountain valleys were enlarged into U-shaped troughs as far down as the ice reached, with hanging lateral valleys on the way. Different stages of cirque development, with accompanying transformation of mountain shape, are finely illustrated in several ranges around the headwaters of the Arkansas river in central Colorado, where the highest summit of the Rocky Mountains is found (Mt Massive, 14,424 ft., in the Sawatch range); and perhaps even better in the Bighorn range of Wyoming. In this central region, however, it is only by way of exception that the cirques were so far enlarged by retrogressive glacial erosion as to sharpen the preglacial dome-like summits into acute peaks; and in no case did glacial action here extend down to the plains at the eastern base of the mountains; but the widened, trough-like glaciated valleys frequently descend to the level of the elevated intermont basins, where moraines were deployed forward on the basin floor. The finest examples of this kind are the moraines about Jackson Lake on the basin floor east of the Teton Range (Grand Teton, 13,747 ft.), a superb north-south range which lies close to the meridional boundary line between Wyoming and Idaho. Farther north in Montana, in spite of a decrease of height, there are to-day a few small glaciers with snowfields of good size; and here the effects of sculpture by the much larger Pleistocene glaciers are seen in forms of almost alpine strength.

The intermont basins which so strongly characterize the Rocky Mountain system are areas which have been less uplifted than the enclosing ranges, and have therefore usually become the depositories of waste from the surrounding mountains.

Some of the most important basins may be mentioned. San Luis "Valley" is an oval basin about 60 m. long near the southern end of the mountain system in New Mexico and Colorado; its level, treeless floor, at an altitude of 7000 ft., is as yet hardly trenched by the Rio Grande, which escapes through an impassable canyon southward on its way to the Gulf of Mexico. The much smaller basin of the upper Arkansas river in Colorado is well known because the Royal Gorge, a very narrow cleft by which the river escapes through the Front Range to the plains, is followed by a railroad at river-level. South Park, directly west of Pike's Peak, is one of the highest basins (nearly 10,000 ft.), and gains its name from the scattered, park-like growth of large pine trees; it is drained chiefly by the South Platte river (Missouri-Mississippi system), through a deep gorge in the dissected mass of the plateau-like Front Range. The Laramie Plains and the Green river basin, essentially a single structural basin between the east-west ranges of Rattlesnake Mountains on the north and the Uinta Range on the south, measuring roughly 260 m. east-west by 100 m. north-south, is the largest intermont basin; it is well known from being traversed through its greatest length by the Union Pacific railway. Its eastern part is drained north-eastward through a gorge that separates the Laramie and Rattlesnake (Front) ranges by the North Platte river to the Missouri-Mississippi; its western part, where the basin floor is much dissected, often assuming a bad-land expression, is drained southward by the Green river, through a deep canyon in the Uinta Range to the Colorado river and then to the Pacific. The Bighorn basin has a moderately dissected floor, drained north-eastward by Bighorn river through a deep canyon in the range of the same name to the Missouri. Several smaller basins occur in Montana, all somewhat dissected and drained through narrow gorges and canyons by members of the Missouri system.

The Plateau Province.

The Plateau province, next west of the southern Rocky Mountains, is characterized for the most part by large-textured forms, developed on a great thickness of nearly horizontal Palaeozoic, Mesozoic and Tertiary formations, and by a dry climate. The province was uplifted and divided into great blocks by faults or monoclinal flexures and thus exposed to long-lasting denudation in a mid-Tertiary cycle of erosion; and then broadly elevated again, with renewed movement on some of the fault lines; thus was introduced in late Tertiary time the current cycle of erosion in which the deep canyons of the region have been trenched. The results of the first cycle of erosion are seen in the widespread exposure of the resistant Carboniferous limestone as a broad platform in the south-western area of greater uplift through central Arizona, where the higher formations were worn away; and in the development of a series of huge, south-facing, retreating escarpments of irregular outline on the edges of the higher formations farther north. Each escarpment stands forth where a resistant formation overlies a weaker one; each escarpment is separated from the next higher one by a broad step of weaker strata. A wonderful series of these forms occurs in southern Utah, where in passing northward from the Carboniferous platform one ascends in succession the Vermilion Cliffs (Triassic sandstones), the White Cliffs (Jurassic sandstones, of remarkably cross-bedded structure, interpreted the dunes of an ancient desert), and finally the Pink Cliffs (Eocene strata of fluviatile and lacustrine origin) of the high, forested plateaus. Associated with these irregular escarpments are occasional rectilinear ridges, the work of extensive erosion on monoclinal structures, of which Echo Cliffs, east of the Painted Desert (so called from its many-coloured sandstones and clays), is a good example.

With the renewal of uplift by which the earlier cycle of erosion was interrupted and the present cycle introduced, inequalities of surface due to renewed faulting were again introduced; these still appear as cliffs, of more nearly rectilinear front than the retreating escarpments formed in the previous cycle. These cliffs are peculiar in gradually passing from one formation to another, and in having a height dependent on the displacement of the fault rather than on the structures in the fault face; they are already somewhat battered and dissected by erosion. The most important line of cliffs of this class is associated with the western and southern boundary of the plateau province, where it was uplifted from the lower ground. The few rivers of the region must have reached the quiescence of old age in the earlier cycle, but were revived by uplift to a vigorous youth in the current cycle; and it is to this newly introduced cycle of physiographic evolution that the deep canyons of the Plateau province are due. Thus the Virgin river, a northern branch of the Colorado, has cut a vertical slit, 1000 ft. deep, hardly wider at the top than at the bottom, in the heavy Triassic sandstones of southern Utah; but the most famous example is the Grand Canyon (*q.v.*) of Arizona, eroded by the Colorado river across the uplifted platform of Carboniferous limestone.

During the current cycle of erosion, several of the faults, whose scarps had been worn away in the previous cycle, have been brought to light again as topographic features by the removal of the weak strata along one side of the fault line, leaving the harder strata on the other side in relief; such scarps are known as "fault-line scarps," in distinction from the original "fault scarps." They are peculiar in having their altitude dependent on the depth of revived erosion, instead of the amount of faulting, and they are sometimes "topographically reversed," in that the revived scarp overlooks a lowland worn on a weak formation in the upheaved fault-block. Another consequence of revived erosion is seen in the occurrence of great landslides, where the removal of weak (Permian) clays has sapped the face of the Vermilion Cliffs (Triassic sandstone), so that huge slices of the cliff face have slid down and forward a mile or two, all shattered into a confused tumult of forms for a score or more of miles along the cliff base.

Volcanic features occur in abundance in the Plateau province. Some of the high plateaus in the north are capped with remnants of heavy lava flows of early eruption. A group of large volcanoes occurs on the limestone platform south of the Grand Canyon, culminating in Mt San Francisco (12,794 ft.), a moderately dissected cone, and associated with many more recent smaller cones and fresh-looking lava flows. Mt Taylor in western New Mexico is of similar age, but here dissection seems to have advanced farther, probably because of the weaker nature of the underlying rocks, with the result of removing the smaller cones and exposing many lava conduits or pipes in the form of volcanic necks or buttes. The Henry Mountains in south-western Utah are peculiar in owing their relief to the doming or blistering up of the plateau strata by the underground intrusion of large bodies or "cisterns" (laccolites) of lava, now more or less exposed by erosion.

The lava plains of the Columbia basin are among the most extensive volcanic outpourings in the world. They cover 200,000 sq. m. or more in south-eastern Washington, eastern Oregon and south-western Idaho, and are known to be 4000 ft. deep in some river gorges. The lava completely buries the pre-existent land forms over most of its extent. The earlier supposition that these vast lava flows came chiefly from fissure eruptions has been made doubtful by the later discovery of flat-sloping volcanic cones from which much lava seems to have been poured out in a very liquid state. Some of the flows are still so young as to preserve their scoriaceous surface; here the "shore-line" of the lava contours evenly around the spurs and enters, bay-like, into the valleys of the enclosing mountains, occasionally isolating an outlying mass. Other parts of the lava flood are much older and have been more or less deformed and eroded. Thus the uplifted, dislocated and dissected lava sheets of the Yellowstone National Park in the Rocky Mountains on the east (about the headwaters of the Snake river) are associated with the older lavas of the Columbian plains.

The Columbia river has entrenched itself in a canyon-like valley around the northern and western side of the lava plains; Snake river has cut a deeper canyon farther south-east where the plains are higher and has disclosed the many lava sheets which build up the plains, occasionally revealing a buried mountain in which the superposed river has cut an even narrower canyon. One of the most remarkable features of this province is seen in the temporary course taken by the Columbia river across the plains, while its canyon was obstructed by Pleistocene glaciers that came from the Cascade Mountains on the north-west. The river followed the temporary course long enough to erode a deep gorge, known as "Grande Coulee," along part of its length.

The lava plains are treeless and for the most part too dry for agriculture; but they support many cattle and horses. Along parts of their eastern border, where the rainfall is a little increased by the approach of the westerly winds to the Rocky Mountains, there is a belt of very deep, impalpably fine soil, supposed to be a dust deposit brought from the drier parts of the plains farther west; excellent crops of wheat are here raised.

The Basin Range Province.

The large province of the Basin ranges, an arid region throughout, even though it reaches the sea in southern California, involves some novel problems in its description. It is characterized by numerous disconnected mountain ranges trending north and south, from 30 to 100 m. in length, the higher ranges reaching altitudes of 8000 or 10,000 ft., separated by broad, intermont desert plains or basins at altitudes varying from sea-level (or a little less) in the south-west, to 4000 or 5000 ft. farther inland. Many of the intermont plains—these chiefly in the north—appear to be heavily aggraded with mountain waste; while others—these chiefly in the south—are rock-floored and thinly veneered with alluvium. The origin of these forms is still in discussion; but the following interpretation is well supported. The ranges are primarily the result of faulting and uplifting of large blocks of the earth's crust. The structure of the region previous to faulting was dependent on long antecedent processes of accumulation and deformation, and the surface of the region then was dependent on the amount of erosion suffered in the prefaulting cycle. When the region was broken into fault blocks and the blocks were uplifted and tilted, the back slope of each block was a part of the previously eroded surface and the face of the block was a surface of fracture; the present form of the higher blocks is more or less affected by erosion since faulting, while many of the lower blocks have been buried under the waste of the higher ones. In the north, where dislocations have invaded the field of the horizontal Columbian lavas, as in south-eastern Oregon and north-eastern California, the blocks are monoclinal in structure as well as in attitude; here the amount of dissection is relatively moderate, for some of the fault faces are described as ravined but not yet deeply dissected; hence these dislocations appear to be of recent date. In western Utah and through most of Nevada many of the blocks exhibit deformed structures, involving folds and faults of relatively ancient (Jurassic) date; so ancient that the mountains then formed by the folding were worn down to the lowland stage of old age before the block-faulting occurred. When this old-mountain lowland was broken into blocks and the blocks were tilted, their attitude, but not their structure, was monoclinal; and in this new attitude they have been so maturely re-dissected in the new cycle of erosion upon which they have now entered as to have gained elaborately carved forms in which the initial form of the uplifted blocks can hardly be perceived; yet at least some of them still retain along one side the highly significant feature of a relatively simple base-line, transecting hard and soft structures alike, and thus indicating the faulted margin of a tilted block. Here the less uplifted blocks are now heavily aggraded with waste from the dissected ranges: the waste takes the form of huge alluvial fans, formed chiefly by occasional boulder-bearing floods from the mountains; each fan heads in a ravine at the mountain base, and becomes laterally confluent with adjacent fans as it stretches several miles forward with decreasing slope and increasing fineness of material.

In the southern part of the Basin Range province the ranges are well dissected and some of the intermont depressions have rock floors with gentle, centripetal slopes; hence it is suggested that the time since the last dislocation in this part of the province is relatively remote; that erosion in the current cycle has here advanced much farther than in the central or northern parts of the province; and that, either by outwash to the sea or by exportation of wind-borne dust, the depressions—perhaps aggraded for a time in the earlier stages of the cycle—have now been so deeply worn down as to degrade the lower and weaker parts of the tilted blocks to an evenly sloping surface, leaving the higher and harder parts still in relief as residual ranges. If this be true, the southern district will furnish a good illustration of an advanced stage of the cycle of arid erosion, in which the exportation of waste from enclosed depressions by the wind has played an important part. In such case the washing of the centripetal slopes of the depressions by occasional "sheet-floods" (widespreading sheets of turbid running water, supplied by heavy short-lived rains) has been efficient in keeping the rock floor at even grade toward a central basin, where the finest waste is collected while waiting to be removed by the winds.

Only a small part of the Basin Range province is drained to the sea. A few intermont areas in the north-west part of the province have outlet westward by Klamath river through the Cascade range and by Pitt river (upper part of the Sacramento) through the Sierra Nevada: a few basins in the south-east have outlet by the Rio Grande to the Gulf of Mexico; a much larger but still narrow medial area is drained south-westward by the Colorado to the head of the Gulf of California, where this large and very turbid river has formed an extensive delta, north of which the former head of the gulf is now cut off from the sea and laid bare by evaporation as a plain below sea-level. It is here that an irrigation project, involving the diversion of some of the river water to the low plain, led to disaster in 1904, when the flooded river washed away the canal gates at the intake and overflowed the plain, drowning the newly established farms, compelling a railway to shift its track, and forming a lake (Salton Sea) which would require years of evaporation to remove (see COLORADO RIVER). Many streams descend from the ravines only to wither away on the desert basin floors before uniting in a trunk river along the axis of a depression; others succeed in uniting in the winter season, when evaporation is much reduced, and then their trunk flows for a few score miles, only to disappear by "sinking" (evaporating) farther on. A few of the large streams may, when in flood, spread out in a temporary shallow sheet on a dead level of clay, or *playa*, in a basin centre, but the sheet of water vanishes in the warm season and the stream shrinks far up its course, the absolutely barren clay floor of the playa, impassable when wet, becomes firm enough for crossing when dry. One of the south-western basins, with its floor below sea-level, has a plain of salt in its centre. A few of the basins are occupied by lakes without outlet, of which Great Salt Lake (*q.v.*), in north-west Utah, is the largest. Several smaller lakes occur in the basins of western Nevada, next east of the Sierra Nevada. During Pleistocene times all these lacustrine basins were occupied by lakes of much greater depth and larger size; the outlines of the eastern (Lake Bonneville) and the western (Lake Lahontan) water bodies are well recorded by shore lines and deltas on the enclosing slopes, hundreds of feet above the present lake surfaces; the abandoned shore lines, as studied by G. K. Gilbert and I. C. Russell, have yielded evidence of past climatic changes second in importance only to those of the Pleistocene glaciated areas. The duration of the Pleistocene lakes was, however, brief as compared with the time since the dislocation of the faulted blocks, as is shown by the small dimensions of the lacustrine beaches compared to the great volume of the ravine-heading fans on which the beaches often lie.

The Pacific Ranges.

Strong mountain ranges follow the trend of the Pacific coast, 150 or 200 m. inland. The Cascade Range enters from Canada, trending southward across the international boundary through Washington and Oregon to latitude 41°; the Sierra Nevada extends thence south-eastward through California to latitude 35°. The lower coast ranges, nearer the ocean, continue a little farther southward than the Sierra Nevada, before giving way to that part of the Basin Range province which reaches the Pacific in southernmost California.

The Cascade Range is in essence a maturely dissected highland, composed in part of upwarped Columbian lavas, in part of older rocks, and crowned with several dissected volcanoes, of which the chief are (beginning in the north) Mts Baker (10,827 ft.), Rainier (14,363 ft.), Adams (12,470 ft.) and Hood (11,225 ft.); the first three in Washington, the last in northern Oregon. These bear snowfields and glaciers; while the dissected highlands, with ridges of very irregular arrangement, are everywhere sculptured in a fashion that strongly suggests the work of numerous local Pleistocene glaciers as an important supplement to preglacial erosion. Lake Chelan, long and narrow, deep set between spurless ridges with hanging lateral valleys, and evidently of glacial origin, ornaments one of the eastern valleys. The range is squarely transected by the Columbia river, which bears every appearance of antecedent origin: the cascades in the river gorge are caused by a sub-recent landslide of great size from the mountain walls. Klamath river, draining several lakes in the north-west part of the Basin Range province and traversing the Cascade Range to the Pacific, is apparently also an antecedent river.

The Cascade Mountains present a marked example of the effect of relief and aspect on rainfall; they rise across the path of the prevailing westerly winds not far inland from a great ocean; hence they receive an abundant rainfall (80 in. or more, annually) on the westward or windward slope, and there they are heavily forested; but the rainfall is light on the eastward slope and the piedmont district is dry; hence the forests thin out on that side of the range and treeless lava plains follow next eastward.

The Sierra Nevada may be described, in a very general way, as a great mountain block, largely composed of granite and deformed metamorphosed rocks, reduced to moderate relief in an earlier (Cretaceous and Tertiary?) cycle of erosion, sub-recently elevated with a slant to the west, and in this position sub-maturely dissected. The region was by no means a peneplain before its slanting uplift; its surface then was hilly and in the south mountainous; in its central and still more in its northern part it was overspread with lavas which flowed westward along the broad open valleys from many vents in the eastern part: near the northern end of the range, eruptions have continued in the present cycle, forming many cones and young lava flows. The tilting of the mountain mass was presumably not a simple or a single movement; it was probably slow, for Pitt river (headwaters of the Sacramento) traverses the northern part of the range in antecedent fashion; the tilting involved the subdivision of the great block into smaller ones, in the northern half of the range at least; Lake Tahoe (altitude 6225 ft.) near the range crest is explained as occupying a depression between two block fragments; and farther north similar depressions now appear as aggraded highland "meadows." The tilting of the great block resulted in presenting a strong slope to the east, facing the deserts of the Basin Range province and in large measure determining their aridity; and a long moderate slope to the west. The altitudes along the upraised edge of the block, or range crest, are approximately 5000 ft. in the north and 11,000 ft. in the south. The mountains in the southern part of the block, which had been reduced to subdued forms in the former cycle of erosion, were thus given a conspicuous height, forming the "High Sierra," and greatly sharpened by revived erosion, normal and glacial. In this way Mt Whitney (14,502 ft.) came to be the highest summit in the United States (excluding Alaska). The displacement of the mountain block may still be in progress, for severe earthquakes have happened in the depression next east of the range; that of Owen's Valley in 1870 was strong enough to have been very destructive had there been anything in the desert valley to destroy. In the new altitude of the mountain mass, its steep eastern face has been deeply carved with short canyons; and on the western slope an excellent beginning of dissection has been made in the erosion of many narrow valleys, whose greatest depth lies between their headwaters which still flow on the highland surface, and their mouths at the low western base of the range. The highlands and uplands between the chief valleys are but moderately dissected; many small side streams still flow on the highland, and descend by steeply incised gorges to the valleys of the larger rivers. Some of the chief valleys are not cut in the floors of the old valleys of the former cycle, because the rivers were displaced from their former courses by lava flows, which now stand up as table mountains. Glacial erosion has been potent in excavating great cirques and small rock-basins, especially among the higher southern surmounting summits, many of which have been thus somewhat reduced in height while gaining an Alpine sharpness of form; some of the short and steep canyons in the eastern slope have been converted into typical glacial troughs, and huge moraines have been laid on the desert floor below them. Some of the western valleys have also in part of their length been converted into U-shaped troughs; the famous Yosemite Valley, eroded in massive granite, with side cliffs 1000 or 2000 ft. in height, and the smaller Hetch-Hetchy Valley not far away, are regarded by some observers as owing their peculiar forms to glacial modifications of normal preglacial valleys.

The western slope of the Sierra Nevada bears fine forests similar to those of the Cascade Range and of the Coast Range, but of more open growth, and with the redwood exchanged for groves of "big trees" (*Sequoia gigantea*) of which the tallest examples reach 325 ft. The higher summits in the south are above the tree line and expose great areas of bare rock: mountaineering is here a delightful summer recreation, with camps in the highland forests and ascents to the lofty peaks. Gold occurs in quartz veins traversing various formations (some as young as Jurassic), and also in gravels, which were for the most part deposited previous to the uplift of the Sierra "block." Some of the gravels then occurred as piedmont deposits along the western border of the old mountains; these gravels are now more or less dissected by new-cut valleys. Other auriferous gravels are buried under the upland lava flows, and are now reached by tunnels driven in beneath the rim of the table mountains. The reputed discovery of traces of early man in the lava-covered gravels has not been authenticated.

The northernmost part of the coast ranges, in Washington, is often given independent rank as the Olympic Range (Mt Olympus, 8150 ft.); it is a picturesque mountain group, bearing snowfields and glaciers, and suggestive of the dome-like uplift of a previously worn-down mass; but it is now so maturely dissected as to make the suggested origin uncertain. Farther south, through Oregon and northern California, many members of the coast ranges resemble the Cascades and the Sierra in offering well-attested examples of the uplift of masses of disordered structure, that had been reduced to a tame surface by the erosion of an earlier cycle, and that are now again more or less dissected.

Several of the ranges ascend abruptly from the sea; their base is cut back in high cliffs; the Sierra Santa Lucia, south of San Francisco, is a range of this kind; its seaward slope is almost uninhabitable. Elsewhere moderate re-entrants between the ranges have a continuous beach, concave seaward; such re-entrants afford imperfect harbourage for vessels; Monterey Bay is the most pronounced example of this kind. On still other parts of the coast a recent small elevatory movement has exposed part of the former sea bottom in a narrow coastal plain, of which some typical harbourless examples are found in Oregon. Most of the recent movements appear to have been upward, for the coast presents few embayments such as would result from the depression and partial submergence of a dissected mountain range; but three important exceptions must be made to this rule.

In the north, the Strait of Juan de Fuca and the intricately branching waterways of Puget Sound between the Cascade and the Olympic ranges occupy trough-like depressions which were filled by extensive glaciers in Pleistocene times; and thus mark the beginning of the great stretch of fiorded coast which extends northward to Alaska. The waterways here afford excellent harbours. The second important embayment is the estuary of the Columbia river; but the occurrence of shoals at the mouth decreases the use that might otherwise be made of the river by ocean-going vessels. More important is San Francisco Bay, situated about midway on the Pacific coast of the United States, the result of a moderate depression whereby a transverse valley, formerly followed by Sacramento river through the outermost of the Coast ranges, has been converted into a narrow strait—the "Golden Gate"—and a wider intermont longitudinal valley has been flooded, forming the expansion of the inner bay.

The Coast Range is heavily forested in the north, where rainfall is abundant in all seasons; but its lower ranges and valleys have a scanty tree growth in the south, where the rainfall is very light: here grow redwoods (*Sequoia sempervirens*) and live oaks (*Quercus agrifolia*). The chief metalliferous deposits of the range are of mercury at New Almaden, not far south of San Francisco. The open valleys between the spaced ranges offer many tempting sites for settlement, but in the south irrigation is needed for cultivation.

The belt of relative depression between the inner Pacific ranges and the Coast range is divided by the fine volcano Mt Shasta (14,380 ft.) in northern California into unlike portions. To the north, the floor of the depression is for the most part above baselevel, and hence is dissected by open valleys, partly longitudinal, partly transverse, among hills of moderate relief. This district was originally for the most part forested, but is now coming to be cleared and farmed.

South of Mt Shasta, the "Valley of California" is an admirable example of an aggraded intermont depression, about 400 m. long and from 30 to 70 m. wide. The floor of this depression being below baselevel, it has necessarily come to be the seat of the mountain waste brought down by the many streams from the newly uplifted

Sierra Nevada on the east and the coast ranges on the west; each stream forms an alluvial fan of very gentle slope; the fans all become laterally confluent, and incline very gently forward to meet in a nearly level axial belt, where the trunk rivers—the Sacramento from the north and the San Joaquin from the south-east—wander in braided courses; their tendency to aggradation having been increased in the last half century by the gravels from gold washing; their waters entering San Francisco Bay. Kings river, rising in the high southern Sierra near Mt Whitney, has built its fan rather actively, and obstructed the discharge from the part of the valley next farther south, which has thus come to be overflowed by the shallow waters of Tulare Lake, of flat, reedy, uncertain borders. A little north of the centre of the valley rise the Marysville Buttes, the remains of a maturely dissected volcano (2128 ft.). Elsewhere the floor of the valley is a featureless, treeless plain. (W. M. D.)

II.—Geology

All the great systems of rock formations are represented in the United States, though close correlation with the systems of Europe is not always possible. The general geological column for the country is shown in the following table:—

Eras of Time. *Groups of Systems.*	*Periods of Time.* *Systems of Rocks.*	
Cainozoic	Present.	
	Pleistocene.	
	Pliocene.	
	Miocene.	
	Oligocene.	
	Eocene.	
	Transition (*Arapahoe and Denver formations*).	
Mesozoic	Upper Cretaceous.	
	Widespread unconformity.	
	Comanchean (Lower Cretaceous).	
	Jurassic.	
	Triassic.	
Palaeozoic	Permian.	
	Coal Measures, or Pennsylvanian.	
	Widespread unconformity.	
	Subcarboniferous, or Mississippian.	
	Devonian.	
	Silurian.	
	Widespread unconformity.	
	Ordovician.	
	Cambrian.	
Proterozoic	*Great unconformity.*	
	Keweenawan.	
	Widespread unconformity.	
	Upper Huronian.	
	Widespread unconformity.	
	Middle Huronian.	
	Widespread unconformity.	
	Lower Huronian.	
Archeozoic	*Great unconformity.*	
	Archean	Great Granitoid Series (intrusive in the main, Laurentian).
		Great Schist Series (Mona, Kitchi, Keewatin, Quinnissec; Lower Huronian of some authors).

Archeozoic (*Archean*) *Group.*—The oldest group of rocks, called the Archean, was formerly looked upon, at least in a tentative way, as the original crust of the earth or its downward extension, much altered by the processes of metamorphism. This view of its origin is now known not to be applicable to the Archean as a whole, since this system contains some metamorphosed sedimentary rocks. In other words, if there was such a thing as an original crust, which may be looked upon as an open question, the Archean, as now defined, does not appear to represent it. The meta-sedimentary rocks of the Archean include metamorphosed limestone, and schists which carry carbonaceous matter in the form of graphite. The marble and graphite, as well as some other indirect evidence of life less susceptible of brief statement, have been thought by many geologists sufficient to warrant the inference that life existed before the close of the era when the Archean rocks were formed. Hence the era of their formation is called the Archeozoic era.

Most of the Archean rocks fall into one or the other of two great series, a schistose series and a granitoid series, the latter being in large part intrusive in the former. The rocks of the granitoid series appear as great masses in the schist series, and in some places form great protruding bosses. They were formerly regarded as older than the schists and were designated on this account "primitive," "fundamental," &c. They have also been called *Laurentian*, a name which is still sometimes applied to them.

Nearly all known sorts of schist are represented in the schistose part of the system. Most of them are the metamorphic products of igneous rocks, among which extrusive rocks, many of them pyroclastic, predominate. Metamorphosed sedimentary rocks are widely distributed in the schistose series, but they are distinctly subordinate to the meta-igneous rocks, and they are so highly metamorphic that stratigraphic methods are not usually applicable to them. In some areas, indeed, it is difficult to say whether the schists are meta-sedimentary or meta-igneous. The likeness of the Archean of one part of the country to that of another is one of its striking features.

The Archean appears at the surface in many parts of the United States, and in still larger areas north of the national boundary. It appears in the cores of some of the western mountains, in some of the deep canyons of the west, as in the Grand Canyon of the Colorado in northern Arizona, and over considerable areas in northern Wisconsin and Minnesota, in New England and the piedmont plateau east of the Appalachian Mountains, and in a few other situations. Wherever it comes to the surface it comes up from beneath younger rocks which are, as a rule, less metamorphic. By means of deep borings it is known at many points where it does not appear at the surface, and is believed to be universal beneath younger systems.

Locally the Archean contains iron ore, as in the Vermilion district of northern Minnesota, and at some points in Ontario. The ore is mostly in the form of haematite.

Proterozoic (*Algonkian*) *Systems.*—The Proterozoic group of rocks (called also Algonkian) includes all formations younger than the Archean and older than the Palaeozoic rocks. The term Archean was formerly proposed to include these rocks, as well as those now called Archean, but the subdivision here recognized has come to be widely approved.

The Proterozoic formations have a wide distribution. They appear at the surface adjacent to most of the outcrops of the Archean, and in some other places. In many localities the two groups have not been separated. In some places this is because the regions where they occur have not been carefully studied since the subdivision into Archeozoic and Proterozoic was made, and in others because of the inherent difficulty of separation, as where the Proterozoic rocks are highly metamorphosed. On the whole, the Proterozoic rocks are predominantly sedimentary and subordinately igneous. Locally both the sedimentary and igneous parts of the group have been highly metamorphosed; but as a rule the alteration of the sedimentary portions has not gone so far that stratigraphic methods are inapplicable to them, though in some places detailed study is necessary to make out their structure.

The Proterozoic formations are unconformable on the Archean in most places where their relations are known. The unconformity between these groups is therefore widespread, probably more so than any later unconformity. Not only is it extensive in area, but the stratigraphic break is very great, as shown by (1) the excess of metamorphism of the lower group as compared with the upper, and (2) the amount of erosion suffered by the older group before the deposition of the younger. The first of these differences between the two systems is significant of the dynamic changes suffered by the Archean before the beginning of that part of the Proterozoic era represented by known formations. The extent of the unconformity is usually significant of the geographic changes of the interval unrecorded by known Proterozoic rocks.

The Proterozoic formations have been studied in detail in few great areas. One of these is about Lake Superior, where the formations have attracted attention on account of the abundant iron ore which they contain. Four major subdivisions or systems of the group have been recognized in this region, as shown in the preceding table. These systems are separated one from another by unconformities in most places, and the lower systems, as a rule, have suffered a greater degree of metamorphism than the upper ones, though this is not to be looked upon as a hard and fast rule. The commoner sorts of rock in the several Huronian systems are quartzite and slate (ranging from shale to schist); but limestone is not wanting, and igneous rocks, both intrusive and extrusive, some metamorphic and some not, abound. Iron ore occurs in the sedimentary part of the Huronian, especially in Minnesota, Michigan, Wisconsin and parts of Canada. The ore is chiefly haematite, and has been developed from antecedent ferruginous sedimentary deposits, through concentration and purification by ground water.

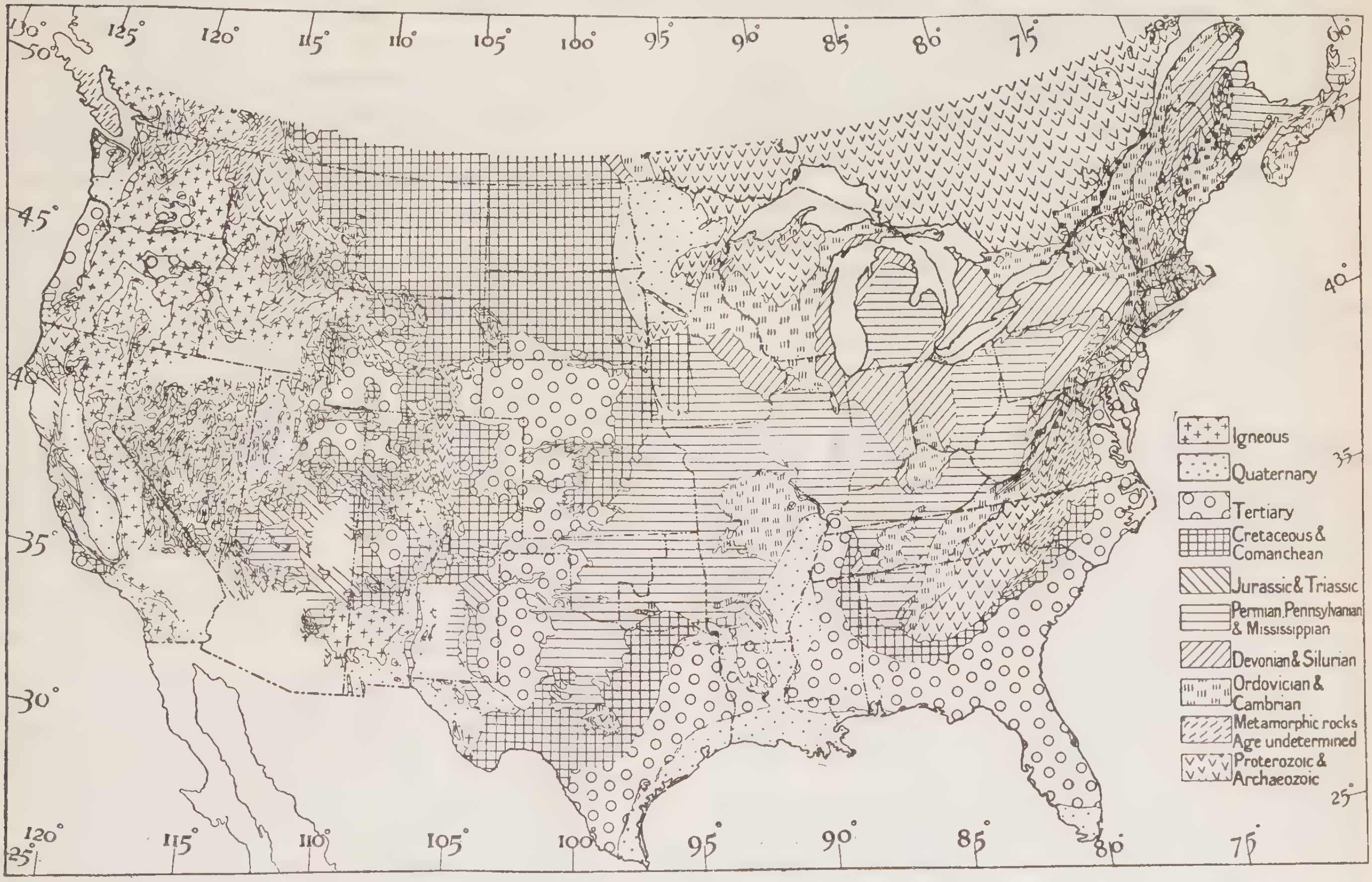
The lower part of the Keweenawan system consists of a great succession of lava flows, of prodigious thickness. This portion of the system is overlain by thick beds of sedimentary rock, mostly conglomerate and sandstone, derived from the igneous rocks beneath. A few geologists regard the sedimentary rocks here classed as Keweenawan as Palaeozoic; but they have yielded no fossils, and are unconformable beneath the Upper Cambrian, which is the oldest sedimentary formation of the region which bears fossils. The aggregate thickness of the Proterozoic systems in the Lake Superior region is several miles, as usually computed, but there are obvious difficulties in determining the thickness of such great systems, especially when they are much metamorphosed. The copper of the Lake Superior region is in the Keweenawan system, chiefly in its sedimentary and amygdaloidal parts.

The Proterozoic formations in other parts of the continent cannot be correlated in detail with those of the Lake Superior region. The number of systems is not everywhere the same, nor are they everywhere alike, and their definite correlation with one another is not possible now, and may never be. The Proterozoic formations have yielded a few fossils in several places, especially Montana and northern Arizona; but they are so imperfect, their numbers, whether of individuals or of species, are so small, and the localities where they occur so few, that they are of little service in correlation throughout the United States. The carbon-bearing shales, slates and schists, and the limestone, are indications that life was relatively abundant, even though but few fossils are preserved. Among the known fossils are vermes, crustacea and probably brachiopods and pteropods

The character of the sediments of the Proterozoic is such as to show that mature weathering affected the older rocks before their material was worked over into the Proterozoic formations. This mature weathering, resulting in the relatively complete separation of the quartz from the kaolin, and both from the calcium carbonate and other basic materials, implies conditions of rock decay comparable to those of the present time.

In all but a few places where their relations are known, the Proterozoic rocks are unconformable beneath the Palaeozoic Where conformity exists the separation is made on the basis of fossils, it having been agreed that the oldest rocks carrying the Olenellus fauna are to be regarded as the base of the Cambrian system.

The Palaeozoic and later formations are usually less altered, more accessible, and better known than the Proterozoic and Archeozoic, and will be taken up by systems.



Cambrian System.—The lower part of the Cambrian system, characterized by the Olenellus fauna, is restricted to the borders of the continent, where it rests on the older rocks unconformably in most places. The middle part of the system, characterized by the Paradoxides fauna, is somewhat more widespread, resting on the lower part conformably, but overlapping it, especially in the south and west. The upper part of the system, carrying the Dicellocephalus fauna, is very much more extensive; it is indeed one of the most widespread series of rocks on the continent. The lower, middle and upper parts of the system all contain marine fossils. This being the case, the distribution of the several divisions indicates that progressive submergence of the United States was in progress during the period, and that most of the country was covered by the sea before its close.

The system is composed chiefly of clastic rocks, and their composition and structure show that the water in which they were deposited was shallow. In the interior, the upper part of the system, the Potsdam sandstone, is generally arenaceous. It is well exposed in New York, Wisconsin, Missouri and elsewhere, about the outcrops of older rocks. The system is also exposed in many of the western mountains or about their borders, especially about those the cores of which are of Archean or Proterozoic rock.

The thickness of the system has been estimated at 10,000 to 12,000 ft. in eastern New York, and almost as much in the southern Appalachian Mountains (Georgia and Alabama); but its average thickness is much less. In Wisconsin, where the Upper Cambrian only is present, the thickness is about 1000 ft. The greater thickness in the east appears to be due in part to the fact that an extensive area of land, *Appalachia*, lay east of the site of the Appalachian Mountains throughout the Palaeozoic era, and quantities of sediment from it were accumulated where these mountains were to arise later. The greatness of the thickness, as it has been measured, is also due in part to the oblique position in which the beds of sediment were originally deposited.

The Cambrian formations have not been notably metamorphosed, except in a few regions where dynamic metamorphism has been effective. The system is without any notable amount of igneous rock. As in other parts of the world, the system here contains abundant fossils, among which trilobites, brachiopods and worms are the most abundant. The range of forms, however, is great.

Ordovician System.—The succeeding Ordovician (Lower Silurian) system of rocks is closely connected with the Cambrian, geographically, stratigraphically and faunally. Its distribution is much the same as that of the Upper Cambrian, with which it is conformable in many places. The Ordovician system contains much more limestone, and therefore much less clastic rock, than the Cambrian, pointing to clearer seas in which life abounded. The succession of beds in New York has become a sort of standard with which the system in other parts of the United States has been compared. The succession of formations in that state is as follows:—

Ordovician	Upper Ordovician (or Cincinnatian)	Richmond beds (in Ohio and Indiana). Lorraine beds. Utica shales.
	Middle Ordovician (or Mohawkian)	Trenton limestone. Black River limestone. Lowville limestone.
	Lower Ordovician (or Canadian)	Chazy limestone. Beekmantown limestone. (=Calciferous).

The classification in the right-hand column of this table is not applicable in detail to regions remote from New York.

There is in some places an unconformity between the Richmond beds (or their equivalent) and underlying formations, and this unconformity, together with certain palaeontological considerations, has raised the question whether the uppermost part of the system, as outlined above, should not be classed as Silurian (Upper Silurian). Over the interior the strata are nearly horizontal, but in the mountain regions of the east and west, as well as in the mountains of Arkansas and Oklahoma, they are tilted and folded, and locally much metamorphosed. The outcrops of the system appear for the most part in close association with the outcrops of the Cambrian system, but the system appears in a few places where the Cambrian does not, as in southern Ohio and central Tennessee. The thickness of the system varies from point to point, being greatest in the Appalachian Mountains, and much less in the interior.

The oil and gas of Ohio and eastern Indiana come from the middle portion of the Ordovician system. So also do the lead and zinc of south-western Wisconsin and the adjacent parts of Iowa and Illinois. The lead of south-eastern Missouri comes from about the same horizon.

The fossils of the Ordovician system show that life made great progress during the period, in numbers both of individuals and of species. The life, like that of the later Cambrian, was singularly cosmopolitan, being in contrast with the provincial character of the life of the earlier Cambrian and of the early (Upper) Silurian which followed. Beside the expansion of types which abounded in the Cambrian, vertebrate remains (fishes) are found in the Ordovician. So, also, are the first relics of insects. The departure of the Ordovician life from that of the Cambrian was perhaps most pronounced in the great development of the molluscs and crinoids (including cystoids), but corals were also abundant for the first time, and graptolites came into prominence.

Silurian System.—The Silurian system is much less widely distributed than the Ordovician. This and other corroborative facts imply a widespread emergence of land at the close of the Ordovician period. As a result of this emergence the stratigraphic break between the Ordovician and the Silurian is one of the greatest in the whole Palaeozoic group.

The classification of the system in New York is as follows:—

Silurian . .	Cayugan (Neo- or Upper Silurian)	Manlius limestone.
		Rondout waterlime.
		Cobleskill limestone.
		Salina beds.
	Niagaran (Meso- or Middle Silurian)	Guelph dolomite.
		Lockport limestone.
		Rochester shale.
		Clinton beds.
	Oswegan (Palaeo-or Lower Silurian)	Medina sandstone.
		Oneida conglomerate.
		Shawangunk grit.

The lower part of this system is chiefly clastic, and is known only in the eastern part of the continent. The middle portion contains much limestone, generally known as the Niagara limestone, and is much more widespread than the lower, being found very generally over the eastern interior, as far west as the Mississippi and in places somewhat beyond. The Niagara limestone contains the oldest known coral reefs of the continent. They occur in eastern Wisconsin and at other points farther east and south. It is over this limestone that the Niagara falls in the world-famous cataract. One member of the middle division of the system (Clinton beds) contains much iron ore, especially in the Appalachian Mountain region. The ore is extensively worked at some points, as at Birmingham, Alabama. The upper part of the system is more restricted than the middle, and includes the salt-bearing series of New York, Ohio and Pennsylvania, with its peculiar fauna. It is difficult to see how salt could have originated in this region except under conditions very different climatically from those of the present time.

In the interior the thickness of the system is less than 1000 ft. in many places, but in and near the Appalachian Mountains its thickness is much greater—more than five times as great if the maximum thicknesses of all formations be made the basis of calculation. In the Great Plains and farther west the Silurian has little known representation. Either this part of the continent was largely land at this time, or the Silurian formations here have been worn away or remain undifferentiated. Rocks of Silurian age, however, are known at some points in Arizona, Nevada and southern California.

Corals, echinoderms, brachiopods and all groups of molluscs abounded. Graptolites had declined notably as compared with the Ordovician, and the trilobites passed their climax before the end of the period. Certain other remarkable crustacea, however, had made their appearance, especially in connexion with the Salina series of the east.

There are numerous outliers of the Silurian north of the United States, even up to the Arctic regions. These outliers have a common fauna, which is closely related to that of the interior of the United States. They give some clue to the amount of erosion which the system has suffered, and also afford a clue to the route by which the animals whose fossils are found in the United States entered this country. Thus, the Niagara fauna of the interior of the United States has striking resemblances to the mid-Silurian faunas of Sweden and Great Britain. It seems probable, therefore, that marine animals found migratory conditions between these regions, probably by way of northern islands. The fauna of the Appalachian region is far less like that of Europe, and indicates but slight connexion with the fauna of the interior. Both the earlier and the later parts of the Silurian period seem to have been times when physical conditions were such as to favour the development of provincial faunas, while during the more widespread submergence of the middle Silurian the fauna was more cosmopolitan.

Devonian System.—The Devonian system appears in some parts of New England, throughout most of the Appalachian region, over much of the eastern interior from New York to the Missouri River, in Oklahoma, and perhaps in Texas. It is absent from the Great Plains, so far as now known, and is not generally present in the Rocky Mountains, though somewhat widespread between them and the western coast. As a whole, the system is more widespread than the Silurian, though not so widespread as the Ordovician. As in the case of the Ordovician and the Silurian, the New York section has become a standard with which the system in other parts of the country is commonly compared. This section is as follows:—

Devonian .	Upper Devonian	Chautauquan-Chemung (including Catskill).	
		Senecan . .	Portage beds.
			Genesee shale.
			Tully limestone.
	Middle Devonian	Erian. . .	Hamilton shale.
			Marcellus shale.
		Ulsterian. .	Onondaga (Corniferous limestone)
			Schoharie grit.
			Esopus grit.
	Lower Devonian	Oriskanian .	Oriskany beds.
		Helderbergian	Kingston beds.
			Becraft limestone.
			New Scotland beds.
			Coeymans limestone.

The formations most widely recognized are the Helderberg limestone, the Onondaga limestone and the Hamilton shale.

The Catskill sandstone, found chiefly in the Catskill Mountain region of New York, is one of the distinctive formations of the system. It has some similarity to the Old Red Sandstone of Great Britain. In part, at least, it is equivalent in time of origin to the Chemung formation; but the latter is of marine origin, while the Catskill formation appears to be of terrestrial origin.

No other system of the United States brings out more clearly the value of palaeontology to palaeogeography. The faunas of the early Devonian seem to have entered what is now the interior of the United States from the mid-Atlantic coast. The Onondaga fauna which succeeded appears to have resulted from the commingling of the resident lower Devonian fauna with new emigrants from Europe by way of the Arctic regions. The Hamilton fauna which followed represents the admixture of the resident Onondaga fauna with new types which are thought to have come from South America, showing that faunal connexions for marine life had been made between the interior of the United States and the lands south of the Caribbean Sea, a connexion of which, before this time, there was no evidence. The late Devonian fauna of the interior represents the commingling of the Hamilton fauna of the eastern interior with new emigrants from the north-west, a union which was not effected until toward the close of the period.

Like the earlier Palaeozoic systems, the Devonian attains its greatest known thickness in the Appalachian Mountains, where sediments from the lands of pre-Cambrian rock to the east accumulated in quantity. Here clastic rocks predominate, while limestone is more abundant in the interior. If the maximum thicknesses of all Devonian formations be added together, the total for the system is as much as 15,000 ft.; but such a thickness is not found in any one place.

The Devonian system yields much oil and gas in western Pennsylvania, south-western New York, West Virginia and Ontario; and some of the Devonian beds in Tennessee yield phosphates of commercial value. The Hamilton formation yields much flagstone.

Among the more important features of the marine life of the period were (1) the great development of the molluscs, especially of cephalopods; (2) the abundance of large brachiopods; (3) the aberrant tendencies of the trilobites; (4) the profusion of corals; and (5) the abundance, size and peculiar forms of the fishes. The life of the land waters was also noteworthy, especially for the great deployment of what may be called the crustacean-ostracodermo-vertebrate group. The crustacea were represented by eurypterids, the ostracoderms by numerous strange, vertebrate-like forms (*Cephalaspis*, *Cyathaspis*, *Trematopsis*, *Bothriolepis*, &c.), and the vertebrates by a great variety of fishes. The land life of the period is represented more fully among the fossils than that of any preceding period. Gymnosperms were the highest types of plants.

The Devonian system is not set off from the Mississippian by any marked break. On the other hand, the one system merges into the other, so that the plane of separation is often indistinct.

Mississippian System.—The Mississippian system was formerly regarded as a part of the Carboniferous, and was described under the name of Lower Carboniferous, or Subcarboniferous, without the rank of a system. This older classification, which has little support except that which is traditional, is still adhered to by many geologists; but the fact seems to be that the system is set off from the Pennsylvanian (Upper Carboniferous) more sharply than the Cambrian is from the Ordovician, the Silurian from the Devonian, or the Devonian from the Mississippian.

The system is well developed in the Mississippi Basin, whence its name. Its formations are much more widespread than those of any other system since the Ordovician. They appear at the surface in great areas in the interior, in the south-west and about many of the western mountains. In many places in the west they rest on what appear to be Ordovician beds, but without unconformity. The explanation of the apparent conformity of the strata from the Cambrian to the Pennsylvanian in some parts of the west, with no fossils defining with certainty any horizon between the Ordovician and the Mississippian, is one of the open problems in the geology of the United States.

The subdivision of the system for various regions in the eastern part of the United States is as follows:—

Mississippi River States.	Ohio.	Pennsylvania.	Maryland.
4. Kaskaskia or Chester	7. Maxville		
3. St Louis	6. Logan		3. Mauch Chunk
2. Osage or Augusta (including the Burlington, Keokuk and Warsaw)	5. Black Hand 4. Cuyahoga 3. Sunbury 2. Berea grit	2. Mauch Chunk	2. Greenbrier
1. Kinderhook or Chouteau	1. Bedford	1. Pocono	1. Pocono

In the interior the Kinderhook series has a distribution similar to that of the Devonian; the Osage series is more widespread, pointing to progressive submergence; and the St Louis is still more extensive. This epoch, indeed, is the epoch of maximum submergence during the period, and the maximum since the Ordovician. Before its close the sea of the Great Basin which had persisted since the Devonian was connected with the shallow sea which covered much of the interior of the United States. The fourth series, the Kaskaskia or Chester, is more restricted, and points to the coming emergence of a large part of the United States. In the Mississippi Basin the larger part of the system is of limestone, though there is some clastic material in both its basal and its upper parts. In Ohio the system contains much clastic rock, and in Pennsylvania little else. The Mauch Chunk series (shale and sandstone) is now believed to be largely of terrestrial origin.

The system ranges in thickness from nearly 5000 ft. maximum in Pennsylvania to 1500 ft. in the vicinity of the Mississippi river. In West Virginia some 2000 ft. of limestone are assigned to this system. The zinc and lead of the Joplin district of Missouri are in the limestone of this system, and the corresponding limestone in some parts of Colorado, as at Leadville, is one of the horizons of rich ore.

The end of the period was marked by the widespread emergence of the continent, and parts of it were never again submerged, so far as is known. Certainly there is no younger marine formation of comparable extent in the continent. When deposition was renewed in the interior of the continent, the formations laid down were largely non-marine, and, over great areas, they rest upon the Mississippian unconformably.

From the conditions outlined it is readily inferred that the faunas of the system were cosmopolitan. All types of life to which shallow, clear sea-water was congenial appear to have abounded in the interior. It was perhaps at this time that the crinoids, as a class, reached their climax, and most forms of lime-carbonate-secreting life seem to have thriven. Where the seas were less clear, as in Ohio, the conditions are reflected in the character of the fossils. Marine fishes had made great progress before the close of the period. Amphibia appeared before its close, and plant life was abundant and varied, though the types were not greatly in advance of those of the Devonian. The time of such widespread submergence was hardly the time for the great development of land vegetation.

Pennsylvanian System.—The Pennsylvanian or Upper Carboniferous system overlies the Mississippian unconformably over a large part of the United States. In the eastern half of the country the system consists of shales and sandstones chiefly, but there is some limestone, and coal enough to be of great importance economically, though it makes but a small part of the system quantitatively. The larger part of the system in this part of the country is not of marine origin; yet the sea had access to parts of the interior more than once, as shown by the marine fossils in some of the beds. The dominantly terrestrial formations of the eastern half of the country are in contrast with the marine formations of the west. The line separating the two phases of the system is a little east of the 100th meridian. West of the Mississippi the Coal Measures are subdivided into two series, the Des Moines below and the Missouri above. In the eastern part of the country (Pennsylvania, Ohio, &c.) the system is divided into four principal parts:—

Pennsylvanian.
4. Monongahela formation (or series)—Upper Productive Coal Measures.
3 Conemaugh formation (or series)—Lower Barren Coal Measures.
2. Allegheny formation (or series)—Lower Productive Coal Measures.
1. Pottsville formation (or series).

The Pottsville formation is chiefly clastic, and corresponds roughly to the Millstone Grit of England. The Allegheny and Monongahela series contain most of the coal, though it is not wanting in the other subdivisions of the system. Productive coal beds are found in five principal fields. These are (1) the Anthracite field in eastern Pennsylvania, nearly 500 sq. m. in extent; (2) the Appalachian field, having an area of about 71,000 sq. m. (75 % being productive), and extending from Pennsylvania to Alabama; (3) the northern interior field, covering an area of about 11,000 sq. m. in southern Michigan; (4) the eastern interior field in Indiana, Illinois and Kentucky, with an area of about 58,000 sq. m. (55 % being productive); and (5) the western interior and south-western field, some 94,000 sq. m. in extent, reaching from Iowa on the north to Texas on the south. There is also a coalfield in Nova Scotia and New Brunswick, about 18,000 sq. m. in extent. Some of the well-known beds of coal are known to be continuous for several thousands of square miles.

Unlike the older systems of the Palaeozoic, the Pennsylvanian system has not its maximum thickness in the Appalachian Mountains, but in Arkansas, in a region which was probably adjacent to high lands at that time. These lands perhaps lay in the present position of the Ouachita Mountains.

The close of the Pennsylvanian period was marked by the beginning of profound changes, changes in geography and climate, and therefore changes in the amount and habitat of life, and in the sites of erosion and sedimentation. One of the great changes of this time was the beginning of the development of the Appalachian Mountain system. The site of these mountains had been, for the most part, an area of deposition throughout the Palaeozoic era, and the body of sediments which had gathered here at the western base of Appalachia, by the close of the Pennsylvanian period, was very great. At this time these sediments, together with some of Appalachia itself, began to be folded up into the Appalachian Mountains. These mountains have since been worn down, so that, in spite of their subsequent periods of growth, their height is not great.

The chief interest of the palaeontology of this system is in the plants, which were very like those of the Coal Measures of other parts of the earth and showed a high development of forms that are now degenerate. Among land animals the amphibia had great development at this time. So also had insects and some other forms of land life.

Permian Period.—The Permian system appears in smaller areas in the United States than any other Palaeozoic system. The "Upper Barren Coal Measures" of some parts of the east (Ohio, Pennsylvania, &c.) are now classed as Permian on the basis of their fossil plants. They represent but a part of the Permian period, and are commonly described under the name of the Dunkard series.

The system has much more considerable development west of the Mississippi than east of it, especially in Texas, Kansas, Nebraska and beyond. Some of the Permian beds of this region are marine, while others are of terrestrial origin. In this part of the country the Permian beds are largely red sandstone, often saliferous and gypsiferous. They are distinguished with difficulty from the succeeding Triassic, for the beds have very few fossils. The system has its maximum known thickness in Texas, where it is said to be 7000 ft. in maximum thickness. West of the Rocky Mountains the Permian has not been very generally separated from overlying and underlying formations, though it has been differentiated in a few places, as in south-western Colorado and in some parts of Arizona. Perhaps the most remarkable feature of the palaeontology of the system is its paucity of fossils, especially in those parts of the system, such as the Red Beds, which are of terrestrial origin.

In the United States no direct evidence has been found of the low temperature which brought about glaciation in many other parts of the earth during this period. Salt and gypsum deposits, and other features of the Permian beds, together with the fewness of fossils, indicate that the climate of the Permian was notably arid in many regions.

Triassic System.—This system has but limited representation in the eastern part of the United States, being known only east of the Appalachian Mountains in an area which was land throughout most of the Palaeozoic era, but which was deformed when the eastern mountains were developed at the close of the Palaeozoic. In the troughs formed in its surface during this time of deformation, sediments of great thickness accumulated during the Triassic period. These sediments are now mostly in the form of red sandstone and shale, with conglomerate, black shale and coal in some places. These rocks do not represent the whole of the period. They are often known as the Newark series, and seem to be chiefly, if not wholly, of terrestrial origin. The sedimentary rocks are affected by many dikes and sheets of igneous rock, some of the latter being extrusive and some intrusive. The strata are now tilted and much faulted, though but little folded. In the western plains and in the western mountains the Triassic is not clearly separated from the Permian in most places. So far as the system is differentiated, it is a part of the Red Beds of that region. The tendency of recent years has been to refer more and more of these beds to the Permian. The

Triassic system is well developed on the Pacific coast, where its strata are of marine origin, and they extend inland to the Great Basin region.

The climate of the period, at least in its earlier part, seems to have been arid like that of the Permian, as indicated both by the paucity of fossils and by the character of the sediments. The salt and gypsum constitute a positive argument for aridity. The character of some of the conglomerate of the Newark series of the east, and the widespread redness of the beds, so far as it is original, also point to aridity.

As in other parts of the earth, the Triassic was the age of gymnosperms, which were represented by diverse types. Reptiles were the dominant form of animals, and land reptiles (dinosaurs) gained over their aquatic allies.

Jurassic System.—This system is not known with certainty in the eastern half of the United States, though there are some beds on the mid-Atlantic coast, along the inland border of the coastal plain, which have been thought by some, on the basis of their reptilian fossils, to be Jurassic. The lower and middle parts of the system are but doubtfully represented in the western interior. If present, they form a part of the Red Beds of that region. On the Pacific coast marine Jurassic beds reach in from the Pacific to about the same distance as the Triassic system. The Upper Jurassic formations are much more widely distributed. During the later part of the period the sea found entrance at some point north of the United States to a great area in the western part of the continent, developing a bay which extended far down into the United States from Canada. In this great bay formations of marine origin were laid down. At the same time marine sedimentation was continued on the Pacific coast, but the faunas of the west coast and the interior bay are notably unlike, the latter being more like that of the coast north of the United States. This is the reason for the belief that the bay which extended into the United States had its connexion with the sea north of the United States.

The Jurassic faunas of the United States were akin to those of other continents. The great development of reptiles and cephalopods was among the notable features. At the close of the period there were considerable deformations in the west. The first notable folding of the Sierras that has been definitely determined dates from this time, and many other mountains of the west were begun or rejuvenated. The close of the period, too, saw the exclusion of the sea from the Pacific coast east of the Sierras, and the disappearance, so far as the United States is concerned, of the great north-western bay of the late Jurassic. Before the close of the period, the aridity which had obtained during the Permian, and at least a part of the Triassic, seems to have disappeared.

Comanchean System.—This system was formerly classed as the lower part of the Cretaceous, but there are strong reasons for regarding it as a separate system. Its distribution is very different from that of the Upper Cretaceous, and there is a great and widespread unconformity between them. The faunas, too, are very unlike. The Comanchean formations are found (1) on the inland border of the coastal plain of the Atlantic (Potomac series) and Gulf coasts (Tuscaloosa series at the east and Comanchean at the west); (2) along the western margin of the Great Plains and in the adjacent mountains; and (3) along the Pacific coast west of the Sierras. In the first two of these positions, the formations show by their fossils that they are of terrestrial origin in some places, and partly of terrestrial and partly of marine origin in others. In the coastal plain the Comanchean beds are generally not cemented, but consist of gravel, sand and clay, occupying the nearly horizontal position in which they were originally deposited. Much plastic clay and sand are derived from them. In Texas, whence the name "Comanchean" comes, and where different parts of the system are of diverse origins, there is some limestone. This sort of rock increases in importance southward and has great development in Mexico. In the western interior there is difference of opinion as to whether certain beds rich in reptilian remains (the Morrison, Atlantosaurus, Como, &c.) should be regarded as Jurassic or Comanchean. On the western coast the term Shastan is sometimes applied to Lower Cretaceous. In the United States, marine Shastan beds are restricted to the area west of the Sierras, but they here have great thickness.

Widespread changes at the end of the period exposed the areas where deposition has been in progress during the period to erosion, and the (Upper) Cretaceous formations rest upon the Comanchean unconformably in most parts of the country. The Comanchean system contains the oldest known remains of netted-veined leaved plants, which mark a great advance in the vegetable world. Reptiles were numerous and of great size. They were the largest type of life, both on land and in the sea.

Cretaceous System.—This system is much more extensively developed in the United States than any other Mesozoic system. It is found (1) on the Atlantic coastal plain, where it laps up on the Comanchean, or over it to older formations beyond its inland margin; (2) on the coastal plain of the Gulf region in similar relations; (3) over the western plains; (4) in the western mountains; and (5) along the Pacific coast. Unlike the Comanchean, the larger part of the Cretaceous system is of marine origin. The distribution of the beds of marine origin shows that the sea crept up on the eastern and southern borders of the continent during the period, covered the western plains, and formed a great mediterranean sea between the eastern and western lands of the continent, connecting the Gulf of Mexico on the south and the Arctic Ocean on the north. This widespread submergence, followed by the deposition of marine sediments on the eroded surface of Comanchean and older rocks, is the physical reason for the separation of the system from the Comanchean. This reason is reinforced by palaeontological considerations.

Both on the Atlantic and over the western plains the system is divided into four principal subdivisions:—

Atlantic Coast.	*Western Plains.*
4. Manasquan formation.	4. Laramie.
3. Rancocas formation.	3. Montana: Fox Hills; Fort Pierre.
2. Monmouth formation.	2. Colorado: Niobrara; Benton.
1. Matawan formation.	1. Dakota.

The most distinctive feature of the Cretaceous of the Atlantic coastal plain is its large content of greensand marl (glauconite). The formations are mostly incoherent, and have nearly their original position. In the eastern Gulf states there is more calcareous material, represented by limestone or chalk. In the Texan region and farther north the limestone becomes still more important. In the western plains, the first and last principal subdivisions of the system (Dakota and Laramie) are almost wholly non-marine. The Dakota formation is largely sandstone, which gives rise to "hogbacks" where it has been tilted, indurated and exposed to erosion along the eastern base of the Rocky Mountains. The Colorado series contains much limestone, some of which is in the form of chalk. This is *par excellence* the chalk formation of the United States. That the chalk was deposited in shallow, clear seas is indicated both by the character of the fossils other than foraminifera and by the relation of the chalk to the clastic portions of the series. The Montana series, most of which is marine, was deposited in water deeper than that of the Colorado epoch, though the series is less widespread than the preceding. The Laramie is the great coal-bearing series of the west, and corresponds in its general physical make-up and in its mode of origin to the Coal Measures of the east. The coal-bearing lands of the Laramie have been estimated at not less than 100,000 sq. m. On the Pacific coast the Cretaceous formations are sometimes grouped together under the name of Chico. The distribution of the Chico formations is similar to that of the Comanchean system in this region.

The Cretaceous system is thick. If maximum thicknesses of its several parts in different localities, as usually measured, are added together, the total would approach or reach 25,000 ft.; but the strata of any one region have scarcely more than half this thickness, and the average is much less.

The close of the period was marked by very profound changes which may be classed under three general headings: (1) the emergence of great areas which had been submerged until the closing stages of the period; (2) the beginning of the development of most of the great mountains of the west; (3) the inauguration of a protracted period of igneous activity, stimulated, no doubt, by the crustal and deeper-seated movements of the time. These great changes in the relation of land and water, and in topography, led to correspondingly great changes in life, and the combination marks the transition from the Mesozoic to the Cainozoic era.

Tertiary Systems.—The formations of the several Tertiary periods have many points of similarity, but in some respects they are sharply differentiated one from another. They consist, in most parts of the country, of unconsolidated sediments, consisting of gravel, sand, clay, &c., together with large quantities of tuff, volcanic agglomerate, &c. Some of the sedimentary formations are of marine, some of brackish water, and some of terrestrial origin. In the western part of the country there are, in addition, very extensive flows of lava covering in the aggregate some 200,000 sq. m. Terrestrial sedimentation was, indeed, a great feature of the Tertiary. This was the result of several conditions, among them the recent development, through warping and faulting and volcanic extrusion, of high lands with more or less considerable slopes. From these high lands sediments were borne down to lodge on the low lands adjacent. The sites of deposition varied as the period progressed, for the warping and faulting of the surface, the igneous extrusions, and the deposition of sediments obliterated old basins and brought new ones into existence. The marine Tertiary formations are confined to the borders of the continent, appearing along the Atlantic, Gulf and Pacific coasts. The brackish water formations occur in some parts of the same general areas, while the terrestrial formations are found in and about the western mountains. As in other parts of the world, the chiefest palaeontological interest of the Tertiary attaches to the mammalian fossils.

Eocene System.

The Eocene beds are unconformable, generally, upon the Cretaceous, and unconformable beneath the Miocene. On the Atlantic coast they are nearly horizontal, but dip gently seaward. On this coast they are nowhere more than a few hundred feet thick. In the Gulf region the system is more fully represented, and attains a greater thickness—1700 ft. at least. In the Gulf region the Eocene system contains not a little non-marine material. Thus the lower Eocene has some lignite in the eastern Gulf region, while in Texas lignite and saliferous and gypsiferous sediments are found, though most of the system is marine and of shallow water origin. The Eocene of the western Gulf region is continued north as far as Arkansas. The classification of the Eocene (and Oligocene) formations in the Gulf region, especially east of the Mississippi, is as follows:—

4. Jacksonian	Upper Eocene.
3. Claibornian	Middle Eocene.
2. Chickasawan	Lower Eocene.
1. Midwayan	

The Jacksonian is sometimes regarded as Oligocene. This classification is based almost wholly on the fossils, for there seems to be little physical reason for the differentiation of the Oligocene anywhere on the continent.

On the Pacific coast the marine Eocene lies west of the Sierras, and between it and the Cretaceous there is a general, and often a great, unconformity. The system has been reported to have a thickness of more than 7000 ft. in some places, and locally (*e.g.* the Pescadero formation) it is highly metamorphic. The Eocene of southern California carries gypsum enough to be of commercial value. It is also the source of much oil. The system is wanting in northern California and southern Oregon, but appears again farther north, and has great development in Oregon, where its thickness has been estimated at more than 10,000 ft. As in other comparable cases, this figure does not make allowance for the oblique attitude in which the sediments were deposited, and should not be construed to mean the vertical thickness of the system.

In Washington the Eocene is represented by the Puget series of brackish water beds, with an estimated thickness exceeding that of the marine formations of Oregon. Workable coal beds are distributed through 3000 ft. of this series. The amount of the coal is very great, though the coal is soft.

Terrestrial Eocene formations—eolian, fluvial, pluvial and lacustrine—are widespread in the western part of the United States, both in and about the mountains. By means of the fossils, several more or less distinct stages of deposition have been recognized. Named in chronological order, these are:—

1. The *Fort Union stage*, when the deposition was widespread about the eastern base of the northern part of the Rocky Mountains, and at some points in Colorado (Telluride formation) and New Mexico (Puerco beds), where volcanic ejecta entered largely into the formation. The Fort Union stage is closely associated with the Laramie, and their separation has not been fully effected.

2. The *Wasatch stage*, when deposition was in progress over much of Utah and western Colorado, parts of Wyoming, and elsewhere.

3. The *Bridger stage*, when deposition was in progress in the Wind River basin, north of the mountain of that name, and in the basin of Green river.

4. The *Uinta stage*, when the region south of the mountains of that name, in Utah and Colorado, was the site of great deposition.

More or less isolated deposits of some or all of these stages are found at numerous points in the western mountain region. The present height of the deposits, in some places as much as 10,000 ft., gives some suggestion of the changes in topography which have taken place since the early Tertiary. The thickness of the system in the west is great, the formations of each of the several stages mentioned above running into thousands of feet, as thicknesses are commonly measured.

Miocene System.

The Miocene system, generally speaking, has a distribution similar to that of the Eocene. The principal formation of the Atlantic coastal plain is the Chesapeake formation, largely of sand. In Florida the system contains calcium phosphate of commercial value. The Miocene of the Atlantic and Gulf regions nowhere attains great thickness. The oil of Texas and Louisiana is from the Miocene (or possibly Oligocene) dolomite. On the Pacific coast the system has greater development. It contains much volcanic material, and great bodies of siliceous shale, locally estimated at 4000 ft. thick and said to be made up largely of the secretions of organisms. Such thicknesses of such material go far to modify the former opinion that the Tertiary periods were short. The Miocene of California is oil-producing. The terrestrial Miocene formations of the western part of the country are similar in kind, and, in a general way, in distribution, to the Eocene of the same region. The amount of volcanic material, consisting of both pyroclastic material and lava flows, is great.

At the close of the Miocene, deformative movements were very widespread in the Rocky Mountains and between the principal development of the Coast ranges of California and Oregon, and mountain-making movements, new or renewed, were somewhat general in the west. At the close of the period the topography of the western part of the country must have been comparable to that of the present time. This, however, is not to be interpreted to mean that it has remained unmodified, or but slightly modified since that time. Subsequent erosion has changed the details of topography on an extensive scale, and subsequent deformative movements have renewed large topographic features where erosion had destroyed those developed by the close of the Miocene. But in spite of these great changes since the Miocene, the great outlines of the topography of the present were probably marked out by the close of that period. Volcanic activity and faulting on a large scale attended the deformation of the closing stages of the Miocene.

Pliocene System.

The Pliocene system stands in much the same stratigraphic relation to the Miocene as the Miocene does to the Eocene. The marine Pliocene has but trifling development on the Atlantic coast north of Florida, and somewhat more extensive development in the Gulf region. The marine Pliocene of the continent has its greatest development in California (the Merced series, peninsula of San Francisco), where it is assigned a maximum thickness of nearly 6000 ft., and possibly as much as 13,000 ft. This wide range is open to doubt as to the correlation of some of the beds involved. Thicknesses of several thousand feet are recorded at other points in California and elsewhere along the coast farther north. Marine Pliocene beds are reported to have an altitude of as much as 5000 ft. in Alaska. The position of these beds is significant of the amount of change which has taken place in the west since the Pliocene period. The non-marine formations of the Pliocene are its most characteristic feature. They are widely distributed in the western mountains and on the Great Plains. In origin and character, and to some extent in distribution, they are comparable with the Eocene and Miocene formations of the same region, and still more closely comparable with deposits now making. In addition to these non-marine formations of the west, there is the widespread Lafayette formation, which covers much of the Atlantic and Gulf coastal plain, reaching far to the north from the western Gulf region, and having uncertain limits, so far as now worked out, in various directions. The Lafayette formation has been the occasion of much difference of opinion, but is by many held to be a non-marine formation, made up of gravels, sands and clays, accumulated on land, chiefly through the agency of rain and rivers. Its deposition seems to have followed a time of deformation which resulted in an increase of altitude in the Appalachian Mountains, and in an accentuation of the contrast between the highlands and the adjacent plains. Under these conditions sediments from the high lands were washed out and distributed widely over the plains, giving rise to a thin but widespread formation of ill-assorted sediment, without marine fossils, and, for the most part, without fossils of any kind, and resting unconformably on Cretaceous, Eocene and Miocene formations. To the seaward the non-marine phase of the formation doubtless grades into a marine phase along the shore of that time, but the position of this shore has not been defined. The marine part of the Lafayette is probably covered by sediments of later age.

In earlier literature the Lafayette formation was described under the name of Orange Sand, and was at one time thought to be the southern equivalent of the glacial drift. This, however, is now known not to be the case, as remnants of the formation, isolated by erosion, lie under the old glacial drift in Illinois, and perhaps elsewhere. It seems probable that the Lafayette formation of the Gulf coastal plain is continuous northward and westward with gravel deposits on the Great Plains, washed out from the Rocky Mountains to the west. The careful study of these fluvial formations is likely to throw much light on the history of the deformative movements and changes in topography in the United States during the late stages of geological history.

Deformative movements of the minor sort seem to have been in progress somewhat generally during the Tertiary periods, especially in the western part of the country, but those at the close of the Pliocene seem to have exceeded greatly those of the earlier stages. They resulted in increased height of land, especially in the west, and therefore in increased erosion. This epoch of relative uplift and active erosion is sometimes called the Sierran or Ozarkian epoch. The details of the topography of the western mountains are largely of post-Pliocene development. The summits of some of the high mountains, such as the Cascades, appear to be remnants of a peneplain developed in post-Miocene time. If so, the mountains themselves must be looked upon as essentially post-Pliocene. Deformative movements resulting in close folding were not common at this time, but such movements affected some of the coast ranges of California. This epoch of great deformation and warping marks the transition from the Tertiary to the Quaternary.

Glacial.

Quaternary Formations.—The best-known formations of the Quaternary period are those deposited by the continental glaciers which were the distinguishing feature of the period and by the waters derived from them. The glacial drift covers something like half of the continent, though much less than half of the United States. Besides the drift of the ice-sheets, there is much drift in the western mountains, deposited by local glaciers. Such glaciers existed in all the high mountains of the west, even down to New Mexico and Arizona.

The number of glacial epochs now recognized is five, not counting minor episodes. Four defined zones of interglacial deposits are detected, all of which are thought to represent great recessions of the ice, or perhaps its entire disappearance. The climate of some of the interglacial epochs was at least as warm as that of the present time in the same regions. The glacial epochs which have been differentiated are the following, numbered in chronological order: (5) Wisconsin, (4) Iowan, (3) Illinoian, (2) Kansan, (1) Sub-Aftonian, or Jerseyan. Of these, the Kansan ice-sheet was the most extensive, and the later ones constitute a diminishing series.

Essentially all phases of glacial and aqueo-glacial drift are represented. The principal terminal moraines are associated with the ice of the Wisconsin epoch. Terminal moraines at the border of the Illinoian drift are generally feeble, though widely recognizable, and such moraines at the margin of the Iowan and Kansan drift sheets are generally wanting. The edge of the oldest drift sheet is buried by younger sheets of drift in most places.

Loess is widespread in the Mississippi River basin, especially along the larger streams which flowed from the ice. Most of the loess is now generally believed to have been deposited by the wind. The larger part of it seems to date from the closing stages of the Iowan epoch, but loess appears to have come into existence after other glacial epochs as well. Most of the fossils of the loess are shells of terrestrial gastropods, but bones of land mammals are also found in not a few places. Some of the loess is thought to have been derived by the wind from the surface of the drift soon after the retreat of the ice, before vegetation got a foothold upon the new-made deposit; but a large part of the loess, especially that associated with the main valleys, appears to have been blown up on to the bluffs of the valleys from the flood plains below. As might be expected under these conditions, it ranges from fine sand to silt which approaches clay in texture. Its coarser phases are closely associated with dunes in many places, and locally the loess makes a considerable part of the dune material.

Much interest attaches to estimates of time based on data afforded by the consequences of glaciation. These estimates are far apart, and must be regarded as very uncertain, so far as actual numbers are concerned. The most definite are connected with estimates of the time since the last glacial epoch, and are calculated from the amount and rate of recession of certain falls, notably those of the Niagara and Mississippi (St Anthony Falls) rivers. The estimate of the time between the first and last glacial epochs is based on changes which the earlier drift has undergone as compared with those which the younger drift has undergone. Some of the estimates make the lapse of time since the first glacial epoch more than a million years, while others make it no more than one-third as long. The time since the last glacial epoch is but a fraction of the time since the first—probably no more than a fifteenth or a twentieth.

Non-glacial.

Outside the region affected by glaciation, deposits by wind, rain, rivers, &c., have been building up the land, and sedimentation has been in progress in lakes and about coasts. The non-glacial deposits are much like the Tertiary in kind and distribution, except that marine beds have little representation on the land. On the coastal plain there is the Columbia series of gravels, sands and loams, made up of several members. Its distribution is similar to that of the Lafayette, though the Columbia series is, for the most part, confined to lower levels. Some of its several members are definitely correlated in time with some of the glacial epochs. The series is widespread over the lower part of the coastal plain. In the west the Quaternary deposits are not, in all cases, sharply separated from the late Tertiary, but the deposits of glacial drift, referable to two or more glacial epochs, are readily differentiated from the Tertiary; so, also, are certain lacustrine deposits, such as those of the extinct lakes Bonneville and Lahontan. On the Pacific coast marine Quaternary formations occur up to elevations of a few scores of feet, at least, above the sea.

Igneous rocks, whether lava flows or pyroclastic ejections, are less important in the Quaternary than in the Tertiary, though volcanic activity is known to have continued into the Quaternary. The Quaternary beds of lakes Bonneville and Lahontan have been faulted in a small way since they were deposited, and the old shore lines of these lakes have been deformed to the extent of hundreds of feet. So also have the shorelines of the Great Lakes, which came into existence at the close of the glacial period.

Much has been written and more said concerning the existence of man in the United States before the last glacial epoch. The present state of evidence, however, seems to afford no warrant for the conclusion that man existed in the United States before the end of the glacial period. Whatever theoretical reasons there may be for assuming his earlier existence, they must be held as warranting no more than a presumptive conclusion, which up to the present time lacks confirmation by certain evidence.

The following sections from selected parts of the country give some idea of the succession of beds in various type regions. The thicknesses, especially where the formations are metamorphosed, are uncertain.

West Central Massachusetts

Triassic.	
Chicopee shale	200 ft. (?)
Granby tuff	580 ,,
Blackrock diabase (cones and dikes).	
Longmeadow sandstone	1000 ,,
Sugarloaf arkose	4660 ,,
Mount Toby conglomerate.	
Unconformity.	
Devonian.	
Bernardston series	1950 ft.
Unconformity.	
Silurian.	
Leyden argillite	300 ft.
Conway schist	5000 ,, (?)
Amherst schist	
Brinfield fibrolite-schist	
Goshen schist	2000 ,, (?)
Unconformity.	
Ordovician.	
Hawley schist	2000 ft. (?)
Savoy schist	5000 ,, (?)
Chester amphibolite	3000 ,, (?)
Rowe schist	4000 ,, (?)
Hoosic schist	1500 ,, (?)
Unconformity.	
Cambrian.	
Becket gneiss	2000 ft.(?)
Unconformity.	
Proterozoic.	
Washington gneiss	2000 ft.(?)
(Base not exposed.)	

The above section is fairly representative for considerable parts of New England.

West Virginia, &c.

Pennsylvanian.	
(Top of system removed by erosion.)	
Braxton formation	700 ft.
Upshur sandstone	300– 500 ,,
Pugh formation	300– 450 ,,
Pickens sandstone	400– 500 ,,
Unconformity.	
Mississippian.	
Canaan formation	1000–1300 ft.
Greenbrier limestone	350– 400 ,,
Pocono sandstone	70– 90 ,,
Devonian.	
Hampshire formation	1500–1800 ft.
Jennings formation	3000–3800 ,,
Romney shale	1000–1300 ,,
Unconformity.	
Monterey sandstone	50– 200 ft.
Silurian.	
Lewiston limestone	550–1050 ft.
Rockwood formation	100– 800 ,,
Cacapon sandstone	100– 630 ,,
Tuscarora quartzite	30– 300 ,,
Juniata formation	205–1250 ,,
Ordovician.	
Martinsburg shale	800–1800 ft.
Middle and Upper Cambrian.	
Shenandoah limestone	2400 ft.
(Base not exposed.)	

This section is fairly representative for the Appalachian Mountain tract, though the Cambrian is often more fully represented.

Ohio

Permian.	
Dunkard formation	*c.* 25 ft.
Pennsylvanian.	
Monongahela formation	200– 250 ft.
Conemaugh formation	400– 500 ,,
Alleghany formation	165– 300 ,,
Pottsville conglomerate	250 ,,
Unconformity.	
Mississippian.	
Maxville limestone	*c.* 25 ft.
Waverley series—	
Logan group	100– 150 ft.
Black Hand conglomerate	50– 500 ,,
Cuyahoga shale	150– 300 ,,
Sunbury shale	5– 30 ,,
Berea grit	5– 175 ,,
Bedford shale	50– 150 ,,
Devonian.	
Ohio shale	300–2600 ft.
Olentangy shale	20– 35 ,,
Delaware limestone	30– 40 ,,
Columbus limestone	110 ,,
Silurian.	
Monroe formation	50– 600 ft.
Niagara group	150– 350 ,,
Clinton limestone	10– 50 ,,
Medina shales (?) (Belfast bed.)	50– 150 ,,

Ordovician.	
Saluda beds	20± ft.
Richmond formation	300± ,,
Lorraine formation	300± ,,
Eden (Utica) shale	250 ,,
Trenton limestone	130 ,,

Iowa

Glacial drift.	
Unconformity.	
Upper Cretaceous.	
Benton formation	0– 150 ft.
Dakota formation	50– 100 ,,
Unconformity.	
Pennsylvanian.	
Missouri formation	1500 ft.
Des Moines formation	250– 400 ,,
Unconformity.	
Mississippian.	
St Louis limestone	100 ft.
Osage (Augusta) formation	200– 300 ,,
Kinderhook formation	150– 200 ,,
Devonian.	
Lime Creek formation	80 ft.
State Quarry beds	20– 40 ,,
Sweetland Creek shales	20– 40 ,,
Unconformity.	
Cedar Valley limestone	250– 300 ft.
Wapsipinicon formation (Independence, Fayette, Davenport)	100– 150 ,,
Silurian.	
Anamosa limestone	50– 75 ft.
Le Claire limestone	50 ,,
Delaware stage	200 ,,
Unconformity.	
Ordovician.	
Maquoketa shales	175 ft.
Possible Unconformity.	
Galena-Trenton limestone	290 ft.
St Peters sandstone	100 ,,
Oneota formation (includes Shakopee, New Richmond and Oneota proper)	300 ,,
Cambrian.	
St Croix sandstone (=Potsdam)	1000 ft.
Unconformity.	
Proterozoic.	
Sioux quartzite	(?)

This section is fairly representative for much of the central Mississippi Basin.

Oklahoma

Pennsylvanian.	
(Summit removed by erosion.)	
Seminole conglomerate	50 ft.
Holdenville shale	260 ,,
Wewaka formation	700 ,,
Wetumka shale	120 ,,
Calvin sandstone	145– 240 ,,
Senora formation	140– 485 ,,
Stuart shale	90– 280 ,,
Thurman sandstone	80– 260 ,,
Boggy shale	2000–2600 ,,
Savannah sandstone	750–1100 ,,
McAlester shale	1150–1500 ,,
Hartshorne sandstone	150– 200 ,,
Atoka formation (Chickahoc chert lentil)	3200 ,,
Wapanucka limestone	100– 150 ,,
Mississippian.	
Caney shale	1500 ft.
Devonian.	
Woodford chert	600 ft.
Silurian.	
Hunton limestone	160 ft.
Sylvan shale (upper part)	50– 100 ,,
Ordovician.	
Sylvan shale (lower part)	250 ft.
Viola limestone	750 ,,
Simpson series	1600 ,,
Arbuckle limestone	4000–6000 ,,
Cambrian.	
Regan sandstone	50– 100 ft.
Unconformity.	
Pre-Cambrian.	
Tishomingo granite	(?)

Composite section. The upper part is taken from vicinity of Coalgate, the lower part from the vicinity of Atoka.

West Central Colorado

Eocene or later.	
West Elk breccia	3000 ft.
Unconformity.	
Cretaceous.	
Ruby formation	2500 ft.
Unconformity.	
Ohio formation (local only)	200 ft.
Unconformity.	
Laramie formation	2000 ft.
Montana formation	2800 ,,
Niobrara formation	100– 200 ,,
Benton formation	150– 300 ,,
Dakota formation	40– 300 ,,
Jurassic.	
Gunnison formation	350– 500 ft.
Unconformity.	
Pennsylvanian.	
Maroon conglomerate	4500 ft.
Possible unconformity.	
Weber limestone	100– 550 ft.
Unconformity.	
Mississippian.	
Leadville limestone	400– 525 ft.
Apparent unconformity.	
Ordovician.	
Yule limestone	350– 450 ft.
Upper Cambrian.	
Sawatch quartzite	50– 350 ft.
Unconformity.	
Archean.	

The Bighorn Mountains of Wyoming

Cretaceous.	
De Smet formation (shale and sandstone)	4000 ft.
Kingsbury conglomerate	0–1500 ,,
Piney formation (shale and sandstone)	2500 ,,
Parkman sandstone	350 ,,
Pierre shale	1500–3500 ,,
Colorado formation	1050–1700 ,,
Comanchean.	
Cloverly formation (upper part may be Cretaceous)	30– 300 ft.
Morrison formation (may be Jurassic)	100– 300 ,,
Jurassic.	
Sundance formation	250– 350 ft.
Unconformity.	
Triassic and Permian.	
Chugwater formation	750–1200 ft.
Pennsylvanian.	
Tensleep sandstone	30– 150 ft.
Amsden sandstone	150– 350 ,,
Mississippian.	
Madison limestone	1000 ft.
Unconformity.	
Ordovician.	
Bighorn limestone	300 ft.
Unconformity.	
Cambrian (Upper).	
Deadwood formation	900 ft.
Unconformity.	
Pre-Cambrian.	
Granites.	

This section is fairly representative for the Rocky Mountains.

Southern California

Quaternary.	
Alluvium, &c.	
Terrace deposits and dune sand.	
Pliocene (?)	
Paso Robles formation	1000+ft.
Unconformity.	
Miocene (?)	
Pismo formation (in south part of area)	3000±ft.
Santa Margarita (in north part of area)	1550± ,,
Unconformity.	
Miocene.	
Monterey shale	5000–7000 ft.
Vaquero sandstone	0– 500 ,,
Unconformity.	
Cretaceous.	
Atascadero formation	3000–4000 ft.
Unconformity.	
Comanchean.	
Toro formation (Knoxville)	3000± ft.
Unconformity.	

Jura-Trias.	
San Luis formation (Franciscan)	1000 ± ft.
Unconformity.	
Granite—age undetermined.	

This section is representative of the southern Pacific coast.

SECTION IN CENTRAL WASHINGTON

Pliocene (?).	
Howson andesite	250 ft.
Miocene.	
Keechelus andesite series	4000 ft.
Unconformity.	
Guye formation (sedimentary beds with some lava flows)	3500 ± ft.
Eocene.	
Roslyn formation (sandstone and shale; coal)	*c.* 3000 ft.
Teanaway basalt	4000 ,,
Kachess rhyolite	0–2000 ,,
Swauk formation (clastic rocks with some tuff, &c.)	200–5000 ,,
Unconformity.	
Pre-Tertiary.	
Igneous and metamorphic rocks.	

This section is representative of the north-west part of the country.

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III.—CLIMATE

The chief features of the climate of the United States may be best apprehended by relating them to the causes by which they are controlled. Two leading features, from which many others follow, are the intermediate value of the mean annual temperatures and the prevalence of westerly winds, with which drift the areas of high and low pressure—cyclonic and anticyclonic areas—controlling the short-lived, non-periodic weather changes. The first of these features is determined by the intermediate position of the United States between the equator and the north pole; the second by the equatorial-polar temperature contrast and the eastward rotation of the planet. Next, dependent on the inclination of the earth's axis, is the division of the planetary year into the terrestrial seasons, with winter and summer changes of temperature, wind-strength and precipitation: these seasonal changes are not of the restrained measure that is characteristic of the oceanic southern temperate zone, but of the exaggerated measure appropriate to the continental interruptions of the northern land-and-water zone, to which the term "temperate" is so generally inapplicable. The effects of the continent are already visible in the mean annual temperatures, in which the poleward temperature gradient is about twice as strong as it is on the neighbouring oceans; this being a natural effect of the immobility of the land surface, in contrast to the circulatory movement of the ocean currents, which thus lessen the temperature differences due to latitude: on the continent such differences are developed in full force. Closely associated with the effect of continental immobility are the effects dependent on the low specific heat and the opacity of the lands, in contrast with the high specific heat and partial transparence of the ocean waters. In virtue of these physical characteristics, the air over the land becomes much warmer in summer and much colder in winter than the air over the oceans in corresponding latitudes; hence the seasonal changes of temperature in the central United States are strong; the high temperatures appropriate to the torrid zone advance northward to middle latitudes in summer, and the low temperatures appropriate to the Arctic regions descend almost to middle latitudes in winter. As a result, the isotherms of July are strongly convex poleward as they cross the United States, the isotherm of 70° sweeping up to the northern boundary in the north-west, and the heat equator leaping to the overheated deserts of the south-west, where the July mean is over 90°. Conversely, the isotherms of January are convex southward, with a monthly mean below 32° in the northern third of the interior, and of zero on the mid-northern boundary. The seasonal bending of the isotherms is, however, unsymmetrical for several reasons. The continent being interrupted on its eastern side by the Gulf of Mexico and Hudson Bay, with the Great Lakes between these two large water bodies, the northward bending of the July isotherms is most pronounced in the western part of the United States. Indeed the contrast between the moderate temperatures of the Pacific coast and the overheated areas of the next interior deserts is so great that the isotherms trend almost parallel to the coast, and are even "overturned" somewhat in southern California, where the most rapid increase of temperatures in July is found not by moving southward over the ocean toward the equator, but north-eastward over the land to the deserts of Nevada and Arizona. So strong is the displacement of the area of highest interior temperatures westward from the middle of the continent that the Gulf of California almost rivals the Red Sea as an ocean-arm under a desert-hot atmosphere. In the same midsummer month all the eastern half of the United States is included between the isotherms of 66° and 82°; the contrast between Lake Superior and the coast of the Gulf of Mexico, 1200 m. to the south, is not so great as between the coast of southern California and the desert 150 m. inland to the north-east. In January the northern water areas of the continent are frozen and snow-covered; Hudson Bay becomes unduly cold, and the greatest southward bending of the isotherms is somewhat east of the continental axis, with an extension of its effects out upon the Atlantic; but the southward bending isotherms are somewhat looped back about the unfrozen waters of the lower Great Lakes. In the midwinter month, it is the eastern half of the country that has strong temperature contrasts; the temperature gradients are twice as strong between New Orleans and Minneapolis as on the Pacific coast, and the contrast between Jacksonville, Fla., and Eastport, Me., is about the same as between San Diego, Cal., and the Aleutian Islands.

The strong changes of temperature with the seasons are indicated also by the distribution of summer maxima and winter minima; summer temperatures above 112° are known in the south-western deserts, and temperatures of 100° are sometimes carried far northward on the Great Plains by the "hot winds" nearly to the Canadian boundary; while in winter, temperatures of −40° occur along the mid-northern boundary and freezing winds sometimes sweep down to the border of the Gulf of Mexico. The temperature anomalies are also instructive: they rival those of Asia in value, though not in area, being from 15° to 20° above the mean of their latitude in the northern interior in summer, and as much below in winter. The same is almost true of the mean annual range (mean of July to mean of January), the states of the northern prairies and plains having a mean annual range of 70° and an extreme range of 135°. In this connexion the effect of the prevailing winds is very marked. The equalizing effects of a conservative ocean are brought upon the Pacific coast, where the climate is truly temperate, the mean annual range being only 10° or 12°, thus resembling western Europe; while the exaggerating effects of the continental interior are carried eastward to the Atlantic coast, where the mean annual range is 40° or 50°.

The prevailing winds respond to the stronger poleward temperature gradients of winter by rising to a higher velocity and a more frequent and severer cyclonic storminess; and to the weaker gradients of summer by relaxing to a lower velocity with fewer and weaker cyclonic storms; but furthermore the northern zone occupied by the prevailing westerlies expands as the winds strengthen in winter, and shrinks as they weaken in summer; thus the stormy westerlies, which impinge upon the north-western coast and give it plentiful rainfall all through the year, in winter reach southern California and sweep across part of the Gulf of Mexico and Florida; it is for this reason that southern California has a rainy winter season, and that the states bordering on the Gulf of Mexico are visited in winter by occasional intensified cold winds, inappropriate to their latitude. In summer the stormy westerly winds withdraw from these lower latitudes, which are then to be more associated with the trade winds. In California the effect of the strong equatorward turn of the summer winds is to produce a dry season; but in the states along the Gulf of Mexico and especially in Florida the withdrawal of the stormy westerlies in favour of the steadier trade winds (here turned somewhat toward the continental interior, as explained below) results in an increase of precipitation. The general winds also are much affected by the changes of pressure due to the strong continental changes of temperature. The warmed air of summer produces an area of low pressure in the west-central United States, which interrupts the belt of high pressure that planetary conditions alone would form around the earth about latitude 30°; hence there is a tendency of the summer winds to blow inward from the northern Pacific over the Cordilleras toward the continental centre, and from the trades of the torrid Atlantic up the Mississippi Valley; conversely in winter time, the cold air over the lands produces a large area of high pressure from which the winds tend to flow outward; thus repelling the westerly winds of the northern Pacific and greatly intensifying the outflow southward to the Gulf of Mexico and eastward to the Atlantic. As a result of these seasonal alternations of temperature and pressure there is something of a monsoon tendency developed in the winds of the Mississippi Valley, southerly inflowing winds prevailing in summer and northerly outflowing winds in winter; but the general tendency to inflow and outflow is greatly modified by the relief of the lands, to which we next turn.

The climatic effects of relief are seen directly in the ascent of the higher mountain ranges to altitudes where low temperatures prevail, thus preserving snow patches through the summer on the high summits (over 12,000 ft.) in the south, and maintaining snowfields and moderate-sized glaciers on the ranges in the north. With this goes a general increase of precipitation with altitude, so that a good rainfall map would have its darker shades very generally along the mountain ranges. Thus the heaviest measured rainfall east of the Mississippi is on the southern Appalachians; while in the west, where observations are as yet few at high level stations, the occurrence of forests and pastures on the higher slopes of mountains which rise from desert plains clearly testifies to the same rule. The mountains also introduce controls over the local winds; diurnal warming in summer suffices to cause local ascending breezes which frequently become cloudy by the expansion of ascent, even to the point of forming local thunder showers which drift away as they grow and soon dissolve after leaving the parent mountain. Conversely, nocturnal cooling produces well-defined descending breezes which issue from the valley mouths, sometimes attaining an unpleasant strength toward midnight.

The mountains are of larger importance in obstructing and deflecting the course of the general winds. The Pacific ranges, standing transverse to the course of the prevailing westerlies near the Pacific Ocean, are of the greatest importance in this respect; it is largely by reason of the barrier that they form that the tempering effects of the Pacific winds are felt for so short a distance inland in winter, and that the heat centre is displaced in summer so far towards the western coast. The rainfall from the stromy westerly winds is largely deposited on the western slopes of the mountains near the Pacific coast, and arid or desert interior plains are thus found close to the great ocean. The descending winds on the eastern slopes of the ranges are frequently warm and dry, to the point of resembling the Föhn winds of the Alps; such winds are known in the Cordilleran region as Chinook winds. The ranges of the Rocky Mountains in their turn receive some rainfall from the passing winds, but it is only after the westerlies are reinforced by a moist indraft from the Gulf of Mexico and the Atlantic—the result of summer or of cyclonic inflow—that rainfall increases to a sufficient measure on the lower lands to support agriculture without irrigation. The region east of the Mississippi is singularly favoured in this way; for it receives a good amount of rainfall, well distributed through the year, and indeed is in this respect one of the largest regions in the temperate zones that are so well watered. The Great Plains are under correspondingly unfavourable conditions, for their scanty rainfall is of very variable amount. Along the transition belt between plains and prairies the climate is peculiarly trying as to rainfall; one series of five or ten years may have sufficient rainfall to enable the farmers to gather good crops; but the next series following may be so dry that the crops fail year after year.

The cyclonic inflows and anticyclonic outflows, so characteristic of the belt of westerly winds the world over, are very irregular in the Cordilleran region; but farther eastward they are typically developed by reason of the great extent of open country. Although of reduced strength in the summer, they still suffice to dominate weather changes; it is during the approach of a low pressure centre that hot southerly winds prevail; they sometimes reach so high a temperature as to wither and blight the grain crops; and it is almost exclusively in connexion with the cloudy areas near and south-east of these cyclonic centres that violent thunderstorms, with their occasional destructive whirling tornadoes, are formed. With the passing of the low pressure centre, the winds shift to west or north-west, the temperature falls, and all nature is relieved. In winter-time, the cyclonic and anticyclonic areas are of increased frequency and intensity; and it is partly for this reason that many meteorologists have been disposed to regard them as chiefly driven by the irregular flow of the westerly winds, rather than as due to convectional instability, which should have a maximum effect in summer. One of the best indications of actual winter weather, as apart from the arrival of winter by the calendar, is the development of cyclonic disturbances of such strength that the change from their warm, sirocco-like southerly inflow in front of their centre, to the "cold wave" of their rear produces non-periodic temperature changes strong enough to overcome the weakened diurnal temperature changes of the cold season, a relation which practically never occurs in summer time. A curious feature of the cyclonic storms is that, whether they cross the interior of the country near the northern or southern boundary or along an intermediate path, they converge towards New England as they pass on toward the Atlantic; and hence that the north-eastern part of the United States is subjected to especially numerous and strong weather changes. (W. M. D.)

IV.—Fauna and Flora

Fauna.—Differences of temperature have produced in North America seven transcontinental life-zones or areas characterized by relative uniformity of both fauna and flora; they are the Arctic, Hudsonian and Canadian, which are divisions of the Boreal Region; the Transition, Upper Austral and Lower Austral, which are divisions of the Austral Region, and the Tropical. The Arctic, Hudsonian and Canadian enter the United States from the north and the Tropical from the south; but the greater part of the United States is occupied by the Transition, Upper Austral and Lower Austral, and each of these is divided into eastern and western subzones by differences in the amount of moisture. The Arctic or Arctic-Alpine zone covers in the United States only the tops of a few mountains which extend above the limit of trees, such as Mt Katahdin in Maine, Mt Washington and neighbouring peaks in the White Mountains of New Hampshire, and the loftier peaks of the Rocky, Cascade and Sierra Nevada Mountains. The larger animals are rare on these mountain-tops and the areas are too small for a distinct fauna. The Hudsonian zone covers the upper slopes of the higher mountains of New England, New York and North Carolina and larger areas on the elevated slopes of the Rocky and Cascade Mountains; and on the western mountains it is the home of the mountain goat, mountain sheep, Alpine flying-squirrel, nutcracker, evening grosbeak and Townsend's solitaire. The Canadian zone crosses from Canada into northern and north-western Maine, northern and central New Hampshire, northern Michigan, and north-eastern Minnesota and North Dakota, covers the Green Mountains, most of the Adirondacks and Catskills, the higher slopes of the mountains in Pennsylvania, West Virginia, Virginia, western North Carolina and eastern Tennessee, the lower slopes of the northern Rocky and Cascade Mountains, the upper slopes of the southern Rocky and Sierra Nevada Mountains, and a strip along the Pacific coast as far south as Cape Mendocino, interrupted, however, by the Columbia Valley. Among its characteristic mammals and birds are the lynx, marten, porcupine, northern red squirrel, Belding's and Kennicott's ground squirrels, varying and snowshoe rabbits, northern jumping mouse, white-throated sparrow, Blackburnian warbler, Audubon warbler, olive-backed thrush, three-toed woodpecker, spruce grouse, and Canada jay; within this zone in the North-eastern states are a few moose and caribou, but farther north these animals are more characteristic of the Hudsonian zone. The Transition zone, in which the extreme southern limit of several boreal species overlaps the extreme northern limit of numerous austral species, is divided into an eastern humid or Alleghanian area, a western arid area, and a Pacific coast humid area. The Alleghanian area comprises most of the lowlands of New England. New York and Pennsylvania, the north-east corner of Ohio, most of the lower peninsula of Michigan, nearly all of Wisconsin, more than half of Minnesota, eastern North Dakota, north-eastern South Dakota, and the greater part of the Appalachian Mountains from Pennsylvania to Georgia. It has few distinctive species, but within its borders the southern mole and cotton-tail rabbit of the South meet the northern star-nosed and Brewer's moles and the varying hare of the North, and the southern bobwhite, Baltimore oriole, bluebird, catbird, chewink, thrasher and wood thrush are neighbours of the bobolink, solitary vireo and the hermit and Wilson's thrushes. The Arid Transition life-zone comprises the western part of the Dakotas, north-eastern Montana, and irregular areas in Washington, Oregon, Idaho, Wyoming, California, Nevada, Utah, Colorado, Arizona, New Mexico and western Texas, covering for the most part the eastern base of the Cascade and Sierra Nevada Mountains and the higher parts of the Great Basin and the plateaus. Its most characteristic animals and birds are the white-tailed jack-rabbit, pallid vole, sage hen, sharp-tailed grouse and green-tailed towhee; the large Columbia ground-squirrel (*Spermophilus columbianus*) is common in that part of the zone which is west of the Rocky Mountains, but east of the Rockies it is replaced by another species (*Cynomys*) which closely resembles a small prairie dog. The Pacific Coast Transition life-zone comprises the region between the Cascade and Coast ranges in Washington and Oregon, parts of northern California, and most of the California coast region from Cape Mendocino to Santa Barbara. It is the home of the Columbia black-tail deer, western raccoon, Oregon spotted skunk, Douglas red squirrel, Townsend's chipmunk, tailless sewellel (*Haplodon rufus*), peculiar species of pocket gophers and voles, Pacific coast forms of the great-horned, spotted, screech and pigmy owls, sooty grouse, Oregon ruffed grouse, Steller's jay, chestnut-backed chickadee and Pacific winter wren. The Upper Austral zone is divided into an eastern humid (or Carolinian) area and a western arid (or Upper Sonoran) area. The Carolinian area extends from southern Michigan to northern Georgia and from the Atlantic coast to western Kansas, comprising Delaware, all of Maryland except the mountainous western portion, all of Ohio except the north-east corner, nearly the whole of Indiana, Illinois, Iowa and Missouri, eastern Nebraska and Kansas, south-eastern South Dakota, western central Oklahoma, northern Arkansas, middle and eastern Kentucky, middle Tennessee and the Tennessee valley in eastern Tennessee, middle Virginia and North Carolina, western West Virginia, north-eastern Alabama, northern Georgia, western South Carolina, the Connecticut Valley in Connecticut, the lower Hudson Valley and the Erie basin in New York, and narrow belts along the southern and western borders of the lower peninsula of Michigan. It is the northernmost home of the opossum, grey fox, fox squirrel, cardinal bird, Carolina wren, tufted tit, gnat catcher, summer tanager and yellow-breasted chat. The Upper Sonoran life-zone comprises south-eastern Montana, central, eastern and north-eastern Wyoming, a portion of south-western South Dakota, western Nebraska and Kansas, the western extremity of Oklahoma, north-western Texas, eastern Colorado, south-eastern New Mexico, the Snake plains in Idaho, the Columbia plains in Washington, the Malheur and Harney plains in Oregon, the Great Salt Lake and Sevier deserts in Utah, and narrow belts in California, Nevada and Arizona. Among its characteristic mammals and birds are the sage cotton-tail, black-tailed jack-rabbit, Idaho rabbit, Oregon, Utah and Townsend's ground squirrels, sage chipmunk, five-toed kangaroo rats, pocket mice, grasshopper mice, burrowing owl, Brewer's sparrow, Nevada sage sparrow, lazuli finch, sage thrasher, Nuttall's poor-will, Bullock's oriole and rough-winged swallow. The Lower Austral zone occupies the greater part of the Southern states, and is divided near the 98th meridian into an eastern humid or Austroriparian area and a western arid or Lower Sonoran area. The Austroriparian zone comprises nearly all the Gulf States as far west as the mouth of the Rio Grande, the greater part of Georgia, eastern South Carolina, North Carolina and Virginia, and extends up the lowlands of the Mississippi Valley across western Tennessee and Kentucky into southern Illinois and Indiana and across eastern and southern Arkansas and eastern Oklahoma into south-eastern Missouri and Kansas. It is the home of the southern fox-squirrel, cotton rat, ricefield rat, wood rat, free-tailed bat, mocking bird, painted bunting, prothonotary warbler, red-cockaded woodpecker, chuckwill's-widow, and the swallow-tailed and Mississippi kites. A southern portion of this zone, comprising a narrow strip along the Gulf Coast from Texas to Florida and up the Atlantic coast to South Carolina, is semi-tropical, and is the northernmost habitation of several small mammals, the alligator (*Alligator mississippiensis*), the ground dove, white-tailed kite, Florida screech owl and Chapman's night-hawk. The Lower Sonoran zone comprises the most arid parts of the United States: south-western Texas, south-western Arizona and a portion of northern Arizona, southern Nevada and a large part of southern California. Some of its characteristic mammals and birds are the long-eared desert fox, four-toed kangaroo rats, Sonoran pocket mice, big-eared and tiny white-haired bats, road runner, cactus wren, canyon wren, desert thrashers, hooded oriole, black-throated desert sparrow, Texas night-hawk and Gambel's quail. It is the northernmost home of the armadillo, ocelot, jaguar, red and grey cats, and the spiny pocket mouse, and in southern Texas especially it is visited by several species of tropical birds. There is some resemblance to the Tropical life-zone at the south-eastern extremity of Texas, but this zone in the United States is properly restricted to southern Florida and the lower valley of the Colorado along the border of California and Arizona, and the knowledge of the latter is very imperfect. The area in Florida is too small for characteristic tropical mammals, but it has the true crocodile (*Crocodilus americanus*) and is the home of a few tropical birds. Most of the larger American mammals are not restricted to any one faunal zone. The bison, although now nearly extinct, formerly roamed over nearly the entire region between the Appalachian and the Rocky Mountains. The black bear and beaver were also widely distributed. The Virginia deer still ranges from Maine to the Gulf states and from the Atlantic coast to the Rocky Mountains. The grizzly bear, cougar, coyote, prairie dog and antelope are still found in several of the Western states, and the grey wolf is common in the West and in northern Minnesota, Wisconsin and Michigan.

Flora.—The Alpine flora, which is found in the United States only on the tops of those mountains which rise above the limit of trees, consists principally of a variety of plants which bloom as soon as the snow melts and for a short season make a brilliant display of colours. The flora of the Hudsonian and the Canadian zone consists largely of white and black spruce, tamarack, canoe-birch, balsam-poplar, balsam-fir, aspen and grey pine. In the Alleghanian Transition zone the chestnut, walnut, oaks and hickories of the South are interspersed among the beech, birch, hemlock and sugar maple of the North. In the Western Arid Transition zone the flora consists largely of the true sage brush (*Artemisia tridentata*), but some tracts are covered with forests of yellow or bull pine (*Pinus ponderosa*). The Pacific coast Transition zone is noted for its forests of giant conifers, principally Douglas fir, Sitka spruce, Pacific cedar and Western hemlock Here, too, mosses and ferns grow in profusion, and the *sadal* (*Gaultheria shallon*), thimble berry (*Rubus nootkamus*), salmon berry (*Rubus spectabilis*) and devil's club (*Fatsia horrida*) are characteristic shrubs. In the Carolinian zone the tulip tree, sycamore, sweet gum, rose magnolia, short-leaf pine and sassafras find their northernmost limit Sage brush is common to both the western arid Transition zone and the Upper Sonoran zone, but in suitable soils of the latter several greasewoods (*Artiplex confertifolia*, *A. canescens*, *A. nuttalli*, *Tetradymia canescens*, *Sarcobatus vermiculatus* and *Grayia spinosa*) are characteristic species, and on the mountain slopes are some nut pines (*piñon*) and junipers. The Austroriparian zone has the long-leaf and loblolly pines, magnolia and live oak on the uplands, and the bald cypress, tupelo and cane in the swamps; and in the semi-tropical Gulf strip are the cabbage palmetto and Cuban pine; here, too, Sea Island cotton and tropical fruits are successfully cultivated. The Lower Sonoran zone is noted for its cactuses, of which there is a great variety, and some of them grow to the height of trees; the mesquite is also very large, and the creosote bush, acacias, yuccas and agaves are common. The Tropical belt of southern Florida has the royal palm, coco-nut palm, banana, Jamaica dogwood, manchineel and mangrove; the Tropical belt in the lower valley of the Colorado has giant cactuses, desert acacias, palo-verdes and the Washington or fan-leaf palm. Almost all of the United States east of the 98th meridian is naturally a forest region, and forests cover the greater part of the Rocky Mountains, the Cascades, the Sierra Nevadas and the Coast Range, but throughout the belt of plains, basins and deserts west of the Rocky Mountains and on the Great Plains east of the Rocky Mountains there are few trees except along the watercourses, and the prevailing type of vegetation ranges from bunch grass to sage brush and cactuses according to the degree of aridity and the temperature. In the eastern forest region the number of species decreases somewhat from south to north, but the entire region differs from the densely forested region of the Pacific Coast Transition zone in that it is essentially a region of deciduous or hardwood forests, while the latter is essentially one of coniferous trees; it differs from the forested region of the Rocky Mountains in that the latter is not only essentially a region of coniferous trees, but one where the forests do not by any means occupy the whole area, neither do they approach in density or economic importance those of the eastern division of the country. Again, the forests of most of the eastern region embrace a variety of species, which, as a rule, are very much intermingled, and do not, unless quite exceptionally, occupy areas chiefly devoted to one species; while, on the other hand, the forests of the west—including both Rocky Mountain and Pacific coast divisions—exhibit a small number of species, considering the vast area embraced in the region; and these species, in a number of instances, are extraordinarily limited in their range, although there are cases in which one or two species have almost exclusive possession of extensive areas.

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V.—Population and Social Conditions

Geographical Growth of the Nation.—The achievement of independence found the people of the United States owning the entire country between the Gulf and the Great Lakes, excepting only Florida, as far to the west as the Mississippi; but the actual settlements were, with a few minor exceptions, confined to a strip of territory along the Atlantic shore. The depth of settlement, from the coast inland, varied greatly, ranging from what would be involved in the mere occupation of the shore for fishing purposes to a body of agricultural occupation extending back to the base of the great Atlantic chain, and averaged some 250 m.[1]

Westward, beyond the general line of continuous settlement, were four extensions of population through as many gaps in the Appalachian barrier, constituting the four main paths along which migration westward first took place: the Mohawk Valley in New York, the upper Potomac, the Appalachian Valley, and around the southern base of the Appalachian system. Four outlying groups beyond the mountains, with perhaps a twentieth part of the total population of the nation,—one about Pittsburg, one in West Virginia, another in northern Kentucky, and the last in Tennessee: all determined in situation by river highways—bore witness to the qualities of strength and courage of the American pioneer. Finally, there were in 1790 about a score of small trading or military posts, mainly of French origin, scattered over the then almost unbroken wilderness of the upper Mississippi Valley and region of the Great Lakes.

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[1] In the *Statistical Atlas* volume of the census of 1900 the reader will find for each decennial census since 1790 a map showing the distribution of population, with indication of the density of settlement, and an elaborate explanatory text. In Orin Grant Libby's *Geographical Distribution of the Vote of the Thirteen States on the Federal Constitution, 1787–1788* (University of Wisconsin, Madison, 1894), along with a valuable map interesting facts are given regarding the social and economic characteristics of different sections.

Twelve decennial censuses taken since that time (1800–1910) have revealed the extraordinary spread of population over the present area of the country (see CENSUS: *United States*). The large percentage of the population, particularly of the great urban centres, that is established to-day in the river lowlands, reflects the rôle that water highways have played in the peopling of the country. The dwindlings and growths of Nevada down to the present day, and to not a slight degree the general history of the settlement of the states of the Rocky Mountain region, are a commentary on the fate of mining industries. The initial settlement of the Pacific coast following the discovery of gold in California in 1848, and of the eastern base of the Rocky Mountains after the discovery of gold in 1859, illustrates the same factor. The Mormons settled Utah to insure social isolation, for the security of their theological system. A large part of the Great Plains to the east of the Rockies was taken up as farms in the decade 1880–1890; abandoned afterwards, because of its aridity, to stock grazing; and reconverted from ranches into farms when a system of dry farming had proved its tillage practicable. The negro more or less consciously moves, individually, closer into the areas whose climate and crops most nearly meet his desires and capabilities as a farmer; and his race as a whole unconsciously is adjusting its habitat to the boundaries of the Austroriparian life zone. The country's centre of population in 110 years moved more than 500 m westward, almost exactly along the 39th parallel of latitude: 9·5 degrees of longitude, with an extreme variation of less than 19 minutes of latitude.

Census Years.	Continental United States, exclusive of Alaska.													
	Population enumerated.				Number of foreign immigrants entering in preceding decade.	Areas (excluding water), in square miles.								
	Population within area of 1790.	Population within added area.	Total population.			Total area.		Settled area.						
			Number.	Decennial increase per cent.		Total.	Area acquired in preceding decade.	Area with not less than two persons per sq. m.	Total area covered by census.		Density of population.			
									Estimated area of isolated settlements beyond the general frontier.	Total.	Of area with not less than two persons per sq. m.	Of entire census area.		
												Area of 1790.	Added area.	Whole area.
1790	3,929,625	—	3,929,214	—	—	819,466	—	239,935	13,850	417,170	16·4	9·4	—	9·6
1800	5,247,355	61,128	5,308,483	35·1	—	819,466	—	305,708	33,800	434,670	17·4	12·6	0·2	12·2
1810	6,779,308	460,573	7,239,881	36·4	—	1,698,107	878,641§	407,945	25,100	556,010	17·7	16·3	0·8	13·0
1820	8,293,869	1,344,584	9,638,453	33·1	250,000†	1,752,347	54,240‖	508,717	4,200	688,670	18·9	19·9	2·4	13·9
1830	10,240,232	2,625,788	12,860,692*	33·5	143,439	1,752,347	—	632,717	4,700	877,170	20·3	24·5	4·3	14·5
1840	11,781,231	5,288,222	17,063,353*	32·7	599,125	1,752,347	—	807,292	2,150	1,183,870	21·1	28·2	7·1	14·4
1850	14,569,584	8,622,292	23,191,876	35·9	1,713,251	2,939,021	1,186,674¶	979,249	38,375	1,519,170	23·7	34·9	5·3	15·2
1860	17,326,157	14,117,164	31,443,321	35·6	2,598,214	2,970,038	31,017**	1,194,754	107,375	1,951,520	26·3	41·5	5·7	16·1
1870	19,687,504	18,870,867	38,558,371	22·6	2,314,824	2,970,038	—	1,272,239	131,910	2,126,290	30·3	47·2	7·6	13·4
1880	23,925,639	26,263,570	50,155,783	30·1	2,812,191	2,970,038	—	1,569,565	260,025	2,727,454	32·0	57·4	10·6	18 4
1890	28,188,321	34,791,445	62,947,714	24·9	5,246,613	2,970,038	—	1,947,280	—	2,974,159	32·2	67·6	13·6	19·2
1900	33,533,630	42,749,757	75,994,575*	20·7	3,844,420	2,970,138	100	1,925,590	—	2,974,159	39·5	80·4	16·7	25·5
1910	—	—	91,972,266*	21·0	7,753,816‡	—	—	—	—	2,974,159	—	—	—	30·9

* Excludes persons of the military and naval service stationed abroad (5318 in 1830; 6100 in 1840; 91,219 in 1900).
† Estimates of total up to 1820.
‡ Total, 27,604,509, exclusive of at least some hundreds of thousands of Canadians and Mexicans.
§ Louisiana purchase from France.
‖ Florida purchase from Spain; population counted first, 1830.
¶ Annexation of Texas (385,926 sq. m.); peace cession from Mexico (520,068 sq. m.); extinction of British claims to Oregon (280,680 sq. m.).
** Gadsden purchase from Mexico.

Growth of the Nation in Population.—If the 19th century was remarkable with respect to national and urban growth the world over, it was particularly so in the growth of the United States. Malthus expressed the opinion that only in such a land of unlimited means of living could population freely increase. The total population increased from 1800 to 1900 about fourteen fold (1331·6%).[1] The rate of growth indicated in 1900 was still double the average rate of western Europe.[2] In the whole world Argentina alone (1869–1895) showed equal (and greater) growth. At the opening of the century not only all the great European powers of to-day but also even Spain and Turkey exceeded the United States in numbers; at its close only Russia. At the census of 1910, while the continental United States population (excluding Alaska) was 91,972,266, the total, including Alaska, Hawaii and Porto Rico, but excluding the Philippine Islands, Guam, Samoa and the Canal Zone, was 93,402,151.

In 1790 there were about 600,000 white families in the United States. Speaking broadly, there were few very rich and few very poor. Food was abundant. Both social traditions and the religious beliefs of the people encouraged fecundity. The country enjoyed domestic tranquillity. All this time, too, the land was but partially settled. Mechanical labour was scarce, and even upon the farm it was difficult to command hired service, almost the only farm labourers down to 1850, in the north, being young men who went out to work for a few years to get a little money to marry upon. A change was probably inevitable and came, apparently, between 1840 and 1850.

The accessions in that decade from Ireland and Germany were enormous, the total immigration rising to 1,713,251 against 500,125 during the decade preceding, and against only 143,439 from 1820 to 1830. These people came in condition to breed with unprecedented rapidity, under the stimulus of an abundance, in regard to food, shelter and clothing, such as the most fortunate of them had never known. Yet in spite of these accessions, the population of the country realized a slightly smaller proportion of gain than when the foreign arrivals were almost insignificant.

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[1] Unless otherwise explicitly stated, by "United States" is to be understood continental United States exclusive of Alaska.

[2] According to Lavasseur and Bodio, 14·5% from 1860 to 1880; 21·2% from 1880 to 1900; from 1886–1900, 11·0%.

For a time the retardation of the normal rate of increase among the native population was concealed from view by the extraordinary immigration. In the decade 1850–1860 it was seen that almost a seventh of the population of the country consisted of persons born abroad. From 1840 to 1860 there came more than four million immigrants, of whom probably three and a half million, with probably as many children born in America, were living at the latter date.

The ten years from 1860 to 1870 witnessed the operation of the first great factor which reduced the rate of national increase, namely the Civil War. The superintendent of the Ninth Census, 1870, presented a computation of the effects of this cause—first, through direct losses, by wounds or disease, either in actual service of the army or navy, or in a brief term following discharge; secondly, through the retardation of the rate of increase in the coloured element, due to the privations, exposures and excesses attendant upon emancipation; thirdly, through the check given to immigration by the existence of war, the fear of conscription, and the apprehension abroad of results prejudicial to the national welfare. The aggregate effect of all these causes was estimated as a loss to the population of 1870 of 1,765,000. Finally, the temporary reduction of the birth-rate, consequent upon the withdrawal of perhaps one-fourth of the national militia (males of 18 to 44 years) during two-fifths of the decade, may be estimated at perhaps 750,000.

The Tenth Census put it beyond doubt that economic and social forces had been at work, reducing the rate of multiplication. Yet no war had intervened; the industries of the land had flourished; the advance in accumulated wealth had been beyond all precedent; and immigration had increased.

It is an interesting question what has been the contribution of the foreign elements of the country's population in the growth of the aggregate. This question is closely connected with a still more important one: namely, what effect, if any, has foreign immigration had upon the birth-rate of the native stock. In 1850 the foreign-born whites (2,244,602 in number) were about two-thirds of the coloured element and one-eighth of the native-white element; in 1870 the foreign-born whites (5,567,229) and the native whites of foreign parentage (5,324,786) each exceeded the coloured. In 1900 the two foreign elements constituted one-third of the total population. The absolute numbers of the four elements were: native whites of native parents, 40,949,362; natives of foreign parents, 15,646,017; foreign-born whites, 10,213,817; coloured, 8,833,994.

Separating from the total population of the country in 1900 the non-Caucasians (9,185,379), all white persons having both parents foreign (20,803,800), and one-half (2,541,365) of the number of persons having only one parent foreign, the remaining 43,555,250 "native" inhabitants comprised the descendants of the Americans of 1790, plus those of the few inhabitants of annexed territories, plus those in the third and higher generations of the foreigners who entered the country after 1790 (or for practical purposes, after 1800). The second element may be disregarded. For the exact determination of the last element the census affords no precise data, but affords material for various approximations, based either upon the elimination of the probable progeny of immigrants since 1790; on the known increase of the whites of the South, where the foreign element has always been relatively insignificant; on the percentage of natives having native grandfathers in Massachusetts in 1905; or upon the assumed continuance through the 19th century of the rate of native growth (one-third decennially) known to have prevailed down at least to 1820. The last is the roughest approximation and would indicate a native mass of 50,000,000 in 1900, or a foreign contribution of approximately half. The results of computations by the first two methods yield estimates of the contribution of foreign stock to the "native" element of 1900 varying among themselves by only 1·8 %. The average by the three methods gives 8,539,626 as such contribution, making 31,884,791 the total number of whites of foreign origin in 1900; and this leaves 35,015,624 as the progeny of the original stock of 1790.[1] Adding to the true native whites of 1900 (35,015,624) the native negroes (8,813,658), the increase of the native stock, white and black, since 1790 would thus be about 1091 %, and of the whites of 1790 (3,172,006) alone about 1104 %. It is evident that had the fecundity of the American stock of 1790 been equal only to that of Belgium (the most fertile population of western Europe in the 19th century) then the additions of foreign elements to the American people would have been by 1900 in heavy preponderance over the original, mainly British, elements. A study of the family names appearing on the census rolls of two prosperous and typical American counties, one distinctively urban and the other rural, in 1790 and 1900, has confirmed the popular impression that the British element is growing little, and that the fastest reproducers to-day are the foreign elements that have become large in the immigration current in very recent decades. In applying to the total population of 1790 the rate of growth shown since 1790 by the white people of the South, this rate, for the purpose of the above computations, is taken in its entirety only up to 1870, and thereafter—in view of the notorious lesser birth-rate since that year in the North and West—only one half of the rate is used. If, however, application be made of the rate in its entirety from 1790 to 1900, the result would be a theoretical pure native stock in 1900 equal to the then actually existing native and foreign stock combined.

In 1900 more than half of every 100 whites in New England and the Middle states (from New York to Maryland) were of foreign parentage (*i.e.* had one or both parents foreign), and in both sections the proportion is increasing with great rapidity. The Southern states, on the other hand, have shown a diminishing relative foreign element since 1870, and had in 1900 only 79 of foreign parentage in 1000 whites. Relatively to their share of the country's aggregate population the North Atlantic states, and those upon the Great Lakes—the manufacturing and urbanized states of the Union—hold much the heaviest share of immigrant population.

The shares of different nationalities in the aggregate mass of foreigners have varied greatly. The family names on the registers of the first census show that more than 90 % of the white population was then of British stock, and more than 80 was English. The Germans were already near 6 %. The entry of the Irish began on a great scale after 1840, and in 1850 they formed nearly half of all the foreign-born. In that year 85·6 % of this total was made up by natives of Great Britain and Germany. The latter took first place in 1880. In 1900 these two countries represented of the total only 52·7 %; add the Dutch, the Danes, Swedes, Norwegians and Swiss to the latter and the share was 65·1 %. A great majority of all of these elements except the British are settled in the states added to the original Union—the Scandinavians being the most typically agricultural element; while almost all the other nationalities are in excess, most of them heavily so, in the original states of 1790, where they land, and where they are absorbed into the lower grades of the industrial organization. Since 1880 Italians, Russians, Poles, Austrians, Bohemians and Hungarians have enormously increased in the immigrant population. Germans, Irish, British, Canadians, Scandinavians, Slavs and Italians were the leading elements in 1900.

In 1790 the negroes were 19·3 % of the country's inhabitants; in 1900 only 11·6 %. While the growth of the country's aggregate population from 1790 to 1900 was 1833·9 %, that of the whites was 2005·9 %, and of the negroes only 1066·7 %.

Certain generalizations respecting the "South" and the "North," the "East" and the "West" are essential to an understanding of parts of the history of the past, and of social conditions in the present. For the basis of such comparisons the country is divided by the census into five groups of states: (1) the North Atlantic division—down to New Jersey and Pennsylvania; (2) the South Atlantic division—from Delaware to Florida (including West Virginia); (3) the North Central division—including the states within a triangle tipped by Ohio, Kansas and North Dakota; (4) the South Central division—covering a triangle tipped by Kentucky, Alabama and Texas; and (5) the Western division—including the Rocky Mountains and Pacific states. The first and third lead to-day in manufacturing interests; the third in agricultural; the fifth in mining.

Groups 1 and 3 (with the western boundary somewhat indefinite) are colloquially known as the "North" and 2 and 4 as the "South." The two sections started out with population growths in the decade 1790–1800 very nearly equal (36·5 and 33·7 %); but in every succeeding decade before the Civil War the growth of the North was greater, and that of the South less, than its increment in the initial decade. In the two twenty-year periods after 1860 the increases of the North were 61·9 and 48·7 %; of the South, 48·4 and 48·5 %. In 1790 the two sections were of almost equal population; in 1890, 1900 and 1910 the population of the North was practically double that of the South. In the decade 1890–1900 the increase of the South exceeded slightly that of the North for the same period owing to the rapid development in recent years of the Southern states west of the Mississippi, which only the Western group has exceeded since 1870.[2] In general the increase of the two sections since 1880 has been nearly equal. But while this growth was relatively uniform over the South, in the North there was a low (often a decreasing) rate of rural and a high rate of urban growth. Throughout the 19th century the rates of growth of the North Central division and that of the eastern half of the South Central division steadily decreased. It is notable that that of the South Atlantic group has grown faster since 1860 than ever before, despite the Civil War and the conditions of an old settled region: a fact possibly due to the effects of the emancipation of the slaves.

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[1] W. S. Rossiter, *A Century of Population Growth* (Bureau of the Census, Washington, 1909), pp. 85 seq.

[2] The number of inhabitants of the North at each census for every 1000 in the South was as follows from 1790 to 1900: 1004; 1025; 1092; 1181; 1253; 1455; 1562; 1769; 2057; 1930; 2005; 1932.

Comparing now the population of the regions east and west of the Mississippi, we find that the population of the first had grown from 3,929,214 in 1790 to 55,023,513 in 1900; and that of the second from 97,401 in 1810 to 20,971,062 in 1900. From 1860 to 1890 the one increased its numbers decennially by one half, and the other by under one fifth; but from 1890 to 1910 the difference in growth was slight, owing to a tremendous falling off in the rate of growth of much of the Western and the western states of the North Central divisions. Only an eighth of the country's total population lived in 1900 west of the 96th meridian, which divides the country into two nearly equal parts. Although, as already stated, the population of the original area of 1790 was passed in 1880 by that of the added area, the natives of the former were still in excess in 1900.

Urban and Rural Population.—The five cities of the country that had 8000 or more inhabitants in 1790 had multiplied to 548 in 1900. Only one of the original six (Charleston) was in the true South, which was distinctly rural. The three leading colonial cities, Philadelphia, New York and Boston, grew six-fold in the 18th century, and fifty-fold in the next. The proportion of the population living in cities seems to have been practically constant throughout the 18th century and up to 1820. The great growth of urban centres has been a result of industrial expansion since that time. This growth has been irregular, but was at a maximum about the middle of the century. On an average throughout the 110 years, the population in cities of 8000 considerably more than doubled every twenty years.[1] The rate of rural growth, on the other hand, fell very slowly down to 1860,[2] and since then (disregarding the figures of the inaccurate census of 1870) has been steady at about half the former rate. In Rhode Island, in 1900, eight out of every ten persons lived in cities of 8000 or more inhabitants; in Massachusetts, seven in ten. In New York, New Jersey and Connecticut the city element also exceeded half of the population. At the other extreme, Mississippi had only 3% of urban citizens. If the limit be drawn at a population of 2500 (a truer division) the urban element of Rhode Island becomes 95·0%; of Massachusetts, 91·5; of Mississippi, 7·7. All the Southern states are still relatively rural, as well to-day as a hundred years ago. Ten states of the Union had a density in 1910 exceeding 100 persons to the square mile: Illinois (100·7), Delaware (103), Ohio (117), Maryland (130·3), Pennsylvania (171·3), New York (191·2), Connecticut (231·3), New Jersey (337·3), Massachusetts (418·8) and Rhode Island (508·5).

There are abundant statistical indications that the line (be the influence that draws it economic or social) between urban centres of only 2500 inhabitants and rural districts is much sharper to-day than was that between the country and cities of 8000 inhabitants (the largest had five times that number) in 1790. The lower limit is therefore a truer division line to-day. Classifying, then, as urban centres all of above 2500 inhabitants, three-tenths of the total population lived in the latter centres in 1880 and four-tenths (30,583,411) in 1900; their population doubled in these twenty years. If one regards the larger units, they held naturally a little more of the total population of the country—just a third (33·1%; ten times their proportion of the country's total in 1790); and they grew a little faster. The same years, however, made apparent a rapid fall, general and marked, yet possibly only temporary, in the rate at which such urban centres, as well as larger ones, had been gaining upon the rural districts; this reaction being most pronounced in the South and least so in the North Atlantic states, whose manufacturing industries are concentrated in dense centres of population.

Interstate migration is an interesting element in American national life. A fifth of the total population of 1900 were living in other states than those of birth; and this does not take account of temporary nor of multiple migration. Every state numbers among its residents natives of nearly every other state. This movement is complicated by that of foreign immigration. In 1900 the percentage of resident natives varied from 92·7% in South Carolina to 15% in Oklahoma; almost all of the Southern states having high percentages.

Sexes.—The percentages of males and females, of all ages, in the aggregate population of 1900, were 51·0 and 49·0 respectively. The corresponding figures for the main elements of the population were as follows: for native whites, 50·7 and 49·3; foreign whites, 54·0 and 46·0; negroes, 49·6 and 50·4. The absolute excess of males in the aggregate population has been progressively greater at every successive census since 1820, save that of 1870—which followed the Civil War, and closed a decade of lessened immigration. The relative excess of males in each unit of population has not constantly progressed, but has been continuous. In densely settled regions females generally predominate; and males in thinly settled regions. In every 1000 urban inhabitants there were, in 1900, 23 (in 1890 only 19) more females than in 1000 rural inhabitants. In the rural districts, so far as there is any excess of females, it is almost solely in the Southern cotton belt, where negro women are largely employed as farm hands.

Vital Statistics, 1900.—The median age of the aggregate population of 1900—that is, the age that divides the population into halves—was 22·85 years. In 1800 it was 15·97 years. A falling birth-rate, a falling death-rate, and the increase in the number of adult immigrants, are presumably the chief causes of this difference. The median age of the foreign-born in 1900 was 38·42 years. The median age of the population of cities of 25,000 or more inhabitants was 3·55 years greater than that of the inhabitants of smaller urban centres and rural districts, owing probably in the main to the movement of middle-aged native and foreign adults to urban centres, and the higher birth-rate of the rural districts. The median age of the aggregate population is highest in New England and the Pacific states, lowest in the South, and in the North Central about equal to the country's average. The average age of the country's population in 1900 was 26·2 years. The United States had a larger proportion (59·1%) within the "productive" age limits of 15 and 60 years than most European countries; this being due to the immigration of foreign adults (corresponding figure 80·3%), the productive group among the native whites (55·8%) being smaller than in every country of Europe. The same is true, however, of the population over 60 years of age.

Death-rate.

The death-rate of the United States, though incapable of exact determination, was probably between 16 and 17 per 1000 in 1900; and therefore less than in most foreign countries. The following statement of the leading causes of death during the eleven years 1890–1900 in 83 cities of above 25,000 population, is given by Dr J. S. Billings:—

Average Annual Death-rate per 100,000 Population for the Cities of the Sections Indicated.	Consumption.	Pneumonia.	Typhoid Fever.	Diphtheria and Croup.
New England . .	244	220	30	77
Middle states . .	259	268	32	101
Lake states . .	156	159	48	79
Southern states .	277	189	50	54
West North Central	183	142	38	61

Marriage.

Families.

Among the statistics of conjugal condition the most striking facts are that among the foreign-born the married are more than twice as numerous as the single, owing to the predominance of adults among the immigrants; and the native whites of foreign parents marry late and in much smaller proportion than do the native whites of native parentage—the explanation of which is probably to be found in the reaction of the first American generation caused on one hand by the high American standard of living, and on the other by the relative economic independence of women. In 1900 1·0% of the males and 10·9% of the females from 15 to 19 years of age were married; from 20 to 24 years, 21·6% and 46·5% respectively. Of females above 15 years of age 31·2% were single, 56·9 married, 11·2 widowed, 0·5 divorced; many of the last class undoubtedly reporting themselves as of the others. The corresponding figures for males were: 40·2, 54·5, 4·6 and 0·3%. In 1850 there were 5·6 persons (excluding the slave population) in an average American family; fifty years later there were only 4·7—a decline, which was constant, of 16·1%. In 1790, 5 persons was also the normal family—*i.e.* the greatest proportion (14%) of the total were of this size; but in 1900 the model family was that of 3 persons by a more decisive proportion (18%). The minimum state average of 1790, which was 5·4 in Georgia, was greater than the maximum of 1900. Within the area of 1790 there were twice as many families in 1900 as in 1790 consisting of 2 persons, and barely half as many consisting of 7 and upward; New England having shown the greatest and the South the least decrease. In 1790 about a third and in 1900 more than one half of all families had less than 5 members.

Birth-rate.

The data gathered by the Federal census have never made possible a satisfactory and trustworthy calculation of the birth-rate, and state and local agencies possess no such data for any considerable area. But the evidence is on the whole cumulative and convincing that there was a remarkable falling off in the birth-rate during the 19th century. And it may be noted, because of its bearing upon the theory of General Francis A. Walker, that the Old South of 1790, practically unaided by immigration, maintained a rate of increase at least approximating that attained by other sections of the country by native and foreign stock combined. Not a state of the Union as it existed in 1850 showed an increase, during the half-century following, in the ratio of white children under 16 to 1000 white females over 16 years: the ratio declined for the whole country from 1600 to 1100; and it has fallen for the census area of 1790 from 1900 in that year to 1400 in 1850 and 1000 in 1900. On the other hand, elaborate colonial censuses for New York in 1703 and 1812 show

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[1] Average 62·2% decennially. [2] Average 31·9% decennially.

Sections of the Country.[1]	Whites under 16 Years per 1000 of Total Population.				
	1790.	1820.	1850.	1880.	1900.
Area of 1790	490	483	414	373	344
New England	470	443	358	309	291
Middle states	494	485	405	358	326
Old South	502	508	464	431	402
Added area	—	526	463	406	368

ratios of 1900 and 2000, and reinforce the suggestions of various other facts that the social, as well as the economic, conditions in colonial times were practically constant.

The decline in the proportion of children since 1860 has been decidedly less in the South (Southern Atlantic and South Central states as defined below) than in the North and West, but in the most recent decades the last section has apparently fast followed New England in having a progressively lesser proportion of children. In the North there was little difference in 1900 in the ratios shown by city and country districts, but in the South the ratio in the latter was almost twice that reported for the former.

The decades 1840–1850, 1880–1890 and 1860–1870 have shown much the greatest decreases in the percentage of children; and some have attributed this to the alleged heavier immigration of foreigners (largely adults) in the case of the two former decades, and the effects of the Civil War in the third. So also the three decades immediately succeeding the above showed minimum decreases; and this has been attributed to a supposed greater birth-rate among the immigrants.

These uncertainties raise a greater one of much significance, viz. what has been the cause of the reduction in the national birth-rate indicated by the census figures? The question has been very differently judged. In the opinion of General Francis A. Walker, superintendent of the censuses of 1870 and 1880, the remarkable fact that such reduction coincided with a cause that was regarded as certain to quicken the increase of population, viz. the introduction of a vast body of fresh peasant blood from Europe, afforded proof that in this matter of population morals are far more potent than physical causes. The change, wrote General Walker, which produced this falling off from the traditional rate of increase of about 3% per annum, was that from the simplicity of the early times to comparative luxury; involving a rise in the standard of living, the multiplication of artificial necessities, the extension of a paid domestic service, the introduction of women into factory labour.[2] In his opinion the decline in the birth-rate coincidently with the increase of immigration, and chiefly in those regions where immigration was greatest, was no mere coincidence; nor was such immigrant invasion due to a weakening native increase, or economic defence; but the decline of the natives was the effect of the increase of the foreigners, which was "a shock to the principle of population among the native element." Immigration therefore, according to this theory, had "amounted not to a reinforcement of our population, but to a replacement of native by foreign stock. That if the foreigners had not come, the native element would long have filled the places the foreigners usurped, I entertain"—says General Walker—"not a doubt."

It is evident that the characteristics of the "factory age" to which reference is made above would have acted upon native British as upon any other stock; and that it has universally so acted there is abundant statistical evidence, in Europe and even in a land of such youth and ample opportunities as Australia. The assumption explicitly made by General Walker that among the immigrants no influence was yet excited in restriction of population, is also not only gratuitous, but inherently weak; the European peasant who landed (where the great majority have stayed) in the eastern industrial states was thrown suddenly under the influence of the forces just referred to; forces possibly of stronger influence upon him than upon native classes, which are in general economically and socially more stable. On the whole, the better opinion is probably that of a later authority on the vital statistics of the country, Dr John Shaw Billings,[3] that though the characteristics of modern life doubtless influence the birth-rate somewhat, by raising the average age of marriage, lessening unions, and increasing divorce and prostitution, their great influence is through the transmutation into necessities of the luxuries of simpler times; not automatically, but in the direction of an increased resort to means for the prevention of child-bearing.

Education.—In the article EDUCATION (*United States*), and in the articles on the several states, details are given generally of the conditions of American education. Here the statistics of literacy need only be considered.

In 1900 illiterates (that is, persons unable to write, the majority of these being also unable to read) constituted nearly one-ninth (10·7%) of the population of at least ten years of age; but the greatest part of this illiteracy is due to the negroes and the foreign immigrants. Since 1880 the proportion of illiteracy has steadily declined for all classes, save the foreign-born between 1880 and 1890, owing to the beginning in these years, on a large scale, of immigration from southern Europe. Illiteracy is less among young persons of all classes than in the older age-groups, in which the foreign-born largely fall. This is due to the extension of primary education during the last half of the 19th century. The older negroes (who were slaves) naturally, when compared with the younger, afford the most striking illustration of this truth. On the other hand, a notable exception is afforded by the native whites of native parents, particularly in the South, where child illiteracy (and child labour) is highest; the declining proportion of illiterates shown by the age-groups of this class up to 24 years is apparently due to a will to learn late in life.

The classification of the illiterate population (above 10 years of age) by races shows that the Indians (56·2%), negroes (44·5%), Chinese (29·0%), Japanese (18·3%), foreign white (13·0%), native white of native parentage (5·7%), and native whites of foreign parents (1·6%), are progressively more literate. The advantage of the last as compared with native whites of native parentage is apparently owing to the lesser concentration of these in cities. The percentages of illiterate children for different classes in 1900 were as follows: negroes, 30·1; foreign whites, 5·6; native whites of foreign parentage, 0·9; native whites of native parentage, 4·4. There is a greater difference in the North than in the South between the child illiteracy of the Caucasian and non-Caucasian elements; also a ranking of the different sections of the country according to the child illiteracy of one and the other race shows that the negroes of the South stand relatively as high as do its whites. All differences are lessened if the comparison be limited to children, and still further lessened if also limited to cities. Thus, the illiteracy of non-Caucasians was 44·5%, of their children 30·1%, and of such in cities of 25,000 inhabitants, 7·7%.

In the total population of 10 years of age and over the female sex is more illiterate than the male, but within the age-group 10 to 24 years the reverse is true. In 1890 females preponderated among illiterates only in the age-group 10 to 19 years. The excess of female illiteracy in the total population also decreased within the same period, from 20·3 to 10·8 illiterates in a thousand. The tendency is therefore clearly toward an ultimate higher literacy for females; a natural result where the two sexes enjoy equal facilities of schooling, and the females greater leisure. Among the whites attending school there was still in 1900 a slight excess of males; among the negro pupils females were very decidedly in excess. In all races there has been since 1890, throughout the country, a large increase in the proportion of girls among the pupils of each age-group; and this is particularly true of the group of 15 years and upward—that is of the grammar school and high school age, in which girls were in 1900 decidedly preponderant. A similar tendency is marked in college education.

Religious Bodies.—According to the national census of religious bodies taken in 1906 there were then in the country 186 denominations represented by 212,230 organizations, 92·2% of which represented 164 bodies which in history and general character are identified more or less closely with the Protestant Reformation or its subsequent development. The Roman Catholic Church contributed 5·9% of the organizations. Among other denominations the Jewish congregations and the Latter Day Saints were the largest. The immigrant movement brings with it many new sects, as, for example, the Eastern Orthodox churches (Russian, Servian, Syrian and Greek), which had practically no existence in 1890, the year of the last preceding census of religious bodies. But the growth of independent churches is most remarkable, having been sixfold since 1890.

The statistics of communicants or members are defective, and because of the different organization in this respect of different bodies, notably of the Protestants and Roman Catholics, comparisons are more or less misleading. Disregarding, however, such incomparability, but excluding 15% of all Roman Catholics (for children under 9 years of age), the total number of church members was 32,936,445, of whom 61·6% were Protestants, 36·7% Roman Catholics and 1·7% members of other churches. The corresponding figures in 1890 were 68·0, 30·3 and 1·7%. For the reasons just given these figures do not accurately indicate the religious affiliations of the population of the United States. In this particular they very largely understate the number of Hebrews, whose

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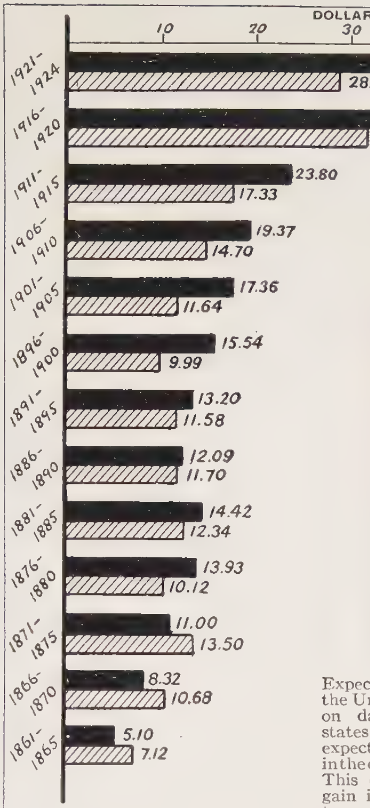
[1] Table from Rossiter, *op. cit.*, p. 103.

[2] See his *Discussions in Economics and Statistics*, ii. 422, "Immigration and Degradation."

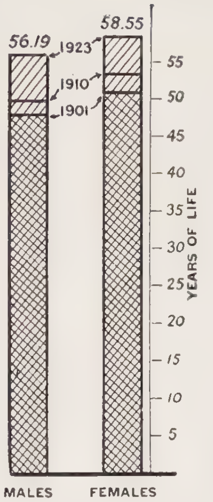
[3] See the *Forum* (June, 1893), xv. 467.

UNITED STATES (Population and Resources)

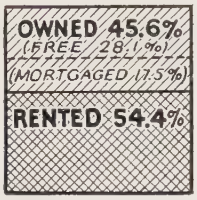
PLATE I.



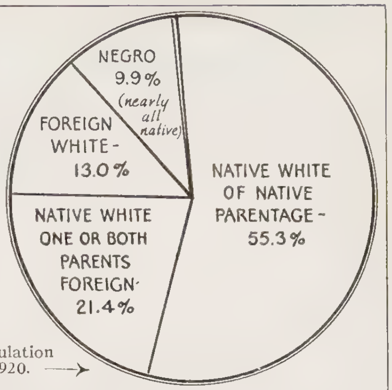
Foreign trade: exports (black bar) and imports (shaded bar) of merchandise (average yearly value per capita of population, by five-year periods, 1861–1924).



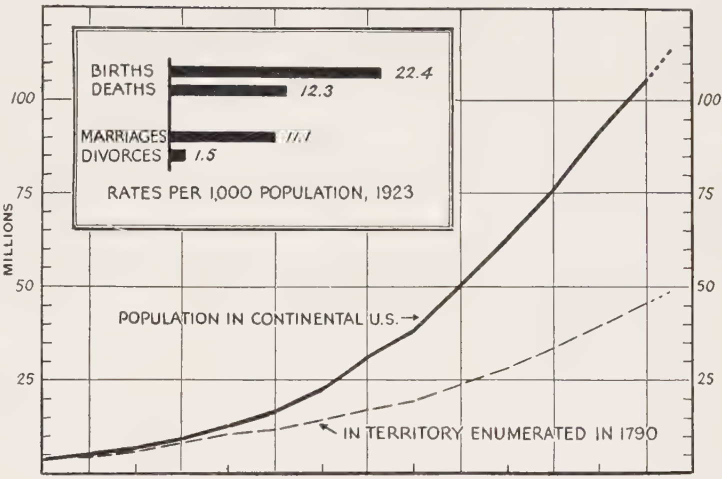
Expectation of life at birth in the United States in 1923, based on data for the registration states, and compared with the expectation in 1910 and in 1901 in the original registration states. This exaggerates slightly the gain in expectation of life between 1901 and 1923, as the original registration area has a higher mortality than the total registration area.



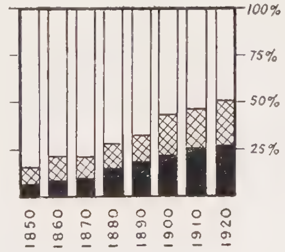
Homes of the 24,351,676 families in 1920.



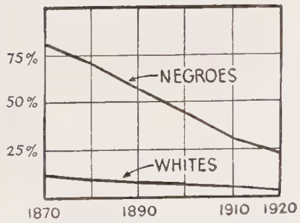
The population in 1920. ⟶



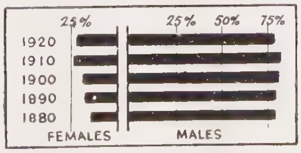
Increase in the population of the United States, exclusive of outlying possessions, 1790–1920, with estimate for 1925. The broken line shows the increase in the area enumerated in 1790; the space between the two lines therefore represents the increase in added area. (*Cf.* map facing p. 664.) In the insert: number of births, deaths, marriages and divorces, per 1,000 population, in 1923.



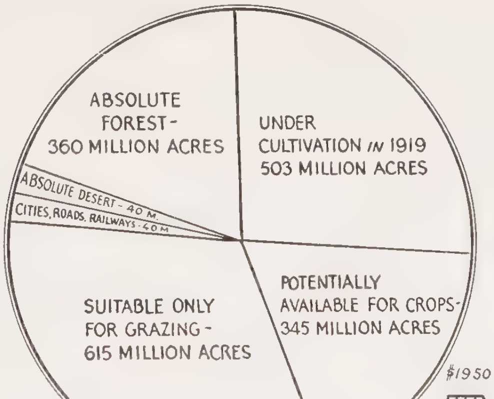
Farm lands: percentage of total land area in farms, 1850–1920, showing percentage improved (black section at bottom of column) and percentage unimproved (cross-hatched section).



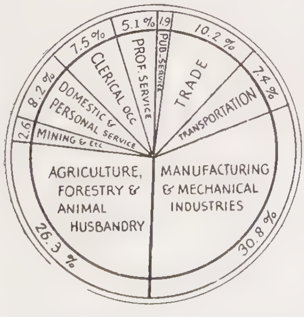
Illiteracy: decrease, 1870–1920, in percentage of the population ten years of age and over who were unable to write in any language; shown separately for Negroes and Whites.



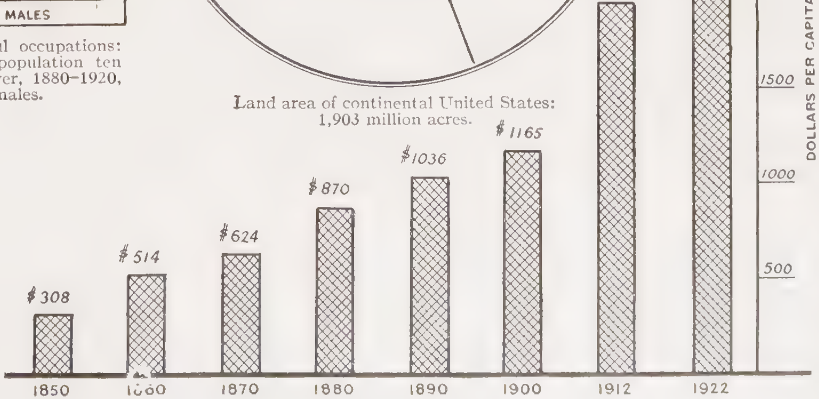
Employed in gainful occupations: percentage of the population ten years of age and over, 1880–1920, for males and for females.



Land area of continental United States: 1,903 million acres.



Occupations of the 41,614,248 persons engaged in gainful occupations in 1920.



National wealth: average amount per capita at intervals from 1850 to 1922. (For 1870 the amount is shown on a gold basis.)

communicants (0·3 %) are heads of families only, and largely of the Protestants; whereas they represent practically the total Roman Catholic population above 9 years of age. In comparing the figures of 1890 with those of 1906 these cautions are not of force, since both census counts were taken by the same methods. The membership of the Protestant bodies increased in the interval 44·8 %, while that of the Roman Catholic Church increased 93·5 %. The immigration from Catholic countries could easily account for (though this does not prove that in fact it is the only cause of) this great increase of the Roman Catholic body.

Among the Protestants, the Methodists with 17·5 % of the total membership, the Baptists with 17·2, the Lutherans with 6·4, the Presbyterians with 5·6 and the Disciples and Christians with 3·5—each of these bodies comprising more than a million members—together include one-half of the total church membership of the country, and four-fifths (81·3 %) of all Protestant members.

The Baptists and Methodists are much stronger in the South, relatively to other bodies, than elsewhere; the former constituting in the South Atlantic states 43·9 % of all church members, and in the South Central states 39·5 %. Adding in the Methodists these proportions become 76·3 and 65·3 %. The Lutherans are relatively strongest in the North Central division of the country (13·2 %); the Presbyterians in the North Atlantic and Western divisions (6·0 %); and the Disciples in the South Central division (6·1 %). The Roman Catholics are strongest in the Western division and the North Atlantic division, with 49·2 % in the former and 56·6 % in the latter of all church members; their share in the North Central division is 36·9 %. Thus the numerical superiority of the Baptists and Methodists in the two Southern divisions is complementary to that of the Roman Catholics in the other three divisions of the country. New York, Rhode Island, Massachusetts and New Hampshire in the eastern part of the country, Louisiana in the south, and New Mexico, Arizona, California and Montana in the western part are distinctively Roman Catholic states, with not less than 63 % of these in the total church body. Racial elements are for the most part the explanation. So also the immigration of French Canadians and of Irish explains the fact that in every state of one-time Puritan New England the Roman Catholics were a majority over Protestants and all other churches. This was true in 1890 of 12 states, while in one other the Roman Catholics held a plurality; in 1906 the corresponding figures were 16 and 20. The Protestant bodies are more widely and evenly distributed throughout the country than are the Roman Catholics.

The total value of church property (almost in its entirety exempt from taxation) reported in 1906 was $1,257,575,867, of which $935,942,578 was reported for Protestant bodies, $292,638,786 for Roman Catholic bodies, and $28,994,502 for all other bodies.

Occupations.—29,073,233 persons 10 years or more of age—nearly two-fifths (38·3 %) of the country's total population—were engaged in gainful occupations in 1900. Occupations were reported first for free males in 1850, and since 1860 women workers have been separately reported. Five main occupation groups are covered by the census: (1) agriculture, (2) professional service, (3) domestic and personal service, (4) trade and transportation, (5) manufacture and mechanical pursuits. The percentage of all wage-earners engaged in these groups in 1900 was 35·7, 4·3, 19·2, 16·4, and 24·4 respectively. Outside of these are the groups of mining and fishing.

Although manufactures have increased tremendously of recent years—their products representing in 1905 a gross total of $14,802,147,087 as compared with $6,309,000,000 for those of farms (according to the U.S. Department of Agriculture)—agriculture is still the predominant industry of the United States, employing nearly half of the workers, and probably giving subsistence to considerably more than half of the people of the country.

Turning to the factor of sex, it may be stated that the total number of the gainfully employed in 1900 above given included 80·0 % of all the men and boys, and 18·8 % of all the women and girls in the country. The corresponding figures in 1880 were 78·7 and 14·7 %. The proportion of women workers is greatest in the North Atlantic group of states (22·1 %) where they are engaged in manufacturing, and in the South (23·8) where negro women are engaged in agricultural operations. The percentage of such wage-earners is therefore increasing much more rapidly in the former region. But in all other parts of the country the increase is faster than in the South; since aside from agriculture, which has long been in a relatively stable condition, there is not by any means so strong a movement of women into professional services in city districts. The increase is universal. There is not a state that does not show it. The greatest increase for any section between 1880 and 1900 was that of the North Central division from 8·8 to 14·3 %. Here too both factors—farm-life, as in North Dakota, and manufacturing, as in Illinois—showed their plain influence.

Of all agricultural labourers 9·4 % were females in 1900 (7·7 in 1880); but in the South the proportion was much greater—16·5 in the South Atlantic and 14·9 in the South Central division. In professional service 34·2 % (in 1880, 29·4) were females, the two northern sections showing the highest proportions. In the occupations of musicians and teachers of music, and of school-teachers and professors (which together account for seven-eighths of professional women) women preponderate. The same sex constituted only 37·5 % (34·6 % in 1880) of the wage-earners of the third group; the South also showing here, as is natural in view of its coloured class, much the highest and the Western division of states much the lowest percentage. Women are in excess in the occupations of boarding and lodging house keepers, housekeepers, launderers, nurses and midwives, and servants and waiters. These account for almost all women in this group; servants and waitresses make up two-thirds of the total. Finally, in the fourth and fifth groups the percentage of women was 10·6 (3·4 in 1880) and 18·5 (16·7 in 1880). In manufactures the South Atlantic states show a higher percentage than the North Central, owing to the element of child-labour already indicated. In the third group women greatly preponderate in the occupation of stenographers and type-writers; and in those of book-keepers and accountants, clerks and copyists, packers and shippers, saleswomen (which is the largest class), and telegraph and telephone operators they have a large representation (13 to 34 %). A great variation exists in the proportion of the sexes employed in different manufacturing industries. Of dress-makers, milliners, seamstresses (which together make up near half of the total in this occupation group) more than 96 % are women. Of the makers of paper boxes, of shirts, collars and cuffs, of hosiery and knitting mill operatives, of glove-makers, silk mill operatives and book-binders they are more than half; so also of other textile workers, excluding wool and cotton mill operatives (these last the second largest group of women workers in manufactures), in which occupations males are in a slight excess. The distribution of women wage-earners in 1900 among the great occupation groups was as follows: in agriculture, 18·4 %; professional service, 8·1 %; domestic and personal service, 39·4 %; trade and transportation, 9·4 %; manufacturing and mechanical pursuits, 24·7 %.

The proportion which children 10 to 15 years of age engaged in gainful occupations bore to the whole number of such children was in 1880 24·4 % for males, and 9·0 % for females. Twenty years later the corresponding figures were 26·1 and 10·2 %. In the North Atlantic and North Central states, notwithstanding their manufacturing industries, the proportions were much lower (17·1 and 17·0 in 1900), and they increased very little in the period mentioned. In the Western group the increase was even less, and the total (10·9 % in 1900) also. But in the South Atlantic and the South Central states—where agriculture, mining and manufacturing have in recent decades become important—although the increase was very slight, the proportions were far above those of the other sections, both in 1880 and in 1900. In the former year the ratios were 40·2 and 41·5; in the latter 41·6 and 42·7 %. In Alabama (70·8 % in 1880), North and South Carolina, and Arkansas the ratio exceeded 50 % in 1900.

National Wealth.—Mulhall has estimated the aggregate wealth of the United States in 1790 at $620,000,000, assigning of this value $479,000,000 to lands and $141,000,000 to buildings and improvements. It is probable that this estimate is generous according to the values of that time. But even supposing $1,000,000,000 to be a juster estimate according to present-day values, it is probable that the increase of this since 1790 has been more than a hundredfold and since 1850 (since when such data have been gathered by the census) about fifteenfold. The value of farm property increased from $3,967,343,580 in 1850 to $20,439,901,164 in 1900. The gross value of manufactures rose in the same interval from $1,019,106,616 to $13,010,036,514; of farm products, from $2,212,540,927 in 1880 to $6,309,000,000 in 1900. The census estimate of the true value of "property" constituting the national wealth was limited in an enumeration of 1850 to taxable realty and privately held personalty; in 1900 it covered also exempt realty, government land, and corporation and public personalty. The estimate of the national wealth of 1850 was $7,135,780,228; in 1904 (made by the census office), $107,104,192,410. It may be added that the net ordinary revenue of the government was in 1850 $43,592,889, and in 1909 $662,324,445; that the value of imports rose from $7·48 *per capita* in 1850 to $14·47 in 1909; and of exports from $6·23 to $18·50. The public debt on the 1st of November 1909, less certificates and notes offset by cash in the Treasury, was $1,295,147,432.04.

(F. S. P.)

VI.—INDUSTRIES AND COMMERCE

Manufactures.—In the colonial period there were beginnings in some lines of manufacturing, but the policy of the British government was generally hostile and the increase was insignificant. In the first decades after the establishment of independence the resources and energies of the nation were absorbed in the task of occupying the vacant spaces of a continent, and subduing it to agriculture; and so long as land was so abundant that the spreading population easily sustained itself upon the fruits of the soil, and satisfied the tastes of a simple society with the products of neighbourhood handicrafts, there was no incentive to any real development of a factory economy. This has been, for the most part, a development since the Civil War.

No attempt was made in the census enumerations of 1790 and 1800 to obtain statistics of manufactures. In 1810 Congress provided for such a report, but the results were so imperfect that there was never published any summary for the country, nor for any state. Nor were the data secured in 1820 and 1840 of much value. Since 1850, however, provision has been made on an ample scale for their collection, although the constant modifications of the schedules under which the statistics were arranged makes very difficult comparisons of the latest with the earlier censuses.

From 1850 to 1900 fairly full industrial statistics were gathered as a part of each decennial census. In 1905 was taken the first of a new series of special decennial censuses of manufactures, in which only true factories—that is, establishments producing standardized products intended for the general market—were included, and mere "neighbourhood" (local) establishments of the hand trades were excluded. Without corrections, therefore, the figures of earlier censuses are not comparable with those of the census of 1905. Thus of 512,254 establishments included in the reports of 1900, six-tenths, employing 11·2 % of the total number of wage-earners and producing 12·3 % of the total value of all manufactures, must be omitted as "neighbourhood" establishments in order to make the following comparison of the results of the two enumerations of 1900 and 1905. The magnitude in 1905 of each of the leading items, and its increase since 1900, then appear as follows: number of factories, 216,262, increase 4·2 %; capital invested, $12,686,265,673, increase 41·3 %; salaries, $574,761,231, increase 50·9 %; total wages, $2,009,735,799, increase 29·9 %; miscellaneous expenses, $1,455,019,473, increase 60·7 %; cost of materials, $8,503,949,756, increase 29·3 %; value of products, including custom work and repairing (in such factories), $14,802,147,087, being an increase of 29·7 %. Of the last item $3,269,757,067 represented the value of the products of rural factories (that is, those in cities of under 8000 inhabitants). The increase of the different items during the five years was greater in every case in the rural than in the urban factories. There was a very slight decline in the number of child labourers both in city and country, their total number in 1905 being 159,899 and in 1900 161,276. The total wages paid to children under 16 years, however, which was in 1905 $27,988,207, increased both in the city and, especially, in the country, and was 13·9 % greater in 1905 than five years earlier. In the same period there was an increase of 16·0 % in the number and of 27·5 % in the wages of women workers of 16 years (and upwards) of age.

Deducting from the total value of manufactured products in 1905 the cost of partially manufactured materials, including mill supplies, a net or true value of $9,821,205,387 remains. Partially manufactured articles imported for use in manufactures are not included. Deducting from this the cost of raw materials and adding the cost of mill supplies, the result—$6,743,399,718—is the value added to materials by manufacturing processes.

The extent to which manufactures are controlled by large factories is shown by the fact that although in 1905 only 11·2 % of the total number reported products valued at $100,000 or over, these establishments controlled 81·5 % of the capital, employed 71·6 % of the wage earners, and produced 79·3 % of the value of the products, of all establishments reported. 52·3 % of the total number, employing 66·3 % of all wage-earners, and producing 69·7 % of the total product-value, were in urban centres.

Only six establishments in a thousand employed as many as 500 workers, and only two in a thousand employed as many as 1000 workers. Cotton mills are most numerous in the last class of establishments. The manufacture of lumber and timber gave employment to the largest total number of workers; and this industry, together with those of foundry and machine shops (including locomotives, stoves and furnaces), cotton goods (including small wares), railway car and repair shops, and iron and steel, were (in order) the five greatest employers of labour.

Measured by the gross value of products, wholesale slaughtering and meat packing was the most important industry in 1905. The products were valued at $801,757,137. In each of four other industries the products exceeded in value five hundred millions of dollars, namely, those of foundry and machine shops, flour and grist mills, iron and steel, and lumber and timber. In one other, cotton goods, the value was little less. These six industries contributed 27·2 % of the value of all manufactured products. Both in 1905 and in 1900 the group of industries classed as of food and kindred products ranked first in the cost of materials used and the value of products; the group of iron and steel ranking first in capital and in wages paid; and textiles in the number of wage-earners employed.

The close relation of manufactures to agriculture is reflected in the fact that, of the raw materials used, 79·4 % came from the farm. The remainder came from mines and quarries, 15·0 %; forests, 5·2 %; the sea, 0·4 %.

Four states—New York, Pennsylvania, Illinois and Massachusetts—each manufactured in 1900 products valued at over $1,000,000,000; New York exceeding and Pennsylvania attaining almost twice that sum. The manufacture of some products is highly localized. Thus, of silk goods, worsteds, the products of blast furnaces, of rolling mills and steel works, glass, boots and shoes, hosiery and knit goods, slaughtering and meat products, agricultural implements, woollens, leather goods, cotton goods and paper and wood pulp, four leading states produced in each case from 88·5 %, in the case of silk goods, to 58·6 % in the case of pulp.

M. G. Mulhall (*Industry and Wealth of Nations*, 1896) assigned fourth place to the United States in 1880 and first place in 1894 in the value of manufactured products, as compared with other countries. Paul Leroy-Beaulieu (*Les États-Unis au xx^{ème} Siècle*, Paris, 1904) would assign primacy to the United States as far back as 1885. Since the English board of trade estimated the exports of British manufactured goods at from 17 to 20 % of the industrial output of the United Kingdom in 1902, this would indicate a manufactured product hardly two-thirds as great as that of the true factory establishments of the United States in 1900. But exact data for comparison do not exist for other countries than the United States. In the production of pig iron, the share of the United States seems to have been in 1850 about one-eighth and that of Great Britain one-half of the world's product; while in 1903 the respective shares were 38·8 and 19·3 %; and Germany's also slightly exceeded the British output. In the manufacture of textiles the United States holds the second place, after Great Britain; decidedly second in cottons, a close competitor with Great Britain and France in woollens, and with France in silks. In the manufacture of food products the United States holds a lead that is the natural result of immense advantages in the production of raw materials. No other country produces half so much of leather. In the dependent industry of boots and shoes her position is commanding. These facts give an idea of the rank of the country among the manufacturing countries of the world. The basis of this position is generally considered to be, partly, immense natural resources available as materials, and, partly, an immense home market.

For *Agriculture*, see the article AGRICULTURE; for *Fisheries*, see FISHERIES; and for *Forestry*, see FORESTS AND FORESTRY.

Minerals.—In 1619 the erection of "works" for smelting the ores of iron was begun at Falling Creek, near Jamestown, Va., and iron appears to have been made in 1620; but the enterprise was stopped by a general massacre of the settlers in that region. In 1643 the business of smelting and manufacturing iron was begun at Lynn, Mass., where it was successfully carried on, at least up to 1671, furnishing most of the iron used in the colony. From the middle of the 17th century the smelting of this metal began to be of importance in Massachusetts Bay and vicinity, and by the close of the century there had been a large number of ironworks established in that colony, which, for a century after its settlement, was the chief seat of the iron manufacture in America, bog ores, taken from the bottom of the ponds, being chiefly used. Early in the 18th century the industry began to extend over New England and into New Jersey, the German bloomery forge being employed for reducing the ore directly to bar iron, and by the middle of that century it had taken a pretty firm hold in the Atlantic colonies. About 1789 there were fourteen furnaces and thirty-four forges in operation in Pennsylvania. Before the separation of the colonies from the mother country, the manufacture of iron had been extended through all of them, with the possible exception of Georgia. As early as 1718 iron (both pig and bar) began to be sent to Great Britain, the only country to which the export was permitted, the annual amount between 1730 and 1775 varying ordinarily between 2000 and 3000 tons, but in one year (1771) rising to between 7000 and 8000 tons.

The first metal other than iron mined by whites within the territory of the United States was lead, the discovery of which on the American continent was recorded in 1621. The first English settlers on the Atlantic bartered lead of domestic origin with the Indians in the 17th century, and so did the French in the upper Mississippi Valley. The ore of the metal occurring in the Mississippi basin—galena—is scattered widely and in large quantities, and being easily smelted by the roughest possible methods was much used at an early date. In the second half of the 18th century, during the period of French and Spanish domination in the valley, lead was a common medium of exchange, but no real mining development took place. Copper was the next metal to be mined, so far as is known. The first company began work about 1709, at Simsbury, Conn. The ore obtained there and in New Jersey seems to have been mostly shipped to England. A few years later attempts were made to work mines of lead and cobalt in Connecticut and Massachusetts.

The first mining excitement of the United States dates back to the discovery of gold by the whites in the Southern states, along the eastern border of the Appalachian range, in Virginia, and in North and South Carolina. The existence of gold in that region had been long known to the aboriginal inhabitants, but no attention was paid to this by the whites, until about the beginning of the 19th century, when nuggets were found, one of which weighed 28 ℔.

From 1824 the search for gold continued, and by 1829 the business had become important, and was attended with no little excitement. In 1833 and 1834 the amount annually obtained had risen to fully a million of dollars. A rapid development of the lead mines of the West, both in Missouri and on the Upper Mississippi in the region where Iowa, Wisconsin and Illinois adjoin one another, took place during the first quarter of the 19th century, and as early as 1826 or 1827 the amount of this metal obtained had risen to nearly 10,000 tons a year. By this time the making of iron had also become important, the production for 1828 being estimated at 130,000 tons.

In 1820 the first cargo of anthracite coal was shipped to Philadelphia. From 1830 the increase in the production was very rapid, and in 1841 the annual shipments from the Pennsylvania anthracite region had nearly reached 1,000,000 tons, the output of iron at that time being estimated at about 300,000 tons. The development of the coal and iron interests, and the increasing importance of the gold product of the Appalachian auriferous belt, and also of the lead product of the Mississippi Valley, led to a more general and decided interest in geology and mining; and about 1830 geological surveys of several of the Atlantic states were begun, and more systematic explorations for the ores of the metals, as well as for coal, were carried on over all parts of the country then open to settlement. An important step was taken in 1844, when a cession of the region on the south shore of Lake Superior was obtained from the Chippewa Indians. Here explorations for copper immediately began, and for the first time in the United States the business of mining for the metals began to be developed on an extensive scale, with suitable appliances, and with financial success. An event of still greater importance took place almost immediately after the value of the copper region in question had been fully ascertained. This was the demonstration of the fact that gold existed in large quantities along the western slope of the Sierra Nevada of California. In five years from the discovery of gold at Coloma on the American river, the yield from the auriferous belt of the Sierra Nevada had risen to an amount estimated at between sixty-five and seventy millions of dollars a year, or five times as much as the total production of this metal throughout the world at the beginning of the century.

Mining Industries about 1850.

The following details show the development of the mineral resources of the country at the middle of the 19th century. In 1850 the shipments of anthracite amounted to nearly 3,500,000 tons; those of Cumberland or semi-bituminous coal were about 200,000 tons. The yearly production of pig iron had risen to between 500,000 and 600,000 tons. The annual yield of gold in the Appalachian belt had fallen off to about $500,000 in value, that of California had risen to $36,000,000, and was rapidly approaching the epoch of its culmination (1851–1853). No silver was obtained in the country, except what was separated from the native gold, that mined in California containing usually from 8 to 10 % of the less valuable metal. The ore of mercury had been discovered in California before the epoch of the gold excitement, and was being extensively worked, the yield in the year 1850–1851 being nearly 2,000,000 ℔. At this time the copper mines of Lake Superior were being successfully developed, and nearly 600 tons of metallic copper were produced in 1850. At many points in the Appalachian belt attempts had been made to work mines of copper and lead, but with no considerable success. About the middle of the century extensive works were erected at Newark, New Jersey, for the manufacture of the oxide of zinc for paint; about 1100 tons were produced in 1852. The extent and value of the deposits of zinc ore in the Saucon Valley, Pennsylvania, had also just become known in 1850. The lead production of the Missouri mines had for some years been nearly stationary, or had declined slightly from its former importance; while that of the upper Mississippi region, which in the years just previous to 1850 had risen to from 20,000 to 25,000 tons a year, was declining, having in 1850 sunk to less than 18,000 tons.

Present Position of Mining Industries.

At the end of the century, in only fifty years, the United States had secured an easy first place among the mineral-producing countries of the world. It held primacy, with a large margin, in the yield of coal, iron, lead and copper, the minerals most important in manufactures; in gold its output was second only to that of South Africa (though practically equalled by that of Australia); and in silver to that of Mexico. Although the data are in general incomplete upon which might be based a comparison of the relative standing of different countries in the production of minerals of lesser importance than those just mentioned, it was estimated by M. G. Mulhall (*Industries and Wealth of Nations*, edition of 1896, pp. 34–35) that Great Britain then produced approximately one-third, the United States one-third, and all other countries collectively one-third of the minerals of the world in weight.

The leading products, as reported by the Geological Survey for 1907, were as follows: coal, $614,798,898 (85,604,312 tons of anthracite coal, 394,759,112 of bituminous); petroleum, $120,106,749; natural gas, $54,222,399; iron ore, $131,996,147 (pig iron, $529,958,000); copper, refined, $173,799,300; gold, coinage value, $90,435,700; building-stone, $71,105,805; silver, commercial value, $37,299,700; lead, refined, $38,707,596; and zinc, refined, $26,401,910.

The North Atlantic and the North Central census groups of states (that is, the territory east of the Mississippi and north of the Ohio rivers, and north of Maryland) produced two-thirds of the total output. Pennsylvania, Ohio, Illinois, West Virginia, California, Colorado, Montana, Michigan, New York and Missouri were the ten states of greatest absolute production in 1907. The rank relative to area or population is of course different. Those which, according to the bureau of the census, produced $1000 or over per sq. m. in 1902 were Pennsylvania, Ohio and West Virginia; $500 to $1000, Illinois, Michigan, Indiana, Vermont and Massachusetts. Seventeen states produced from $100 to $500 per sq. m.

The total mineral output for the decade 1899–1908 according to the United States Geological Survey was as follows:—

Year.	Total Value of Products.	Value of Non-metallic Products.	Value of Metallic Products.
	$	$	$
1908	1,595,670,186	1,045,497,070	549,923,116
1907	2,071,607,964	1,167,705,720	903,802,244
1906	1,902,517,565	1,016,206,709	886,110,856
1905	1,623,928,720	921,075,619	702,453,101
1904	1,361,067,554	859,383,604	501,099,950
1903	1,491,928,980	793,962,609	624,318,008
1902	1,323,102,717	617,251,154	642,258,584
1901	1,141,972 309	567,318,592	518,266,259
1900	1,107,020,352	512,195,262	550,425,286
1899	1,014,355,705	446,090,251	525,472,981

The vastly greater part of mineral products are used in manufactures within the United States, and only an insignificant part (for example, 2·47 % in 1902) is exported in the crude form.

Coal.

Coal exists in the United States in large quantity in each of its important varieties: anthracite, or hard coal; bituminous, or soft coal; and lignite; and in various intermediate and special grades. Geologically the anthracite and bituminous coals mainly belong to the same formation, the Carboniferous, and this is especially true of the better qualities; though it is stated by the United States Geological Survey that the geologic age of the coal beds ranges from Carboniferous in the Appalachian and Mississippi Valley provinces to Miocene (Tertiary) on the Pacific coast, and that the quality of the coal varies only to a very uncertain degree with the geologic age. The following estimates rest upon the same authority: (1) total area underlaid by coal measures, 496,776 sq. m., of which 250,531 are credited to anthracite and bituminous, 97,636 to sub-bituminous and 148,609 to lignite; (2) total original coal supply of the country, 3,076,204,000,000 short tons, including 21,000,000,000 tons of anthracite in Pennsylvania, and small amounts elsewhere (semi-anthracite and semi-bituminous), 650,157,000,000 tons of sub-bituminous and 743,590,000,000 tons of lignite; (3) easily accessible coal still available, 1,992,979,000,000 tons; (4) available coal accessible with difficulty, 1,153,225,000,000 tons.

The total production of coal from 1814 (the year in which anthracite was first mined in Pennsylvania) to 1908 amounted to 7,280,940,265 tons, which represented an exhaustion—adding 50 % for waste in mining and preparation—of 11,870,049,900, or four-tenths of 1 % of the supposed original supply.

In 1820 the total production was only 3450 tons In 1850 it was already more than 7,000,000. And since then, while the population increased 230 % from 1850 to 1900, the production of coal increased 4,084 %. At the same time that the per capita consumption thus rose in 1907 to 5·6 tons, the waste was estimated by the National Conservation Commission at 3·0 tons per capita. This waste, however, is decreasing, the coal abandoned in the mine having averaged, in the beginning of mining, two or three times the amount taken out; and the chief part of the remaining waste is in imperfect combustion in furnaces and fire-boxes. Thus, notwithstanding the fact that the supposed supply still available at the close of 1908 was 7369 times the production of that year, and 4913 times the exhaustion such production represented, so extraordinary has been the increased consumption of the country that, in the opinion of the Geological Survey (1907), "if the rate of increase that has held for the last fifty years is maintained, the supply of easily available coal will be exhausted before the middle of the next century" (A.D. 2050).

In 1870 both Great Britain and Germany exceeded the United States in the production of coal. Germany was passed in 1871 (definitively in 1877); Great Britain in 1899. Since 1901 the United States has produced more than one-third of the world's output.

Coal was produced in 1908 in 30 states out of the 46 of the Union; and occurs also in enormous quantities in Alaska; 690,438 men were employed in this year in the coal mines. Pennsylvania (117,179,527 tons of bituminous and 83,268,754 of anthracite), Illinois (47,659,690), West Virginia (41,897,843), Ohio (26,270,639), Indiana (12,314,890) and Alabama (11,604,593) were the states of greatest production. The production of each was greater still in 1907.

The total output amounted to 415,842,692 short tons, valued at

$532,314,117 in 1908; and to 480,363,424 tons, valued at $614,798,898 in 1909. Pennsylvania produced three-fourths of the total output of the country in 1860, and since 1900 slightly less than one-half. Up to 1870 there was more anthracite mined in Pennsylvania than bituminous in the whole country, but since that year the production of the latter has become vastly the greater, the totals in 1907, in which year each stood at its maximum, being 83,268,754 and 332,573,944 tons respectively.

Inasmuch as the present production is not considered locally—and with more or less justice—as at all indicative of the wealth in coal of the respective states, it may be said that according to estimates of the Geological Survey the following states are credited with the deposits indicated of true bituminous coal, including local admixtures of anthracite, the figures being millions of short tons: Colorado, 296,272; Illinois, 240,000; West Virginia, 231,000; Utah, 196,408; Pennsylvania, 112,574; Kentucky, 104,028; Ohio, 86,028; Alabama, 68,903; Indiana, 44,169; Missouri, 40,000; New Mexico, 30,805; Tennessee, 25,665; Virginia, 21,600; Michigan, 12,000; Maryland, 8,044; Texas, 8,000; Kansas, 7,022; and Montana, 5,000; with lesser deposits in other states. At the same time there are estimated deposits of sub-bituminous coal, isolated or mixed with bituminous, amounting to 75,498 millions of tons in Colorado (which is probably the richest coal area of the country); and in other states as follows: Wyoming, 423,952 millions of tons; New Mexico, 132,975; Washington, 20,000; Montana, 18,560; California and Oregon, 1,000 each; and lesser amounts elsewhere. Finally, of true lignite beds, or of lignite mixed with sub-bituminous qualities, the states of North Dakota, Montana, Texas and South Dakota are credited with deposits of 500,000; 279,500; 23,000; and 10,000 millions of tons respectively. But it is to be remembered that the amount and the fuel value of both the lignite and, to a lesser degree, the sub-bituminous coals, is uncertain to a high degree.

Petroleum.

Petroleum, according to the report of the National Conservation Commission in 1908, was then the sixth largest contributor to the nation's mineral wealth, furnishing about one-sixteenth of the total. Oil was produced in 1908 in sixteen states. This productive area is divided by the United States Geological Survey into six "fields" (in addition to some scattering states) with reference to the quality of oil that they produce, such quality determining their uses. The Appalachian field (Pennsylvania, New York, Ohio, West Virginia and Tennessee) produces oil rich in paraffin, practically free from sulphur and asphalt, and yielding the largest percentage of gasoline and illuminating oils. This is the highest grade crude oil produced in the world. The California field produces oil characterized by much asphalt and little or no paraffin, and low in volatile constituents. The Lima (Ohio)-Indiana, the Illinois, the Mid-Continent (Kansas, Oklahoma and northern Texas) and the Gulf (Texas and Louisiana) fields produce oils containing more or less of sulphur and asphalt between the extremes of the two other fields just mentioned. The geological conditions of the different fields, and the details of the composition of the oils yielded, are exceedingly varied, and their study has been little more than begun

In 1859, when the total output of the country is supposed to have been only 2000 barrels of oil, production was confined to Pennsylvania and New York. Ohio, West Virginia and California appeared as producers in 1876, Kentucky and Tennessee in 1883, Colorado in 1887, Indiana in 1889, along with Illinois, Kansas, Texas and Missouri, Oklahoma in 1891, Wyoming in 1894, and, lastly, Louisiana in 1902. From 1859 to 1876 the Appalachian field yielded 100% of the total output of the country; in 1908 its share had fallen to 13·9%. In the same period of 50 years the yearly output rose from 2000 to 179,572,479 barrels (134,717,580 in 1905) and to a grand total of 1,986,180,942 barrels,[1] worth $1,784,583,943, or more than half the value of all the gold, and more than the commercial value of all the silver produced in the country since 1792. The production in 1908 exceeded in value the output of both metals. Deducing from the figures of production since 1859 an equation of increase, one finds that in each nine years as much oil has been produced as in all preceding years together, and in recent years the factor of increase has been higher. So rapid has been the extension of the yielding areas, so diverse the fate of many fields, so shifting their relative rank in output, that the outlook from year to year as regards all these elements is too uncertain to admit of definite statements respecting the relative importance of the five fields already mentioned. The total output of these, it may be stated, from 1901 to 1908—uniting the yield of the Illinois to the Lima-Indiana field (since their statistics were long so united, until their industrial differences became apparent), and adding a sixth division for the production of scattered areas of production—was as follows: Appalachian, 235,999,859; Lima-Indiana-Illinois, 219,609,347; Mid-Continent, 136,148,892; Gulf, 159,520,306; California, 27,931,687; and others, 3,367,666; the leading producers in 1907-1908 being the Mid-Continent and the California areas.

The world's output of oil was trebled between 1885 and 1895, and quadrupled between 1885 and 1900. In this increase the United States had the largest share. So recently as 1902 the output of the United States was little greater than that of Russia (the two yielding 91·4% of the world's product), but this advantage has since then been greatly increased, so that the one has produced 63·1 and the other 21·8% of the total output of the world. In 1908 the Geological Survey issued a preliminary map of the then known areas productive of oil and natural gas in the United States, estimating the extent of the former at 8850 and of the latter at 9365 sq. m. The supply of oil in this area was estimated at from 15,000,000,000 to 20,000,000,000 barrels; and the National Conservation Commission of 1908 expressed the opinion that in view of the rapid increase of production and the enormous loss through misuse the supply cannot be expected to last beyond the middle of this century.

Natural Gas.

Natural gas, as a source of light and for metallurgical purposes, became important in the mid-eighties. In recent years its use for industrial purposes has lessened, and for domestic purposes increased. The existence of outflows or springs of gas in the region west of the Alleghanies had long been known, and much gas was used for illuminating purposes in Fredonia, New York, as early as 1821. Such gas is a more or less general concomitant of oil all through the petroleum-bearing areas of the country. The total output of the country rose from a value of $215,000 in 1882 to one of $54,640,374 in 1908, with several fluctuations up and down in that interval. Pennsylvania, with a product valued at $155,620,395 from 1899 to 1908, West Virginia with $84,955,496, Ohio with $48,172,450 and Indiana with $46,141,553 were the greatest producers of the Union.

The National Conservation Commission in 1908 estimated the area of the known gas fields of the country at 9000 sq. m.; the portion of their yield in 1907 that was utilized at 400,000,000,000 cub. ft.; and the waste at an equal amount—more than 1,000,000,000 of cub. ft. daily, or enough to supply all the cities in the United States of above 100,000 population.

Of other non-metallic mineral substances, apart from coal, petroleum and natural gas, little need be said in detail. Stone is of the greatest actual importance, the value of the quarry output, including some prepared or manufactured product, such as dressed and crushed stone, averaging $65,152,312 annually in 1904–1908. Limestone is by far the largest element, and with granite makes up two-thirds of the total value. Vermont, Pennsylvania and New York are the leading producers. In this, as in other cases, actual product may indicate little regarding potential resources, and still less regarding the distribution of these throughout the Union. Glass and other sands and gravel ($13,270,032), lime ($11,091,186), phosphate rock ($10,653,558), salt ($7,553,632), natural mineral waters ($7,287,269), sulphur ($6,668,215, almost wholly from Louisiana), slate ($6,316,817), gypsum ($4,138,560), clay ($2,599,986), asphalt ($1,888,881), talc and soapstone ($1,401,222), borax ($975,000, all from California), and pyrite ($857,113) were the next most important products in 1908. It may be noted that the output in almost every item of mineral production was considerably greater in 1907 than in 1908, and the isolated figures of the latter year are of little interest apart from showing in a general way the relative commercial importance of the products named. In the yield of gypsum, phosphate rock and salt the United States leads the world. In sulphur it is a close second to Sicily. Phosphate rock is heavily exported, and in the opinion of the National Conservation Commission of 1908 the supply cannot long satisfy the increasing demand for export, which constitutes a waste of a precious natural resource. Other minerals whose production may be found stated in detail in the annual volume on *Mineral Resources* of the United States Geological Survey are: natural pigments, felspar, white mica, graphite, fluorspar, arsenic, quartz, barytes, bromine. Some dozens of varieties of precious stones occur widely. Of building-stone, clay, cement, lime, sand and salt, the country's supply was estimated by the National Conservation Commission of 1908 to be "ample."

Iron.

In 1907 iron ore was mined for blast-furnace use in twenty-nine states only, but the ore occurs in almost every state of the Union. As nearly as can be estimated from imperfect statistics, the total ore production of the country rose steadily from 2,873,400 long tons in 1860 to 51,720,619 tons in 1907. The United States became practically independent of foreign ore imports during the decade 1870 to 1879. The iron-producing area of the country may be divided, with regard to natural geographic, historic and trade considerations, into four districts: (1) the Lake Superior district, embracing the states of Minnesota, Michigan and Wisconsin; (2) the southern district, embracing the triangle tipped by Texas, Maryland and Georgia; (3) the northern district, embracing the triangle tipped by Ohio, New Jersey and Massachusetts, plus the states of Iowa and Missouri; (4) the western district, which includes the states of the Rocky Mountain region and Pacific coast. Of these districts the Lake Superior region—which embraces the Marquette range (opened in 1854), the Menominee (1872), the Gogebic (1884), the Vermilion (1884) and the Mesabi (1892)—first attracted exploration about 1844, when the copper deposits of the same region were opened, and produced from 1854 to 1908 a total of 410,239,551 long tons, of which 341,036,883 were mined in the period 1889–1908. From the Mesabi range alone, opened in 1892, no less than 168,143,661 long tons were taken up to 1908. The share of the whole district for some years past has been practically four-fifths of the total output of the country; and together with the yield of the southern district, more than 90%. Minnesota alone produces more than half of the same total, having multiplied her product since 1889 by more than 33 times. Michigan held first place in output until 1901. Alabama is the third great producer of the Union, and with the other two made up in 1907 more than four-fifths of the country's total. In 1907 the product of Minnesota (28,969,658 long tons) was greater than that of Germany (with Luxemburg), and nearly twice the production of Great Britain.

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[1] Barrels of 42 gallons.

Of the two classes of iron minerals used as ores of that metal, namely, oxides and carbonates, the latter furnish to-day an insignificant proportion of the country's product, although such ores were the basis of a considerable part of the early iron industry, and even so late as 1889 represented one-thirteenth of the total. Of the oxides, various forms of the brown ores in locations near to the Atlantic coast were the chief basis of the early iron industries. Magnetites were also early employed, at first in Catalan forges, in which by means of a direct process the metal was secured from the ores and forged into blooms without being cast; later they were smelted in blast furnaces. But in the recent and great development of the iron industry the red haematite ores have been overwhelmingly predominant. From 1889 to 1907 the average yearly percentages of the red haematite, brown ores, magnetite and carbonate in the total ore production were respectively 82·4, 10·1, 7·1 and 0·4. In the census of 1870 the share of the three varieties appeared almost equal; in 1899 that of the red ores had risen to near two-thirds of the total. The red and brown ores are widely distributed, every state in the Union in 1907, save Ohio and North Carolina, producing one or both. Magnetite production was confined to mountain regions in the east and west, and only in Ohio were carbonates mined.

An investigation was made in 1908 for the National Conservation Commission of the ore reserves of the country. This report was made by Dr. C. W. Hayes of the Geological Survey. With the reservations that only in the case of certain red haematite bedded deposits can any estimate be made of relative accuracy, say within 10%; that the concentration deposits of brown ore can be estimated only with an accuracy represented by a factor varying between 0·7 and 3; and that the great Lake Superior and the less known Adirondack deposits can be estimated within 15 to 20%, the total supply of the country was estimated at 79,594,220,000 long tons—73,210,415,000 of which were credited to haematite ores and 5,054,675,000 to magnetite. Almost 95% is believed to lie about Lake Superior.

The output of pig iron and steel in 1907 was 25,781,361 and 23,362,594 long tons respectively. It is believed that the first steel made in the United States was made in Connecticut in 1728. Crucible steel was first successfully produced in 1832, Bessemer and open-hearth in 1864. Pennsylvania, Ohio, Illinois, Alabama and New York are the leading states in production.

Gold and Silver.

The washing of the high or Tertiary gravels by the hydraulic process and the working of mines in the solid rock did not, on the whole, compensate for the diminished yield of the ordinary placer and river diggings, so that the product of gold in California continued to fall off, and by 1860 had decreased to about half what it had been ten years before. Discoveries in other Cordilleran territories, notably in Montana and Idaho, made up, however, in part for the deficiency of California, so that in 1860 the total amount of gold produced in the United States was estimated at not less than $45,000,000. In the latter part of the decade 1850–1859 the territories adjacent to California on the east, north and south were overrun by thousands of miners from the Sierra Nevada goldfields, and within a few years an extraordinary number of discoveries were made, some of which proved to be of great importance. The most powerful impulse to mining operations, and the immediate cause of a somewhat lengthy period of wild excitement and speculation, was the discovery and successful opening of the Comstock lode in 1859, in the western part of what is now Nevada, but was then part of Utah. About this lode grew up Virginia City. From 1859 to 1902 the total yield of this lode was $204,653,040 in silver and $148,145,385 in gold; the average annual yield from 1862 to 1868 was above eleven millions; the maximum yield $36,301,537 in 1877; and the total product to July 1880 was variously estimated at from $304,752,171·54 to $306,181,251·25. The lode was an ore channel of great dimensions included within volcanic rocks of Tertiary age, themselves broken through pre-existing strata of Triassic age, and exhibited some of the features of a fissure vein, combined in part with those of a contact deposit and in part with those of a segregated vein. The gangue was quartz, very irregularly distributed in bodies often of great sizes, for the most part nearly or quite barren of ore. The metalliferous portion of the lode was similarly distributed in great masses, known as "bonanzas." The next most famous lode is that of Leadville, Colorado, which from 1879 to 1889 yielded $147,834,186, chiefly in silver and lead. In later years the Cripple Creek district of Colorado became specially prominent.

The total output of gold and silver in the United States according to the tables published by the Director of the Mint has been as follows:—

Years.	Gold.		Silver.	
	Quantity in Fine Ounces.	Value.	Quantity in Fine Ounces.	Commercial Value.
		$		$
1792-1847	1,187,170	24,537,000	309,500	404,500
1848-1872	58,279,778	1,204,750,000	118,568,200	157,749,900
1873-1908	88,833,231	1,836,344,000	1,664,271,300	1,379,892,200
	148,300,179	$3,065,631,000	1,783,149,000	$1,538,046,600

Colorado ($22,871,000), Alaska ($19,858,800), California ($19,329,700), Nevada ($11,689,400), South Dakota ($7,742,200), Utah ($3,946,700), Montana ($3,160,000) and Arizona ($2,500,000) were the leading producers in 1908, in which year the totals for the two metals were $94,560,000 for gold and $28,050,600 for silver.

The grade of precious ores handled has generally and greatly decreased in recent years—according to the census data of 1880 and 1902, disregarding all base metallic contents—from an average commerical value of $29·07 to one of $8·29; nevertheless the product of gold and silver has greatly increased. This is due to improvements in mining methods and reduction processes, which have made profitable low-grade ores that were not commercially available in 1880.

Copper.

Copper was produced in 1908 in twenty-four states of the Union. Their output was almost seventeenfold the quantity reported by the census of 1860. The quantity produced from 1845—the year in which the Lake Superior district became a producer, and in which the total product was only 224,000 ℔—up to 1908 was 13,106,205,634 ℔. The increases from 1845 to 1850, in each decennial period thereafter, and from 1901 to 1908, were as follows, in percentages: 50·0, 27·0, 6·1, 7·2, 14·8, 9·1 and 5·8. The total product passed 10,000,000 ℔ in 1857, 20,000,000 ℔ in 1867, 30,000,000 ℔ in 1873, 40,000,000 ℔ in 1875, 50,000,000 ℔ in 1879 and 100,000,000 ℔ in 1883. Comparing the product of the United States with that of the world, the figures for the two respectively were 23,350 and 151,936 long tons in 1879, when the United States was second to both Spain (and Portugal) and Chile as a producer; 51,570 and 199,406 long tons in 1883, when the Unites States first took leading rank; 172,300 and 334,565 long tons in 1895, when the yield of the United States first exceeded that of all other parts of the world combined; and 942,570,000 and 1,667,098,000 ℔ in 1908.

The three leading producing states or Territories of the Union are, and since the early 'eighties have been, Arizona, Montana and Michigan. With Utah and California their yield in 1908 was 93% of the total. During the decade ending with that year the average yearly output of the three first-named was 197,706,968 ℔, 267,172,951 ℔ and 192,187,488 ℔ respectively.

Lead.

The production of lead was for many years limited, as already mentioned, to two districts near the Mississippi: one the so-called Upper Mines of Wisconsin, Iowa and Illinois; the other the Lower Mines of south-eastern Missouri. The national government, after reserving the mineral lands (1807) and attempting to lease them, concluded in 1847 to sell them, owing to the difficulty of preventing illegal entry and collecting royalties. The yield of the Upper Mines culminated about 1845, and long ago became insignificant. The greatest lead district is in south-western Missouri and south-eastern Kansas, known as the Joplin-Galena district after the names of the two cities that are its centre. The United States is the greatest lead producer and consumer in the world, its percentage of the total output and consumption averaging 30·4% and 32·5% respectively in the years 1904–1908. Since 1825 the total product of lead refined from domestic ores and domestic base bullion was, up to the close of 1908, 7,091,548 short tons. An annual yield of 100,000 tons was first passed in 1881; of 200,000, in 1891; of 300,000, in 1898. The total refined domestic product in 1907 was 337,340, and the total domestic lead smelted was 365,166 tons. Of the smelter domestic product 235,559 tons were of desilverized lead and 129,607 of soft lead. Considerable quantities of foreign ores and base bullion are also refined in the United States. The average percentage of metallic recovery from lead ores was about 68%, in 1880, and again in 1902, according to the national censuses of these years. According to the bureau of the census the value in 1902 of the lead yielded by copper, by non-argentiferous lead and zinc, and by gold and silver ores respectively was $19,053, $5,850,721 and $12,311,239. This reflects the revolutionary change in the history of lead mining since the first discovery of argentiferous lead ores in the Rocky Mountain states in 1864, which became available only after the building of railways. Until the completion of the Union Pacific in 1869 there was no smelting of such ores except for their silver contents. The deposits in the Joplin-Galena district were discovered in 1848, but attracted little attention for three decades. Of the soft lead smelted in 1907 no less than 94·8% came from Missouri. Idaho, Utah and Colorado produce together almost as great a proportion of the desilverized lead, half of which has come in recent years from Idaho.

Spelter production began in the United States in 1858 in an experimental way, and regular production in 1860. The census of

Zinc.

the latter year reported an output of product valued at $72,600. According to the census data for 1889 and 1902 there was an increase in value of product of 184·1 % in the interval, and of 109·5 % in the quantity of ore produced. The value of products in 1902 were reported as $340,686 from gold and silver ores, and $8,665,675 from non-argentiferous lead and zinc ores. The total product of zinc from domestic ore for the entire country was 7343 short tons in 1873, passed 100,000 tons in 1898, and 200,000 in 1907, when it amounted to 223,745 tons. From 1904 to 1908 the share of the United States in the world's output averaged 28·2 %, and in the world's consumption (disregarding stocks) 27·5 %. Of the product of 1907 above stated no less than 63·4 % came from Missouri alone; Colorado, Wisconsin, Kansas and New Jersey yielding together 30·8 % more.

Mercury.

Most of the quicksilver produced in the United States comes from California (86 % of the total in 1908), but a considerable quantity comes from Texas, and small amounts are produced in Utah, Arizona and Oregon. Veins of cinnabar are known elsewhere in the Rocky Mountain and Sierra Nevada regions but not in workable quantities. The mercurial ores of the Pacific Coast ranges occur in very irregular deposits in the form of strings and bunches, disseminated through a highly metamorphosed siliceous rock. The first locality where the metal was successfully mined was at New Almaden, about 100 m. south of San Francisco. These mines have been productive since 1824. Another old mine, discovered in 1853, is the New Idria located another 100 m. farther south. These two are still among the foremost producers.

From 1850 to 1908 California produced a total of 2,052,000 flasks of metal, of 76·5 ℔ (since June 1, 1904, 75·0 ℔ net) each. The year of greatest yield was 1877, with 79,395 flasks. The production had steadily fallen to 16,984 flasks in 1908, but in the opinion of the United States Geological Survey this reduction is mainly attributable, in recent years at least, to market conditions, and does not truly indicate the exhaustion of the mines, although the ores now available are of low grades, those of New Almaden having shown a decrease in yield from 36·7 % in 1850–1851 to 0·74 % in 1895–1896, so that only the greatest metallurgical skill and business economy can sustain the mines against a weak market.

Other Metals.

Bauxite was produced on a commercial scale in four states in 1908: Alabama, Arkansas, Georgia and Tennessee; Arkansas producing—as for years past—more than six-tenths of the total product of the country. This rose from an insignificant amount in 1889 to 97,776 long tons (valued at $480,330) in 1907. The consumption of the United States is, however, much larger than its product, and is rapidly growing. The production of aluminium rose from 83 ℔ in 1883 to 7,500,000 ℔ in 1903, and a consumption (the Geological Survey not reporting the production) of 17,211,000 ℔ in 1907. Antimony, bismuth, selenium, tellurium, chromic iron ore, tin, nickel, cobalt, vanadium, titanium, molybdenum, uranium and tantalum are produced in the United States in small amounts, but such "production" in several cases has amounted to only slight discoveries, and in general they are of little importance in the market. Of tungsten the United States was in 1907 the greatest producer in the world (1640 tons in a total of 6062). Tin ores have been widely discovered, but though much has been hoped for from them, particularly from the deposits in the Black Hills region of South Dakota, there has been no more than a relatively insignificant commercial production.

Commerce, Foreign and Domestic.—The English colonies that became the United States carried on during the colonial period a commerce with the mother country, and also, both so far as the legislative trammels of the British colonial system permitted it and illicitly, a fairly active commerce with the West Indies. This latter became of increasing moment in the successive periods of European colonial wars of the 18th century. With the achievement of independence by the United States the same interest became of still greater importance to the new nation, so as to constitute a leading element in its early diplomacy. Although relatively unsuccessful in securing access to the British islands, the importance of the United States as a supplier of the other West Indies continually grew, and when the communication of the French and Spanish islands with their metropolises was practically cut off by the British during the Napoleonic wars, the dependence of these colonies upon the American carrying trade became absolute. It was the profits of this neutral trade, notwithstanding the losses to which it was exposed by the high-handed measures of the British and the French governments, that caused these insults to be more or less patiently endured by the trading interests. When President Jefferson, and after him President Madison, attempted to secure redress for these injuries by the imposition of an embargo on American vessels, the West Indian trade was temporarily ruined, the war of 1812–15 with Great Britain contributing to the same end. The East Indian trade had been opened from New England ports late in the 18th century. The whaling and cod and mackerel fisheries were of earlier colonial origin. As general carriers American ships gained no importance until the Napoleonic wars; and this interest was greater in the West Indies than in Europe. Such were the main branches of national commerce up to the time of the second war with England. After the war of 1812 new outlets were found in all directions, and the commerce of the country grew apace, until in the years immediately preceding the Civil War the United States was a close second to Great Britain among the trading countries of the world. The Civil War caused enormous losses to the merchant marine, and the world-wide substitution about this time of iron steamers for wooden steamers and sailing vessels contributed to prevent a recovery; because, although ship-building was one of the earliest arts developed in the colonies, and one that was prosecuted with the highest success so long as wooden ships were the dominant type, the United States has never achieved marked success with the iron steamer, and the law has precluded the registry as American of vessels built abroad. The American "clipper" ships that were constructed at Baltimore and elsewhere during the last three decades before the Civil War were doubtless the swiftest sailers that have ever been built.

The total trade of the country by land and sea, the movement inward and outward, is shown in the following table for various years since 1861:—

Year.	Imports by Land and Sea.	Exports by Land and Sea.	Total Commerce.
	$	$	$
1861	335,650,153	249,344,913	584,995,066
1870	462,377,587	529,519,302	991,896,889
1880	667,954,746	835,638,658	1,503,593,404
1890	789,310,409	857,828,684	1,647,139,093
1900	849,941,184	1,394,483,082	2,244,424,266
1905	1,117,513,071	1,518,561,666	2,636,074,737
1909	1,475,612,580	1,728,203,271	3,203,815,851

The excess of exports over imports in the decade 1899–1908 totalled $5,728,214,844; and in the same period there was an excess of exports of gold and silver, above imports, of $444,908,963. Of the total exports of 1909 $1,700,743,638 represented domestic merchandise. The remainder, or element of foreign exports, has been of similarly small relative magnitude since about 1880, but was of course much larger while the carrying trade was of importance. From 1820 up to 1880 agricultural products made up with remarkable steadiness almost exactly four-fifths of all exports of domestic merchandise. Since then the increase of manufactures, and to a slight degree that of minerals, has lessened much the share of agricultural products, which in 1906 was 56·43 %, that of manufactures being 35·11 % and of minerals 3·09 %. The following table indicates in a general way the increased value, in round millions of dollars, of the leading agricultural exports since 1860:—

Year.	Raw Cotton.	Bread Stuffs.	Leaf Tobacco.	Meats and Dairy Products.	Cattle, and other Animals.
1860	192·0	24·0	16·0	16·9	1·8
1900	242·9	262·7	29·4	184·5	43·6
1905	381·4	107·7	29·8	200·0	46·7
1909	461·9	139·5	36·8	152·0	20·8

Classifying imports and domestic exports as of six groups: (1) crude foodstuffs and good animals; (2) foodstuffs partly or wholly prepared; (3) raw materials for use in manufacturing; (4) manufactured articles destined to serve as materials in further processes of manufacture; (5) finished manufactures; (6) miscellaneous products—the table on p. 645 shows the distribution of imports and exports among these six classes since 1820.[1]

It will be seen from the table that the share of the first two classes in both imports and exports has been relatively constant. On the other hand the great increase of imports of class III., and the great decrease of class V.; and of exports the great increase of those of class IV., and decrease of those of classes III. and V., all reflect the great development of manufactures in modern times. The table also shows the great rapidity of this change in recent years.

Europe takes, of course, a large share of the exports of finished manufactures—a little more than a third of the total in the quinquennial period 1903–1908; but North America takes but very slightly less. On the other hand, above 70 % of manufactures destined to serve as material in further processes of manufacture went, in the same years, to Europe, and from eight- to nine-tenths of the first three classes of exports. After Europe the largest shares of exports are taken by North America, Asia and Oceania, South America and Africa in order. The share of the five continental divisions in 1909 was as follows, respectively: $1,169,672,326; $344,767,613; $113,129,907; $83,509,047 and $17,124,298. The respective shares of the same divisions in the imports of the country were as follows: $763,704,486; $277,863,210; $223,254,724; $193,202,131 and $17,558,029. It will be seen that the commercial

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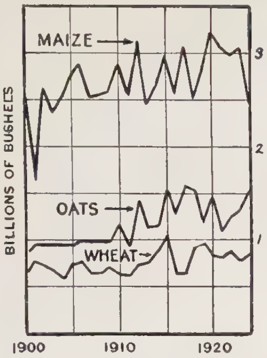
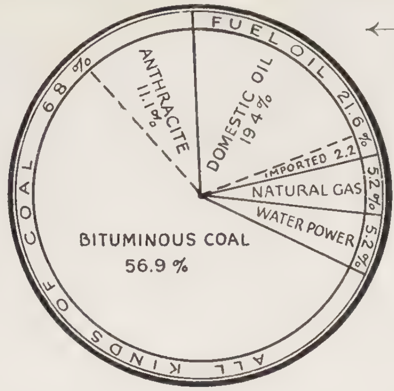
[1] The official statistics are kept current since 1820. For the years 1789–1818 consult Adam Seybert's *Statistical Annals* (Philadelphia, 1818), which are based upon official documents, a large part of which are no longer in existence.

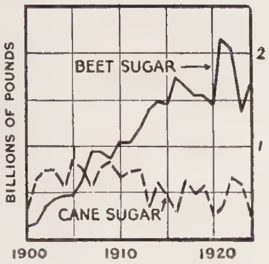
UNITED STATES (Production)

PLATE II.

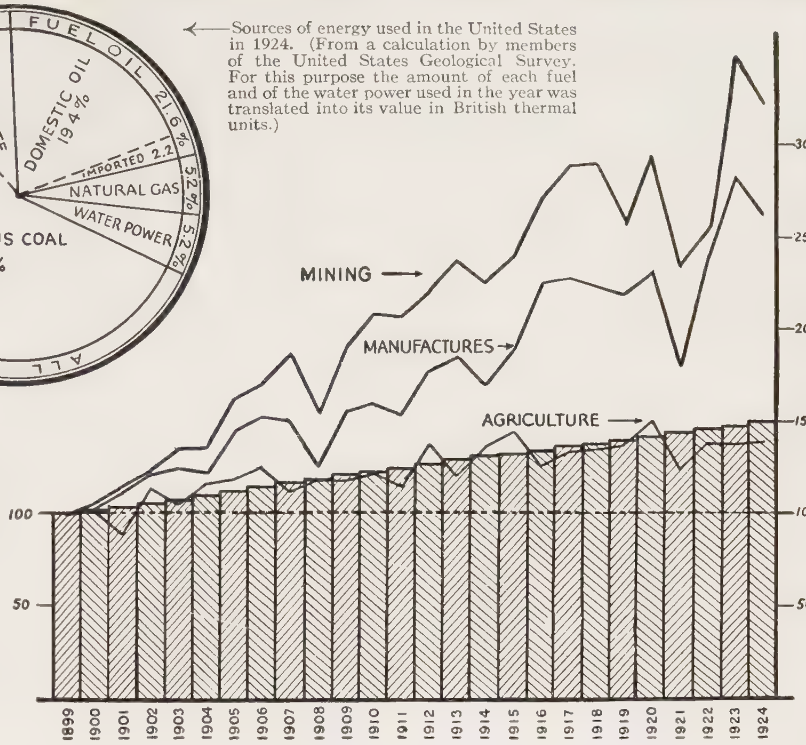


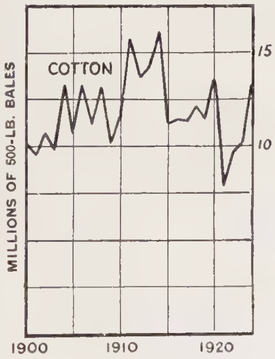


Sources of energy used in the United States in 1924. (From a calculation by members of the United States Geological Survey. For this purpose the amount of each fuel and of the water power used in the year was translated into its value in British thermal units.)

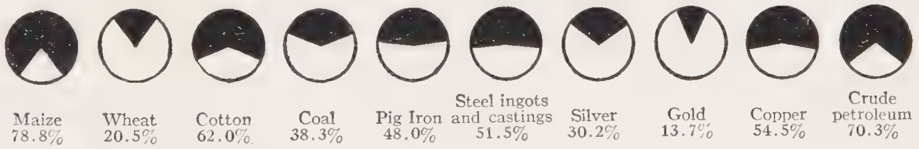


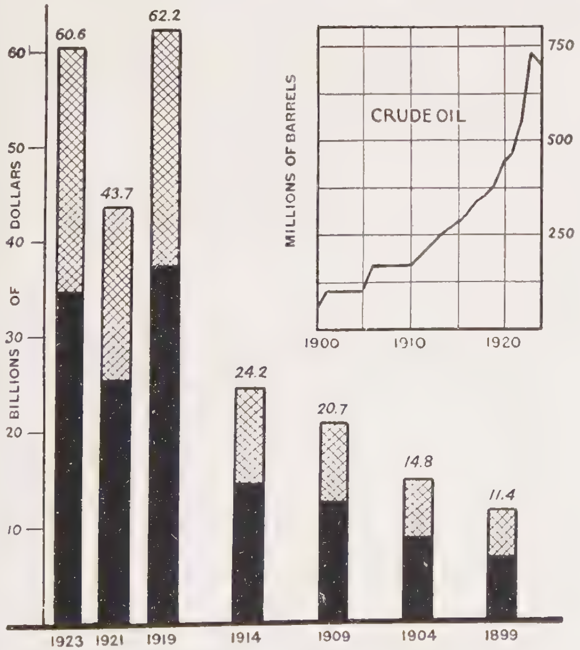
Physical volume of production, in agriculture, mining and manufacture, in the twentieth century: index numbers (with amount for 1899=100) for agriculture (representing 12 important crops); for manufacture (34 branches); and for mining (19 minerals); and, as background, for population, represented by the shaded columns. (Devised by Professor E. E. Day, of Harvard University.)





Of the total world production of the following commodities in 1923 or 1924 (according to availability of statistics) the United States produced portion shown by the black sector of the circle.



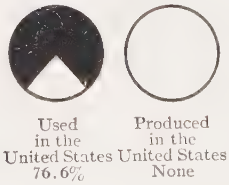


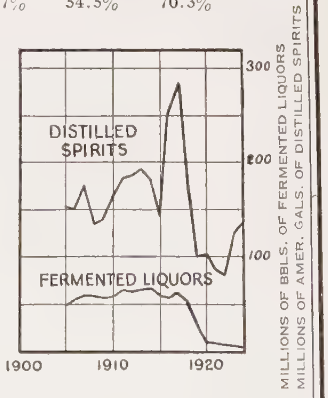
Manufacturing industries: value of factory product at each census of manufactures from 1899–1923, divided to show cost of materials used (at bottom of column) and value added by manufacture (at top). In 1921 and 1923 the census omitted establishments with a product valued at less than $5,000; before 1921, only those whose product was less than $500; but the difference in the aggregate value due to this change was negligible.

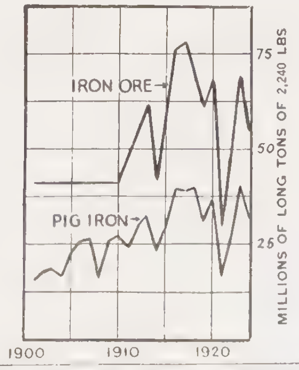
OF THE WORLD'S PRODUCTION OF

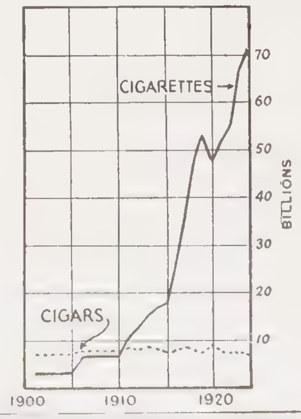
RUBBER

IN 1924









Years.	All Imports. Percentages by Classes.						Exports of Domestic Merchandise. Percentages by Classes.					
	I.	II.	III.	IV.	V.	VI.	I.	II.	III.	IV.	V.	VI.
1820	11·15	19·85	3·64	7·48	56·86	1·02	4·79	19·51	60·46	9·42	5·66	0·16
1830	11·77	15·39	6·72	8·22	56·97	0·93	4·65	16·32	62·34	7·04	9·34	0·31
1840	15·54	15·46	11·71	11·56	45·09	0·64	4·09	14·27	67·61	4·34	9·47	0·22
1850	10·38	12·37	6·75	15·08	54·93	0·49	5·59	14·84	62·26	4·49	12·72	0·10
1860	10·11	15·26	10·48	6·67	56·52	1·00	3·85	12·21	68·31	3·99	11·33	0·31
1870	12·38	22·08	12·18	12·51	39·69	1·16	11·12	13·53	56·64	3·66	14·96	0·09
1880	15·01	17·69	19·74	16·59	29·43	1·54	32·30	23·47	28·98	3·52	11·26	0·47
1890	16·28	16·89	21·62	14·81	29·23	1·17	15·62	26·59	36·03	5·50	15·68	0·58
1900	11·52	15·65	32·50	15·79	23·90	0·64	16·59	23·21	23·75	11·15	24·22	1·08
1908	12·19	12·31	30·43	16·43	27·77	0·87	10·30	18·10	30·34	14·23	26·68	0·35
1909	11·67	10·99	35·89	17·48	23·24	0·73	6·75	16·76	33·62	14·89	27·52	0·46

interests in South America are relatively small. The shares of the ten nations having the largest part in the trade of the country were as follows in 1909:—

	Imports from	Exports to
	$	$
Great Britain	247,474,104	521,281,999
Germany	161,951,673	247,310,084
Canada, Newfoundland and Labrador	88,321,706	191,438,400
France	132,069,748	126,361,959
Cuba	107,334,716	48,217,689
Brazil	117,062,725	19,765,836
Holland	30,905,712	89,121,124
Mexico	52,578,454	53,512,947
Japan	68,116,665	23,471,837
Belgium	36,236,568	44,477,380

The leading imports in 1909 were as follows, indicating in each case, when not evidently unnecessary, the value of finished manufactures and of unmanufactured materials: Silk (manufactured, $32,963,162; unmanufactured, $75,512,401); hides and skins, other than fur skins ($103,758,277); sugar and molasses ($91,535,466); fibres, vegetables and textile grasses (manufactured, $33,511,696; unmanufactured, $54,860,698); coffee ($86,524,006); chemicals ($86,401,432); cotton (manufactured, $68,380,780; raw and waste, $15,421,854); rubber (manufactured, $1,462,541, unmanufactured, $83,682,013); wool (manufactured, $22,058,712; unmanufactured, $55,530,366); and wood (manufactured, $43,620,591; unmanufactured, $13,584,172). Precious stones ($43,620,591); fruits and nuts; copper, iron and steel; tobacco (leaf $25,897,650; manufactured, $4,138,521); tin; spirits, wines and liquors; oils, paper, works of art, tea and leather ($16,270,406), being the remaining items in excess of $15,000,000 each. The leading exports of domestic merchandise in excess of the same value were the following: cotton ($496,334,448); iron and steel, excluding ores ($157,680,331); meat and dairy products ($151,964,037); petroleum, vegetable and animal oils ($126,350,916); wheat and wheat flour ($100,529,381); copper, excluding ores ($92,584,640); wood ($72,312,880); leather ($47,146,415); tobacco ($41,554,058); coal ($38,441,518); agricultural implements ($27,327,428); corn and corn meal ($27,062,128); animals ($21,007,122); chemicals ($20,330,335); oil-cake ($20,245,818); fruits and nuts ($18,707,670); vehicles ($16,774,036); naval stores ($16,103,076); and paper ($15,280,541).

New York, New Orleans, Boston, Galveston, Philadelphia, Baltimore, San Francisco and Puget Sound are, in order, the leading customs districts of the country in the value of their imports and exports. Almost one-half of the country's foreign trade is done through the single port of New York. In 1909 more than eight-tenths of all imports of the country entered by, and more than seven-tenths of all exports went out through, the eight customs districts just named. Savannah and Charleston are other great ports and southern outlets, particularly for cotton.

Of the imports and exports of 1861 two-thirds (in value) were carried in American vessels. By 1864 the proportion had fallen to 27·5%, and except for a temporary slight recovery after the close of the war there has been a steady progress downward since that time, until in 1908 only 9·8% of the commerce of the country was carried on under its own flag. More than half the shipping entering and leaving the ports of the United States in 1908 was British; Germany, the Scandinavian countries, France, Holland and Italy ranking next in order; the United States, although ranking after Great Britain, contributed less than a seventh of the total. The total tonnage entered was 38,539,195 net tons (of 100 cub. ft. each), as compared with 18,010,649 tons in 1880.

Of the total of tonnage entered in 1909, 30,443,695 tons represented seaport entries, the remainder entering across the land frontiers.

The merchant marine of the United States in 1900 totalled 5,164,839 net tons, which was less than that of 1860 (5,353,808), in which year American shipping attained an amount which only in recent years has been again reached. In the decline that followed the Civil War an apparent minimum was reached of 4,068,034 tons in 1880; but this does not adequately indicate the depression of the shipping interest, inasmuch as the aggregate was kept up by the tonnage of vessels engaged in the coasting trade and commerce of the inland waters, from which foreign shipping is by law excluded. The decline of tonnage engaged in ocean traffic was from 2,546,237 net tons in 1860 to 1,352,810 in 1880; and this decline continued in later years. On the other hand the aggregate tonnage of the country has again begun to rise, and in 1908 the total was 7,365,445 net tons, a third of this being on the Great Lakes, and somewhat under one-half on the Gulf and Atlantic coasts. Of the same total 6,371,865 tons represented the coasting trade, only 930,413 tons being engaged in the foreign trade of the country. New England still supplies a quarter of the shipping annually built along the entire seaboard of the country; but more is yearly built upon the Great Lakes than upon the seaboard.

Internal Commerce: Railways and Canals.—Large as has become the foreign commerce of the country, it is small beside the aggregate interior commerce between the states of the Union. The basis of this is necessarily facilities for transportation. At the end of 1908 the railway lines[1] of the country totalled 232,046 m.—more than those of all Europe. The traffic on these, measured in units moved one mile, was 28,797,781,231 passenger-miles, and 214,340,129,523 freight miles. Various systems, with joint or separate outlets from the Pacific coast to the Mississippi Valley, provide for the handling of transcontinental freight. Rivers and canals are relatively much less important to-day than in the middle decades of the 19th century, before the growth of the railway traffic made small by comparison the movement on the interior watercourses. According to a special report of the department of commerce and labour of 1906, 290 streams are used to a " substantial degree " for navigation, affording together an aggregate of 2600 m. of 10 ft. navigation, or 5800 m. of 6 ft. navigation at ordinary water. Of the last almost half belongs to the Mississippi river. More than $250,000,000 has been spent by the national government for the improvement of waterways, yet no general system exists, and a large part of this enormous sum has been wasted on unimportant or impossible projects, especially in recent decades, since the river navigation has been a declining interest. 1360 m. of state-owned canals and 632 m. of private canals of " some importance " were also reported as in operation in 1909. More than an equal length of canal ways (2444 m., costing $80,000,000) was reported as having been abandoned after construction. Of recent years there has been a great revival of interest in the improvement of inland waterways upon systematic plans, which promises better than an earlier period of "internal improvements" in the first half of the 19th century, the results of which were more or less disastrous for the state and local governments that undertook them, and only less so for the national government. The Erie Canal in New York, the Chesapeake & Delaware Canal, and the Sault Ste Marie Canal are the most important in the country.

Coal, iron ore, building materials, lumber, livestock, cotton, fruits, vegetables, tobacco and grain are the great items in the domestic commerce of the country, upon its railways, inland waterways, and in the coasting trade. The magnitude of these items is so great as to defy exact determination; data for the formation of some idea of them can be found in the account of the mineral, forest and agricultural resources of the country. It was estimated by the Bureau of the Census that in 1906 the tonnage of freight moved by American vessels within American waters, excluding harbour traffic, was 177,519,758 short tons (as compared with 1,514,906,985 long tons handled by the railways of the country). Of this total 42·6% was moved on the Great Lakes, and 36·8% on the Atlantic and Gulf coasts and waterways.

The Great Lakes are connected by canals with the Atlantic, the St Lawrence river and the Mississippi; the connexion with the first being through the Erie Canal, a 7-ft. waterway, and that with the St Lawrence through Canadian canals that afford a 14-ft. navigation. The connexion with the Mississippi is through the drainage-canal of Chicago, and thence into branches of the Mississippi affording as yet even less water than the Atlantic outlet. The commerce on the lakes is largely in grain, coal, iron and lumber. The tonnage of vessels cleared between American ports on the lakes in 1908 was 103,271,885 net tons; the freight they carried came to 80,974,605 long tons. Vessels aggregating 46,751,717 net tons, carrying 57,895,149 tons of freight, valued at $470,141,318, passed through the Sault Ste Marie Canal and 47,621,078 tons of freight were moved through the Detroit river in the same year. In these figures no account is taken of the trade of the Canadian ports on the lakes. Compared with this volume of traffic the movement through the Suez Canal is small.

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[1] See further RAILWAY.

It has been estimated by O. P. Austin, chief of the national bureau of statistics, using data of 1903, that the internal commerce of the United States exceeds in magnitude the total international commerce of the world. (F. S. P.)

VII.—Constitution and Government

I.—*Introductory.*

§ 1. A description of the government of the United States falls naturally into three parts:—

First, an account of the states and their governments.

Second, an account of the Federal system, including the relation of the states as communities to the Federation as representing the whole nation.

Third, an account of the structure and organization of the Federal government considered as the general government of the nation.

As the states are older than the Federal government, and as the latter was, indeed, in many respects modelled upon the scheme of government which already existed in the thirteen original states, it may be convenient to begin with the states and then to proceed to the national government, whose structure is more intricate and will require a fuller explanation.

Before entering, however, on a description of the state governments, one feature must be noticed which is common both to the states and to the Federation, and gives to the governmental system of both a peculiar character, different from that of the government of Great Britain. This feature is the existence of a supreme instrument of government, a document, enacted by the people, which controls, and cannot be altered by, any or all of the ordinary organs of government. In Great Britain parliament is the supreme power, and can change any of the laws of the country at any moment. In the American Union, and in every state of the Union, there exists a documentary or rigid constitution, creating and defining the powers of every authority in the government. It is the expression of the ultimate sovereignty of the people, and its existence gives to the working both of the Federal government and of the several state governments, a certain fixity and uniformity which the European, and especially the British, reader must constantly bear in mind, because under such a constitution every legislative body enjoys far scantier powers than in the United Kingdom and most European countries.

II.—*The State Governments.*

Origin of the American State.

§ 2. The state is the oldest political institution in America, and is still the basis and the indestructible unit of the American system. It is the outgrowth from, or rather the continuation of, the colony, as the latter existed before the Declaration of Independence in 1776. In every one of the North American colonies there was in operation at that date a system of self-government, in seven colonies under a charter from the Crown. In each there was a governor, with minor executive officers, a legislature, and a judiciary; and although the Crown retained the power of altering the charter, and the British parliament could (in strict legal view) legislate over the head of the colonial legislature so as to abrogate statutes passed by the latter, still in practice each colony was allowed to manage its own affairs and to enact the laws it desired. Thus the people were well accustomed to work their institutions, and when they gained their independence continued to maintain those institutions with comparatively little change. In two colonies, Rhode Island and Connecticut, the colonial charter was substantially maintained as the constitution of the state for many years, in the former case till 1842, in the latter till 1818.

Rights and Powers of a State.

§ 3. Each state was under the Confederation of 1781 sovereign (except as regarded foreign relations), and for most purposes practically independent. In adopting the Federal Constitution of 1787–1789, each parted with some of the attributes of sovereignty, while retaining others. Those which were retained have been to some extent diminished by the 14th and 15th amendments to the Constitution, and if the right to secede from the Union ever existed (a point much controverted), it was finally negatived by the Civil War of 1861–65. Otherwise, however, these attributes survive. The powers of a state are inherent, not delegated, and each retains all such rights and functions of an independent government as it has not, by entering the Union, affirmatively divested itself of in favour of the Federal government. Each has its own documentary constitution; its legislature of two elective houses; its executive, consisting of a governor and other officials; its judiciary, whose decisions are final, except in cases involving Federal law; its system of local government and local taxation; its revenue, system of taxation, and debts; its body of private civil and criminal law and procedure; its rules of citizenship, which may admit persons to be voters in state and national elections under conditions differing from those prevailing in other states.

The rights and functions of a state practically cover the field in which lie most of the relations of private citizens to one another and to the authorities with which they come into contact in daily life. An American may through a long life never be reminded of the Federal government, except when he votes at Federal elections (once in every two years), lodges a complaint against the post office, or is required to pay duties of customs or excise. His direct taxes are paid to officials acting under state laws. The state (or a local authority created by the state) registers his birth, appoints his guardian, provides schools for him and pays for them, allots him a share in the property of a parent dying intestate, licences him when he enters a trade (if the trade needs a licence), marries him, divorces him, entertains civil actions against him, tries and executes him for murder. The police that guard his house, the local boards which care for the poor, control highways, provide water, all derive their powers from the state. Nevertheless the state is (as will be explained later) a slightly declining factor in the public life of the nation, because public interest tends more and more to centre in the Federal or national government.

State Constitutions.

§ 4. The constitution of each state is framed and enacted by the state itself, without any Federal interference, save that the Federal Constitution requires that the Constitution under which a new state seeks admission to the Union must be "republican"; and under this requirement, Congress has seemed to assume a right of making the adoption, or omission, of any particular provision in a state constitution a condition of the admission of that particular state. Even in these cases, however, the constitution derives its force not from the national government, but from the people of the state. The invariable method of forming a constitution is for the citizens to elect by special popular vote a body called a convention to draft the document, which, when drafted and circulated, is usually, though not quite invariably, submitted to popular vote. This is done either when a state is to be formed out of a Territory (as to which see *post*, § 10), or when an existing state desires to give itself a new constitution.[1]

A state constitution usually consists of the following parts:—

A description of the state boundaries (now frequently omitted);

A bill of rights, defining the so-called "primordial rights" of the citizens to security of life, liberty and property;

A declaration and enactment of the frame of state government, *i.e.* the names, functions and powers of the houses of the legislature, the chief executive officials, and the courts of justice, with provisions regulating the electoral franchise;

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[1] Details as to state constitutions will be found in J. Bryce, *American Commonwealth*, chs. xxxvii.–xxxix., which is referred to here and subsequently as containing a fuller treatment of all the topics dealt with in this article. Further details may be found also in the articles on the separate states.

Provisions creating, or directing the creation of, a system of local government for cities and rural areas;

Miscellaneous provisions relating to law and administration, including the militia, revenue and taxation, state prisons and hospitals, agriculture, banking and other corporations, railways, labour questions;

Provisions for the amendment of the constitution;

A schedule prescribing the method of submitting the draft constitution to the vote of the people, with temporary provisions regulating the mode of transition from the old constitutional arrangements to the new ones.

The method of amending the constitution varies in detail from state to state, but that most usual is for the legislature to propose amendments, often by a prescribed majority, and for these amendments to be voted on by the people. Such amendments have latterly come to include many matters not strictly constitutional, and so to constitute a species of direct legislation by the people similar in principle to what is called in Switzerland the Referendum. Some states have recently allowed a prescribed number of voters to propose, by what is called the Initiative, amendments which are submitted to the vote of all the citizens without the intervention of the legislature.

Two remarkable changes have passed over the state constitutions. In the earlier days of the republic they were comparatively short and simple instruments, confined to the definition of civic rights and the establishment of a frame of government. They have now become very long and elaborate documents, seven, eight or ten times as long as the Federal Constitution, and containing a vast number of provisions on all sorts of subjects, many of them partaking of the nature of ordinary statutes passed by a legislature rather than safeguards suitable to a fundamental instrument. And secondly, whereas in earlier days the constitutions were seldom changed, they are now frequently recast or amended. Only Maine and Massachusetts and a few of the newer states live under original constitutions, and only Massachusetts is under a constitution older than the 19th century. Some have recast their constitutions seven or eight times. Some provide for the revision of the constitution at stated intervals. Notwithstanding the facility and frequency of amendments, the variations between one constitution and another are less conspicuous than might have been expected. There is, however, a distinction of type and character between those of the western and southern and those of the eastern states, the former being generally more prolix, more prone to go into details, more apt to contain new experiments in legislation.

Comparing the old constitutions with the new ones, it may be said that the note of those enacted in the first thirty or forty years of the republic was their jealousy of executive power and their careful safeguarding of the rights of the citizen; that of the second period, from 1820 to the Civil War (1861–65), the democratization of the suffrage and of institutions generally; that of the third period (since the war to the present day), a disposition to limit the powers and check the action of the legislature, and to commit power to the hands of the whole people voting at the polls.

State Legislatures.

§ 5. In every state the legislature consists of two houses. This remarkable feature, originally due to the practice that had prevailed in some colonies, and to the example of Great Britain, soon became universal, and the belief in its necessity has passed into a fundamental dogma, the idea being that a single chamber would be either hasty, or tyrannical or unscrupulous—perhaps all three—so that there must always be a second chamber to keep the first in order. The smaller house is called the Senate, the larger one is (usually) called the House of Representatives, sometimes, however, the Assembly—sometimes the House of Delegates. Both are chosen by popular vote, almost universally by the same voters, and usually in single-membered districts, and at the same time. The senatorial districts are, of course, larger than the house districts. A senator is usually chosen for a longer term (often four years) than a representative, and, in most cases, whereas the house is elected all at once, the senate is renewed only partially at each election. In some states by law, and in all by custom also, a member must reside in the district which he represents.

Universal manhood suffrage, subject to certain disqualifications (*e.g.* certain crimes or receipt of poor relief), is the rule in the great majority of states. Certain terms of residence within the United States, in the state, and in the voting district are generally prescribed, the periods varying from state to state. Nine states allow voting rights to aliens who have declared their intention to become citizens, and in some they can as taxpayers vote on financial matters submitted to a special vote. Kansas grants them a full municipal suffrage. Fourteen prescribe some sort of educational qualification. Five states—Wyoming, Colorado, Utah, Idaho and Washington—give the suffrage for all elections to women.[1] In 1905 women could vote at school elections in twenty-four states. Of late years seven Southern states, beginning with Mississippi (constitution of 1890) and including Virginia, North Carolina, South Carolina, Georgia, Alabama and Louisiana, have so altered their constitutions as to exclude from voting the great bulk of their respective negro populations, by means of educational tests, property qualifications, a combination of both, or by other means, while various ingenious devices have been employed to admit a large part, at least, of the illiterate whites. In 1910 Oklahoma adopted provisions of the same kind. The suffrage for legislature elections generally determines that for all other elections within the state, and as a rule it carries with it eligibility to office. And by the Federal Constitution it is also the suffrage for Federal elections, viz. elections of representatives in Congress and of presidential electors.

Elections are now practically everywhere conducted under that system of secret voting, which is called in America "the Australian ballot," and which is very similar to that used in the United Kingdom since 1872. There used to be a good deal of fraud practised at elections, including "personating" and "repeating," as well as a good deal of bribery in a few states and in some of the larger cities. Legislation has reduced these evils in recent years; and efforts have been made to prevent the excessive expenditure of money at elections, and the making of contributions to party "campaign funds" by wealthy corporations who desire to secure some benefit for themselves. Another evil which has not yet been dealt with is the large number of posts for which the voter is expected at an election to select the best men. This, of course, does not apply to elections to a legislature; but in city elections, and to some extent in state elections and county elections also, it creates great difficulties, for how is the average citizen to know (especially in a large city) who are the fittest men out of a long list of candidates for perhaps ten or twenty offices, all of which have to be filled by election at the same time? The perception of these difficulties has evoked a movement for what is called "a short ballot."

The number of members of the legislative chambers varies from state to state. Delaware with 17 senators and 35 representatives, has the smallest; Minnesota, with 63 senators, has the largest Senate; and New Hampshire (a small state) has, with its 390 representatives, the largest House. The New York houses number 51 and 150 respectively; those of Pennsylvania, 50 and 204; of Illinois, 51 and 153; of Ohio, 34 and 118; of Massachusetts, 40 and 240. In all states, members of the legislature receive a salary, which is the same for both houses, some states fixing an annual sum, but most preferring a per diem rate, while the maximum is generally determined by a limitation on the length of the session.

It has become the wish of the people in most places to have sessions both short and few. Whereas formerly legislatures met annually, regular sessions are now biennial except in New York, New Jersey, Massachusetts, Rhode Island, Georgia and South Carolina—all original states. In Alabama the legislature meets regularly once only in four years, though it may be convoked in the interval.

Powers and Functions of the State Legislatures.

The Senates act as courts for the trial of state officers impeached by the house (in imitation of the British House of Lords and the Federal Senate), and have in some states the function of confirming or refusing appointments made by the governor. Otherwise the powers and procedure of the two houses are everywhere substantially identical, though it is worth noting that whereas every house chooses its own Speaker, the president of the Senate is, in most states, a lieutenant-governor, whom the people have directly elected. Bills may originate in either house, but in about half of the states money bills must originate in the House of Representatives—a survival of British custom which has here, where both houses equally represent the people, no functional value. Both houses do most of their work by committees, much after the fashion (to be presently described) of the Federal Congress, and it is in these committees that the form of bills is usually settled and their fate decided. Sometimes, when a committee is taking evidence on an important question, reporters are present, and the proceedings receive comment in the newspapers; but in general the proceedings of committees and even debates in the houses are imperfectly reported and excite no great public interest. In all the states except one, viz. North Carolina, bills passed by the two houses must be submitted to the state governor for his approval. Should he return it to the legislature disapproved, it is lost unless repassed "over his veto" by a majority usually of two-thirds, but sometimes larger, in each house. A good governor is apt to use his veto freely—indeed, a frequent exercise of the power is deemed in many states to be a sort of test of the governor's judgment and courage.

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[1] Woman suffrage amendments to state constitutions have been rejected by the people in at least twelve states and in two territories. State organizations of women to oppose the extension of the suffrage to women exist in Illinois, Massachusetts, New York and Oregon: possibly in other states also.

Subjects of state legislation may be classified under three heads:—

1. Ordinary private law, including property, contracts, torts, family relations, offences, civil and criminal procedure.

2. Administrative law, including the regulation of urban and rural local government, state and local taxation and finance, education, public works, the liquor traffic, vaccination, adulteration, charities, asylums, prisons, the inspection of mines and factories, general laws relating to corporations, railways, labour questions.

3. Matters of a local or special nature, such as bills for chartering and incorporating gas, water, canal, tramway, railway or telephone companies, or for conferring franchises in the nature of monopolies or special privileges upon such companies, or for altering their constitutions, as also for incorporating cities or minor communities and regulating their affairs. Although there usually exist general laws under which corporations or companies (including railway and electric car companies) can be formed, laws which in some states and for some purposes confer a greater freedom of incorporation than the general law allows in the United Kingdom, there is nevertheless a noticeable tendency to come to the legislature for special purposes of this kind.

As respects class 1, there is not much change in the law from year to year. The legal profession does not like to see the ordinary and established rules disturbed. Sometimes the laws belonging to this class are codified, or rather consolidated, and then usually by a special committee of competent lawyers whose work is passed *en bloc* by the legislature.

As respects class 2, a good many measures are passed, particularly in matters affecting labour, and for the protection of any sections of the population which may be deemed to need protection.

It is, however, in class 3 that the legislatures show most activity, much of it pernicious, because prompted by persons seeking to serve private interests which are often opposed to the interests of the whole community. The great "public service" corporations have, in particular, frequently succeeded in obtaining franchises of large pecuniary value without making any adequate payment therefor. A peculiarly notable form of this special or private bill legislation is that of dealing by special statutes with the governmental forms and details of management of municipalities; and the control exercised by the state legislatures over city governments is not only a most important branch of legislative business, but at the same time a means of power to scheming politicians and of enrichment to greedy ones. This has led in some states to the grant of power to cities to frame their own charters. Speaking generally, it is chiefly in the sphere of special or private legislation that state legislatures have shown their weak side, and incurred, in many states, the distrust of the people.

The members of these bodies belong for the most part, though by no means entirely, and least so in the agricultural states, to the class of professional politicians. They are seldom persons of shining ability or high standing in their communities. Except as a stepping-stone to a seat in Congress or a high executive post, the place is not one which excites the ambition of aspiring men. The least respected legislatures are those of the richest and most populous states, such as New York and Pennsylvania, because in such states the opportunities offered to persons devoid of scruple are the largest.

The general decline in the quality of these bodies, and especially their proneness to pass ill-considered or pernicious bills at the instance of private promotors, has led to the restriction in recent years of their powers by the insertion in the state constitutions of many provisions forbidding the enactment of certain classes of measures, and regulating the procedure to be adopted in the passing, either of statutes generally or of particular kinds of statutes. Even these provisions, however, are frequently evaded.

The State Executive.

§ 6. At the head of every state government stands an official called the governor, who is the descendant and representative of the governor of colonial times. Under the earlier constitutions of most of the original thirteen states he was chosen by the legislature, but he is now everywhere directly elected by the people, and by the same suffrage as the legislature. His term of office is four years in twenty-three states (including Pennsylvania and Illinois), three years in one state, two years in twenty, and one year in two (Massachusetts and Rhode Island). In a few states there are prohibitions on re-election.

It is the duty of the governor to see that the laws of the state are faithfully administered by all officials, and the judgments of the courts carried out. He has, in most states, the right of reprieving or pardoning offenders, but some recent constitutions place restrictions on this power. He is also commander of the militia or other armed forces of the state, which he can direct to repel invasion, or suppress insurrection or riot. He appoints some of the state officials, his nominations usually requiring the concurrence of the state senate; but his patronage is in most states not very large—in many it is indeed insignificant—because the offices of greatest importance are filled by direct popular election. He has also the almost mechanical function of representing the state for various formal purposes, such as demanding from other states the extradition of offenders, the issuing of writs for the election of members of the legislature and of members of the Federal House of Representatives, and the receiving of reports from various state officials or boards.

Not less important than his directly executive work is the influence which the governor exerts upon state legislation through his possession (in all the states but one) of a veto power. His right of recommending measures to the legislature (which does not formally include that of framing and presenting bills, but practically permits him to have a bill prepared and use all his influence on its behalf) is of greater value according to the extent to which he leads the public opinion of his state. The legislature need not regard his counsels, but if he is a strong man whom the people trust, it may fear him and comply with his demands. When a commercial crisis occurs much may depend on his initiative. Moreover, his veto is a thing to be reckoned with. It is seldom overridden by the prescribed majority, especially if the bill against which it is directed be one of a jobbing nature. And as the people look to him to kill bad measures, he is frequently able, if he be a man both strong and upright, to convey intimations to the legislature, or to those who are influential in it, that he will not approve of certain pending measures, or will approve of them only if passed in a form satisfactory to him. The use of this potential authority, which the possession of the veto power gives, has now become one of a governor's most important duties.

In New England, and in the greater states generally, the governorship is still a post of dignity, and affords an opportunity for a display of character and talents. During the War of Secession, when each governor was responsible for organizing troops from his state, much turned upon his energy, popularity and loyalty. And in recent years the danger of riots during strikes has, in some states, made it important to have a man of decision and fearlessness in the office which issues orders to the state militia. There has been of late years a revival in the case of some able governors of the old respect for, and deference to, the office.

In thirty-five states there is a lieutenant-governor, elected by popular vote. He is usually president of the state senate, is sometimes a member of some administrative boards, and steps into the governor's place should it become vacant.

Executive councils advising the governor, but not chosen by him, existed under the first constitutions of all the original thirteen states. In New York the council of appointment advised the governor only in regard to appointing officers; and in Georgia there was no executive council after 1789. True executive councils have now disappeared except in Massachusetts, Maine and New Hampshire.

Administrative Offices in a State.

§ 7. The names and duties of the other officers vary from state to state. In every state there are a secretary of state, who is custodian of the documents and archives, and a treasurer. Nearly everywhere there are also a comptroller or auditor, who keeps the accounts and is the principal financial officer, an attorney-general or legal adviser, an adjutant-general, who has immediate charge of the militia, and a superintendent of public instruction, with some little authority over the public schools. Most of the states have also a board of charities, a board of health, a board of railway commissioners, and either boards or single commissioners for banking, insurance, agriculture, public lands and prisons. Other administrative departments found in different states are those having control of public works—principally canals—insane hospitals, factory inspection, labour statistics and immigration. New York state, with nearly fifty different administrative bureaus, has a larger number than any other state. In many states the most important of these officials are elected by the people at a general election, but some officials are either chosen by the legislature or appointed by the governor, the latter method applying mainly to offices of recent creation. The terms of office vary for the different offices, very few exceeding four years. The state officials, being thus largely independent of the governor, and responsible only to the people, are in no sense a cabinet (save in North Carolina). Each administers his own department, subject to the detailed regulation imposed by statutes, and as these statutes determine such matters as might come into controversy, a general agreement in policy among the administrative officials is not essential.

In many states officials may be removed, not only by impeachment, but also sometimes by vote of the legislature, sometimes by the governor on the address of both houses, or by the governor either alone or with the concurrence of the senate; but such removals must be made for specific misconduct.

The extent of direct state administration of public institutions and works is very limited, and most of the state bureaus have only a supervision over private enterprises, or over local administrative officers. On this account the subordinate civil service of the state is not large compared with that of either the Federal government or of the large municipalities, and only in a few states does it possess any importance. However, these bureaus are seldom well manned, because salaries and tenure of office are seldom such as to induce able men to offer themselves, while the places are often given as rewards for political service. New York, Massachusetts and a few other states have systems of civil service examinations, similar to those in the Federal administration, which serve to keep certain branches out of politics.

The State Judiciary.

§ 8. The judiciary is in every state an independent department of the government, directly created by the state constitution, and not controlled in the exercise of its functions either by the legislature or by the executive. In every state it includes three sets of courts: a supreme court or court of appeal; superior courts of record; and local courts, but the particular names and relations of these several tribunals vary greatly from state to state. Most of the original thirteen colonies once possessed also separate courts of chancery; and these were maintained for many years after the separation from Great Britain, and were imitated in several of the earlier among the new states, but special chancery courts now exist only in a few of the states, chiefly in the East and South. In other states the common law judges have also equity jurisdiction; and in four states—New York, North Carolina, California and Idaho—there has been a complete fusion of law and equity.

In colonial days the superior judges were appointed by the governors, except in Rhode Island and Connecticut, where the legislatures elected them. These precedents were followed in all the revolutionary constitutions, except in Georgia, where election by the people was established. During the democratizing period from 1820 to 1860 the system of popular election was extended, especially in the new states, and at present this system prevails in thirty-six states, including practically all of the new states and five of the original states—New York, Pennsylvania, Maryland, North Carolina and Georgia. Three of the original thirteen have their judges elected by the legislatures, and in five others, together with Maine and Mississippi among the newer states, they are appointed by the governor, subject to the approval of the executive council, the Senate, or (in Connecticut) the General Assembly. Local judges are generally chosen by the voters of the district in which they hold court.

Originally the superior judges were in most states appointed for life and held office during good behaviour, but only three states now retain this system. Eight to ten years is the average term of service; it is longer in New York (14), Maryland (15), and Pennsylvania (21), where alone superior judges are not re-eligible. Salaries, too, are small in most states, often not more than one-tenth of what a prominent lawyer can make by private practice.

These three factors—popular election, limited terms and small salaries—have all tended to lower the character of the judiciary; and in not a few states the state judges are men of moderate abilities and limited learning, inferior (and sometimes conspicuously inferior) to the best of the men who practise before them. Nevertheless, in most states the bench is respectable in point of character, while in some it is occasionally adorned by men of the highest eminence. The changes introduced since 1870 have been, on the whole, for the better, though there is still room for further improvement. Corruption seems to be very rare, but instances of subservience to powerful political groups sometimes shake public confidence. Things would doubtless have become worse but for the watchfulness which the bar generally shows in endeavouring to secure the selection of honest and fairly competent men. The administration of civil justice is decidedly better than that of criminal justice. The latter is in many states neither prompt nor certain, offenders frequently escaping through the excessive regard for technicalities even more than through the indulgence of juries and the occasional weakness of judges.

It must be remembered that the courts of each state form a judicial system, complete in itself, and independent of the Federal courts, and, of course, of other states. There is no appeal from the highest state court, except in those cases where a question of Federal law is involved, for then such cases may be removed, in manner to be explained hereafter, to the Federal courts. And, subject only to this limitation, the jurisdiction of the state courts covers the entire field of civil and criminal law. The existing legal system of all the states, except Louisiana, whose law is based on the Roman, have been built upon the foundation of the principles contained in the common and statute law of England as that law stood in 1776, when the thirteen colonies declared their independence. In the development of the law since that time the courts of one state are not bound either by law or by usage to follow the decisions either of the Federal courts or of the courts of any other state, any more than they would follow English courts, although such decisions are used and discussed as evidence of the common law, and great deference is always shown to the opinions expressed by the Federal courts. In many states the legislatures have taken action in the development of law by adopting statutory codes of procedure, and in some instances have even enacted codes embodying the substance of the common law fused with the statutes. These latter codes have not, however, received the general approval of the legal profession.

It is, of course, to the state courts that the duty belongs of construing the constitution as well as the statutes of the state, and if they find any state law to be inconsistent with the state constitution it is their duty to declare it invalid. It is also the duty of the state court to declare any state law invalid if it is contrary to the Federal constitution or to a Federal statute or treaty. As in the case of the similar power of the Federal judges, this is founded on no special commission, but arises out of the ordinary judicial function of expounding the law and discriminating between the fundamental law and laws of inferior authority (see *post*, § 25).

Change in the Political Importance of the State.

§ 9. Wide as is the range of the rights and powers of a state, and elaborate as is the structure of its government, the state holds a practically less important position in the American system than it once did, and has not so strong a hold as it had in the first quarter of the 19th century upon the loyalty and affection of its citizens. The political interest and the patriotism of the people generally are now given rather to the nation as a whole than to a state, whereas in the two generations following the Revolutionary War the opposite would have been the case. This notable difference is due not to any constitutional changes, for there has been none except those contained in the 13th, 14th and 15th amendments to the Constitution, but to the three following causes:—

The first is the growth of the party system with its complicated machinery, which has linked the citizens of different states more closely together, and has led to the eclipsing of political issues confined to a state by issues which are matters of controversy throughout the nation.

The second cause is the Civil War of 1861–65, which practically negatived the far-reaching claims of state sovereignty and the right of secession made by statesmen of the type of Calhoun, and showed that the nation was really much stronger than any group of states.

The third is the enormous development of swift and cheap communications by land and water, and the growth of commerce and of productive industry, which have brought every part of the country into much closer relations with every other part, and have increased the sense of economic solidarity.

The Territories.

§ 10. During the entire history of the United States there has been a considerable area within the jurisdiction of the Federal government not included in that of any one or more of the states; and the systems of government for the various parts of this area require some description. The Territories (strictly so called) were at one time important, though now less so, because there remain only two, the unorganized Territory or District of Alaska, and the Hawaiian Islands in the Pacific Ocean. Till 1910 there were the two organized Territories of Arizona and New Mexico, but in that year Congress passed an act for their admission as states. Previously to that year there had been ever since 1787 a large area of the continent which, while belonging to the United States, was deemed too thinly peopled to be fit to be divided up into states. Parts of this area were, however, set off and organized as Territories, receiving a qualified form of self-government while under the ultimate control of Congress for the purposes of legislation. When these parts had been sufficiently filled up by settlers, they were allowed to organize themselves as states, each giving itself a constitution. The Territorial government consisted of a legislature of two houses elected by the people, with a governor appointed by the president of the United States, with the consent of the Senate, and judges similarly appointed. The Territories were not represented in Congress, but each could send a delegate to the House of Representatives, who could speak there but not vote.

Since the Spanish War of 1898 there have been added to the United States various transmarine dominions, none of which has been formed into a state, or is likely to be so formed for a good while to come; and there is also one small piece of original area of the United States, viz. the District of Columbia, which is outside any state, because it contains the national capital. The transmarine dominions are Alaska, the Hawaiian Islands, Porto Rico, the Philippine Islands, and the Canal Zone on the Isthmus of Panama.

III.—*Local Government.*

Rural Local Government.

§ 11. Every state in the Union has its own system of local administrative areas and local authorities, working under its own laws, these systems agreeing in many points with one another, and differing in many others. Three main types of rural local government may be distinguished, prevailing in different regions. The first is characterized by its unit, the town or township, and exists in the six New England states. The second is characterized by a much larger unit, the county, and prevails in the southern states. The third may be called the mixed system, combining some features of the first with some of the second, and is found under a considerable variety of forms in the middle and north-western states. The different types spring from the original differences in the character of the colonists who settled on the Atlantic coast, and in the conditions under which the various colonial communities developed. (See *American Commonwealth*, chs. xlvii. and xlix.)

The *town*, or township, of New England is generally a rural community occupying a comparatively small area, and with a population averaging about 3000, but ranging from 200 in newly-settled districts or thinly-peopled hilly districts up to 17,000 in the vicinity of large cities and in manufacturing neighbourhoods. Each town is governed by the town meeting, an assembly of all the qualified voters within the limits, which meets at least once a year in the spring, and also at other times when specially summoned. This assembly elects the town officials at the annual meetings, but it is much more than an electoral body. It is also a deliberative assembly and the legislative authority for local matters. It enacts by-laws and ordinances, receives the reports of the local officials, passes their accounts, manages the town property, votes appropriations for each item of expenditure, and authorizes the necessary taxation. Every resident citizen has the right to bring forward and to speak in favour of any proposal. The meeting is presided over by a chairman called the moderator. In rural communities the attendance is usually good, the debates are sensible and practical, and a satisfactory administration is generally secured. But when the town meeting has grown to exceed seven or eight hundred persons, and especially when the farming class of native American stock has been replaced by factory operatives of other nationalities, the institution works far less perfectly.

The town officials consist of the "selectmen" (usually three, five or seven, sometimes nine), the town clerk, treasurer, assessors, tax collector, school committee men, and the holders of divers minor offices according to local needs. These are elected annually, except that in some cases the "selectmen" and school committee have a term of several years, one member of each board being elected annually. The "selectmen," who receive no regular salary, but may charge for expenses actually incurred, form a sort of directory or executive committee, which manages the ordinary administrative and financial business under such instructions as may have been given by the town meeting.

In the Middle and Western states the township is a more artificial organism than the rural town of New England. In one group of states—Pennsylvania, New Jersey, New York, Ohio, Indiana, Iowa—while the township has more or less power, and there are town officials, there is no town meeting. In another group—Michigan, Illinois, Wisconsin, Minnesota, the two Dakotas—the town meeting reappears, though in a less primitive and less perfect form. In the states west of the Alleghanies each township covers an artificial area 6 m. square, and a separate quasi-municipal organization is usually provided for the villages which have grown up in many townships.

The *county* is to be found in every state of the Union, but its importance varies inversely with the position held in the system of local government by that smaller and older organism, the town. In New England the county was originally an aggregation of towns for judicial purposes, and in that part of the Union it is still in the main a judicial district. There is no general representative council or board, but judicial officers, a sheriff and a clerk, are elected in each county, and also a county treasurer and county commissioners. The latter have the management of county buildings, such as court-houses and prisons, have power to lay out new main highways, to grant licences, and to apportion among the towns and cities the taxation necessary to meet county expenses. Besides these officials there are generally to be found in New England a county school superintendent and an overseer of roads. In the Southern states the county is the local administrative unit, and in addition to its original judicial and financial functions it has now also control over public schools, the care of the poor and the construction and management of roads. County government is generally vested in a board of county commissioners, elected (in almost every state) by the people, and in various officials also directly elected. In some Southern states some counties have been subdivided into school districts, each of which elects a school committee, and from this nucleus there may possibly develop something resembling the New England town. In those Middle and Western states where the town meeting is not found, the functions and officials of the county tend to resemble those existing in the Southern states, while even in those parts of the west where the town meeting is found the county remains more important than in New England. Thus in many of these states poor relief is a county and not a town charge. In most states county administration belongs to a small board of three commissioners elected for the county at large, but in New York, Michigan, Illinois and Wisconsin there is a larger board of supervisors elected by townships and cities within each county. Although local affairs do not now enlist, even in New England, so large a measure of interest and public spirit as the town system used to evoke in Massachusetts, Rhode Island and Connecticut in the 'thirties, still, broadly speaking, the rural local government of America may be deemed satisfactory. The administration is fairly cheap and fairly efficient, most so, on the whole, in the Northern and Western states, while jobbery and corruption are uncommon. The value of local self-government as a training for the duties of citizenship has been very great, and in many parts of the country, especially where the funds dealt with are small, elections are not fought and offices not distributed upon party lines.

City Government.

§ 12. The tendency, now so marked in nearly all civilized countries, to the development of urban communities has been nowhere more marked than in the United States. The increase in the range and importance of municipal functions has been not less striking than the growth of urban population. This can best be illustrated by the figures of municipal expenditure. In 1810 the annual budget of New York city—with a population of 100,000—was $100,000; to-day an average city of 100,000 population has an annual expenditure of from $1,000,000 to $2,000,000, and the total expenditure of the city of New York in 1909 exceeded $150,000,000. Municipal government is therefore a matter of high concern to America, and plays a large part in any study of American political institutions.

The historical origin of American municipal government is to be found in certain boroughs which had been chartered in the colonial period, after the fashion of English boroughs. These American corporations had the usual English system of borough government, consisting of a mayor, aldermen and councilmen, who carried out the simple administrative and judicial functions needed for the then small communities. The basis for the government of each American city is still a charter, but since the Revolution these charters have been granted by the state legislatures, and are subject to constant change by statute. The charters of cities have shown the same process of increasing length and detailed regulation as the state constitutions; and in details there are many differences between different cities. In some states cities are now permitted to enact their own charters. (See *American Commonwealth*, chs. l.–lii.)

As a rule, one finds (1) a mayor, elected directly by the voters within the city, who is the head of the administration; (2) administrative officers or boards, some directly elected by the city voters, others nominated by the mayor or chosen by the council; (3) a council or assembly, consisting sometimes of two, but more frequently of one chamber, elected directly by the city voters; and (4) judges, usually elected by the city voters, but sometimes appointed by the state.

The mayor is by far the most important official in the city government. He is elected usually for two years, but sometimes for one, three or four (in New York his term is now four years). He has almost everywhere a veto on all ordinances passed by the council, modelled on the veto of the Federal president and of a state governor. In many cities he appoints some or all of the heads of the administrative departments, usually with the approval of the council, but in some important cities the mayor has an absolute power of appointment. As the chief executive officer, he preserves the public peace. In practice he is often allowed to exert a certain discretion as to the enforcement of the laws, especially those providing for Sunday closing, and this discretion has sometimes become a source of mischief. He usually receives a considerable salary, varying with the size of the city.

The practical work of municipal administration is carried on by a number of departments, some under single heads, and some under boards or commissions. The number and classification of these departments vary widely in the different cities. The board of education, which controls the public schools, is usually largely independent of the council, and in some important cities has an independent power of taxation. In Boston, St Louis, Baltimore, and some few other cities, the police board (or commissioner) is appointed by the governor because police matters had been mismanaged by the municipal authorities and occasionally allowed to become a means of extortion and a door to corruption.

The city councils pass local ordinances, vote appropriations, levy taxes and generally exert some control over appointments to administrative positions. The recent tendency has been, however, to decrease the powers of the council and to increase those of the mayor. In some cities the mayor has received an absolute power of appointment; the departments, especially the boards of health, have large ordinance-making powers; statutes passed by the state legislature determine (excepting the states where cities can make their own charters) the principal lines of municipal policy, and the real control over appropriations and taxes is occasionally found vested in a board of estimate, consisting of the mayor, comptroller (the chief financial officer), and a few other administrative officials. In New York City, where the council had lost public confidence, and in some other places, the only important power still possessed by the council is that of granting franchises to street railways, gas companies and the like. In the smaller cities, however, the councils have retained a wider measure of authority. In 1902 the city of Galveston, in Texas, adopted a new form of municipal government by vesting all powers in a commission of five persons, elected by the citizens on a "general ticket," one of whom is mayor and head of the commission, while each of the others has charge of a department of municipal administration. A similar plan, differing in some details, was subsequently introduced in the city of Des Moines, in Iowa; and the success which has attended this new departure in both cities has led to its adoption in many others, especially, but not exclusively, in the Western states. In 1910 more than seventy cities were so administered. Under it administration would appear to have become both more pure and more efficient. The functions of city government may be distributed into three groups: (*a*) Those which are delegated by the state out of its general coercive and administrative powers, including the police power and the granting of licences; (*b*) those which, though done under general laws, are properly matters of local charge and subject to local regulation, such as education and the relief of the poor; and (*c*) those which involve no questions of policy, but are of a purely business nature, such as the paving and cleansing of streets, the construction and maintenance of drains, the provision of water, &c.

Initiative, Referendum and Recall.

It is here proper to advert to a remarkable extension of direct popular government which has in recent years been applied both to states and to cities. Several state constitutions now contain provisions enabling a prescribed number (or proportion) of the voters in a state or city to submit a proposition to all the registered voters of the state (or city) for their approval. If carried, it takes effect as a law. This is the Initiative. These constitutions also allow a prescribed number of voters to demand that a law passed by the state legislature, or an ordinance passed by the municipal authority, be submitted to all the voters for their approval. If rejected by them, it falls to the ground. This is the Referendum. Some cities also provide in their charters that an official, including the mayor or a member of the council, may be displaced from office if, at a special election held on the demand of a prescribed number of the city voters, he does not receive the largest number of votes cast. This is the Recall. All these three institutions are in operation in some Western states and are spreading to some of the Eastern cities. Their working is observed with lively interest, for they carry the principle of direct popular sovereignty to lengths unprecedented except in Switzerland. But it is not merely to the faith of the Western Americans in the people that their introduction is due. Quite as much must be ascribed to the want of faith in the legislatures of states and cities, which are deemed too liable to be influenced by selfish corporations.

IV.—*The Federal System.*

§ 13. When, in 1776, the thirteen colonies threw off their allegiance to the British Crown and took the title of states, they proceeded to unite themselves in a league by the Articles of Confederation of 1781. This scheme of union proved defective, for its central authority, an assembly called Congress, was hopelessly weak. It had neither an executive nor a judiciary, nor had it proper means of coercing a recalcitrant state. Its weakness became so apparent, especially after the pressure of the war with Great Britain had been removed, that the opinion of the wisest men called for a closer and more effective union. Thus the present Constitution was drafted by a convention in 1787, was ratified by nine states (the prescribed number) in 1788, and was set to work under George Washington as first president in 1789.

The Federal Constitution.

§ 14. The Constitution is a document of the first importance in the history of the world, because it has not only determined the course of events in the American Republic, but has also influenced, or become a model for, other constitutions, such as those of Switzerland (1848 and 1874), Canada (1867), Australia (1900), besides Mexico and the numerous republics of South and Central America. It was in substance a compromise effected between those who wished for a centralized government and those who desired to leave very wide powers to the component states; and many subsequent difficulties arose from the omission to settle certain points, and from the somewhat vague language in which other points were referred to. Of these omissions and points left vague, some were inevitable, because an agreement could not have been reached, some were due to the impossibility of foreseeing what difficulties the future would bring with it. But they were, considering the conditions under which the instrument was framed, comparatively few, and the Constitution, when one regards it as a piece of drafting, deserves the admiration which it has received from nearly all American and most foreign critics. It is, on the whole, admirably clear, definite and concise, probably superior in point of technique to all the documents since framed on its model.

As respects substance, the Constitution, being enacted by and expressing the will of the people, who are the ultimate source of political power, is the supreme law of the land over the whole Union, entitled to prevail over all laws passed by Congress, the legislature which it creates, as well as over all state constitutions and all state laws. It can be altered only by the people, in manner to be hereafter mentioned. It is a comparatively short document, and consists of seven articles, subdivided into sections. Art. I. deals with the Federal legislature, its structure and powers, and imposes certain restrictions upon the states. Art. II. provides for the election of an executive head, the president, and assigns certain powers and duties to him. Art. III. treats of the judicial power, defining its range and the mode of its exercise. Arts. IV., V. and VI. contain certain miscellaneous provisions, including those which regulate the mode of amendment. Two alternative methods of proposing amendments and also two of passing them are recognized. They may be proposed either by a two-thirds vote in each house of Congress, or by a convention called by Congress on the application of the legislatures of two-thirds of the states. They may be passed either by the legislatures of three-fourths of the states, or by conventions in three-fourths of the states. Congress has in every instance preferred the method of itself proposing amendments and the method of submitting them to the state legislatures for ratification.

The provisions of the Constitution, which is later in date than the creation of the original states, and presupposes the existence and activity of those communities, include two sets of matters, which must be considered separately—(*a*) the Federal system, *i.e.* the relations of the national government to the states; and (*b*) the structure of the national government itself.

Distribution of Powers between the Nation and the State.

§ 15. In the determination and allotment of the rights and powers of the national government on one side and of the states on the other, a determination which is the foundation of every federal system, the American Constitution proceeds upon these principles:—

1. No powers are expressly allotted to the states, because the states are contemplated as continuing to enjoy those pre-existing powers which they have by their own right, and not as devolved upon them by the nation.

2. The powers allotted to the national government are those, and those only, which are required for the purposes of the collective life of the nation, *i.e.* (*a*) powers which relate to its action in the international sphere; and (*b*) powers which can be exercised within the Union more efficiently and more to the benefit of the people by one central government than by a number of separate governments.

3. All powers which are not expressly allotted to the national government are left to the states, unless specially forbidden to be exercised by the latter, *i.e.* powers not specifically referred to remain with the states, and if the national government wishes to claim any particular power, it must show affirmatively that that power has been granted to it by the Constitution. [This principle has been followed in the Constitution of Australia, but not in that of Canada.]

The powers given to the national government may be described as those which subserve purposes of common national utility.[1] They are the following (see Const. art. I. § 8):—

To impose and collect taxes, which must be uniform throughout the United States;

To borrow money on the credit of the United States;

To regulate foreign and inter-state commerce;

To establish a uniform rule of naturalization and a uniform bankruptcy law;

To coin money and fix the standard of weights and measures;

To establish post offices and post roads;

To secure exclusive rights for limited time by granting patents and copyrights;

To constitute tribunals inferior to the Supreme Court;

To declare war, and regulate captures on land and water;

To raise and maintain an army and a navy;

To provide for calling out the militia, for organizing and arming them, and for governing such part of them as may be in the actual service of the United States;

To exercise exclusive jurisdiction in the area selected for the seat of the national government and over spots acquired for military or naval purposes;

To make all laws necessary for carrying out the above powers (including laws punishing such offences as fall within Federal jurisdiction as being transgressions of Federal law);

To pass laws protecting citizens of the United States against unjust or discriminating legislation by any state (amendments xiii. and xiv.).

Powers withheld from the National Government.

§ 16. The national government is, however, interdicted from using these powers in certain directions by the following prohibitions (art. I. § 9, and first ten amendments): It may not suspend the writ of habeas corpus (except in time of war or public danger) or pass a bill of attainder or an *ex post facto* law; give any state a commercial preference over another; grant any title of nobility; establish or prohibit any religion, or impose any religious test as a condition of holding office; abridge the freedom of speaking or writing, or of public meeting, or of bearing arms; try any person for certain offences except on the presentment of a grand jury, or otherwise than by a jury of his state and district; decide any common law action where the value in dispute exceeds $20 except by a jury.

Although prima facie all powers not given to the national government remain with the states, the latter are debarred from some powers. No state may (art I. § 10, and amendments xiii., xiv. and xv.) make any treaty or alliance; coin money or make anything, save gold and silver coin, a legal tender; pass any bill of attainder or *ex post facto* law, or law impairing the obligation of contracts; have any but a republican form of government; grant any title of nobility; maintain slavery; abridge the privileges of any citizen of the United States, or deny to him the right of voting on account of race, colour or previous condition of servitude; deprive any person of life, liberty or property without due process of law; deny to any person the equal protection of the laws.

There are also certain powers which, though not absolutely withdrawn from the states, can be exercised only with the consent of the national legislature, viz. those of laying duties on exports or imports, keeping troops or war-ships in time of peace, entering into agreements with another state or foreign power, engaging in war unless invaded. And it may be added that there are certain powers which, since they do not lie within the province of the national government, and have been refused to the states, are said to be "reserved to the people." This expression means that it is only the people who can confer them and direct them to be exercised. Should the people wish to confer them, they would have to do so by way of amending the Constitution; and herein lies a remarkable difference between the American system on the one hand and those of some European countries on the other, which, although they have created rigid constitutions, do not expressly debar the legislature from using any and every power of government.

Relations of the National Government to the States.

§ 17. The aim of those who framed the Constitution was to avoid friction between the state governments and the Federal government by rendering their respective spheres of action as separate and distinct as possible. They saw that the less contact the less danger of collision. Their wish was to keep the two mechanisms as independent of each other as was compatible with the still higher need of subordinating, for national purposes, the state to the central government.

Nevertheless there are, as was unavoidable, certain points of contact between the two, the chief of which are the following:—

The Constitution requires each state government to direct the choice of, and accredit to the seat of the national government, two senators and so many representatives as the state is (in respect of its population) entitled to send; to provide for the election, meeting and voting of presidential electors in each state, and to transmit their votes to the national capital; to organize and arm the militia forces of the state, which, when duly summoned by the national government for active service, are placed under the command of the president.

Besides these direct services imposed upon the states, each state is of course practically limited in its legislative and executive action by the power of the Federal judiciary (in the exercise of its function of interpreting the Constitution) to declare invalid laws passed or acts done inconsistent with the Federal Constitution, or with statutes passed by the Federal legislature within the scope of its authority under the Constitution.

So, too, when a subject, such as bankruptcy, is one on which a state may legislate in the absence of legislation by Congress, the state law is valid only so long as Congress does not legislate.

Finally, another point of contact exists in the right of a state to call upon the national government to protect it against invasion or domestic violence. This right has been several times exerted. The national government is also bound to guarantee to every state a republican form of government. (See *American Commonwealth*, ch. xxviii.)

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[1] As to the scheme and working of the Federal government in its relation to the states, see *American Commonwealth*, chs. xxvii.–xxx.

Direct Authority of the National Government over the Citizens of the States.

§ 18. It is a fundamental principle of the American system that the national government possesses a direct and immediate authority over all its citizens, quite irrespective of their allegiance and duty to their own state. This authority corresponds to and is coextensive with the sphere of the Federal government. So far as the functions of that government extend, it acts upon the citizens not through the states, but as of its own right and by its own officers. Beyond that sphere its authority stops, and state authority, unless inhibited by the Federal Constitution, begins. But Federal authority is always entitled to prevail, as against a state legislature or officer, in all matters specifically allotted to it; and in these its power of direct action has two great advantages. It makes the citizen recognize his allegiance to the power which represents the unity of the nation; and it avoids the necessity of calling upon the state to enforce obedience to Federal authority, for a state might possibly be weak or dilatory, or even itself inclined to disobedience. Thus the indirect taxes of customs and excise which the Federal government imposes are levied by Federal custom-house collectors and excisemen, and the judgments of Federal courts are carried out by United States marshals distributed over the country. Nothing has done more to give cohesion to the American Federal system than the direct action of the Federal executive and judiciary.

V.—*The Federal Government.*

§ 19. The Federal or national government was created *de novo* by the Constitution of 1787–1789. It was really a new creation rather than a continuation of the feeble organization of the pre-existing Confederation. But the principles on which it was constructed were old principles, and most of its features were drawn from the state governments as they then existed. These states themselves had been developed out of the previous colonial governments, and both they and the national government have owed something to the example of the British Constitution, which had suggested the division of the legislature into two branches and the independent position of the judiciary. It was, however, mainly from the state constitutions, and not from the arrangements prevailing in Great Britain or in any other country, that the men of the convention of 1787 drew their ideas and precedents.

Following what was then deemed a fundamental maxim of political science, they divided the government into three departments, the legislative, the executive and the judicial, and sought to keep each of these as far as possible detached from and independent of the other two.

The Federal Legislature.

In 1787 all the states but three had bicameral legislatures—it was therefore natural that the new national government should follow this example, not to add that the division into two branches seems calculated to reduce the chances of reckless haste, and to increase the chances of finding wisdom in a multitude of counsellors. There was, however, another reason. Much controversy had raged over the conflicting principles of the equal representation of states and of representation on the basis of numbers, the larger states advocating the latter, the smaller states the former principle; and those who made themselves champions of the rights of the states professed to dread the tyrannical power which an assembly representing population might exert. The adoption of a bicameral system made it possible to give due recognition to both principles. One house, the Senate, contains the representatives of the states, every state sending two; the other, the House of Representatives, contains members elected on a basis of population. The two taken together are called Congress, and form the national legislature of the United States.

House of Representatives.

§ 20. The House of Representatives is composed of members elected by popular vote in each of the various states, the representation of each state being in proportion to its population. Each state is at liberty under the Constitution to adopt either the "general ticket" system, *i.e.* the plan of electing all its members by one vote over the whole state, or to elect them in one-membered districts (the "district system"). The system of single-member districts now prevails almost everywhere. (Pennsylvania, however, has two representatives elected at large from the entire state, and there have been other similar instances.) The number of members in the house was originally 65, but it has steadily increased until, in December 1910, there were 398. Besides the full members, each of the Territories is allowed to send a delegate, who has, however, no vote. The electoral franchise on which the house is elected is for each state the same as that by which, under the provisions of the state constitution, the members of the more numerous branch of the state legislature are chosen. Originally franchises varied much in different states, but for many years prior to 1890 what was practically manhood suffrage prevailed in nearly all of the states. In that year and since, not a few of the southern states have introduced restrictions which tend to exclude the bulk of the coloured population (see *ante*, § 5). It has already been observed that paupers and convicted criminals are excluded in many states, illiterates in some states. Every member must reside in the state which sends him, and custom, rarely broken, requires that he should reside even in the district which he represents. This habit restricts the field of choice and has operated unfavourably on the political life of the nation.

The House of Representatives is chosen for two years, the terms of all the members expiring together. The election of a new house takes place in November[1] of the even years (*i.e.* 1910, 1912, &c.). Members enter on their term of service in the March following, but the first regular session does not begin until the following December, or more than a year after the election. In fact, the old house holds its second regular session of three months after the new house has been elected. The rules are very complicated, and considerably limit the power of debate. A remedy against obstruction has been found in a system of closure called the "previous question." Speeches are limited to one hour, and may be confined in committee of the whole house to five minutes. There is comparatively little good debating in the European sense of the term, and this is due partly to the great size of the hall, partly to the system of legislation by committees.

The Committee System.

The organization of the house is entirely different from that of the British House of Commons or of most assemblies on the European continent. The ministers of the president do not sit, and since there are thus no officials to undertake the leadership of the majority and conduct business, legislative work is shaped and directed by a number of committees in each house. Every bill when introduced is referred to some committee, and each bill comes up for consideration by the whole house on the report of the committee which has dealt with it. There were in 1910 62 regular or standing committees in the House of Representatives, each consisting of from 3 to 20 members. The most important committees are the following: ways and means, rules, elections, appropriations (with several committees for different branches of public expenditure), rivers and harbours, banking and currency, and foreign affairs. Each committee has complete control of all bills referred to it, and nineteen-twentieths of the bills introduced meet their death by the failure of the committee to take action on them. The bills taken up for action are debated and freely amended by the committees, and sometimes public hearings are held. The committees on the expenditure of the various government departments conduct minute investigations into the administration of each. A bill, as finally agreed on by a committee, is reported to the house, and when taken up for action the fate of most bills is decided by an hour's discussion, opened by the member of the committee making the report. The more important measures, including taxation and appropriation bills, receive genuine discussion by the house at large, through special orders submitted by the committee on rules. Of the enormous number of bills brought in very few pass.

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[1] In June in Oregon; in September in Maine and Vermont.

The Speaker.

The unifying force of this complicated system of committee legislation is the Speaker of the House of Representatives. Like the Speaker of the British House of Commons, he is primarily the presiding official, but the character of his office has become different from that of the impartial moderator of the British house. The American Speaker, who of course has a vote like other members, always belongs to the party which commands a majority, and is, indeed, virtually the leader of the majority party in the House of Representatives. He resembles in some respects a European prime minister, and is second only to the president in political importance. His power is derived from three main sources. He appoints the members of nearly all committees, he chooses the chairman of each, and he directs the reference of bills to the various committees. Of the committee on rules, which practically determines the order in which important measures come before the house, he was formerly chairman, and he had the power of appointing the committee; but on the 19th of March 1910, the house passed a resolution which increased the membership of this committee from 5 to 10, excluded the Speaker, and transferred the appointments to the house. As presiding officer the Speaker exercises a right of discrimination between members rising to speak in debate, and can thus advance or retard the progress of a measure. He is elected by the House of Representatives at its first session for the whole Congress, and his election is regularly carried by a strict party vote.

The Senate.

§ 21. The Senate in 1910 consisted of 92 members, two persons deputed from each state, be it great or small (New York with 9,100,000 population and Nevada with 81,875 having the same representation), who must be inhabitants of that state, and at least thirty years of age. They are elected by the legislature of their state for six years, and are re-eligible. It used to be supposed by many Europeans, following Tocqueville, that this method of election was the cause of the (former) superiority of the senators to members of the House. This was an error, the true reason being that able men preferred a seat in the Senate owing to its larger powers and longer term. One-third retire every two years, so that the old members are always twice as numerous as the new members, and the body has been continuous ever since its first creation. Senators are re-elected more frequently than members of the House, so there is always a considerable proportion of men of long service and mature experience.

There has long been a demand for an amendment to the Constitution which should vest the election of senators in the peoples of the several states, and more than one-half of the state legislatures have at one time or another passed resolutions in favour of the change. Within the last few years the object desired has been practically attained in a few states by provisions they have introduced for taking a popular vote as to the person whom the legislature ought to elect, the latter being expected to defer to the popular will.

The vice-president of the United States is *ex officio* presiding officer of the Senate, and this is his only active function in the government. He has, however, no vote in the Senate, except a casting vote when the numbers are equally divided, and his authority on questions of order is very limited.

The methods of procedure in the Senate are somewhat different from those in the House of Representatives. There is a similar committee system, but the Senate committees and their chairmen are chosen, not by the presiding officer, but by the Senate itself voting by ballot. Practically they are selected by caucuses of the majority and minority parties. The Senate rules have no provision for the closure of debate, nor any limitation on the length either of a debate or of a speech. For the consideration of some classes of business the Senate goes into executive or secret session, although what is done at this session usually leaks out, and finds its way to the public through the press.

The functions of the Senate fall into three classes—legislative, executive and judicial. In legislative matters its powers are identical with those of the House of Representatives, with the single restriction that bills for raising revenue must originate in the popular assembly. In practice, too, the Senate is at least as influential in legislation as the House. Disagreements, which are frequent, are usually settled in conference, and in these the Senate is apt to get the better of its antagonist. Serious deadlocks are of comparatively rare occurrence.

The executive functions of the Senate are: (1) To approve or disapprove the president's nominations of Federal officers, including judges, ministers of state and ambassadors; (2) to approve, by a majority of two-thirds of those present, of treaties submitted by the president. Through the latter power the Senate secures a general control over foreign policy. Its approval is necessary to any important action, and in general the president finds it advisable to keep the leaders of the senatorial majority, and in particular the Senate committee on foreign relations, informed of pending negotiations. Foreign governments often complain of this power of the Senate, because it prevents them from being able to rely upon the carrying out of arrangments they have made with the executive; but as the president is not responsible to Congress and is irremovable (except by impeachment) during his term of office, there would be objections to giving him an unqualified treaty-making authority. Through the power of confirming or rejecting the president's nominations to office, the senators of the president's party are able to influence a large amount of patronage. This sort of "dual control" works with less friction and delay than might have been expected, but better appointments would probably be secured if responsibility were more fully and more clearly fixed on the president alone, though there would no doubt be a risk that the president might make a serious error.

The judicial function of the Senate is to sit as a high court for the trial of persons impeached by the House of Representatives, a vote of two-thirds of those present being needed for conviction. There have been eight cases of impeachment. The most important was that of President Johnson, whose conviction failed by one vote—35 to 19. Five of the other seven cases also ended in acquittal, one for want of jurisdiction,[1] and one by the resignation of the official before the impeachment was preferred in the Senate. Two Federal judges were many years ago thus deprived of office, impeachment being the only process by which a Federal judge can be removed.

Congressional Legislation and Finance.

§ 22. The procedure of each house in framing and passing bills has already been noted. When a bill has passed one chamber it is sent to the other, and there referred to the appropriate committee. In course of time this committee may report the bill as received from the other house, but frequently an amended or an entirely new measure is presented, which is discussed and enacted on by the second house. When bills passed by the two chambers are not identical, and each persists in its own view, the regular procedure is to appoint a committee of conference, consisting of an equal number of members from the Senate and from the House. These meet in secret, and generally agree upon a compromise measure, which is forthwith adopted by both chambers. If no compromise can be arranged, the conflict continues until one side yields, or until it ends by the adjournment of Congress. After passing both houses, the bill goes to the president, and if approved by him, or not returned by him within ten days, becomes law: if vetoed, it returns to the house in which it originated; and if re-passed by a two-thirds vote, is sent to the other house; and if again passed there by a two-thirds vote, it becomes law without the president's consent.

The scope of Congressional legislation has been indicated in the list given of the powers of the national government

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[1] This case was that of the impeachment of a senator, and the failure to convict arose from the fact that some of the senators at the time held the now generally accepted opinion that a member of Congress is not subject to impeachment.

(see *ante*, § 15). The most important measures are those dealing with the revenues and appropriations; and the procedure on these matters is slightly different from that on other bills. The secretary of the treasury sends annually to Congress a report containing a statement of the national income and expenditure and of the condition of the public debt, together with remarks on the system of taxation and suggestions for its improvement. He also sends what is called his annual letter, enclosing the estimates, framed by the various departments, of the sums needed for the public service of the United States during the coming year. With this the action of the executive ceases, and the matter passes into the hands of Congress.

Revenue bills for imposing or continuing the various customs duties and internal taxes are prepared by the House committee on ways and means, whose chairman is always a leading man in the majority party. The report presented by the secretary of the treasury has been referred to this committee, but the latter does not necessarily in any way regard that report. Neither does it proceed on estimates of the sums needed to maintain the public service, for, in the first place, it does not know what appropriations will be proposed by the spending committees; and in the second place, a primary object of the customs duties has been for many years past, not the raising of revenue, but the protection of American industries by subjecting foreign imports to a very high tariff. Regular appropriation bills down to 1883 were all passed by the House committee on appropriations, but in that year a new committee—on rivers and harbours—received a large field of expenditure; and in 1886 certain other supply bills were referred to sundry standing committees. These various appropriation committees start from, but are not restricted by and do not in fact adopt, the estimates of the secretary of the treasury. Large changes are made both by way of increasing and reducing his estimates.

The financial bills are discussed, as fully as the pressure of work permits, in committee of the whole House. Fresh items of appropriations are often added, and changes are made in revenue bills in the interest of particular purposes or localities. If the Senate is controlled by the same party as the House, it is likely to secure the acceptance of many of its amendments. The majorities in the two houses then labour together to satisfy what they believe to be the wishes of their party. Important legislation is almost impossible when one of the houses is controlled by one party and the other house by the other.

When finally adopted by the House, the bills go to the Senate and are forthwith referred to the committee on finance or to that on appropriations. The Senate committees amend freely both classes of bills, and further changes may be made by the Senate itself. When the bills go back to the House that body usually rejects the amendments: the Senate declines to recede, and a conference committee is appointed by which a compromise is arranged, usually hastily and in secret, often including entirely new items, and this compromise is accepted with little or no discussion, generally at the end of the session.

Thus it comes that comparatively slight use is made of the experience of the permanent financial officials in the framing of revenue-raising and appropriation bills. There is little relation between the amounts proposed to be spent in any one year and the amounts proposed to be raised, and there is a strong tendency to deplete the public treasury through special grants secured by individual members. These defects have long been felt, but Congress is not disposed either to admit officials to attend its sittings or to modify the methods to which it has grown accustomed. A tariff commission was, however, created by statute in 1909, the reports of which may have some influence on the framing of tariffs in future.

The President.

§ 23. The executive power of the nation is vested in a president of the United States of America, who holds office during the term of four years. He, together with the vice-president, is nominally chosen by a system of double election through an electoral college, but in practice this system operates merely as a roundabout way of getting the judgment of the people, voting by states.

The Electoral College.

The Constitution directs each state to choose a number of "presidential electors equal to the number of its representatives in Congress" (both senators and members of the House of Representatives). Members of Congress and holders of Federal offices are ineligible as electors. These electors (in 1908, 483) meet in each state on the second Monday in January, and give their votes in writing for the president and vice-president. The votes are transmitted to Washington, and there opened by the president of the Senate, in the presence of both houses of Congress, and counted. A majority of the whole number of electors is necessary to elect. If no person have such majority, the president is chosen by the House of Representatives voting by states, and the vice-president is chosen by the Senate. This plan of creating an electoral college to select the president was expected to secure the choice by the best citizens of each state, in a tranquil and deliberate way, of the man whom they in their unfettered discretion should deem fittest to be the chief magistrate of the Union. In fact, however, the electors exercise no discretion, and are chosen under a pledge to vote for a particular candidate. Each party during the summer preceding a presidential election holds a huge party meeting, called a national convention, which nominates candidates for president and vice-president. (See *post*, § 33.) Candidates for the office of elector are also nominated by party conventions, and the persons who are in each state chosen to be electors—they are chosen by a strict party vote—are expected to vote, and do in point of fact vote, for the presidential candidates named by their respective parties at the national conventions. The Constitution leaves the method of choosing electors to each state, but by universal custom they are now everywhere elected by popular vote, and all the electors for each state are voted for on a "general ticket." In the early days the electors were chosen in many states by the legislatures, but by 1832 South Carolina was the only state retaining this method, and in 1868 she also dropped it. Some states also, for a time, chose electors by districts, but by 1832 all had adopted the "general ticket" system. Michigan, however, in the election of 1892 reverted to the "district" system, thereby dividing its electoral vote. Thus the election is virtually an election by states, and the struggle concentrates itself in the large states, where the great parties are often nearly equally divided, *e.g.* the party which carries New York by even a small majority gains all the 39 electoral votes of that state. The polling for electors takes place early in November on the same day over the whole union, and when the result is known the contest is over, because the subsequent meeting and voting of the electors is a mere matter of form. Nevertheless, the system here described, being an election by states, is not the same thing as a general popular vote over the union, for it sometimes happens that a person is chosen president who has received a minority of the popular vote cast.

The Constitution requires the president to be a native-born citizen of the United States, not under thirty-five years of age, and for fourteen years resident in the United States. There is no legal limitation to his re-eligibility any number of times; but tradition, dating from the refusal of George Washington to be nominated for a third term, has virtually established the rule that no person shall be president for more than two continuous terms. If the president dies, the vice-president steps into his place; and if the latter also dies in office, the succession passes to the secretary of state.[1] The president receives a salary of $75,000 a year, besides $25,000 a year for travelling expenses, and has an official residence called the Executive Mansion, or more familiarly the White House.

Functions of the President.—These may be grouped into three classes: those which (1) relate to foreign affairs; (2) concern legislation; (3) relate to domestic administration.

The president appoints ambassadors and ministers to foreign countries, and receives those sent by foreign countries to the United States. He has, through his secretary of state, immediate direction of all negotiations with such countries, and an unfettered initiative in all foreign affairs. He does not, however, enjoy a free hand in finally determining the foreign policy of the government. Treaties require the approval of two-thirds of the Senate, and the foreign affairs committee of that body is usually kept informed of the negotiations which are being conducted by the executive. The power to declare war formally belongs to Congress; but the executive may, without an act of Congress, virtually engage in hostilities and thus bring about a state of war, as happened in 1845–46, when war broke out with Mexico.

As respects legislation, the position of the president is in marked contrast to that of the British crown. While nearly all important measures are brought into parliament by the ministers of the sovereign, and nominally under his instructions, the American president cannot introduce bills either directly or through his ministers. All that the Constitution permits him to do in this direction is to inform Congress of the state of the nation and to recommend the measures which he deems to be necessary. This latter function is discharged by written messages addressed by the president to Congress, the message sent at the beginning of each session being usually the most important; but the suggestions made in these messages do not necessarily or directly induce legislation, although it is open to him to submit a bill or have one drafted by a minister presented to Congress through a member.

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[1] The order of succession, after the secretary of state, is as follows: the secretary of the treasury, the secretary of war, the attorney-general, the postmaster-general, the secretary of the navy, the secretary of the interior—this order to apply only to such officers as "shall have been appointed by the advice and consent of the Senate . . . and such as are eligible to the office of president . . . and not under impeachment. . . ."

More constantly effective is the president's part in the last stage of legislation. His so-called "veto-power" permits him to return to Congress, within ten days after its passage, any bill of which he may disapprove, and, unless this bill re-passes both houses by a two-thirds vote, it does not become law. Most presidents have made use of the veto power sparingly. Jackson, however, as well as Tyler, Johnson and especially Cleveland, employed it pretty boldly. Most of Johnson's vetoes were promptly overruled by the large majority opposed to him in both houses, but the vetoes of all the other presidents have generally prevented the enactment of the bills of which they disapproved.

The domestic executive authority of the president in time of peace is small, because by far the larger part of law and administration belongs to the state and local governments, while the Federal administration is regulated by statutes which leave little discretion to the executive. The power of making appointments to the administrative service would invest him with a vast influence but for the constitutional requirement of securing the consent of the Senate to the more important appointments made. The president is given a free hand in choosing his cabinet ministers; but for most other appointments, whether or not they are by law in his sole gift, the senators belonging to the president's party have practically controlled the selections for offices lying within their respective states, and a nomination made by the president against the will of the senator concerned will generally be disapproved by the Senate. The members of the president's party in the House also demand a share in the bestowal of offices as a price for their co-operation in those matters wherein the executive may find it necessary to have legislative aid. Nevertheless, the distribution of offices under the so-called "spoils system" remains the most important ordinary function of the president, and the influence he exerts over Congress and legislation is due mainly to his patronage.

In time of war or of public disturbance, however, the domestic authority of the president expands rapidly. This was markedly the case during the Civil War. As commander-in-chief of the army and navy, and as "charged with the faithful execution of all laws," he is likely to assume, and would indeed be expected to assume, all the powers which the emergency requires. In ordinary times the president may be almost compared to the managing clerk in a large business establishment, whose chief function is to select his subordinates, the policy of the concern being in the hands of the board of directors. But when foreign affairs reach a critical stage, or when disorders within the Union require Federal intervention, immense responsibility is then thrown on one who is both commander-in-chief of the army and the head of the civil executive. In no European country is there any personage to whom the president can be said to correspond. He may have to exert more authority, even if he enjoys less dignity, than a European king. He has powers which are in ordinary times narrower than those of a European prime minister; but these powers are more secure, for instead of depending on the pleasure of a parliamentary majority, they run on to the end of his term. Although he is always elected as a party candidate, he generally receives, if he shows tact and dignity, abundant respect and deference from all citizens, and is able to exert influence beyond the strict limits of his legal power.

The only way of removing the president from office is by impeachment, an institution borrowed from Great Britain, where it had not become obsolete at the time when the United States constitution was adopted. The House of Representatives may impeach the president. The Senate tries him, and a two-thirds majority is required for conviction. Andrew Johnson is the only president who has been impeached.

The Cabinet and Administrative Officials.

§ 24. There is in the government of the United States no such thing as a cabinet, in the British or French or Italian sense of the word. But the term is regularly used to describe a council of the president, composed of the heads of the chief administrative departments: the secretary of state, the secretary of the treasury, secretary of war, attorney-general, secretary of the navy, postmaster-general, secretary of the interior, secretary of agriculture, and secretary of commerce and labor. Like the British cabinet, this council is not formally recognized by the law, but it is nevertheless accepted as a permanent feature in the government. It is really a group of persons, each individually dependent on, and answerable to, the president, but with no joint policy, no collective responsibility. The final decision on all questions rest with the president, who is solely and personally responsible. Moreover, the members of the cabinet are excluded from Congress, and are entirely independent of that body, so that an American cabinet has little to do in the way of devising parliamentary tactics, or of preparing bills, or of discussing problems of foreign policy. It is not a government, as Europeans understand the term, but a group of heads of departments, whom their chief, though he usually consults them separately, often finds it useful to bring together for a talk about current politics and the course proper for the administration to take in them, or in order to settle some administrative question which lies on the borderland between the provinces of two ministers.

Administrative Departments.

The principal administrative departments are those already named, whose heads form the president's cabinet. The most important are the state and treasury departments. The former has the conduct of foreign affairs and interests, and directs the diplomatic service, but is obliged to keep in touch with the Senate, because treaties require the consent of the latter. It also has charge of the great seal of the United States, keeps the archives, publishes the statutes of Congress and controls the consular service.

The two main functions of the treasury department are the administration of the government revenues and expenditures, and of the banking and currency laws. The secretary has, however, a smaller range of action than a finance minister in European countries, for, as he is excluded from Congress, he has nothing directly to do with the imposition of taxes, and very little with the appropriations for government expenditure.

The department of the interior is less important than in France or Italy, since the principal functions which there belong to it lie, in the United States, within the field of state powers. In the United States the principal matters in this department are the management of the public lands, the conduct of Indian affairs, the issue of patents, the administration of pension laws, of the national census and of the geological survey, and the collection of educational information.

The department of war controls the formerly very small, but now largely increased, army of the United States; and its corps of engineers execute the river and harbour improvements ordered by Congress. The navy department has charge of the dockyards and vessels of war; and the post office department directs the postal system, including the railway mail service. The department of agriculture includes the weather bureau, the bureau of animal industry and other bureaus which conduct investigations and experiments. The attorney-general is the legal adviser of the president, public prosecutor and standing counsel for the United States, and also has general oversight of the Federal judicial administration, especially of the prosecuting officers called district attorneys and of the executive court officers called marshals.

The department of commerce and labor controls the bureaus which deal with the mercantile marine, the lighthouse and life-saving service, commercial statistics, immigration, and the coast and geodetic survey, and the census is also under its charge.

Two commissions not connected with any of the above departments deserve some notice. The inter-state commerce commission, established by statute in 1887, is a semi-judicial, semi-administrative board of five members, with limited powers of control over inter-state railway transportation. The chief duty is to prevent discriminations in freight rates and secret rebates from the published list of charges. Its powers have been much extended by subsequent acts, especially that of 1910. The civil service commission, established in 1883, conducts competitive examinations for appointments to subordinate positions under all of the administrative departments. Some 235,000 posts have now been placed under civil service rules and withdrawn from the category of spoils.

The Federal Judiciary.

§ 25. The Federal judicial system is made by the Constitution independent both of the legislature and of the executive. It consists of the Supreme Court, the circuit court of appeals, the circuit courts and the district courts.

The Supreme Court is created by the Constitution, and consisted in 1910 of nine judges, who are nominated by the president and confirmed by the Senate. They hold office during good behaviour, *i.e.* are removable only by impeachment, thus having a tenure even more secure than that of English judges. The court sits at Washington from October to July in every year. The sessions of the court are held in the Capitol. A rule requiring the presence of six judges to pronounce a decision prevents the division of the court into two or more benches; and while this secures a thorough consideration of every case, it also retards the despatch of business. Every case is discussed twice by the whole body, once to ascertain the view of the majority, which is then directed to be set forth in a written opinion; then again when the written opinion, prepared by one of the judges, is submitted for criticism and adoption by the court as its judgment.

The other Federal courts have been created by Congress under a power in the Constitution to establish "inferior courts." The circuit courts consist of twenty-nine circuit judges, acting in nine judicial circuits, while to each circuit there is also allotted one of the justices of the Supreme Court. The judges of each circuit, acting with or without the justice of the Supreme Court for the circuit, constitute a circuit court of appeals, established to relieve the Supreme Court. Some cases may, however, be appealed to the Supreme Court from the circuit court of appeals, and others directly from the lower courts. The district courts are now eighty in number, each having usually a single justice, rarely two. There is also a special tribunal called the court of claims, which deals with the claims of private persons against the Federal government. It is not strictly a part of the general judicial system, but is a creation of Congress designed to relieve that body of a part of its own labours. A customs court of five judges was created by an act of 1909 for the hearing of cases relating to the tariff.

The jurisdiction of the Federal courts extends only to those cases in which the Constitution makes Federal law applicable. All other cases are left to the state courts, from which there is no appeal to the Federal courts, unless where some specific point arises which is affected by the Federal Constitution or a Federal law. The classes of cases dealt with by the Federal courts are as follows:—

1. Cases in law and equity arising under the Constitution, the laws of the United States and treaties made under their authority;
2. Cases affecting ambassadors, other public ministers and consuls;
3. Cases of admiralty and maritime jurisdiction;
4. Controversies to which the United States shall be a party;
5. Controversies between two or more states, between a state and citizens of another state, between citizens of different states, between citizens of the same state claiming lands under grants of different states, and between a state or the citizens thereof and foreign states, citizens or subjects (Const. art. iii. § 2). Part of this jurisdiction has, however, been withdrawn by the eleventh amendment to the Constitution, which declares that "the judicial power of the United States shall not be construed to extend to any suit in law or equity commenced or prosecuted against one of the United States by citizens of another state, or by citizens or subjects of any foreign state."

The jurisdiction of the Supreme Court is original in cases affecting ambassadors, and wherever a state is a party; in other cases it is appellate. In some matters the jurisdiction of the Federal courts is exclusive; in others it is concurrent with that of the state courts.

As it frequently happens that cases come before state courts in which questions of Federal law arise, a provision has been made whereby due respect for the latter is secured by giving the party to a suit who relies upon Federal law, and whose contention is overruled by a state court, the right of having the suit removed to a Federal court. The Judiciary Act of 1789 (as amended by subsequent legislation) provides for the appeal to the Supreme Court of the United States of "a final judgment or decree in any suit rendered in the highest court of a state in which a decision in the suit could be had where is drawn in question the validity of a treaty or statute for an authority exercised under the United States, and the decision is against their validity; or where is drawn in question the validity of a statute of, or an authority exercised under, any state, on the ground of their being repugnant to the Constitution, treaties or laws of the United States, and the decision is in favour of their validity; or where any title, right, privilege or immunity is claimed under the Constitution, or any treaty or statute of, or commission held or authority exercised under the United States, and the decision is against the title, right, privilege or immunity specially set up or claimed by either party under the Constitution, treaty, statute, commission or authority." If the decision of the state court is in favor of the right claimed under Federal law or against the validity or applicability of the state law set up, there is no ground for appeal, because the applicability or authority of Federal law in the particular case could receive no further protection from a Federal court than has in fact been given by the state court.

The power exercised by the Supreme Court in declaring statutes of Congress or of state legislatures (or acts of the executive) to be invalid because inconsistent with the Federal Constitution, has been deemed by many Europeans a peculiar and striking feature of the American system. There is, however, nothing novel or mysterious about it. As the Federal Constitution, which emanates directly from the people, is the supreme law of the land everywhere, any statute passed by any lower authority (whether the Federal Congress or a state legislature) which contravenes the Constitution must necessarily be invalid in point of law, just as in the United Kingdom a railway bye-law which contravened an act of parliament would be invalid. Now, the functions of judicial tribunals—of all courts alike, whether Federal or state, whether superior or inferior—is to interpret the law, and if any tribunal finds a congressional statute or state statute inconsistent with the Constitution, the tribunal is obliged to hold such statute invalid. A tribunal does this not because it has any right or power of its own in the matter, but because the people have, in enacting the Constitution as a supreme law, declared that all other laws inconsistent with it are *ipso jure* void. When a tribunal has ascertained that an inferior law is thus inconsistent, that inferior law is therewith, so far as inconsistent, to be deemed void. The tribunal does not enter any conflict with the legislature or executive. All it does is to declare that a conflict exists between two laws of different degrees of authority, whence it necessarily follows that the weaker law is extinct. This duty of interpretation belongs to all tribunals, but as constitutional cases are, if originating in a lower court, usually carried by appeal to the Supreme Court, men have grown accustomed to talk of the Supreme Court as in a special sense the guardian of the Constitution.

The Federal courts never deliver an opinion on any constitutional question unless or until that question is brought before them in the form of a lawsuit. A judgment of the Supreme Court is only a judgment on the particular case before it, and does not prevent a similar question being raised again in another lawsuit, though of course this seldom happens, because it may be assumed that the court will adhere to its former opinion. There have, however, been instances in which the court has virtually changed its view on a constitutional question, and it is understood to be entitled so to do.

Results of Constitutional Interpretation.

§ 26. As the Federal Constitution is a short document, which deals very concisely with most of the subjects it touches, a vast number of questions have arisen upon its interpretation in the course of the 122 years which have elapsed since its enactment. The decisions of the Supreme Court upon these questions form a large body of law, a knowledge of which is now indispensable to a mastery of the Constitution itself. By them the Constitution has been so expanded in the points which it expressly treats of, and so filled up in the matters which it covers only by way of implication, that it is now a much more complete instrument than it was when it came from the hands of its framers. Thus the courts have held that, while the national government can exercise only such powers as have been affirmatively granted, it is not restricted in its choice of the methods for exercising such powers as have been granted. From this doctrine there has been derived a conspicuous activity of the national government in such fields as taxation, borrowing of money, regulating commerce and carrying on war. Executive and legislative acts not authorized by the letter of the Constitution have also been allowed to remain unchallenged, and thus precedents have been in fact established.

with the tacit recognition of the courts and the people, through which the sphere of the national government has been enlarged. The purchase of Louisiana from France by President Jefferson is an instance. It may indeed be said that the Constitution as it now stands is the result of a long process of development; and that process is still going on. In 1901 the Supreme Court delivered several judgments in cases arising out of the annexation of Porto Rico, which handled, though they did not fully settle, divers points of novelty and of importance, and still more recently questions of great intricacy affecting the respective legislative rights of the Federal and the state governments have come before it.

Development of the Constitution by Usage.

§ 27. It is not, however, only by way of interpretation that the Constitution has been developed. A great many matters which it passed over have become the subject of legislation by Congress; and there has also sprung up a large mass of usages regulating matters not touched either by the Constitution or by any express enactment. These usages have in many cases lasted so long and become so generally accepted, that they may be regarded as parts of the actual or (so to speak) "working" Constitution, although of course they could be at any moment changed. Among the matters that are now thus settled by usage the following may be mentioned:—

The president practically is limited to two continuous terms of office. The presidential electors are expected to vote for the candidate of the party which has chosen them, exercising no free will of their own. The Senate always confirms the nominations to a cabinet office made by the President.

It may be added that in respect of one matter assigned by the Constitution to the states a momentous change has taken place since the enactment of the Constitution. This matter is the electoral franchise in Federal elections. In 1789 property qualifications were general, but now in all the northern and western states these have been long since abolished, and the electoral suffrage is practically manhood suffrage. In Wyoming, Colorado, Utah, Idaho and Washington universal adult suffrage prevails. Down till 1890 manhood suffrage had prevailed in all the Southern states also (as to some Southern states now see *ante*, § 5). As the electoral suffrage for state legislature elections is also that for Federal elections (including the election of presidential electors), the working of the Federal Constitution has thus been affected without any change in the Constitution itself.

Amendments to the Constitution.

§ 28. Besides these changes which have been brought about by judicial interpretation and by usage, the Constitution has also been altered in the regular and formal way which its own provisions permit (see *ante*, § 14). This has happened four times. Ten amendments were enacted immediately after the adoption of the Constitution itself, in order to meet certain objections which had been taken to it. These may be described as a sort of bill of rights. Another, the eleventh, was enacted in 1794–1798 to negative the construction which the Supreme Court had put upon its own powers in holding that it could entertain a suit by a private person against a state. Another, the twelfth (1803–1804), corrected a fault in the method of choosing the president; and three more (1865–1870) confirmed and secured some of the results of the victory of the North in the War of Secession (1861–65). In 1909 Congress proposed an amendment for enabling the national legislature to impose an income tax. But few amendments pass beyond the first stage of a formal proposal. This is due not merely to the respect of the Americans for their fundamental law, but also to the difficulties which surround the process of change. It is hard to secure the requisite majorities in Congress, and still harder a majority in three-fourths of the states. The obstacles placed in the way of amendment, which are greater than in the case of almost any other Constitution, may be reckoned among the causes which led to the War of Secession.

General character of the Frame of National Government.

§ 29. As compared with the cabinet system of Great Britain, of the British self-governing colonies, and of such European countries as France, Italy, Holland and Belgium, the characteristic features of the scheme of the American national government are the following:—

a. The legislature and the executive are independent and disjoined. The executive does not depend upon the legislature, but holds its powers by a direct commission from the people. No member of the executive sits in the legislature, nor can the legislature eject any one from office save by impeachment.

b. Both the legislature and the executive sit for fixed terms.

c. No method is provided for getting rid of deadlocks, either between the legislature and the executive or between the two branches of the legislature. Should action be needed which cannot be legally taken without the concurrence of these different authorities, and should they be unable to concur, the legal situation must remain *in statu quo* until by a new election the people have changed one or more of the conflicting authorities, and so brought them into harmony.

d. The judiciary holds a place of high importance, because it is the proper interpreter of the will of the people expressed in the supreme law, the Federal Constitution, which the people have enacted.

It will be noted that the structure of the Federal Government is less democratic than that of the state governments. The only posts in the former conferred by popular election are those of the president and the members of the legislature, and while the two houses are a check on each other, the president is a check upon both.

The defects which have been remarked in this system are, broadly speaking, the following: There is a danger that prompt action, needed in the interests of the nation, may fail to be taken owing to a deadlock between legislature and executive, or between the two branches of the legislature. There may be a difficulty in fixing responsibility upon any person, or small group of persons, because cases may arise in which the executive, being unable to act without the concurrence of the legislature, can hardly be blamed for failing to act, while yet it is unable to relieve itself by resigning; while on the other hand the legislature—which consists of two bodies, each of them numerous, and in neither of which are there recognized leaders—contains no person on whom responsibility can be fixed. On the other hand, the characteristic merits of the system may be summed up as consisting in the safeguards it provides against the undue predominance of any one power or person in the government, and therewith against any risk there may be that the president should become a despot, and in the full opportunities it secures for the due consideration of all important measures. It is a system amply provided with checks and balances; it recognizes and enforces the principle of popular sovereignty, while subjecting that principle to many checks in practice; and it is well calculated to maintain unchanged the relation of its component parts each to the other. There has been, in point of fact, no permanent shifting of weight or strength from any one organ of government to any other. At some particular epoch the president has seemed to be gaining upon Congress, at other epochs Congress has seemed to be gaining upon the president. Much depends on the personal qualities of the president and his power of inspiring the people with trust in his courage and his uprightness. When he possesses that power he may overawe Congress, and make them follow, even reluctantly, in the path he points out. Now and then the Senate has been more influential than the House, now and then it has fallen back, at least so far as the confidence of the people in it is concerned. The part played by the judiciary has at some moments been of special importance, while at others it has been little noticed. But, taking the history of the republic as a whole, that equilibrium between the several organs of the government which the Constitution was intended to secure has been substantially maintained.

VI.—*The Party System.*

§ 30. The actual working of the government of the Union and of the governments of the several states cannot be properly

Influence of the Party System upon the Working of the Government.

understood without some knowledge of the party system as it exists in the United States. That system is, as has been well observed by H. J. Ford,[1] a sort of link between the executive and the legislative departments of government, and thus the policy and action of the party for the time being in power forms a sort of second and unofficial government of the country, directing the legal government created by the Constitution. In no country have political parties been so carefully and thoroughly organized. In no country does the spirit of party so completely pervade every department of political life; not that party spirit is any more bitter than it is in Europe, for in some respects it is usually less bitter and less passionate than in France, the United Kingdom or Austria, but that it penetrates farther into the body of the people, and exerts a more constant influence upon their minds. Party organizations have in the United States a wide range of action, for they exist to accomplish five purposes. Three of these are pursued in other countries also. These three are: first, to influence governmental policy; secondly, to form opinion; and thirdly, to win elections. But the two others are almost (if now not quite) peculiar to the United States, viz. to select candidates for office and to procure places of emolument for party workers. The selecting by a party of its candidates, instead of allowing candidates to start on their own account, is a universal practice in the United States, and rests upon the notion that the supreme authority and incessant activity of the people must extend not only to the choice of officials by vote, but even to the selection of those for whom votes shall be cast. So the practice of securing places for persons who have served the party, in however humble a capacity, has sprung from the maxim that in the strife of politics "the spoils belong to the victors," and has furnished a motive of incomparable and ever-present activity ever since the administration (1829–1837) of President Andrew Jackson. It is chiefly through these two practices that the party organizations have grown so powerful, and have been developed into an extremely complicated system of machinery, firm yet flexible, delicate yet quickly set up, and capable of working efficiently in the newest and roughest communities.

Origin and History of the Parties.

§ 31. The contests over the adoption of the Federal Constitution by the several states in 1787–1790 brought to the surface two opposite tendencies, which may be called the centrifugal and centripetal forces, a tendency to maintain both the freedom of the individual and the independence, in legislation, in administration and in jurisdiction, of the several states, and an opposite tendency to subordinate the states to the nation, and to vest large powers in the central Federal authority. These tendencies soon arranged themselves in concrete bodies, and thus two great parties were formed. One, which took the name of Republican, became the champion of states' rights, and claimed to be also the champion of freedom. It was led by Thomas Jefferson. The other, the Federalist party, led by Alexander Hamilton, stood for an energetic exercise of the powers of the central government, and for a liberal interpretation of the powers granted that government by the Federal Constitution. The Jeffersonian party has had an unbroken continuity of life, though it has been known since about 1830 as the Democratic party. The Federalist party slowly decayed, and ultimately vanished between 1820 and 1830, but out of its ruins a new party arose, practically its heir, which continued powerful, under the name of Whigs, till 1854, when it broke up over questions connected with the extension of slavery. Very soon thereafter a party, nominally new, but largely formed out of the Whigs, and maintaining many of its traditions, sprang up, and took the name of Republicans. Since 1856 these two great parties, Democrats and Republicans, have confronted one another, including between them the vast majority of the people. After the Civil War, when the questions attending Reconstruction had become less acute, economic discontents gave rise to other smaller parties, such as Greenbackers, Labor party and Populists, and the sense of the harm done by the licensed sale of alcohol evoked a party which became known as the Prohibitionists. Still later the growth of Collectivist views, especially among the immigrants from Continental Europe, led to the formation of a Socialist Labor party and a Socialist party, some of those who had belonged to the Populists associating themselves with these new groups.

The Democratic party began to form for itself a regular organization in the presidency (1829–1837) of Andrew Jackson, and the process seems to have been first seriously undertaken in New York state. The Whigs did the same; and when the Republicans organized themselves, shortly after the fall of the Whigs, they created a party machinery on lines resembling those which their predecessors had struck out. The establishment of the system in its general form may be dated from before the Civil War, but it has since been perfected in its details.

Outline of the System of Party Organization.

§ 32. The machinery of an American party consists of two distinct but intimately connected sets of bodies, the one permanent, the other temporary, or rather intermittent. The function of the former is to manage the general business of the party from month to month and year to year. That of the latter is to nominate candidates for the next ensuing elections and to make declarations of party opinion intended to indicate the broad lines of party policy.

Party Committees.

The permanent organization consists of a system of committees, one for each of the more important election areas. There is a committee for every city, every county, and every congressional district, and in some states even for every township and every state legislature district. There is, of course, a committee for every state, and at the head of the whole stands a national committee for the whole Union, whose special function it is to make arrangements for the conduct of party work at a presidential election. Thus the country from ocean to ocean is covered by a network of committees, each having a sphere of action corresponding to some election area, whether a Federal area or a state area. Each committee is independent and responsible so far as regards the local work to be done in connexion with the election in its own area, but is subordinate to the party committees above it as respects work to be done in its own locality for the general purposes of the party. The ordinary duties of these committees are to raise and spend money for electioneering and otherwise in the interests of the party, to organize meetings, to "look after the press," to attend to the admission of immigrants or new-comers as voters, and generally to attract and enrol recruits in the party forces. At election times they also direct and superintend the work of bringing up voters to the polls and of watching the taking and counting of the votes; but in this work they are often aided or superseded by specially appointed temporary bodies called "campaign committees." These party committees are permanent, and though the membership is renewed every year, the same men usually continue to serve. The chairman in particular is generally reappointed, and is often, in a populous area, a person of great and perhaps autocratic power, who has large funds at his disposal and a regular army of "workers" under his orders.

Party Nominating Conventions.

The other and parallel branch of the party organization consists of the bodies whose function it is to nominate party candidates for elective posts, whether legislative or executive. (It must be remembered that many executive state, county and city officers are chosen by direct popular vote.) These bodies are meetings of the members of the party resident in each election area. In the smallest areas, such as the township or city ward, the meeting is composed of all the recognized members of the party who are entitled to vote, and it is then called a primary. In the larger election areas, such as a county or city, the number of voters who would be entitled to be present renders it impossible to admit all, so the nominating meetings in these areas are composed of delegates elected in the various primaries included in the area, and the meeting is called a nominating convention. This is the rule, but in some parts of the South and West nominations for members of the state legislature and county officials, and even for members of Congress, are made by primary assemblies meeting over the entire area, which all the party voters are entitled to attend. Where candidates are to be nominated for a state election, the number of delegates from primaries would be too large, so the state nominating convention is composed of delegates chosen at representative conventions held in smaller areas.

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[1] *Rise and Growth of American Politics.*

Every registered voter belonging to the party in the local election area for which party candidates are to be nominated is presumably entitled to vote in the primary. In rural districts little difficulty arises, because it is known what citizens belong to each party; but in cities, and especially in large cities, where men do not know their neighbours by sight, it becomes necessary to have regular lists of the party voters entitled to attend a primary; and these lists are either prepared and kept by the local party committee, or are settled by the votes of the persons previously on the party rolls. The composition of these lists is of course a serious matter, because the primary is the foundation of the whole party edifice. Accordingly, those who control the local organizations usually take pains to keep on the lists all the voters whom they can trust, and are apt to keep off those whom they think likely to show a dangerous independence. By their constant activity in this direction, and by their influence over the pliable members of the party, they are generally able to have a primary subservient to their will, which is ready to nominate those whom they may suggest as suitable candidates, and to choose as delegates to the conventions persons on whom they can rely. In this way a few leaders may sometimes be able to obtain control of the nominating machinery of a city, or even of a state, for the local committees usually obey instructions received from the committees above them. (See, as to the details of party machinery, *American Commonwealth*, chs. lix.-lxiv., M. Ostrogorski on *Democracy in England and America*, and Professor Jesse Macy on *Party Organization and Machinery*, 1904.)

The great importance of these nominating bodies lies not only in the fact that there are an enormous number of state, county and city offices (including judicial offices) filled by direct popular election, but also in the fact that in the United States a candidate has scarcely any chance of being elected unless he is regularly nominated by his party, that is to say, by the recognised primary or convention. To control the primary or the convention (as the case may be) of the party which is strongest in any given area is therefore, in ninety-nine cases out of a hundred, to control the election itself, so far as the party is concerned, and in many places one party has a permanent majority.

As the desire to dominate primaries was found to lead to many abuses, both in the way of manipulating the lists of party voters and in the unfair management of the primary meetings themselves, a movement was started for reforming the system, which, beginning soon after 1890, gathered so much support that now in the large majority of the states laws have been enacted for regulating the proceedings at primary nomination meetings. These laws vary greatly in their details from state to state, but they all aim at enabling the voters to exercise a free and unfettered voice in the selection of their candidates, and they have created a regular system of elections of candidates preliminary to the election of office-holders from among the candidates. In most states the voter is required, when he obtains his ballot at the primary election, to declare to which party he belongs, but sometimes the primary is "open" and he may vote for any one of the persons who are put forward as desiring to be selected as candidates. The laws usually contain provisions punishing fraud or bribery practised at a primary, similar to those which apply to the subsequent elections to office. Although political parties were originally mere private organizations, little objection seems to have been felt to giving them statutory recognition and placing the proceedings at them under full official control.

The National Nominating Convention.

§ 33. One nominating body is of such conspicuous magnitude as to need special notice. For the selection of party candidates for the offices of president and vice-president of the United States there is held once every four years, in the summer preceding the election (which takes place in November) of the president, a huge party assembly of delegates from conventions held in the several states, each state having twice as many delegates as it has electoral votes to cast (*i.e.* twice as many as its Federal senators and Federal representatives). Two delegates are chosen for each congressional district by a district convention, and four delegates for the state at large by a state convention. Each state delegation usually keeps together during the national convention, and holds private meetings from time to time to decide on its course.

When the national convention has been duly organized by the appointment of committees and of a chairman, its first business is to discuss and adopt a series of resolutions (prepared by the committee on resolutions, but subject to amendment by the convention as a whole), which, taken together, embody the views, programme and policy of the party, and constitute what is called its "platform" for the ensuing election. This declaration of principles and plans is sometimes of importance, not only as an appeal to the people in respect of the past services and merits of the party, but as pledging them to the measures they are to introduce and push forward if they win the election. It then proceeds to receive the nomination of various aspirants to the position of party candidate for the presidency. The roll of states is called alphabetically, and each state, as reached in the roll, is entitled to present a candidate. Thereafter a vote is taken between the several aspirants. The roll of states is again called, and the chairman of each state delegation announces the vote of the state. In Democratic conventions a state delegation, when instructed by the state convention to cast its whole vote solid for the particular aspirant favoured by the majority of the delegation, must do so (this is called the unit rule); in the conventions of the other parties individual delegates may vote as they please. If one aspirant has obtained on the first roll-call an absolute majority of the whole number of delegates voting—or, in Democratic conventions, a majority of two-thirds of those voting—he is held to have been duly chosen, and the choice is then made unanimous. If, however, no one obtains the requisite majority, the roll is again called until some one competitor secures the requisite number of votes. Sometimes one or two votings are sufficient, but sometimes the process has to be repeated many times—it may even continue for several days—before a result is reached. Where this happens there is much room for the display of tactical skill by the party managers in persuading delegates who favour one of the less prominent aspirants to transfer their votes to the person who seems most likely to unite the party.

When one aspirant has been duly selected as the party candidate for the presidency, the convention proceeds to choose in the same way a person to be candidate for the vice-presidency. This is a much simpler matter, because the post is much less sought after, and it is usually despatched with ease and promptitude. The two nominees are then deemed to be the candidates of the whole party, entitled to the support, at the ensuing election, of the party organizations and of all sound party men throughout the Union, and the convention thereupon dissolves.

Influences which guide the Parties.

§ 34. It is hardly too much to say that in the United States the parties work the government. The question follows, Who work the parties? The action of the parties depends upon and is the resultant of three factors, which are indeed more or less present in all constitutional representative governments. These are (*a*) individual leaders, who are powerful either by their talents or by the influence they enjoy over the citizens; (*b*) rich men, who can supply the party with the very large sums of money needed for maintaining the party machinery in efficiency and for fighting the elections; and (*c*) the opinion of the mass of the citizens, who, though generally disposed to adhere to the traditions and follow the leaders of the party to which they belong, do, especially in the more educated classes and in the most advanced parts of the country, exert a certain measure of independence, and may refuse to vote for the party candidates if they either distrust those candidates personally or disapprove of the policy which the party seems to be following. It need hardly be said that the relative importance of these three factors varies from time to time. Fortunately that of the second has grown weaker in recent years.

General Results of the Power of the Party System.

§ 35. The national parties have been so pervasive in their influence, and the working of their machinery has formed so important a part of the political history of the United States, that it is necessary here to call attention to the high significance of this element in the system of the Republic. The party system has made nearly all elections, including those for state offices and city offices, the functions of which have, as a rule, nothing whatever to do with national party issues, matters of party strife fought upon party lines. It has disposed voters in state and city elections to support party candidates, of whom they might otherwise have disapproved, for the sake of maintaining in full strength for national purposes the local party organization, and it has thereby become a fruitful source of municipal misgovernment. It has thrown great power into the hands of party managers, because where the strife between the two great parties is keen and the result of a contest doubtful, discipline and obedience are deemed needful for success. It has tended to efface state lines, and to diminish the interest in state issues, and has thus helped to make the nation overshadow the states. (J. Br.)

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VIII.—FINANCE

The taxing powers within the United States are as follows:—

a. The national government, whose revenue powers are only limited by: (*a*) the provision of the constitution which prohibits all duties on exports, and (*b*) the provision that all direct taxes must be levied in proportion to population—a provision which deprives direct taxes of nearly all their efficiency for revenue purposes.

b. The several states, whose revenue powers are only limited by: (*a*) restrictions in their respective constitutions, and (*b*) the general principle that those powers must not be exercised in such a way as to contravene laws of the United States, or to destroy sources of the national revenue, although a state may prohibit within its borders the sale of liquors, from taxes upon which the United States Treasury derives a considerable part of its receipts.

c. Within each state powers of taxation, to a determinate or to an indeterminate extent, as the case may be, are by the constitution and laws of the state conferred, almost always for strictly defined purposes, (1) upon counties, (2) upon cities, boroughs and incorporate villages, and (3) in nearly all the states, though in widely varying degrees, upon the primary geographical divisions of counties, such as the "town" of New England and the "township" of the Middle and Western states.

The revenues of the several states, and of minor governmental areas within them, are mainly derived from a general property tax, laid directly upon realty and personalty. More than 82% of the tax revenues of state and local governments were thus derived in 1902. The average real rate of assessment was $0·72 in 1880 and $0·74 in 1902. The details of this system, which has no other refuge in the civilized world save partially in Switzerland, are remarkable for a most extraordinary diversity in the manner of collection, which practically becomes, however, self-assessment, and an equally extraordinary and general evidence of the crudity and inadequacy of the system, which has been the target of state tax reports throughout the Union for half a century. Nevertheless, only recently have other sources of revenue been largely developed, and the general property tax to a degree abandoned. Thus an inheritance tax was first adopted by Pennsylvania in 1826, yet sixty years later only two states were taxing collateral inheritances. In 1907 there were 34 such, and 19 of these were taxing direct inheritances as well. This is a modern democratic tax, and there are similar tendencies in other taxes. Business taxes are fast increasing, and many special property taxes, these two classes yielding in 1902 7·24% of state and local revenues. The taxation of corporations is recent and rapidly increasing. The same is true of habitation taxes. A beginning has been made with income taxes. Finally, the strain upon municipal finances incident to a realization of civic improvements has called attention to intangible wealth: street railways are no longer taxed as scrap iron but as working systems, with due attention to their franchises; and there is a beginning of the doctrine that the increase in value of unimproved realty constitutes income that should be taxed. The same conditions have made of importance general theories, such as the single tax theory of Henry George, for taxing landed values. All these tendencies, although strongest in municipal finances, are general.

Restrictions upon the taxing power, and unwise classifications of property for taxation purposes, embodied without good understanding in state constitutions, have been a primary obstacle to the development of sound systems of taxation in the several states. A lack of interstate comity, and double taxation of certain classes of property, have also offered difficulties. The progress toward better conditions has, however, been in late years rapid.

A similar restriction placed by the Constitution (art. 1, § 2) upon the power of the Federal government to lay "direct taxes" has been interpreted by the Supreme Court, by a bare majority, in such a way as to make very difficult, if not impossible, the imposition of an income tax (although, it may be added, such taxes had been unanimously held constitutional by the court in earlier decisions, which rested in turn upon interpretations of the constitutional provision just referred to given by the court when it counted among its members justices who had been members of the convention that framed the constitution).

The entire Federal system is the result, partly of constitutional provisions, partly of experience. The Federal authority naturally resorted first to customs duties upon foreign commerce, because in this field it had exclusive authority. It adopted next excise duties on articles produced or consumed within the country, notably liquors and tobacco. These two species of indirect taxes have from the beginning been the main sources of national revenue. At three periods, namely 1800–1802, 1814–1817 and 1863–1871, direct taxes have contributed considerable amounts to the revenue. These taxes included in the last period—that of the Civil War—income and legacy taxes, taxes on commercial transactions, and taxes on persons and property. At times also the proceeds of the sales of public lands have formed an important element of the receipts of government, although it has been the accepted policy to sell such lands to actual settlers at rates so low as to be inconsistent with the object or attainment (relatively) of revenue. Indeed, under the homestead law, large portions of the public domain have been given away to settlers (see HOMESTEAD AND EXEMPTION LAWS), while even larger amounts have been alienated in aid of schools, public improvements, &c., so that the portion sold has not been a third of the total amount alienated. It is possible, however, that the growing consciousness of the necessity of conserving the national resources may lead to a much greater income in the future from the small amounts still remaining in the hands of the national government. In 1908 there still remained unappropriated and unsurveyed, according to the General Land Office, 754,895,296 acres. Of these, 387,000,000 acres were still open to entry, but most of this vast extent consisted, in the opinion of the National Conservation Commission of 1908, of lands either arid or otherwise unsuited for settlement. There were also, in July 1908, about 235,000,000 acres of national forests, parks and other reservations for public use.

Customs duties have been found to be in general the most cheaply collected, the least conspicuous, and least annoying of all taxes. They have, however, never been a stable source of revenue, even during periods when the tariff was constant; and compared with the steady returns shown by the selected articles of the British tariff list this instability has been most extraordinary. Very often their income has been far above the amount needed for all disbursements of the government. In times of war they have of course fallen to a minimum. Thus, in the period 1791 to 1811 their ratio to total government expenditure ranged from 41·6 to 189·6%; during the years 1812–1817, from 17·2 in 1814, when war finances reached their weakest point, to 131·4% in 1817, showing how rapid was their response under the return of peace; in the period 1817–1859 from 29·9% in the crisis year of 1837 to 158·9%; in the period 1860–1869 from 6·5% in 1865, when the government's bonds fell in price to $50·93 per hundred and the war policy of loans was most desperate, to 84·1%; in the years 1870–1893 from 51·4 to 85%; and, finally, in the years 1893–1909, from 36·9% (in 1898) to 52·7%.

Of the total imports of 1909 47·4%, of a value of $699,799,771, entered duty free. More than half of these were crude materials for manufactures. The total imports per capita and the duty collected upon them per capita have been as follows since 1885, taking every fifth year: 1885—$10·32 and $3·17; 1890—$12·35 and $3·62; 1895—$10·61 and $2·17; 1900—$10·88 and $3·01; 1905—$13·08 and $3·11; 1908—$13·57 and $3·24.

The attempts of the Federalist party to create a system of internal taxation was a leading cause of its downfall. During the years in which it was in power little more than a tenth of the national revenue was derived from excises, yet they became a national political issue, and the Whisky Rebellion shows how little they were fitted to the nation at that time. The excise system disappeared with the incoming of the Democratic party in 1801. As a temporary necessity such taxes were again resorted to during the war of 1812, and again during the Civil War. In the latter period the excise proved of great richness, and quickly responsive in its returns; whereas the customs were inelastic so long as the war continued. After the war a system of internal revenue was therefore continued.

Of recent years the growing stringency of both national and local finances by enormously increased disbursements has made important the question of the relation of national with state and local taxation. The customs revenue, in its form of high protection, has always had against it a strong free trade sentiment, generally unorganized, and this seems to be growing. The internal revenue is affected by the remarkable spread of the prohibition movement. A considerable and growing public sentiment in favour of the use of the taxing power for the regulation of wealth taken from society demands the introduction into the Federal system of income and inheritance taxes. The last—inasmuch as an income tax that is constitutional can perhaps not be framed—is the only promising source that can give the addition to the Federal revenues that must be needed in case the customs or the excise revenues are reduced.

From 1860 to 1870 the population increased 22·6%, and the net ordinary expenditures of government, not including payments on the national debt, rose 173%; from 1870 to 1900 the corresponding figures (using the official estimated population) were 129% and 408%. The aggregate net ordinary receipts into the United States treasury, from 1791 to the 30th of June 1885, were as follows, in millions of dollars: from customs, 5642; from internal revenue, 3449; from direct taxes, 28; from public lands, 241; from miscellaneous sources, 578; total, 9938. The corresponding figures for the years from 1886 to the 30th of June 1909 were as follows, respectively: 5403; 4618; 0·142; 121; 969.

The expenditures of the government increased steadily per capita up to the opening of the Civil War. The ease with which money was acquired in the war period, the acquiescence of the people, and the influences of extravagance and corruption engendered by the war, opened, at the return of peace, a period of extravagant expenditure that has continued with progressive increase down to the present. A phenomenal growth of both customs and excise revenue has made such expenditures easy. From 1791 to 1886 the aggregate net ordinary expenditures of the government—these expenditures being exclusive of payments on account of principal and interest of the public debt—were as follows, in millions of dollars: for the army, 4563; navy, 1106; military pensions, 900; miscellaneous, 2168; total 8737. The corresponding figures for the period 1887 (June 30) to 1908 (June 30) were: 2003; 1219; 2884; 2790; total 8896.

The average yearly ordinary receipts of the decade 1900–1909, distributed by source, was as follows: from customs, $280,728,741·30; from excise, $257,477,356·45; from miscellaneous sources, $48,736,721·89; total ordinary revenue, $586,942,919·64 or $7·11 per capita; revenue from sale of Panama bonds, $8,730,959·48; from premiums exclusive of Panama bonds, $397,894·20. The average yearly disbursements during the decade, distributed according to object, were as follows: for civil list and miscellaneous objects, $143,697,123·09; army, $130,416,902·62; navy, $96,722,000·90; military pensions, $144,856,529·16; Indians, $12,966,563·00; on account of debt, $25,632,072·60; total, $586,942,920.

In 1909 the ordinary receipts were $637,773,165, or $7·17 per capita; and the ordinary disbursements $670,507,889, or $7·54 per capita. The revenues of all the states, counties, cities and other local governments, plus those of the national government, aggregated in 1879 only $584,980,614.

Since 1870 the national census office has determined several times the aggregate indebtedness of the national, state and other local governments. The results are stated below, for 1870 and 1902, in round millions of dollars. Sinking funds are deducted.

Government.	1870.		1902.	
	Total.	Per capita.	Total.	Per capita.
	$	$	$	$
United States	2,331·2	60·46	925·0	11·77
States and territories	352·9	9·15	234·9	2·99
Counties	187·6	4·87	196·6	2·50
Other local governments, excluding rural school districts	328·2	8·51	1,387·3	17·65
School districts outside of urban centres of 8000 or more inhabitants	—*	—	46·2	0·59

* Included in 1870 in the preceding category.

The national government set out in 1790 with a revolutionary debt of about 75 millions of dollars. This debt continued, slightly increased but without any very important change, until 1806, when a reduction began, continuing until 1812, when the debt was about 45 millions. The then ensuing war with England carried the debt up to 127 millions in 1816. This was reduced to 96 millions in 1819, to 84 millions in 1825 and to 24 millions in 1832, and in the three years following was extinguished. The crisis of 1837, and the financial difficulties ensuing, created indebtedness, fluctuating in amount, which at the beginning of the war with Mexico was about 16 millions. At the conclusion of peace the debt had risen to 63 millions, near which point it remained until about 1852, from which time successive reductions brought it down to 28 millions in 1857. The financial crisis of that year caused an increase, which continued until the imminence of the Civil War, when it rose from 65 millions in 1860 to 91 millions in 1861, to 514 in 1862, to 1120 in 1863, to 1816 in 1864, to 2681 in June, and its maximum (2846 millions) in August 1865. These figures are of gross indebtedness. The amount of the debt per capita of population, less cash in the treasury, was $15·63 in 1800; it fell to $0·21 in 1840; rose again, and in 1865 reached a maximum of $76·98; since when it had fallen by the 30th of June 1908 to $10·76. The amount of the debt outstanding, minus gold and silver certificates and Treasury notes offset by cash in the Treasury, was $1,295,147,432·04 on the 1st of November 1909. Of this amount $913,317,490 was bearing interest.

IX.—Army

The regular army has always been small, and in time of war reliance has been upon volunteer forces (see Army). This was truer of the Civil War than of the War of Independence or the war with Mexico. In the last the numbers of militia and volunteers was but little more than twice, and in the second little more than equal to the number of regulars engaged; while in the Civil War the proportion was as one to twenty. Again, the number of regular troops engaged in the War of Independence (namely, 130,711 men enlisted) was greater, absolutely, than that engaged in the Civil War (126,587). Finally, it is interesting to note that in 1799, when war seemed probable with France, the army was organized with a force of 52,766 men, and during the second war with Great Britain the number was made 57,351 in 1813 and 62,674 in 1814; while the organized strength under the law of 1861, which was in force throughout the Civil War, was only 39,273 men. Small as the regular force has always been, its organization has been altered some two score of times in all.

The law for its organization in force in 1910 provides that the total enlisted strength shall not at any one time exceed 100,000. The full active force of the present organization is as follows: 15 regiments of cavalry, with 765 officers and 13,155 enlisted men; 6 regiments of field artillery, with 236 officers and 5220 enlisted men; 30 regiments of infantry, with 1530 officers and 26,731 enlisted men; 3 battalions of engineers, with 2002 enlisted men, commanded by officers detailed from the corps of engineers; a special regiment of infantry for Porto Rico, with 31 officers and 576 enlisted men; a provisional force of 50 companies of native scouts in the Philippines, with 178 officers and 5731 enlisted men; staff men, service school detachments, the military academy at West Point, Indian scouts, &c., totalling 11,777 enlisted men. The total number of commissioned officers, staff and line, on the active list, is 4209 (including 219 first lieutenants of the medical reserve corps on active duty). The total enlisted strength, staff and line, is 78,782, exclusive of the hospital corps and the provisional force. (See also Navy and Navies.)

(F. S. P.)

X.—History

A.—*Beginnings of Self-government, 1578–1690.*

1. The American nation owes its origin to colonizing activities in which the British, Dutch, Swedes, French and Spaniards bore a share, and which were continued during a period of more than two centuries at the beginning of the modern era. The settlements of the Dutch and Swedes (New Netherland and New Sweden) were soon merged in those of the British, and of the territory colonized by Frenchmen and Spaniards the United States, as it was in 1783, included only certain outlying regions (Florida and certain posts on the Great Lakes and in the Mississippi Valley). All the European nations which were interested in colonization shared in the enterprise, and the population of the region was therefore cosmopolitan from the outset. But the British, especially after 1660, secured a controlling influence, to such an extent that the history of the period can properly be regarded as the record of an experiment in British colonization.

Permanent settlements on the Atlantic seaboard were first made in the early years of the 17th century, and they continued steadily to increase until after 1680. Relatively speaking, that was the period of settlement, but population continued slowly to advance westward. In the 18th century occurred a large immigration of Germans and Scottish-Irish, who settled in Pennsylvania and New York and thence overflowed into the western parts of Virginia and the Carolinas. The only colony which was founded in the 18th century was Georgia (1732), by means of which British outposts on the Florida frontier were strengthened.

General Aspects of Colonization.

2. British colonization originated chiefly in private initiative, though it acted in half-conscious obedience to certain general principles of action. From this fact originated the trend toward self-government, which was fundamental and controlling in the history of the British on the American continent. But to an extent the tendencies which favoured self-government were counteracted by the influence of the British Crown and parliament. The influence of the Crown was continuous, except during the period of the Civil War and Commonwealth (1642–1660), while that of parliament was not felt until the middle of the 17th century, and its colonial legislation subsequent to that time was chiefly confined to matters of trade. The activities of Crown and parliament were directed toward the securing of Imperial interests and of that degree of subordination and conformity which, in states that have developed from Roman and feudal origins, attaches to the condition of colonies or dependencies. The term "imperial control" therefore suggests the second tendency in colonial affairs, to the discussion of which the historian must address himself.

3. Among the colonists the trend toward local independence and self-government was in harmony with the spirit of the English. Neither was it lacking among the other nationalities represented in the colonies. But in the case of the British it was greatly strengthened by the fact that the colonies were founded by private initiative, the government legalizing the efforts of the "adventurers" and planters, but leaving them in many cases almost wholly to themselves. Hence many small colonies and settlements were founded along the coast. A variety of motives—economic, religious and political—contributed to the founding of these colonies, and people correspondingly different in type came to inhabit them. As they differed from one another, so their descendants came to differ from the Europeans, out of the midst of whom they had come. The remoteness of the colonies from Europe and the difficulties under which communication with them was maintained confirmed and perpetuated the tendency toward independence both of England and its government. Somewhat similar conditions controlled intercolonial relations, kept the colonists apart from one another and checked efforts at co-operation. Thus it was that the causes which confirmed the colonists in the spirit of independence toward the mother country at the same time made them jealous of any external authority.

Chartered Colonies.

4. The term "chartered colonies" is the one which best describes the forms under which the British-American settlements were founded and under which they all continued for periods varying from a single generation to that of the entire duration of their colonial existence. They were the direct and characteristic results of private initiative in colonization. The discoverers and would-be

colonizers, acting individually or in groups, collected the ships, men and resources necessary for their enterprises, and procured from the Crown a charter. By this document the king conveyed to them a claim to the soil which would be valid in English law, gave them the right to transfer Englishmen thither as colonists, to trade with them and with the natives, and to govern the colony, subject to the conditions of allegiance and of British sovereignty in general. The rights and liberties of the colonists as British subjects, without attempt to define what they were, were guaranteed by the charters, and the grantee was prohibited from passing laws or issuing orders which were repugnant to those of England. In only a part of the charters—those chiefly which were issued subsequent to 1660—was express reference made to the calling of assemblies in the colonies. So general were the provisions of the charters that they only remotely determined the forms which government should assume under them and what the rights of the colonists should be. A considerable variety of institutions and social types existed under them. But their very indefiniteness made them valuable as objects of appeal to those who in time of controversy were upholding local rights and liberties.

Proprietary Provinces.

5. Of the chartered colonies there were two varieties—proprietary provinces and corporate colonies. Though alike in the fact that the patentees who founded them were mesne tenants of the Crown, they were quite unlike in their internal organization and to a considerable extent also in the character of the people who inhabited them. The proprietary province was a development from the principle of the fief, though with many variations. The early charters of discovery, those for example which were granted to John and Sebastian Cabot and to Sir Humphrey Gilbert, contemplated the founding of feudal principalities in the New World. The grant to Sir Walter Raleigh, which resulted in the abortive colonial experiment at Roanoke, was of the same character. At the period of transition from the rule of the Tudors to that of the Stuarts, trading companies and companies whose purpose was colonization were increasing in number and importance. The first half of the 17th century was distinguished by the founding of many such, in France and the Netherlands as well as in England. The joint companies which were chartered by James I. in 1606, one to have its residence at London and the other at Plymouth, were of this character. They were granted the right to colonize, the one in northern and the other in southern "Virginia"; the intervening territory, three degrees in breadth, being left common to the two. The rights of the companies were confined to those of settlement and trade. The Plymouth patentees achieved no permanent result; but those of London founded Jamestown (1607) and other settlements along the James river, which later became the province of Virginia (*q.v.*).

London and Plymouth Companies.

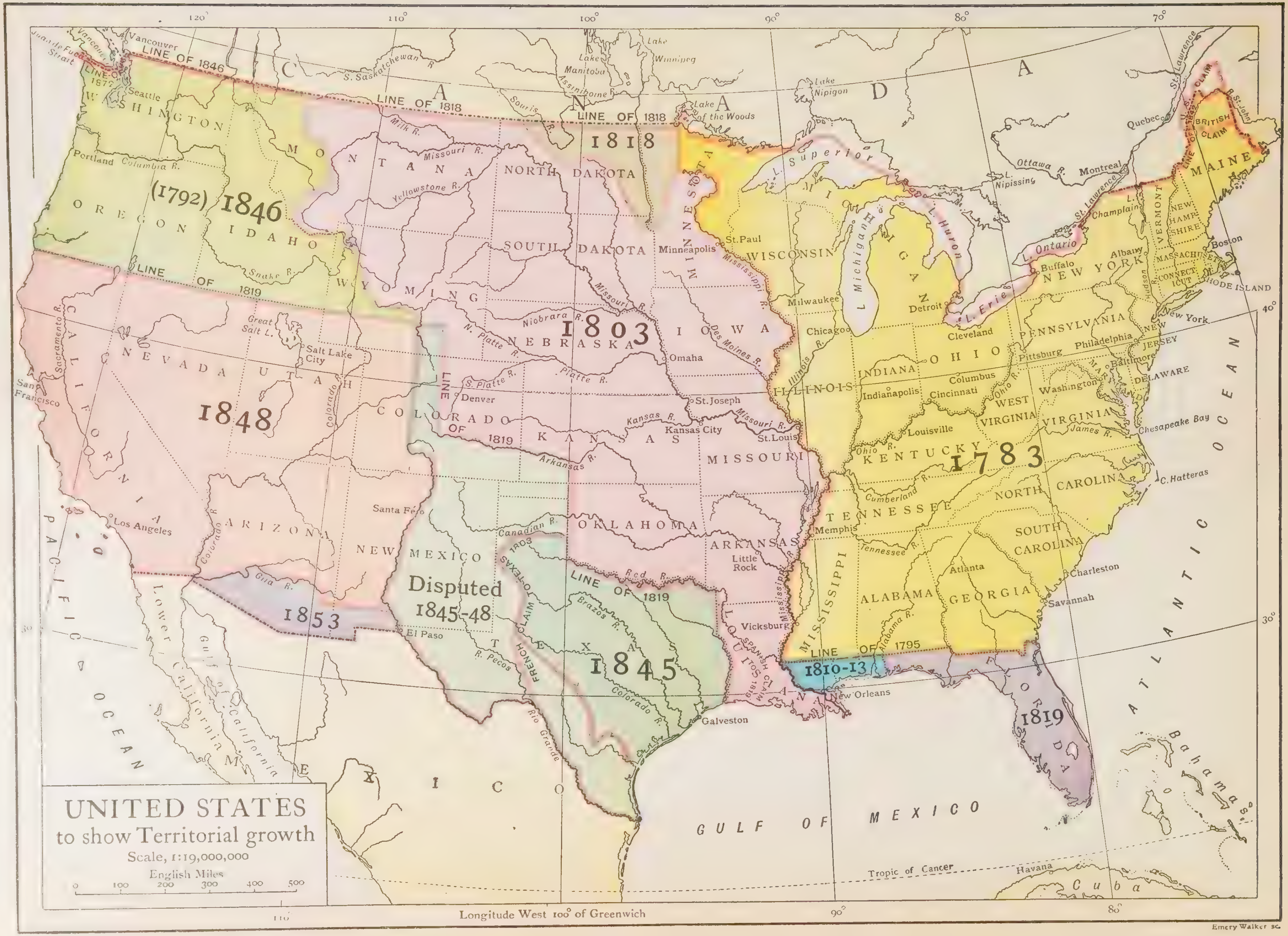
6. But before this result had been reached the London patentees had secured in succession two new charters, one in 1609 and another in 1612. By means of these grants they had practically separated from the Plymouth Company, had secured a concession of territory 400 m. broad and extending through the continent, and had been able to perfect the organization of their company. By the grant of 1606 the right to govern the colonies had been reserved to councils of royal appointees, one resident in England and one in each distinct colony which should be founded. But by their later charters the London patentees were fully incorporated, and in connection therewith received not only the power to grant land but rights of government as well. This made the Virginia Company of London in the full sense of the word the proprietor of the province which it was founding. It now appointed resident governors, councillors and other officials for the colony, and instructed and controlled them in all ways, subject of course to the general supervision of the king in council. Under the charter of 1606, in order to facilitate colonization on a strange continent, joint management of land and trade was temporarily instituted. But under the fully organized company, as managed by Sir Thomas Smith, and especially by Sir Edwin Sandys and the Ferrars, this system was abandoned, and private property in land and the control of trade through private "magazines" were established. A number of distinct plantations and settlements were founded which later developed into counties and parishes. From these localities, in 1619, under authority from the company, representatives were elected who met with the governor and council at Jamestown and formed the first colonial assembly held on American soil. Its acts were duly submitted to the company in London for its approval or disapproval. Other assemblies were called, the tobacco industry was established and the principles upon which traffic in that staple was to be conducted with Europe were announced. Thus Virginia assumed the form of a proprietary province, with an English trading company as its proprietor.

New England Council.

7. Meantime west of England men had been making fishing voyages and voyages of discovery to northern "Virginia", which now was coming to be known as New England. In 1620 a new charter was procured, the reorganized company being known, in brief, as the New England Council. Like the London patentees, this body was now fully incorporated and received a grant of the vast territory between 40° and 48° N. lat. and extending through to the South Sea (Pacific). Full rights of government, as well as of trade and settlement, were also bestowed. The moving spirit in this revived enterprise was Sir Ferdinando Gorges (*q.v.*), an Anglican and royalist from the west of England. For a time John Mason (*q.v.*) was his most active coadjutor. Such backing as the company received came from nobles and courtiers, and it had the sympathy of the court. But lack of resources and of active interest on the part of most of the patentees, together with the development of a Puritan interest in New England, led to the failure of this enterprise. No colony was established directly by the council itself, but that part of its vast territory which lay adjacent to the coast was parcelled out among the patentees and by them a few weak and struggling settlements were founded. They were all proprietary in character, and those along the northern coast were more or less connected with Anglican and royalist interests. But, as events proved, Plymouth Colony (founded in 1620), which was Puritan and Separatist to the core, became a patentee of the New England Council; and the colony of Massachusetts Bay (founded in 1628–1630), which was to become the citadel of Puritanism in America, procured the original title to its soil from the same source. At the outset both Massachusetts and Plymouth must be classed as proprietary settlements, though far different from such in spirit and destiny. Massachusetts soon (in 1629) secured a royal charter for its territory between the Merrimac and Charles rivers, and thus took a long step towards independence of the council. At the same time the Plymouth settlers were throwing aside the system of joint management of land which, as in the case of Virginia, had been imposed upon them by adventurers who had lent money for the enterprise; were paying their debts to these same adventurers and securing control of the trade of the colony; were establishing a system of self-government similar to that of Massachusetts. Thus a strong Puritan interest grew up in the midst of the domain which had been granted to the New England Council, and in connexion therewith the type of colony to which we have given the name corporate came into existence.

Corporate Colonies; the Virginia Company.

8. In order to understand the nature of the corporate colony, it is necessary to explain the internal organization of that type of company which, like the Virginia Company of London, was founded for purposes of trade and colonization. It was composed of stockholders, who became members as the result of the purchase of shares or of migration to the colony as planters, or of both acts combined. In the Virginia Company they were known as the "generality," in the Massachusetts and other companies as the "freemen." In them, when met as a democratically organized body under the name of "quarter court" or "general court," was vested the governing power of the company. It



UNITED STATES
to show Territorial growth
Scale, 1:19,000,000

English Miles
0 100 200 300 400 500
Longitude West 100° of Greenwich
Emery Walker sc.
120° 110° 100° 90° 80° 70° 40° 30°
1783
1803
1818
1819
1810-13
1845
1846
(1792)
1848
1853
Disputed 1845-48
LINE OF 1846
LINE OF 1818
LINE OF 1819
LINE OF 1795
LINE OF 1872
LINE OF 1842
BRITISH CLAIM
FRENCH CLAIM TO TEXAS 1803
SPANISH CLAIM TO 1819
C A N A D A
M E X I C O
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
Gulf of California
Lower California
Tropic of Cancer
Bahamas
Cuba
Havana
Juan de Fuca Strait
Vancouver
WASHINGTON
OREGON
IDAHO
MONTANA
WYOMING
CALIFORNIA
NEVADA
UTAH
ARIZONA
NEW MEXICO
COLORADO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
NEW JERSEY
DELAWARE
MARYLAND
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
MAINE
Seattle
Portland
San Francisco
Los Angeles
Sacramento R.
Columbia R.
Snake R.
Great Salt L.
Salt Lake City
Colorado R.
Gila R.
Santa Fé
El Paso
Denver
Rio Grande
R. Pecos
Canadian R.
Red R.
Brazos R.
Colorado R.
Galveston
Arkansas R.
Kansas R.
Kansas City
Platte R.
N. Platte R.
S. Platte R.
Niobrara R.
Missouri R.
Yellowstone R.
Milk R.
S. Saskatchewan R.
Souris R.
Assiniboine R.
Lake Manitoba
Lake Winnipeg
Lake of the Woods
Lake Nipigon
L. Superior
L. Michigan
L. Huron
L. Erie
L. Ontario
L. Nipissing
L. Champlain
Ottawa R.
St. Lawrence R.
R. St. John
Montreal
Quebec
Omaha
St. Joseph
St. Louis
Des Moines R.
Minneapolis
St. Paul
Mississippi R.
Milwaukee
Chicago
Illinois R.
Detroit
Cleveland
Columbus
Cincinnati
Indianapolis
Louisville
Ohio R.
Cumberland R.
Tennessee R.
Memphis
Little Rock
Vicksburg
New Orleans
Alabama R.
Atlanta
Savannah
Charleston
C. Hatteras
James R.
Chesapeake Bay
Washington
Baltimore
Philadelphia
Pittsburg
Buffalo
Albany
Hudson R.
New York
Boston

elected the officers, chief among whom were a treasurer or governor, and a council or board of assistants. These, as well as the subordinate officers, held for annual terms only. Four times a year, at the law terms, the general courts met for the transaction of business, elections being held at the spring meeting. Membership in such companies might be indefinitely increased through the issue and sale of shares. They were, in other words, open companies, whereas the New England Council was a closed body, its membership being limited to forty. The Massachusetts Company was an open corporation of the type just described.

Massachusetts Company; Removal of Charter to Massachusetts.

9. In 1629 the prospects of Protestantism at large, and of Puritanism in England, were so dark that the founders of the Massachusetts Company, who were decidedly Puritan in spirit and inclined to nonconformity in practice, resolved to remove with their charter and the governing body of their company into New England. Preparatory to this, John Winthrop was elected governor and a settlement was made of their business relations in England. After the removal had been made, the assistants and general court met in New England and business was carried on there exclusively by planters. An order was soon passed that none should vote or hold office who were not members of some one of the churches within the colony. As all these churches were Independent or Congregationalist in form and doctrine, this order gave a wholly new definition to the term "freemen." It made of this colony something approximating to a biblical commonwealth, and subordinated trade, land-holding and settlement to the interests of the Puritan faith. The board of assistants now assumed political and judicial functions. As local settlements about Massachusetts Bay were founded, the general court, which before had been a primary assembly—simply the freemen of the company—came to consist partly of representatives elected by the freemen of the towns. In this way a second chamber—that of the deputies—was added to the assistants to form the general court of the colony. Taxes were levied by this body, and laws and orders proceeded from it which related to all functions of government. It elected or appointed the governor and other chief officials, and determined the times of its own meeting. The governor had no veto and the general court was the controlling organ in the system.

10. Of primary importance in the affairs of the colony was everything which concerned religious belief and church government. The churches and their relation to the civil power presented the great questions upon which hinged its policy. This was true not only in its internal affairs, but in its relations with other colonies and with the mother country. An ecclesiastical system was developed in which Independent and Presbyterian elements were combined. By a rigid system of tests this was upheld against Antinomians, Baptists, Quakers and dissenters of all sorts. The securing of revenue from land and trade was considered subordinate to the maintenance of the purity of the faith. It was this which gave a point and vigour to the spirit of self-government in the New England colonies which is not perceptible elsewhere.

Connecticut; New Haven Colony; Rhode Island.

As a consequence of the Puritan migration from England and of the expulsion of dissenters from Massachusetts, Plymouth, Connecticut (*q.v.*), the New Haven Colony, and the towns about Narragansett Bay which became the colony of Rhode Island (*q.v.*), were settled. These all were corporate colonies, organized upon fundamentally the same plan as Massachusetts but differing from it in minor particulars. Their settlers at the outset had no charters, but by means of plantation or town covenants assumed powers of government, which ultimately were vested in general courts similar to that of Massachusetts. Rhode Island was formed by a union of towns, but elsewhere the colony was coeval with or antedated the town. Connecticut and Rhode Island, the former in 1662 and the latter in 1663, secured royal charters by which they were incorporated within New England itself and the governments which they had established there were legalized. New Haven was absorbed by Connecticut in 1664 under the charter of 1662 (see CONNECTICUT), and Plymouth remained without a charter from the king until, toward the close of the 17th century, it became a part of the enlarged province of Massachusetts.

11. The most prominent feature of the New England land system was the "town grant," which in every case became the territorial basis of a group settlement. Throughout New England, and in the outlying districts which were colonized by New Englanders, settlement was effected by groups. The process began in Plymouth and was extended through the entire section. The Puritan migration from Europe was of the same general character. Groups of people, animated by a common religious or political ideal, broke away from their original or temporary abiding-places and pushed farther into the wilderness, where tracts of land were granted to them by the general court. The corporate colonies did not seek profit from their land, but granted it freely to actual settlers, and in such amounts as suited their needs. No distinct land office was established by any New England colony. Land was not sold by the colony; nor, as a general rule, was it leased or granted to individuals. Rent formed no appreciable part of the colony revenue.

12. Over the founding of towns the general courts, as a rule, exercised a watchful supervision. Not only did the courts fix and maintain their bounds, but they issued regulations for the granting of lands, for common fields, fences, herds, the punishment of trespass, the admission of inhabitants and freeholders, the requirement that records of land titles should be kept, and the like. But subject to these general regulations, the allotment and management of its land was left to each town. The colonies had no land system apart from the town. It was partly in order to manage their lands that the towns were made centres of local government and town meetings or boards of town proprietors were established. By means of town action, taken in town meetings and by local officials, the land of each settlement was laid off as house lots, common and common fields, meadow and pasture. Detailed regulations were made for the management of common fields and for their ultimate division and allotment among their proprietors. The same was true of fences and herds. The result was an organization similar to the English manor, but with the lord of the manor left out; for in the case of the New England town administrative authority resided in the body of the freeholders. To this peculiarity in the form of New England settlement is due the prominence of the town, as compared with the county, in its system of local government. The town was the unit for purposes of taxation and militia service as well as of elections. It was also an important ecclesiastical centre, the parish usually corresponding with it in extent.

13. As a result of the process thus sketched, southern New England was settled by a population of English origin, with similar instincts and a form of political organization which was common to them all. Gorges, meantime, had secured (1639) a royal charter for his province of Maine, but Mason had died before he obtained such a guaranty for his settlements on the Piscataqua river. The small communities along that entire coast remained weak and divided. In 1635 the New England Council surrendered its charter. The helplessness of the Gorges family was insured by its adherence to the royalist cause in the English Civil War. Massachusetts availed itself of a forced interpretation of the language of its charter respecting its northern boundary to extend its control over all the settlements as far north-east as the Kennebec river. This was accomplished soon after 1650, and for the time Anglican and royalist interests throughout New England seemed hopelessly wrecked. New England had thus developed into a clearly defined section under Puritan domination. This fact was also clearly indicated by the organization, in 1643, of the New England Confederacy, or the United Colonies of New England (see NEW ENGLAND), which comprised the orthodox Puritan colonies, whose leading magistrates, as annually elected commissioners, for twenty years exercised an advisory control over New England.

Middle and Southern Colonies.

14. The colonies of the middle and southern sections of the territory, which later became the United States, were wholly proprietary in form. This was true of New Netherland (founded by the Dutch West India Company in 1621) and of New Sweden (settled under the authority of the Swedish Royal Company in 1638), as well as of the English colonies which were established on that coast. In the case of Virginia and of the Dutch and Swedish settlements, trading companies were the proprietors. But the later English colonies, beginning with Maryland in 1632, and continuing with the Carolinas (1663), New York (1664), New Jersey (1665), Pennsylvania and the Lower Counties, afterwards Delaware (1681), were founded by individual proprietors or proprietary boards. Georgia (1732), the only English colony settled after 1681 on the continent, existed for twenty years under a proprietary board of trustees. By the efforts of adventurers of this class, put forth chiefly during the period of the Restoration, the entire coast-line from Florida to Acadia was permanently occupied by the English. But, unlike New England, the population of the other sections was of a mixed character, as were their economic and religious systems, and to an extent also their political institutions.

15. As has already been stated, in their internal structure and in the course of their history the proprietary provinces differed very materially from the corporate colonies. Those of later English origin also differed in some important respects from Virginia under the company and from New Netherland and New Sweden. The system of joint management of land and trade, which was so characteristic of early Virginia, was outgrown before the other proprietary provinces were founded. Neither did it prevail in the Dutch and Swedish provinces, but there the law and institutions of government of those nations existed, and no provision whatever was made for assemblies.

16. In the proprietary province the proprietor, or board of proprietors, was the grantee of powers, while in the corporate colony it was the body of the freemen organized as an assembly or general court. The proprietor might or might not be a resident of the province. He might exercise his powers in person, or, as was usually the case, delegate them to one or more appointees. In any case, the form of government of the proprietary province was essentially monarchical in character. The powers that were bestowed were fundamentally the same as those which were enjoyed during the middle ages by the counts palatine of Chester and Durham. In some charters express reference was made to Durham as a model. The normally developed provinces which resulted were miniature kingdoms, and their proprietors petty kings. As Coke said, their powers were king-like though not sovereign. This character arose from the fact that the grantee of power was the executive of the province. This branch of government was thereby brought into the forefront. At the beginning and for a long time thereafter it continued to bear the leading part in affairs. It was not so in the corporate colony, for there the freemen and the general court stood at the centre of the system, and their ultimate control, which no one dreamed of disputing, was maintained through a system of annual elections. In most of the corporate colonies the executive (*i. e.* the body of magistrates) was strong, but that was due to the political and social influence which its officials had gained, and not to their tenure of office. But the nature of the proprietary province demands further explanation.

Government of the Proprietary Province.

17. In every case, apart from the ordinary rights of trade and the guarantees of the liberties of the colonists, the powers which were bestowed on the proprietors were territorial and governmental. The territory of the provinces was granted under the conditions which by English law controlled private estates of land. An entire province, or any part of it, could be leased, sold or otherwise disposed of like a private estate. It was an estate of inheritance, descending to heirs. The attitude of proprietors toward it was that of landlords, investors or speculators in land. They advertised for settlers, and, in doing so, an ever present motive with them was the desire to secure more private income from land. In 1664 the duke of York sold New Jersey to Berkeley and Carteret, and the sale was effected by deeds of lease and release. In 1708 William Penn mortgaged Pennsylvania, and under his will devising the province legal complications arose which necessitated a suit in chancery. Thus proprietors and proprietary boards changed with every generation or oftener. All this, of course, was different in the corporate colony.

18. In all the later proprietary charters, except that of New York, the operation of the statute *Quia emptores* was suspended, so far as relations between the proprietor and his immediate grantees were concerned. By virtue of this provision each proprietor, or board, became the centre from which originated an indefinite number of grants. These were held directly of the proprietor and through him of the Crown. In practice the same was true also of New York. The proprietors were thus left free to make grants on such conditions as they chose—limited by the nature of their patents—to erect or permit the erection of manors, to devise the machinery necessary for surveying, issuing and recording grants, and collecting rents. Preparatory to the exercise of this power, the proprietors issued so-called "concessions" or "conditions of plantation," stating the terms on which they would grant lands to colonists. These were often accompanied by descriptions of the country, which were intended to be advertisements for settlers. Under a system of head rights, analogous to that which existed in Virginia, land was thus bestowed on settlers upon easy terms. Proportional amounts of land were granted upon the importation of servants, and in this way a traffic in servants and their head rights to land was encouraged among planters and masters of merchant vessels. In all the provinces, except New Netherland, a quit rent was imposed on all grants. In the Dutch province rents were sometimes imposed, but they varied in character and differed from the English quit rent. In Maryland fines were levied on alienations. In Maryland and Pennsylvania the demand for land became so great that it was sold. In most of the provinces manorial grants were made, but in none except New Netherland did the manor become an institution of government. In all the provinces territorial affairs were administered directly by the provincial authorities, and not by towns as in New England. In Maryland a land office was fully organized, towns developed only to a very limited extent, and when they did originate they were in no sense village communities. Lots in them were granted by provincial authorities and they were subject to a quit rent. They were simply more densely populated parts of the counties, and, unless incorporated as boroughs, had no distinct institutional life. In almost all cases land, in the provinces, was granted to individuals, and individual ownership, with direct relations between the owners or tenants and the proprietary authorities, was the rule. This was in marked contrast to the conditions which have been described as existing in the corporate colonies. In the corporate colony the elements of the fief had been eliminated, but in the provinces they still survived to a considerable degree.

19. Had governmental powers not accompanied the territorial grants which have been described, these grants would have been estates of land, unusually large, no doubt, but nothing more. In cases where the governmental rights of proprietors were suspended or resigned into the hands of the Crown, they remained thereafter only private landlords. But the fact that rights of government were bestowed with the land made the territory a province and the proprietor its political head. The bestowment of rights of land carried with it not only the obligation to pay quit rent, but to take to the proprietor the oath of fidelity.

20. In the discussion of the corporate colony it was necessary to dwell first and chiefly on the legislature. But in the case of the proprietary province the executive, for the reason already mentioned, demands first attention. The provincial charters made the proprietors the executives of their provinces and for the most part left it to them to determine how and under what forms the governmental powers which they had received should

be exercised. The powers which were definitely bestowed were executive and judicial in character—the ordinance power, the authority to appoint all officers, to establish courts, to punish and pardon, to organize a military forçe and defend the provinces, to bestow titles of honour, to found churches and present to livings. The executive thus became the centre from and around which development in the province chiefly occurred. It gave to the proprietor an importance, especially at the outset, which was comparable with that enjoyed by the general courts in the corporate colonies. It made him in a derived and inferior sense the source, within the province, of office and honour, the fountain of justice, the commander of the militia, the recipient of the provincial revenue, the constituent part of the legislature. But in most cases the proprietors did not attempt to exercise these powers in person. Even if resident in their provinces they needed the assistance of officials. By means of commissioners they appointed a group of leading officials for their provinces, as a governor, councillors, a secretary, surveyor-general, receiver-general or treasurer, and somewhat later an attorney-general. These all held office at the pleasure of the proprietor, and were subject to guidance by his instructions.

The Provincial Governor.

Altogether the chief place among these officials was held by the governor. He was *par excellence* the agent for the proprietor for all purposes of administration. He regularly corresponded with the proprietor and received the latter's directions. In making appointments the proprietor was usually guided by his recommendations. In some cases he was a relative of the proprietor, and family influence in Maryland after the Restoration came to dominate the government of the province. In all his important acts the governor was required to take the advice of his council, and that body was expected to co-operate closely with him in all matters; but the governor was not bound to follow their advice. The relations between the two was the same as that between the king and his privy council in England. As settlements multiplied and counties and other local subdivisions were formed, other and inferior offices were created, the right of appointment to which rested with the governor, though it was exercised in the name of the proprietor. By means of an executive, thus organized, land was granted and the revenue from it collected, counties and other local divisions were established, relations were developed with the Indians, early preparations were made for defence, courts were opened and the administration of justice begun.

21. But in the later proprietary charters generally, with the exception of that issued to the duke of York, provision was made for assemblies. It was made, however, in very general terms, and it was left to the option of the proprietors to determine when, where and how they would call them. These legislatures did not originate in the natural or pre-existent rights of Englishmen, nor did the existence of a parliament in England make them necessary, though it greatly increased the difficulties of governing the colonies without them. Though they were not original in the sense which attached to the executive, they were immediately proven to be indispensable and their activity in the provinces gradually opened the way for the growth of modern democratic institutions.

The Provincial Legislature.

22. When met in regular form, the provincial legislature consisted of the governor, the council or upper house, and the assembly or deputies. The latter, who were elected by the localities, constituted the only representative part of the legislature. In tenure and functions the governor and council were largely independent both of the deputies and of the electors. They were a part of the executive and were naturally swayed by a regard for the interests of the proprietor and by administrative traditions. Though a component of the legislature, the council was the legal advisor of the governor. In many cases the importance of the councils was increased by the fact that, with the governor, in early times they formed the highest judicial tribunal in the province. As the governor had the sole power of calling, proroguing and dissolving the general assembly, the council might advise him in such a way as to destroy the body itself or thwart its plans. The joint work of the council and assembly was subject to the veto of the proprietor, or of both the proprietor and his governor. The legislature of the province, therefore, differed materially from the general court, though in practice this was somewhat offset by the fact that in the New England colonies the magistrates were usually re-elected for a long series of terms.

23. In the province, as in the kingdom, the legislature was in a sense an expansion of the executive, developed out of it, and was to an extent controlled by it. Out of this relation arose the possibility of conflict between the two parts of the legislature—that which represented the people and that which represented the proprietor. In the history of the provinces this formed the central line of cleavage. From the first the assemblies largely controlled taxation. Using this as a lever, they endeavoured to limit and define the powers of the executive and to extend the sphere of legislation more widely. Fees, from which officials derived most of their support, were a favourite object of their regulation. Occasionally offices which had originally been appointive were made elective. Protests of various kinds were made against official cliques. British statutes which favoured liberty and the powers of parliament were often referred to as guides and ideals of the opposition. Now and again the lower house came to a deadlock with council or governor. Threatened or actual revolt was sometimes necessary to bring the executive to terms. By such tactics as these the popular elements in the constitutions of the provinces asserted themselves. The sphere of ordinance was gradually limited and that of statute extended, while incidentally the system of government became more complex.

Constitutions.

In a number of provinces—the Carolinas, New Jersey and Pennsylvania—the proprietors at various times initiated elaborate constitutions, in which not only a land system, but forms and functions of government were prescribed on a large scale. These were variously known as fundamental constitutions, concessions and agreements, frames of government, and in every case were submitted to the general assembly for its acceptance or rejection. Long struggles often ensued over the question of acceptance, which usually ended in the modification or rejection of the schemes as too cumbersome for use or because they reserved excessive powers to the provincial executive.

Course of Development.

24. Though the main features in the form and development of the proprietary provinces have thus been indicated, it should be noted that their history was by no means uniform. In New Netherland and New York occurred a struggle for the establishment of a legislature, which continued at intervals for forty years and was not permanently successful until after New York had become a royal province. The proprietors of New Jersey never secured a royal charter, and therefore were not able to establish satisfactorily their claim to rights of government. As grants of land had been made to the settlers in certain localities within that province before its purchase by Berkeley and Carteret, opposition was made to the collection of quit rents, as well as to the enforcement of rights of government, and disturbances, resulting from these causes, became chronic. The province was also divided into East and West Jersey, the boards of proprietors being greatly increased in both, and West Jersey attaining an organization which was almost democratic in character. Within the vast reaches of the Carolina grant developed two provinces. One of these—North Carolina—was almost entirely neglected by the proprietors, and the weakened executive repeatedly succumbed to popular violence. In South Carolina many violent controversies occurred, especially over the efforts of the proprietors to compel the acceptance of the Fundamental Constitutions, which originated with Locke and Shaftesbury. But in the end this failed, and a simple form of government, such as was adapted to the needs of the province, was developed. In Pennsylvania the liberal policy of the proprietor led at the beginning to unusual concessions

in favour of the colonists. One of the most characteristic of these was the grant of an elective Council, which was intended to be aristocratic and the chief institution in the province. But owing to conflicts between it and the governors, affairs came to a deadlock. The total neglect of provision for defence by the Quaker province led to the suspension of Penn's powers of government for about two years after the English Revolution and the outbreak of the war with France. This did away with the elective Council for the time, and an appointive Council was soon substituted. Finally, in 1701, the Council was deprived of its powers of legislation and thereafter the legislature of Pennsylvania consisted of only one house—the Assembly.

B.—*Development of Imperial Control, 1606–1760.*

The Crown.

25. Turning now to the exercise of imperial control over the colonies, it is to be noted that it proceeded chiefly from the English Crown. It was exercised through the secretary of state, the privy council and a succession of boards subordinate to it which were known as commissioners of plantations or the board of trade; by the treasury and admiralty boards and their subordinate bureaus; by the attorney-general and the solicitor-general and by the bishop of London. The more continuous and intimate supervision proceeded from the privy council and the commissioners subordinate to it, and from the treasury board. The latter caused the auditing of such revenue as came from the colonies, supervised expenditures for them and had an oversight over appointments in the colonial service. The privy council received letters and petitions on almost every kind of colonial business, caused hearings and inquiries to be held, and issued letters, instructions and orders in council on an equally great variety of matters. It also acted as the regular court of appeal for the plantations. As time advanced, more of the administrative business passed directly into the office of one of the secretaries of state and the privy council became less active. The admiralty was concerned with the equipment of the navy for service in the colonies, and the high court of admiralty with the trial of prize cases and of cases arising from violations of the acts of trade. The assistance of the law officers of the Crown was sought in the drafting of charters, in the prosecution of suits for their recall, and in all cases which required the interpretation of the law as affecting the colonies and the defence of the interests of the British government in relation thereto. The bishop of London had supervision over the appointment and conduct of clergymen of the English Church in the colonies and over parish schools there. Not all of these boards and officials were active from the first, but they were created or brought into service in colonial affairs as the importance of the dominions increased.

Parliamentary Control.

26. The parliament by mentioning the dominions in its statutes could extend their provisions to the colonies. The early acts of supremacy and uniformity contained such reference, but it was dropped after the Restoration and no serious attempt was ever made to enforce uniformity in the colonies. Parliament did not begin to legislate seriously for the colonies until after the Restoration. Then the acts of trade and navigation were passed, to which additions were made in the reign of William III. and from time to time during the 18th century. This body of legislation, including about fifty statutes, comprised the most important acts relating to the colonies which were passed by parliament. A few statutes relating to military affairs were passed about the middle of the 18th century. Certain other laws relating to currency and coinage, to naturalization, to the punishment of governors, to the post office, to the collection of debts, and to a few other miscellaneous subjects complete the colonial legislation of parliament prior to 1760. About one hundred statutes in all were passed. The colonists themselves imitated in a general way the organization and procedure of the English courts. The main features of the common law came spontaneously into force in the colonies. The legislatures of several of the colonies adopted large parts of the statute law of England. The colonists were always accustomed to avail themselves, as far as possible, of the great English statutes which guaranteed liberty. After about 1690 the obligation was very generally enforced upon the colonies of sending the acts of their assemblies to England for acceptance or rejection by the king in council. Thus a general agreement between colonial and English law was attained.

27. But this, though far-reaching, was only one of the objects which were sought through the exercise of imperial control. Its object was to maintain the rights of Great Britain over the colonies and her interests in them in all respects. The diplomacy of Great Britain concerned itself to an increasing extent, as the 18th century advanced, with the acquisition or losses of colonial territory, with the fixing of boundaries and with the securing of commercial interests. The interests of trade, more than any other subject, determined the colonial policy of England. The Church and her interests also demanded attention. In all these matters the English executive—the Crown—continuously, and for the most part exclusively, managed colonial affairs. During the Commonwealth in the 17th century parliament was the source of all activity, whether legislative or executive, but at other times, as we have seen, its legislation was confined chiefly to the subject of trade. The English courts also played a minor part except when, in conjunction with the executive, they were concerned in the revocation of colonial charters.

Isolation of the Colonies.

28. A natural condition which affected colonial administration as a whole and to a large extent determined its limits and character was the remoteness of the colonies from England. With this the conditions of sparse and scattered settlements in a new continent in the midst of savages were closely connected. At best three months were required for sending a despatch from London to America and procuring a return. This explains the large degree of self-government which the colonies possessed and the indifference with which their affairs were usually viewed, even by British officials. Only a relatively small part of colonial business came before English officials or received their serious attention. Only at long intervals and in summary fashion was it brought to the attention of parliament. It is believed that the affairs of the continental colonies were never seriously debated in parliament until after the beginning of the controversy which led to the American War of Independence. Social and political intercourse with the colonists and governmental control over them were therefore very imperfectly developed, as compared with that which existed within the realm. That is the real meaning of the distinction between the realm and the dominions. Over the counties and other local jurisdictions of the realm the control of Crown and central courts and parliament was continuously felt. In law and theory the same was true of the dominions; in fact, the control over them was almost wholly executive, and during most of the period it was to a degree unintelligent and weak. In theory the British Empire was a consolidated structure; in fact it was something more resembling a federation.

Development of the Chartered Colony.

29. The central fact in colonial history during the 17th century was the development of the chartered colonies. At their founding, as we have seen, the Crown delegated rights of settlement and subordinate rights of government to proprietors, who used them in a variety of ways. The effect of this was to introduce a number of mesne lords between the king and his colonial subjects, a phenomenon which centuries before had vanished from England itself. The patentees governed the colonists, and the Crown only interfered at intervals to adjust matters. And when the Crown did this, its dealings were far more with the patentees and their officials than with the body of the colonists. The king had no officials of his own in the colonies, and a practical system of immunity existed. Under the first two Stuarts some rather desultory efforts were made to check the development of such a system in the early stages. After a controversy over a contract for

the sole importation of tobacco, which became involved with the political struggles of the time in England, the charter of the Virginia Company of London was revoked (1624). A royal commission was appointed to readjust the affairs of Virginia and to inaugurate its government as a royal province, and the king declared that he desired the government of all his dominions to be monarchical in form. Several commissions were later appointed to manage the tobacco trade. In 1634 a board of commissioners of plantations was created and it received very large powers over the colonies. Of this body Archbishop Laud was the moving spirit. The year following the New England Council resigned its charter, a writ of *quo warranto* was issued against the Massachusetts charter, and a plan was nearly perfected for sending out Sir Ferdinando Gorges as royal governor, or rather governor-general, to New England. But means were lacking, the suit against the Massachusetts patent failed to accomplish its purpose, and troubles at home soon absorbed the attention of the government.

30. During the Great Rebellion in England New England was left practically to itself. Strife broke out in Maryland, over which the home government was scarcely able to exercise even a moderating influence. The Dutch from New Netherland and Europe were able to monopolize a large part of the carrying trade in tobacco and European goods. Virginia, with Barbadoes and a few other island colonies, assumed an attitude of distrust or hostility toward the new government in England. In 1651 and 1652 parliament sent out a commission, with an armed force, which reduced the island colonies to submission and adjusted affairs in Virginia by suspending government under Sir William Berkeley, the royalist governor, and leaving control in the hands of the Assembly. By a stretch of power the commissioners also took control of affairs in Maryland, but there they intensified rather than allayed the strife. Baltimore, however, managed to save his interests from total wreck, and at the Restoration was able fully to re-establish his authority.

Commercial Influences; Administrative Changes; Navigation Acts and other Restrictive Legislation.

31. During this period of unstable government in England the seeds were planted of a colonial policy which was henceforth to dominate imperial relations. It was then that England entered upon the period of commercial rivalries and wars. The Cromwellian government determined to wrest the control of the carrying trade from the Dutch, and the Navigation Act of 1651 and the first Dutch War were the result. General Robert Sedgwick was sent against New Netherland, but ended in attacking Acadia. At this time also the national hatred of Spain, which had so characterized the age of Elizabeth, reasserted itself and the Spanish seas were invaded, Hispaniola was attacked, and Jamaica was conquered. In connexion with these events plans were formed for a more systematic colonial administration, which Cromwell did not live to execute, but which were taken up by Clarendon, the duke of York, the earl of Shaftesbury and a large group of officials, lawyers and merchants who surrounded them. They took definite shape after the Restoration in the creation of a council for trade and a council for foreign plantations, in the passage of the acts of trade, in the conquest of New Netherland and the organization within it of three English provinces, in the settlement of the Carolinas, in a resolute attempt to remedy grievances and adjust disputes in New England. These events and their consequences give greater importance to the next three or four decades than to any later period until the colonial revolt.

32. The council for foreign plantations was continued, sometimes under a patent and sometimes as a committee of the privy council, until, in 1696, it was commissioned as the board of trade. As a board of inquiry and report, subordinate to the privy council, the most important business relating to the colonies was transacted before it. The acts of trade, in which the principles of the system were laid down, were passed in 1660, 1663, 1673 and 1696. They expanded and systematized the principles of mercantilism as they had long been accepted, and as in some particulars they had already been applied to the Virginia tobacco trade. The import and export trade of the colonies was required to be carried on in English and colonial built ships, manned and commanded by Englishmen. The policy of the staple was applied to the trade of the colonies by the enumeration of their chief products which could not be raised in England and the requirement that such of these as were exported should be brought to England and pay duties there, and that thence the supplies not needed for the English market should be sent to foreign countries. The same policy was applied to all colonial imports by the requirement that they should pass through English ports. In order to prevent intercolonial traffic in enumerated commodities, which might lead to smuggling, the act of 1673 provided for the levy of an export duty on them in the colonies in cases where a bond was not given to land them in the realm. In the 18th century severe restrictive measures were passed to prevent the growth of manufactures, especially of wool, hats and iron, in the colonies; but these acts proved mostly a dead letter, because the colonies had not reached the stage where such industries could be developed on any scale. Certain compensations, favourable to the colonies, also appear in the system, *e.g.* the measures to suppress the raising of tobacco in England and Ireland, in order that the colonists might have the monopoly of that market; the payment of bounties on the importation of naval stores and on the production of indigo by the colonists; the allowance, on the re-exportation of colonial products, of drawbacks of part or all of the duties paid on importation; the admission of colonial imports at lower rates of duty than were charged on the same products from foreign countries. In order to ensure the enforcement of these acts elaborate provisions became necessary for the issue of bonds, and this, with the collection of a duty in the colonies, led to the appointment of colonial customs officers who were immediately responsible to the commissioners of the customs and the treasury board in England. With them the governors were ordered to co-operate. Courts of vice-admiralty, with authority to try cases without a jury, were established in the colonies; and just before the close of the seventeenth century they were given jurisdiction over violations of the acts of trade, a power which they did not have in England. Naval officers were very generally provided for by colonial law, who were to co-operate with the customs officers in the entry and clearance of vessels; but in some cases their aim was rather to keep control over trade in colonial hands. It thus appears that the resolve to enforce the policy set forth in the acts of trade resulted in a noteworthy extension of imperial control over the colonies. How far it was successful in the immediate objects sought it is impossible to say. In some of the colonies and at some times the acts were practically nullified. Illegal trading was always carried on, especially in time of war. In such times it was closely allied with privateering and piracy. But in the large it is probable that the acts were effective, and their existence always furnished a standard to which officials were required by their instructions and oaths to conform. By the Act of Union of 1707 Scotland was admitted to the advantages of the English trade system. In 1733, in order to check the development of the French colonies and prevent the importation of their products into English possessions, the Molasses Act was passed. This provided for high specific duties on rum, molasses and sugar, when imported from foreign colonies into those of Great Britain. So high were these rates that they could not be collected, and therefore no serious attempt was made to enforce the act.

Molasses Act.

33. Returning again to the 17th century, in order to trace in other connexions the notable advance which was then made in colonial administration, we are to note that the conquest of New Netherland by the British in 1664 was an event of great importance. Taken in connexion with the settlement of the Carolinas, it completed the hold which the English had upon the North American coast and gave them for the first time an extent of territory which could be profitably developed.

The occupation of New Netherland was effected by a royal commission, which was also empowered to hear complaints and report a plan for the settlement of disputes in New England. Precedents for such a commission existed in the past, and a little more than ten years later a similar body, accompanied by a military force, was sent to Virginia to adjust matters at the close of Bacon's rebellion. But the commission of 1664 was the most noteworthy example of its kind. Yet, though it succeeded at New Amsterdam and in the southern colonies of New England, it failed at Boston. Massachusetts would not admit its right to hear appeals. It did not succeed in wresting from Massachusetts the territory of New Hampshire and Maine, which the heirs of Gorges and Mason claimed.

Dominion of New England.

34. In 1676 Edward Randolph was sent as a special agent to Massachusetts, to require it to send agents to England. He returned to England the sworn enemy of that colony and continued to be its tireless prosecutor. A series of negotiations ensued which lasted for almost a decade, and ended in the revocation of the Massachusetts charter by a degree in chancery, 1684. New Hampshire had already been organized as a royal province. Government under the charters of Rhode Island and Connecticut was soon after suspended. All New England was then organized as a dominion or vice-royalty under Sir Edmund Andros. Assemblies were everywhere abolished and government was left wholly in the hands of the executive. New York—also without an assembly—and New Jersey were soon after incorporated with the Dominion of New England, its boundary being extended to the Delaware river (see NEW ENGLAND). After Bacon's rebellion in 1676 the lines of executive control were strengthened in Virginia, but the Assembly continued active. These rapid changes involved the downfall of the former system of chartered colonies and the substitution of royal provinces in their place. The effect of this was to introduce into the colonies a large number of officials of royal appointment—the governors, members of the council, judges, secretaries, surveyors-general, receivers-general and attorneys-general. The entire executive and judiciary in a royal province was appointed directly or indirectly by the king. Its members held under commissions subject to the king's pleasure and were controlled by his instructions. The exclusiveness of the chartered jurisdictions no longer obtained, but the Crown through its officials was brought into direct relations with the body of the colonists. Government could now be carried on under relations analogous to those between Crown and people in England.

Colonial Reorganization.

35. By the abolition of assemblies and the union of colonies on a large scale James II. did violence to the strongest feelings and traditions of the colonists. The New Englanders not only viewed the levy of taxes by prerogative with the utmost aversion, but they feared a general unsettlement of land titles, the destruction of much that was valuable in their system of town government, and the introduction of Anglican worship among them. They shared also in the fear, which was widespread among the colonists, that the Crown intended by an alliance with the French and Indians to force Roman Catholicism upon them. Therefore the fall of the Stuart government in England was the signal for an uprising at Boston (April 1689) followed by a less successful one at New York. The Dominion of New England at once collapsed and the old colony governments were generally restored. A revolt against the Catholic proprietor in Maryland resulted in the suspension of his powers of government and the organization of Maryland as a royal province. William III. granted a new charter to Massachusetts (1691) in which full provision was made for an assembly, but also for a governor and secretary of royal appointment. Rhode Island and Connecticut were allowed to remain under their corporate charters. New York and New Hampshire were organized as royal provinces with assemblies. Proprietary government struggled back into existence in New Jersey. In Pennsylvania the governmental powers of the proprietor were suspended for two years (1692–1694), because of his neglect of provision for defence; then they were restored and Pennsylvania continued under proprietary government until the War of Independence.

36. The transition from the system of chartered colonies to that of royal provinces was thus begun and well advanced towards completion. But it was a gradual process, and the later stages of it were not reached until the second decade of the 18th century. South Carolina became provisionally a royal province in 1719, and a parallel change was completed in North Carolina a decade later. Georgia received a royal government in 1752. But in 1715 Maryland was permitted to resume its proprietary form. After the Revolution of 1689 the change to royal governments did not involve in any case the abolition of colonial assemblies. Henceforward the Crown had a fully equipped executive in every royal province, and for the maintenance of its rights could depend upon its efforts and the influence which it was able to exert upon the assemblies. The governors exercised the royal rights of calling, proroguing and dissolving the assemblies; they assisted in initiating legislation and exercised the right of veto. All bills passed by the assemblies were required to be submitted to the king in council, for acceptance or disallowance. The upper houses of the legislature were the councils of the provinces. These were small bodies and consisted, in every case except Massachusetts, of royal appointees. Their support was in most cases given to the governors, and by that means they were greatly assisted in resisting the encroachments of the lower houses of assembly, which were elected by the freeholders. But, as a rule, the Crown made no provision for the salaries of its governors and other officials, and left them largely dependent for support on appropriations by the assemblies. In very many cases the withholding of salaries was successfully resorted to by the assemblies as a means of thwarting the executive or forcing it into submission. Under this system of balanced forces, analogous in general to that which was reached after the Revolution in England, the colonies entered upon the long period of the French wars.

C.—*The Struggle with the French, 1690–1760.*

37. Early French discoveries and colonization in North America were confined chiefly to the valley and gulf of the St Lawrence. These led, in the early 17th century, to the establishment of the province of Canada. By 1610 the French had possessed themselves of the valley of the lower St Lawrence, and the relations with the Indian tribes were being determined. During the next fifty years Canada grew slowly into an autocratically governed province, in which a mild form of feudalism existed and in which the Catholic Church was so strong as to contest supremacy at times with the civil power. The fur trade became from the first a most important industry in the province. The Jesuits and other priestly orders undertook missionary work on a large scale among the natives. The fur trader and the missionary soon extended French influence through the region of the Great Lakes and involved the province in intimate relations with the Indian tribes, and that throughout a large area of country. Between the Iroquois and the French wars were almost continuous, but with the other Indian tribes the French were in general on friendly terms. The Iroquois, on the other hand, maintained friendly relations with the Dutch and afterwards with the English. This deeply affected relations between the English and the French, as well as the entire development of the province of New York.

French Expansion.

38. Exploration was a most important incident of both the fur trade and the missionary enterprises of the French. Between 1670 and 1690 their work culminated in the great exploring activity of Marquette, Joliet and La Salle. The Ohio and Mississippi rivers were discovered and their courses were mainly or wholly traced. Explorers also penetrated far into the regions beyond the Mississippi. Posts were established at various points along the Great Lakes. During the first two decades of the 18th century the French also established themselves on the Gulf of Mexico, Mobile being founded in 1702 and New Orleans in 1718.

Quebec and the Gulf ports were then connected by a series of forts which, though few and weak, sufficed for communication and for the establishment of a claim to the Mississippi Valley. They were Niagara and Detroit, commanding the approaches to lakes Erie and Huron; Fort Miami, on the Maumee river; Fort St Joseph, at the southern end of Lake Michigan; Vincennes and French Fort, on the Wabash; Fort Chartres, on the Mississippi opposite St Louis; Michillimackinac and Ste Marie, which guarded the upper lakes. French zeal and enterprise had thus seized upon the heart of the continent, and was prepared to oppose any westward movement which the English might in the future attempt. It seemed possible that English settlements might be confined to the coast, for they expanded slowly and no genius for exploration or sympathy with Indian life was shown. The tendency of British commercial policy was likewise to confine them there, for in no other way did it seem possible to restrict the trade of the colonists to British markets. The Indian alliances of the English were also far less extensive than those of the French. The provinces of South Carolina and Georgia had conflicts with the Spanish on the Florida frontier, and in these the Indian tribes of the south were also involved. But these rivalries were slight and local in character, when compared with the struggle for supremacy which was preparing between the French and English.

39. The conflict with the French was precipitated by events in Europe. It was the English Revolution of 1689 that opened the great conflict between France and England. The question of Protestantism versus Catholicism was involved, but at bottom the struggle was one for the balance of power among European states. Rival claims between the two powers in America, Africa and Asia existed at the beginning of the conflict, or originated and were intensified as it progressed. Questions of commercial and naval supremacy world-wide in extent were involved, and the colonial possessions of the two states were necessarily drawn into the struggle. In America it involved four intercolonial wars, which were closed respectively by the treaties of Ryswick (1697), Utrecht (1713), Aix-la-Chapelle (1748), and Paris (1763). Between the second and third wars intervened thirty years of peace, the early period of Hanoverian and Whig ascendancy in England, the so-called Walpole era. On the American continent during the first two wars the struggle was confined to the northern frontier, and consisted of devastating raids by the French and Indians, which in turn provoked retaliatory efforts on the part of the English. These took the form in part of attacks on Acadia and of unsuccessful efforts to conquer Canada by means of joint expeditions by sea and land. The favourite land route was that from New York by way of Lake Champlain to Montreal, while the expeditions by sea were forced to make the long and perilous voyage round Nova Scotia and through the Gulf and River St Lawrence to Quebec. In 1690, and again in 1711, an enterprise of this kind was actually undertaken. Acadia, "with its ancient limits," and the claim of France to Newfoundland and the Hudson Bay territory were, however, ceded to England by the treaty of Utrecht.

Wars between British and French in America.

40. As the great world-conflict progressed the relative importance of the colonial and maritime issues which were involved increased. The first two wars had their origin primarily in European questions. The third war had its beginning in the Spanish West Indies, and clearly revealed the existence of the Bourbon Family Compact, which bound France and Spain together in active alliance. On the American continent its most striking event was the capture, in 1745, of Louisburg, a stronghold which the French had recently fortified on Cape Breton for the purpose of defending its interests in the Gulf of St Lawrence. This victory was secured largely by the efforts of the New England colonists. In the following year another plan for the conquest of Canada was thwarted by the necessities of war in Europe. At the close of the war Louisburg, too, was restored to the French. After this fashion did the world-struggle react upon the special interests of the English in North America, and perplex and irritate the colonists. In the fourth intercolonial war (1754–63) the struggle between the two nationalities in North America was decided. Events which immediately preceded this war—the occupation of the Ohio Valley and the building of Fort Duquesne—clearly revealed an intention on the part of the French to exclude the English from the Mississippi Valley and confine them to the Atlantic slope. A persistent effort was also made to recover Acadia. The western, as well as the northern, frontier was not threatened, and the war which followed affected all the colonies. Great Britain sent over a succession of commanders-in-chief. Great improvement was made upon the crude efforts at joint colonial action which had characterized the earlier wars. To as great a degree did the Albany Congress of 1754 (see Albany, New York) surpass in importance the meetings of governors and military officers which had occasionally been held in previous times, though its plan of colonial union failed to meet the approval both of the colonists and of the government of Great Britain. The campaigns of this war were all upon a comparatively large scale. Campaigns were carried on not merely along the line of Lake Champlain and in Acadia, but against Fort Duquesne (see Pittsburg, Penn.), Oswego, and Fort Frontenac, Louisburg, and Quebec (*q.v.*) itself. The weak Spanish power was overthrown in Florida and expeditions were sent against the southern Indians. In all quarters, and especially after Pitt became secretary of state, the British assumed the offensive. The navy of Great Britain, as well as its army, was called into action on a much larger scale in America than ever before. The result was the conquest by the British of Canada, and with it of all North America east of the Mississippi river; the French claim to territory west of this river was ceded to Spain in 1762.

41. The wars with the French brought the problem of colonial defence among the English into greater prominence than ever before, and added it to the other questions which had been of practical moment from the first. Against the Indians the colonists in the 17th century had provided for their own defence. Chiefly with this object in view, each colony had developed a militia system, modelled in general after that of England. But such a force was not fitted for long campaigns or large operations. It was comparatively undisciplined; both officers and men were inexperienced and destitute of proper habits of command, as well as those of subordination; the commissariat was poor or totally lacking, and the men were able to remain away from their homes for only brief periods. The colonists possessed no navy, and for coast defence only a few rude forts. So poor were means of communication and so isolated were the colonies from one another, that co-operation in joint expeditions was very difficult. Equally difficult was it to secure proportional contributions of money from the colonies. Early in the French wars the British government prescribed quotas both of men and money to be raised by the colonies, but little attention was paid to these except by the colonies which were in immediate peril. Because of the limited amount of available money and the modest resources of the colonists heavy taxation was impossible, and the financing of the wars was a matter of great difficulty. The assemblies resorted to the issue of bills of credit, to which they gave the legal tender quality, and for the redemption of which in nearly all cases they made inadequate provision. The paper depreciated and in some colonies became worthless. Great confusion resulted, involving loss to all, and among the sufferers were British merchants. Strained relations were produced between the assemblies and the colonial executive, because the latter, acting under royal instructions, persisted in vetoing bills for additional issues of currency. For this reason, in addition to others, the assemblies withheld the salaries of governors and other officials, and in this way sought to coerce the executives into submission. In some colonies the Assembly secured the right of electing the treasurer, and in most of them appropriations were made specific. Thus by skilfully utilizing their control over the purse, and that during a long period of war, the colonial assemblies were able materially to limit the authority of the executives and to establish not a few privileges for

themselves and their constituents. It was in such ways as these that the constitutions of the provinces became developed and liberalized during the French wars. Many a precedent was then established which was utilized in the later struggle with the mother country. The home government on its part also became convinced that requisitions were altogether inadequate as a method of procuring revenue for general purposes.

42. The quality of the rank and file of the Canadian militia was not essentially different from that of the British colonies. But the Canadian government was autocratic. The power of the French was also concentrated in a single large province, and not distributed among thirteen or more colonies. These conditions greatly promoted military efficiency. When taken in connexion with their Indian alliances, they enabled the French to take the offensive in the earlier wars much oftener than did the English, and with much greater effect. The government at Quebec was not subject to the limitations of quotas and requisitions. There were no assemblies to thwart its will. The English frontier was also more accessible and more exposed than was the lower part of the valley of the St Lawrence. Quebec was in every sense a citadel to which additional security was given during a large part of every year by the intense cold of the Canadian winter. But so superior were the training and enterprise of the French *coureur de bois* that, with his Indian allies, he was far better able than the English farmer or artisan to penetrate the wilderness, whether in winter or in summer, and massacre the exposed dwellers on the frontier. It was this class which gave the French the superiority in the long succession of raids by which the English frontier was laid waste.

43. Though the French by their skill and boldness achieved a remarkable success, their defects and weaknesses were equally evident. The flow of population from France to America was never great, and even it was diminished by the exclusion of Huguenots. The natural growth of population within New France was not rapid. The result was that the French colonists did not become sufficiently numerous to maintain the interests to which their vast claims and possessions gave rise. The disparity between their numbers and those of the British colonists became greater with every generation. At the opening of the last intercolonial war the proportion of English to French colonists was approximately 15 to 1. New York alone had about the same population as that of all the French colonies on the North American continent combined. The resources of the British exceeded those of the French colonists to a corresponding degree. Had the decision of the questions at issue depended upon population and wealth alone, the issue could not long have remained doubtful. But the tendencies arising from these fundamental conditions were to such an extent offset by other circumstances, already alluded to, that the result of the struggle was for a long time uncertain. Had it been confined to the forces of the colonies alone, it would perhaps never have been decided. The English could have defended the territory which they occupied; so could the French. Moreover, with the French and English thus facing one another, it would have been impossible for the latter to have declared their independence. The French would never have desired to do this. Therefore, the two peoples must apparently have remained in the condition of colonists for an indefinite period. But the motherlands were to be the decisive factors in the problem, which thus depended to an extent on complications which existed in Europe or even on remoter seas and continents. When the climax of the struggle was reached the result might have been different if France at the time had not been so deeply involved in the politics of central Europe.

44. Of the first importance in reaching a decision were the fleets and armies of Great Britain and France, or those parts of them which were available for use on the continent of North America. During the larger part of the period under review the French neglected their fleet, while the English steadily advanced toward naval and commercial supremacy. But the first conspicuous service on the northern coasts was that which was rendered by Commodore Peter Warren and his squadron at the capture of Louisburg in 1745. In the next year a large French fleet was despatched to North America, but it accomplished nothing. In the last intercolonial war the operations before Louisburg in 1758 and at Quebec (*q.v.*) in 1759 decisively proved the superiority of the British navy. The colonies also, in the later stages of the struggle, contributed loyally toward the result. France failed to make her natural military superiority effective in North America, and therefore her power on that continent had to yield before the combined attacks of Great Britain and her colonies by land and sea.

D.—*The Colonial Revolt, 1763–1776.*

British Acquisitions of Territory.

45. The Treaty of Paris (1763), by which the period of colonial wars—but not the struggle between England and France—was concluded, added vast stretches of territory to the dominions of Great Britain in North America. The Floridas, Canada and Louisiana as far west as the Mississippi river now came into the possession of the English. Of the islands which were occupied, the two most important—Guadaloupe and Martinique—were restored to the French. The retention of Canada in preference to these involved an important change in the nature and objects of British colonization. Hitherto tropical colonies had been preferred to those in northern climes. The occasion of this had been the view that, as England was not over-populated, colonies were not needed as "homes for a surplus population." Instead, they were estimated in proportion to their commercial value. The ideal was a self-sufficing commercial empire. The supporters of this view now argued that the islands which had been conquered from the French were more valuable than Canada and should be retained in preference to the northern continental territories, which had yet produced nothing for export except furs. But the government did not hesitate. Following the lead of Pitt, it was now bent upon continental expansion. Canada and the West were retained and the most important French islands were given back. The development of modern industry—the so-called industrial revolution—had already begun in Great Britain. Its effect was vastly to increase the population of the British Isles and to necessitate an overflow into the unoccupied regions of the globe. Colonies therefore began to be regarded from this point of view, and the retention of Canada opened the way for the change. Henceforth, as time progressed, colonies were to be valued as homes for a surplus population quite as much as sources of raw materials and food supplies. The retention of Canada and the West also coincided exactly with the desires of the continental colonies. The chief gains of the war went therefore to them and not to the island colonies. They now possessed a continental domain which was adequate to their need for expansion, and their long-cherished desire to be rid of the French was gratified. Though, as expansion progressed, conflicts with the Indian tribes of the interior, and that on a large scale, were to be expected, the conquest of the French removed the sense of dependence on Great Britain for military aid which the northern colonies in particular had previously felt.

Changed Colonial Policy of Great Britain; Strengthening of Imperial Control.

46. In consequence of the policy thus adopted, largely increased burdens were devolved on the imperial government, while the conquest and the events which led to it strengthened imperialist sentiment and ambitions. The course of action which was at first favoured by leading officials, both in England and the colonies, was a more systematic administration of Indian affairs, the employment of sufficient regular troops under the commander-in-chief to defend the newly acquired territory, the maintenance of posts with English settlers in the interior on a scale sufficient to prevent the French or Spanish from securing the trade of the region. Improved methods of administration were urged through the press by Thomas Pownall, Henry McCulloh, Francis Bernard and Dr John Campbell. French methods were praised and

the shortcomings of the surviving chartered colonies were again emphasized. This all required additional revenue, as well as administrative vigour, and that at a time when Great Britain was specially burdened with debt and when several of the colonies had recently incurred heavy expenditures. The large acquisitions of territory also necessitated some changes in the acts of trade. The necessity for their more vigorous enforcement was revealed by the existence of a large contraband trade between the colonists and the enemy during the later years of the war and also of a considerable illegal trade with Europe. These conditions, together with the conviction that, as the continental colonies had reaped the chief advantages of the war, some favour should be extended to the islands, led to the passage of the Sugar Act by the Grenville ministry in 1764. It also caused a resort to writs of assistance in two of the colonies, and finally the legalization of them in all the colonies by act of parliament (1767). The aid of the navy was directly invoked in the enforcement of the trade laws, and the activity of the customs officials and of the admiralty courts in the colonies was increased. Garrisons of regular troops—numbering several thousand—with a commander-in-chief were now present in the colonies in time of peace, and their aid might possibly be invoked by the civil power to suppress disorder. The Sugar Act itself was a trade and revenue act combined, and the fact was expressed in the preamble of the measure. It was intended directly to affect the traffic between the northern colonies and the foreign West Indies in lumber and food-stuffs, molasses and rum. The duty on foreign molasses, for which provision had been made in the Molasses Act of 1733, was halved; but now it was proposed really to collect this duty. A cry was immediately raised in New England that, if the duty was collected, the manufacture of rum—of which molasses was the staple material—would be lessened or wholly prevented and a most important industry sacrificed. The fisheries would incidentally suffer. The supply of coin, with which colonial balances were paid in England, they also said, would be lessened. Another act of parliament, passed about this time, prohibited the bestowment of the legal tender quality on colonial bills of credit. Though parliament regarded this act as a necessary remedy for the excesses of which many of the colonies had been guilty in the issue of paper money, it was generally regarded in America as a blow at a necessary system of credit. In spite, however, of the opposition and criticism which it provoked in the northern colonies, it is probable that the Sugar Act could have been permanently enforced. The Act of Trade of 1673 and the Molasses Act—though the latter was not fully executed—were two early instances of the exercise by parliament of the right to tax the colonies. Had the Sugar Act been enforced, a clear and decisive precedent in favour of this right would have been established. In view of the general situation, that was probably as far as the British government should have gone at that time. But it immediately committed itself to another and still more significant measure, and the two acts combined caused an outburst of protest and resistance from the colonists.

47. Repeatedly in earlier years the imposition of a stamp duty upon the colonies had been suggested. Archibald Cummings, William Keith, ex-governor of Pennsylvania, and Governor George Clinton of New York had prominently urged this policy. With the outbreak of the fourth intercolonial war comprehensive plans of parliamentary taxation were repeatedly proposed. The cost of the regular troops which must be stationed in America was estimated at about £300,000 annually. The Sugar Act was expected to yield about £45,000 a year. It was thought that the colonies should raise about £100,000 more as their reasonable share of the cost. George Grenville resolved to secure this by means of a stamp duty. This would fall upon the island colonies equally with those of the continent, though it would be expended chiefly for the enlarged military force on the mainland. Though its simplicity and ease of collection recommended it, the Stamp Act was a purely fiscal measure, and its character was not concealed by any features which allied it to the earlier acts for the regulation of trade. It involved an extension of the British system of stamp duties to the colonies, and was intended to draw revenue directly from many lines of their activity. It was passed by parliament in 1765, almost without debate and with scarcely a thought that it would be resisted. It provided for the appointment of officials to distribute the stamped papers in the colonies and further extended the power of the admiralty courts by giving them jurisdiction over violations of this act. The legal theory upon which the act was based was that of the unqualified sovereignty of parliament as the representative body for the whole empire, and that its authority, if it chose to use it, was as effective for purposes of taxation as for the regulation of trade or other objects of legislation. But never before, during the century and a half of colonial history, had the taxing power been so unqualifiedly exercised or in such trenchant force as by this statute. It followed close on the heels of the Sugar Act, which itself had aroused much hostile criticism. The two measures also came at a time when the consciousness of strength among the colonists had been increased by the defeat and expulsion of the French. Moreover, at the time when the policy was initiated, George III. had undertaken to crush the Whig party and to revive the latent prerogatives of his office. This resulted in the formation of a series of coalition ministries. Vacillation and uncertainty were thus introduced into the colonial policy of the government. The royal policy also brought into the public service in England and kept there an unusually large group of inferior men who persistently blundered in the treatment of colonial questions. It was only with the accession of the North ministry, in 1770, that permanence and a certain consistency were secured. But, in the view of the colonists, the prestige of the government had by that time been seriously lowered, and the stubborn self-will of the king became the only available substitute for broad and intelligent statesmanship.

Stamp Act.

48. Determined opposition to the Stamp Act was shown in all the colonies, by or before the time (Nov. 1) when it was to go into effect. The forms assumed by this opposition were such as characterized the entire controversy with Great Britain until the opening of hostilities in 1775. It consisted in the passage of resolutions of protest by the lower houses of some of the colonial legislatures; in the calling of a congress at New York, which was attended by delegates from nine of the colonies; in the activity of mobs organized under the name of the "Sons of Liberty" in all the large seaports and in some smaller inland towns; and, finally, in a somewhat widely extended movement against the importation of British, or even foreign, goods and in favour of frugality and the encouragement of home manufactures. The newspaper press also sprang into much greater activity than ever before, and many notable pamphlets were published in defence of the colonial cause. The most important resolutions at the outset were those adopted by the Virginia House of Burgesses and by the House of Representatives of Massachusetts. Through the first-named body the dramatic eloquence of Patrick Henry (*q.v.*) forced five resolutions. Two others, which threatened resistance and the coercion of any who should venture to uphold the home government, failed to pass, but the whole seven were published broadcast through the colonies. The calling of a general congress was proposed by the House of Representatives of Massachusetts. Prominent among its members was James Otis, who had already distinguished himself by radical opposition to measures of the government, especially in the case against writs of assistance which was argued before the superior court in 1761. Samuel Adams (*q.v.*), already a prominent man, was now elected a member of the house from Boston. He almost immediately became its leader, drafting its most important resolutions and papers, and to a large extent directing its policy. With the aid of others he was able greatly to increase the activity of the town-meeting in Boston, and in the course of a few years to develop it on occasion into a great popular convention, which could be utilized to overawe the government. Throughout New England the town and its institutions served well the purposes of opposition and

facilitated its extension over large areas. The county system of the provinces along the middle and southern coast was not so well adapted to these purposes, and their population was more dispersed. The intense Puritan spirit, with its century and a half of pronounced independence, both in polity and temper, was also lacking outside New England; though on the frontiers of the provinces from Pennsylvania southward was a Scottish-Irish population which exhibited many of the New England characteristics. But the tenant farmers of New York, the German pietist sects of Pennsylvania, the Quakers wherever they had settled, and in general the adherents of the English Church were inclined toward indifference or, as the controversy progressed, toward positive loyalism. Hence the mixture of nationalities in the Middle Colonies greatly increased the difficulty of rousing that section to concerted action. In Pennsylvania the issues were obscured by a struggle on the part of the western counties to secure equal representation with those of the east. This helped to make loyalists of the Quakers. Special grievances also produced among the frontier settlements of North and South Carolina quite as much dislike of the officials and social leaders of the tide-water region as they could possibly feel toward Crown and parliament. Throughout the struggle New England and Virginia exhibited a unity and decision in action which were not equalled elsewhere.

Colonial Opposition.

49. But to return to the Stamp Act. Before the meeting of the Congress at New York outbreaks of mob violence in Boston had forced the stamp distributor there to resign, and had wrecked the house of Thomas Hutchinson, the chief justice. Owing largely to the indecision of the elective council, the government had proved powerless to check the disorder. The resolutions passed by the Congress, as well as its petitions to the home government, gave authoritative form to the claims of the colonial opposition in general, though the body which issued them, like all the congresses which followed until 1776, was extra-legal and, judged by the letter of the law, was revolutionary. In these utterances, as later, the colonists sought to draw their arguments from British precedents and their own history. As they owed allegiance in common with subjects within the realm, so the rights of the two were the same. The two British rights which, it was claimed, were violated by the Stamp Act were the right to trial by jury and the right to be taxed only by an assembly in which they were represented. The former grievance was simply an incident of the latter, and was occasioned by the extension of the jurisdiction of the admiralty courts. The tax was a direct grievance. Therefore, for purposes of legislation like this these bodies denied that parliament was representative of the whole empire (so-called virtual representation), and asserted that it represented only the realm. For purposes of taxation, their assemblies, they affirmed, were the only representative bodies they had known. Therefore, ignoring the earlier and tentative measures by which parliament had actually taxed the colonies, and falling back upon the sweeping declarations of their assemblies, they denied the right of parliament to tax them. They declared that the recent policy of parliament was wholly an innovation and insisted upon a return to the Constitution as it was before 1763. The doctrine of natural right and compact was also resorted to with increasing emphasis in New England utterances. For purposes of government they had all along acknowledged—and now did so expressly—that parliament bound them; and the inference would have been fair that they were represented in it. But they did not draw this inference, nor did they seek by any scheme of reform to secure representation in the imperial legislature. James Otis was the only colonial leader who ever contemplated the possibility of such a solution. Adams early declared it to be undesirable. The British never proposed it, and therefore it played practically no part in the discussion.

50. The decisive blows, however, were struck by the mobs in the colonies and by the government itself in England. As the time for the execution of the Stamp Act approached, more or less violent demonstrations occurred in New York and in many other localities. The stamp distributors were forced to resign. Everywhere in the original continental colonies the use of stamped papers was prevented, except to a slight extent in Georgia. Business requiring the use of stamps was in part suspended, but far more generally it was carried on without their use. Without the aid of the militia, which in no case was invoked, the colonial executives proved indisposed or powerless to enforce the act and it was effectively nullified. In England the petitions of the colonists produced little effect. There the decisive events were the accession of the Rockingham ministry to power and the clamours of the merchants which were caused by the decline in American trade. What might have happened if Grenville had remained in office, and if the duke of Cumberland had not been suddenly removed by death, it would be impossible to tell. But the serious lack of adjustment between British politics and colonial government is illustrated by the fact that, more than three months before the Stamp Act was to go into effect, the ministry whose measure it was resigned, and a cabinet which was indifferent, if not hostile, to it was installed in office. Preparations were soon made for its repeal. The slight extent to which relations with the colonies had been defined is indicated by the fact that the debates over the repeal contain the first serious discussion in parliament of the constitution of the British Empire. While the colonies were practically united in their views a great variety of opinions was expressed in parliament. On the question of right Lord Mansfield affirmed the absolute supremacy of parliament in realm and dominions, while Camden and Pitt drew the same sharp line of distinction between taxation and legislation upon which the colonists insisted, and denied the right of parliament to tax the colonies. The debates at this time gave rise to the fancied distinction between internal and external taxes, of which much was made for a few months and then it was dropped. But motives of expediency, arising both from conditions in the colonies and in England, proved decisive, and in the spring of 1766 the Stamp Act was repealed, while its repeal was accompanied with the passage of a statute (The Declaratory Act) affirming the principle that Great Britain had the right to bind the colonies in all cases whatsoever. This measure was received with demonstrations of joy in the colonies, but the prestige of the home government had received a severe blow, and the colonists were quick to resent further alleged encroachments.

Repeal of the Stamp Act; the Declaratory Act.

Townshend Acts.

51. These soon came in the form of a colonial Mutiny Act and of the so-called Townshend Acts (1767). The former was intended largely to meet the needs of the troops stationed in the West and in the new colonies, but it also affected the older colonies where garrisons of regular soldiers existed. The act provided for a parliamentary requisition for barrack supplies, and partly because it included certain articles which were not required for the soldiers in Europe, the New York legislature at first refused to make the necessary appropriation. Partly through the influence of the governor, it later came to think better of it and in a non-committal way appropriated the supplies required. But meantime in England the Pitt-Grafton ministry had come into office, in which the brilliant but reckless Charles Townshend was chancellor of the exchequer. Pitt himself was disabled by illness, and the ministry, lacking his control, steadily disintegrated. Townshend availed himself of this situation to spring upon his colleagues and upon parliament a new measure for colonial taxation, and with it a bill legalizing writs of assistance and establishing a board of commissioners of the customs in America, and a third bill suspending the functions of the assembly of New York until it should comply with the terms of the Mutiny Act. These Bills all became law. Before the last-mentioned one reached the colonies, the New York Assembly had complied, and therefore the necessity for executing this act of parliament was avoided. The establishment of a customs board at Boston, of itself, did not provoke much criticism. But the Act of Trade and Revenue, which provided for the collection in the colonies of duties on glass, lead, painters' colours, paper and tea, and that out of the revenue

raised therefrom salaries should be paid to the governors and judges in America, opened anew the controversy over taxation.

52. John Dickinson, in his *Letters of a Farmer* (1767–1768), denied *in toto* the authority of parliament to tax the colonies, and his argument was widely accepted. Massachusetts petitioned the home government, and in a circular letter conveyed its views to the other colonies and asked an expression of theirs in return. This provoked Hillsborough, the incumbent of the new colonial secretaryship, to order the Massachusetts house to rescind its action and the other colonies to treat the letter with contempt. The Massachusetts assembly refused to rescind and was dissolved by the governor. The activity of the customs officials at Boston in seizing John Hancock's sloop, "Liberty," occasioned rioting, which in turn was followed by the transfer of two regiments to Boston. Several vessels of war were also stationed in its harbour (autumn of 1768). Deprived of their assembly, the towns of Massachusetts chose deputies, who met in convention, but without important result. Favourable replies to its circular letter were, however, received from a majority of the colonies. Resolutions against the new act were passed by many colonial assemblies, and in several cases petitions were sent to England. But, either because these addresses were not sent through the regular constitutional channels, or because they expressed views inconsistent with the Declaratory Act, they were laid on the table or rejected outright. The king and ministers expressed the view that the Americans were opposed to all restrictions, and that in Massachusetts treason or misprision of treason had already been committed. In this they had the support of large majorities in parliament. The statute of 35 Henry VIII., for the punishment in England of such offences when committed outside the realm, was now revived, and the royal officials in Massachusetts were instructed to collect evidence against suspected popular leaders with a view to their deportation across sea for trial. Though sufficient evidence was not found, nothing could have been better calculated to increase the exasperation of the colonists than a threat of this kind. It drew from the Virginia burgesses strong addresses and resolutions of protest. Fear lest the English Church would induce the government to establish a colonial episcopate caused much discussion at this time, especially in New England, and led to plans for joint action on the part of Dissenters, in self-defence. Though the government never sanctioned the plan, the fears which were aroused by its discussion contributed appreciably to the general agitation. In the course of 1769 the policy of commercial non-intercourse was again revived, and resolutions in favour of its enforcement were passed by many local bodies. But it was found difficult to enforce these, and, as the colonies were prosperous, trade, open and illicit, with Europe continued to be large. The British merchants did not clamour for relief, as they had done at the time of the Stamp Act, but gave loyal support to the policy of the government. The king was also steadily gaining an ascendancy, which in 1770 was permanently established by the accession of Lord North to the premiership. Thus, on both sides of the ocean, parties were bracing themselves for a struggle, the one for and the other against the principle of the Declaratory Act. The question of revenue was now largely obscured by that of right and power.

Tea Tax.

53. It cannot be said that the Townshend Revenue Act was nullified, for to a certain limited extent it was executed. But in 1770, on the specious plea that the duties were uncommercial because they were levied on British manufactures, all except the duty on tea—3d. per ℔—were repealed, and a drawback of one-fourth and later of three-fifths of this duty was granted on the re-exportation of tea to the colonies. But the preamble of the act was retained, and with it the principle of taxation. For this reason opposition continued and non-importation agreements, especially against tea, were maintained. But after the collision which occurred between the troops and the people in Boston, in March 1770, the soldiers were removed from that town and affairs became more quiet. For more than a year it seemed as if the controversy was wearing itself out and that the old relations would be restored. But the conduct of certain naval officers and small vessels of war which had been trying to suppress illegal trade in Narragansett Bay led, in June 1772, to the destruction of the schooner "Gaspee." The inquiry which necessarily followed this, together with legislation for the protection of the royal dockyards, ships and supplies, again revealed the possibility that colonists might be removed to England for trial. About the same time provision was made for the payment by the home government of the salaries of the governors and of the judges of the superior court of Massachusetts while those officials continued to hold at the pleasure of the Crown. These events occasioned a movement in Massachusetts and Virginia which led at once to the organization of committees of correspondence, and these ultimately extended far and wide throughout the colonies. At the same time in England the East India Company appealed to parliament for relief from the losses caused by the transfer of the American trade so largely to the Dutch, and in response the Tea Act was passed authorizing the company to import its teas into the colonies and providing that the English duties should be wholly drawn back on exportation, and that no compensation need be made to the government for consequent loss of revenue. This, it was expected, would enable the company to out-compete the Dutch. But popular uprisings prevented the reception or sale of the tea at any of the ports and culminated in the destruction (Dec. 16, 1773) of 340 chests at Boston. As the king and the North ministry were now fully intrenched in power, coercion was at once resorted to and affairs were thus brought to a crisis.

Quebec Act.

54. Those among the colonists who were intelligent enough to watch the course of events had long felt that they were being enveloped in a network of relations over which they had no control. This was a result of the development of the empire, with its world-wide interests and its policies the motives for which had their origin in conditions which by the colonists were dimly perceived, if perceived at all. They were particularists whose views and resources were alike narrow, but whose perception of their interests was clear. The Quebec Act, which was passed by parliament near the close of the session of 1774, furnished a case in point. Owing to the failure of the imperial government to secure the revenue which it had hoped to collect under the Stamp Act and the later statutes, it had been forced to abandon its plans for the vigorous administration of Indian affairs and of the West. In view of these facts, it was thought wisest and cheapest to commit the immediate charge of the West to the province of Quebec, and therefore to extend its bounds southward to the Ohio. The Roman Catholic religion was recognized as legal within Quebec, and no provision was made for an assembly. Its extension also indicated a purpose to prevent the westward movement of population across the mountains, which was already beginning from the Middle and Southern colonies. It is true that this act involved the possibility of danger to the colonies, but exaggerated inferences were drawn respecting it and the motives which probably impelled its passage. So it had been with the distinctively imperialist measures from the first and so it was to continue.

55. But the acts of the session of 1774 which were of most immediate importance were those which directly affected Massachusetts, where lay the centre of disturbance. One of these closed the port of Boston, another substituted an appointed for an elected council in Massachusetts and took the selection of jurors out of the hands of the people, and a third made possible the removal from Massachusetts of the trials of persons indicted for capital offences committed in support of the government into neighbouring colonies or to Great Britain, where a fair hearing was considered possible. General Thomas Gage, who had been commander-in-chief in America, was now appointed governor of Massachusetts, with authority to uphold the new acts with military force. As soon as knowledge of the fate impending over Boston reached the other colonies, conventions, local and provincial, were held, and the plan of a general congress, as proposed by Massachusetts and Virginia, was adopted. Delegates were chosen from all the colonies except Georgia, though that province fell into line when the

First Continental Congress.

The Association, or Non-Importation and Non-Exportation Agreement.

second Congress met. The members were instructed to the general effect that they should consult together and adopt such measures as were best calculated to secure the just rights of the colonists and redress their grievances. Voting by colonies, but occasionally listening to utterances which implied that Americans were now thrown into a single mass, this body sent addresses to the king, to the people of the colonies, of Quebec and of Great Britain, and prepared a declaration of rights. It is a significant fact that an address was not sent to either of the houses of parliament. In its statement of rights the Congress (known as the First Continental Congress) limited itself to those which it believed had been infringed since 1763. These acts they described as innovations, and claimed themselves to be the true conservatives who only desired peace on the basis of the former Constitution. Even Joseph Galloway's elaborate plan of union (see GALLOWAY) between Great Britain and the colonies was debated, at great length and was laid on the table by a majority of only one, though later all reference to it was expunged from the record. But, on the other hand, the warlike "Suffolk Resolves" (see MILTON, Mass.) were approved, as was the opposition which Massachusetts was making to the recent acts of parliament; and the view was expressed that, if an attempt were made to execute them by force, all America should support Massachusetts. Though the work of this Congress was deliberative, it performed one positive act which contained the germ out of which new governments were to develop. That was the issue of the Association, or non-importation and non-exportation agreement, accompanied with resolutions for the encouragement of agriculture and home manufactures and for the organization of committees to carry these measures into effect. Coercion, according to the principle of the boycott, was to be applied by the colonies and other local bodies to all who declined to accept and obey the terms of the Association. This policy had been followed at intervals since the time of the Stamp Act. It had been revived and urged by very many local and provincial bodies during the past few months. The Congress had been called with a view to its enforcement throughout the continent. Its issue of the Association gave this policy wide extension, and at the same time strengthened the system of committees, whose energies were henceforth to be chiefly devoted to its enforcement. The Association became the touchstone by which loyalty to the colonies, or loyalty to the king, was determined. Those whose loyalty to the king forbade their submission to the new regulations now felt the coercive power of committees, even to the extent of virtual trial, imprisonment or banishment. Local bodies, acting under general regulations of Congress, and all revolutionary in character, accomplished these results and thus laid the foundation of the new governments. From this action the First Continental Congress derived its chief significance.

56. The line of policy thus indicated was not such as would conciliate the home government, though it is doubtful if at that time anything short of an acknowledgment of the principle of the Declaratory Act would have been effective. All measures of congresses and committees, everything which did not emanate from the assemblies and come through legal channels, savoured of sedition and was little likely to secure a hearing. The Association, with its threats and coercive spirit, and depending as it did upon extra-legal bodies for enforcement, was a direct blow at the commercial system of the empire and could scarcely help provoking retaliation. When the Congress adjourned, some of its members predicted war. In New England the impression that war was inevitable was widespread. In Massachusetts a provincial congress was at once organized, which assumed the reins of government and began to prepare for defence. A committee of safety was chosen to carry on the work during recesses of the Congress. Thomas Gage, the governor, began fortifying Boston, while he looked about for opportunities to seize military stores which the colonists were accumulating. The raising of voluntary militia companies was soon begun in Virginia. In South Carolina, as earlier in Boston and New York, a quantity of tea was now actually destroyed, and a general committee assumed practical control of the province. From New York City and Philadelphia as centres the process of revolutionizing the two most conservative provinces was carried on. When parliament met, at the close of 1774, the king and ministers declared that a most daring spirit of resistance existed in Massachusetts, which was countenanced by the other colonies, where unlawful combinations against the trade of Great Britain were already widely extended. In these opinions the government had the support of the majority in the two houses, and in a joint address the rebellion in Massachusetts was declared to be a fact. As a conciliatory measure Chatham proposed that parliament agree by resolution not to levy any tax upon the colonies, but that the Continental Congress be required to make a free grant of a perpetual revenue which should be fully at the disposition of parliament, the Congress fixing the quota which should be paid by each province. But the imperialist and mercantilist ideas of Chatham were expressed in the further provisions that the system of trade and navigation should not be changed and that the army might be lawfully kept in any part of the dominions where it was deemed necessary, though it should never be used to violate the just rights of the people. Edmund Burke, in his great speech on conciliation, advocated a return to the system of requisitions and did not consider a representation of the colonists in parliament as a possibility. But these motions were rejected, and a resolution introduced by Lord North was passed. This contained no recognition of extra-legal bodies, but provided that when the assembly of any colony should engage to support civil government within the colony and contribute according to its ability to the common defence, the king and parliament would then forbear to levy any more taxes on that province except what were necessary for the regulation of trade. The colonies, with the exception of New York, North Carolina and Georgia, were excluded from the fisheries, as a counterstroke to the Association. North's resolution proved utterly futile, and the two parties drifted steadily toward war, though, as Burke never tired of asserting, the British government in its military estimates made no adequate provision for meeting the crisis.

Outbreak of Hostilities; Lexington and Concord; Bunker Hill.

57. On the 19th of April 1775 hostilities began in Massachusetts. They had been narrowly escaped two months before, when, on a Sunday, Gage had sent an expedition by water to Salem in search of powder. Now, on a week-day, a force was sent overland to Concord, 20 m. from Boston, to seize or destroy the military stores which the colonists had brought together at that village. The minute-men were warned to oppose the approaching force, and at Lexington (*q.v.*), a village situated on the road to Concord, occurred a skirmish in which the first blood of the American War of Independence was shed. The troops marched on to Concord (*q.v.*) and destroyed such of the stores as had not been removed or concealed. On their return march they were pursued by a galling fire from behind fences and buildings, and had it not been for the arrival of a relieving force the command would have been destroyed before it reached the protection of the British vessels of war at Boston. The "Lexington alarm" brought in throngs of militiamen from all parts of New England. Officers were appointed by the provincial congress of Massachusetts and by similar bodies in the other colonies, and immediately the so-called siege of Boston began. Cannon, as well as every other form of military equipment, were now in great demand. In order to secure a supply of the former and at the same time strike a telling blow at British authority in the north, Ticonderoga (*q.v.*) was surprised and taken on the 10th of May. Men from Connecticut, Massachusetts, and the New Hampshire Grants (later Vermont) co-operated in this enterprise. It was soon followed by a dash into Canada, by steps which involved New York in the affair, and by the organization of a military force under General Philip Schuyler for permanent service on the northern frontier.

Meantime reinforcements reached Boston, led by Howe, Clinton and Burgoyne, and it was resolved to extend the British lines by occupying the heights of Dorchester on the south and those of Charlestown on the north. The Americans, hearing of this, seized Breed's Hill, overlooking Charlestown, where they hastily threw up a redoubt on the night of the 16th of June. The British might easily have entrapped them, but instead on the next day the American position was assaulted on the left and carried, though with much difficulty and after a loss to the assailants of more than 1000 men. Such was the battle of Bunker Hill (*q.v.*), one of the most dramatic encounters in the war which was then beginning. In connexion with all these events the Americans, as in their earlier conventions and manifestoes, claimed to be acting on the defensive. But it was not difficult to perceive that, especially in New England, this claim only imperfectly concealed an intensely aggressive spirit. (For military events of the war, see AMERICAN WAR OF INDEPENDENCE.)

Second Continental Congress.

58. The news of the outbreak of hostilities aroused strong feeling throughout the colonies. The Second Continental Congress met under its influence. Its members, however, had been chosen and instructed before the clash of arms, and for that reason the course which had been worked out for them differed only slightly, if at all, from that which had been followed by their predecessors. To a certain extent the new body adhered to the former course of action. But a state of war now existed in New England and on the Canadian border. Troops were expected soon to arrive at New York. Reports of these events were thrust upon the attention of Congress at once, and the provinces involved asked for advice as to what course they should pursue. The northern frontier especially demanded attention. As a result of these events in the colonies generally the Association was being changed from a system of co-operation against British trade into a union for purposes of defence. This new situation the Congress was forced to meet. This it did largely by resolutions of advice to the colonies, but also by positive orders. Of the former class were the resolutions about the procuring of military supplies, the assumption of powers of government by the various colonies, and concerning defence at New York City, on the northern frontier and, later, in the Highlands of the Hudson. Of a more decisive character was the appointment of officers for the army, George Washington being made commander-in-chief, the prescribing of their pay, the issue of continental bills of credit, the issue of articles of war, the regulation of trade and of Indian affairs, and the establishment of postal communication. As the colonies were passing through a strong reaction against executive authority, the Congress did its business with the help of temporary committees and did not seek to establish a permanent executive. The same was true for a time of the congresses and conventions in the different colonies. As the movement progressed through 1775 and the early months of 1776, executive authority in the royal and proprietary provinces collapsed. The assemblies were either dissolved or ceased to meet. The governors, their authority gone, retired on board British vessels of war, returned to England or, perchance, found themselves prisoners in the hands of the revolutionists. This gradual fall of the old governments, imperial and colonial, was the revolution on its negative side. The rise of the system of congresses, conventions and committees, deriving their authority from the people, was the revolution on its positive side, and foreshadowed the new federal system which was rising on the ruins of the half-federated empire. The process in the different colonies was as varied as were their social and political conditions.

Collapse of the Royal Governments.

59. In Connecticut and Rhode Island the corporate system of government, which they had inherited from the 17th century, necessitated no change. The general assemblies always had been the centres of power, and the leading officials were elective for short terms and were subject to the control of the electorate. So far as the internal organization of the colonies was concerned that was all which the revolution demanded. In the two proprietary provinces—Pennsylvania and Maryland—the executives were not so directly interested and pledged to support the imperial government as were those of the royal provinces. But Governor Robert Eden of Maryland was so tactful that, though the last Assembly met in 1774, he was able, with the courts, to keep up some form of government there in the name of the Crown and proprietor until the early summer of 1776. In Pennsylvania the proprietors, though in sympathy with the British government, never sought actively to influence events in their province. So strong was the conservative spirit there that the proprietary Assembly even met—though without a quorum—as late as September 1776, at the time when the convention was completing the first constitution of the state. In the royal provinces the prorogation of the legislatures for indefinite or prolonged periods caused them early to disappear—that of Massachusetts in October 1774. The burgesses of Virginia last met for business in May 1774. They were prorogued to several later dates, but the governor was never again able to meet them. The long and important session of January–March 1775 was the last ever held by the New York Assembly. In April 1775 Governor John Martin of North Carolina met the Assembly for the last time, and even then the Provincial Convention was in session at the same time and place and the membership of the two bodies was the same. In May 1775 disappeared the Assembly of Georgia; in June those of New Hampshire and South Carolina met for the last time. Governor William Franklin was able to meet the Assembly of New Jersey as late as November, but months before that date the Provincial Convention had practically assumed the control of affairs. The royal courts and executives continued some form of activity a few months longer and then totally vanished.

Evacuation of Boston; American Expeditions against Canada.

60. After Bunker Hill the command at Boston had been transferred from Gage to Sir William Howe. In July Washington took command of the colonists and gradually established some degree of order and discipline among them. Though the American levies were raw and ever fluctuating in numbers, the British never seriously attempted to break through their lines. Indeed, it was not the plan of the British to make New England the chief seat of war. As early as the 2nd of August 1775 Lord Dartmouth wrote to General Gage on "the obvious advantages that would attend the taking Possession of New York and the hazard of the Army's continuing at Boston." On the 5th of September he wrote to Howe that every day's intelligence exhibited this fact in a clearer light. Rhode Island was considered as a convenient naval station, and steps were soon taken to secure possession of it and its surrounding waters. This indicates what was necessarily the fact, that the British would so plan the war as to secure the maximum of advantage from their fleet. This would give them an easy command of the entire coast, and enable them to secure a foothold at strategic centres. Hence it was that, though the arrival of a fresh supply of cannon enabled Washington to fortify Dorchester Heights, this simply enabled him to hasten a process for which Howe had long been preparing. The evacuation occurred on the 17th of March 1776, and the British force withdrew temporarily to Halifax. Meantime the bold expeditions of Arnold and Montgomery against Canada—suggesting the joint efforts of the French wars—had met with only a partial success. Montreal had been occupied, but the assault upon Quebec had failed. A small American force awaited the return of spring in Canada, in order that they might renew the struggle for that colony.

61. The view, as it was now repeatedly expressed by king and parliament, was that the colonists were in open rebellion. North's offer of conciliation was peremptorily rejected by Congress. The acts of parliament were being openly resisted, and Congress in its manifestoes had ignored the two houses. Therefore the British government stood committed to coercion. That was the meaning of the legislation of the winter of 1776—the prohibition of trade with the rebellious colonies, the increase

of the estimates for the army and navy, the employment of German auxiliaries for service in America. Preparations were made to send a large military and naval force against the colonies the following season, and that it should operate in part against the insurgents in New York and the southern colonies and in part through Canada. New England was no longer to be the direct object of attack. The Howes, as commanders of the royal army and navy, were appointed commissioners to grant assurance of peace and pardon and the repeal of the obnoxious acts, provided submission was made and some way could be found by parliament in which an imperial revenue for purposes of defence could be secured from the colonies. Military operations, meanwhile, should be directed against points of least resistance, and in that way, if possible, the union of the colonies should be broken. The trend of British policy indicated that an invasion from Canada might be attempted and the effort be made to hold Charleston, Philadelphia, and especially New York as strategic points on the coast.

Organization of State Governments; Declaration of Independence.

62. The course of events in the colonies by which this situation was met was the erection of a system of feeble defences about New York and the removal thither of the army of about 9000 men in the spring of 1776; the fitting out of privateers to prey on British commerce and of a few small armed vessels by the colonies and the general government to watch the coast and procure supplies; the disarming of loyalists; the opening of American ports to the trade of all peoples who were not subject to the British Crown; and the tentative opening of relations with France. As the result of a combination of ill luck, bad management and American energy the British suffered a repulse at Charleston, South Carolina, in June, which was analogous to the affair of the year before at Bunker Hill, and which necessitated a postponement of their plans in the South. The Congress and the various revolutionary bodies in the colonies were forced to carry on war upon a constantly increasing scale. They had to assume powers of government and gradually to perfect their organization for the purpose. Committees in Congress became more permanent. Conditions approximating to those which existed the year before in New England extended through the colonies generally. On the 15th of May 1776, as the result of various earlier applications on the subject, and especially of one from certain Whigs in New York, the Congress recommended to the assemblies and conventions of the colonies where no government sufficient to the exigencies of their affairs had been established, "to adopt such government as shall, in the opinion of the representatives of the people, best conduce to the happiness of their constituents in particular and of America in general." The preamble to this resolution set forth as facts the statements that the colonies had been excluded from the protection of the Crown, that no answer had been given to their petitions for redress, and that the whole force of the kingdom was to be used for their destruction, and therefore that it was no longer reasonable or honest for the colonists to take the oaths or affirmations necessary for the support of government under the Crown. Though the preamble was warmly debated, it was adopted. And this act marked a turning-point, for the progress of events from that time to the declaration of independence was rapid and decisive. The colonies—now becoming states—one after another, in response to letters from Philadelphia, empowered their delegates to concur in declaring independence. On the 7th of June R. H. Lee of Virginia introduced in Congress a resolution "that these United Colonies are and of right ought to be free and independent states," that it was expedient forthwith to take effectual measures for securing foreign allies, and that a plan of confederation should be formed. John Dickinson and others, speaking for the Middle Colonies, argued that the order of procedure should be reversed. But John Adams and the more aggressive party insisted that the proposed declaration would simply state the facts and would open the way for foreign alliances; that it was useless to wait for unanimity. The debate showed that the delegates from the Middle Colonies and South Carolina could not act, and so the decision was postponed for three weeks. In the interval steps were taken to draft a plan of treaties and articles of confederation. A board of war and ordnance, the earliest germ of an executive department, was also created by Congress. At the end of the three weeks the delegates from all the colonies except Georgia, South Carolina and New York had received instructions favourable to independence. The two former left their delegates free, and under the influence of the British attack on Charleston they voted for independence. News had just come that Howe had landed with a large force at Sandy Hook—as events proved, it was an admirably equipped army of 30,000 men, supported by a fleet. Under the impression of these stirring events Dickinson and his leading supporters ceased their opposition, and the Declaration, substantially in the form given to it by Thomas Jefferson, was agreed to (July 4, 1776), only three adverse votes being cast. The delegates from New York took no part, but a few days later the act was approved by the convention of that state. The signing of the document by the members took place at a later time. Thus triumphed the tendencies toward self-government which had been predominant in the continental colonies from the first, and which the system of imperial control had only superficially modified and restrained. But the most significant part of the document for the future was the preamble, in which the democratic aspirations of the new nation were set forth, the spirit to which Thomas Paine had just made so powerful an appeal in his *Common Sense*. Governments, it was said, derive their just powers from the consent of the governed, and when any system becomes destructive of these ends it is the right of the people to abolish it and to institute a new government, establishing it upon such principles and under such forms as seem most likely to effect their safety and happiness. (See INDEPENDENCE, DECLARATION OF.)

E.—*The Struggle to Maintain Independence, 1776–1783.*

Finance; Weaknesses and Defects of the American General Government.

63. Viewed from one standpoint, the declaration of independence was apparently an act of the utmost recklessness. The people were by no means a unit in its support, and in several of the states widespread indifference to it, or active sympathy with the British, prevailed. In New York, South Carolina and Georgia a condition of civil war came sooner or later to exist. The United States, as yet, had no international status, and it would seem that that must be secured, if at all, by a series of victories which would ensure independence. But how could these be won against the greatest naval power on the globe, supported by veteran armies of continental and British troops? The colonies had no money; the few vessels which, as a collective body, they did send out, were more like privateers than anything else. Their army was an undisciplined throng of militiamen, serving on short enlistments, without organized commissariat, and for the most part under inexperienced officers. Its numbers, too, were far inferior to those of the British. Taxation by the Continental Congress for the support of the war was not among the possibilities of the case. The colonies were struggling against taxation by one imperial body, and it was not likely that they would submit to similar impositions at the hands of another. The Congress, moreover, as has truly been said, was little more than a general committee or interstate council of safety, and had to proceed largely by way of advice. A strong tendency also toward the provision for immediate needs by the issue of bills of credit had been inherited from the period of the French wars, and resort was again had to that device. The battle of Bunker Hill had been immediately followed by an order of Congress for the issue of $2,000,000 in that form of currency. Issues followed in rapidly increasing amounts, until by the close of 1779 $241,000,000 had been authorized. The states put out nearly as much ($209,000,000), Virginia and the two Carolinas issuing the largest amounts. All that Congress could do to secure the redemption of its issues was to recommend to the states to provide the means therefor; but this they failed to do, or even to provide for the redemption of their own issues. The continental paper money depreciated until it became

worthless, as to a large extent did that of the states also. The states decreed it to be legal tender, and dire threats were uttered against those who refused to receive the bills; but all to no purpose. The Congress also tried to induce the states to tax themselves for the general cause and was forced to rely on requisitions for the purpose. The colonies had insisted that the system of requisitions was good enough for the mother country, but when applied by Congress it proved as complete a failure as when resorted to by the Crown. The revolution was therefore never financed. It early became necessary to resort to loans and that chiefly from foreign sources. It was therefore an absolute necessity that the colonies should secure international recognition and status. Then loans were obtained from the governments of France and Spain and from private bankers in Holland to the amount of about $7,830,000.

64. The collapse of royal government left the colonies in a chaotic state. The old institutions had disappeared and new ones could not be immediately developed to take their place. But the institutions of local government, the town and county systems, were left intact, and upon these as a basis the new fabrics were erected. It was therefore easier to construct the governments of the states than to define and develop the general government. At first little else was intended than that the Congress should be the mouthpiece of the patriot party. It proceeded mainly by way of recommendation, and looked to the states, rather than to itself, as the ultimate sources of authority. Upon them it depended for the execution of its measures. The common will, as well as enactment, was lacking which would have given the force of positive law to the measures of Congress. As the war proceeded the states grew jealous of the central body and tried to prevent appeals to it from the state courts in prize cases. Under the pressure of war, moreover, the enthusiasm, which had been strong at the outset, declined, and it became increasingly difficult to secure co-operation or sacrifice toward any general enterprise. At the same time, war devolved upon Congress an enormous burden of work. It was forced to devise general policies and provide for their execution, and also to attend to an infinite number of administrative details. This was due not only to the exigencies of the time, but to the fact that no general executive was developed. As was characteristic not only of this revolution, but of all others, the committee system underwent an enormous development. "The whole congress," wrote John Adams, "is taken up, almost, in different committees, from seven to ten in the morning. From ten to four or sometimes five we are in congress, and from six to ten in committees again." "Out of a number of members," writes another, "that varied from ten dozen to five score, there were appointed committees for a hundred varying purposes." Upon its president and secretary the Congress was forced to depend not a little for the diligence and ability which was requisite to keep the machine going. But as the war progressed most of the able members were drawn off into the army, into diplomatic service or into official service in the states. Sectional and state jealousies also developed and became intense. By many the New Englanders were regarded with aversion, and members from that section looked with dislike upon the aristocrats from the South. As the Congress voted by states the smaller commonwealths were often moved by jealousy of their larger rivals to thwart important measures. But, above all, the conduct of the war and foreign relations occasioned infinite jealousies and cabals, while many of the most important measures seemed to meet with downright indifference. Washington's correspondence abounds in evidence of these facts, while it is well known that he was the object against whom one of the cabals of the time was directed. Benjamin Franklin was the object of somewhat similar jealousies. But, as time passed, rudimentary executive departments, beginning with the board of war and the postmaster-general, were developed, and some advance was made toward a working and permanent system. In 1781 the offices of foreign secretary, superintendent of finance, secretary of war and secretary of marine were created.

65. For a time, and indeed during most of the struggle, the course of the land war seemed to justify these criticisms and gloomy fears. Until its very close the campaign of 1776, from the American standpoint, was a dismal failure. The battle of Long Island was lost by the Americans and, as at Bunker Hill, it would have been quite possible for the British to have captured the entire force which opposed them on Long Island. Howe compelled Washington to evacuate New York City. On the 16th of November the practical abandonment of the state of New York by the main army was necessitated by the capture of Fort Washington. Earlier in the year the Americans had been compelled to retire from Canada, while the Tories in northern New York were contributing valuable aid to the British.

Fort Washington.

66. But there was another side to the picture, and already certain faint outlines of it might be discerned. The British commander was proceeding slowly, even according to established European methods. At almost every step he was failing to seize the advantages that were within his reach, while Washington was learning to play a losing game with consummate patience and tact. Although he was constantly trying to rouse Congress and the states to more vigorous action, he showed no disposition to break with the civil power. Already, too, the physical obstacles arising from the wooded and broken character of the country, and from the extremely poor means of communication, were becoming apparent to the British; while the Americans always had the alternative, if too hard pressed, of withdrawing beyond the mountains. After Washington had crossed the Delaware, Howe, instead of seizing Philadelphia and driving Congress and the American army to some remote places of refuge, as he might have done, prepared for winter quarters. Washington seized the opportunity to return across the Delaware and surprise the British outposts at Trenton (Dec. 26, 1776) and Princeton (Jan. 3, 1777), and thus secured a safe post of observation for the winter at Morristown. Confidence was to an extent restored, the larger part of New Jersey was regained, and many loyalists were compelled to take the oath of allegiance. Howe's plan for the next campaign involved the strengthening of his army by large reinforcements from home and by all the men who could be spared from Canada. With this force he proposed to capture Philadelphia and thereby to bring the War of Independence to an end in Pennsylvania, New Jersey and New York. New England and the states farther south could then be dealt with in detail. But Howe was overruled by Lord George Germain, the colonial secretary, whose plan included an invasion from Canada, in which Tories and Indians should share, while Howe should advance up the Hudson and meet the northern forces at Albany. If this ambitious scheme should succeed, the British would occupy the valley of the Hudson and New England would be cut off from the rest of the colonies. General Burgoyne was appointed to command the northern expedition. But the failure of the plan was almost ensured from the outset by neglect on the part of British officials to instruct General Howe as to his part in its execution, while Burgoyne was forced to surrender near Saratoga on the 17th of October. Meanwhile, Howe, who had long waited for instructions respecting the northern expedition, was finally informed that he might undertake the Pennsylvania campaign, but with the hope that at its close he would still be able to march up the Hudson. Thereupon, embarking his army, Howe sailed for Chesapeake Bay, at the head of which he landed and advanced towards Philadelphia. Washington's army opposed his march at the Brandywine (Chad's Ford), but was defeated (Sept. 11, 1777) and forced to retire beyond Philadelphia. The British then entered the city (Sept. 26) and the Congress withdrew to Lancaster, and later to York, in the interior of Pennsylvania. The British fleet had in the meantime arrived in Delaware Bay, and, after a prolonged and brave defence, had captured Forts Mercer and Mifflin. When the winter began the Delaware, as well as lower New York and Rhode Island, was in the possession of the British. With the fragments of an army Washington retired to Valley Forge (*q.v.*).

French-American Alliance.

67. But the influence of Burgoyne's surrender in Europe was to prove a turning-point in the war. Since 1763 a strong sentiment at the French court had been favourable to a resumption of war with Great Britain. An opportunity was now presented by the colonial revolt. In November 1775 the Congress created a committee of secret correspondence, which, in April 1777, was developed into a committee of foreign affairs, and this continued until 1781, when the office of foreign secretary was established. To Congress, and to the members who were serving on its secret committee, the possible attitude of France was known from an early date. The necessity of securing supplies and loans from Europe was also imperative, though the United States had nothing to pledge in repayment except the future products of her soil. In February 1776 Silas Deane (*q.v.*) was sent to Paris, ostensibly as a business agent, and with the connivance of the French government supplies were sent to America and American vessels were received into French ports. Soon American privateers were bringing their prizes into French harbours, and British commerce began to suffer from these attacks. On the French side Beaumarchais and others actively co-operated in this. In the autumn of 1776 Congress appointed three commissioners to France, and resolved that Spain, Prussia, Austria and other European states should be approached with a view to securing recognition and aid. In December 1776 Franklin, who, with Deane and Arthur Lee, had been appointed commissioner to France, arrived at Paris, bringing with him proposals for treaties of commerce and alliance. But, though the attitude of the French court toward the Americans was friendly, and though it continued to send secret aid, and to exert a favourable influence upon Spain, yet it could not be induced to abandon its outward appearance of neutrality until after the news of Burgoyne's surrender arrived. Then the real purpose of the French government was revealed. On the 6th of February 1778 the treaties were signed, and in the following summer war between France and England began. The influence of France under the Family Compact was also persistently used to bring Spain into the alliance. The latter was naturally hostile to England, but her aversion to colonial revolts and her desire to substitute mediation for war kept her from declaring against England until April 1779. In October 1779 Henry Laurens (*q.v.*) was elected minister to the Netherlands, and sailed for Europe, taking with him a plan of a commercial treaty. But Laurens and his papers were captured by the British at sea, and partly by that event the Netherlands were forced into war with England. With the other states of northern Europe they undertook to defend the interests of neutrals against the arrogant enforcement by Great Britain of the rights of search at sea. Thus the conflict expanded into a commercial and naval war, Great Britain being confronted by the larger part of Europe.

68. The conclusion of the treaty of alliance by France was immediately followed by the equipment of a fleet under the comte d'Estaing, which sailed from Toulon in April 1778, having on board M. Conrad Alexandre Gérard de Rayneval, who had been accredited as minister to the United States, and Silas Deane, who was returning to report to Congress. Sir Henry Clinton had now succeeded Howe in command of the British army. The certainty that a French fleet would soon appear in American waters made it necessary for the British to evacuate Philadelphia and return to a point on the coast where the army could be in easy communication with the fleet. This fact shows how the French alliance had changed the nature of the war. It now became to a large extent a contest between the two navies, the principal evolutions of which occurred in West Indian and European seas. (See AMERICAN WAR OF INDEPENDENCE.) In the north the British now relatively neglected the land war, and refrained from sending such forces to the eastern coast as had supported Howe in 1776. The Americans, on the other hand, had a naval force upon which they relied, in the hope that the blockade of their coasts might be raised and trade routes opened more freely. On the evacuation of Philadelphia in June Washington's army pursued the British as they retired toward New York, and the indecisive battle of Monmouth was fought on the 28th of June. It did not prevent Clinton from reaching New York, and that city continued to be the centre of British power and operations in the north until the close of the war. The Congress returned to Philadelphia, where Gérard was received, and where he was soon exercising an influence favourable to the policies of Washington and opposed to the clique of which General Horatio Gates was the leader. Washington's army came gradually to occupy a line of forts, of which West Point in the Highlands of the Hudson was the citadel. From there as a centre it was possible to communicate with Newport on the east and with the Delaware region on the south, and at the same time to prevent the British from gaining access to the interior of the country. Though the fleet of D'Estaing carried a heavier equipment of cannon than did that of Admiral Howe, the French commander did not choose to risk an attack on New York, but passed eastward to Newport. Howe followed him, while Washington and his generals planned active co-operation with the new allies by land. But a sudden storm so dispersed and injured the fleets that the French admiral retired to Boston for repairs and later sailed for the West Indies.

State Constitutions.

69. While the war and foreign relations were thus developing, the states were organizing their governments and Congress was beginning to consider articles of confederation between the states. In this way an effort was made to gather up and make permanent the positive results of the revolution. As under the chartered and royal governments of the colonial period the source of political authority had been the Crown, now by a necessary reaction this was sought in the people. This principle had been stated in the Declaration of Independence, and had been implied throughout the earlier controversy and in much of the history of the colonies as well. The colonies had insisted on a more precise definition of the powers of government; they had opposed parliament because its powers were undefined and therefore dangerous. Following these ideas, the states now described their institutions of government and defined their powers by means of written constitutions. These were formulated by the provincial congresses—which had now become the legislatures—or, as they came to insist upon a more specific expression of the popular will, by conventions chosen for the purpose by the electors. Connecticut and Rhode Island retained their colonial charters. In the earlier days of hasty and temporary devices, the constitutions, like statutes, had been promulgated by the legislatures which formed them and had been put into force by their authority alone. But as time passed and more permanent arrangements became necessary an express popular approval of the instruments was insisted upon and was obtained before they were put into force. The establishment of state governments in this way began before the issue of the Declaration of Independence. It was actively continued during 1776 and the early months of the following year, by which time all of the states had secured at least a temporary constitution. South Carolina and New Hampshire revised theirs before the close of the war. Massachusetts did not secure a constitution which suited her until 1780, but then her procedure corresponded in all particulars with what was to be later American practice in such matters. Of the constitutions of the revolutionary period the two most striking features were the bills of rights and the provisions which were made concerning the executives and their relations to the legislatures. The men of that generation were jealous of government. They insisted upon individual rights, not as acquired and guaranteed by the state, but as original, natural and inhering in time prior to all governments. Governments were instituted for the common benefit, protection and security. Officials were trustees and were accountable to the people. There should be no hereditary title to office or power. There should be no titles of nobility, and in Virginia the system of entails was swept away. Monopolies were declared to be inconsistent with the spirit of a free state. The doctrine that it was unlawful to resist

arbitrary power was declared to be absurd. Freedom of the press and of conscience was asserted, and no obstacles to fair and speedy jury trials were to be tolerated. Elections should be free and frequent, and a preference was expressed for short terms of office. The legislature was universally regarded as the most important department of government. Although the principle of the separation of powers was recognized, in eight states provision was made that the executives should be elected by the legislatures, eleven withheld from them the veto, and the states generally provided for a council to advise them. So manifold and important, however, were the restrictions on suffrage that the states were as yet far from being democracies. On the other hand, many wild and impractical ideas were cherished, and there were anarchic tendencies, which were revealed soon after the war and still later, under the influence of the French Revolution.

The Articles of Confederation.

70. The first draft of the Articles of Confederation between the states was prepared by John Dickinson in the early summer of 1776 and was reported. The report was debated for some weeks after the issue of the Declaration of Independence. Owing to the pressure of war it was then laid aside until the autumn of 1777. By that time the feeling in favour of state sovereignty had so increased that the impossibility of securing assent to the articles in any form had begun to be feared. But the document was completed and submitted to the states in November 1777, when all were encouraged by the news of Burgoyne's surrender. The system for which provision was made in this document was a "confederacy," or "firm league of friendship" between the states, for their common defence, security and general welfare. The Congress was to be continued, and was to consist of delegates annually appointed by the legislature of each state and paid by their states. No attempt was made to create an executive for the confederacy, though authority was given to Congress to appoint a council of state which should manage general affairs, especially during recesses of Congress. To Congress various general powers were entrusted, as deciding on peace and war and superintending the conduct of the same, building a navy, controlling diplomatic relations, coining money and emitting bills of credit, establishing post offices, regulating Indian trade, adjusting boundary disputes between the states. The financial powers entrusted to Congress included those of borrowing money and determining necessary expenditures, but not the power to tax. For supplies the general government had to depend on requisitions from the states. The same system also had to suffice for the raising and equipment of troops. Congress could not make its laws or orders effective in any matter of importance. This was simply a continuation of the policy under which the revolution was being conducted. The Americans had thought that the military and financial concerns of the British Empire could be managed under a system of requisitions, and now they were bent upon trying it in their own imperial relations. The control of trade was also practically left with the states, the Americans in this matter failing to live up to the requirements of the British system. The predominance of the states was further ensured by the provision that no votes, except those for daily adjournment, could be carried without the assent of a majority of all the states, and no important measure without the consent of nine states. But a common citizenship was declared to exist, and Congress received authority to establish a court of appeal which might pass finally on all disputes between states. Taken as a whole, the Articles of Confederation would bear favourable comparison with other schemes of their kind, and they fairly represented the stage of development to which the American states had then attained. The defects which existed in them were reflections of the immaturity, political and social, which had always been apparent in the Americans as colonists and which was to characterize them as a nation for generations to come.

The West.

71. We have seen that, on the whole, the attitude of Great Britain, after the peace of 1763, was not favourable to the colonization of the Mississippi Valley. To the colonists the Quebec Act gained in offensiveness by seeming to imply that it was intended to exclude them from the West. But all such plans were swept away by the outbreak of the War of Independence. Already, before the beginning of hostilities, emigrants had begun to flock across the mountains. Plans were on foot for the establishment of a number of commonwealths, or proprietary provinces, as the case might be. Vandalia was planned in western Virginia, Watauga in western North Carolina. Daniel Boone and his associates pushed farther west into the Kentucky region, and there it was proposed to establish the commonwealth of Transylvania. Other similar projects were started, all repeating in one form or another the political methods which were used when the seaboard colonies were first settled. The backwoodsmen who managed these enterprises were extreme individualists, believed in the propriety of resistance to governments, and were in full sympathy with the War of Independence. They desired to escape to the free land and life of the West and be rid of the quit-rents and other badges of dependence which still lingered in the East. The states which had claims in the West opposed the founding of independent settlements there and, if possible, induced the settlers to be content with the status of counties within some one of the eastern states. After the beginning of the War of Independence, the British from Detroit incited Indian raids for the purpose of destroying or driving out the settlers, especially in Kentucky. These provoked the expeditions of George Rogers Clark (*q.v.*), in 1778 and 1779. With a force of Virginians he seized Kaskaskia and later, after a long march, captured Vincennes and compelled General Henry Hamilton, who had come with a relief force from Detroit, to surrender. This secured to the Americans a permanent hold upon the North-West. But Spain, after she entered upon the war, was determined, if possible, to wrest the valley of the Mississippi from the British and to keep all, or the larger part of it, for herself. To that end, operating from New Orleans, her troops took possession of Natchez, and other posts on the lower Mississippi, and occupied Mobile and Pensacola. These events prevented the possibility of the expulsion of the Americans from the West, but devolved upon their representatives at Paris the necessity of engaging in a diplomatic contest against Spain for the purpose of securing the Mississippi as the western boundary of the United States. But meanwhile the occupation of the West by Americans had a notable influence upon the ratification of the Articles of Confederation.

Articles of Confederation Ratified.

72. Within the Confederacy a fundamental line of cleavage was that between the large and small states. It was jealousy on the part of the latter, their fear lest they might be absorbed by their larger neighbours, which had necessitated the adoption of the plan that in the Congress the delegates should vote by states. When the articles were referred to the states for ratification, the difficulty reappeared. Massachusetts, Connecticut and New York, with Virginia and the three states to the south of it, had large claims to territory between the Appalachians and the Mississippi. New Hampshire, Rhode Island, New Jersey, Delaware and Maryland, which were without hope of westward extension, hesitated to enter the Confederacy, if the large states were to be still further increased by additions to their areas of vast stretches of western country. They insisted that before ratification the states which had claims to western lands should surrender these for the common benefit of the United States. Maryland insisted upon this until, in the end, the cause of state equality and of nationality triumphed. Congress declared that the ceded lands should be formed into states, which should become members of the union with the same rights as other states. When, in 1781, this course of action had become possible, Maryland ratified the articles and they came into effect. The possibility of the expansion of the United States through the development of territories was thus ensured.

73. So far as the North American continent was concerned, the character of the last stage of the struggle with Great Britain

The War in the South.

was determined by the fact that the British resolved to transfer the main seat of war to the Southern states, in the hope that Georgia and South Carolina might be detached from the Union. At the close of 1778 Savannah was captured. In September 1779 D'Estaing returned and assaulted Savannah, but, failing to capture it, sailed for France. In 1780 Clinton sailed from New York, besieged Charleston with a force much superior to that of Lincoln, and captured it (May 12). State government in South Carolina ceased. But the chance of detaching those states from the Union and of bringing the war in that region to an end was finally lost by the British. This was chiefly due to an order which recalled the paroles of many of those who had surrendered at Charleston and required that they should perform military service under the British. The attempt to enforce this order, with the barbarities of Colonel Banastre Tarleton and certain Tory bands, provoked a bloody partisan conflict in the upper districts, especially of South Carolina, which contributed more than any other cause to turn the scale against the British in the remote South. By the winter of 1781 they were forced back to Charleston and Savannah. (See AMERICAN WAR OF INDEPENDENCE.)

Yorktown.

74. During the summer of 1780 Washington was prevented from accomplishing anything in the North by the demoralized condition of the finances and by the decline of public spirit. It was very difficult to secure recruits or supplies. The pay of the troops had fallen so into arrears that some of them had already begun mutiny. A second French squadron and military force, under De Ternay and Rochambeau, landed at Newport, but they were at once shut up there by the British. Clinton and Cornwallis were now planning that the latter, having put down resistance in the remote South, should march through North Carolina and Virginia to Baltimore and Philadelphia and that a junction of the two British forces should be effected which, it was believed, would complete the ruin of the American cause. This, too, was the period of Arnold's treason and the death of André. But the turn of the tide in favour of the Americans began with the partisan warfare in South Carolina, which delayed the northward march of Cornwallis, who retired to Wilmington and thence marched north with a small force into Virginia, and in July retired to Yorktown, in the peninsula of Virginia. Washington and Rochambeau had meantime been planning a joint move against the British at New York, or possibly in Virginia, and a letter was sent to De Grasse, the French admiral in the West Indies, suggesting his co-operation. De Grasse replied that he would sail for the Chesapeake. This confirmed Washington and Rochambeau in the opinion that they should march at once for Virginia and, after junction with the force of Lafayette, co-operate with De Grasse against Cornwallis. By well-timed movements the forces were brought together before Yorktown (*q.v.*), and Cornwallis was forced to surrender on the 19th of October 1781.

Treaty of Peace.

75. As the effect of this event was to drive Lord North from power in England, it proved to be the last important operation of the war in America. The king was compelled to give way. Rockingham was called into office at the head of a cabinet which considered the recognition of American independence to be indispensable. The negotiations fell into the hands of Shelburne, the friend of Franklin and disciple of Adam Smith. Richard Oswald was the leading British agent, while Franklin, Jay, John Adams and Henry Laurens were the American negotiators. From the first the acknowledgment of independence, the settlement of the boundaries and the freedom of fishing were insisted on as necessary terms by the Americans. Free commercial intercourse and the cession of Canada to the United States, partly in payment of war claims and partly to create a fund for the compensation of loyalists, were also put forward as advisable conditions of peace. The first three points were early conceded by the British. They also agreed to restrict Canada to its ancient limits. But discussions later arose over the right to dry fish on the British coasts, over the payment of debts due to British subjects prior to the war, and over the compensation of the loyalists. Adams vigorously insisted upon the right to dry and cure fish on British coasts, and finally this concession was secured. Franklin was opposed to the demands of the loyalists, and they had to be content with a futile recommendation by Congress to the states that their claims should be adjusted. It was also agreed that creditors on either side should meet with no lawful impediment to the collection of their debts. Both France and Spain considered the claims of the Americans to be excessive, and were not inclined to yield to them. But the Americans negotiated directly with the British and the articles were signed without consultation with the French government. This course was offensive to Vergennes, but it was insisted upon as necessary, especially by Jay and Adams, while the diplomatic skill of Franklin prevented a breach with France. Peace was formally ratified on the 3rd of September 1783.

76. The American army was now disbanded. Since the close of active military operations both officers and men had been striving to secure their pay, which was hopelessly in arrears. Congress had voted half-pay to the officers for life, and many had agreed to accept a commutation of this in the form of full pay for a certain number of years. Certificates for these amounts were issued. But in this, as in other cases, it was found impossible to procure the money for the purpose from the states. Parts of the army repeatedly mutinied, and it was only the influence of Washington which prevented a general outbreak against Congress and the civil government. When the disbandment was finally effected the officers found their certificates depreciated in value and the states indisposed to honour them. They consequently received only a small part of their due, and the privates scarcely anything. This deplorable result was due in part to poverty, but quite as much to bad faith. The country was left in a most demoralized condition, the result of the long war and the general collapse of public and private credit which had accompanied it. It should not be forgotten that the conflict had taken to a considerable extent the form of a civil war. In many of the states Loyalists and Whigs had been arrayed against one another, and had been more or less fully incorporated with the two contending armies. In general the Loyalists showed less capacity for combined action than did their opponents, and in the end they were everywhere defeated. The real tragedy of the conflict will be found, not in the defeat of the British, but in the ruin of the Loyalists. It was accompanied by wholesale confiscations of property in many quarters, and by the permanent exile of tens of thousands of the leading citizens of the republic. These were the *émigrés* of the War of American Independence, and their removal deeply affected property relations and the tone and structure of society in general. Many of those who had been social and political leaders were thus removed, or, if they remained, their influence was destroyed (see LOYALISTS). New men and new families rose in their places, but of a different and in some ways of an inferior type. By this process sympathizers with the War of Independence gained and kept the ascendancy. British and monarchical influences were weakened, and in the end the permanence of republican institutions was ensured. But, as had been foreseen, society in this period of transition exhibited so many repulsive features as almost to cause the stoutest hearts to despair.

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F.—*The Struggle for National Government, 1783–1789.*

77. The long struggle to secure the ratification of the Articles of Confederation had given time for careful consideration of the new scheme of government. Maryland's persistent criticism had prepared men to find defects in them. Conventions of New England states, pamphlets, and private correspondence had found flaws in the new plan; but a public trial of it was a necessary preliminary to getting rid of it. The efforts of the individual states to maintain the war, the disposition of each state to magnify its own share in the result, the popular jealousy of a superior power, transferred now from parliament to the central government, were enough to ensure the articles some lease of life. A real national government had to be extorted through the "grinding necessities of a reluctant people."

Territorial Cessions.

78. Congress and its committees had already begun to declare that it was impossible to carry on a government efficiently under the articles. Its expostulations were to be continued for several years before they were heard. In the meantime it did not neglect the great subject which concerned the essence of nationality—the western territory. Virginia had made a first offer to cede her claims, but it was not accepted. A committee of Congress now made a report (1782) maintaining the validity of the rights which New York had transferred to Congress; and in the next year Virginia made an acceptable offer. Her deed was accepted (March 1, 1784); the other claimant states followed; and Congress, which was not authorized by the articles to hold or govern territory, became the sovereign of a tract of some 430,000 sq. m., covering all the country between the Atlantic tier of states and the Mississippi river, from the British possessions nearly to the Gulf of Mexico.

Territorial Government.

The Ordinance of 1787.

79. In this territory Congress had now on its hands the same question of colonial government in which the British parliament had so signally failed. The manner in which Congress dealt with it has made the United States the country that it is. The leading feature of its plan was the erection, as rapidly as possible, of states, similar in powers to the original states. The power of Congress over the Territories was to be theoretically absolute, but it was to be exerted in encouraging the development of thorough self-government, and in granting it as fast as the settlers should become capable of exercising it. Copied in succeeding acts for the organization of Territories, and still controlling the spirit of such acts, the Ordinance of 1787 (July 13, 1787) is the foundation of almost everything which makes the modern American system peculiar.

80. The preliminary plan of Congress was reported by a committee of which Thomas Jefferson (*q.v.*) was chairman, and was adopted by Congress on the 23rd of April 1784. It provided for the erection of seventeen states, north and south of the Ohio, with some odd names, such as Sylvania, Assenisipia, Metropotamia, Polypotamia and Pelisipia. These states were for ever to be a part of the United States, and to have republican governments. The provision, "After the year 1800 there shall be neither slavery nor involuntary servitude in any of the said states, other than in the punishment of crimes whereof the party shall have been duly convicted," represented Jefferson's feeling on this subject, but was lost for want of seven states in its favour.

81. The final plan of 1787 was reported by a committee of which Nathan Dane, of Massachusetts, was chairman. The prohibition of slavery was made perpetual, and a fugitive slave clause was added. The ordinance covered only the territory north of the Ohio, and provided for not less than three nor more than five states. Ohio, Indiana, Illinois, Michigan and Wisconsin have been the resultant states. At first Congress was to appoint the governor, secretary, judges and militia generals, and the governor and judges were, until the organization of a legislature, to make laws subject to the veto of Congress. When the population reached 5000 free male adult inhabitants the Territory was to have an assembly of its own, to consist of the governor, a legislative council of five, selected by Congress from ten nominations by the lower house, and a lower House of Representatives of one delegate for every 500 free male inhabitants.[1] This assembly was to choose a delegate to sit, but not to vote, in Congress, and was to make laws not repugnant to "the principles and articles" established and declared in the ordinance. These were as follows: the new states or Territories were to maintain freedom of worship, the benefits of the writ of *habeas corpus*, trial by jury, proportionate representation, bail, moderate fines and punishments, and the preservation of liberty, property and private contracts; they were to encourage education and keep faith with the Indians; they were to remain for ever a part of the United States; and they were not to interfere with the disposal of the soil by the United States, or to tax the lands of the United States, or to tax any citizen of the United States for the use of the navigable waters leading into the Mississippi or St Lawrence rivers. These articles were to be unalterable unless by mutual consent of a state and the United States. The transformation of the Territory, with its limited government, into a state, with all the powers of an original state, was promised by Congress as soon as the population should reach 60,000 free inhabitants, or, under certain conditions, before that time.

82. The Constitution, which was adopted almost immediately afterwards, provided merely (art. iv, § 3) that "Congress shall have power to dispose of, and make all needful rules and regulations respecting, the territory or other property belonging to the United States," and that "new states may be admitted by the Congress into this Union." Opinions have varied as to the force of the Ordinance of 1787. The Southern school of writers have been inclined to consider it *ultra vires* and void; and they adduce the fact that the new Congress under the Constitution thought it necessary to re-enact the ordinance (Aug. 7, 1789). The opposite school have inclined to hold the ordinance as still in force. Even as to the Territorial provision of the Constitution, opinions have varied.

Difficulties of the Confederation.

83. In the interval of the settlement of the territorial question the affairs of the "league of friendship," known as the United States, had been going from bad to worse, culminating in 1786. The public debt amounted in 1783 to about $42,000,000, of which $8,000,000 was owed abroad—in Holland, France and Spain. Congress had no power to levy taxes for the payment of interest or principal; it could only make requisitions on the states. In the four years ending in 1786 requisitions had been made for $10,000,000 and the receipts from them had amounted to but one-fourth of what had been called for. Even the interest on the debt was falling into arrears, and the first instalment of the principal fell due in 1787. To pay this, and subsequent annual instalments of $1,000,000, was quite impossible. Robert Morris, the financier of the War of Independence, resigned in 1783 rather than "be the minister of injustice," hoping thus to force upon the states the necessity of granting taxing powers to Congress. Washington, on retiring from the command-in-chief, wrote a circular letter to the governors of all the states, urging the necessity of granting to Congress some power to provide a national revenue. Congress (April 18, 1783) appealed to the states for power to levy specific duties on certain enumerated articles, and 5% on others. It was believed that with these duties and the requisitions, which were now to be met by internal taxation, $2,500,000 per annum could be raised. Some of the states ratified the proposal; others ratified it with modifications; others rejected it, or changed their votes; and it never received the necessary ratification of all the states. The obedience to the requisitions grew more lax. In 1786 a committee of Congress reported that any further reliance on requisitions would be "dishonourable to the understandings of those who entertain such confidence."

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[1] When the total number should reach 25, the legislature itself was to have the power of regulating the number and proportion. Property qualifications were prescribed for electors, representatives and members of the council.

Of the States.

Of Congress.

84. In the states the case was even worse. Some of them had been seduced into issuing paper currency in such profusion that they were almost bankrupt. Great Britain, in the treaty of peace, had recognized the independence of the individual states, naming them in order; and her government followed the same system in all its intercourse with its late colonies. Its restrictive system was maintained, and the states, vying with each other for commerce, could adopt no system of counteracting measures. Every possible burden was thus shifted to American commerce; and Congress could do nothing, for, though it asked for the power to regulate commerce for fifteen years, the states refused it. The decisions of the various state courts began to conflict, and there was no power to reconcile them or to prevent the consequences of the divergence. Several states, towards the end of this period, began to prepare or adopt systems of protection of domestic productions or manufactures, aimed at preventing competition by neighbouring states. The Tennessee settlers were in insurrection against the authority of North Carolina; and the Kentucky settlers were disposed to cut loose from Virginia. Poverty, with the rigid execution of process for debt, drove the farmers of western Massachusetts into an insurrection (Shays's Insurrection) which the state had much difficulty in suppressing; and Congress was so incompetent to aid Massachusetts that it was driven to the expedient of imagining an Indian war in that direction, in order to transfer troops thither. Congress itself was in danger of disappearance from the scene. The necessity for the votes of nine of the thirteen states for the passage of important measures made the absence of a state's delegation quite as effective as a negative vote. Congress even had to make repeated appeals to obtain a quorum for the ratification of the treaty of peace with Great Britain. In 1784 Congress actually broke up in disgust, and the French minister reported to his government—"There is now in America no general government—neither Congress, nor president, nor head of any one administrative department." Everywhere there were symptoms of a dissolution of the Union.

Proposals for a Convention.

85. Congress was evidently incompetent to frame a new plan of national government; its members were too dependent on their states, and would be recalled if they took part in framing anything stronger than the articles. The idea of a convention of the states, independent of Congress, was in the minds and mouths of many; Thomas Paine had suggested it as long ago as his *Common Sense* pamphlet: "Let a continental conference be held . . . to frame a continental charter . . . fixing the number and manner of choosing members of Congress, members of assembly . . . drawing the line of business and jurisdiction between them." To a people as fond of law and the forms of law as the Americans there was a difficulty in the way. The articles had provided that no change should be made in them but by the assent of every state legislature. If the work of such a convention was to be subject to this rule, its success would be no greater than that of Congress; if its plan was to be put into force on the ratification of less than the whole number of states, the step would be more or less revolutionary. In the end the latter course was taken, though not until every other expedient had failed; but the act of taking it showed the underlying consciousness that union, independence and nationality were now inextricably complicated, and that the thirteen had become one in some senses.

Convention of 1786.

86. The country drifted into a convention by a roundabout way. The navigation of Chesapeake Bay and the Potomac needed regulation; and the states of Maryland and Virginia, having plenary power in the matter, appointed delegates to arrange such rules. The delegates met (1785) at Alexandria, Va. (*q.v.*), and at Washington's house, Mount Vernon. Maryland, in adopting their report, proposed that Pennsylvania and Delaware be asked to nominate commissioners, and Virginia went further and proposed a meeting of commissioners from all the states to frame commercial regulations for the whole. The convention met (1786) at Annapolis (*q.v.*), Maryland, but only five states were represented, and their delegates adjourned, after recommending another convention at Philadelphia in May 1787.

Convention of 1787.

87. Congress had failed in its last resort—a proposal that the states should grant it the impost power alone; New York's veto had put an end to this last hope. Confessing its helplessness, Congress approved the call for a second convention; twelve of the states (all but Rhode Island) chose delegates; and the convention met at Philadelphia (May 25, 1787), with an abler body of men than had been seen in Congress since the first two Continental Congresses. Among others, Virginia sent Washington, James Madison, Edmund Randolph, George Mason and George Wythe; Pennsylvania: Franklin, Robert and Gouverneur Morris and James Wilson; Massachusetts: Rufus King, Elbridge Gerry and Caleb Strong; Connecticut: William S. Johnson, Roger Sherman and Oliver Ellsworth; New York: Alexander Hamilton; New Jersey: William Paterson; and South Carolina the two Pinckneys and John Rutledge. With hardly an exception the fifty-five delegates were clear-headed, moderate men, with positive views of their own and firm purpose, but with a willingness to compromise.

The Virginia Plan.

The New Jersey Plan.

88. Washington was chosen to preside, and the convention began the formation of a new Constitution, instead of proposing changes in the old one. Two parties were formed at once. The Virginia delegates offered a plan (see RANDOLPH, EDMUND), proposing a Congress, of two houses, having power to legislate on national subjects, and to compel the states to fulfil their obligations. This is often spoken of as a "national" plan, but very improperly. It was a "large-state" plan, proposed by those states which had or hoped for a large population. It meant to base representation in both houses on population, so that the large states could control both of them, and it left the appointment of the president or other executive and the Federal judges to Congress —so that the whole administration of the new government would fall under large-state control. On behalf of the "small states" Paterson of New Jersey brought in another plan.[1] It continued the old Confederation, with its single house and equal state vote, but added the power to regulate commerce and raise a revenue, and to compel the states to obey requisitions. The large states had a general majority of six to five, but the constant dropping off of one or more votes, on minor features, from their side to that of the small states prevented the hasty adoption of any radical measures. Nevertheless, the final collision could not be evaded; the basis of the two plans was in the question of one or two houses, of equal or proportionate state votes, of large-state supremacy or of state equality. In July the large states began to show a disposition to force their plan through, and the small states began to threaten a concerted withdrawal from the convention.

The Compromise.

89. The Connecticut delegates, from their first appearance in the convention, had favoured a compromise. They had been trained under the New England system, in which the assemblies were made up of two houses, one representing the people of the whole state, according to population, and the other giving an equal representation to the towns. They proposed that the new Congress should be made up of two houses, one representing the states in proportion to their population, the other giving an equal vote to each state. At a deadlock the convention referred the proposition to a committee, and it reported in favour of the Connecticut compromise. Connecticut had been voting in the large-state list, and the votes of her delegates could not be spared from their slender majority; now another of the large states, North Carolina, came over to Connecticut's proposal, and it was adopted. Thus the first great struggle of the convention resulted in a compromise, which took shape in an important feature of the Constitution, the Senate.

90. The small states were still anxious, in every new question, to throw as much power as possible into the hands of their

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[1] A third plan was introduced by Charles Pinckney; for a discussion of this plan see the separate article on PINCKNEY.

The Work of the Convention.

special representative, the Senate; and that body thus obtained its power to act as an executive council as a restraint on the president in appointments and treaties. This was the only survival of the first alignment of parties; but new divisions arose on almost every proposal introduced. The election of the president was given at various times to Congress and to electors chosen by the state legislatures; and the final mode of choice, by electors chosen by the states, was settled only two weeks before the end of the convention, the office of vice-president coming in with it. The opponents and supporters of the slave trade compromised by agreeing not to prohibit it for twenty years. Another compromise included three-fifths of the slaves in enumerating population for representation. This provision gave the slaveholders abnormal power as the number of slaves increased.

91. Any explanation of the system introduced by the Constitution must start with the historical fact that, while the national government was practically suspended, from 1776 until 1789, the only power to which political privileges had been given by the people was the states, and that the state legislatures were, when the convention met, politically omnipotent, with the exception of the few limitations imposed on them by the early state constitutions. The general rule, then, is that the Federal government has only the powers granted to it by the Federal Constitution, while the state has all governmental powers not forbidden to it by the state or the Federal Constitution. But the phrase defining the Federal government's powers is no longer "expressly granted," as in the Articles of Confederation, but merely "granted," so that powers necessary to the execution of granted powers belong to the Federal government, even though not directly named in the Constitution. This question of the interpretation or "construction" of the Constitution is at the bottom of real national politics in the United States: the minimizing parties have sought to hold the Federal government to a strict construction of granted powers, while their opponents have sought to widen those powers by a broad construction of them. The strict-construction parties, when they have come into power, have regularly adopted the practice of their opponents, so that construction has pretty steadily broadened.

The Constitution.

92. Popular sovereignty, then, is the basis of the American system. But it does not, as does the British system, choose its legislative body and leave unlimited powers to it. It makes its "Constitution" the permanent medium of its orders or prohibitions to all branches of the Federal government and to many branches of the state governments: they must do what the Constitution directs and leave undone what it forbids. The people, therefore, are continually laying their commands on their governments; and they have instituted a system of Federal courts to ensure obedience to their commands. A British court must obey the act of parliament; the American court is bound and sworn to obey the Constitution first, and the act of Congress or of the state legislature only so far as it is warranted by the Constitution. But the American court does not deal directly with the act in question; it deals with individuals who have a suit before it. One of these individuals relies on an act of Congress or of a state legislature; the act thus comes before the court for examination; and it supports the act or disregards it as "unconstitutional," or in violation of the Constitution. If the court is one of high rank or reputation, or one to which a decision may be appealed, as the United States Supreme Court, other courts follow the precedent, and the law falls to the ground. The court does not come into direct conflict with the legislative body; and, where a decision would be apt to produce such a conflict, the practice has been for the court to regard the matter as a "political question" and refuse to consider it.

93. The preamble states that "we, the people of the United States," establish and ordain the Constitution. Events have shown that it was the people of the whole United States that established the Constitution, but the people of 1787 seem to have inclined to the belief that it was the people of each state for itself. This belief was never changed in the South; and in 1861 the people of that section believed that the ordinances of secession were merely a repeal of the enacting clause by the power which had passed it, the people of the state. An account of the form of government established by the Constitution appears elsewhere (see UNITED STATES: VII.—*Constitution and Government*, pp. 646 sqq.).

Its Power over Individuals.

94. The Constitution's leading difference from the Confederation is that it gives the national government power over individuals. The Federal courts are the principal agent in securing this essential power; without them, the Constitution might easily have been as dismal a failure as the Confederation. It has also been a most important agent in securing to the national government its supremacy over the states. From this point of view the most important provision of the Constitution is the grant of jurisdiction to Federal courts in cases involving the construction of the Constitution or of laws or treaties made under it. The 25th section of the Judiciary Act of 1789 permitted any Supreme Court justice to grant a writ of error to a state court in a case in which the constitutionality of a Federal law or treaty had been denied, or in which a state law objected to as in violation of the Federal Constitution had been maintained. In such cases, the defeated party had the right to carry the "Federal question" to the Federal courts. It was not until 1816 that the Federal courts undertook to exercise this power; it raised a storm of opposition, but it was maintained, and has made the Constitution what it professed to be—"the supreme law of the land." Treason was restricted to the act of levying war against the United States, or of adhering to their enemies, giving them aid and comfort. The states, however, have always asserted their power to punish for treason against them individually. It has never been fully maintained in practice; but the theory had its effect in the secession period.

Treason.

The Sovereignty.

95. The system of the United States is almost the only national system, in active and successful operation, as to which the exact location of the sovereignty is still a mooted question. The contention of the Calhoun school—that the separate states were sovereign before and after the adoption of the Constitution, that the Union was purely voluntary, and that the whole people, or the people of all the other states, had no right to maintain or enforce the Union against any state—has been ended by the Civil War. But that did not decide the location of the sovereignty. The prevalent opinion is still that first formulated by Madison: that the states were sovereign before 1789; that they then gave up a part of their sovereignty to the Federal government; that the Union and the Constitution were the work of the states, not of the whole people; and that reserved powers are reserved to the people of the states, not to the whole people. The use of the bald phrase "reserved to the people," not to the people of the several states, in the 10th amendment, seems to argue an underlying consciousness, even in 1789, that the whole people of the United States was already a political power quite distinct from the states, or the people of the states; and the tendency of later opinion is in this direction. The restriction to state lines seems to be a self-imposed limitation by the national people, which it might remove, as in 1789, if an emergency should make it necessary.

Details of the System.

96. By whatever sovereignty the Constitution was framed and imposed, it was meant only as a scheme in outline, to be filled up afterwards, and from time to time, by legislation. The idea is most plainly carried out in the Federal judiciary: the Constitution only directs that there shall be a Supreme Court, and marks out the general jurisdiction of all the courts, leaving Congress, under the restriction of the president's veto power, to build up the system of courts which shall best carry out the design of the Constitution. But the same idea is visible in every department, and it has carried the Constitution safely through a century which has radically altered every other civilized government. It has combined elasticity with the limitations necessary to make democratic government successful over a vast territory, having infinitely diverse interests, and needing, more than almost anything else, positive opportunities for sober second thought by the people. A sudden revolution of popular thought or feeling is enough to change the House of Representatives from top to bottom; it must continue for several years before it can make a radical change in the Senate, and for years longer before it can carry this change through the judiciary, which holds for life; and all these changes must take place before the full effects upon the laws or Constitution are accomplished. But minor changes are reached in the meantime easily and naturally in the course of legislation. The members of the Convention of 1787 showed their wisdom most plainly in not trying to do too much; if they had done more they would have done far less.

Submission to Congress.

97. The convention adjourned on the 17th of September 1787, having adopted the Constitution. Its last step was a resolution that the Constitution be sent to the Congress of the Confederation, with the recommendation that it be submitted to conventions elected by the people of each state for ratification or rejection; that, if nine states should ratify it, Congress should appoint days for the popular election of electors, and that then the new Congress and president should, "without delay, proceed to execute this Constitution." Congress resolved that the report of the convention be sent to the several legislatures, to be submitted to conventions; and this was all the approval the Constitution ever received from Congress. Both Congress and the convention were careful not to open the dangerous question, How was a government which was not to be changed but by the legislatures of all the states to be entirely supplanted by a different system through the approval of conventions in three-fourths of them? They left such questions to be opened, if at all, in the less public forum of the legislatures.

98. Before the end of the year Delaware, Pennsylvania and

Federalists and Anti-Federalists.

New Jersey had ratified; and Georgia, Connecticut and Massachusetts followed during the first two months of 1788. Thus far the only strong opposition had been in Massachusetts, a "large state." In it the struggle began between the friends and the opponents of the Constitution, with its introduction of a strong Federal power; and it raged in the conventions, legislatures, newspapers and pamphlets. In a classic series of papers, the *Federalist*, Alexander Hamilton, with the assistance of James Madison and John Jay, explained the new Constitution and defended it. As it was written before the Constitution went into force, it speaks much for the ability of its writers that it has passed into a standard textbook of American constitutional law.

Ratification.

99. The seventh and eighth states—Maryland and South Carolina—ratified in April and May 1788; and, while the conventions of Virginia and New York were still wrangling over the great question, the ninth state, New Hampshire, ratified, and the Constitution passed out of theory into fact. The Anti-Federalists of the Virginia and New York conventions offered conditional ratifications of all sorts; but the Federalists stubbornly refused to consider them, and at last, by very slender majorities, these two states ratified. North Carolina refused to ratify the Constitution, and in Rhode Island it was referred to the several towns instead of to a convention and was rejected by an overwhelming majority, the Federalists, who advocated the calling of a convention, refraining from voting (§112). Congress named the first Wednesday of January 1789 as the day for the choice of electors, the first Wednesday in February for the choice of president and vice-president, and the first Wednesday in March for the inauguration of the new government, at New York City. The last date fell on the 4th of March, which has been the limit of each president's term since that time.

Inauguration.

Fall of the Confederation.

100. When the votes of the electors were counted before Congress, it was found that Washington had been unanimously elected president, and that John Adams, standing next on the list, was vice-president. Long before the inauguration the Congress of the Confederation had expired of mere inanition; its attendance simply ran down until (Oct. 21, 1788) its record ceased, and the United States got on without any national government for nearly six months. The struggle for nationality had been successful, and the old order faded out of existence.

Slavery in the United States.

101. The first census (1790) followed so closely upon the inauguration of the Constitution that the country may fairly be said to have had a population of nearly four millions in 1789. Something over half a million of these were slaves, of African birth or blood. Slavery of this sort had taken root in almost all the colonies, its original establishment being everywhere by custom. When the custom had been sufficiently established statutes came in to regulate a relation already existing. But it is not true, as the Dred Scott decision held long afterwards (§215), that the belief that slaves were chattels simply, things, not persons, held good at the time of the adoption of the Constitution. Times had changed somewhat. The peculiar language of the Constitution itself, describing a slave as a "person held to service or labour," under the laws of any state, puts the general feeling exactly: slaves were persons from whom the laws of some of the states withheld personal rights for the time. In accordance with this feeling most of the Northern states were on the high road towards abolition of slavery. Vermont had never allowed it. In Massachusetts it was swept out by a summary court decision that it was irreconcilable with the new state constitution. Other states soon began systems of gradual abolition, which finally extinguished slavery north of Maryland, but so gradually that there were still 18 apprentices for life in New Jersey in 1860, the last remnants of the former slave system. In the new states north of the Ohio slavery was prohibited by the ordinance of [illegible]1), and the prohibition was maintained in spite of ma[illegible] rights. [illegible]ts to get rid of it and introduce slavery.

Abolition in the North.

Feeling in the South

102. The sentiment of thinking men in the South was exactly the same, or in some cases more bitter from their personal entanglement with the system. Jefferson's language as to slavery is irreconcilable with the chattel notion; no abolitionist agitator ever used warmer language than he as to the evils of slavery; and the expression, "our brethren," used by him of the slaves, is conclusive. Washington, George Mason and other Southern men were almost as warm against slavery as Jefferson, and there were societies for the abolition of slavery in the South. In the Constitutional convention of 1787 the strongest opposition to an extension of the period of non-interference with the slave trade from 1800 to 1808 came from Virginia, whereas every one of the New England states, in which the trade was an important source of profit, voted for this extension. No thinking man could face with equanimity the future problem of holding a separate race of millions in slavery. Like most slave laws, the laws of the Southern states were harsh: rights were almost absolutely withheld from the slave, and punishments of the severest kind were legal; but the execution of the system was milder than its legal possibilities might lead one to imagine. The country was as yet so completely agricultural that Southern slavery kept all the patriarchal features possible to such a system.

Agriculture, Commerce and Manufactures.

103. Indeed, the whole country was almost exclusively agricultural, and, in spite of every effort to encourage manufactures by state bounties, they formed the meagrest element in the national production. Connecticut, which now teems with manufactures, was just beginning the production of tinware and clocks; Rhode Island and Massachusetts were just beginning to work in cotton from models of jennies and Arkwright machinery surreptitiously obtained from England; and other states, beyond local manufactures of paper, glass and iron, were almost entirely agricultural, or were engaged in industries directly dependent on agriculture. Commerce was dependent on agriculture for export and manufactured imports were enough to drown out every other form.

Changes since 1790.

104. There were but five cities in the United States having a population of more than 10,000—New York (33,000), Philadelphia (28,500), Boston (18,000), Charleston (16,000) and Baltimore (13,000). The population of the city of New York is now greater than that of the original thirteen states in 1790; the state of New York has now about twice as many inhabitants as the thirteen had in 1790; and the new states of Ohio and Illinois, which had hardly any white inhabitants in 1789, have each a larger population than the whole thirteen then had. Imports have swollen from $23,000,000 to $1,475,612,580 (1909); exports from $20,000,000 to $1,728,203,271 (1909), since 1790. The revenues of the new government in 1790 were $4,000,000; the expenditures, excluding interest on the public debt, but $1,000,000; now both the revenues and the expenditures are about $1,000,000,000. It is not easy for the modern American to realize the poverty and weakness of his country at the inauguration of the new system of government, however he may realize the simplicity of the daily life of its people.

The West.

105. Outside the cities communication was slow. One stage a week was enough for the connexion between the great cities; and communication elsewhere depended on private conveyance. The Western settlements were just beginning to make the question more serious. Enterprising land companies were the moving force which had impelled the passage of the Ordinance of 1787; and the first column of their settlers was pouring into Ohio and forming connexion with their predecessors in Kentucky and Tennessee. Marietta and Cincinnati had been founded. But the intending settlers were obliged to make the journey down the Ohio river from Pittsburg in bullet-proof flat-boats, for protection against the Indians, and the return trip depended on the use of oars. For more than twenty years these flat-boats were the chief means of river commerce in the West; and in the longer trips, as to New Orleans the boats were generally broken up at the end and sold for lumber

the crew making the trip home on foot or on horseback. John Fitch and others were already experimenting on what was soon to be the steamboat; but the statesman of 1789, looking at the task of keeping under one government a country of such distances, with such difficulties of communication, may be pardoned for having felt anxiety as to the future. To almost all thinking men of the time the Constitution was an experiment, and the unity of the new nation a subject for very serious doubt.

Literature.

106. The comparative isolation of the people everywhere, the lack of books, the poverty of the schools and newspapers, were all influences which worked strongly against any pronounced literary development. Poems, essays and paintings were feeble imitations of European models; history was annalistic, if anything; and the drama hardly existed. In two points the Americans were strong, and had done good work. Such men as Jonathan Edwards had excelled in various departments of theology, and American preaching had reached a high degree of quality and influence; and, in the line of politics, the American state papers rank among the very best of their kind. Having a very clear perception of their political purposes, and having been restricted in study and reading to the great masters of pure and vigorous English, and particularly to the English translators of the Bible, the American leaders came to their work with an English style which could hardly have been improved. The writings of Franklin, Washington, the Adamses, Hamilton, Jefferson, Madison, Jay and others show the secret of their strength in every page. Much the same reasons, with the influences of democracy, brought oratory, as represented by Patrick Henry, Fisher Ames, John Randolph and others, to a point not very far below the mark afterwards reached by Daniel Webster. The effect of these facts on the subsequent development of the country is not often estimated at its full value. All through an immigration of every language and dialect under heaven the English language has been protected in its supremacy by the necessity of going back to the "fathers of the republic" for the first, and often the complete, statement of principles in every great political struggle, social problem or lawsuit.

Limits of Settlement.

107. The cession of the "North-West Territory" by Virginia and New York had been followed up by similar cessions by Massachusetts (1785), Connecticut (1786) and South Carolina (1787). North Carolina did not cede Tennessee until early in 1790, nor Georgia her western claims until 1802. Settlement in all these regions was still very sparse. The centres of Western settlement, in Tennessee and Kentucky, had become more firmly established, and a new one, in Ohio, had just been begun. The whole western limits of settlement of the old thirteen states had moved much nearer their present boundaries; and the acquisition of the Western title, with the liberal policy of organization and government which had been begun, was to have its first clear effects during the first decade of the new government. Almost the only obstacle to its earlier success had been the doubts as to the attitude which the Spanish authorities, at New Orleans and Madrid, would take towards the new settlements.

The Mississippi River.

They had already asserted a claim that the Mississippi was an exclusively Spanish stream from its mouth up to the Yazoo, and that no American boat should be allowed to sail on this part of it. To the Western settler the Alleghanies and bad roads were enough to cut him off from any other way to a market than down the Mississippi; and it was not easy to restrain him from a forcible defiance of the Spanish claim. The Northern states were willing to allow the Spanish claim for a period of years in return for a commercial treaty; the Southern states and the Western settlers protested angrily; and once more the spectre of dissolution appeared, not to be laid again until the new government had made a treaty with Spain in 1795 (see PINCKNEY, THOMAS), securing common navigation of the Mississippi.

Social Conditions.

108. Contemporary authorities agree that a marked change had come over the people since 1775, and few of them seem to think the change one for the better. Many attribute it to the looseness of manners and morals introduced by the French and British soldiers; others to the general effects of war; a few, Tories all, to the demoralizing effects of rebellion. The successful establishment of nationality would be enough to explain most of it; and if we remember that the new nation had secured its title to a vast western territory, of unknown but rich capacities, which it was now moving to reduce to possession by emigration, it would seem far more strange if the social conditions had not been somewhat disturbed.

G.—*The Development of Democracy, 1789–1801.*

Democracy in the United States.

109. All the tendencies of political institutions in the United States had certainly been towards democracy; but it cannot be said that the leading men were hearty or unanimous in their agreement with this tendency. Not a few of them were pronounced republicans even before 1775, but the mass of them had no great objections to a monarchical form of government until the war-spirit had converted them. The Declaration of Independence had been directed rather against *the* king than against *a* king. Even after popular sovereignty had pronounced against a king, class spirit was for some time a fair substitute for aristocracy. As often happens, democracy at least thought of a Caesar when it apprehended class control. Certain discontented officers of the Continental Army proposed to Washington that he become king, but he promptly and indignantly put the offer by. The suggestion of a return to monarchy in some form, as a possible road out of the confusion of the Confederation, occurs in the correspondence of some of the leading men; and while the Convention of 1787 was holding its secret sessions a rumour went out that it had decided to offer a crown to an English prince.

110. The state constitutions were democratic, except for property or other restrictions on the right of suffrage, or provisions carefully designed to keep the control of at least one house of the state legislature "in the hands of property." The Federal Constitution was so drawn that it would have lent itself kindly either to class control or to democracy. The electoral system of choosing the president and vice-president was altogether anti-democratic, though democracy has conquered it: not an elector, since 1796, has disobeyed the purely moral claim of his party to control his choice. Since the Senate was to be chosen by the state legislatures, "property," if it could retain its influence in those bodies, could control at least one house of Congress. The question whether the Constitution was to have a democratic or an anti-democratic interpretation was to be settled in the next twelve years.

Influence of Immigration.

111. The states were a strong factor in the final settlement, from the fact that the Constitution had left to them the control of the elective franchise: they were to make its conditions what each of them saw fit. Religious tests for the right of suffrage had been quite common in the colonies; property tests were almost universal. The former disappeared shortly after the War of Independence; the latter survived in some of the states far into the constitutional period. But the desire to attract immigration was always a strong impelling force to induce states, especially frontier states, to make the acquisition of full citizenship and political rights as easy and rapid as possible. This force was not so strong at first as it was after the great stream of immigration began about 1848, but it was enough to tend constantly to the development of democracy. In later times, when state laws allow the immigrant to vote even before the period assigned by Federal laws allows him to become a naturalized citizen, there have been demands for the modification of the ultra state democracy; but no such danger was apprehended in the first decade.

Organization of the New Government.

112. The Anti-Federalists had been a political party, but a party with but one principle. The absolute failure of that principle deprived the party of all cohesion; and the Federalists controlled the first two Congresses almost entirely. Their pronounced ability was shown in their organizing measures, which still govern the American system very largely. The departments of state, of the treasury, of war, of justice, and of the post-office were rapidly and successfully organized; acts were passed for the regulation of seamen, commerce, tonnage duties, lighthouses, intercourse with the Indians, Territories, and the militia; a national capital was selected; a nati[illegible] chartered; the national debt was funded, and th[illegible] assumed as

Completion of the Union.

part of it. The first four years of the new system showed that the states had now to deal with a very different power from the impotent Congress of the Confederation. The new power was even able to exert pressure upon the two states which had not ratified the Constitution, though the pressure was made as gentle as possible. As a first step, the higher duties imposed on imports from foreign countries were expressly directed to apply to imports from North Carolina and Rhode Island. North Carolina having called a second convention, her case was left to the course of nature; and the second convention ratified the Constitution (November 21, 1789). The Rhode Island legislature asked that their state might not be considered altogether foreigners, made their duties agree with those of the new government, and reserved the proceeds for "continental" purposes. Still no further steps were taken. A bill was therefore introduced, directing the president to suspend commercial intercourse with Rhode Island, and to demand from her her share of the continental debt. This was passed by the Senate, and waited but two steps further to become law. Newspaper proposals to divide the little state between her two nearest neighbours were stopped by her ratification of the Constitution (May 29, 1790). The "old thirteen" were thus united under the Constitution; and yet, so strong is the American prejudice for the autonomy of the states that these last two were allowed to enter in the full conviction that they did so in the exercise of sovereign freedom of choice. Their entrance, however, was no more involuntary than that of others. If there had been real freedom of choice, nine states would never have ratified: the votes of Pennsylvania, Massachusetts, New Hampshire, Virginia and New York were only secured by the pressure of powerful minorities in these states, backed by the almost unanimous votes of the others.

Hamiltonian Protection.

113. Protection was begun in the first Tariff Act, whose object, said its preamble, was the protection of domestic manufactures. The duties, however, ranged only from 7½ to 10%, averaging about 8½%. The system, too, had rather a political than an economic basis. Until 1789 the states had controlled the imposition of duties. The separate state feeling was a factor so strong that secession was a possibility which every statesman had to take into account. Hamilton's object, in introducing the system, seems to have been to create a class of manufacturers, running through all the states, but dependent for prosperity on the new Federal government and its tariff. This would be a force which would make strongly against any attempt at secession, or against the tendency to revert to control by state legislatures, even though it based the national idea on a conscious tendency towards the development of classes. The same feeling seems to have been at the bottom of his establishment of a national bank, his assumption of state debts, and most of the general scheme which his influence forced upon the Federalist party. (See HAMILTON, ALEXANDER; and FEDERALIST PARTY.)

The First Cabinet.

114. In forming his cabinet Washington had paid attention to the opposing elements which had united for the temporary purpose of ratifying the Constitution. The national element was represented by Hamilton, secretary of the treasury, and Henry Knox, secretary of war; the particularist element (using the term to indicate support of the states, not of a state) by Jefferson, secretary of state, and Edmund Randolph, attorney-general. At the end of 1792 matters were in train for the general recognition of the existence of two parties, whose struggles were to decide the course of the Constitution's development. The occasion came in the opening of the following year, when the new nation was first brought into contact with the French Revolution.

The Jefferson School of Politics.

115. The controlling tendency of Jefferson and his school was to the maintenance of individual rights at the highest possible point, as the Hamilton school was always ready to assert the national power to restrict individual rights for the general good. Other points of difference are rather symptomatic than essential. The Jefferson school supported the states, in the belief that they were the best bulwarks for individual rights. When the French Revolution began its usual course in America by agitation for the "rights of man," it met a sympathetic audience in the Jefferson party and a cold and unsympathetic hearing from the Hamilton school of Federalists. The latter were far more interested in securing the full recognition of the power and rights of the nation than in securing the individual against imaginary dangers, as they thought them. For ten years the surface marks of distinction between the two parties were to be connected with the course of events in Europe; but the essence of distinction was not in the surface marks.

The Hamilton School.

116. The new government was not yet four years old; it was not familiar, nor of assured permanency. The only national governments of which Americans had had previous experience were the British government and the Confederation: in the former they had had no share, and the latter had had no power. The only places in which they had had long-continued, full, and familiar experience of self-government were their state governments: these were the only governmental forms which were then distinctly associated in their minds with the general notion of republican government. The governing principle of the Hamilton school, that the construction or interpretation of the terms of the Constitution was to be such as to broaden the powers of the Federal government, necessarily involved a corresponding trenching on the powers of the states. It was natural, then, that the Jefferson school should look on every feature of the Hamilton programme as "anti-republican," meaning, probably, at first no more than opposed to the state system, though the term soon came to imply something of monarchical and, more particularly, of English tendencies. The disposition of the Jefferson school to claim for themselves a certain peculiar title to the position of "republicans" developed into the appearance of the first Republican, or the Democratic-Republican, party, about 1793.

Party Differences.

The National Capital.

Genet's Mission.

The Whisky Insurrection.

Admission of Vermont, Kentucky and Tennessee.

117. Many of the Federalists were shrewd and active business men, who naturally took prompt advantage of the opportunities which the new system offered. The Republicans therefore believed and asserted that the whole Hamilton programme was dictated by selfish or class interest; and they added this to the accusation of monarchical tendencies. These charges, with the fundamental differences of mental constitution, exasperated by the passion which differences as to the French Revolution seemed to carry with them everywhere, made the political history of this decade a very unpleasant record. The provision for establishing the national capital on the Potomac (1790) was declared to have been carried by a corrupt bargain; and accusations of corruption were renewed at every opportunity. In 1793 a French agent, Edmond Charles Edouard Genet (1765–1834), appeared to claim the assistance of the United States for the French republic, and went to the length of commissioning privateers and endeavouring to secure recruits, especially for a force which he expected to raise for the conquest of Louisiana from Spain. Washington decided to issue a proclamation of neutrality, the first act of the kind in American history. It was the first indication, also, of the policy which has made the course of every president, with the exception of Polk, a determined leaning to peace, even when the other branches of the government have been intent on war. Genet, however, continued his activities, and made outrageous demands upon the government, so that finally Washington demanded and secured (1794) his recall.[1] The proclamation of 1793 brought about the first distinctly party feeling; and it was intensified by Washington's charge that popular opposition in western Pennsylvania (1794) to the new excise law (see WHISKY INSURRECTION) had been fomented by the extreme French party. Their name, Democrat, was applied by the Federalists to the whole Republican party as a term of contempt, but it was not accepted by the party for some twenty years; then the compound title "Democratic-Republican" became, as it

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[1] Genet, fearing the fate of his fellow Girondists in France, remained in the United States and became a naturalized American citizen.

still is, the official title of the party. There was no party opposition, however, to the re-election of Washington in 1792, or to the admission of Vermont (1791), Kentucky (1792) and Tennessee (1796) as new states.

Jay's Treaty.

Election of 1796.

118. The British government had accredited no minister to the United States, and it refused to make any commercial treaty or to give up the forts in the western territory of the United States, through which its agents still exercised a commanding influence over the Indians. In the course of its war with France, the neutral American vessels, without the protection of a national navy, fared badly. A treaty negotiated in 1794 by Chief-Justice John Jay (*q.v.*) settled these difficulties for the following twelve years. But, as it engaged the United States against any intervention in the war on behalf of France, was silent on the subject of the right of search, and agreed to irksome limitations on the commercial privileges of the United States, the Republicans, who were opposed to the negotiation of any treaty at this time with Great Britain, made it very unpopular, and the bitter personal attacks on Washington grew out of it. In spite of occasional Republican successes, the Federalists retained a general control of national affairs; they elected John Adams president in 1796, though Jefferson was chosen vice-president with him; and the national policy of the Federalists kept the country out of entangling alliances with any of the European belligerents. To the Republicans, and to the French republic, this last point of policy was only a practical intervention against France and against the rights of man.

The "X.Y.Z." Mission.

Quasi-war with France.

119. At the end of Washington's administration the French Directory broke off relations with the United States, demanding the abrogation of Jay's treaty and a more pronounced sympathy with France. Adams sent three envoys, C. C. Pinckney (*q.v.*), John Marshall and Elbridge Gerry (*q.v.*), to endeavour to re-establish the former relations; they were met by demands for "money, a great deal of money," as a prerequisite to peace. They refused; their letters home were published,[1] and the Federalists at last had the opportunity of riding the whirlwind of an intense popular desire for war with France. Intercourse with France was suspended by Congress (1798); the treaties with France were declared at an end; American frigates were authorized to capture French vessels guilty of depredations on American commerce, and the president was authorized to issue letters of marque and reprisal; and an American army was formed, Washington being called from his retirement at Mount Vernon to command it. The war never went beyond a few sea-fights, in which the little American navy did itself credit, and Napoleon, seizing power the next year, renewed the peace which should never have been broken. But the quasi-war had internal consequences to the young republic which surpassed in interest all its foreign difficulties: it brought on the crisis which settled the development of the United States towards democracy.

Error of the Federalists.

120. The reaction in Great Britain against the indefinite "rights of man" had led parliament to pass an alien law, a sedition law suspending the writ of *habeas corpus*, and an act giving wide and loosely defined powers to magistrates for the dispersion of meetings to petition for redress of grievances. The Federalists were in control of a Congress of limited powers; but they were strongly tempted by sympathies and antipathies of every sort to form their programme on the model furnished from England. The measures which they actually passed were based only on that construction of the Constitution which is at the bottom of all American politics; they only tended to force the Constitution into an anti-democratic direction. But it was the fixed belief of their opponents that they meant to go farther, and to secure control by some wholesale measure of political persecution.

The Alien and Sedition Laws.

121. Three alien laws were passed in June and July 1798. The first (repealed in April 1802) raised the number of years necessary for naturalization from five to fourteen. The third (still substantially in force) permitted the arrest or removal of subjects of any foreign power with which the United States should be at war. The second, which is usually known as the Alien Law, was limited to a term of two years; it permitted the president to arrest or order out of the country any alien whom he should consider dangerous to the country. As many of the Republican editors and local leaders were aliens, this law really put a large part of the Republican organization in the power of the president elected by their opponents. The Sedition Law (to be in force until March 1801 and not renewed) made it a crime, punishable by fine and imprisonment, to publish or print any false, scandalous and malicious writings against the government of the United States, either house of Congress, or the president, or to stir up sedition or opposition to any lawful act of Congress or of the president, or to aid the designs of any foreign power against the United States. In its first form the bill was even more sweeping than this and alarmed the opposition thoroughly.

The Republican Opposition.

122. Most of the ability of the country was in the Federalist ranks; the Republicans had but two first-rate men—Jefferson and Madison. In the sudden issue thus forced between individual rights and national power, Jefferson and Madison could find but one bulwark for the individual—the power of the states; and their use of it gave their party a pronounced list to state sovereignty from which it did not recover for years. They objected to the Alien Law on the grounds that aliens were under the jurisdiction of the state, not of the Federal government; that the jurisdiction over them had not been transferred to the Federal government by the Constitution, and that the assumption of it by Congress was a violation of the Constitution's reservation of powers to the states; and, further, because the Constitution reserved to every "person," not to every citizen, the right to a jury trial. They objected to the Sedition Law on the grounds that the Constitution had specified exactly the four crimes for whose punishment Congress was to provide; that criminal libel was not one of them; and that amendment I. forbade Congress to pass any law restricting freedom of speech or of the press. The Federalists asserted a common-law power in Federal judges to punish for libel, and pointed to a provision in the Sedition Law permitting the truth to be given in evidence, as an improvement on the common law, instead of a restriction on liberty.

Virginia and Kentucky Resolutions.

123. The Republican objections might have been made in court, on the first trial. But the Republican leaders had strong doubts of the impartiality of the Federal judges, who were Federalists. They resolved to entrench the party in the state legislatures. The Virginia legislature in 1798 passed a series of resolutions prepared by Madison, and the Kentucky legislature in the same year passed a series prepared by Jefferson (see KENTUCKY: *History*). Neglected or rejected by the other states, they were passed again by their legislatures in 1799, and were for a long time a documentary basis of the Democratic party. The leading idea expressed in both was that the Constitution was a "compact" between the states, and that the powers (the states) which had made the compact had reserved the power to restrain the creature of the compact, the Federal government, whenever it undertook to assume powers not granted to it. Madison's idea seems to have been that the restraint was to be imposed by a second convention of the states. Jefferson's idea is more doubtful; if it meant that the restraint should be imposed by any state which should feel aggrieved, his scheme was merely Calhoun's idea of nullification; but there are some indications that he agreed with Madison.

Effects of the Laws.

124. The first Congress of Adams's term of office ended in 1799. Its successor, elected in the heat of the French war excitement, kept the Federalist policy up to its first pitch. Out of Congress the execution of the objectionable laws had taken the shape of political persecution. Men were arrested, tried and punished for writings which the people had

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[1] In these letters as published the letters X, Y and Z were substituted for the names of the French agents with whom the American envoys dealt; and the letters are known as the X Y Z correspondence.

been accustomed to consider within legitimate political methods. The Republican leaders made every trial as public as possible, and gained votes constantly, so that the Federalists began to be shy of the very powers which they had sought. Every new election was a storm-signal for the Federalist party; and the danger was increased by schism in their own ranks.

Federalist Schism.

Election of 1800.

125. Hamilton was now a private citizen of New York; but he had the confidence of his party more largely than its nominal head, the president, and he maintained close and confidential relations with the cabinet which Adams had taken unchanged from Washington. The Hamilton faction saw no way of preserving and consolidating the newly acquired powers of the Federal government but by keeping up and increasing the war feeling against France; Adams had the instinctive leaning of an American president towards peace. Amid cries of wrath and despair from his party he accepted the first overtures of the new Napoleonic government, sent envoys to negotiate a peace, and ordered them to depart for France when they delayed too long. Then, discovering flat treachery in his cabinet, he dismissed it and blurted out a public expression of his feeling that Hamilton and his adherents were "a British faction." Hamilton retorted with a circular letter to his party friends, denouncing the president; the Republicans intercepted it and gave it a wider circulation than its author had intended; and the Hamilton faction tried so to arrange the electoral vote that C. C. Pinckney should be chosen president in 1800 and Adams should be shelved into the vice-presidency. The result depended on the electoral vote of New York; and Aaron Burr, who had introduced the drill and machinery of a modern American political party there, had made the state Republican and secured a majority for the Republican candidates. These (Jefferson and Burr) received the same number of electoral votes (73),[1] and the House of Representatives (controlled by the Federalists) was thus called upon to decide which should be president. There was an effort by the Federalists to disappoint the Republicans by making Burr president; but Jefferson obtained that office, Burr becoming vice-president for four years. This disputed election, however, led to the adoption in 1804 of the 12th amendment to the Constitution, which prescribed that each elector should vote separately for president and vice-president, and thus prevent another tie vote of this kind; this amendment, moreover, made very improbable the choice in the future of a president and a vice-president from opposing parties.

"Revolution of 1800."

126. The "Revolution of 1800" decided the future development of the United States. The new dominant party entered upon its career weighted with the theory of state sovereignty; and a civil war was necessary before this dogma, put to use again in the service of slavery, could be banished from the American system. But the democratic development never was checked. From that time the interpretation of the Federal Constitution has generally favoured individual rights at the expense of governmental power. As the Republicans obtained control of the states they altered the state constitutions so as to cut out all the arrangements that favoured property or class interests, and reduced political power to the dead level of manhood suffrage. In most of the states outside of New England this process was completed before 1815; but New England tenacity was proof against the advancing revolution until about 1820. For twenty years after its downfall of 1800 the Federalist party maintained its hopeless struggle, and then it faded away into nothing, leaving as its permanent memorial the excellent organization of the Federal government, which its successful rival hardly changed. Its two successors—the Whig and the second Republican party—have also been broad-constructionist parties, but they have admitted democracy as well; the Whig party adopted popular methods at least, and the Republican went further in the direction of individual rights, securing the emancipation of enslaved labour.

The New Capital.

127. The disputed election of 1800 was decided in the new capital city of Washington, to which the government had just been removed, after having been for ten years at Philadelphia. Its streets and parks existed only on paper. The Capitol had been begun; the Executive Mansion was unfinished, and its audience room was used by Mrs Adams as a drying room for clothes; and the congressmen could hardly find lodgings. The inconveniences were only an exaggeration of the condition of other American cities. Their sanitary conditions were bad, and yellow fever and cholera from time to time reduced several of them almost to depopulation. More than once, during this decade, the fever visited Philadelphia and New York, drove out most of the people, and left grass growing in the streets. The communication between the cities was still wretched. The traveller was subject to every danger or annoyance that bad roads, bad carriages, bad horses, bad inns and bad police protection could combine to inflict upon him. But the war with natural obstacles had fairly begun, though it had little prospect of success until steam was brought into use as the ally of man.

The West.

128. About this time the term "the West" appears. It meant then the western part of New York, the new territory north of the Ohio, and Kentucky and Tennessee. In settling land boundaries New York had transferred (1786) to Massachusetts, whose claims crossed her territory, the right to (but not jurisdiction over) a large tract of land in central New York, and to another large tract in the Erie basin. The sale of this land had carried population considerably west of the Hudson. After other expeditions against the Ohio Indians had been defeated, one under General Anthony Wayne had compelled them in 1794–95 to give up all the territory now in the state of Ohio. Settlement received a new impetus. Between 1790 and 1800 the population of Ohio had risen from almost nothing to 45,000, that of Tennessee from 36,000 to 106,000, and that of Kentucky from 74,000 to 221,000—the last-named state now exceeding six of the "old thirteen" in population. The difficulties of the western emigrant, however, were still enormous. He obtained land of his own, fertile land and plenty of it, but little else. The produce of the soil had to be consumed at home, or near it; ready money was scarce and distant products scarcer; and comforts, except the very rudest substitutes of home manufacture, were unobtainable. The new life bore most hardly upon women; and, if the record of woman's share in the work of American colonization could be fully made up, the price paid for the final success would seem enormous.

Post Office.

129. The number of post offices rose during these ten years from 75 to 903, the miles of post routes from 1900 to 21,000, and the revenue from $38,000 to $231,000. These figures seem small in comparison with the 61,158 post offices, 430,738 m. of post routes (besides 943,087 m. of rural delivery routes), and a postal revenue of $191,478,663 in 1908, but the comparison with the figures of 1790 shows a development in which the new Constitution, with its increased security, must have been a factor.

Patents.

130. The power of Congress to regulate patents was already bearing fruit. Until 1789 this power was in the hands of the states, and the privileges of the inventor were restricted to the territory of the patenting state. Now he had a vast and growing territory within which all the profits of the invention were his own. Twenty patents were issued in 1793, and 23,471 one hundred years afterwards; but one of the inventions of 1793 was Eli Whitney's cotton gin.

Cotton.

131. When the Constitution was adopted it was not known that the cultivation of cotton could be made profitable in the Southern states. The "roller gin" could clean only 6 ℔ a day by slave labour. In 1784 eight bags of cotton, landed in Liverpool from an American ship, were seized on the ground that so much cotton could not be the produce of the United States. Eli Whitney (*q.v.*) invented the saw-gin, by which the cotton was dragged through parallel wires with openings too narrow to allow the seeds to pass; and one slave could now clean 1000 ℔ a day. The exports of cotton leaped from 189,000 ℔ in

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[1] Adams received 65, Pinckney 64 and John Jay 1.

1791 to 21,000,000 ℔ in 1801, and doubled in three years more. The influence of this one invention, combined with the wonderful series of British inventions which had paved the way for it, can hardly be estimated in its commercial aspects. Its political influences were even wider, but more unhappy. The introduction of the commercial element into the slave system of the South robbed it at once of the patriarchal features which had made it tolerable; while it developed in slave-holders a new disposition to defend a system of slave labour as a "positive good." The abolition societies of the South began to dwindle as soon as the results of Whitney's invention began to be manifest.

Slavery and Democracy.

132. The development of a class whose profits were merely the extorted natural wages of the black labourer was certain; and its political power was as certain, though it never showed itself clearly until after 1830. And this class was to have a peculiarly distorting effect on the political history of the United States. Aristocratic in every sense but one, it was ultra-Democratic (in a purely party sense) in its devotion to state sovereignty, for the legal basis of the slave system was in the laws of the several states. In time, the aristocratic element got control of the party which had originally looked to state rights as a bulwark of individual rights; and the party was finally committed to the employment of its original doctrine for an entirely different purpose—the suppression of the black labourer's wages.

H.—*Democracy and Nationality, 1801–1829*

Democracy and Nationality.

133. When Jefferson took office in 1801 he succeeded to a task larger than he imagined. His party, ignoring the natural forces which tied the states together even against their wills, insisted that the legal basis of the bond was in the power of any state to withdraw at will. This was no nationality; and foreign nations naturally refused to take the American national coin at any higher valuation than that at which it was current in its own country. The urgent necessity was for a reconciliation between democracy and nationality; and this was the work of this period. An underlying sense of all this has led Democratic leaders to call the war of 1812–15 the "Second War of Independence"; the result was as much independence of past ideas as of Great Britain.

Louisiana.

134. The first force in the new direction was the acquisition of Louisiana in 1803. Napoleon had acquired it from Spain, and, fearing an attack upon it by Great Britain, offered it to the United States for $15,000,000. The Constitution gave the Federal government no power to buy and hold territory, and the party was based on a strict construction of the constitution. Possession of power forced the strict-construction party to broaden its ideas, and Louisiana was bought, though Jefferson quieted his conscience by talking for a time of a futile proposal to amend the Constitution so as to grant the necessary power. (See LOUISIANA PURCHASE; and JEFFERSON, THOMAS.) The acquisition of the western Mississippi basin more than doubled the area of the United States, and gave them control of all the great river-systems of central North America.

The Steamboat.

The difficulties of using these rivers were removed almost immediately by Robert Fulton's utilization of steam in navigation (1807). Within four years steamboats were at work on western waters; and thereafter the increase of steam navigation and that of population stimulated one another.

Centre of Population.

The "centre of population" has been carefully ascertained by the census authorities for each decade, and it represents the westward movement of population very closely. During this period it advanced from about the middle of the state of Maryland to its extreme western limit; that is, the centre of population was in 1830 nearly at the place which had been the western limit of population in 1770.

The Oregon Country.

135. Jefferson also laid the basis for a further acquisition in the future by sending an expedition under Meriwether Lewis (*q.v.*) and William Clark to explore the territory north of the then Spanish territory of California and west of the Rocky Mountains—the "Oregon country" as it was afterwards called. The explorations of this party (1804–1806), with Captain Robert Gray's discovery of the Columbia river (1792), made the best part of the claims of the United States to the country forty years later.

Election of 1804.

136. Jefferson was re-elected in 1804,[1] serving until March, 1809; his party now controlled almost all the states outside of New England, and could elect almost any one whom it chose to the presidency. Imitating Washington in refusing a third term of office, Jefferson established more firmly the precedent, not since violated, restricting a president to two terms, though the Constitution contains no such restriction. The great success of his presidency had been the acquisition of Louisiana, which was a violation of his party principles; but all his minor successes were, like this, recognitions of the national sovereignty which he disliked so much. After a short and brilliant naval war the Barbary pirates were reduced to submission (1805). The long-continued control of New Orleans by Spain, and the persistent intrigues of the Spanish authorities, looking towards a separation of the whole western country from the United States, had been ended by the acquisition of Louisiana, and the full details concerning them will probably remain for ever hidden in the secret history of the early West. They had left behind a dangerous ignorance of Federal power and control, of which Aaron Burr (*q.v.*) took advantage (1806–07). Organizing an expedition in Kentucky and Tennessee, probably for the conquest of the Spanish colony of Mexico, he was arrested on the lower Mississippi and brought back to Virginia. He was acquitted; but the incident opened up a vaster view of the national authority than democracy had yet been able to take. It had been said, forty years before, that Great Britain had long arms, but that three thousand miles was too far to extend them; it was something to know now that the arms of the Federal government were long enough to reach from Washington city to the Mississippi.

Difficulties with Great Britain.

137. All the success of Jefferson was confined to his first four years; all his heavy failures were in his second term, in which he and his party as persistently refused to recognize or assert the inherent power of the nation in international affairs. The Jay treaty expired in 1806 by limitation, and American commerce was thereafter left to the course of events, Jefferson refusing to accept the only treaty which the British government was willing to make. All the difficulties which followed may be summed up in a few words: the British government was then the representative of the ancient system of restriction of commerce, and had a powerful navy to enforce its ideas; the American government was endeavouring to force into international recognition the present system of neutral rights and unrestricted commerce, but its suspicious democracy refused to give it a navy sufficient to command respect. The American government apparently expected to gain its objects without the exhibition of anything but moral force.

Neutral Commerce.

138. Great Britain was now at war, from time to time, with almost every other nation of Europe. In time of peace European nations followed generally the old restrictive principle of allowing another nation, like the United States, no commercial access to their colonies; but, when they were at war with Great Britain, whose navy controlled the ocean, they were very willing to allow the neutral American merchantmen to carry away their surplus colonial produce. Great Britain had insisted for fifty years that the neutral nation, in such cases, was really intervening in the war as an ally of her enemy; but she had so far modified her claim as to admit that "transhipment," or breaking bulk, in the United States was enough to qualify the commerce for recognition. The neutral nation thus gained a double freight, and grew rich in the traffic; the belligerent nations no longer had commerce afloat for British vessels to capture; and the "frauds of the neutral flags" became a standing subject of complaint among British merchants and naval officers. About 1805 British prize courts

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[1] Jefferson received 162 electoral votes and his opponent, C. C. Pinckney, only 14.

began to disregard transhipment and to condemn American vessels which made the voyage from a European colony to the mother country by way of the United States. This was really a restriction of American commerce to purely American productions, or to commerce with Great Britain direct, with the payment of duties in British ports.

Expatriation.

Impressment.

139. The question of expatriation, too, furnished a good many burning grievances. Great Britain maintained the old German rule of perpetual allegiance, though she had modified it by allowing the right of emigration. The United States, founded by immigration, was anxious to establish what Great Britain was not disposed to grant, the right of the subject to divest himself of allegiance by naturalization under a foreign jurisdiction. Four facts thus tended to break off friendly relations: (1) Great Britain's claim to allegiance over American naturalized subjects; (2) her claim to the belligerent right of search of neutral vessels; (3) her claim of right to impress for her vessels of war her subjects who were seamen wherever found; and (4) the difficulty of distinguishing native-born American from British subjects, even if the right to impress naturalized American subjects were granted. British naval officers even undertook to consider all who spoke the English language as British subjects, unless they could produce proof that they were native-born Americans. The American sailor who lost his papers was thus open to impressment. A particularly flagrant case of seizure of Americans occurred in 1807. On the 27th of June the British ship "Leopard" fired upon the American frigate "Chesapeake," which, after having lost 3 men killed and 18 wounded, hauled down its flag; the British commander then seized four of the "Chesapeake's" crew. This action aroused intense anger throughout the country, and but for the impotence of the government would undoubtedly have led to immediate war. The American government in 1810 published the cases of such impressments since 1803 as numbering over 4000, about one-third of the cases resulting in the discharge of the impressed man; but no one could say how many cases had never been brought to the attention of a government which never did anything more than remonstrate about them.

Orders in Council.

Berlin and Milan Decrees.

140. In May 1806 the British government, by orders in council, declared a blockade of the whole continent of Europe from Brest to the Elbe, about 800 m. In November, after the battle of Jena, Napoleon answered by the "Berlin decree," in which he assumed to blockade the British Isles, thus beginning his "continental system." A year later the British government answered by further orders in council, forbidding American trade with any country from which the British flag was excluded, allowing direct trade from the United States to Sweden only, in American products, and permitting American trade with other parts of Europe only on condition of touching in England and paying duties. Napoleon retorted with the "Milan decree," declaring good prize any vessel which should submit to search by a British ship; but this was evidently a vain fulmination.

The Navy.

The Embargo.

141. The Democratic party of the United States was almost exclusively agricultural and had little knowledge of or sympathy with commercial interests; it was pledged to the reduction of national expenses and the debt, and did not wish to take up the responsibility for a navy; and, as the section of country most affected by the orders in council, New England, was Federalist, and made up of the active and irreconcilable opposition, a tinge of political feeling could not but colour the decisions of the dominant party. Various ridiculous proposals were considered as substitutes for a necessarily naval war; and perhaps the most ridiculous was adopted. Since the use of non-intercourse agreements as revolutionary weapons against Great Britain, an overweening confidence in such measures had sprung up, and one of them was now resorted to—the embargo of the 22nd of December 1807, forbidding foreign commerce altogether. It was expected to starve Great Britain into a change of policy; and its effects may be seen by comparing the $20,000,000 exports of 1790, $49,000,000 of 1807 and $9,000,000 of 1808. It does not seem to have struck those who passed the measure that the agricultural districts also might find the change unpleasant; but that was the result, and their complaints reinforced those of New England, and closed Jefferson's second term in a cloud of recognized misfortune. The pressure had been slightly relieved by the substitution of the Non-Intercourse Law of the 1st of March 1809 for the embargo; it prohibited commercial intercourse with Great Britain and France and their dependencies, leaving other foreign commerce open, prohibited the importation from any quarter of British and French goods, and forbade the entrance of British or French vessels, public or private, into any port of the United States. Madison, Jefferson's secretary of state, who succeeded Jefferson in 1809, having defeated the Federalist candidate C. C. Pinckney in the election of 1808, assumed in the presidency a burden which was not enviable. New England was in a ferment, and was suspected of designs to resist the restrictive system by force; and the administration did not face the future with confidence.

Non-intercourse Law. Election of 1808.

Election of 1812. War with England.

142. The Non-Intercourse Law was to be in force only "until the end of the next session of Congress" and was to be abandoned as to either belligerent which should abandon its attacks on neutral commerce, and maintained against the other. In 1810 the American government was led to believe that France had abandoned its system. Napoleon continued to enforce it in fact; but his official fiction served its purpose of limiting the non-intercourse for the future to Great Britain, and thus straining relations between that country and the United States still further. The elections of 1811–1812 resulted everywhere in the defeat of "submission men" and in the choice of new members who were determined to resort to war against Great Britain. Henry Clay, John C. Calhoun, William H. Crawford and other new men seized the lead in the two houses of Congress, and forced Madison, it is said, to agree to a declaration of war as a condition of his renomination in 1812 when he defeated De Witt Clinton by an electoral vote of 128 to 89. (See MADISON.) Madison sent to Congress a confidential "war message" on the 1st of June and on the 18th war was declared. The New England Federalists always called it "Mr Madison's war," but the president was about the most unwilling participant in it.

Tippecanoe.

Theatre of the War.

143. The national democracy meant to attack Great Britain in Canada, partly to gratify its western constituency, who had been harassed by Indian attacks, asserted to have been instigated from Canada. Premonitions of success were drawn from the battle of Tippecanoe, in which William Henry Harrison had defeated in 1811 the north-western league of Indians formed by Tecumseh (*q.v.*). Between the solidly settled Atlantic states and the Canadian frontier was a wide stretch of unsettled or thinly settled country, which was itself a formidable obstacle to war. Ohio had been admitted as a state in 1802, and Louisiana was admitted in 1812; but their admission had been due to the desire to grant them self-government rather than to their full development in population and resources. Cincinnati was a little settlement of 2500 inhabitants; the fringe of settled country ran not very far north of it; and all beyond was a wilderness of which little was known to the authorities. The case was much the same with western New York; the army which was to cross the Niagara river must journey almost all the way from Albany through a very thinly peopled country. It would have been far less costly, as events proved, to have entered at once upon a naval war; but the crusade against Canada had been proclaimed all through Kentucky and the West, and their people were determined to wipe out their old scores before the conclusion of the war. (For the military and naval events of the war see AMERICAN WAR OF 1812.)

144. The war opened with disaster—General William Hull's surrender of Detroit; and disaster attended it for two years. Political appointments to positions in the regular army were

Disaster by Land. **Chippewa and Lundy's Lane.** **Washington Burnt.** numerous, and such officers were worse than useless. The war department showed no great knowledge, and poverty put its little knowledge out of service. Futile attempts at invasion were followed by defeat or abortion, until the political officers were weeded out at the end of the year 1813, and Jacob Brown, Winfield Scott, E. W. Ripley and others who had fought their way up were put in command. Then for the first time the men were drilled and brought into effective condition; and two successful battles in 1814—Chippewa and Lundy's Lane—threw some glory on the end of the war. So weak were the preparations even for defence that a British expedition in 1814 met no effective resistance when it landed and burned Washington. For some of the disasters the responsibility rested as much, or more, upon the war department as upon the officers and soldiers in the field.

State of the Navy. 145. The American navy was but a puny adversary for the British navy, which had captured or shut up in port all the other navies of Europe. But the small number of American vessels, with the superabundance of trained officers, gave them one great advantage: the training and discipline of the men, and the equipment of the vessels, had been brought to the very highest point. Captains who could command a vessel but for a short time, yielding her then to another officer who was to take his sea service in rotation, were all ambitious to make their mark during their term. "The art of handling and fighting the old broadside sailing frigate" had been carried in the little American navy to a point which unvarying success and a tendency to fleet-combats had now made far less common among British captains. Altogether the American vessels gave a remarkably good account of themselves.

Feeling in New England. **Hartford Convention.** 146. The home dislike to the war had increased steadily with the evidence of incompetent management by the administration. The Federalists, who had always desired a navy, pointed to the naval successes as the best proof of folly with which the war had been undertaken and managed. New England Federalists complained that the Federal government utterly neglected the defence of their coast, and that Southern influence was far too strong in national affairs. They showed at every opportunity a disposition to adopt the furthest stretch of state sovereignty, as stated in the Kentucky Resolutions; and every such development urged the national democracy unconsciously further on the road to nationality. When the New England states sent delegates to meet at Hartford, Conn. (*q.v.*), and consider their grievances and the best remedies—a step perfectly proper on the Democratic theory of a "voluntary Union"—treason was suspected, and a readiness to suppress it by force was plainly shown. The recommendations of the convention came to nothing; but the attitude of the dominant party towards it is one of the symptoms of the manner in which the trials of actual war were steadily reconciling democracy and nationality. The object which Hamilton had sought by high tariffs and the development of national classes had been attained by more natural and healthy means.

Peace. 147. In April 1814 the first abdication of Napoleon took place, and Great Britain was able to give more attention to her American antagonist. The main attack was to be made on Louisiana, the weakest and most distant portion of the Union. A fleet and army were sent thither, but the British assault was completely repulsed (Jan. 8, 1815) by the Americans under Andrew Jackson. Peace had been made at Ghent fifteen days before the battle was fought, but the news of the battle and the peace reached Washington almost together, the former going far to make the latter tolerable.

148. The United States really secured a fairly good treaty. It is true that it said not a word about the questions of impressment, search and neutral rights, the grounds of the war; Great Britain did not abandon her position on any of them. But everybody knew that circumstances had changed. The new naval power whose frigates alone in the past twenty years had shown their ability to fight English frigates on equal terms was not likely to be troubled in future with the question of impressment; and in fact, while not renouncing the right, the British government no longer attempted to enforce it. The navy, it must be confessed, was the force which had at last given the United States a recognized and cordial acceptance in the family of nations; it had solved the problem of the reconciliation of democracy and nationality.

Extinction of the Federalist Party. 149. The remainder of this period is one of the barrenest in American history. The opposition of the Federalist party to the war completed the measure of its unpopularity, and it had only a perfunctory existence for a few years longer. Scandal, intrigue and personal criticism became the most marked characteristics of American politics until the dominant party broke at the end of the period, and real party conflict was renewed. But the seeds of the final disruption are visible from the peace of 1814. The old-fashioned Republicans looked with intense suspicion on the new form of Republicanism generated by the war, a type which instinctively bent its energies toward the further development of national power. Clay was the natural leader of the new Democracy; but John Quincy Adams and others of Federalist antecedents or leanings took to the new doctrines kindly; and even Calhoun, Crawford and others of the Southern interest were at first strongly inclined to support them. One of the first effects was the revival of protection and of a national bank.

Bank of the United States. 150. The charter of the national bank had expired in 1811, and the dominant party had refused to recharter it. The attempt to carry on the war by loans resulted in almost a bankruptcy and in a complete inability to act efficiently. As soon as peace gave time for consideration, a second bank was chartered (April 10, 1816) for twenty years, with a capital of $35,000,000, one-fifth of which was to be subscribed for by the national government. It was to have the custody of the government revenues, but the secretary of the treasury could divert the revenues to other custodians, giving his reasons for such action to Congress.

Protection. **Manufactures.** 151. Protection was advocated again on national grounds, but not quite on those which had moved Hamilton. The additional receipts were now to be expended for fortifications and other national defences, and for national roads and canals, the latter to be considered solely as military measures, with an incidental benefit to the people. Business distress among the people gave additional force to the proposal. The war and blockade had been an active form of protection, under which American manufactures had sprung up in great abundance. As soon as peace was made English manufacturers drove their American rivals out of business or reduced them to desperate straits. Their cries for relief had a double effect. They gave the spur to the nationalizing advocates of protection, and, as most of the manufacturers were in New England or New York, they developed in the citadel of Federalism a class which looked for help to a Republican Congress, and was therefore bound to oppose the Federalist party. This was the main force which brought New England into the Republican fold before 1825. An increase in the number of spindles from 80,000 in 1811 to 500,000 in 1815, and in cotton consumption from 500 bales in 1800 to 90,000 in 1815, the rise of manufacturing towns, and the rapid development of the mechanical tendencies of a people who had been hitherto almost exclusively agricultural, were influences which were to be reckoned with in the politics of a democratic country.

Tariff of 1816. 152. The tariff of 1816 imposed a duty of about 25% on imports of cotton and woollen goods, and specific duties on iron imports, except pig-iron, on which there was an *ad valorem* duty of 20%. In 1818 this duty also was made specific (50 cents a cwt.). The *ad valorem* duties carried most of the manufacturers through the financial crisis of 1818–1819, but the iron duties were less satisfactory. In English manufacture the substitution of coke for charcoal in iron production led to continual decrease in price. As the price went down the specific duties were continually increasing the absolute amount of protection. Thus spared the necessity for improvements in production, the American manufacturers felt English competition more keenly as the years went by, and called for more protection.

"Era of Good Feeling."

Admission of New States.

153. James Monroe (*q.v.*) succeeded Madison as president in 1817, and, re-elected with hardly any opposition in 1820, he served until 1825.[1] So complete was the supremacy of the Republican party that this is often called "the era of good feeling." It came to an end when a successor to Monroe was to be elected; the two sections of the dominant party then had their first opportunity for open struggle. During Monroe's two terms of office the nationalizing party developed the policy on which it proposed to manage national affairs. This was largely the product of the continually swelling western movement of population. The influence of the steamboat was felt more and more every year, and the want of a similar improvement in land transport was correspondingly evident. The attention drawn to western New York by the war had filled that part of the state with a new population. The southern Indians had been completely overthrown by Andrew Jackson during the War of 1812, and forced to cede their lands. The admission of the new states of Indiana (1816), Mississippi (1817), Illinois (1818), Alabama (1819), Maine (1820) and Missouri (1821)—all but Maine the product and evidence of western growth—were the immediate results of the development consequent upon the war. All the territory east of the Mississippi, except the northern part of the North-West Territory, was now formed into self-governing states; the state system had crossed the Mississippi; all that was needed for further development was the locomotive engine. The four millions of 1790 had grown into thirteen millions in 1830; and there was a steady increase of one-third in each decade.

Erie Canal.

The "American System."

Tariffs of 1824 and 1828.

154. The urgent demand of western settlers for some road to a market led to a variety of schemes to facilitate intercourse between the East and the West—the most successful being that completed in New York in 1825, the Erie Canal. The Hudson river forms the great natural breach in the barrier range which runs parallel to the Atlantic coast. When the traveller has passed up the Hudson through that range he sees before him a vast champaign country extending westward to the Great Lakes, and perfectly adapted by nature for a canal. Such a canal, to turn western traffic into the lake rivers and through the lakes, the canal, and the Hudson to New York City, was begun by the state through the influence of De Witt Clinton, was derisively called "Clinton's big ditch" until its completion, and laid the foundations for the great commercial prosperity of New York state and city. Long before it was finished the evident certainty of its success had seduced other states into far less successful enterprises of the kind and had established as a nationalizing policy the combination of high tariffs and expenditures for internal improvements which was long known as the "American system."[2] The tariffs of duties on imports were to be carried as high as revenue results would justify; within this limit the duties were to be defined for purposes of protection; and the superabundant revenues were to be expended on enterprises which would tend to aid the people in their efforts to subdue the continent. Protection was now to be for national benefit, not for the benefit of classes. Western farmers were to have manufacturing towns at their doors, as markets for the surplus which had hitherto been rotting on their farms; competition among manufacturers was to keep down prices; migration to all the new advantages of the West was to be made easy at national expense; and Henry Clay's eloquence was to commend the whole policy to the people. The old Democracy, particularly in the South, insisted that the whole scheme really had its basis in benefits to classes, that its communistic features were not such as the Constitution meant to cover by its grant of power to Congress to levy taxation for the general welfare, and that any such legislation would be unconstitutional. The dissatisfaction in the South rose higher when the tariffs were increased in 1824 and 1828. The proportion of customs revenue to dutiable imports rose to 37% in 1825 and to 44% in 1829; and the ratio to aggregate imports to 33% in 1825 and 37% in 1829. As yet, Southern dissatisfaction showed itself only in resolutions of state legislatures.

155. In the sudden development of the new nation circumstances had conspired to give social forces an abnormally materialistic cast, and this had strongly influenced the expression of the national life. Its literature and its art had amounted to little, for the American people were still engaged in the fiercest of warfare against natural difficulties, which absorbed all their energies.

The Monroe Doctrine.

156. In international relations the action of the government was strong, quiet and self-respecting. Its first weighty action took place in 1823. It had become pretty evident that the Holy Alliance, in addition to its interventions in Europe to suppress popular risings, meant to aid Spain in bringing her revolted South American colonies to obedience. Great Britain had been drifting steadily away from the alliance, and George Canning, the new secretary, determined to call in the weight of the transatlantic power as a check upon it. A hint to the American minister was followed by a few pregnant passages in Monroe's annual message in December. "We could not view," he said, "any interposition for the purpose of oppressing them [the South American states], or controlling in any other manner their destiny by any European power, in any other light than as the manifestation of an unfriendly disposition towards the United States." If both the United States and Great Britain were to take this ground the fate of a fleet sent by the Alliance across the Atlantic was not in much doubt, and the project was at once given up.

157. It was supposed at the time that Spain might transfer her colonial claims to some stronger power; and Monroe therefore said that "the American continents, by the free and independent condition which they have assumed and maintained, are henceforth not to be considered as subjects for future colonization by any European powers." This declaration and that quoted above constitute together the "Monroe doctrine" as originally proclaimed. The doctrine has remained the rule of foreign intercourse for all American parties. Added to the already established refusal of the United States to become entangled in any European wars or alliances, it has separated Europe and America to their common advantage. (See MONROE DOCTRINE.)

The North-west Boundary.

158. By a treaty with Russia (1825) that power gave up all claims on the Pacific coast south of the present limits of Alaska. The northern boundary of the United States had been defined by the treaty of 1783; and, after the acquisition of Louisiana, a convention with Great Britain (1818) settled the boundary on the line of 49° N. lat. as far west as the Rocky Mountains. West of these mountains the so-called Oregon country, on whose limits the two powers could not agree, was to be held in common possession for ten years. This common possession was prolonged by another convention (1827) indefinitely, with the privilege to either power to terminate it, on giving twelve months' notice. This arrangement lasted until 1846 (see OREGON: *History*).

159. Monroe's term of office came to an end in March 1825. He had originally been an extreme Democrat, who could hardly speak of Washington with patience; he had slowly modified his views, and his tendencies were now eagerly claimed by

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[1] In 1816 Monroe received 183 electoral votes and his opponent, Rufus King, 34; in 1820 Monroe received 231 and his opponent, John Quincy Adams, 1.

[2] For a generation the making of "internal improvements" by the Federal government was an issue of great political importance. In 1806 Congress made an appropriation for the National or Cumberland Road, eventually constructed from Fort Cumberland, Md., to Vandalia, Ill. The policy of making such improvements was opposed on the ground that the Constitution gave to the Federal government no power to make them, that it was not an "enumerated power," and that such improvements were not a "necessary and proper" means of carrying out any of the enumerated powers. Others argued that the Federal government might constitutionally make such improvements, but could not exercise jurisdiction over them when made.

Election of 1824.

the few remaining Federalists as identical with their own. The nationalizing faction of the dominant party had scored almost all the successes of the administration, and the divergence between it and the opposing faction was steadily becoming more apparent. All the candidates for the presidency in 1824—Andrew Jackson, a private citizen of Tennessee; William H. Crawford, Monroe's secretary of the treasury; John Quincy Adams, his secretary of state; and Henry Clay, the speaker of the House of Representatives—claimed to be Republicans alike; but the personal nature of the struggle was shown by the tendency of their supporters to call themselves "Adams men" or "Jackson men," rather than by any real party title. Calhoun was supported by all groups for the vice-presidency, and was elected without difficulty. The choice of a president was more doubtful.

Party Divergence.

160. None of the four candidates had anything like a party organization behind him. Adams and Clay represented the nationalizing element, as Crawford and Jackson did not; but there the likeness among them stopped. The strongest forces behind Adams were the new manufacturing and commercial interests of the East; behind Clay were the desires of the West for internal improvements at Federal expense as a set-off to the benefits which the seaboard states had already received from the government; and the two elements were soon to be united into the National Republican or Whig party (*q.v.*). Crawford was the representative of the old Democratic party, with all its Southern influences and leanings. Jackson was the personification of the new democracy—not very cultured, perhaps, but honest, and hating every shade of class control instinctively. As he became better known the whole force of the new drift of things turned in his direction. Crawford was taken out of the race, just after the electors had cast their votes, by physical failure, and Adams, later, by the revival of ancient quarrels with the Federalists of New England; and the future was to be with Clay or with Jackson. But in 1824 the electors gave no one a majority; and the House of Representatives, voting by states, gave the presidency to Adams.

The Adams Administration 1825–29.

161. Adams's election in 1825 was due to the fact that Clay's friends in the House—unable to vote for him, as he was the lowest in the electoral vote, and only three names were open to choice in the House—very naturally gave their votes to Adams. As Adams appointed Clay to the leading position in his cabinet, the defeated party at once raised the cry of "bargain and intrigue," one of the most effective in a democracy, and it was kept up throughout Adams's four years of office. Jackson had received the largest number of electoral votes, though not a majority,[1] and the hazy notion that he had been injured because of his devotion to the people increased his popularity. Though demagogues made use of it for selfish purposes, this feeling was an honest one, and Adams had nothing to oppose to it. He tried vigorously to uphold the "American system," and succeeded in passing the tariff of 1828; he tried to maintain the influence of the United States on both the American continents; but he remained as unpopular as his rival grew popular. In 1828 Adams was easily displaced by Jackson, the electoral vote being 178 to 83. Calhoun was re-elected vice-president.

Election of 1828. Democracy and Nationality.

162. Jackson's inauguration in 1829 closes this period, as it ends the time during which a disruption of the Union by the peaceable withdrawal of any state was even possible. The party which had made state sovereignty its bulwark in 1798 was now in control of the government again; but Jackson's proclamation in his first term, in which he warned South Carolina that "disunion by armed force is treason," and that blood must flow if the laws were resisted, speaks a very different tone from the speculations of Jefferson on possible future divisions of the United States. And even the sudden attempt of South Carolina to exercise independent action (§§ 172-173) shows that some interest dependent upon state sovereignty had taken alarm at the drift of events, and was anxious to lodge a claim to the right before it should slip from its fingers for ever. Nullification was only the first skirmish between the two hostile forces of slavery and democracy.

Slavery.

163. When the vast territory of Louisiana was acquired in 1803 the new owner found slavery already established there by custom recognized by French and Spanish law. Congress tacitly ratified existing law by taking no action; slavery continued legal, and spread further through the territory; and the state of Louisiana entered as a slave state in 1812. The next state to be carved out of the territory was Missouri, admitted in 1821. A Territory, on applying for admission as a state, brings a constitution for inspection by Congress; and when it was found that the new state of Missouri proposed to recognize and continue slavery, a vigorous opposition spread through the North and West, and carried most of the senators and representatives from those sections with it. In the House of Representatives these two sections had a greatly superior number of members; but, as the number of Northern and Southern states had been kept about equal, the compact Southern vote, with one or two Northern allies, generally retained control of the Senate. Admitted by the Senate and rejected by the House, Missouri's application hung suspended for two years until it was successful by the admission of Maine, a balancing Northern state,[2] and by the following arrangement, known as the Missouri Compromise of 1820: Missouri was to enter as a slave state; slavery was for ever prohibited throughout the rest of the Louisiana Purchase north of lat. 36° 30′, the main southern boundary of Missouri; and, though nothing was said of the territory south of the compromise line, it was understood that any state formed out of it was to be a slave state, if it so wished (see MISSOURI COMPROMISE and MISSOURI, § *History*). Arkansas entered under this provision in 1836.

The Missouri Compromise.

Sectional Divergence.

164. The question of slavery was thus set at rest for the present, though a few agitators were roused to more zealous opposition to the essence of slavery itself. In the next decade these agitators succeeded only in the conversion of a few recruits, but these recruits were the ones who took up the work at the opening of the next period and never gave it up until slavery was ended. It is plain now, however, that North and South had already drifted so far apart as to form two sections, and it became evident during the next forty years that the wants and desires of these two sections were so divergent that it was impossible for one government to make satisfactory laws for both. The chief cause was not removed in 1820, though one of its effects was got out of the way for the time.

The Settled Area.

165. The vast flood of human beings which had been pouring westward for years had now pretty well occupied the territory east of the Mississippi, while, on the west side of that stream, it still showed a disposition to hold to the river valleys. The settled area had increased from 240,000 sq. m. in 1790 to 633,000 sq. m. in 1830, with an average of 20·3 persons to the square mile. There was still a great deal of Indian territory in the Southern states of Georgia, Alabama, Mississippi, and Florida, for the Southern Indians were among the finest of their race; they had become semi-civilized, and were formidable antagonists to the encroaching white race. The states interested had begun preparations for their forcible removal, in public defiance (see GEORGIA: *History*) of the attempts of the Federal government to protect the Indians (1827); but the removal was not completed until 1835. In the North, Wisconsin and Michigan, with the northern halves of Illinois and Indiana, were still very thinly settled, but everything indicated early increase of population. The first lake steamboat, the "Walk-in-the-Water," had appeared at Detroit in 1818, and the opening of the Erie Canal in 1825 added to the number

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[1] Jackson received 99, Adams 84, Crawford 41, and Clay 37; in the House of Representatives Adams received the votes of 13 states, Jackson of 7, and Crawford of 4. For vice-president Calhoun received 182 electoral votes, and his principal competitors, Nathan Sanford, of New York, and Nathaniel Macon, of North Carolina, received 30 and 24 respectively.

[2] A prompt admission of Missouri would have balanced the slave and free states, but Alabama's admission as a slave state balanced them in 1819.

The Steamboat.

of such vessels. Lake Erie had seven in 1826; and in 1830, while the only important lake town, Detroit, was hardly yet more than a frontier fort, a daily line of steamers was running to it from Buffalo, carrying the increasing stream of emigrants to the western territory.

The Land System.

166. The land system of the United States had much to do with the early development of the West. From the first settlement, the universally recognized rule had been that of absolute individual property in land, with its corollary of unrestricted competitive or "rack" rents; and this rule was accepted fully in the national land system, whose basis was reported by Jefferson, as chairman of a committee of the Confederation Congress (1785). The public lands were to be divided into "hundreds" each ten miles square and containing one hundred mile-square plots. The hundred was called a "township," and was afterwards reduced to six miles square, of thirty-six mile-square plots of 640 acres each. From time to time principal meridians and east and west base lines have been run, and townships have been determined by their relations to these lines. The sections (plots) have been subdivided, but the transfer describes each parcel from the survey map, as in the case of "the south-west quarter of section 20, township 30, north, range 1 east of the third principal meridian." The price fixed in 1790 as a minimum was $2 per acre; it has tended to decrease, and no effort has ever been made to gain a revenue from it. When the nation acquired its western territory it secured its title to the soil, and always made it a fundamental condition of the admission of a new state that it should not tax United States lands. To compensate the new states for the freedom of unsold public lands from taxation, one township in each thirty-six was reserved to them for educational purposes; and the excellent public school systems of the Western states have been founded on this provision. The cost of obtaining a quarter section (160 acres), under the still later homestead system of granting lands to actual settlers, has come to be only about $26; the interest on this, at 6%, represents an annual rent of one cent per acre—making this, says F. A. Walker, as nearly as possible the "no-rent land" of the economists.

167. The bulk of the early westward migration was of home production; the great immigration from Europe did not begin until about 1847. The West as well as the East thus had its institutions fixed before being called upon to absorb an enormous foreign element.

I.—*Industrial Development and Sectional Divergence, 1829–1850.*

New Political Methods.

168. The eight years 1829–1837 have been called "the reign of Andrew Jackson"; his popularity, his long struggle for the presidency, and his feeling of his official ownership of the subordinate offices gave to his administration at least an appearance of Caesarism. But it was a strictly constitutional Caesarism; the restraints of written law were never violated, though the methods adopted within the law were new to national politics. Since about 1800 state politics in New York and Pennsylvania had been noted for the systematic use of the offices and for the merciless manner in which the office-holder was compelled to work for the party which kept him in place. The presence of New York and Pennsylvania politicians in Jackson's cabinet taught him to use the same system. Removals, except for cause, had been relatively rare before; but under Jackson men were removed almost exclusively for the purpose of installing some more serviceable party tool; and a clean sweep was made in the civil service. Other parties adopted the system, and it remained the rule at a change of administration until comparatively recent years.

The New Organization of Parties.

169. The system brought with it a semi-military reorganization of parties. Hitherto nominations for the more important offices had been made mainly by legislative caucuses; candidates for president and vice-president were nominated by caucuses of congressmen, and candidates for the higher state offices by caucuses of the state legislatures. Late in the preceding period "conventions" of delegates from the members of the party in the state were held in New York and Pennsylvania; and in 1831–1832 this became the rule for presidential nominations. It rapidly developed into systematic state, county, and city "conventions"; and the result was the appearance of that complete political machinery, the American political party, with its local organizations, and its delegates to county, state and national conventions. The Democratic machinery was the first to appear, in Jackson's second term (1833–1837). Its workers were paid in offices, or hopes of office, so that it was said to be built on the "cohesive power of public plunder"; but its success was immediate and brilliant. The opposing party, the Whig party (*q.v.*), had no chance of victory in 1836; and its complete overthrow drove its leaders into the organization of a similar machinery of their own, which scored its first success in 1840. Since that time these strange bodies, unknown to the law, have governed the country by turns; and their enormous growth has steadily made the organization of a third piece of such machinery more difficult or hopeless.

Bank of the United States.

The Whig Party.

Removal of the Deposits.

170. The Bank of the United States had hardly been heard of in politics until the new Democratic organization came into hostile contact with it. A semi-official demand upon it for a political appointment was met by a refusal; and the party managers called Jackson's attention to an institution which he could not but dislike the more he considered it. His first message spoke of it in unfriendly terms, and every succeeding message brought a more open attack. The old party of Adams and Clay had by this time taken the name of Whigs, probably from the notion that they were struggling against "the reign of Andrew Jackson," and they adopted the cause of the bank with eagerness. The bank charter did not expire until 1836, but in 1832 Clay brought up a bill for a new charter. It was passed and vetoed; and the Whigs made the veto an important issue of the presidential election of that year. They were beaten; Jackson was re-elected, receiving 219 electoral votes, and Clay, his Whig opponent, only 49, and the bank party could never again get a majority in the House of Representatives for the charter. The insistence of the president on the point that the charter was a "monopoly" bore weight with the people. But the president could not obtain a majority in the Senate. He determined to take a step which would give him an initiative, and which his opponents could not induce both houses to unite in overriding or punishing. Taking advantage of the provision that the secretary of the treasury might order the public funds to be deposited elsewhere than in the bank or its branches, he directed the secretary to deposit *all* the public funds elsewhere. Thus deprived of its great source of dividends, the bank fell into difficulties, became a state bank after 1836, and then went into bankruptcy. (See Banks and Banking: *United States*; and Jackson, Andrew.)

Opposition to the "American System."

171. All the political conflicts of Jackson's terms of office were close and bitter. Loose in his ideas before 1829, Jackson showed a steady tendency to adopt the strictest construction of the powers of the Federal government, except in such official perquisites as the offices. He grew into strong opposition to all traces of the "American system," and vetoed bills for internal improvements unsparingly; and his feeling of dislike to all forms of protection is as evident, though he took more care not to make it too public. There are many reasons for believing that his drift was the work of a strong school of leaders—Martin Van Buren, Thomas H. Benton, Edward Livingston, Roger B. Taney, Levi Woodbury, Lewis Cass, W. L. Marcy and others—who developed the policy of the party, and controlled it until the great changes of parties about 1850 took their power from them. At all events, some persistent influence made the Democratic party of 1830–1850 the most consistent and successful party which had thus far appeared in the United States.

Calhoun and Jackson.

172. Calhoun (*q.v.*) and Jackson were of the same stock—Scottish-Irish—much alike in appearance and characteristics, the former representing the trained and educated logic of the race, the latter its instincts and passions. Jackson was led to break off his friendly relations with

Nullification.

Calhoun in 1830, and he had been led to do so more easily because of the appearance of the doctrine of nullification (*q.v.*), which was generally attributed, correctly enough, to the authorship of Calhoun. Asserting, as the Republican party of 1798 had done, the sovereign powers of each state, Calhoun held that, as a means of avoiding secession and violent struggle upon every occasion of the passage of an act of Congress which should seem unconstitutional to any state, the state might properly suspend or "nullify" the operation of the law within its jurisdiction, in order to protect its citizens against oppression. The passage of the Tariff Act of 1832, which organized and systematized the protective system, forced the Calhoun party into action. A state convention in South Carolina (*q.v.*) on the 24th of November 1832 declared the Tariff Act null, and made ready to enforce the declaration.

173. But the time was past when the power of a single state could withdraw it from the Union. The president issued a proclamation, warning the people of South Carolina against any attempt to carry out the ordinance of nullification; he ordered a naval force to take possession of Charleston harbour to collect the duties under the act; he called upon Congress for additional executive powers, and Congress passed what nullifiers called the "bloody bill," putting the land and naval forces at the disposal of the president for the collection of duties against "unlawful combinations"; and he is said to have announced, privately and profanely, his intention of making Calhoun the first victim of any open conflict. Affairs looked so threatening that an unofficial meeting of "leading nullifiers" agreed to suspend the operation of the ordinance until Congress should adjourn; whence it derived the right to suspend has never been stated.

Tariff of 1833.

174. The president had already asked Congress to reduce the duties; and many Democratic members of Congress, who had yielded to the popular clamour for protection, were very glad to use "the crisis" as an excuse for now voting against it. A compromise Tariff Act, scaling down all duties over 20% by one-tenth of the excess every two years until 1842, when the remaining excess over 20% should be dropped, was introduced by Clay and became law. Calhoun and his followers claimed this as all that the nullification ordinance had aimed at; and the ordinance was formally repealed. But nullification had received its death-blow; even those Southern leaders who maintained the right of secession refused to recognize the right of a state to remain in the Union while nullifying its laws; and, when protection was reintroduced by the tariff of 1842, nullification was hardly thought of.

The Locomotive.

175. All the internal conditions of the United States were completely altered by the introduction of railways. For twenty years past the Americans had been pushing in every direction which offered a hope of the means of reconciling vast territory with enormous population. Stephenson's invention of the locomotive came just in time, and Jackson's two terms of office marked the outburst of modern American life. The miles of railway were 23 in 1830, 1098 in 1835, some 2800 in 1840, and thereafter they about doubled every five years until 1860.

Railways of 1840.

Anthracite.

Iron.

Ocean Navigation. The Telegraph.

176. A railway map of 1840 shows a fragmentary system, designed mainly to fill the gaps left by the means of communication in use in 1830. One or two short lines run back into the country from Savannah and Charleston; another runs north along the coast from Wilmington to Baltimore; several lines connect New York with Washington and other points; and short lines elsewhere mark the openings which needed to be filled at once—a number in New England and the Middle states, three in Ohio and Michigan, and three in Louisiana. Year after year new inventions came in to increase and aid this development. The anthracite coal of the Middle states had been known since 1790, but no means had been devised to put the refractory agent to work. It was now successfully applied to railways (1836), and to the manufacture of iron (1837). Hitherto wood had been the best fuel for iron-making; now the states which relied on wood were driven out of competition, and production was restricted to the states in which nature had placed coal alongside of iron. Steam navigation across the Atlantic was established in 1838. The telegraph came next, S. F. B. Morse's line being erected in 1844. The spread of the railway system brought with it, as a natural development, the rise of the American system of express companies, whose first phases of individual enterprise appeared in 1839. No similar period in American history is so extraordinary for material development as the decade 1830–1840. At its beginning the country was an overgrown type of colonial life; at its end American life had been shifted to entirely new lines, which it has since followed. Modern American history had burst in with the explosiveness of an Arctic summer.

Western Settlement.

Admission of Arkansas and Michigan.

177. The steamboat had aided Western development, but the railway aided it far more. Cities and states grew as if the oxygen of their surroundings had been suddenly increased. The steamboat influenced the railway, and the railway gave the steamboat new powers. Vacant places in the states east of the Mississippi were filling up; the long lines of emigrant waggons gave way to the new and better methods of transport; and new grades of land were made accessible. Chicago was but a frontier fort in 1832; within a half-dozen years it was a flourishing town, with eight steamers connecting it with Buffalo, and dawning ideas of its future development of railway connexions. The maps change from decade to decade, as mapmakers hasten to insert new cities which have sprung up. Two new states, Arkansas and Michigan, were admitted (1836 and 1837). The population of Ohio grew from 900,000 to 1,500,000, that of Michigan from 32,000 to 212,000, and that of the country from 13,000,000 to 17,000,000, between 1830 and 1840.

Social Conditions.

178. With the change of material surroundings and possibilities came a steady amelioration of social conditions and a development of social ideals. Such features of the past as imprisonment for debt and the cruel indifference of old methods of dealing with crime began to disappear; the time was past when a state could use an abandoned copper mine as its state prison, as Connecticut had formerly done (see SIMSBURY, Connecticut). The domestic use of gas and anthracite coal, the introduction of expensive aqueducts for pure water, and the changing life of the people forced changes in the interior and exterior of American dwellings. Wood was still the common building material; imitations of Greek architecture still retained their vogue; but the interiors were models of comfort in comparison with the houses even of 1810. In the "new" regions this was not yet the case, and here social restraints were still so few that society seemed to be reduced almost to its primitive elements. Western steamers reeked with gambling, swindling, duelling and every variety of vice. Public law was almost suspended in some regions; and organized associations of counterfeiters and horse-thieves terrorized whole sections of country. But this state of affairs was altogether temporary, as well as limited in its area; the older and more densely settled states had been well prepared for the change and had never lost command of the social forces, and the process of settling down went on, even in the newer states, with far more rapidity than could reasonably have been expected. Those who took part in the movements of population in 1830–1840 had been trained under the rigid forms of the previous American life; and these soon re-asserted themselves. The rebound was over before 1847, and the Western states were then as well prepared to receive and digest the great immigration which followed as the older states would have been in 1830.

Literature.

179. A distinct American literature dates from this period. Most of the publications in the United States were still cheap reprints of foreign works; but native productions no longer followed foreign models with servility. Between 1830 and 1840 Whittier, Longfellow, Holmes, Poe, Hawthorne, Emerson, Bancroft and Prescott joined the advance-guard of American writers—Bryant, Dana, Halleck, Drake,

Common School System.

Newspapers.

Irving and Cooper; and even those writers who had already made their place in literature showed the influence of new conditions by their growing tendency to look less to foreign models and methods. (See AMERICAN LITERATURE.) Popular education was improved. The new states had from the first endeavoured to secure the best possible system of common schools. The attempt came naturally from the political instincts of the class from which the migration came; but the system which resulted was to be of incalculable service during the years to come. Their absolute democracy and their universal use of the English language have made the common schools most successful machines for converting the raw material of immigration into American citizens. This supreme benefit is the basis of the system and the reason for its existence and development, but its incidental advantage of educating the people has been beyond calculation. It was an odd symptom of the general change that American newspapers took a new form during these ten years. The old "blanket-sheet" newspaper, cumbrous to handle and slow in all its ways, met its first rival in the type of newspaper which appeared first in New York City, in the *Sun*, the *Herald* and the *Tribune* (1833, 1835 and 1841). Swift and energetic in gathering news, and fearless, sometimes reckless, in stating it, they brought into American life, with very much that is evil, a great preponderance of good.

Land Sales.

Speculation.

180. The chaos into which a part of American society had been thrown had a marked effect on the financial institutions of the country, which went to pieces before it for a time. It had not been meant to make the public lands of the United States a source of revenue so much as a source of development. The sales had touched their high-water mark during the speculative year 1819, when receipts from them had amounted to $3,274,000; in other years they seldom went above $2,000,000. When the railway set the stream of migration moving faster than ever, and cities began to grow like mushrooms, it was natural that speculation in land should feel the effects. Sales rose to $3,200,000 in 1831, to $4,000,000 in 1833, to $5,000,000 in 1834, to $15,000,000 in 1835, and to $25,000,000 in 1836. In 1835 the president announced to Congress that the public debt was extinguished, and that some way of dealing with the surplus should be found. Calhoun's proposal, that after the year 1836 any surplus in excess of $5,000,000 should be divided among the states as a loan, was adopted, as regards the surplus (almost $37,000,000) of that year; and some $28,000,000—still carried on the books of the treasury as unavailable funds—were actually distributed before the crisis of 1837 put an end to the surplus and to the policy. The states had already taken a hand in the general speculation by beginning works of public improvement. Foreign, particularly English, capital was abundant; and states which had been accustomed to think a dozen times over a tax of a hundred thousand dollars now began to negotiate loans of millions of dollars and to appropriate the proceeds to the digging of canals and the construction of railways. Their enterprises were badly conceived and badly managed, and only added to the confusion when the crash came. If the Federal government and the states felt that they were rich, the imaginations of individuals ran riot. Every one wanted to buy; prices rose, and every one was growing richer on paper. The assessed value of real estate in New York City in 1832 was $104,000,000; in 1836 it had grown to $253,000,000. In Mobile the assessed value rose from $1,000,000 to $27,000,000. Fictitious values were the rule.

Corporations.

181. When Jackson in 1833 ordered the government revenues to be deposited elsewhere than in the Bank of the United States, there was no government agent to receive them. The secretary of the treasury selected banks at various points in which the revenue should be deposited by the collecting officers; but these banks were organized under charters from their states, as were all banks except that of the United States. The theory of the dominant party denied the constitutional power of Congress to charter a bank, and the states had not yet learned how to deal with such institutions. Their grants of bank charters had been based on ignorance, intrigue, favouritism or corruption, and the banks were utterly unregulated. The Democratic feeling was that the privilege of forming banking corporations should be open to all citizens, and it soon became so. Moreover, it was not until after the crash that New York began the system of compelling such deposits as would really secure circulation, which was long afterward further developed into the present national bank system. In most of the states banks could be freely organized with or without tangible capital, and their notes could be sent to the West for the purchase of government lands, which needed to be held but a month or two to gain a handsome profit. (See BANKS AND BANKING: *United States*.) "Wild-cat banks" sprang up all over the country; and the "pet banks," as those chosen for the deposit of government revenues were called, went into speculation as eagerly as the banks which hardly pretended to have capital.

The "Specie Circular."

Panic of 1837.

Repudiation.

182. The Democratic theory denied the power of Congress to make anything but gold or silver coin legal tender. There have been "paper-money heresies" in the party; but there was none such among the new school of Democratic leaders which came in in 1829; they were "hard-money men." In July 1836 Jackson's secretary of the treasury ordered land agents to take nothing in payment for lands except gold or silver. In the following spring the full effects of the order became evident; they fell on the administration of Van Buren, Jackson's successor.[1] Van Buren had been Jackson's secretary of state, the representative man of the new Democratic school, and, in the opinion of the opposition, the evil genius of the Jackson administration; and it seemed to the Whigs poetic justice that he should bear the weight of his predecessor's errors. The "specie circular" turned the tide of paper back to the East, and when it was presented for payment most of the banks suspended specie payment with hardly a struggle. There was no longer a thought of buying; every one wanted to sell; and prices ran down with a rapidity even more startling than that with which they had risen. Failures, to an extent and on a scale unprecedented in the United States, made up the "panic of 1837." Many of the states had left their bonds in the hands of their agents, and, on the failure of the latter, found that the bonds had been hypothecated or disposed of, so that the states got no return from them except a debt which was to them enormous. Saddled suddenly with such a burden, and unable even to pay interest, some of the states "repudiated" their obligations; and repudiation was made successful by the fact that a state could not be sued by its creditors except by its own consent. Even the Federal government felt the strain, for its revenues were locked up in suspended banks. A little more than a year after Congress had authorized the distribution of its surplus revenues among the states Van Buren was forced to call it into special session to provide some relief for the government itself.

Sub-treasury Scheme.

183. Van Buren held manfully to the strictest construction of the powers of the Federal government. He insisted that the panic would best right itself without government interference, and, after a four years' struggle, he succeeded in making the "sub-treasury scheme" law (1840). It cut off all connexion of the government with banks, putting collecting and disbursing officers under bonds to hold money safely and to transfer it under orders from the treasury, and restricting payments to or by the United States to gold and silver coin. Its passage had been preceded by another commercial crisis (1839), more limited in its field, but more discouraging to the people. It is true that Jackson, in dealing with the finances, had "simply smashed things," leaving his successor to repair damages; but it is far from certain that this was not the best way available at the time. The wisest scheme of financial reform would have had small chance

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[1] In the election of 1836 Van Buren received 170 electoral votes, W. H. Harrison (Whig) 73, Hugh L. White 26, Daniel Webster 14 and W. P. Mangum 11.

of success with the land-jobbers in Congress, and Van Buren's firmness found the way out of the chaos.

Election of 1840.

Tariff of 1842.

184. Van Buren's firmness was unpopular, and the Whig party now adopted methods which were popular if somewhat demagogical. It nominated William H. Harrison in 1840; it contrasted his homely frontier virtues with Van Buren's "ostentatious indifference to the misfortunes of the people" and with the supposed luxury of his life in the White House; and, after the first of the modern "campaigns" of mass meetings and processions, Harrison was elected, receiving 234 electoral votes and Van Buren only 60. He died on the 4th of April 1841, only a month after his inauguration, and the vice-president, John Tyler, became president. Tyler was of the extreme Calhoun school, which had shown some disposition to grant to Van Buren a support which it had refused to Jackson; and the Whigs had nominated Tyler to retain his faction with them. Now he was the nominal leader of the party, while his politics were opposite to theirs, and the real leader of the party, Clay, was ready to force a quarrel upon him. The quarrel took place; the Whig majority in Congress was not large enough to pass any measures over Tyler's veto; and the first two years of his administration were passed in barren conflict with his party. The "sub-treasury" law was repealed (1841); the tariff of 1842 introduced a modified protection; and there the Whigs were forced to stop. Their dissensions made Democratic success comparatively easy, and Tyler had the support of a Democratic House behind him during the last two years of his term.

185. The success of the Democratic machinery, and the reflex of its temporary check in 1840, with the influences brought to bear on it by the returning Calhoun faction, were such as to take the control of the party out of the hands of the leaders who had formed it. They had had high regard for political principle, even though they were willing to use doubtful methods for its propagation; these methods had now brought out new men, who looked mainly to success, and to close connexion with the controlling political element of the South as the easiest means of attaining success. When the Democratic convention of 1844 met it was expected to renominate Van Buren. A majority of the delegates had been sent there for that purpose, but many of them would have been glad to be prevented from doing so. They allowed a resolution to be passed making a two-thirds vote necessary for nomination; Van Buren was unable to command so many votes; and, when his name was withdrawn, James K. Polk was nominated. The Whigs nominated Clay.

Abolitionist Movement.

186. The beginning of the abolitionist movement in the United States, the establishment of the *Liberator* (1831), and of the American Anti-Slavery Society (1833), and the subsequent divisions in it, are dealt with elsewhere (see GARRISON, WILLIAM LLOYD). Up to that time "abolition" had meant *gradual* abolition; it was a wish rather than a purpose. Garrison called for *immediate* abolition. The basis of the American system was in the reserved rights of the states, and slavery rested on their will, which was not likely to be changed. But the cry was kept up. The mission of the Abolitionists was to force the people to think of the question; and, in spite of riots, assaults and persecution of every kind, they fulfilled it manfully. In truth, slavery was more and more out of harmony with the new economic conditions which were taking complete control of the North and West, but had hardly been felt in the South. Thus the two sections, North and South, were more and more disposed to take opposite views of everything in which slavery was involved, and it had a faculty of involving itself in almost everything. The status of slavery in the Territories had been settled in 1820; that of slavery in the states had been settled by the Constitution; but even in minor questions the intrusive element had to be reckoned with. The Abolitionists sent their documents through the mails, and the South wished the Federal government to interfere and stop the practice. The Abolitionists persisted in petitioning Congress for the passage of various measures which Congress regarded as utterly unconstitutional; and the disposition of Congress to deny or regulate the right of petition in such matters (see ADAMS, JOHN QUINCY) excited the indignation of Northern men who had no sympathy with abolition. But the first occasion on which the views of the two sections came into flat contrast was on the question of the annexation of Texas.

Texas.

Oregon.

187. The United States had had a vague claim to Texas until 1819, when the claim was surrendered to Spain in part compensation for Florida. On the revolt of Mexico Texas became a part of that republic. It was colonized by Americans, mainly southerners and slave-holders, seceded from Mexico in 1835, and defeated the Mexican armies and established its independence in the following year. Southern politicians desired its annexation to the United States for many reasons. Its people were kindred to them; its soil would widen the area of slavery; and its territory, it was hoped, could be divided into several states, to reinforce the Southern column in the Senate. People in the North were either indifferent or hostile to the proposal; Van Buren had declared against it, and his action was a reason for his defeat in the Democratic convention. On the other hand, there were indications that the joint occupation of the Oregon country could not last much longer. American immigration into it had begun, while the Hudson's Bay Company, the British tenant of the soil, was the natural enemy of immigration. To carry the sentiment of both sections, the two points were coupled; and the Democratic convention declared for the reannexation of Texas and the reoccupation of Oregon.

Liberty Party.

Election of 1844.

Admission of Texas.

188. One of the cardinal methods of the political Abolitionists was to nominate candidates of their own against a doubtful friend, even though this secured the election of an open enemy. Clay's efforts to guard his condemnation of the Texas annexation project were just enough to push the Liberty party (*q.v.*), the political Abolitionists, into voting for candidates of their own in New York; on a close vote their loss was enough to throw the electoral votes of that state to Polk, and its votes decided the result. Polk was elected (November 1844);[1] and Texas was annexed to the United States in the following spring. At the next meeting of Congress (1845) Texas was admitted as a state.

189. West of Texas the northern prolongation of Mexico ran right athwart the westward movement of American population; and, though the movement had not yet reached the barrier, the Polk administration desired further acquisitions from Mexico. The western boundary of Texas was undefined; a strip of territory claimed by Texas was settled exclusively by Mexicans; but the Polk administration directed General Zachary Taylor, the American commander in Texas, to cross the Nueces river and seize the disputed territory. Collisions with Mexican troops followed; they were beaten in the battles of Palo Alto and Resaca de la Palma, and were chased across the Rio Grande. Taylor followed and took the city of Monterey.

War with Mexico.

Peace.

190. On the news of the first bloodshed Congress declared war against Mexico, over the opposition of the Whigs. A land and naval force took possession of California, and a land expedition occupied New Mexico, so that the authority of Mexico over all the soil north of her present boundaries was abruptly terminated (1846). At the opening of 1847 Taylor fought the last battle in northern Mexico (Buena Vista), defeating the Mexicans, and General Winfield Scott, with a new army, landed at Vera Cruz for a march upon the city of Mexico. Scott's march was marked by one successful battle after another, usually against heavy odds; and in September he took the capital city and held it until peace was made (1848) by the treaty of Guadalupe Hidalgo. Among the terms of peace was the cession of the present California, Utah, Arizona and New Mexico, the consideration being a payment of $15,000,000 by the United States and the assumption of some $3,000,000 of debts due by Mexico to American citizens. With a subsequent rectification of frontier (1853) by the Gadsden Treaty (see GADSDEN, JAMES), this cession

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[1] Polk received 170 electoral votes and Clay 105.

added some 500,000 sq. m. to the area of the United States; Texas itself made up a large additional area. The settlement of the north-east and north-west boundaries (see MAINE and OREGON) by the Webster-Ashburton and Buchanan-Pakenham treaties (1842, 1846) with the Texas and Mexican cessions, gave the United States the complete territorial form retained until the annexation of Alaska in 1867.

Slavery in the New Territory.

191. In the new territory slavery had been forbidden under Mexican law; and its annexation brought up the question of its status under American law. He who remembers the historical fact that slavery had never been more than a custom, ultimately recognized and protected by state law, will not have much difficulty in deciding about the propriety of forcing such a custom by law upon any part of a territory. But, if slavery was to be excluded from the new territory, the states which should ultimately be formed out of it would enter as free states, and the influence of the South in the Senate would be decreased. For the first time the South appears as a distinct *imperium in imperio* in the territorial difficulties which began in 1848.

“Squatter Sovereignty.”

Wilmot Proviso.

Free Soil Party.

192. The first appearance of these difficulties brought out in the Democratic party a solution which was so closely in line with the prejudices of the party, and apparently so likely to meet all the wishes of the South, that it bade fair to carry the party through the crisis without the loss of its Southern vote. This was “squatter sovereignty,” the notion that it would be best for Congress to leave the people of each Territory to settle the question of the existence of slavery for themselves. The broader and democratic ground for the party would have been that which it at first seemed likely to take—the “Wilmot Proviso,” a condition proposed to be added to the act authorizing acquisitions of territory, providing that slavery should be forbidden in all territory to be acquired under the act (see WILMOT, DAVID). In the end apparent expediency carried the dominant party off to “squatter sovereignty,” and the Democratic adherents of the Wilmot Proviso, with the Liberty party and the anti-slavery Whigs, united in 1848 under the name of the Free Soil party (*q.v.*). The Whigs had no solution to offer; their entire programme, from this time to their downfall as a party, consisted in a persistent effort to evade or ignore all difficulties connected with slavery.

Election of 1848.

193. Taylor, after the battle of Buena Vista, resigned and came home, considering himself ill-used by the administration. He refused to commit himself to any party; and the Whigs were forced to accept him as their candidate in 1848. The Democrats nominated Lewis Cass; and the Free Soil party, or “Free-Soilers,” nominated Van Buren. By the vote of the last-named party the Democratic candidate lost New York and the election, and Taylor was elected president, receiving 163 electoral votes, while Cass received 127. Taking office in March 1849, he had on his shoulders the whole burden of the territorial difficulties, aggravated by the discovery of gold in California and the sudden rise of population there. Congress was so split into factions that it could for a long time agree upon nothing; thieves and outlaws were too strong for the semi-military government of California; and the Californians, with the approval of the president, proceeded to form a constitution and apply for admission as a state. They had so framed their constitution as to forbid slavery; and this was really the application of the Wilmot Proviso to the richest part of the new territory, and the South felt that it had been robbed of the cream of what it alone had fought cheerfully to obtain.

Admission of California.

Compromise of 1850.

Fugitive Slave Law.

Personal Liberty Laws.

194. The admission of California was not secured until September 1850, soon after Taylor's sudden death (July 9), and then only by the addition of a bonus to Texas, the division of the rest of the Mexican cession into the Territories of Utah and New Mexico without prohibition of slavery, and the passage of a fugitive slave law. The slave trade, but not slavery, was forbidden in the District of Columbia. The whole was generally known as the Compromise Measures of 1850 (*q.v.*). Two of its features need notice. As has been said, slavery was not mentioned in the act; and the status of slavery in the Territories, was thus left uncertain. Congress can veto any legislation of a territorial legislature, but, in fact, the two houses of Congress were hardly ever able to unite on anything after 1850, and both these Territories did establish slavery before 1860, without a Congressional veto. The advantage here was with the South. The other point, the Fugitive Slave Law (*q.v.*), was a special demand of the South. The Constitution contained clauses directing that fugitive criminals and slaves should be delivered up, on requisition, by the state to which they had fled. In the case of criminals the delivery was directed to be made by the executive of the state to which they had fled; in the case of slaves no delivering authority was specified, and an act of Congress in 1793 had imposed the duty on Federal judges or on local state magistrates. Some of the states had passed “Personal Liberty Laws,” forbidding or limiting the action of their magistrates in such cases, and the act of 1850 transferred the decision of such cases to United States commissioners, with the assistance of United States marshals. It imposed penalties on rescues, and denied a jury trial.

Tariff of 1846.

195. The question of slavery had taken up so much time in Congress that its other legislation was comparatively limited. The rates of postage were reduced to five and ten cents for distances less and greater than 300 m. (1845); and the naval school at Annapolis was established in the same year. The military academy at West Point had been established as such in 1802. When the Democratic party had obtained complete control of the government, it re-established (by act of 6th August, 1846), the “sub-treasury,” or independent treasury, which is still the basis of the treasury system. In the same year, after an exhaustive report by Robert J. Walker, Polk's secretary of the treasury, the tariff of 1846 was passed; it reduced duties, and moderated the application of the protective principle. Apart from a slight reduction of duties in 1857, this remained in force till 1861.

Admission of Florida, Iowa and Wisconsin.

Railways and Telegraphs.

196. Five states were admitted during the last ten years of this period: Florida (1845), Texas (1845), Iowa (1846), Wisconsin (1848) and California (1850). The early entrance of Iowa, Wisconsin and Florida had been due largely to Indian wars—the Black Hawk War (see BLACK HAWK) in Iowa and Wisconsin (1832), and the Seminole War in Florida (1835–37), after each of which the defeated Indians were compelled to cede lands as the price of peace. The extinction of Indian titles in northern Michigan brought about the discovery of the great copper fields of that region, whose existence had been suspected long before it could be proved. Elsewhere settlement followed the lines already marked out, except in the new possessions on the Pacific coast, whose full possibilities were not yet known. Railways in the Eastern states were beginning to show something of a connected system; in the South they had hardly changed since 1840; in the West they had only been prolonged on their original lines. The telegraph was brought into use in 1844; but it is not until the census of 1860 that its effects are seen in the fully connected network of railways which then covers the whole North and West.

Invention.

197. The sudden development of wealth in the country gave an impetus to the spirit of invention. Charles Goodyear's method of vulcanizing rubber (1839) had come into use. Cyrus Hall M'Cormick had made an invention whose results have been hardly less than that of the locomotive in their importance to the United States. He had patented a reaping machine in 1834, and this, further improved and supplemented by other inventions, had brought into play the whole system of agricultural machinery, whose existence was scarcely known elsewhere until the London “World's Fair” of 1851 brought it into notice. A successful sewing-machine came in 1846; the power-loom and the surgical use of anaesthetics in the same year; and the rotary press for printing in 1847.

The Mormons.

198. All the conditions of life were changing so rapidly that it was natural that the minds of men should change with them or become unsettled. This was the era of new sects, of communities, of fantastic proposals of every kind, of transcendentalism in literature, religion, and politics. Not the most fantastic or benevolent, but certainly the most successful, of these was the sect of Mormons or Latter-day Saints. They settled in Utah in 1847, calling their capital Salt Lake City, and spreading thence through the neighbouring Territories. They became a menace to the American system; their numbers were so great that it was against American instincts to deprive them of self-government; while their polygamy and total submission to their hierarchy made it impossible to erect them into a state having complete control of marriage and divorce. The difficulty was lessened by their renunciation of polygamy in 1890 (see MORMONS).

The South.

199. The material development of the United States since 1830 had been extraordinary, but every year made it more evident that the South was not sharing in it. It is plain now that the fault was in the labour system of the South: her only labourers were slaves, and a slave who was fit for anything better than field labour was prima facie a dangerous man. The divergence had as yet gone only far enough to awaken intelligent men in the South to its existence, and to stir them to efforts as hopeless as they were earnest, to find some artificial stimulus for Southern industries. In the next ten years the process was to show its effects on the national field.

J.—*Tendencies to Disunion, 1850–1861.*

Slavery and the Sections.

200. The Abolitionists had never ceased to din the iniquity of slavery into the ears of the American people. Calhoun, Webster and Clay, with nearly all the other political leaders of 1850, had united in deploring the wickedness of these fanatics, who were persistently stirring up a question which was steadily widening the distance between the sections. They mistook the symptom for the disease. Slavery itself had put the South out of harmony with its surroundings. Even in 1850, though they hardly yet knew it, the two sections had drifted so far apart that they were practically two different countries.

The "Slave Power."

201. The South remained much as in 1790; while other parts of the country had developed, it had stood still. The remnants of colonial feeling, of class influence, which advancing democracy had wiped out elsewhere, retained all their force here, aggravated by the effects of an essentially aristocratic system of employment. The ruling class had to maintain a military control over the labouring class, and a class influence over the poorer whites. It had even secured in the Constitution provision for its political power in the representation given to three-fifths of the slaves. The twenty additional members of the House of Representatives were not simply a gain to the South; they were still more a gain to the "black districts," where whites were few, and the slave-holder controlled the district. Slave-owners and slave-holders together, there were but 350,000 of them; but they had common interests, the intelligence to see them, and the courage to contend for them. The first step of a rising man was to buy slaves; and this was enough to enrol him in the dominant class. From it were drawn the representatives and senators in Congress, the governors, and all the holders of offices over which the "slave power," as it came to be called, had control. Not only was the South inert; its ruling class, its ablest and best men, united in defence of tendencies hostile to those of the rest of the country.

Immigration.

202. Immigration into the United States was not an important factor in its development until about 1847. The immigrants, so late as 1820, numbered but 8000 per annum; their number did not touch 100,000 until 1842, and then it fell for a year or two almost to half that number. In 1847 it rose again to 235,000, in 1849 to 300,000, and in 1850 to 428,000; all told, more than two and a quarter million persons from abroad settled in the United States between 1847 and 1854. Leaving out the dregs of the immigration, which settled down in the seaboard cities, its best part was a powerful nationalizing force. It had not come to any particular state, but to the United States; it had none of the traditional prejudices in favour of a state, but a strong feeling for the whole country; and the new feelings which it brought in must have had their weight not only on the gross mass of the people, but on the views of former leaders. And all the influences of this enormous immigration were confined to the North and West. The immigration avoided slave soil as if by instinct. So late as 1880 the census reported that the Southern states, except Florida, Louisiana and Texas, are "practically without any foreign element"; but it was only in 1850–1860 that this differentiating circumstance began to show itself plainly. And, as the sections began to differ further in aims and policy, the North began to gain heavily in ability to ensure its success.

The Sections in Congress.

203. Texas was the last slave state ever admitted; and, as it refused to be divided, the South had no further increase of numbers in the Senate. Until 1850 the admission of a free state had been so promptly balanced by the admission of a slave state that the senators of the two sections had remained about equal in number; in 1860 the free states had 36 senators and the slave states only 30. As the representation in the House had changed from 35 free state and 30 slave state members in 1790 to 147 free state and 90 slave state in 1860, and as the number of presidential electors is the sum of the numbers of senators and representatives, political power had passed away from the South in 1850. If at any time the free states should unite they could control the House of Representatives and the Senate, elect the president and vice-president, dictate the appointment of judges and other Federal officers, and make the laws what they pleased. If pressed to it, they could even control the interpretation of the laws by the Supreme Court. No Federal judge could be removed except by impeachment, but an act of Congress could at any time increase the number of judges to any extent, and the appointment of the additional judges could reverse the opinion of the court.

Tendencies to Disunion.

204. In circumstances so critical a cautious quiescence and avoidance of public attention was the only safe course for the "slave power," but that course had become impossible. The numbers interested had become too large to be subject to complete discipline; all could not be held in cautious reserve; and, when an advanced proposal came from any quarter of the slave-holding lines, the whole army was shortly forced up to the advanced position. Every movement of the mass was necessarily aggressive; and aggression meant final collision. If collision came it must be on some question of the rights of the states; and on such a question the whole South would move as one man.

Sectarian Division.

205. The Protestant churches of the United States had reflected in their organization the spirit of the political institutions under which they lived. Acting as purely voluntary associations, they had been organized into governments by delegates, much like the "conventions" which had been evolved in the political parties. The omnipresent slavery question intruded into these bodies, and split them. The Methodist Episcopal Church was thus divided into a Northern and a Southern branch in 1844, and the equally powerful Baptist Church met the same fate in the following year. Two of the four great Protestant bodies were thus no longer national; it was only by the most careful management that the integrity of the Presbyterian Church was maintained until 1861, when it also yielded; and only the Episcopal and Roman Catholic Churches retained their national character.

Party Changes.

206. The political parties showed the same tendency. Each began to shrivel up in one section or the other. The notion of "squatter sovereignty," attractive at first to the Western democracy, and not repudiated by the South, enabled the Democratic party to pass the crisis of 1850 without losing much of its Northern vote, while Southern Whigs began to drift in, making the party continually

Election of 1852.

more pro-slavery. This could not continue long without beginning to decrease its Northern vote, but this effect did not become plainly visible until after 1852. The efforts of the Whig party to ignore the great question alienated its anti-slavery members in the North, while they did not satisfy its Southern members. The Whig losses were not at first heavy, but, as the electoral vote of each state is determined by the barest plurality of the popular vote, they were enough to defeat the party almost everywhere in the presidential election of 1852. The Whigs nominated General Winfield Scott and the Democrats Franklin Pierce; and Pierce carried all but four of the thirty-one states, and was elected, receiving 254 out of the 296 electoral votes. This revelation of hopeless weakness was the downfall of the Whig party; it maintained its organization for four years longer, but the life had gone out of it. The future was with the Free Soil party, though it had polled but few votes in 1852.

Changes in Leadership.

207. During the administration of Taylor (and Vice-President Millard Fillmore, who succeeded him) Clay, Webster, Calhoun, Polk and Taylor were removed by death, and there was a steady drift of other political leaders out of public life. New men were pushing in everywhere, and in both sections they showed the prevailing tendency to disunion. The best of them were unprecedentedly radical. Charles Sumner, William H. Seward, and Salmon P. Chase came into the Senate, bringing the first accession of recognized force and ability to the anti-slavery feeling in that body. The new Southern men, such as Jefferson Davis, and the Democratic recruits from the Southern Whig party, such as Alexander H. Stephens, were ready to take the ground on which Calhoun had always insisted—that Congress was bound not merely to the negative duty of not attacking slavery in the Territories, but to the positive duty of protecting it. This, if it should become the general Southern position, was certain to destroy the notion of "squatter sovereignty," and thus to split the Democratic party, which was almost the last national ligament that now held the two fragments of the Union together.

Social Divergence.

208. The social disintegration was as rapid. Northern men travelling in the South were naturally looked upon with increasing suspicion, and were made to feel that they were on a soil alien in sympathies. Some of the worst phases of democracy were called into play in the South; and, in some sections, law openly yielded supremacy to popular passion in the cases of suspected Abolitionists. Southern conventions, on all sorts of subjects, became common; and in these meetings, permeated by a dawning sense of Southern nationality, hardly any proposition looking to Southern independence of the North was met with disfavour.

Progress of Disunion.

209. Calhoun, in his last and greatest speech, called attention to the manner in which one tie after another was snapping. But he ignored the real peril of the situation—its dangerous facts: that the South was steadily growing weaker in comparison with the North, and more unable to secure a wider area for the slave system; that it was therefore being steadily forced into demanding active Congressional protection for slavery in the Territories; that the North would never submit to this; and that the South must submit or bring about a collision by attempting to secede.

Fugitive Slave Law.

Kansas-Nebraska Act.

210. Anti-slavery feeling in the North was stimulated by the manner in which the Fugitive Slave Law was enforced immediately after 1850. The chase after fugitive slaves was prosecuted in many cases with circumstances of revolting brutality, and features of the slave system which had been tacitly looked upon as fictitious were brought home to the heart of the free states. (See Fugitive Slave Laws.) The added feeling showed its force when the Kansas-Nebraska Act was passed by Congress (1854). It organized the two new Territories of Kansas and Nebraska. Both of them were for ever free soil by the terms of the Missouri Compromise (*q.v.*). But the success of the notion of squatter sovereignty in holding the Democratic party together while destroying the Whig party had intoxicated Stephen A. Douglas (*q.v.*), and other Northern Democrats; and they now applied the doctrine to these Territories. They did not desire "to vote slavery up or down," but left the decision to the people of the two Territories and the essential feature of the Missouri Compromise was specifically repealed.

The "American Party."

The Republican Party.

211. This was the grossest political blunder in American history. The status of slavery had been settled, by the Constitution or by the compromises of 1820 and 1850, on every square foot of American soil; right or wrong, the settlement was made. The Kansas-Nebraska Act took a great mass of territory out of the settlement and flung it into the arena as a prize for which the sections were to struggle. The first result of the act was to throw parties into chaos. An American or "Know-Nothing" (*q.v.*) party, a secret oath-bound organization, pledged to oppose the influence or power of foreign-born citizens, had been formed to take the place of the defunct Whig party. It had been quite successful in state elections for a time, and was now beginning to have larger aspirations. It, like the Whig party, intended to ignore slavery, but, after a few years of life, the questions complicated with slavery entered its organization and divided it also. Even in 1854 many of its leaders in the North were forced to take position against the Kansas-Nebraska Act, while hosts of others joined in the opposition without any party organization. No American party ever rose so swiftly as this latter; with no other party name than the awkward title of "Anti-Nebraska men," it carried the Congressional elections of 1854 at the North, forced many of the former Know-Nothing leaders into union with it, and controlled the House of Representatives of the Congress which met in 1855. The Democratic party, which had been practically the only party since 1852, had now to face the latest and strongest of its broad-constructionist opponents, one which with the nationalizing features of the Federalist and Whig parties combined democratic feelings and methods, and, above all, had a democratic purpose at bottom. It acknowledged, at first, no purpose aimed at slavery, only an intention to exclude slavery from the Territories; but, under such principles, it was the only party which was potentially an anti-slavery party, the only party to which the enslaved labourer of the South could look with the faintest hope of aid in reaching the status of a man. The new party had grasped the function which belonged of right to its great opponent, and it seized with it its opponent's original title. The name Democrat had quite taken the place of that first used—Republican—but the latter had never passed out of popular remembrance and liking at the North. The new party took quick and skilful advantage of this by assuming the old name (see Republican Party), and early in 1856 the two great parties of the present—Democratic and Republican—were drawn up against one another.

Koszta Case.

Japan.

Ostend Manifesto; Filibustering.

212. The foreign relations of the United States during Pierce's term of office were overshadowed by the domestic difficulties, but were of importance. In the Koszta case (1853) national protection had been afforded on foreign soil to a person who had only taken the preliminary steps to naturalization (see Marcy, W. L.). Japan had been opened to American intercourse and commerce (1854). But the question of slavery was more and more thrusting itself even into foreign relations. A great Southern republic, to be founded at first by the slave states, but to take in gradually the whole territory around the Gulf of Mexico and include the West Indies, was soon to be a pretty general ambition among slave-holders, and its first phases appeared during Pierce's administration. Efforts were begun to obtain Cuba from Spain; and the three leading American ministers abroad, meeting at Ostend, united in declaring the possession of Cuba to be essential to the well-being of the United States (1854). (See Buchanan, James.) "Filibustering" expeditions against Cuba or the smaller South American states, intended so to revolutionize them as to lay a basis for an

application to be annexed to the United States, became common, and taxed the energies of the Federal government. But these yielded in importance to the affairs in Kansas.

Kansas.

213. Nebraska was then supposed to be a desert, and attention was directed almost exclusively to Kansas. No sooner had its organization left the matter of slavery to be decided by its "people" than the anti-slavery people of the North and West felt it to be their duty to see that the "people" of the Territory should be anti-slavery in sympathy. Emigrant associations were formed, and these shipped men and families to Kansas, arming them for their protection in the new country. Southern newspapers called for similar measures in the South, but the call was less effective. Southern men without slaves, settling a new state, were uncomfortably apt to prohibit slavery, as in California. Only slaveholders were trusty pro-slavery men; and such were not likely to take slaves to Kansas and risk their ownership on the result of the struggle. But for the people of Missouri, Kansas would have been free soil at once. Lying across the direct road to Kansas, the Missouri settlers blockaded the way of free-state settlers, crossed into Kansas, and voted profusely at the first Territorial election. The story of the contest between the free-state and pro-slavery settlers is told elsewhere (see KANSAS: § *History*); here it need only be said that the struggle passed into a real civil war, the two powers mustering considerable armies, fighting battles, capturing towns and paroling prisoners. The struggle was really over in 1857, and the South was beaten. There were, however, many obstacles yet to be overcome before the new state of Kansas was recognized by Congress, after the withdrawal of the senators of the seceding states (1861).

Election of 1856.

214. In the heat of the Kansas struggle came the presidential election of 1856. The Democrats nominated James Buchanan, declaring, as usual, for the strictest limitations of the powers of the Federal government on a number of points specified, and reaffirming the principle of the Kansas-Nebraska Act—the settlement of slavery by the people of a Territory. The remnant of the Whig party, including the Know-Nothings of the North and those Southern men who wished no further discussion of slavery, nominated the president who had gone out of office in 1853, Millard Fillmore. The Republican party nominated John C. Frémont; the bulk of its manifesto was taken up with protests against attempts to introduce slavery into the Territories; but it showed its broad-construction tendencies by declaring for appropriations of Federal moneys for internal improvements. The Democrats were successful in electing Buchanan;[1] but the position of the party was quite different from the triumph with which it had come out of the election of 1852. It was no longer master of twenty-seven of the thirty-one states; all New England and New York, all the North-West but Indiana and Illinois, all the free states but five, had gone against it; its candidate no longer had a majority of the popular vote. For the first time in the history of the country a distinctly anti-slavery candidate had obtained an electoral vote, and had even come near obtaining the presidency. Fillmore had carried but one state, Maryland; Buchanan had carried the rest of the South, with a few states in the North, and Frémont the rest of the North and none of the South. If things had gone so far that the two sections were to be constituted into opposing political parties, it was evident that the end was near.

The Dred Scott Decision.

215. Oddly enough the constitutionality of the Compromise of 1820 had never happened to come before the Supreme Court for consideration. In 1856–1857 it came up for the first time. One Dred Scott, a Missouri slave who had been taken in 1834 to Illinois, a free state, and in 1836 to Minnesota, within the territory covered by the Compromise, and had some years after being taken back to Missouri in 1838 sued for his freedom, was sold (1852) to a citizen of New York. Scott then transferred his suit from the state to the Federal courts, under the power given them to try suits between citizens of different states, and the case came by appeal to the Supreme Court. Its decision, announced on the 6th of March 1857, put Scott out of court on the ground that a slave, or the descendant of slaves, could not be a citizen of the United States or have any standing in Federal courts. The opinion of Chief Justice Taney went on to attack the validity of the Missouri Compromise, for the reasons that one of the Constitutional functions of Congress was the protection of property; that slaves had been recognized as property by the Constitution, and that Congress was bound to protect, not to prohibit, slavery in the Territories.[2] The mass of the Northern people held that slaves were looked upon by the Constitution, not as property, but as "persons held to service or labour" by state laws; that the Constitutional function of Congress was the protection of liberty as well as of property; and that Congress was thus bound to prohibit, not to protect, slavery in the Territories. A large part of the North flouted the decision of the Supreme Court, and the storm of angry dissent which it aroused did the disunionists good service at the South. From this time the leading newspapers in the South maintained that the radical Southern view first advanced by Calhoun, and but slowly accepted by other Southern leaders, as to the duty of Congress to protect slavery in the Territories, had been confirmed by the Supreme Court; that the Northern Republicans had rejected it; even the "squatter sovereignty" of Northern Democrats could no longer be submitted to by the South.

Admission of Minnesota and Oregon.

John Brown's Raid.

216. The population of the United States in 1860 was over 31,000,000, an increase of more than 8,000,000 in ten years. As the decennial increases of population became larger, so did the divergence of the sections in population, and still more in wealth and resources. Two more free states came in during this period—Minnesota (1858) and Oregon (1859)—and Kansas was clamouring loudly for the same privilege. The free and slave states, which had been almost equal in population in 1790, stood now as 19 to 12. And of the 12,000,000 in slave states, the 4,000,000 slaves and the 250,000 free blacks were not so much a factor of strength as a possible source of weakness and danger. No serious slave rising had ever taken place in the South; but John Brown's attack (1859) on Harper's Ferry as the first move in a project to rouse the slaves (see BROWN, JOHN), and the alarm which it carried through the South, were tokens of a danger which added a new horror to the chances of civil war. It was not wonderful that men, in the hope of finding some compromise by which to avoid such a catastrophe, should be willing to give up everything but principle, nor that offers of compromise should urge Southern leaders further into the fatal belief that "the North would not fight."

Division of the Democratic Party.

217. Northern Democrats, under the lead of Douglas, had been forced already almost to the point of revolt by the determination of Southern senators to prevent the admission of Kansas as a free state, if not to secure her admission as a slave state. When the Democratic convention of 1860 met at Charleston the last strand of the last national political organization parted; the Democratic party itself was split at last by the slavery question. The Southern delegates demanded a declaration in favour of the duty of Congress to protect slavery in the Territories. It was all that the Douglas Democrats could then do to maintain themselves in a few Northern states; such a declaration meant political suicide everywhere, and they voted it down. The convention divided into two bodies. The Southern body adjourned to Richmond, and the Northern and Border state convention to Baltimore. Here the Northern delegates, by seating some delegates friendly to Douglas,

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[1] Buchanan received 174 electoral votes, Frémont 114 and Fillmore 8. The popular vote was: for Buchanan, 1,838,169; for Frémont, 1,341,264; for Fillmore, 874,534.

[2] In his decision Taney, referring to the period before the adoption of the Constitution, wrote: "They (negroes) had for more than a century before been regarded as beings of an inferior order, and altogether unfit to associate with the white race, either in social or political relations; and so far inferior that they had no rights which the white man was bound to respect." This was intended to be merely a historical statement, but it is often incorrectly quoted as if it referred to the status of the negro in 1857.

provoked a further secession of border state delegates, who, in company with the Richmond body, nominated John C. Breckinridge (*q.v.*) and Joseph Lane for president and vice-president. The remainder of the original convention nominated Douglas and H. V. Johnson.

Constitutional Union Party; Republican Party.

218. The remnant of the old Whig and Know-Nothing parties, now calling itself the Constitutional Union party, met at Baltimore and nominated John Bell (*q.v.*) and Edward Everett. The Republican convention met at Chicago. Its "platform" of 1856 had been somewhat broad-constructionist in its nature and leanings, but a strong Democratic element in the party had prevented it from going too far in this direction. The election of 1856 had shown that, with the votes of Pennsylvania and Illinois, the party would have then been successful, and the Democratic element was now ready to take almost anything which would secure the votes of these states. This state of affairs will go to explain the nomination of Abraham Lincoln, of Illinois, for president, with Hannibal Hamlin, a former Democrat, for vice-president, and the declaration of the platform in favour of a protective tariff. The mass of the platform was still devoted to the necessity of excluding slavery from the Territories. To sum up: the Bell party wished to have no discussion of slavery; the Douglas Democrats rested on "squatter sovereignty" and the Compromise of 1850, but would accept the decision of the Supreme Court; the Republicans demanded that Congress should legislate for the prohibition of slavery in the Territories; and the Southern Democrats demanded that Congress should legislate for the protection of slavery in the Territories.

The Parties and Slavery in the Territories.

Election of 1860.

219. No candidate received a majority of the popular vote, Lincoln standing first and Douglas second. But Lincoln and Hamlin had a clear majority of the electoral vote, and so were elected, Breckinridge and Lane coming next.[1] It is worthy of mention that, up to the last hours of Lincoln's first term of office, Congress would always have contained a majority opposed to him but for the absence of the members from the seceding states. The interests of the South and even of slavery were thus safe enough under an anti-slavery president. But the drift of events was too plain. Nullification had come and gone, and the nation feared it no longer. Even secession by a single state was now almost out of the question; the letters of Southern governors in 1860, in consultation on the state of affairs, agree that no state would secede without assurances of support by others. If this crisis were allowed to slip by without action, even a sectional secession would soon be impossible.

Secession.

220. In October 1860 Governor W. H. Gist, of South Carolina, sent a letter to the governor of each of the other cotton states except Texas, asking co-operation in case South Carolina should resolve upon secession, and the replies were favourable. The democratic revolution which, since 1829, had compelled the legislature to give the choice of presidential electors to the people of the states had not affected South Carolina; her electors were still chosen by the legislature. That body, after having chosen the state's electors on the 6th of November, remained in session until the telegraph had brought assurances that Lincoln had secured a sufficient number of electors to ensure his election; it then (on the 10th) summoned a state convention and adjourned. The state convention, which is a legislative body chosen for a special purpose, met first at Columbia and then at Charleston, and on the 20th of December unanimously passed an "ordinance of secession," repealing the acts by which the state had ratified the Constitution and its amendments, and dissolving "the union now subsisting between South Carolina and other states, under the name of the 'United States of America.'" The convention took all steps necessary to prepare for war, and adjourned. Similar ordinances were passed by conventions in Mississippi (Jan. 9, 1861), Florida (Jan. 10), Alabama (Jan. 11), Georgia (Jan. 19), Louisiana (Jan. 26) and Texas (Feb. 1).

The Argument for Secession.

221. The opposition in the South did not deny the right to secede, but the expediency of its exercise. Their effort was to elect delegates to the state conventions who would vote not to secede. They were beaten, says A. H. Stephens, by the cry, originally uttered by T. R. R. Cobb before his state legislature (Nov. 12, 1860), "we can make better terms out of the Union than in it." That is, the states were to withdraw individually, suspend the functions of the Federal government within their jurisdiction for the time, consider maturely any proposals for guarantees for their rights in the Union, and return as soon as satisfactory guarantees should be given. A second point to be noted is the difference between the notions of a state convention prevalent in the North and in the South. The Northern state convention was generally considered as a preliminary body, whose action was not complete or valid until ratified by a popular vote. The Southern state convention was looked upon as the incarnation of the sovereignty of the state, and its action was not supposed to need a popular ratification. When the conventions of the seceding states had adopted the ordinances of secession, they proceeded to other business. They appointed delegates, who met at Montgomery, the capital of Alabama, formed a provisional constitution (Feb. 8) for the "Confederate States," chose a provisional president and vice-president (Jefferson Davis and A. H. Stephens), and established an army, treasury, and other executive departments. The president and vice-president were inaugurated on the 18th of February. The permanent constitution, adopted on the 11th of March, was copied from that of the United States, with variations meant to maintain state sovereignty, to give the cabinet seats in Congress, and to prevent the grant of bounties or any protective features in the tariff or the maintenance of internal improvements at general expense; and it expressly provided that in all the territory belonging to the Confederacy but lying without the limits of the several states "the institution of negro slavery, as it now exists in the Confederate States, shall be recognized and protected by Congress and by the Territorial government" (see CONFEDERATE STATES OF AMERICA).

Action at the State Conventions.

The "Confederate States."

Constitutional Rights.

222. Under what claim of Constitutional right all this was done passes comprehension. That a state convention should have the final power of decision on the question which it was summoned to consider is quite as radical doctrine as has yet been heard of; that a state convention, summoned to consider the one question of secession, should go on, with no appeal to any further popular authority or mandate, to send delegates to meet those of other states and form a new national government, which could only exist by warring on the United States, is a novel feature in American Constitutional law. It was revolution or nothing. Only in Texas, where the call of the state convention was so irregular that a popular vote could hardly be escaped, was any popular vote allowed. Elsewhere the functions of the voter ceased when he voted for delegates to the state convention; he could only look on helplessly while that body went on to constitute him a citizen of a new nation.

The Border States.

223. The Border states were in two tiers—North Carolina, Tennessee and Arkansas next to the seceding states, and Delaware, Maryland, Virginia, Kentucky and Missouri next to the free states. None of these was willing to secede. There was, however, one force which might draw them into secession. A state which did not wish to secede, but believed in state sovereignty and the abstract right of secession, would be inclined to take up arms to resist any attempt by the Federal government to coerce a seceding state. In this way, in the following spring, the original seven seceding states were reinforced by four of the Border states.

224. In the North and West surprisingly little attention was given to the systematic course of procedure along the

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[1] Lincoln received 180 electoral votes, Breckinridge 72, Bell 39 and Douglas 12. Their popular votes were 1,866,352, 847,514, 587,830 and 1,375,157 respectively.

Feeling in the North.

Gulf. The people of those sections were very busy; they had heard much of this talk before, and looked upon it as a kind of stage-thunder, the inevitable accompaniment of recent presidential elections. Republican politicians, with the exception of a few, were inclined to refrain from public declarations of intention. Some of them such as Seward, showed a disposition to let the "erring sisters" depart in peace, expecting to make the loss good by accessions from Canada. A few, like Senator Zachariah Chandler, believed that there would be "blood-letting," but most of them were still doubtful as to the future. In the North the leaders and the people generally shrank from the prospect of war, and many were prepared to make radical concessions to avert hostilities. Among the various proposals to this end that offered in the Senate by John J. Crittenden, of Kentucky, and known as the Crittenden Compromise, was perhaps received with most favour. This took the form of six proposed amendments to the Constitution, of which two were virtually a re-phrasing of the essential feature of the Missouri Compromise and of the principle of popular or squatter sovereignty, and others provided that the national government should pay to the owner of any fugitive slave, whose return was prevented by opposition in the North, the full value of such slave, and prohibited the abolition of slavery in the District of Columbia "so long as it exists in the adjoining states of Virginia and Maryland or either." This proposed compromise was rejected by the Senate by a close vote on the 2nd of March 1861. A Peace Congress, called by Virginia, met in Washington from the 4th to the 27th of February 1861, 21 states being represented, and proposed a constitutional amendment embodying changes very similar to those of the Crittenden Compromise, but its proposal was not acted upon by Congress. Democratic politicians were hide-bound by their repetition of the phrase "voluntary Union"; they had not yet hit upon the theory which carried the War Democrats through the final struggle, that the sovereign state of New York could make war upon the sovereign state of South Carolina for the unfriendly act of secession, and that the war was waged by the non-seceding against the seceding states. President Buchanan publicly condemned the doctrine of secession, though he added a confession of his inability to see how secession was to be prevented if a state should be so wilful as to attempt it. Congress did nothing, except to admit Kansas as a free state and adopt the protective Morrill tariff; even after its members from the seceding states had withdrawn, those who remained made no preparations for conflict, and, at their adjournment in March 1861, left the Federal government naked and helpless.

Admission of Kansas; Morrill Tariff of 1861.

The "War Governors."

225. The only sign of life in the body politic, the half-awakened word of warning from the Democracy of the North and West, was its choice of governors of states. A remarkable group of men, soon to be known as the "war governors"—Israel Washburn of Maine, Erastus Fairbanks of Vermont, Ichabod Goodwin of New Hampshire, John Albion Andrew of Massachusetts, William Sprague of Rhode Island, William Alfred Buckingham of Connecticut, Edwin Dennison Morgan of New York, Charles Smith Olden of New Jersey, Andrew Gregg Curtin of Pennsylvania, William Dennison of Ohio, Oliver Perry Morton of Indiana, Richard Yates of Illinois, Austin Blair of Michigan, Alexander Williams Randall of Wisconsin, Samuel Jordan Kirkwood of Iowa, and Alexander Ramsey of Minnesota—held the executive powers of the Northern states in 1861–1862. Some of these governors, such as Andrew and Buckingham, as they saw the struggle come nearer, went so far as to order the purchase of warlike material for their states on their private responsibility, and their action saved days of time.

Seizure of United States Property.

226. The little army of the United States had been almost put out of consideration; wherever its detachments could be found in the South they were surrounded and forced to surrender and were transferred to the North. After secession, and in some of the states even before it, the forts, arsenals, mints, custom-houses, ship-yards and public property of the United States had been seized by authority of the state, and these were held until transferred to the new Confederate States organization. In the first two months of 1861 the authority of the United States was paralysed in seven states, and in at least seven more its future authority seemed of very doubtful duration.

Position of the Remaining Forts.

227. Only a few forts, of all the magnificent structures with which the nation had dotted the Southern coast, remained to it—the forts near Key West, Fortress Monroe at the mouth of Chesapeake Bay, Fort Pickens at Pensacola and Fort Sumter in Charleston harbour. Both the last-named were beleaguered by hostile batteries, but the administration of President Buchanan, intent on maintaining the peace until the new administration should come in, instructed their commanding officers to refrain from any acts tending to open conflict. The Federal officers, therefore, were obliged to look idly on while every preparation was made for their destruction, and even while a vessel bearing supplies for Fort Sumter was driven back by the batteries between it and the sea.

Slavery and Disunion.

228. The divergence between the two sections of the country had thus passed into disunion, and was soon to pass into open hostility. The legal recognition of the custom of slavery, acting upon and reacted upon by every step in their economic development and every difference in their natural characteristics, surroundings and institutions, had carried North and South further and faster apart, until the elements of a distinct nationality had appeared in the latter. Slavery had had somewhat the same effect on the South that democracy had had on the colonies. In the latter case the aristocracy of the mother-country had made a very feeble struggle to maintain the unity of its empire. It remained to be seen, in the American case, whether democracy would do better.

K.—*The Civil War, 1861–1865.*

Embarrassments of the Government.

229. Secession had taken away many of the men who had for years managed the Federal government, and who understood its workings. Lincoln's party was in power for the first time; his officers were new to the routine of Federal administration; and the circumstances with which they were called upon to deal were such as to daunt any spirit. The government had become so nearly bankrupt in the closing days of Buchanan's administration that it had only escaped by paying double interest, and that by the special favour of the New York banks, which obtained in return the appointment of John A. Dix as secretary of the treasury. The army had been almost broken up by captures of men and material and by resignations of competent and trusted officers. The navy had come to such a pass that, in February 1861, a House committee reported that only two vessels, one of twenty, the other of two guns, were available for the defence of the entire Atlantic coast. And, to complicate all difficulties, a horde of clamorous office-seekers crowded Washington.

Fort Sumter. Rising in the North.

230. Before many weeks of Lincoln's administration had passed, the starting of an expedition to provision Fort Sumter brought on an attack by the batteries around the fort, and after a bombardment of 36 hours the fort surrendered (April 14, 1861). It is not necessary to rehearse the familiar story of the outburst of feeling which followed this event and the proclamation of President Lincoln calling for volunteers. The 75,000 volunteers called for were supplied three or four times over, and those who were refused felt the refusal as a personal deprivation.

The North-West.

231. There had been some belief in the South that the North-West would take no part in the impending conflict, and that its people could be persuaded to keep up friendly relations with the new nationality until the final treaty of peace should establish all the fragments of the late Union upon an international basis. In the spring months of 1861 Douglas, who had long been

denounced as the tool of the Southern slave-holders, was spending the closing days of life in expressing the determination of the North-West that it would never submit to have "a line of custom-houses" between it and the ocean. The batteries which Confederate authority was erecting on the banks of the Mississippi were fuel to the flame. Far-off California, which had been considered neutral by all parties, pronounced as unequivocally for the national authority.

"Following the State."

232. The shock of arms put an end to opposition in the South as well. The peculiar isolation of life in the South precluded the more ignorant voter from any comparisons of the power of his state with any other; to him it was almost inconceivable that his state should own or have a superior. The better educated men, of wider experience, had been trained to think state sovereignty the foundation of civil liberty, and, when their state spoke, they felt bound to "follow their state." The president of the Confederate States issued his call for men, and it also was more than met.

The Border States.

233. Lincoln's call for troops met with an angry reception wherever the doctrine of state sovereignty had a foothold. The governors of the Border states generally returned it with a refusal to furnish any troops. Two states, North Carolina and Arkansas, seceded and joined the Confederate States. In two others, Virginia and Tennessee, the state politicians formed "military leagues" with the Confederacy, allowing Confederate troops to take possession of the states, and then submitted the question of secession to "popular vote." The secession of these states was thus accomplished, and Richmond became the Confederate capital. The same process was attempted in Missouri, but failed, and the state remained loyal. The politician class in Maryland and Kentucky took the extraordinary course of attempting to maintain neutrality; but the growing power of the Federal government soon enabled the people of the two states to resume control of their governments and give consistent support to the Union. Kentucky, however, had troops in the Confederate armies; and one of her citizens, the late vice-president, John C. Breckinridge, left his place in the Senate and became an officer in the Confederate service. Delaware cast her lot from the first with the Union.

Civil War.

234. The first blood of the war was shed in the streets of Baltimore, when a mob attempted to stop Massachusetts troops on their way to Washington (April 19). For a time there was difficulty in getting troops through Maryland because of the active hostility of a part of its people, but this was overcome, and the national capital was made secure. The Confederate lines had been pushed up to Manassas Junction, about 30 m. from Washington. When Congress, called into special session by the president for the 4th of July, came together, the outline of the Confederate States had been fixed. Their line of defence held the left bank of the Potomac from Fortress Monroe nearly to Washington; thence, at a distance of some 30 m. from the river, to Harper's Ferry; thence through the mountains of western Virginia and the southern part of Kentucky, crossing the Mississippi a little below Cairo; thence through southern Missouri to the eastern border of Kansas; and thence south-west through the Indian Territory and along the northern boundary of Texas to the Rio Grande. The length of the line, including also the Atlantic and Gulf coasts, has been estimated at 11,000 m. The territory within it comprised about 800,000 sq. m., with a population of over 9,000,000 and great natural resources. Its cotton was almost essential to the manufactories of the world; in exchange for it every munition of war could be procured; and it was hardly possible to blockade a coast over 3000 m. in length, on which the blockading force had but one port of refuge, and that about the middle of the line. Nevertheless President Lincoln issued his first call for troops on the 15th of April, President Davis then issued a proclamation (on the 17th) offering letters of marque and reprisal against the commerce of the United States to private vessels, and on the 19th Lincoln answered with a proclamation announcing the blockade of the Southern coast. The news brought out proclamations of neutrality from Great Britain and France, and, according to subsequent decisions of the Supreme Court, made the struggle a civil war, though the minority held that this did not occur legally until the act of Congress of the 13th of July 1861, authorizing the president, in case of insurrection, to shut up ports and suspend commercial intercourse with the revolted district.

The Blockade.

Suspension of "Habeas Corpus."

235. The president found himself compelled to assume powers never granted to the executive authority, trusting to the subsequent action of Congress to validate his action. He had to raise and support armies and navies; he even had to authorize seizures of necessary property, of railroad and telegraph lines, arrests of suspected persons, and the suspension of the writ of habeas corpus in certain districts. Congress supported him, and proceeded in 1863 to give the president power to suspend the writ anywhere in the United States; this power he promptly exercised. The Supreme Court, after the war, in the Milligan case (4 Wallace, 133) decided that no branch of the government had power to suspend the writ in districts where the courts were open—that the *privilege* of the writ might be suspended as to persons properly involved in the war, but that the writ was still to issue, the court deciding whether the person came within the classes to whom the suspension applied. This decision, however, did not come until "arbitrary arrests," as they were called, had been a feature of the entire war. A similar suspension took place in the Confederate States.

Congress.

236. When Congress met (July 4, 1861) the absence of Southern members had made it heavily Republican. It decided to consider no business but that connected with the war, authorized a loan and the raising of 500,000 volunteers, and made confiscation of property a penalty of rebellion. While it was in session the first serious battle of the war—Bull Run, or Manassas—took place (July 21), and resulted in the defeat of the Federal army. (For this and the other battles of the war see American Civil War, and the supplementary articles dealing with particular battles and campaigns.) The over-zealous action of a naval officer in taking the Confederate envoys James M. Mason and John Slidell out of the British steamer "Trent" sailing between two neutral ports almost brought about a collision between the United States and Great Britain in November. But the American precedents were all against the United States, and the envoys were given up.

Bull Run.

The "Trent" Case.

Paper Currency; Slavery.

237. The broad-construction tendencies of the Republican party showed themselves more plainly as the war grew more serious; there was an increasing disposition to cut every knot by legislation, with less regard to the constitutionality of the legislation. A paper currency, commonly known as "greenbacks" (*q.v.*), was adopted and made legal tender (Feb. 25, 1862). The first symptoms of a disposition to attack slavery appeared: slavery was prohibited (April 16) in the District of Columbia and the Territories (June 19); the army was forbidden to surrender escaped slaves to their owners; and slaves of insurgents were ordered to be confiscated. In addition to a homestead act (see Homestead and Exemption Laws) giving public lands to actual settlers at reduced rates, Congress began a further development of the system of granting public lands to railways. Another important act (1862) granted public lands for the establishment of agricultural and mechanical colleges (see Morrill, J. S.).

Railways in 1850.

238. The railway system of the United States was but twenty years old in 1850, but it had begun to assume some consistency. The day of short and disconnected lines had passed, and the connexions which were to develop into railway systems had appeared. Consolidation of smaller companies had begun; the all-rail route across the state of New York was made up of more than a dozen original companies at its consolidation in 1853. The Erie railway, chartered in 1832, was completed from

Land Grants.

Piermont to Dunkirk, New York, in 1851; and another line—the Pennsylvania—was completed from Harrisburg to Pittston, Pennsylvania, in 1854. These were at least the germs of great trunk lines. The cost of American railways has been only from one-half to one-fourth of the cost of European railways; but an investment in a Far Western railway in 1850–1860 was an extra-hazardous risk. Not only did social conditions make any form of business hazardous; the new railway often had to enter a territory bare of population, and there create its own towns, farms and traffic. Whether it could do so was so doubtful as to make additional inducements to capital necessary. The means attempted by Congress in 1850, in the case of the Illinois Central railroad, was to grant public lands to the corporation, reserving to the United States the alternate sections. At first grants were made to the states for the benefit of the corporations; the act of 1862 made the grant directly to the corporation.

The Pacific Railways.

239. The vital military and political necessity of an immediate railway connexion with the Pacific coast was hardly open to doubt in 1862; but the necessity hardly justified the terms which were offered and taken. The Union Pacific railroad was incorporated; the United States government was to issue to it bonds, on the completion of each 40 m., to the amount of $16,000 per mile, to be a first mortgage; through Utah and Nevada the aid was to be doubled, and for some 300 m. of mountain building to be trebled; and, in addition to this, alternate sections of land were granted. The land-grant system, thus begun, was carried on extensively, the largest single grants being those of 47,000,000 acres to the Northern Pacific (1864) and of 42,000,000 to the Atlantic & Pacific line (1866).

Prices in Paper.

240. Specie payments had been suspended almost everywhere towards the end of 1861; but the price of gold was but 102·5 at the beginning of 1862. About May its price in paper currency began to rise. It touched 170 during the next year, and 285 in 1864; but the real price probably never went much above 250. Other articles felt the influence in currency prices. Mr D. A. Wells, in 1866, estimated that prices and rents had risen 90% since 1861, while wages had not risen more than 60%.

Tariff and Internal Revenue Taxation.

241. The duties on imports were driven higher than the original Morrill tariff had ever contemplated. The average rates, which had been 18% on dutiable articles and 12% on the aggregate in 1860–1861, rose, before the end of the war, to nearly 50% on dutiable articles and 35% on the aggregate. Domestic manufactures sprang into new life under such hothouse encouragement; every one who had spare wealth converted it into manufacturing capital. The probability of such a result had been the means of getting votes for an increased tariff; free traders had voted for it as well as protectionists. For the tariff was only a means of getting capital into positions in which taxation could be applied to it, and the "internal revenue" taxation was merciless beyond precedent. The annual increase of wealth from capital was then about $550,000,000; the internal revenue taxation on it rose in 1866 to $310,000,000, or nearly 60%.

Bonds.

Paper Issues in the South.

242. The stress of all this upon the poor must have been great, but it was relieved in part by the bond system on which the war was conducted. While the armies and navies were shooting off large blocks of the crops of 1880 or 1890, work and wages were abundant for all who were competent for them. It is true, then, that the poor paid most of the cost of the war; it is also true that the poor had shared in that anticipation of the future which had been forced on the country, and that, when the drafts on the future came to be redeemed, it was done mainly by taxation on luxuries. The destruction of a Northern railway meant more work for Northern iron mills and their workmen. The destruction of a Southern road was an unmitigated injury; it had to be made good at once, by paper issues; the South could make no drafts on the future, by bond issues, for the blockade had put cotton out of the game, and Southern bonds were hardly saleable. Every expense had to be met by paper issues; each issue forced prices higher; every rise in prices called for an increased issue of paper, with increased effects for evil. *A Rebel War-Clerk's Diary* gives the following as the prices in the Richmond market for May 1864: "Boots, $200; coats, $350; pantaloons, $100; shoes, $125; flour, $275 per barrel; meal, $60 to $80 per bushel; bacon, $9 per pound; no beef in market; chickens, $30 per pair; shad, $20; potatoes, $25 per bushel; turnip greens, $4 per peck; white beans, $4 per quart or $120 per bushel; butter, $15 per pound; lard, same; wood, $50 per cord." How the rise in wages, always far slower than other prices, could meet such prices as these one must be left to imagine. Most of the burden was sustained by the women of the South.

Manufactures.

243. The complete lack of manufactures told heavily against the South from the beginning. As men were drawn from agriculture in the North and West, the increased demand for labour was shaded off into an increased demand for agricultural machinery; every increased percentage of power in reaping-machines liberated so many men for service at the front. The reaping-machines of the South—the slaves—were incapable of any such improvement, and, besides, required the presence of a portion of the possible fighting-men at home to watch them. There is an evident significance in the exemption from military duty in the Confederate States of "one agriculturist on such farm, where there is no white male adult not liable to duty, employing 15 able-bodied slaves between ten and fifty years of age." But, to the honour of the enslaved race, no insurrection took place.

Confederate Congress and President.

244. The pressing need for men in the army made the Confederate Congress utterly unable to withstand the growth of executive power. Its bills were prepared by the cabinet, and the action of Congress was quite perfunctory. The suspension of the writ of *habeas corpus*, and the vast powers granted to President Davis, or assumed by him under the plea of military necessity, with the absence of a watchful and well-informed public opinion, made the Confederate government by degrees almost a despotism. It was not until the closing months of the war that the expiring Confederate Congress mustered up courage enough to oppose the president's will. (See CONFEDERATE STATES OF AMERICA.) The organized and even radical opposition to the war in the North, the meddlesomeness of Congress and its "committees on the conduct of the war," were no doubt unpleasant to Lincoln but they carried the country through the crisis without the effects visible in the South.

National Banking System.

245. Another act of Federal legislation—the National Bank Act (Feb. 25, 1863; supplemented by the act of June 3, 1864)—should be mentioned here, as it was closely connected with the sale of bonds. The banks were to be organized, and, on depositing United States bonds at Washington, were to be permitted to issue notes up to 90% of the value of the bonds deposited. As the redemption of the notes was thus assured, they circulated without question all over the United States. By a subsequent act (1865) the remaining state bank circulation was taxed out of existence. (See BANKS AND BANKING: *United States.*)

Admission of West Virginia.

246. At the beginning of 1862 the lines of demarcation between the two powers had become plainly marked. The western part of Virginia had separated itself from the parent state, and was admitted as a state (1863) under the name of West Virginia. It was certain that Delaware, Maryland, Kentucky and Missouri had been saved to the Union, and that the battle was to be fought out in the territory to the south of them.

247. At the beginning of the war the people and leaders of the North had not desired to interfere with slavery, but circumstances had been too strong for them. Lincoln had declared that he meant to save the Union as he best could—by preserving slavery, by destroying it, or by destroying part

The Emancipation Proclamation.

and preserving part of it. Just after the battle of Antietam (17 Sept. 1862) he issued his proclamation calling on the revolted states to return to their allegiance before the next year, otherwise their slaves would be declared free men. No state returned, and the threatened declaration was issued on the 1st of January 1863. As president, Lincoln could issue no such declaration; as commander-in-chief of the armies and navies of the United States he could issue directions only as to the territory within his lines; but the Emancipation Proclamation applied only to territory outside of his lines. It has therefore been debated whether the proclamation was in reality of any force. It may fairly be taken as an announcement of the policy which was to guide the army, and as a declaration of freedom taking effect as the lines advanced. At all events, this was its exact effect. Its international importance was far greater. The locking up of the world's source of cotton supply had been a general calamity, and the Confederate government and people had steadily expected that the English and French governments, or at least one of them, would intervene in the war for the purpose of raising the blockade and releasing the Southern cotton. The conversion of the struggle into a crusade against slavery made intervention impossible for governments whose peoples had now a controlling influence on their policy and intelligence enough to understand the issue.

Confederate Privateers.

248. Confederate agents in England were numerous and active. Taking advantage of every loophole in the British Foreign Enlistment Act, they built and sent to sea the "Alabama" and "Florida," which for a time almost drove Federal commerce from the ocean. Whenever they were closely pursued by United States vessels they took refuge in neutral ports until a safe opportunity occurred to put to sea again. Another, the "Georgia," was added in 1863. All three were destroyed in 1864. (See ALABAMA ARBITRATION.) Confederate attempts to have ironclads equipped in England and France were unsuccessful.

The Current of Success changes.

249. The turning-point of the war was evidently in the early days of July 1863, when the victories of Vicksburg and Gettysburg came together. The national government had at the beginning cut the Confederate States down to a much smaller area than might well have been expected; its armies had pushed the besieging lines far into the hostile territory, and had held the ground which they had gained; and the war itself had developed a class of generals who cared less for the conquest of territory than for attacking and destroying the opposing armies. The great drafts on the future which the credit of the Federal government enabled the North to make gave it also a startling appearance of prosperity; so far from feeling the war, it was driving production of every kind to a higher pitch than ever before.

250. The war had not merely developed improved weapons and munitions of war; it had also spurred the people on to a more careful attention to the welfare of the soldiers, the fighting men drawn from their own number. The sanitary commission, the Christian commission, and other voluntary associations for the physical and moral care of soldiers, received and disbursed very large sums. The national government was paying an average amount of $2,000,000 per day for the prosecution of the war, and, in spite of the severest taxation, the debt grew to $500,000,000 in June 1862, to twice that amount a year later, to $1,700,000,000 in June 1864, and reached its maximum on the 31st of August 1865—$2,845,907,626. But this lavish expenditure was directed with energy and judgment. The blockading fleets were kept in perfect order and with every condition of success. The railway and telegraph were brought into systematic use for the first time in modern warfare. Late in 1863 Edwin M. Stanton, the secretary of war, moved two corps of 23,000 men from Washington to Chattanooga, 1200 m., in seven days. A year later he moved another corps, 15,000 strong, from Tennessee to Washington in eleven days, and within a month had collected vessels and transferred it to North Carolina.

Conscription.

251. On the other hand, the Federal armies now held almost all the great southern through lines of railroad, except the Georgia lines and those which supplied Lee from the South. The want of the Southern people was merely growing in degree, not in kind. The conscription, sweeping from the first, had become omnivorous; towards the end of the war every man between seventeen and fifty-five was legally liable to service, and in practice the only limit was physical incapacity. In 1863 the Federal government also was driven to conscription. The first attempts to carry it out resulted in forcible resistance in several places, the worst being the "draft riots" in New York (July), when the city was in the hands of the mob for several days. All the resistance was put down; but exemptions and substitute purchases were so freely permitted that the draft in the North had little effect except as a stimulus to the states in filling their quotas of volunteers by voting bounties.

Election of 1864.

Admission of Nevada.

252. In 1864 Lincoln was re-elected with Andrew Johnson as vice-president. The Democratic Convention had declared that, after four years of failure to restore the Union by war, during which the Constitution had been violated in all its parts under the plea of military necessity, a cessation of hostilities ought to be obtained, and had nominated General George B. McClellan and G. H. Pendleton. Farragut's victory in Mobile Bay (Aug. 5), by which he sealed up the last port, except Wilmington, of the blockade-runners, and the evidently staggering condition of the Confederate resistance in the East and the West, were the sharpest commentaries on the Democratic platform; and its candidates carried only three of the twenty-five states which took part in the election.[1] The thirty-sixth state—Nevada—had been admitted in 1864.

Surrender of Lee.

Surrender of Johnston.

253. The actual fighting of the war may be said to have ended with the surrender of General Robert E. Lee to General U.S. Grant at Appomattox, Va., on the 9th of April 1865. All the terms of surrender named by Grant were generous: no private property was to be surrendered; both officers and men were to be dismissed on parole, not to be disturbed by the United States government so long as they preserved their parole and did not violate the laws; and he instructed the officers appointed to receive the paroles "to let all the men who claim to own a horse or mule take the animals home with them to work their little farms." It should be stated, also, to Grant's honour that, when the politicians afterwards undertook to repudiate some of the terms of surrender, he personally intervened and used the power of his own name to force an exact fulfilment. General Joseph E. Johnston, with the only other considerable army in the field, surrendered on much the same terms at Durham Station, N.C. (April 26), after an unsuccessful effort at a broader settlement. All organized resistance had now ceased; Union cavalry were ranging the South, picking up government property or arresting leaders; but it was not until May that the last detached parties of Confederates gave up the contest.

Death of Lincoln.

254. Just after Lee's surrender President Lincoln died by assassination (April 15), the crime of a half-crazed enthusiast. Even this event did not impel the American people to any vindictive use of their success for the punishment of individuals. In the heat of the war, in 1862, Congress had so changed the criminal law that the punishment of treason and rebellion should no longer be death alone, but death or fine and imprisonment. Even this modified punishment was not inflicted. There was no hanging; some of the leaders were imprisoned for a time, but never brought to trial.

The Opposing Armies.

255. The armies of the Confederacy are supposed to have been at their strongest (700,000) at the beginning of 1863; and it is doubtful whether they contained 200,000 men in March 1865. The dissatisfaction of the southern people at the manner in which Davis

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[1] Lincoln received 212 electoral votes and McClellan only 21; but Lincoln's popular vote was only about 407,000 in excess of McClellan's, out of about 4,000,000.

had managed the war seems to have been profound; and it was only converted into hero-worship by the ill-advised action of the Federal government in arresting and imprisoning him. Desertion had become so common in 1864, and the attempts of the Confederate government to force the people into the ranks had become so arbitrary, that the bottom of the Confederacy, the democratic elements which had given it all the success it had ever obtained, had dropped out of it before Sherman moved northward from Savannah; in some parts the people had really taken up arms against the conscripting officers. On the contrary, the numbers of the Federal armies increased steadily until March 1865, when they were a few hundreds over a million. As soon as organized resistance ceased, the disbanding of the men began; they were sent home at the rate of about 300,000 a month, about 50,000 being retained in service as a standing army. The cost of the Civil War has been variously estimated: by Mulhall (*Dictionary of Statistics*, 4th ed., 1899, p. 541) at £555,000,000 and (p. 586) at £740,000,000; by Nicolay and Hay (*Abraham Lincoln*, vol. x., p. 339) at $3,250,000,000 to the North and $1,500,000,000 to the South; by Edward Atkinson (the *Forum*, October 1888, p. 133), including the first three years of Reconstruction at $5,000,000,000 to the North and $3,000,000,000 to the South. The last alone of these estimates is an approximation to the truth. The ordinary receipts of the government for the four fiscal years 1862 to 1865 totalled $729,458,336, as compared with $196,963,373 for the four preceding years, 1858–1861; the difference representing the effort of the treasury to meet the burden of war. In the same period more than $2,600,000,000 was secured in loans upon the credit of the nation; and this total was raised by later borrowings on account of the war to more than $2,800,000,000. The immediate and direct cost of the struggle to the North was therefore about $3,330,000,000. To this sum must be added, in order to obtain the final and total cost: (1) the military pensions paid on account of the war since 1861—about $3,600,000,000 up to 1909, inclusive; (2) the interest on the war debt, approximately $3,024,000,000 in the same period; (3) the expenditures made during the war by state and local governments, which have never been totalled, but may be put at $1,000,000,000; and (4) the abnormal expenditures for army and navy during some years following the war, which may be put, conservatively, at $500,000,000. The result is a total of some $11,450,500,000 for the North alone. But the cost to the South also was enormous; $4,000,000,000 cannot be an exaggeration. It follows that, up to 1909, the cost of the war to the nation had approximated the tremendous total of $15,500,000,000.

Cost of the War.

Results of the War.

256. In return for such an expenditure, and the death of probably 300,000 men on each side, the abiding gain was incalculable. The rich section, which had been kept back in the general development by a single institution, and had been a clog on the advance of the whole country, had been dragged up to a level with the rest of the country. Free labour was soon to show itself far superior to slave labour in the South; and the South was to reap the largest material gain from the destruction of the Civil War. The persistent policy of paying the debt immediately resulted in the higher taxation falling on the richer North and West. As a result of the struggle the moral stigma of slavery was removed. The power of the nation, never before asserted openly, had made a place for itself; and yet the continuing power of the states saved the national power from a development into centralized tyranny. And the new power of the nation, by guaranteeing the restriction of government to a single nation in central North America, gave security against any introduction of international relations, international armament, international wars, and continual war taxation into the territory occupied by the United States. Finally, democracy in America had certainly shown its ability to maintain the unity of its empire.

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The Library of Congress has 333 vols. of *Washington Manuscripts*, 135 vols. of *Jefferson Manuscripts*, 75 vols. of *Madison Manuscripts*, 64 vols. of *Alexander Hamilton Manuscripts*, more than 200 letters between Jackson and Van Buren, a collection of Polk papers, the more important part of Webster's correspondence, a few Clay letters, 22 vols. of Salmon P. Chase papers besides over 6300 letters, and 440 Blennerhassett manuscripts. The Massachusetts Historical Society has the Adams papers; the Historical Society of Pennsylvania has the Buchanan papers; the Historical Society of New Hampshire has a large collection of Webster papers; and the Historical Society of Chicago has some of the Polk papers. Various valuable reports on manuscript materials available to students of this period have been published in the *Annual Reports* of the Historical Manuscripts Commission of the American Historical Association, and there is much valuable material in the *Annual Reports* of the association and in the volumes of the *American Historical Review*. The American Historical Association has published an index in its "Bibliography of American Historical Societies," edited by A. P. C. Griffin, in vol. ii. of its *Annual Report* for 1905 (Washington, 1907). See also, for social and economic sources, *Documentary History of American Industrial Society* (Cleveland, O., 1910 sqq.). Among the most useful published works of the public men of the period are: *The Writings of George Washington* edited by W. C. Ford (14 vols., New York, 1889–1893); *Complete Works of Alexander Hamilton*, edited by H. C. 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L.—*History, 1865–1910.*

257. The capitulation of Lee (April 9, 1865), followed by the assassination of Lincoln (April 15) and the surrender of the last important Confederate army, under J. E. Johnston, marked the end of the era of war and the beginning of that of Reconstruction, a problem which involved a revolution in the social and political structure of the South, in the relation of state and nation in the American Federal Union, and in the economic life of the whole country.

258. Economically the condition of the South was desperate. The means of transport were destroyed; railways and bridges were ruined; Southern securities were valueless; the Confederate currency system was completely disorganized. Great numbers of the emancipated negroes wandered idly from place to place, trusting the Union armies for sustenance, while their former masters toiled in the fields to restore their plantations.

Social and Economic Condition of the South.

259. The social organization of the South had been based on negro slavery. Speaking generally, the large planters had constituted the dominant class, especially in the cotton states; and in the areas of heaviest negro population these planters had belonged for the most part to the old Whig party. Outside of the larger plantation areas, especially in the hill regions and the pine barrens, there was a population of small planters and poor whites who belonged in general to the Democratic party. In the mountain regions, where slavery had hardly existed, there were Union areas, and from the poor whites of this section had come Andrew Johnson, senator and war governor of Tennessee, who was chosen vice-president on the Union ticket with Lincoln in 1864 as a recognition of the Union men of the South. Accidental as was Johnson's elevation to the presidency, there was an element of fitness in it, for the war destroyed the former ruling class in the Southern States and initiated a democratic revolution which continued after the interregnum of negro government. Of this rise of the Southern masses Johnson was representative.

Distrust of President Johnson.

260. The importance of personality in history was clearly illustrated when the wise and sympathetic Lincoln, who had the confidence of the masses of the victorious North, was replaced by Johnson, opinionated and intemperate, whose antecedents as a Tennessean and Democrat, and whose state rights' principles and indifference to Northern ideals of the future of the negro made him distrusted by large numbers of the Union Republican party.

Union Republican Party.

261. The composition of this party was certain to endanger its stability when peace came. It had carried on the war by a coalescence of Republicans, War Democrats, Whigs, Constitutional Unionists and Native Americans, who had rallied to the cause of national unity. At the outset it had asserted that its purpose was not to interfere with the established institutions in slave states, but to defend the Constitution, and to preserve the Union with all the dignity, equality and rights of the several states unimpaired. But the war had destroyed slavery, as well as preserved the Union, and the civil status of the negro and the position of the revolted states now became burning questions, reviving old antagonisms and party factions. To the extremists of the Radical wing it seemed in accordance with

the principles of human liberty that the negro should not only be released from slavery but should also receive full civil rights, including the right to vote on an equality with the whites. This group was also ready to revolutionize Southern society by destroying the old ascendancy of the great planter class. Of this idealistic school of radical Republicans, Charles Sumner, of Massachusetts, was the spokesman in the Senate, and Thaddeus Stevens, of Pennsylvania, in the House.

262. For many years before the war parties had differed on such important questions as the tariff, internal improvements and foreign policy; and the South had used its alliance with the Northern Democracy to resist the economic demands of the industrial interests of the North. A return of Southern congressmen, increased in numbers by the inapplicability to the new conditions of the constitutional provision by which they had representation for only a fraction of the slaves, might mean a revival of the old political situation, with the South and the Northern Democracy once more in the saddle.

Northern Attitude towards the South.

263. Any attempt to restore the South to full rights, therefore, without further provision for securing for the freedmen the reality of their freedom, and without some means of establishing the political control of the victorious party, would create party dissension. Even Lincoln had aroused the bitter opposition of the radical leaders by his generous plan of Reconstruction. Johnson could have secured party support only by important concessions to the powerful leaders in Congress; and these concessions he was temperamentally unable to make. The masses of the North, especially in the first rejoicings over the peace, were not ungenerous in their attitude; and the South, as a whole, accepted the results of defeat in so far as to acquiesce in the permanence of the Union and the emancipation of the slaves, the original issues of the war.

264. In the settlement of the details of Reconstruction, however, there were abundant opportunities for the hatred engendered by the war to flame up once more. As it became clear that the Northern majority was determined to exclude the leaders of the South from political rights in the reconstruction of the Union, and especially as the radicals disclosed their purpose to ensure Republican ascendancy by subjecting the section to the rule of the loyalist whites and, later, to that of the emancipated negroes, good will disappeared, and the South entered upon a fight for its social system. The natural leaders of the people, men of intelligence and property, had been the leaders of the section in the war. Whatever their views had been at first as to secession, the great majority of the Southern people had followed the fortunes of their states. To disfranchise their leaders was to throw the control into the hands of a less able and small minority of whites; to enfranchise the blacks while disfranchising the white leaders was to undertake the task of subordinating the former political people of a section to a different race, just released from slavery, ignorant, untrained, without property and fitted only to follow the leadership of outside elements. The history of this attempt and its failure constitutes much of that of the Reconstruction.

265. These underlying forces were in reality more influential than the constitutional theories which engaged so much of the discussion in Congress, theories which, while they afford evidence of the characteristic desire to proceed constitutionally were really urged in support of, or opposition to, the interests just named.

Theories Regarding the Status of the Southern States.

266. The most extreme northern Democrats, and their southern sympathizers, starting from the premise that constitutionally the Southern states had never been out of the Union, contended that the termination of hostilities restored them to their former rights in the Federal Union unimpaired and without further action. This theory derived support from President Lincoln's view that not states, but assemblages of individuals, had waged war against the government. The theory of the extreme Republican Radicals was formulated by Sumner and Stevens. The former contended that, while the states could not secede, they had by waging war reduced themselves to mere Territories of the United States, entitled only to the rights of Territories under the Constitution. Stevens went further and, appealing to the facts of secession, declared the Southern states conquered provinces, subject to be disposed of under international law at the will of the conqueror. In the end Congress adopted a middle ground, holding that while the states could not leave the Union, they were, in fact, out of normal relations, and that the constitutional right of the Federal government to guarantee republican governments to the various states gave to Congress the power to impose conditions precedent to their rehabilitation.

President Lincoln's Policy.

267. It is necessary to recall the initiation of Reconstruction measures by President Lincoln rightly to understand the position which was taken by President Johnson. Impatient of theoretical discussion, Lincoln laid down practical conditions of restoration in his proclamation of the 8th of December 1863. In this he offered amnesty to those who would take an oath of loyalty for the future and accept the acts of Congress and the proclamation of the president with reference to slaves. From the amnesty he excepted the higher military, civil and diplomatic officers of the Confederacy as well as those who had relinquished judicial stations, seats in Congress, or commissions in the army or navy to aid the rebellion, and those who had treated persons in the Federal service otherwise than lawfully as prisoners of war. The proclamation provided, further, that when in any of the seceding states (except Virginia, where the president had already recognized the loyal government under Governor Francis H. Pierpont) a number of persons not less than one-tenth of the voters in 1860 should have taken the above described oath, and, being qualified voters under the laws of the state in 1860, should have established a state government, republican in form, it should be recognized. Lincoln's comprehension of Southern difficulties was shown in his declaration in this proclamation that the president would not object to such provisions by the states regarding the freedmen as should, while declaring their freedom and providing for their education, recognize their condition as a labouring, landless and homeless class.

Attitude of Congress; the First Reconstruction Bill.

268. Although Lincoln expressly pointed out that the admission of the restored states to representation in Congress rested exclusively with the respective houses, and announced his readiness to consider other plans for Reconstruction, heated opposition by the radicals in Congress was called out by this proclamation. They feared that it did not sufficiently guarantee the abolition of slavery, which up to this time rested on the war powers of the president, and they asserted that it was the right of Congress, rather than that of the president, to determine the conditions and the process of Reconstruction. In a bill which passed the House by a vote of 73 to 59 and was concurred in by the Senate, Congress provided that Reconstruction was to be begun only when a majority of the white male citizens of any one of the Confederate States should take oath to support the Constitution of the United States. The president should then invite them to call a constitutional convention. The electors of this convention would be required to take an oath of allegiance which excluded a much larger class than those deprived of the benefit of the amnesty proclamation, for it eliminated all who had voluntarily borne arms against the United States, or encouraged hostility to it, or voluntarily yielded support to any of the Confederate governments. In addition to entrusting the formation of a constitution to the small minority of thorough-going loyalists, the bill required that the state constitution should exclude a large proportion of the civil and military officers of a Confederate government from the right of voting, and that it should provide that slavery be for ever abolished and that state and Confederate debts of the war period should never be paid. In July 1864 Lincoln gave a "pocket veto" to the bill and issued a proclamation explaining his reasons for refusing to sign, whereupon Benjamin F. Wade and Henry W. Davis (*q.v.*), leaders of

the radicals, violently attacked the president. The triumph of Lincoln in the election of 1864 did not clearly signify the will of the people upon the conditions of Reconstruction, or upon the organ of government to formulate them, for the declaration of the Democratic convention that the war was a failure overshadowed the issue, and the Union party which supported Lincoln was composed of men of all parties.

Thirteenth Amendment.

269. On January 31st 1865 the House concurred in the vote of the Senate in favour of the Thirteenth Amendment to the Constitution abolishing slavery throughout the Union. Four years earlier Congress had submitted to the states another Thirteenth Amendment by the terms of which no amendment should ever authorize Congress to interfere with slavery within the states. But owing to the war this amendment had remained unratified, and now Congress proposed to place beyond constitutional doubt, or the power of states to change it, the emancipation of slaves. By the 18th of December 1865 the amendment had been ratified and was proclaimed in force.

270. In the meantime, Louisiana, in accordance with Lincoln's proclamation, had adopted a constitution and abolished slavery within the state. Owing to the obstructive tactics of Sumner, aided by Democrats in the Senate, Congress adjourned on the 4th of March 1865 without having recognized this new state government as legitimate. "If we are wise and discreet," said Lincoln, "we shall reanimate the states and get their governments in successful operation with order prevailing and the Union re-established before Congress comes together in December."

271. Such was the situation when Johnson took up the presidency upon Lincoln's death. After an interval of uncertainty, in which he threatened vengeance against various Southern leaders and gave the radicals some hope that he would favour negro suffrage, President Johnson accepted the main features of Lincoln's policy. Congress not being in session, he was able to work out an executive Reconstruction on the lines of Lincoln's policy during the summer and autumn of 1865. On the 29th of May he issued a proclamation of amnesty, requiring of those who desired to accept its provisions an oath to support the Constitution and Union, and the laws and proclamations respecting the emancipation of slaves. Certain specified classes of persons were excepted, including certain additions to those excluded by Lincoln, especially "all persons who have voluntarily participated in said rebellion and the estimated value of whose taxable property is over twenty thousand dollars." This provision was characteristic of Johnson, who disliked the Southern planting aristocracy, and aimed at placing the preponderant power in the hands of the Democratic small farmers, who had been his supporters. To those of the excepted classes who would ask pardon from the president, he promised a liberal clemency. As part of his system he issued another proclamation in which he appointed a governor for North Carolina and laid down a plan for Reconstruction. By this proclamation it was made the duty of the governor to call a convention chosen by the loyal people of the state, for the purpose of altering the state constitution and establishing a state government. The right to vote for delegates to this convention was limited to those who had taken the oath of amnesty and who had been qualified to vote prior to the secession of the state. To the state itself was to be left the determination of the future qualifications of electors and office-holders.

Policy of President Johnson.

272. Already Virginia, Tennessee, Louisiana and Arkansas had governments which had been recognized by Lincoln. Between the 13th of June and the 13th of July 1865 Johnson applied the same process which he had outlined for North Carolina to the remaining states of the Confederacy. Before Congress met in December all the Confederate states, except Texas (which delayed until the spring of 1866), had formed constitutions and elected governments in accordance with the presidential plan. All of their legislatures, except that of Mississippi, ratified the Thirteenth Amendment abolishing slavery.

273. Gradually, however, the South turned to its former leaders to shape its policy, and the radical Republicans of the North were alarmed at the rapidity of the process of restoration on these principles. The disorganized and idle condition of the former slaves constituted a serious element in the Southern situation, as Lincoln had foreseen. The negroes expected a grant of land from confiscated Southern estates, and it was difficult to preserve order and to secure a proper labour supply.

Southern "Black Codes."

274. Under these conditions the efforts of the South to provide security for their communities by bodies of white militia were looked upon with apprehension by the North, and there was sufficient conflict between the two races to give colour to charges that the South was not accepting in good faith the emancipation of the slaves. Especially irritating to Northern sentiment were the so-called "black codes" or "peonage laws," passed by the newly elected Southern legislatures. They rested on the belief that it was necessary that the former slaves should be treated as a separate and dependent class, and varied in severity in the different states. Some of these imposed special disabilities upon the negro in the matter of carrying weapons and serving as witnesses. Vagrancy laws and provisions regarding labour contracts which had precedents in colonial and English legislation, but were specifically framed to restrain the negroes only, were common. Mississippi denied them the right to own land, or even to rent it outside of incorporated towns; South Carolina restricted them to husbandry and to farm or domestic service, unless specially licensed. Although several of the Southern states, perceiving that their course was likely to arouse the North to drastic measures, repealed or mitigated the most objectionable laws, the North had received the impression that an attempt had been made to restore slavery in disguised form.

The Freedmen's Bureau.

275. The problem of succouring and protecting the negroes had forced itself upon the attention of the North from the beginning of the war, and on the 3rd of March 1865 Congress had created the Freedmen's Bureau (*q.v.*), with the power to assign abandoned lands, in the states where the war had existed, to the use of the freedmen; to supervise charitable and educational activities among them; to exercise jurisdiction over controversies in which a freedman was a party; and to regulate their labour contracts. The local agents of the bureau were usually Northern men; some of them gave the worst interpretation to Southern conditions and aroused vain hopes in the negroes that the lands of the former masters would be divided among them; and later many of them became active in the political organization of the negro.

276. Although the national government itself had thus recognized that special treatment of the freedmen was necessary, Congress, on assembling in December 1865, was disposed to regard the course of the South in this respect with deep suspicion. Moreover, as the Thirteenth Amendment was now ratified, it was seen that the South, if restored according to the presidential policy, would return to Congress with added representatives for the freed negroes. Only three-fifths of the negro slaves had been counted in apportioning representatives in Congress; though now free they were not allowed to vote.

277. Under the leadership of the Radicals Congress refused, therefore, to receive the representatives of the states which had met the conditions of the president's proclamations. A joint committee of fifteen took the whole subject of Reconstruction under advisement, and a bill was passed continuing the Freedmen's Bureau indefinitely. When this was vetoed by President Johnson (Feb. 19, 1866) Congress retaliated by a concurrent resolution (March 2) against admitting any reconstructed state until Congress declared it entitled to recognition, thus asserting for the legislative body the direction of Reconstruction.

278. While the measure was under consideration the president in an intemperate public address stigmatized the leaders of the radicals by name as labouring to destroy the principles

of the government and even intimated that the assassination of the president was aimed at. It was hardly possible to close the breach after this, and the schism between the president and the leaders of the Union Republican party was completed when Congress passed (April 9, 1866) the Civil Rights Bill over Johnson's veto. The act declared the freedmen to be citizens of the United States with the same civil rights as white persons and entitled to the protection of the Federal government. It provided punishment for those who, relying upon state authority, should discriminate against the negroes.

Breach between the President and Congress; the Civil Rights Bill.

The Fourteenth Amendment.

279. To place this measure beyond the danger of overthrow by courts, or by a change of party majority, on the 13th of June 1866 Congress provided for submitting to the states a Fourteenth Amendment to the Constitution. This gave constitutional guarantee of citizenship and equal civil rights to freedmen, and, in effect, provided that when in any state the right to vote should be denied to any of the male inhabitants twenty-one years of age and citizens of the United States, except for participation in rebellion or other crime, the basis of representation in the state should be reduced in the proportion which the number of such citizens bore to the whole number of male citizens twenty-one years of age in the state. This section of the amendment, therefore, left the states the option between granting the suffrage to the negro or suffering a proportionate reduction in the number of representatives in Congress. It was a fair compromise which might have saved the South from a long period of misrule and the North from the ultimate breakdown of its policy of revolutionizing Southern political control by enfranchisement of the blacks and disfranchisement of the natural leaders of the whites. But the South especially resented that section of the amendment which disqualified for Federal or state office those who, having previously taken an oath to support the Constitution of the United States, afterwards engaged in rebellion, which involved the repudiation of their leaders. The amendment further safeguarded the validity of the United States debt and declared null the war debt of the seceding states and the Confederacy and forbade the payment of claims for emancipation.

280. In order to ensure the passage of this amendment the Radical leaders proposed bills which declared that, after its adoption, any of the seceding states which ratified it should be readmitted to representation. But it also provided that the higher classes of officials of the Confederacy should be ineligible to office in the Federal government. These bills were allowed to await the issue of the next election.

281. For further protection of the rights of the negro, Congress succeeded in passing, over President Johnson's veto, an act continuing the Freedmen's Bureau for two years. Tennessee having ratified the Fourteenth Amendment was (July 24, 1866) restored to representation and Congress adjourned, leaving the issue between the president and the legislative body to the people in the Congressional elections.

Party Realignments.

282. The campaign brought with it some realignment of party. President Johnson having broken with the leaders of the Union Republican party was more and more forced to rely upon Democratic support, although his executive appointments were still made from the ranks of the Republicans. The so-called National Union Convention, which met in Philadelphia in midsummer in an effort to abate sectionalism, and to endorse the president's policy, included a large number of War Democrats who had joined the Union party after the secession of the South, many moderate Southerners, a fragment of the Republican party, and a few Whigs, especially from the Border states. They claimed that the southern States had a right to be represented in Congress. Other meetings friendly to the Radicals were called, and under the designation of Union-Republican party they declared for the Congressional policy. While the campaign for elections to Congress was in progress the president made a journey to Chicago, speaking at various cities *en route* and still further alienating the Republicans by coarse abuse of his opponents. As a result of the autumn elections two-thirds of the members of the House of Representatives were opposed to him. Almost contemporaneously every seceding state except Tennessee rejected the Fourteenth Amendment, and thereby paved the way for the entire triumph of the Northern extremists, who favoured negro suffrage on idealistic grounds or as a means for forcing the South to agree to the Republican policy.

Tenure of Office Act.

283. In the ensuing winter and spring Congress completed the conquest of the president, awed the Supreme Court, and provided a drastic body of legislation to impose negro suffrage on the South. By the Tenure of Office Act (March 2, 1867) Congress forbade the president to remove civil officers without the consent of the Senate, and at the same time by another act required him to issue military orders only through the general of the army (Grant), whom the president was forbidden to remove from command or to assign to duty at another place than Washington, unless at the request of the officer or by the prior assent of the Senate. These extraordinary invasions of the presidential authority were deemed necessary to prevent Johnson from securing control of the military arm of the government, and to protect Edwin Stanton, the secretary of war, and General Grant. Fearing lest the president might take advantage of the interim during which Congress would not be in session, the Fortieth Congress was required to meet on the 4th of March immediately following the expiration of the thirty-ninth.

Reconstruction Act of March 2, 1867.

284. The Reconstruction Act of the 2nd of March 1867 provided for the military government of the Southern states while the drastic policy of Congress was being carried out. It was passed over the veto of the president and declared that no legal governments or adequate protection for life or property existed in the seceding states, except Tennessee. These states it divided into five military districts, each to be placed under the command of a general of the army, whose duty it was to preserve law and order, using at discretion either local civil tribunals or military commissions. But the existing civil governments were declared provisional only and subject to the paramount authority of the United States to abolish, modify, control, or supersede them. The act further provided that a constitutional convention might be elected by the adult male citizens of the state, of whatever race, colour or previous condition, resident in the state for a year, except such as might be disfranchised for rebellion or felony. No persons excluded from holding office under the Fourteenth Amendment were eligible for election to the convention or entitled to vote for its members.

285. When the convention, thus chosen under negro suffrage, and with the exclusion of Confederate leaders, should have framed a state constitution conforming to the Federal Constitution and allowing the franchise to those entitled to vote for the members of the convention, the constitution was to be submitted for the approval of Congress. If this were obtained and if the state adopted the Fourteenth Amendment, and this amendment became a part of the Federal Constitution, then the state should be entitled to representation in Congress; but the senators and representatives sent to Congress were required to take the "iron-clad oath," which excluded those who had fought in the Confederate service, or held office under any government hostile to the United States, or given support to any such authority.

Supplementary Acts.

286. By the pressure of military control Congress thus aimed at forcing the adoption of the Fourteenth Amendment, as well as the acceptance of negro suffrage in the state constitutions of the South. A supplementary act of the 23rd of March 1867 and an act of interpretation passed on the 19th of July completed this policy of "thorough." In the registration of voters the district commanders were required to administer an oath which excluded those disfranchised for rebellion and those who after holding state or Federal office had given aid and comfort to the enemies of the United States.

287. Against this use of military power to govern states in

Supreme Court Decisions.

time of peace the Supreme Court interposed no effective obstacle. Like the executive it was subordinated to Congress. It is true that in the case *ex parte Milligan*, decided in December 1866, the court held military commissions unlawful where the ordinary civil tribunals were open. In the case of *Cummings* v. *Missouri* (Jan. 14, 1867) it decided also that a state test oath excluding Confederate sympathizers from professions was a violation of the prohibition of *ex post facto* laws; and the court (*ex parte Garland*) applied the same rule to the Federal test oath so far as the right of attorneys to practise in Federal courts was concerned.

288. But threats were made by the radicals in Congress to take away the appellate jurisdiction of the court, and even to abolish the tribunal by constitutional amendment. The judges had been closely divided in these cases and, when the real test came, the court refused to set itself in opposition to Congress. When Mississippi attempted to secure an injunction to prevent the president from carrying out the Reconstruction acts, and when Georgia asked the court to enjoin the military officers from enforcing these acts in that state, the Supreme Court refused (April and May 1867), pleading want of jurisdiction. Chief Justice Salmon P. Chase argued that if the president refused to obey the court could not enforce its decree, while if he complied with the order of the court, and if the House of Representatives impeached him for refusing to enforce the law, the Supreme Court would be forced to the vain attempt to enjoin the Senate from sitting as a court of impeachment.

McCardle Case.

289. In one instance it seemed inevitable that the court would clash with Congress; the *McCardle case* involved an editor's arrest by military authority for criticizing that authority and the Reconstruction policy. But Congress, apprehending that the majority of the court would declare the Reconstruction acts unconstitutional, promptly repealed that portion of the act which gave the court jurisdiction in the case, and thus enabled the judges to dismiss the appeal. Afterwards, when the Reconstruction policy had been accomplished, the court, in the case of *Texas* v. *White* (1869), held that the Constitution looked to "an indestructible Union composed of indestructible states"; and that although the secession acts were null, and the Federal obligations of the seceding states remained unimpaired, yet their rights were suspended during the war. It also held that in re-establishing the broken relations of the state with the Union, Congress, under the authority to guarantee to every state a republican form of government, was obliged to regard the freedmen as part of the people of the state, and was entitled to decide what government was the established one. This decision, though it did not involve the direct question of the constitutionality of the Reconstruction acts, harmonized with the general doctrines of the Congressional majority.

Texas v. White.

Impeachment of President Johnson.

290. The powerful leaders of the Republicans in Congress had been awaiting their opportunity to rid themselves of President Johnson by impeachment. After various failures to convince a majority of the House that articles should be preferred against him, an opportunity seemed to present itself when Johnson, in the summer recess of 1867, suspended Secretary Stanton and made General Grant the acting secretary of war. The Senate, on reassembling, refused to consent to the suspension, and General Grant yielded his office to Stanton, thus spoiling the president's plan to force Stanton to appeal to the courts to obtain his office and so test the constitutionality of the Tenure of Office Act. This proved to be a turning-point in Grant's political career, for by his break with Johnson he gained new support among the masses of the Republican party. To Johnson's foes it seemed that the president had delivered himself into their hands when he next defied Congress by taking the decisive step of removing Stanton in defiance of the Tenure of Office Act, and the House announced to the Senate (Feb. 25, 1868) its decision to bring articles of impeachment against the president. But careful reading of the law showed that it could not be relied on as conclusive ground for impeachment, for it provided that cabinet officers should hold office during the term of the president by whom they were appointed and for one month thereafter, subject to removal with the consent of the Senate. As Stanton had been appointed by President Lincoln and had merely continued under Johnson, a doubtful question was raised. The leaders, therefore, incorporated additional charges in the articles of impeachment which they pushed through the House of Representatives. By these the president was accused of attempting to bring the legislative branch into disgrace by his public utterances and of stigmatizing it as a Congress of only part of the states. This raised the question whether it was necessary to show a legal, technical crime or misdemeanour as the necessary ground of impeachment. Had the theory of the leaders that this was not the case been successful, the executive would have been reduced to an obvious dependence upon Congress. In the spring of 1868, however, the trial by the Senate resulted in a verdict of acquittal. (See JOHNSON, ANDREW.)

Acquittal by the Senate.

"Carpet-baggers" and "Scalawags"; the Union League.

291. Meanwhile the military Reconstruction of the South and the organization of the negro vote progressed effectively. The party management of the negroes was conducted by "carpet-baggers," as the Northern men who came South to try their fortunes under these new conditions were nicknamed, and by the white loyalists of the South, to whom was given the name "scalawags." In the work of marshalling the freedmen's vote for the Republican party secret societies like the Loyal League, or Union League (*q.v.*), played an important part. As the newly enfranchised mass of politically untrained negroes passed under Northern influence politically, the Southern whites drew more and more together in most of the former Confederate States, and although they were unable under the existing conditions to take control, they awaited their opportunity. A "Solid South" was forming in which old party divisions gave way to the one dominant antagonism to Republican ascendancy by negro suffrage; and a race antagonism developed which revealed the fact that underneath the slavery question was the negro question.

292. Politically the important fact was that the Republicans had rejected the possibility of reviving the old party lines in the South, and had gambled upon the expectation of wielding the united coloured vote with such leadership and support as might be gained from former Northerners and loyal whites. In the end negro rule failed, as was inevitable when legal disabilities and military force were removed; but the masses of the Southern whites emerged with a power which they had not possessed under the old rule of the planting aristocracy. For the time being, however, negro votes gave control to the Republicans. In South Carolina, Florida, Alabama, Mississippi and Louisiana the negroes were in a majority; in Virginia, North Carolina, Arkansas and Texas they were in the minority; while in Georgia the two races were nearly evenly balanced.

Policy of the South; the Ku-Klux Klan.

293. The white leaders of the South were divided as to the best means of meeting the problem. Some advocated that those entitled to vote should register, and then refrain from the polls, in order to defeat the constitutions made under negro suffrage, for the law required them to be ratified by a majority of the qualified voters. Others would have the white race bear no part in the process. Societies such as the "Ku-Klux Klan" and the "Knights of the White Camelia" were organized to intimidate or restrain the freedmen. But for the present the Republicans carried all before them in the South. Some of the new state constitutions imposed severe disfranchisement upon the former dominant class, and before the end of July 1868 all of the former Confederate States, except Virginia, Mississippi and Texas, had ratified the Fourteenth Amendment, which was proclaimed in effect. By the beginning of 1870 these three states had also ratified the amendment, as had

Georgia a second time, because of her doubtful status at the time of her first ratification.

Six Southern States Restored to the Union.

294. By the summer of 1868 Arkansas, South Carolina, North Carolina, Georgia, Alabama, Louisiana and Florida, having satisfied the requirements of the Reconstruction acts, were entitled to representation in Congress. But Georgia did not choose her senators until after the adjournment of Congress, and, inasmuch as the state excluded the negro members of the legislature in September, Congress on reassembling returned the state to military rule until its submission. Alabama was restored in spite of the fact that her white voters had remained away from the polls in sufficient numbers to prevent a majority of all the voters registered from having ratified the constitution of the state, as the Reconstruction acts had required. The nominating conventions and the campaign of 1868 gave interesting evidence of the trend of political and economic events. Party lines, which had broken down in the North when all united in saving the Union, were once more reasserting themselves. President Johnson, who had been elected by the Union Republican party, had found his most effective support among the Democrats. The Republicans turned to General Grant, a Democrat before the outbreak of the war. His popularity with the Republicans was due not only to his military distinction, but also to his calm judgment in the trying period of the struggle between the president and Congress. He was seriously considered by the Democrats until he broke with Johnson in the Stanton episode.

National Republican Convention; Grant Nominated for the Presidency.

295. The Republican nominating convention met on the 20th of May 1868, a few days after the failure of the impeachment proceedings, and it chose Grant as the candidate for the presidency. The platform supported the Congressional Reconstruction measures. Upon the vital question whether universal negro suffrage should be placed beyond the power of states to repeal it by a new constitutional amendment, the platform declared: "The guarantee by Congress of equal suffrage to all loyal men at the South was demanded by every consideration of public safety, of gratitude and of justice, and must be maintained; while the question of suffrage in all the loyal states properly belongs to the people of those states." Nowhere in the North was the negro an important element in the population, but the North had shown an unwillingness to apply to itself the doctrines of negro rights which had been imposed upon the South. Between 1865 and 1868 Connecticut, Wisconsin, Minnesota, Kansas, Ohio and Michigan had refused to give the negro the right to vote within their own bounds, and this plank was evidence of the unwillingness of the party to make a direct issue of universal negro suffrage. Although the platform failed to indicate the future proposals of the Republican leaders on the negro question, on the topics of finance and currency it clearly showed that the party was controlled by economic interests which were to exercise increasing influence upon it. It pronounced in favour of payment of the public debt, not only according to the letter but the spirit of the laws under which it was contracted. The significance of this lay in its challenge to the Democratic agitation on the currency question.

296. It was this question which gave the tone to the proceedings of the Democracy at their convention in July 1868. The situation can best be presented by a brief review of the financial history just preceding the convention. Together with the discussion over political Reconstruction in the South, Congress and the administration had been obliged to deal with the reconstruction of debt, taxation and currency in the nation at the close of four years of expensive war. At its maximum point the debt had risen to $2,758,000,000, of a complicated variety of forms, and of the total less than one-half was funded. The problems of funding, readjustment of taxation, and resumption of specie payments proved to be so complicated with the industrial growth of the nation that they led to issues destined to exert a long continued influence.

Finance; the Tariff; Internal Revenue.

297. The various war tariffs, passed primarily for the sake of increased revenue, had been shaped for protection under the influence of the manufacturing interests, and they had been framed also with reference to the need of compensating the heavy internal taxes which were imposed upon the manufacturers. When the war ended public sentiment demanded relief from these heavy burdens, and especially from the irksome internal taxes. The rapidly growing grain-raising districts of the Middle West exhibited a lively discontent with the protective tariff, but this did not prevent the passage in 1867 of the Wool and Woollens Act, which discriminated in favour of the woollen manufacturers and raised the *ad valorem* duty on wool. In spite of several large reductions of internal revenue, the national debt was being extinguished with a rapidity that only a prosperous and growing nation could have endured.

The Currency Question; "Greenbacks."

298. The currency question, however, furnished the economic issue which was most debated in the period of Reconstruction. One set of interests aimed at rapidly reducing the volume of the currency by retiring the legal tender notes, or "greenbacks," issued during the war, on the ground that they had been provided only as a war measure, that the country needed a contraction of this currency, and that specie payments would be hastened by the withdrawal of the greenbacks. The secretary of the treasury, Hugh McCulloch, pressed this policy to the foreground, and desired authority to issue bonds to retire these notes. Another set of interests demanded the retention of the greenbacks, supporting their views by arguments varying according to the degree of radicalism of the speakers. The more moderate, like Senator John Sherman, of Ohio, who reflected the views of parts of the West, argued that the recuperation of the nation and the rapid increase of business would absorb the existing currency, while gold would cease to go abroad. Thus, by the increasing credit of the government, specie payment would be automatically resumed, and the holders of currency certificates would convert them into coin obligations at a lower interest rate. Others wished to use the greenbacks to pay the principal of such of the bonds as did not explicitly specify coin as the medium of payment; the most extreme, so far from contracting the currency by retiring the greenbacks, wished to increase this form of money, while diminishing the circulation of the notes of the national banks. The discussion tended to produce a sectional issue with the West against the East, and a social issue with bondholders and the creditor class in general arrayed against the less well-to-do. Congress agreed with Secretary McCulloch, and in the Funding Act of 1866 not only provided for converting short-time securities into long-term bonds, but also for retiring ten million dollars of greenbacks in six months and thereafter not more than four millions monthly. But the agricultural depression of 1866 produced a reaction. Loud demands were made that bonds should be paid in greenbacks instead of coin, that United States securities should be taxed, and the national bank notes suppressed. In 1868, on the eve of the presidential campaign, Congress, alarmed by the extent of these popular demands, suspended the process of contraction by decisive majorities in both houses, after forty million dollars in greenbacks had been retired by the secretary of the treasury.

The "Ohio Idea."

299. Ohio was the storm centre of the agitation. The "Ohio idea" that greenbacks should become the accepted currency of the country was championed by George H. Pendleton, of that state, and his friends now brought him forward for the Democratic nomination for president on this issue. In the national convention of that party they succeeded in incorporating into the platform their demands that there should be one currency for the government and the people, the bondholder and the producer, and that where the obligations of the government did not expressly provide for payment in coin, they should be paid in lawful money (*i.e.* greenbacks) of the United States.

300. But another wing of the Democratic party desired to

make prominent the issue against the Reconstruction measures of the Republicans. This wing added to the platform and declaration that these acts were unconstitutional and void, and the demand that the Southern states should be restored to their former rights and given control over their own elective franchise.

National Democratic Convention; Seymour Nominated for the Presidency.

301. Although the followers of Pendleton had shaped the financial plank of the platform, they could not nominate their leader. The opposition was at first divided between the various candidates. New York, which feared the effect upon the conservative financial interests of the East if Pendleton were nominated, attempted to break the deadlock by proposing an Ohio man, Chief Justice Chase. But eager as Chase was for the presidency he had flatly refused to abandon the views which he held in favour of negro suffrage. Ohio was, therefore, able to retaliate by stampeding the convention in favour of Horatio Seymour, of New York, chairman of the convention. As the war governor of his state he had been a consistent critic of the extremes to which the Federal administration had carried its interpretation of the war power. For vice-president the convention nominated Francis P. Blair, jun., of Missouri, who had denounced the unconstitutionality of the Reconstruction acts in unmeasured terms.

Grant Elected.

302. But the popularity of Grant in the North, together with the Republican strength in the states of the South which had been reconstructed under negro suffrage, gave an easy victory to the Republicans in the election of 1868. Seymour carried only Delaware, New Jersey, New York and Oregon, of the North; and Maryland, Kentucky, Georgia and Louisiana of the South. Tennessee, and five of the former Confederate States, upon which negro suffrage had been imposed under military Reconstruction (North Carolina, South Carolina, Florida, Alabama and Arkansas) voted for Grant. Virginia, Mississippi and Texas had not yet been restored.

Fifteenth Amendment.

303. This decisive victory and the knowledge that it had been won by the advantage of the negro vote in the restored states led the Republican leaders to ignore their recent platform declaration in regard to negro suffrage. Shortly after Congress assembled propositions were made to place the freedman's right to vote beyond the power of the states to change. To do this by constitutional enactment it was necessary to make the provision universal, and Congress, therefore, submitted for ratification the Fifteenth Amendment declaring that "the right of citizens of the United States to vote shall not be denied or abridged by the United States or by any state on account of race, color or previous condition of servitude." Congress was given power to enforce the amendment by appropriate legislation. By the 30th of March 1870 the amendment had been ratified; but it is doubtful whether this could have been accomplished by legislatures chosen on the issue. As it was, the states of Virginia, Mississippi, Texas and Georgia were required to ratify it as a condition of their readmittance to representation in Congress, and the three former states, having been permitted to vote separately on the obnoxious provisions of their constitutions in regard to the disfranchisement of former Confederates, rejected those clauses, adopted the Fifteenth Amendment and were restored in 1870. Georgia, after a new experience of military rule, likewise ratified the amendment, and her representatives were likewise admitted to Congress.

Georgia Readmitted.

New Congressional Measures.

304. As soon as the Fifteenth Amendment was proclaimed in effect, and the military governments of the South were superseded, the dominant party proceeded to enact measures of enforcement. These seemed especially necessary in view of the fact that, partly by intimidation of the coloured vote, Louisiana (1868) and Tennessee (1869) broke away from the Republican column; while in the election of 1870 Tennessee, North Carolina, Georgia, Virginia and Alabama went Democratic. The enforcement legislation of 1870 provided penalties for violating the Fourteenth and Fifteenth amendments and re-enacted the Civil Rights Act of 1866. Jurisdiction was given to the Federal courts to maintain the equality of the races before the law. The underlying doctrine of the acts was that the amendments guaranteed the freedmen against invasion of their rights by the acts of individuals as well as by explicit legislation of the states. In the next two years (1871 and 1872) acts were passed providing for effective Federal supervision of Congressional elections, and the "Ku-Klux Acts" (1871 and 1872) still further increased the power of the Federal courts to enforce the amendments and authorized the president to suspend the writ of *habeas corpus* and use military force to suppress the public disorders occasioned by the attempts to intimidate negro voters. But these stern measures were accompanied by some efforts to restore harmony, such as the repeal of the "iron-clad oath" for ex-Confederates, in 1871, and the passage of the General Amnesty Act of 1872. The North was becoming restive under the long continued use of the Federal military arm within state borders in time of peace, and especially with the results of negro rule under "carpet-bag" leadership.

Extravagance of Reconstruction Governments.

305. In any case the cost of rehabilitating the public works and providing education and the political and judicial institutions which should equally apply to the hitherto non-political class of the blacks, would have been a heavy one. But the legislatures, especially of Louisiana, South Carolina, Tennessee, Arkansas and Alabama, plunged into an extravagance made possible by the fact that the legislatures contained but few representatives who paid considerable taxes, and that they were controlled by Northern men who were sometimes corrupt, and often indifferent to the burdens laid upon the propertied classes of the South. In 1872 it was estimated that the public debts of the eleven reconstructed states amounted to nearly $132,000,000, two-thirds of which was composed of guarantees to corporations, chiefly railway companies. Legislative expenses were grotesquely extravagant, the coloured members in some states engaging in a saturnalia of corrupt expenditure. Gradually this alienated from the so-called Radical party the support of Southern whites, because they resented the concessions of the carpet-bag leaders to the negro vote, because they suffered from the burden of taxation, and above all because race friction increased, drawing the whites together, in spite of former antagonisms between localities and classes.

306. By 1872 a coalition had been formed under the name of Conservatives. But the control of electoral machinery in the strongly centralized state executives chosen by negro votes, and coercion by the Federal authority, still upheld Republican rule in various Southern states. Virginia and North Carolina were practically bankrupt, the capitals of Louisiana, Arkansas and Alabama, where rival state officers claimed possession, were occupied by Federal troops, and many of the governments were so corrupt that only the contemporaneous revelations of rottenness in New York City and in certain branches of the Federal government afford a parallel.

307. It was a time of lax public morals after war, which was ill suited to the difficult experiment of transferring political power to a race recently enslaved. Only the strong arm of the Federal authority sufficed to prevent the whites of the South from overthrowing a condition of things which it was impossible under American political ideas permanently to maintain.

Economic Changes in the South.

308. An important economic reorganization was in progress in the South. White districts were recovering from the war and were becoming the productive cotton areas by the use of fertilizers and by the more intelligent white labour. Cities were rising, and the mines and manufactures of the southern Appalachians were developing. In the black belt, or region of denser negro settlement, the old centres of cotton production and the citadels of the Southern political aristocracy, the blacks became tenant farmers, or workers on shares, but the white farmer in other areas raised his cotton at less cost than the planter who lived in the rich soils of the former cotton areas. The effective and just direction of negro labour was a difficult problem and was aggravated by

the political agitation which intensified race friction. It became evident that there was a negro problem as well as a slavery question, and that the North was unable to solve it.

Foreign Relations.

Maximilian.

Alaska.

309. In the meantime important foreign relations had been dealt with by Secretary William H. Seward, under Johnson, and by Secretary Hamilton Fish, under Grant. Not only were many treaties of commerce and extradition, including one with China, negotiated by Seward, but he also brought about a solution of more important diplomatic problems. The relations of the United States with France and England had been strained in the course of the war, by the evident friendliness of the governments of France and England for the South. Not only had Napoleon III. been inclined to recognize the Confederacy, but he had also taken advantage of the war to throw into Mexico a French army in support of the emperor Maximilian. The temptation to use force while American military prestige was high appealed even to General Grant; but Seward by firm and cautious diplomatic pressure induced France to withdraw her troops in 1867; the power of Maximilian collapsed, and the United States was not compelled to appeal to arms in support of the Monroe Doctrine. Russia's friendly attitude throughout the war was signalized by her offer to sell Alaska to the United States in 1867. Seward promptly accepted it and the treaty was ratified by the Senate and the purchase money ($7,200,000) was voted by the reluctant House, which saw little in the acquisition to commend it. Later years revealed it as one of the nation's treasure houses, particularly of gold and coal.

The "Alabama" Claims.

San Juan Island.

310. With England affairs were even more threatening than with France. Confederate cruisers (notably the "Alabama"), built in England and permitted by the negligence of the British government to go to sea, had nearly swept the American merchant marine from the ocean. Unsettled questions of boundary and the fisheries aggravated the ill feeling, and England's refusal in 1865 to arbitrate made a serious situation. Prolonged negotiations followed a change of attitude of England with regard to arbitration, and in 1870 President Grant recommended to Congress that the United States should pay the claims for damages of the Confederate cruisers, and thus assume them against England. However, in 1871, the treaty of Washington was negotiated under Secretary Fish, by the terms of which England expressed regret for the escape of the cruisers and for their depredations, and provided for arbitration of the fisheries, the north-western boundary, and the "Alabama" claims. Senator Sumner had given fiery expression to demands for indirect damage done by the destruction of our merchant marine and our commerce, and for the expenses of prolonging the war. For a time this so aroused the passions of the two nations as to endanger a solution. But Sumner, who quarrelled with the president, was deposed from the chairmanship of the committee on foreign relations, and Secretary Fish so arranged matters that the Geneva arbitration tribunal ruled these indirect claims out. Thus limited, the case of the United States was victorious, the tribunal awarding damages against Great Britain to the amount of $15,500,000. Two months later the German emperor gave to the United States the disputed north-west boundary, including the San Juan island in Puget Sound. The fisheries controversy was not settled until 1877.

Danish West Indies; Santo Domingo.

The "Virginius" Affair.

311. In the West Indies also important questions were presented. Seward had negotiated a treaty of purchase of the Danish West Indies, but the Senate refused to ratify it, nor did Grant's attempt to acquire Santo Domingo meet with a different fate at the hands of that body (1870). In Cuba another insurrection was in progress. Secretary Fish "pigeon-holed" a proclamation of President Grant recognizing the Cubans as belligerents, and secured a policy of neutrality which endured even the shock of the "Virginius affair" in 1873, when fifty of the men of the filibustering steamer flying the American flag were shot by the Spanish authorities (see SANTIAGO, CUBA). It was shown that the vessel had no right to the flag. Negotiations about an isthmian canal resulted only in a treaty with Nicaragua in 1868 giving to the United States a right of way across the isthmus and in provisions for a government survey of the Panama route. Foreign relations in this period were chiefly significant in that they were conducted in a spirit of restraint and that peace was preserved.

312. It was in the field of domestic concerns, in economic and social development, that the most significant tendencies appeared. The old issues were already diminishing in importance before the other aspect of Reconstruction which came from the revived expansion of the nation toward the West and the new forms taken by the development of American industrial society.

Financial Measures.

313. The Republican party, following the traditions of the Whigs, was especially responsive to the demands of the creditor class, who demanded legislation to conserve their interests. Its victory in 1868 was signalized by the passage in the spring of the following year of an act pledging the faith of the United States to pay in coin or its equivalent all the obligations of the United States, except in cases where the law authorizing the issue had expressly provided otherwise. In 1870 and 1871 refunding acts were passed, providing for the issue of bonds to the total amount of $1,800,000,000, one billion of which was to run for thirty years at 4%. This abandonment of the doctrine of early convertibility was made in order to render the bonds acceptable to capitalists, but in fact they soon went to a premium of over 25%. Long before their maturity the government had a surplus, but although it could then borrow at 2½% these bonds could not be retired. While the legislature was thus scrupulous of the credit of the nation and responsive to the views of capital, the Supreme Court was engaged in deciding the question of whether the legal tender notes (greenbacks) were constitutional. Successive decisions in 1868 determined that they were not legal tender for state taxes, that they were exempt from taxation, and that they were not legal tender in the settlement of contracts providing for payment in specie. In the case of *Hepburn* v. *Griswold* (1870) Chief Justice Chase, under whom, as secretary of the treasury, the notes were first issued, gave the opinion of the court denying that they were legal tender in settlement of contracts made before the first Legal Tender Act, and intimating that they were not legal tender for later contracts. The judges had divided, four to three. Within a year the court was changed by the appointment of one new judge to fill a vacancy, and the addition of another in accordance with a law enlarging the court. In 1871 the former decision was reversed and the constitutionality of the Legal Tender Acts sustained on loose-construction reasoning. In 1884 the court went to the extent of affirming the right of Congress to pass legal tender acts in time of peace, in accordance with the usage of sovereign governments, as an incident to the right of coinage, and it declared that the power to borrow money includes the power to issue obligations in any appropriate form. In 1871 and 1872 Secretary George S. Boutwell illustrated the power of the administration to change the volume of the currency, by issuing in all over six million dollars of legal tender notes; and, following the practice of his predecessors, he sold gold from the treasury to check speculations in that part of the currency. The most noteworthy instance of this was in 1869, when two Wall Street speculators, Jay Gould and James Fisk, jun., attempting to corner the gold market and relying upon a supposed influence in the councils of President Grant, ran up the premium on gold until Secretary Boutwell ordered the sale of gold by the government. The result was the financial crash of "Black Friday."

314. Speculation and the rapid growth of great fortunes were characteristic of the period. The war itself had furnished means for acquiring sudden riches; the reorganization of taxation, currency and banking increased the opportunities as well as the uncertainties; and the opening of new fields of speculative enterprise in the oil fields of Pennsylvania and Ohio and the gold and silver mines of the mountains of the Far West tended in the

Manufactures.

same direction. An enormous development of manufactures resulted from the diminished commerce and increased demand for manufactured goods, the protection afforded by the tariff, the stimulus due to rising prices, and the consumption of the rapidly growing West. It was officially reported in 1869 that "within five years more cotton spindles had been put in motion, more iron furnaces erected, more iron smelted, more bars rolled, more steel made, more coal and copper mined, more lumber sawn and hewn, more houses and shops constructed, more manufactories of different kinds started, and more petroleum collected, refined and exported, than during any equal period in the history of the country."

Pacific Railways.

315. Between the Civil War and 1872 the extension of the nation's activity to the industrial conquest of the great West, as well as the economic reorganization of the East, had a profound effect upon the development of the United States. Between 1862 and 1872 grants were made to the Union Pacific and Central Pacific companies, and to other connecting corporations, for railways from the Missouri to the Pacific, amounting to nearly 33,000,000 acres, and in the same period large loans of funds were made by the general government for this enterprise. Construction advanced rapidly after 1866, and by 1869 an all-rail connexion had been established on the line of the Union Pacific and Central Pacific railways between the East and San Francisco. Various grants were made in these years to other roads, both transcontinental and Middle Western. Between 1850 and 1871 Congress granted about 155,000,000 acres for railway construction, but not all these grants were perfected. It is estimated that some $500,000,000 were invested in the construction of Western railways between 1868 and the panic of 1873, and about 30,000 m. of railway had been added.

Effects of Railway Extension.

316. The effects of this extraordinary extension of railway transportation were immediately apparent. In the Far West the railway lines rapidly made possible the extinction of the bison herds which had occupied the great plains. Divided into the northern and southern herds by the Union Pacific railway in 1869, the southern herds were slaughtered in the period between 1871 and 1879, and the northern herds between 1880 and 1883. This opened the way for the great extension of the cattle country, following the retreat of the Indians. Upon the plains Indians the effect was revolutionary. Their domain had been penetrated by the railways, at the same time that their means of subsistence had been withdrawn. During the Civil War most of these Western tribes had engaged in hostilities against the Federal government. In 1866 and 1867 General George Crook was reducing the Indians of the South-West to submission, while other generals trained in the Civil War were fighting the Indians in the northern plains and Kansas, Nebraska and Oklahoma. By the Peace Commission Act of the 20th of July 1867 commissioners, including General William T. Sherman, were sent to negotiate treaties. As a result the tribes of the Indian Territory were so concentrated as to permit the transfer of other Western tribes to the same region, while the Sioux of the northern plains were given a reservation embracing the western portions of the Dakotas. Discontent with these treaties resulted, however, in hostilities following 1867. Between the close of the war and 1880 some $22,000,000 were expended in Indian wars, although the act of 1871 inaugurated the change of policy whereby the Indians were no longer dealt with by treaty, but were regarded as wards of the nation, to be concentrated on reservations and fed at the expense of the nation under the supervision of Indian agents.

Mining.

317. Part of these Indian difficulties were due to the opening up of new mining areas in the Rocky Mountains, some of them within the Indians' choicest hunting grounds. At the beginning of the Civil War a preliminary mining boom struck Colorado; the rich Comstock lode was opened in Nevada; Arizona was the scene of mining rushes; the Idaho mines were entered; and the Montana ores were discovered; so that in the period of the Civil War itself the Territories of Nevada, Idaho and Montana had been organized and the mountains provisionally occupied from the northern to the southern limit. The discovery of gold in the Black Hills in 1874 continued the same movement. In 1860 the nation produced $156,000 worth of silver, in 1861 over $2,000,000 and in 1873 nearly $36,000,000. In the last-mentioned year the production of gold amounted also to $36,000,000, although in 1860 it had been $46,000,000. Capital in mines and quarries of the United States was over $65,000,000 in 1860, over $245,000,000 in 1870, and nearly $1,500,000,000 in 1880.

Development of the Middle West.

318. This revolution in the life of the great plains and the Rocky Mountains, opening the way to agriculture and to cattle raising, and preparing for the exploitation of the precious metals of that great area, was contemporaneous with the important development of the farming regions of the Middle West. Even during the Civil War the agricultural development of the northern half of the Mississippi Valley had continued. This was aided by the demand for food products to supply the armies and was made possible by the extension of railways, the taking up of the prairie lands through the operation of the Homestead Law of 1862, the marketing of the railway land grants, and the increased use of agricultural machinery in those years. Between 1860 and 1870 the population of the North Central group of states (engaged chiefly in grain raising) increased over 42%, and in the next decade by 34%, a total addition to the population in those two decades of 8,000,000. Between 1870 and 1880 about 200,000 sq. m. were added to the farm lands of the United States, an area almost equal in extent to that of France. In the same decade the North Central states increased their improved farms from near 78,500,000 acres to over 136,800,000 acres. The product of Indian corn about doubled between 1860 and 1880, and that of wheat and oats more than doubled. The addition came chiefly from the Middle West. In 1860 the North Central states raised 95,000,000 bushels of wheat; in 1870 nearly 195,000,000; in 1880 329,000,000. In 1870 the same states produced 439,000,000 bushels of corn; in 1880 they produced over 1,285,000,000.

Railway Abuses.

319. The pressing need of increased transportation facilities had led, as we have seen, to lavish land grants and to subsidies by nation, states and municipalities to the railways. The railways themselves, tempted by these opportunities, had extended their lines in some cases beyond the immediate needs of the regions entered in advance of settlement. Extravagances in construction and operation, aggravated by "construction rings" of railway officials, who secured the contracts for themselves and their friends, and by rolling stock companies who received extravagant prices by favouritism, as well as the watering of stock in the creation of systems by absorption andc onsolidation of railway corporations, brought about a condition where the roads were no longer able to meet the demands of their stockholders for returns on the investment without imposing rates that the Western farmer deemed extortionate. In the competitive development of these roads and in the struggle of business corporations and localities with each other, the roads also discriminated between persons and places. This condition chiefly accounted for the political unrest which manifested itself in the West in the so-called "Granger" movements of the 'seventies.

320. The farmers felt the pressure of the unsettled currency, taxes were very heavy, the protective tariff seemed to them to bear unduly upon the producers of crops which exceeded the home consumption and had to seek the foreign markets. The price of Indian corn, wheat and cotton in the early 'seventies tended to fall as production rose, so that the gold value of the total crop was not greatly increased during the decade after the war, in spite of the extraordinary extension of agricultural settlement and the increase of production. Dissatisfaction with his share in the prosperity of the country, and especially with the charges of middlemen and transportation companies, discontent with the backwardness of rural social conditions, and a desire for larger political influence, all aided in fostering the growth of

organizations designed to promote the farmers' interests. The most influential of these organizations was the Patrons of Husbandry, which was founded in 1867 and spread chiefly after 1872 by local clubs or "granges," especially in the West and South.

The "Granger" Movement.

321. The height of the movement was reached in the autumn of 1874. It threatened the disruption of the old political parties in most of the Middle Western states. By holding the balance of power the Grangers secured legislation in many of these states, fixed maximum railway rates, and provided for regulation through commissions to prevent discriminations. In the reaction after the panic of 1873 (when nearly a fifth of the railway mileage of the United States had passed into the hands of receivers) many of the "Granger laws" were repealed, the regulation was rendered nominal and the railways more than regained their political power in the states; yet the agitation had established the important principle, sanctioned by decisions of the Supreme Court, that the railways were common carriers subject fully to public regulation so far as it was not confiscatory. The movement for regulation of interstate commerce by congressional legislation was begun at this time under the leadership of congressmen from the Granger states. Later efforts were more wisely considered and more effective; but the rural democracy showed its opposition to the increasing political influence of capital, to special privileges and to the attempts of corporations to avoid public control periodically thereafter (see FARMERS' MOVEMENT). The attempt to eliminate the middlemen by co-operative stores and grain elevators was another feature of the time which gained a brief strength but soon declined.

The Tweed Ring.

322. The presidential election of 1872 took place in the midst of this Western upheaval. At the same time in the South the reform Republicans and Democrats were uniting under the name of "Conservatives" against the carpet-bag rule, and control was passing into their hands. A reform movement was active against the evident corruption in national and municipal administrations, for Grant's trust in his appointees was grossly violated. The Tweed Ring was systematically looting New York City, and prior to Tweed's indictment in 1871 (See NEW YORK (City); TAMMANY HALL; TILDEN, S. J.) it was acquiring large power in state legislation. Jay Gould, the railway operator, was one of the signers of Tweed's million dollar bail bond. Civil service reformers, men of moderate views with respect to Reconstruction, such as Carl Schurz, many War Democrats who had adhered to the Union party, and tariff reformers began to break away.

Liberal Republican Movement.

323. The Liberal-Republican movement started in Missouri, and a national convention was called to meet at Cincinnati on the 1st of May 1872. Their platform announced irreconcilable differences on the tariff and left it to the Congressional districts, attacked the corruption of civil service by the administration, supported the results of the war as embodied in the last three amendments and demanded amnesty and local civil government for the South. It opposed further land grants to railways, but denounced repudiation and demanded specie payments in terms which excluded from its support the advocates of inflation of the currency. This effort to combine the opponents of Grant's administration was wrecked by the nomination of Horace Greeley, a strong protectionist, who did not command the confidence of the masses of the disaffected. Although endorsed by the Democrats, Greeley was defeated by Grant, who ran on the record of the Republican party, which now dropped the word Union from its name. Greeley died before the electoral count; the Democrats won only the states of Maryland, Kentucky, Missouri, Tennessee, Georgia and Texas, the votes of Louisiana and Arkansas being thrown out.

Grant Re-elected.

Panic of 1873.

324. The enormous cost of the war, the excessive railway building, over-trading, and inflated credit and fluctuating currency, the sinking of capital in opening new farming lands and in readjusting manufactures to new conditions brought their results in the panic of 1873, precipitated by the failure (Sept. 18) of Jay Cooke, the financier of the Northern Pacific railway. For over five years the nation underwent a drastic purgation; railway building almost ceased, and so late as 1877 over 18% of the railway mileage of the nation was in the hands of receivers. The iron industry was prostrated, and mercantile failures for four years amounted to $775,000,000. At the close of the period there was a replacement of partnerships and individual businesses by corporations, but in the interval political unrest was in the foreground.

The Crédit Mobilier; the Salary Grab.

325. The charges that congressmen had been bribed by stock in the Crédit Mobilier (*q.v.*), a construction company controlled by Union Pacific stockholders, led to a congressional investigation which damaged the reputations of prominent Republicans, including Vice-president Schuyler Colfax; but the same Congress which investigated this scandal voted itself retroactive increases of salary, and this "back-pay grab" created popular indignation. Evidences of fraud and corruption in revenue collection under the "moiety system," and the general demoralization of the civil service continued. The demand for relief from the stringency of the crisis of 1873 expressed itself in the so-called Inflation Bill (passed April 1874), providing a maximum of four hundred million dollars for greenback issues. This was vetoed by Grant, but he later signed a bill accepting as a maximum the existing greenback circulation of $382,000,000. This compromise was satisfactory neither to contractionists nor greenbackers. The latter especially resented the provisions regarding the national banks and their circulation.

Republicans lose Control of Congress.

326. The "tidal wave" in the Congressional elections of 1874 was the result of these conditions. It marked a political revolution. The House of Representatives, which exhibited a two-thirds Republican majority in 1872, showed an opposition majority of about seventy, and the Senate was soon to be close. Such Republican strongholds as Pennsylvania, Ohio and Massachusetts went over to the Democrats in the state elections, while in the grain-raising states of the Middle West the Grangers were holding the balance of power, and in the South the Republican radicals remained in force in few states and only by the use of Federal troops. President Grant in his message of December 1874 acknowledged that public opinion was opposed to this use of force, but declared that without it negro suffrage would be worse than a mockery. Thus by the year 1874 the era of triumphant Republicanism and Reconstruction was closing. The leaders perceiving power about to pass from them rapidly enacted a series of party measures before the meeting of the newly elected Congress. Under the leadership of Senator John Sherman an act was passed (Jan. 14, 1875) providing for resumption of specie payments on the 1st of January 1879, gradually contracting greenbacks to three hundred million dollars and compensating this by expanding the circulation of the national banks. Sherman's personal preference was to make the greenbacks exchangeable for 4% bonds and thus to make the general public instead of the banking houses the purchasers of these securities, but he was unable to convince his colleagues. In the field of the tariff a similar policy was followed. The act of 1870 had somewhat reduced duties on tea, coffee, sugar and iron; but under Western pressure in 1872 the Republican Congress had consented to a 10% reduction on most classes of goods in order to save the general system of protection. On the eve of their relinquishment of full power the Republicans (March 3, 1875) repealed the Tariff Act of 1872, increased the duties on molasses and sugar and increased the revenue tax on tobacco and spirits. Thus the tariff was restored to the war basis, before the incoming Democratic House could block the advance. Similarly on the 1st of March Congress passed a Civil Rights Act, milder than the measure for which Sumner had fought so long, guaranteeing equal rights to the negroes in hotels, public conveyances, and places of amusement and forbidding the exclusion of them from juries. But an effort to pass a new force bill levelled against the intimidation of negro voters failed. By these measures the Republicans placed the

The Tariff.

Civil Rights Act.

important features of their policy where they could be overturned only by a Democratic capture of presidency and Senate.

Supreme Court Decisions

327. In the midst of these changes the Supreme Court handed down decisions undoing important portions of the Reconstruction system by restraining the tendency of the nation to encroach on the sphere of the state; and restricting the scope of the recent constitutional amendments. On the 14th of April 1873, in the Slaughter House cases, the courts held that the amendments were primarily restrictions upon the states for the protection of the freedom of the coloured man, rather than extensions of the power of the Federal government under the definition of United States citizenship, and that general fundamental civil rights remained under state protection. In the case of the *United States* v. *Reese*, decided on the 27th of March 1876, the court declared parts of the act of 1870 (which provided for the use of Federal force to protect the negro in his right to vote) unconstitutional, on the ground that they did not specify that the denial of suffrage must be on the sole ground of race or colour. A reasonable prerequisite, such as a poll tax, for voting was permissible. The South later took advantage of this decision to restrain negro suffrage indirectly. In *United States* v. *Cruikshank* (1876) the court held that the amendments to the Constitution left it still the duty of the state, rather than of the United States, to protect its citizens, even when whites had mobbed the negroes. The right of the nation in the case was held to be limited to taking care that the state governments and laws offered equal protection to whites and blacks. The affirmation of the power of the states over common carriers in the *Granger cases* (1877) has been mentioned. In 1883 the court declared the conspiracy clause of the Ku-Klux Act unconstitutional and restricted the application of the law to acts of a state through its officers and not to private citizens. In the same year it declared the Civil Rights Act of 1875 invalid.

328. In 1875 President Grant refused the appela of the "carpet-bagger" Governor Adelbert Ames of Mississippi to be supported by troops, whereupon Ames resigned his office into the hands of the Conservatives. The Mississippi plan of general intimidation of negroes to keep them from the polls was followed in Louisiana, South Carolina and Florida which alone remained Republican. Thus steadily the radical Reconstruction policy and Republican control of the South were being reversed. It was made clear that negro suffrage could be enforced upon the South only by military rule which could no longer command Northern sympathy or the sanction of the Federal court. Northern interest increasingly turned to other issues, and especially to discontent over administrative corruption.

The Whisky Ring.

329. The spoils system had triumphed over the advocates of civil service reform to such an extent that Grant abandoned the competitive system in 1875 on the ground that Congress did not support him in the policy. Enormous frauds in the collection of the internal revenue by the Whisky Ring with the connivance of Federal officials were revealed in 1875, and about the same time, Secretary of War William W. Belknap resigned to avoid impeachment for corruption in the conduct of Indian affairs. The enforced resignation in 1876 of Secretary of the Treasury Benjamin H. Bristow (*q.v.*) after he had successfully exposed the Whisky Ring, and of Postmaster-General Marshall Jewell, who had resisted the spoils system in his department, tended to discredit the administration. Blaine, the leader of the Republicans in the House of Representatives, fell under suspicion on account of his earlier relations with the Little Rock & Fort Smith and Northern Pacific railways (see BLAINE, J. G.), which left it doubtful, in spite of his aggressive defence, whether he had not used his influence as speaker in previous Congresses to secure pecuniary advantages from land grant railways. This clouded Blaine's prospects for a presidential nomination, and the House of Representatives voted a resolution against the third term which Grant seemed not unwilling to accept.

Party Platforms of 1876.

330. Thus the campaign of 1876 approached, with the Republicans divided into (1) steadfast supporters of the Grant administration, (2) a discontented reform wing (which favoured ex-Secretary Bristow), and (3) an intermediate group which followed Blaine. This statesman made a bold stroke to shift the fighting which the Democrats planned to make against the scandals of the administration, to the old time war issues. By proposing to exclude Jefferson Davis from amnesty, he goaded southern congressmen into indiscreet utterances which fanned anew the fires of sectional animosity. The Republican platform, while deprecating sectionalism, placed the war record of the party in the foreground and denounced the Democracy, because it counted upon the united South as its chief hope of success. A compromise candidate was selected in the person of Governor Rutherford B. Hayes, of Ohio, who had vigorously opposed the greenback movement in his state, and whose life and character, though little known to the general public, made him acceptable to the reform leaders of the party. The Democrats, demanding reform, economy, a revenue tariff and the repeal of the resumption clause of the act of 1875, chose the reform governor of New York, Samuel J. Tilden, as their candidate. The Independent National, or Greenback, party, which was to develop rapidly in the next two years, nominated Peter Cooper, a New York philanthropist, and demanded the repeal of the Resumption Act, and the enactment of a law providing a paper currency issued directly by the government, and convertible on demand into United States obligations bearing a rate of interest not exceeding one cent a day for each one hundred dollars and exchangeable for United States notes at par. It also proposed the suppression of bank paper, and was in general antagonistic to the bond-holding and banking interests.

Hayes-Tilden Contest; the Electoral Commission.

331. The election proved to be a very close contest. Tilden, according to the count of both parties, had a plurality of over a quarter of a million votes, and at first the leading Republican journals conceded his election. He had carried New York, Indiana, New Jersey and Connecticut and, by the Democratic count, the solid South. But the Republican headquarters claimed the election of Hayes by one electoral vote, based on the belief that the states of South Carolina, Florida and Louisiana,[1] had gone Republican. Since these states were in the midst of the transition from negro to white government, and elections were notorious for fraudulent practices, a serious question was raised, first as to the proper authority to count the electoral vote, and second, how far it was permissible to go behind the returns of the state authorities to ascertain the validity of the canvass of the votes in the state. The political capacity and moderation of the nation were severely tested; but in the end a characteristic American solution was found by the creation of an Electoral Commission (*q.v.*) in which five associate justices of the Supreme Court were joined with an equal number of representatives from each of the two houses of Congress. The result was that this commission refused to "go behind the returns," and Hayes was declared elected by one vote.

Hayes Elected.

To prevent the threatened danger of a filibuster by Democrats of the House of Representatives against the completion of the count until after legal date for the inauguration of the president, Hayes's friends agreed with leading Democrats that he would withdraw the Federal troops from Louisiana. Thus a new era began under a moderate and reforming Republican president, a close Republican Senate and a Democratic House of Representatives. The Southern question was not settled, but other issues of an economic and social nature increasingly forced themselves to the front. They were concealed in a measure by the fact that the following of each of the leading political parties was divided on financial policies, which resulted in attempts to compromise and evade the issue by the party managers. During the dozen years that followed Hayes's inauguration neither party held complete possession of both the executive and the two houses of Congress. His own moderate character, the conditions of his election and the check imposed during the first two years by a Democratic House of Representatives (and during the second two years by an opposition in both houses) made the period of Hayes's administration a transition from the era of Reconstruction to the era of dominant economic and reform agitation.

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[1] There was a conflict with regard to the electoral vote of Oregon also. (See OREGON: *History*.)

332. When he withdrew the troops which sustained the Republican governments in Louisiana and South Carolina, those states returned to the rule of the white Democrats. In the Congress elected in 1878 the former slave states chose 101 Democrats to the House of Representatives and only four Republicans. Leading Republicans like Blaine protested vigorously against the policy, declaring that the men who saved the Union should govern it; and on the other hand the Democrats in Congress added "riders" to appropriation bills designed to starve the administration into complete cessation of the use of troops and Federal deputy marshals at Southern elections. Extra sessions had to be summoned in 1877 and 1879 to provide supplies for the government, due to this policy. Hayes assisted his party by vetoing these coercive attempts of the Democrats and it was not until later that Federal attempts to supervise Southern elections entirely ceased.

Civil Service Reform.

333. As his early policy toward the South had dissatisfied many of the leaders of his party, his opposition to the spoils system alienated others. In 1877 a Civil Service Reform Association was formed in New York, and under the leadership of reformers like George William Curtis, Carl Schurz, John Jay and Dorman B. Eaton, it extended to other states. In June 1877 President Hayes issued an executive order against the participation of Federal officers in political management, and he furnished evidence of his sincerity by removing Alonzo B. Cornell, the naval officer of New York, who was also chairman of both state and national Republican committees, and Chester A. Arthur, collector of the port of New York. As both men were friends of Senator Roscoe Conkling of that state, the leader of the Grant men, this was a bold challenge. The "Stalwarts" answered it by soon afterward securing the nomination of Cornell as governor of New York and Arthur as vice-president of the United States.

Coinage Act of 1873.

334. The monetary question rose to primary importance at this time. Hayes himself had campaigned in Ohio successfully against the Greenback movement, and he chose as his secretary of the treasury, John Sherman, former senator from that state, whose long service as chairman of the finance committee had made him familiar with conditions and influential with moderate men of all factions. The *per capita* circulation of the nation had fallen from $20·57 in 1865 to $15·58 in 1877 and was still declining. The remarkable increase in the production of silver, as the new mining regions were opened, was accompanied by a fall in its ratio to gold from 15 to 1 in 1860 to 17 to 1 in 1877. Congress had, in 1873, passed an act dropping the standard silver dollar from the list of coins; but the significance of this omission of a coin not widely circulated, although it came at a time when European nations were adopting the gold standard, passed almost unnoticed at the moment; but the demonetization of silver was afterward stigmatized as a conspiracy, "the crime of 1873." As the date (January 1, 1879) for the redemption of the greenbacks in specie approached, demands were renewed for the replacement of national bank notes by greenbacks, for the postponement, or abandonment of resumption, for the free coinage of silver, and for the use of silver as well as gold in the payment of bonds redeemable in "coin." Sectional grouping of the debtor against the creditor regions, rather than party alignment, showed itself in the votes, for each party had its "soft money" as well as its "hard money" followers. Many who could not support the Greenback party in its theory that currency derived value from purchasing power based on the government's credit and authority rather than on convertibility, would, nevertheless, make larger use of paper money; while men who did not assent to the free coinage reasoning opposed the single gold standard as too narrow and too much under the influence of the speculative and banking interests, and would adopt some system of bi-metallism.

The Bland-Allison Act.

335. A Monetary Commission, appointed in 1876, reported in 1877, but without agreement or real influence upon the country. The president took strong ground against free coinage (though he would resume coinage of silver in limited quantities) and against the payment of bonds in silver; but the House of Representatives passed the measure, known as the Bland Bill, for the free coinage of silver, by a vote of 163 to 34. In the Senate this was amended, and as it finally passed both houses it was known as the Bland-Allison Act after the two leaders, the Democratic representative from Missouri and the Republican senator from Iowa. This compromise was carried over the veto of President Hayes and became a law on the 28th of February 1878. In the vote of the 15th of February, all but one of the senators from New England, New York and New Jersey opposed it, while the states west of the Alleghanies furnished only four opposing votes. The law restored the legal tender character of the silver dollar and authorized the secretary of the treasury to buy silver bullion at the market price, to an amount of not less than $2,000,000 nor more than $4,000,000 per month, and to coin the bullion into silver dollars. Silver certificates of denominations not less than ten dollars were to be issued upon deposit of silver dollars. As neither the silver nor the certificates circulated freely the denominations of the certificates were reduced in 1886, when they filled the deficiency in the contracting bank-note circulation.

336. Hardly had the Bland-Allison compromise been effected on the silver issue when an act was passed (May 31, 1878) forbidding the further retirement of greenbacks, which remained at $346,681,000. Substantially the same sectional alignment was followed in the vote on this bill as in the silver votes. Not satisfied with this legislation, nearly a million voters cast their ballots for Greenback party candidates at the Congressional elections in the autumn of 1878. The preparations of Secretary Sherman had been so carefully made, and the turning tide of trade brought coin so freely to the United States, that before the date of resumption of specie payments a gold reserve had been accumulated to the amount of $133,000,000 in excess of matured liabilities and the greenbacks rose to par before the date of redemption.

Party Platforms of 1880.

337. In the campaign of 1880, Hayes and Tilden both declined to stand for renomination. Thus the issue of the "fraud of 1876," which the Democratic platform called the paramount issue, was subordinated. Nor was it possible for the Republicans to force the tariff question into a commanding position, for although the Democratic platform declared for a tariff for revenue only, a considerable wing of that party led by Samuel J. Randall, of Pennsylvania, favoured protection. General Winfield S. Hancock, a distinguished soldier in the Civil War, whose nomination for the presidency by the Democrats was designed to allay Northern distrust, refused to make the tariff a national issue. The recent adjustment of the monetary question and the return of prosperity relegated the discussion of the currency also to a subordinate place, so that the Greenback party was able to poll only a little over 300,000 votes instead of the million which it commanded two years before. It favoured unlimited coinage of silver as well as the replacement of bank-notes by greenbacks.

Garfield Elected President.

338. The Republicans, after a heated convention in which the followers of Grant (who had recently returned from a several years' trip round the world), Blaine and Sherman, fought each other to a deadlock, selected General James A. Garfield (*q.v.*) of Ohio, who was political manager for Sherman in the convention. This was a blow to the Grant, or "Stalwart" wing, which was partly placated by the nomination of Arthur for the vice-presidency. Garfield's popular plurality was only a little over seven thousand out of a total vote of over nine millions; but his electoral vote was 214 to Hancock's 155. The area of the former slave

states marked the boundaries between the Republican and the Democratic states, except that Hancock also carried New Jersey, Nevada and California. The Republicans won the elections for the House of Representatives which would meet in 1881, and the Senate was at first nearly evenly divided, two independents holding the balance. In the ensuing four years party lines were badly broken, factions made bitter war upon each other, and the independent reformers or "Mugwumps" (*q.v.*) grew in numbers. The selection of Blaine as secretary of state committed Garfield to the anti-Grant wing, and the breach was widened by his appointment of the collector of the port of New York against the protests of Roscoe Conkling and Thomas C. Platt, the "Stalwart" senators from New York. They resigned, then sought re-election in order to vindicate the right of senatorial recommendation; but were defeated.

Assassination of Garfield; Arthur becomes President.

339. In the midst of this excitement the president was assassinated by a disappointed office-seeker of unsound mind. Vice-President Arthur, who succeeded Garfield in September 1881, by his tact and moderation won the admiration of former opponents; but the bad crops in 1881 and the dissatisfaction with boss rule among independent voters caused a Democratic victory in the Congressional campaign of 1882. Garfield's assassination had given new impetus to the movement against the spoils system, a National Civil Service Reform League had been organized in 1881, President Arthur presented the question in his message of December of that year, and in 1882 George H. Pendleton, a Democratic senator from Ohio, urged the subject upon the attention of Congress. Stimulated by the elections of 1882 Congress passed an act (January 16, 1883) authorizing the president to appoint a commission to classify certain of the Federal employees, and providing for appointment and promotion within this classified list by competitive examination, the employees being distributed among the states and territories according to population, with preference for soldiers and sailors of the Civil War. Congressional recommendations for these offices were not to be received, and political assessments for campaign purposes were forbidden. This was an effective beginning in the purification of the civil service; but the evil of assessment of employees was succeeded by the evil of soliciting campaign contributions from corporations interested in legislation. The extension of the competitive list proceeded gradually through succeeding administrations. The Edmunds Anti-Polygamy Act (1882) was levelled at the Mormons (*q.v.*), and the Chinese Exclusion Act was passed at the demand of labour, after a long agitation in 1882, the way having been prepared by the Treaty of Peking in 1880. Bills to this effect had been vetoed by Hayes and Arthur as violative of international agreement, but the desire of the politicians to win the California vote, and the compromise by which the exclusion was limited to ten years finally carried the measure, and the Supreme Court (1889) held it constitutional. Later acts modified and extended the exclusion.

Pendleton Act.

Anti-Polygamy Act; Chinese Exclusion.

340. From 1879 to 1890 the treasury showed a surplus of revenue over expenditure. This furnishes the explanation of much of the legislation of that period. It led to extravagant appropriations, such as the Arrears of Pensions Act of 1879, and the River and Harbor Act of 1882 providing for the expenditure of more than $18,000,000, which was passed over the veto of Arthur. Appropriation bills were merely constructed in various committees of Congress under a system of bargaining between interests and sections with primary reference to the political fortunes of the congressmen.

341. The surplus also strengthened the demand for a reduction of the tariff. A tariff commission, composed of men friendly to protection, appointed in 1882, proposed an average reduction of 20 to 25%. Nevertheless in the act as passed in 1883 duties were increased in general on those protected articles which continued to be imported in large volume, especially on certain woollen goods and about two-thirds of the imported cotton goods, and on iron ore and some steel products, while they were lowered on finer grades of wool and cheaper grades of woollen and cotton fabrics, &c. It was unsatisfactory to large portions of both parties and did not materially lower the revenue; but the act of 1883 made extensive reductions in internal taxes. As the Senate had just fallen into the hands of the Republicans, and the House would not become Democratic until the new Congress met, this protective law gave the former the advantage of position. Moreover the Democrats were themselves divided, nineteen Representatives (one-third from Pennsylvania) voting with the Republicans on the act of 1883. In the next Congress (1884), when the leaders made an attempt to rally the Democrats to show their position by passing a bill for a horizontal reduction of 20% in general, forty-one Democrats voted against the bill and prevented its passage through the House.

Party Platforms of 1884.

342. Thus the campaign of 1884 found both parties still lacking unity of policy although it seemed possible that the tariff might become the touchstone of the contest. The Republicans challenged the independents by nominating Blaine, whose record was objectionable to many reformers, and who had been chiefly identified with the Reconstruction politics. The Democrats, taking advantage of the situation, nominated Grover Cleveland (*q.v.*) of New York. He had won approval by his reform administration as mayor of Buffalo and as governor of New York during the past two years, when he had shown an independence of party "bosses" and had convinced the public of his sincerity and strength of character. He represented conceptions and interests which had grown up since the war, and which appealed to a new generation of voters. The platform emphasized the idea that "new issues are born of time and progress," and made the leading question that of reform and change in administration, lest the continued rule of one party should corrupt the government. On the question of tariff the Democrats took a conservative attitude, emphasizing their desire to promote healthy growth, rather than to injure any domestic industries, and recognizing that capital had been invested and manufactures developed in reliance upon the protective system. Subject to these limitations, they demanded correction of the abuses of the tariff and adjustment of it to the needs of the government economically administered. The Greenbackers nominated General Benjamin F. Butler of Massachusetts, recently chosen governor of that state on the Democratic ticket, but he polled only 175,000 votes, while John P. St John, the candidate of those who would prohibit the liquor traffic, secured 150,000 votes, an unprecedented gain. The Prohibitionist platform included a demand that all money, coin and paper, should be made, issued and regulated by the government and be a legal tender for all debts, public and private.

Cleveland Elected President.

343. The campaign abounded in bitter personalities, and the popular vote was close, Cleveland's plurality being only twenty-three thousand. The great state of New York, with electoral votes enough to have turned the scale, was carried by the Democrats by only a few more than one thousand votes out of a total of over a million. Cleveland's electoral majority was 37. The election was nevertheless recognized as making an epoch. For the first time since victory came to Lincoln and the Republicans on the eve of the Civil War, nearly a quarter of a century earlier, the country had entrusted power to the Democrats, although over two-thirds of their electoral vote came from the former slave states. New York, Connecticut, New Jersey and Indiana constituted their Northern territory. Perhaps the most significant thing about the result was the evidence that in the North political and sectional habits and prejudices were giving way among a sufficient number of independent voters, responsive to strong personal leadership on reform issues, to turn the political scale. The transition from war issues which began in 1872, and became marked in 1876, was completed by the election of Cleveland in 1884.

Civil Service.

During the first half of his term President Cleveland had the opposition of a strongly Republican Senate. In the second half the Senate remained Republican by a majority of two, and the House continued Democratic. His civil service policy naturally met severe criticism not only from his party foes, but also from the spoilsmen among his Democratic followers, who desired a clean sweep of Republican office-holders, and from those of his independent supporters who looked to him to establish the service on a strictly non-partisan basis. The outcome of the first two years of his administration was that, of the entire body of Federal office-holders, two-thirds were changed and the obnoxious Tenure of Office Act was repealed, thus leaving the president the right of removal without presenting his reasons. Nevertheless there was a gain, for Cleveland somewhat checked the political activity of office-holders, the criticism by the Republicans placed them on record against the former spoils system, and before leaving the presidency (but after the election of 1888 showed that power was to pass to the Republicans), he transferred the railway mail service to the classified list requiring competitive examination.

344. The transition of executive power for the time to the Democratic party, however much it impressed the imaginations of the public as the end of an era, was not so significant as the national growth and expansion in the decade between 1880 and 1890 whereby forces were set loose which determined the characteristics of the succeeding period. Between these years the nation grew from about fifty millions to over sixty-two millions. The Middle West, or North Central group of states, gained nearly five millions and the Western division over a million and a quarter. West of the Alleghanies altogether more than eight million souls had been added, while the old Eastern states gained but four millions. In 1890 the North Central division alone had achieved a population nearly five millions greater than that of the North Atlantic, while the trans-Alleghany region surpassed the whole East by about ten millions, and the numbers of its representatives in House and Senate placed the political destiny of the nation in its hands.

Development of the West.

345. One of the most important reasons for the wholesale taking up of Western resources in these and the following years was the burst of railway building subsequent to the interruption of the panic of 1873. The eager pioneers pushed into western Kansas and Nebraska as they had into the northern Ohio Valley a half-century before. Nebraska grew from a population of one hundred and twenty-three thousand in 1870 to nearly half a million in 1880 and to over a million in 1890. From about a third of a million in 1870, Kansas rose to almost a million in 1880, and to nearly a million and a half in 1890. The railway had "boomed" the Golden West and a cycle of abundant rains seemed to justify the belief that the "Great American Desert" was a myth. Thus settlers borrowed money to secure farms beyond the region of safe annual rainfall under the agricultural methods of traditional pioneering. Swift disappointment overtook them after 1886, when droughts and grasshoppers ruined the crops and turned back the tide of Middle Western colonists until the western parts of these states were almost depopulated, Kansas alone losing one-seventh of its population; nor did prosperity return for a decade.

346. As the column of settlement along the Ohio Valley had extended its flanks into the old North-West between the Ohio and the Great Lakes, and into the old South-West of the lower Mississippi after the War of 1812, so the later pioneers by railway trains began to take possession of the remoter and vaster North-West and South-West. The "granger roads," centring in Chicago, thrust their lines out to develop wheat farms in interior Iowa, Minnesota and the Dakotas, where the virgin soil of the prairie farms brought returns that transferred the wheat belt to this new land of promise, and by competition forced the older wheat areas to develop varied agriculture. The introduction of the recently invented steel roller system of making flour into the Minneapolis mills not only built up a great flour industry there but created a demand for the hard wheat suited to the North-western prairies. The pine forests of Michigan, Wisconsin and Minnesota were exploited in the same era.

347. A more impressive movement was in progress as additional transcontinental railways were extended from the frontier to the Pacific. In 1870 for a thousand miles west of Duluth, at the head of Lake Superior, along the line of the projected Northern Pacific railway there were no cities or little towns. Relying upon its land grant and upon the undeveloped resources of the vast tributary region, the railway, after halting for a few years subsequent to the panic of 1873 at Bismarck on the Missouri rushed its construction to Seattle and was opened in 1883. The Great Northern, a product of the vision and sound judgment of James J. Hill, started from St Paul without a land grant and reached Puget Sound in 1893, constructing lateral feeders as it built. Thus a new industrial zone had been brought into existence. Colorado had become a state in 1876; in 1889 North Dakota, South Dakota, Washington and Montana were admitted as states and the next year Idaho and Wyoming were added. The Western political forces, especially the friends of silver, were thus given the balance of power in the Senate and additional weight in the electoral college.

The South-West.

348. As a new North-West was opened by the completion of the Canadian Pacific (1883), the Northern Pacific (1883) and the Great Northern (1893), so the new South-West was entered by the completion of the Southern Pacific from New Orleans across Texas, New Mexico, Arizona and southern California to San Francisco by 1883. In 1883 also the lines which became the Atchison, Topeka & Santa Fé, extending from the lower Missouri valley, with St Louis and Kansas City as important terminals, through south-eastern Colorado, northern Arizona and New Mexico, reached the same goal. The Denver & Rio Grande in the same period opened new mining areas between Denver and Ogden. Not only additional mines were reached by these lines, but a great cattle country, recently the habitat of the bison and the Indian, was opened. All the large cities commanding the approaches to this country developed packing industries, but Chicago especially profited. Although her main supply was still the Middle Western farms, this domestic supply was supplemented by vast quantities of range cattle. South-eastern Texas was the original home of these cattle ranches, but the driving of herds to supply the miners of the Rocky Mountains revealed the fact that the whole bison country was capable of supporting range cattle, and the practice grew of driving the stock to the feeding ground of the north and returning. The height of the movement along the cattle trail, which in its largest extent ran through the public lands of the great plains from Texas to the Dakotas and Montana, was reached in 1884. In that period cattlemen fought over the possession of the range, controlled vast tracts by seizing the approaches to the water supplies under perversion of the land laws, fenced in the public domain, either defiantly or by leases from land grant roads, and called out proclamations of presidents from Hayes to Cleveland. The steady advance of the farmer, and protective measures against the spread of the cattle diseases known as Texas fever, gradually prevented the continuance of the trail, and ultimately broke down the system of great ranches. The grade of cattle was improved and great packing interests organized the industry on the basis of concentrated large scale production. About 1870 shipment of livestock from Chicago had become significant, and within a decade the refrigerator car revolutionized the packing industry by making possible the shipment of dressed beef not only to the markets of the Eastern United States but even to Europe. The value of slaughtering and packing industries in the United States increased from less than thirty million dollars in 1870, to over three hundred millions in 1880, and to five hundred and sixty-four millions in 1890.

349. Another important revolution in American economic life was effected by the opening of new iron-mines, the growth of the steel and coal industry and the rise of an extraordinary internal commerce along the whole length of the Great Lakes. By 1890 the output of pig-iron in the United States surpassed

Mining and Commerce.

that of Great Britain, having doubled since 1880. The full meaning of the revolution is seen in the fact that by 1907 the United States produced more pig-iron and steel than Great Britain, Germany and France combined. As a result of the growth of the wheat, lumber and iron-ore production of the North-West, the traffic along the thousand miles of the Great Lakes grew (chiefly after 1890) by leaps, and changed from wooden sailing vessels to steel ships driven by steam. The traffic through the Sault Ste Marie Canal came greatly to exceed that through the Suez Canal.

The South.

350. The South shared in these industrial transformations. Not only did white labour produce an increasing proportion of the cotton crop, which was now extended into the cut-over pine lands, but cheap white labour came from the uplands to cotton mills situated at the water-powers. This, with the abundant supply of raw material, enabled the South to develop cotton manufacture between 1880 and 1890 on a scale that threatened New England's dominance. The southern Appalachians began to yield their treasures of coal and iron; northern Alabama became one of the great centres of the iron industry and the South produced nearly 400,000 tons of pig iron in 1880 and two and a half millions twenty years later. By 1890 the production of coal, iron-ore and pig-iron in this section was as great as that of the United States in 1870. The value of the products of manufacture in the South rose from $338,000,000 in 1880 to $1,184,000,000 in 1900. The exploitation of the long leaf pine forests also attracted Northern capital. Fruit and truck gardening grew rapidly, and the South began to exhibit traits of industrial development familiar in the North and West. Protective tariffs and the interests of capital found recruits in the old-time planting states; but the negro problem continued to hold the South as a whole to the Democratic party.

Industrial and Financial Changes.

351. The opportunities opened to capital by these forces of growth in the West and South, as well as the general influence of an age of machine production, led to transformations in the East which brought new difficulties for political solution. The East began to exhibit characteristics of other long-settled countries where increasing density of population and highly developed industry are accompanied by labour troubles, and where problems of democratic society and government take the form of forcible action or political revolt, in the absence of ample outlets into adjacent areas of cheap lands and new opportunities. To capital the opening resources of the West, and the general national prosperity after 1879, offered such inducements that large scale production by corporations and vast designs became the order of the day. The forces which had exhibited themselves in increased manufacture and railway development between the Civil War and the panic of 1873 now found expression in a general concentration of industries into fewer plants with vastly greater capital and output, in the combination of partnerships into corporations, and of corporations into agreements, pools and trusts to avoid competition and to secure the needed capital and economies for dealing with the new problems of industrial magnitude. Western farming competition led to the actual abandonment of much inferior land in New England and to agricultural disadvantages in the Middle states. As agriculture became less attractive and as industrial demands grew, the urban population of the East increased at the expense of the rural. The numbers of cities of the United States with more than 8000 people nearly doubled between 1880 and 1890; by 1900 the urban population constituted a third of the total, and this phenomenon was especially marked in the North Atlantic division, where by 1900 over half the population was in cities of more than eight thousand inhabitants.

352. In similar fashion concentration of industry in large establishments was in progress. In 1880 nearly two thousand mills were engaged in the woollen industry; in 1890 not many more than thirteen hundred. Even more marked was the change in iron and steel, where large-scale production and concentration of mills began to revolutionize this fundamental industry, and other lines of production showed the same tendency. The anthracite mines of Pennsylvania, the great resource for the nation, fell into the possession of seven coal-carrying railways which became closely allied in interest. In most of the important industries the tendency of large organizations to subject or drive out the small undertakings became significant. Already the railways to avoid "cut-throat competition" had begun to consolidate their systems by absorption of component lines, to form rate agreements and to "pool" their earnings in given districts. Western agitation had led to reports and bills by committees headed by Western congressmen, such as the report of William Windom, of Minnesota, in 1874, where the construction of Federal lines to regulate rates by competition, was suggested; the report of George W. McCrary of Iowa, whose bill for regulation was passed by the House in 1874 under the stimulus of the Granger movement, but failed in the Senate; that of John H. Reagan, of Texas (1878), whose bill forbidding pooling and compelling publicity of rates by the machinery of the Federal courts, was discussed for several years, but failed to become law; and that of Shelby M. Cullom, of Illinois, in 1886.

The Interstate Commerce Act.

353. The decision of the Supreme Court in the *Wabash case*, made in that year, reversed the doctrine followed in the case of *Munn* v. *Illinois*, and held that the regulative power of the state (even in the absence of Federal legislation) was limited to traffic wholly within the state and not passing from one state to another. The Cullom bill as enacted into the Interstate Commerce Law of the 4th of February 1887, was framed to prevent unjust discriminations by the railroads between persons, places and commodities, the tendency of which was, as the report declared, to foster monopoly. The law forbade discriminations and pooling, made a higher charge for a short haul than for a long haul over the same road illegal (unless permitted after investigation by the commission), required publicity of rates, and provided for a commission to investigate and fine offenders. But the decisions of the commission were reviewable by the Federal courts and the offender could be coerced, if he refused to obey the commission, only by judicial proceedings. The commission was empowered to provide uniform accounting and to exact annual reports from the roads. The principle settled by the law was an important one, and marked the growing reliance of the former individualistic nation upon Federal regulation to check the progress of economic consolidation and monopoly. But the difficulties by no means disappeared; the Federal judiciary refusing to accept the findings of the commission on questions of fact, retried the cases; and the Supreme Court overruled the commission on fundamental questions, and narrowed the scope of the act by interpretation.

Labour Combinations; Industrial and Social Unrest.

354. Labour exhibited the tendency to combination shown by capital. The Knights of Labor, founded in 1869, on the basis of "the individual masses" instead of the trades unions, and professing the principle that "the injury of one is the concern of all," grew from a membership of about one hundred thousand in 1885 to seven hundred and thirty thousand in 1886. The number of strikes in 1886 was over twice as many as in any previous year. In one of the strikes on the Gould railway system six thousand miles of railway were held up. In New York, Henry George, author of books proposing the single tax on land as a remedy for social ills, ran for mayor of the city and received 68,000 out of 219,000 votes. At the same time socialistic doctrines spread, even among Western farmers. But sympathetic strikes, anarchistic outbreaks, and drastic plans for social change did not appeal to the people as a whole. The Knights of Labor began to split, and the unions, organized as the American Federation of Labor, began to take their place with a less radical membership. President Cleveland broke with precedents in 1886 by sending in the first message on labour, in which he advocated, without success, a labour commission to settle controversies. A national bureau of labour to collect statistics had been established in 1884; state legislation increasingly provided for arbitration of labour disputes, and regulation of factories and child

labour. Early in 1885 a law had been enacted forbidding the importation of labour under contract, and in 1888 the Chinese Exclusion Act was continued. **Immigration.** Immigration was exceptionally large in the decade from 1880 to 1890, amounting to about five and a quarter millions as compared with two million eight hundred thousand for the previous decade. But a large number of these new-comers settled on the newly opened lands of the Middle West. By 1890 the persons of German parentage in the Middle West numbered over four millions—more than half the total of persons of German parentage in the nation. Minnesota held 373,000 persons of Scandinavian parentage, and of the whole of this element the Middle West had all but about 300,000. The Irish constituted the largest element among the English-speaking immigrants. The population of foreign parentage amounted to one-third of the whole population of the United States in 1890. In the midst of this national development and turmoil President Cleveland struggled to unite his party on a definite issue. The silver question continued to divide each party, the continued fall of silver leading to renewed agitation for free coinage. In 1886 a bill for this purpose was defeated by a majority of 37 in the House, 98 Democrats favouring it, and 70 opposing, as against 26 Republicans for it and 93 against. **Cleveland's Vetoes.** The surplus led to extravagant appropriation bills, such as special pension bills, which Cleveland vetoed by the wholesale, thereby incurring criticism by veterans of the Civil War, and river and harbour improvement measures, particularly the act of 1886, to which the president gave reluctant assent and the bill of 1887 to which he gave a "pocket veto" by refusing his signature. But the retention of the surplus in the treasury would create a monetary stringency, its deposit in banks aroused opposition, and its use to buy bonds was unpopular with the Democrats. **Tariff Message.** Cleveland boldly met the issue and gave purpose to his party by his annual message of December 1887, which he entirely devoted to an exposition of the situation arising from the surplus, and to a demand for a revision of the tariff in order to reduce revenue. He did not profess free trade doctrines: "It is a condition which confronts us, not a theory," he declared. **The Mills Bill.** The election of 1886 had reduced the Democratic majority in the House, but the president was able to induce his party to pass the Mills Bill (1888) through that body as a concrete presentation of policy. The bill put many important raw materials (including wool and unmanufactured lumber) on the free list, substituted *ad valorem* for specific duties to a large extent, and generally reduced the protective duties. It was believed that the measure would remit over fifty and a-half million dollars of duties, nearly twenty millions of which would result from additions to the free list. The Republican Senate also found party unity on the tariff issue and its committee on finance, under the leadership of Senator Nelson W. Aldrich of Rhode Island, drafted a counter proposal. They would reduce revenue by repealing the taxes on tobacco, and the taxes on spirits used in the arts and for mechanical purposes, and by revising the tariff so as to check imports of articles produced at home.

355. On the tariff issue the two parties contested the election of 1888, the Republicans denouncing the Mills Bill and the Democrats supporting it. **Benjamin Harrison elected President.** Blaine having withdrawn from the contest, and John Sherman having secured but little more than half the votes necessary to nominate, the Republicans picked from a multitude of candidates General Benjamin Harrison of Indiana, grandson of President William Henry Harrison, to run against Mr Cleveland. The popular vote was exceedingly close, but Harrison had an electoral majority of 65, having carried all of the states except the solid South, Connecticut and New Jersey. The increasing use of money to influence the election, and particularly the association of great business interests with such political "bosses" as Matthew S. Quay of Pennsylvania and Thomas C. Platt of New York, were features of the campaign. The Congressional elections ensured to the Republicans the undisputed control of all branches of the government when the Fifty-first Congress should convene, and it was generally agreed that the party had a mandate to sustain the protective tariff.

356. Lacking a large majority in either house the Republicans were not only exposed to the danger of free silver defections in the Senate, but to "filibustering" by the Democratic minority in the House as a means of blocking the victorious party's programme. **Speaker Thomas B. Reed.** These obstructive tactics were made possible chiefly by the use of privileged motions and roll calls to delay business, and the refusal to respond on the roll call for a vote, thus preventing a quorum. Speaker Thomas B. Reed of Maine, a virile and keen-witted leader, greatly strengthened the power of the speaker, as well as expediting the business of the House, by ruling that the Constitution required a present, not a voting, quorum; and in spite of disorderly protests he "counted a quorum" of those actually present. By securing rules sanctioning this action and empowering the speaker to refuse to entertain dilatory motions, that officer became the effective agent for carrying on the business of the party majority. As his power through the committee on rules, which he appointed, grew, he came, in the course of time, also to dominate the action of the House, refusing to recognize members except for motions which he approved, and through his lieutenants on important committees selecting such measures for consideration as seemed most desirable. This efficiency of action was secured at a loss to the house as a representative and debating body, responsive to minority proposals.

357. But the discipline of party caucus and House rules enabled the Republican leaders to put through with rapidity a number of important laws. **The Sherman Anti-Trust Act.** One of these was the measure known as the Sherman Anti-Trust Act of the 2nd of July 1890, which declared combinations affecting commerce between the several states, or with foreign nations, illegal and punishable by fine or imprisonment or both. This act, the full power of which was not exhibited until later, was a response to the growing unrest of the nation as other corporations emulated the success of the Standard Oil Trust (formed in 1882). The members of a trust combined in an organization managed by boards of trustees whose certificates the former owners accepted instead of their shares of stock in the component companies. Competition was thus eliminated within the combination and the greatly increased capital and economies enabled it not only to deal with the increasing magnitude of business operation, but also to master the smaller concerns which opposed it. State legislation had proved unable to check the process, partly because the trust was an interstate affair. By putting into operation its power under the Constitution to regulate interstate commerce, Congress responded to the popular demand for Federal restraint of these great combinations which threatened the old American ideals of individualism and freedom of competition. The trusts, although embarrassed, soon showed their ability to find other devices to maintain their unified control. Nor was the act used, in this period, to prevent the railways from agreements and combinations which in large measure neutralized the anti-pooling clause of the Interstate Commerce Act of 1887.

358. Another important law was the so-called Sherman Silver Purchase Act of the 14th of July 1890. By 1889 the ratio of silver to gold had fallen to 1 to 22. **Sherman Silver Purchase Act.** In the twelve years of the Bland-Allison Act of 1878 over 378,000,000 silver dollars had been coined from bullion purchased at the market price. This bullion value was falling: it was $·89 in 1877 and $·72 in 1889. The production of gold in the United States in 1878 was about two and one-half million fine ounces, and of silver about thirty-five millions; in 1890 the gold production was 1,588,000 and the silver 54,500,000. The Silver Purchase Act authorized the secretary of the treasury to purchase each month 4,500,000 oz. of silver at its market price and to pay for it in treasury notes redeemable at his discretion, in silver or gold. This law, passed to placate the demands of the free silver men by increasing the use of silver, was insufficient to prevent the Senate from passing a free coinage bill by a combination of Democrats and the

silver Republicans, chiefly from the newer states of the Far West; but this free coinage bill was lost in the House by a small majority. The explanation of this sudden re-opening of the question was that of party apprehension. In some of the Republican states of the Middle West, long relied upon as safe, the Farmers' Alliance had been spreading, and fomenting a demand for unlimited coinage of silver. A silver convention held at St Louis in the fall of 1889 had been attended by many delegates from this region as well as from the new silver-mining states whose increased power in the Senate was soon to be effective. It was feared, therefore, that a veto of a free coinage measure might array the West and South-West against the East and break up the party.

The McKinley Tariff.

359. The customs duties upon which the fighting of the campaign of 1888 had turned was promptly taken up, and in the McKinley Tariff Act of the 1st of October 1890 the Republicans embodied their conceptions of protection to American industry. Some of the main features of this law were: the addition of agricultural products to the protected articles; the extension of the free list, particularly the inclusion therein of raw sugar, which had been bringing in a revenue of $50,000,000 annually; the granting of compensating bounties to sugar planters to an amount of about $10,000,000 a year; and the raising of duties to the prohibitory point on many articles of general consumption which could be produced at home. Mr Blaine, then secretary of state, had just been active in promoting closer relations with South America wherein he hoped for an extension of American trade and he severely criticized the bill as it passed the House, because the free list opened wide the doors of American trade, particularly to sugar producing countries, without first exacting compensating advantages for our products in those markets. To meet this criticism a provision was finally added authorizing the president to impose discriminating duties where it was necessary to obtain the advantages of reciprocity.

360. This tariff, which passed on the eve of the Congressional elections of 1890, was immediately followed by such increases in prices and the cost of living that it was potent in bringing about the political revolution, or "land slide," which swept the Republicans from power in the House of Representatives. The Republicans returned but 88 members as compared with nearly twice that number in the Congress which passed the McKinley Bill. The South sent but four Republicans; New England a majority of Democrats; and such strongholds of Republicanism as the Middle Western states of Illinois, Michigan, Wisconsin, Iowa and Kansas, hitherto responsive to the traditions of the Civil War, sent Democratic or independent delegations. Looked at broadly, the movement was a rural uprising, strongest in the South and Middle West, the old Granger areas, against forces which seemed to them to threaten their ideals of American democracy. But the movement was recruited by the silver-mining states and discontented labour interests.

Western Discontent.

361. Farm products had not proportionally shared the general increase in prosperity. This convinced large portions of the agricultural West that the currency system had too narrow a basis in gold, which was appreciating in value. Much of the Middle Western agricultural development had been made on borrowed Eastern capital, and it seemed to the farmer that the principal of his mortgage was in effect increasing with the rise in the price of gold, at the same time that his crops brought a smaller net profit. He did not give due attention to the effect of greatly increased production, as the new wheat lands were opened on such a grand scale; but he was keenly sensitive to increased freight rates and discriminations, to the influence of Eastern capitalists, banks, bondholders, trusts and railways upon Federal and state legislatures and judiciary, and to the large amount of railway lands, unproductively held by the companies, while the land hunger of the nation was exhibited in the rush to newly opened Indian lands, such as Oklahoma (1889) and parts of the Sioux reservation (1890). After the evidence of the power of this tide of Western discontent in the elections of 1890, those portions of it which were ripest for revolt combined in 1892 as the People's party or Populists, soon to prove an important political factor.

Pensions.

362. The Republicans meanwhile had been actively reducing the surplus. In 1892 the excess of revenue over expenditures was ten million dollars; by 1893 only two millions. This was effected not only by the Tariff Act but by such measures as the Dependent Pension Act of 1890 (resulting in a list of pensioners of the Civil War which cost the nation $68,000,000 by 1893, over half of these pensioners having been added during Harrison's administration); the rapid construction of the new navy, raising the United States from twelfth to fifth in the list of naval powers; the repayment of the direct war tax to the states (1891) to the amount of fifty-one millions; and other appropriations such as those provided by river and harbour bills. The Democrats stigmatized this Congress as a "billion dollar Congress" from its expenditures, to which Speaker Reed replied that the United States was a billion dollar nation. In fact the Democrats when they regained power were not able greatly to diminish the cost of government.

Homestead Strike.

363. The Democratic House in the Fifty-second Congress repressed obstructive Republican tactics by methods like those adopted by Speaker Reed, and contented itself with passing a series of bills through that body proposing reductions of the tariff in special schedules, including free wool and a reduction of the duty on woollens, free raw material for the cotton planters of the South, free binding twine for the farmers of the North and a reduced duty on tin plate for the fruit raisers. The new industries of the southern Appalachians prevented action on coal and iron. Of course these bills failed in the Republican Senate. A bloody strike on the eve of the election of 1892 in the great steel works at Homestead, Pennsylvania, where armed guards engaged by the company fired upon the mob which sought higher wages, was not without its adverse effect upon public sentiment in regard to the Republican tariff for the protection of labour.

364. During the campaign of 1892 the Democrats rejected a conservative tariff plank, denounced the McKinley tariff in violent language, and denied the constitutional power to impose tariff duties except for the purpose of revenue only. But Cleveland, who was renominated in spite of vigorous opposition from leading politicians of his own state, toned down the platform utterances on the tariff in his letter of acceptance. In their declarations upon the currency the Democrats furnished a common standing ground for the different factions by attacking the Silver Purchase Act of 1890 as a cowardly makeshift.

The People's Party.

365. The People's party, in its national convention at Omaha (July 1892), drew a gloomy picture of government corrupted in all of its branches, business prostrated, farms covered with mortgages, labour oppressed, lands concentrating in the hands of capitalists. Demanding the restoration of government to the "plain people," they proposed an expansion of its powers, to afford an adequate volume of currency and to check the tendency to "breed tramps and millionaires." Among their positive proposals were: the free and unlimited coinage of silver at the legal ratio of sixteen to one; the expansion of a national currency issued directly to the people; the establishment of postal savings banks; government ownership of the railways, telegraph and telephone; restoration to the government of the lands held by railways and other corporations in excess of their needs; and a graduated income tax. In supplementary resolutions the Australian ballot system, which had spread rapidly in the past few years, was commended, as also were the initiative and referendum in law-making. Combining with the Democratic party in various states beyond the Mississippi, and with Republicans in some of the Southern states, they won large masses of voters in the West, and exerted an influence upon public opinion in that section beyond what was indicated in the returns, although General James B. Weaver of Iowa, their candidate for the presidency, received over 1,000,000 popular votes and 22 votes in the electoral college. The Republicans renominated President Harrison, though he lacked an enthusiastic personal following. They

supported the McKinley Tariff Act in spite of the wave of opposition shown in the elections of 1890. But, fearing party divisions, they, like the Democrats, made an ambiguous declaration on the currency. The result of the election of 1892 was to return the Democrats under Cleveland to power by a plurality of over 380,000 and an electoral plurality of 132. Congress in both branches was to be Democratic in 1893, and the way was open for the first time in a generation for that party to carry out a policy unchecked by any legislative or executive branch of government.

Cleveland re-elected President.

Panic of 1893.

366. But before Cleveland was fairly started in his second administration the disastrous panic of 1893 swept the nation, nor did prosperity return during the four years that followed. The panic is not, directly at least, to be traced to the silver purchases, but was the result of various causes, including the agricultural depression, farm mortgages, reckless railway financiering and unsound banking in the United States, as well as to Argentine and European financial troubles. The panic began in the spring with the failure of the Reading railway (which had undertaken the acquisition of coal land and an extension of activity beyond its resources) and the collapse of the National Cordage Company, one of the numerous examples of reckless trust financiering into which large banks had also been drawn. Clearing-house certificates were resorted to by the New York banks in June, followed in August by partial suspension of specie payments. Currency remained at a premium for a month; deposits in national banks shrank enormously; national bank loans contracted more than 14·7%; failures were common; 22,000 m. of railways were under receiverships, and construction almost ceased. The interruption to business is indicated by the decline of iron production by one-fourth.

Railway Strike.

367. The panic of 1893 was in many ways a turning-point in American history. It focused attention upon monetary questions, prostrated the silver-mining states, embittered the already discontented farming regions of the West, produced an industrial chaos out of which the stronger economic interests emerged with increased power by the absorption of embarrassed companies, and was accompanied by renewed labour troubles. Most noteworthy of these was the Pullman Car Company strike near Chicago in 1894, which led to sympathetic strikes by the American Railway Union, extending over twenty-seven states and Territories from Cincinnati to San Francisco. Mobs of the worst classes of Chicago burned and looted cars. The refusal of Governor John P. Altgeld of Illinois to call out the militia, and the interference with the United States mails, led President Cleveland to order Federal troops to the scene, on the constitutional ground that they were necessary to prevent interference with interstate commerce and the postal service and to enforce the processes of the Federal courts. The latter issued a sweeping injunction requiring that the members of the American Railway Union or other persons desist from interference with the business of the railways concerned. The president of the striking organization, Eugene V. Debs, was imprisoned for contempt of court and conspiracy.

Repeal of Silver Purchase Act.

368. The most immediate political effect of the panic was upon the silver issue. Soon after the outbreak of the financial crisis, the gold reserve, which protected the greenbacks and the treasury notes issued under the Silver Purchase Act, shrank ominously, while foreigners returned their American securities instead of sending gold. To sell bonds in order to replenish the gold reserve, and to repeal the Silver Purchase Act without substituting free coinage, would aggravate western discontent and turn away the promise of recruits to the Democratic party from the Populists of the prairie and silver-mining states; to carry out the Democratic platform by a tariff for revenue only while mills were shutting down would be hazardous in the East. The fruits of victory were turning to ashes; but Cleveland summoned a special session of Congress for August, while the panic was acute, and asked his party to repeal the Silver Purchase Act without accompanying the repeal with provisions for silver. Not until the last of October 1893 was repeal carried, by a vote in which the friends of repeal in the House were about equally divided between Democrats and Republicans, and nearly two-thirds of its opponents Democrats.

369. By this time the surplus had disappeared and the gold reserve was drawn upon for ordinary expenses. Early in 1894 the administration, failing to secure legislation from Congress to authorize the sale of gold bonds on favourable terms to protect the reserve, sold under the Resumption Act of 1875 $50,000,000 5% bonds, redeemable in ten years. Part of this very gold, however, was withdrawn from the reserve by the presentation of legal tender notes for redemption, and the "endless chain" continued this operation to the verge of extinguishing the reserve, so that another loan of $50,000,000 in 1894 was followed in 1895 by a dramatic meeting between Cleveland and some of his cabinet with the important Wall Street banker, J. Pierpont Morgan, who agreed on behalf of his syndicate to sell the government $65,166,000 of gold for $62,315,000 of bonds, equivalent to 4% bonds for thirty years at a price of 104. In return the syndicate agreed to use its influence to protect the withdrawals of gold from the treasury. These securities were over-subscribed when offered to the public at 112¼. President Cleveland had protected the treasury and sustained the parity of gold and silver, but at the cost of disrupting his party, which steadfastly refused to authorize gold bonds. Again, in the beginning of 1896, the treasury was forced to sell bonds, but this time it dealt directly with the public and easily placed $100,000,000 in bonds at about 111, affording a rate of interest about equal to 3·4%.

The Wilson Bill.

370. Before the political harvest of the monetary issue was reaped, the Democrats had also found party ties too weak to bear the strain of an effective redemption of the party pledges on the tariff. The Wilson Bill prepared as the administrative measure was reported late in 1893, while the panic was still exerting a baneful influence. Its leading features were the substitution of *ad valorem* for specific duties in general, the extension of the free list to include such materials of manufacture as iron ore, wool, coal, sugar and lumber, and the reduction of many prohibitory rates. The loss in revenue was partly provided for by an income tax, significant of the new forces affecting American society, and an increase in the duty on distilled liquors. Although the bill passed the House by an overwhelming majority, it met the opposition in the Senate of the representatives, Democratic as well as Republican, of those states whose interests were adversely affected, especially the iron ore and coal producing states of the Southern Appalachians, the sugar producers of Louisiana, the wool growers and manufacturers of Ohio, and the regions of accumulated property in the East, where an income tax was especially obnoxious. Led by Senators Arthur P. Gorman, of Maryland; Calvin S. Brice, of Ohio; and David B. Hill, of New York, the bill was transformed by an alliance between Democratic and Republican senators, on the plea that it would otherwise result in a deficit of $100,000,000. Coal, iron ore and sugar were withdrawn from the free raw materials and specific duties replaced *ad valorem* in many cases, while many other individual schedules were amended in the direction of protection. The House, given the alternative of allowing the McKinley Act to remain or to accept the Senate's bill, yielded, and the Wilson-Gorman Tariff Act became a law without the president's signature, on the 27th of August 1894. He called upon his followers still to fight for free raw materials, and wrote bitterly of "the trusts and combinations, the communism of pelf, whose machinations have prevented us from reaching the success we deserved." Even the income tax was soon (1895) held by the Supreme Court to be unconstitutional.

371. Toward the close of his administration Cleveland's brusque message on the Venezuelan boundary question (see later) aroused such excitement and so rallied the general public (though not the more conservative) that the war spirit, shown soon afterwards against Spain, might have been a potent factor

Free Silver Issue; William J. Bryan.

Gold Democrats.

in the election of 1896 had not England exhibited exceptional moderation and self-restraint in her attitude. The silver question, therefore, became the important issue. The Republicans nominated McKinley and declared for the gold standard in opposition to free coinage, losing thereby an influential following in the silver-mining and prairie states, but gaining the support of multitudes of business men among the Democrats in the East and Middle West, who saw in the free-silver programme a violation of good faith and a menace to returning prosperity. The Democratic convention marked a revolution in the party. The old school leaders were deposed by decisive majorities, and a radical platform was constructed which made "the free and unlimited coinage of both silver and gold at the present legal ratio of sixteen to one, without waiting for the aid or consent of any other nation," the paramount issue. Objecting also to the decision against the income tax, and to "government by injunction as a new and highly dangerous form of oppression," they incurred the charge of hostility to the Federal judiciary. William J. Bryan made a brilliant speech in behalf of free coinage, and so voiced the passion and thought of the captivated convention that he was nominated by it for the presidency over the veteran free-silver leader, Richard P. Bland of Missouri. The Cleveland men, or "gold Democrats," broke with their party after it became committed to free silver, and holding a convention of their own, nominated General John McA. Palmer of Illinois for the presidency on a platform which extolled Cleveland, attacked free coinage, and favoured the gold standard. Its main influence was to permit many Cleveland men to vote against Bryan without renouncing the name of Democrats. On the other hand the Populist convention also nominated Bryan on a platform more radical than that of the Democrats, since it included government ownership of the railways, the initiative and referendum, and a currency issued without the intervention of banks.

William McKinley elected President.

372. The contest was marked by great excitement as Bryan travelled across the country addressing great audiences. The endangered business interests found an efficient manager in Marcus A. Hanna of Ohio, McKinley's adviser, and expended large sums in a campaign of education. In the event, the older states of the Middle West, holding the balance between the manufacturing and capitalistic East and the populistic prairie and mining states of the West, gave their decision against free silver. But class appeals and class voting were a marked feature of the campaign, the regions of agricultural depression and farm mortgages favouring Bryan, and those of urban life favouring McKinley. Labour was not convinced that its interests lay in expanding the currency, and Mr Hanna had conducted McKinley's campaign successfully on the plea that he was the advance agent of prosperity under the gold standard and a restoration of confidence. McKinley carried all the Northern states east of the Missouri, and North Dakota, Oregon and California of the Farther West, as well as Maryland, Delaware, West Virginia and Kentucky along the borders of the South. His plurality over Bryan in the popular vote was more than 600,000, and his electoral majority 95. All the departments of government were transferred by the election to the Republicans.

Dingley Tariff.

373. Having secured power, the administration called a special session of Congress, and enacted the Dingley protective tariff (July 24, 1897), under which the deficit in the treasury was turned into a surplus. The act raised duties to their highest point, and as the protective schedules included some important articles produced by trusts which had a practical monopoly, such as sugar and petroleum, this was seized upon by the Democrats to stigmatize the tariff as the "mother of trusts." Many articles which had been placed on the free list in the Tariff Act of 1894, including lumber, wool and the raw material for cotton baling, were made dutiable. The high rates were defended, in part, by the provision authorizing the president to negotiate reciprocity treaties under which they might be lowered. Several such treaties were signed, but the Senate refused to ratify them.

Gold Standard Act.

374. The Republicans also wrote their triumph into the Gold Standard Act of the 4th of March 1900, which ensured the maintenance of this standard by reserving $150,000,000 of gold coin and bullion to redeem the United States notes and the treasury notes of 1890, and by authorizing the sale of bonds when necessary to maintain the reserve. National banks were authorized in the smaller towns (three thousand or less) with a capital of $25,000, half of that formerly required, and increased circulation was further provided for by permitting the national banks to issue United States bonds up to their par value.

Economic and Industrial Changes.

375. The economic policy of the Republicans was facilitated by the prosperity which set in about 1898. The downfall of silver-mining turned the prospectors to seek new gold fields, and they found them, especially in Alaska, about this time; and contemporaneously the chemists discovered cheaper and more efficient methods of extracting the gold from low-grade ores. Within five years after the crisis of 1893 the gold production of the United States nearly doubled. The United States coined $437,500,000 in gold in the five-year period 1897-1902, while the average for five-year periods since 1873 had been only $224,000,000. Thus gold instead of silver began to inundate the market, and to diminish the demand for expansion of the currency. Agriculture, prostrated in the years immediately preceding and following the panic of 1893, turned to the scientific study of its problems, developed dry farming, rotation and variety of crops, introduced forage crops like alfalfa, fed its Indian corn to cattle and hogs, and thus converted it into a profitable and condensed form for shipment. Range cattle were brought to the corn belt and fattened, while packing industries moved closer to these western centres of supply. Dairy-farming replaced the unprofitable attempts of older sections of the Middle West and the East to compete with the wheat-fields of the Farther West. Truck and fruit farming increased in the South, and the canning industry added utility to the fruits and vegetables of the West. Following the trend of combination the farmers formed growers' associations and studied the demand of the market to guide their sales. The mortgaged farms were gradually freed from debt. The wheat crop increased from less than 400,000,000 bushels valued at $213,000,000 in 1893 to 675,000,000 bushels valued at $392,000,000 in 1898. Prosperity and contentment replaced agitation in the populistic West for the time, and the Republican party gained the advantage of these changed conditions. Land values and the price of farm products rose. The farmers soon found it profitable to sell all or part of their land and re-invest in the cheaper virgin soils of the farther North-West and South-West, and thus began a new movement of colonization into the new West, while the landowners who remained gained an increasingly higher status, though farm labour failed to share proportionally in this advance.

The South.

376. In the South also there was greater contentment as the new industries of iron, textiles and forestry grew, and as the cotton crops increased. Unrest was diminished by the new state constitutions, which after 1890 disqualified negro voters by educational and tax requirements so contrived as not to disfranchise the poor whites.

"High Financiering."

377. In the decade which followed the crisis of 1893 a new industrial structure was made out of the chaos of the panic. "High financiering" was undertaken on a scale hitherto unknown. Combinations absorbed their weaker rivals; Standard Oil especially gained large interests in New York banks and in the iron mines and transportation lines about the Great Lakes, while it extended its power over new fields of oil in the South-West. In general, a small group of powerful financial interests acquired holdings in other lines of business, and by absorptions and "community of interest" exerted great influence upon the whole business world. The group of financiers, headed by J. Pierpont

Morgan, came to dominate various Southern transportation lines and the anthracite coal roads and mines, and extended their influence to the Northern Pacific railway, while a new genius in railway financiering, Edward H. Harriman, began an avowed plan of controlling the entire railway system of the nation. Backed by an important banking syndicate he rescued the Union Pacific from bankruptcy, and with its profits as a working basis he started in to acquire connecting and competing lines. Labour also shared in the general prosperity after 1898. Relative real wages increased, even allowing for the higher cost of living, and the length of the working day in general decreased except in special industries.

General Prosperity.

378. By 1900 the continental United States had a population of 76,000,000; an aggregate real and personal wealth of $88,500,000,000; a per capita public debt of $14·52, and per capita money circulation of $26·94 against $21·41 in 1896. In 1901 bank clearings amounted to nearly $115,000,000,000 against $45,000,000,000 in 1894. Imports of merchandise had fallen in this period, while exports rose from about $847,000,000 in 1893 to $1,394,000,000 in 1900. Of these exports food stuffs and food animals, crude and partly manufactured, aggregated nearly 40% of the total. The production of pig-iron, which was about 7,000,000 long tons in 1893, was nearly twice that in 1900. This economic prosperity and these far-reaching processes of social change by which the remaining natural resources of the nation were rapidly appropriated, went on contemporaneously with the extension of the activity of the nation oversea. The first rough conquest of the wilderness accomplished, the long period of internal colonization drawing to a close, the United States turned to consider its position as a world power.

Isthmian Canal.

379. To understand this position it is necessary to return to an earlier period and briefly survey the foreign relations since the close of the Reconstruction era. The most significant and persistent influence came from the growing interest of the United States in the Pacific, as its population and economic power extended to that ocean. The problem of an overflow of Chinese migration to the Pacific coast, and the jeopardizing of the American standard of labour by this flood, had been settled by various treaties and laws since 1880. The question of the relation of the United States to an interoceanic canal was not so easily settled. In 1878 Colombia granted a concession to a French company, promoted by Ferdinand de Lesseps, the engineer of the Suez Canal, to dig a tide-level canal through the Isthmus of Panama. President Hayes voiced the antagonism of the United States to this project of European capital in his message of 1880 in which he declared that such a canal should be under the control of this nation, and that it would be "virtually a part of the coast-line of the United States." Although an American company was organized to construct a canal under a concession from Nicaragua in 1884, no real progress was made, and the French company, defeated by engineering and sanitary difficulties, failed at the close of 1888.

Pan-American Congress.

Chile.

Bering Sea.

380. Meantime, for a few months, Blaine, as secretary of state under President Garfield, began a vigorous foreign policy with especial reference to the Pacific. He attempted to get the consent of England to abrogate the Clayton-Bulwer Treaty of 1850, which contemplated the construction of an isthmian canal by private enterprise under joint control and neutralization of the United States and Great Britain, together with such other powers as should join them. In South America he actively pressed the influence of the United States to settle the war between Chile and Peru. Again, in the years from 1889 to 1892, Blaine held the portfolio of state, and attempted to increase the influence of his country in Spanish America by the Pan-American Congress of 1890, which proposed a great international railway system and bank, commercial reciprocity and arbitration, without immediate results. (See PAN-AMERICAN CONFERENCES.) Indeed, the bad feeling aroused by his earlier policy toward Chile found expression in 1891 in a mob at Valparaiso, when some of the men from the United States ship "Baltimore" on shore leave were killed and wounded. An apology averted the war which President Harrison threatened. Blaine also asserted, against Canada particularly, the right of the United States to the seals of the Bering Sea; but in 1893 arbitrators decided against the claim.

Samoan Islands.

Hawaiian Islands.

381. As the navy grew and American policy increasingly turned to the Pacific, the need of coaling stations and positions advantageous to its sea power was appreciated. By a tripartite treaty in 1889 the Samoan islands were placed under the joint control of the United States, England and Germany, and, a decade later, they were divided among these powers, Tutuila and the harbour of Pago-Pago falling to the United States. The Hawaiian islands, which had been brought under the influence of civilization by American missionaries, were connected by commercial ties with the United States. Upon the attempt of the ruler to overturn the constitution, the American party, aided by the moral support of the United States, which landed marines, revolted, set up a republic, and asked annexation to the Union. A treaty, negotiated under President Harrison to this end, was withdrawn by President Cleveland, after investigation, on the ground that the part of the United States in the revolution was improper. He attempted without success to restore the original state of affairs, and on the 7th of July 1898 the islands were annexed.

Venezuelan Boundary.

382. President Cleveland's conservatism in this and other matters of foreign policy had not prepared the people for the sudden exhibition of firmness in foreign policy with which he startled the nation in his message of December 1895 upon the question of the boundary of Venezuela. That nation and England had a long-standing dispute over the line which separated British Guiana from Venezuela. Great Britain declined to arbitrate, at the suggestion of the United States, and gave an interpretation to the Monroe Doctrine which the administration declined to accept. President Cleveland thereupon brusquely announced to Congress his belief that Great Britain's attitude was in effect an attempt to control Venezuela, and proposed that a commission on the part of the United States should report upon the disputed boundary, and support Venezuela in the possession of what should be ascertained to be her rightful territory. Secretary-of-State Richard Olney declared: "To-day the United States is practically sovereign on this continent, and its fiat is law upon the subjects to which it confines its interposition." Great Britain tactfully accepted arbitration, however, and in the end (1899) was awarded most of the territory regarding which she had been unwilling to arbitrate.

Cuba; Spanish-American War.

The growing activity of the United States in foreign relations next manifested itself against Spain. Cuba in its commanding position with reference to the Gulf of Mexico and the approaches to the proposed isthmian canal, as well as in its commercial relations, and its menace as a breeding spot for yellow fever, had long been regarded by the United States as an important factor in her foreign policy. Successive administrations from the time of Jefferson had declared that it must not fall to another European nation, if Spain relinquished it, and that it was against the policy of the United States to join other nations in guaranteeing it to Spain. Between 1868 and 1878 a harsh war had been in progress between the island and the mother country, and American intervention was imminent. But Spain promised reforms and peace followed; again in 1895 revolt broke out, accompanied by severe repressive measures, involving grave commercial injury to the United States. (See SPANISH-AMERICAN WAR.)

Treaty of Paris, 1898.

383. By the Treaty of Paris, signed on the 10th of December 1898, Spain lost the remaining fragments of her ancient American Empire. She relinquished Cuba, which the United States continued temporarily to occupy without holding the sovereignty pending the orderly establishment of an independent government for the island. Porto

Rico, Guam and the Philippines were ceded outright to the United States, which agreed to pay $20,000,000 to Spain, and to satisfy the claims of its citizens against that power. By the treaty Congress was to determine the civil rights and political status of the native inhabitants of the ceded territory.

Results of the War.

384. As a result of the Spanish-American War, the United States found itself in a position of increased importance and prestige among the nations of the world. Especially in the Pacific, it was immediately involved in the diplomatic situation created by the efforts of European states to divide China into spheres of influence or of actual possession. The interests of the United States in the trade with China, as well as her new position in the Philippines, inclined her to oppose this policy, and Secretary-of-State John Hay showed himself one of the great American diplomats in his treatment of this difficult problem. In order to preserve Chinese entity and the "open door" for trade, he drew replies from the nations concerned, the result of which was to compel them to avow and moderate their intentions. When the Boxer insurrection broke out in China in 1900, and the legations were besieged at Peking, it was largely through the United States that a less rigorous treatment was secured for that disordered nation.

385. The acquisition of Porto Rico and the acceptance of responsibilities in Cuba gave new importance to the isthmian canal and increased the relative weight of the United States in regard to its control. The popular excitement with which the voyage of the "Oregon" was followed, as it took its way 14,000 m. around South America to participate in the destruction of the Spanish fleet in the battle of Santiago, brought home to the American people the need of such communication between the Atlantic and Pacific coasts.

The Philippines.

386. But the immediate political issues were concerned with problems of the relation of the newly won lands to the United States government. Bryan had persuaded his party to join in ratifying the treaty of Paris, expecting to determine the status of the islands later. But attention soon turned to the insurrection which broke out (Feb. 4, 1899) in the Philippines (*q.v.*) under Aguinaldo, after it became probable that the administration intended to retain these islands, not under a weak protectorate, but as a possession to be ruled and "assimilated." It was not until the spring of 1902 that this insurrection was completely put down, and in the interval the question of the destiny of the islands and the harshness of the measures of repression aroused political debate. The Democrats and many Republicans charged the administration with a policy of imperialism.

Porto Rico and Cuba.

387. The same issue was involved, in its constitutional and economic aspects, in the treatment of Porto Rico and Cuba. While the insurrection continued in the Philippines the government there was legally a military one, although exercised in part through civil officers and commissions. But in the case of Porto Rico the question was whether the "Constitution follows the flag," that is, whether it extended of its own force without an act of Congress to acquired territory, and covered the inhabitants with all the rights of citizens of the United States, as an integral part of the American people. Not only was it a question whether the native inhabitants of these new acquisitions could be wisely entrusted with this degree of political liberty, but the problem of the tariff was involved. The beet sugar producers of the United States feared the effect of the competition of Porto Rican sugar unless a protective tariff excluded this commodity. But if Porto Rico were an integral part of the United States the Dingley tariff could not be applied against its products, since this act imposed duties only on articles from "foreign countries." To meet this difficulty the Foraker Act of 1900 imposed a special tariff for two years upon Porto Rico, the proceeds to go to that island's own treasury. The act further asserted the principle that the inhabitants of the new possessions were not incorporated into the United States or entitled to all the privileges of citizens of the United States under the Constitution, by declaring that statutory acts of the United States locally inapplicable should not be in force in Porto Rico. The Supreme Court sustained this act in 1901, holding that Porto Rico was not so strictly a part of the United States that separate customs tariffs could not be imposed upon the territory. The close division of the court and the variety of opinions by which the decision was sustained left it somewhat uncertain whether and how far the Constitution extended of its own force to these annexations. The Foraker Act also provided a government for the island (see PORTO RICO). In Cuba the United States remained in authority until the 20th of May 1902, and details of the work of the government there, and the subsequent arrangements whereby the United States secured the substantial advantages of a protectorate without destroying the independence of Cuba, will be found in the article on CUBA.

"Imperialism."

Re-election and Assassination of McKinley.

388. Meantime, in the election of 1900, the Democrats renominated Bryan on a platform which opposed the Republican administration's acts in relation to the newly acquired territory and declared that "imperialism" was the paramount issue. The platform reaffirmed its silver doctrine of the previous campaign and denounced the tariff as a breeder of trusts. The Republicans renominated McKinley and endorsed his administration. While the Democrats declared for publicity in the affairs of interstate corporations and favoured enlargement of the interstate commerce law to prevent discriminations in railway rates, the Republicans were less hostile in their attitude toward the combinations, admitting the necessity of honest co-operation of capital to meet new business conditions. The Populists divided, the "anti-fusionists" supporting a separate ticket, with free silver, government ownership of railways, and anti-imperialism prominent in their demands; the other wing supported Bryan. Marcus A. Hanna, the Republican campaign manager, who was increasingly influential with the great business interests of the country, appealed to labour to support the administration and thereby retain "a full dinner pail." McKinley received an electoral majority of 137 and a popular plurality of 849,790. Before his second term was fairly begun he was shot by an anarchist while attending the Pan-American Exposition at Buffalo, and died on the 14th of September 1901. His wisdom in choosing able cabinet officers, his sympathetic tact in dealing with men and with sections, as well as the victories of the Spanish-American War, had brought him popularity even among his political opponents. But McKinley, like Cleveland, lacked the imagination to perceive and the desire to voice the aspirations and demands that had been gathering force for many years for legislation and executive action that should deal with the problem of effective regulation of the economic forces that were transforming American society. This gave his opportunity to Theodore Roosevelt (*q.v.*), who as vice-president now succeeded to office.

Roosevelt.

It was in foreign relations, which Secretary Hay continued to conduct, that continuity with McKinley's administration was most evident. But even here a bolder spirit, a readiness to break new paths and to take short cuts was shown by the new president. Venezuela had long delayed the payment of claims of citizens of various nations. In 1901, the president, having been informed by Germany of its intention to collect the claims of its citizens by force, but without acquisition of territory, announced that the United States would not guarantee any state against punishment if it misconducted itself, provided that the punishment did not take the form of acquisition of territory. As a result, a blockade of Venezuela was undertaken by the joint action of Germany, England and Italy at the close of 1902. The diplomatic intervention of the United States early the next year resulted in Venezuela's agreement to pay the claims in part and to set aside a portion of her customs receipts to this end. But since the blockading powers demanded preferential treatment, the United States secured a reference of the question to the Hague court, which decided that this demand was justified. San

San Domingo.

Domingo offered a similar problem, having a debt incurred by revolutionary governments, beyond its power to pay, and being threatened with forcible intervention by European states. President Roosevelt, in 1904, declared that in case of wrongdoing or impotency requiring intervention in the western hemisphere the United States might be forced "to the exercise of an international police power." In 1905 San Domingo and the United States signed a protocol under which the latter was empowered to take possession of the custom-house, conduct the finances and settle the domestic and foreign debts of San Domingo. In spite of the refusal of the Senate to assent to this protocol, President Roosevelt put the arrangement unofficially into effect, until, in 1907, the Senate consented to a treaty authorizing it with some modifications.

Policy in the Far East; the Portsmouth Treaty.

389. In the Far East the Boxer insurrection in China had been followed by the combined military expedition of the powers to the relief of Peking (in which the United States shared), and the exaction of a huge indemnity, of which the United States relinquished nearly half of its share, as in excess of the actual losses. The United States protested against Russian demands upon China, and actively participated in the negotiations which resulted in Russia's agreement to evacuate Manchuria. The delays of that power and her policy toward China having led Japan to declare war, Secretary Hay's diplomacy was influential in limiting the zone of hostilities; and the good offices of President Roosevelt brought about the conference between the two powers at Portsmouth, New Hampshire, which terminated hostilities in 1905. In this, and in his efforts to promote peace by extending the power of the various international peace congresses and by making the Hague tribunal an effective instrument for settling disputes, Roosevelt won the approval of Europe as well as of America. The dispute over the boundary between Alaska and Canada was narrowed by diplomatic discussion, and the remaining questions, involving the control of important ports at the head of the great inlets which offered access to the goldfields, were settled by arbitration in 1903 favourably to the American contentions.

The Panama Canal.

390. The Isthmian Canal also received a settlement in this administration by a process which was thoroughly characteristic of the resolution of President Roosevelt. The Clayton-Bulwer treaty was superseded by the Hay-Pauncefote treaty of 1901, by which Great Britain withdrew her objections to a canal constructed by the United States, and under the sole guarantee of neutralization by the latter power. The treaty also omitted a clause previously insisted on, forbidding the fortification of the canal. Having thus cleared the way, the United States next debated the advantages of the Nicaragua and the Panama routes. Influenced by the cost of acquiring the rights and property of the French company, an American commission reported in 1901 in favour of the Nicaraguan route; but upon receiving information that a smaller sum would be accepted, the Spooner Law was enacted (June 28, 1902) authorizing the president to purchase the rights and property of the Panama Company for $40,000,000, to acquire upon reasonable terms the title and jurisdiction to a canal strip at least 6 m. wide from Colombia, and through the Isthmian Canal Commission to construct the canal. But if the president was unable to secure a valid title from the French company and the control from Colombia within "a reasonable time and upon reasonable terms" the Nicaraguan route was to be made the line of the canal. With this means of pressure the president acquired the French rights; but Colombia declined to ratify the treaty negotiated for the purpose of giving the United States the specified control, on the terms offered. In this emergency an insurrection broke out in Panama on the 3rd of November 1903. The naval force of the United States, acting under the theory that it was obliged to keep open the transit across the isthmus by its treaty obligations, excluded armed forces from the canal strip, and the Republic of Panama, having declared its independence of Colombia, was promptly recognized on the 6th of November. Twelve days later a treaty was negotiated with this republic, by which the United States paid Panama $10,000,000, together with an annuity of $250,000 to begin ten years later, and guaranteed the independence of the republic, receiving in exchange the substantial sovereignty and ownership of a ten-mile strip for the canal. This treaty was ratified by the Senate on the 23rd of February 1904, and excavation was begun in 1907. (See PANAMA CANAL.)

The Philippines.

391. In the Philippines early in 1901 municipal and provincial governments were provided for, and the president had been for a brief time granted full power to govern the archipelago. He appointed Judge Taft civil governor, and limited the power of the military governor to regions where insurrection continued. On the 1st of July 1902 Congressional authority was substituted for that of the president, but Taft remained governor. The provisions of the Constitution guaranteeing life, liberty and property were in general extended specifically to the dependency, and a legislative assembly was promised, the lower house elective, and the upper house to consist of the Philippine Commission. By negotiations with Rome Governor Taft secured for the Philippines the "friars' lands" which had been a source of friction. On the 16th of October 1907 the first Philippine assembly was convened in the presence of Taft, then secretary of war.

392. The tariff question complicated American relations with both the Philippines and Cuba. Beet sugar and tobacco interests feared the competition of these products, and opposed freedom of trade between the United States and the new territories. The Philippine tariff of 1902 made a reduction of only 25% from the Dingley tariff in the case of the products of those islands, instead of the 75% urged by Taft; but the duties were to go to the Philippines. In the case of Cuba a more heated controversy arose over the tariff—Roosevelt strongly urged a substantial reduction in justice to Cuba at several regular and special sessions of Congress; but not until the close of 1903 was a treaty in operation which, under the principle of reciprocity, admitted some products of the United States to Cuba at reduced rates, and allowed Cuban products a reduction of 20% from the Dingley tariff, stipulating at the same time that so long as this arrangement continued no sugar should be admitted at reduced rates from any other country. This sacrifice of the means of reciprocity with sugar countries for the advantage of the beet sugar raisers of the West was quickly followed by the acquisition of preponderant interest in the beet sugar refineries by the Sugar Trust, which was thus able to control the domestic market; but for the time being it was evident that the forces friendly to the protective tariff had increased their following in important agricultural regions.

393. The dominant historical tendencies of the beginning of the 20th century in the United States, however, were characterized by huge combinations of capital and labour, the rapid passing of natural resources into private possession, and the exploitation of these resources on the principle of individualism by aggregations of capital which prevented effective competition by ordinary individuals. Pioneer conceptions of individual industrial achievement free from governmental restraint were adopted by huge monopolies, and the result was a demand for social control of these dangerous forces.

Combinations of Capital.

394. After the Sherman Anti-Trust Act of 1890 the combinations found in the favourable laws of states like New Jersey opportunity to incorporate under the device of the "holding company," which was supposed to be within the law. A "promotion mania" set in in 1901. The steel industry, after a threatened war between the Standard Oil and Carnegie groups, was united by Pierpont Morgan into the United States Steel Corporation with stocks and bonds aggregating $1,400,000,000. This was only one of the many combinations embracing public utilities of all kinds. Where open consolidation was not effected, secret agreements, as in the case of the meat packers, effectively regulated the market. In the field of railway transportation, Harriman used the bonds of the

Union Pacific to acquire the Southern Pacific with the Central Pacific, and by 1906 he was dictator of one-third of the total mileage of the United States. Meanwhile the Great Northern and the Northern Pacific had been brought into friendly working arrangements under James J. Hill, and tried to secure the Burlington railway. A fierce contest followed between the Hill, Morgan and Harriman forces, resulting in a compromise by which the Northern Securities Company, a holding company for the joint interests of the contestants, was created. It was admitted by the counsel for this company that the machinery provided in this organization would permit the consolidation of all the railways of the country in the hands of three or four individuals. By using notes of one railway company, based on its treasury securities, it was possible to acquire a controlling interest in others; and by watering the capital stock to recover the cost of the undertaking, while the public paid the added rates to supply dividends on the watered stock.

The Northern Securities Company.

395. Following a similar tendency the great Wall Street banking houses were dominated by the large financial groups in the interest of speculative undertakings, the directors of banks loaning to themselves, as directors of industrial combinations, the funds which flowed into New York from all the banks of the interior. By a similar process the great insurance and trust companies of New York became feeders to the same operations. Thus a community of control over the fundamental economic interests of the nation was lodged in a few hands. Rebates and discriminations by the railways gave advantage to the powerful shippers, and worked in the same direction.

The Elkins Law; the Bureau of Corporations.

396. Such was the situation in domestic affairs which confronted Roosevelt when he became president. In his first message he foreshadowed his determination to grapple with these problems. In 1903 he instructed the attorney-general to bring suit to dissolve the Northern Securities Company as a combination in restraint of trade, and in 1904 the Supreme Court held the merger illegal. But the effect was to increase the tendency to change from incomplete combination of financial interests to consolidated corporations owning the property, and to lead the government, on the other hand, to seek to regulate these vast business interests by legislation. The Elkins Law, passed in 1903, increased the power of the interstate commerce commission to prosecute offenders, especially those who violated the anti-rebating clauses. In the same year the creation of the Federal Bureau of Corporations provided for increased publicity in the affairs of these organizations.

Combinations of Labour.

397. Labour was combining in its turn. Not only did local unions in most of the trades increase in number and power, but workers in separate industries over large areas were combined for collective bargaining and the national organization, the American Federation of Labor, had a membership by 1905 of approximately 2,000,000. Labour legislation by the states increased under these influences, and political leaders became increasingly aware of the power of the labour vote, while employers began to form counter organizations to check the growth of the movement. In 1902 Pennsylvania members of the United Mine Workers of America, led by John Mitchell, struck. Inasmuch as their employers were the owners of the anthracite coal monopoly under the control of an allied group of coal-carrying railways, the contest was one of far-reaching importance, and soon brought about a coal famine felt throughout the nation. So threatening was the situation that President Roosevelt called a conference of the contestants, and succeeded in inducing them to submit their difficulties to an arbitration commission which, by its report, in the spring of 1903, awarded to the miners shorter hours and an increase of wages.

Economic Measures of the Federal Government.

398. Steadily the United States enlarged its economic functions. In 1903 Congress created a Department of Commerce and Labor and made the secretary a member of the cabinet. The reports of this department gave publicity to investigations of the perplexing industrial conditions. The Department of Agriculture enlarged its staff and its activity, investigating diseases of plants and animals, ascertaining means of checking insect pests, advising upon the suitability of soils to crops, seeking new and better seeds, and circulating general information. The contemporaneous development of agricultural education in the various Western and Southern states whose agricultural colleges had been subsidized by land grants and appropriations by the Federal government, and the experimental farms conducted by railways, all worked to the same end. Congress passed acts to limit the substitution of oleomargarine for butter (1902) and provided for the limitation of the spread of live-stock diseases (1903). The nation began also to awake to the need of protecting its remaining forests, which were rapidly falling into the hands of corporations by perversion of homestead and other land laws. President Cleveland had withdrawn large forest tracts, and in 1898 Gifford Pinchot was made head of a division of forestry in the Department of Agriculture. In 1901 the work was organized under a separate bureau, and four years later the National Forests were placed under his management.

The Reclamation Service.

399. The increasing demand for lands for agriculture led also, under Roosevelt, to the real beginning of national irrigation actively in the vast arid area of the Far West. The Reclamation Service was created by the act of the 17th of June 1902, which set aside the proceeds of the sale of public lands in thirteen states and three Territories as a fund for irrigation works. The government itself reserved timber and coal tracts, water powers and other requisites for construction, and sold the irrigated lands to actual settlers in small farms, while retaining title to the reservoirs and the works. The income from the reclamation fund between 1901 and 1910 aggregated over $60,000,000. By the use of suitable crops and dry farming agricultural occupation was extended into formerly desert lands.

When corruption was discovered in the Land Office and Post Office, Roosevelt, instead of yielding to the effort to conceal the scandal, compelled effective investigation. Two United States senators were convicted of land frauds. The application to all kinds of lands, whether coal lands, timber tracts, water rights or other natural resources, of the general principle of homesteads governing the acquisition of agricultural lands, had invited fraudulent entries. The Homestead Act of 1862, the Timber Culture Act of 1873, the Desert Land Act of 1877, the Stone and Timber Act of 1878 had all been used by corporations to secure great tracts of valuable land through employing men to homestead them, and the laws themselves were loosely enforced. In successive messages, and by reports of public land commissions, the administration urged the importance of readjusting the land laws for the protection of the public.

Elections of 1904.

400. In the election of 1904 the popularity of President Roosevelt, after his strenuous activity in challenging some of the strongest tendencies in American life, was put to the test. His political management exhibited the fact that he was trained in the school of the New York politician as well as in the reformer's camp, and he was easily nominated by the Republicans on a platform which endorsed his administration, and made no promise of tariff changes. The Democrats turned to the conservative wing, omitted any reference to silver or the income tax, and nominated Judge Alton B. Parker, of New York. The radicals, who favoured William R. Hearst, the well-known newspaper proprietor, who was influential with the masses of large cities, were largely represented in the convention, but unable to poll a third of its vote. Parker accepted the nomination after telegraphing that he regarded the gold standard as irrevocably established The issue of imperialism had been largely eliminated by the current of events and the anti-trust issue was professed by both parties. In the outcome Roosevelt won by the unprecedented popular plurality of over 2,500,000, and an electoral majority of 196.

401. The state elections of the same period showed that a

wave of reform and of revolt against former political forces was rising. In five states which Roosevelt carried by his popularity the machine Republican candidates for governor were defeated by reforming Democratic candidates, and in cities like Chicago and Philadelphia the issues of reform and radicalism won unexpected though temporary success. Roosevelt had "stolen the thunder" of the parties of social unrest, including the old populistic areas of the Middle West and the labour element of the cities at the same time that he retained control of the Republican party machinery.

The President's Radicalism.

402. In his second administration President Roosevelt pressed his policies so hard and with such increasing radicalism that he lost control of the regular organization in Congress before the end of his term. In the House Speaker Joseph G. Cannon, of Illinois, exhibited the full power of his office in concentrating party policies in the hands of the few regular leaders, while in the Senate a directing group of New England men who had served for a long time, chiefly senators Nelson W. Aldrich and Eugene Hale, showed a similar mastery. Against this control a significant revolt, illustrative of revived discontent in the Middle West, was made by the Republican senator Robert M. La Follette, of Wisconsin, who had won his fight in that state against the faction friendly to the railways, and had secured primary elections, railway rate regulation on the basis of expert valuation of the physical property of the railways, and a system of taxation which rested more heavily upon public utilities. In pressing similar policies upon Congress he became isolated from the party leaders, but forced them to go on record by roll calls.

New York Insurance Investigation.

403. In New York a legislative investigation of the insurance companies disclosed such connexions with the high financiering of Wall Street as to create widespread distrust and to lead to reform legislation. The attorney who conducted the investigation, Charles Evans Hughes (b. 1862), had shown such ability that he was chosen governor of New York in 1906.[1] His administration was marked by independence of the party machine and a progressive policy. Foreign relations were conducted during the second administration of Roosevelt by Secretary Elihu Root from 1905. He fostered friendly relations with the other American nations, allaying their concern lest ambitious designs of their larger neighbour might endanger their independence. In Cuba a signal illustration of the good faith of the United States was exhibited when an insurrection in the summer of 1906 left the republic substantially without a government. Mr Taft, then secretary of war, was sent, under the treaty provisions for intervention, to organize a provisional government. During his few days' service as governor-general he set in motion the machinery for restoring order. But President Roosevelt had plainly stated that if the insurrectionary habit became confirmed in Cuba she could not expect to retain continued independence.

Cuba.

Japanese Immigration.

404. Attention was again fixed upon the Pacific coast, not only by the earthquake and conflagration which in 1906 destroyed the business parts and much of the residence section of San Francisco, but also by municipal regulations there against the presence of Japanese in the public schools. The incident seemed to threaten grave consequences, which were averted by the popularity of Roosevelt both in California and in Japan. In the Immigration Act of the 20th of February 1907 the problem of exclusion of Japanese labour, which underlay the difficulty, was partly solved by preventing the entrance to the continental United States by way of neighbouring countries of persons holding passports issued by a foreign government for going to other countries or dependencies of the United States. Since Japan discouraged its citizens from migrating directly to the United States this satisfied California.

405. As a demonstration of the naval power of the United States in Pacific waters, the President sent the American fleet on a cruise around the world, in the course of which they were received in a friendly spirit by Japan. The navy was increased to keep pace with the growth of that of other nations, both in numbers and size of vessels, in this period, but not to the extent demanded by the administration. Already a more efficient organization of both army and navy had been effected. While the nation prepared for war, it also engaged prominently in the successive international peace congresses between 1899 and 1907, aiming consistently to increase the use of arbitration.

Railway Rate Regulation Act.

406. The tendencies of the government to deal with social improvement were exemplified by the laws of 1906 providing for pure food and meat inspection. The Railway Rate Regulation Act of 1906 strengthened previous inter-state acts by including pipe lines (except for gas and water) under the jurisdiction of the Interstate Commerce Commission, and extending the meaning of "common carrier" to include express and sleeping-car companies. Published rate schedules were required, not to be changed without thirty days' notice, and more stringent provisions were made to prevent rebating. The act provided for review by the Federal courts, and did not permit the commission to investigate an increase of rates until the rates went into operation, nor did it provide for a valuation of the railways as a basis of rate-making which the commission had desired. Later acts partly met the demands of railway employés by increasing the liability of common carriers and by providing for shorter hours.

Financial Panic of 1907.

407. Although Roosevelt had made concessions to the railways in the formation of the act of 1906, his utterances showed a tendency alarming to the large business interests and the holders of corporation securities generally. The unsettled business conditions were reflected in the stock market, and began to produce a reaction against the activity of government in this direction. The panic of 1907 started with the downfall of an attempted combination of a chain of banks, copper interests and other enterprises of F. Augustus Heinze and Charles W. Morse, two daring operators in Wall Street, and was followed by the collapse of the Knickerbocker Trust Company (October 21, 1907). Already, in 1903, liquidation had begun in some of the stocks so actively issued in the preceding years. The leading New York banks failed to check speculation, however, and were even contributors to the movement up to the time of the panic. The country was generally prosperous, though much of the banking funds was tied up in New York City at this juncture. Clearing-house certificates were resorted to; by the 1st of November partial suspension was general throughout the nation; and banking facilities were more completely interrupted than at any time since the Civil War. The government greatly increased its deposits, and offered Panama 2% bonds to the amount of $50,000,000, and 3% certificates for $100,000,000, with the object of providing the national banks a basis for additional note issues. But these were taken only to a small amount, as they proved useful for their moral effect chiefly. An enormous addition to the money supply was made in the course of the panic, both by governmental activity, gold imports and national bank-notes. The crisis was brought to a close before the end of 1907 by the vigour of the government and the activity of the large financial interests under the lead of J. P. Morgan, who finally entered the field to stop the decline, at the same time that his associates in the Steel Trust acquired possession of their last remaining rival of importance, the Tennessee Coal & Iron Company.

Conservation.

408. The reaction after the panic, and the loss of influence resulting from his announcement that he would not permit his renomination for the campaign of 1908, left Roosevelt unable to exercise the compelling power which he had displayed in previous years. Congress under the control of the conservatives refused him legislation which he asked, but before he left the presidency he raised a new issue to national importance in his calling of a congress of state governors and experts to consider the need

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[1] In 1910 Hughes was appointed a justice of the United States Supreme Court.

of the conservation of natural resources (see IRRIGATION: *United States*; and the article ROOSEVELT). This congress met in May 1908 and endorsed the proposal for vigorous attention by state and nation to the question.

409. In the campaign of 1908 he succeeded, against the opposition of both the extreme conservative and the radical wings, in procuring the nomination of Secretary Taft by the Republicans on a platform endorsing the Roosevelt policies, promising a revision of the tariff at a special session, on the basis of such protection as would equal the difference between the cost of production at home and abroad, together with a reasonable profit to American industries, and providing for maximum and minimum rates to be used in furthering American commerce and preventing discriminations by other nations. A postal bank was promised, a more effective regulation of the railways, and a modification of the Sherman Anti-Trust Act. Labour failed to secure a thoroughgoing pledge to prevent the use of the writ of injunction in labour disputes, but the convention promised legislation to limit its use. The Democrats again selected William J. Bryan as their candidate; demanded the enforcement of criminal law against "trust magnates" and such additional legislation as would prevent private monopoly; opposed the use of injunctions in cases where they would issue if no industrial dispute was involved; impugned the Republicans' good faith in tariff revision, promising for themselves a substantial reduction of duties; favoured an income tax and a guarantee fund by national banks to pay depositors of insolvent banks, or a postal savings bank, if the guaranteed bank could not be secured; demanded election of United States senators by direct vote of the people, legislation to prevent contributions by corporations to campaign funds, and a more efficient regulation of railways. The party also declared against centralization, favouring the use of both Federal and state control of interstate commerce and private monopoly.

William H. Taft, President.

410. The Republicans won a sweeping victory, Taft's popular plurality reaching about 1,270,000 and his electoral majority 159. But it had been won by some ambiguity of utterance with respect to tariff and railway regulation. The result was made manifest early in the new administration, when party contentions over the direction of revision of the tariff, the thoroughness of the regulation of railways and corporations, and the question of where the postal bank fund should be placed, resulted in a movement of "insurgency" among the Republicans of the Middle West. The insurgents termed themselves "Progressive Republicans," and did not hesitate to join forces with the Democrats in order to shape legislation to their wishes. Progressives and Democrats united in overturning the control of Speaker J. G. Cannon in the House of Representatives by modifying the rules, and a group of senators, chiefly from the Middle Western states, destroyed the control of the regular leaders in the Upper House. President Taft's influence over the revolting wing was further weakened by the charges made against his secretary of the interior, Richard A. Ballinger, on behalf of Gifford Pinchot, the chief forester, who accused the administration of obstructing Mr Roosevelt's "conservation" policy.

Roosevelt's "New Nationalism."

411. Mr Pinchot was indeed removed from office, but the "conservation" issue was raised to primary importance by the return of Mr Roosevelt from his African trip. His influence was revealed even while he was enjoying the hospitality of European countries on his return. There was a widely extended desire to know his judgment of the administration's policy; but he maintained silence until the close of the summer of 1910, when in a series of public utterances in the West he ranged himself, on the whole, with the progressive wing and announced a "new nationalism" which should enlarge the power of the Federal government and drive the "special interests" out of politics. The "insurgents" achieved remarkable victories in the Middle West, California, New Hampshire and New York in the fall conventions and primary elections, retiring various leaders of the regular wing of the Republicans. Senators Aldrich and Hale, former regular leaders in the Senate, had already announced their purpose to resign. President Taft's utterances indicated his intention to discontinue the use of patronage against the leaders of the progressive wing and to secure additional tariff revision by separate schedules. The result of the autumn elections was a pronounced victory for the Democratic party.

412. At the close of the first decade of the 20th century the United States was actively engaged in settling its social economic questions, with a tendency toward radicalism in its dealings with the great industrial forces of the nation. The "sweat shops" and slums of the great cities were filled with new material for American society to assimilate. To the sisterhood of states had been added Oklahoma (1907), and in 1910 Congress empowered New Mexico and Arizona to form constitutions preparatory to statehood, thus extinguishing the last Territories, except the insular dependencies and Alaska. Already the food supply showed signs of not keeping pace with the growth of population, while the supply of gold flowed in with undiminished volume. High prices became a factor in the political situation. Between 1890 and 1900, in the continental United States, farms were added in area equal to that of France and Italy combined. Even the addition of improved farm land in that decade surpassed the whole area of France or of the German Empire in Europe. But intensive cultivation and agricultural returns hardly kept pace with the growth in population or the extension of farms.

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UNITED STATES NAVAL ACADEMY, an institution for the education of officers of the United States Navy, at Annapolis, Maryland, occupying about 200 acres on the banks of the Severn. Its principal buildings are the marine engineering building, the academic building (containing the library), the chapel, the gymnasium, the physics and chemistry building, the auditorium, the armoury, the power-house, the administration building, Bancroft Hall (the midshipmen's quarters), officers' mess and club, and Sampson Row, Upshur Row and Rodgers Row, the officers' quarters.[1] By an Act of Congress passed in 1903 two midshipmen (as the students have been called since 1902; "naval cadets" was the term formerly used) were allowed for each senator, representative, and delegate in Congress, two for the District of Columbia, and five each year at large; but after 1913 only one midshipman is to be appointed for each senator, representative and delegate in Congress. Candidates are nominated by their senator, representative, or delegate in Congress, and those from the District of Columbia and those appointed at large are chosen by the President; but to be admitted they must be between sixteen and twenty years of age and must pass an entrance examination. Each midshipman is paid $600 a year, beginning with the date of his admission; and he must bind himself to serve in the United States Navy for eight years (including the years spent in the academy) unless he is discharged sooner. The course of instruction is for four years—"final graduation" comes only after six years, the additional years being spent at sea—and is in eleven departments: discipline, seamanship, ordnance and gunnery, navigation, marine engineering and naval construction, mathematics and mechanics, physics and chemistry, electrical engineering, English, modern languages, naval hygiene and physiology. Vessels for practice work of midshipmen in the first, second, and third year classes are attached to the academy during the academic year, and from early in June to September of each year the midshipmen are engaged in practice cruises. The academy is governed by the Bureau of Navigation of the United States Navy Department, and is under the immediate supervision of a superintendent appointed by the secretary of the navy, with whom are associated the Commandant of Midshipmen, a disciplinary officer, and the Academic Board, which is composed of the superintendent and the head of each of the eleven departments. The institution was founded as the Naval School in 1845 by the secretary of the navy, George Bancroft, and was opened in October of that year. Originally a course of study for five years was prescribed, but only the first and last were spent at the school, the other three being passed at sea. The present name was adopted when the school was reorganized in 1850, being placed under the supervision of the chief of the Bureau of Ordnance and Hydrography, and under the immediate charge of the superintendent, and the course of study was extended to seven years; the first two and the last two to be spent at the school, the intervening three years to be passed at sea. The four years of study were made consecutive in 1851, and the practice cruises were substituted for the three consecutive years at sea. At the outbreak of the Civil War the three upper classes were detached and were ordered to sea, and the academy was removed to Fort Adams, Newport, Rhode Island (May 1861), but it was brought back to Annapolis in the summer of 1865. The supervision of the academy was transferred from the Bureau of Ordnance and Hydrography to the Bureau of Navigation when that bureau was established in 1862; and, although it was placed under the direct care of the Navy Department in 1867, it has been (except in 1869–1889) under the Bureau of Navigation for administrative routine and financial management. The Spanish-American War greatly emphasized its importance, and the academy was almost wholly rebuilt and much enlarged in 1899–1906.

See J. R. Soley, *Historical Sketch of the United States Naval Academy* (Washington, 1876); Park Benjamin, *The United States Naval Academy* (New York, 1900); Randall Blackshaw, "The New Naval Academy," in the *Century Magazine* for October 1905.

UNITS, DIMENSIONS OF. Measurable entities of different kinds cannot be compared directly. Each one must be specified in terms of a unit of its own kind; a single number attached to this unit forms its measure. Thus if the unit of length be taken to be L centimetres, a line whose length is l centimetres will be represented in relation to this unit by the number l/L; while if the unit is increased [L] times, that is, if a new unit is adopted equal to [L] times the former one, the numerical measure of each length must in consequence be divided by [L]. Measurable entities are either fundamental or derived. For example, velocity is of the latter kind, being based upon a combination of the fundamental entities length and time; a velocity may be defined, in the usual form of language expressive of a limiting value, as the rate at which the distance from some related mark is changing per unit time. The element of length is thus involved directly, and the element of time inversely in the derived idea of velocity; the meaning of this statement being that when the unit of length is increased [L] times and the unit of time is increased [T] times, the numerical value of any given velocity, considered as specified in terms of the units of length and time, is diminished [L]/[T] times. In other words, these changes in the units of length and time involve change in the unit of velocity determined by them, such that it is increased [V] times where $[V]=[L][T]^{-1}$. This relation is conveniently expressed by the statement that velocity is of $+1$ dimension in length and of -1 dimension in time. Again, acceleration of motion is defined as rate of increase of velocity per unit time; hence the change of the units of length and time will increase the corresponding or derived unit of acceleration [V]/[T] times, that is $[L][T]^{-2}$ times: this expression thus represents the dimensions (1 in length and -2 in time) of the derived entity acceleration in terms of its fundamental elements length and time. In the science of dynamics all entities are derived from the three fundamental ones, length, time and mass; for example, the dimensions of force (P) are those of mass and acceleration jointly, so that in algebraic form $(P)=[M][L][T]^{-2}$. This restriction of the fundamental units to three must therefore be applicable to all departments of physical science that are reducible to pure dynamics.

The mode of transformation of a derived entity, as regards its numerical value, from one set of fundamental units of reference to another set, is exhibited in the simple illustrations above given. The procedure is as follows. When the numerical values of the new units, expressed in terms of the former ones, are substituted for the symbols, in the expression for the dimensions of the entity under consideration, the number which results is the numerical value of the new unit of that entity in terms of the former unit: thus all numerical values of entities of this kind must be divided by this number, in order to transfer them from the former to the latter system of fundamental units.

As above stated, physical science aims at reducing the phenomena of which it treats to the common denomination of the positions and movements of masses. Before the time of Gauss it was customary to use a statical measure of force, alongside the kinetic measure depending on the acceleration of motion that the force can produce in a given mass. Such a statical measure could be conveniently applied by the extension of a spring, which, however, has to be corrected for temperature, or by weighing against standard weights, which has to be corrected for locality. On the other hand, the kinetic measure is independent of local conditions, if only we have absolute scales of length and time at our disposal. It has been found to be indispensable, for simplicity and precision in physical science, to express the measure of force in only one way; and statical forces are therefore now generally referred in theoretical discussions to the kinetic unit of measurement. In mechanical engineering the static unit has largely survived; but the increasing importance of electrical applications is introducing uniformity there also. In the science of electricity two different systems of units, the electrostatic and the electrodynamic, still to a large extent persist. The electrostatic system arose because in the development of the subject statics came before kinetics; but in the complete synthesis it is usually found convenient to express the various quantities in terms of the electrokinetic system alone.

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[1] The old quarters of the superintendent, a colonial house, once the official residence of the governors of Maryland, was destroyed in 1900. In 1909 old Fort Severn, a small circular structure with thick walls, built in 1809, was torn down.

The system of measurement now adopted as fundamental in physics takes the centimetre as unit of length, the gramme as unit of mass, and the second as unit of time. The choice of these units was in the first instance arbitrary and dictated by convenience; for some purposes subsidiary systems based on multiples of these units by certain powers of ten are found convenient. There are certain absolute entities in nature, such as the constant of gravitation, the velocity of light in free space, and the constants occurring in the expression giving the constitution of the radiation in an enclosure that corresponds to each temperature, which are the same for all kinds of matter; these might be utilized, if known with sufficient accuracy, to establish a system of units of an absolute or cosmical kind. The wave-length of a given spectral line might be utilized in the same manner, but that depends on recovering the kind of matter which produces the line.

In physical science the uniformities in the course of phenomena are elucidated by the discovery of permanent or intrinsic relations between the measurable properties of material systems. Each such relation is expressible as an equation connecting the numerical values of entities belonging to the system. Such an equation, representing as it does a relation between actual things, must remain true when the measurements are referred to a new set of fundamental units. Thus, for example, the kinematical equation $v^2=nf^2l$, if n is purely numerical, contradicts the necessary relations involved in the definitions of the entities velocity, acceleration, and length which occur in it. For on changing to a new set of units as above the equation should still hold; it, however, then becomes $v^2/[\mathrm{V}]^2=n\cdot f^2/[\mathrm{F}]^2\cdot l/[\mathrm{L}]$. Hence on division there remains a dimensional relation $[\mathrm{V}]^2=[\mathrm{F}]^2[\mathrm{L}]$, which is in disagreement with the dimensions above determined of the derived units that are involved in it. The inference follows, either that an equation such as that from which we started is a formal impossibility, or else that the factor n which it contains is not a mere number, but represents n times the unit of some derived quantity which ought to be specified in order to render the equation a complete statement of a physical relation. On the latter hypothesis the dimensions $[\mathrm{N}]$ of this quantity are determined by the dimensional equation $[\mathrm{V}]^2=[\mathrm{N}][\mathrm{F}]^2[\mathrm{L}]$ where, in terms of the fundamental units of length and time, $[\mathrm{V}]=[\mathrm{L}][\mathrm{T}]^{-1}$, $[\mathrm{F}]=[\mathrm{L}][\mathrm{T}]^{-2}$; whence by substitution it appears that $[\mathrm{N}]=[\mathrm{L}]^{-1}[\mathrm{T}]^2$. Thus, instead of being merely numerical, n must represent in the above formula the measure of some physical entity, which may be classified by the statement that it has the conjoint dimensions of time directly and of velocity inversely.

It often happens that a simple comparison of the dimensions of the quantities which determine a physical system will lead to important knowledge as to the necessary relations that subsist between them. Thus in the case of a simple pendulum the period of oscillation τ can depend only on the angular amplitude α of the swing, the mass m of the bob considered as a point, and the length l of the suspending fibre considered as without mass, and on the value of g the acceleration due to gravity, which is the active force; that is, $\tau=f(\alpha, m, l, g)$. The dimensions must be the same on both sides of this formula, for, when they are expressed in terms of the three independent dynamical quantities mass, length, and time, there must be complete identity between its two sides. Now, the dimensions of g are $[\mathrm{L}][\mathrm{T}]^{-2}$; and when the unit of length is altered the numerical value of the period is unaltered, hence its expression must be restricted to the form $f(\alpha, m, l/g)$. Moreover, as the period does not depend on the unit of mass, the form is further reduced to $f(\alpha, l/g)$; and as it is of the dimensions $+1$ in time, it must be a multiple of $(l/g)^{\frac{1}{2}}$, and therefore of the form $\phi(\alpha)\sqrt{(l/g)}$. Thus the period of oscillation has been determined by these considerations except as regards the manner in which it depends on the amplitude a of the swing. When a process of this kind leads to a definite result, it will be one which makes the unknown quantity jointly proportional to various powers of the other quantities involved; it will therefore shorten the process if we assume such an expression for it in advance, and find whether it is possible to determine the exponents definitely and uniquely so as to obtain the correct dimensions. In the present example, assuming in this way the relation $\tau=\mathrm{A}a^pm^ql^rg^s$, where A is a pure numeric, we are led to the dimensional equation $[\mathrm{T}]=[a]^p[\mathrm{M}]^q[\mathrm{L}]^r[\mathrm{LT}^{-2}]^s$, showing that the law assumed would not persist when the fundamental units of length, mass, and time are altered, unless $q=0$, $s=-\frac{1}{2}$, $r=\frac{1}{2}$; as an angle has no dimensions, being determined by its numerical ratio to the *invariable* angle forming four right angles, p remains undetermined. This leads to the same result, $\tau=\phi(\alpha)l^{+\frac{1}{2}}g^{-\frac{1}{2}}$, as before.

As illustrating the power and also the limitations of this method of dimensions, we may apply it (after Lord Rayleigh, *Roy. Soc. Proc.*, March 1900) to the laws of viscosity in gases. The dimensions of viscosity (μ) are (force/area) ÷ (velocity/length), giving $[\mathrm{ML}^{-1}\mathrm{T}^{-1}]$ in terms of the fundamental units. Now, on the dynamical theory of gases viscosity must be a function of the mass m of a molecule, the number n of molecules per unit volume, their velocity of mean square $\bar{v}$, and their effective radius a; it can depend on nothing else. The equation of dimensions cannot supply more than *three* relations connecting these four possibilities of variation, and so cannot here lead to a definite result without further knowledge of the physical circumstances. And we remark conversely, in passing, that wherever in a problem of physical dynamics we know that the quantity sought can depend on only three other quantities whose dynamical dimensions are known, it must vary as a simple power of each. The additional knowledge required, in order to enable us to proceed in a case like the present, must be of the form of such an equation of simple variation. In the present case it is involved in the new fact that in an actual gas the mean free path is very great compared with the effective molecular radius. On this account the mean free path is inversely as the number of molecules per unit volume; and therefore the coefficient of viscosity, being proportional to these two quantities jointly, is independent of either, so long as the other quantities defining the system remain unchanged. If the molecules are taken to be spheres which exert mutual action only during collision, we therefore assume

$$\mu \propto m^x\bar{v}^ya^z,$$

which requires that the equation of dimensions

$$[\mathrm{ML}^{-1}\mathrm{T}^{-1}]=[\mathrm{M}]^x[\mathrm{LT}^{-1}]^y[\mathrm{L}]^z$$

must be satisfied. This gives $x=1$, $y=1$, $z=-2$. As the temperature is proportional to $m\bar{v}^2$, it follows that the viscosity is proportional to the square root of the mass of the molecule and the square root of the absolute temperature, and inversely proportional to the square of the effective molecular radius, being, as already seen, uninfluenced by change of density.

If the atoms are taken to be Boscovichian points exerting mutual attractions, the effective diameter a is not definite; but we can still proceed in cases where the law of mutual attraction is expressed by a simple formula of variation—that is, *provided* it is of type km^2r^s, where r is the distance between the two molecules. Then, noting that, as this is a force, the dimensions of k must be $(\mathrm{M}^{-1}\mathrm{L}^{s+1}\mathrm{T}^{-2}]$, we can assume

$$\mu \propto m^x\bar{v}^yk^w,$$

provided $$[\mathrm{ML}^{-1}\mathrm{T}^{-1}]=[\mathrm{M}]^x[\mathrm{LT}^{-1}]^y[\mathrm{M}^{-1}\mathrm{L}^{s+1}\mathrm{T}^{-2}]^w,$$
which demands and is satisfied by

$$x-w=1,\ y+2w=1,\ y+(s+1)w=-1,$$

so that $$w=-\frac{2}{s-1},\ y=\frac{s+3}{s-1},\ x=\frac{s-3}{s-1}.$$

Thus, on this supposition,

$$\mu \propto m^{\frac{s-9}{2s-2}}k^{-\frac{2}{s-1}}\theta^{\frac{s+3}{2s-2}}$$

where θ represents absolute temperature. (See DIFFUSION.)

When the quantity sought depends on more than three others, the method may often be equally useful, though it cannot give a complete result. Cf. Sir G. G. Stokes, *Math. and Phys. Papers*, v. (1881) p. 106, and Lord Rayleigh, *Phil. Mag.* (1905), (1) p. 494, for examples dealing with the determination of viscosity from observations of the retarded swings of a vane, and with the formulation of the most general type of characteristic equation for gases respectively. As another example we may consider what is involved in Bashforth's experimental conclusion that the air-resistances to shot of the same shape are proportional to the squares of their linear dimensions. *A priori*, the resistance is a force which is determined by the density of the air ρ, the linear dimensions l of the shot, the viscosity of the air μ, the velocity of the shot v, and the velocity of sound in air c, there being no other physical quantity sensibly involved. Five elements are thus concerned, and we can combine them in two ways so as to obtain quantities of no dimensions; for example, we may choose $\rho vl/\mu$ and v/c. The resistance to the shot must therefore be of the form $\mu^x \rho^y v^z \phi(\rho vl/\mu) f(v/c)$ this form being of sufficient generality, as it involves an undetermined function for each element beyond three. On equating dimensions we find $x=2$, $y=-1$, $z=0$. Now, Bashforth's result shows that $\phi(\chi)=\chi^2$. Therefore the resistance is $\rho v^2 l^2 f(v/c)$, and is thus to our degree of approximation independent of the viscosity. Moreover, we might have assumed this practical independence straight off, on known hydrodynamic grounds; and then the argument from dimensions could have predicted Bashforth's law, if the present application of the doctrine of dimensions to a case involving turbulent fluid motion not mathematically specifiable is valid. One of the important results drawn by Osborne Reynolds from his experiments on the *régime* of flow in pipes was a confirmation of its validity: we now see that the ballistic result furnishes another confirmation.

In electrical science two essentially distinct systems of measurement were arrived at according as the development began with the phenomena of electrostatics or those of electrokinetics. An electric charge appears as an entity having different dimensions in terms of the fundamental dynamical units in the two cases: the ratio of these dimensions proves to be the dimensions of a velocity. It was found, first by W. Weber, by measuring the same charge by its static and its kinetic effects, that the ratio of the two units is a velocity sensibly identical with the velocity of light, so far as regards experiments conducted in space devoid of dense matter. The emergence of a definite absolute velocity such as this, out of a comparison of two different ways of approaching the same quantity, entitles us to assert that the two ways can be consolidated into a single dynamical theory only by some development in which this velocity comes to play an actual part. Thus the hypothesis of the mere existence of some complete dynamical theory was enough to show, in the stage which electrical science had reached under Gauss and Weber, that there is a definite physical velocity involved in and underlying electric phenomena, which it would have been hardly possible to imagine as other than a velocity of propagation of electrical effects of some kind. The time was thus ripe for the reconstruction of electric theory by Faraday and Maxwell.

The power of the method of dimensions in thus revealing general relations has its source in the hypothesis that, however complicated in appearance, the phenomena are really restricted within the narrow range of dependence on the three fundamental entities. The proposition is also therein involved, that if a changing physical system be compared with another system in which the scale is altered in different ratios as regards corresponding lengths, masses, and times, then if all quantities affecting the second system are altered from the corresponding quantities affecting the first in the ratios determined by their physical dimensions, the stage of progress of the second system will always correspond to that of the first; under this form the application of the principle, to determine the correlations of the dynamics of similar systems, originated with Newton (*Principia*, lib. ii. prop. 32). For example, in comparing the behaviour of an animal with that of another animal of the same build but on a smaller scale, we may take the mass per unit volume and the muscular force per unit sectional area to be the same for both; thus [L], [M], . . . being now ratios of corresponding quantities, we have $[\mathrm{ML}^{-3}]=1$ and $[\mathrm{ML}^{-1}\mathrm{T}^{-2}]=1$, giving $[\mathrm{L}]=[\mathrm{T}]$; thus the larger animal effects movements of his limbs more slowly in simple proportion to his linear dimensions, while the velocity of movement is the same for both at corresponding stages.

But this is only on the hypothesis that the extraneous force of gravity does not intervene, for that force does not vary in the same manner as the muscular forces. The result has thus application only to a case like that of fishes in which gravity is equilibrated by the buoyancy of the water. The effect of the inertia of the water, considered as a perfect fluid, is included in this comparison; but the forces arising from viscosity do not correspond in the two systems, so that neither system may be so small that viscosity is an important agent in its motion. The limbs of a land animal have mainly to support his weight, which varies as the cube of his linear dimensions, while the sectional areas of his muscles and bones vary only as the square thereof. Thus the diameters of his limbs should increase in a greater ratio than that of his body—theoretically in the latter ratio raised to the power $\frac{3}{2}$, if other things were the same. An application of this principle, which has become indispensable in modern naval architecture, permits the prediction of the behaviour of a large ship from that of a small-scale model. The principle is also of very wide utility in unravelling the fundamental relations in definite physical problems of such complexity that complete treatment is beyond the present powers of mathematical analysis; it has been applied, for example, to the motions of systems involving viscous fluids, in elucidation of wind and waves, by Helmholtz (*Akad. Berlin*, 1873 and 1889), and in the electrodynamics of material atomic systems in motion by Lorentz and by Larmor.

As already stated, the essentials of the doctrine of dimensions in its most fundamental aspect, that relating to the comparison of the properties of correlated systems, originated with Newton. The explicit formulation of the idea of the *dimensions*, or the *exponents of dimension*, of physical quantities was first made by Fourier, *Théorie de la chaleur*, 1822, ch. ii. sec. 9; the homogeneity in dimensions of all the terms of an equation is insisted on by him, much as explained above; and the use of this principle as a test of accuracy and precision is illustrated. (J. L.*)

UNITS, PHYSICAL. In order that our acquaintance with any part of nature may become exact we must have not merely a qualitative but a quantitative knowledge of facts. Hence the moment that any branch of science begins to develop to any extent, attempts are made to measure and evaluate the quantities and effects found to exist. To do this we have to select for each measurable magnitude a *unit* or standard of reference (Latin, *unitas*, unity), by comparison with which amounts of other like quantities may be numerically defined. There is nothing to prevent us from selecting these fundamental quantities, in terms of which other like quantities are to be expressed, in a perfectly arbitrary and independent manner, and as a matter of fact this is what is generally done in the early stages of every science. We may, for instance, choose a certain length, a certain volume, a certain mass, a certain force or power as our units of length, volume, mass, force or power, which have no simple or direct relation to each other. Similarly we may select for more special measurements any arbitrary electric current, electromotive force, or resistance, and call them our units. The progress of knowledge, however, is greatly assisted if all the measurable quantities are brought into relation with each other by so selecting the units that they are related in the most simple manner, each to the other and to one common set of measurable magnitudes called the *fundamental quantities*.

The progress of this co-ordination of units has been greatly aided by the discovery that forms of physical energy can be converted into one another, and that the conversion is by definite rule and amount (see ENERGY). Thus the mechanical energy associated with moving masses can be converted into heat, hence heat can be measured in mechanical energy units. The amount of heat required to raise one gramme of water through 1° C. in the neighbourhood of 10° C. is equal to forty-two million *ergs*, the *erg* being the kinetic energy or energy of motion associated with a mass of 2 grammes when moving uniformly, without rotation, with a velocity of 1 cm. per second. This number is commonly called the "mechanical equivalent of heat," but would be more exactly described as the "mechanical equivalent of the specific heat of water at 10° C." Again, the fact that the maintenance of an electric current requires energy, and that when produced its energy can be wholly utilized in heating a mass of water, enables us to make a similar statement about the energy required to maintain a current of one ampere through a resistance of one ohm for one second, and to define it by its equivalent in the energy of a moving mass. Physical units have therefore been selected with the object of establishing simple relations between each of them and the fundamental mechanical units. Measurements based on such relations are called *absolute measurements.* The science of dynamics, as far as that part of it is concerned which deals with the motion and energy of material substances, starts from certain primary definitions concerning the measurable quantities involved. In constructing a system of physical units, the first thing to consider is the manner in which we shall connect the various items. What, for instance, shall be the unit of force, and how shall it be determined by simple reference to the units of mass, length and time?

The modern absolute system of physical measurement is founded upon dynamical notions, and originated with C. F. Gauss. We are for the most part concerned in studying motions in nature; and even when we find bodies at rest in equilibrium it is because the causes of motion are balanced rather than absent. Moreover, the postulate which lies at the base of all present-day study of physics is that in the ultimate issue we must seek for a mechanical explanation of the facts of nature if we are to reach any explanation intelligible to the human mind. Accordingly the root of all science is the knowledge of the laws of motion, and the enunciation of these laws by Newton laid the foundation of a more exact knowledge of nature than had been possible before. Our fundamental scientific notions are those of *length*, *time*, and *mass*. No metaphysical discussion has been able to resolve these ideas into anything simpler or to derive them from each other. Hence in selecting units for physical measurements we have first to choose units for the above three quantities.

Fundamental Units.—Two systems of fundamental units are in common use: the British system, having the yard and pound as the standard units of length and mass, frequently termed the "foot-pound-second" (F.P.S.) system; and the "centimetre-gramme-second" system (C.G.S.), having the centimetre and gramme as standard units of length and mass, termed the "metric" system. The fundamental unit of time is the same in both systems, namely, the "mean solar second," 86,400 of which make 1 solar day (see TIME). Since these systems and the corresponding standards, together with their factors of conversion, are treated in detail in the article WEIGHTS AND MEASURES, we need only deal here with such units as receive special scientific use, *i.e.* other than in ordinary commercial practice. The choice of a unit in which to express any quantity is determined by the magnitude and proportional error of the measurement. In astronomy, where immense distances have to be very frequently expressed, a common unit is the mean radius of the earth's orbit, the "astronomical unit" of length, *i.e.* 92,900,000 miles. But while this unit serves well for the region of our solar system, its use involves unwieldy numerical coefficients when stellar distances are to be expressed. Astronomers have therefore adopted a unit of length termed the "light year," which is the distance traversed by light in a year; this unit is 63,000 times the mean radius of the earth's orbit. The relative merits of these units as terms in which astronomical distances may be expressed is exhibited by the values of the distance of the star α Centauri from our earth, namely, 25,000,000,000,000 miles = 275,000 astronomical units = 4·35 light years.

As another example of a physical unit chosen as a matter of convenience, we may refer to the magnitudes of the wave-lengths of light. These quantities are extremely small, and admit of correct determination to about one part in ten-thousand, and range, in the visible spectrum, from about 6 to 4 ten-millionths of a metre. Since their values are determined to four significant figures, it is desirable to choose a unit which represents the value as an integer number; the unit is therefore a ten-thousand-millionth of a metre, termed a "tenth metre," since it is 10^{-10} metres. Sometimes the thousand-millionth of a metre, the "micromillimetre," denoted by $\mu\mu$, serves as a unit for wave lengths. Another relatively minute unit is the "micron," denoted by μ, and equal to one-millionth of a metre; it is especially used by bacteriologists.

Units in Mechanics.—The quantities to be measured in mechanics (*q.v.*) are velocity and acceleration, dependent on the units of length and time only, momentum, force, energy or work and power, dependent on the three fundamental units. The unit of velocity in the British system is 1 foot, 1 yard, or 1 mile per second; or the time to which the distance is referred may be expressed in hours, days, &c., the choice depending upon the actual magnitude of the velocity or on custom. Thus the muzzle velocity of a rifle or cannon shot is expressed in feet per second, whereas the speed of a train is usually expressed in miles per hour. Similarly, the unit on the metric system is 1 metre, or any decimal multiple thereof, per second, per hour, &c. Since acceleration is the rate of increase of velocity per unit time, it is obvious that the unit of acceleration depends solely upon the units chosen to express unit velocity; thus if the unit of velocity be one foot per second, the unit of acceleration is one foot per second per second, if one metre per second the unit is one metre per second per second, and similarly for other units of velocity. Momentum is defined as the product of mass into velocity; unit momentum is therefore the momentum of unit mass into unit velocity; in the British system the unit of mass may be the pound, ton, &c., and the unit of velocity any of those mentioned above; and in the metric system, the gramme, kilogramme, &c., may be the unit of mass, while the metre per second, or any other metric unit of velocity, is the remaining term of the product.

Force, being measured by the change of momentum in unit time, is expressed in terms of the same units in which unit momentum is defined. The common British unit is the "poundal," the force which in one second retards or accelerates the velocity of a mass of one pound by one foot per second. The metric (and scientific) unit, named the "dyne," is derived from the centimetre, gramme, and second. The poundal and dyne are related as follows:—1 poundal = 13,825·5 dynes.

A common unit of force, especially among engineers, is the "weight of one pound," by which is meant the force equivalent to the gravitational attraction of the earth on a mass of one pound. This unit obviously depends on gravity; and since this varies with the latitude and height of the place of observation (see EARTH, FIGURE OF), the "force of one pound" of the engineer is not constant. Roughly, it equals 32·17 poundals or 980 dynes. The most frequent uses of this engineer's unit are to be found in the expressions for pressure, especially in the boilers and cylinders of steam engines, and in structures, such as bridges, foundations of buildings, &c. The expression takes the form: pounds per square foot or inch, meaning a force equivalent to so many pounds' weight distributed over a square foot or inch, as the case may be. Other units of pressure (and therefore special units of force) are the "atmosphere" (abbreviated "atmo"), the force exerted on unit area by the column of air vertically above it; the "millimetre or centimetre of mercury," the usual scientific units, the force exerted on unit area by a column of mercury one millimetre or centimetre high; and the "foot of water," the column being one foot of water. All these units admit of ready conversion:—1 atmo = 760 mm. mercury = 32 feet of water = 1,013,600 dynes.

Energy of work is measured by force acting over a distance. The scientific unit is the "erg," which is the energy expended when a force of one dyne acts over one centimetre. This unit is too small for measuring the quantity of energy associated, for instance, with engines; for such purposes a unit ten-million times as great, termed the "joule," is used. The British absolute unit is the "poundal-foot." As we noticed in the case of units of force, common-life experience has led to the introduction of units dependent on gravitation, and therefore not invariable: the common British practical unit of this class is the "foot-pound"; in the metric system its congener is the "kilogramme-metre."

Power is the rate at which force does work; it is therefore expressed by "units of energy per second." The metric unit in use is the "watt," being the rate equal to one joule per second. Larger units in practical use are: "kilowatt," equal to 1000 watts; the corresponding energy unit being the kilowatt-second, and 3600 kilowatt-seconds or 1 kilowatt-hour called a "Board of Trade unit" or a "kelvin." This last is a unit of energy, not power. In British engineering practice the common unit of power is the "horse-power" (HP), which equals 550 foot-pounds performed per second, or 33,000 foot-pounds per minute; its equivalent in the metric system is about 746 watts, the ratio varying, however, with gravity.

Units of Heat.—In studying the phenomena of heat, two measurable quantities immediately present themselves:—(1) temperature or thermal potential, and (2) quantity of heat. Three arbitrary scales are in use for measuring temperature (see THERMOMETRY), and each of these scales affords units suitable for the expression of temperature. On the Centigrade scale the unit, termed a "Centigrade degree," is one-hundredth of the interval between the temperature of water boiling under normal barometric pressure (760 mm. of mercury) and that of melting ice; the "Fahrenheit degree" is one-hundred-and-eightieth, and the "Réaumur degree" is one-eightieth of the same difference. In addition to these scales there is the "thermo-dynamic scale," which, being based on dynamical reasoning, admits of correlation with the fundamental units. This subject is discussed in the articles THERMODYNAMICS and THERMOMETRY.

Empirical units of "quantity of heat" readily suggest themselves as the amount of heat necessary to heat a unit mass of any substance through unit temperature. In the metric system the unit, termed a "calorie," is the quantity of heat required to raise a gramme of water through one degree Centigrade. This quantity, however, is not constant, since the specific heat of water varies with temperature (see CALORIMETRY). In defining the calorie, therefore, the particular temperatures must be specified; consequently there are several calories particularized by special designations:—(1) conventional or common gramme-calorie, the heat required to raise 1 gramme of water between 15° C. and 17° C. through 1° C.; (2) "mean or average gramme calorie," one-hundredth of the total heat required to raise the temperature of 1 gramme of water from 0° C. to 100° C.; (3) "zero gramme calorie," the heat required to raise 1 gramme of water from 0° C. to 1° C. These units are thus related:—1 common calorie = 1·987 mean calories = 0·992 zero calories. A unit in common use in thermo-chemistry is the *major calorie*, which refers to one kilogramme of water and 1° C. In the British system the common unit, termed the "British Thermal Unit" (B.Th.U.), is the amount of heat required to raise one pound of water through one degree Fahrenheit.

A correlation of these units of quantity of heat with the fundamental units of mass, length and time attended the recognition of the fact that heat was a form of energy; and their quantitative relationships followed from the experimental determinations of the so-called "mechanical equivalent of heat," *i.e.* the amount of mechanical energy, expressed in ergs, joules, or foot-pounds, equivalent to a certain quantity of heat (cf. CALORIMETRY). These results show that a gram-calorie is equivalent to about 4·2 joules, and a British thermal unit to 780 foot-pounds.

Electrical Units.—The next most important units are the electrical units. We are principally concerned in electrical work with three quantities called respectively, electric current, electromotive force, and resistance. These are related to one another by Ohm's law, which states that the electric current in a circuit is directly as the electromotive force and inversely as the resistance, when the current is unvarying and the temperature of the circuit constant. Hence if we choose units for two of these quantities, the above law defines the unit for the third. Much discussion has taken place over this question. The choice is decided by the nature of the quantities themselves. Since resistance is a permanent quality of a substance, it is possible to select a certain piece of wire or tube full of mercury, and declare that its resistance shall be the unit of resistance, and if the substance is permanent we shall possess an unalterable standard or unit of resistance. For these reasons the practical unit of resistance, now called the international ohm, has been selected as one of the above three electrical units.

It has now been decided that the second unit shall be the unit of electric current. As an electric current is not a thing, but a process, the unit current can only be reproduced when desired. There are two available methods for creating a standard or unit electric current. If an unvarying current is passed through a neutral solution of silver nitrate it decomposes or electrolyses it and deposits silver upon the negative pole or cathode of the electrolytic cell. According to Faraday's law and all subsequent experience, the same current deposits in the same time the same mass of silver. Hence we may define the unit current by the mass of silver it can liberate per second. Again, an electric current in one circuit exerts mechanical force upon a magnetic pole or a current in another circuit suitably placed, and we may measure the force and define by it a unit electric current. Both these methods have been used. Thirdly, the unit of electromotive force may be defined as equal to the difference of potential between the ends of the unit of resistance when the unit of current flows in it.

Absolute electrical units.

Apart, however, from the relation of these electrical units to each other, it has been found to be of great importance to establish a simple relation between the latter and the absolute mechanical units. Thus an electric current which is passed through a conductor dissipates its energy as heat, and hence creates a certain quantity of heat per unit of time. Having chosen our units of energy and related unit of quantity of heat, we must so choose the unit of current that when passed through the unit of resistance it shall dissipate 1 unit of energy in 1 unit of time.

British Association units.

A further consideration has weight in selecting the size of the units, namely, that they must be of convenient magnitude for the ordinary measurements. The founders of the modern system of practical electrical units were a committee appointed by the British Association in 1861, at the suggestion of Lord Kelvin, which made its first report in 1862 at Cambridge (see *B. A. Report*). The five subsequent reports containing the results of the committee's work, together with a large amount of most valuable matter on the subject of electric units, were collected in a volume edited by Prof. Fleeming Jenkin in 1873, entitled *Reports of the Committee on Electrical Standards*. This committee has continued to sit and report annually to the British Association since that date. In their second report in 1863 (see *B.A. Report*, Newcastle-on-Tyne) the committee recommended the adoption of the absolute system of electric and magnetic units on the basis originally proposed by Gauss and Weber, namely, that these units should be derived from the fundamental dynamical units, but assuming the units of length, mass and time to be the metre, gramme and second instead of the millimetre, milligramme and second as proposed by Weber. Considerable differences of opinion existed as to the choice of the fundamental units, but ultimately a suggestion of Lord Kelvin's was adopted to select the centimetre, gramme, and second, and to construct a system of electrical units (called the C.G.S. system) derived from the above fundamental units. On this system the unit of force is the *dyne* and the unit of work the *erg*. The dyne is the uniform force which when acting on a mass of 1 gramme for 1 second gives it a velocity of 1 centimetre per second. The erg is the work done by 1 dyne when acting through a distance of 1 centimetre in its own direction. The electric and magnetic units were then derived, as previously suggested by Weber, in the following manner: If we consider two very small spheres placed with centres 1 centimetre apart in air and charged with equal quantities of electricity, then if the force between these bodies is 1 dyne each sphere is said to be charged with 1 unit of electric quantity on the electrostatic system. Again, if we consider two isolated magnetic poles of equal strength and consider them placed 1 centimetre apart in air, then if the force between them is 1 dyne these poles are said to have a strength of 1 unit on the electromagnetic system. Unfortunately the committee did not take into account the fact that in the first case the force between the electric charges depends upon and varies inversely as the dielectric constant of the medium in which the experiment is made, and in the second case it depends upon the magnetic permeability of the medium in which the magnetic poles exist. To put it in other words, they assume that the dielectric constant of the circumambient medium was unity in the first case, and that the permeability was also unity in the second case.

The result of this choice was that two systems of measurement were created, one depending upon the unit of electric quantity so chosen, called the *electrostatic system*, and the other depending upon the unit magnetic pole defined as above, called the *electromagnetic system* of C.G.S. units. Moreover, it was found that in neither of these systems were the units of very convenient magnitude. Hence, finally, the committee adopted a third system of units called the practical system, in which convenient decimal multiples or fractions of the electromagnetic units were selected and named for use. This system, moreover, is not only consistent with itself, but may be considered to be derived from a system of dynamical units in which the unit of length is the earth quadrant or 10 million metres, the unit of mass is 10^{-11} of a gramme and the unit of time is 1 second. The units on this system have received names derived from those of eminent discoverers. Moreover, there is a certain relation between the size of the units for the same quantity on the electrostatic (E.S.) system and that on the electromagnetic (E.M.) system, which depends upon the velocity of light in the medium in which the measurements are supposed to be made. Thus on the E.S. system the unit of electric quantity is a point charge which at a distance of 1 cm. acts on another equal charge with a force of 1 dyne. The E.S. unit of electric current is a current such that 1 E.S. unit of quantity flows per second across each section of the circuit. On the E.M. system we start with the definition that the unit magnetic pole is one which acts on another equal pole at a distance of 1 cm. with a force of 1 dyne. The unit of current on the E.M. system is a current such that if flowing in circular circuit of 1 cm. radius each unit of length of it will act on a unit magnetic pole at the centre with a force of 1 dyne. This E.M. unit of current is much larger than the E.S. unit defined as above. It is v times greater, where $v=3\times10^{10}$ is the velocity of light in air expressed in cms. per second. The reason for this can only be understood by considering the *dimensions* of the quantities with which we are concerned. If L, M, T denote length, mass, time, and we adopt certain sized units of each, then we may measure any derived quantity, such as velocity, acceleration, or force in terms of the derived dynamical units as already explained. Suppose, however, we alter the size of our selected units of L, M or T, we have to consider how this alters the corresponding units of velocity, acceleration, force, &c. To do this we have to consider their dimensions. If the unit of velocity is the unit of length passed over per unit of time, then it is obvious that it varies directly as the unit of length, and inversely as the unit of time. Hence we may say that the dimensions of velocity are L/T or LT^{-1}; similarly the dimensions of acceleration are L/T^2 or LT^{-2}, and the dimensions of a force are MLT^{-2}.

For a fuller explanation see above (UNITS, DIMENSIONS OF), or Everett's *Illustrations of the C.G.S. System of Units*.

Electrostatic and electromagnetic units.

Accordingly on the electrostatic system the unit of electric quantity is such that $f=q^2/Kd^2$, where q is the quantity of the two equal charges, d their distance, f the mechanical force or stress between them, and K the dielectric constant of the dielectric in which they are immersed. Hence since f is of the dimensions MLT^{-2}, q^2 must be of the dimensions of KML^3T^{-2}, and q of the dimensions $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-1}K^{\frac{1}{2}}$. The dimensions of K, the dielectric constant, are unknown. Hence, in accordance with the suggestion of Sir A. Rücker (*Phil. Mag.*, February 1889), we must treat it as a fundamental quantity. The dimensions of an electric current on the electrostatic system are therefore those of an electric quantity divided by a time, since by current we mean the quantity of electricity conveyed per second. Accordingly current on the E.S. system has the dimensions $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-2}K^{\frac{1}{2}}$.

We may obtain the dimensions of an electric current on the magnetic system by observing that if two circuits traversed by the same or equal currents are placed at a distance from each other, the mechanical force or stress between two elements of the circuit, in accordance with Ampère's law (see ELECTRO-KINETICS), varies as the square of the current C, the product of the elements of length ds, ds' of the circuits, inversely as the square of their distance d, and directly as the permeability μ of the medium in which they are immersed. Hence $C^2ds\,ds'\mu/d^2$ must be of the dimensions of a force or of the dimensions MLT^{-2}. Now, ds and ds' are lengths, and d is a length, hence the dimensions of electric current on the E.M. system must be $M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}\mu^{-\frac{1}{2}}$. Accordingly the dimensions of current on the E.S. system are $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-2}K^{\frac{1}{2}}$, and on the E.M. system they are $M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}\mu^{-\frac{1}{2}}$, where μ and K, the permeability and dielectric constant of the medium, are of unknown dimensions, and therefore treated as fundamental quantities.

The ratio of the dimensions of an electric current on the two systems (E.S. and E.M.) is therefore $LT^{-1}K^{\frac{1}{2}}\mu^{\frac{1}{2}}$. This ratio must be a mere numeric of no dimensions, and therefore the dimensions of $\sqrt{K\mu}$ must be those of the reciprocal of a velocity. We do not know what the dimensions of μ and K are separately, but we do know, therefore, that their product has the dimensions of the reciprocal of the square of a velocity.

Again, we may arrive at two dimensional expressions for electromotive force or difference of potential. Electrostatic difference of potential between two places is measured by the mechanical work required to move a small conductor charged with a unit electric charge from one place to the other against the electric force. Hence if V stands for the difference of potential between the two places, and Q for the charge on the small conductor, the product QV must be of the dimensions of the *work* or *energy*, or of the force × length, or of ML^2T^{-2}. But Q on the electrostatic system of measurement is of the dimensions $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-1}K^{\frac{1}{2}}$; the potential difference V must be, therefore, of the dimensions $M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}K^{-\frac{1}{2}}$. Again, since by Ohm's law and Joule's law electromotive force multiplied by a current is equal to the power expended on a circuit, the dimensions of electromotive force, or, what is the same thing, of potential difference, in the electromagnetic system of measurement must be those of power divided by a current. Since mechanical power means *rate of doing work*, the dimensions of power must be ML^2T^{-3}. We have already seen that on the electromagnetic system the dimensions of a current are $M^{\frac{1}{2}}L^{\frac{1}{2}}T^{-1}\mu^{-\frac{1}{2}}$; therefore the dimensions of electromotive force or potential on the electromagnetic system must be $M^{\frac{1}{2}}L^{\frac{3}{2}}T^{-2}\mu^{\frac{1}{2}}$. Here again we find that the ratio of the dimensions on the electrostatic system to the dimensions on the electromagnetic system is $L^{-1}TK^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$.

In the same manner we may recover from fundamental facts and relations the dimensions of every electric and magnetic quantity on the two systems, starting in one case from electrostatic phenomena and in the other case from electromagnetic or magnetic. The electrostatic dimensional expression will always involve K, and the electromagnetic dimensional expression will always involve μ, and in every case the dimensions in terms of K are to those in terms of μ for the same quantity in the ratio of a power of $LT^{-1}K^{\frac{1}{2}}\mu^{\frac{1}{2}}$. This therefore confirms the view that whatever may be the true dimensions in terms of fundamental units of μ and K, their product is the inverse square of a velocity.

Table I. gives the dimensions of all the principal electric and magnetic quantities on the electrostatic and electromagnetic systems.

It will be seen that in every case the ratio of the dimensions on the two systems is a power of $LT^{-1}K^{\frac{1}{2}}\mu^{\frac{1}{2}}$, or of a velocity multiplied by the square root of the product K and μ; in other words, it is the product of a velocity multiplied by the geometric mean of K and μ. This quantity $1/\sqrt{K\mu}$ must therefore be of the dimensions of a velocity, and the questions arise, What is the absolute value of this velocity? and, How is it to be determined? The answer is, that the value of the velocity in concrete numbers may be obtained by measuring the magnitude of any electric quantity in two ways, one making use only of electrostatic phenomena, and the other only of electromagnetic. To take one instance:—It is easy to show that the electrostatic capacity of a sphere suspended in air or in vacuo at a great distance from other conductors is given by a number equal to its radius in centimetres. Suppose such a sphere to be charged and discharged rapidly with electricity from any source, such as a battery. It would take electricity from the source at a certain rate, and would in fact act like a resistance in permitting the passage through it or by it of a certain quantity of electricity per unit of time. If K is the capacity and n is the number of discharges per second, then nK is a quantity of the dimensions of an electric conductivity, or of the reciprocal of a resistance. If a conductor, of which the electrostatic capacity can be calculated, and which has associated with it a commutator that charges and

TABLE I.—DIMENSIONS OF ELECTRIC QUANTITIES

Quantity.	Symbol.	Dimensions on the Electrostatic System E.S.	Dimensions on the Electromagnetic System E.M.	Ratio of E.S to E.M.
Magnetic permeability .	(μ)	$L^{-2}\ T^{2}\ K^{-1}$	μ	$L^{-2}\ T^{2}\ K^{-1}\ \mu^{-1}$
Magnetic force or field . .	(H)	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}\ T^{-2}\ K^{\frac{1}{2}}$	$L^{-\frac{1}{2}}\ M^{\frac{1}{2}}\ T^{-1}\mu^{-\frac{1}{2}}$	$L\ \ T^{-1}K^{\frac{1}{2}}\ \mu^{\frac{1}{2}}$
Magnetic flux density or induction .	(B)	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ K^{-\frac{1}{2}}$	$L^{-\frac{1}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Total magnetic flux .	(Z)	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}\ K^{-\frac{1}{2}}$	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Magnetization	(I)	$L^{-\frac{3}{2}}M^{\frac{1}{2}}\ K^{-\frac{1}{2}}$	$L^{-\frac{1}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{\frac{1}{2}}$
Magnetic pole strength .	(m)	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}\ K^{-\frac{1}{2}}$	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Magnetic moment .	(M)	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ K^{-\frac{1}{2}}$	$L^{\frac{5}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Magnetic potential or magnetomotive force	(M.M.F.)	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ T^{-2}\ K^{\frac{1}{2}}$	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}\ T^{-1}\ \mu^{-\frac{1}{2}}$	$L\ \ T^{-1}K^{\frac{1}{2}}\ \mu^{\frac{1}{2}}$
Specific inductive capacity .	(K)	K	$L^{-2}\ T^{2}\ \mu^{-1}$	$L^{2}\ \ T^{-2}K\ \mu$
Electricforce.	(e)	$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}K^{-\frac{1}{2}}$	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}T^{-2}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Electric displacement .	(D)	$L^{-\frac{1}{2}}M^{\frac{1}{2}}T^{-1}K^{\frac{1}{2}}$	$L^{-\frac{3}{2}}\ M^{\frac{1}{2}}\ \mu^{-\frac{1}{2}}$	$L\ \ T^{-1}K^{\frac{1}{2}}\ \mu^{\frac{1}{2}}$
Electricquantity . .	(Q)	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}T^{-1}\ K^{\frac{1}{2}}$	$L^{\frac{1}{2}}\ \ M^{\frac{1}{2}}\ \mu^{-\frac{1}{2}}$	$L\ \ T^{-1}K^{\frac{1}{2}}\ \mu^{\frac{1}{2}}$
Electric current . .	(A)	$L^{\frac{3}{2}}\ M^{\frac{1}{2}}\ T^{-2}K^{\frac{1}{2}}$	$L^{\frac{1}{2}}\ \ M^{\frac{1}{2}}\ T^{-1}\ \mu^{-\frac{1}{2}}$	$L\ \ T^{-1}K^{\frac{1}{2}}\ \mu^{\frac{1}{2}}$
Electric potential Electromotive force	(V) (E.M.F.)	$L^{\frac{1}{2}}\ M^{\frac{1}{2}}T^{-1}\ K^{-\frac{1}{2}}$	$L^{\frac{3}{2}}\ \ M^{\frac{1}{2}}\ T^{-2}\ \mu^{\frac{1}{2}}$	$L^{-1}\ T\ \ K^{-\frac{1}{2}}\mu^{-\frac{1}{2}}$
Electric resistance .	(R)	$L^{-1}T\ \ K^{-1}$	$L\ \ T^{-1}\ \mu$	$L^{-2}\ T^{2}\ K^{-1}\mu^{-1}$
Electric capacity. .	(C)	$L\ \ K$	$L^{-1}\ T^{2}\ \mu^{-1}$	$L^{2}\ \ T^{-2}K\ \ \mu$
Self inductance . . Mutual inductance .	(L) (M)	$L^{-1}\ T^{2}\ K^{-1}$	$L\ \ \mu$	$L^{-2}\ T^{2}\ \ K^{-1}\mu^{-1}$

discharges it *n* times per second, is arranged in one branch of a Wheatstone's Bridge, it can be treated and measured as if it were a resistance, and its equivalent resistance calculated in terms of the resistance of all the other branches of the bridge (see *Phil. Mag.*, 1885, 20, 258).

Accordingly, we have two methods of measuring the capacity of a conductor. One, the electrostatic method, depends only on the measurement of a length, which in the case of a sphere in free space is its radius; the other, the electromagnetic method, determines the capacity in terms of the quotient of a time by a resistance. The ratio of the electrostatic to the electromagnetic value of the same capacity is therefore of the dimensions of a velocity multiplied by a resistance in electromagnetic value, or of the dimensions of a velocity squared. This particular experimental measurement has been carried out carefully by many observers, and the result has been always to show that the velocity v which expresses the ratio is very nearly equal to 30 thousand million centimetres per second; v=nearly 3×10^{10}. The value of this important constant can be determined by experiments made to measure electric quantity, potential, resistance or capacity, both in electrostatic and in electromagnetic measure. For details of the various methods employed, the reader must be referred to standard treatises on Electricity and Magnetism, where full particulars will be found (see Maxwell, *Treatise on Electricity and Magnetism*, vol. ii. ch. xix. 2nd ed.; also Mascart and Joubert, *Treatise on Electricity and Magnetism*, vol. ii. ch. viii., Eng. trans. by Atkinson).

Table II. gives a list of some of these determinations of v, with references to the original papers.

It will be seen that all the most recent values, especially those in which a comparison of capacity has been made, approximate to 3×10^{10} centimetres per second, a value which is closely in accord with the latest and best determinations of the velocity of light.

Practical units.

We have in the next place to consider the question of practical electric units and the determination and construction of concrete standards. The committee of the British Association charged with the duty of arranging a system of absolute and magnetic units settled also on a system of practical units of convenient magnitude, and gave names to them as follows:—

10^9 absolute electromagnetic units of resistance = 1 ohm
10^8 ,, ,, units of electromotive force = 1 volt
$\frac{1}{10}$th of an ,, ,, unit of current = 1 ampere
$\frac{1}{10}$th of an ,, ,, unit of quantity = 1 coulomb
10^{-9} ,, ,, units of capacity = 1 farad
10^{-15} ,, ,, units of capacity = 1 microfarad

Since the date when the preceding terms were adopted, other multiples of absolute C.G.S. units have received practical names, thus:—

10^7 ergs or absolute C.G.S. units of energy = 1 joule
10^7 ergs per second or C.G.S. units of power = 1 watt
10^9 absolute units of inductance = 1 henry
10^8 absolute units of magnetic flux = 1 weber[1]
1 absolute unit of magnetomotive force = 1 gauss[1]

An Electrical Congress was held in Chicago, U.S.A., in August 1893, to consider the subject of international practical electrical units, and the result of a conference between scientific representatives of Great Britain, the United States, France, Germany, Italy, Mexico, Austria, Switzerland, Sweden and British North America, after deliberation for six days, was a unanimous agreement to recommend the following resolutions as the definition of practical international units. These resolutions and definitions were confirmed at other conferences, and at the last one held in London in October 1908 were finally adopted. It was agreed to take:—

"As a unit of resistance, the *International Ohm*, which is based upon the ohm equal to 10^9 units of resistance of the C.G.S. system of electromagnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice 14·4521 grammes in mass, of a constant cross-sectional area and of the length of 106·3 cm.

"As a unit of current, the *International Ampere*, which is one-tenth of the unit of current of the C.G.S. system of electromagnetic units, and which is represented sufficiently well for practical use by the unvarying current which, when passed through a solution of nitrate of silver in water, deposits silver at the rate of 0·00111800 of a gramme per second.

"As a unit of electromotive force, the *International Volt*, which is the electromotive force that, steadily applied to a conductor whose resistance is one international ohm, will produce a current of one international ampere. It is represented sufficiently well for practical purposes by $\frac{10000}{10184}$ of the E.M.F. of a normal or saturated cadmium Weston cell at 20° C., prepared in the manner described in a certain specification.

"As a unit of quantity, the *International Coulomb*, which is the quantity of electricity transferred by a current of one international ampere in one second.

"As the unit of capacity, the *International Farad*, which is the capacity of a condenser charged to a potential of one international volt by one international coulomb of electricity.

"As a unit of work, the *Joule*, which is equal to 10^7 units of work in the C.G.S. System, and which is represented sufficiently well for practical use by the energy expended in one second by an international ampere in an international ohm.

"As a unit of power, the *Watt*, which is equal to 10^7 units of power in the C.G.S. System, and which is represented sufficiently well for practical use by the work done at the rate of one joule per second.

"As the unit of inductance, the *Henry*, which is the induction in a circuit when an electromotive force induced in this circuit is one international volt, while the inducing current varies at the rate of one ampere per second."

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[1] Neither the weber nor the gauss has received very general adoption, although recommended by the Committee of the British Association on Electrical Units. Many different suggestions have been made as to the meaning to be applied to the word "gauss." The practical electrical engineer, up to the present, prefers to use *one ampere-turn* as his unit of magnetomotive force, and *one line of force* as the unit of magnetic flux, equal respectively to $10/4\pi$ times and 1 times the C.G.S. absolute units. Very frequently the "kiloline," equal to 1000 lines of force, is now used as a unit of magnetic flux.

TABLE II.—OBSERVED VALUES OF *V* IN CENTIMETRES PER SECOND

Date.	Name.	Reference.	Electric Quantity Measured.	*v* in Centimetres per Second.
1856	W. Weber and R. Kohlrausch	*Electrodynamische Massbestimmungen* and *Pogg. Ann.* xcix., August 10, 1856	Quantity	$3{\cdot}107\times10^{10}$
1867 1868	Lord Kelvin and W. F. King	*Report of British Assoc.*, 1869, p. 434; and *Reports on Electrical Standards*, F. Jenkin, p. 186	Potential	$2{\cdot}81\times10^{10}$
1868	J. Clerk Maxwell .	*Phil. Trans. Roy. Soc.*, 1868, p. 643	„	$2{\cdot}84\times10^{10}$
1872	Lord Kelvin and Dugald M'Kichan	*Phil. Trans. Roy. Soc.*. 1873, p. 409	„	$2{\cdot}89\times10^{10}$
1878	W. E. Ayrton and J. Perry	*Journ. Soc. Tel. Eng.* vol. viii. p. 126	Capacity	$2{\cdot}94\times10^{10}$
1880	Lord Kelvin and Shida	*Phil. Mag.*, 1880, vol. x. p. 431	Potential	$2{\cdot}955\times10^{10}$
1881	A. G. Stoletow .	*Soc. Franc. de Phys.*, 1881	Capacity	$2{\cdot}99\times10^{10}$
1882	F. Exner . .	*Wien. Ber.*, 1882	Potential	$2{\cdot}92\times10^{10}$
1883	Sir J. J. Thomson	*Phil. Trans. Roy. Soc.*, 1883, p. 707	Capacity	$2{\cdot}963\times10^{10}$
1884	I. Klemencic . .	*Journ. Soc. Tel. Eng.*, 1887, p. 162	„	$3{\cdot}019\times10^{10}$
1888	F. Himstedt . .	*Electrician*, March 23, 1888, vol. xx. p. 530	„	$3{\cdot}007\times10^{10}$
1888	Lord Kelvin, Ayrton and Perry	*British Association*, Bath; and *Electrician*, Sept. 28, 1888	Potential	$2{\cdot}92\times10^{10}$
1888	H. Fison . .	*Electrician*, vol. xxi. p. 215; and *Proc. Phys. Soc. Lond.*, June 9, 1888	Capacity	$2{\cdot}965\times10^{10}$
1889	Lord Kelvin . .	*Proc. Roy. Inst.*, 1889	Potential	$3{\cdot}004\times10^{10}$
1889	H. A. Rowland .	*Phil. Mag.*, 1889	Quantity	$2{\cdot}981\times10^{10}$
1889	E. B. Rosa . .	*Phil. Mag.*, 1889	Capacity	$3{\cdot}000\times10^{10}$
1890	Sir J. J. Thomson and G. F. C. Searle	*Phil. Trans.*, 1890	„	$2{\cdot}995\times10^{10}$
1897	M. E. Maltby. .	*Wied. Ann.* 1897	Alternating currents	$3{\cdot}015\times10^{10}$

In connexion with the numerical values in the above definitions much work has been done. The electrochemical equivalent of silver or the weight in grammes deposited per second by 1 C.G.S. electromagnetic unit of current has been the subject of much research. The following determinations of it have been given by various observers:—

Name.	Value.	Reference.
E. E. N. Mascart . .	0·011156	*Journ. de physique*, 1884, (2), 3, 283.
F. and W. Kohlrausch .	0·011183	*Wied. Ann.*, 1886, 27, 1.
Lord Rayleigh and Mrs Sedgwick	0·011179	*Phil. Trans. Roy. Soc.*, 1884, 2, 411.
J. S. H. Pellat and A. Potier	0·011192	*Journ. de Phys.*, 1890, (2), 9, 381.
Karl Kahle . . .	0·011183	*Wied. Ann.*, 1899, 67, 1.
G. W. Patterson and K. E. Guthe	0·011192	*Physical Review*, 1898, 7, 251.
J. S. H. Pellat and S. A. Leduc	0·011195	*Comptes rendus*, 1903, 136, 1649.

Although some observers have urged that the 0·01119 is nearer to the true value than 0·01118, the preponderance of the evidence seems in favour of this latter number and hence the value per ampere-second is taken as 0·0011800 gramme. The exact value of the electromotive force of a Clark cell has also been the subject of much research. Two forms of cell are in use, the simple tubular form and the H-form introduced by Lord Rayleigh. The Berlin Reichsanstalt has issued a specification for a particular H-form of Clark cell, and its E.M.F. at 15° C. is taken as 1·4328 international volts. The E.M.F. of the cell set up in accordance with the British Board of Trade specification is taken as 1·434 international volts at 15° C. The detailed specifications are given in Fleming's *Handbook for the Electrical Laboratory and Testing Room* (1901), vol. i. chap. 1; in the same book will be found copious references to the scientific literature of the Clark cell. One objection to the Clark cell as a concrete standard of electromotive force is its variation with temperature and with slight impurities in the mercurous sulphate used in its construction. The Clark cell is a voltaic cell made with mercury, mercurous sulphate, zinc sulphate, and zinc as elements, and its E.M.F. decreases 0·08% per degree Centigrade with rise of temperature. In 1891 Mr Weston proposed to employ cadmium and cadmium sulphate in place of zinc and zinc sulphate and found that the temperature coefficient for the cadmium cell might be made as low as 0·004 % per degree Centigrade. Its E.M.F. is, however, 1·0184 international volts at 20° C. For details of construction and the literature of the subject see Fleming's *Handbook for the Electrical Laboratory*, vol. i. chap. 1.

In the British Board of Trade laboratory the ampere and the volt are not recovered by immediate reference to the electrochemical equivalent of silver or the Clark cell, but by means of instruments called a standard ampere balance and a standard 100-volt electrostatic voltmeter. In the standard ampere balance the current is determined by weighing the attraction between two coils traversed by the current, and the ampere is defined to be the current which causes a certain attraction between the coils of this standard form of ampere balance. The form of ampere balance in use at the British Board of Trade electrical standards office is described in Fleming's *Handbook for the Electrical Laboratory*, vol. i., and that constructed for the British National Physical Laboratory in the report of the Committee on Electrical Standards (*Brit. Assoc. Rep.*, 1905). This latter instrument will recover the ampere within one-thousandth part. For a further description of it and for full discussion of the present position of knowledge respecting the values of the international practical units the reader is referred to a paper by Dr F. A. Wolff read before the International Electrical Congress at St Louis Exhibition, U.S.A., in 1904, and the subsequent discussion (see *Journ. Inst. Elec. Eng. Lond.*, 1904–5, 34, 190, and 35, 3).

The construction of the international ohm or practical unit of resistance involves a knowledge of the specific resistance of mercury. Numerous determinations of this constant have been made. The results are expressed either in terms of the length in cm. of the column of pure mercury of 1 sq. mm. in section which at 0° C. has a resistance of 10^9 C.G.S. electromagnetic units, or else in terms of the weight of mercury in grammes for a column of constant cross-sectional area and length of 100·3 cm. The latter method was adopted at the British Association Meeting at Edinburgh in 1892, but there is some uncertainty as to the value of the density of mercury at 0° C. which was then adopted. Hence it was proposed by Professor J. Viriamu Jones that the redetermination of the ohm should be made when required by means of the Lorentz method (see J. V. Jones, "The Absolute Measurement of Electrical Resistance," *Proc. Roy. Inst.* vol. 14, part iii. p. 601). For the length of the mercury column defining the ohm as above, Lord Rayleigh in 1882 found the value 106·27 cm., and R. T. Glazebrook in the same year the value 106·28 cm. by a different method, while another determination by Lord Rayleigh and Mrs Sedgwick in 1883 gave 106·22 cm. Viriamu Jones in 1891 gave the value 106·30 cm., and one by W. E. Ayrton in 1897 by the same method obtained the value 106·27 to 106·28 cm. Hence the specific resistance of mercury cannot be said to be known to 1 part in 10,000, and the absolute value of the ohm in centimetres per second is uncertain to at least that amount. (See also J. Viriamu Jones, "On a Determination of the International Ohm in Absolute Measure," *Brit. Assoc. Report*, 1894.)

Rational system of electrical units.

The above-described practical system based on the C.G.S. double system of theoretical units labours under several very great disadvantages. The practical system is derived from and connected with an abnormally large unit of length (the earth quadrant) and an absurdly small unit of mass. Also in consequence of the manner in which the unit electric quantity and magnetic pole strength are defined, a coefficient, 4π, makes its appearance in many practical equations. For example, on the present system the magnetic force H in the interior of a long spiral wire of N turns per centimetre of length when a current of A amperes circulates in the wire is $4\pi \mathrm{AN}/10$. Again, the electric displacement or induction D through a unit of area is connected with the electric force E and the dielectric constant K by the equation $\mathrm{D}=\mathrm{KE}/4\pi$. In numerous electric and magnetic equations the constant 4π makes its appearance where it is apparently meaningless. A system of units in which this constant is put into its right place by appropriate definitions is called a rational system of electric units. Several physicists have proposed such systems. Amongst others that of Professor G. Giorgi especially deserves mention.

Giorgi's system of electrical units.

We have seen that in expressing the dimensions of electric and magnetic qualities we cannot do so simply by reference to the units of length, mass and time, but must introduce a fourth fundamental quantity. This we may take to be the dielectric constant of the ether or its magnetic permeability, and thus we obtain two systems of measurement. Professor Giorgi proposes that the four fundamental quantities shall be the units of length, mass, time and electrical resistance, and takes as the concrete units or standards the metre, kilogramme, second and ohm. Now this proposal not only has the advantage that the theoretical units are identical with the actual practical concrete units, but it is also a rational system. Moreover, the present practical units are unaltered; the ampere, volt, coulomb, weber, joule and watt remain the actual as well as theoretical units of current, electromotive force, quantity, magnetic flux, work and power. But the unit of magnetic force becomes the ampere-turn per metre, and the unit of electric force the volt per metre; thus the magnetic units are measured in terms of electric units. The numerical value of the permeability of ether or air becomes $4\pi \times 10^{-7}$ and the dielectric constant of the ether or air becomes $1/4\pi \times 9 \times 10^{9}$; their product is therefore $1/(3 \times 10^{8})^{2}$, which is the reciprocal of the square of the velocity of light in metres per second.

For a discussion of the Giorgi proposals, see a paper by Professor M. Ascoli, read before the International Electrical Congress at St Louis, 1904 (*Journ. Inst. Elect. Eng. Lond.*, 1904, 34, 176).

It can hardly be said that the present system of electrical units is entirely satisfactory in all respects. Great difficulty would of course be experienced in again altering the accepted practical concrete units, but if at any future time a reformation should be possible, it would be desirable to bear in mind the recommendations made by Oliver Heaviside with regard to their rationalization. The British Association Committee defined the strength of a magnetic pole by reference to the mechanical stress between it and another equal pole: hence the British Association unit magnetic pole is a pole which at a distance of one centimetre attracts or repels another equal pole with a force of one dyne. This, we have seen, is an imperfect definition, because it omits all reference to the permeability of the medium in which the experiment takes place; but it is also unsatisfactory as a starting-point for a system of units for another reason. The important quantity in connexion with polar magnets is not a mechanical stress between the free poles of different magnets, but the magnetic flux emanating from, or associating with, them. From a technical point of view this latter quality is far more important than the mechanical stress between the magnetic poles, because we mostly employ magnets to create induced electromotive force, and the quantity we are then mostly concerned with is the magnetic flux proceeding from the poles. Hence the most natural definition of a unit magnet pole is that pole from which proceeds a total magnetic flux of one unit. The definition of one unit of magnetic flux must then be that flux which, when inserted into or withdrawn from a conducting circuit of one turn having unit area and unit conductivity, creates in it a flow or circulation of one unit of electric quantity. The definition of a unit magnetic pole ought, therefore, to have been approached from the definition of a unit of electric quantity.

On the C.G.S. or British Association system, if a magnetic filament has a pole strength m—that is to say, if it has a magnetization I, and a section s, such that Is equals m—then it can be shown that the total flux emanating from the pole is $4\pi m$. The factor 4π, in consequence of this definition, makes its appearance in many practically important expressions. For instance, in the well-known magnetic equation connecting the vector values of magnetization I, magnetic force H and magnetic flux density B, where we have the equation

$$B = H + 4\pi I,$$

the appearance of the quantity 4π disguises the real physical meaning of the equation.

The true remedy for this difficulty has been suggested by Heaviside to be the substitution of *rational* for *irrational* formulae and definitions.

Heaviside's rational system.

He proposes to restate the definition of a unit magnetic pole in such a manner as to remove this constant 4π from the most frequently employed equations. His starting-point is a new definition according to which a unit magnetic pole is said to have a strength of m units if it attracts or repels another equal pole placed at a distance of d centimetres with a force of $m^2/4\pi d^2$ dynes. It follows from this definition that a rational unit magnetic pole is weaker or smaller than the irrational or British Association unit pole in the ratio of $1/\sqrt{4\pi}$ to 1, or ·28205 to 1. The magnetic force due to a rational pole of strength m at a distance of d centimetres being $m/4\pi d^2$ units, if we suppose a magnetic filament having a pole of strength m in rational units to have a smaller sphere of radius r described round its pole, the magnetic force on the surface of this sphere is $m/4\pi r^2$ units, and this is therefore also the numerical value of the flux density. Hence the total magnetic flux through the surface of the sphere is

$$4\pi r^2 \times m/4\pi r^2 \text{ units} = m \text{ units};$$

and therefore the number which denotes the total magnetic flux coming out of the pole of strength m in rational units is also m.

The Heaviside system thus gives us an obvious and natural definition of a unit magnetic pole, namely, that it is a pole through which proceeds the unit of magnetic flux. It follows, therefore, that if the intensity of magnetization of the magnetic filament is I and the section is s, the total flux traversing the centre of the magnet is Is units; and that if the filament is an endless or poleless iron filament magnetized uniformly by a resultant external magnetic force H, the flux density will be expressed in rational units by the equation $B = I + H$. The physical meaning of this equation is that the flux per square centimetre in the iron is simply obtained by adding together the flux per square centimetre, if the iron is supposed to be removed, and the magnetization of the iron at that place. On the rational system, since the unit pole strength has been decreased in the ratio of I to $1/\sqrt{4\pi}$, or of 3·5441 to 1, when compared with the magnitude of the present irrational unit pole, and since the unit of magnetic flux is the total flux proceeding from a magnetic pole, it follows that Heaviside's unit of magnetic flux is larger than the C.G.S. unit of magnetic flux in the ratio of 3·5441 to 1.

It will be seen, therefore, that the Heaviside rational units are all incommeasurable with the practical units. This is a great barrier to their adoption in practice, because it is impossible to discard all the existing resistance coils, ammeters, voltmeters, &c., and equally impossible to recalibrate or readjust them to read in Heaviside units. A suggestion has been made, in modification of the Heaviside system, which would provide a system of rational practical units not impossible of adoption. It has been pointed out by J. A. Fleming that if in place of the ampere, ohm, watt, joule, farad and coulomb, we employ the dekampere, dekohm, the dekawatt, the dekajoule, the dekafarad and the dekacoulomb, we have a system of practical units such that measurements made in these units are equal to measurements made in Heaviside rational units when multiplied by some power of 4π. Moreover, he has shown that this power of 4π, in the case of most units, varies inversely as the power under which μ appears in the complete dimensional expression for the quantity in electromagnetic measurement. Thus a current measured in Heaviside rational units is numerically equal to $(4\pi)^{\frac{1}{2}}$ times the same current measured in dekamperes, and in the electromagnetic dimensional expression for current, namely, $L^{\frac{1}{2}}M^{\frac{1}{2}}T^{-1}\mu^{-\frac{1}{2}}$, μ appears as $\mu^{-\frac{1}{2}}$. If, then, we consider the permeability of the ether to be numerically 4π instead of unity, the measurement of a current in dekamperes will be a number which is the same as that given by reckoning in Heaviside rational units. In this way a system of *Rational Practical Units* (R.P. Units) might be constructed as follows:—

The R.P. Unit of Magnetic Force = 4π × the C.G.S. Unit.
,, ,, Magnetic Polarity = $1/4\pi$ × ,, ,,
,, ,, Magnetic Flux = 1 ,,
,, ,, Magnetomotive Force = 1 ,,
,, ,, Electric Current = 1 ,,
,, ,, Electric Quantity = 1 ,,
,, ,, Electromotive Force = 10^3 ,,
,, ,, Resistance = 10^8 ,,
,, ,, Inductance = 10^8 ,,
,, ,, Power = 10^8 ,,
,, ,, Work = 10^8 ,,
,, ,, Capacity = 10^{-8} ,,

All except the unit of magnetic force and magnetic polarity are commensurable with the corresponding C.G.S. units, and in multiples which form a convenient practical system.

Even the rational systems already mentioned do not entirely fulfil the ideal of a system of physical units. There are certain constants of nature which are fundamental, invariable, and, as far as we know, of the same magnitude in all parts of the universe. One of these is the *mass* of the atom, say of hydrogen. Another is the *length* of a wave of light of particular refrangibility emitted by some atom, say one of the two yellow lines in the spectrum of sodium or one of the hydrogen lines. Also a *time* is fixed by the velocity of light in space which is according to the best measurement very close to 3×10^{10} cms. per sec. Another natural unit is the so-called *constant of gravitation*, or the force in dynes due to the attraction of two spherical masses each of 1 gramme with centres at a distance of 1 cm. Very approximately this is equal to 648×10^{-10} dynes. Another natural electrical unit of great importance is the electric charge represented by 1 electron (see ELECTRICITY). This according to the latest determination is nearly $3{\cdot}4\times10^{-10}$ electrostatic units of quantity on the C.G.S. system. Hence, 2930 million electrons are equal to 1 E.S. unit of quantity on the C.G.S. system, and the quantity called 1 coulomb is equal to 879×10^{16} electrons. In round numbers 9×10^{18} electrons make 1 coulomb. The electron is nature's unit of electricity and is the charge carried by 1 hydrogen ion in electrolysis (see CONDUCTION, ELECTRIC, § *Liquids*). Accordingly a truly natural system of physical units would be one which was based upon the electron, or a multiple of it, as a unit of electric quantity, the velocity of light or fraction of it as a unit of velocity, and the mass of an atom of hydrogen or multiple of it as a unit of mass. An approximation to such a natural system of electric units will be found discussed in chap. 17 of a book on *The Electron Theory*, by E.E. Fournier d'Albe (London, 1906), to which the reader is referred.

See J. Clerk Maxwell, *Treatise on Electricity and Magnetism*, vol. ii. chap. x. (3rd ed., Oxford, 1892); E. E. N. Mascart and J. Joubert, *Treatise on Electricity and Magnetism*, translation by E. Atkinson, vol. i. chap. xi. (London, 1883); J. D. Everett, *Illustrations of the C.G.S. System of Units* (London, 1891); Magnus Maclean, *Physical Units* (London, 1896); Fleeming Jenkin, *Reports on Electrical Standards* (London, 1873); *Reports* of the British Association Committee on Electrical Units from 1862 to present date; J. A. Fleming, *A Handbook for the Electrical Laboratory and Testing-Room* (2 vols., London, 1901); Lord Rayleigh, *Collected Scientific Papers*, vol. ii. (1881–87); A. Grey, *Absolute Measurements in Electricity and Magnetism*, vol. ii. part ii. chap. ix. p. 150 (London, 1893); Oliver Heaviside, *Electromagnetic Theory*, i. 116 (London, 1893); Sir A. W. Rücker, "On the Suppressed Dimensions of Physical Quantities," *Proc. Phys. Soc. Lond.* (1888), 10, 37; W. Williams, "On the Relation of the Dimensions of Physical Quantities to Directions in Space," *Proc. Phys. Soc. Lond.* (1892), 11, 257; R. A. Fessenden, "On the Nature of the Electric and Magnetic Quantities," *Physical Review* (January 1900).

(J. A. F.)

UNIVERSALIST CHURCH, a religious body organized in the United States, and represented chiefly by parishes and churches in that country and in Canada. While the distribution of the denomination extends to every state in the Union, the greater number of organizations and members are found in New England and New York.

A distinction should be noted between Universalism and the Universalist denomination. Universalism is found very early in the history of the Christian Church—apparently from the beginning. It was certainly held and taught by several of the greatest of the Apostolic and Church fathers: as Clement of Alexandria, Gregory of Nyssa, Origen and probably by Chrysostom and Jerome. It was taught in a majority of the Christian Schools of the second and third centuries; at Alexandria, at Antioch, at Edessa and at Nisibis.[1] But the Universalist denomination is of modern origin and confined mostly to the American continent. It dates from the arrival in Good Luck, N.J., of the Rev. John Murray (1714–1815),[2] of London, in September 1770; although there were some preachers of the doctrine in the country before Mr Murray came. He preached in various places in New Jersey, New York, Pennsylvania and Massachusetts, and societies sprang up as the result of his ministry in all these states. His first regular settlement was in Gloucester, Mass., in 1774, whence in 1793 he removed to Boston, which from that time forth became the headquarters of the denomination. A contemporary of Murray in his later years was Hosea Ballou (*q.v.*), also of Boston, who soon became the recognized leader of the movement, and for half a century was its most honoured and influential name. During his ministry the sect developed from twenty or thirty churches to five hundred, with a distribution over the Eastern and Middle states. In the period of Mr Ballou's domination little attention was paid to organization. It was the period of the propagation of the doctrine and of the controversies to which that gave rise. But about 1860 began an agitation for a more coherent organization, and a polity better suited to unity and progress than the spontaneous congregationalism that had developed during the earlier period. The result of that agitation was the adoption, at the Centennial Convention in 1870, of a somewhat elaborate plan of organization, and a manual of administration under which the denomination has since been conducted.

The plan of organization of the Universalist body follows, with necessary modifications, the scheme of the civil organization of the national government. While the local parish is the unit, the states are organized as independent federations, and combined into a national congress or convention. The parishes within the territory of a state are organized into a state convention; representatives, duly elected by the several state conventions, constitute the General Convention, which is the supreme legislative authority of the denomination. The state conventions meet annually; the General Convention once in two years. In the interval of sessions a Board of Trustees, consisting of eleven members, of whom the secretary, the chief administrative officer of the Convention, is one, administer the affairs of the denomination, except those concerns "reserved to the states and the people."

Doctrine.—The historic symbol of the denomination remains the Winchester Profession, adopted at the meeting of the General Convention—then a spontaneous yearly gathering of Universalists, without ecclesiastical authority—in Winchester, N.H., in Sept. 1803. It consists of three brief articles, as follows:—

> Article I.—We believe that the Holy Scriptures of the Old and New Testaments contain a revelation of the character of God and of the duty, interest and final destination of mankind.
>
> Article II.—We believe that there is one God, whose nature is Love, revealed in one Lord Jesus Christ, by one Holy Spirit of Grace, who will finally restore the whole family of mankind to holiness and happiness.
>
> Article III.—We believe that holiness and true happiness are inseparably connected, and that believers ought to be careful to maintain order and practise good works; for these things are good and profitable unto men.[3]

At the session of the General Convention in Boston in October 1900, a still briefer "Statement of Essential Principles" was adopted and made the condition of fellowship, in the following terms:—

> 1. The Universal Fatherhood of God; 2. the Spiritual authority and leadership of His Son, Jesus Christ; 3. the trustworthiness of the Bible as containing a revelation from God; 4. the certainty of just retribution for sin; 5. the final harmony of all souls with God.

Universalism, shortly described, is the belief that what ought to be will be. In a sane and beneficent universe the primacy belongs to Truth, Right, Love. These are the supreme powers. The logic of this conception of the natural and moral order is imperious. It compels the conclusion that, although we see not yet all things put under the sway of the Prince of Peace, we see the Divine plan set forth in Him, and cannot doubt the consummation which He embodies and predicts. Universalists are those members of the Christian family in whom this thought has become predominant. The idea that there is a Divine order, and that it contemplates the final triumph of Good over Evil, in human society as a whole and in the history of each individual, has taken possession of them. Hence they are Universalists.

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[1] See Dr Edward Beecher's *History of Opinions on the Scriptural Doctrine of Retribution* (New York, 1878), and Hosea Ballou 2nd's *Ancient History of Universalism* (Boston, 1829).

[2] A Wesleyan, then a follower of Whitefield, Murray became a Universalist after reading the tract on *Union* (1759) written by James Relly (1720–1778), minister of a Universalist congregation in London. Murray was a chaplain in a Rhode Island brigade during the War of American Independence, and a friend of General Nathanael Greene. His Universalism was Calvinistic in its tone, arguing from a universal election to a universal redemption—Ballou first openly broke with Calvinism. Murray's parish in Gloucester through him brought successful suit for the recovery of property appropriated for the use of the original (Congregational) parish, and thus gained the first legal recognition granted in New England to a Universalist society. See the *Autobiography* (Boston, 1816) edited by his wife, Judith Sargent Murray (1751–1820).

[3] Certain Universalists objected to the last clause of Article II. as implying a universal fall in Adam's sin; and others objected to the material and utilitarian construction which might be put on the last clause of Article III.

The Universalist Church embraces but a fraction of those who hold the Universalist belief. The literature of religion, the testimony of common knowledge, the drift of theological thinking, equally with the results of expert investigation, confirm this conclusion. But the denomination holds aloft the banner, conducts the campaign of education and organization, and represents in the religious world the principle, that the best possible outcome is to be expected to the human experiment.

Work.—Some idea of the work carried on by the denomination may be derived from the extent and variety of its organized forces. There were in 1907 about 1000 parishes on its roll; and these, with large numbers of families not included in parishes, were organized into 41 state and provincial conventions; into a National Young People's Christian Union of over 600 local societies, with a membership of 10,000; into one National Women's Missionary Association and several state societies; and into one General Convention, with its Board of Trustees, Secretary, Superintendent, and Committees on Missions, Education, Investments, Ways and Means and Fellowship.

a. The Home Missionary work devolves in the first instance on the several State Conventions, which have a Board and local secretaries and superintendents charged with this particular business in their several territories. In the next place, the Home Missionary work in new fields and where the local organization is weak, is in charge of the Board of Trustees of the General Convention. They employ a Southern Missionary and a General Superintendent, and appoint and aid in maintaining superintendents and missionaries in the newer states and Territories—as the North-Western Superintendent, the California Superintendent, &c.

b. Foreign Missions. In 1907 the Universalist denomination had for about fifteen years maintained a mission in Japan, where five American and five native missionaries were regularly employed, with teachers and helpers of varying numbers. The parent church of this mission is established in Tokyo, and plantings have been made at eight or nine other points throughout the empire. A Girls' Home is maintained in Tokyo, and a considerable work in teaching and training is conducted under the auspices of the Mission in universities and other schools elsewhere. A mission under the auspices of the Universalist General Convention is also maintained at Columbia, Province of Camagüey, Cuba.

c. The educational interests and activities of the denomination are expressed in four colleges, established by the Universalists—Tufts College (1852), at Medford, Massachusetts; Lombard College (1855; opened in 1852 as Illinois Liberal Institute), at Galesburg, Illinois; St Lawrence University (1856), at Canton, New York; and Buchtel College (1872), at Akron, Ohio; three theological schools, connected with the first three colleges just named and founded respectively in 1869, 1881 and 1858; and three academies, Dean Academy, Franklin, Massachusetts, Goddard Seminary, Barre, Vermont, and Westbrook Seminary, Portland, Maine; and a publishing house in Boston with a branch in Chicago is one of the denomination's chief agencies for the spread of the knowledge of what it holds to be the truth.

d. The Chapin Home in New York, the Church of the Messiah Home in Philadelphia, the Washburne Home in Minneapolis and the Bethany Home in Boston are examples of the benevolent and charitable work in which the Universalist body is interested and enlisted.

As stated above, the Universalist denomination embraces about 1000 churches, with congregations numbering about 200,000 persons; a membership of communicants reported in 1906 as 55,831; a membership in Sunday schools of 52,538; and church property valued at $10,598,100·39.

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UNIVERSAL LANGUAGES. The inconveniences resulting from the diversity of languages have been felt since the dawn of civilization. Even the most gifted linguist cannot master more than a comparatively small number of languages, and has to rely more or less on interpreters in his intercourse with speakers of foreign languages.

Advancing civilization brought with it a partial remedy at different periods and in different parts of the world by the spread of such languages as Assyrian, Greek, Latin, Arabic, English over a wide area as the accompaniment of political supremacy, or as a vehicle of culture. Even when Latin split up into the Romance languages, and ceased to be a living language itself, it still survived as the common learned language of Europe both in speech and writing (see Latin Language and Classics), till the rapid development of modern science and modern thought and the rapidly increasing complexity of modern life outstripped the limited range of a language never suited for international use.

Meanwhile the growth of the spirit of nationality has largely increased the number of literary languages. Russian men of science are no longer content to record their discoveries in French or German. The English student of science or philosophy has to leave unread many important works written in the more remote European languages, or make their acquaintance through an often inaccurate translation—perhaps in a language of which he is only imperfectly master.

The question of the adoption of a common language becomes, therefore, more and more pressing.

The most obvious solution of the problem would be the adoption of some one existing language as a means of international communication. But which? To revive the international use of Latin is out of the question. If it is to be a dead language, post-classical Greek would afford a more flexible —and perhaps an easier—means of expression. If we dismiss dead languages as impracticable, the choice of a living language raises new difficulties. To exalt English, or French, or Spanish to the rank of a world-language would give its native speakers such an advantage over the other nationalities that it has been seriously proposed to disarm international jealously by selecting such a language as Norwegian, which is spoken by a small community and is at the same time comparatively simple in structure.

But even if agreement were possible, we are still met by the difficulty that to the average human being it is practically impossible to acquire anything like an easy, thorough command of any foreign language. No natural language is really easy. In fact, we may go further and say that all languages are equally difficult (see H. Sweet, *Practical Study of Languages*, p. 66); although some are made more difficult than they need be by the way in which they are written—by the crabbedness of their alphabet, or by their unphonetic spelling—by the want of handbooks or their unpractical character, by the artificiality of their literature, and other purely external causes. Norwegian is easy to a Swede because it is practically a mere dialect of his own language: he knows two-thirds of it already. But that does not prove that Norwegian is easy in itself—that it would be easy, for instance, to an Oriental. The dialects of Chinese are mutually unintelligible, but it takes a Chinaman only about six months to learn another dialect, which would occupy even a gifted European at least three years to learn to speak; and yet Chinese is, from a European point of view, far simpler in structure than Norwegian, or even English.

Natural languages are difficult because they are imperfect expressions of thought: because language is only partly rational. The greatest difficulty of a language is the vocabulary; and the foundation of the vocabulary of all languages is practically arbitrary: there is no connexion between sound and meaning except in a few isolated words. And even that part of a language which can be brought more or less under general rules is full of irregularities and exceptions, ambiguities and redundancies of expression, and superfluous or irrational distinctions such as those of grammatical gender, so that when we have learnt one sentence we can never be sure that it will serve as a pattern for another.

These considerations suggest a further step towards the attainment of a common language: to rationalize and make regular some existing language. Even if we agreed to adopt an existing language unaltered in itself, we should certainly get rid of its external difficulties: neither English nor French could become world-languages till they had got rid of their unphonetic spelling. But from this it would be a natural step to eliminate such grammatical difficulties as those of *shall* and *will* in English. If this were once agreed on, why not go a step further and get rid of all grammatical irregularities, making, for instance, *better men* into *gooder mans*, *saw*, *seen* into *seed*, and so on? The vocabulary would offer little obstacle to a parallel simplification. The self-evident method would be to select certain words as the foundation: to use them as root-words from which all the other words could be formed by derivation and composition. The inconvenient length of many of the words so formed would then suggest reducing the root-words to a monosyllabic form, with such modifications as would be required to prevent confusions of form or meaning, or to make their pronunciation easier.

It is on these principles that the well-known Volapük (*q.v.*) is constructed (1880)—the first artificial language that achieved a certain measure of success. But its roots are so disguised by arbitrary alterations that the English basis is not generally easy to recognize.

Volapük is mainly an adapted (borrowed) or a-posteriori language, as opposed to an original or a-priori one, although it belongs partly to the latter class as well. Its vocabulary is adapted, but its grammar is, to a great extent, original.

On the ruins of Volapük there rose Esperanto (*q.v.*), which by 1907 had become the most widely known and used of its numerous competitors. In its grammar Esperanto is partly original, partly borrowed. Its vocabulary is not based exclusively on that of any one language, but is selected from the chief European languages—including Latin and Greek—the words being generally unaltered except in spelling. The extensive use made of word-composition and of derivative prefixes and suffixes enables the author to reduce the number of his root-words to between two and three thousand. This does not include international literary, scientific and technical words such as *professor*, *telegraph*, which are not translated into Esperanto compounds or derivatives, but are simply incorporated into the language with the minimum of change.

The most formidable rival of Esperanto is unquestionably Idiom Neutral (1902). It is the collective work of the *Akademi internasional de lingu universal*, its real author being the director of the *Akademi*, M. Rosenberger, of St Petersburg. This academy was originally instituted by the two international Volapük congresses in 1887 and 1889: it now numbers among its members not only many former adherents of the defunct Volapük, but also many ex-Esperantists. The most marked feature of Idiom Neutral is that its vocabulary is definitely and consistently based on the principle of the maximum of internationality for the roots. A systematic examination of the vocabularies of the seven chief European languages—English, French, German, Spanish, Italian, Russian, Latin—showed that the number of international roots and words was much greater than had been supposed. There are many, such as *apetit* and *tri*, "three," which occur in all seven; and it is only occasionally that it has been found necessary to adopt a word or root which occurs in less than four of them. The result is that instead of the unpleasant mixture of Romance elements with words taken arbitrarily from English and German which makes a great part of the vocabulary of Esperanto unintelligible to learners who know only one language, Idiom Neutral offers a vocabulary which is practically Romance-Latin. Thus the Idiom Neutral *ornit*, "bird," and *diurn*, "day," are almost self-interpreting even apart from any context, while the Esperanto *bird* and *tag* are unintelligible except to those who know English and German; and as the former is pronounced in Esperanto approximately as English *beard*, it is only intelligible to English speakers when written, not when spoken. In its grammar Idiom Neutral is almost entirely a-posteriori on a Romance basis, generally following French, sometimes in a somewhat slavish and unintelligent fashion, as in the use of *eske* as an interrogative particle, and of *leplu* as the mark of the superlative, although there is no definite article in Idiom Neutral. On the whole, there can be no doubt that Idiom Neutral is the simplest language that has yet been devised, and the most easily understood by any educated European; those who take several days to learn to read Esperanto find that they can read Idiom Neutral in as many minutes. Compare the following extract from a letter written by a Norwegian doctor to a colleague in Russia with the specimens given under the headings VOLAPÜK and ESPERANTO:—

> Idiom Neutral es usabl no sole pro skribasion, ma et pro perlasion; sikause in kongres sekuant internasional de medisinisti mi av intension usar ist idiom pro mie raport di maladitet "lupus," e mi esper esar komprended per omni medisinisti present.

But the construction of such languages is by no means so easy as would at first sight appear. All a-posteriori systems are liable to various defects, the inevitable result of the conflict between their old and new elements, and the difficulties and embarrassments of an arbitrary selection. Thus Idiom Neutral, which ought to be the most perfect of these attempts, admits homonyms (*kar*="carriage" and "dear," adj.), alternative forms such as *sientik* and *sientifik*, and ambiguities such as *filosofi*, which is both an abstract noun and the plural of *filosof*, "philosopher." Esperanto is better constructed in this respect; but it often only avoids confusion by arbitrary alteration of its words.

Another difficulty is that of national associations. No one likes to have his own language travestied. Thus Esperanto, which looks like bad Italian, is on that account less popular among the speakers of Romance languages (except in France) than elsewhere. It is a significant fact that none of the inventors of these languages base them on their native speech.

And then, these languages are not international after all. A really international language ought to be as acceptable to speakers of Arabic, Chinese or Japanese as to a European. Even from a European point of view they are not wholly international.

And they are not independent languages: they are only parasites—sickly parasites—on other languages. Their vocabularies are liable to incessant change and addition; and the meanings of their words are liable to be misunderstood in different ways by speakers of different languages. It is no answer to say that they are only auxiliary languages, which are not intended to supplant the national languages; for every artificial language must, at first at least, content itself with this rôle.

It is evident that the a-priori is the only basis which is really international, neutral and independent. And it is a significant fact that the earlier attempts were all a-priori. But all these attempts—beginning with Dalgarno's *Ars signorum* (1661) and Wilkins' well-known *Real Character* (1668)—have been failures. They were failures because the ground was not sufficiently prepared. A great part of Wilkins' folio is taken up with attempts to lay the necessary foundations. He saw—what none of his successors has yet seen—the necessity of a knowledge of the formation of sounds and the principles of their representation; and his sketch of phonetics is still valuable. His classification of the ideas expressed by language is an attempt to do what was afterwards done by Linnaeus and his successors and by Roget in the *Thesaurus of English Words and Phrases*.

Wilkins was only a dilettante, because the greater part of science was then only in the dilettante stage. We have a right now to demand that our universal language shall be the work, not of dilettantes, but of experts: that is, of trained philologists.

Now that the ground has been prepared—now that the principles of linguistic science are the common property of the educated world, and the chief languages of the earth have been made accessible, and whole families of languages have been included in comparative grammars and dictionaries—we have a right to ask that no one shall henceforth come before the public as the inventor of a new language till he has made himself acquainted with those branches of the science of language which form the natural foundation for such a work.

The first step in constructing an artificial language is to settle what sounds it is to contain. The answer, of course, is: the easiest. To the man in the street the only easy sounds are those of his own language. The question, which sounds are easiest in themselves, can only be settled by means of general practical phonetics, which often leads to conclusions directly contradicting popular prejudices. Then comes the question, how these sounds are to be written. It would be an easy matter to re-write Esperanto in the alphabet, say, of the International Phonetic Association, instead of its present antiquated and unpractical orthography; but the mere fact that the author of Esperanto did not take the trouble to make himself acquainted with the principles of phonetics and sound-representation before attacking so stupendous a problem makes us sceptical of his competence for the rest of his task.

The grammar of the new language must not be a mere imitation of that of Latin or an ordinary modern European language: it must be based on first principles. The inventor, after carefully considering the grammatical structure of languages of different types, must not only pick out what is best in each, but must consider whether he cannot do still better.

As regards the vocabulary, we are told that the inventor of Esperanto in his first attempts to construct a new language began with forming his roots by arbitrary combinations of letters, but failed to arrive at any satisfactory result in this way. It is, in fact, impossible to construct words arbitrarily: the attempt to do so inevitably results in distorted reminiscences of words already familiar to the experimenter. There are only two ways in which it is possible to construct an a-priori vocabulary: the *schematic* and the *symbolic*. The systems of Dalgarno and Wilkins belong to the former class. Wilkins's vocabulary is founded on a classification of all ideas under 40 categories, each expressed by the combination of a consonant and a vowel in a certain arbitrary (partly alphabetic) order. Thus *de* signifies " element," from which is formed the first subdivision *deb*, " fire," from which, again, is formed the further subdivision *deba*, " flame." The objections to this method are that there is no direct connexion between the words and their meanings, and that it involves not only knowing by heart the endless categories, and subdivisions of these, on which it is founded, but also their order and number—a task beyond any human memory. Even if it were not, no one would care to learn a classification which the advance of knowledge might render obsolete in a few years—together with the language itself.

The symbolic method, on the other hand, aims at establishing a direct association between the word and the idea it expresses, as is already the case, to some extent, in existing languages. Thus we have imitative words such as *cuckoo*, interjectional words, such as *hush*, and specially symbolic or gesture-words, such as *thou*, *me*, *mother*.

The difficulty in carrying out the symbolic principle is that the associations are few and often vague. But the material is sufficient, if handled in a practical spirit. However far removed from theoretical perfection the result might be, it would have at least two advantages:—(1) There would be none of that waste of material which is common to all natural languages and those artificial ones which are founded on them. (2) This would result in a brevity far exceeding that of the opposite type of language.

A well constructed a-priori language would, indeed, have many uses far transcending those of a rough-and-ready language of the Esperanto type. It would be more than a mere auxiliary language. It would be useful not only as a means of international communication, but as a means of expression superior in most respects to the native language: as an aid, not a hindrance, to accurate thought and scientific exactitude. It would repel by its unfamiliarity. It would have to be learnt; and it would not be learnt without effort, for its use would imply accurate thought and emancipation from the associations of the native language. But the difficulties would be impartially distributed: the new language would not necessarily be more difficult for the speakers of one language than for those of another.

The obstacles to the construction and adoption of an a-priori language are many; and meanwhile the need is pressing. So it is possible that the problem may be partially solved in the near future by the provisional adoption of an adapted language. Although such a language would not be very acceptable to non-European nations, it would still be easier to them than any European language. But whatever language may be adopted, it must be imposed by a competent tribunal, which, as in all analogous cases, will refuse to consider any scheme which has not been worked out by experts—that is, by scientific linguists. (H. Sw.)

UNIVERSITIES.[1] The medieval Latin term *universitas* (from which the English word " university " is derived) was originally employed to denote any community or corporation regarded under its collective aspect. When used in its modern sense, as denoting a body devoted to learning and education, it required the addition of other words in order to complete the definition—the most frequent form of expression being " universitas magistrorum et scholarium " (or " discipulorum "). In the course of time, probably towards the latter part of the 14th century, the term began to be used by itself, with the exclusive meaning of a community of teachers and scholars whose corporate existence had been recognized and sanctioned by civil or ecclesiastical authority or by both. But the more ancient and customary designation of such communities in medieval times (regarded as places of instruction) was " studium " (and subsequently " studium generale "), a term implying a centre of instruction for all.[2] The expressions " universitas studii " and " universitatis collegium " are also occasionally to be met with in official documents.

It is necessary, however, to bear in mind, on the one hand, that a university often had a vigorous virtual existence long before it obtained that legal recognition which entitled it, technically, to take rank as a " studium generale," and, on the other hand, that hostels, halls and colleges, together with complete courses in all the recognized branches of learning, were by no means necessarily involved in the earliest conception of a university. The university, in its earliest stage of development, appears to have been simply a scholastic gild—a spontaneous combination, that is to say, of teachers or scholars, or of both combined, and formed probably on the analogy of the trades gilds, and the gilds of aliens in foreign cities, which, in the course of the 13th and 14th centuries, are to be found springing up in most of the great European centres. The design of these organizations, in the first instance, was little more than that of securing mutual protection—for the craftsman, in the pursuit of his special calling; for the alien, as lacking the rights and privileges inherited by the citizen. And so the university, composed as it was to a great extent of students from foreign countries, was a combination formed for the protection of its members from the extortion of the townsmen and the other annoyances incident in medieval times to residence in a foreign state. It was a first stage of development in connexion with these primary organizations, when the chancellor of the cathedral, or some other authority, began, as we shall shortly see, to accord to other masters permission to open other schools than the cathedral school in the neighbourhood of his church; a further stage was reached when a licence to teach—granted only after a formal examination—empowered a master to carry on his vocation at any similar centre that either already existed or might afterwards be formed throughout Europe—"facultas ubique docendi.” It was a still further development when it began to be recognized that, without a licence from either pope, emperor or king, no “studium generale” could be formed possessing this right of conferring degrees, which originally meant nothing more than licences to teach.

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[1] It is the design of the present article to exhibit the universities in their general historical development; more detailed information respecting the *present condition* of each will be found in the separate articles under topographical headings.

[2] Denifle, *Die Universitäten des Mittelalters*, i. 1–29.

Meaning of “studium generale.”

Origin of the term “university.”

In the north of Europe such licences were granted by the Chancellor Scholasticus, or some other officer of a cathedral church; in the south it is probable that the gilds of masters (when these came to be formed) were at first free to grant their own licences, without any ecclesiastical or other supervision. But in all cases such permissions were of a purely local character. Gradually, however, towards the end of the 12th century, a few great schools claimed from the excellence of their teaching to be of more than merely local importance. Practically a doctor of Paris or Bologna would be allowed to teach anywhere; while those great schools began to be known as *studia generalia*, *i.e.* places resorted to by scholars from all parts. Eventually the term came to have a more definite and technical signification. The emperor Frederick II. set the example of attempting to confer by an authoritative bull upon his new school at Naples the prestige which the earlier *studia* had acquired by reputation and general consent. In 1229 Gregory IX. did the same for Toulouse, and in 1233 added to its original privileges a bull by which any one who had been admitted to the doctorate or mastership in that university should have the right to teach anywhere without further examination. Other *studia generalia* were subsequently founded by papal or imperial bulls; and in 1292 even the oldest universities, Paris and Bologna, found it desirable to obtain similar bulls from Nicolas IV. From this time the notion began to prevail among the jurists that the essence of the *studium generale* was the privilege of conferring the *jus ubicunque docendi*, and that no new *studium* could acquire that position without a papal or imperial bull. By this time, however, there were a few *studia generalia* (*e.g.* Oxford) whose position was too well established to be seriously questioned, although they had never obtained such a bull; these were held to be *studia generalia ex consuetudine*. A few Spanish universities founded by royal charter were held to be *studia generalia respectu regni*. The word *universitas* was originally applied only to the scholastic gild (or gilds) within the *studium*, and was at first not used absolutely; the phrase was always *universitas magistrorum*, or *scholarium* or *magistrorum et scholarium*. By the close of the medieval period, however, the distinction between the terms *studium generale* and *universitas* was more or less lost sight of, and in Germany especially the term *universitas* began to be used alone.[1]

History of learning before the university era.

In order, however, clearly to understand the conditions under which the earliest universities came into existence, it is necessary to take account, not only of their organization, but also of their studies, and to recognize the main influences which, from the 6th to the 12th century, served to modify both the theory and the practice of education. In the former century, the schools of the Roman empire, which had down to that time kept alive the traditions of pagan education, had been almost entirely swept away by the barbaric invasions. The latter century marks the period when the institutions which supplied their place—the episcopal schools attached to the cathedrals and the monastic schools—attained to their highest degree of influence and reputation. Between these and the schools of the empire there existed an essential difference, in that the theory of education by which they were pervaded was in complete contrast to the simply secular theory of the schools of paganism. The cathedral school taught only what was supposed to be necessary for the education of the priest; the monastic school taught only what was supposed to be in harmony with the aims of the monk. But between the pagan system and the Christian system by which it had been superseded there yet existed something that was common to both: the latter, even in the narrow and meagre instruction which it imparted, could not altogether dispense with the ancient text-books, simply because there were no others in existence. Certain treatises of Aristotle, of Porphyry, of Martianus Capella and of Boetius continued consequently to be used and studied; and in the slender outlines of pagan learning thus still kept in view, and in the exposition which they necessitated, we recognize the main cause which prevented the thought and literature of classic antiquity from falling altogether into oblivion.

Revival in time of Charlemagne.

Under the rule of the Merovingian dynasty even these scanty traditions of learning declined throughout the Frankish dominions; but in England the designs of Gregory the Great, as carried out by Theodorus, Bede and Alcuin, resulted in a great revival of education and letters. The influence of this revival extended in the 8th and 9th centuries to Frankland, where Charlemagne, advised and aided by Alcuin, effected a memorable reformation, which included both the monastic and the cathedral schools; while the school attached to the imperial court, known as the Palace School, also became a famous centre of learned intercourse and instruction.

General causes of formation of first universities.

But the activity thus generated, and the interest in learning which it served for a time to diffuse, well-nigh died out amid the anarchy which characterizes the 10th century in Latin Christendom, and it is at least questionable whether any real connexion can be shown to have existed between this earlier revival and that remarkable movement in which the university of Paris had its origin. On the whole, however, a clearly traced, although imperfectly continuous, succession of distinguished teachers has inclined the majority of those who have studied this obscure period to conclude that a certain tradition of learning, handed down from the famous school over which Alcuin presided at the great abbey of St Martin at Tours, continued to survive, and became the nucleus of the teaching in which the university took its rise. But, in order adequately to explain the remarkable development and novel character which that teaching assumed in the course of the 12th and 13th centuries, it is necessary to take account of the operation of certain more general causes to which the origin of the great majority of the earlier universities may in common unhesitatingly be referred. These causes are—(1) the introduction of new subjects of study, as embodied in a new or revived literature; (2) the adoption of new methods of teaching which were rendered necessary by the new studies; (3) the growing tendency to organization which accompanied the development and consolidation of the European nationalities.

Rise of university of Salerno.

That the earlier universities took their rise to a great extent in endeavours to obtain and provide instruction of a kind beyond the range of the monastic and cathedral schools appears to be very generally admitted, but with respect to the origin of the first European university—that of Salerno in Italy, which became known as a school of medicine as early as the 9th century—the circumstances are pronounced by a recent investigator to be “veiled in impenetrable obscurity.”[2] One writer[3] derives its origin from an independent tradition of classical learning which continued to exist in Italy down to the 10th century. Another writer[4] maintains that it had its beginning in the teaching at the famous Benedictine monastery of Monte Cassino, where the study of medicine was undoubtedly pursued. But the most authoritative researches point to the conclusion that the medical system of Salerno was originally an outcome of the Graeco-Roman tradition of the old Roman world, and the Arabic medicine was not introduced till the highest fame of the Civitas Hippocratica was passing away. It *may* have been influenced by the late survival of the Greek language in southern Italy, though this cannot be proved. In the first half of the 9th century the emperor at Constantinople sent to the Caliph

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[1] Denifle i. 34-39.

[2] Rashdall, *Universities of Europe in the Middle Ages*, i. 76.

[3] De Renzi, *Storia Documentata della Scuola Medica di Salerno* (ed. 1857), p. 145.

[4] Puccinotti, *Storia della Medicina*, i. 317-26.

Mamoun at Bagdad a considerable collection of Greek manuscripts, which seems to have given the earliest impulse to the study of the Hellenic pagan literature by the Saracens. The original texts were translated into Arabic by Syrian Christians, and these versions were, in turn, rendered into Latin for the use of teachers in the West. Of the existence of such versions we have evidence, according to Jourdain,[1] long prior to the time when Constantine the African (d. 1087) began to deliver his lectures on the science at Salerno, although these early versions have since altogether disappeared. Under his teaching the fame of Salerno as a medical school became diffused all over Europe; it was distinguished also by its catholic spirit, and, at a time when Jews were the object of religious persecution throughout Europe, members of this nationality were to be found both as teachers and learners at Salerno. Ordericus Vitalis, who wrote in the first half of the 12th century, speaks of it as then long famous. In 1231 it was constituted by the emperor Frederick II. the only school of medicine in the kingdom of Naples.

Bologna.

Decretum of Gratian and the canon law.

Foreign students at Bologna

The great revival of legal studies which took place at Bologna about the year 1000 had also been preceded by a corresponding activity elsewhere—at Pavia by a famous school of Lombard law, and at Ravenna by a yet more important school of Roman law. And in Bologna itself we have evidence that the Digest was known and studied before the time of Irnerius (1100–30), a certain Pepo being named as lecturing on the text about the year 1076. The traditional story about the "discovery" of the Pandects at Amalfi in 1135 was disproved even before the time of Savigny. Schulte has shown that the publication of the *Decretum* of Gratian must be placed earlier than the traditional date, *i.e.* not later than 1142. This instruction again was of a kind which the monastic and cathedral schools could not supply, and it also contributed to meet a new and pressing demand. The neighbouring states of Lombardy were at this time increasing rapidly in population and in wealth; and the greater complexity of their political relations, their growing manufactures and commerce, demanded a more definite application of the principles embodied in the codes that had been handed down by Theodosius and Justinian. But the distinctly secular character of this new study, and its close connexion with the claims and prerogatives of the Western emperor, aroused at first the susceptibilities of the Roman see, and for a time Bologna and its civilians were regarded by the church with distrust and even with alarm. These sentiments were not, however, of long duration. In the year 1151 the appearance of the *Decretum* of Gratian, largely compiled from spurious documents, invested the studies of the canonist with fresh importance; and numerous decrees of past and almost forgotten pontiffs now claimed to take their stand side by side with the enactments contained in the *Corpus Juris Civilis*. They constituted, in fact, the main basis of those new pretensions asserted with so much success by the popedom in the course of the 12th and 13th centuries. It was necessary, accordingly, that the *Decretum* should be known and studied beyond the walls of the monastery or the episcopal palace, and that its pages should receive authoritative exposition at some common centre of instruction. Such a centre was to be found in Bologna. The needs of the secular student and of the ecclesiastical student were thus brought for a time into accord, and from the days of Irnerius down to the close of the 13th century we have satisfactory evidence that Bologna was generally recognized as the chief school both of the civil and the canon law.[2] It has, indeed, been asserted that university degrees were instituted there as early as the pontificate of Eugenius III. (1145–53), but the statement rests on no good authority, and is in every way improbable. There is, however, another tradition which is in better harmony with the known facts. When Barbarossa marched his forces into Italy on his memorable expedition of 1155, and reasserted those imperial claims which had so long lain dormant, the professors of the civil law and their scholars, but more especially the foreign students, gathered round the Western representative of the Roman Caesars, and besought his intervention in their favour in their relations with the citizens of Bologna. A large proportion of the students were probably from Germany; and it did not escape Frederick's penetration that the civilian might prove an invaluable ally in the assertion of his imperial pretensions. He received the suppliants graciously, and, finding that their grievances were real, especially against the landlords in whose houses they were domiciled, he granted the foreign students substantial protection, by conferring on them certain special immunities and privileges (November 1158).[3] These privileges were embodied in the celebrated *Authentica, Habita*, in the *Corpus Juris Civilis* of the empire (bk. iv. tit. 13), and were eventually extended so as to include all the other universities of Italy. In them we may discern the precedent for that state protection of the university which, however essential at one time for the security and freedom of the teacher and the taught, has been far from proving an unmixed benefit—the influence which the civil power has thus been able to exert being too often wielded for the suppression of that very liberty of thought and inquiry from which the earlier universities derived in no small measure their importance and their fame.

The "universities" at Bologna.

But, though there was a flourishing school of study, it is to be observed that Bologna did not possess a university so early as 1158. Its first university was not constituted until the close of the 12th century. The "universities" at Bologna were, as Denifle has shown, really student gilds, formed under influences quite distinct from the protecting clauses of the *Authentica*, and suggested, as already noted, by the precedent of those foreign gilds which, in the course of the 12th century, began to rise throughout western Europe. These were originally only two in number, the *Ultramontani* and the *Citramontani*, and arose out of the absolute necessity, under which residents in a foreign city found themselves, of obtaining by combination that protection and those rights which they could not claim as citizens. These societies were modelled, Denifle considers, not on the trade gilds which rose in Bologna in the 13th century, but on the Teutonic gilds which arose nearly a century earlier in north-western Europe, being essentially "spontaneous confederations of aliens on a foreign soil." Originally, they did not include the native student element and were composed exclusively of students in law.

Their democratic character.

Other similar communities in Italy.

The power resulting from this principle of combination, when superadded to the privileges conferred by Barbarossa, gave to the students of Bologna a superiority of which they were not slow to avail themselves. Under the leadership of their rector, they extorted from the citizens concessions which raised them from the condition of an oppressed to that of a specially privileged class. The same principle, when put in force against the professors, reduced the latter to a position of humble deference to the very body whom they were called upon to instruct, and imparted to the entire university that essentially democratic character by which it was afterwards distinguished. It is not surprising that such advantages should have led to an imitation and extension of the principle by which they were obtained. Denifle considers that the "universities" at Bologna were at one time certainly more than four in number, and we know that the Italian students alone were subdivided into two—the Tuscans and the Lombards. In the centres formed by secession from the parent body a like subdivision took place. At Vercelli there were four *universitates*, composed respectively of Italians, English, Provençals and Germans; at Padua there were similar divisions into Italians,

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[1] *Sur l'âge et l'origine des traductions latines*, &c., p. 225.

[2] Denifle, *Die Universitäten*, &c., i. 48.

[3] See Savigny, *Gesch. d. röm. Rechts*, iii. 152, 491–92. See also Giesebrecht, *Gesch. d. Kaiserzeit* (ed. 1880), v. 51–52. The story is preserved in a recently discovered metrical composition descriptive of the history of Frederick I.; see *Sitzungsberichte d. Bairisch. Akad. d. Wissenschaft, Phil.-Hist. Klasse* (1879), ii. 285. Its authenticity is called in question by Denifle, but it would seem to be quite in harmony with the known facts.

French (*i.e. Francigenae*, comprising both English and Normans), Provençals (including Spaniards and Catalans). When, accordingly, we learn from Odofred that in the time of the eminent jurist Azo, who lectured at Bologna about 1200, the number of the students there amounted to some ten thousand, of whom the majority were foreigners, it seems reasonable to conclude that the number of these confederations of students (*societates scholarium*) at Bologna was yet greater. It is certain that they were not formed simultaneously, but, similarly to the free gilds, one after the other—the last in order being that of the Tuscans, which was composed of students from Tuscany, the Campagna and Rome. Nor are we, again, to look upon them as in any way the outcome of those democratic principles which found favour in Bologna, but rather as originating in the traditional home associations of the foreign students, fostered, however, by the peculiar conditions of their university life. As the Tuscan division (the one least in sympathy, in most respects, with Teutonic institutions) was the last formed, so, Denifle conjectures, the German "university" may have introduced the conception which was successively adopted by the other nationalities.

The rector.

In marked resemblance to the gilds, these confederations were presided over by a common head, the "rector scholarium," an obvious imitation of the "rector societatum" or "artium" of the gild, but to be carefully distinguished from the "rector scholarum" or director of the studies, with whose function the former officer had, at this time, nothing in common. Like the gilds, again, the different nations were represented by their "consiliarii," a deliberative assembly with whom the rector habitually took counsel.

Mature age of the students.

While recognizing the essentially democratic character of the constitution of these communities, it is to be remembered that the students, unlike the majority at Paris and later universities, were mostly at this time of mature years. As the civil law and the canon law were at first the only branches of study, the class whom they attracted were often men already filling office in some department of the church or state—archdeacons, the heads of schools, canons of cathedrals, and like functionaries forming a considerable element in the aggregate. It has been observed, indeed, that the permission accorded them by Frederick I. of choosing, in all cases of dispute, their own tribunal, thus constituting them, to a great extent, *sui juris*, seems to presuppose a certain maturity of judgment among those on whom this discretionary power was bestowed.

Innocent IV., in according his sanction to the new statutes of the university in 1253, refers to them as drawn up by the "rectores et universitas scholarium Bononiensium."

Formation of the universitates.

Faculties instituted.

About the year 1200 were formed the two faculties of medicine and philosophy (or "the arts"[1]), the former being somewhat the earlier. It was developed, as that of the civil law had been developed, by a succession of able teachers, among whom Thaddeus Alderottus was especially eminent. The faculty of arts, down to the 14th century, scarcely attained to equal eminence. The teaching of theology remained for a long time exclusively in the hands of the Dominicans; and it was not until the year 1360 that Innocent VI. recognized Bologna as a "studium generale" in this branch—in other words, as a place of theological education for all students, with the power of conferring degrees of universal validity.

Account of the university by Anglicus.

In the year 1371 the cardinal legate, Anglicus, compiled, as chief director of ecclesiastical affairs in the city, an account of the university, which he presented to Urban V. The information it supplies is, however, defective, owing to the fact that only the professors who were in receipt of salaries from the municipality are mentioned. Of these there were twelve of civil law and six of canon law; three of medicine, three of practical medicine and one of surgery; two of logic, and one each of astrology, rhetoric and notarial practice. The professors of theology, who, as members of the religious orders, received no state remuneration, are unmentioned. The significance of the term "college," as first employed at Bologna, differed, like that of "university," from that which it subsequently acquired. The *collegia* of the doctors no more connoted the idea of a place of residence than did the *universitates* of the students. There were the College of Doctors of Civil Law, the College of Doctors of Canon Law, the College of Doctors in Medicine and Arts and (from 1352) the College of Doctors in Theology. Though the professors were largely dependent upon the students, they had separate organizations of their own; the college alone was concerned in the conferment of degrees. Each faculty was therefore at Bologna entirely independent of every other (except for the union of medicine and arts): the only connecting link between them was the necessity of obtaining their degrees (after 1219) from the same chancellor, the archdeacon of Bologna. The decline in the reputation of the *studium* from about 1250 was largely due to the successful efforts of the doctors to exclude all but Bolognese citizens from membership of the doctoral colleges (which alone possessed the valuable "right of promotion"), and from the more valuable salaried chairs. They even attempted and partially succeeded in restricting these privileges to members of their own families.

The universities at Bologna.

The earliest colleges.

Colleges as places of residence for students existed, however, at Bologna at a very early date, but it is not until the 14th century that we find them possessing any organization; and the humble *domus*, as it was termed, was at first designed solely for necessitous students, not being natives of Bologna. A separate house, with a certain fund for the maintenance of a specified number of scholars, was all that was originally contemplated. Such was the character of that founded by Zoen, bishop of Avignon, in February 1256 (O.S.), the same month and year, it is to be noted, in which the Sorbonne was founded in Paris. It was designed for the maintenance of eight scholars from the province of Avignon, under the supervision of three canons of the church, maintaining themselves in the university. Each scholar was to receive 24 Bolognese lire annually for five years. The college of Brescia was founded in 1326 by William of Brescia, archdeacon of Bologna, for poor foreign students without distinction as to nationality. The Spanish college, founded in 1364, for twenty-four Spanish scholars and two chaplains, is noted by Denifle as the one college founded in medieval times which still exists on the Continent.

Origin of university of Paris.

Of the general fact that the early universities rose in response to new wants the commencement of the university of Paris supplies us with a further illustration. The study of logic, which, prior to the 12th century, was founded exclusively on one or two meagre compends, received about the year 1100, on two occasions, a powerful stimulus—in the first instance, from the memorable controversy between Lanfranc and Berengar; in the second, from the no less famous controversy between Anselm and Roscellinus. A belief sprang up that an intelligent apprehension of spiritual truth depended on a correct use of prescribed methods of argumentation. Dialectic was looked upon as "the science of sciences"; and when, somewhere in the first decade of the 12th century, William of Champeaux opened in Paris a school for the more advanced study of dialectic as an art, his teaching was attended with marked success. Among his pupils was Abelard, in whose hands the study made a yet more notable advance; so that, by the middle of the century, we find John of Salisbury, on returning from the French capital to England, relating with astonishment, not unmingled with contempt, how all learned Paris had gone well-nigh mad in its pursuit and practice of the new dialectic.

Study of logic.

Teaching of Abelard.

Abelard taught in the first instance at the cathedral school at Notre Dame, and subsequently at the schools on the Montagne Ste Geneviève, of which he was the founder, and where he imparted to logic its new development. But in 1147 the secular canons of Ste Geneviève

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[1] The arts course of study was that represented by the ancient *trivium* (*i.e.* grammar, logic and rhetoric) and the *quadrivium* (*i.e.* arithmetic, geometry, music and astronomy) as handed down from the schools of the Roman empire. See J. B. Mullinger's *History of the University of Cambridge*, i. 24–27.

Study of theology.

Lombard's "Sentences."

gave place to canons regular from St Victor; and henceforth the school on the former foundation was merely a school for the teaching of theology, and was attended only by the members of the house.[1] The schools out of which the university arose were those attached to the cathedral on the Île de la Cité, and presided over by the chancellor—a dignitary who must be carefully distinguished from the later chancellor of the university. For a long time the teachers lived in separate houses on the island, and it was only by degrees that they combined themselves into a society, and that special buildings were constructed for their class-work. But the flame which Abelard's teaching had kindled was not destined to expire. Among his pupils was Peter Lombard, who was bishop of Paris in 1159, and widely known to posterity as the compiler of the famous volume of the *Sentences*. The design of this work was to place before the student, in as strictly logical a form as practicable, the views (*sententiae*) of the fathers and all the great doctors of the church upon the chief and most difficult points in the Christian belief. Conceived with the purpose of allaying and preventing, it really stimulated, controversy. The logicians seized upon it as a great storehouse of indisputable major premises, on which they argued with renewed energy and with endless ingenuity of dialectical refinement; and upon this new compendium of theological doctrine, which became the text-book of the middle ages, the schoolmen, in their successive treatises *Super sententias*, expended a considerable share of that subtlety and labour which still excite the astonishment of the student of metaphysical literature.

Rise of other early universities.

It is in these prominent features in the history of these early universities—the development of new methods of instruction concurrently with the appearance of new material for their application—that we find the most probable solution of the question as to how the university, as distinguished from the older cathedral or monastic schools, was first formed. In a similar manner, it seems probable, the majority of the earlier universities of Italy—Reggio, Modena, Vicenza, Padua and Vercelli—arose, for they had their origin independently alike of the civil and the papal authority. Instances, it is true, occur, which cannot be referred to this spontaneous mode of growth. The university of Naples, for example, was founded solely by the fiat of the emperor Frederick II. in the year 1224; and, if we may rely upon the documents cited by Denifle, Innocent IV. about the year 1245 founded in connexion with the curia a "studium generale,"[2] which was attached to the papal court, and followed it when removed from Rome, very much as the Palace School of Charles the Great accompanied that monarch on his progresses.

Early organization of university of Paris.

As the university of Paris became the model, not only for the universities of France north of the Loire, but also for the great majority of those of central Europe as well as for Oxford and Cambridge, some account of its early organization will here be indispensable. Such an account is rendered still further necessary by the fact that the recent and almost exhaustive researches of Denifle, the Dominican father, have led him to conclusions which on some important points run altogether counter to those sanctioned by the high authority of Savigny

Inception.

The bachelor of arts.

The original university, as already stated, took its rise entirely out of the movement carried on by teachers on the island, who taught by virtue of the licence conferred by the chancellor of the cathedral. In the second decade of the 13th century, it is true, we find masters withdrawing themselves from his authority by repairing to the left bank of the Seine and placing themselves under the jurisdiction of the abbot of the monastery of Ste Geneviève; and in 1255 this dignitary is to be found appointing a chancellor whose duty it should be to confer *licentia docendi* on those candidates who were desirous of opening schools in that district. But it was around the bestowal of this licence by the chancellor of Notre Dame, on the Île de la Cité, that the university of Paris grew up. It is in this licence that the whole significance of the master of arts degree is contained; for what is technically known as admission to that degree was really nothing more nor less than receiving the chancellor's permission to "incept," and by "inception" was implied the master's formal entrance upon, and commencement of, the functions of a duly licensed teacher, and his recognition as such by his brothers in the profession. The previous stage of his academic career, that of bachelordom, had been one of apprenticeship for the mastership; and his emancipation from this state was symbolized by placing the magisterial cap (*biretta*) upon his head, a ceremony which, in imitation of the old Roman ceremony of manumission, was performed by his former instructor, "under whom" he was said to incept. He then gave a formal inaugural lecture, and, after this proof of magisterial capacity, was welcomed into the society of his professional brethren with set speeches, and took his seat in his master's chair.

The university formed.

This community of teachers of recognized fitness did not in itself suffice to constitute a university, but some time between the years 1150 and 1170, the period when the *Sentences* of Peter Lombard were given to the world, the university of Paris came formally into being. Its first written statutes were not, however, compiled until about the year 1208, and it was not until long after that date that it possessed a "rector." Its earliest recognition as a legal corporation belongs to about the year 1211, when a brief of Innocent III. empowered it to elect a proctor to be its representative at the papal court. By this permission it obtained the right to sue or to be sued in a court of justice as a corporate body.

Difficulties of first development.

This papal recognition was, however, very far from implying the episcopal recognition, and the earlier history of the new community exhibits it as in continual conflict alike with the chancellor, the bishop and the cathedral chapter of Paris, by all of whom it was regarded as a centre of insubordination and doctrinal licence. Had it not been, indeed, for the papal aid, the university would probably not have survived the contest; but with that powerful assistance it came to be regarded as the great Transalpine centre of orthodox theological teaching. Successive pontiffs, down to the great schism of 1378, made it one of the foremost points of their policy to cultivate friendly and confidential relations with the authorities of the university of Paris, and systematically to discourage the formation of theological faculties at other centres. In 1231 Gregory IX., in the bull *Parens Scientiarum*, gave full recognition to the right of the several faculties to regulate and modify the constitution of the entire university—a formal sanction which, in Denifle's opinion, rendered the bull in question the Magna Charta of the university.

The "nations."

In comparing the relative antiquity of the universities of Paris and Bologna, it is difficult to give an unqualified decision. The university of masters at the former was probably slightly anterior to the university of students at the latter; but there is good reason for believing that Paris, in reducing its traditional customs to statutory form, largely availed itself of the precedents afforded by the already existing code of the Transalpine centre. The fully developed university was divided into four faculties—three "superior," viz. those of theology, canon law and medicine, and one "inferior," that of arts, which was divided into four "nations." These nations, which included both professors and scholars, were—(1) the French nation, composed, in addition to the native element, of Spaniards, Italians and Greeks; (2) the Picard nation, representing the students from the north-east and from the Netherlands; (3) the Norman nation; (4) the English nation, comprising, besides students from the provinces under English rule, those from England, Ireland, Scotland and

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[1] The view of Thurot (*De l'organisation de l'enseignement dans l'université de Paris*, pp. 4–7) that the university arose out of a combination of these several schools is rejected by Denifle (see *Die Universitäten*, &c., i. 653–94).

[2] Where the words *studium generale* are placed within marks of quotation they occur in the original charter of foundation of the university referred to.

Germany. The head of each faculty was the dean; the head of each nation was the proctor. The rector, who in the first instance was head of the faculty of arts, by whom he was elected, was eventually head of the whole university. In congregations of the university matters were decided by a majority of faculties; the vote of the faculty of arts was determined by a majority of nations. The chancellor of Notre Dame, whose functions were now limited to the conferment of the licence, stood as such outside the university or gild altogether, though as a doctor of theology he was always a member of that faculty. Only "regents," that is, masters actually engaged in teaching, had any right to be present or to vote in congregations. Neither the entire university nor the separate faculties had thus, it will be seen, originally a common head, and it was not until the middle of the 14th century that the rector became the head of the collective university, by the incorporation under him, first, of the students of the canon law and of medicine (which took place about the end of the 13th century), and, secondly, of the theologians, which took place about half a century later.

The Sorbonne.

In the course of the 16th and 17th centuries this democratic constitution of the middle ages was largely superseded by the growth of a small oligarchy of officials. The tribunal of the university—the rector, deans and proctors—came to occupy a somewhat similar position to the old "Hebdomadal Board" of heads of colleges at Oxford and the *Caput* at Cambridge. Moreover, the teaching functions of the university, or rather of the faculty of arts, owing chiefly to the absence of any endowment for the regents or teaching graduates, practically passed to the colleges. Almost as much as the English universities, Paris came to be virtually reduced to a federation of colleges, though the colleges were at Paris less independent of university authority, while the smaller colleges sent their members to receive instruction in the larger ones (*collèges de plein exercise*), which received large numbers of non-foundation members. This state of things lasted till the French Revolution swept away the whole university system of the middle ages. It may be remarked that the famous Sorbonne was really the most celebrated college of Paris—founded by Robert de Sorbonne *circa* 1257—but as this college and the college of Navarre were the only college foundations which provided for students in theology, the close connexion of the former with the faculty and the use of its hall for the disputations of that body led to the word Sorbonne becoming a popular term for the theological faculty of Paris.

Paris and Bologna contrasted.

Papal policy.

Apart from the broad differences in their organization, the very conception of learning, it will be observed, was different at Bologna from what it was at Paris. In the former it was entirely professional—designed, that is to say, to prepare the student for a definite and practical career in after life; in the latter it was sought to provide a general mental training, and to attract the learner to studies which were speculative rather than practical. In the sequel, the less mercenary spirit in which Paris cultivated knowledge added immensely to her influence and reputation, which about the middle of the 14th century may be said to have reached their apogee. It had forty colleges, governed either by secular or religious communities, and numbered among its students representatives of every country in Europe (Jourdain, *Excursions historiques*, c. xiv.). The university became known as the great school where theology was studied in its most scientific spirit; and the decisions of its great doctors upon those abstruse questions which absorbed so much of the highest intellectual activity of the middle ages were regarded as almost final. The popes themselves, although averse from theological controversies, deemed it expedient to cultivate friendly relations with a centre of such importance for the purpose of securing their influence in a yet wider field. Down therefore to the time of the great schism (1378), they at once conciliated the university of Paris and consulted what they deemed to be the interests of the Roman see, by discouraging the creation of faculties of theology elsewhere. The apparent exceptions to this policy are easily explained: the four faculties of theology which they sanctioned in Italy—Pisa (1343), Florence (1349), Bologna (1362) and Padua (1363)—were designed to benefit the Italian monasteries, by saving the monks the expense and dangers of a long journey beyond the Alps; while that at Toulouse (1229) took its rise under circumstances entirely exceptional, being designed as a bulwark against the heresy of the Albigenses. The popes, on the other hand, favoured the creation of new faculties of law, and especially of the canon law, as the latter represented the source from which Rome derived her most warmly contested powers and prerogatives. The effects of this twofold policy were sufficiently intelligible: the withholding of each charter which it was sought to obtain for a new school of theology only served to augment the numbers that flocked to Paris; the bestowal of each new charter for a faculty of law served in like manner to divert a certain proportionate number from Bologna. These facts enable us to understand how it is that, in the 13th and 14th centuries, we find, even in France, a larger number of universities created after the model of Bologna than after that of Paris.

Reggio and Modena.

Vicenza.

Padua.

In their earliest stage, however, the importance of these new institutions was but imperfectly discerned alike by the civil and the ecclesiastical power, and the first four universities of Italy, after Bologna, rose into existence, like Bologna itself, without a charter from either pope or emperor. Of these the first were those of Reggio nell' Emilia and Modena, both of which are to be found mentioned as schools of civil law before the close of the 12th century. The latter, throughout the 13th century, appears to have been resorted to by teachers of sufficient eminence to form a flourishing school, composed of students not only from the city itself, but also from a considerable distance. Both of them would seem to have been formed independently of Bologna, but the university of Vicenza was probably the outcome of a migration of the students from the former city, which took place in the year 1204. During the next fifty years Vicenza attained to considerable prosperity, and appears to have been recognized by Innocent III.; its students were divided into four nations, each with its own rector; and in 1264 it included in its professoriate teachers, not only of the civil law, but also of medicine, grammar and dialectic. The university of Padua was unquestionably the direct result of the migration in 1222 of a considerable number of students from Bologna. Some writers, indeed, have inferred that the "studium" in the latter city was transferred in its entirety, but the continued residence of a certain proportion in Bologna is proved by the fact that two years later we find them appealing to Honorius III. in a dispute with the civic authorities. In the year 1228 the students of Padua were compelled by circumstances to transfer their residence to Vercelli, and the latter city guaranteed them, besides other privileges, the right to rent no less than five hundred lodging-houses at a fixed rental for a period of eight years. At first Padua was a school only of the civil and canon law; and during the oppressive tyranny of Ezzelin (1237–60) the university maintained its existence with some difficulty. But in the latter part of the century it incorporated the faculties of grammar, rhetoric and medicine, and became known as one of the most flourishing schools of Italy, and a great centre of the Dominicans, at that time among the most active promoters of learning.

Naples.

The university of Naples was founded by the emperor Frederick II. in the year 1225, as a school of theology, jurisprudence, the arts and medicine—his design being that his subjects in the kingdom of Naples should find in the capital adequate instruction in every branch of learning, and "not be compelled in the pursuit of knowledge to have recourse to foreign nations or to beg in other lands." In the year 1231, however, he decreed that the faculty of medicine should cease to exist, and that the study should be pursued nowhere in the kingdom but at Salerno. The university never attained to much eminence, and after the death of Frederick came for a time altogether to an end, but was restored in 1258 by King Manfred. In 1266 its faculty of medicine was reconstituted, and from 1272–74 Thomas Aquinas was one of its teachers of theology. The commencement of the university of Vercelli belongs to about the year 1228; it probably included, like Naples, all the faculties, but **Vercelli.** would seem to have been regarded with little favour by the Roman See, and by the year 1372 had ceased to exist, although mention of colleges of law and medicine is to be found after that date. The two universities of Piacenza and Pavia stand in close connexion with each other. **Piacenza.** The former is noted by Denifle as the earliest in Italy which was founded by virtue of a papal charter (6th February 1248), although the scheme remained for a long time inoperative. At length, in the year 1398, the university was reconstituted by Giovanni Galeazzo Visconti, duke of Milan, who in the same year caused the university of Pavia to be transferred thither. Piacenza now became the scene of a sudden but short-lived academic prosperity. We are told of no less than twenty-seven professors of the civil law—among them the celebrated Baldus; of twenty-two professors of medicine; of professors of philosophy, astrology, grammar and rhetoric; and of lecturers on Seneca and Dante. The faculty of theology would appear, however, never to have been duly constituted, and but one lecturer in this faculty is mentioned. With the death of Galeazzo in 1402, this precarious activity came suddenly to an end; and in 1404 the university had ceased to exist. Its history is, indeed, unintelligible, unless taken in conjunction with that of Pavia. Even before Irnerius taught at Bologna, Pavia had been widely known as a seat of legal studies, **Pavia.** and more especially of the Lombard law, although the evidence is wanting which would serve to establish a direct connexion between this early school and the university which was founded there in 1361, by virtue of the charter granted by the emperor Charles IV. The new "studium" included faculties of jurisprudence, philosophy, medicine and the arts, and its students were formally taken under the imperial protection, and endowed with privileges identical with those which had been granted to Paris, Bologna, Oxford, Orleans and Montpellier; but its existence in Pavia was suddenly suspended by the removal, above noted, of its students to Piacenza. It shared again in the decline which overtook the university of Piacenza after the death of Giovanni Galeazzo, and during the period from 1404 to 1412 it altogether ceased to exist. But in October 1412 the lectures were recommenced, and the university entered upon the most brilliant period of its existence. Its professors throughout the 15th century were men of distinguished ability, attracted by munificent salaries such as but few other universities could offer, while in the number of students who resorted thither from other countries, and more especially for the study of the civil law, Pavia had no rival in Italy but Padua. Arezzo appears to have been **Arezzo.** known as a centre of the same study so early as 1215, and its earliest statutes are assigned to the year 1255. By that time it had become a school of arts and medicine also; but for a considerable period after it was almost entirely deserted, and is almost unmentioned until the year 1338, when it acquired new importance by the accession of several eminent jurists from Bologna. In May 1355 it received its charter as a *studium generale* from Charles IV. After the year 1373 the school gradually dwindled, although it did not become altogether extinct until about the year 1470. The university of **Rome.** Rome (which is to be carefully distinguished from the school attached to the Curia) owed its foundation (1303) to Boniface VIII., and was especially designed by that pontiff for the benefit of the poor foreign students sojourning in the capital. It originally included all the faculties; but in 1318 John XXII. decreed that it should possess the power of conferring degrees only in the canon and civil law. The university maintained its existence throughout the period of the residence of the popes of Avignon, and under the patronage of Leo X. could boast in 1514 of no less than eighty professors. This imposing array would seem, however, to be but a fallacious test of the prosperity of the academic community, for it is stated that many of the professors, owing to the imperfect manner in which they were protected in their privileges, were in the receipt of such insufficient fees that they were compelled to combine other employments with that of lecturing in order to support themselves. An appeal addressed to Leo X. in the year 1513 represents the number of students as so small as to be sometimes exceeded by that of the lecturers ("ut quandoque plures sint qui legant quam qui audiant"). Scarcely any of the universities in Italy in the 14th century attracted a larger concourse than that of Perugia, **Perugia.** where the study chiefly cultivated was that of the civil law. The university received its charter as a *studium generale* from Clement V. in the year 1308, but had already in 1306 been formally recognized by the civic authorities, by whom it was commended to the special care and protection of the podestà. In common with the rest of the Italian universities, it suffered severely from the great plague of 1348–49; but in 1355 it received new privileges from the emperor, and in 1362 its first college, dedicated to Gregory the Great, was founded by the bishop of Perugia. The university of **Treviso.** Treviso, which received its charter from Frederick the Fair in 1318, was of little celebrity and but short duration. The circumstances of the rise of the university of **Florence.** Florence are unknown, but the earliest evidence of academic instruction belongs to the year 1320. The dispersion of the university of Bologna, in the March and April of the following year, afforded a favourable opportunity for the creation of a *studium generale*, but the necessary measures were taken somewhat tardily, and in the meantime the greater number of the Bolognese students had betaken themselves to Siena, where for the space of three years twenty-two professors gathered round them a body of enthusiastic students. Eventually the majority returned to Bologna, and when in 1338 that city was placed under an interdict by Benedict XII. another exodus of students repaired to Pisa, which in 1343 received from Clement VI. its charter as a *studium generale*. Closed in 1406, Pisa, aided by the powerful intervention of Lorenzo de' Medici, reopened in 1473, to undergo, however, a long series of vicissitudes which at last found a termination in 1850, when its fortunes were placed on a more stable basis, and it gradually acquired the reputation of ranking among the foremost universities of a reunited Italy. The charter of foundation for Florence, on the other hand, was not granted until May 31, 1349, when Clement VI. decreed that there should be instituted a *studium generale* in theology, jurisprudence, medicine and every other recognized faculty of learning, the teachers to be professors who had obtained the degree of doctor or master either at Bologna or Paris, or "some other *studium generale* of celebrity." On the 2nd of January 1364 the university also obtained the grant of imperial privileges from Charles IV. On 14th February 1388 it adopted a body of statutes which are still extant, and afford an interesting study in connexion with the university history of the period. The university now entered upon that brilliant period in its history which was destined to so summary an extinction. "It is almost touching," says Denifle, "to note how untiringly Florence exerted herself at this period to attract as teachers to her schools the great masters of the sciences and learning." In the year 1472, however, it was decided that Florence was not a convenient seat for a university, and its students joined the throngs which repaired to the reopened halls of Pisa. A special interest attaches to the rise of the university of Siena, **Siena.** as that of one which had made good its position prior to becoming recognized either by emperor or pope. Its beginning dates from about the year 1241, but its charter was first granted by the emperor Charles IV., at the petition of the citizens, in the year 1357. It was founded as a *studium generale* in jurisprudence, the arts and medicine. The imperial charter was confirmed by Gregory XII. in 1408, and the various bulls relating to the university which he subsequently issued afford a good illustration of the conditions of academic life in these times. Residence on the part of the students appears to have been sometimes dispensed with. The bishop of Siena was nominated chancellor of the university, just as, says the bull, he had been appointed to that office by the imperial authority. The graduates were to be admitted to the same privileges as those of Bologna or Paris; and a faculty of theology was added to the curriculum of studies. The university of Ferrara owes its foundation to the house of Este—Alberto, marquess of Este, having obtained from Boniface IX. in 1391 a charter couched in terms precisely similar to those of the charter for Pisa. In the first half of the 15th century the university was adorned by the presence of several distinguished humanists, but its fortunes were singularly chequered, and it would appear for a certain period to have been altogether extinct. It was, however, restored, and became in the latter part of the century one of the most celebrated of the universities of Italy. In the year 1474 its circle of studies comprised all the existing faculties, and it numbered no less than fifty-one professors or lecturers. In later times Ferrara has been noted chiefly as a school of medicine.

Ferrara.

Of the universities modelled on that of Paris, Oxford would appear to have been the earliest, and the manner of its development was probably similar. Certain schools, opened within the precincts of the dissolved nunnery of St Frideswyde and of Oseney abbey, are supposed to have been the nucleus round which the university grew up. In the year 1133 one Robert Pullen, a theologian of considerable eminence (but whether an Englishman or a Breton is uncertain), arrived from Paris and delivered lectures on the Bible. It has been maintained, on the authority of Gervase of Canterbury, that Vacarius, a native of Lombardy, who, in the latter half of the 12th century, incurred the displeasure of King Stephen by lecturing in England on the civil law, delivered lectures at Oxford. H. S. Denifle, however (*Die Entstehung der Universitäten*, p. 241), maintains that the naming of Oxford is a gratuitous assumption on the part of Gervase, and that we have, at best, only presumptive evidence of a *studium generale* there in the 12th century. Of this, Mr Rashdall inclines to find the beginning in a migration of English students from Paris about 1167 or 1168. In the first-mentioned year we are told by John of Salisbury that "France, the mildest and most civil of nations," has "expelled her foreign scholars" (*Materials for the History of Thomas Becket*, ed. Robertson, vi. pp. 235–36). At about the same time we hear of an edict of Henry II., during the quarrel with Becket, recalling all clerks holding benefices in England (as they loved their benefices), and forbidding all clerks in England to cross the Channel (ibid. i. pp. 53–54). The archbishop himself remarks that "The king wills that all scholars shall be compelled to return to their country or be deprived of their benefices" (ibid. vii. p. 146). Paris was at this time the great place of higher education for English students. No English school was a recognized *studium generale*. Immediately after 1168 allusions to Oxford as a *studium* and a *studium generale* begin to multiply. The natural inference is that the breaking off of relations between England and Paris in 1167 or 1168 led to the growth of a *studium generale* in Oxford, formed no doubt in the first instance of seceders from Paris. In the 13th century mention first occurs of university "chests," especially the Frideswyde chest, which were benefactions designed as funds for the assistance of poor students. Halls, or places of licensed residence for students, also began to be established. In the year 1257, when the bishop of Lincoln, as diocesan, had trenched too closely on the liberties of the community, the deputies from Oxford, when preferring their appeal to the king at St Albans, could venture to speak of the university as "schola secunda ecclesiae," or second only to Paris. Its numbers about this time were probably some three thousand; but it was essentially a fluctuating body, and whenever plague or tumult led to a temporary dispersion a serious diminution in its numerical strength generally ensued for some time after. Against such vicissitudes the foundation of colleges proved the most effectual remedy. Of these the three earliest were University College, founded in 1249 by William of Durham; Balliol College, founded about 1263 by John Balliol, the father of the king of Scotland of the same name; and Merton College, founded in 1264. The last-named is especially notable as associated with a new conception of university education, namely, that of collegiate discipline for the secular clergy, instead of for any one of the religious orders, for whose sole benefit all similar foundations had hitherto been designed. The statutes given to the society by Walter de Merton are not less noteworthy, as characterized not only by breadth of conception, but also by a careful and discriminating attention to detail, which led to their adoption as the model for later colleges, not only at Oxford but at Cambridge. Of the service rendered by these foundations to the university at large we have significant proof in the fact that, although representing only a small numerical minority in the academic community at large, their members soon obtained a considerable preponderance in the administration of affairs.

Oxford.

The university of Cambridge, although it rose into existence somewhat later than Oxford, may reasonably be held to have had its origin in the same century. There was probably a certain amount of educational work carried on by the canons of the church of St Giles, which gradually developed into the instruction belonging to a regular *studium*. In the year 1112 the canons crossed the river and took up their residence in the new priory in Barnwell, and their work of instruction acquired additional importance. In 1209 a body of students migrated thither from Oxford. Then, as early as the year 1224, the Franciscans established themselves in the town, and, somewhat less than half a century later, were followed by the Dominicans. At both the English universities, as at Paris, the Mendicants and other religious orders were admitted to degrees, a privilege which, until the year 1337, was extended to them at no other university. Their interest in and influence at these three centres was consequently proportionably great. In the years 1231 and 1233 certain royal and papal letters afford satisfactory proof that by that time the university of Cambridge was already an organized body with a chancellor at its head—a dignitary appointed by the bishop of Ely for the express purpose of granting degrees and governing the *studium*. In 1229 and 1231 the numbers were largely augmented by migrations from Paris and from Oxford. Cambridge, however, in its turn suffered from emigration; while in the year 1261, and again in 1381, the records of the university were wantonly burnt by the townsmen. Throughout the 13th century, indeed, the university was still only a very slightly and imperfectly organized community. Its endowments were of the most slender kind; it had no systematic code for the government of its members; the supervision of the students was very imperfectly provided for. Although both Oxford and Cambridge were modelled on Paris, their higher faculties never developed the same distinct organization; and while the two proctors at Cambridge originally represented "north" and "south," the "nations" are scarcely to be discerned. An important step in the direction of discipline was, however, made in the year 1276, when an ordinance was passed requiring that every one who claimed to be recognized as a scholar should have a fixed master within fifteen days after his entry into the university. The traditional constitution of the English universities was in its origin an imitation of the Parisian chancellor, modified by the absence of the cathedral chancellor. As Oxford was not in the 12th century a bishop's see, the bishop (in 1214, if not earlier) appointed a chancellor for the express purpose of granting degrees and governing the *studium*. But he was from the first elected by the masters, and early obtained recognition as the head of the university as well as the representative of the bishop. The *procuratores* (originally also *rectores*) remained representatives of the faculty of arts and (there being at Oxford no deans) of the whole university. But the feature which most served to give permanence and cohesion to the entire community was, as at Oxford, the institution of colleges. The earliest of these was Peterhouse, first founded as a separate

Cambridge.

institution by Hugh Balsham, bishop of Ely, in the year 1284, its earliest extant code being that given in 1344 by Simon de Montacute, which was little more than a transcript of that drawn up by Walter de Merton for his scholars at Oxford. In 1323 was founded Michaelhouse, and two years later, in 1326, Edward II. instituted his foundation of "king's scholars," afterwards forming the community of King's Hall. Both these societies in the 16th century were merged in Trinity College. To these succeeded Pembroke Hall (1347) and Gonville Hall (1348). All these colleges, although by no means conceived in a spirit of hostility to either the monastic or the mendicant orders, were expressly designed for the benefit of the secular clergy. The foundation of Trinity Hall (*Aula*)[1] in 1350 by Bishop Bateman, on the other hand, as a school of civil and canon law, was probably designed to further ultramontane interests. That of Corpus Christi (1352), the outcome of the liberality of a gild of Cambridge townsmen, was conceived with the combined object of providing a house of education for the clergy, and at the same time securing the regular performance of masses for the benefit of the souls of departed members of the gild. But both Trinity Hall and Corpus Christi College, as well as Clare Hall, founded in 1359, were to a great extent indebted for their origin to the ravages caused among the clergy by the great plague of 1349. In the latter half of the same century, the coming change of feeling is shown by the fact that the chancellor was under the necessity of issuing a decree (1374) in order to protect the house of the Carmelites from molestation on the part of the students.

Montpellier.

Returning to France, or rather to the territory included within the boundaries of modern France, we find Montpellier a recognized school of medical science as early as the 12th century. William VIII., lord of Montpellier, in the year 1181 proclaimed it a school of free resort, where any teacher of medical science, from whatever country, might give instruction. Before the end of the century it possessed also a faculty of jurisprudence, a branch of learning for which it afterwards became famed. The university of medicine and that of law continued, however, to be totally distinct bodies with different constitutions. Petrarch was sent by his father to Montpellier to study the civil law. On 26th October 1289 Montpellier was raised by Nicholas IV. to the rank of a "studium generale," a mark of favour which, in a region where papal influence was so potent, resulted in a considerable accession of prosperity. The university also now included a faculty of arts; and there is satisfactory evidence of the existence of a faculty of theology before the close of the 14th century, although not formally recognized by the pope before the year 1421. In the course of the same century several colleges for poor students were also founded. ***Toulouse.*** The university of Toulouse is to be noted as the first founded in any country by virtue of a papal charter. It took its rise in the efforts of Rome for the suppression of the Albigensian heresy, and its foundation formed one of the articles of the conditions of peace imposed by Louis IX. on Count Raymond of Toulouse. In the year 1233 it first acquired its full privileges as a "studium generale" by virtue of a charter given by Gregory IX. This pontiff watched over the university with especial solicitude, and through his exertions it soon became noted as a centre of that Dominican teaching which involved the extermination of the Catharists. As a school of arts, jurisprudence and medicine, although faculties of each existed, it never attained to any reputation. ***Orleans.*** The university of Orleans had a virtual existence as a studium generale as early as the first half of the 13th century, but in the year 1305 Clement V. endowed it with new privileges, and gave its teachers permission to form themselves into a corporation. The schools of the city had an existence long prior—as early, it is said, as the 6th century—and subsequently supplied the nucleus for the foundation of a university at Blois; but of this university no records are extant.[2] Orleans, in its organization, was modelled mainly on Paris, but its studies were complementary rather than in rivalry to the older university. The absorbing character of the study of the civil law, and the mercenary spirit in which it was pursued, had led the authorities at Paris to refuse to recognize it as a faculty. The study found a home at Orleans, where it was cultivated with an energy which attracted numerous students. In January 1235 we find the bishop of Orleans soliciting the advice of Gregory IX. as to the expediency of countenancing a study which was prohibited in Paris. Gregory decided that the lectures might be continued; but he ordered that no beneficed ecclesiastic should be allowed to devote himself to so eminently secular a branch of learning. Orleans subsequently incorporated a faculty of arts, but its reputation from this period was always that of a school of legal studies, and in the 14th century its reputation in this respect was surpassed by no other university in Europe. ***Angers.*** Prior to the 13th century it had been famed for its classical learning; and Angers, which received its charter at the same time, also once enjoyed a like reputation, which, in a similar manner, it exchanged for that of a school for civilians and canonists. The roll of the university forwarded in 1378 to Clement VII. contains the names of 8 professors *utriusque juris*, 2 of civil and 2 of canon law, 72 licentiates, 284 bachelors of both the legal faculties, and 190 scholars. ***Avignon.*** The university of Avignon was first recognized as a "studium generale" by Boniface VIII. in the year 1303, with power to grant degrees in jurisprudence, arts and medicine. Its numbers declined somewhat during the residence of the popes, owing to the counter-attractions of the "studium" attached to the Curia; but after the return of the papal court to Rome it became one of the most frequented universities in France, and possessed at one time no less than seven colleges. ***Cahors.*** The university of Cahors enjoyed the advantage of being regarded with especial favour by John XXII. In June 1332 he conferred upon it privileges identical with those already granted to the university of Toulouse. In the following October, again following the precedent established at Toulouse, he appointed the *scholasticus* of the cathedral chancellor of the university. In November of the same year a bull, couched in terms almost identical with those of the Magna Charta of Paris, assimilated the constitution of Cahors to that of the oldest university. The two schools in France which, down to the close of the 14th century, most closely resembled Paris were Orleans and Cahors. The civil immunities and privileges of the latter university were not, however, acquired until the year 1367, when Edward III. of England, in his capacity as duke of Aquitaine, not only exempted the scholars from the payment of all taxes and imposts, but bestowed upon them the peculiar privilege known as *privilegium fori*. Cahors also received a licence for faculties of theology and medicine, but, like Orleans, it was chiefly known as a school of jurisprudence. ***Grenoble.*** It was as a "studium generale" in the same three faculties that Grenoble, in the year 1339, received its charter from Benedict XII. The university never attained to much importance, and its annals are for the most part involved in obscurity. At the commencement of the 16th century it had ceased altogether to exist, was reorganized by Francis of Bourbon in 1542, and in 1565 was united to the university of Valence. ***Perpignan. Orange.*** The university of Perpignan, founded, according to Denifle, in 1379 by Clement VII. (although tradition had previously ascribed its origin to Pedro IV. of Aragon), and that of Orange, founded in 1365 by Charles IV., were universities only by name and constitution, their names rarely appearing in contemporary chronicles, while their very existence becomes at times a matter for reasonable doubt.

Palencia, Huesca, Lerida.

To some of the earlier Spanish universities—such as Palencia, founded about the year 1214 by Alphonso VIII.; Huesca, founded in 1354 by Pedro IV.; and Lerida, founded in 1300 by James II.—the same description is applicable; and their insignificance is probably indicated by the fact that they entirely failed to attract foreign students.

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[1] *Aula* denoting the building which the "college" of scholars was to inhabit; the society continued to retain this designation in order to distinguish it from Trinity *College*, founded in 1546.

[2] See Ch. Desmaze, *L'Université de Paris* (1200–1875).

Valladolid.

Alcalà.

Seville and Salamanca.

Valladolid, which received its charter from Pope Clement VI. in 1346, attained, however, to great celebrity; and the foreign teachers and students frequenting the university became so numerous that in 1373 King Enriquez II. caused an enactment to be passed for securing to them the same privileges as those already accorded to the native element. But the total number of the students in 1403 was only 116, and grammar and logic, along with jurisprudence (which was the principal study), constituted the sole curriculum. In 1418, however, at the council of Constance, Martin V. not only decreed that Valladolid should take rank as a *studium generale*, but also as a "universitas theologiae," and that the new faculty should possess the same privileges as those of the same faculty in Paris. From this time accordingly the advance of the university in numbers was steady and continuous throughout the 15th century, and, along with Salamanca, it served as the model for Alcalà in 1499. The university which rose on the banks of the Henares and became famous under the direction of the eminent Ximenes, was removed in 1623 to Madrid; and for the next century and a half the foremost place among the universities of Spain must be assigned to Salamanca, to which Seville, in the south, stood in the relation of a kind of subsidiary school, having been founded in 1254 by Alphonso the Wise, simply for the study of Latin and of the Semitic languages, especially Arabic. Salamanca had been founded in 1243 by Ferdinand III. of Castile as a studium generale in the three faculties of jurisprudence, the arts and medicine. The king also extended his special protection to the students, granting them numerous privileges and immunities. Under his son Alphonso (above named) the university acquired a further development, and eventually included all the faculties save that of theology. But the main stress of its activity, as was the case with all the earlier Spanish universities until the beginning of the 15th century, was laid on the civil and the canon law. The provision for the payment of its professors was, however, at first so inadequate and precarious that in 1298 they by common consent suspended their lectures, in consequence of their scanty remuneration. A permanent remedy for this difficulty was thereupon provided, by the appropriation of a certain portion of the ecclesiastical revenues of the diocese for the purpose of augmenting the professors' salaries, and the efforts of Martin V. established a school of theology which was afterwards regarded almost as an oracle by Catholic Europe. About the year 1600 the students are shown by the matriculation books to have numbered over 5000. According to Cervantes they were noted for their lawlessness. The earliest of the numerous colleges founded at Salamanca was that of St Bartholomew, long noted for its ancient library and valuable collection of manuscripts, which now form part of the royal library in Madrid.

Coimbra.

The one university possessed by Portugal had its seat in medieval times alternately in Lisbon and in Coimbra, until, in the year 1537, it was permanently attached to the latter city. Its formal foundation took place in 1309, when it received from King Diniz a charter, the provisions of which were mainly taken from those of the charter given to Salamanca. In 1772 the university was entirely reconstituted.

Prague.

Of the universities included in the present Austrian empire, Prague, which existed as a "studium" in the 13th century, was the earliest. It was at first frequented mainly by students from Styria and Austria, countries at that time ruled by the emperor Charles IV., who was also king of Bohemia, and at whose request Pope Clement VI., on the 26th of January 1347, promulgated a bull authorizing the foundation of a "studium generale" in all the faculties. In the following year Charles himself issued a charter for the foundation. This document, which, if original in character, would have been of much interest, has but few distinctive features of its own, its provisions being throughout adapted from those contained in the charters given by Frederick II. for the university of Naples and by Conrad for Salerno—almost the only important feature of difference being that Charles bestows on the students of Prague all the civil privileges and immunities which were enjoyed by the teachers of Paris and Bologna. Charles had himself been a student in Paris, and the organization of his new foundation was modelled on that university, a like division into four "nations" (although with different names) constituting one of the most marked features of imitation. The numerous students—and none of the medieval universities attracted in their earlier history a larger concourse—were drawn from a gradually widening area, which at length included, not only all parts of Germany, but also England, France, Lombardy, Hungary and Poland. Contemporary writers, with the exaggeration characteristic of medieval credulity, even speak of thirty thousand students as present in the university at one time—a statement for which Denifle proposes to substitute two thousand as a more probable estimate. It is certain, however, that Prague, prior to the foundation of Leipzig, was one of the most frequented centres of learning in Europe, and Paris suffered a considerable diminution in her numbers owing to the counter-attractions of the great *studium* of Slavonia.

Cracow.

The university of Cracow in Poland was founded in May 1364, by virtue of a charter given by King Casimir the Great, who bestowed on it the same privileges as those possessed by the universities of Bologna and Padua. In the following September Urban V., in consideration of the remoteness of the city from other centres of education, constituted it a "studium generale" in all the faculties save that of theology. It is, however, doubtful whether these designs were carried into actual realization, for it is certain that, for a long time after the death of Casimir, there was no university whatever. Its real commencement must accordingly be considered to belong to the year 1400, when it was reconstituted, and the papal sanction was given for the incorporation of a faculty of theology. From this time its growth and prosperity were continuous; and with the year 1416 it had so far acquired a European reputation as to venture upon forwarding an expression of its views in connexion with the deliberations of the council of Constance. Towards the close of the 15th century the university is said to have been in high repute as a school of both astronomical and humanistic studies.

Vienna.

The Avignonese popes appear to have regarded the establishment of new faculties of theology with especial jealousy; and when, in 1364, Duke Rudolph IV. founded the university of Vienna, with the design of constituting it a "studium generale" in all the faculties, Urban V. refused his asssent to the foundation of a theological school. Owing to the sudden death of Duke Rudolph, the university languished for the next twenty years, but after the accession of Duke Albert III., who may be regarded as its real founder, it acquired additional privileges, and its prosperity became marked and continuous. Like Prague, Vienna was for a long time distinguished by the comparatively little attention bestowed by its teachers on the study of the civil law.

Fünfkirchen.

No country in the 14th century was looked upon with greater disfavour at Rome than Hungary. It was stigmatized as the land of heresy and schism. When, accordingly, in 1367 King Louis applied to Urban V. for his sanction of the scheme of founding a university at Fünfkirchen, Urban would not consent to the foundation of a faculty of theology, although theological learning was in special need of encouragement in those regions; the pontiff even made it a condition of his sanction for a studium generale that King Louis should first undertake to provide for the payment of the professors. We hear but little concerning the university after its foundation, and it is doubtful whether it survived for any length of time the close of the century. "The extreme east of civilized continental Europe in medieval times," observes Denifle, "can be compared, so far as university education is concerned, only with the extreme west and the extreme south. In Hungary, as in Portugal and in Naples, there was constant fluctuation, but the west and the south, although troubled by yet greater commotions than Hungary, bore better fruit. Among all the countries possessed of universities in medieval times, Hungary occupies the lowest place—a state of affairs of which, however, the proximity of the Turk must be looked upon as a main cause."

Heidelberg. The university of Heidelberg (the oldest of those of the German realm) received its charter (October 23, 1385) from Urban VI. as a "studium generale" in all the recognized faculties save that of the civil law—the form and substance of the document being almost identical with those of the charter granted to Vienna. It was granted at the request of the elector palatine, Rupert I., who conferred on the teachers and students, at the same time, the same civil privileges as those which belonged to the university of Paris. In this case the functionary invested with the power of bestowing degrees was non-resident, the licences being conferred by the provost of the cathedral at Worms. But the real founder, as he was also the organizer and teacher, of the university was Marsilius of Inghen, to whose ability and energy Heidelberg was indebted for no little of its early reputation and success. The omission of the civil law from the studies licensed in the original charter would seem to show that the pontiff's compliance with the elector's request was merely formal, and Heidelberg, like Cologne, included the civil law among its faculties almost from its first creation. No medieval university achieved a more rapid and permanent success. Regarded with favour alike by the civil and ecclesiastical potentates, its early annals were singularly free from crises like those which characterize the history of many of the medieval universities. The number of those admitted to degrees from the commencement of the first session (19th October 1386 to 16th December 1387) amounted to 579.[1]

Cologne. Owing to the labours of the Dominicans, Cologne had gained a reputation as a seat of learning long before the founding of its university; and it was through the advocacy of some leading members of the Mendicant orders that, at the desire of the city council, its charter as a "studium generale" (21st May 1388) was obtained from Urban VI. It was organized on the model of the university of Paris, as a school of theology and canon law, and "any other recognized faculty"—the civil law being incorporated as a faculty soon after the promulgation of the charter. In common with the other early universities of Germany—Prague, Vienna and Heidelberg—Cologne owed nothing to imperial patronage, while it would appear to have been, from the first, the object of special favour with Rome. This circumstance serves to account for its distinctly ultramontane sympathies in medieval times and even far into the 16th century. In a report transmitted to Gregory XIII. in 1577, the university expressly derives both its first origin and its privileges from the Holy See, and professes to owe no allegiance save to the Roman pontiff. ***Erfurt.*** Erfurt, no less noted as a centre of Franciscan than was Cologne of Dominican influence, received its charter (16th September 1379) from the anti-pope Clement VII. as a "studium generale" in all the faculties. Ten years later (4th May 1389) it was founded afresh by Urban VI., without any recognition of the act of his pretended predecessor. In the 15th century the number of its students was larger than that at any other German university—a fact attributable partly to the reputation it had acquired as a school of jurisprudence, and partly to the ardour with which the nominalist and realist controversies of the time were debated in its midst; its readiness in according a hearing to novel theories causing it to be known as *novorum omnium portus*.

The collegiate system is to be noted as a feature common to all these early German universities; and, in nearly all, the professors were partly remunerated by the appropriation of certain prebends, appertaining to some neighbouring church, to their maintenance.

Relations of the popes to the universities. During the first half of the 15th century the relations of the Roman pontiffs to the universities continued much the same, although the independent attitude assumed by the deputies of those bodies at the great councils of Constance and Basel, and especially by those from Paris, could not fail to give rise to apprehensions. The papal bulls for each new foundation begin to indicate a certain jealousy with respect to the appropriation of prebends by the founders. Where such appropriations are recognized, and more particularly in France, a formal sanction of the transfer generally finds a place in the bull authorizing the foundation; but sometimes the founder or founders are themselves enjoined to provide the endowments requisite for the establishment and support of the university. In this manner the control of the pontiff over each newly created seat of learning assumed a more real character, from the fact that his assent was accompanied by conditions which rendered it no longer a mere formality. The imperial intervention, on the other hand, was rarely invoked in Germany—Greifswald, Freiburg and Tübingen being the only instances in which the emperor's confirmation of the foundation was solicited.[2] The inadequacy of the traditional studies to meet the growing wants of civilization, and the consequent lack of sympathy on the part of each civic population in which a new studium was founded, now become frequently apparent. ***Würzburg.*** Of such conditions the fortunes of the studium at Würzburg in Bavaria—founded in 1402 by a bishop, with a charter bestowed by Boniface IX.—illustrate the dangers. The students belonged chiefly to the faculties of law and theology, and the frequency of their conflicts with the citizens made it necessary before ten years had elapsed to close the university, which was not reopened until 1582. Under the patronage of the prince Bishop Julius Echter von Mespelbrunn, however, it soon became largely frequented by Catholic students. At the present time, under the patronage of the house of Wittelsbach, it is widely famed as a school of medicine.

In Turin the university founded in 1412 by the counts of Savoy had to be refounded in 1431. The efforts of Parma in the 14th century to raise itself by papal aid to the dignity of a university proved altogether abortive, and it was not until 1422 that, under the protection of the dukes of Milan, its object was attained. ***Catania, Barcelona.*** In Sicily, Catania, the earliest of its high schools, was created a university by Alphonso of Aragon in 1445. Five years later Barcelona received from Pope Nicholas V. the same privileges as Toulouse had obtained from Gregory IX. Among the Spanish universities, however, none has had a more chequered history, although now taking rank with foremost.

Budapest. In Hungary, Mathias Corvinus obtained from Paul II. in 1465 permission to found a general studium where he thought best within his realms—a latitude of choice conceded probably in consequence of the dangers which menaced the kingdom alike from Bohemia and from the Turks; while the fact that the university at Ofen (Hungarian *Buda*) was not actually founded until some ten years later, may have been owing to the resolute stand made by the youthful monarch against the claims to nominate bishops put forward not only by Pope Paul but by his successor Sixtus IV. (1471–84). After a series of eventful experiences, the university of Budapest remains, at the present time, almost exclusively Magyar. It has a school of law at Pressburg, which is all that remains of the university there founded by Mathias Corvinus in 1465.

Foundation of Louvain. In northern Germany and in the Netherlands, on the other hand, the growing wealth and prosperity of the different states especially favoured the formation of new centres of learning. In the flourishing duchy of Brabant the university of Louvain (1426) was to a great extent controlled by the municipality; and their patronage, although ultimately attended with detrimental results, long enabled Louvain to outbid all the other universities of Europe in the munificence with which she rewarded her professors. In the course of the next century the "Belgian Athens," as she is styled by Lipsius, ranked second only to Paris in numbers and reputation. In its numerous separate foundations and general organization—it possessed no less than twenty-eight colleges—it closely resembled the English universities; while its active press afforded facilities to the author and the controversialist of which both Cambridge and Oxford were at that time almost destitute. It embraced all the faculties, and no degrees in Europe stood so high as guarantees of general acquirements. Erasmus records it as a common saying, that "no one could graduate at Louvain without knowledge, manners and age." Sir William Hamilton speaks of the examination at Louvain for a degree in arts as "the best example upon record of the true mode of such examination, and, until recent times, in fact, the only example in the history of universities worthy of consideration at all." He has translated from Vernulaeus the order and method of this examination.[1] In 1788 the faculties of jurisprudence, medicine and philosophy were removed to Brussels, and in 1797 the French suspended the university altogether.

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[1] The statistics of Hautz (*Gesch. d. Univ. Heidelberg*, i. 177–178) are corrected by Denifle (*Die Entstehung der Universitäten*, p. 385).

[2] Meiners, *Gesch. d. hohen Schulen*, i. 370.

Leipzig.

In Germany the conditions under which the new centres were created reflect and illustrate the history of the country in a remarkable manner. Those connected with the rise of the university of Leipzig are especially noteworthy, it having been the result of the migration of almost the entire German element from the university of Prague. This element comprised (1) Bavarians, (2) Saxons, (3) Poles (this last-named division being drawn from a wide area, which included Meissen, Lusatia, Silesia and Prussia), and, being represented by three votes in the assemblies of the university, while the Bohemians possessed but one, had acquired a preponderance in the direction of affairs which the latter could no longer submit to. Religious differences, again, evoked mainly by the preaching of John Huss, further intensified the existing disagreements; and eventually, in the year 1409, King Wenceslaus, at the prayer of his Bohemian subjects, issued a decree which exactly reversed the previous distribution of votes,—three votes being assigned to the Bohemian nation and only one to all the rest. The Germans took deep umbrage, and seceded to Leipzig, where, a bull having been obtained from Alexander V. (September 9, 1409), a new "studium generale" was founded by the landgrave of Thuringia and the margraves of Meissen. The members were divided into four nations—composed of natives of Meissen, Saxony, Bavaria and Poland. Two colleges were founded, a greater and a smaller, but designed, not for poor students, but for masters of arts—twelve being admitted on the former and eight on the latter foundation.

Rostock.

Greifswald.

At Rostock, in the north, the dukes John and Albert of Mecklenburg conceived the design of founding a university from which the faculty of theology should be excluded. Pope Martin V., to whom they applied for his sanction, was scarcely in a position to refuse it, absorbed as he was with the pacification of Italy, the consolidation of his own temporal power, and the restoration of his almost ruinous capital. The university was accordingly founded as proposed in 1419; but in 1431 Eugenius IV. instituted a faculty of theology, and two colleges were founded with the same design and on the same scale as at Leipzig. Six years later the whole academic community having incurred the papal ban was fain to migrate to Greifswald, returning, however, to Rostock in 1443, but with one important exception, that of a master of arts named Henry Rubenow, who remained to become burgomaster of the former city, and succeeded in persuading Duke Wratislaw of Pommern to make it the seat of a university. Calixtus III. granted a bull in 1456, but it was stipulated that the rector should be a bishop, and the professorial chairs were also made partially dependent for endowment on canonries. Greifswald thus became exposed to the full brunt of the struggle which had ensued when the endeavour to nationalize the German church was terminated by the Concordat of Vienna (1448). Of its original statutes only those of the arts faculty are extant.

Freiburg.

Tübingen.

The universities of Freiburg in Baden and Tübingen in Württemberg, on the other hand, reflect the sympathies of the Catholic party under the Austrian rule. They alike owed their foundation to the countess Matilda, by whose persuasion her husband, the archduke of Austria, known as Albrecht VI., was induced to found Freiburg in 1455, and Count Eberhard (her son by a former marriage) to found Tübingen in 1477. The first session at Freiburg opened auspiciously in 1460 under the supervision of its rector, Matthew Hummel of Villingen, an accomplished and learned man, and its numbers were soon largely augmented by migrations of students from Vienna and from Heidelberg, while its resources, which originally were chiefly an annual grant from the city council, were increased by the bestowal of canonries and prebends in the neighbouring parishes. Erasmus had made Freiburg his residence from 1529 to 1535, during which time he may have originated a tradition of liberal learning, but in 1620, under the rule of the archduke Maximilian, the control of the Humanistic studies and of the entire faculty of philosophy was handed over to the Jesuits, who also gained possession of two of the chairs of theology. Although Strassburg since 1872 has been able to offer considerable counter-attractions, Freiburg has held her own, and numbers over 1600 students. The university of Tübingen was founded in 1477 with four faculties—those of theology, law, medicine and the arts—and numbered scholars such as John Reuchlin and Melanchthon among its teachers; while in the last century it was famous both for its school of medicine and that of theology (see TÜBINGEN). Its general condition in the year 1541–1542, and the sources whence its revenues were derived, have been illustrated by Hoffmann in a short paper which shows the fluctuating nature of the resources of a university in the 16th century—liable to be affected as they were both by the seasons and the markets.[2]

Aix in Provence.

Poitiers.

Caen.

The earliest 15th-century university in France was that of Aix in Provence. It had originally been nothing more than a school of theology and law, but in 1409 it was reorganized under the direction of the local count as a studium generale on the model of Paris. The sphere of its activity is indicated by the fact that the students were divided into Burgundians, Provençals and Catalans. The next foundation, that of Poitiers, had a wider significance as illustrating the struggle that was going on between the French crown and the Roman see. It was instituted by Charles VII. in 1431, almost immediately after his accession, with the special design of creating a centre of learning less favourable to English interests than Paris had at that time shown herself to be. Eugenius IV. could not refuse his sanction to the scheme, but he endeavoured partially to defeat Charles's design by conferring on the new "studium generale" simply the same privileges as those possessed by Toulouse, and thus placing it at a disadvantage in comparison with Paris. Charles rejoined by an extraordinary exercise of his own prerogative, conferring on Poitiers all the privileges collectively possessed by Paris, Toulouse, Montpellier, Angers and Orleans, and at the same time placing the university under special royal protection. The foundation of the university of Caen, in the diocese of Bayeux, was attended by conditions almost exactly the reverse of those which belonged to the foundation of that at Poitiers. It was founded under English auspices during the short period of the supremacy of the English arms in Normandy in the 15th century. Its charter (May 1437) was given by Eugenius IV., and the bishop of Bayeux was appointed its chancellor. The university of Paris had by this time completely forfeited the favour of Eugenius by its attitude at the council of Basel, and Eugenius inserted in the charter for Caen a clause of an entirely novel character, requiring all those admitted to degrees to take an oath of fidelity to the see of Rome, and to bind themselves to attempt nothing prejudicial to her interests. To this proviso the famous Pragmatic Sanction of Bourges was Charles's rejoinder in the following year. On the 18th of May 1442 we find King Henry VI. writing to Eugenius, and dwelling with satisfaction on the rapid progress of the new university, to which, he says, students had flocked from all quarters, and were still daily arriving.[1] Ten years later, when the English had been expelled, its charter was given afresh by Charles in terms which left the original charter unrecognized; both teachers and learners were subject to the civil authorities of the city, and all privileges made previously conferred in cases of legal disputes were abolished. From this time the university of Caen was distinguished by its loyal spirit and firm resistance to ultramontane pretensions; and, although swept away at the French Revolution, it was afterwards restored, owing to the sense of the services it had thus once rendered to the national cause.[2]

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[1] *Dissertations and Discussions*, Append. iii

[2] *Ökonomischer Zustand der Universität Tübingen gegen die Mitte des 16ten Jahrhunderts* (1845).

Bordeaux, Valence, Nantes.

No especially notable circumstances characterize the foundation of the university of Bordeaux (1441) or that of Valence (1452), but that of Nantes, which received its charter from Pius II. in 1463, is distinguished by the fact that it did not receive the ratification of the king of France, and the conditions under which its earlier traditions were formed thus closely resemble those of Poitiers. It seems also to have been regarded with particular favour by Pius II., a pontiff who was at once a ripe scholar and a writer upon education. He gave to Nantes a notable body of privileges, which not only represent an embodiment of all the various privileges granted to universities prior to that date, but afterwards became, with their copious and somewhat tautological phraseology, the accepted model for the great majority of university charters, whether issued by the pope or by the emperor, or by the civil authority. The bishop of Nantes was appointed head of the university, and was charged with the special protection of its privileges against all interference from whatever quarter.[3]

Bourges.

The bull for the foundation of the university of Bourges was given in 1465 by Paul II. at the request of Louis XI. and his brother. It confers on the community the same privileges as those enjoyed by the other universities of France. The royal sanction was given at the petition of the citizens; but, from reasons which do not appear, they deemed it necessary further to petition that their charter might also be registered and enrolled by the parlement of Paris.

Basel.

Founded about the same time, and probably in a spirit of direct rivalry to Freiburg, the university of Basel was opened in 1460 under the auspices of its own citizens. The cathedral school in that ancient city, together with others attached to the monasteries, afforded a sufficient nucleus for a studium, and Pius II., who, as Aeneas Sylvius, had been a resident in the city, was easily prevailed upon to grant the charter (November 12, 1459). During the first seventy years of its existence the university prospered, and its chairs were held by eminent professors, among them historical scholars, such as Sebastian Brant and Jacob Wimpheling. But with the Reformation, Basel became the arena of contests which menaced the very existence of the university itself, the professors being, for the most part, opposed to the new movement with which the burghers warmly sympathized. Eventually, the statutes were revised, and in the latter half of the 16th century the university may be said to have attained its apogee.

Ingolstadt.

Before he had signed the bull for the foundation of the university of Basel, Pope Pius, at the request of Duke William of Bavaria, had issued another bull for the foundation of a university at Ingolstadt (7th April 1459). But it was not until 1472 that the work of teaching was actually commenced there. Some long-existing prebends, founded by former dukes of Bavaria, were appropriated to the endowment, and the chairs in the different faculties were distributed as follows: theology 2, jurisprudence 3, medicine 1, arts 6—arts in conjunction with theology thus obtaining the preponderance. As at Caen, twenty-two years before, an oath of fidelity to the Roman pontiff was imposed on every student admitted to a degree.[4] That this proviso was not subsequently abolished, as at Caen, is a feature in the history of the university of Ingolstadt which was attended by important results. Nowhere did the Reformation meet with more stubborn resistance, and it was at Ingolstadt that the Counter-Reformation was commenced. In 1556 the Jesuits made their first settlement in the university.

Treves.

The next two universities took their rise in the archiepiscopal seats of Treves and Mainz. That at Treves received its charter as early as 1450; but the first academical session did not commence until 1473. Here the ecclesiastical influences appear to have been unfavourable to the project. The archbishop demanded 2000 florins as the price of his sanction. The cathedral chapter threw difficulties in the way of the appropriation of certain livings and canonries to the university endowment; and so obstinate was their resistance that in 1655 they succeeded in altogether rescinding the gift on payment of a very inadequate sum. It was not until 1722 that the assembly of deputies, by a formal grant, relieved the university from the difficulties in which it had become involved.

Mainz.

The university of Mainz, on the other hand, was almost entirely indebted to the archbishop Diether for its foundation. It was at his petition that Sixtus IV. granted the charter, 23rd November 1476; and Diether, being himself an enthusiastic humanist, thereupon circulated a letter, couched in elegant Latinity, addressed to students throughout his diocese, inviting them to repair to the new centre, and dilating on the advantages of academic studies and of learning. The rise of these two universities, however, neither of which attained to much distinction, represents little more than the incorporation of certain already existing institutions into a homogeneous whole, the power of conferring degrees being superadded.

Upsala and Copenhagen.

Nearly contemporaneous with these foundations were those of Upsala (1477) and Copenhagen (1479), which, although lying without the political boundaries of Germany, reflected her influence. The charter for Copenhagen was given by Sixtus IV. as early as 1475. The students attracted to this new centre were mainly from within the radius of the university of Cologne, and its statutes were little more than a transcript of those of the latter foundation.

Wittenberg.

The electorates of Wittenberg and Brandenburg were now the only two considerable German territories which did not possess a "studium generale," and the university founded at Wittenberg by Maximilian I. (6th July 1502) is notable as the first established in Germany by virtue of an imperial as distinguished from a papal decree. Its charter is, however, drawn up with the traditional phraseology of the pontifical bulls, and is evidently not conceived in any spirit of antagonism to Rome. Wittenberg is constituted a "studium generale" in all the four faculties—the right to confer degrees in theology and canon law having been sanctioned by the papal legate some months before, on the 2nd of February 1502. The endowment of the university with church revenues duly received the papal sanction—a bull of Alexander VI. authorizing the appropriation of twelve canonries attached to the castle church, as well as of eleven prebends in outlying districts—*ut sic per omnem modum unum corpus ex studio et collegio praedictis fiat et constituatur*. No university in Germany attracted to itself a larger share of the attention of Europe at its commencement. And it was its distinguishing merit that it was the first academic centre north of the Alps where the antiquated methods and barbarous Latinity of the scholastic era were overthrown.

Frankfort-on-the-Oder.

The last university founded in Germany prior to the Reformation was that of Frankfort-on-the-Oder. The design, first conceived by the elector John of Brandenburg, was carried into execution by his son Joachim, at whose request Pope Julius II. issued a bull for the foundation, 15th March 1506. An imperial charter, identical in its contents with the papal bull, followed on the 26th of October. The university received an endowment of canonries and livings similar to that of Wittenberg, and some houses in the city were assigned for its use by the elector.

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[1] Bekynton's *Correspondence*, i. 123.

[2] De la Rue, *Essais hist. sur la ville de Caen*, ii. 137–140.

[3] Meiners i. 368.

[4] Paulsen, in speaking of this proviso as one "die weder vorher noch nachher sonst vorkommt," would consequently seem to be not quite accurate. See *Die Gründung der deutschen Universitäten*, [illegible]

St Andrews.

The first university in Scotland was that of St Andrews, founded in 1411 by Henry Wardlaw, bishop of that see, and modelled chiefly on the constitution of the university of Paris. It acquired all its three colleges—St Salvator's, St Leonard's and St Mary's—before the Reformation—the first having been founded in 1456 by Bishop James Kennedy; the second in 1512 by the youthful Archbishop Alexander Stuart (natural son of James IV.), and John Hepburn, the prior of the monastery of St Andrews; and the third, also in 1512, by the Beatons, who in the year 1537 procured a bull from Pope Paul III. dedicating the college to the Blessed Virgin Mary of the Assumption, and adding further endowments. The most ancient of the universities of Scotland, with its three colleges, was thus reared in an atmosphere of medieval theology, and undoubtedly designed as a bulwark against heresy and schism. But "by a strange irony of fate," it has been observed, "two of these colleges became, almost from the first, the foremost agents in working the overthrow of that church which they were founded to defend." St Leonard's more especially, like St John's or Queens' at Cambridge, became a noted centre of intellectual life and Reformation principles. That he "had drunk at St Leonard's well" became a current expression for implying that a theologian had imbibed the doctrines of Protestantism. **Glasgow.** The university of Glasgow was founded as a "studium generale" in 1453, and possessed two colleges. Prior to the Reformation it acquired but little celebrity; its discipline was lax, and the number of the students but small, while the instruction was not only inefficient but irregularly given; no funds were provided for the maintenance of regular lectures in the higher faculties; and there was no adequate executive power for the maintenance of discipline. **Aberdeen.** The university of Aberdeen, which was founded in 1494, at first possessed only one college, namely, King's, which was coextensive with the university and conferred degrees. Marischal College, founded in 1593 by George Keith, fifth Earl Marischal, was constituted by its founder independent of the university in Old Aberdeen, being itself also a college and a university, with the power of conferring degrees. Bishop Elphinstone, the founder both of the university and of King's College (1505), had been educated at Glasgow, and had subsequently both studied and taught at Paris and at Orleans. To the wider experience which he had thus gained we may probably attribute the fact that the constitution of the university of Aberdeen was free from the glaring defects which then characterized that of the university of Glasgow.[1] But in all the medieval universities of Germany, England and Scotland, modelled as they were on a common type, the absence of adequate discipline was, in a greater or less degree, a common defect. In connexion with this feature we may note the comparatively small percentage of matriculated students proceeding to the degree of B.A. and M.A. when compared with later times. **Degrees taken at Leipzig.** Of this disparity the table on next column, exhibiting the relative numbers in the university of Leipzig for every ten years from the year 1427 to 1552, probably affords a fair average illustration—the remarkable fluctuations probably depending quite as much upon the comparative healthiness of the period (in respect of freedom from epidemic) and the abundance of the harvests as upon any other cause.

General aspects of German medieval universities.

The German universities in these times seem to have admitted for the most part their inferiority in learning to older and more favoured centres; and their consciousness of the fact is shown by the efforts which they made to attract instructors from Italy, and by the frequent resort of the more ambitious students to schools like Paris, Bologna, Padua and Pavia. That they took their rise in any spirit of systematic opposition to the Roman see (as Meiners and others have contended), or that their organization was something external to and independent of the church, is an assertion somewhat qualified by the foregoing evidence. Generally speaking, they were eminently conservative bodies, and the new learning of the humanists and the new methods of instruction that now began to demand attention were alike for a long period unable to gain admission within academic circles. Reformers such as Hegius, John Wessel and Rudolphus Agricola carried on their work at places like Deventer remote from university influences. That there was a considerable amount of mental activity going on in the universities themselves is not to be denied; but it was mostly of that unprofitable kind which, while giving rise to endless controversy, turned upon questions in connexion with which the implied postulates and the terminology employed rendered all scientific investigation hopeless. At almost every university—Leipzig, Greifswald and Prague (after 1409) being the principal exceptions—the so-called Realists and Nominalists represented two great parties occupied with an internecine struggle. At Paris, owing to the overwhelming strength of the theologians, the Nominalists were indeed under a kind of ban; but at Heidelberg they had altogether expelled their antagonists. It was much the same at Vienna and at Erfurt—the latter, from the ready reception which it gave to new speculation, being styled by its enemies "novorum omnium portus." At Basel, under the leadership of the eminent Johannes a Lapide, the Realists with difficulty maintained their ground. Freiburg, Tübingen and Ingolstadt, in the hope of diminishing controversy, arrived at a kind of compromise, each party having its own professor, and representing a distinct "nation." At Mainz the authorities adopted a manual of logic which was essentially an embodiment of Nominalistic principles.

Years.	Matriculations.	Years.	B.A.	M.A.	Percentage of	
					B.A's.	M.A's.
1427–1430	737	1429–1432	151	28	20·4	3·8
1437–1440	715	1439–1442	199	50	27·8	6·9
1447–1450	808	1449–1452	274	(50)	33·9	..
1457–1460	1,447	1459–1462	559	81	38·6	5·6
1467–1470	1,137	1469–1472	410	61	36·0	5·4
1477–1480	1,163	1479–1482	458	49	39·4	4·2
1487–1490	1,858	1489–1492	714	62	38·4	3·4
1497–1500	1,288	1499–1502	497	59	38·5	4·6
1507–1510	1,948	1509–1512	510	65	26·1	3·4
1517–1520	1,445	1519–1522	247	35	17·0	2·4
1527–1530	419	1529–1532	77	33	18·4	7·9
1537–1540	686	1539–1542	122	27	17·8	3·9
1547–1550	1,318	1549–1552	200	72	15·2	5·5
	14,969		4418	672	29·5	4·5

Abandonment of logical studies in Italy.

In Italy, almost without exception, it was decided that these controversies were endless and that their effects were pernicious. It was resolved, accordingly, to expel logic, and allow its place to be filled by rhetoric. It was by virtue of this decision, which was of a tacit rather than a formal character, that the expounders of the new learning in the 15th century—men like Emmanuel Chrysoloras, Guarino, Leonardo Bruni, Bessarion, Argyropulos and Valla—carried into effect that important revolution in academic studies which constitutes a new era in university learning, and largely helped to pave the way for the Reformation.[2] This discouragement of the controversial spirit, continued as it was in relation to theological questions after the Reformation, obtained for the Italian universities a fortunate immunity from dissensions like those which, as we shall shortly see, distracted the centres of learning in Germany. **High reputation of Italian professors.** The professorial body also attained to an almost unrivalled reputation. It was exceptionally select, only those who were in receipt of salaries being permitted, as a rule, to lecture; it was also famed for its ability, the institution of concurrent chairs proving an excellent stimulus. These chairs were of two kinds—"ordinary" and "extraordinary"—the former being the more liberally endowed and fewer in number. For each subject of importance there were thus always two and sometimes three rival chairs, and a powerful and continuous emulation was thus maintained among the teachers. "From the integrity of their patrons, and the lofty standard by which they were judged," says Sir W. Hamilton, "the call to a Paduan or Pisan chair was deemed the highest of all literary honours. The status of professor was in Italy elevated to a dignity which in other countries it has never reached; and not a few of the most illustrious teachers in the Italian seminaries were of the proudest nobility of the land. While the universities of other countries had fallen from Christian and cosmopolite to sectarian and local schools, it is the peculiar glory of the Italian that, under the enlightened liberality of their patrons, they still continued to assert their European universality. Creed and country were in them no bar—the latter not even a reason of preference. Foreigners of every nation are to be found among their professors; and the most learned man in Scotland, Thomas Dempster, sought in a Pisan chair that theatre for his abilities which he could not find at home."[1]

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[1] *Fasti Aberdonenses*, Pref. p. xvi.

[2] For an excellent account of this movement, see Georg Voigt, *Die Wiederbelebung des classischen Alterthums* (2nd ed., 2 vols., 1880)

Valencia.
Seville.
Granada.
Oviedo.

To such catholicity of sentiment the Spanish universities during the same period offer a complete contrast, their history being so strongly modified by political and religious movements that some reference to these becomes indispensable. Valencia, founded in 1501 as a school not only of theology and of civil and canon law, but also of the arts and of medicine, and sanctioned at the petition of its council by Alexander VI. (see Denifle, i. 645–46), and Seville, sanctioned by Julius II. in 1505, appear both to have been regarded without mistrust at Rome. But although the latter pontiff had approved the foundation of the university of Santiago as early as 1504, the bull for its creation was not granted by Clement VII. until 1526. While, again, the design of establishing a university at Granada had been approved by Charles V. in the same year, it was not until 1531 that Clement gave his consent, and even then the work of preparation was deferred for another six years. Little indeed is to be learnt respecting the new society until the foundation of the liberally endowed College de Sacro Monte by the archbishop of the province in 1605. These delays are partly to be accounted for by the well-known political jealousies that existed between the monarch and the pontiff; but it is also to be noted that at precisely the same period a movement of no slight importance, whereby it was sought to gain the recognition by the church of the writings and teaching of Erasmus, had been going on in the universities of Spain, and had ultimately died out. It died out at the uncreating voice of the Dominican Melchior Cano, who revived the ancient scholasticism and the teaching of Aquinas. Then followed the Jesuits, whom Cano himself had once denounced as "precursors of Antichrist," and under their direction the scholastic philosophy, together with a certain attention to Greek and Hebrew, became the dominant study. And when the council of Trent had done its work, and doctrinal controversy seemed to have been finally laid to rest, Gregory XIII. in 1574 authorized the foundation of the university of Oviedo; but this was not opened until 1608, and then only with a faculty of law. After this time the universities in Spain shared in the general decline of the country; and even after the expulsion of the Jesuits in 1769 no marked improvement is discernible in their schools. On the contrary, the departure of a body of very able instructors, who, whatever objections might be taken to their doctrinal teaching, were mostly good scholars and men in close touch with the outer world, distinctly favoured that tendency to lifeless routine and unreasoning tradition which characterizes the Spanish universities until the second half of the 19th century.

Italian universities.
Macerata.
Camerino.
Urbino.
Modena.
Sicily.
Palermo.
Sassari.
Cagliari.

The comparative unimportance of the universities founded during the same period in Italy is partially explained by the number of those which previously existed. In the papal states Macerata and Camerino were founded at a wide interval; the former, according to tradition, by a bull of Nicholas IV. as early as the 13th century, the latter not until the year 1727 by a bull of Benedict XIII. Macerata, however, ceased to exist as a university in the last century, retaining only a faculty of law, but contributing to the maintenance of the medical faculty at Camerino, which was constituted one of the newly created "free universities" (along with Urbino, Ferrara and Perugia) in 1890, but continued to exist only with the aid of contributions levied on the local parishes. Urbino, originally opened as a studium under papal patronage in 1671, was also constituted a free university, its chief study being that of law. At Modena there had long existed a faculty of the same study which enjoyed a high repute, but it was not until 1683 that it received its charter from Duke Francis II. of Este as the university of his capital. Like Camerino, Modena had to rely chiefly on funds collected in the commune, but was able nevertheless to acquire some reputation as a school of law and medicine, declining, when the Jesuits were installed by the Austrian authorities, to revive again in the general recovery which took place among the seats of learning after the unification of Italy. In Sicily, Palermo (1779) originated in an earlier institution composed mainly of subjects of Ferdinand IV., who had followed him on his expulsion from the throne of the Two Sicilies at Naples towards the end of the 18th century. It was closed in 1805, but reopened in 1850 to become a school of considerable importance in all the faculties with over 1000 students. The two universities of Sardinia—Sassari (1634) and Cagliari (1596)—were founded under the Spanish rule, and both died out when that rule was exchanged for that of Austria. Under the auspices of the house of Savoy they were re-established, but neither can be said to have since achieved any marked success.

For the most part, however, the Reformation represents the great boundary line in the history of the medieval universities, and long after Luther and Calvin had passed away was still the main influence in the history of those new foundations which arose in Protestant countries. Even in Catholic countries its secondary effects were scarcely less perceptible, as they found expression in connexion with the Counter-Reformation. In Germany the Thirty Years' War was attended by consequences which were felt long after the 17th century. In France the Revolution of 1789 resulted in the actual uprooting of the university system.

Pernicious influences of sectarianism.

The influence of the Humanists, and the special character which it assumed as it made its way in Germany in connexion with the labours of scholars like Erasmus, John Reuchlin and Melanchthon, augured well for the future. It was free from the frivolities, the pedantry, the immoralities and the scepticism which characterized so large a proportion of the corresponding culture in Italy. It gave promise of resulting at once in a critical and enlightened study of the masterpieces of classical antiquity, and in a reverent and yet rational interpretation of the Scriptures and the Fathers. The fierce bigotry and the ceaseless controversies evoked by the promulgation of Lutheran or Calvinistic doctrine dispelled, however, this hopeful prospect, and converted what might otherwise have become the tranquil abodes of the Muses into gloomy fortresses of sectarianism. Of the manner in which it affected the highest culture, the observation of Henke in his *Life of Calixtus* (i. 8), that for a century after the Reformation the history of Lutheran theology becomes almost identified with that of the German universities, may serve as an illustration.

Marburg.

The first Protestant university was that of Marburg, founded by Philip the Magnanimous, landgrave of Hesse, 30th May 1527. Expressly designed as a bulwark of Lutheranism, it was mainly built up out of the confiscation of the property of the religious orders in the Hessian capital. The house of the Dominicans, who had fled on the first rumour of spoliation, was converted into lecture-rooms for the faculty of jurisprudence. The church and convent of the order known as the "Kugelherrn" was appropriated to the theological faculty. The friary of the Barefooted Friars was shared between the faculties of medicine and philosophy. The university, which was the object of the landgrave's peculiar care, rapidly rose to celebrity; it was resorted to by students from remote countries, even from Greece, and its professors were of distinguished ability. How much, however, of this popularity depended on its theological associations is to be seen in the fact that after the year 1605, when, by the decree of Count Maurice, its formulary of faith was changed from Lutheran to Calvinistic, its numbers greatly declined. This dictation of the temporal power now becomes one of the most notable features in academic history in Protestant Germany. The universities, having repudiated the papal authority, while that of the episcopal order was at an end, now began to pay especial court to the temporal ruler, and sought in every way to conciliate his goodwill, representing with peculiar distinctness the theory—*cujus regio, ejus religio.* This tendency was further strengthened by the fact that their colleges, bursaries and other similar foundations were no longer derived from or supported by ecclesiastical institutions, but were mainly dependent on the civil power.

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[1] Hamilton, *Discussions*, 2nd ed. p. 373.

Königsberg.

The Lutheran university of Königsberg was founded 17th August 1544 by Albert III., margrave of Brandenburg, and the first duke of Prussia, and his wife Dorothea, a Danish princess. In this instance, the religious character of the foundation not having been determined at the commencement, the papal and the imperial sanction were both applied for, although not accorded. King Sigismund of Poland, however, which kingdom exercised at that time a protectorate over the Prussian duchy, ultimately gave the necessary charter (29th September 1561), at the same time ordaining that all students who graduated as masters in the faculty of philosophy should rank as nobles of the Polish kingdom. When Prussia was raised to the rank of a kingdom (1701) the university was made a royal foundation, and the "collegium Fridericianum," which was then erected, received corresponding privileges. In 1862 the university buildings were rebuilt, and the number of the students soon after rose to nearly a thousand.

Jena.

The Lutheran university of Jena had its origin in a gymnasium founded by John Frederick the Magnanimous, elector of Saxony, during his imprisonment, for the express purpose of promoting Evangelical doctrines and repairing the loss of Wittenberg, where the Philippists had gained the ascendancy. Its charter, which the emperor Charles V. had refused to grant, and which was obtained with some difficulty from his brother, Ferdinand I., enabled the authorities to open the university on the 2nd of February 1558. Distinguished for its vehement assertion of Lutheran doctrine, its hostility to the teaching of Wittenberg was hardly less pronounced than that with which both centres regard Roman Catholicism. For a long time it was chiefly noted as a school of medicine, and in the 17th and 18th centuries was in bad repute for the lawlessness of its students, among whom duelling prevailed to a scandalous extent. The beauty of its situation and the eminence of its professoriate have, however, generally attracted a considerable proportion of students from other countries. Its numbers in 1906 were 1281.

Helmstedt.

The Lutheran university of Helmstedt, founded by Duke Julius (of the house of Brunswick-Wolfenbüttel), and designated after him in its official records as "Academia Julia," received its charter, 8th May 1575, from the emperor Maximilian II. No university in the 16th century commenced under more favourable auspices. It was munificently endowed by the founder and by his son; and its "Convictorium," or college for poor students, expended in the course of thirty years no less than 100,000 thalers, an extraordinary expenditure for an institution of such a character in those days. Beautifully and conveniently situated in what had now become the well-peopled region between the Weser and the lower Elbe, and distinguished by its comparatively temperate maintenance of the Lutheran tenets, it attracted a considerable concourse of students, especially from the upper classes, not a few being of princely rank. Throughout its history, until suppressed in 1809, Helmstedt enjoyed the special and powerful patronage of the dukes of Saxony.

Altdorf.

The "Gymnasium Aegidianum" of Nuremberg, founded in 1526, and removed in 1575 to Altdorf, represents the origin of the university of Altdorf. A charter was granted in 1578 by the emperor Rudolph II., and the university was formally opened in 1580. It was at first, however, empowered only to grant degrees in arts; but in 1623 the emperor Ferdinand II. added the permission to create doctors of law and medicine, and also to confer crowns on poets; and in 1697 its faculties were completed by the permission given by the emperor Leopold I. to create doctors of theology. Like Louvain, Altdorf was nominally ruled by the municipality, but in the latter university this power of control remained practically inoperative, and the consequent freedom enjoyed by the community from evils like those which brought about the decline of Louvain is thus described by Hamilton: "The decline of that great and wealthy seminary (Louvain) was mainly determined by its vicious patronage, both as vested in the university and in the town. Altdorf, on the other hand, was about the poorest university in Germany, and long one of the most eminent. Its whole endowment never rose above £800 a year; and, till the period of its declension, the professors of Altdorf make at least as distinguished a figure in the history of philosophy as those of all the eight universities of the British empire together. On looking closely into its constitution the anomaly is at once solved. The patrician senate of Nuremberg were too intelligent and patriotic to attempt the exercise of such a function. The nomination of professors, though formally ratified by the senate, was virtually made by a board of four curators; and what is worthy of remark, as long as curatorial patronage was a singularity in Germany, Altdorf maintained its relative pre-eminence, losing it only when a similar mean was adopted in the more favoured universities of the empire."[1]

The conversion of Marburg into a school of Calvinistic doctrine gave occasion to the foundation of the universities of Giessen and of Rinteln. **Giessen.** Of these the former, founded by the margrave of Hesse-Darmstadt, Louis V., as a kind of refuge for the Lutheran professors from Marburg, received its charter from the emperor Rudolph II. (19th May 1607). When, however, the margraves of Darmstadt acquired possession of Marburg in 1625, the university was transferred thither; in 1650 it was moved back again to Giessen. The number of matriculated students, which at the beginning of last century was about 250, had risen before its close to over 800. In common with the other universities of Germany, but with a facility which obtained for it a specially unenviable reputation, Giessen was for a long time wont to confer the degree of doctor *in absentia* in the different faculties without requiring adequate credentials. This practice drew forth an emphatic protest from the eminent historian Mommsen, and was abandoned long before his death. **Rinteln.** The university of Rinteln was founded 17th July 1621 by the emperor Ferdinand II. Almost immediately after its foundation it became the prey of contending parties in the Thirty Years' War, and its early development was thus materially hindered. It never, however, attained to much distinction, and in 1819 it was suppressed. **Strassburg.** The university of Strassburg was founded in 1621 on the basis of an already existing academy, to which the celebrated John Sturm stood, during the latter part of his life, in the relation of "rector perpetuus" and of which we are told that in 1578 it included more than a thousand scholars, among whom were 200 of the nobility, 24 counts and barons and three princes. It also attracted students from all parts of Europe, and especially from Portugal, Poland, Denmark, France and England. The method of Sturm's teaching became the basis of that of the Jesuits, and through them of the public school instruction in England. In 1621 Ferdinand II. conferred on this academy full privileges as a university; in the language of the charter, "in omnibus facultatibus, doctores, licentiatos, magistros, et baccalaureos, atque insuper *poetas laureatos* creandi et promovendi."[2] In 1681

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[1] *Discussions*, &c., 2nd ed., pp. 388–89.

[2] *Promulg. Acad. Privil.*, &c. (Strassburg, 1628).

Strassburg became French, and remained so until 1872, when it was refounded by the Emperor William I., and before the close of the century numbered over 1100 students.

Moscow. Wilna. Dorpat.

At the beginning of last century Russia possessed but three universities—that of Moscow (1755), founded by the Empress Elizabeth; of Wilna (1578), which was Polish and chiefly in the hands of the Jesuits; and of Dorpat [Yuriev] in Livonia, which was virtually German.

Charkow. Kasan. St Petersburg.

Under the enlightened policy of Alexander I. was founded the university of Charkow (1804) for New Russia, that of Kazan (1804) for the countries about the Volga, but designed also for the populations of Finland and Siberia, and that of St Petersburg (1819). Each of the foregoing six universities had a definite district assigned to it, from whence it was entitled to recruit students, and, as a further incentive to the pursuit of academic studies, a *ukaz* promulgated in 1809 proclaimed that in all appointments to official posts throughout the empire the holders of a university degree would receive the first consideration in the competition for vacancies.

Helsingfors.

In 1826 the university at Åbo in Finland was removed to Helsingfors, and still preserves the charter whereby, in its original home, it had been constituted a university by Queen Christina and her chancellor Oxenstiern in the year 1640.

Kiev. Odessa.

In 1832 the foundation of the St Wladimir University of Kiev absorbed both that at Wilna and the lyceum of Kremenetz. Odessa, founded in 1865, was designed to represent the university of New Russia. Although at St Petersburg considerable attention was regularly given to the teaching of languages, especially those of Armenia, Georgia, and Tatary, the general status of the Russian universities continued throughout the greater part of last century exceptionally low; and in 1884 they were all reconstituted by the promulgation of a "universal code"; with this the statutes of the universities at Dorpat (1632) and Warsaw (1886) are essentially in agreement. The former, originally founded at the suggestion of the governor-general, with the design of bringing "martial Livonia into the path of virtue and morality," was at first almost exclusively taught by German professors, of whom, however, very few had retained their chairs at the conclusion of last century. The study of the Slavonic languages, on the other hand, received a considerable stimulus; and when, by a decree in May 1887, the use of the Russian language was made obligatory in all places of instruction throughout the Baltic provinces, Russian began to displace German as the language of the lecture-room, the only faculties in which the use of German continued to be permissible being those of theology and medicine.

Tomsk.

The university of Tomsk in western Siberia, founded in 1888, recruited its numbers chiefly from students in the same faculties. It was, however, without endowment, and depended chiefly on a grant from the state aided by private liberality.

Influence of Dorpat.

During the ensuing twenty years the general influence of Dorpat rapidly spread far beyond the Baltic provinces, while the number of students, which in 1879 was 1106, rose to nearly 2000.[1] In 1889, however, the appointment of the university officials was taken from the Senatus Academicus and entrusted to the state minister, a change which went far to deprive the university of its claim to be considered German.

Prague.

A like contest between contending nationalities met with a final solution at Prague, where a Czech university having been established on an independent basis, the German university began its separate career in the winter session of 1882–83. The German foundation retains certain revenues accruing from special endowments, but the state subvention is divided between the two.

The repudiation on the part of the Protestant universities of both papal and episcopal authority evoked a counter-demonstration among those centres which still adhered to Catholicism, while their theological intolerance gave rise to a great reaction, under the influence of which the medieval Catholic universities were reinvigorated and reorganized (although strictly on the traditional lines), while new and important centres were created. It was on the tide of this reaction, aided by their own skilful teaching and practical sagacity, that the Jesuits were borne to that commanding position which made them for a time the arbiters of education in Europe.

Bamberg.

The earliest university whose charter represented this reaction was that of Bamberg, founded by the prince-bishop Melchior Otto, after whom it was named "Academia Ottoniana." It was opened 1st September 1648, and received both from the emperor Frederick III. and Pope Innocent X. all the civil and ecclesiastical privileges of a medieval foundation. At first, however, it comprised only the faculties of arts and of theology; to these was added in 1729 that of jurisprudence, and in 1764 that of medicine. In this latter faculty Dr Ignatius Döllinger (the father of the historian) was for a long time a distinguished professor. The university library is of especial interest, as including that of an earlier Jesuit foundation and also valuable collections by private donors. Its collection of manuscripts in like manner includes those contained in some thirty suppressed monasteries, convents, and religious institutions at the time of the "secularization."

Innsbruck.

The university of Innsbrück was founded in 1672 by the emperor Leopold I., from whom it received its name of "Academia Leopoldina." In the following century, under the patronage of the empress Maria Theresa, it made considerable progress, and received from her its ancient library and bookshelves in 1745. In 1782 the university underwent a somewhat singular change, being reduced by the emperor Joseph II. from the status of a university to that of a lyceum, although retaining in the theological faculty the right of conferring degrees. In 1791 it was restored to its privileges by the emperor Leopold II., and since that time the faculties of philosophy, law and medicine have been represented in nearly equal proportions.

Breslau.

The foundation of the university of Breslau was contemplated as early as the year 1505, when Ladislaus, king of Hungary, gave his sanction to the project; but Pope Julius II., in the assumed interests of Cracow, withheld his assent.

The Jesuits in the university.

Nearly two centuries later, in 1702, under singularly altered conditions, the Jesuits prevailed upon the emperor Leopold I. to found a university without soliciting the papal sanction. When Frederick the Great conquered Silesia in 1741, he took both the university and the Jesuits in Breslau under his protection, and when in 1774 the order was suppressed by Clement XIV. he established them as priests in the Royal Scholastic Institute, at the same time giving new statutes to the university. In 1811 the university was considerably augmented by the incorporation of that at Frankfort-on-the-Oder, and was ultimately reconstituted on lines similar to those of the newly founded university of Berlin.

Condition of the University of Paris.

In no country was the influence of the Jesuits on the universities more marked than in France. The civil wars in that country during the thirty years which preceded the close of the 16th century told with disastrous effects upon the condition of the university of Paris, and with the commencement of the 17th century its collegiate life seemed at an end, and its forty colleges stood absolutely deserted. To this state of affairs the obstinate conservatism of the academic authorities not a little contributed. The statutes by which the university was still governed were those which had been given by the cardinal D'Estouteville, the papal legate, in 1452, and remained entirely unmodified by the influences of the Renaissance. In 1579 the edict of Blois promulgated a scheme of organization for all the universities of the realm (at that time twenty-one in number)—a measure which, though productive of unity of teaching, did nothing towards the advancement of the studies themselves. The theological instruction became largely absorbed by the episcopal colleges, and acquired, in the schools of the different orders, a narrower and more dogmatic character. The eminent lawyers of France, unable to find chairs in Paris, distributed themselves among the chief towns

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[1] See *Die deutsche Universität Dorpat im Lichte der Geschichte*, 1882.

Colleges of the Jesuits in France.

of the provinces. The Jesuits did not fail to profit by this immobility and excessive conservatism on the part of the university, and during the second half of the 16th century and the whole of the 17th they had contrived to gain almost a complete monopoly of both the higher and the lower education of provincial France. Their schools rose at Toulouse and Bordeaux, at Auch, Agen, Rhodez, Périgueux, Limoges, Le Puy, Aubenas, Béziers, Tournon, in the colleges of Flanders and Lorraine, Douai and Pont-à-Mousson—places beyond the jurisdiction of the parlement of Paris or even of the crown of France. Their banishment from Paris itself had been by the decree of the parlement alone, and had never been confirmed by the crown. "Lyons," says Pattison, "loudly demanded a Jesuit college, and even the Huguenot Lesdiguières, almost king in Dauphiné, was preparing to erect one at Grenoble. Amiens, Rheims, Rouen, Dijon, and Bourges were only waiting a favourable opportunity to introduce the Jesuits within their walls."[1] The university was rescued from the fate which seemed to threaten it only by the excellent statutes given by Richer in 1598, and by the discerning protection extended to it by Henry IV., while its higher culture was in some measure provided for by the establishment by Richelieu in 1635 of the Académie française.

Edinburgh.

The "college of Edinburgh" was founded by charter of James VI., dated 14th April 1582. This document contains no reference to a *studium generale*, nor is there ground for supposing that the foundation of a university was at that time contemplated. In marked contrast to the three older centres in Scotland, the college rose comparatively untrammelled by the traditions of medievalism, and its creation was not effected without some jealousy and opposition on the part of its predecessors. Its first course of instruction was commenced in the Kirk of Field, under the direction of Robert Rollock, who had been educated at St Andrews under Andrew Melville, the eminent Covenanter. "He began to teach," says Craufurd, "in the lower hall of the great lodging, there being a great concourse of students allured with the great worth of the man; but diverse of them being not ripe enough in the Latin tongue, were in November next put under the charge of Mr Duncan Narne, . . . who, upon Mr Rollock's recommendation, was chosen second master of the college."[2] In 1585 both Rollock and Nairne subscribed the National Covenant, and a like subscription was from that time required from all who were admitted to degrees in the college.

Results of the Thirty Years' War.

Halle.

Disastrous as were the effects of the Thirty Years' War upon the external condition of the German universities, resulting in not a few instances in the total dispersion of the students and the burning of the buildings and libraries, they were less detrimental and less permanent than those which were discernible in the tone and temper of these communities. A formal pedantry and unintelligent method of study, combined with a passionate dogmatism in matters of religious belief and a rude contempt for the amenities of social intercourse, became the leading characteristics, and lasted throughout the 17th century. But in the year 1693 the foundation of the university of Halle opened up a career to two very eminent men, whose influence, widely different as was its character, may be compared for its effects with that of Luther and Melanchthon, and served to modify the whole current of German philosophy and German theology. Halle has indeed been described as "the first real modern university." It was really indebted for its origin to a spirit of rivalry between the conservatism of Saxony and the progressive tendencies of the house of Brandenburg, but the occasion of its rise was the removal of the ducal court from Halle to Magdeburg. The archbishopric of the latter city having passed into the possession of Brandenburg in 1680 was changed into a dukedom, and the city itself was selected as the ducal residence. This change left unoccupied some commodious buildings in Halle, which it was decided to utilize for purposes of education. A "Ritterschule" for the sons of the nobility was opened, and in the course of a few years it was decided to found a university. Saxony endeavoured to thwart the scheme, urging the proximity of Leipzig; but her opposition was overruled by the emperor Leopold I., who granted (19th October 1693) the requisite charter, and in the following year the work of the university commenced. Frankfort-on-the-Oder had by this time become a centre of the Reformed party, and the primary object in founding a university in Halle was to create a centre for the Lutheran party; but its character, under the influence of its two most notable teachers, Christian Thomasius and A. H. Francke, soon expanded beyond the limits of this conception to assume a highly original form. Thomasius and Francke had both been driven from Leipzig owing to the disfavour with which their liberal and progressive tendencies were there regarded by the academic authorities, and on many points the two teachers were in agreement. They both regarded with contempt alike the scholastic philosophy and the scholastic theology; they both desired to see the rule of the civil power superseding that of the ecclesiastical power in the seats of learning; they were both opposed to the ascendancy of classical studies as expounded by the humanists—Francke regarding the Greek and Roman pagan writers with the old traditional dislike, as immoral, while Thomasius looked upon them with contempt, as antiquated and representing only a standpoint which had been long left behind; both again agreed as to the desirability of including the elements of modern culture in the education of the young. But here their agreement ceased. It was the aim of Thomasius, as far as possible, to secularize education, and to introduce among his countrymen French habits and French modes of thought; his own attire was gay and fashionable, and he was in the habit of taking his seat in the professorial chair adorned with gold chain and rings, and with his dagger by his side. Francke, who became the leader of the Pietists, regarded all this with even greater aversion than he did the lifeless orthodoxy traditional in the universities, and was shocked at the worldly tone and disregard for sacred things which characterized his brother professor. Both, however, commanded a considerable following among the students. Thomasius was professor in the faculty of jurisprudence, Francke in that of theology. And it was a common prediction in those days with respect to a student who proposed to pursue his academic career at Halle, that he would infallibly become either an atheist or a Pietist. But the services rendered by Thomasius to learning were genuine and lasting. He was the first to set the example, soon after followed by all the universities of Germany, of lecturing in the vernacular instead of in the customary Latin; and the discourse in which he first departed from the traditional method was devoted to the consideration of how far the German nation might with advantage imitate the French in matters of social life and intercourse. His more general views, as a disciple of the Cartesian philosophy and founder of the modern Rationalismus, exposed him to incessant attacks; but by the establishment of a monthly journal (at that time an original idea) he obtained a channel for expounding his views and refuting his antagonists which gave him a great advantage. On the influence of Francke, as the founder of that Pietistic school with which the reputation of Halle afterwards became especially identified, it is unnecessary here to dilate.[3] Christian Wolf, who followed Thomasius as an assertor of the new culture, was driven from Halle by the accusations of the Pietists, who declared that his teaching was fraught with atheistical principles. In 1740, however, he was recalled by Frederick II., and reinstated in high office with every mark of consideration and respect. Throughout the whole of the 18th century Halle was the leader of academic thought and advanced theology in Protestant Germany, although sharing that leadership, after the middle of the century, with Göttingen. The university of Göttingen (named after its founder "Georgia Augusta") was endowed with the amplest privileges as a university by George II. of England, elector of Hanover, 7th December

Influence of Thomasius and Francke.

Göttingen.

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[1] *Life of Casaubon*, p. 181.

[2] Craufurd, *Hist. of the Univ. of Edinburgh*, pp. 19–28.

[3] See Paulsen, *Gesch. des gelehrten Unterrichts*, &c., pp. 348–58.

1736. The imperial sanction of the scheme had been given three years before (13th January 1733), and the university was formally opened 17th September 1737. The king himself assumed the office of "rector magnificentissimus," and the liberality of the royal endowments (doubling those of Halle), and the not less liberal character of the spirit that pervaded its organization, soon raised it to a foremost place among the schools of Germany. Halle had just expelled Wolf; and Göttingen, modelled on the same lines as Halle, but rejecting its Pietism and disclaiming its intolerance, appealed with remarkable success to the most enlightened feeling of the time. It included all the faculties, and two of its first professors—Mosheim, the eminent theologian, from Helmstedt, and G. L. Böhmer, the no less distinguished jurist from Halle—together with Gesner, the man of letters, at once established its reputation. Much of its early success was also due to the supervision of its chief curator (there were two)—Baron Münchhausen, himself a man of considerable attainments, who by his sagacious superintendence did much to promote the general efficiency of the whole professoriate. Not least among its attractions was also its splendid library, located in an ancient monastery, and now containing over 200,000 volumes and 5000 MSS. In addition to its general influence as a distinguished seat of learning, Göttingen may claim to have been mainly instrumental in diffusing a more adequate conception of the importance of the study of history. Before the latter half of the 18th century the mode of treatment adopted by university lecturers was singularly wanting in breadth of view. Profane history was held of but little account, excepting so far as it served to illustrate ecclesiastical and sacred history; while this, again, was invariably treated in the narrow spirit of the polemic, intent mainly on the defence of his own confession, according as he represented the Lutheran or the Reformed Church. The labours of the professors at Göttingen, especially Putter, Gatterer, Schlözer and Spittler, combined with those of Mascov at Leipzig, did much towards promoting both a more catholic treatment and a wider scope. Not less beneficial was the example set at Göttingen of securing the appointment of its professors by a less prejudiced and partial body than a university board is only too likely to become. "'The Great Münchhausen,' says an illustrious professor of that seminary, 'allowed our university the right of presentation, of designation, or of recommendation, as little as the right of free election; for he was taught by experience that, although the faculties of universities may know the individuals best qualified to supply their vacant chairs, *they are seldom or never disposed to propose for appointment the worthiest within their knowledge.*'"[1] The system of patronage adopted at Göttingen was, in fact, identical with that which had already been instituted in the universities of the Netherlands by Douza. The university of Erlangen, a Lutheran centre, was founded by Frederick, margrave of Baireuth. Its charter was granted by the emperor Charles VII., 21st February 1743, and the university was formally constituted, 4th November. From its special guardian, Alexander, the last margrave of Ansbach, it was styled "Academia Alexandrina." In 1791, Ansbach and Baireuth having passed into the possession of Prussia, Erlangen also became subject to the Prussian government, and, as the 19th century advanced, her theological faculty became distinguished by the fervour and ability with which it championed the tenets of Lutheranism.

Erlangen.

The English and German universities compared.

On comparison with the great English universities, the universities of Germany must be pronounced inferior both in point of discipline and of moral control over the students. The superiority of the former in these respects is partly to be attributed to the more systematic care which they took, from a very early date, for the supervision of each student, by requiring that within a certain specified time after his entry into the university he should be registered as a pupil of some master of arts, who was responsible for his conduct, and represented him generally in his relations to the academic authorities. Marburg in its earliest statutes (those of 1529) endeavoured to establish a similar rule, but without success.[2] The development of the collegiate system at Oxford and Cambridge materially assisted the carrying out of this discipline. Although again, as in the German universities, feuds were not unfrequent, especially those between "north" and "south" (the natives of the northern and southern counties), the fact that in elections to fellowships and scholarships only a certain proportion were allowed to be taken from either of these divisions acted as a considerable check upon the possibility of any one college representing either element exclusively. In the German universities, on the other hand, the ancient division into nations, which died out with the 15th century, was revived under another form by the institution of national colleges, which largely served to foster the spirit of rivalry and contention. The demoralization induced by the Thirty Years' War and the increase of duelling intensified these tendencies, which, together with the tyranny of the older over the younger students, known as "Pennalismus," were evils against which the authorities contended, but ineffectually, by various ordinances. The institution of "Burschentum," having for its design the encouragement of good fellowship and social feeling irrespective of nationality, served only as a partial check upon these excesses, which again received fresh stimulus by the rival institution of "Landsmannschaften," or societies of the same nationality. The latter proved singularly provocative of duelling, while the arrogant and even tyrannical demeanour of their members towards the unassociated students gave rise to a general combination of the latter for the purposes of self-defence and organized resistance.

Extinction of German universities during 1798–1815.

Munich.

Münster.

The political storms which marked the close of the 18th and the beginning of the 19th century gave the death-blow to not a few of the ancient universities of Germany. Mainz and Cologne ceased to exist in 1798; Bamberg, Dillingen and Duisburg in 1804; Rinteln and Helmstedt in 1809; Salzburg in 1810; Erfurt in 1816. Altdorf was united to Erlangen in 1807, Frankfort-on-the-Oder to Breslau in 1809, and Wittenberg to Halle in 1815. The university of Ingolstadt was first moved in 1802 to Landshut, and from thence in 1826 to Munich, where it was united to the academy of sciences which was founded in the Bavarian capital in 1759. Münster in Prussia was for the first time constituted a university in four faculties by Maximilian Frederick (elector and archbishop) in 1771. Its charter was confirmed by Clement XIV. in 1773, and again by the Emperor Joseph II. The university was abolished in the year 1818; but two faculties, those of theology and philosophy, continued to exist, and in 1843 it received the full privileges of a Prussian university together with the designation of a royal foundation. Of those of the above centres which altogether ceased to exist, but few were much missed or regretted—that at Mainz, which had numbered some six hundred students, being the one notable exception. The others had for the most part fallen into a perfunctory and lifeless mode of teaching, and, with wasted or diminished revenues and declining numbers, had long ceased worthily to represent the functions of a university, while the more studious in each centre were harassed by the frequency with which it was made an arena for political demonstrations. Whatever loss may have attended their suppression was more than compensated by the activity and influence of the three great German universities which rose in the last century.

Munich, after having been completely reorganized, soon became a distinguished centre of study in all the faculties; and its numbers, allowing for two great wars, have been continuously on the increase, the eminence of its professoriate, among whom have been Döllinger, Liebig, Schelling, Zeuss and Giesebrecht, having attracted students from all parts of Europe.

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[1] Hamilton, *Discussions*, p. 381.

[2] "Volumus neminem in hanc nostram Academiam admitti, aut per rectorem in album recipi, qui non habeat privatum atque domesticum praeceptorem, qui ejus discipulum agnoscat, ad cujus judicium quisque pro sua ingenii capacitate atque Marte lecturas et publicas et privatas audiat, a cujus latere aut raro aut nunquam discedat." Koch expressly compares this provision with the discipline of Oxford and Cambridge, which, down to the commencement of the present century, was very much of the same character (Koch, *Gesch. des academischen Pädagogiums in Marburg*, p. 11).

Berlin.

The university of Berlin, known as the *Royal* Friedrich Wilhelm University, was founded in 1809, immediately after the peace of Tilsit, when Prussia had been reduced to the level of a third-rate Power. Under the guiding influence of Wilhelm von Humboldt, however, supported by the strong purpose of Frederick William III., the principles adopted in connexion with the new seat of learning not only raised it to a foremost place among the universities of Europe, but also largely conduced to the regeneration of Germany. It had not only incorporated at the time of its foundation the famous "Academy of Sciences" of the city, but expressly repudiated all attachment to any particular creed or school of thought, and professed subservience only to the interests of science and learning. "Each of the eminent teachers with whom the university began its life—F. A. Wolfe, Fichte, Savigny, Reil—represented only himself, the path of inquiry or the completed theory which he had himself propounded. Its subsequent growth was astonishing, and before the 19th century closed the number of its matriculated students exceeded that of every other university except Vienna."

Bonn.

The university of Bonn, founded in 1818 and also by Friedrich Wilhelm III., thus became known as the *Rhenish* Friedrich Wilhelm University—it being the design of the founder to introduce into the Rhine provinces the classic literature and the newly developed scientific knowledge of Germany proper. With this aim he summoned to his aid the best available talent, among the earlier instructors being Niebuhr, A. W. von Schlegel, with C. F. Nasse in the faculty of medicine and G. Hermes in that of theology. In the last-named faculty it further became noted for the manner in which it combined the opposed schools of theological doctrine—that of the Evangelical (or Lutheran) Church and that of the Roman Catholic Church here standing side by side, and both adorned by eminent names. After the war with Austria in 1859 the German universities underwent a considerable change owing to the enforced military service required by the law of 1867; and the events of 1870 were certainly not disconnected with the martial spirit which had been evoked in the student world, while in the universities themselves there had risen up a new and more lively interest in political affairs.

Fluctuations of numbers in the faculty of theology.

In 1878 a comparison of the numbers of the students in the different faculties in the Prussian universities with those for the year 1867 showed a remarkable diminution in the faculty of theology, amounting in Lutheran centres to more than one-half, and in Catholic centres to nearly three-fourths. In jurisprudence there was an increase of nearly two-fifths, in medicine a decline of a third, and in philosophy an increase of one-fourth.

Universities of United Provinces.

Leiden.

The universities of the United Provinces, like those of Protestant Germany, were founded by the state as schools for the maintenance of the principles of the Reformation and the education of the clergy, and afforded in the 16th and 17th centuries a grateful refuge to not a few of those Huguenot or Port-Royalist scholars whom persecution compelled to flee beyond the boundaries of France, as well as to the Puritan divines who were driven from England. The earliest, that of Leiden (in what was then the county of Holland), founded in 1575, commemorated the gallant and successful resistance of the citizens to the Spanish forces under Requesens. Throughout the 17th century Leiden was distinguished by its learning, the ability of its professors, and the shelter it afforded to the more liberal thought associated at that period with Arminianism. Much of its early success was owing to the wise provisions and the influence of the celebrated Janus Douza:—"Douza's principles," says Hamilton, "were those which ought to regulate the practice of all academical patrons; and they were those of his successors. He knew that at the rate learning was seen prized by the state in the academy, would it be valued by the nation at large. . . . He knew that professors wrought more even by example and influence than by teaching, that it was theirs to pitch high or low the standard of learning in a country, and that, as it proved easy or arduous to come up with them, they awoke either a restless endeavour after an even loftier attainment, or lulled into a self-satisfied conceit." Douza was, for Leiden and the Dutch, what Münchhausen afterwards was for Göttingen and the German universities. "But with this difference: Leiden was the model on which the younger universities of the republic were constructed; Göttingen the model on which the older universities of the empire were reformed. Both Münchhausen and Douza proposed a high ideal for the schools founded under their auspices; and both, as first curators, laboured with paramount influence in realizing this ideal for the same long period of thirty-two years. Under their patronage Leiden and Göttingen took the highest place among the universities of Europe; and both have only lost their relative supremacy by the application in other seminaries of the same measures which had at first determined their superiority." The appointment of the professors at Leiden was vested in three (afterwards five) curators, one of whom was selected from the body of the nobles, while the other two were appointed by the states of the province—the office being held for nine years, and eventually for life. With these was associated the mayor of Leiden for the time being. The university of Franeker was founded in 1585 on a somewhat less liberal basis than Leiden, the professors being required to declare their assent to the rule of faith embodied in the Heidelberg Catechism and the confession of the "Belgian Church." Its four faculties were those of theology, jurisprudence, medicine, and "the three languages and the liberal arts."[1] For a period of twelve years (*c.* 1610–22) the reputation of the university was enhanced by the able teaching of William Ames ("Amesius"), a Puritan divine and moralist who had been driven by Archbishop Bancroft from Cambridge and from England. His fame and ability are said to have attracted to Franeker students from Hungary, Poland and Russia.

Franeker.

Harderwijk.

Groningen.

Utrecht.

Ghent.

Liége.

With similar organization were founded the universities of Harderwijk (1600), Groningen (1614) and Utrecht (1634), the last-named being much frequented in the 18th century by both English and Scottish students who repaired thither to obtain instruction of a kind that Oxford and Cambridge at that time failed altogether to impart—more than a fourth of the students of Utrecht about the year 1736 being of those nationalities. In the 19th century, however, political considerations began seriously to diminish such intercourse between different centres, and during the first Napoleon's tenure of the imperial dignity the universities in both the "kingdom of Holland" and the Austrian Netherlands (as they were then termed) were in great peril. But on the settlement of Europe in 1814–15 the restoration of the house of Orange and consequent formation of the "kingdom of the Netherlands" brought both realms under a single rule. The universities of Franeker and Harderwijk were suppressed, and those of Ghent and Liége created, while a uniform constitution was given both to the Dutch and Belgian universities. It was also provided that there should be attached to each a board of curators, consisting of five persons, "distinguished by their love of literature and science and by their rank in society," to be nominated by the king, and at least three of them to be chosen from the province in which the university was situated, the other two from adjacent provinces. After the lapse of another fifteen years, however, the kingdom of the Netherlands having been reduced to its present limits and the kingdom of Belgium (identical for the most part with the Austrian Netherlands) newly created, an endeavour was made in dealing with the whole question of secondary education to give a fuller recognition to both traditional creeds and ethnic affinities. At Louvain, the chief Catholic centre, the faculties of law, medicine

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[1] *Statuta et Leges* (Franeker 1647), p. 3.

Brussels. **Amsterdam.**

and philosophy had already, in 1788, been removed to Brussels—an almost unique example of a university which owed its origin neither to a temporal nor an ecclesiastical authority—and in 1834 Brussels was constituted a free and independent university with a new fourth faculty of natural science, and supported mainly by contributions from the Liberal party. Having, however, no charter, it continued incapable by law of possessing property. While Louvain and Brussels thus represented to a great extent the two chief political parties in the realm, the universities of Ghent on the Scheldt and Liége on the Meuse recruited their students mainly from the two chief races—the Flemish and the Walloon. In Holland, on the other hand, where no such marked racial differences exist, the universities of Groningen, Leiden and Utrecht have been assimilated (1876) in constitution, each being administered by a consistory of five rectors with a senate composed of the professors in the respective faculties. The foundation of the university of Amsterdam (1877) more than repaired the loss of Franeker and Harderwijk, and the progress of this new centre during the first ten years of its existence was remarkably rapid. The higher education of women has made some progress in the Netherlands.

Universities of Sweden and Norway. **Lund.** **Upsala.** **Christiania.**

In Sweden the foundation of the university of Upsala, sanctioned in 1477 by Sixtus IV. as a studium generale on the model of Bologna, was followed at a long interval by that of Lund (1666), which was created during the minority of Charles XI. with statutes and privileges almost identical with those of Upsala and with an endowment largely derived from the alienated revenues of the chapter of the cathedral. The students were recruited from Denmark, Germany and Sweden; and Puffendorf, the civilian, was one of its first professors. During Charles's reign its resources were in turn confiscated, and the university itself was closed in 1676 in consequence of the war with Denmark. When again opened it remained for a long time in a very depressed condition, from which it failed to rally until the 19th century, when it took a new departure, and the erection of its handsome new buildings (1882) invested it with additional attractions. The royal university of Upsala, roused to new life in the 17th century by the introduction of the Cartesian philosophy, has been throughout (notwithstanding its singularly chequered history), the chief home of the higher Swedish education. In the 18th century lectures began to be delivered in Swedish; while the medieval division of the students into "nations" continued, as at Lund, until the second quarter of the 19th. The various changes and events during the interesting period 1872 to 1897 have been recorded at length in the national tongue by Reinhold Geijer in a handsome quarto which appeared in 1897. Gothenburg, on the other hand, with its society of science and literature, dating from 1841, has represented rather a popular institution, existing independently of the state, maintained chiefly by private contributions, and governed by a board called the *Curatorium*. For a long time it was not empowered to hold examinations. Stockholm (1878) still remains a gymnasium, but its curriculum is to a certain extent supplemented by its connexion with Upsala, from which it is little more than forty miles distant by rail. The university of Christiania in Norway, founded in 1811, and the Swedish universities are strongly Lutheran in character; and all alike are closely associated with the ecclesiastical institutions of the Scandinavian kingdoms. The same observation applies to Copenhagen—where, however, the labours of Rask and Madvig have done much to sustain the reputation of the university for learning.

Kiel.

The royal university of Kiel was founded in 1665 by Duke Christian Albrecht of Holstein (who himself assumed the office of rector) with faculties of theology, law, medicine and philosophy. It maintained its ground, although not without difficulty, amid the feuds that frequently arose between its dukes and the kings of Denmark, and under the rule of Catherine II. of Russia and after the incorporation of Schleswig-Holstein with the kingdom of Denmark made a marked advance. In the latter half of last century it acquired new buildings and rose into high reputation as a school of chemistry, physiology and anatomy, while its library in 1904 exceeded 250,000 volumes.

Genoa. **Messina.** **Marseilles.**

The number of universities founded in the last century is in striking contrast to the paucity which characterizes the two preceding centuries, an increase largely resulting, however, from the needs of English colonies and dependencies. In the Mediterranean, Genoa (1812), Messina (1838) and Marseilles (1854) were foundations which supplied a genuine want and have gradually attained to a fair measure of success. The first had previously existed as a school of law and medicine, but when, along with the rest of the Ligurian republic, it became incorporated in the empire under Napoleon I., the emperor, in order to conciliate the population, raised it to the rank of a university in 1812. The university subsequently fell into the hands of the Jesuits, who maintained their tenure of the principal chairs until the unification of the Italian kingdom under Victor Emmanuel, when Messina, which had been founded during the rule of the Bourbons over the Two Sicilies, became similarly included under Italian rule. Of Marseilles mention has above been made.

Dôle. **Dijon.**

In France the fortunes of academic learning were even less happy than in Germany. The university of Dôle in Franche Comté had for two hundred years been a flourishing centre of higher education for the aristocracy, and was consequently regarded with envy by Besançon. In 1691, however, when the country had been finally ceded to France, and Savoy had been subjugated by the arms of Catina, Louis XIV. was induced, on the payment of a considerable sum, to transfer the university to Besançon. Here it forthwith acquired enhanced importance under the direction of the Jesuits. But in 1722, on the creation of a university at Dijon, the faculty of law was removed to that city, where it continued to exist until the Revolution.

University of Paris from the 17th century.

The university of Paris indeed was distracted, throughout the 17th century, by theological dissensions—in the first instance owing to the struggle that ensued after the Jesuits had effected a footing at the Collège de Clermont, and subsequently by the strife occasioned by the teaching of the Jansenists. Its studies, discipline and numbers alike suffered. Towards the close of the century a certain revival took place, and a succession of illustrious names—Pourchot, Rollin, Grenan, Coffin, Demontempuys, Crevier, Lebeau—appear on the roll of its teachers. But this improvement was soon interrupted by the controversies excited by the promulgation of the bull Unigenitus in 1713, condemning the tenets of Quesnel, when Rollin himself, although a man of singularly pacific disposition, deemed it his duty to head the opposition to Clement XI. and the French episcopate. At last, in 1762, the parlement of Paris issued a decree (August 6) placing the colleges of the Jesuits at the disposal of the university, and this was immediately followed by another for the expulsion of the order from Paris, the university being installed in possession of their vacated premises. Concurrently with this measure, the curriculum of prescribed studies assumed a more hopeful character, and both history and natural science began to be cultivated with a certain success. These innovations, however, were soon lost sight of in the more sweeping changes which followed upon the Revolution. On the 15th of September 1793 the universities and colleges throughout France, together with the faculties of theology, medicine, jurisprudence and arts, were abolished by a decree of the convention, and the whole system of national education may be said to have remained in abeyance, until, in 1808, Napoleon I. promulgated the scheme which in its essential features is almost identical with that which at present obtains—the whole system of education, both secondary and primary, being made subject to the control and direction of the state. In pursuance of this conception, the "university of France," as it was henceforth styled, became little more than an abstract term[1] signifying collectively the various centres of professional education in their new relations to the state. All France was divided into seventeen districts, designated "academies," each administered by its own rector and council, but subject to the supreme authority of the minister of public instruction, and representing certain faculties which varied at different centres in conformity with the new scheme of distribution for the entire country.

Lille, Lyons and Rennes. While, accordingly, three new "academies"—those of Lille, Lyons and Rennes—date their commencement from 1808, many of the pre-existing centres were *completely suppressed.* In some cases, however, the effacement of an ancient institution was avoided by investing it with new importance, as at Grenoble; in others, the vacated premises were appropriated to new uses connected with the department, as at Avignon, Cahors and Perpignan. Each rector of an "academy" was also constituted president of a local *conseil d'enseignement*, in conjunction with which he nominated the professors of lycées and the communal schoolmasters,[2] these appointments being subsequently ratified by a promotion committee sitting in Paris. **Institution of "free faculties."** In 1895, however, the government was prevailed upon to sanction the institution of certain "free faculties," as they were termed, to be placed under the direction of the bishop, and depending for support upon voluntary contributions, and each including a faculty of theology. The faculty at Marseilles, on the other hand, which originated in an earlier "faculty of sciences" founded in 1854, was now called upon to share the governmental grant with Aix, and the two centres became known as the Académie d'Aix-Marseille—the faculties in the latter being restricted to mathematics and natural science (including a medical school), while faculties of law and philosophy were fixed at Aix, which possesses also the university library properly so termed. **Aix-Marseille.** In the capital itself, the university of Paris and the École Pratique des Hautes Études carried on the work of higher instruction independently of each other—the former with faculties of Protestant theology, law, medicine, science, letters and chemistry distributed over the Quartier Latin; the latter with schools of mathematics, natural science, history, philology, and history of religions centred at the Sorbonne.

Collège de France. The Collège de France, founded in the 16th century by Francis I., was from the first regarded with hostility both by the university and by the Sorbonne. It became, however, so highly esteemed as a school of gratuitous instruction in Latin, Greek and Hebrew, that it not only held its ground, but at the Revolution ultimately survived alike the universities and their hostility. As reconstituted in 1831 it became chiefly known as an institution for the instruction of adults, and its staff of professors, some fifty in number (including their deputies), has comprised from time to time the names of not a few of the most distinguished scholars and men of science in the country. **Strassburg.** The university of Strassburg, which in the latter part of the 18th century had been distinguished by an intellectual activity which became associated with the names of Goethe, Herder and others, was also swept away by the Revolution. It was revived in 1804 as a Protestant "academy," but four years later incorporated in the newly created "academy" of Nancy, with a faculty of Protestant theology which lasted only until 1818.

Switzerland. In Switzerland the universities shared in the conflicts handed down from the days when the Helvetic republic had been first created, and each with somewhat similar experiences. In 1832, Basel having joined the *Sarner Bund* or League of the Catholic Cantons, the Confederates divided the canton into two, and agreed to raise the flourishing Hochschule which already existed at Zürich to the rank of a university—a measure which may be said to mark a turning-point in the history of the higher education of the republic. **Zürich.** In 1839, however, the teaching of D. F. Strauss, who had been installed in the chair of theology at Zürich soon after his expulsion from Tübingen, gave rise to a popular demonstration which not only brought about the overthrow of the governing body, but placed the existence of the university itself in jeopardy. But the storm was successfully weathered, and in 1859 the statutes were revised and a considerable addition made to the professoriate. **Bern.** The gymnasium of Bern, originally established under the teaching of Ulrich Zwingli, developed in 1834 into a university with all the faculties, those of medicine and philosophy rising with the advance of the century into high repute. **Lausanne.** As early as 1586 Lausanne had been a noted school for the education of Protestant ministers, but it was not until 1806 that chairs of philosophy and law were established, to which those of natural science and literature were added in 1836, and, somewhat later, that of medicine. It was not, however, until 1891 that Lausanne was formally constituted a university. **Geneva.** At Geneva the famous academy of the 16th and 17th centuries, long distinguished as a centre of Calvinistic teaching, became merged in 1876 in a university, where the instruction (given mainly in the French language) was carried on by a staff of forty-one professors. With this was also incorporated an earlier school of science, in which De Saussure and De Candolle had once been teachers. **Fribourg.** Fribourg, founded in 1889 as a university of the canton so named, began with only two faculties—those of law and philosophy, to which one of theology was added in the following year. A certain spirit of innovation characterized most of the Swiss universities at this time, especially in connexion with female education. At Zürich, in 1872 (and somewhat later at Geneva and Bern), women were admitted to the lectures, and in 1892 were permitted themselves to lecture, a lady, Frau Dr Emilie Kempin, succeeding to the chair of Roman law. At Fribourg the proposition was first brought forward that all professors should be appointed only for a specified period, a limitation which along with other questions affecting the professorial body gave rise to much divergence of opinion.

In Spain the act of 1857 introduced a radical change similar to that in France, the whole system of education being placed under the responsible control of the minister for that department, while the entire kingdom was at the same time divided into ten university districts—Madrid, Barcelona, Granada, Oviedo, Salamanca, Santiago, Seville, Valencia, Valladolid and Saragossa—the rector of the universities in each district representing the chief authority. The degrees to be conferred at each were those of bachelor, licentiate and doctor. **Spain and Portugal.** Each university received a rector of its own, selected by the government from among the professors, and a precise plan of instruction was prescribed in which every hour had its appointed lecturer and subject. Philosophy, natural science, law and medicine were to be studied at all these universities, and at the majority a school of chemistry was subsequently instituted, except at Oviedo, which was limited to a faculty of law and a school for notaries. But at Salamanca, Valladolid, Seville and Saragossa no school of chemistry was instituted, and at the first three that of medicine ultimately died out. No provision was made for instruction in theology, this being relegated to the seminaries in the episcopal cities. The university of Manila in the Philippines was opened in 1601 as a school for the nobility, and ten years later the famous college of St Thomas was founded by the Dominican order; but it was not until 1857 that the university, properly speaking, was founded by royal Spanish decree. **Coimbra.** In Portugal, Coimbra, which narrowly escaped suppression in the 16th century and was removed from 1380 to 1537 to Lisbon, has long been a flourishing school. Its instruction is given gratis; but, as all members of the higher courts of judicature and administration in the realm are required to have graduated at the university, it is at the same time one of the most aristocratic schools in Europe. Of its five faculties, theology, jurisprudence, medicine, mathematics and philosophy, that of law is by far the most flourishing, the number of students in this faculty nearly equalling the aggregate of all the rest. In 1772 the university received new statutes and was to a great extent reorganized. There is a valuable library, largely composed of collections formerly belonging to suppressed convents. As a school of theology Coimbra has always been distinctly anti-ultramontane.

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[1] It retains a certain professional meaning, in that a student studying for the "university" is understood to be one who is himself aiming at the profession of a teacher in a *lycée*.

[2] The préfet of the department has since taken the place of the rector with regard to nominations.

Italy.

In Italy, as in Spain, education for the church has been relegated almost entirely to the numerous "seminaries," where it is of an almost entirely elementary character. In 1875 a laudable effort was made by R. Bonghi, the minister of education, to introduce reforms and to assimilate the universities in their organization and methods to the German type. His plans were, however, to a great extent reversed by his successor, Coppino.

Austria-Hungary. Vienna. Olmütz. Graz. Salzburg. Lemberg. Czernowitz.

In Austria the universities, being modelled on the same system as those of the German Empire, present no especially noteworthy features, except that the sphere of the functions of a rector corresponds precisely with that of the rector in those German universities which have no curator, and the faculties are represented by the ordinary professors as a body along with two representatives of the "Privatdozents." Vienna has long been chiefly distinguished for its school of medicine, which enjoyed in the last century a reputation almost unrivalled in Europe. The other faculties were, however, suffered to languish, and throughout the first half of the last century the whole university was in an extremely depressed state. From this condition it was in a great measure restored by the exertions of Count Thun. The university of Olmütz, founded in 1581, was formerly in possession of what is now the imperial library, and contained also a valuable collection of Slavonic works, which were carried off by the Swedes and ultimately dispersed. It was suppressed in 1853, and is now represented only by a theological faculty. The university of Graz, the capital of Styria, was founded in 1586, and has long been one of the most flourishing centres, with nearly 2000 students, chiefly in law and philosophy. The university of Salzburg, founded in 1623, was suppressed in 1810; that of Lemberg, founded in 1784 by the Emperor Joseph II., was removed in 1805 to Cracow and united to that university. In 1816 it was opened on an independent basis. In the bombardment of the town in 1848 the university buildings were burnt down, and the site was changed to what was formerly a Jesuit convent. The fine library and natural history museum were at the same time almost entirely destroyed. The most recent foundation is that of Czernowitz (1875), with faculties of theology (Greek Church), law and political economy, and philosophy.

Budapest. Klausenburg. Agram. Debreczen.

The universities of the Hungarian kingdom are three in number:—Budapest, originally founded at Tyrnau in 1635 under the auspices of the Jesuits, now possessing four faculties—theology, jurisprudence, medicine and philosophy (number of professors in 1903, 180; students, 3223); Kolozsvar (Klausenburg), the chief Magyar centre, founded in 1872 and also comprising four faculties, but where mathematics and natural science supply the place of theology; Zágráb (Agram), the Slovack university, in Croatia, originally founded by Maria Theresa in 1776 from some suppressed schools of the Jesuits, and reopened in 1874 with three faculties, viz. jurisprudence, theology and philosophy. The chief centre of Protestant education is the college at Debreczen, founded in 1531, which in past times was not infrequently subsidized from England. It has faculties of law and theology, courses of instruction in philosophy, and a school for teachers, and possesses a fine library.

Japan.

In Japan there are two imperial universities—Tokyo (1868) and Kioto (1897)—the former representing the union of two pre-existing foundations, on which occasion it was placed under the control of the minister of instruction with yearly grants from the treasury. The ordinary course of studies was limited to three years, that of medicine being extended to four. Kioto was formed out of four previously existing colleges of law, medicine, science and engineering.

Athens.

The "National University" of Athens (founded May 22, 1837) was modelled on the university systems of northern Germany, on a plan originally devised by Professor Brandis. It originally included only four faculties, viz. theology, jurisprudence, medicine and philosophy, to which one of applied mathematics was subsequently added.

Turkey and Bulgaria.

In European Turkey the university of Jassy (1860) in Rumania was founded by its ruler, Prince Cuza, and together with the newly founded university of Bucharest received its completed organization in 1864. Both were constituted state institutions and were represented in the senate, although not receiving any fixed revenues from the government. Its students are instructed and examined gratuitously. In the university of Sophia (1888) in Bulgaria, faculties were established, in the course of the ensuing four years, of history, philology, physics, mathematics and jurisprudence, the main object in view being the training of competent teachers of schools and of lawyers, and affording them the means of gaining an intelligent insight into the real wants of the native population. The university of Constantinople was founded in 1900 at the jubilee festival in honour of the sultan's succession to the throne. It included five faculties and was placed under the control of a director and sub-director, the former being invested with authority over teachers and scholars alike.

The English universities since the medieval period.

The history of the two English universities during the 16th and following centuries has presented, for the most part, features which contrast strongly with those of the continental seats of learning. Both suffered severely from confiscation of their lands and revenues during the period of the Reformation, but otherwise have generally enjoyed a remarkable immunity from the worst consequences of civil and political strife and actual warfare. Both long remained centres chiefly of theological teaching, but their intimate connexion at once with the state and with the Church of England, as "by law established," and the modifications introduced into their constitutions, prevented their becoming arenas of fierce polemical contentions like those which distracted the Protestant universities of Germany.

Influence of the Renaissance.

The influence of the Renaissance, and the teaching of Erasmus, who resided for some time at both universities, exercised a notable effect alike at Oxford and at Cambridge. The names of Colet, Grocyn and Linacre illustrate this influence at the former centre; those of Bishop Fisher, Sir John Cheke and Sir Thomas Smith at the latter.

The Reformation at Cambridge.

The labours of Erasmus at Cambridge, as the author of a new Latin version of the New Testament, with the design of placing in the hands of students a text free from the errors of the Vulgate, were productive of important effects, and the university became a centre of Reformation doctrine some years before the writings of Luther became known in England. The foundation of Christ's College (1505) and St John's College (1511), through the influence of Fisher with the countess of Richmond, also materially aided the general progress of learning at Cambridge. The Royal Injunctions of 1535, embodying the views and designs of Thomas Cromwell, mark the downfall of the old scholastic methods of study at both universities; and the foundation of Trinity College, Cambridge, in 1547 (partly by an amalgamation of two older societies), represents the earliest conception of such an institution in England in complete independence of Roman Catholic traditions. Trinity (1554) and St John's (1555) at Oxford, on the other hand, founded during the reactionary reign of Mary, serve rather as examples of a transitional period.

In the reign of Elizabeth Cambridge became the centre of another great movement—that of the earlier Puritanism, St John's and Queens' being the strongholds of the party led by Cartwright, Walter Travers and others. ***Puritanism at Cambridge.*** Whitaker, the eminent master of St John's, although he sympathized to some extent with these views, strove to keep their expression within limits compatible with conformity to the Church of England. But the movement continued to gather strength; and Emmanuel College, founded in 1584, owed much of its early prosperity to the fact that it was a known school of Puritan doctrine. Most of the Puritans objected to the discipline enforced by the university and ordinary college statutes—especially the wearing of the cap and the surplice and the conferring of degrees in divinity. ***Elizabethan statutes of 1570.*** The Anglican party, headed by such men as Whitgift and Bancroft, resorted in defence to a repressive policy, of which subscription to the Acts of Supremacy and Uniformity, and the Elizabethan statutes of 1570 (investing the "caput" with larger powers, and thereby creating a more oligarchical form of government), were the most notable results. Oxford, although the Puritans were there headed by Leicester, the chancellor, devised at the same time a similar scheme, the rigid discipline of which was further developed in the Laudian or Caroline statutes of 1636. ***Laudian statutes of 1636.*** It was under these respective codes—the Elizabethan statutes of 1570 and the Laudian statutes of 1636—that the two universities were governed until the introduction of the new codes of 1858. The fidelity with which both universities adhered to the royal cause in the Civil War caused them to be regarded with suspicion by the Puritan party, and under the Commonwealth both Oxford and Cambridge were for a brief period in great danger owing to the distrust, which culminated among the members of the "Nominated Parliament" (July–December 1653), of university education generally, as tending to foster contentiousness with respect to religious belief. It was even proposed by William Dell—himself the master of Caius College—to abolish the two universities altogether, as hopelessly pledged to antiquated and obsolete methods, and to establish in their place schools for the higher instruction throughout the country. They were saved, however, by the firmness of Cromwell, at that time chancellor of Oxford, and, although Aristotle and the scholastic philosophy no longer held their ground, a marked improvement was observable both in discipline and morality among the students, and the prescribed studies were assiduously pursued. At Oxford, under the influence and teaching of Dr Wilkins, Seth Ward and John Wallis, a flourishing school of mathematics was formed at a time when the study had died out at Cambridge.

After the Restoration Cambridge became the centre of a remarkable movement (a reflex of the influence of the Cartesian philosophy), which attracted for a time considerable attention. ***The Cambridge Platonist movement.*** Its leaders, known as the Cambridge Platonists, among whom Henry More, Cudworth and Whichcote were especially conspicuous, were men of high character and great learning, although too much under the influence of an ill-restrained enthusiasm and purely speculative doctrines. ***The Newtonian philosophy.*** The spread of the Baconian philosophy, and the example of a succession of eminent scientific thinkers, among whom were Isaac Barrow, master of Trinity (1673–77), the two Lucasian professors, Isaac Newton (prof. 1669–1702) and his successor William Whiston (prof. 1702–11), and Roger Cotes (Plumian prof. 1707–16), began to render the exact sciences more and more an object of study, and the institution of the tripos examinations in the course of the first half of the 18th century established the reputation of Cambridge as a school of mathematical science. At Oxford, where the study had in turn declined, and where the statutable requirements with respect to lectures and exercises were suffered to fall into neglect, the degeneracy of the whole community as a school of academic culture is attested by evidence too emphatic to be gainsaid. ***Methodism.*** The moral tone at both universities was at this time singularly low; and the rise of Methodism as associated with the names of the two Wesleys and Whitefield at Oxford and that of Berridge at Cambridge, operated with greater effect upon the nation at large than on either of the two centres where it had its origin. With the advance of the next century, however, a perceptible change took place. ***Simeonism. Tractarianism.*** The labours of Charles Simeon at Cambridge, in connexion with the Evangelical party, and the far more celebrated movement known as Tractarianism, at Oxford, exercised considerable influence in developing a more thoughtful spirit at either university. At both centres, also, the range of studies was extended: written examinations took the place of the often merely formal *viva voce* ceremonies; at Cambridge the study of the classics was raised in 1824 to the dignity of a new tripos. The number of the students at both universities increased, the matriculations at each rising to over four hundred. Further schemes of improvement were put forward and discussed. And in 1850 it was decided by the government to appoint commissioners to inquire what additional reforms might advantageously be introduced. ***Reforms of 1858.*** Their recommendations were not all carried into effect, but the main results were as follows: "The professoriate was considerably increased, reorganized and re-endowed, by means of contributions from colleges. The colleges were emancipated from their medieval statutes, were invested with new constitutions, and acquired new legislative powers. The fellowships were almost universally thrown open to merit, and the effect of this was not merely to provide ample rewards for the highest academical attainments, but to place the governing power within colleges in the hands of able men, likely to promote further improvements. The number and value of scholarships were largely augmented, and many, though not all, of the restrictions upon them were abolished. The great mass of vexatious and obsolete oaths was swept away; and, though candidates for the M.A. degree and persons elected to fellowships were still required to make the old subscriptions and declarations, it was enacted that no religious test should be imposed at matriculation or on taking a bachelor's degree."[1]

Admission of non-collegiate students. In 1869 a statute was enacted at Cambridge admitting students as members of the university without making it imperative that they should be entered at any hall or college, but simply be resident either with their parents or in duly licensed lodgings.

Abolition of tests. The entire abolition of tests followed next. After being rejected on several occasions in parliament it was eventually carried as a government measure, and passed the House of Lords in 1871.

Reforms of 1877. In 1877 the reports of two new commissions were followed by further changes, the chief features of which were the diversion of a certain proportion of the revenues of the colleges to the uses of the university, especially with a view to the encouragement of studies in natural science; the enforcement of general and uniform regulations with respect to the salaries, selection and duties of professors, lecturers and examiners; the abolition (with a few exceptions) of all clerical restrictions on headships or fellowships; and the limitation of fellowships to a uniform amount.

That these successive and fundamental changes were on the whole in unison with the national wishes and requirements may fairly be inferred from the remarkable increase in numbers at both universities, especially at Cambridge, where the number of undergraduates, which in 1862 was 1526, rose in 1887 to 2979. In the academic year 1862–63 the number of matriculations was 448, and in 1906–7 1083. ***Affiliated universities and colleges.*** The following universities and colleges, twenty-two in number, have since, in the order of their enumeration, sought and received the privilege of affiliation: University College, Nottingham; university of Sheffield; university of Adelaide; St David's College, Lampeter; university of Calcutta; university college of Wales, Aberystwyth; university of New Zealand; university of the Cape of Good Hope; university of Allahabad; Punjab University; university of Bombay; university of Toronto; St Edmund's College, Ware; university of Madras; university of Sydney; M'Gill University, Montreal; university of Tasmania; university of New Brunswick; Hartley University

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[1] Brodrick, *University of Oxford*, pp. 136, 137.

College, Southampton; University College of South Wales and Monmouthshire, Cardiff; university of King's College, Windsor, Nova Scotia; university of Queen's College, Kingston, Ontario.

Further changes at Oxford and Cambridge.

The changes introduced by the legislation of 1877 have been gradually carried out as the occurrence of vacancies in the colleges has made possible the appropriation of portions of their revenue for the foundation of professorships and other university purposes, though in some cases the intentions of the commissioners have been frustrated by the effects of agricultural depression upon college revenues. The general effect of the revolution has been a marked diminution in the clerical character of the college teaching bodies, the conversion of the college teaching staff from a temporary employment for bachelors awaiting livings or other preferment into a permanent profession, and the growth of a resident and working university professoriate. At the same time a change of almost equal significance has taken place in the teaching system of the university through the gradual growth of "inter-collegiate lectures." At Oxford nearly all honour lectures given by college tutors and lecturers have been thrown open to all members of the university: the college tutor is now recognized by the university as a teacher in the faculty to which he belongs, and the institution of boards of faculties has done something to bring the organization of the university into harmony with that of universities outside the British Isles.[1] At Cambridge the system of inter-collegiate lectures has also developed itself, but to a considerably smaller extent. At both the old English universities the great widening of the courses of study open to senior students (honour men), which began about the middle of the 19th century, has been continued, while there has been some widening and modernizing of the studies by which a pass or "poll" degree can be obtained. At Oxford there are now the following "Final Honour Schools": Litterae Humaniores (Classics, Ancient History and Philosophy), Mathematics, Natural Science, Jurisprudence, Modern History, Theology, Oriental Languages, English Literature; and at Cambridge there are the following "Triposes": Mathematics, Classics, Moral Sciences, Natural Sciences, Theology, Law, History, Oriental Languages, Medieval and Modern Languages, Mechanical Sciences (Engineering). Degrees in letters and science have also been instituted at both Oxford and Cambridge. The doctorate is given for original work. At Oxford the B.Litt. and B.Sc. can be taken by dissertation or original research, without passing the examination for B.A. At Cambridge the B.A. can be obtained in a similar manner by advanced students.

The strenuous efforts of both universities fully to meet the constantly increasing requirements of scientific education have necessitated appeals for public aid which have met with much generous response. Among the latest instances is that of the late Sir W. G. Pearce, who appointed to Trinity College, Cambridge, a certain trust fund over which he had a general power of appointment, and also bequeathed to the society the residue of a considerable estate.

Durham.

So long ago as the year 1640 an endeavour had been made to bring about the foundation of a northern university for the benefit of the counties remote from Oxford and Cambridge. Manchester and York both petitioned to be made the seat of the new centre. Cromwell, however, rejected both petitions, and decided in favour of Durham. Here he founded the university of Durham (1657), endowing it with the sequestered revenues of the dean and chapter of the cathedral, and entitling the society "The Mentor or Provost, Fellows and Scholars of the College of Durham, of the foundation of Oliver, &c." This scheme was cancelled at the Restoration, and not revived until the present century; but on the 4th July 1832 a bill for the foundation of a university at Durham received the royal assent, the dean and chapter being thereby empowered to appropriate an estate at South Shields for the establishment and maintenance of a university for the advancement of learning. The foundation was to be directly connected with the cathedral church, the bishop of the diocese being appointed visitor, and the dean and chapter governors; while the direct control was vested in a warden, a senate and a convocation. A college, modelled on the plan of those at the older universities, and designated University College, Durham, was founded in 1837, Bishop Hatfield's Hall in 1846, and Bishop Cosin's Hall (which no longer exists) in 1851. The university includes all the faculties, and in 1865 there was added to the faculty of arts a school of physical science, including pure and applied mathematics, chemistry, geology, mining, engineering, &c. In 1871 the corporation of the university, in conjunction with some of the leading landed proprietors in the adjacent counties, gave further extension to this design by the foundation of a college of physical science at Newcastle-upon-Tyne (subsequently designated Armstrong College), designed to teach scientific principles in their application to engineering, mining, manufactures and agriculture. Students who had passed the required examinations were made admissible as associates in physical science of the university. There is also at Newcastle the College of Medicine which stands in similar relations to Durham, of which university Codrington College, Barbados, and Fourah Bay College, Sierra Leone, are likewise affiliated colleges.

University of London.

The university of London had its origin in a movement initiated in the year 1825 by Thomas Campbell, the poet, in conjunction with Henry (afterwards Lord) Brougham, Mr (afterwards Sir) Isaac Lyon Goldsmid, Joseph Hume and some influential Dissenters, most of them connected with the congregation of Dr Cox of Hackney. The scheme was originally suggested by the fact that Dissenters were practically excluded from the older universities; but the conception, as it took shape, was distinctly non-theological. The first council, appointed December 1825, comprised names representative of nearly all the religious denominations, including (besides those above mentioned) Zachary Macaulay, George Grote, James Mill, William Tooke, Lord Dudley and Ward, Dr Olinthus Gregory, Lord Lansdowne, Lord John Russell and the duke of Norfolk. On 11th February 1826 the deed of settlement was drawn up; and in the course of the year seven acres, constituting the site of University College, were purchased, the foundation stone of the new buildings being laid by the duke of Sussex 30th April 1827. The course of instruction was designed to include "languages, mathematics, physics, the mental and the moral sciences, together with the laws of England, history and political economy, and the various branches of knowledge which are the objects of medical education." In October 1828 the college was opened as the university of London. But in the meantime a certain section of the supporters of the movement, while satisfied as to the essential soundness of the primary design as a development of national education, entertained considerable scruples as to the propriety of altogether dissociating such an institution from the national church. This feeling found expression in the foundation and incorporation of King's College (14th August 1829), opened 8th October 1831, and designed to combine with the original plan instruction in "the doctrines and duties of Christianity, as the same are inculcated by the United Church of England and Ireland." This new phase of the movement was so far successful that in 1836 it was deemed expedient to dissociate the university of London from University College as a "teaching body," and to limit its action simply to the institution of examinations and the conferring of degrees—the college itself receiving a new charter, and being thenceforth designated as University College, London, while the rival institution was also incorporated with the university, and was thenceforth known as King's College, London. In the charter now given to the university it was stated that the king "deems it to be the duty of his royal office to hold forth to all classes and denominations of his faithful subjects, without any distinction whatsoever, an encouragement for pursuing a regular and liberal course of education." The charters of the university of London and of University College, London, were signed on the same day, 28th November 1836. In 1869 both the colleges gave their adhesion to the movement for the higher education of women which had been initiated elsewhere, and in 1880 women were for the first time admitted to degrees.

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[1] The proposed reforms initiated by Lord Curzon as chancellor of Oxford University, though largely administrative, may be mentioned here. In 1909 he issued his "Principles and Methods of University Reform." Committees of Council were formed to prepare definite schemes in the various directions indicated, and in 1910 a volume on the subject was issued to the members of Congregation. It was proposed, *inter alia*, to make Greek an optional subject in Responsions, thus foreshadowing changes in Moderations and final schools. Responsions itself was to be replaced by an entrance examination, though it has long practically served as such. The creation of "a diploma specially suitable for candidates contemplating a commercial career" was recommended. Additional provision to assist poor students, including the resignation of their emoluments by non-necessitous students in favour of exhibition funds for necessitous students in the colleges, and changes in the system of college fellowships, with especial reference to the encouragement of research in combination with tutorial work, were also indicated. Among purely administrative reforms, besides certain changes in the rules governing eligibility to the Hebdomadal Council and Congregation, it was proposed to reconstitute the method of election to and membership of the boards of faculties, at the same time creating a general board of the faculties, to control the individual boards, and to "relieve the Hebdomadal Council of the greater part of the business connected with *curricula* and examinations." A finance board was proposed to review the accounts of the university, all university institutions and colleges, and to act in an advisory and supervisory capacity. [Ed.]

By the University of London Act 1898, and the statutes of the commissioners named therein (issued in 1900), the university of London was reconstituted. The senate is composed of the chancellor and fifty-four members, of whom four are appointed by the king in council, sixteen by the convocation (*i.e.* doctors and proctors) of the university, sixteen by the various faculties, and the remainder by various public bodies or institutions. The senate is the supreme governing body, and has three standing committees, of which one is the academic council for "internal students," another the council for "external students" and the third a board to promote the extension of university teaching. Provision is made for the appointment of professors and other teachers by the university itself, and also for the recognition as teachers of professors and others teaching in such institutions in or near London as may be recognized as schools of the university. The following bodies are constituted schools of the university: University College and King's College, London; the Royal Holloway College, Egham, Bedford College, London, and Westfield College, Hampstead (colleges for women); the Imperial College of Science and Technology; the medical schools of the principal London hospitals; the London School of Economics and Political Science; the South-Eastern Agricultural College, Wye; the Central Technical College of the City and Guilds of London Institute, and the East London College; and several theological colleges. The "appointed" and "recognized" teachers in each group of subjects form the various faculties of the university. Of these there are eight—theology, arts, law, music, medicine, science, engineering, economics and political science (including commerce and industry). Each faculty elects its dean. Courses of study are to be provided by the university for its "internal" students, *i.e.* those who pursue their studies in one of the schools of the university. Its degrees remain open to "external" students as heretofore, but separate examinations are in future to be held for "internal" and for "external" students respectively, and the senate is to "provide that the degrees conferred upon both classes of students shall represent, as far as possible, the same standard of knowledge and attainments." The whole scheme may be described as a compromise between the views of various schools of reformers—as an attempt to create a teaching university without destroying the existing purely examining university or erecting two distinct universities of London, and at the same time, without any immediate endowments, to create a university which might hereafter expand by utilizing existing institutions. One of the most important of these, King's College, it may be observed, has, without losing its connexion with the Church of England, abandoned its theological test for members of its teaching body.

The university of Manchester.

The Owens College, Manchester—so called after a wealthy citizen of that name, to whom it owed its foundation—was founded on the 12th of March 1851, for the purpose of affording to students who were unable, on the ground of expense, to resort to Oxford or Cambridge, an education of an equally high class with that given at those centres. The institution was, from the first, unsectarian in character; and, for more than a quarter of a century, students desirous of obtaining a university degree availed themselves of the examinations conducted by the university of London. In July 1877, however, a memorial was presented to the privy council petitioning for the grant of a charter whereby the college should be raised to the rank of a university with power to grant degrees. This petition having received a favourable hearing, it was at first decided that the new university should be styled the university of Manchester, and the New University College at Liverpool and the Yorkshire College at Leeds were invited to become affiliated institutions. But before the charter was issued, exception having been taken to the localization implied in the above title, it was resolved that the new institution should be styled the "Victoria University of Manchester," and under this name the university on the 20th of April 1880 received its charter. Since then, however, not only Liverpool (1881) and Leeds (1904), but the Mason University College at Birmingham (1900) and the University College at Sheffield (1905) have aspired to and attained like independence. The academic authorities at Manchester have accordingly since preferred, in other than legal documents, to revert to the original designation of the "university of Manchester."

Changes in universities of Scotland.

In Scotland the next change to be noted in connexion with the university of St Andrews is the appropriation in 1579 of the two colleges of St Salvator and St Leonard to the faculty of philosophy, and that of St Mary to theology. In 1747 an act of parliament was obtained for the union of the two former colleges into one, while in 1880 the university college at Dundee was instituted as a general school both of arts and science in similar connexion. Glasgow, in the year 1577, received a new charter, and its history from that date down to the Restoration was one of almost continuous progress. The re-establishment of episcopacy, however, involved the alienation of a considerable portion of its revenues, and the consequent suspension of several of its chairs. With the Revolution of 1689 it took a new departure, and several additional chairs were created. In 1864 the old university buildings were sold, and a government grant having been obtained, together with private subscriptions, new buildings were erected from the joint fund. By the act of 1858 important measures were passed in connexion with all the four universities. In Aberdeen, King's College and Marischal College, with their independent powers of conferring degrees, were amalgamated. In Glasgow the distribution of the "nations" was modified in order more nearly to equalize their respective numbers. The right of returning two members of parliament was bestowed on the four universities collectively—one representing Aberdeen in conjunction with Glasgow, the other Edinburgh in conjunction with St Andrews. Other important changes were enacted, which, however, became merged in turn in those resulting from the commission of 1889, whereby, after investigations extending over nearly ten years, a complete transformation was effected of both the organization and the curriculum of each university.

The government was transferred from the senatus to the courts, which were enlarged so as to include representatives from the senatus, the general councils of graduates, and the municipality within which the university is situated. In addition to these representatives, the principal, the lord rector, his assessor, the chancellor's assessor, and the lord provosts of the cities of Aberdeen, Edinburgh and Glasgow, and the provost of St Andrews have seats in the courts of their respective universities. The provost of Dundee occupies a seat in the university court of St Andrews. The lord rector is the president of the court. To the court is entrusted the management of the property and finances, and, in most cases, such patronage as does not belong to the crown; but in the case of Edinburgh, the patronage of some of the older chairs is in the hands of a body of curators. Disciplinary powers are retained by the senatus, and the general council remains, as under the act of 1858, a purely advisory body. Another advisory body—the students' representative council—was added by the commission. The curriculum of all the faculties (except divinity) was reorganized: the most important alterations consisted in the abolition of the once sacred six as compulsory subjects in arts (Latin, Greek, Mathematics, Natural Philosophy, Logic and Moral Philosophy).[1] The curriculum was greatly widened, an elaborate scheme of "options" introduced, and a new system of honours degrees was established. The length of residence required was reduced from four years to three, and the courts were empowered to institute summer sessions, and to admit women to lectures and degrees in all faculties.

There has been since the act of 1858 a great development of student life, illustrated by the institution of student's unions in all four universities, by the publication of undergraduate magazines, and by the growth, in Edinburgh, of combined residences and settlements.

Parliamentary grants to Scottish universities.

All the four universities of Scotland were aided from time to time in the last century by grants from government, and in 1905 received a material addition to their resources by the magnificent donation of £2,000,000 from Mr Carnegie.

Trinity College, Dublin.

Trinity College, Dublin, was founded in 1591, under the auspices of Sir John Perrot, the Irish viceroy. A royal charter nominated a provost and a minimum number of three fellows and three scholars as a body corporate, empowered to establish among themselves "whatever laws of either of the universities of Cambridge or Oxford they may judge to be apt and suitable; and especially that no other persons should teach or profess the liberal arts in Ireland without the queen's special licence." The first five provosts of Trinity College were all Cambridge men, and under the influence of Archbishop Loftus, the first provost, and his successors, the foundation received a strongly Puritan bias. The original statutes were mainly the work of Temple, the fourth provost, modified by Bedell, the eminent bishop of Kilmore, and the policy of Laud and Wentworth was to make the college more distinctly Anglican as regards its tone and belief. At the Restoration its condition was found to be that of a well-ordered home of learning and piety, with its estates well secured and its privileges unimpaired. Under Bishop Jeremy Taylor, who succeeded to the vice-chancellorship, its progress in learning was considerable, and the statutes underwent a further modification. Prior to the year 1873 the provostship, fellowships and foundation scholarships could be held only by members of the Church of Ireland; but all such restrictions were abolished by Act 36 Vict. c. 21, whereby the requirement of subscription to any article or formulary of faith was finally abrogated.

Queen's University.

Royal University of Ireland.

Colleges at Belfast, Cork, and Galway.

University of Dublin.

The first departure from the above exclusive system dates from the creation of the Queen's University, incorporated by royal charter on the 3rd of September 1850. By this charter the general legislation of the university, together with its government and administration, was vested in the university senate. In 1864 the charter of 1850 was superseded by a supplementary charter, and the university reconstituted "in order to render more complete and satisfactory the courses of education to be followed by students in the colleges"; and finally, in 1880, by virtue of the act of parliament known as the University Education (Ireland) Act 1879, the Queen's University gave place to the Royal University of Ireland, which was practically a reconstitution of the former foundation, the dissolution of the Queen's University being decreed so soon as the newly constituted body should be in a position to confer degrees; at the same time all graduates of the Queen's University were recognized as graduates of the new university with corresponding degrees, and all matriculated students of the former as entitled to the same status in the latter. The university confers degrees in arts (B.A., M.A., D.Litt.), science, engineering, music, medicine, surgery, obstetrics and law. The preliminary pass examinations in arts were to be held at annually selected centres,—those chosen in 1885 being Dublin, Belfast, Carlow, Cork, Galway, Limerick and Londonderry—all honour examinations, and all examinations in other faculties, in Dublin. The Queen's Colleges at Belfast, Cork and Galway were founded in December 1845, under an act of parliament "to enable Her Majesty to endow new colleges for the advancement of learning in Ireland," and were subsequently incorporated as colleges of the university. Their professors were at the same time constituted professors in the university, and conducted the examinations. But in the reconstruction of 1880 the chief share in the conduct of the examinations and advising the senate with respect to them was vested in a board of fellows, elected by the senate in equal numbers from the non-denominational colleges and the purely Roman Catholic institutions. The colleges retained, however, their independence, being in no way subject to the control of the university senate except in the regulations with respect to the requirements for degrees and other academic distinctions. In 1907 a scheme was projected by Mr Bryce (then chief secretary for Ireland) for reconstructing the university, whereby Trinity College was to become merged in a new "University of Dublin," in which the Queen's Colleges and a new college for Roman Catholics were also to be included. The control of the entire community was to be vested in a board, partly nominated by the crown and partly by the colleges and the general body of students. The scheme, however, was strongly opposed by the Dublin University Defence Committee on the ground that the ideals which had hitherto dominated the aims and teaching of Trinity College were incompatible with a system in which regard for the principle of authority and the repudiation of scientific theorization (as it finds expression in the *Index*) are leading features. On the other hand, the Irish bishops, while admitting the need for more efficient scientific instruction of the Catholic youth throughout their respective dioceses, declined to give support to measures whereby such students would be attracted into an atmosphere inimical to their religious faith. It was consequently next proposed by the government to establish two new universities—one in Dublin (side by side with Trinity College) and one in Belfast—in which, although no religious tests were to be enforced, it should be tacitly agreed that the former was to be the resort for Catholics, the latter for Presbyterians, Trinity College remaining, as before, the recognized Episcopalian centre. To this considerable exception was taken—the nonconformists, more especially, maintaining that such an arrangement could not fail to be prejudicial to the higher interests of the people by imparting to education a denominational bias which it was most desirable to avoid—and eventually Mr Birrell's measure was brought forward and ultimately adopted, whereby Trinity College has been left intact, but two new universities were created, one in Dublin and one in Belfast, the former involving the erection of another college (towards the expense of which the government was pledged to contribute) and the incorporation of the Queen's Colleges at Cork and Galway; while the college in Belfast was to form the nucleus of the second university. In order further to ensure their representative character, the new university of Dublin had a nominated senate of 36 members, of whom all but seven were to be Roman Catholics; that of Belfast had a similar body, of whom all but one were to be Protestants. In all these new centres there were to be no religious tests either for professors or students. On the other hand, the obligation formerly imposed of a preliminary course of study at one or other of the colleges before admission to degrees had been abolished at the foundation of the Royal University, the examinations being now open, like those of the university of London, to all matriculated students on payment of certain fees.

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[1] At Edinburgh there was a *seventh*, viz. rhetoric and English literature.

Wales.

The university of Wales, which received the royal charter in 1893, incorporated three earlier foundations—the university colleges of Aberystwyth, Bangor and Cardiff. St David's College at Lampeter was founded in 1822 for the purpose of educating clergymen in the principles of the established Church of England and Wales, mainly for the supply of the Welsh dioceses, but, although affiliated to both Oxford and Cambridge, retained its independence and also the right of conferring the degrees of bachelor of arts and of divinity. Bangor in North Wales, on the other hand, which received its charter in 1885, is designed to "provide instruction in all the branches of a liberal education except theology."

India.

In India the three older universities all date from 1857—that of Calcutta having been incorporated January 24, Bombay July 18, Madras September 5, in that year. At these three universities the instruction is mainly in English. "A university in India is a body for examining candidates for degrees, and for conferring degrees. It has the power of prescribing text-books, standards of instruction, and rules of procedure, but is not an institution for teaching. Its governance and management are vested in a body of fellows, some of whom are *ex officio*, being the chief European functionaries of the state. The remainder are appointed by the Government, being generally chosen as representative men in respect of eminent learning, scientific attainment, official position, social status or personal worth. Being a mixed body of Europeans and natives, they thus comprise all that is best and wisest in that division of the empire to which the university belongs, and fairly represent most of the phases of thought and philosophic tendencies observable in the country. The fellows in their corporate capacity form the senate. The affairs of the university are conducted by the syndicate, consisting of a limited number of members elected from among the fellows. The faculties comprise arts and philosophy, law, medicine and civil engineering. A degree in natural and physical science has more recently been added" (Sir R. Temple, *India in 1880*, p. 145). The Punjab University was incorporated in 1883—the Punjab University College, prior to that date, having conferred titles only and not degrees. The main object of this university is the encouragement of the study of the Oriental languages and literature, and the rendering accessible to native students the results of European scientific teaching through the medium of their own vernacular. The Oriental faculty is here the oldest, and the degree of B.O.L. (bachelor of Oriental literature) is given as the result of its examinations. At the Oriental College the instruction is given wholly in the native languages, and the success of the institution was sufficiently demonstrated before the close of the 19th century by the fact that twelve centres of instruction at Lahore and elsewhere had been affiliated. The university of Allahabad was founded in 1887 as an examining university for the united provinces of Agra and Oudh. In 1887 the senate at Cambridge (mainly on the representations of Mr C. P. Ilbert, formerly vice-chancellor of the university of Calcutta) adopted resolutions whereby some forty-nine collegiate institutions already affiliated to the latter body were affiliated to the university of Cambridge, their students becoming entitled to the remission of one year in the requirements with respect to residence at Cambridge.

Australasia.

In Australia the university of Sydney was incorporated by an act of the colonial legislature which received the royal assent 9th December 1851, and on 27th February 1858 a royal charter was granted conferring on graduates of the university the same rank, style and precedence as are enjoyed by graduates of universities within the United Kingdom. Sydney is also one of the institutions associated with the university of London from which certificates of having received a due course of instruction may be received with a view to admission to degrees. The design of the university is to supply the means of a liberal education to all orders and denominations, without any distinction whatever. An act for the purpose of facilitating the erection of colleges in connexion with different religious bodies was, however, passed by the legislature during the session of 1884, and since that time colleges representing the Episcopalian, Presbyterian and Roman Catholic Churches have been founded. In the same year women were first admitted to degrees, and subsequently became an appreciable element, numbering before the close of the 19th century one-fifth of the entire number of students. The university of Melbourne, in the state of Victoria, was incorporated and endowed by royal act on the 22nd of January 1853. This act was amended on the 7th of June 1881. Here also no religious tests are imposed on admission to any degree or election to any office. The council is empowered, after due examination, to confer degrees in all the faculties (excepting divinity) which can be conferred in any university within the British dominions. It is also authorized to affiliate colleges; and Trinity College (Church of England), Ormond College (Presbyterian) and Queen's College (Methodist) were all established in the 19th century. The university of Adelaide in South Australia (founded mainly by the exertions and munificence of Sir Walter Watson Hughes) was incorporated by an act of the colonial legislature in 1874, in which year it was further endowed by Sir Thomas Elder. In 1881 degrees conferred by the university were constituted of equal validity with those of any university of the United Kingdom. The university of Tasmania at Hobart was founded in 1890 by act of parliament as a state university with an annual grant, and was subsequently affiliated both to Oxford and Cambridge.

The university of New Zealand, founded in 1870, and reconstituted in 1874 and 1875, was empowered by royal charter to grant the several degrees of bachelor and master of arts, and bachelor and doctor in law, medicine and music. Women have since been made admissible to degrees. To this university, University College at Auckland, Canterbury College at Christchurch, and the university of Otago at Dunedin have successively been admitted into connexion as affiliated institutions, while the university of New Zealand itself has become affiliated to that of Cambridge. Otago was founded in 1869 by an order of the provincial council, with the power of conferring degrees in arts, medicine and law, and received as an endowment 100,000 acres of pastoral land. It was opened in 1871 with a staff of three professors, all in the faculty of arts. In 1872 the provincial council further subsidized it by a grant of a second 100,000 acres of land, and the university was thereby enabled to establish a lectureship in law, and to lay the foundations of a medical school. In 1874 an agreement was made between the university of New Zealand and that of Otago, whereby the functions of the former were restricted to the examination of candidates for matriculation, for scholarships and for degrees; while the latter bound itself to become affiliated to the university of New Zealand and to hold in abeyance its power of granting degrees. As the result of this arrangement, the university of Otago became possessed of 10,000 acres of land which had been set apart for university purposes in the former province of Southland. In 1877 a school of mines was established in connexion with the university.

Canada.

Prior to the union of the two provinces of Lower and Upper Canada, the M'Gill College and University in the former province had been instituted in Montreal by royal charter in 1821, on the foundation of the Honourable James M'Gill, who died in that city on the 19th of December 1813. It was designed to be Protestant but undenominational. With this a group of colleges in the same province—the Stanstead Wesleyan, Vancouver, Victoria, and King's—have since become associated as affiliated institutions, as also have the four Protestant colleges in Montreal itself, such affiliation, however, extending no further than the examinations in the faculty of arts. Into similar relation the Université Laval in Quebec, founded as a Catholic university in 1852, was admitted in 1878. Notwithstanding the difficulties presented by divergencies of race, Montreal has prospered during the chancellorship of Lord Strathcona, and numbers over 1100 students. The university of Toronto in Upper Canada, or Ontario, was originally established by royal charter in 1827, under the title of King's College, with certain religious restrictions, but in 1834 these restrictions were abolished. In 1849 the designation of the university was changed into that of the university of Toronto, and the faculty of divinity was abolished. In 1853 the university was constituted with two corporations, "the university of Toronto" and "University College," the latter being restricted to the teaching of subjects in the faculty of arts. In 1873 further amendments were made in the constitution of the university. The chancellor was made elective for a period of three years by convocation, which was at the same time reorganized so as to include all graduates in law, medicine and surgery, all masters of arts, and bachelors of arts of three years' standing, all doctors of science, and bachelors of science of three years' standing. The powers of the senate were also extended to all branches of literature, science and the arts, to granting certificates of proficiency to women, and to affiliating colleges. The whole work of instruction was now assigned to University College, which is maintained out of the endowment of the provincial university, and governed by a council composed of the residents and the professors. Its several chairs include classical literature, logic and rhetoric, mathematics and natural philosophy, chemistry and experimental philosophy, history and English literature, mineralogy and geology, metaphysics and ethics, meteorology and natural history, and lectureships on Oriental literature, German and French. Trinity College, in the same university, is the Church of England college, founded in 1852 in consequence of the above-mentioned suppression of the theological faculty. Other universities and colleges with power to confer degrees are the Dalhousie College at Halifax, which obtained the rights of a university in 1841 and was subsequently organized as such in 1863, with the governor of Nova Scotia as supreme authority; the Victoria University at Cobourg (1836), supported by the Methodist Church of Canada; Queen's University, Kingston (1841).

In South America the beginning of the "national university" of Buenos Aires may be assigned (in the absence of any charter) to about the year 1890. Before the close of the century it had become a flourishing school of law, medicine and the exact sciences,

South America.

with professors in all the faculties and considerably over 2000 students. Monte Video in Uruguay had its origin in a faculty of medicine established in 1876, with courses of study extending over six years. It is here imperative when the diploma is taken by those who are not natives that it should be attested by the consul of their own country. Faculties of law and mathematics were subsequently created, and also a faculty of preparatory studies corresponding with the gymnasium or *Realschule* of Germany. The new "national university of La Plata" has recently (1905–1908) been opened in the city of that name, under the auspices of the university of Philadelphia. It claims to be the exponent of the most advanced theories in relation to subjects and methods of instruction and to university extension. In the north of the continent the academy at Caracas is little more than a branch of the royal Spanish academy for education in the Spanish language, and is subsidized by the Venezuelan government.

South Africa.

The university of the Cape of Good Hope (see CAPE COLONY) grants degrees, but is not a teaching institution. An inter-state commission, appointed in 1907, recommended the establishment of a Federal University for South Africa with constituent colleges. While the colleges would possess freedom in management and teaching, it was recommended that the university should test all candidates seeking admission to the colleges and for the final examinations for degrees, &c. At the opening of the first Union parliament in November 1910 the ministry announced that a scheme for a national South African University would be submitted. It was also announced that the Beit bequest of £200,000 for a university at Johannesburg (*q.v.*) would be diverted towards the creation of a teaching university at Groote Schuur, and that Sir Julius Wernher would make a donation towards it of £300,000.

In 1903 a highly influential conference was held at Burlington House to promote closer relations between British and colonial universities, the sittings being presided over by Mr Bryce, Lord Strathcona and Sir Gilbert Parker. The conference held that Great Britain should help the colonial universities to co-operate one with another, and increase their own efficiency by combination and specialization. (J. B. M.)

Universities in the United States.

Origins.

In the United States the word "university" has been applied to institutions of the most diverse character, and it is only since 1880 or thereabouts that an effort has been seriously made to distinguish between collegiate and university instruction; nor has that effort yet completely succeeded. Harvard, William and Mary, and Yale, the three pioneers of colonial times, were organized in the days of colonial poverty, on the plans of the English colleges which constitute the universities of Oxford and Cambridge. Graduates of Harvard and Yale carried these British traditions to other places, and similar colleges grew up in New York, New Jersey, Pennsylvania, New Hampshire and Rhode Island, and later in many other states. The underlying principle in these institutions was discipline—mental, moral and religious. Dormitories and commons were provided, and attendance upon religious worship in the chapel was enforced. Harvard and Yale were the children of the Congregational churches, Columbia was fostered by the Episcopalians, Princeton by the Presbyterians, Rutgers by the Dutch Reformed and Brown by the Baptists. Around or near these nuclei, during the course of the 19th century, one or more professional schools were frequently attached, and so the word "university" was naturally applied to a group of schools associated more or less closely with a central school or "college." Harvard, for example, most comprehensive of all, has seventeen distinct departments, and Yale has almost as many. Columbia and Pennsylvania have a similar scope. In the latter part of the 19th century Yale, Columbia, Princeton and Brown, in recognition of their enlargement, formally changed their titles from colleges to universities. The ecclesiastical, or religious, note was a strong characteristic of these foundations. Protestant evangelical doctrines were taught with authority, especially among the undergraduates, who were spoken of as constituting "the college proper." In the oldest and largest colleges this denominational influence has ceased to have the importance it once possessed.

Noteworthy innovations came when Thomas Jefferson, the philosophical statesman, returned to the United States from France, emancipated from some of the narrow views by which his countrymen were bound. He led the Virginians to establish, on a new plan, the university of Virginia as a child of the state; and the freshness of his advice, the importation of distinguished foreign teachers, and the freedom of the student from an enforced curriculum awakened admiration and emulation on the one hand, and animadversion on the other. But this university unquestionably led to broad conceptions of academic work, which appeared foreign and even questionable, if not irreligious, to the colonial universities already mentioned, although many of the features which were then regarded as doubtful peculiarities are now familiar everywhere. Following Virginia's example, many of the new states in the West established state universities, most of which included a central college of the colonial type and afterwards one or more professional schools. Freedom from ecclesiastical control is found in all the foundations that make up this second group—the state universities. Michigan, Wisconsin, Minnesota and California present distinguished examples of such organizations. In earlier days, Maryland, North and South Carolina, Georgia and other states of the South had anticipated in a limited way the state support of higher education which was made so conspicuous in Virginia. In their plans of education, intellectual and moral, they adhered closely to the college methods which the Northern institutions had introduced from English antecedents. Since 1865 another class of universities has arisen, quite distinct from the colonial establishments and from the wards of the state. These are independent foundations due to individual generosity. The gifts of Cornell, Johns Hopkins, Rockefeller (University of Chicago), Tulane, De Pauw, Clark and Leland Stanford have brought into being universities which have no dependence upon state control,[1] and when a denominational character is assured this fact is not made prominent.

Thus, looking at their origin, we see three impulses given to American high schools, from churches, states and individuals. It is true that all receive from the state some degree of authority as incorporations, but this authority is so easily obtained that in a single city there may be, and in some places there are, several incorporations authorized to bestow degrees and to bear the name of universities. A foreigner cannot understand nor can an American justify this anomaly. The most that can be said for it is that there is complete freedom of organization, and that the best, and only the best, are likely to survive. Another influence, proceeding from the national government, must also be borne in mind. During the Civil War, Congress, led by Senator Morrill of Vermont, bestowed upon every state a certain portion of the public domain in the Far West—"land-scrip," as it was called—the proceeds of its sale to be devoted to the establishment and maintenance of one or more colleges in each state, where instruction should be given in agriculture and the mechanic arts, not excluding liberal studies, and including military tactics. In some states this bounty was directed to existing universities. New departments were organized in old institutions. Elsewhere new institutions were created. While all these schools were regarded as practical and technical at the first, most of them as they developed became liberal and scientific; and when Congress made later large appropriations for "experiment stations" in the sciences relating to agriculture, an impulse of the most valuable character was given to many departments of scientific research.

This sketch would not be complete without the mention of two foundations, each unique. The Catholic University in Washington has been created by the pope, and in its government the hierarchy of the Roman Catholic Church is made dominant. Already the Roman Catholics had established, especially under the charge of the Jesuit fathers and of the Sulpicians, excellent colleges for liberal education, as well as schools of theology; but the newer metropolitan university was distinctly organized on a broader plan, in closer accordance with the universities of continental Europe, and with a pronounced recognition of the importance of science. The university of the State of New York is a supervisory (not a teaching) body exercising a general control over all the schools of higher instruction in the state, and especially guarding the conditions upon which degrees are conferred.

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[1] Cornell, however, received New York's share of the Congressional land grant of 1862, and the state is represented on its board of trustees. See CORNELL UNIVERSITY.

Organization.

Professional schools.

The interior organization of these institutions may now be considered. Some of them have but one department, the philosophical, which includes the liberal arts and sciences; others have two, three or many correlated departments. Clark University, for example, has but one faculty, the philosophical; Harvard, as already stated, has many departments, including philosophy, law, medicine and theology. So has Yale. Princeton has four. Johns Hopkins has two, the philosophical and the medical. In most American universities a sharp distinction is made between undergraduates and graduates, between those who are candidates for the baccalaureate degree (A.B., S.B., and Ph.B.) and those who are engaged in higher professional study, like law, medicine and theology, or in the manifold branches of modern science, like philology, historical and political science (including economics), philosophy (including logic, ethics and psychology), mathematics, physics, chemistry, biology, geology, &c. In certain places, as at Johns Hopkins, since 1876, emphasis is given to the idea that college instruction is disciplinary, requiring definite, but not uniform methods, and a certain deference to the authority of a master; while university instruction is much freer, and the scholar is encouraged to inquire rather than to accept; to test and observe rather than to hear and recite; to walk with a friendly guide rather than to obey a commander. This distinction is not universally recognized. Indeed, it has been made but recently in American institutions, so that older men are often heard asking, " What is the difference between a college and a university? " But generally it is admitted that college training is one thing, and work in a university is another; that thorough instruction in language, history, mathematics, natural and physical sciences, and in morals, should precede the discipline of professional schools and the pursuit of the higher and more advanced studies in letters and science. In a complete university provision should be made, according to ancient and widespread usages, for the study of law, medicine and theology; but unfortunately the development of such schools in the United States has been fettered by narrow conditions. The schools of theology, with rare exceptions, are under denominational control; and so established is this usage, that in the state universities, and in most of the private foundations (Chicago being an exception), theological departments are not encouraged, because of the dread of religious rivalries and dogmatism. Until recently there have been no endowments for medical schools to any adequate extent, and consequently the fees paid by students have been distributed among the teachers, who have usually been the real managers of the institution, although acting under the name of some university. It is nearly the same in law. There are many indications that changes are at hand in these particulars. Theological schools make their denominational characteristics less pronounced, and the old colleges no longer speak of the schools of law and medicine as " outside " departments. The rapid growth of the physical and natural sciences during the 19th century, and the extension of scientific methods of inquiry and verification to subjects which were formerly taught by the traditional methods of authority, have led to the development of laboratories and libraries. Everywhere special buildings, well equipped with the latest and best apparatus, are springing up, where the students of chemistry, physics, biology (in its numerous subdepartments—bacteriology among them) and electricity have every facility for study and research. The introduction of laboratories for psychology is specially noteworthy. Pathological laboratories have become essential in schools of medicine.

Libraries are—as they always have been and always will be—storehouses where the books and manuscripts of the past are preserved; but in American universities they have taken on another characteristic. Subdivided into special departments, or supplemented by fresh additions, they are the working rooms of "seminaries," where capable teachers, surrounded by scholars properly qualified, are engaged in teaching, studying and writing. Seminaries and laboratories distinguish the modern philosophical departments from those of old, where the lecture-room was the seat of instruction. Numerous memoirs and monographs proceed from this active life. Books, periodicals and dissertations are contributions to the advancement of knowledge. Two agencies have effected these changes, most of which are the product of the last quarter of the 19th century. In the first place, gifts for higher education have been munificent, sometimes, especially in the East, from private citizens—often, especially in the West, from the treasuries of separate states. Quite as important has been the growth of liberal ideas. Very many of the foremost professors in American universities are the scholars of European teachers, especially Germans. Candidates for professorships are resuming the usages which prevailed early in the 19th century, of studying in France and Great Britain. On their return it is essential that they should keep themselves familiar with the latest literature in their departments, whatsoever may be the language in which it appears. Hence the American universities are no longer provincial. They must be judged, for better or for worse, by the standard of universities established in Europe. The bestowal of academic degrees ought to be strictly governed by some recognized authority, and according to ancient usages it is one of the highest functions of a university. In the United States there is but little restraint proceeding from law, tradition or public opinion. Every " college " is at liberty to exercise this privilege. Hence the variety of academic titles that have been introduced; hence, also, occasional and scandalous frauds in the issue of diplomas. The best institutions exercise due diligence; the public may be protected by requiring that every one who claims the privileges of his degree, or who appends to his name the usual abbreviations indicative of professional or academic authority, should make it clear where, when and how he received his title.

The institutions in the United States which claim to be universities, in the world-wide use of that designation, recognize these principles and, so far as their means allow, adhere to these methods: 1. There is a disciplinary stage in education which is the requisite introduction to the higher and freer work of the university. This is the sphere of the colleges. 2. The success of the higher work depends upon the intellectual and moral qualities of the professors. No amount of material prosperity is of value unless the dominant authorities are able to discover, secure and retain as teachers men of rare gifts, resolute will, superior training and an indomitable love of learning. 3. The professors in a university should be free from all pecuniary anxiety, so that their lives may be consecrated to their several callings. Pensions should be given them in cases of disability, and, in case of premature death, to their families. In methods of instruction they should have as large an amount of freedom as may be consistent with due regard for the co-operation of their colleagues and the plans of the foundation. 4. The steady improvement of the libraries and laboratories is essential if the institution is to keep in the front line. The newest books and the best apparatus are indispensable, for instruments and books quickly deteriorate and must be superseded. 5. For all these outlays large endowments are required. To a considerable extent reliance must be placed on wealthy and public-spirited citizens. In order to enlist such support, the members of a faculty should manifest their interest in public affairs, and by books, lectures and addresses should inform the public and interest them in the progress of knowledge. 6. Publication is one of the duties of a professor. He owes it not only to his reputation but also to his science, to his colleagues, to the public, to put together and set forth, for the information and criticism of the world, the results of his inquiries, discoveries, reflections and investigations. Qualified students should also be encouraged, under his guidance, to print and publish their dissertations.

College improvements.

Closely associated with the development of the university idea since 1875 is the improvement of the American college. Complaints are often made that the number of colleges is too large, and it is undoubtedly true that some institutions, inferior to city high schools, have usurped the names, the forms and some of the functions that should be restricted to establishments with larger endowments and better facilities for the promotion of scholarship; but while this is admitted, the great benefits which have resulted from the recognition, far and wide over the vast domain of the United States, of the value of higher education must not be forgotten. The support of churches of every name and the gifts of states, cities and private citizens, have been everywhere enlisted in behalf of learning. In every college worthy of the name, mathematics, ancient and modern languages, and the elements at least of modern science, are taught. More or less choice is permitted in the courses requisite to a bachelor's degree. Moral and religious influences are brought to bear on the formation of character. All this is favourable to the enlightenment of the people, and excuses, if it does not justify, the multiplication which is so often deprecated. The establishment of colleges for women, fully equal to the colleges for men, and in many places the admission of women to colleges and universities not originally intended for women, is one of the most noteworthy of the advances in higher education. Opinions are still divided in respect of the widsom of co-education, especially in the undergraduate period, but there is no longer any question as to the wisdom of giving to women the very best opportunities for intellectual culture; while the success that women have shown in the pursuit of many branches of science has led in many universities to their admission to the established laboratories and lecture-rooms. Separate colleges for women are now maintained in close connexion with Harvard, Columbia, Tulane and other institutions, and this mode of procedure seems likely to be introduced elsewhere. At the same time, independent foundations like Vassar, Smith, Wellesley, Bryn Mawr and Goucher are supported with so much vigour, and with such able faculties, that it is not easy to say which organization is the best, and indeed there is no occasion to raise the question. In the Western universities generally, as in Michigan, Wisconsin, California, Chicago, &c., women are admitted to all courses on the same terms as men. (D. C. G.)

Authorities.—On the earlier history and organization of the medieval universities, the student should consult F. C. von Savigny, *Gesch. d. römischen Rechts im Mittelalter* (7 vols., 1826–51); for the university of Paris, Du Boulay, *Historia Universitatis Parisiensis* (6 vols., Paris, 1665); Crevier, *Hist. de l'université de Paris* (7 vols., Paris, 1761); and C. Jourdain, *Hist. de l'université de Paris au XVII^e^ et au XVIII^e^ siècle* (Paris, 1862), and also articles on special points in the same writer's *Excursions historiques* (1888).

The work of Du Boulay (Bulaeus) is one of great research and labour, but wanting in critical judgment, while that of Crevier is little more than a readable outline drawn from the former. The views of Du Boulay have been challenged on many important points by P. H. Denifle in the first volume of his *Die Universitäten des Mittelalters bis 1400* (1885), and more particularly on those relating to the organization of the early universities. The results of Denifle's researches have been largely incorporated in Mr Rashdall's *Universities of Europe in the Middle Ages* (2 vols., Oxford, 1895), especially in connexion with the *origines* of Paris, Oxford and Cambridge; and the earlier works of Meiners, *Gesch. d. Entstehung und Entwickelung der hohen Schulen* (4 vols., 1802–5); and T. A. Huber, *Die englischen Universitäten* (Cassel, 1839–40), translation by F. W. Newman (3 vols., 1845), are thus to a great extent superseded. Much useful criticism on the comparative merits of the German and the English universities prior to the 19th century is to be found in the *Discussions* (1853) of Sir W. Hamilton. For the German universities exclusively, Zarncke's *Die deutschen Universitäten im Mittelalter* (Leipzig, 1857); Heinrich von Sybel, *Die deutschen Universitäten* (2nd ed., 1874); and Georg Kaufmann's *Gesch. der deutschen Universitäten* (2 vols.), are indispensable. Of the latter, vol. i. (1888) treats of the *origines*; vol. ii. (1896) carries the subject to the end of the middle ages, dealing generally with the history of academic institutions rather than the details of separate universities. Georg Voigt's *Die Wiederbelebung des classischen Alterthums* (2 vols., 1880–81) throws much light on the history of both Italian and German scholarship at the time of the Renaissance, and supplies a useful bibliography. The work of Professor Friedrich Paulsen, *Gesch. d. gelehrten Unterrichts auf den deutschen Schulen und Universitäten* (2nd ed., 2 vols., 1906; English translation by M. E. Sadler, London, 1906), is a masterly survey of the whole modern period down to the close of last century. Tholuck, *Das academische Leben des 17 Jahrhunderts* (2 vols., Halle, 1853–54); Dolch, *Gesch. des deutschen Studententhums* (1858); J. Conrad, *The German Universities for the Last Fifty Years*, translated by Hutchinson, preface by Bryce (Glasgow, 1885); T. Ziegler, *Der deutsche Student am Ende des 19 Jahrhunderts* (Stuttgart, 1895), all deal with special periods. Adolf Harnack, *Geschichte der königlich-preussischen Academie der Wissenschaften zu Berlin* (4 vols., 1900), is also of high value, the first two volumes for the medieval, the latter two for the modern period. To these may be added, as useful for reference, the *Geschichte der Erziehung vom Anfang an bis auf unsere Zeit* (Stuttgart, 1896–1901), by Dr K. A. and Georg Schmidt, containing critical bibliographies at the beginning of each chapter; while the *Bibliographie der deutschen Universitäten* by Wilhelm Erman and Ewald Horn (3 vols., Leipzig, 1904–6) is most complete for the literature of the entire subject down to the close of last century. For a comparative estimate of the history of the different faculties, *Die Universität Giessen von 1607 bis 1907* (2 vols., Giessen, 1907) is highly suggestive. The *Monumenta Germaniae Paedagogica* (20 vols., 1886–1900), though relating mainly to schools, often supplies valuable illustrative matter.

The statutes of the French universities, so far as ascertainable, have been edited by Fournier, *Statutes et privilèges des universités françaises* (1890); the *Chartularium* of the university of Paris, as edited by Denifle and Chatelain (4 vols., Paris, 1889–97), coming down to 1452. Works dealing with later history are Gréard, *Nos adieux à la vieille Sorbonne* (Paris, 1893); H. Schön, *Die französischen Hochschulen seit der Revolution* (Munich, 1896); L. Liard, *L'Enseignement supérieur en France, 1789–1894* (2 vols., Paris, 1894); Joseph Prost, *La Philosophie à l'académie protestante de Saumur, 1606–1685* (Paris, 1907).

For Italy, the *origines* of Bologna are dealt with by Chiapelli, *Lo Studio Bolognese* (Pistoia, 1888); Fitting, *Die Anfänge der Rechtsschule zu Bologna* (Bologna and Leipzig, 1888); Ricci, *I primordi d. Studio di Bologna* (2nd ed., Bologna, 1888). All the extant statutes are edited by Carlo Malagola, *Statuti d. univ. e dei collegi d. studio bolognese* (Bologna, 1888); and a new edition has appeared of the learned C. J. Sarti's *De claris Archigymnasii Bononiensis Professoribus* (Bologna, 1888, &c.). In connexion with Padua we have *Die Statuten der Juristen-Universität Padua vom Jahre 1331*, ed. H. Denifle, a reprint from the *Archiv*. For Spain, the work of De La Fuente (Madrid, 1855) gives a concise summary of the main facts in the growth of the universities and also of the other institutions for public instruction throughout the country; the *Libro Memoria*, by Solier and Vilches (1895) gives the necessary information down to a later period, in connexion with the central institution in Madrid. The history of the faculty of theology at the Portuguese university of Coimbra has been recorded on a more elaborate scale by Dr Manuel Eduardo da Motta Veiga (Coimbra, 1872). The *Universidades y Colegios* of Dr Joaquin v. González (Buenos Aires, 1907) contains an interesting account of the new university movement in Argentina. For Oxford there are the laborious collections by Anthony Wood, *History and Antiquities of the University and of the Colleges and Halls of Oxford*, edited with continuation by Rev. J. Gutch (5 vols., 1786–96), and *Athenae* and *Fasti Oxonienses*, edited by Dr P. Bliss (4 vols., 1813–20); *A History of the University of Oxford from the Earliest Times to 1530*, by H. C. Maxwell Lyte (1886); and *Statutes of the University of Oxford compiled in 1636 under Authority of Archbishop Laud*, ed. Griffiths (Oxford, 1888). The publications of the late Joseph Foster, *Alumni Oxonienses, 1500–1886* (8 vols.), supply the facts that are contained in the registers relating to the academic careers of graduates; his *Oxford Men and their Colleges, 1880–92* (2 vols., 1893) contains, vol. i., college life and antiquities, with illustrations; vol. ii., completion of *Alumni* and *Matriculation Register, 1880–92*. The publications of the Oxford Historical Society include some valuable histories of separate colleges, that of Pembroke (by Macleane), Corpus Christi (by Fowler), Merton (by Brodrick); also Anthony Wood's *Life and Times*, ed. Rev. Andrew Clark (4 vols.); Hearne's *Collections*, ed. Doble and Rannie (4 vols.); and *Early Oxford Press* (to 1640), by Falconer Madan. The series of *College Histories*, originally published by F. E. Robinson (now by Hutchinson & Co.), is often serviceable both to the historian and the biographer. For Cambridge, the researches of C. H. Cooper, greatly surpassing those of Wood in thoroughness and impartiality, are comprised in three series: (1) *Annals of Cambridge* (5 vols., 1842–1908); (2) *Athenae Cantabrigienses, 1500–1609* (2 vols., 1858–61); (3) *Memorials of Cambridge* (3 vols.; new ed. 1884). The *Architectural History of the University of Cambridge and of the Colleges*, by the late Robert Willis, edited and continued by J. Willis Clark (4 vols., 1886), is a work of admirable thoroughness and completeness. The *Grace Books*, in 3 vols., down to 1526, have been carefully edited and published by the University Press. J. B. Mullinger, *History of the University of Cambridge from the Earliest Times to Accession of Charles I.* (2 vols., 1873–85), vol. 3 at press, and *Cambridge Described and Illustrated*, by T. D. Atkinson and J. W. Clark (1897), deal chiefly with the course of education and learning, and with the antiquities respectively. To these may be added Thomas Baker's *History of the College of St John the Evangelist*, edited by Professor Mayor (2 vols., 1869); also, by same editor, *Admissions to St John's* (3 vols., 1630–1765); and *Records* of same society (2 series), edited by R. F. Scott—all three works being valuable aids both to the biography and history of contemporary times. Equally so is Dr Venn's excellent *Biographical History of Caius College* (3 vols., 1897–1901). Mr J. A. Venn's *Statistical Chart*, exhibiting conjointly the *Matriculation Statistics* at both universities from 1544 to 1906, has been reproduced, along with an explanatory article, in the *Oxford and Cambridge Review* for Lent term, 1908, and a similar chart for the colleges (in Cambridge) has been published by the same editor. For both universities see the *Documents* issued by the Oxford and Cambridge Commissions of 1858.

Mr M. E. Sadler's *Special Report to the Education Office on the Admission of Women to the Universities* is the most authoritative source of information on the subject. Of the existing endowments, faculties and professoriate of universities throughout the world, the serial entitled *Minerva*, edited by Dr K. Trübner (Trübner, Strassburg), has supplied trustworthy particulars since its first publication in 1891, together with concise information and references to original sources respecting the origin and history of the universities themselves. (J. B. M.)

Academic Hoods

1. *Great Britain and Ireland*

Aberdeen.—D.D., scarlet cloth, lined purple; B.D., black,[1] lined purple; LL.D., scarlet cloth, lined pale blue; LL.B., black, bordered pale blue; M.D., scarlet cloth, lined crimson; M.B., black, lined crimson; D.Litt., scarlet cloth, lined white; D.Phil., scarlet cloth, lined white; D.Sc., scarlet cloth, lined green; B.Sc., black, lined green; M.A., black, lined white.

Cambridge.—D.D., scarlet cloth, lined pink and violet shot, with loops of black cord; B.D., black, unlined; LL.M., black, lined white; LL.D., scarlet cloth, lined pink; LL.B., black silk or stuff, edged white fur; M.D. scarlet cloth, lined dark cherry colour; M.B., black, lined dark cherry colour; Mus.D., cream damask, lined cherry colour; Mus.B., dark cherry colour, lined white fur; Litt.D., scarlet cloth, lined scarlet; D.Sc., scarlet cloth, lined pink and light blue shot; M.A., black, lined white; B.A., black stuff or silk, edged white fur. Proctors as their Congregation habit wear the ruff and black and white hood; on other occasions they wear the hood "squared."

Dublin.—(The hoods are the same for the Royal University, except M.B., Mus.D. and divinity degrees, which it does not grant.) D.D., scarlet cloth, lined black; B.D., black, unlined; LL.D., scarlet cloth, lined pink; LL.B., black, bordered white; M.D., scarlet cloth, lined scarlet; M.B., black, lined white fur (Royal University, black, bordered scarlet); Mus.D., crimson cloth, lined white (Royal University, white damask, faced and lined rose satin); Mus.B., blue, lined white fur (rabbit-skin); Litt.D., scarlet cloth, lined white; D.Sc., scarlet cloth, lined blue; M.A., black, lined blue; B.A., black, edged white fur; Proctor, black silk, lined "ermine."

Durham.—D.D., scarlet "cassimere," lined "palatinate purple"; B.D., black, unlined; D.C.L., scarlet cassimere, lined white; B.C.L., palatinate purple, edged white fur; M.D., scarlet cassimere, lined scarlet, bordered palatinate purple; M.B., scarlet silk, lined palatinate purple, edged white fur; Mus.D., white brocade, lined palatinate purple; Mus.B., palatinate purple, edged white fur; Litt.D., scarlet cassimere, lined old-gold satin; Litt.B., old-gold satin, edged white fur; D.Sc., palatinate purple cassimere, lined scarlet; B.Sc., palatinate purple, edged white fur; M.A., black, lined palatinate purple; B.A., black stuff or silk, edged white fur.

Edinburgh.—D.D., black cloth, lined purple; B.D., black silk, lined purple, edged white fur; LL.D., black cloth, lined blue; LL.B., black silk, lined blue, edged white fur; B.L., black, bordered blue, edged white fur; M.D., black cloth, with cape attached, lined and faced crimson silk; M.B., black, lined crimson, edged white fur; Mus.D., scarlet cloth, lined white corded silk; Mus.B., scarlet silk, lined white, edged white fur; Litt.D., black cloth, lined royal blue shot with maize; D.Phil., black cloth, lined white, shot with "Vesuvius"; D.Sc., black cloth, lined green; B.Sc., black silk, lined green, edged white fur; M.A., black silk, lined white.

Glasgow.—D.D., scarlet cloth, lined white; B.D., black, lined light cherry colour, bordered scarlet cloth; LL.D., scarlet cloth, lined Venetian red; LL.B., black, lined Venetian red, bordered scarlet cloth; B.L., black, bordered Venetian red; M.D., scarlet cloth, lined scarlet; M.B., black, lined scarlet, bordered scarlet cloth; D.Sc., scarlet cloth, lined gold colour; B.Sc., black, lined gold colour, bordered scarlet cloth; M.A., black silk, lined "bell-heather" colour (purplish red); B.A., black silk or stuff, bordered bell-heather red.

London.—(Bachelors, if members of Convocation, have their hoods lined white silk, bordered with the colour of their faculty.) D.D., scarlet cloth, lined "sarum red"; B.D., black, bordered sarum red; LL.D., scarlet cloth, lined blue; LL.B., black, bordered blue; M.D., scarlet cloth, lined violet; M.B., and B.S., black, bordered violet; Mus.D., scarlet cloth, lined white, if a member of Convocation, if not, same as Mus.B., blue, lined white, watered silk; Litt.D., scarlet cloth, lined russet; D.Sc., scarlet cloth, lined gold colour; B.Sc., black, bordered gold colour; M.A., black, lined russet; B.A., black, bordered russet.

Oxford.—D.D., scarlet cloth, lined black; B.D., black, unlined; D.C.L., scarlet cloth, lined rose; B.C.L., light blue, edged white fur; M.D., scarlet cloth, lined rose; M.B., dark blue, edged white fur; Mus.D., white damask, lined crimson; Mus.B., light blue, edged white fur; Litt.D., scarlet cloth, lined slate colour; Litt.B., light blue, edged white fur; M.A., black, lined red; B.A., black silk or stuff, edged white fur; Proctors wear a "miniver" hood.

St Andrews.—D.D., violet silk or cloth, lined white satin; B.D., violet silk or cloth, lined white satin, edged white fur; LL.D., scarlet silk or cloth, lined white satin; LL.B., scarlet silk or cloth, lined white satin, edged white fur; M.D., crimson silk or cloth, lined white satin; M.B., crimson silk or cloth, lined white satin, edged white fur; Mus.D., cerulean blue silk or cloth, lined white satin; Mus.B., cerulean blue, lined white satin, edged white fur; D.Sc., "amaranth" silk or cloth, lined white satin; B.Sc., amaranth silk or cloth, lined white satin, edged white fur; M.A., black, lined red.

Victoria University.—LL.D., gold velvet or satin, lined light gold; LL.B., black, bordered violet; M.D., gold velvet or satin, lined light gold; M.B., black, bordered red; Litt.D., gold velvet or satin, lined light gold; D.Sc., gold velvet or satin, lined light gold; B.Sc., black, bordered pale red; M.A., black, lined pale blue; B.A., black, bordered pale blue.

University of Wales and Lampeter.—B.D. (Lampeter), black, lined violet, bordered white; B.A., black, bordered blue and green shot.

2. *Australia*

Sydney.—B.A., black stuff, edged white fur; M.A., black, lined blue; LL.B., black, bordered blue; LL.D., scarlet cloth, lined blue; B.Sc., black stuff, bordered amber; D.Sc., scarlet cloth, lined amber; B.E. (Engineering), black stuff, bordered light maroon; M.E., black, lined light maroon; M.B., black, bordered purple; M.C., black, lined French grey; M.D., scarlet cloth, lined purple.

Adelaide.—B.A., black, lined grey; M.A., black, lined dark grey; LL.B., black, lined blue; LL.D., dark blue, lined light blue; B.Sc., black, lined yellow; D.Sc., dark yellow, lined light yellow; M.B., black, lined rose; M.C. (Surgery), black, lined dark rose; M.D., dark rose, lined light rose; Mus.B., black, lined green; Mus.D., dark green, lined light green.

Melbourne.—B.A., black, lined dark blue; M.A., black, lined violet; Litt.D., black, lined dark blue; LL.B., black, lined white fur; LL.M., black cloth, edged red silk, lined white; LL.D., black, lined white; B.Sc., black, lined moss-green, edged white fur; M.Sc., black, lined moss-green; D.Sc., scarlet cloth, lined moss-green; B.E. (Engineering), black, lined light blue; M.E., black, lined yellow; M.B., black, lined white; M.C. (Surgery), black, lined dark amber; M.D., black, lined crimson; Mus.B., black, lined lavender, edged white fur; Mus.D., black, lined lavender.

New Zealand.—B.A., black, lined pink, edged white fur; M.A., black, lined pink; LL.B., black, lined blue, edged white fur; LL.D., black, lined light blue; B.Sc., black, lined dark blue, edged white fur; D.Sc., black, lined dark blue; M.B., black, lined mauve, edged white fur; M.D., black, lined mauve; Mus.B., black, lined white, edged white fur; Mus.D., black, lined white.

3. *Canada*

These follow the British model, with the exception of Laval, Quebec, which grants the same degrees as the University of France, the distinctive mark of which is the *scarf*.

Dalhousie (*N.S.*).—B.A., black stuff, lined white fur; M.A., black stuff, lined crimson; B.L. (Letters), black stuff, lined white, bordered light blue; M.L., black stuff, lined light blue; LL.B., black, lined white, bordered gold; LL.D., black, lined purple; B.Sc., black stuff, lined white silk, bordered crimson; M.Sc., black stuff, lined crimson; B.E. (Engineering), black stuff, lined white silk, bordered purple; M.C., scarlet cloth, bordered white; M.D., scarlet silk, bordered white; Mus.B., black stuff, lined white, bordered lavender.

Fredericton (*N.B.*).—B.A., black stuff, edged white fur; M.A., black, lined blue; B.C.L., black, lined blue silk, edged white fur; D.C.L., scarlet cloth, lined pink.

McGill (*Montreal*).—B.A., black stuff, edged white fur; M.A., black, lined blue; Litt.D. (Literature), scarlet cloth, lined pale blue; B.C.L., black, lined French grey, edged white fur; D.C.L., scarlet cloth, lined French grey; B.Sc., black, lined yellow, edged white fur; M.Sc., black, lined yellow; D.Sc., scarlet cloth, lined yellow; M.B., black, lined dark blue; M.D., scarlet cloth, lined dark blue; D.V.S. (Doctor of Veterinary Science), scarlet cloth, lined fawn.

Toronto.—D.D. (Trinity College), scarlet cloth, lined black; B.D. (Trinity College), black, unlined; B.A., black stuff, edged white fur; M.A., black, lined crimson; LL.B., blue, lined white fur; LL.D., scarlet cloth, lined pink; M.B., blue, lined white fur; M.D., scarlet cloth, lined pink.

Windsor (*N.S.*).—B.A., black stuff, edged white fur; M.A., black, lined crimson; B.C.L., blue, edged white fur; D.C.L., scarlet cloth, lined pink.

4. *India*

These follow the British model, but also give Oriental degrees, the distinctive mark of which is a sash. They also grant the degree of Licentiate in certain subjects, which has a hood.

Allahabad.—B.A., black, bordered amber; M.A., black, lined amber; LL.B., black, lined blue; LL.D., pale blue.

Bombay.—B.A., black stuff, bordered garter blue; M.A., garter blue, lined same; LL.B., black, bordered scarlet cloth; B.Sc., black stuff, bordered garter blue; L.C.E. (Engineering), black stuff, bordered brown; M.E., brown, lined garter blue; L.M. and S. (Medicine and Surgery), black stuff, bordered crimson; M.D., crimson, lined garter blue; L.Ag. (Agriculture), black stuff, bordered green.

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[1] Where not otherwise stated, the hood is of silk.

Calcutta.—B.A., black, bordered dark blue; M.A., black, lined blue; LL.B., black, bordered green; LL.D., scarlet, lined white satin; B.Sc., black, bordered light blue; B.E., black, bordered orange; M.E., black, lined green; M.B., black, bordered scarlet; M.D., black, lined scarlet.

Madras.—B.A., black, bordered crimson; M.A., black, lined crimson; LL.B., black, lined purple; M.L., purple silk; LL.D., scarlet silk; B.E., black, lined orange; M.B., black, lined light blue; L.M. and S., black, lined light blue; M.C., black, lined light blue; M.D., scarlet cloth, lined light blue; L.San.Sc. (Sanitary Science), black, bordered terra-cotta; L.T. (Teaching), black, lined gold.

Punjab.—B.A., purple, lined yellow; M.A., purple, lined claret; Litt.D., purple, lined scarlet; LL.B., white, lined blue; LL.D., scarlet silk; M.B., purple, lined purple cloth; M.D., purple, lined purple.

5. *South Africa*

Cape of Good Hope.—B.A., black, bordered orange-brown; M.A., black, lined orange-brown, bordered black; Litt.D., orange-brown, lined white, bordered black; LL.B., black, bordered red; LL.D., red, lined white, bordered black; B.Sc., black, bordered green; M.Sc., green, bordered black; D.Sc., green, lined white, bordered black; M.B., black, bordered blue; M.D., blue, lined white, bordered black; Mus.B., black, bordered purple; Mus.M., purple, bordered black; Mus.D., purple, lined white, bordered black.

6. *United States*

The American universities have adopted a uniform system, according to which the length and shape of the hood indicate the degree (bachelor, master, doctor), the silk lining displays the official colours of the university or college granting the degree (*e.g.* crimson for Harvard, blue for Yale, orange and black for Princeton, light blue and white for Columbia, royal purple and white for Cornell and red and blue for Pennsylvania), while the velvet trimming indicates the faculty or department. Thus the trimming for arts and letters is white, for theology scarlet, laws purple, philosophy blue, science gold-yellow, fine arts brown, medicine green, music pink, pharmacy olive, dentistry lilac, forestry russet, veterinary science grey and library science lemon. It is also usual in America for a graduate of a German university to wear a hood lined with the colours of the university charged with a trichevron of the German colours, black, white and red.

UNIVERSITY COURTS, in the English universities of Oxford and Cambridge, courts of inferior jurisdiction, administering principles of justice originally founded on the canon and civil law, but now defined and limited by the common law (see particularly *Ginnett* v. *Whittingham*, 1886, 16 Q.B.D. 769).

At Oxford the judge of the chancellor's court is the vice-chancellor, who is his deputy or assessor; the court has had since 1244 civil jurisdiction, to the exclusion of the king's courts, in all matters and suits wherein a scholar or privileged person of the university is one of the parties, except in actions relating to freehold. It had also, from 1290 downwards, jurisdiction of all injuries and trespasses against the peace, mayhem and felony excepted, but since the Summary Jurisdiction Acts this is possibly no longer exercisable, but the chancellor, vice-chancellor and the vice-chancellor's deputy are justices of the peace for Oxford, Oxfordshire and Berkshire, where scholars are concerned, and exercise this jurisdiction under the Summary Jurisdiction Acts. By the Oxford University Act 1854 the vice-chancellor's court now administers the common and statute law of the realm.

The criminal jurisdiction of Cambridge University in cases where any person not a member of the university is a party has ceased, and its jurisdiction over light women, which was founded on a charter and statute of Elizabeth, was taken away in 1894 by a private act of that year (c. 60), and an act of 6 Geo. IV. c. 97, dealing with them and applicable till then only to Oxford University, was extended to Cambridge University. Previous to 1891, women of light character, who had been convicted of consorting with or soliciting members of the university *in statu pupillari*, were detained in a house of correction called the *spinning house*, but in that year a conviction was held bad (*ex parte* Hopkins, 1891, 61 L.J.Q.B. 240; see also, however, *Kemp* v. *Nevill*, 1861, 10 C.B.N.S. 523).

UNNA, a town of Germany, in the Prussian province of Westphalia, 15 m. by rail E. of Dortmund, on the line to Hamm. Pop. (1905) 16,324. It has two Roman Catholic and two Protestant churches, a synagogue and several schools. Its chief industries are iron foundries, machine shops, salt works and breweries—other articles of manufacture being bricks and cement. In the middle ages Unna formed part of the electorate of Cologne. It received municipal rights in 1256 and was a member of the Hanseatic League.

UNTERWALDEN, one of the cantons of central Switzerland, extends to the south of the lake of Lucerne, 14 sq. m. of which are included within the canton (13 being in Nidwalden). It is composed of two valleys, through which run two streams, both called Aa, and both flowing into the lake of Lucerne. The more westerly of these glens is called Obwalden, and the more easterly Nidwalden. These names really come from the 13th century expression for the inhabitants, *homines intramontani* (men dwelling in the mountains), whether of *vallis superioris* (of the upper valley) or *vallis inferioris* (of the lower valley). But in the 14th century the relative position of the two valleys is defined as "upper" and "lower" with reference to the great Kerns forest (stretching between Stans and Kerns), and hence is derived the historically inaccurate name of "Forest cantons," now so well known. The total area of the canton is 295·4 sq. m. (Obwalden has 183·2 and Nidwalden 112·1, though it must be borne in mind that the upper portion of what should be the territory of Nidwalden is, as regards the Blacken Alp, in Uri, while the Engelberg region is in Obwalden). Of this area 238·2 sq. m. (154·1 in Obwalden and 84·1 in Nidwalden) are classed as "productive," forests covering 73·8 sq. m. (47 in Obwalden and 26·8 in Nidwalden), while of the rest glaciers occupy 5·2 sq. m. (3·9 in Obwalden and 1·3 in Nidwalden), the highest point in the canton being the Titlis (10,627 ft.) situated in the Obwalden half. The small lakes of Sarnen and of Lungern are wholly situated in Obwalden. Obwalden, as including the Engelberg region, is far more mountainous than Nidwalden, which is rather hilly than mountainous. The inhabitants in both cases are mainly devoted to pastoral and, in a lesser degree, to agricultural pursuits. In Obwalden there are 290 "alps," or mountain pastures, capable of supporting 13,399 cows, and of an estimated capital value of 5,474,400 fr.: the figures for Nidwalden are respectively 166, 5207 and 3,899,900. In 1900 the total population of the canton was 28,330 (15,260 in Obwalden and 13,070 in Nidwalden), of whom all but the most insignificant proportion were German-speaking and Romanists. Till 1814 the canton was in the diocese of Constance, but since then it is practically administered by the bishop of Coire, though legally included in no diocese. The capital of Obwalden is Sarnen (*q.v.*), and of Nidwalden Stans (*q.v.*). The other most considerable villages are all in Obwalden—Kerns (2392 inhab.), Engelberg (1973 inhab.) and Lungern (1828 inhab.). The canton is traversed by the Brünig railway line from Hergiswil (in Nidwalden) to the top of the pass (20 m.), but most of the electric line from Stansstad to Engelberg (14 m.) is in Nidwalden. The mountain lines up Pilatus (Obwalden), the Stanserhorn, and to the Bürgenstock (both in Nidwalden) are also in the canton. Each half forms a single administrative district, and has its own independent local institutions, while in Obwalden there are 7 communes and in Nidwalden 11. In each the supreme legislative authority is the "*Landsgemeinde*," or primitive democratic assembly (meeting in both cases on the last Sunday in April), composed of all male citizens of 20 (Obwalden) or 18 (Nidwalden) years of age. In both cases the *Landsgemeinde* elects the executive for three years (Nidwalden) or four years (Obwalden), while it is composed of 11 (Nidwalden) or 7 (Obwalden) members, out of whom the *Landsgemeinde* elects annually the chief officials. In each half there is also a sort of "standing committee" (the *Landrath*, Nidwalden, or *Kantonsrath*, Obwalden), which drafts measures to be submitted to the *Landsgemeinde*, supervises the cantonal administration, and is empowered to spend sums below a certain amount. In each case the *Landrat* is composed of the members of the executive, plus a certain number of members elected in each "commune," in the proportion of 1 member to every 250 inhabitants, or fraction over 125 (so Nidwalden, which allows them to hold office for six years), or 1 member to every 200 inhabitants (Obwalden, which allows them to hold office for four years). These *Landsgemeinden* are of immemorial antiquity, while the other constitutional details are settled by the constitution of 1877 in Nidwalden, and by that of 1902 in Obwalden. In each half the single member of the Federal *Ständerat* is elected by the *Landsgemeinde*, while the single member enjoyed by each in the Federal *Nationalrat* is chosen by a popular vote, but not by the *Landsgemeinde*. The people of the canton have always been very pious and religious. In the church of Sachseln (near Sarnen) still lie the bones of the holy hermit, Nicholas von der Flüe, fondly known as "Bruder Klaus" (1417–1487), while at Sarnen there are several convents, though the most famous of all the monasteries in the canton, the great Benedictine house of Engelberg (founded about 1120) is situated at the head of the Nidwalden valley, though politically in Obwalden. At the lower end of the Nidwalden valley is Stans, the home of the Winkelried family (*q.v.*).

It is very remarkable that in both valleys the old "common lands" are still in the hands of the old gilds, and "communes" consist of natives, not merely residents, though in Obwalden these contribute to the expenses of the new "political communes" of residents, while in Nidwalden the latter have to raise special taxes. In Engelberg (which still retains some independence) the poor are greatly favoured in the division of the common lands and their proceeds, and unmarried persons (or widowers and widows) receive only half of the share of those who are married.

Historically, both Obwalden (save a small bit in the Aargau) and Nidwalden were included in the Zürichgau. In both there were many great landowners (specially the abbey of Murbach and the Habsburgs) and few free men; while the fact that the Habsburgs were counts of the Aargau and the Zürichgau further delayed the development of political freedom. Both took part in the risings of 1245–47, and in 1247 Sarnen was threatened by the pope with excommunication for opposing its hereditary lord, the count of Habsburg. The alleged cruelties committed by the Habsburgs do not, however, appear in history till Justinger's *Chronicle*, 1420 (see TELL). On the 16th of April 1291, Rudolph the future emperor bought from Murbach all its estates in Unterwalden, and thus ruled this district as the chief landowner, as count and as emperor. On the 1st of August 1291 Nidwalden (Obwalden is not named in the text of the document, though it is named on the seal appended to it) formed the "Everlasting League" with Uri and Schwyz (this being the first known case in which its common seal is used). In 1304 the two valleys were joined together under the same local deputy of the count, and in 1309 Henry VII. confirmed to them all the liberties granted by his predecessor—though none is known to have been granted. However, this placed Unterwalden on an equal political footing with Uri and Schwyz; and as such it took part (1315) in Morgarten fight (also driving back an invasion over the Brünig Pass) and in the renewal of the Everlasting League at Brunnen (1315), as well as at Sempach (1386) and in driving back the Gugler or English freebooters (1375). For physical reasons, it was difficult for Unterwalden to enlarge its territories. Yet in 1368 it acquired Alpnach, and in 1378 Hergiswil. So too Obwalden shared with Uri in the conquest of the Val Leventina (1403) and in the purchase of Bellinzona (1419), as well as in the loss of both (1422). It was Nidwalden that, with Schwyz and Uri, finally won (1500) and ruled (till 1798) Bellinzona, the Riviera, and the Val Blernio; while both shared in conquests of the Aargau (1415), the Thurgau (1460), and Locarno, &c. (1512), and in the temporary occupation of the Val d' Ossola (1410–14, 1416–22, 1425–26, 1512–15). In the Burgundian war Unterwalden, like the other Forest cantons, long hung back through jealousy of Bern, but came to the rescue in time of need. In 1481 it was at Stans that the Confederates nearly broke up the League for various reasons, and it was only by the intervention then of the holy hermit Nicholas von der Flüe (of Sachseln in Obwalden) that peace was restored, and the great Federal agreement known as the compact of Stans concluded. Like the other Forest cantons, Unterwalden clung to the old faith at the time of the Reformation, being a member of the "Christliche Vereinigung" (1529) and of the Golden League (1586).

In 1798 Unterwalden resisted the Helvetic republic, but, having formed part of the short-lived Tellgau, became a district of the huge canton of the Waldstätten. Obwalden submitted at an early date, but Nidwalden, refusing to accept the oath of fidelity to the constitution mainly on religious grounds, rose in desperate revolt (September 1798), and was only put down by the arrival of 16,000 armed men and by the storming of Stans. In 1803 its independence as a canton was restored, but in 1815 Nidwalden refused to accept the new constitution, and Federal troops had to be employed to put down its resistance, the punishment inflicted being the transfer (1816) to Obwalden of the jurisdiction over the abbey lands of Engelberg (since 1462 "protected" by the four Forest cantons), which in 1798 had fallen to the lot of Obwalden and had passed in 1803 to Nidwalden. Since that time the history of Unterwalden has been like that of the other Forest cantons. It was a member of the "League of Sarnen" (1832), to oppose the reforming wishes of other cantons, and of the "Sonderbund" (1845); it was defeated in the war of 1847; and it voted against the acceptance of the Federal constitution both in 1848 and in 1874.

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UNTON (or UMPTON), **SIR HENRY** (*c.* 1557–1596), English diplomatist, was the second son of Sir Edward Unton, or Umpton (d. 1583), of Wadley, near Faringdon, Berkshire, his mother, Anne (d. 1588), being a daughter of Edward Seymour, duke of Somerset, the protector. Educated at Oriel College, Oxford, Unton became a member of parliament in 1584 and served with the English forces in the Netherlands in 1585 and 1586, being present at the skirmish of Zutphen. In 1586 he was knighted. In 1591, through the good offices of the earl of Essex, Unton was sent as ambassador to Henry IV. of France; he became very friendly with this king and accompanied him on a campaign in Normandy before he was recalled to England in June 1592. Again securing a seat in parliament he lost for a short time the favour of Queen Elizabeth; however, in 1593 he went again as ambassador to France. He died in the French camp at La Fère on the 23rd of March 1596, a collection of Latin verses being published in his memory at Oxford later in the year. This was edited by his chaplain, Robert Wright (1560–1643), afterwards bishop of Lichfield and Coventry.

There is an interesting picture in the National Portrait Gallery representing Unton and various scenes in his life. Many of his official letters are in the British Museum and in the Public Record Office, London. A collection of these was edited by Joseph Stevenson (1847), and some are printed in W. Murdiu's *Burghley Papers* (1759).

UNYAMWEZI, a region of German East Africa, lying S. of Victoria Nyanza and E. of Lake Tanganyika. It is mentioned as early as the 16th century by the Portuguese and by Antonio Pigafetta, under the name Munemugi or "Land of the Moon," which is the exact equivalent of the name—Wu-nya-mwezi—by which the land is known to its own people. It is part of the plateau between the two great rift-valleys of East Africa, is rich in woods and grass, and has many villages surrounded by well cultivated farms and gardens. The western portions, however, are somewhat swampy and unhealthy. The people of Unyamwezi, called Wanyamwezi, are Bantu-negroes of medium size and negroid features, but with long noses and curly rather than woolly hair, suggestive of mixed blood. Dwelling on the main road from Bagamoyo to Tanganyika, the route by which J. H. Speke, Richard Burton, J. A. Grant, H. M. Stanley and others travelled, and having from early times had commercial relations with the Arabs, the Wanyamwezi are more civilized than the neighbouring races. They practise tattooing, file or extract the upper incisor teeth, and load their legs and arms with brass wire rings. The men look after the flocks and poultry, while the women do the field-work. They often keep bees; in some cases the hives are inside the huts, and the bees form an efficient protection against intruders. Inheritance is to the direct issue, not as is often the case among Negro races to the nephew. In some parts, one of twins is always killed. On Stanley's first visit in 1871, the Zanzibar Arabs were predominant in the country, but later the natives rose and, under Mirambo, who from a common porter rose to be a conquering chief—earning for himself the title of the "Black Bonaparte"—a Negro kingdom was formed. Since 1890 the country has been under German control and the power of the native chiefs greatly curtailed. As a people the Wanyamwezi are extremely vigorous and have shown great capacity for expansion, being energetic and enterprising.

See H. Brode, *Tippoo Tib: the Story of his Career in Central Africa* (1907); Sir H. H. Johnston, *The Uganda Protectorate* (1902); Sir Charles Eliot, *The East Africa Protectorate* (1905).

UNYORO, called by its people Bunyoro, a country of east central Africa lying N.W. of the kingdom of Buganda (Uganda) and bounded E. and N. by the Victoria Nile. On the west, Unyoro includes nearly all the eastern shores of Albert Nyanza and a strip of territory—incorporated in Belgian Congo in 1910—west of that lake. In 1896 a British protectorate was established over Unyoro, which now forms the S.W. part of the northern province of the Uganda Protectorate. The limits of Unyoro have varied according to the strength of its rulers; during the 19th century the states of Bunyoro and Buganda appear to have been rivals for the overlordship of the region between the Bahr-el-Jebel and the great lakes. The Banyoro (as its people call themselves) had a certain degree of civilization and were skilled in iron-work, pottery and wood-work. The ruling class is of Hima stock, the Bahima possessing large herds of cattle. The first Europeans to enter the country were J. H. Speke and J. A. Grant, who spent part of 1862 there, the king, Kamurasi, putting many obstacles in the way of the travellers continuing their journey down the Nile. Its next white visitors were Sir Samuel and Lady Baker, who in 1864 discovered the Albert Nyanza. At this time ivory and slave traders, nominally Egyptian subjects, penetrated as far south as Unyoro, and a few years later (1870–74) Baker, as governor-general of the Equatorial Provinces, extended Egyptian influence over the country and placed a garrison at Foweira on the Victoria Nile. He formally annexed Unyoro to the Egyptian dominions at Masindi on the 14th of May 1872. General Gordon, who succeeded Baker, established posts at Masindi and Mruli. With King Kabarega, a son of Kamurasi, the Egyptians had many encounters. Egyptian authority ceased altogether with the withdrawal of Emin Pasha in 1888, but not long afterwards British influence began to be felt in the country. Kabarega in 1891 found himself in conflict with Captain F. D. Lugard, who entered Unyoro from the south. From this point the history of Unyoro is traced in the article UGANDA. It need only be stated here that in 1899 Kabarega was captured by the British and deported to the Seychelles, and that one of his sons (Yosia, a minor) was subsequently recognized as chief in his place, though with very restricted powers, the province being virtually administered directly by the British government.

Unyoro has played rather an important rôle in the past (unwritten) history of Equatorial Africa as being the region from which the ancient Gala (Hamitic) aristocracy, coming from Nileland, penetrated the forests of Bantu Africa, bringing with them the Neolithic civilization, the use of metals, and the keeping of cattle. Unyoro, though not a large country, is in many ways remarkable. It is thought to contain gold in the north and north-east. In the west and south-west are the vast primeval forests of Budonga and Bugoma, containing large chimpanzees and a peculiar sub-species of straight-tusked elephants (only found in Unyoro).

See the works of Speke, Grant and Baker; also *Colonel Gordon in Central Africa* (4th ed., 1885); J. F. Cunningham's *Uganda and its Peoples* (1905); and Winston Churchill's *My African Journey* (1908). (H. H. J.)

UPAS, a Javanese word meaning poison, and specially applied to the poison derived from the gum of the anchar tree (*Antiaris toxicaria*), a member of the fig-family (Moraceae), and a native of the Sunda Islands, which was commonly used to envenom the darts of the natives. The name of the upas tree has become famous from the mendacious account (professedly by one Foersch, who was a surgeon at Samarang in 1773) published in the *London Magazine*, December 1783, and popularized by Erasmus Darwin in "Loves of the Plants" (*Botanic Garden*, pt. ii.). The tree was said to destroy all animal life within a radius of 15 m. or more. The poison was fetched by condemned malefactors, of whom scarcely two out of twenty returned. All this is pure fable, and in good part not even traditional fable, but mere invention. The milky juice of the tree contains an active principle named *antiarin*, which has been recommended as a cardiac stimulant. It is without any properties, however, that entitle it to clinical employment. The tree is described as one of the largest in the forests of Java, the straight cylindrical stem rising without a branch to the height of 60 to 80 ft. It has a whitish bark and on being wounded yields plentifully the milky juice from which the poison is prepared.

For a full account of the tree, see Bennett and Brown, *Plantae Javanicae rariores*, p. 52 (1838).

UPHOLSTERER, in modern usage, a tradesman who supplies coverings, cushions, padding and stuffing for chairs, sofas or beds, or who repairs the same, and more generally one who also provides carpets, curtains and household furniture. The word first appears as "upholder," then as "upholdster" or "upholster," and finally with repetition of -er, as in "poulterer," "upholsterer." The first meaning seems to have been a broker or dealer in small wares. Probably the name was given to a broker who sold such goods by auction, holding them up to public view as is the manner of auction-rooms.

UPPER SIND FRONTIER, a district of British India, in the Sind province of Bombay, with administrative headquarters at Jacobabad. Area, 2621 sq. m. In the north-east the country is hilly; the remainder consists of a narrow strip of level plain, one half being covered with jungle and subject to inundation, from which it is protected by artificial embankments. The land is watered by canals from the Indus, of which the chief are the Begari and Desert canals. The district contains several thriving timber plantations. The climate is remarkable for its dryness and for its extraordinary variations of temperature. The annual rainfall at Jacobabad averages less than 5 in. In 1901 the population was 232,045, showing an increase of no less than 33% in the decade, chiefly due to immigration from Baluchistan. The principal crops are millets, oil-seeds, pulses, wheat and rice. The internal trade is principally in grain, the greater part of which is sent to the sea-board; the transit trade from Central Asia into Sind crosses the district, bringing wool and woollen goods, fruits, carpets and horses. The district is crossed by the Quetta branch of the North-Western railway. The wild Baluchi inhabitants were pacified by General John Jacob between 1847 and his death in 1858.

UPPINGHAM, a market town of Rutland, England, 98 m. N.N.E. of London, on a branch of the London & North-Western railway. Pop. (1901) 2588. The church of St Peter and St Paul has Decorated portions in the nave, tower and spire. The pulpit is of the 17th century. Jeremy Taylor was rector here at the outbreak of the Civil War. The principal institution of Uppingham is the school. It is coeval with the grammar school of Oakham (1584), and had the same founder, Robert Johnson, archdeacon of Leicester. It rose in the last half of the 19th century to a place of distinction among English public schools, owing to the exertions of its headmaster (1853–77), the Rev. Edward Thring. A new group of school-buildings, with chapel, was erected in 1863 from the designs of G. E. Street. New (Tercentenary) class-rooms were opened in 1890, and a memorial chapel, containing a statue of Edward Thring, by T. Brock, R.A., was erected in 1891. The Victoria Building, containing museum, laboratory and lecture theatre, was opened in 1897. The quadrangle is by T. G. Jackson, R.A., and over the gateway is a statue of the founder, by G. J. Frampton, R.A. The school contains about 450 boys. There are general exhibitions to the universities, and also several, in which scholars of this school and Oakham school have preference, at St John's, Clare, Emmanuel and Sidney Sussex colleges, Cambridge. The town of Uppingham has some agricultural trade.

UPSALA, or UPPSALA, a city of Sweden, the seat of a university and of the archbishop of Sweden, chief town of the district (*län*) of Upsala, 41 m. N. of Stockholm by the Northern railway. Pop. (1900) 22,855. It has water-communication with Stockholm by the river Fyris and the northward arm of Lake Mälar, into which it flows. The older part of the city lies on its sloping west bank, the cathedral and castle occupying dominating heights, with the university buildings below. West and south is a girdle of gardens. The new town occupies the flat east bank, and the whole is set in a fertile plain.

The university, the chief and oldest in Sweden, was founded in 1477 by Archbishop Jakob Ulfsson. The university building, completed in 1887, lies west of the cathedral. It has a fine vestibule with galleries, lit from a cupola, a senate-hall, rooms for the governing body, and lecture rooms. The whole is very richly adorned. The library building was erected in 1819–41. It is on the site of the Academia Carolina, founded by Charles IX., and is known in consequence as *Carolina Rediviva.* Since 1707 the library has had the right of receiving a copy of every work printed in Sweden, and its MS. collection is also large and valuable. Among the MSS. is the famous *Codex Argenteus* (6th century), a translation of the Gospels in the Gothic of Bishop Ulfilas (4th century). Other university institutions are the chemical laboratory, the chemical, physical and pathological institutes, the anatomy house, and the collection of Northern antiquities. The last is situated in the old botanic garden, where Rudbeck and Linnaeus worked, and Linnaeus had his residence. The new botanic garden, W. of the castle hill, was given by Gustavus III. in 1787. The astronomical observatory was founded in 1730, though there was a professorial chair in the preceding century. The Victoria Museum contains Egyptian antiquities. The Royal Society of Sciences, founded in 1710 by Archbishop Erik Benzelius, occupies a house of its own and has a valuable library. Among other learned societies in the university are the Royal Association for Literary Science, and the Society for Swedish Literature. The annual expenditure of the university amounts to about £56,000, a large proportion of which is covered by a grant from parliament. The revenue of the university itself, however, amounts to about £25,000, a considerable part of which is still drawn from the property with which Gustavus Adolphus endowed it in 1624 from his private estates, amounting to 360 farms. There are about sixty professors, and a large number of assistants, lecturers and docents. The number of students is from 1500 to 2000, but it fluctuates considerably; the average in 1886–90 was 1825. Every student must belong to a "nation" (*landskap*), of which there are thirteen, each comprising mainly students from a particular part of the country. Each nation has generally its own club-house and fund. There are also societies for special branches of study, athletics and music, especially singing, for which the students have a deservedly high reputation. A cap of white velvet with a black border is worn by the students.

The cathedral stands nobly above the town; its tall western towers with their modern copper-sheathed spires are visible for many miles. It is of simple form, consisting of a nave with aisles and flanking chapels, short transepts, and choir with ambulatory and chapels and an apsidal eastern end. It is French in style (the first architect was a Frenchman, Étienne de Bonneuil) modified by the use of brick as building material. Ornamentation is thus slight except at the southern portal. The church was building from 1287 to 1435. It suffered from several fires, and a thorough restoration was completed in 1893. The easternmost chapel is the fine mausoleum of Gustavus Vasa. The castle was founded in 1548 by Gustavus I. but was not finished till a century later, when it was often used as a royal residence. It was destroyed by fire in 1702, and is still in part ruined, but part is used as the offices of the government of the *län* and the residence of the governor. Apart from the cathedral and a few insignificant buildings, there are no other medieval remains. Among institutions may be mentioned the Ultuna Agricultural Institute, immediately south of the city. The industries are unimportant.

The name of Upsala originally belonged to a place still called Old Upsala nearly 2 m. N. of the present city. This Upsala, mentioned as early as the 9th century, was famous throughout Scandinavia for its splendid heathen temple, which, gleaming with gold, made it the centre of the country, then divided into a great number of small kingdoms. Three huge grave mounds or barrows remain here. In the same place the first cathedral of the bishops of Upsala was also erected (*c.* 1100). On the destruction of this building by fire, the inconvenient situation caused the removal in 1273 of the archiepiscopal see to the present city, then called Ostra Aros,[1] but within a short time it came to be generally called Upsala. During the middle ages the cathedral and the see of the archbishop made Upsala a kind of ecclesiastical capital. Here the kings were crowned, after their election had taken place at the Mora Stones, 10 m. S.E. of Upsala. In 1567 Eric XIV. murdered in the castle five of the most eminent men of the kingdom, three of them belonging to the family of Sture. In 1593 was held the great synod which marks the final victory of Protestantism in Sweden; in the same year the university was restored by Charles IX. In the castle, Christina, daughter of Gustavus Adolphus, resigned her crown to Charles X. in 1654. In 1702 nearly the whole city, with the castle and the cathedral, was burnt down. Among the teachers of the university who have carried its name beyond the boundaries of their own country the following (besides Linnaeus) deserve to be mentioned: Olof Rudbeck the elder, the author of the *Atlantica* (1630–1702); Torbern Bergman (1735–1784), the celebrated chemist; and Erik Gustaf Geijer (1783–1847), the historian.

UR, one of the most important of the early Babylonian cities, represented to-day by the ruin mounds called Mughair (Moghair), or, more properly, Muqayyar (Muḳayyar), "the pitched," or "pitch-built." It lay 140 m. S.E. of Babylon (30° 95′ N., 46° 5′ E.), about 6 m. S. of the present bed of the Euphrates, half-way between that and the low, pebbly sandstone hills which form the border of the Syrian desert, and almost opposite the mouth of the Shatt-el-Haï, on the Sa'ade canal. It was the site of a famous temple, E-Nannar, "house of Nannar," and the chief seat in Babylonia of the worship of the moon-god, Nannar, later known as Sin (*q.v.*). Under the title Ur of the Chaldees, it is mentioned in the Bible as the original home of Abraham. It is worthy of notice that Haran, in upper Mesopotamia, which also was a home of Abraham, was likewise a famous site of worship of the god Sin, and that the name of that god also appears in Mount Sinai, which was historically connected with the origin of the Hebrew nation and religion. While not equal, apparently, in antiquity, and certainly not in religious importance, to the cities of Nippur, Eridu and Erech, Ur, from a very early period, played a most important part politically and commercially. Lying at the junction of the Euphrates and Tigris, at the head of the Persian Gulf, it enjoyed very extensive water-communications with rich and important regions. Lying close to the Syrian desert, at a natural point of communication with Arabia, it was the centre of caravan communication with interior, southern and western Arabia. In the Sumerian period, antedating the time of Sargon, about or before 3000 B.C., we find Ur exercising hegemony in Babylonia under a king whose name is read Lugal-Kigub-Nidudu. Comparatively early, however, it became a centre of Semitic influence and power, and immediately after the time of the Sargonids it comes to the front, under King Ur-Gur, or Ur-Engur, the great builder of *ziggurats* (stage-towers) in the ancient Babylonian cities, as mistress of both northern and southern Babylonia, and even seems to have exacted tribute from countries as far remote as southern Syria. With relatively brief intervals, during which Erech and Isin come to the fore, Ur held the hegemony in Babylonia until or shortly before the Elamite invasion, when Larsa became the seat of authority. After the period of the Elamite dominion and the establishment of the empire of Babylon, under Khammurabi, about or shortly after 2000 B.C., Ur lost its political independence and, to a considerable extent, its political importance. The gradual filling up of the Persian Gulf had probably also begun to interfere with its trade supremacy. It continued, however, to be a place of religious and literary importance until the close of the Babylonian period. The ruins of the ancient site were partly excavated by Loftus and Taylor in 1854. They are egg-shaped, with the sharper end towards the north-west, somewhat elevated above the surrounding country, which is liable to be inundated by the Euphrates, and encircled by a wall 2946 yards in circumference, with a length of 1056 and a greatest breadth of 825 yds. The principal ruin is the temple of E—Nannar, in the north-western part of the mounds. This was surrounded by a low outer wall, within which rose a platform, about 20 ft. in height, on which stood a two-storeyed *ziggurat*, or stage-tower, a right-angled parallelogram in shape, the long sides towards the north-east and south-west. The lower stage measured 198 ft. in length by 133 ft. in breadth, and is still standing to the height of 27 ft. The second storey was 14 ft. in height and measured 119 by 75 ft. The ascent to the first storey was by a stairway 8 ft. broad, on the north-east side. Access to the summit of the second storey was had on the same side, either by an inclined plane or a broad stairway—it is not clear which—extending, apparently, the whole length of that stage. Ruins on the summit show that there was a chamber on top, apparently of a very ornamental character, like that at Eridu. The bricks of the lower stage are laid in bitumen, and bear the inscription of Ur-Gur. The bricks of the upper stage are laid in mortar, and clay cylinders found in the four corners of this stage bore an inscription of Nabonidus, the last king of Babylon (639 B.C.), closing with a prayer for his son Belshar-uzur (Bel-sarra-Uzur), the Belshazzar of the book of Daniel. Between these two extremes were found evidences of restoration by Ishme-Dagan of Isin and Gimil-Sin of Ur, somewhere towards the middle of the 3rd millennium B.C., and of Kuri-galzu, a Cossaean (Kassite) king of Babylon, of the 14th century B.C. Nebuchadrezzar also claims to have rebuilt this temple. Taylor further excavated an interesting Babylonian building, not far from the temple, and part of an ancient Babylonian necropolis. All about the city he found abundant remains of burials of later periods. Apparently, in the later times, owing to its sanctity, Ur became a favourite place of sepulture, so that after it had ceased to be inhabited it still continued to be used as a necropolis. The great quantity of pitch used in the construction of these ruins, which has given them the name by which they are to-day known among the Arabs, is evidence of a peculiarly close relation with some pitch-producing neighbourhood, presumably Hit, which lay at the head of the Sa'ade canal on which Ur was located. Large piles of slab and scoria, in the neighbourhood of Ur, show, apparently, that the pitch was also used for manufacturing purposes, and that Ur was a manufacturing as well as a commercial city. Since Taylor's time Mughair has been visited by numerous travellers, almost all of whom have found ancient Babylonian remains, inscribed stones and the like, lying upon the surface. The site is rich in remains, and is relatively easy to explore.

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[1] The name first occurs in Snorro Sturluson in connection with events of the year 1018; it signifies "the mouth of the eastern river."

See J. E. Taylor, *Journal of the Royal Asiatic Society* (1855), vol. xv.; W. K. Loftus, *Chaldaea and Susiana* (1857); John P. Peters, *Nippur* (1897); H. V. Hilprecht, *Excavations in Assyria and Babylonia* (1904). (J. P. Pe.)

URAL-ALTAIC, the general term for a group of languages (also called Turanian, Finno-Tatar, &c.) constituting a primary linguistic family of the eastern hemisphere. Its subgroups are Turkish, Finno-Ugrian, Mongol and Manchu. Philologists have differentiated various forms of the languages into numerous subdivisions; and considerable obscurity rests on the relationship which such languages as Japanese or ancient Accadian and Etruscan bear to the subgroups already named, which are dealt with in other articles.

In its morphology Ural-Altaic belongs to the agglutinating order of speech, differing from other languages of this order chiefly in the exclusive use of suffixes attached to the unmodified root, and partly blended with it by the principle of progressive vowel harmony, in virtue of which the vowels of all the suffixes are assimilated to that of the root. Thus the typical formula is R+R+R+R, &c., where R is the root, always placed first, and R, R, R . . . the successive postfixed relational elements, whose vowels conform by certain subtle laws of euphony to that of the root, which never changes. These suffixes differ also from the case and verbal endings of true inflecting languages (Aryan, Semitic) in their slighter fusion with the root, with which they are rather mechanically united (agglutinated) than chemically fused into a term in which root and relational element are no longer separable. Hence it is that the roots, which in Aryan are generally obscured, blurred, often even changed past the possibility of identification, in Ural-Altaic are always in evidence, unaffected by the addition of any number of formative particles, and controlling the whole formation of the word. For instance, the infinitive element *mak* of the Osmanli *yaz-mak*=to write becomes *mek* in *sev-mek*=to love (vowel harmony), and shifts its place in *sev-il-mek*=to be loved (imperfect fusion with the root), while the root itself remains unchanged as to form and position in *sev-ish-il-mek*=to be impelled to love, or in any other possible combination with suffixed elements. The facility with which particles are in this way tacked on produces an exuberance, especially of verbal forms, which in Osmanli, Finnish, Magyar, Tungus and Mordvinian may be said to run riot. This is particularly the case when the numerous modal forms become further complicated by incorporating the direct pronominal object, as in the Magyar *varjak*=they await him, and the Mordvinian *palasa*=I embrace him. Thus arise endless verbal combinations, reckoned in Turki at nearly 30,000, and past counting in the Ugrian group.

Another marked peculiarity of the Ural-Altaic, at least as compared with the inflecting orders of speech, is weak subjectivity, the subject or agent being slightly, the object of the action strongly accentuated, so that "it was done by him" becomes "it was done with him, through him, or in his place" (*apud eum*). From this feature, which seems to be characteristic of all the branches, there follow some important consequences, such as a great preponderance of locative forms in the declension,—the nominative, and often even the possessive, being expressed by no special suffix. Hence also the object normally precedes the subject, while the idea of possession (to have) is almost everywhere replaced by that of being (to be), so that, even in the highly developed Osmanli, "I have no money" becomes "money-to-me not-is" (*Akchehīm yokdür*). In fact the verb is not clearly differentiated from the noun, so that the conjugation is mainly participial, being effected by agglutinating pronominal, modal, temporal, negative, passive, causative, reciprocal, reflexive and other suffixes to nominal roots or gerunds: I write = writing-to-me-is. Owing to this confusion of noun and verb, the same suffixes are readily attached indifferently to both, as in the Osmanli *ján* = soul, *ján-ler* = souls, and *yázár* = he will write, *yázár-ler* = they will write. So also, by assimilation, the Yakut *kötördör kötöllör* = the birds fly (from root *köt* = flying), where *kötöl* stands for *kötör*, and *dör* for *lör*, the Osmanli *ler*, or suffix of plurality.

But, notwithstanding this wealth of nominal or verbal forms, there is a great dearth of general relational elements, such as the relative pronoun, grammatical gender, degrees of comparison, conjunctions and even postpositions. Byrne's remark, made in reference to Tungus, that "there is a great scarcity of elements of relation, very few conjunctions, and no true postpositions, except those which are given in the declension of the noun,"[1] is mainly true of the whole family, in which nouns constantly do duty for formative suffixes. Thus nearly all the Ostiak postpositions are nouns which take the possessive suffix and govern other nouns in the genitive, precisely as in the Hindi: *ādmī-kī-ṭărăf (men) găyā* = man-of-direction (in) I went = I went towards the man, where the so-called postposition *ṭărăf*, being a feminine noun = direction, requires the preceding possessive particle to be also feminine (*kī* for *kē*).

As there are thus only two classes of words—the roots, which always remain roots, and the suffixes, which always remain suffixes—it follows that there can be no true composition or word-building, but only derivation. Even the numerous Magyar nominal and adjectival compounds are not true compounds, but merely two words in juxtaposition, unconnected by vowel harmony and liable to be separated in construction by intervening particles. Thus in *aran-sinü* = gold-colour = golden, the first part *aran* receives the particle of comparison, the second remaining unchanged, as if we were to say "gold-er-colour" for "more golden"; and *ata-fi* = relative becomes *ata-m-fi-a* = my relative, with intrusion of the pronominal *m* = my.

But, while these salient features are common, or nearly common, to all, it is not to be supposed that the various groups otherwise present any very close uniformity of structure or vocabulary. Excluding the doubtful members, the relationship between the several branches is far less intimate than between the various divisions of the Semitic and even of the Aryan family, so that, great as is, for instance, the gap between English and Sanskrit, that between Lapp and Manchu is still greater.

After the labours of Castrén, Csink, Gabelentz, Schmidt, Böhtlingk, Zenker, Almqvist, Radlov, Munkacsi-Berat and especially Winkler, their genetic affinity can no longer be seriously doubted. But the order of their genetic descent from a presumed common organic Ural-Altaic language is a question presenting even greater difficulties than the analogous Aryan problem. The reason is, not only because these groups are spread over a far wider range, but because the dispersion from a common centre took place at a time when the organic speech was still in a very low state of development. Hence the various groups, starting with little more than a common first germ, sufficient, however, to give a uniform direction to their subsequent evolution, have largely diverged from each other during their independent development since the remotest prehistoric times. Hence also, while the Aryan as now known to us represents a descending line of evolution from the synthetic to the analytic state, the Ural-Altaic represents on the contrary an upward growth, ranging from the crudest syntactical arrangements in Manchu to a highly agglutinating but not true inflecting state in Finnish.[2] No doubt Manchu also, like its congeners, had formerly possessive affixes and personal elements, lost probably through Chinese influences; but it can never have possessed the surprisingly rich and even superabundant relational forms so characteristic of Magyar, Finn, Osmanli and other western branches. As regards the mutual relations of all the groups, little more can now be said than that they fall naturally into two main divisions—Mongolo-Turkic and Finno-Ugro-Samoyedo-Tungusic—according to the several methods of employing the auxiliary elements. Certainly Turkic lies much closer to Mongolic than it does to Samoyedic and Tungusic, while Finno-Ugric seems to occupy an intermediate position between Turkic and Samoyedic, agreeing chiefly in its roots with the former, in its suffixes with the latter. Finno-Ugric must have separated much earlier, Mongolic much later, from the common connexion, and the latter, which has still more than half its roots and numerous forms in common with Turkic, appears on the whole to be the most typical member of the family. Hence many Turkic forms and words can be explained only by reference to Mongolic, which has at the same time numerous relations to Finno-Ugric and Samoyedic that have been lost in Turkic and Tungusic. It may therefore be concluded that the Finno-Ugric migrations to the north and west and the Tungusic to the east had been completed while the Turkic and Mongolic tribes were still dwelling side by side on the Altai steppes, the probable cradle of the Ural-Altaic peoples.

How profoundly the several groups differ one from the other even in their structure is evident from the fact that such assumed universal features as unchangeable roots and vowel harmony are subject to numerous exceptions, often spread over wide areas. Not only is assimilation of final consonants very common, as in the Osmanli *bulun-mak* for the Uighur *bulul-mak*, but the root vowel itself is frequently subject to *umlaut* through the influence of suffixed vowels, as in the Aryan family. Thus in the Surgut dialect of Ostiak the long vowels of nominal stems become modified before the possessive suffix, *ā* and *ē* to *ī* and *ō* to *ū* (Castrén). It is still more remarkable to find that the eastern (Yenisei) Ostiak has even developed verbal forms analogous to the Teutonic strong conjugation, the presents *tabāq'*, *abbatag'an* and *datpaq'* becoming in the past *tobāq'*, *abbatog'an* and *datpiyaq'* respectively; so also *taig, tōrg and tārg*, present, past and imperative, are highly suggestive of Teutonic inflexion, but more probably are due to Tibetan influences. In the same dialects many nouns form their plurals either by modifying the root vowel, in combination with a suffixed element, or by modification alone, the suffix having disappeared, as in the English *foot—feet, goose—geese.* So also vowel harmony, highly developed in Finnish, Magyar and Osmanli, and of which two distinct forms occur in Yakutic, scarcely exists at all in Cheremissian, Votyak and the Revel dialect of Esthonian, while in Mordvinian and Syryenian, not the whole word, but the final vowels alone are harmonized. The unassimilated Uighuric *kilur-im* answers to the Osmanli *kilur-um*, while in Manchu the concordance is neglected, especially when two consonants intervene between the root and the suffixed vowels. But too much weight should not be attached to the phenomenon of vowel harmony, which is of comparatively recent origin, as shown in the oldest Magyar texts of the 12th century, which abound in such discordances as *halál-nek, tiszta-seg*, for the modern *halál-nak, tiszta-sag*. It clearly did not exist in the organic Ural-Altaic speech, but was independently developed by the different branches on different lines after the dispersion, its origin being due to the natural tendency to merge root and suffix in one harmonious whole.

This progressive vocalic harmony has been compared to a sort of progressive *umlaut*, in which the suffixed vowels are brought by assimilation into harmony with those of the root. All vowels are broadly divided into two categories, the guttural or hard and the palatal or weak, the principle requiring that, if the root vowel be hard, the suffixed must also be hard, and vice versa. But in some of the groups there is an intermediate class of "neutral" vowels, which do not require to be harmonized, being indifferent to either category. In accordance with these general principles the vowels in some of the leading members of the Altaic family are thus classified by L. Adam:[3]—

	Gutturals.	Palatals.	Neutrals.
Finnish	u, o, a	ü, ö, ä	e, i
Magyar	u, o, a	ü, ö	e, i
Mordvinian . . .	u, o, a	ä, i	. .
Syryenian	ô, a	ä, i, e	. .
Osmanli	u, o, a, e	ü, ö, e, i	. .
Mongolian	u, o, a	ü, ö, ä	i
Buriat	u, o, a	ü, ö, ä	e, i
Manchu	ô, ȯ, a	e	u, i

A close analogy to this law is presented by the Irish rule of "broad to broad" and "slender to slender," according to which under certain conditions a broad (*a, o, u*) must be followed in the next syllable by a broad, and a slender (*e, i*) by a slender. Obvious parallelisms are also such forms in Latin as *annus, perennis, ars, iners, lego, diligo*, where, however, the root vowel is modified by the affix, not the affix by the root. But such instances suffice to show that the harmonic principle is not peculiar to the Ural-Altaic, but only more systematically developed in that than in most other linguistic families.

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[1] *Gen. Prin. of Struct. of Lang.* i. 391 (London, 1885).

[2] "Meine Ansichten werden sich im Fortgange ergeben, so namentlich dass ich nicht entfernt die finnischen Sprachen für flexivische halten kann" (H. Winkler, *Uralaltaische Völker*, 1884, i. p. 54). Yet even true inflexion can scarcely be denied at least to some of the so-called Yenisei Ostiak dialects, such as Kotta and others still surviving about the middle Yenisei and on its affluents, the Agul and Kan (Castrén, *Yen., Ostjak und Kott. Sprachlehre*, 1858, Preface, pp. v-viii). These, however, may be regarded as aberrant members of the family, and on the whole it is true that the Ural-Altaic system nowhere quite reaches the stage of true inflexion.

[3] *De l'harmonie des voyelles dans les langues Ouralo-Altaïques* (Paris, 1874).

Bibliography.—Besides the references given above, the chief general treatises on Ural-Altaic philology are: Winkler, *Das Uralaltaische und seine Gruppen* (Berlin, 1885); Kellgren, *Die Grundzüge der finnischen Sprachen mit Rücksicht auf die Ural-altaischen Sprachstämme* (Berlin, 1847); Castrén, *Ueber die Ursitze des finnischen Volkes* (Helsingfors, 1849); ibid., *Syrjaen. Gram.*, *Samojed. Gram.*, and numerous other comparative grammars, dictionaries and general treatises, chiefly on the Finno-Ugric and Samoyedic groups; W. Thomsen, *Ueber den Einfluss der germanischen Sprachen auf die Finnisch-Lappischen* (Germ. trans. by Sievers, Halle, 1870—a classical work); Abel Rémusat, *Recherches sur les langues Tartares* (Paris, 1820); L. Adam, *Gram. de la langue Mandchoue*(Paris, 1872), and *Gram. de la langue Tongouse*(Paris, 1874); Böhtlingk, *Die Sprache der Jakuten* (St Petersburg, 1851); Radloff, *Volksliteratur der türkischen Stämme Süd-Sibiriens* (St Petersburg, 1872), and "Remarks on the Codex Comanicus," *Bull. St Petersb. Acad. Sc.* xxxi. No. 1; Zenker, *Gram. der türkischen-tatarischen Sprachen*; Schmidt, *Mongol. Gram.*; Gabelentz, *Gram. Mandchoue* (Altenburg, 1833); Csink, *Hung. Gram.* (London, 1853); and Vambéry, *Das Türkenvolk* (Leipzig, 1885), and *Uigurische Sprach-Monumente u. das Kudatkü Bilik* (Innsbruck, 1870). (A. H. K.)

URAL MOUNTAINS, a system of mountains which extends from the Arctic Ocean southwards nearly to the Caspian Sea, and is regarded as separating Europe from Asia. Russians describe them either as Kameñ (stone) merely, or by the appropriate name of Poyas (girdle), while the name of Urals (*Uraly*)—derived either from the Ostyak *urr* (chain of mountains) or from the Turkish *aral-tau* or *ural-tau*—has with them become a generic name for extensive mountain chains. Although the real structure of the Urals, both orographical and geological, is imperfectly ascertained, enough is known to warrant the statement that they have been affected by a series of separate upheavals, some having a north-western strike and some a north-eastern, and that they reach their maximum altitudes along a zone stretching nearly north and south. The composite nature of the Urals is best seen at the northern and southern extremities of the system, where the upheavals assume the character of distinct chains of mountains.

The Paë-khoy or coast ridge (Samoyedic "stony ridge") is quite independent of the Urals proper, from which it is separated by a marshy *tundra*, some 30 m. wide. It has a distinct north-north-westerly and north-westerly trend along the shores of the Kara Sea; and, although it is cut through by the Ugrian Strait (Yugorskiy-shar), there is no doubt that it is continued in Vaygach Island and Novaya-Zemlya. Its dome-shaped summits, which rise 1000 ft. above the *tundra* (Vozaipaë, 1312 ft.), are completely destitute of trees, and its stony crags are separated by broad marshy *tundras*.

The Obdorsk or Northern Urals, which begin within a few miles of the head of Kara Bay (Konstantinov Kameñ, in 68° 30′ N., 1465 ft.), and extend south-west as far as the 64th parallel, form a distinct range, stony and craggy, sloping steeply towards the south-east and gently towards the marshes of European Russia. Its highest elevations (*e.g.* Khard-yues, 3715 ft., and Paë-yer, 4650 ft.) are on the 66th and 67th parallels. Sometimes the main chain has on the west two or three secondary chains, formed by the upheaval of sedimentary rocks, and it is towards the southern extremity of one of these that the highest peaks of the Urals occur (Sablya, 5135 ft., in 64° 47′ N., and Töll-poz-iz or Muraï-chakhl, 5535 ft. in 63° 55′). Dense forests, chiefly fir, pine and larch, clothe the slopes of the mountains and the narrow valleys; but, as the less hospitable latitudes are approached, every species except the larch gradually disappears and the upper limit of vegetation (2400 ft. in the south) rapidly descends till it reaches the very base of the mountains towards the Arctic Circle, and forest vegetation disappears altogether about 65° N. (67° in the plains of Russia and Siberia).

Although usually reckoned to the Northern Urals, the section between 64° and 61° N. has again a wholly distinct character. Here the main chain (or, more correctly, the main water-parting) of the Urals is a succession of plateaus stretching in a north-westerly direction, and dimpled with broad, flat, marshy valleys, rising here and there into isolated dome-shaped, flattened summits, mostly under 3000 ft. (Yang-tump, 62° 43′ N., 4170 ft.). The whole region, except the mountain summits, is densely clothed with coniferous forests, birch appearing only occasionally in the south, and even the Scotch pine only in a few valleys. This part of the range is also uninhabited.

The Middle Urals, between 61° and 55° 30′ N. and about 80 m. in breadth, are the best known, as they contain the richest iron, copper and gold mines (Bogoslovsk, Goroblagodatsk and Ekaterinburg Urals). The Denezhkin Kameñ in the north (5355 ft.) and the Tara-tash in the south (2800 ft.) may be considered as marking the limits of this section. Here the orographical structure is still more complicated. In the north (61st to 60th parallel) there is a succession of chains with a distinct north-eastern trend; and it still remains an open question whether, for two degrees farther south, the whole of the Bogoslovsk Urals (4795 ft. in the Konzhakovski-Kameñ, and from 3000 to 4000 ft. in several other summits) do not consist of chains having the same direction. South of Kachkanar (2885 ft.), *i.e.* from the 58th to the 56th parallel, the Urals assume the appearance of broad swellings 1000 to 2000 ft. in height, deeply trenched by ravines. These low and ravine-broken plateaus, the higher parts of which can be reached from Russia on a very gentle gradient, have been utilized for centuries as the chief highway to Siberia. The water-parting between the Russian and Siberian rivers is here not more than 1245 ft. above sea-level on the great Russo-Siberian highway (W. of Ekaterinburg). The eastern slope is steeper, but even there Ekaterinburg is only 435 ft. below the water-parting. The valleys have a decidedly south-eastern direction, and such is also the course of the railway from Perm to Tyumeñ, as soon as it reaches the Siberian slope. The Middle Urals are densely forested. The valleys and lower slopes are covered with a thick sheet of rich humus and have become the site of large and wealthy villages. The mines also support a considerable population.

The Southern Urals (55° 30′ to 51° N.), instead of being made up of three chains of mountains radiating from Mount Yurma, as was formerly supposed, consist of three parallel chains running north-east and south-west, and therefore constitute a quite independent part of the Ural system. The Urals proper are a low sinuous chain extending due south-west and hardly exceeding 2200 to 2800 ft. in altitude. They slope gently towards the north-west and abruptly towards the south-east, where several short, low spurs (Ilmeñ, Irenly) rise in the basins of the Miyas and the Ui. In the west a chain, separated from the main range, or Ural-tau, by a longitudinal valley, accompanies it throughout its entire length. This, although pierced by the rivers which rise in the longitudinal valley just mentioned (Ai, Upper Byelaya), nevertheless rises to a much greater height than the main range. Its wild stony crest reaches an extreme altitude of 5230 ft. Farther west, another series of chains reach nearly the same altitudes. The gorges by which the rivers pierce the Devonian limestones on their way towards the lower terraces are most picturesque in the west, where the Urals assume an alpine character. The forests are no longer continuous; the gentle slopes of the hilly tracts are dotted with woods, mostly of deciduous trees, while the hollows contain rich pasture grounds. The whole region, formerly the exclusive abode of the Bashkirs, is being colonized by Russians.

Farther south, between the 53rd and 51st parallels, the main range continues in the same direction, and, except when deeply trenched by the rivers, assumes the appearance of a plateau which hardly reaches 1500 ft. It is continued farther south-west (towards the Volga) under the name of Obshchiy Syrt.

As a rule, the Urals are not considered to continue south of the great bend of the Ural river, where quite independent ranges of hills, or flat swellings, appear (*e.g.* Dzhaman-tau, Mugodzhar Hills). It appears, however, that the Mugodzhar Hills may safely be regarded as an actual prolongation of the upheavals which constitute the Urals. These consist of diorites and crystalline slates, and reach their maximum in Aïryuk (1885 ft.). A range of heights connects the Mugodzhar Hills with the Ust-Urt plateau (see Transcaspian Region).

Geology.—The Ural Mountains are no more than the western edge of a broad belt of folding of which the greater part is buried beneath the Tertiary deposits of western Siberia. Throughout the greater portion of the chain a broad strip of granites, diorites, peridotites, gneisses and other crystalline rocks rises directly from the Siberian plain, and is covered towards the west by Silurian, Devonian, Carboniferous, Permian and Triassic strata, which are thrown into numerous folds parallel to the length of the chain and usually rise to much greater heights than the crystalline zone. In the north, however, folded sedimentary rocks lie to the east as well as to the west of the crystalline axis, and between 60° 40′ and 46° 50′ N. Fedorov distinguishes three zones: (i.) the eastern hill region, where one finds Mesozoic rocks (Chalk, Jurassic) in the north, and Devonian limestones, porphyrites and quartz-porphyries farther south; in this zone most gold placers are found; (ii.) the central mountain zone consists of various amphibolitic metamorphic slates, and also of syenite and gabbro; granites, gneisses, and occasionally serpentines and porphyrites are found subordinately; and (iii.) the western hilly zone consists chiefly of Carboniferous and Permo-Carboniferous deposits; Middle and Upper Devonian limestones and, occasionally, crystalline slates are found in a few meridional ridges. The crystalline rocks are usually believed to be of Archean age. The Carboniferous deposits—coal-bearing in the Middle and Southern Urals—although appearing at the surface only as a narrow strip in the west Urals, occupy an extensive area, but are concealed by the largely developed Permian deposits, and that series of sediments which must be considered as intermediate between the Carboniferous and the Permian. These latter, described as "Permo-Carbon" by Russian and German geologists, are largely developed in the west Urals. The Permian deposits cover a wide zone all along the western slope of the Urals from north to south, and are most important on account of their copper ores, salt beds and salt springs. They are also covered with variegated marls which are almost destitute of fossil organisms, so that their age is not yet quite settled.

Climatic, Geo-Botanical and Geo-Zoological Importance.—The importance of the Urals as a climatic and geo-botanical boundary can no longer be regarded as very great. Most European species of plants freely cross the Urals into Siberia, and several Siberian species travel across them into northern Russia. But, being a zone of hilly tracts extending from north to south, the Ural Mountains necessarily exercise a powerful influence in pushing a colder northern climate, as well as a northern flora and fauna, farther south along their axis. The harshness of the climate at the meteorological stations of Bogoslovsk, Zlatoust and Ekaterinburg is not owing merely to their elevation a few hundred feet above sea-level. Even if reduced to sea-level, the average temperatures of the Ural meteorological stations are such as to produce a local deflexion of the isotherms towards the south. The same is true with regard to the limits of distribution of vegetable and animal species. The reindeer, for instance, is met with as far south as the 52nd parallel. The Southern Urals introduce into the Cis-Caspian steppes the flora and fauna of middle Russia.

In the distribution of the races of mankind the Urals have played an important part. To the present day the Northern Urals are inhabited by Finnish races (Samoyedes, Syryenians, Voguls and Permians) who have been driven from their former homes by Slav colonization, while the steppes on the slopes of the Southern Urals have continued to be inhabited by the Turkish Bashkirs. The Middle Urals were in the 9th century the abode of the Ugrians, and their land, Bjarmeland or Biarmia (now Perm), was well known to the Byzantine historians for its mineral wealth,—there being at that time a lively intercourse between the Ugrians and the Greeks. Compelled to abandon these regions, they moved (in the 9th century) south along the Ural slopes towards the land of the Khazars, and through the prairies of south-eastern and southern Russia (the Λεβεδία of Constantine Porphyrogenitus) towards the Danube and to their present seat—Hungary—leaving but very few memorials behind them in the Northern and Middle Urals.[1] At present the Urals, especially the Middle and the Southern, are being more and more colonized by Great Russian immigrants, while the Finnish tribes are rapidly melting away.

Metallurgy and Mining.—The mineral wealth of the Urals was known to the Greeks in the 9th century, and afterwards to the Novgorodians, who penetrated there in the 11th century for trade with the Ugrians. When the colonies of Novgorod (Vyatka, Perm) fell under the rule of Moscow, the Russian tsars soon grasped the importance of the Ural mines, and Ivan III. sent out German engineers to explore that region. In 1558 the whole of the present government of Perm was granted by the rulers of Moscow to the brothers Stroganov, who began to establish salt-works and mines for iron and copper. Peter the Great gave a new impulse to the mining industry by founding several iron-works, and from 1745, when gold was first discovered, the Russian colonization of the Urals took a new departure. The colonization was of a double character, being partly free—chiefly by Nonconformists in search of religious freedom—and partly compulsory,—the government sending peasant settlers who became serfs at the iron and copper works. Until 1861 all work at the mines was done by serfs belonging either to private persons (the Stroganovs, Demidovs and others) or to the crown. Not only are the Urals very rich in minerals, but the vast areas covered with forests afford an almost inexhaustible supply of cheap fuel for smelting purposes. Thus for a long time the Urals were the chief mining region in Russia. But when coal began to be used for smelting purposes, south Russia generally, and Ekaterinoslav in particular, became the chief iron-producing region. Attention has, however, again been directed to the great mineral wealth locked up in the mountain region, and the last two years of the 19th century witnessed a "boom" in the purchase of iron and gold mines by foreign companies. The chief pig-iron and iron-works are at Nizhniy-Tagilsk, and the principal steel-works at Bogoslovsk. The manufacture of agricultural machinery has increased in the southern Urals, especially at Krasno-ufimsk, and the manufacture of tea-urns has grown in importance at Perm.

Gold is met with in the Urals both in veins and in placers; the output increased from about 30,000 oz. in 1883 to three times that amount at the end of the century. The Urals have also rich placers of platinum, often mixed with gold, iridium, osmium and other rare metals, and supply annually some 13,000 ℔, *i.e.* 95% of all the platinum obtained in the world. Silver, mercury, nickel, zinc and cobalt ores are found. Rich mines of copper are found at Turinsk, Gumishev and other places, yielding as much as 5% of pure copper; nickel is obtained at Revdinsk, and the extraction of iron chromates has developed. Coal exists in many places on the western slope of the Urals, mainly on the Yaiva river, in the basin of the Kama, and on the Usva (basin of the Chusovaya), and about 500,000 tons are raised annually. Several beds of coal have been found on the eastern slope; excellent anthracite exists at Irbit and good coal at Kamyshlov. Sapphires, emeralds, beryls, chrysoberyls, tourmalines, aquamarines, topaz, amethysts, rock-crystals, garnets and many kinds of jade, malachite and marble are cut and polished at several stone-cutting works, especially at Ekaterinburg; and diamond-mining may prove successful. Good asbestos is extracted, and pyrites is worked for the manufacture of sulphuric acid Many varieties of mineral waters occur in the Urals, the best being those at Serginsk, Klyuchevsk and Elovsk.

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(P. A. K.; J. T. BE.)

URALSK, a province of Asiatic Russia, lying N. of the Caspian Sea, with an area of 140,711 sq. m. It is bounded by the government of Astrakhan on the W., Samara and Orenburg on the N., Turgai and the Sea of Aral on the E., and the Caspian Sea and Transcaspian region on the S. It is geographically situated mostly within the boundaries of Asia, *i.e.* E. of the Ural river, and both its physical features and its inhabitants are, to a very large extent, Asiatic. Administratively, it belongs to the "Kirghiz provinces," or governor-generalship of the Steppes. Apart from a narrow strip of land in the north, where the slopes of the Obshchiy-Syrt plateau, covered with fertile black earth and stretches of forest, descend towards the Ural river, and the gentle slopes of the Mugojar Hills in the north-east, Uralsk consists of arid steppes and deserts, which incline with an imperceptible gradient towards the Caspian. Most of the province is below sea-level, the zero altitude line running from Kamyshin on the Volga to the south of the town of Uralsk.

Uralsk is drained by the river Ural or Yaik, which rises in Orenburg and flows south, west and south, entering the Caspian after a course of 900 m. Its chief tributaries, the Sakmara, the Qr and the Ilek, are in the north; along its lower course the Great and Little Uzeñ and many small streams on the left bank become lost in lakes before reaching the Ural. The Emba, which flows through the north of the Ust-Urt plateau, reaches the Caspian by a series of shallow lagoons, which were navigable in the 18th century.

The climate is influenced by the Central Asian steppes. A cold and dry winter is succeeded by a hot and still drier summer, during which the grass, and sometimes all the crops, are destroyed by the burning heat. Uralsk, although lying wholly to the south of 52° N., has the same average yearly temperature as Moscow and south Finland (39°·5); its January is colder than that of north Finland (3°), while July averages 73°.

The estimated population in 1906 was 730,300. It consists of three different elements—Ural Cossacks, who constitute about one-fifth; some 15,000 Russian peasants, and Kirghiz. The Kirghiz are almost entirely dependent on pastoral pursuits. The Cossacks, descendants of those independent communities of free settlers and Raskolniks who are so often mentioned in Russian history under the name of Yaik Cossacks, owing to their unwillingness to submit to the rule of the tsars, are fine representatives of the Great Russian race, though not without some admixture of Tatar and Kalmuck blood. Their chief occupations are live-stock breeding and fishing.

History.—In the first half of the 16th century Uralsk was occupied by the Nogai horde, a remnant of the Mongol Golden Horde, which retired there after the fall of Astrakhan and Kazan; the khans resided at Saraichik on the river Ural. At the same time the lower parts of the Ural were occupied by Russian runaway serfs and free Cossacks who did not recognize the authority of Moscow. They took Saraichik in 1560 and formed an independent community, like that of the Zaporogian Cossacks. When the Moscow princes attempted to bring them under their rule and prosecuted them for nonconformity, the Cossacks revolted, first under Stenka Razin (1667–71) and afterwards under Pugachev (1773–75). After the latter rising, the name of Ural was officially given to the Yaik river and the Yaik Cossacks. The disbanding of their artillery, the planting of Russian garrisons within the domains of the *voisko*, and the interference of Russian officials in their interior organization during the 19th century occasioned a series of smaller outbreaks, the latest of which, in 1874, resulted in the deportation of 2500 Cossacks, with their families, to Turkestan.

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[1] Comp. *Moravia and the Madiars*, by K. J. Groth; Zabyelin's *History of Russian Life*, and the polemics on the subject in *Izvestia* of the Russ. Geogr. Soc., xix. (1883).

URALSK, a town of Asiatic Russia, the capital of the province of the same name, on the Ural river, 165 m. W.S.W. of Orenburg, and 270 m. by rail E. of Saratov. Pop. (1885) 26,055; (1901) 38,919. It is rapidly developing owing to its trade with the nomad Kirghiz in cattle, sheep and animal products, all of which are exported to Russia; it is also a centre for trade in grain. It has two cathedrals, founded, one in the 18th century, the other in 1837; a small museum, a school farm, a people's palace, free libraries, and branches of the Russian Geographical and the Fisheries Societies.

URANIUM [symbol U, atomic weight 238·5 ($O=16$)], a metallic chemical element. In 1789 Klaproth isolated from pitchblende a yellow oxide which he viewed as the oxide of a new metal, which he named uranium, after the newly discovered planet of Herschel. By reducing the oxide with charcoal at a high temperature, he obtained a product which he took to be metallic uranium. Berzelius about 1823 found that the yellow oxide, when treated with excess of sulphuric acid, gave a sulphate not unlike the ferric salt. He concluded that the uranium salt was $Ur_2O_3 3SO_3$, where Ur_2O_3, according to his analysis, represents 864 parts of yellow oxide ($O=16$). Like Fe_2O_3, the yellow oxide lost 48 parts of oxygen per Ur_2O_3 (=864 parts) as water, while $Ur_2=816$ parts of metal remained. These results were adopted until Péligot in 1840 discovered that Berzelius's (and Klaproth's) metal contains oxygen, and that his $(Ur_2)O_3$ really is $(U_6O_6)\cdot O_3=3U_2O_3$, where $U=120$ is one equivalent weight of real uranium. Péligot's results, though called in question by Berzelius, have been amply confirmed by all subsequent investigators; only now, on theoretical grounds, first set forth by Mendeléeff, we double Péligot's atomic weight, so that U now signifies 240 parts of uranium, while UO_3 stands as the formula of the yellow oxide, and UO_2 as that of Berzelius's metal.

The only practically available raw material for the extraction of uranium is pitchblende (*q.v.*). Pure pitchblende is U_3O_8, which, in relatively good specimens, forms some 80% or more of the whole. It is remarkable as always containing helium (*q.v.*) and radioactive elements (see RADIOACTIVITY). To extract the metal, the pitchblende is first roasted in order to remove the arsenic and sulphur. In one process the purified ore is disintegrated with hot nitric acid to produce nitrates, which are then converted into sulphates by evaporation with sulphuric acid. The sulphates are treated with water, which dissolves the uranium and other soluble salts, while silica, lead sulphate, &c., remain; these are removed by filtration. From the solution the arsenic, copper, &c., are precipitated by sulphuretted hydrogen as sulphides, which are filtered off. The filtrate contains the uranium as uranous and the iron as ferrous salt. These are oxidized and precipitated conjointly by excess of ammonia. The precipitate, after having been collected and washed, is digested with a warm concentrated solution of ammonium carbonate, which dissolves the uranium as a yellow solution of ammonium uranate, while the hydrated oxide of iron, the alumina, &c., remain. These are filtered off hot, and the filtrate is allowed to cool, when crystals of the uranate separate out. The mother liquor includes generally more or less of nickel, cobalt, zinc and other heavy metals, which, as Wöhler showed, can be removed as insoluble sulphides by the addition of ammonium sulphide; uranium, under the circumstances, is not precipitated by this reagent. The filtrate, on being boiled down, yields a second crop of uranate. This uranate when ignited in a platinum crucible leaves a green oxide of the composition U_3O_8, *i.e.* artificial pitchblende, which serves as a starting-point for the preparation of uranium compounds. The green oxide, as a rule, requires to be further purified. One method for this purpose is to convert it into a solution of the nitrate $UO_2(NO_3)_2$, and from it to precipitate the metal as oxalate by oxalic acid (Péligot). The latter ($UO_2\cdot C_2O_4$) yields a purer oxide, UO_2, or, in the presence of air, U_3O_8, on ignition.

Metallic uranium, as shown by Péligot, can be obtained by the reduction of a mixture of dry chloride of potassium and dry uranous chloride, UCl_4, with sodium at a red heat. A better process is that of H. Moissan (*Compt. rend.*, 1896, 122, p. 1088), in which the oxide is heated with sugar charcoal in the electric furnace. Uranium is a white malleable metal, which is pretty hard, though softer than steel. Its specific gravity has the high value 18·7; its specific heat is 0·02765, which, according to Dulong and Petit's law, corresponds to $U=240$. It melts at bright redness. The compact metal when exposed to the air tarnishes only very slowly. The powdery metal when heated in air to 150° or 170° C. catches fire and burns brilliantly into U_3O_8; it decomposes water slowly at ordinary temperatures, but rapidly when boiling. It burns in oxygen at 170°, in chlorine at 180°, in bromine at 210°, in iodine at 260°, in sulphur at 500°, and combines with nitrogen at about 1000°. Dilute sulphuric acid attacks it but slowly; hydrochloric acid, especially if strong, dissolves it readily, with the formation, more immediately, of a hyacinth-coloured solution of U_2Cl_6, which, however, readily absorbs oxygen from the air, with the formation of a green solution of UCl_4, which in its turn gradually passes into one of yellow uranyl salt, $UO_2\cdot Cl_2$.

Uranium is chemically related to chromium, molybdenum and tungsten. If forms two series of salts, one, the uranous compounds, are derived from the oxide UO_2, the other, the uranyl compounds, contain the divalent group UO_2.

Uranous Compounds.—Uranium dioxide, UO_2 (Berzelius's metal), is a brown to copper-coloured powder, obtained by heating U_3O_8 or uranyl oxalate in hydrogen. It fires when heated in air, and dissolves in acids to form uranous salts. It may be obtained as jet black octahedra (isomorphous with thoria) by fusion with borax. Uranous hydrate is obtained as reddish-brown flakes by precipitating a uranous solution with alkali. The solution in sulphuric acid deposits green crystals of the sulphate, $U(SO_4)_2\cdot 8H_2O$, on evaporation. Uranous chloride, UCl_4, was first prepared by Péligot by heating an intimate mixture of the green oxide and charcoal to redness in a current of dry chlorine; it is obtained as sublimate of black-green metallic-looking octahedra. The chloride is very hygroscopic. By heating in hydrogen it yields the trichloride, UCl_3, and by direct combination with chlorine the pentachloride, UCl_5. With hydroflouric acid it yields uranous fluoride, UF_4, which forms double salts of the type $MF\cdot UF_4$. Uranous bromide, UBr_4, and uranous iodide, UI_4, also exist.

Uranyl or Uranic Compounds.—Uranic oxide, UO_3 or $UO_2\cdot O$, is obtained by heating uranyl nitrate to 250° as a yellow solid, insoluble in water, but soluble in acids with the formation of uranyl salts. Various hydrates have been described, but they cannot be formed by precipitating a uranyl salt with an alkali, this reagent giving rise to salts termed *uranates*. These salts generally resemble the bichromates; they are yellow in colour, insoluble in water, soluble in acids, and decomposed by heat. Sodium uranate, $Na_2U_2O_7$, is used as a pigment for painting on glass and porcelain under the name of uranium yellow. It is manufactured by heating pitchblende with lime, treating the resulting calcium uranate with dilute sulphuric acid, and adding sodium carbonate in excess. Dilute sulphuric acid precipitates uranium yellow, $Na_2U_2O_7\cdot 6H_2O$, from the solution so obtained. Ammonium uranate heated to redness yields pure U_3O_8, which serves as a raw material for uranium compounds. Uranyl nitrate, $UO_2(NO_3)_2\cdot 6H_2O$, is the most important uranium salt. It is obtained as fine lemon yellow deliquescent prisms by evaporating a solution of any of the oxides in nitric acid. By electrolysis it yields uranium dioxide as a pyrophoric powder, and peruranic hydroxide, $UO_4\cdot 2H_2O$, when treated with hydrogen peroxide. The latter gives rise to salts, the peruranates, *e.g.* $(Na_2O_2)_2UO_4\cdot 8H_2O$. Uranyl nitrate is used in photography, and also in analytical chemistry as a precipitant for phosphoric acid (as uranyl ammonium phosphate, $UO_2\cdot NH_4\cdot PO_4$). Uranyl chloride, UO_2Cl_2, is a yellow crystalline mass formed when chlorine is passed over uranium dioxide at a red heat. It is also obtained by dissolving the oxide in hydrochloric acid and evaporating. It forms double salts with metallic chlorides and with the hydrochlorides of organic bases. Uranyl sulphide, UO_2S, is a black precipitate obtained by adding ammonium sulphide to a uranyl solution. Exposed to air this mixture is oxidized to the pigment *uranium red*, $U_6(NH_4)_2SO_9$, which is a fine blood-coloured amorphous powder.

Analysis.—A borax bead dissolves uranium oxides in the reducing flame with a green, in the oxidizing flame with a yellow, colour. Solutions of uranyl salts (nitrate, &c.) behave to reagents as follows: sulphuretted hydrogen produces green uranous salt with precipitation of sulphur; sulphide of ammonium in neutral solutions gives a black precipitate of UO_2S, which settles slowly and, while being washed in the filter, breaks up partially into hydrated UO_2 and sulphur; ammonia gives a yellow precipitate of uranate of ammonia, characteristically soluble in hot carbonate of ammonia solution; prussiate of potash gives a brown precipitate which in appearance is not unlike the precipitate produced by the same reagent in cupric salts.

URANUS, in astronomy, the seventh major planet in the order of distance from the sun, and denoted by the symbol ⛢ or ♅. It was discovered by the elder Herschel on the

13th of March 1781. He saw it as a round nebulous disk, slowly moving among the stars, and at first supposed it to be a comet, and announced it as such to the Royal Society. But a few weeks' observation showed it to be moving in a nearly circular orbit at a distance from the sun about nineteen times that of the earth. Its planetary character was thus established, and Herschel named it the *Georgium Sidus* in honour of his royal patron. This name was long recognized in England, and "the Georgian" was officially used in the Nautical Almanac up to 1850. But it was never received with favour on the continent of Europe, nor was that of the discoverer, which was proposed by Lalande. The name Uranus was proposed by Bode, and adopted everywhere outside of England.

As seen in a telescope of the highest power, Uranus presents to the eye the appearance of a disk about four seconds in diameter of a faint sea-green tint. No trace of a marking can be seen on the surface, and, so far as measures have yet been made on it, no deviation of the disk from a circular form has been established. Nothing is therefore known as to its axial rotation. Although the planet is commonly considered a telescopic one, it is really of the sixth magnitude, and therefore faintly visible to the naked eye if one knows precisely where to look for it. Long before its discovery it had been observed as a fixed star by J. Flamsteed. P. C. Lemonnier also made eight observations of it during the opposition of 1768–69, which would have revealed its planetary character had he reduced and compared them. For other particulars relating to Uranus, its spectrum, &c., see PLANET.

Satellites of Uranus.—In January 1787 Herschel detected two satellites of Uranus of which the inner one, now known as Titania, had a period of 9 days, the outer, Oberon, of 13½ days. He also on other occasions saw what he supposed to be two additional satellites, but careful investigation of his observations has shown that the supposed objects could not have been of this character. But in 1851–52 William Lassell at Malta, in conjunction with his assistant A. Marth, observed two satellites yet nearer the planet than those of Herschel. These are now known as Ariel and Umbriel. Their periodic times are about 2½ and 4 days respectively. Lassell's telescopes, which were reflectors, were superior to others of his time in light-power, and these inner satellites were not seen by other astronomers for more than twenty years after their discovery. Indeed, doubts of their reality sometimes found expression until, in 1873, they were observed with the Washington 26-inch telescope, and observations upon them showed their identity with the objects discovered by Lassell. The greater difficulty in seeing the inner than the outer satellites arises from their proximity to the planet. There is no very great difference in the actual brightness of the four objects. It is found that Umbriel, though less easy to see than Titania, actually exceeds it in light. But none of them has been seen except in a few of the most powerful telescopes. The most remarkable feature of these bodies is that, instead of the planes of their orbits being near that of the ecliptic, they are actually inclined to it nearly 90°. The result is that, as the planet performs its orbital revolution, there are two opposite points near which the orbits are seen edgewise, and the satellites seem to us to swing north and south on each side of the planet. This was the case in 1882, and will be the case again in 1924. At the points midway between these two, through which the planet passed in 1861 and 1903, and will pass again in 1945, the orbits are seen almost perpendicularly, so that the apparent orbit, like the real one, is nearly circular.

Orbits of the Satellites of Uranus.—So far as has yet been determined, the four satellites all revolve in the same plane, the position of which, referred to the Earth's equator and equinox, is—

R.A. of ascending node, $166^\circ{\cdot}05+0^\circ{\cdot}01420t$.
Inclination of orbit, $75^\circ{\cdot}28-0^\circ{\cdot}0013t$.

None of the orbits seems to have a measurable eccentricity. The positions of the satellites in the orbits at any time may be found from the following elements, where u is the angular distance from the node upon a plane parallel to that of the Earth's equator, and the motion is that in a Julian year.

Satellite.	u at Epoch.	Annual Motion.	Daily Motion.	Mean Dist.
Ariel . .	22°·61	579 rev. +242°·64	142°·836	13″·78
Umbriel . .	136°·49	352 ,, +195°·31	86°·869	19″·20
Titania . .	229°·93	167 ,, +294°·20	41°·351	31″·48
Oberon . .	154°·90	108 ,, +186°·27	26°·739	42″·10

The epoch force is 1872, January 0, Washington mean noon. The mean distance is the angle subtended by the radius of the orbit as seen at the mean distance of Uranus from the Sun ($\log a=1{\cdot}28310$).

BIBLIOGRAPHY.—Details as to Uranus are found in Chambers's *Descriptive Astronomy*, and all the current treatises on popular astronomy. For researches on the spectrum of the planet see Sir William Huggins in *Proceedings of the Royal Society*, vol. xix., (1871); H. C. Vogel, *Astrophysical Journal*, vol. i.; and P. Lowell, *Bulletin of the Lowell Observatory*, No. 13. Tables of the motions of this planet were published by Alexis Bouvard in 1813, S. Newcomb in 1873 (*Smithsonian Contributions to Knowledge*, No. 262), Leverrier in 1877 (*Annales de l'observatoire de Paris, Mémoires*, tome xiv.), and Newcomb again in *Astronomical Papers of the American Ephemeris*, vol. vii. Tables of the four satellites are found in Newcomb, *Uranian and Neptunian Systems* (Appendix I. to *Washington Observations* for 1873). Observations are found in the Bulletins of the Lick Observatory and elsewhere. (S. N.)

URANUS (Heaven), in Greek mythology, the husband of Gaea (Earth), and father of Cronus (Saturn) and other deities. As such he represents the generative power of the sky, which fructifies the earth with the warmth of the sun and the moisture of rain. For the legend of his treatment by Cronus and its meaning, see SATURN. Uranus and other Greek gods anterior to Zeus were probably deities worshipped by earlier barbarous inhabitants of the land.

The Roman Caelus (or Caelum) is simply a translation of the Greek Οὐρανός, not the name of a distinct national divinity. There is no evidence of the existence of a cult of Caelus, the occurrence of the name in dedicatory inscriptions being due to Oriental influences, the worship of the sky being closely connected with that of Mithras. Caelus is sometimes associated with Terra, represented in plastic art as an old, bearded man holding a robe stretched out over his head in the form of an arch.

See Wissowa, *Religion der Römer* (1902), p. 304, and his article in Pauly-Wissowa's *Realencyclopädie*, iii. pt. 1 (1897); also Steuding in Roscher's *Lexikon der Mythologie* and De Vit's *Onomasticon* (suppt. to Forcellini's *Lexicon*).

URA-TYUBE, or ORA-TEPE, a town of Russian Turkestan, in the province of Samarkand, lying 37 m. S.W. of Khojent, on the road from Ferghana to Jizak across the Zarafshan range. Pop. (1900) 22,088, chiefly Uzbegs. It is surrounded by a wall and has a citadel. The inhabitants carry on trade in horses and camel-wool cloth, and manufacture cottons, boots and shoes, oil, and camel's-hair shawls. Ura-tyube is supposed to have been founded by Cyrus under the name of Cyropol, and was taken in 329 B.C. by Alexander the Great of Macedon. Later it was the capital of an independent state, though often held by either Bokhara or Kokand. The Russians took it in 1866.

URBAN (Urbanus), the name of eight popes.

St URBAN, first pope of that name, was bishop of Rome from 222 to 230. He had been preceded by Calixtus, and was followed by Pontianus.

URBAN II. (Odo or Otho or Eudes de Lagary), pope from the 12th of March 1088 to the 29th of July 1099, was born of knightly rank at Lagary (or Lagery or Lagny), near Reims. He studied for the church, became archdeacon of Auxerre, and later joined the congregation of Cluny. Displaying great ability as reformer and theologian, he was chosen subprior of the celebrated monastery. He was created cardinal-bishop of Ostia in 1078 by Gregory VII., to whom he displayed such loyalty, especially as papal legate in Germany (1084), that he was imprisoned for a time by Henry IV. He was designated by Gregory as one of four men most worthy to succeed him, and, after a vacancy of more than five months following the decease of Victor III., he was elected pope on the 12th of March 1088 by forty cardinals, bishops, and abbots assembled at Terracina, together with representatives of the Romans and of Countess Matilda. He frankly took up the policy of Gregory VII., but, while pursuing it with equal determination, showed greater flexibility and diplomatic skill. Throughout the major part of his pontificate he had to reckon with the presence of the powerful antipope Clement III. (Guibert of Ravenna) in Rome; but a series of well-attended synods at Rome, Amalfi, Benevento and Troia, supported him in renewed declarations against simony, lay investiture, and clerical marriages, and in a policy of continued opposition to Henry IV. He maintained an alliance with the Norman Duke Roger, Robert Guiscard's son and successor, and united the German with the Italian opposition to the emperor by promoting the marriage of the Countess Matilda with young Welf of Bavaria. He aided Prince Conrad in his rebellion against his father and crowned him king of the Romans at Milan in 1093, and likewise encouraged the Empress Praxedis in her charges against her husband. By excommunicating Philip I. of France for matrimonial infidelity in 1095, Urban opened a struggle which was not terminated until after his death. Invited to Tuscany by the Countess Matilda, he convoked a council at Piacenza in March 1095, attended by so vast a number of prelates and laymen that its sessions were held in the open air, and addressed by ambassadors of Alexis, the Byzantine emperor, who sought aid against the Mussulmans. Urban crossed the Alps in the summer, and remained over a year in France and Burgundy, being everywhere reverently received. He held a largely attended council at Clermont in November 1095, where the preaching of the First Crusade marked the most prominent feature of Urban's pontificate. Thenceforth until his death he was actively engaged in exhorting to war against the infidels. Crusaders on their way through Italy drove the antipope Clement III. finally from Rome in 1097, and established Urban firmly in the papal see. With a view to facilitating the crusade, a council was held at Bari in October 1098, at which religious differences were debated and the exiled Anselm of Canterbury combated the Eastern view of the Procession of the Holy Ghost. Urban died suddenly at Rome on the 29th of July 1099, fourteen days after the capture of Jerusalem, but before the tidings of that event had reached Italy. His successor was Paschal II.

It is well established that Urban preached the sermon at Clermont which gave the impetus to the crusades. The sermon was written out by Bishop Baudry, who heard it, and is to be found in full in J. M. Watterich, *Pontif. Roman. Vitae*. Letters of Urban are published in J. P. Migne, *Patrol. Lat.*, vol. 151.

See J. Langen, *Geschichte der römischen Kirche von Gregor VII. bis Innocenz III.* (Bonn, 1893); F. Gregorovius, *Rome in the Middle Ages*, vol. 4, trans. by Mrs G. W. Hamilton (London, 1900–2); K. J. von Hefele, *Conciliengeschichte*, vol. 5 (2nd ed., 1873–90); Jaffé-Wattenbach, *Regesta pontif. Roman.* vol. 1 (1885–88); H. H. Milman, *History of Latin Christianity*, vol. 3 (London, 1899); M. F. Stern, *Zur Biographie des Papstes Urbans II.* (Berlin, 1883); A. de Brimont, *Un Pape au moyen age—Urbain II.* (Paris, 1862); W. Norden, *Das Papsttum und Byzanz* (Berlin, 1903); Gigalski, "Die Stellung des Papstes Urbans II. zu den Sacramentshandlungen der Simonisten, Schismatiker und Häretiker," in the *Tübinger theol. Quartalschrift* (1897).

URBAN III. (Uberto Crivelli), pope from the 25th of November 1185 to the 20th of October 1187, was a Milanese, and had been made cardinal-priest of St Lorenzo in Damaso and archbishop of Milan by Lucius III., whom he succeeded. His family had suffered greatly at the hands of Frederick I., and he now took up vigorously his predecessor's quarrels with the emperor, including the standing dispute about the territories of the Countess Matilda. His opposition to the pretensions of the Roman senate to govern the Papal States, moreover, compelled him to remain in exile through his pontificate. He suspended the patriarch of Aquileia for crowning the emperor's son, Henry, king of Italy (January 1186), in violation of his own rights as archbishop of Milan; and only the entreaties of the citizens of Verona, where he was stopping, prevented him from excommunicating Frederick. In 1187 he exhorted the Christian kings to renewed endeavours in the Holy Land, and the fall of Jerusalem on the 2nd of October is said to have caused his death. He died at Ferrara and was succeeded by Gregory VIII. His letters are in J. P. Migne, *Patrol. Lat.*, vol. 202.

See J. Langen, *Geschichte der römischen Kirche von Gregor VII. bis Innocenz III.* (Bonn, 1893); Jaffé-Wattenbach, *Regesta pontif. Roman.* (1885–88); F. Gregorovius, *Rome in the Middle Ages*, vol. 4, trans. by Mrs G. W. Hamilton (London, 1896); P. Scheffer-Boichorst, *Friedrichs I. letzter Streit mit der Curie* (Berlin, 1866); W. Meyer, "Zum Streite Kaiser Friedrichs I. mit Papst Urban III.," in *Forschungen zur deutschen Geschichte*, vol. 19 (1879).

URBAN IV. (Jacques Pantaléon), pope from the 29th of August 1261 to the 2nd of October 1264, was the son of a shoemaker of Troyes. Having received a monastic education, he became archdeacon of Liége and papal legate of Innocent IV. to Poland and Prussia; he was consecrated bishop of Verdun in 1253, and two years later was translated to the patriarchate of Jerusalem. While on a trip to Italy to explain at court a quarrel with the Hospitallers he was elected to succeed Alexander IV., after a three months' vacancy in the Holy See. He never visited Rome, but lived most of his pontificate at Orvieto. He favoured his own countrymen, and under him began that preponderance of the French in the curia which later led to the papal residence at Avignon, and indirectly to the Great Schism. He endeavoured without success to stir up Louis IX. of France to undertake a new crusade. In 1264 he instituted the festival of Corpus Christi. His chief domestic problems arose out of the competing claims for the crown of the Two Sicilies. He favoured Charles of Anjou, and declared in June 1263 that the papal grant of the kingdom to Edmund, son of Henry III. of England, had expired because of the latter's inability to oust the usurper Manfred. Urban died before the arrival of Charles of Anjou, and was succeeded by Clement IV.

The registers of Urban IV. have been published by L. Dorez and J. Guiraud in the *Bibliothèque des écoles françaises d'Athènes et de Rome* (Paris, 1892).

See F. Gregorovius, *Rome in the Middle Ages*, vol. 5, trans. by Mrs G. W. Hamilton (London, 1900–2); H. H. Milman, *Latin Christianity*, vol. 6 (London, 1899); K. Hampe, "Urban IV. und Manfred" in *Abhandlungen zur mittleren u. neueren Geschichte* (Heidelberg, 1905); Sievert, "Das Vorleben Papst Urbans IV." in *Die römische Quartalschrift* (1898); A. Potthast, *Regesta pontif. Roman.* (Berlin, 1875).

URBAN V. (Guillaume Grimoard or Grimaud de Beauvoir), pope from the 28th of October 1362 to the 19th of December 1370, was born in 1309 near Lozère in Languedoc, and entered the Benedictine priory of Chiriac. After receiving orders he became successively professor of canon law at Avignon and Montpellier, vicar-general of the dioceses of Clermont and Uzès, abbot of St Germain d'Auxerre, abbot of St Victor at Marseilles, administrator of the bishopric of Avignon, and papal legate to Naples. He was returning from his mission to Italy when news reached him at Corneto that he had been chosen to succeed Innocent VI. He announced his acceptance from Marseilles, and was consecrated at Avignon on the 6th of November 1362. Urban witnessed the completion of the work of tranquillizing Italy under the able Cardinal Albornoz, and in 1364, in the interests of peace, made heavy concessions to Bernabo Visconti. Moved by Peter of Lusignan, king of Cyprus, and by the celebrated Carmelite Peter Thomas, who had come to Avignon in February 1363, the pope proclaimed another crusade, which found some echo in France and resulted in the temporary occupation of Alexandria (1365). Urban, yielding to the entreaties of the Emperor Charles IV. and of Petrarch, left Avignon on the 30th of April 1367, despite the opposition of the French cardinals, and made his entry into Rome on the 16th of October. The following year he was visited by Charles IV., and crowned the Empress Elizabeth (1st of November); and in 1369 he received the Greek emperor, John Palaeologus, who renounced the schism but for whom the pope was unable to secure assistance. Urban sanctioned the order of Jesuates and founded the medical school at Montpellier. On account of the poor repair of Rome, the restlessness of the Romans and the discontent of the French cardinals in Italy, he at length announced his intention of returning to France, avowedly to settle trouble between France and England. He took ship at Corneto on the 5th of September 1370, and, arriving at Avignon on the 24th of the same month, died on the 19th of December. Urban was serious and humble, opposed to all nepotism, simony, and secular pomp. He was himself of blameless morality and reformed many abuses in the curia. He was honoured as a saint immediately after his death, and beatified by Pius IX. in 1870. Urban's successor was Gregory XI.

See H. J. Tomaseth, "Die Register u. Secretäre Urbans V. u. Gregors XI." in *Mitteilungen des Instituts für österreichische Geschichtsforschung* (1898); Baluzius, *Vitae Pap. Avenion.*, vol. 1 (Paris, 1693); L. Pastor, *History of the Popes*, vol. 1, trans. by F. I. Antrobus (London, 1899); F. Gregorovius, *Rome in the Middle Ages*, vol. 6, trans. by Mrs G. W. Hamilton (London, 1900–2); J. P. Kirsch, *Die Rückkehr der Päpste Urban V. u. Gregor XI. von Avignon nach Rom* (Paderborn, 1898); J. H. Albanès, *Actes anciens concernant le bienheureux Urbain V.* (Paris, 1897); J. B. Magnan, *Histoire d'Urbain V.* (2nd ed., Paris, 1863); H. J. Wurm, *Cardinal Albornoz* (Paderborn, 1892); H. H. Milman, *Latin Christianity*, vol. 7 (London, 1896); J. B. Christophe, *Histoire de la papauté pendant le XIV$^{\text{ème}}$ siècle*, vol. 2 (Paris, 1853).

URBAN VI. (Bartolommeo Prignano), pope from the 8th of April 1378 to the 15th of October 1389, was born at Naples in 1318. He was made bishop of Acerenza in 1364, and in 1377 was translated to the archiepiscopal see of Bari and placed in charge of the papal chancery. On the death of Gregory XI., who had finally returned to Rome from Avignon, he was elected pope in a conclave held under circumstances of great excitement, owing to popular apprehension of an intention of the French cardinals to elect a French pope and again abandon Rome. The populace broke into the hall after the election had been made and dispersed the cardinals, but the latter returned and confirmed their action on the following day. Urban VI. turned his attention at once to the reformation of the higher clergy, and, in spite of the warnings of Catherine of Siena, so angered the cardinals by his harsh and ill-tempered measures that they assembled at Anagni in July 1378, and revoked his election, in which they declared they had acted under fear of violence. On the 20th of September they elected at Fondi the Cardinal Robert of Geneva, who called himself Clement VII. and took up his residence at Avignon. Urban, on the other hand, remained at Rome, where he appointed twenty-six new cardinals and excommunicated Clement and his adherents. Thus began the Great Schism which divided the Western Church for about fifty years. Urban deposed Joanna of Naples (21st of April 1380) for adhering to France and Savoy in support of the antipope, and gave her kingdom to Charles of Durazzo. Charles was crowned at Rome on the 1st of June 1381, but three years later quarrelled with the pope and shut him up in Nocera. Urban succeeded in escaping to Genoa, where he put several of his cardinals to death for suspected disloyalty. On the death of Charles he set out with an army apparently to seize Naples for his nephew if not for himself. To raise funds he proclaimed, by bull of the 11th of April 1389, a jubilee for every thirty-three years, but before the celebration could be held he died of injuries caused by a fall from his mule. Urban was frugal and never practised simony, but harshness, lack of tact, and fondness for unworthy nephews disgraced his pontificate. He was succeeded by Boniface IX.

The chief sources for the life of Urban VI. are in Baluzius, *Vitae Pap. Avenion.* (Paris, 1693); *Theoderici de Nyem De schismate Libri tres*, ed. by G. Erler (Leipzig, 1890); Sauerlande, "Actenstücke zur Gesch. des Papstes Urban VI.," in *Hist. Jahrbuch der Görres-Gesellschaft*, xiv. (1893); "Acta Urbani VI. et Bonifatii IX.," ed. C. Krofta, in *Monumenta vaticana res gestas Bohemicas illustrantia* (Prague, 1905); *Der Liber Cancellariae Apostolicae vom Jahre 1380*, ed. by G. Erler (Leipzig, 1888); *Il Trattato di S. Vincenzo Ferrer intorno al grande schisma d'Occidente*, ed. by A. Sorbelli (Bologna, 1906). See L. Pastor, *History of the Popes*, vol. 1, trans. by F. I. Antrobus (London, 1899); M. Souchon, *Die Papstwahlen in der Zeit des grossen Schismas*, vol. 1 (Brunswick, 1898); N. Valois, *La France et le grand schisme d'Occident* (Paris, 1896–1902); M. Creighton, *History of the Papacy*, vol. 1 (London, 1899); F. Gregorovius, *Rome in the Middle Ages*, vol. 6, trans. by Mrs G. W. Hamilton (London, 1900–2); R. Jahr, "Die Wahl Urbans VI." in *Hallische Beiträge zur Geschichtsforschung* (1892); T. Lindner, "Papst Urban VI.," in *Zeitschrift für Kirchengeschichte*, iii. (1879); W. St C. Baddeley, *Charles III. of Naples and Urban VI.* (1894); J. B. Christophe, *Histoire de la papauté pendant le XIV$^{\text{ème}}$ siècle*, vol. 3 (Paris, 1853). (C. H. HA.)

URBAN VII. (Giovanni Battista Castagna), successor of Sixtus V., was born on the 4th of August 1521. He became governor of Bologna, archbishop of Rossano, and was long nuncio to Spain. Gregory XIII. made him a cardinal, 1583; and in 1590 he was elected pope by the Spanish faction, but died twelve days later, on the 27th of September 1590, and was succeeded by Gregory XIV.

See Ciaconius, *Vitae et res gestae summorum Pontiff. Rom.* (Rome, 1601–2); Cicarella, continuator of Platina, *De vitis Pontiff. Rom.* (both contemporary; the latter prolix and tedious); Arrigho, *Vita Urbani VII.* (Bologna, 1614); and Ranke, *Popes* (Eng. trans., Austin), ii. 227.

URBAN VIII. (Maffeo Barberini), pope from 1623 to 1644, was born in 1568, of a wealthy Florentine family. He early entered the prelacy, became prefect of Spoleto, twice nuncio to France, cardinal (1606), and finally, on the 6th of August 1623, succeeded Gregory XV. as pope. Urban was vain, self-willed and extremely conscious of his position; he accepted the papacy chiefly as a temporal principality, and made it his first care to provide for its defence and to render it formidable. He built Castelfranco on the northern frontier; fortified the port of Civita Vecchia; and strengthened the Castel Sant' Angelo, equipping it with cannon made from the bronze of the Pantheon, an act of vandalism which the Romans punished by the epigram, "Quod non fecerunt barbari, fecerunt Barberini." He also established an arsenal and a factory of arms. But all this provision was to no purpose. The only territory gained during Urban's pontificate, the duchy of Urbino, the last addition to the papal states, was acquired by reversion (1631); and in his one war, with the duke of Parma, for the district of Castro, he met defeat and humiliation (1644). The Thirty Years' War Urban professed to regard as waged for political, not for religious, ends. He therefore took counsel merely with his interest as a temporal prince, threw in his lot with France, supported the duke of Nevers in the Mantuan Succession, and, under stress of fear of Habsburg supremacy, suffered himself to be drawn into closer relations with the Protestants than beseemed his office, and incurred the reproach of rejoicing in the victories of heretics. Later, in keeping with his position, he opposed all concessions to the Protestants; but still showed himself so vacillating that the papacy ceased to be regarded as a serious political factor, and was entirely ignored in the final settlement of Westphalia, 1648.

Urban was the last pope to practise nepotism on a grand scale. He failed to found a princely house; but he enriched his family to an extent that astonished even the Romans. Urban bore a hand in the condemnation of Galileo. He acknowledged the genius of the astronomer, and had not approved of the action of the Inquisition in 1616; but subsequently, believing himself to have been caricatured in the *Dialogo*, he permitted the Inquisition to have its way and to compel an abjuration (1633). Urban also denounced the doctrines of Jansen, 1644 (see JANSENISM). He promulgated the famous bull *In Coena Domini* in its final form, 1627; published the latest revision of the Breviary, 1631; founded the College of the Propaganda for the education of missionaries, 1627; and accorded the title of "eminence" to the cardinals, 1630. Urban did much to embellish the city. Conspicuous among his works are the Barberini Palace, the College of the Propaganda, the Fountain of the Triton, and the baldachin of St Peter's. His hymns and poems, which have frequently been published, are evidence of his literary taste and ability. Urban died on the 29th of July 1644, and was succeeded by Innocent X.

For contemporary accounts of Urban see: Tommasucci, in Platina, *De vitis Pontiff. Rom*; Oldoin, continuator of Ciaconius, *Vitae et res gestae summorum Pontiff. Rom.*; and Simonin, *Gesta Urbani* (Antwerp, 1637). A rich collection of materials was made by Andrea Niccoletti, *Della vita di Papa Urbano VIII. e storia del suo pontificato*, never published, but extensively used by Ranke and others. See also Ranke, *Popes* (Eng. trans., Austin), ii. 552 seq., iii. 1 seq., 21 seq.; v. Reumont, *Gesch. der Stadt Rom*, iii. 2, 611 seq., 702 seq.; Santa Pieralisa, *Urbano VIII. e Galileo Galilei* (Rome, 1875); Gregorovius, *Urban VIII. im Widerspruch zu Spanien u. dem Kaiser* (Stuttgart, 1879); and Weech, *Urban VIII.* (London, 1905). (T. F. C.)

URBANA, a city and the county-seat of Champaign county, Ohio, U.S.A., about 47 m. W. by N. of Columbus. Pop. (1890) 6510; (1900) 6808, including 796 negroes and 405 foreign-born; (1910) 7739. Urbana is served by the Erie, the Pittsburg, Cincinnati, Chicago & St Louis, and the Cleveland, Cincinnati, Chicago & St Louis railways, and by the Ohio Electric inter-urban line. It has a public library (1890) and a county children's home (1892), and is the seat of Urbana University (co-educational), founded in 1850 under the auspices of the New Church. The city is situated in a fertile farming region. Its manufactures include furniture, telephones, woollen goods, paper, foundry and machine-shop products, &c. Urbana was laid out in 1805 by Colonel William Ward, of Greenbriar, Va., who owned the land included in the original survey and gave many lots to the county on condition that the proceeds from their sale should be used for public improvements; it was incorporated as a village in 1816 and was chartered as a city in 1867. Colonel Ward was the grandfather of the sculptor J. Q. A. Ward, who was born here and here first pursued, unaided, his study of art. Urbana was also the home for several years (after 1802), and is the burial place, of Simon Kenton, the famous pioneer and Indian fighter.

URBINO (anc. *Urvinum Mataurense*), a city and archiepiscopal see of the Marches, Italy, in the province of Pesaro and Urbino, 19 m. direct S.W. of Pesaro and 50 m. by rail N. by W. of Fabriano, a junction on the line from Ancona to Rome. Pop. (1901) 6809 (town), 18,244 (commune). It is picturesquely situated on an abrupt hill 1480 ft. above sea-level; its streets are narrow and crooked, and the town has a medieval aspect. It is dominated by the ducal palace erected by Luciano da Laurana, a Dalmatian architect, in 1460–82, for Federigo Montefeltro, and regarded by the contemporaries of the founder as the ideal of a princely residence. The sculptured doorways, chimneys and friezes of the interior are especially fine. Some are by Domenico Rosselli of Florence, others by Ambrogio d'Antonio da Milano. The rich and beautifully executed intarsia work may be due to Baccio Pontelli. The massive irregularity of the exterior is due to the unevenness of the site. The decoration of the exterior was never completed; but the arcaded courtyard is the finest of the Renaissance, except perhaps that of the Cancelleria at Rome (Burckhardt). The palace is now partly used for government purposes, and also contains the municipal archives, a collection of ancient inscriptions, formed by the epigraphist Raffaele Fabretti (many of them from Rome), a gallery of sculpture of various periods and a picture gallery. This last contains a small but interesting collection of pictures, including works by Paolo Uccello, Giovanni Santi, Justus of Ghent, Timoteo della Vite, and other 15th-century artists, also a "Resurrection" by Titian (a late work). The picture of the "Last Supper" by Justus is specially valuable from its containing fine portraits of the Montefeltro family and members of the ducal court. The cathedral, a building of no special interest, stands in the great piazza close to the ducal palace. It was erected in 1801 after the collapse of the former structure. In the sacristy there is a very beautiful miniature-like painting of the "Scourging of Christ," by Piero della Francesca, and other pictures by later artists. In the crypt there is a fine pietà in marble by Giovanni da Bologna. Opposite the palace is the church of S. Domenico, a Gothic building with a good early Renaissance portal and a relief in the lunette by Luca della Robbia (1449). The interior was spoilt in the 17th century. S. Francesco has a fine 14th-century loggia and campanile, and a handsome portal of a chapel in the interior by Constantino Trappola (15th century). S. Bernardino, outside the town, is a plain early Renaissance structure. On the walls of the chapel of the gild or confraternity of San Giovanni Battista are some valuable early frescoes, painted by Lorenzo and Giacomo Salimbene da San Severino in 1416. In the church of S. Spirito are two paintings by Luca Signorelli, the "Crucifixion" and the "Day of Pentecost," originally intended for a processional banner. The modest house where Raphael was born and spent his boyhood is preserved. It is now the property of a society of artists. Its rooms form a museum of engravings and other records of Raphael's works, together with a picture of the Madonna by his father, Giovanni Santi, formerly thought to be by Raphael himself. A monument was erected to him in the piazza in 1897. The theatre, decorated by Girolamo Genga, is one of the earliest in Italy; in it was performed the first Italian comedy, the *Calandria* of Cardinal Bibbiena, the friend of Leo X. and Raphael. The magnificent library formed by the Montefeltro and Della Rovere dukes was removed to Rome, and incorporated in the Vatican library (but with a separate numbering) in 1657. There is a free university founded in 1564 which has two faculties (with 163 students in 1902–03), and also a technical school. The town has manufactures of silk, majolica and bricks.

The ancient town of *Urvinum Mataurense* (taking its name from the river Mataurus or Metaurus) is mentioned a few times in classical literature, and many inscriptions relating to it exist. The course of its walls can still be traced. It was an important place in the Gothic wars, and is frequently mentioned by Procopius. At the end of the 12th or beginning of the 13th century it came into the possession of the family of Montefeltro. Of this by far the most important member was Federigo da Montefeltro, lord of Urbino from 1444 to 1482, one of the most successful condottieri chiefs of his time, and not only a man of great military and political ability, but also an enthusiastic patron of art and literature, on which he lavished immense sums of money. Federigo much strengthened his position, first by his own marriage with Battista, one of the powerful Sforza family, and secondly by marrying his daughter to Giovanni della Rovere, the favourite nephew of Pope Sixtus IV., who in return conferred upon Federigo the title of duke. Federigo's only son Guidubaldo, who succeeded his father, married in 1489 the gifted Elizabeth Gonzaga, of the ruling family in Mantua. In 1497 he was expelled from Urbino by Caesar Borgia, son of Alexander VI., but regained his dukedom in 1503, after Caesar's death. Guidubaldo was the last duke of the Montefeltro line; at his death in 1508 he bequeathed his coronet to Francesco Maria della Rovere, nephew of Julius II., and for about a century Urbino was ruled by its second dynasty of the Della Rovere family. In 1626 the last descendant of Francesco, called Francesco Maria II., when old and childless abdicated in favour of Pope Urban VIII., after which time Urbino, with its subject towns of Pesaro, Fano, Fossombrone, Gubbio, Castel Durante, Cagli and about 300 small villages, became part of the papal states until the suppression of the temporal power in 1870.

During the reigns of Federigo and Guidubaldo, Urbino was one of the foremost centres of activity in art and literature in Italy. The palace erected by Federigo has already been mentioned. It was at his court that Piero della Francesca wrote his celebrated work on the science of perspective, Francesco di Giorgio Martini his *Trattato d' architettura* (published by Saluzzo, Turin, 1841), and Giovanni Santi his poetical account of the chief artists of his time. The refined magnificence of Guidubaldo's court is eloquently described by Baldassare Castiglione (*q.v.*) in his *Cortegiano*. When Henry VII. of England conferred the order of the Garter on Guidubaldo, Castiglione was sent to England with a letter of thanks and with the small picture, now in the Louvre, of "St George and the Dragon," painted by Raphael in 1504, as a present to the English king. This painting was among Charles I.'s collection which was sold by order of the Commonwealth in 1649.

Throughout the whole of the 16th century the state of Urbino was one of the chief centres for the production of majolica, especially the towns of Gubbio and Castel Durante. Most of the finest pieces of Urbino ware were made specially for the dukes, who covered their sideboards with the rich storied *piatti di pompa*. Among the distinguished names which have been associated with Urbino are those of the Ferrarese painter and friend of Raphael, Timoteo della Vite, who spent most of his life there, and Bramante, the greatest architect of his age. The Milanese sculptor, Ambrogio, who worked so much for Federigo, married a lady of Urbino, and was the progenitor of the Baroccio family, among whom were many able mathematicians and painters. Federigo Baroccio, Ambrogio's grandson, was a very popular painter, some of whose works still exist in the cathedral and elsewhere in Urbino. This city was also the birthplace of Pope Clement XI., of several cardinals of the Alban family, and of Bernardino Baldi, Fabretti, and other able scholars. An interesting view of Urbino, in the first half of the 16th century, occurs among the pen drawings in the MSS. *Arte del vasajo*, by the potter Piccolpasso, now in the Victoria and Albert Museum.

See also E. Calzini, *Urbino e i suoi monumenti* (1897); G. Lipparini, *Urbino* (Bergamo, 1903).

URBS SALVIA (mod. *Urbisaglia*), an ancient town of Picenum, Italy, about 8 m. S. of the modern Macerata, and 10 m. S. of Ricina. It was the meeting-point of several ancient roads; the road leading south from Ancona through Ricina and Falerio to Asculum was crossed here at right angles by that from Fanum to Tolentinum, Septempeda (S. Severino) and Nuceria Camellaria, while another led north-east from Urbs Salvia to Pausulae and the coast at Potentia (near mod. Porto Recanati). It seems to have been also called Pollentia. The date of its foundation is unknown, but it became a colony in the time of Trajan, and its importance seems to begin from this period. It was utterly destroyed by Alaric, and both Procopius (*B.G.* ii. 16, 17) and Dante (*Paradiso*, xvi. 73) speak of its desolation. The *arx* is occupied by the modern village; below it considerable remains of the city walls and of the buildings within them, alike of brickwork of the imperial period, are preserved —an amphitheatre 328×249 ft., with an arena 190×112 ft., a theatre, baths, tombs, &c. A subterranean aqueduct and a number of inscriptions have been found on the site. Close by is a little chapel with paintings of the early 16th century. The Romanesque abbey church of the Fiastra, about 3 m. to the north, is noticeable. The territory of Urbs Salvia probably extended as far as the old Romanesque church of S. Maria di Rambona, 8 m. to the north-west.

URDŪ, the name of that variety of Hindostani which borrows a great part of its vocabulary from Persia and Arabic, as contrasted with "Hindi," the variety which eschews such words, but borrows from Sanskrit instead. It is spoken by Mussulmans and those Hindus who have come under Mussulman influences, and has a considerable literature. See HINDOSTANI and HINDOSTANI LITERATURE.

UREA, or CARBAMIDE, $CO(NH_2)_2$, the amide of carbonic acid, discovered in 1773 by H. M. v. Rouelle, is found in the urine of mammalia, birds and some reptiles; human urine contains approximately 2–3%, a grown man producing about 30 grammes daily. It is also a constituent of the blood, of milk, and other animal fluids. Its synthesis in 1828 by F. Wöhler (*Pogg. Ann.*, 1828, 12, p. 253) is of theoretical importance, since it was the first organic compound obtained from inorganic materials. Wöhler oxidized potassium ferrocyanide to potassium cyanate by fusing it with lead or manganese dioxide, converted this cyanate into ammonium cyanate by adding ammonium sulphate, and this on evaporation gives urea, thus:—

$$K_4Fe(NC)_6 \rightarrow KCNO \rightarrow NH_4CNO \rightarrow CO(NH_2)_2.$$

It may also be prepared by the action of ammonia on carbonyl chloride, diethyl carbonate, chlorcarbonic ester or urethane; by heating ammonium carbamate in a sealed tube to 130–140° C.; by oxidizing potassium cyanide in acid solution with potassium permanganate (E. Baudrimant, *Jahresb.*, 1880, p. 393); by the action of 50 % sulphuric acid on cyanamide: $CN{\cdot}NH_2+H_2O=CO(NH_2)_2$; by the action of mercuric oxide on oxamide (A. Williamson): $(CONH_2)_2+HgO=CO(NH_2)_2+Hg+CO_2$; by decomposing potassium cyanide with a dilute solution of sodium hypochlorite, followed by adding ammonium sulphate (A. Reychler, *Bull. Soc. Chim.*, 1893 [3], 9, p. 427); and by oxidation of uric acid. It may be obtained from urine by evaporating to dryness on the water bath, taking up the residue in absolute alcohol and evaporating the alcoholic solution to dryness again. The residue is then dissolved in water, decolorized by animal charcoal and saturated at 50° C. with oxalic acid. The urea oxalate is recrystallized and decolorized and finally decomposed by calcium carbonate (J. J. Berzelius, *Pogg. Ann.*, 1830, 18, p. 84). As an alternative method, A. N. E. Millon (*Ann. chim. phys* [2], 8, p. 235) concentrates the urine and precipitates the urea by nitric acid. The precipitate is dissolved in boiling water, decolorized by potassium permanganate and decomposed by barium carbonate. The solution is then evaporated to dryness and extracted by alcohol.

Urea crystallizes in long needles or prisms which melt at 132° C. and sublime when heated *in vacuo*. It is readily soluble in water and in alcohol, but is insoluble in chloroform and ether. When heated above its melting-point, it yields ammonia, cyanuric acid, biuret and ammelide. On warming with sodium, it yields cyanamide. Dry chlorine gas passed into melted urea decomposes it with formation of cyanuric acid and ammonium chloride, nitrogen and ammonia being simultaneously liberated. Alkaline hypobromites or hypochlorites or nitrous acid decompose urea into carbon dioxide and nitrogen. It is also decomposed by warm aqueous solutions of caustic alkalis, with evolution of ammonia and carbon dioxide. When heated with alcohol in sealed tubes, it yields carbamic esters; with alcohol and carbon bisulphide at 100° C., carbon dioxide is liberated and ammonium sulphocyanide is formed. Acid potassium permanganate oxidizes it to carbon dioxide and nitrogen. It acts as a monacid base.

Urea may be recognized by its crystalline oxalate and nitrate, which are produced on adding oxalic and nitric acids to concentrated solutions of the base; by the white precipitate formed on adding mercuric nitrate to the neutral aqueous solutions of urea; and by the so-called "biuret" reaction. In this reaction urea is heated in a dry tube until it gives off ammonia freely; the residue is dissolved in water, made alkaline with caustic soda, and a drop of copper sulphate solution is added, when a fine violet-red coloration is produced. Several methods are employed for the quantitative estimation of urea. R. Bunsen (*Ann.*, 1848, 65, p. 875) heated urea with an ammoniacal solution of barium chloride to 220° C., and converted the barium carbonate formed into barium sulphate, which is then weighed (see also E. Pflüger and K. Bohland, *Zeit. f. anal. Chem.*, 1886, 25, p. 599; K. A. H. Mörner, *ibid.*, 1891, 30, p. 389). Among the volumetric methods used, the one most commonly employed is that of W. Knop (ibid., 1870, 9, p. 226), in which the urea is decomposed by an alkaline hypobromite and the evolved nitrogen is measured (see A. H. Allen, *Commercial Organic Analysis*). J. v. Liebig (*Ann.*, 1853, 85, p. 289) precipitates dilute solutions of urea with a dilute standard solution of mercuric nitrate, using alkaline carbonate as indicator. In this process phosphates must be absent, and the nitric acid liberated during the reaction should be neutralized as soon as possible. Chlorides also prevent the formation of the precipitate until enough of the mercury solution has been added to convert them into mercuric chloride (see also E. Pflüger, *Zeit. f. anal. Chem.*, 1880, 19, p. 378). E. Riegler (ibid., 1894, 33, p. 49) decomposes urea solutions by means of mercury dissolved in nitric acid, and measures the evolved gas.

Urea chlorides are formed by the action of carbonyl chloride on ammonium chloride (at 400° C.), or on salts of primary amines. They are readily hydrolysed by water, and combine with bases to form alkyl ureas, and with alcohols to form carbamic esters. Substituted urea chlorides are formed by the direct action of chlorine (F. D. Chattaway and D. F. S. Wunsch, *Jour. Chem. Soc.*, 1909, 95, p. 129). Urea chloride, $NH_2{\cdot}CO{\cdot}Cl$ (L. Gattermann, *Ann.*, 1888, 244, p. 30), melts at 50° C. and boils at 61–62° C. In the presence of anhydrous aluminium chloride it reacts with aromatic hydrocarbons to form the amides of aromatic acids. *Nitrourea*, $H_2N{\cdot}CO{\cdot}NH{\cdot}NO_2$, prepared by adding urea nitrate to well-cooled concentrated sulphuric acid (J. Thiele and A. Lachmann, *Ann.*, 1895, 288, p. 281), is a crystalline powder, soluble in water, and which decomposes on heating. It is a strong acid and is stable towards oxidizing agents. Diazomethane converts it into the methyl derivatives of isocyanic acid, and nitramide, NH_2NO_2. *Amidourea*, or semicarbazide, $NH_2\cdot CO\cdot NH\cdot NH_2$, is best prepared from hydrazine sulphate and potassium cyanate (J. Thiele and O. Stange, *Ber.*, 1894, 27, p. 31). It may also be obtained by reducing nitrourea in acid solution with zinc dust. It crystallizes in prisms, which melt at 96° C., and are easily soluble in water. It reduces Fehling's solution in the cold. It reacts with carbonyl compounds, giving *semi-carbazones*, and in consequence is frequently used for characterizing such substances. *Hydroxy-urea*, $NH_2\cdot CO\cdot NH\cdot OH$, is produced from hydroxylamine and cyanic acid (W. F. Dresler and R. Stein, *Ann.*, 1869, 150, p. 242), or from ammonium hypochlorite and potassium cyanate (A. Hantzsch, *Ann.*, 1898, 299, p. 99). It crystallizes in needles, which melt at 128–130° C., and is decomposed on long heating. It is readily soluble in water and reduces warm silver solutions. Hyponitrous acid is formed by passing nitrous fumes into its methyl alcohol solution.

Alkyl ureas are formed by the action of primary or secondary amines on isocyanic acid or its esters: $CONH+NH_2R=R\cdot NHCONH_2$; $CONR+NHR_2=NR_2\cdot CO\cdot NHR$; by the action of carbonyl chloride on amines: $COCl_2+2NHR_2=CO(NR_2)_2+2HCl$; and in the hydrolysis of many ureides. The tetra-alkyl derivatives are liquids, the remainder being solids. Hydrolysis by alkalis decomposes them into carbon dioxide, amines and ammonia. The symmetrically substituted ureas are generally tasteless, while the asymmetrical derivatives are sweet. For example, *αα*-dimethyl urea is sweet, *αβ*-dimethyl urea is tasteless; *p*-phenetol carbamide or dulcin, $NH_2\cdot CO\cdot NH\cdot C_6H_4\cdot OC_2H_5$, is sweet, while the di-*p*-phenetol carbamide, $CO(NH\cdot C_6H_4\cdot OC_2H_5)_2$, is tasteless.

The derivatives of urea containing acid radicles are known as *ureides*. Those derived from monobasic acids, obtained by the action of acid chlorides or anhydrides on urea, decompose on heating and do not form salts. Those containing more than one acyl group are formed by the action of carbonyl chloride on acid amides:

$$COCl_2+2CH_3CONH_2=CO(NHCOCH_3)_2+2HCl.$$

Acetyl urea, $NH_2\cdot CO\cdot NH\cdot COCH_3$, formed by the action of acetic anhydride on urea, crystallizes in needles which melt at 212° C. and, on heating, strongly decomposes into acetamide and cyanuric acid. *Methyl acetyl urea*, $CH_3NH\cdot CO\cdot NHCOCH_3$, is formed by the action of potash on a mixture of bromine (1 mol.) and acetamide (2 mols.) (A. W. v. Hofmann, *Ber.*, 1881, 14, p. 2725), or of methylamine on acetylurethane (G. Young, *Jour. Chem. Soc.*, 1898, 73, p. 364). When heated with water it is decomposed into carbon dioxide, ammonia, methylamine and acetic acid. *Bromural* or *α*-bromisovaleryl urea, $NH_2\cdot CO\cdot NH\cdot CO\cdot CHBr\cdot CH(CH_3)_2$, has been introduced as an hypnotic; its action is mild, and interfered with by the presence of pain, cough or delirium.

The ureides of oxy-acids and dibasic acids form closed chain compounds (see Allantoin; Alloxan; Hydantoin; Purin). *Parabanic acid* (oxalyl urea), $CO[NH\cdot CO]_2$, is formed by oxidizing uric acid; or by condensing oxalic acid and urea in the presence of phosphorus oxychloride. It crystallizes in needles and is readily hydrolysed by alkalis. It behaves as a monobasic acid and forms unstable salts. When heated with urea, it forms oxalyl diureide, $H_2N\cdot CO\cdot CO\cdot NH\cdot CO\cdot NH\cdot CO\cdot NH_2$. *Dimethylparabanic acid* (cholesterophane), $CO[NCH_3\cdot CO]_2$, is formed by oxidizing caffeine or by methylating parabanic acid. It crystallizes in plates, which melt at 145·5° C., and is soluble in cold water. Hydrochloric acid at 200° C. decomposes into oxalic acid, carbon dioxide and methylamine, whilst an alcoholic solution of a caustic alkali gives dimethyl urea and oxalic acid. *Barbituric acid* (malonyl urea), $CH_2[CO\cdot NH]CO\cdot 2H_2O$, formed by condensing malonic acid with urea (E. Grimaux, *Bull. Soc. Chem.*, 1879, 31, 146), crystallizes in prisms, which decompose on heating. It yields a nitroso derivative, is nitrated by nitric acid to dilituric acid and brominated by bromine. It is a dibasic acid. *Veronal* (*q.v.*) is diethyl malonyl urea. For isobarbituric acid see T. B. Johnson and E. V. McCollum, *Jour. Biol. Chem.*, 1906, 1, p. 437. *Tartronyl urea* (dialuric acid), $CO[NH\cdot CO]CH\cdot OH$, formed by the reduction of alloxan (J. v. Liebig and F. Wöhler, *Ann.*, 1838, 26, p. 276), or of alloxantin (A. Baeyer, *Ann.*, 1863, 127, p. 12), crystallizes in needles or prisms and possesses a very acid reaction. It becomes red on exposure, and in the moist condition absorbs oxygen from the air, giving alloxantin. *Allophanic acid*, $NH_2\cdot CO\cdot NH\cdot CO_2H$, is not known in the free state, as when liberated from its salts, it is decomposed into urea and carbon dioxide. Its esters are formed by passing the vapours of cyanic acid into alcohols (W. Traube, *Ber.*, 1889, 22, p. 1572):

$$CONH\rightarrow NH_2\cdot CO_2R\rightarrow NH_2CO\cdot NH\cdot CO_2R;$$

by the action of chlorcarbonic esters on urea (H. Schiff, *Ann.*, 1896, 291, p. 367); and by the action of urethanes on urea chloride (L. Gattermann, *Ber.*, 1888, 21, p. 293 R). They are readily decomposed by alkalis, yielding cyanuric acid and ammonia. *Biuret* (allophanamide), $NH_2\cdot CO\cdot NH\cdot CO\cdot NH_2$, is formed by heating urea; by the action of ammonia on allophanic ester; and by heating urea to 140° C. and passing chlorine into the melt at 140–150° C. (J. Thiele, *Ann.*, 1898, 303, p. 95 Anm.). It crystallizes in needles which melt at 190° C. (with decomposition), and is readily soluble in hot water. When heated strongly it is decomposed into ammonia and cyanuric acid. Baryta water hydrolyses it to carbon dioxide, ammonia and urea. With silver nitrate and caustic soda it yields a silver salt, $Ag_2C_2H_3N_3O_2$. With nitric acid in the presence of sulphuric acid it yields a nitro derivative.

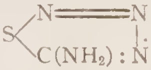
Thiourea, or sulphocarbamide, $CS(NH_2)_2$, is formed by prolonged fusion of ammonium thiocyanate (E. Reynolds, *Ann.*, 1869, 150, p. 224), by passing sulphuretted hydrogen into an ethereal solution of cyanamide (E. Baumann, *Ber.*, 1873, 6, p. 1375), or by heating isopersulpho-cyanic acid (F. D. Chattaway, *Jour. Chem. Soc.*, 1897, 71, p. 612). It crystallizes in thick prisms which melt at 180° C. and is readily soluble in water. When heated for some time with water to 140° C. in a sealed tube, it is transformed into ammonium thiocyanate, a similar result being obtained by heating the base alone for some hours to 160–170° C. On heating alone for some hours to 170–180° C. it is converted into guanidine thiocyanate. It is hydrolysed by alkalis, giving carbon dioxide, ammonia and sulphuretted hydrogen. It is readily desulphurized by silver oxide, mercuric oxide or lead oxide. Potassium permanganate oxidizes it to urea (R. Maly, *Monats.*, 1890, 11, p. 278). It acts as a weak base and forms salts with one equivalent of an acid.

The alkyl derivatives of thiourea are obtained by the action of ammonia and of primary and secondary amines on the mustard oils (A. W. Hofmann, *Ber.*, 1867, 1, p. 27):

$$CSNR+NH_3=NH_2\cdot CS\cdot NHR;\ CSNR+NH_2R=R\cdot NH\cdot CS\cdot NHR,$$

or by heating the amide salts of the alkyl dithio-carbaminic acids, viz., $NR\cdot CS\cdot S(NH_3R)$. The monoalkyl derivatives are desulphurized by lead hydroxide in the presence of sodium carbonate, the *αβ* dialkyl and trialkyl derivatives being unaffected (A. E. Dixon, *Jour. Chem. Soc.*, 1893, 63, p. 325). The dialkyl thioureas when digested with mercuric oxide and amines give guanidines. $CS(NHR)_2+NH_2R+HgO\rightarrow HgS+RN{:}C(NHR)_2$.

Thiourea and many of its unsymmetrical derivatives have marked physiological action; thiourea causes a slowing of the pulse and respiration, cardiac failure, and death in convulsions; phenyl-, ethyl- and acetyl-thiourea are actively toxic. The most important derivative pharmacologically is allyl-thiourea, also known as thiosinamine or rhodallin, $NH_2\cdot CS\cdot NH\cdot CH_2\cdot CH{:}CH_2$.

Thiosemicarbazide, $NH_2\cdot CS\cdot NH\cdot NH_2$, prepared from hydrazine sulphate, potassium carbonate and thiocyanate (N. Freund, *Ber.*, 1895, 28, p. 946; 1896, 29, p. 2501), crystallizes in long needles, which melt at 181–183° C. The addition of sodium nitrite to an aqueous solution of its hydrochloride converts it into amido-triazsulphol  The hydrochloride with potassium cyanate gives hydrazothio-carbonamide, $NH_2\cdot CO\cdot NH\cdot NH\cdot CS\cdot NH_2$.

Medicine.—Urea has been given in medicine in doses of 10 to 60 grs. either in mixture or hypodermically. It has been used with success as an antiperiodic and antipyretic in ague, and also as a diuretic in gout and kidney affections. Thiosinamine is given internally in doses of ½ to 1 gr. in capsule. Larger doses usually upset the digestion. It has been used for the cure of lupus and of keloid, in which case it is administered hypodermically. In keloid 20 minims of a 10% solution is injected directly into the part. It causes a local reaction with absorption of the scar tissue. For this reason it is used to remove corneal opacities, deafness due to thickening of the membrane, stricture of the oesophagus and hypertrophy of the pylorus, it has also been successful in the treatment of adhesive parametritis. Fibrolysin is a modified form of thiosinamine made by mixing it with sodium salicylate Fibrolysin is freely soluble and may be given in hypodermic or intra-muscular injection. Like thiosinamine it has a specific action on scar tissue and has been used in urethral strictures. Both these preparations should only be used in cases where it is possible to exclude any tuberculous foci, or by their action in breaking down protective fibrous tissues they may cause a quiescent lesion to become active. In large doses toxic symptoms are produced, death following on coma.

URETHANE, $NH_2CO_2C_2H_5$, the ethyl ester of carbamic acid, is synthesized from ammonia and chlorcarbonic ester or diethyl carbonate; by prolonged boiling of urea with alcohol (A. W. Hofmann, *Ber.*, 1871, 4, p. 268); by the action of alcoholic hydrochloric acid on cyanogen; by the action of alcohol on urea chloride (L. Gattermann, *Ann.*, 1888, 244, p. 40); and by warming alcoholic hydrochloric acid with an alcoholic solution of potassium cyanate (O. Folin, *Amer. Chem. Jour.*, 1897, 19, p. 341). It crystallizes in large plates, readily soluble in water and melting at 49–50° C. When heated with ammonia to 180° C., it gives urea. Cold alcoholic potash decomposes it into potassium cyanate and alcohol.

Nitroso-urethane, $NO\cdot NH\cdot CO_2C_2H_5$, formed by reducing ammonium nitro-urethane with zinc dust and glacial acetic acid (J. Thiele, *Ann.*, 1895, 288, p. 304), crystallizes in needles which melt at 51–52° C. (with decomposition). It is decomposed by alkalis and by acids:

$$C_3H_6N_2O_3 = CO_2 + C_2H_5OH + N_2 \quad \text{(alkalis)},$$
$$2C_8H_6N_2O_3 = 2CO_2 + C_2H_5OH + 2N_2 + H_2O + C_2H_4 \quad \text{(acids)}.$$

On oxidation it yields nitro-urethane. With a methyl alcoholic solution of potash it yields a yellow precipitate, which is probably the potassium salt of nitrosocarbamic acid, $NK{\cdot}NO{\cdot}CO_2K$. *Nitro-urethane*, $NO_2{\cdot}NH{\cdot}CO_2C_2H_5$, formed by dissolving urethane in concentrated sulphuric acid and adding ethyl nitrate to the well-cooled mixture (J. Thiele, ibid.), crystallizes in plates which melt at 64° C. and is soluble in water. It has a strongly acid reaction, its salts, however, being neutral. Its silver salt with methyl iodide gives a methyl ether, which is readily split by ammonia into methyl nitramine and methyl urethane (cf. A. P. Franchimont, *Rec. trav. chim.*, 1894, 13, p. 309). On reduction with zinc dust and acetic acid it yields hydrazine carboxylic ester. *Phenyl urethena*, $C_6H_5NH{\cdot}CO_2C_2H_5$, is formed by the action of cyanformic ester on aniline at 100° C.; by the action of absolute alcohol on benzoyl azoimide (T. Curtius, *Jour. prak. Chem.* [2], 52, p. 214); and by the action of bromine and sodium ethylate on benzamide (E. Jeffreys, *Amer. Chem. Jour.*, 1899, 22, p. 41). It crystallizes in long needles which melt at 51–52° C. and boil at 227–228° C. (with partial decomposition). It is easily soluble in alcohol and when heated in a sealed tube yields aniline and urea. With phosphorus pentasulphide it yields phenyl mustard oil.

Physiologically urethane has a rapid hypnotic action, producing a calm sleep and having no depressant effect on the circulation. It is much used as an anaesthetic for animals. Di-urethane, $NH(CO_2C_2H_5)_2$, and hedonal, $NH_2CO_2CH(CH_3){\cdot}(C_3H_7)$, are also narcotics, the latter being, in addition, a powerful diuretic. Phenyl urethane or euphorin has a physiological action more like that of acetanilide and phenacetin than of urethane. It depresses the temperature and is an analgesic. It is of little value as an hypnotic.

URFÉ, HONORÉ D', Marquis de Valbromey, Comte de Châteauneuf (1568–1625), French novelist and miscellaneous writer, was born at Marseilles on the 11th of February 1568, and was educated at the Collège de Tsarnon. A partisan of the League, he was taken prisoner in 1595, and, though soon set at liberty, he was again captured and imprisoned. During his imprisonment he read Ronsard, Petrarch and above all the *Diana enamorada* of George de Montemayor and Tasso's *Aminta*. Here, too, he wrote the *Epîtres morales* (1598). Honoré's brother Anne, comte D'Urfé, had married in 1571 the beautiful Diane de Châteaumorand, but the marriage was annulled in 1598 by Clement VIII. Anne D'Urfé was ordained to the priesthood in 1603, and died in 1621 dean of Montbrison. Diane had a great fortune, and to avoid the alienation of the money from the D'Urfé family, Honoré married her in 1600. This marriage also proved unhappy; D'Urfé spent most of his time separated from his wife at the court of Savoy, where he held the charge of chamberlain. The separation of goods arranged later on may have been simply due to money embarrassments. It was in Savoy that he conceived the plan of his novel *Astrée*, the scene of which is laid on the banks of the Lignon in his native province of Forez. It is a leisurely romance in which the loves of Céladon and Astrée are told at immense length with many digressions. The recently discovered circumstances of the marriages of the brothers have disposed of the idea that the romance is autobiographical in its main idea, but some of the episodes are said to be but slightly veiled accounts of the adventures of Henry IV. The shepherds and shepherdesses of the story are of the conventional type usual to the pastoral, and they discourse of love with a casuistry and elaborate delicacy that are by no means rustic. The two first parts of *Astrée* appeared in 1610, the third in 1619, and in 1627 the fourth part was edited and a fifth added by D'Urfé's secretary Balthazar Baro. *Astrée* set the fashion temporarily in the drama as in romance, and no tragedy was complete without wire-drawn discussions on love in the manner of Céladon and Astrée. D'Urfé also wrote two poems, *La Sireine* (1611) and *Sylvanire* (1625). He died from injuries received by a fall from his horse at Villafranca on the 1st of June 1625 during a campaign against the Spaniards. The best edition of *Astrée* is that of 1647. In 1908 a bust of D'Urfé was erected at Virien (Ain), where the greater part of *Astrée* was written.

URGA (the Russian form of the Mongol Orgo = palace of a high official), a city of Mongolia, and the administrative centre of the northern and eastern Kalka tribes, in 48° 20′ N., 107° 30′ E., on a tributary of the Tola river. It is the holy city of the Mongols and the residence of the "Living Buddha," metropolitan of the Kalka tribes, who ranks third in degree of veneration among the dignitaries of the Lamaist Church. This "resplendently divine lama" resides in a sacred quarter on the western side of the town, and acts as the spiritual colleague of the Chinese amban, who controls all temporal matters, and who is specially charged with the control of the frontier town of Kiakhta and the trade conducted there with the Russians.

Hurae, as the Mongols call Urga (Chinese name, K'ulun), stands on the high road from Peking to Kiakhta (Kiachta), about 700 m. N.W. of Peking and 165 m. S. of Kiakhta. There are three distinct quarters: the *Kuren* or monastery, the residence of the "Living Buddha"; the Mongol city proper (in which live some 13,000 monks); and the Chinese town, two or three miles from the Mongol quarter. Besides the monks the inhabitants number about 25,000. The Chinese town is the great trading quarter. The houses in this part are more substantially built than in the Mongol town, and the streets have a well-to-do appearance. The law which prohibits Chinamen from bringing their wives and families into the place tends to check increase. There is considerable trade between the Russians, Mongols and Chinese, chiefly in cattle, camels, horses, sheep, piece-goods and milk. Until the second half of the 19th century bricks of tea formed the only circulating medium for the retail trade at Urga, but Chinese brass cash then began to pass current in the markets. The trade of Urga is valued at over £1,000,000 a year.

The temples in the Mongol quarter are numerous and imposing, and in one is a gilt image of Maitreya Bodhisattva, 33 ft. in height and weighing 125 tons. When in 1904, on the occasion of the British expedition to Tibet, the Dalai Lama withdrew from Lhassa he went to Urga, where he remained until 1908. During his residence there the Dalai Lama would have no communication with the Urga Lama—described as a drunken profligate (see *The Chinese Empire*, ed. M. Broomhall, London, 1907, p. 357). The Chinese contemplate building a railway from Peking to Urga. The first section, to Kalgan, was completed in 1909 (see China, § *Communications*).

URI, one of the cantons of central Switzerland, and one of the earliest members of the confederation. The name is probably connected with the same obscure root as Reuss and Ursern, and is popularly derived from Urochs or Auerochs (wild bull), a bull's head having been borne for ages as the arms of the region. The total area of the canton is 415·3 sq. m., of which 184·3 are reckoned as "productive" (forests covering 43·9 sq. m.), while of the rest 44·3 are occupied by glaciers and 7½ sq. m. by the cantonal share of the Lake of Lucerne. The highest summit in the canton is the Dammastock (11,920 ft.). The canton is composed of the upper valley of the Reuss, a mountain torrent that has cut for itself a deep bed, save in case of the basin of Ursern, near its upper end, and the plain of Altdorf, just before it forms the Lake of Lucerne. Hence, save in these two cases, the canton is made up of a wild Alpine valley, very picturesque in point of scenery, but not offering much chance of cultivation. Through nearly the whole of this savage glen runs the main line of the St Gotthard railway (opened in 1882), the part (28½ m.) in the canton being that between Sisikon, on the Lake of Lucerne, and Göschenen, at the northern mouth of the great tunnel (9¼ m.) through the Alps, and at the lower end of the wild Schöllenen gorge that cuts it off from the basin of Ursern. The most remarkable engineering feats are near Wassen. There is also an electric tramway from Altdorf to its port, Flüelen. On the other hand, several magnificent carriage roads are within the borders of the canton, leading to or over the mountain passes that give access either to Glarus (the Klausen Pass, 6404 ft.), or to Ticino (St Gotthard Pass, 6936 ft.), or to the Grisons (Oberalp Pass, 6719 ft.), or to the Valais (Furka Pass, 7992 ft.). Owing to the physical conformation of the canton, it was difficult for it to extend its rule save towards the south (see below), but since very early days it has held the splendid pastures of the Urnerboden, on the other slope of the Klausen Pass, as well as the Blacken Alp, at the head of the Engelberg valley, though the northernmost slope of the St Gotthard Pass still belongs to Ticino. In 1900 the population of the canton was only 19,700, of whom 18,685 were German-speaking, 947 Italian-speaking (this number varied much during the construction of the St Gotthard railway, mainly by Italian navvies), and 24 French-speaking, while 18,924 were Romanists, 773 Protestants, and 1 a Jew. The capital is Altdorf (*q.v.*), indissolubly connected with the legend of William Tell (*q.v.*). The only other important villages are Erstfeld (2416 inhab.), a great railway centre, where the mountain engines are put on, and Silenen (1892 inhab.). The population is all but exclusively pastoral, natural causes limiting much effort in the way of agriculture, save near Altdorf. In the canton there are 102 "alps" or mountain pastures, capable of supporting 10,354 cows, and of an estimated capital value of 5,771,000 fr. Till 1814 Uri formed part of the diocese of Constance (save Ursern, which has always been in that of Coire), while since that date it is administered by the bishop of Coire, though legally in no diocese. The inhabitants are very industrious and saving, though not rich in worldly goods, as their land is so barren. They are extremely conservative, and passionately attached to their religion. Wooden sandals are still commonly worn in the Alpine glens. Of recent years the canton has been much visited by travellers, who have brought much money into it. It forms a single administrative district, which comprises twenty communes. The legislature of the canton is the time-honoured primitive democratic assembly, called the *Landsgemeinde*, composed of all male citizens of 20 years of age, and meeting once annually near Altdorf on the first Sunday in May. It has retained many curious antique ceremonies and customs. It elects the single member of the Federal *Ständerat*, as well as the cantonal executive of seven members (holding office for four years), two of whom are the highest officials, the Landammann and his deputy. There is also a sort of standing committee, called the *Landrat*, which is charged with the administration and minor legislative matters. It is composed of members elected for four years by a popular vote in the proportion of one to every 400 (or fraction over 200) inhabitants, though each commune, even if not attaining this standard of population, is entitled to a member. The single member of the Federal *Nationalrat* is elected by a popular vote. The constitutional details, apart from the *Landsgemeinde*, are settled by the cantonal constitution of 1888 (since revised slightly).

Uri is first mentioned in 732 as the place of banishment of Eto, the abbot of Reichenau, by the duke of Alamannia. In 853 it was given by Louis the German to the nunnery (*Frauenmünster*) at Zürich which he had just founded, and of which his daughter, Hildegard, was the first abbess. Hence the "abbey folk" in Uri enjoyed, as such, the privilege of exemption from all jurisdictions save that of the king's *Vogt* or "steward of the manor" at Zürich, this *Vogtei* being cut off from the country of the Zürichgau. The rule of the abbess was mild, so that the other inhabitants of Uri either became her tenants or obtained similar privileges. Little by little the gathering together of all the inhabitants for the purpose of regulating the customary cultivation of the land created a corporate feeling and led to a sort of local government. On the extinction of the Zäringen dynasty (1218), the *Vogtei* reverted to the king, who gave it to the Habsburgs. But in 1231 King Henry bought Uri from them, and thus it became again immediately dependent on the king, the purchase being perhaps due to the rising importance of the route over the St Gotthard Pass (first distinctly mentioned in 1236). As early as 1243 Uri had a common seal, and in the confirmation of its privileges (1274) granted by Rudolf of Habsburg mention is made of its "head-man" (*Amman*) and of the "commune" (*universitas*). Uri therefore was quite ready to take part, with Schwyz and Unterwalden, in founding the "Everlasting League" (germ of the later Swiss confederation) on the 1st of August 1291, defending its liberty in the fight of Morgarten (1315) and renewing the League of the Three at Brunnen (1315). Later it took part in the victory of Sempach (1386). In 1403, with the help of Obwalden, it won the Val Leventina from the duke of Milan, but it was lost in 1422, though in 1440 Uri alone reconquered it and kept it (winning the bloody fight of Giornico in 1478) till 1798. In 1419, with Obwalden, Uri bought Bellinzona, but lost it at the battle of Arbedo (1422), though, with Schwyz and Nidwalden, it won it back in 1500, keeping it also till 1798. In 1512 Uri shared in the conquest of Lugano, &c., by the Confederates, her natural position forcing her to extend her rule towards the south, though many attempts on and temporary occupations of the Val d'Ossola (1410–1515) ultimately failed. In 1410 a perpetual alliance was made with the valley of Ursern or Val Orsera, the latter being allowed its own head-man and assembly, and courts under those of Uri, with which it was not fully incorporated till 1888. Ursern originally belonged to the great Benedictine monastery of Disentis, at the head of the Vorder Rhine valley, and was most probably colonized in the 13th century by a German-speaking folk from the Upper Valais. At the Reformation Uri clung to the old faith, becoming a member of the "Christliche Vereinigung" (1529) and of the Golden League (1586). In 1798, on the formation of the Helvetic republic, Uri became part of the huge canton of the Waldstätten and lost all its Italian possessions. In September 1799 Suworoff and the Russian army, having crossed the St Gotthard to Altdorf, were forced by the French to pass by the Kinzigkulm Pass into Schwyz, instead of sailing down the lake to Lucerne. In 1803 Uri became an independent canton again, with Ursern, but without the Val Leventina. It tried hard to bring back the old state of things in 1814–15, and opposed all attempts at reform, joining the League of Sarnen in 1832 to maintain the pact of 1815, opposing the proposed revision of the pact, and being one of the members of the Sonderbund in 1845. Despite defeat in the civil war of 1847, Uri voted against the Federal constitution of 1848, and by a crushing majority against that of 1874.

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URIC ACID, $C_5H_4N_4O_3$, in organic chemistry, an acid which is one of the penultimate products of the tissue waste in the human body. While the bulk of the nitrogen of the albuminoids passes off through the bladder as urea, a small portion of it stops at the uric acid stage. Human urine contains only a fraction of a per cent. of the acid, chiefly as sodium salt; abundance of uric acid is met with in the excrement of serpents and birds, with whom it is the principal nitrogenous product of tissue waste. For its preparation guano is boiled repeatedly with a solution of borax in 120 parts of water. The filtered solution is acidified with hydrochloric acid, when impure uric acid separates out as a brown precipitate, which is washed with cold water; it is then dissolved in hot dilute caustic potash or soda, the solution filtered, and the filtrate saturated with carbon dioxide. An almost insoluble urate is precipitated, which is filtered, washed and decomposed by hot dilute hydrochloric acid. Uric acid separates as a white precipitate, which is filtered off, washed and dried, to be repurified by a repetition of the alkali process or otherwise. Pure uric acid forms a snow-white micro-crystalline powder, devoid of smell or taste, soluble in 1800 parts of boiling and in 14,000 parts of cold water, but insoluble in alcohol and in ether. For its detection in urine, the urine is mixed with excess of hydrochloric acid, and allowed to stand, when the uric acid separates out, generally coloured reddish by impurities. The precipitate is dissolved in a few drops of nitric acid and the solution cautiously evaporated to dryness. The residue when exposed to ammonia gas assumes the intense purple colour of murexide.

The acid, which was discovered by C. Scheele in 1776 in urinary calculi, was afterwards investigated by Liebig and Wöhler. The determination of its constitution, and its relation to other vegetable and animal products, followed from the researches of A. von Baeyer and E. Fischer (see Purin).

URICONIUM (more correctly *Viroconium*), a large Romano-British country town, chef-lieu of the Cornovii, now Wroxeter on the Severn, 5. m. E. of Shrewsbury. At first perhaps (A.D. 45–55) a Roman legionary fortress, held by Legio XIV. Gemina against the Welsh hill-tribes, its garrison was soon removed and it became a flourishing town with stately town hall, baths and other appurtenances of a thoroughly civilized and Romanized city. It was larger and probably richer than—for example—Silchester. The lines of its walls can still be traced, enclosing an area of 170 acres, and parts of the town hall and baths have been uncovered. Its originally Celtic name seems to survive in the names of Wroxeter and the neighbouring hill, Wrekin.

See *Victoria History of Shropshire*, i. 215–56. (F. J. H.)

URIM AND THUMMIM, in the Bible. These descriptive terms are applied to one of the methods of divination employed by the ancient Hebrews, which, it is now generally agreed, consisted in a species of sacred lot. Together with "dreams" and the prophetic oracle it formed the recognized channel by which divine communications were given (cf. 1 Sam. xxviii. 6). That some method of casting lots is denoted by the terms is evident from 1 Sam. xiv. 41 f. The Hebrew text in this passage, as emended by the LXX and in this form generally accepted, runs as follows: "And Saul said: 'O Jehovah, God of Israel, why dost Thou not answer Thy servant to-day? If this fault be in me or in Jonathan my son, give Urim, and if it be in Thy people Israel, give Thummim.' And the lot fell upon Saul and Jonathan, and the people escaped. And Saul said: 'Cast (the lot) between me and Jonathan my son, and on whomsoever Jehovah shall cause the lot to fall let him die.' So they cast (the lot) between him and Jonathan his son, and Jonathan was taken."

From this illuminating passage it is clear (*a*) that by means of the Urim and Thummim the guilt or innocence of the suspected parties was determined; (*b*) that this was effected by a series of categorical questions implying the simple alternative of "yes" or "no," or something positive or negative. A further inference (*c*) from a comparison of 1 Sam. xiv. 41 f. with ver. 36 (Greek text) is that this method of casting the sacred lot was closely connected with divination by the ephod (*q.v.*), and was the prerogative of the priests. This last point appears explicitly in the "Blessing of Moses" (Deut. xxxiii.), where the opening words of the Benediction on Levi run thus (text as emended by Ball, following LXX; *P.S.B.A.* 1896, 118 f.):—

"Give to Levi Thy Thummim,
And Thy Urim to the man of Thy favour."

Similar modes of divination were practised, it would seem, among the pre-Islamic Arabs. The following custom is cited by Professor G. F. Moore,[1] on the testimony of Moslem writers, as having been in vogue: "Two arrow shafts (without heads or feathers), on one of which was written 'Command,' on the other 'Prohibition,' or words of similar purport, were placed in a receptacle, and according as one or the other of them was drawn out it was known whether the proposed enterprise was in accordance with the will of the god and destined to succeed or not" (cf. Prov xvi. 33; Acts i. 26).

Regarding the form and material of the Urim and Thummim no details are given in the Old Testament. They seem to have fallen into desuetude at a comparatively early period. No mention is made of their use in the historical books after the time of David and Solomon, though it is probable that such use is implied in passages where the ephod is mentioned (*e.g.* Hosea iii. 4). In the post-exilic Priestly Code (*i.e.* the bulk of the Levitical legislation of the Pentateuch), however, the Urim and Thummim figure as part of the equipment of the high priest (cf. Ex. xxviii. 30; Lev. viii. 8; Num. xxvii. 21). Here it is stated that they are kept in a square pouch which is worn upon the high priest's breast ("the breastplate of judgment"), and attached to the ephod. Thus the association of the Urim and Thummim with the ephod, which appears in the oldest narratives, is retained in the Priestly Code (P). It is doubtful, however, whether P had any clear notion as to what exactly the Urim and Thummim were. The priestly writer gives no directions as to how they were to be made. They were retained in his ideal legislation, apparently, because their use was already invested with the mystery of a long-vanished past, and they were regarded as having formed one of the most venerable adjuncts of the priesthood. That this method of divination was not in actual use after the Exile is shown by Neh. vii. 65 (Ezra ii. 63; 1 Esdras v. 40) where an important point affecting the priestly families is reserved "till there stood up a priest with Urim and Thummim." Later references (Ecclus. xlv. 10; in Josephus and the Talmud) prove that no real tradition survived on the subject. The identification of them with the jewels of the breastplate and on the shoulders of the high priest (which apparently has the authority of Josephus) is unwarranted; other ancient guesses are equally baseless. Nor has any satisfactory explanation of the names Urim and Thummim been proposed. As vocalized in the Massoretic Hebrew text the names = "Lights and perfection." But the Greek translators read the former *'orim* and connected it with *torah*, "decision"; it would thus = "doctrine"; so Symmachus, cf. 1 Esd. v. 40, where "a high priest wearing Urim and Thummim" (R.V.) is given as "a high priest clothed in doctrine and truth" in A.V. Nor can the attempt of the American scholar Muss-Arnolt to explain them as cognate with the Babylonian Tablets of Destiny be pronounced successful. Perhaps the conjecture least open to objection is that which regards the terms Urim and Thummim as the names of two lots[2] (perhaps actually written on them) of opposite import. In this case the former of the two names might be derived from the root *'arar*, "to curse"; the other from a root meaning "to be without fault." The one would thus signify "that a proposed action was satisfactory to God, the other that it provoked His wrath" (Professor G. F. Moore). But all such explanations are highly precarious.

Bibliography.—For the older views, see Spencer, *De leg. Hebr. rit.* Diss. VII.; and a useful summary by Plumptre in Smith's *Bib. Dict.* For modern discussions, see the articles "Urim and Thummim" in the Bible dictionaries; the relevant sections in the treatises on archaeology; and W. Muss-Arnolt, *The Urim and Thummim* (reprinted from the *American Journal of Semitic Languages*, July 1900). (G. H. Bo.)

URINARY SYSTEM. The urinary system in the fully developed human being consists of (1) the kidneys, (2) the ureters, (3) the urinary bladder, and (4) the urethra.

As the greater part of the male urethra is a generative as well as a urinary canal, its description will be found in the article on the Reproductive System.

Kidneys.

The *kidneys* are two bean-shaped granular masses, firm in consistence and reddish brown in colour, about 4½ in. long, and placed obliquely behind the other abdominal viscera—one on each side of the last thoracic and three upper lumbar vertebrae. Each is imperfectly covered on its ventral surface by peritoneum and is moulded to some extent by the viscera which press on it. Around them there is usually a considerable amount of fat and areolar tissue, by which, as well as by the peritoneum and by the presence of the surrounding viscera, the kidneys are retained in their place. In rare cases the kidney may slip from its usual place in the loins to a lower position (movable kidney), and may even be movable in the abdominal cavity (floating kidney)—a condition often productive of serious consequences. The kidney in the foetus is lobulated, but the intervals between the lobes become smoothed out in later years of childhood. Each gland is invested by a firm, closely adherent, fibrous capsule, under which is an imperfect lamina of unstriped muscle. The inner and ventral margin of each kidney is concave, and into this *hilum* or concavity the renal artery from the aorta passes. Here also the renal vein escapes and joins the vena cava inferior. The ureter or metanephric duct, always behind and below the blood vessels, emerges here and passes downward to the bladder. When the kidney is longitudinally divided from hilum to outer edge, the cut surface is seen to consist of two parts—an outer layer, the cortex, and an inner part, the medulla (fig. 1). The latter consists of a series of eight to sixteen pyramids, whose bases and sides are invested with cortical matter, and whose apices or papillae project into the hilum, where they are severally surrounded by membranous tubes (calices), which by their union make up the ureter. The part of the ureter situated in the hilum is dilated, and is named the pelvis of the kidney.

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[1] *Encycl. Biblica*, iv. (col. 5236), where further details are given.

[2] The lots may have been small pebbles, or small tablets of wood or bone.

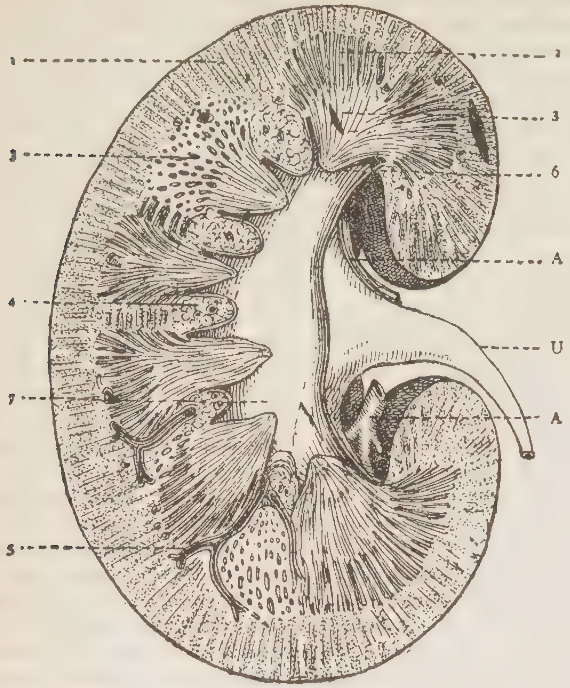
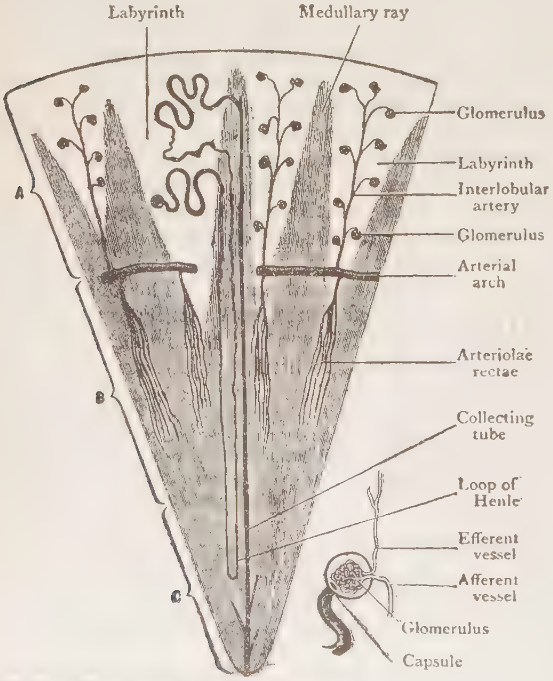


FIG. 1.—Vertical Section through the Kidney. A, branch of renal artery; U, ureter. 1, cortical substance with cortical pyramids, and labyrinth substance of tortuous tubes; 2 and 3, medullary pyramids of straight tubules; 4, fatty masses around blood vessels (5); 6, papilla; 7, pelvis.



From A. F. Dixon, Cunningham's *Text-Book of Anatomy*.

FIG. 2.—Diagrammatic Representation of the Structures forming a Kidney Lobe.

In the middle part of the figure the course of one of the kidney tubules is indicated, and in the lateral parts the disposition of the larger arteries. A, cortex; B, intermediate zone; C, papillary portion.

The diagram at the right-hand side of the lower part of the figure illustrates the connexions of the structures composing a Malpighian corpuscle.

In minute structure the kidney is the most complex gland in the body. Each of the papillae consists of a large number of straight tubes—collecting tubules—which open by pores on its surface. When these are traced into the pyramid, they are seen to divide several times, their fine end-branches projecting in little tufts into the cortical matter at the base of each pyramid. Here the branches coming from the tube change in structure and become convoluted in the cortex—the convoluted tubules. Next, each suddenly dips back again as a long straight loop—the loop of Henle—into the pyramid, reaching nearly to the papillary region; then turning sharply on itself, passes back straight to the cortex, where it again becomes convoluted, ultimately ending by dilating into a flask-like bulb called a Malpighian corpuscle. The renal artery, after breaking up into branches between the pyramids, ends in minute end-arteries in the cortex. Each of these pierces into one of the flasks just described, and there becomes branched, the branches being collected into a little ball or glomerulus which nearly fills the flask. From this an efferent vessel escapes, which, joining with its neighbouring vessels of the same kind, makes a close network around the convoluted tubes, ultimately ending in the renal vein. It is supposed that the different constituents of the urine are eliminated in different parts of these tubes—some, especially the watery parts, in the flask, and some, especially the more solid constituents, in the convoluted tubular apparatus. A peculiar form of glandular epithelium lines the two convoluted areas of the tubes and the limb of the loop nearer the straight or collecting tubes.

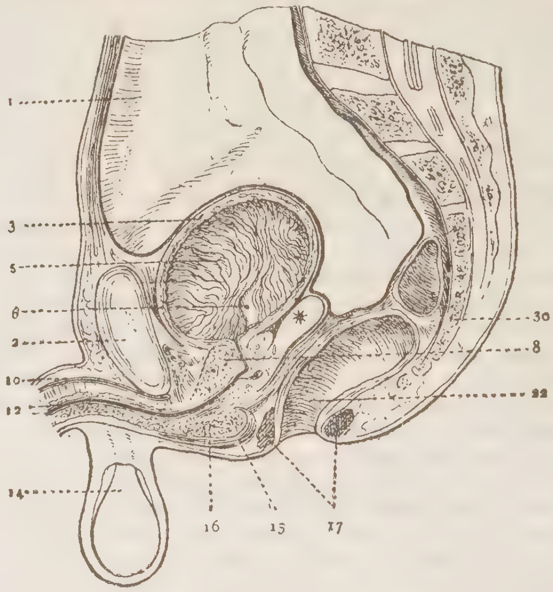
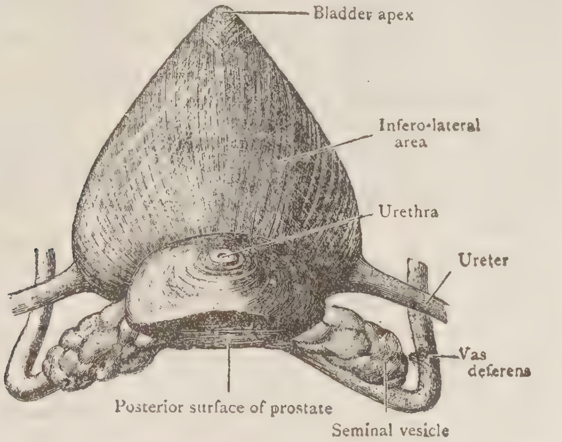


FIG. 3.—Vertical Section through Pelvis, showing urinary bladder and rectum *in situ*. 1, peritoneum; 2, pubic symphysis; 3, muscular coat of bladder; 5, mucous membrane folded and wrinkled; 6, opening of ureter; 8, prostate; 10, vena dorsalis penis; 12, corpus spongiosum; 14, testis in its sac; 15, bulbo-cavernosus muscle; 16, bulb; 17, sphincters of the anus; 22, anal opening; 30, coccyx; *, vesicula seminalis.

Bladder and urethra.

The *ureter* or duct of the kidney begins at the hilum and descends on the back wall of the abdominal cavity to open into the bladder. It is usually about 12 in. in length and as thick as a goose quill. At its termination it passes obliquely through the coats of the bladder, so that when the bladder is distended the lumen of its end is closed. The *urinary bladder* is a membranous bag lying in the pelvic cavity directly behind and above the dorsal surface of the pubes. In the foetus and infant, however, the bladder lies in the abdomen, not in the pelvis. During life it is seldom distended so as to hold more than about 10 oz., but when the abdomen is opened it can be dilated to more than double that size. When distended it rises and is applied closely against the back of the ventral abdominal wall. The bladder has a strong muscular investment of unstriped muscle in several layers, which are innervated by branches from the sacral nerves. It has a peculiar epithelial lining of several strata, the superficial cells of which are cubical when the sac is collapsed, but become flattened and scale-like when it is distended. At the lower part of the bladder there is a triangular space known as the trigone, the angles of which are formed by the openings of the two ureters and the urethra. In this space the mucous membrane is smooth and firmly bound to the subjacent muscle; elsewhere it is thrown into numerous folds when the bladder is empty. A muscular band called the torus uretericus or Mercier's bar joins the orifices of the ureters. The female urethra is only 1½ in. in length and is comparable only with that part of the male urethra which extends from the bladder to the openings of the seminal ducts (fig. 3).

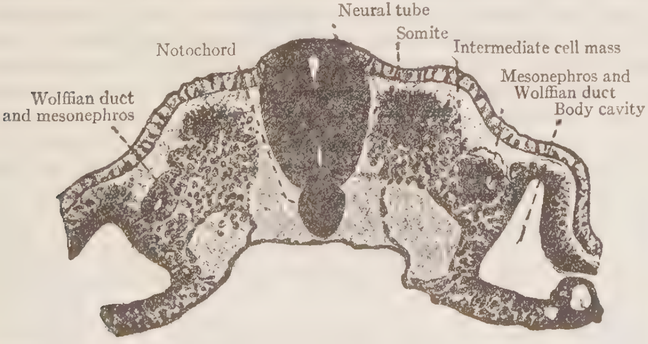


From A. F. Dixon, Cunningham's *Text-Book of Anatomy.*

Fig. 4.—The Bladder, Prostate and Seminal Vesicles, viewed from below. Taken from a subject in which the viscera were hardened *in situ.* The bladder contained but a small amount of fluid.

Embryology.

The excretory organs of the embryo are developed as a series of small tubes in the intermediate cell mass (see fig. 5), the ventral part of which projects to form the Wolffian ridge. Three sets of these tubes appear in succession and occupy the whole length of the body from the cervical to the lumbar region. The most anterior—*pronephros* or *head kidney*—is represented in man by only two or three small tubules on each side which appear as ingrowths from the neighbouring coelom (fig. 6, Pro.N.). From the study of comparative anatomy it is probable that these are mere vestiges. Although the pronephros is rudimentary, the duct which in lower types carries away its excretion is well developed. This is the *Wolffian duct,* which appears in man before the pronephric tubes are formed, and runs longitudinally back in each intermediate cell mass to open into the cloaca (fig. 6, W.D.). In certain parts of its course it is at an early date in very close relation with the skin on the dorsal side of the intermediate cell mass, and many embryologists hold that it is originally ectodermal in origin, and has sunk into the mesoderm secondarily. Others think that it is primarily mesodermal but has gained secondary connexions with the ectoderm. From a morphological point of view, as will be explained in the comparative anatomy section, the former view seems the more likely.



From A. F. Dixon, Cunningham's *Text-Book of Anatomy.*

Fig. 5.—Transverse Section through the Body of a Fowl Embryo.

When the pronephric tubules disappear, which they do at an early stage of the embryo's development, the Wolffian duct persists and acts as the drain for another and much more important series of tubules, which are formed in the intermediate cell mass behind the region of the pronephros, and make up the *mesonephros* or *middle kidney* (fig. 6, M.N.). There is some doubt as to whether these tubes are strictly homologous and in series with those of the pronephros; but they are certainly of later development.

By about the sixth week of intra-uterine life these tubules reach their maximum development and form the *Wolffian body,* which projects into the coelom as the now very definite *Wolffian ridge* and acts as the functional excretory organ of the embryo (see fig. 7). When the permanent kidney is formed this organ degenerates and its ultimate fate is discussed in the article on the Reproductive System.

The *metanephros* or *hind kidney* begins as a diverticulum from the dorsal side of the Wolffian duct close to its opening into the cloaca (see fig. 6, Mt.N.); this occurs about the fourth week of intra-uterine life, and the diverticulum grows forward (cephalad), dorsal to the hind end of the Wolffian body. In doing this it forms a duct—the *metanephric duct* or *ureter*—the cephalic end of which enlarges and divides to form the calices of the kidney. From the calices numerous smaller ducts grow into the mesoderm of the hind (caudal) end of the intermediate cell mass and become the collecting tubes of the kidney. While this is going on another set of tubules, probably in series with the mesonephric tubules, develop independently in the intermediate cell mass and so form all the rest of the tubular system of the kidney. Toward these tubules, at one point, branches from the aorta push their way and invaginate each tube, thus forming the Malpighian corpuscles.

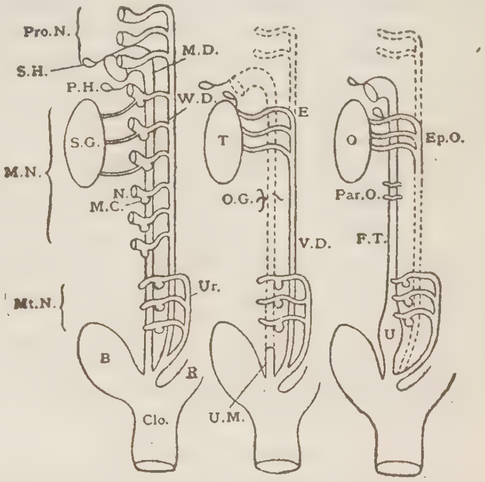
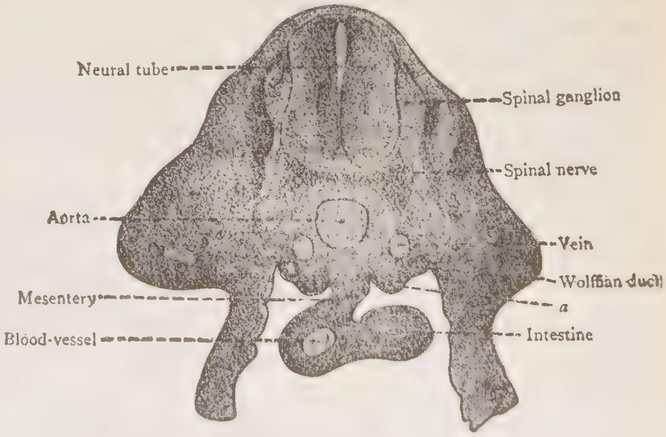


Fig. 6.—Diagram of the Formation of the Genito-Urinary Apparatus. The first figure is the generalized type, the second the male and the third the female specialized arrangements. Suppressed parts are dotted.

Pro. N.	Pronephros.	N.	Nephrostome.
M. N.	Mesonephros.	M. C.	Malpighian corpuscle.
Mt. N.	Metanephros.	T.	Testis.
B.	Bladder.	E.	Epididymis.
Clo.	Cloaca.	O. G.	Organ of Giraldès.
R.	Rectum.	V. D.	Vas deferens.
M. D.	Mullerian duct.	U. M.	Uterus masculinus.
W. D.	Wolffian duct.	O.	Ovary.
Ur.	Ureter.	Ep. O.	Epoöphoron.
S. H.	Sessile hydatid.	Par. O.	Paroöphoron.
P. H.	Pedunculated hydatid.	F. T.	Fallopian tube.
S. G.	Sexual gland.	U.	Uterus.



From A. F. Dixon, Cunningham's *Text-Book of Anatomy.*

Fig. 7.—Transverse Section through the Body of a Rat Embryo. The position where the germinal epithelium arises is indicated at *a.*

By the eighth week the kidney is definitely formed and takes over the excretory work of the mesonephros, which now atrophies; its surface is distinctly lobulated, a condition which persists until after birth.

At first, as has been stated, the ureters open into the Wolffian ducts, but later on each gains a separate opening into the cloaca, and eventually these shift in a ventral direction until they reach their permanent connexion with the allantoic bladder.

The *bladder* is developed from that part of the cloaca from which the allantois has grown out, and also from that part of the allantois which is nearest the cloaca. At first it is a tubular structure, but after the second month becomes more pyriform, the stalk of the pear corresponding to the fibrous *urachus* which reaches the umbilicus. Most of that part of the tubular allantois which lies between the permanent openings of the ureters and the Wolffian ducts becomes the *urinary sinus* and does not dilate in the same way that the permanent bladder does. This, in the female, forms the whole of the urethra, and in the male the upper part of the prostatic urethra. Behind (caudad) the urinary sinus is the urogenital sinus, which is treated of in the article on the Reproductive System.

The *Müllerian ducts* (fig. 6, M.D.) are formed after the Wolffian ducts are fully developed. A ridge appears in the intermediate cell mass ventral to the Wolffian duct, and into the anterior (cephalic) end of this a tubular process of the coelom forces its way backward (caudad). Before reaching the cloaca the two Müllerian ducts coalesce and open between the orifices of the two Wolffian ducts. These ducts, as is shown in the article on the Reproductive System, form the oviducts, uterus and at least part of the vagina.

For further details and literature see Quain's *Anatomy*, vol. i. (Longmans, Green & Co., London, 1908); J. M'Murrich, *The Development of the Human Body* (Rebman, London, 1906), and A. Keith, *Human Embryology and Morphology* (Arnold, London).

Comparative Anatomy.

In the Acrania (Amphioxus) the nephridial tubules are segmentally arranged and are only found in the pharyngeal region; each opens into the coelom by several ciliated funnels called nephrostomes, and also into the atrium, which is practically the exterior of the animal, by an opening called the nephridiopore. There is reason to believe that we have here a pronephros of a very primitive type and arranged on the same plan, in many respects, as the simple nephridia of such lowly forms as the earthworm. There is nothing to indicate that a mesonephros is present, nor are there any Malpighian corpuscles or longitudinal ducts.

Among the Cyclostomata (lampreys and hags) the pronephros persists throughout life in Bdellostoma and probably in the hag (Myxine), but a Wolffian (archinephric) duct has been evolved so that the tubules no longer open on the surface by nephridiopores. It has been surmised that in a transitional type the tubules opened into a groove on each side of the surface of the animal and that the edges of this, coming together, formed a duct. At any rate the superficial openings of the primitive nephridia make it probable that the Wolffian duct was originally of ectodermal origin. A mesonephros has now appeared behind (caudad) the pronephros, though it is not certain whether its tubules (mesonephridia) are in series with those of the pronephros or whether they are structures on a more dorsal plane; but they certainly open into the Wolffian duct, which also drains the pronephros, and so this duct is functionally simply a ureter and has nothing to do with the sexual glands. No Müllerian duct has yet been evolved.

In the Teleostomi (bony and ganoid fish) the pronephros is usually aborted in the adult and the mesonephros is the functional kidney. As the genital glands have special coelomic relations the Wolffian duct is still merely a ureter, and in the Teleostei at least there is no true Müllerian duct.

In the Elasmobranchii (sharks and rays) the pronephros is more completely and more early aborted than in the last subclass, and the mesonephros is divided into an anterior or genital part, which receives the vasa efferentia in the male from the testis and thus is the first appearance phylogenetically of an epididymis and a posterior or renal part. The Wolffian duct therefore acts both as a vas deferens for the sperm and a ureter for the urine, though in the female it is merely a ureter. In the hindmost part of the mesonephros there are separate ducts which are called ureters and open into the lower part of the Wolffian duct in the same way that the metanephric ducts of the Amniota do; it is, however, very doubtful whether they are really homologous with these ducts. The Müllerian duct (see Reproductive System) is present in elasmobranchs and according to modern views arises as a backgrowth from the coelom as in the Amniota.

The Dipnoi or mudfish are remarkable for having a cloacal caecum which probably functions as an urinary bladder. It is situated on the dorsal wall of the cloaca and is not homologous with the allantoic bladder of higher forms. A good deal of the kidney (mesonephros) as it appears to the naked eye is composed of lymphoid tissue.

In the Amphibia the snake-like forms (Gymnophiona) show a very primitive arrangement of the kidney tubules, each having its nephrostome, Malpighian capsule and short convoluted part leading to the Wolffian duct which acts both as ureter and vas deferens.

In the adult Anura (frogs and toads) the nephrostomes lose their connexion with the nephridia and communicate with the renal veins. In the amphibians a true allantoic bladder first appears as a diverticulum from the ventral wall of the cloaca; in different forms it may be single, bilobed or even double.

In Reptilia the hind kidney or metanephros is developed and takes over all the excretory work; it is usually lobulated, its nephridia are never provided with nephrostomes and its duct (the ureter) opens into the Wolffian duct or vas deferens before reaching the cloaca. The allantoic bladder is present in the Lacertilia (lizards) and Chelonia (turtles), but is absent in others. Birds resemble reptiles very closely in their urinary system except that there is never any bladder and that the ureters and vasa deferentia open independently into the cloaca.

In the Mammalia the bean shape of the kidney is fairly characteristic. In foetal life the organ is always lobulated, and this sometimes persists throughout adult life as in the ox, bear, seal and whale. More often the lobulation disappears on the surface and is only imperfectly represented, on making a section, by the pyramids; even these in some cases fuse so closely that their apices appear as a single papilla. This is the case in many monkeys, carnivores and rodents.

In the Monotremata (Ornithorhynchus and Echidna) there is an allantoic bladder, but the ureters open into the cloaca as they do in birds. In all other mammals they have reached the bladder and open into it by valvular orifices.

On comparing the embryology (ontogeny) of the urinary system with its comparative anatomy (phylogeny) the harmony of the two from a broad point of view is very striking.

For further details see Parker and Haswell, *Text-Book of Zoology* (Macmillan, London, 1897); Wiedersheim's *Comparative Anat. of Vertebrates*, translated by W. N. Parker (London, 1907); Gegenbaur, *Vergleich. Anat. der Wirbeltiere* (Leipzig, 1901).

URMIA (the name as written by the Persians is *Urūmīeh* and *Urmieh*; the inhabitants of the place say *Urmi*), a town in the province of Azerbaijan in Persia, situated at an elevation of 4400 ft., in an extremely fertile and highly cultivated plain, 78 m. S.W. of Tabriz (120 by road), 11 to 12 m. from the western shore of the lake of the same name, in 37° 34′ N. and 45° 4′ E. It is surrounded by a wall and deep dry ditch that can be flooded, and is encircled by orchards and gardens which extend all round for miles and even penetrate the heart of the town. The streets are broader than is usual in Persian cities, and most of them have a stream of water running down the middle. There are a busy bazaar and some old mosques. The population is about 35,000, and there are post and telegraph offices. The only building of importance is the ark, or citadel, a walled building in the centre of the town containing an arsenal and barracks for a small garrison. Urmia has for many years been the headquarters of various missions to the Nestorians of the neighbourhood: an American mission (since 1835) representing the "Board of the Foreign Missions of the Presbyterian church of the United States of America"; the French Lazarists (since 1840); British, "The Anglican Mission" founded by Archbishop Benson (1884), and a Russian mission (Orthodox, since 1902). Urmia is the capital of a fertile district 50 m. long and about 20 m. broad, having the same name and containing more than 300 flourishing villages. It exports great quantities of dried fruit and excellent *tutun*, tobacco for chibuks, or Turkish pipes.

URMIA, LAKE OF (also spelt Urumiah), a lake in north-western Persia, between 37° 10′ and 38° 20′ N. and between 45° 10′ and 46° E., which takes its name (Pers. *Deryacheh i Urmia*, Turk. *Urmi göl*) from the town of Urmia, situated near its western shore, but is also known as the Deryacheh i Shahi and Shahi göl. The limits of the lake vary much, the length, N.–S., from 80 to 90 m., the width, E.–W., from 30 to 45, being greater in the season of high water—in spring when the snows melt—and considerably less in the season of low water. A rise of the level by only a few inches extends the shore of the lake for miles inland, and it may be estimated that the surface covered by the lake during high water is half as much again as that during low water. The Shahi peninsula, which juts out into the lake from the eastern bank, is an island during the season of high water and also sometimes after heavy autumnal rains, separated from the mainland by several miles of shallow water. The mean depth of the lake is 15 to 16 ft., and its greatest depth probably does not exceed 50 ft. The lake has in recent years exhibited extraordinary changes of level, and it is not certain whether some occasional extraordinary rises of level were due to a movement of the earth's crust or merely to an increase of rainfall as compared with evaporation. Günther calculated that the lake covered 1795 sq. m., but he did not state whether during high or low water. De Morgan gives 4000 and 6000 sq. kilometres (1544 and 2317 sq. m.) for low and high water respectively. In the southern half of the lake is a cluster of about fifty rocky islands composed of Miocene strata with marine shells, echinoderms and corals, much resembling the beds of the Vienna basin. The largest of these islands, Koyun daghi, *i.e.* "Sheep-mountain," is 3 to 4 m. long and has a spring of sweet water near which a few people settle occasionally for looking after herds of goats and sheep taken there for grazing. All the islands are uninhabited and some are mere bare rocks of little extent. Although fed by many rivers and streams of sweet water the lake is very saline and its water is about three-fifths as salt as the water of the Dead Sea—far too salt to permit the existence of fish life. The specific gravity of the water is 1·155 during low water and 1·113 during high water. The principal salts contained in solution are sodium chloride, bromide and iodide and sulphates of magnesia, soda and iron. The only organisms living in the lake are a species of artemia, a crustacean known from other brine lakes in Europe and North America, the larva of a species of dipterous insect, probably allied to ephydra, and green vegetable masses composed of bacterial zoogloeae covered with a species of diatom. The rivers which flow into the lake drain an area of nearly 20,000 sq. m.; chub and roach are found in all of them, silurus in some. The lake is navigated by a few round-bottomed boats with round bows and flat sterns, each of about 20 tons burden and carrying an enormous square sail.

Strabo (xi. c. 13, 2) mentions the lake with the name Spauta, a clerical error for Kapauta, from Pers. *Kapaut*, New Pers. *Kebud*, meaning "blue." Old Armenian writers have Kapoit-dzov, "the blue sea." In the *Zendavesta* and *Bundahish* it is called "Chaechasta," and Firdousi in his *Shahnamah* (11th century) has "Chichast."

See J. de Morgan, *Mission scientifique en Perse* (1894); R. T. Günther, "Lake Urmi and its Neighbourhood," *Geogr. Journ.* (November 1899). (A. H.-S.)

URN (Lat. *urna*, either from root of *urere*, to burn, being made of burnt clay, or connected with *urceus*, Gr. ὕρχα, jar), a vessel or vase, particularly one with an oviform body and a foot. The Roman term *urna* was used primarily of a jar for carrying or drawing water, but was also specifically applied to the vessel in which the voting-tablets (*tabellae*) and lots (*sortes*) were cast, whence its figurative use for the urn of fate from which are drawn the varying lots of man's destiny. The ashes of the cremated dead were deposited in cinerary urns, a custom perpetuated by the marble or other urns placed upon funeral monuments. The Roman *urna* was also a liquid measure containing half an *amphora*, or about $3\frac{1}{2}$ gallons. Modern usage has given the name to large silver or copper vessels containing tea or coffee with a tap for drawing off the liquids and heated either by a spirit lamp or, as in the older forms, by the insertion of a hot iron in a special receptacle placed in the body of the vessel.

UROTROPIN (hexamethylenetetramine), known also in the United States under the name *Uritone*, a medicinal preparation due to the action of ammonia on formaldehyde. It consists of colourless granular crystals freely soluble in water and having an alkaline reaction. Urotropin is among the most powerful of urinary antiseptics. It was formerly thought that its action was due to the setting free of formaldehyde in the urine, but it is now known by the researches of P. Cammidge that this is not so. It is used to render the urine acid in cases where it is alkaline, loaded with phosphates or purulent, and is thus useful in cases of cystitis. It is slightly diuretic. Experimentally it has been shown to have a solvent action on uric acid, but its action in this direction in the body requires confirmation. Urotropin is very valuable in sterilizing the urine of patients who have suffered from typhoid fever and thus preventing the spread of the disease by what are known as "typhoid carriers." Analogous preparations are cystamine, helmitol and hetralin. Chinotropin is urotropin quinate, and borovertin is urotropin triborate.

URQUHART, DAVID (1805–1877), British diplomatist and publicist, born at Braelangwell, Cromarty. He came of a good Scottish family and was educated in France, Switzerland and Spain, and then at St John's College, Oxford. In 1827 he went under Lord Cochrane (Dundonald) to fight for the Greeks in the War of Independence; he was present at the action of the 28th of September when Captain Hastings destroyed the Turkish squadron in the Bay of Salona, and as lieutenant of the frigate "Hellas" he was severely wounded in the attack on Scio. In November 1828 he left the Greek service. In 1830 he privately examined the new Greek frontier as determined by the protocol of March 22, 1829, and the value of his reports to the government led to his being named British commissioner to accompany Prince Leopold of Coburg to Greece, but the appointment fell to the ground with that prince's refusal of the Greek throne. His knowledge of the local conditions, however, led to his being appointed in November 1831 attaché to Sir Stratford Canning (Lord Stratford de Redcliffe, *q.v.*), ambassador extraordinary to the sultan, for the purpose of finally deliminating the frontiers of Turkey and Greece. On his return to England he published in 1833 *Turkey and its Resources*, a violent denunciation of Russia. In 1833 he was sent on a secret mission to Turkey to inquire into possible openings for British trade, and at Constantinople he gained the complete confidence of the Turkish government. The situation, however, was a delicate one, and Urquhart's outspoken advocacy of British intervention on behalf of the sultan against Mehemet Ali, the policy of Stratford Canning, made him a danger to international peace; he was consequently recalled by Palmerston. At this time appeared his pamphlet *England, France, Russia and Turkey*, the violent anti-Russian character of which brought him into conflict with Richard Cobden. In 1835 he was appointed secretary of embassy at Constantinople, but an unfortunate attempt to counteract Russian aggressive designs in Circassia, which threatened to lead to an international crisis, again led to his recall in 1837. In 1835, before leaving for the East, he founded a periodical called the *Portfolio*, and in the first issue printed a series of Russian state papers, which made a profound impression. From 1847 to 1852 he sat in parliament as member for Stafford, and carried on a vigorous crusade against Lord Palmerston's foreign policy. The action of England in the Crimean War provoked indignant protests from Urquhart, who contended that Turkey was in a position to fight her own battles without the assistance of other Powers. To attack the government, he organized "foreign affairs committees" which became known as "Urquhartite," throughout the country, and in 1855 founded the *Free Press* (in 1866 renamed the *Diplomatic Review*), which numbered among its contributors the socialist Karl Marx. In 1860 he published his book on *The Lebanon*. From 1864 until his death Urquhart's health compelled him to live on the continent, where he devoted his energies to promoting the study of international law. He died on the 16th of May 1877. His wife (Harriet Chichester Fortescue), by whom he had two sons and two daughters, and who died in 1889, wrote numerous articles in the *Diplomatic Review* over the signature of "Caritas."

To Urquhart is due the introduction into Great Britain of hot-air Turkish baths. He advocated their use in his book called *Pillars of Hercules* (1850), which attracted the attention of the Irish physician Dr Richard Baxter (1802–1870), and the latter introduced them in his system of hydropathy at Blarney, Co. Cork. The Turkish baths in Jermyn Street, London, were built under Urquhart's direction.

URQUHART, or URCHARD, SIR THOMAS (1611–1660), Scottish author and translator of Rabelais, was the son of Sir Thomas Urquhart of Cromarty, the representative of a very ancient family, and of Christian, daughter of the fourth Lord Elphinstone. Sir Thomas was hard pressed by his creditors and after part of the family estate had been alienated received a "letter of protection" from his creditors from Charles I. in 1637. In the same year, his son Thomas and a younger one were accused of forcibly detaining their father in an upper room, but the matter was settled without further proceedings. Thomas was educated at King's College, Aberdeen, spending his spare time in the pursuit of physical science. On leaving the university he travelled over Europe, succeeded to his embarrassed inheritance, and got together a remarkable library, which, however, fell into the hands of his creditors. All his later life was disturbed by pecuniary and political difficulties. He was an enthusiastic Royalist; and, so far as religious matters went, his principles may be judged from his favourite signature, "C. P.," for Christianus Presbyteromastix. He took part in the "Trot of Turriff" in 1639, and was rewarded by being knighted on 7th April 1641 by the king's own hand at Whitehall. He took occasion by this visit to London to see through the press his first work, a collection of *Epigrams* of no great merit. Four years later, in 1645, he produced a tract called *Trissotetras*, a treatise on logarithms, adjusted to a kind of memoria technica, like that of the scholastic logic. In 1649 he was proclaimed a rebel and traitor at the Cross of Edinburgh for taking part in the abortive rising at Inverness on behalf of Charles II. in that year; but no active proceedings were taken against him. He took part in the march to Worcester, and was there wounded and taken prisoner. His MSS. were destroyed after the battle, with the exception of a few pages of the preface to his *Universal Language*. Urquhart was imprisoned in the Tower and at Windsor, but was released by Cromwell's orders in 1651. He published in rapid succession during 1652 and 1653 three tracts with quaint titles and quainter contents. Παντοχρονοχανον is an amazing genealogy of the house of Urquhart up to Adam, with the names extemporized for the earlier ages in a kind of gibberish. 'Εκσκυβαλαυρον is supposed to be a treatise on the virtues of a jewel found in the streets of Worcester. The jewel is the recovered sheets of his manuscript. The defence of his system for a universal language was supplemented by a eulogy of the Scottish character, as shown in the Admirable Crichton and others. Finally, in *Logopandecteision* he again handled the subject of a universal language. The *Translation of Rabelais* (Books I. and II.), which Urquhart produced in 1653, is of the highest value as literature, and, by general testimony, one of the great masterpieces of translation. Though by no means a close rendering, it reproduces the spirit of the original with remarkable felicity. The translation was reprinted in 1664; and in 1693 that of the Third Book was added. Next to nothing is known of Urquhart after 1553; it is said that he sought refuge, like other cavaliers, on the continent, and died (1660) of a fit of laughing, brought on by joy at hearing of the Restoration.

His original *Works*, with such scanty particulars of his life as are known, and with reproductions of two original and curious frontispieces, which represent him as a handsome and dandified wearer of full cavalier costume, were published by the Maitland Club (1834). See also *Sir Thomas Urquhart of Cromartie*, by John Willcock (1899), and the articles in the *New Review* (July 1897) and *Dict. Nat. Biog.* The Rabelais has been frequently reprinted; Peter Motteux's translation of the whole appeared in 1708, and Ozell's in 1737, each incorporating Urquhart's portions. Theodore Martin in 1838, and Henry Morley in 1883, published editions of Urquhart's text.

URSA MAJOR ("THE GREAT BEAR"), in astronomy, a constellation of the northern hemisphere, supposed to be referred to in the Old Testament (Job ix. 9, xxxviii. 22), mentioned by Homer, Ἄρκτος θ', ἥν καὶ ἄμαξαν ἐπίκλησιν καλέονται (*Il.* 18. 487), Eudoxus (4th century B.C.) and Aratus (3rd century B.C.). The Greeks identified this constellation with the nymph Callisto (*q.v.*), placed in the heavens by Zeus in the form of a bear together with her son Arcas as "bear-warder," or Arcturus (*q.v.*); they named it Arctos, the she-bear, Helice, from its turning round the pole-star. The Romans knew the constellation as *Arctos* or *Ursa*; the Arabians termed the quadrilateral, formed by the four stars α, β, γ, δ, *Na'sh*, a bier, whence it is sometimes known as *Feretrum majus*. The Arabic name should probably be identified with the Hebrew name *'Ash* and *'Ayish* in the book of Job (see G. Schiaparelli *Astronomy in the Old Testament*, 1905). Ptolemy catalogued 8 stars, Tycho 7 and Hevelius 12. Of these, the seven brightest (α of the 1st magnitude, β, γ, ε, ζ, η of the 2nd magnitude, and δ of the 3rd magnitude) constitute one of the most characteristic figures in the northern sky; they have received various names—Septentriones, the wagon, plough, dipper and Charles's wain (a corruption of "churl's wain," or peasant's cart). With the Hindus these seven stars represented the seven Rishis. α and β are called the "pointers," since they are collinear with, or point to, the pole-star. ξ *Ursae majoris* is a beautiful binary star, its components having magnitudes 4 and 5; this star was one of the first to be recognized as a binary—*i.e.* having two components revolving about their common centre of gravity—and the first to have its orbit calculated. ζ *Ursae majoris* is perhaps the best known double star in the northern hemisphere, the larger component is itself a spectroscopic double. The nebula M. 97 *Ursae majoris* is of the planetary type; the earl of Rosse observed two spiral condensations turning in opposite directions,—hence its name,—the "Owl nebula."

URSA MINOR ("THE LITTLE BEAR"), in astronomy, a constellation of the northern hemisphere, mentioned by Thales (7th century B.C.) and by Eudoxus and Aratus. By the Greeks it was sometimes named *Cynosura* (Gr. κυνός, dog's; οὐρά, tail), alleging this to be one of the dogs of Callisto, who became *Ursa major*. The Phoenicians named it Phoenice, or the Phoenician constellation, possibly in allusion to the fact that the brightest star is α *Ursae minoris* or the pole-star, which being situated very close to the north pole is of incalculable service to navigators. Ptolemy catalogued 8 stars, Tycho Brahe 7 and Hevelius 12. α *Ursae minoris*, more generally known as the pole-star or *Polaris*, a star of the 2nd magnitude, describes a circle of 2° 25′ daily about the north pole; it has a 9th-magnitude companion, and is also a spectroscopic binary.

URSINS, MARIE ANNE DE LA TRÉMOILLE, PRINCESS DES (1642–1722), lady of the Spanish court, was the daughter of the duke of Noirmontier and his wife Renée Julie Aubri. She was born in 1642, and was married young to Adrien Blaise de Talleyrand, Prince de Chalais. Her husband, having been concerned in the duel of four against four, in which the duke of Beauvilliers was killed in 1663, was compelled to fly the country. He died soon afterwards in Spain, and his widow established herself in Rome. In 1675 she married Flavio Orsini, duke of Bracciano. The marriage was far from harmonious, but her husband left her his fortune. It brought her a series of lawsuits and troubles with Livio Odescalchi, who claimed that he had been adopted by the duke. At last the widow sold the title and estates to Odescalchi. She then assumed the title of Princess des Ursins, a corruption of Orsini, and was tacitly allowed to use it, though it had no legal existence. The Princess des Ursins had indulged in a great deal of unofficial diplomacy at Rome, more particularly with Neapolitans and Spaniards of rank, whom it was desirable to secure as French partisans in view of the approaching death of Charles II. of Spain, and the plans of Louis XIV. for placing his family on the Spanish throne. Her services were rewarded in 1699 by a pension which her spendthrift habits made necessary to her. When Philip, duke of Anjou, grandson of the French king, was declared heir by the will of Charles II., the princess took an active part in arranging his marriage with a daughter of the duke of Savoy. Her ambition was to secure the post of *Camarera Mayor*, or chief of the household to the young queen, a mere child of twelve. By quiet diplomacy, and the help of Madame de Maintenon, she succeeded, and in 1701 she accompanied the young queen to Spain. Till 1714 she was the most powerful person in the country. Her functions about the king and queen were almost those of a nurse. Her letters show that she had to put them to bed at night, and get them up in the morning. She gives a most amusing description of her embarrassments when she had to enter the royal bedroom, laden with articles of clothing and furniture. But if the *Camarera Mayor* did the work of a domestic servant, it was for a serious political purpose. She was expected to look after French interests in the palace, and to manage the Spanish nobles, many of whom were of the Austrian party, and who were generally opposed to foreign ways, or to interferences with the absurdly elaborate etiquette of the Spanish court. Madame des Ursins was resolved not to be a mere agent of Versailles. During the first period of her tenure of office she was in frequent conflict with the French ambassadors, who claimed the right of sitting in the council and of directing the government. Madame des Ursins wisely held that the young king should rely as much as possible on his Spanish subjects. In 1704 her enemies at the French court secured her recall. But she still had the support of Madame de Maintenon, and her own tact enabled her to placate Louis XIV. In 1705 she returned to Spain, with a free hand, and with what was practically the power to name her own ministry. During the worst times of the war of the Spanish Succession she was the real head of the Bourbon party, and was well aided by the spirited young queen of Philip V. She did not hesitate to quarrel even with such powerful personages as the Cardinal Archbishop of Toledo, Portocarrero, when they proved hostile, but she was so far from offending the pride of the nation, that when in 1709 Louis the XIV., severely pressed by the allies, threatened, or pretended, to desert the cause of his grandson, she dismissed all Frenchmen from the court and threw the king on the support of the Castilians. Her influence on the sovereigns was so strong that it would probably have lasted all through her life, but for the death of the queen. Madame des Ursins confesses in her voluminous correspondence that she made herself a burden to the king in her anxiety to exclude him from all other influence. She certainly rendered him ridiculous by watching him as if he were a child. Philip was too weak to break the yoke himself, and could only insist that he should be supplied with a wife. Madame des Ursins was persuaded by Alberoni to arrange a marriage with Elizabeth Farnese of Parma, hoping to govern the new queen as she had done the old. Elizabeth had, however, stipulated that she should be allowed to dismiss the *Camarera Mayor*. Madame des Ursins, who had gone to meet the new queen at Quadraque near the frontier, was driven from her presence with insult, and sent out of Spain without being allowed to change her court dress, in such bitter weather that the coachman lost his hand by frostbite. After a short stay in France, she went to Italy, and finally established herself in Rome, where she had the satisfaction of meeting Alberoni after his fall, and where she died on the 5th of December 1722. Madame des Ursins has the credit of having begun to check the overgrown power of the church and the Inquisition in Spain, and of having attempted to bring the finances to order.

A readable life of Madame des Ursins was published in Paris in 1858 by N. F. Combes, and there is an English life by C. Hill, *The Princess des Ursins in Spain* (London, 1899). See her *Lettres inédites*, edited by A. Geoffroy (Paris, 1859), and her correspondence with Madame de Maintenon (Paris, 1826).

URSINUS, ZACHARIAS (1534–1583), German theologian, and one of the authors of the *Heidelberg Catechism* (*q.v.*), was born at Breslau on the 18th of July 1534, and became a disciple of Melanchthon at Wittenberg. He afterwards studied divinity at Geneva under Calvin, and Hebrew at Paris under Jean Mercier. In 1561 he was appointed professor in the Collegium Sapientiae at Heidelberg, where in 1563 at the instance of the elector-palatine, Frederick III., he drew up the *Catechism* in co-operation with Kaspar Olevian. The death of the elector in 1576 led to the removal of Ursinus, who from 1578 till his death in 1583 occupied a professorial chair at Neustadt-an-der-Haardt.

His *Works* were published in 1587–89, and a more complete edition by his son and two of his pupils, Pareus and Reuterus, in 1612.

URSULA, ST, and her companions, virgins and martyrs, are commemorated by the Roman Catholic church on the 21st of October. The *Breviary* gives no legend; but in current works, such as Butler's *Lives of the Saints*, it is to the effect that "these holy martyrs seem . . . to have met a glorious death in defence of their virginity from the army of the Huns. . . . They came originally from Britain, and Ursula was the conductor and encourager of the holy troop." The scene of the martyrdom is placed near the lower Rhine.

The date has been assigned by different writers to 238, *c.* 283 and *c.* 451. The story, however, is unknown both to Jerome and to Gregory of Tours—and this though the latter gives a somewhat detailed description of the Cologne church dedicated to that Theban legion with which the tradition of the martyred virgins was very early associated. The story of their fate is not entered under 21st October in the martyrology of Bede (*ob. c.* 735), of Ado (*c.* 858), of Usuard (*ante* 877), Notker Balbulus (896) or Hrabanus Maurus (845); but a 9th-century life of St Cunibert (*ob.* 663) associates a prominent incident in the life of this saint with the basilica of the sacred virgins at Cologne (Surius vi. 275, ed. 1575). Not only does Archbishop Wichfrid attest a grant to the church of the sacred virgins outside the walls of Cologne (in 927), but he was a large donor in his own person. Still earlier a Cologne martyrology, written, as Binterim (who edited it in 1824) argues, between 889 and 891, has the following entry under 21st October: "xi. virg. Ursule Sencie Gregorie Pinose Marthe Saule Britule Satnine Rabacie Saturie Paladie." Much shorter entries are found in two of the old martyrologies printed in Migne (cxxxviii. 1207, 1275). A more definite allusion to the legend may be found (*c.* 850) in Wandelbert of Prüm's metrical martyrology (21st October):

> "Tunc numerosa simul Rheni per littora fulgent
> Christo virgines erecta tropaea maniplis
> Agrippinae urbi, quarum furor impius olim
> Millia mactavit ductricibus inclyta sanctis."

The full legend first makes its appearance in a festival discourse (*sermo*) for the 21st of October, written, as internal evidence seems to show, between 731 and 839. This *sermo* does not mention St Ursula, but makes Pinnosa or Vinnosa the leader of these spiritual "amazons," who, to avoid Maximian's persecution, left their island home of Britain, following their bridegroom Christ towards that East whence their faith had come a hundred years before. The concurrent traditions of Britain, Batavia, *i.e.* the Netherlands (where many chapels still preserved their memory), and Cologne are called in evidence to prove the same origin. The legend was already very old and the festival "nobis omni tempore celeberrima"; but, as all written documents had disappeared since the burning of the early church erected over the sacred bones, the preacher could only appeal to the continuous and careful memory of the society to which he belonged (*nostrates*). Even in his time there were sceptics who pointed dubiously to the full-grown bones of "widows" and of men among the so-called virgin relics. The author of the *sermo* pointedly rejects the two theories that connected the holy virgins with the Theban band and brought them as pilgrims from the East to the West; but he adds that even in his days there still existed an inscription in the church, showing how it had been restored from its foundations by a certain "*Clematius, vir consularis, ex partibus Orientis.*"

Two or three centuries later the *Passio XI. MM. SS. Virginum*, based apparently on the revelations made to Helentrude, a nun of Heerse near Paderborn, gives a wonderful increase of detail. The narrative in its present form may date somewhere between 900 and 1100, while Helentrude apparently flourished before 1050. According to her account, the son of a powerful pagan king demands in marriage Ursula, the beautiful daughter of Deonotus, a king "in partibus Britanniae." Ursula is warned by a dream to demand a respite of three years, during which time her companions are to be 11,000 virgins collected from both kingdoms. After vigorous exercise in all kinds of manly sports, to the admiration of the populace, they are carried off by a sudden breeze in eleven triremes to Thiel on the Waal in Gelderland. Thence they sail up the Rhine by way of Cologne to Basel, at which place they make fast their vessels and proceed on foot to Rome. Returning, they re-enter their ships at Basel, but are slaughtered by the Huns when they reach Cologne. Their relics are then collected and buried "sicut hodie illic est cernere," in a spot where "to this day" no meaner sepulture is permitted. Then follows the usual allusion to Clematius; the date is expressly fixed at 238, and the whole revelation is seemingly ascribed to St Cordula, one of the 11,000 who, after escaping death on the first day by hiding in one of the vessels, on the morrow gave herself up to death of her own accord. Towards the beginning of the 12th century Sigebert of Gembloux (*ob.* 1112) gives a brief *résumê* of the same story. He is the first to introduce the name of Attila, and dates the occurrence 453.

Passing over the visions and exhumations of the first half of the 12th century, we come to the singular revelations of St Elizabeth of Schönau. These revelations, delivered in Latin, German or a mixed jargon of both languages, were turned into simple Latin by Elizabeth's brother Egbert, from whose words it would seem that in 1156 an old Roman burial-ground had lately been laid open near Cologne. The cemetery was naturally associated with the legend of St Ursula; and, this identification once accepted, it is not unlikely that when more careful investigations revealed male skeletons and tombstones bearing the names of men, other and more definite epitaphs were invented to reconcile the old traditions with the facts of such a damaging discovery. Hence perhaps the barefaced imposture: "Cyriacus, papa Romanus, qui cum gaudio suscepit sanctas virgines et cum eis Coloniam reversus martyrium suscepit." One or two circumstantial forgeries of this kind would form the basis of a scheme for explaining not a few other problems of the case, such as the plain inscription "Jacobus," whom St Elizabeth promptly transformed into a supposititious British archbishop of Antioch, brother to the equally imaginary British Pope Cyriacus. For these epitaphs, with others of a humbler kind, were brought before St Elizabeth to be identified in her ecstatic converse with St Verena, her cousin St Ursula, and others. Elizabeth herself at times distrusted her own revelations: there was no Cyriac in the list of the popes; Antherus, who was said to be his successor (235–36), died more than two centuries before Attila, to whom common report assigned the massacre; and it was hardly credible that James of Antioch could cut 11,000 epitaphs in less than three days. Every doubt, however, was met by the invention of a new and still more improbable detail. According to St Verena, the virgins suffered when Maximus and "Africanus" were *principes* at Rome (? 387–88).

In 1183 the mantle of St Elizabeth fell upon Hermann Joseph, a Praemonstratensian canon at Steinfeld. He had to solve a more difficult problem than St Elizabeth's; for the skeletons of little children, ranging in age from two months to seven years, had now been found buried with the sacred virgins. But even such a difficulty Hermann explains away: the little children were brothers, sisters or more distant relatives of the 11,000. Hermann's revelations are mainly taken up with an attempt to show the mutual relationship of nearly all the characters he introduces. The names are a most extraordinary mixture. Among British bishops we have Michael, William, James and Columbanus. Sovereign princes—an Oliver, a Clovis and a Pepin—start out in every page, till the writer finds it necessary to apologize for the number of his kings and his own blunders. But, for all this, Hermann exposes his own doubts when he tells that often, as he was preparing to write, he heard a voice bidding him lay down the pen, "for whatever you write will be an unmixed lie." Hermann makes St Ursula a native of Brittany, and so approximates to the version of the story given by Geoffrey of Monmouth (*Historia Britonum*), according to whom Maximian, after fleeing from Rome and acquiring Britain by marriage, proceeds to conquer Brittany and settle it with men from the island opposite. For these settlers he has to find British wives, and to this end collects 11,000 noble and 60,000 plebeian virgins, who are wrecked on their passage across. Certain of the vessels being driven upon "barbarous islands," their passengers are slain by Guanius and Melga, "kings of the Huns and Picts," whom Gratian had called in to his aid against Maximian. In this version St Ursula is a daughter of Dionotus, king of Cornwall. Hermann alludes more than once to the *Historia Britonum*, and even to King Arthur.

The legend of St Ursula is perhaps the most curious instance of the development of an ecclesiastical myth. Even in the earliest form known to us this legend is probably the complex growth of centuries, and any claim to the discovery of the first germ can hardly approve itself to the historic sense. These remarks apply especially to that venerable rationalization which evolves the whole legend from a misreading of *Undecimilla*, the name of Ursula's companion, into *undecim millia*, *i.e.* 11,000. A more modern theory makes St Ursula the Christianized representative of the old Teutonic goddess Freya, who, in Thuringia, under the name of Hörsel or Ursel, and in Sweden Old Urschel, welcomed the souls of dead maidens. Not a few singular coincidences seem to point in the same direction, especially the two virgins, "Martha and Saula," whom Usuard states to have suffered "cum aliis pluribus" on the 20th of October, whence they were probably transferred to the 21st. It is curious to note that Jerome and many of the earliest martyrologies extant have on the 21st of October the entry, "Dasius Zoticus, Gaius *cum duodecim militibus*." Even in copies of Jerome this is transformed into *millibus*; and it is perhaps not impossible that to this misreading we may indirectly owe the "thousands" in the Ursula legend. The two entries seem to be mutually exclusive in all the early martyrologies mentioned in this article, and in those printed in Migne, cxxxvii. The earlier "Dasius" entry seems to disappear steadily, though slowly, as the Ursula legend works its way into current martyrologies.

See H. Crombach, *Vita et Martyrium S. Ursulae* (Cologne, 1647), and the Bollandist *Acta Sanctorum*, 21st October, where the story fills 230 folio pages. The rationalization of the story is to be found in Oscar Schade, *Die Sage von der heiligen Ursula* (Hanover, 1854), of which there is a short *résumé* in S. Baring-Gould's *Lives of the Saints*. See also S. Baring-Gould, *Popular Myths of the Middle Ages*; A. G. Stein, *Die Heilige Ursula* (Cologne, 1879). The credibility of some of the details was doubted as early as the 13th century by Jacobus de Voragine in the *Legenda aurea*. For further works, especially medieval, see A. Potthast, *Bibliotheca hist. med. aevi* (Berlin, 1896), p. 1616. (T. A. A.; A. J. G.)

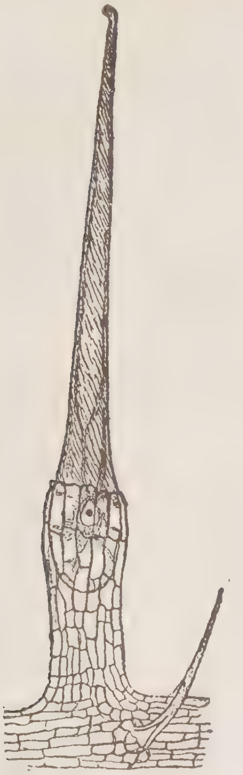
URSULINES, a religious order founded at Brescia by Angela Merici (1470–1540) in November 1535, primarily for the education of girls and the care of the sick and needy. It was approved in 1544 by Paul III., and in 1572 Gregory XIII., at the instance of Charles Borromeo, declared it a religious order under the rule of St Augustine. In the following century it was powerfully encouraged and supported by St Francis of Sales. In most cases, especially in France, the sisters adopted enclosure and took solemn vows; they were called the "religious" Ursulines as distinct from the "congregated" Ursulines, who preferred to follow the original plan. There were Ursulines in Canada in 1639, who taught the catechism to Indian children, and subsequently helped to preserve a religious spirit among the French population and to humanize the Indians and half-breeds. Towards the beginning of the 18th century, the period of its greatest prosperity, the order embraced some 20 congregations, with 350 convents and from 15,000 to 20,000 nuns. The members wear a black dress bound by a leathern girdle, a black sleeveless cloak, and a close-fitting head-dress with a white veil and a longer black veil. Their patron is the St Ursula mentioned above. The founder was beatified by Clement VIII. in 1768 and canonized as St Agnes of Brescia by Pius VII. in 1807. The Irish Ursulines were established at Cork in 1771 by Miss Nano Nagle. The Ursulines do not increase now as rapidly as they did, congregations taking simple vows like the Sisters of Mercy being apparently more adapted to modern needs.

URSWICK, CHRISTOPHER (1448–1522), English diplomatist, was born at Furness in Lancashire and was probably educated at Cambridge. He became chaplain to Margaret, countess of Richmond and Derby, and was employed by her to forward the schemes for securing the English throne for her son, Henry of Richmond, afterwards Henry VII. He crossed from Harfleur to Wales with Henry in August 1485, and was present at the battle of Bosworth; then followed for him a series of ecclesiastical preferments, the most important of which was to the deanery of York. He was sent on several weighty embassies, including one to Ferdinand and Isabella of Spain to arrange the marriage between Prince Arthur and Catherine of Aragon, and another to France in 1492, when he signed the treaty of Etaples. In 1495 he became dean of Windsor, and he died on the 24th of March 1522. Urswick was very friendly with Erasmus and with Sir Thomas More. He did some building at Windsor, and one of the chapels in St George's chapel there is still called the Urswick chapel. Urswick's kinsman, Sir Thomas Urswick, was a Yorkist partisan, who was recorder of London and chief baron of the exchequer.

See Urswick, *Records of the Family of Urwick or Urswick* (1893).

URTICACEAE (nettle family), in botany, an order of Dicotyledons belonging to the series Urticiflorae, which includes also Ulmaceae (elm family), Moraceae (mulberry, fig, &c.) and Cannabinaceae (hemp and hop). It contains 41 genera, with about 500 species, mainly tropical, though several species such as the common stinging nettle (*Urtica dioica*) are widely distributed and occur in large numbers in temperate climates. Two genera are represented in the British Isles, *Urtica* (see NETTLE) and *Parietaria* (pellitory, *q.v.*).

The plants are generally herbs or somewhat shrubby, rarely, as in some tropical genera, forming a bush or tree. The simple, often serrated, leaves have sometimes an alternate sometimes an opposite arrangement and are usually stipulate—exstipulate in *Parietaria*. The position of the stipules varies in different genera; thus in *Urtica* they are lateral and distinct from the leaf-stalk, in other cases they are attached on the base of the leaf-stalk or stand in the leaf-axil when they are more or less united. Stinging hairs often occur on the stem and leaves (fig. 1). The bast-fibres of the stem are generally long and firmly attached end to end, and hence of great value for textile use. Thus in ramie (*q.v.*, *Boehmeria nivea*) a single fibre may reach nearly 9 in. in length, and in stinging nettle as much as 3 in. The small inconspicuous regular flowers (figs. 3 and 4) are arranged in definite (cymose) inflorescences often crowded into head-like clusters. They are unisexual and monoecious or dioecious. The four or five green perianth leaves (or sepals) are free or more or less united; the male flowers (fig. 2) contain as many stamens, opposite the sepals, which bend inwards in the bud stage, but when mature spring backwards and outwards, the anther at the same time exploding and scattering the pollen. The flowers are thus adapted for wind-pollination. The female flower contains one carpel bearing one style with a brush-like stigma and containing a single erect ovule. The fruit is dry and one-seeded; it is often enclosed within the persistent perianth. The straight embryo is surrounded by a rich oily endosperm.



From Strasburger's *Lehrbuch der Botanik*, by permission of Gustav Fischer.

FIG. 1.—Stinging Hair of *Urtica dioica*, with a portion of the epidermis, and, to the right, a small bristle

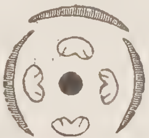
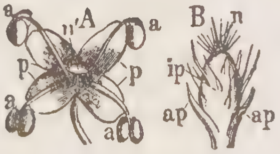


FIG. 2.—Male Flower of the Nettle (*Urtica*). The four sepals are arranged symmetrically, an outer median and an inner lateral pair. A stamen is opposite each sepal, and in the centre of the flower is the rudiment of a pistil.



From Vines's *Students' Text-Book of Botany*, by permission of Swan Sonnenschein & Co.

FIG. 3.—*A* staminal (♂), *B* carpellary (♀) flower of the Nettle. *p*, perianth; *a*, stamen; *n'*, rudimentary ovary of the ♂ flower; *ap*, outer, *ip*, inner, whorl of the perianth; *n*, stigma of the ♀ flower (enlarged).

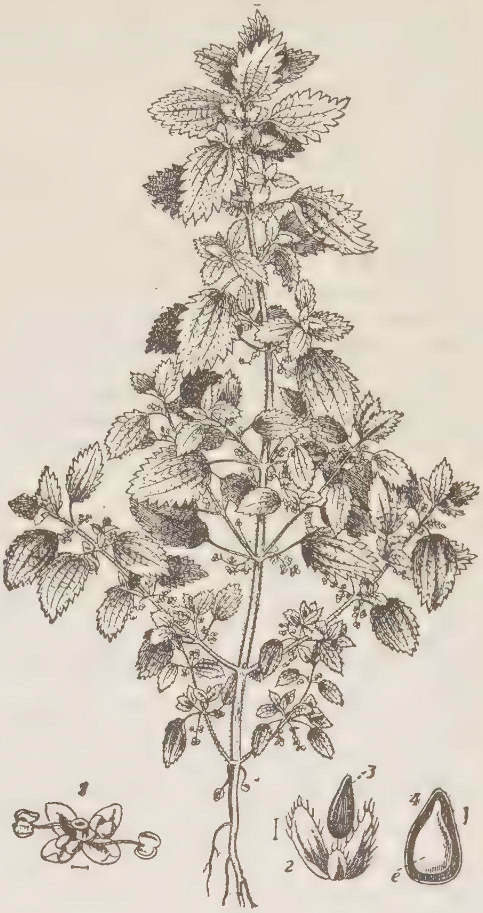


FIG. 4.—*Urtica urens* (after Curtis, *Flora Londinensis*).
1, male flower; 2, female flower in fruiting stage—the dry compressed fruit 3 escaping from the persistent perianth; 4, fruit cut open, revealing the seed within the large straight embryo *e*. 1, 2, 3, enlarged.

URUGUAY (officially the *Oriental Republic of the Uruguay*, and long locally called the *Banda Oriental*, meaning the land on the eastern side of the river Uruguay, from which the country takes its name), the smallest independent state in South America. It runs conterminous with the southern border of Brazil, and lies between 30° and 35° S. and between 53° 25′ and 57° 42′ W. (for map, see ARGENTINA). It has a seaboard on the Atlantic Ocean of 120 m., a shore-line to the south on the Rio de la Plata of 235 m., and one of 270 m. along the Uruguay on the west. The boundaries separating it from Rio Grande do Sul, a province of Brazil, are Lake Mirim, the rivers Chuy, Jaguarão and Quarahy, and a *cuchilla* or low range of hills called Santa Ana. The extent of the northern frontier is 450 m. The southern half of the country is mostly undulating grass land, well watered by streams and springs. The northern section is more broken and rugged; barren ridges and low rocky mountain-ranges, interspersed with fertile valleys, being its characteristic features. There is no forest, timber of any size being found only in the valleys near running water. Uruguay is intersected nearly from west to north-east by the river Negro and its affluent the Yi. The Uruguay is navigable all the year by steamers from the island of Martin Garcia at the mouth to Salto (200 m.). Above this place the navigation is interrupted by rapids. The ordinary volume of water in the Uruguay averages 11 millions of cub. ft. per minute. Excluding the Uruguay, the Negro, of which the principal port is Mercedes, is the principal navigable river. Others are navigable only for short distances by steamers of light draught. Besides the rivers mentioned, the chief streams are the Santa Lucia, which falls into the Plata a little west of Montevideo; the Queguay, in Paysandú; and the Cebollati, rising in the sierras in Minas and flowing into Lake Mirim. These rivers as well as the Uruguay are fed by innumerable smaller streams or *arroyos*, such as the Arapey in Salto, the Dayman in Paysandú, the Jaguary (an affluent of the Negro) in Tacuarembo, the Arroyo Grande between the departments of Soriano and San José, and the San José (an affluent of the Santa Lucia). None of the sierras or mountains in Uruguay exceeds (or perhaps even attains) a height of 2000 ft.; but, contrasting in their tawny colour with the grassy undulating plains, they loom high and are often picturesque. They are ramifications of the highlands of Brazil. The main chains are the Cuchilla de Haedo on the north and west and the Cuchilla Grande on the south and east.

Geology.—Little is known of the geology of Uruguay. There is a foundation of schists and crystalline rocks upon which rests a series of sandstones. The latter is, no doubt, identical with the similar sandstone series which is found in the neighbouring Brazilian province of Rio Grande do Sul, and which has there yielded plants which prove it to belong to the Permian or the upper part of the Carboniferous. The plains are covered by a formation similar to that of the Argentine pampas and by the alluvial deposits of the present rivers.

Climate.—Uruguay enjoys the reputation of possessing one of the most healthy climates in the world The geographical position ensures uniformity of temperature throughout the year, the summer heat being tempered by the Atlantic breezes, and severe cold in the winter season being unknown. Endemic diseases are unknown and epidemics are rare. In the interior, away from the sea and the shores of the great rivers, the temperature frequently rises in summer to 86° F. and in winter falls to 35°·6. In the districts bordering on the coast the thermometer seldom falls below 37°; and only for a few moments and at long intervals has it been known to rise as high as 105°. The annual rainfall is about 43 in.

Flora.—The pastoral wealth of Uruguay, as of the neighbouring Argentine Republic, is due to the fertilizing constitutents of "pampa mud," geologically associated with gigantic antediluvian animals, whose fossil remains are abundant. The country is rich in hard woods, suitable for cabinet work and certain building purposes. The principal trees are the alder, aloe, palm, poplar, acacia, willow and eucalyptus. The *montes*, by which are understood plantations as well as native thickets, produce among other woods the algarrobo, a poor imitation of oak; the guayabo, a substitute for boxwood; the quebracho, of which the red kind is compared to sandalwood; and the urunday, black and white, not unlike rosewood. Indigenous palms grow in the valleys of the Sierra José Ignacio, also to some extent in the departments of Minas, Maldonado and Paysandú. The myrtle, rosemary, mimosa and the scarlet-flowered ceibo are common. The valleys within the hill ranges are fragrant with aromatic shrubs. In the plains below, the swards are gay with the scarlet and white verbena and other brilliant wild flowers. The country abounds in medicinal plants. The sarsaparilla even colours the water of the Rio Negro and gives it its name—the "black river."

Fauna.—Among wild animals the tiger or ounce—called in the Guaraní language the *ja-guá* or "big dog"—and the puma are found on the frontier of Brazil and on the wooded islets and banks of the larger rivers. The tapir, fox, deer, wild cat, wild dog, carpincho or water hog and a few small rodents nearly complete the list of quadrupeds. A little armadillo, the mulita, is the living representative of the antediluvian giants *Mylodon*, *Megatherium*, &c. The ostrich—*Rhea americana*—roams everywhere in the plains; and there are a few specimens of the vulture tribe, a native crow (lean, tall and ruffed), partridges and quails. Parakeets are plentiful in the *montes*, and the lagoons swarm with waterfowl. The most esteemed is the *pato real*, a large duck. Of the birds of bright plumage the humming-bird and the cardinal—the scarlet, the yellow and the white—are the most attractive. The fish of the lagoons and streams are coarse, and some of them primitive in type; but two or three kinds, found generally in the large rivers, are much prized. The varieties of fish on the sea coast are many and excellent. More than 2000 species of insects have been classified. The scorpion is rare, but large and venomous spiders are common. The principal reptiles are a lizard, a tortoise, the *vivora de la cruz* (a dangerous viper, so called from marks like a cross on its head) and the rattlesnake in Maldonado and the stony lands of Minas.

Area and Population.—The area of the republic is estimated at 72,210 sq. m., and has a population of 1,042,668 according to the census of 1908 (in 1900 it was 915,647). The country is divided into 19 departments, the area and the population of which, according to the census of 1908, are given in the subjoined table:—

Departments.	Area, Sq. Miles.	Population, 1908.
Artigas	4,392	26,298
Canelones	1,833	87,931
Cerro Largo	5,753	44,806
Colonia	2,192	54,679
Durazno	5,525	42,313
Flores	1,744	16,158
Florida	4,763	45,393
Maldonado	1,584	28,804
Minas	4,844	51,170
Montevideo	256	309,231
Paysandú	5,115	38,528
Rio Negro	3,269	19,909
Rivera	3,790	35,653
Rocha	4,280	34,110
Salto	4,863	46,304
San José	2,687	46,267
Soriano	3,560	39,431
Tacuarembo	8,074	46,927
Treinta-y-Tres	3,686	28,756
Total	72,210	1,042,668

The average density of population on the above figures is 12·9 per sq. m., ranging (exclusive of Montevideo) from 47·9 in Canelones to 5·8 in Tacuarembo and 6 in Artigas. The great majority of the foreign population are Italians or Spaniards, with lesser numbers, in descending scale, of Brazilian, Argentine and French birth. British, Swiss and Germans are comparatively few. In 1907, 26,105 Italian immigrants arrived, 21,927 Spanish, 2355 British, 2315 French and 1823 German.

The natives of Uruguay, though living in conditions similar to those of the Argentine population, are in general more reserved, showing more of the Indian type and less of the Spaniard. In the north there is a strong Brazilian element and the people are intensely conservative. The average annual birth-rate is about 35 per 1000, and the death-rate about 15·5. About 26% of the births are illegitimate. The principal towns are Montevideo, Salto, Paysandú and San José.

Agriculture.—The condition of agriculture is fairly satisfactory. In 1885 Uruguay imported most of her breadstuffs; now not only is wheat grown in sufficient quantities to meet the local demand, but a surplus (about 20,000 metric tons in 1908–9) is annually available for export. Land for farming purposes is expensive, and wages are high, leaving small profit, unless it happens that a man, with his family to assist him, works his own land. The farmers are chiefly Italians, Canary Islanders and Frenchmen. The principal crops in addition to wheat are oats, barley, maize, linseed and bird seed. Since 1890 the cultivation of the grape and the manufacture of wine have considerably extended, especially in the department of Salto, Montevideo, Canelones and Colonia. Red wine, a smaller quantity of white, grape alcohol and wine alcohol are produced. The olive-planting industry is becoming important; the trees thrive well, and the area devoted to their cultivation is annually increasing. Tobacco is also cultivated.

Cattle-breeding and sheep-farming, however, are the principal industries. The lands are admirably adapted for cattle-breeding purposes, although not capable of fattening animals. The cattle are destined chiefly for the *saladero* establishments for the preparation of *tasajo*, or jerked beef, for the Brazilian and Cuban markets, and for the Liebig factory, where large quantities of extract of meat are prepared for the European trade. Cattle-breeding is carried on in all parts of the republic, but chiefly in the departments of Salto, Paysandú and Rio Negro. In the southern districts, where the farmers are Europeans, the breed of cattle is being steadily improved by the introduction of Durham and Hereford bulls. Dairy-farming is making some progress, especially in the Swiss colony near San José.

Sheep-farming flourishes chiefly in Durazno and Soriano. Uruguayan wool is favourably regarded in foreign markets, on account of the clean state in which it is shipped, this being largely due to the natural conditions of the land and climate. The business of shipping live sheep and frozen mutton has not been attempted on a large scale, owing principally to the lack of facilities for loading at the port of Montevideo or elsewhere.

Mining.—Minerals are known to exist in the northern section of the republic, and gold-mining is carried on to a small extent. Expert opinions have been advanced stating that gold-mining in Uruguay is capable of development into an important industry. The other minerals found are silver, lead, copper, magnesium and lignite coal.

Commerce.—The economic development of Uruguay was retarded by the corruption of successive governments, by revolutionary outbreaks, by the seizure of farm stock, without adequate compensation, for the support of military forces, by the consequences of reckless borrowing and over-trading in 1889 and 1890, and also by the transference of commercial undertakings from Montevideo to Buenos Aires between 1890 and 1897, on the opening of the harbour and docks at that port. The annual value of the imports (4·7 dollars taken at £1) was £5,101,740 in 1900 and £7,365,703 in 1908; that of exports was £6,257,600 in 1900 and £7,932,026 in 1908.

The principal imports consist of machinery, textiles and clothing, food substances and beverages, and live stock. The chief exports are animal products and agricultural products. Of the imports about 27% in value are from Great Britain, 14% from Germany, and smaller proportions from France, Argentina, Italy, Spain, the United States and Belgium. Of the exports, France, Argentina, Belgium and Germany take the bulk. Trade is controlled by foreigners, the British being prominent in banking, finance, railway work and the higher branches of commerce; Spaniards, Italians and French in the wholesale and retail trade. Uruguayans find an insignificant place in commerce. The foreign trade passes mainly through Montevideo, where the port has been greatly improved.

In addition to the natural lines of communication provided by the rivers bordering on or belonging to the republic, there are about 2240 m. of national road, besides more than 3000 m. of departmental roads. The railways had a length of 1380 m. open for traffic, and the system is steadily extending. There are over 170 m. of tramway in operation.

Government.—The legislative power of the state rests with the general assembly, consisting of two chambers, one of senators (19 in number) and one of representatives (75). The deputies of the lower house are elected for three years directly by the people, one deputy for every 3000 male adults who can read and write. One senator is named for each department by an electoral college, whose members are elected directly by the people. The senators are elected for six years, and one-third of their number retire every two years. The executive power is exercised by the president of the republic, who is elected by the general assembly for a four years' term. He is assisted by a council of ministers representing the departments of the interior, foreign affairs, finance, war and marine, industry, labour and instruction and public works. Each department or province of the republic has a governor appointed by the executive, and an administrative council, whose members are chosen by popular vote. The judicial power is vested in a high court and many subordinate courts. The general assembly elects the five judges who compose the high court. There are civil, commercial and criminal courts in Montevideo, a departmental court in each departmental capital, and a justice of the peace in each of 205 judicial districts into which the republic is divided, with sub-district courts under deputy judges in addition. The administration of justice in Uruguay has long been of bad repute. It was reformed on the above lines in 1907.

Education is much neglected, and the public-school system is inefficient. The attendance of children at the schools is small, and the instruction they receive is inferior. Primary instruction is nominally obligatory; nevertheless at the beginning of the 20th century nearly half the population over six years of age was illiterate. Montevideo possesses a university and a number of preparatory schools, a state-supported technical school and a military college. The state religion is Roman Catholic, and there is an archbishop of Montevideo with two suffragan bishops. A number of seminaries are maintained throughout the republic. Other religions are tolerated.

Army.—There is a standing army with a peace strength of about 7000 officers and men. Service is nominally voluntary, though it appears that a certain amount of compulsion is exercised. In addition to this there is compulsory service in the National Guard (*a*) in the first class, consisting of men between seventeen and thirty years of age, liable for service with the standing army, and numbering some 15,000; (*b*) in the second class, for departmental service only, except in so far as it may be drawn upon to make up losses in the more active units in time of war, consisting of men from thirty to forty-five years of age, and (*c*) in the third class, for local garrison duty, consisting of men between forty-five and sixty years old. The army and guard are well equipped with modern arms.

Finance.—Of the national revenue nearly half is derived from customs duties, taxes being levied also on real estate, licences, tobacco, stamped paper and in other ways. Nearly half the expenditure goes to meet debt charges, while government, internal development and defence absorb most of the remainder. The receipts for the years specified were as follows, Uruguayan dollars being converted into sterling at the par value, 4·7 = £1:—

Years.	Revenue.	Expenditure.
1894–1895	£3,403,324	..
1899–1900	3,236,300	..
1904–1905	3,438,300	£3,438,510
1909–1910[1]	4,971,660	4,704,500

[1] Estimate.

In 1891, when the debt of the republic amounted to $87,789,973, or about £18,678,710, the government suspended payment of interest, and an arrangement was made with the bondholders. A new consolidated debt of £20,500,000 was issued at 3½% interest, and, as security for payment of interest, 45% of the customs receipts at Montevideo was assigned. At the same time the interest guaranteed to the railway companies was reduced from 7 to 3½%. In 1896 a 5% loan of £1,667,000 was issued, and the debt was subsequently increased, until on January 1, 1909, it was £27,692,795, and in the same year the annual debt charge amounted to £2,185,347.

The Bank of the Republic was established in 1896 with a nominal capital of $12,000,000, and in 1899 it received the right to issue further shares amounting to $5,000,000. Its note issue (for which it has an exclusive right) may not exceed the value of half the subscribed capital. Besides a number of local banks, branches of German, Spanish, French and several British banks are established in Montevideo.

There is no Uruguayan gold coin in circulation, but the theoretical monetary unit is the gold *peso nacional*, weighing 1·697 grammes, ·917 fine. The silver peso weighs 25 grammes, ·900 fine. A half, fifth and tenth of a peso are coined in silver, in addition to bronze coins.

The metric system of weights and measures has been officially adopted, but the old Spanish system is still in general use.

History.—In 1512 Juan Diaz de Solis entered the Paranaguazu or "sealike" estuary of the Plata and landed about 70 miles east of the present city of Montevideo. Uruguay at that time was inhabited by Indians, of whom the dominant tribe was called Charrua, a people described as physically strong and well-formed, and endowed with a natural nobility of character. Their habits were simple, and they were disfigured neither by the worst crimes nor by the primitive superstitition of savages. They are said to have revealed no vestige of religion. The Charruas are generally classified as a yellow-skinned race, of the same family as the Pampa Indians; but they are also represented as tanned almost black by the sun and air, without any admixture of red or yellow in their complexions. Almost beardless, and with thin eyebrows, they had on their heads thick, black, lustrous hair, which neither fell off nor turned grey until extreme old age. They lived principally upon fish, venison and honey. In the Guarani language "Charrua" means turbulent, and by their enemies the Charruas were accounted as such, and even ferocious, although admitted to be generous to their captives. They were a curiously taciturn and reticent race. Their weapons were the bow and arrow and stones.

Solis, on his second visit, 1515–1516, was slain by the Charruas in Colonia. Eleven years later Ramon, the lieutenant of Sebastian Cabot, was defeated by the same tribe. In 1603 they destroyed in a pitched battle a veteran force of Spaniards under Saavedra. During the next fifty years three unsuccessful attempts were made by the Spaniards to subdue this courageous people. The real conquest of Uruguay was begun under Philip III. by the Jesuit missions. It was gradually consummated by the military and commercial settlements of the Portuguese, and subsequently by the Spaniards, who established themselves formally in Montevideo under Governor Zavala of Buenos Aires in 1726, and demolished the rival Portuguese settlement in Colonia in 1777. From 1750 Montevideo enjoyed a provincial government independent of that of Buenos Aires. The American rebellion, the French Revolution and the British invasions of Montevideo and Buenos Aires (1806–7), under Generals Auchmuty (1756–1822) and John Whitelocke (1757–1833), all contributed to the extinction of the Spanish power on the Rio de la Plata. During the War of Independence, Montevideo was taken in 1814 by the Buenos-Airean general Alvear (see further MONTEVIDEO). A long struggle for dominion in Uruguay between Brazil and the revolutionary government of Buenos Aires was concluded in 1828, through the mediation of Great Britain, Uruguay being declared a free and independent state. The republic was formally constituted in 1830. Subsequently Juan Manuel Rosas, dictator of Buenos Aires, interfered in the intestine quarrels of Uruguay; and Montevideo was besieged by his forces, allied with the native partisans of General Oribe, for nine years (1843–52).

After the declaration of independence the history of Uruguay becomes a record of intrigues, financial ruin, and political folly and crime. The two great political factors for generations have been the Colorados and the Blancos. So far as political principles are concerned, there is small difference between them. Men are Colorados or Blancos largely by tradition and not from political conviction. The Colorados have held the government for many years, and the attempts of the Blancos to oust them have caused a series of revolutions. The military element, moreover, has frequently conspired to elect a president amenable to its demands. In 1875 General Latorre headed a conspiracy against President Ellauri and at first placed Dr Varela in power as dictator, but in 1876 proclaimed himself. In the following year Latorre caused himself to be elected president, but political unrest caused him to resign in March 1880. The president of the senate, Dr Vidal, nominally administered the government for two years, when General Santos, who had held the real power, became president. His administration was so vicious and tyrannical that the opposition organized a revolution. Their forces, however, were surprised by the government troops at Quebracho, on the Rio Negro, and defeated. Ultimately the Colorados themselves exiled Santos. He had plundered the national revenues and scorned constitutional government. The Colorados now made General Tajes president, the practical direction of the administration being in the hands of Julio Herrera y Obes. In March 1890 General Tajes handed over the presidency to Herrera y Obes, a clever but unscrupulous man, who filled every official post with his own friends and ensured the return of his supporters to the chamber. In 1891 he was obliged to suspend the service of the public debt and make arrangements by which the bondholders accepted a reduced rate of interest. The country was at this period conducted practically as if it were the private estate of the president, and no accounts of revenue or expenditure were vouchsafed to the public. In 1894 the Colorados nominated Señor Idiarte Borda for the presidency. He seemed at first inclined to govern honestly, but corruption soon became as marked as under the preceding régime. The Blancos, using the fraudulent elections in 1896 as a pretext, now broke out in armed revolt under the leadership of Aparicio Saraiva. The president made no attempt to conciliate them, and in March 1897 a body of government troops suffered a reverse. On the 25th of August 1897 Borda, after attending a Te Deum at the cathedral in Montevideo, was shot dead by a man named Arredondo, who was sentenced in 1899 to two years' imprisonment. The defence was that the murder was a political offence, and therefore not punishable as an ordinary case of assassination for personal motives.

The president of the senate, Juan Cuestas, in accordance with the constitution, assumed the duties of president of the republic. He arranged that hostilities should cease on the conditions that representation of the Blancos was allowed in Congress for certain districts where their votes were known to predominate; that a certain number of the *jefes politicos* should be nominated from the Blancos; that free pardon be extended to all who had taken part in the revolt; that a sufficient sum in money be advanced to allow the settlement of the expenses contracted by the insurgents; and that the electoral law be reformed on a basis allowing the people to take part freely in elections. Cuestas, on attempting to reform corrupt practices, was soon threatened with another revolution, and on the 10th of February 1898 he assumed dictatorial powers, dissolved the Chambers and suspended all constitutional guarantees. In the following year he resigned and was re-elected to the presidency on the 1st of March 1899. His second term was marked by premonitions of further disorder. In July 1902 a plot for his assassination was frustrated, and in 1903, on the election of José Battle to the presidency, civil war broke out. On September 3, 1904, the revolutionary general Saraiva died of wounds received in battle; and later in the year peace was declared. Claudio Williman became president in 1907. The Colorados favoured Battle as his successor, and before the elections to the chamber in November 1910 the Blancos were again in arms.

See F. Bauza, *La Dominacion Española en el Uruguay* (Montevideo, 1880); F. A. Berro, A. de Vedia and M. de Pena, *Album de la Republica Oriental del Uruguay* (Montevideo, 1882); R. L. Lomba, *La Republica Oriental del Uruguay* (Montevideo, 1884); *The Uruguay Republic, Territory and Conditions*, reprinted by order of the Consul-General of Uruguay (London, 1888); V. Arreguine, *Historia del Uruguay* (Montevideo, 1892); M. G. and E. T. Mulhall, *Handbook of the River Plate* (London, 1892); H. Roustan and C. M. de Pena, *Uruguay en la Exposicion . . . de Chicago* (Montevideo, 1893); O. Aranjo, *Compendio de la Geografia Nacional* (Montevideo, 1894); *Uruguay, its Geography, History*, &c. (Liverpool, 1897); P. F. Martin, *Through Five Republics* (London, 1905); *Anuario Estadistico* and *Anuario Demografico* (official, Montevideo); British and American *Consular Reports*; Publications, Bureau of American Republics.

URUGUAYANA, a city and river port of the state of Rio Grande do Sul, Brazil, on the left bank of the Uruguay river, 348 ft. above sea-level (at the R. R. station) and about 360 m. in a direct line W. of Porto Alegre. Pop. (1900) 13,638. A railway connects with Quarahim (47 m.) on the Uruguayan frontier, and thence by a Uruguayan line with Montevideo by way of Paysandú. The same line extends N. 62 m. to the naval station of Itaquy. A cross-country line was under construction in 1909 to Cacequy, which is in direct communication with Porto Alegre and the city of Rio Grande. The upper Uruguay is navigable from the Quarahim to the town of São Tomé, and small river steamers ply regularly between Ceibo, on the Argentine side, and the latter. Opposite Uruguayana is the Argentine town of Restauracion, or Paso los Libres. The river is 2 m. wide at this point, and 154 ft. above sea-level. Uruguayana is prettily situated on a low hill rising gently from the riverside and its low houses are surrounded by orange groves. There are large military barracks near the shore, a theatre and a custom-house. The surrounding country is chiefly pastoral, but there is a small area under vineyards, and in addition to grapes some other fruits are produced. Uruguayana was captured by a Paraguayan force under General Estigarribia on the 5th of August 1865, and was recaptured without a fight by the allied forces under General Bartolomé Mitre on the 18th of September. The Paraguayan occupation left the town partially in ruins, and it remained in a decadent condition until near the end of the century, when reviving industries in the state and a renewal of railway construction promoted its commercial activity and growth.

USAS (from the root *vas*, to shine, and cognate to Latin *Aurora* and Greek ’Ηώς,) in Hindu mythology, the goddess of dawn. She is celebrated in some twenty hymns of the Rig Veda, and is the most graceful creation of Vedic poetry. She is borne on a shining car drawn by ruddy cows or bulls. She is the daughter of the sky and the sun is her lover. She is described as "rising resplendent as from a bath, showing her charms she comes with light . . . ever shortening the ages of men she shines forth . . . she reveals the paths of men and bestows new life . . . she opens the doors of darkness as the cows their stalls." Scarcely the name of the goddess survives to-day, so completely was she associated with the Vedism long dead and gone.

See A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

USEDOM, an island of Germany, in the Prussian province of Pomerania, lying off the Baltic coast, and separated by the Swine from the island of Wollin, which together with it divides the Stettiner Haff from the open sea. It is 31 m. in length, 13 broad and 160 sq. m. in area. The surface is generally flat (only a few sand-hills rising to any height) and is diversified by moor, fen, lakes and forest. Agriculture, cattle-rearing, fishing and other maritime pursuits are the chief occupations of the inhabitants. Swinemünde and Usedom (pop. 1700) are the chief towns, and Heringsdorf, Ahlbeck and Zinnowitz are frequented watering-places. Pop. (1900) 33,000.

See Gadebusch, *Chronik der Insel Usedom* (Anklam, 1863), and C. Müller, *Die Seebäder der Inseln Usedom und Wollin* (6th ed., Berlin, 1896).

USELIS (mod. *Usellus*), an ancient town of Sardinia, situated in the hills to the S.E. of Oristano, 900 ft. above sea-level. A bronze tablet of A.D. 158 (a *tabula patronatus*, setting forth that M. Aristius Balbinus had accepted the position of patron of the town for himself and his heirs) speaks of the place as *Colonia Julia Augusta Uselis*. From this it would seem that it had become a colony under Augustus, were it not that Pliny (*H.N.* iii. 85) asserts that Turris Libisonis was the only colony in Sardinia at his time. It may be that civic rights were obtained from Augustus (Th. Mommsen in *Corp. Inscr. Lat.* x. p. 816). The site of the ancient town is marked by the church of S. Reparata, and various antiquities have been found there. The episcopal see was transferred to Ales in the 12th century, though the old name is still officially used.

USES, in law, equitable or beneficial interests in land. In early law a man could not dispose of his estate by will nor could religious houses acquire it. As a method of evading the common law arose the practice of making feoffments to the *use* of, or upon trust for, persons other than those to whom the seisin or legal possession was delivered, to which the equitable jurisdiction of the chancellor gave effect. To remedy the abuses which it was said were occasioned by this evasion of the law was passed the famous Statute of Uses (1536), which, however, failed to accomplish its purpose. Out of this failure of the Statute of Uses arose the modern law of TRUSTS, under which heading will be found a full history of uses. See also CONVEYANCING.

USHAK, a town of Asia Minor, altitude 3160 ft. in the Kutaiah sanjak of the Brusa vilayet, situated in a fertile district, on a tributary of the Menderes, and connected with Smyrna and Konia by rail. Pop. 9000 Moslems and 2000 Christians. It is noted for its heavy pile carpets, *khali*, known as "Turkey carpets." The Oriental character of the carpets has been almost destroyed by the adoption of aniline dyes and the introduction of Western patterns. The town has a trade in valonia, cereals and opium.

USHANT (Fr. *Ouessant*), the most westerly of the islands off the coast of France, about 14 m. from the coast of Finistère, of which department it forms a canton and commune. Pop. (1906) 2761. Ushant is about 3850 acres in extent and almost entirely granitic, with steep and rugged coasts accessible only at a few points, and rendered more dangerous by the frequency of fogs. The island affords pasturage to a breed of small black sheep, and about half its area is occupied by cereals or potatoes. The male inhabitants are principally pilots and fishermen, the women working in the fields. Ushant was ravaged by the English in 1388. The lordship was made a marquisate in 1597 in favour of René de Rieux de Sourdéac, governor of Brest. In 1778 a naval action without decisive result was fought off Ushant between the English under Keppel and the French under the Count d'Orvilliers.

USHER (or USSHER), **JAMES** (1581–1656), Anglican divine and archbishop, was born in the parish of St Nicholas, Dublin, on the 4th of January 1581. He was descended from the house of Nevill, one of whose scions, accompanying John Plantagenet to Ireland in the capacity of usher in 1185, adopted his official title as a surname. James Usher was sent to a school in Dublin opened by two political agents of James VI. of Scotland, who adopted this manner of averting the suspicions of Elizabeth's government from their real object, which was to secure a party for James in Ireland in the event of the queen's death. In 1594 Usher matriculated at the newly founded university of Dublin, whose charter had just been obtained by his uncle, Henry Usher, archbishop of Armagh. He proved a diligent student, devoting much attention to controversial theology, graduated as M.A. in 1600 and became a fellow of Trinity College. On the death of his father in 1598 he resigned the family estate to his younger brother, reserving only a small rent-charge upon it for his own maintenance, and prepared to take orders. When he was but nineteen he accepted a challenge put forth by Henry Fitzsimons, a learned Jesuit, then a prisoner in Dublin, inviting discussion of Bellarmine's arguments in defence of Roman Catholicism, and acquitted himself with much distinction. In 1600 he was appointed proctor of his college and catechetical lecturer in the university, though still a layman, and was ordained deacon and priest on the same day, in 1601, while still under the canonical age, by his uncle the primate. In 1607 he became regius professor of divinity and also chancellor of St Patrick's cathedral, Dublin. He was a frequent visitor to England, and made the acquaintance of contemporary scholars like Camden, Selden, Sir Thomas Bodley and Sir Robert Cotton. In 1613 he published his first printed work, though not his first literary composition—*Gravissimae Quaestionis de Christianarum Ecclesiarum, in Occidentis praesertim partibus, ab Apostolicis temporibus ad nostram usque aetatem, continua successione et statu, Historica Explicatio*, wherein he took up the history of the Western Church from the point where Jewel had left off in his *Apology for the Church of England*, and carried it on from the 6th till past the middle of the 13th century, but never completed it. In 1615 he took part in an attempt of the Irish clergy to impose a Calvinistic confession, embodying the Lambeth Articles of 1595, upon the Irish Church, and was delated to King James in consequence. But on his next visit to England in 1619 he brought with him an attestation to his orthodoxy and high professional standing, signed by the lord deputy and the members of the privy council, which, together with his own demeanour in a private conference with the king, so influenced the latter that he nominated Usher to the vacant see of Meath, of which he was consecrated bishop in 1621. In 1622 he published a controversial *Discourse of the Religion anciently Professed by the Irish and British*, designed to show that they were in agreement with the Church of England and opposed to the Church of Rome on the points in debate between those churches. In 1623 he was made a privy councillor for Ireland, and in the same year was summoned to England by the king that he might more readily carry on a work he had already begun upon the antiquity of the British churches. While he was detained on this business the archbishop of Armagh died in January 1625, and the king at once nominated Usher to the vacant primacy; but severe illness and other causes impeded his return to Ireland until August 1626.

For many years Usher was actively employed both in the government of his diocese and in the publication of several learned works, amongst which may be specified *Emmanuel* (a treatise upon the Incarnation), published in 1638, and *Britannicarum Ecclesiarum Antiquitates*, in 1639. In 1629 he discountenanced Bishop William Bedell's proposal to revive the Irish language in the service. In 1634 he took part in the convocation which drafted the code of canons that formed the basis of Irish ecclesiastical law till the disestablishment of the Irish Church in 1869, and defeated the attempt of John Bramhall, then bishop of Derry and later his own successor in Armagh, to conform the Irish Church exactly to the doctrinal standards of the English. He put the matter on the ground of preserving the independence of the Irish Church, but the real motive at work was to maintain the Calvinistic element introduced in 1615. In 1640 he paid another visit to England on one of his usual scholarly errands, meaning to return when it was accomplished. But the rebellion of 1641 broke out while he was still at Oxford, and he never saw his native country again. He published a collection of tracts at Oxford in that year, including a defence of episcopacy and the doctrine of non-resistance. All Usher's property in Ireland was lost to him through the rebellion, except his books and some plate and furniture, but he was assigned the temporalities of the vacant see of Carlisle for his support. In 1643 he was offered a seat in the Assembly of Divines at Westminster, but declined it publicly in terms which drew upon him the anger of the House of Commons, and an order for the confiscation of his library was averted only by the interposition of Selden. He quitted Oxford in 1645 and went into Wales, where he remained till 1646, when he returned to London, and was in 1647 elected preacher to the Society of Lincoln's Inn, an office which he continued to hold until near his death. During his residence in Wales a hyper-Calvinistic work entitled *A Body of Divinity; or the Sum and Substance of the Christian Religion*, was published under his name by John Downham; and, although he repudiated the authorship in a letter to the editor, stating that the manuscript from which it was printed was merely a commonplace-book into which he had transcribed the opinions of Cartwright and other English divines, often disapproving of them and finding them dissonant from his own judgment, yet it has been persistently cited ever since as Usher's genuine work, and as lending his authority to positions which he had long abandoned, if he ever maintained them. In 1648 he had a conference with Charles I. in the Isle of Wight, assisting him in the abortive negotiations with parliament on the question of episcopacy. About this time Richelieu offered him a pension. In 1650–54 he published the work which was long accounted his most important production, the *Annales Veteris et Novi Testamenti*, in which he propounded a now disproved scheme of Biblical chronology, whose dates were inserted by some unknown authority in the margin of reference editions of the Authorized Version. In 1655 Usher published his last work, *De Graeca LXX Interpretum Versione Syntagma*. He died on the 20th of March 1656, in Lady Peterborough's house at Reigate, and was buried in Westminster Abbey. He was long remembered, not only for his great learning but for his modesty and kindly disposition. His daughter sold his library to the state, and in 1661 it was placed in the library of Trinity College, Dublin, of which it still forms a part.

Usher's works are very numerous, and were first collected by C. R. Elrington and J. H. Todd, Dublin (1847–64, in 17 vols.). See *Life* by Carr (1895); W. B. Wright, *The Ussher Memoirs* (1889).

USHER (O. Fr. *ussier*, *uissier*, mod. *huissier*, from Lat. *ostiarius*, a door-keeper, *ostium*, doorway, entrance, *os*, mouth), properly an official or servant who guards the entrance to a building, admits those who have the right of admission and keeps out strangers; such functions as the introduction of those who are admitted, the conducting them to their seats or to the presence of the persons receiving them and the keeping of order and silence are also performed by them. The "ushers" of a law-court are familiar officials of this kind. The name is also applied to various members of the British royal household, in which there are several "gentlemen-ushers." The four principal British orders of knighthood style one of their chief officers "usher"; thus there is a gentleman-usher of the Black Rod, who is also one of the high officials of the House of Lords (see further, BLACK ROD, and KNIGHTHOOD AND CHIVALRY, § *Orders of Knighthood*). A common usage of the word, now obsolescent, is for an undermaster at a school.

USK, THOMAS (d. 1388), the author of *The Testament of Love*, was born in London. His name was first added to the history of English literature in 1897 by Mr Henry Bradley's discovery that *The Testament of Love*, an important prose work hitherto attributed to Chaucer, bore in the initial letters of its chapters a statement of authorship—"Margarete of virtw, have merci on thin Usk." By the light of this perception, various autobiographical statements became luminous, and there remained no possible doubt that the author was Thomas Usk, who was clerk of the closet to John of Northampton when he was mayor of London from 1381 to 1383. In July 1384 Usk was seized and put in prison, but was released on promise of bringing charges against the mayor. Usk had no wish to be what he called "a stinking martyr," and he freely produced evidence which sent John of Northampton to gaol. For this he was not forgiven by the duke of Gloucester's party, although he continued to hold confidential posts in London until the close of 1386, when he was appointed sub-sheriff of Middlesex. But he fell with the king, in the triumph of the duke of Gloucester, and on the 3rd of February 1388 Usk, among others, was tried for treason and condemned. He was sentenced "to be drawn, hung and beheaded, and that his head should be set up over Newgate." John of Malvern, in his continuation of Ralph Higden's *Polychronicon*,[1] gives a horrid description of his execution, which occurred on the 4th of March 1388, in circumstances of rude barbarity; it took thirty blows of a sword to sever Usk's head from his shoulders. Professor Skeat has shown that the date of his book must be about 1387, for in it he reviews the incidents of his career, including the odd facts that, after his first imprisonment in 1384, he challenged any one who "contraried" his "saws"—that is to say, denied his allegations—to fight, but that no one took up his wager of battle. From 1381 to 1383, while Chaucer was comptroller of customs, Usk was collector, and they were doubtless acquainted. In *The Testament of Love*, the god is made to praise "mine own true servant, the noble philosophical poet in English," who had composed "a treatise of my servant Troilus." Usk had at one time been a Lollard, but in prison he submitted to the Church and thought he was forgiven. His solitary work is remarkable, and the most elaborate production in original English prose which the end of the 14th century has bequeathed to us. It is, however, excessively tedious, and of its obscurity and dullness a very amusing proof is given by the fact that successive editors—and even Dr Henry Bradley and Professor Skeat—did not discover till too late that the leaves of the original MS. had been shuffled and the body of the treatise misarranged. No MS. of *The Testament of Love* has been preserved; it was first printed by W. Thynne in his edition of *Chaucer*, 1532. In 1897 Professor Skeat, with cancelled sheets to cover the unlucky mistake above referred to, issued a revised and annotated text in his *Chaucerian and other Pieces*.

(E. G.)

USK, a river of Wales and England, rising on the borders of Carmarthenshire and Brecknockshire, and flowing to the Bristol Channel with a course of 70 m., and a drainage area of 540 sq. m. The source lies at an elevation of 1700 ft. on the north flank of Carmarthen Van, a summit of the Brecon Beacons; and the course is at first northerly, but soon turns east through a beautiful valley closely beset with lofty hills. The river passes the finely situated town of Brecon, and then turns south-east past Crickhowell and south past Abergavenny. Between these towns it forms a short stretch of the Welsh boundary before entering England (Monmouthshire). The valley now broadens, and the course of the river becomes sinuous as it flows by the ancient towns of Usk and Caerleon. The scenery throughout is most beautiful. Not far from the mouth lies Newport, with its extensive docks, to which the estuary gives access. Except in this part, the Usk is not used for navigation, but the Monmouthshire and Brecon and Abergavenny canals, in part following the valley, carry a small trade up to Brecon. The Usk is noted for its salmon and trout fishing.

USK, a small market town, is beautifully situated on the right bank of the Usk river, 10 m. N.N.E. of Newport. Pop. of urban district (1901), 1476. It unites with Newport and Monmouth to form the Monmouth parliamentary district of boroughs, returning one member. It is of high antiquity, occupying the site of a Roman-British village or fort; and there are picturesque ruins of an ancient castle erected in defence of the Welsh marches, and as such, a scene of frequent strife from Norman times until the days of the warlike Owen Glendower, about 1400. The church of St Mary originally belonged to a Benedictine nunnery of the 12th century.

USKOKS, or Uscocs. During the early years of the 16th century, the Turkish conquest of Bosnia and Herzegovina drove large numbers of the Christian inhabitants from their homes. A body of these *Uskoks*, as they were called, from a Serbo-Croatian word meaning "refugee," established itself in the Dalmatian fortress of Clissa, near Spalato, and thence waged continual war upon the Turks. Clissa, however, became untenable, and the Uskoks withdrew to Zengg, on the Croatian coast, where, in accordance with the Austrian system of planting colonies of defenders along the Military Frontier, they were welcomed by the Emperor Ferdinand I., and promised an annual subsidy in return for their services. Their new stronghold, screened by mountains and forests, was unassailable by cavalry or artillery, but admirably suited to the light-armed Uskoks, whose excellence lay in guerilla warfare. The Turks, on their side, organized a body of equally effective troops called *Martelossi*, for defence and reprisals. Thus, checked on land, and with their subsidy rarely paid, the Uskoks turned to piracy. Large galleys could not anchor in the bay of Zengg, which is shallow and exposed to sudden gales, so the Uskoks fitted out a fleet of swift boats, light enough to navigate the smallest creeks and inlets of the Illyrian shore, and easily sunk and recovered, if a temporary landing became necessary. With these they preyed upon the commerce of the Adriatic. Their ranks were soon swelled by outlaws from all nations, and by their own once peaceful neighbours, from Novi, Ottočac and other Croatian towns. After 1540, however, Venice, as mistress of the seas, guaranteed the safety of Turkish merchant vessels, and provided them with an escort of galleys. The Uskoks retaliated by ravaging the Venetian islands of Veglia, Arbe and Pago, and by using the Venetian territories in Dalmatia as an avenue of attack upon the Turks. Meanwhile the corsairs of Greece and Africa were free to raid the unprotected southern shores of Italy; and Venice was besieged with complaints from the Porte, the Vatican, the Viceroy of Naples and his sovereign, the king of Spain. An appeal to Austria met with little success, for the offences of the Uskoks were outweighed by their services against the Turks; while, if Minucci may be trusted, a share of their spoils, in silk, velvet and jewels, went to the ladies of the Archducal Court of Graz, where the matter was negotiated. From 1577 onwards, Venice endeavoured to crush the pirates without offending Austria, enlisting Albanians in place of their Dalmatian crews, who feared reprisals at home. For a time the Uskoks only ventured forth by night, in winter and stormy weather. In 1592 a Turkish army invaded Croatia, hoping to capture Zengg, but it was routed and dispersed in the following year. Austria being thus involved in war with Turkey, the Venetian Admiral Giovanni Bembo blockaded Trieste and Fiume, whither the pirates forwarded their booty for sale. They also erected two forts to command the passages from Zengg to the open sea. In 1602 a raid by the Uskoks upon Istria resulted in an agreement between Venice and Austria, and the despatch to Zengg of the energetic commissioner Rabatta with a strong bodyguard. All these measures, however, availed little. Rabatta was murdered, the fugitive Uskoks returned to Zengg and piracy was resumed, with varying fortunes, until 1615, when a grosser outrage than usual led to open war between Venice and Austria. By the treaty of peace concluded at Madrid, in 1617, it was arranged that the Uskoks should be disbanded, and their ships destroyed. The pirates and their families were, accordingly, transported to the interior of Croatia, where they gave their name to the *Uskoken Gebirge*, a group of mountains on the borders of Carniola. Their presence has also been traced near Monte Maggiore, in Istria, where such significant family names as *Novlian* (from Novi), *Ottocian* (from Ottočac) and *Clissan* (from Clissa), were noted by Franceschi in 1879.

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[1] Ed. J. R. Lumby, Rolls Series (1886), vol. ix. p. 147.

See Minuccio Minucci, *Historia degli Uscochi* (Venice, 1603); enlarged by P. Sarpi, and translated into French as a supplement to Amelot de la Houssaye's *Histoire du gouvernement de Venise* (Amsterdam, 1705). Minucci was one of the Venetian envoys at Graz. See also the conciser narratives in C. de Franceschi's *L'Istria*, chap. 37 (Parenzo, 1879); and T. G. Jackson's *Dalmatia, the Quarnero and Istria*, chap. 27 (Oxford, 1887).

USKÜB, Uscup, or Skopia (anc. *Scupi*, Turk. *Üshküb*, Slav. *Skoplye*), the capital of the vilayet of Kossovo, European Turkey; on the left bank of the river Vardar, and at the junction of the railways from Nish and Mitrovitza to Salonica. Pop. (1905) about 32,000, consisting chiefly of Slavs (Serbs and Bulgars), Turks, Albanians and a few gipsies. Usküb occupies a picturesque and strategically important position at the foot of a valley which severs two mountain ranges, the Shar Planina and Kara Dagh. Main roads radiate N.W. to Prizren, W. to Gostivar, an important centre of distribution, E.N.E. to Kumanovo, and thence into Bulgaria, and S. to Koprülü and Monastir. The city is the headquarters of an army corps, and the see of an Orthodox Greek archbishop, of the archbishop of the Roman Catholic Albanians and of a Bulgarian bishop. Its principal buildings are the citadel, the palace of the vali or provincial governor, the Greek and Bulgarian schools, numerous churches and mosques and a Roman aqueduct. The industries include dyeing, weaving, tanning and the manufacture of metal-work, wine and flour, but Usküb is chiefly important as the commercial centre of the whole vilayet of Kossovo (*q.v.*). The Imperial Ottoman Bank and the Banque de Salonique have branches in the city, and French is to a remarkable extent the language of commerce. Usküb retains in a modified form the name of Scupi, one of the chief cities of northern Macedonia. A few unimportant ruins mark the ancient site, about 1½ m. N.W. Scupi was destroyed by an earthquake in A.D. 518, but was rebuilt by Justinian under the name of Justiniana Prima. Up to the 14th century it was at times the capital of the Servian tsars.

USTARANA, a Pathan tribe who inhabit the outer hills opposite the extreme south portion of Dera Ismail Khan district in the North-West Frontier Province of India. Originally the Ustaranas were entirely a pastoral and trading tribe; but a quarrel with their neighbours, the Musa Khel, put a stop to their annual westward immigration, and they were forced to take to agriculture, and have since acquired a good deal of the plain country below the hills. Their territory includes only the eastern slopes of the Suliman mountains, the crest of the range being held by the Musa Khel, Isots and Zmarais (see Suliman Hills). The Ustaranas are venturesome traders, carrying goods from Kandahar as far as Bengal. They are a fine manly race, quiet and well-behaved, and many of them enlist in the Indian army and police.

USTICA, an island off the N. coast of Sicily, 41½ m. N.N.W. of Palermo. Pop. (1861) 2231; (1901) 1916. It is the Osteodes of the Greeks, but in Roman times was known as Ustica. The island is entirely volcanic and subject to earthquakes, and is fertile. There is a considerable penal colony. There are some Roman tombs excavated in the rock.

USTYUG VELIKIY, a town of Russia, in the government of Vologda, 216 m. N.E. from the city of Vologda, on the navigable Sukhona river, near its confluence with the Yug. Pop. (1885) 8119; (1897) 11,309. It manufactures hosiery, woollens and linens, has sawmills, and carries on an active trade in corn, hemp, flax, bristles and butter, which it exports. It has two important yearly fairs. Its artisans are famous for their jewelry, for engraving upon silver and the fabrication of boxes with secret locks.

USURY. An ancient legal conception, it has been said, corresponds not to one but to several modern conceptions; and the proposition is equally true when economic is substituted for legal. Until quite recent times the term "usury" (Lat. *usura*, use, enjoyment, interest, from *usus*, use) covered a number of essentially different social phenomena. "Thou shalt not lend upon usury to thy brother; usury of money, usury of victuals, usury of anything that is lent upon usury. Unto a stranger thou mayest lend upon usury; but unto thy brother thou shalt not lend upon usury, that the Lord thy God may bless thee" (Deut. xxiii. 19, 20). In this sentence we find interest of all kinds blended together, and the natural economic tendencies directly counteracted by the moral and religious law. At the present day, "usury," if used in the old sense of the term, would embrace a multitude of modes of receiving interest upon capital to which not the slightest moral taint is attached.

The man who does not in some shape or other lend his capital upon "usury" is, in the modern world, generally considered as lacking in his duty to himself or his family. The change in the moral attitude towards usury is perhaps best expressed by saying that in ancient times so much of the lending at interest was associated with cruelty and hardship that all lending was branded as immoral (or all interest was usury in the moral sense), whilst at present so little lending takes place, comparatively, except on commercial principles, that all lending is regarded as free from an immoral taint. This change in the attitude of common-sense morality in respect to "anything that is lent upon usury" is one of the most peculiar and instructive features in the economic progress of society.

"It is worthy of remark," says Grote (*History of Greece*, iii. 144), "that the first borrowers must have been for the most part men driven to this necessity by the pressure of want, and contracting debt as a desperate resource without any fair prospect of ability to pay; debt and famine run together in the mind of the poet Hesiod. The borrower is in this unhappy state rather a distressed man soliciting aid than a solvent man capable of making and fulfilling a contract; and if he cannot find a friend to make a free gift to him in the former character he would not under the latter character obtain a loan from a stranger except by the promise of exorbitant interest and by the fullest eventual power over his person which he is in a position to grant." This remark, though suggested by the state of society in ancient Greece, is largely applicable throughout the world until the close of the early middle ages. Borrowers were not induced to borrow as a rule with the view of employing the capital so obtained at a greater profit, but they were compelled of necessity to borrow as a last resort. The conditions of ancient usury find a graphic illustration in the account of the building of the second temple at Jerusalem (Neh. v. 1–12). The reasons for borrowing are famine and tribute. Some said, "We have mortgaged our lands, vineyards and houses, that we might buy corn, because of the dearth." Others said, "We have borrowed money for the king's tribute, and that upon our lands and vineyards . . . and, lo, we bring into bondage our sons and our daughters to be servants, . . . neither is it in our power to redeem them, for other men have our lands and vineyards." In ancient Greece we find similar examples of the evil effects of usury, and a law of bankruptcy resting on slavery. In Athens about the time of Solon's legislation (594 B.C.) the bulk of the population, who had originally been small proprietors or metayers, became gradually indebted to the rich to such an extent that they were practically slaves. Those who still kept their property nominally were in the position of Irish cottiers: they owed more than they could pay, and stone pillars erected on their land showed the amount of the debts and the names of the lenders. Usury had given all the power of the state to a small plutocracy. The remedy which Solon adopted was of a kind that we are accustomed to consider as purely modern. In the first place, it is true that according to ancient practice he proclaimed a general *seisachtheia*, or shaking off of burdens: he cancelled all the debts made on the security of the land or the person of the debtor. This measure alone would, however, have been of little service had he not at the same time enacted that henceforth no loans could be made on the bodily security of the debtor, and the creditor was confined to a share of the property. The consequence of this simple but effective reform was that Athens was never again disturbed by the agitation of insolvent debtors. Solon left the rate of interest to be determined by free contract, and sometimes the rate was exceedingly high, but none of the evils so generally prevalent in antiquity were experienced.

When we turn to Rome, we find exactly the same difficulties arising, but they were never successfully met. As in Athens in early times, the mass of the people were yeomen, living on their own small estates, and in time they became hopelessly in debt. Accordingly, the legislation of the XII. Tables, about 500 B.C., was intended to strike at the evil by providing a maximum rate of interest. Unfortunately, however, no alteration was made in the law of debt, and the attempt to regulate the rate of interest utterly failed. In the course of two or three centuries the small free farmers were utterly destroyed. By the pressure of war and taxes they were all driven into debt, and debt ended practically, if not technically, in slavery. It would be difficult to overestimate the importance of the influence of usury on the social and economic history of the Roman republic. In the provinces the evils of the system reached a much greater height. In 84 B.C. the war tax imposed by Sulla on the province of Asia was at first advanced by Roman capitalists, and rose within fourteen years to six times its original amount. It is interesting to observe that the old law of debt was not really abolished until the dictatorship of Julius Caesar, who practically adopted the legislation of Solon more than five centuries before; but it was too late then to save the middle class. About this time the rate of interest on first-class security in the city of Rome was only about 4%, whilst in the provinces from 25 to 50% were rates often exacted. Justinian made the accumulation of arrears (*anatocismus*) illegal, and fixed the rate at 6%, except for mercantile loans, in which the rate received was 8%. On the whole, it was truly said of usury during the republic and early years of the empire: "Sed vetus urbi faenebre malum et seditionum discordiarumque creberrima causa." Even when it came to be authorized by Roman law under certain restrictions, it was still looked upon as a pernicious crime. "Cicero mentions that Cato, being asked what he thought of usury, made no other answer to the question than by asking the person who spoke to him what he thought of murder."

It was only natural, considering the evils produced by usury in ancient Greece and Rome, that philosophers should have tried to give an a priori explanation of these abuses. The opinion of Aristotle on the barrenness of money became proverbial, and was quoted with approval throughout the middle ages. This condemnation by the moralists was enforced by the Fathers of the church on the conversion of the empire to Christianity. They held usury up to detestation, and practically made no distinction between interest on equitable moderate terms and what we now term usurious exactions.[1] The consequence of the condemnation of usury by the church was to throw all the dealing in money in the early middle ages into the hands of the Jews. A full account of the mode in which this traffic was conducted in England is given by Madox in chapter vii. of his *History of the Exchequer* (London, 1711). The Jews were considered as deriving all their privileges from the hand of the king, and every privilege was dearly bought. There can be no doubt that they were subjected to most arbitrary exactions. At the same time, however, their dealings were nominally under the supervision of the Jews' exchequer, and a number of regulations were enforced, partly with the view of protecting borrowers and partly that the king might know how much his Jews could afford to pay. It was probably mainly on account of this money-lending that the Jews were so heartily detested and liable to such gross ill-treatment by the people. A curious illustration of this popular animosity is found in the insertion of a clause in the charters granted by Henry III. to Newcastle and Derby, forbidding any Jew to reside in either place. Ultimately in 1290 the Jews were expelled in a body from the kingdom under circumstances of great barbarity, and were not allowed to return until the time of Cromwell. Before the expulsion of the Jews, however, in spite of canonical opposition, Christians had begun to take interest openly; and one of the most interesting examples of the adaptation of the dogmas of the Church of Rome to the social and economic environment is found in the growth of the recognized exceptions to usury. In this respect the canonical writers derived much assistance from the later Roman law. Without entering into technicalities, it may be said generally that an attempt was made to distinguish between usury, in the modern sense of unjust exaction, and interest on capital. Unfortunately, however, the modifications which were really admitted were not openly and avowedly made by a direct change in the statutes, but for the most part they were effected (as so many early reforms) under the cover of ingenious legal fictions. One of the most curious and instructive results of this treatment has been well brought out by Walter Ross in the introduction to his *Lectures on the Law of Scotland* (1793). He shows, in a very remarkable manner and at considerable length, that "to the devices fallen upon to defeat those laws (*i.e.* against usury) the greatest part of the deeds now in use both in England and Scotland owe their original forms" (i. 4). One of the consequences of this indirect method of reforming the law was that in some cases the evil was much exaggerated. "The judges," says Ross, "could not award interest for the money; that would have been contrary to law, a moral evil, and an oppression of the debtor; but, upon the idea of damages and the failure of the debtor in performance, they unmercifully decreed for double the sum borrowed." He may well remark that imagination itself is incapable of conceiving a higher degree of inconsistency in the affairs of men (compare Blackstone, iii. 434, 435).

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[1] For a popular account of the reasons given in support of the canonical objections to usury, and of the modifications and exceptions admitted in some quarters, see W. Cunningham's *Usury*.

In the limits assigned to this article it is impossible to enter further into the history of the question (see also MONEYLENDING), but an attempt may be made to summarize the principal results so far as they bear upon the old controversy, which has again been revived in some quarters, as to the proper relation of law to usury and interest. (1) The opinion of Bentham that the attempt directly to suppress usury (in the modern sense) will only increase the evil is abundantly verified. Mere prohibition under penalties will practically lead to an additional charge as security against risk. The evils must be partly met by the general principles applicable to all contracts (the fitness of the contracting parties, &c.) and partly by provisions for bankruptcy. Peculiar forms of the evil, such as mortgaging to excessive amounts in countries largely occupied by peasant proprietors, may be met by particular measures, as, for example, by forbidding the accumulation of arrears. (2) The attempt to control interest in the commercial sense is both useless and harmful. It is certain to be met by fictitious devices which at the best will cause needless inconvenience to the contracting parties; restraints will be placed on the natural flow of capital, and industry will suffer. (3) In the progress of society borrowing for commercial purposes has gradually become of overwhelming importance compared with borrowing for purposes of necessity, as in earlier times. By far the greater part of the interest now paid in the civilized world is, in the language of the English economists, only a fair reward for risk of loss and for management of capital, and a necessary stimulus to saving.

See *Capital and Interest* (Eng. trans., 1890), by E. Boehm von Bawerk; *Nature of Capital and Income*, by Irving Fisher (1906).

(J. S. N.)

UTAH,[1] one of the Central Western states of the United States of America. It lies between latitudes 37° and 42° N. and between longitudes 32° and 37° W. from Washington (*i.e.* about 109° 1′ 34″ and 114° 1′ 34″ respectively W. of Greenwich). The state is bounded wholly by meridians and parallels, and is bordered on the N. by Idaho and Wyoming, on the E. by Wyoming and Colorado, on the S. by Arizona, and on the W. by Nevada. Utah has an area of 84,990 sq. m., of which 2806 sq. m. are water surface, including Great Salt, Utah and other lakes. The state has a maximum length of 345 m. N. and S., and a maximum width of about 280 m. E. and W.

Physical Features.—The eastern portion of Utah consists of high plateaus, and constitutes a part of the Colorado Plateau province. The remaining western portion of the state is lower, belongs in the Great Basin province, and is characterized by north-south mountain ranges separated by desert basins. The high plateaus consist of great blocks of the earth's crust which are separated from each other by fault-lines, and which have been uplifted to different heights. Erosion has developed deep and sometimes broad valleys along the fault-lines and elsewhere, so that many of the blocks and portions of blocks are isolated from their neighbours. As a rule the blocks have not been greatly tilted or deformed, but consist of nearly horizontal layers of sandstone, shales and limestone. In some cases these sedimentary rocks lie deeply buried under lavas poured out by volcanoes long extinct. The plateau summits rise to elevations of 9000, 10,000 and 11,000 ft., are generally forested, but are too difficult of access to be much inhabited. The people live along the streams in the valleys between the plateaus. In the southern part of the state the high plateaus are terminated by a series of giant terraces which descend to the general level of the Grand Canyon Platform in northern Arizona. The terraces represent the out-cropping edges of hard sandstone layers included in the series of plateau sediments, and are named according to the colour of the rock exposed in the south-facing escarpments, the Pink Cliffs (highest), White Cliffs and Vermilion Cliffs. A still lower terrace, terminating in the Shinarump Cliffs, is less conspicuous; but the higher ones afford magnificent scenery. The northernmost member of the high plateaus is a broad east-west trending arch known as the Uinta Mountains. Local glaciation has carved the higher levels of this range into a maze of amphitheatres containing lakes, separated from each other by *arêtes* and alpine peaks. Among the peaks are King's Peaks (13,498 ft. and 13,496 ft.), the highest points in the state; Mt. Emmons (13,428 ft.); Gilbert Peak (13,422 ft.); Mt. Lovenia (13,250 ft.); and Tokewanna Peak (13,200 ft.). In the south-eastern part of the state are lower desert plateaus, and several mountain groups which do not properly belong to the plateau system. Most interesting among these are the Henry Mountains, formed by the intrusion of molten igneous rock between the layers of sediments, causing the overlying layers to arch up into dome mountains. Stream erosion has dissected these domes far enough to reveal the core of the igneous rock and to give a rugged topography. The highest peaks exceed 11,000 ft. By far the greater part of the high plateau district is drained by the Colorado river and its branches, the most important of which are the Green, Grand and San Juan, portions of whose courses lie in canyons of remarkable grandeur. The western members of the high plateaus drain into the Great Basin for the most part, and in this drainage system the Sevier river is perhaps most prominent. Inasmuch as the streams entering the basin have no outlet to the ocean, their waters disappear by evaporation, either directly from alluvial slopes over which they pass, or from saline lakes occupying depressions between the mountain ranges.

The lower basin portion of Utah is separated from the high plateaus by a series of great fault scarps, by which one descends abruptly to a level of but 5000 or 6000 ft. One of the fault scarps is known as the Hurricane Ledge, and continues as a prominent landmark from a point south of the Grand Canyon in Arizona to the central part of Utah, where it is replaced by other scarps farther east. The floor of the Basin Region is formed of alluvium washed from the high plateaus and mountain ranges, a part of which has accumulated in alluvial fans, and part in the greatly expanded lakes which existed here in the glacial period. This alluvium gives gently sloping or level desert plains, from which isolated mountain ranges rise like islands from the sea. The barren "mud flats," frequently found on the desert floor, result from the drying up of temporary shallow lakes, or playas. Lake Bonneville is the name given to the most important of the much greater lakes of the glacial period, whose old shore-lines are plainly visible on many mountain slopes. Great Salt Lake (*q.v.*) is a shrunken remnant of Lake Bonneville. The mountain ranges of the Basin Region are most frequently formed by faulted and tilted blocks of the earth's crust, which have been carved by stream erosion into rugged shapes. Oquirrh, Tintic, Beaver, House and Mineral Mountains are typical examples of these north-south "basin ranges," which rise abruptly from the desert plains and are themselves partial deserts. The Wasatch Mountain range constitutes the eastern margin of the Great Basin in central and northern Utah, and resembles the true basin ranges in that it is formed by a great block of the earth's crust uptilted along a north-south fault-line. Its steep fault scarp faces west, and rises from 4000 to 6000 ft. above the basin floor; the eastern slope is more gentle, but both slopes are much scored by deep canyons, some of which have been modified in form by ancient glaciers. Among the highest summits are Timpanogos Peak (11,957 ft.), Mt. Nebo (11,887 ft.), Twin Peak (11,563 ft.), and Lone Peak (11,295 ft.). At the western base of the Wasatch are Salt Lake City, Ogden, Provo and other smaller towns, situated where streams issue from the mountains, soon to disappear on the desert plains. In such places agriculture is made possible by irrigation, and the Mormon villages, both here and farther south along the base of the Hurricane Ledge, depend largely on this industry. Important mining operations are carried on in the Wasatch Mountains and in a number of the basin ranges. Mercur, Tintic, Bingham and Park City are well-known mining centres.

Fauna.—In the open country the mule deer, the pronghorn antelope and the coyote are found, and the bison formerly ranged over the north-eastern part of the state; the side-striped ground-squirrel, Townsend's spermophile, the desert pack-rat and the desert pack-rabbit inhabit the flat country. In the mountainous districts and high plateaus are the grizzly, formerly more common, the black bear, the four-striped chipmunk and the yellow-haired porcupine. Various species of small native mice and voles are abundant.

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[1] The name is that of a Shoshonean Indian tribe, more commonly called Ute.

In the marshes of the Salt Lake breed grebes, gulls and terns, and formerly the white pelican. Many ducks breed here, and many others pass through in migration: of the former, the most numerous are mallard and teal; of the latter, pintail, shoveler, scaup, ring-neck ducks, and mergansers. Wood and glossy ibises are commonly seen, and the white ibis breeds in numbers; the sand-hill crane is less common than formerly. A few varieties of shore birds breed here, as the Western willet, the Bartramian sandpiper, and the long-billed curlew. Gambel's partridge is resident in the southern part of the state, and the sage-hen and sharp-tail grouse on the plains. The dusky grouse and grey ruffed grouse are confined to the mountains and plateaus. The California vulture is very rare; various species of hawks and golden and bald eagles are common. The burrowing owl is found on the plains, and various species of small birds are characteristic of the different physical divisions of the state. A few lizards are found in the arid districts. The trout of the Utah mountain streams is considered a distinct species.

Flora.—Western Utah and vast areas along the Colorado river in the east and south-east are practically treeless. The lower plateaus and many of the basin ranges, as well as the basins themselves, are deserts. The higher plateaus, the Uinta and Wasatch mountains, bear forests of fir, spruce and pine, and the lower slopes are dotted with piñon, juniper, and scrub cedar. On the slopes of mountain valleys grow cedars, dwarf maples and occasional oaks. Willows and cottonwoods grow along streams. The west slope of the Wasatch has been largely denuded of its forests to supply the demands of the towns at its base. Among other plants common to the state are the elder, wild hop, dwarf sunflower, and several species of greasewood and cacti. The sagebrush, artemisia, is characteristic of the desert areas. Bunch grass is abundant on the hillsides the year round, and affords valuable pasturage.

Climate.—On account of its great diversity in topography, the state of Utah is characterized by a wide range in climatic conditions. Extremely cold weather may occur on the lofty plateaus and mountain ranges, while the intervening valleys and basins have a milder climate. The mean temperature of the state ranges from 58° in the extreme south to 42° in the north. Winter temperatures as low as 36° below zero are known for the higher altitudes; in the south, summer temperatures of 110° and higher have been recorded. At Salt Lake City the mean winter temperature is 31°, the mean summer temperature 73°. Corresponding figures for St George, in the south-western part of the state, are 38° and 80°. In general Utah may be said to have a true continental climate, although the presence of Great Salt Lake has a modifying effect on the climate of that portion of the Basin Region in which it lies. Killing frosts occur early in September and as late as the last of May, and in the higher valleys they may occur at any time. The mean annual precipitation is only 11 in., the greater part of which occurs in the form of snow in the winter months, summer being the dry season. At Salt Lake City the annual precipitation is 15.8 in., of which 2 in. fall in summer. For St George the figures are: annual precipitation, 6.6 in.; summer, 1.3 in. Both Salt Lake City and St George are near the boundary between the Basin Region and the high plateaus. Well out in the basin deserts the precipitation is still less; and the same holds true for the low desert plateaus in the south-eastern part of the state, where Hite has an annual precipitation of only 2.3 in., of which 0.4 in. falls in the summer. On the other hand, the precipitation on the high plateaus probably exceeds 30 in. in places. In the inhabited parts of the state, irrigation is generally necessary for agriculture.

Soil.—The alluvium of the desert basins furnishes much good soil, which produces abundant crops where irrigated. Alkali soils are also common in the basins, but when water is available they can often be washed out and made productive. Very rich floodplain soils occur along the larger streams. Vast areas of unreclaimable desert exist in the west and south-east. In the protected valleys between the high plateaus alluvial soils are cultivated; but the plateau summits are relatively inaccessible, and, being subject to summer frosts, are not cultivated. Comparatively poor, sandy soil is found on the lower desert plateaus in the south-east, where population is scanty.

Forests.—The forest resources of Utah are of little value: the total wooded area was about 10,000 sq. m. in 1900, or about 12⅕ % of the land area of the state. The only timber of commercial importance is found in the Uinta Range in the north-eastern corner of the state, and is chiefly yellow pine. The timber of the Wasatch Range is small and scattering. In 1910 there were in the state fourteen national forests varying in size from 1,250,610 acres (the Uinta reserve), 947,490 acres (the Ashley reserve), and 786,080 acres (the Manti reserve), down to the smallest Pocatello (10,720) on the Idaho border. The total area of these reserves was 7,436,327 acres.

Irrigation.—Under the Federal Reclamation Fund, established in 1902, $830,000 was allotted to Utah in 1902–9, and $200,000 more in 1910, for the development of the Strawberry Valley project. This project, which was about one-third completed in the beginning of 1910, provides for the irrigation in Strawberry Valley (Utah and Wasatch counties, S. of Provo), of 60,000 acres, by a 6800-acre reservoir of 110,000 acre-feet capacity, on Strawberry river; by a tunnel, 19,000 ft. long, connecting the reservoir with Diamond Fork, a tributary of Spanish Fork river; by a storage dam, 50 ft. high, of 60,000 cub. yds. contents, diverting water from Spanish Fork river into two canals, one on each side of the river, for the irrigation of land in the valley of Utah lake; by a hydro-electric power plant about 3 m. below the diversion dam; and by the enlargement of existing canal systems. The diversion dam, the power canal, and the first unit of the power plant were completed in 1909. Irrigation of the arid western regions of the United States began in the Great Basin of Utah when the Mormon pioneers in 1847 diverted the waters of City Creek upon the parched soil of Salt Lake Valley. In 1900 nearly 90 % of the land reclaimed by irrigation in the whole state lay within the Great Basin. Between 1889 and 1899 the number of irrigators in the state (exclusive of Indian reservations) increased from 9724 to 17,924, or 84.3 %, and the number of acres irrigated from 263,473 to 629,293, or 138.8 %. In 1900, of the total improved acreage (1,029,226 acres) 61.2 % (629,293 acres) was irrigated; and in 1899, of the 686,374 acres in crops, 537,588 acres, or 78.3 %.

Agriculture.—The number of farms in Utah (not including those of less than 3 acres and of small productivity) in 1880 was 9452; in 1890, 10,517; and in 1900, 19,007: their average size in 1880 was 69.4 acres; in 1890, 125.9 acres; and in 1900, 216.6 acres. The total number of all farms in the state in 1900 was 19,387; and the number of white farmers, 19,144. The greatest number of farms were between 100 acres and 500 acres—1916 in 1880, and 5565 in 1900. Other holdings were as follows: between 20 acres and 50 acres, 3688 in 1880, and 5261 in 1900; between 50 acres and 100 acres, 2056 in 1880 and 3741 in 1900; less than 10 acres, 434 in 1880 and 1622 in 1900; 1000 acres and more, 9 in 1880 and 248 in 1900. The proportion of farms operated by owners decreased from 95.4 % (9019 farms) in 1880 to 91.2 % (17,674 farms) in 1900; those operated by cash tenants increased from 0.6 % (60 farms) in 1880 to 2.6 % (506 farms) in 1900, and those operated by share tenants from 4 % (373 farms) in 1880 to 6.2 % (1207 farms) in 1900. The total area of farms increased from 655,524 acres in 1880 to 4,116,951 acres in 1900, but the proportion of improved land decreased from 63.5 % (416,105 acres) in 1880 to 25.1 % (1,032,117 acres) in 1900, indicating the great increase in land used for grazing.

The value of farm property, including land with improvements, implements and machinery, and live-stock was $19,333,569 in 1880 and $75,175,141 in 1900; the average value per farm was $2045 in 1880 and $3878 in 1900; and the average value per acre of farm land was $29.49 in 1880 and $18.26 in 1900. The value of all farm products was $3,337,410 in 1879 and $16,502,051 in 1899, and the amount expended for fertilizers increased only from $11,394 to $14,300.

In 1899 hay and grain furnished the principal income from 35.4 % of all farms in the state, and live-stock from 28.1 % of all farms. In 1899, 255,699 acres, or 37.3 % of the acreage of all crops, was sown to cereals, which were valued at $2,386,789, or 29 % of the value of all crops. The production of cereals (which grow chiefly in the northern counties of the state) was 130,842 bu. in 1849, 770,287 bu. in 1869, 2,395,744 bu. in 1889, and 5,381,125 bu. in 1899. The principal cereal was wheat, the value of which was $1,575,064 (3,413,470 bu.) in 1899, and $5,481,000 (6,090,000 bu.) in 1909.[1] The value and product of oats in 1899 was $553,847 (1,436,225 bu.), and in 1909, $1,319,000 (2,536,000 bu.); of Indian corn, in 1899, $121,872 (250,020 bu.), and in 1909, $355,000 (408,000 bu.); of barley, in 1899, $121,826 (252,140 bu.), and in 1909, $343,000 (520,000 bu.); of rye in 1899, $13,761 (28,630 bu.), and in 1909, $46,000 (66,000 bu.). The value of the hay and forage crop in 1899 was $3,862,820, or 46.9 % of the value of all crops, and its acreage was 388,043 acres, or 56.5 % of the acreage of all crops; in 1909, the acreage in hay was 375,000 acres, and its value was $9,792,000. Alfalfa (or lucerne) formed the principal part of the hay crop in 1899, and was produced chiefly in the counties of Utah (95,316 tons), Salt Lake (91,266 tons), Cache (64,543 tons) and Boxelder (50,019 tons), all in the northern part of the state.

The vegetable crop in 1899 occupied 24,042 acres, or 3.5 % of the acreage of all crops, and its value was $1,250,713, or 15.2 % of the value of all crops. The product of potatoes increased very rapidly from 519,497 bu. in 1889 to 1,483,570 bu. valued at $487,816 in 1899, and to 2,700,000 bu. valued at $1,161,000 in 1909. The production of other vegetables in 1899 was as follows: water-melons, 620,440; musk-melons, 516,500; tomatoes, 254,052 bu.; cabbages, 997,690 heads, and sweet corn, 16,192 bu. For the important sugar-beet crop, see below under *Manufactures*. On Gunnison and Hat islands in Great Salt Lake are valuable guano deposits which are used as fertilizers for vegetable gardens.

The value of live-stock on farms and ranges in 1890 was $9,914,766; on farms in 1900, $21,474,241. The number of neat cattle in 1900 was 343,690, valued at $7,152,844; on January 1, 1910,[2] 415,000,

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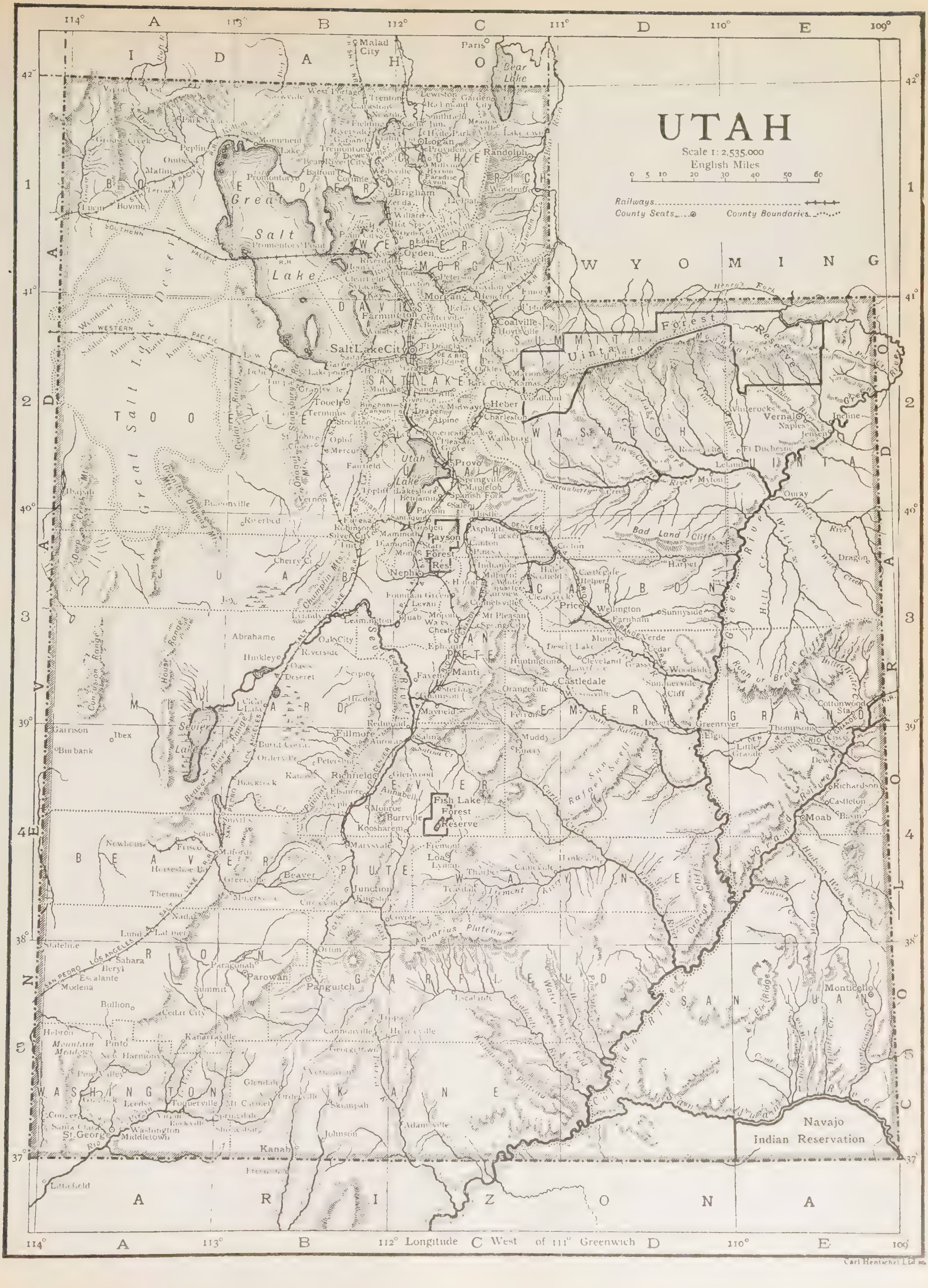
[1] 1909 statistics are from the *Year Book* of the U.S. Department of Agriculture.

[2] These 1910 figures for live-stock are taken from the *Year Book* (1909) of the United States Department of Agriculture.


UTAH
Scale 1: 2,535,000
English Miles
0 5 10 20 30 40 50 60
Railways
County Seats
County Boundaries
114° A 113° B 112° C 111° D 110° E 109°
112° Longitude C West of 111° Greenwich D
42° 41° 40° 39° 38° 37°
1 2 3 4 5
I D A H O
W Y O M I N G
C O L O R A D O
A R I Z O N A
N E V A D A
Malad City
Paris
Bear Lake
Great Salt Lake
Great Salt Lake Desert
Utah Lake
Sevier Lake
BOX ELDER
CACHE
RICH
WEBER
MORGAN
DAVIS
SUMMIT
SALT LAKE
TOOELE
WASATCH
UTAH
UINTA
JUAB
SANPETE
CARBON
EMERY
MILLARD
SEVIER
BEAVER
PIUTE
WAYNE
GRAND
IRON
GARFIELD
SAN JUAN
WASHINGTON
KANE
Logan
Randolph
Brigham
Ogden
Morgan
Farmington
Coalville
Salt Lake City
Tooele
Heber
Provo
Vernal
Nephi
Price
Manti
Castledale
Fillmore
Richfield
Junction
Beaver
Parowan
Panguitch
Moab
Monticello
St. George
Kanab
Loa
Uinta Forest Reserve
Payson Forest Reserve
Fish Lake Forest Reserve
Navajo Indian Reservation
Southern Pacific
Western Pacific
Denver & Rio Grande
San Pedro Los Angeles & Salt Lake R.R.
Green River
Colorado River
Sevier River
Bad Land Cliffs
Aquarius Plateau
San Rafael Swell
Park City
Park Valley
Promontory
Garrison
Ibex
Burbank
Frisco
Milford
Cedar City
Hebron
Modena
Lund
Greenriver
Thompsons
Helper
Wellington
Sunnyside
Fort Duchesne
Roosevelt
Myton
Ouray
Jensen
Naples
Eureka
Mammoth
Silver City
Springville
Spanish Fork
Mt Pleasant
Ephraim
Gunnison
Salina
Marysvale
Escalante
Hanksville
Leeds
Toquerville
Washington
Middletown
Pinto
Mountain Meadows
Enterprise
Bluff
Dewey
Cisco
Cottonwood Sta.

Carl Hentschel Ltd sc.

valued at $8,976,000, of which 88,000 were milch cows valued at $2,992,000. The number and value of other live-stock were as follows: sheep, in 1900, 3,818,423 ($10,256,488), and on January 1, 1910, 3,177,000 ($13,026,000); horses, in 1900, 115,884 ($3,396,313), and in 1910, 130,000 ($11,050,000); mules, in 1900, 2116 ($58,850), and in 1910, 3000 ($240,000); swine, in 1900, 65,732 ($293,115), and in 1910, 61,000 ($549,000).

The total value of dairy products in 1899 was $1,522,932. The principal products were: milk, in 1890, 8,614,694 gals., and in 1899, 25,124,642 gals. (received from sales, $645,550); butter, in 1890, 1,759,354 ℔ and in 1899, 2,812,122 ℔ (received from sales, $214,910); cheese, in 1890, 163,539 ℔, and in 1899, 169,215 ℔ (received from sales, $122,933). The value of all poultry raised in 1899 was $262,503; the product of eggs was 3,387,340 doz., and their value, $424,628.

The product of wool in 1890 (exclusive of wool shorn after the 1st of June) was 9,685,513 ℔, in 1900, 17,050,977 ℔, and in 1910, 14,850,000 ℔. The value of the honey and wax produced in 1899 was $94,364. Honey was a large crop with the early settlers, who put a hive and honey-bees on the state-seal of Deseret and of Utah.

Mining.—The mineral resources of Utah are varied and valuable, but their development was retarded for many years by the policy of the Mormon Church, which practically forbade its members to do any mining; more recently the development has been slow because of inadequate transportation facilities, and the inaccessibility of some of the deposits. In 1902 the state ranked fourteenth among the states in the value of its mineral products, $12,378,350, and took thirteenth rank in 1907, with a product of $38,099,756, but dropped to the fifteenth rank in 1908, when the total value of its product was $26,422,121.[1] The value of products manufactured from minerals in 1902 was $9,123,228, or 43·1% of all the manufactures in the state. The relative importance of mining and manufacturing may be shown thus: in 1902 the mines and quarries of the state employed 5712 wage-earners and paid to them $5,089,122, and in 1900 manufacturing industries employed 6615 wage-earners, who received $3,388,370 in wages.

Systematic prospecting for the precious metals did not begin in Utah until 1862, when Colonel Patrick E. Connor (1820–1891) of the Third California Infantry established Camp Douglas near Salt Lake City. He permitted many members of his regiment who had been prospectors in California to prospect the territory, with the result that mines were located at Stockton, Bingham Canyon, Little Cottonwood and elsewhere; but attempts to smelt lead-silver ore near Stockton about 1866 were not successful, and the mining of precious metals did not become an established industry in the Territory until about 1870. Ores of good quality are now known to be quite generally distributed throughout the state. In 1902 the state ranked third in the value of its gold and silver production, $8,500,904; in 1908 it ranked sixth in gold, $3,946,700 (a decrease of $1,174,900 since 1907), and fourth in silver, $4,520,600 (a decrease of $3,007,900 since 1907). In 1908 the richest producers of gold were Salt Lake (60,872·63 oz.), Juab (58,679·17 oz.) and Tooele (41,969·96 oz.) counties, which produced about nine-tenths of the total for the state; in Salt Lake and Juab counties the principal source was copper ore, but in Tooele county almost all the gold was from siliceous ores. For the whole state, of a total of 179,054·60 oz. in 1908, 111,086·12 were from copper ore, 47,439·15 from siliceous ores, and 19,986·36 from lead ores. In the same year the largest producing gold mines were the Centennial Eureka in Juab county, the Mercur in Tooele county, and the Utah Consolidated and the Utah Copper in Salt Lake county. The principal silver regions in 1908 were the Tintic, in Juab and Utah counties, and the Park City, in Summit and Wasatch counties. Of the total production, 8,451,338 oz. (valued at $4,479,209) in 1908, 2,748,289 oz. (of which more than two-thirds was from copper ores) were from Juab county; 2,463,735 oz. (all but 9586 oz., which were from lead zinc ore, being from lead ores) were from Summit and Wasatch counties; 1,561,983 oz. (all from lead ore, except 1158 oz. from copper ore) were from Utah county; 1,125,209 oz. (704,358 from copper ore, 329,276 from lead ore, 47,130 from copper-lead ore and 44,445 from siliceous ore) were from Salt Lake county; and 378,373 oz. (of which 341,375 oz. were from lead ore) were from Tooele county. The principal source of the silver was the lead ores mined, from which in 1908 about two-thirds of the total of the silver was secured.

Far larger in value than either gold or silver, and larger than both together, was the output of copper in Utah in 1907 ($12,851,377) and in 1908 ($11,463,383). Up to 1905 the output of silver in the state was greater than that of copper. In the production of copper in 1908 Utah ranked fourth among the states. Most of the metal was produced in the Bingham, or West Mountain district, Salt Lake county, where there were four mines in 1908 with an output of more than 1,000,000 ℔; the Tintic district in Juab county; the Frisco district in Beaver county; and the Lucin district in Boxelder county. In 1908 more than two-thirds of the total output was from the low-grade porphyry ores mined at Newhouse, Beaver county, and at Bingham, Salt Lake county. There are copper smelters at Garfield, Copperton and Binghamton. An anti-smoke injunction in 1908 closed the furnaces in the immediate vicinity of Salt Lake City. The production of copper in 1883 was 341,885 ℔; in 1890, 1,006,636 ℔; in 1895, 2,184,708 ℔; in 1900, 18,354,726 ℔; in 1904, 46,417,234 ℔; in 1907, 64,256,884 ℔; and in 1908, 81,843,812 ℔.[2]

Third in value (less than copper or silver) in 1908, but usually equalling silver in value, was the state's output of lead. The maximum production, 125,342,836 ℔, was in 1906; in 1908 the output was 88,777,498 ℔ (valued at $3,728,655). The decrease in output and value is largely due to the lower price of lead in the market and the higher smelting rate. In 1908 the following mines produced more than 5,000,000 ℔ each of lead: Silver King at Park City, the Colorado in the Tintic district, the Daly West and the Daly Judge in the Park City district, and the Old Jordan and the Telegraph at Bingham, and there were fifteen other mines that produced between 1,000,000 and 3,000,000 ℔ of lead.

Zinc has been produced in commercial quantities in Summit, Tooele and Beaver counties. In 1906 the output was 6,474,615 ℔, valued at $394,952; in 1908 it was 1,460,554 ℔, valued at $68,646, and almost the entire output was from Summit county.

The apparently inexhaustible supplies of iron ore in southern Utah, and especially in Iron county, had been little worked up to 1910 on account of their inaccessibility. The beds of magnetite and hematite, in the southern portion of the Wasatch Mountains, are the largest in the western United States; in 1902 the four productive mines in Milford, Juab and Utah counties produced 16,240 tons of ore, valued at $27,417. There are valuable manganese deposits in the sandstone of the eastern plateau.

Coal was first discovered in Utah in 1851 along Coal Creek near Cedar City (in what is now Iron county) in the south-western part of Utah, and there was some mining of coal at Wales, Sanpete county, as early as 1855, but there was no general mining until about twenty years later, and the industry was not well established until 1888. Thereafter its development was rapid, and the discovery of outcroppings throughout the central and southern parts of the state gave evidence of the existence of great bodies of the mineral. The only important region of coal mining in the state up to 1910 was in Carson county, where more than nine-tenths of the total output of the state was mined in 1907 and in 1908. The production in 1870 was 5800 tons; in 1880, 14,748 tons (probably an underestimate); in 1890, 318,159 tons; in 1900, 1,147,027 tons; in 1903, 1,681,409 tons; in 1907, 1,947,607 tons (the maximum); and in 1908, 1,846,792 tons. The total production from 1870 to 1908 was 20,683,974 tons, or allowing for coal lost, about 31,000,000 tons, which is estimated to represent 0·016% of the original supply. In 1909 the United States Geological Survey reported workable beds of coal aggregating 13,130 sq. m. in area, and 2000 sq. m. more in which it seemed probable that coal might be found. The shales of Utah, Sanpete, Juab and San Juan counties may furnish a valuable supply of petroleum if transportation facilities are improved; and there are rich supplies of asphalt—19,033 tons (valued at $100,324) was the output for 1908.

Salt is obtained by solar evaporation chiefly of the waters of Great Salt Lake and other brine found in that vicinity; at Nephi City, Juab county; near Gunnison, Sanpete county; in Sevier and Millard counties, and at Withee Junction in Weber county. The value of this product in 1907 was $199,779 (345,557 bbls.), and in 1908, $169,833 (242,678 bbls.).

Of other non-metallic products, among the most important were limestone—valued in 1902 at $186,663, and in 1908 at $253,088—and sandstone—valued in 1902 at $105,011 and in 1908 at $25,097. Some marble is quarried at Beaver in Beaver county, and Utah onyx has been used for interior decoration, notably in the city and county building of Salt Lake City. The clay products of the state in the same year were valued at $658,517. There are considerable deposits of sulphur, of varying degrees of richness, near Black Rock in Beaver county. Many semi-precious and precious stones are found in Utah, including garnet (long sold to tourists by the Navaho Indians), amethyst, jasper, topaz, tourmaline, opal, variscite (or "Utahlite"), malachite, diopside and Smithsonite. In 1908 the reported value of precious stones from Utah was $20,350.

Manufactures.—The manufacturing industry was long comparatively unimportant, being largely for local markets. It is still largely dependent on local raw material. But, with the growth of the mineral industry and of the cultivation of sugar beets, there was a remarkable growth in manufacturing between 1900 and 1905: the amount of capital increased from $13,219,039 to $26,004,011, or 96·7%; the average number of wage-earners from 5413 to 8052, or 48·8; and the value of factory products from $17,981,648 to $38,926,464, or 116·5%. In the period under discussion, urban establishments (*i.e.* those in the two municipalities—Salt Lake City and Ogden—having a population in 1900 of at least 8000), increased in number from 205 to 256 or 24·9%, and rural establishments decreased in number from 370 to 350 (5·4%); the capitalization of urban establishments increased from $4,212,972 to $7,700,750 (82·8%), and that of the rural from $9,006,067 to $18,303,361 (103·2%); the average number of wage-earners in urban establishments increased from 2832 to 3859 (36·3%), and those in rural establishments from 2581 to 4193 (62·5%); the value of the products of urban establishments increased from $5,521,140 to $10,541,040 (90·9%) and that of rural establishments from $12,460,508 to $28,385,424 (127·8%). This unusual predominance of rural over urban manufacturing is further shown by the fact that in 1900, 64·3% of the establishments reporting, and 69·3% of the value of their products were from factories classified as rural, and in 1905 the proportion of rural factories was 58·8%, and the value of their products 72·9% of the total. This predominance was largely due to the smelting and refining industry, the smelters being chiefly in the rural districts.

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[1] The 1907 and 1908 statistics are from the *Mineral Resources of the United States*, published by the United States Geological Survey.

[2] These statistics for 1904, 1907 and 1908 are from *Mineral Resources of the United States for 1908*.

The flour and grist mill industry was the most important in the state, with products valued at $1,659,223 in 1900, and $2,425,791 in 1905. The values of the products of other industries in 1900 and 1905, in the order of their importance, were as follows: Car and general shop construction and repairs by steam railway companies, in 1900, $1,306,591, and in 1905, $1,886,651; printing and publishing, in 1900, $770,848, and in 1905, $1,466,549; confectionery, in 1900, $403,379, and in 1905, $1,004,601; canning and preserving fruit and vegetables in 1900, $300,349, and in 1905, $801,958. The value of the products of industries of lesser importance in 1905 were: slaughtering and meat packing (wholesale), $653,314; malt liquors, $636,688; and foundry and machine shop products, $587,484.

The beet sugar industry is one of growing importance in Utah: there were in 1900 3 refineries, having a daily total capacity of 1100 tons of beets; in 1905, 4, with a daily total capacity of 2850 tons; and in 1909,[1] 5, which treated 455,064 tons of beets and produced 48,884 tons of sugar. In 1853 a sugar factory bought in England was erected at Provo, but no sugar was manufactured there, and none was successfully refined until 1889. Sugar beets were first grown by irrigation in Utah; under that system it becomes possible to estimate closely the tonnage of the product. Slicing stations established at distances of from 12 to 25 m. from a factory receive the beets, extract the juice and force it through pipes to the factory.

Transportation.—The first trade route to be established by white men within the present boundaries of Utah was the old Spanish trail from Santa Fé to Los Angeles. The trail entered what is now Utah, just east of the Dolores river, crossed the Grand river near the Sierra La Salle and the Green river at the present crossing of the Denver & Rio Grande railway, proceeded thence to the Sevier river and southward along its valley to the headwaters of the Virgin river, which it followed southward, and then westward, so that its line left the present state near its south-west corner. The presence of this and other trails to California was of great importance during the gold excitement of 1849, when many miners outfitted at Salt Lake City and the Mormons grew rich in this business. The first considerable railway enterprise in the territory was the Union Pacific, which was completed to Ogden in 1869. This system (which includes the Oregon Short line) has since been supplemented by the Denver & Rio Grande, the Southern Pacific, the San Pedro, Los Angeles & Salt Lake, and various connecting lines. The railway mileage in 1870 was 257 m.; in 1890, 1265 m.; and in 1909, 1962·87 m.

Population.—The population in 1850 was 11,380; in 1860, 40,273; in 1870, 86,786; in 1880, 143,963; in 1890, 207,905; in 1900, 276,749; and in 1910, 373,351. Of the population in 1900, 219,661 were native whites, 53,777, or 19·4%, were foreign-born, 2623 were Indians (of whom 1472 were not taxed), 672 were negroes, 572 were Chinese and 417 were Japanese. The reservation Indians in 1909 were chiefly members of the Uinta, Uncompahgre and White River Ute tribes on the Uinta Valley reservation (179,194 acres unallotted) in the north-eastern part of the state.[2] Of the 1900 native-born population 3870 were born in Illinois, 3032 in New York, 2525 in Ohio and 2519 in Pennsylvania. Of the foreign-born by far the largest number, 18,879, were natives of England, 9132 were Danes, 7025 were Swedes; and natives of Scotland, Germany, Wales and Norway were next in numbers. The large English immigration is to be ascribed to the successful proselytizing efforts of the Mormons in England. The same influence may be traced in the other immigration figures. There was, however, a relative decrease in the number of foreign-born in the state from 1890 to 1900. Of the total 1900 population 169,473 were of foreign parentage (*i.e.* either one or both parents were foreign-born), and 42,735 were of English, 18,963 of Danish and 12,047 of Swedish parentage, both on the father's and on the mother's side. The Latter-Day Saints (Mormons) are far more numerous than any other sect, this church having a membership in 1906 of 151,525 (of these 493 were of the Reorganized Church of Jesus Christ of Latter-Day Saints) out of a total of 172,814 in all denominations; there were 479 members of this denomination to every 1000 of the population in the state, and the next largest sect, the Roman Catholics, had only 26 per 1000 of population and no Protestant body more than 6 per 1000. In the same year there were 8356 Roman Catholics, 1902 members of the Northern Presbyterian Church, 1537 members of the Northern Methodist Episcopal Church, 1174 Congregationalists, and 987 Baptists (of the Northern Conference). The state in 1900 had 3·4 inhabitants to the sq. m. While this approached the average—3·5 for all the states west of the Rocky Mountains taken together, with the exception of Colorado, which had 5·2—it was noticeably higher than that of its immediate neighbours, Idaho (1·9), Arizona (1·1) and Nevada (0·4). At the census of 1880 the density of the population was 1·8 and in 1890 it was 2·6. From 1890 to 1900 the urban population (*i.e.* the population of places having 4000 inhabitants or more) increased from 69,456 to 81,480, or 17·3%, the urban population in 1900 being 29·4% of the total; the semi-urban population (*i.e.* population of incorporated places, or the approximate equivalent, having less than 4000 inhabitants) increased from 36,867 to 83,740, 71·1% of the total increase in population; while the rural population (*i.e.* population outside of incorporated places) increased from 104,456 to 111,529, 10·7% of the total increase. The principal cities of the state are: the capital, Salt Lake City, pop. (1910) 92,777; Ogden, 25,580; Provo, 8925; and Logan, 7522.

Administration.—The state is governed under the first constitution adopted on the 5th of November 1895, and amended in November 1900, November 1906, and November 1908. An amendment may be submitted to the people at the next general election by a two-thirds vote of the members elected to each house of the legislature, and only a majority of the electors voting thereon is required for approval. By a two-thirds majority the legislature may recommend that a constitutional convention be called; and if a majority of the electors at the next general election approve, the legislature shall provide for the convention, but the approval of a majority of the electors voting is necessary for ratification of the work of the convention. Article III., which guarantees religious freedom, forbids sectarian control of public schools, prohibits polygamy and defines the relation of the state to the public lands of the United States, is irrevocable except by consent of the United States. Every citizen of the United States, male or female, twenty-one years old or over, who has lived one year within the state, four months within the county and sixty days within the precinct has the right of suffrage, except that idiots, insane, and those convicted of treason or crime against the elective franchise are disfranchised; but in elections levying a special tax, creating indebtedness or increasing the rate of state taxation, only those who have paid a property tax during the preceding year may vote. A form of the Australian ballot with party columns is provided at public expense. As in so many of the newer Western states, the constitution specifies minutely many details which in the older instruments are left to be fixed by statute. For example, the employment of women or of children under fourteen in mines and the leasing of convict labour by contract are forbidden, and eight hours must constitute a day's work in state, county or municipal undertakings.

Executive.—The executive department consists of the governor, secretary of state, auditor, treasurer, attorney-general and superintendent of public instruction, all elected by the people at the time of the presidential election, and holding office for four years from the first day of January following. All these officers must be qualified electors and must have resided within the state for five years preceding their election. The auditor and treasurer may not succeed themselves, and governor and secretary of state must be at least thirty years old. The governor may call the legislature in extraordinary session or may summon the Senate alone. With the consent of the Senate he appoints all officers whose election or appointment is not otherwise provided for, including the bank examiner, state chemist, dairy and food commissioners, the boards of labour and health, the directors of the state institutions, &c., and fills all vacancies in elective offices until new officers are chosen and qualified. The governor, justices of the supreme court and the attorney-general constitute a board of pardons. The governor and other state officers form other boards, but the legislature is given power to establish special boards of directors. The veto of the governor, which extends to separate items in appropriation bills, can be overcome only by a two-thirds vote of each house of the legislature; but if the bill is not returned to the legislature, within five days it becomes a law without the governor's approval. The governor may not be elected to the United States Senate during his gubernatorial term.

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[1] *Year Book* of the United States Department of Agriculture.

[2] The *Report* of the commissioner of Indian Affairs for 1909 gives the following figures for the Indian population: under the Panguitch School, Kanab Kaibab, 81, Shivwitz Paiute, 118; under the Uinta and Puray Agency, Uinta Ute, 443, Uncompahgre Ute, 469, White River Ute, 296; not under agency, Paiute 370.

Legislative.—The legislative power is vested in (1) the legislature, consisting of the Senate and House of Representatives, and (2) in the people of Utah. The legislature meets biennially on the second Monday in January of the odd-numbered years. No person is eligible to either house who is not a citizen of the United States, twenty-five years of age, a resident of the state for three years and of the district from which he is chosen for one year. Senators are elected for four years, but one-half the membership of the Senate retires every two years. The representatives are elected for two years. No person who holds any office of profit or trust under the state or the United States is eligible to the legislature, and no member, during the term for which he was chosen, shall be appointed or elected to any office created, or the emoluments of which have been increased during his term. Each house is the judge of the election and qualification of its own members. The membership of each house is fixed by law every five years, but the number of senators must never exceed thirty, and the number of representatives must never be less than twice nor more than three times the number of senators. In 1909 the Senate had eighteen and the House forty-five members. The legislature is forbidden to pass any special act where a general law can be made applicable, and is specifically forbidden to pass special acts on a number of subjects, including divorce, the rate of interest, and the incorporation of cities, towns or villages, or the amendment of their charters, &c. Neither the state nor any political subdivision may lend its credit or subscribe to the stock of any private corporation. The powers of the houses are the same, except that the Senate confirms or rejects the governor's nominations and sits as an impeachment court, while the Representatives initiate impeachments. By an amendment of 1900, the legislature was instructed to provide that a fixed fraction of the voters might cause any law to be submitted to the people, or that they might require any legislative act (except one passed by a two-thirds vote of each house) to be so submitted before going into effect, but up to 1910 no law had been passed putting the amendment into force.

Judiciary.—The judicial power is vested in the Senate sitting as a court of impeachment, in the Supreme Court, the district courts, in justices of the peace, and in "such inferior courts as may be established by law." The Supreme Court is composed of three justices (but the number may be increased to five whenever the legislature shall deem it expedient) each of whom must be thirty years old, learned in the law, and a resident of the state for five years preceding his election. They are elected by the people for a term of six years, but the term of one expires every two years, and that justice who shall have the shortest time to serve acts as chief justice. The court has original jurisdiction to issue writs of *mandamus*, *certiorari*, prohibition, *quo warranto* and *habeas corpus*. Otherwise its jurisdiction is exclusively appellate, and every final decision of a district court is subject to review. The court holds three terms yearly in the capital. The state is divided into seven districts, in which from one to four judges are elected for terms of four years. They must be twenty-five years old, residents of the state for three years, and of the district in which they are chosen. They have original jurisdiction of civil, criminal and probate matters, not specifically assigned to other tribunals, and appellate jurisdiction from the inferior courts. At least three terms yearly must be held in each county. In cities of the second class (5000–30,000 inhabitants) municipal courts may be established. In cities of the first class (30,000 or more) a city court was established in 1901. Special juvenile courts may be established in cities of the first and second class. Each precinct elects a justice of the peace, who has civil jurisdiction when the debt or damage claimed does not exceed three hundred dollars, and has primary criminal jurisdiction.

Local Government.—The county is the unit of local government. The chief fiscal and police authority is the Board of County Commissioners of three members, two elected every two years, one for two years and one for four. They create and alter subdivisions, levy taxes, care for the poor, construct, maintain and make regulations for roads and bridges, erect and care for public buildings, grant franchises, issue licences, supervise county officers, make and enforce proper police regulations (but the authority does not extend to incorporated towns or cities), and perform such other duties as may be authorized by law. Other county officers are the clerk (who is *ex officio* clerk of the district court and of the commissioners), sheriff, treasurer, auditor, recorder, surveyor, assessor, attorney and superintendent of district schools, but where the assessed valuation of any county is less than $20,000,000 the clerk is *ex officio* auditor, and the commissioners may consolidate offices. The precincts are laid off by the commissioners and each elects a justice of the peace and a constable. Cities are divided into classes (see above) according to population, and are governed by a mayor and a council. In cities of the first class fifteen, and of the second ten, councilmen are elected by wards, while in cities of the third class (all having less than 5000 inhabitants) five councilmen are elected on a general ticket.

Miscellaneous Laws.—Men and women may hold and dispose of property on the same terms, except that a husband cannot devise more than two-thirds of real estate away from his wife without her consent, and that a woman attains her majority at eighteen or when she marries. The property of an intestate leaving a widow or widower, but no issue, goes to the survivor if not over $5000 in value; if over that amount, one-half the excess goes to the survivor and one-half to the father and mother of the deceased or to either of them. If neither father nor mother survives, their share goes to the brothers and sisters of the deceased or to their descendants. If there are no descendants, the whole goes to the surviving husband or wife. If a husband or wife and one child survive, they share the estate equally; if more than one child, the surviving husband or wife takes one-third and the children divide the remainder. If the intestate leaves issue but no husband or wife, the issue takes the whole. Failing all these, the estate goes to the next of kin. An illegitimate child is an heir of its mother and of the person who acknowledges himself to be its father. Estates exceeding $10.000 pay an inheritance tax of 5% on the excess. A homestead not exceeding $1500 for the head of the family and $500 additional for the husband or wife and $250 additional for each other member of the family is not subject to execution except for the purchase price, or mechanic's and labourer's liens, lawful mortgage or taxes. The district courts have exclusive jurisdiction in divorce, which may be granted because of impotency at time of marriage, adultery, wilful desertion for more than one year, wilful neglect to provide the necessities of life, habitual drunkenness, conviction for felony, intolerable cruelty, and permanent insanity which has existed for at least five years. An interlocutory decree is entered which becomes absolute at the end of six months, unless appeal is entered. The guilty party forfeits all rights acquired through marriage. Children over ten years of age may select the parent to whom they will attach themselves. A marriage may be annulled on ground of idiocy, insanity, bigamy, loathsome disease at time of marriage, epilepsy, miscegenation (white and negro or white and Mongolian), or when a male is less than sixteen or a female less than fourteen years of age. A marriage licence is required. No female and no male under fourteen may work in a mine. Eight hours is the limit of a day's work in mines and smelters. A person sentenced to death may choose one of two methods of execution—hanging or shooting.

Education.—Before 1890 some districts in the state under a local option law had established free schools, but the general free school system was founded in 1890 by a law which consolidated all the districts in each city into one large school district and classified Salt Lake City as a city of the first class, and Ogden, Logan and

Provo as cities of the second class for school purposes; in 1908–9 six county school districts of the first class were formed. In 1892–1893 text-books and supplies were first furnished free to pupils in the grades; and in the same year supervisory work was introduced. At the head of the public school system is a state superintendent of public instruction, elected for four years, and a board of education, composed of the state superintendent, the president of the state university, the president of the Agricultural College, and two appointees of the governor serving for four years. There is a county superintendent whose term is two years. And in each district there is a board of three trustees, one retiring each year. Two or more contiguous districts may unite to form a high school district. School attendance is compulsory for twenty weeks each year in rural districts and for thirty weeks each year in cities of the first and second class for all children between eight and sixteen years. In 1900 the percentage of illiterates at least ten years old was 3·1. In 1909 there were 685 public schools in the state; the total number of pupils of school age (six to eighteen years) was 102,050, the number enrolled in the public schools was 84,804, and the average daily attendance was 66,774; the total number of teachers was 2255 (1645 women), and the average monthly salary of men teachers was $88·13 and of women $57·44; and the total expenditure for public education was $2,762,581 for the year, being more than twice as much as was expended by the state ten years before. The laws of the state provide for a commission, in cities and counties, for the retirement of public school teachers on a pension. The university of Utah at Salt Lake City was opened in 1850 as the state university of the "state of Deseret." The State Agricultural College and Experiment Station (1888) is at Logan. At Cedar City, in Iron county, is a branch normal school, connected with the state university. There is a state school for the deaf and the blind (1884) at Ogden. The Art Institute at Salt Lake City has an annual art exhibit, a state art collection, and a course of public lectures on art. There is a state commission which promotes the establishment of free libraries and gymnasiums. The Mormons control Brigham Young University (1876) at Provo, Brigham Young College (1878) at Logan, the Latter-day Saints University (1887) at Salt Lake City, and academies at Ogden, Ephraim, Castle Dale, Beaver and Vernal. Other denominational schools are: St Mary's Academy (1875; Roman Catholic) in Salt Lake City; All Hallows College (1886; Roman Catholic) in Salt Lake City; Westminster College (1897; Presbyterian) in Salt Lake City, and Presbyterian academies at Logan, Springville and Mt. Pleasant; Rowland Hall Academy (1880; Protestant Episcopal) for girls at Salt Lake City; and Gordon Academy (1870; Congregational) at Salt Lake City.

Charitable and Penal Institutions.—The state supports a Mental Hospital (1884, with provision for feeble-minded and non-insane epileptics since 1907) at Provo, a state Industrial School (1889) at Ogden and a state prison (1850) at Salt Lake City. Under a law of 1905, amended in 1907 and 1909, provision is made for separate juvenile courts in all districts in which there are cities of the first (Salt Lake City) or the second class (Ogden, Logan and Provo) with jurisdiction over children under eighteen years of age; and similar jurisdiction is given to district courts elsewhere. In connexion with the juvenile court detention homes have been established, and in certain conditions justices of the peace are empowered to act as judges of the juvenile court in their respective precincts. There are many denominational charities, especially Mormon, the entire state being divided into ecclesiastical units or "stakes" for charity organization.

Finance.—The principal source of public revenue is the property tax. An amendment of 1908 provides for the taxation of mines and mining property. The state assumed the Territorial debt of $700,000, and has added to it a bonded indebtedness of $200,000; the bonds, formerly 5%, have been refunded at 3½ and 3%. There were only private banks until 1872, when Brigham Young organized a national bank. The first savings bank was organized in 1873, and state banks now outnumber national banks. The banking business for many years was largely in the hands of high Mormon officials, and the loyalty of church members built up a remarkable financial confidence, so that no Utah banks failed even in the panic of 1893.

History.—Existing documents seem to indicate that Francisco Vasquez de Coronado, the Spanish explorer, sent out an expedition of twelve men under Captain Garcia Lopez de Cardenas in 1540, which succeeded in reaching the Colorado river at a point now within the state of Utah. But more extended exploration was conducted by two Franciscan friars, Francisco Atanasio Dominguez and Silvestre Velez de Escalante, who, on the 29th of July 1776, left Santa Fé with seven others to discover a direct route to Monterey on the coast of Alta California. This party came in sight of Utah lake on the 23rd of August. Almost half a century later, in the winter of 1824–25, James Bridger, a trapper, discovered the Great Salt Lake while seeking the source of the Bear river. Many trappers in their skin boats followed his lead, notably William H. Ashley, of the Rocky Mountain Fur Company, who, in 1825, at the head of about 120 men and a train of horses, left St Louis and established the fort named for him at Lake Utah. In 1843 General John C. Frémont with Kit Carson and three others explored the Great Salt Lake in a rubber boat. With Brigham Young and his little band of Mormon followers (between 140 and 150 members), who entered the Great Salt Lake Valley in July 1847, begins the story of settlement and civilization (see MORMONS). Before the end of 1848 about 5000 Mormons had settled in the Salt Lake Valley. The treaty of Guadalupe Hidalgo (Feb. 2, 1848) ceded to the United States the vast western territory which included Utah. Early in 1849 the Mormon community was organized as the state of Deseret[1] with Brigham Young as governor. Deseret then comprised not only the present state of Utah, but all Arizona and Nevada, together with parts of New Mexico, Colorado, Wyoming and California. Application was made to Congress to admit it as a state or Territory, and on the 9th of September 1850 the Territory of Utah, then comprising the present state and portions of Nevada, Colorado and Wyoming, was established under an Act, which provided that it should be admitted as a state, with or without slavery, as the constitution adopted at the time of admission prescribed. (See COMPROMISE OF 1850.) The Republican party and (less violently) the Democratic in their national platforms and in Congress attacked and opposed the Mormon institution of polygamy. Statehood, therefore, was not granted until the 4th of January 1896, owing to the apparent hostility of the Mormon authorities to non-Mormon settlers and to repeated clashes between the Mormon Church and the United States government regarding extent of control, polygamous practices, &c. And even after the admission of the state these questions arose in the matter of seating prominent Mormons who were elected to Congress. For a detailed account of these difficulties and of the growth of the "Gentile" or non-Mormon element see the article MORMONS.

Through irrigation experiments agriculture became the industrial foundation of the desert community. The waters of City Creek were at first diverted and a canal was built; and the results were encouraging, though in the summer of 1848 crops were destroyed by a swarm of black crickets; but in turn this pest was devoured by sea-gulls, and the phrase "gulls and crickets" has become one of peculiar historic significance in Utah. After 1849 the gold-fever horde bound for California furnished a source of revenue to the Mormons, as their settlement afforded an admirable post for supplies.

The division of land among the Mormons was singularly equitable. Each city block consisted of 10 acres divided into eight 1¼-acre lots, which were assigned to professional and business men. Then a tier of 5-acre lots was apportioned to mechanics, and 10- and 20-acre parcels of land were given to farmers, according to the size of their families. As Great Salt Lake City grew all landholders benefited, either by the location of their property or because of its size, the smaller lots being closer to the business centre and the larger tracts being in the outlying districts.

In 1847 Brigham Young had succeeded Joseph Smith as president of the Mormons, and he held that position of veritable dictator until his death (1877); John Taylor succeeded him, and Wilford Woodruff in 1890 was chosen head of the organization; then Lorenzo Snow was president in 1898–1901, and Joseph Fielding Smith was elected in 1901.

From time to time the Indians have risen against the Mormons. Between 1857 and 1862 outbreaks were frequent, and on the 29th of January 1863 occurred the battle of Bear river, where some 300 Shoshones and Bannocks and about 200 of Colonel P. E. Connor's command participated in a bloody engagement. In April 1865 an Indian war broke out under the leadership of Blackhawk, which lasted intermittently until the end of 1867. But in June 1865 treaties were concluded with the majority of Utah tribes, whereby they agreed to remove to Uinta Valley, where a reservation had been made for them. One other important reservation, the Uncompahgre, has also been opened for the Indians of the state.

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[1] According to the Book of Mormon, "Deseret" means "land of the working bee."

The state has chosen Republican governors and, except in 1896, when it gave its electoral vote to W. J. Bryan, the Democratic candidate for the presidency, has voted for the Republican nominees in presidential elections.

GOVERNORS

State of Deseret

Brigham Young	1849–1850

Territorial

Brigham Young	1850–1857
Alfred Cumming	1857–1861
John W. Dawson	1861
Frank Fuller (Acting Governor)	1861–1862
Stephen S. Harding	1862–1863
James Duane Doty	1863–1865
Charles Durkee	1865–1869
Edwin Higgins (Acting Governor)	1869–1870
S. A. Mann (Acting Governor)	1870
J. Wilson Schaffer	1870
Vernon H. Vaughan (Acting Governor)	1870–1871
George L. Woods	1871–1874
S. B. Axtell	1874–1875
George B. Emery	1875–1880
Eli H. Murray	1880–1886
Caleb W. West	1886–1889
Arthur L. Thomas	1889–1893
Caleb W. West	1893–1896

STATE GOVERNORS

Heber M. Wells (Republican)	1896–1905
John C. Cutler (Republican)	1905–1909
William Spry (Republican)	1909–

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UTAMARO (1754–1806), one of the best known of the Japanese designers of colour-prints, was born at Kawayoye. His father was a well-known painter of the Kanō School, Toriyama Sekiyen (Toyofusa), a pupil of Kanō Chikanobu; and Utamaro traced his descent from the old feudal clans of the Minamoto, whose war with the Taira family belongs to the romantic period of Japanese history. Utamaro's personal name was Yusuke; and he first worked under the signature Toriyama Toyo-aki; but after a quarrel with his father substituted the name Kitagawa for the former appellation. His distinct style was the outcome of that of his father, tempered with the characteristics of the Kanō school. As a painter, his landscapes and drawings of insects are most highly considered by Japanese critics; but his fame will always rest among Europeans on his designs for colour-prints, the subjects of which are almost entirely women—professional beauties and the like. These were done for the most part while he lived, in a sort of bondage, in the house of a publisher, Tsutaya Shigesaburo. His talents were wasted by an unbroken career of dissipation, culminating in a term of imprisonment for a pictorial libel on the shogun Iyenari, in 1804. From this he never recovered, and died on the third day of the fifth month, 1806. The colour-prints of Utamaro are distinguished by an extreme grace of line and of colour. His composition is superb; and even in his lifetime he achieved such popularity among his contemporaries as to gain the title Ukiyo-ye Chūkō-no-so, "great master of the Popular School." His work has a considerable reputation with the Dutch who visited Nagasaki, and was imported into Europe before the end of the 18th century. His book illustrations are also of great beauty. Three portraits of him are known: two colour-prints by himself, and one painting by Chobunsai Yeishi (in the collection of Mr Arthur Morrison). His prints were frequently copied by his contemporaries, especially by the first Toyokuni and by Shunsen; and many of those bearing his name are really the work of Koikawa Harumachi, who had been a fellow-student, and afterwards married his widow. That artist is known by the name of Utamaro II. Most of these imitations were made between 1808 and 1820. Utamaro II., who afterwards changed his name to Kitagawa Tetsugorō, died between 1830 and 1843.

See E. de Goncourt, *Outamaro* (1891); E. F. Strange, *Japanese Illustration* (1897); and Japanese Colour-Prints (Victoria and Albert Museum *Handbook*, 1904). (E. F. S.)

UTE, or UTAH, a tribe of North American Indians of Shoshonean stock. They originally ranged over central and western Colorado and north-eastern Utah. They were divided into five sub-tribes, all acknowledging the authority of one chief. They were a wild warlike people, constantly fighting the Plain Indians and raiding as far south as New Mexico. Their relations with the whites have been generally friendly. The outbreak of the White River Band in 1879 is almost the only exception. They are now on reservations in Utah and Colorado, and number over 2000.

UTICA, a city of ancient Africa on the *sinus Uticensis*, 15½ m. N.W. of Carthage and Tunis, on the route from Carthage to Hippo Diarrhytus (Bizerta) and Hippo Regius (Bona). The modern marabout of Sidi Bu Shater, at the foot of Jebel Menzel el Gul, occupies the site of the ruins of Utica, which in ancient times stood at the mouth of the Bagradas (Mejerda). The mouth of the river is now 12 m. to the north, owing to alluvial deposits, and the level of the ancient town is covered with low-lying meadows, pools of water and marshes. The name *Utica* is of uncertain origin; the coins give the form אתג (*Atag, Ätig*); it is therefore with justification that Movers, Tissot and other scholars have suggested a form עתיקא (*Atiqa*) meaning "the ancient" or "the magnificent," or *Statio nautarum* (Movers, *Die Phönizier*, ii. 2nd part, p. 512; Olshausen in *Rheinisches Museum*, 1853, p. 329; Tissot, *Géogr. comp. de l'anc. prov. d'Afrique*, ii. p. 58). The Greeks transliterated the Punic name as Ἰτύκη, Οὐτίκη, Οὐτίκα and the Romans by *Utica*. According to tradition, Utica was one of the oldest Phoenician settlements on the African coast, founded three centuries before Carthage. It soon acquired importance as a commercial centre, and was only partially eclipsed by Carthage itself, of which it was always jealous, though it had to submit to its authority. It is mentioned in the commercial treaty of 348 B.C. between Rome and Carthage (Polyb. iii. 24). Agathocles easily captured it in his expedition to Africa in 310. It remained faithful to Caesar during the First Punic War (Polyb. i. 82), but soon withdrew its support in view of the revolt of the Mercenaries. In the Third Punic War it declared for the Romans (Livy, *Epit.* xlix.; Polyb. xxxvi. 1; Appian viii. 75). After the destruction of Carthage it received the rank of a *civitas libera* with an accession of territory (Appian viii. 135; *C.I.L.* i. 200; Caesar, *De bell. civ.* ii. 36; A. Audollent, *Carthage romaine*, p. 30). Having become the city of an administration of the new Roman province up to the time of the rebuilding of Carthage, it played an important part in the wars at the end of the Republic. After the battle of Thapsus in 46 Cato shut himself up in Utica for the final struggle against Caesar, and there committed suicide. Augustus gave the town the rank of *municipium* with full civic rights (Dio Cass. xlix. 16; Pliny, *Hist. nat.* v. 4, 24); its inhabitants were enrolled in the Quirinal tribe (*municipium Julium Uticense*). Under Hadrian it became a *colonia romana*, with the title *Colonia Julia Aelia Hadriana Augusta Utica* (Aul. Gell. *Noct. Attic.* xiii. 4; *C.I.L.* viii. 1181 and 1183).

Septimius Severus conferred upon it the *Ius Italicum* (*Digest.* 50. 15; 8. 11).

We find evidence of the African Church at Utica as early as at Carthage; it was the seat of a bishop and had its martyrs from the 3rd century onwards. But its harbour was beginning to silt; the *Stadiasmus Maris Magni* (cxxvi.) states that already it was no longer a harbour but merely an anchorage. It was captured by Genseric and the Vandals in 439, reconquered by the Byzantines in 534, and finally, in 698, it fell into the hands of the Arabs and was depopulated. The last inhabitants were driven away by fever after the 8th century.

The ruins of the left bank of the Mejerda are often visited by travellers, but very little is left above the level of the ground. In 1869 A. Daux, the French engineer, explored them and made some important investigations. He was able to distinguish the fortifications, the acropolis, the quays of the commercial harbour and also of the military harbour or Cothon. Conjectural attempts have been made to identify the remains of large buildings with a temple of Apollo, the municipal Curia, the Arsenal and the Palace. The only certain identification, however, is that of the ruins of the amphitheatre, which was capable of holding 20,000 spectators, of the theatre, the baths, the reservoirs and the aqueduct which brought drinking water to the city. Subsequently there was found a Punic cemetery dating from the 5th century B.C. (Delattre, *Comptes-rendus de l'Acad. des Inscrip. et Belles Lettres*, 1906, p. 60). A number of coins have been found with Punic legends with the name Utica and heads of the Dioscuri Castor and Pollux. For the Roman period the coins have Latin legends and heads of Livia and Tiberius; they have also the names of the pro-consuls of the African province and of the local Duumvirs.

AUTHORITIES.—Hérisson, *Relation d'une mission archéologique en Tunisie* (1881); Sainte-Marie, *Mission à Carthage* (1884); *Revue archéologique* (1881 and 1882); A. Daux in *Le Tour du Monde* (1872) (views of the ruins); a mosaic of Utica is in the British Museum: *Graeco-Roman Sculpture*, ii. p. 86; A. Daux, *Recherches sur l'origine et l'emplacement des emporia phéniciens dans le Zeugis et le Byzacium* (1869); Ch. Tissot, *Géographie comparée de la province romaine d'Afrique* (1888), ii. pp. 57 et seq.; Lud. Müller, *Numismatique de l'ancienne Afrique*, ii. p. 159. (E. B.*)

UTICA, a city and the county-seat of Oneida county, New York, U.S.A., on the Mohawk river, about 45 m. E. of Syracuse and about 85 m. W. of Albany. Pop. (1890) 44,007; (1900) 56,383, of whom 13,470 were foreign-born, including 3696 Germans, 2458 Irish, 1661 Italians and 1165 Welsh; (1910, census) 74,419. Utica is served by the New York Central & Hudson River and several lines leased by it, including the Rome, Watertown & Ogdensburg; the Delaware, Lackawanna & Western; the New York, Ontario & Western; and the West Shore railways; by the Erie Canal, and by interurban electric railways. The city is situated on ground rising gradually from the river. There are many fine business and public buildings, especially on Genesee Street, the principal thoroughfare, and Utica is known for the number of its institutions, public and private. Those of an educational character include, in addition to the public schools and the Utica Free Academy, the New School (for girls) and the Utica Catholic Academy. Among the libraries are included the Public Library (1893) with 54,000 volumes in 1909, the library of the Oneida Historical Society (which occupies the Munson-Williams Memorial Building), the Utica Law Library and the Deutscher Leserverein. The city is the seat of a State Hospital for the Insane (1843). Among its many charitable institutions are a Masonic Home and School (1893), a Home for the Homeless (1867), St Elizabeth's Home (1886), St Luke's Home (1869), a Home for Aged Men and Couples (1879), Utica Orphan Asylum (1830), St Joseph's Infant Home (1893) and St John's Female Orphan Asylum (1834), both under the Sisters of Charity; the House of the Good Shepherd (1872; Protestant Episcopal); and the General (1873; City of Utica), Homeopathic (1895), St Luke's (1869; supported by the Protestant Episcopal Churches), St Elizabeth's (1866; Sisters of the Third Order of St Francis) and Faxton (1873) hospitals. Among the public buildings are a Federal building, the city hall, the County Court House, a Y.M.C.A. building, a Masonic Temple, an Odd-Fellows' Temple and a State Armoury and Arsenal. The city has a number of fine parks. In Forest Hill Cemetery are the graves of Horatio Seymour and Roscoe Conkling. On West Canada creek, about 15 m. N. of Utica, are Trenton Falls, which descend 312 ft. in 2 m., through a sandstone chasm, in a series of cataracts, some of them having an 80 ft. fall. From the geological formation here the name Trenton is applied to the upper series of the Ordovician (or Lower Silurian) system, and, particularly, to the lowest stage of this series.

Utica has varied and extensive manufactures. In 1905 the capital invested in manufacturing industries was $21,184,033, and the total value of the factory products was $22,880,317, an increase of 38·8% since 1900. Of this product, hosiery and knit goods, with a total value of $5,261,166, comprised 23% of all, and cotton goods ($4,287,658), 18·7%. The hosiery and knit goods constituted 3·9% of the total value of that product of the entire country. Other important products were: men's clothing ($2,943,214); foundry and machine-shop products ($1,607,258); steam fittings and heating apparatus ($1,010,755); malt liquors ($933,278); and lumber products ($869,000). Among the other manufactures are food preparations, wooden ware, wagons and carriages, stoves and furnaces, boots and shoes, tobacco and cigars, flour, candy, gloves, bricks, tile and pottery, furniture, paper boxes and firearms. Utica is a shipping point for the products of a fertile agricultural region, from which are exported dairy products (especially cheese), nursery products, flowers (especially roses), small fruits and vegetables, honey and hops.

The territory on which Utica was built was part of the 22,000-acre tract granted in 1734 by George II. to William Cosby (*c.* 1695–1736), colonial governor of New York in 1732–36, and to his associates, and it was known as Cosby's Manor. During the Seven Years' War a palisaded fort was erected on the south bank of the Mohawk at the ford where Utica later sprung up. It was named Fort Schuyler, in honour of Colonel Peter Schuyler, an uncle of General Philip Schuyler. A fort subsequently built at Rome also was at first called Fort Schuyler (and afterwards Fort Stanwix), and the fort at Utica was then distinguished from it by the prefix "old" and it was as "Old Fort Schuyler" that Utica was first known. The most used trade route to the western country crossed the Mohawk here. In default of payment of arrears of rent Cosby's Manor was sold at sheriff's sale in 1792 and was bid in by General Philip Schuyler, General John Bradstreet, John Morin Scott and others for £1387, or about 15 cents an acre. Soon after the close of the War of Independence a settlement was begun, most of the newcomers being Palatine Germans from the lower Mohawk. In 1786 the proprietors had the manor surveyed. An inn was erected in 1788, and new settlers, largely New Englanders, began to arrive. Among these, in 1789, was Peter Smith (1768–1837), later a partner of John Jacob Astor, and father of Gerrit Smith, who was born here in 1797. In 1792 a bridge was built across the Mohawk. In 1797 Oneida county was established, and the village was incorporated under the name of Utica. The first newspaper, the *Gazette*, began publication in the same year, and the first church, Trinity (Protestant Episcopal), was built. The Erie Canal, completed in 1825, added to Utica's prosperity. Utica was chartered as a city in 1832.

See Pomroy Jones, *Annals and Recollections of Oneida County* (Rome, N.Y., 1851); M. M. Bagg, *Pioneers of Utica* (Utica, 1877); *Outline History of Utica and Vicinity* (Utica, 1900); and the publications of the Oneida Historical Society (Utica, 1881 sqq.).

UTILITARIANISM (Lat. *utilis*, useful), the form of ethical doctrine which teaches that conduct is morally good according as it promotes the greatest happiness of the greatest number of people. The term "utilitarian" was put into currency by J. S. Mill, who noticed it in a novel of Galt; but it was first suggested by Bentham. The development of the doctrine has been the most characteristic and important contribution of British thinkers to philosophical speculation. While British philosophizing up to a recent date has been notably lacking in width of metaphysical outlook, it has taken a very high place in its handling of the more practical problems of conduct. This is due in part, no doubt, to national character; but in the main, probably, to religious and political freedom, and the habit of discussing philosophical questions with regard to their bearing upon matters of religious and political controversy. The British moralists who wrote with political prepossessions are interesting, not merely as contributors to speculation, but as exponents of spiritual tendencies which were expressed practically in the political agitations of their times.

The history of utilitarianism (if we may use the term for the earlier history of a philosophic tendency which appeared long before the invention of the term) falls into three divisions, which may be termed theological, political and evolutional respectively. Hobbes, when he laid it down that the state of nature is a state of war, and that civil organization is the source of all moral laws, was under the influence of two great aversions, political anarchy and religious domination. It is in a clerical work written to refute Hobbes, Bishop Cumberland's *De Legibus Naturae* (pub. in 1672), that we find the beginnings of utilitarianism. Hobbes's conception of the state of nature antecedent to civil organization as a state of war and moral anarchy was obviously very offensive to churchmen. Their interest was to show that the gospel precept of universal benevolence, which owes nothing to civil enactment, was both agreeable to nature and conducive to happiness. Cumberland, therefore, lays it down that "The greatest possible benevolence of every rational agent towards all the rest constitutes the happiest state of each and all. Accordingly common good will be the supreme law"; and this supreme and all-inclusive law is essentially a law of nature. This important principle was developed by Cumberland with much originality and vigour. But his handling of it is clumsy and confused; and he does not make it sufficiently clear *why* the law of nature should be obeyed. He does, however, lay much stress upon the naturally social character of man; and this points forward to that treatment of morality as a function of the social organism which characterizes modern ethical theory. The further development of theological utilitarianism was conditioned by opposition to the Moral Sense doctrine of Shaftesbury and Hutcheson. Both these writers, more particularly the latter, had postulated in controverting Hobbes the existence of a moral sense to explain the fact that we approve benevolent actions, done either by ourselves or by others, which bring no advantage to ourselves. There was a general feeling that the advocates of the moral sense claimed too much for human nature and that they assumed a degree of unselfishness and a natural inclination towards virtue which by no means corresponded with the hard facts. The fire of human enthusiasm burnt low in the 18th century, and theologians shared the general conviction that self-interest was the ruling principle of men's conduct. Moral sense seemed to them a subjective affair, dangerous to the interests of religion. For, if the ultimate ground of obligation lay in a refined sensitiveness to differences between right and wrong, what should be said to a man who might affirm that, just as he had no ear for music, he was insensitive to ethical differences commonly recognized? Moreover, if mere sense were sufficient to direct our conduct, what need had we for religion? Such considerations prevailed where we might least expect to find them, in the mind of the idealist Berkeley. And it was another clergyman, John Gay, who in a dissertation prefixed to Law's translation of Archbishop King's *Origin of Evil* (pub. in 1731) made the ablest and most concise statement of this form of doctrine. What he says comes to this: that virtue is benevolence, and that benevolence is incumbent upon each individual, because it leads to his individual happiness. Happiness arises from the rewards of virtue. The mundane rewards of virtue are very great, but need to be reinforced by the favour or disfavour of God. Further advances along the same line of thought were made by Abraham Tucker in his *Light of Nature Pursued* (pub. 1768–74). Gay and Tucker supplied nearly all the important ideas of Paley's *Principles of Moral and Political Philosophy* (pub. in 1785), in which theological utilitarianism is summarized and comes to a close. Paley, though an excellent expositor and full of common sense, had the usual defect of common-sense people in philosophy—that of tame acquiescence in the prejudices of his age. His two most famous definitions are that of virtue as "the doing good to mankind, in obedience to the will of God and for the sake of everlasting happiness," and that of obligation as being "urged by a violent motive resulting from the command of another": both of which bring home to us acutely the limitations of 18th-century philosophizing in general and of theological utilitarianism in particular. Before we proceed to the next period of utilitarian theory we ought to go back to notice Hume's *Inquiry concerning the Principles of Morals* (pub. in 1751), which though utilitarian is very far from being theological. Hume, taking for granted that benevolence is the supreme virtue, points out that the essence of benevolence is to increase the happiness of others. Thus he establishes the principle of utility. "Personal merit," he says, "consists entirely in the usefulness or agreeableness of qualities to the person himself possessed of them, or to others, who have any intercourse with him." This is plain enough; what remains doubtful is the reason why we approve of these qualities in another man which are useful or agreeable to others. Hume raises the question explicitly, but answers that here is an ultimate principle beyond which we cannot hope to penetrate. For this reason Hume is sometimes classed as a moral-sense philosopher rather than as a utilitarian. From his point of view, however, the distinction was not important. His purpose was to defend what may be called a humanist position in moral philosophy; that is, to show that morality was not an affair of mysterious innate principles, or abstract relations, or supernatural sanctions, but depended on the familiar conditions of personal and social welfare.

The rise of political utilitarianism illustrates most strikingly the way in which the value and dignity of philosophical principles depends on the purpose to which they are applied. Abstractly considered, Bentham's interpretation of human nature was not more exalted than Paley's. Like Paley, he regards men as moved entirely by pleasure and pain, and omits from the list of pleasures most of those which to well-natured men make life really worth living: and he treats all pleasures as homogeneous in character so that they can be measured into equal and equally desirable lots. But his purpose was the exalted one of effecting reforms in the laws and constitution of his country. He took up the greatest happiness principle not as an attractive philosopheme, but as a criterion to distinguish good laws from bad. Sir John Bowring tells us that when Bentham was casting about for such a criterion "he met with Hume's *Essays* and found in them what he sought. This was the principle of utility, or, as he subsequently expressed it with more precision, the doctrine that the only test of goodness of moral precepts or legislative enactments is their tendency to promote the greatest possible happiness of the greatest possible number." These opinions are developed in his *Principles of Morals and Legislation* (pub. in 1789) and in the *Deontology* (published posthumously in 1834). Philosophically Bentham makes but little advance upon the theological utilitarians. His table of springs of actions shows the same mean-spirited omissions that we notice in his predecessors; he measures the quantity of pleasures by the coarsest and most mechanical tests; and he sets up general pleasure as the criterion of moral goodness. It makes no considerable difference that he looked for the moral sanction not to God but to the state: men, in his scheme, are to be induced to obey the rules of the common good by legally ordained penalties and rewards. He never faced the question how a man is to be induced to act morally in cases where these governmental sanctions could be evaded or did not exist in the particular state in which a man chanced to find himself. These principles of Bentham were the inspiration of that most important school of practical English thinkers, the Philosophic Radicals of the early 19th century; these were the principles on which they relied in those attacks upon legal and political abuses. From Bentham the leadership in utilitarianism passed to James Mill, who made no characteristic addition to its doctrine, and from him to John Stuart Mill. John Mill wrote no elaborate treatise on the subject. But he did something better than this. His essay *Utilitarianism* (pub. in 1863) sums up in brief and perfect form the essential principles of his doctrine, and is a little masterpiece worthy to be set beside Kant's *Metaphysic of Morals* as an authoritative statement of one of the two main forms of modern ethical speculation. Though in its abstract statement John Mill's doctrine may not differ very greatly from that of his predecessors, actually there is a vast change. To say that pleasure is the moral end is a merely formal statement: it makes all the difference what experiences you regard as pleasant and which pleasures you regard as the most important. Mill belonged to a generation in which the most remarkable feature was the growth of sympathy. He puts far greater stress than his predecessors upon the sympathetic pleasures, and thus quite avoids that appearance of mean prudential selfishness that is such a depressing feature in Paley and Bentham. Moreover, it is in sympathy that he finds the obligation and sanction of morality. "Morality," he says, "consists in conscientious shrinking from the violation of moral rules; and the basis of this conscientious sentiment is the social feelings of mankind; the desire to be in unity with our fellow-creatures, which is already a powerful principle in human nature, and happily one of those which tend to become stronger from the influences of advancing civilization." Such passages in Mill have their full significance only when we take them in connexion with that rising tide of humanitarian sentiment which made itself felt in all the literature and in all the practical activity of his time. The other notable feature of John Mill's doctrine is his distinction of value between pleasures: some pleasures, those of the mind, are higher and more valuable than others, those of the body. It is commonly said that in making this distinction Mill has practically given up utilitarianism, because he has applied to pleasure (alleged to be the supreme criterion) a further criterion which is not pleasure. But the validity of this criticism may fairly be questioned. Pleasure is nothing objective and objectively measurable: it is simply feeling pleased. The merest pleasure-lover may consistently say that he prefers a single glass of good champagne to several bottles of cooking-sherry; the slight but delicate experience of the single glass of good wine may fairly be regarded as preferable to the more massive but coarser experience of the large quantity of bad wine. So also Mill is justified in preferring a scene of Shakespeare or an hour's conversation with a friend to a great mass of lower pleasure. The last writer who, though not a political utilitarian, may be regarded as belonging to the school of Mill is Henry Sidgwick, whose elaborate *Methods of Ethics* (1874) may be regarded as closing this line of thought. His theory is a sort of reconciliation of utilitarianism with intuitionism, a position which he reached by studying Mill in combination with Kant and Butler. His reconciliation amounts to this, that the rule of conduct is to aim at universal happiness, but that we recognize the reasonableness of this rule by an intuition which cannot be further explained.

Even before the appearance of Sidgwick's book utilitarianism had entered upon its third or evolutional phase, in which principles borrowed from biological science make their entrance into moral philosophy. The main doctrine of evolutional or biological ethics is stated with admirable clearness in the third chapter of Darwin's *Descent of Man* (pub. in 1871). The novelty of his treatment, as he says, consists in the fact that, unlike any previous moralist, he approached the subject "exclusively from the side of natural history." Theological and political utilitarianism alike had been individualistic. But Darwin shows how the moral sense or conscience may be regarded as derived from the social instincts, which are common to men and animals. To understand the genesis of human morality we must study the ways of sociable animals such as horses and monkeys, which give each other assistance in trouble, feel mutual affection and sympathy, and experience pleasure in doing actions that benefit the society to which they belong. Both in animals and in human societies individuals of this character, being conducive to social welfare, are encouraged by natural selection: they and their society tend to flourish, while unsociable individuals tend to disappear and to destroy the society to which they belong. Thus, in man, do sentiments of love and mutual sympathy become instinctive and, when transmitted by inheritance, innate. When man has advanced so far as to be sensitive to the opinions of his fellow-men, their approbation and disapprobation reinforce the influence of natural selection. When he has reached the stage of reflection there arises what we know as conscience. He will approve or disapprove of himself according as his conduct has fulfilled the conditions of social welfare. "Thus the imperious word *ought* seems merely to imply the consciousness of a persistent instinct, either innate or partly acquired, serving as a guide, though liable to be disobeyed."

The most famous of the systematic exponents of evolutional utilitarianism is, of course, Herbert Spencer, in whose *Data of Ethics* (1879) the facts of morality are viewed in relation with his vast conception of the total process of cosmic evolution. He shows how morality can be viewed *physically*, as evolving from an indefinite incoherent homogeneity to a definite, coherent heterogeneity; *biologically*, as evolving from a less to a more complete performance of vital functions, so that the perfectly moral man is one whose life is physiologically perfect and therefore perfectly pleasant; *psychologically*, as evolving from a state in which sensations are more potent than ideas (so that the future is sacrificed to the present) to a state in which ideas are more potent than sensations (so that a greater but distant pleasure is preferred to a less but present pleasure); *sociologically*, as evolving from approval of war and warlike sentiments to approval of the sentiments appropriate to international peace and to an industrial organization of society. The sentiment of obligation Spencer regards as essentially transitory; when a man reaches a condition of perfect adjustment, he will always do what is right without any sense of being obliged to it. The best feature of the *Data of Ethics* is its anti-ascetic vindication of pleasure as man's natural guide to what is physiologically healthy and morally good. For the rest, Spencer's doctrine is valuable more as stimulating to thought by its originality and width of view than as offering direct solutions of ethical problems. Following up the same line of thought, Leslie Stephen with less brilliance but more attention to scientific method has worked out in his *Science of Ethics* (1882) the conception of morality as a function of the social organism: while Professor S. Alexander in his *Moral Order and Progress* (pub. in 1889) has applied the principles of natural competition and natural selection to explain the struggle of ideals against each other within society: moral evil, says Professor Alexander, is in great part a defeated variety of moral ideal. There is no doubt that much remains still to be done in illustrating human morality by the facts and principles of biology and natural history. A. Sutherland's *Origin and Growth of the Moral Instinct* (pub. in 1898) is a capable piece of work in this direction. Professor L. T. Hobhouse's *Morals in Evolution* and Professor Westermarck's *Origin and Development of the Moral Ideas* (both published in 1906) deal with the matter from the side of anthropology.

See E. Albee's *History of English Utilitarianism* (1902), a complete and painstaking survey. Leslie Stephen's *English Utilitarians* (pub. in 1900) deals elaborately with Bentham and the Mills, but more as social and political reformers than as theoretic moralists. See also ETHICS. (H. St.)

UTMAN KHEL, a Pathan tribe who occupy the hills to the north of Peshawar in the North-West Frontier Province of India. Their country lies between the Mohmands and the Ranizais of Swat, to the west and south-west of the junction of the Swat and Panjkora rivers. They claim to be descendants of Baba Utman, who accompanied Mahmud of Ghazni in his expedition into India in 997. The Utman Khel are a tall, stout and fair race, but in their dress and general customs have assimilated themselves to the neighbouring peoples of Bajour. They have none of the vices of the Yusafzais. Their country is very hilly and difficult, but well cultivated in terraces. They number some 40,000, and their fighting strength is about 8000 men. British expeditions were necessary against them in 1852, 1878 and 1898.

UTOPIA, an ideal commonwealth, or an imaginary country whose inhabitants are supposed to exist under the most perfect conditions possible. Hence the terms *Utopia* and *Utopian* are also used to denote any visionary scheme of reform or social theory, especially those which fail to recognize defects inherent in human nature. The word first occurs in Sir Thomas More's *Utopia*, which was originally published in Latin under the title *De Optimo Reipublicae Statu, deque Nova Insula Utopia* (Louvain, 1516). It was compounded by More (*q.v.*) from the Greek *οὐ*, not, and *τόπος*, a place, meaning therefore a place which has no real existence, an imaginary country.

The idea of a Utopia is, even in literature, far older than More's romance; it appears in the *Timaeus* of Plato and is fully developed in his *Republic*. The idealized description of Sparta in Plutarch's life of Lycurgus belongs to the same class of literary Utopias, though it professes to be historical. A similar idea also occurs in legends of world-wide currency, the best known of these being the Greek, and the medieval Norse, Celtic and Arab legends which describe an earthly Paradise in the Western or Atlantic Ocean (see ATLANTIS). Few of these survived after the exploration of the Atlantic by Columbus, Vasco da Gama and others in the 15th century; but in literature More's *Utopia* set a new fashion. An ideal state of society is described in the writings of Hobbes, Sir Robert Filmer and J. J. Rousseau. In Bacon's *New Atlantis* (1624–29) science is the key to universal happiness; Tommaso Campanella's *Civitas Solis* (1623) portrays a communistic society, and is largely inspired by the *Republic* of Plato; James Harrington's *Oceana* (1656), which had a profound influence upon political thought in America, is a practical treatise rather than a romance, and is founded on the ideas that property, especially in land, is the basis of political power, and that the executive should only be controlled for a short period by the same man or men. Bernard de Mandeville's *Fable of the Bees* is unique in that it describes the downfall of an ideal commonwealth. Other Utopias are the "Voyage en Salente" in Fénelon's *Télémaque* (1699); Étienne Cabet's *Voyage en Icarie* (1840); Bulwer Lytton's *The Coming Race* (1871); Samuel Butler's *Erewhon* (1872) and *Erewhon Revisited* (1901); Edward Bellamy's *Looking Backward* (1888); William Morris's *News from Nowhere* (1890); H. G. Wells's *Anticipations* (1901), *A Modern Utopia* (1905) and *New Worlds for Old* (1908). Many Utopias, such as the *Fable of the Bees* and *Erewhon*, are designed to satirize existing social conditions as well as to depict a more perfect civilization. There are separate articles on all the authors mentioned above. A large number of the more recent Utopias have been inspired by socialistic or communistic ideals; among these may be mentioned *Freiland, ein soziales Zukunftsbild* (1890) and *Reise nach Freiland* (1893), by the Austrian political economist Theodor Hertzka (b. Budapest, 1845), which portray an imaginary communistic colony in Central Africa.

UTRECHT, a town of northern Natal, 30 m. by rail E. by N. of Newcastle. Pop. (1904) 1315. It is the chief place in a district of the same name, originally settled in 1848 by emigrant Boers from Natal. They formed an independent community and in 1854 obtained, in exchange for a hundred head of cattle, formal cession of the territory from Panda, the Zulu king. In 1858 the district was united with the republic of Lydenburg, and in 1860, with Lydenburg, became part of the South African Republic. In 1903 it was, with the neighbouring district of Vryheid, annexed to Natal. The town of Utrecht is built in a hollow among the foothills of the Drakensberg. In the neighbourhood are extensive coal-fields.

UTRECHT, the smallest province of Holland, bounded S. by Gelderland and South Holland, W. by South Holland, N. by North Holland and the Zuider Zee and E. by Gelderland. It has an area of 534 sq. m. and a pop. (1905) of 276,543. It belongs chiefly to the basin of the Rhine; the Lower Rhine, which skirts its southern border, after sending off the Crooked Rhine at Wijk, becomes the Lek, and the Crooked Rhine in its turn, after sending off the Vecht at Utrecht to the Zuider Zee, becomes the Old Rhine. The north-eastern portion of the province is drained by the Eem, which falls into the Zuider Zee. The watershed between the Rhine and the Eem is formed by a plateau of sand and gravel hills which extend from the south-east corner on the Rhine to Zeist near Utrecht, and also northwards to Huizen on the Zuider Zee. On its western side the plateau declines into the clay lands (and in the north-west low fen) which characterize the western half of the province. The region of sand and gravel is covered with bare heaths and patches of woods, and the occupations of the scanty population are chiefly those of buckwheat cultivation and peat-digging, as in Drente. Amersfoort is here the only town of any size, but along the western edge of this tract there is a row of thriving villages, namely, Amerongen, Leersum, Doorn, Driebergen and Zeist. Bunschoten on the Zuider Zee is a fishing village; Venendaal, on the south-eastern border, originally a fen-colony, is now a market for the bee-keeping industry in the east. On account of the picturesqueness of this part of the province, many country houses and villa residences are found scattered about it. The western half of the province is flat and often below sea-level. Cattle-rearing and the making of cheese (of the Gouda description) and butter are here the chief occupations. Agriculture is practised along the Crooked Rhine, wheat, barley, beans and peas being the chief products, and there is considerable fruit-farming in the south-west. The development of towns, however, has here been restricted by the rise of Utrecht, the chief town of the province, as a commercial centre. A number of small old towns are found along the Rhine, the Lek and the Holland Ysel, such as Rhenen (or Reenen), Wyk-by-Duurstede, Yselstein, Montfoort. Rhenen was once the seat of an independent lordship, though afterwards joined to the bishopric of Utrecht. The ancient church has a fine tower (1492–1531). Wyk-by-Duurstede, originally a Roman settlement, was of some commercial importance as early as the 7th and 8th centuries, but decayed owing to Norman raids in the 10th century. The ruined castle of the bishops of Utrecht still remains. The lordship of Yselstein can be traced back to the younger brother of Gysbrecht IV. of Amstel, who bought lands and built a castle here before 1279. In the beginning of the next century it had grown to the size of a small town and was granted civic rights and surrounded with walls, and in the course of the following centuries was frequently attacked and even devastated. About 1377 Ystelstein descended to the house of Egmont, and in 1551 to the house of Orange, and by paying an annual contribution to the United Provinces remained an independent barony till 1795. The remains of the castle are picturesque. Montfoort owes its origin to a castle built by the bishop of Rhenen in 1170, which was frequently besieged in the 14th and 15th centuries. In 1833 it was bought by the government, and now serves as a reformatory for women. Vreeland on the Vecht has a similar origin in the castle built by Bishop Hendrik of Vianen in 1253–59 as a protection to the province against the lords of Amstel. The castle was demolished in 1529 when the province came under Burgundian rule. The province is traversed by the main railway lines, which all converge at Utrecht, and is also amply provided with navigable waterways.

The province represents the bulk of the territories once comprised in the ancient prince-bishopric of the same name, *het Sticht* (the see) of Dutch historians. The see was founded in 722 by St Willibrord, and the diocese thus formed, saving for a short time when it was an archbishopric, was subordinate to the see of Cologne. It covered all the northern Netherlands between the Scheldt and the Ems. The bishops, in fact, as the result of grants of immunities by a succession of German kings, and notably by the Saxon and Franconian emperors, gradually became the temporal rulers of a dominion as great as the neighbouring counties and duchies. Bishop Balderic (918–76) successfully defended the see against the Northmen, and received from the emperor Otto I. the right to coin money and all the land between the Leck and the Zuider Zee. The bishopric was weak, however, as compared with the neighbouring states, Holland, Gelderland and Brabant, from the mere fact of its ecclesiastical character. The bishop had no hereditary or dynastic interest in his land, and, as a temporal ruler, his powers were limited by the necessity of having to secure the goodwill of the higher clergy, of the nobles and of the cities, and also because of his relations to the German king and the pope as an ecclesiastical prince of the empire. The middle ages were marked by constant wars between the bishops of Utrecht and the counts of Holland and Gelderland. The growth of the power of Holland, however, under a succession of strong and capable rulers led to the bishopric becoming, during the 14th century, almost a dependency of the county. The death of every bishop was always the signal for violent disputes among the neighbouring feudal states, each of them intriguing to secure the election of its own candidate; but, as stated above, Brabant and Gelderland had at last to recognize the fact of the supremacy of Holland over the see. In the 15th century this supremacy passed to the dukes of Burgundy, and finally, in 1527, Bishop Henry of Bavaria sold his temporal rights to the emperor Charles V. In 1559 the see of Utrecht was by Pope Paul IV. raised to the dignity of an archbishopric. At the time of the revolt against Spain Utrecht took the Protestant side, and was one of the seven provinces which signed the Union of Utrecht in 1579. Each of these provinces retained in a large measure its sovereign rights and its own laws, privileges and customs. During the republican period the estates of Utrecht consisted of three " members." The chapter of the see was secularized, and out of the members of the five colleges a certain number, known as " the Elected " (*Geëligerden*), were chosen by the other two " members " of the estates. They held office for life, and were reckoned as the " first member " of the estates. The knights formed the " second member," the representatives being chosen by co-option. The city of Utrecht, with the four smaller towns of Amersfoort, Rheenen, Wijk-by-Duurstede and Montfoort, made up the " third member."

(G. E.)

The later history of the see of Utrecht is of considerable ecclesiastical interest. The last archbishop of Utrecht, Frederick van Schenk van Toutenburg, died in 1580, a few months before the suppression of Roman Catholic public worship by William of Orange. Two successors were nominated by Spain, both of whom were unable from political causes to take possession of the see. In 1583 the chapter elected Sasbold Vosmeer, Catholic priest at the Hague, vicar-general; the election was confirmed in 1590 by the papal nuncio at Brussels, and in 1602 Vosmeer was consecrated at Rome archbishop of Philippi *in partibus*. After Vosmeer's death (1612) Philip Rovenius van Ardensul was elected by the chapter and confirmed by the pope. In 1631 he formed the surviving members of the chapters of Utrecht and Haarlem into a collegiate body which became known as the chapter of Utrecht. Rovenius was succeeded as vicar-general in 1651 by Jacob de la Torre, consecrated as archbishop of Ephesus. Under his vicariate trouble with Rome began, the pope insisting on his right as universal bishop to appoint the vicar-general's coadjutor and successor. It was not, however, until the vicariate of Peter Codde, consecrated vicar-general with the title of bishop of Sebaste *in partibus* in 1669, that the quarrel came to a head. Codde was the nominee of the Dutch secular clergy, and these had for years past been at violent odds with the Jesuits, the champions of the ultramontane principle. The publication of an anonymous pamphlet in 1697, entitled " A Short Memoir on the State and Progress of Jansenism in Holland " (*Kort gendenkschrift van den staat en voortgang van het Jansenisme in Holland*), gave the latter their opportunity. Codde was accused of being its author, and though he successfully refuted this charge, he was ultimately deposed for Jansenism (1702), his opponent, Theodor de Kock, being appointed in his place. The result was a schism which was only temporarily checked by the expulsion of de Kock from the country by the states-general. Codde himself died in 1710. The Church of Utrecht was now without a bishop, and it was believed at Rome that the movement of revolt would soon perish for want of priests, especially as, with the constant influx of regulars, the number of Codde's adherents had steadily decreased. As a result of the publication of the bull *Unigenitus* by Pope Clement VII. in 1713, however, many French Jansenist priests took refuge in Holland, and so kept the church alive. In 1723 the chapter of Utrecht, in order to preserve the canonical succession of the Dutch clergy, elected Cornelius Steenoven archbishop. He was consecrated (15th October 1724) by Dominique Varlet, bishop of Babylon *in partibus*, who, having been deposed by the pope for Jansenism, had settled in Amsterdam in 1720. The pope replied to this by excommunicating all those who had taken part in the election and consecration. Undeterred by this, the chapter, on the death of Steenoven, elected as archbishop Cornelis Jan Burchman, who was consecrated by the bishop of Babylon on the 30th of September 1725. From this time onward the Jansenist Church of Holland has continued as an independent body, accepting the authority of the general councils, up to and including that of Trent, but basing itself on the Gallican theory of Episcopacy (*q.v.*) and rejecting the Vatican council, the infallibility of the pope and the papal dogma of the Immaculate Conception. Under Archbishop Peter Jan Meindaerts (d. 1767) two suffragan sees were created, that of Haarlem in 1742, that of Deventer in 1757. The Church had shrunk considerably since the 18th century, but in the first decade of the 20th showed signs of revival as a *point d'appui* for Catholics restive under the yoke of the ultramontanism dominant in the Roman Church. With the Church of Utrecht the Old Catholic movement in Germany at first established close relations, the first German Old Catholic bishop, Dr Reinkens, being consecrated by H. Heykamp, bishop of Deventer, in 1873. The Jansenist Church is, however, intensely conservative, and viewed with extreme disapproval the departures made by the German Old Catholics from Catholic tradition, notably in the matter of clerical celibacy. It refused, moreover, to recognize the validity of Anglican orders, and consequently to follow the example of the other Old Catholics in establishing intercommunion with the Church of England. This attitude towards the English Church was accentuated by the consecration, on the 28th of April 1908, of Mr Arnold Harris Mathew[1] as bishop of the Old Catholics in England by Dr Gerard Gul, Jansenist archbishop of Utrecht. The singular offshoot of the Church of Utrecht thus created established its headquarters in a former Congregational chapel (dedicated significantly to the Englishman St Willibrord, the first bishop of Utrecht) in River Street, London, N., the minister of which had joined the movement with his congregation. In 1910 Bishop Mathew claimed that his community numbered between 500 and 600, with ten priests, and that he had had many inquiries from both Roman Catholic priests, discontented with the Vatican policy, and Anglican clergy, uneasy about the validity of their orders (see an " interview " in the *Daily Graphic*, September 4, 1910). Meanwhile, in Holland itself the Roman Catholic hierarchy had been restored by Pope Pius IX. in 1851, with Utrecht as the archiepiscopal see. (W. A. P.)

Authorities.—K. Burmen, *Utrechtsche Jaarboeken*, &c., annals and documents (3 vols., 1750); A. Buchelius, *De Episcopis Ultrajectensibus*, containing the chronicles of J. de Beka and G. Heda (Utrecht, 1643); J. van d. Water, *Groot Placaetboek der Stadt Utrecht* (3 vols., Utrecht, 1729); J. J. de Geer, *Bijdragen tot de Geschied. en Oudheiden der Provincie Utrecht* (Utrecht, 1861); T. van Riemsdijk, *Geschied. van de Kerspelkerk van St Jacob te Utrecht* (Leiden, 1882); S. Muller, *Openbare verzamelingen der Gemeente Utrecht* (Utrecht, 1881); V. T. Blondeel, *Beschrijving der Stad Utrecht, de opvolging der Bischoppen* (Utrecht, 1757); S. Muller, *Rechtsbronnen der Stad Utrecht* (2 vols., Utrecht, 1883); R. Fruin, *Geschied. der Staats-Instellingen in Nederland* (the Hague, 1901). For the Old Catholic Church see the article "Jansenistenkirche," by Dr J. A. Gerth van Wijk, in Herzog-Hauck, *Realencyklopädie* (3rd ed., Leipzig, 1900), pp. 599–606, where further references are given.

UTRECHT, a city of Holland, capital of the province of Utrecht, on the Crooked Rhine, which here divides into the

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[1] Bishop Mathew (b. 1855) about the year 1892 claimed and for a while assumed the title of earl of Llandaff (*sic*), as grandson of Arnold Nesbit Mathew (d. 1820), who was said to have been the eldest son of the first earl of Llandaff, though neither he nor his eldest son ever claimed the title (see G. E. C(okayne)), *Complete Peerage*; corrigenda to vol. v. in vol. viii. p. 450).

Old Rhine and the Vecht. Pop. (1905) 114,321. It is an important junction station 22 m. by rail S.S.E. of Amsterdam. Tramways connect it with Vreeswyk on the Lek (where are the large locks of the Merwede canal), Amsterdam, and by way of De Bilt with Zeist, and thence with Arnhem. It is a picturesque and interesting old town with more regular streets and shady squares and fewer canals than most Dutch towns. It is an important fortress, forming the principal *point d'appui* of the line of defensive inundations called the "New Holland Water Line," in addition to its position as a railway centre. The defences consist of an inner line of works which preserve the place against surprise, and of an outlying chain of detached forts of fairly modern construction, forming roughly two-thirds of a circle of three miles radius. Of these the works facing the east would in war time cover the assembly of troops destined to operate outside the Water Line, while those of the north and south fronts would be surrounded by inundations and serve chiefly to control the sluices. The line of the ancient ramparts, demolished in 1830, is now only marked by the Singel, or outer canal, which surrounds the oldest part of the city, with pleasant gardens and promenades laid out on the inside. Two canals, the Oude and the Nieuwe Gracht, intersect the town from end to end. On the Oude Gracht the roadway and quay are on different levels, the roadway lying over vaults, which open on the quay wall and are used as cellars and poor dwelling-houses. On the east of the town is the Maliebaan or Mall, consisting of an ancient triple avenue of lime trees, now largely replanted. Utrecht is the seat of a university, and of a Roman Catholic archbishopric. It is also the seat of the archbishop of the Dutch Old Catholics. The Domkerk, dedicated to St Martin, the former cathedral church of the bishops of Utrecht, is a large Gothic building, erected in 1254–1267 on the site of the original church founded by St Willibrord about 720 and completed by Bishop Adelbold about 1015. An open space forming the heart of the square in which the church stands separates the solitary western tower (14th century) from the choir and transept, the nave having been blown down by a violent hurricane in 1674 and never rebuilt. The interior (30 ft. wide and 115 ft. high) has been clumsily fitted up with pews and galleries for Protestant worship, so that the effect of its slender columns is spoilt. It contains the monuments of Admiral van Gent (d. 1672) and of Bishops Guy of Hainaut (d. 1317) and George of Egmont (d. 1559), while in the crypt are preserved the hearts of the German emperors Conrad II. (1039) and Henry V. (1125). The Roman Catholic cathedral of St Catherine dates from 1524 and has been restored in modern times. Other churches of very early foundation in Utrecht are the Pieterskerk and the Janskerk. Attached to the Domkerk by fine old Gothic cloisters is the university, which was founded in 1634 and enlarged in 1894. The students number some 750, and there are five faculties of theology, law, medicine, mathematics and science, and letters. The *aula* (restored in 1879) was originally the chapter-house of the cathedral. Connected with the university are a valuable library, occupying the palace built for Louis Bonaparte, king of Holland, in 1807 and containing upwards of 200,000 volumes and MSS.; a museum of natural history; an ophthalmic institute; physical and chemical laboratories; a veterinary school; a botanic garden; and an observatory. The archiepiscopal museum (1872) contains examples of all branches of sacred art in the Netherlands. In the Museum Kunstliefde is a small picture-gallery, chiefly remarkable for some pictures by Jan Scorel (1495–1562); the museum of antiquities contains a miscellaneous collection. Other buildings of interest are the museum of industrial art; the so-called "Pope's house," built in 1517 by Adrian Floriszoon Boeyens, afterwards Pope Adrian VI., and a native of Utrecht; the royal mint of Holland; the Fleshers' Hall (1637); the home for the aged, occupying a 14th-century mansion; the town hall (1830); and the large hospital prison and barracks. The most important industrial establishments are cigar manufactories, manufactories of chemicals and earthenware, and brass foundries, and there is also an active trade in the agricultural produce of the surrounding country.

The country round about Utrecht is pretty and plentifully studded with country houses, especially on the road to Arnhem. Close by, on the north-east, is the village of De Bilt, the seat of the Dutch Meteorological Institute. In this parish was formerly situated the famous Benedictine convent of Oostbroek, founded in the beginning of the 12th century. The abbey was demolished in 1850. The manor of Zuilen on the Vecht, four miles north-west of Utrecht, was partly held in fief from this abbey and partly from the bishops of Utrecht. The lords of Zuilen grew very powerful and built a castle here at the end of the 13th century. In 1302 this possession passed by marriage to the influential family of van Borsele, lords of Veere and governors of Zeeland. But on the extinction of that house towards the end of the 15th century the castle passed through various hands until it came by marriage in 1665 to the family of Baron van Tuyll van Serooskerke. The castle was carefully restored in 1752, and is still in excellent preservation. Five miles east of Utrecht is the village of Zeist, the seat of a Moravian settlement established here in 1746. There are also a fine castle (1667) and grounds, a sanatorium for children and numerous modern villa residences. At Ryzenburg, close by, is a Roman Catholic seminary, founded in connexion with the establishment of the Roman Catholic hierarchy in 1853 and practically serving as an archiepiscopal palace.

Utrecht (*i.e. Oude Trecht* or Old Ford, rendered in Latin documents *Vetus Trajectum*) is a city of great antiquity and much historic interest, especially as illustrating the growth of civic liberties during the middle ages. The place existed in Roman times and is mentioned in the itinerary of Antoninus. Though the name *Trecht* or *Trajectum* is almost universally found in old documents and on coins, the town was known by another name among the Frisians and Franks. Bede, writing in the 8th century, speaks of *Wiltaburg, id est oppidum Wiltorum, lingua autem Gallica Trajectum vocatur*. That any such people as the Wilten existed there is little evidence, but Wiltaburg (or variants of it) occurs in chronicles as late as the 12th century, and it is still preserved in the name Wildenburg, given to a Roman camp near the city.

The earliest authentic record of the town is that of the building of a chapel—afterwards destroyed by the heathen Frisians—by Dagobert I., king of the Franks, in 636; but the importance of the place began when St Willibrord (*q.v.*), the apostle of the Frisians, established his see there. This fact determined the development of the city. The bishop's seat had to be fortified against the incursions of the heathen Frisians and Northmen, and the security thus afforded attracted population till, after the destruction of its rival Dorestad by the Normans in the 9th century, Utrecht became the chief commercial centre of the northern Netherlands. Bishop Balderic (A.D. 918–976) was the real founder of the prosperity of the town. On his accession to the see Utrecht had just been sacked by the Northmen. He succeeded in driving the raiders away, rebuilt the walls, and during the fifty-eight years of his episcopate the town grew and prospered. Its gradual acquisition of civic rights followed the same line of development as in the German episcopal cities. At first the bishop, holding immediately of the Empire, was supreme. In feudal subordination to him a royal count, who was also *Vogt* (*advocatus*) of the cathedral church of St Martin, had his seat at Utrecht as the chief town of the *Gouw* (*Gau, pagus*) of Ifterlake. In the 11th century a burgrave (châtelain, *castellanus*), who was an episcopal officer, is found exercising jurisdiction in the city as well as the Vogt. Bishop Godebald (1122–1127) granted to the inhabitants of Utrecht and of Muiden, the neighbouring port on the Zuider Zee, their first privileges, which were confirmed on the 22nd of June 1122 by the emperor Henry V., who died at Utrecht in 1125. The extant imperial charter does not specify what were the municipal rights that were conceded, but it is certain that at this time they were very limited. The magistrates, the *Schout* or high bailiff and his assessors, the *Schepenen* (*scabini, échevins*), were nominated by the burgrave from the order of knights. In 1196 we read for the first time of councillors (*consules, consiliarii, adjurati*) as assessors of the magistrates, but these, who a little later were known as the *Raad* or council, were also nominated. The position was simplified when, in 1220, Albert van Cuyck, the last of the hereditary burgraves, sold his rights to the bishop. These ecclesiastical princes were churchmen in little but name, and their desire to be absolute rulers found itself confronted by the determination of the burghers to secure greater independence. As the 13th century advanced, the council, representing the wealthy and powerful gild of merchants, began to take a larger share in the government, and to restrict more and more the direct exercise of the episcopal authority. Of the rise of the craft gilds in Utrecht there is no record. They appear suddenly as fully developed organized corporations, able to impose their will upon bishop and aristocracy. All through the 13th century a continual struggle went on, but at last the gilds were victorious and were able to secure in the *Gildebrief* of 1304, confirmed by the bishop in 1305, a new constitution for the city. According to this, as emended by a later Gildebrief of 1347, the existing board of seven Schepenen were to retain office for life, but the new ones, elected yearly, were in future to be chosen by the Raad either in or outside the gilds. The Raad itself was to be chosen by the aldermen of the gilds. Two aldermen, later styled burgomasters, were to preside, the one over the Schepenen, the other over the Raad, sharing this presidency with two episcopal officials. The Schout was still to be nominated by the bishop from among the knights, but his powers were now comparatively insignificant. The two chief aldermen of the gilds, with the two episcopal official presidents above mentioned, together were to form the supreme government of the city. The victory of the democratic principle was entirely new in the Netherlands, though it had been anticipated in Florence, and was perhaps inspired by Italian example. In all other cities of the Netherlands the craft gilds remained in humble subjection to a council co-opted from a limited number of wealthy patrician families. In Utrecht, however, power was henceforth concentrated in the gilds, which became not only trade but political associations, which together constituted the sovereign community. In this government, though the Schepenen retained a dignified precedence, all power was practically concentrated in the popularly elected Raad, even the estates of the see (*Sticht*) had "nothing to say in the city."

The new liberties, as might be expected, did not tend to improve the relations between the town of Utrecht and its ecclesiastical sovereign; and the feud reached its climax (1481–84) in the "groote vorlag," or great quarrel, between the citizens and Bishop David, the Bastard of Burgundy, who had been foisted upon the unwilling chapter by the combined pressure of Duke Philip of Burgundy, his half-brother, and the pope. With the aid of John, burgrave of Montfoort, who had been called in, after the manner of the Italian podestas, and endowed with supreme power for the defence of the town, the Utrechters defeated all the efforts of their bishop, aided by the Hollanders and an aristocratic faction. They only succumbed when the weight of the archduke Maximilian was thrown into the scale against them (1484). Even then Bishop David was once more expelled in 1491. The last prince-bishop of Utrecht was Henry of Bavaria, who was elected, in May 1524, in succession to Philip of Burgundy. He took the part of the nobles against the burghers, but Duke Charles of Gelderland, jealous of the growing power of the house of Habsburg, intervened, put an end to the strife, and, in 1527, himself occupied the city. In July of the next year Bishop Henry was back again, having gained possession of the city by surprise; and in the following October he sold his temporal rights to the emperor Charles V. Utrecht, thus brought into immediate relations with the Spanish Habsburgs, proved no more tolerant of their rule than of that of its bishops, and took a leading part in the revolt of the Netherlands. The union of the seven northern provinces, proclaimed at Utrecht in 1579, laid the foundation of Dutch independence (see NETHERLANDS). The city proved indeed a refractory member of the new league; and, after the death of William the Silent, the Utrechters, jealous of the influence of their old enemies the Hollanders, refused to recognize the authority of the council of state, and elected a stadtholder of their own. Inside the city the old aristocratic and democratic factions still carried on their traditional struggle, complicated now by religious difficulties. The Roman Catholics, though still in the majority in the bishopric, had little influence on the politics of the city, where the aristocrats inclined to the moderate (libertine) opinions advocated by the preacher Hubrecht Duifhuis, while the democrats were organized in the new church order introduced by the uncompromising Calvinist Petrus Dathenus (d. 1581). The adhesion of Utrecht to the party of revolt was the work of the aristocratic party, and the critical state of affairs made it for a while dominant in the town. The gilds and burgher militia were deprived of all voice in the government, and the town council became an hereditary body. After the advent of the earl of Leicester as governor-general of the Netherlands in 1585, a change took place. The ultra-Calvinistic Adolph, count of Nuenar, who was elected stadtholder, overthrew the aristocratic government and placed the people in power. The Utrechters, under the leadership of Gerard Prouninek, otherwise Deventer, vehemently took the side of Leicester in his quarrel with the estates of Holland, and the English governor-general made the town his headquarters during residence in the Netherlands, and took it under English protection. Though heartily disliked in Holland, Leicester made himself so popular in Utrecht that the burgher guard even presented him with a petition that he would assume the sovereignty. The withdrawal of Leicester from the Netherlands was followed by the defeat of Deventer and the return of the aristocratic party to power. The issue was decided (October 5, 1558) when the democrats were defeated in battle. Deventer was imprisoned and banished, and the former Schout, Nicolas van Zuylen van Sevender, was restored to office. An attempt of the democratic party to regain power was temporarily successful (January 10, 1610); but the estates appealed to the States General and Maurice of Nassau, who had been appointed stadtholder on the death of Nuenar, put down the movement with a strong hand, and the Utrechters found themselves compelled to yield. From this time, until the French Revolution, the ancient democratic institutions of the city remained nothing but a name; the rights of the community were exercised by a municipal aristocracy, who held all power in their own hands. The gilds, once supreme, henceforth ceased to have any political importance. At Utrecht the treaty which closed the War of the Spanish Succession was signed on the 11th of April 1713. (G. E.)

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UTRECHT, TREATY OF, the general name given to the important series of treaties which in 1713 and 1714 concluded the great European war of the Spanish Succession (*q.v.*), and by which *inter alia* England obtained possession of Newfoundland, Nova Scotia and Gibraltar.

Worsted, mainly through the genius of Marlborough, in his efforts to secure the whole of the great Spanish monarchy for his grandson, Philip, duke of Anjou, Louis XIV. made overtures for peace in 1706 and again in 1709. These were rejected, and failure also attended the negotiations between France and the United Provinces which took place at Gertruydenberg in 1710, negotiations only entered upon by the Dutch after they had by a treaty with England (October 1709) secured a guarantee that they would obtain the coveted barrier of fortresses against France. But matters changed greatly during 1710 and 1711. In England in August and September 1710, the Tories, the party of peace, succeeded the Whigs, the party of war and the inheritors of the tradition of William III., in the conduct of affairs. In the Empire in April 1711, the archduke Charles, Philip's rival for the throne of Spain, succeeded his brother Joseph I. as ruler of Austria and became prospective emperor, and England and the United Provinces, having waged a long and costly war to prevent the union of the crowns of France and Spain, were equally averse from seeing Spain and Austria under the same ruler. Moreover, the allies realized at last that it was impossible to dislodge Philip from Spain, and all the peoples were groaning under the expenses and the sufferings of the war. France and England came to terms, and the preliminaries of peace were signed in London in October 1711, their basis being a tacit acquiescence in the partition of the Spanish monarchy.

The congress opened at Utrecht on the 29th of January 1712, the English representatives being John Robinson, bishop of Bristol, and Thomas Wentworth, earl of Strafford. Reluctantly the United Provinces accepted the preliminaries and sent representatives, but the emperor refused to do so until he was assured that these preliminaries were not binding. This assurance was given, and in February the imperial representatives made their appearance. As Philip was not yet recognized, as king, Spain did not at first send plenipotentiaries, but the duke of Savoy sent one, and Portugal was also represented.

One of the first questions discussed was the nature of the guarantees to be given by France and Spain that these crowns would be kept separate, and matters did not make much progress until after the 10th of July 1712, when Philip signed a renunciation. Then, England and France having concluded a truce, the pace was quickened and the main treaties were signed on the 11th of April 1713.

By the treaty between England and France Louis XIV. recognized the Protestant succession in England and undertook to give no further aid to the Stuarts. France ceded to England Newfoundland, Nova Scotia or Acadia, the island of St Kitts or St Christopher, and the Hudson's Bay Territory ("sinum et fretum de Hudson, una cum omnibus terris, maribus, maritimis, fluviis, locisque, in dicto sinu et freto sitis"), and promised to demolish the fortifications of Dunkirk and to fill up its harbour. A commercial treaty signed between the two countries on the same day provided that each should allow the other the most favoured nation treatment, while each gave up the claim to the indiscriminate seizure of shipping which had been practised during the war.

The treaty between France and the United Provinces was mainly concerned with securing the barrier of fortresses. These arrangements were somewhat complicated and to a large extent provisional, as Austria and Bavaria, two countries which were deeply interested in the fate of the Netherlands, had not yet assented to the terms of peace. By a commercial treaty concluded on the same day, France gave to the Dutch commercial privileges similar to those enjoyed by England. Other treaties concluded at the same time were between France and Savoy, France and Prussia, and France and Portugal. By the first the duke of Savoy regained Savoy and Nice, taken from him during the war, and France undertook to obtain for him the island of Sicily and the title of king. By the second Prussia secured some small additions of territory, including part of Gelderland and Neuchâtel; in return France definitely and finally obtained the principality of Orange. It is interesting to note that as a constituent of the Empire Prussia was still fighting against France. The treaty between France and Portugal mainly concerned the Portuguese settlements in Brazil, her claim to these being recognized by France.

Other treaties were signed at Utrecht between Spain and the allies, Philip now concluding these as the recognized and lawful king of Spain. On the 13th of July 1713 a treaty was signed between England and Spain, which embodied certain commercial arrangements previously made between the two countries. Spain ceded to England Gibraltar and Minorca and promised to give up Sicily to Savoy. She gave also to England the monopoly for thirty years of the lucrative slave trade with Spanish America, hitherto enjoyed by France: this was the famous Asiento treaty. Finally, there was an article concerning the inhabitants of Catalonia, who had fought bravely for Charles of Austria, and who had a large claim upon the protection of England. However, the protection granted to them was a mere sham, and the Catalans were soon the victims of the revenge of Philip of Spain. The peace between Spain and the United Provinces was signed on the 26th of June 1714, but the conclusion of the one between Spain and Portugal was delayed until the following February. The former was concerned mainly with commercial matters, Spain giving the United Provinces the treatment of a most favoured nation, except as regards Spanish America. The latter dealt with the frontier between the two countries and with the colony of St Sacrament in Uruguay, which was transferred to Spain.

The treaty of Utrecht also provided some compensation for the emperor Charles VI. as soon as he surrendered his claim to Spain. It was arranged that he should receive Naples and Milan, and also the Spanish Netherlands, henceforward known as the Austrian Netherlands.

But the general pacification was still incomplete, as France and the Empire continued the war, albeit somewhat languidly. It was not long, however, before Charles VI. realized how inadequate were his forces, unsupported by those of England and of Holland, to meet the armies of France, and towards the close of 1713 he was for the first time seriously inclined to consider conditions of peace. Accordingly, his representative, Prince Eugene, met the French marshal Villars at Rastatt in November 1713, and here, after negotiations had been broken off and again resumed, peace was made on the 7th of March 1714, Charles VI. concluding the treaty without waiting for the assent of the different states of the Empire. This consent, however, was necessary, and a little later the representatives of some of the princes of the Empire met those of France at Baden, where, on the 7th of September 1714, the treaty of Baden, the last of the treaties included in the general peace of Utrecht, was signed. This dealt entirely with the question of the frontier between France and the Empire, which was restored as it was before the outbreak of the war except that France gained Landau.

One important matter dealt with at Utrecht remains to be mentioned. A second barrier treaty between England and the United Provinces was signed on the 30th of January 1713, and a third treaty signed at Antwerp on the 15th of November 1715 clinched the matter. Seven fortresses were to be garrisoned by a total of 35,000 men, three-fifths of the cost being borne by the imperial government and the remainder by the United Provinces.

The treaty of Utrecht is second to none in importance in English history. Its provisions were a most potent factor in assisting the expansion of England's colonial empire and also in the building up of the country's commercial greatness. In the domestic politics of the 18th century, too, the peace has a great and recurring importance. Its terms were bitterly assailed by the Whigs, and after the accession of George I. four of its Tory authors, Bolingbroke, Oxford, Ormonde and Strafford, were impeached for concluding it, the charges brought against them being that they had corresponded with the queen's enemies and had betrayed the honour and interest of their own country, while the abandonment of the Catalans was not forgotten.

The text of the treaty of Utrecht is published as the *Actes, mémoires et autres pièces authentiques concernant la paix d'Utrecht* (Utrecht, 1714–1715); and by C. W. von Koch and F. Schöll in the *Histoire abrégée des traités* (1817–1818). As far as it concerns the party politics of England, there is much about the peace in Dean Swift's works. See also C. Giraud, *La Paix d'Utrecht* (Paris, 1847); I. S. Leadam, *Political History of England 1702–1760* (1909); A. W. Ward in the *Cambridge Modern History*, vol. v. (1908), and the *State Trials* for the proceedings against the impeached English ministers. But perhaps the most valuable work on the whole peace is O. Weber's *Der Friede von Utrecht. Verhandlungen zwischen England, Frankreich, dem Kaiser und den Generalstaaten 1710–1713* (Gotha, 1891). (A. W. H.*)

UTRERA, a town of southern Spain, in the province of Seville; on the Arroyo de la Antigua, a right-hand tributary of the river Guadalquivir, and at the junction of the Seville-Cadiz and Cordova-Utrera railways. Pop. (1900) 15,138. Utrera contains few noteworthy buildings, although it is an ancient town, still partly surrounded by medieval fortifications. The principal church, Santa Maria, is Gothic in style, dates from the 15th century, and contains some interesting tombs; but it was to a great extent restored in the 17th century. Agriculture and especially stock-farming are foremost among the local industries, which also include manufactures of leather, soap, oil and spirits. Large numbers of horses, sheep and fighting bulls are bred in the moorlands and marshes which extend eastward towards the Gaudalquivir, and a fair is held yearly in September for the sale of live stock and farm produce. Utrera was occupied by the Moors in the 8th century, and, though retaken by St Ferdinand (1230–52), was not finally incorporated in the kingdom of Castile until 1340. In the middle ages it was notorious as a favourite refuge of brigands and outlaws.

UTTARPARA, a town of British India, in the Hugli district of Bengal, on the river Hugli. Pop. (1901) 7036. It is famous for the public library founded and endowed by Jai Krishna Mukharji, which is specially rich in books on local topography. There is an aided college, and a girls' school supported by a native association.

UTTOXETER, a market town in the Burton parliamentary division of Staffordshire, England, 15 m. N.E. by E. of Stafford by a branch of the Great Northern railway. Pop. of urban district (1901) 5133. It is also served by the North Staffordshire railway. The town lies pleasantly on high ground near the river Dove, a western tributary of the Trent, here the boundary with Derbyshire. There are large works for the manufacture of agricultural implements, and brewing and brick-making are carried on. Several agricultural fairs are held annually. The church of St Mary has a fine decorated tower and spire; the rest of the fabric dates from 1828. Alleyn's grammar-school was founded in 1558. In the market-place here Dr Johnson stood hatless in the rain doing voluntary penance for disobedience to his father. A bas-relief commemorates the incident. The name of the town is locally Uxeter, or an approximate pronunciation. At Denstone, 5 m. N. of Uttoxeter, is St Chad's College, a large middle-class school for boys, founded in connexion with St Nicholas' College, Lancing

Uttoxeter (*Wotocheshede, Uttokeshather, Utcester, Uttoxater*) was probably not a Roman site, although the termination of the name suggests one, and a few remains have been discovered. It formed part of the estates of Algar, earl of Mercia; at the time of the Domesday Survey it was held by the king; later it passed to the Ferrers family and was included in the honour of Tutbury. In the early 12th century Earl Robert de Ferrers constituted Uttoxeter a free borough, and granted to the inhabitants freedom from all tolls, tonnage, poundage and other exactions. These privileges were confirmed and amplified by a charter, dated August 15, 1251, from William de Ferrers, earl of Derby. Uttoxeter, with the rest of the honour of Tutbury, escheated to the Crown in 1266 owing to the complicity of Robert Ferrers in the barons' rebellion; it was regranted to Edmund Crouchback, ancestor of the dukes of Lancaster, under whom it became part of the duchy of Lancaster, from which it was not severed until 1625. The Wednesday market, which is still held, was granted by Henry III. to William Ferrers, earl of Derby, together with a fair to be held on the feast of the Nativity of the Blessed Virgin (September 8), which was kept up in the 18th century. In 1308 Thomas, earl of Lancaster, obtained the grant of a fair on the vigil, day and morrow of St Mary Magdalene. In Leland's time "the men of the town used grazing" in the "wonderful pastures upon Dove," and in the 17th and 18th centuries the market was the greatest in that part of England for cattle and provisions; in the 18th century it furnished cheeses to many London cheesemongers. In 1648, on the defeat of the invading Scottish army under the marquis of Hamilton by Cromwell, its leader was captured here by Lambert.

UXBRIDGE, a market town in the Uxbridge parliamentary division of Middlesex, England, 18 m. W. by N. of St Paul's Cathedral, London, on the river Colne, and on branches of the Great Western and Metropolitan railways. Pop. of urban district (1901), 8585. There are breweries, foundries and engineering works, and a considerable traffic is carried on by means of the Grand Junction Canal. The town, which is connected by electric tramway with Hammersmith, London, has extended considerably in modern times as a residential centre. The church of St Margaret is Perpendicular, and retains a fine font in that style, and several ancient monuments.

Uxbridge is an ancient borough, stated to have been one of those originated by Alfred the Great, but it is not mentioned in Domesday. Here negotiations were begun, on the 30th of January 1645, between the commissioners of Charles I. and the parliament, but were broken off on the 22nd of February. A part of the "Treaty House," in which they were carried on, remains. In 1647 the parliamentary forces had for some time their headquarters in the town. It remained a garrison town until 1689. It obtained the grant of a market from Henry II.

UXMAL, a deserted city of the Mayas in the state of Yucatán, Mexico, 20 m. W. of Tikul, a station on the railway between Merida and Valladolid. The ruins stand on a wooded plain, and cover an area of a little more than half a mile square, although fragments are found over a much larger space. Uxmal is the largest and most important of the deserted cities of Yucatán, and shows some of the finest specimens of Maya architecture. The climate is much drier than that of Chiapas, and the structures are in a better state of preservation than those of Palenque, but the rank vegetation and the decay of the wooden lintels over the doorways have broken down many of the walls. Uxmal was inhabited for some time after the Spanish conquest, but perhaps only by a remnant of a population once much larger. The neighbourhood is now very unhealthy, and it may be presumed that the process of depopulation, caused by increasingly unhealthy conditions and diminishing sources of food supply, was gradual. There are no streams near the ruins, and the water-supply was derived from cisterns and from a few pools now filled with soil and vegetation. A rather soft limestone was used in the buildings, but the locality of the quarries has not been discovered. The walls are commonly about 3 ft. thick, in some cases much thicker, and the stones were set in a whitish mortar. Stone implements were used. The outer surfaces of the walls are usually divided by a horizontal moulding into two unequal zones, the lower one plain with a band of sculptured ornaments at the base, and the upper elaborately sculptured. The interior walls were generally plastered and rarely ornamented. There are no windows, but large doorways. The jambs were of dressed stone, usually plain, and the longer lintels were of zapote wood; some of them, where protected from the weather, are still to be seen, sometimes covered with inscriptions. The buildings are rectangular in shape, long and narrow, divided usually into two ranges of rooms. They are generally arranged in groups of four, enclosing a quadrangular court, and sometimes singly on massive eminences. The interiors are cut up into numerous small rooms by transverse partitions, while numerous beam-holes and dumb-sheaves indicate other divisions. The rooms are covered by acutely pointed vaults, the stones forming the sides of the vault being bevelled to the angle, and the apex being covered by capstones covering spaces of one to two feet. The spaces between the vaults are filled with solid masonry, and above all is the roof covering, also of masonry, which is sometimes surmounted with an ornamental roof-comb. The buildings stand upon raised terraces, or upon truncated pyramids, approached by broad stairways, usually of cut stone.

There are five principal buildings or groups—the Temple of the Magician, Nunnery Quadrangle, House of the Turtles, House of the Pigeons and Governor's Palace. There are other structures and groups, smaller and more dilapidated. One of them, standing immediately S. of the Nunnery, consists of two parallel walls only; it is usually described as the ball-court, or gymnasium, a structure common to most Maya cities. The Temple of the Magician crowns an unusually steep pyramid 240×180 ft. at the base and 80 ft. high. It has three rooms, and a smaller temple is built against the upper western side of the pyramid. A broad steep stairway ascends to the summit platform on the E., and a narrower stairway to the lower temple on the W. The west front is filled with remarkable figures and designs, including the lattice work common in Uxmal. The Nunnery Quadrangle consists of four large rectangular independent buildings, enclosing a quadrangular court, the whole occupying a terrace over 300 ft. square at the base and upwards of 15 ft. above the level of the plain. The buildings resemble each other in the arrangement of their rooms, and their elaborately ornamented façades face inwards upon the court. The division of the buildings into numerous small rooms is understood to signify that they were used as communal habitations, possibly of priestly orders. The Governor's Palace, standing upon a triple terrace S. of the Nunnery, is, according to W. H. Holmes, "the most important single structure of its class in Yucatán, and for that matter in America." It is 320 ft. long, 40 ft. wide and 25 or 26 ft. high, divided into a long central and two end sections, separated by recesses and two transverse archways about 25 ft. long, 10 ft. wide and 20 ft. high. These archways were subsequently blocked, and may have been intended originally as portals to a quadrangle which was never built. The upper zone of the exterior walls is about 10 ft. wide, exclusive of the mouldings and ornamental frieze, and its total length of 720 ft. is crowded with sculptures, in which there are three principal motives—the mask, the fret and the lattice. The projecting snouts in the line of masks forming the upper part of this zone are a peculiar feature of Uxmal ornamentation. The House of the Turtles is a comparatively small structure near the N.W. corner of the Governor's Palace. It has the same features found in the other structures except for a line of sculptured turtles on the mouldings of the frieze. Immediately S.W. of the Governor's Palace is a huge truncated pyramid, 200×300 ft. at the base and 60 to 70 ft. high. Beyond this is another large quadrangular group known as the House of the Pigeons. It resembles the Nunnery Quadrangle, except that the northern building carries a peculiar roof-comb of colossal size, running its entire length and rising to a height of about 16 ft. The base of this comb is 4 ft. high, capped by a moulding and perforated by over 50 openings. Above this the comb is divided into nine sections rising by large steps to the apex, each pierced by 30 or more openings, like an immense dovecote. Projecting stones suggest that they were built to carry statues or figures like the roof-combs of Palenque.

UZ, JOHANN PETER (1720–1796), German poet, was born at Ansbach on the 3rd of October 1720. He studied law, 1739–43, at the university of Halle, where he associated with the poets Johann Ludwig Gleim (*q.v.*) and Johann Nikolaus Götz (*q.v.*), and in conjunction with the latter translated the odes of Anacreon (1746). In 1748 Uz was appointed unpaid secretary to the *Justizcollegium*, an office he held for twelve years; in 1763 he became assessor to the imperial court of justice at Nuremberg, in 1790 was made a judge and, on the annexation of

Ansbach to Prussia (2nd of December 1791), entered the Prussian judicial service, and died, shortly after his appointment as *Landrichter*, at Ansbach on the 12th of May 1796. Uz wrote a number of graceful lyrics in Gleim's style, and some patriotic odes; he is the typical representative of the rococo period in German poetry. In 1749 the first collection of his *Lyrische Gedichte* was anonymously published. He also wrote, in alexandrines, *Der Sieg des Liebesgottes* (1753), a close imitation of Alexander Pope's *Rape of the Lock*, and a didactic poem, *Versuch über die Kunst stets fröhlich zu sein* (1760).

A complete edition of Uz's works—*Sämtliche Poetische Werke*—was published at Leipzig, 1768; a new edition (Vienna, 1804), which has been often reprinted. A critical edition was published by A. Sauer in 1890. See Henriette Feuerbach, *Uz und Cronegk* (1866), *Briefe von Uz an einen Freund aus den Jahren 1753–82* (published by A. Henneberger (1866) and E. Petzet, *Johann Peter Uz* (Ansbach, 1896).

UZ. The "land of Uz" (ארץ עוץ) is best known as the scene of the story of Job. Its precise location is a matter of uncertainty, opinion being divided between a position N. of Palestine ("Aram Naharaim") and one to the S.E., in the neighbourhood of Edom. In favour of the former are the references in Gen. x. 23, xxii. 21, the inclusion of Job among "the children of the East," the possibility that Bildad the Shuhite (cf. Gen. xxv. 2, 6) belonged to the Sūḫu, a people living on the right bank of the Euphrates, and the description of Elihu as a Buzite (xxxii. 2). Whether the name Uz is found or not in the cuneiform inscriptions is disputed. In favour of the S.E. position we have the description of Elihu as of the family of Ram[1] which (1 Chron. ii.) was a distinctly southern people, the fact that Eliphaz was a Temanite (*i.e.* he came from Edom, cf. Gen. xxxvi. 4) and the references in Gen. xxxvi. 28 and Lam. iv. 21. The mention of Uz in Jer. xxv. 20 is probably a gloss. While Edom and Uz are not to be identified, the traditional association of "wisdom" with Edom may incline us to place the Uz of Job in its neighbourhood rather than in that of the Euphrates. The tradition which places Job's home in Hauran has no value. It is worth noting that the Septuagint forms from Uz the adjective *Αὐσῖτις*, which points to a pronunciation *Auṣ*=Arabic *Auḍ*, the name of a god whose worship was widely spread and might therefore be readily borne by tribes or attached to districts in several regions.

UZÈS, a town of southern France, capital of an arrondissement in the department of Gard, finely situated on an eminence above the Alzon, 16 m. N. by E. of Nîmes by road. Pop. (1906) 4008. Uzès, the seat of an episcopal see from the 5th century to 1790, has a cathedral almost destroyed by the Protestants during the religious wars and rebuilt in the 17th and 18th centuries, but still flanked by a round tower of five storeys lighted by arched openings and dating from the 12th century. The Duché, a château of powerful lords, at first viscounts, and in 1565 dukes, of Uzès, preserves a donjon originally of the 12th century; the main building, flanked by a Gothic chapel, is Renaissance in style. The most ancient structure in the town is a crypt beneath a private house, attributed to the early centuries of the Christian era. The sub-prefecture and the tribunal of first instance occupy the old bishop's palace (17th century). There is a statue of Admiral Brueys (1753–1798), a native of the town. Uzès has a communal college for boys, and carries on the manufacture of silk, bricks and fireproof earthenware, and liquorice, and trade in the truffles for which the district is noted.

UZHITSE (also written Užice and Ushitsa), the capital of the Uzhitse department of Servia. As implied by its name, which may be translated "the narrow places," Uzhitse is built in a narrow and lonely glen amongst the south-western mountains, 1385 ft. above the sea. The surrounding heights, though rugged and barren, produce some of the finest Servian tobacco. Weaving is taught in the girls' school, and fairs are held for the sale of farm produce; but the absence of a railway and the badness of the roads retard commerce. Uzhitse possesses a court of first instance and a prefecture. Despite the prevailing poverty, it has also a real-school with good buildings, founded in 1865, and attended by about 300 pupils in 1900. The houses in Uzhitse are quite unlike those of more prosperous Servian towns, being tall, narrow structures of timber, frequently blackened by the damp. Pop. (1900) about 7000.

Early in the 13th century Uzhitse was the seat of St Sava, the first archbishop, and the patron saint of Servia. The archbishopric was soon removed to Ipek, in Old Servia; but after the Turkish garrison had been expelled in 1862 the city became once more the head of a diocese. At Arilye, 13 m. E.S.E., there is a 13th-century church, dedicated to St Aril, who, according to tradition, was martyred in the 9th century by unconverted Serbs. On the Bosnian frontier, 15 m. W. by N., are the mineral springs of Bayina Bashta (*i.e.* "the Garden Bath"), with Racha monastery close by; and in the neighbourhood is Dobrinye, the home of the Obrenovich family, with a church built by Milosh Obrenovich, called "the Liberator of Servia" (1818–1839).

UZZIAH (Heb. for "Yah[weh] is [my] strength"), more correctly Azariah (Hebrew for "Yah[weh] helps"), son of Amaziah, grandson of Joash I., and king of Judah (2 Kings xiv. 22, xv. 1–7). Of his long reign of fifty-two years little is recorded. He recovered Elath at the head of the Aelanitic Gulf, evidently in the course of a successful campaign against Edom (a possible reference in Isa. xvi. 1); we read further in 2 Chron. xxvi. of great wars against Philistines, Arabians and Meunim, of building operations in Jerusalem (probably after the attack by Joash), and of political and social reforms. The prosperity which Judah enjoyed during this period (middle of 8th century) is illustrated by the writings of Amos and by the earliest prophecies of Isaiah (*e.g.* ii. 6 sqq.). In his old age Uzziah was a leper (2 Kings xv. 5), and the later history (2 Chron. xxvi. 16 sqq.) regarded this as a punishment for a ritual fault of which the king was guilty; whilst Josephus (*Ant.* ix. 10. 4) records the tradition that on the occasion of his transgression the land was shaken by the terrible earthquake to which Amos i. 1 and Zech. xiv. 5 refer. During Uzziah's seclusion his son Jotham acted as regent. The growing power of Judah, however, aroused the jealousy of Israel, which, after the death of Jeroboam (2), had fallen on evil days (see Menahem). Jotham's victory over Ammon (2 Chron. xxvii. 5) could only increase the hostility, and preparations were made by Israel for an alliance with Damascus which culminated in an attack upon Judah in the time of Jotham's son, Ahaz (*q.v.*).

The identification (Schrader, McCurdy, &c.) of Azariah with Azriyau of Ja'udi, the head of a North Syrian confederation at Hamath (Hamah) overcome by Tiglath-Pileser IV. (738 B.C.), conflicts with the chronological evidence, with what is known of Uzziah's life and policy, and with the historical situations represented in the Biblical narratives (see Winckler, *Alttest. Forschungen* [1893], i. 1–23; S. A. Cook, *Ency. Bib.* col. 5244; Whitehouse, *Dict. Bib.* iv. p. 844 seq.; id. *Isaiah*, p. 9 seq.; Skinner, *Kings*, p. 359). On the other hand, the interrelation of events in Palestine and Syria during this period combine with the sudden prominence of Judah (under Uzziah) and the subsequent anti-Judaean and anti-Assyrian coalition (against Ahaz) to suggest that Uzziah had been supported by Assyria (cf. Winckler, *Keilinschr. u. d. Alte Test.*, 3rd. ed., p. 262). In fact, since the Biblical evidence is admittedly incomplete, and to a certain extent insecure, the question of the identification of Azariah of Judah and Azriyau of Ja'udi may be reopened. See H. M. Haydn, *Journ. of Bibl. Lit.*, xxviii. (1909), pp. 182–199, and artt. Jews, §§ 13 (beginning), 15; Palestine, *Old Test. Hist.* (S. A. C.)

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[1] Perhaps a mistake or an abbreviation for Aram.

V This letter was originally, like Y, only one of the earlier forms of the letter U. According to Florio (1611) V is "sometimes a vowel, and sometimes a consonant." In modern times attempts have been made to assign to it the consonantal value of U, but in English another symbol W is used for this, while V has received the value of the voiced form of F, which itself had originally a sound resembling the English W (see under F). V is therefore a voiced labio-dental spirant, the breath escaping through a very narrow slit between the lower lip and the upper teeth. In German, however, V is used with the same value as F, while W takes the value that V has in English. Apart from some southern dialect forms which have found their way into the literary language, as *vat* (for *fat* or *wine-fat* which still survives in the English Bible) and *vixen* the feminine of *fox*, all the words in English which begin with V are of foreign, and most of Latin origin. In the middle of words between vowels *f* was originally regularly voiced: *life, lives*; *wife, wives*, &c. The Latin V, however, was not a labio-dental spirant like the English *v*, but a bi-labial semivowel like the English *w*, as is clear from the testimony of Quintilian and of later grammarians. This quality has remained to it in southern Italy, in Spain and Gascony. In Northern French and in Italian it has become the labio-dental *v*, and from French English has adopted this value for it. Early borrowings like *wine* (Latin *vinum*), *wall* (Latin *vallum*), retain the *w* sound and are therefore spelt with *w*. In the English dialects of Kent, Essex and Norfolk there is a common change of *v* to *w*, but Ellis says (*English Pronunciation*, V, pp. 132, 229) that though he has made diligent search he has never been able to hear the *v* for *w* which is so characteristic of Sam and Tony Weller in the *Pickwick Papers*. It is, however, illustrated in Pegge's *Anecdotes of the English Language* (1803) and confirmed by the editor of the 3rd edition (1844), pp. 65–66. The history of V as the Latin numeral for 5 is uncertain. An old theory is that it represents the hand, while X=10 is the two hands with the finger tips touching. This was adopted by Mommsen (*Hermes*, xxii. 598). The Etruscan used the same *v*-symbol inverted. V with a horizontal line above it was used for 5000. (P. Gi.)

VAAL, a river of South Africa, chief affluent of the Orange (*q.v.*). It rises at an elevation of over 5000 ft. above the sea on the slopes of the Klipstapel, in the Drakensberg mountains, Ermelo district of the Transvaal, and about 170 m. in a direct line west of Delagoa Bay. It flows in a general S.W. direction, with a markedly winding course, across the plateau of inner South Africa, joining the Orange in 29° 3′ S., 23° 36′ E. The river valley is about 500 m. long, the length of the river being some 750 m.

The first considerable tributary is the Klip (80 m. long), which rises in the Draken's Berg (the hill which gives its name to the range) and flows N.W., its junction with the Vaal being in 27° S., 29° 6′ E., 12 m. S.W. of Standerton. From this point to the eastern frontier of the Cape the Vaal forms the boundary between the Orange Free State and the Transvaal. The river is usually shallow and is fordable at many places, known as *drifts*. But after the heavy summer rains the stream attains a depth of 30 or more feet. At such times the banks, which are lined with willows and in places very steep, are inundated. As a rule little water is added to the Vaal by its tributaries. Of these, the Wilge (190 m.), which also rises on the inner slopes of the Drakensberg, flows first S.W., then N.W. across the eastern part of Orange Free State and joins the Vaal 60 m. below the Klip confluence. Lower down the river receives from the south the Rhenoster, Valsch, Vet and other streams which drain the northern part of the Orange Free State. On the north the basin of the Vaal is contracted by the Witwatersrand and Magaliesberg range, and its tributaries are few and, save in the case of the Harts river, short. The Klip, not to be confounded with the southern Klip already described, rises on the south side of the Witwatersrand about 15 m. W. of Johannesburg, is joined by several small streams, and after a S.E. course of 70 m. reaches the Vaal 2 m. E. of Vereeniging. The Klip is of importance in the supply of water to many of the Black Reef gold mines. The Mooi rises in the Witwatersrand west of the Klip and, after running almost due S. 75 m., unites with the main stream about 90 m. below Vereeniging. It gets its name Mooi (Beautiful) on account of the picturesqueness of its banks. Some of its sources are at Wonderfontein, where they issue from stalactite caves. The Harts river (200 m.) rises on the S.W. slopes of the Witwatersrand and flowing S. by W. unites with the Vaal about 65 m. above the confluence of that stream with the Orange. The volume of water in the Harts is often very slight, but that part of the country, the eastern division of Griqualand West, in which the Vaal receives its last tributaries and itself joins the Orange, is the best watered of any of the inland districts of the Cape. The Vaal here flows in a wide rocky channel, with banks 30 ft. high, through an alluvial plain rendered famous in 1867–70 by the discovery of diamonds in the bed of the river and along its banks. The diamonds are washed out by the water and found amid debris of all kinds, frequently embedded in immense boulders. The last affluent of the Vaal, the Riet river, rises in the Beyers Bergen S.E. of Reddersburg and flows N.W. 200 m. through Orange Free State, being joined, a mile or two within the Cape frontier, by the Modder river (175 m.), which rises in the same district as the Riet but takes a more northerly course. The united Riet-Modder joins the Vaal 18 m. above the Orange confluence.

The name Vaal is a partial translation by the Dutch settlers of the Hottentot name of the river—Kai Gariep, properly Garib (yellow water), in reference to the clayey colour of the stream. The Transvaal is so named because the first white immigrants reached the country from the south by crossing the Vaal.

VAALPENS (dusty-bellies), a little-known nomadic people of South Africa, who survive in small groups in the Zoutpansberg and Waterberg districts of the Transvaal, especially along the Magalakwane river. They are akin to the Bushmen (*q.v.*). In 1905 their total number was estimated by the Transvaal military authorities at "a few hundreds." The Vaalpens were so called by the Boers from the dusty look of their bodies, due, it is said, to their habit of crawling along the ground when stalking game. But their true colour is black. In height the men average about 4 ft., *i.e.* somewhat less than the shortest Bushmen. Socially the Vaalpens occupy nearly as low a position as even the Fuegians or the extinct Tasmanians. They were nearly exterminated by the Aman'debele, a tribe of Zulu stock which entered the Transvaal about the beginning of the 19th century. The Vaalpens, who live entirely by hunting and trapping game, dwell in holes, caves or rock-shelters. They wear capes of skins, and procure the few implements they need in exchange for skins, ivory or ostrich feathers. They form family groups of thirty or forty under a chief or patriarch, whose functions are purely domestic, as must be the case where there are no arts or industries, nothing but a knowledge of hunting and of fire with which to cook their meals. Their speech appears to be so full of clicks as to be incapable of expression by any clear phonetic system. Hence it is impossible to say whether the Vaalpens possess any folklore or other oral literature analogous to that of the Bushmen.

VACARESCU, the name, according to tradition, of one of the oldest noble families in Walachia. Its mythical founder is said to have been a certain Kukenus, of Spanish origin, settled in Transylvania as lord over Fogaras. Others connect the family with Ugrin, count of Fogaras. The first member of historical importance was Ianache (b. 1654), the grand treasurer of Walachia, who was killed with his master, Prince Brancovan, in Constantinople, 1714. His grandson through his son Stephan, also called Ianache (or "Enakitza the Ban," 1730–1796), starts a line of Rumanian scholars and poets; he was the author of the first known Rumanian grammar in the vernacular, printed in 1787. While in exile in Nicopolis he wrote the contemporary history of the Turkish empire in two volumes (1740–1799). He was also the first to attempt Rumanian versification. Greater as a poet is his son Alecu (Alexander), who died as a prisoner in Constantinople in 1798. In 1796 a collection of his poems appeared in Rumania. His brother Nikolaes (d. 1830) also wrote some poems, but they remained in MS. until 1860, when they were published. By far the greatest member of the Vacarescu family in the male line was Iancu (1786–1863), the son of Alexander. He received an excellent education not only in Greek but also in German and French, and was well versed in the literature of the West. An ardent patriot, he sided with the national movement in 1821, and assisted in establishing the Rumanian theatre, translating many books and plays from German and French into Rumanian, notably the *Britannicus* of Corneille, a literary event of no small importance at the time. He inaugurated modern Rumanian poetry. In 1830 appeared his first volume of verse. He died in 1863. A niece of Alexander is the gifted writer Elena Vacarescu (Hélène Vacaresco), who inherited the poetical talent of her family and has enriched Rumanian literature with her *Bard of the Dimbovitza*, and other poems and novels in Rumanian and in French. (M. G.)

VACARIUS (1120–1200?), Italian civilian and canonist, the first known teacher of Roman law in England, was doubtless of the school of Bologna, though of a later generation than the hearers of Irnerius. He was brought to Canterbury, possibly by Becket, together with a supply of books upon the civil law, to act as counsel (*causidicus*) to Archbishop Theobald in his struggle, which ended successfully in 1146, to obtain the transfer of the legateship from the bishop of Winchester to himself. We next hear of Vacarius as lecturing at Oxford, in 1149, to "crowds of rich and poor," and as preparing, for the use of the latter, a compendium, in nine books, of the Digest and Code of Justinian, "sufficient," it was said, "if thoroughly mastered, to solve all legal questions commonly debated in the schools." It became a leading text-book in the nascent university, and its popular description as the *Liber pauperum* gave rise to the nickname *pauperistae* applied to Oxford students of law. Nearly complete MSS. of this work are still in existence, notably in the cathedral libraries at Worcester and Prague and in the town library at Bruges. Fragments of it are also preserved in the Bodleian and in several college libraries at Oxford.

The new learning was not destined to make its way without opposition. King Stephen silenced Vacarius, and ordered the destruction of the books of civil and canon law which had been imported by Theobald. The edict to this effect seems, however, not to have been in force after the death of its royal author in 1154 ("eo magis virtus legis invaluit quo eam amplius nitebatur impietas infirmare," Joh. Sarisburiensis). There is ample evidence that the civil law was soon once more a favourite study at Oxford, where we learn that, in 1190, two students from Friesland were wont to divide between them the hours of the night for the purpose of making a copy of the *Liber pauperum*. Whether or no Vacarius ever resumed his Oxford lectures after their interruption by Stephen we are not informed. In any case he was soon called off to practical work, as legal adviser and ecclesiastical judge in the northern province, by his old friend and colleague at Canterbury, Roger de Pont l'Évêque, after the promotion of the latter, in the year of Stephen's death, to the archbishopric of York. Thenceforth the name of "magister Vacarius" is of very frequent occurrence, in papal letters and the chronicles of the period, as acting in these capacities. He was rewarded with a prebend in the collegiate church of secular canons at Southwell, half of which he was allowed in 1191 to cede to his "nephew" Reginald. He is last heard of in 1198, as commissioned, together with the prior of Thurgarton, by Pope Innocent III. to carry into execution, in the north of England, a letter with reference to the crusade. It is doubtless to the second half of the life of Vacarius that the composition must be attributed of two works the MS. of which, formerly the property of the Cistercian Abbey of Biddleston, is now in the Cambridge University library. One of these, *Summa de assumpto homine*, is of a theological character, dealing with the humanity of Christ; the other, *Summa de matrimonio*, is a legal argument, to the effect that the essential fact in marriage is neither, as Gratian maintains, the *copula*, nor, as Peter Lombard, consent by *verba de praesenti*, but mutual *traditio*.

AUTHORITIES.—Most of the original authorities are textually set out and annotated by Prof. T. E. Holland in vol. ii. of the *Oxford Historical Society's Collectanea* (1890). Wenck, in his *Magister Vacarius* (1820), prints the prologue, and a table of contents, of the *Liber pauperum*, from a MS. now lost. He returns to the subject in Stieber's *Opuscula academica* (1834). F. Maitland in the *Law Quarterly Review*, xiii. pp. 133, 270 (1897), gives a full account of the Cambridge MSS., printing *in extenso* the *Summa de matrimonio* See also Muhlenbruch, *Obs. juris Rom.* i. 36; Hänel, in the *Leips. Lit. Zeitung* (1828), No. 42, "Intelligenzblatt," p. 334; Savigny, *Geschichte*, iv. 423; Stolzel, *Lehre von der operis novi denunt.* (1865), pp. 592–620, and in the *Zeitschrift für Rechtsgeschichte*, vi. p. 234; *Catalogue général des MSS. des bibliothèques publiques de France: Départements*, t. x. Lieberman, in the *English Historical Review*, xi. (1906), pp. 305, 514, identified Vacarius with one "Vac." of Mantua, the author of *Contraria legum Longobardorum*, but withdrew this antecedently improbable suggestion (ib. vol. xiii.) after T. Patella had shown, in the *Atti della R. Academia di Torino*, xxxii., that "Vac. Mantuanus," the author of the *Contraria*, must have been "Vacella," who, in 1189, was a judge at Mantua. (T. E. H.)

VACCINATION (from Lat. *vacca*, a cow), the term originally devised for a method of protective inoculation against small-pox, consisting in the intentional transference to the human being of the eruptive disease of cattle called cow-pox (*vaccinia*). The discovery of vaccination is due to Dr Edward Jenner (*q.v.*), at the time a country medical practitioner of Berkeley, in the vale of Gloucester, whose investigations were first published in 1798 in the form of a pamphlet entitled *An Inquiry into the Causes and Effects of the Variolae Vaccinae, &c.* Many years previously, while he was an apprentice to a medical man at Sodbury, near Bristol, his attention was directed to a belief, widely prevalent in Gloucestershire during the latter half of the 18th century, that those persons who in the course of their employment on dairy farms happened to contract cow-pox were thereby protected from a subsequent attack of small-pox. In particular, his interest was aroused by a casual remark made by a young countrywoman who happened to come to the surgery one day for advice, and who, on hearing mention made of small-pox, immediately volunteered the statement that she could not take the disease, as she had had cow-pox. On coming up to London in 1770, to finish his medical education, Jenner became a pupil of John Hunter, with whom he frequently discussed the question of the possibility of obtaining protection against small-pox. On his return to his native village of Berkeley in 1773, to practise as a medical man, he took every opportunity of talking over and investigating the matter, but it was not until May 1796 that he actually began to make experiments. His first case of vaccination was that of a boy eight years of age, named James Phipps, whom he inoculated in the arm with cow-pox matter taken from a sore on the hand of Sarah Nelmes, a dairymaid, who had become infected with the disease by milking cows suffering from cow-pox. It was apparently not until 1798 that he made his first attempt to carry on a strain of lymph from arm to arm. In the spring of that year he inoculated a child with matter taken directly from the nipple of a cow, and from the resulting vesicle on the arm of the child first operated upon, he inoculated, or, as it may now be more correctly termed, "vaccinated," another. From this child several others were vaccinated. From one of these a fourth remove was successfully carried out, and finally a fifth. Four of these children were subsequently inoculated with small-pox—the "variolous test"—without result. The success of many such experiments, in his own hands and in those of his contemporaries, led Jenner to express his belief—a mistaken one, as events have proved—that the protective influence of vaccination would be found to last throughout the lifetime of the person operated on. Obviously he did not realize the fact that the data at his disposal were insufficient for the formation of an accurate judgment on this point, since time alone could prove the exact duration of the protection originally obtained. Subsequent experience has demonstrated that, as has been well said by a writer in the *Edinburgh Review*, "even after efficient vaccination a slow progress away from safety and towards danger is inevitable, and re-vaccination at least once after childhood is necessary if protection is to be maintained."

Relationship of small-pox and cow-pox.

In applying to cow-pox the term "variolae vaccinae," Jenner gave expression to his belief that this disease was in reality nothing more nor less than small-pox of the cow. But soon it was discovered that if there were such a malady as "small-pox of the cow," there was also, as Dr Loy first satisfactorily demonstrated, a small-pox of the horse, which, under the name of "grease," was resorted to from time to time as a source of vaccine lymph. Jenner had, indeed, put forward the suggestion that "grease" was a necessary antecedent to cow-pox; but even taking this term to have been used by him in the sense of horse-pox, he was, in all probability, mistaken in his assumption. At the same time, however, there can be little doubt that these two diseases are very closely allied, if indeed they be not identical. As evidence of a definite relationship between human small-pox and cow-pox, it may be mentioned that whereas, prior to the introduction of vaccination, epidemics of these disorders frequently arose concurrently, the so-called "natural" cow-pox has now in great measure disappeared. There is, moreover, no appreciable difference in the minute anatomical appearances characteristic of the eruption following on inoculation of one or other of these two affections in the human subject. But of far greater importance in this connexion are the results obtained by numerous observers who, in various parts of the world, and almost from the time of Jenner onwards, have set themselves the task of attempting, by experimental methods, to solve the problem of the true relationship of variola to vaccinia. As the outcome of this work it may now be definitely stated that small-pox lymph, more especially, as the present writer has shown, if obtained from the primary vesicle of a case of the inoculated form of the disease, by passage through the system of the calf can be so altered in character as to become deprived of its power of causing a generalized eruption, while inducing at the site of inoculation a vesicle indistinguishable from a typical vaccine vesicle; and, more important still, that when transferred again to man, it has by such treatment completely lost its former infectious character. Such being the case, it may fairly be asserted that cow-pox, or rather that artificially inoculated form of the disease which we term *vaccinia*, is nothing more nor less than *variola* modified by transmission through the bovine animal. An outbreak of small-pox, indeed, may be turned to account for raising, by appropriate experimental methods, a fresh stock of vaccine lymph.

Bacteriology.

There is much evidence to prove that the results following on vaccination are due to a specific contagium, and, moreover, that the particular micro-organism concerned is capable of existing, during one period of its life-cycle, in a resting or spore form, in which condition it is more resistant to the germicidal effects of glycerine than is the case with non-sporing microbes. Advantage is taken of this fact, in the method devised by the present writer, and now employed officially in England, as also on the Continent and in America, for ensuring the bacteriological purity of vaccine lymph. Up to the present, unfortunately, no satisfactory method has been discovered by which the micro-organism of vaccinia can be unfailingly cultivated on artificial media while still retaining its specific properties.

Vaccination Commission, 1889-96.

The publication in 1896 of the final report of the English Royal Commission on Vaccination, in which the various phases of the vaccination question are discussed on the basis of evidence obtained from witnesses of all shades of opinion during a period extending over no less than six years, considerably simplifies the task of dealing with this subject. The Royal Commission, originally numbering fifteen members,[1] with Lord Herschell as president, was appointed in May 1889, the terms of reference being as follows: "To inquire and report as to—(1) The effect of vaccination in reducing the prevalence of, and mortality from, small-pox. (2) What means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination. (3) The objections made to vaccination on the ground of injurious effects alleged to result therefrom; and the nature and extent of any injurious effects which do, in fact, so result. (4) Whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination; and whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination. (5) Whether any alterations should be made in the arrangements and proceedings for securing the performance of vaccination, and, in particular, in the provisions of the Vaccination Acts with respect to prosecutions for non-compliance with the law."

The evidence given before the Royal Commission was published at intervals in a series of Blue-books, but, as stated, it was not until August 1896 that the final report made its appearance. As regards the effect of vaccination in reducing the prevalence of, and mortality from, small-pox, the following conclusions were arrived at, Dr Collins and Mr Picton alone dissenting: "(1) That it diminishes the liability to be attacked by the disease. (2) That it modifies the character of the disease and renders it (*a*) less fatal, and (*b*) of a milder or less severe type. (3) That the protection it affords against attacks of the disease is greatest during the years immediately succeeding the operation of vaccination. It is impossible to fix with precision the length of this period of highest protection. Though not in all cases the same, if a period is to be fixed, it might, we think, fairly be said to cover in general a period of nine or ten years. (4) That after the lapse of the period of highest protective potency, the efficacy of vaccination to protect against attack rapidly diminishes, but that it is still considerable in the next quinquennium, and possibly never altogether ceases. (5) That its power to modify the character of the disease is also greatest in the period in which its power to protect from attack is greatest, but that its power thus to modify the disease does not diminish as rapidly as its protective influence against attacks, and its efficacy, during the later periods of life, to modify the disease is still very considerable. (6) That re-vaccination restores the protection which lapse of time has diminished, but the evidence shows that this protection again diminishes, and that, to ensure the highest degree of protection which vaccination can give, the operation should be at intervals repeated. (7) That the beneficial effects of vaccination are most experienced by those in whose case it has been most thorough. We think it may fairly be concluded that where the vaccine matter is inserted in three or four places, it is more effectual than when introduced into one or two places only, and that if the vaccination marks are of an area of half a square inch, they indicate a better state of protection than if their area be at all considerably below this."

For the evidence, statistical or otherwise, on which these conclusions are based, the Reports of the Royal Commission should be consulted. But reference may here be made to two facts of which proof is overwhelming. (1) Small-pox, in pre-vaccination days a disease of infancy and childhood—like measles at the present day—has in the United Kingdom become a disease mainly of adults. The shifting of age-incidence can only be accounted for by the custom of vaccination in infancy. To this day, when small-pox attacks young unvaccinated children, it is found to be as virulent as, or even more virulent than, small-pox in the unvaccinated at higher ages. On the other hand, small-pox is practically unknown among well-vaccinated children. When, quite exceptionally, such children have been attacked, the disease has been so trivial in character as to be liable to escape recognition altogether. (2) Medical men, nurses and other persons exposed to the disease habitually protect themselves by efficient re-vaccination, and when this precaution has been taken, never contract small-pox.

Efficient vaccination.

The clinical activity and bacteriological purity of the lymph employed for vaccination; the skilful performance of the operation itself; the making an adequate number of insertions of lymph over a sufficient area; the observance of precautions needful for ensuring strict asepsis, both at the time of vaccination and subsequently until the vaccination wounds are soundly healed—all these are matters to be regarded as essential to "efficient vaccination." Certain principles in respect of them are generally recognized, and in the case of public vaccinators, whose work comes under government inspection, a series of instructions on these several points are prescribed by the Local Government Board. First in regard to lymph. That which is now almost universally employed in Great Britain is glycerinated calf lymph, the use of which has entirely superseded, in public vaccinations, the arm-to-arm method which for many years previously had been employed as the best means then attainable of ensuring the activity and comparative purity of the lymph. Glycerinated lymph, under proper conditions, usually retains its potency for many weeks or months; but nevertheless, in certain circumstances at present imperfectly understood, is liable to become gradually weakened, and even eventually to become altogether inert. Possibly the condition of the calves from which the lymph is obtained, especially as regards their general health and the suppleness or the reverse of their skins, or exposure of the lymph to the action of light or to a high temperature, are of special importance. Consequently, in order to ensure the best results from its use, it is not only necessary that great care should be exercised in its manufacture, but it is also advisable that the lymph should be employed for vaccination as soon as possible after bacteriological examination has demonstrated its freedom from suppurative and other extraneous micro-organisms. As regards the carrying out of the operation itself, it is somewhat unfortunate that there exists no official definition of what constitutes a "successful vaccination," and in consequence it is open to any practitioner to give a certificate of successful vaccination in cases where but one minute vesicle may have been produced. It is to be feared that such certificates are too frequently given, and it cannot be too strongly urged that vaccination of this sort involves incomplete protection. The standard laid down by the Local Government Board—the production, namely, of a total area of vesiculation of not less than half a square inch, divided among four separate vesicles or groups of vesicles, not less than half an inch from one another—has for the most part proved easily attainable in practice, and it is much to be desired that in private as in public work the attainment of this standard should be aimed at in every instance.

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[1] The original Commissioners were—Lord Herschell, C. Bradlaugh, Dr Bristowe, Dr Collins, Sir C. Dalrymple, J. S. Dugdale, Q.C., Prof. M. Foster, Sir E. H. Galsworthy, Sir Guyer Hunter, J. Hutchinson, Sir James Paget, J. A. Picton, Sir William Savory, S. Whitbread, F. Meadows White, Q.C. Mr Bradlaugh, Dr Bristowe and Sir William Savory died during the progress of the inquiry. Only one of the vacancies thus caused was filled up, Mr J. A. Bright having been appointed on the death of Mr Bradlaugh.

The protection afforded by a primary vaccination tends gradually to diminish, and eventually to disappear more or less completely, with the lapse of time. In consequence, it is desirable that the operation should be repeated at the age of from seven to ten years, and thereafter, if it be possible, at intervals during later life. The final report of the Royal Commission thus summarizes the evidence as to the value of such additional procedure:—

> "Where re-vaccinated persons were attacked by, or died from, small-pox, the re-vaccination had for the most part been performed a considerable number of years before the attack. There were very few cases where a short period only had elapsed between the re-vaccination and the attack of small-pox. This seems to show that it is of importance, in the case of any persons specially exposed to the risk of contagion, that they should be re-vaccinated, and that in the case even of those who have been twice re-vaccinated with success, if a long interval since the last operation has elapsed, the operation should be repeated for a third, and even a fourth time."

It not unfrequently happens that in the case of a re-vaccination the process runs a somewhat different course from that witnessed in a typical primary vaccination. In a successful re-vaccination, the site of the operation may be distinctly reddened and somewhat irritable by the second day, while papules will probably make their appearance about the third to the fifth day. The papules may or may not develop further into vesicles and pustules. Occasionally a re-vaccination appears to fail altogether; but, as pointed out by the Royal Commission, it is advisable, as in the case of a primary vaccination, to make further attempts with lymph of known potency before concluding that the individual is really insusceptible.

Alleged injurious effects.

In a certain small proportion of cases the operation of vaccination has been followed, after a longer or shorter interval, by various complications, of which by far the most important are those of an inflammatory nature, such as erysipelas, which are not peculiar to vaccination, but which constitute the danger of any local lesion of the skin, however caused. During the many decades in which vaccination from arm to arm was practised, in many millions of children, a few authenticated cases were recorded in which there was reason to believe that syphilis could have been invaccinated. Such an occurrence could at no time have happened if proper care had been taken by the vaccinator; and now that the use of calf lymph has become practically universal, the possibility of such occurrence in the future may be disregarded, since the calf is not capable of contracting this disease. Tubercle in its various forms and leprosy have also been included in the list of possible complications of vaccination, though without any sufficient proof. The employment of calf lymph, treated with glycerine after the manner first advocated by S. Monckton Copeman, will obviate any such danger, for even if tubercle bacilli or the streptococcus of erysipelas were by chance present in the lymph material when collected, it has been found experimentally that they are quite unable to survive prolonged exposure to the action of a 50% solution of glycerine in water. Leprosy is not communicable to the calf. In view of the frequency of various skin eruptions in infancy, it is to be expected that in a proportion of cases they will appear during the weeks following vaccination. Eczema and impetigo in particular have, *post hoc*, been attributed to vaccination, but no direct connexion has been proved to exist between the operation and the occurrence of these disorders. In section 434 of the final report of the Royal Commission on Vaccination the extent to which other inoculable diseases are liable to complicate vaccination is thus summed up:—

> "A careful examination of the facts which have been brought under our notice has enabled us to arrive at the conclusion that although some of the dangers said to attend vaccination are undoubtedly real, and not inconsiderable in gross amount, yet when considered in relation to the extent of vaccination work done, they are insignificant. There is reason, further, to believe that they are diminishing under the better precautions of the present day, and with the additions of the future precautions which experience suggests, will do so still more in the future." (S. M. C.)

Compulsory vaccination.

Legislation making vaccination *compulsory* was first introduced in Bavaria (1807), Denmark (1810), Sweden (1814), Würtemburg, Hesse and other German states (1818), Prussia (1835), the United Kingdom (1853), German empire (1874), Rumania (1874), Hungary (1876), Servia (1881), Austria (1886). But in many cases there had been earlier provisions indirectly making it necessary. In the same way, though there is no federal compulsory law in Switzerland, most of the cantons enforce it; and though there is no statutory compulsion in France, Italy, Spain, Portugal, Belgium, Norway, Russia or Turkey, there are government facilities and indirect pressure, apart from the early popularity of vaccination which made it the usual practice. In the United States there is no federal law, but many of the separate states make their own compulsion either directly or indirectly, Massachusetts starting in 1809.

English legislation.

The benefit of vaccination proved itself in the eyes of the world by its apparent success in stamping out small-pox; but there continued to be people, even of the highest competence, who regarded this as a fallacious argument—*post hoc, ergo propter hoc.* The cause of "anti-vaccination" has had many followers in England, and their persistence has had important effect in English legislation. Under the provisions of the Vaccination Act 1898, and of the Vaccination Order (1898) of the Local Government Board, with some minor changes in succeeding acts, numerous changes in connexion with vaccination administration and with the performance of the operation were introduced, in addition to the supersession of arm-to-arm vaccination, by the use of glycerinated calf lymph. Thus, whereas by the Vaccination Acts of 1867 and 1871 the parent or person having the custody of any child was required to procure its vaccination within three months of birth, this period by the act of 1898 was extended to six months. Again, parents were relieved of any penalty under the compulsory clauses of the Vaccination Acts who afforded proof that they had, within four months of the birth of a child, satisfied a stipendiary magistrate, or two justices in petty sessions, that they conscientiously believed that vaccination would be prejudicial to the health of the child. Moreover, proceedings were not to be taken more than twice against a defaulting parent, namely, once under section 29 of the act of 1867, and once under section 31 of the same act, provided that the child had reached the age of four years. Finally, the public vaccinator was now required to visit the homes of children for the purpose of offering vaccination with glycerinated calf lymph, "or such other lymph as may be issued by the Local Government Board." The operative procedure in public vaccinations was formerly based on the necessity of carrying on a weekly series of transferences of vaccine lymph from arm to arm; and for the purposes of such arm-to-arm vaccination the provision of stations, to which children were brought first for the performance of the operation, and again, after a week's interval, for inspection of the results, was an essential. The occasional hardships to the mothers, and a somewhat remote possibility of danger to the children, involved in being taken long journeys to a vaccination station in bad weather, or arising from the collecting together in one room of a number of children and adults, one or more of whom might happen to be suffering at the time from some infectious disorder, are a few of the reasons which appeared to render a change in this regulation desirable; as a matter of fact, it would appear that nothing but good has arisen from the substitution of domiciliary for stational vaccination. There have naturally been some curious discussions before the magistrates as to what is "conscientious" or not, but the working of the so-called "conscience clause" by no means justified the somewhat gloomy forebodings expressed, both in Parliament and elsewhere, at the time of its incorporation in the act of 1898. On the contrary, its operation appeared to tend to the more harmonious working of the Vaccination Acts, by affording a legal method of relief to such parents and guardians as were prepared to affirm that they had a conscientious belief that the performance of the operation might, in any particular instance, be prejudicial to the health of the child.

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VACHEROT, ÉTIENNE (1809–1897), French philosophical writer, was born of peasant parentage at Torcenay, near Langres, on the 29th of July 1809. He was educated at the École Normale, and returned thither as director of studies in 1838, after some years spent in provincial schoolmasterships. In 1839 he succeeded his master Cousin as professor of philosophy at the Sorbonne. His *Histoire critique de l'école d'Alexandrie* (3 vols. 1846–51), his first and best-known work, drew on him attacks from the Clerical party which led to his suspension in 1851. Shortly afterwards he refused to swear allegiance to the new imperial government, and was dismissed the service. His work *Démocratie* (1859) led to a political prosecution and imprisonment. In 1868 he was elected to the French Academy. On the fall of the Empire he took an active part in politics, was *maire* of a district of Paris during the siege, and in 1871 was in the National Assembly, voting as a Moderate Liberal. In 1873 he drew nearer the Conservatives, after which he was never again successful as a parliamentary candidate, though he maintained his principles vigorously in the press. He died on the 28th of July 1897 Vacherot was a man of high character and adhered strictly to his principles, which were generally opposed to those of the party in power. His chief philosophical importance consists in the fact that he was a leader in the attempt to revivify French philosophy by the new thought of Germany, to which he had been introduced by Cousin, but of which he never had more than a second-hand knowledge. Metaphysics he held to be based on psychology. He maintains the unity and freedom of the soul, and the absolute obligation of the moral law. In religion, which was his main interest, he was much influenced by Hegel, and appears somewhat in the ambiguous position of a sceptic anxious to believe. He sees insoluble contradictions in every mode of conceiving God as real, yet he advocates religious belief, though the object of that belief have but an abstract or imaginary existence.

His other works are: *La Métaphysique et la science* (1858), *Essais de philosophie critique* (1864), *La Religion* (1869), *La Science et la conscience* (1870), *Le Nouveau Spiritualisme* (1884), *La Démocratie libérale* (1892).

See Ollé Laprune, *Étienne Vacherot* (Paris, 1898).

VACQUERIE, AUGUSTE (1819–1895), French journalist and man of letters, was born at Villequier (Seine Inférieure) on the 19th of November 1819. He was from his earliest days an admirer of Victor Hugo, with whom he was connected by the marriage of his brother Charles with Léopoldine Hugo. His earlier romantic productions include a volume of poems, *L'Enfer de l'esprit* (1840); a translation of the *Antigone* (1844) in collaboration with Paul Meurice; and *Tragaldabas* (1848), a melodrama. He was one of the principal contributors to the *Événement* and followed Hugo into his exile in Jersey. In 1869 he returned to Paris, and with Paul Meurice and others founded the anti-imperial *Rappel*. His articles in this paper were more than once the occasion of legal proceedings. After 1870 he became editor. Other of his works are *Souvent homme varie* (1859), a comedy in verse; *Jean Baudry* (1863), the most successful of his plays; *Aujourd'hui et demain* (1875); *Futura* (1900), poems on philosophical and humanitarian subjects. Vacquerie died in Paris on the 19th of February 1895. He published a collected edition of his plays in 1879.

VACUUM-CLEANER, an appliance for removing dust from carpets, curtains, &c., by suction, and consisting essentially of some form of air-pump drawing air through a nozzle which is passed over the material that has to be cleaned. The dust is carried away with the air-stream and is separated by filtration through screens of muslin or other suitable fabric, sometimes with the aid of a series of baffle-plates which cause the heavier particles to fall to the bottom of the collecting receptacle by gravity. In the last decade of the 19th century compressed air came into use, especially in America, for cleaning railway carriages, but it was found difficult to arrange for the collection of the dust that was blown out by the jets of air, and in consequence recourse was had to working by suction. From this beginning several types of vacuum cleaner have developed.

In the first instance the plants were portable, consisting of a pump driven by a petrol engine or electric motor, and were periodically taken round to houses, offices &c., when cleaning was required. The second stage was represented by the permanent installation of central plants in large buildings, with a system of pipes running to all floors, like gas or water pipes, and provided at convenient points with valves to which could be attached flexible hose terminating in the actual cleaning tools. The vacuum thus rendered available is in some cases utilized for washing the floors in combination with another system of piping connected to a tank containing soap and water, which having been sprayed over the floor by compressed air is removed with the dirt it contains and discharged into the sewers; or in a simpler arrangement the soap and water is contained in a portable tank from which it is distributed, to be sucked up by means of the vacuum as before. In their third stage vacuum cleaners have become ordinary household implements, in substitution for, or in addition to the broom and duster, and small machines are now made in a variety of forms, driven by hand, by foot, or by an electric motor attached to the lighting circuit. In addition to their domestic uses, other applications have been found for them, as for instance in removing dust from printers' type-cases.

VACUUM TUBE. The phenomena associated with the passage of electricity through gases at low pressures have attracted the attention of physicists ever since the invention of the frictional electrical machine first placed at their disposal a means of producing a more or less continuous flow of electricity through vessels from which the air had been partially exhausted. In recent years the importance of the subject in connexion with the theory of electricity has been fully realized; indeed, the modern theory of electricity is based upon ideas which have been obtained from the study of the electric discharge through gases. Most of the important principles deduced from these investigations are given in the article CONDUCTION, ELECTRIC (*Through Gases*); here we shall confine ourselves to the consideration of the more striking features of the luminous phenomena observed when electricity passes through a luminous gas.

Methods of producing the Discharge.—To send the current through the gas it is necessary to produce between electrodes in the gas a large difference of potential. Unless the electrodes are of the very special type known as Wehnelt electrodes, this difference of potential is never less than 200 or 300 volts and may rise to almost any value, as it depends on the pressure of the gas and the size of the tube. In very many cases by far the most convenient method of producing this difference of potential is by means of an induction coil; there are some cases, however, when the induction coil is not suitable, the discharge from a coil being intermittent, so that at some times there is a large current going through the tube, while at others there is none at all, and certain kinds of measurement cannot be made under these conditions. Not only is the current intermittent, but it is apt with the coil to be sometimes in one direction and sometimes in the opposite; there is a tendency to send a discharge through the tube not only when the current through the primary is started but also when it is stopped. These discharges are in opposite directions, and though that produced by stopping the current is more intense than that due to starting it, the latter may be quite appreciable. The reversal of the current may be remedied by inserting in series with the discharge tube a piece of apparatus known as a "rectifier" which allows a current to pass through it in one direction but not in the opposite. A common type of rectifier is another tube containing gas at a low pressure and having one of its electrodes very large and the other very small; a current passes much more easily through such a tube from the small to the large electrode than in the opposite direction. Sometimes an air-break inserted in the circuit with a point for one electrode and a disk for the other is sufficient to prevent the reversal of the current without the aid of any other rectifier.

There are cases, however, when the inevitable intermittence of the discharge produced by an induction coil is a fatal objection. When this is so, the potential difference may be produced by a battery of a large number of voltaic cells, of which the most convenient type, where more than a few milli-ampères of current are required, are small storage cells. As each of these cells only produces a potential difference of two volts, a very large number of cells are required when potential differences of thousands of volts have to be produced, and the expense of this method becomes prohibitive. When continuous currents at these high potential differences are rquired, electrostatic induction machines are most generally used. By means of Wimshurst machines, with many plates, or the more recent Wehrsen machines, considerable currents can be produced and maintained at a very constant value.

The exhaustion of the tubes can, by the aid of modern mercury pumps, such as the Töpler pump or the very convenient automatic Gaede pump, be carried to such a point that the pressure of the residual gas is less than a millionth of the atmospheric pressure. For very high exhaustions, however, the best and quickest method is that introduced by Sir James Dewar. In this method a tube containing small pieces of dense charcoal (that made from the shells of coco-nuts does very well) is fused on to the tube to be exhausted. The preliminary exhaustion is done by means of a water-pump which reduces the pressure to that due to a few millimetres of mercury and the charcoal strongly heated at this low pressure to drive off any gases it may have absorbed. The tube is then disconnected from the water-pump and the charcoal tube surrounded by liquid air; the cold charcoal greedily absorbs most gases and removes them from the tube. In this way much higher exhaustions can be obtained than is possible by means of mercury pumps; it has the advantage, too, of getting rid of the mercury vapour which is always present when the exhaustion is produced by mercury pumps. Charcoal does not absorb much helium even when cooled to the temperature of liquid air, so that the method fails in the case of this gas; the absorption of hydrogen, too, is slower than that of other gases. Both helium and hydrogen are vigorously absorbed when the charcoal is cooled to the temperature of liquid hydrogen.

When first the discharge is sent through an exhausted tube, a considerable amount of gas (chiefly hydrogen and carbon monoxide) is liberated from the electrodes and the walls of the tube, so that to obtain permanent high vacua the exhaustion must be continued until the discharge has been going through the tube for a considerable time. One of the greatest difficulties experienced in getting these high vacua is that even when all the joints are carefully made there may be very small holes in the tube through which the air is continually leaking from outside, and when the hole is very small it is sometimes very difficult to locate the leak. The writer has found that a method due to Goldstein is of the greatest service for this purpose. In this method one of the electrodes in the tube and one of the terminals of the induction coil are put to earth, and the pressure of the gas in the tube is reduced so that a discharge would pass through the tube with a small potential difference. The point of an insulated wire attached to the other terminal of the induction coil is then passed over the *outside* of the tube. When it comes to the hole, a very bright white spark may be seen passing through the glass, and in this way the leak located. The appearance of the discharge when the exhaustion is going on is a very good indication as to whether there is any leakage in the tube or not. If the colour of the discharge remains persistently red in spite of continued pumping, there is pretty surely a leak in the tube, as the red colour is probably due to the continued influx of air into the tube. Platinum is the only metal which can be fused through the glass with any certainty that the contact between the glass and the metal will be close enough to prevent air leaking into the tube. Platinum, however, when used as a cathode at low pressures "sputters," and the walls of the tube get covered with a thin deposit of the metal: to avoid this, the platinum is often fastened to a piece of aluminium, which does not sputter nearly so much. Tantalum is also said to possess this property, and it has the advantage of being much less fusible than aluminium. This sputtering depends to some extent on the kind of gases present in the tube, as in monatomic gases, such as mercury vapour, even aluminium sputters badly.

Electrodeless Tubes.—As some gases, such as chlorine and bromine, attack all metals, it is impossible to use metallic electrodes when the discharge through these gases has to be investigated. In these cases "electrodeless" tubes are sometimes used. These are of two kinds. The more usual one is when tin-foil is placed at the ends of the tube on the outside, and the terminals of the induction coil connected with these pieces of foil; the glass under the foil virtually acts as an electrode. A more interesting form of the electrodeless discharge is what is known as the "ring" discharge. The tube in this case is placed inside a wire solenoid which forms a part of a circuit connecting the outside coatings of two Leyden jars, the inside coatings of these jars being connected with the terminals of an induction coil or electrical machine; the jars are charged up by the machine, and are discharged when sparks pass between its terminals. As the discharge of the jars is oscillatory (see Electric Waves), electric currents surge through the solenoid surrounding the discharge tube, and these currents reverse their direction hundreds of thousands of times per second. We may compare the solenoid with the primary coil of an induction coil, and the exhausted bulb with the secondary; the rapidly alternating currents in the primary induce currents in the secondary which show themselves as a luminous ring inside the tube. Very bright discharges may be obtained in this way, and the method is especially suitable for spectroscopic purposes (see *Phil. Mag.* [5], 32, pp. 321, 445).

Appearance of the Discharge in Vacuum Tubes.—Fig. 15 b of the article Conduction, Electric (*Through Gases*) represents the appearance of the discharge when the pressure in the tube is comparable with that due to a millimetre of mercury and for a particular intensity of current. With variations in the pressure or the current some of these features may disappear or be modified. Beginning at the negative electrode *k*, we meet with the following phenomena: A velvety glow runs, often in irregular patches, over the surface of the cathode; this glow is often called the first negative layer. The spectrum of this layer is a bright line spectrum, and Stark has shown that it shows the Döppler effect due to the rapid motion of the luminous particles towards the cathode. Next to this there is a comparatively dark region known as the "Crookes' dark space," or the second negative layer. The luminous boundary of this dark space is approximately such as would be got by tracing the locus of the extremities of normals of constant length drawn from the negative electrode; thus if the electrode is a disk, the luminous boundary of the dark sphere is nearly plain over a part of its surface as in fig. 1, while if the electrode is a ring of wire (fig. 2) the luminous boundary resembles that shown in fig. 17 of the article CONDUCTION, ELECTRIC (*Through Gases*). The length of the dark space depends on the pressure of the gas and on the intensity of the current passing through it. The width of the dark space increases as the pressure diminishes, and may, according to the experiments of Aston (*Pro. Roy. Soc.* 79, p. 81), be represented with considerable accuracy by the expression $a+b/p$ or $a+c\lambda$, where a, b, c are constants, p the pressure and λ the mean free path of a corpuscle through the gas. The thickness of the dark space is larger than this free path; for hydrogen, for example, the value of c is about 4.

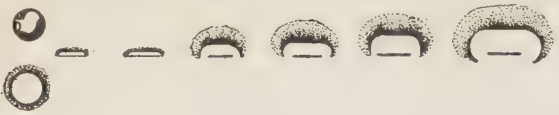

FIG. 1.

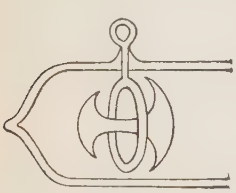

FIG. 2.

When the current is so large that the whole of the cathode is covered with glow the width of the dark space depends upon the current decreasing as the current increases. In helium and hydrogen Aston (*Pro. Roy. Soc.* 80 A., p. 45) has detected the existence of another thin dark space quite close to the cathode whose thickness is independent of the pressure. The farther boundary of the Crookes' dark space is luminous and is known as the negative glow or the third negative layer. Until the current gets so large that the glow next the cathode covers the whole of its surface the potential difference between the cathode and the negative glow is independent of the pressure of the gas and the current passing through it; it depends only on the kind of gas and the metal of which the cathode is made. This difference of potential is known as the cathode fall of potential; the values of it in volts for some gases and electrodes as determined by Mey (*Verh. deuts. Phys. Ges.*, 1903, v. p. 72) are given in the table.

CATHODE FALL

GAS	ELECTRODE										
	Pt	Hg	Ag	Cu	Fe	Zn	Al	Mg	Na	Na-K	K
O_2	369	..	..	..	..	..	..	..	..	..	—
H_2	300	..	295	280	230	213	190	168	185	169	172
N_2	232	226	..	..	..	..	..	207	178	125	170
He	226	..	..	..	..	..	..	..	80	78·5	69
Arg	167	..	..	..	..	..	100	..	..	..	—

The cathode fall of potential measures the smallest difference of potential which can produce a spark through the gas. Thus, for example, it is not possible to produce a spark through nitrogen with platinum electrodes with a potential difference of less than 232 volts, except when the electrodes are placed so close together that with a smaller potential difference the electric force between the terminals amounts to more than a million volts per centimetre; for this to be the case the distance between the electrodes must be comparable with the wave-length of sodium light.

When the current is small the glow next the cathode does not cover the whole of the surface, and when this occurs an increase in the current causes the glow to cover a greater area, but does not increase the current density nor the cathode fall. When the current is so much increased that the glow covers the whole of the cathode an increase in current must result in an increase of the current density over the cathode, and this is accomplished by a rapid increase in the cathode fall of potential. The cathode fall in this case has been investigated by Stark (*Phys. Zeit.* 111, p. 274), who finds that its value K can be represented by the equation

$$K=K_n+k(C-xpf)^{\frac{1}{2}}/pf^{\frac{1}{2}},$$

where K_n is the normal cathode fall, f the area of the cathode, C the current through the tube, p the pressure of the gas and k and x constants.

The increase in the potential fall is much more marked in small tubes than in large ones, as with small tubes the formation of the negative glow is restricted; this gives rise to a greater concentration of the current at the cathode and an increase in the cathode fall. The intensity of the electric field in the dark space has been measured by many observers. Aston used very large plain cathodes and measured the electric force by observing the deflection of a small pencil of cathode rays sent across the dark space at different distances from the cathode. He found that the magnitude of the force at a point in the dark space was proportional to the distance of the point from the junction of the negative glow and the dark space. This law of force shows that positive electricity must be in excess in the dark space, and that the density of the electrification must be constant throughout that space. The force inside the negative glow if not absolutely zero is so small that no one has as yet succeeded in measuring it; thus the surface of this glow must be very approximately an equi-potential surface. In the dark space there is a stream of positively electrified particles moving towards the cathode and of negatively electrified corpuscles moving away from it, these streams being mutually dependent; the impact of the positive particles against the cathode gives rise to the emission of corpuscles from the cathode; these, after acquiring kinetic energy in the dark space, ionize the gas and produce the positive ions which are attracted by the cathode and give rise to a fresh supply of corpuscles. The corpuscles which carry the negative electricity are very different from the carriers of the positive; the former have a mass of only $\frac{1}{1700}$ of the atom of hydrogen, while the mass of the latter is never less than that of this atom.

The stream of positive particles towards the cathode is often called the *Canalstrahlen*, and may be investigated by allowing the stream to flow through a hole in the cathode and then measuring, by the methods described in CONDUCTION, ELECTRIC (*Through Gases*), the velocity and the value of e/m when e is the charge on a carrier and m its mass. It has been found that this stream is somewhat complex and consists of—

α. A stream of neutral particles.

β. A stream of positively electrified particles moving with a constant velocity of 2×10^8 cm./sec., and having $e/m=10^4$. This is a secondary stream produced by the passage of α through the gas, and it is very small when the pressure of the gas is low.

γ. Streams of positively electrified atoms and perhaps molecules of the gases in the tube. The velocity of these depends upon the cathode fall of potential.

The streams of negative corpuscles and positive particles produce different kinds of phosphorescence when they strike against a solid obstacle. The difference is especially marked when they strike against lithium chloride. The corpuscles make it phosphoresce with a steely blue light giving a continuous spectrum; the positive particles, on the other hand, make it shine with a bright red light giving in the spectroscope the red lithium line. This affords a convenient method of investigating the rays; for example, the distribution of the positive stream over the cathode is readily studied by covering the cathode with fused lithium chloride and observing the distribution of the red glow. Goldstein has observed that the film of metal which is deposited on the sides of the tube through the sputtering of the cathode is quickly dissipated when the positive stream impinges on it. This suggests that the sputtering of the cathode is caused by the impact against it of the positive stream. This view is supported by the fact that the sputtering is not very copious until the increase in the current produces a large increase in the cathode fall of potential. The magnitude of the potential fall and the length of the dark space are determined by the condition that the positive particles when they strike against the cathode must give to it sufficient energy to liberate the number of cathode particles which produce, when they ionize the gas, sufficient positive particles to carry this amount of energy. Thus the cathode fall may be regarded as existing to make the cathode emit negative corpuscles. If the cathode can be made to emit corpuscles by other means, the cathode fall of potential is not required and may disappear. Now Wehnelt (*Ann. Phys.*, 1904, 14, p. 425), found that when lime or barium oxide is heated to redness large quantities of negative corpuscles are emitted; hence if a cathode is covered with one of these substances and made red hot it can emit corpuscles without the assistance of an electric field, and we find that in this case the cathode fall of potential disappears, and current can be sent through the gas with very much smaller differences of potential than with cold cathodes. With these hot cathodes a luminous current can under favourable circumstances be sent through a gas with a potential difference as small as 18 volts.

The dimensions of the parts of the discharge we have been considering—the dark space and the negative glow—depend essentially upon the pressure of the gas and the shape of the cathode, and do not increase when the distance between the anode and cathode is increased. The dimensions of the other part of the discharge which reaches to the anode and is called the positive column depends upon the length of the tube, and in long tubes constitutes by far the greater part of the discharge. This positive column is separated from the negative glow by a dark interval generally known as the Faraday dark space; the dimensions of this dark interval are very variable—it is sometimes altogether absent.

The positive column assumes a considerable variety of forms as the current through the gas and the pressure are varied: sometimes it is a column of uniform luminosity, at others it breaks up into a series of bright and dark patches known as striations. Some examples of these are given in fig. 17 of CONDUCTION, ELECTRIC (*Through Gases*). The distance between the striations varies with the pressure of the gas and the diameter of the tube, the bright parts being more widely separated when the pressure is low and the diameter of the tube large, than when the pressure is high and the tube small. The striations are especially brilliant and steady when a Wehnelt cathode covered with hot lime is used and the discharge produced by a number of storage cells; by this means large currents can be sent through the tube, resulting in very brilliant striations. When the current is increased the positive column shortens, retreating backwards towards the anode, and may, by using very low currents, be reduced to a glow over the surface of the anode. The electric force in the positive column has been measured by many observers. It is small compared with the forces which exist in the dark space; when the luminosity in the positive column is uniform, the force there is uniform; when the positive column is striated there are periodic variations in the electric force, the force being greater in the bright parts of the striation than in the dark.

Anode Drop of Potential.—Skinner (*Wied. Ann.* 68, p. 752; *Phil. Mag.* [6], 8, p. 387) has shown that there is a sudden change in potential between the anode itself and a point in the gas close to the anode. This change amounts to about 20 volts in air; it is thus much smaller than the cathode fall of potential, and it is also much more abrupt. There does not seem to be any region at the anode comparable in dimensions with the Crookes' dark space in which the drop of potential occurs.

The highly differentiated structure we have described is not the only way in which the current can pass through the tube. If a large Leyden jar is suddenly discharged through the tube the discharge passes as a uniform, continuous column stretching without interruption from anode to cathode; Goldstein has shown (*Verh. deutsch. phys. Ges.* 9, p. 321) that the spectrum of this discharge shows very interesting characteristics. (J. J. T.)

VÁCZ (Ger. *Waitzen*), a town of Hungary, in the county of Pest-Pilis-Solt-Kis-Kun, 20 m. N. of Budapest by rail. Pop. (1900) 16,563. It is situated on the left bank of the Danube, at the point where this river takes its southern course, and at the foot of the Nagyszál (Ger. *Waitzenberg*), on the outskirts of the Carpathians. It is the seat of a Roman Catholic bishopric, founded in the 11th century, and contains a beautiful cathedral, built in 1761–1777, after the model of St Peter's at Rome. Amongst other buildings are the episcopal palace, with a museum of Roman and medieval antiquities, several convents, and the principal deaf and dumb institute in the country. There are large vineyards in the neighbouring hilly district, and the exportation of grapes is extensively carried on. Vácz was the scene of two victories gained by the Austrians against the Turks, one in 1597 and the other in 1684.

VADE-MECUM, a Latin phrase meaning literally "come with me" (*vade*, imperative of *vadere*, to go or come; *cum*, with; *me*, abl. of *ego*, I), and used in French, Spanish and English for something that a person is in the habit of constantly taking about with him, especially a book of the nature of a handy guide or work of reference.

VAGRANCY (formed from "vagrant," wandering, unsettled; this word appears in Anglo-Fr. as *wakerant* and O.Fr. as *wancrant*, and is probably of Teut. origin, cf. M.L.G. *welkern*, to walk about; it is allied to Eng. "walk," and is not to be directly referred to Lat. *vagari*), the state of wandering without any settled home; in a wider sense the term is applied in England and the United States to a great number of offences against the good order of society. An English statute of 1547 contains the first mention of the word "vagrant," using it synonymously with "vagabond" or "loiterer." Ancient statutes quoted by Blackstone define vagrants to be "such as wake on the night and sleep on the day and haunt customable taverns and alehouses and routs about; and no man wot from whence they come ne whither they go." The word vagrant now usually includes idle and disorderly persons, rogues, vagabonds, tramps, unlicensed pedlars, beggars, &c.

The social problem of vagrancy is one that in 1910 had not yet been satisfactorily dealt with, so far as the United Kingdom is concerned. Indeed, the legislation of the early 19th century remained still in force in England and Wales. In early times, legislation affecting the deserving poor and vagrants was blended. It was only very gradually that the former were allowed to run a freer course, but provisions as to vagrancy and mendicity, including stringent laws in relation to constructive "sturdy beggars," "rogues" and "vagabonds," formed, until well on in the 19th century, a prominent feature of Poor Law legislation. In 1713 an act was passed for reducing the laws relating to rogues, vagabonds, sturdy beggars and vagrants into one act, and for more effectually punishing them and sending them to their homes, the manner of conveying them including whipping in every county through which they passed. This act was in turn repealed in 1740; the substituted consolidation act (13 Geo. II. c. 24), embracing a variety of provisions, made a distinction between idle and disorderly persons, rogues and vagabonds and incorrigible rogues. Four years later was passed another statute which continued the rough classification already mentioned. The laws relating to idle and disorderly persons, rogues and vagabonds, incorrigible rogues and other vagrants in England were again consolidated and amended in 1822, but the act was superseded two years later by the Vagrancy Act (5 Geo. IV. c. 83), which in 1910 was the operative statute.

The offences dealt with under the act of 1824 may be classified as follows: (1) offences committed by persons of a disreputable mode of life, such as begging, trading as a pedlar without a licence, telling fortunes, or sleeping in outhouses, unoccupied buildings, &c., without visible means of subsistence; (2) offences against the poor law, such as leaving a wife and family chargeable to the poor rate, returning to and becoming chargeable to a parish after being removed therefrom by an order of the justices, refusing or neglecting to perform the task of work in a workhouse, or damaging clothes or other property belonging to the guardians; (3) offences committed by professional criminals, such as being found in possession of house-breaking implements or a gun or other offensive weapon with a felonious intent, or being found on any enclosed premises for an unlawful purpose, or frequenting public places for the purpose of felony.

Offences specially characteristic of vagrancy are begging, sleeping out, and certain offences in casual wards, such as refusal to perform a task of work and destroying clothes. Persons committing these last-mentioned offences are classed as "idle and disorderly persons" and are liable on summary conviction to imprisonment with hard labour for fourteen days or on conviction by a petty sessional court to a fine of £5 or a month's imprisonment with or without hard labour. A second conviction makes a person a "rogue and vagabond" liable on summary conviction to imprisonment for fourteen days or on conviction by a petty sessional court to a fine of £25 or imprisonment for three months with or without hard labour. Any person sleeping out without visible means of subsistence is a rogue and vagabond, or on second conviction an incorrigible rogue, while an ordinary beggar is an idle and disorderly person. Under the poor law as reformed in 1834 the primary duty of boards of guardians was to relieve destitute persons within their district, but legislation and administration gradually widened that duty, so that eventually they came to administer relief to vagrants also, or casual paupers, as they are officially termed.

Casual Wards.

Within the limits prescribed by the local government board the treatment in English casual wards varies in a striking degree. Before admission to a casual ward a vagrant requires an order, obtained either from a relieving officer or his assistant. In cases of sudden or urgent necessity, however, the master of the workhouse has power to admit without an order. Generally speaking, vagrants are not admitted to the casual wards before 4 p.m. in winter or 6 p.m. in summer. On admission, they are supposed to be searched, but this is not usually done with much thoroughness; broken food found on them is sometimes allowed to be eaten in the ward; money, pipe, tobacco, &c., are restored to them on discharge. As soon as practicable after admission vagrants are required to be cleansed in a bath with water of suitable temperature. Their clothes are taken away and disinfected and a nightshirt provided. Sleeping accommodation is provided either on the cellular system or in associated wards, the proportion of workhouses providing the former being 2 to 1. Vagrants are, as a general rule, supposed to be detained two nights and are required to perform a task of work. This consists of stone-breaking, wood-sawing, wood-chopping, pumping, digging or oakum picking, and should represent nine hours' work.

The supervising authority has endeavoured, in prescribing the work to which vagrants are put, to make it as deterrent as possible, but in practice the work presents little difficulty to the habitual vagrant, and very few workhouses enforce the two nights' detention rule. The fare provided for vagrants is a welcome relief, too, from their usual scanty fare, and in many of the modern workhouses the wards are almost luxurious in their style and equipment.

Reform movement.

The consequence of this generous treatment of those who are "work-shy" is that instead of being repelled or reformed by their treatment, the class is continually on the increase. This increase has received the serious attention of social reformers, and in 1904 the president of the local government board appointed a departmental committee to inquire into the subject of vagrancy. The committee presented its report in 1906, which with the evidence of witnesses is a most valuable exposition of the subject. Among the various recommendations of the committee the most important were the transference of casual wards to the control of police authorities; the issue of way-tickets, as used on the continent of Europe and a very few English counties, by the police to *bona fide* work-seekers, and more especially the detention of habitual vagrants in labour colonies. This last recommendation was also that of the Royal Commission on the Poor Laws which reported in 1909, to which those interested are also referred for valuable information.

The system of way-tickets has been found useful in Germany and Switzerland in assisting the genuine work-seeker on his way and in discriminating between him and the idle vagrant. In Germany those leaving their districts must carry certain papers of identification in addition to a *Wanderschein* or way-ticket. For the relief of the destitute wayfarer there is the *Herberge* or lodging-house, maintained by a voluntary society, and the *Verpflegungs-station*, or relief station, maintained by the local authorities. In each, those in search of work can obtain lodging and food either for a small payment or by the performance of three hours' work, such as wood-chopping or stone-breaking. In Switzerland way-tickets are issued by a society named the Inter-Cantonal Union to those who can prove that they have worked for an employer within the three preceding months, and that at least five days have elapsed since that employment ceased. The Vagrancy Committee recommended that the English way-ticket in book form should give the man's personal description, his usual trade, his reason for wanting to travel and his proposed destination, and should contain his signature and, possibly, his finger-prints for the purpose of testing identity. The name of each casual ward visited should be stamped on the ticket. The duration of the ticket should be limited to a certain period, possibly a month. With such a ticket, a man should be entitled at the casual ward to a night's lodging, supper and breakfast, and after performing two hours' work to help to pay for his food and lodging he should be free to leave whenever he liked. The name of the next ward on the direct line of his route, which he could reach that night, should be entered on the ticket, and on his arrival at that place he should be treated in the same manner. The ticket would thus form a record of his journey and show whether he was genuinely in search of work.

Labour colonies.

The remedy which has been considered as most likely to be effective for the cure of habitual vagrancy in England is that of labour colonies, which have been tried on the continent of Europe with a substantial measure of success. These European labour colonies are described in detail in the appendices to the Report and Evidence of the Vagrancy Committee and in the books mentioned at the end of this article, but a *résumé* of the more important colonies may here be given.

Holland.—There are two classes of colonies, both originally established by the *Maatschaapij van Weldadigheid* (Society of Beneficence), a society founded by General van den Bosch (1780–1844) in 1818. The *Free Colonies* were designed for the reception of indigent persons, for the purpose of teaching them agriculture, and so enabling them eventually to earn their own living independently. There are three of these free colonies, viz. Frederiksoord, Willemsoord and Wilhelminasoord, forming practically one colony, with a population of about 1500. The expenses of the colonies are met by voluntary subscriptions, but it has been found that the persons who enter the free colonies remain there and few fresh cases are received. The number of inmates has been steadily decreasing. The society also maintained *Beggar Colonies* for the compulsory detention of persons committing the offence of begging. They were more penal than reformatory institutions, and the inmates were taught certain occupations by which they might support themselves on leaving. They did not prove self-supporting and were eventually taken over by the state. The chief institution is that at Veenhuizen, which occupies some 3000 acres of land, and where some 4000 men of the vagrant class are detained for periods varying from not less than six months to not more than three years. There is a similar institution for women at Leiden.

Belgium.—In Belgium the institutions for the repression of vagrancy are maintained by the state under a law of November 27th, 1891. They are of three kinds:—(1) *Dépôts de mendicité* (beggars' depots); (2) *maisons de refuge* (houses of refuge); and (3) *écoles de bienfaisance* (reformatory schools). The beggars' depots are "exclusively devoted to the confinement of persons whom the judicial authority shall place at the disposal of the government" for that purpose, and these are classified as (*a*) able-bodied persons who, instead of working for their living, depend upon charity as professional beggars; (*b*) persons, who, owing to idleness, drunkenness or immorality, live in a state of vagrancy; and (*c*) *souteneurs*. There are two of these depots: one for men at Merxplas, and another for women at Bruges. Persons are committed to the depots on summary conviction for a period of not less than two years or more than seven years. The population of Merxplas is over 5000; the colonists are employed in land reclamation, farming and various industries. Small daily wages, varying from 1d. to 3d., are paid, but these may be withheld for disciplinary purposes. One half of the wages is retained by the management and paid out to the colonist on leaving, the other half being given monthly in the shape of tokens to spend at the canteen in articles of food, tobacco, &c.

The houses of refuge are for men who from age or infirmity are unable to work, or who have been driven to begging or vagrancy by the want of work or misfortune. The chief house of refuge is at Hoogstraeten, where the helpless and sick are received; that at Wortel being reserved for the able-bodied. The colonists earn wages ranging from 1d. to 7d. a day, one-third of this being given to them to spend, and they may take their discharge when they have saved 12s. from their earnings or can show that they have work to go to. The maximum period of detention is one year.

Germany.—In Germany there are between thirty and forty labour colonies, under the management of a charitable association, the Labour Colony Central Board. There is however, no compulsory detention. The institutions which deal with vagrants and persons who neglect to maintain themselves are termed "workhouses" (*Arbeitshäuser*), but they correspond to the compulsory colonies of Belgium and Holland. Under the penal code of 1900, any one (*a*) who wanders about as a vagabond; (*b*) who begs, or causes or allows his children to beg; (*c*) who through gambling, drunkenness or idleness is forced to apply for relief for himself, or those for whose maintenance he is responsible; (*d*) who while in receipt of public relief refuses to do work given him by the authorities; (*e*) who after losing his lodging fails to procure another within a certain time, is liable to detention in a workhouse for a period not exceeding two years. The workhouses are under strict military discipline, the inmates being termed prisoners. They are taught domestic, agricultural and industrial occupations.

Switzerland.—Labour colonies are of two kinds, voluntary and compulsory. The voluntary colonies, of which there are three in Switzerland, are managed by philanthropic societies. Entry and discharge are voluntary, but those seeking admission must agree to stay a stated time, usually one or two months. Compulsory colonies are established in every canton, under the management of the cantonal council. Beggars can be arrested, and, if habitual offenders, can be sent to a labour colony for a period varying from six months to two years. If the man is found to have refused work, he can be sent to a labour colony as a "work-shy" for from three months to two years. Owing in great measure to the success of these labour colonies, vagrancy has considerably diminished in Switzerland, and the colonies everywhere are small; that at Witzwyl, the largest, having less than 200 inmates. Punishment is generally inflicted by reduction of food; the inmates receive no wages, but by industry may earn a remission of their period of detention

AUTHORITIES.—For a history of vagrancy see C. J. Ribton-Turner, *History of Vagrants and Vagrancy* (1887); see also *Reports, Evidence and Appendices of Departmental Committee on Vagrancy, 1906*—a most valuable publication—as well as *The Vagrancy Problem* (1910), by W. H. Dawson, who was a witness before the committee, and whose work quoted is full of first-hand information. Two Board of Trade Reports on "Agencies and Methods for dealing with the Unemployed," 1893 and 1904, will be found useful, as also Rev. W. Carlile and V. W. Carlile's *The Continental Outcast* (1906).

(T. A. I.)

VAISON, a town of south-eastern France, in the department of Vaucluse, 26 m. N.N.E. of Avignon by road. Pop. (1906) 2148. The Ouvèze, a tributary of the Rhone, divides Vaison into two quarters—the Roman and early medieval town on the right bank, and the town of the later middle ages on the left bank,—the two communicating by an ancient Roman bridge consisting of a single arch. On the right bank is the church (once the cathedral) of Ste Marie, the choir of which is thought to date in parts from the 9th century, while the nave belongs to the 12th century. A Romanesque cloister containing a collection of old sculpture flanks the church on the north. Remains of a Roman amphitheatre and the chapel of St Quenin (dedicated to a bishop of the 6th century), with a curious apse of the end of the 11th century, are also to be seen in the old town. On the left bank are the parish church (15th and 16th centuries), remains of the medieval fortifications, and the keep of a castle of the counts of Toulouse. The industries of the town include the manufacture of wooden shoes, bellows and agricultural implements. Vaison, under the name of *Vasio*, was one of the principal towns of the *Vocontii*, and was a place of great importance under the Romans, as is shown by an abundance of objects unearthed by excavation, amongst which may be mentioned a fine statue of an athlete (the Diadumenos) in the British Museum. The bishopric established in the 3rd century was suppressed in 1791. Its holders, towards the end of the 12th century, were despoiled of the temporal power in the town by the counts of Toulouse. Subsequently Vaison came, together with the rest of Comtat-Venaissin, under the power of the popes.

VALAIS (Ger. *Wallis*, Ital. *Vallese*), one of the cantons of southern Switzerland. Its name has been explained as meaning the "Wälsch" (*i.e.* non-Teutonic) land. But it is pretty certainly derived from *vallis* or *vallensis pagus*, for the region is simply the old *Vallis Poenina*, or upper valley of the Rhone from its source in the Rhone glacier to the gorge of St Maurice, together with the left bank of the Rhone from that gorge to the Lake of Geneva. The spelling "Vallais" prevailed till the end of the 18th century, and was officially superseded early in the 19th century by "Valais," a form that is very rarely found previously.

The total area of the canton is 2016·6 sq. m. (exceeded only by that of the Grisons and of Bern), of which, however, only 1107 is reckoned as "productive" (forests covering 297·4 sq. m. and vineyards 10·7 sq. m.), while of the rest no fewer than 375 sq. m. (the most considerable stretch in Switzerland) is occupied by glaciers, and 41¾ sq. m. by the cantonal share of the Lake of Geneva. It is therefore naturally one of the poorest cantons in the confederation. It would be still poorer were it not for its excellent wines, and for the fact that in summertime it is visited by many thousands of travellers, for whom inns have been built in nearly every glen and on many high pastures (Zermatt, Saas, Riffel Alp, Evolena, Arolla, Zinal, Champéry, in the Val de Bagnes, in the Lötschen valley, the Bel Alp, the Rieder Alp, the Eggishorn, Binn, and near the Rhone glacier). It consists of a deep and long trench, which becomes a mere gorge between Niederwald and Brieg, the general direction being south-west, till at Martigny the valley makes a sharp bend to the north-west. The loftiest point in the canton is the culminating summit or Dufourspitze (15,217 ft.) of Monte Rosa, which rises on a short spur projecting from the watershed, but the highest mountain which is wholly situated in the canton is the Dom (14,942 ft.), the culminating point of the Mischabel range.

A railway line runs through the canton from Le Bouveret, on the Lake of Geneva, to (73 m.) Brieg, at the N. mouth of the magnificent Simplon tunnel (12¼ m., opened in 1906), the line from St Maurice (about 14 m. from Bouveret) onwards forming the through line from Lausanne towards Milan. There are also mountain railways from Visp up to Zermatt (thence a branch up to the Gornergrat), and from Vernayaz (near Martigny) past Salvan towards Chamonix, while the new tunnel, begun in 1906, beneath the Lötschen Pass or Lötschberg, connects Kandersteg, in the Bernese Oberland, with Brieg, and thus opens up a new direct route from London and Paris to Italy. As the canton is shut in almost throughout its entire length by high mountain ranges it is as a rule only accessible by foot paths or mule paths across this lofty Alpine barrier. But there are excellent carriage roads over the Great St Bernard Pass (8111 ft.), as well as over the Simplon Pass (6592 ft.), both leading to Italy. At the very head of the Rhone valley two other finely engineered carriage roads give access to Uri over the Furka Pass (7992 ft.) and to the canton of Bern over the Grimsel Pass (7100 ft.). Being thus shut in it was almost impossible for the canton to extend its boundaries, save in 1536, when it won the left bank of the Rhone below the gorge of St Maurice. But at early though unknown dates it acquired and still holds the upper bit of the southern slope of the Simplon Pass, as well as the Alpine pastures on the northern slope of the Gemmi. The mineral waters of Leukerbad, and, to a lesser degree, those of Saxon, attract some summer visitors, the vast majority of whom, however, prefer the glorious scenery of the various high Alpine glens.

The canton forms the diocese of Sion (founded in the 4th century), and has St Théodule (or Theodore) as its patron saint. Till 1513 the diocese was in the ecclesiastical province of Moûtiers in the Tarentaise (Savoy), but since then has been immediately dependent on the pope. Within its limits are the three famous religious houses (all now held by Austin Canons) of St Maurice (6th century), of the Great St Bernard, and of the Simplon. Since 1840 the abbot of St Maurice has borne the title of bishop of Bethlehem "in partibus infidelium." Ecclesiastical affairs are managed without any control or interference on the part of the state, though the cantonal legislature presents to the pope as bishop one of four candidates presented by the chapter of Sion.

In 1900 the population was 114,438, of whom 74,562 were French-speaking, 34,339 German-speaking, and 5469 Italian-speaking, while 112,584 were Romanists, 1610 Protestants, and 25 Jews. The linguistic frontier has varied in the course of ages. Nowadays from Sierre (10 m. above Sion) upwards a dialect of German is generally spoken (though it is said that the opening of the Simplon through route has given a considerable impetus to the extension of French among the railway officials), while below Sierre a French dialect (really a Savoyard patois) is the prevailing tongue. To a considerable degree the history of the Valais is a struggle between the German element (predominant politically till 1798) and the French element. Good wines are produced in the district, especially Muscat and Vin du Glacier. Otherwise the inhabitants of the main valley (at least from Brieg onwards) are engaged in agriculture, though suffering much from the inundations of the Rhone, against which great embankments have been constructed, while many swampy tracts have been drained, and so the plague of malarial fever abated to a certain extent.

In the higher valleys the inhabitants are employed in pastoral occupations. The number of "alps" or mountain pastures is 547 (319 in the Lower Valais and 228 in the Upper Valais, the line of division being drawn a little above Sierre), capable of supporting 50,735 cows (33,192 and 17,543 respectively) and of an estimated capital value of 10,873,900 fr. (7,969,500 and 2,904,400 respectively), so that, as might be expected for other reasons, the lower portion of the valley where the climate is less rigorous is richer and more prosperous than the upper portion where other conditions prevail. The capital is Sion (*q.v.*). Next in point of population came (in 1900) Naters (3953), on account of the numbers of Italian workmen engaged in piercing the Simplon tunnel. The neighbouring town of Brieg had then 2182 inhabitants, and the wide commune of Monthey 3392.

The canton is divided into 13 administrative districts, which comprise 166 communes. The cantonal constitution was little advanced till 1907 when it was entirely remodelled. The legislature (*Grand Conseil* or *Gross Rath*) is composed of members elected in the proportion of one for every 1000 (or fraction over 500) citizens, and holds office for four years. The executive (*Conseil d'État* or *Staatsrath*) is composed of five members, named by the Grand Conseil, and holds office for four years. The "obligatory referendum" prevails, while 4000 citizens (6000 in the case of a revision of the cantonal constitution) have the right of "initiative" as to legislative projects. The two members of the Federal *Ständerath* are named by the Grand Conseil, but the six members of the Federal *Nationalrath* are elected by a popular vote. The 1907 cantonal constitution has a curious provision (art. 84) that while members of the cantonal legislature are ordinarily elected by all the voters of a *Bezirk* or district, yet if one or several communes (numbering over 500 inhabitants) demand it, this commune or these communes form a *kreis* or *cercle* and elect a member or members.

The Vallis Poenina was won by the Romans after a great fight at Octodurus (Martigny) in 57 B.C., and was so thoroughly Romanized that the Celtic aboriginal inhabitants and the Teutonic Burgundian invaders (5th century) became Romance-speaking peoples. According to a tradition which can be traced back to the middle of the 8th century, the "Theban legion" was martyred at St Maurice about 285 or 302. Valais formed part of the kingdom of Transjurane Burgundy (888), which fell to the empire in 1032, and later of the duchy of Burgundia Minor, which was held from the emperors by the house of Zähringen (extinct 1218). In 999 Rudolph III. of Burgundy gave all temporal rights and privileges to the bishop of Sion, who was later styled "praefect and count of the Valais," and is still a prince of the Holy Roman Empire; the pretended donation of Charlemagne is not genuine. The bishops had much to do in keeping back the Zähringen, and later the counts of Savoy. The latter, however, succeeded in winning most of the land west of Sion, while in the upper part of the valley there were many feudal lords (such as the lords of Raron, those of La Tour-Châtillon, and the counts of Visp). About the middle of the 13th century we find independent communities or "tithings" (*dizains* or *Zehnten*) growing up, these, though seven in number, taking their name most probably from a very ancient division of the bishop's manors for administrative and judicial purposes. In the same century the upper part of the valley was colonized by Germans from Hasli (Bern), who thoroughly Teutonized it, though many Romance local names still remain. In 1354 the liberties of several of the seven "tithings" (Sion, Sierre, Leuk, Raron, Visp, Brieg and Conches) were confirmed by the Emperor Charles IV. A little later the influence of Savoy became predominant, and the count secured to his family the bishopric of Sion, of which he was already the suzerain. His progress was resisted by the tithings, which in 1375–76 crushed the power of the house of La Tour-Châtillon, and in 1388 utterly defeated the forces of the bishop, the count and the nobles at Visp, this being a victory of the Teutonic over the Romance element in the land. From 1384 the Morge stream (a little below Sion) was recognized as the boundary between Savoyard or Lower Valais and episcopal or Upper Valais. In 1416–17 the *Zehnten* of the upper bit of the valley made an alliance with Lucerne, Uri and Unterwalden, with a view partly to the conquest of the Val d'Ossola, which was finally lost in 1422, and partly to the successful crushing of the power of the lords of Raron (1420). By the election of Walther von Supersax of Conches as bishop in 1457 the Teutonic element finally won the supremacy. On the outbreak of the Burgundian War the bishop of Sion and the tithings made a treaty with Bern. In November of the same year (1475) they seized all Lower or Savoyard Valais up to Martigny, and in 1476 (March), after the victory of Grandson, won St Maurice, Evian, Thonon and Monthey. The last three districts were given up in 1477, but won again in 1536, though finally by the treaty of Thonon in 1569 Monthey, Val d'Illiez and Bouveret alone were permanently annexed to the Valais, these conquests being maintained with the help of their old allies, Uri, Schwyz and Unterwalden. These conquered districts (or Lower Valais) were always ruled as subject lands by the bishop and tithings of Upper Valais. The Valais took part in the Milanese war of 1512–16, and henceforth was reckoned as an "ally" of the Swiss Confederation. In 1533 a close alliance was made with the Romanist cantons; but by 1551 the Protestants had won so much ground that toleration was proclaimed by the local assembly. In 1586 Upper Valais became a member of the Golden League, and finally in 1603–04 the four tithings of Conches, Brieg, Visp and Raron carried the day in favour of the old faith against those of Leuk, Sierre and Sion. In 1790–91 Lower Valais rose in revolt; but it was not finally freed till 1798, when the whole of Valais became one of the cantons of the Helvetic Republic. Such prolonged and fierce resistance was, however, offered to French rule by the inhabitants that in 1802 Bonaparte declared Valais an independent state under the name of the "Rhodanic Republic," yet in 1810, for strategic reasons, he incorporated it with France as the "department of the Simplon," and it was not freed till the Austrians came in 1813. In 1815 a local assembly was created, in which each of the seven tithings of Upper and each of the six of Lower Valais (though the latter had nearly double the population of the former) elected four members, the bishop being given four votes. This constitution was approved by the Federal Swiss Diet, which thereupon (1815) received the Valais as a full member of the Swiss Confederation. In 1832 the Valais joined the League of Sarnen to maintain the Federal Pact of 1815. In 1839–40 it was convulsed by a struggle between the Conservative and Radical parties, the split into two half cantons being only prevented by the arrival of Federal troops. The constitution was revised in 1839, the local assembly was to be elected according to population (1 member for every 1000 inhabitants), and the bishop was given a seat instead of his four votes, while the clergy elected one deputy. In 1844 civil war raged, many Liberals being slain at the bridge of Trient (May 1844), and the Valais becoming a member of the Sonderbund. By the 1844 constitution the clergy elected a second deputy. The introduction of the Jesuits embittered matters, and the Valais was the last canton to submit in the Sonderbund War (1847); it contented itself, however, with voting steadily against the acceptance of the Federal constitutions of 1848 and 1874. By the constitution of 1848 all ecclesiastical exemptions from taxation were swept away, and the bishop lost his seat in the assembly. New constitutions were framed in 1852, in 1875 and in 1907.

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VALDEMAR I., king of Denmark (1131–1182), the son of the chivalrous and popular Canute Lavard and the Russian princess Ingeborg, was born a week after his father's murder, and was carefully brought up in the religious and relatively enlightened household of Asser Rig, whose sons Absalon and Esbjörn Snare, or "the Swift," were his playmates. On the death of King Eric Lam in 1147 Valdemar came forward as one of the three pretenders to the Danish crown, Jutland falling to his portion (compact of Roskilde, 9th of August 1157). Narrowly escaping assassination, at a banquet a few days later, at the hands of his rival, King Sweyn III., he succeeded only with the utmost difficulty in escaping to Jutland, but on the 23rd of October utterly routed Sweyn at the great battle of Grathe Heath, near Viborg, Sweyn perishing in his flight from the field. Valdemar had no longer a competitor. He was the sole male survivor of the ancient royal line; his valour and ability were universally recognized, and in Absalon, elected bishop of Roskilde in 1158, he possessed a minister of equal genius and patriotism. The first efforts of the new monarch were directed against the Wendish pirates who infested the Baltic and made not merely the political but even the commercial development of the Danish state impossible. What the Northmen were to the Western powers in the 8th and 9th the Wends were to the Scandinavian lands in the 11th and 12th centuries. But the Wendish pirates were more mischievous because less amenable to civilization than the Vikings. They lived simply for plunder, and had neither the ambition nor the ability to found colonies like Normandy or Northumbria. We may form some idea of the extent and the severity of their incursions from the fact that at the beginning of the reign of Valdemar the whole of the Danish eastern coast lay wasted and depopulated. Indeed, according to Saxo, one-third of the realm was a wilderness. The stronghold of the Wends was the isle of Rügen. Here lay Arkona their chief sanctuary and Garz their political capital. Both places were captured in 1169 by a great expedition under the command of Valdemar and Absalon; the hideous colossal idol of Rügievit was chopped into firewood for the Danish caldrons, and the Wends were christened at the point of the sword and placed beneath the jurisdiction of the see of Roskilde. This triumph was only obtained, however, after a fierce struggle of ten years, in which the Danes were much hampered by the uncertain and selfish co-operation of their German allies, chief among whom was Henry the Lion, duke of Saxony and Bavaria, who appropriated the lion's share of the spoil. For at the beginning of his reign Valdemar leaned largely upon the Germans and even went the length, against the advice of Absalon, of acknowledging the overlordship of the Emperor Frederick Barbarossa at the reichstag of Dôle, 1162. Very different was Valdemar's second conference with Barbarossa, on the banks of the Eider, in 1182, when the two monarchs met as equals in the presence of their respective armies, and a double marriage was arranged between two of Valdemar's daughters and two of the emperor's sons. The only serious domestic trouble during Valdemar's reign was the rebellion of the Scanian provinces, which objected to the establishment of a strong monarchy inimical to local pretensions and disturbances, and especially to the heavy taxes and tithes necessary to support the new reign of law and order. The rising was ultimately suppressed by Absalon at the battle of Dysiaa, 1181. In the following year died King Valdemar. His services to his country are aptly epitomized in the epitaph on his ancient monument at Ringsted church which describes him as "Sclavorum dominator, patriae liberator et pacis conservator." His fame has been somewhat obscured by that of his great minister Absalon, whom their common chronicler Saxo constantly magnifies at the expense of his master. Valdemar's worst faults were a certain aloofness and taciturnity. He is the only one of Saxo's heroes in whose mouth the chronicler never puts a speech. But his long reign is unstained by a single ignoble deed, and he devoted himself heart and soul to the promotion of the material and spiritual welfare of Denmark.

See *Danmarks Riges Historie*, vol. i. pp. 570–670 (Copenhagen, 1897–1905); Saxo, *Gesta Danorum*, books 10–16 (Strassburg, 1886). (R. N. B.)

VALDEMAR II., king of Denmark (1170–1241), was the second son of Valdemar I. and brother of Canute VI., whom he succeeded on the 12th of November 1202. Already during his brother's lifetime, as duke of Schleswig, Valdemar had successfully defended Denmark against German aggression. In 1201 he assumed the offensive, conquered Holstein, together with Hamburg, and compelled Count Henry of Schwerin to acknowledge the over-lordship of the Danish crown. Immediately after his coronation, he hastened to his newly won territories, accompanied by the principal civil and ecclesiastical dignitaries of Denmark, and was solemnly acknowledged lord of Northalbingia (the district lying between the Eider and the Elbe) at Lübeck, Otto IV., then in difficulties, voluntarily relinquishing all German territory north of the Elbe to Valdemar, who in return recognized Otto as German emperor. Thus the three bishoprics of Lübeck, Ratzeburg and Schwerin, which hitherto had been fief of the *Reich*, now passed under Danish suzerainty. Lübeck was a peculiarly valuable possession. The city had been founded in 1158 with the express object of controlling the Baltic trade. Only through Lübeck, moreover, could supplies and reinforcements be poured into the German military colonies in Livonia. By closing Lübeck Valdemar had German trade and the German over-seas settlements entirely at his mercy. This state of things was clearly recognized by German statesmen, and in 1208, when the Emperor Otto felt more secure upon his unstable throne, he became overtly hostile to Denmark and would have attempted the recovery of the lost German territory but for the interposition of Pope Innocent III., who threatened to excommunicate any German prince who should attack Valdemar, the equally pious and astute Danish king having undertaken, at the bidding of the holy see, to lead a crusade against the heathen Esthonians. Valdemar's position was still further strengthened when Frederick II., the successful rival of Otto IV., was, in 1215, crowned at Aix-la-Chapelle. Valdemar at once cultivated the friendship of the new emperor; and Frederick, by an imperial brief, issued in December 1214 and subsequently confirmed by Innocent III. and Honorius III., formally renounced all the German lands north of the Elbe and Elde, as well as the Wendish lands on the Baltic, in favour of Valdemar.

An attempt by Otto in 1215 to recover Northalbingia was easily frustrated by Valdemar, who henceforth devoted himself to the extension of the Danish empire over the eastern Baltic shores. Here, however, he had already been forestalled. At the end of the 12th century the whole of the Baltic littoral from semi-Christian Pomerania to orthodox Pleskow was fiercely and obstinately pagan. The connecting link between the western and the eastern Baltic was the isle of Gotland, where German merchants from Lübeck had established a depot (the later Visby). The fur-trade with the Esthonians and Livonians proved so lucrative that a German colony was planted in Livonia itself at what was afterwards Riga, and in 1201 for its better security the colony was converted into a bishopric. A still firmer footing was gained by the Germans on Livonian soil when Abbot Theoderick of Riga founded the order of the Sword (a foundation confirmed by the pope in 1204), whose duty it was to convert the heathen Esths and Livs and appropriate as much of their land in the process as possible. Two years later Valdemar, urged by Archbishop Anders Sunesön, also appeared off the Esthonian coast and occupied the isle of Oesel. In 1210 Valdemar led a second expedition eastwards, this time directed against heathen Prussia and Samland, the chief result of which was the subjection of Mestwin, duke of Pomerania, the leading chieftain in those parts.

Now was to be seen the determining influence of sea-power even in those days. Despite its superior weapons and mode of warfare, the German east Baltic colony was constantly in danger of being overborne by the endless assaults of the dogged aborigines, whose hatred of the religion of the Cross as preached by the knights is very intelligible; and in 1218 Bishop Albert of Riga was driven to appeal for assistance to King Valdemar. Valdemar cheerfully undertook a new crusade "for the honour of the Blessed Virgin and the remission of my own sins." In 1218 he set sail for Esthonia with one of the largest fleets ever seen in northern waters, including a Wendish contingent led by Prince Vitslav. Landing at Lyndantse (the modern Reval) in north Esthonia, Valdemar at once received the submission of the inhabitants, but three days later was treacherously attacked in his camp and only saved from utter destruction by his own personal valour and the descent from heaven, at the critical moment, of a red banner with a white cross on it, the Dannebrog (Danes' Cloth), of which we now hear for the first time, and which henceforth was to precede the Danish armies to victory till its capture by the Ditmarshers, three hundred years later. This victory was followed by the foundation of Reval and the occupation of Harrien and Wirland, the northern districts of Esthonia, by the Danes.

Valdemar was now, after the king of England, the most powerful potentate in the north of Europe. The south-western Baltic was a Danish Mediterranean, and Danish territory extended from the Elbe to lake Peipus. But this scattered and heterogeneous empire required a large standing army and a strong central government to hold it together. It is doubtful whether even the genius of Valdemar would have proved equal to such a stupendous task. He never had the opportunity of attempting it. In May 1223 he was seized at midnight in his tent on the isle of Lyö, whither he had come to hunt, by his vassal and guest Count Henry of Schwerin, and conveyed with his son and many other valuable hostages to the inaccessible castle of Dannenberg-on-Elbe. In this dungeon he languished for two and a half years, and, despite all the efforts of Pope Honorius III. on his behalf, was ultimately forced to pay a heavy ransom, and surrender Northalbingia and all his Wendish conquests except Rügen. On his release Valdemar attempted to retrieve his position by force of arms, but was utterly defeated at the battle of Bornhöved (22nd of July 1227), which deserves a place among the decisive battles of history, for it destroyed at once and for ever the Danish dominion of the Baltic and established the independence of Lübeck, to the immense detriment in the future of all the Scandinavian states. On the other hand Valdemar, by prudent diplomacy, contrived to retain the greater portion of Danish Esthonia (compact of Stensby, 1238). With rare resignation Valdemar devoted the remainder of his life to the great work of domestic reform. His noblest achievement in this respect is the codification of the Danish laws known as the *Jydske Lov* (Jutland Code), which he lived to see completed a few days before his death at Vordingborg on the 28th of March 1241. Valdemar was twice married, his first consort being Dragomir (Dagmar) of Bohemia, his second Berengaria of Portugal. All his four sons, Valdemar, Eric, Abel and Christopher became kings of Denmark.

See *Danmarks Riges Historie*, vol. i. pp. 736–849 (Copenhagen, 1897–1905). (R. N. B.)

VALDEMAR IV., king of Denmark (*c.* 1320–1375), was the youngest son of Christopher II. of Denmark. Valdemar was brought up at the court of the German emperor, Louis of Bavaria, during those miserable years when the realm of Denmark was partitioned among Holstein counts and German *Ritter*, while Scania, "the bread-basket" of the monarchy, sought deliverance from anarchy under the protection of Magnus of Sweden. Even the Hanse Towns, the hereditary enemies of Denmark, regarded the situation with disquietude. "One would gladly have seen a single king in Denmark if only for peace sake," says the contemporary Lübeck chronicle, "for peace was not to be had either at sea or on land." The assassination at Randers of the detested Holstein tyrant Count Gerhard III. (1340), who for nine years had held Jutland and Funen and dominated the rest of Denmark, first opened Valdemar's way to the throne, and on midsummer day 1340 he was elected king at a *Landsting* held at Viborg, after consenting to espouse Helveg, the sister of his most important confederate, Valdemar, duke of Schleswig.

Neither the time nor the place of Valdemar's birth is known, but he could not have been more than twenty when he became the nominal king of Denmark, though, as a matter of fact, his territory was limited to the northernmost county of Jutland. His precocious maturity is strikingly evident from the first. An energy which never slackened, a doggedness which no adversity could crush, a fiery ambition coupled with the coolest calculation, and a diplomatic unscrupulousness which looked always to the end and never to the means, these were the salient qualities of the reconstructor of the dismembered Danish state. First Valdemar aimed at the recovery of Zealand, which was actually partitioned among a score of Holstein mortgagees who ruled their portions despotically from their strong castles, and sucked the people dry. The oppressed clergy and peasantry regarded Valdemar as their natural deliverer; but so poor and friendless was he that the work of redemption proved painfully slow. In November 1343 he obtained the town and castle of Copenhagen from King Magnus Smek of Sweden, by reconfirming in still more stringent terms the previous surrender of the rich Scanian provinces, and by the end of the following year he had recovered the whole of North Zealand. In 1347 the remainder of Zealand was redeemed, and the southern isles, Laaland, Falster and Mön, also fell into the king's strenuous hands. By this time, too, the whole of Jutland (except the province of Ribe) had fallen to him, county by county, as their respective holders were paid off. In 1349, at the *Landsting* of Ringsted, Valdemar proudly rendered an account of his stewardship to the Estates of Zealand, and the bishop of Roskilde congratulated him on having so miraculously delivered his people from foreign thraldom. In August 1346, he prudently rid himself of the distant and useless province of Esthonia by selling it very advantageously to the Livonian Order.

Valdemar now gave full play to his endless energy. In north German politics he interfered vigorously to protect his brother-in-law the Margrave Louis of Brandenburg against the lords of Mecklenburg and the dukes of Pomerania, with such success that the emperor, Charles IV., at the conference of Bautzen, was reconciled to the Brandenburger and allowed Valdemar an annual charge of 16,000 silver marks on the city of Lübeck (1349). Some years later Valdemar seriously thought of reviving the ancient claims of Denmark upon England, and entered into negotiations with the French king, John, who in his distress looked to this descendant of the ancient Vikings for help. A matrimonial alliance between the two crowns was even discussed, and Valdemar offered, for the huge sum of 600,000 gulden, to transport 12,000 men to England. But the chronic state of rebellion in western Denmark, which, fomented by the discontented Jutish magnates, lasted with short intervals from 1350 to 1360, compelled Valdemar to renounce these far-reaching and fantastic designs. On the other hand, he proved more than a match for his domestic rebels, especially after his great victory at Brobjaerg in Funen (1357). Finally, the compact of Kalundborg restored peace to the kingdom.

Valdemar now turned his eyes from the west to the east, where lay the "kingdom of Scania." Valdemar had indeed pledged it solemnly and irrevocably to King Magnus of Sweden, who had held it for twenty years; but profiting by the difficulties of Magnus with his Norwegian subjects, after skilfully securing his own position by negotiations with Albert of Mecklenburg and the Hanseatic League, Valdemar suddenly and irresistibly invaded Scania, and by the end of 1361 all the old Danish lands, except North Holland, were recovered.

By the recovery of Scania Valdemar had become the lord of the great herring-fishery market held every autumn from St Bartholomew's day (24th of August) to St Denis's day (9th of October) on the hammer-shaped peninsula projecting from the S.W. corner of Scania containing the towns of Skanör and Falsterbo. This flourishing industry, which fully occupied 40,000 boats and 300,000 fishers assembled from all parts of Europe to catch and salt the favourite Lenten fare of the whole continent, was the property of the Danish crown, and the innumerable tolls and taxes imposed by the king on the frequenters of the market was one of his most certain and lucrative sources of revenue. Foreign chapmen eagerly competed for special privileges of Skanör and Falsterbo, and the Hanseatic merchants in particular aimed at obtaining a monopoly there. But Valdemar was by no means disposed to submit to their dictation, and political conjunctures now brought about actual hostilities between Valdemar and the Hansa, or at least that portion of it known as the Wendish Towns,[1] whose commercial interests lay principally in the Baltic.

From time immemorial the isle of Gotland had been the staple of the Baltic trade, and its capital, Visby, whose burgesses were more than half German, the commercial intermediary between east and west, was the wealthiest city in northern Europe. In July 1361 Valdemar set sail from Denmark at the head of a great fleet, defeated a peasant army before Visby, and a few days later the burgesses of Visby made a breach in their walls through which the Danish monarch passed in triumph. The conquest of Gotland at once led to a war between Valdemar and Sweden allied with the Hanseatic towns; but in the spring of 1362 Valdemar repulsed from the fortress of Helsingborg a large Hanseatic fleet provided with "shooting engines" (cannon) and commanded by Johan Wittenburg, the burgomaster of Lübeck. In Sweden proper he was equally successful, and the general pacification which ensued in April 1305, very greatly in his favour, was cemented by the marriage of his daughter Margaret with Hakon VI. of Norway, the son of King Magnus.

Valdemar was now at the height of his power. Every political rival had been quelled. With the papal see, since his visit to Avignon in 1364, he had been on the best of terms. His ecclesiastic patronage was immense, and throughout the land he had planted strong castles surely held by the royal bailiffs. But in the winter of 1367–68 a hostile league against him of all his neighbours threatened to destroy the fruits of a long and strenuous lifetime. The impulse came from the Hansa. At a *Hansetag* held at Cologne on the 11th of November 1367, three groups of the towns, seventy in number, concerted to attack Denmark, and in January 1368 Valdemar's numerous domestic enemies, especially the Jutlanders and the Holstein counts, acceded to the league, with the object of partitioning the realm among them. And now an astounding and still inexplicable thing happened. At Easter-tide 1368, on the very eve of this general attack, Valdemar departed for three years to Germany, leaving his realm in the capable hands of the earl-marshal Henning Podbusk. Valdemar's skilful diplomacy, reinforced by golden arguments, did indeed induce the dukes of Brunswick, Brandenburg and Pomerania to attack the confederates in the rear; but fortune was persistently unfriendly to the Danish king, and peace was finally concluded with the towns by Podbusk and the Danish Council of State at the congress of Stralsund, 1370. The conditions of peace were naturally humiliating for Valdemar,[1] though, ultimately, he contrived to render illusory many of the inordinate privileges he was obliged to concede. He was also able, shortly before his death on the 24th of October 1375, to recover the greater part of Holstein from the rebels.

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[1] Rostock, Greifswald, Wismar and Stralsund.

We know astonishingly little of him personally. A few caustically witty sayings of his, and St Bridget's famous comparison of him to a fowler who could entice the shyest birds with his fluting, are almost all his *personalia*. It would be a mistake to regard him as a patriot. He was too unscrupulous and self-centred to play for anything but his own hand. Yet no other Danish king did so much for his country. His statesmanship, as judged from his acts, was all but flawless, and he was certainly one of the greatest of the medieval diplomatists. His character peeps forth most clearly perhaps in the saying which has become his epithet, *Atterdag* ("There will be a to-morrow"), which is an indication of that invincible doggedness to which he owed most of his successes.

See *Danmarks Riges Historie*, vol. ii. pp. 275–356 (Copenhagen, 1897–1905). (R. N. B.)

VALDEPEÑAS, a town of Spain, in the province of Ciudad Real; near the right bank of the river Jabalon, a tributary of the Guadiana, and on the Madrid-Cordova and Valdepeñas-La Calzada railways. Pop. (1900) 21,015. Valdepeñas is the largest town in the Campo de Calatrava, an extensive plain north of the Sierra Morena. Its commerce developed rapidly in the last quarter of the 19th century, largely as a result of improvements in its communications by road and rail; the population in the same period increased by more than one-third. Valdepeñas contains large distilleries, tanneries, flour mills, cooperages, and other factories; but its trade is chiefly in the red wines for which the district is famous throughout Spain. There are hot mineral springs near the town.

VALDES, JUAN DE (*c.* 1500–1541), Spanish religious writer, younger of twin sons of Fernando de Valdes, hereditary regidor of Cuenca in Castile, was born about 1500 at Cuenca. He has been confused with his twin-brother Alphonso (in the suite of Charles V. at his coronation in Aix-la-Chapelle, 1520; Latin secretary of state from 1524, died in 1532 at Vienna). Juan, who probably studied at the university of Alcala, first appears as the anonymous author of a politico-religious *Diálogo de Mercurio y Caron*, written and published about 1528. A passage in this work may have suggested Don Quixote's advice to Sancho Panza on appointment to his governorship. The *Diálogo* attacked the corruptions of the Roman Church; hence Valdes, in fear of the Spanish Inquisition, left Spain for Naples in 1530. In 1531 he removed to Rome, where his criticisms of papal policy were condoned, since in his *Diálogo* he had upheld the validity of Henry VIII.'s marriage with Catherine of Aragon. On the 12th of January 1533 he writes from Bologna, in attendance upon Pope Clement VII. From the autumn of 1533 he made Naples his permanent residence, his name being Italianized as Valdesso and Val d'Esso. Confusion with his brother may account for the statement (without evidence) of his appointment by Charles V. as secretary to the viceroy at Naples, Don Pedro de Toledo; there is no proof of his holding any official position, though Curione (in 1544) writes of him as "cavalliere di Cesare." His house on the Chiaja was the centre of a literary and religious circle; his conversations and writings (circulated in manuscript) stimulated the desire for a spiritual reformation of the church. His first production at Naples was a philological treatise, *Diálogo de la Lengua* (1533). His works entitle him to a foremost place among Spanish prose writers. His friends urged him to seek distinction as a humanist, but his bent was towards problems of Biblical interpretation in their bearing on the devout life. Vermigli (Peter Martyr) and Marcantonio Flaminio were leading spirits in his coterie, which included Vittoria Colonna and her sister-in-law, Giulia Gonzaga. On Ochino, for whose sermons he furnished themes, his influence was great. Carnesecchi, who had known Valdes at Rome as "a modest and well-bred courtier," found him at Naples (1540) "wholly intent upon the study of Holy Scripture," translating portions into Spanish from Hebrew and Greek, with comments and introductions. To him Carnesecchi ascribes his own adoption of the Evangelical doctrine of justification by faith, and at the same time his rejection of the policy of the Lutheran schism. Valdes died at Naples in May 1541.

His death scattered his band of associates. Abandoning the hope of a regenerated Catholicism, Ochino and Vermigli left Italy. Some of Valdes's writings were by degrees published, in Italian translations. Showing much originality and penetration, they combine a delicate vein of semi-mystical spirituality with the personal charm attributed to their author in all contemporary notices. Llorente traces in Valdes the influence of Tauler; any such influence must have been at second hand. The *Aviso* on the interpretation of Scripture, based on Tauler, was probably the work of Alphonso. Valdes was in relations with Fra Benedetto of Mantua, the anonymous author of *Del Benefizio di Gesù Cristo Crocefisso*, revised by Flaminio (reprinted by Dr Babington, Cambridge, 1855). The suggestion that Valdes was unsound on the Trinity was first made in 1567 by the Transylvanian bishop, Francis Dávid (see article SOCINUS); it has been adopted by Sand (1684), Wallace (1850) and other anti-Trinitarian writers, and is countenanced by Bayle. To this view some colour is given by isolated expressions in his writings, and by the subsequent course of Ochino (whose heterodox repute rests, however, on the insight with which he presented objections). Valdes never treats of the Trinity (even when commenting on Matt. xxviii. 19), reserving it (in his *Latte Spirituale*) as a topic for advanced Christians; yet he explicitly affirms the consubstantiality of the Son, whom he unites in doxologies with the Father and the Holy Spirit (*Opusc.* p. 145). Practical theology interested him more than speculative; his aim being the promotion of a healthy and personal piety.

The following is a list of his writings:—

(1) *Diálogo de Mercurio y Caron* (no date or place; 1528?). An Italian translation by Nicolo Franco, Venice (no date); reprinted, Venice, 1545. Bound with the original (and with the translation) will usually be found a *Diálogo* by Alphonso de Valdes on the sack of Rome in 1527; this is also ascribed to Juan in the reprint, *Dos Diálogos* (1850).

(2) *Diálogo de la Lengua* (written, 1533; first printed, Madrid, 1737; reprinted, 1860, 1873).

(3) *Qual Maniera si devrebbe tenere a informare . . . gli figliuoli de Christiani delle Cose della Religione* (no date or place; before 1545, as it was used by the Italian translator of Calvin's catechism, 1545). No Spanish original is known. Reproduced as *Latte Spirituale*, Basel, 1549; Paris, 1550; in Latin, by Pierpaolo Vergerio, 1554; 1557; in Spanish, by Ed. Boehmer, 1882; in English, by J. T. Betts, 1882; also in German (twice) and in Polish.

(4) *Trataditos*, Bonn, 1881, from a manuscript in the Palatine Library, Vienna; in Italian, *I Cinque Tratatelli Evangelici*, Rome, 1545; reprinted, 1869; in English, by J. T. Betts, in *XVII Opuscules*, 1882.

(5) *Alfabeto Christiano* (written about 1537), in Italian, Venice, 1545; in English, by B. B. Wiffen, 1861; no Spanish original is known.

(6) *Ciento i Diez Conçideraçiones;* all copies of the original edition suppressed by the Spanish Inquisition; thirty-nine of the *Conçideraçiones*, published with the *Trataditos*, from a Vienna manuscript; in Italian, by Celio Secondo Curione, *Le Cento et Dieci Divine Consideratione*, Basel, 1550; in French, by Claude de Kerquifinen, Lyons, 1563; Paris, 1565; in English, by Nicholas Ferrar (at the instance of George Herbert), Oxford, 1638; Cambridge, 1646; another version by J. T. Betts, 1865; in Spanish, by Luis Usóz i Rio, 1855.

(7) *Seven Doctrinal Letters* (original published with the *Trataditos* from Vienna manuscript), in English, by J. T. Betts, with the *Opuscules*.

(8) *Comentario Breve . . . sobre la Epistola de San Pablo a los Romanos*, Venice, 1556 (with text; edited by Juan Perez de Pineda); reprinted, 1856; in English, by J. T. Betts, 1883.

(9) *Comentario Breve . . . sobre la Primera Epistola de san Pablo a los Corintios*, Venice, 1557 (edited, reprinted and translated as No. 8).

(10) *El Evangelio de San Mateo* (text and commentary), 1881, from Vienna manuscript; in English, by J. T. Betts, 1883.

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[1] They even gave the Hansa a vote in the future election of the Danish kings.

(11) *El Salterio* (the Psalms from Hebrew into Spanish), published with the *Trataditos* from Vienna manuscript.

(12) At Vienna is an unpublished commentary in Spanish on Psalms i.-xli.

(13) Sand mentions a commentary on St John's Gospel, not known to exist.

Notices of Valdes in Sand (*Biblioth. Antitrinitar*, 1684), Bayle and Wallace (*Antitrin. Biog.*, 1850) are inadequate. Revival of interest in him is due to McCrie (*Hist. Ref. in Italy*, 1827; *Hist. Ref. in Spain*, 1829). Fuller knowledge of his career was opened up by Benjamin B. Wiffen, whose *Life* of Valdes is prefixed to Betts's translation of the *Considerations*, 1865. Discoveries have since been made in the Aulic Library, Vienna, by Dr Edward Boehmer; cf. his *Span. Reformers of Two Centuries* (1874), his *Lives of J. and A. de Valdes* (1882), and his article in *Realencyklopädie für prot. Theol. und Kirche* (1885). See also M. Young, *Aonio Paleario* (1860); K. Benrath, *Bernardino Ochino* (1875;) Menendez Pelayo, *Los Heterodoxos Españoles* (1880); G. Bonet-Maury, *Early Sources of Eng. Unit. Christ.* (trans. E. P. Hall, 1884). (A. Go.*)

VALDIVIA, a southern province of Chile, bounded N. by Cautin, E. by Argentina, S. by Llanquihue and W. by the Pacific. Area, 8649 sq. m. Pop. (1895) 60,687; (1902, estimated) 76,000. The province is roughly mountainous in the E., is heavily forested and is traversed by numerous rivers. There is a chain of lakes across its eastern side near the Andes, the largest of which are Villarica, Rinihue and Ranco. The rivers are the Tolten on the northern boundary, the Valdivia, or Calle-Calle, with its large tributaries in the central part of the province, and the Bueno on the southern frontier. The Valdivia (about 100 m. long) has its sources in the Andes and flows W. to the Pacific. Its largest tributary on the N. is the Rio Cruces. The Valdivia is the outlet for Lake Rinihue and is navigable for a long distance. Valdivia is one of the most recently settled provinces and has a large immigrant element, chiefly German. Its most important industry is that of clearing away the heavy forests and marketing the timber. Stock-raising is an important industry, and wheat is grown on the cleared lands. Lumber, cattle, leather, flour and beer are exported. The capital is Valdivia, a flourishing city on the Valdivia river, 12 m. above its port, Corral, near the mouth of the river. Pop. (1895) 8062; (1902, estimated) 9704. It is a roughly built pioneer town, in which wood is the principal building material. The mean annual temperature is 59·9° and its annual rainfall is 115 in. A government railway runs to Osorno on the S., and in 1909 was being connected with the central line running S. through Bio-Bio and Cautin. The port of Corral, at the mouth of the Valdivia river, in lat. 39° 49′ S., long. 73° 19′ W., is situated on the S. side of a broad, lagoon-like sheet of water, forming one of the best natural harbours on the coast. It is a port of call for several lines of steamers, including those of the Pacific Mail running between Liverpool and Valparaiso.

VALDOSTA, a city and the county-seat of Lowndes county, Georgia, U.S.A., about 155 m. S.W. of Savannah. Pop. (1890) 2845; (1900) 5613 (2958 negroes); (1910) 7656. Valdosta is served by the Atlantic Coast Line, the Georgia Southern & Florida, and the Georgia & Florida railways. The city has a public library; the principal public buildings are the County Court House and the Federal building. Valdosta is in a rich farming and forest country; among its manufactures are cotton products, lumber, &c. The city owns and operates the water works. Valdosta was first settled in 1859, was incorporated as a town in 1860, and was chartered as a city in 1901.

VALENCE, a town of south-eastern France, capital of the department of Drôme, situated on the left bank of the Rhone, 65 m. S. of Lyons on the railway to Marseilles. Pop. (1906), town, 22,950; commune, 28,112. The river is here crossed by a fine suspension bridge. The cathedral of St Apollinaris, which has an interesting apse, was rebuilt in the 11th century in the Romanesque style of Auvergne and consecrated in 1095 by Urban II. It was greatly injured in the wars of religion, but restored in the first decade of the 17th century. The porch and the stone tower above it were rebuilt in 1861. The church contains the monument of Pius VI., who died at Valence in 1799. A curious house (Maison des Têtes) of the 16th century has a sculptured front with heads of Homer, Hippocrates, Aristotle, Pythagoras, &c. The Maison Dupré-Latour with a beautifully carved doorway and the sepulchral monument known as the Pendentif date from the same century. The library and the museum containing Roman antiquities, sculptures and a picture gallery, are housed in the old ecclesiastical seminary. The most notable of the monuments erected by Valence to its natives are those to Emile Augier the dramatist by the duchess of Uzès (1897) and to General Championnet (1762–1800).

Valence is the seat of a bishop, a prefect and a court of assizes, and has a tribunal of first instance, a board of trade arbitration, a chamber of commerce, a branch of the Bank of France, training colleges for both sexes, and a communal college. Among the industries are flour-milling, cooperage and the manufacture of furniture, liquorice, whitewash, and tapioca and similar foods. Trade, in which the port on the Rhone shares, is in fruit, cattle and live-stock, wine, early vegetables and farm produce, &c.

Valentia was the capital of the Segalauni, and the seat of a celebrated school prior to the Roman conquest, a colony under Augustus, and an important town of *Viennensis Prima* under Valentinian. Its bishopric dates probably from the 4th century. It was ravaged by the Alani and other barbarians, and fell successively under the power of the Burgundians, the Franks, the sovereigns of Arles, the emperors of Germany, the dukes of Valentinois, the counts of Toulouse, and its own bishops. The bishops were often in conflict with the citizens and the dukes of Valentinois, and to strengthen their hands against the latter the pope in 1275 united their bishopric with that of Die. The citizens put themselves under the protection of the dauphin, and in 1456 had their rights and privileges confirmed by Louis XI. and put on an equal footing with those of the rest of Dauphiné, the bishops consenting to recognize the suzerainty of the dauphin. In the 16th century Protestantism spread freely under Bishop Jean de Montluc, and Valence became the capital of the Protestants of the province in 1563. The town was fortified by Francis I. It had become the seat of a celebrated university in the middle of the 15th century; but the revocation of the edict of Nantes struck a fatal blow at its industry, commerce and population.

VALENCIA, or VALENTIA, an island off the south-western coast of Ireland, county Kerry, forming the southern horn of Dingle Bay. It is about 7 m. long and 3 broad at its widest part. The strait between the island and the mainland forms a fine natural harbour, land-locked with narrow entrances, and a depth of about 40 ft. at low tide, and thus capable of accommodating large vessels. At its north end is the Valencia Harbour station on a branch of the Great Southern & Western railway, with a ferry across the strait to Knightstown, the town on the island. The harbour is sometimes visited by warships, and is extensively used by fishing vessels, for which it is the headquarters of a district. At Knightstown are the buildings of the Anglo-American Telegraph Company, for it was from Valencia, after several unsuccessful attempts from 1857 onward, that the steamer "Great Eastern" first succeeded in laying the cable to Newfoundland in 1866. There are four cables across the Atlantic and one to Emden in Germany. On the island are Protestant and Roman Catholic churches, constabulary barracks and a coastguard station. The meteorological reports received by the central office in London from Valencia are of high importance as giving the first indication from any station in the United Kingdom of weather influences from the Atlantic. Valencia formerly exported slate of fine quality. Its cliff scenery is magnificent, and its luxuriant semi-tropical vegetation remarkable. Its name is of Spanish origin; the Irish originally called it Dairbhre, or Darrery, the oak forest.

VALENCIA, the name of a maritime province of eastern Spain, and of the kingdom in which this province was formerly included. The province is bounded on the N. by Teruel and Castellon de la Plana, E. by the Mediterranean, S. by Alicante and W. by Albacete and Cuença. Pop. (1900) 806,556; area, 4150 sq. m. Along the coast the surface is for the most part low and level, the fertile *vegas*, or cultivated plains, of Valencia, Játiva and Gandia in many places rising very little above sea-level. To the west of these is a series of tablelands with a mean elevation of about 1000 ft., which in turn rise into the mountains that form the eastern boundary of the tableland of New Castile, and attain within the province a maximum elevation of nearly 4000 ft. The coast is skirted by considerable stretches of sand-dune, and by a series of these the lagoon called the Albufera (*q.v.*) de Valencia is separated from the Mediterranean. The principal rivers are the Guadalaviar or Turia and the Jucar (*q.v.*). The Guadalaviar enters the province in the extreme north-west, flows south-east, and falls into the sea below the city of Valencia; it receives numerous tributaries of little importance, and it dispenses fertility by numerous aqueducts, mostly of Moorish origin, throughout the lower part of its course. Both the Jucar and its right-hand tributary the Albaida supply water for an extensive system of irrigation canals.

In the lowlands, especially towards the coast, very little rain falls; but heavy rain and melting snow among the highlands in which the principal rivers rise occasionally cause sudden and disastrous floods. The *vegas* have an exceptionally fine, almost sub-tropical climate. In their low-lying portions rice is the favourite crop; elsewhere wheat, maize and all kinds of fruit are abundantly grown; the mulberry is cultivated for silk; and wine and oil are produced. Esparto grass is grown in the less fertile areas. The tablelands produce, according to their elevation and exposure, figs, almonds, olives or vines. The pastures of the higher grounds sustain numerous sheep and goats; but cattle and horses are relatively few. The hillsides are somewhat bare of timber. The mineral resources of the province are little developed. The fishing industry on the coast is considerable, and there are manufactures of silk, carpets and tapestry, woollen, hemp and linen fabrics, glass, pottery and leather; there are also iron foundries, distilleries, cooperages and oil refineries. These industries are important, although the silk manufactures declined after three decades of prosperity (from 1850 to 1880). The coast railway from Barcelona traverses the province, passing through the city of Valencia on the way south to Alicante and Murcia. From Játiva another important line diverges westward to Albacete, and there are branch lines from Valencia to Liria and to Utiel, from Silla to Cullera, from Carcagénte to Gandía, and thence to Dénia and Alcóy in the province of Alicante. Valencia, the capital and principal seaport, and the towns of Alcira, Requena, Sueca, Játiva, Carcagénte, Cullera, Utiel, Onteniente and Gandía, are described in separate articles. Other towns of more than 7000 inhabitants are Algemesí, Catarroja, Liria, Sagunto, Tabernas de Valldigna and Torrente.

When the ancient kingdom of Valencia was incorporated into Aragon in 1238, it included the provinces of Castellon de la Plana (*q.v.*) and Alicante (*q.v.*). It was bounded inland on the N. by Catalonia, W. by Aragon and New Castile, and S. by Murcia. This region has an area of 8830 sq. m.; its present population is about 1,600,000. For its history see VALENCIA (city). The inhabitants are of very mixed race, owing to the successive occupation of the country by Iberians, Greeks, Carthaginians, Romans, Visigoths and Moors. Their dialect resembles Catalan but is softer, and contains a larger percentage of Arabic words. On the physique of the people, as on their customs and the architecture of their houses, Moorish rule left a durable imprint. The elaborate irrigation-works and the system of intensive agriculture which have rendered the *huertas* or gardens of Valencia celebrated were initiated by the Moors; the fame of the Elche date-groves, the Alicante vineyards and the Valencia orange plantations, was also originally due to them. With the decline of the caliphate of Cordova early in the 11th century, Valencia became an independent kingdom, which passed successively into the power of the Almoravides and Almohades. When James I. of Aragon captured the city of Valencia in 1238, he found so large a number of Mozarabic Christians who had adopted the Arabic language and many of the customs of their rulers, that it was found necessary to translate the Bible into Arabic for their use. In 1609, 200,000 Moriscoes, or Moors who outwardly professed Christianity, were banished from the country. In 1833 Valencia was divided into the three provinces already named.

VALENCIA, the capital of the Spanish province of Valencia, on the right bank of the river Guadalaviar or Turia, 3 m. from the Mediterranean Sea, and 304 m. by rail E.S.E. of Madrid. Pop. (1877) 143,856; (1900) 213,550. Valencia is connected by numerous railways with all parts of Spain, and has one of the most secure and capacious harbours on the east coast. It is the seat of an archbishop, a court of appeal, a university, a captain-general and an army corps. All round it stretches the beautiful and closely cultivated Huerta de Valencia, an alluvial plain planted with groves of oranges, lemons and mulberries. The climate is mild and very dry; rain hardly ever falls except when the east wind blows from the sea. The white houses of the city, often Moorish in many details of their architecture, and the multitude of domes and towers overlaid with blue, white and gold tiles, give to Valencia an oriental appearance which is remarkable even in south-eastern Spain. Until 1871 it was enclosed by a wall founded by the Romans and rebuilt in 1356 by Pedro IV.; two picturesque gateways with machicolated towers still remain, but few other remnants are left of the old fortifications, the site of which is now occupied by fine boulevards. The river, reduced, except in time of flood, to a scanty stream by the demands made upon it for irrigation, is crossed by several bridges, of which the longest has thirteen arches. The streets are for the most part narrow, crooked and somewhat gloomy, but in the more modern quarters there are some broad and handsome thoroughfares. Towards the close of the 19th century Valencia was lighted by gas and electricity; electric tramways were laid down and a good water-supply and drainage system secured.

The cathedral (La Seo), begun in 1262, was in 1459 lengthened in its original Gothic style, but in such a way as to spoil its proportions, and in the 18th century it was further injured by pseudo-Classic additions. It possesses some fine examples of the sculpture and metal-work of the 15th century, as well as of the Valencian school of painting. The campanile (el Miguelete), an isolated octagonal Gothic tower, 152 ft. in height, commands an extensive view of the town and surrounding country. Near the cathedral is the episcopal palace; its large and valuable library, rich in medals and other antiquities, suffered greatly during the French occupation in 1812. Besides the cathedral, Valencia has numerous parish churches and other ecclesiastical buildings, none of them of great architectural beauty or interest; the church of St Nicholas (of Moorish origin) has, however, good specimens of paintings by Vicente Juanes as well as frescoes by Dionis Vidal; and Ribalta can be studied in the chapel of the Colegio de Corpus or del Patriarcha.

Valencia University was formed about 1500 by the fusion of an episcopal school of theology with a municipal school of arts, medicine and law, both dating from the middle of the 14th century. New colleges were soon added, and up to 1600 the university attained much prosperity and a high reputation. It then began to decline, but was reorganized after 1848, and resumed its place as one of the leading universities. The average number of students is 1750; law, philosophy, natural science and medicine are the subjects taught. The large but uninteresting university buildings date from the 16th century. The library, containing about 60,000 volumes, was robbed of its chief treasures by the French in 1812. There is a rich provincial museum, with paintings by Velazquez, Ribera, Dürer, Juanes, Bosco, Goya and many modern artists. Among other public buildings may be mentioned the court-house, a Doric edifice, dating from the time of Ferdinand the Catholic, and having curious frescoes (1592) in its main hall; the custom-house (1758), now a cigar manufactory, employing some 3500 women; and the silk exchange, a large and elegant Gothic hall (1482). The citadel, on the north-east of the town, was built by Charles V. as a protection against Khair-ed-Din Barbarossa, the sea-rover; in the south-west of the town is the former College of Saint Augustine, now used as a model prison, adjoining which is a large hospital. Beyond the old line of the walls there are a botanic garden, a large bull-ring, and various shady promenades, including the beautiful "Glorieta," and, on the north side of the river, the alameda, leading to the port (El Grao). The principal manufacture is silk, and the town is also celebrated for its coloured tiles or "azulejos," and its oranges. Linen, woollen and esparto fabrics, hats, fans, leather, paper, cigars, glass and pottery are also manufactured, and there are foundries and printing-works. Corn, rice, silk, saffron, oranges, raisins, almonds, figs and other fruits are extensively exported, and iron, hardware, timber, manure, grain and colonial produce are imported.

The port and the village of Villanueva del Grao are 3 m. E. by N. of Valencia, and are connected with it by two railways and two tramways. The harbour works, begun in 1792 at local expense, have been steadily improved, and now provide many facilities for loading or discharging on the moles and wharves. During the five years, 1901–5, about 2600 ships of 1,500,000 tons entered at the port every year. About 2000 of these were Spanish, including a large number of small coasters. The majority of the foreign ocean-going ships were British. The fishing fleet of El Grao comprises about 600 boats with 2800 hands. About 1 m. N. is the town of Pueblo Nuevo del Mar or El Cabañal, to which large numbers of the Valencians migrate in summer for sea-bathing.

The earliest historical mention of Valencia (*Valentia*) is by Livy (*Epit.* lv.), according to whom Junius Brutus settled the soldiers of Viriathus here in 138 B.C., and invested the town with the *jus Latinum*. It sided with Sertorius (*c.* 77 B.C.), and was accordingly taken and partially destroyed by Pompey in 75 B.C.; but it must have recovered speedily, as it is mentioned by Pliny (iii. 4) as a colony in the region of the Edetani, and by Mela as an important place. It was taken by the Visigoths in A.D. 413, and by the Moors in 714. After the downfall of the caliphate of Cordova, an independent Moorish kingdom of Valencia was established in 1021, and extended along the coast from Almeria to the Ebro estuary. The Almoravides occupied the city in 1094, but it was retaken within a few months by the Christians under the Cid (*q.v.*), from whom it is sometimes called Valencia del Cid. The Moors recovered possession in 1101 and the kingdom was re-established in 1146. After 1172 it became tributary to Aragon, and in 1238 James I. of Aragon added it to his dominions. The first Spanish printing-press is said to have been set up here in 1474. Towards the close of the 15th century Valencia was annexed to Castile and placed under the rule of a viceroy. In the 16th and 17th centuries it became the seat of a considerable school of painting, of which Vicente Juanes (1523–1579) may be regarded as the founder, and to which belonged also Francisco de Ribalta (1550–1628), Juan de Ribalta (1597–1628), José Ribera (1588–1656), Pedro Orrente (1560–1644) and J. G. Espinosa (1600–1680). In the beginning of the 17th century Valencia and its surrounding district suffered greatly from the expulsion of the Moriscos, its most industrious and enterprising cultivators. In the War of Succession Valencia sided emphatically with the house of Austria, for which it was punished by being deprived of many of its ancient privileges. In 1808 an abortive attempt to capture it was made by the French; they succeeded, however, in 1812, and held it till June 1813. Queen Christina signed her abdication at Valencia in 1840.

VALENCIA, a city of Venezuela and capital of the state of Carabobo, 111 m. by rail W.S.W. of Caracas, and 24 m. direct (33½ m. by rail) S. by E. of Puerto Cabello. Pop. (1894) 38,654. There is railway connexion with Caracas by the Great Venezuela line (German) and with Puerto Cabello by the Puerto Cabello and Valencia line (English), which crosses the N. range of the Maritime Andes. There is also a steamboat service on Lake Valencia. The city is situated on the N.W. border of a lacustrine plain occupied in great part by Lake Tacarigua, or Valencia,[1] and nearly 2 m. from its western margin. It is beautifully situated in a large fertile valley between parallel ranges of the Maritime Andes, about 1625 ft. above sea-level, and in the midst of rich plantations and luxuriant tropical vegetation. The climate is mild and pleasant, the temperature ranging from 66° to 87° F. with an annual mean of 76°, and the rainfall being about the same as that of Caracas, or 23 to 30 in. Near Valencia on the Puerto Cabello railway are the Las Trincheras thermal springs. Among Valencia's public edifices and institutions are some good churches, the government palace, a university, a national college for women, a normal school for men and a public library.

Valencia was founded in 1555 and is older than Caracas. It was occupied for a time in 1561 by Aguirre and his band of outlaws. At the beginning of the War of Independence it was made the capital of Venezuela, and the patriot congress was in session there in 1812 when Caracas was destroyed by an earthquake. It changed masters several times during the war, its most famous events being two successful defences in 1814 against Spanish besieging forces. The town suffered much in the war and from subsequent revolutions, but the remarkable productiveness of the surrounding districts and its advantageous commercial position ensured a prompt recovery from all reverses.

VALENCIA DE ALCÁNTARA, a town of western Spain, in the province of Cáceres; on the Madrid-Cáceres-Lisbon railway, near the right bank of the Sever, a small stream which here divides Spain from Portugal. Pop. (1900) 9417. Valencia de Alcántara is the most important custom-house for direct traffic between the Peninsular kingdoms except Badajoz, and has a flourishing trade in farm produce of all kinds, and in phosphates from the neighbouring mines. The town is occupied by a garrison, and retains its old-fashioned loopholed walls and dismantled citadel. A Roman aqueduct still brings water to the main street, and there are other Roman remains in the district; the courtyards and windows of many houses are Moorish in style. The interesting church of Roqueamador dates from the 14th century, the church of Encarnacion, the town hall and a fine convent, from the 16th. From the 16th century to the 18th Valencia was a celebrated border fortress; it was captured by the Portuguese in 1664 and 1698.

VALENCIENNES, a town of northern France in the department of Nord on the Scheldt, at its confluence with the Rhônelle, 30 m. S.E. of Lille by rail. Pop. (1906), town, 25,977; commune, 31,759. The Scheldt here divides into two branches, one of which flows through the town, while the other, canalized and forming a port, skirts it on the west. Of the fortifications, dismantled in 1892, and replaced by boulevards, the Tour de la Dodenne (13th and 15th centuries) and the citadel (17th century) are the chief remains. Valenciennes is the centre of a rich coal-field, to which Anzin (*q.v.*), an industrial town a little over a mile to the north-west, has given its name. To this fact is due the existence of the important foundries, forges, rolling-mills, wire-works and machine shops which line the bank of the Scheldt. There is also an extensive beetroot cultivation, with attendant sugar-works and distilleries, and glass, starch, chemicals and soap are produced. Hosiery, trimmings and handkerchiefs are manufactured and cotton weaving and printing are carried on, though little of the famous lace is now made. Other industries are brewing and malting. There are a sub-prefecture, courts of first instance and of commerce, a chamber of commerce, a board of trade arbitration, and a branch of the Bank of France, a lycée, a school of music and a school of fine art (founded in 1782). The town hall is a fine building of the early 17th century, but its façade was rebuilt in 1867 and 1868. The museum contains galleries of painting and sculpture, with works by Antoine, Louis and François Watteau, Carpeaux, all of whom were natives of the town, and by Rubens and other Flemish artists. Opposite the museum there is a monument commemorating the defence of the town in 1793. The principal church is that of Notre-Dame du Cordon, a fine modern building in the Gothic style surmounted by a tower 272 ft. in height. The church of St Géry preserves a few pillars dating from the 13th century. Near it stands the statue of Antoine Watteau, and there is also a statue of Jean Froissart, born at Valenciennes.

Valenciennes is said to owe its name and foundation to one of the three Roman emperors named Valentinian. In the middle ages it was the seat of a countship which in the 11th century was united to that of Hainaut. In the 16th century Valenciennes became the stronghold of Protestantism in Hainaut, but was conquered by the Spaniards, who committed all sorts of excesses. In 1656 the Spaniards under Condé made a successful defence against the French under Turenne; but in 1677 Louis XIV. took the town after an eight days' siege, and Vauban constructed the citadel. Valenciennes, which then became the capital of Hainaut, has since always belonged to France. In 1793, after forty-three days' bombardment, the garrison, reduced to 3000 men, surrendered to the allied forces numbering some 140,000 or 150,000 men, with 400 cannon. In 1815 it defended itself successfully.

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[1] Lake Valencia occupies one of the so-called Aragua valleys, enclosed between the parallel ranges of the Maritime Andes. It is 1348 ft. above the sea, is about 30 m. long, has an area of 216 sq. m., and a catchment basin of 1782 sq. m., and lies partly in the state of Aragua. It includes a number of small islands, some inhabited, and receives the waters of a score of small streams from the surrounding mountains.

VALENCY. The doctrine of valency, in chemistry, may be defined as the doctrine of the combining power of the atoms or elementary radicles of which compound molecules consist. The conception that each elementary atom has a definite atom-fixing power, enunciated by Frankland in 1852, is the foundation of the system of rational or structural formulae which now plays so great a part in chemical science. Frankland dealt more particularly with the valency of the metallic elements, in which he was specially interested at the time; but in conjunction with his co-worker Kolbe, he subsequently applied it to compounds of carbon. At that time (1852–56), the application of Avogadro's theorem to the determination of atomic weights was not yet recognized; it was only when Cannizzaro[1] made this clear that it became possible to develop the doctrine of valency upon a consistent basis. Kekulé, whose services in this field rank with those of Frankland, was the first to develop the consequences of the conception that carbon is a quadrivalent element and to apply it in a logical manner to the explanation of the structure of carbon compounds generally; his paper published in 1858, "On the Constitution and Metamorphoses of Chemical Compounds and on the Chemical Nature of Carbon," is admittedly the foundation of the modern theory of the structure of these compounds.

An admirable though brief summary of the historical development of the doctrine of valency is to be found in the lecture delivered in 1898 by Professor Japp in memory of Kekulé (*Journ. Chem. Soc.* 73, p. 97). Several discoveries have since been made which have an important bearing on the doctrine.

Frankland held that each element has a certain maximum valency but may manifest one or more subordinate valencies, the affinities in abeyance in cases in which only the lower valency is manifest satisfying each other mutually. By a logical extension of this view, elements have been divided into those of odd and those of even valency; apart from a few exceptional compounds, elements are to be reckoned as belonging either to the one or to the other of these two classes.

Kekulé always maintained that valency could not vary and in discussing this question Professor Japp goes so far as to say: "Of all the doctrines which we owe to Kekulé, that of fixed valency is probably the one that has met with least acceptance even among chemists of his own school. At the present day it is, so far as I am aware, without supporters." But he adds, "Yet Kekulé held it to the last." And such a fact cannot be overlooked: that Kekulé went too far in asserting that valency could not vary is probably true; the essential feature in his objection—that in many cases valency was overestimated by the Frankland school—cannot be so easily disposed of.

He saw clearly that structure is the determining factor to be taken into account in all such discussions; he also considered that it was necessary always to make use of univalent or monad elements in determining valency; moreover, that the only compounds on which valid arguments could be based were those which could be volatilized without undergoing decomposition—a condition that must be fulfilled if the molecular weight of a compound is to be placed beyond question. He therefore objected to the use of compounds such as ammonium chloride and phosphorus pentachloride as criteria of valency, as they undergo decomposition when volatilized. This objection has been somewhat robbed of its force by Brereton Baker's observation that decomposition can be prevented if the utmost care be taken to exclude moisture. In objecting to the use of such compounds, however, Kekulé took the further important step of dividing compounds into two classes—that of atomic compounds, such as ammonia and hydrogen chloride, in which the components are held together by atomic affinities; and that of molecular compounds, such as ammonium chloride, containing atomic compounds held together by molecular affinities: but Kekulé never gave any very clear explanation of the difference. Notwithstanding Brereton Baker's observations, the question remains with us to-day, the only difference being that we have substituted the more precise term "residual affinity" for Kekulé's term "molecular affinity."

Hydrogen is the one element which at present can be affirmed to be of unvarying valency: as no compound of determinable molecular weight is known in which a single atom of this element can be supposed to be present in the molecule in association with more than a single atom of another element, the hydrogen atom may be regarded as a consistent univalent or monad radicle. As the element of unit valency, hydrogen is, therefore, the one fit atomic measure to be used in ascertaining valency; unfortunately, it cannot always be applied, as so few elements form volatile hydrides. Hydrocarbon radicles such as methyl, CH_3, however, are so entirely comparable with the hydrogen radicle that they form equally efficient standards; as many elements form volatile methides, some assistance may be obtained by the use of such radicles. But in all other cases the difficulty becomes very great; indeed, it is doubtful if a trustworthy standard can then be found—we are still forced, in fact, to recognize the wisdom of Kekulé's contentions. The greatest difficulty of all that we have to meet is due to the fact that valency is a dependent variable in the case of many if not of most elements, the degree in which it is manifest depending on the reciprocal affinities of the associating elements, as well as on environmental conditions.

Among univalent elements, carbon is the only one that appears to have a determinate maximum valency; this is manifest in methane, CH_4, the simplest hydride the element forms, the first parent of the mighty host of compounds numbering thousands upon thousands which are the subject-matter of organic chemistry. Carbon, it is well known, is distinguished from all other elements by forming a great variety of compounds with hydrogen—the hydrocarbons; from these, in turn, other series of compounds are formed by the displacement of hydrogen atoms in the hydrocarbons by various radicles. The chemistry of the carbon compounds is, in fact, the chemistry of substitution compounds; no other element can be said to give rise to substitution compounds. It is because of this fact—because of the simple relationship obtaining between the various series of hydrocarbons and between these and their substitution compounds—that we are able to deduce structural formulae for carbon compounds with a degree of certainty not attainable in the case of any other element; and we are consequently able to infer the valency of carbon with a degree of definiteness that cannot be approached in any other case. Several of the simpler derivatives of carbon exhibit peculiarities which may be referred to as of particular interest, as showing how difficult it is to arrive at any understanding of the manner in which valency is exercised. Apparently the compound represented by the symbol CH_2 cannot exist, all attempts to isolate it having failed, the hydrocarbon ethylene, formed by the union of two such groups, being obtained in its place. This would be in no way surprising were it not that the corresponding oxygenated compound, carbon monoxide, CO, has no tendency whatever to undergo polymerization under ordinary conditions and is, in fact, speaking generally, a remarkably inert substance, although in certain cases it forms compounds without difficulty—yet always in a very quiet manner. A single atom of oxygen apparently has the power, if not of satisfying, at least of stilling the needs of the carbon atom. One other case which makes the behaviour of carbon monoxide still more exceptional may be referred to, that of the analogous sulphur compound carbon monsulphide, CS, recently discovered by Sir James Dewar and Mr H. O.

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[1] Stanislao Cannizzaro, *A Course of Chemical Philosophy* (1858). Alembic Club Reprints, No. 18. [1910.]

Jones. This compound is so unstable, so active, that it polymerizes with explosive violence at temperatures slightly above that at which liquid air boils. Such illustrations afford clear proof that, as before mentioned, valency is a reciprocal function—that it is impossible to regard the units of affinity of the atoms of different elements as of equivalent value and capable of satisfying each other mutually.

There is no reason to suppose that an uneven number of affinities can be active in the carbon atom; in devising structural formulae, it is therefore always considered necessary to account for the disposition of the four units of affinity, the four valencies, of the carbon atom. In 1900 some excitement was aroused by the discovery by Gomberg of a remarkable hydrocarbon formed by the withdrawal of the chlorine atom from chlorotriphenylmethane, $C(C_6H_5)_3Cl$: at first it was contended that this was a compound of triad carbon, *triphenylmethyl*; it is now generally admitted, however, that such cannot well be the case and that one of the phenyl groups becomes altered in structure and converted into a dyad radicle (see TRIPHENYLMETHANE).

The homologues of methane—the hydrocarbons of the paraffin or C_nH_{2n+2} series, in which the carbon atoms are associated by single affinities, their remaining affinities being engaged by hydrogen atoms—behave chemically as saturated compounds and are apparently incapable of entering into combination with other molecules. But it is important to guard against the assumption that they are actually saturated in any absolute sense. Even gases such as helium and argon, destitute as they appear to be of all chemical activity, must be credited with the possession of some measure of affinity—as they can be liquefied; moreover, as Sir James Dewar has shown, when helium is liquefied in contact with charcoal a not inconsiderable amount of heat is liberated beyond that given out in the mere liquefaction of the gas. The argument may be extended to hydrogen and the paraffins and it may even be supposed that the amount of residual affinity increases gradually as the series is ascended—this would account for the fact that their activity, the readiness with which they are attacked, increases slightly as the series is ascended. In any case, it cannot well be supposed that carbon and hydrogen mutually satisfy each other even in the paraffins.

The manner in which the valencies of the carbon atom are disposed of in the case of unsaturated hydrocarbons—that is to say, those containing a lower proportion of hydrogen than is indicated by the formula C_nH_{2n+2}—has given rise to much discussion, the subject being one which affords an opportunity for great difference of opinion. In ethylene, C_2H_4, each carbon atom is attached to only two hydrogen atoms, as two affinities of each atom are therefore free to enter reciprocally into combination. These atoms certainly do not combine twice over in the way in which the two atoms of carbon in ethane, $H_3C{\cdot}CH_3$, enter into combination—if they did, ethylene should be a saturated compound, whereas actually it behaves as an eminently unsaturated substance. It was contended by Julius Thomsen, on the basis of determinations of the heat of combustion of the hydrocarbons, that the two carbon atoms in ethylene are less firmly united in ethylene than are those in ethane; moreover, that in acetylene, C_2H_2, in which there are three affinities at the disposal of each of the two carbon atoms, the union is even less firm than in ethylene. The argument on which these conclusions are founded has been called in question and the data are clearly insufficient to justify their acceptance; moreover, the stability of acetylene at high temperatures, also the readiness with which ethylene is often formed and with which ethenoid compounds revert to the paraffin type may be cited as arguments against them.

In dealing with such a problem, it is necessary to take into account the evidence we have that valency is a directed function. The tetrahedron is now accepted as the most suitable model of the carbon atom to be visualized whenever carbon is thought of; moreover, it is held that the directions in which valency acts are appropriately pictured if they are regarded as proceeding from the centre of mass to the four solid angles of the tetrahedron. In such a case, two affinities proceeding from each of two carbon atoms do not meet and overlap but cross, each pair at a considerable angle through which they must be deflected to bring them into contact. Von Baeyer has suggested that this angle, $\frac{1}{2}(109^\circ\ 28')$, is the measure of the strain imposed upon the affinities and that the existence of this strain affords an explanation of the readiness with which ethylene lapses into a derivative of ethane when suitable opportunity is given to combine with some other substance. Another way of looking at the matter is to suppose that the affinities do not, as it were, overlap but merely cross each other and that the angle of approach referred to is a direct measure of the degree of unsaturatedness: such a view is more in accordance with Thomsen's contention. In any case, the ethenoid condition of unsaturatedness at the junction of two carbon atoms is a centre at which altogether peculiar properties, chemical and physical, are developed—the most noteworthy being the enhanced refractive power. The ethenoid symbol $C=C$ is therefore of peculiar significance. It is a remarkable fact that the properties of ring systems generally are in accordance with the above hypothesis—the degree of unsaturatedness diminishing as "the angle of approach" is diminished, the more nearly the affinities can be pictured as overlapping.

The most stable arrangement of the carbon affinities would appear to be that in benzene and compounds of the benzene type—whatever that may be. The determination of the "structure" of this hydrocarbon has given rise to a large amount of paper warfare. Two tendencies may be said to have been brought together in the course of this discussion: on the one hand, the desire to arrive at a determination of the actual structure; on the other, the desire to devise formulae which shall be faithful expressions of functional behaviour and broadly indicative of the structural relationship of the constituent elements. The latter is perhaps the tendency which is now in the ascendant: we are beginning to realise, particularly in the case of carbon compounds, that formulae are primarily expressive of behaviour—being based on the observation of behaviour. Thus in the case of all paraffinoid compounds, the symbol $C{-}C$ has a distinctive meaning, as indicating saturation; in the case of ethenoid compounds, the symbol $C=C$ has an equally distinctive meaning, indicating a particular degree of unsaturatedness.

From this point of view, therefore, the benzene symbol originally proposed by Kekulé is misleading, inasmuch as it indicates that the hydrocarbon contains three ethenoid junctions; it should therefore be an eminently unsaturated compound, which is not the case. On this account the centric formula is to be preferred as an expression of the properties of the compound.

The non-metallic elements other than carbon all form volatile hydrides and methides from which their fundamental valencies can be deduced without difficulty. Chlorine, oxygen, nitrogen and silicon may be regarded as typical of the four classes into which the non-metals fall. But the number of hydrogen and methyl radicles which the atom carries cannot be taken as the measure of absolute valency in the case of elements of the chlorine, oxygen and nitrogen classes. The hydrides of the elements of these classes must all be regarded as more or less unsaturated compounds, the fact that gases such as hydrogen chloride and ammonia are intensely soluble in water being clearly a proof that their molecules are greatly attracted by and have great attraction for water molecules; it is remarkable, however, that although hydrogen chloride and ammonia are easily soluble in water and also combine readily with one another, they are gases which are by no means easily condensed—in other words, the molecules in each gas have little tendency to associate among themselves. It may also be pointed out that, to account for the properties of liquid water, it is necessary to suppose that the simple molecules represented by the symbol H_2O have a very considerable mutual affinity and that water consists largely of complex molecules.[1] Taking into account the estimate we are able to form, on the one hand, of the functions of hydrogen, on the other of those of elements such as chlorine, oxygen and nitrogen, it seems probable that in the hydrides of these elements the extra attractive power is exercised entirely by the element which enters into combination with the hydrogen—in other words, that chlorine in hydrogen chloride, oxygen in hydrone and nitrogen in ammonia are each possessed of considerable residual affinity. The great question at issue has been and still is—What is the nature of this residual affinity and how is it exercised? This is the question raised by Kekulé and left by him as a legacy to be decided upon. When hydrogen chloride and ammonia enter into combination to form ammonium chloride, for example, do they combine in some special manner, molecularly, so that each molecule retains its individuality as a radicle in the new compound; or is a redistribution effected, so that the several atoms become arranged around the one which exercises the dominant influence much as they are in the parent compound ammonia? In the former case, two orders of affinity would come into operation; in the latter, only one. The general opinion has always been in favour of the latter view.

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[1] On this account it is desirable to confine the term water to the liquid and to distinguish the simple molecule represented by the symbol H_2O by a separate name—that proposed is *Hydrone*. Liquid water is probably a mixture of several polyhydrones together with more or less hydrone.

The discovery that compounds of sulphur containing four different monad radicles together with a single sulphur atom, such as the chloride, $S(CH_3)(C_2H_5)(CH_2{\cdot}CO_2H)Cl$, are optically active may be said to have set the question at rest, as optical activity is only to be expected in the case of a compound of asymmetric structure having the four radicles separately associated with and arranged around the sulphur atom. If it be granted that sulphur can thus function as a tetrad, it may equally be admitted that nitrogen can function as a pentad element in the ammonium compounds.

The discussion has entered on another stage, however, now that Barlow and Pope have been successful in subjecting the problem to geometric treatment by correlating crystalline form with chemical constitution. The fundamental conception upon which the relationship is based is that each atom present in a compound occupies a distinct portion of space by virtue of an influence which it exerts uniformly in every direction. A crystalline structure is regarded as a close-packed, homogeneous assemblage of the spheres of influence of the component atoms. According to this view, valency acquires volume significance. For example, the hydrogen atom being represented by a sphere of unit volume, that of the tetrad carbon atom is represented by one of four times this unit volume; the monad elements —chlorine, bromine and iodine—are supposed, in like manner, to occupy approximately unit spheres of influence. Whilst they are prepared to admit that the spheres of atomic influence of the univalent elements, for example, are not quite the same —moreover, that the volume ratios of the spheres of influence of various elements may alter slightly under changes of condition— Barlow and Pope contend that the relative magnitudes are only slightly affected in passing from compound to compound. In their view, however, the absolute magnitudes of the spheres of influence often change considerably.

For example, taking the spheres of atomic influence of carbon as of volume 4 and those of hydrogen, chlorine and bromine as of volume 1, they find that benzene, C_6H_6, hexachlorobenzene, C_6Cl_6, and hexabromobenzene, C_6Br_6, present an almost identical spatial arrangement of the spheres of atomic influence. This could not be the case if the atoms of carbon, hydrogen, chlorine and bromine appropriated respectively the volumes 11·0, 5·5, 22·8 and 27·8—the so-called atomic volumes deduced by Kopp. Barlow and Pope therefore consider that, both in benzene of molecular volume 77·4 and in a derivative such as tetrabromobenzene of molecular volume 130·2, the sphere of influence of the carbon atom is about four times as large as that of either hydrogen or bromine; on displacing the hydrogen atoms by bromine atoms, however, the volumes of the carbon atoms in the benzene molecule and of the remaining hydrogen atoms expand proportionally in the ratio of 77·4 : 130·2. This remarkable conclusion is a most helpful addition to the doctrine of valency. The relative fundamental valency volume, according to Barlow and Pope, is a constant—when compounds of a "higher type" are produced, greater number of atoms become arranged about the centralizing atom but the relative valency volumes do not change. They have shown that if an atom of valency 1 be inserted into the space already occupied by an atom of valency *m*, a gap is produced which must be filled up by another atom of valency 1 if the close packing is to be restored without remarshalling, thus accounting for the progression of valency by two units. Ammonium chloride, for example, is to be regarded as formed by the insertion into the ammonia assemblage of a chlorine atom of volume 1 and of an atom of hydrogen of volume 1, the nitrogen atom retaining its fundamental valency 3. This geometric conception affords a justification of Kekulé's conception of fixed valency; at the same time it gives expression to the view he advocated that a distinction was to be drawn between atomic and molecular compounds; but it also supports the contention of Kekulé's opponents that in the two classes of compound the atoms must be regarded equally as arranged about a centralizing atom. The two points of view are therefore brought into harmony. But the problem is by no means solved—other modes of arrangement than those pictured must also be possible. To take the case of a solution of ammonia, for example: it is generally admitted that only a very small proportion is present as the hydroxide $NH_4{\cdot}OH$; far the greater part must be held in solution in some other form, either as $H_3N=OH_2$ or in the form of more complex molecules of the polymethylene type. These may be regarded as Kekulé's molecular compounds and as the forerunners of the "more organized" compounds in which the atoms are centralized in the crystal structure. It has not been found necessary hitherto to attribute spheres of atomic influence of different relative volumes to the same element under different conditions—that is to say, elements such as sulphur and nitrogen always exhibit the fundamental valencies 2 and 3 respectively; moreover, in the case of per- and proto-metallic salts all known facts accord with the assumption of one and only one fundamental valency of the metal. One other conclusion of interest which Barlow and Pope are inclined to draw may be referred to, namely, that although silicon apparently functions as a tetrad element, its relative valency volume is probably only 2; they even question whether any element other than carbon has a valency volume four times that of hydrogen. It may well be that the peculiar stability of carbon compounds is to be sought in this peculiarity.

The Barlow-Pope hypothesis, however, affords a purely static representation of the facts: we are still unable to apply dynamic considerations to the explanation of valency. From the time of Faraday onwards, chemists have been willing to regard chemical affinity as electrical in its origin; on this account, the atomic-charge hypothesis advocated by Helmholtz has been most favourably received: but this hypothesis does not in any way enable us to understand the many qualitative peculiarities which are apparent when the reciprocal affinities of various elements are taken into account; moreover, it affords no explanation of the apparent variations in valency which are so frequently manifest; and it affords no satisfactory explanation of the fact that many compounds of like radicles, such as the elementary gases hydrogen, nitrogen and chlorine, for example, are among the most stable compounds known— more stable than many compounds consisting of elements of opposite polarity. Attempts have been made of late to apply the electronic hypothesis—these attempts, however, have involved little more than a paraphrase of current static views and they are in no way helpful in the directions in which help is most needed. It is no way surprising, however, that we should know so little of the origin of a property that may be said to be the fundamental property of matter—if we could explain it, we could explain most things; what we have reason to be surprised at is that it should have been possible to develop so consistent a doctrine as that now at our disposal.

It is scarcely necessary to point out that the sketch above given is but a bare outline of the subject, one in which attention is drawn to certain points of importance in the hope that it may be clear that the problems cannot be discussed usefully in the formal manner which is too frequently adopted. Our knowledge of valency cannot be expressed in a few symbols or in a few formal statements. (H. E. A.)

VALENS, East Roman emperor from 364 to 378, owed his elevation in the thirty-sixth year of his age to his brother Valentinian, who chose him to be his associate in the empire, of which a formal division into East and West was now once for all definitively arranged (see VALENTINIAN I.). Valens had been attached to Julian's bodyguard, but he did not inherit the military ability of his father, Gratian of Pannonia, who had risen from the ranks to a high position. A revolt headed by Procopius in the second year of his reign, and backed up by the public opinion of Constantinople and the sympathy of the Gothic princes and chiefs on the Danube, seemed so alarming to him that he thought of negotiation; but in the following year the revolt collapsed before the firmness of his ministers and generals. In the year 366 Valens at one stroke reduced the taxes of the empire by one-fourth, a very popular measure, though one of questionable policy in the face of the threatening attitude of the Goths on the lower Danube. Before venturing on a campaign against them, Valens received baptism from Eudoxus, the bishop of Constantinople and the leader of the Arian party. After some small successes over the Goths, won by his generals (367–9), Valens concluded a peace with them, which lasted six years, on a general understanding that the Danube was to be the boundary between Goths and Romans. On his return to Constantinople in 369–70 Valens began to persecute his orthodox and Catholic subjects, but he lacked the energy to carry out his edicts rigorously.

In the years 371 to 377 Valens was in Asia Minor, most of the time at the Syrian Antioch. Though anxious to avoid an Eastern war, because of danger nearer home from the restlessness of the Goths, he was compelled to take the field against Shapur II. who had invaded and occupied Armenia. It seems that Valens[1] crossed the Euphrates in 373, and in Mesopotamia his troops drove back the king of Persia to the farther bank of the Tigris. But the Roman success was by no means decisive, and no definite understanding as to boundaries was come to with Persia. Valens returned to Antioch, where in the winter of 373–4 he instituted a persecution of magicians and other people whom he foolishly believed to imperil his life. Between 374 and 377 we read of grievous complaints of injustice and extortion perpetrated under legal forms, the result probably of the recent panic, and pointing to an increasing weakness and timidity at headquarters. Although preparations were made for following up the war with Persia and securing the frontier, a truce was patched up, rather to the disadvantage of the empire, Armenia and the adjacent country being half conquered and annexed by Shapur. The armies of Rome, in fact, were wanted in another quarter. The Huns, of whom we now hear for the first time, were beginning in 376 to press the Goths from the north, and the latter asked leave of the emperor to cross the Danube into Roman territory. This they were allowed to do, on the condition that they came unarmed, and their children were transported to Asia as hostages. The conditions, however, were not observed by the imperial generals, who for their own profit forced the new settlers to buy food at famine prices. Accordingly, the enraged Goths, under their chief Fritigern, streamed across the Balkans into Thrace and the country round Adrianople, plundering, burning and slaughtering as they went. They were driven back for a time, but returned in the spring of 378 in greater force, with a contingent of Huns and Alans; and again, after some repulses, they penetrated to the neighbourhood of Adrianople. Valens, who had now returned to Constantinople, left the capital in May 378 with a strong and well-officered army. Without awaiting the arrival of his nephew Gratian, emperor of the West, who had just won a great victory over one of the barbarous tribes of Germany in Alsace, Valens attacked the enemy at once, although his troops had to go into action heated and fatigued by a long march on a sultry August day. The battle, which was fought on confined ground in a valley, was decided by a cavalry charge of the Alans and Sarmatians, which threw the Roman infantry into confusion and hemmed it in so closely that the men could scarcely draw their swords. The slaughter, which continued till the complete destruction of the Roman army, was one of the greatest recorded in antiquity. Valens either perished on the field, or, as some said, in a cottage fired by the enemy. From the battle of Adrianople the Goths permanently established themselves south of the Danube.

See Ammianus Marcellinus, bks. 26–31; E. Gibbon, *The Decline and Fall of the Roman Empire* (ed. Bury, London, 1896), chs. 25–26; W. Judeich in *Deutsche Zeitschrift für Geschichtswissenschaft* (1891), pp. 1–21.

VALENTIA, SIR FRANCIS ANNESLEY, VISCOUNT (1585–1660), Anglo-Irish statesman, son of Robert Annesley of Newport Pagnel in Buckinghamshire, was born in 1585, and settled in Ireland at an early age, acquiring property in various parts of the island. His friendship with the lord deputy, Sir Arthur Chichester, procured for him government employment and the favour of King James I., who conferred on him a grant of the land and fort of Mountnorris, county Armagh, in 1612. He was returned to the Irish parliament by the county Armagh in 1614, and four years later was appointed secretary for Ireland, being created a baronet in 1620. In the following year he received, by an unusual patent, a reversionary grant of the viscountcy of Valencia after the death without male issue of a kinsman (Sir Henry Power, created viscount of Valentia in 1621), the then living viscount. In 1625 Sir Francis Annesley was elected member for the county of Carmarthen in the English parliament; and in the same year he was made vice-treasurer and receiver-general of Ireland. In 1628 he was created Baron Mountnorris in the peerage of Ireland. He strongly opposed the policy of Lord Falkland, who became lord deputy in 1622, and procured his recall in 1629. When Sir Thomas Wentworth, afterwards the famous earl of Strafford, went to Ireland in 1633, he took action against Mountnorris, whom he accused of corruption and malversation of public money. The two men became violent opponents, and at a dinner at the lord chancellor's house in April 1635 Mountnorris used insulting and threatening language in reference to the lord deputy. Wentworth brought him before a court-martial on a charge of insubordination as an officer in the army, and by this tribunal Mountnorris was condemned to death. The sentence was not carried out, but he was imprisoned and deprived of all his offices on the report of a committee appointed by the privy council to inquire into the charges of corruption. The vindictiveness of the proceedings against Mountnorris, which afterwards constituted one of the counts in the impeachment of Strafford, has been strongly condemned by some historians and extenuated by others; that the trial by court-martial and the sentence were at all events not illegal, has been shown by S. R. Gardiner. Mountnorris was not long detained in prison, and in 1640 his relations with Strafford were examined by a committee of the Long Parliament, which pronounced the sentence passed on him unjust and illegal. In 1642 he succeeded, under the above-mentioned reversion, to the title of viscount of Valentia. During the Commonwealth he again held the post of secretary in Ireland to the lord deputy, Henry Cromwell, with whom he was on friendly terms. Valentia died in 1660. His wife was Dorothy, daughter of Sir John Phillipps of Picton, Pembrokeshire, by whom he was the father of Arthur Annesley, earl of Anglesey (*q.v.* for later history).

See S. R. Gardiner, *History of England*, vol. viii. (London, 1883–84); Strafford's *Letters and Dispatches*, edited by W. Knowler (2 vols., Dublin, 1740); G. E. C., *Complete Peerage*, vol. v. (London, 1893).

VALENTINE, or VALENTINUS, the name of a considerable number of saints. The most celebrated are the two martyrs whose festivals fall on the 14th of February—the one, a Roman priest, the other, bishop of Terni (Interamna). The *Passion* of the former is part of the legend of SS. Marius and Martha and their companions; that of the latter has no better historical foundation: so that no argument can be drawn from either account to establish the differentiation of the two saints. It would appear from the two accounts that both belonged to the same period, *i.e.* to the reign of the emperor Claudius (Gothicus); that both died on the same day; and that both were buried on the Via Flaminia, but at different distances from Rome. The *Martyrologium Hieronymianum* mentions only one Valentinus: "Interamnae miliario LXIIII. via Flaminia natale Valentini." It is probable that the basilica situated at the second milestone on the Via Flaminia was also dedicated to him. It is impossible to fix the date of his death. The St Valentinus who is spoken of as the apostle of Rhaetia, and venerated in Passau as its first bishop, flourished in the 5th century. Although the name of St Valentine is very popular in England, apparently no church has been dedicated to him. For the peculiar observances that used to be commonly connected with St Valentine's Eve and Day, to which allusion is frequently made by English writers, such works as John Brand's *Popular Antiquities* (edited by W. C. Hazlitt, vol. ii. pp. 606–11, London, 1905), W. Hone's *Every-Day Book*, and Chambers's *Book of Days* may be consulted. Their appropriateness to the spring season is, in a general way perhaps, obvious enough, but the association of the lovers' festival with St Valentine seems to be purely accidental.[1]

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[1] Amm. Marc. xxix. 1; the narrative is brief and not very clear.

See *Acta Sanctorum*, February, ii. 753, 756, and January, i. 1094; G. B. de Rossi, *Bullettino di archeologia cristiana* (1871), p. 101 and (1878) p. 59. (H. De.)

VALENTINE AND ORSON, a romance which has been attached to the Carolingian cycle. It is the story of twin brothers, abandoned in the woods in infancy. Valentine is brought up as a knight at the court of Pippin, while Orson grows up in a bear's den to be a wild man of the woods, until he is overcome and tamed by Valentine, whose servant and comrade he becomes. The two eventually rescue their mother Bellisant, sister of Pippin and wife of the emperor of Greece, by whom she had been unjustly repudiated, from the power of a giant. There are versions of the tale, which appears to rest on a lost French original, in French, English, German, Icelandic, Dutch and Italian. In the older versions Orson is described as the "nameless" one. The kernel of the story lies in Orson's upbringing and wildness, and is evidently a folk-tale the connexion of which with the Carolingian cycle is purely artificial. The story of the wife unjustly accused with which it is bound up is sufficiently common, and was told of the wives both of Pippin and Charlemagne.

The French prose romance was printed at Lyons in 1489 and often subsequently. *The Historye of the two Valyannte Brethren: Valentyne and Orson* . . . by Henry Watson, printed by William Copland about 1550, is the earliest known of a long series of English versions. A ballad on the subject was printed in Bishop Percy's *Reliques of English Poetry*, and the tale adapted for the nursery was illustrated by Walter Crane in the *Three Bears' Picture Book* (1876). For a detailed bibliography of the English, French, German, Dutch and Italian forms of the tale, see W. Seelman, "Valentin und Namelos" (Norden and Leipzig, 1884), in vol. iv. of *Niederdeutsche Denkmäler*, edited by the Verein für niederdeutsche Sprachforschung.

VALENTINIAN I., Roman emperor of the West from A.D. 364 to 375, was born at Cibalis, in Pannonia. He had been an officer of the guard under Julian and Jovian, and had risen high in the imperial service. Of robust frame and distinguished appearance, he possessed great courage and military capacity. He was chosen emperor in his forty-third year by the officers of the army at Nicaea in Bithynia in 364, and shortly afterwards named his brother Valens (*q.v.*) colleague with him in the empire. The two brothers, after passing through the chief cities of the neighbouring district, arranged the partition of the empire at Naissus (Nissa) in Upper Moesia. As emperor of the West, Valentinian took Italy, Illyricum, Spain, the Gauls, Britain and Africa, leaving to Valens the eastern half of the Balkan Peninsula, Greece, Egypt, Syria and Asia Minor as far as Persia. During the short reign of Valentinian there were wars in Africa, in Germany and in Britain, and Rome came into collision with barbarian peoples of whom we now hear for the first time—Burgundians, Saxons, Alamanni. The emperor's chief work was guarding the frontiers and establishing military positions. Milan was at first his headquarters for settling the affairs of northern Italy; next year (365) he was at Paris, and then at Reims, to direct the operations of his generals against the Alamanni. This people, defeated at Scarpona (Charpeigne) and Catelauni (Châlons-sur-Marne) by Jovinus, were driven back to the German bank of the Rhine, and checked for a while by a chain of military posts and fortresses. At the close of 367, however, they suddenly crossed the Rhine, attacked Moguntiacum (Mainz) and plundered the city. Valentinian attacked them at Solicinium (Sulz in the Neckar valley or Schwetzingen) with a large army, and defeated them with great slaughter, but his own losses were so considerable that he abandoned the idea of following up his success. Later, in 374, he made peace with their king, Macrianus, who from that time remained a true friend of the Romans. The next three years he spent at Trier, which he chiefly made his headquarters, organizing the defence of the Rhine frontier, and personally superintending the construction of numerous forts. During his reign the coasts of Gaul were harassed by the Saxon pirates, with whom the Picts and Scots of northern Britain joined hands, and ravaged the island from the wall of Antoninus to the shores of Kent. In 368 Theodosius was sent to drive back the invaders; in this he was completely successful, and established a new British province, called Valentia, in honour of the emperor. In Africa the Moorish prince, Firmus, raised the standard of revolt, being joined by the provincials, who had been rendered desperate by the cruelty and extortions of Count Romanus, the military governor. The services of Theodosius were again requisitioned. He landed in Africa with a small band of veterans, and Firmus, to avoid being taken prisoner, committed suicide. In 374 the Quadi, a German tribe in what is now Moravia and Hungary, resenting the erection of Roman forts to the north of the Danube in what they considered to be their own territory, and further exasperated by the treacherous murder of their king, Gabinius, crossed the river and laid waste the province of Pannonia. The emperor in April of the following year entered Illyricum with a powerful army, but during an audience to an embassy from the Quadi at Brigetio on the Danube (near Pressburg) died in a fit of apoplexy. His general administration seems to have been thoroughly honest and able, in some respects beneficent. If he was hard and exacting in the matter of taxes, he spent them in the defence and improvement of his dominions, not in idle show or luxury. Though himself a plain and almost illiterate soldier, he was a founder of schools, and he also provided medical attendance for the poor of Rome, by appointing a physician for each of the fourteen districts of the city. He was an orthodox Catholic, but he permitted absolute religious freedom to all his subjects. Against all abuses, both civil and ecclesiastical, he steadily set his face, even against the increasing wealth and worldliness of the clergy. The great blot on his memory is his cruelty, which at times was frightful, and showed itself in its full fierceness in the punishment of persons accused of witchcraft, soothsaying or magical practices.

See Ammianus Marcellinus xxv.–xxx.; Gibbon, *Decline and Fall*, chap. 25; T. Hodgkin, *Italy and her Invaders*, bk. i. chap. 3; H. Schiller, *Geschichte der römischen Kaiserzeit* (Gotha, 1883–87), bk. iii. chap. iv. 27–30; H. Richter, *Das weströmische Reich* (Berlin, 1865), pp. 240–68.

After his death, his son, VALENTINIAN II., an infant of four years of age, with his half-brother Gratian (*q.v.*) a lad of about seventeen, became the emperors of the West. They made Milan their home; and the empire was nominally divided between them, Gratian taking the trans-Alpine provinces, whilst Italy, Illyricum in part, and Africa were to be under the rule of Valentinian, or rather of his mother, Justina. Justina was an Arian, and the imperial court at Milan pitted itself against the Catholics, under the famous Ambrose, bishop of that city. But so great was his popularity that the court was decidedly worsted in the contest, and the emperor's authority materially shaken. In 387 Magnus Maximus (*q.v.*), who had commanded a Roman army in Britain, and had in 383 (the year of Gratian's death) made himself master of the northern provinces, crossed the Alps into the valley of the Po and threatened Milan. The emperor and his mother fled to Theodosius, the emperor of the East and husband of Galla, Valentinian's sister. Valentinian was restored in 388 by Theodosius, through whose influence he was converted to Orthodox Catholicism. Four years later he was murdered at Vienne in Gaul, probably at the instigation of his Frankish general Arbogast, with whom he had quarrelled.

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[1] Until nearly the close of the 19th century the custom of sending "valentines"—*i.e.* anonymous love-tokens, written or otherwise—on St Valentine's day was fairly general. They gradually lost their original significance, and the custom, where it survives, has become completely vulgarized.

See Gibbon, *Decline and Fall*, chap. 27; Schiller, *Geschichte der römischen Kaiserzeit*, bk. iii. vol. iv. pp. 32, 33; L. Ranke, *Weltgeschichte*, bk. iv. vol. i. chap. 6; and especially H. Richter, *Das weströmische Reich unter den Kaisern Gratian, Valentinian II. und Maximus* (Berlin, 1865), pp. 577–650, where full references to authorities are given.

VALENTINIAN III., emperor of the West from 425 to 455, the son of Constantius and Placidia, daughter of the great Theodosius. He was only six years of age when he received the title of Augustus, and during his minority the conduct of affairs was in the hands of his mother, who purposely neglected his education. His reign is marked by the dismemberment of the Western Empire; the conquest of the province of Africa by the Vandals in 439; the final abandonment of Britain in 446; the loss of great portions of Spain and Gaul, in which the barbarians had established themselves; and the ravaging of Sicily and of the western coasts of the Mediterranean by the fleets of Genseric. As a set-off against these calamities there was the great victory of Aëtius over Attila in 451 near Châlons, and his successful campaigns against the Visigoths in southern Gaul (426, 429, 436), and against various invaders on the Rhine and Danube (428–31). The burden of taxation became more and more intolerable as the power of Rome decreased, and the loyalty of her remaining provinces was seriously impaired in consequence. Ravenna was Valentinian's usual residence; but he fled to Rome on the approach of Attila, who, after ravaging the north of Italy, died in the following year (453). In 454 Aëtius, between whose son and a daughter of the emperor a marriage had been arranged, was treacherously murdered by Valentinian. Next year, however, the emperor himself was assassinated by two of the barbarian followers of Aëtius. He not merely lacked the ability to govern the empire in a time of crisis, but aggravated its dangers by his self-indulgence and vindictiveness.

Our chief original sources for the reign of Valentinian III. are Jordanes, Prosper's *Chronicles*, written in the 6th century, and the poet Apollinaris Sidonius. See also Gibbon *Decline and Fall*, chaps. 33–35; J. B. Bury, *Later Roman Empire*, bk. ii. chaps. 6–8; E. A. Freeman, "Tyrants of Britain, Gaul and Spain" (*Eng. Hist. Review*, January 1886), and "Aëtius and Boniface" (*ibid.*, July 1887).

VALENTINOIS, the name of a countship in France, the chief town of which was Valence (Drôme). From the 12th to the 15th century Valentinois belonged to a family of Poitiers, which must not be confused with that of the counts of Poitiers. To the detriment of his kinsmen, the lords of St Vallier, Count Louis II. (d. 1419) bequeathed his counties of Valentinois and Diois to the Dauphin Charles, afterwards King Charles VII.; and in 1498 Louis XII. erected the countship of Valentinois into a duchy, and gave it to Caesar Borgia, son of Pope Alexander VI. A few years later Borgia was deprived of the duchy, which, in 1548, was given by Henry II. to his mistress, Diane de Poitiers, a descendant of the counts of Valentinois. Having again reverted to the Crown, the duchy was given by Louis XIII. to Honoré Grimaldi, prince of Monaco, whose descendants retained it until the French Revolution. The new duchy of Valentinois, however, did not consist of the lands attached to the former one, but was made up of several scattered lordships in Dauphiné. The title of duke of Valentinois is still borne by the prince of Monaco.

See J. Chevalier, *Mémoires pour servir à l'histoire des comtés de Valentinois et de Diois* (Paris, 1897–1906).

VALENTINUS, pope for thirty or forty days in 827, in succession to Eugenius II. (824–27). He was a Roman by birth, and, according to the *Liber Pontificalis*, was first made a deacon by Paschal I. (817–24). Nothing further is known of his history. His successor was Gregory IV. (827–44).

VALENTINUS and **THE VALENTINIANS.** I. Valentinus, the most prominent leader of the Gnostic movement, was born, according to Epiphanius (*Haer.* 31, 2), near the coast in Lower Egypt, and was brought up and educated in Alexandria. He then went to Rome, as we learn from Irenaeus, *Adv. haer.* iii. 4, 3; Valentinus came to Rome during the episcopate of Hyginus, flourished under Pius and stayed till the time of Anicetus. The duration of the episcopates of the Roman bishops at this period is not absolutely established, but we can hardly go altogether wrong if, with Harnack (*Chronologie der altchristlichen Literatur*, i. 291), we fix the period 135–60 for Valentinus's residence in Rome. This is confirmed by the fact that Justin Martyr in his *Apology*, i. 26, begun about 150, mentions that in his earlier work against heresy, the *Syntagma*, he attacked, among others, Valentinus; so that his heresy must have begun to appear at least as early as 140. According to Irenaeus iii. 3, 4, Polycarp, during his sojourn in Rome under the episcopate of Anicetus, converted a few adherents of the Valentinian sect. Tertullian (*Adv. Valentin.* cap. 4) declares that Valentinus came to Rome as an adherent of the orthodox Church, and was a candidate for the bishopric of Rome, but he abandoned the Church because a confessor was preferred to him for this office. The credibility of this statement may be questioned. There is nothing impossible in it, but it has rather the appearance of a piece of the usual church gossip. Great uncertainty attaches to the residence of Valentinus in Cyprus, recorded by Epiphanius (*loc. cit.*), who places it after his stay in Rome, adding that it was here that he definitely accomplished his secession from the Church. Scholars are divided as to whether this stay in Cyprus was before or after that in Rome. But on the whole it seems to be clear from the various notices that Valentinus did not, *e.g.* like Marcion, break with the Church from the very beginning, but endeavoured as long as possible to maintain his standing within it.

II. The authorities which we have to consider deal for the most part with Valentinianism in its fully developed form, and not with the original teaching of the master. Justin's *Syntagma* (*v.s.*), which treats of Valentinus, is unfortunately lost. Irenaeus in his section i. 11, 1–3, has preserved what is obviously an older document, possibly from Justin, dealing with Valentinus's own teaching and that of two of his disciples. The sketch which he gives is the best guide for the original form of Valentinianism. For Valentinus himself we have also to consider the fragments of his writings preserved by Clemens Alexandrinus. The best edition of and commentary on them is Hilgenfeld's *Ketzergeschichte des Urchristentums* (pp. 293–307). Irenaeus in his treatise *Adv. haer.* gives a detailed account of the two chief schools following Valentinus, the school of Ptolemaeus (i. 1–10), and Marcus and the Marcosians (i. 13–21). For his account of the Ptolemaeans, Irenaeus seems to have used various writings and expositions of the school, especially prominent being a collection of Scripture proofs which may have once had a separate literary existence (i. 1, 3; 3, 1–5 (6); 8, 2–4). To this work is appended in a somewhat disconnected fashion a commentary on the prologue to the fourth Gospel (i. 8; 5). Irenaeus himself twice prefaces his remarks by saying he is indebted to other authorities for his exposition (i. 2, 3–4; 7, 2–5). Section 6, 2–4, interrupts and disturbs the continuity, and section 5, 1–3, is a duplicate of 5, 4. We see how the account of Irenaeus is built up from small fragments. In his account of Marcus and the Marcosians the chapters on the sacraments (i. 13 and 20) seem originally to have formed part of the same whole. Very valuable too are the *Excerpta ex Theodoto* which are to be found in the works of Clemens Alexandrinus, and may be looked upon as a collection made by the author with a view to the eighth book of his *Stromateis*, which was never finished. Of these excerpts paragraphs 4, 5, 8–15, 17b–20, 27, should be distinguished as Clemens's own observations; the remaining parts are extracted from Gnostic writings (cf. Zahn, *Geschichte des Kanons*, ii. pp. 269 seq.). Yet the *Excerpta*, as their contents show, are not homogeneous, and cannot have been borrowed from one writing. The question as to whether Clemens' method of quotations, which mentions sometimes Theodotus, sometimes the Valentinians as his sources for these excerpts, is of any use as a guide to an estimate between these sources. must be left undecided. The most important sections are paragraphs 29–68, in which an attempt is made at a continuous exposition of the system (though here again from various sources), and section 69–86, which deals with the Gnostic doctrine of the sacraments and that of the liberation of the *Heimarmene*. The lost *Syntagma* of Hippolytus, which, as we know, is preserved in the works of Philastrius and the pseudo-Tertullian, seems to furnish us with valuable information as to the earlier doctrines of the sect, and in his second treatise against heretics, the so-called *Philosophumena* (6, 29 seq.). Hippolytus gives a homogeneous and continuous exposition of a later Valentinian system, possibly connected with the school of Ptolemaeus. Important, too, are Hippolytus' references to an Italic and an Anatolian branch of the Valentinian sect (6, 35). Tertullian gives at the beginning of his treatise against the Valentinians a few separate notices of the life and disciples of Valentinus, but his further argument is closely dependent upon Irenaeus' exposition of the Ptolemaean system, which he embellishes in his usual fashion with bitterly sarcastic comments. Epiphanius deals with Valentinus and his school in sections 31–36 of his work. In cap. 31, 1–8, he gives an account of the Valentinians, which seems to be based on his own observation. Thus in 31, 5–6, we find yet another verbal extract from a Valentinian doctrinal work. For the rest he copies the text of Irenaeus word for word, which has the advantage of preserving for us Irenaeus' Greek phraseology, which we otherwise should only know in a Latin translation. In his section on Ptolemaeus, cap. 33, Epiphanius has preserved for us a valuable letter of Ptolemaeus to Flora, which is a document of the highest importance for the understanding of Gnosticism.

III. Valentinus is the only one of the Gnostics who had a whole series of disciples who are known by name—indeed, in the accounts of the Church Fathers his own system and views are almost entirely obscured by the accounts of those of his disciples. His fundamental ideas can be with difficulty reconstructed from Irenaeus i. 11, from the fragments contained in Clemens, and to a certain extent from the *Syntagma* of Hippolytus, with the aid of later systems connected with his. Two early disciples of Valentinus are enumerated in Irenaeus ii. 2–3, one of whom is named Secundus; according to Irenaeus we have to trace back to him the division of the Valentinian Sophia into the double form of an aeon abiding in heaven, and her daughter, Sophia Achamoth. The second disciple is not named by Irenaeus; it is conjectured that he may have been Colorbases, the teacher of Marcus (i. 14, 1). The most important disciples of Valentinus, then, are the two dealt with at length by Irenaeus, Ptolemaeus and Marcus, who both seem to have had a numerous following. Besides these we should also mention Herakleon, of whose commentary on the gospel of St John extensive fragments are preserved by Origen. Ptolemaeus and Herakleon are counted by Hippolytus (6, 35) among the Italic branch of Valentinianism. There was also the Anatolian branch, as representative of which Hippolytus mentions Axionicus, who is also referred to by Tertullian as having actually been taught in Antioch. The *Excerpta ex Theodoto* in Clemens are also, according to the superscription, fragments from the Anatolian Gnosticism. It is, however, an error when Hippolytus speaks of Bardesanes as representative of this branch, for he had an entirely distinct position.

IV. In the important section of Irenaeus (i. 11) devoted to Valentinus, his teaching is definitely connected with the so-called "falsely reputed Gnostics." It will be useful, in trying to ascertain the teaching and view of life of Valentinus, to keep closely before us that of the "Gnostics" in the narrower sense of the word, as preserved in the expositions of Irenaeus (i. 29, 30) and Epiphanius (*passim*). The Gnostics were *par excellence* worshippers of the supreme Mother-goddess, the Μήτηρ, in whom we have no difficulty in recognizing the characteristics of the goddess of heaven of anterior Asia. This "Meter" is, in the system of these Gnostics, also at one time the stern, austere goddess, the Mother, who dwells in heaven, at other times the licentious goddess of love, the great courtesan (*Prunikon*), who, *e.g.* in the Simonian system, takes the form of the prostitute Helena, in whose worship all kinds of obscene rites were celebrated. She dwells in the eighth or highest heaven, whence her name Ogdoas. Next to her stands the supreme and shadowy form of the unknown and nameless Father; below her in the seven lower heavens reign the seven planetary, world-creating angelic powers, headed by Jaldabaoth, who was later to be identified with the God of the Old Testament. The Gnostics are children of the supreme Mother; from her the heavenly seed, the divine spark, descended in some way to this lower world, and thus the children of heaven still exist in this gross material world, subject to the Heimarmene and in the power of hostile spirits and powers; and all their sacraments and mysteries, their formulae and symbols, must be part of her worship, in order to find the way upwards, back to the highest heaven, "where the Mother dwells." This idea that the Gnostics know themselves to be in a hostile and evil world reacted in the same direction upon the conception of the Mother of heaven. She became likewise a fallen goddess, who has sunk down into the material world and seeks to free herself from it, receiving her liberation at the hands of a heavenly Redeemer, exactly like the Gnostics. Various myths have contributed towards this; one of these is the widespread naïve pagan myth of a goddess who disappears, carried off by the powers of evil, to be set free and taken back to her home by a divine liberator, a brother or betrothed. The moon-goddess with her disappearance may have been the prototype of this mythical figure (there are, indeed, certain analogies to be remarked between the Simonian Helena and Selene). With this myth are connected certain Jewish Theologumena; the goddess who sinks down into the material may readily be identified with Ruach (Rucha), the Spirit of God, who broods over Chaos, or even with the later Sophia (Chokma Achamoth), who was generally conceived of as a world-creating agent. Thirdly, the chief influence at work here seems to have been the oriental myth of the Primal Man sunk in the material world, which appears in its simple form in individual Gnostic systems, *e.g.* in Poimandres (in the *Corpus hermeticum*) and in Manichaeism. In the Gnostic systems of Irenaeus i. 29, 30, the Anthropos (*i.e.* the Primal Man) no longer appears as the world-creative power sinking down into the material world, but as a celestial aeon of the upper world (or even as the supreme god), who stands in a clearly defined relationship to the fallen goddess; it is possible that the rôle of the Anthropos is here transferred to Sophia Achamoth. The fallen Sophia next becomes, in like manner, a world creative power. And now the highest of the world-creating angels, Jaldabaoth, appears as her son, and with this whole conception are then linked up the ideas of liberation and redemption. Next to the Sophia stands a male redeeming divinity. In all the Gnostic systems known to us Christ already appears as the Saviour, and so in this respect a Christianizing of Gnosticism has been carried out; but originally this Saviour-divinity had nothing in common with the figure of the Christian Redeemer. This is clear from Irenaeus's account of the Gnostics (i. 30). For here the redemption is actually and essentially effected through the uniting in marriage of the fallen goddess with her higher celestial brother, and they are expressly described as the bride and bridegroom. That is to say, we have here the purely mythical idea of the deliverance of a goddess by a god, and of the celestial marriage of a divine pair. This myth can only with difficulty be connected with the historic redemption through Jesus of Nazareth, by further relating that Christ, having been united to the Sophia, descends into the earthly Jesus.

V. This primitive "Gnosticism" was very closely followed by Valentinus, who may have come to know these doctrines in Egypt. This can be seen from the fact that in Valentinianism the Mother-goddess always stands absolutely at the centre of the system. Irenaeus (i. 6, 1) is very instructive on this point, characterizing the Gnostics as the *pneumatici* who have a perfect knowledge of God, and have been initiated into the mysteries of Achamoth. A mighty system is certainly erected here out of the modest elements of Gnosticism.

(1) More especially, the superstructure of the celestial system, the celestial world of aeons, which exists above the fallen goddess, is

here developed in the most complicated way. Valentinus has a system of thirty aeons, but we can with but little trouble recognize the simple system underlying this great superstructure. The quite shadowy plurality of ten and twelve aeons (the Dekas and the Dodekas) of the Valentinian system we may at once set aside as mere fantastical accretions. We have left only a group of eight celestial beings, the so-called Ogdoas, and of these eight figures four again are peculiar to the Valentinian system, and are probably artificial interpolations. For instance, when for the third pair of aeons we find the Logos and Zoë, figures which occur only here, and perceive, moreover, that the place of this pair of aeons is not firmly established, but that in this Valentinian tradition they occur sometimes before and sometimes after the fourth pair of aeons, the Anthropos and the Ekklesia, we cannot be far wrong in suspecting that here already we find Valentinus to have been influenced by the prologue of the fourth Gospel (we also find the probably Johannine names Monogenes and Parakletos in the series of aeons).

(2) The first pair of aeons, Bythos and Sige, is likewise an original innovation of the Valentinian school, and clearly betrays a monistic tendency. According to Irenaeus's account of the "Gnostics" (i. 29), their theory was that Sophia casts herself into the primal substratum of matter to be found outside the celestial world of aeons. In the Valentinian system, primal matter (Bythos), the original Chaos, is brought into connexion with the celestial world of aeons. And thus it is effected that matter is here not found originally and irretrievably separated from the higher celestial world, but that the latter originally exists for itself alone; the fall or disturbance is accomplished within the celestial world, and the material world first comes into existence through the fall. When we subtract from the Ogdoas the two pairs of aeons whose later introduction into the Valentinian system has been demonstrated, we are left actually with a double pair of aeons, the Father and Truth, the Anthropos and the Ekklesia. These strongly recall the Gnostic systems set forth in Irenaeus i. 29 and 30 (cf. i. 29, 3). And thus the *Anthropos* (man), a leading figure of primitive Gnosticism, now half-forgotten, moves back into the centre of the system and the direct vicinity of the fallen goddess. It is also clear why the Ekklesia appears together with the Anthropos. With the celestial Primal Man—of whom the myth originally relates that he has sunk into matter and then raised himself up from it again—is associated the community of the faithful and the redeemed, who are to share the same fate with him. Similarly among the Gnostics of Irenaeus i. 29, 3, perfect Gnosis (and thus the whole body of Gnostics) is connected with the Anthropos.

(3) The fallen goddess, mentioned above, occurs in the Valentinian system, as in the Gnostic systems described by Irenaeus, and in the older systems it is again the celestial aeon himself who falls, and whose fate outside the Pleroma is related (cf. the exposition in Irenaeus i. 11, *Excerpta ex Theodoto*, § 31 seq., and Hippolytus, *Syntagma*, in the pseudo-Tertullian). In the later Valentinian systems, probably from Secundus onwards (see above), the figure appears in double guise. The higher Sophia still remains within the upper world after creating a disturbance, and after her expiation and repentance; but her premature offspring, Sophia Achamoth, is removed from the Pleroma, and becomes the heroine of the rest of the drama (we have dealt in the preceding section with the other conception of the fall of Sophia).

(4) In the true Valentinian system the so-called Christos is the son of the fallen Aeon, who is thus conceived as an individual. Sophia, who in a frenzy of love had sought to draw near to the unattainable Bythos, brings forth, through her longing for that higher being, an aeon who is higher and purer than herself, and at once rises into the celestial worlds. Among the Gnostics of Irenaeus we find a kindred conception, but with a slight difference. Here Christos and Sophia appear as brother and sister, Christos representing the higher and Sophia the lower element. In the enigmatic figure of Christos we again find hidden the original conception of the Primal Man, who sinks down into matter but rises again. (In the later Valentinian systems this origin of the Christos is entirely obscured, and Christ, together with the Holy Spirit, becomes a later offspring of the celestial world of aeons; this may be looked upon as an approximation to the Christian dogma).

(5) A figure entirely peculiar to Valentinian Gnosticism is that of Horos (the Limiter). The name is perhaps an echo of the Egyptian Horus. The peculiar task of Horos is to separate the fallen aeons from the upper world of aeons. At the same time he becomes (first, perhaps, in the later Valentinian systems) a kind of world-creative power, who in this capacity helps to construct an ordered world out of Sophia and her passions. He is also called, curiously enough, Stauros (cross), and we frequently meet with references to the figure of Stauros. But we must not be in too great a hurry to conjecture that this is a Christian figure. Speculations about the Stauros are older than Christianity, and a Platonic conception may have been at work here. Plato had already stated that the world-soul revealed itself in the form of the letter Chi (X); by which he meant that figure described in the heavens by the intersecting orbits of the sun and the planetary ecliptic. Since through this double orbit all the movements of the heavenly powers are determined, so all "becoming" and all life depend on it, and thus we can understand the statement that the world-soul appears in the form of an X, or a cross. The cross can also stand for the wondrous aeon on whom depends the ordering and life of the world, and thus Horos-Stauros appears here as the first redeemer of Sophia from her passions, and as the orderer of the creation of the world which now begins. This explanation of Horos, moreover, is not a mere conjecture, but one branch of the Valentinian school, the Marcosians, have expressly so explained this figure (Irenaeus i. 17, 1). Naturally, then, the figure of Horos-Stauros was often in later days assimilated to that of the Christian Redeemer.

(6) Peculiarly Valentinian is the above-mentioned derivation of the material world from the passions of Sophia. Whether this already formed part of the original system of Valentinus is, indeed, questionable, but at any rate it plays a prominent part in the Valentinian school, and consequently appears with the most diverse variations in the account given by Irenaeus. By it is effected the comparative monism of the Valentinian system. The dualism of the conception of two separate worlds of light and darkness is overcome by the derivation of the material world from the passions of Sophia. Older myths may here have served as a model; for instance, we may recall the myth of the derivation of the world from the body and limbs of the Primal Man (Bousset, *Hauptprobleme der Gnosis*, p. 211).

(7) This derivation of the material world from the passions of the fallen Sophia is next affected by an older theory, which probably occupied an important place in the true Valentinian system. According to this theory the son of Sophia, whom she forms on the model of the Christos who has disappeared in the Pleroma, becomes the Demiourgos, and this Demiourgos with his angels now appears as the real world-creative power. These two conceptions had now to be combined at all costs. And it is interesting to observe here what efforts were made to give the Demiourgos a better position. According to the older conception, he was an imperfect, ignorant, half-evil and malicious offspring of his mother, who has already been deprived of any particle of light (Irenaeus i. 29, 30). In the Valentinian systems he appears as the fruit of Sophia's repentance and conversion. Even his name has been changed from that of the older Gnosticism. He is no longer called Jaldabaoth, but has been assigned the better name, drawn from the philosophy of Plato, of Demiourgos. We must not forget here that the Demiourgos of the Gnostic is known to have corresponded to the God of the Old Testament, who was the God of the Christian Church, and that we can thus lay our finger here on a compromise with the faith of the great Christian community.

(8) With the doctrine of the creation of the world is connected the subject of the creation of man. We fortunately know, from a fragment preserved by Clemens, that Valentinus here preserved the old Gnostic myth practically unaltered in his system. According to it, the world-creating angels—not one, but many—create man, but the seed of the spirit comes into their creature without their knowledge, by the agency of a higher celestial aeon, and they are then terrified by the faculty of speech by which their creature rises above them, and try to destroy him. In the Valentinian system known to us this myth has practically lost its original freshness and colour, and can only be arrived at from allusions. On the other hand, the speculations of the Valentinians delight in accounts of the artificial and complicated putting together of the first man out of the various elements. And a specifically Valentinian idea is here added in that of the threefold nature of man, who is represented as at once spiritual, psychical and material. In accordance with this there also arise three classes of men, the *pneumatici*, the *psychici* and the *hylici* (ὕλη, matter). It is significant that Valentinus himself is credited with having written a treatise upon the three natures (Schwartz, *Aporien*, i. 292). Here we have another instance of the theological compromise of the Valentinians. All the other Gnostic systems recognize only a dual division, the children of light and the children of darkness. That the Valentinians should have placed the *psychici* between the *pneumatici* and *hylici* signifies a certain recognition of the Christian Church and its adherents. They are not numbered simply among the outcasts, but considered as an intermediate class, to whom is left the choice between the higher celestial nature and the lower and earthly.

(9) At the centre of the whole Valentinian system naturally stands the idea of redemption, and so we find here developed particularly clearly the myth of the heavenly marriage already known from Irenaeus i. 30 to be Gnostic. Redemption is essentially accomplished through the union of the heavenly Soter with the fallen goddess. There is great uncertainty in the Valentinian system as to who this celestial Soter is. In the Gnostic systems of Irenaeus i. 30 he is the Christos, the celestial brother who turns back to the fallen sister. In the Valentinian system the redeemer is likewise sometimes brought into relation with the Christos, sometimes, in a significant way, with the Anthropos, and sometimes again with Horos-Stauros. In the fully developed Ptolemaean system he appears as the common offspring of the whole Pleroma, upon whom all the aeons confer their best and most wonderful qualities (we may compare here the Marduk myth, in which it is related that all the gods transfer their qualities and powers to the young god Marduk, who is recognized as their leader). And this celestial redeemer-aeon now enters into a marriage with the fallen goddess; they are the "bride and bridegroom." It is boldly stated in the exposition in Hippolytus's *Philosophumena* that

they produce between them 70 celestial sons (angels). (In the other accounts these angels no longer appear as the sons of the celestial pair, but as the heavenly attendants accompanied by whom the Soter approaches Sophia.) It is obvious from the number 70 that we have here a marriage between a celestial and divine pair. This marriage relation between the Soter and Sophia is expounded in quite a material way even in Irenaeus iii. 3, 4, where the Old Testament phrase *πᾶν ἄρρεν διανοῖγον μήτραν* is translated, "the Pan (the all, a name for the Soter), the masculinity which opens the mother's womb." This myth of the redeemer, as we shall see more fully below, and as may be mentioned here, is of great significance for the practical piety of the Valentinian Gnostics. It is the chief idea of their pious practices mystically to repeat the experience of this celestial union of the Soter with Sophia. In this respect, consequently, the myth underwent yet wider development. Just as the Soter is the bridegroom of Sophia, so the heavenly angels, who sometimes appear as the sons of the Soter and Sophia, sometimes as the escort of the Soter, are the males betrothed to the souls of the Gnostics, which are looked upon as feminine. Thus every Gnostic had his angel standing in the presence of God, and the object of a pious life was to bring about and experience this inner union with the celestial abstract personage. This leads us straight to the sacramental ideas of this branch of Gnosticism (see below). And it also explains the expression used of the Gnostics in Irenaeus i. 6, 4, that they always meditate upon the secret of the heavenly union (the Syzygia).

(10) With this celestial Soter of the Valentinians and the redemption of Sophia through him is connected, in a way which is now not quite intelligible to us, the figure of Jesus of Nazareth and the historical redemption connected with his name. The Soter, the bridegroom of Sophia, and the earthly Jesus answer to each other as in some way identical. Here again we recognize the entirely artificial compromise between Gnosticism and Christianity. It is characteristic of this that in one passage in the account of Irenaeus it is directly stated that the redeemer came specially on account of the *psychici*, for the *pneumatici* (the Gnostics) already belong by nature to the celestial world, and no longer require any historical redemption, while the *hylici* have fallen beforehand into damnation, so that with the *psychici* only is there any question as to whether they will turn to redemption or damnation, and for them the historical redeemer is of efficacy (Irenaeus i. 6, 1). This assertion is in thorough agreement with the fundamental tendency of Gnostic piety; for the Gnostics individual redemption has actually been accomplished in the union between the Soter and Sophia, and is effected for the individual Gnostics in repeating the experience of this union. So that in effect they no longer require the historical redemption through Jesus.

(11) Among the manifold confusion of opinions as to the nature and characteristics of the Redeemer Jesus of Nazareth, certain explanations stand out as characteristically Valentinian, especially those in which it is laid down that even the redeemer has a threefold nature; from his mother, Sophia, he derived his nature as a *pneumaticos*, in the world of the Demiourgos he was united with the Christos, and finally a wonderful bodily nature was formed for him from celestial elements, which was yet not of earthly material. As such he was miraculously born of the Virgin, as through a canal (*διὰ σωλῆνος*). The compromises with the Catholic Church are here obvious. According to this theory Jesus, having an element of the psychical nature, can appear in virtue of this as the son of the Demiourgos, *i.e.* of the Old Testament God, and as the Redeemer of the *psychici*; and when we read of this miraculous bodily nature, which is not composed of earthly material, there is an obvious compromise between the fundamental heresy of Gnosticism, Docetism and the dogma of the Christian Church as to the true bodily nature of the Redeemer. Into this already complicated Christology is now introduced by an obscure combination, in the systems known to us, the idea that upon this Jesus, so constituted, yet another celestial nature, the Christos or the Soter, has descended at his baptism. This is the older and peculiar Gnostic conception of Irenaeus i. 30, which appears to have been introduced into Valentinianism at a late stage of its development. The express statement in Hippolytus 6, 35, that this doctrine was shared only by the Italic branch of the Valentinians, but disclaimed by the Anatolian branch, also bears on the point.

(12) The close of the drama and the final accomplishment of the redemption is also depicted by the Valentinian writings in accordance with the old Gnosticism. A general ascent takes place, the Soter returns with the liberated Sophia into the Pleroma, and likewise the Gnostics with the angels with whom they are connected. But it is characteristic of the Valentinian system that the Demiourgos and the *psychici* who are connected with him also ascend to the eighth or highest heaven of Achamoth, while the remaining material world sinks into flames.

VI. The first survey of these confused speculations, these myths gathered together and preserved from the ancient world, this marshalling together of the most varied traditions, and above all, these artificial attempts at compromise dictated by practical prudence, makes us inclined to doubt whether it was possible for any true piety to coexist with all this. Yet such piety existed, indeed we have here a set of regular mystics. It is not, indeed, a purely spiritual and mystical piety, but a mysticism much distorted and over-grown with sacramental additions and a mysterious cult. But all this is not without an inner value and an attractive atmosphere. Our information, it is true, is scant; most of it is to be found in the fragments of the letters and homilies of the master of the school preserved for us by Clemens. The central point of the piety of Valentinus seems to have been the mystical contemplation of God; in a letter preserved in Clemens ii. 20, 114, he sets forth that the soul of man is like an inn, which is inhabited by many evil spirits, "But when the Father, who alone is good, looks down and around him, then the soul is hallowed and lies in full light, and so he who has such a heart as this is to be called happy, for he shall behold God." But this contemplation of God, as Valentinus, closely and deliberately following the doctrines of the Church, and with him the compiler of the Gospel of John declares, is accomplished through the revelation of the Son. This mystic and visionary also discusses the Psalm which is preserved in the *Philosophumena* of Hippolytus (6, 37). With celestial enthusiasm Valentinus here surveys and depicts the heavenly world of aeons, and its connexion with the lower world.[1] Exalted joy of battle and a valiant courage breathe forth in the sermon in which Valentinus addresses the faithful (Clemens iv. 13, 91): "Ye are from the beginning immortal and children of eternal life, and desire to divide death amongst you like a prey, in order to destroy it and utterly to annihilate it, that thus death may die in you and through you, for if ye dissolve the world, and are not yourselves dissolved, then are ye lords over creation and over all that passes away." From Tertullian, *de carne Christi* cap. 17, 20, we learn that Valentinus composed psalms. We may conjecture that these psalms were similar in their kind to the beautiful odes of Solomon which have lately been discovered, though without suggesting that these particular psalms were specifically Gnostic or Valentinian.

VII. But with this mysticism, of which we possess only a few of the beautiful flowers, is connected the mystery and cult of the sacrament. The lofty spirituality of the Gnostic degenerates over and over again into a distinctly material and sensual attitude, in which all kinds of efforts are made actually to assimilate to oneself the divine through external means. Our authorities for the sacramental practices of the Valentinians are preserved especially in the accounts of the Marcosians given in Irenaeus i. 13 and 20, and in the last section of the *Excerpta ex Theodoto*. We must point out once again how the mother aeon stands absolutely at the centre of this cult. There are moreover various figures in the fully developed system of the Valentinians who are in the Gnostic's mind when he calls upon the Mother goddess; sometimes it is the fallen Achamoth, sometimes the higher Sophia abiding in the celestial world, sometimes Aletheia, the consort of the supreme heavenly father, but it is always the same person, the Mother goddess, on whom the fervent faith of the Gnostics is fixed. Thus a baptismal confession of faith of the Gnostics (Irenaeus i. 21, 3) runs, "In the name of the unknown Father of all, by Aletheia, the mother of all, by the name which descended upon Jesus." And in almost all the sacramental prayers of the Gnostics handed down to us by Irenaeus, the mother is the object of the invocation. If the interpretation generally given of the Aramaean baptismal formula by Irenaeus in the same passage is correct, it began with the words: "In the name of Achamoth." Hence we can understand how, according to Irenaeus i. 5, 3, Sophia Achamoth had among the Valentinians the title of *kyrios* (lord), and, a question closely connected with this, why they did not call Jesus *kyrios*, but Soter, as Irenaeus expressly assures us (i. 1, 3). *Kyrios* is the title given to the hero who is the subject of a cult among a given body of people, and the heroine of the cult of the Valentinians, Sophia Achamoth, therefore receives this title

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[1] Cf. Goethe's *Faust*, I.:

> "Wie Himmelskräfte auf und niedersteigen
> Und sich die goldnen Eimer reichen"

The chief sacrament of the Valentinians seems to have been that of the bridal chamber.

We have stated above the relation of this sacrament with the Valentinian speculations. Just as the apostle Paul represented his Christianity as a living, dying and rising again with Christ, so the first concern of the pious Valentinian was the experience of the divine marriage feast of Sophia. As Sophia was united with the Soter, her bridegroom, so the faithful would experience a union with their angel in heaven (*i.e.* their "double," *Doppelgänger*). The ritual of this sacrament is briefly indicated by Irenaeus i. 21, 3: "A few of them prepare a bridal chamber and in it go through a form of consecration, employing certain fixed formulae, which are repeated over the person to be initiated, and stating that a spiritual marriage is to be performed after the pattern of the higher Syzygia." Through a fortunate chance, a liturgical formula which was used at this sacrament appears to be preserved, though in a garbled form and in an entirely different connexion, the author seeming to have been uncertain as to its original meaning. It runs: "I will confer my favour upon thee, for the father of all sees thine angel ever before his face . . . we must now become as one; receive now this grace from me and through me; deck thyself as a bride who awaits her bridegroom, that thou mayest become as I am, and I as thou art. Let the seed of light descend into thy bridal chamber; receive the bridegroom and give place to him, and open thine arms to embrace him. Behold, grace has descended upon thee."

Besides this the Gnostics already practised baptism, using the same form in all essentials as that of the Christian Church. The name given to baptism, at least among certain bodies, was *apolytrosis* (liberation); the baptismal formulae have been mentioned above. Great importance attaches in the Gnostic sacramental speculations to invocation (of the name). The Gnostics are baptized in the mysterious name which also descended upon Jesus at his baptism. The angels of the Gnostics have also had to be baptized in this name, in order to bring about redemption for themselves and the souls belonging to them (*excerpta ex Theodoto*, 22). In this connexion we also find the formula λύτρωσιν ἀγγελικήν (for the angelic redemption, Irenaeus i. 21, 3). In the baptismal formulae the sacred name of the Redeemer is mentioned over and over again. In one of the formulae occur the words: "I would enjoy thy name, Saviour of Truth." The concluding formula of the baptismal ceremony is: "Peace over all upon whom the Name rests" (Irenaeus i. 21, 3). This name pronounced at baptism over the faithful has above all the significance that the name will protect the soul in its ascent through the heavens, conduct it safely through all hostile powers to the lower heavens, and procure it access to Horos, who frightens back the lower souls by his magic word (*exc. ex Theodoto*, 22). And for this life also baptism, in consequence of the pronouncing of the protecting name over the baptized person, accomplishes his liberation from the lower daemonic powers. Before baptism the Heirmarmene is supreme, but after baptism the soul is free from her (*exc. ex Theod.* 77).

With baptism was also connected the anointing with oil, and hence we can also understand the death sacrament occurring among the Valentinians consisting in an anointing with a mixture of oil and water (Irenaeus i. 21, 4). This death sacrament has naturally the express object of assuring the soul the way to the highest heaven "so that the soul may be intangible and invisible to the higher mights and powers" (Irenaeus, *loc. cit.*). In this connexion we also find a few formulae which are entrusted to the faithful, so that their souls may pronounce them on their journey upwards. One of these formulae runs: "I am a son of the Father, the Father who was before the whole world—I came to see everything, that which is strange and that which is my own; and deep down there is nothing strange, but only that which belongs to Achamoth. For she is the feminine aeon, and she has made all things. I draw my sex from that which was before the world, and take back to it the property from which I came" (Irenaeus i. 21, 5). Another formula is appended, in which there is a distinction in the invocation between the higher and lower Sophia. Another prayer of the same style is to be found in Irenaeus i. 13, and it is expressly stated that after prayer is pronounced the Mother throws the Homeric helmet (cf. the *Tarnkappe*) over the faithful soul, and so makes him invisible to the mights and powers which surround and attack him.

On the other hand, we see how here and there a reaction took place against the absurdity of this sacramental superstition. Thus Irenaeus (i. 21, 4) tells us of certain Gnostics who would admit no external holy practices as efficacious: "The completed *apolytrosis* is the actual knowledge of the inexpressible majesty (of God), for through ignorance arose all faultiness and suffering, and through knowledge will be removed all the conditions which arose from ignorance; and therefore knowledge (*gnosis*) is the perfecting of the inner man." A pure piety, rising above mere sacramentalism, breathes in the words of the Gnostics preserved in *excerpta ex Theodoto*, 78, 2: "But not baptism alone sets us free, but knowledge (*gnosis*): who we were, what we have become, where we were, whither we have sunk, whither we hasten, whence we are redeemed, what is birth and what rebirth."

VIII. It has already been seen clearly that Valentinian Gnosticism affected the nearest approach of all the Gnostic sects to the Catholic Church. Valentinus's own life indicates that he for a long time sought to remain within the official Church, and had at first no idea of founding a community of his own. Many compromises in his theories point the same way. The Johannine tendencies of his doctrine of the aeons (Logos, Zoë, Aletheia, Parakletos); the attempt to modify the sharp dualism of Gnosticism in a monistic direction; the derivation of the world from the fallen Sophia; the favourable judgment of the Demiourgos, and his origin in the repentance and conversion of Sophia, which are peculiar to the Valentinian system; the triple division of mankind into *pneumatici*, *psychici* and *hylici*, which is obviously contrived for the benefit of the *psychici*; the inclusion of an element of the *psychici* in the composition of the Redeemer; the theory that Jesus possessed a miraculous body formed in the upper world; the emphasis on the fact that the redemption of Jesus was primarily for the *psychici*; the doctrine that by the final redemption the Demiourgos and the *psychici* find a place in the Ogdoas; the adoption of Christian baptism—all this, and perhaps more, indicates a definite and deliberate approach towards the doctrine of the Church.

These Gnostics, as in the case of most of the other Gnostic sects, possessed their own peculiar holy writings and books, but they also made a great use in their own circle of the canon of the Christian Church, especially the canon of the New Testament and—though with a few reservations—of the Old Testament. Irenaeus in his account of the Ptolemaean sects has used a source which contained a detailed scriptural exposition of the Valentinian doctrines based on the New Testament. We can even—and this is of great interest and significance for the history of the canon—establish the contents of the Gnostic canon. It included the three first gospels and the apostle Paul. The proofs are constantly drawn firstly from the utterances of the Saviour, and then from the Epistles of Paul. The Gospel of John does not seem to have yet found a place in this canon, for the very good reason that it was not yet widely known and circulated. Later Valentinian Gnosticism delighted in making use of the Johannine Gospel as a crowning testimony. Thus to the older and ancient scriptural evidences which we mentioned above, Irenaeus (i. 8, 5) directly appends a commentary on the Gospel of John, which is ascribed to Ptolemaeus himself. And in the *excerpta ex Theodoto*, 6 seq., we also find a commentary on the prologue to this Gospel. And we know that the later Valentinian Herakleon wrote a detailed exposition of the whole Gospel. But the Old Testament too was a sacred book of these Gnostics, and its statements were used as evidence and proofs. This was done with some diffidence and caution. The attitude, at least of the later Valentinians, is best indicated by the letter of Ptolemaeus to Flora, which is preserved in Epiphanius 33, 3–7. Ptolemaeus here openly attacks the doctrine that the Old Testament is the work of the devil, or that it cannot at least be ascribed unconditionally to the Supreme God. The Old Testament he considers to contain a system of laws given by God himself, a system of laws given by Moses according to his own ideas, and precepts interpolated by the elders of the people. The laws of God himself fall then into three classes: the true law, which is not interwoven with evil; the law permeated with unrighteousness, which the Redeemer has dissolved; and the typical and symbolical law, which the Redeemer has translated from the material into the spiritual. Thus there is a gradual approach to the Christian Church's conception of the Old Testament. (It should indeed be remarked that Ptolemaeus in the above-mentioned letter has purposely expounded the exoteric doctrine in special approximation with the Catholic Church, while for the actual difficult questions as to the nature of the Demiourgos and his relation with the unity of the Divine nature he consoles Flora with a further and more intimate instruction.)

And yet this reconciliation of Gnosticism was a fruitless and henceforward a purposeless undertaking. Oriental dualism and wildly intemperate Oriental mythology had grown into so radical and essential a part of Gnosticism that they could not be separated from it to make way for a purer and more spiritual view of religion. And at a time when the prevailing tendency of Christianity was a struggle out of the darkness of Oriental mythology and eschatology into clearness, and an effort towards union with the lucid simplicity of the Hellenic spirit, these Gnostics, for all their efforts, and even the most noble of them, had come too late. They are not the men of a forward movement, but they are, and remain, in spite of all clearer insight, the rear-guard in the history of piety, who have gone under and disappeared in a struggle with the impossible. None the less we cannot omit the observation that the Christian Church in later centuries to a certain extent travelled again over Gnostic ground in its sacramental theories and fully developed Christological speculations.

See Bibliography to article GNOSTICISM. Also A. Harnack, *Dogmengeschichte*, vol. i. (4th ed., 1909); W. Bousset, *Hauptprobleme der Gnosis* (1907). See also Pauly-Wissowa, *Realencyklopädie des klassischen Altertums*, s.v. *Gnosticismus*, *Gnostiker*. More particularly devoted to Valentinianism are: G. Heinrici, *Die Valentinianische Gnosis und die heiligen Schriften* (1871); E. Schwartz, "Aporien im 4 Evangelium" in *Nachrichten der Gött. Gesellsch. der Wissensch.* (1908), ii. 127–41; A. Harnack, *Brief des Ptolemaeus an die Flora*, *Sitzungsber. der Berl. Akademie* (1909). (W. Bo.)

VALENZUELA, FERNANDO DE (1630–1692), Spanish royal favourite and minister, was born at Naples on the 19th of January 1630. His father, Don Francisco de Valenzuela, a gentleman of Ronda, had been compelled to flee from Spain in consequence of a brawl, and had enlisted as a soldier in Naples, where he married Doña Leonora de Encisa. Francisco de Valenzuela having died young, his son was placed by his mother as a page in the household of the duke of Infantado. He lost his place owing to a reduction of the duke's establishment, and for several years he lived obscurely; but by good fortune he succeeded in persuading Maria de Uceda, one of the ladies-in-waiting of Mariana, second wife of Philip IV., to marry him. By her help Valenzuela obtained a footing in the palace. He was appointed introducer of ambassadors on the 12th of October 1671, and it became notorious that whoever had a petition to present or a place to ask for must apply to him. He became popularly known as the *duende*, the fairy or brownie of the palace, and was believed to be the lover of the queen. In 1675 a court intrigue, conducted by his rivals and supported by the younger Don John of Austria, was so far successful that he was driven from court; but the queen gave him the title of marquis of Villa Sierra, and appointed him ambassador to Venice. Valenzuela succeeded in getting the embassy exchanged for the governorship of Granada. His stay at this post was short, for he was able to organize a counter-intrigue which soon brought him back to court. The queen-regent now openly appointed him prime minister, gave him official quarters in the palace, and conferred a grandeeship on him, to the profound indignation of the other grandees. In January 1678 a palace revolution broke out against the queen-regent, who was driven from Madrid, and Valenzuela fled for refuge to the monastery of the Escorial. He was, however, taken out by force, and his house was pillaged. His property was confiscated—his jewels, furniture and ready money were estimated to amount to £120,000—he was degraded from the grandeeship and exiled to the Philippines. At a later period he was released from close confinement and allowed to settle in Mexico, where a pension was given him. He died in Mexico, from the kick of a horse he was breaking in, on the 7th of February 1692. Part of his property, and the title of Villa Sierra, but not the grandeeship, were restored to his wife and children. The career of Valenzuela probably helped to suggest the subject of *Ruy Blas* to Victor Hugo.

See *Documentos Inéditos para la Historia de España*, vol. lxvii. (Madrid, 1842, &c.), which contain an artful and well-written defence of himself addressed to King Charles II. of Spain from Mexico.

VALERA Y ALCALÁ GALIANO, JUAN (1824–1905), Spanish novelist, son of a retired commodore, José Valera, who married Doña Dolores Alcalá Galiano, marquesa de la Paniega, widow of a Swiss general named Freuller, was born on the 18th of October 1824 at Cabra (Cordova). Valera was educated at Malaga and at the university of Granada, where he took a degree in law. Entering diplomacy in 1847, he became unpaid attaché to the Spanish embassy at Naples under the famous Duke de Rivas, the leader of the romantic movement in Spain. Valera witnessed the events of the Revolution, was promoted second secretary to the embassy at Lisbon in 1850, and in 1851 was transferred as first secretary to Rio de Janeiro, where he remained for two years. After a short period passed at Dresden, he was appointed to the permanent staff of the Foreign Office at Madrid, and in 1857 was attached to the special embassy to St Petersburg under the Duke de Osuna. In 1858 he resigned his post, was elected deputy for Archidona, in the province of Malaga, took his seat with the advanced Liberal Opposition, and joined with Albareda and Fabié in founding *El Contemporáneo*, a very influential journal. An expert in the art of covering an opponent with polite ridicule, his writings in the press attracted general attention. He was elected a member of the Spanish Academy in 1861, and remained in Opposition till 1865, when O'Donnell appointed him minister at Frankfort; on the flight of Isabella II. in 1868 he was elected deputy for Montilla in the province of Cordova, became under-secretary of state for foreign affairs, and was one of the deputation who offered the crown to Amadeus of Savoy in the Pitti Palace at Florence. Though he always called himself a Moderate Liberal, Valera invariably voted for what are considered Radical measures in Spain, and a speech delivered by him in February 1863 against the temporal power of the pope created a profound sensation. However, though a member of the revolutionary party, he steadily opposed organic constitutional changes, and therefore he retired from public life during the period of republican government. After the Bourbon restoration he acted as minister at Lisbon (1881–1883), at Washington (1885), at Brussels (1886) and as ambassador at Vienna (1893–1895), retiring from the diplomatic service on the 5th of March 1896. During the last ten years of his life he took no active part in politics. He died on the 18th of April 1905.

Valera's first publication, *Canciones, Romances y Poemas*, was published in 1856. His verses are melodious, finished and various in subject; but they are rather the imitative exercises of a scholarly man of the world than the inspirations of an original poet. That they failed to attract notice is not altogether to be regretted, for, as Valera himself confessed later in his half-ironical, half-ingenuous preface to the second edition (1885), "In spite of my idleness, I should have shown a most deplorable fecundity had I been received with favour and applause." However, if he published little more in the shape of verse, he wrote incessantly in prose. More than two-thirds of his work is still uncollected, buried in reviews and newspapers; but we may take it that he rescued what he thought most valuable. His criticism may be read in the *Estudios críticos sobre literatura* (1864), in the *Disertaciones y juicios literarios* (1878) and in the *Nuevos estudios críticos* (1888); yet, with all his penetration and taste, Valera laboured under one disadvantage not frequent in critics. He suffered from an excessive amiability. He said a hundred incisive, wise, witty, subtle and suggestive things concerning the mysticism of St Theresa, the art of novel-writing, *Faust*, the Inquisition, *Don Quixote*, Shakespeare, the psychology of love in literature; but, to do himself justice, it was an almost indispensable condition that he should deal with the past. In the presence of a living author Valera was disarmed. Unless the writer were an incurable pessimist, Valera would find something in his work to praise, exhausting the vocabulary of compliment and graceful tribute; but, except in the *Cartas americanas* (1889), where the laudation was manifestly so exaggerated that no harm could come of it, this trick of eulogy became perplexing and misleading. Valera, in effect, refused to criticize contemporary literature; as a rival author it seemed to him an indelicacy to censure his competitors, and he was either laudatory or silent. It is regrettable, for criticism was and is greatly needed in Spain.

Valera, then, excelled neither as a poet nor as an impartial critic; he had the vocation of the novelist, though he was slow in discovering it, since he was in his fiftieth year before he published the novel which was to make him famous. *Pepita*

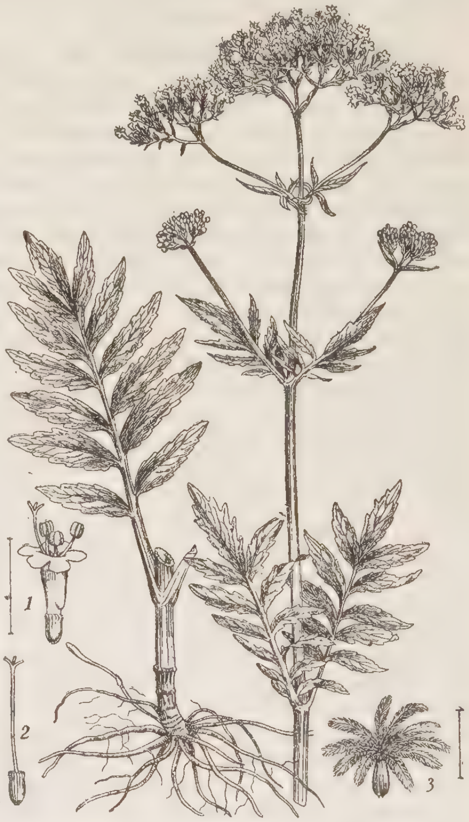
Jiménez (1874) is a recital of the fall of Luis de Vargas, a seminarist who conceived himself to be a mystic and a potential saint, and whose aspirations dissolve at the first contact with reality. It is easy to point out blemishes: the story is not well constructed, and it has pauses during which the writer's fantasy plays at pleasure over a hundred subjects not very germane to the matter; but its characters are as real as any in fiction, the love story is told with the most refined subtlety and malicious truth, while page upon page is written in such Spanish as would do credit to the best writers of the 16th and 17th centuries. Unquestionably *Pepita Jiménez* is a very remarkable achievement—so remarkable, that contemporaries were reluctant to admit the superiority of its successors. It is certain that Valera's second novel, *Las ilusiones del Doctor Faustino* (1875), was received with marked disfavour, and that it has the faults of over-refinement and of cruelty; yet in keen analysis and in humour it surpasses *Pepita Jiménez.* The *Comendador Mendoza* (1877) is more pathetic and of a profounder significance; and if *Doña Luz* (1879) repeats the situation and the general idea already used in *Pepita Jiménez,* it strikes a deeper and more tragic note, which came as a surprise to those familiar only with the lighter side of Valera's genius. Besides these elaborate psychological studies, Valera issued a volume of *Cuentos* (1887), some of these short tales and dialogues being marvels of art and of insight. Thenceforward he was silent for eight years, but after his retirement from politics he published several good books—*El hechicero* (1895), *Juanita la larga* (1896), *Genio y figura* (1897), *De varios colores* (1898) and *Morsamor* (1899). These are not all of equal excellence, but they are characteristic of their author, and abound in understanding, humorous comment and sympathetic creation.

At the close of the 19th century Valera was recognized as the most eminent man of letters in Spain. He had not Pereda's force nor his energetic realism; he had not the copious invention nor the reforming purpose of Pérez Galdós; yet he was as realistic as the former and as innovating as the latter. And, for all his cosmopolitan spirit, he fortunately remained intensely and incorrigibly Spanish. His aristocratic scepticism, his strange elusiveness, his incomparable charm are his own: his humour, his flashing irony, his urbanity are eminently the gifts of his land and race. He is by no means an impersonal artist; in almost every story there is at least one character who talks and thinks and subtilizes and refines as Valera himself wrote in his most brilliant essays. This may be a fault in art; but, if so, it is a fault which many great artists have committed, from Cervantes to Thackeray. It is dangerous to attempt a forecast of Valera's final place in literary history, yet it seems safe to say that, though his poems and essays will be forgotten, *Pepita Jiménez* and *Doña Luz* will survive changes of fashion and of taste, and that their author's name will be inseparably connected with the renaissance of the modern Spanish novel. (J. F.-K.)

VALERIA, VIA, an ancient highroad of Italy, the continuation north-eastwards of the Via Tiburtina (*q.v.*). It probably owed its origin to M. Valerius Messalla, censor in 154 B.C. It ran first up the Anio valley past Varia (*q.v.*), and then, abandoning it at the 36th mile, where the Via Sublacensis diverged, ascended to Carseoli (*q.v.*), and then again to the lofty pass of Monte Bove (4003 ft.), whence it descended again to the valley occupied by the Lago di Fucino (*q.v.*). It is doubtful whether it ran farther than the eastern point of the territory of the Marsi at Cerfennia, to the N.E. of the Lacus Fucinus, before the time of Claudius. Strabo states that in his day it went as far as Corfinium, and this important place must have been in some way accessible from Rome, but probably, beyond Cerfennia, only by a track. The difficult route from Cerfennia to the valley of the Aternus—a drop of nearly 1000 ft., involving too the crossing of the main ridge of the Apennines (3675 ft.) by the Mons Imeus (mod. Forca Caruso)—was, however, probably not made into a highroad until Claudius's reign: one of his milestones (*Corp. Inscr. Lat.* ix. 5973) states that he in A.D. 48–49 made the Via Claudia Valeria from Cerfennia to the mouth of the Aternus (mod. Pescara). He also constructed a road, the Via Claudia Nova, connecting the Via Salaria, which it left at Foruli (mod. Civitatomassa, near Amiternum) with the Via Valeria near the modern Popoli. This road was continued south (we do not know by whom or when) to Aesernia. From Popoli the road followed the valley of the Aternus to its mouth, and there joined the coast-road at Pescara. The modern railway from Rome to Castellammare Adriatico follows closely the line of the Via Valeria.

See E. Albertini in *Mélanges de l'École française de Rome* (1907), 463 sqq. (T. As.)

VALERIAN, a genus of herbaceous perennial plants of the natural order Valerianaceae. Two species—*Valeriana officinalis* and *V. dioica*—are indigenous in Britain, while a third, *V. pyrenaica,* is naturalized in some parts. The valerians have opposite leaves and small flowers, usually of a white or reddish tint, and arranged in terminal cymes. The limb of the calyx is remarkable for being at first inrolled and afterwards expanding in the form of a feathery pappus which aids in the dissemination of the fruit. The genus comprises about 150 species, which are widely distributed in the temperate parts of the world. In medicine the root of *V. officinalis* is intended when valerian is mentioned. The plant grows throughout Europe from Spain to the Crimea, and from Iceland through northern Europe and Asia to the coasts of Manchuria. Several varieties of the plant are known, those growing in hilly situations being considered the most valuable for medicinal purposes. Valerian is cultivated in England (in several villages near Chesterfield in Derbyshire), but to a much greater extent in Prussian Saxony (in the neighbourhood of Cölleda, north of Weimar), in Holland and in the United States (Vermont, New Hampshire and New York). The dried root or rhizome consists of a short central erect portion, about the thickness of the little finger, surrounded by numerous rootlets about $\frac{1}{10}$ of an inch in diameter, the whole being of a dull brown colour. When first taken from the ground it has no distinctive smell; but on drying it acquires a powerful odour of valerianic acid. This odour, now regarded as intolerable, was in the 16th century considered to be fragrant, the root being placed among clothes as a perfume (Turner, *Herbal,* 1568, part iii. p. 76), just as *V. celtica* and some Himalayan species of the genus are still used in the East. By the poorer classes in the north of England it was esteemed of such medicinal value that "no broth, pottage or physical meat" was considered of any value without it (Gerard, *Herball,* 1633, p, 1078).



Habit after Curtis, *Flora Londinensis.*

FIG. 1.—Valerian (*Valeriana officinalis*), one-third natural size. 1, flower; 2, flower after removal of corolla; 3, fruit crowned by the feathery pappus. 1, 2, 3 enlarged.

The red valerian of gardens is *Centranthus ruber*, also belonging to the Valerianaceae; but Greek valerian is *Polemonium coeruleum*, belonging to the natural order Polemoniaceae. Cats are nearly as fond of the smell of this plant as of the true valerian, and will frequently roll on the plant and injure it.

The chief constituent of valerian is a volatile oil, which is present in the dried root to the extent of 1–2 %, plants growing on dry or stony soil being said to yield the largest quantity. The oil is of complex composition, containing valerianic (valeric), formic and acetic acids combined with a terpene, $C_{10}H_{16}$; the alcohol known as borneol; and pinene. The valerianic acid present in the oil is not the normal acid, but isovalerianic acid. It occurs in many plants and in cod-liver oil. It is strongly acid, burning to the palate, and with the odour of the plant. The oil is soluble in thirty parts of water and readily in alcohol and ether. The British Pharmacopeia contains the tinctura valerianae ammoniata, containing valerian, oil of nutmeg, oil of lemon and ammonia. It is an extremely nauseous and offensive preparation. The valerianate of zinc is also official in Great Britain, but, like valerianic acid itself, it is pharmacologically inert and therapeutically useless.

Valerian acts medicinally entirely in virtue of its volatile oil, which exerts the actions typical of its class. The special use of this drug, like that of others which contain an offensive volatile oil—such as asafoetida—is in hysteria or, as it is more properly styled, neuromimesis. It is generally believed that the drug acts in virtue of its unpleasant odour and taste, which cause the patient to display so much volition as shall enable him or her to control the symptoms and thereby obtain the discontinuance of the drug. Good results are sometimes obtained, however, when the drug is given in capsules or in some other form which puts this mode of action out of the question. Binz of Bonn has shown that the volatile oils act as sedatives of the motor cells in the anterior horns of grey matter in the spinal cord, and it is probable that this action may account for the good results often obtained by the use of valerian in neuromimesis; though there is little doubt that the *modus operandi* above described may also come into play. The valerianates of iron, quinine, guaiacol and sodium share with that of zinc the disability of exerting no action attributable to their acid radicle, but have frequently been employed. Valerianic diethylamide, or valyl, has also been employed as a substitute for the preparations in ordinary use.

VALERIANUS, PUBLIUS LICINIUS, Roman emperor from A.D. 253 to 260. He was of noble family, and in 238 was *princeps senatus*. In 251, when Decius revived the censorship with legislative and executive powers so extensive that it practically embraced the civil authority of the emperor, Valerian was chosen censor by the senate. After the death of Decius Valerian retained the confidence of his successor, Trebonianus Gallus, who sent him to fetch troops to quell the rebellion of Aemilianus, governor of Moesia and Pannonia. The soldiers in Raetia, however, proclaimed Valerian emperor; and marching slowly towards Rome he found both his rivals dead, slain by their own soldiers. Valerian was about sixty-three years of age, and had scarcely the vigour to deal with the enemies that threatened every frontier of the empire. Taking his son Gallienus as colleague, he left the wars in Europe to his direction, under which matters went from bad to worse and the whole West fell into disorder. Valerian chose for his own part the war in the East, where Antioch had fallen into the hands of a Persian vassal and Armenia was occupied by Shapur (Sapor) I., while in 258 the Goths ravaged Asia Minor. Valerian recovered Antioch, fought in Mesopotamia with mixed success and finally was taken captive. It is said that he was subjected to the greatest insults by his captors, and that after his death his skin was stuffed with straw and preserved as a trophy in the chief Persian temple. Owing to imperfect and contradictory authorities, the chronology and details of this reign are very uncertain.

See Trebellius Pollio, *Life of Valerian* (frags.); Aurelius Victor, *Caesares*, 32; Eutropius ix. 6; Ammianus Marcellinus xxiii. 5; Zosimus i. 27; Gibbon, *Decline and Fall*, chap. 10; H. Schiller, *Geschichte der römischen Kaiserzeit*, i. pt. 2.

VALERIC ACID, or Valerianic Acid, $C_4H_9{\cdot}CO_2H$, an organic acid belonging to the fatty acid series, which exists in four isomeric forms, one of which contains an asymmetric carbon atom and consequently occurs in two optically active modifications and one optically inactive modification. Ordinary valeric acid (baldrianic acid) is a mixture of isovaleric acid or isopropylacetic acid, $(CH_3)_2CH{\cdot}CH_2{\cdot}CO_2H$, and optically active methylethylacetic acid, $(CH_3)\,(C_2H_5)CH{\cdot}CO_2H$, which occur free or as esters in the vegetable and animal kingdoms, chiefly in the roots of *Angelica archangelica* and *Valeriana officinalis*. It may be extracted by boiling with water or soda. A similar product is obtained by oxidizing fermentation amyl alcohol with chromic acid. Isovaleric acid is an oily liquid having the odour of stale cheese and boiling at 174°; the salts are usually greasy to the touch. Potassium permanganate oxidizes it to β-oxyisovaleric acid $(CH_3)_2{\cdot}C(OH){\cdot}CH_2{\cdot}CO_2H$, whilst nitric acid gives, among other products, dinitropropane, $(CH_3)_2C(NO_2)_2$. The acid has been synthesized, as has also the inactive form of methylethylacetic acid; this modification is split into its optical antipodes by crystallization of its brucine salt. Normal valeric acid or propylacetic acid, $CH_3{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H$, is a liquid boiling at 186°. The remaining isomer, pivalic or trimethylacetic acid, $(CH_3)_3C{\cdot}CO_2H$, melts at 35° and boils at 163°. Both these acids are synthetic products.

VALERIUS, PUBLIUS, surnamed Publicola (or Poplicola), "friend of the people," the colleague of Brutus in the consulship in the first year of the Roman republic (509 B.C.). According to Livy and Plutarch, his family, whose ancestor Volusus had settled in Rome at the time of King Tatius, was of Sabine origin. He took a prominent part in the expulsion of the Tarquins, and though not originally chosen as the colleague of Brutus he soon took the place of Tarquinius Collatinus. On the death of Brutus, which left him sole consul, the people began to fear that he was aiming at kingly power. To calm their apprehensions he discontinued the building of his house on the top of the Velian Hill, and also gave orders that the fasces should be lowered whenever he appeared before the people. He further introduced two laws to protect the liberties of the citizens, one enacting that whosoever should attempt to make himself a king might be slain by any man at any time, while another provided an appeal to the people on behalf of any citizen condemned by a magistrate (*lex Valeria de provocatione*: see Rome, *History*, II. "The Republic"). He died in 503, and was buried at the public expense, the matrons mourning him for ten months.

Livy ii. 6–8; Dion. Halic. iv. 67, v. 12–40; *Life* by Plutarch.

VALERIUS FLACCUS, GAIUS, Roman poet, flourished under Vespasian and Titus. He has been identified on insufficient grounds with a poet friend of Martial (i. 61. 76), a native of Padua, and in needy circumstances; but as he was a member of the College of Fifteen, who had charge of the Sibylline books (i. 5), he must have been well off. The subscription of the Vatican MS., which adds the name Setinus Balbus, points to his having been a native of Setia in Latium. The only ancient writer who mentions him is Quintilian (*Instit. Orat.* x. 1. 90), who laments his recent death as a great loss, although it does not follow that he died young; as Quintilian's work was finished about A.D. 90, this gives a limit for the death of Flaccus. His work, the *Argonautica*, dedicated to Vespasian on his setting out for Britain, was written during the siege, or shortly after the capture, of Jerusalem by Titus (70). As the eruption of Vesuvius (79) is alluded to, it must have occupied him a long time. The *Argonautica* is an epic in eight books on the Quest of the Golden Fleece. The poem is in a very corrupt state, and ends abruptly with the request of Medea to accompany Jason on his homeward voyage. It is a disputed question whether part has been lost or whether it was ever finished. It is a free imitation and in parts a translation of the work of Apollonius of Rhodes (*q.v.*), already familiar to the Romans in the popular version of Varro Atacinus. The object of the work has been described as the glorification of Vespasian's achievements in securing Roman rule in Britain and opening up the ocean to navigation (as the Euxine was opened up by the Argo). Various estimates have been formed of the genius of Flaccus, and some critics have ranked him above his original, to whom he certainly is superior in liveliness of description and delineation of character. His diction is pure, his style correct, his versification smooth though monotonous. On the other hand, he is wholly without originality, and his poetry, though free from glaring defects, is artificial and elaborately dull. His model in language was Virgil, to whom he is far inferior in taste and lucidity. His tiresome display of learning, rhetorical exaggeration and ornamentations make him difficult to read, which no doubt accounts for his unpopularity in ancient times.

The *Argonautica* was unknown till the first four and a half books were discovered by Poggio at St Gall in 1417. The *editio princeps* was published at Bologna (1474). Recent editions by G. Thilo (1863), with critical notes; C. Schenkl (1871), with bibliography; E. Bährens (1875), with critical introduction; P. Langen (1896), with Latin notes, and short introductions on the style and language; Caesar Giarratano (1904); see also J. Peters, *De V. F. Vita et Carmine* (1890); W. C. Summers, *Study of the Argonautica* (1894).

VALERIUS MAXIMUS, Latin writer, author of a collection of historical anecdotes, flourished in the reign of Tiberius. Nothing is known of his personal history except that his family was poor and undistinguished, and that he owed everything to Sextus Pompeius (consul A.D. 14), proconsul of Asia, whom he accompanied to the East in 27. This Pompeius was a kind of minor Maecenas, and the centre of a literary circle to which Ovid belonged; he was also the intimate of the most literary prince of the imperial family, Germanicus. The style of Valerius's writings seems to indicate that he was a professional rhetorician. In his preface he intimates that his work is intended as a commonplace book of historical anecdotes for use in the schools of rhetoric, where the pupils were trained in the art of embellishing speeches by references to history. According to the MSS., its title is *Nine Books of Memorable Deeds and Sayings*. The stories are loosely and irregularly arranged, each book being divided into sections, and each section bearing as its title the topic, most commonly some virtue or vice, or some merit or demerit, which the stories in the section are intended to illustrate. Most of the tales are from Roman history, but each section has an appendix consisting of extracts from the annals of other peoples, principally the Greeks. The exposition exhibits strongly the two currents of feeling which are intermingled by almost every Roman writer of the empire—the feeling that the Romans of the writer's own day are degenerate creatures when confronted with their own republican predecessors, and the feeling that, however degenerate, the latter-day Romans still tower above the other peoples of the world, and in particular are morally superior to the Greeks.

The author's chief sources are Cicero, Livy, Sallust and Pompeius Trogus, especially the first two. Valerius's treatment of his material is careless and unintelligent in the extreme; but in spite of his confusions, contradictions and anachronisms, the excerpts are apt illustrations, from the rhetorician's point of view, of the circumstance or quality they were intended to illustrate. And even on the historical side we owe something to Valerius. He often used sources now lost, and where he touches on his own time he affords us some glimpses of the much debated and very imperfectly recorded reign of Tiberius. His attitude towards the imperial household has often been misunderstood, and he has been represented as a mean flatterer of the same type with Martial. But, if the references to the imperial administration be carefully scanned, they will be seen to be extravagant neither in kind nor in number. Few will now grudge Tiberius, when his whole action as a ruler is taken into account, such a title as *salutaris princeps*, which seemed to a former generation a specimen of shameless adulation. The few allusions to Caesar's murderers and to Augustus hardly pass beyond the conventional style of the writer's day. The only passage which can fairly be called fulsome is the violently rhetorical tirade against Sejanus. But it is as a chapter in the history of the Latin language that the work of Valerius chiefly deserves study. Without it our view of the transition from classical to silver Latin would be much more imperfect than it is. In Valerius are presented to us, in a rude and palpable form, all the rhetorical tendencies of the age, unsobered by the sanity of Quintilian and unrefined by the taste and subtlety of Tacitus. Direct and simple statement is eschewed and novelty pursued at any price. The barrier between the diction of poetry and that of prose is broken down; the uses of words are strained; monstrous metaphors are invented; there are startling contrasts, dark innuendoes and highly coloured epithets; the most unnatural variations are played upon the artificial scale of grammatical and rhetorical figures of speech. It is an instructive lesson in the history of Latin to compare minutely a passage of Valerius with its counterpart in Cicero or Livy. In the MSS. of Valerius a tenth book is given, which consists of the so-called *Liber de Praenominibus*, the work of some grammarian of a much later date. The collection of Valerius was much used for school purposes, and its popularity in the middle ages is attested by the large number of MSS. in which it has been preserved. Like other schoolbooks it was epitomated. One complete epitome, probably of the 4th or 5th century, bearing the name of Julius Paris, has come down to us; also a portion of another by Januarius Nepotianus. Editions by C. Halm (1865), C. Kempf (1888), contain the epitomes of Paris and Nepotianus.

VALET (Fr. *valet*; O. Fr. *vaslet*), a term now restricted in meaning to that of a gentleman's personal servant. The origin of the word is debated. Du Cange (*Glossarium*, s. *Valeti*) explains it as the diminutive of *vassallus*, a vassal, the sons of *vassalli* being termed *vasseleti* (and so *vasleti*, *valeti*), on the analogy of *domicelli* (*damoiseaux*) for the sons of *domini*. This view is also taken by W. W. Skeat (*Etym. Dict.* s. "Varlet"); but Hatzfeld and Darmesteter (*Dict. gén. de la langue française*), dispute this derivation as phonetically impossible, preferring that from *vassulittus* from a hypothetical *vassulus*, diminutive of *vassus*, from which *vassallus* also is ultimately derived (see VASSAL). Just as *vassus* was in Merovingian times the Gallo-Roman word for "servitor," which the Franks borrowed to designate the domestic soldiers of their kings, so "valet" retained this, its sole surviving sense, throughout the middle ages. Yet the phrase "gentleman's gentleman," commonly used of the modern valet, is more historical than may at first sight appear. For valet, like esquire (*écuyer*), long signified the apprentice stage of knighthood, at first with a certain difference, the esquire being mounted, the valet unmounted, but afterwards with scarce a shade of distinction. Later, "valet" became the usual term for gentlemen who were not knights. In England it was not till the early years of the 14th century that *valletus* in this sense was superseded by *armiger*, and that "valet" (valete, vadlete, verlet, varlet[1]) began to be applied to the class of free men below the rank of esquire. In France the word *valet*, though in Saintonge and Poitou it survived till the close of the 14th century, had elsewhere—like *damoiseau*—much earlier been replaced generally by *écuyer* as the designation of an unknighted gentleman.

At the outset, "valet" had meant no more than "youth" or "boy." Thus Wace in the *Roman de Rou* (III. v. 2903), speaking of William the Conqueror, says: *Guillaume fu vadlet petiz* ("William was a little boy"). The various developments of the word are closely parallel with those of some of its synonyms. Youth suggested both strength and service, the qualifications for nobility in a primitive society, where service in arms was the title to rank. *Puer* (boy) was early used, as a synonym for *vassus*, of the soldiers of the Frankish bodyguard (*pueri ad ministerium*); the Greek *τέκνον* ("child") is etymologically related to O.H. Ger. *degan*, M.H. and Mod. Ger. *degen*, "warrior," A.S. *thegn*, "thane"; "child" itself was applied in the 13th and 14th centuries to young men of gentle birth awaiting knighthood, as a title of dignity, and was perhaps a translation of *valet* (see CHILD), with which may be compared the Spanish *infanzon* and German *junker*. So, too, *cniht* (a "lad" or "servant"), becomes first a warrior and then develops into a title of dignity as "knight," while in Germany the parallel word *knecht* remains as "servant." But valet has also shared with other synonyms a downward development. Just as "knave" (*cnafa*) meant originally a boy (cf. Ger. *knabe*) or servant, and has come to mean a rogue, so *valet* in its English (15th century) form of "varlet" had decayed, before it became obsolete, from its meaning of "servant" to signify a "scoundrel" or "low fellow."

See Du Cange, *Glossarium* (ed. Niort, 1887); A. Luchaire, *Manuel des institutions françaises* (Paris, 1892); P. Giulhiermoz, *Essai sur l'origine de la noblesse en France au moyen âge* (Paris, 1902); Note on the word "Valet" by Maurice Church, App. xix. to Sir R. Hennell's *Hist. of the Yeomen of the Guard* (Westminster, 1904).

(W. A. P.)

VALHALLA (Old Norse *Valhöll*, *i.e.* "hall of the slain"), the name given by the heathen Scandinavians to the abode in which the god Odin received the souls of those who had fallen in battle. There they are represented as spending their time in constant fighting and feasting in his service. See TEUTONIC PEOPLES, *ad fin.*

VALKYRIES (Old Norse *valkyriur*, "choosers of the slain"), figures of Northern mythology, generally represented as divine (less frequently human) maidens who ride through the air on Odin's service. Clad in full armour they are sent forth to determine the course of battles and to select brave warriors for Valhalla (*q.v.*). Beings with the same name (*waelcyrgean*) were known also in England, where we find them associated with witches. The name is used in Anglo-Saxon glossaries to translate various Latin terms for "War-goddess" or "Fury" (Bellona, Erinys, &c.). See TEUTONIC PEOPLES, *ad fin.* (H. M. C.)

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[1] The form *valectus* led to the spelling *valect* in transcribing from Latin documents.

VALLA, LORENZO, or LAURENTIUS (*c.* 1406–1457), Italian humanist, was born at Rome, of parents from the neighbourhood of Piacenza, about 1406, his father, Luca delle Vallea, being an advocate. He was educated at Rome, attending the classes of eminent professors, among them Leonardi Bruni and Giovanni Aurispa (*c.* 1369–1459), from whom he learned Latin and Greek. In 1431 he became a priest, and after trying vainly to secure a position as apostolic secretary in Rome he went to Piacenza, whence he proceeded to Pavia, where he obtained a professorship of eloquence. Valla wandered from one university to another, accepting short engagements and lecturing in many cities. During this period he made the acquaintance of Alphonso V. of Aragon, whose service he entered about 1435. Alphonso made Valla his private secretary, defended him against the attacks of his numerous enemies, and at a later date encouraged him to open a school in Naples.

By this time Valla had won a high reputation by his dialogue *De Voluptate*, and by his treatise *De Elegantiis Latinae Linguae*. In the former work he contrasted the principles of the Stoics with the tenets of Epicurus, openly proclaiming his sympathy with those who claimed the right of free indulgence for man's natural appetites. It was a remarkable utterance. Here for the first time the paganism of the Renaissance found deliberate expression in a work of scholarly and philosophical value. *De Elegantiis* was no less original, although in a different sphere of thought. This work subjected the forms of Latin grammar and the rules of Latin style and rhetoric to a critical examination, and placed the practice of composition upon a foundation of analysis and inductive reasoning. The same originality and critical acumen were displayed in his treatise on the Donation of Constantine (*De falso credita et ementita Constantini donatione declamatio*), written in 1439 during the pontificate of Eugenius IV., in which the nature of the forged document known as the *Constitutum Constantini* was for the first time exposed (see DONATION OF CONSTANTINE). From Naples Valla continued his war against the Church. He showed that the supposed letter of Christ to Abgarus was a forgery, and by throwing doubt upon the authenticity of other spurious documents, and by questioning the utility of monastic life, he aroused the anger of the faithful. He was compelled to appear before an inquisitory tribunal composed of his enemies, and he only escaped by the special intervention of Alphonso. He was not, however, silenced; he ridiculed the Latin of the Vulgate and accused St Augustine of heresy. In 1444 he visited Rome, but in this city also his enemies were numerous and powerful, and he only saved his life by flying in disguise to Barcelona, whence he returned to Naples. But a better fortune attended him after the death of Eugenius IV. in February 1447. Again he journeyed to Rome, where he was welcomed by the new pope, Nicholas V., who made him an apostolic secretary, and this entrance of Valla into the Roman Curia has been justly called "the triumph of humanism over orthodoxy and tradition." Valla also enjoyed the favour of Pope Calixtus III. He died in Rome on the 1st of August 1457.

All the older biographical notices of Valla are loaded with long accounts of his many literary and theological disputes, the most famous of which was the one with Poggio (*q.v.*), which took place after his settlement in Rome. It is almost impossible to form a just estimate of Valla's private life and character owing to the clouds of dust which were stirred up by this and other controversies, in which the most virulent and obscene language was employed. He appears, however, as a vain, jealous and quarrelsome man, but he combined the qualities of an elegant humanist, an acute critic and a venomous writer, who had committed himself to a violent polemic against the temporal power of Rome. In him posterity honours not so much the scholar and the stylist as the man who initiated a bold method of criticism, which he applied alike to language, to historical documents and to ethical opinions. Luther had a very high opinion of Valla and of his writings, and Cardinal Bellarmine calls him *praecursor Lutheri*, while Sir Richard Jebb says that his *De Elegantiis* "marked the highest level that had yet been reached in the critical study of Latin."

Collected, but not quite complete, editions of Valla's works were published at Basel in 1540 and at Venice in 1592 fol., and *De Elegantiis* was reprinted nearly sixty times between 1471 and 1536. For detailed accounts of Valla's life and work see G. Voigt, *Die Wiederbelebung des classischen Alterthums* (1880–81); J. A. Symonds, *Renaissance in Italy* (1897–99); G. Mancini, *Vita di Lorenzo Valla* (Florence, 1891); M. von Wolff, *Lorenzo Valla* (Leipzig, 1893); J. Burckhardt, *Kultur der Renaissance* (1860); J. Vahlen, *Laurentius Valla* (Berlin, 1870); L. Pastor, *Geschichte der Päpste*, Band ii. English trans. by F. I. Antrobus (1892); the article in Herzog-Hauck's *Realencyklopädie*, Band xx. (Leipzig, 1908); and J. E. Sandys, *Hist. of Class. Schol.* ii. (1908), pp. 66–70.

VALLADOLID, an inland province of Spain, one of the eight into which Old Castile was divided in 1833; bounded on the N. by Leon and Palencia, E. by Burgos, S. by Segovia, Ávila and Salamanca, and W. by Zamora. Pop. (1900) 278,561; area, 2922 sq. m. The province belongs entirely to the basin of the Duero (Douro), which traverses it from E. to W., and within its limits receives the Pisuerga (with the Esgueva) on the right, and the Duraton, the Cega, the united Adaja and Eresma, the Zapardiel and the Trabancos on the left. The country watered by these rivers is for the most part flat and exceedingly fertile, the only part that can be called in any sense hilly being in the north-west, where the low Montes de Torozos occur. For the excellence and abundance of its grain crops Valladolid shares with the Tierra de Campos in Palencia the title of granary of the Peninsula.

Besides wheat, maize, barley and oats, the province produces hemp, flax, various fruits, red and white wine, oil and madder. The Montes de Torozos are thinly covered with oaks and other timber, and there are forests in the S.E. The pastures are extensive and large numbers of asses, mules and sheep, as well as some horses and cattle, are reared. Honey, wax and silk are also produced. The woollen fabrics of Valladolid were once highly esteemed, but this industry has now greatly declined, although in the larger towns there are still linen and cloth factories, besides iron foundries, tanneries, saw-mills and flour-mills. But agriculture is by far the foremost industry of the province. Trade is facilitated by the Canal de Castilla, which connects Valladolid, on the Pisuerga, with Alar del Rey, in Palencia, also on that river. See PALENCIA (province). Valladolid is traversed by the national highways from Madrid to Santander, Leon and Corunna, and by the Calatayud and Salamanca roads. It is also traversed from N. to S. by the northern railway from Madrid to France via Irun, which has branches from Valladolid to Medina del Rioseco, and from Medina del Campo to Salamanca and Zamora. Apart from the capital Valladolid, Nava del Rey (6148), Medina del Campo (5971) and Medina del Rioseco (5007) are the only towns with more than 5000 inhabitants. For an account of the people and history of the province, see CASTILE.

VALLADOLID, a town of Mexico, in the state of Yucatan, 90 m. S.E. of Merida, with which it is connected by rail. Pop. about 5000. It is situated in a healthy and fertile part of Yucatan, and is a resort for invalids. It has a number of old churches, a Jesuits' college, town hall, hospital and aqueduct, and the better class of residences are of the usual type, low, large-roomed structures in the midst of gardens. It was founded in 1544, soon after the conquest, and was planned to be a great ecclesiastical centre, but these plans were not realized and its churches and other fine buildings have fallen into decay. Its manufactures include cotton goods and tobacco. The inhabitants, chiefly descendants of the ancient Mayas, have frequently revolted against their rulers. In 1910 they were in a state of insurrection, assisted by the wild tribesmen of the neighbouring territory of Quintana Roo, on which occasion Valladolid was captured by them and many of its officials and prominent white residents were massacred.

VALLADOLID, the capital of the Spanish province of Valladolid, situated 2228 ft. above sea-level, at the confluence of the river Pisuerga with the Esgueva. Pop. (1900) 68,789. Valladolid is an archbishopric, and the seat of an army corps, a court of appeal and a university. It is connected by numerous railways with every province of Spain. Its site is a small valley, enclosed by steep and rugged but not very high hills, which merge into the vast upland plain of Castile. The city was formerly surrounded by walls and entered by four principal gates, but it has been to a great extent modernized, and possesses many fine streets and squares. There are broad avenues and public gardens beside the rivers. Among the chief open spaces are the arcaded Plaza Mayor, the Campo Grande, a wooded park and the Paseo de la Avenida, a wide boulevard in which is the statue of the poet José Zorilla (1817–1893). The granite cathedral was begun in 1585 by Juan de Herrera in the Renaissance style. Herrera's original model is preserved in the muniment-room, but only the nave and one tower (out of four) were completed after his design, and the tower fell in 1841. The building was continued by Churriguera (d. 1725). The interior contains some pictures by Luca Giordana (1623–1705) and the celebrated silver monstrance wrought by Juan de Arphe (b. 1523), which is 6½ ft. high; it is in the form of a temple, decorated with figures of Adam and Eve in the garden of Eden. The tower and nave of the church of Santa Maria la Antigua date from about 1200. The church of San Pablo is later (1286); its chief feature of interest is a beautiful Flamboyant portal, and formerly it had exquisite cloisters. Adjoining is San Gregorio (15th century) with a fine Plateresque façade. San Benito, dating from the end of the 14th century, is a Gothic building with a lofty roof finely groined. The Plateresque college of Santa Cruz, built by Enrique de Egas in 1479–92, contains an interesting collection of pictures and sculptures, including three pictures by Rubens, which have been somewhat damaged, and some remarkable wooden statues by Alonso Berruguete (d. 1581) and others. The college of San Gregorio, dating from the same period, was wrecked by the French in 1808, but has a magnificent late Gothic façade. This building has been converted into municipal offices. The university is attended by about 1200 students, and has faculties of law, medicine, natural science, philosophy and literature. Originally founded at Palencia early in the 13th century, it was transferred to Valladolid before 1250 and attained its greatest prosperity from the 16th century to the 18th. The library contains many rare MSS. The university buildings date from the 17th century and are extravagantly ornate. Among other public buildings of Valladolid may be mentioned the royal palace, built in the beginning of the 17th century, the court-house, the town hall, several convents used as barracks, the provincial institute, training schools for teachers and primary schools, royal academy for cavalry cadets, provincial lunatic asylum, hospitals, seminary (raised in 1897 by Pope Leo XIII. to the rank of a pontifical university), archaeological museum, picture gallery and public library. The house in which Cervantes lived (1603–1606) is owned by the state. The principal industries are the manufacture of linen, silk and woollen fabrics, pottery, gold and silver work, flour, wine, beer, chocolate, leather, ironware and paper. There is also a large agricultural trade.

Valladolid is sometimes identified with the ancient Pintia of Ptolemy, described as a town of the Vaccaei on the road from Asturica to Caesaraugusta. Its Roman origin is uncertain. The present name is undoubtedly Moorish, but its meaning is obscure. Valladolid was recovered from the Moors in the 10th century, but is first named in a public document by Sancho II. of Leon in 1072. The cortes of Castile frequently met here in the following centuries, and in the beginning of the 15th century John II. made it his principal residence. After the removal of the capital to Madrid by Philip II. in 1560 it began rapidly to decay. In December 1808 it was taken and sacked by the French, who destroyed many fine buildings and works of art. Columbus died (1506) and Philip II. was born (1527) at Valladolid.

VALLANDIGHAM, CLEMENT LAIRD (1820–71), American politician, was born in New Lisbon, Ohio, on the 29th of July 1820. He was educated in the common schools and afterwards studied law and was admitted to the bar in 1842. Elected to the Ohio House of Representatives in 1845, he became one of the extremest of the state rights Democrats of his section, emphasizing his principles in the legislature in the local and national party conventions, and in the columns of a newspaper, the *Western Empire*, which he edited at Dayton, Ohio, in 1847–49. From 1858 to 1863 he was in the lower house of Congress, where he was noted for his strong opposition to the principles and policies of the growing Republican party, his belief that the South had been grievously wronged by the North, his leadership of the Peace Democrats or Copperheads, who were opposed to the prosecution of the war, and his bitter attacks upon the Lincoln administration, which, he said, was destroying the Constitution and would end by destroying civil liberty in the North. Attempts were made to expel him, but without success. In 1863 he made violent speeches in Ohio against the administration, and for these he was arrested by the military authorities, tried by military commission, and sentenced to imprisonment. President Lincoln commuted this sentence to banishment, and Vallandigham was sent into the Confederate lines, whence he made his way to Canada. While in exile he was elected supreme commander of the Knights of the Golden Circle in Ohio and received the Democratic nomination for governor of Ohio, but was defeated. In 1864 he returned to Ohio, took active part in the campaign of that year, wrote part of the National Democratic platform at Chicago, and assisted to nominate McClellan for the presidency. After the war he denounced the Reconstruction policy of the Republicans as unconstitutional and tyrannical, but in 1870, seeing the uselessness of further opposition, he advised his party to accept the situation and adopt new issues. He thus initiated what was known as the "New Departure" Democratic movement. Vallandigham was a good lawyer and a popular politician. He was fanatically devoted to the Constitution as he understood that document, and in his course during the war he was not, as his enemies asserted, trying to aid the Confederates, but merely desirous of restoring "the Union as it was." He died in Lebanon, Ohio, on the 17th of June 1871.

See J. L. Vallandigham, *Life of Clement L. Vallandigham* (Baltimore, 1872); and J. F. Rhodes, *History of the United States from the Compromise of 1850* (New York, 1893–1906).

VALLE, PIETRO DELLA (1586–1652), Italian traveller in the East, came of a noble Roman family, and was born on the 11th of April 1586, in the family palace built by Cardinal Andrea. His early life was divided between the pursuits of literature and arms. He saw active service against the Moors of Barbary, but also became a member of the Roman academy of the Umoristi, and acquired some reputation as a versifier and rhetorician. The idea of travelling in the East was suggested by a disappointment in love, as an alternative to suicide, and was ripened to a fixed purpose by a visit to the learned Mario Schipano, professor of medicine in Naples, to whom the record of Pietro's travels was addressed in the form of very elaborate letters, based on a full diary. Before leaving Naples he took a vow of pilgrimage to the Holy Land, and, sailing from Venice on the 8th of June 1614, reached Constantinople, where he remained for more than a year, and acquired a good knowledge of Turkish and a little Arabic. On the 25th of September 1615 he sailed for Alexandria with a suite of nine persons, for he travelled always as a nobleman of distinction, and with every advantage due to his rank. From Alexandria he went on to Cairo, and, after an excursion to Mount Sinai, left Cairo for the Holy Land on the 8th of March 1616, in time to assist at the Easter celebrations at Jerusalem. Having visited the holy sites, he journeyed by Damascus to Aleppo, and thence to Bagdad, where he married a Syrian Christian named Maani, a native of Mardin, who died in 1621. He now desired to visit Persia; but, as that country was then at war with Turkey, he had to leave Bagdad by stealth on the 4th of January 1617. Accompanied by his wife he proceeded by Hamadan to Isfahan, and joined Shah Abbas in a campaign in northern Persia, in the summer of 1618. Here he was well received at court and treated as the shah's guest. On his return to Isfahan he began to think of returning by India rather than adventure himself again in Turkey; but the state of his health, and the war between Persia and the Portuguese at Ormuz, created difficulties. In October 1621 he started from Isfahan, and, visiting Persepolis and Shiraz, made his way to the coast; but it was not till January 1623 that he found passage for Surat on the English ship "Whale." In India he remained till November 1624, his headquarters being Surat and Goa. He was at Muscat in January 1625, and at Basra in March. In May he started by the desert route for Aleppo, and took ship at Alexandretta on a French vessel. Touching at Cyprus he reached Rome on the 28th of March 1626, and was received with much honour, not only by literary circles, but by Pope Urban VIII., who appointed him a gentleman of his bedchamber. The rest of his life was uneventful; he married as second wife a Georgian orphan of noble family, Mariuccia (Tinatin de Ziba), whom his first wife had adopted as a child, and who had accompanied him in all his journeys. By her he had fourteen sons. He died at Rome on the 21st of April 1652.

In Pietro della Valle's lifetime there were printed—(1) a *Funeral Oration on his Wife Maani*, whose remains he brought with him to Rome and buried there (1627); (2) an *Account of Shah Abbas*, printed at Venice in 1628, but not published; (3) the first part of the letter describing his *Travels* (Turkey, 1650). The *Travels* in Persia (2 parts) were published by his sons in 1658, and the third part (India) in 1663. An English translation appeared in 1665 (fol.). Of the Italian text the editon of Brighton, 1843 (2 vols. 8vo), is more esteemed than the other reprints. It contains a sketch of the author's life by Gio. P. Bellori (1622). Della Valle's story is often prolix, with a tendency to the rhetorical; but he is clear and exact, well informed and very instructive, so that his work still possesses high value.

VALLEJO, a city of Solano county, California, U.S.A., on the San Pablo Bay, at the mouth of the Napa river, about 24 m. N.E. of San Francisco. Pop. (1890) 6343; (1900) 7965 (2033 foreign-born); (1910) 11,340. It is served by a branch of the Southern Pacific railway, by steamboats to San Francisco, and by an interurban electric line. The city is situated at the mouth of the great interior valley of the state, and has a good harbour, the channel of which, since the removal of a shoal by the Federal government in 1902–1906, has a maximum depth at low tide of 24 ft. Directly opposite the city, half a mile distant and connected by ferry, is Mare Island, the headquarters of the Pacific Naval Squadron of the United States, with a large United States Navy Yard, a naval arsenal, two stone dry docks (one 750 ft. long) and a lighthouse. The Navy Yard was established in 1854, and its first commandant was D. G. Farragut. In the city are a Carnegie library, St Vincent's Academy and a Good Templars' Home (1869) for orphans. Vallejo is the outlet of the beautiful Napa Valley, one of the finest fruit-growing regions of the state, and, besides fruit, ships large quantities of wheat. Among its manufactures are flour, leather, dairy products and lumber. The municipality owns and operates its waterworks, the water-supply being obtained from the mountains 25 m. distant. The city takes its name from General Mariano Guadalupe Vallejo, a prominent Mexican leader in the years immediately preceding the annexation of California to the United States. It was a dull and out-of-the-way settlement in 1851, when, through General Vallejo's efforts, it became the state capital. The state legislature met here in 1851, 1852 and 1853. In 1871 Vallejo ranked third in population among the cities of the state, and its position and the excellence of its harbour made it a rival of Oakland in the struggle (1869–72) for the terminus of the Central Pacific railway; but Vallejo was unsuccessful, and after 1872 began to decline in relative importance.

VALLÈS, JULES (1832–1885), French journalist and author, was born at Puys, France, on the 10th of June 1832. Coming to Paris, he joined the staff of the *Figaro*, and became a constant contributor to the other leading journals. In 1866 he republished much of his newspaper work in *Refractaires*, the volume forming a romance of the seamy side of Paris life. He was in Paris during the siege of 1870, and after the capitulation was a member of the Commune and founded *Le Cri du Peuple*. He took a conspicuous part in the fighting in the Paris streets, but finally made his escape to London, whence he contributed anonymously to the French press. In 1878 he began in the *Siècle* the serial publication of his principal work, *Jacques Vingtras*, a long autobiographical romance. He died in Paris on the 14th of February 1885.

VALLETTA, or VALETTA, the capital of Malta (since 1570). Pop. (1901) 24,685; or 40,406, including suburbs. The nucleus of the city is built on a ridge of rock (Mount Sceberras) which runs like a tongue into the middle of a bay, which it thus divides into two harbours, the Grand Harbour to the east and the Marsamuschetto to the west, which are subdivided again by three other peninsulas into creeks. On two of these peninsulas on the east side of the Grand Harbour, and at their base, are built the aggregate of towns called the Three Cities—Vittoriosa, Conspicua and Senglea (see MALTA). On the main promontory, with Valletta, stands the suburb Floriana; Fort St Elmo, with a lighthouse, stands on the extremity of the promontory; the suburb Sliema lies on the point which encloses the Marsamuschetto harbour; Fort Ricasoli on the opposite point enclosing the east, Grand, or Great Harbour. The streets of Valletta, paved with stone, run along and across the ridge, and end on each side towards the water in steep flights of steps. Many of the houses, which are of stone throughout, with flat roofs, are large and luxuriously built; wooden-covered balconies project from the windows and give a peculiar aspect to the streets. There are several fine public buildings, as the governor's palace, the new opera-house, the public library and museum of Maltese antiquities, and the *auberges* or lodges of the Knights of Malta (especially the Auberge de Castile) which are now used for military offices, club-rooms, and other purposes. Roman Catholic churches in Valletta are very numerous; the cathedral of S. Giovanni, dating from 1576, is famous for its rich inlaid marbles, its Brussels tapestries, its roof painted by Matteo Preti (1661–1699), the picture by Michael Angelo da Caravaggio of the beheading of John the Baptist, numerous memorials of the knights and other relics.

The governor's palace was formerly that of the grand master of the Maltese Order, and it also contains relics of the knights, tapestries, armour, &c. Extensive bagnios under the rock, formerly occupied by the slaves of the knights, are now used for stores. The knights strengthened Valletta and its harbour by bastions, curtain-walls, lines and forts, towards the sea, towards the land and on every available point, taking advantage in every particular of the natural rock and of the marvellous advantages of situation, rendering it then almost impregnable. The work of fortifying the place has been carried on by the British government, which possesses here a naval hospital, military prison and other necessary institutions. Since the British occupation Valletta has been a naval and military station of the first importance. The dock and victualling yards occupy together an area of some 100 acres spread over the shores on both sides of those arms of the great harbour known as "Dockyard" and "French" creeks, the dockyard being partly on the former, but principally on the latter creek. In 1880 the graving dock accommodation consisted of one double dock at the extremity of Dockyard creek, known as Nos. 1 and 2 Docks, with a total length of about 525 ft. and with 25 ft. over the sill at average water-level, the tidal range at Malta being but slight; and opening into French creek a dry dock of more modern construction, known as No. 3, or the Somerset Dock, 427 ft. long on floor, and with 34 ft. over the sill. Subsequently to this period the fine range of buildings known as the iron ship repairing shop was erected close to the Somerset Dock, and added greatly to the repairing resources of the yard. Dock No. 4, or the Hamilton Dock, was completed in 1891, having a length on floor of 520 ft., a width of entrance of 94 ft. and with 35 ft. 5 in. depth over the sill at average water-level. Associated with this dock was the construction of adjacent deep-water wharf walls, together with the great 160-ton crane. Among later additions were gun-mounting stores, boiler shop, boat sheds, canteen, coal stores &c., together with a double dock 750 ft. long over all, and a single dock 550 ft. long. The large transit trade and the local trade of the island centre upon Valletta. The influx of winter visitors adds to the wealth of the city.

VALLEYFIELD, town and port of entry, Beauharnois county, Quebec, Canada, 25 m. S.W. of Montreal, at the foot of Lake St Francis—an expansion of the river St Lawrence—and at the head of the Beauharnois canal. Pop. (1891) 5515; (1901) 11,055. It is a station on the Canada Atlantic and New York Central railways, and a port of call for all steamers plying between Montreal and Lake Ontario ports. It is the see of a Roman Catholic bishop, and contains a college and a convent. It has extensive cotton, flour, canning and paper mills.

VALLEY FORGE, a small village in Chester county, Pennsylvania, U.S.A., on the S. bank of the Schuylkill river, about 20 m. N.W. of Philadelphia. It is served by the Philadelphia & Reading railway. The village lies in part of the tract occupied in the winter of 1777–1778 by the American army (under General Washington), whose sufferings from cold, starvation and sickness made the place historic. On the 19th of December (after the battles of Brandywine and Germantown and the occupation of Philadelphia by the British) the army, numbering about 10,000, went into camp here, the site having been selected by Washington partly because the hilly ground was favourable for defence, and partly because the army was thus placed between the British forces and York, Pennsylvania (about 65 m. W. of Valley Forge), where Congress was in session. The camp was almost unapproachable from the west by reason of the precipitous hillsides and Valley Creek, a small stream flowing northward at their base into the Schuylkill river which afforded a barrier on the north; on the east a series of intrenchments and rifle-pits were built. In this vicinity the army remained encamped until the middle of June. As a result of the mismanagement and general incapacity of the Commissary Department, the army received little food or clothing during the winter months; in the latter part of December nearly 2900 men were unfit for duty on account of sickness or the lack of clothing, and by the 1st of February this number had increased by nearly 1000, a state of affairs which Washington said was due to "an eternal round of the most stupid mismanagement [by which] the public treasure is expended to no kind of purpose, while the men have been left to perish by inches with cold and nakedness." There were many desertions and occasional symptoms of mutiny, but for the most part the soldiers bore their suffering with heroic fortitude. On the 27th of February Baron Steuben (*q.v.*) reached the camp, where he drilled and reorganized the army. In 1893 the state of Pennsylvania created a commission of ten members, which (with $365,000 appropriated up to 1911) bought about 475 acres (in Chester and Montgomery counties) of the original camp ground, now known as the Valley Forge Park, preserved Washington's headquarters (built in about the year 1758) and other historic buildings, and reproduced several bake-ovens and huts of the kind used by the army. The state has also erected (1908) a fine equestrian statue by Henry K. Bush-Brown to General Anthony Wayne, and a number of granite markers which indicate the situation of the camps of the different brigades. The state of Maine erected in 1907 a granite memorial to the soldiers from Maine who camped here, and in 1910 Massachusetts appropriated $5000 for a memorial to her troops. Valley Forge took its name from an iron forge (also called "Mountjoy forge") built on the east side of Valley Creek, near its mouth, in about 1750, and destroyed by the British in 1777.

VALLOMBROSA, a summer resort of Tuscany, Italy, in the province of Florence, reached by a cable railway 5 m. long from the station of S. Ellero (which is 16 m. S.E. of Florence) and 328 ft. above sea-level, on the N.W. slope of the Prato Magno chain. The former monastery, suppressed in 1816, is occupied by the Royal School of Forestry. A number of hotels have been built. Similar summer resorts are situated among the woods above the Casentino or upper valley of the Arno to the east, such as Camaldoli, Badia di Prataglia, &c. Camaldoli was the original headquarters of the Camaldulensian order, now partly occupied by an hotel. Five hours' journey to the S. of the last on foot and 7½ m. to the E. of Bibbiena by road is the monastery of La Verna, 3660 ft. above sea-level, founded by St Francis in 1215.

VALLOMBROSIANS, an order of monks under the Benedictine rule, founded by St John Gualbert in 1038. He was son of a Florentine nobleman, and became first a Benedictine and then a Camaldulian. Finally, about 1030, he withdrew to Vallombrosa, a shady dale on the side of a mountain in the Apennines, 10 m. from Florence, and for some years led a completely solitary life. Disciples, however, gathered around him, and he formed them into an order in which the cenobitical and the eremitical lives should be combined. The monks lived in a monastery, not in separate huts like the Camaldulians, and the Benedictine rule was the basis of the life; but the contemplative side was strongly emphasized, and every element of Benedictine life was eliminated that could be supposed to interrupt the attention of the mind to God—even manual labour. The Vallombrosians spread in Italy and France, but they never had more than sixty houses. They now have three, with some sixty monks in all. The habit was originally grey, but it became black; and the life also has been assimilated to that of the Benedictines. There were some convents of Vallombrosian nuns.

See Helyot, *Histoire des Ordres religieux* (1718), v. cc. 28, 29; Max Heimbucher, *Orden u. Kongregationen* (1907), I. § 44.
(E. C. B.)

VALLS, a town of north-eastern Spain, in the province of Tarragona; 11 m. N. of Tarragona, on the Picamoixons-Roda railway. Pop. (1900) 12,625. Valls is an old town, and its walls and towers still remain. Wool and cotton spinning and weaving, dyeing, distilling, paper-making and tanning are carried on here with considerable activity.

VALOIS, COUNTS AND DUKES OF. The French countship of Valois (*pagus Vadensis*) takes its name from Vez (Latin *Vadum*), its early capital, a town in the department of the Oise. From the 10th to the 12th century it was owned by the counts of Vermandois and of Vexin; but on the death of Eleanor, sister and heiress of Count Raoul V. (d. 1167), it was united to the crown by King Philip Augustus. Soon detached from the royal domain, Valois was the property of Blanche of Castile, widow of Louis VIII., from 1240 to 1252, and of Jean Tristan, a younger son of Louis IX., from 1268 to 1270. In 1285 Philip III. gave the county to his son Charles (d. 1325), whose son and successor, Philip, count of Valois, became king of France as Philip VI. in 1328. Sixteen years later Valois was granted to Philip's son, Philip, duke of Orleans; then passing with the duchy of Orleans in 1392 to Louis (d. 1407), a son of Charles V., it was erected into a duchy in 1406, and remained the property of the dukes of Orleans until Duke Louis became king of France as Louis XII. in 1498, when it was again united with the royal domain.

After this event the duchy of Valois was granted to several ladies of the royal house. Held by Jeanne, countess of Taillebourg (d. 1520), from 1516 to 1517, and by Marie, countess of Vendôme, from 1530 until her death in 1546, it was given to Catherine de Medici, the widow of Henry II., in 1562, and in 1582 to her daughter, Margaret of Valois, the wife of Henry of Navarre. In 1630 Louis XIII. granted Valois to his brother Gaston, duke of Orleans, and the duchy formed part of the lands and titles of the dukes of Orleans from this time until the Revolution.

The house of Valois, a branch of the great Capetian family, is thus descended from Charles, a son of Philip III., and has been divided into several lines, three of which have reigned in France. These are: (1) the direct line, beginning with Philip VI., which reigned from 1328 to 1498; (2) the Orleans branch, descended from Louis, duke of Orleans, a son of Charles V., from 1498 to 1515; (3) the Angoulême branch, descendants of John, another son of the same duke, from 1515 to 1589. Excluding the royal house, the most illustrious of the Valois branches are: the dukes of Alençon, descendants of Charles, a younger son of Charles I., count of Valois; the dukes of Anjou, descendants of Louis, the second son of King John II.; and the dukes of Burgundy, descendants of Philip, the fourth son of the same king.

VALOIS, HENRI DE [VALESIUS] (1603–1676), French scholar, was born at Paris on the 10th of September 1603. He was a pupil of the Jesuits at the college of Clermont, then studied law at Bourges. He was called to the bar in 1623, but before long devoted himself entirely to literature. He had an extraordinary memory and a thorough knowledge of the classics, and to him we owe editions of several of the Greek historians, with excellent Latin translations, the only fault found with which is that they are too elegant: *Polybii, Diodori Siculi, Nicolai Damasceni, Dionysii Halicarnassii, Appiani et Joannis Antiocheni excerpta* (1634; Henri de Valois used for this edition a manuscript coming from Cyprus, which had been acquired by Peiresc); *Ammiani Marcellini rerum gestarum libri 18* (1636); *Eusebii ecclesiastica historia, et vita imperatoris Constantini, graece et latine* (1659); *Socratis, Sozomeni, Theodoreti et Evagrii Historia ecclesiastica* (1668–1673). When almost sixty years of age, and nearly blind, he married Marguerite Chesneau (1664), and had by her four sons and three daughters. He died in Paris on the 7th of May 1676.

His brother, ADRIEN DE VALOIS (1607–1692), was also a well-known scholar. He made the acquaintance of Father Petau, Father Sirmond and the brothers Dupuy, who turned his attention towards medieval studies. He was appointed historiographer in 1660. He undertook the task of writing a critical history of France, but did not get further than the deposition of Childeric III. (752). He devoted, however, to this period three folio volumes (*Gesta Francorum seu rerum francicarum tomi tres*, 1646–1658), which form a critical commentary of much value, and in many points new, on the chroniclers of the Merovingian age. His study on the palaces constructed by the Merovingian kings (*De basilicis quas primi Francorum reges condiderunt*, 1658–1660) is noteworthy in this connexion. In 1675 appeared his *Notitia Galliarum ordine litterarum digesta*, a work of the highest merit, which laid the foundations of the scientific study of historical geography in France; but, like all the scholars of his age, he had no solid knowledge of philology. His last work was a life of his elder brother (*De Vita Henrici Valesii*, 1677).

Adrien's son, CHARLES DE VALOIS (1671–1747), was a distinguished numismatist, and formed a fine collection of medals, chiefly Roman. He entered at an early age the *Académie des Inscriptions et Belles Lettres*, where he became first a pupil (1705), then an associate (1714) and finally a *pensionnaire* (1722). He published little; we know, however, an *Histoire des Amphictyons* by him. His best work, the *Valesiana* (1694), was inspired by filial affection; in it he collected a number of historical and critical observations, anecdotes and Latin poems of his father. His *Éloge*, by Fréret, is in the *Mémoires de l'Académie des Inscriptions*, vol. xxi. p. 234 (1747).

VALPARAISO, a province of Chile on the Pacific coast, bounded N. by Aconcagua, E. and S. by Santiago and W. by the ocean. Area, 1953 sq. m. Pop. (1895) 220,756; (1902, estimated) 249,885. Its surface is chiefly mountainous, and in great part barren. The river and mountain valleys, however, are fertile, and where irrigation is possible yield large crops, especially cereals. The valley of the Aconcagua, which flows across the N. end of the province, is celebrated for its fertility, especially in the vicinity of Quillota, sometimes called the "garden of Chile." The capital is Valparaiso, and the principal town outside the capital is Quillota.

VALPARAISO, a city and seaport of Chile, capital of the province of Valparaiso, on a broad open bay of the Pacific in lat. 33° 0′ 2″ S., long. 71° 41′ 15″ W., about 70 m. N.W. of Santiago. Pop. (1902) 142,282; (1907, estimated) 180,600. The almost semicircular Bay of Valparaiso is slightly over 3 m. across from Punta Angeles to Punta Gruesa, and the city stands on the south side, on the slopes of a spur of barren hills projecting into the Pacific and forming a rocky peninsula terminating in Punta Angeles. This point affords good shelter from southerly and westerly storms, but the bay is open to those from the north. The city occupies a narrow strip of beach extending around the head of the bay, and extends up the steep slopes and valleys of the enclosing hills, which have an altitude of 1000 to 1400 ft. The extreme outer points of the bay are strongly fortified. Valparaiso is pre-eminently a commercial city. The foreign trade is largely in the hands of foreign merchants. Among industrial establishments are the government railway shops, large foundry and machine shops, coach-building works, a large sugar refinery, breweries, distilleries, bottling works and numerous small factories. The trade of the port, which is the largest and most important on the Pacific coast of South America, makes it a terminal and port of call for several regular lines of steamers, which afford frequent communication with Europe and the United States. The transcontinental railway line between Valparaiso and Buenos Aires (the Andean tunnel was opened in April 1910) adds to the traffic of the port, through the transhipment of passengers and freight to escape the long and dangerous voyage by way of the Straits of Magellan. Two cable lines give telegraphic communication with Europe and the United States—a West Coast line running N. to Panama, and a land line across the Andes to Buenos Aires in connexion with the cable to Europe from that port. There is but one railway out of Valparaiso—the government line to Santiago, with a branch running to Los Andes and the international tunnel through the Andes. There are a wireless telegraph station in regular communication with the islands of Juan Fernandez, state telegraph lines communicating with all parts of the republic, and an efficient telephone service. Valparaiso has an attractive suburb, Viña-del-Mar, immediately E. of Punta Gruesa, only 15 minutes by rail from the city.

Valparaiso was founded in 1536 by Juan de Saavedra, who named it after his birthplace near Cuenca, Spain. It was an ill-chosen name, however, for there is nothing in it descriptive of the barren hills, dirty streets and foul-smelling shores of Valparaiso (Paradise Valley). The port and town were of but little note during the colonial period, for free commercial intercourse with the colony was forbidden. In 1819, near the end of the war with Spain, its population barely reached 5000. In 1578 it was captured by Sir Francis Drake, and in 1596 by Sir John Hawkins. In 1600 it was sacked by the Dutch under Van Noort. On the 31st of March 1866, it was bombarded by a Spanish fleet under the command of Admiral Nunez, when a large part of the town was laid in ruins, and on the 28th of August 1891, after the victory of the congressional troops over Balmaceda's forces in the vicinity, it was partially sacked by the Chileans themselves. Valparaiso has suffered much from earthquakes—in 1730, 1822, 1839, 1873 and 1908. The last-mentioned caused the destruction of a large part of the city, including public edifices, private residences, the water mains, public lighting service and transportation facilities. A large part of the population was deprived of shelter and had to take refuge on the plateau above. Aid was promptly given by the national government, and assistance was sent from foreign countries; and the national government made a grant for the rebuilding of the city.

VALPARAISO, a city and the county-seat of Porter county, Indiana, U.S.A., about 40 m. S.E. of Chicago. Pop. (1890) 5090; (1900) 6280, including 660 foreign-born; (1910) 6987. It is served by the Grand Trunk, the New York, Chicago & St Louis, and the Pennsylvania railways. The city has a public library (1905), and is the seat of an Institute of Telegraphy (founded in 1874; chartered in 1900) and of Valparaiso University (1873; formerly known as the Valparaiso Normal Training School). This university was founded to furnish a practical education at a low cost, and in 1910 had 187 instructors and a total enrolment of 5367 students. Valparaiso was settled about 1835, incorporated in 1856 as a village and chartered as a city in 1865.

VALPY, RICHARD (1754–1836), English schoolmaster, was born in Jersey on the 7th of December 1754. He was sent to schools in Normady and Southampton, and completed his education at Pembroke College, Oxford. In 1777 he took orders, and in 1781 became head master of Reading grammar school, a post which he held for fifty years. He was the author of Greek and Latin grammars which enjoyed a large circulation. He died in London on the 28th of March 1836.

His second son, ABRAHAM JOHN VALPY (1787–1854), printer and publisher, is remembered in connexion with two great undertakings in the department of classical literature. These were reissues of (1) Stephanus's Greek *Thesaurus*, for which E. H. Barker was chiefly responsible; (2) the Delphin Classics in 143 volumes with *variorum* notes, under the editorial superintendence of George Dyer. He also founded the *Classical Journal* in 1810.

VALS (Vals-les-Bains), a village of south-western France, in the department of Ardèche, 3 m. N.N.W. of Aubenas, with which it communicates by tramway. Pop. (1906) town, 2694; commune, 4352. Vals is situated on the Volane amongst volcanic mountains. It is celebrated for its numerous cold mineral springs impregnated in most cases with bicarbonate of soda. They are used chiefly for drinking but also as baths, and are efficacious in maladies of the digestion, liver and kidneys, and for gravel and gout. Seven or eight million bottles annually are exported. Wood-turning and silk-milling are carried on.

VALTELLINA (Ger. *Veltlin*; the name comes from the former capital, Teglio, near Tresenda), properly the name of the upper valley of Adda, in north Italy. Historically and officially, it also comprises the Italian Liro or San Giacomo valley, which extends from the Splügen Pass past Chiavenna (where the Liro is absorbed by the Mera, flowing from the Swiss Val Bregaglia) to the Lake of Como, the Mera entering this lake slightly to the north of the Adda. These two valleys (but not Colico, which is in the province of Como) form together the province of Sondrio. Pop. 145,265 (exclusive of Colico) or 122,466 (omitting Chiavenna). Politically the whole valley belongs to the kingdom of Italy, except the side valley of Poschiavo (Puschlav), which belongs to the Swiss canton of the Grisons (Graubünden). The chief town is Sondrio (7172), other important places being Tirano (5870), Chiavenna (4592) and Morbegno (3603). Near Bormio (Ger. *Worms*) there are some frequented mineral springs (sulphur and lime), known in Pliny's time, and efficacious in diseases of the skin. There are several other baths in the side valleys, such as Santa Caterina (chalybeate), Masino and Le Prese (sulphur).

The highest points in the ranges enclosing the valley are the Piz Zupo (13,131 ft.) in the Bernina group and the Königsspitze (12,655 ft.) in the Ortler district; the Monte della Disgrazia (12,067 ft.) is the highest peak comprised entirely within the water-basin of the valley. Four well-marked Alpine passes are traversed by good carriage-roads—the Stelvio Pass or Stilfserjoch (9055 ft., the highest carriage-road in Europe) from Bormio to Meran in the Adige valley, the Bernina Pass (*q.v.*) road from Tirano to Samaden in the Upper Engadine, and the Aprica Pass (3875 ft.) from Tirano to the Val Camonica and the Lake of Iseo, while from near the top of the Stelvio a fourth road leads over the Umbrail Pass (8242 ft., the highest in Switzerland) to the Swiss valley of Münster, which is reached at the village of Santa Maria. The main valley is traversed from end to end by a magnificent carriage-road constructed by the Austrian Government in 1820–1825. A railway runs from Colico, on the Lake of Como, past Sondrio to Tirano, a distance of 42 m., while there is another from Colico to Chiavenna ($16\frac{3}{4}$ m.).

The population is wholly Italian-speaking and Roman Catholic, the valley being in the diocese of Como. The shrine of the Madonna of Tirano (founded 1520) annually attracts a large number of pilgrims. The valley, particularly in its lower portion, is extremely fertile; and of late years vigorous measures have been taken to prevent the damage caused by the frequent inundations of the Adda. Chestnuts, vines, mulberry trees and fig trees abound; and there are many picturesquely situated churches, castles and villages. The chief articles exported are wine and honey. The wine is largely consumed in north Italy and Switzerland, the best varieties being Grumello, Sassella and Montagna. Large quantities of honey are annually sent abroad.

History.—The political history of Valtellina is made up of the histories of three districts—(1) the "free community" of Poschiavo (first mentioned as such in 1200–1201); (2) the county of Bormio (first mentioned as a county in 1347); and (3) Valtellina proper, extending from the defile of the Serra di Morignone on the east to the Lake of Como on the west. After the defeat of the Lombards (774) these three districts were given (775) by Charlemagne to the abbey of St Denis near Paris, which never seems to have exercised its rights. In 824 Lothair I., confirming an earlier donation (803) made by Charlemagne, gave the churches of Poschiavo and Bormio to the bishop of Como. Bormio was in 1205 won by the men of Como, who in 1006 had received one-half of Valtellina from the emperor, and by 1114 they were masters of the entire valley. They retained Bormio till 1300, when it freed itself; but in 1336 it belonged to the bishop of Chur. In 1335 the Visconti, lords (later dukes) of Milan, became lords of Como, and therefore of Valtellina. In 1350 they seized on Bormio and Poschiavo, the latter being won back by the bishop of Chur in 1394, and again lost to the Visconti in 1470. As early as 1360 the men of Rhaetia made incursions into Valtellina under the pretext that it had formed part of ancient Rhaetia. This idea was confirmed in 1404, when, in return for kind treatment received during his exile, Mastino Visconti (son of Barnabò) gave to the bishop of Chur his share of the Milanese, including Poschiavo, Bormio and Valtellina. Relying on this donation, the men of the Three Leagues of Rhaetia (best known by the name of one, Graubünden) invaded the valley in 1486–1487, Poschiavo becoming in 1486 permanently a member (not a subject land) of the *Gotteshausbund*. This donation served too as the excuse for seizing, in 1512, on Chiavenna, Bormio and Valtellina, which were harshly ruled as "subject bailiwicks." Under the governor at Sondrio there were four "podestas" for the three divisions of Valtellina (Morbegno and Traona, Sondrio and Tirano), besides one at Teglio and one at Bormio. Mastino Visconti's donation was solemnly confirmed in 1516 by the emperor Maximilian I. In 1530 the bishop of Chur was forced to sell to the Three Leagues for a small sum his title to these two districts. At the time of the Reformation Poschiavo became Protestant. The other two districts clung to the old faith and came under the influence of Carlo Borromeo, who, when founding in 1579 his "Collegium Helveticum" at Milan for Swiss students for the priesthood, reserved for Valtellina six out of the forty-two places. Valtellina was extremely important to the Habsburgs as affording the direct route between their possessions of the Milanese and Tirol. Hence a great struggle, into which religious questions and bribery largely entered, took place between Austria and Spain on one side and France and Venice on the other. In 1603 Fuentes, the Spanish governor of the Milanese, built a fortress (of which traces still remain) close to the Lake of Como, and at the entrance to the valley, in order to overawe it. The religious conflicts in Graubünden led to reprisals in the "subject land" of Valtellina. In 1620 (19th July–4th August) the Spanish and Romanist faction (headed by the Planta family) massacred a great number of Protestants in the valley, 350 to 600 according to different accounts (*Veltliner Mord*). For the next twenty years the valley was the scene of great strife, being held by the Spaniards (1621–23, 1629–31, 1637–39), by the French (1624–27, 1635–37), and by the pope (1623, 1627). At length George Jenatsch, a former pastor, who had been the active and unscrupulous leader of the Protestant party, became a Romanist (1635) in order to free the land from the French by aid of the Spaniards (1637), who finally (1639) gave it back to its old masters on condition that the Protestants were excluded from the valley. In this way the local struggles of Valtellina came to be mixed up with the Thirty Years' War. In 1797 Bormio and Valtellina were annexed to the Cisalpine republic, in 1805 to the kingdom of Italy (of which Napoleon was king), and in 1815 (despite the remonstrances of the Raetian leagues) to the kingdom of Lombardo-Venetia, held by the emperor of Austria. In 1859 they became, like the rest of Lombardy, part of the kingdom of united Italy. Poschiavo followed the fortunes of the "Gotteshausbund." It became (after 1798) part of the canton Raetia of the Helvetic republic, and in 1803 of the canton of the Graubünden or Grisons, which was then first received a full member of the Swiss Confederation.

See G. Leonhardi, *Das Veltlin* (1859) and *Das Poschiavinothal* (1860); Romegialli, *Storia della Valtellina* (1834–39, 5 vols.); C. von Moor, *Geschichte von Currätien* (1870–74); P. C. von Planta, *Die currätischen Herrschaften in der Feudalzeit* (1881); W. Coxe, *Travels in Switzerland*, &c. (4th ed., 1801; Letters 74–78); G. B. Crollalanza, *Storia del Contado di Chiavenna* (Milan, 1870); D. W. Freshfield, *Italian Alps* (London, 1875); Edmondo Brusoni, *Guida della Valtellina* (Sondrio, 1906); A. Giussani, *Il Forte di Fuentes*

(Como, 1905); P. A. Lavizari, *Storia della Valtellina* (2 vols., Capolago (Tessin), 1838): A. Lorria and E. A. Martel, *Le Massif de la Bernina* (Zürich, 1894); E. Rott, *Henri IV., les Suisses, et la Haute Italie—la Lutte pour les Alpes, 1598–1610* (Paris, 1882); E. Rott, *Histoire de la représentation diplomatique de la France auprès des cantons Suisses* (Bern; vols. iii. (1906) and iv. relate to the French in the Valtellina from 1620 sqq.); E. Haffter, *Georg Jenatsch* (Davos, 1894); F. Pieth, *Die Feldzüge des Herzogs Rohan im Veltlin und in Graubünden* (Bern, 1905); F. Fossati, *Codice Diplomatico della Rezia* (originally published in the *Periodico* of the *Società Storica a Comense* at Como; separate reprint, Como, 1901); L. von Ranke, *History of the Popes*, bk. vii.; and H. Reinhardt, "Das Veltliner Mord," in *Geschichtsfreund* (vol. xl., 1885).

VALUATION AND VALUERS. A valuation of property may be required in view of a proposed sale or purchase, or in order to ascertain the amount for which it will constitute a sufficient security if mortgaged, or which should be paid by way of compensation where it is compulsorily taken or wrongfully damaged. It may also be necessary with a view to the assessment of property for rating, or for fiscal or other purposes. Where it is desired to ascertain the amount which may properly be invested in the purchase of land or buildings, the valuer will consider their character and situation, and the greater or less degree of risk incidental to their nature, in order to determine the rate of interest which they ought to yield. The valuation will proceed upon the basis that the property should return to the purchaser the capital which he invests together with interest at the rate so settled, or afford him security for such interest while he keeps the property and the return of the capital when he desires to realize it. Accordingly, the net rent which it may be expected to yield must be ascertained by deducting the known and estimated outgoings and any other allowances which have to be taken into consideration from the gross amount which a knowledge of the local circumstances indicates as the probable return. Where the property is leasehold held for a term of fixed duration, the number of years' purchase will depend upon the length of the unexpired portion of the term, and can be ascertained without special calculation by reference to a table in common use. If the duration of the term or other interest in the property is uncertain, as, for example, in the case of a lease for lives, the number of years' purchase which may fairly be taken will be found in some other of the tables (*e.g.* Inwood's or Willich's), which have been prepared to meet the different classes of cases with which valuers have to deal. If the property is freehold the number of years' purchase can be found by dividing one hundred by the rate of the interest required.

A valuation or appraisement, under English law, need not be stamped where it is made (1) for, and for the information of, one party only, and is not obligatory as between parties; (2) in pursuance of the order of a court of admiralty or on appeal therefrom; (3) of property of a deceased person for the information of an executor, or other person required to deliver an affidavit of the estate of such deceased person; or (4) of any property for the purpose of ascertaining the legacy or succession or account duty payable in respect thereof. Any other valuation or appraisement, whether of property or any interest therein or of the annual value thereof, or of any dilapidations or of any repairs wanted or of the materials and labour used, or to be used, in any building or of any artificer's work, must be stamped. An appraiser who makes an appraisement or valuation chargeable with stamp duty must, within fourteen days after making it, write it out in words and figures showing the full amount thereof upon duly stamped material. If he omits to do so, or in any other manner discloses the amount, he becomes liable to a fine of £50. Any person who receives from an appraiser, or pays for the making of, any such appraisement or valuation not so written out and stamped, becomes liable to a fine of £20.

Where a contract has been made for the sale of property at a valuation, a valuation made in accordance with its terms will be conclusive as between the parties, in the absence of fraud, collusion or mistake. Where there has been an agreement to sell goods on the terms that the price is to be fixed by the valuation of a third party and such third party cannot or does not make such valuation, the agreement is avoided; but if the goods or any part thereof have been delivered to and appropriated by the buyer he must pay a reasonable price therefor. Where the third party is prevented from making the valuation by the fault of the seller or buyer, the party not in fault may maintain an action for damages against the party in fault. Where the fixing of a value by valuers is not of the essence of an agreement, but is wholly subsidiary to it, the courts will, if justice require it, ascertain the value in order to carry the agreement into effect. Where an agreement had been entered into for the sale of a house at a fixed price and of the fixtures and furniture therein at a valuation by a person named by both parties, and he undertook the valuation but was refused permission by the vendor to enter the premises for that purpose, the vendor was ordered to allow the entry so that the valuation might proceed.

A person who exercises the calling of an appraiser or who, for or in expectation of any fee or reward makes any valuation or appraisement chargeable with stamp duty, must (unless he is licensed as an auctioneer or house agent) have an appraiser's licence, upon which a duty of £2 is charged and which continues in force from the day of its date until the following 5th of July. By default in this respect a liability to a penalty of £50 is incurred. Moreover, an unlicensed appraiser cannot recover remuneration. A valuer is liable to the person who has employed him for the consequences of negligence or want of due care and skill on his part. If his services are thereby rendered worthless he will not be able to recover anything by way of remuneration. A valuation of a house taken by a railway company made by a surveyor who did not enter the house was held not to be a proper valuation. Although a valuer cannot be expected to possess a minute and accurate knowledge of the law, he ought to be acquainted with the general principles applicable to the valuations which he undertakes so far as is necessary in order to enable him to make them properly. The valuer, however, will be liable for the consequences of his negligence only towards the person who employed him, and not to any one else who may happen in fact to have been prejudiced thereby. (H. Ha.)

VALUE (O. Fr. *value*, from *valoir*, to be worth, Lat. *valere*), in general usage a term signifying worth. It has, however, a special meaning in economics, which is the subject of this article.

In some departments of economic theory it is still convenient to use as the basis of the exposition the opinions of J. S. Mill, because he embodied in his treatise on Political Economy in a remarkable manner nearly everything of importance from the theoretical standpoint in the work of his predecessors, and to a considerable extent subsequent advances in economic science have been made by way of criticism or development of his version. This observation is especially true of the theory of value. In this subject Mill had digested the mass of previous learning with such effect that he commences his treatment with the remark: "Happily there is nothing in the laws of value which remains for the present or any future writer to clear up; the theory of the subject is complete. The only difficulty to be overcome is that of so stating it as to solve by anticipation the chief perplexities which occur in applying it." Curiously enough this part of economic theory was the first to receive at the hands of Jevons and others serious modification, the nature and need for which can, however, only be properly understood after a preliminary examination of the old orthodox position.

As regards the question of definition, Mill starts with the distinction somewhat loosely drawn by Adam Smith between value in use and value in exchange. When we say that a thing possesses a certain value in use, we say in more words than are necessary that it is useful: that is to say, value in use is an awkward phrase for utility. The conception of utility (see Wealth) is the most fundamental in economics. It is held by Mill to mean the capacity to satisfy a desire or serve a purpose, and thus "useful," the corresponding adjective, is as fitly applied to ices as to steam-engines. It has always seemed rather paradoxical to apply the term utility (with its adjective useful) to things which the common sense of mankind (or of any representative section) considers to be deleterious or trivial. Accordingly V. Pareto has proposed the term *ophélimité* (Gr. ὠφέλιμος) for this wider interpretation of "utility." But utility in this sense is obviously much wider than value, and Mill proceeds to say that by value in political economy we should always understand exchange value. This language seems familiar and definite, but on analysis it is clear that exchange implies two terms at least. If we say that a thing can be exchanged, we imply that it can be exchanged for something else, and when we speak of the exchange value of a thing we must directly or indirectly refer to the value of some other thing or things. In practice in modern societies this other thing is standard money: an Englishman who talks of the exchange value of anything means the number of pounds sterling (or parts thereof) which it will fetch in the market or be appraised at by a fair arbitrator. On this view then the value of a thing is its price; but a very little experience in the theory or history of economics will show that it is often desirable, and sometimes necessary, to contrast value with price. "At the same time and place," says Adam Smith, "money is the exact measure of the real exchangeable value of all commodities. It is so, however, at the same time and place only." If, however, the exchange value of a thing is not its price, what is it? According to Mill, "The value of a thing is its general power of purchasing, the command which its possession gives over purchasable commodities in general." But what, we may well ask with Mill, is meant by command over commodities in general? Are we to understand the complete national inventory of wealth, or the total of things consumed in a given time by a nation? Obviously such conceptions are extremely vague and possibly unworkable. If, however, we make a selection on any representative principle, this selection will be more or less arbitrary.

The elaborate work of C. M. Walsh on the *Measurement of General Exchange Value* (1901) gives a critical analysis of the views of the chief writers on the subject and indicates the advances made since Mill. Mill is to some extent aware of the difficulties, although he never subjected them to a rigorous analysis; and he points to the obvious fact that a coat, for example, may exchange for less bread this year than last, but for more glass or iron, and so on through the whole range of commodities it may obtain more of some and less of others. But in this case are we to say that the value of the coat has risen or fallen? On what principles are we to strike an average? The attempt to answer these questions in a satisfactory manner is at present engaging the attention of economists more than any other problem in the pure theory. Mill, however, instead of attempting to solve the problem, frankly assumed that it is impossible to say except in one simple case. If, owing to some improvement in manufacture, the coat exchanges for less of all other things, we should certainly say that its value had fallen. This line of argument leads to the position: "The idea of general exchange value originates in the fact that there really are causes which tend to alter the value of a thing in exchange for things generally, that is, for all things that are not themselves acted upon by causes of similar tendency." There can be no doubt as to the truth of the latter part of this statement, especially if we substitute for one commodity groups of commodities. But it is doubtful if the idea of general exchange value arises from a consideration of the causes of value; and later writers have constantly emphasized the distinction between any change and the causes of the change. Following out the idea in the last sentence quoted, Mill goes on to say that any change in the value of one thing compared with things in general may be due either to causes affecting the one thing or the large group of all other things, and that in order to investigate the former it is convenient to assume that all commodities but the one in question remain invariable in their relative values. On this assumption any one of them may be taken as representing all the rest, and thus the money value of the thing will represent its general purchasing power. That is to say, if for the sake of simplicity we assume that the prices of all other things remain constant, but that one thing falls or rises in price, the fall or rise in price in this thing will indicate the extent of the change in its value compared with things in general. There can be no doubt that, in discussing any practical problem as to the changes in the relative value of any particular thing, it is desirable to take the changes in price as the basis, and much confusion and cumbrousness of expression would have been avoided in the theory of the subject if, to adapt a phrase of Cournot's, money had by Mill and others been used to oil the wheels of thought, just as in practice it is used to oil the wheels of trade.

Requisites for value.

By this method of abstraction the treatment of the theory of value becomes essentially an examination of the causes which determine the values of particular commodities relatively to a standard which is assumed to be fixed. Cournot compares this hypothetical point of the standard of value to the "mean sun" of astronomers. In order that anything may possess value in this sense, that it may exchange for any portion of standard money or its representatives, it is evident on the first analysis that two conditions must be satisfied. First, the thing must have some utility; and secondly, there must be some difficulty in its attainment. As regards utility, Mill apparently regards it simply as a kind of entrance examination which every commodity must pass to enter the list of valuables, whilst the place in the list is determined by variations in the degree of the difficulty of attainment. Later writers, however, have given much more prominence to utility, and have drawn a careful distinction between final or marginal and total utility. Following Jevons, most economists have adopted this distinction, and the writers of the Austrian school in particular have made it of vital importance, and by attempting to introduce it when the conception is inappropriate have often caused much unnecessary complexity. The distinction is certainly useful in throwing light on the advantages of, and motives for, exchanging commodities. Suppose that on a desert island A possesses all the food, so many measures—(say) pecks—of corn, and B all the drinking water, so many measures—(say) pints. Then A, taking into account present and future needs, might ascribe to the possession of each portion of his stock so much utility. The utility of the first few pecks of corn might be regarded as practically infinite; but, if his stock were abundant, and a speedy rescue probable, the utility ascribed to successive portions would be less and less. In the same way B might make an estimate of the utility of successive measures of the drinking water. Now, if we regard only *total* utilities from the point of view of each, both are infinite. If an exchange were made of the total stocks of both men, the position of neither would be improved. But, if A sets aside (say) half his stock, then it may well happen that he could advantageously exchange the rest against part of B's drinking water. In precisely the same way B might set aside so much of his stock for his own consumption, and then the utility of the remaining portion would be much less than the utility he would gain if he obtained in exchange A's surplus. Thus, if the two men exchange their remainders, both will gain in utility; in the case supposed they will make an enormous gain. For simplicity we have supposed each stock to be divided into two portions, but nothing has been said of the principles of the division. It is, however, clear that A can advantageously go on exchanging a measure of corn for a measure of water so long as by doing so he makes a gain of utility. Conversely B can advantageously offer water so long as he gains greater utility from the corn received in exchange. The utility of the last portion of corn retained by A (or of water by B) is the *final* or marginal utility of the stock retained, and similarly the utility of the last measure obtained in exchange may be called the final utility of the stock purchased. A will have done his best if these utilities are just equal. For at this point, if he were to offer (at the same rate of exchange) more corn, it is clear that he would lose more utility than he would gain. *Mutatis mutandis*, the same reasoning applies to B; and thus the rate of exchange will be so adjusted as to bring about this equality of marginal utilities on both sides. It follows that, if A gains on the last portion received just as much utility as he loses on the portion parted with, on all the other portions received he will have gained more than he lost. The total of these gains over successive portions has been called by Professor Marshall *consumer's rent* or surplus.

Final or marginal and total utility.

Difficulty of attainment.

However useful this theory of marginal utility may be in throwing light on the fundamental nature of value, and on the advantages of exchange, it is obviously too abstract to be applied to the explanation of the relative values of the endless series of commodities and services which constitute a nation's stock of valuables at any time. For this purpose we must resort to the law of supply and demand, which requires a very careful statement owing to the ambiguities of popular language. Mill has succeeded in getting rid of most of these ambiguities, but he has hardly given due emphasis to the fundamental character of the law. He argues, after the brief consideration allotted to the element of utility, that the other preliminary condition necessary for value—

Three laws of value.

difficulty of attainment—is not always the same kind of difficulty, and he arrives at three distinct laws of value, according to three forms or degrees of this difficulty. (1) In the first place, the difficulty may consist in an absolute limitation of the supply, and in this case the corresponding law is said to be the law of supply and demand. Even on Mill's view the class of commodities which comes under this heading is both large and important, for it includes not only the favourite examples of old pictures, china, &c., but also land, and especially building sites in large cities. Again, it is pointed out that, although comparatively few commodities may be absolutely limited, almost all commodities may be so locally and temporarily, which is really only another way of saying that the law of supply and demand governs all market values; for it is obvious that the supply actually forthcoming or obtainable in a specified time in any market is limited—a point which may be well illustrated by the extreme case of a "corner." Again, under certain circumstances the supply may be artificially limited, as in the case of monopolies, the classical example being the destruction by the Dutch of some of their spice, in order that the limited quantity might sell for a total higher price. Besides all these important instances of the operation of the law of supply and demand, Mill is compelled also to bring under the same law the wages of labour, the values of the staples of international trade, and some other peculiar cases of value. In fact, step by step he is almost forced to the conclusion, now generally accepted, that the law of supply and demand is the fundamental law of value, of which the other laws are only particular cases. At the outset, however, he appears to consider the two others as of co-ordinate importance. (2) When the difficulty of attainment consists not in the absolute limitation but simply in the fact that the article requires labour and capital to produce it, the normal or natural value is said to be determined by the cost of production. (3) In the last case taken by Mill it is supposed that an article can be increased in quantity, but only at an increasing cost, and in this case the corresponding law of value is the cost of production of that portion which is obtained under the most unfavourable circumstances. These three laws of value may now be examined critically and their mutual relations discussed, for the last two, if not properly of co-ordinate importance with the first, are at any rate wide generalizations.

Supply and demand.

In order to understand the law of supply and demand, it is best to take separately the general law of demand and the general law of supply, and then effect a combination. Demand must be defined as the quantity of any article demanded at some particular price, it being assumed of course that the bidder of the price can meet his engagements, or, as is sometimes said, that the demand is an effectual demand. It is quite clear that by demand we cannot simply mean desire to possess, because in a sense every one desires everything, and the less the means of payment so much greater in general is the desire. Again, it is obviously necessary to insert the qualifying clause "at some particular price," because, as a rule, with a change in price a different quantity will be demanded. It is, indeed, this variation of quantity demanded, according to variation in price, which gives rise to the statement of the general law of demand, namely: As the price of any article falls, other things remaining the same, the quantity demanded increases, and, conversely, as the price rises the quantity demanded decreases. A very good example of this law is found in the effects of the remission of taxes. The repeal of a tax leads to a fall in price, and the fall in price is accompanied by increased consumption. Conversely, it has often been found that to increase the amount of a tax does not increase the revenue from it, because the demand for the article falls off. The general law of demand is best expressed as by Cournot by saying that the quantity demanded is a function of the price. If we suppose that corresponding to the smallest change in price there is a change in the quantity demanded the law of demand may be illustrated by curves. Marshall has introduced the idea of demand schedules, the quantities demanded being written in one column and the corresponding prices in another. The precise connexion between the price and the quantity demanded differs in different cases, and, strictly speaking, is probably never the same for any two commodities. Every commodity has its own curve or schedule. At the same time, however, commodities may be placed in large classes according to the general character of the variation. The variation of quantity demanded according to price will ultimately rest on the principle of *marginal utility* explained above. A person with a limited amount of money to spend will hit the economic mark in the centre if the final utilities of his several purchases are equal. This is a rather technical way of saying that a prudent man will not spend a penny more on any particular thing if the penny spent upon some new object would give him a little greater satisfaction. Reverting to the variations of demand according to price, a contrast will at once be observed between necessaries and luxuries. However much the price rises, so long as people have the means they must consume a certain amount of necessaries, but, however much the price falls, the limit of consumption of bread, for example, must soon be reached. On the other hand, a great fall in price of many luxuries may cause an enormous increase in the demand, whilst a great rise may almost destroy the demand. The rate of charge—the quantity demanded according to the changes in price—is referred to as *elasticity* of demand. If for a small change in price there is a considerable increase in the quantity demanded, the demand is said to be very *elastic*. Other characteristics of demand are indicated by the terms direct, derived, compounded, &c , the demand for any one thing being obviously affected by the possible use of substitutes on the one side and on the other by the emergence of other uses. Recent writers, notably Marshall, have given much attention to the development of the law of demand in its various aspects, which has been too much neglected in the Ricardian analysis followed by Mill. A great deal of light might be thrown on many interesting problems in the progress of a nation and of its various component classes, if the laws of demand, or the statistics of consumption according to price, were obtainable.

Law of demand.

Law of supply.

Turning to the element of supply, this term in a similar way may be defined as the quantity offered for sale at some particular price, and the general law of supply may be stated thus: As the price rises, other things remaining the same, the quantity offered tends to increase, and, conversely, as the price falls the quantity offered tends to diminish. Expressed in this manner, supply appears to be exactly analogous to demand, and the analogy seems to hold good even when we push the analysis up to the utility to the seller as compared with the utility to the buyer. For, as the price rises, the seller will obtain greater utility, and will thus retain less for his own use or will be induced to produce more. On closer inspection, however, the law of supply is found to be not so simple as the law of demand. It would only be so if the seller had simply to compare the relative advantages of exchanging his commodity and of retaining it for his own use, without any further reference to the conditions of, or the motives for, production. In most commodities, however, the determining influence is not the comparative utility of consumption by the owner on the one hand or of the consumption of something else obtained by exchange on the other, but it is rather a comparison of the trouble of producing with the advantage of selling the article when produced. Of course, if we are considering finished products in any market the case is more simple; but even here the question of the relative advantages of present sale and reservation for a future market or distant place must be determined, and then the element of cost of production will again be brought back. The law of supply may be developed on lines corresponding to the law of demand, and we may construct supply schedules on curves indicating the relations between the range of prices and the quantities offered at those prices.

Before considering the relation of cost of production to supply, it will be convenient to combine the laws of supply and demand, taking the former in its simplest aspect, and

Equation between demand and supply.

to state the general law of supply and demand as governing value. Excluding the simple case of the barter of two commodities of which the rate of exchange will be determined as explained above in reference to marginal utility, and meaning by demand the quantity demanded in a market at a certain price, and by supply the quantity there and then offered at a certain price, the general law may be stated thus: In any market the price of any article will be so adjusted that the quantity demanded will exactly equal the quantity offered at that price. The force by which the adjustment is made is, in general, competition. Thus, if the price were above the point indicated by the law, there would be a lessened demand, and the competition of sellers would tend to lower the price. Conversely, if the price were lower the competition caused by the increased demand would tend to raise it. The law as thus stated corresponds to what Mill calls the equation between demand and supply. He was induced to adopt this phrase in place of the more popular expression, the ratio of demand to supply, on the ground of its greater accuracy. And, if the term ratio is to be taken strictly, no doubt Mill's criticism is perfectly just. At the same time the equation must be stated very carefully to avoid falling into the truism suggested by Cairnes, namely, that in any market the quantity bought at any price is equal to the quantity sold at that price. The point is that in accordance with the general principles of supply and demand the quantities offered and demanded vary with the price. And, however inaccurate the literal use of the term ratio may be, it has the advantage of suggesting a change of price according to changes in demand and supply. The equilibrium between demand and supply was illustrated by Cournot by the intersection of the demand and supply curves, and for purposes of theory this mathematical method offers great advantages.

Monopoly values.

It may be useful at this point to consider the principles by which monopoly values are regulated. The simplest case is when one individual possesses the whole stock, and the cost of production is so small that it may be neglected. Take the case, for example, of some natural well having a unique character for the mineral waters it supplies. The monopolist will, in the first place, have to discover the law of demand for his article. If he fixes a very high price, he may only occasionally sell a pint to a king or a millionaire; whilst, if he fixes a very low price, he may sell to every peasant and yet get a very poor return. He will, in fact, have to work out a problem in mathematics, and must so adjust his price that the quantity sold multiplied by the price per unit will be a maximum. The same kind of difficulty is found in the case in which the expenses of production, although considerable, are practically fixed or only increase slightly in proportion to the quantity furnished. The minimum price will be given by the expenses of production, whilst the actual price will tend to be such as to yield the maximum profit. Take, for example, the case of a steamer which has a practical monopoly and is not controlled by government. The owner will not send out the steamer at all unless the passengers and cargo pay the expenses; but, if there is a great demand, he will raise the price so as to secure a maximum profit. In general, however, any increase in the quantity of the article produced (or the service rendered) will be accompanied by an increase in the necessary outlays, and this increase may be greater or less per unit. In these cases the calculation of the maximum profit is a matter of great difficulty. Take, for example, the case of a railway which has a monopoly in a certain tract of country. The manager may aim at keeping down expenses and charging high rates, being contented with a moderate traffic; or he may lower his charges and incur additional expense to increase the gross income. It is worthy of remark that in many cases the monopolist has a choice of two methods which give practically equally good results, one starting with low and the other with high prices. But it is clear that the mass of the general public or the great body of consumers have an interest in low prices being adopted, whilst, on the other hand, the tendency is usually for the monopolist to charge higher prices than are really profitable in a maximum degree. The simplicity of the method of high prices is always attractive and often deceptive. Accordingly, even on these very general grounds, the interference of government with monopolies may sometimes be defended as being in the interests of the public and not against the interests of the monopolists. The case of the parliamentary third-class tickets furnishes an instructive example. At first the railways made their parliamentary trains as slow and inconvenient as possible, whereas now there is hardly a train which does not carry passengers at parliamentary rates without compulsion. As a rule, however, in modern commercial countries legal monopolies are an exception. Any one, for example, can prosecute any trade or manufacture if he can provide the requisite skill, labour and capital; and even as regards land—at any rate in the greater part of England and Scotland—there is from the point of view of cultivation no real monopoly. But although legal monopolies (apart from patents and the like) are not general, and in most countries the law is adverse to the creation of monopolies,[1] as a matter of fact in modern times there has been an increasing tendency to the amalgamation of businesses of all kinds into large combinations (trusts, kartells, &c.), which have the power of monopolies. In the same way in the relation of labour and capital the method of collective bargaining partakes of the character of monopoly. There may be *buyers'* as well as sellers' monopoly, and capitalistic combinations operate by this method in dealing with the production of raw material or other requisites and also with labour.

Competition values.

The theory of monopolies being a case of the determination of *maxima* is essentially mathematical, and many of the problems, especially as regards the incidence of taxes and the benefits of the public acquisition of "natural" monopolies, can only be fully explained mathematically as by Marshall. In recent years great attention has been given to the realistic study of monopolies (J. W. Jenks, H. W. Macrosty, &c.; see TRUSTS). When competition arises, and is effective, exceptional profit ceases, and thus a new principle for determining values comes into play. If the producer of any article is obtaining more than the usual rate of profit, he at once provokes competition, and thus even the dread of this possible competition may keep down prices. This is often expressed by saying that the potential supply affects prices almost as much as the actual supply. It thus becomes obvious that, as regards freely produced commodities the production of which may be extended indefinitely at the same or at a decreasing cost, the value tends to conform to the minimum cost of production, and that any other value is consequently unstable. It will be observed, however, that cost of production only determines values by operating through the actual or potential supply, and thus that the law of demand and supply is fundamental. Once a thing is made, the actual cost of production has no influence on its value, except as indicating the conditions of future possible supply.

Cost of production.

At this point it becomes necessary to analyse and explain the nature of cost of production. In the last resort it will be found that nothing can be produced without labour, and in a modern society capital must be added. Thus the component elements of production are labour and capital acting by natural forces upon raw material. But, since both the forces and the produce of nature require labour and capital for their exploitation, the elements that must be considered primary and fundamental in the case of commodities that can be indefinitely increased are labour and capital. Capital, again, is itself a product of labour, and it is also wealth set aside by the owner for future use instead of for present consumption. Accordingly, in order that a thing may be continuously produced, labour must obtain a sufficient reward for toil, and capital a sufficient reward for "abstinence" or "waiting," or for preservation and accumulation of wealth. Thus the ultimate elements in the real cost of production are the toil and trouble and irksomeness of labour and of saving. But this toil and trouble will not be submitted to unless in any particular case the fair reward of industrial competition is forthcoming. However much pleasure a good workman may take in his work or a prudent man in his savings, in the industrial world as at present constituted both labour and capital will be attracted towards the point of highest reward (compare WAGES); and, accordingly, it is a necessary condition of the production of any article that the price obtained will yield the average rate of wages and profit obtainable for that species of work. Now these rates of wages and profit can be expressed in terms of money, and may be designated, following Marshall, the *expenses of production* as distinguished from the *real cost.* The real cost of production would on analysis consist of a confused unworkable mass of "efforts and abstinences," or "disutilities," and the relation of these mental strains to their material rewards is the problem of wages and profits. But for the purpose of relative values it is not necessary to push the analysis so far; and thus, if we regard the capitalist as the producer, we may look on the elements of production as consisting of wages and profits. And this is quite in accordance with customary thought and language: every one who asks for the details of the cost of a thing expects to have a statement of the wages and profits directly involved, and of the material, which again directly involves wages and profits. So far, then, as freely produced commodities are concerned, the general law is that they tend to sell at such a price as will yield on the average the ordinary rate of wages and profits which by industrial competition the occupation can command. It is at this point that the difficulty emerges as to the precise nature of the connexion between the prices of commodities and the money wages and profits of producers. Are we to consider that the former are determined by the latter, or the latter by the former? If, for example, commodity A sells for twice as much as commodity B, are we to say that this is because wages are higher in the former case, or are the wages higher because the price is higher? The answer to this question is given in the theory of WAGES (*q.v.*). It is sufficient to state here that, in discussing relative values, we may assume that industrial competition has established certain relative rates of wages and profits in various employments, and that any prices of articles which yielded more than these rates, whilst in other cases no corresponding rise took place, would be unstable. Thus, in discussing the normal values of freely produced commodities, we have to consider the quantity of labour and the rates of wages and the quantity of capital and the rate of profits, the *normal* rates of these wages and profits being given.

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[1] The general theory of monopolies was admirably treated by the French mathematician and economist Cournot, *Recherches sur les principes mathématiques de la théorie des richesses* (1838), and as far as possible without mathematics in the *Revue sommaire des doctrines économiques* (1877).

Expenses of production.

Wages and values.

The use of the term "normal" requires some explanation. The word *norma* properly refers to the square used by masons and carpenters, &c., and thus a thing may be said to be in its normal position when no change will be made: that is to say, the normal position is the stable position, or it is the position to which the workman will try to adjust his work. And, similarly, by the use of normal as applied to wages and profits, we mean the stable rate or the rate towards which they are attracted. It is thus quite possible that the normal rate may differ from the average rate or the rate obtained over a term of years. For it may easily happen that as regards wages, for example, a high rate for a short period may lead to such an increase in that kind of production that for a much longer period the rate will fall below the normal. The normal rate seems to refer to the actual conditions of industry, the rate which can be obtained for a given amount of exertion, taking the average of employments at the time, rather than to the particular rate obtained for some class of work over a period of years.

Normal value.

With these explanations the proposition holds good that the normal values of freely produced commodities tend to be equal to their cost, or rather expenses, of production, and any price which yields a greater or less return to labour and capital is unstable.

Marshall (*Principles of Economics*, bk. v. 5th ed., 1907) has treated very fully the subject of normal values and the relations of normal and market values from the side of theory; but the nature and importance of the distinction is perhaps best realized if we compare the normal relative values of important commodities over a period of centuries, as was done by Adam Smith and in the monumental work by Thorold Rogers on the *History of Agriculture and Prices.* At this stage in the analysis the difficulty must be met that even in a position of stable equilibrium, *i.e.* when the normal demand is just satisfied by the normal supply, the different portions of the aggregate supply may be produced at different costs according to differences in the natural environment or in the availability of different *factors of production.* In dealing with this difficulty the modern conception of *marginal cost* is of importance. If a commodity is produced at a uniform cost per unit whatever the amount, then the normal value depends simply on this uniform or normal cost; any temporary divergence in market prices will lead to a contraction or increase in the supply until the exceptional gains or losses are got rid of. It may happen, however, that portions of the supply can be obtained at different costs, and in this case the normal value is determined by the cost at the margin. It is this *marginal cost* which just gives the rates of remuneration to labour and capital which suffice to keep up the continuous supply of the requisite factors of production. If a commodity is produced according to the law of *diminishing return*, or, what is the same thing, if the supply can only be increased after a certain point at an increasing cost per unit, then the marginal portion just pays its expenses and the previous portions yield a differential remuneration which constitutes economic rent. If the conditions of difference in cost are natural and permanent we have the case of pure economic rent (see below), but if the factors of production in response to the stimulus of extra remuneration can be increased or improved the extra rates of remuneration tend to disappear with the increase in supply of the more advantageous factors, and instead of pure economic rent we have various species of *quasi*-rents. "Even the rent of land is seen not as a thing by itself but as the leading species of a large genus; though indeed it has peculiarities of its own which are of vital importance from the point of view of theory as well as of practice" (Marshall). Marshall has given special attention to the development of this application of the principle of continuity, of which Cournot was the first writer to realize the significance.

If a commodity is produced according to the law of *increasing return* (or diminishing cost per unit as the quantity is increased) the solution of the problem of normal value presents peculiar difficulties which cannot be treated in a preliminary survey. Two results, however, of practical importance may be noted. In the first, under increasing return the first established business can be expanded more easily than it is possible to start a new concern, and if new competing concerns are started there are obvious advantages in amalgamation, so that we arrive at the modern generalization that the natural tendency of increasing return production is to monopoly. This again gives the chief economic justification for "trusts"; it being said that through the adoption of various external and internal economies they more than neutralize the higher prices of monopoly.

The other result of importance is that under competition the less advantageous methods of production tend to be extruded and the law of increasing return gives way to that of constant return. For further consideration of these difficulties the reader may refer to the analysis by Marshall (*Principles of Economics*, bk. v. ch. xi.). The economic analysis of cost of production (or if we take the money measures of the various elements involved, expenses of production) involves a reference to the other great departments of economics, namely production and distribution; and it is necessary to take account of the interconnexion and mutual dependence of these departments and that of exchange, in which the idea of value is predominant. In the last resort production will not be carried on unless labour and capital receive a sufficient reward and the sufficient reward is the normal value of the factors of production. But when we are comparing the relative values of commodities and are seeking to explain, for example, how it is that for long periods of time these relative values are stable, or conform to some regular law, we have to break up the elements of value into the constituents of the expenses of the various factors of production. This leads up to the analysis of cost (or expenses) of production as dependent on the amounts and qualities of the labour and capital required.

Elements of expenses of production.

If all commodities were produced directly by the expenditure of labour, and in such a way that capital need not be considered, as in the simple natural state of society taken by Ricardo, then the only element to consider in value would be the quantity of labour. And in a society of a more developed character, in which wages are paid, if we consider that the rate of wages is uniform, and that profits may be disregarded in comparison with wages, the quantity of labour is the most important consideration, and a fall in the relative value of any article can only take place through some economy of labour. But, as we approach more nearly to the actual constitution of modern industrial societies, we find serious differences in the rates of wages in different employments, the use of fixed capital becomes of greater importance, and in some cases the lapse of time necessary for the completion of the commodity is considerable. Thus interest and profits, as well as the differential rates of wages, have to be taken into account just as much as the quantity of labour, and it is generally convenient to consider also the established differences in various returns to capital under different conditions (risk, irregularity, &c.). Indirectly, of course, since all capital in the ordinary sense is the result of labour, the quantity of labour is always of primary importance; but, in considering the proximate causes of relative values, it is best to consider capital and labour as independent factors. It follows, then, that, in order to compare the relative values of two commodities, A and B, freely produced in a modern industrial society, we must take into account, first of all, the relative wages and relative profits, and the relative amounts of labour and capital employed. If the producers of A are skilled workmen, and if the return to the capital is uncertain, whilst in the case of B the labour is unskilled and profit steady, then the value of A will be higher than that of B, supposing each produced by the same amount of capital and the same quantity of labour. Obviously, too, any change in the relative wages and profits will affect the relative values. If the commodities considered are not capable of division into similar parts (such as yards of cloth or silk), but must be considered in their entirety (*e.g.* ships and houses), then we must take into account also the different quantities of labour and capital required for their completion, as well as the relative rates of wages and profits. As regards changes of value in this case, it will be observed that, if the proportions are different in which labour and capital are employed in the production of two commodities, then any change in the *general* rates of wages and profits will affect relative values. By making various suppositions as to changes in the different elements of the expenses of production, a great many cases may be obtained, as is done, for example, by Mill (*Pol. Econ.* bk. iii. ch. iv.).

General formula for expenses of production.

All the cases enumerated and others may, however, be deduced from a general formula. Let E_1 represent the total expenses of production of commodity A. Let Q_1 be the quantity of fixed capital employed, and let r_1 be the rate of wear and tear per annum, so that the loss is Q_1/r_1. Let P_1 be the rate of profits per cent. per annum which must be obtained on the whole capital. Let Q_2 be the number of labourers, and w_2 the rate of wages per annum. Let represent the time taken for production reckoned in years (t_1 may be less than unity, thus t_1/Q_2 would be weeks). Then the total expenses of production are

$$E_1=\left\{Q_1\left(\frac{P_1}{100}+\frac{1}{r}\right)+Q_2\cdot w_2\left(1+\frac{P_1}{100}\right)\right\}t_1.$$

This simply means that the commodity must return in the normal case profits on the fixed capital with repair of waste, and also the wages expended (the amount depending on the number of labourers and the rate of wages), with profit on the circulating capital over all the time necessary to complete production. In some cases, it may be observed, it would be necessary to take t differently for the fixed capital and the labour or circulating capital. Then, in a similar way E_2, the expenses of production of B, may be expressed:

$$E_2=\left\{Q_3\left(\frac{P_3}{100}+\frac{1}{r_3}\right)+Q_4\cdot w_4\left(1+\frac{P_3}{100}\right)\right\}t_2.$$

Changes in relative values.

Thus the relative values of A and B will be found by comparing the aggregate of these several elements expressed on the right-hand sides of the equations. It will now be evident on what a number of variable elements relative values must depend, even when we consider that the commodities can be indefinitely increased by the proper expenditure of capital and employment of labour. With the progress of invention and the development of industrial competition, constant changes are taking place in the various elements, and in the somewhat complicated formula given certain practical elements have been eliminated. Even if we suppose, for the sake of simplicity, that P_1 and P_3 are equal, as also w_2 and w_4 and t_1 and t_2—that is, if we suppose a uniform rate of wages and profits, and the same amount of time required—still any change in these *general* rates will affect relative values, owing to the different proportions in which fixed and circulating capital may be employed in the two cases. Thus, for example, we arrive at Mill's statement: "All commodities in the production of which machinery bears a large part, especially if the machinery is very durable, are lowered in their relative value when profits fall." And it will be found on trial that by making various suppositions as to the identity of certain of the elements, or as to their disappearance, many other causes of changes in relative values may be deduced. Two important practical conclusions of a general character may be drawn from this analysis. (1) Relative values are liable to constant disturbances, and accordingly, since relative prices tend to be adjusted to relative values, relative prices must be constantly changing. (2) It is extremely difficult to measure changes in the value of the monetary standard, or movements in the general level of prices, or variations in the purchasing power of money incomes.

Value and rent.

These difficulties are further increased by the importance of the group of commodities which can only be increased (the arts of production remaining the same) at an increasing cost, and which are placed by Mill under a third law of value. The most important examples of this law are agricultural and mining produce. In order to make the principles on which this law depends clear and intelligible, it is necessary to proceed at first by the abstract method. Assume then that there is an isolated country and that its agricultural produce consists of corn. Then at any given stage of the growth of wealth and population the amount of corn may be increased (the art of agriculture remaining stationary) either by taking into cultivation inferior lands or else by cultivating with greater care and expense the lands already in cultivation. But in either case what is known as the law of diminishing return would come into play, and the additional supply could only be obtained at an additional cost. It may be assumed that at any stage of development the cultivation would be carried to such a point as to give just the ordinary return to capital on the last "dose" of capital expended. Further it cannot be carried, for no farmer will work at a continuous loss; and competition will ensure that it is carried so far, for, if this last application of capital yields ordinary profit, the former "doses" must yield more, that is to say, rent as well as profit. It thus becomes manifest that, under the conditions supposed, the extent to which "the margin of cultivation" will extend depends upon the price of the produce, and in the normal case the price must be equal to the expenses of production of that part which is produced under the most unfavourable circumstances. This then is the third law of value, from which the economic theory of rent is an immediate deduction. For, if the last dose obtains just a sufficient return, the former doses must yield more, and the sum of these extra profits is rent. It thus appears, also, that rent depends upon price and not price upon rent.

Qualifications of pure theory of rent.

The pure theory of rent is arrived at by making certain hypotheses and abstractions, and accordingly it must not be applied to particular practical cases without further consideration. The theory certainly indicates the effect of very important causes, but requires in practice a certain amount of qualification. (1) The essence of the theory is that the return to each dose of capital applied can be separated, and that the application of capital will cease when the last dose yields only ordinary profits; and no doubt it is roughly true to say that a farmer will discover on trial at what point he should cease applying capital, and that this will depend upon the price of the produce. At the same time, however, it is quite possible that a farmer who owns the land which he tills may find it advantageous to carry cultivation to a further pitch than if he only rented his land. For he will apply his own labour and capital at a less return on his own land. There can be little doubt that very many important improvements made by landowners have yielded less than the ordinary rate of profit, just as peasant proprietors obtain a poor return by way of wages for their own labour. A landowner cultivating his own land has the whole margin of economic rent to fall back upon, but a farmer has to pay his rent as a first charge. Thus it is possible, provided always that the land is cultivated in both cases with the same skill, that food would be cheaper if all the land were cultivated by the owner and not by tenants farming for a profit, and thus the fact that many American farmers pay no rent may account partially for the lower prices at which they sell their corn. (2) Again, the pure theory takes no account of the size of the portions into which the land is divided, nor of the kinds of crops which are grown. But, when most of the land of a country is rented, both of these factors have to be considered, and it may be more convenient to the landowner to let the land with certain restrictions, which again indirectly operate on the price. (3) It has been well observed by Passy[1] that the principal effect of various land laws is to increase or diminish the amount of the gross produce, which in Ricardian phraseology would mean to extend or contract the margin of cultivation. It thus appears that it is not always true to say that the payment of rent makes no real difference to the general public, and that it is simply a necessary method of equalizing farmers' profits. At the same time, however, with the necessary qualifications, there is no doubt that price determines rents, and not rent price, especially when prices are affected by foreign competition. In Great Britain a striking example has been afforded both of the abandonment of inferior lands (the contraction of the margin) and of a heavy fall in rent under the influence of falling prices.

Progress and rent.

The hypothetical history implied in Ricardo's theory as to the effects of the progress of society upon the value of agricultural produce also requires some criticism, such as that given by the historian of agriculture and prices, Thorold Rogers. The theory assumes that in the first place population increases, and thus there is a greater demand for food, and that therefore the margin of cultivation extends and the price rises, and rent rises also. But, as Rogers observes, history shows that agricultural improvements of all kinds have first of all increased the amount of food, and thus allowed of an increase in population. It is worth noticing that in our own times an increasing population in rural districts (*e.g.* the Highlands of Scotland and the west of Ireland) may indirectly tend to lower or destroy rents through minute subdivision. Ricardo's theory, however, accounts very well for the rise in the ground-rents of towns and cities, and it is there far more than in the rural districts that the unearned increment is to be found.

Value of mining produce.

The value of mining produce is determined generally in the same way as that of agricultural produce; but similar qualifications must be introduced. The theory is that both extensively and intensively the produce of mines is subject to the law of diminishing return, that the margin recedes as the price falls and extends as it rises, and that thus the price is determined by the most costly portion which it just pays to bring to market. The principal point to observe is that mines are gradually quite exhausted. In general the produce of mines is, like that of land, consumed in a comparatively short time, and thus the value is subject to fluctuations according to the conditions of the annual demand and supply.

Precious metals.

The peculiar durability of the precious metals, however, makes them in this respect differ widely from most mining produce. It is of course undeniable that (supposing coinage free) the value of standard coins will be equal to the value of the same amount of bullion, and, conversely, that the bullion will be equal in value to the same amount of coins. The older economists argued that the precious metals had their value determined by their cost of production under the most unfavourable circumstances, and then argued that in consequence the value of money (or coins) tended to be governed by the cost of production of bullion. If, however, it is remembered that the annual production does not probably amount to 2% of the quantity in the hands of man, that cost of production can only operate through actual or potential supply, and that in the case of money the increase must be real to affect prices, it will be readily seen that the value of bullion is determined by the general level of prices (or the value of money), and not that the value of money depends upon the value of the bullion. At the same time, however, it is true that, if prices become very high,—in other words, if the value of money, and thus of bullion, becomes very low,—then a check is placed upon production from the mines, and, conversely, with falling prices or a rise in the value of the precious metals mining for them is extended and encouraged. But the difference in the annual supply due to this influence will be small under present or similar conditions. On the whole, this case of the precious metals furnishes perhaps the best example of the way in which the cost of production can only act through the law of supply and demand.

Law governing value of joint products.

There is one other part of the general theory of value which requires some notice. Some articles can only be produced in conjunction with others (*e.g.* hides and beef, wool and mutton), and some modification of the theory is needed to suit this case. The law deduced is that—The sum of the values must be equal to the joint expenses of production, and the relative values *inter se* are determined by demand and supply. Thus the Australian sheep-farmers will extend their sheep-farms so long as for wool and mutton together they obtain a fair profit, but the amount contributed by each portion will be determined by the relative demand. It is interesting to observe that in the progress of society the value of the meat has risen as compared with that of the hides and the wool. The same principle determines the kind of produce which will be raised from land, though the application is rather more difficult owing to rotation of crops, &c.

Theory of international values.

Much discussion has taken place recently on the question whether a distinct theory of international values is required. In the limits assigned to this article it is only possible to indicate the principal points in dispute. The "orthodox" theory, as held by Ricardo, Mill and Cairnes, has been attacked by Cournot, Sidgwick and others, and has been re-stated with admirable clearness and much original power by C. F. Bastable.[2] The best way to answer the question seems to be to make clear the assumptions on which the values of commodities produced within any "nation" are determined, and then to consider whether any change must be made when we bring in other nations. We are at once met with the difficulty, What is a "nation"? The orthodox answer appears to be that within any nation (for which the term "economic area" might perhaps be advantageously substituted) there is effective industrial and commercial competition. This appears to imply no more than is contained in the principle noticed above, that relative values tend to be equal to the normal expenses of production (*commercial* competition), and that the expenses tend to be proportioned to the real cost (*industrial* competition). The question then arises,

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[1] *Systèmes de culture en France.*

[2] *Theory of International Trade.*

Comparative cost.

Do these conditions not exist in international trade? The answer appears to be, first, that commercial competition certainly holds good; for as soon as a trade is established the commodities will sell at the same prices in both countries (allowance being made for cost of carriage). It would plainly be absurd to say that the value of Manchester goods is determined by their expenses of production if they are consumed in England, but by something else if they are sent to India. If then there is any difference between domestic and international values, it must arise owing to the absence of effective industrial competition; that is to say, in the same country (or economic area) the real cost determines the expenses of production on account of the supposed perfect mobility of labour and capital, but between different economic areas these agents of production do not pass with sufficient readiness to secure a similar correspondence. It thus follows that a country may import articles which it could produce at less real cost, provided that it pays for these imports with exports which cost even less. A very striking example of this doctrine of *comparative cost*, as it is termed, was furnished by Victoria after the great gold discoveries. All kinds of produce were imported and paid for with gold, because there was less real cost involved in obtaining the gold to pay for imports than in making the articles. According to this theory every country will devote its labour and capital to its most productive uses; and, if by some new imports a domestic industry is checked or abolished, it is argued that the labour and capital will be devoted to increasing the exports so as to pay for the new imports. It must clearly be assumed as axiomatic that in the absence of loans, tributes, &c., imports can in the long run only be paid for by exports, and also that those articles will be exported which can be produced at the least comparative real cost. This theory then may be held to explain in a satisfactory manner the origin and development of international *trade*; but the question of *values* is still undetermined.

Reciprocal demand.

Consistently with exports paying for imports many different rates of exchange are possible, and the particular rate actually adopted is said to depend entirely on reciprocal demand. And in an extreme case, in which new countries trade solely in articles of which each has a monopoly, this answer would seem to be correct; but, when we consider that under present conditions trading countries have many articles in common, and that a slight margin of profit suffices to expand or diminish an export trade, this answer seems too vague and unreal.

Foreign exchanges.

In general it is clear that the rate will be determined independently of the foreign trade, or at least that the foreign trade is only one factor to be considered. If the rate of profit falls, a trade which before was impossible becomes possible. The opinion may be hazarded that the best way of explaining the general theory of international values would be to start with the foreign exchanges; but such an investigation is too technical and difficult for this place (see EXCHANGE).

See J. S. Nicholson's *Principles of Political Economy*, vol. ii. book iii. ch. 25–28, for the development of this line of criticism of the Ricardian theory; and C. F. Bastable's *Theory of International Trade* (Appendix) for reply to this and other criticisms. (J. S. N.)

VALVE (Lat. *valva*, a leaf of a double or folding door, allied to *volvere*, to roll, as of a door on its hinges), a term applied to many mechanical appliances, devices or natural features, which control, by opening and shutting, the flow of air, liquids, vapour, gas, &c., through a passage, tube, pipe or other vessel.

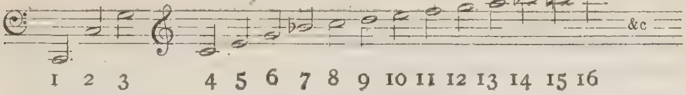
VALVES, or PISTONS (Fr. *pistons*, *cylindres*; Ger. *Ventile*; Ital. *pistoni*), in music, mechanical contrivances applied to wind instruments in order to establish a connexion between the main tubing and certain supplementary lengths required for the purpose of lowering the pitch. Various devices have been tried from the days of ancient Greece and Rome to produce this effect, the earliest being the additional tubes (πλάγιαι ὁδοί) inserted into the lateral holes of the aulos and tibia in order to prolong the bore and deepen the pitch of each individual hole; these tubes were stopped by the fingers in the same manner as the holes. This device enabled the performer to change the mode or key in which he was playing, just as did the crooks many centuries later. But the resourcefulness of the ancients did not stop there. The tibiae found at Pompeii (see AULOS) had sliding bands of silver, one covering each lateral hole in the pipe; in the band were holes (sometimes one large and one small, probably for semitone and tone) corresponding with those on the pipe. By turning the band the holes could be closed, as by keys when not required. By fixing the ὁδοί in the holes of the bands, the bore was lengthened instantly at will, and just as easily shortened again by withdrawing them; this method was more effective than the use of the crooks, and foreshadowed the valves of eighteen centuries later. The crooks, or coils of tubing inserted between the mouthpiece and the main tube in the trumpet and horn, and between the slide and the bell joint in the trombone, formed a step in this direction.

Although the same principle underlies all these methods, *i.e.* the lengthening of the main column of air by the addition of other lengths of tubing, the valve itself constitutes a radical difference, for, the adjustment of crooks demanding time and the use of both hands, they could only be effective for the purposes of changing the key and of rendering a multiplicity of instruments unnecessary. The action of the valve being as instantaneous as that of the key, the instrument to which it was applied was at once placed on a different basis; it became a chromatic instrument capable of the most delicate modulations from key to key. The slide had already accomplished this desirable result, but as its application was limited to instruments of which the greater part of the bore was cylindrical, *i.e.* the trumpet and trombone, its influence on concerted musical composition could not be far-reaching. In fact it is doubtful whether the chromatic possibilities of the slide were fully realized until the end of the 18th century, when key mechanism having made some advance, it was being applied successfully to the transverse flute and to the clarinet and oboe families. In 1760 Kölbel, a Bohemian horn-player engaged in the St Petersburg Imperial Orchestra, turned his attention to this method of extending the compass of brass instruments. His experiments, followed up by Anton Weidinger of Vienna at the beginning of the 19th century, produced a trumpet with five keys and a complete chromatic compass. Halliday followed with the keyed bugle in 1810. Halary applied the principle of the keyed bugle to the bass horn in 1817, and produced the ophicleide—an ideal chromatic bass as far as technical possibilities were concerned. The horn had become a chromatic instrument through Hampel's discovery of *bouché* sounds, but the defects in intonation and timbre still remained.

Such were the conditions prevailing among the wind instruments of the orchestra when the successful application of the valve to brass wind instruments by Heinrich Stölzel of Silesia caused an instantaneous revolution among makers of wind instruments. Further efforts to perfect the key system as applied to the brass wind were abandoned in favour of valves. The short space of two decades witnessed the rise of the Flügelhorns, the tubas, the saxhorns and the cornet-à-pistons; the trombone, French horn and trumpet having led the van.

Sound is produced on brass wind instruments by overblowing the members of the harmonic series (see HORN). The harmonic series itself is invariable, whether obtained from a string or a column of air; the structural features of the instrument determine which members of the series it is able to produce.

HARMONIC SERIES IN C



Although the valves of brass wind instruments vary in form and detail according to the makers, the general principles governing their action are the same for all types. The piston placed on some branch of the main tube must be so constructed that on being depressed it closes the natural windways through the main bore and opens others into the additional piston length. The piston seated on a spring instantly regains its normal position when the finger is removed. After the actual shape and construction of the valve and its box had been successfully evolved, it was the boring and disposition of the windways which engaged the attention of makers, whose object was to avoid complexity and sharp angles and turns in the tubing. The pitch of all tubes is determined by the length of the column of air set in vibration therein. Any variation in the length of this column of air produces a proportional variation in the pitch of the instrument. When the piston is depressed, therefore, a partition wall is removed and the column of air within the additional length of tubing representing a definite interval is added to the main column, so that the length of the sound wave is proportionally increased whether the column is vibrating as a whole (when it gives the fundamental or first note of the series) or whether it has been induced to divide into equal portions in which sound waves of equal length are simultaneously generated. The numbers under the notes of the harmonic series represent the aliquot parts into which the column of air must divide in order to produce the harmonics. The length of tubing attached to each valve is therefore calculated on the basis of the length of the main column, to give for the first piston a tone, for the second a semitone, for the third a tone and a half, and for the fourth two tones.

In order to illustrate the working of the pistons, we will take as an example the bombardon or bass tuba in E♭. Depressing the second piston lowers the pitch of the instrument to D, giving it the harmonic series proper to that key; the third harmonic, which on the open tube would be B♭, now becomes A; the fifth harmonic, which was G, is now F♯, and so on. The first piston on being depressed similarly transforms the E♭ bombardon into an instrument in D♭, a tone lower; the third piston lowering the pitch 1½ tones changes the key to C. So far the intonation of the notes produced by means of the pistons is as accurate as that of the harmonics. The variations in the length of the column of air correspond to the positions of the slide on the trombone, the first position being that of the instrument with all valves in their normal position. The use of the three pistons in turn gives the second, third and fourth positions. In order to obtain a complete chromatic compass there must be seven positions or different lengths of tubing available, as on the trombone, each having its proper harmonic series. On valve instruments the three other positions are obtained by means of combinations of pistons; the fifth position consists of a combination of pistons 2 and 3 (½ and 1½ tones), which would transpose our bombardon into the key of B; the sixth position consists of a combined use of pistons 1 and 3, producing a drop in pitch of 2½ tones from E♭ to B♭. In the seventh position all three pistons come into play simultaneously, lowering the pitch three tones. The intonation of the notes obtained in positions 5, 6, 7 is not so faultless as that of notes from the other positions, for the following reason:—On the bombardon in E♭ piston 1 lowers the pitch one tone to D♭; in the sixth position, when pistons 1 and 3 are used simultaneously, the third piston is no longer attached to a bombardon in E♭, on which it would produce the effect of C, but to one in D♭, on which it lowers the pitch to B♭; it is clear, therefore, that the supplementary tubing will not be quite long enough to give the correct intonation, and that the B♭ obtained as the 2nd harmonic in the sixth position will be a little too sharp, a defect which the performer corrects as best he can with his lip. The exact differences in length can be found from the table of ratios given by Victor Mahillon in *La Trompette, son histoire, sa théorie, sa construction* (Brussels and London, 1907), p. 38.

This inherent defect of the valve system was understood and explained a few years after the invention of valves by Gottfried Weber,[1] and the record of the successive endeavours of brass instrument makers to overcome this defect without unduly complicating the mechanism or adding greatly to the weight of the instruments constitutes the history of valve instruments.

The accredited inventor and patentee of valves applied to musical instruments was Heinrich Stölzel[2] of Pless in Silesia in 1815. The credit, however, is really due to Blümel,[3] also a Silesian, who sold his rights to Stölzel.

The first valves made by Stölzel worked in large square brass boxes and consisted of square blocks of solid brass through which the windways were bored in the same horizontal plane. A trumpet having two valves of this make is preserved in the museum of the Brussels Conservatoire (No. 1310 in catalogue). In 1825 Stölzel had improved upon this primitive valve, making it tubular and calling it *Schub-Ventil*: its action was lighter and more rapid than that of the original valve. Charles Sax of Brussels took up the manufacture of these valves and applied them to the cornet with two pistons. The scale of instruments with only two pistons had several gaps, and could not be strictly termed chromatic. In order to complete the scale, C. A. Müller of Mainz constructed a trumpet in the early 'thirties which not only had three valves, but also tuning-slides for all three additional lengths of tubing[4] and key crooks, for which corresponding piston lengths could be inserted. This was, therefore, the first attempt at compensation, for which the honour is due to Germany.

The early improvements and modifications of Stölzel's invention may be briefly[5] summed up as follows:—

In 1824 John Shaw, of Glossop, invented a system of valves known as transverse spring slides, both ascending and descending, *i.e.* respectively having pistons which cut off certain lengths of tubing, thereby raising the pitch, or pistons adding certain lengths, and lowering the pitch thereby. These transverse slides were afterwards improved by Schott in 1830, and became known as the *Wiener Ventil*, which had an enormous success on the continent of Europe, and were applied to all kinds of brass instruments. In 1827 Blümel invented the rotary valve or cylinder action known as *Dreh* or *cylinder Ventil*, a system still in use in Germany and Austria, and preferred to piston systems by many.

In 1833 J. G. Moritz (who was associated with Wieprecht, inventor of the batyphone and bass tuba) made the large pistons of generous diameter known as *Berliner Pumpen*. In 1835 John Shaw patented a variation of the rotary valve, known as *patent lever*. In 1839 Périnet of Paris invented the most modern form of valve, called by his name, similar to the Schub-Ventil and Berliner Pumpen, but of a diameter between the two. In 1851 and 1852 Dr J. P. Oates made his equilateral valves adopted by Antoine Courtois for his cornets; the same clever acoustician invented a piston with four straight windways, afterwards patented by A. Sax of Paris.

Various attempts to improve the windways and get rid of angularities were made by Gustave Besson in 1851, 1854 and 1855, when a system was devised having the same bore throughout the windways. This decided improvement forms the basis of the present system of the same firm. Until now efforts had mainly been directed towards the improvement of the technical construction of valves and windways. The first attempt since Müller's (which appears to have passed unnoticed in France and England) to remedy by compensation the inherent defect of the valve system when pistons are used in combination was made in 1850, when Adolphe Sax devised a system of six pistons, one for each position, in which it was impossible to use any two pistons in combination: this system was ascending instead of descending. Gustave Besson's *registre* in 1856–57 followed, providing a large horizontal piston, which, by connecting other duplicate lengths of tubing of the proper theoretical length, gave eight independent positions. In 1858 G. Besson and Girardin produced the *transpositeur*, in which two extra pistons when depressed automatically lengthened the slides of the three usual pistons to the required length for combination. In 1859 came the first suggestion for automatic compensation made by Charles Mandel in his book on the *Instrumentation of Military Bands*, p. 39. It does not appear that he put his suggestion into practice or patented it. In this ingenious system the valves were so constructed that when two or three pistons were used simultaneously the length of tubing thrown open was automatically adjusted to the correct theoretical length required. The same ingenious principle, elaborated and admirably carried out in practice, was patented by D. J. Blaikley in 1878. The working of his device differs from the action of ordinary valves only when the pistons are used in combination. The exact theoretical length is then obtained by bringing into use extra compensating lengths of tubing corresponding to the difference between the piston length for a semitone, a tone and one and a half tones on the open tube and on the tube already lengthened by means of one of the other pistons. The value of this invention, enhanced by the advantage of leaving the fingering unaltered, is more especially appreciated on the large brass instruments, in which correction of faulty intonation by means of the lips is more difficult to accomplish satisfactorily than on the smaller instruments. A similar device was patented in France in 1881 by Sudre.

Victor Mahillon, who had been for some years at work on similar lines, did not patent his invention till 1886, when his *piston*

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[1] *Caecilia* (Mainz, 1835), xvii. 89–91.

[2] See Captain G. B, Bierey in *Allg. musik. Ztg.* (Leipzig, 1815), p. 309, and idem for patent 1817, p. 814.

[3] Ibid. 1818, p. 531.

[4] Gottfried Weber, *op. cit.* p. 98.

[5] Fuller accounts may be derived from Captain C. R. Day, *Descriptive Catalogue of Musical Instruments* (London, 1891), pp. 182 seq.; Victor Mahillon, *Catalogue descriptif*, vol. i. 2nd ed. pp. 282 seq.; and from the pages of the *Allg. musik. Ztg.* (Leipzig) and *Caecilia* (Mainz).

régulateur was introduced: this first device was not automatic, and was shortly afterwards improved and patented as the *automatic regulating pistons.*

A later valuable development in the history of valve systems is the *enharmonic*, invented by Messrs Besson & Co., in which they have perfected and simplified the principle of independent positions tried in the *registre* of the fifties. In the enharmonic valve system each position has its independent length of tubing theoretically accurate, which comes into play as the valves are depressed, and there is besides a tuning slide for the open notes.

Finally, there is an improvement in a different direction to be chronicled, unconnected with compensation, in Rudall Carte & Co.'s system (Klussmann's patent) of conical bore throughout, the open tube and the valve slides, which by means of ingeniously combined joints and slides preserve the tone without loss of air. This system has been applied to all valve instruments, and has been found to produce a remarkable improvement in the timbre. (K. S.)

VALYEVO (sometimes written Valjevo or Valievo), a town of western Servia, prettily situated on the river Kolubara, in a well-wooded valley, 627 ft. above the sea. Valyevo gives its name to the department of which it is the capital. It is a garrison town, with streets lighted by electricity, a high-school or gymnasium, a prefecture and a court of first instance. In the neighbouring Medvenik mountains lead-mining and smelting are carried on by an English company; lead and antimony being also worked at Podgora and other places in the same department. Besides being the centre of the plum-growing and distilling industries, Valyevo has a considerable trade in cattle, for which the pastures watered by the Kolubara are celebrated. Pop (1900) about 6800.

VÁMBÉRY, ÁRMIN (1832–), Hungarian Orientalist and traveller, was born of humble parentage at Duna-Szerdahely, a village on the island of Shütt, in the Danube, on the 19th of March 1832. He was educated at the village school until the age of twelve, and owing to congenital lameness had to walk with crutches. At an early age he showed remarkable aptitude for acquiring languages, but straitened circumstances compelled him to earn his own living. After being for a short time apprentice to a ladies' tailor, he became tutor to an innkeeper's son. He next entered the untergymnasium of St Georgen, and proceeded thence to Pressburg. Meanwhile he supported himself by teaching on a very small scale, but his progress was such that at sixteen he had a good knowledge of Hungarian, Latin, French and German, and was rapidly acquiring English and the Scandinavian languages, and also Russian, Servian and other Slavonic tongues. At the age of twenty he had obtained sufficient knowledge of Turkish to lead him to go to Constantinople, where he set up as teacher of European languages, and shortly afterwards became a tutor in the house of Pasha Hussein Daim. Under the influence of his friend and instructor, the Mollah Ahmed Effendi, he became, nominally at least, a full Osmanli, and entering the Turkish service, was afterwards secretary to Fuad Pasha. After spending six years in Constantinople, where he published a *Turkish-German Dictionary* and various linguistic works, and where he acquired some twenty Oriental languages and dialects, he visited Teheran; and then, disguised as a dervish, joined a band of pilgrims from Mecca, and spent several months with them in rough and squalid travel through the deserts of Asia. He succeeded in maintaining his disguise, and on arriving at Khiva went safely through two audiences of the khan. Passing Bokhara, they reached Samarkand, where the emir, whose suspicions were aroused, kept him in audience for a full half-hour; but he stood the test so well that the emir was not only pleased with "Resid Effendi" (Vámbéry's assumed name), but gave him handsome presents. He then reluctantly turned back by way of Herat, where he took leave of the dervishes, and returned with a caravan to Teheran, and subsequently, in March 1864, through Trebizond and Erzerúm to Constantinople. By the advice of Prokesch-Osten and Eötvös, he paid a visit in the following June to London; there his daring adventures and linguistic triumphs made him the lion of the day. In the same year he published his *Travels in Central Asia.* In connexion with this work it must be remembered that Vámbéry could write down but a few furtive notes while with the dervishes, and dared not take a single sketch; but the weird scenes, with their misery and suffering, were so strongly impressed on his memory that his book is convincing by its simplicity, directness and evidence of heroic endurance. Vámbéry also called the attention of politicians to the movements of Russia in Central Asia, and aroused much general interest in that question. From London he went to Paris, and he notes in his *Autobiography* that the Parisians were much more interested in his strange manner of travelling than in the travels themselves. He had an interview with Napoleon III., who failed to impress him "as the great man which the world in general considers him." Returning to Hungary, he was appointed professor of Oriental languages in the university of Budapest: there he settled down, contributing largely to periodicals, and publishing a number of books, chiefly in German and Hungarian. His travels have been translated into many languages, and his *Autobiography* was written in English. Amongst the best known of his works, besides those alluded to, are *Wanderings and Adventures in Persia* (1867); *Sketches of Central Asia* (1868); *History of Bokhara* (1873); *Manners in Oriental Countries* (1876); *Primitive Civilization of the Turko-Tatar People* (1879); *Origin of the Magyars* (1882); *The Turkish People* (1885); and *Western Culture in Eastern Lands* (1906).

VAMPIRE, a term, apparently of Servian origin (*wampir*), originally applied in eastern Europe to blood-sucking ghosts, but in modern usage transferred to one or more species of blood-sucking bats inhabiting South America.

In the first-mentioned meaning a vampire is usually supposed to be the soul of a dead man which quits the buried body by night to suck the blood of living persons. Hence, when the vampire's grave is opened, his corpse is found to be fresh and rosy from the blood which he has thus absorbed. To put a stop to his ravages, a stake is driven through the corpse, or the head cut off, or the heart torn out and the body burned, or boiling water and vinegar are poured on the grave. The persons who turn vampires are generally wizards, witches, suicides and those who have come to a violent end or have been cursed by their parents or by the church. But any one may become a vampire if an animal (especially a cat) leaps over his corpse or a bird flies over it. Sometimes the vampire is thought to be the soul of a living man which leaves his body in sleep, to go in the form of a straw or fluff of down and suck the blood of other sleepers. The belief in vampires chiefly prevails in Slavonic lands, as in Russia (especially White Russia and the Ukraine), Poland and Servia, and among the Czechs of Bohemia and the other Slavonic races of Austria. It became specially prevalent in Hungary between the years 1730 and 1735, whence all Europe was filled with reports of the exploits of vampires. Several treatises were written on the subject, among which may be mentioned Ranft's *De masticatione mortuorum in tumulis* (1734) and Calmet's *Dissertation on the Vampires of Hungary*, translated into English in 1750. It is probable that this superstition gained much ground from the reports of those who had examined the bodies of persons buried alive though believed to be dead, and was based on the twisted position of the corpse, the marks of blood on the shroud and on the face and hands—results of the frenzied struggle in the coffin before life became extinct. The belief in vampirism has also taken root among the Albanians and modern Greeks, but here it may be due to Slavonic influence.

Two species of blood-sucking bats (the only species known) —*Desmodus rufus* and *Diphylla ecaudata*—representing two genera (see CHIROPTERA), inhabit the tropical and part of the subtropical regions of the New World, and are restricted to South and Central America. They appear to be confined chiefly to the forest-clad parts, and their attacks on men and other warm-blooded animals were noticed by some of the earliest writers. Thus Peter Martyr (Anghiera), who wrote soon after the conquest of South America, says that in the Isthmus of Darien there were bats which sucked the blood of men and cattle when asleep to such a degree as to even kill them. Condamine, a writer of the 18th century, remarks that at Borja (Ecuador) and in other places they had entirely destroyed the cattle introduced by the missionaries. Sir Robert Schomburgk relates that at Wicki, on the river Berbice, no fowls could be kept on account of the ravages of these creatures, which attacked their combs, causing them to appear white from loss of blood. The present writer, when in South and Central America, had many accounts given him as to the attacks of the vampires, and it was agreed upon by most of his informants that these bats when attacking horses showed a decided preference for those of a grey colour. It is interesting to speculate how far the vampire bats may have been instrumental—when they were, perhaps, more abundant—in causing the destruction of the horse, which had disappeared from America previous to the discovery of that continent.

Although these bats were known thus early to Europeans, the species to which they belonged were not determined for a long time, several of the large frugivorous species having been wrongly set down as blood-suckers, and named accordingly. Thus the name *Vampyrus* was suggested to Geoffroy and adopted by Spix, who also considered that the long-tongued bats of the group *Glossophaga* were addicted to blood, and accordingly described *Glossophaga soricina* as a very cruel blood-sucker (*sanguisuga crudelissima*), believing that the long brush-tipped tongue was used to increase the flow of blood. *Vampyrus spectrum*, a large bat inhabiting Brazil, of sufficiently forbidding aspect, which was long considered by naturalists to be thoroughly sanguivorous in its habits, and named accordingly by Geoffroy, has been shown by the observations of travellers to be mainly frugivorous, and is considered by the inhabitants of the countries in which it is found to be perfectly harmless. Charles Waterton believed *Artibeus planirostris*, a common bat in British Guiana, usually found in the roofs of houses, and now known to be frugivorous, to be the veritable vampire; but neither he nor any of the naturalists that preceded him had succeeded in detecting any bat in the act of drawing blood. It fell to the lot of Charles Darwin to determine one of the blood-sucking species at least, and the following is his account of the circumstances under which the discovery of the sanguivorous habits of *Desmodus rufus* was made: "The vampire bat is often the cause of much trouble by biting the horses on their withers. The injury is generally not so much owing to the loss of blood as to the inflammation which the pressure of the saddle afterwards produces. The whole circumstance has lately been doubted in England; I was therefore fortunate in being present when one was actually caught on a horse's back. We were bivouacking late one evening near Coquimbo, in Chile, when my servant, noticing that one of the horses was very restive, went to see what was the matter, and, fancying he could detect something, suddenly put his hand on the beast's withers, and secured the vampire" (*Naturalist's Voyage Round the World*, p. 22).

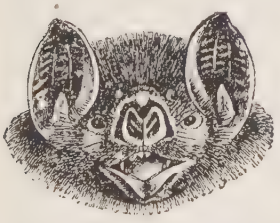

FIG. 1.—Head of Blood-sucking Vampire (*Desmodus rufus*).

Desmodus rufus, the common blood-sucking bat, is widely spread over the tropical and subtropical parts of Central and South America from Oaxaca to southern Brazil and Chile. It is a comparatively small bat, a little larger than the noctule, the head and body about 3 in. in length, the forearm 2½, with a remarkably long and strong thumb; it is destitute of a tail, and has a very peculiar physiognomy (fig. 1). The body is covered with rather short fur of a reddish-brown colour but varying in shade, the extremities of the hairs sometimes ashy. The teeth are peculiar and characteristic, admirably adapted for the purposes for which they are employed. The upper front teeth (incisors), of which there are only two, are enormously enlarged (see fig. 2), and in shape obliquely triangular like small guillotines. The canines, though smaller than the incisors, are large and sharp; but the cheek-teeth, so well developed in other bats, are very small and reduced in number to two above and three below, on each side, with laterally compressed crowns rising but slightly above the level of the gum, their longitudinally disposed cutting edges (in the upper jaw) being continuous with the base of the canine and with each other. The lower front teeth (incisors) are small, bifid, in pairs, and separated from the canines, with a space in front. The lower cheek-teeth are narrow, like those in the upper jaw, but the anterior tooth is slightly larger than the others, and separated by a small space from the canines. Behind the lower incisors the jaw is deeply hollowed out to receive the extremities of the large upper incisors.

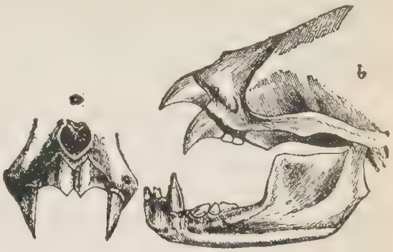

FIG. 2.—Teeth of *D. rufus*.

With this peculiar dentition there is associated as remarkable a departure from the general type in the form of the digestive apparatus. The exceedingly narrow oesophagus opens at right angles into a narrow, intestine-like stomach, which almost immediately terminates on the right, without a distinct pylorus, in the duodenum, but on the left forms a greatly elongated caecum, bent and folded upon itself, which appears at first sight like part of the intestines. This, the cardiac extremity of the stomach, is, for a short distance to the left of the entrance of the oesophagus, still very narrow, but soon increases in size, till near its termination it attains a diameter quite three times that of the short pyloric portion. The length of this cardiac diverticulum of the stomach appears to vary from 2 to 6 in., the size in each specimen probably depending on the amount of food obtained by the animal before it was captured.

The only other known species of blood-sucking bat, *Diphylla ecaudata*, inhabits Brazil, and appears to be much less abundant than *Desmodus rufus*, from which it is distinguished by its slightly smaller size, by the absence of a groove in the front of the lower lip, the non-development of the interfemoral membrane in the centre, and the presence of a short calcaneum (absent in *D. rufus*), but more particularly by the presence of an additional rudimentary cheek-tooth (?molar) above and below, and the peculiar form of the lower incisors, which are much expanded in the direction of the jaws and pectinated, forming a semicircular row touching each other, the outer incisors being wider than the inner ones, with six notches, the inner incisors with three each.

Travellers describe the wounds inflicted by the large sharp-edged incisors as being similar to those caused by a razor when shaving: a portion of the skin is shaved off and, a large number of severed capillary vessels being thus exposed, a constant flow of blood is maintained. From this source the blood is drawn through the exceedingly narrow gullet—too narrow for anything solid to pass—into the intestine-like stomach, whence it is, probably, gradually drawn off during the slow progress of digestion, while the animal, sated with food, is hanging in a state of torpidity from the roof of its cave or from the inner sides of a hollow tree. (G. E. D.)

VAMPYRELLA (L. Cienkowski), a genus of azoosporous Proteomyxa (*q.v.*), parasitic on freshwater algae.

VAN. (1) The chief town of a vilayet of the same name in Asiatic Turkey; altitude, 5400 ft. Pop. 28,000, of whom 14,000 are Armenians, and the remainder Moslems, mostly of a mixed Kurdish race. It is situated about a mile from the eastern shore of Lake Van, and built along the south side of the citadel rock, an isolated rocky ridge 1300 yds. long, rising 360 ft. out of a plain which extends up to the sharply defined rocky mass of the Varak range, 8 m. distant. On the gently sloping ground east of the citadel are the Gardens, covering an area of 5 m. by 3, and containing several suburbs and detached houses, along central avenues fringed with trees, and having channels of running water by the sides for irrigation.

The town itself is a poor place with flat-roofed mud houses, narrow winding streets, and surrounded by a ruinous mud wall; but it still contains the business quarter, the government offices and the principal bazaars. In the Gardens are vineyards and orchards of apple, pear, quince, plum and apricot; the houses of the wealthier inhabitants are imposing, built of a wood-framework on a stone foundation and filled in with sun-dried bricks. Many of them are brightly ornamented in the Persian style. Water comes from *karez* or underground channels and streams from Varak, fed from the Sikhe Lake, an ancient reservoir which preserves the snow waters on the summit of the mountain. For the southern quarter there is the Shemiram Canal, also of very ancient construction, which derives its supply from a large spring 19 m. distant, near Meshingird. There are British, Russian and French consuls who reside in the Gardens. There are a large American Mission with schools, orphanage and a resident doctor, a French (Dominican) Mission with schools, and also a branch of the archbishop of Canterbury's Mission to the Nestorian Christians who live in the mountains to the south. The climate is generally healthy, extremely cold in winter, with 2 to 3 ft. of snow from December to March, while the summer heat is not excessive. The Persian trade of Van has declined; European goods, with which the bazaars are fairly well supplied, come from Trebizond through Erzerum. There is a fair local trade in wheat and agricultural produce, also sheep and cattle, wool, hides and furs for export. A thick woollen cloth called *shayak*, coarse cotton chintzes and a kind of soap prepared from the efflorescences of the lake, with dried and salted fish, are also produced.

The cuneiform inscriptions of Van are very numerous, the town having been the capital of the Vannic kingdom of the Assyrian period. At the end of the Gardens is the rocky mass of Toprak Kale, on which was a fire temple and altar; near it is the Meker Kapusi (" Door of Mithridates "), a large inscribed slab of rock with the names of several deities. On the citadel rock are several inscriptions, the principal being a trilingual one of Xerxes on the southern face. Many other inscribed stones and tablets have been found built into modern buildings, while the excavation of a mound brought to light relics of a stone age.

Van occupies the site of Dhuspas, of which the native name was Biainas (Assyrian, *Urardhu*), the Byana of Ptolemy and the Ivan of Cedrenus, whence the modern Van. Dhuspas, the Thospia of Ptolemy, gave its name to the district of Thospitis, the modern Thosp. The Biainian dynasty, of which Sarduris I. (*c.* 833 B.C.) was the first king, died out with Sarduris II., who in 645 B.C. entered into an alliance with Assur-bani-pal. Inscriptions of nearly all the kings exist, and the various excavations at Toprak Kale show an advanced state of civilization and great technical skill (see illustrations in Maspero's *Histoire ancienne*, vol. iii., *Les Empires*). In the 6th century B.C. Van passed into the hands of the Persians, and shortly before it fell to Alexander the Great it was rebuilt, according to Armenian historians, by a native prince called Van. In 149 B.C. Valarsaces or Vagharshag, the first Armenian king of the Arsacidae, rebuilt the town, and a colony of Jews was settled in it by Tigranes (94–56 B.C.). In the middle of the 4th century A.D. it was taken by Sapor (Shapur) II., and became the capital of an autonomous province of the Sassanian Empire, until it fell into the hands of the Arabs (*c.* 640), under whom it regained its autonomy. About 908 the governor of Van or Vaspuragan was crowned king by the caliph Moktadir, and in 1021 his descendant Senekherim was persuaded by Basil II. to exchange his kingdom for the viceroyalty of the Sebasteian theme. After having formed part of the possessions of the Seljuks, Mongols, Tatars and Persians, Van passed in 1514, after the defeat of Shah Ismail by Selim I. at the battle of Kalderan, to the Osmanlis, who only occupied the town in 1543. In 1636 it was taken by the Persians, but soon recovered. In 1845 the town was held for a time by the Kurd chief Khan Mahmud, who eventually surrendered and was exiled.

(2) The vilayet of Van lies along the Persian frontier between the vilayets of Erzerum and Mosul. The northern sanjak comprises open plateau country N. and E. of the lake (with a large Armenian agricultural population and Kurdish seminomad tribes occupied chiefly in cattle and sheep raising), also of several fertile districts along the south shore of the lake. The southern sanjak is entirely mountainous, little developed and having the tribes only partly under government control. This comprises most of the upper basin of the Great Zab, with the country of the Nestorian Christians and many districts inhabited by Kurdish tribes, some of them large nomad tribes who descend for the winter to the plains of the Tigris.

The mineral wealth of the vilayet has never been fully explored, but is believed to be great. There are petroleum springs at Kordzot, deposits of lignite at Sivan and Nurduz, several hot springs at Zilan Deresi and Julamerk. Excellent tobacco is grown in Shemsdinan for export to Persia.

(3) Lake Van, called Arsissa Palus and also Thospitis from its Armenian names, is roughly rectangular 55 m. long and 40 broad, with a long north-eastern arm which increases the greatest length to 80 m. It stands about 5260 ft. above sea-level. It is without an outlet, and its greatest depth is along the southern shore. It has constant steady fluctuations, rising and falling some 8 ft. in a periodic movement of five years. In the middle of the 19th century a sudden rise submerged several places on the banks, including Arjish Kale, and the waters did not again subside. The north-eastern arm is much shallower than the rest. The water is bitter and undrinkable, being largely impregnated with carbonate and sulphate of soda with some borax. The salts are evaporated in pans, and called *perek*, being sold for washing purposes. There is, however, good water along the coast from springs and streams.

The lake has been navigated from the earliest times, and about 80 sailing boats, carrying about 20 tons burden, now ply on it, chiefly with wheat and firewood. Severe storms make navigation dangerous in winter. The southern shore is fringed by a steep range of mountains, with several thriving villages along the coast. The hills have now been almost denuded of trees. At the south-eastern corner is the island of Akhtamar with its ancient church, erected (*c.* 928) by Gagig, first king of the Ardzrunian dynasty. The Catholicos of Akhtamar is one of the highest offices in the Armenian Church, and dates from 1113. The small islands of Lim and Gdutz have also monasteries and churches. Large numbers of *darekh*, a kind of herring, exist in the lake, and are caught in nets from boats or when they enter the shallow lagoons in the spring and summer. Either fresh or salted they form an important article of diet of the poorer people.

See Sayce, " Cuneiform Inscriptions of Lake Van," in *Journal of Royal Asiatic Society*, vols. xiv., xx. and xxvi.; Lynch, *Armenia*, vol. ii. (1901); Belck and Lehmann, papers in *Verhand. d. Berliner Ges. für Anthropologie* (1892–99); *Zeit. für Ethnologie* (1892, 1899); *Mitt. d. Geog. Ges.* (Hamburg, 1898, 1899). (C. W. W.; F. R. M.)

VAN, an homonymous word, whose different meanings have no etymological connexion. In the most common sense " van " is merely an abbreviation of the Oriental word " caravan " (*q.v.*), and is applied to any large covered cart or vehicle used for the conveyance of goods, especially furniture, or, on railways, to a closed carriage for passengers' luggage, or for the accommodation of the guard. In the sense of the front portion of an army or fleet, or the advanced portion of any body, actually or metaphorically, " van " represents the French *avant* (Lat. *ab ante*), in front, as in *avant-garde*, van-guard, the earliest form in which the word came into English. Lastly, the word is used as a variant of " fan " (Lat. *vannus*), for a contrivance for winnowing grain, for a bird's wing, and in mining to an appliance for separating ore by washing.

VANADINITE, a mineral consisting of lead chloro-vanadate, $(PbCl)Pb_4(VO_4)_3$, crystallizing in the hexagonal system and isomorphous with pyromorphite and mimetite (*q.v.*). The crystals are usually six-sided prisms terminated by the basal planes, but are sometimes modified by numerous pyramidal planes which exhibit parallel hemihedrism. Rounded crystals and groups also occur. The colour is usually light brown or yellow, but crystals from Arizona are bright red. Owing to isomorphous replacement of the vanadium by phosphorus and arsenic, the specific gravity varies from 6·6 to 7·2; a variety containing much arsenic is called *endlichite*. The hardness is 3. The mineral is one of secondary formation in veins of lead ore. It was first found in Mexico, and in 1801 was asserted to contain a new element, which was called " erythronium "; this was later proved to be identical with the subsequently discovered element vanadium. Other well-known localities are Wanlockhead in Dumfriesshire, Kappel (Eisen-Kappel), near Klagenfurt in Carinthia, Arizona and New Mexico. (L. J. S.)

VANADIUM [symbol, V; atomic weight, 51·2 (O=16)], a metallic chemical element. It was first mentioned in 1801 by M. del Rio (*Gilb. Ann.*, 1801, 71, p. 7), but subsequently thought by him to be an impure chromium. Later, it was examined by N. G. Sefström, who found it in the slags of the Taberg iron ores (*Pogg. Ann.*, 1830, 21, p. 48), by J. J. Berzelius (ibid., 1831, 22, p. 1), and finally by Sir H. Roscoe (*Trans. Roy. Soc.*, 1868–1870), who showed that the supposed vanadium obtained by previous investigators was chiefly the nitride or an oxide of the element. In his researches, Roscoe showed that the atomic weight of the metal as determined by Berzelius and the formulae given to the oxides were incorrect, and pointed out that the element falls into its natural place in group V of the periodic classification along with phosphorus and arsenic, and not in the chromium group where it had originally been placed.

In small quantities, vanadium is found widely distributed, the chief sources being vanadite, mottramite, descloizite, roscoelite, dechenite and pucherite, whilst it is also found as a constituent of various clays, iron-ores and pitchblendes. Vanadium salts may be obtained from mottramite by digesting the mineral with concentrated hydrochloric acid, the liquid being run off and the residue well washed; the acid liquid and the washings are then evaporated with ammonium chloride, when ammonium metavanadate separates. This is recrystallized and roasted to vanadium pentoxide, which is then suspended in water into which ammonia is passed, when ammonium metavanadate is again formed and may be purified by recrystallization. The pure metal may be obtained by reducing vanadium dichloride in hydrogen, the operation being exceedingly difficult (for details, see Roscoe's original papers). In a somewhat impure condition it may be obtained by the reduction of vanadium pentoxide with a mixture of the rare earth metals which are obtained by reduction of the waste oxides formed in the manufacture of thoria (Weiss and Aichel, *Ann.*, 1904, 337, p. 380); from the oxide by Goldschmidt's thermite method (Koppel and Kaufmann, *Zeit. anorg. Chem.*, 1905, 45, p. 352); by electrolysis in a bath of fused fluorspar containing a steel cathode and an anode composed of carbon and vanadium pentoxide (M. Gin, *L'Électricien*, 1903, 25, p. 5); and by the electrolysis of vanadium trioxide when heated in an evacuated glass tube (W. v. Bolton, *Zeit. f. Elektrochem.*, 1905, 11, p. 45). H. Moissan (*Comptes rendus*, 1896, 122, p. 1297) obtained a vanadium containing from 10 to 16% of carbon by fusing vanadic anhydride with carbon in the electric furnace. For other methods of obtaining vanadium and its compounds, see Cowper Cowles, *Engin. and Mining Journ.* 67, p. 744; Herrenschmidt, *Comptes rendus*, 1904, 139, p. 635; M. Gin, *Elektrochem. Zeit.*, 1906, 13, p. 119; W. Prandtl and B. Bleyer, *Zeit. anorg. Chem.*, 1909, 64, p. 217.

Vanadium is a light-coloured metal of specific gravity 5·5. It is not volatilized even when heated to redness in a current of hydrogen, and it burns readily to the pentoxide when heated in oxygen. It dissolves slowly in hydrofluoric acid and in nitric acid, the solution turning blue; it is insoluble in hydrochloric acid. When fused with caustic soda, hydrogen is liberated and a vanadate is formed. It precipitates platinum, gold and silver from solutions of their salts, and also reduces mercuric, cupric and ferric salts. It absorbs nitrogen when heated in a current of that gas, forming a nitride. Vanadium may be detected by converting it into the pentoxide, which on passing sulphuretted hydrogen through its acid solution becomes reduced to the dioxide, the solution at the same time becoming lavender blue in colour; or if zinc be used as a reducing agent, the solution becomes at first green and ultimately blue.

Five oxides of vanadium are known (cf. Nitrogen), the mono-, di- and trioxides being basic in character, the tetra- and pentoxides being acidic and also feebly basic. The *monoxide*, V_2O, is formed when the metal is oxidized slowly in air. In a hydrated form it is obtained by the reduction of vanadyl monochloride, VOCl, with sodium amalgam, being precipitated from the liquid by the addition of ammonia (Locke and Edwards, *Zeit. anorg. Chem.*, 1899, 19, p. 378). The *dioxide*, V_2O_2, is formed in the reduction of vanadyl trichloride by hydrogen (Roscoe). It is a grey powder which is insoluble in water, but dissolves in acids to give a lavender-blue solution which possesses strong reducing properties. The addition of ammonia to this solution precipitates a brown hydrated oxide. The dioxide when heated in oxygen burns, forming the pentoxide. The *trioxide*, V_2O_3, is formed when the pentoxide is reduced at a red heat in a current of hydrogen, or by the action of oxalic acid on ammonium metavanadate. It forms a black amorphous powder or a dark green crystalline mass, and is insoluble in water and in most acids. The *tetroxide*, V_2O_4, results when the pentoxide is heated with dry oxalic acid and the resulting mixture of the tri- and pentoxide is warmed in the absence of air, or when the pentoxide is reduced by sulphur dioxide. It is an amorphous or crystalline mass of indigo-blue or steel-grey colour, which is insoluble in water and is also infusible. It oxidizes slowly in moist air, and dissolves easily in acids with the formation of blue solutions. The *pentoxide*, V_2O_5, is obtained when ammonium metavanadate is strongly heated, on calcining the sulphide, or by the decomposition of vanadyl trichloride with water. According to Ditte (*Comptes rendus*, 101, p. 698) it exists in three forms: a red amorphous soluble form which results when ammonium metavanadate is heated in a closed vessel and the residue oxidized with nitric acid and again heated; a yellow amorphous insoluble form which is obtained when the vanadate is heated in a current of air at 440° C.; and a red crystalline form which is almost insoluble in water. It is soluble in hot concentrated sulphuric acid and in concentrated hydrochloric acid. It is an energetic oxidizing agent and is consequently readily reduced when heated with various metals (zinc, magnesium, &c.), with carbon and with oxalic acid. On fusion with the caustic alkalis and alkaline carbonates it yields vanadates. It forms numerous compounds with potassium fluoride. Many complex derivatives are known, such, for example, as phosphor-vanadates, arsenio-vanadates, tungsto-vanadates, molybdo-vanadates, &c. For the use of this oxide in the electrolytic oxidation and reduction of organic compounds, see German Patents 172654 (1903) and 183022 (1905).

Many salts of oxy-acids of vanadium are known, but of the more common oxy-acids, metavanadic acid, HVO_3, and pyrovanadic acid, $H_4V_2O_7$, alone appear to have been isolated. *Metavanadic acid* is obtained in the form of yellow scales by boiling copper vanadate with an aqueous solution of sulphur dioxide. It is only very slightly soluble in water. *Pyrovanadic acid* is deposited as a dark brown unstable powder when an acid vanadate is decomposed by nitric acid. Of the salts of these acids, those of the ortho- and pyro-acids are the least stable, the orthovanadates being obtained on fusion of vanadium pentoxide with an alkaline carbonate. The metavanadates are usually yellowish or colourless solids. Ammonium metavanadate is obtained when the hydrated vanadium pentoxide is dissolved in excess of ammonia and the solution concentrated. It has been used in dyeing with aniline black. Tetra- and hexavanadates have also been described (see Ditte, *Comptes rendus*, 104, pp. 902, 1061; 102, p. 918; Manasse, *Ann.* 240, p. 23). The hypovanadates are insoluble in water, except those of the alkali metals, which are obtained by the addition of caustic alkalis to concentrated solutions of the chloride or sulphate of the tetroxide. They are brown in colour and easily oxidize. Pure hypovanadic acid has been obtained by G. Gain (*Comptes rendus*, 1906, 143, p. 823) by calcining ammonium metavanadate and saturating a solution of the resulting oxides with sulphur dioxide; the resulting blue solution (from which a sulphate of composition $2V_2O_4 \cdot 3SO_2 \cdot 10H_2O$ can be isolated) is then boiled with water, when sulphur dioxide is liberated and a pale red crystalline powder of hypovanadic acid, $H_4V_2O_5$, is precipitated.

Vanadium dichloride, VCl_2, is a green crystalline solid obtained when the tetrachloride is reduced with hydrogen at a dull red heat. It is very deliquescent and readily soluble in water. The *trichloride*, VCl_3, is a deliquescent solid formed when the tetrachloride is heated in a retort as long as chlorine is given off (Roscoe), or by heating vanadium trisulphide in a current of chlorine and fractionally distilling the resulting product at 150° C. in a current of carbon dioxide (Halberstadt, *Ber.*, 1882, 15, p. 1619). The *tetrachloride*, VCl_4, is formed by the direct union of vanadium and chlorine or by the action of sulphur chloride on vanadium pentoxide (Matignon, *Comptes rendus*, 1904, 138, p. 631). It is a fuming liquid, which is soluble in benzene and in acetic acid; it dissolves in water to form a deep blue solution. Several oxychlorides have also been described. *Vanadium carbide*, VC, was prepared by H. Moissan (*Comptes rendus*, 1896, 122, p. 1297) by heating vanadium pentoxide and carbon for a few minutes in the electric furnace. It is a volatile compound which burns when heated in oxygen and which is unacted upon by sulphuric and hydrochloric acids.

For vanadium steels, see Iron and Steel Manufacture.

VAN BEERS, JAN (1821–1888), Belgian poet, usually called "the elder" to distinguish him from his son, Jan van Beers, the well-known painter, was born at Antwerp on the 22nd of February 1821. He was essentially a Netherlander, though politically a Belgian, expressing his thoughts in the same language as any North Netherland writer. In fact, the poems of Jan van Beers are perhaps more popular in Holland than in Belgium, and of many of them there exist more editions printed in Holland than in his political fatherland. Van Beers started life as a teacher of Dutch language and literature, first at Malines, then at Lierre, and in 1860 was appointed a professor of both at the Athenaeum (high school) in Antwerp, where he had also been a sub-librarian in the communal library. Van Beers as a teacher was early in the field, with Hendrik Conscience, Willems and others, when the Flemish movement began. He composed a Dutch grammar (1852), which, in enlarged editions, still holds the field, and a volume of selections from Dutch authors, both books being so much appreciated that the Belgian government made them text-books in the public schools. Van Beers's historical poems, the principal of which is, perhaps, *Jakob Van Maerlant* (Amsterdam, 1860), helped the Flemish revival in Belgium as powerfully as his school-books. He is best known, however, as the writer of ballads and songs. *Jongelingsdroomen* ("A Young Man's Dreams") first appeared at Antwerp and Amsterdam in 1853. These poems were followed by *Levensbeelden* ("Life Figures or Pictures," Amsterdam, 1858) and by *Gevoel en Leven* ("Feeling—Living," Amsterdam, 1861). His *Rijzende Bladen* ("Rising Leaves") first made its appearance at Ghent and Rotterdam in 1883. In the following year an *édition de luxe* of his poetry was published, adorned with pen-and-ink sketches by Jan van Beers the younger, and a popular edition of his collected poems was published at Ghent and Rotterdam in 1873 and 1884. Among the best known are *De Blinde* ("Blind"), *De Zieke Jongeling* ("Young and Doomed"), *Bij 't Kerkportaal* ("At the Church Porch"). Van Beers's poetry, full of glow and pathos, simple yet forcible, is somewhat akin to that of Longfellow. Van Beers died at Antwerp on the 14th of November 1888.

VANBRUGH, SIR JOHN (1664–1726), British dramatist and architect, was born in the parish of St Nicolas Acons in the City of London, and christened on the 24th of January 1664. His grandfather, Gillis van Brugg, of Ghent, migrated to England in the reign of James I., was naturalized, resided as a merchant and was buried in the parish of St Stephen's Walbrook. The dramatist's father, Giles (1631–1689), a wealthy sugar baker, who married into the Carleton family, was driven from London by the plague and settled at Chester. The mother (Elizabeth Carleton, of the Dorchester family) survived to see her son famous; she died at Claygate, near Esher, in 1711, and was buried at Thames Ditton. After a few years at the King's School, Chester, John at nineteen was sent to France to study the arts; after two years' absence he returned to take up a commission in the regiment soon to be known as the 13th Foot. In the early autumn of 1690 Vanbrugh was arrested at Calais on a charge of espionage. The informant against him was a lady. He was imprisoned at Vincennes, but on the 1st of Feb. 1692, by a *lettre de cachet*, he was removed to the Bastille. On the 12th of November he found surety to the extent of one thousand pistoles, but was confined to the fortifications of Paris until his exchange was effected on the cartel. His enforced leisure was responsible for the first draft of the *Provok'd Wife*. Voltaire said in his *Lettres sur les Anglais* that he could not imagine what had gained such a comic writer the distinction of detention in such a grim fortress. As a matter of fact, a considerable number of English officers were arrested about this time on a similar charge, as may be seen from the Bastille archives.[1] For a time after his return he resumed his commission and was known as Captain Vanbrugh.

The production of Cibber's *Love's Last Shift* at the Theatre Royal in January 1696 kindled afresh his attachment to the comic muse. He thought it would be interesting to develop the situation upon which Cibber had rung down the curtain, and the result was *The Relapse*, "got, conceived and born in six weeks' space." It was given on Boxing Day 1696, with Cibber as Foppington, one of the three parts borrowed from the preceding comedy. The Sir Novelty Fashion of Cibber was developed in this play into Lord Foppington, who has been pronounced "the best fop ever brought upon the stage." The play has been revived in various forms: Sheridan adapted it in *A Trip to Scarborough*, and it inspired two modern versions in 1870 and 1890, *The Man of Quality* and *Miss Tomboy*. *Aesop*—produced at Drury Lane immediately after *The Relapse*—was an adaptation of Boursault's dramatic sermon on the same subject. It ran for a week only, but the success of *The Relapse* was so triumphant that Montague, afterwards Lord Halifax, asked at once for the *Provok'd Wife* for the theatre in Lincoln's Inn Fields, and it was produced at that theatre in May 1697. All that could be said in answer to those who condemned it on account of its unblushing libertinism was that Sir John Brute is sufficiently brutal to drive any woman into rebellion, and that since the glorious days of the Restoration a wife's rebellion and a wife's adultery were synonymous terms. The play was a complete triumph, and Brute was one of Garrick's great parts. Vanbrugh was fiercely attacked by Jeremy Collier for immorality in 1698, and wrote nothing more for the stage until 1700, when an adaptation of the *Pilgrim* of Beaumont and Fletcher was produced at Drury Lane. In this play, in the part of Alinda, Anne Oldfield scored her first success. Two years later appeared *The False Friend*, a version of Le Sage's *Traître puni*. Other adaptations from the French were *A Country House*, from Dancourt's *Maison de campagne*; *Confederacy* (1705), from the same author's *Bourgeoises à la mode*; *Squire Trelooby* (1704), a version of Molière's *Monsieur de Pourceaugnac*; and *The Mistake* (1705), from Molière's *Dépit amoureux*.

Collier's attack and the resulting movement must have been responsible in part for "Van" turning his attention to architecture. The demand for splendid country seats in the new Palladian style was steadily increasing, and his reputation as a modern wit was an introduction in itself. In 1702 he was entered as comptroller of the Royal Works (now the Board of Works, where several of his designs may still be seen). In 1703 he wrote to ask his friend Jacob Tonson to procure him a "Palladio," and in the same year he was a commissioner at Greenwich, where the secretary William Vanbrugh was a kinsman of his own, whom Evelyn had appointed at his request. In the meantime, Vanbrugh had been appointed architect to the earl of Carlisle, and the result, completed in 1714, was the Corinthian mansion of Castle Howard. The work is an extension of the Palladian plan introduced by Inigo Jones, with the addition of immense corridors in segmental colonnades leading from the main entrance to the wing blocks. From a scenic artist's point of view, it is a magnificent (and certainly his best) piece of work. The earl, then deputy earl-marshal, testified his satisfaction by procuring for Vanbrugh a high place in the College of Arms. In March 1704 he was actually promoted Clarenceux, though he not only knew nothing of heraldry but had openly ridiculed that grave science in *Aesop*. The indignant college protested in vain, and the architect stuck to his place. His next work was to prepare designs for Kneller Hall near Hounslow. But the success of Castle Howard now caused him to entertain the rash project of building a theatre in the Haymarket, from his own design, for the acting of his own plays. The joyous courage with which, having persuaded thirty people in the fashionable world to aid him in finding the money, and Congreve to aid him in finding the plays, he began to build in perfect unconsciousness of the danger before him, is the only passage in his life which may be called pathetic, save of course his struggle with the "wicked woman of Marlborough." The magnitude of Vanbrugh's architectural ideas grew as the work went on, and with the ideas the structure grew till a theatre meant for the delicate *bijouterie* work of polite comedy seemed growing to the proportions of the Roman Colosseum. Whether Congreve endeavoured to put a check upon his friend's architectural and authorial fervour does not appear. But it must be remembered that not only Vanbrugh's plays but his own were to be acted there, and that, although Congreve was a man of great sagacity, no man, not even he who pretended to set his gentility above his genius, is sagacious when confronted by the surpassing excellence of his own poems and plays. When at length the time came to test the acoustics of the pile, it was found to be sadly defective. What changes were made to rectify the errors of structure does not appear. The theatre was opened to the public with an Italian opera, which was followed by three of Molière's comedies, and these by the *Confederacy*, Vanbrugh's masterpiece on the whole, though perhaps its finest scenes are not equal to the finest scenes in *The Relapse*.

Vanbrugh at last withdrew from the disastrous speculation; Congreve had already withdrawn. But a man to whom Fortune had been so kind as she had been to Vanbrugh could hardly be depressed by any of her passing frowns. Queen Anne at once sent him abroad on an important state errand, and afterwards he was commissioned to build Blenheim. Upon the merits and demerits of this famous "hollowed quarry" there has been much conflict of opinion. As to the sarcasms by Swift, Walpole, Evans, and the rest, they are as nothing when set against Sir Joshua Reynolds's defence of Vanbrugh and his style. Blenheim Palace is probably the largest domestic building in England, and consists of three blocks, the centre containing the private living rooms, one wing the stables, and the other the kitchens and storehouses. It is planned on a colossal scale. Vanbrugh considered a building and the parts of a building as simply so much material for effect, without regard to their reasonable use and the necessary limitations of design. Thus he would support his main block by subordinate groups without considering for a moment the inconvenience that might be caused by the kitchen being removed by four hundred yards from the dining-room. Personal comfort was sacrificed to perspective. Windows were to adorn the elevation, not to light the interior; and, as Voltaire said, if the rooms had only been as wide as the walls were thick, the château would have been convenient enough. After Blenheim and Castle Howard, his next largest palace was probably Fleurs, near Kelso. His plans were only suitable to the largest kind of palace. Blenheim, however, was a source of great sorrow to the kindly dramatist. Though parliament had voted for the building of it, no provision had been made for the supplies. The queen while she lived paid them, and then Vanbrugh was left to the meanness of the duke of Marlborough, and afterwards to the insolence of the "wicked woman," who did her best to embitter his life. Besides Castle Howard and Blenheim, he built many other country mansions, such as Grimsthorpe and Duncombe Hall in Yorkshire, Eastbury in Dorsetshire, Seaton-Delaval in Northumberland, King's Weston near Bristol, Oulton Hall in Cheshire, old Claremont House at Esher, old Eaton Hall, Iver Grove, Bucks. He also restored Kimbolton Castle for the earl of Manchester. In 1716 he became architect to Greenwich Hospital.

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[1] Ravaisson; and Funck-Brentano, *Liste des prisonniers de la Bastille*.

In January 1719 Vanbrugh married Henrietta Maria, daughter of Colonel Yarborough of Heslington, and four years afterwards, at the accession of George I., he was knighted. He afterwards wrote again for the stage, and the unfinished fragment of the *Journey to London* (completed by Cibber as *The Provok'd Husband* in 1728) shows that his powers remained to the last as fine as ever. His married life was mostly spent at Blackheath, very probably in "Bastile House" on Maze Hill, repaired in 1904 and now known as Vanbrugh Castle. His wife died there at a great age in 1776, but "Van" himself died on the 26th of March 1726 in his modest town house, built in 1703 out of the ruins of Whitehall and satirized by Swift as the "goose pie." The site is occupied to-day by the War Office. The famous epitaph, "Lie heavy on him, earth," is attributed to Abel Evans. The best portrait of the dramatist is the kit-cat by Kneller.

Vanbrugh's works were edited in 2 vols., 1893, by W. C. Ward (portraits). *Select Plays* were issued in the Mermaid Series (ed. A. E. H. Swaen) in 1896. See G. H. Lovegrove's *Life, Works and Influence of Sir John Vanbrugh* (1902), Max Dametz's *Vanbrughs Leben und Werke* (1898), and *Swift's Works* (Bohn), xii. 80 sq. (T. Se.)

VAN BUREN, MARTIN (1782–1862), eighth president of the United States, was born at Kinderhook, New York, on the 5th of December 1782, of Dutch descent. His father was a farmer and tavern-keeper. His education was limited to that which could be obtained in the common schools and at Kinderhook Academy, and there is testimony to the effect that as late as 1829, when he became secretary of state, he wrote crudely and incorrectly. In 1796 he began the study of law, completing his preparation in 1802 at New York, where he studied under William Peter Van Ness (1778–1826), an eminent lawyer and later Aaron Burr's second in the duel with Alexander Hamilton. Van Buren made the acquaintance of Burr, but did not fall under his influence. In 1803 he was admitted to the bar and continued in active and successful practice for twenty-five years. His practice made him financially independent, and paved the way for his entrance into politics. New York politics after 1800, the year of the election of Jefferson and the downfall of the Federalists, were peculiarly bitter and personal. The Republicans were divided into three factions, followers respectively of George Clinton (and later of his nephew, De Witt Clinton), Robert R. Livingston and Aaron Burr; and such Federalist control as there was from time to time after 1799 depended upon coalition with one or other of these groups. Van Buren, who early allied himself with the Clintonians, was surrogate of Columbia county from 1808 until 1813, when he was removed. In 1812 he entered the state Senate, and he also became a member of the court for the correction of errors, the highest court in New York until 1847.

His career in the Senate covered two terms (1812–1820). In 1815 he became attorney-general, an office which he held, still as a member of the Senate, until 1819, when he was displaced to make room for a Federalist. He had already, in 1808, removed from Kinderhook to Hudson, and in 1816 he took up his residence in Albany, where he continued to reside until he entered Jackson's cabinet in 1829. As a member of the state Senate he supported the War of 1812 and drew up a classification act for the enrolment of volunteers. He was chosen to draft the resolution of thanks voted by the legislature to General Andrew Jackson after the battle of New Orleans. He broke with De Witt Clinton in 1813, but nevertheless favoured, in 1817, Clinton's plan for the Erie Canal. His attitude towards slavery at the moment was shown by his vote, in January 1820, for a resolution opposing the admission of Missouri as a slave state. In the same year he was chosen a presidential elector. It is at this point that Van Buren's connexion began with so-called "machine politics," a connexion which has made his name odious to some historians of the period. He was a leading member of the "Albany regency," a group of politicians who for more than a generation controlled the politics of New York and powerfully influenced those of the nation, and which did more than any other agency to make the "spoils system" a recognized procedure in national, state and local affairs. Van Buren did not originate the system, for it was already well developed when he entered public life; but the nickname of "Little Magician" which presently attached to him testifies to the skill with which he exploited it, and to the popular impression which his political methods produced.

In February 1821 he was elected to the United States Senate. Before taking his seat he served also as a member of the state constitutional convention, where he opposed the grant of universal suffrage. His course in the Senate was not altogether consistent, though in this respect he is not to be judged more harshly than some of his associates. He at first favoured internal improvements, and in 1824 proposed a constitutional amendment to authorize such undertakings, but the next year took ground against them. He voted for the tariff of 1824, then gradually abandoned the protectionist position. In the presidential election of 1824 he appeared as a strong supporter of William H. Crawford, and received the electoral vote of Georgia for vice-president; but he shrewdly kept out of the acrimonious controversy which followed the choice of John Quincy Adams. He early recognized the availability of Andrew Jackson, however, as a presidential candidate, and after the election sought to bring the Crawford and Jackson followers together, at the same time strengthening his control as a party leader in the Senate. Always notably courteous in his treatment of opponents, he showed no bitterness either towards J. Q. Adams or Henry Clay, and voted for Clay's confirmation as secretary of state notwithstanding the "corrupt bargain" charge; at the same time he opposed internal improvements and declined to support the proposal for a Panama Congress. As chairman of the judiciary committee, he brought forward a number of measures for the improvement of judicial procedure, and in May 1826 joined with Benton in presenting a report on executive patronage. In the debate on the "tariff of abominations" in 1828 he took no part, but voted for the measure in obedience to instructions from the New York legislature—an action which was cited against him as late as the presidential campaign of 1844. Van Buren was not an orator, but his more important speeches show careful preparation and his opinions carried weight; and the oft-repeated charge that he refrained from declaring himself on crucial questions is hardly borne out by an examination of his senatorial career. In February 1827 he was re-elected to the Senate by a large majority. He was now one of the recognized managers of the Jackson campaign, and a tour of Virginia, the Carolinas and Georgia in the spring of 1827 won support for Jackson from Crawford.

In 1828 Van Buren was elected governor of New York for the term beginning on the 1st of January 1829, and resigned his seat in the Senate. But on the 5th of March he was appointed by President Jackson secretary of state, an office which probably had been assured to him before the election, and he resigned the governorship. As secretary of state he took care to keep on good terms with the "kitchen cabinet," the group of politicians who acted as Jackson's advisers, and won the lasting regard of Jackson by his courtesies to Mrs John H. Eaton, wife of the secretary of war, with whom the wives of the cabinet officers had refused to associate. He did not oppose Jackson in the matter of removals from office, but was not himself an active "spoilsman," and protested strongly against the appointment of Samuel Swartwout (1783–1856), who was later a defaulter to a large amount as collector of the port of New York. He skilfully avoided entanglement in the Jackson-Calhoun imbroglio. No diplomatic questions of the first magnitude arose during his service as secretary of state, but the settlement of long-standing claims against France was prepared for, and trade with the British West India colonies was opened. In the controversy with the Bank of the United States he sided with Jackson. After the breach between Jackson and Calhoun, Van Buren was clearly the most prominent candidate for the vice-presidency. Jackson in December 1829 had already made known his own wish that Van Buren should receive the nomination. In April 1831 Van Buren resigned, though he did not leave office until June. In August he was appointed minister to England, and arrived in London in September. He was cordially received, but in February learned that his nomination had been rejected by the Senate on the 25th of January. The rejection, ostensibly attributed in large part to Van Buren's instructions to Louis McLane, the American minister to England, regarding the opening of the West India trade, in which reference had been made to the results of the election of 1828, was in fact the work of Calhoun, the vice-president; and when the vote was taken enough of the majority refrained from voting to produce a tie and give Calhoun his longed-for "vengeance." No greater impetus than this could have been given to Van Buren's candidacy for the vice-presidency. After a brief tour on the Continent he reached New York on the 5th of July. In May the Democratic convention, the first held by that party, had nominated him for vice-president on the Jackson ticket, notwithstanding the strong opposition to him which existed in many states. No platform was adopted, the widespread popularity of Jackson being relied upon to win success at the polls. His declarations during the campaign were vague regarding the tariff and unfavourable to the United States Bank and to nullification, but he had already somewhat placated the South by denying the right of Congress to abolish slavery in the District of Columbia without the consent of the slave states. In the election he received 189 electoral votes, while Jackson received 219 for President. Jackson now determined to make Van Buren president in 1836, and bent all his energies to that end. In May 1835 Van Buren was unanimously nominated by the Democratic convention at Baltimore. He expressed himself plainly during the canvass on the questions of slavery and the bank, at the same time voting, perhaps with a touch of bravado, for a bill offered in 1836 to subject abolition literature in the mails to the laws of the several states. Calhoun, bitterly hostile to the last, objected to the usual vote of thanks to the retiring vice-president, but withdrew his objection. In the election Van Buren received 170 electoral votes against 73 for William Henry Harrison, his principal opponent; but the popular vote showed a plurality of less than 25,000 in a total vote of about 1,500,000. The election was in fact a victory for Jackson rather than for Van Buren.

The details of Van Buren's administration belong to the history of the United States (see UNITED STATES). He announced his intention "to follow in the footsteps of his illustrious predecessor," took over all but one of Jackson's cabinet, and met with statesmanlike firmness the commercial crisis of 1837, already prepared for before he took office. No exhibition of ability or courage, however, nor yet the most skilful manipulation of the political machinery of the party, could prevent continued hostility to him and to the methods for which he was widely believed to stand. The state elections of 1837 and 1838 were disastrous for the Democrats, and the partial recovery in 1839 was offset by a second commercial crisis in that year. Nevertheless, Van Buren was unanimously renominated by the Democrats in 1840. Charged with being "a Northern man with Southern principles," he was frequently interrogated during the campaign, and his nomination obviously failed to arouse enthusiasm or even inspire confidence. The revolt against Democratic rule was undoubtedly serious, but a study of the popular vote shows that the election of Harrison, the Whig candidate, was less of a revolution than many affected to think. On the expiration of his term Van Buren retired to his estate at Kinderhook, but he did not withdraw from politics or cease to be a figure of national importance. It was even proposed to make him a member of the Federal Supreme Court in order to get him out of political life. He confidently expected to be nominated for president in 1844, and his famous letter of the 27th of April, in which he frankly opposed the immediate annexation of Texas, though doubtless contributing greatly to his defeat, was not made public until he felt practically sure of the nomination. In the Democratic convention, though he had a majority of the votes, he did not have the two-thirds which the rule of the convention required, and after eight ballots his name was withdrawn. In 1848 he was again nominated, first by the "Barnburner" faction of the Democrats, then by the Free Soilers, with whom the "Barnburners" coalesced, but no electoral vote was won by the party. In the election of 1860 he voted for the fusion ticket in New York which was opposed to Abraham Lincoln, but he could not approve of President Buchanan's course in dealing with secession, and later supported Lincoln. He died in Kinderhook on the 24th of July 1862. His memoirs, to 1834, remain unpublished, but an *Inquiry into the Origin and Course of Political Parties in the United States* was compiled from it by his sons and published in 1867. Van Buren married in 1807 Hannah Hoes (1782–1819), by whom he had four sons.

Van Buren's son ABRAHAM (1807–1873) graduated at West Point in 1827, served under General Winfield Scott against the Seminole Indians in 1836, and was made captain of the First Dragoons. In 1837 he resigned from the army to become his father's private secretary, but in 1846, at the outbreak of the war with Mexico, he was reappointed with the rank of major and paymaster. In August 1847 he was breveted lieutenant-colonel for gallant and meritorious conduct at Contreras and Churubusco. In 1854 he retired to private life. Another son, JOHN (1810–1866), graduated at Yale in 1828, was admitted to the bar at Albany in 1830 and was attorney-general of New York in 1845–1846. He was popularly known as "Prince John" because of his manners and appearance.

The best biography of Van Buren is by Edward M. Shepard, in the "American Statesmen Series" (revised ed., Boston, 1899). The Life by George Bancroft (New York, 1889) is highly eulogistic. Von Holst's *United States*, MacDonald's *Jacksonian Democracy*, Garrison's *Westward Extension* and T. C. Smith's *Parties and Slavery* (the last three in the "American Nation Series") give much attention to Van Buren's public career. The Van Buren manuscripts are in the Library of Congress. (W. MACD.*)

VANCE, ZEBULON BAIRD (1830–1894), American political leader, was born in Buncombe county, North Carolina, on the 13th of May 1830. He was educated at Washington College, at Salem, Tennessee, and the university of North Carolina (1851–52). Entering politics as a Whig, he was elected solicitor of Buncombe county (1852) and a member of the state House of Commons (1854), and served in the national House of Representatives from December 1858 until the 3rd of March 1861. As captain of a company in the 14th and as colonel of the 26th North Carolina regiments, he took part in the Virginia campaigns of 1861–62. From 1862 until the close of the war he was governor of the state, and from the 20th of May to the 5th of July 1865, when he was released on parole, was held as a prisoner by the United States authorities in Washington. Having been elected to the United States Senate in 1870 and been refused admission because his disabilities—due to his participation in the war—had not been removed, he took the lead in the fight against "carpet-bag" misrule and was chosen governor in the political revolution of 1876, serving in 1877–79. He was again elected to the Senate in 1878 and was re-elected in 1884 and 1890, serving from March 1879 until his death. Senator Vance was a typical Southern Whig. He disliked slavery and he hated secession. In common with other Whigs, he was forced to remain in the Democratic party after the war by the fear of negro domination. He died at Asheville, North Carolina, on the 14th of April 1894.

See the Life by Clement Dowd (Charlotte, N.C., 1897).

VANCOUVER, GEORGE (*c.* 1758–1798), English navigator, was born in 1758. He entered the navy at the age of thirteen, and accompanied James Cook in his second (1772–74) and third (1776–80) voyages of discovery. After serving for several years in the West Indies, both under Rodney (his commander in the action of the 12th of April 1782) and under Alan Gardner (1786–89), Vancouver, on Gardner's recommendation, was appointed to command an expedition to the north-west coast of America, to take over from the Spaniards the territory they had seized (and subsequently relinquished) in that region, to explore the coast from 30° N. round to Cook's River (or Inlet), to search for an eastward passage to the great lakes, and to ascertain the true character of Juan de Fuca Strait. Vancouver, accompanied by Lieutenant Broughton, left Falmouth on the 1st of April 1791 and proceeded by way of the Cape of Good Hope to Australia, where he carefully surveyed part of the south-west coast, especially King George's Sound, whose value as a harbour he pointed out. He next made for Dusky Bay, New Zealand (which he was the first properly to explore), and thence sailing north-east, discovered Oparo Islet (27° 36′ S.; 144° 12′ W.), and on the 30th of December reached Tahiti, where he was again joined by Broughton, who meanwhile had discovered Chatham Island. After staying about three weeks at Tahiti and several weeks at the Hawaiian Islands, Vancouver on the 18th of April 1792 sighted the west coast of North America (California, then known as New Albion) in 39° 27′ N. He examined the coast up to 52° 18′ N. with minute care, surveying all inlets, discovering the Gulf of Georgia, and circumnavigating Vancouver Island (named after him). After another visit (February–March 1793) to the Hawaiian Islands, in whose races and affairs he took great interest, Vancouver resumed his exploration of the American coast in April, surveying north to 56° N., and south (past the Spanish Californian settlements) to 35° N. During a fresh stay at the Hawaiian Islands (January–March 1794) Vancouver accepted their submission to Great Britain, but his annexation seems never to have been officially ratified. Quitting the group again in March 1794, Vancouver sailed, by Chernigov Island and Kodiak Island, to Cook's Inlet, which was now proved to be no river. After a fresh survey of much of the coast north of San Francisco, Vancouver set out homewards via Cape Horn and St Helena in October 1794. On the way he made a careful examination of Cape St Lucas, the southern point of Lower California, the Galapagos Islands and some other points. He reached the mouth of the Shannon on the 13th of September 1795 (the Thames on the 20th of October), and immediately set about the preparation of his narrative; but he died at Petersham in Surrey on the 10th of May 1798, before he had completed his task. His brother John, assisted by Captain Puget, published the complete record in 1798.

See *A Voyage of Discovery to the North Pacific Ocean and round the World . . . in 1790–5 . . . under Captain George Vancouver*, 3 vols. (1798), with an atlas of maps and plates.

VANCOUVER, a city and the county-seat of Clarke county, Washington, U.S.A., on the Columbia river about 100 m. from its mouth, about 5 m. E. of its confluence with the Willamette, and 8 m. N. of Portland, Oregon. Pop. (1890) 3545; (1900) 3126 (547 foreign-born); (1910) 9300. It is served by the Northern Pacific, the Great Northern, the Oregon & Washington, and the Spokane, Portland & Seattle railways, and by steamship lines, being accessible to sea-going vessels; a ferry connects with the Portland Electric railway. The city is the seat of St James College (Roman Catholic; 1856) and of the state school for defective youth (1886). Vancouver Barracks, east of the city, is an important U.S. military post (established in 1849) and the headquarters of the Military Department of the Columbia (including Washington, Oregon, Idaho, except the part in Yellowstone Park, and Alaska); the military reservation includes some 640 acres. The post commands an excellent view of the Columbia, and of the mountain peaks, Mt Hood, Three Sisters, Jefferson and St Helens. The city has a public library and a public park, and there is a U.S. Land Office here. Vancouver lies in a region of extensive forests and of fruit-growing and farming lands; among its manufactures are lumber products, barrels, condensed milk, flour, beer and canned fruit. It was a post of the Hudson's Bay Company in 1828–1846, and was protected by a large stockade, to which settlers fled for protection when attacked by the Indians. It was made the county-seat in 1854, was incorporated as a village in 1858 and was chartered as a city in 1889.

VANCOUVER, a city and port in the province of British Columbia, Canada, on the southern side of Burrard Inlet. Pop. (1906) about 45,000. It is the western terminus of the Canadian Pacific railway. The harbour of Vancouver is one of the finest natural harbours in the world. The city is the largest in British Columbia, and is the chief Canadian shipping port for Japan, China, Australia and the islands at which the C.P.R. mail steamers call. There are regular lines of steamers running between Vancouver and Alaska and the points of connexion with the Yukon territory, as well as lines to Puget Sound and San Francisco in the United States. The port also has regular and frequent communication by steamer with Victoria, and is the headquarters of an extensive coasting trade. In 1886, soon after its establishment, a fire swept the whole town out of existence, but the inferior wooden buildings at first erected have been largely replaced by stone and brick structures, giving a handsome appearance to the principal streets. Vancouver has well-paved streets and is well supplied with water, electric lighting, electric cars and all the improvements of a modern city. Stanley Park, a large reserve of 900 acres, is one of the principal pleasure resorts. There is also fine sea-bathing at English Bay on the outskirts of the city. The "McGill University College of British Columbia" at Vancouver is one of the colleges of McGill University (Montreal). There are a sugar refinery and cooperage works, as well as large sawmills, shingle factories and many other industrial concerns. A large wholesale trade is carried on with all the settlements of the province. Vancouver is the centre of the important timber industry of British Columbia.

VANCOUVER ISLAND, the largest of an archipelago of innumerable islands which fringes the Pacific coast of Canada, being at the same time the largest island on the west coast of North America. It forms part of British Columbia. It extends from 48° 20′ to 51° N. and from 123° to 128° 30′ W., and is thus 285 m. long and from 40 to 80 m. wide, with an area of about 20,000 sq. m., being nearly the size of Nova Scotia, which occupies a corresponding position on the Atlantic coast. It is bounded on the south by the Strait of Juan de Fuca, and is separated from the mainland of the province by the Strait of Georgia and Queen Charlotte Sound. A partially submerged range of mountains, which has been termed the Vancouver Range, runs parallel to the coast of British Columbia; a portion of this range forms Vancouver Island, and it again rises above the level of the sea farther north, forming the Queen Charlotte Islands. The coast-line is generally precipitous. The west coast is much broken by bays and inlets—the transverse valleys of the sunken range—which penetrate far inland. Among these may be mentioned the Alberni Canal, which is 20 m. long with a fine harbour at its head, the width of the inlet varying from a half to one mile; Nootka Sound, 6 m. wide, and sending three arms inland which are from 40 to 160 fathoms deep, as well as Clayoquot, Esperanza, Kyuquot and Quatsino Sounds, which also penetrate deeply into the island. The general height of the mountain-range on Vancouver Island is from 2000 to 3000 ft.; some peaks are 6000 ft.; and Victoria Peak is 7484 ft. high. The island is composed largely of crystalline and metamorphic rocks, but contains some cretaceous areas which hold extensive beds of coal, especially on the east coast. These are mined at Nanaimo, Ladysmith and other points. The island is covered everywhere with an exceedingly dense forest, which makes its interior very difficult to traverse, so that there are still portions of the island which have not been thoroughly explored. These forests yield immense supplies of magnificent timber, which together with the coal-field and fisheries constitute the chief resources of the island. There are some level tracts on the south-east coast, as well as in the narrow, well-watered valleys of the interior, which afford excellent agricultural land on which cereals of all kinds, as well as all the fruits of the temperate zone, flourish, and which are also suitable for raising sheep and cattle. The climate of Vancouver Island, especially in the south, is wonderfully mild for the latitude—as mild as that of Great Britain, with dryer summers. The mean temperature of December at Victoria in the south of the island is about 41° Fahr., while that of July is about 60°. In the north and west the rainfall is greater than on the south and east coasts. (F. D. A.)

VANDALS (Lat. *Vandili* or *Vandilii*), a term used by early writers only as a collective designation for a group of Teutonic tribes including, according to Pliny, the Burgundians and the Goths. As a tribal name Vandali occurs first in connexion with the Marcomannic War. The people to whom the name is there applied seem to be identical with those formerly known as Lugii. Another tribe called Silingae by Ptolemy likewise appears among the Vandals at a later time. Both these tribes appear to have inhabited the upper part of the basin of the Oder, and the name of the Silingae is preserved in Silesia. The Vandals figure in the earliest legends both of the Goths and the Lombards, both of whom they are said to have encountered unsuccessfully. They first came into contact with the Romans during the Marcomannic War. In the time of Aurelian they invaded Pannonia, and during the reign of Probus we find them fighting in Dacia. In the time of Constantine I., according to Jordanes, they suffered a great defeat at the hands of Geberich, king of the Goths, their own king Visimar being killed, and the survivors were allowed by the Romans to settle in Pannonia. Here they seem to have remained in subjection to the Romans for about sixty years. In the year 406 they moved westward, according to some writers at the instigation of Stilicho, who is himself said to have been of Vandal origin, and crossing the Rhine at Mainz proceeded towards Gaul. A portion of the nation is, however, said to have remained behind, and Procopius tells a story that these remnants sent an embassy to Gaiseric, asking that their kinsfolk in Africa should renounce their claims to the lands which their forefathers had held in the old homes of the race. (F. G. M. B.)

In Gaul the Vandals fought a great battle with the Franks, in which they were defeated with the loss of 2000 men, and their king Godégisel was slain. In 409 his son Gunderic led them across the Pyrenees. They appear to have settled in Spain in two detachments. One, the Asdingian Vandals, occupied Galicia, the other, the Silingian, Andalusia. Twenty years of bloody and purposeless warfare with the armies of the empire and with their fellow-barbarians, the Goths and the Suevi, followed. The Silingian Vandals were well-nigh exterminated, but their Asdingian brethren (with whom were now associated the remains of a Turanian people, the Alani, who had been utterly defeated by the Goths) marched across Spain and took possession of Andalusia.

In 428 or 429 the whole nation set sail for Africa, upon an invitation received by their king from Bonifacius, count of Africa, who had fallen into disgrace with the court of Ravenna. Gunderic was now dead, and supreme power was in the hands of his bastard brother, who is generally known in history as Genseric, though the more correct form of his name is Gaiseric. This man, short of stature and with limping gait, but with a great natural capacity for war and dominion, reckless of human life and unrestrained by conscience or pity, was for fifty years the hero of the Vandal race and the terror of Constantinople and Rome. Probably in the month of May 428 he assembled all his people on the shore of Andalusia, and numbering the males among them from the greybeard down to the newborn infant found them to amount to 80,000 souls. The passage was effected in the ships of Bonifacius, who, however, soon returning to his old loyalty, besought his new allies to depart from Africa. They, of course, refused, and Bonifacius turned against them, too late, however, to repair the mischief which he had caused. Notwithstanding his opposition, the progress of the Vandals was rapid, and by May 430 only three cities of Roman Africa—Carthage, Hippo and Cirta—remained untaken. The long siege of Hippo (May 430 to July 431), memorable for the last illness and death of St Augustine, which occurred during its progress, ended unsuccessfully for the Vandals. At length (30th January 435) peace was made between the emperor Valentinian III. and Gaiseric. The emperor was to retain Carthage and the small but rich proconsular province in which it was situated, while Hippo and the other six provinces of Africa were abandoned to the Vandal. Gaiseric observed this treaty no longer than suited his purpose. On the 19th of October 439, without any declaration of war, he suddenly attacked Carthage and took it. The Vandal occupation of this great city, the third among the cities of the Roman empire, lasted for ninety-four years. Gaiseric seems to have counted the years of his sovereignty from the date of its capture. Though most of the remaining years of Gaiseric's life were passed in war, plunder rather than territorial conquest seems to have been the object of his expeditions. He made, in fact, of Carthage a pirate's stronghold, whence he issued forth, like the Barbary pirates of a later day, to attack, as he himself said, "the dwellings of the men with whom God is angry," leaving the question who those men might be to the decision of the elements. Almost alone among the Teutonic invaders of the empire he set himself to form a powerful fleet, and was probably for thirty years the leading maritime power in the Mediterranean. Gaiseric's celebrated expedition against Rome (455), undertaken in response to the call of Eudoxia, widow of Valentinian, was only the greatest of his marauding exploits. He took the city without difficulty, and for fourteen days, in a calm and business-like manner, emptied it of all its movable wealth. The sacred vessels of the Jewish temple, brought to Rome by Titus, are said to have been among the spoils carried to Carthage by the conqueror. Eudoxia and her two daughters were also carried into captivity. One of the princesses, Eudocia, was married to Hunneric, eldest son of Gaiseric; her mother and sister, after long and tedious negotiations, were sent to Constantinople.

There does not seem to be in the story of the capture of Rome by the Vandals any justification for the charge of wilful and objectless destruction of public buildings which is implied in the word "vandalism." It is probable that this charge grew out of the fierce persecution which was carried on by Gaiseric and his son against the Catholic Christians, and which is the darkest stain on their characters. This persecution is described with great vividness, and no doubt with some exaggeration, by the nearly contemporary Victor Vitensis. Churches were burned; bishops and priests were forced by cruel and revolting tortures to reveal the hiding-places of the sacred vessels; the rich provincials who were employed about the court, and who still adhered to the Catholic faith, were racked and beaten, and put to death. The bishops were almost universally banished, and the congregations were forbidden to elect their successors, so that the greater part of the churches of Africa remained "widowed" for a whole generation. In 476, at the very close of Gaiseric's life, by a treaty concluded with the Eastern emperor, the bishops were permitted to return. There was then a short lull in the persecution; but on the death of Gaiseric (477) and the accession of Hunneric it broke out again with greater violence than ever, the ferocity of Hunneric being more thoroughly stupid and brutal than the calculating cruelty of his father.

On the death of Hunneric (484) he was succeeded by his cousin Gunthamund, Gaiseric having established seniority among his own descendants as the law of succession to his throne. Gunthamund (484–96) and his brother Thrasamund (496–523), though Arians, abated some of the rigour of the persecution, and maintained the external credit of the monarchy. Internally, however, it was rapidly declining, the once chaste and hardy Vandals being demoralized by the fervid climate of Africa and the sinful delights of their new capital, and falling ever lower into sloth, effeminacy and vice. On the death of Thrasamund, Hilderic (523–31), the son of Hunneric and Eudocia, at length succeeded to the throne. He adhered to the creed of his mother rather than to that of his father; and, in spite of a solemn oath sworn to his predecessor that he would not restore the Catholic churches to their owners, he at once proceeded to do so and to recall the bishops. Hilderic, elderly, Catholic and timid, was very unpopular with his subjects, and after a reign of eight years he was thrust into prison by his warlike cousin Gelimer (531–34).

The wrongs of Hilderic, a Catholic, and with the blood of Theodosius in his veins, afforded to Justinian a long-coveted pretext for overthrowing the Vandal dominion, the latent weakness of which was probably known to the statesmen of Constantinople. A great expedition under the command of Belisarius (in whose train was the historian Procopius) sailed from the Bosporus in June 533, and after touching at Catana in Sicily finally reached Africa in the beginning of September. Gelimer, who was strangely ignorant of the plans of Justinian, had sent his brother Tzazo with some of his best troops to quell a rebellion in Sardinia (that island as well as the Balearic Isles forming part of the Vandal dominions), and the landing of Belisarius was entirely unopposed. He marched rapidly towards Carthage and on the 13th of September was confronted by Gelimer at Ad Decimum, 10 m. from Carthage. The battle did not reflect any great credit either on Byzantine or Vandal generalship. It was in fact a series of blunders on both sides, but Belisarius made the fewest and victory remained with him. On the 14th of September 533 the imperial general entered Carthage and ate the feast prepared in Gelimer's palace for its lord. Belisarius, however, was too late to save the life of Hilderic, who had been slain by his rival's orders as soon as the news came of the landing of the imperial army. Still Gelimer with many of the Vandal warriors was at liberty. On the return of Tzazo from Sardinia a force was collected considerably larger than the imperial army, and Gelimer met Belisarius in battle at a place about 20 m. from Carthage, called Tricamarum (December 533). This battle was far more stubbornly contested than that of Ad Decimum, but it ended in the utter rout of the Vandals and the flight of Gelimer. He took refuge in a mountain fortress called Pappua on the Numidian frontier, and there, after enduring great hardships in the squalid dwellings of the Moors, surrendered to his pursuers in March 534. The well-known stories of his laughter when he was introduced to Belisarius, and his chant, "Vanitas vanitatum," when he walked before the triumphal car of his conqueror through the streets of Constantinople, probably point to an intellect disordered by his reverses and hardships. The Vandals who were carried captive to Constantinople were enlisted in five squadrons of cavalry and sent to serve against the Parthians under the title "Justiniani Vandali." Four hundred escaped to Africa and took part in a mutiny of the imperial troops, which was with difficulty quelled by Belisarius (536). After this the Vandals disappear from history. The overthrow of their kingdom undoubtedly rendered easier the spread of Saracen conquest along the northern shore of Africa in the following century. In this as in many other fields Justinian sowed that Mahomet might reap. (T. H.)

See Pliny, *Natural History*, iv. 99; Tacitus, *Germania*, cc. 2, 43; Ptolemy, ii. c. 11, §§ 18 ff.; Julius Capitolinus, *De Bello Marcomannico*, 17; Vopiscus, *Probus*, 18; Dexippus, *Excerpta*, pp. 19 ff. (Bonn); and Jordanes, 4, 16, 22; Procopius, *De Bello Vandalico*, a first-rate authority for contemporary events, must be used with caution for the history of the two or three generations before his time. The chroniclers Idatius, Prosper and Victor Tunnunensis supply some facts, and for the persecution of the Catholics Victor Vitensis and the *Vita Augustini* of Posidius may be consulted. See also E. Gibbon, *Decline and Fall*, chaps. xxxiii. and xli.; Papencordt, *Geschichte der vandalischen Herrschaft in Afrika* (Berlin, 1837); T. Hodgkin, *Italy and her Invaders* (1880–99); L. Schmidt, *Geschichte der Wandalen* (Leipzig, 1901); and F. Martroye, *L'Occident à l'époque byzantine* (1904).

VANDAMME, DOMINIQUE RENÉ, COUNT (1770–1830), French soldier, was born at Cassel, near Dunkirk, on the 5th of November 1770. He enlisted in the army in 1786, served in Martinique in 1788 and on returning to France entered into the Revolutionary movement, raising a company of light infantry at his native place. His extraordinary bravery and vigour in the campaign of 1793 ensured his rapid promotion, and after Hondschoote he was made a general of brigade. He served in this rank in the campaigns of 1794 in the Low Countries, 1795 on the Rhine and 1796 in Germany, and at the outbreak of the war in 1799 he was promoted general of division. In that year and in 1800 he served under Brune, Moreau and Macdonald in Holland, Germany and Switzerland. He was renowned for his tenacity and fearlessness as a fighting general as well as for his frank, rough manners and plundering and dissolute life, but once he came under Napoleon's influence he was (unlike most of the Rhine Army officers) his absolutely devoted servant. In 1805, for his splendid leadership at Austerlitz, he was given the Grand Eagle of the Legion of Honour, and in 1806–7 he commanded a small corps of the *Grande Armée* which reduced the Silesian fortresses. In 1808 he was made count of Unebourg. In 1809 he served in the Eckmühl campaign with distinction, but in 1812, while commanding the Westphalian contingent he quarrelled with King Jerome Bonaparte and returned to France. He returned to the army in 1813. But his corps, sent against the line of retreat of the Allies at the time of the battle of Dresden, was entangled in the mountains, surrounded and after a fierce resistance compelled to surrender at Kulm (see NAPOLEONIC CAMPAIGNS). In his captivity he appears to have been treated with especial harshness, and when the end of the war released him he was forbidden to enter Paris, and sent to Cassel by Louis XVIII. He was thus free of all obligations towards the Bourbons, and when Napoleon returned, joined him without hesitation. The emperor made him a peer of France and placed him at the head of the III. corps in the Army of the North (see WATERLOO CAMPAIGN). After Waterloo, under Grouchy's command, he brought back his corps in good order to Paris and thence to the Loire. The Restoration first imprisoned and then exiled him, and unlike most of his comrades he was never re-employed as a general. He died at Cassel on the 15th of July 1830.

See Du Casse, *Le Général Vandamme et sa correspondance*.

VANDERBILT, CORNELIUS (1794–1877), American capitalist, was born near Stapleton, Staten Island, New York, on the 27th of May 1794. He was a descendant of Jan Aersten Van der Bilt, who emigrated from Holland about 1650 and settled near Brooklyn. The family removed to Staten Island in 1715. At the age of 16 he bought a sailboat, in which he carried farm produce and passengers between Staten Island and New York. He was soon doing a profitable carrying business, and in 1813 carried supplies to fortifications in New York Harbour and the adjacent waters. Recognizing the superiority of steam over sailing vessels, he sold his sloops and schooners, and in 1817–1829 was a captain on a steam ferry between New York and New Brunswick. During the next twenty years he developed an extensive carrying trade along the coast in a fleet which became so large as to win for him the popular designation of "Commodore." In 1849 he got from the Nicaraguan government a charter for a route from Greytown on the Atlantic by the San Juan river and Lake Nicaragua to San Juan del Sur, on the Pacific; and in 1851–1853 by means of this route he conducted a semi-monthly steamship line between New York and San Francisco. In 1855–1861 he operated a freight and passenger line between New York and Havre, and by carrying the United States mails free drove out of business his only rival, the Collins line—the Cunard boats being at that time in use for the Crimean War. In 1857–1862 he sold his steamships and turned his attention more and more to the development of railways. In 1857 he became a director, and in 1863 president, of the New York & Harlem railway company, operating a line between New York and Chatham Four Corners, in Columbia county, and he greatly improved this service. He then acquired a controlling interest in the Hudson River railway, of which he became president in 1865; and after a sharp struggle in 1868 he became president of the New York Central (between Albany and Buffalo), which in 1869 he combined with the Hudson River road, under the name of the New York Central & Hudson River railroad, of which he became president. His acquisition of the Lake Shore & Michigan Southern railway in 1873 established a through line (controlled by him) between New York and Chicago. At the time of his death (in New York City on the 4th of January 1877) he owned a majority interest in the New York Central & Hudson River, the Lake Shore & Michigan Southern, the Harlem, and the Canada Southern railways, and had holdings in many others, and his fortune was variously estimated at from $90,000,000 to $100,000,000, about $80,000,000 of which he left to his son, William Henry. He made considerable benefactions to Vanderbilt University, and gave $50,000 during his life to the Church of the Strangers in New York.

His eldest son, **William Henry Vanderbilt** (1821–1885), was born in New Brunswick, New Jersey, on the 8th of May 1821. He was a clerk in a New York banking house from 1839 to 1842, when his father bought him a farm of 75 acres near New Dorp, Staten Island, New York. In 1860 he was appointed receiver of the Staten Island railway, of which he was elected president in 1862, and which he brought into connexion with New York by means of a line of ferry-boats. He became vice-president of the Hudson River railway in 1865, vice-president of the New York Central & Hudson River railway in 1869, and president in June 1877, succeeding his father as president of the Lake Shore & Michigan Southern, the Canada Southern, and the Michigan Central railways. He died in New York on the 8th of December 1885. His fortune at the time of his death was estimated at $200,000,000. In 1880 he paid all the expenses ($100,000) incident to the removal of the obelisk ("Cleopatra's Needle") from Egypt to Central Park, New York; in the same year he gave $100,000 to found the Theological School of Vanderbilt University, which his father had endowed. In 1884 he gave $500,000 to found a school of medicine in connexion with the College of Physicians and Surgeons in New York. By his will he left $200,000 to Vanderbilt University, $100,000 to the Domestic and Foreign Missionary Society of the Protestant Episcopal Church, $100,000 to St Luke's Hospital in New York, $100,000 to the Young Men's Christian Association of New York, $100,000 to the Metropolitan Museum of Art in New York, $50,000 to the American Museum of Natural History, $100,000 to the Protestant Episcopal Mission Society of New York, and $250,000 in all to various other religious and charitable organizations and institutions.

William Henry's eldest son, **Cornelius** (1843–1899), became assistant treasurer of the Harlem railway in 1865, and treasurer in 1867; in 1877, after the death of his grandfather, was elected first vice-president of the New York Central, and in 1878 became treasurer of the Michigan Central and vice-president and treasurer of the Canada Southern. In 1883, under a reorganization of the New York Central and Michigan Central railways, he became chairman of the boards of directors of those two systems and their responsible head. His benefactions included $250,000 (1897) for an addition to St Bartholomew's Hospital in New York; to Yale, $1,500,000, part of which was used in building Vanderbilt Hall (a dormitory); and $100,000 to the fund for the building of the Episcopal Cathedral of St John the Divine in New York. To the Metropolitan Museum of Art in New York he presented Rosa Bonheur's "Horse Fair."

See W. A. Croffut, *The Vanderbilts and the Story of their Fortune* (Chicago, Ill., 1886); D. W. Cross, "The Railroad Men of America," in *Magazine of Western History*, vol. viii. (Cleveland, Ohio, 1888); and Burton J. Hendrick, "The Vanderbilt Fortune," in *McClure's Magazine*, vol. xxxii. (New York, 1908–1909).

VANDERLYN, JOHN (1776–1852), American artist, was born at Kingston, New York, on the 15th of October 1776. He was employed by a print-seller in New York, and was first instructed in art by Archibald Robinson (1765–1835), a Scotsman who was afterwards one of the directors of the American Academy. He copied some of Gilbert Stuart's portraits, including one of Aaron Burr, who placed him under Gilbert Stuart as a pupil. In 1796 Vanderlyn went to Paris, and in 1805 to Rome, where he painted his picture of "Marius amid the Ruins of Carthage," which was shown in Paris, and obtained a gold medal there. This success caused him to remain in Paris for seven years, during which time he prospered greatly. In 1812 he showed a nude "Ariadne" (engraved by Durand, and now in the Pennsylvania Academy), which increased his fame. When Aaron Burr fled to Paris, Vanderlyn was for a time his only support. Vanderlyn returned to America in 1815, but did not meet with success; he worked very slowly, and neither his portraits nor various panorama which he exhibited brought him any considerable financial return. In 1842, through friendly influences, he was commissioned by Congress to paint "The Landing of Columbus" for one of the panels in the rotunda of the Capitol at Washington. Going to Paris, he employed to assist him a French artist, who, it is said, did most of the work. He died in absolute want at Kingston, New York, on the 23rd of September 1852. Vanderlyn was the first American to study in France instead of in England, and to acquire accurate draughtsmanship. He was more academic than his fellows; but, though faithfully and capably executed, his work was rather devoid of charm. He painted portraits of Presidents Washington (a copy of Stuart's portrait, for the National House of Representatives), Monroe, Madison, Jackson and Taylor, and of the statesmen Robert R. Livingston (New York Historical Society), John C. Calhoun and George Clinton.

VAN DER STAPPEN, CHARLES (1843–1910), Belgian sculptor, was born in Brussels, September 1843. His first contribution to the Brussels Salon was "The Faun's Toilet" of 1869, and thereafter he began to produce work of a high and novel order in every class of sculpture, and soon, along with Paul de Vigne, became recognized as the leader of the section of the new Belgian school of sculpture which, while aiming at truth to life, allowed itself nevertheless to be inspired by the classic perfection of the art of Greece and the spirit of the Italian Renaissance. Van der Stappen has shown his greatest power in decorative sculpture, such as we see in the decoration on the Palais des Postes, Brussels (1872), as well as the pediment "Orchestration" for the Conservatoire de Musique, and the noble bronze group, "The Teaching of Art," on the façade of the Palace of Fine Arts, Brussels. Among his other decorative work are the statues for the Alhambra Theatre and the caryatides for the house of the architect M. de Curté (1874). His best-known monuments are those to "Alexandre Gendebien" (1874) and "Baron Coppens," at Sheel (1875). His statues include "William the Silent," set up in the Square du Petit Sablon, "The Man with the Sword," and "The Sphinx"—the last two in the Brussels Museum. The bronze group "Ompdrailles" was acquired by the Belgian government (1892). In 1893 the sculptor began his collaboration with Constantin Meunier for the elaborate decoration of the botanical gardens of Brussels, and the result of the connexion may be seen in "The Builders of Cities," a group which might almost have come from his companion, so strongly is it imbued with the sentiment and illustrative of the types of the "socialistic art" of Meunier.

See *Charles van der Stappen*, by Camille Lemonnier; *Les Artistes belges contemporains*, by E. L. de Taye; *The Renaissance of Sculpture in Belgium*, by O. G. Destrée (London, 1895).

VAN DER WEYDEN, ROGER (*c.* 1400–1464), Flemish painter, also known as Roger de la Pasture, Rogier de Bruxelles, &c., was born at Tournay, where in 1427 he entered the studio of Robert Campin. He established himself in Brussels about 1435. He was in Italy in 1449–1450, but his visit shows no result on his style, which owes nothing to Italian models; and he returned to Brussels, where he died on the 18th of June 1464. His vigorous, subtle and expressive painting and popular religious conceptions had considerable influence on the art of Flanders and Germany. Memlinc was his greatest pupil; and his place in the early Flemish school is second only to that of the Van Eycks. He was not a pupil of Jan van Eyck, as was at one time supposed. His principal paintings were: a "Descent from the Cross" (1440), now in Madrid, and another (1443) in the church of St Pierre at Louvain; a triptych (1438–1440), now in the Berlin Museum; "Madonna with Saints" (1450), at the Städel Institute, Frankfort; a "Last Judgment" (1451), in the hospital of Beaune, France; the portraits of Philip the Good (Antwerp Museum) and Charles the Bold (Brussels Museum), painted about 1456–1458; the "Altarpiece of St John" and the triptych from Middelburg (Berlin Museum); an "Entombment of Christ" (National Gallery); a "Woman Crying" (Brussels Museum); "Descent from the Cross" (Louvre); "Adoration of the Magi" (Old Pinakothek at Munich); "Descent from the Cross" (the Hague); "Seven Sacraments" (Antwerp Museum); "Descent from the Cross" (Brussels Museum). Some of these latter, and others, are only doubtfully attributed to the master. The "Crucifixion" in the Brussels Museum, assigned either to him or to Memlinc, and containing portraits of the Sforzas, probably represents Roger van der Weyden in some of the principal figures at least, though Memlinc may have completed the picture.

There was a younger Roger van der Weyden (*c.* 1450–1529), to whom a brilliant "Mary Magdalen" in the National Gallery is attributed.

There are Lives of the elder Van der Weyden by A. Wauters (1856) and Alex. Pinchart (1876).

VANDEVELDE, ADRIAN (1639–1672), Dutch animal and landscape painter, a brother of William Vandevelde (*q.v.*), the marine painter, was born at Amsterdam in 1639. He was trained in the studio of Jan Wynants, the landscape painter, where he made the acquaintance of Philip Wouwerman, who is believed to have aided him in his studies of animals, and to have exercised a powerful and beneficial influence upon his art. Having made exceptionally rapid progress, he was soon employed by his master to introduce figures into his landscape compositions, and he rendered a similar service to Hobbema, Ruysdael, Verboom and other contemporary artists. His favourite subjects are scenes of open pasture land, with sheep, cattle and goats, which he executed with admirable dexterity, with much precision of touch and truth of draughtsmanship, and with clear silvery colouring. He painted a few small but excellent winter scenes with skaters, and several religious subjects, such as the "Descent from the Cross," for the Roman Catholic church in Amsterdam. In addition to his paintings, of which nearly two hundred have been catalogued, he executed about twenty etchings, several of which appear from their dates to have been done in his fourteenth year. They are simple but pleasing in tonality, and are distinguished by great directness of method and by delicacy and certainty of touch. Adrian Vandevelde died at Amsterdam in January 1672.

VANDEVELDE, WILLIAM (1633–1707), the younger, Dutch painter, a son of William Vandevelde, the elder, also a painter of sea-pieces, was born at Amsterdam in 1633. He was instructed by his father, and afterwards by Simon de Vlieger, a marine painter of repute at the time, and had achieved great celebrity by his art before he came to London. In 1674 he was engaged by Charles II., at a salary of £100, to aid his father in "taking and making draughts of sea-fights," his part of the work being to reproduce in colour the drawings of the elder Vandevelde. He was also patronized by the Duke of York and by various members of the nobility. He died in London on the 6th of April 1707. Most of Vandevelde's finest works represent views off the coast of Holland, with Dutch shipping. His best productions are delicate, spirited and finished in handling, and correct in the drawing of the vessels and their rigging. The numerous figures are tellingly introduced, and the artist is successful in his renderings of sea, whether in calm or storm.

Vandevelde was a most prolific artist: in addition to his paintings, of which Smith catalogues about three hundred and thirty, he executed an immense number of drawings, sketches and studies, which are prized by collectors.

VAN DORN, EARL (1820–1863), American soldier, was born near Vicksburg in 1820, and entered the army of the United States from West Point in 1842. For several years previous to the Mexican War he was employed in garrison duty, but in that war he saw a good deal of active service, distinguishing himself at Cerro Gordo and Churubusco, returning to the United States a brevet-major. He also fought in the Seminole War and in 1858 against the Comanches. When his state seceded in 1861 he resigned his commission in the U.S. army, and in the September of that year became major-general C.S.A. He commanded the Confederates in the hard-fought battle of Pea Ridge, but was superseded for failing to win it. Later in 1862 he won promotion and a second independent command in the West, and led the Confederates at the battle of Corinth (the 3rd and 4th of October 1862) at which he came very near to success. In spite of the verdict of a court of inquiry, he was again superseded. As a subordinate of Lieut.-General Pemberton he did splendid service to the Confederate cause in defeating Grant's first advance on Vicksburg at Holly Springs (1862). He was shot in a private quarrel on the 8th of May 1863.

VAN DYCK, SIR ANTHONY (1599–1641), Flemish painter, was born in Antwerp on the 22nd of March 1599. Though the name of Van Dyck is frequently met with in the list of Antwerp painters, Anthony's pedigree cannot be traced beyond his grandparents, who were silk mercers of some standing. He was the seventh of twelve children of Frans Van Dyck, an Antwerp tradesman in good circumstances. His mother, Maria Cupers, who died when he was scarcely eight years of age, seems to have attained a certain degree of excellence in art needlework. Of the boy's early education nothing is known. He was little over ten when he was apprenticed to Hendrick Van Balen, the painter of many delicate little pictures as well as an occasional collaborator of Rubens and Breughel, and the master of Snyders. From a document in the state paper office at Brussels, relating to a lawsuit between a picture dealer and an Antwerp churchman, which arose out of the sale, in 1660, of a series of Apostles' heads ascribed to Van Dyck, it appears that, as far back as 1615, Van Dyck had worked independently, with pupils of his own, and that his pictures were greatly valued by artists and amateurs. Professor Woermann has identified several of the Apostles' heads here spoken of with some paintings in the gallery at Dresden. Another is in the possession of Earl Spencer at Althorp.

Before he was nineteen (February 1618) Van Dyck became a full member of the Antwerp gild of painters; and some idea of his ability at the time may be gained from the excellent portraits of an old lady and gentleman, formerly ascribed to Rubens, in the Dresden gallery. Dated 1618, they were originally entered as works of Van Dyck, and, as Professor Woermann observes, are undoubtedly the same as those spoken of by Mols in his MS. annotations on Walpole's *Anecdotes*, now in the library at Brussels. But the same admiration cannot be accorded to the earliest religious composition known to have been painted by him—"Christ falling under the Cross," in St Paul's at Antwerp. This picture, of some ten life-size figures, still preserved in the place for which it was originally destined, distinctly proves that from the outset of his career Van Dyck's power of conception was vastly inferior to his refined taste as a portrait painter. At first sight it seems also that with him, as with most other Flemish painters of the period, every conception, whether sacred or profane, needed to be cast in the mould of Rubens. It would be too much, however, to assert that Van Dyck at this time stood under the guidance of that master; their association, indeed, does not seem to have begun until 1619, and Bellori (1672), who got his information from Sir Kenelm Digby, Van Dyck's bosom friend, tells us that he was first employed in making drawings (probably also chiaroscuros) for the use of the great master's engravers, and that among works of the kind one of the first was the "Battle of the Amazons" (1619).

In 1620, we know, Van Dyck was working with Rubens, for on 20th March, in making arrangements with the Antwerp Jesuits for the decoration of their church, the master is allowed to avail himself of his pupil's assistance, and obtains for him the promise of a picture. This proof of Van Dyck's personal reputation is fully confirmed (17th July) by a correspondent of the earl of Arundel, who speaks of Van Dyck as a young man of one-and-twenty whose works are scarcely less esteemed than those of his master, and adds that, his relations being people of considerable wealth, he could hardly be expected to leave his home. Van Dyck was, however, thus persuaded, for on 28th November Sir Toby Mathew mentions the artist's departure to Sir Dudley Carleton, adding that he is in receipt of an annual pension of £100 from the king. There is evidence of Van Dyck's presence in London till the end of February 1621. He is first mentioned in the order-books of the Exchequer on the 17th of that month as receiving a reward of £100 "for special service by him performed for His Majesty," and on the 28th, "Antonio van Dyck, gent., *His Majesties servant*, is allowed to travaile 8 months, he havinge obtayneid his Ma^ties leave in that behalf, as was signified by the E. of Arundell." What Van Dyck did in London is not known. Among his numerous paintings still preserved in English houses one only is admitted as belonging to the period of this first visit, a full-length portrait of James I. in the royal collection. That he was at the time a portrait painter of the rarest merit may easily be seen from the portrait of "Van der Geest" in the National Gallery (London), and from his own likenesses of himself when still quite young and beardless, in the National Gallery, in the Pinakothek at Munich and in the Wallace Collection. In this last admirable specimen the young painter has represented himself in the character of Paris. Early paintings by Van Dyck are certainly not scarce in British galleries; at Dulwich there is his admirable Samson and Delilah, ascribed to the school of Rubens.

Though the leave of absence was probably obtained by Van Dyck for the purpose of studying the masters in Italy, the eight months had almost elapsed before he started from Antwerp, whither he had gone from London. He left Antwerp on the 3rd of October 1621, and arrived at Genoa on the 21st of November of the same year. Though Van Dyck unquestionably first became acquainted with the masterpieces of the great Venetian colourists in Rubens's *atelier*, there can be little doubt that most of the pictures which were formerly ascribed to his earliest period really date from the years of his Italian journey. In fact, studies for some of them can be found in the Chatsworth sketch-book. Among these early works are the "Martyrdom of St Peter" (Brussels), the "Crowning with Thorns" (Berlin), the "Betrayal of Christ" (Madrid and Lord Methuen), "St Martin dividing his Cloak" (Windsor Castle),—a magnificent production, generally ascribed to Rubens, but easily identified through Van Dyck's admirable sketch at Dorchester House.

It is unnecessary to dwell on a number of tales connected with Van Dyck's early life, all of which have on closer examination proved to be apocryphal; but one story has been too frequently told to be altogether ignored. At the very outset of his Italian journey the inflammable youth was captivated by the beauty of a country girl, and for the love of her painted the altar-piece still to be seen in the church at Saventhem, near Brussels, in which he himself is supposed to be represented on a grey horse, given by Rubens to his pupil. It is now known, however, that the picture was commissioned by a gentleman living at Saventhem (to the charms of whose daughter Van Dyck in reality seems not to have been altogether insensible), and a closer study makes it almost certain that it was executed after, not before, his Italian journey. On a reduced scale, and with the omission of two or three figures, the "St Martin" at Saventhem is a reproduction of the picture at Windsor Castle.

With the exception of a short visit to Antwerp at the time of his father's death in 1622, Van Dyck spent the next five years in Italy. No master from beyond the Alps ever took up a higher position than Van Dyck among the most celebrated representatives of Italian art. Study, as a matter of course, had been one of his principal objects. No doubt can be entertained as to the great influence exerted by the works of Titian, Paul Veronese and the other great masters of the Venetian school in the development of his genius; still the individuality of the painter remains a striking feature of what may be termed his Italian works, especially portraits. Their peculiar character seems to originate even more in the stateliness of the personages he was fortunate enough to have as sitters than in any desire to follow individual predilection or prevailing fashion. As in later years Van Dyck gives us a striking picture of the higher classes in England, so at this stage he makes us acquainted with Italian beauty and style; and at no other period is his talent more advantageously shown than in some of the glorious portraits he painted at Rome, at Florence, and, above all, at Genoa. At Rome, whither he journeyed after a prolonged stay in Venice, he resided with Cardinal Guido Bentivoglio, who had been papal nuncio in Flanders from 1607 to 1617. For this patron were painted several works of very great importance, the most renowned being the prelate's own portrait, now in the Pitti Palace at Florence. Another work was a "Crucifixion," representing Christ dying on the cross with uplifted eyes. Most probably the picture spoken of by Bellori ought to be identified with the admirable canvas now in the gallery at Naples, catalogued as "Scuola di Van Dyck," unsurpassed by any of those at Antwerp, Paris, Vienna, Rome or elsewhere. Besides these he painted religious subjects and portraits, several of which are reckoned among his finest examples, such as the portrait of Duquesnoy, better known as Fiammingo, the famous sculptor, formerly belonging to the king of the Belgians, and those of Sir Robert Shirley and his wife, in Persian attire, now at Petworth.

Bellori tells us of Van Dyck's prepossessing appearance, of his elegance and distinction, altogether so different from the habits of his compatriots in Rome, who formed a jovial "gang," as they termed their association. Van Dyck seems to have kept out of their way, and incurred in consequence such annoyance as made his stay in Rome much shorter than it would otherwise have been. In the company of Lady Arundel he travelled to Turin, but he was eager to reach Genoa, where Rubens had worked with great success some twenty years before, and where his Antwerp friends, Luke and Cornelis de Wael, for many years resident in Italy, now were. Van Dyck remained their guest for several months, and their portraits, now in the Pinacoteca Capitolina at Rome (engraved by W. Hollar from the monochrome at Cassel), may be supposed to have been one of his first Genoese productions. Though several of the palaces of the "proud" city no longer retain their treasures, and, among the specimens of Van Dyck's genius still left, too many have been greatly injured by cleaning and retouching, Genoa can still boast of a good number of his most attractive productions, portraits of the beautiful ladies and haughty cavaliers of the noble houses of Doria, Brignole Sale, Pallavicini, Balbi, Cattaneo,[1] Spinola, Lommelini and Grimaldi. It would scarcely be possible to speak too highly of such works as the portrait of the lady in white satin and the Durazzo children at the Durazzo Palace, the Balbi children at Panshanger, the Marchesa Balbi at Dorchester House, the equally beautiful portraits of the Lommelini and of the knight in black armour, buff jacket and boots in the Scottish National Gallery at Edinburgh, or the Marchesa Brignole Sale (formerly at Warwick Castle, and afterwards in America). Van Dyck's "Genoese manner" is a current expression, and indeed his Genoese portraits are remarkable for their richness of tonality and what might be called royal splendour, perhaps never before attained in works of the kind. This we may suppose to have had its origin, not only in his recent study of Titian, but also in decorative necessities—the size of the palatial galleries and the rich hues of the Genoese velvets, on which these portraits were to find their place, obliging the painter to find a most uncommon strength of contrast. It must also be acknowledged that the beauty and distinction of Van Dyck's models are greatly enhanced by a splendour of costume entirely different from the dullness then prevalent almost everywhere else. In Italy, moreover, he found the reality of those gorgeous backgrounds—flowing draperies, beautiful gardens, ornamental pillars, marble terraces and balustrades—which elsewhere must be regarded as fictions merely. Here, finally, he was for the first time called upon to paint some of his grandest equestrian portraits, and the often-recurring grey steed with flowing mane (an admirable study of which belongs to Lord Brownlow) was first employed for the portrait of Antonio Giulio Brignole (still at Genoa) and for another picture which we may suppose to represent the same personage at Stafford House. As with Rubens, Titian seems to have been paramount in Van Dyck's regard. Copies in great number we know he possessed of the master's best works, and several little sketches in the British Museum and in the Chatsworth sketch-book bear proof of his devout study of the great Venetian. Some of Van Dyck's earlier paintings, religious and mythological—the "Tribute Money" (Brignole Palace), "Holy Family" (Turin), "Virgin and Saints" (Louvre), "Virgin" (Grosvenor House), "Martyrdom of St Lawrence" (S. Maria dell' Orto, Venice), "Bacchanal" (Lord Belper)—engraved at Genoa as early as 1628—"St Sebastian" (Edinburgh)—are certainly Titianesque in the extreme. Still the master's individuality is not obliterated, and the gallery at Parma has a "Virgin with the Infant Asleep," which may be termed a marvel of realistic simplicity.

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[1] Of the Cattaneo portraits, originally eight in number, seven were privately sold out of Italy in 1906, and in the following year one, a half-length "Portrait of a Man," was acquired for the National Gallery, London, for £13,500. The official acquisition

In 1624 Van Dyck sailed from Genoa to Palermo and there painted several persons of rank, including the viceroy, Emmanuel Philibert of Savoy. While in Sicily he became acquainted with the painter Sofonisba Anguisciola (or Angussola), who was then ninety-six years of age and blind; and he was wont to say that he had received more valuable information from a blind woman than from many a seeing man. No important works of Van Dyck are now to be found in Sicily, except the "Virgin and Child" at S. Caterina in Palermo, and a "Virgin and Child with Saints" in the same city. Bellori tells us that a plague broke out and compelled him to leave abruptly, taking with him an unfinished picture of St Rosalia, which was destined for a confraternity of that name, and was completed in Genoa. The composition was repeated in Antwerp for the Bachelors' Brotherhood, a picture now in Vienna. Van Dyck most probably remained in Genoa till 1626, and here in all likelihood he painted the De Jodes, father and son, the celebrated engravers, who are represented together in a masterly portrait in the Capitol at Rome, the companion picture to the brothers De Wael; and Nicholas Lanière, musician-in-chief to Charles I., a painting spoken of in Van der Dort's catalogue as "done beyond the seas." Lanière was in Italy precisely at this time, and it was through his portrait (now at Windsor Castle), Walpole assures us, that Van Dyck attracted the notice of Charles I.

Traversing the Mont Cenis pass, Van Dyck stopped at Aix with Peiresc, the famous scholar and friend of Rubens, and probably proceeded straight to Antwerp. His beautiful portrait of Langlois, the Paris print-seller, from which it was conjectured that he spent some time at Paris, was unquestionably painted in Genoa. It is very likely that, before settling again at Antwerp, Van Dyck at this time paid a second visit to England, to paint a portrait of Queen Henrietta Maria, but left again when he found Mytens firmly established as court favourite. He probably returned to Antwerp in 1627, though there is no recorded proof of his presence before the 3rd of March 1628. One of his sisters had died in a convent the year before, and he now made a will in favour of Susan and Isabella, two other sisters, also nuns. That Van Dyck was in Antwerp on the 18th of May is proved by a letter from Lord Carlisle to Buckingham (Sainsbury, ciii.).

Great as may have been the strength of Italian reminiscence, from the moment Van Dyck again trod Flemish soil the influence of Rubens became predominant, and we can scarcely doubt that a competition speedily arose between master and pupil. At this period churches and convents were numerous and richly endowed; and the number of pictures, stained glass windows and elaborate carvings in Belgian churches before the French conquest was enormous. Hardly fifty years had elapsed since these buildings had been stripped of their artistic treasures, and the devout were now eager once more to adorn them with productions of the greatest painters. Hence Van Dyck's share could be very copious without in any degree interfering with the vast undertakings assigned to Rubens. The latter was also absent for many months in 1629 and 1630, so that Van Dyck was for a time the first master in the Netherlands. Among the earliest works after his return to Antwerp we find the "Crucifixion," given to the Dominican nuns, in accordance with the wish expressed by the painter's dying father, and now in the Antwerp museum. The figures are life-size, and at the foot of the cross, besides a weeping angel, are St Catherine of Siena and St Dominic. Neither in type nor in general effect does it suggest the master's immediately preceding works. As a new feature we observe a kind of elegance, not entirely free from mannerism, which is often conspicuous with Van Dyck even when the technical excellence commands our warmest admiration. Inspiration, as Waagen observes, was far more limited with Van Dyck than with Rubens. His truly delicate nature led him to restrain his conceptions within the bounds of an academic evenness, generally more pleasing to the uninitiated than the strength of expression which sometimes imparts a sort of violence to the works of Rubens. To Van Dyck's second—more justly speaking third—manner belong some of his best religious works. The "Crucifixion" in the cathedral at Mechlin is termed by Sir Joshua Reynolds one of the finest pictures in the world. Other Crucifixions are in St Michael's at Ghent (sketches in Lord Brownlow's collection and the Brussels museum) and in the church at Termonde. Still finer are the two works painted for the Antwerp Jesuits and now at Vienna—"The Mystic Marriage of the Blessed Herman Joseph" and "St Rosalia Crowned by the Infant Saviour." To this period likewise belong the celebrated "Elevation of the Cross" at Courtrai and the "St Augustine in Ecstasy," in the church of the Jesuits at Antwerp; the general effect of this last, it must be acknowledged with Reynolds, is inferior to that of the beautiful engraving by De Jode, and also to the earl of Northbrook's magnificent sketch. At Dulwich we find the first idea of the composition, with many interesting differences. It may be a matter of individual preference to pronounce Van Dyck's Flemish portraits superior to those of an earlier period; but nobody can fail to admit that, technically speaking, they indicate a further step towards perfection. The darkness of the Genoese portraits has vanished; broad daylight now freely illuminates the model, and such works as the portraits of Francisco de Moncada (Louvre) and of the Count de Bergh (Prado) are perhaps as close to material excellence as any painting could be. The full-length likenesses of Philip Le Roy (1630) and his wife

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of this picture, in view of the Italian law of 1902, created considerable discussion in Italy and England. The companion female portrait was soon after also purchased.

(1631) (Wallace Collection) and of Mary Louisa of Tassis (Prince Liechtenstein, Vienna) are not only the finest examples of the master's talent, but deserve to rank among the most beautiful portraits ever painted. The "Snyders" at Castle Howard is regarded by Waagen as not inferior to the most celebrated Raphaels, Titians or Holbeins; and of almost equal excellence are the "Wife of Colin de Nole" in the Munich gallery, the "Lady and her Daughter" at the Louvre, and the "Lady in Black" at Cassel.

Rapidly rising to honour and wealth, Van Dyck shared with Rubens the official title of court painter, and his numerous portraits of the infanta in her monastic garb (Paris, Vienna, Turin, Parma, &c.) bear testimony to the great favour in which he stood with her. When Marie de Medicis, after her flight from France, took up her residence in Brussels (1631), she honoured Van Dyck, as well as Rubens, with repeated visits, and several times called upon him to paint her likeness, as well as those of Gaston of Orleans and his wife Margaret of Lorraine, and several of the personages of their court. From Gerbier's letters we learn that Van Dyck at this time was contemplating another journey to England, and was very anxious to be commissioned by the infanta and the queen of France to take over their portraits as presents for the king and royal family. He soon travelled to the Hague to paint the prince and princess of Orange and their son. Quite at the beginning of 1632 Constantine Huygens, who was then living at the Hague, inscribes in his diary, "Pingor a Van Dyckio." When, towards the end of March, Van Dyck sailed for England, he took all these portraits with him, as we learn from an account of the 8th of August 1632 (Carpenter's *Pictorial Notices*). Dutch authors speak of a visit paid by Van Dyck to Frans Hals at Haarlem, and of a portrait of the latter through which the Antwerp master was at once recognized by his Dutch colleague. An engraving of a portrait of Hals after Van Dyck seems to confirm the story.

In undertaking this new journey to London, Van Dyck was assured of success, for Gerbier's letters show that the king had personally desired his presence. As early as March 1629 Endymion Porter, one of the gentlemen of the king's bedchamber, had been commissioned to order a picture from Van Dyck, "Rinaldo and Armida." The canvas, now belonging to the duke of Newcastle, may be looked upon as one of the master's finest creations. Exceptional favours were bestowed upon Van Dyck almost from the day of his arrival in London. Besides the title of painter in ordinary, and the grant of an annual pension of £200, he received the honour of knighthood after a residence of less than three months at court (5th July 1632). He rapidly achieved popularity among the higher classes, and, as Walpole says, his works are so frequent in England that to most Englishmen it is difficult to avoid thinking of him as their countryman.

His refined nature is strikingly illustrated in his admirable interpretation of English beauty and style. And, if Van Dyck be compared to Mytens and Cornelius Janssen, the most distinguished painters employed by the English court immediately before him, few artists, whether in England or elsewhere, have more richly endowed their models with distinction of feature and elegance in bearing. To him may be applied what Opie says of Titian, "that he combines resemblance with dignity, costume with taste, and art with simplicity." We are particularly struck with the thorough and immediate identification of his talent with local tastes and exigencies. Charles I. and Henrietta Maria, although pictured by several other painters, are known to posterity almost exclusively through Van Dyck, not from a greater closeness of resemblance to the original, but from a particular power of expression and bearing which, once seen, it is impossible to forget. The artist was lodged at the expense of the crown, with a summer residence at Eltham Palace, and was frequently honoured with the visits of the king at his studio at Blackfriars. Portraits now followed each other with a rapidity scarcely credible to those unacquainted with the artist's method. In fact, his mode of living and his love of pleasure sufficiently explain his great need of money. During the first year of his presence in England he painted the king and queen a dozen times. The first of these noble portraits is the admirable full-length of Charles I., with the queen and their two eldest children, at Windsor Castle. The style he adopted in England is generally termed his third manner; we might better say his fourth, as he already had a very particular style before he set out on his Italian journey. De Piles gives us some account of Van Dyck's methods at this period of his career. He began with a small sketch on grey paper with black and white chalks, or a monochrome in oils. This study was passed on to assistants in order to be copied on the required scale. When the clothes were sufficiently advanced by the pupils from those sent by the model, as well as the background and accessories, the master was enabled in a few sittings of an hour each to complete the work. Van Dyck excelled in painting the hands; he is said to have kept special models for this part of his work. It need hardly be said that a system of this kind, although employed by Rubens for his larger creations, was exceedingly ill adapted to portrait painting. In Van Dyck's later productions we too often detect marks of haste, as if the brush were becoming a mere implement of trade.

Nearly the whole of 1634 and 1635 were spent by Van Dyck in the Netherlands, whence his brother, an Antwerp priest, had been called over by the queen to act as her chaplain. The archduchess died on 1st December 1633, and Van Dyck naturally wished to get his official title renewed by her successor, Ferdinand of Austria, brother of Philip IV. That Van Dyck's residence in Antwerp was only to be temporary is shown by the power given to his sister Susan for the administration of his affairs in Belgium (14th April, 1634). On the arrival of the new governor Van Dyck was immediately called upon to paint his likeness, a picture now in the Madrid gallery, where the same personage is also represented by Rubens and Velazquez. Several other portraits of Ferdinand, either in his cardinal's robes or in military dress, by Van Dyck, occur elsewhere. One on horseback was exhibited at the Grosvenor Gallery, London, in 1887, as the duke of Alva (lent by Mr S. Kynaston Mainwaring). Van Dyck was greatly in demand at this time, and his prices were correspondingly high, as the Antwerp municipality found when they asked for a portrait of the late infanta to decorate one of the triumphal arches for the reception of the new governor. The most important of Van Dyck's works, at any rate as a portrait painter, belong to this period. The picture representing in life-size the members of the Brussels corporation, which was destroyed by fire during the siege of 1695, is spoken of with intense admiration by several writers. Bullart, for instance, is very enthusiastic about its fine colour and life-like qualities. Among the religious paintings of undisputed excellence belonging to the same period are the "Adoration of the Shepherds" in the church at Termonde, and the "Deposition," where the body of Christ rests upon the lap of the Virgin, in the Antwerp museum. Among the portraits are the admirable full-length of Scaglia, the king's frequent agent in the Netherlands (at Dorchester House; a replica in the museum at Antwerp), the equestrian portrait of Albert of Arenberg (Arenberg Palace at Brussels), and a portrait of the same nobleman on foot, in the black velvet Spanish dress with golden chamberlain's key (long said to be Rubens) at Althorp, the full-length of Helena Fourment, Rubens's second wife (at St Petersburg), the beautiful duchess of Havre, Mary Clara de Croy, signed and dated 1634 (Mr Ayscough Fawkes), and other members of the same family (at Munich), Thomas of Savoy (at Berlin), an admirable half-length of a lady in black (in the Vienna gallery), and above all the grandiose picture in which John of Nassau is represented at full-length, with his wife and children (at Panshanger). Several portraits of Brussels and Antwerp magistrates must also be mentioned, the most important being John Van Merstraeten, a Brussels lawyer (at Cassel).

After being chosen honorary president of the Antwerp gild of St Luke, Van Dyck returned to London before the end of 1635. In spite of the vast number of his later portraits, some of them deserve to be ranked among the most celebrated of his productions. The group of three English royal children in the gallery at Turin (1635), the portraits of Charles I. in the Louvre and in the National Gallery, London, the picture of the Pembroke family at Wilton House, Sir George and Sir Francis Villiers, and the earls of Bristol and Bedford, at Althorp, as well as those of Francis Russell, fourth earl of Bedford, and Anne Carr, his consort, at Woburn Abbey (1636), all belong to the years immediately following the master's return from the Netherlands.

He now married Lady Mary Ruthven, daughter of Sir Patrick Ruthven and granddaughter of the earl of Gowrie. There are several portraits of her by her husband, the most important being in the Munich gallery, in which she is represented in white satin, playing on the violoncello. She is also said to figure as the Virgin in a picture belonging to Lord Lyttelton. There is a capital engraving of her by Bolswert. In another picture, said to be Mary Ruthven, an exceedingly handsome lady is represented as "Herminia Putting on Clarinda's Armour." There can be no doubt as to the model having been Margaret Lemon, a celebrated beauty, whose portrait was engraved by W. Hollar and J. Morin and painted by Van Dyck at Hampton Court. "She was," says Mr Ernest Law, in his excellent catalogue of this gallery, "the most beautiful and celebrated, though far from being the only mistress of Van Dyck. The great artist, in fact, loved beauty in every form, and found the seduction of female charms altogether irresistible. She lived with him at his house at Blackfriars." The precise date of Van Dyck's marriage has not been ascertained. It was probably towards the end of 1639. The union is said to have been promoted by the artist's friends in order to save him from the consequence of his pernicious way of living. Margaret Lemon resented the event most cruelly, and tried to maim Van Dyck's right hand.

Van Dyck found few occasions in England to paint anything but portraits. There exists at Belvoir Castle a sketch by him representing a procession of the knights of the Garter, a really grandiose composition, engraved by Cooper. We know from Bellori that Van Dyck had suggested, through his friend Sir Kenelm Digby, for the banqueting-room at Whitehall, a series of decorations illustrating the history of the order of the Garter, and that the king had been much pleased with the idea. The plan, however, failed through the excessively high price asked by the painter, and perhaps also because the king had thought of having the work done in tapestry. Van Dyck's pension was five years in arrear, and, instead of £560, he received finally, besides his pension, only £200.

When the news of Rubens's death reached London (June 1640) Van Dyck contemplated a return to his native country, and a letter from Ferdinand of Austria to Philip IV. speaks of his intended journey to Antwerp on St Luke's Day (18th October). Rubens had left unfinished a series of paintings commanded by the king of Spain, and from correspondence published by Professor Justi we learn that Van Dyck had been thought of to give them the finishing touch. But he absolutely refused to finish them. It was then agreed that he should paint an independent canvas destined to complete the series. Van Dyck was delighted with this order, and Ferdinand tells his brother that he returned to London in great haste "to make preparations for his change of residence; possibly," adds the letter, "he may still change his mind, for he is stark mad." Whether Van Dyck found it possible to work during his short stay in the Netherlands is a matter of doubt. Most authors suppose that Van Dyck's principal object in travelling to the continent was to be entrusted with the decoration of one of the galleries of the Louvre. There may be some truth in this, for Mariette speaks of a letter he saw, written by Claude Vignon, the French painter, in January 1641, asking Langlois for an introduction to Van Dyck, who was then in Paris. Unfortunately the great painter was thwarted in his aspirations. His health was beginning to fail. After his return to London he was frequently obliged to interrupt his work; and a letter written (13th August) from Richmond by Lady Anne Roxburgh to Baron W. van Brederode at the Hague states that the portraits of the Princess Mary had been greatly delayed through Van Dyck's illness, and that the prince's (William II. of Orange) would be ready in eight days. "As Van Dyck intends leaving England in the course of ten or twelve days at latest," she adds, "he will take the paintings himself to the princess of Orange." These portraits, now in the museum at Amsterdam, are the last Van Dyck painted in England. Of works dated 1639 the portrait of Lady Pembroke, in the gallery of Darmstadt, is a fine example; and to the same year belongs a full-length portrait of Arthur Goodwin at Chatsworth. The twin portrait of Thomas Carew and Thomas Killigrew, in the royal collection, dated 1638, is certainly most delicate, but very weak in tone and slight in handling. Van Dyck sailed in September, and probably spent some time with his Antwerp friends. Early in November he reached Paris, and succeeded in obtaining some important work, when, on 16th November, he was compelled to resign his commissions on account of the state of his health. Scarcely three weeks later (9th December 1641) he died at his residence at Blackfriars. Van Dyck was buried in old St Paul's, where a Latin inscription was placed on his tomb by Charles I.

An elegy in Cowley's *Miscellanies* speaks, not only of the painter's talent, but of his amiable disposition. We may perhaps point to the coincidence that a Mrs Cowley is in Van Dyck's will (of 1st December) named guardian of his child, Justiniana Anna, born only eight days before her father's death. The painter had in the Netherlands an illegitimate daughter, Maria Theresia, who was entrusted to his sister, and to whom he bequeathed £4000. The name of her mother is not known. Not long after her husband's death Lady Van Dyck became the second wife of Sir Richard Pryse of Gogerddan in Cardiganshire. She was dead in 1645. Justiniana Van Dyck, who was married when scarcely twelve years old to Sir John Stepney of Prendergast, was also something of an artist: she painted a "Crucifixion," with four angels receiving Christ's blood in chalices. A similar subject had been painted by Van Dyck, as Bellori tells us, for the duke of Northumberland. After the Restoration a pension of £200 for life was granted to Justiniana Van Dyck, who died before 1690.

Properly speaking, Van Dyck cannot be said to have formed a school. He was followed to London by some of his earlier collaborators, and there soon met a considerable number of others. Jan van Reyn, David Beek, Adrian Hanneman, Mathew Merian, John Bockhorst (Lang Jan), Remy van Leemput and Peter Thys were foremost among foreigners, Henry Stone and William Dobson among Englishmen. To their assistance the master owed much; but they are also responsible for the vast number of constantly recurring copies which go by his name. It often requires a very discriminating eye to distinguish some of these copies from the original paintings. Nevertheless, after Van Dyck's death many of his coadjutors produced works of undeniable merit. No school more strikingly reflects the influence of Van Dyck than the British school. Stone and Dobson were, properly speaking, the most fortunate of his continuators; and there is little doubt that such masters as Reynolds, Gainsborough, Lawrence and Raeburn owe a large measure of their superiority to their study of his works.

Though Van Dyck's reputation greatly suffered through the numerous copies he allowed his pupils to take from his works, the case is otherwise with engraving: Vorsterman, Pontius, Peter de Jode, P. Balliu and S. Bolswert were seldom more fortunate than when under his guidance. De Jode's "St Augustine," Bolswert's "Ecce Homo" and "Crucifixion," Vorsterman's "Deposition," and especially Pontius's "Herman Joseph" rank among the masterpieces of the art of engraving. Van Dyck was himself an incomparable etcher, and with the needle arrived at a degree of excellence scarcely inferior to that exhibited in his paintings. Such prints as the portraits of Vorsterman, John de Wael, Snyders, Josse de Momper, Adam van Noort, and above all his own effigy, bear witness to his prodigious knowledge of design. Print collectors pay extravagant prices for a first proof taken from the plates engraved by Van Dyck himself. Van Dyck also employed some of the best engravers of his time for the production of a gallery of illustrious heads, men and women, of different countries. Whether all were taken from life is questionable. Gustavus Adolphus and Wallenstein he can hardly have met. Du Breucq, the architect, he never knew. But all the sketches and drawings were done by himself, and are often met with in public and private galleries. The engravings are sometimes very beautiful and in their first states very rare. Published successively by Martin van der Enden, Giles Hendrickx and John Meyssens, the collection originally consisted of sixteen warriors and statesmen, twelve scholars and fifty-two artists. Hendrickx raised the number to ninety-nine, and used as a frontispiece the portrait of Van Dyck, with the following inscription: *Icones principum, virorum doctorum, &c. &c., numero centum ab Antonio Van Dyck pictore ad vivum expressae eiusq. sumtibus aeri incisae*, 1645. Seventeen editions were published, the last in 1759, with 124 plates. Many of the plates are the property of the French Government, and belong to the Chalcographie Nationale in Paris.

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VANE, SIR HENRY (1589–1654), English secretary of state, eldest son of Henry Vane or Fane, of Hadlow, Kent, a member of an ancient family of that county, by his second wife, Margaret, daughter of Roger Twysden of East Peckham, Kent, was born on the 18th of February 1589. He matriculated from Brasenose College, Oxford, on the 15th of June 1604, was admitted to Gray's Inn in 1606, and was knighted by James I. on the 3rd of March 1611. He purchased several offices at court, was made comptroller of the king's household about 1629, and in spite of a sharp quarrel with Buckingham managed to keep the king's favour, in 1639 becoming treasurer. He was returned to parliament in 1614 for Lostwithiel, from 1621 to 1626 for Carlisle, in 1628 for Retford, and in the Short and Long Parliament, assembled in 1640, he sat for Wilton. He was despatched on several missions in 1629 and 1630 to Holland, and in 1631 to Gustavus Adolphus to secure the restitution of the Palatinate, but without success. In 1630 Vane had become a privy councillor and one of the chief advisers of the king. He was made a commissioner of the Admiralty in 1632 and for the colonies in 1636. He was one of the eight privy councillors appointed to manage affairs in Scotland on the outbreak of the troubles there, and on the 3rd of February 1640, through the influence of the queen and of the marquis of Hamilton and in opposition to the wishes of Strafford, he was made secretary of state in the room of Sir John Coke. In the Short Parliament, which assembled in April, it fell to Vane, in his official capacity, to demand supplies. He proposed a bargain by which the king should give up ship-money and receive in return twelve subsidies. Parliament, however, proved intractable and was dissolved on the 5th of May, to prevent a vote against the continuance of the war with the Scots. In the impeachment of Strafford, Vane played a very important part and caused the earl's destruction. He asserted that Strafford had advised the king at a meeting of the privy council, "You have an army in Ireland; you may employ it to reduce this kingdom." He refused to admit or deny the meaning attributed by the prosecution that "this kingdom" signified England; he was unsupported by the recollection of any other privy councillor, and his statement could not be corroborated by his own notes, which had been destroyed by order of the king, but a copy obtained through his son, the younger Vane, was produced by Pym and owned by Vane to be genuine. He was on bad terms with Strafford, who had opposed his appointment to office and who had given him special provocation by assuming the barony of Raby, a title ardently desired by Vane himself. He was not unnaturally accused of collusion and treachery, and there is no doubt that he desired Strafford's removal not only on private but on public grounds, believing that his sacrifice would satisfy the demands of the parliament. Nevertheless, there has appeared no evidence to support the charge that he deliberately compassed his destruction. Suspicions of his fidelity, however, soon increased, and after having accompanied the king to Scotland in August 1641, he was dismissed from all his appointments on the 4th of November on Charles's return. Vane immediately joined the parliament; on Pym's motion, on the 13th of December, he was placed on the committee for Irish affairs, was made lord lieutenant of Durham on the 10th of February 1642, became a member of the committee of both kingdoms on the 7th of February 1644, and in this capacity attended the Scots army in 1645, while the parliament in the treaty of Uxbridge demanded for him from Charles a barony and the repayment of his losses. He adhered to the parliament after the king's death, and in the first parliament of the Protectorate he was returned for Kent, but the House had refused to appoint him a member of the council of state in February 1650. He died in 1654. He had married Frances, daughter and co-heir of Thomas Darcy of Tolleshurst Darcy in Essex, by whom he had a large family of children, of whom the eldest son, Sir Henry Vane, the younger, is separately noticed.

Clarendon invariably speaks of Vane in terms of contempt and reproach. He describes him as merely fit for court duties, "of very ordinary parts by nature and . . . very illiterate. But being of a stirring and boisterous disposition, very industrious and very bold, he still wrought himself into some employment." He declares that motives of revenge upon Strafford influenced not only his conduct in the impeachment but his unsuccessful management of the king's business in the Short Parliament, when he "acted that part maliciously and to bring all into confusion." The latter accusation, considering the difficulties of the political situation and Vane's total want of ability in dealing with them, is probably unfounded. On the general charge of betraying the king's cause, Vane's mysterious conduct in the impeachment, his great intimacy with Hamilton, and the favour with which he was immediately received by the Opposition on his dismissal from office, raise suspicions not altogether allayed by the absence of proof to substantiate them, while the alacrity with which he transferred himself to the parliament points to a character, if not of systematic treachery, yet of unprincipled and unscrupulous time-serving. Materials, however, to elucidate the details and motives of his ill-omened career have hitherto been wanting.

VANE, SIR HENRY (1613–1662), English statesman and author, known as "the younger" to distinguish him from his father, Sir Henry Vane (*q.v.*), was baptized on the 26th of May 1613, at Debden, Essex. After an education at Westminster, where he was noted for his high and reckless spirits, and at Magdalen Hall, Oxford, where he neither matriculated nor took his degree, he was attached to the embassy at Vienna and at Leiden and Geneva. He had already acquired strong Puritan views which, in spite of the personal efforts of Laud, who made the attempt at the king's request, he refused to give up. In 1635, in order to obtain the free exercise of his religion, he emigrated to Massachusetts, where he was elected governor in 1636. After one year in office, during which he showed some administrative ability, he was defeated by Winthrop, the former governor, chiefly on account of the protection he had given to Mrs Hutchinson in the religious controversies which she raised. He, however, never lost his interest in the colonies, and used his influence hereafter on several occasions in their support.

Vane returned to England in August 1637. He was made joint-treasurer of the navy with Sir W. Russell in January 1639, was elected for Hull in the Short and Long Parliaments, and was knighted on the 23rd of June 1640. Accidentally finding among his father's papers some notes of Strafford's speech in the council of May 5, 1640, he allowed Pym to take a copy, and was thus instrumental in bringing about Strafford's downfall. He carried up the impeachment of Laud from the Commons, was a strong supporter, when on the committee of religion, of the "Root and Branch" bill, and in June 1641 put forward a scheme of church government by which commissioners, half lay and half cleric, were to assume ecclesiastical jurisdiction in each diocese. During the absence of Pym and Hampden from the House at the time of Charles's attempted arrest of the five members, Vane led the parliamentary party, and was finally dismissed from his office in December 1641, being reinstated by the parliament in August 1642. The same month he was placed upon the committee of defence. In 1643 he was the leading man among the commissioners sent to treat for a league with the Scots. Vane, who was bitterly opposed to the tyranny of the Presbyterian system, was successful in two important points. The aim of the Scots was chiefly the propagation of their discipline in England and Wales, and for this they wanted only a "covenant." The English desired a political "league." Vane succeeded in getting the bond termed the Solemn League and Covenant, and further in substituting the whole expression "*according to the word of God and* the example of the best Reformed churches" for the latter part alone. He succeeded to the leadership of the party on Pym's death. He promoted, and became a chief member of, the committee of both kingdoms established in February 1644, and was sent to York in the summer of the year to urge Fairfax and Manchester to march against Prince Rupert, and secretly to propose the king's deposition. In 1645 he was one of the negotiators of the treaty of Uxbridge. He was, with Cromwell, a prime mover in the Self-Denying Ordinance and the New Model, and his adherence to the army party and to religious tolerance now caused a definite breach with the Scots. Vane had at the Westminster Assembly, writes Baillie indignantly, "prolixly, earnestly and passionately reasoned for a full liberty of conscience to all religions," a policy directly opposed to Presbyterianism, and his leadership terminated when the latter party obtained the supremacy in parliament in 1646. During the subsequent struggle he was one of the six commissioners appointed to treat with the army by the parliament, and endeavoured to effect a compromise, but failed, being distrusted by both the Levellers and the Presbyterians. His views of government may be studied in *The People's Case Stated*, written shortly before his death. "The power which is directive, and states and ascertains the morality of the rule of obedience, is in the hand of God; but the original, from whence all just power arises, which is magistratical and coercitive, is from the will or free gift of the people, who may either keep the power in themselves or give up their subjection and will in the hand of another." King and people were bound by "the fundamental constitution or compact," which if the king violated, the people might return to their original right and freedom.

In spite, however, of these free opinions, Vane still desired the maintenance of the monarchy and the constitution. He voted for a declaration to this effect on the 28th of April 1648, and had consistently opposed the various votes of "non-addresses." Several communications had already been fruitlessly attempted with Vane from the king's side, through the agency of Lord Lovelace in January 1644, and through that of John Ashburnham in March 1646. Vane now supported the renewal of negotiations, and was appointed on the 1st of September 1648 one of the commissioners for the treaty of Newport. He here showed a desire to come to terms on the foundation of toleration and a "moderate episcopacy," of which Cromwell greatly disapproved, and opposed the shaking off of the conferences. He absented himself from parliament on the occasion of "Pride's Purge," and remained in retirement until after the king's death, a measure in which he took no part, though he continued to act as a member of the government. On the 14th of February 1649 he was placed on the council of state, though he refused to take the oath which expressed approbation of the king's execution. Vane now showed himself an able administrator. He served on innumerable committees of importance, and was assiduous in his attendance. He furnished the supplies for Cromwell's expedition to Scotland, and was one of the commissioners sent there subsequently to settle the government and negotiate a union between the two countries. He showed great energy in colonial and foreign affairs, was a leading member of the committee dealing with the latter, and in 1651 went on a secret mission to negotiate with Cardinal de Retz, who was much struck with his ability, while his knowledge of foreign policy, in which he inclined in favour of Holland, earned the praise also of Milton. To Vane, as chief commissioner of the navy, belongs largely the credit of the victories obtained against Van Tromp.

In domestic politics Vane continued to urge his views of toleration and his opposition to a state church. On the 9th of January 1650 he brought forward as chairman the report of a committee on the regulation of elections. He wished to reform the franchise on the property basis, to disfranchise some of the existing boroughs, and to give increased representation to the large towns; the sitting members, however, were to retain their seats. In this he was opposed to Cromwell, who desired an entirely new parliament and the supremacy of the army representation. On the 20th of April Cromwell forcibly dissolved the Long Parliament while in the act of passing Vane's bill. On the latter's protesting, "This is not honest; yea, it is against morality and common honesty," Cromwell fell a-railing at him, crying out with a loud voice, "O Sir Henry Vane, Sir Henry Vane; the Lord deliver me from Sir Henry Vane!" (Ludlow, *Mem.* i. 353). Hitherto they had lived on intimate terms of friendship, but this incident created a permanent breach. In his seclusion at Raby he now wrote the *Retired Man's Meditations* (1655). In 1656 he proposed in *A Healing Question* (reprinted in the "Somers Tracts," vol. vi. ed. Scott) a new form of government, insisting as before upon a Puritan parliament supreme over the army. The seditious movements of the Anabaptists were also attributed to his influence, and on the 29th of July 1656 he was summoned before the council. Refusing to give security not to disturb the public peace, he was on the 9th of September sent prisoner to Carisbrooke Castle, and there remained until the 31st of December. He addressed a letter to Cromwell in which he repudiated the extra-parliamentary authority he had assumed. In the parliament of Richard Cromwell he was elected for Whitchurch, when he urged that the protector's power should be strictly limited, and the negative voice of the new House of Lords disallowed.

Subsequently he allied himself with the officers in setting aside the protectorate and in restoring the Long Parliament, and on Richard Cromwell's abdication he regained his former supremacy in the national counsels. He was a member of the committee of safety and of the council of state appointed in May, was commissioner for the navy and for the appointment of army officers, managed foreign affairs and superintended finance. He adhered to Lambert, remained a member of the government after the latter had turned out the Long Parliament, and endeavoured to maintain it by reconciling the disputing generals and by negotiating with the navy, which first deserted the cause. In consequence, at the restoration of the Long Parliament he was expelled the House and ordered to retire to Raby.

At the Restoration Vane was imprisoned in the Tower by the king's order. After several conferences between the houses of parliament, it was agreed that he should be excepted from the indemnity bill, but that a petition should be sent to Charles asking that his life might be spared. The petition was granted. On the meeting, however, of the new parliament of 1661, a vote was passed demanding his trial on the capital charge, and Vane was taken back to the Tower in April 1662 from the Scilly Isles, where he had been imprisoned. On the 2nd of June he appeared before the king's bench to answer the charge of high treason, when he made a bold and skilful defence, asserting the sovereign power of parliament in justification of his conduct. He was, however, found guilty, and executed on Tower Hill on the 14th of June 1662. He had married, in 1640, Frances, daughter of Sir Christopher Wray of Barlings, by whom he had a large family of sons and daughters. Of these Christopher, the fifth son, succeeded to his father's estates and was created Baron Barnard by William III.

Vane's great talents as an administrator and statesman have been universally acknowledged. He possessed, says Clarendon, "extraordinary parts, a pleasant wit, a great understanding, a temper not to be moved," and in debate "a quick conception and a very sharp and weighty expression." His patriotism and assiduity in the public service, and complete freedom from corruption, were equally admirable and conspicuous. His religious writings, apart from his constant devotion to toleration and dislike of a state church, are exceedingly obscure both in style and matter, while his enthusiasm and fanaticism in speculative doctrine combine curiously, but not perhaps incongruously, with exceptional sagacity and shrewdness in practical affairs. "He had an unusual aspect," says Clarendon, "which . . . made men think there was something in him of the extraordinary; and his whole life made good that imagination." Besides the works already mentioned and several printed speeches, Vane wrote: *A Brief Answer to a certain Declaration* of John Winthrop (reprinted in the Hutchinson Papers, publ. by the Prince Society, 1865); *A Needful Corrective or Balance in Popular Government . . .* in answer to Harrington's *Oceana*; *Of Love of God and Union with God*; two treatises, viz. (1) *An Epistle General to the Mystical Body of Christ on Earth*, (2) *The Face of the Times: A Pilgrimage into the Land of Promise . . .* (1664). *The Trial of Sir Henry Vane, Knight* (1662), contains, besides his last speech and details relating to the trial, *The People's Case Stated* (reprinted in Forster's *Life of Vane*), *The Valley of Jehoshaphat*, and *Meditations concerning Man's Life*. *A Letter from a True and Lawful Member of Parliament to one of the Lords of His Highness's Council* (1656), attributed to Vane, was written by Clarendon; and *The Light Shining out of Darkness* was probably by Henry Stubbe; while *The Speech against Richard Cromwell* is the composition of some contemporary pamphleteer.

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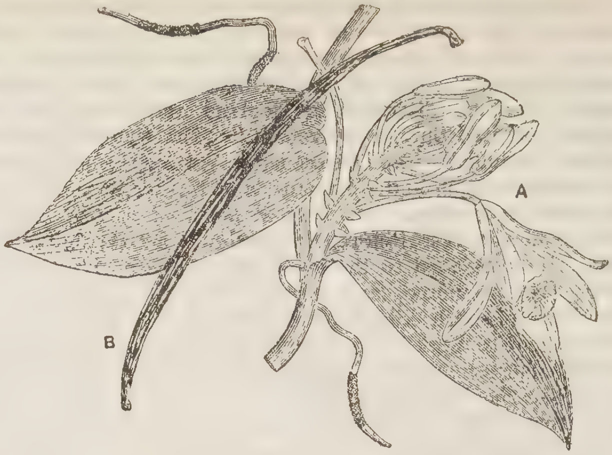
VANE (formerly spelt "fane," *i.e.* pennon, flag; cf. Ger. *Fahne*, Du. *vaan*, Fr. *girouette*, Ital. *banderuola*, Ger. *Wetterfahne*), the weathercock on a steeple. Vanes seem in early times to have been of various forms, as dragons, &c.; but in the Tudor period the favourite design was a beast or bird sitting on a slender pedestal and carrying an upright rod, on which a thin plate of metal is hung like a flag, ornamented in various ways.

VAN HORNE, SIR WILLIAM CORNELIUS (1843–), Canadian financier, was born in Will county, Illinois, U.S.A., on the 3rd of February 1843, of Dutch descent. He was educated in the common schools of the state, and in 1857 began work as office boy in a railway station. His ability and force brought him to the front, and he rose till in 1881 he was appointed general manager of the Canadian Pacific railway. For the successful completion of this great road his strong will and mental grasp were largely responsible, and he it was who not only controlled but steadily extended its operations during the lean years which followed. In 1884 he became vice-president of the line, in 1888 president, and in 1899 chairman of the board of directors. From 1885 onward he was more and more associated with every branch of Canadian mercantile and financial life, and as a publicist gave shrewd expression to his views on political and economic questions. After the Spanish-American War (1898) he became one of the chief promoters of railway and industrial enterprise in Cuba. In May 1894 he was knighted by Queen Victoria in acknowledgment of his distinguished public services. He was also known as a patron of art and literature and an amateur painter of no little merit.

VANILLA, a flavouring agent largely used in the manufacture of chocolate, in confectionery and in perfumery. It consists of the fermented and dried pods of several species of orchids belonging to the genus *Vanilla*.[1] The great bulk of the commercial article is the produce of *V. planifolia*, a native of south-eastern Mexico, but now largely cultivated in several tropical countries, especially in Bourbon, the Seychelles, Tahiti and Java. The plant has a long fleshy stem and attaches itself by its aerial rootlets to trees; the roots also penetrate the soil and derive a considerable portion of their nourishment from it. The leaves are alternate, oval-lanceolate and fleshy; the light greenish flowers form axillary spikes. The fruit is a pod from 6 to 10 in. long, and when mature about half an inch in diameter. The wild plant yields a smaller and less aromatic fruit, distinguished in Mexico as *Baynilla cimarona*, the cultivated vanilla being known as *B. corriente*.



Vanilla Plant (*Vanilla planifolia*). A, shoot with flower, leaf and aerial rootlets; B, pod or fruit.

Vanilla was used by the Aztecs of Mexico as an ingredient in the manufacture of chocolate before the discovery of America by the Spaniards, who adopted its use. The earliest botanical notice is given in 1605 by Clusius (*Exoticorum Libri Decem*), who had received fruits from Hugh Morgan, apothecary to Queen Elizabeth; but he seems to have known nothing of its native country or uses. The Mexican vanilla had been introduced to cultivation before the publication of the second edition of Philip Miller's *Gardeners' Dictionary* (1739). It was reintroduced by the marquis of Blandford, and in 1807 a flowering specimen was figured and described by R. A. Salisbury (*Paradisus*, London, t. 82). Mexican vanilla is regarded as the best. It is principally consumed in the United States. In Bourbon about 3000 acres are under cultivation; the crop is sent to Bordeaux, the chief centre of the trade in France. Its odour is said to differ from the Mexican variety in having a suggestion of tonqua bean. The Seychelles produce large quantities of exceedingly fine quality; the produce of these islands goes chiefly to the London market. The Java vanilla, grown chiefly in Krawang and the Preanger Regencies, is shipped to Holland. The Tahiti produce is inferior in quality.

Mr Hermann Mayer Senior, in the *Chemist and Druggist*, June 30, 1906, gives the following figures, which approximately represent the world's output of vanilla during the seasons 1905–1906: Bourbon, 70 tons; Seychelles, 45 tons; Mauritius, 5 tons; Comores, Mayotte, Madagascar, &c., 120 tons; Guadeloupe, Java, Ceylon and Fiji, 10 tons; Mexica, 70 tons; Tahiti, 100 tons—total, about 420 tons.

The best varieties of vanilla pods are of a very dark chocolate brown or nearly black colour, and are covered with a crystalline efflorescence technically known as *givre*, the presence of which is taken as a criterion of quality. The peculiar fragrance of vanilla is due to vanillin, $C_8H_8O_3$, which forms this efflorescence. Chemically speaking, it is the aldehyde of methyl-protocatechuic acid. It is not naturally present in the fleshy exterior of the pod, but is secreted by hair-like papillae lining its three internal angles, and ultimately becomes diffused through the viscid oily liquid surrounding the seeds. The amount of vanillin varies according to the kind: Mexican vanilla yields 1·69, Bourbon or Réunion 1·9 to 2·48, and Java 2·75%. Besides vanillin, the pods contain vanillic acid (which is odourless), about 11% of fixed oil, 2·3% of soft resin, sugar, gum and oxalate of lime.

Vanillin forms crystalline needles, fusible at 81° C., and soluble in alcohol, ether and oils, hardly soluble in cold, but more so in boiling water. Like other aldehydes, it forms a compound with the alkaline bisulphites, and can by this means be extracted from bodies containing it. Vanillin has been found in Siam benzoin and in raw sugar, and has been prepared artificially from coniferin, a glucoside found in the sapwood of fir-trees, from asafoetida, and from a constituent of oil of cloves named eugenol. It is from the last-named that vanillin is now prepared on a commercial scale, chiefly in Germany. Vanillin does not appear to have any physiological action on human beings when taken in small doses, as much as 10 to 15 grains having been administered without noxious results. On small animals, however, such as frogs, it appears to act as a convulsive. It has been suggested as a stimulant of an excito-motor character in atonic dyspepsia. It is a constituent of Günzburg's reagent (phloro-vanillin-glucin) for the detection of free hydrochloric acid in the gastric contents. The poisonous effects that have on several occasions followed from eating ices flavoured with vanilla are not to be attributed to the vanilla, but probably to the presence of *tyrotoxicon* (*Pharm. Journ.* [3], xvii. p. 150), a poison found in milk which has undergone certain putrefactive changes, and producing choleraic effects, or perhaps to the presence of microscopic fungi in the vanilla, the plantations being liable to the attack of *Bacterium putredinis*. Workmen handling the beans in the Bordeaux factories are subject to itching of the hands and face; but this is caused by an *Acarus* which occupies the end of the pod. In some cases, however, symptoms of dizziness, weariness and malaise, with muscular pains, have been felt, due possibly to the absorption of the oily juice by the hands of the workmen.

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[1] Span. *vainilla*, dim. of *vaina*, a pod.

See also R. A. Rolfe, "Vanillas of Commerce," in *Kew Bulletin* (1895), p. 169, and "Revision of the Genus Vanilla," in *Journal of The Linnean Society* (Botany), xxxii. 439 (1896); also S. J. Galbraith, on "Cultivation in the Seychelles," *U.S. Dept. of Agriculture, Division of Botany, Bulletin 21* (1898).

VANINI, LUCILIO, or, as he styled himself in his works, GIULIO CESARE (1585–1619), Italian free-thinker, was born at Taurisano, near Naples, in 1585. He studied philosophy and theology at Rome, and after his return to Naples applied himself to the physical studies which had come into vogue with the Renaissance. Like Giordano Bruno, though morally and intellectually inferior to him, he was among those who led the attack on the old scholasticism and helped to lay the foundation of modern philosophy. Vanini resembles Bruno, not only in his wandering life and in his tragic death, but also in his anti-Christian bias. From Naples he went to Padua, where he came under the influence of the Alexandrist Pomponazzi (*q.v.*), whom he styles his divine master. At Padua he studied law, and was ordained priest. Subsequently he led a roving life in France, Switzerland and the Low Countries, supporting himself by giving lessons and disseminating anti-religious views. He was obliged to flee from Lyons to England in 1614, but was imprisoned in London for some reason for forty-nine days. Returning to Italy he made an attempt to teach in Genoa, but was driven once more to France, where he made a valiant effort to clear himself of suspicion by publishing a book against atheists, *Amphitheatrum Aeternae Providentiae Divino-Magicum* (1615). Though the definitions of God are somewhat pantheistic, the book is sufficiently orthodox, but the arguments are largely ironical, and cannot be taken as expounding his real views. Vanini expressly tells us so in his second (and only other published) work, *De Admirandis Naturae Reginae Deaeque Mortalium Arcanis* (Paris, 1616), which, originally certified by two doctors of the Sorbonne, was afterwards re-examined and condemned to the flames. Vanini then left Paris, where he had been staying as chaplain to the maréchal de Bassompierre, and began to teach in Toulouse. In November 1618 he was arrested, and after a prolonged trial was condemned, as an atheist, to have his tongue cut out, and to be strangled at the stake, his body to be afterwards burned to ashes. The sentence was executed on the 9th of February 1619.

See Cousin, *Fragments de philosophie cartésienne* (Brussels, 1838–40), i. 1–99; French trans. M. X. Rousselot (Paris, 1842); John Owen, *Skeptics of the Italian Renaissance* (London, 1893), 345–419; J. Toulan, *Étude sur L. Vanini* (Strassburg, 1869); Cesare Cantu, *Gli Eretici d'Italia* (Turin, 1867), iii. 72 ff.; Fuhrmann, *Leben und Schicksale* (Leipzig, 1800); Vaïsse, *L. Vanini* (Paris, 1871); Palumbo, *Vanini, e i suoi tempi* (Naples, 1878); Passamonti in *Rivista italiana di filosofia* (1893), vol. iii.

VANLOO, CHARLES ANDREW (1705–1765), subject painter, a younger brother of John Baptist Vanloo (*q.v.*), was born at Nice on the 15th of February 1705. He received some instruction from his brother, and like him studied in Rome under Luti. Leaving Italy in 1723, he worked in Paris, where he gained the first prize for historical painting. After again visiting Italy in 1727, he was employed by the king of Sardinia, for whom he painted a series of subjects illustrative of Tasso. In 1734 he settled in Paris, and in 1735 became a member of the French Academy; and he was decorated with the order of St Michael and appointed principal painter to the king. By his simplicity of style and correctness of design, the result of his study of the great Italian masters, he did much to purify the modern French school; but the contemporary praise that was lavished upon his productions now appears undue and excessive. His "Marriage of the Virgin" is preserved in the Louvre. He died at Paris on the 15th of July 1765.

VANLOO, JOHN BAPTIST (1684–1745), French subject and portrait painter, was born at Aix in Provence on the 14th of January 1684. He was instructed in art by his father. Having at an early age executed several pictures for the decoration of the church and public buildings at Aix, he was employed on similar work at Toulon, which he was obliged to leave during the siege of 1707. He was patronized by the prince of Carignan, who sent him to Rome, where he studied under Benedetto Luti. Here he was much employed on church pictures, and in particular executed a greatly praised "Scourging of Christ" for St Maria in Monticelli. At Turin he painted the duke of Savoy and several members of his court. Then, removing to Paris, where he was elected a member of the French Academy, he executed various altar-pieces and restored the works of Primaticcio at Fontainebleau. In 1737 he went to England, where he attracted attention by his portrait of Colley Cibber and of Owen McSwiny, the theatrical manager; the latter, like many other of Vanloo's works, was engraved in mezzotint by the younger Faber. He also painted Sir Robert Walpole, whose portrait by Vanloo in his robes as chancellor of the exchequer is in the National Portrait Gallery (London), and the prince and princess of Wales. He did not, however, practise long in England, for his health failing he retired to Paris in 1742, and afterwards to Aix, where he died on the 19th of December 1745. His likenesses were striking and faithful, but seldom flattering, and his heads are forcible in colouring. The draperies and accessories in his pictures were usually painted by Van Achen, Eccardt and Root.

VANNES, a town of western France, capital of the department of Morbihan, 84 m. N.W. of Nantes on the railway to Brest. Pop. (1906), town, 16,728; commune, 23,561. It is situated 10 m. from the open sea, at the confluence of two streams forming the Vannes river, which debouches into the land-locked Gulf of Morbihan about a mile below the town. The narrow, steep and crooked streets of the old town, which lie on a hill facing the south, are surrounded by fortifications of the 14th, 15th and 17th centuries, pierced by four gates and flanked by nine towers and five bastions, connected by battlements. In the Constable's Tower Olivier de Clisson was confined in 1387. The modern suburbs, with the port, the public buildings, barracks, convents, squares and promenades, notably the Garenne and the park of the Prefecture, surround the old town. The archaeological museum, the contents of which are mainly the fruit of excavations at Carnac and elsewhere in the vicinity, includes one of the richest collections of prehistoric remains in Europe. There are also a museum of natural history and a library. The cathedral of St Peter overlooks the old town; burnt by the Normans in the 10th century, it was rebuilt in the 13th, 15th and 18th centuries. It has remains of a cloister and contains the relics and tomb of the Spanish Dominican preacher St Vincent Ferrier, who died at Vannes in 1419. The curious round Chapelle du Pardon to the left of the nave was built in 1537 in the Italian style. Some interesting old houses, including that of the presidents of the parlement of Brittany, the rich private collections of M. de Limur, and the church of St Paterne (18th century) are also worthy of mention. There is a monument to Le Sage, born near Vannes. Vannes is the seat of a prefect, a bishop and a court of assizes, and has tribunals of first instance and of commerce and a branch of the Bank of France. A communal college is among the educational institutions. Among the industries are building, tanning and cotton-weaving. The port of Vannes, to the south of the town, is formed by the Vannes river and is accessible only to small vessels. Vessels of 800 tons can make the harbour of Conleau about $2\frac{1}{2}$ m. from the town.

Vannes (*Dariorigum*), the capital of the Veneti (whence *Gwened*, the Breton name of the town), was at the head of the Armorican league against Julius Caesar, who in 56 B.C. overcame their fleet and opened up their country by six roads. St Paternus, the first bishop, was consecrated in 465. In the 5th century Vannes was ruled for a time by independent counts, but soon came under the yoke of the Franks. Nomenoé, the lieutenant of Louis I., the Pious, in Brittany, assumed the title of king in 843, and one of his brothers was the founder of a line of counts who distinguished themselves against the Normans in the 9th and 10th centuries. Vannes became part of the duchy of Brittany at the end of the 10th century. The estates of Brittany met there for the first time in 1203 to urge Philip Augustus to avenge the death of Arthur of Brittany. In the course of the War of Succession the town was besieged four times in 1342. Duke John IV. built here the castle of L'Hermine and made it his habitual residence. In 1487 the town was for a year in the hands of Charles VIII. of France. In 1532 Brittany was definitively united to France. The estates met at Vannes several times in the 17th and 18th centuries. During the Revolution this town was the scene of the execution in 1795 of some of the prisoners after the royalist disaster at Quiberon.

VAN RENSSELAER, STEPHEN (1764–1839), American political leader and soldier, "last of the patroons," was born at New York City on the 1st of November 1764. He was fifth in descent from KILLIAN VAN RENSSELAER (*c.* 1580-1645), the original patroon of Rensselaerwyck, New York, who acquired his large estates between 1630 and 1637. Stephen was graduated at Harvard in 1782. In 1789–90 he was a member of the New York Assembly, and from 1791 to 1795 served as a member of the state Senate. He was lieutenant-governor of New York (1795–1801) for the two terms in which John Jay was governor. In 1801 he presided over the state constitutional convention, and from 1808 to 1810 was again in the Assembly. He was an ardent promoter of the Erie Canal, and as a commissioner to examine the proposed route, &c., he reported favourably to the Assembly in 1811. In the second war with Great Britain he commanded the First Division of the detached militia of the state of New York, with the rank of major-general, and on the 13th of October 1812 was defeated at the battle of Queenston Heights. As he was a Federalist he was severely criticised and censured for this defeat and resigned from the army. At the close of the war the Erie Canal project was renewed, and from 1816 till his death he was a member of the board of canal commissioners, and for nearly fifteen years was its president. In 1818 he was again elected to the Assembly; in 1819 he became a regent of the State University of which he was for a time chancellor; and in 1821 he was a delegate to the New York constitutional convention. From 1822 to 1829 he was a member of the National House of Representatives,[1] and there voted for John Quincy Adams for the presidency, and served as chairman of the committee on agriculture. In 1820–23 he sent out at his own expense Professors Amos Eaton (1776–1842) and Edward Hitchcock to make extensive surveys, results of which were published as *An Agricultural and Geological Survey of the District adjoining the Erie Canal* (Albany, 1824). In 1824 he founded a school in Troy which was incorporated two years later as the Rensselaer Polytechnic Institute. He died at Albany, New York, on the 26th of January 1839.

See D. D. Barnard, *A Discourse on the Life, Services and Character of Stephen Van Rensselaer* (Albany, 1839).

VANSITTART, HENRY (1732–1770 or 1771), Anglo-Indian governor, was born in London on the 3rd of June 1732. His father, Arthur van Sittart (1691–1760), and his grandfather, Peter van Sittart (1651–1705), were both wealthy merchants and directors of the Russia company. Peter, a merchant adventurer, who had migrated from Danzig to London about 1670, was also a director of the East India company. The family name is taken from the town of Sittard in Limburg. Educated at Reading school and at Winchester college, Henry Vansittart joined the society of the Franciscans, or the "Hell-fire club," at Medmenham, his elder brothers, Arthur and Robert, being also members of this fraternity. In 1745 he entered the service of the East India company and sailed for Fort St David; here he showed himself very industrious, made the acquaintance of Robert Clive and rose rapidly from one position to another. As a member of the council of Madras he helped to defend the city against the French in 1759, and in July 1760 he went to Bengal as president of the council and governor of Fort William. Courageously facing the difficulties of his new position, which included a serious lack of funds, he deposed the subadar of Bengal, Mir Jafar, whom he replaced by his son-in-law, Mir Kasim, a circumstance which increased the influence of England in the province. He was, however, less successful in another direction. Practically all the company's servants were traders in their private capacity, and as they claimed various privileges and exemptions this system was detrimental to the interests of the native princes and gave rise to an enormous amount of corruption. Vansittart sought to check this, and in 1762 he made a treaty with Mir Kasim, but the majority of his council were against him and in the following year this was repudiated. Reprisals on the part of the subadar were followed by war, and, annoyed at the failure of his pacific schemes, the governor resigned and returned to England in 1764. His conduct was attacked before the board of directors in London, but events seemed to prove that he was in the right, and in 1769 he became a director of the company, having in the previous year obtained a seat in parliament. He was now sent on an important mission to India; he left England in September 1769, but the ship in which he sailed was lost at sea late in 1770 or early in 1771. One of his five sons was Nicholas Vansittart, Baron Bexley (*q.v.*). To defend his conduct in Bengal Vansittart published some papers as *A Narrative of the Transactions in Bengal from 1760 to 1764* (London, 1766).

Vansittart's brother, Robert Vansittart (1728–1789), who was educated at Winchester and at Trinity College, Oxford, was regius professor of civil law at Oxford from 1757 until his death on the 31st of January 1789. Another brother, George Vansittart (1745–1825), of Bisham Abbey, Berkshire, was the father of General George Henry Vansittart (1768–1824) and of Vice-Admiral Henry Vansittart (1777–1843).

VAN'T HOFF, JACOBUS HENDRICUS (1852–), Dutch chemist and physicist, was born in Rotterdam on the 30th of August 1852. He studied from 1869 to 1871 at the polytechnic at Delft, in 1871 at the university of Leiden, in 1872 with F. A. Kekulé at Bonn, in 1873 with C. A. Wurtz at Paris, and in 1874, when he took his doctor's degree, with E. Mulder at Utrecht. In 1876 he became lecturer on physics at the veterinary school at Utrecht, and two years later he was chosen professor of chemistry, mineralogy and geology in Amsterdam University. In 1894 he declined an invitation to the chair of physics at Berlin University, but in 1896 he went to Berlin as professor to the Prussian Academy of Sciences, with a salary and a laboratory, but freedom to do whatever he liked; and at the same time he accepted an honorary professorship in the university so that he might lecture if he were so minded. On taking up these appointments he announced that, the application of mathematics to chemistry remaining his chief aim, he proposed to devote himself to the study of the formation of oceanic salt deposits, with special reference to the Stassfurt deposits. He may be regarded as the founder of the doctrine of stereoisomerism (*q.v.*), for he was the first, in 1874, to introduce a definite mechanical theory of valency, and to connect the optical activity exhibited by many carbon compounds with their chemical constitution. In respect of this doctrine of the "asymmetric carbon atom," van't Hoff's name is generally linked with that of J. A. le Bel (born on the 21st of January 1847, at Pechelbronn, Lower Alsace), who, only two months later, independently enunciated the theory of asymmetric combinations with carbon; though it must be noted that J. Wislicenus, to whom van't Hoff, in fact, acknowledged his indebtedness, had already suggested that in order to explain the constitution of certain organic bodies, the tridimensional arrangement of atoms in space must be taken into account. For this work van't Hoff and Le Bel received the Davy medal jointly from the Royal Society in 1893. From 1874 to 1884 van't Hoff's attention was mainly given to the law of mass-action, and he established the theorem known by his name, which connects quantitative displacement of equilibrium with change of temperature. From 1885 to 1895 he was engaged on the theory of solutions, and developing the analogy between dilute solutions and gases he showed that the osmotic pressure of a solution has the same value as the pressure that solute would exert if it were contained as a gas in the same volume as is occupied by the solution. From 1885 he published the *Zeitschrift für physikalische Chemie*, in collaboration with Professor W. Ostwald of Leipzig.

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[1] He succeeded his cousin, Solomon Van Rensselaer (1744–1852), who was in the regular army in 1792–1800, who had fought under General Anthony Wayne at Maumee Rapids in 1794 and under Stephen Van Rensselaer at Queenston Heights in 1812, and who was in the House of Representatives in 1819-18[illegible]

VAN WERT, a city and the county-seat of Van Wert county, Ohio, U.S.A., about 28 m. W. by N. of Lima. Pop. (1890) 5512; (1900) 6422 (221 foreign-born); (1910) 7157. Van Wert is served by the Pennsylvania and the Cincinnati Northern railways, and by an interurban electric line. Among the principal buildings are the city hall, the court house, the Brumback Library of Van Wert county (containing 14,650 volumes in 1908), the Home Office Building of the Home Guards of America (a fraternal society incorporated in 1899 and having about 16,000 members in 1910), and the Home Office Building of the Central Manufactures' Insurance Co. Van Wert is situated in a rich agricultural region. It has railway and machine shops and various manufactures. The municipality owns and operates the waterworks. Van Wert was settled about 1840, was incorporated as a town in 1848 and was chartered as a city in 1903. The county and the city were named in honour of Isaac Van Wert (1760–1828), one of the captors of Major John André.

VAPEREAU, LOUIS GUSTAVE (1819–1906), French man of letters and lexicographer, was born at Orleans on the 4th of April 1819. Educated at the École Normale he became a teacher of philosophy, and was entrusted by Victor Cousin with the preparation of his studies on the *Pensées* of Pascal. Under the empire his republican principles cost him his position, and Vapereau studied for the bar. He practised, however, little or not at all, and after 1870 he was appointed prefect of Cantal (1870) and of Tarn et Garonne (1871–73). From 1877 to 1888 he was inspector-general of public instruction. He was the author of some excellent editions of the classics, and of works on political and social questions, but he is famous for his valuable *Dictionnaire universel des contemporains* (1858; 6th ed., 1893), brought up to date in 1895 by a supplementary volume. He also drew up a *Dictionnaire universel des littérateurs* (1876). At the time of his death at Norsang-sur-Orge in 1906, he had been for twenty-six years a regular contributor to *L'Illustration*, some of his notes written for this journal being collected in 1896 as *L'Homme et la vie*.

VAPHIO, an ancient site in Laconia, Greece, on the right bank of the Eurotas, some 5 m. S. of Sparta. It is famous for its "bee-hive" tomb, excavated in 1889 by Dr Tsountas. This consists of a walled approach, or δρόμος, about 97 ft. long, leading to a vaulted chamber some 33 ft. in diameter, in the floor of which the actual grave was cut. The objects found here and transferred to the National Museum in Athens include a large number of gems and amethyst beads, together with articles in gold, silver, bronze, iron, lead, amber and crystal. But by far the finest of them are two golden cups decorated with scenes in relief, picturing the capture of bulls. These form perhaps the most perfect works of "Mycenaean" or "Minoan" art which have survived. It seems likely that the Vaphio cups do not represent a local art but were imported from Crete, which at that early period was far ahead of mainland Greece in artistic development. The tomb, which probably belonged to Amyclae rather than to Pharis, as is commonly stated, is now almost entirely destroyed.

See C. Tsountas, Ἐφημερὶς Ἀρχαιολογική (1889), 136–172; J. G. Frazer, *Pausanias's Description of Greece*, iii. 135 f. (with full bibliography); W. Ridgeway, *The Early Age of Greece*, i. 26–28; R. C. Bosanquet, *Journal of Hellenic Studies* (1904), xxiv. 317 ff.; A. Riegl, *Jahreshefte d. österr. arch. Institutes* (1906), ix. 1 ff.

(M. N. T.)

VAPORIZATION. 1. In common language a *vapour* is a gaseous or elastic fluid, which emanates or evaporates from the surface of a solid or liquid at temperatures below its boiling-point. A *volatile* liquid or solid is one which evaporates rapidly at ordinary temperatures. It is a matter of common experience that evaporation is accelerated by currents of air, or by the use of an exhaust pump, or by any process which removes the vapour rapidly from the liquid. On the other hand, it is retarded, and finally ceases, if the vapour is allowed to accumulate in a closed space. When this equilibrium state is reached, the space is said to be *saturated* with the vapour; the density of the vapour is then the maximum which can exist in the presence of the liquid at the temperature of the experiment, and its pressure is called the *saturation-pressure*. The term vapour-pressure, when used without qualification, is also generally employed to denote the saturation or maximum pressure. Dalton showed that the saturation-pressure of a vapour depends only on the temperature, and is unaffected by the presence of any neutral gas or vapour. This relation has been more accurately verified by many subsequent observers, and the exceptions to it have been minutely studied and elucidated. The saturation-pressure invariably increases rapidly with rise of temperature, according to a regular law which has been the subject of many elaborate investigations. When the vapour-pressure of a liquid becomes equal to the external pressure, bubbles of vapour are freely formed in the interior of the liquid by the familiar process of boiling or ebullition. The temperature at which this occurs under the normal atmospheric pressure of 760 mm. of mercury (reduced to 0° C. and sea-level in latitude 45°) is termed the *boiling-point* (B.P.) of the liquid, and is usually determined by taking the temperature of the saturated vapour under normal pressure, to avoid error from superheating (see below, 3) of the liquid. If the external pressure remains constant, the temperature will also remain constant, provided that the liquid is pure and that its composition remains unaltered, until the whole is vaporized. If, on the other hand, the liquid is contained in a *closed* space, it may be made to boil at much lower temperatures by diminishing the pressure; or the temperature of the liquid may be raised considerably above the normal boiling-point, as in the boiler of a steam-engine, if the pressure is raised by preventing the free escape of the vapour. In all cases, if the temperature is given, there is a corresponding equilibrium or saturation-pressure of the vapour, and vice versa, in accordance with Dalton's law. It was shown, however, by Cagniard de la Tour (*Ann. Chim. Phys.*, 1822, 1823) that the temperature and pressure of the liquid could not be raised indefinitely in this manner. By heating liquids in strong glass bulbs with manometers attached, he found that at a certain temperature the meniscus or curved surface separating the liquid from the vapour disappeared, and the bulb became filled with an apparently uniform substance. The temperature at which this mixing of liquid and vapour occurs is definite for each liquid, and is called the *critical temperature*. La Tour found the critical temperature in the case of water to be 362° C., a result which has been remarkably confirmed by later researches (Cailletet, *Ann. Chim. Phys.* 25, p. 519, 1892). In many books of recent years it has been the custom, following a suggestion of Andrews, to restrict the term "gas" to temperatures above the critical temperature, and the term "vapour" to temperatures below. But this is often inconvenient in practice, as there is no sudden change in the gaseous phase at ordinary pressures on passing the critical temperature. It is more convenient to employ the terms "vapour" only when discussing the properties of the gaseous phase in relation to the liquid or solid, and to follow the common usage in describing substances like CO_2, or even SO_2 and NH_3, as gases at ordinary temperatures and pressures.

2. *Continuity of State.*—The form of the isothermal curve, representing the compression of a vapour at constant temperature, consists, as shown in fig. 1, A, of three discontinuous branches. The relation between pressure and volume for an

unsaturated vapour is represented by the branch DE, which is similar to the isothermal of a gas obeying Boyle's law. When the saturation-pressure is reached at D the vapour begins to condense, and the volume diminishes without further increase of pressure, giving the isopiestic branch DCB. At B, when the vapour is completely liquefied, further compression produces a rapid rise of pressure, as shown by the branch BA, representing the behaviour of the liquid. It is possible, however, to trace the branch DN for the supersaturated vapour continuously beyond D without liquefaction in the absence of nuclei. It is similarly possible to trace the liquid branch ABM beyond B to lower pressures in the absence of dissolved gases. As the temperature is raised, the length of the branch BD, representing the increase of volume in passing from the liquid to the gas, diminishes, as shown in fig. 1, B, which represents the isothermals of CO_2,[1] according to Andrews (*Phil. Trans.* 1869). Above the critical temperature, the discontinuities at B and D disappear from the isothermal curve, and it is impossible to obtain separation of the two states, liquid and gas, however great the pressure applied. The critical pressure is the vapour-pressure of the liquid at the critical temperature. It is possible to obtain a perfectly continuous passage from the gaseous to the liquid state by keeping the vapour at a pressure greater than the critical pressure while it is cooled from a temperature above the critical point, at which it would expand indefinitely (if the pressure were reduced) without separation into two phases, to a temperature below the critical point, at which expansion would produce separation into liquid and vapour as soon as the pressure was reduced to the saturation value. It was maintained by Andrews, on the basis of these and similar observations, that the gaseous and liquid states were merely widely separated forms of the same condition of matter, since one could be converted into the other without any breach of continuity or sudden evolution of heat or change of volume; just as an amorphous solid in the process of fusion becomes gradually more and more plastic as the temperature is raised, and passes into the state of a viscous liquid with continually diminishing viscosity. The same idea was further developed by James Thomson (*Proc. R.S.*, 1871), who suggested that the discontinuity of the isothermal at temperatures below the critical point was only apparent. He supposed that the extensions of the liquid and vapour curves BM, DN, in fig. 1, A, representing the states of superheated liquid and supersaturated vapour, might theoretically be joined by a continuous curve MN, representing a homogeneous transformation, which, however, could not be realized in practice, as the state of the substance corresponding to this part of the curve would be unstable. Maxwell (*Nature*, 1875) showed that the straight line BCD representing the saturation-pressure must cut off loops BMC, CND, of equal area from this imaginary isothermal; otherwise it would be theoretically possible to obtain a balance of work without any difference of temperature by taking the substance through the isothermal cycle BCDNCMB. The theoretical isothermal of James Thomson is qualitatively represented by an equation of the type devised by Van der Waals, in which the mutual attraction of the molecules of a gas is regarded as equivalent to an internal pressure of the form a/v^2, which he supposes identical with the capillary pressure of the liquid. It has been found, however, that this simple expression is not sufficiently exact. It is probable that it is not merely a question of varying attraction between similar molecules. A vapour should rather be regarded as containing a certain proportion of compound or coaggregated molecules, which partially dissociate when the pressure is diminished or the temperature raised. A liquid similarly contains dissolved molecules of vapour, and the state of equilibrium is more nearly analogous to that between conjugate saturated solutions (*e.g.* water and phenol).

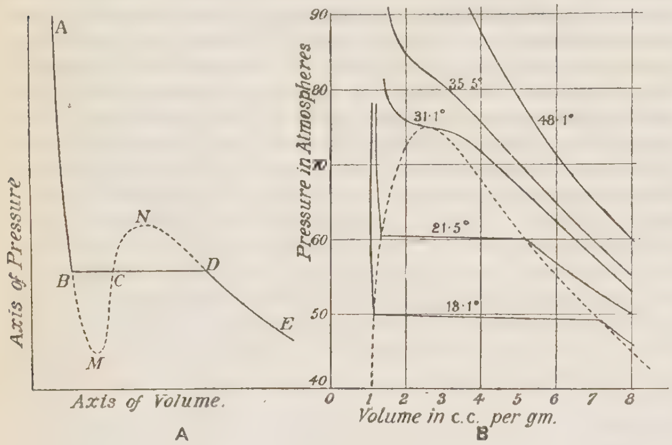

FIG. 1.

A, James Thomson Isothermal; B, Isothermals of CO_2 (Andrews).

3. *Effect of Capillary Pressure on Ebullition.*—It was remarked at a very early date that water and other liquids could be raised under atmospheric pressure several degrees above their normal boiling-points in a clean glass vessel without ebullition occurring, and that, when a bubble was formed, it would expand explosively, producing the phenomenon of "bumping"; but that, if metallic filings or other bodies capable of supplying small bubbles of air were introduced, ebullition would proceed quietly at the normal temperature. L. Dufour succeeded in raising small drops of water, suspended in an oil mixture of suitable density, to a temperature of nearly 180° C. under atmospheric pressure. Similar observations lead to the conclusion that the phenomenon of ebullition, or boiling with the formation of bubbles, depends essentially on the presence of air or dissolved gas to provide nuclei for the starting-points of the bubbles. This is a natural consequence of the capillary pressure due to surface tension. The vapour-pressure p inside a small spherical bubble of radius r must exceed the pressure P in the liquid just outside the bubble by $2T/r$, where T is the surface tension of the liquid. The capillary pressure $2T/r$ may be very large if r is small. It is often stated on the strength of this relation that a bubble of radius r in a liquid will not expand indefinitely and rise to the surface as in ebullition, until the vapour-pressure p inside the bubble exceeds the external pressure P by $2T/r$. But this neglects the effect of the air or gas contained in the bubble, which plays an essential part in the phenomenon. A bubble of vapour containing no air or gas could not exist at all in stable equilibrium in a liquid. If its radius r were such as to make $2T/r$ greater than $p-P$, it would collapse entirely. A bubble containing gas, on the contrary, is in stable equilibrium when its radius r is such that the pressure of the gas and vapour inside it balance the external pressure P together with the capillary pressure $2T/r$. Any diminution of r produces an increase in the pressure of the gas which is more than sufficient to balance the increase of the capillary pressure $2T/r$. Supposing that the external pressure and temperature remain constant, the partial pressure of the gas inside the bubble varies inversely as the volume of the bubble, and may be represented by a/r^3. The size of the bubble is determined by the equation $p+a/r^3=P+2T/r$. The equilibrium is always stable if p is less than P. If p is greater than P, the equilibrium becomes unstable (and the bubble expands indefinitely), when the gas-pressure a/r^3 is one-third of the capillary pressure $2T/r$. This follows immediately by differentiating the above equation with respect to r, assuming the difference $p-P$ to remain constant. Substituting $2T/3r$ for a/r^3 we obtain the condition of stability,

$$p-P<4T/3r. \quad . \quad . \quad . \quad . \qquad (1)$$

In other words, the temperature of a liquid containing bubbles of radius r will rise until the excess pressure given by (1) is reached, and ebullition will begin as soon as the excess pressure amounts to two-thirds of the capillary pressure, and will not be delayed until the full capillary pressure is reached, as might appear at first sight. Bubbles 1 millimetre in diameter in water at P = 760 mm. become unstable when the temperature reaches 100·05° C. approximately. To obtain a superheat of 10° C., where the excess pressure is 316 mm., the bubbles must not exceed about $\frac{1}{200}$th mm. diameter. The condensation of a vapour is also retarded by the effect of capillary pressure, but the relation in this case is somewhat different.

4. *Effect of Capillary Pressure on Vapour-Pressure.*—It was observed by Sir W. Thomson (Lord Kelvin) (*Phil. Mag.* iv. 42, p. 448, 1871) that if a capillary tube of radius r is immersed in a liquid of surface tension T, and the liquid rises to a height h above the plane surface (the whole being enclosed in a vessel of uniform temperature containing only the vapour of the liquid) the pressure of the vapour at the curved surface of the meniscus in the capillary tube will be less than that at the plane surface by the amount, gh/v, where g is the acceleration of gravity, and $1/v$ is the density of the vapour. But the vapour must be in equilibrium with the liquid at both surfaces. Otherwise perpetual motion would ensue

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[1] The slight increase of pressure observed during condensation was attributed by Andrews to the presence of a trace of air in the CO_2.

in an enclosure at uniform temperature. Consequently the equilibrium value of the vapour-pressure must vary with the curvature of the surface, or with the capillary pressure due to the curvature.

If P, p are the hydrostatic pressures in the liquid and vapour close to the meniscus, the difference $P-p=2T/r$. This is negative if r is negative, *i.e.* if the liquid rises in the tube, but is positive if the meniscus is convex and the liquid is depressed in the tube. If P_0, p_0 are the pressures in the liquid and vapour at the plane surface, $P_0=p_0$, and if $1/V$ is the density of the liquid, the differences of pressure in the liquid and vapour respectively corresponding to a difference of level h, are $P-P_0=-gh/V$, $p-p_0=-gh/v$. Combining these with the relation $P-p=2T/r$ and eliminating gh, we obtain, for the change of vapour-pressure $p-p_0$, due to change of pressure $P-p_0$, or to curvature $1/r$,

$$p-p_0=(P-P_0)V/v=2TV/r(v-V). \quad . \quad . \quad (2)$$

This increase of vapour-pressure with curvature affords a natural explanation of the fact that it is possible to cool a vapour considerably below the saturation temperature without condensation. The vapour-pressure in a fog containing small drops of radius r must exceed the normal vapour-pressure over a plane surface at the same temperature by the amount $2TV/r(v-V)$, which may be considerable if r is small. The same expression measures the supersaturation required to induce condensation in the presence of dust or other nuclei of radius r, and explains why it is that condensation always takes place on dust particles if any are present. This phenomenon forms the basis of J. Aitken's method of counting dust particles, or Wilson's method of counting electrical ions, which are also capable of acting as nuclei for starting condensation.

5. *Extension to Higher Pressures.*—The approximate formula above given for the effect of hydrostatic pressure on the vapour-pressure assumes the densities of the liquid and vapour constant, and is true for small differences of pressure only. If we take P_0 and p_θ to represent corresponding values of the pressure in the liquid and vapour at the same level (and not necessarily at the plane surface where $P_0=p_0$), and if the difference of level from P, p is small, substituting dP and dp for the small differences of pressure, we have accurately the relation $vdp=VdP$, where V and v are the specific volumes of the liquid and vapour under the pressures P and p respectively. In order to apply the formula to large differences of pressure, it is only necessary to integrate it at constant temperature between the required limits of P and p. We thus obtain the general equation,

$$\int_{p_0}^{p} v\,dp=\int_{P_0}^{P} V\,dP. \quad . \quad . \quad . \quad . \quad (3)$$

In applying the general equation (3) to an actual case, the compressibility of the liquid is the most uncertain factor. Assuming the compressibility constant, we may write $V=V_0(1-aP)$. For the vapour we may employ equation (17) THERMODYNAMICS, viz. $v=R\theta/p-c+b$, as a very close approximation over a wide range. The small quantities c and b are functions of the temperature only. Making these substitutions and integrating the equation we obtain

$$R\theta \log_e(p/p_0)=(c-b)(p-p_0)+V_0(P-P_0)-\tfrac{1}{2}aV_0(P^2-P^2_0). \quad (4)$$

C. T. R. Wilson (*Phil. Trans.* 1898) has observed that in the absence of nuclei a very fine mist is formed in a vapour on sudden expansion when its density is about eight times the saturation value. Putting $p/p_0=8$ in equation (4), and taking for water vapour $R=4{\cdot}61\times10^6$, and $\theta=300°$ Abs. we find $P-P_0$ equal to 3000 atmospheres approximately as the pressure required to produce this degree of supersaturation, allowing for compressibility of V. The term $(c-b)$ may be neglected in this case, as p is small, but it would amount to about 17% of PV at 200° C. The result obtained from the approximate formula (2) would be 9200 atmospheres, which is more than treble, and indicates the inapplicability of the simple formula in an extreme case. Taking $P=3000$ atmospheres, and assuming that the formula $2T/r$ applies for the capillary pressure, we find the equivalent radius of a nucleus corresponding to the fine misty condensation to be $5{\cdot}0\times10^{-8}$ cm. This is a quantity of molecular dimensions, and lends support to the view that a vapour contains a certain proportion of coaggregated molecules, represented by the term c in the equation, which are capable of acting as nuclei for condensation. The analogous phenomenon of cloudy crystallization, which takes place in a supercooled liquid in the labile state, suggests that a liquid may similarly contain molecular crystals of solid, which would account, in the case of water, for its anomalous expansion and for the variation of its specific heat near the freezing-point.

For small values of the vapour-pressure p, the term $(c-b)$ $(p-p_0)$ in equation (4) may generally be neglected, as in the case of water at ordinary temperatures. For moderate values of P, not exceeding say 100 atmospheres, V may be taken as nearly constant, and the equation reduces to the simpler form $PV/R\theta=\log_e(p/p_0)$, which is often sufficiently exact.

6. *Application to a Solid.*—If we imagine a vertical column of solid in a porous vessel at uniform temperature surrounded by vapour, it would appear probable by similar reasoning that it would be in equilibrium under its own hydrostatic pressure with the pressure of the vapour at different levels. This would give the same formula as (2) for the variation of vapour-pressure, with V′, the specific volume of the solid, in place of V. But since the surface tension analogy does not exactly apply in the case of a solid, it is perhaps better to deduce the formula from a consideration of the effect of pressure on the freezing-point. The freezing-point θ_0 is the point at which the solid and liquid have the same vapour-pressure p_0. Otherwise they could not remain together in equilibrium. When the freezing-point is changed by pressure, the vapour-pressures p', p'', of the solid and liquid must be the same at the new freezing-point. The rise of the freezing-point $\theta-\theta_0$, for an increase of pressure $P-P_0$, is given by the thermodynamic equation (THERMODYNAMICS, equation (5))

$$L(\theta-\theta_0)/\theta_0=(P-P_0)(V''-V'), \quad . \quad . \quad . \quad (5)$$

where L is the latent heat of fusion, and V′, V″ are the specific volumes of the solid and liquid respectively. The difference $(p'-p'')$ of the vapour-pressures of the solid and liquid under normal pressure P_0 at a temperature θ near the normal freezing-point θ_0, is deduced from the same equation (see section 24 below)

$$p'-p''=L(\theta-\theta_0)/v\theta_0, \quad . \quad . \quad . \quad (6)$$

where v is the specific volume of the vapour. Substituting for θ in terms of P from (5), we have for the difference of the vapour-pressures at θ_0 under pressure P,

$$p'-p''=(P-P_0)\ (V''-V')/v. \quad . \quad . \quad . \quad (7)$$

The increase of vapour-pressure of the liquid when the pressure is increased to P is given by (2), viz. $p''-p_0=(P-P_0)V''/v$. The increase of vapour-pressure of the solid must be less than that of the liquid by the amount given by (7), in order that their vapour-pressure may be the same at the new freezing-point θ. We thus obtain by subtraction

$$p'-p_0=(P-P_0)\{V''/v-(V''-V')/v\}=(P-P_0)V'/v.$$

Which is precisely the same as relation (2) for the liquid, with V′ substituted for V″. Hence the effect of pressure on the vapour-pressure follows the same law for both liquid and solid (J. H. Poynting, *Phil. Mag.* xii. p. 40, 1881).

7. *Vapour-Pressure of Solutions.*—The rise of boiling-point produced by a substance in solution was demonstrated by M. Faraday in 1820, but the effect had been known to exist for a long time previously. C. H. L. Babo, 1847, gave the law known by his name, that the "relative lowering" $(p-p_0)/p_0$ of the vapour-pressure of a solution, or the ratio of the diminution of vapour-pressure $(p-p_0)$ to the vapour-pressure p_0 of the pure solvent at the same temperature, was constant, or independent of the temperature, for any solution of constant strength. A. Wüllner (*Pogg. Ann.* 1858, 103, p. 529) found the lowering of the vapour-pressure to be nearly proportional to the strength of the solution for the same salt. W. Ostwald, employing Wüllner's results, found the lowering of vapour-pressure produced by different salts in solution in water to be approximately the same for solutions containing the same number of gramme-molecules of salt per c.c. F. M. Raoult (*Comptes Rendus*, 1886–87) employed other solvents besides water, and showed that the relative lowering for different solvents and different dissolved substances was the same in many cases for solutions in which the ratio of the number of gramme-molecules n of the dissolved substance to the number of molecules N of the solvent was the same, or that it varied generally in proportion to the ratio n/N. The relative lowering of the vapour-pressure can be easily measured by Dalton's method of the barometer tube for solvents such as ether, which have a sufficient vapour-pressure at ordinary temperatures. But in many cases it is more readily determined by observing the rise of the boiling-point or the depression of the freezing-point of the solution. For the rise in the boiling-point, we have by Clapeyron's equation, $dp/d\theta=L/\theta v$, nearly, neglecting the volume of the liquid as compared with that of the vapour v. If dp is the difference of vapour-pressure of solvent and solution, and $d\theta$ the rise in the boiling-point, we have the approximate relation,

$$n/N=dp/p=mLd\theta/R\theta^2, \text{ Raoult's law}, \quad . \quad . \quad (8)$$

where m is the molecular weight of the vapour, and R the gas-constant which is nearly 2 calories per degree for a gramme-molecule of gas. For the depression of the freezing-point a relation of the same form applies, but $d\theta$ is negative, and L is the latent heat of fusion. At the freezing-point, the solution must have the same vapour-pressure as the solid solvent, with which it is in equilibrium. The relation follows immediately from Kirchhoff's expression (below, section 14) for the difference of vapour-pressure of the liquid and solid below the freezing-point.

The most important apparent exceptions to Raoult's law in dilute solutions are the cases, (1) in which the molecules of the dissolved substance in solution are associated to form compound molecules, or dissociated to form other combinations with the solvent, in such a way that the actual number of molecules n in the solution differs from that calculated from the molecular weight corresponding to the accepted formula of the dissolved substance; (2) the case in which the molecules of the vapour of the solvent are associated in pairs or otherwise so that the molecular weight m of the vapour is not that corresponding to its accepted formula. These cases are really included in the equation if we substitute the proper values of n or m. In the case of electrolytes, S. Arrhenius (*Zeit. phys. Chem.* i. p. 631) showed how to calculate the effective number of molecules $n''=(1+ek/k_0)n$, from the molecular conductivity

k of the solution and its value k_0 at infinite dilution, for an electrolyte giving rise to $e+1$ ions. The values thus found agreed in the main with Raoult's law for dilute solutions (see SOLUTIONS). For strong solutions the discrepancies from Raoult's law often become very large, even if dissociation is allowed for. Thus for calcium chloride the depression of the freezing-point, when $n=7$, $N=100$, is nearly 60° C. At this point $n''=10$ nearly, and the depression should be only 10·4° C. These and similar discrepancies have been very generally attributed to a loose and variable association of the molecules of the dissolved substance with molecules of the solvent, which, according to H. C. Jones (*Amer. Chem. Jour.* 1905, 33, p. 584), may vary all the way from a few molecules of water up to at least 30 molecules in the case of $CaCl_2$, or from 12 to 140 for glycerin. It has been shown, however, by Callendar (*Proc. R.S.A.* 1908) that, if the accurate formulae for the vapour-pressure given below are employed, the results for strong solutions are consistent with a very slight, but important, modification of Raoult's law. It is assumed that each molecule of solute combines with a molecules of solvent according to the ordinary law of chemical combination, and that the number a, representing the degree of hydration, remains constant within wide limits of temperature and concentration. In this case the ratio of the vapour-pressure of the solution p'' to that of the solvent p' should be equal to the ratio of the number of free molecules of solvent $N-an$ to the whole number of molecules $N-an+n$ in the solution. The explanation of this relation is that each of the n compound molecules counts as a single molecule, and that, if all the molecules were solvent molecules, the vapour-pressure would be p', that of the pure solvent. This assumption coincides exactly with Raoult's law for the relative lowering of vapour-pressure, if $a=1$, and agrees with it in the limit in all cases for very dilute solutions, but it makes a very considerable difference in strong solutions if a is greater or less than 1. It appears that the relatively enormous deviations of $CaCl_2$ from Raoult's law are accounted for on the hypothesis that $a=9$, but there is a slight uncertainty about the degree of ionization of the strongest solutions at -50° C. Cane-sugar appears to require 5 molecules of water of hydration both at 0° C. and at 100° C., whereas KCl and NaCl take more water at 100° C. than at 0° C. The cases considered by Callendar (*loc. cit.*) are necessarily limited, because the requisite data for strong solutions are comparatively scarce. The vapour-pressure equations are seldom known with sufficient accuracy, and the ionization data are incomplete. But the agreement is very good so far as the data extend, and the theory is really simpler than Raoult's law, because many different degrees of hydration are known, and the assumption $a=1$ (all monohydrates), which is tacitly involved in Raoult's law, is in reality inconsistent with other chemical relations of the substances concerned.

8. *Vapour-Pressure and Osmotic Pressure.*—W. F. P. Pfeffer (*Osmotische Untersuchungen*, Leipzig, 1877) was the first to obtain satisfactory measurements of osmotic pressures of cane-sugar solutions up to nearly 1 atmosphere by means of semi-permeable membranes of copper ferrocyanide. His observations showed that the osmotic pressure was nearly proportional to the concentration and to the absolute temperature over a limited range. Van't Hoff showed that the osmotic pressure P due to a number of dissolved molecules n in a volume V was the same as would be exerted by the same number of gas-molecules at the same temperature in the same volume, or that $PV=R\theta n$. Arrhenius, by reasoning similar to that of section 5, applied to an osmotic cell supporting a column of solution by osmotic pressure, deduced the relation between the osmotic pressure P at the bottom of the column and the vapour-pressure p'' of the solution at the top, viz. $mPV/R\theta=\log_e(p'/p'')$, which corresponds with the effect of hydrostatic pressure, and is equivalent to the assumption that the vapour-pressure of the solution at the bottom of the column under pressure P must be equal to that of the pure solvent. Poynting (*Phil. Mag.* 1896, 42, p. 298) has accordingly defined the osmotic pressure of a solution as being the hydrostatic pressure required to make its vapour-pressure equal to that of the pure solvent at the same temperature, and has shown that this definition agrees approximately with Raoult's law and van't Hoff's gas-pressure theory. It is probable that osmotic pressure is not really of the same nature as gas-pressure, but depends on equilibrium of vapour-pressure. The vapour-molecules of the solvent are free to pass through the semi-permeable membrane, and will continue to condense in the solution until the hydrostatic pressure is so raised as to produce equality of vapour-pressure. Lord Berkeley and E. J. G. Hartley (*Phil. Trans.* A. 1906, p. 481) succeeded in measuring osmotic pressures of cane-sugar, dextrose, &c., up to 135 atmospheres. The highest pressures recorded for cane-sugar are nearly three times as great as those given by van't Hoff's formula for the gas-pressure, but agree very well with the vapour-pressure theory, as modified by Callendar, provided that we substitute for V in Arrhenius's formula the actual specific volume of the solvent in the solution, and if we also assume that each molecule of sugar in solution combines with 5 molecules of water, as required by the observations on the depression of the freezing-point and the rise of the boiling-point. Lord Berkeley and Hartley have also verified the theory by direct measurements of the vapour-pressures of the same solutions.

9. *Total Heat and Latent Heat.*—To effect the conversion of a solid or liquid into a vapour without change of temperature, it is necessary to supply a certain quantity of heat. The quantity required per unit mass of the substance is termed the *latent heat of vaporization*. The *total heat* of the saturated vapour at any temperature is usually defined as the quantity of heat required to raise unit mass of the liquid from any convenient zero up to the temperature considered, and then to evaporate it at that temperature under the constant pressure of saturation. The total heat of steam, for instance, is generally reckoned from the state of water at the freezing-point, 0° C. If h denote the heat required to raise the temperature of the liquid from the selected zero to the temperature t° C., and if H denote the total heat and L the latent heat of the vapour, also at t° C., we have evidently the simple relation

$$H=L+h. \qquad (9)$$

The pressure under which the liquid is heated makes very little difference to the quantity h, but, in order to make the statement definite, it is desirable to add that the liquid should be heated under a constant pressure equal to the final saturation-pressure of the vapour. The usual definition of total heat applies only to a saturated vapour. For greater simplicity and generality it is desirable to define the total heat of a substance as the function $(E+pv)$, where E is the intrinsic energy and v the volume of unit mass (see THERMODYNAMICS). This agrees with the usual definition in the special case of a saturated vapour, if the liquid is heated under the final pressure p, as is generally the case in heat engines and in experimental measurements of H.

The method commonly adopted in measuring the latent heat of a vapour is to condense the vapour at saturation-pressure in a calorimeter. The quantity of heat so measured is the total heat of the vapour reckoned from the final temperature of the calorimeter, and the heat of the liquid h must be subtracted from the total heat measured to find the latent heat of the vapour at the given temperature. It is necessary to take special precautions to ensure that the vapour is dry or free from drops of liquid. Another method, which is suitable for volatile liquids or low temperatures, is to allow the liquid to evaporate in a calorimeter, and to measure the quantity of heat required for the evaporation of the liquid at the temperature of the calorimeter and at saturation-pressure. The first method may be called the method of condensation. It was applied in the most perfect manner by Regnault to determine the latent heats of steam and several other vapours at high pressures. The second method may be called the method of evaporation. It is more difficult of application than the first, but has given some good results in the hands of Griffiths[1] and Dieterici, although the experiments of Regnault by this method were not very successful.

It was believed for many years, in consequence of some rough experiments made by J. Watt, that the total heat of steam was constant. This was known as Watt's law, and was sometines extended to other vapours. An alternative supposition, due to J. Southern, was that the latent heat was constant. The very careful experiments of Regnault, published in 1847, showed that the truth lay somewhere between the two. The formula which he gave for the total heat H of steam at any temperature t° C., which has since been universally accepted and has formed the basis of all tables of the properties of steam, was as follows:—

$$H=606{\cdot}5+0{\cdot}305t. \qquad (10)$$

He obtained similar formulae for other vapours, but the experiments were not so complete or satisfactory as in the case of steam, which may conveniently be taken as a typical vapour in comparing theory and experiment.

10. *Total Heat of Ideal Vapour.*—It was proved theoretically by W. J. M. Rankine (*Proc. R.S.E.* vol. xx. p. 173) that the increase of the total heat of a saturated vapour between any two temperatures should be equal to the specific heat S of the vapour at constant pressure multiplied by the difference of temperature, provided that the saturated vapour behaved as an ideal gas, and that its specific heat was independent of the pressure and temperature. Expressed in symbols, the relation may be written

$$H'-H''=S(\theta'-\theta''). \qquad (11)$$

This relation gives a linear formula for the variation of the total heat, a result which agrees in form with that found by Regnault for steam, and implies that the coefficient of t in his formula should be equal to the specific heat S of steam. Rankine's equation follows directly from the first law of thermodynamics, and may be proved as follows: The heat absorbed in any transformation is the change of intrinsic energy *plus* the external work done. To find the total heat H of a vapour, we have $H=E+p(v-b)$, where the intrinsic energy E is measured from the selected zero θ_0 of total heat. The external work done is $p(v-b)$, where p is the constant pressure, v the volume of the vapour at θ, and b the volume of the liquid at θ_0. If the saturated vapour behaves as a perfect gas, the change of intrinsic energy E depends only on the temperature limits, and is equal to $s(\theta-\theta_0)$, where s is the specific heat at constant volume. Taking the difference between the values of H for any two temperatures

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[1] "Latent Heat of Steam," *Phil. Trans.* A. 1895; of "Benzene," *Phil. Mag.* 1896.

θ' and θ'', we see that Rankine's result follows immediately, provided that $p(v-b)$ is equal to $(\mathrm{S}-s)\theta$ or $\mathrm{R}\theta/m$, which is approximately true for gases and vapours when v is very large compared with b. We may observe that the equation (11) is accurately true for an ideal vapour, for which $pv=(\mathrm{S}-s)\theta$, provided that the total heat is defined as equal to the change of the function $(\mathrm{E}+pv)$ between the given limits. Adopting this definition, without restriction to the case of an ideal vapour or to saturation-pressure, the rate of variation of the total heat with temperature $(d\mathrm{H}/d\theta)$ at constant pressure is equal to S under all conditions, whether S is constant, or varies both with p and θ. (See THERMODYNAMICS, § 7.)

11. *Specific Heat of Vapours.*—The question of the measurement of the specific heat of a vapour possesses special interest on account of this simple theoretical relation between the specific heat and the variation of the latent and total heats. The first accurate calculations of the specific heats of air and gases were made by Rankine in a continuation of the paper already quoted. Employing Joule's value of the mechanical equivalent of heat, then recently published, in connexion with the value of the ratio of the specific heats of air $\mathrm{S}/s=1\cdot40$ deduced from the velocity of sound, Rankine found for air $\mathrm{S}=\cdot240$, which was much smaller than the best previous determinations (*e.g.* Delaroche and Berard, $\mathrm{S}=\cdot267$), but agreed very closely with the value $\mathrm{S}=\cdot238$, found by Regnault at a later date. Adopting for steam the same value of the ratio of the specific heats, viz. 1·40, Rankine found $\mathrm{S}=\cdot385$, a value which he used, in default of a better, in calculating some of the properties of steam, although he observed that it was much larger than the coefficient ·305 in Regnault's formula for the variation of the total heat. The specific heat of steam was determined shortly afterwards by Regnault (*Comptes Rendus*, 36, p. 676) by condensing superheated steam at two different temperatures (about 125° and 225° C.) successively in the same calorimeter at atmospheric pressure, and taking the difference of the total heats observed. The result found in this manner, viz. $\mathrm{S}=\cdot475$, greatly increased the apparent discrepancy between Regnault's and Rankine's formulae for the total heat. The discrepancy was also noticed by G. R. Kirchhoff, who rediscovered Rankine's formula (*Pogg. Ann.* 103, p. 185, 1858). He suggested that the high value for S found by Regnault might be due to the presence of damp in his superheated steam, or, on the other hand, that the assumption that steam at low temperatures followed the law $pv=\mathrm{R}\theta$ might be erroneous. These suggestions have been frequently repeated, but it is probable that neither is correct. G. A. Zeuner, at a later date (*La Chaleur*, p. 441), employing the empirical formula $pv=\mathrm{B}\theta+\mathrm{C}p^{\cdot25}$ for saturated steam, found the value $\mathrm{S}=\cdot568$, which further increased the discrepancy. G. A. Hirn and A. A. Cazin (*Ann. Chim. Phys.* iv. 10, p. 349, 1867) investigated the form of the adiabatic for steam passing through the state $p=760$ mm., $\theta=373°$ Abs., by observing the pressure of superheated steam at any temperature which just failed to produce a cloud on sudden expansion to atmospheric pressure. Assuming an equation of the form $\log(p/760)=a\log(\theta/373)$, their results give $a=\mathrm{S}/\mathrm{R}=4\cdot305$, or $\mathrm{S}=0\cdot474$, which agrees very perfectly with Regnault's value. It must be observed, however, that the agreement is rather more perfect than the comparative roughness of the method would appear to warrant. More recently, Macfarlane Gray (*Proc. Inst. Mech. Eng.* 1889), who has devoted minute attention to the reduction of Regnault's observations, assuming $\mathrm{S}/s=1\cdot400$ as the theoretical ratio of specific heats of all vapours on his "aether-pressure theory," has calculated the properties of steam on the assumption $\mathrm{S}=0\cdot384$. He endeavours to support this value by reference to sixteen of Regnault's observations on the total heat of steam at atmospheric pressure with only 19° to 28° of superheat. These observations give values for S ranging from 0·30 to 0·46, with a mean value 0·3778. But it must be remarked that the superheat of the steam in these experiments is only 1 or 2 % of the total heat measured. A similar objection applies, though with less force, to Regnault's main experiments between 125° and 225° C., giving the value $\mathrm{S}=0\cdot475$, in which the superheat (on which the value of S depends) is only one-sixteenth of the total heat measured. Gray explains the higher value found by Regnault over the higher range as due to the presence of particles of moisture in the steam, which he thinks "would not be evaporated up to 124° C., but would be more likely to be evaporated in the higher range of temperature." J. Perry (*Steam Engine*, p. 580), assuming a characteristic equation similar to Zeuner's (which makes v a linear function of the temperature at constant pressure, and S independent of the pressure), calculates S as a function of the temperature to satisfy Regnault's formula (10) for the total heat. This method is logically consistent, and gives values ranging from 0·305 at 0° to 0·341 at 100° C. and 0·464 at 210° C., but the difference from Regnault's $\mathrm{S}=0\cdot475$ cannot easily be explained.

12. *Throttling Calorimeter Method.*—The ideal method of determining by direct experiment the relation between the total heat and the specific heat of a vapour is that of Joule and Thomson, which is more commonly known in connexion with steam as the method of the throttling calorimeter. It was first employed in the case of steam by Peabody as a means of estimating the wetness of saturated steam, which is an important factor in testing the performance of an engine. If steam or vapour is "wire-drawn" or expanded through a porous plug or throttling aperture without external loss or gain of heat, the total heat $(\mathrm{E}+pv)$ remains constant (THERMODYNAMICS, § 11), provided that the experiment is arranged so that the kinetic energy of flow is the same on either side of the throttle. Thus, starting with saturated steam at a temperature θ' and pressure p', as represented by the point A on the $p\theta$ diagram (fig. 2), if the point B represent the state $p''\theta''$ after passing the throttle, the total heat at A is the same as that at B, and exceeds that at any other point D (at the same pressure p'' as at B, but at a lower temperature θ) by the amount $\mathrm{S}\times(\theta''-\theta)$, which would be required to raise the temperature from D to B at constant pressure. We have therefore the simple relation between the total heats at A and D—

$$\mathrm{H_A}-\mathrm{H_D}=\mathrm{S}(\theta''-\theta). \quad (12)$$

If the steam at A contains a fraction z of suspended moisture, the total heat $\mathrm{H_A}$ is less than the value for dry saturated steam at A by the amount $z\mathrm{L}$. If the steam at A were dry and saturated, we should have, assuming Regnault's formula (10), $\mathrm{H_A}-\mathrm{H_D}=\cdot305\,(\theta'-\theta)$, whence, if $\mathrm{S}=\cdot475$, we have $z\mathrm{L}=\cdot305\,(\theta'-\theta)-\cdot475\,(\theta''-\theta)$. It is evident that this is a very delicate method of determining the wetness z, but, since with dry saturated steam at low pressures this formula always gives *negative* values of the wetness, it is clear that Regnault's numerical coefficients must be wrong.

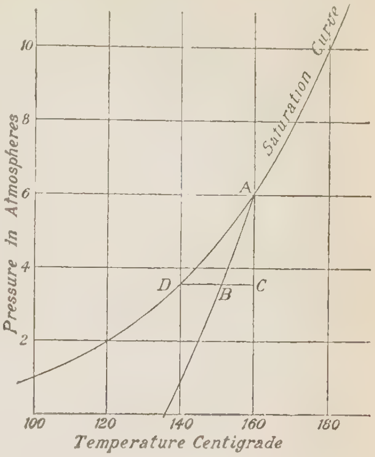

FIG. 2.—Throttling Calorimeter Method.

From a different point of view, equation (12) may be applied to determine the specific heat of steam in terms of the rate of variation of the total heat. If we assume Regnault's formula (10) for the total heat, we have evidently the simple relation $\mathrm{S}=0\cdot305(\theta'-\theta)/(\theta''-\theta)$, supposing the initial steam to be dry, or at least of the same quality as that employed by Regnault. This method was applied by J. A. Ewing (*B.A. Rep.* 1897) to steam near 100° C. He found the specific heat smaller than 0·475, but no numerical results were given. A very complete investigation on the same lines was carried out by J. H. Grindley (*Phil. Trans.* 1900) at Owens College under the direction of Osborne Reynolds. Assuming $d\mathrm{H}/d\theta=0\cdot305$ for saturated steam, he found that S was nearly independent of the pressure at constant temperature, but that it varied with the temperature from 0·387 at 100° C. to 0·665 at 160° C. Writing Q for the Joule-Thomson "cooling effect," $d\theta/dp$, or the slope BC/AC of the line of constant total heat, he found that Q was nearly independent of the pressure at constant temperature, a result which agrees with that of Joule and Thomson for air and $\mathrm{CO_2}$; but that it varied with the temperature as $(1/\theta)^{3\cdot8}$ instead of $(1/\theta)^2$. These results for the variation of Q are independent of any assumption with regard to the variation of H. Employing the values of S calculated from $d\mathrm{H}/d\theta=0\cdot305$, he found that the product SQ was independent of both pressure and temperature for the range of his experiments. Assuming this result to hold generally, we should have $\mathrm{S}=0\cdot306$ at 0° C., which agrees with Rankine's view; but increasing very rapidly at higher temperatures to $\mathrm{S}=1\cdot043$ at 200° C., and 1·315 at 220° C. The characteristic equation, if $\mathrm{SQ}=$ constant, would be of the form $(v+\mathrm{SQ})=\mathrm{R}\theta/p$, which does not agree with the well-known behaviour of other gases and vapours. Whatever may be the objections to Regnault's method of measuring the specific heat of a vapour, it seems impossible to reconcile so wide a range of variation of S with his value $\mathrm{S}=0\cdot475$ between 125° and 225° C. It is also extremely unlikely that a vapour which is so stable a chemical compound as steam should show so wide a range of variation of specific heat. The *experimental* results of Grindley with regard to the mode of variation of Q have been independently confirmed by Callendar (*Proc. R.S.* 1900), who quotes the results of similar experiments made at McGill College in 1897, but gives an entirely different interpretation, based on a direct measurement of the specific heat at 100° C. by an electrical method.

The method of deducing the specific heat from Regnault's formula for the variation of the total heat is evidently liable in a greater degree to the objections which have been urged against his method of determining the specific heat, since it makes the value of the specific heat depend on small differences of total heat observed under conditions of greater difficulty at various pressures. The more logical method of procedure is to determine the specific heat independently of the total heat, and then to deduce the variations of total heat by equation (12). The simplest method of measuring the specific heat appears to be that of supplying heat electrically to a steady current of vapour in a vacuum-jacket calorimeter, and observing the rise of temperature produced. Employing this method, Callendar finds $\mathrm{S}=0\cdot497$ for steam at one atmosphere between 103° C. and 113° C. This is about 4% larger than Regnault's value, but is not really inconsistent with it, if we suppose that the specific heat at any given pressure diminishes slightly with rise of temperature, as indicated in formula (16) below.

13. *Corrected Equation of Total Heat.*—Admitting the value S=0·497 for the specific heat at 108° C., it is clear that the form of Regnault's equation (10) must be wrong, although the numerical value of the coefficient 0·305 may approximately represent the average rate of variation over the range (100° to 190° C.) of the experiments on which it chiefly depends. Regnault's experiments at lower temperatures were extremely discordant, and have been shown by the work of E. H. Griffiths (*Proc. R.S.* 1894) and C. H. Dieterici (*Wied. Ann.* 37, p. 504, 1889) to give values of the total heat 10 to 6 calories too large between 0° and 40° C. At low pressures and temperatures it is probable that saturated steam behaves very nearly as an ideal gas, and that the variation of the total heat is closely represented by Rankine's equation with the ideal value of S. In order to correct this equation for the deviations of the vapour from the ideal state at higher temperatures and pressures, the simplest method is to assume a modified equation of the Joule-Thomson type (THERMODYNAMICS, equation (17)), which has been shown to represent satisfactorily the behaviour of other gases and vapours at moderate pressures. Employing this type of equation, all the thermodynamical properties of the substance may conveniently be expressed in terms of the diminution of volume c due to the formation of compound or coaggregated molecules,

$$(v-b) = R\theta/p - c_0(\theta_0/\theta)^n = V - c. \quad . \quad . \quad (13)$$

The index n in the above formula, representing the rate of variation of c with temperature, is approximately the same as that expressing the rate of variation of the cooling effect Q, which is nearly proportional to c, and is given by the formula

$$SQ = (n+1)c - b. \quad . \quad . \quad . \quad . \quad (14)$$

The corresponding formula for the total heat is

$$H - H_0 = S_0(\theta-\theta_0) - (n+1)\ (cp - c_0p_0) + b(p-p_0), \quad . \quad (15)$$

and for the variation of the specific heat with pressure

$$S = S_0 + n(n+1)pc/\theta, \quad . \quad . \quad . \quad (16)$$

where S_0 is the value of S when $p=0$, and is assumed to be independent of θ, as in the case of an ideal gas.

Callendar's experiments on the cooling effect for steam by the throttling calorimeter method gave $n=3{\cdot}33$ and $c=26{\cdot}3$ c.c. at 100° C. Grindley's experiments gave nearly the same average value of Q over his experimental range, but a rather larger value for n, namely, 3·8. For purposes of calculation, Callendar (*Proc. R.S.* 1900) adopted the mean value $n=3{\cdot}5$, and also assumed the specific heat at constant volume $s=3{\cdot}5$ R (which gives $S_0=4{\cdot}5$ R) on the basis of an hypothesis, doubtfully attributed to Maxwell, that the number of degrees of freedom of a molecule with m atoms is $2m+1$. The assumption $n=s/R$ simplifies the adiabatic equation, but the value $n=3{\cdot}5$ gives $S_0=0{\cdot}497$ at zero pressure, which was the value found by Callendar experimentally at 108° C. and 1 atmosphere pressure. Later and more accurate experiments have confirmed the experimental value, and have shown that the limiting value of the specific heat should consequently be somewhat smaller than that given by Maxwell's hypothesis. The introduction of this correction into the calculations would slightly improve the agreement with Regnault's values of the specific heat and total heat between 100° and 200° C., where they are most trustworthy, but would not materially affect the general nature of the results.

Values calculated from these formulae are given in the table below. The values of H at 0° and 40° agree fairly with those found by Dieterici (596·7) and Griffiths (613·2) respectively, but differ considerably from Regnault's values 606·5 and 618·7. The rate of increase of the total heat, instead of being constant for saturated steam as in Regnault's formula, is given by the equation

$$dH/d\theta = S(1 - Q\,dp/d\theta) \quad . \quad . \quad . \quad (17)$$

and diminishes from 0·478 at 0° C. to about 0·40 at 100° and 0·20 at 200° C., decreasing more rapidly at higher temperatures. The mean value, 0·313 of $dH/d\theta$, between 100° and 200° agrees fairly well with Regnault's coefficient 0·305, but it is clear that considerable errors in calculating the wetness of steam or the amount of cylinder condensation would result from assuming this important coefficient to be constant. The rate of change of the latent heat is easily deduced from that of the total heat by subtracting the specific heat of the liquid. Since the specific heat of the liquid increases rapidly at high temperatures, while $dH/d\theta$ diminishes, it is clear that the latent heat must diminish more and more rapidly as the critical point is approached. Regnault's formula for the total heat is here again seen to be inadmissible, as it would make the latent heat of steam vanish at about 870° C. instead of at 365° C. It should be observed, however, that the assumptions made in deducing the above formulae apply only for moderate pressures, and that the formulae cannot be employed up to the critical point owing to the uncertainty of the variation of the specific heats and the cooling effect Q at high pressures beyond the experimental range. Many attempts have been made to construct formulae representing the deviations of vapours from the ideal state up to the critical point. One of the most complete is that proposed by R. J. E. Çlausius, which may be written

$$R\theta/p - v = R\theta(v-b)(A - B\theta^n)/p(v+a)^2\theta_n; \quad . \quad (18)$$

but such fomulae are much too complicated to be of any practical use, and are too empirical in their nature to permit of the direct physical interpretation of the constants they contain.

14. *Empirical Formulae for the Saturation-Pressure.*—The values of the saturation-pressure have been very accurately determined for the majority of stable substances, and a large number of empirical formulae have been proposed to represent the relation between pressure and temperature. These formulae are important on account of the labour and ingenuity expended in devising the most suitable types, and also as a convenient means of recording the experimental data. In the following list, which contains a few typical examples, the different formulae are arranged to give the logarithm of the saturation-pressure p in terms of the absolute temperature θ. As originally proposed, many of these formulae were cast in exponential form, but the adoption of the logarithmic method of expression throughout the list serves to show more clearly the relationship between the various types.

$\log p = A + B\theta$ . . . . (Dalton, 1800). . . (19)
$\log p = C \log (A + B\theta)$ . . . (Young, 1820).
$\log p = A\theta/(B + C\theta)$ . . . (Roche, 1830).
$\log p = A + Bb^\theta + Cc^\theta$ . . . (Biot, 1844; Regnault).
$\log p = A + B/\theta + C/\theta^2$ . . (Rankine, 1849).
$\log p = A + B/\theta + C \log \theta$ . . (Kirchhoff, 1858; Rankine, 1866).
$\log p = A + B/\theta^b$ . . . . (Unwin, 1887).
$\log p = A + B \log \theta + C \log (\theta + c)$. (Bertrand, 1887).
$\log p = A + B/(\theta + C)$ . . . (Antoine, 1888).

The formula of Dalton would make the pressure increase in geometrical progression for equal increments of temperature. In other words, the increase of pressure per degree $(dp/d\theta)$ divided by p should be constant and equal to B; but observation shows that this ratio decreases, *e.g.* from 0·0722 at 0° C. to 0·0357 at 100° C. in the case of steam. Observing that this rate of diminution is approximately as the square of the reciprocal of the absolute temperature, we see that the almost equally simple formula $\log p = A + B/\theta$ represents a much closer approximation to experiment. As a matter of fact, the two terms $A + B/\theta$ are the most important in the theoretical expression for the vapour-pressure given below. They are not sufficient alone, but give good results when modified, as in the simple and accurate formulae of Rankine, Kirchhoff, L. C. Antoine and Unwin. If we assume formulae of the simple type $A + B/\theta$ for *two different substances* which have the same vapour-pressure p at the absolute temperatures θ' and θ'' respectively, we may write

$$\log p = A' + B'/\theta' = A'' + B''/\theta'', \quad . \quad . \quad (20)$$

from which we deduce that the ratio θ'/θ'' of the temperatures at which the vapour-pressures are the same is a linear function of the temperature θ' of one of the substances. This approximate relation has been employed by Ramsay and Young (*Phil. Mag.* 1887) to deduce the vapour-pressures of any substance from those of a standard substance by means of two observations. More recently the same method has been applied by A. Findlay (*Proc. R.S.* 1902), under Ramsay's direction, for comparing solubilities which are in many respects analogous to vapour-pressures. The formulae of Young and Roche are purely empirical, but give very fair results over a wide range. That of Biot is far more complicated and troublesome, but admits greater accuracy of adaptation, as it contains five constants (or six, if θ is measured from an arbitrary zero). It is important as having been adopted by Regnault (and also by many subsequent calculators) for the expression of his observations on the vapour-pressures of steam and various other substances. The formulae of Rankine and Unwin, though probably less accurate over the whole range, are much simpler and more convenient in practice than that of Biot, and give results which suffice in accuracy for the majority of purposes.

15. *Theoretical Equation for the Saturation-Pressure.*—The empirical formulae above quoted must be compared and tested in the light of the theoretical relation between the latent heat and the rate of increase of the vapour-pressure $(dp/d\theta)$, which is given by the second law of thermodynamics, viz.

$$\theta(dp/d\theta) = L/(v-w), \quad . \quad . \quad . \quad (21)$$

in which v and w are the volumes of unit mass of the vapour and liquid respectively at the saturation-point (THERMODYNAMICS, § 4). This relation cannot be directly integrated, so as to obtain the equation for the saturation-pressure, unless L and $v-w$ are known as functions of θ. Since it is much easier to measure p than either L or v, the relation has generally been employed for deducing either L or v from observations of p. For instance, it is usual to calculate the specific volumes of saturated steam by assuming Regnault's formulae for p and L. The values so found are necessarily erroneous if formula (10) for the total heat is wrong. The reason for adopting this method is that the specific volume of a saturated vapour cannot be directly measured with sufficient accuracy on account of the readiness with which it condenses on the surface of the containing vessel. The specific volumes of superheated vapours may, however, be measured with a satisfactory degree of approximation. The deviations from the ideal volume may also be deduced by the method of Joule and Thomson. It is found by these methods that the behaviour of superheated vapours closely resembles that of non-condensible gases, and it is a fair inference that similar behaviour would be observed up to the saturation-point if surface condensation could be avoided. By assuming suitable forms of the characteristic equation to represent the variations of the specific volume within certain limits of pressure and temperature, we may therefore with propriety deduce equations to represent the saturation-pressure, which will certainly be thermodynamically consistent, and will probably give correct numerical results within the assigned limits.

The simplest assumptions to make are that the vapour behaves as a perfect gas (or that $p(v-w)=\mathrm{R}\theta$), and that L is constant. This leads immediately to the simple formula

$$\log_e(p/p_0)=(1/\theta_0-1/\theta)\mathrm{L}/\mathrm{R}, \quad . \quad . \quad . \quad (22)$$

which is of the same type as $\log p=\mathrm{A}+\mathrm{B}/\theta$, and shows that the coefficient B should be equal to L/R. A formula of this type has been widely employed by van't Hoff and others to calculate heats of reaction and solution from observations of solubility and vice versa. It is obvious, however, that the assumption L = constant is not sufficiently accurate in many cases. The rate of variation of the latent heat at low pressures is equal to $\mathrm{S}-s$, where s is the specific heat of the liquid. Under these conditions both S and s may be regarded as approximately constant, so that L is a linear function of the temperature. Substituting $\mathrm{L}=\mathrm{L}_0+(\mathrm{S}-s)(\theta-\theta_0)$, and integrating between limits, we obtain the result

$$\log_e p=\mathrm{A}+\mathrm{B}/\theta+\mathrm{C}\log_e\theta, \quad . \quad . \quad . \quad (23)$$

where

$$\mathrm{C}=(\mathrm{S}-s)/\mathrm{R},\ \mathrm{B}=-[\mathrm{L}_0+(s-\mathrm{S})\theta_0]/\mathrm{R},$$

and

$$\mathrm{A}=\log_e p_0-\mathrm{B}/\theta_0-\mathrm{C}\log_e\theta_0.$$

A formula of this type was first obtained by Kirchhoff (*Pogg. Ann.* 103, p. 185, 1858) to represent the vapour-pressure of a solution, and was verified by Regnault's experiments on solutions of H_2SO_4 in water, in which case a constant, the heat of dilution, is added to the latent heat. The formula evidently applies to the vapour-pressure of the pure solvent as a special case, but Kirchhoff himself does not appear to have made this particular application of the formula. In the paper which immediately follows, he gives the oft-quoted expression for the difference of slope $(dp/d\theta)_s-(dp/d\theta)_l$ of the vapour-pressure curves of a solid and liquid at the triple point, which is immediately deducible from (21), viz.

$$\theta(dp/d\theta)_s-\theta(dp/d\theta)_l=(\mathrm{L}_s-\mathrm{L}_l)/(v-w)=\mathrm{L}_f/(v-w), \quad (24)$$

in which L_s and L_l are the latent heats of vaporization of the solid and liquid respectively, the difference of which is equal to the latent heat of fusion L_f. He proceeds to calculate from this expression the difference of vapour-pressures of ice and water in the immediate neighbourhood of the melting-point, but does not observe that the vapour-pressures themselves may be more accurately calculated for a considerable interval of temperature by means of formula (23), by substituting the appropriate values of the latent heats and specific heats. Taking for ice and water the following numerical data, $\mathrm{L}_s=674{\cdot}7$, $\mathrm{L}_l=595{\cdot}2$, $\mathrm{L}_f=79{\cdot}5$, $\mathrm{R}=0{\cdot}1103$ cal./deg., $p_0=4{\cdot}61$ mm., $s-\mathrm{S}={\cdot}519$ cal./deg., and assuming the specific heat of ice to be equal to that of steam at constant pressure (which is sufficiently approximate, since the term involving the difference of the specific heats is very small), we obtain the following numerical formulae, by substitution in (23),

Ice . . $\log_{10}p=0{\cdot}6640+9{\cdot}73t/\theta,$

Water . $\log_{10}p=0{\cdot}6640+8{\cdot}585t/\theta-4{\cdot}70(\log_{10}\theta/\theta_0-\mathrm{M}t/\theta),$

where $t=\theta-273$, and $\mathrm{M}=0{\cdot}4343$, the modulus of common logarithms. These formulae are practically accurate for a range of 20° or 30° C. on either side of the melting-point, as the pressure is so small that the vapour may be treated as an ideal gas. They give the following numerical values:—

Temperature, C.	−20°	−10°	0°.	+10°	+20°
V.P. of ice, mms.	0·79	1·97	4·61	10·20	21·27
V.P. of water, mms.	0·96	2·17	4·61	9·27	17·58

The error of the formula for water is less than 1 mm. (or a tenth of a degree C.), at a temperature so high as 60° C.

Formula (23) for the vapour-pressure was subsequently deduced by Rankine (*Phil. Mag.* 1866) by combining his equation (11) for the total heat of gasification with (21), and assuming an ideal vapour. A formula of the same type was given by Athenase Dupré (*Théorie de chaleur*, p. 96, Paris, 1869), on the assumption that the latent heat was a linear function of the temperature, taking the instance of Regnault's formula (10) for steam. It is generally called Dupré's formula in continental text-books, but he did not give the values of the coefficients in terms of the difference of specific heats of the liquid and vapour. It was employed as a purely empirical formula by Bertrand and Barus, who calculated the values of the coefficients for several substances, so as to obtain the best general agreement with the results of observation over a wide range, at high as well as low pressures. Applied in this manner, the formula is not appropriate or satisfactory. The values of the coefficients given by Bertrand, for instance, in the formula for steam, correspond to the values $\mathrm{S}={\cdot}576$ and $\mathrm{L}=573$ at 0° C., which are impossible, and the values of p given by his formula (*e.g.* 763 mm. at 100° C.) do not agree sufficiently with experiment to be of much practical value. The true application of the formula is to low pressures, at which it is very accurate. The close agreement found under these conditions is a very strong confirmation of the correctness of the assumption that a vapour at low pressures does really behave as an ideal gas of constant specific heat. The formula was independently rediscovered by H. R. Hertz (*Wied. Ann.* 17, p. 177, 1882) in a slightly different form, and appropriately applied to the calculation of the vapour-pressures of mercury at ordinary temperatures, where they are much too small to be accurately measured.

16. *Corrected Equation of Saturation-Pressure.*—The approximate equation of Rankine (23) begins to be 1 or 2% in error at the boiling-point under atmospheric pressure, owing to the coaggregation of the molecules of the vapour and the variation of the specific heat of the liquid. The errors from both causes increase more rapidly at higher temperatures. It is easy, however, to correct the formula for these deviations, and to make it thermodynamically consistent with the characteristic equation (13) by substituting the appropriate values of $(v-w)$ and $\mathrm{L}=\mathrm{H}-h$ from equations (13) and (15) in formula (21) before integrating. Omitting w and neglecting the small variation of the specific heat of the liquid, the result is simply the addition of the term $(c-b)/\mathrm{V}$ to formula (23)

$$\log p=\mathrm{A}+\mathrm{B}/\theta+\mathrm{C}\log\theta+(c-b)/\mathrm{V}. \quad . \quad . \quad (25)$$

The values of the coefficients B and C remain practically as before. The value of c is determined by the throttling experiments, so that all the coefficients in the formula with the exception of A are determined independently of any observations of the saturation-pressure itself. The value of A for steam is determined by the consideration that $p=760$ mm. by definition at 100° C. or 373° Abs. The most uncertain data are the variation of the specific heat of the liquid and the value of the small quantity b in the formula (13). The term b, however, is only 4% of c at 100° C., and the error involved in taking b equal to the volume of the liquid is probably small. The effect of variation of the specific heat is more important, but is nearly eliminated by the form of the equation. If we write $h=s_0t+dh$, where s_0 is a selected constant value of the specific heat of the liquid, and dh represents the difference of the actual value of h at t from the ideal value s_0t, and if we similarly write $\phi=s_0\log_e(\theta/\theta_0)+d\phi$ for the entropy of the liquid at t, where $d\phi$ represents the corresponding difference in the entropy (which is easily calculated from a table of values of h), it is shown by Callendar (*Proc. R.S.* 1900, *loc. cit.*) that the effect of the variation of the specific heat of the liquid is represented in the equation for the vapour-pressure by adding to the right-hand side of (23) the term $-(d\phi-dh/\theta)/\mathrm{R}$. If we proceed instead by the method of integrating the equation $\mathrm{H}-h=\theta(v-w)dp/d\theta$, we observe that the expression above given results from the integration of the terms $-dh/R\theta^2+w(dp/d\theta)/\mathrm{R}\theta$, which were omitted in (25). Adopting the formula of Regnault as corrected by Callendar (*Phil. Trans. R.S.* 1902) for the specific heat of water between 100° and 200° C., we find the values of the difference $(d\phi-dh/\theta)$ to be less than one-tenth of $d\phi$ at 200° C. The whole correction is therefore probably of the same order as the uncertainty of the variation of the specific heat itself at these temperatures. It may be observed that the correction would vanish if we could write $dh=w\theta dp/d\theta=w\mathrm{L}/(v-w)$. This assumption is made by Gray (*Proc. Inst. C.E.* 1902). It is equivalent, as Callendar (*loc. cit.*) points out, to supposing that the variation of the specific heat is due to the formation and solution of a mass $w/(v-w)$ of vapour molecules per unit mass of the liquid. But this neglects the latent heat of solution, unless we may suppose it included by writing the internal latent heat L_i in place of L in Callendar's formula. In any case the correction may probably be neglected for practical purposes below 200° C.

It is interesting to remark that the simple result found in equation (25) (according to which the effect of the deviation of the vapour from the ideal state is represented by the addition of the term $(c-b)/\mathrm{V}$ to the expression for $\log p$) is independent of the assumption that c varies inversely as the n^{th} power of θ, and is true generally provided that $c-b$ is a function of the temperature only and is independent of the pressure. But in order to deduce the values of c by the Joule-Thomson method, it is necessary to assume an empirical formula, and the type $c=c_0(\theta_0/\theta)^n$ is chosen as being the simplest. The justification of this assumption lies in the fact that the values of c found in this manner, when substituted in equation (25) for the saturation-pressure, give correct results for p within the probable limits of error of Regnault's experiments.

17. *Numerical Application to Steam.*—As an instance of the application of the method above described, the results in the table below are calculated for steam, starting from the following fundamental data: $p=760$ mm. at $t=100°$ C. or 373·0° Abs. $p\mathrm{V}/\theta=0{\cdot}11030$ calories per degree for ideal steam. $\mathrm{S}_0=0{\cdot}478$ calories per degree at zero pressure, $\mathrm{L}=540{\cdot}2$ calories at 100° C. (Joly-Callendar), $n=3{\cdot}33$, $c_{100}=26{\cdot}30$ c.c., $b=1$ c.c., $h=0{\cdot}9970t+w\mathrm{L}/(v-w)$. 750 mm. Hg. = 1 megadyne per sq. cm.

Table of Properties of Saturated Steam[1]

Temp. Cent.	Coaggregation, c, cub. cms.	Total Heat, H, calories.	Latent Heat, L, calories.	Specific Heat, S, cals./deg.	Saturation-Pressure, p, mm. of Hg.
0°	74·43	595·2	595·2	·4786	4·6
20°	58·81	604·7	584·7	·4796	17·6
40°	47·19	614·0	574·0	·4818	55·4
60°	38·68	623·1	536·1	·4860	149·4
80°	31·60	631·9	551·9	·4926	355·0
100°	26·30	640·3	540·2	·5027	760·0
120°	21·93	648·1	527·8	·5163	1490·4
140°	18·73	655·1	514·5	·5347	2715·8
160°	16·00	661·4	500·3	·5571	4647
180°	13·76	666·9	485·3	·5834	7534
200°	11·92	671·6	469·3	·6134	11660

The values of the coaggregation-volume c, which form the starting-point of the calculation, are found by taking $n=10/3$ for convenience of division in formula (13). The unit of heat assumed in the table is the calorie at 20° C., which is taken as equal to 4·180 joules, as explained in the article CALORIMETRY. The latent heat L (formula 9) is found by subtracting from H (equation 15) the values of the heat of the liquid h given in the same article. The values of the specific heat in the next column are calculated for a constant pressure equal to that of saturation by formula (16) to illustrate the increase of the specific heat with rise of pressure. The specific heat at any given pressure diminishes with rise of temperature. The values of the saturation-pressure given in the last column are calculated by formula (25), which agrees with Regnault's observations better than his own empirical formulae. The agreement of the values of H with those of Griffiths and Dieterici at low temperatures, and of the values of p with those of Regnault over the whole range, are a confirmation of the accuracy of the foregoing theory, and show that the behaviour of a vapour like steam may be represented by a series of thermodynamically consistent formulae, on the assumption that the limiting value of the specific heat is constant, and that the isothermals are generally similar in form to those of other gases and vapours at moderate pressures. Although it is not possible to represent the properties of steam in this manner up to the critical temperature, the above method appears more satisfactory than the adoption of the inconsistent and purely empirical formulae which form the basis of most tables at the present time.

A similar method of calculation might be applied to deduce the thermodynamical properties of other vapours, but the required experimental data are in most cases very imperfect or even entirely wanting. The calorimetric data are generally the most deficient and difficult to secure. An immense mass of material has been collected on the subject of vapour-pressures and densities, the greater part of which will be found in Winkelmann's *Handbook*, in Landolt's and Bornstein's *Tables*, and in similar compendiums. The results vary greatly in accuracy, and are frequently vitiated by errors of temperature measurement, by chemical impurities and surface condensation, or by peculiarities of the empirical formulae employed in smoothing the observations; but it would not be within the scope of the present article to discuss these details. Even at the boiling-points the discrepancies between different observers are frequently considerable. The following table contains the most probable values for a few of these points which have been determined with the greatest care or frequency:—

Table of Boiling-Points at Atmospheric Pressure on Centigrade Scale

Hydrogen	−252°·6	Benzophenone	+305°·8
Oxygen	−182°·8	Mercury	+356°·7
Carbon dioxide	− 78°·3	Sulphur	+444°·5
Sulphur dioxide	− 10°·0	Cadmium	+756°
Aniline	+184°·1	Zinc	+916°
Naphthalene	+218°·0		

Alphabetical Index of Symbols

A, B, C, Empirical constants in formulae; section 14.
b, Minimum volume or co-volume of vapour, equation (13).
C, Concentration of solution, gm. mols. per c.c.
c, Coaggregation-volume of vapour, equation (13).
D, d, Density of liquid and vapour.
E, Intrinsic energy of vapour.
g, Acceleration of gravity.
H, Total heat of vapour.
h, Heat of the liquid; height of capillary ascent.
L, Latent heat of vaporization.
M, Modulus of logarithms.
m, Molecular weight.
n, Index of θ in expression for c, equation (13).
P, Osmotic or capillary pressure.
p, Pressure of vapour.
Q, Cooling effects in adiathermal expansion.
R, Constant in gas equation, $pv=R\theta$.
r, Radius of curvature, formula (1).
S, Specific heat of vapour at constant pressure.
s, Specific heat of liquid, equation (23).
Specific heat of vapour at constant volume; section 8.
T, Surface tension of liquid.
t, Temperature Centigrade.
V, Ideal volume of vapour, equation (13).
Specific volume of solid or liquid, equation (5).
v, Specific volume of vapour or steam.
w, Specific volume of water or liquid.
θ, Temperature on thermodynamic scale.
ϕ, Entropy of vapour or liquid.

(H. L. C.)

VAQUERO, a Spanish word meaning a cowherd or herdsman, and so particularly used in Mexico and Spanish America for the whole class of men employed on the large cattle-ranches or *vaquerias*. The word, like the corresponding Fr. *vacher*, cowherd, comes from the Med. Lat. *vaccarius* (*vacca*, cow).

VAR, a department in S.E. France. It was formed in 1790 of a part of Lower Provence, but in 1860 it was reduced by the transfer of the district of Grasse to the newly formed department of the Alpes Maritimes, which is the reason why the Var does not now flow in the department to which it gives its name. It is bounded N. by the department of the Basses Alpes (the Verdon river forming the boundary), E. by that of the Alpes Maritimes (the Siagne stream forming the limit), S. by the Mediterranean, and W. by the department of the Bouches du Rhône. Its area is 2266 sq. m., its greatest length is about 62 m., and its greatest breadth about 56 m.

The surface of the department is very hilly, the highest point being the Signal des Chens (5620 ft.) at its north-east corner. These calcareous hills are much fissured and very dry on the highest plateaux, but are rich in springs, which is the cause of very beautiful verdure in the valleys. To the W. is the chain (3786 ft.) of the Ste Baume, wherein is the celebrated grotto (now a frequented pilgrimage place) wherein St Mary Magdalene is said to have taken refuge. This chain is connected with the hills (2329 ft.) above Toulon. The thickly wooded Montagnes des Maures (2556 ft.), which extend above the coast from Hyères to near Fréjus are separated from the Ste Baume chain by the Gapeau stream and from that of the Estérel by the Argens river: the Maures chain, with the Argens valley, forms a sort of geological island in Provence, being composed of granite, gneiss and schists. To the north of the Argens valley and in the north-eastern portion of the department rises the Estérel chain, the highest summit of which (the Mont Vinaigre) attains 2021 ft.: this chain is mainly composed of igneous rocks, with some schists and porphyry. The principal river in the department is the Argens, which traverses it from W. to E., and falls into the sea near Fréjus after a course of about 68 m. Its chief tributary is the Nartuby, on which stands Draguignan, the chief town, while other streams are the Arc, the Huveaune and the Gapeau. The extreme north-western extremity of the department borders for 2½ m. the Durance, which separates it from the department of Vaucluse. The coast line, which is one of the most picturesque and varied in France, runs first W. to E., from the Gulf of La Ciotat to Cape Camarat, and then S.W. to N.E., from the Gulf of St Tropez to that of La Napoule. The shore is dotted (from W. to E.) successively by the sand-covered remains of the Phocaean city of Tauroentum; the little ports of Bandol and St Nazaire; the peninsula of Cape Sicié (on which rises the chapel of Notre Dame de la Garde, and a famous lighthouse, 1178 ft.) with its eastward projection Cape Cépet (338 ft.), bristling with fortifications to protect the great harbour of Toulon, to the north-east; the roads of Toulon; those of Giens, on the site of the Gallo-Roman town of Pomponiana; the curious peninsula of Giens, formerly an island, but now attached to the mainland by two long spits of sand, between which lies the lagoon of Les Pesquiers, with its *salines*; the great anchorage of Hyères, shut off from the Mediterranean by the hilly and wooded islands of Porquerolles, Port Cros and Le Levant; the bold promontories of the Montagnes des Maures, that divide the coast into lovely bays; Cape Camarat (1066 ft.), with a lighthouse; the deep Gulf of St Tropez, with perhaps the best natural anchorage in all Provence; the Gulf of Fréjus, where, owing to the accumulated alluvial deposits at the mouth of the Argens, the Roman port of Forum Julii is now occupied by the inland town of Fréjus; the red porphyry headlands of the Estérel chain, with the roads of Agay between them; and Cape Roux (1486 ft.) looking towards Cannes, still farther N.E. The department is divided into three arrondissements (Draguignan, Brignoles and Toulon), 30 cantons and 148 communes. The climate is remarkably fine and mild on the coast, where there is complete shelter from the wind, St Raphaël (with Valescure above it) and Hyères being now much frequented winter resorts. The department now forms the bishopric of Fréjus (4th century), which is in the ecclesiastical province of Aix en Provence: in 1801 there was annexed to it the episcopal see of Toulon, founded in the 5th century, and in the ecclesiastical province of Arles. There are in the department 135 m. of broad gauge railways, and 148½ m. of narrow gauge lines. The principal towns are Toulon, La Seyne, Hyères, Draguignan, its political capital, Brignoles and Fréjus. There are a number of mines (chiefly iron and coal) in the department, and salt is extracted from the marshes near Hyères, while there are manufactories of pottery and extensive vineyards. La Seyne is the principal centre of industrial activity. Cut flowers are largely exported from Hyères. In 1901 the population of the department was 326,384. (W. A. B. C.)

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[1] Complete tables of the properties of steam have been worked out on the basis of Callendar's formulae by Professor Dr R. Mollier of Dresden, *Neue Tabellen und Diagramme für Wasserdampf*, published by J. Springer (Berlin, 1906).

VARALLO SESIA, a town of Piedmont, Italy, in the province of Novara, from which it is 34 m. N.N.W. by rail, situated in the valley of the Sesia, 1480 ft. above sea-level. Pop. (1901) 3330 (town); 4265 (commune). The churches of S Gaudenzio, S Maria delle Grazie and S Maria di Loreto, all contain works by Gaudenzio Ferrari (1471–1546), who was born in the neighbouring Val Duggia, while the Sacro Monte, a place of pilgrimage rising above the town (1995 ft.), is approached by a path leading past forty-five chapels containing groups of life-size painted terra-cotta figures representing scenes from sacred history, with backgrounds in fresco (by Ferrari and others), to the pilgrimage church built by Pellegrino Tibaldi after 1578. In the works mentioned, as Burckhardt remarks, Ferrari's whole development may be traced.

VARCHI, BENEDETTO (1502–1565), Florentine historian. He fought in the defence of Florence during the siege by the Mediceans and imperialists in 1530, and was exiled after the surrender of the city. In 1536 he took part in Piero Strozzi's unsuccessful expedition against Medicean rule, but seven years later he was called back to Florence by Cosimo I., who gave him a pension and commissioned him to write a history of the city; the work covers the period from 1527 to 1538. Varchi also wrote a number of plays, poems, dialogues and translations from the classics. His history, in sixteen books, was first published in Florence in 1721.

VARDANES, the name of two Parthian kings.

VARDANES I., succeeded Artabanus II., probably his father, in A.D. 40 (Joseph. *Ant.* xx. 3, 4), but had continually to fight against his rival Gotarzes (*q.v.*). The coins show that he was in full possession of the throne from 42 to 45. In 43 he forced Seleucia on the Tigris to submit to the Parthians again after a rebellion of seven years (Tac. *Ann.* xi. 9). Ctesiphon, the residence of the kings on the left bank of the Tigris, opposite to Seleucia, naturally profited by this war; and Vardanes is therefore called founder of Ctesiphon by Ammianus Marc. xxiii. 6. 23. He also prepared for a war against Rome, with the aim of reconquering Armenia (cf. Joseph, *Ant.* xx. 3, 4), but did not dare to face the Roman legions (Tac. *Ann.* xi. 10). In a new war with Gotarzes he gained a great success against the eastern nomads. He is praised by Tacitus as a young and highly gifted ruler of great energy (cf. Philostratus, *Vita Apollon. Tyan.* i. 21. 28), but lacking in humanity. In the summer of 45 he was assassinated while hunting, and Gotarzes became king again.

VARDANES II. rebelled against his father Vologaeses I. in A.D. 54 (Tac. *Ann.* xiii. 7). We know nothing more about him and it is not certain whether the coins of a young beardless king, which are generally attributed to him, really belong to him (Wroth, *Catalogue of the Coins of Parthia*, p. L. ff.). (ED. M.)

VARENIUS, BERNHARDUS [BERNHARD VAREN] (1622–1650), German geographer, was born at Hitzacker on the Elbe, in the Lüneburg district of Hanover. His early years (from 1627) were spent at Uelzen, where his father was court preacher to the duke of Brunswick. Varenius studied at the gymnasium of Hamburg (1640–42), and at Königsberg (1643–45) and Leiden (1645–49) universities, where he devoted himself to mathematics and medicine, taking his medical degree at Leiden in 1649. He then settled at Amsterdam, intending to practise medicine. But the recent discoveries of Tasman, Schouten and other Dutch navigators, and his friendship for Blaeu and other geographers, attracted Varenius to geography. He died in 1650, aged only twenty-eight, a victim to the privations and miseries of a poor scholar's life.

In 1649 he published, through L. Elzevir of Amsterdam, his *Descriptio Regni Japoniae*, an excellent compilation. In this was included a translation into Latin of part of Jodocus Schouten's account of Siam (*Appendix de religione Siamensium, ex Descriptione Belgica Iodoci Schoutenii*), and chapters on the religions of various peoples. Next year (1650) appeared, also through Elzevir, the work by which he is best known, his *Geographia Generalis*, in which he endeavoured to lay down the general principles of the subject on a wide scientific basis, according to the knowledge of his day. The work is divided into—(1) absolute geography, (2) relative geography and (3) comparative geography. The first investigates mathematical facts relating to the earth as a whole, its figure, dimensions, motions, their measurement, &c. The second part considers the earth as affected by the sun and stars, climates, seasons, the difference of apparent time at different places, variations in the length of the day, &c. The third part treats briefly of the actual divisions of the surface of the earth, their relative positions, globe and map-construction, longitude, navigation, &c.

Varenius, with the materials at his command, dealt with the subject in a truly philosophic spirit; and his work long held its position as the best treatise in existence on scientific and comparative geography. The work went through many editions. Sir Isaac Newton introduced several important improvements into the Cambridge edition of 1672; in 1715 Dr Jurin issued another Cambridge edition with a valuable appendix; in 1733 the whole work was translated into English by Dugdale; and in 1736 Dugdale's second edition was revised by Shaw. In 1716 an Italian edition appeared at Naples; in 1750 a Dutch translation followed; and in 1755 a French version, from Shaw's edition, came out at Paris. Among later geographers d'Anville and A. von Humboldt especially drew attention to Varen's genius and services to science.

See Breusing, "Lebensnachrichten von Bernhard Varenius" (*Geogr. Mittheil.*, 1880); H. Blink's paper on Varenius in *Tijdschr. van het Nederl. Aandrijksk. Genotschap* (1887), ser. ii. pt. 3; and F. Ratzel's article "Bernhard Varenius," in *Allgemeine Deutsche Biographie*, vol. xxxix. (Leipzig, 1895).

VARESE, a town of Lombardy, Italy, in the province of Como, 18 m. by rail W. of that town, and 37 m. N.W. of Milan, 1253 ft. above sea-level. Pop. (1901) 7692 (town); 17,666 (commune). It is a well-to-do place, beautifully situated near the Lake of Varese, and for this reason a favourite summer and autumn resort of the Milanese, who have numerous country houses in the vicinity. Among them the Villa Litta and the Villa Ponte may be specially mentioned. The principal church is that of S. Victor (rebuilt 1580–1615 and 1795), to which is attached an ancient baptistery (dating from the 9th century but rebuilt in the 13th). The fine campanile of the church is 246 ft. high. There is an archaeological museum with prehistoric antiquities from the lake-dwellings on an island in the Lake of Varese. To the N.W. (a journey of 2½ hours) is the pilgrimage church of the Madonna del Monte (2885 ft.), approached by a path which passes fourteen chapels adorned with 17th-century frescoes and groups in stucco illustrating the mysteries of the rosary. Varese is the seat of active silk-spinning, tanning, paper-making and the manufacture of organs and vehicles. Excellent wine is made. Varese is a junction for Porto Ceresio and Laveno.

VARIA (mod. Vicovaro), an ancient village of Latium, Italy, in the valley of the Anio, on its right bank, and on the Via Valeria, 8 m. N.E. of Tibur (Tivoli). It was probably an independent town and not within the territory of Tibur, and Horace speaks of it as Sabine. Some remains of its walls, in rectangular blocks of travertine, still exist. One mile to the east is a picturesque gorge of the Anio, in which may be seen remains of the ancient aqueducts which supplied Rome, consisting partly of rock-cut channels and partly of ruined bridges: above it is the monastery of S Cosimato. Close to this point begins the valley of the Digentia (mod. Licenza) in which Horace's Sabine farm was situated. On the hill at the east of the entrance is the village of Cantalupo or Bardella, which has now assumed the name of Mandela, being identified thus (correctly) with Horace's "rugosus frigore pagus" (*Epist.* i. 18, 104). An inscription of the Christian period, found at S Cosimato, speaks of the Massa Mandelana (*Corp. Inscr. Lat.* xiv. 3482). About 3 m. up the valley, close to the road on the west (right) bank of the stream, are traces of a Roman dwelling-house in *opus reticulatum* with remains of two mosaic pavements; this is generally identified with the villa of Horace, and probably corresponds fairly closely with its site. That the Fons Bandusiae was near the Sabine farm is not a necessary inference from *Od.* iii. 13, in which alone it is mentioned; though the scholiasts state it; indeed a fountain of this name near Venusia is mentioned in a bull of 1103. On the other hand, that there was an abundant fountain near the Sabine farm is clear from *Epist.* i. 16. 12, and *Sat.* ii. 6. 2. It is generally identified with the Fonte dei Ratini, but the spring of Vigna la Corte, a little farther north, is still more plentiful. Some have supposed that the site of the villa was higher up the hillside, above Rocca Giovane. For Horace speaks of having written *Epist.* i. 10 "post fanum putre Vacunae," and an inscription recording a temple of Victoria restored by Vespasian was copied at Rocca Giovane in the 16th century (*Corp. Inscr. Lat.* xiv. 3485). The identification of Victoria with the Sabine goddess Vacuna is not, however, absolutely certain: and there is here, as elsewhere in Roman literature, a play on the connexion of the name with *vacare*, "to take a holiday." In any case, the site of the Sabine farm can be approximately, if not exactly, fixed as in the neighbourhood of Rocca Giovane.

See T. Berti, *La Villa di Orazio* (Rome, 1886); G. Boissier, *Nouvelles promenades archéologiques* (Paris, 1886). (T. As.)

VARIATION AND SELECTION, in biology. Since the publication in 1859 of Charles Darwin's *Origin of Species*, the theory of evolution of animals and plants (see EVOLUTION) has rested on a linking of the conceptions of variation and selection. Living organisms vary, that is to say, no two individuals are exactly alike; the death-rate and the multiplication-rate are to a certain extent selective, that is to say, on the average, in the long run, they favour certain variations and oppress other variations. Co-operation of the two factors appears to supply a causal theory of the occurrence of evolution; the suggestion of their co-operation and the comparison of the possible results with the actual achievements of breeders in producing varieties were the features of Charles Darwin's theoretical work which made it a new beginning in the science of biology, and which reduced to insignificance all earlier work on the theory of evolution. P. Geddes, J. H. Stirling, E. Clodd and H. F. Osborn have made careful studies of pre-Darwinian writers on evolution, but the results of their inquiries only serve to show the greatness of the departure made by Darwin.

Several of the ancients had a vague belief in continuity between the inorganic and the organic and in the modifying or variation-producing effects of the environment. Medieval writers contain nothing of interest on the subject, and the speculations of the earliest of the modern evolutionists, such as C. Bonnet, were too vague to be of value. G. L. L. Buffon, in a cautious, tentative fashion, suggested rather than stated the mutability of species and the influence of the forces of nature in moulding organisms. Immanuel Kant, in his *Theory of the Heavens* (1755), foreshadowed a theory of the development of unformed matter into the highest types of animals and plants, and suggested that the gradations of structure revealed by comparative anatomy pointed to the existence of blood relationship of all organisms, due to derivation from a common ancestor. He appeared to believe, however, that the successive variations and modifications had arisen in response to mechanical laws of the organisms themselves rather than to the influence of their surroundings. J. G. von Herder suggested that increase by multiplication with the consequent struggle for existence had played a large part in the organic world, but his theme remained vague and undeveloped. Erasmus Darwin, the grandfather of Charles Darwin, set forth in *Zoonomia* a much more definite theory of the relation of variation to evolution, and the following passage, cited by Clodd, clearly expresses it:—

> "When we revolve in our minds the metamorphoses of animals, as from the tadpole to the frog; secondly, the changes produced by artificial cultivation, as in the breeds of horses, dogs and sheep; thirdly, the changes produced by conditions of climate and season, as in the sheep of warm climates being covered with hair instead of wool, and the hares and partridges of northern climates becoming white in winter; when, further, we observe the changes of structure produced by habit, as shewn especially by men of different occupations; or the changes produced by artificial mutilation and prenatal influences, as in the crossing of species and production of monsters; fourth, when we observe the essential unity of plan in all warm-blooded animals—we are led to conclude that they have been alike produced from a single living filament."

G. R. Treviranus, in the beginning of the 19th century, laid stress on the indefiniteness of variation, but assumed that some of it was adaptive response to the environment, and some due to sexual crossing. J. B. P. Lamarck was the first author to work out a connected theory of descent and to suggest that the relationships of organic forms were due to actual affinities. He believed that life was an expanding, growing force, and that animals responded to the environment by developing new wants, seeking to satisfy these by new movements and thus by their own striving producing new organs which were transmitted to their descendants. Variation was in fact a purposive response.

In 1813 W. C. Wells definitely propounded the theory of natural selection, but applied it only to certain human characters. In 1831 Patrick Matthew, in the appendix to a book on naval timber and arboriculture, laid stress on the extreme fecundity of nature "who has in all the varieties of her offspring a prolific power much beyond (in many cases a thousandfold) what is necessary to fill up the vacancies caused by senile decay. As the field of existence is limited and preoccupied, it is only the hardier, more robust, better-suited-to-circumstance individuals, who are able to struggle forward to maturity, these inhabiting only the situations to which they have superior adaptation and greater power of occupancy than any other kind; the weaker and less circumstance-suited being prematurely destroyed. This principle is in constant action; it regulates the colour, the figure, the capacities and instincts; those individuals in each species whose colour and covering are best suited to concealment or protection from enemies, or defence from inclemencies or vicissitudes of climate, whose figure is best accommodated to health, strength, defence and support; whose capacities and instincts can best regulate the physical energies to self-advantage according to circumstances—in such immense waste of primary and youthful life those only come to maturity from the strict ordeal by which nature tests their adaptation to her standard of perfection and fitness to continue their kind by reproduction." G. St Hilaire and afterwards his son Isodore regarded variation as not indefinite but directly evoked by the demands of the environment. L. von Buch laid stress on geographical isolation as the cause of production of varieties, the different conditions of the environment and the segregated interbreeding gradually producing local races. K. E. von Baer and M. J. Schleiden regarded variation and the production of new or improved structures as an unfolding of possibilities latent in the stock. Robert Chambers, in the once famous *Vestiges of Creation*, interested and shocked his contemporaries by his denial of the fixity of species and his insistence on creation by progressive evolution, but had no better theory of the cause of variation than to suppose that organisms—"from the simplest and oldest to the highest and most recent" were possessed of "an inherent impulse, imparted by the Almighty both to advance them from the several grades and modify their structure as circumstances required." In 1852 C. Naudin compared the origin of species in nature with that of varieties under cultivation. Herbert Spencer from 1852 onwards maintained the principle of evolution and laid special stress on the moulding forces of the environment which called into being primarily new functions and secondarily new structures.

Although the pre-Darwinian writers amongst them invoked nearly every principle that Darwin or his successors have suggested, they failed to carry conviction with regard to evolution, and they neither propounded a coherent philosophy of variation nor suggested a mechanism by which variations that appeared might give rise to new species. The anticipations of Darwin were little more than formal and verbal. As T. H. Huxley pointed out in his essay on the reception of the *Origin of Species* in the second volume of Darwin's *Life and Letters*, "The suggestion that new species may result from the selective action of external conditions upon the variations from their specific type which individuals present—and which we call 'spontaneous' because we are ignorant of their causation—is as wholly unknown to the historian of scientific ideas as it was to biological specialists before 1858. But that suggestion is the central idea of the *Origin of Species*, and contains the quintessence of Darwinism."

C. Darwin opened his argument by consideration of plants and animals under domestication. He pointed to the efflorescence of new forms that had come into existence under the protection of man. A multitude of varieties of cultivated plants and domesticated animals existed, and these differed amongst themselves and from their nearest wild allies to an extent that, but for the fact of their domestication, would entitle them to the systematic rank of species. Some of these changes he supposed to have been the result of new conditions, including abundance of food and protection from enemies, but most he attributed to the accumulated results of selective breeding. No doubt such domesticated species might revert, and it has been shown that many do revert when restored to wild conditions, but such reversion is natural if we reflect that the domestic varieties are under the guardianship of man and have been selected according to his whim and advantage. Comparing domesticated varieties with species and varieties in nature, Darwin showed that the distinction between varieties and species was chiefly a matter of opinion, and that the discovery of new linking forms often degraded species to varieties. Species, in fact, were not fixed categories, but halting-places, often extremely difficult to choose, for the surveying mind of the systematist. He considered that a struggle for existence was the inevitable result of the operation of the principle of Malthus in the animal and vegetable worlds. The struggle would be most acute between individuals and varieties of the same species, with the result that "any being, if it vary however slightly, in any manner profitable to itself, under the complex and somewhat varying conditions of life, will have a better chance of surviving, and thus be naturally selected." Under natural selection the less well-adapted forms of life would on the average have a heavier death-rate and a lower multiplication-rate. He did not suggest that every variation and every character must have a "selection value," although he pointed out that, because of our ignorance of animal physiology, it was extremely rash to set down any characters as valueless to their owners. It is even more important to notice that he did not suggest that every individual with a favourable variation must be selected, or that the selected or favoured animals were better or higher, but merely that they were more adapted to their surroundings.

With regard to variation, Darwin was urgent in stating his opinion that the laws of variation were not understood and that the phrase "chance" variation was a wholly incorrect expression. He thought it probable that circumstances affecting the reproductive system of the parents had much influence in producing a plastic condition of the progeny. He doubted, but did not exclude, the importance of the direct effect of differences of climate and food and of increased use and disuse, except so far as the individual was concerned, but his opinion as to these Lamarckian factors changed from time to time. He laid much stress on the unity of the organism in every stage of its existence, with the resulting correlation of variations, so that the favouring of one particular variation entailed modifications of correlated structures. He recognized the existence of the large variations, but he believed these to be of little value in evolution, and he attached preponderating importance to relatively minute indeterminate variations. On the other hand, he was far from advocating the view that has been pithily expressed as the "selection of the fit from the fortuitous"; he recognized that variations, although perhaps suggested or excited by the environment, were determined by internal causes. He showed how different varieties in a species, or species in a genus, tended to display parallel variation, clearly indicating that the range and direction of variation were limited or determined by the nature of the organism.

Alfred Russel Wallace, the co-discoverer of the Darwinian principles, had sent to Darwin early in 1858 an outline of a theory of the origin of species. Darwin found that it was, in all essential respects, identical with his own theory at the exposition of which he had been working for many years. With an unselfish generosity which must always shine in the history of science, and indeed of the human race, Darwin proposed at once to communicate his correspondent's essay to the Linnaean Society of London, but was persuaded by his friends to send with it an outline of his own views. Accordingly, on the same evening, in July 1858, both communications were made to the Linnaean Society. When Wallace found how much more fully Darwin was equipped for expounding the new views, he exhibited an unselfish modesty that fully repaid Darwin's generosity, henceforth described himself as a follower of Darwin, entitled his most important publication on the theory of evolution *Darwinism*, and did not issue it until 1889, long after the world had given full credit to Darwin. In most respects his ideas were closely parallel with those of Darwin. He believed that species had been formed by means of natural selection. He insisted that the great powers of increase of all organisms led to a tremendous struggle for existence, and that variability extended to every part and organ of every organism; that the variability was large in amount in proportion to the size of the part affected, and occurred in a considerable proportion of the individuals of those large and dominant species which might be supposed to be breaking up into new species. He pointed to the changes wrought on domesticated organisms by the artificial selection of similar variations, and drew the inference that there must be parallel occurrences under wild nature. In the sphere of nature, with its vast numbers and constant pressure, not every more favoured individual would survive, nor every surviving individual be the more favoured, but throughout the changes and chances there would be a constant and important bias in favour of the individuals more fitted to their conditions. Wallace, however, brought into his scheme a factor excluded by Darwin. He believed that behind the natural world lay a spiritual world, irruptions from which had disturbed the natural sequence of causation, certainly in the production of the higher emotional and mental qualities of man, probably in the appearance of self-consciousness, and possibly in the first origin of life.

It is to be remembered that the origin of species by the modification of pre-existing species,—in fact, the doctrine of organic evolution,—although first made credible by Darwin and Wallace, does not depend upon their theory of the relation of natural selection to variation. The theory of evolution is supported by a great range of evidence, much of which was first collected by Darwin, and which has been enormously increased by subsequent workers excited by his genius. Such evidence relates to the facts of classification, structure, development, and geographical and geological distribution. It now remains to examine in closer detail the further knowledge that has been gained with regard to variation and the bearing of that on the Darwinian position.

Magnitude of Variation.—Darwin was well aware that variation ranged from differences so minute as to become apparent only on careful measurement to those large departures from the normal which may be called abnormalities, malformations or monstrosities. He was of the opinion that the summation of minute differences had played a preponderating if not exclusive part in the formation of species. Wallace, whilst insisting that the range of observed and measured variation was much larger in proportion to the size of the organisms or parts of organism affected than was generally believed, leaned to the Darwinian view in excluding from the normal factors in the origin of species variations of the extremer ranges of magnitude. Later writers, and in particular W. Bateson and H. de Vries, have urged that as species are discontinuous—that is to say, marked off by structural differences of considerable magnitude—it is more probable that they have arisen from similarly discontinuous variations. De Vries gave the name "mutations" to such considerable variations (it is to be noted that a further concept, that of the mode of origin, has been added to the word mutation, and that the conception of relative size is being removed from it), and Bateson, de Vries and other writers have added many striking cases to those recorded by Darwin. It is doubtful, however, if there is any philosophical basis for distinguishing between variations merely by their magnitude. Differences which at their first appearance are very minute may result in the kind of variations which certainly would be classed as discontinuous. When the cells of the *morula* stage of an embryo are shaken asunder, each, instead of forming the appropriate part of a single organism, may form a complete new organism. And similarly in the development of a complicated organism, the suppression or doubling of a single cell or group of cells may bring about striking differences in the symmetry of the adult, or the reduction or increase in the number of metameric organs. A slight change in the structure or activity of a gland, by altering the internal secretion, may produce widespread alterations even in an adult organism; and we have good reason to suppose that, if compatible with viability, such minute changes would have even a greater ultimate effect if they occurred in an embryo. Even amongst the extreme advocates of the theory of mutations, the importance of magnitude is being discounted by their suggestion that some of the minute variations which have hitherto been regarded by them as insignificant "fluctuating variations" may be significant mutations. This in effect is to say that not magnitude but something else has to be sought for if we are to pick out amongst observed variations those which may be the material for the differentiation of species. So far as magnitude is concerned, the attack on the Darwinian position has failed, and it is agreed that species may be discontinuous and none the less have been produced from minute variations.

Causes of Variation.—Darwin was careful to insist that we did not know the laws of variation, and that when variation was attributed to "chance" no more should be read into the statement than an expression of our ignorance of the causation. It cannot now be doubted that a very large amount of observed variation, and especially of the indefinite variation which is sometimes spoken of as fluctuating variation, and which is usually distributed indefinitely round a mean, is directly associated with or induced by the environment. On various grounds attempts have been made to exclude such variation from the material for the making of species. The variations which de Vries has called mutations, and which were at first associated by Bateson with what he called discontinuous variations as the exclusive source of new species, are now supposed by de Vries to be distinguished from fluctuating variations by their mode of origin. Such mutations are not the product of the environment, but are an outcrop of the constitution of the germinal material of the varying organism, the result either of causes as yet undetected, or of the premutations and eliminations suggested by the work of Mendel (see MENDELISM). These attempts to reject environmental variation rest on several grounds. In the first place the variations in question are "acquired characters." When Darwin and Wallace framed their theories it was practically assumed that acquired characters were inherited, and the continuous slow action of the environment, moulding each generation to a slight extent in the same direction, was readily accepted by a generation inspired by Sir C. Lyell's doctrine of uniformitarianism in geological change, as a potent force. A. Weismann, however, from theoretical considerations and from analysis of supposed cases has at the least thrown doubt on the transmission of acquired characters. And so the newer school discard acquired characters and all the Lamarckian factors and leave the board clear for "mutations." Analysis of any acquired character, however, shows that there are two factors involved. The organism is not a passive medium; the amount and nature of the response it makes to the action of environment depends on its own qualities, and these qualities, on any theory of inheritance, pass from generation to generation. Successful organisms, or well-adapted organisms, are those that have responded to the environment, whether by large or small variations, in suitable fashion. It is the character as acquired that affords the opportunity for selection, but the quality of responding to the environment so as to produce that character is transmitted. The conceptions of Weismann afford no ground for rejecting fluctuating variations from the materials for the production of species.

In the second place, it has been urged, particularly by de Vries, that experiment and observation have shown that the possible range of fluctuating variation is strictly limited. Breeders, he says, who try to build up qualities by the selection of the fluctuating variations that occur soon find that they reach a maximum beyond which their efforts fail, unless they turn to the more rarely occurring but heritable mutations. Something will be said later in this article as to the limitation of variation; here it is necessary only to say that de Vries is introducing no new idea. It is well known that some races and some organs in plants and animals are extremely variable, and that others are much less variable, and further, that whilst some of these differences may be due to intrinsic causes, others can be modified by experiment. As Sir W. T. Thiselton-Dyer has pointed out, what is called "specific stability" is a familiar obstacle to the producer of novelties, but one which he frequently succeeds in breaking down by cultural and other methods. In a survey of the palaeontological history of plants and animals, it is plain that extreme stability and extreme mutability both have occurred, sometimes having persisted for untold ages, sometimes having succeeded one another for varying periods. As yet no solid reason has been alleged for excluding fluctuating variations, on account of their limitation, from the materials for specific change. J. Cossar Ewart and H. M. Vernon have adduced experimental evidence as to the induction of variation by such causes as difference in the ages of the parents, in the maturity or freshness of the conjugating germ cells, and in the condition of nutrition for the embryos. Such cases show in the plainest way the co-operation of external or environmental and internal or constitutional factors.

With our present knowledge it is impossible to discriminate between variation that may or that may not be the material for the differentiation of species by scrutinizing either magnitude or probable causation. It is equally impossible to draw an exact line between variation induced by the environment and variation that may be termed intrinsic. Extrinsic and intrinsic factors are involved in every case, although there is a range from instances in which the external factor appears to be extreme to instances where the intrinsic factor is dominant. Even the results of mutilation involve an intrinsic factor, for they range, according to the organ and organism affected, from complete regeneration to the most imperfect healing. In the effects of exercise, of physiological activity and the gross results of such external agencies as food, temperature, climate, light, pressure and so forth the intrinsic factor appears to become more important. The interplay of extrinsic and intrinsic factors also differs with the age of the organism affected: the more nearly adult it may be, the more direct appears to be the influence of the environment; the more nearly embryonic the organism may be, the less direct is the result of a force impressed from without. The old organism is more stable and responds in obvious ways to direct assaults from without; the young organism is at once less stable and more profoundly modified by environmental change, replying in terms less easy to predict from knowledge of the nature and amount of the impinging agency. And finally, there are a series of variations, amongst which no doubt are the mutations of de Vries and the disintegrations and recombinations of the unit factors with which Mendel and his followers have worked, in which the external or environmental factor is most remote from the actual result.

Correlated Variation.—Every organism is an individual, its different parts, organs and functions being associated in a degree of intimacy that varies, but that corresponds roughly with the integration of the individual and its place in the ascending scales of animal or vegetable life. One aspect of organic individuality is the correlation of variations, the fact that when one part varies, other parts vary more or less simultaneously. So far, our knowledge of correlation is almost entirely empirical, and the arrangement of the observed facts cannot be brought into exact harmony with our guesses at their causation.

Much correlation is the inevitable result of organic structure. The various parts of a living organism affect each other in adult life and during growth. If, for instance, the testes fail to develop normally, the secretion which they discharge into the blood is abnormal in character and amount, with the result that the characters of the remotest parts of the body are more or less profoundly affected. It is now known that similar internal secretions, or hormones, pass into the blood from every organ and tissue, so reaching and affecting every part of the body. If we reflect on the multitude and complexity of such actions and reactions in operation from the youngest stages to the end of the life of each individual, we cannot be surprised at any correlation. Change in the size of any part or organ, however it may have been produced, must bring with it many others changes, directly or indirectly. A difference in calibre, elasticity or branching of a blood vessel, the smallest variation in a nerve or group of vessel-cells, any anatomical or physiological divergence, is reflected throughout the organism. Much of the character of organisms is due to various symmetries, radial, bilateral, metameric and so forth, and these symmetries arise, partly at least, from the mode of growth by cell division and the marshalling of groups of cells to the places where they are destined to proliferate. Here, again, a variation in the order, nature and number of the divisions, in itself simple, may result in symmetrical or correlated changes in all the progeny of the affected embryonic part.

Every new individual starts life (see REPRODUCTION) as a mass of germinal material derived from one or from two parents, but with a coherent individuality of its own. This individuality is the result of the particular selection of qualities it receives from its parents, a selection that obviously differs in different cases, as, save in the case of "identical twins," which are supposed to be the product of a single fertilized ovum, no individual pair of brothers, or pair consisting of brother and sister, are alike. We are still ignorant of the causes that determine the associated selection of inherited qualities that go to the making of any individual. Those who have followed up the work of Mendel believe that the qualities of the new individual are a precise selection from and reconstruction of the parental qualities, and that were complete analysis possible, the characters of the new individual could be predicted with chemical accuracy. On other views of inheritance, there would be required for prediction knowledge not only of the immediate parents but of the whole line of ancestry, with the result that prediction could reach only some degree of probability for any single individual and be accurate only for the average of a sufficient number of individuals. But whatever be the theory of the mode of inheritance, or the mechanism by which the germinal plasm of an individual is made up, it is plain that there is correlation between the various qualities of an individual due to the mode of origin of its germ plasm as a selected individual portion of the parental germ plasm.

Observed cases of correlation cover almost every kind of anatomical and physiological fact, and range from simple cases such as the relation between height of body and length of face to such an unexpected nexus as that between fertility and height in mothers of daughters. The statistical investigation of correlations forms a new branch of biological inquiry, generally termed "Biometrics," inaugurated by F. Galton and carried on by Karl Pearson and the late W. F. R. Weldon.

We quote from the article "Variation and Selection," in the tenth edition of this *Encyclopaedia*, an exposition of the biometric method by Weldon:—

> The characters of individual animals or plants depend upon so many complex conditions, most of which are generally unknown to us, that the statements we can make concerning them are of a peculiar kind. We cannot predict with any exactness the characters of a single unborn individual; but if we consider a large number of unborn individuals, we can predict with considerable accuracy the percentage of individuals which will have the mean character proper to their generation, or will differ from that mean character within any assigned limits. So long as we confine our attention to one or two individuals, we fail to detect any order in the occurrence of variations; but when we examine large numbers we find that it is possible to arrange them in an orderly series, which can be easily and simply described. The series into which we can arrange the results of observing phenomena of complex causation, whether exhibited by living organisms or not, have certain properties in common, which are dealt with by the theory of chance. Many of the properties of such series, and the methods of describing them, are dealt with elsewhere (see PROBABILITY: *Law of Error*); and the frequency with which the mean value or any deviation from the mean value of a character occurs in a race of animals or of plants may probably always be expressed in terms of one or other of the series there described. The theory of chance was applied to the study of human variation by Quetelet; but the most important applications of this theory to biological problems are due in the first instance to Francis Galton, who used the theory of *correlation* in describing the relation between the deviation of one character in an animal body from the mean proper to its race and that of a second character in the same body (correlation as commonly understood), or between deviation of a parent from the mean of its generation and deviation of offspring from the mean of the following generation (inheritance). The conceptions indicated by Galton have been extended and added to by Karl Pearson, who has also developed the theory of chance so as to provide a means of describing many series of complex results in a simpler and more accurate way than was hitherto possible.
>
> The conception of a race of animals or of plants as a group of individuals capable of being arranged in an orderly series with respect to the condition of a particular character enables us to define the "type" of that character proper to the race. Table I. shows the number of female swine which had a given number of "Müller's glands" on the right fore leg, in a sample of 2000 swine observed by Davenport in Chicago. If we take the whole number of glands in the series, and divide this by the whole number of swine, we obtain the *mean* number of glands per swine. For many purposes this is the most convenient "type" of the series. Two other ways of determining a "type" will be obvious by reference to the diagram, fig. 1, in which the observed results are recorded by the thick continuous line, and the form of Pearson's "generalized probability curve" best fitted to represent them by a dotted line. The ordinate of the dotted curve which contains its "centre of gravity" has, of course, for its abscissa the "mean" number of glands; the maximum ordinate of the curve is, however, at 2·98, or sensibly at 3 glands, showing what Pearson has called the "modal" number of glands, or the number occurring most frequently. The ordinate which divides the area of the dotted curve into two equal areas is the *median* of Galton: it lies in this case nearly at 3·38 glands. The best simple measure of the frequency of deviations from the mean character is the "standard deviation" or "error of mean square" of the system (see article PROBABILITY), in this case equal to 1·68 glands.

TABLE I.

Number of Glands.	Number of Swine.	Number of Glands.	Number of Swine.
0	15	6	134
1	209	7	72
2	365	8	22
3	482	9	8
4	414	10	2
5	277		

> In cases of nearly symmetrical distribution about the mean, the three "types," the mean, the median and the mode, may sensibly coincide. For example, in Powis's table of the frequency of statures in male Australian criminals between 40 and 50 years

of age (*Biometrika*, vol. i. part 1, p. 41), the mean stature is 66·91 in., the modal 66·96 in., the median lying between the two. In other cases the difference between the three may be considerable. As an example of extreme asymmetry we may take de Vries's record of the frequency with which given numbers of petals occur in a certain race of buttercups. Pearson has shown (*Phil. Trans.*, A., 1893) that this frequency may be closely represented by the curve whose equation is

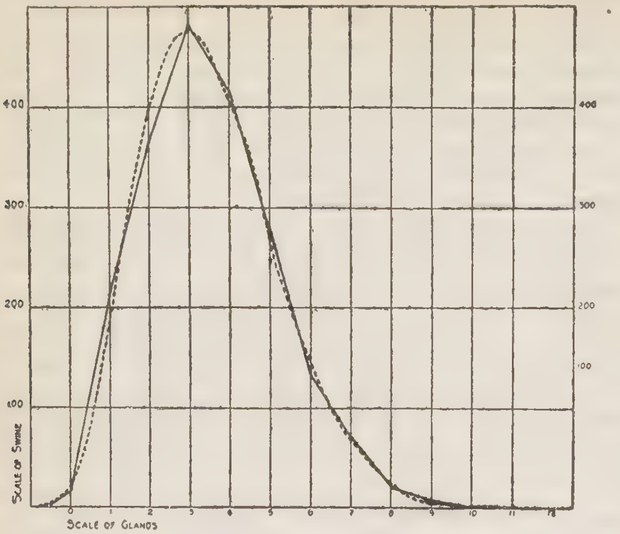

Fig. 1.

$$y = 0{\cdot}211225x^{-0{\cdot}332}(7{\cdot}3253 - x)^{3{\cdot}142}.$$

The curve, and the observations it represents, are drawn in fig. 2. The two are compared numerically in Table II. Here the mode is at 4·5 petals, the mean at 5·6 petals, the median lying of course between the two.

Table II.

Numbers of petals .	5	6	7	8	9	10	11
Frequency observed.	133	55	23	7	2	2	0
Frequency given by Pearson's curve .	136·9	48·5	22·6	9·6	3·4	0·8	0·2

The distributions represented in figs. 1 and 2 may be taken as examples of three common forms of series into which the individuals of a race may be arranged with respect to a single character; a comparison of them will show how little can be learnt from a mere statement of racial type, without some knowledge of the way in which deviations from the type are distributed.

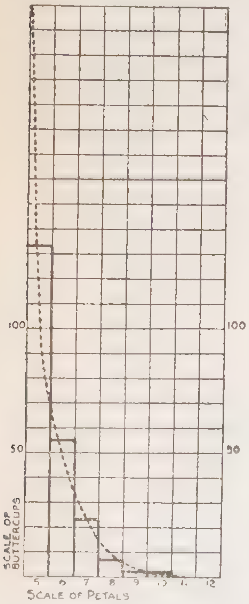

Fig. 2.

The variability of structures which are repeated in the body of the same individual (serial homologues) has been studied by Pearson and his pupils with important results. The simplest of such repeated elements are the cells of the tissues, more complex are cell-aggregates, from hairs, scales, teeth and the like, up to limbs or metameres in animals, or the leaves and their homologues in plants. Serially homologous structures, borne on the same body, are commonly differentiated into sets, the mean character of a set produced in one part of the body, or during one period of life, differing from the mean character of a set produced in a different region or at a different time. Such differentiation may be measured by determining the correlation between the position or the time of production and the character of the organs produced, the methods by which the correlation is measured being those described in the article Error, Law of. An excellent example of structures differentiated according to position is given by the appendages borne on the stem of an ordinary flowering plant—the one or two seed leaves; the stem leaves, which may or may not be differentiated into secondary sets; and the various floral organs borne at the apex of the stem or its lateral branches. The change which often occurs in the mean character and variability of the flowers produced at different periods of the flowering season by the same plant is an example of differentiation associated with time of production; as this kind of differentiation is less familiar than differentiation according to the region of production, it may be well to give an example. In a group of plants of *Aster prenanthoides*, examined by G. H. Shull (*American Naturalist*, xxxvi., 1902), the mean number of bracts, ray-florets and disc-florets, and the standard deviation of each, was determined on four different days, with the following result:—

Table III.

	Sept. 27.	Sept. 30.	Oct. 4.	Oct. 8.
Mean No. of bracts .	47·41	44·34	43·83	41·92
Standard deviation .	5·52	5·15	5·28	4·89
Mean No. of ray-florets	30·77	28·71	28·25	26·34
Standard deviation .	3·99	3·57	3·50	3·01
Mean No. disc-florets .	56·43	51·71	49·16	45·78
Standard deviation .	3·99	4·99	4·88	4·78

Notwithstanding this differentiation, the mean character of a series of repeated organs is often constant through a considerable region of the body or a considerable period of time; and the standard deviation of an "array" of repeated parts, chosen from such an area, or within such limits of time, may be taken as a measure of the individual variability of the organism which produces them. If such an array of repeated organs be chosen from the proper region of the body, within proper limits of time, in each of a large series of individuals belonging to a race, and if all the arrays so chosen be added together, a series will be formed from which the *racial variability* can be determined. Thus a series of arrays of beech leaves, gathered, subject to the precautions indicated, from each of 100 beech trees in Buckinghamshire by Professor Pearson, gave 16·1 as the mean number of veins per leaf, the standard deviation of the veins in the series being 1·735. The number of leaves gathered from each tree was 26, and the frequency of leaves with any observed number of veins in the whole series of 2600 leaves was as follows:—

Table IV.

No. of veins .	10	11	12	13	14	15	16	17	18	19	20	21	22
No. of leaves.	1	7	34	110	318	479	595	516	307	181	36	15	1

The whole series contains 2600 leaves. If a leaf from this series be chosen at random, it is clearly more likely to have sixteen veins than to have any other assigned number; but if a first leaf chosen at random should prove to have some number of veins other than sixteen, a second leaf, chosen at random from the same series, is still more likely to have sixteen veins than to have any other assigned number. If, however, a series of leaves *from the same tree* be examined in pairs, the fact that one leaf from the tree is known to possess an abnormal number of veins makes it probable that the next leaf chosen from the same tree will also be abnormal—or, in other words, the fact that leaves are borne by the same tree establishes a correlation between them. Professor Pearson has measured this correlation. Taking each leaf of his series, with an assigned number of veins, he has determined the array of pairs of leaves which can be formed by pairing the chosen leaf with all others from its own tree in succession. The pairs so formed were collected in a table, from which the correlation between the first leaf and the second leaf of a pair, chosen from one tree, could be determined by the methods indicated in the article Probability. The mean and standard deviation of all first leaves or of all second leaves will clearly be the same as those already determined for the series of leaves; since every leaf in the series is used once as a first member and once as a second member of a pair. The coefficient of correlation is 0·5699, which indicates that the standard deviation of an array is equal to that of the leaves in general multiplied by $\sqrt{1-(0{\cdot}5699)^2}$; and performing this multiplication, we find 1·426 as the standard deviation of an array. The variability of an array of such a table—that is, of any line or column of it—is the mean variability of pairs of leaves, each pair chosen from one tree, and having one leaf of a particular character; it may therefore be taken as a fair measure of the variability of such a tree. We see therefore that while leaves, gathered in equal numbers from each of 100 trees, are distributed about their mean with a standard deviation of 1·735 veins, the leaves gathered from a single tree are distributed about their mean with a standard deviation of 1·426 veins, the ratio between variability of the race and variability of the individual tree being $\sqrt{1-(0{\cdot}5699)^2} = 0{\cdot}822$.

The correlation between undifferentiated sets of serial homologues, produced by a single individual, is the measure of what Pearson has called homotyposis. In an elaborate memoir on the homotyposis in plants (*Phil. Trans.*, vol. 197 A., 1901), from which the foregoing statements about beech leaves are taken, Pearson has given the correlation between such sets of organs in a large number of plants: he and his pupils have subsequently determined the correlation between structures repeated in the bodies of individual animals. The results obtained are sometimes puzzling, because it is sometimes difficult to choose the whole series of structures osbserved from a region of the body which is not affected by differentiation. In spite of this difficulty, however, the values of the correlation coefficients so far obtained cluster fairly well round the mean value of all of them, which is almost exactly ½. From this result it follows (see PROBABILITY) that the standard deviation of the array, which we have taken as a measure of individual variability, is equal to the standard deviation of the race multiplied by $\sqrt{1-\left(\frac{1}{2}\right)^2}$ or by $\frac{\sqrt{3}}{2}$. These results cannot be accepted as final, but they are based on so many investigations of animals and plants, of such widely different kinds, that they may confidently be expected to hold for large classes of organic characters. We may therefore conclude that for large classes of characters, both animal and vegetable, the variability of an individual, as measured by the standard deviation of its undifferentiated but repeated organs, is a constant fraction of the variability of its race, as measured by the standard deviation of the corresponding series of organs produced by all the individuals of its race.

Among the most important structures produced in repeated series are the reproductive cells; and Pearson points out that if the variability of animals or of plants be supposed to depend upon that of the germ-cells from which they arise, then the correlation between brothers in the array produced by the same parents will give a measure of the correlation between the parental germ-cells, the determination requiring, of course, the same precautions to avoid the effects of differentiation as are necessary in the study of other repeated organs. After a large series of measurements, involving the most varied characters of human brothers, Pearson has shown that the correlation has a value very nearly equal to ½; so that the variability of human children obeys the same law as that of other repeated structures, the standard deviation of an array, produced by the same parents, having an average value equal to the standard deviation of the whole filial generation multiplied by $\sqrt{1-\left(\frac{1}{2}\right)^2}$ or by $\frac{\sqrt{3}}{2}$. Such measurements of fraternal correlation in the lower animal as Pearson and his pupils have at present made give values very close to ½. The evidence that the correlation between sexually produced brethren is the same as that existing between the asexually repeated organs on an individual body renders it impossible to accept Weismann's view that one of the results produced by the differentiation of animals and plants into two sexes is an increase in the variability of their offspring. Warren has shown by direct observation that the correlation between brothers among the broods produced parthenogenetically by one of the *Aphides* has a value not far from the ½ observed in sexually produced brethren (*Biometrika*, vol. i., 1902); he has obtained a fairly concordant result for the broods of parthenogenetic *Daphnia* (*Proc. Roy. Soc.* vol. lxv., 1899). Finally, Simpson has measured the correlation between the pairs of young produced by the simple asexual division of *Paramoecium* (*Biometrika*, vol. i. part 4, 1902), and after some necessary corrections the value he obtains is 0.56, a value which probably does not, if we remember the difficulties of the inquiry, differ very significantly from ½. There is therefore in a large class of cases an indication that the variability of an array of brethren, produced either sexually or asexually, is a constant fraction of the variability of the race to which the brethren belong.

Variation and Mendelism.—The conceptions of the disciples of Mendel, amongst whom W. Bateson is pre-eminent, would appear to simplify the problem of variation, especially on its mechanical and physiological sides. Their experimental work shows that many facts of inheritance correspond with the theory that the essential fabric of an organism is a mosaic of unit characters. Such units frequently occur in pairs, one member of the pair being characterized by the presence, the other by the absence of a problematical body at least comparable with a ferment, the result of the presence or absence being a notable modification of the whole organism or of parts of it. According to their view, in the formation of the germ cells a segregation of the unit pairs occurs—that is to say, the peculiar body or ferment is handed on to one daughter-cell but not to the other. A similar kind of segregation may take place in the formation of the repeated parts of an organism, so that symmetrical repetition may be compared with normal heredity, and be due to the presence of similar factors in the divisions of the embryonic cells, whilst the differentiation of repeated parts may be due to the unequal distribution of such factors and be comparable with variation. On such an interpretation, variation would result from asymmetrical division and normal inheritance from symmetrical division. It is equally clear that there is a broad analogy between the kind of characters on which systematists often have to rely for the separation of species and those which Mendelian workers have shown to behave in accordance with the Mendelian theories of mosaic inheritance with segregation. The analogy possibly may be extended to such cases as the occurrence of flora or fauna with alpine characters on the summits of mountains separated by broad zones of tropical climate. Segregated inheritance may have produced the appropriate combinations which were latent in the capacities of the race, and the exigencies of the environment protected them in the suitable localities. It is to be noticed, however, that the Mendelian conceptions are in no sense an alternative to Darwinism; at the most they would serve to assist in explaining the mechanism of variation, and by enlarging our idea of the factors, increase the rate at which we may suppose selection to work.

Limitation of Variations; Orthogenesis.—Darwin and his generation were deeply imbued with the Butlerian tradition, and regarded the organic world as almost a miracle of adaptation, of the minute dovetailing of structure, function and environment. Darwin certainly was impressed with the view that natural selection and variation together formed a mechanism, the central product of which was adaptation. From the Butlerian side, too, came the most urgent opposition to Darwinism. How is it possible, it was said, that fortuitous variations can furnish the material for the precise and balanced adaptations that all nature reveals? Selection cannot create the materials on which it is supposed to operate; the beginnings of new organs, the initial stages of new functions cannot be supposed to have been useful. Moreover, many naturalists, especially those concerned with palaeontology, pointed to the existence of orthogenetic series, of long lines of ancestry, which displayed not a sporadic differentiation in every direction, but apparently a steady and progressive march in one direction. E. D. Cope put such a line of argument in the most cogent fashion; the course of evolution, both in the production of variations and their selection, seemed to him to imply the existence of an originative, conscious and directive force, for which he invented the term "bathmism" (Gr. βαθμός, a step or beginning). On the other hand, dislike of mystical interpretations of natural facts has driven many capable naturalists to another extreme and has led them to insist on the "all-powerfulness of natural selection" and on the complete indefiniteness of variation. The apparent opposition between the conflicting schools is more acute than the facts justify. Both sides concur in the position assumed by Darwin, that the word "chance" in such a phrase as "chance variation" does not mean that the occurrences are independent of natural causation and so far undetermined, but covers in the first place our ignorance of the exact causation. The implication of the phrase may go farther, suggesting that there is no connexion between the appearance of the variation and the use to which it may be put. No doubt a large amount of variation is truly indefinite, so that many meaningless or useless variations arise, and in one sense it is a mere coincidence if a particular variation turn out to be useful. But there are several directions in which the field of variation appears to be not only limited but defined in a certain direction. Obviously variations depend on the constitution of the varying organism; a modification, whether it be large or small, is a modification of an already definite and limited structure. When beetles, or medusae, or cats vary, the range of possible variation is limited and determined by the beetle, medusa or cat constitution, and any possible further differentiation or specialization must be in a sense at least orthogenetic—that is to say, a continuation of the line along which the ancestors of the individual in question have been forced. Darwin himself showed that different species in a genus, or varieties in a species, tended to show parallel variations, whilst comparative anatomy has made known a multitude of cases where allied series of animals or plants show successive stages of parallel but independent variations of important organs and functions. The phenomena of convergence are to some extent other instances of the same kind and supply evidence that organisms, so to say, fall into grooves, that their possibilities of change are defined and limited by their past history. Variation, again, as has been shown in this article, is limited by correlation; as any change involves other changes, the possibilities are limited by the organic whole. Finally, it is important to remember that the fundamental characteristic of a living organism is its power of response to environment, a response or series of responses being necessary in a continuous environment for the normal facies of the organism to appear, and necessary in a shifting environment if the organism is to change suitably and not to perish. A continuous environment both from the point of view of production of variation and selection of variation would appear necessarily to result in a series with the appearance of orthogenesis. The past history of the organic world displays many successful series and these, as they have survived, must inevitably display orthogenesis to some extent; but it also displays many failures which indeed may be regarded as showing that the limitation of variation has been such that the organisms have lost the possibility of successful response to a new environment.

Selection and Adaptation.—Although knowledge of variation has become much wider and more definite, the estimation in which natural selection is held has changed very little since Darwin and Wallace first expounded their theories. Variation provides the material for selection, and although opinions may differ as to the nature of that material, the modes by which it comes into existence and their relative values and permanences, there is an increasingly wide consensus of opinion that all such material has to pass through the sieve of natural selection and that the sifted products form new varieties and species, and new adaptations. It appears to be necessary to distinguish between the production of species and the production of adaptation. We have still to admit with Darwin that it is difficult or impossible to assign utility to all the characters that distinguish species, and particularly to those characters by which systematists identify species. The modern tendency for a more complete and detailed separation of individual forms into specific and sub-specific groups, and the immensely larger range of material at the disposal of systematic experts, have combined to make it increasingly difficult to imagine conditions of the environment under which the species of systematists would have been produced by selection. On the other hand, the work of modern systematists shows an extraordinarily exact relation between their species and geographical locality, and the fact of divergent evolution can be almost demonstrated in museum collections when localities have been recorded exactly. The decision as to whether it is the course of variation or the course of selection that has been different in different localities can be made only by the field naturalist and the experimental breeder.

With regard to adaptations, it is becoming more and more apparent, as experimental knowledge advances, that it is a fundamental property of every living organism in every stage of its existence to display adaptive response to its environment. To what extent such responses are transmitted to offspring, and what part they play in the formation of the adaptive characters that are conspicuous in many animals, remain dubious, but it is at least clear that natural selection can favour those individuals and those races which show the greatest power of responsive plasticity in the individual. There remains open a wide field for inquiry as to the precise relations between selection and variation on the one hand, and their products, specific differences and adaptive structures, but the advance of knowledge has supplied no alternative to the Darwinian principles.

In the broadest way variation in organisms is primarily the necessary result of the absence of uniformity in the distribution of physical forces on the globe, in fact is a mere necessary response to the variation of inorganic conditions. So, also, in the broadest way, the result of the existence of variation is equally inevitable. Some individuals happen to fit the environment better, or to respond to the environment better, and these on the average will survive their less fortunate neighbours. It is plain that whilst the existence of variation can be demonstrated and the occurrence of evolution established by induction and deduction, the part played by selection must remain largely theoretical.

We append, however, again from the late Professor Weldon's article, a summary of the lines on which it seems possible that the actual process of selection may be demonstrated.

Selection and its results can be adequately studied only in those cases which admit of statistical tabulation. In any race of animals, the number of young produced in a season is almost always greater than the number which survives to attain maturity; it is not certain that every one of those which become mature will breed, and not all of those which breed contribute an equal number of offspring to the next generation. At every stage some individuals are prevented from contributing to the next generation, and if the continual process of elimination affects individuals possessing any one character more strongly than it affects others, so that a relation is established between individual character and the chance of producing a certain number of young, selection is said to occur.

We may distinguish broadly two ways by which such selective elimination of individuals from the number of those who contribute to the next generation may occur, viz. a *differential destruction*, which prevents certain classes of individuals from breeding by killing them, and a series of processes leading to *differential fertility* among the survivors, without necessarily involving any differential death-rate. A third form of selection, which may affect the composition of the next generation without of necessity involving a differential death-rate or a differential fertility, is *assortative mating*, or the tendency of those members of one sex which exhibit a particular character to mate only with members of the other sex which exhibit the same or some other definite character.

Differential fertility may be induced in either of two ways. Individuals may not be able to pair unless they possess a character which is absent, or insufficiently developed, in some members of the race. The kind of selection involved may then be measured by comparing those animals which pair with the general body of adults. This is what Darwin especially intended to denote by the term "sexual selection." Or, again, individuals of certain character may be able to pair, but the fertility of their union may not be the same as that of unions between individuals with other characters. This kind of selection, called by Pearson "reproductive" or "genetic" selection, may be measured by finding the correlation between the characters of the individuals which pair and the number of young produced. For an attempt to treat the whole problem of differential fertility and assortative mating numerically, see Pearson, *The Grammar of Science*, 2nd edition, London, 1900.

Assortative mating exists when individuals which mate are not paired at random, but a definite correlation is established between the characters of one mate and those of the other. This kind of selection is measured by the correlation between deviation of either mate from the type, and deviation of the other. Pearson has shown that Galton's function has a value of 0·28 for stature of middle-class Englishmen and their wives.

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(P. C. M.)

VARIATIONS, in music, the term given to groups of progressively developed versions of a complete self-contained theme, retaining the form of that theme though not necessarily its melody. This at least is the classical sense of the term, though there are modern developments of the variation form to which this definition is at once too broad and too precise to apply. The aesthetic principle of variations appeared at very early stages of music; and it soon became something far more definite than the use of ornamental versions of a melodic phrase, a use which must have been natural almost as soon as music was articulate at all. During the 16th century principles aesthetically indistinguishable from some types of variation-form inevitably arose in the polyphonic treatment of Gregorian hymns verse by verse. Accordingly, the hymns and Magnificats of Palestrina might without great extravagance be described as contrapuntal sets of variations on ecclesiastical tunes, like very free examples of the type shown later in extreme simplicity and formality by Haydn's variations on his Austrian national anthem in the "Emperor" quartet (*Op.* 76, No. 3).

Already in the 16th century instrumental music was assuming such independence as it could attain by means of a primitive variation-form, growing partly out of the habit of playing vocal madrigals on the virginals or similar keyed instruments, or singing the top part as a solo to an instrumental accompaniment, with an overwhelming weight of ornaments beneath which the original madrigal was quite unrecognizable. (See, for example, the "diminutions" given in the 30th volume of Breitkopf & Härtel's complete edition of Palestrina's works.) A favourite plan, of which numerous examples may be found in the *Fitzwilliam Virginal Book*, was to put together several popular or original tunes, with an ornamental variation sandwiched between each. Sometimes, however, sets of variations on a single tune were produced, with essentially modern effect, as in Byrd's variations on "The Carman's Whistle." Such variations were naturally grouped in order of increasing complexity and brilliance. Some of the keyboard passages in which the early English variation-writers indulged are of extraordinary difficulty, even from the standpoint of modern pianoforte technique.

In the 17th century a highly artistic form of variation arose, very favourable to the earliest composers of the transition period, because of the simplicity of its principle, which relieved the composer of all the graver problems of formal organization. This was the *ground-bass*, a single phrase placed in the bass and repeating itself as long as the composer had fresh harmonies and superstructure with which to vary it. In typical examples the ground-bass was derived from the dance forms of the *passacaglia* and the *chaconne*, which in classical music resembled each other in being in slow time, and did not otherwise differ markedly, except that in the *passacaglia* the theme could be transferred now and then to the treble or to an inner part, a purely natural aesthetic resource which makes no radical difference to the art-form. The genius of Purcell was cruelly hampered by the lack of possibilities for organizing large musical forms in his time, and nothing is more significant than the avidity with which he seizes upon the ground-bass as a means of giving coherence to his ideas.

By the time of Bach and Handel a lighter type of variation-work, less capable of high organization, and more like Byrd's variations on "The Carman's Whistle," had arisen. Bach's *Aria variata alla maniera Italiana* is an instance of this; and so is the *air et doubles* that appears now and then in Handel's instrumental works. The principle of this form is simply to take a symmetrical melody (generally in binary form) and embroider it. Such variations are called *doubles* whenever each variation divides the rhythm systematically into quicker notes than the one before. The most familiar example is that known as "The Harmonious Blacksmith" in Handel's E major suite. Sometimes the air itself was stated in a tangle of ornamentation, while the *doubles* made it float in a simplified form over an accompaniment of increasingly rapid flow. (See, for example, Handel's D minor suite and the little set in B flat on a theme afterwards varied in the noblest modern style by Brahms.)

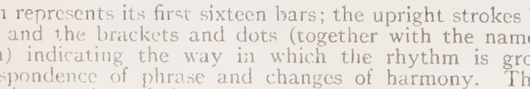
But Bach had meanwhile applied the principle of the ground-bass to variations on a complete symmetrical movement in binary form. His Air and 30 Variations, commonly known as the "Goldberg" variations, is (with the exception of Beethoven's 33 *Veränderungen* on a waltz by Diabelli) not only the most gigantic set of variations in the world, but one of the three largest compositions in any form ever written for a single instrument. Of course in so large a work the conception of the ground-bass, as a clearly recognizable theme repeated with no more than slight ornament, would be inadequate whatever the variety of the superstructure: but so steady is the drift of Bach's bass that he is enabled to represent it by countless alternative harmonies and analogous chromatic progressions, without weakening its individuality. The grouping of the thirty variations is extremely subtle in balance and climax; the more so because there are no means within the terms of Bach's art for making a free coda to the work, his ground-bass being both too long and too purely a bass to be taken as the theme of a fugue, like that in his great *passacaglia* for organ. Yet Bach contrives to round off the work perfectly by the simple direction *aria da capo* at the end. There is no question of retaining or varying the melody of the aria, which indeed is so ornamental as to be pointless and unrecognizable as a basis for variations; nor could it, like the above-mentioned Italian examples of Handel, be simplified, since most of its ornaments are integral parts of the phrases.

The next chapter in the history of the variation form is intimately connected with the sonata style. A set of variations used as a movement for a sonata inevitably tends to be variations on the melody. The sonata style implies the identification of themes by their melodies rather than by their texture, the very term "theme" being primarily used in a melodic connotation (see MELODY). Hence a set of exclusively harmonic variations would not be in the sonata style. Now, most of the best sets of variations by Mozart and Haydn are movements in their sonata works; and this should always be remembered in discussing the tendency of their treatment of the form. Few of their independent sets are of any importance, since most are very early works, or were written for pupils, or intended as encore pieces for concerts. Haydn shows a great fondness for a special form which, even if earlier specimens can be found, he may properly be said to have invented. It consists of alternating variations on two themes, the first a highly organized complete binary melody, and the other a shorter binary melody, often beginning with the same figure as the first, but clearly contrasted with it, inasmuch as, whichever theme is in the major, the other is in the minor. The first theme usually returns as if it were going to be unvaried, but its first repeat is an ornamental variation. The form is rarely worked out far enough to include more than one variation of the second theme; but the effect is always that of a happy blend of a clearly marked variation form with a more contrasted scheme a little more highly organized than the round-and-round symmetry of a minuet and trio, but not so elaborate as a rondo. The only later example exactly corresponding to Haydn's form is the first allegretto of Beethoven's pianoforte trio in E flat, *Op.* 70, No. 2; although, with a wider range of key, a free application of the principle of alternating themes is magnificently illustrated by the slow movement of his C minor symphony.

Beethoven in his last works invented another variation-form on two themes, in which the first theme is very free in structure and the second theme is a more rigid melody in a different key and time. The examples of this are the slow movement of the 9th Symphony and the Lydian figured chorale in the A minor quartet. A fine later development of this is the slow movement of Brahms's F major string quintet, *Op.* 88, in which the alternation of the two keys gives rise, in the last line of the movement, to one of the most astonishing and subtle dramatic strokes in all music.

In sonata works, Beethoven's examples of the normal variation form based on a single theme are as wonderful as may be expected from him; but nothing is more significant than his strict adherence in sonata works to the melodic principle of variation. He uses the form as an unsurpassable means of obtaining repose in slow movements. The extreme case of this is the slow movement of the sonata, *Op.* 57 (commonly called *Appassionata*), which is described in the article on SONATA FORMS. In this and in many other instances, his method is aesthetically that of the *air et doubles*, as being the simplest possible means of obtaining variety and climax without leaving the fundamental key. Until his latest works, such sets of variations are never finished. Their dramatic force is that of a repose which is too unearthly to last; and at the first sign of dramatic motion or change of key the sublime vision "fades into the light of common day," a light which Beethoven is far too great an idealist to despise. (See the andante of the B flat trio, *Op.* 97; and the slow movement of the violin concerto, which contains two episodic themes in the same key.) In his later works Beethoven found means, by striking out into foreign keys or foreign rhythms, of organizing a coda which, as it were, finally spins down in fragmentary new variations, or even returns to the plain theme. Thus he was able to end his sonatas, *Opp.* 109 and 111, with solemn slow movements in which, with the utmost richness of detail and novelty of idea, the melodic variation form is nevertheless paramount. Beethoven also found many ways of combining melodic variations with the principles of the rondo and other more highly organized continuous movements. Thus the finale of the Eroica Symphony has not only the theme but many ideas of the variations and fugue-passages in common with the brilliant set of variations for pianoforte on a theme from *Prometheus*, *Op.* 35; and the Fantasia for pianoforte, chorus and orchestra, and the choral finale of the 9th Symphony, are sets of melodic variations with freely developed connecting links and episodes. In the case of the 9th Symphony, a second thematic idea eventually combines with the figures of the first theme in double fugue.

But Beethoven's highest art in variation-form is to be found in his independent sets of variations. In some of the earliest of these, notably in the 24 on a theme by Righini (which was his chief bravura performance as a young pianoforte player), he far transcends not only the earlier or sonata-form idea of melodic variations, but fuses their resources with those of the ground-bass, and adds to them his own unparalleled grasp of rhythmic organization. Beethoven is the first composer who can be said to have discovered that a theme consists not only of melody and harmony but of rhythm and form. With earlier composers the form of the theme was automatically preserved in consequence of the preservation of either its melody or its harmony; but Beethoven had an unerring judgment as to when the form of a theme might be definite enough to remain as a basis for a variation which departed radically from both the harmony and the melody. The climax in the history of variations dates from the moment when Beethoven was just about to begin his 9th Symphony, and received from A. Diabelli a waltz which that publisher was sending round to all the musicians in Austria so that each might contribute a variation to be published for the benefit of the sufferers in the late Napoleonic wars. Diabelli's theme was absurdly prosaic, but it happened to be perhaps the sturdiest piece of musical anatomy that Beethoven or any composer since has ever seen. Not only was its harmonic form exceptionally clear and firm, but its phrase-rhythm was as simple, recognizable and heterogeneous as its other qualities. Its melodic merit was nil, yet it had plenty of recognizable melodic figures. All these prosaic technicalities are far more likely to impress a great composer as good practical resources than those high poetic qualities which critics discuss incessantly, but which are to a great artist the air he breathes. Diabelli's waltz moved Beethoven to defer his work on the 9th Symphony!



The shape of Diabelli's theme may be illustrated by a diagram which represents its first sixteen bars; the upright strokes being the bars, and the brackets and dots (together with the names underneath) indicating the way in which the rhythm is grouped by correspondence of phrase and changes of harmony. The second part also consists of sixteen bars, moving harmonically back from the dominant to the tonic, and rhythmically of exactly the same structure as the first part. This harmonic and sequential plan, together with this straightforward square tapering rhythmic structure, is so formal in effect that Beethoven can substitute for it almost anything equally familiar that corresponds in its proportions. Thus, the alternation of tonic and dominant in the first eight bars may be represented by another familiar form in which three bars of tonic and a fourth of dominant are answered by three bars of dominant and a fourth of tonic; as in variation 14 (which must be reckoned in half-bars). Again, the antithesis of tonic and dominant is accompanied in Diabelli's theme by a part of the melodic figure being repeated a step higher at the change of harmony; and this naturally produces such devices as the answering of the tonic by the supertonic in variation 8, and, still more surprisingly, by the flat supertonic in variation 30. In so enormous and resourceful a work, occupying fifty minutes in performance, it is natural that some variations should drift rather farther from the anatomy of the theme than can be explained by any strict principle; and so the jocular transformation of the beginning of Diabelli's bass into the theme of Mozart's *Notte e giorno faticar* leads to a couple of extra bars at the end of its second part; otherwise the *fughetta* (variation 24) and variations 29 and 31 are the only cases in which any considerable part of the structure of the theme is lost, except the fugue (variation 32), which is simply an elaborate movement on a salient feature of what must by courtesy be called Diabelli's melody. A free fugue is a favourite solution of the difficult problem of the coda in a set of variations.

But for the works of Brahms, which invariably retain the classical conceptions while developing them in a thoroughly modern and living language, it can hardly be claimed that the art of variation-writing has advanced since Beethoven. The term is now used for a somewhat nondescript method of stringing together a series of short fantasias on a theme; a method which may be legitimate and artistic in individual cases, but hardly constitutes an art-form. There is this great disadvantage in variations that neglect the anatomy of the theme, that the only way in which, in the absence of other means of connexion, they can show any coherence at all is by more or less frequently harping on scraps of the melody. The effect is (except in unusually happy examples such as the *Études symphoniques* of Schumann and the *Enigma Variations* of Elgar) curiously apologetic; because no ambitious composer in the "free" modern variation style thinks a melodic variation quite worthy of his dignity, and so the melodic allusions become the more tiresome from their furtive manner. Many "advanced" specimens of variation-form undoubtedly owe their origin to a vague impulse of revolt from the unsound statements of unobservant writers of mid-19th century text-books, who contented themselves with laying down crude rules such as that a variation might "either retain the melody and change the harmony, or retain the harmony and change the melody," &c., without any attempt to see how the classical composers really analysed their themes. It is very characteristic of Schumann's modesty and grasp of facts that he, who was the first to produce serious art in a free non-anatomical variation style, did not call his experiments variations without qualification. He never wrote a set in which the anatomy of the theme was of real importance to the whole; and, with him, whenever at least the initial melodic figure of his theme is not traceable throughout a section, that section is simply an episode. But Schumann knows this perfectly well, and acknowledges it. The *Études symphoniques* are called variations only in those sections which are fairly strict variations. Elsewhere they are simply numbered as *études*. The slow movement of the F major string quartet (in which a second theme masquerades as the first variation, and some of the other variation-like sections are quite free) is called *andante quasi variazione*; and even the strictest of all his variation works is called *Impromptus, on a theme by Clara Wieck*, *Op.* 5. There is, no doubt, great scope for a variation-form which is neither melodic nor anatomic, and we have not a word to say against the legitimacy of many forms of effective modern fantasia-variations; but the fact remains that it is very hazardous to talk of an "advance" in the variation-form, when even the best fantasia-variations are not only unconnected with any classical type but evidently unable to get nearly as far from either the melody or the harmony of their theme as the 25th of Bach's "Goldberg" variations or many variations in the earliest sets by Beethoven. Indeed, the only sound classification of composers of modern variations, from the time of Mendelssohn onwards, is that which distinguishes the composers who seem to know their theme from those who do not. (D. F. T.)

Origin of the Calculus.

VARIATIONS, CALCULUS OF, in mathematics. The calculus of variations arose from the attempts that were made by mathematicians in the 17th century to solve problems of which the following are typical examples. (i) It is required to determine the form of a chain of given length, hanging from two fixed points, by the condition that its centre of gravity must be as low as possible. This problem of the *catenary* was attempted without success by Galileo Galilei (1638). (ii) The resistance of a medium to the motion of a body being assumed to be a normal pressure, proportional to the square of the cosine of the angle between the normal to the surface and the direction of motion, it is required to determine the meridian curve of a surface of revolution, about an axis in the direction of motion, so that the resistance shall be the least possible. This problem of the *solid of least resistance* was solved by Sir Isaac Newton (1687). (iii) It is required to find a curve joining two fixed points, so that the time of descent along this curve from the higher point to the lower may be less than the time along any other curve. This problem of the *brachistochrone* was proposed by John (Johann) Bernoulli (1696).

Early history.

The contributions of the Greek geometry to the subject consist of a few theorems discovered by one Zenodorus, of whom little is known. Extracts from his writings have been preserved in the writings of Pappus of Alexandria and Theon of Smyrna. He proved that of all curves of given perimeter the circle is that which encloses the largest area. The problems from which the subject grew up have in common the character of being concerned with the maxima and minima of quantities which can be expressed by integrals of the form

$$\int_{x_0}^{x_1} \mathrm{F}(x, y, y')dx,$$

in which y is an unknown function of x, and F is an assigned function of three variables, viz. x, y, and the differential coefficient of y with respect to x, here denoted by y'; in special cases x or y may not be explicitly present in F, but y' must be. In any such problem it is required to determine y as a function of x, so that the integral may be a maximum or a minimum, either absolutely or subject to the condition that another integral or like form may have a prescribed value. For example, in the problem of the catenary, the integral

$$\int_{x_0}^{x_1} y(1+y'^2)^{\frac{1}{2}}dx$$

must be a minimum, while the integral

$$\int_{x_0}^{x_1} (1+y'^2)^{\frac{1}{2}}dx$$

has a given value. When, as in this example, the length of the sought curve is given, the problem is described as *isoperimetric.* At the end of the first memoir by James (Jakob) Bernoulli on the infinitesimal calculus (1690), the problem of determining the form of a flexible chain was proposed. Gottfried Wilhelm Leibnitz gave the solution in 1691, and stated that the centre of gravity is lower for this curve than for any other of the same length joining the same two points. The first step towards a theory of such problems was taken by James Bernoulli (1697) in his solution of the problem of the brachistochrone. He pointed out that if a curve, as a whole, possesses the maximal or minimal property, every part of the curve must itself possess the same property. Beyond the discussion of special problems, nothing was attempted for many years.

Euler.

The first general theory of such problems was sketched by Leonhard Euler in 1736, and was more fully developed by him in his treatise *Methodus inveniendi . . .* published in 1744. He generalized the problems proposed by his predecessors by admitting under the sign of integration differential coefficients of order higher than the first. To express the condition that an integral of the form

$$\int_{x_0}^{x_1} \mathrm{F}(x, y, y', y'', \ldots y^{(n)})dx$$

may be a maximum or minimum, he required that, when y is changed into $y+u$, where u is a function of x, but is everywhere "infinitely" small, the integral should be unchanged. Resolving the integral into a sum of elements, he transformed this condition into an equation of the form

$$\Sigma u\Delta x\left[\frac{\partial \mathrm{F}}{\partial y}-\frac{d}{dx}\frac{\partial \mathrm{F}}{\partial y'}+\frac{d^2}{dx^2}\frac{\partial \mathrm{F}}{\partial y''}-\ldots+(-1)^n\frac{d^n}{dx^n}\frac{\partial \mathrm{F}}{\partial y^{(n)}}\right]=0,$$

and he concluded that the differential equation obtained by equating to zero the expression in the square brackets must be satisfied. This equation is in general of the $2n$th order, and the $2n$ arbitrary constants which are contained in the complete primitive must be adjusted to satisfy the conditions that $y, y', y'', \ldots y^{(n-1)}$ have given values at the limits of integration. If the function y is required also to satisfy the condition that another integral of the same form as the above, but containing a function ϕ instead of F, may have a prescribed value, Euler achieved his purpose by replacing F in the differential equation by $\mathrm{F}+\lambda\phi$, and adjusting the constant λ so that the condition may be satisfied. This artifice is known as the *isoperimetric rule* or *rule of the undetermined multiplier.* Euler illustrated his methods by a large number of examples.

Lagrange.

The new theory was provided with a special symbolism by Joseph Louis de la Grange (commonly called Lagrange) in a series of memoirs published in 1760–62. This symbolism was afterwards adopted by Euler (1764), and Lagrange is generally regarded as the founder of the calculus of variations. Euler had been under the necessity of resolving an integral into a sum of elements, recording the magnitude of the change produced in each element by a slight change in the unknown function, and thence forming an expression for the total change in the sum under consideration. Lagrange proposed to free the theory from this necessity. Euler had allowed such changes in the position of the curve, along which the integral, to be made a maximum or minimum, is taken, as can be produced by displacement parallel to the axis of ordinates. Lagrange admitted a more general change of position, which was called *variation.* The points of the curve being specified by their co-ordinates, x, y, z, and differentiation along the curve being denoted, as usual, by the symbol d, Lagrange considered the change produced in any quantity Z, which is expressed in terms of $x, y, z, dx, dy, dz, d^2x, \ldots$ when the co-ordinates x, y, z are changed by "infinitely" small increments. This change he denoted by $\delta\mathrm{Z}$, and regarded as the variation of Z. He expressed the rules of operation with δ by the equations

$$\delta d\mathrm{Z}=d\delta\mathrm{Z},\ \ \delta\textstyle\int\mathrm{Z}=\int\delta\mathrm{Z}.$$

The symbol δ.

By means of these equations $\int\delta\mathrm{Z}$ can be transformed by the process of integration by parts into such a form that differentials of variations occur at the limits of integration only, and the transformed integral contains no differentials of variations. The terms at the limits and the integrand of the transformed integral must vanish separately, if the variation of the original integral vanishes. The process of freeing the original integral from the differentials of variations results in a differential equation, or a system of differential equations, for the determination of the form of the required curve, and in special terminal conditions, which serve to determine the constants that enter into the solution of the differential equations. Lagrange's method lent itself readily to applications of the generalized principle of virtual velocities to problems of mechanics, and he used it in this way in the *Mécanique analytique* (1788). The terminology and notation of mechanics are still largely dominated by these ideas of Lagrange, for his methods were powerful and effective, but they are rendered obscure by the use of "infinitely" small quantities, of which, in other departments of mathematics, he subsequently became an uncompromising opponent. The same ideas were applied by Lagrange himself, by Euler, and by other mathematicians to various extensions of the calculus of variations. These include problems concerning integrals of which the limits are variable in accordance with assigned conditions, the extension of Euler's rule of the multiplier to problems in which the variations are restricted by conditions of various types, the maxima and minima of integrals involving any number of dependent variables, such as are met with in the formulation of the dynamical Principle of Least Action, the maxima and minima of double and multiple integrals. In all these cases Lagrange's methods have been applied successfully to obtain the differential equation, or system of differential equations, which must be satisfied if the integral in question is a maximum or a minimum. This equation, or equations, will be referred to as the *principal equation*, or principal equations, of the problem.

Extensions of Lagrange's method.

Formulation of the First Problem.

The problems and method of the calculus admit of more exact formulation as follows: We confine our attention to the case where the sought curve is plane, and the function F contains no differential coefficients of order higher than the first. Then the problem is to determine a curve joining two fixed points (x_0, y_0) and (x_1, y_1) so that the *line integral*

$$\int_{x_0}^{x_1} \mathrm{F}(x, y, y')dx$$

taken along the curve may be a maximum or a minimum. When it is said that the integral is a minimum for some curve, it is meant that it must be possible to mark a finite area in the plane of (x, y), so that the curve in question lies entirely within this area, and the integral taken along this curve is less than the integral taken along any other curve, which joins the same two points and lies entirely within the delimited area. There is a similar definition for a maximum. The word *extremum* is often used to connote both maximum and minimum. The problem thus posed is known as the *First Problem of the Calculus of Variations.* If we begin with any curve joining the fixed end points, and surround it by an area of finite breadth, any other curve drawn within the area, and joining the same end points, is called a *variation* of the original curve, or a *varied curve*. The original curve is defined by specifying y as a function of x. Necessary conditions for the existence of an extremum can be found by choosing special methods of variation.

Weak variations.

One method of variation is to replace y by $y+\epsilon u$, where u is a function of x, and ϵ is a constant which may be taken as small as we please. The function u is independent of ϵ. It is differentiable, and its differential coefficient is continuous within the interval of integration. It must vanish at $x=x_0$ and at $x=x_1$. This method of variation has the property that, when the ordinate of the curve is but slightly changed, the direction of the tangent is but slightly changed. Such variations are called *weak variations*. By such a variation the integral is changed into

$$\int_{x_0}^{x_1}\mathrm{F}(x,\ y+\epsilon u,\ y'+\epsilon u')dx,$$

and the increment, or variation of the integral, is

$$\int_{x_0}^{x_1}\{\mathrm{F}(x,y+\epsilon u,\ y'+\epsilon u')-\mathrm{F}(x,\ y,\ y')\}dx.$$

The first variation.

In order that there may be an extremum it is necessary that the variation should be one-signed. We expand the expression under the sign of integration in powers of ϵ. The first term of the expansion contributes to the variation the term

$$\epsilon\int_{x_0}^{x_1}\left(\frac{\partial\mathrm{F}}{\partial y}u+\frac{\partial\mathrm{F}}{\partial y'}u'\right)dx.$$

This term is called the *first variation*. The variation of the integral cannot be one-signed unless the first variation vanishes. On transforming the first variation by integration by parts, and observing that u vanishes at $x=x_0$ and at $x=x_1$, we find a necessary condition for an extremum in the form

$$\int_{x_0}^{x_1}\left(\frac{\partial\mathrm{F}}{\partial y}-\frac{d}{dx}\frac{\partial\mathrm{F}}{\partial y'}\right)u\,dx=0.$$

It is a fundamental theorem that this equation cannot hold for all admissible functions u, unless the differential equation

$$\frac{d}{dx}\frac{\partial\mathrm{F}}{\partial y'}-\frac{\partial\mathrm{F}}{\partial y}=0$$

Stationary curves.

is satisfied at every point of the curve along which the integral is taken. This is the principal equation for this problem. The curves that are determined by it are called the *stationary curves*, or the *extremals*, of the integral. We learn that the integral cannot be an extremum unless it is taken along a stationary curve.

Parametric method.

A difficulty might arise from the fact that, in the foregoing argument, it is tacitly assumed that y, as a function of x, is one-valued; and we can have no a priori ground for assuming that this is the case for the sought curve. This difficulty might be met by an appeal to James Bernoulli's principle, according to which every arc of a stationary curve is a stationary curve between the end points of the arc—a principle which can be proved readily by adopting such a method of variation that the arc of the curve between two points is displaced, and the rest of the curve is not. But another method of meeting it leads to important developments. This is the method of parametric representation, introduced by K. Weierstrass. According to this method the curve is defined by specifying x and y as one-valued functions of a parameter θ. The integral is then of the form

$$\int_{\theta_0}^{\theta_1}f(x,\ y,\ \dot x,\ \dot y)d\theta,$$

where the dots denote differentiation with respect to θ, and f is a homogeneous function of $\dot x$, $\dot y$ of the first degree. The mode of dependence of x and y upon θ is immaterial to the problem, provided that they are one-valued functions of θ. A weak variation is obtained by changing x and y into $x+\epsilon u$, $y+\epsilon v$, where u and v are functions of θ which have continuous differential coefficients and are independent of ϵ. It is then found that the principal equations of the problem are

$$\frac{d}{d\theta}\frac{\partial f}{\partial\dot x}-\frac{\partial f}{\partial x}=0,\ \frac{d}{d\theta}\frac{\partial f}{\partial\dot y}-\frac{\partial f}{\partial y}=0.$$

These equations are equivalent to a single equation, for it can be proved without difficulty that, when f is homogeneous of the first degree in $\dot x$, $\dot y$

$$\frac{1}{\dot y}\left\{\frac{d}{d\theta}\frac{\partial f}{\partial\dot x}-\frac{\partial f}{\partial x}\right\}=-\frac{1}{\dot x}\left\{\frac{d}{d\theta}\frac{\partial f}{\partial\dot y}-\frac{\partial f}{\partial y}\right\}=\frac{\partial^2 f}{\partial y\partial\dot x}-\frac{\partial^2 f}{\partial x\partial\dot y}+f_1(\ddot x\dot y-\ddot y\dot x),$$

where

$$f_1=\frac{1}{\dot y^2}\frac{\partial^2 f}{\partial\dot x^2}=-\frac{1}{\dot x\dot y}\frac{\partial^2 f}{\partial\dot x\partial\dot y}=\frac{1}{\dot x^2}\frac{\partial^2 f}{\partial\dot y^2}.$$

The stationary curves obtained by this method are identical with those obtained by the previous method.

Problem of the catenoid.

The formulation of the problem by the parametric method often enables us to simplify the formation and integration of the principal equation. A very simple example is furnished by the problem: Given two points in the plane of $(x,\ y)$ on the same side of the axis of x, it is required to find a curve joining them, so that this curve may generate, by revolution, about the axis of x, a surface of minimum area. The integral to be made a minimum is

$$\int_{\theta_0}^{\theta_1}y(\dot x^2+\dot y^2)^{\frac{1}{2}}d\theta,$$

and the principal equation is

$$\frac{d}{d\theta}\left\{\frac{y\dot x}{(\dot x^2+\dot y^2)^{\frac{1}{2}}}\right\}=0,$$

of which the first integral is

$$y\dot x(\dot x^2+\dot y^2)^{-\frac{1}{2}}=c,$$

or

$$\frac{y}{c}=\left\{1+\left(\frac{dy}{dx}\right)^2\right\}^{\frac{1}{2}};$$

and the stationary curves are the catenaries

$$y=c\cosh\{(x-a)/c\}.$$

The required minimal surface is the *catenoid* generated by the revolution of one of these catenaries about its directrix.

Path of a ray.

The parametric method can be extended without difficulty so as to become applicable to more general classes of problems. A simple example is furnished by the problem of forming the equations of the path of a ray of light in a variable medium. According to Fermat's principle, the integral $\int\mu ds$ is a minimum, ds representing the element of arc of a ray, and μ the refractive index. Thus the integral to be made a minimum is

$$\int_{\theta_0}^{\theta_1}\mu(\dot x^2+\dot y^2+\dot z^2)^{\frac{1}{2}}d\theta.$$

The equations are found at once in forms of the type

$$\frac{d}{d\theta}\left\{\mu\frac{\dot x}{(\dot x^2+\dot y^2+\dot z^2)^{\frac{1}{2}}}\right\}-\frac{\partial\mu}{\partial x}(\dot x^2+\dot y^2+\dot z^2)^{\frac{1}{2}}=0;$$

and, since $(\dot x^2+\dot y^2+\dot z^2)^{\frac{1}{2}}d\theta=ds$, these equations can be written in the usual forms of the type

$$\frac{d}{ds}\left(\mu\frac{dx}{ds}\right)-\frac{\partial\mu}{\partial x}=0.$$

Rule of the multiplier.

The formation of the first variation of an integral by means of a weak variation can be carried out without difficulty in the case of a simple integral involving any number of dependent variables and differential coefficients of arbitrarily high orders, and also in the cases of double and multiple integrals; and the quantities of the type ϵu, which are used in the process, may be regarded as equivalent to Lagrange's δx, δy, . . . The same process may not, however, be applied to isoperimetric problems. If the first variation of the integral which is to be made an extremum, subject to the condition that another integral has a prescribed value, is formed in this way, and if it vanishes, the curve is a stationary curve for this integral. If the prescribed value of the other integral is unaltered, its first variation must vanish; and, if the first variation is formed in this way, the curve is a stationary curve for this integral also. The two integrals do not, however, in general possess the same stationary curves. We can avoid this difficulty by taking the variations to be of the form $\epsilon_1u_1+\epsilon_2u_2$, where ϵ_1 and ϵ_2 are independent constants; and we can thus obtain a completely satisfactory proof of the rule of the undetermined multiplier. A proof on these lines was first published by P. Du Bois-Reymond (1879). The rule had long been regarded as axiomatic.

The parametric method enables us to deal easily with the problem of variable limits. If, in the First Problem, the terminal point $(x_1,\ y_1)$ is movable on a given guiding curve $\phi(x_1,\ y_1)=0$, the first variation of the integral can be written

$$\epsilon\left[u_1\frac{\partial f}{\partial\dot x}+v\frac{\partial f}{\partial\dot y}\right]_{x=x_1,\ y=y_1}-\epsilon\int_{\theta_0}^{\theta_1}\left[\left\{\frac{d}{d\theta}\frac{\partial f}{\partial\dot x}-\frac{\partial f}{\partial x}\right\}u+\left\{\frac{d}{d\theta}\frac{\partial f}{\partial\dot y}-\frac{\partial f}{\partial y}\right]v\right\}d\theta,$$

where $(x_1+\epsilon u_1,\ y_1+\epsilon v_1)$ is on the curve $\phi(x_1,\ y_1)=0$, and u_1, v_1 denote the values of u, v at $(x_1,\ y_1)$. It follows that the required curve must be a stationary curve, and that the condition

$$\frac{\partial f}{\partial\dot x}\frac{\partial\phi}{\partial y_1}-\frac{\partial f}{\partial\dot y}\frac{\partial\phi}{\partial x_1}=0$$

Variable limits.

must hold at $(x_1,\ y_1)$. The corresponding condition in the case of the integral

$$\int_{x_0}^{x_1}\mathrm{F}(x,\ y,\ y')dx$$

is found from the equations

$$\frac{\partial f}{\partial\dot x}=\mathrm{F}-y'\frac{\partial\mathrm{F}}{\partial y'},\ \frac{\partial f}{\partial\dot y}=\frac{\partial\mathrm{F}}{\partial y'}$$

to be

$$\mathrm{F}(x,\ y,\ y')+\left(\frac{dy_1}{dx_1}-y'\right)\frac{\partial\mathrm{F}}{\partial y'}=0.$$

This discussion yields an important result, which may be stated as follows: Let two stationary curves of the integral be drawn from the same initial point A to points P, Q, which are near together, and let the line PQ be of length ν, and make an angle ω with the axis of x (fig. 1). The excess of the integral taken along AQ, from A to Q, above the integral taken along AP, from A to P, is expressed, correctly to the first order in ν, by the formula

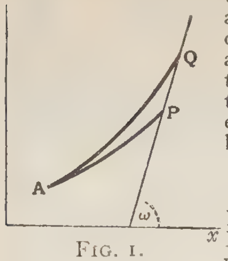


FIG. 1.

$$\nu\cos\omega\left\{F(x, y, y')+(\tan\omega-y')\frac{\partial F}{\partial y'}\right\}.$$

In this formula x, y are the co-ordinates of P, and y' has the value belonging to the point P and the stationary curve AP. When the coefficient of $\nu\cos\omega$ in the formula vanishes, the curve AP is said to be cut *transversely* by the line PQ, and a curve which cuts a family of stationary curves transversely is described as a *transversal* of those curves. In the problem of variable limits, when a terminal point moves on a given guiding curve, the integral cannot be an extremum unless the stationary curve along which it is taken is cut transversely by the guiding curve at the terminal point. A simple example is afforded by the shortest line, drawn on a surface, from a point to a given curve, lying on the surface. The required curve must be a geodesic, and it must cut the given curve at right angles.

Transversals of stationary curves.

The problem of variable limits may always be treated by a method of which the following is the principle: In the First Problem let the initial point (x_0, y_0) be fixed, and let the terminal point (x_1, y_1) move on a fixed guiding curve C_1. Now, whatever the terminal point may be, the integral cannot be an extremum unless it is taken along a stationary curve. We have then to choose among those stationary curves which are drawn from (x_0, y_0) to points of C_1 that one which makes the integral an extremum. This can be done by expressing the value of the integral taken along a stationary curve from the point (x_0, y_0) to the point (x_1, y_1) in terms of the co-ordinates x_1, y_1, and then making this expression an extremum, in regard to variations of x_1, y_1, by the methods of the differential calculus, subjecting (x_1, y_1) to the condition of moving on the curve C_1.

Alternative method.

An important example of the first variation of integrals is afforded by the Principle of Least Action in dynamics. The kinetic energy T is a homogeneous function of the second degree in the differential coefficients $\dot{q}_1, \dot{q}_2, \ldots \dot{q}_n$ of the co-ordinates $q_1, q_2, \ldots q_n$ with respect to the time t, and the potential energy V is a function of these co-ordinates. The energy equation is of the form

$$T+V=E,$$

where E is a constant. A *course* of the system is defined when the co-ordinates q are expressed as functions of a single parameter θ. The *action* A of the system is defined as the integral $\int_{t_0}^{t_1}2T\,dt$, *taken along a course* from the initial position $(q^{(0)})$ to the final position $(q^{(1)})$, but t_0 and t_1 are not fixed. The equations of motion are the principal equations answering to this integral. To obtain them it is most convenient to write $\Phi(\dot{q})$ for T, and to express the integral in the form

Principle of least action.

$$\int_{\theta_0}^{\theta_1}2(E-V)^{\frac{1}{2}}\{\Phi(q')\}^{\frac{1}{2}}d\theta,$$

where q' denotes the differential coefficient of a co-ordinate q with respect to θ, and, in accordance with the parametric method, the limits of integration are fixed, and the integrand is a homogeneous function of the q''s of the first degree. There is then no difficulty in deducing the Lagrangian equations of motion of the type

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{q}}-\frac{\partial T}{\partial q}+\frac{\partial V}{\partial q}=0.$$

These equations determine the actual course of the system. Now if the system, in its actual course, passes from a given initial position $(q^{(0)})$ to a variable final position (q), the action A becomes a function of the q's, and the first method used in the problem of variable limits shows that, for every q

$$\frac{\partial A}{\partial q}=\frac{\partial T}{\partial \dot{q}}.$$

When the kinetic energy T is expressed as a homogeneous quadratic function of the momenta $\partial T/\partial\dot{q}$, say

$$T=\tfrac{1}{2}\Sigma_{r,s}\left(b_{rs}\frac{\partial T}{\partial\dot{q}_r}\frac{\partial T}{\partial\dot{q}_s}\right),\ (b_{sr}=b_{rs}),$$

and the differential coefficients of A are introduced instead of those of T, the energy equation becomes a non-linear partial differential equation of the first order for the determination of A as a function of the q's. This equation is

$$\tfrac{1}{2}\Sigma_{r,s}\left(b_{rs}\frac{\partial A}{\partial q_r}\frac{\partial A}{\partial q_s}\right)+V=E.$$

Principle of varying action.

A complete integral of this equation would yield an expression for A as a function of the q's containing n arbitrary constants, $a_1, a_2, \ldots a_n$, of which one a_n is merely additive to A; and the courses of the system which are compatible with the equations of motion are determined by equations of the form

$$\frac{\partial A}{\partial a_1}=b_1, \frac{\partial A}{\partial a_2}=b_2, \ldots \frac{\partial A}{\partial a_{n-1}}=b_{n-1}$$

where the b's are new arbitrary constants. It is noteworthy that the differential equations of the second order by which the geodesics on an ellipsoid are determined were first solved by this method (C. G. J. Jacobi, 1839).

It has been proved that every problem of the calculus of variations, in which the integral to be made an extremum contains only one independent variable, admits of a similar transformation; that is to say, the integrals of the principal equations can always be obtained, in the way described above, from a complete integral of a partial differential equation of the first order, and this partial differential equation can always be formed by a process of elimination. These results were first proved by A. Clebsch (1858).

Principle of varying action generalized.

Among other analytical developments of the theory of the first variation we may note that the necessary and sufficient condition that an expression of the form

$$F(x, y, y', \ldots y^{(n)})$$

should be the differential coefficient of another expression of the form

Condition of integrability.

$$F_1(x, y, y', \ldots y^{(n-1)})$$

is the identical vanishing of the expression

$$\frac{\partial F}{\partial y}-\frac{d}{dx}\frac{\partial F}{\partial y'}+\frac{d^2}{dx^2}\frac{\partial F}{\partial y''}-\ldots+(-1)^n\frac{d^n}{dx^n}\frac{\partial F}{\partial y^{(n)}}.$$

The result was first found by Euler (1744).

A differential equation

$$\phi(x, y, y', y'')=0$$

is the principal equation answering to an integral of the form

$$\int F(x, y, y')dx$$

if the equation

$$\frac{d}{dx}\frac{\partial\phi}{\partial y''}=\frac{\partial\phi}{\partial y'}$$

is satisfied identically. In the more general case of an equation of the form

Condition that a differential equation may arise from a problem of the calculus of variations.

$$\phi(x, y, y', \ldots y^{(2n)})=0$$

the corresponding condition is that the differential expression obtained by Lagrange's process of variation, viz.,

$$\frac{\partial\phi}{\partial y}\delta y+\frac{\partial\phi}{\partial y'}\frac{d\delta y}{dx}+\ldots+\frac{\partial\phi}{\partial y^{(2n)}}\frac{d^{2n}\delta y}{dx^{2n}},$$

must be identical with the "adjoint" differential expression

$$\frac{\partial\phi}{\partial y}\delta y-\frac{d}{dx}\left(\frac{\partial\phi}{\partial y'}\delta y\right)+\frac{d^2}{dx^2}\left(\frac{\partial\phi}{\partial y''}\delta y\right)-\ldots+\frac{d^{2n}}{dx^{2n}}\left(\frac{\partial\phi}{\partial y^{(2n)}}\delta y\right).$$

This matter has been very fully investigated by A. Hirsch (1897).

To illustrate the transformation of the first variation of multiple integrals we consider a double integral of the form

$$\iint\psi(x, y, z, p, q, r, s, t)dxdy,$$

taken over that area of the z plane which is bounded by a closed curve s'. Here $p, q, \ldots t$ denote the partial differential coefficients of z with respect to x and y of the first and second orders, according to the usual notation. When z is changed into $z+\epsilon w$, the terms of the first order in ϵ are

First variation of a double integral.

$$\epsilon\iint\left(\frac{\partial\psi}{\partial z}w+\frac{\partial\psi}{\partial p}\frac{\partial w}{\partial x}+\frac{\partial\psi}{\partial q}\frac{\partial w}{\partial y}+\frac{\partial\psi}{\partial r}\frac{\partial^2 w}{\partial x^2}+\frac{\partial\psi}{\partial s}\frac{\partial^2 w}{\partial x\partial y}+\frac{\partial\psi}{\partial t}\frac{\partial^2 w}{\partial y^2}\right)dxdy.$$

Each term must be transformed so that no differential coefficients of w are left under the sign of double integration. We exemplify the process by taking the term containing $\partial^2 w/\partial x^2$. We have

$$\iint\frac{\partial\psi}{\partial r}\frac{\partial^2 w}{\partial x^2}dxdy=\iint\left\{\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\frac{\partial w}{\partial x}\right)-\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\right)\cdot\frac{\partial w}{\partial x}\right\}dxdy$$

$$=\iint\left[\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\frac{\partial w}{\partial x}\right)-\frac{\partial}{\partial x}\left\{w\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\right)\right\}+w\frac{\partial^2}{\partial x^2}\left(\frac{\partial\psi}{\partial r}\right)\right]dxdy.$$

The first two terms are transformed into a line integral taken round the boundary s', and we thus find

$$\iint\frac{\partial\psi}{\partial r}\frac{\partial^2 w}{\partial x^2}dxdy=\int\cos(x,\nu)\left\{\frac{\partial\psi}{\partial r}\frac{\partial w}{\partial x}-w\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\right)\right\}ds'+\iint w\frac{\partial^2}{\partial x^2}\left(\frac{\partial\psi}{\partial r}\right)dxdy,$$

where ν denotes the direction of the normal to the edge s' drawn outwards. The double integral on the right-hand side contributes a term to the principal equation, and the line integral contributes terms to the boundary conditions. The line integral admits of further transformation by means of the relations

$$\frac{\partial w}{\partial x}=\frac{\partial w}{\partial\nu}\cos(x, \nu)-\frac{\partial w}{\partial s'}\cos(y, \nu),$$

$$\int\cos(x, \nu)\cos(y, \nu)\frac{\partial\psi}{\partial r}\frac{\partial w}{\partial s'}ds'=-\int\frac{\partial}{\partial s'}\left\{\cos(x, \nu)\cos(y, \nu)\frac{\partial\psi}{\partial r}\right\}wds'.$$

It becomes

$$\int \cos^2(x,\nu)\frac{\partial\psi}{\partial r}\,\frac{\partial w}{\partial\nu}ds'$$

$$+\int\left[\frac{\partial}{\partial s'}\left\{\cos(x,\nu)\cos(y,\nu)\frac{\partial\psi}{\partial r}\right\}-\cos(x,\nu)\frac{\partial}{\partial x}\left(\frac{\partial\psi}{\partial r}\right)\right]wds'.$$

In forming the first term within the square brackets we then use the relations

$$\frac{\partial}{\partial s'}\cos(x,\nu)=-\frac{1}{\rho'}\cos(y,\nu),\ \frac{\partial}{\partial s'}\cos(y,\nu)=\frac{1}{\rho'}\cos(x,\nu),$$

$$\frac{\partial}{\partial s'}\frac{\partial\psi}{\partial r}=-\cos(y,\nu)\frac{\partial}{\partial x}\frac{\partial\psi}{\partial r}+\cos(x,\nu)\frac{\partial}{\partial y}\frac{\partial\psi}{\partial r},$$

where ρ' denotes the radius of curvature of the curve s'.

The necessity of freeing the calculus of variations from dependence upon the notion of infinitely small quantities was realized by Lagrange, and the process of discarding such quantities was partially carried out by him in his *Théorie des fonctions analytiques* (1797). In accordance with the interpretation of differentials which he made in that treatise, he interpreted the variation of an integral, as expressed by means of his symbol δ, as the first term, or the sum of the terms of the first order, in the development in series of the complete expression for the change that is made in the value of the integral when small finite changes are made in the variables. The quantity which had been regarded as the variation of the integral came to be regarded as the first variation, and the discrimination between maxima and minima came to be regarded as requiring the investigation of the second variation. The first step in this theory had been taken by A. M. Legendre in 1786.

The second variation.

In the case of an integral of the form

$$\int_{x_0}^{x_1}F(x,y,y')dx$$

Legendre defined the second variation as the integral

$$\int_{x_0}^{x_1}\frac{1}{2}\left\{\frac{\partial^2F}{\partial y^2}(\delta y)^2+2\frac{\partial^2F}{\partial y\partial y'}\delta y\delta y'+\frac{\partial^2F}{\partial y'^2}(\delta y')^2\right\}dx.$$

To this expression he added the term $\left[\frac{1}{2}\alpha(\delta y)^2\right]_{x_0}^{x_1}$, which vanishes identically because δy vanishes at $x=x_0$ and at $x=x_1$. He took α to satisfy the equation

$$\frac{\partial^2F}{\partial y'^2}\left(\frac{\partial^2F}{\partial y^2}+\frac{d\alpha}{dx}\right)=\left(\frac{\partial^2F}{\partial y\partial y'}+\alpha\right)^2,$$

and thus transformed the expression for the second variation to

$$\int_{x_0}^{x_1}\frac{\partial^2F}{\partial y'^2}(\delta y'+m\delta y)^2dx,$$

where

$$m\frac{\partial^2F}{\partial y'^2}=\frac{\partial^2F}{\partial y\partial y'}+\alpha.$$

From this investigation Legendre deduced a new condition for the existence of an extremum. It is necessary, not only that the variation should vanish, but also that the second variation should be one-signed. In the case of the First Problem Legendre concluded that this cannot happen unless $\partial^2F/\partial y'^2$ has the same sign at all points of the stationary curve between the end points, and that the sign must be + for a minimum and − for a maximum. In the application of the perametric method the function which has been denoted by f_1 takes the place of $\partial^2F/\partial y'^2$.

Legendre's condition.

The transformation of the second variations of integrals of various types into forms in which their signs can be determined by inspection subsequently became one of the leading problems of the calculus of variations. This result came about chiefly through the publication in 1837 of a memoir by C. G. J. Jacobi. He transformed Legendre's equation for the auxiliary function α into a linear differential equation of the second order by the substitution

Jacobi.

$$\frac{\partial^2F}{\partial y\partial y'}+\alpha=-\frac{\partial^2F}{\partial y'^2}\,\frac{1}{w}\,\frac{dw}{dx},$$

and he pointed out that Legendre's transformation of the second variation cannot be effected if the function w vanishes between the limits of integration. He pointed out further, that if the stationary curves of the integral are given by an equation of the form

$$y=\phi(x,a,b),$$

where a, b are arbitrary constants, the complete primitive of the equation for w is of the form

$$w=A\frac{\partial\phi}{\partial a}+B\frac{\partial\phi}{\partial b},$$

where A, B are new arbitrary constants. Jacobi stated these propositions without proof, and the proof of them, and the extension of the results to more general problems, became the object of numerous investigations. These investigations were, for the most part, and for a long time, occupied almost exclusively with analytical developments; and the geometrical interpretation which Jacobi had given, and which he afterwards emphasized in his *Vorlesungen über Dynamik*, was neglected until rather recent times. According to this interpretation, the stationary curves which start from a point (x_0, y_0) have an envelope; and the integral of F, taken along such a curve, cannot be an extremum if the point (ξ_0, η_0) where the curve touches the envelope lies on the arc between the end points. Pairs of points such as (x_0, y_0) and (ξ_0, η_0) were afterwards called *conjugate points* by Weierstrass. The proof that the integral cannot be an extremum if the arc of the curve between the fixed end points contains a pair of conjugate points was first published by G. Erdmann (1878).

Conjugate points.

Examples of conjugate points are afforded by antipodal points on a sphere, the conjugate foci of geometrical optics, the kinetic foci of analytical dynamics. If the terminal points are a pair of conjugate points, the integral is not in general an extremum; but there is an exceptional case, of which a suitably chosen arc of the equator of an oblate spheroid may serve as an example. In the problem of the catenoid a pair of conjugate points on any of the catenaries, which are the stationary curves of the problem, is such that the tangents to the catenary at the two points A and A′ meet on the axis of revolution (fig. 2). When both the end points of the required curve move on fixed guiding curves C_0, C_1, a stationary curve C, joining a point A_0 of C_0 to a point A_1 of C_1, cannot yield an extremum unless it is cut transversely by C_0 at A_0 and by C_1 at A_1. The envelope of stationary curves which set out from C_0 towards C_1, and are cut transversely by C_0 at points near A_0, meets C at a point D_0; and the envelope of stationary curves which proceed from C_0 to C_1, and are cut transversely by C_1 at points near A_1, meets C at a point D_1. The curve C, drawn from A_0 to A_1, cannot yield an extremum if D_0 or D_1 lies between A_0 and A_1, or if D_0 lies between A_1 and D_1. These results are due to G. A. Bliss (1903). A simple example is afforded by the shortest line on a sphere drawn from one small circle to another. In fig. 3 D_0 is that pole of the small circle A_0B_0 which occurs first on great circles cutting A_0B_0 at right angles, and proceeding towards A_1B_1; D_1 is that pole of the small circle A_1B_1 which occurs first on great circles cutting A_1B_1 at right angles, and drawn from points of A_0B_0 towards A_1B_1. The arc A_0A_1 is the required shortest line, and it is distinguished from B_0B_1 by the above criterion.

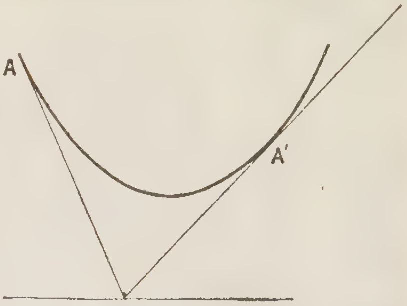


FIG. 2.

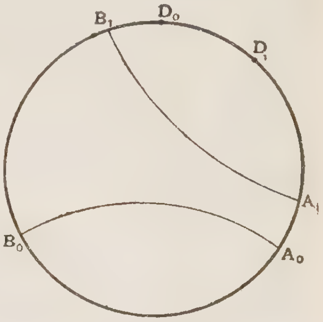


FIG. 3.

Jacobi's introduction of conjugate points is one of the germs from which the modern theory of the calculus of variations has sprung. Another is a remark made by Legendre (1786) in regard to the solution of Newton's problem of the solid of least resistance. This problem requires that a curve be found for which the integral

$$\int yy'^2(1+y'^2)^{-1}dy$$

should be a minimum. The stationary curves are given by the equation

$$yy'^3(1+y'^2)^{-2}=\text{const.},$$

a result equivalent to Newton's solution of the problem; but Legendre observed that, if the integral is taken along a broken line, consisting of two straight lines equally inclined to the axis of x in opposite senses, the integral can be made as small as we please by sufficiently diminishing the angle of inclination. Legendre's remark amounts to admitting a variation of Newton's curve, which is not a weak variation. Variations which are not weak are such that, while the points of a curve are but slightly displaced, the tangents undergo large changes of direction. They are distinguished as *strong variations*. A general theory of strong variations in connexion with the First Problem, and of the conditions which are sufficient to secure that the integral taken along a stationary curve may be an extremum, was given by Weierstrass in lectures. He delivered courses of lectures on the calculus of variations in several years between 1865 and 1889, and his chief discoveries in the subject seem to have been included in the course for 1879. Through these lectures his theory became known to some students and teachers in Europe and America, and there have been published a few treatises and memoirs devoted to the exposition of his ideas.

Sources of Weierstrass's theory.

In the First Problem the following conditions are known to be necessary for an extremum. I. The path of integration must be a stationary curve. II. The expression $\partial^2F/\partial y'^2$, or the expression denoted by f_1 in the application of the parametric method, must not change sign at any point of this curve between the end points. III. The arc of the curve between the end points must not contain a pair of conjugate points. All these results are obtained by using weak variations. Additional

Necessary conditions.

results, relating to strong as well as weak variations, are obtained by a method which permits of the expression of the variation of an integral as a line integral taken along the varied curve. Let A, B be the end points, and let the stationary curve AB be drawn. If the end points A, B are not a pair of conjugate points, and if the point conjugate to A does not lie on the arc AB, then we may find a point A′, on the backward continuation of the stationary curve BA beyond A, so near to A that the point conjugate to A′ lies on the forward continuation of the arc AB beyond B. This being the case, it is possible to delimit an area of finite breadth, so that the arc AB of the stationary curve joining A, B lies entirely within the area, and no two stationary curves drawn through A′ intersect within the area. Through any point of such an area it is possible to draw one, and only one, stationary curve which passes through A′. This family of stationary curves is said to constitute a *field* of stationary curves about the curve AB. We suppose that such a field exists, and that the varied curve AQPB lies entirely within the delimited area. The variation of the integral $\int F(x, y, y')dx$ is identical with the line integral of F taken round a contour consisting of the varied curve AQPB and the stationary curve AB, in the sense AQPBA. The line integral may, as usual, be replaced by the sum of line integrals taken round a series of cells, the external boundaries of the set of cells being identical with the given contour, and the internal boundaries of adjacent cells being traversed twice in opposite senses. We may choose a suitable set of cells as follows. Let Q, P be points on the varied curve, and let A′Q, A′P be the stationary curves of the field which pass through Q, P. Let P follow Q in the sense AQPB in which the varied curve is described. Then the contour consisting of the stationary curve A′Q, from A′ to Q, the varied curve QP, from Q to P, and the stationary curve A′P, from P to A′, is the boundary of a cell (fig. 4). Let us denote the integral of F taken along a stationary curve by round brackets, thus (A′Q), and the integral of F taken along any other curve by square brackets, thus [PQ]. If the varied curve is divided into a number of arcs such as QP we have the result

$$[AQPB]-(AB)=\Sigma\{(A'Q)+[QP]-(A'P)\},$$

and the right-hand member can be expressed as a line integral taken along the varied curve AQPB.

Field of stationary curves.

General expression for variation of an integral.

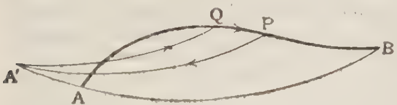


FIG. 4.

To effect this transformation we seek an approximate expression for the term $(A'Q)+[QP]-(A'P)$ when Q, P are near together. Let Δs denote the arc QP, and ψ the angle which the tangent at P to the varied curve, in the sense from A to B, makes with the axis of x (fig. 5). Also let ϕ be the angle which the tangent at P to the stationary curve A′P, in the sense from A′ to P, makes with the axis of x. We evaluate $(A'Q)-(A'P)$ approximately by means of a result which we obtained in connexion with the problem of variable limits. Observing that the angle here denoted by ψ is equivalent to the angle formerly denoted by $\pi+\omega$ (cf. fig. 1), while $\tan\phi$ is equivalent to the quantity formerly denoted by y', we obtain the approximate equation

$$(A'Q)-(A'P)=-\Delta s.\cos\psi\left\{F(x,y,p)+(\tan\psi-p)\frac{\partial F}{\partial p}\right\}_{p=\tan\phi}$$

which is correct to the first order in Δs. Also we have

$$[QP]=\Delta s\,.\,\cos\psi F(x,y,\tan\psi)$$

correctly to the same order. Hence we find that, correctly to the first order in Δs,

$$(A'Q)+[QP]-(A'P)=E(x,y,\tan\phi,\tan\psi)\Delta s,$$

where

$$E(x,y,\tan\phi,\tan\psi)$$
$$=\cos\psi\left\{F(x,y,\tan\psi)-F(x,y,p)-(\tan\psi-p)\frac{\partial F}{\partial p}\right\}_{p=\tan\phi}.$$

When the parametric method is used the function E takes the form

$$\left(\lambda\frac{\partial f}{\partial\dot{x}}+\mu\frac{\partial f}{\partial\dot{y}}\right)_{\dot{x}=\lambda,\,\dot{y}=\mu}-\left(\lambda\frac{\partial f}{\partial\dot{x}}+\mu\frac{\partial f}{\partial\dot{y}}\right)_{\dot{x}=l,\,\dot{y}=m}$$

where λ, μ are the direction cosines of the tangent at P to the curve AQPB, in the sense from A to B, and l, m are the direction cosines of the tangent at P to the stationary curve A′P, in the sense from A′ to P.

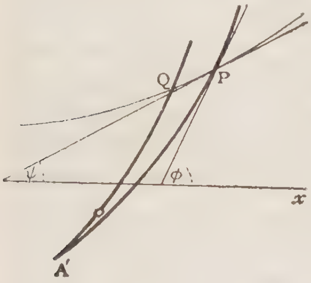


FIG. 5.

The function E, here introduced, has been called Weierstrass's *excess function*. We learn that the variation of the integral, that is to say, the excess of the integral of F taken along the varied curve above the integral of F taken along the original curve, is expressible as the line integral $\int E ds$ taken along the varied curve. We can therefore state a *sufficient* (but not necessary) condition for the existence of an extremum in the form:—When the integral is taken along a stationary curve, and there is no pair of conjugate points on the arc of the curve terminated by the given end points, the integral is certainly an extremum if the excess function has the same sign at all points of a finite area containing the whole of this arc within it. Further, we may specialize the excess function by identifying A′ with A, and calculating the function for a point P on the arc AB of the stationary curve AB, and an arbitrary direction of the tangent at P to the varied curve. This process is equivalent to the introduction of a particular type of strong variation. We may in fact take, as a varied curve, the arc AQ of a neighbouring stationary curve, the straight line QP drawn from Q to a point of the arc AB, and the arc PB of the stationary curve AB (fig. 6). The sign of the variation is then the same as that of the function $E(x, y, \tan\phi, \tan\psi)$, where (x, y) is the point P, ψ is the angle which the straight line QP makes with the axis of x, and ϕ is the angle which the tangent at P to the curve APB makes with the same axis. We thus arrive at a new *necessary* (but not sufficient) condition for the existence of an extremum of the integral $\int F ds$, viz. the specialized excess function, so calculated, must not change sign between A and B.

Weierstrass's excess function.

Sufficient and necessary conditions.

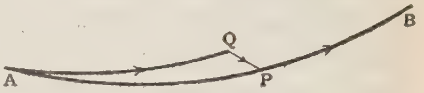


FIG. 6.

The sufficient condition, and the new necessary condition, associated with the excess function, as well as the expression for the variation as $\int E ds$, are due to Weierstrass. In applications to special problems it is generally permissible to identify A′ with A, and to regard QP as straight. The direction of QP must be such that the integral of F taken along it is finite and real. We shall describe such directions as *admissible*. In the statement of the sufficient condition, and the new necessary condition, it is of course understood that the direction specified by ψ is admissible. The excess function generally vanishes if $\psi=\phi$, but it does not change sign. It can be shown without difficulty that, when ψ is very nearly equal to ϕ, the sign of E is the same as that of

$$(\tan\psi-\tan\phi)^2\cos\phi\left(\frac{\partial^2 F}{\partial y'^2}\right)_{y'=\tan\phi}$$

and thus the necessary condition as to the sign of the excess function includes Legendre's condition as to the sign of $\partial^1 F/\partial y'^2$.

Developments connected with the excess function.

Weierstrass's conditions have been obtained by D. Hilbert from the observation that, if p is a function of x and y, the integral

$$\int\left\{F(x,y,p)+(y'-p)\left(\frac{\partial F}{\partial y'}\right)_{y'=p}\right\}dx,$$

taken along a curve joining two fixed points, has the same value for all such curves, provided that there is a field of stationary curves, and that p is the gradient at the point (x, y) of that stationary curve of the field which passes through this point.

An instructive example of the excess function, and the conditions connected with it, is afforded by the integral

$$\int y^2y'^{-2}dx \text{ or } \int y^2\dot{x}^3\dot{y}^{-2}d\theta.$$

The first integral of the principal equation is

$$y^2\dot{x}^2\dot{y}^{-2}=\text{const.},$$

and the stationary curves include the axis of x, straight lines parallel to the axis of y, and the family of exponential curves $y=ae^{cx}$. A field of stationary curves is expressed by the equation

$$y=y_0\exp\{c(x-x_0)\},$$

and, as these have no envelope other than the initial point (x_0, y_0), there are no conjugate points. The function f_1 is $6\dot{x}\dot{y}^{-4}$, and this is positive for curves going from the initial point in the positive direction of the axis of x. The value of the excess function is

$$y^2\cos\psi(\cot^2\psi-3\cot^2\phi+2\tan\psi\cot^3\phi).$$

The directions $\psi=0$ and $\psi=\pi$ are inadmissible. On putting $\psi=\frac{1}{2}\pi$ we get $2y^2\cot^3\phi$; and on putting $\psi=\frac{3}{2}\pi$ we get $-2y^2\cot^3\phi$. Hence the integral taken along AQ′PB is greater than that taken along APB, and the integral taken along AQPB is less than that taken along APB, when Q′Q are sufficiently near to P on the ordinate of P (fig. 7). It follows that the integral is neither a maximum nor a minimum.

Example of the excess function.

It has been proved by Weierstrass that the excess function cannot be one-signed if the function f of the parametric method is a rational function of $\dot{x}$ and $\dot{y}$. This result includes the above example, and the problem of the solid of least resistance, for which, as Legendre had seen, there can be no solution if strong variations are admitted. As another example of the calculation of excess functions, it may be noted that the value of the excess function in the problem of the catenoid is $2y\sin^2\frac{1}{2}(\psi-\phi)$.

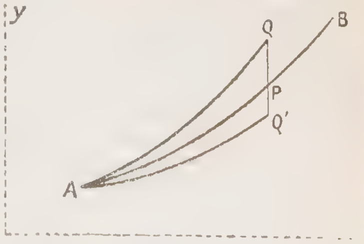


FIG. 7.

Field of stationary curves and transversals.

In general it is not necessary that a field of stationary curves should consist of curves which pass through a fixed point. Any family of stationary curves depending on a single parameter may constitute a field. This remark is of importance in connexion with the adaptation of Weierstrass's results to the problem of variable limits. For the purpose of this adaptation A. Kneser (1900) introduced the family of stationary curves which are cut transversely by an assigned curve. Within the field of these curves we can construct the transversals of the family; that is to say, there is a finite area of the plane, through any point of which there passes one stationary curve of the field and one curve which cuts all the stationary curves of the field transversely. These curves provide a system of curvilinear co-ordinates, in terms of which the value of $\int F dx$, taken along any curve within the area, can be expressed. The value of the integral is the same for all arcs of stationary curves of the field which are intercepted between any two assigned transversals.

Discontinuous solutions.

In the above discussion of the First Problem it has been assumed that the curve which yields an extremum is an arc of a single curve, which must be a stationary curve. It is conceivable that the required curve might be made up of a finite number of arcs of different stationary curves meeting each other at finite angles. It can be shown that such a broken curve cannot yield an extremum unless both the expressions $\partial F/\partial y'$ and $F-y'(\partial F/\partial y')$ are continuous at the corners. In the parametric method $\partial f/\partial\dot{x}$ and $\partial f/\partial\dot{y}$ must be continuous at the corners. This result limits very considerably the possibility of such discontinuous solutions, though it does not exclude them. An example is afforded by the problem of the catenoid. The axis of x and any lines parallel to the axis of y satisfy the principal equation; and the conditions here stated show that the only discontinuous solution of the problem is presented by the broken line ACDB (fig. 8). A broken line like AA′B′B is excluded. Discontinuous solutions have generally been supposed to be of special importance in cases where the required curve is restricted by the condition of not crossing the boundary of a certain limited area. In such cases part of the boundary may have to be taken as part of the curve. Problems of this kind were investigated in detail by J. Steiner and I. Todhunter. In recent times the theory has been much extended by C. Carathéodory.

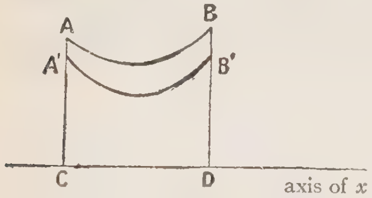


FIG. 8.

Existence-theorems.

In any problem of the calculus of variations the first step is the formation of the principal equation or equations; and the second step is the solution of the equation or equations, in accordance with the assigned terminal or boundary conditions. If this solution cannot be effected, the methods of the calculus fail to answer the question of the existence or non-existence of a solution which would yield a maximum or minimum of the integral under consideration. On the other hand, if the existence of the extremum could be established independently, the existence of a solution of the principal equation, which would also satisfy the boundary conditions, would be proved. The most famous example of such an existence-theorem is Dirichlet's principle, according to which there exists a function V, which satisfies the equation

$$\frac{\partial^2 V}{\partial x^2}+\frac{\partial^2 V}{\partial y^2}+\frac{\partial^2 V}{\partial z^2}=0$$

at all points within a closed surface S, and assumes a given value at each point of S. The differential equation is the principal equation answering to the integral

$$I=\iiint\left\{\left(\frac{\partial V}{\partial x}\right)^2+\left(\frac{\partial V}{\partial y}\right)^2+\left(\frac{\partial V}{\partial z}\right)^2\right\}dx\,dy\,dz$$

taken through the volume within the surface S. The theorem of the existence of V is of importance in all those branches of mathematical physics in which use is made of a potential function, satisfying Laplace's equation; and the two-dimensional form of the theorem is of fundamental importance in the theory of functions of a complex variable. It has been proposed to establish the existence of V by means of the argument that, since I cannot be negative, there must be, among the functions which have the prescribed boundary values, some one which gives to I the smallest possible value. This unsound argument was first exposed by Weierstrass. He observed that precisely the same argument would apply to the integral $\int x^2y'^2dx$ taken along a curve from the point $(-1, a)$ to the point $(1, b)$. On the one hand, the principal equation answering to this integral can be solved, and it can be proved that it cannot be satisfied by any function y at all points of the interval $-1 \leqslant x \leqslant 1$ if y has different values at the end points. On the other hand, the integral can be made as small as we please by a suitable choice of y. Thus the argument fails to distinguish between a *minimum* and an *inferior limit* (see FUNCTION). In order to prove Dirichlet's principle it becomes necessary to devise a proof that, in the case of the integral I, there cannot be a limit of this kind. This has been effected by Hilbert for the two-dimensional form of the problem.

Dirichlet's principle.

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VARICOSE VEINS (Lat. *varix*, a dilated vein), a condition of the veins which mostly occurs in those parts of the bloodstream which are farthest from the heart and occupy a dependent position. Thus they are found in the legs and thighs; in the lowest part of the bowel (piles; see HAEMORRHOIDS), and in the spermatic cord (varicocele). Any condition which hinders the return of blood from the veins is apt to cause their permanent dilatation; thus is explained the occurrence of varicose veins in the leg from the wearing of a tight garter, and of piles as the result of the pressure of an ovarian tumour or of a pregnant uterus, or of disease of the liver.

Sometimes the trouble is begun by a direct injury to the vein, which, by setting up an inflammation, weakens the coats of the vein, which then yield under the pressure of the blood-stream. In the case of varicocele, the dilatation of the veins is probably of developmental origin; many other causes are given, but not one of them appears satisfactory. Examination of a varicose vein shows that it is increased in length as well as in capacity. In some parts of its course the vein has its coats much thickened, but at those places where there is most dilatation the walls are very thin. Veins thus affected give rise to pains and achings, and they are, moreover, liable to attacks of inflammation which end in clotting of the blood (*thrombosis*). This is a dangerous condition, as a sudden or violent movement is apt to cause the detachment of a piece of the clot, which, carried up to the brain or the lung, may cause sudden death. Less serious results of varicose veins are swelling of the parts below (*oedema*), ulceration and abscess.

As regards treatment, the wearing of a well-fitting elastic stocking will prove beneficial in the case of a moderate dilatation of the veins of the leg; the individual must avoid long standing and fatigue. It is well also to have the foot of the bed raised three or four inches, so that during the night the veins may be kept as empty as possible. If the case is more serious, the thinned veins threatening to give way, it will be advisable, provided the dilatations are fairly well localized, and the general condition of the patient permits, to excise the diseased parts, tying the cut ends of the veins, and closing the surface wounds with fine sutures. Should a varicose vein be plugged with clot, it will be advisable to tie it high up where the coats are healthy, and to remove the lower part by dissection. This will render the person safe from the very serious risk of a piece of the clot being carried to the heart, and will also permanently rid him of his trouble. It may be said generally that any operative treatment for varicose veins in the lower extremity is best associated with the application of a ligature upon the large surface vein just before it enters the common femoral vein below the fold of the groin. This operation removes the risk of the downward pressure of blood in the veins whose dilatation has rendered the valves useless.

In the case of a varicose vein being opened by accident or disease, it is quite possible for the individual to bleed to death. The first-aid treatment for the serious haemorrhage should consist in laying the patient on the floor, raising the limb upon the seat of a chair, and fixing a pad over the open vessel by a handkerchief or bandage.

Varicose veins of the spermatic cord (*varicocele*) of the left side are met with in adolescents. The dilatation is, in all probability, of developmental origin, making its appearance at puberty. It is, as a rule, of no serious moment, and, unless present in an extreme degree, had best be treated merely by a suspension bandage. If, however, it is causing real physical distress, it may be treated by excision of an inch or two of the bunch of dilated veins. The presence of varicocele is apt to cause inconvenience or even discomfort to men living in India or the tropics, but the Englishman who intends spending his life in temperate climes will do well to ignore a varicocele. It will become less and less noticeable as time goes on. (E. O.*)

VARIOLITES (Lat. *variola*, smallpox), in petrology, a group of dark green basic igneous rocks which, especially on weathered surfaces, exhibit pale coloured spots that give them a pock-marked appearance. In some conditions these spots weather out prominently; they are grey, pale green, violet or yellowish, while the matrix of the rock is usually dark green. The variolites are related most closely to the basalts or diabases. They are nearly always much decomposed, and, since they are also fine-grained rocks, their original composition may be much obscured by secondary changes. The variolitic spots are rounded in outline and are often about a quarter of an inch in diameter, but may much exceed this size. They have a radiate structure and are sometimes, though not generally, zoned with concentric circles of different appearance and composition. Many authors have compared them with the spherulites of the acid rocks (obsidians and rhyolites), and undoubtedly some kinds of variolite are merely glassy spherulitic varieties of basalt. The tachylyte selvages of the dolerite dikes of the west of Scotland, for example, often contain large brown spherulites which are easily visible in hand specimens. These spherulites consist of very thin divergent fibres, and their nature is often difficult to determine on account of the indefiniteness of the optical characters of minerals in this state. It seems probable, however, that they are mostly felspar embedded in dark brown glass. Small phenocrysts or skeleton crystals of olivine, augite and plagioclase felspar may occur in these tachylytes.

Other variolites are glassy or partly crystalline facies of olivine-free dolerites, occurring as thin dikes or intrusions, or at the margins of dolerite masses. In these the felspars are well crystallized as thin rods, with square or forked ends, radiating outwards from a centre. They are commonly oligoclase, and sometimes assume branching or feathery forms. Some authors would call these "sphaero-crystals" rather than spherulites; they are an intermediate stage between the latter and the stellate groupings of felspar which occur frequently in igneous rocks. In the same rocks augite spherulites occur also, but this mineral forms plumose growths, branching and curved, which spread through the glassy base and do not interfere with the felspar spherulites. They have much resemblance to the feathery ice crystals which form on window-panes. Occasionally olivine-dolerites have a coarsely spherulitic structure with long rods of plagioclase felspar converging to a point; one example of these rocks from Skye contains variolites over three inches in diameter.

Another group of variolites includes the most famous rock of this type, which comes from the Durance, in France. Pebbles of this were well known to collectors for a long time before they were traced to their source at Mont Genèvre. They were proved to belong to a diabasic rock which shows well-marked "pillow-structure" or "spheroidal jointing." Each pillow has a marginal portion which is variolitic, but towards the centre of the block-shaped masses the structure becomes coarse and groups of radiate felspars make their appearance. It is doubtful whether the variolite is an intrusive rock or a lava flow. Many of these pillow lavas (or spilites) occur in the Devonian rocks of Germany, and often they have variolitic facies which seem to belong to the same group as the rock of the Durance. Their spherulites are very often oligoclase felspar or decomposition products after a felspathic mineral. In other cases they consist of chlorite or pale green amphibole, both of which may be secondary after pyroxene. The ground mass is very fine grained and is filled with chlorite, epidote, leucoxene, and other secondary minerals. There is much reason to believe that it was originally in large measure vitreous but has suffered devitrifaction. Sometimes little steam cavities occur and may serve as a nucleus from which the variolite has grown. The radiate structure of the varioles is often nearly obliterated in these much-decomposed rocks, in fact it may never have been very perfect. Variolites are found also in several parts of the Swiss Alps at Jatluga on Lake Onega, in Anglesey, the Lleyn district and Fishguard in Wales, in Cornwall, and in more than one place in Ireland.

Finally, there is a group of spotted rocks formerly known to French petrographers as the *variolites du Drac* from the locality in which they are found, but they have been proved to be merely vesicular, rotten diabases, with steam cavities filled with white calcite and other secondary minerals. (J. S. F.)

VARISCITE, a native hydrous aluminium phosphate, $AlPO_4 \cdot 2H_2O$, named by A. Breithaupt, in 1837, in consequence of its occurrence in the Saxon Voigtland (Variscia). It is a green mineral generally occurring as an incrustation or in nodules. A compact nodular variety was discovered about 1894 in Cedar Valley, near Old Camp Floyd, Utah, and was described by Dr G. F. Kunz as utahlite. Its beautiful apple-green colour has led to its use, when cut and polished, as an ornamental stone. The term utahlite must be distinguished from utahite, the name given by A. Arzruni to a basic ferric sulphate, $3(FeO)_2SO_4 \cdot 4H_2O$, from Utah.

VARLEY, CORNELIUS (1781–1873), English water-colour painter, a younger brother of John Varley (*q.v.*), was born at Hackney, London, on the 21st of November 1781. He was educated by his uncle, a philosophical instrument maker, and under him acquired a knowledge of the natural sciences; but about 1800 he joined his brother in a tour through Wales, and began the study of art. He was soon engaged in teaching drawing. From 1803 till 1859 he was an occasional exhibitor in the Royal Academy; and he also contributed regularly to the displays of the Water-Colour Society, of which, in 1803, he was one of the founders, and of which he continued a member till 1821. His works consist mainly of carefully finished classical subjects, with architecture and figures. He published a series of etchings of "Boats and other Craft on the River Thames," and during his life as an artist he continued deeply interested in scientific pursuits. For his improvements in the camera lucida, the camera obscura and the microscope he received the Isis gold medal of the Society of Arts; and at the International

Exhibition of 1851 he gained a medal for his invention of the graphic telescope. He died at Hampstead on the 2nd of October 1873.

VARLEY, JOHN (1778–1842), English water-colour painter, was born at Hackney, London, on the 17th of August 1778. His father, a man of scientific attainments and tutor in the family of Lord Stanhope, discouraged his leanings towards art, and placed him under a silversmith. But on his parent's death Varley escaped from this uncongenial employment, and, after working with a portrait painter, engaged himself at the age of sixteen to an architectural draughtsman, who took him on a provincial tour to sketch the principal buildings in the towns they visited. His spare hours were employed in sketching from nature, and in the evenings he was permitted, like Turner and Girtin, to study in the house of Dr Munro. In 1798 he exhibited his first work, a "View of Peterborough Cathedral," in the Royal Academy. In 1799 he visited North Wales, and in its wild mountain scenery found the subjects best suited to his brush. He returned to the same district in 1800, and again in 1802, and the impressions then received powerfully influenced the whole course of his art. In 1804 he became a foundation member of the Water-Colour Society, and contributed over forty works to its first exhibition. He had married in the previous year; and, in order to provide for the wants of an increasing family, he was obliged to produce for the dealers much work of a slight and commonplace character. He also taught drawing, and some of his pupils, such as John Linnell and William Hunt, afterwards became celebrated. He was a firm believer in astrology, skilful in casting horoscopes; and some curious instances were related of the truth of his predictions. It was at his house that his friend William Blake sketched his celebrated "Visionary Heads." Varley died at London on the 17th of November 1842.

Varley's landscapes are graceful and solemn in feeling, and simple and broad in treatment, being worked with a full brush and pure fresh transparent tints, usually without any admixture of body-colour. Though his works are rather mannered and conventional, they are well considered and excellent in composition. Some of his earlier water-colours, including his "Views of the Thames," were painted upon the spot, and possess greater individuality than his later productions, which are mainly compositions of mountain and lake scenery, produced without direct reference to nature. Among his literary works are *Zodiacal Physiology* (1828); *Observations on Colour and Sketching from Nature* (1830); *A Practical Treatise on Perspective, and Principles of Landscape Design for Young Artists.*

VARNA, a fortress, seaport, departmental capital and episcopal city of Bulgaria; on the Bay of Varna, an inlet of the Black Sea, in 43° 12′ N. and 27° 56′ E. Pop. (1906) 37,155. Varna is built on the hilly north shore of the bay, overlooking the estuary of the river Devna or Pravadi, which flows seaward through a magnificent valley surrounded by mountains. It is the eastern terminus of the Varna-Rustchuk railway, opened in 1867, and is connected with all parts of the kingdom by branches of this line. The so-called "Varna quadrilateral," which has played an important part in Bulgarian military history, consists of the fortresses of Varna, Shumla, Rustchuk and Silistria (*q.v.*). Varna is the third city of the kingdom in population, after Sofia and Philippopolis, and ranks with Burgas as one of the two principal seaports. Its deep and capacious bay is sheltered from northerly and north-easterly winds, and the construction of modern harbour works has greatly increased the facilities for trade. The principal exports are cattle and dairy produce, grain, lamb and goat skins, and cloth (*shayak*); the imports include coal, iron and machinery, textiles, petroleum and chemicals. In 1907 the port was entered by 869 ships of 926,449 tons, the largest number of vessels being Bulgarian and the greatest tonnage Austro-Hungarian. Wine is largely produced in the department, and in the city there are breweries, distilleries, tanneries and cloth factories; cotton-spinning was introduced by a British firm. There is a large and commercially important colony of Greeks; the Jews, Turks and gipsies are also numerous. Much of the city has been constructed since 1878, and the barracks, post office, college for girls and National Bank are handsome modern buildings. Near Varna is the summer palace of the king of Bulgaria.

Varna has been identified with the ancient Milesian colony of *Odessus* on the coast of Moesia Inferior. It figures largely in the history of more recent times, and close by was fought in 1444 the battle in which Murad II. slew Wladislaus III. of Poland and Hungary, and routed his forces commanded by Hunyadi János. Varna was occupied in 1828 by the Russians, in 1854 by the allies, who here organized the invasion of the Crimea, and in 1877 by the Egyptian troops summoned to the defence of Turkey against the Russians. By the treaty of Berlin (1878) it was ceded to Bulgaria. It has long been the seat of a Greek metropolitan and since 1870 of a Bulgarian bishop.

VARNHAGEN VON ENSE, KARL AUGUST (1785–1858), German biographer, was born at Düsseldorf on the 21st of February 1785. He studied medicine at Berlin, but devoted more attention to philosophy and literature, which he afterwards studied more thoroughly at Halle and Tübingen. He began his literary career in 1804 as joint-editor with Adelbert von Chamisso (*q.v.*) of a *Musenalmanach.* In 1809 he joined the Austrian army, and was wounded at the battle of Wagram. Soon afterwards he accompanied his superior officer, Prince Bentheim, to Paris, where he carried on his studies. In 1812 he entered the Prussian civil service at Berlin, but in the following year resumed his military career, this time as a captain in the Russian army. He accompanied Tettenborn, as adjutant, to Hamburg and Paris, and his experiences were recorded in his *Geschichte der Hamburger Ereignisse* (London, 1813), and his *Geschichte der Kriegszüge des Generals von Tettenborn* (1815). At Paris he entered the diplomatic service of Prussia, and in 1814 acted under Hardenberg at the congress of Vienna. He also accompanied Hardenberg to Paris in 1815. He was resident minister for some time at Karlsruhe, but was recalled in 1819, after which, with the title of "Geheimer Legationsrat," he lived chiefly at Berlin. He had no fixed official appointment, but was often employed in important political business. In 1814 he married Rahel Antonie Friederike, originally called Levin, afterwards Robert, and sister of the poet, Ludwig Robert (1778–1832). She was born in 1771 at Berlin, where she died in 1833. By birth she was a Jewess; but before her marriage she made profession of Christianity. Although she never wrote anything for publication, she was a woman of remarkable intellectual qualities, and exercised a powerful influence on many men of high ability. Her husband, who was devotedly attached to her, found in her sympathy and encouragement one of the chief sources of his inspiration as a writer. After her death he published a selection from her papers, and afterwards much of her correspondence was printed. Varnhagen von Ense never fully recovered from the shock caused by her death. He himself died suddenly in Berlin on the 10th of October 1858.

He made some reputation as an imaginative and critical writer, but he is famous chiefly as a biographer. He possessed a remarkable power of grouping facts so as to bring out their essential significance, and his style is distinguished for its strength, grace and purity. Among his principal works are *Goethe in den Zeugnissen der Mitlebenden* (1824); *Biographische Denkmale* (5 vols., 1824–30; 3rd ed., 1872); and biographies of General von Seydlitz (1834), Sophia Charlotte, queen of Prussia (1837), Field-Marshal Schwerin (1841), Field-Marshal Keith (1844), and General Bülow von Dennewitz (1853). His *Denkwürdigkeiten und vermischte Schriften* appeared in 9 vols. in 1843–59, the two last volumes appearing after his death. His niece, Ludmilla Assing, between 1860 and 1867, edited several volumes of his correspondence with eminent men, and his *Tagebücher* (14 vols., 1861–70). *Blätter aus der preussischen Geschichte* appeared in 5 vols. (1868–69); his correspondence with Rahel in 6 vols. (1874–75); and with Carlyle (1892). His selected writings appeared in 19 vols. in 1871–76. There is also an extensive literature dealing with Rahel Varnhagen von Ense; see especially her husband's *Rahel, ein Buch des Andenkens* (3 vols., 1834); *Aus Rahels Herzensleben* (1877); E. Schmidt-Weissenfels, *Rahel und ihre Zeit* (1857); *Briefwechsel zwischen Karoline von Humboldt, Rahel und Varnhagen von Ense* (1896); O. Berdrow, *Rahel Varnhagen* (1900).

VARNISH, a liquid consisting of a gum or resin dissolved in alcohol (spirit varnish) or an oil (oil varnish), which on application to wooden and other surfaces improves their appearance and permanency (see PAINTER-WORK).

VARRO, MARCUS TERENTIUS (116–27 B.C.), Roman polymath and man of letters, was born at Reate in the Sabine country. Here he imbibed in his earlier years a good measure of the hardy simplicity and strong seriousness which the later Romans attributed to the men of the early republic—characteristics which were supposed to linger in the Sabine land after they had fled from the rest of Italy. The chief teacher of Varro was L. Aelius Stilo, the first systematic student, critic and teacher of Latin philology and literature, and of the antiquities of Rome and Italy. Varro also studied at Athens, especially under the philosopher Antiochus of Ascalon, whose aim it was to lead back the Academic school from the scepticism of Arcesilaus and Carneades to the tenets of the early Platonists, as he understood them. He was really a stoicizing Platonist; and this has led to the error of supposing Varro to have been a professed Stoic. The influence of Antiochus is clearly to be seen in many remains of Varro's writings. The political career of Varro seems to have been late and slow; but he arrived at the praetorship, after having been tribune of the people, quaestor and curule aedile. In politics and war he followed Pompey's lead; but it is probable that he was discontented with the course on which his leader entered when the first triumvirate was formed, and he may thus have lost his chance of rising to the consulate. He actually ridiculed the coalition in a work entitled the *Three-Headed Monster* (Τρικάρανος in the Greek of Appian). He did not, however, refuse to join the commission of twenty by whom the great agrarian scheme of Caesar for the resettlement of Capua and Campania was carried into execution (59 B.C.). Despite the difference between them in politics, Varro and Caesar had literary tastes in common, and were friends in private life. Under Pompey Varro saw much active service: he was attached to Pompey as pro-quaestor, probably during the war against Sertorius in Spain. We next find him, as legate, in command of a fleet which kept the seas between Delos and Sicily, while Pompey was suppressing the pirates, and he even won the "naval crown," a coveted reward of personal prowess. A little later he was legate during the last Mithradatic war. In the conflict between Caesar and the Pompeian party Varro was more than once actively engaged. In his *Civil War* (ii. 17–20) Caesar tells how Varrò, when legate in Spain along with Afranius and Petreius, lost his two legions without striking a blow, because the whole region where he was quartered joined the enemy. Caesar curiously intimates that, though Varro did his best for Pompey from a sense of duty, his heart was really with the other leader. Nevertheless he proceeded to Epirus before the battle of Pharsalia, and awaited the result at Dyrrachium in the company of Cicero and Cato. Like Cicero, Varro received harsh treatment from Mark Antony after the Pompeian defeat. Some of his property was actually plundered, but restored at the bidding of Caesar, to whom Varro in gratitude immediately dedicated one of his most important writings. The dictator employed the scholar in aiding him to collect and arrange great stores of Greek and Latin literature for the vast public library which he intended to found. We have glimpses of Varro at this time in the *Letters* of Cicero. He appears as harsh and severe, and a poor stylist. The formation of the second triumvirate again plunged Varro into danger. Antony took possession anew of the property he had been compelled to surrender, and inserted Varro's name on the list of the proscribed. His friends, however, afforded him protection. He was able to make peace with the triumvirs, but sacrificed his property and much of his beloved library. He was permitted to spend in quiet study and in writing the last fifteen years of his life. He is said to have died (27 B.C.) almost pen in hand.

Varro was not surpassed in the compass of his writings by any ancient, not even by any one of the later Greek philosophers, to some of whom tradition ascribes a fabulous number of separate works. In a passage quoted by Gellius, Varro himself, when over seventy years of age, estimated the number of "books" he had written at 490; but "book" here means, not merely such a work as was not subdivided into portions, but also a portion of a subdivided work. For example, the *Menippean Satires* numbered 150, and are all counted separately in Varro's estimate. Jerome made or copied a catalogue of Varro's works which has come down to us in a mutilated form. From this and from other extant materials Ritschl has set down the number of the distinct literary works at 74 and the number of separate "books" at about 620. The later years of the author's life were therefore even more fruitful than the earlier. The complete catalogue may be roughly arranged under three heads—(1) belles lettres, (2) history and antiquities, (3) technical treatises on philosophy, law, grammar, mathematics, philology and other subjects.

The first of these three classes no doubt mainly belonged to Varro's earlier life. In poetry he seems to have attempted nothing that was very elaborate, and little of a serious character. His genius tended naturally in the direction of burlesque and satire. In belles lettres he showed himself throughout, both in matter and form, the pupil and admirer of Lucilius, after whom he wrote satires. One poetical work probably consisted of short pieces in the style of the more satirical poems of Catullus. It is doubtful whether, as has often been supposed, Varro wrote a philosophical poem somewhat in the style of Lucretius; if so, it should rather be classed with the prose technical treatises. One curious production was an essay in popular illustrated literature, which was almost unique in ancient times. Its title was *Imagines*, and it consisted of 700 prose biographies of Greek and Roman celebrities, with a metrical *elogium* for each, accompanied in each case by a portrait. But the lighter works of Varro have perished almost to the last line, with the exception of numerous fragments of the *Menippean Satires*. The Menippus whom Varro imitated lived in the first half of the 3rd century B.C., and was born a Phoenician slave. He became a Cynic philosopher, and is a figure familiar to readers of Lucian. He flouted life and all philosophies but the Cynic in light compositions, partly in prose and partly in verse. A careful study of the fragments does not justify Mommsen's glowing account. That the remains exhibit variety and fertility, that there are in them numerous happy strokes of humour and satire, and many felicitous phrases and descriptions, is true, but the art is on the whole heavy, awkward and forced, and the style rudely archaic and untasteful. The Latin is frequently as rough and uncouth as that of Lucilius. No doubt Varro contemned the Hellenizing innovations by which the hard and rude Latin of his youth was transformed into the polished literary language of the late republican and the Augustan age. The titles of the *Menippean Satires* are very diverse. Sometimes personal names are chosen, and they range from the gods and demigods to the slaves, from Hercules to Marcipor. Frequently a popular proverb or catchword in Greek or Latin supplies the designation: thus we have as titles "I've got You" (Ἔχω σε); "You don't Know what Evening is to Bring" (*Nescis quid vesper serus vehat*); "Know Thyself" (Γνῶθι σεαυτόν). Occasionally the heading indicates that the writer is flying at some social folly, as in "Old Men are Children for the Second Time" (Δὶς παῖδες οἱ γέροντες) and in the "Bachelor" (*Caelebs*). In many satires the philosophers were pounded, as in the "Burial of Menippus" and "Concerning the Sects" (Περὶ αἱρεσέων). Each composition seems to have been a genuine medley or *lanx satura*: any topic might be introduced which struck the author's fancy at the moment. There are many allusions to persons and events of the day, but political bitterness seems to have been commonly avoided. The whole tone of the writer is that of a *laudator temporis acti*, who can but scoff at all that has come into fashion in his own day. From the numerous citations in later authors it is clear that the *Menippean Satires* were the most popular of Varro's writings. Not very unlike the *Menippean Satires* were the *Libri Logistorici*, or satirical and practical expositions, possibly in dialogue form, of some theme most commonly taken from philosophy on its ethical side. A few fragments in this style have come down to us and a number of titles. These are twofold: that is to say, a personal name is followed by words indicating the subject-matter, as *Marius de Fortuna*, from which the contents may easily be guessed, and *Sisenna de Historia*, most likely a dialogue in which the old annalist of the name was the chief speaker, and discoursed of the principles on which history should be written. Among the lighter and more popular works may be mentioned twenty-two books of *Orations* (probably never spoken), some funeral eulogies (*Laudationes*), some "exhortations" (*Suasiones*), conceivably, of a political character, and an account of the author's own life.

The second section of Varro's works, those on history and antiquities, form to the present day the basis on which a large part of our knowledge of the earlier Roman history, and in particular of Roman constitutional history, ultimately rests. These writings were used as a quarry by the compilers and dilettanti of later times, such as Pliny, Plutarch, Gellius, Festus, Macrobius, and by Christian champions like Tertullian, Arnobius and Augustine, who did not disdain to seek in heathen literature the means of defending their faith. These men have saved for us a few remains from the great wreck made by time. Judging from what has been casually preserved, if any considerable portion of Varro's labours as antiquarian and historian were to be now discovered, scholars might find themselves compelled to reconstruct the earlier history of the Roman republic from its very foundations. Varro's greatest predecessor in this field of inquiry, the man who turned over the virgin soil, was Cato the Censor. His example, however, seems to have remained unfruitful till the time of Varro's master, Lucius Aelius Stilo Praeconinus. From his age to the decay of Roman civilization there were never altogether wanting men devoted to the study of their nation's past; but none ever pursued the task with the advantages of Varro's comprehensive learning, his indefatigable industry and his reverent yet discriminating regard for the men and the institutions of the earlier ages. The greatest work of this class was that on *Antiquities*, divided into forty-one books. Of these the first twenty-five were entitled the *Antiquities of Human Things* (*Antiquitates Rerum Humanarum*), while the remaining sixteen were designated the *Antiquities of Things Divine* (*Antiquitates Rerum Divinarum*). The book was the fruit of Varro's later years, in which he gathered together the material laboriously amassed through the period of an ordinary lifetime. The second division of the work was dedicated to Caesar as supreme pontiff. The design was as far-reaching as that of the *Natural History* of Pliny. The general heads of the exposition in the secular portion of the book were four—(1) "who the men are who act (*qui agant*), (2) the places in which they act (*ubi*), (3) the times at which they act (*quando*), (4) the results of their action (*quid agant*)." In the portion relating to divine affairs there were divisions parallel to these four, with a fifth, which dealt with the gods in whose honour action in divine affairs is taken. Our knowledge of this great book is to a large extent derived from the works of the early Christian writers, and especially from Augustine's *De Civitate Dei*. These writers naturally quote in the main from the religious section. It is a great misfortune that no similar series of citations from the secular part of the *Antiquitates* has come down to us. Most of the other historical and antiquarian writings of Varro were special elaborations of topics which he could not treat with sufficient fulness and minuteness in the larger book. The treatise on the *Genealogy of the Roman People* dealt mainly with the relation of Roman chronology to the chronology of Greece and the East. Dates were assigned even to mythological occurrences, because Varro believed in the theory of Euhemerus, that all the beings worshipped as gods had once lived as men. To Varro's researches are mainly due the traditional dates assigned to the era of the kings and to that of the early republic. Minor writings of the same class were the *De Vita Populi Romani*, apparently a kind of history of Roman civilization; the *De Familiis Trojanis*, an account of the families who "came over" with Aeneas; the *Aetia* (Αἴτια), an explanation of the origin of Roman customs, on which Plutarch drew largely in his *Quaestiones Romanae*; a *Tribuum Liber*, used by Festus; and the constitutional handbook written for the instruction of Pompey when he became consul. Nor must the labour expended by Varro in the study of literary history be forgotten. His activity in this direction, as in others, took a wide range. One of his greatest achievements was to fix the canon of the genuine plays of Plautus. The "Varronian plays" were the twenty which have come down to us, along with one which has been lost.

The third class of treatises, which we have called technical, was also numerous and very varied. Philosophy, grammar, the history and theory of language, rhetoric, law, arithmetic, astronomy, geometry, mensuration, agriculture, naval tactics, were all represented. The only works of this kind which have come down to our days are the *De Lingua Latina* (in part) and the *De Re Rustica*. The former originally comprised twenty-five books, three of which (the three succeeding the first) are dedicated to a P. Septimius who had served with the author in Spain, and the last twenty-one to Cicero. The whole work was divided into three main sections, the first dealing with the origin of Latin words, the second with their inflexions and other modifications, the third with syntax. The books still preserved (somewhat imperfectly) are those from the fifth to the tenth inclusive. The Latin style is harsh, rugged and far from lucid. As Mommsen remarks, the clauses of the sentences are often arranged on the thread of the relative pronoun like thrushes on a string. The arrangement of the subject-matter, while pretending to much precision, is often far from logical. The fifth, sixth and seventh books give Varro's views on the etymology of Latin words. The principles he applies are those which he had learned from the philosophers of the Stoic school—Chrysippus, Antipater and others. The study of language as it existed in Varro's day was thoroughly dominated by Stoic influences. Varro's etymologies could be only a priori guesses, but he was well aware of their character, and very clearly states at the outset of the fifth book the hindrances that barred the way to sound knowledge. He was thoroughly alive to the importance of not arguing merely from the forms and meanings of words as they existed in his day, and was fully conscious that language and its mechanism should be studied historically. The books from the eighth to the tenth inclusive are devoted to the inflections of words and their other modifications. These Varro classes all under the head of "declinatio," which implies a swerving aside from a type. Thus *Herculi* from *Hercules* and *manubria* from *manus* are equally regarded as examples of *declinatio*. Varro adopts a compromise between the two opposing schools of grammarians, those who held that nature intended the *declinationes* of all words of the same class to proceed uniformly (which uniformity was called *analogia*) and those who deemed that nature aimed at irregularity (*anomalia*). The matter is treated with considerable confusion of thought. But the *facts* incidentally cited concerning old Latin, and the statements of what had been written and thought about language by Varro's predecessors, are of extreme value to the student of Latin. The other extant prose work, the *De Re Rustica*, is in three books, each of which is in the form of a dialogue, the circumstances and in the main the interlocutors being different for each. The dramatic introductions and a few of the interludes are bright and interesting, and the Latin style, though still awkward and unpolished, is far superior to that of the *De Lingua Latina*.

AUTHORITIES.—The fragments of the different treatises have been partially collected in many separate publications of recent date. The best editions of the *De Lingua Latina* are those by C. O. Müller and by L. Spengel (re-edited by his son in 1885). The most recent and best recension of the *De Re Rustica* is that of Keil (Leipzig, 1884). Of modern scholars Ritschl has deserved best of Varro. Several papers in his *Opuscula* treat of the nature of Varro's works which have not come down to us. The work of G. Boissier, *Étude sur la vie et les ouvrages de M. T. Varron* (1861), though superficial, is still useful; but a comprehensive work on Varro, on the present level of scholarship, is greatly needed. (J. S. R.)

VARRO, PUBLIUS TERENTIUS, surnamed ATACINUS (*c.* 82–36 B.C.), Latin poet, was born near the river Atax in Gallia Narbonensis. He was perhaps the first Roman born beyond the Alps who attained eminence in literature. He seems to have taken at first Ennius and Lucilius as his models, and wrote an epic, entitled *Bellum Sequanicum*, eulogizing the exploits of Caesar in Gaul and Britain, and also *Satires*, of which Horace (*Satires*, i. 10) speaks slightingly. Accordingly to Jerome, Varro did not begin to study Greek literature until his thirty-fifth year. The last ten years of his life were given up to the imitation of Greek poets of the Alexandrian school. Quintilian (*Instit.* x. 1, 87), who describes him as a "translator," speaks of him in qualified terms of praise. Although not vigorous enough to excel in the historical epic or in the serious work of the Roman *satura*, Varro yet possessed in considerable measure the lighter gifts which we admire in Catullus.

His chief poem of the later period was the *Argonautae*, closely modelled on the epic of Apollonius Rhodius. The age was prolific of epics, both historical and mythological, and that of Varro seems to have held a high rank among them. It is highly spoken of by Ovid (*Am.* i. 15, 21, *A.A.* iii. 335, *Tristia*, ii. 439) and Statius (*Silvae*, ii. 7, 77), and Propertius (ii. 34, 85) awards equal praise to his erotic elegies. Varro was also the author of a *Cosmographia*, or *Chorographia*, a geographical poem imitated from the Greek of Eratosthenes or of Alexander of Ephesus, surnamed Lychnus; and of an *Ephemeris*, a hexameter poem on weather-signs after Aratus, from which Virgil has borrowed. Fragments in A. Riese's edition of the fragments of the *Menippean Satires* of Varro of Reate; see also monographs by F. Wüllner (1829) and R. Unger (1861).

VARTHEMA (BARTHEMA, VERTOMANNUS, &c.), **LUDOVICO DI,** of Bologna (fl. 1502–1510), Italian traveller and writer. He was perhaps a soldier before beginning his distant journeys, which he undertook apparently from a passion for adventure, novelty and the fame which (then especially) attended successful exploration. He left Europe near the end of 1502; early in 1503 he reached Alexandria and ascended the Nile to Cairo. From Egypt he sailed to Beirut and thence travelled to Tripoli, Aleppo and Damascus, where he managed to get himself enrolled, under the name of Yunas (Jonah), in the Mameluke garrison—doubtless after adopting Islam. From Damascus he made the pilgrimage to Mecca and Medina as one of the Mameluke escort of the Hajj caravan (April–June 1503); he describes the sacred cities of Islam and the chief pilgrim sites and ceremonies with remarkable accuracy, almost all his details being confirmed by later writers. With the view of reaching India, he embarked at Jidda, the port of Mecca, and sailed down the Red Sea and through the Straits of Bab-el-Mandeb to Aden, where he was arrested and imprisoned as a Christian spy. He gained his liberty—after imprisonment both at Aden and Radaa—through the partiality of one of the sultanas of Yemen, made an extensive tour in south-west Arabia (visiting Sana, &c.), and took ship at Aden for the Persian Gulf and India. On the way he touched at Zaila and Berbera in Somaliland; he then (early in 1504?) ran across to the Indian port of Diu in Gujarat, afterwards famous as a Portuguese fortress. From Diu he sailed up the Gulf of Cambay to Gogo, and thence turning back towards the Persian Gulf made Julfar (just within the entrance of the gulf), Muscat and Ormuz. From Ormuz he seems to have journeyed across Persia to Herat, returning thence south-west to Shiraz, where he entered into partnership with a Persian merchant, who accompanied him during nearly all his travels in South Asia. After an unsuccessful attempt to reach Samarkand, the two returned to Shiraz, came down to Ormuz, and took ship for India. From the mouth of the Indus Varthema coasted down the whole west coast of India, touching at Cambay and Chaul; at Goa, whence he made an excursion inland to Bijapur; at Cannanore, from which he again struck into the interior to visit Vijayanagar on the Tungabudra; and at Calicut (1505?), where he stops to describe the society, manners and customs of Malabar, as well as the topography and trade of the city, the court and government of its sovereign (the Zamorin), its justice, religion, navigation and military organization. Nowhere do Varthema's accuracy and observing power show themselves more strikingly. Passing on by the "backwater of Cochin," and calling at Kulam (Quilon), he rounded Cape Comorin, and passed over to Ceylon (1506?). Though his stay here was brief (at Colombo?), he learnt a good deal about the island, from which he sailed to Pulicat, slightly north of Madras, then subject to Vijayanagar. Thence he crossed over to Tenasserim in the Malay Peninsula, to Banghella, perhaps near Chittagong, at the head of the Bay of Bengal, and to Pegu, in the company of his Persian friend and of two Chinese Christians (Nestorians?) whom he met at Banghella. After some successful trading with the king of Pegu, Varthema and his party sailed on to Malacca, crossed over to Pider (Pedir) in Sumatra, and thence proceeded to Bandan (Banda) and Monoch (one of the Moluccas), the farthest eastward points reached by the Italian traveller. From the Moluccas he returned westward, touched at Borneo, and there chartered a vessel for Java, the "largest of islands," as his Christian companions reckoned it. He notes the use of compass and chart by the native captain on the transit from Bornei to Giava, and preserves a curious, more than half-mythical, reference to supposed Far Southern lands. From Java he crossed over to Malacca, where he and his Persian ally parted from the Chinese Christians; from Malacca he returned to the Coromandel coast, and from Negapatam (?) in Coromandel he voyaged back, round Cape Comorin, to Kulam and Calicut. Varthema was now anxious to resume Christianity and return to Europe; after some time he succeeded in deserting to the Portuguese garrison at Cannanore (early in 1506?). He fought for the Portuguese in various engagements, and was knighted by the viceroy Francisco d'Almeida, the navigator Tristan da Cunha being his "sponsor." For a year and a half he acted as Portuguese factor at Cochin, and on the 6th of December 1507 (?) he finally left India for Europe by the Cape route. Sailing from Cannanore, Varthema apparently struck Africa about Malindi, and (probably) coasting by Mombasa and Kilwa arrived at Mozambique, where he notices the Portuguese fortress then building, and describes with his usual accuracy the negroes of the mainland. Beyond the Cape of Good Hope he encountered furious storms, but arrived safely in Lisbon after sighting St Helena and Ascension, and touching at the Azores. In Portugal the king received him cordially, kept him some days at court "to learn about India," and confirmed the knighthood conferred by d'Almeida. His narrative finally brings him to Rome, where he takes leave of the reader. As Richard Burton says (*Pilgrimage to . . . Meccah*, 1855, vol. ii. p. 352): "For correctness of observation and readiness of wit" Varthema "stands in the foremost rank of the old Oriental travellers." In Arabia and in the Indian archipelago east of Java he is (for Europe and Christendom) a real discoverer. Even where passing over ground traversed by earlier European explorers, his keen intelligence frequently adds valuable original notes on peoples, manners, customs, laws, religions, products, trade, methods of war, &c.

Varthema's work (*Itinerario de Ludouico de Varthema Bolognese . . .*) was first published in Italian at Rome in 1510 (*ad instātia de Lodouico de Henricis da Corneto Vicētino*). Other Italian editions appeared at Rome, 1517, at Venice, 1518, 1535, 1563, 1589, &c., at Milan, 1519, 1523, 1525, &c. Latin translations appeared at Milan, 1511 (by Archangelus Madrignanus); and at Nuremberg, 1610 (Frankfort, 1611); as well as in the *Novus Orbis* of Simon Grynaeus (Basel, 1532). German versions came out at Augsburg, 1515 (Strassburg, 1516); at Strassburg, by Michael Herr, in his *New Welt*, from Grynaeus, 1534; at Leipzig, by Hieronymus Megiserus, 1610 (and 1615), &c. A Spanish translation was issued at Seville, 1520 (from the Latin), and a French at Lyons, 1556. Dutch versions were printed at Antwerp, 1563 (from Grynaeus), at Utrecht, 1615 (from the Leipzig German of 1610), and again at Utrecht, 1655. The first English translation was of 1576–1577 (in Richard Eden's *History of Travayle*); an extract from Varthema was inserted in Samuel Purchas's *Pilgrimage* (London, 1625–1626); and in 1863 appeared the Hakluyt Society edition by J. W. Jones and G. P. Badger (*Travels of Ludovico di Varthema*, London). (C. R. B.)

VARUNA, in early Hindu mythology, the greatest, with Indra, of the gods of the Rig Veda. He is invoked with his double Mitra in some dozen hymns. As contrasted with Indra the war god, Varuna is the lord of the natural laws, the upholder of the physical and moral order of the universe. His power is limitless, his anger at wrong-doing unassuageable, and he is omniscient. He makes the sunshine; the wind is his breath; river valleys are hollowed out at his command. Unlike Indra, Varuna has no myths related of him. In the later Vedic period he is specially connected with the nocturnal heavens. Ultimately in post-Vedic mythology he becomes the Hindu Neptune. The earlier conception of Varuna is singularly similar to that of Ahuramazda of the Avesta. The name Varuna may be Indo-European, identifiable, some believe, with the Greek οὐρανός (Uranus), and ultimately referable to a root *var*, "to cover," Varuna thus meaning "the Encompasser." Among Varuna's aliases are Jalapati, "Lord of Water," and Amburaja, "King of Water."

See A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897).

VASA, or NIKOLAISTAD, in the grand duchy of Finland, capital of the province of Vasa, on the east coast of the Gulf of Bothnia, 327 m. by rail north-west of Helsingfors. Pop. (1904) 18,028. It has two classical lyceums for boys and three for girls, a school of navigation, and a large number of primary schools. There is a shipyard and a considerable export trade. Vasa was founded on the coast of the Gulf of Bothnia in 1606, but after the great fire of 1852, as the sea had already receded for a considerable distance, the town was rebuilt nearer to the shore and received the official name of Nikolaistad. The population of the province (1904) was 295,187.

VASARI, GIORGIO (1511–1571), Italian painter and architect, whose main distinction, however, rests on his valuable history of Italian art, was born at Arezzo on the 30th of July 1511. At a very early age he became a pupil of Guglielmo da Marsiglia, a very skilful painter of stained glass, to whom he was recommended by his own kinsman, the painter Luca Signorelli. At the age of sixteen he went to Florence, where he studied under Michelangelo and Andrea del Sarto, aided by the patronage of the Medici princes. In 1529 he visited Rome and studied the works of Raphael and others of his school. The paintings of Vasari were much admired by the rapidly degenerating taste of the 16th century; but they possess the smallest amount of merit, being in the main feeble parodies of the powerful works of Michelangelo. Vasari was largely employed in Florence, Rome, Naples, Arezzo and other places. Many of his pictures still exist, the most important being the wall and ceiling paintings in the great hall of the Palazzo Vecchio in Florence, and his frescoes on the cupola of the cathedral, which, however, were not completed at the time of his death. As an architect he was perhaps more successful: the loggia of the Uffizi by the Arno, and the long passage connecting it with the Pitti Palace, are his chief works. Unhappily he did much to injure the fine medieval churches of S. Maria Novella and Santa Croce, from both of which he removed the original rood-screen and loft, and remodelled the retro-choir in the degraded taste of his time. Vasari enjoyed a very high reputa during his lifetime and amassed a considerable fortune. He built himself in 1547 a fine house in Arezzo, and spent much labour in decorating its walls and vaults with paintings. He was elected one of the municipal council or priori of his native town, and finally rose to the supreme office of gonfaloniere. He died at Florence on the 27th of June 1571.

Personally Vasari was a man of upright character, free from vanity, and always ready to appreciate the works of others: in spite of the narrow and meretricious taste of his time, he expresses a warm admiration of the works of such men as Cimabue and Giotto, which is very remarkable. As an art historian of his country he must always occupy the highest rank. His great work was first published in 1550, and afterwards partly rewritten and enlarged in 1568, bearing the title *Delle Vite de' più eccellenti pittori, scultori, ed architettori.* It was dedicated to Cosimo de' Medici, and was printed at Florence by the Giunti; it is a small quarto illustrated with many good woodcut portraits. This *editio princeps* of the complete work is usually bound in three volumes, and also contains a very valuable treatise on the technical methods employed in all branches of the arts, entitled *Le Tre Arti del disegno, cioè architettura, pittura, e scoltura.* His biographies are written in a very pleasant style, interspersed with amusing stories. With a few exceptions Vasari's judgment is acute and unbiased. And though modern criticism—with all the new materials opened up by research—has done valuable work in upsetting a good many of his traditional accounts and attributions, the result is a tendency very often to underestimate Vasari's accuracy and to multiply hypotheses of a rather speculative character. The work in any case remains a classic, however it may be supplemented by the more critical research of modern days.

Vasari gives a sketch of his own biography at the end of his *Vite*, and adds further details about himself and his family in his lives of Lazzaro Vasari and Francesco Salviati. The best edition of Vasari's works is that published at Florence by Milanesi (1878–1882), which embodies the valuable notes in the earlier edition by Le Monnier (1846); another, by Venturi, was begun in 1896. The *Lives* has been translated into French, German and English (by Mrs Foster, London, 1850).

VASCULAR SYSTEM. I. Anatomy.—The circulatory or blood vascular apparatus consists of the central pump or heart, the arteries leading from it to the tissues, the capillaries, through the walls of which the blood can give and receive substances to and from the tissues of the whole body, and the veins, which return the blood to the heart. As an accessory to the venous system, the lymphatics, which open finally into the great veins, help in returning some of the constituents of the blood. Separate articles are devoted to the *heart*, *arteries*, *veins* and *lymphatic* system, and it only remains here to deal with the capillaries.

The *blood capillaries* form a close network of thin-walled tubules from $\frac{1}{2000}$ to $\frac{1}{3000}$ of an inch in diameter, permeating, with a few exceptions, the whole of the body, and varying somewhat in the closeness of its meshwork in different parts. In the smallest capillaries, in which the arteries end and from which the veins begin, the walls are formed only of somewhat oval endothelial cells, each containing an oval nucleus and joined to its adjacent cells by a serrated edge, in the interstices of which is a small amount of intercellular cement, easily demonstrated by staining the preparation with nitrate of silver. Here and there the cement substance is more plentiful, and these spots when small are known as *stigmata*, when large as *stomata*. As the capillaries approach the arteries on the one hand and the veins on the other they blend and become larger, and a delicate connective tissue sheath outside the endothelium appears, so that the transition from the capillaries into the arterioles and venules is almost imperceptible; indeed, the difference between a large artery or vein and a capillary, apart from size, is practically the amplification and differentiation of its connective tissue sheath.

Embryology.—The first appearance of a vascular system is outside the body of the embryo in the wall of the yolk sac, that is to say, in the mesoderm or the middle one of the three embryonic layers. The process is a very early one and in the chick is seen to begin at the end of the first day of incubation. The first occurrence is a network made up of solid cords of cells forming in certain places solid cell masses called the *blood islands of Pander*. The central cells of these islands divide by karyokinesis and gradually float away into the vessels which are now being formed by fluid from the exterior, finding its way into the centre of the cell cords and pressing the peripheral cells flat to form the endothelial lining. These free cells from the blood islands are known as *erythroblasts* and are the primitive corpuscles of the foetal blood. They have a large reticular nucleus and at first are colourless though haemoglobin gradually develops within them and the blood becomes red (see Blood). The erythroblasts continue to multiply by karyokinesis in early foetal life, especially in the liver, spleen, bone marrow and lymphatic glands, though later on their formation only occurs in the red bone marrow. In most of the erythroblasts the nucleus soon becomes contracted, and the cell is then known as a *normoblast*, while ultimately the general view is that the nucleus disappears by extrusion from the cell and the non-nucleated red blood plates or *erythrocytes* remain. The leucocytes or white blood corpuscles appear later than the red, and are probably formed from lymphoid tissue in various parts of the body. The blood vessels thus formed in the so-called vascular area gradually travel along the vitelline stalk into the body of the embryo, and two vessels larger than the rest are formed one on each side of the stalk. These are the vitelline veins, which, as they pass towards the caudal end of the embryo, become the two primitive aortae, and these fuse later on to form the heart. After the inversion of the pericardial region and formation of the head fold (see Coelom and Serous Membranes) the front of the developing heart becomes the back, and the vitelline veins now enter it from behind. It must be understood that most of our knowledge of the early history of the blood vessels is derived from the study of lower mammals and birds, and that this is being gradually checked by observations on human embryos and on those of other primates. It seems probable that in these mammals, owing to the small size of the yolk sac, the vessels of the embryo establish an early communication with those of the chorion before the vitelline veins are formed (see Quain's *Anatomy*, vol. i., London, 1908). The later stages of the embryology of the vascular system are sketched in the articles on Heart, Arteries, Veins and Lymphatic System (*q.v.*). (F. G. P.)

II. History of Discovery

Galen.

Galen, following Erasistratus (*ob.* 280 B.C.) and Aristotle, clearly distinguished arteries from veins, and was the first to overthrow the old theory of Erasistratus that the arteries contained air. According to him, the vein arose from the liver in two great trunks, the *vena porta* and *vena cava*. The first was formed by the union of all the abdominal veins, which absorbed the chyle prepared in the stomach and intestines, and carried it to the liver, wher it was converted into blood. The vena cava arose in the liver, divided into two branches, one ascending through the diaphragm to the heart, furnishing the proper veins of this organ; there it received the *vena azygos*, and entered the right ventricle, along with a large trunk from the lungs, evidently the pulmonary artery. The vena azygos was the *superior vena cava*, the great vein which carries the venous blood from the head and upper extremities into the right auricle. The descending branch of the great trunk supposed to originate in the liver was the *inferior vena cava*, below the junction of the hepatic vein. The arteries arose from the left side of the heart by two trunks, one having thin walls (the pulmonary veins), the other having thick walls (the aorta). The first was supposed to carry blood to the lungs, and the second to carry blood to the body. The heart consisted of two ventricles, communicating by pores in the septum; the lungs were parenchymatous organs communicating with the heart by the pulmonary veins. The blood-making organ, the liver, separates from the blood subtle vapours, the *natural spirits*, which, carried to the heart, mix with the air introduced by respiration, and thus form the *vital spirits*; these, in turn carried to the brain, are elaborated into *animal spirits*, which are distributed to all parts of the body by the nerves.[1] Such were the views of Galen, taught until early in the 16th century.

Vesalius.

Jacobus Berengarius of Carpi (*ob.* 1530) investigated the structure of the valves of the heart. Andreas Vesale or Vesalius (1514–1564) contributed largely to anatomical knowledge, especially to the anatomy of the circulatory organs. He determined the position of the heart in the chest;

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[1] See Burggraeve's *Histoire de l'anatomie* (Paris, 1880).

he studied its structure, pointing out the fibrous rings at the bases of the ventricles; he showed that its wall consists of layers of fibres connected with the fibrous rings; and he described these layers as being of three kinds—straight or vertical, oblique, and circular or transverse. From the disposition of the fibres he reasoned as to the mechanism of the contraction and relaxation of the heart. He supposed that the relaxation, or diastole, was accounted for principally by the longitudinal fibres contracting so as to draw the apex towards the base, and thus cause the sides to bulge out; whilst the contraction, or systole, was due to contraction of the transverse or oblique fibres. He showed that the pores of Galen, in the septum between the ventricles, did not exist, so that there could be no communication between the right and left sides of the heart, except by the pulmonary circulation. He also investigated minutely the internal structure of the heart, describing the valves, the *columnae carneae* and the *musculi papillares*. He described the mechanism of the valves with much accuracy. He had, however, no conception either of a systemic or of a pulmonary circulation. To him the heart was a reservoir from which the blood ebbed and flowed, and there were two kinds of blood, arterial and venous, having different circulations and serving different purposes in the body. Vesalius was not only a great anatomist: he was a great teacher; and his pupils carried on the work in the spirit of their master. Prominent among them was Gabriel Fallopius (1523–1562), who studied the anastomoses of the blood vessels, without the art of injection, which was invented by Frederick Ruysch (1638–1731) more than a century later. Another pupil was Columbus (Matthieu Reald Columbo, *ob.* 1560), first a prosector in the anatomical rooms of Vesalius and afterwards his successor in the chair of anatomy in Padua; his name has been mentioned as that of one who anticipated Harvey in the discovery of the circulation of the blood. A study of his writings clearly shows that he had no true knowledge of the circulation, but only a glimpse of how the blood passed from the right to the left side of the heart. In his work there is evidently a sketch of the pulmonary circulation, although it is clear that he did not understand the mechanism of the valves, as Vesalius did. As regards the systemic circulation, there is the notion simply of an oscillation of the blood from the heart to the body and from the body to the heart. Further, he upholds the view of Galen, that all the veins originate in the liver; and he even denies the muscular structure of the heart.[1]

Columbus.

Servetus.

In 1553 Michael Servetus (1511–1553), a pupil or junior fellow-student of Vesalius, in his *Christianismi Restitutio*, described accurately the pulmonary circulation.[2] Servetus perceived the course of the circulation from the right to the left side of the heart through the lungs, and he also recognized that the change from venous into arterial blood took place in the lungs and not in the left ventricle. Not so much the recognition of the pulmonary circulation, as that had been made previously by Columbus, but the discovery of the respiratory changes in the lungs constitutes Servetus's claim to be a pioneer in physiological science.

Cesalpino.

Andrea Cesalpino (1519–1603), a great naturalist of this period, also made important contributions towards the discovery of the circulation, and in Italy he is regarded as the real discoverer.[3] Cesalpino knew the pulmonary circulation. Further, he was the first to use the term "circulation," and he went far to demonstrate the systemic circulation. He experimentally proved that, when a vein is tied, it fills below and not above the ligature. The following passage from his *Quaestiones Medicae* (lib. v. cap. 4, fol. 125), quoted by Gamgee, shows his views:—

> "The lungs, therefore, drawing the warm blood from the right ventricle of the heart through a vein like an artery, and returning it by anastomosis to the venal artery (pulmonary vein), which tends towards the left ventricle of the heart, and air, being in the meantime transmitted through the channels of the aspera arteria (trachea and bronchial tubes), which are extended near the venal artery, yet not communicating with the aperture as Galen thought, tempers with a touch only. This circulation of the blood (*huic sanguinis circulationi*) from the right ventricle of the heart through the lungs into the left ventricle of the same exactly agrees with what appears from dissection. For there are two receptacles ending in the right ventricle and two in the left. But of the two only one intromits; the other lets out, the membranes (valves) being constituted accordingly."

Still Cesalpino clung to the old idea of there being an efflux and reflux of blood to and from the heart, and he had confused notions as to the veins conveying nutritive matter, whilst the arteries carried the vital spirits to the tissues. He does not even appear to have thought of the heart as a contractive and propulsive organ, and attributed the dilatation to "an effervescence of the spirit," whilst the contraction—or, as he termed it, the "collapse"—was due to the appropriation by the heart of nutritive matter. Whilst he imagined a communication between the termination of the arteries and the commencement of the veins, he does not appear to have thought of a direct flow of blood from the one to the other. Thus he cannot be regarded as the true discoverer of the circulation of the blood. More recently Ercolani has put forward claims on behalf of Carlo Ruini as being the true discoverer. Ruini published the first edition of his anatomical writings in 1598, the year William Harvey entered at Padua as a medical student. This claim has been carefully investigated by Gamgee, who has come to the conclusion that it cannot be maintained.[4]

Discovery of circulation of blood.

The anatomy of the heart was examined, described and figured by Bartolomeo Eustacheo (*c.* 1500–1574) and by Julius Caesar Aranzi or Arantius (*c.* 1530–1589), whose name is associated with the fibro-cartilaginous thickenings on the free edge of the semilunar valves (*corpora Arantii*). Hieronymus Fabricius of Acquapendente (1537–1619), the immediate predecessor and teacher of Harvey, made the important step of describing the valves in the veins; but he thought they had a subsidiary office in connexion with the collateral circulation, supposing that they diverted the blood into branches near the valves; thus he missed seeing the importance of the anatomical and experimental facts gathered by himself. At the time when Harvey arose the general notions as to the circulation may be briefly summed up as follows: the blood ebbed and flowed to and from the heart in the arteries and veins; from the right side at least a portion of it passed to the left side through the vessels in the lungs, where it was mixed with air; and, lastly, there were two kinds of blood—the venous, formed originally in the liver, and thence passing to the heart, from which it went out to the periphery by the veins and returned by those to the heart; and the arterial, containing "spirits" produced by the mixing of the blood and the air in the lungs—sent out from the heart to the body and returning to the heart by the same vessels. The pulmonary circulation was understood so far, but its relation to the systemic circulation was unknown. The action of the heart, also, as a propulsive organ was not recognized. It was not until 1628 that Harvey announced his views to the world by publishing his treatise *De Motu Cordis et Sanguinis*. His conclusions are given in the following celebrated passage:—

Harvey.

> "And now I may be allowed to give in brief my view of the circulation of the blood, and to propose it for general adoption. Since all things, both argument and ocular demonstration, show that the blood passes through the lungs and heart by the auricles and

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[1] An interesting account of the views of the precursors of Harvey will be found in Willis's edition of the *Works* of Harvey, published by the Sydenham Society. Compare also P. Flourens, *Histoire de la decouverte de la circulation du sang* (Paris, 1854), and Professor R. Owen, *Experimental Physiology, its Benefits to Mankind, with an Address on Unveiling the Statue of W. Harvey, at Folkestone, 6th August 1881*.

[2] See Willis, *Servetus and Calvin* (London, 1877).

[3] A learned and critical series of articles by Sampson Gamgee in the *Lancet*, in 1876, gives an excellent account of the controversy as to whether Cesalpino or Harvey was the true discoverer of the circulation; see also the Harveian oration for 1882 by George Johnston (*Lancet*, July 1882), and Professor G. M. Humphry, *Journ. Anat. and Phys.*, October 1882.

[4] Gamgee, "Third Historical Fragment," in *Lancet*, 1876.

ventricles, and is sent for distribution to all parts of the body, where it makes its way into the veins and pores of the flesh, and then flows by the veins from the circumference on every side to the centre, from lesser to the greater veins, and is by them finally discharged into the vena cava and right auricle of the heart, and this in such a quantity, or in such a flux and reflux, thither by the arteries, hither by the veins, as cannot possibly be supplied by the ingestor, and is much greater than can be required for mere purposes of nutrition, it is absolutely necessary to conclude that the blood in the animal body is impelled in a *circle*, and is in a state of ceaseless motion, that this is the act or function which the heart performs by means of its pulse, and that it is the sole and only end of the motion and contraction of the heart" (bk. x. ch. xiv. p. 68).

Opposed to Caspar Hofmann of Nuremberg (1571–1623), Veslingius (Vesling) of Padua (1598–1649), and J. Riolanus the younger, this new theory was supported by Roger Drake, a young Englishman, who chose it for the subject of a graduation thesis at Leiden in 1637, by Werner Rolfinck of Jena (1599–1673), and especially by Descartes, and quickly gained the ascendant; and its author had the satisfaction of seeing it confirmed by the discovery of the capillary circulation, and universally adopted. **Capillary circulation.** The circulation in the capillaries between the arteries and the veins was discovered by Marcellus Malpighi (1628–1694) of Bologna in 1661. He saw it first in the lungs and the mesentery of a frog, and the discovery was announced in the second of two letters, *Epistola de Pulmonibus*, addressed to Borelli, and dated 1661.[1] Malpighi actually showed the capillary circulation to the astonished eyes of Harvey. Anthony van Leeuwenhoek (1632–1723) in 1673 repeated Malpighi's observations, and studied the capillary circulation in a bat's wing, the tail of a tadpole and the tail of a fish. William Molyneux studied the circulation in the lungs of a water newt in 1683.[2]

The idea that the same blood was propelled through the body in a circuit suggested that life might be sustained by renewing the blood in the event of some of it being lost. **Transfer of blood.** About 1660 Lower, a London physician (died 1691), succeeded in transferring the blood of one animal directly from its blood vessels into those of another animal. This was first done by passing a "quill" or a "small crooked pipe of silver or brass" from the carotid artery of one dog to the jugular vein of another.[3] This experiment was repeated and modified by Sir Edmund King (1629–1709), Thomas Coxe (1615–1685), Gayant and Denys with such success as to warrant the operation being performed on man, and accordingly it was carried out by Lower and King on the 23rd of November 1667, when blood from the arteries of a sheep was directly introduced into the veins of a man.[4] It would appear that the operation had previously been performed with success in Paris.

The doctrine of the circulation being accepted, physiologists next directed their attention to the force of the heart, the pressure of the blood in the vessels, its velocity, and the phenomena of the pulse wave. **Force of heart and velocity of blood.** Giovanni Alphonso Borelli (1608–1679) investigated the circulation during the lifetime of Harvey. He early conceived the design of applying mathematical principles to the explanation of animal functions; and, although he fell into many errors, he must be regarded as the founder of animal mechanics. **Borelli.** In his *De Motu Animalium* (1680–85) he stated his theory of the circulation in eighty propositions, and in prop. lxxiii., founding on a supposed relation between the bulk and the strength of muscular fibre as found in the ventricles, erroneously concluded that the force of the heart was equal to the pressure of a weight of 180,000 ℔. He also recognized and figured the spiral arrangement of fibres in the ventricles. The question was further investigated by James Keill, a Scottish physician (1673–1719), who in his **Keill.** *Account of Animal Secretion, the Quantity of Blood in the Human Body, and Muscular Motion* (1708) attempted to estimate the velocity of blood in the aorta, and gave it at 52 ft. per minute. Then, allowing for the resistance of the vessels, he showed that the velocity diminishes towards the smaller vessels, and arrived at the amazing conclusion that in the smallest vessels it travels at the rate of ¼ in. in 278 days,—a good example of the extravagant errors made by the mathematical physiologists of the period. Keill further described the hydraulic phenomena of the circulation in papers communicated to the Royal Society and collected in his *Essays on Several Parts of the Animal Oeconomy* (1717). In these essays, by estimating the quantity of blood thrown out of the heart by each contraction, and the diameter of the aortic orifice, he calculated the velocity of the blood. He stated (pp. 84, 87) that the blood sent into the aorta with each contraction would form a cylinder 8 in. (2 oz.) in length and be driven along with a velocity of 156 ft. per minute. Estimating then the resistances to be overcome in the vessels, he found the force of the heart to be "little above 16 oz.,"—a remarkable difference from the computation of Borelli. Keill's method was ingenious, and is of historical interest as being the first attempt to obtain quantitative results; but it failed to obtain true results, because the data on which he based his calculations were inaccurate. These calculations attracted the attention not only of the anatomico-physiologists, such as Haller, but also of some of the physicists of the time, notably of Jurin and D. Bernoulli. Jurin (died 1750) gave the force of the left ventricle at 9 ℔ 1 oz., and that of the right ventricle at 6 ℔ 3 oz. He also stated with remarkable clearness, considering that he reasoned on the subject as a physicist, without depending on experimental data gathered by himself, the influence on the pulse induced by variations in the power of the heart or in the resistance to be overcome.[5] **Hales.** The experimental investigation of the problem was supplied by Stephen Hales (1677–1761), rector of Teddington in Middlesex, who in 1708 devised the method of estimating the force of the heart by inserting a tube into a large artery and observing the height to which the blood was impelled into it. Hales is the true founder of the modern experimental method in physiology. He observed in a horse that the blood rose in the vertical tube, which he had connected with the crural artery, to the height of 8 ft. 3 in. perpendicular above the level of the left ventricle of the heart. But it did not attain its full height at once: it rushed up about half-way in an instant, and afterwards gradually at each pulse 12, 8, 6, 4, 2, and sometimes 1 in. When it was at its full height, it would rise and fall at and after each pulse 2, 3 or 4 in.; and sometimes it would fall 12 or 14 in., and have there for a time the same vibrations up and down at and after each pulse as it had when it was at its full height, to which it would rise again after forty or fifty pulses.[6] He then estimated the capacity of the left ventricle by a method of employing waxen casts, and, after many such experiments and measurements in the horse, ox, sheep, fallow deer and dog, he calculated that the force of the left ventricle in man is about equal to that of a column of blood 7½ ft. high, weighing 51½ ℔, or, in other words, that the pressure the left ventricle has to overcome is equal to the pressure of that weight. When we contrast the enormous estimate of Borelli (180,000 ℔) with the under-estimate of Keill (16 oz.), and when we know that the estimate of Stephen Hales (1677–1761), as corroborated by recent investigations by means of elaborate scientific appliances, is very near the truth, we recognize the far higher service rendered to science by careful and judicious experiment than by speculations, however ingenious. With the exception of some calculations by Dan Bernoulli (1700–1782) in 1748, there was no great contribution to haemadynamics till 1808, when two remarkable papers appeared from Thomas Young (1773–1829). **Thomas Young.** In the first, entitled "Hydraulic Investigations," which appeared in the *Phil. Trans.*, he investigated the friction and discharge of fluids running in pipes and the velocity of rivers, the resistance occasioned by flexures in pipes and rivers, the propagation of an impulse through an elastic tube, and some of the phenomena of pulsations. This paper was preparatory to the second, "On the Functions of the Heart and Arteries,"—the Croonian lecture for 1808—in which he showed more clearly than had hitherto been done (1) that the blood pressure gradually diminishes from the heart to the periphery; (2) that the velocity of the blood becomes less as it passes from the greater to the smaller vessels; (3) that the resistance is chiefly in the smaller vessels, and that the elasticity of the coats of the great arteries comes into play in overcoming this resistance in the interval between systoles; and (4) that the contractile coats do not act as propulsive agents, but assist in regulating the distribution of blood.[1]

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[1] See his *Opera Omnia*, vol. i. p. 328.

[2] Lowthorp, *Abridgement of Trans. Roy. Soc.*, 5th ed. vol. iii. p. 230.

[3] Ibid. p. 231.

[4] Ibid. p. 226.

[5] Jones, *Abridgement of Phil. Trans.* (3d ed., 1749), vol. v. p. 223. See also for an account of the criticisms of D. Bernoulli the elder and others, Haller's *Elementa Physiologiae*, vol. i. p. 448.

[6] Hales, *Statical Essays, containing Haemastatics*, &c. (1733), vol. ii. p. 1.

Use of instruments.

The next epoch of physiological investigation is characterized by the introduction of instruments for accurate measurement, and the graphic method of registering phenomena, now so largely used in science.[2] In 1825 appeared E. and Wilhelm Weber's (1804–1891) *Wellenlehre*, and in 1838 Ernest Weber's (1795–1878) *Ad Notat. Anatom. et Physiolog.* i., both of which contain an exposition of E. H. Weber's *schema* of the circulation, a scheme which presents a true and consistent theory. In 1826 Jean Louis Marie Poiseuille invented the haemadynamometer.[3] This was adapted with a marker to a recording cylinder by Ludwig in 1847, so as to form the instrument named by Alfred Volkmann (1801–1877) the kymograph. Volkmann devised the haemadromometer for measuring the velocity of the blood in 1850; for the same purpose Vierordt constructed the haematachometer in 1858; Chauveau and Pierre Lortet (1792–1868) first used their haemadromograph in 1860; and lastly, Ludwig and Dogiel obtained the best results as regards velocity by the "stream-clock" in 1867. As regards the pulse, the first sphygmograph was constructed by Karl Vierordt (1818–1884) in 1856; and Étienne Marey's form, of which there are now many modifications, appeared in 1860. In 1861 Jean Chauveau (b. 1827) and Marey obtained tracings of the variations of pressure in the heart cavities (see below), by an experiment which is of great historical importance. During the past twenty-five years vast accumulations of facts have been made through the instruments of precision above alluded to, so that the conditions of the circulation, as a problem in hydrodynamics, have been thoroughly investigated. Since 1845, when the brothers Weber discovered the inhibitory action of the vagus, and 1858, when Claude Bernard (1813–1878) formulated his researches showing the existence of a vaso-motor system of nerves, much knowledge has been acquired as to the relations of the nervous to the circulatory system. The Webers, John Reid (1816–1895), Claude Bernard and Carl Ludwig (1809–1849) may be regarded as masters in physiology equal in standing to those whose researches have been more especially alluded to in this historical sketch. The Webers took the first step towards recognizing the great principle of inhibitory action; John Reid showed how to investigate the functions of nerves by his classical research on the eighth pair of cranial nerves; Claude Bernard developed the fundamental conception of vaso-motor nerves; and Ludwig showed how this conception, whilst it certainly made the hydraulic problems of the circulation infinitely more complicated than they were even to the scientific imagination of Thomas Young, accounted for some of the phenomena and indicated at all events the solidarity of the arrangements in the living being. Further, Ludwig and his pupils used the evidence supplied by some of the phenomena of the circulation to explain even more obscure phenomena of the nervous system, and they taught pharmacologists how to study in a scientific manner the physiological action of drugs. (J. G. M.)

III. Physiology

The general principles of the circulation.

The unicellular animal immersed in water absorbs nutritive matter and oxygen, and excretes waste materials with its whole surface. Owing to the small mass of the protozoa the metabolic products can penetrate throughout the whole. With the evolution of the multicellular organs of the metazoa and the division of physiological labour a circulatory mechanism became of immediate need. A double-layered animal like the common water polype Hydra can exist, it is true, without such a mechanism, but communities of polypes, such as the sponges, form channels for the circulation of water. With the development of the three-layered animal the coelom or body cavity arose by the splitting of the mesoderm, and it was in this body cavity that the evolution of the circulatory system took place, an evolution which finally became perfected in the higher members of the metazoa into a closed vascular system filled with red blood. The evolution of the red matter, haemoglobin, as a special carrier of oxygen was necessitated by the increasing mass and muscular activity of the higher animal, in comparison with the size of the oxygen-absorbing surface—the gill or lung. The blood vascular system of the invertebrata such as the Arthropoda and Insecta, is not generally a closed system, but consists of a pulsatile heart whence proceed arteries which open into lacunar spaces forming part of the coelom. The lacunae exist between the organs and tissues of the body, and the blood from these spaces is returned to a venous sinus whence the heart draws its supply through valved openings. The movements of the animal help to return the blood from the tissue spaces to the heart, while the heart by its rhythmic contraction drives the blood into the arteries. Somewhere in the course of this system are placed the gills and renal organs, and it appears to be a matter of indifference whether the gills be placed on the arterial or venous side of the system, both arrangements being found in different types. In some types (mussel, earthworm), the whole blood passes through the renal organs at each circulation, in others (crayfish) only parts. In the earthworm the vascular system is closed, the arteries and veins being connected by capillaries in place of lacunae. The movement of tissue juices may be maintained by physico-chemical forces alone, *e.g.* by the forces of osmosis and adsorption, as is seen in the movements of sap in the vascular bundles of plants, in the streaming of protoplasm in the plant cell and in the marvellous rhythmic to-and-fro movements of the richly granular juice contained in the veins of the spreading protoplasmic sheet of myxomycetes. Such agencies come into play in the lacunar or capillary part of the circulation of the metazoa and are assisted by the movements of the body wall and of the alimentary organs. The evolution of a special pumping organ, the heart, associated with the aeration of the body fluids in the gills, led to the perfection of the efficient system of circulation which is found in the vertebrata.

The blood is to be regarded as alive in as strict a sense as any other component of the living body. It is a tissue consisting of mobile elements—the blood corpuscles—and a plasma—a colloidal albuminous fluid which is analogous to the more solid intercellular material of other tissues. The primary sources of its elements are the blood-forming organs—the bone marrow, the haemolymph and lymphatic glands and other lymphatic tissue, and the spleen. It circulates as the middleman between the tissues, conveying from the alimentary canal the products of digestion—sugar, fat, amino-acids and salts; oxygen from the lungs; carbonic acid, urea and other waste products of the tissues to the lungs and kidneys; internal secretions from one organ to another; and acts not only as a carrier, but deals with the material remitted to it on the way. One other function of the blood, a most important one, must not be omitted, that of defence against the invasion of bacteria and their toxins, and other parasites.

The blood is contained in a continuous system of vessels; *arteries* lead from the heart and divide into a multitude of

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[1] See *Miscellaneous Works*, ed. Peacock (2 vols., London, 1855).

[2] See Marey, *La Méthode graph. dans les sc. expér.* (Paris, 1878).

[3] Magendie's *Journal*, vol. viii. p. 272.

capillary vessels, and these lead into the *veins* which finally pass back to the heart. The heart is to be regarded as a double organ, each half consisting of an *auricle* and a *ventricle*. The right half contains dark venous blood which has been returned from the body and is sent to the lungs: the left heart contains the bright oxygenated blood which has been returned from the lungs and is distributed to the body. There are thus two circulations—the one *pulmonary*, from the right side of the heart to the pulmonary artery and thence to the capillaries of the lungs and to the left heart by the pulmonary veins—the other *systemic*, from the left side of the heart, by the aorta, to the arteries and capillaries of the body tissues and organs, whence the blood returns by the veins to the right side of the heart.

The course of the circulation in mammals.

A schematic representation is given of the circulatory system in the accompanying diagram. The venous blood flows into the right auricle (RA) from the superior vena cava and the inferior vena cava. The right ventricle (RV) drives through the lungs the blood received from the right auricle. The right auriculo-ventricular valve, or tricuspid, and the pulmonary semilunar valve are represented directing the flow of blood in this direction. From the pulmonary capillaries the blood returns by the pulmonary veins (PV) into the left auricle (LA), and so through the left auriculo-ventricular or mitral valve into the left ventricle (LV). By the left ventricle the blood is driven through the aortic semilunar valve, and is distributed to the systemic arteries, and so to the capillaries of the various organs and back to the veins. The muscular wall of the auricles and that of the right ventricle are much thinner than that of the left ventricle. This is so, because the energy required of the left ventricle must exceed that of the right ventricle, inasmuch as the resistance in the systemic system exceeds that in the pulmonary circuit.

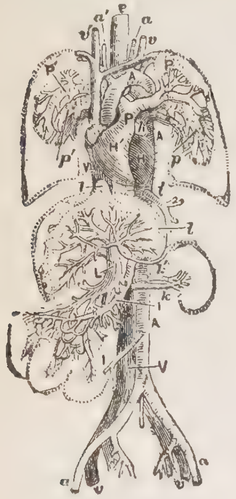

FIG. 1.—General Course of Circulation and some of the Principal Vessels. H', right ventricle; H, left ventricle; A, A, A, aorta; *h*, part of left auricle; P, pulmonary artery, going to lungs; P, pulmonary veins; *v*, ascending or lower vena cava; *e*, trachea or wind-pipe; *p*, *p'*, bronchial tubes; *a'*, *a*, right and left carotid arteries; *v*, *v'*, veins from root of neck (internal jugular and subclavian), joining to form descending or upper vena cava; *i*, hepatic artery *l*, hepatic vein; I, superior mesenteric artery, going to mesentery and bowels; L, portal vein, going to liver; *k'*, renal artery; *k*, renal vein; V, inferior vena cava, splitting into the two iliac veins, *v*, *v*.

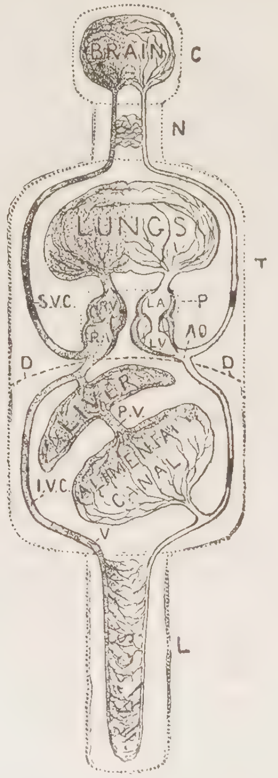

FIG. 2.—Scheme of the Circulation of the Blood in Man, standing erect. The venous system is stippled. C, rigid cranial wall; N, muscles and cutaneous wall of neck; T, thoracic wall; A, muscular and cutaneous wall of abdomen; D, diaphragm; L, muscles and cutaneous wall of limbs; P, pericardium; AO, aorta; S. V. C, I. V. C, venae cavae; P.V, portal vein; V, valves in veins of neck, or legs; RA, LA, right and left auricles; RV, LV, right and left ventricles.

The heart fills with venous blood during its expansion or *diastole*, and forces the blood into the arteries during its contraction or *systole*. The large arteries are of less capacity than the corresponding veins, and their walls are essentially extensile and elastic. The pulmonary arteries are especially extensile structures. The small arteries and *arterioles* are essentially muscular tubes and can vary considerably in diameter. The arterioles open into the capillaries, and these are so numerous that each organ may be regarded as a sponge full of blood. The skeletal muscles and the muscular walls of the viscera at each contraction express the blood within them, and materially influence the circulation. The whole muscular system, as well as the heart, must therefore be regarded as a pump to the vascular system. The capillary wall is composed of a single layer of flattened cells, separating the blood within from the tissues without. Through this layer, which is of extraordinary tenuity, there takes place an exchange of material between the blood and the tissues, an exchange which depends on the physico-chemical conditions which characterize the living state of the cells. The phenomena of adsorption and osmosis come into play here, but the conditions still await complete elucidation. The veins are of larger calibre than the corresponding arteries, and have tough and inextensile walls. Their walls are muscular, and contract on local stimulation. The veins are not, as a rule, distended with blood to their full potential capacity. The latter is so great that the whole blood of the body can collect within the veins.

The heart and lungs are placed within the thoracic cavity (T), the floor of which is formed by the muscular diaphragm (D); the heart is itself enclosed in a tough inextensile bag, *the pericardium* (P), the function of which is to check over-dilatation of the heart. The pericardium bears to the muscular wall of the heart the same relation as the leather case of a football does to the bag within. In particular, it prevents over-distension of the heart during muscular efforts.

The abdominal organs and blood vessels are encompassed by the muscular wall of the abdomen (A), and may be regarded as enclosed in a sphere of muscle. Above is the dome of the diaphragm (T), and below the basin-like levator ani, closing the outlet of the pelvis; in front are the recti muscles, behind the quadrati lumborum and the spine; while the oblique and transverse muscles complete the wall at either side. The brain is enclosed in a rigid and unyielding box of bone—*the cranium*, while the limbs are encompassed by the extensile and, in health, taut and elastic skin.

The heart's energy is spent in maintaining a pressure of blood in the elastic arteries, and by the difference of pressure in the arteries and veins the blood is kept flowing through the capillaries into the veins. The movements of the body and particularly of respiration help to return the blood from the capillaries and veins back to the heart, valves being set in the veins to direct the blood in this direction. The blood is a viscous fluid and its viscosity varies; it is propelled by a heart which varies both in rate and energy; it circulates through a system of muscular and elastic arteries and veins, which varies in capacity and may alter in elasticity. The width of bed through which it flows varies greatly at different parts of the circuit, and the resistance offered to the moving blood is very much greater in the capillary-sized vessels than in the large arteries and veins. The blood continually varies, both in quantity and in quality, as it effects exchanges through the capillary walls with the tissues. The problems of the circulation are thus far from simple. They resolve themselves mainly into a consideration of (1) the physiology of the heart; (2) the physical characters of the circulation; (3) the control of the heart and vessels by the nervous system.

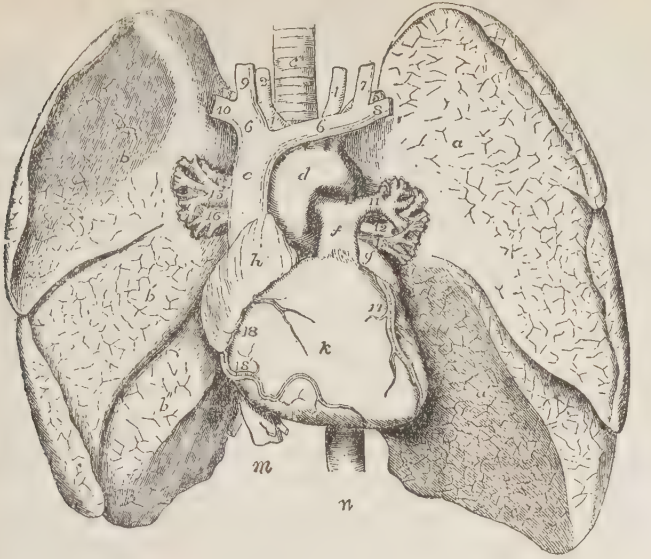

FIG. 3.—The Thoracic Viscera. In this diagram the lungs are turned to the side, and the pericardium removed to display the heart. *a*, upper, *a′*, lower lobe of left lung; *b*, upper, *b′*, middle, *b″*, lower lobe of right lung; *c*, trachea; *d*, arch of aorta; *e*, superior vena cava; *f*, pulmonary artery; *g*, left, and *h*, right auricle; *k*, right, and *l*, left ventricle; *m*, inferior vena cava; *n*, descending aorta; 1, innominate artery; 2, right, and 4, left common carotid artery; 3, right, and 5, left subclavian artery; 6, 6, right and left innominate vein; 7 and 9, left and right internal jugular veins; 8 and 10, left and right subclavian veins; 11, 12, 13, left pulmonary artery, bronchus and vein; 14, 15, 16, right pulmonary bronchus, artery and vein; 17 and 18, left and right coronary arteries.

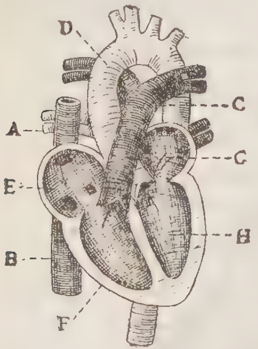

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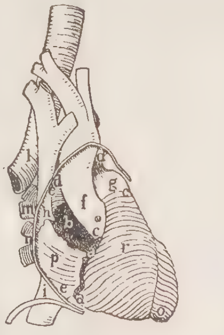
FIG. 4.—Diagram of Chambers of Heart and Large Vessels.

A, Vena cava, superior.
B, Vena cava, inferior.
C, Pulmonary artery.
D, Aorta.
E. Right auricle.
F, Right ventricle.
G, Left auricle, into which open the four pulmonary veins.
H, Left ventricle.

The arrows point the course of the blood.



A. Keith, in *Journal of Anatomy and Physiology.*

FIG. 5.—Showing the Attachments of the Heart. *a*, *a*, auricular base of ventricle; *c*, *c*, aortic base of ventricles; *d*, *d*, arterial mesocardium; *e*, *e*, venous mesocardium; *f*, ascending aorta; *g*, pulmonary aorta: *h*, superior vena cava: *i*, inferior vena cava, perforating diaphragm and pericardium; *l*, *m*, *n*, structures at the root of the lung—bronchus, pulmonary artery, and pulmonary veins; *o*, vortex at apex; *p*, pectinate musculature of right auricle; *r*, superficial musculature of right ventricle.

The Action of the Heart.

The permanent position and general arrangements of the heart are described in a separate article, and it is only necessary here to allude to certain points of physiological importance. The substance of the heart is composed of a special kind of muscular tissue which must be regarded as a syncytium in which no distinct and separate cells occur, a complex plexus of branching and anastomosing fibres, forming one functional whole. The fibres are nucleated, have a cross-striated structure and are surrounded by delicate connective tissue sheaths. The cross-striations are due to the primitive fibrils which as in skeletal muscle are differentiated into alternate doubly and singly refracting substances. These fibrils are embedded in a granular nucleated sarcoplasm. Between the bundles of fibres are thin layers of connective tissue containing closely spun networks of capillaries. The muscle of the auricles consists of a circular layer common to both and a deeper layer separate for each chamber. The auriculo-ventricular ring consists of connective tissue surrounding the auriculo-ventricular orifices and separating the auricular from the ventricular muscle with the exception of an important band, the *auriculo-ventricular bundle*. The superficial fibres of the ventricles appear to have origin in the auriculo-ventricular ring, to wind about the heart spirally and to end in the tendons of the papillary muscles or pass up to the ring again on the inner surface of the heart. The middle layers consist of bundles of fibres running more or less circularly round the ventricles.

The greater part of the heart lies free in the pericardial sac. The pericardium is reflected from the wall of the sac on to the wall of the heart and attaches the heart at the point where the venae cavae and aorta leave the sac. This part of the pericardium gives a fixation point to the auricles, for it is attached to the roots of the lungs and thereby to the thoracic wall, to the diaphragm and to the structures at the root of the neck. On opening the chest the normal fulcra for the movements of the auricles are lost, and this renders it difficult to record the exact movements of the heart. The attached part of the heart is called the *base*, and the venous part of the base is the beginning and the arterial part the end of the tube, coiled on itself, from which in the embryo the heart develops. The longitudinal and circular muscle fibres of the ventricles are antagonists. The circular fibres by their contraction tend to lengthen the apex-base diameter, the longitudinal fibres resist this and the two together wring the blood out of the heart. The apex is maintained as a fixed point by this antagonistic action, and thus the longitudinal fibres are enabled to expand the auricles by pulling down the floor of these chambers. This action is important, as it contributes to the filling of the auricles simultaneously with the emptying of the ventricles. Tracings of the jugular pulse give evidence of such action.

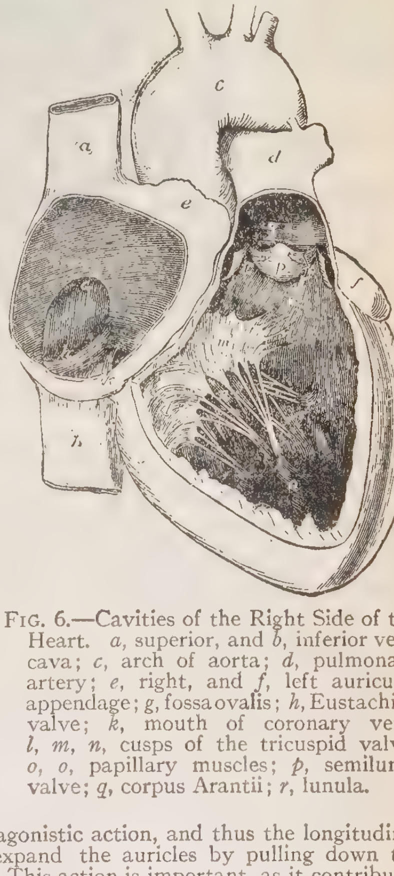


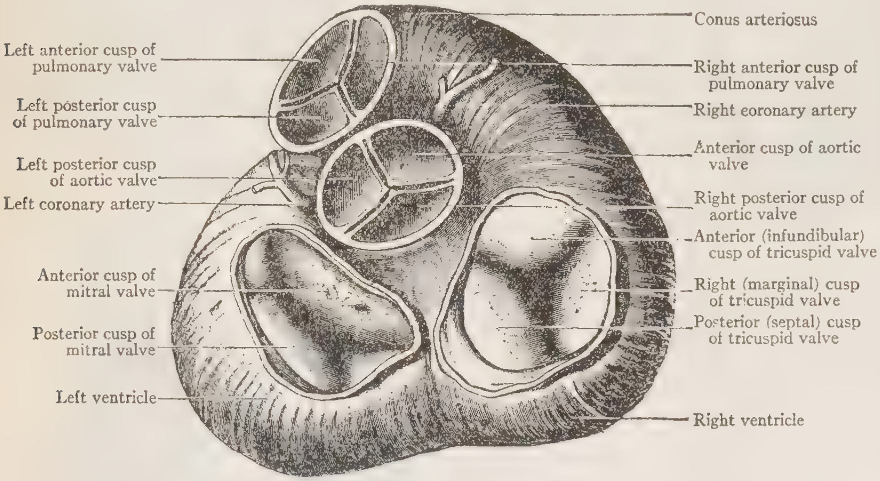
FIG. 6.—Cavities of the Right Side of the Heart. *a*, superior, and *b*, inferior vena cava; *c*, arch of aorta; *d*, pulmonary artery; *e*, right, and *f*, left auricular appendage; *g*, fossa ovalis; *h*, Eustachian valve; *k*, mouth of coronary vein; *l*, *m*, *n*, cusps of the tricuspid valve; *o*, *o*, papillary muscles; *p*, semilunar valve; *q*, corpus Arantii; *r*, lunula.

In the case of the auricles the longitudinal musculi pectinati not only help the circular fibres to expel the blood, but draw up the base of the ventricle to meet its load of blood. Thus the base of the ventricular part (or floor of the auricles) is pulled up during auricular systole, and down during ventricular systole. The posterior and upper borders of the left auricle lie against the unyielding structures of the posterior mediastinum, the pulmonary artery and bronchi, the floor and anterior part in contact with the base of the ventricle and ascending aorta respectively. The latter parts alone are free to move during systole. Thus the left ventricular base is drawn up and the aorta back on auricular systole (A. Keith).

The valves of the heart.

As regards the valves of the heart—(1) the tricuspid guards the right auriculo-ventricular opening, and consists of three flaps of fibrous tissue, covered, like all the internal surfaces of the heart, with the smooth shining membrane, the endocardium. The flaps are continuous at their base, forming an annular membrane surrounding the opening. The bicuspid or mitral consists of two cusps and guards the left auriculo-ventricular opening. The under surface and free edge of each cusp of these valves are attached by chordae tendinae to two papillary muscles; these are pillars of muscle which rise up from the inner surface of the ventricles.

The edges of these valves which come into opposition are exceedingly thin and delicate, while the outer parts, which bear the full systolic pressure of the blood, are tough. The cardiac muscle, by its contraction, limits the size of the auriculo-ventricular orifices and so maintains the competency of the valves. It is the papillary muscles and chordae tendineae which pull down the diaphragm formed by the closed valves (the floor of the auricles), thus expanding the auricles and enabling the valvular as well as the muscular parts of the wall of the ventricles to approach together and wring out the blood. The thin, moist, film-like edges of the valves of the heart come into perfect apposition and prevent all leakage, while the fibrous parts give strength and support. The ventricles are never completely emptied, for some blood remains in contact with the auriculo-ventricular valves up to the end of systole and ensures their closure. Incompetency of the valves may arise when the right heart is greatly dilated. The aortic and pulmonary valves consist of three semilunar, pocket-shaped cusps. A fibrous nodule is placed centrally in the free edge of each cusp, whence numerous tendinous fibres radiate to the attached borders of the cusp. The rest of the free edges which come into apposition are thin and delicate. Opposite the cusps are bulgings of the aortic walls—the sinuses of Valsalva. From the anterior one arises the right coronary artery and from the left posterior, the left coronary artery, these vessels supply the substance of the heart with blood. Eddies formed in the sinuses during the period of systolic output bring the semilunar valves into apposition, so that they close without noise or jar at the moment when the intraventricular becomes less than the aortic pressure. The auriculo-ventricular valves are likewise floated up by eddies, and brought into apposition at the moment the intraventricular pressure surmounts that in the auricles.


Left anterior cusp of pulmonary valve
Left posterior cusp of pulmonary valve
Left posterior cusp of aortic valve
Left coronary artery
Anterior cusp of mitral valve
Posterior cusp of mitral valve
Left ventricle
Conus arteriosus
Right anterior cusp of pulmonary valve
Right coronary artery
Anterior cusp of aortic valve
Right posterior cusp of aortic valve
Anterior (infundibular) cusp of tricuspid valve
Right (marginal) cusp of tricuspid valve
Posterior (septal) cusp of tricuspid valve
Right ventricle

From Young and Robinson, Cunningham's *Text-Book of Anatomy*.

FIG. 7.—The Bases of the Ventricles of the Heart, showing the auriculo-ventricular, aortic and pulmonary orifices and their valves.

The heart in size is about equal to the closed fist of a man. The average weight of the heart in the new-born baby is about 24 grms., in the adult 300 grms. The percentage which the heart weight bears to the whole body weight is 0·76 in the new-born and 0·46 in the adult. While the whole body increases in weight 21-fold, the heart increases only 12·74-fold (Vierordt, Karl, 1818–1884). The average weight of the male and female heart is almost the same.

The average volume of the whole heart is about 270 c.c. The capacity, estimated by filling the heart with wax, is for each auricle about 100–150 c.c., and 150–230 c.c. for each ventricle. There are considerable sources of error in such measurements. The muscle of the left ventricle is about 1·6 cm. in thickness, and of the right ventricle 0·5 cm. The left ventricle has twice the muscular mass of the right. The circumference of the left auriculo-ventricular orifice is about 14·0 cm.; of the right, about 12·5 cm.; of the aortic orifice, 8·0 cm.; of the pulmonary orifice, 9·0 cm. The average diameter of the vena cava superior is about 23 mm.; of the vena cava inferior, 34 mm.; of each of the four pulmonary veins about 13–14 mm.; of the pulmonary artery, 28 mm.; of the aorta, 32 mm.

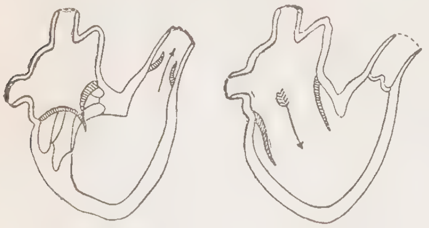


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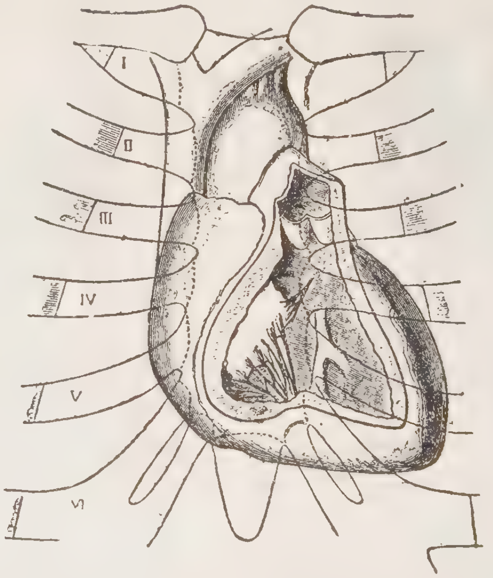
FIG. 8.—Position of the Valves of the Heart in Systole and Diastole.

Modes of examining the living heart.

The physiologist or physician has many means at his disposal of examining the heart's action. By palpation with the hand over the region of the heart, its stroke, the *cardiac impulse*, can be felt. By *auscultation* with the ear directly, or with use of the stethoscope the sounds of the heart can be heard. By *percussion* the anatomical limits of the organ can be defined. The cardiac impulse can be recorded by tambour methods of registration, the heart sounds by means of the microphone and capillary electrometer, while the volume and movements of the heart can be studied with the help of the Röntgen rays

The cardiac impulse.

The impulse is caused by the sudden hardening of the muscular mass of the ventricles against the wall of the thorax. It is synchronous with the beginning of systole. The position at which the impulse is felt varies with changing posture of the body, as different parts of the thorax come in turn in contact with the ventricle. In the supine position it is usually to be felt in the fifth intercostal space 3½ inches from the midsternal line. The chest wall is driven out by the systole only where the heart muscle touches it; at other places it is slightly drawn in. This indrawing is attributed to the expulsion of the blood out of the thorax by the left ventricle. The thorax is a closed cavity and the vacuum therein produced by systolic output into the arteries of the head, limbs and abdomen is filled by (1) the drawing of air into the lungs, (2) the drawing of venous blood into the great veins and right auricle, (3) the slight indrawing of the chest wall. The impulse is recorded by placing a small cup, or receiving tambour, over the spot where it is most evident, and connecting the inside of the cup by a tube to a recording tambour. The cup can be closed by a rubber dam, or an air-tight junction can be effected by pressing it upon the skin. The stroke of the heart is transmitted as a wave of compression to the air within the system of tambours. The recording tambour is brought to write on a drum, moved by clockwork, and covered with a paper smoked with lamp-black. From the record so obtained we can obtain information as to the time relations of the heart-beat, but no accurate information as to its energy or amount of contraction.



From Young and Robinson, Cunningham's *Text-Book of Anatomy*.

FIG. 9.—The Relation of the Heart to the Anterior Wall of the Thorax.

I, II, III, IV, V, VI, the upper six costal cartilages.

Movements of the heart.

The movements of the heart consist of a series of contractions which succeed each other with a certain rhythm. The period of contraction is called the *systole* and that of relaxation the *diastole*. The two auricles contract and relax synchronously, and these movements are followed by the synchronous contraction and relaxation of the ventricles. Finally, there is a short period when the whole heart is in diastole. The whole series of movements is known as the *cardiac* *cycle.* Taking 75 as the average number of heart-beats per minute, each cardiac cycle will occupy ·8 seconds. Of this period

auricular systole occupies	·1 second
auricular diastole occupies	·7 ,,
ventricular systole occupies	·3 ,,
ventricular diastole occupies	·5 ,,

In 1861 Chauveau and Marey obtained direct records of the heart of a horse, and determined the sequence and duration of the events happening in the heart, and measured the endo-cardiac pressure by an instrument termed the cardiac sound. The sound—a two-way tube—was pushed down the jugular vein until the orifice of one tube lay in the right ventricle and of the other in the right auricle. The tubes were connected with recording tambours which wrote on a moving drum covered with smoked paper.

Another tambour was used to record the cardiac impulse. The tracings so obtained (fig. 10) teach us the following facts: (1) The auricular contraction is less sudden than the ventricular, and lasts only a very short time, as indicated by the line *ab*. The ventricle, on the other hand, contracts suddenly and forcibly and remains contracted a considerable time, as shown by the line *c′d′* and by the flat top to the curve which succeeds *d′*. (2) The auricular movement precedes the ventricular, and the latter coincides with the impulse of the apex against the wall of the chest. (3) The contraction of the auricle influences the pressure in the ventricle as shown by the small rise *a′b′*, and that of the ventricle influences the pressure in the auricle somewhat as shown by the waves *cd*. Much labour has been spent in the contrivance of rapidly acting spring pressure gauges, freed as far as possible from inertia, in order to investigate more exactly the changes of intracardiac pressure, which were first described by Chauveau and Marey. As the intraventricular pressure may rise 150 mm. of mercury in one-tenth of a second, it is no easy matter to contrive an instrument which will respond as rapidly and yet yield an accurate result without overshooting the mark. The final result of a most careful inquiry is the confirmation in almost every point of Chauveau and Marey's pressure curves. Karl Hürthle's differential manometer has proved to be an instrument of great value and precision. A double-bored tube cannula is introduced so that one tube reaches the right auricle and the other the right ventricle. In observations on the left side of the heart, one tube is placed in the left ventricle and the other in the aorta, and each of these tubes is brought into connexion with a tambour. The two tambours are placed one on either side of the fulcrum of a lever. This lever works against a light spring, which in its turn sets in motion a writing-style. The style records the pressure changes on a drum covered with smoked paper. By this means there can be recorded the exact moment at which the auricular pressure exceeds that in the ventricle, that is to say, the moment when the auriculo-ventricular valves open; likewise the moment when the ventricular pressure becomes greater than that in the auricles, and the auriculo-ventricular valves shut. Similarly, there can be recorded the moment when the intraventricular pressure exceeds that in the aorta and the semilunar valves open, and the moment at which the diastole of the ventricle begins, when the aortic pressure becomes the greater, and the semilunar valves shut. The smoothness with which the heart works is shown by the fact that neither the opening nor the closing of the valves is marked by any peak or point on the pressure curves.

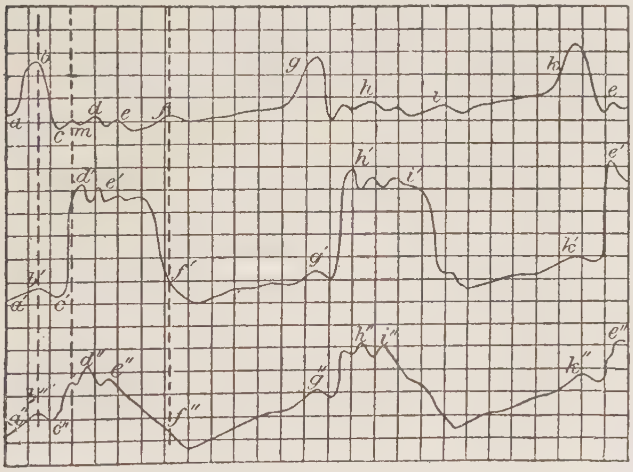
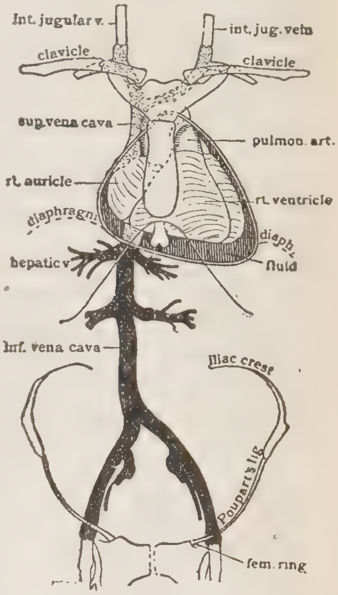


Fig. 10.—Tracings from the Heart of a Horse, by Chauveau and Marey. The upper tracing is from the right auricle, the middle from the right ventricle, and the lowest from the apex of the heart. The horizontal lines represent time, and the vertical amount of pressure. The vertical dotted lines mark coincident points in the three movements. The breadth of one of the small squares represents one-tenth of a second.

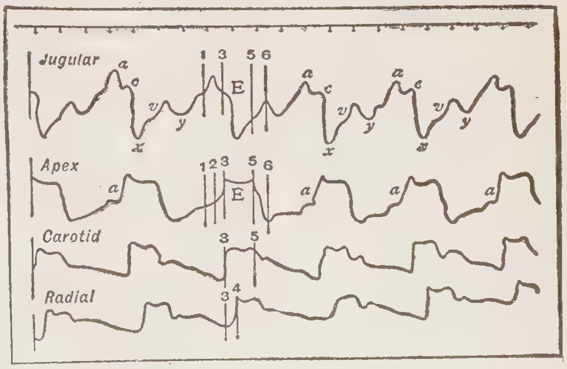
The absence of a mechanism for preventing regurgitation of blood from the auricles of birds and mammals is remarkable, for in fishes, amphibia and reptiles this is effected by valves guarding the sino-auricular junction. In the warm-blooded vertebrata with the appearance of the diaphragm the sinus becomes merged into the right auricle, and the venous cistern formed by the superior and inferior venae cavae, the innominate, iliac, hepatic and renal veins takes the place of the sinus. Six pairs of valves prevent regurgitation from this cistern, viz. those placed in the common femoral, the sub-clavian and jugular veins. The cistern when filled holds some 400 c.c. of blood; in the liver there is some 500 c.c. of blood, and this can be expressed into the cistern by abdominal pressure; in the portal venous system, when distended, another 500 c.c. may be held, which can be expressed through the liver into the cistern. A large volume of blood is thus at the disposal of the heart for it to draw on during diastole. Respiration by the aspirating action of the thorax sucks this blood into the heart, while the inspiratory descent of the diaphragm squeezes the abdominal contents and forces blood from the liver and cistern into the heart. These forces take the place of the sinus and are far more efficient. The intra-abdominal pressure may be raised on bending or straining till it becomes equivalent to the pressure of a column of mercury 80–100 mm. high (Keith). Under such conditions the pericardium prevents the right side of the heart being over-distended with venous blood.



A. Keith, in *Journal of Anatomy and Physiology.*

Fig. 11.—Diagram of the Venous Cistern from which the Heart is filled. The abdominal or infra-diaphragmatic part of the cistern is indicated in black; the thoracic or supra-diaphragmatic is stippled.

With these facts in view, we can now describe the complete course of a cardiac cycle. We will start at the moment when the blood is pouring from the venae cavae and pulmonary veins into the two auricles. The auricles are relaxed and their cavities open into the ventricles by the funnel-shaped apertures formed by the dependent segments of the tricuspid and mitral valves. The blood passes freely through these apertures into the ventricles. The small positive pressure which is always present in the venous cistern (aided by the respiratory forces) is at this time filling the right heart, while the positive pressure in the pulmonary veins is filling the left heart. The auricular systole now takes place. The circular muscle bands compress the blood out of the auricles into the ventricles, while the longitudinal bands aid in this and pull up the base of the ventricles to meet the load of blood. As the contraction starts from the mouths of the venae cavae, and sweeps towards the ventricles, there can



From *Diseases of the Heart*, by James Mackenzie, M.D., by permission.

Fig. 12.—Tracings of the Jugular Pulse Apex Beat, Carotid and Radial Pulses. The perpendicular lines represent the time of the following events:—1, the beginning of the auricular systole; 2, the beginning of ventricular systole; 3, the appearance of the pulse in the carotid; 4, the appearance of the pulse in the radial; 5, the closing of the semilunar valves; 6, the opening of the tricuspid valves.

occur but little regurgitation of blood into the venous cistern, but the cessation of flow into the auricle during its systole does produce a slight rise of pressure in the cistern, as is shown by tracings taken from the jugular pulse. The function of the auricles is to rapidly complete the filling of the ventricles.

The auriculo-ventricular valves are floated up and brought into apposition by eddies set up in the blood which streams into the ventricles, and close without noise or jar at the moment when the intra-ventricular pressure exceeds in the least that in the auricles. The systole of the ventricles immediately following that of the auricles closes the auriculo-ventricular valves, and as the intra-ventricular pressure rises above that in the pulmonary artery and aorta respectively the semilunar valves open and the blood is expelled: these elastic vessels are in their turn expanded by the expulsive force of the heart so as to receive the blood. The papillary muscles, by contracting synchronously with the muscular wall of the ventricles, pull down and flatten the dome-like diaphragm formed by the closed auriculo-ventricular valves, thus shortening the longitudinal diameter of the ventricles, while at the same time they enlarge the auricles and so help to fill these cavities. The outflow of blood from the ventricles is rapid at first. It becomes slower as the big arteries become distended and the pressure of blood rises within them, and ceases finally when the pressure becomes equal to that in the ventricles. As the outflow diminishes the semilunar pockets are filled by eddies of blood, and their thin edges are brought nearer and nearer, until finally they come into apposition. The closure is effected without jar or noise at the moment when the outflow ceases and the ventricles begin to expand. The heart, as a good pump should, works with the least possible jar. During the contraction of the ventricles blood has been pouring from the veins into the auricles, and directly the ventricular systole ceases the auriculo-ventricular valves open, and the blood begins to fill the expanding ventricular cavities. For a brief moment the ventricles remain dilated and at rest, then the auricles contract again, and the cycle of changes, once more, is repeated. During the first period of ventricular systole—the period of rising tension—all the valves are closed and the ventricle is getting up pressure. This period has been measured and is found to occupy ·02″–·04″. The second period is that of systolic output, and lasts about ·2″, that is, from the moment when the semilunar valves open to the moment when they close. The upstroke of the pulse curve taken in the aorta, or in the carotid artery in man, can be taken as marking the moment when the semilunar valves open, while the dicrotic notch on the pulse curve marks their closure. The second sound of the heart occurs immediately after their closure, and can be used to mark the time of this event on the impulse curve.

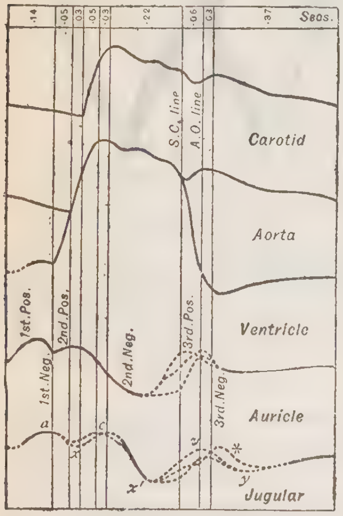


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FIG 13.—Diagrammatic representation of the Cardiac Cycle and of the Carotid and Jugular Pulses in relation to standard movements. The scale of abscissae is 1 mm. to $\frac{1}{100}$ sec. S.C. = semilunar valve closure; A. O. = auriculo - ventricular valves open. The broken lines indicate those portions of the respective curves over which there is doubt or controversy.

The intra-ventricular pressure curve may rise or fall during the output period according to the state of the peripheral resistance. If the carotid pulse be recorded synchronously with the impulse curve, the time relations can be determined for the human heart. The beginning of the upstroke of the impulse curve marks the beginning of systole, that of the pulse curve marks the opening of the semilunar valves, and the dicrotic notch, which precedes the dicrotic wave, marks the closure of these valves and the end of the output. The first sound of the heart is synchronous with the upstroke of the impulse curve. The maximal systolic pressure exerted by the heart varies with the degree of diastolic filling and with the obstruction to outflow. The heart responds to the latter by a greater output of energy, and this it does with little loss in rapidity of action. The total fluid pressure to which the wall of the heart is submitted rapidly increases as the radii of curvature become greater. Hence the greater energy required of a dilated heart, its tendency to hypertrophy and liability to fail. By its reserve power the heart may throw out three or even six times the volume of the normal output per minute, and may maintain its output when the aortic pressure is twice its normal value.

The maximal and minimal pressures have been accurately recorded in the heart by a manometer fitted with a valve arranged so that either only a rise or a fall of pressure is recorded. In the right ventricle of the dog the maximal pressures recorded equalled 35–62 mm. of mercury, in the left ventricle 114–135 mm., in the auricles 2–20 mm. (Michael Jäger, 1795–1838). A negative pressure, of considerable amount but of very fleeting duration, sometimes occurs in the ventricles at the beginning of diastole. This is produced by the elastic rebound of the fleshy columns of the inner wall of the heart, which become pressed together as the blood is wrung out of the ventricular cavities. The entry of the first few drops of blood from the auricles abolishes this negative pressure, and it has no important influence on the filling of the heart.

The sounds of the heart.

When the ear is applied over the cardiac region of the chest, or a stethoscope is employed, two sounds are heard, the first, heard most intensely over the apex, is a duller and longer sound than the second, which is shorter and sharper and is heard best over the base of the heart. The syllables *lub*, *dupp* express fairly well the characters of the two sounds, and the accent is on lub when the stethoscope is over the apex, thus—lúb-dupp—lúb-dupp—lúb-dupp, and on the second sound when over the base, thus—lub-dúpp—lub-dúpp—lub-dúpp. The sounds of the heart have been successfully recorded by means of the microphone. Hürthle inserted the microphone in the primary circuit of an E. Du Bois-Reymond induction coil, and placed the nerve of a frog-muscle preparation in the secondary circuit. The muscle, being attached to a lever, recorded its contraction on a revolving drum at the moment when the sound of the heart reached the microphone and closed the primary circuit. A capillary electrometer can be inserted in place of the frog-muscle indicator, and the movements of the electrometer photographed on a sensitized plate moved by clockwork (Willem Einthoven). Each sound gives rise to a succession of vibrations of the mercury meniscus of the capillary electrometer. The first sound is formed of many component tones derived from the sudden tension, and consequent vibration, of the ventricular muscle, and of the auriculo-ventricular valves with their chordae tendineae. The first sound can be resolved by a trained musical ear into two tones, one deep and the other high. The deeper tone alone is heard on the contraction of the excised and bloodless heart, while the higher tone is produced by throwing the auriculo-ventricular valves into tension (John Berry Haycraft). In the cold-blooded animal, such as the turtle, the heart muscle does not become tense rapidly enough to produce a sound (Allen). This sound is not produced by fluid friction as the blood rushes through the arterial orifices, for the velocity of outflow is too small to produce in this way any noise. Nor is it produced by sudden opening of the semilunar valves, for these open quietly and without jar at the moment when the intra-ventricular pressure rises above that in the aorta.

The second sound of the heart is produced by the tension of the semilunar valves in the aorta and pulmonary artery at the moment when the ventricles pass into diastole. These valves close without any jar or shock so soon as the arterial pressures rise to the slightest degree above that in the ventricles. In the next moment the ventricles dilate, and the valves, no longer supported on one side, become taut. The elastic vibrations of the walls of the distended arteries probably share in the production of this sound.

When the sounds and the impulse are recorded together the record shows that the first sound begins about 0·01 sec. before the cardiagram marks the beginning of systole, and for the first 0·06 sec. of its duration this sound is heard only over the apex. Over the base of the heart the first sound is heard just at the time when the semilunar valves open and the output begins. The first sound ceases before the ventricular contraction is over, for it is the sudden tension, not the continuance of contraction, that causes it. The beginning of the second sound marks the sudden tension of the semilunar valves which immediately follows their closure.

For practical purposes it is important to bear in mind what is happening in the heart whilst one listens to its sounds. During the first sound we have (1) contraction of the ventricles, closure of the auriculo-ventricular valves and impulse of the apex against the chest; (2) rushing of the blood into the aortic and pulmonary artery, and filling of the auricles. With the second sound we have closure of the semilunar valves from the elastic recoil of the aorta and pulmonary artery, relaxation of the ventricular walls, opening of the auriculo-ventricular valves so as to allow the passage of blood from auricle to ventricle, and diminished pressure of apex against chest wall. With the long pause there are (1) gradual refilling of the ventricle from the auricle, and (2) contraction of the auricle so as to entirely fill the ventricle. The sound of the tricuspid valve is heard loudest at the junction of the lower right costal cartilages with the sternum, of the mitral over the apex beat, of the aortic semilunar valves in the direction of the aorta where it comes nearest to the surface at the second right costal cartilage, and of the valves of the pulmonary orifice over the third left costal cartilage, to the left and external to the margin of the sternum. The sounds are changed in character by valvular lesion or muscular weakness of the heart, and afford important signs to the physician. Murmurs are produced by eddies setting some part of the membranous walls or valve flaps in vibration.

If a stethoscope be placed over a large artery, a murmur will be heard, caused by the blood rushing through the vessel narrowed by the pressure of the instrument. The fluid escapes into a wider portion of the vessel beyond the point of pressure, and the sound is caused by the eddies set up there throwing the membranous wall of the vessel into vibration. Such a sound is heard over an aneurism. The placental bruit heard during pregnancy is a sound of this kind, arising from pressure on the uterine arteries. In cases of insufficient aortic valves a double blowing murmur may be heard, the first being due to the rush of blood into the vessel, and the second to the regurgitation of the blood back into the ventricle. These murmurs are produced by eddies of blood setting the membranous parts into vibration.

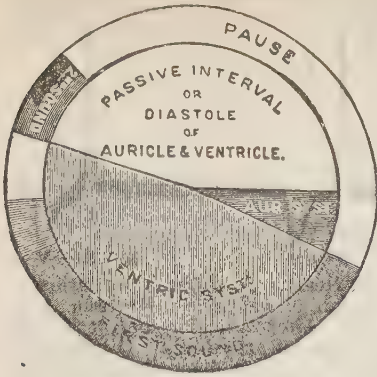


FIG. 14.—Scheme of a Cardiac Cycle. The inner circle shows what events occur in the heart, and the outer the relation of the sounds and silences to these events.

Occasionally a murmur is produced by the displacement of air in the bronchial vessels by the beat of the heart, and may simulate the murmur of aortic incompetence. By placing a stethoscope over the jugular vein on the right above the collar bone a murmur is heard, the *bruit de diable*, particularly if the subject turn his head to the left. This is held to be due to the vibration of the blood in the jugular vein rushing from the dilated to the contracted part. It is more marked during auricular diastole and during inspiration.

The nutrition of the heart.

In the lower vertebrates, as the frog, the heart is directly nourished by the blood which fills the cavities in its sponge-like structure. In the warm-blooded vertebrates there is a special arrangement of coronary vessels. The two coronary arteries (right and left) originate at the root of the aorta from the sinuses of Valsalva. Their branches penetrate the muscular substance and end in a rich plexus of capillaries. From these arise the radicles of the coronary veins which open into the right auricle by the coronary sinus and other small veins. These openings are valved. The heart in contracting exerts a greater pressure than that of the coronary arteries, and so arrests the flow in these during the height of systole, and squeezes the blood within the coronary capillaries and veins on into the right auricle. On diastole the coronary system fills again. Sudden occlusion of any large part of the coronary arteries produces irregular and inco-ordinate contractions, followed by death of the heart. Gradual occlusion of the coronary arteries by degenerative changes in advanced life is one of the causes of the distressing form of cardiac distress known as angina pectoris.

The work of the heart.

The work of the left ventricle is calculated by the formula $W=VP+mv^2$, where V=volume of blood in c.c. expelled per beat, P=mean pressure in aorta, m=mass of the blood expelled on systole, and v=the velocity imparted to it. The volume of the output has been determined directly by inserting the stromuhr in the ascending aorta (Robert Adolf Tigerstedt), and indirectly by determining (1) how much oxygen is absorbed per minute, (2) the difference in the oxygen content of the arterial and venous blood, (3) the number of heart beats. If 1000 c.c. of oxygen are absorbed from the air breathed in a minute, and the arterial blood contains 10% more oxygen than the venous, it is clear that 100×100 c.c. of blood must have passed through the lungs in that time, and if the heart beat 100 times, the output for each beat would be 100 c.c. From the determinations made on animals the output is calculated for man to be 60–100 c.c. The velocity of the output can be calculated if the volume of the output is known, the duration of the period of output, and the diameter of the aorta. The pressure is measured with a manometer. The velocity is much greater at the orifice than in the aorta, for the blood can flow from the aorta during the whole cardiac cycle, while the whole of it must escape through the orifice into the aorta during the period of output. The work spent on maintaining the velocity is not, however, more than $\frac{1}{40}$ of the whole and is generally neglected in the calculation. The output is not greater than 60–100 c.c. (3 oz.) (Tigerstedt, Nathan Zuntz), and the mean arterial pressure in a healthy man, determined by the sphygmometer, is not more than 110 mm. of mercury (L. Hill). The work of the right heart can be reckoned to be $\frac{1}{3}$ that of the left, for the pressure in the pulmonary artery does not exceed 30 mm. The total work of the heart during the day may be taken as equal to 20,000 kilogr.-metres, and this would be equivalent to 50 calories out of the total 2500 calories which a man takes in as food. A labourer does about 150,000 kilogrm.-metres of external work a day. The work of the heart is increased two or three times over during severe muscular labour. It has been estimated that the heart requires per diem, to maintain its energy, an amount of solid food (water-free) equal to the weight of solids in the heart itself, *i.e.* about 60 grms. of sugar or proteid. 30 c.c. of blood must be circulated per minute through the coronary arteries of a dog to maintain the vigour of the heart.

The artificial circulation of the heart.

The use of oxygen per grm. of weight per minute is high for the heart. Thus for the whole body of the dog there was used ·017 c.c. per grm. per min., for the heart ·045–·083, and for the active secretory glands ·07–1·0 (Barcroft and Dixon). It has long been known that the heart of frog or tortoise can be kept beating normally for hours after removal from the body, if it is provided with an artificial circulation of blood or a suitable solution of salts. Sydney Ringer worked out the necessary ingredients of this solution to be

Sodium chloride	0·7 %
Potassium ,,	0·03 %
Calcium ,,	0·025 %

The excised mammalian heart can be kept beating in the same way provided the nutritive fluid is oxygenated and the heart kept at body temperature. A solution containing one-third defibrinated blood and two-thirds Ringer's salt solution is most suitable. A mammalian heart thus was restored to activity 7 days after death. The beat of the heart of a child was restored 20 hours after death from pneumonia. The excised heart of a cat was kept beating for 4 days. The heart of a monkey was restored after freezing the body of the animal. The nerves of the excised heart retain their action for some time if the nutritive fluid is immediately circulated through the coronary arteries. Thus the heart's action can be conveniently studied when taken from the body of a mammal.

The cause of the heart beat.

The cause of the heart beat has naturally been one of the most continued objects of inquiry, and the point of view shifts with each advance of our experimental methods, and the wider extension of the inquiry throughout the animal world. H. Allen in 1757 was the first to announce that the activity of the heart is not dependent on its connexion with the nervous system. The excised heart, properly fed, continues to beat. The heart of a dog continued to work effectively and the animal to keep in health for months after division of all the nerves passing to the heart. The heart, it is true, is controlled and influenced constantly by the nervous system—attuned to the general needs of the body—but this control is not essential to life. The above dog, when exercised, became fatigued quickly, owing to the lack of the nervous control of the heart. When in 1848 Robert Remak discovered that groups of nerve cells are contained in the heart of the frog, the causation of the beat was attributed to the activity of these ganglia.

Confirmation of this view was found in the experiment of Hermann Stannius which demonstrates that the apex of the heart ceases to beat rhythmically if physiologically separated from the rest of the heart by ligature or momentary application of a clamp. The sinus, on the other hand, which contains ganglion cells, continues its beat as before when separated. Further experiment has shown that the beat of the heart cannot be ascribed to the rhythmic activity of the ganglion cells, which in the mammalian heart lie scattered in the base of the heart, in the neighbourhood of the venous opening and in the auriculo-ventricular groove. That this is so is shown by the fact that every strip of heart muscle, whether free of ganglion cell or not, is capable of rhythmic activity under suitable conditions (Walter Gaskell, 1847–   , Theodor Wilhelm Engelmann, Alfred Wm. Porter). The inherent power of rhythmic contraction is most clearly seen in the embryonic heart, for the pulsation of the chick's heart became visible by the 24th to 48th hour of incubation, while the migration of the ganglion cells into the heart from the sympathetic system does not take place until the sixth day (His.). The heart muscle is pervaded by a network of nerve fibrils, and the supporters of the neurogenic theory have had to fall back upon this network as the cause of the beat. The "myogenic" theorists place the causation in the muscle itself.

The pulsating "umbrella" of the jelly-fish is formed of a network of nerve fibril and contractile elements, and this can be excited to contract by irritating any one of the sensory endings of the nervous network which are situated on the edge of the "umbrella." In the manifestation of a "refractory period" the "umbrella" behaves like the heart. Against this view we may cite the experiment of Julius Bernstein (1839), who clamped off the apex of the frog's heart to destroy the physiological continuity, kept the animal alive till the nerve network had degenerated and then found the apex could be mechanically excited to contract. Moreover, skeletal muscle-fibres can be thrown into rhythmic contraction by the application of a suitable solution of salts (Wilhelm Biedermann, 1854), and it is probable that heart muscle is excited to rhythmic activity by such means. At any rate the beat is profoundly affected by varying slightly the nature and percentage of salts supplied in the nutritive fluid. Carlson has recorded experiments upon the heart of the horseshoe crab (*Limulus*) which show that its beat at any rate depends on the integrity of the median nerve (and its ganglion cells) which runs down the heart. On the other hand, Gaskell has shown that any small bridge of heart muscle left connecting the auricle and ventricle of the tortoise heart will transmit the wave of contraction, while if the nerve passing from sinus to ventricle be left, and the muscular connexions entirely severed, no wave passes. In contradistinction to cross-striated muscle, the structural unit of the heart is not also a functional unit, for the heart-cells are, from the earliest stage of development, joined together by branches into networks and bands so as to form one functional whole, and hence excitation of any one part leads to the contraction of the whole. The first part to begin to functionate in the embryo is the venous end, and the waves of contraction passing thence spread over the developing ventricular segment. The muscle-cells of the ventricles are thicker, less sarcoplasmic and more clearly striated than the auricular muscle, which is more embryonic in structure. The contraction lasts longer in the ventricular than in the auricular muscle, while the automatic rhythm not only persists longer in the auricles, but is of greater frequency, as is clearly seen when the cavities of the heart are divided from each other. The venous orifices of the heart are least sensitive to injury, beat longest after death, and are the first to recover after arrest. Owing to the more powerful automatism of the venous extremity, the contraction normally proceeds thence, and passing as a peristaltic wave over the auricles and ventricles, finally reached the arterial orifices. This peristaltic form of contraction is invariable in all periods of development and in all hearts, both of invertebrate and vertebrate animals. The peristalsis may, with difficulty, be artificially reversed by the application of a powerful rhythmic stimulus to the ventricular end. Antiperistalsis does not, however, take place easily, because the comparatively slow excitatory process in the ventricle has little effect on the auricular muscle. The latter, by initiating more rapid contraction-waves, over-dominates the former. The frequency of the whole heart is accelerated by warming the auricles, while the period of systole is alone shortened on warming the ventricles.

The sequence in the beat of the three chambers of the heart is attributed by Gaskell to the delay that occurs in the excitatory wave passing through the muscular connexions in the sino-auricular and auriculo-ventricular junctions. He showed that such delay could be imitated by moderately clamping a strip of heart muscle; the compressed part transmitted the wave less readily, so that the part above and below the clamp contracted in sequence.

In the mammalian heart there has recently been discovered a remarkable remnant of primitive fibres persisting in the neighbourhood of the venous orifices (representing the sinus). These fibres are in close connexion with the vagus and sympathetic nerves, and form the sino-auricular node of A. Keith and Martin Flack. If this node is squeezed by a clamp, it prevents the effect of excitation of the vagus reaching the heart. The auricle and ventricles of the mammalian heart are connected through the septum by a remarkable bundle of muscle fibres which is believed to convey the excitatory wave from the one cavity to the other. The root of this auriculo-ventricular bundle lies in the right auricle; the main part is buried in the inter-ventricular septum; its branches and twigs are distributed to all parts of either ventricle; the papillary muscles and fleshy columns, in particular, receive a direct supply. The muscle fibres are of a peculiar type, known as the cells of Purkinje. By this bundle it is believed every part of the ventricle is brought into synchronous contraction. To its degeneration has been ascribed certain cases of disturbed cardiac rhythm, when the ventricle no longer follows the sequence of auricle. The evidence of such degeneration is, at present, not convincing.

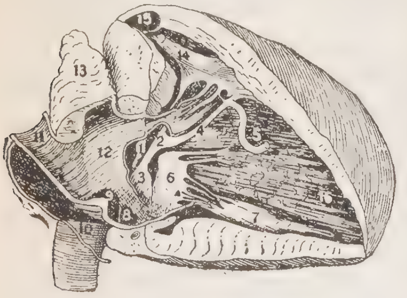


FIG. 15.—The Right Auricle and Ventricle of a Calf's Heart, exposed to show the course and connexions of the auriculo-ventricular bundle. 1, central cartilage exposed by dissection; 2, the main bundle; 3, auricular fibres from which the main bundle arises; 4, right septal division; 5, moderator band; 6, a cusp of the tricuspid valve; 7, posterior group of the musculi papillaries; 8, orifice of the coronary sinus; 9, above orifice of the inferior vena cava (10); 11, orifice of the superior vena cava; 12, septal wall of the right auricle; 13, appendix of the right auricle; 14, septal wall of the infundibulum; 15, beginning of the pulmonary artery; 16, apex of the right ventricle. (After A. Keith, in *Journal of Anatomy and Physiology*.)

The electrical change of the heart.

The contraction of the heart, like that of other muscle, is accompanied by an electrical change. The part in contraction is at different potential to the part at rest. Thus an electrical wave accompanies the wave of contraction. This has been studied by means of the capillary, or the string, electrometer (Sir John Scott Burdon-Sanderson and Page, Einthoven, Gotch). The photographic records obtained with these instruments afford us a most beautiful method of recording the rhythm of normal and abnormal hearts in man, for they can be obtained by connecting the right hand and left foot of a patient with the instrument. Einthoven, by making use of the telephone wires, recorded in his laboratory the electrical changes of the hearts of patients seated in a hospital 2 m. away.

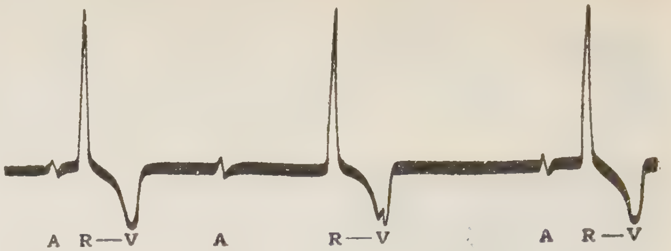


FIG. 16.—Electrical Changes of Heart. A, diphasic variation of auricle; R—V, diphasic variation of ventricle. R=base negative; V=apex negative to base. After auricular contraction the ventricular is delayed—an example of arhythmia. (Einthoven.) The string galvanometer is the best method for elucidating disorders of cardiac rhythm.

The heart during the period of systole is refractive to artificial excitation, but its susceptibility returns with diastole. The force and amplitude of any cardiac contraction depend on the previous activity of the heart and on such physical conditions as the degree of diastolic filling, the resistance to systolic outflow, temperature, &c., but are independent of the strength of the artificial stimulus so long as the latter is efficient. Owing to the refractory period, the slow rate of contraction and the independence of the amplitude of contraction on the strength of stimulus, the heart under ordinary conditions cannot be thrown by rapidly repeated excitation, into a complete state of tetanic spasm. The refractory period can be shortened by heat (40° C.), or by calcium and sodium salts until tetanus is obtainable. The cardiac muscle is rich in sarcoplasm, and on this depends its power of slow, sustained contraction. The heart-muscle, besides rhythmically contracting, possesses "tone," and this tone varies with the conditions of metabolism, temperature, &c. Chloroform, for example, produces a soft dilated, strychnine, adrenalin or ammonia a tonically contracted heart. The mammalian heart ceases to beat at temperatures below 7° C. and above 44° C., and passes into "heat rigor" at 45° C.

The Cardiac Nerves.—In 1845 the brothers Weber made the astonishing discovery that the vagus nerve, when excited, slowed or even arrested the action of the heart. This was the first proof of the existence of inhibitory nerves. The cardiac inhibitory nerves have since been found in all classes of vertebrates and in many invertebrates. Some years later v. Beyeld (1862) and Moses and Il'ya Cyon (1843–) discovered the existence of nerve fibres which, when excited, augmented and accelerated the beat of the heart. These nerves arise from 1–5 thoracic anterior spinal nerve roots and have their "cell stations" in the first thoracic and inferior cervical ganglia, whence they pass to the heart partly in company with the cardiac branches of the vagus, and partly as separate twigs. The vagus cardiac fibres arise by the middle of the lowermost group of vagus roots, and have their cell-stations in the ganglion cells of the heart. These ganglion cells lie chiefly in the sub-pericardial tissue in the posterior wall of the auricles between and around the orifices of the venae cavae and pulmonary veins and between the aorta and pulmonary artery. The minute structure of these ganglia and the terminations of the nerves have been studied particularly by Dogiel. The inhibitory fibres arise from a centre in the spinal bulb which is in tonic action and constantly bridles the heart's action. When the vagi are divided the frequency of the heart increases and the blood pressure rises. The vagus centre is reflexly excited by the inhalation of chloroform, ammonia or other vapour irritant to the air passages, also by the want of oxygen in the blood in asphyxia. It may be excited by irritation of the abdominal nerves, *e.g.* a blow on the abdomen, and by increased pressure in the cerebral vessels. The acceleratory and augmenting fibres

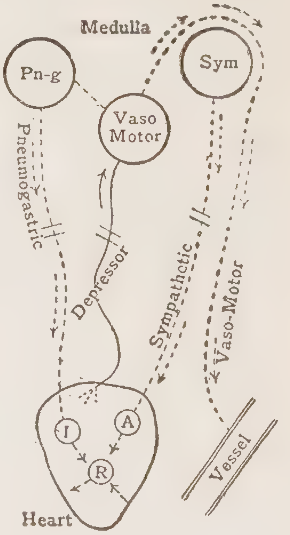
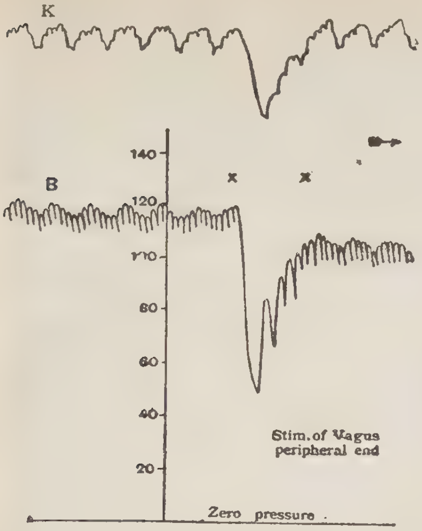


FIG. 17.—The origins of pneumogastric and vaso-motor systems are in medulla, that of the sympathetic in upper portion of cord. The arrows indicate direction of nerve currents. In the heart R represents a reflex centre, I an inhibitory centre and A an accelerating centre.

likewise have their centre in the spinal bulb, and are in tonic action, antagonizing more or less the action of the vagal centre. The vagus nerve works directly on the cardiac muscle, and produces some change (signalized by a positive variation in the electrical state of the heart) which results in a depression of the excitability, the conductivity, the force and the frequency of the heart. After the vagal arrest the heart beats more forcibly, owing, it is thought, to the greater accumulation of contractile material during the period of rest. The converse of all these effects occurs on stimulation of the accelerator nerves. Excitation of these nerves may excite to renewed efforts an excised heart which has just ceased to beat after withdrawal of the supply of nutritive solution. Hence it is thought by some that the accelerator nerves tonically exert a sustaining influence on the heart.



From Howell's *Text-Book of Physiology*, by permission of W. B. Saunders Co.

Fig. 18.—B, arterial blood pressure. K, record of volume of kidney. Inhibition of heart on faradizing vagus nerve.

The alkaloid atropin paralyses the vagal nerve endings in the heart, while nicotine paralyses the ganglion cells. Muscarin obtained from poisonous fungi slows and finally arrests the heart. Adrenalin, the active principle of the medulla of the supra-renal glands, augments its power. Chloroform depresses it and in poisonous dose throws the heart into paralytic dilatation. A great many of the cardiac vagal fibres convey impulse to the spinal bulb (centripetal), and reflexly influence the heart frequency, the breathing and the tonus of the blood vessels. In particular certain fibres, termed *depressor* (discovered by Ludwig and Cyon, 1866), cause dilatation of the arterioles and a fall of arterial pressure by inhibiting the tonic action of the vaso-motor centre in the spinal bulb. The depressor fibres arise from the root of the aorta, and over-distension of this part excites them, as evidenced not only by the above effect, but also by the electrical variation (action current) which has been observed passing up the depressor nerve. Sensory impressions originating in the heart do not as a rule enter into consciousness. They are carried by the cardiac nerves to the sympathetic ganglia, and thence to the upper thoracic region of the spinal cord, where they come into relation with the sensory nerves from the pectoral region, upper limb, shoulder, neck and head. The impressions are not felt in the heart, but referred to these sensory cutaneous nerves. Thus cardiac pain is felt in the chest wall and upper limbs and particularly on the left side. The function of the cardiac nerves is to co-ordinate the beat of the heart with the needs of the body and to co-ordinate the functions of other organs with the needs of the heart. For example, an undue rise of arterial pressure, induced, let us say, by compression of the abdomen, excites the centre of the vagus and produces slowing of the heart and a consequent lowering of arterial pressure. The heart of a mammal, however, continues to functionate after a section of all the branches of the cardiac plexus has been made, so that the nervous control and co-ordination of the heart are not absolutely essential to the continuance of life.

Certain physical factors concerning the circulation.

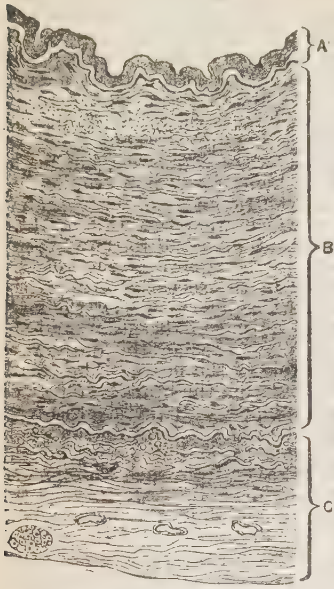
Water flowing through a tube from a constant head of pressure encounters a resistance occasioned by the friction of the moving water particles against each other and against the stationary layer that wets the wall of the tube. Part of the potential energy of the head of pressure is spent in endowing the fluid with kinetic energy, the greater part in overcoming this resistance is rubbed down into heat. The narrower the tube is made, the greater the friction, until finally the flow ceases, the total energy being then insufficient to overcome the resistance.

The resistance may be measured at any point in the tube by inserting a side tube in the vertical position. The water rises to a certain height in the side tube, indicating the head of pressure spent in overcoming the resistance between the point of measurement and the orifice. If the lower end of the side tube is bent thus ⌋ and inserted so that its orifice faces the stream, the water will rise higher than it did in the first case. The extra rise indicates the head of pressure spent in maintaining the velocity of flow. Such a method has been used to measure the velocity of flow in the vascular system (Napoleon Cybulski). When a stream of water is transmitted intermittently by the frequent strokes of a pump through a long elastic rubber tube, the fluid does not issue in jets as it would in the case of a rigid tube, but flows out continuously. The elastic tube is distended by the force of the pump, and its elasticity maintains the outflow between the strokes. The continuous outflow here depends on the elasticity of the tube and the resistance to flow.

In the vascular system an area of vessels of capillary size is placed between the large arteries and veins. This area opposes a great resistance to flow. The arteries also are extensile elastic tubes. The effect of the peripheral resistance, as it is called, is to raise the pressure on the arterial side and lower it on the venous. The resistance to flow is situated chiefly, not in the capillaries, but in the small arteries, where the velocity is high; for "skin friction"—that is, the friction of the moving concentric layers of blood against one another and against the layer which wets the wall of these blood vessels is proportional to the surface area and to the viscosity of the blood—is nearly proportional to the square of the velocity of flow, and is inversely proportional to the sectional area of the vessels. Owing to the resistance to the capillary outflow, the large arteries are expanded by each systolic output of the heart, and the elasticity of their walls comes into play, causing the outflow to continue during the succeeding diastole of the heart. The conditions are such that the intermittent flow from the heart is converted into a continuous flow through the capillaries. If the arteries were rigid tubes, it would be necessary for the heart to force on the whole column of blood at one and the same time; but, owing to the elasticity of these vessels, the heart is saved from such a prolonged and jarring strain, and can pass into diastolic rest, leaving the elasticity of the distended arteries to maintain the flow. As a result of disease, the elastic tissue may degenerate and the arteries become rigid. Besides the saving of heart-strain, there are other advantages in the elasticity of the arteries. It has been found that an intermittently acting pump maintains a greater outflow through an elastic than through a rigid tube; that is to say, if the tubes be of equal bore. The four chief factors which co-operate in producing the conditions of pressure and velocity in the vascular system are—(1) the heart-beat, (2) the peripheral resistance, (3) the elasticity of the arteries, (4) the quantity of blood in the system. Suppose the body to be in the horizontal position and the vascular system to be brought to rest by, say, excitation of the vagus nerve and arrest of the heart. A sufficiency of blood to distend it collects within the venous cistern. The arterial system, owing to its elasticity and contractility, empties. If the heart now begin to beat, blood is taken from the venous system and is driven into the arterial system. The arteries receive more blood than can escape through the capillary vessels, and the arterial side of the system becomes distended, until equilibrium is reached, and as much blood escapes into the venous side per unit of time as is delivered by the heart. The flow in the capillaries and veins has now become a constant one and if the side pressure be measured it will be found to fall from the arteries to the capillaries, and from the capillaries to the venae cavae. In the large arteries there is a large side pressure which rises and falls with the pulses of the heart. The pulse waves spread out over a wider and wider area as the arteries branch. They finally die away in the arterioles. An increase or decrease in the energy of the heart-beat will increase or decrease respectively the velocity of flow and pressure of the blood. An increase or decrease in the total width of the arterioles respectively will lessen or raise the resistance; increase or decrease the velocity; lower or raise the blood pressure. A loss of blood, other conditions remaining the same, would cause a decrease in pressure and velocity. As a matter of fact, such a loss is compensated for by the adjustability of the vascular system. Tissue lymph passes from the tissues into the blood, and the blood vessels of the limbs and abdomen constrict, and thus the pressure is kept up, and an efficient circulation maintained through the brain, lungs and coronary vessels of the heart.

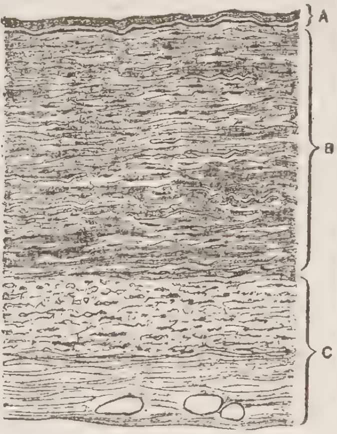
Structure of the blood vessels.

The whole vascular system is lined within by a layer of flattened cells, the *endothelium*; each cell is exceedingly thin and cemented to its fellows by a wavy border of an interstitial protoplasmic substance. The endothelium affords a smooth surface along which the blood can flow with ease. Outside it there exists in the arteries and veins a middle and an external coat. The middle coat varies greatly in thickness and contains most of the non-striated muscle-cells, which in the smaller arteries and arterioles form a particularly well developed band. In the larger arteries (fig. 19) a great deal of yellow elastic tissue, together with some white, fibrous tissue, pervades the middle coat. At the inner and outer border of this coat the elastic fibres fuse to form an internal and external fenestrated membrane. This coat endows the arteries with extensibility, elasticity and contractility. The outside coat consists mostly of white fibrous tissue and not only protects the arteries, but by its rigidity prevents over-distension. In the veins (fig. 20), where the middle coat is somewhat thinner and contains less elastic tissue, the outer coat consists mostly of muscle-fibres. The valves of the veins are formed of fibrous and elastic tissue covered with endothelium. As the arterioles branch into capillaries the muscular and elastic elements become less and less, until in the capillaries themselves there is left only the layer of endothelium, supported by some stellate connective tissue cells The capillaries form networks which accommodate themselves to the structure of the organs, *e.g.* longitudinal networks in muscle, loops in the papillae of the skin, close-meshed networks round the alveoli of glands, cells of liver, &c. In the liver the blood penetrates into the substance of the liver-cells. As the capillaries join together to form the vennules, muscle fibres again appear and coat the walls of the latter. The veins have a greater capacity than the arteries. Blood vessels, the vasa vasorum, supply the walls of the large vessels with nutrition.



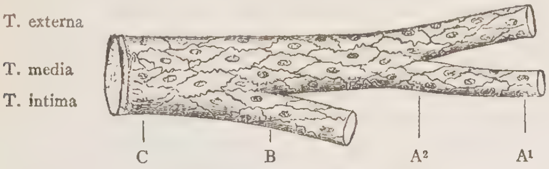
From Young and Robinson, Cunningham's *Text-Book of Anatomy.*

FIG. 19.—Transverse Section through the Wall of a Large Artery. A, tunica intima; B, tunica media; C, tunica externa.



From Young and Robinson, Cunningham's *Text-Book of Anatomy.*

FIG. 20.—Transverse Section of the Wall of a Vein. A, tunica intima; B, tunica media; C, tunica externa.



From Young and Robinson, Cunningham's *Text-Book of Anatomy.*

FIG. 21.—Structure of Blood Vessels (diagrammatic). A^1, capillary—with simple endothelial walls. A^2, larger capillary—with connective tissue sheath, "adventitia capillaris"; B, capillary arteriole—showing muscle cells of middle coat, few and scattered; C, artery—muscular elements of the tunica media forming a continuous layer.

The vaso-motor nerves end in a plexus of fibrils among the muscle-fibres. Ganglion cells occupy the larger nodes of the nerve plexus. The ends of a torn artery retract, coil up within the external coat and prevent haemorrhage. The arteries contract when mechanically irritated and remain contracted for a long time after excision. They tend to contract when submitted to increased blood pressure. The capillaries cannot contract of themselves, but their lumen can be widened or narrowed by the varying contractility or turgidity of the tissues in which they run.

The arteries successfully withstand elastic strain of the pulse 70 times a minute throughout the years of a long life. It has proved possible to stitch divided arteries and veins together so perfectly that the circulation can continue through them. A kidney has thus been successfully transplanted from one dog to another, and has continued to functionate normally.

The elastic coefficients of the several layers of the coat of an artery increase from within out, and thus great strength is obtained with the use of a small amount of material. Over-expansion of the arteries is checked by an external coat of inextensible connective tissue. The elasticity of a healthy artery is almost perfect, while the breaking strain is very great and far above that exerted by the blood pressure. The small arteries and arterioles are essentially muscular tubes, and can, under the influence of the central nervous system, vary considerably in diameter.

The pulse. By the expulsion of the blood at each systole the walls of the aorta are suddenly distended. From the aorta a wave of distension ripples down the walls of the arteries. This wave of distension is called the pulse. As the pulse is distributed over an ever-widening field its energy is expended and it disappears finally in the arterioles. From a wounded artery the blood flows out in pulses, from a wounded vein continuously. To stop the haemorrhage the ligature must be applied between the wound and the heart in the case of the artery, and between the peripheral parts and the wound in the case of the vein. The pulse travels about 20 times as fast as the blood flows in the arteries (7–8 metres per second). By feeling the pulse we can tell whether the heart-beat is frequent, quick, strong, regular, &c., and whether the wall of the artery is normal and the pressure in the arteries high or low. Frequency expresses the number per minute, quickness the duration of a single beat. The pulse is a most important guide to the physician. The pulse can be registered graphically by means of a sphygmograph. A lever rests on the radial artery and transmits the pulse to a system of levers which magnifies the movement and records it on a smoked surface moved by clockwork.

In such a record, or sphygmograph, the upstroke corresponds to systolic output of the left ventricle, marking the opening of the aortic valves, and the pouring of the blood into the arteries.

The downstroke represents the time during which the blood is flowing out of the arteries into the capillaries. There are subsidiary waves on the downstroke. The chief of these is called the dicrotic wave, the notch preceding which marks the closure of the semilunar valves. The dicrotic wave is caused by the jerk back of the blood towards the heart when the outflow ceases, and is most manifest when the systole is short and sharp and the output of blood from the arterioles rapid, in other words when the heart-beat is strong, the systolic pressure high and the diastolic pressure low. A smaller wave, predicrotic, preceding this occurs during the period of output and sometimes is placed on the ascending limb of the pulse curve. This occurs when the peripheral resistance is great, and the pulse is then termed anacrotic.

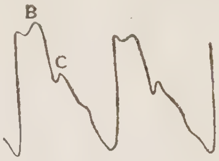


FIG. 22.— Anacrotic Pulse.

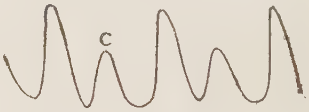
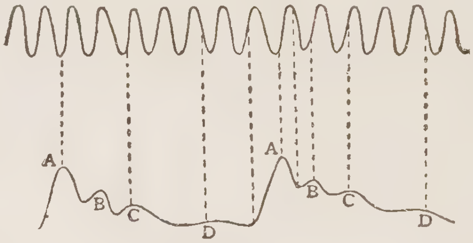


FIG. 23.—Dicrotic Pulse.



FIGS. 22, 23 and 24 from Allchin's *Manual of Medicine*, by permission of Macmillan & Co. Ltd.

FIG. 24.—Normal Pulse, and Time Tracing in $\frac{1}{10}$ sec.
A, Primary wave. C, Dicrotic wave.
B, Predicrotic wave. D, Post-dicrotic wave.

The form of these waves is modified by the pressure of application of the sphygmograph, and by instrumental errors; and we have no scale by which we can measure the blood pressure in sphygmograph tracings. To do this another instrument, the sphygmomanometer, is employed.

The pulse may pass through the arterioles and reach the capillaries when the arterioles are dilated or when the capillaries are only filled at each systole, as may be seen in the pink of the nail when the arm is held above the head, and in cases of aortic regurgitation.

A venous pulse may be recorded in the jugular vein; it exhibits oscillations synchronous with auricular and ventricular systole, and affords us important information in certain cases of heart disease. The normal average pulse rate is 72 per minute, in woman about 80; but individual variations from 40–100 have been observed consistent with health. In the newborn the pulse beats on the average 130–140 times a minute; in a one-year-old child 120–130; three years 100; ten years 90; fifteen years 70–75. Active muscular exercise may increase the pulse rate to 130. Nervous excitement, extreme debility and rise of body temperature also increase it markedly. The pulse is more frequent when one stands than when one sits, or lies down, and this is especially so in states of debility. The taking of food, especially hot food, increases it. By placing tambours on, say, the carotid and radial arteries and recording the two pulses synchronously, it has been found that the pulse occurs later, the further the seat of observation is from the heart. The velocity with which the pulse wave travels down the arteries has been determined thus. It is about 7–8 metres per second. The wave length of the pulse is obtained by multiplying the duration of the inflow of blood into the aorta by the velocity of the pulse wave. It is about 3 metres. As the return of venous blood and pulmonary circulation is favoured during inspiration so that the output of the left ventricle during the first part of inspiration is lessened and subsequently increased, the sphygmograph reveals respiratory oscillations; the whole line of the tracing falls during the first part of inspiration and rises subsequently.

The capillary circulation.

The circulation in the capillaries may be studied by placing under the microscope a transparent membrane such as the web of the frog's foot, tail of tadpole, wing of bat, &c. By a special illumination one may see the shadow of the blood corpuscles moving through the retinal vessels of one's own eye, and even calculate the velocity of flow. The diameter of the smaller capillaries is such as to permit the passage of the red blood corpuscles in single file only; their length is about $\frac{1}{50}$th of an inch. The endothelial cells confine the blood from direct contact with the tissue lymph and so prevent its coagulation, but allow and regulate the exchange of material between the blood and lymph. This exchange is regulated by the vital activity of the cells, and does not follow such laws as pertain to filtration and diffusion through dead membranes. There is evidence to show that the cells of the hepatic capillaries are capable of protoplasmic movement and of phagocytosis. The pressure in the capillaries stands in closer relationship to that in the veins than to that in the arteries; for example, a rise of pressure in the venae cavae, other things remaining the same, raises the pressure in the hepatic capillaries to a like amount, while a rise of pressure in the aorta does not, for most of the arterial pressure is spent in overcoming the peripheral resistance. The filling of the capillaries in the skin varies greatly with temperature, posture, &c. When the hand is cold the arterioles are so constricted that blood only passes through the wider and more direct capillaries. As the skin becomes warm it flushes, the arterioles dilating and all the capillary networks becoming filled with blood. Muscular movements express the blood out of the capillaries, as may be seen by the blanching of the skin which occurs on clenching the hand. Raising the hand blanches, and lowering it congests the capillaries. The pressure and velocity in the capillaries thus constantly vary, owing to alterations in hydrostatic pressure, the pressure of the body against external objects, the contraction of the muscles, and the contraction of the arterioles. It is not possible therefore to set any definite figure to the capillary pressure or velocity. In the frog's web, with the foot confined and at rest, the velocity is about 1 mm. per second. We continually make slight movements to counteract the hydrostatic effect and prevent the congestion of blood in the capillaries of lower parts of the body. It is this tendency to congestion which makes it so difficult to stand absolutely motionless for any length of time. The red corpuscles, being the heavier, occupy the axis, and the white corpuscles the peripheral layer of the capillary stream. If an irritant is placed on the membrane it will be observed that the capillaries become wider and crowded with corpuscles, the flow slackening and finally becoming arrested owing to the passing out of the plasma through the damaged capillary wall. The white corpuscles creep out between the endothelial cells into the tissues. Such are the first phenomena of inflammation. After obstruction of an artery collateral pathways are in most parts rapidly formed, for the anastomatic capillaries, stimulated by the increased blood flow, develop into arterioles and arteries.

The flow in the veins.

Numerous anastomoses exist between the veins, so that if the flow of blood be obstructed in one direction it readily finds a passage in another. Muscular movement, alterations of posture and respiratory movements particularly forward the venous circulation. The barber's pole of the barber surgeon was grasped to increase the flow in the old blood-letting days. The valves in the veins allow the blood to be forced only towards the heart. The pressure in the veins varies according to the hydrostatic pressure of the blood column above the point of measurement. In the horizontal position, when this factor is almost eliminated, the pressure in the large veins is about equal to 5–10 mm. of mercury, and even may become negative on taking a deep inspiration. There thus arises the danger of air being sucked into a wounded jugular vein. If air does thus gain entry it may fatally obstruct the circulation.

The venous circulation is impeded by (1) a lessening of heart power, (2) valvular defects, such as incompetence or narrowing of the orifice which they guard, (3) obstruction to the filling of the heart, as in cases of pericardial effusion, (4) obstruction of the pulmonary circulation as in coughing, by pleuritic effusion, &c. The results of venous congestion are a less efficient arterial circulation, a dusky appearance of the skin, a fall of cutaneous temperature, and an effusion of fluid into the tissue spaces producing oedema and dropsy. This last effect is not due to increased capillary pressure producing increased transudation as has been supposed, for no such increase in venous and capillary pressure persists under the conditions. It is due to the altered nutrition of the capillary endothelium and the tissues, which results from the deficient circulation.

If for any reason the left ventricle fail to maintain its full systolic output, it ceases to receive the full auricular input, and in consequence the pulmonary vessels congest. This tells back on the right heart, and the right ventricle is unable to empty itself into the congested pulmonary vessels, and this in its turn leads to venous congestion. The final result of any obstruction thus is a pooling of the blood in the venous cistern. Dyspnoea results from cardiac insufficiency. It is excited by the increased venosity of the blood acting on the respiratory centre. Both excess of carbon dioxide and deficiency of oxygen excite this centre. The increased respiratory movements aid the circulation.

Haemorrhage and transfusion.

The venous side of the vascular system, owing to the great size of the veins, has a large potential capacity, while many of the capillaries in each organ are empty and collapsed, except at those periods of vaso-dilatation and hyperaemia which accompany extreme activity of function. The vascular system cannot be regarded as a closed system, for the blood-plasma, whenever the capillary pressure is increased, transudes through the capillary wall into the tissue-spaces and enters the lymphatics. Thus, if fluid be transfused into the circulatory system, it not only collects in the capacious reservoirs of the veins and capillaries—especially in the lungs, liver and abdominal organs—but leaks into the tissue-spaces. Hence the pressure in the vascular system cannot be raised above the normal for any length of time by the injection of even enormous quantities of fluid. The lymphatics of tissue-spaces must be regarded as part of the vascular system. There is a constant give and take between the blood-plasma and the tissue lymph. If the fluid part of the blood be increased, then the capillary transudation becomes greater, and the excess of fluid is excreted from the kidneys and glands of the alimentary canal. If the fluid part of the blood diminish, then fluid passes from the tissue-spaces into the blood, and the sensation of thirst arises, and more drink is taken. The circulation may be greatly aided by the transfusion of salt solution (0·8 %) or blood after severe hemorrhage, or in states of surgical shock. Only the blood of man must be used. The direct giving of blood by connecting the radial artery of a relation to the median vein of a patient has been used as a means of effecting restoration. Blood may be withdrawn from the system slowly to the extent of 4 %, rapidly to the extent of 2 % of the bodyweight, without lowering the arterial pressure, owing to the compensatory contraction of the arterioles and the rapid absorption of fluid from the tissues into the blood. The withdrawal of the tissue-lymph excites extreme thirst and the great need for water which occurs after severe hemorrhage. About 75 % by weight of the tissues, excluding fat and bone, consists of water. The quantity of blood in the body is about $\frac{1}{20}$th of the body weight. That of tissue-lymph is unknown, but it must be considerable, probably greater than that of the blood. The lymphatics drain off the excess of fluid which transudes from the capillaries, and finally return it to the vascular system. The interchange between tissue, blood and lymph depends on the forces of the living cells, which are as yet far from complete elucidation.

The velocity of blood flow.

We may define the velocity of the blood at any point in a vessel as the length of the column of blood flowing by that point in a second. In the case of a tube, supplied by a constant head of pressure, we can divide the tube and measure the outflow per second; knowing the volume of this, and the cross area of the artery, we can determine the length of the column. This kind of experiment cannot be done on the living animal, because the opening of the vessel alters the resistance to flow, and the loss of blood also changes the physiological conditions. To determine the velocity other means must be devised. Ludwig invented an instrument called the stromuhr, consisting of two bulbs mounted on a rotating platform pierced with two holes. One bulb is filled with oil—the other with blood. The bulbs are connected together by a tube at their upper end, and the lower end of the one full of oil is brought over the hole in the platform. The central end of the artery is connected to the same hole and the peripheral end to the other, over which stands the bulb full of blood. The blood being allowed to flow displaces the oil out of the one bulb into the other; directly this happens, the bulbs are rotated and the one full of oil is again brought over the central end of the artery. The number of rotations per minute is counted, and the volume of the bulb being known we obtain the volume of blood that passes through the instrument per minute. In another instrument, the haemodromograph of Chauveau, there is inserted into the artery a ⊥ tube in which hangs a small pendulum; the stem of the pendulum passing through a rubber dam which closes the vertical limb of the tube. The pendulum is deflected by the flow, and the greater the velocity the greater the deflection. The deflection can be recorded by connecting the free end of the pendulum to a tambour arrangement. This instrument allows us to record and measure the variations of velocity during systole and diastole of the heart, but it can only be used in the vessels of large animals. Still other methods have been employed by Cybulski and Stewart. The general relations of the velocity of the blood in the arteries, capillaries and veins is expressed by the curve shown in fig. 26. The velocity in the large arteries may reach 500 mm. per second

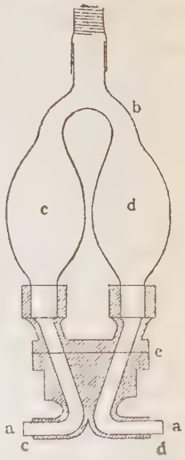


FIG. 25.—Ludwig's Stromuhr.

in systole and fall to 150 mm. in diastole. The smaller the artery the less is this difference and the more uniform the rate of flow.

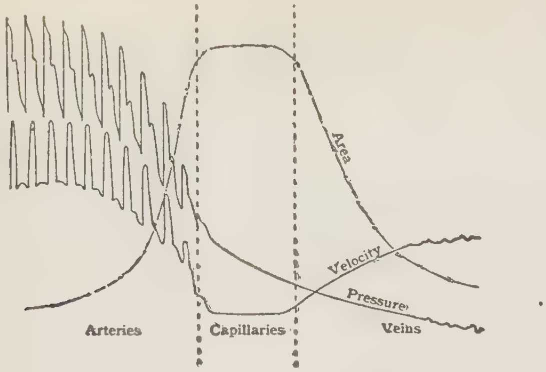


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Fig. 26.—Diagram showing General Relations of the Velocity of the Blood in the Arteries, Capillaries and Veins.

The flow in the large veins is approximately equal to that in the large arteries. In the jugular vein of a dog the mean velocity was found to be 225 mm. and in the carotid 260 mm. per second. The velocity in the capillaries has been measured by direct observation with the microscope. It is very small, *e.g.* 0·5–1 mm. per second. The variation of velocity in different parts of the vascular system is explained by the difference in width of bed through which the stream flows. The vascular system may be compared to a stream which on entering a field is led into a multitude of irrigation channels, the sum of the cross sections of all the channels being far greater than that of the stream. The channels unite together again and leave the field as one stream. If the flow proceeds uniformly for any given unit of time, the same volume must flow through any cross section of the system. Thus the greatest velocity is where the total bed is narrowest, and slowest where the bed widens to the dimensions of a lake.

The time necessary for a complete circulation.

The blood in leaving the heart may take a short circuit through the coronary system of the heart and so back to the right heart, or it may take a long and devious course to the toes and back, or through the intestinal capillaries, portal system and hepatic capillaries. It is obvious, then, that the time any two particles of blood take to complete the circuit may be widely different. Experiments have been made to determine how rapidly any substance, like a poison, which enters the blood may be distributed over the body. A salt such as potassium ferrocyanide is injected into the jugular vein, and the blood collected in successive samples at seconds of time from the opposite jugular vein. These samples are tested for the presence of the salt, or a strong solution of methylene blue is injected into the jugular vein, and the moment determined with a stop-watch when the blue colour appears in the carotid artery.

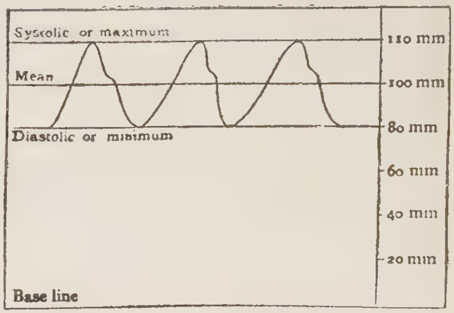
The velocity of flow also can be determined in any organ by injecting salt solution into an artery, and observing, with the aid of a Wheatstone's bridge arrangement, the galvanometric change in electrical resistance which occurs in the corresponding vein when the salt solution reaches it. The moment of injection and that of the alteration in resistance are observed with a stop-watch (Stewart).

It has been determined that the blood travelling fastest can complete the circuit in about the time occupied by 25 to 30 heart-beats, say in 20 to 30 seconds; a result which shows how rapidly methods must be taken to prevent the absorption of poisons—for example, snake-poison. The blood travelling fastest in the pulmonary circuit occupies only about one-fifth of the time spent by that in the systemic circuit. That some of the blood takes a very long time to return to the heart is shown by the long time it takes to wash the vascular system free of blood by the injection of salt solution.

The pressure relation in the vascular system.

That the blood is under different pressure in the various parts of the system has long been known. From a divided artery the blood flows out in forcible spurts, while from a vein it flows out continuously and with little force. It takes very little pressure of the fingers to blanch the capillaries of the skin, but an appreciable amount to obliterate the radial artery.

Stephen Hales (1733) was the first to measure the blood pressure. He inserted a brass tube into the femoral vein of a horse and connected it to a long glass tube held vertically, using the trachea of a goose as a flexible tube, and found the blood rose to the height of 8 ft., oscillated there with each heart-beat, and rose and fell somewhat with inspiration and expiration. In the vein he found the pressure to be only about 12 in. Poiseuille (1828) adapted to the same purpose the mercurial manometer, a U-shaped tube containing mercury, which, being 13·5 times heavier than blood, allowed the manometer to be brought to a convenient height. The introduction of rubber tubing for the connexions made the method of inquiry comparatively simple. The tubing connecting the arterial cannula and the manometer was filled with a suitable fluid to prevent coagulation of the blood; also to prevent more than a trace of blood entering the connexions. A saturated solution of sodium sulphate, or a 1% solution of sodium citrate, may be employed for this purpose. Ludwig (1847) added a float provided with a writing style to the mercurial manometer, and brought the style to write on a drum covered with smoked paper and driven slowly round by clockwork—a kymograph By this means tracings of the arterial blood pressure are obtained, and the influence upon the blood pressure of various agents recorded and studied. For the veins a manometer filled with salt solution is used, as mercury is too heavy a fluid to record the far slighter changes of venous pressure. The manometer may be connected with a recording tambour.



From Howell's *Text-Book of Physiology*, by permission of W. B. Saunders Co.

Fig. 27.—Diagram showing Systolic, Mean and Diastolic Pressure.

The arterial blood-pressure record obtained with the mercurial manometer exhibits cardiac and respiratory oscillations as shown in fig. 18. The method gives us a fairly accurate record of the mean pressure, but the mass of the mercury causes such inertia that the instrument is quite unable to faithfully record the systolic and diastolic variations of pressure. To effect this record, delicate spring manometers of rapid action and small inertia have been invented. A mercury manometer provided with maximum and minimum valves has also been employed to indicate the maximal systolic and minimal diastolic pressure. To determine the blood pressure in man, an instrument called the sphygmometer is used. The writer's sphygmometer consists of a rubber bag covered with silk which is filled with air, and connected by a short length of tube to a manometer. This manometer consists of a graduated glass tube, open at one end. A small hole is in the side of the tube near this end. A meniscus of water is introduced up to the side hole—the zero mark on the scale—by placing the open end of the tube in water. The bag is now connected to the gauge so that the side hole is closed by the rubber tube. Covering the rubber bag with the hand and pressing it on the radial artery until the pulse (felt beyond) is obliterated, one reads the height to which the meniscus rises in the manometer, and this gives us the systolic pressure in the artery. The air above the meniscus acts as a spring, converting the instrument into a spring manometer. It is empirically graduated in mm. Hg.

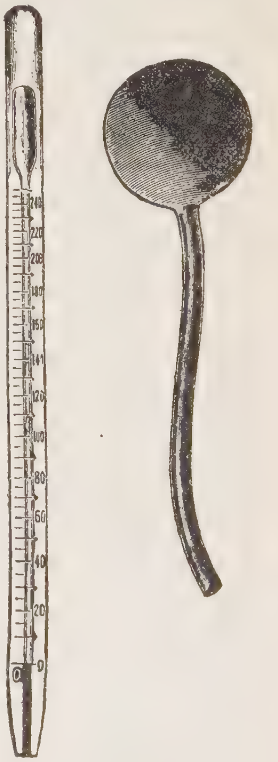


Fig. 28.—Hill's Sphygmometer.

It is very necessary to remember that the blood pressures, taken in different vessels and postures, vary with the hydrostatic pressure of the column of blood above the point of measurement. Thus in the standing posture the arterial pressure in the arteries of the leg is higher than in the arm by the height of the column of blood that separates the two points of measurement. In the horizontal posture the pressure is practically the same in all the big arteries. The pressure in the ascending aorta is kept about the same in all postures, while that of the leg arteries varies widely. The effect of gravity is compensated there by active changes in heart force, splanchnic dilatation, &c. (L. Hill). The systolic pressure of young men, taken in the radial artery with the arm at the same level as the heart, may be taken to be about 110 mm. of Hg. In men of 40–60 years the systolic pressure is often about 140 mm., but in some robust men it is no higher than in youth.

The venous pressure in man may be measured by finding the pressure just required to prevent a cutaneous vein refilling after it has been emptied beyond a valve. There is no accurate method of measuring the capillary pressure. It and the venous pressure constantly vary from nothing to a positive amount with rest or movement of muscles, change of posture, &c.

The arterial pressure is raised during exertion by the more forcible beat of the heart—*e.g.* pressures of 140–190 mm. Hg have been observed immediately after a 3-mile race. It rapidly sinks to a lower level than usual after the exertion is over, *e.g.* 90 mm. Hg, owing to the quieter action of the heart and the persistence of the cutaneous dilatation of the blood vessels which is evoked by the rise of body temperature. The writer has observed in athletes rectal temperatures of 102–105° F. after long races. After meals there is an increase in cardiac force to maintain the flow through the dilated splanchnic vessels. Mental excitement raises the pressure—*e.g.* the writer's pressure may be 110 mm. before and 125 mm. Hg after giving a lecture. The origin of the blood pressure in the arteries is the energy of the heart. The pressure gradient depends on the peripheral resistance. In the arterials the pressure is spent, and little of it reaches the capillaries. The return of the capillary blood to the veins and the pressure in the veins is due partly to the remainder of the cardiac force, but more largely to the contraction of the skeletal muscles and the viscera, to the action of gravity in changes of posture and to the respiratory pump.

The pulmonary circulation.

The pulmonary artery, carrying venous blood, divides and subdivides, and the smallest branches end in a plexus of capillaries on the walls of the air-cells of the lung. From this plexus the blood is drained by the radicles of the four pulmonary veins which open into the left auricle. The pressure in the pulmonary artery is less than one-third the aortic pressure, and the blood takes only one-third of the time to complete the pulmonary circuit that it takes to make the systemic. The four chief factors which influence the pulmonary circulation are: (1) the force and output of the right ventricle; (2) the diastolic filling action of the left auricle and ventricle; (3) the diameter of the pulmonary capillaries, which varies with the respiratory expansion of the lungs; (4) the intrathoracic pressure.

In inspiration the lungs are distended in consequence of the greater positive pressure on the inner surfaces being greater than the negative pressure on their outer pleural surfaces. The negative pressure in the intrathoracic cavity results from the enlargement of the thorax by the inspiratory muscles. When the elastic lungs are distended by a full inspiration they exert an elastic traction amounting to about 15 mm. Hg. The heart and vessels within the thorax are submitted to this traction—that is, to the pressure of the atmosphere minus 15 mm. Hg—while the vascular system of the rest of the body bears the full atmospheric pressure. The thin-walled auricles and veins yield more to this elastic traction than the thick-walled ventricles and arteries. Thus inspiration exerts a suction action, which furthers the filling of the veins and auricles. This action is assisted by the positive pressure exerted by the descending diaphragm on the contents of the abdomen. Blood is thus both pushed and sucked into the heart in increased amount during inspiration.

Experiment has shown that the blood vessels of the lungs when distended are wider than those of collapsed lungs. Suppose an elastic bag having minute tubes in its walls be dilated by blowing into it, the lumina of the tubes will be lessened, and the same occurs in the lungs if they are artificially inflated with air; but if the bag be placed in a glass bottle, and the pressure on its outer surface be diminished by removing air from the space between the bag and the side of the bottle, the bag will distend and the lumina of the tubes be increased. Thus it is evident that inspiration, by increasing the calibre of the pulmonary vessels, draws blood into the lungs, and the movements of the lungs become an effective force in carrying on the pulmonary circulation. It has been estimated that there is about one-twelfth of the whole blood quantum in the lungs during inspiration, and one-fifteenth during expiration. The great degree of distensibility of the pulmonary vessels allows of frequent adjustments being made, so that within wide limits as much blood in a given time will pass through the pulmonary as through the systemic system. The limits of their adjustment may, however, be exceeded during violent muscular exertion. The compressive action of the skeletal muscles returns the blood to the venous cistern, and if more arrives than can be transmitted through the lungs in a given time, the right heart becomes engorged, breathlessness occurs, and signs of venous congestion appear in the flushed face and turgid veins. The weaker the musculature of the heart the more likely is this to occur; hence the breathlessness on exertion which characterizes cardiac affections. The training of an athlete consists largely in developing and adjusting his heart to meet this strain. Similarly the weak heart may be trained and improved by carefully adjusted exercise. Rhythmic compression of the thorax is the proper method of resuscitation from suffocation, for this not only aerates the lungs, but produces a circulation of blood. By compressing the abdomen to fill the heart, and then compressing the thorax to empty it, the valves meanwhile directing the flow, a pressure of blood can be maintained in the aorta even when the heart has ceased to beat, and this if patiently continued may lead to renewal of the heart-beat. There is no certain evidence that the pulmonary arteries are controlled by vaso-motor nerves. In the intact animal it is difficult to determine whether a rise of pressure in the pulmonary artery is induced really by constriction of the pulmonary system, or by changes in the output of the heart; hence different observers have reached conflicting conclusions. In the case of lungs which have been supplied with an artificial circulation and a constant head of pressure to eliminate the action of the heart, no diminution in outflow has been observed in exciting the branches of the vagus or sympathetic nerves which supply the lungs, or by the injection of adrenalin (Sir Benjamin C. Brodie (1783–1862), and Dixon, Burton-Spitz).

The portal circulation.

The portal circulation is peculiar in that the blood passes through two sets of capillaries. Arterial blood is conveyed to the capillary networks of the stomach, spleen, pancreas and intestines by branches of the abdominal aorta. The portal vein is formed by the confluence of the mesenteric veins with the splenic vein, which together drain these capillaries. The portal blood breaks up into a second plexus of capillaries within the substance of the liver. The hepatic veins carry the blood from this plexus into the inferior vena cava. Ligation of the portal vein causes intense congestion of the abdominal vessels, and so distensile are these that they can hold nearly all the blood in the body: thus the arterial pressure quickly falls, and the animal dies just as if it had been bled to death. The portal circulation is largely maintained by the action of the respiratory pump, the peristaltic movements of the intestine and the rhythmic contractions of the spleen; these agencies help to drive the blood through the second set of capillaries in the liver. The systole of the heart may tell back on the liver and cause it to swell, for there are no valves between it and the inferior vena cava. Obstruction in the right heart or pulmonary circulation at once tells back on the liver. The increased respiration which results from muscular exercise greatly furthers the hepatic circulation, while it increases the consumption of food material. Thus exercise relieves the over-fed man. The liver is so vascular and extensile that it may hold one-quarter of the blood in the body.

The cerebral circulation.

The circulation of the brain is somewhat peculiar, since this organ is enclosed in a rigid bony covering. The limbs, glands and viscera can expand considerably when the blood pressure rises, but the expansion of the brain is confined. By the expression of venous blood from the veins and sinuses the brain can receive a larger supply of arterial blood at each pulse. Increase in arterial pressure increases the velocity of flow through the brain, the whole cerebral vascular system behaving like a system of rigid tubes when the limits of expansion have been reached. For as the pressure transmitted directly through the arteries to the capillary veins must always be greater than that transmitted through the elastic wall of the arteries to the brain tissue, the expansion of the arteries cannot obliterate the lumina of the veins. The pressure of the brain against the skull wall is circulatory in origin: in the infant's fontanelle the brain can be felt to pulse with each heart-beat and to expand with expiration. The expiratory impediment to the venous flow produces this expansion. A blood clot on the brain or depressed piece of bone raise the brain pressure by obliterating the capillaries in the compressed area and raising the pressure therein to the arterial pressure. The arterial supply to the brain by the two carotid and two vertebral arteries is so abundant, and so assured by the anastomosis of these vessels in the circle of Willis, that at least two of the arteries in the monkey can be tied without grave effect. Sudden compression of both carotids may render a man unconscious, but will not destroy life, for the centres of respiration, &c., are supplied by the vertebral arteries. The vertebral arteries in their passage to the brain are protected from compression by the cervical vertebrae.

Whether the muscular coat of the cerebral arteries is supplied with vaso-motor nerves is uncertain. Hürthle and others observed a rise of pressure in the peripheral end of the carotid artery on stimulating the cervical sympathetic nerve. The writer found this to be so only when the cervical sympathetic nerve was excited on the same side as the carotid pressure was recorded. If the circle of Willis was constricted, excitation of either nerve ought to have the effect; it is possible that the effect was produced by the vaso-constriction of the extra-cranial branches of the carotid. After establishing an artificial circulation of the brain Wiggins found that adding adrenalin to the nutritive fluid reduced the outflow, and it is supposed that adrenalin acts by stimulating the ends of the vaso-motor nerves, rather than by stimulating the muscular coats of the arteries. The veins of the pia and dura mater have no middle muscular coat and no valves. The venous blood emerges from the skull in man mainly through the opening of the lateral sinuses into the internal jugular vein; there are communications between the cavernous sinuses and the ophthalmic veins of the facial system, and with the venous plexuses of the spinal cord. The points of emergence of the veins are well protected from closure by compression. The brain can regulate its own blood supply by means of the cardiac and vaso-motor centres. Deficient supply to these centres excites increased frequency of the heart and constriction of the arteries, especially those of the great splanchnic area. Cerebral excitement has the same effect, so that the active brain is assured of a greater blood supply (Bayliss and L. Hill).

The circulation during muscular activity.

In each unit of time the same quantity of blood must, on the average, flow through the lesser and greater circuit, for otherwise the circulation would not continue. Likewise, the average velocity at any part of the vascular system must be inversely proportional to the total cross-section at that part. In other words, where the bed is wider, the stream is slower; the total sectional area of the capillaries is roughly estimated to be 700 times greater than that of the aorta or venae cavae. Any general change in velocity at any section of this circuit tells both backwards and forwards on the velocity in all other sections, for the average velocity in the arteries, veins and capillaries, these vessels being taken respectively as a whole, depends always on the relative areas of their total cross-sections.

The vascular system is especially constructed so that considerable changes of pressure may be brought about in the arterial section, without any (or scarcely any) alteration of the pressures in the venous or pulmonary sections of the circulatory system. A high-pressure main (the arteries) runs to all the organs, and this is supplied with taps; for by means of the vaso-motor nerves which control the diameter of the arterioles, the stream can be turned on here or there, and any part flushed with the blood, while the supply to the remaining parts is kept under control. Normally, the sum of the resistances which at any moment opposes the outflow through the capillaries is maintained at the same value, for the vascular system is so co-ordinated by the nervous system that dilatation of the arterioles in any one organ is compensated for by constriction in another. Thus the arterial pressure remains constant, except at times of great activity. The great splanchnic area of arterioles acts as "the resistance box" of the arterial system. By the constriction of these arterioles during mental or muscular activity the blood current is switched off the abdominal organs on to the brain and muscles, while by dilating during rest and digestion they produce the contrary effect. The constriction of the splanchnic vessels does not sensibly diminish the capacity of the total vascular system, for the veins possess little elasticity. Thus variations of arterial pressure, brought about by constriction or dilatation of the arterial system, produce little or no effect on the pressure in the great veins or pulmonary circuit. The contraction of the abdominal muscles, on the other hand, greatly influences the diastolic or filling pressure of the heart. It is obviously of the utmost importance that the heart should not be over-dilated by an increased filling pressure during the period of diastole.

When a man strains to lift a heavy weight he closes the glottis, and by contracting the muscles which are attached to the thorax raises the intrathoracic pressure. The rise of intrathoracic pressure aids the pericardium in supporting the heart, and prevents over-dilatation by resisting the increase in venous blood pressure. This increase results from the powerful and sustained contraction of the abdominal and other skeletal muscles. In the diagram already given it is clear that the contraction of T will counteract the contraction of A. At the same time the rise of intrathoracic pressure supports the lungs, and prevents the blood, driven out from the veins, from congesting within the pulmonary vessels. Over-dilatation both of the heart and lungs being thus prevented, the blood expressed from the abdomen is driven through the lungs into the left ventricle, and so into the arteries. So long as the general and intense muscular spasms continue, there is increased resistance to the outflow of the blood through the capillaries both of the abdominal viscera and the limbs. The arterial pressure rises, therefore, and the flow of blood to the central nervous system is increased. The rise of the intrathoracic and intra-abdominal pressures, and the sustained contraction of the skeletal muscles, alike hinder the return of venous blood from the capillaries to the heart, and, owing to this, the face and limbs become congested until the veins stand out as knotted cords. It is obvious that at this stage the total capacity of the vascular system is greatly diminished, and the pressure in all parts of the system is raised. It is during such a muscular effort that a degenerated vessel in the brain is prone to rupture and occasion apoplexy. The venous obstruction quickly leads to diminished diastolic filling of the heart, and to such a decreased velocity of blood flow that the effort is terminated by the lack of oxygen in the brain. During any violent exercise, such as running, the skeletal muscles alternately contract and expand, and the full flood of the circulation flows through the locomotor organs. The stroke of the heart is then both more energetic and more frequent, and the blood circulates with increased velocity. Under these conditions the filling of the heart is maintained by the pumping action of the skeletal and respiratory muscles. The abdominal wall is tonically contracted, and the reserve of blood is driven from the splanchnic vessels to fill the dilated vessels of the locomotor organs. The thorax is tonically elevated and the thoracic cavity enlarged, so that the pulmonary vessels are dilated. At each respiration the pressure within the thoracic cavity becomes less than that of the atmosphere, and the blood is aspirated from the veins into the right side of the heart and lungs; conversely, at each expiration the thoracic pressure increases, and the blood is expressed from the lungs into the left side of the heart. While the respiratory pump at all times renders important aid to the circulation of the blood, its action becomes of supreme importance during such an exercise as running. The runner pants for breath, and this not only increases the intake of oxygen, but maintains the diastolic filling of the heart. It is of the utmost importance that man should grasp the fact that the circulation of the blood depends not only on the heart, but on the vigour of the respiration and the activity of the skeletal muscles. Muscular exercise is for this reason a *sine quâ non* for the maintenance of vigorous mental and bodily health. Under the influence of the muscular system comes not only the blood but the lymph. The lymphatics form a subsidiary system of small valved vessels, and drain the tissues of the excess of lymph, which transudes from the capillaries of the organs during functional activity, or in consequence of venous obstruction. The larger lymphatics open into the veins at the root of the neck. It is chiefly by the compressive action of the skeletal and visceral muscles, and the aspirating action of the respiratory pump, that the lymph is propelled onwards. It must be borne in mind that the descent of the diaphragm during inspiration compresses the abdominal organs, and thus aids the aspirating action of the thorax in furthering the return to the heart both of venous blood and of lymph.

Influence of posture on the circulation.

The circulation remains efficient not only in the horizontal but also in the erect position, and just as much so when a man, like a gymnast, is ceaselessly shifting the position of his body. Yet in a man standing six feet the hydrostatic pressure of a column of blood reaching from the vertex to the soles of the feet is equal to 14 cm. of mercury. The blood, owing to its weight, continually presses downwards, and under the influence of gravity would sink if the veins and capillaries of the lower parts were sufficiently extensile to contain it. Such is actually the case in the snake or eel, for the heart empties so soon as one of these animals is immobilized in the vertical posture. This does not occur in an eel or snake immersed in water, for the hydrostatic pressure of the column of water outside balances that of the blood within. During the evolution of man there have been developed special mechanisms by which the determination of the blood to the lower parts is prevented, and the assumption of the erect posture rendered possible. The pericardium is suspended above by the deep cervical fascia, while below it is attached to the central tendon of the diaphragm. Almost all displacement of the heart is thus prevented. The pericardium supports the right heart when the weight of a long column of venous blood suddenly bears upon it, as, for example, when a man stands on his head. The abdominal viscera are slung upwards to the spine, while below they are supported by the pelvic basin and the wall of the abdomen, the muscles of which are arranged so as to act as a natural waist-band. In tame hutch rabbits, with large patulous abdomens, death may result in from 15 to 30 minutes if the animals are suspended and immobilized in the erect posture, for the circulation through the brain ceases and the heart soon becomes emptied of blood. If, however, the capacious veins of the abdomen be confined by an abdominal bandage, no such result occurs. Man is naturally provided with an efficient abdominal belt, although this in many is rendered toneless by neglect of exercise and gross or indolent living. The splanchnic arterioles are maintained in tonic contraction by the vaso-motor centre, and thus the flow of blood to the abdominal viscera is confined within due limits. The veins of the limbs are broken into short segments by valves, and these support the weight of the blood in the erect posture. The brain is confined within the rigid wall of the skull, and by this wall are the cerebral vessels supported and confined when the pressure is increased by the head-down posture. Every contraction of the skeletal muscles compresses the veins of the body and limbs, for these are confined beneath the taut and elastic skin. The pressure of the body against external objects has a like result. Guided by the valves of the veins, the blood is by such means continually driven upwards into the venae cavae. If the reader hangs one arm motionless, until the veins at the back of the hand become congested, and then either elevates the limb or forcibly clenches the fist, he will recognize the enormous influence which muscular exercise, and continual change of posture, has on the return of blood to the heart. It becomes wearisome and soon impossible for a man to stand motionless. When a man is crucified—that is to say, immobilized in the erect posture—the blood slowly sinks to the most dependent parts, oedema and thirst result, and finally death from cerebral anaemia ensues. In man, standing erect, the heart is situated above its chief reservoir—the abdominal veins. The blood is raised by the action of the respiratory movements, which act both as a suction and as a force pump, for the blood is not only aspirated into the right ventricle by the expansion of the thoracic cavity, but is expressed from the abdomen by the descent of the diaphragm. When a man faints from fear, his muscular system is relaxed and respiration inhibited. The blood in consequence sinks into the abdomen, the face blanches and the heart fails to fill. He is resuscitated either by compression of the abdomen, or by being placed in the head-down posture. To prevent faintness and drive the blood-stream to his brain and muscles, a soldier tightens his belt before entering into action. Similarly, men and women with lax abdominal wall and toneless muscles take refuge in the wearing of abdominal belts, and find comfort in prolonged immersion in baths. It would be more rational if they practised rope-hauling, and, like fishermen, hardened their abdominal muscles.

Foetal. In the mature foetus the fluid brought from the placenta by the umbilical vein is partly conveyed at once to the vena cava ascendens by means of the *ductus venosus* and partly flows through two trunks that unite with the portal vein, returning the blood from the intestines into the substance of the liver, thence to be carried back to the vena cava by the hepatic vein. Having thus been transmitted through the placenta and the liver, the blood that enters the vena cava is purely arterial in character; but, being mixed in the vessels with the venous blood returned from the trunk and lower extremities, it loses this character in some degree by the time that it reaches the heart. In the right auricle, which it then enters, it would also be mixed with the venous blood brought down from the head and upper extremities by the descending vena cava were it not that a provision exists to impede (if it does not entirely prevent) any further admixture. This consists in the arrangement of the Eustachian valve, which directs the arterial current (that flows upwards through the ascending vena cava) into the left side of the heart, through the foramen ovale—an opening in the septum between the auricles—whilst it directs the venous current (that is being returned by the superior vena cava) into the right ventricle. When the ventricles contract, the arterial blood contained in the left is propelled into the ascending aorta, and supplies the branches that proceed to the head and upper extremities before it undergoes any further admixture, whilst the venous blood contained in the right ventricle is forced into the pulmonary artery, and thence through the *ductus arteriosus*—branching off from the pulmonary artery before it passes to the two lungs—into the descending aorta, mingling with the arterial currents which that vessel previously conveyed, and thus supplying the trunk and lower extremities with a mixed fluid. A portion of this is conveyed by the umbilical arteries to the placenta, in which it undergoes the renovating influence of the maternal blood, and from which it is returned in a state of purity. In consequence of this arrangement the head and upper extremities are supplied with pure blood returning from the placenta, whilst the rest of the body receives blood which is partly venous. This is probably the explanation of the fact that the head and upper extremities are most developed, and from their weight occupy the inferior position in the uterus. At birth the course of the circulation undergoes changes. As soon as the lungs are distended by the first inspiration, a portion of the blood of the pulmonary artery is diverted into them and undergoes aeration; and, as this portion increases with the full activity of the lungs, the ductus arteriosus gradually shrinks, and its cavity finally becomes obliterated. At the same time the foramen ovale is closed by a valvular fold, and thus the direct communication between the two auricles is cut off. When these changes have been accomplished, the circulation, which was before carried on upon the plan of that of the higher reptiles, becomes that of the complete warm-blooded animal, all the blood which has been returned in a venous state to the right side of the heart being transmitted through the lungs before it can reach the left side or be propelled from its arterial trunks. After birth the umbilical arteries shrink and close up and become the lateral ligaments of the bladder, while their upper parts remain as the superior vesical arteries. The umbilical vein becomes the ligamentum teres. The ductus venosus also shrinks and finally is closed. The foramen ovale is also closed, and the ductus arteriosus shrivels and becomes the ligamentum arteriosum.

The vaso-motor nerves. The blood vessels are supplied with constrictor and dilator nerve fibres which regulate the size of the vascular bed and the distribution of the blood to the various organs. The arteries may be compared to a high pressure main supplying a town. By means of the vaso-motor nerves the arterioles (the house taps) can be opened or closed and the current switched on to or off any organ according to its functional needs. If all the arterioles be dilated at one and the same time, the aortic pressure falls, and the blood taking the pathways of least resistance, gravitates to the most dependent parts of the vascular system, just as if all the taps in a town were opened at once the pressure in the main would fail, and only the taps in the lower parts of the town would receive a supply. The discovery of the vaso-motor nerves is due to Claude Bernard (1851). He discovered that by section of the cervical sympathetic nerve he could make the ear of a rabbit flush, while by stimulation of this nerve he could make it blanch. Claude Bernard had the good fortune to make the further discovery that stimulation of certain nerves, such as the chorda tympani supplying the salivary gland, produces an active dilatation of the blood vessels. The vaso-constrictor fibres issue in the anterior spinal roots, from the second thoracic to the second lumbar root, and pass to the sympathetic chain of ganglia. The fibres are of small diameter, and probably arise from cells situated in the lateral horn of the grey matter of the spinal cord. They each have a cell station in one other ganglion and proceed as post-ganglionic fibres to the cervical sympathetic, to the mesenteric nerves and to the nerves of the limbs. Nicotine paralyses ganglion cells, and by applying this test to the various ganglia the cell stations of the vaso-constrictor fibres supplying each organ have been mapped out. The vaso-dilator fibres have not so restricted an origin, for they issue in the efferent roots in all parts of the neural axis. The two kinds of nerves, although antagonistic in action, end in the same terminal plexus which surrounds the vessels. The presence of vaso-dilator fibres in the common nerve trunks is masked, on excitation, by the overpowering action of the vaso-constrictor nerves. The latter are, however, more rapidly fatigued than the former, and by this and other means the presence of vaso-dilator fibres can be demonstrated in almost all parts of the body. The nervi-erigentes to the penis and the chorda tympani supplying the salivary glands are the most striking examples of vaso-dilator nerves. The vaso-dilator nerves for the limbs issue in the posterior spinal roots (Bayliss). The posterior roots contain the afferent nerves (touch, pain, &c.). Excitation of these fibres causes reflexly a rise of blood pressure directly, a vaso-dilatation of the part the nerves supply. Thus it is assured that the irritated or injured part receives immediately a greater supply of blood. The vaso-motor centre exerts a tonic influence over the calibre of the arterial and portal systems.

Much labour has been done since to determine the origin and exact distribution of the vaso-motor nerves to the various organs, and the reflex conditions under which they come normally into action, and, as the fruit, our knowledge of these inquiries has come to a condition of considerable exactness. This knowledge is of great practical importance to the physician, and it is worth noting that it has been obtained entirely by experiment on living but anaesthetized animals. No dissections of the dead animal could have informed us of the vaso-motor nerves. Vaso-motor effects can be studied by (1) inspection of the flushing or blanching of an organ; (2) measuring the venous outflow; (3) recording the pressure in the artery going to and the vein leaving the organ; (4) observations on the volume of an organ. To make these observations, the organ is enclosed in a suitable air-tight box or plethysmograph, an opening being contrived for the vessels of the organ to pass through so that the circulation may continue. The box is filled with air or water and is connected with a recording tambour (see fig. 18).

The chief effects of vaso-constriction are an increased resistance and lessened flow through the organ, diminished volume and tension of the organ, the venous blood issues from it darker in colour and the pressure rises in the artery and falls in the vein of the organ, and its temperature sinks. Lastly, if a large area be constricted the general arterial pressure rises.

The centre is situated in the spinal bulb beneath the middle of the floor of the fourth ventricle. The tone of the vascular system is not disturbed when the great brain and mid brain is destroyed as far as the region of the pons Varolii, but as soon as the spinal bulb is injured or destroyed the arterial pressure falls very greatly, and the animal passes into the condition of surgical shock if kept alive by artificial respiration. Painting the floor of the fourth ventricle with a local anaesthetic, *e.g.* cocaine, has the same lowering effect on the blood pressure. Division of the cervical spinal cord or of the splanchnic nerves lowers the blood pressure greatly. The one lesion cuts off the whole body, the other the abdominal organs from the tonic influence of the centre. The fall of pressure is due almost entirely to the pooling of the blood in the portal veins and vena cava inferior. On the other hand, electrical excitation of the lower end of the divided cord or splanchnic nerves raises the pressure by restoring the vascular tone. If an animal be kept alive after division of the spinal cord in the lower cervical region, as it may be, for the phrenics, the chief motor nerves of respiration, come off above this region, it is found that the vascular tone after a time becomes restored and the condition of shock passes away. By no second section of the spinal cord can the general condition of shock be reproduced, but a total obstruction of the cord once more causes a general loss of the vascular tone. From the experimental result, so obtained, it is argued that subsidiary vaso-motor centres exist in the spinal cord, and there is evidence to show that these centres may be excited reflexly. After the lumbar cord has been destroyed the tone of the vessels of the lower limbs is recovered in the course of a few days. In this case the recovery is attributed to the ganglionic and nervous structures which are intercalated between the spinal cord and the muscular walls of the blood vessels. There are thus three mechanisms of control, the bulbar centre influenced particularly by the visual, auditory and vestibular nerves, the spinal centres and the peripheral ganglionic structures.

The vaso-motor centre is reflexly excited by the afferent nerves, and its ever-varying tonic action is made up of the balance of the "pressor" and "depressor" influences which thus reach it, and from the quality of the blood which circulates through it. Pressor effects, *i.e.* those causing increased constriction and rise of arterial pressure, may be produced by stimulating the central end of almost any afferent nerve, and especially that of a cutaneous nerve. Depressor effects are always obtained by stimulating the depressor nerve, and may be obtained by stimulating the afferent nerves under special conditions. That these reflex vaso-motor effects frequently occur is shown by the blush of shame, the blanching of the face by fear, the blanching of the skin by exposure to cold and the flushing which is produced by heat. The rabbit's ear blanches if its feet are put into cold water. The vaso-motor mechanism is one of the most important of those mechanisms which control the body heat. Stimulation of the nasal mucous membrane causes flushing of the vessels of the head, constriction elsewhere and a rise of arterial pressure. Food in the mouth, or even the sight or smell of food, cause dilatation of the vessels of the salivary gland. The mucous membrane of the air passages flush and secrete more actively when a draught of cold air strikes the skin. Ice placed on the abdomen constricts not only the vessels in the skin but those in the kidney. Many other examples might be given of the control which the vaso-motor system exerts, but the above are sufficient to suggest the influence which the physician can bring to bear on the blood supply of the various organs.

Discussion has taken place as to whether depressor reflexes are brought about by lessening of the vaso-constrictor tone or by excitation of vaso-dilator nerves. Proof of an undoubtable character seems to have been produced that after division of the vaso-constrictor nerves dilatation of a limb can be brought about reflexly by stimulating the depressor nerve, and in this case the effect must be produced by active excitation of the vaso-dilator nerves.

Under certain unusual conditions, *e.g.* deficient supply of oxygen, the vaso-motor centre exhibits rhythmical variations in tonicity which make themselves visible as rhythmical rises and falls of arterial pressure of slow tempo. A waxing and waning of respiration (Cheyne-Stokes breathing) frequently accompanies these waves. Such are observed in sleep, especially in children and in hibernating animals.

BIBLIOGRAPHY.—References to all the authoritative papers up to 1892 on the circulation of the blood will be found in Tigerstedt's *Lehrbuch der Physiologie des Kreislaufs*, and up to 1905–1908 in the articles on the circulation published in Nagel's *Handbuch der Physiologie des Menschen*, viz. "Allgemeine Physiologie des Herzens, Die Innervation der Kreislaufsorgane," by F. B. Hofmann, "Die Mechanik der Kreislaufsorgane," by O. Frank. An elementary introduction to the subject will be found in Leonard Hill's *Manual of Physiology*, and a more extensive treatment of it in the same author's article on the "Mechanism of the Circulation," and Gaskell's article on the "Heart" in Schäfer's *Text-Book of Physiology*, or in one of the larger text-books of physiology, such as that of Howell, Stewart Halliburton or Starling. (L. E. H.)

IV. PATHOLOGY OF THE VASCULAR SYSTEM

On account of its intimate relations with every part of the body, the circulation is prone to disturbances arising from a great series of causes. Some of these produce effects which may be regarded as functional—mere changes in metabolism, whose disturbances react upon the rest of the body; others give rise to definite structural alterations. In considering the pathology of the circulation, it is useful to divide it into that of the heart, that of the blood vessels and that of the blood.

The heart.

The heart is liable to changes in the pericardium, malformations, changes in the myocardium, changes in the endocardium, valvular lesions and functional disorders.

(1) *The pericardium* may become the seat of morbid changes in various cardiac enlargements, it may become stretched or distended; but the most common and important of the changes is an inflammatory one, *i.e. pericarditis.* This may arise by way of the blood stream, as in rheumatism, scarlatina and other infective diseases, or by way of the lymph stream. The micro-organisms chiefly responsible for the production of pericarditis are the pneumococcus, the different varieties of streptococci and staphylococci, the bacillus tuberculosis, the bacillus coli, and sometimes the gonococcus. In the acute form of the disease the shining serous membrane becomes first dull and lustreless, the blood vessels engorged and an exudation of serum takes place; then fibrin is deposited both on the visceral and parietal layers. When the fluid is insufficient to keep the surfaces apart, the separation at each diastole gives rise to the well-known "friction rub." Sometimes the amount of exudation pent up in the pericardial sac is so great as to necessitate its being drawn off. The fluid may be serous or sero-fibrinous, or may be haemorrhagic, or have undergone a putrefactive change. An effusion of serous fluid into the pericardial sac causes considerable embarrassment to the course of the blood, by rendering the negative pressure, normally present in the sac, positive. The reason for the interference with the circulation brought about by this alteration of pressure is that the auricles are by compression rendered incapable of accommodating the blood-return from the veins. Analogous effects are produced by pressure upon the heart from without, whether by aneurysm or tumour, and pleural effusion or pneumothorax, affecting the viscera from without. In pericarditis it has further to be remembered that the effect of the process itself upon the muscle fibres lying beneath the membrane is to cause a softening of texture and weakening of function, whereby the driving power of the heart is diminished. In obliteration of the pericardium, again, the presence of the adhesions between these two layers leads to interference with the contraction of the myocardium, whereby its functions are interfered with. Acute ventricular dilatation may be associated with pericarditis particularly when the latter is of rheumatic origin and is the result of the myocardial softening referred to. Pericardial effusions usually undergo absorption, but various adhesions, and thickenings known as "white spots," may remain. Effusions other than inflammatory are found in the pericardium, *i.e. hydropericardium*, a dropsical accumulation, may be mistaken for an inflammatory one. It occurs in scarlatina, Bright's disease, as part of a general dropsy, or occasionally from some mechanical difficulty interfering with the local circulation. When the fluid is abundant, it may produce the effects noticed under the inflammatory effusion, and the pericardium may become soddened and its endothelium degenerated. *Haemopericardium*, or blood in the pericardium, may occur apart from the amount that may be mixed with inflammatory effusions. It is associated with foreign bodies penetrating from the oesophagus, rupture of an aneurysm, or occasionally associated with scurvy and purpura. Gas and air may sometimes distend the pericardium. It is also liable to new growths, which are usually secondary in character, and tuberculosis and hydatids are sometimes found.

(2) *Malformations.*—We are ignorant of the causes which lead to imperfect development of the heart. Many of its malformations are of purely pathological interest, but others, such as deficiencies of the intraventricular septum, non-closure of the foramen ovale, patency of the ductus arteriosus, or malformations of the valves, produce a series of secondary effects resultant on the deficient aeration of the blood and sluggishness of the circulation and of venous congestion. The train of symptoms is similar to those mentioned below under acquired valvular lesions, but dropsy is very rare.

(3) *The Myocardium.*—The coverings of the heart muscle cannot long be diseased without affecting the contractile substance itself. Any morbid changes in the lung tissues which impede the circulation through them, and more particularly emphysema, lead to change in the substance of the right ventricle, while morbid changes in the systemic arteries lead to changes in the left ventricle. In *hypertrophy* we have an increase of substance. Tangl found by direct measurement that the muscle cells are increased in diameter. The hypertrophy may be due to increased work thrown upon the muscle, as in athletics (idiopathic hypertrophy), or may be compensatory, when the muscle is trying to overcome a circulatory defect, as in valvular stenosis or regurgitation. Hypertrophy, when within physiological limits, is to be considered as a means of adaptation. When occurring in pathological circumstances, it must be regarded as a method of compensation. Every structure and every function in a healthy body has greater or lesser reserve of energy. In healthy conditions the ordinary demands made upon various organs are far below their possible responses, and if these be excessive in extent or duration, the organs adapt themselves to the conditions imposed on them. In abnormal circumstances the process of hypertrophy is brought about by the power which the structures have of responding to the demands made upon them; and so long as the process is adequate, all disturbances may be averted. As an example of such readjustment may be cited the fact that in chronic renal cirrhosis, with increased thickness of the middle tunic of the arteries, there is hypertrophy of the left ventricle.

Dilatation of the heart is due to the inability of the heart muscle to expel the contents of its cavities. It may occur from temporary overstress or in the failing compensation of valvular disease, or may accompany pathological changes in the muscle such as myocarditis or one of the degenerations.

From the presence of toxic substances in the blood (whether introduced from without or arising within the body) the cells of the cardiac muscle fibres are apt to undergo what is termed *cloudy swelling*—the simplest form of degenerative process. The cells become larger and duller, with a granular appearance, and the nuclei are less distinct. As a result of interference with nutrition, whether by simple diminution or perverted processes, *fatty degeneration* ensues. It may be associated, but is not necessarily connected, with adipose accumulation and encroachment commonly termed infiltration. In true fatty degeneration the muscle cells have part of their protoplasm converted into adipose tissue. The fibres become granular, and the cells lose their definition, while the nuclei are obscure.

The myocardium undergoes both acute and chronic reaction changes. In the former there is enlargement of the nuclei, with proliferation but without karyokinesis. The muscle cells become swollen and lose their striation, while they are softer in texture and altered in outline. The intermuscular tissues are swollen, and may be invaded by leucocytes; this may end in abscess formation or in the production of newly formed fibrous tissue. Chronic processes affecting the myocardium give rise to a large amount of fibrosis, and the newly formed fibrous tissue separates and compresses the areas of muscle fibres, giving rise to what is commonly known as chronic interstitial myocarditis.

Restitution or recovery may occur to a varying extent in almost all of the disease-processes which have been considered, but it has to be kept in view that in certain of the degenerative affections there is little if any possibility of getting rid of the results of the process, which in the reactive changes terminating in the formation of much fibrous tissue, or its conversion into adipose or calcareous material, the same holds true. Many of the changes, which are no doubt in their essence conservative, lead to far-reaching consequences, by their interference with nutritive possibilities.

Diseased conditions of the myocardium are frequently associated with atheromatous degenerations of the coronary arteries, and angina pectoris is said to depend upon such state of malnutrition.

The causes which operate by means of the myocardium are almost invariably of a secondary character. The various degenerations already detailed, and the different forms of myocarditis, as well as simple debility of the muscle, are all examples of changes due to general or local disturbance. All processes which directly or indirectly interfere with the energy of the walls of the heart produce twofold effects, by diminishing the aspiratory or suction-pump action during diastole, and by lessening its expulsive or force-pump action during systole. The immediate result upon the heart itself of such disturbances is dilatation of that cavity immediately affected. This may occur under perfectly healthy conditions. In these, however, the dilatation is evanescent, while in the circumstances now under consideration it is permanent, and, although compensated, it leads to persistent dilatation. Upon the blood vessels the result, whether on account of diminished aspiratory or propulsive energy, is that the amount of blood in the arterial system is decreased, while it is increased in the venous. It is not a necessary consequence that because there is less blood in the arteries the arterial pressure will be diminished, or the venous pressure increased because the veins contain more than their normal amount of blood, seeing that the blood pressure depends upon many different factors. It is a fact, nevertheless, that in consequence of the alteration in the relative amount of blood in the arteries and veins there is a considerable disturbance of blood pressure. Gravitation may overcome the contractile and elastic factors, and several consequences arise from the resulting venous engorgement. From transudation, oedema of the dependent parts of the body and the serous membranes occurs. From the sluggish nature of the current, the blood absorbs too much carbonic acid and loses too much oxygen, hence cyanosis is the result. On account, also, of the slowness of the circulation, there is a longer period for radiation of heat, and the superficial parts of the body accordingly become cold.

The engorgement of internal organs leads to distinct changes in them. The solid viscera, such as the liver, the spleen, the kidney and the lung, become enlarged and hyperaemic, and if the disturbance be continued, cyanotic atrophy ensues. Change in structure, with loss of function, takes place from blocking of the vessels by blood-clot, whether due to coagulation on the spot, or by the conveyance thither of clots formed elsewhere; a cirrhotic termination also is not infrequent, although there is still some doubt whether in this latter condition other concomitant causes have not at the same time been operative. The brain, although suffering less from hyperaemia, is subject to disturbance of the circulation through it, while it is a common seat of embolic and thrombotic processes. The heart itself, lastly, suffers in consequence of the disturbed circulation through it, and by undergoing venous stasis, with weakening of its walls and increase of its fibrous tissue, it completes the final link in a vicious circle. Effusion into the serous sacs, such as the pleura, the pericardium and the peritoneum, leads to great disturbance of the viscera with which they are connected. The mucous membranes, both respiratory and digestive, become the seat of catarrhal changes in consequence of the backward pressure and impure blood.

(4) *Changes in the Endocardium.*—In *endocarditis*, or inflammation of the lining membrane of the heart, that portion of the membrane which covers the valves is invariably affected first. Two varieties of endocarditis are described, simple and infective or ulcerative, but it is difficult to separate them pathologically. Both result from poisoning of the membrane by micro-organisms and their toxins; the main difference seems to lie in the variety of micro-organism present. Simple endocarditis may be associated with a variety of diseases, acute rheumatism and scarlet fever being the most frequent. In many fatal cases of chorea associated with endocarditis the micrococcus rheumaticus has been found in the endocardium, while the streptococci present in tonsilitis have produced endocarditis in animals. The membrane covering the valves loses its smoothness, granulations or elevations forming on the free edges; then the endothelium proliferates and is destroyed and fibrin becomes deposited, producing what is termed a "vegetation." In the lower layers of this vegetation micro-organisms can be demonstrated. Finally, portions of the vegetations may be broken off and carried as emboli in the blood stream, or two valves may become glued together, narrowing the opening and producing stenosis, or the deformed valves may be unable to close properly and regurgitation takes place. Thus the lesions of valvular disease are produced. In infective or ulcerative endocarditis, occurring in conjunction with such diseases as pyaemia, septicaemia, smallpox, and pneumonia, pyogenic micrococci are carried into the blood stream, and purulent deposits take place around the valves. In this case, however, the emboli are septic, and when carried to distant tissues produce there ulceration and pus-formation. Numerous abscesses may occur in the wall of the heart muscle itself.

(5) *Valvular Lesions.*—All the valves of the heart are not equally liable to disease; those most frequently affected are the aortic and mitral valves. We have seen how the lesions of the valves are brought about. A valvular lesion may act in two ways: it may impede the onward flow of the blood by narrowing the orifice, or the mal-closure of the valves may allow a reflux of blood. Either of these processes may occur at any of the valvular orifices of the heart. Obstruction is usually complicated by some regurgitation as well, though the converse does not hold good. An increase of the quantity of blood in the auricles, particularly the left, has a less marked effect on the heart itself than an increase in the contents of the ventricles, owing to the left auricle being in continuity with the pulmonary system; whereas if the amount of blood in the left ventricle be doubled the ventricle must dilate in order to accommodate it. The reserve power of the heart is called upon to meet the dilatation, the muscular tissues becoming hypertrophied, and a more powerful systole is produced. As the left is the chief ventricle to undergo this change, the apex of the heart becomes displaced downwards. Similar changes take place in the right ventricle in pulmonary stenosis or tricuspid incompetency. Changes in the right ventricle other than primary valvular disease of the right side of the heart are frequently preceded by mitral incompetence, and are due to extra pressure being thrown upon the pulmonary semilunar valves by the pressure in the overfull pulmonary system. In mitral regurgitation the accumulation of blood in the right auricular cavity leads to its dilatation and an engorgement of the pulmonary vessels, pulmonary oedema and induration of the lung, which in turn affects the right heart. Should compensatory hypertrophy of the right ventricle fail to be established, we get the general venous congestion, dropsy and sequence before alluded to.

(6) *Functional Cardiac Disorders.*—Cardiac rhythm may be modified in several ways; there may be variation in either the length or the strength of the beat, or the beats may not be asynchronous. In palpitation or *tachycardia* its frequency is increased. This increase depends upon the inhibition of the action of the cardio-inhibitory centre, impulses passing to it from the stomach (as in dyspepsia) or from other organs. Tachycardia is also produced by toxic action, as in diphtheria and Graves's disease. In *bradycardia* the frequency is diminished. It may be due to toxins or to degenerative changes. Intermittence may simulate bradycardia, though the actual rate of the beat is not lessened; but the weak beats fail to reach the periphery. Various irregularities may take place, dependent upon perverted nerve action. It is considered that the intrinsic nerve elements play a large part in these, and in some forms of disease the irregularity is of myocardial origin.

The blood vessels.

The blood vessels possess the properties of contractility and elasticity in different degrees. Their contractility is characterized by great tonicity, considerable rhythmic action and little or no rapidity of contraction. Their elasticity stores up energy in a potential condition, and this may be liberated in kinetic form as required. The vessels are supported in various degrees by the different tissues in which they are found. In the more solid viscera they are strongly supported, as in the liver and kidney, while in those which are less dense, as in the case of the brain and the lungs, they are not so well sustained.

In many conditions the contractility and elasticity of the blood vessels become diminished according as they may be involved in various pathological processes—purulent, tuberculous or syphilitic. Chronic toxic conditions lead to numerous degenerations, such as fatty degeneration or *hyaline degeneration* of muscle fibre, apparently as the effect of coagulative processes. The tissues assume a somewhat glassy appearance, with a distinct tendency towards segmentation. *Calcareous infiltration* is brought about by the deposition of lime salts in tissues which have previously undergone fatty or fibroid changes; it particularly affects the arteries in senile affections. In consequence of many toxic agencies as part of a senile change, and as the effect of long-continued stress, the blood vessels undergo a loss of their normal properties. This is compensated by the growth of an excessive amount of fibrous tissue, leading to various forms of *arterial sclerosis*, of which the best known are *endarteritis obliterans*, which affects the smaller arteries and is due to a toxic irritant and may occur at any age, and *endarteritis deformans* (*atheroma*), which affects the larger arteries during middle age, and is usually due to mechanical irritation. As the result of these fibrous changes there is interference with the blood current, since the vessels become unyielding yet frangible, instead of distensile and elastic, tubes. The sclerotic changes lead, moreover, to dilatation of blood vessels, as well as to the formation of definite aneurysms. They also pave the way for coagulation of blood within them, *i.e.* thrombosis, while in certain situations, more particularly in the brain and in the kidney, rupture is apt to take place. Upon the heart also these changes bring about far-reaching effects. Dilatation, accompanied by hypertrophy, is a certain result of generalized arterial degeneration, while changes in the coronary arteries lead to some of the definite results in the walls of the heart which have already been considered.

Veins are subject also to mechanical and toxic effects. The pressure of abdominal tumours, the effects of the weight of a column of blood on a long vein, constipation or obstruction to the venous return may cause dilatations or varicosity. The dilatation thins the walls of the veins and the valves become incompetent; the dilated vessel then becomes twisted and the surrounding tissues thickened by the growth of fibrous tissue. The thinned walls may rupture, and, owing to the loss of the valves, extensive haemorrhages may take place. Thrombosis may follow the slowing of the blood current, and phleboliths are produced by the deposit of lime salts in it. *Phlebitis* is an acute inflammation of a vein. Apart from injury it usually follows invasion by a septic thrombus, as in the well-known *phlegmasia alba dolens*, when an infective clot from the uterine sinuses reaches the iliac veins. The pathology of the blood itself is treated under BLOOD.

VASE (through Fr. from Lat. *vas*, a vessel, pl. *vasa*, of which the singular *vasum* is rarely found; the ultimate root is probably *was*-, to cover, seen in Lat. *vestis*, clothing, Eng. "vest," Gr. ἐσθής, and also in "wear," of garments), a vessel, particularly one of ornamental form or decoration; the term is often confined to such vessels which are uncovered and with two handles, and whose height is great in proportion to their width. It is the general term applied to the decorative pottery of the ancient Greeks and Romans, of whatever shape (see CERAMICS).

VASELINE, or mineral jelly, the *Paraffinum molle* of the British Pharmacopoeia, a commercial product of petroleum which is largely employed in pharmacy, both alone and as a vehicle for the external application of medicinal agents, especially when local action rather than absorption is desired, and as a protective coating for metallic surfaces. "Vaseline" is a registered proprietary name (coined from the German *Wasser*, water, the Greek ἔλαιον, oil, and the termination *-ine*), and is strictly applicable only to the material manufactured by one company (the Chesebrough Manufacturing Company), but it is commonly applied in a generic sense. As met with in commerce, vaseline is a semi-solid mixture of hydrocarbons, having a melting-point usually ranging from a little below to a few degrees above 100° F. It is colourless, or of a pale yellow colour, translucent, fluorescent, amorphous and devoid of taste and smell. It does not oxidize on exposure to the air, and is not readily acted on by chemical reagents. It is soluble in chloroform, benzene, carbon bisulphide and oil of turpentine. It also dissolves in warm ether and in hot alcohol, but separates from the latter in flakes on cooling.

The process employed by the Chesebrough Manufacturing Company in the manufacture of vaseline is said to consist essentially in the careful distillation of selected crude petroleum, vacuum-stills being used to minimize dissociation, and filtration of the residue through granular animal charcoal. The filters are either steam-jacketed, or are placed in rooms heated to 120° F., or higher. The first runnings from the filters are colourless, and when they become coloured to a certain extent they are collected for use as a lubricant under the name of "filtered cylinder oil." (B. R.)

VASILKOV, a town of Russia, in the government of Kiev, 23 m. by rail S.W. of the city of Kiev. Pop. 18,000, chiefly agricultural. Vasilkov was founded in the 10th century, but laid waste during the Mongol invasion of 1239–42. In 1320 it was taken by the Lithuanians, and later by the Poles, under whom it remained until 1686, when it was annexed to Russia.

VASLUI, the capital of the department of Vaslui, Rumania; on a hill at the confluence of the Bêrlad and Vaslui rivers, and on the railway from Jassy to Galatz. Pop. (1900) 13,405. There are a fine old church and ruins of a palace built in 1471 by Stephen the Great. The chief trade is in corn, wine, cattle and timber. A fair is held yearly on the first ten days of September.

VASSAL (Fr. *vassal*, *vassaut*, *vassault*, &c.), the tenant and follower of a feudal lord (see FEUDALISM). The etymology of the word has been a matter of considerable dispute. The late Henri de Tourville, in his *Histoire de la formation particulariste*, maintained that vassal is derived from the German *Gast*, a guest, meaning an outsider to whom a portion of a free domain was assigned in return for rent and certain fixed services. This derivation has a somewhat fantastic air, and seems to have been framed to suit an hypothesis. The commonly accepted etymology is from the Breton *gwaz*, Welsh *gwas*, a lad or a servant. As the word in its Latin form *vassus* was at first uniformly employed in the sense of slave, this explanation is the more acceptable of the two. If it is correct we may say that "vassal" was analogous in origin to the name of "boy" given to a coloured servant by Europeans in Asia and Africa. The word gained in dignity under the Frankish empire through the *vassi dominici*, *i.e.* servants of the royal household, great officers of state, who were sent on extraordinary missions into the provinces, to act as assessors to the counts in the courts, or generally to settle any questions in the interests of the central power. Sometimes they were sent to organize and govern a march, sometimes they were rewarded with benefices, and as, with the growth of feudalism, these developed into hereditary fiefs, the word *vassus* or *vassallus* was naturally retained as implying the relation to the king as overlord, and was extended to the holders of all fiefs whether capital or mediate. As feudal independence increased, the word vassal lost every vestige of its original servile sense, and, since it had come to imply a purely military relation, acquired rather the meaning of "free warrior." Thus in medieval French poetry *vasselage* is commonly used in the sense of "prowess in arms," or generally of any knightly qualities. In this sense it also became acclimatized in England, and "vassal" came to be used as equivalent to free-born, soldierly, valiant and loyal, in which sense it is commonly used in medieval poetry. In countries which were not feudally organized—in Castile, for instance—vassal meant simply subject, and during the revolutionary period acquired a distinctly offensive significance as being equivalent to slave. The diminutive form *vasseletus*, for the son of a vassal, after strange fortunes returned to something of its original sense of "household servant" in the modern "valet" (*q.v.*) (see also VAVASSOR).

See *Dictionnaire de l'ancienne langue française* (Paris, 1895), for numerous examples of the use of the word vassal; also Du Cange, *Glossarium*, *s.* "Vassus."

VASSAR COLLEGE, a non-sectarian institution for the higher education of women, about 2 m. E. of Poughkeepsie, New York, U.S.A. It was incorporated in 1861 as Vassar Female College (which was changed to Vassar College in 1867), and was named in honour of its founder,[1] Matthew Vassar, who transferred to a board of trustees of his own selection about $400,000 (increased by his will to twice that amount) and the tract of about 200 acres of land upon which the college was built. Building began in June 1861, and the institution was opened on the 20th of September 1865, with John Howard Raymond[2] (1814–1878) as president, and Hannah W. Lyman (1816–1871) as lady principal; it had a faculty of eight professors and twenty instructors and teachers, and an enrolment of 353 pupils. The first graduating class was that of 1867, and comprised four members, to whom were given temporary certificates stating that they were "entitled to be admitted to the *First Degree of Liberal Arts*," as the propriety of awarding the degree of "bachelor" to women was questioned at that time; in 1868 these certificates were replaced by diplomas bestowing the degree of A.B. The present equipment includes more than twenty buildings, and the campus has an area of about 400 acres. The college confers the baccalaureate degree in arts (A.B.) upon the completion of the regular course of four years, and a second degree in arts (A.M.) upon Bachelors of Arts of Vassar or any approved college who have completed (by examination and thesis) a course of advanced non-professional study. In 1909–10 there were about ninety professors and instructors and 1040 students. The college had in 1909 total productive funds of about $1,360,000, yielding an income of about $600,000. James Monroe Taylor (b. 1848), a graduate of the university of Rochester and of Rochester Theological Seminary, became president of the college in 1886.

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[1] Matthew Vassar (1791–1868) was born at East Dereham, Tuddenham parish, Norfolk, England, on the 29th of April 1791, son of a Baptist who emigrated to the United States in 1796, settled 3 m. E. of Poughkeepsie in 1797 and in 1801 established a brewery there. The brewery was burned in 1811, and Matthew took up the business and in 1812 established an "ale and oyster saloon" and a brewery, from which he became wealthy. He was a prominent member of the Baptist church. He got the idea of founding a college for women from his niece, Lydia Booth, a school teacher. He died on the 23rd of June 1868 while reading his farewell report to the Board of Trustees. His nephew, MATTHEW VASSAR, Jun. (1809–1881), was born in Poughkeepsie, became manager of his uncle's brewery, was a member of the Board of Trustees of Vassar College, and its treasurer until his death, gave in all about $500,000 to the institution, and with his brother, John Guy Vassar (1811–1888), also one of the trustees and a benefactor of the college, gave to the college the Vassar Brothers' Laboratory.

[2] Raymond graduated at Union College in 1832; studied law and then (at Hamilton, N.Y.) theology; in 1839–49 taught rhetoric and English literature at Madison (now Colgate) University, at Hamilton, N.Y.; was professor of belles-lettres at Rochester University in 1850–56; and organized the Brooklyn Polytechnic Institute in 1856–65.

See Benson J. Lossing's *Vassar College and its Founder* (New York, 1867) and Frances A. Wood's *Earliest Years at Vassar* (Poughkeepsie, N.Y., 1909).

VASTO (anc. *Histonium*), a fortified town of the Abruzzi, Italy, in the province of Chieti, situated high on an olive-clad slope, about a mile from the Adriatic, 32 m. direct S.E. by E. of Chieti and 131 m. by rail from Ancona, 525 ft. above sea-level. Pop. (1901), 10,090 (town); 15,542 (commune). It is surrounded by medieval walls, and commands fine views extending to the Tremiti Islands and Monte Gargano. The churches of S. Pietro and S. Giuseppe have Gothic façades. There is a medieval castle. The municipal buildings contain a collection of Roman antiquities and inscriptions. There are manufactures of earthenware, woollen cloth and silk; but the inhabitants are chiefly employed in the culture of the olive and in fishing.

The ancient *Histonium* was a town of the Frentani, and an Oscan inscription of the period of its independence speaks of censors there, probably officers of the whole community of the Frentani (see R. S. Conway, *Italian Dialects*, i. 208, Cambridge, 1897). Though hardly mentioned in history, it was a flourishing municipal town under the Roman Empire, as is shown by the numerous inscriptions found there. One of these mentions its Capitolium or temple of Jupiter, Juno and Minerva. It lay on the line of the ancient road which prolonged the Via Flaminia to the S.E., and reached the coast here after having passed through Anxanum (Lanciano). It was, and still is, subject to severe earthquakes. (T. As.)

VATICAN COUNCIL, THE, of 1869 and 1870, the last ecumenical council of the Roman Catholic Church, and the most important event in her historical development since the Tridentine synod. The preliminaries were surrounded by the closest secrecy. As early as the end of the year 1864, Pius IX. had commissioned the cardinals resident in Rome to tender him their opinions as to the advisability of a council. The majority pronounced in favour of the scheme, dissentient voices being rare. After March 1865 the convocation of the council was no longer in doubt. Thirty-six carefully selected bishops of diverse nationalities were privately interrogated with regard to the tasks which, in their estimation, should be assigned to the prospective assembly. Some of them proposed, *inter alia*, that the doctrine of papal infallibility should be elevated to the rank of a dogma. In public, however, Pius IX. made no mention of his design till the 26th of June 1867, when Catholic bishops from every country were congregated round him in Rome on the occasion of the great centenary of St Peter. On the 29th of June 1868 the bull *Aeterni Patris* convened the council to Rome, the date being fixed for the 8th of December 1869. And since the Roman Catholic Church claims that all baptized persons belong to her, special bulls were issued, with invitations to the bishops of the Oriental Churches, to the Protestants and to the other non-Catholics, none of which groups complied with the request.

The object of the council was long a mystery. The Bull of Convocation was couched in perfectly general terms, and specified no definite tasks—a circumstance which at first ensured a favourable reception for the scheme, as it allowed ample scope to hope and imagination. But, among liberal Catholics, this mood underwent a complete reversal when information began to leak out as to the object of the Curia in convening the council. The first—epoch-making—revelation was given, in February 1869, by an article in the *Civiltà Cattolica*, a periodical conducted under Jesuit auspices. It was there stated, as the view of many Catholics in France, that the council would be of very brief duration, since the majority of its members were in agreement. As a presumptive theme of the deliberations, it mentioned *inter alia* the proclamation of papal infallibility. The whole proceeding was obviously an attempt, from the Jesuit side, to gauge the prevalent opinion with regard to this favourite doctrine of ultramontanism. The repudiation was energetic and unmistakable, especially in Germany. Certain articles on "The Council and the Civiltà," published by Döllinger in the *Allgemeine Zeitung*, worked like a thunderbolt. Unions of the laity, designed to repel the encroachments of ultramontanism, sprang up immediately; and all manner of old ideas for the remodelling of the clergy were broached anew. It must, however, be admitted that counter demonstrations were not lacking. The attitude adopted by the German episcopate well exemplifies the ecclesiastical situation of that period. The bishops tried to allay the excitement by publishing a pastoral letter drawn up in common; but in a written address to the pope they declared against the contemplated definition of infallibility. In France also a violent conflict broke out. Here it was principally the writings of Bishop Maret in Paris (*Du concile général et de la paix religieuse*, 2 vols., 1869), and of Bishop Dupanloup of Orleans, which gave expression to the prevalent unrest, and led to those literary controversies in which Archbishop Manning of Westminster and Dechamps of Mechlin came forward to champion the opposite cause. In Italy the free-thinkers considered the moment opportune for renewing their agitations on a larger scale. They even attempted—though with no success worth the name—to counteract the Vatican Council by a rival council in Naples. That the projected dogma had weighty opponents among the higher clergy of Austria-Hungary, Italy and North America was demonstrated during the progress of the council; but before it met all was quiet in these countries. The credit of inviting the European governments to consider their attitude towards the forthcoming synod belongs to the president of the Bavarian ministry, Prince Chlodwig of Hohenlohe-Schillingsfürst, the future imperial chancellor. In his circular note to the Powers of the 9th of April 1869 he analysed the political import of the doctrine of papal infallibility,[1] and proposed a common course of action. But his overtures met with no response. In view of the strained international situation, none of the Powers approached was willing to take a step which might easily have resulted in a bitter conflict with the Church; and the studied vagueness of the Curia in its official pronouncements on the council enabled them to assume an attitude of reserve and suspension of judgment. France was equally inactive, though it rested with her to decide whether the council could even meet in Rome: for the withdrawal of her troops from the papal state would have been the signal for a patriotic Italy to sweep this last impediment to national unity from the face of the earth.

On none of the previous ecumenical councils did the Roman see exercise so pronounced an influence as on the Vatican. As early as the year 1865 a committee of cardinals had been formed as a "special directive congregation for the affairs of the future general council," a title which was usually abbreviated to that of "Central Commission." Among the earliest preliminaries, a number of distinguished theologians and canonists were retained as *consultors* to the council. In the selection of these the preference for men of ultramontane tendencies was so pronounced—Döllinger, for instance, was not invited—that the influences at work in the convocation of the council were obvious long before its opening. Under the control of the Central Commission were six sub-commissions: (1) for dogma; (2) for matters of ecclesiastical discipline; (3) for the religious orders; (4) for the Oriental Churches and the missions; (5) for the secular policy of the Church;

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[1] The note was drafted by Döllinger (see INFALLIBILITY).

(6) for the ceremonial of the council. The pope nominated the presidents of the council (Cardinals Reisach, de Luca, Bizarri, Bilio and Capalti); also the secretaries and the remaining officials. Again, before the proceedings began, he determined the order of business on his own initiative (*Multiplices inter d. d.* Nov. 27, 1869),—thus precluding the members of the synod from any opportunity of co-operating in the task. In these regulations the right of fixing the subjects for debate was reserved to the pope. The members of the synod, it is true, enjoyed the privilege of proposing motions; but these motions could never reach the stage of discussion, except by the papal sanction. Another fact of great importance was the strict privacy in which the labours of the council were to be conducted, the members being pledged to silence on every point. For their deliberations, two forms of assembly, analogous to those employed at Trent, were instituted: the *congregationes generales* and the *sessiones.* The General Congregations, presided over by cardinals, were employed in considering the *schemata* (drafts) submitted to the synod; and provisory votes—not regarded as binding—were there taken. The sessions witnessed the definitive voting, the results of which were to be immediately promulgated as ecclesiastical law by the pope. The form of this promulgation was, in itself, sufficiently characteristic; for the pope was represented as the real agent, while the acknowledgment of the share of the council was confined to the phrase *sacro approbante concilio.* In contrast to this, we may refer to the synods of Constance and Trent (C. Mirbt, *Quellen u.s.w.*, pp. 155–202, and the articles CONSTANCE, COUNCIL OF, and TRENT, COUNCIL OF). In the event of the drafts submitted by the Curia not being unanimously adopted by the General Congregations, they were to be remitted, together with the objections raised, to special committees chosen from the body of the council. These committees (*congregationes speciales deputationes*), the presidents of which were also nominated by the pope, were four in number: (1) for matters of belief; (2) for questions of ecclesiastical discipline; (3) for the religious orders; (4) for affairs of the Oriental Churches. The whole proceedings took place in the church of St Peter, the south transept of which had been prepared especially for the purpose. That the acoustic properties of the structure were unequal to the demands made upon them was obvious from the first day, and occasioned numerous complaints.

On the 8th of December the first session met, and the council was solemnly opened by Pius IX. From beginning to end it was dominated by the "Infallibility" problem. At the elections to the committees the fact was already obvious; for the leaders of the synodal majority in favour of the dogma took excellent care that no one should be chosen who was known to lean toward the opposite side. The order of procedure excited considerable dissatisfaction in many; and a series of petitions, with alternative suggestions, was submitted to the pope, but without success. The very first transactions of the council gave proof that numerous bishops held the theory that their convocation implied the duty of serious and united work, and that they were by no means inclined to yield a perfunctory assent to the papal propositions, which—in part at least—stood in urgent need of emendation. The Curia awoke to this unpleasant fact during the discussion upon the first draft laid before the council,—the schema *De Fide,*—and some perplexity was the result; for on the 8th of December the second session had already been announced for the 6th of January. Since the consideration of the *schema* could not possibly be completed by that date, and since it was now futile to hope that the doctrine of infallibility would be carried by acclamation, and without debate, in that session,—Archbishop Darboy informing Cardinal de Luca that, in this event, a hundred bishops would leave Rome at once,—the second session, on the 6th of January, was reduced to a mere formality, the delegates again declaring their allegiance to the *Professio Fidei Tridentinae*, to which they had already pledged themselves at ordination. On the 10th of January the schema *De Fide* was referred to the committee "for matters of belief," to receive further revision.

From the 10th of January to the 22nd of February 1870 the council was occupied with proposals concerning ecclesiastical discipline and with questions of church life. On this occasion it became evident that the synod was not blind to the necessity for many and various reforms. Even the College of Cardinals and the Curia did not escape. Complaint was made, for instance, that the papal chair and the Roman Congregations were filled almost exclusively by Italians; while the control of the Church was too much centralized in Rome. Again, the treatment of impediments to marriages, of licences and of the scales of charges, was submitted to criticism. The fact was elicited that the resolutions of provincial synods, when transmitted to Rome for approbation, were there subjected to arbitrary changes, so that the contents no longer corresponded with those to which the bishops had affixed their signatures. Even the desire for national assemblies and for ecumenical councils, held at regular intervals, found expression. The delicate subject of the compulsory celibacy of the clergy was also discussed; the notorious defects of the Roman Breviary were considered, and a long debate ensued with regard to the policy of drawing up a short catechism for the whole of Catholic Christendom. Even the proposals which led to these declarations of opinion—many of which were neither anticipated nor desired—were not accepted by the council, but returned for revision to the respective committees.

That matters progressed slowly was undeniable. It was the third month, and not one of the proposals under consideration had been despatched. That this unexpected delay was a natural sequel to the character of the proposals themselves was a fact which the Curia declined to recognize. Consequently, as that body could rely upon a complacent majority, it resolved to proclaim a new order of procedure, by means of which it would be possible to end these unwelcome discussions and quicken the pace of the council. By the papal decree of the 20th of February the influence of the committees was increased; the majority was allowed to cut short a debate by accepting a motion for its closure; a plurality of votes was declared sufficient to carry a proposal; and the voting itself was modified by the institution of a "conditional affirmative" (*placet iuxta modum*) in addition to the regular affirmative and negative (*placet* and *non placet*). Since neither the presidents nor the majority of the council could well be expected to employ the extensive powers thus placed at their disposal with much consideration for the rights of the minority, protests by the weaker party against the new regulations were handed in to the pope, but to no effect.

The main object, however, of this alteration in procedure was to ensure that if the council could not be induced to accept the doctrine of infallibility by acclamation, it should at least do so by resolution. From the first the general interest was almost exclusively concentrated on this question, which divided the members of the synod into two hostile camps. The adherents of the contemplated dogma—among whom Archbishop Manning of Westminster and Bishop Senestrey of Regensburg admittedly held the leading position—circulated petitions to the pope requesting the introduction of a proposal to meet their views; and, as a result of their efforts, the signatures of 480 bishops were obtained. This manœuvre aroused the other side. Petitions to the opposite effect were now similarly distributed, and signed by 136 bishops. On the 9th of February the committee of examination—as was only to be expected—resolved to recommend the pope to grant the wishes of the majority. The remarkable feature of the situation created by these agitations was not that the majority of members declared in favour of the dogmatization of infallibility—that was a foregone conclusion in view of the strides made by ultramontanism in the Roman Catholic Church—but that so many could be found with courage enough to withstand the aspiration to which Pius IX. had given open expression on every possible occasion. The weight of their opposition was accentuated by the fact that the finest intellects and the ablest theologians of Catholicism were included in their ranks. The presence of striking personalities, whose devotion to the Church was beyond question, —Archbishop Scherr of Munich, Melchers of Cologne, Bishop

Ketteler of Mainz, Bishop Hefele of Rottenburg, Cardinal Schwarzenberg of Prague, Cardinal Rauscher of Vienna, Archbishop Haynald of Kalossa, Bishop Strossmayer of Sirmium, Archbishop Darboy of Paris, Bishop Dupanloup of Orleans, to say nothing of the others,—assured this group an influence which, in spite of itself, the opposing faction was bound to feel. If the minority indeed had formed one compact phalanx, the council might possibly have taken a different course; but this it was not, and the fatal truth could not be concealed from the pope and his advisers. The bond which united its members was not a repudiation of the doctrine of infallibility itself, but simply a common sentiment that its elevation to the rank of dogma was inopportune *at the time*. Some—possibly many—may have entertained serious doubts with regard to that doctrine; but, if such was the case, they succeeded in repressing and disciplining their suspicions, and the greatest anxiety was shown to avoid the least attempt at founding their resistance on a dogmatic basis. And here the weakness of the opposition is at once manifest; it lacked a clear and positive goal.

In outside circles the proceedings at Rome were followed with strained attention, and the battle round the question of infallibility was waged with equal violence in France and Germany. In the one country public interest was focused on the writings of Gratry, the former Oratorian; in the other on the trenchant attacks of Döllinger. In England, Newman protested against the dogma. The progress of the council was marked by a plethora of controversial literature with which it was almost impossible to keep pace; articles and pamphlets were poured forth in increasing volume month after month, and even yet no classified collection of them is extant. Among them all, none exceeded in influence the *Römische Briefe*, first published in the Augsburg *Allgemeine Zeitung*, which gave a regular account of the most intimate transactions of the council, and maintained a high reputation for accuracy in spite of all attempts to discredit their authenticity. Important service in disseminating information among widely extended circles was done by the brochure *Ce qui se passe au concile* (May 1870), which revealed a number of proceedings never intended for publicity.

Among the secret propositions submitted to the council by the Curia was the schema *De Ecclesia Christi*, which was distributed to the members on the 21st of January. This contained fifteen sections, in which were defined the nature of the Church, the position of the pope in the Church, and, more especially, the relationship between the Church and the State. In case the harmony between these two magnitudes is disturbed, the responsibility lies with the State, because it thereby disregards the rights and duties of the Church (cap. 13). The divine law is binding on temporal sovereigns, but the administration of that law is a question which can only be decided by the supreme doctrinal authority of the Church (cap. 14). In addition to the education of youth, the Church demands absolute freedom in the training of its clergy and the abrogation of all restrictions on the religious orders, &c. Thus the superiority of Church to State was here enunciated in the same drastic terms as in the *Syllabus* of Pius IX. (1864)—a declaration of war against the modern political and social order, which in its day provoked the unanimous condemnation of public opinion. When, in spite of the injunction of secrecy, the schema became known outside Rome, its genuineness was at first impugned; but as soon as the authenticity of the text was established beyond the possibility of doubt, this attempt to dogmatize the principles of the notorious *Syllabus* excited the most general indignation, even in the strongholds of Catholicism—France and Austria. It almost appeared as if both governments, incensed by these encroachments on the sphere of the State, were at last bent upon bringing pressure to bear on the future deliberations of the council; but the international situation enabled the Curia to persist in its attitude of strict negation towards the despatches of Count Beust and Count Daru. On political grounds Napoleon was not inclined to employ any form of coercion against the synod; Bismarck maintained a like reserve; and although Lord Acton influenced Gladstone in the contrary direction, Lord Clarendon followed Odo Russell, his *chargé d'affaires* in Rome, who was himself adroitly kept in hand by Manning. Thus the danger that the attitude of the secular powers might imperil the liberties of the council was averted for the second time.

From the 22nd of February to the 18th of March no meetings of the General Congregations took place, on account of structural alterations in the *aula* itself. During this interval all uncertainty as to whether the question of infallibility would actually be broached was dispelled. On the 6th of March a supplementary article to section 11 of the schema *De Ecclesia*, dealing with the primacy of the Roman see, was transmitted to the members, and in it the much disputed doctrine received formal expression. But before the animated discussions which centred round this problem could begin, it was imperative to conclude the debate on the schema *De Doctrina Catholica*. From the deputation "for matters of faith" it returned to the *plenum* in a considerably modified form, and there it occupied the attention of the assembly for a full month, beginning with the 18th of March. Even in this later stage it frequently gave rise to trenchant criticism; but the greatest sensation was created by a speech of Bishop Strossmayer, who took exception to the terms of the proposal on the ground that it described Protestantism as the fountain-head of naturalism and as an unclean thing (*pestis*). There followed a dramatic scene: the orator was interrupted by the president and compelled by the outcries of the indignant fathers to quit the tribune. Nevertheless, Strossmayer by his courageous protest succeeded in modifying the objectionable clauses. The bishops of the minority were still dissatisfied with several passages in the *schema*, but, desirous of concentrating their whole available force in opposition to the next proposal, they suppressed their doubts; and the result was that, on the 24th of April, in the third public session, the *Constitutio dogmatica de Fide Catholica*[1] was adopted unanimously and immediately confirmed by the pope.

Meanwhile, the elaboration of the all-important business of the council had been quietly proceeding. Influenced by the alarming number of amendments to the schema *De Ecclesia*, and anxious above all to ensure an early acceptance for the dogma of infallibility, the deputation abandoned the idea of subjecting the entire doctrine of the Church to debate, and resolved to eliminate everything save the one question of papal authority, and to submit this to the council alone. That this procedure directly challenged criticism was obvious enough, and, within the synod, several speakers drew attention to the capriciousness of a method which required them to consider the infallibility of the pope before the nature of the Church herself had been defined. The event, however, justified the wire-pullers of the council in their policy, for the path they chose obviated the danger that the discussion might lose itself in a maze of generalities. It is impossible to give a short and, at the same time, an adequate account of the debate: lengthy disquisitions were the order of the day, and the disputants did not scruple to indulge in verbose repetition of arguments worn threadbare by their predecessors. A pleasant impression is left by the great candour of the opposition speakers, who, in the course of the next few weeks, made every point against the doctrine which in their position it was possible to make. In the general debate, begun on the 13th of May, Bishop Hefele of Rottenburg, author of the well-known *Konziliengeschichte*, criticized the dogma from the standpoint of history, adducing the fact that Pope Honorius I. had been condemned by the sixth ecumenical council as a heretic (680). Others were of opinion that the doctrine implied a radical change in the constitution of the Church: one speaker even characterized it as sacrilege. The contention that the dogma was necessitated by the welfare of the Church, or justified by contemporary conditions, met with repeated and energetic repudiation. The champions of infallibility were, indeed, confronted with no slight task:—to establish their theory by Holy Writ and tradition, and to defend it against the arguments of history.

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[1] Mirbt, *Quellen*, 371–77.

But to them it was no hypothesis waiting to be verified, but an already existing truth, the possession of which no extraneous attacks could for a moment affect. On the 3rd of June the general debate was closed, and forty prospective orators compulsorily silenced.

In the special debate, which dealt with the proposal in detail, every important declaration with regard to the pope was impugned by one party and upheld by the other. The main assault was naturally directed upon the fourth section, "concerning the doctrinal authority of the pope," and Archbishop Guidi of Bologna, in particular, incurred the resentment of the majority through his outspoken utterances on the subject. Immediately after the session he was summoned to the Vatican, and, on defending his attitude by an appeal to tradition, received from Pius IX. the celebrated answer, "I am the tradition." From the beginning of July onwards it became increasingly evident that the council was on the verge of exhaustion: the great heat was positively dangerous to members accustomed to a colder climate, and the opinion gained ground that the spokesmen of both parties had sufficiently elucidated their views for the benefit of the conclave. Many delegates who had announced their intention of speaking relinquished the privilege, and on the 13th of July it was found possible to conclude the debate. On that day the voting in the 85th General Congregation, on the whole schema, showed that, out of 601 members present, 451 had voted *placet*, 88 *non placet* and 62 *placet iuxta modum*. That the number of prelates who rejected the *placet* would amount to 150 had not been expected. The question was now: Could the doctrine of infallibility be raised to dogmatic rank when it was repudiated by so formidable a minority? At the height of the crisis several leaders of the opposition attempted, by a direct appeal to the pope, to secure a modification in the terms of the dogma, which might enable them to give their assent. On the evening of the 15th of July six bishops were accorded an audience with Pius IX., in which they preferred their modest requests. Ketteler threw himself at the feet of the pope and implored him to restore peace to the Church by a little act of compliance. The touching scene appeared to have made some impression on Pius IX.; but, after the deputation had left, opposing influences gained the ascendant, and the result was simply that the clauses on which everything hinged received an addition the reverse of conciliatory (General Congregation, 16th July). The bishops who had hitherto formed the recalcitrant minority were now face to face with the final decision. On the one hand was their loyalty to the pope, allied with the desire to avoid any demonstration calculated to impair the prestige of the Church; on the other, their conviction that the very doctrine which the council was about to proclaim as dogma was a gigantic error. There was but one way out of the *impasse*,—to leave Rome before the deciding session,—and on the 16th of July the pope met their wishes and accorded the leave of absence previously withheld. A section of the dissentient bishops reiterated their views in a letter to Pius IX., and agreed to direct their subsequent actions in common,—a compact which was not observed. On the 18th of July, in the fourth public session, the dogma was accepted by 535 dignitaries of the Church, and at once promulgated by the pope; only two members repeated their *non placet*, and these submitted in the same session. The council continued its labours for a few more weeks, but its main achievement was over, and the remainder of its time was occupied with affairs of secondary importance. When, coincident with the outbreak of the Franco-German War, the papal state collapsed, the pope availed himself of the altered situation, and prorogued the council by the bull *Postquam Dei munere* (October 20). The Italian government at once protested against his statement that the liberties of the council would be prejudiced by the incorporation of Rome into the kingdom of Italy.

The resolutions of the Vatican Council entirely revolutionized the position of the pope within the Church. He is first accredited with "complete and supreme jurisdictionary authority over the whole Church, not simply in matters of faith and morality, but also in matters touching the discipline and governance of the Church; and this authority is a regular and immediate authority, extending over each and every Church and over each and every pastor and believer" (*Sessio* iv. cap. 3, *fin.*; Mirbt, *Quellen*, p. 380). These words conceded to the pope a universal episcopate in the entire Church, in virtue of which he may, at any time, in any diocese, exercise the functions of the regular bishop: the individual bishop forfeited the independence which he had formerly enjoyed, and the episcopate as a whole was dispossessed of that position which, in preceding centuries, had enabled it to champion the true welfare of the Church against a decadent papacy. Nor was this all: it is laid down "as a dogma revealed by God, that the Roman pontiff, when he speaks *ex cathedra*,—that is to say, when, in virtue of his supreme apostolical authority, and in the exercise of his office as pastor and instructor of all Christians, he pronounces any doctrine touching faith or morality to be binding on the whole Church,—is, by reason of the divine assistance promised to him in the person of St Peter, endowed with that infallibility which, according to the will of the Redeemer, is vouchsafed to the Church when she desires to fix a doctrine of faith or morality; and that consequently all such decisions of the Roman pontiff are *per se* immutable and independent of the subsequent assent of the Church. But if any man,—which Heaven forefend!" proceeds the document, "shall venture to deny this definition, let him be accursed!" (*Sessio* iv. cap. 4; Mirbt, *Quellen*, p. 381). These clauses contain the doctrine of papal infallibility, and make the recognition of that doctrine incumbent on all Catholic Christians. But how are we to recognize whether the decision of the pope is given "in the exercise of his doctrinal office," or not? No criterion is assigned, and no authentic interpretation has been accorded from the chair of St Peter. Thus great uncertainty prevails with regard to utterances *ex cathedra*; and the result has been that every papal declaration has tended to be invested with the halo of infallibility. Again, the dogma implies a fundamental change in the position of the ecumenical councils, which, in conjunction with the papacy, had till then been supposed to constitute the representation of the Roman Catholic Church. By the *Vaticanum* they lost every vestige of actual, independent authority, for their function of defining the doctrine of the Church now passed to the pope; and, though in the future they may still be convened, their indispensability is a thing of the past. They have ceased to form a constituent organ of the Church, and are sunk to the level of a decorative or consultative assembly. Thus the decrees of the council possess a double significance; they have not only erected the papacy into the sole tribunal for questions of belief, but have at the same time radically transformed the constitution of the Church. The two factors which previously served to check the papal ambition have been shorn of their strength, and the papacy has attained the status of an absolute monarchy. The concurrent loss of the papal states, so far from enfeebling this new absolutism, tended, in spite of the protests of the Curia, to increase its strength, for its position now became unassailable, and it was enabled to concentrate its energies on a purely international policy to a greater extent than formerly.

The bishops, who, on the council, had impugned the doctrine of papal infallibility, submitted without exception to the promulgated dogma. Confronted with the alternative of either seceding from the Church or adopting a theory which they had previously attacked, they resorted to the "sacrifice of reason," many with bleeding hearts; many, as it would seem, without any pangs of conscience. But though they submitted they failed to carry with them the whole of the theologians and laymen who had ranged themselves at their side in the battle against the dogma; and after the conclusion of the council a new Church was formed, which, in contrast with the *fin de siècle* Catholicism which, by the Vatican Synod, had cut itself loose from the traditions of the past, was termed Old Catholic (see the special article).

In the sphere of politics also the *Vaticanum* was attended by important results. The secular governments could not remain indifferent to the prospect that the proclamation of papal infallibility would invest the *dicta* of the medieval popes, as to the relationship between Church and State, with the character of inspired doctrinal decisions, and confer dogmatic authority on the principles enunciated in the *Syllabus* of Pius IX. Nor was the fear of these and similar consequences diminished by the proceedings of the council itself. The result was that on the 30th of July 1870, Austria annulled the Concordat arranged with the Curia in 1855. In Prussia the so-called *Kulturkampf* broke out immediately afterwards, and in France the synod so accentuated the power of ultramontanism, that, in late years, the republic has taken effectual steps to curb it by revoking the Concordat of 1801 and completely separating the Church from the State.

The antecedent history of the council was long; its subsequent history is a chapter which has not yet been closed. That the dogma was carefully prepared beforehand, mainly by the Society of Jesus, is a demonstrable and demonstrated fact, notwithstanding the denials emanating from writers belonging to the society.

The general position of Roman Catholicism was consolidated by the Vatican Council in more respects than one; for not only did it promote the centralization of government in Rome, but the process of unification soon made further progress, and the attempts to control the intellectual and spiritual life of the Church have now assumed dimensions which, a few decades ago, would have been regarded as anachronistic. On the other hand, however, a counter-movement can be traced in all countries with a predominant Catholic population,—the so-called Reformed Catholicism, which may wear a different aspect in different districts and different strata of society, but is everywhere distinguished by the same fundamental aspiration towards increased liberty. Thus the victory gained by ultramontane influences within the Church—a victory for which the *Vaticanum* was largely responsible—closes one period of development, but a second has already begun, the keynote of which is the search for a *modus vivendi* between this Vatican system and the Catholicism which is rooted in the intellectual life of the modern world.

Bibliography.—A résumé of the literature bearing on the history of this council is given by C. Mirbt in the *Realencyclopädie*, vol. xx. 445 seq. (ed. 3, Leipzig, 1908). The two most detailed accounts are: J. Friedrich, *Geschichte des Vatikanischen Konzils* (3 vols., Bonn, 1877, 1883, 1887); and Th. Grauderath, S.J., *Geschichte des Vatikanischen Konzils* (ed. K. Kirch, 3 vols., Freiburg im Breisgau, 1903–6). The last-mentioned work represents the Jesuitico-Curial standpoint (cf. C. Mirbt, "Die Geschichtschreibung des Vatikanischen Konzils," *Historische Zeitschrift*, Band 101, 1908, pp. 529–600). The most important collections of the *acta* are: *Collectio Lacensis*, tome vii. (Freiburg, 1890); E. Friedberg, *Sammlung der Aktenstücke zum ersten Vatikanischen Konzil* (Tübingen, 1872); J. Friedrich, *Documenta ad illustrandum Concilium Vaticanum* (Nördlingen, 1871); A. v. Roskovany, *Romanus Pontifex*, tomes 7–16, Suppl. 7–10 (Nitriae, 1871–79). For the dogmatic resolutions see also C. Mirbt, *Quellen zur Geschichte des Papsttums* (ed. 2, Tübingen, 1901), pp. 371–82. For the internal history of the councils one of the main sources is Quirinus, *Römische Briefe vom Konzil* (Munich, 1870). Also, J. Friedrich, *Tagebuch während des Vatikanischen Konzils* (Nördlingen, 1871); Lord Acton, *Zur Geschichte des Vatikanischen Konziles* (Munich, 1871, Eng. in *Hist. Essays*, 1907); J. Fessler, *Das Vatikanische Concilium* (Vienna, 1871); Manning, *The True Story of the Vatican Council* (London, 1877); E. Ollivier, *L'Église et l'état au concile du Vatican* (2 vols., Paris, 1879); Purcell, *Life of Cardinal Manning* (2 vols., London, 1896). Cecconi's great work, *La Storia del Concilio ecumenico Vaticano* (4 vols., Rome, 1873–79), is incomplete. For criticism of the council, see Janus, *Der Papst und das Konzil* (Leipzig, 1869), revised by J. Friedrich under the title *F. v. Döllinger, Das Papsttum* (Munich, 1892). Also, Gladstone's *Vatican Decrees and Vaticanism* (London, 1874). (C. M.)

VATKE, JOHANN KARL WILHELM (1806–1882), German Protestant theologian, was born at Behndorf, near Magdeburg, on the 14th of March 1806. After acting as *Privatdozent* in Berlin, he was appointed in 1837 professor extraordinarius. Vatke was one of the founders of the newer Hexateuch criticism. In the same year in which David Strauss published his *Life of Jesus*, Vatke issued his book, *Die Religion des Alten Testaments nach den kanonischen Büchern entwickelt*, which contained the seeds of a revolution in the ideas held about the Old Testament. Since, however, his book was too philosophical to be popular, the author's theories were practically unnoticed for a generation, and the new ideas are now associated especially with the names of A. Kuenen and J. Wellhausen (*qq.v.*). He died on the 18th of April 1882.

His other works include: *Die menschliche Freiheit in ihrem Verhältniss zur Sünde und zur göttlichen Gnade* (1841), *Historisch-kritische Einleitung in das Alte Testament* (1886), and *Religionsphilosophie* (1888). See O. Pfleiderer, *Development of Theology* (1890), and T. K. Cheyne, *Founders of Old Testament Criticism* (1893).

VATTEL, EMERIC (Emer) **DE** (1714–1767) Swiss jurist, the son of a Protestant minister, was born at Couvet, in the principality of Neuchâtel, on the 25th of April 1714. He studied at Basel and Geneva. During his early years his favourite pursuit was philosophy; and, having carefully examined the works of G. W. Leibnitz and C. Wolff, he published in 1741 a defence of Leibnitz's system against J. P. de Crousaz. In the same year Vattel, who was born a subject of the king of Prussia, repaired to Berlin in the hope of obtaining some public employment from Frederick II., but was disappointed in his expectation. Two years later he proceeded to Dresden, where he experienced a very favourable reception from Count Brühl, the minister of Saxony. In 1746 he obtained from the elector, Augustus III., the title of councillor of embassy, accompanied with a pension, and was sent to Bern in the capacity of the elector's minister. His diplomatic functions did not occupy his whole time, and much of his leisure was devoted to literature and jurisprudence. Among other works he published *Loisirs philosophiques* (1747) and *Mélanges de littérature, de morale, et de politique* (1757). But his reputation chiefly rests on his *Droit des gens, ou Principes de la loi naturelle appliqués à la conduite et aux affaires des nations et des souverains* (Neuchâtel, 1758). During the same year he was recalled from Switzerland, to be employed in the cabinet of Dresden, and was soon afterwards honoured with the title of privy councillor. His labours now became so intense as to exhaust his strength, and his health broke down. After a period of rest he returned to Dresden in 1766; but his renewed exertions soon produced a relapse, and he made another excursion to Neuchâtel, where he died on the 28th of December 1767. His last work was entitled *Questions de droit naturel, ou Observations sur le traité du droit de la nature, par Wolff* (Bern, 1762).

Vattel's *Droit des gens*, which is founded on the works of Wolff, had in its day a great success, in truth, greater than it deserved. His principal and only merit consists in his having rendered the ideas of that author accessible to the political and diplomatic world. The *Droit des gens* passed through many editions, and was translated into various languages (English in 1760).

VAUBAN, SÉBASTIEN LE PRESTRE DE (1633–1707), marshal of France, the most celebrated of military engineers (see Fortification), was born at Saint-Léger-Vauban (Yonne). At the age of ten he was left an orphan in very poor circumstances, and his boyhood and youth were spent amongst the peasantry of his native place. A fortunate event brought him under the care of the Carmelite prior of Sémur, who undertook his education, and the grounding in mathematics, science and geometry which he thus received was of the highest value in his subsequent career. At the age of seventeen Vauban joined the regiment of Condé in the war of the Fronde. His gallant conduct won him within a year the offer of a commission, which he declined on account of poverty. Condé then employed him to assist in the fortification of Clermont-en-Argonne. Soon afterwards he was taken prisoner by the royal troops; but though a rebel he was well treated, and the kindness of Mazarin converted the young engineer into a devoted servant of the king. He was employed in the siege of St Ménéhould (which he had helped to storm as a Frondeur) and won a lieutenancy in the regiment of Burgundy, and at Stenay he was twice wounded. Soon afterwards he besieged and took his own first fortress, Clermont; and in May 1655 he received his commission as an *ingénieur du roi*, having served his apprenticeship under the Chevalier de Clerville, one of the foremost engineers of the time. Between that year and the peace of 1659 he had taken part in or directed ten sieges with distinction, had been several times wounded, and was rewarded by the king with the free gift of a company in the famous Picardy regiment. About this time he married a cousin, Jeanne d'Aulnay. After the peace Vauban was put in charge of the construction of several important defences, amongst other places at Dunkirk, where his work continued until the year before his death. On the renewal of war in 1662 he conducted, under the eyes of the king, the sieges of Douai, Tournai and Lille. At Lille he so distinguished himself that he received a lieutenancy in the guard (ranking as a colonelcy).

The peace of Aix-la-Chapelle confirmed France in the possession of new fortresses, which Vauban now improved or rebuilt. Hitherto the characteristic features of his method of fortification had not been developed, and the systems of preceding engineers were faithfully followed. Colbert and Louvois were profoundly interested in the work, and it was at the request of the latter that the engineer drew up in 1669 his *Mémoire pour servir à l'instruction dans la conduite des sièges* (this, with a memorandum on the defence of fortresses by another hand, was published at Leiden in 1740). On the renewal of war Vauban again conducted the most important sieges (Rheinbergen and Nijmwegen 1672, Maestricht and Trier 1673, Besançon 1674). In the latter year he also supervised the only defence in which he ever took part, that of Oudenarde. This was followed by the reduction of Dinant, Huy and Limburg. At this time he wrote for the commandants of Verdun and Le Quesnoy, valuable *Instructions pour la défense* (MS. Dépôt des Fortifications, Paris; see also Quincy, *Art de la guerre*, Paris, 1740). In 1676 he was made *maréchal de camp*. He took Condé, Bouchain and other places in that year, Valenciennes and Cambrai in 1677, Ghent and Ypres in 1678.

It was at this time that Vauban synthesized the methods of attacking strong places, on which his claim to renown as an engineer rests far more than on his systems of fortification. The introduction of a systematic approach by parallels (said to have been suggested by the practice of the Turks at Candia in 1668) dates from the siege of Maestricht, and in principle remains to this day the standard method of attacking a fortress. The peace of Nijmwegen gave more territory to France, and more fortresses had to be adapted. Vauban was named *commissaire-général des fortifications* on the death of De Clerville, and wrote in 1679 a memorandum on the places of the new frontier, from which it appears that from Dunkirk to Dinant France possessed fifteen fortresses and forts, with thirteen more in second line. Most of these had been rebuilt by Vauban, and further acquisitions, notably Strassburg (1681), involved him in unceasing work. At Saarlouis for the first time appeared Vauban's "first system" of fortification, which remained the accepted standard till comparatively recent times. He never hesitated to retain what was of advantage in the methods of his predecessors, which he had hitherto followed, and it was in practice rather than in theory, that he surpassed them. In 1682 his "second system," which introduced modifications of the first designed to prolong the resistance of the fortress, began to appear; and about the same time he wrote a practical manual entitled *Le Directeur-Général des fortifications* (Hague, 1683–85). Having now attained the rank of lieut.-general, he took the field once more, and captured Courtrai in 1683, and Luxemburg in the following year. The unexpected strength of certain towers designed by the Spanish engineer Louvigni (fl. 1673) at Luxemburg suggested the tower-bastions which are the peculiar feature of Vauban's second system (see Augoyat, *Mémoires inédits du Ml. de Vauban*, Paris, 1841) which was put into execution at Belfort in the same year (Provost du Vernois, *De la fortification depuis Vauban*, Paris, 1861).. In 1687 he chose Landau as the chief place of arms of Lower Alsace, and lavished on the place all the resources of his art. But side by side with this development grew up the far more important scheme of attack. He instituted a company of miners, and the elaborate experiments carried out under his supervision resulted in the establishment of all the necessary formulae for military mining (*Traité des mines*, Paris, 1740 and 1799; Hague, 1744); while at the siege of Ath in 1697, having in the meanwhile taken part in more sieges, notably that of Namur in 1692 (defended by the great Dutch engineer Coehoorn), he employed ricochet fire for the first time as the principal means of breaking down the defence. He had indeed already used it with effect at Philipsburg in 1688 and at Namur, but the jealousy of the artillery at outside interference had hindered the full use of this remarkable invention, which with his other improvements rendered the success of the attack almost certain. After the peace of Ryswick Vauban rebuilt or improved other fortresses, and finally New Breisach, fortified on his "third system"—which was in fact a modification of the second and was called by Vauban himself *système de Landau perfectionné*. His last siege was that of Old Breisach in 1703, when he reduced the place in a fortnight. On the 14th of January of that year Vauban had been made a marshal of France, a rank too exalted for the technical direction of sieges, and his active career came to an end with his promotion. Soon afterwards appeared his *Traité de l'attaque des places*, a revised and amplified edition of the older memoir of 1669, which contains the methods of the fully developed Vauban attack, the main features of which are the parallels, ricochet fire and the attack of the defending personnel by vertical fire (ed. Augoyat, Paris, 1829).

But Louis XIV. was now thrown on the defensive, and the war of the Spanish Succession saw the gradual wane of Vauban's influence, as his fortresses were taken and retaken. The various captures of Landau, his *chef-d'œuvre*, caused him to be regarded with disfavour, for it was not realized that the greatness of his services was rather in the attack than in the defence. In the darkness of defeat he turned his attention to the defence; but his work *De la défense des places* (ed. by General Valazé, Paris, 1829) is of far less worth than the *Attaque*, and his far-seeing ideas on entrenched camps (*Traité des fortifications de campagne*) were coldly received, though therein may be found the elements of the "detached forts" system now universal in Europe. The close of his life, saddened by the consciousness of waning influence and by failing health, he devoted largely to the arrangement of the voluminous manuscripts (*Mes oisivetés*) which contained his reflections on war, administration, finance, agriculture and the like. In 1689 he had had the courage to make a representation to the king in favour of the republication of the Edict of Nantes, and in 1698 he wrote his *Projet d'une dix$^{me.}$ royale* (see *Economistes financières du XVIII^{e} siècle*, Paris, 1851), a remarkable work foreshadowing the principles of the French Revolution. Vauban was deeply impressed with the deplorable condition of the peasantry, whose labour he regarded as the main foundation of all wealth, and protested in particular against the unequal incidence of taxation and the exemptions and privileges of the upper classes. His *dix$^{me.}$ royale*, a tax to be impartially applied to all classes, was a tenth of all agricultural produce payable in kind, and a tenth of money chargeable on manufacturers and merchants. This work was published in 1707, and instantly suppressed by order of the king. The marshal died heart-broken at the failure of his efforts a few days after the publication of the order (March 30, 1707). At the Revolution his remains were scattered, but in 1808 his heart was found and deposited by order of Napoleon in the church of the Invalides.

Vauban's attention was closely engaged, not only in general military matters, but in political and financial reform and the inland navigation of France. He carried out the rearmament of the French infantry with flint-lock muskets and the socket bayonet. The order of St Louis was suggested by him, and lastly may be mentioned the fortress-models which he constructed, most of which are in the Invalides at Paris, and some in the Berlin Zeughaus. The actual total of his work as an engineer is worth recording. He conducted forty sieges and took part in more than three hundred combats, while his skill and experience were employed on the construction or rebuilding of more than 160 fortresses of all kinds. *Mes oisivetés* long remained unpublished, and of the twelve volumes of manuscript seven are lost. The remainder were published in Paris, 1841–45, in an abridged form, and of the five manuscript volumes three are in public hands, and two belong to the families of two famous engineers, Augoyat and Haxo. At the Hague (1737–1742) appeared, dedicated to Frederick of Prussia, De Hondt's edition of *De l'attaque et défense*, &c., and of this work an improved edition appeared subsequently. But the first satisfactory editions are those of Augoyat and Valazé mentioned above.

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VAUCLUSE, a department of south-eastern France, formed in 1793 out of the countship of Venaissin, the principality of Orange, and a part of Provence, and bounded by Drôme on the N., Basses-Alpes on the E., Bouches-du-Rhône (from which it is separated by the Durance) on the S., and Gard and Ardèche (from which it is separated by the Rhone) on the W. It has also an enclave, the canton of Valréas, in the department of Drôme. Pop. (1906) 239,178. Area, 1381 sq. m. The western third of Vaucluse belongs to the Rhone valley, and consists of the rich and fertile plains of Orange, Carpentras and Cavaillon. To the east, with a general west-south-west direction and parallel to one another, are the steep barren ranges of Ventoux, Vaucluse and Lubéron, consisting of limestones and sandstones. The first-mentioned, which is the most northerly, has a maximum elevation of 6273 ft.; the culminating peak, on which is a meteorological observatory, is isolated and majestic. The Vaucluse chain does not rise above 4075 ft. The most southerly range, that of Lubéron (3691 ft.), is rich in palaeontological remains of extant mammals (the lion, gazelle, wild boar, &c.). The Rhone is joined on the left by the Aygues, the Sorgue (rising in Petrarch's celebrated fountain of Vaucluse, which has given its name to the department), and the impetuous Durance. The Sorgue has an important tributary in the Ouvèze and the Durance in the Coulon (or Calavon). These and other streams feed the numerous irrigation canals (Canal de Pierrelatte, Canal de Carpentras, &c.) to which is largely due the success of the farmers and market-gardeners of the department. The climate is that of the Mediterranean region. The valley of the Rhone suffers from the mistral, a cold and violent wind from N.N.W.; but the other valleys are sheltered by the mountains, and produce the oleander, pomegranate, olive, jujube, fig, and other southern trees and shrubs. The mean annual temperature is 55° F. at Orange and 58° at Avignon; the extremes of temperature are 5° and 105° F. Snow is rare. The south wind, which is frequent in summer, brings rain. The average annual rainfall is 29 in. in the hill region and 22 in the plains.

Wheat, potatoes, and oats are the most important crops; sugar-beet, sorghum, millet, ramie, early vegetables and fruits, among which may be mentioned the melons of Cavaillon, are also cultivated, and to these must be added the vine, olive and mulberry. The truffles of the regions of Apt and Carpentras, and the fragrant herbs of the Ventoux range, are renowned. Sheep are the principal live-stock, and mules are also numerous. Lignite and sulphur are mined; rich deposits of gypsum, fire-clay, ochre, &c., are worked. Montmirail has mineral springs of some repute. The industrial establishments include silk mills, silk-spinning factories, oil mills, flour mills, paper mills, wool-spinning factories, confectionery establishments, manufactories of pottery, earthenware, bricks, mosaics, tinned provisions, chemicals, candles, soap and hats, breweries, puddling works, iron and copper foundries, cabinet workshops, blast furnaces, sawmills, edge-tool workshops and nursery gardens. Coarse cloth, carpets, blankets, and ready-made clothes are also produced. The department is served by the Paris-Lyon-Méditerranée railway, and the Rhone is navigable for 40 m. within it. It is divided into 4 arrondissements (Avignon, Apt, Carpentras and Orange), 22 cantons and 150 communes. Avignon, the capital, is the seat of an archbishop. The department belongs to the region of the XV. army corps and to the *académie* (educational circumscription) of Aix, and has its appeal court at Nîmes.

Avignon, Apt, Carpentras, Cavaillon, Orange and Vaison, the most noteworthy towns, are treated separately, and the interesting abbey of Senanque, of Romanesque architecture. Other places of interest are Gordes, with a town hall of Renaissance architecture; Pernes, which has a church of the 11th century and medieval fortifications; La Tour d'Aigues, with fine ruins of the Renaissance château of the barons of Central Bonnieux, near which there is a bridge of the 2nd or 3rd century over the Calavon; Venasque, of Gallo-Roman or even earlier origin, with a baptistery of the 8th or 9th century; and Le Thor, with a fine church in the Provençal Romanesque style.

VAUD (Ger. *Waadt*), one of the cantons of south-western Switzerland. Its total area is 1255·2 sq. m. (thus ranking after the Grisons, Bern and the Valais), of which 1056·7 sq. m. are reckoned as "productive" (forests covering 320·1 sq. m. and vineyards 24·9 sq. m., this last region being more extensive than in any other canton). Of the rest, $160\frac{1}{4}$ sq. m. are occupied by the portions of various lakes partly in the canton (Geneva, $123\frac{1}{2}$ sq. m.; Neuchâtel, 33 sq. m.; and Morat, $3\frac{1}{2}$ sq. m.) and 4·3 by glaciers, the loftiest point in the canton being the Diablerets (10,650 ft.). The canton is of very irregular shape, as it owes its artificial existence solely to historical causes. It includes practically the whole northern shore of the Lake of Geneva, while it stretches from the "Alpes Vaudoises" and Bex, on the S.E., to the Jura and the French frontier, on the N.W. A long narrow tongue extending past Payerne (Peterlingen) to the Lake of Neuchâtel is just disconnected with the Avenches region that forms an "enclave" in the canton of Fribourg, while in the canton of Vaud, Fribourg holds the two "enclaves" of Vuissens and Surpierre. A small stretch of the right bank of the Rhone (from Bex to the Lake of Geneva) is within the canton, while various short streams flow down into the Lake of Geneva. But the more northerly portion of the canton, beyond the Jorat range, to the north of Lausanne, and in particular the valley of the Broye, belongs to the Aar, and so to the Rhine basin. The canton is thus hilly rather than mountainous, save at its south-eastern extremity. It is well supplied with railways, including that along the northern shore of the Lake of Geneva, while from Bex through Vallorbes runs the main Simplon line towards Paris. There are also numerous "regional" or small-gauge railways, as well as mountain lines from Montreux past Glion up the Rochers de Naye, and from Vevey up the Mont Pèlerin, not to speak of that ("Montreux-Oberland" line) direct to the head of the Sarine valley and so by the Simme valley to the Lake of Thun. In 1900 the population was 281,279, of whom 243,463 were French-speaking, 24,372 German-speaking, and 10,667 Italian-speaking, while 242,811 were Protestants (Calvinists, whether of the larger *église nationale* or of the smaller *église libre*, founded in 1847), 36,980 Romanists, and 1076 Jews. Agriculture is the main occupation of the inhabitants: the land is much subdivided and very highly cultivated.

The vineyards give employment to great numbers of people. Much more white wine is produced than red wine. The best white wines of the canton are Yvorne (near Aigle) and La Côte (west of Lausanne), while the vineyard of Lavaux (east of Lausanne) produces both red and white wine. There is not very much industry in the canton, though at Ste Croix in the Jura watches and musical boxes are made, while at Payerne tobacco is grown. Many foreigners reside in the canton, partly for reasons of health, partly on account of the educational advantages that it offers. They chiefly favour Lausanne, Vevey and the collection of hamlets known as

"Montreux," as well as Châteaux d'Oex, in the upper Sarine valley. Lausanne (*q.v.*) is the political capital of the canton. Next in point of population comes the "agglomeration" known as Montreux (*q.v.*), with 14,144, and Vevey (*q.v.*), with 11,781. Other important villages or small towns are Yverdon (7985 inhab.), Ste Croix (5905 inhab.), Payerne (5224 inhab.), Nyon (4882 inhab.), Morges (4421 inhab.), Aigle (3897 inhab.), and Château d'Oex (3025 inhab.). In educational matters the canton holds a high place. The academy of Lausanne dates from 1537, and was raised to the rank of a university in 1890; and there are a very large number of schools and educational establishments at Morges, Lausanne, Vevey, and elsewhere. Pestalozzi's celebrated institution flourished at Yverdon from 1806 to 1825. Among the remarkable historical spots in the canton are Avenches (the chief Roman settlement in Helvetia), Grandson (*q.v.*) (scene of the famous battle in 1476 against Charles the Bold), and the castle of Chillon (where Bonivard, the prior of St Victor at Geneva, was imprisoned from 1530 to 1536 for defending the freedom of Geneva against the duke of Savoy).

The canton is divided into 19 administrative districts, which comprise 388 communes. The cantonal constitution dates from 1885. The government consists of a *Grand Conseil*, or great council (one member to every 300 electors or fraction over 150), for legislative and a *conseil d'état*, or council of state, of seven members (chosen by the *Grand Conseil*) for executive purposes. In both cases the term of office is four years. Six thousand citizens can compel consideration of any project by the legislature ("initiative," first in 1845), and the *referendum* exists in its "facultative" form, if demanded by 6000 citizens, and also in case of expenditure (not included in the budget) of over half a million francs. The two members of the Federal *Ständerath* are named by the *Grand Conseil*, while the fourteen members of the Federal *Nationalrath* are chosen by a popular vote. Capital punishment was abolished in 1874.

The early history of the main part of the territories comprised in the present canton is identical with that of south-west Switzerland generally. The Romans conquered (58 B.C.) the Celtic Helvetii and so thoroughly colonized the land that it has remained a Romance-speaking district, despite conquests by the Burgundians (5th century) and Franks (532) and the incursions of the Saracens (10th century). It formed part of the empire of Charlemagne, and of the kingdom of Transjurane Burgundy (888–1032), the memory of "good queen Bertha," wife of King Rudolph II., being still held in high honour. After the extinction of the house of Zähringen (1218) the counts of Savoy gradually won the larger part of it, especially in the days of Peter II., "le petit Charlemagne" (d. 1268). The bishop of Lausanne (to which place the see had probably been transferred from Aventicum by Marius the Chronicler at the end of the 6th century), however, still maintained the temporal power given to him by the king of Burgundy, and in 1125 had become a prince of the empire. (We must be careful to distinguish between the present canton of Vaud and the old medieval Pays de Vaud: the districts forming the present canton very nearly correspond to the Pays Romand.) Late in the 15th century Bern began to acquire lands to the south from the dukes of Savoy, and it was out of those conquests that the canton was formed in 1798. In 1475 she seized Aigle and (in concert with Fribourg) Échallens and Grandson as well as Orbe (the latter held of the county of Burgundy). Vaud had been occupied by Bern for a time (1475–1476), but the final conquest did not take place till 1536, when both Savoyard Vaud and the bishopric of Lausanne (including Lausanne and Avenches) were overrun and annexed by Bern (formally ceded in 1564), who added to them (1555) Château d'Oex, as her share of the domains of the debt-laden count of the Gruyère in the division of the spoil she made with Fribourg. Bern in 1526 sent Guillaume Farel, a preacher from Dauphiné, to carry out the Reformation at Aigle, and after 1536 the new religion was imposed by force of arms and the bishop's residence moved to Fribourg (permanently from 1663). Thus the whole land became Protestant, save the district of Échallens. Vaud was ruled very harshly by bailiffs from Bern. In 1588 a plot of some nobles to hand it over to Savoy was crushed, and in 1723 the enthusiastic idealist Davel lost his life in an attempt to raise it to the rank of a canton. Political feeling was therefore much excited by the outbreak of the French Revolution, and a Vaudois, F. C. de la Harpe, an exile and a patriot, persuaded the Directory in Paris to march on Vaud in virtue of alleged rights conferred by a treaty of 1565. The French troops were received enthusiastically, and the "Lemanic republic" was proclaimed (January 1798), succeeded by the short-lived Rhodanic republic, till in March 1798 the canton of Léman was formed as a district of the Helvetic republic. This corresponded precisely with the present canton minus Avenches and Payerne, which were given to the canton of Vaud (set up in 1803). The new canton was thus made up of the Bernese conquests of 1475, 1475–76, 1536 and 1555. The constitutions of 1803 and 1814 favoured the towns and wealthy men, so that an agitation went on for a radical change, which was effected in the constitution of 1831. Originally acting as a mediator, Vaud finally joined the anti-Jesuit movement (especially after the radicals came into power in 1845), opposed the Sonderbund, and accepted the new federal constitution of 1848, of which Druey of Vaud was one of the two drafters. From 1839 to 1846 the canton was distracted by religious struggles, owing to the attempt of the radicals to turn the church into a simple department of state, a struggle which ended in the splitting off (1847) of the "free church." The cantonal feeling in Vaud is very strong, and was the main cause of the failure of the project of revising the federal constitution in 1872, though that of 1874 was accepted. In 1879 Vaud was one of the three cantons which voted (though in vain) against a grant in aid of the St Gotthard railway. In 1882 the radicals obtained a great majority, and in 1885 the constitution of 1861 was revised.

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(W. A. B. C.)

VAUDEVILLE, a term now generally given to a musical drama of a light, humorous or comic description interspersed with songs and dances. In English usage "vaudeville" is practically synonymous with what is more generally known as "musical comedy," but in America it is applied also to a music-hall variety entertainment. This modern sense is developed from the French *vaudeville* of the 18th century, a popular form of light dramatic composition, consisting of pantomime, dances, songs and dialogue, written in couplets. It is generally accepted that the word is to be identified with *vau-de-vire*, the name given to the convivial songs of the 15th century. This name originated with a literary association known as the "*Compagnons Gallois*," *i.e.* "boon companions" or "gay comrades" in the valley of the Vire and Virène in Normandy. The most famous of the authors of these songs was Olivier Basselin (*q.v.*). When in the 17th century the term had become applied to topical, satiric verses current in the towns, it was corrupted into its present form, either from *à vau le ville*, or *voix de ville*.

VAUGELAS, CLAUDE FAVRE, SEIGNEUR DE, BARON DE PÉROGES (1595–1650), French grammarian and man of letters, was born at Meximieu, department of Ain, on the 6th of January 1595. He became gentleman-in-waiting to Gaston d'Orléans, and continued faithful to this prince in his disgrace, although his fidelity cost him a pension from the crown on which he was largely dependent. His thorough knowledge of the French language and the correctness of his speech won for him a place among the original academicians. On the representation of his colleagues his pension was restored so that he might have leisure to pursue his admirable *Remarques sur la langue française*

(1647). In this work he maintained that words and expressions were to be judged by the current usage of the best society, of which, as an habitué of the Hôtel de Rambouillet, Vaugelas was a competent judge. He shares with Malherbe the credit of having purified French diction. His book fixed the current usage, and the classical writers of the 17th century regulated their practice by it. Protests against the academical doctrine were not lacking. Scipion Dupleix in his *Liberté de la langue française dans sa pureté* (1651) pleaded for the richer and freer language of the 16th century, and François de la Mothe le Vayer took a similar standpoint in his *Lettres à Gabriel Naudé touchant les Remarques sur la langue française.* Towards the end of his life Vaugelas became tutor to the sons of Thomas Francis of Savoy, prince of Carignan. He died in Paris in February 1650. His translation from Quintus Curtius, *La Vie d'Alexandre* (posthumously published in 1653) deserves notice as an application of the author's own rules.

BIBLIOGRAPHY.—See *Remarques sur la langue française*, edited with a key by V. Conrart, and introductory notes by A. Chassang (Paris, 1880). The principles of Vaugelas's judgments are explained in the *Études critiques* (7ᵉ série) of M. Brunetière, who regards the name of Vaugelas as a symbol of all that was done in the first half of the 16th century to perfect and purify the French language. See also F. Brunot in the *Histoire de la langue et littérature française* of Petit de Julleville.

VAUGHAN, CHARLES JOHN (1816–1897), English scholar and divine, was educated at Rugby and Cambridge, where he was bracketed senior classic with Lord Lyttelton in 1838. In 1839 he was elected fellow of Trinity College, Cambridge, and for a short time studied law. He took orders, however, in 1841, and became vicar of St Martin's, Leicester. Three years later he was elected headmaster of Harrow. He resigned the headmastership in 1859 and accepted the bishopric of Rochester, but afterwards withdrew his acceptance. In 1880 he was appointed vicar of Doncaster. He was appointed master of the Temple in 1869, and dean of Llandaff in 1879. In 1894 he was elected president of University College, Cardiff, in recognition of the prominent part he took in its foundation. Vaughan was a well-known Broad Churchman, an eloquent preacher and an able writer on theological subjects, his numerous works including lectures, commentaries and sermons; he was joint-author with the Rev. John Llewelyn Davies (b. 1826)—also a well-known Cambridge scholar and Broad Churchman—of a well-known translation of Plato's *Republic*.

VAUGHAN, HENRY (1622–1695), called the "Silurist," English poet and mystic, was born of an ancient Welsh family at Newton St Briget near Scethrog by Usk, Brecknockshire, on the 17th of April 1622. His grandfather, Thomas Vaughan, was the son of Charles Vaughan of Tretower Castle, and had acquired the farm of Newton by marriage. From 1632 to 1638 he and his twin brother Thomas, noticed below, were privately educated by the Rev. Matthew Herbert, rector of Llangattock, to whom they both addressed Latin verses expressing their gratitude. Anthony à Wood, who is the main authority for Vaughan's biography, says that Henry was entered at Jesus College, Oxford, in 1638, but no corroboration of the statement is forthcoming, although Thomas Vaughan's matriculation is entered, nor does Henry Vaughan ever allude to residence at the university.[1] He was sent to London to study law, but turning his attention to medicine, he became a physician, and settled first at Brecon and later at Scethrog to the practice of his art. He was regarded, says Wood, as an "ingenious person, but proud and humorous." It seems likely that he fought on the king's side in the Welsh campaign of 1645, and was present at the battle of Rowton Heath. In 1646 appeared *Poems, with the Tenth Satyre of Juvenal Englished*, by Henry Vaughan, Gent. The poems in this volume are chiefly addressed to "Amoret," and the last is on Priory Grove, the home of the "matchless Orinda," Mrs Katharine Philips. A second volume of secular verse, *Olor Iscanus*, which takes its name from the opening verses addressed to the Isca (Usk), was published by a friend, probably Thomas Vaughan, without the author's consent, in 1651. The book includes three prose translations from Latin versions of Plutarch and Maximus of Tyre, and one in praise of a country life from Guevara. The preface is dated 1647, and the reason for Vaughan's reluctance to print the book is to be sought in the preface to *Silex Scintillans: or Sacred Poems and Pious Ejaculations* (1650). There he says: "The first that with any effectual success attempted a diversion of this foul and overflowing stream (of profane poetry) was the blessed man, Mr George Herbert, whose holy life and verse gained many pious converts, of whom I am the least." He further expresses his debt in "The Match," when he says that his own "fierce, wild blood . . . is still tam'd by those bright fires which thee inflam'd." His debt to Herbert extended to the form of his poetry and sometimes to the actual expressions used in it, and a long list of parallel passages has been adduced. His other works are *The Mount of Olives: or Solitary Devotions*, with a translation, *Man in Glory*, from the Latin of Anselm (1652); *Flores Solitudinis* (1654), consisting of two prose translations from Nierembergius, one from St Eucherius, and a life of Paulinus, bishop of Nola; *Hermetical Physick*, translated from the *Naturae Sanctuarium* of Henricus Nollius; *Thalia Rediviva; The Pass-Times and Diversions of a Country Muse* (1678), which includes some of his brother's poems. Henry Vaughan died at Scethrog on the 23rd of April 1695, and was buried in the churchyard of Llansantffraed.

As a poet Vaughan comes latest in the so-called "metaphysical" school of the 17th century. He is a disciple of Donne, but follows him mainly as he saw him reflected in George Herbert. He analyses his experiences, amatory and sacred, with excessive ingenuity, striking out, every now and then, through his extreme intensity of feeling and his close observation of nature, lines and phrases of marvellous felicity. He is of imagination all compact, and is happiest when he abandons himself most completely to his vision. It is, as Canon H. C. Beeching has said, "undoubtedly the mystical element in Vaughan's writing by which he takes rank as a poet . . . it is easy to see that he has a passion for Nature for her own sake, that he has observed her moods; that indeed the world is to him no less than a veil of the eternal spirit, whose presence may be felt in any, even the smallest part." In this imaginative outlook on Nature he no doubt exercised great influence on Wordsworth, who is known to have possessed a copy of his poems, and it is difficult to avoid seeing in "The Retreat" the germ of the later poet's "Ode on Intimations of Immortality." By this poem, with "The World," mainly because of its magnificent opening stanza, "Beyond the Veil," and "Peace," he is best known to the ordinary reader.

The complete works of Henry Vaughan were edited for the Fuller Worthies Library by Dr A. B. Grosart in 1871. The *Poems of Henry Vaughan, Silurist*, were edited in 1896 by Mr E. K. Chambers, with an introduction by Canon H. C. Beeching, for the Muses' Library.

VAUGHAN, HERBERT (1832–1903), cardinal and archbishop of Westminster, was born at Gloucester on the 15th of April 1832, the eldest son of lieutenant-colonel John Francis Vaughan, head of an old Roman Catholic family, the Vaughans of Courtfield, Herefordshire. His mother, a daughter of John Rolls of The Hendre, Monmouthshire, was intensely religious; and all the daughters of the family entered convents, while six of the eight sons took priest's orders, three of them rising to the episcopate, Roger becoming archbishop of Sydney, and John bishop of Sebastopolis. Herbert spent six years at Stonyhurst, and was then sent to study with the Benedictines at Downside, near Bath, and subsequently at the Jesuit school of Brugelette, Belgium, which was afterwards removed to Paris. In 1851 he went to Rome. After two years of study at the Accademia dei nobili ecclesiastici, where he became a friend and disciple of Manning, he took priest's orders at Lucca in 1854. On his return to England he became for a period vice-president of St Edmund's College, Ware, at that time the chief seminary for candidates for the priesthood in the south of England. Since childhood he had been filled with zeal for foreign missions, and he conceived the determination to found a great English missionary college to fit young priests for the work of evangelizing the heathen. With this object he made a great begging expedition to America in 1863, from which he returned with £11,000. St Joseph's Foreign Missionary College, Mill Hill Park, London, was opened in 1869. Vaughan also became proprietor of the *Tablet*, and used its columns vigorously for propagandist purposes. In 1872 he was consecrated bishop of Salford, and in 1892 succeeded Manning as archbishop of Westminster, receiving the cardinal's hat in 1893. Vaughan was a man of very different type from his predecessor; he had none of Manning's intellectual *finesse* or his ardour in social reform, but he was an ecclesiastic of remarkably fine presence and aristocratic leanings, *intransigeant* in theological policy, and in personal character simply devout.

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[1] Two poems in the *Eucharistica Oxoniensia* (1641) are signed "H. Vaughan, Jes. Coll.," but are probably by a contemporary of the same name, noticed by Wood. See Mr E. K. Chambers's biographical note in vol. ii. of Vaughan's *Works*.

It was his most cherished ambition to see before he died an adequate Roman Catholic cathedral in Westminster, and he laboured untiringly to secure subscriptions, with the result that its foundation stone was laid in 1895, and that when he died, on the 19th of June 1903, the building was so far complete that a Requiem Mass was said there over his body before it was removed to its resting-place at Mill Hill Park.

See the *Life of Cardinal Vaughan*, by J. G. Snead Cox (2 vols., London, 1910).

VAUGHAN, THOMAS (1622–1666), English alchemist and mystic, was the younger twin brother of Henry Vaughan, the "Silurist." He matriculated from Jesus College, Oxford, in 1638, took his B.A. degree in 1642, and became fellow of his college. He remained for some years at Oxford, but also held the living of his native parish of Llansantfread from 1640 till 1649, when he was ejected, under the Act for the Propagation of the Gospel in Wales, upon charges of drunkenness, immorality and bearing arms for the king. Subsequently he lived at his brother's farm of Newton and in various parts of London, and studied alchemy and kindred subjects. He married in 1651 and lost his wife in 1658. After the Restoration he found a patron in Sir Robert Murray, with whom he fled from London to Oxford during the plague of 1665. He appears to have had some employment of state, but he continued his favourite studies and actually died of the fumes of mercury at the house of Samuel Kem at Albury on the 27th of February 1666. Vaughan regarded himself as a philosopher of nature, and although he certainly sought the universal solvent, his published writings deal rather with magic and mysticism than with technical alchemy. They also contain much controversy with Henry More the Platonist. Vaughan was called a Rosicrucian, but denied the imputation. He wrote or translated *Anthroposophia Theomagica* (1650); *Anima Magica Abscondita* (1650); *Magia Adamica* and *Coelum Terrae* (1650); *The Man-Mouse taken in a Trap* (1650); *The Second Wash; or the Moor Scoured once more* (1651); *Lumen de Lumine* and *Aphorisimi Magici Eugeniani* (1651); *The Fame and Confession of the Fraternity of R.C.* (1652); *Aula Lucis* (1652); *Euphrates* (1655); *Nollius' Chymist's Key* (1657); *A Brief Natural History* (1669). Most of these pamphlets appeared under the pseudonym of Eugenius Philalethes. Vaughan was probably, although it is by no means certain, *not* the famous adept known as Eirenaeus Philalethes, who was alleged to have found the philosopher's stone in America, and to whom the *Introitus Apertus in Occlusum Regis Palatium* (1667) and other writings are ascribed. In 1896 Vaughan was the subject of an amazing mystification in the *Mémoires d'une ex-Palladiste.* These formed part of certain alleged revelations as to the practice of devil-worship by the initiates of freemasonry. The author, whose name was given as Diana Vaughan, claimed to be a descendant of Thomas and to possess family papers which showed amongst other marvels that he had made a pact with Lucifer, and had helped to found freemasonry as a Satanic society. The inventors of the hoax, which took in many eminent Catholic ecclesiastics, were some unscrupulous Paris journalists.

The Magical Writings of Thomas Vaughan were edited by Mr A. E. Waite in 1888. His miscellaneous Latin and English verses are included in vol. ii. of Dr A. B. Grosart's Fuller Worthies Library edition of the *Works* of Henry Vaughan (1871). A manuscript book of his, with alchemical and autobiographical jottings made between 1658 and 1662, forms *Brit. Mus. Sloane MS.* 1741. Biographical data are in Mr E. K. Chambers's Muses Library edition of the *Poems* of Henry Vaughan (1896), together with an account and criticism of the *Mémoires d'une ex-Palladiste.* These fabrications were also discussed by Mr A. E. Waite, *Devil-Worship in France* (1896), and finally exposed by M. Gaston Méry, *La Vérité sur Diana Vaughan.* (E. K. C.)

VAUGHAN, WILLIAM (1577–1641), English author and colonial pioneer, son of Walter Vaughan (d. 1598), was born at Golden Grove, Carmarthenshire, his father's estate, in 1577. He was descended from an ancient prince of Powys. His brother, John Vaughan (1572–1634), became 1st earl of Carbery; and another brother, General Sir Henry or Harry Vaughan (1587–1659), was a well-known royalist leader. William was educated at Jesus College, Oxford, and took the degree of LL.D. at Vienna. In 1616 he bought a grant of land in the south coast of Newfoundland, to which he sent two batches of settlers. In 1622 he visited the settlement, which he called Cambriol, and returned to England in 1625. Vaughan apparently paid another visit to his colony, but his plans for its prosperity were foiled by the severe winters. He died at his house of Torcoed, Carmarthenshire, in August 1641.

His chief work is *The Golden Grove* (1600), a general guide to morals, politics and literature, in which the manners of the time are severely criticized, plays being denounced as folly and wickedness. The section in praise of poetry borrows much from earlier writers on the subject. *The Golden Fleece . . . transported from Cambriol Colchis . . . by Orpheus jun., alias Will Vaughan*, which contains information about Newfoundland, is the most interesting of his other works.

VAULT[1] (Fr. *voute*, Ital. *volta*, Ger. *Gewölbe*), in architecture, the term given to the covering over of a space with stone or brick in arched form, the component parts of which exert a thrust and necessitate a counter resistance. In the case of vaults built under the level of the ground, the latter gave all that was required, but, when raised aloft, various expedients had to be employed, such as great thickness of walls in the case of barrel or continuous vaults, and cross walls or buttresses when intersecting vaults were employed. The simplest kind of vault is that known as the barrel, wagon or tunnel vault, which is generally semicircular in section, and may be regarded as a continuous arch, the length of which is in excess of its diameter; like the arch (*q.v.*), the same provision is required as regards its temporary support whilst the voussoirs constituting one of its rings are being placed in position, for until the upper voussoir, or keystone, is introduced it is not self-supporting. At the present day, when timber of all kinds is easily procurable, this temporary support is given by centring, consisting of a framed truss with semicircular or segmental head, which carries the voussoirs until the ring of the whole arch is completed and is then, with a barrel vault, shifted on to support other rings; in early times, and particularly in Chaldaea and Egypt, where timber was scarce, other means of support had to be contrived, and it would seem that it was only in Roman times that centring was regularly employed.

The earliest example known of a vault is that found under the Chaldaean ziggurat at Nippur in Babylonia, ascribed to about 4000 B.C., which was built of burnt bricks cemented with clay mortar. The earliest tunnel vaults in Egypt are those at Requaqnah and Denderah, *c.* 3500 B.C.; these were built in unburnt brick in three rings over passages descending to tombs: in these cases, as the span of the vault was only 6 ft., the bricks constituting the voussoirs were laid flatwise, and adhered sufficiently to those behind to enable the ring to be completed without other support; in the granaries built by Ramessu II., still in part existing behind the Ramesseum, at Thebes, the span was 12 ft., and another system was employed; the lower part of the arch was built in horizontal courses, up to about one-third of the height, and the rings above were inclined back at a slight angle, so that the bricks of each ring, laid flatwise, adhered till the ring was completed, no centring of any kind being required; the vault thus formed was elliptic in section, arising from the method of its construction. A similar system of construction was employed for the vault over the great hall at Ctesiphon, where the material employed was burnt bricks or tiles of great dimensions, cemented with mortar; but the span was close upon 83 ft., and the thickness of the vault was nearly 5 ft. at the top, there being four rings of brickwork. It is probable that the great vaults of the Assyrian palaces were constructed in the same way, but with unburnt bricks dried only in the sun: one of the drains discovered by Layard at Nimrud was built in rings sloping backwards. From the fact that each Assyrian monarch on his accession to the throne commenced his reign by the erection of a palace, it is probable that, owing to the ephemeral construction of these great vaults, half a century was the term of their existence. This may also account for the fact that no domed structures exist of the type shown in one of the bas reliefs from Nimrud (fig. 1); the tradition of their erection, however, would seem to have been handed down to their successors in Mesopotamia, viz. to the Sassanians, who in their palaces at Serbistan and Firuzabad built domes of similar form to those shown in the Nimrud sculptures, the chief difference being that, constructed in rubble stone and cemented with mortar, they still exist, though probably abandoned on the Mahommedan invasion in the 7th century.

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[1] For the form of safe so called see SAFES.

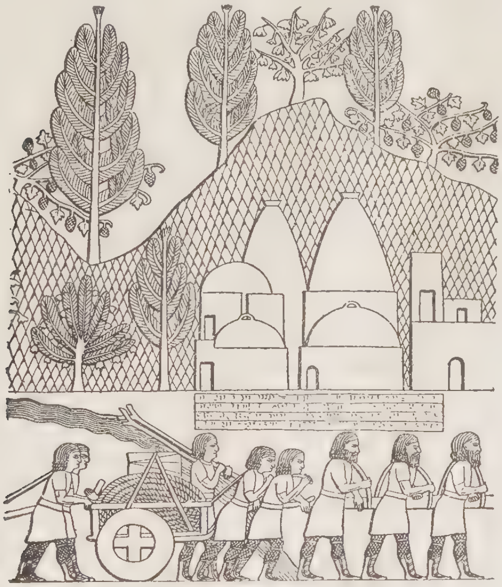

Fig. 1.

In all the instances above quoted in Chaldaea and Egypt the bricks, whether burnt or sun-dried, were of the description to which the term "tile" would now be given; the dimensions varied from 18 or 20 in. to 10 in., being generally square and about 4 to 2 in. thick, and they were not shaped as voussoirs, the connecting medium being thicker at the top than at the bottom. The earliest Egyptian examples of regular voussoirs in stone belong to the XXVIth Dynasty (*c.* 650 B.C.) in the additions made then to the temple of Medinet-Abou, and here it is probable that centring of some kind was provided, as the vaults are built in rings, so that the same centring could be shifted on after the completion of each ring. The earliest example of regularly shaped voussoirs, and of about the same date, is found in the *cloaca* at Graviscae in Etruria, with a span of about 14 ft., the voussoirs of which are from 5 to 6 ft. long. The *cloaca maxima* in Rome, built by Tarquin (603 B.C.) to drain the marshy ground between the Palatine and the Capitoline Hills, was according to Commendatore Boni vaulted over in the 1st century B.C., the vault being over 800 ft. long, 10 ft. in span, with three concentric rings of voussoirs.

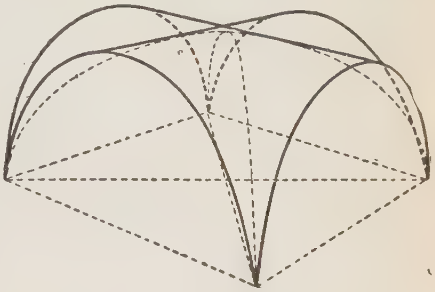

Fig. 2.

So far, all the vaults mentioned have been barrel vaults, which, when not built underground, required continuous walls of great thickness to resist their thrust; the earliest example of the next variety, the intersecting barrel vault, is said to be over a small hall at Pergamum, in Asia Minor, but its first employment over halls of great dimensions is due to the Romans. When two semicircular barrel vaults of the same diameter cross one another (fig. 2) their intersection (a true ellipse) is known as a groin, down which the thrust of the vault is carried to the cross walls; if a series of two or more barrel vaults intersect one another, the weight is carried on to the piers at their intersection and the thrust is transmitted to the outer cross walls; thus in the Roman reservoir at Baiae, known as the *piscina mirabilis*, a series of five aisles with semicircular barrel vaults are intersected by twelve cross aisles, the vaults being carried on 48 piers and thick external walls. The width of these aisles being only about 13 ft. there was no great difficulty in the construction of these vaults, but in the Roman Thermae the tepidarium had a span of 80 ft., more than twice that of an English cathedral, so that its construction both from the statical and economical point of view was of the greatest importance. The researches of M. Choisy (*L'Art de bâtir chez les Romains*), based on a minute examination of those portions of the vaults which still remain *in situ*, have shown that, on a comparatively slight centring, consisting of trusses placed about 10 ft. apart and covered with planks laid from truss to truss, were laid—to begin with—two layers of the Roman brick (measuring nearly 2 ft. square and 2 in. thick); on these and on the trusses transverse rings of brick were built with longitudinal ties at intervals; on the brick layers and embedding the rings and cross ties concrete was thrown in horizontal layers, the haunches being filled in solid, and the surface sloped on either side and covered over with a tile roof of low pitch laid direct on the concrete. The rings relieved the centring from the weight imposed, and the two layers of bricks carried the concrete till it had set. As the walls carrying these vaults were also built in concrete with occasional bond courses of brick, the whole structure was homogeneous. One of the important ingredients of the mortar was a volcanic deposit found near Rome, known as pozzolana, which, when the concrete had set, not only made the concrete as solid as the rock itself, but to a certain extent neutralized the thrust of the vaults, which formed shells equivalent to that of a metal lid, the Romans, however, do not seem to have recognized the extraordinary value of this pozzolana mixture, for they otherwise provided amply for the counteracting of any thrust which might exist by the erection of cross walls and buttresses. In the tepidaria of the Thermae and in the basilica of Constantine, in order to bring the thrust well within the walls, the main barrel vault of the hall was brought forward on each side and rested on detached columns, which constituted the principal architectural decoration. In cases where the cross vaults intersecting were not of the same span as those of the main vault, the arches were either stilted so that their soffits might be of the same height, or they formed smaller intersections in the lower part of the vault; in both of these cases, however, the intersections or groins were twisted, for which it was very difficult to form a centring, and, moreover, they were of disagreeable effect: though every attempt was made to mask this in the decoration of the vault by panels and reliefs modelled in stucco.

The widest hall vaulted by the Romans was that of the throne room in the palace of Diocletian on the Palatine Hill, and this had the enormous span of 100 ft., its thrust being counteracted by other halls on either side with buttresses outside. In provincial towns and in other parts of the Roman Empire, where the material pozzolana was not procurable, the Romans had to trust to their mortar as a cementing medium, but this, though excellent of its kind, was not of sufficient cohesive strength to allow of the erection of vaults of more than about 40 ft. span, which were generally built in rubble masonry. There still exist in Asia Minor and Syria some vaulted halls, generally attached to thermae, which are carried on walls of great thickness. There were many varieties of the Roman vault, whether continuous or intersected, such as those employed over the corridors on the Colosseum and the theatre of Marcellus, but in these cases the springing of the vault was above the summit of the arches of the main front, so that there was no intersection; on the other hand, over the corridors were either elliptical or semicircular, or over the staircases rising vaults, all of which were more difficult to construct; there were also numerous solutions of vault over circular halls, of which that of the Pantheon was the most important example, having a diameter of 142 ft., and over the hemicycles, which were sometimes of great size; that known as Canopus in Hadrian's villa at Tivoli had a diameter of 75 ft., and was vaulted over with a series of ribs, between which were alternating rampant flat and semicircular webs and cells; in the same villa and in Rome were octagonal halls with various other combinations of vault. Another type of vault not yet referred to is that of the Tabularium arcade where the cloister vault was employed. Fig. 3 compared with fig. 2 will show the difference; in the former the angles of intersection are inset, and in the latter they are groins with projecting angles at the base, which die away at the summit.

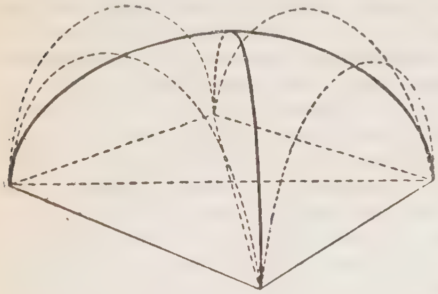

FIG. 3.

The vault of the basilica, commenced by Diocletian and completed by Constantine, was the last great work carried out by the Romans, and two centuries pass before the next important development is found in the church of Sta Sophia at Constantinople. It is probable that the realization of the great advance in the science of vaulting shown in this church owed something to the eastern tradition of dome vaulting seen in the Assyrian domes, which are known to us only by the representations in the bas-relief from Nimrud (fig. 1), because in the great water cisterns in Constantinople, known as the Yeri Batan Serai (the underground palace) and Bin bir-derek (cistern with a thousand and one columns), both built by Constantine, we find the intersecting groin vaults of the Romans already replaced by small cupolas or domes. These domes, however, are of small dimensions when compared with that projected and carried out by Justinian in Sta Sophia. Previous to this the greatest dome was that of the Pantheon at Rome, but this was carried on an immense wall 20 ft. thick, and with the exception of small niches or recesses in the thickness of the wall could not be extended, so that Justinian apparently instructed his architect to provide an immense hemicycle or apse at the eastern end, a similar apse at the western end, and great arches on either side, the walls under which would be pierced with windows.

The diagram (fig. 4) shows the outlines of the solution of the problem. If a hemispherical dome is cut by four vertical planes, the intersection gives four semicircular arches; if cut in addition by a horizontal plane tangent to the top of these arches, it describes a circle; that portion of the sphere which is below this circle and between the arches, forming a spherical spandril, is the pendentive (fig. 5), and its radius is equal to the diagonal of the square on which the four arches rest. Having obtained a circle for the base of the dome, it is not necessary that the upper portion of the dome should spring from the same level as the arches, or that its domical surface should be a continuation of that of the pendentive. The first and second dome of Sta Sophia apparently fell down, so that Justinian determined to raise it, possibly to give greater lightness to the structure, but mainly in order to obtain increased light for the interior of the church. This was effected by piercing it with forty windows—the effect of which was of an extraordinary nature, as the light streaming through these windows gave to the dome the appearance of being suspended in the air. The pendentive which carried the dome rested on four great arches, the thrust of those crossing the church being counteracted by immense buttresses which traversed the aisles, and the other two partly by smaller arches in the apse, the thrust being carried to the outer walls, and to a certain extent by the side walls which were built under the arches. From the description given by Procopius we gather that the centring employed for the great arches consisted of a wall erected to support them during their erection. The construction of the pendentives is not known, but it is surmised that to the top of the pendentives they were built in horizontal courses of brick, projecting one over the other, the projecting angles being cut off afterwards and covered with stucco in which the mosaics were embedded; this was the method employed in the erection of the Perigordian domes, to which we shall return; these, however, were of less diameter than those of Sta Sophia, being only about 40 to 60 ft. instead of 107 ft. The apotheosis of Byzantine architecture, in fact, was reached in Sta Sophia, for although it formed the model on which all subsequent Byzantine churches were based, so far as their plan was concerned, no domes approaching the former in dimensions were even attempted. The principal difference in some later examples is that which took place in the form of the pendentive on which the dome was carried. Instead of the spherical spandril of Sta Sophia, large niches were formed in the angles, as in the mosque of Damascus, which was built by Byzantine workmen for the Sherif al Walid in A.D. 705; these gave an octagonal base on which the hemispherical dome rested (fig. 6); or again, as in the Sassanian palaces of Serbistan and Firuzabad of the 4th and 5th century of our era, when a series of concentric arch rings, projecting one in front of the other, were built, giving also an octagonal base; each of these pendentives is known as a squinch.

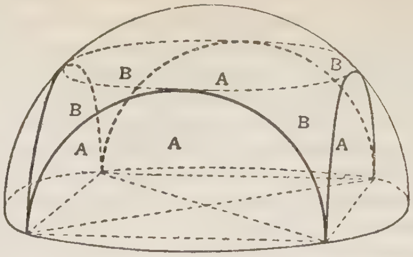

FIG. 4.

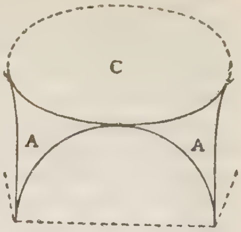

FIG. 5.—AA, pendentive.

There is one other remarkable vault, also built by Justinian, in the church of S. Sergius and Bacchus in Constantinople. The central area of this church was octagonal on plan, and the dome is divided into sixteen compartments; of these eight consist of broad flat bands rising from the centre of each of the walls, and the alternate eight are concave cells over the angles of the octagon, which externally and internally give to the roof the appearance of an umbrella.

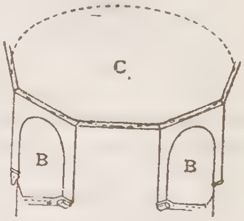

FIG. 6.—BB, niche or squinch pendentive.

Although the dome constitutes the principal characteristic of the Byzantine church, throughout Asia Minor are numerous examples in which the naves are vaulted with the semicircular barrel vault, and this is the type of vault found throughout the south of France in the 11th and 12th centuries, the only change being the occasional substitution of the pointed barrel vault, adopted not only on account of its exerting a less thrust, but because, as pointed out by Fergusson (vol. ii. p. 46), the roofing tiles were laid directly on the vault and a less amount of filling in at the top was required. The continuous thrust of the barrel vault in these cases was met either by semicircular or pointed barrel vaults on the aisles, which had only half the span of the nave; of this there is an interesting example in the chapel of St John in the Tower of London—and sometimes by half-barrel vaults. The great thickness of the walls, however, required in such constructions would seem to have led to another solution of the problem of roofing over churches with incombustible material, viz. that which is found throughout Perigord and La Charente, where a series of domes carried on pendentives covered over the nave, the chief peculiarities of these domes being the fact that the arches carrying them form part of the pendentives, which are all built in horizontal courses.

The intersecting and groined vault of the Romans was employed in the early Christian churches in Rome, but only over the aisles, which were comparatively of small span, but in these there was a tendency to raise the centres of these vaults, which became slightly domical; in all these cases centring was employed.

Reference has been made to the twisting of the groins in Roman work, where the intersecting barrel vaults were not of the same diameter; their construction must at all times have been somewhat difficult, but where the barrel vaulting was carried round over the choir aisle and was intersected, as in St Bartholomew's, Smithfield, by semicones, instead of cylinders, it became worse and the groins more complicated; this would seem to have led to a change of system, and to the introduction of a new feature, which completely revolutionized the construction of the vault. Hitherto the intersecting features were geometrical surfaces, of which the diagonal groins were the intersections, elliptical in form, generally weak in construction and often twisting (Plate I. fig. 13). The medieval builder reversed the process, and set up the diagonal ribs first, which were utilized as permanent centres, and on these he carried his vault or web, which henceforward took its shape from the ribs. Instead of the elliptical curve which was given by the intersection of two semicircular barrel vaults, or cylinders, he employed the semicircular arch for the diagonal ribs; this, however, raised the centre of the square bay vaulted above the level of the transverse arches and of the wall ribs, and thus gave the appearance of a dome to the vault, such as may be seen in the nave of Sant' Ambrogio, Milan. To meet this, at first the transverse and wall ribs were stilted, or the upper part of their arches was raised, as in the Abbaye-aux-Hommes at Caen, and the abbey of Lessay, in Normandy. The problem was ultimately solved by the introduction of the pointed arch for the transverse and wall ribs—the pointed arch had long been known and employed, on account of its much greater strength and of the less thrust it exerted on the walls. When employed for the ribs of a vault, however narrow the span might be, by adopting a pointed arch, its summit could be made to range in height with the diagonal rib; and, moreover, when utilized for the ribs of the annular vault, as in the aisle round the apsidal termination of the choir, it was not necessary that the half ribs on the outer side should be in the same plane as those of the inner side; for when the opposite ribs met in the centre of the annular vault, the thrust was equally transmitted from one to the other, and being already a broken arch the change of its direction was not noticeable.

The first introduction of the pointed arch rib would seem to have taken place in the choir aisles of the abbey of St Denis, near Paris, built by the Abbé Suger in 1135, and it was in the church at Vezelay (1140) that it was extended to the square bay of the porch. Before entering into the question of the web or stone shell of the vault carried on the ribs, the earlier development of the great vaults which were thrown over the naves of a cathedral, or church, before the introduction of the pointed arch rib, shall here be noted. As has been pointed out, the aisles had already in the early Christian churches been covered over with groined vaults, the only advance made in the later developments being the introduction of transverse ribs[1] dividing the bays into square compartments; but when in the 12th century the first attempts were made to vault over the naves, another difficulty presented itself, because the latter were twice the width of the aisles, so that it became necessary to include two bays of the aisles to form one square bay in the nave. This was an immense space to vault over, and, moreover, it followed that every alternate pier served no purpose, so far as the support of the nave vault was concerned, and this would seem to have suggested an alternative, viz. to provide a supplementary rib across the church and between the transverse ribs. This resulted in what is known as a sexpartite, or six-celled vault, of which one of the earliest examples is found in the Abbaye-aux-Hommes (S. Étienne) at Caen. This church, built by William the Conqueror, was originally constructed to carry a timber roof only, but nearly a century later the upper part of the nave walls were partly rebuilt, in order that it might be covered with a vault. The immense size, however, of the square vault over the nave necessitated some additional support, so that an intermediate rib was thrown across the church, dividing the square compartment into six cells, and called the sexpartite vault (fig. 7); this was adopted in the cathedrals of Sens (1170), Laon (1195), Noyon (1190), Paris (1223–35), and Bourges (1250). The intermediate rib, however, had the disadvantage of partially obscuring one side of the clerestory windows, and it threw unequal weights on the alternate piers, so that in the cathedral of Soissons (1205) a quadripartite (fig. 8) or four-celled vault was introduced, the width of each bay being half the span of the nave, and corresponding therefore with the aisle piers. To this there are some exceptions, in Sant' Ambrogio, Milan, and San Michele, Pavia (the original vault), and in the cathedrals of Spires, Mainz and Worms, where the quadripartite vaults are nearly square, the intermediate piers of the aisles being of much smaller dimensions. In England sexpartite vaults exist at Canterbury (1175) (set out by William of Sens), Rochester (1200), Lincoln (1215), Durham (east transept), and St Faith's chapel, Westminster Abbey.

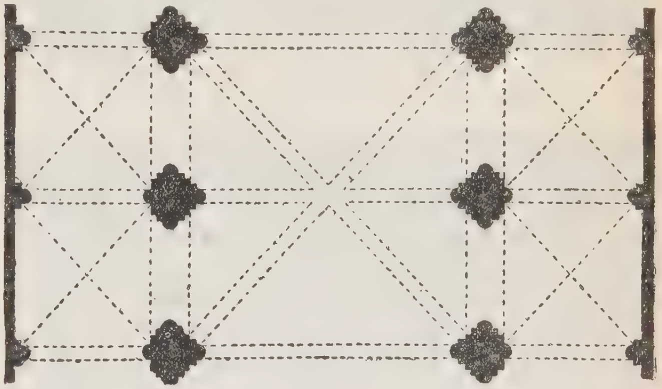

Fig. 7.—Sexpartite.

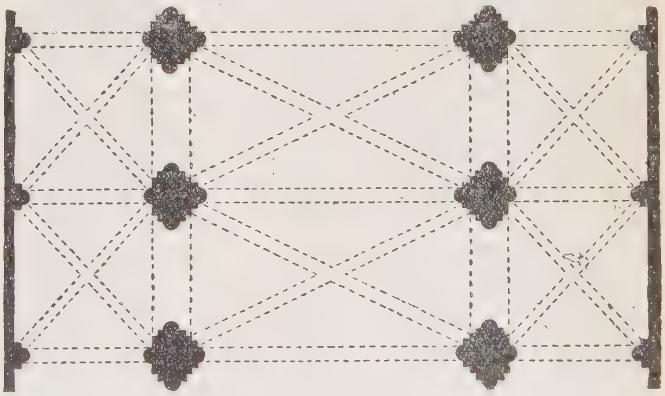

Fig. 8.—Quadripartite.

In the earlier stage of rib vaulting, the arched ribs consisted of independent or separate voussoirs down to the springing; the difficulty, however, of working the ribs separately led to two other important changes: (1) the lower part of the transverse diagonal and wall ribs were all worked out of one stone; and (2) the lower courses were all made horizontal, constituting what is known as the tas-de-charge (*q.v.*) or solid springer. Fig. 9 is a diagram made by Professor Willis taken from the south transept of Westminster Abbey. The horizontal courses rise to N. or about half the height of the vault, but the ribs are freed from one another from the point M. The tas-de-charge, or solid springer, had two advantages: (1) it enabled the stone courses to run straight through the wall, so as to bond the whole together much better; and (2) it lessened the span of the vault, which then required a centring of smaller dimensions. As soon as the ribs were completed, the web or stone shell of the vault was laid on them. In some English work, as may be seen in fig. 9, each course of stone was of uniform height from one side to the other; but, as the diagonal rib was longer than either the transverse or wall rib, the courses dipped towards the former, and at the apex of the vault were cut to fit one another. At an early period, in consequence of the great span of the vault and the very slight rise or curvature of the web, it was thought better to simplify the construction of the web by introducing intermediate ribs between the wall rib and the diagonal rib and between the diagonal and the transverse ribs; and in order to meet the thrust of these intermediate ribs a ridge rib was required, and the prolongation of this rib to the wall rib hid the junction of the web at the summit, which was not always very sightly, and constituted the ridge rib. In France, on the other hand, the web courses were always laid horizontally, and they are therefore of unequal height, increasing towards the diagonal rib. Each course also was given a slight rise in the centre, so as to increase its strength; this enabled the French masons to dispense with the intermediate rib, which was not introduced by them till the 15th century, and then more as a decorative than a constructive feature, as the domical form given to the French web rendered unnecessary the ridge rib, which, with some few exceptions, exists only in England. In both English and French vaulting centring was rarely required for the building of the web, a template (Fr. *cerce*) being employed to support the stones of each ring until it was complete. In Italy, Germany and Spain the French method of building the web was adopted, with horizontal courses and a domical form. Sometimes, in the case of comparatively narrow compartments, and more especially in clerestories, the wall rib was stilted, and this caused a peculiar twisting of the web, as may be seen in fig. 9, where the springing of the wall rib is at K: to these twisted surfaces the term "ploughshare vaulting" is given.

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[1] Transverse ribs under the vaulting surfaces had been employed from very early times by the Romans, and utilized as permanent stone centrings for their vaults; perhaps the earliest examples are those in the corridor of the Tabularium in Rome, which is divided into square bays, each vaulted with a cloister dome. Transverse ribs are also found in the Roman Piscinae and in the Nymphaeum at Nîmes; they were not introduced by the Romanesque masons till the 11th century.

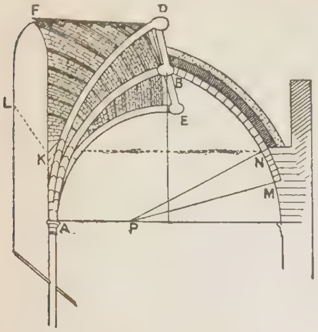


FIG. 9.—AB, springing of transverse and diagonal ribs; P, centre of the same; DE, longitudinal ridge rib; DF, intersection of webs; M, top of solid springer; KN, starting level of web; LK, springing of wall rib; EBD, bosses at intersection of ribs.

One of the earliest examples of the introduction of the intermediate rib is found in the nave of Lincoln Cathedral, and there the ridge rib is not carried to the wall rib. It was soon found, however, that the construction of the web was much facilitated by additional ribs, and consequently there was a tendency to increase their number, so that in the nave of Exeter Cathedral three intermediate ribs were provided between the wall rib and the diagonal rib. In order to mask the junction of the various ribs, their intersections were ornamented with richly carved bosses, and this practice increased on the introduction of another short rib, known as the lierne, a term in France given to the ridge rib. Lierne ribs in English vaults are short ribs crossing between the main ribs, and were employed chiefly as decorative features, as, for instance, in the stellar vault (see Plate I. fig. 16), one of the best examples of which exists in the vault of the oriel window of Crosby Hall, London. The tendency to increase the number of ribs led to singular results in some cases, as in the choir of Gloucester (see Plate II. fig. 17), where the ordinary diagonal ribs become mere ornamental mouldings on the surface of an intersected pointed barrel vault, and again in the cloisters, where the introduction of the fan vault, forming a concave-sided conoid, returned to the principles of the Roman geometrical vault. This is further shown in the construction of these fan vaults, for although in the earliest examples each of the ribs above the tas-de-charge was an independent feature, eventually it was found easier to carve them and the web out of the solid stone, so that the rib and web were purely decorative and had no constructional or independent functions.

The fan vault would seem to have owed its origin to the employment of centrings of one curve for all the ribs, instead of having separate centrings for the transverse, diagonal wall and intermediate ribs; it was facilitated also by the introduction of the four-centred arch, because the lower portion of the arch formed part of the fan, or conoid, and the upper part could be extended at pleasure with a greater radius across the vault. The simplest version is that found in the cloisters of Gloucester Cathedral, where the fans meet one another at the summit, so that there are only small compartments between the fans to be filled up. In later examples, as in King's College chapel, Cambridge (see Plate II. fig. 18), on account of the great dimensions of the vault, it was found necessary to introduce transverse ribs, which were required to give greater strength. Similar transverse ribs are found in Henry VII.'s chapel (see Plate II. fig. 19) and in the divinity schools at Oxford, where a new development presented itself. One of the defects of the fan vault at Gloucester is the appearance it gives of being half sunk in the wall; to remedy this, in the two buildings just quoted, the complete conoid is detached and treated as a pendant.

One of the most interesting examples of the fan vault is that over the staircase leading to the hall of Christ Church, Oxford, and here the complete conoid is displayed in its centre carried on a central column. This vault, not built until 1640, is an exceptional example of the long continuance of traditional workmanship, probably in Oxford transmitted in consequence of the late vaulting of the entrance gateways to the colleges. Fan vaulting is peculiar to England, the only example approaching it in France being the pendant of the Lady chapel at Caudebec, in Normandy. In France, Germany and Spain the multiplication of ribs in the 15th century led to decorative vaults of various kinds, but with some singular modifications. Thus in Germany, recognizing that the rib was no longer a necessary constructive feature, they cut it off abruptly, leaving a stump only; in France, on the other hand, they gave still more importance to the rib, by making it of greater depth, piercing it with tracery and hanging pendants from it, and the web became a horizontal stone paving laid on the top of these decorated vertical webs. This is the characteristic of the great Renaissance work in France and Spain; but it soon gave way to Italian influence, when the construction of vaults reverted to the geometrical surfaces of the Romans, without, however, always that economy in centring to which they had attached so much importance, and more especially in small structures. In large vaults, where it constituted an important element in expense, the chief boast of some of the most eminent architects has been that centring was dispensed with, as in the case of the dome at Florence, built by Brunelleschi, and Ferguson cites as an example the great dome of the church at

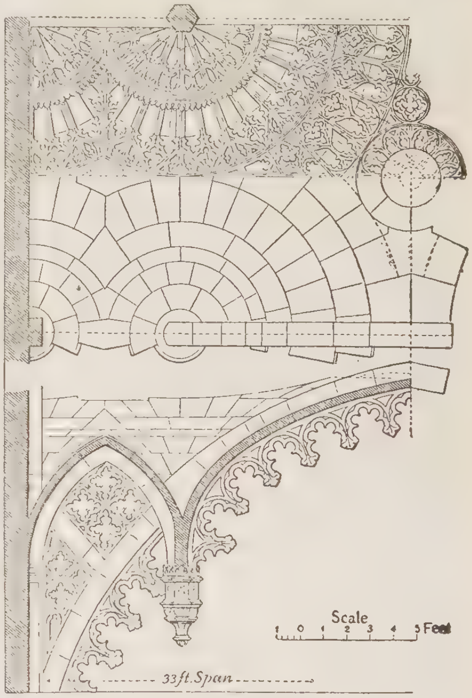


FIG. 10.

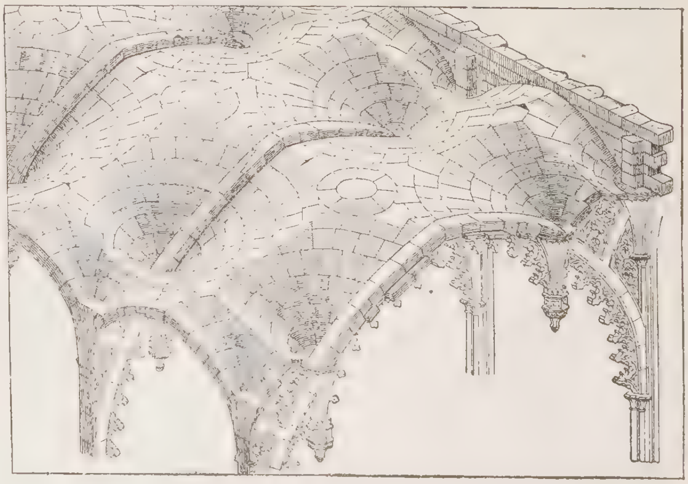
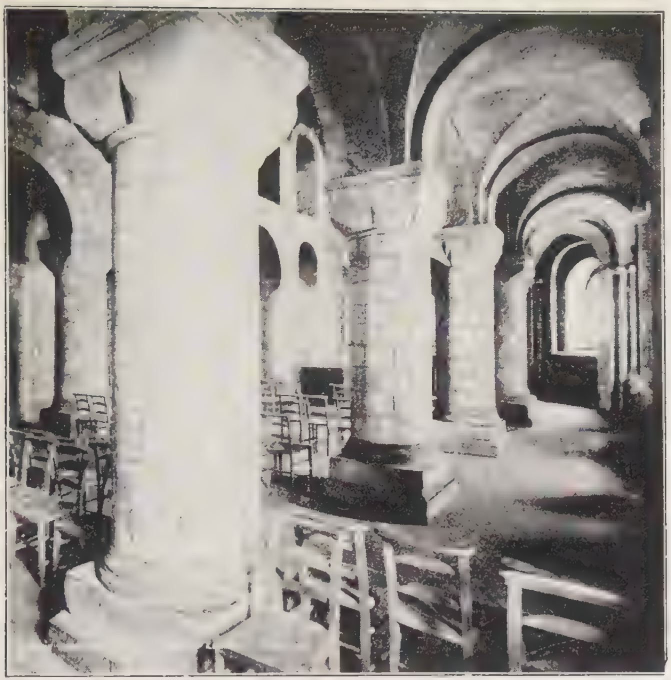


FIG. 11.



Photo, Valentine & Sons.

FIG. 13.—INTERSECTING GROINED VAULTING. Early example. St John's Chapel, Tower of London.

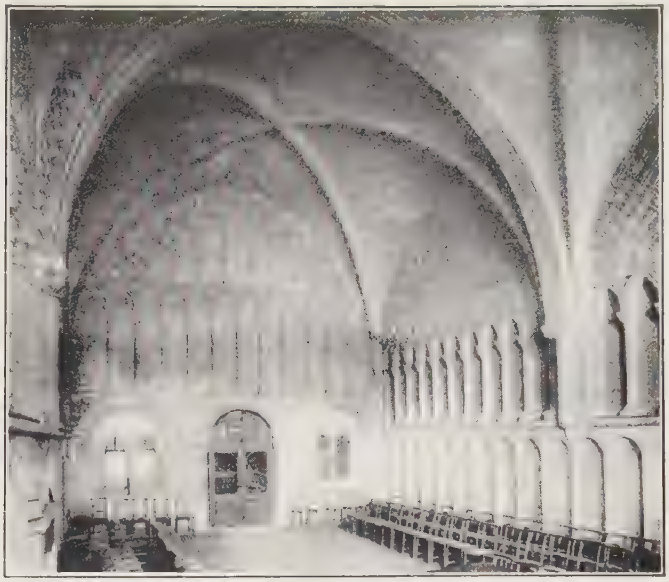


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FIG. 14.—INTERSECTING RIBBED VAULTING. Late example. Chapter House, Bristol Cathedral.

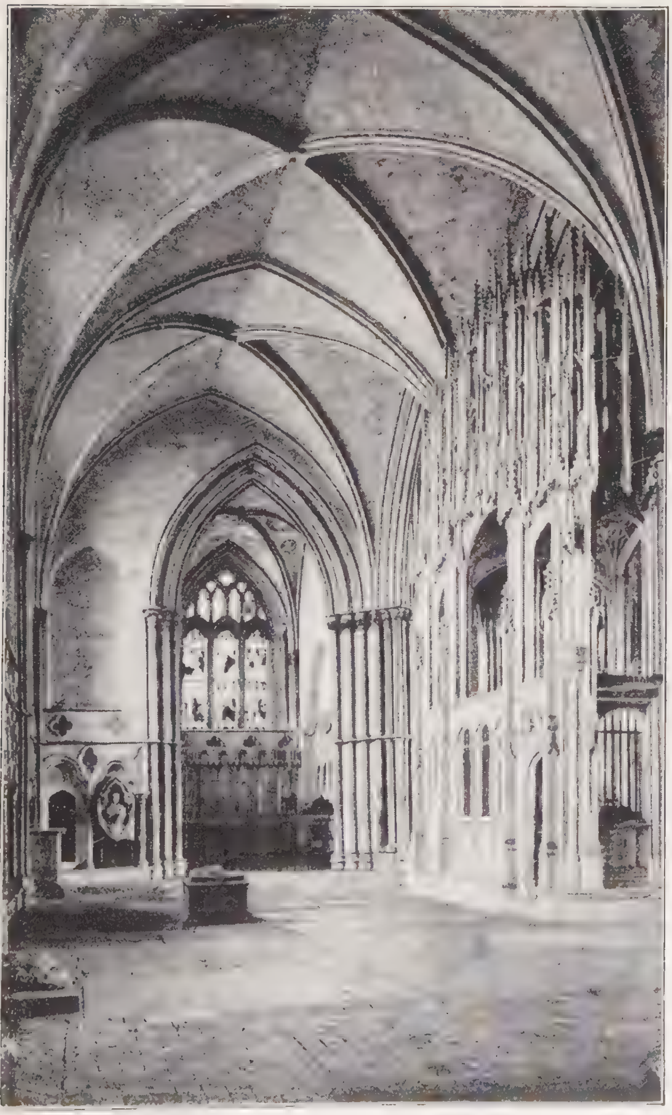

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FIG. 15.—EARLY ENGLISH VAULTING. Winchester Cathedral, Waynfleet's Chantry.

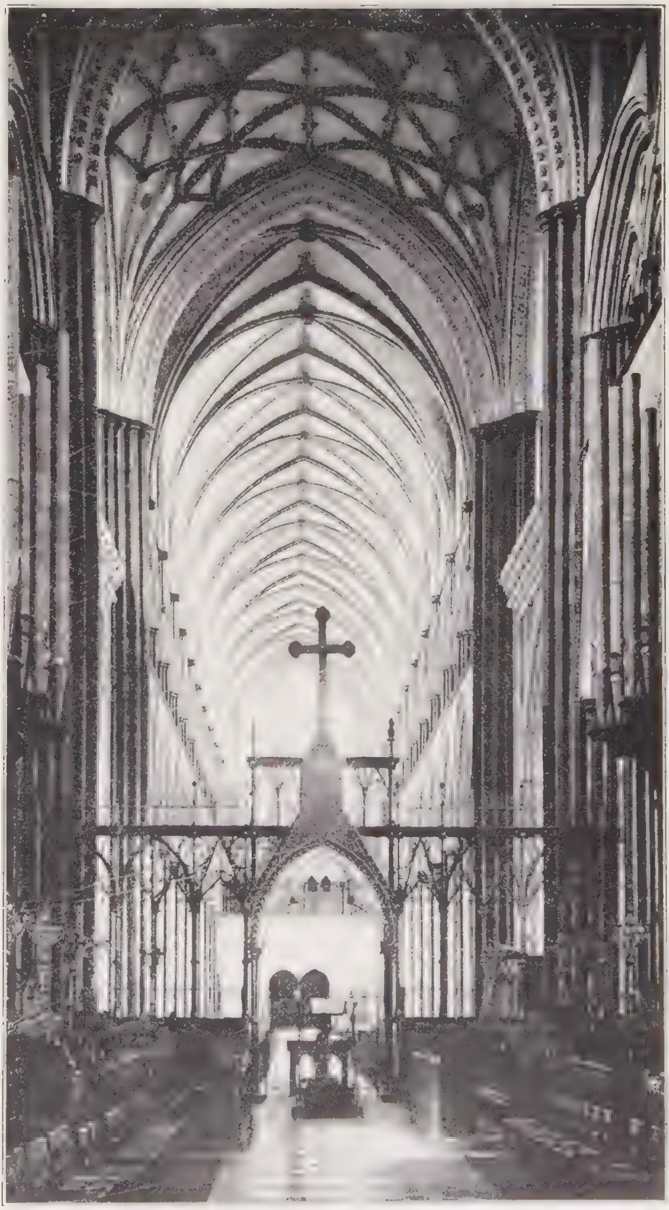

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FIG. 16.—EARLY ENGLISH LIERNE VAULTING, Tower of Salisbury Cathedral.

VAULT

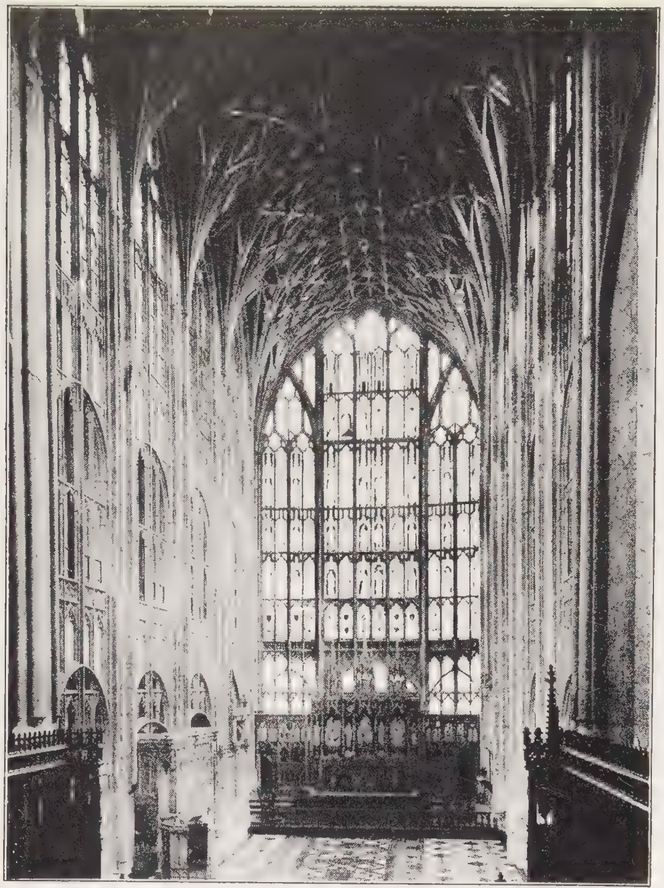

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FIG. 17.—DECORATED OR LIERNE VAULTING.
Choir of Gloucester Cathedral.
(See also Plate VIII., Fig. 82, ARCHITECTURE.)

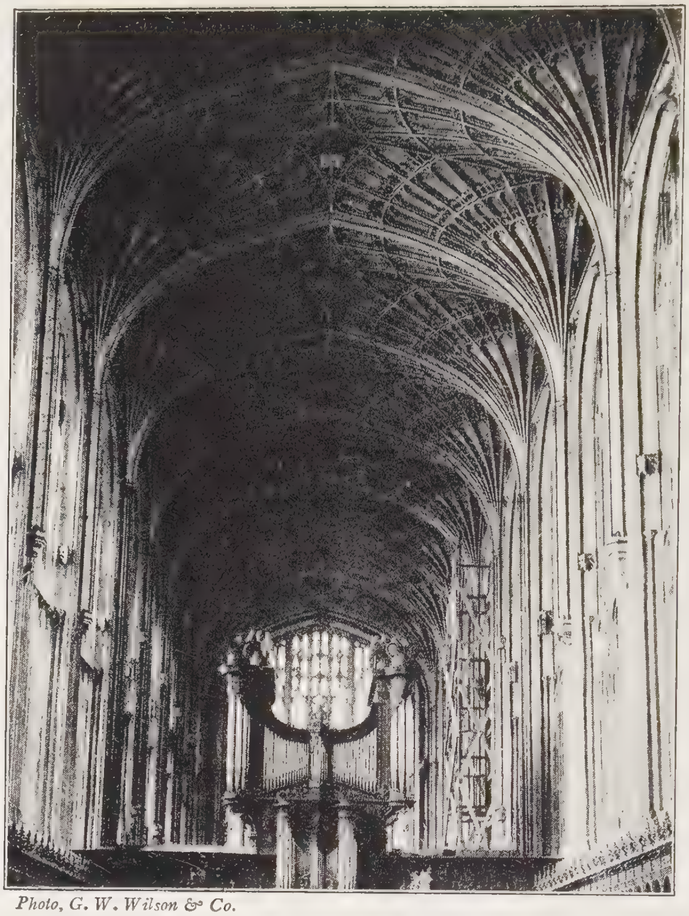

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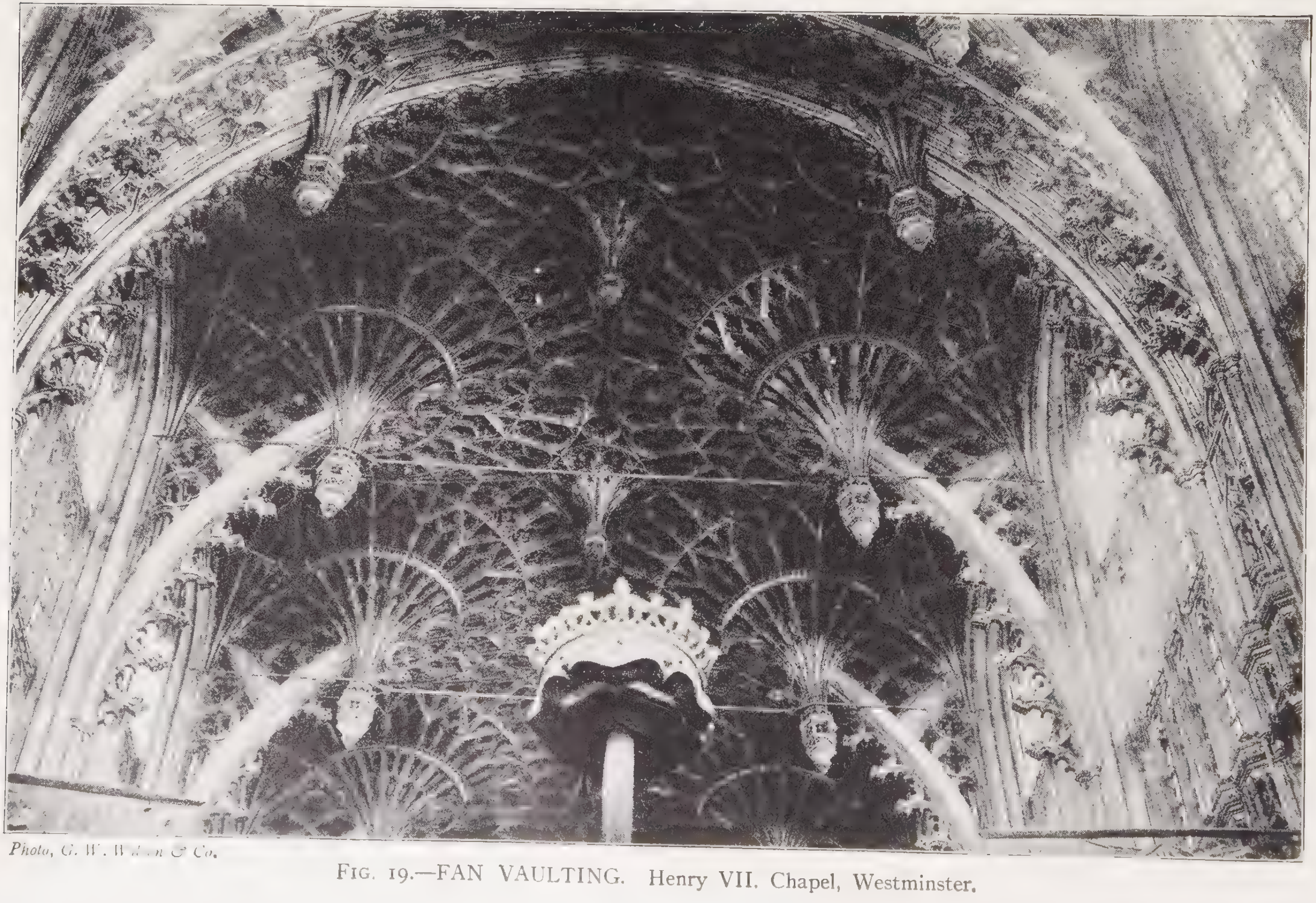
FIG. 18.—FAN VAULTING. King's College Chapel, Cambridge.



Photo, G. W. Wilson & Co.

FIG. 19.—FAN VAULTING. Henry VII. Chapel, Westminster.

Mousta in Malta, erected in the first half of the 19th century, which was built entirely without centring of any kind. Fig. 10 is a plan and section of the vault of Henry VII.'s chapel and fig. 11 a perspective view, in which it will be seen that the transverse rib thrown across the chapel carries the pendant, the weight of the latter probably preventing a rise in the haunches.

There are two other ribbed vaults in India which form no part of the development of European vaults, but are too remarkable to be passed over; one carries the central dome of the Jumma Musjid at Bijapur (A.D. 1559), and the other is the tomb of Mahommed (A.D. 1626–1660) in the same town. The vault of the latter was constructed over a hall 135 ft. square, to carry a hemispherical dome. The ribs, instead of being carried across the angles only, thus giving an octagonal base for the dome, are carried across to the further pier of the octagon (fig. 12) and consequently intersect one another, reducing the central opening to 97 ft. in diameter, and, by the weight of the masonry they carry, serving as counterpoise to the thrust of the dome, which is set back so as to leave a passage about 12 ft. wide round the interior. The internal diameter of the dome is 124 ft., its height 175 ft. and the ribs struck from four centres have their springing 57 ft. from the floor of the hall. The Jumma Musjid dome was of smaller dimensions, on a square of 70 ft. with a diameter of 57 ft., and was carried on piers only instead of immensely thick walls as in the tomb; but any thrust which might exist was counteracted by its transmission across aisles to the outer wall.

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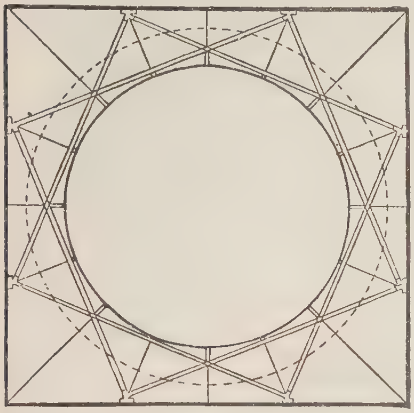

FIG. 12.—Plan of Bijapur Dome.

VAUQUELIN, LOUIS NICOLAS (1763–1829), French chemist, was born at Saint-André-d'Hebertot in Normandy on the 16th of May 1763. His first acquaintance with chemistry was gained as laboratory boy to an apothecary in Rouen (1777–1779), and after various vicissitudes he obtained an introduction to A. F. Fourcroy, in whose laboratory he was an assistant from 1783–1791. At first his work appeared as that of his master and patron, then in their joint-names; but in 1790 he began to publish on his own authority, and between that year and 1833 his name is associated with 376 papers. Most of these were simple records of patient and laborious analytical operations, and it is perhaps surprising that among all the substances he analysed he only detected two new elements—beryllium (1798) in beryl and chromium (1797) in a red lead ore from Siberia. Either together or successively he held the offices of inspector of mines, professor at the School of Mines and at the Polytechnic School, assayer of gold and silver articles, professor of chemistry in the *Collège de France* and at the *Jardin des Plantes*, member of the Council of Industry and Commerce, commissioner on the pharmacy laws, and finally professor of chemistry to the Medical Faculty, to which he succeeded on Fourcroy's death in 1809. His lectures, which were supplemented with practical laboratory teaching, were attended by many chemists who subsequently attained distinction. He died at his birthplace on the 14th of November 1829.

VAUQUELIN DE LA FRESNAYE, JEAN (1536–1608), French poet, was born at the château of La Fresnaye, near Falaise in Normandy, in 1536. He studied the humanities at Paris and law at Poitiers and Bourges. He fought in the civil wars under Marshal Matignon and was wounded at the siege of Saint-Lô (1574). Most of his life was spent at Caen, where he was president, and he died there in 1608. La Fresnaye was a disciple of Ronsard, but, while praising the reforms of the Pléiade, he laid stress on the continuity of French literary history. He was a student of the trouvères and the old chroniclers, and desired to see French poetry set on a national basis. These views he expounded in an *Art poétique*, begun at the desire of Henry III. in 1574, but not published until 1605.

His *Foresteries* appeared in 1555; his *Diverses poésies*, including the *Art poétique*, the *Satyres françoises*, addressed to various distinguished contemporaries, and the *Idylles*, with some epigrams and sonnets, appeared in 1605. Among his political writings may be noted *Pour la monarchie du royaume contre la division* (1569).

The *Art poétique* was edited by G. Pellissier in 1885. It is summarized for English readers in vol. ii. of Mr George Saintsbury's *History of Criticism*. A notice of the poet by J. Travers is prefixed to an edition of the *Œuvres diverses* (Caen, 1872).

VAUVENARGUES, LUC DE CLAPIERS, MARQUIS DE (1715–1747), French moralist and miscellaneous writer, was born at Aix in Provence on the 6th of August 1715. His family was poor though noble; he was educated at the collège of Aix, where he learned little—neither Latin nor Greek—but by means of a translation acquired a great admiration for Plutarch. He entered the army as sub-lieutenant in the king's regiment, and served for more than ten years, taking part in the Italian campaign of Marshal Villars in 1733, and in the disastrous expedition to Bohemia in support of Frederick the Great's designs on Silesia, in which the French were abandoned by their ally. Vauvenargues took part in Marshal Belle-Isle's winter retreat from Prague. On this occasion his legs were frozen, and though he spent a long time in hospital at Nancy he never completely recovered. He was present at the battle of Dettingen, and on his return to France was garrisoned at Arras. His military career was now at an end. He had long been desired by the marquis of Mirabeau, author of *L'Ami des hommes*, and father of the statesman, to turn to literature, but poverty prevented him from going to Paris as his friend wished. He wished to enter the diplomatic service, and made applications to the ministers and to the king himself. These efforts were unsuccessful, but Vauvenargues was on the point of securing his appointment through the intervention of Voltaire when an attack of smallpox completed the ruin of his health and rendered diplomatic employment out of the question. Voltaire then asked him to submit to him his ideas of the difference between Racine and Corneille. The acquaintance thus begun ripened into real and lasting friendship. Vauvenargues removed to Paris in 1745, and lived there in the closest retirement, seeing but few friends, of whom Marmontel and Voltaire were the chief. Among his correspondents was the archaeologist Fauris de Saint-Vincens. Vauvenargues published in 1746 an *Introduction à la connaissance de l'esprit humain*, with certain *Réflexions* and *Maximes* appended. He died in Paris on the 28th of May 1747.

The bulk of Vauvenargues's work is very small, but its interest is very considerable. In the *Introduction*, in the *Réflexions* and in the minor fragments, it consists, in fact, of detached and somewhat desultory thoughts on questions of moral philosophy and of literary criticism. Sainte-Beuve has mildly said that as a literary critic Vauvenargues "shows inexperience." His literary criticism is indeed limited to a repetition in crude form of the stock ideas of his time. Thus he exaggerates immensely the value of Racine and Boileau, but depreciates Corneille and even Molière. As a writer he stands far higher. His style is indeed, according to strict academic judgment, somewhat incorrect, and his few excursions into rhetoric have the artificial and affected character which mars so much 18th-century work. His strength, however, is not really in any way that of a man of letters, but that of a moralist. He did not adopt the complete *philosophe* attitude; in his letters, at any rate, he poses as "neutral" between the religious and the anti-religious school. In some of his maxims about politics there is also traceable the hollow and confused jargon about tyrants and liberty which did so much to bring about the struggles of the Revolution. It is in morals proper, in the discussion and application of general principles of conduct, that Vauvenargues shines. He is not an exact psychologist, much less a rigorous metaphysician. His terminology is popular and loose, and he hardly attempts the co-ordination of his ideas into any system. His real strength is in a department which the French have always cultivated with greater success than any other modern people—the expression in more or less epigrammatic language of the results of acute observation of human conduct and motives, for which he had found ample leisure in his campaigns. The chief distinction between Vauvenargues and his great predecessor La Rochefoucauld is that Vauvenargues, unlike La Rochefoucauld, thinks nobly of man, and is altogether inclined rather to the Stoic than to the Epicurean theory. He has indeed been called a modern Stoic, and, allowing for the vagueness of all such phrases, there is much to be said for the description.

An edition of the *Œuvres* of Vauvenargues, slightly enlarged, appeared in the year of his death. There were some subsequent editions, superseded by that of M. Gilbert (2 vols., 1857), which contains some correspondence, some *Dialogues of the Dead*, "characters" in imitation of Theophrastus and La Bruyère, and numerous short pieces of criticism and moralizing. The best comments on Vauvenargues, besides those contained in Gilbert's edition, are to be found in four essays by Sainte-Beuve in *Causeries du lundi*, vols. iii. and xiv., and in Villemain's *Tableau de la littérature française au XVIII^{me} siècle*.

See also M. Paléologue, *Vauvenargues* (1890); and *Selections from . . . La Bruyère and Vauvenargues*, with memoir and notes by Miss Elizabeth Lee (1903).

VAUX, CALVERT (1824–1895), American architect and landscape gardener, was born in London on the 24th of December 1824. He was educated at Merchant Taylors' School and in the office of Lewis N. Cottingham (1787–1847). In 1850 he went to America and became A. J. Downing's architectural partner. In 1856 and 1866 Vaux was associated with F. L. Olmsted in the plans for the improvement of various parks. He designed the Belvidere in Central Park, New York, and built a number of country houses in Newport, besides many town houses and public institutions.

VAUX OF HARROWDEN, THOMAS VAUX, 2ND BARON (1510–1556), English poet, eldest son of Nicholas Vaux, 1st Baron Vaux, was born in 1510. In 1527 he accompanied Cardinal Wolsey on his embassy to France; he attended Henry VIII. to Calais and Boulogne in 1532; in 1531 he took his seat in the House of Lords, and was made Knight of the Bath at the coronation of Anne Boleyn. He was captain of the Isle of Jersey until 1536. He married Elizabeth Cheney, and died in October 1556. Sketches of Vaux and his wife by Holbein are at Windsor, and a finished portrait of Lady Vaux is at Hampton Court. Two of his poems were included in the *Songes and Sonettes of Surrey* (Tottel's *Miscellany*, 1557). They are "The assault of Cupid upon the fort where the lover's hart lay wounded, and how he was taken," and the "Dittye . . . representinge the Image of Deathe," which the gravedigger in Shakespeare's *Hamlet* misquotes. Thirteen pieces in the *Paradise of Dainty Devices* (1576) are signed by him. These are reprinted in Dr A. B. Grosart's *Miscellanies of the Fuller Worthies Library* (vol. iv., 1872).

VAUXHALL, a district on the south bank of the river Thames, in London, England, included in the metropolitan borough of Lambeth. The manor was held by Falkes de Breauté (whence the name, Falkes Hall) in the time of John and Henry III. About 1661 public gardens were laid out here, known as the New Spring Garden, and later as Spring Gardens, but more familiar under the title of Vauxhall Gardens. They soon became the favourite fashionable resort of the metropolis; but as a place of general entertainment they underwent great development from 1732 under the management of Jonathan Tyers (d. 1767) and his sons Thomas and Jonathan. In 1822, with the approval of George IV., who frequented the gardens before his accession, the epithet Royal was added to their title. By the middle of the 19th century, however, Vauxhall had lost its high reputation; in 1859 the gardens were finally closed, and the site was quickly built over.

VAVASSOR (Med. Lat. *valvassor*, *vasvassor*; Fr. *vavassour*, *vavassor*, *vasseur*, &c.), in its most general sense a mediate vassal, *i.e.* one holding a fief under a vassal. The word was, however, applied at various times to the most diverse ranks in the feudal hierarchy, being used practically as the synonym of vassal. Thus tenants-in-chief of the crown are described by the Emperor Conrad (*Lex Lamgob.* lib. iii. tit. 8, § 4) as *valvassores majores* as distinguished from mediate tenants, *valvassores minores*. Gradually the term without qualification was found convenient for describing sub-vassals, tenants-in-chief being called *capitanei* or *barones* (see BARON). Its implication, however, still varied in different places and times. Bracton (lib. i. cap. 8, § 2) ranks the *magnates seu valvassores* between barons and knights; for him they are "men of great dignity," and in this order they are found in a charter of Henry II. (1166). But in the *regestum* of Philip Augustus (fol. 158) we find that five vavassors are reckoned as the equivalent of one knight. Finally, Du Cange quotes two charters, one of 1187, another of 1349, in which vavassors are clearly distinguished from nobles.

The derivation of the word vavassor is very obscure. The fanciful interpretation of Bracton, *vas sortitum ad valetudinem* (a vessel chosen to honour), may be at once rejected. Others would derive it from *vassi ad valvas* (at the folding-doors, *valvae*), *i.e.* servants of the royal antechamber. Du Cange, with more justice, regards it merely as an obscure variant of *vassus*. (W. A. P.)

VAYGACH (variously Waigats, Waigatch, &c.), an island off the Arctic coast of Russia, between it and Novaya Zemlya, bounded S. by the narrow Yugor Strait, and N. by that of Kara. It is roughly oblong in form; its length from S.E. to N.W. is 70 m., and its greatest breadth 28. Its greatest elevation scarcely exceeds 300 ft. For the most part it consists of tundra, with frequent marshes and small lakes. Slight rocky ridges run generally along its length, and the coast has low cliffs in places. The island consists in the main of limestone, and its elevation above the sea is geologically recent. Raised beaches are frequently to be traced. The rocks are heavily scored by ice, but this was probably marine ice, not that of glaciers. Grasses, mosses and Arctic flowering plants are abundant, but there are no trees excepting occasional dwarf willows. Foxes and lemmings are met with, but whereas animals are few, birds are very numerous; a variety of ducks, waders, &c., frequent the marshes and lakes. The island is visited periodically by a few Samoyedes; they formerly considered it sacred, and some of their sacrificial piles, consisting of drift-wood, deer's horns and the skulls of bears and deer, have been observed by travellers. In spite of their conversion to Christianity, the Samoyedes still regard these piles with superstition. The origin of the name Vaygach is as dubious as its orthography; it has been held to be Dutch (*waaien*, to blow, and *gat*, a strait, hence "windy strait") or Russian, in which case it is probably a surname.

Comparatively little was known of the interior of the island until Mr F. G. Jackson made the circuit of it on foot in 1893 (see his *Great Frozen Land*, London, 1895; also H. J. Pearson, *Beyond Petsora Eastward*, London, 1899).

VECTOR ANALYSIS, in mathematics, the calculus of vectors. The position of a point B relative to another point A is specified by means of the straight line drawn from A to B. It may equally well be specified by any equal and parallel line drawn in the same sense from (say) C to D, since the position of D relative to C is the same as that of B relative to A. A straight line conceived in this way as having a definite length, direction and sense, but no definite location in space, is called a *vector*. It may be denoted by $\overrightarrow{AB}$ (or $\overrightarrow{CD}$), or (when no confusion is likely to arise) simply by AB. Thus a vector may be used to specify a displacement of translation (without rotation) of a rigid body. Again, a force acting on a particle, the velocity or momentum of a particle, the state of electric or magnetic polarization at a particular point of a medium, are examples of physical entities which are naturally represented by vectors.

The quantities, on the other hand, with which we are familiar in ordinary arithmetical algebra, and which have merely magnitude and sign, without any intrinsic reference to direction, are distinguished as *scalars*, since they are completely specified by their position on the proper scale of measurement. The mass of a body, the pressure of a gas, the charge of an electrified conductor, are instances of scalar magnitudes. It is convenient to emphasize this distinction by a difference of notation; thus scalar quantities may be denoted by italic type, vectors (when they are represented by single symbols) by "black" or "Clarendon" type.

There are certain combinations of vectors with one another, and with scalars, which have important geometrical or physical significance. Various systems of "vector analysis" have been devised for the purpose of dealing methodically with these; we shall here confine ourselves to the one which is at present in most general use. Any such calculus must of course begin with definitions of the fundamental symbols and operations; these are in the first instance quite arbitrary conventions, but it is convenient so to frame them that the analogy with the processes of ordinary algebra may as far as possible be maintained.

As already explained, two vectors which are represented by equal and parallel straight lines drawn in the same sense are regarded as identical. Again, the product of a scalar m into a vector $\mathbf{A}$ is naturally defined as the vector whose direction is the same as that of $\mathbf{A}$, but whose length is to that of $\mathbf{A}$ in the ratio m, the sense (moreover) being the same as that of $\mathbf{A}$ or the reverse, according as m is positive or negative. We denote it by $m\mathbf{A}$. The particular case where $m=-1$ is denoted by $-\mathbf{A}$, so that a change of sign simply reverses the sense of a vector.

As regards combinations of two vectors, we have in the first place the one suggested by composition of displacements in kinematics, or of forces or couples in statics. Thus if a rigid body receive in succession two translations represented by $\overrightarrow{AB}$ and $\overrightarrow{BC}$, the final result is equivalent to the translation represented by $\overrightarrow{AC}$. It is convenient, therefore, to regard $\overrightarrow{AC}$ as in a sense the "geometric sum" of $\overrightarrow{AB}$ and $\overrightarrow{BC}$, and to write

$$\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{AC}.$$

This constitutes the definition of vector *addition*; and it is evident at once from fig. 1 that

$$\overrightarrow{BC}+\overrightarrow{AB}=\overrightarrow{AD}+\overrightarrow{DC}=\overrightarrow{AC}=\overrightarrow{AB}+\overrightarrow{BC}.$$

Hence, $\mathbf{A}$ and $\mathbf{B}$ being any two vectors, we have

$$\mathbf{A}+\mathbf{B}=\mathbf{B}+\mathbf{A}, \quad . \quad . \quad . \quad . \quad . \quad (1)$$

i.e. addition of vectors, like ordinary arithmetical addition, is subject to the "commutative law." As regards subtraction, we define $\mathbf{A}-\mathbf{B}$ as the equivalent of $\mathbf{A}+(-\mathbf{B})$; thus in fig. 1, if $\overrightarrow{AB}=\mathbf{A}$, $\overrightarrow{BC}=\mathbf{B}$, we have

$$\mathbf{A}+\mathbf{B}=\overrightarrow{AC},\ \mathbf{A}-\mathbf{B}=\overrightarrow{DB}.$$

When the sum (or difference) of two vectors is to be further dealt with as a single vector, this may be indicated by the use of curved brackets, *e.g.* $(\mathbf{A}+\mathbf{B})$. It is easily seen from a figure that

$$(\mathbf{A}+\mathbf{B})+\mathbf{C}=\mathbf{A}+(\mathbf{B}+\mathbf{C}), \quad . \quad . \quad . \quad . \quad (2)$$

and so on; *i.e.* the "associative law" of addition also holds.

Again, if m be any scalar quantity, we have

$$m(\mathbf{A}+\mathbf{B})=m\mathbf{A}+m\mathbf{B}, \quad . \quad . \quad . \quad . \quad (3)$$

or, in words, the multiplication of a vector sum by a scalar follows the "distributive law." The truth of (3) is obvious on reference to the similar triangles in fig. 2, where

$$\overrightarrow{OP}=\mathbf{A},\ \overrightarrow{PQ}=\mathbf{B},\ OP'=m\mathbf{A},\ P'Q'=m\mathbf{B}.$$

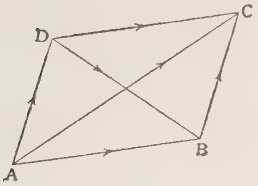

FIG. 1.

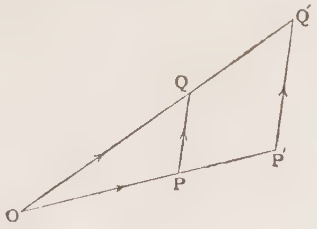

FIG. 2.

It will be noticed that the proofs of (1) and (3) involve the fundamental postulate of the Euclidean geometry.

The definition of "work" in mechanics gives us another important mode of combination of vectors. The product of the absolute magnitudes A, B (say) of two vectors $\mathbf{A}$, $\mathbf{B}$ into the cosine of the angle θ between their directions is called the *scalar product* of the two vectors, and is denoted by $\mathbf{A}.\mathbf{B}$ or simply $\mathbf{AB}$. Thus

$$\mathbf{AB}=AB\cos\theta=\mathbf{BA}, \quad . \quad . \quad . \quad . \quad . \quad (4)$$

so that the "commutative law of multiplication" holds here as in ordinary algebra. The "distributive law" is also valid, for we have

$$\mathbf{A}(\mathbf{B}+\mathbf{C})=\mathbf{AB}+\mathbf{AC}, \quad . \quad . \quad . \quad . \quad . \quad (5)$$

the proof of this statement being identical with that of the statical theorem that the sum of the works of two forces in any displacement of a particle is equal to the work of their resultant.

For an illustration of the next mode of combination of vectors we may have recourse to the geometrical theory of the rotation of a rigid body about a fixed point O. As explained under MECHANICS, the state of motion at any instant is specified by a vector $\overrightarrow{OI}$ representing the angular velocity. The instantaneous velocity of any other point P of the body is completely determined by the two vectors $\overrightarrow{OI}$ and $\overrightarrow{OP}$, viz. it is a vector normal to the plane of OI and OP, whose absolute magnitude is $OI.OP.\sin\theta$, where θ denotes the inclination of OP to OI, and its sense is that due to a right-handed rotation about OI. A vector derived according to this rule from any two given vectors $\mathbf{A}$, $\mathbf{B}$ is called their *vector product*, and is denoted by $\mathbf{A}\times\mathbf{B}$ or by $[\mathbf{AB}]$. This type of combination is frequent in electro-magnetism; thus if $\mathbf{C}$ be the current and $\mathbf{B}$ the magnetic induction, at any point of a conductor, the mechanical force on the latter is represented by the vector $[\mathbf{CB}]$. It will be noticed in the above kinematical example that if the rôles of the two vectors OI, OP were interchanged, the resulting vector would have the same absolute magnitude as before, but its sense would be reversed. Hence

$$[\mathbf{AB}]=-[\mathbf{BA}], \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

so that the commutative law does *not* hold with respect to vector products. On the other hand, the distributive law applies, for we have

$$[\mathbf{A}(\mathbf{B}+\mathbf{C})]=[\mathbf{AB}]+[\mathbf{AC}], \quad . \quad . \quad . \quad . \quad . \quad (7)$$

as may be proved without difficulty by considering the kinematical interpretation.

Various types of triple products may also present themselves, the most important being the scalar product of two vectors, one of which is itself given as a vector product. Thus $\mathbf{A}[\mathbf{BC}]$ is equal in absolute value to the volume of the parallelepiped constructed on three edges OA, OB, OC drawn from a point O to represent the vectors $\mathbf{A}$, $\mathbf{B}$, $\mathbf{C}$ respectively, and it is positive or negative according as the lines OA, OB, OC follow one another in right- or left-handed cyclical order. It follows that

$$\mathbf{A}[\mathbf{BC}]=\mathbf{B}[\mathbf{CA}]=-\mathbf{B}[\mathbf{AC}]=\&c. \quad . \quad . \quad . \quad . \quad (8)$$

In order to exhibit the correspondence between the shorthand methods of vector analysis and the more familiar formulae of Cartesian geometry, we take a right-handed system of three mutually perpendicular axes Ox, Oy, Oz, and adopt three fundamental *unit-vectors* i, j, k, having the positive directions of these axes respectively. As regards the scalar products of these unit-vectors, we have, by (4),

$$i^2=j^2=k^2=1,\ jk=kj=ji=0. \quad . \quad . \quad . \quad (9)$$

Any other vector $\mathbf{A}$ is expressed in terms of its scalar projections A_1, A_2, A_3 on the co-ordinate axes by the formula

$$\mathbf{A}=iA_1+jA_2+kA_3. \quad . \quad . \quad . \quad . \quad . \quad (10)$$

For the scalar product of any two vectors we have

$$\mathbf{AB}=(iA_1+jA_2+kA_3)(iB_1+jB_2+kB_3)=A_1B_1+A_2B_2+A_3B_3, (11)$$

as appears on developing the product and making use of (9). In particular, forming the scalar square of $\mathbf{A}$ we have

$$A^2=A_1^2+A_2^2+A_3^2, \quad . \quad . \quad . \quad . \quad (12)$$

where A denotes the absolute value of $\mathbf{A}$.

Again, the rule for vector products, applied to the fundamental units, gives

$$\left.\begin{array}{c}[i^2]=[j^2]=[k^2]=0,\\ [jk]=-[kj]=i,\ [ki]=-[ik]=j,\ [ij]=-[ji]=k.\end{array}\right\} \quad (13)$$

Hence

$$\begin{aligned}[\mathbf{AB}]&=[(iA_1+jA_2+kA_3)(iB_1+jB_2+kB_3)]\\ &=i(A_2B_3-A_3B_2)+j(A_3B_1-A_1B_3)+k(A_1B_2-A_2B_1)\\ &=-[\mathbf{BA}]. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)\end{aligned}$$

The correspondence with the formulae which occur in the analytical theory of rotations, &c., will be manifest. If we form the scalar product of a third vector $\mathbf{C}$ into $[\mathbf{AB}]$, we obtain

$$\mathbf{C}[\mathbf{AB}]=\begin{vmatrix}A_1, & B_1, & C_1\\ A_2, & B_2, & C_2\\ A_3, & B_3, & C_3\end{vmatrix} \quad . \quad . \quad . \quad . \quad . \quad (15)$$

in agreement with the geometrical interpretation already given.

In such subjects as hydrodynamics and electricity we are introduced to the notion of scalar and vector *fields*. With every point P of the region under consideration there are associated certain scalars (*e.g.* density, electric or magnetic potential) and vectors (*e.g.* fluid velocity, electric or magnetic force) which are regarded as functions of the position of P. If we treat the partial-differential operators $\partial/\partial x$, $\partial/\partial y$, $\partial/\partial z$, where x, y, z are the co-ordinates of P, as if they were scalar quantities, we are led to some remarkable and significant expressions. Thus if we write

$$\nabla=\left(i\frac{\partial}{\partial x}+j\frac{\partial}{\partial y}+k\frac{\partial}{\partial z}\right), \quad . \quad . \quad . \quad (16)$$

and operate on a scalar function ϕ, we obtain the vector

$$\nabla\phi=i\frac{\partial\phi}{\partial x}+j\frac{\partial\phi}{\partial y}+k\frac{\partial\phi}{\partial z}. \quad . \quad . \quad . \quad . \quad (17)$$

This is called the *gradient* of ϕ and sometimes denoted by "grad ϕ"; its direction is that in which ϕ most rapidly increases, and its magnitude is equal to the corresponding rate of increase. Thus

$$(\nabla\phi)^2=\left(\frac{\partial\phi}{\partial x}\right)^2+\left(\frac{\partial\phi}{\partial y}\right)^2+\left(\frac{\partial\phi}{\partial z}\right)^2. \quad . \quad . \quad . \quad (18)$$

A repetition of the operation ∇ gives

$$\nabla^2\phi=\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}. \quad . \quad . \quad . \quad . \quad (19)$$

In the theory of attractions this expression is interpreted as measuring the degree of *attenuation* of the quantity ϕ at P; if we reverse the sign we get the *concentration*, $-\nabla^2\phi$.

Again, if we form the scalar product of the operator ∇ into a vector **A** we have

$$\nabla\mathbf{A}=\left(i\frac{\partial}{\partial x}+j\frac{\partial}{\partial y}+k\frac{\partial}{\partial z}\right)(iA_1+jA_2+kA_3)=\frac{\partial A_1}{\partial x}+\frac{\partial A_2}{\partial y}+\frac{\partial A_3}{\partial z}. \quad . \quad (20)$$

If A represent the velocity at any point (x, y, z) of a fluid, the latter expression measures the rate at which fluid is flowing away from the neighbourhood of P. By a generalization of this idea, it is called the *divergence* of **A**, and we write

$$\nabla\mathbf{A}=\text{div }\mathbf{A}. \quad . \quad . \quad . \quad . \quad (21)$$

The vector product $[\nabla\mathbf{A}]$ has also an important significance. We find

$$[\nabla\mathbf{A}]=\left[\left(i\frac{\partial}{\partial x}+j\frac{\partial}{\partial y}+k\frac{\partial}{\partial z}\right)(iA_1+jA_2+kA_3)\right]$$
$$=i\left(\frac{\partial A_3}{\partial y}-\frac{\partial A_2}{\partial z}\right)+j\left(\frac{\partial A_1}{\partial z}-\frac{\partial A_3}{\partial x}\right)+k\left(\frac{\partial A_2}{\partial x}-\frac{\partial A_1}{\partial y}\right) \quad . \quad (22)$$

If **A** represent as before the velocity of a fluid, the vector last written will represent the (doubled) angular velocity of a fluid element. Again if A represent the magnetic force at any point of an electro-magnetic field, the vector $[\nabla\mathbf{A}]$ will represent the electric current. In the general case it is called the *curl*, or the *rotation*, of **A**, and we write

$$[\nabla\mathbf{A}]=\text{curl }\mathbf{A},\text{ or rot }\mathbf{A}. \quad . \quad . \quad . \quad (23)$$

These definitions enable us to give a compact form to two important theorems of C. F. Gauss and Sir G. G. Stokes. The former of these may be written

$$\int\text{div }\mathbf{A}\,.\,dV=\int\mathbf{A}n\,dS, \quad . \quad . \quad . \quad (24)$$

where the integration on the left hand includes all the volume-elements dV of a given region, and that on the right includes all the surface-elements dS of the boundary, n denoting a unit vector drawn outwards normal to dS. Again, Stokes's theorem takes the form

$$\int\mathbf{A}ds=\int\text{curl }\mathbf{A}\,.\,ndS, \quad . \quad . \quad . \quad (25)$$

where the integral on the right extends over any open surface, whilst on the left ds is an element of the bounding curve, treated as a vector. A certain convention is implied as to the relation between the positive directions of n and ds.

It is to be observed that the term "vector" has been used to include two distinct classes of geometrical and physical entities. The first class is typified by a displacement, or a mechanical force. A *polar* vector, as it is called, is a magnitude associated with a certain linear direction. This may be specified by any one of a whole assemblage of parallel lines, but the two "senses" belonging to any one of the lines are distinguished. The members of the second class, that of *axial* vectors, are primarily not vectors at all. An axial vector is exemplified by a couple in statics; it is a magnitude associated with a closed contour lying in any one of a system of parallel planes, but the two senses in which the contour may be described are distinguished. It was therefore termed by H. Grassmann a *Plangrösse* or *Ebenengrösse.* Just as a polar vector may be indicated by a length, regard being paid to its sense, so an axial vector may be denoted by a certain area, regard being paid to direction round the contour. A theory of "Plangrössen" might be developed throughout on independent lines; but since the laws of combination prove to be analogous to those of suitable vectors drawn perpendicular to the respective areas, it is convenient for mathematical purposes to include them in the same calculus with polar vectors. In the case of couples this procedure has been familiar since the time of L. Poinsot (1804). In the Cartesian treatment of the subject no distinction between polar and axial vectors is necessary so long as we deal with congruent systems of co-ordinate axes. But when we pass from a right-handed to a left-handed system the formulae of transformation are different in the two cases. A polar vector (*e.g.* a displacement) is reversed by the process of reflection in a mirror normal to its direction, whilst the corresponding axial vector (*e.g.* a couple) is unaltered.

REFERENCES.—The methods of vector analysis are chiefly used as a means of condensed expression of various important relations which are of frequent occurrence in mathematical physics, more especially in electricity. They are freely employed, for example, in many recent German treatises. The historical development of the subject can only be briefly referred to. The notions of scalar and vector products originated independently with Sir W. R. Hamilton (1843) (see QUATERNIONS) and H. Grassmann (1844), but were associated with various other conceptions of which no use is made in the simplified system above sketched. The present currency of this latter system is due mainly to the advocacy of O. Heaviside and J. W. Gibbs, although for the systematic physical interpretation of the various combinations of symbols which constantly recur in electricity and allied subjects we are indebted primarily to the classical treatise of J. C. Maxwell on *Electricity and Magnetism* (1873). For further details and applications of the calculus reference may be made to the following: O. Heaviside, *Electro-Magnetic Theory* (London, 1894); J. W. Gibbs, *Vector Analysis* (2nd ed., New York, 1907); M. Abraham, *Die Maxwellsche Theorie d. Elektrizität* (Leipzig, 1904); the articles by H. E. Timerding and M. Abraham in vol. iv. of the *Encycl. d. Math. Wiss.* (Leipzig, 1901–2); A. H. Bucherer, *Elemente d. Vektor-Analysis* (Leipzig, 1905). For an account of other systems of vector analysis see H. Hankel, *Theorie d. complexen Zahlensysteme* (Leipzig, 1867); and A. N. Whitehead, *Universal Algebra*, vol. i. (Cambridge, 1898). (H. LB.)

VEDDAHS, or WEDDAHS (from Sanskrit *veddha*, "hunter"), a primitive people of Ceylon, probably representing the *Yakkos* or "demons" of Sanskrit writers, the true aborigines of the island. During the Dutch occupation (1644–1796) they were found as far north as Jaffna, but are now confined to the south-eastern district, about the wooded Bintenna, Badulla and Nilgala hills, and thence to the coast near Batticaloa. They are divided into two classes, the *Kele Weddo* or jungle Veddahs, and the *Gan Weddo*, or semi-civilized village Veddahs. The Veddahs exhibit the phenomenon of a race living the wildest of savage lives and yet speaking an Aryan dialect. Craniometrical evidence strongly favours the theory, now generally accepted, that they represent a branch of the pre-Aryan Dravidians of southern India, and that their ancestors probably made a settlement in the island of Ceylon in prehistoric times, detaching themselves from a migrating horde which passed through the island to find at last a permanent home in the continent of Australia.

The true jungle veddahs are almost a dwarfish race. They are dark-skinned and flat-nosed, slight of frame and very small of skull, and average no more than 5 ft. Their black hair is shaggy rather than lank. They are a shy, harmless, simple folk, living chiefly by hunting; they lime birds, catch fish by poisoning the water, and are skilled in getting wild honey; they have bows with iron-pointed arrows and breed hunting dogs. They dwell in caves or bark huts, and their word for house is Sinhalese for a hollow tree, *rukula.* They count on their fingers, and make fire with the simplest form of fire-drill twirled by hand. They are monogamous, and their conjugal fidelity contrasts strongly with the vicious habits of the Sinhalese. Their religion has been described as a kind of demon-worship, consisting of rude dances and shouts raised to scare away the evil spirits, whom they confound with their ancestors.

The Veddahs are not to be confounded with the Rodiyas of the western uplands, who are a much finer race, tall, well-porportioned, with regular features, and speak a language said to be radically distinct from all the Aryan and Dravidian dialects current in Ceylon. There is, however, in Travancore, on the mainland, a low-caste "Veda" tribe, nearly black, with wavy or frizzly hair, and now speaking a Malayâlim (Dravidian) dialect (Jagor), who probably approach nearer than the insular Veddahs to the aboriginal pre-Dravidian "negrito" element of southern India and Malaysia.

See Percival, *Description of Island of Ceylon* (1805); Cordiner, *Description of Ceylon* (1807); John Davy, *Ceylon and its Inhabitants* (1821); Stirr, *Ceylon and the Singhalese* (1850), Sir Emerson Tennent, *Ceylon* (1859); J. Baily, *Trans. of Ethnol. Soc.*, New Series, vol. ii. (1863); Rolleston, *Trans. of Brit. Ass.* (1872); B. F. Hartshorne, *Fortnightly Review*, New Series, vol. xix. p. 406. The most elaborate monograph is that of Professor Virchow, *Über die Weddas von Ceylon und ihre Beziehungen zu den Nachbarstämmen* (Berlin, 1882). See also E. B. Tylor, *Primitive Culture*; A. Thomson, "Osteology of Veddahs," in *Journ. Anthrop. Institute* (1889), vol. xix. p. 125; L. de Zoysa, "Origin of Veddahs," in *Journal, Ceylon Branch, Royal Asiatic Society*, vol. vii.

VEDDER, ELIHU (1836–), American artist, was born in New York City on the 26th of February 1836. He studied under the genre and historical painter Tompkins H. Matteson (1813–1884), at Sherburne, N.Y., later under Picot, in Paris, and then, in 1857–61, in Italy. After 1867 he lived in Rome, making occasional visits to America. He was elected to full membership in the National Academy of Design, New York, in 1865. He devoted himself to the painting of genre pictures, which, however, attracted only modest attention until the publication, in 1884, of his illustrations to the *Rubaiyat* of Omar Khayyâm; these immediately gave him a high place in the art world. Important decorative work came later, notably the painting symbolizing the art of the city of Rome, in the Walker Art Gallery of Bowdoin College, Maine, and the five lunettes (in the entrance hall) symbolical of government, and the mosaic "Minerva" in the Congressional Library at Washington. Among his better-known pictures are: "Lair of the Sea Serpent," in the Boston Museum of Fine Arts; "Young Marsyas," "Cumaean Sibyl," "Nausicaa," in the collection of J. Pierpont Morgan; and "Genii and Fisherman," in the collection of Martin Brimmer, Boston.

VEDETTE, a French military term (formed from Lat. *videre*, to see), adopted into English and other languages for a mounted sentry or outpost, whose function it is to bring information, give signals or warnings of danger, etc., to the main body of troops.

VEERE, a town in the province of Zeeland, Holland, on the island of Walcheren, 4 m. N.N.E. of Middelburg, with which it is connected by canal (1867–72). It contains several interesting architectural remains of the days of its former prosperity, many of its quaintly gabled old houses dating from the 16th century. There is a fine Gothic church dating from 1348, but subsequently in part destroyed and used for secular purposes; the town hall (1475) has a fine gable filled with sculpture, and contains some interesting antiquities.

VEGA, GARCILASO DE LA (1503–1536), Spanish soldier and poet, was born at Toledo on the 6th of February 1503. His father, Garcilaso (Garcias Laso or Garcilasso) de la Vega, was counsellor of state to Ferdinand and Isabella, and for some time their ambassador at the court of Rome; by his mother he was descended from the illustrious house of Guzman. At the age of seventeen he was attached to the bodyguard of Charles V., and fought against the insurgent *comuneros*, being wounded at the battle of Olias near Toledo. He afterwards served in the north of Italy, and gained great distinction by his bravery at the battle of Pavia in 1525. In the following year he married a lady-in-waiting to Queen Eleanor. He took part in the repulse of the Turks from Vienna in 1529, was present at the coronation of the emperor at Bologna in 1530, and was charged with a secret mission to Paris in the autumn of the same year. In 1531 he accompanied the duke of Alva to Vienna, where, for conniving at the clandestine marriage of his nephew to a maid-of-honour, he was imprisoned on an island in the Danube. During this captivity he composed the fine cancion, "Con un manso ruido de agua corriente y clara." Released and restored to favour in June 1532, he went to Naples on the staff of Don Pedro de Toledo, the newly appointed viceroy, by whom he was twice sent on public business of importance to Barcelona, in 1533 and 1534. After having accompanied the emperor on the expedition to Tunis (1535), where he received two severe wounds, he was employed as a confidential agent at Milan and Genoa in negotiations connected with the proposed invasion of Provence, and joined the expedition when it took the field. Being with Charles in the neighbourhood of Fréjus during the retreat from Marseilles, Garcilaso de la Vega was ordered to storm a fort at Muy, which had checked the advance of the army. In the successful discharge of this duty he was mortally wounded and died twenty-one days afterwards, at Nice (14th of October 1536). His poems were entrusted to his friend Boscan, who was preparing them for publication along with his own when death overtook him in 1540. The volume ultimately appeared at Barcelona in 1543, and has often been reprinted. Garcilaso's share in it consists principally of three *eglogas* or pastorals, which the Spaniards regard as among the finest works of the kind in their language, and which for sweetness of versification and delicacy of expression take a high rank in modern European literature. In addition to the pastorals, there are thirty-seven sonnets, five canciones, two elegies and a blank verse epistle, all influenced by Italian models. The poems rapidly gained a wide popularity; and within a century of their appearance they were edited as classics by Francisco Sanchez (1577), Herrera (1580) and Tamayo de Vargas (1622). An English translation of his works was published by Wiffen in 1823. Garcilaso's delicate charm has survived all changes of taste, and by universal consent he ranks among the most accomplished and artistic of Spanish poets.

See E. Fernández de Navarrete, "Vida de Garcilaso de la Vega," in the *Documentos inéditos para la historia de España*, vol. xvi.; Francesco Flamini, "Imitazioni italiani in Garcilaso de la Vega," in the *Biblioteca delle scuole italiane* (Milano 1899).

VEGA, GARCILASO DE LA, called "Inca" (*c.* 1535–1616), historian of Peru, was born at Cuzco. His father, Sebastiano Garcilaso (d. 1559), was a cadet of the illustrious family of La Vega, who had gone to Peru in the suite of Pedro de Alvarado, and his mother was of the Peruvian blood-royal, a circumstance of which he was very proud as giving him a right to the title which he claimed by invariably subscribing himself "Inca." About 1560 he removed to Spain, and after serving against the Moors incurred the hatred of Philip II. and was imprisoned at Valladolid. He died in Spain in 1616. A diligent student of the language and traditions of his maternal ancestors, Garcilaso left a valuable work on Peruvian history; the first part, entitled *Comentarios reales que tratan del origen de los Yncas*, was first published at Lisbon in 1609, and the second part, *Historia general del Peru*, in 1617.

His history is a source from which all subsequent writers on the subject have largely drawn, and still continues to be one of the chief authorities on ancient Peru. An English translation by Sir Paul Rycaut was published in 1688; one of the first part of the work by Sir C. R. Markham for the Hakluyt Society (London, 1869–71); and the book has also been translated into French. Garcilaso also wrote a history of Florida, *La Florida del Ynca, historia del adelantado Hernando de Soto* (Lisbon, 1605, and again Madrid, 1723). An edition of his works in seventeen volumes was published at Madrid in 1800. See W. H. Prescott, *History of the Conquest of Peru*, vol. i. (London, 1902); Sir C. R. Markham, *The Incas of Peru* (1910).

VEGA CARPIO, LOPE FELIX DE (1562–1635), Spanish dramatist and poet, was born on the 25th of November 1562 at Madrid. His father and mother, Felix de Vega Carpio and Francisca Hernandez Flores, originally came from the valley of Carriedo in Asturias, where the hamlet of Vega still exists. Lope began his studies at the Theatine college in Madrid, and according to his admiring biographer, Pérez de Montalbán, his precocity was extraordinary. On leaving college he entered the service of Don Jerónimo Manrique, bishop of Avila, and appears to have then begun the composition of his earlier dramas. He quitted the bishop's service to enter the university of Alcalá de Henares, where he devoted himself to what was called philosophy. The date of Lope's matriculation is unknown, as his name does not appear in the university books; but it seems probable that he was in residence between 1576 and 1581. He took part in the expedition to the Azores in 1582, and from 1583 to 1587 was secretary to the marqués de las Navas. In February 1588 he was banished for circulating criminal libels against his mistress, Elena Osorio, whom he has celebrated under the name of Filis. He defied the law by returning to Madrid soon afterwards and eloping with Isabel de Urbina, daughter of Philip II.'s herald; he married her by proxy on the 10th of May 1588, and joined the Invincible Armada, losing his brother in one of the encounters in the Channel. He settled for a short while at Valencia, where he made acquaintance with a circle of young poets who were afterwards to be his ardent supporters in founding the new comedy. He joined the household of the duke of Alva, with whom he remained till 1595. Soon afterwards he lost his wife; he was prosecuted for criminal conversation in 1596, became secretary to the marquis de Malpica (afterwards count de Lemos), and in 1598 married a second wife, Juana de Guardo, by whom he had two children (Carlos, who died in 1612, and Feliciana Felix); but she died, shortly after giving birth to the latter, in 1613. During this wife's lifetime the poet had by a mistress, Micaelade Luxan, two other children—Marcela del Carpio, who became a nun in 1621, and Lope Felix del Carpio y Luxan, who chose the profession of arms and perished at sea about 1634. Widowed a second time in 1613, Lope sought a refuge in the church. After having been for some time affiliated to a tertiary order, he took priest's orders.

At this juncture, about 1614, he was in the very zenith of his glory. A veritable dictator in the Spanish world of letters, he wielded over all the authors of his nation a power similar to that which was afterwards exercised in France by Voltaire. At this distance of time Lope is to us simply a great dramatic poet, the founder of the Spanish theatre; but to his contemporaries he was much more. His epics, his pastorals, his odes, his sonnets, now forgotten, all placed him in the front rank of authorship. Such was his prestige that he dealt with his noble patrons almost on a footing of equality. The duke of Sessa in particular, his Maecenas from 1605 onwards, was also his personal friend, and the tone of Lope's letters to him is one of frank familiarity, modified only by some forms of deference. Lope's fame, too, had travelled abroad: foreigners of distinction passing through Madrid made a point of visiting him; papal legates brought him the compliments of their master; in 1627 Urban VIII., a Barberini, sent him the diploma of doctor of theology in the Collegium Sapientiae and the cross of the order of St John of Jerusalem (whence the poet's titles of "Doctor" and "Frey"). His last days were full of sadness; the death of his son Lope, the elopement of his daughter, Antonia Clara, wounded him to the soul. Montalbán tells us that every Friday the poet scourged himself so severely that the walls of his room were sprinkled with his blood. His death, on the 27th of August 1635, was followed by national mourning.

Leaving out of account certain theories which in the long run greatly influenced his manner of writing, Lope belonged in literature to what may be called the school of good sense; he boasted that he was a Spaniard *pur sang*, and steadfastly maintained that a writer's business is to write so as to make himself understood. When brought face to face with the coterie of the *précieux* and *quintessenciés*, Lope takes the position of a defender of the language of ordinary life, the good old Castilian tongue. In the dispute which arose between the partisans of the two schools of *cultos* and *llanos*, he ranged himself on the side of the latter. In the matter of versification he refuses to admit that the long Italian verse has the advantage of the Castilian octosyllabic. Unfortunately the books that he read, his literary connexions, his fear of Italian criticism, all exercised an influence upon his naturally robust spirit, and, like so many others, he caught the prevalent contagion of mannerism and of pompous phraseology. His literary culture was chiefly Latin-Italian; and, if he defends the tradition of the nation and the pure simplicity of the old Castilian against "los de la nueva poesía," that is to say, the innovators of the school of Góngora and against the jargon of the *cultos*, still he does not wish to be taken for an uninformed person, a writer devoid of classical training: he especially emphasizes the fact that he has passed through the university, and is continually accentuating the difference between the *ingenios científicos* (those who know Latin) and *legos ignorantes* (ignorant laymen). With what a sense of superiority, for example, does he mention that Cervantes was not to his mind sufficiently *científico* (preface to *Las Fortunas de Diana*), the fact being that Cervantes had been neither at Alcalá nor at Salamanca!

For a rapid survey of the works of Lope, it is convenient to begin with those which the Spaniards include under the name of *Obras Sueltas*, the title of the large collection of the poet's non-dramatic works (Madrid, 21 vols. 4to, 1776-79). We shall enumerate the most important of these, as far as possible in the order of publication. The *Arcadia* (1598), a pastoral romance, inspired by Sannazaro, is one of the poet's most wearisome productions. *La Dragontea* (1598) is a fantastic history in verse of Sir Francis Drake's last expedition and death. *Isidro* (1599), a narrative of the life of Isidore, patron of Madrid, is called a Castilian poem on account of the rhythm in which it is composed—*quintillas* of octosyllabic verse. The *Hermosura de Angélica* (1602), in three books, is a sort of continuation of the *Orlando Furioso*, in octaves after the fashion of the original poem. Finally, the *Rimas* are a miscellany of short pieces. In 1604 was published the *Peregrino en su Patria*, a romance similar in kind to the *Aethiopica* of Heliodorus. Having imitated Ariosto, he proceeded to imitate Tasso; but his *Jerusalem Conquistada* (1609) has preserved nothing of the art shown in its model, and is an insipid performance. Next follows the *Pastores de Belen* (1612), a pious pastoral, dedicated to his son Carlos, which forms a pendant to his secular *Arcadia*; and incidental pieces published in connexion with the solemnities of the beatification and canonization of St Isidore in 1620 and 1622. It is enough to mention *La Filomena* (1621), *La Circe* (1624) and other poems published about the same date, as also the four prose novels, *Las Fortunas de Diana*, *El Desdichado por la Honra*, *La Más Prudente Venganza* and *Guzmán el Bravo*. The great success of the *Novelas Exemplares* of Cervantes (1613) had stimulated Lope, but in this instance at least the *científico* was completely defeated by the *lego*: Lope's novels have none of the grace, naturalness or interest which characterize those of his rival. The last important work which has to be mentioned before we leave the narrative poetry of Lope is the *Laurel de Apolo* (1630). This piece describes the coronation of the poets of Spain on Helicon by Apollo, and it is more meritorious as a bibliographical manual of Spanish poetry at that time than as genuine poetry. One other *obra suelta*, closely akin to Lope's dramatic works, though not, properly speaking, a drama, is *La Dorotea* (1632). Lope describes it as an "action in prose," but it is rather a "romance in dialogue"; for, although divided into acts, the narrative is dramatic in form only. Of all Lope's productions *Dorotea* shows most observation and study; the style also is unusually simple and easy. Of all this mass of *obras sueltas*, filling more than twenty volumes, very little (leaving *Dorotea* out of account) holds its own in the judgment of posterity. The lyrical element alone retains some vitality. From the *Rimas* and other collections of detached pieces one could compile a pleasing anthology of sonnets, epistles, elegies and romances, to which it would be proper to add the *Gatomaquia*, a burlesque poem published along with other metrical pieces in 1634 by Lope under the pseudonym of Tomé de Burguillos. But here the list would end.

It is, however, to his dramatic writings that Lope owes his eminent place in literary history. It is very curious to notice how he himself always treats the art of comedy-writing as one of the humblest of trades (*de pane lucrando*), and protests against the supposition that in writing for the stage his aim is glory and not money. The reason is not far to seek. The Spanish drama, which, if not literally the creation of Lope, at least owes to him its definitive form—the three-act comedy—was totally regardless of the precepts of the school, the pseudo-Aristotelianism of the doctors of the period. Lope accordingly, who stood in awe of the criticism of the *científicos*, felt bound to prove that, from the point of view of literary art, he attached no value to the "rustic fruits of his humble *vega*." In his *Arte Nuevo de hacer comedias en este tiempo* (1609), Lope begins by showing that he knows as well as any one the established rules of poetry, and then excuses himself for his inability to follow them on the ground that the "vulgar" Spaniard cares nothing about them. "Let us then speak to him in the language of fools, since it is he who pays us." Another reason which made it necessary for him to speak deprecatingly of his dramatic works, is the circumstance that the vast majority of them were written in haste and to order. The poet does not hesitate to confess that "more than a hundred of my comedies have taken only twenty-four hours to pass from my brain to the boards of the theatre." Perez de Montalbán, who has a great admiration for this kind of cleverness, tells how, at Toledo, on a certain occasion, Lope composed fifteen acts in fifteen days—that is to say, five entire comedies, which he read to his friends step by step with the process of their composition. On another occasion, when pressed by a manager who wanted something for the carnival, Lope took Montalbán as a collaborator; the two friends parcelled out the comedy between them, Lope undertaking the first act, Montalbán the second, and the third, to save time, was divided between them. In two days they had finished the first two acts, and on the third Montalbán rose at two in the morning and at eleven he had finished. Then he went in search of Lope, who, when questioned as to his progress, replied: "I got up at five, finished the act, breakfasted, wrote an epistle of fifty tercets, and have now finished watering the garden, and a rather tough business it has been." Nevertheless, Lope did write dramas in which the plan is more fully matured and the execution more carefully carried out; still, hurried composition and reckless production are after all among the distinctive marks of his theatrical works. Towards the close of his career Lope somewhat modified the severe and disdainful judgments he had formerly passed upon his dramatic performances; he seems to have had a presentiment that posterity, in spite of the grave defects of his work in that department, would nevertheless place it much higher than *La Dragontea*, the *Jerusalem Conquistada* and other works of which he himself thought so much. We may certainly credit Lope with creative power, with the instinct which enabled him to reproduce the facts of history or those supplied by the imagination in a multitude of dramatic situations with an astonishing cleverness and flexibility of expression; but unfortunately, instead of concentrating his talent upon the production of a limited number of works which he might have brought to perfection, he dissipated it, so to say, and scattered it to the winds.

The catalogue of Lope's comedies has been drawn up by himself; and, in spite of some discrepancies in his figures, it is established that up to 1604 he had composed, in round numbers, as many as 230. In 1609 the figure had risen to 483, in 1618 to 800, in 1620 to 900, in 1625 to 1070, and in 1632 to 1500. Ultimately Montalbán in the *Fama Postuma* (1636) set down the total of Lope's dramatic productions at 1800 plays and more than 400 *autos sacramentales*. Of this number there are 637 plays which are known to us by their titles (from the lists of the *Peregrino*); but the printed or MS. text of only 458 is actually accessible, besides some 50 *autos* and a few *entremeses*. Very many of these pieces were printed during Lope's lifetime, either in collections of *varios autores* or as separate issues by booksellers who surreptitiously bought from the actors the manuscripts of their rôles or else caused the unpublished comedy to be written down from memory by persons whom they sent to attend the first representation. Such pieces therefore as do not figure in the collection published under Lope's own direction or under that of his friends cannot be regarded as perfectly authentic, and it would be unfair to hold their author responsible for all the faults and defects they exhibit. On the other hand, there exist comedies in Lope's own handwriting which have not yet been printed.

The classification of this enormous mass of dramatic literature is a task of great difficulty, inasmuch as the terms usually employed, such as comedy, tragedy and the like, do not apply here. There is not explicitness enough in the division current in Spain, which recognizes three categories:—(1) *comedias de capa y espada*, the subjects of which are drawn from everyday life and in which the persons appear as simple *caballeros*; (2) *comedias de ruido* or *de teatro*, in which kings and princes are the leading characters and the action is accompanied with a greater display of dramatic machinery; (3) *comedias divinas* or *de santos*. Some other arrangement must be attempted. In the first place, Lope's work belongs essentially to the drama of intrigue; be the subject what it may, it is always the plot that determines everything else. Lope in the whole range of his dramatic works has no piece comparable to *La Verdad Sospechosa* of Ruiz de Alarcón, the most finished example in Spanish literature of the comedy of character; and the comedy of manners is represented only by *El Galán Castrucho*, *El Anzuelo de Fenisa*, and one or two others. It is from history, and particularly Spanish history, that Lope has borrowed more than from any other source. It would in fact be difficult to say what national and patriotic subjects, from the reign of the half-fabulous King Pelayo down to the history of his own age, he has not put upon the stage. But it is to the class of *capa y espada*—also called *novelesco*, because the subjects are almost always love intrigues complicated with affairs of honour—that Lope's most celebrated plays belong. In these he has most fully displayed his powers of imagination (the subjects being all invented) and his skill in elaborating a plot. Among the plays of this class which are those best known in Europe, and most frequently imitated and translated, may be specially mentioned *Los Ramilletes de Madrid*, *La Boba para los Otros y Discreta para si*, *El Perro del Hortelano*, *La Viuda de Valencia*, and *El Maestro de Danzar*. In some of them Lope has sought to set forth some moral maxim, and illustrate its abuse by a living example. Thus, on the theme that "poverty is no crime," we have the play entitled *Las Flores de Don Juan*, in which he shows in the history of two brothers the triumph of virtuous poverty over opulent vice; at the same time he attacks indirectly the institution of primogeniture, which often places in the hands of an unworthy person the honour and substance of a family when the younger members would be much better qualified for the trust. Such pieces are, however, rare in Lope's repertory; in common with all other writers of his order in Spain, with the occasional exception of Ruiz de Alarcón, his sole aim is to amuse and stir his public, not troubling himself about its instruction. The strong point of such writers is and always will be their management of the plot. As has been said by Le Sage, a good judge: "The Spaniards are our masters in the art of planning and skilfully working out a plot; they know how to set forth their subject with infinite art and in the most advantageous light." It is not necessary to dwell here upon the other varieties of comedy represented in Lope's works, that is, the *comedias divinas*, *fiestas* (mythological dramas for the most part), *entremeses* and *autos*. In none of them has he produced anything of the highest order, or even comparable to the better performances of his contemporaries and successors.

To sum up, Lope found a poorly organized drama, plays being composed sometimes in four acts, sometimes in three; and, though they were written in verse, the structure of the versification was left far too much to the caprice of the individual writer. The style of drama then in vogue he adopted, because the Spanish public liked it. The narrow framework it afforded he enlarged to an extraordinary degree, introducing everything that could possibly furnish material for dramatic situations,—the Bible, ancient mythology, the lives of the saints, ancient history, Spanish history, the legends of the middle ages, the writings of the Italian novelists, current events, Spanish life in the 17th century. Before him manners and the conditions of persons and characters had been barely sketched; with fuller observation and more careful description he created real types, and gave to each social order the language and drapery appropriate to it. The old comedy was awkward and poor in its versification; he introduced order into the use of all the forms of national poetry, from the old romance couplets to the rarest lyrical combinations borrowed from Italy. Hence he was justified in saying that those who should come after him had only to go on along the path which he had opened up.

Bibliography.—Hugo Albert Rennert, *The Life of Lope de Vega* (Glasgow, 1904); C. A. de la Barrera, *Nueva Biografía de Lope de Vega* (Madrid, 1890); C. Pérez Pastor, *Proceso de Lope de Vega por libelos contra unos cómicos* (Madrid, 1901), to which is appended *Datos desconocidos para la vida de Lope de Vega*. For Lope's literary theories and doctrine of dramatic art, reference may be made to M. Menéndez y Pelayo, *Historia de las Ideas Estéticas en España*, and to A. Morel Fatio, *La Comédie espagnole du XVII*^{me} *siècle* (8vo, Paris, 1885). The *Obras Sueltas* were published by Francisco Cerdá y Rico (21 vols. 4to, Madrid, 1776–1779). A complete edition of the *Obras de Lope de Vega*, edited by M. Menéndez y Pelayo, has been undertaken by the Spanish Academy. Rennert's biography contains an admirable bibliography of Lope's plays and *autos*.

(A. M.-Fa.; J. F.-K.)

VEGETABLE (Late Lat. *vegetabilis*, full of life, animating, from *vegetare*, frequentative of *vegere* to quicken, arouse, *vegetus*, vigorous, active, cf. *vigor*, strength, vigour, &c.), a word used as a general term for plants (*q.v.*), and specifically, in popular language, of such plants as can be eaten by man or animals, whether cooked or raw, and whether the whole of such plants are edible, or only the leaves or the roots or tubers. Among such edible or culinary plants or portions of plants, a further distinction is made popularly between "fruits" and "vegetables," for which see Fruit.

For the botany and cultivation of vegetables see under the specific names, *e.g.* Potato, Turnip, &c. &c., and generally, Horticulture.

VEGETABLE MARROW, *Cucurbita Pepo*, var. *ovifera*, the most important of the gourds (*q.v.*), used as an esculent, furnishing in good seasons a very large supply for the table. They are best when eaten quite young and not over-boiled, the flesh being then tender, and the flavour sweet and nutty. The *Custard Marrow*, or crown gourd, bears a peculiar-looking flattened fruit with scalloped edges, which has a sweeter and less nutty flavour than the true marrow. A very distinct form known as Pen-y-Byd has a delicate creamy white nearly globular fruit, with a firm flesh. The bush marrows are more bushy in habit and taller and more sturdy in growth.

Vegetable marrows require a warm situation and a rich soil free from stagnant moisture. They do well on a rubbish or old-dung heap, or in a warm border on little hillocks made up with any fermenting material, to give them a slight warmth at starting. The seeds should be sown in a warm pit in April, and forwarded under glass, but in a very mild heat; the plants must be shifted into larger pots, and be gradually hardened previous to being planted out, when the mild weather sets in in May or June. The use of hand-glasses makes it possible to transplant earlier than would otherwise be advisable. The seeds may be sown early in May in pots under a hand-glass, or towards the end of May in the open ground, if heat is not at command. The true vegetable marrow bears fruit of an oblong-elliptical shape, about 9 in. long, pale-greenish while young, with whitish flesh, and scarcely any indication of ribs; when mature it is of a pale yellow colour. There is a variety which is more oblong, grows to 15 or 18 in., and has the surface slightly marked by irregular longitudinal obtuse ribs. The shoots may be allowed to run along the surface of the ground, or they may be trained against a wall or paling, or on trellises. As the gourds cross readily, care is necessary to keep any particular variety true. One of the best vegetable marrows is called Moore's Vegetable Cream.

VEGETARIANISM, a comparatively modern word, which came into use about the year 1847, as applied to the practice of living upon foods from which fish, flesh and fowl are excluded. There have from time to time been various sects or schools of thought that have advocated narrower views. Some of these have excluded all animal products—such as milk and eggs and cheese. Some have excluded all cooked foods, and have preached the virtues of fruits and nuts and grains in their natural ripe state. Some have abstained from all underground-grown roots and tubers, and have claimed special benefits from using only those fruits and vegetables that are grown in the sunlight. Some have given up all grain and pulse foods, and have declared that old age can be best resisted by living entirely upon fruits, salads, nuts, soft water and milk products. Some have added fish to their dietary; but, speaking generally, all who are called vegetarians will be found to abstain from the use of flesh and fowl and almost invariably also from fish as food.

The fact, however, must not be overlooked that while vegetarian societies claim as "vegetarians" all who abstain from flesh foods, there is a large and growing number of people who repudiate the name of "vegetarian" because of its associations, but who none the less, for some of the reasons detailed below, abstain from eating anything that has been killed. The Order of the Golden Age, for example, with its headquarters at Barcombe Hall, Paignton, South Devon, adopted the words "Fruitarian" and "Fruitarianism" to denote the dietary of its members. The rule laid down by the Order is abstinence so far as possible from all foods which are obtained by the cruel infliction of pain, and the minimum that is set is complete "abstinence from flesh and fowl," while net-caught fish may be used by associate members.

The reasons that are advanced for the practice of fruitarianism or vegetarianism are very comprehensive, but the principal ones may be considered to be the following:—

1. *Health.*—(α) On the ground that animals are affected by diseases which are communicable, and are actually communicated, to man by the ingestion of their flesh, *e.g.* parasites, tuberculosis; (β) on the ground that the flesh of artificially fed animals is full of excretory substances, and that, therefore, *under modern conditions*, flesh-eating is injurious, and may be a cause of excretory substance and uric acid deposits or rapid tissue-destroying diseases in man; *e.g.* gout, cancer.
2. *Economy.*—On the ground that the assimilable nutriment from a given weight of selected fruit and grain and nut and vegetable foods will cost less than the same nutriment obtained from flesh foods.
3. *Social Economy.*—On the ground that an acre of cultivable land under fruit and vegetable cultivation will produce from two to twenty times as much food as if the same land were utilized for feeding cattle.
4. *Racial Improvement.*—On the ground that the aim of every prosperous community should be to have a large proportion of hardy country yeomen, and that horticulture and agriculture demand such a high ratio of labour, as compared with feeding and breeding cattle, that the country population would be greatly increased by the substitution of a fruit and vegetable for an animal dietary.
5. *Character Improvement.*—On the ground that after the virtues of courage and valour and fearlessness have been taught in the lower stages of evolution, the virtue of gentle humaneness and extended sympathy for all that can suffer should be taught in the higher cycles of the evolutionary spiral. Flesh-eating entailing necessarily an immense volume of pain upon the sentient animal creation should be abstained from by the "higher classes" in the evolutionary scale.

Organizations have been established to advocate this method of living under the name of "Vegetarian Societies" in many countries—chiefly the United Kingdom, America, Germany, France, Austria, Holland and Australia. Propagandism is carried on by lectures, literature, cookery demonstrations and restaurants. In England, the oldest and one of the most important societies is "The Vegetarian Society," of which the headquarters are at Oxford Street, Manchester. There are also several small London societies, and an active London Association. A few provincial towns, too, have small societies. An attempt has been made to organize the various vegetarian societies of the world under the title of "The Vegetarian Federal Union." The headquarters of the London societies and of the "Union" are at Memorial Hall, Farringdon Street, E.C.

There are nominally about 35 organized societies in existence, but the extent to which public opinion and practice in the matter of dietary has been affected by vegetarianism is not to be gauged by the membership of such organizations. There are in England a number of vegetarian restaurants and boarding-houses, one hospital and one or two sanatoria. In Germany and America there are many institutions where flesh is only prescribed in special cases. Flesh food is not included in the dietary of the chief hospitals and orphanages of the native states of India, excepting in the wards devoted to Europeans.

The athletic side of the movement has been represented in national and international races by vegetarians winning the Berlin and Dresden walking match (125 m.), the Carwardine Cup (100 m.) and Dibble Shield (6 hours) cycling races (1901 and 1902), the amateur championship of England in racquets and in tennis (held by Mr Eustace Miles for a series of years), the cycling championship of India (3 years), half-mile running championship of Scotland (1896), world's amateur cycle records for all times from 4 hours to 13 hours (1902), 100 miles championship Yorkshire Road Club (1899, 1901).

In the religious world the Seventh-Day Adventists (who are connected with many sanatoria and the manufacture of food specialities) and some Bible Christians, the worshippers of Vishnu and the Swami Narang and Vishnoi sects, amongst others, preach abstinence from flesh food. The Salvation Army, the Tolstoyans and the Doukhobors encourage it. A number of orders in the Roman Catholic church (*e.g.* the Trappists) and in the Hindu faith (*e.g.* the Dadupanthi Sadus) are pledged abstainers.

The general question of food values is discussed in the article DIETETICS; see also NUTRITION. But there is no doubt that, whatever may be the view taken as to the extreme theory of vegetarianism, it has had considerable effect in modifying the excessive meat-consuming régime of previous days, and in introducing new varieties of vegetable cooking into the service of the table.

The literature on the subject is considerable, but the two classics are perhaps *The Ethics of Diet*, by Howard Williams, and *The Perfect Way in Diet*, by Dr Anna Kingsford. In former years the "Vegetarian Society" was the most active in producing literature, but since about 1901 the Order of the Golden Age has come to the front with new and up-to-date books, booklets and leaflets, and the Ideal Publishing Union has reprinted much of the earlier literature. The chief periodicals are the *Vegetarian* (weekly), the *Herald of the Golden Age* (monthly), the *Vegetarian Messenger* (monthly), the *Vegetarian* (American monthly), the *Children's Garden* (monthly). (J. O.)

VEGETIUS (FLAVIUS VEGETIUS RENATUS), a celebrated military writer of the 4th century. Nothing is known of his life, station and military experience, save that in MSS. he is called *vir illustris* and also *comes*. His treatise, *Epitoma rei militaris, sive institutorum rei militaris libri quinque*, was dedicated to the reigning emperor (? Theodosius the Great). His sources, according to his own statement, were Cato, Cornelius Celsus, Frontinus, Paternus and the imperial constitutions of Augustus, Trajan and Hadrian. The book, which is a confused and unscientific compilation, has to be used with great caution, but is none the less invaluable to the student of the ancient art of war.

The first book is a plea for army reform, and vividly portrays the military decadence of the empire. The third contains a series of military maxims which were (rightly enough, considering the similarity in the military conditions of the two ages) the foundation of military learning for every European commander, from William the Silent to Frederick the Great. When the French Revolution and the "nation in arms" came into history, we hear little more of Vegetius. Some of the maxims may be mentioned here as illustrating the principles of a war for limited political objects (see ARMY) with which he deals. "All that is advantageous to the enemy is disadvantageous to you, and all that is useful to you, damages the enemy"; "No man is to be employed in the field who is not trained and tested in discipline"; "It is better to beat the enemy through want, surprises and care for difficult places (*i.e.* through manœuvre) than by a battle in the open field"—maxims that have guided the leaders of professional armies in all countries and at all times, as witness the Chinese generals Sun and Wu (see E. F. Calthrop, *The Book of War*, London, 1908). His "seven normal dispositions for battle," once in honour amongst European students of the art of war, are equally ludicrous if applied to present-day conditions. His book on siegecraft is important as containing the best description of late empire and medieval siege matters, &c., and from it amongst other things we learn details of the siege engine called *onager*, which afterwards played a great part in sieges. The fifth book is an account of the material and personnel of the Roman navy.

In manuscript, Vegetius's work had a great vogue from the first, and its rules of siegecraft were much studied in the middle ages. It was translated into English, French and even Bulgarian before the invention of printing. The first printed editions are assigned to Utrecht (1473), Cologne (1476), Paris (1478), Rome (in *Veteres de re mil. scriptores*, 1487), and Pisa (1488). A German translation by Ludwig Hohenwang appeared at Ulm in 1475. Vegetius's position as the premier military critic was thenceforward assured. As late as the 18th century we find so eminent a soldier as Marshal Puységur basing his own works on this acknowledged model, and the famous Prince de Ligne wrote "C'est un livre d'or." The fullest and most important modern edition is that of Karl Lang (Leipzig, 1869). An English version through the French was published by Caxton in 1489. For a detailed critical estimate of Vegetius's works and influence see Max Jähns, *Gesch. der Kriegswissenschaften*, i. 109–125.

VEGLIA (Slavonic, *Krk*), an island in the Adriatic Sea, off the west coast of Croatia, from which it is separated by the Canale della Morlacca. It is situated in the Gulf of Quarnero, and is separated from the island of Cherso, lying on the S.W., by the Canale di Mezzo. Together with Cherso and Lussin, the three principal islands of the Quarnero group, it forms the administrative district of Lussin, belonging to the Austrian crownland of Istria. Veglia is the largest island of the Quarnero group, having an area of 146 sq. m. It is 24 m. long and about 14 m. across at its widest part. The surface is mostly rugged and mountainous; but the central, southern and western districts are fertile. The principal town is Veglia (pop. 2074), situated on the south-west coast, with a good harbour and an interesting cathedral.

VEII, an ancient town of Etruria, Italy, situated about 10 m. N. by W. of Rome by road. It is mentioned in the earliest history of Rome as a constant enemy, being the nearest Etruscan city to Rome. The story of the slaughter of the Fabii, who had encamped in the territory of Veii, and of whom but one boy escaped, is well known. After constant warfare, the last war (the fourteenth, according to the annalists) broke out in 406 B.C. The Romans laid siege to the city, and, after a ten years' siege, M. Furius Camillus took it by storm in 396, by means, so we are told, of a tunnel leading into the citadel. According to the legend, the *emissarium* of the Alban Lake was constructed in obedience to the Delphic oracle, which declared that, until it was drained, Veii could not be taken. The territory of Veii was three years afterwards divided among the Roman plebs. Veii is mentioned in connexion with the defeat of the Romans at the Allia in 390 B.C., after which many Roman soldiers fled there, while a project was actually broached for abandoning Rome for Veii, which was successfully opposed by Camillus. From this time onwards we hear little or nothing of Veii up to the end of the Republic. Propertius speaks indeed of the shepherds within its walls. Augustus, however, founded a municipality there (*municipium Augustum Veiens*), inscriptions of which have been found down to the time of Constantius, after which, at some date unknown, the place was deserted. The medieval castle of Isola Farnese, on a hill to the south of the city,[1] is first mentioned in a document of A.D. 1003; but Veii itself had disappeared to such an extent that its very site was uncertain, though some scholars identified it correctly, until the excavations of the 19th century finally decided the question. Veii was not on a high road, but was reached by branch roads from the Via Clodia. The site is characteristic—a plateau, the highest point of which is 407 ft. above sea-level, divided from the surrounding country by deep ravines, and accessible only on the west, where it was defended by a wall and fosse. Remains of the city walls, built of blocks of tufa 2 ft. high, may be traced at various points in the circuit. The area covered measures about 1 sq. m. There are no other remains on the site of the city earlier than the Roman period, and these are now somewhat scanty. The site of the Forum has been discovered on the west side of the plateau; a statue of Tiberius, now in the Vatican, and the twelve Ionic columns now decorating the colonnade on the W. side of the Piazza Colonna at Rome were found there. The acropolis was at the eastern extremity of the site, where the two ravines converge; it is connected with the rest of the plateau by a narrow neck, and here a large number of ex-votos in terra-cotta, indicating the presence of a temple, and dating at earliest from the 3rd century B.C., have been found. The first discovery of them was made in 1655–1667, when remains of the temple (of Juno?) to which they belonged were also found (R. Lanciani, *Pagan and Christian Rome*, London, 1892, p. 64). In the deep ravine to the N. of the site of the town, traversed by the Cremera brook, are the ruins of two ancient bridges and of some baths of the Roman period; and here is also the Ponte Sodo, a natural tunnel, artificially enlarged, through which the stream passes. Outside the city tombs have been discovered at various times. The earliest belonged to the Villanova period (8th and 9th centuries, B.C.), probably before the coming of the Etruscans. Others are cut in the rock and are Etruscan. The most famous is the Grotta Campana found in 1843, which contains paintings on the walls with representations of animals, among the earliest in Etruria. There are also several tumuli. To a later period belongs a columbarium cut in the rock, with niches for urns.

See L. Canina, *L'antica città di Veio* (Rome, 1847); G. Dennis, *Cities and Cemeteries of Etruria* (London, 1883), i. 1 sqq.

(T. As.)

VEIL (O.Fr. *veile*, mod. *voile*, from Lat. *velum*, cloth, awning, sail), a cloth or piece of other fabric used as a means of concealing something from the view, as in the veils of the Jewish tabernacle, which hung before the Holy Place, and before the Most Holy Place. The word is, however, chiefly used of a covering for the face and head, as worn by women. The veiling of the face by women is a practice among the Mohammedan races of the East and among those peoples which have come under the influence of Islam. It is observed only when outside the harem and not by slaves or by the very poor, and rarely by the Bedouin women. The face-veil (*burka'*) is a long strip of white muslin covering the whole of the face except the eyes and reaching nearly to the feet. Among the poorer classes the *burka'* is made of coarse black crêpe, or the *tarhah*, the head-veil, is drawn round the lower part of the face. There is also the double veil or *yashmak*, serving as a head- and face-veil (see INDIA, § *Indian Costume*). In European countries the veil has played a large part in the head-dress of women. It took many shapes in the early middle ages and could be brought over the face as a covering or protection. Later it became a mere ornamental appendage, hanging down from the high, peaked and elaborate head-dresses then worn. In modern times it has become a piece of gauze, lace or net attached to the hat or bonnet and used as a protection against dust, light or wind.

VEINS, in anatomy. The veins (Lat. *vena*) are blood vessels which return the blood from the capillaries toward the heart. As they approach that organ they join together to form larger and larger trunks. In man and other mammals three venous systems are recognized: (1) the *general venous system*; (2) the *pulmonary system*; and (3 the *hepatic portal system.* (See also VASCULAR SYSTEM.)

The *general venous system* consists of superficial and deep veins; the former lie in the superficial fascia and are often visible through the skin. They are usually accompanied by lymphatic vessels though not as a rule by arteries, and, sooner or later, they empty their blood into the deep veins, often passing through special openings in the deep fascia to do so. The deep veins always accompany arteries, and are therefore known as *venae comites.* With small and medium-sized arteries—that is to say, arteries whose diameter is not much greater than that of an ordinary lead pencil—there are two of these venae comites, one on each side, connected by occasional cross communications, but arteries of a larger calibre have only one companion vein. In the scalp and face the superficial veins are remarkable for accompanying, more or less closely, corresponding arteries—more or less closely because the arteries in this region are very tortuous (see ARTERIES), and so are sometimes near their veins and sometimes far away, since the veins run a comparatively straight course. *Frontal, superficial temporal, posterior auricular* and *occipital veins* are found in the scalp, their names indicating the areas they drain. Like all other superficial veins, they anastomose freely with one another and also at certain places communicate, through foramina in the skull, with the intracranial blood sinuses; these communications are known as *emissary veins*, and act as safety-valves to the sinuses. The frontal vein on the forehead passes down on the inner side of the eyelids, where it is known as the *angular*, and then becomes the *facial vein*, which runs down to an inch in front of the angle of the jaw, whence it passes into the neck to join the common facial. In the greater part of its course it lies some distance behind the facial artery. The *superficial temporal vein* runs down in front of the ear, where it joins the internal maxillary vein from the pterygoid plexus and so forms the *temporo-maxillary trunk*, which passes down, embedded in the parotid gland, to about the angle of the jaw. Here it divides into an anterior branch, which joins the facial vein to form the common facial, and a posterior, which receives the posterior auricular vein and in this way forms the external jugular.

The *external jugular vein* is easily recognized through the skin and platysma muscle on the side of the neck, and eventually pierces the deep fascia above the middle of the clavicle to join the subclavian vein. The *occipital vein* sinks deeply into the back of the neck and so forms the beginning of the vertebral vein.

The *intracranial blood sinuses* lie between two layers of the dura mater and differ from the veins in having fibrous walls which do not contract or expand. The *superior longitudinal sinus* runs along the upper margin of the falx cerebri (see BRAIN), while the inferior longitudinal sinus runs along the lower margin; these drain the surface of the brain, and the blood passes backward in both. Where the falx meets the tentorium cerebelli, the inferior longitudinal sinus receives the *veins of Galen* from the interior of the brain and then passes backward as the *straight sinus* to join the superior longitudinal sinus at the internal occipital protuberance (see SKULL). This meeting-place is known as the *torcular Herophili*, and from it the blood passes outward and downward through the right and left *lateral sinuses*, which groove the cranium (see SKULL) until they reach the posterior lacerated foramina, through which they pass to form the beginning of the internal jugular veins. Most of the blood from the base of the brain passes into the *cavernous sinuses* which lie in the middle cranial fossa, one on each side of the pituitary fossa. These receive the ophthalmic veins from the orbit in front and, after running backward for about an inch, divide into the *superior* and *inferior petrosal sinuses*, the former of which joins the lateral sinus within the cranium, but the latter runs to the posterior lacerated foramen, after passing through which it joins the lateral sinus, which is now becoming the internal jugular vein.

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[1] Some have considered Isola Farnese to have been the arx of Veii, but this is unlikely.

The *internal jugular vein* (fig. 5, I.J.) thus formed runs down at first behind and then to the outer side of the internal and common carotid arteries and at the root of the neck joins the subclavian vein of its own side to form the innominate vein. In its course down the neck it receives the common facial vein already mentioned, as well as tributaries from the tongue, pharynx, larynx and thyroid body. The deep veins of the head and face tend to form plexuses rather than venae comites; of these, *pterygoid*, *deep temporal*, *pharyngeal* and *suboccipital plexuses* are recognized.

Veins of the Upper Extremity.—On the dorsum of the hand and in front of the wrist superficial venous plexuses are easily seen through the skin. From these the blood passes up the forearm chiefly on its flexor surface by the *radial*, *median* and *anterior* and *posterior ulna veins.* Just below the bend of the elbow the median vein communicates with the deep veins and then divides into two branches like the limbs of a Y. Of these the inner is the *median basilic* and is noticeable as the vein from which patients were usually bled, while the outer is the *median cephalic.* After a course of an inch or two the median basilic is joined by the anterior and posterior ulnar veins and the median cephalic by the radial. After this junction the median basilic is continued up the inner side of the arm as the *basilic* which pierces the deep fascia about the middle of the arm and in the axilla joins the venae comites of the brachial artery to form the *axillary vein*, which lies on the inner side of its artery. The median cephalic vein after joining the radial runs up the outer side of the arm as the *cephalic* and a little below the clavicle passes through the costo-coracoid membrane to enter the upper part of the axillary vein. At the outer border of the first rib the axillary vein becomes the subclavian (fig. 5, S.), which lies in front of and below its artery and is separated from it by the scalenus anticus muscle. The arrangement of the superficial veins, especially in front of the elbow, is liable to great variation and often differs on the right and left sides of the same body.

Veins of the Lower Extremity.—The superficial veins of the lower extremity begin in a venous arch on the dorsum of the foot. From the inner extremity of this the *internal saphenous vein* runs up, in front of the inner ankle, along the inner side of the leg, and, passing behind the inner side of the knee, continues up the thigh, gradually working forward until it reaches the *saphenous opening* in the deep fascia of the thigh a little below the spine of the pubis. Here it pierces the deep fascia (*fascia lata*) to enter the common femoral vein. In this long course it has many valves and receives numerous tributaries, one of which, the *saphenous collateral*, runs up nearly parallel to it and on its outer side and joins it just below the saphenous opening. From the inner end of the dorsal arch of the foot the *external saphenous vein* runs up behind the outer ankle along the mid line of the calf to pierce the deep fascia in the popliteal space behind the knee to open into the popliteal vein. Among the deep veins venae comites are found until the popliteal artery is reached, while above this *superficial*, *deep* and *common femoral veins* accompany their respective arteries. In the groin the common femoral vein lies on the inner side of its artery.

Veins of the Abdomen.—The common femoral vein, after passing deep to Poupart's ligament, becomes the *external iliac* (fig. 5, E.I.) which runs along the brim of the true pelvis and, after a course of some three inches, joins the *internal iliac* (fig. 5, I.I.) which drains the pelvis and so forms the *common iliac vein.* In front of the body of the fifth lumbar vertebra the common iliac veins of the two sides unite to form the *inferior vena cava* (fig. 5, I.V.C.), a very large trunk which runs up on the right of the abdominal aorta to an opening in the diaphragm (*q.v.*). On its way it receives spermatic or ovarian veins from the genital glands, *renal veins* (fig. 5, R.V.) from the kidneys, and *lumbar veins* (fig. 5, L.V.) from the abdominal walls. Before reaching the diaphragm it lies in a groove in the back of the liver (*q.v.*) and receives the *hepatic veins* from that organ. The hepatic portal system which lies in the abdomen will be treated later.

Veins of the Thorax.—The inferior vena cava, after piercing the diaphragm, has a very short thoracic course and opens into the lower and back part of the right auricle of the heart (*q.v.*). The *right* and *left innominate veins* (fig. 5, R.I. and L.I.) are formed behind the sternal end of the clavicle by the union of the subclavian and internal jugulars of their own side. The left vein is much longer than the right and runs nearly horizontally behind the upper half of the manubrium sterni to join its fellow on the right side of that bone just below the first rib. By the junction of these the *superior vena cava* (fig. 5, S.V.C.) is formed, which runs down to the right auricle of the heart. The chief tributaries of the innominate veins are the *vertebral*, the *internal mammary* and the *inferior thyroid.*

The intercostal veins open into the *azygos veins*, which begin in the abdomen sometimes by a vertical trunk joining the lumbar veins known as the *ascending lumbar*, sometimes on the right side by a communication with the inferior vena cava. The right azygos vein is known as the *vena azygos major* (fig. 5, A.M.) and passes through the aortic opening of the diaphragm. Entering the thorax, it runs up in front of the thoracic vertebrae, to the right of the aorta and thoracic duct, and receives the intercostal veins of the right side. At the level of the fourth thoracic vertebra it arches forward to open into the posterior surface of the superior vena cava.

On the left side, the upper intercostal veins join to form the left superior intercostal vein (fig. 5, L.S.I.), which opens into the left innominate. Lower down the intercostal veins from the fourth to the seventh spaces form the *superior hemiazygos vein* or hemiazygos accessoria (fig. 5, H.A.), which runs down on the left of the spinal column and, crossing it about the level of the eighth or ninth thoracic vertebra, opens into the vena azygos major. The lower intercostal veins on the left side join the *inferior hemiazygos vein* (fig. 5, H.V.), which runs up and opens either into the superior hemiazygos or into the azygos major below the opening of that vein.

Pulmonary Venous System.—The veins emerging from the lungs bring back the oxygenated blood from those organs to the left ventricle of the heart and also the greater part, if not all, of the blood carried by the bronchial arteries to nourish the lungs. The existence of bronchial veins is asserted, but they are extremely difficult to demonstrate, and if present are quite incapable of returning all the blood which the bronchial arteries carry to the lungs. There are three pulmonary veins coming out of the right lung, while on the left there are only two. On the right side, however, two of the three veins usually unite in the root of the lung, so that there are, as a rule two pulmonary veins entering the left auricle of the heart on each side, but it is not uncommon to find three on the right side or one on the left. The pulmonary veins have no valves and return the blood carried to the lungs by the pulmonary arteries as well as most, if not all, of that carried by the bronchial arteries.

Hepatic Portal System.—The veins which drain the blood from the stomach, intestines, spleen and pancreas unite to form a large vein which begins behind the head of the pancreas and ends by dividing into right and left branches in the transverse fissure of the liver. This is the *portal vein* which lies in front of the inferior vena cava and is about three inches long. Its formative tributaries are the *superior* and *inferior mesenteric* and the *splenic veins.* These accompany the arteries of the same name, and their most usual method of termination is that the inferior mesenteric runs up and joins the splenic to the left of the middle line of the body, and this, after running horizontally to a point a little to the right of the middle line, joins the superior mesenteric, and so the portal vein is formed. There are two marked characteristics of the portal system; one is that it has no valves and the other that it begins and ends in capillaries, since the two terminal branches of the portal vein branch and rebranch in a manner already described in the article LIVER. In the lower part of the rectum the veins run partly into the portal and partly into the general system, and in this dependent position they are liable to become varicose and to form haemorrhoids or piles.

The histology of the veins corresponds very closely to that of the arteries (*q.v.*); their walls are, however, much thinner and there is less muscular and elastic tissue. At certain places, especially where tributaries come in, the endothelial lining is raised to form semilunar pocket-like valves. In most cases there are two cusps to each valve, but three or one are sometimes found. The opening of the pocket is of course arranged so that it shall only be filled when there is a tendency to regurgitation of the blood.

Embryology.

The *vitelline* or *omphalo-mesenteric veins*, returning the blood from the yolk sac, are the first to appear, and later on, with the formation of the placenta, the umbilical veins develop. Both these open into the hinder (caudal) part of the heart, which is already being constricted off as the *sinus venosus* (see fig. 1).

While this is going on the veins from the different body segments are received into two longitudinal trunks on each side, the anterior (cephalic) of which is the *primitive jugular* or anterior cardinal (fig. 1, P.J.), and the posterior (caudal), the *posterior cardinal* or simply *cardinal vein* (fig. 1, P.C.). As the heart is at first situated in the region which will later be the neck of the embryo, the primitive jugular receives very few segmental veins and the cardinal very many. These two trunks join one another on each side and open into the side of the *sinus venosus* (S.V.) by a transverse communication which is called the *duct of Cuvier* (D.C.). The condition of the venous system at this stage is shown in the accompanying diagram (fig. 1).

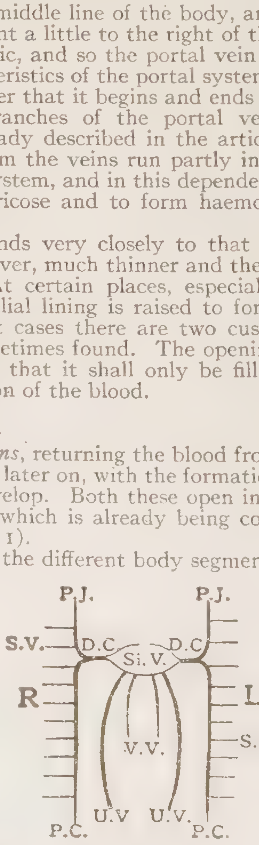

FIG. 1.

As the vitelline veins run from the yolk sac to the heart along each side of the primitive fore-gut they pick up the mesenteric veins from the intestines as well as the splenic and pancreatic veins as soon as these viscera are formed. The liver, however, is developed right across their path, and both they and the umbilical veins break up into a mass of capillaries in it, leaving that part of them which lies between the liver and the heart to form the primitive hepatic veins (fig. 2, H.V.). While the vitelline veins are lying on each side of the fore-gut (future duodenum) they are connected by three transverse channels, the anterior and posterior of which appear on the ventral side of the gut, the middle on the dorsal side (see fig. 2).

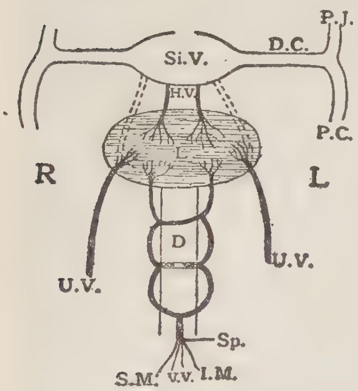

FIG. 2.

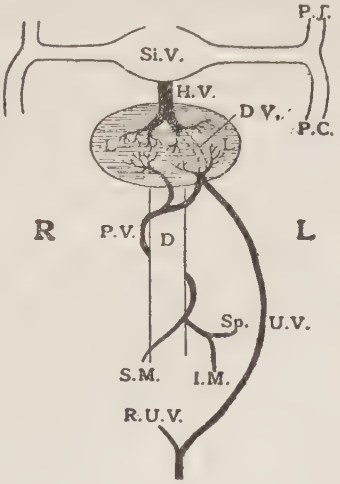

FIG. 3.

This figure of eight does not persist, however, because the anterior (cephalic) part of it on the left and the posterior (caudal) part on the right become obliterated, and what is left forms the *portal vein* (fig. 3, P.V.). The two umbilical veins unite at the umbilicus (fig. 3) and soon all the blood from the placenta passes through the left one, the right becoming rudimentary.

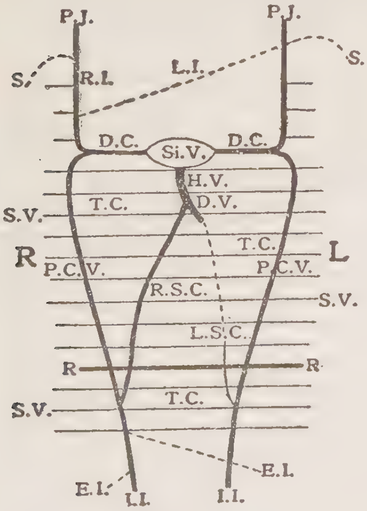

FIG. 4.

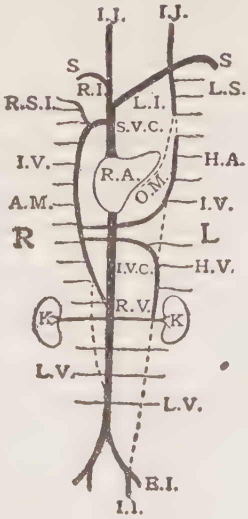

FIG. 5.

The left umbilical vein on reaching the liver now joins the left branch of the portal vein and establishes a new communication with the left hepatic vein. This is the *ductus venosus* (fig. 3, D.V.), and, as soon as it is formed, there is no longer any need that all the blood returning from the placenta should pass through the liver capillaries. The development of the cardinal veins must now be returned to. As the heart moves from the neck into the thorax the primitive jugulars elongate and it is now recognized become the internal jugulars in the greater part of their extent. When the arms begin to bud out subclavian veins are developed (fig. 4, S.) and an oblique connecting vein (figs. 4 and 5, L.I.) is established between the point of junction of the left subclavian with the primitive jugular and the hinder part of the primitive jugular of the right side. This connexion becomes the left innominate vein, while the hinder part of the primitive jugular persists as the *left superior intercostal vein* (fig. 5, L.S.I.). On the right side that part of the primitive jugular between the subclavian and the junction with the left innominate becomes the right innominate (figs. 4 and 5, R.I.) while the hinder (caudal) part of the right primitive jugular and the right duct of Cuvier become the superior vena cava (figs. 4 and 5, S.V.C.). The external jugular is a later formation. The right and left posterior cardinal veins receive the intercostal and lumbar segmental veins and are continued into the lower limbs as the internal iliac and eventually the sciatic veins (figs. 4 and 5, I.I.), the primitive bloodpath from the thighs. The veins from the primitive kidneys open into the segmental veins, and when the permanent kidney is formed (see URINARY SYSTEM) a large *renal vein* on each side is established. There are, however, many cross communications (fig. 4, T.C.) between the right and left posterior cardinal veins, some of which become very important later on, though most of them are transitory. The probable origin of the *inferior vena cava* is to be sought in a pair of veins called *subcardinals* which have been found in the rabbit embryo lying parallel and a little ventral to the posterior cardinals (fig. 4, R.S.C.–L.S.C.) and effecting a junction with the renals and transverse communications (T.C.) as they cross these. Posteriorly (caudal) they join the cardinals, but anteriorly the right one establishes a communication with the ductus venosus (fig. 4, D.V.) a little below the point at which that vessel joins the left hepatic. It is from the right one of these that the greater part of the inferior vena cava is formed. It will now be seen that the adult vena cava is formed by contributions from four embryonic veins, most anteriorly the hepatic, then the ductus venosus, then the right subcardinal and posteriorly the right posterior cardinal (F. T. Lewis, *Am. J. of Anat.* vol. 1, 229, 1902). The anterior (cephalic) part of the right posterior cardinal forms the *vena azygos major*, and an inspection of fig. 4 will show that in the adult this may rise from the renal, from an ascending lumbar vein or, by a cross communication above the renal, from the inferior vena cava. The left posterior cardinal becomes obliterated below and its segmental tributaries find their way by cross communications to the vena cava (fig. 5). Above (cephalad) the left renal vein the left cardinal forms the hemiazygos (fig. 5, H.V.) and, higher still, the hemiazygos accessoria (fig. 5, H.A.). These open into the azygos major by persistent cross communications which lie dorsal to the heart when that organ reaches its permanent position. It must be mentioned in this connexion that some modern authorities doubt whether the azygos veins of mammals are really persistent cardinals except quite in their anterior parts, just before they join the ducts of Cuvier. The left duct of Cuvier is only represented in the human adult by the oblique vein of Marshall on the dorsum of the left auricle. The external iliac veins (figs. 4 and 5, E.I.) become fully developed, like their arteries, when the blood changes its course from the back to the front of the thigh. After birth the umbilical vein and the ductus venosus become converted into fibrous cords and the circulation in the pulmonary veins is established. (For further details see *Development of the Human Body*, by J. P. McMurrich, London, 1906. In this will be found the literature of the subject up to that date, the writings of F. Hochstetter being the most important. See also Quain's *Anat.* vol. i., 1908.)

Comparative Anatomy.

In the Acrania (*Amphioxus*), although there is no heart, the blood vessels returning the blood to the subpharyngeal region are distinctly of a vertebrate type. There is a subintestinal vessel or vein bringing the blood from the intestine to the liver and breaking up into capillaries in that organ just as the portal vein does in the higher forms. From the liver a hepatic vein carries the blood forward to the region below the pharynx where the heart is formed in Vertebrata. There is no renal portal system. In the Cyclostomata (lampreys and hags) the cardinal veins are formed and the blood from the caudal vein passes directly into the posterior cardinals without any renal portal system. In fishes the single caudal vein divides into two branches, each of which runs forward to the outer side of its respective kidney and ends by giving numerous branches to that viscus. The blood returning from the kidney passes into the beginning of its own posterior cardinal vein or sinus, which lies on the inner side of the kidney. This constitutes a *renal portal system.* The cardinal veins and ducts of Cuvier closely resemble the arrangement already detailed in the human foetus, while the hepatic portal system from the intestine to the liver is constant in this and all other vertebrates.

In the Dipnoi (mud-fish) a pulmonary vein from the lung-like swim-bladder is formed and an inferior vena cava or postcaval vein carries the blood from the kidneys to the heart. This is its first appearance in the vertebrate phylum. In the lower fishes there is a vein of the lateral line on each side, but in the Dipnoi these coalesce and form a median anterior (ventral) abdominal vein which is constant in the Amphibia. Subclavian and iliac veins return the blood from the fins and open respectively into the junction of the anterior and posterior cardinals and into the caudal vein.

In the tailed Amphibia (*Urodela*) the postcaval and posterior cardinal veins are well developed, the former vessel running from the right cardinal vein a little in front of (cephalad) the kidney to the hepatic vein, in this way closely foreshadowing man's embryology. In the Anura (frogs and toads) the posterior cardinals are usually suppressed, but these are very specialized animals. The anterior abdominal vein in amphibians joins the portal vein close to the liver.

In the Reptilia the renal portal circulation persists, but is rudimentary in birds and disappears in mammals. The anterior abdominal or epigastric vein of amphibians and reptiles returns the blood from the allantois in the embryo and in higher forms becomes the umbilical veins returning the blood from the placenta; there is, therefore, a continuous line of ascent from the lateral line veins of the fish to the umbilical vein of man. In reptiles, birds, monotremes, marsupials and many rodents, insectivores, bats and ungulates, a left superior vena cava (precaval vein) is present as well as a right; it passes ventral to the root of the left lung and then dorsal to the left auricle of the heart until it reaches the coronary sinus to open into the right auricle. Its course is indicated in man by the left superior intercostal vein, the vestigial fold of Marshall (see Coelom and Serous Membranes) and the oblique vein of Marshall. It can be readily reconstructed from figs. 4 and 5 if the transverse communication (L.I.) is obliterated. In some mammals the postcaval vein is double, especially in its hinder (caudal) part, and this sometimes occurs as a human abnormality (see F. W. McClure, *Am. Journ. of Anat.* vol. 2, 1903, and vol. 5, 1906, also *Anat. Anzeiger*, Bd. 29, 1906).

Except in Cetacea, one or both azygos veins are always present in mammals. When there is only one it is usually the right, though a few forms among the marsupials, rodents and ungulates have only the left (F. E. Beddard, *P.Z.S.*, 1907, p. 181). In many of the lower mammals the external jugular vein is much larger than the internal and returns most of the blood from the brain through an opening called the postglenoid foramen. For this reason it was formerly regarded as the representative of the primitive jugular. It is now, however, thought that the internal jugular is that representative, and that the arrangement of man, in which the internal jugular drains the interior of the cranium, is the more generalized and primitive.

For further details and literature see R. Wiedersheim's *Comparative Anatomy of Vertebrates*, translated by W. N. Parker (London, 1907). (F. G. P.)

VEINS, in geology, masses of rock which occupy fissures in other rocks. They may have originated in many different ways and present a great variety of forms and structures. We may classify them in three groups: (i.) veins of igneous rock, (ii.) of sedimentary, and (iii.) of minerals deposited by water or by gases.

Veins of igneous rock are practically the same as dikes; yet a distinction is sometimes made that dikes are narrow, often straight-walled and run for considerable distances, while veins are irregular, discontinuous and of limited extent. Where granite invades sedimentary or metamorphic rocks it very commonly emits vast numbers of dikes. The margin of the granite is full of blocks of all sizes, so that it is often impossible to say where the solid granite ends and the fringe of veins begins. An intrusion plexus of this sort seldom extends for more than a few hundred yards; many granites, on the other hand, have sharp and well-defined margins and send few veins into the country rock.

In plutonic rock areas veining is also very common. Great intrusive masses have not as a rule been injected in one stage but have been slowly enlarged by gradual or repeated inflows, and often the earliest portions had consolidated before the last were introduced. Very frequently the older rocks are of a different character, being usually more basic than those which succeed them, and this makes the veining more obvious. For instance, it is common to find peridotite traversed by many veins of gabbro, or diorite injected with numerous veins of granite, though in either case the rocks are part of one plutonic boss or laccolite. The crystalline structure of the vein-rock and the surrounding mass is usually quite similar and there may be no fine-grained edges to the veins; these facts establish that the older mass though solid had not yet cooled down, so that the veining is directly connected with the injection process and the two rocks have been derived from the same source, but one is slightly later than the other.

Among the Laurentian or Lewisian gneisses, which resemble granites, diorites and gabbros in composition, but have a banded or foliated structure, veining of this type is almost universal. The veins are of all sizes and of very irregular shape. Frequently they run along the foliation of the gneiss, but often also they cross it obliquely or at right angles. Such gneisses were produced by the injection of a partly differentiated and consequently non-homogeneous magma, by successive stages, under a rock crust which was in movement or was subjected to intermittent pressures during consolidation.

In certain cases the new material introduced into the rock by these veins bulks almost as largely as the original substance. A shale, slate or phyllite is sometimes so filled with threads of granite that its composition and appearance are completely altered. Thin pale threads of quartz and felspar, not more than a tenth of an inch in thickness may be seen following the bedding planes, or the cleavage and sometimes also the slip-cleavage. The distance between the veins may be no greater than the breadth of the veins themselves, and thus a striped or banded rock is produced, resembling a gniess but of dual origin, a mixed rock which is described properly as a "composite" or "synthetic" gneiss. The French geologists who first insisted on the importance of this group of rocks have called the process *lit par lit* (bed-by-bed) injection. The best examples of this in Britain are to be found around the granites of Mull and northern Sutherlandshire. The rocks invaded by granite in this manner often show intense contact alteration and are to a large extent recrystallized.

The short irregular veins which commonly occur within areas of granite, diorite, gabbro and other plutonic rocks are often much more coarsely crystalline than the rock around them. This is no doubt partly due to the high temperature of the whole complex and to slow crystallization, but it may also be ascribed to the action of vapours dissolved in the magma and gradually released as it solidifies. Such coarse-grained igneous rocks are called pegmatites (*q.v.*). It is clear that they are not purely igneous but are partly pneumatolytic.

With the pegmatites we may class the fine-grained acid veins (aplites) which are found not only in granites but also in many diabases. They occur in irregular streaks or as long branching well-defined veins, and are usually more rich in quartz and felspar than the surrounding rock. Formerly they were often described as contemporaneous or as segregation veins; but no vein can be in strict accuracy contemporaneous with the rock which it intersects, and many of them give evidence of having been intruded into their present situation, since their minerals are so arranged as to show flexion structure. But they are always intimately connected, as their mineral composition indicates, with the rock mass in which they lie, and they represent merely the last part of the magma to consolidate. The fissures they occupy are presumably due to contraction, seeing that they are not accompanied by displacement, brecciation or faulting.

Veins of sedimentary rock are few and of little importance. They occur where sediment has gathered in cavities of other rocks. Lava streams, for example, when they cool become split up into irregular blocks, and in the crevices between these ashes, sand and clay will settle. Submarine lavas are often traversed by great numbers of thin veins of sandstone, and a similar phenomenon may also be noted in the tuff of submarine necks or other ash beds. Cracks in limestone and dolomite are widened by the solvent action of percolating waters and may be filled with gravel, soil, clay and sand. In the Carboniferous Limestone, for instance, veins of bedded sandstone sometimes pass down from overlying Triassic deposits. The upper surface of the chalk in the south of England has frequently many deep funnel-shaped pipes which are occupied by Tertiary or recent accumulations.

The third group of veins, namely, those which have been filled by deposits from solution in water or in vapours, is of the greatest importance as including a very large number of mineral veins and ore-bodies. They are also the source of the great majority of the finely crystallized specimens of minerals.

The deposition of minerals on the walls of fissures by a process of sublimation may be observed at any active volcano. The cracks in the upper part of lava flows are often lined by crystals of sal-ammoniac, sodium chloride, ferric chloride and other volatile substances. By oxidation of the iron chloride bright scales of haematite (ferric oxide) arise; sulphurous acid and sulphuretted hydrogen, given out as gases, react on one another, producing yellow encrustations of sulphur; and copper oxide (tenorite) and a great variety of other minerals (alum, iron sulphate, realgar, borates and fluoride) are found about fumaroles of Vesuvius and other volcanoes.

Most veins, however, are not of superficial origin but have been formed at some depth. The heat given out by masses of rocks which were injected in a molten state is no doubt sufficiently high to volatilize many minerals. The pressure, however, also must be taken into account, as it tends to retain these substances in a liquid condition. Water vapour is always the most abundant gas in a volcanic magma, and next to it are carbonic acid, sulphurous acid, sulphuretted hydrogen and hydrochloric acid. The physical condition of the substances passing outwards from an igneous mass through fissures in the superincumbent rocks will depend on the nature of the substances, on the temperature and the pressure. Near the granite the heat is so great, at first at any rate, that gaseous materials must greatly preponderate; but farther away many of them will be condensed and hot aqueous solutions of complex composition will fill the cracks.

Veins deposited by the action of gases and vapours are said to be of "pneumatolytic" origin; where hot aqueous solutions have been the principal agency in their formation they are "hydatogenetic." It is often very difficult to ascertain to which of these classes a mineral vein belongs, especially as we are in ignorance of the behaviour of many substances at high temperatures and under great pressures.

The veins which yield tin-ores in Cornwall and in most other tin-producing countries are generally regarded as typical pneumatolytic deposits. Tin forms a volatile fluoride which may be decomposed by water, forming tin oxide, the fluorine passing into hydrofluoric acid which may act as a catalytic agent or carrier by again combining with tin. Around tin-bearing veins and in the material which fills them there are usually many minerals containing fluorine, such as topaz, fluor-spar and white mica. Some borates too are volatile at high temperatures, and minerals containing boron (especially tourmaline) are very common in tin veins. Also since ore deposits of this character are found nearly invariably in granite or in the rocks which have been invaded by granite there is good reason to hold that fluoric and boric gases were important agents in the production of tin veins. It is not necessary, however, to believe that all the materials which are found in these veins were introduced as vapours, for as the temperature sank currents of hot water would follow which would fill up any cavities.

The tin veins of Cornwall often contain copper ores in their upper parts and at greater distances from the granite, a fact which indicates that the copper salts were deposited from solution at lower temperatures than the tin ores. A very large number of important ore deposits have been laid down by hot waters emanating from deep-seated intrusive masses. Nearly all the principal goldfields (except gravels or placers) are in districts where igneous dikes, veins and sills abound, and it is often perfectly clear that the introduction of the gold ores is intimately connected with the intrusive masses. The Witwatersrand deposits, although by many considered to be old auriferous gravel, have been regarded as owing their value to gold deposited from vapours emanating from certain of the dikes which traverse the banket rock or conglomerate. The importance of these hot ascending currents of water, proceeding from eruptive magmas, has been fully recognized, and is now probably the most widely accepted theory of the genesis of mineral veins.

The water falling on the earth's surface will to a large extent percolate downwards into the rocks, and it will dissolve mineral matters, especially at the greater depths, owing to the increased temperature and pressure; conversely, as it ascends it will lay down deposits or veins. This is the theory of "lateral secretion," at one time in great favour, but now regarded as of less importance. Ferruginous waters on passing through limestone rocks may deposit their iron as haematite or siderite, removing a proportionate amount of lime, and in this way great bodies of ironstone have been formed, as in Cumberland and Yorkshire, partly along the bedding of the limestone but also in veins, pockets and irregular masses. Many lead and zinc veins probably belong also to this class. By analysis it has been proved that in nearly all the common rocks there exist very minute quantities of such metals as gold, silver, lead, copper, zinc. If these can be extracted in solution in water they might conceivably be deposited subsequently in fissures in the rocks.

Controversy has raged between opposing schools of geologists, one considering that most mineral veins owe their existence to currents of hot water ascending from deep-seated igneous rocks, and the other that the metals were derived from the country rocks of the veins and were extracted from them by cold descending currents of water. There are cases which can be explained on one of these hypotheses only, and sufficiently establish that both of them are valid; but the general opinion at the present time is in favour of the first of these explanations as the most general.

The fissures in which veins have been deposited owe their origin to a variety of causes. Many of them are lines of fault, the walls of which have been displaced before the introduction of the vein minerals. Others seem to be of the same nature as joints, and are due either to contraction of the rocks on solidification, to folding or to earthquake shocks. In the vicinity of intrusive masses many fissures have been produced by the contraction of rock masses which had been greatly heated and then slowly cooled. Veins often occur in groups or systems, which have a parallel trend and may sometimes be followed for many miles. The larger veins may branch and the branches sometimes unite after a time, enclosing masses of country rock or "horses." Cross-courses are fissures which intersect the lodes; they are often barren, and at other times carry an entirely different suite of minerals from those of the mineral veins. A peculiar group of veins has been described from the Bendigo district of Australia; they are saddle-shaped and in transverse section resemble an inverted U. The beds in which they occur are folded sharply into arches and troughs, and in folding they have separated at the crests of the arches, leaving hollows which were subsequently filled up with ore.

The minerals occurring in the veins are sometimes classified as "ores" and "gangue": the former being those which are of value while the others are unprofitable. The commonest of the gangue minerals are quartz, calcite, barytes and fluor-spar. Usually a large number of minerals occurs in each vein, and the natural association or "paragenesis" of certain minerals which frequently are found together is a practical guide of much value to the engineer and prospector. A definite sequence in the order of deposit of the constituent minerals can often be recognized, the earlier being situated on the walls of the fissures or enclosed and surrounded by the later, and the microscopic study of veinstone shows that they have often a complicated history.

Many types of structure are met with in veinstones and vein deposits. Some are structureless, homogeneous or massive, like the quartz veins which are often found in districts composed of slate or phyllite. Others are banded, with sheets of deposit, each consisting of one mineral, usually parallel to the walls of the lode. These veins are often symmetrical, with corresponding layers following one another inwards from the walls on each side.

The veinstones are frequently crushed either by faulting or by irregular movements of the walls, and in such cases the veinstones have a shattered or brecciated appearance. If the crushing took place while the ore deposits were still being introduced, the broken rock is often cemented together into a compact mass. Rounded masses of rock or of veinstone are often met with, looking exactly like pebbles, but they are analogous to crush-conglomerates, as the fragments have been shaped by the movements of the walls of the vein. Frequently these movements have reopened a fissure which had been filled up, and a new vein is subsequently formed alongside of the old one; this process may be repeated several times.

The mineral-bearing solutions may exert a powerful influence on the walls of the veins, removing certain constituents and depositing others; in this way the walls of the vein become ill defined. The commonest change of this kind is silicification, and rocks of many different kinds, such as slate, limestone, andesite and felsite, are often completely replaced by quartz in the vicinity of mineral veins which have a quartzose gangue. Tin veins in granite and slate may be surrounded by a zone of rock which has been impregnated with cassiterite and is worth working for the metal. These changes are of a "metasomatic" type involving replacement of the original rock-substance by introduced materials. Many of the best examples of this are furnished by limestone, which is one of the rocks most easily affected by percolating solutions.

The distinction between mineral veins and other veins is to a large extent artificial. With improvement of methods of mining and extraction deposits formerly unprofitable become payable, and in all cases veins vary considerably in the amount of ore they carry. The rich parts are sometimes called shoots or bonanzas, while the barren portions are often left standing in the mine. Near the ground surface the veinstones become oxidized and the metallic minerals are represented by oxides, carbonates, hydrates, or in the case of gold and silver veins they may be rich in the metals themselves. Below the zone where oxidizing surface-waters percolate a different series of minerals occurs, such as sulphides, arsenides and tellurides. If the ores are insoluble they will tend to be concentrated in the upper part of the vein rock, which may be greatly enriched in this way. Pyritic veins are changed to rusty-looking masses, "gossans," owing to the oxidation of the iron at the surface. Though instances are known of veins which come to an end when followed downwards, it seems probable that the majority of veins descend to great depths, and there is little reason to believe that they become less rich in the heavy metals. (J. S. F.)

VEIT, PHILIPP (1793–1877), German painter, one of the leaders of the German romantic school, was born in Berlin. Having received his first art education in Dresden and Vienna, he was strongly influenced by, and joined the group of, the Nazarenes in Rome, where he worked for some years before taking up his abode in Frankfort. In this city, where his most important works are preserved at the Staedel Institute, he was active from 1830 to 1843, as director of the art collections and as professor of painting. From 1853 to his death in 1877 he held the post of director of the municipal gallery at Mayence. Like his fellow-Nazarenes he was more draughtsman than painter, and though his sense of colour was stronger than that of Overbeck or Cornelius, his works are generally more of the nature of coloured cartoons than of paintings in the modern sense. His principal work is the large fresco of "The Introduction of Christianity into Germany by St Boniface," at the Staedel Institute in Frankfort. In the cathedral of that city is his "Assumption," whilst the Berlin National Gallery has his painting of "The Two Marys at the Sepulchre." To Veit is due the credit of having been the first to revive the almost forgotten technique of fresco painting.

See *Kunst, Künstler und Kunstwerke*, by Valentin Veit.

VEITCH, JOHN (1829–1894), Scottish poet, philosopher, and historian of the Scottish border, son of a Peninsular veteran, was born at Peebles on the 24th of October 1829, and educated at Edinburgh University. He was assistant lecturer successively to Sir William Hamilton and A. Campbell Fraser (1856–60). In 1860 he was appointed to the chair of logic, metaphysics and rhetoric at St Andrews, and in 1864 to the corresponding chair at Glasgow. In philosophy an intuitionist, he dismissed the idealist arguments with some abruptness, and thereby lost much of the influence gained by the force of his personal character. He died on the 3rd of September 1894. He will be remembered chiefly for his work on Border literature and antiquities.

He published translations of Descartes' *Discours de la méthode* (1850) and *Méditationes* (1852); an edition of Sir W. Hamilton's lectures with memoir (1869, in collaboration with H. L. Mansel); *Tweed, and other Poems* (1875); *History and Poetry of the Scottish Border* (1877; ed. 1893); *Institutes of Logic* (1885); *Knowing and Being* (1889); *Merlin* (1889); *Dualism and Monism* (1895); *Border Essays* (1896). See *Memoir* by his niece, Mary R. L. Bryce (1896).

VEJÉR DE LA FRONTERA, a town of southern Spain, in the province of Cadiz, on the right bank of the river Barbate and on the Cadiz-Tarifa railway. Pop. (1900) 11,298. Vejér de la Frontera occupies a low hill overlooking the Straits of Gibraltar and surrounded by orchards and orange groves. It contains several ancient churches and convents, and the architecture of many of its houses recalls the period of Moorish rule, which lasted from 711 until the town was captured by St Ferdinand of Castile in 1248. Agriculture and fruit-farming are the chief industries; fighting bulls are also bred in the neighbourhood.

VELARIUM, the curtain or awning extended above the auditorium of the Roman theatres and amphitheatres to protect the spectators from sun and rain.

VELAZQUEZ, DIEGO RODRIGUEZ DE SILVA Y (1599–1660), the head of the Spanish school of painting and one of the greatest painters the world has known, was born in Seville early in June 1599, the year in which Van Dyck also first saw the light at Antwerp. His European fame is of comparatively recent origin, dating from the first quarter of the 19th century. Till then his pictures had lain immured in the palaces and museum of Madrid; and from want of popular appreciation they had to a large extent escaped the rapacity of the French marshals during the Peninsular War. In 1828 Sir David Wilkie[1] wrote from Madrid that he felt himself in the presence of a new power in art as he looked at the works of Velazquez, and at the same time found a wonderful affinity between this master and the English school of portrait painters, being specially reminded of the firm, square touch of Raeburn. He was struck by the sense of modernness of impression, of direct contact with nature, and of vital force which pervaded all the work of Velazquez, in landscape as well as in portraiture. Time and criticism have now fully established his reputation as one of the most consummate of painters, and accordingly Ruskin says of him that "everything Velazquez does may be taken as absolutely right by the student." At the present day his marvellous technique and strong individuality have given him a power in European art such as is exercised by no other of the old masters. Although acquainted with all the Italian schools, and the friend of the foremost painters of his day, he was strong enough to withstand every external influence and to work out for himself the development of his own nature and his own principles of art. A realist of the realists, he painted only what he saw; consequently his imagination seems limited. His religious conceptions are of the earth earthy, although some of his works, such as the "Crucifixion" and the "Christ at the Column," are characterized by an intensity of pathos in which he ranks second to no painter. His men and women seem to breathe, his horses are full of action and his dogs of life, so quick and close is his grasp of his subject. England was the first nation to recognize his extraordinary merit, and it owns by far the largest share of his works outside of Spain.[2] But Velazquez can only be seen in all his power in the gallery of the Prado at Madrid, where over sixty of his works are preserved, including historical, mythological and religious subjects, as well as landscapes and portraits. It is hardly creditable to the patriotism of Seville, his native town, that no example of his work is to be seen in the gallery of that city. Seville was then in the height of its prosperity, "the pearl of Spain," carrying on a great trade with the New World, and was also a vigorous centre of literature and art. For more than a hundred years it had fostered a native school of painting which ranked high in the Peninsula, and it reckoned among its citizens many whose names are prominent in Spanish literature.

Velazquez was the son of Rodriguez de Silva, a lawyer in Seville, descended from a noble Portuguese family, and was baptized on the 6th of June 1599. Following a common Spanish usage, he is known by his mother's name Velazquez. There has been considerable diversity of opinion as to his full name, but he was known to his contemporaries as Diego de Silva Velazquez, and signed his name thus. He was educated, says Palomino, by his parents in the fear of God, and was intended for a learned profession, for which he received a good training in languages and philosophy. But the bent of the boy was towards art, and he was placed under the elder Herrera, a vigorous painter who disregarded the Italian influence of the early Seville school. From his works in Seville we can see that Herrera was a bold and effective painter; but he was at the same time a man of unruly temper, and his pupils could seldom stay long with him. Velazquez remained but one year—long enough, however, to influence his life. It was probably from Herrera that he learned to use long brushes, or, as J. E. Hodgson, R.A., suggested, brushes with long bristles, by means of which his colours seem to be floated on the canvas by a light, fluent touch, the envy and despair of his successors. From Herrera's studio Velazquez betook himself to a very different master, the learned and pedantic Pacheco, the author of a heavy book on painting, and, as we see by his works at Madrid, a dull, commonplace painter, though at times he could rise to a rare freedom of handling and to a simple, direct realism that is in direct contradiction to the cult of Raphael preached by him in his writing. A portrait by Pacheco, owned by Sir Frederick Cook, which shows this master's full power, was exhibited at Burlington House in 1907. In Pacheco's school Velazquez remained for five years, studying proportion and perspective, and seeing all that was best in the literary and artistic circles of Seville. Here also he fell in love with his master's daughter Juana, whom he married in 1618 with the hearty approval of Pacheco, who praises his hand and heart, claiming at the same time all the credit of having been his master. The young painter set himself to copy the commonest things about him—earthenware jars of the country people, birds, fish, fruit and flowers of the market-place. To paint well and thoroughly what he saw, to model with his brush, and to colour under the influence of light and shade were for him the vital purpose, the first lesson, in his art. It was with deliberate purpose that Velazquez painted these *bodegones* (tavern-pieces), as they were called; for we are told that he said he would rather be the first painter of common things than the second in higher art. Carrying out this idea still further, Velazquez felt that to master the subtlety of the human face he must make this a special study, and he accordingly engaged a peasant lad to be his servant and model, making innumerable studies in charcoal and chalk, and catching his every expression. We see this model, probably, in the laughing boy of the Hermitage "Breakfast," or in the youngest of the "Musicians" acquired for the Berlin Museum in 1906. In such work as this, and in his studies by the wayside, Velazquez laid the foundation of his subsequent mastery of expression, of penetration into character, and of rendering the life of his sitter to the quick. He saw the world around him teeming with life and objects interesting to the painter, and he set himself to render these. His manner is as national as that of Cervantes. He lived and died racy of the soil. The position and reputation of Velazquez were now assured at Seville. There his wife bore him two daughters—all his family so far as is known. The younger died in infancy, while the elder, Francisca, in due time married Bautista del Mazo, a painter, whose large family is that which is represented in the important picture in Vienna which was at one time called the "Family of Velazquez." This picture is now by common consent given to Mazo. In the gallery at Madrid there is a portrait of Juana, his wife, holding a drawing-tablet on her knee. There was formerly in the possession of Lord Dudley another portrait of his wife by Velazquez, painted, perhaps, in the first year of their happy marriage. Of this early Seville manner we have an excellent example in "El Aguador" (the Water-Carrier) at Apsley House (London). Firm almost to hardness, it displays close study of nature. One can see in it the youthful struggle to portray the effects of light stealing here and there over the prominent features of the face, groping after the effects which the painter was to master later on. The brushwork is bold and broad, and the outlines firmly marked. As is usual with Velazquez at this time, the harmony of colours is red, brown and yellow, reminding one of Ribera. For sacred subjects we may turn to the "Adoration of the Magi" at Madrid, dated 1619, and the "Christ and the Pilgrims of Emmaus" in the collection of Don Manuel de Soto in Zurich, in both of which we have excellent examples of his realism. In the "St John in the Desert" we again find his peasant boy transformed into the saint.

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[1] See Cunningham's *Life*, vol. ii.

[2] Of the 274 works attributed to Velazquez by Mr Curtis, 121 are in the United Kingdom, while France has but 13, Austria-Hungary 12, Russia 7, and Germany about the same number. Beruete, who only allows 90 known pictures to be genuine works of Velazquez, allots 14 to the United Kingdom, which number still considerably exceeds that of any other country save Spain.

But Velazquez was now eager to see more of the world. Madrid, with its fine Titians, held out strong inducements. Accordingly, in 1622, fortified with letters of introduction to Fonseca, who held a good position at court, he spent some months there, accompanied only by his servant. Here he painted the portrait of the poet Gongora, a commission from Pacheco, but the picture known by that name in the gallery at Madrid cannot with certainty be identified as Velazquez's portrait; it is more probably by Zurbaran. The impression which Velazquez made in the capital must have been very strong, for in the following year he was summoned to return by Olivares, the all-powerful minister of Philip IV., fifty ducats being allowed to defray his expenses. On this occasion he was accompanied by his father-in-law. Next year (1624) he received from the king three hundred ducats to pay the cost of the removal of his family to Madrid, which became his home for the remainder of his life. Weak and worthless as a king, Philip had inherited the art-loving propensities of his race, and was proud to be considered a poet and a painter. It is one of the best features of his character that he remained for a period of thirty-six years the faithful and attached friend of Velazquez, whose merit he soon recognized, declaring that no other painter should ever paint his portrait. By his equestrian portrait of the king, painted in 1623, Velazquez secured admission to the royal service with a salary of twenty ducats per month, besides medical attendance, lodgings and payment for the pictures he might paint. The portrait was exhibited on the steps of San Felipe, and was received with enthusiasm, being vaunted by poets, among them Pacheco. It has unfortunately disappeared, having probably perished in one of the numerous fires which occurred in the royal palaces. The Prado, however, has two portraits of the king (Nos. 1070 and 1071) in which the harshness of the Seville period has disappeared and the tones are more delicate. The modelling is firm, recalling that of Antonio Mor, the Dutch portrait painter of Philip II., who exercised a considerable influence on the Spanish school. In the same year the prince of Wales (afterwards Charles I.) arrived at the court of Spain. We are told that he sat to Velazquez, but the picture has disappeared.[1]

In 1628 Rubens visited Madrid on a diplomatic mission for nine months, and Velazquez was appointed by the king to be his guide among the art treasures of Spain. Rubens was then at the height of his fame, and had undertaken as a commission from Olivares the large pictures which now adorn the great hall in Grosvenor House (London). These months might have been a new turning-point in the career of a weaker man than Velazquez, for Rubens added to his brilliant style as a painter the manner of a fascinating courtier. Rubens had a high opinion of the talent of Velazquez, as is attested by Fuensalida, but he effected no change in the style of the strong Spaniard. He impressed him, however, with the desire to see Italy and the works of her mighty painters. In 1627 the king had given for competition among the painters of Spain the subject of the Expulsion of the Moors. Velazquez bore off the palm; but his picture was destroyed in a fire at the palace in 1734. Palomino, however, describes it. Philip III. points with his baton to a crowd of men and women driven off under charge of soldiers, while Spain, a majestic female, sits looking calmly on. The triumph of Velazquez was rewarded by his being appointed gentleman usher. To this was shortly afterwards added a daily allowance of twelve reals, the same amount as was allowed to the court barbers, and ninety ducats a year for dress, which was also paid to the dwarfs, buffoons and players about the king's person—truly a curious estimate of talent at the court of Spain. As an extra payment he received (though it was not paid for five years) one hundred ducats for the picture of Bacchus, painted in 1629 (No. 1058 of the Madrid gallery). The spirit and aim of this work are better understood from its Spanish name, "Los Borrachos" or "Los Bebedores" (the Topers), who are paying mock homage to a half-naked ivy-crowned young man seated on a wine barrel. It is like a story by Cervantes, and is brimful of jovial humour. One can easily see in this picture of national manners how Velazquez had reaped the benefit of his close study of peasant life. The painting is firm and solid, and the light and shade are more deftly handled than in former works. Altogether, this production may be taken as the most advanced example of the first style of Velazquez. It is usual to divide his artistic career by his two visits to Italy, his second style following the first visit and his third the second. Roughly speaking, this somewhat arbitrary division may be accepted, though it will not always apply, for, as is usual in the case of many great painters, his styles at times overlap each other. Velazquez rarely signed his pictures, and the royal archives give the dates of only his more important works. Internal evidence and history, as regards his portraits, supply to a certain extent the rest.

In 1629 Philip gave Velazquez permission to carry out his desire of visiting Italy, without loss of salary, making him besides a present of four hundred ducats, to which Olivares added two hundred. He sailed from Barcelona in August in the company of the marquis de Spinola, the conqueror of Breda, then on his way to take command of the Spanish troops at Milan. It was during this voyage that Velazquez must have heard the details of the surrender of Breda from the lips of the victor, and he must have sketched his fine head, known to us also by the portrait by Van Dyck. But the great picture was not painted till many years later, for Spinola had fallen into disfavour at court. In Venice Velazquez made copies of the "Crucifixion" and the "Last Supper" of Tintoretto, which he sent to the king, and in Rome he copied Michelangelo and Raphael, lodging in the Villa Medici till fever compelled him to remove into the city. Here he painted the "Forge of Vulcan" (No. 1059 of the Madrid gallery), in which Apollo narrates to the astonished Vulcan, a village blacksmith, the news of the infidelity of Venus, while four Cyclops listen to the scandal. The mythological treatment is similar to that of the "Bacchus": it is realistic and Spanish to the last degree, giving a picture of the interior of an Andalusian smithy, with Apollo thrown in to make the story tell. The conception is commonplace, yet the impression it produces is undoubted from the vividness of the representation and the power of expression. The modelling of the half-naked figures is excellent. Altogether this picture is much superior to the other work painted at the same time, "Joseph's Coat," which now hangs in the Escorial. Both these works are evidently painted from the same models.

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[1] In 1847 Mr John Snare of Reading exhibited a picture which had come from the sale of Lord Fife in 1809, and which he maintained to be the long-lost work. This led to much controversy; but the claim was rejected by experts, and the picture is said to be now in America.

In looking at these two pictures the spectator is especially struck by the fact that they betray no trace of the influence of the Italians. Velazquez remained true to himself. At Rome he also painted the two beautiful landscapes of the gardens of the Villa Medici, now in the Madrid museum (1106 and 1107), full of sparkle and charm. Landscape as an expression of art never had attraction for the Spaniards; but Velazquez here shows how great a master he was in this branch. The silvery views of Aranjuez, which at one time passed under his name, are now considered to be the work of his pupil Mazo. After a visit to Naples in 1631, where he worked with his countryman Ribera, and painted a charming portrait of the Infanta Maria, sister of Philip, Velazquez returned early in the year to Madrid.

He then painted the first of many portraits of the young prince, Don Baltasar Carlos, the heir to the throne, dignified and lordly even in his childhood, caracoling in the dress of a field-marshal on his prancing steed. The Wallace collection includes an example which is probably a copy by Mazo; but the finest in the United Kingdom is the well-known picture at Grosvenor House, a masterly example of the second manner of Velazquez. The colour is warm and bright, the workmanship solid and fused like enamel, while light and air pervade every corner. The scene is in the riding-school of the palace, the king and queen looking on from a balcony, while Olivares is in attendance as master of the horse to the prince. Don Baltasar died in 1646 at the age of seventeen, so that judged by his age this picture must have been painted about 1641, two years before the fall of Olivares. This powerful minister was the early and constant patron of the painter. His impassive, saturnine face is familiar to us from the many portraits painted by Velazquez, a face which, like his royal master's, seems never to have known a smile, and in which are written pride and disdain. Two are of surpassing excellence—the full-length formerly in the Holford collection (exhibited at Burlington House in 1887), stately and dignified, in which he wears the green cross of Alcantara and holds a wand, the badge of his office as master of the horse; the other the great equestrian portrait of the Madrid gallery (No. 1069), in which he is flatteringly represented as a field-marshal in all his pomp during an action. It is difficult to overpraise the excellence of this work, either as regards its dramatic power or its masterly execution. In these portraits Velazquez has well repaid the debt of gratitude which he owed to his first patron, whom he stood by in his fall, thus exposing himself to the risk—and it was not a light one—of incurring the anger of the jealous Philip. The king, however, showed no sign of malice towards his favoured painter. Faithful in few things, Philip kept true to Velazquez, whom he visited daily in his studio in the palace, and to whom he stood in many attitudes and costumes, as a huntsman with his dogs, as a warrior in command of his troops, and even on his knees at prayer, wearing ever the same dull uninterested look. His pale face and lack-lustre eye, his fair flowing hair and moustaches curled up to his eyes, and his heavy projecting Austrian under-lip are known in many a portrait and nowhere more supremely than in the wonderful canvas of the London National Gallery (No. 745), where he seems to live and breathe. Few portraits in the whole range of art will compare with this work, in which the consummate handling of Velazquez is seen at its best, for it is in his late and most perfect manner.[1] From one of the equestrian portraits of the king, painted in 1638, the sculptor Montañes modelled a statue which was cast in bronze by the Florentine sculptor Tacca, and which now stands in the Plaza del Oriente at Madrid, "a solid Velazquez," as it has been well named by Ford. This portrait exists no more; but there is no lack of others, for Velazquez was in constant and close attendance on Philip, accompanying him in his journeys to Aragon in 1642 and 1644, and was doubtless present with him when he entered Lerida as a conqueror. It was then that he painted the great equestrian portrait (No. 1066 of the Madrid gallery) in which the king is represented as a great commander leading his troops—a rôle which Philip never played except in a theatrical pageant. All is full of animation except the stolid face of the king. It hangs as a pendant to the great Olivares portrait—fit rivals of the neighbouring Charles V. by Titian, which doubtless fired Velazquez to excel himself, and both remarkable for their silvery tone and their feeling of open air and harmony combined with brilliancy. The light plays on the armour and scarf thrown to the wind, showing how completely Velazquez had mastered the effects he strove to reach in his early days. Of these two great works the Wallace collection includes small but excellent copies.

But, besides the forty portraits of Philip by Velazquez, or attributed to him, we have portraits of other members of the royal family, of Philip's first wife, Isabella of Bourbon, and her children, especially of her eldest son, Don Baltasar Carlos, of whom, besides those already mentioned, there is a beautiful full-length in a private room at Buckingham Palace. Cavaliers, soldiers, churchmen and poets of the court, as for example the Quevedo at Apsley House (shown in Burlington House in 1887), sat to the painter and, even if forgotten by history, will live on his canvas. The Admiral Pulido Pareja from Lord Radnor's collection, now at the National Gallery, is said to have been taken by Philip for the living man; nevertheless, A. de Beruete is emphatic in denying Velazquez's authorship of this picture, which he attributes to Mazo. It has been remarked that the Spaniards have always been chary of committing to canvas the portraits of their beautiful women. Queens and infantas may be painted and exhibited, but ladies rarely. One wonders who the beautiful woman can be that adorns the Wallace collection, the splendid brunette so unlike the usual fair-haired female sitters to Velazquez. She belongs to this period of his work, to the ripeness of his middle period. Instinct with life, her bosom seems to heave and the blood to pulsate through her veins. The touch is firm but free, showing the easy strength of the great master. Rarely has flesh been painted with such a glow, yet with such reserve. This picture is one of the ornaments of the Wallace collection. But, if we have few ladies of the court of Philip, we have in great plenty his buffoons and dwarfs. Even these deformed or half-witted creatures attract our sympathy as we look at their portraits by Velazquez, who, true to his nature, treats them gently and kindly, as in "El Primo" (the Favourite), whose intelligent face and huge folio with ink-bottle and pen by his side show him to be a wiser and better-educated man than many of the gallants of the court. "El Bobo de Coria," "El Niño de Vallecas" and "Pablillos," a buffoon evidently acting a part, all belong to this middle period. From these commissioned portraits of the menials of the court it is pleasant to turn to one of the greatest of historical works, the "Surrender of Breda," often known as "Las Lanzas," from the serried rank of lances breaking the sky, which is believed to have been painted about 1647. It represents the moment when the vanquished Justin of Nassau in front of his Dutch troops is submissively bending as he offers to his conqueror Spinola the keys of the town, which, with courteous grace, the victor refuses to accept, as he lays his hand gently on the shoulder of his defeated foe. Behind Spinola stand the Spanish troops bearing their lances aloft, while beyond is a long stretch of the Low Country, dotted with fortifications and giving the impression of vast space and distance. The picture is full of light and air, and is perhaps the finest example of the silvery bluish style of Velazquez. In conception it is as fine as in execution, and one looks in vain for a trace of "the malicious pencil" which Sir William Stirling-Maxwell discerned in the treatment of Justin and his gallant Dutchmen.

The greatest of the religious paintings by Velazquez belongs also to this middle period, the "Christ on the Cross" (Madrid gallery, No. 1055). Palomino says it was painted in 1638 for the convent of San Placido. It is a work of tremendous power and of great originality, the moment chosen being that immediately after death. The Saviour's head hangs on his breast and a mass of dark tangled hair conceals part of the face. The beautiful form is projected against a black and hopeless sky from which light has been blotted out. The figure stands absolutely alone, without any accessory. The skull and serpent described by Sir William Stirling-Maxwell were added by some pious bungler at a much later date. The picture was lengthened to suit its place in an oratory; but this addition has since been removed. To the same period belongs the great "Boar Hunt" at the National Gallery, a magnificent work in spite of some restorations. The smaller "Boar Hunt" in the Wallace collection is from the brush of Mazo; and the "Conversation, a Group of Thirteen Persons," at the Louvre, a picture which in conception has much in common with these hunting scenes, probably owes its origin to the same artist. A. de Beruete emphatically denies Velazquez's authorship of this much belauded picture, which he describes as a "mediocre imitation, probably by Mazo."

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[1] In this and in all his portraits Philip wears the *golilla*, a stiff linen collar projecting at right angles from the neck. It was invented by the king, who was so proud of it that he celebrated it by a festival, followed by a procession to church to thank God for the blessing (Madame D'Aulnoy, *Voyage d'Espagne*). The *golilla* was thus the height of fashion and appears in most of the male portraits of the period. In regard to the wonderful structure of Philip's moustaches, it is said that, to preserve their form, they were encased during the night in perfumed leather covers called *bigoteras*.

Velazquez's son-in-law Mazo had succeeded him as usher in 1634, and he himself had received steady promotion in the royal household, receiving a pension of 500 ducats in 1640, increased to 700 in 1648, for portraits painted and to be painted, and being appointed inspector of works in the palace in 1647. Philip now entrusted him with the carrying out of a design on which he had long set his heart, the founding of an academy of art in Spain. Rich in pictures, Spain was weak in statuary, and Velazquez was commissioned to proceed to Italy to make purchases. Accompanied by his faithful slave Pareja, whom he taught to be a good painter, he sailed from Malaga in 1649, landing at Genoa, and proceeding thence by Milan to Venice, buying Titians, Tintorettos and Veroneses as he went. A curious conversation which he is said to have had with Salvator Rosa is reported by Boschini,[1] in which the Spaniard with perfect frankness confesses his want of appreciation of Raphael and his admiration of Titian, "first of all Italian men." It seems a possible story, for Velazquez bought according to his likings and painted in the spirit of his own ideals. At Modena he was received with much favour by the duke, and doubtless here he painted the portrait of the duke at the Modena gallery and two splendid portraits which now adorn the Dresden gallery, for these pictures came from the Modena sale of 1746. They presage the advent of the painter's third and latest manner, a noble example of which is the great portrait of Innocent X. in the Doria palace at Rome, to which city Velazquez now proceeded. There he was received with marked favour by the pope, who presented him with a medal and gold chain. Of this portrait, thought by Sir Joshua Reynolds to be the finest picture in Rome, Palomino says that Velazquez took a copy to Spain. There exist several in different galleries, some of them possibly studies for the original or replicas painted for Philip. One of the most remarkable is that in Apsley House, exhibited in Burlington House in 1887. The modelling of the stern impassive face comes near to perfection, so delicate are the gradations in the full light; all sharpness of outline has disappeared; and the features seem moulded by the broad and masterly brushwork. When closely examined, the work seems coarse, yet at the proper distance it gives the very essence of living flesh. The handling is rapid but unerring. Velazquez had now reached the *manera abreviada*, as the Spaniards call this bolder style. This is but another way of saying that his early and laborious studies and his close observation of nature had given to him in due time, as to all great painters, the power of representing what he saw by simpler means and with more absolute truth. At Rome he painted also a portrait of his servant Pareja, probably the picture of Lord Radnor's collection, which procured his election into the academy of St Luke. Philip was now wearying for his return; accordingly, after a visit to Naples, where he saw his old friend Ribera, he returned to Spain by Barcelona in 1651, taking with him many pictures and 300 pieces of statuary, which he afterwards arranged and catalogued for the king. Undraped sculpture was, however, abhorrent to the Spanish Church, and after Philip's death these works gradually disappeared.

Isabella of Bourbon had died in 1644, and the king had married Mariana of Austria, whom Velazquez now painted in many attitudes. He was specially chosen by the king to fill the high office of "aposentador major," which imposed on him the duty of looking after the quarters occupied by the court whether at home or in their journeys—a responsible function, which was no sinecure and interfered with the exercise of his art. Yet far from indicating any decline, his works of this period are amongst the highest examples of his style. The dwarf "Don Antonio el Inglés" (the Englishman) with his dog, "Aesop," "Menippus" and "the Sculptor Montañes," all in the Madrid gallery, show his surest and freest manner. To these may be added the charming portraits of the royal children in the Louvre and Vienna, among the choicest of his works. It is one of these infantas, Margarita Maria, the eldest daughter of the new queen, that is the subject of the well-known picture "Las Meniñas" (the Maids of Honour), 1062, in the Madrid gallery, painted in 1656, where the little lady holds court, surrounded by her ladies-in-waiting, her dwarfs and her mastiff, while Velazquez is seen standing at his easel. This is the finest portrait we have of the great painter. It is a face of much dignity, power and sweetness—like his life, equable and serene, unruffled by care. "Las Meniñas" was the picture of which Luca Giordano said that it was the "theology of painting," another way of expressing the opinion of Sir Thomas Lawrence, that this work is the philosophy of art, so true is it in rendering the desired effect. The result is there, one knows not by what means, as if by a first intention without labour, absolutely right. The story is told that the king painted the red cross of Santiago on the breast of the painter, as it appears to-day on the canvas. Velazquez did not, however, receive the honour till 1659, three years after the execution of this work. Even the powerful king of Spain could not make his favourite a belted knight without a commission to inquire into the purity of his lineage on both sides of the house. The records of this commission have been found among the archives of the order of Santiago by M. Villaamil. Fortunately the pedigree could bear scrutiny, as for generations the family was found free from all taint of heresy, from all trace of Jewish or Moorish blood and from contamination by trade or commerce. The difficulty connected with the fact that he was a painter was got over by his being painter to the king and by the declaration that he did not sell his pictures. But for this royal appointment, which enabled him to escape the censorship of the Inquisition, we should never have had his splendid "Venus and Cupid," formerly belonging to Mr Morritt of Rokeby Hall and bought by the National Art Collections Fund for £45,000 for the National Gallery in 1905. It is painted in his latest manner and is worthy of comparison with Titian.[2] There were in truth but two patrons of art in Spain—the church and the art-loving king and court. Murillo was the artist favoured by the church, while Velazquez was patronized by the crown. One difference, however, deserves to be noted. Murillo, who toiled for a rich and powerful church, left scarcely sufficient means to pay for his burial, while Velazquez lived and died in the enjoyment of good salaries and pensions. Yet on occasions Philip gave commissions for religious pictures to Velazquez—among others, and belonging to this later period, the "Coronation of the Virgin" (Madrid, 1056), splendid in colour—a harmony of red, blue and grey—but deficient in religious feeling and dignity. It was painted for the oratory of the queen, doubtless Mariana, in the palace at Madrid. Another royal commission for the hermitage of Buen Retiro was the "St Anthony the Abbot and St Paul the Hermit," painted in 1659, the landscape of which excited the warm admiration of Sir David Wilkie (No. 1057 in the Prado). The last of his works which we shall name is "Las Hilanderas" or the Spinners (Madrid, 1061), painted about 1656, representing the interior of the royal tapestry works. The subject is nothing, the treatment everything. It is full of light, air and movement, splendid in colour and marvellous in handling. This picture, Raphael Mengs said, seemed to have been painted not by the hand but by the pure force of will. We see in it the full ripeness of the power of Velazquez, a concentration of all the art-knowledge he had gathered during his long artistic career of more than forty years. In no picture is he greater as a colourist. The scheme is simple—a harmony of red, bluish-green, grey and black, which are varied and blended with consummate skill.

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[1] See Stirling-Maxwell's *Velazquez and his Works*, p. 161.

[2] Some uncertainties in the proprietorial history of this picture have led to considerable discussion concerning its authenticity. But the suggestion that Mazo's signature could be detected on it was repudiated by an expert committee in 1910 who carefully examined the painting.

In 1660 a treaty of peace between France and Spain was to be consummated by the marriage of the infanta Maria Theresa with Louis XIV., and the ceremony was to take place in the Island of Pheasants, a small swampy island in the Bidassoa. Velazquez was charged with the decoration of the Spanish pavilion and with the whole scenic display. In the midst of the grandees of the first two courts in Christendom Velazquez attracted much attention by the nobility of his bearing and the splendour of his costume. On the 26th of June he returned to Madrid, and on the 31st of July he was stricken with fever. Feeling his end approaching, he signed his will, appointing as his sole executors his wife and his firm friend Fuensalida, keeper of the royal records. He died on the 6th of August 1660, passing away in the full possession of his great powers, and leaving no work behind him to show a trace of decay. He was buried in the Fuensalida vault of the church of San Juan, and within eight days his wife Juana was laid beside him. Unfortunately this church was destroyed by the French in 1811, so that his place of interment is now unknown. There was much difficulty in adjusting the tangled accounts outstanding between Velazquez and the treasury, and it was not till 1666, after the death of Philip, that they were finally settled.

Velazquez can hardly be said to have formed a school of painting. Apart from the circumstance that his occupations at court would have prevented this, his genius was too personal for transmission by teaching. Yet his influence on those immediately connected with him was considerable. In 1642 he befriended young Murillo on his arrival in Madrid, received him into his house, and directed his studies for three years. His son-in-law Mazo painted in his manner, and doubtless many pictures by Mazo are attributed to the master. Carreño, though never a pupil, was a favourite and had the good sense to appreciate him and imitate him. His faithful slave Pareja studied his methods and produced work which by the favour of Velazquez procured his manumission from Philip. But the appreciation of the fine talent of Velazquez passed away quickly in Spain, as that country began to fall to pieces.

In addition to the standard works by Palomino (1724), Cean Bermudez (1800) and Pacheco (1649), see the biographical notice by Don Pedro de Madrazo in his *Catalogo del Museo del Prado* (1872); *Velazquez and his Works* (1855) and *Annals of Artists of Spain* (1848), by W. Stirling (afterwards Sir W. Stirling-Maxwell); Ford's *Handbook to Spain* (1855) and his article in the *English Cyclopaedia*; *Velazquez and Murillo*, by Charles B. Curtis (1883); the works of W. Burger (T. Thoré); *Gesch. d. Malerei*, by Woltmann and Woermann; Sir Edmund Head's *Handbook of Spanish Painting* (1848); *Works of Velazquez* (prints), by G. W. Reid (1872); *Gaz. d. Beaux Arts*, art. "Velazquez," by Paul Lefort (second period, 1879–82); Carl Justi, *Diego Velazquez u. sein Jahrhundert* (2 vols., Bonn, 1888); *The Life of Velazquez*, by Sir Walter Armstrong (London, 1896); *Velazquez*, by R. A. M. Stevenson (London, 1899); *Velazquez outside the Prado Museum*, by Don Manuel Mesonero Romanos (Madrid, 1899); *The Life and Works of Don Diego Velazquez*, by Don Jacinto Octavio Picon (Madrid, 1899); *Days with Velazquez*, by C. Lewis Hind (London, 1906); and, finally, Don A. de Beruete's standard work on the subject, *Velazquez* (London, 1906), which contains reproductions of all the master's paintings of which the author admits the authenticity. (J. F. W.; P. G. K.)

VELEIA, an ancient town of Aemilia, Italy, situated about 20 m. S. of Placentia. It is mentioned by Pliny among the towns of the eighth region, though the Veleiates were Ligurians by race. Its inhabitants were in the census of Vespasian found to be remarkable for their longevity. Nothing further was known of it until 1747, when some ploughmen found the famous *Tabula alimentaria*, now in the museum at Parma. This, the largest inscribed bronze tablet of antiquity (4 ft. 6 in. by 9 ft. 6 in.) contains the list of estates in the territories of Veleia, Libarna, Placentia, Parma and Luca, in which Trajan had assigned before 102 B.C. 72,000 sesterces (£720) and then 1,044,000 sesterces (£10,440), on a mortgage bond to forty-six estates, the total value of which was reckoned at over 13,000,000 sesterces (£130,000), the interest on which at 5% was to serve for the support of 266 boys and 36 girls, the former receiving 16, the latter 12 sesterces a month. See *Ligures Baebiani* for a similar inscription. Excavations were begun on the site in 1760, and were at first successful; the forum and basilica, the thermae and the amphitheatre, private houses, &c., with many statues (twelve of marble from the basilica, and a fine bronze head of Hadrian) and inscriptions were discovered. Pre-Roman cremation tombs have also been found, with objects of bronze and iron of no great value. But later excavations which were carried on at intervals up to 1876 have given less fruitful results. The oldest dated monument is a bronze tablet with a portion of the text of the *Lex Rubria* of 49 B.C. which dealt with the administration of justice in Cisalpine Gaul in connexion with the extension to it of the privileges of the Roman franchise, the latest an inscription of A.D. 276. How and when it was abandoned is uncertain: the previously prevalent view that it was destroyed by a landslip was proved to be mistaken by the excavations of 1876. Most of the objects found are in the museum at Parma.

See G. Antolini, *Le Rovine di Veleia* (Milan, 1831); G. Mariotti in *Notizie degli Scavi* (1877), 157; E. Bormann in *Corpus Inscript. Latin* (Berlin, 1888), xi. 204 sqq. (T. As.)

VÉLEZ-MÁLAGA, a town of southern Spain, in the province of Málaga, finely situated in a fertile valley at the southern base of the lofty Sierra de Alhama, and on the left bank of the small river Vélez, 1 m. from its mouth and 27 m. by road E.N.E. of Málaga. Pop. (1900) 23,586. Vélez-Málaga formerly was a place of considerable commercial importance, but its prosperity has much declined; there is no railway, and the town suffered severely in the earthquakes of 1884 and the floods of 1907. The vegetation of the neighbourhood is most luxuriant, including the aloe, palm, sugar-cane, prickly pear, orange, vine, olive and sweet potato. Vélez-Málaga was held by the Moors from 711 to 1487, when it was captured by Ferdinand of Castile. Under Moorish rule the citadel was built and the town became an important trading station and fortress. Its harbour, the Vélez estuary, affords good anchorage and is well sheltered.

VELIA (Gr. Ὑέλη, later Ἐλέα), an ancient town of Lucania, Italy, on the hill now crowned by the medieval castle of Castellammare della Bruca, 440 ft. above sea-level, on the S.W. coast, 1¾ m. N.W. of the modern railway station of Ascéa, 25 m. S.E. of Paestum. Remains of the city walls, with traces of one gate and several towers, of a total length of over 3 m., still exist, and belong to three different periods, in all of which the crystalline limestone of the locality is used. Bricks were also employed in later times; their form is peculiar to this place, each having two rectangular channels on one side, and being about 15 in. square, with a thickness of nearly 4 in. They all bear Greek brick-stamps. There are some remains of cisterns on the site, and various other traces of buildings. The town was mainly celebrated for the philosophers who bore its name (see ELEATIC SCHOOL). About 530 B.C. the Phocaeans, driven from Corsica, seized it from the Oenotrians. Its coins were widely diffused in S. Italy, and it kept its independence even in Roman times, and only became a *municipium* after the Social War.

See W. Schlenning in *Jahrbuch des K. Deutschen Arch. Instituts* (1889), iv. 169 sqq. (T. As.)

VELIUS LONGUS (2nd cent. A.D.), Latin grammarian during the reign of Trajan (or Hadrian), author of an extant treatise on Orthography (H. Keil, *Grammatici Latini*, vii.). He is mentioned by Macrobius (*Saturnalia*, iii. 6, 6) and Servius (on *Aen.* x. 245) as a commentator on Virgil.

See M. Schanz, *Geschichte der römischen Litteratur*, iv. 1 (1904); Teuffel, *Hist. of Roman Literature* (Eng. trans., 1900), 343, 2.

VELLEIUS PATERCULUS, MARCUS (*c.* 19 B.C.–*c.* A.D. 31), Roman historian. Although his praenomen is given as Marcus by Priscian, some modern scholars identify him with Gaius Velleius Paterculus, whose name occurs in an inscription on a north African milestone (*C.I.L.* viii. 10, 311). He belonged to a distinguished Campanian family, and early entered the army. He served as military tribune in Thrace, Macedonia, Greece and the East, and in A.D. 2 was present at the interview on the Euphrates between Gaius Caesar, grandson of Augustus, and the Parthian king. Afterwards, as praefect of cavalry and legatus, he served for eight years (from A.D. 4) in Germany and Pannonia under Tiberius. For his services he was rewarded with the quaestorship in 7, and, together with his brother, with the praetorship in 15. He was still alive in 30, for history contains many references to the consulship of M. Vinicius in that year. It has been conjectured that he was put to death in 31 as a friend of Sejanus, whose praises he celebrates in a most fulsome manner.

He wrote a compendium of Roman history in two books dedicated to M. Vinicius, from the dispersion of the Greeks after the siege of Troy down to the death of Livia (A.D. 29). The first book brings the history down to the destruction of Carthage, 146 B.C.; portions of it are wanting, including the beginning. The later history, especially the period from the death of Caesar, 44 B.C., to the death of Augustus, A.D. 14, is treated in much greater detail. Brief notices are given of Greek and Roman literature, but it is strange that no mention is made of Plautus, Horace and Propertius. The author is a vain and shallow courtier, and destitute of real historical insight, although generally trustworthy in his statements of individual facts. He may be regarded as a courtly annalist rather than an historian. His knowledge is superficial, his blunders numerous, his chronology inconsistent. He labours at portrait-painting, but his portraits are daubs. On Caesar, Augustus and above all on his patron Tiberius, he lavishes praise or flattery. The repetitions, redundancies, and slovenliness of expression which disfigure the work may be partly due to the haste with which (as the author frequently reminds us) it was written. Some blemishes of style, particularly the clumsy and involved structure of his sentences, may perhaps be ascribed to insufficient literary training. The inflated rhetoric, the straining after effect by means of hyperbole, antithesis and epigram, mark the degenerate taste of the Silver Age, of which Paterculus is the earliest example. He purposed to write a fuller history of the later period, which should include the civil war between Caesar and Pompey and the wars of Tiberius; but there is no evidence that he carried out this intention. His chief authorities were Cato's *Origines*, the *Annales* of Q. Hortensius, Pompeius Trogus, Cornelius Nepos and Livy.

Velleius Paterculus was little known in antiquity. He seems to have been read by Lucan and imitated by Sulpicius Severus, but he is mentioned only by the scholiast on Lucan, and once by Priscian. The text of the work, preserved in a single badly written and mutilated MS. (discovered by Beatus Rhenanus in 1515 in the abbey of Murbach in Alsace and now lost), is very corrupt. Editio princeps, 1520; early editions by the great scholars Justus Lipsius, J. Gruter, N. Heinsius, P. Burmann; modern editions, Ruhnken and Frotscher (1830–39), J. C. Orelli (1835), F. Kritz (1840, ed. min. 1848), F. Haase (1858), C. Halm (1876), R. Ellis (1898) (reviewed by W. Warde Fowler in *Classical Review*, May 1899); on the sources see F. Burmeister, "De Fontibus Vellei Paterculi," in *Berliner Studien für classische Philologie* (1894), xv. English translation by J. S. Watson in Bohn's Classical Library.

VELLETRI (anc. *Velitrae*), a town and episcopal see of the province of Rome, Italy, at the south-east foot of the outer ring wall of the Alban crater, 26 m. S.E. of Rome by rail, 1155 ft. above sea-level. Pop. (1901) 14,243 (town), 18,734 (commune). It is the seat of the bishop of Ostia, and has a statue of Pope Clement VIII. Good wine is made in the fertile vineyards of the district, and there is a government experimental station for viticulture. Velletri is the junction of the Terracina line and a branch to Segni on the main line to Naples. Velletri has a fine view of the Volscian mountains and over the Pomptine Marshes to the Circeian promontory. The town contains a few objects of interest; at the highest point is the prominent municipal palace, containing a few ancient inscriptions, among them one relating to a restoration of the amphitheatre under Valentinian and Valens. The internal façade of the Palazzo Ginetti is finely decorated with stucco, and has a curious detached baroque staircase by Martino Lunghi the younger, which Burckhardt calls unique if only for the view to which its arched colonnades serve as a frame. The lofty campanile of S. Maria in Trivio, erected in 1353 in gratitude for the liberation of the city from a plague which devastated it in 1348, is in the style of contemporary brick campanili in Rome, but built mainly of black selce, with white marble columns at the windows. The cathedral (the see of the titular bishop of Ostia) was reconstructed in 1660, but contains traces of the older structure. Of the ancient town nothing practically remains above ground; scanty traces of the city walls have been excavated (and covered again) near the railway station, and the present walls are entirely medieval.

The ancient city of Velitrae was Volscian in Republican times, and it is the only Volscian town of which an inscription in that language is preserved (4th century B.C.). It mentions the two principal magistrates as *medix*. It was, however, a member of the Latin League in 499 B.C., so that in origin it may have been Latin and have fallen into Volscian hands later. It was important as commanding the approach to the valley between the Alban and Volscian mountains. In 494 it was taken from the Volscians and became a Roman colony. This was strengthened in 404, but in 393 Velitrae regained its freedom and was Rome's strongest opponent; it was only reduced in 338, when the freedom of Latium finally perished. Its resistance was punished by the destruction of its walls and the banishment of its town councillors to Etruria, while their lands were handed over to Roman colonists. We hear little or nothing of it subsequently except as the home of the *gens Octavia*, to which the Emperor Augustus belonged. The neighbourhood contains some remains of villas, but not proportionately very many; there are more on the side towards Lanuvium (W.). The Via Appia passed considerably below the town (some 5 m. away), which was reached by a branch road from it, diverging at the post station of Sublanuvio. During the whole of the middle ages it was subject to the papacy.

(T. As.)

VELLORE, a town of British India, in the North Arcot district of Madras, on the river Palar and the South Indian railway, 87 m. W. of Madras city. Pop. (1901) 43,537. It has a strongly built fortress, which was famous in the wars of the Carnatic. It dates traditionally from the 13th century, but more probably only from the 17th. It is a fine example of Indian military architecture, and contains a temple adorned with admirable sculptures. In 1780 it withstood a siege for two years by Hyder Ali. After the fall of Seringapatam (1799) Vellore was selected as the residence of the sons of Tippoo Sahib, and to their intrigues has been attributed the mutiny of the sepoys here in 1806. An American mission manages a high school, raised to the rank of a college in 1898; and the police training school for the presidency is also situated here. Vellore has a large grain trade, and flowers are cultivated in the vicinity.

VELVET, a silken textile fabric having a short dense piled surface. In all probability the art of velvet-weaving originated in the Far East; and it is not till about the beginning of the 14th century that we find any mention of the textile. The peculiar properties of velvet, the splendid yet softened depth of dye-colour it exhibited, at once marked it out as a fit material for ecclesiastical vestments, royal and state robes, and sumptuous hangings; and the most magnificent textures of medieval times were Italian velvets. These were in many ways most effectively treated for ornamentation, such as by varying the colour of the pile, by producing pile of different lengths (pile upon pile, or double pile), and by brocading with plain silk, with uncut pile or with a ground of gold tissue, &c. The earliest sources of European artistic velvets were Lucca, Genoa, Florence and Venice, and Genoa continues to send out rich velvet textures. Somewhat later the art was taken up by Flemish weavers, and in the 16th century Bruges attained a reputation for velvets not inferior to that of the great Italian cities.

VELVETEEN, a cotton cloth made in imitation of velvet. The term is sometimes applied to a mixture of silk and cotton. Some velveteens are a kind of fustian, having a rib of velvet pile alternating with a plain depression. The velveteen trade varies a good deal with the fashions that control the production of velvet. Velveteens are commonly woven in sheeting looms, and manufacturers are able to alternate the two kinds of goods according to the demand.

VENAFRUM, an ancient town of Campania, Italy, close to the boundaries of both Latium adjectum and Samnium. Its site is occupied by the modern Venafro, a village with 4716 inhabitants (1901), on the railway from Isernia to Caianello, 15 m. S.W. of the former, 658 ft. above sea-level. Ancient authors tell us but little about it, except that it was one of those towns governed by a prefect sent yearly from Rome, and that in the Social War it was taken by the allies by treachery. Augustus founded a colony there and provided for the construction of an aqueduct (cf. the long decree relating to it in *Corp. Inscr. Lat.* x. No. 4842). It seems to have been a place of some importance. Its olive oil was the best in Italy, and Cato mentions its brickworks and iron manufactures. The original line of the Via Latina probably ran through Venafrum, making a détour, which the later road seems to have avoided (cf. LATINA, VIA). Rufrae was probably dependent on it. Roads also ran from Venafrum to Aesernia and to Telesia by way of Allifae. Of ancient remains hardly anything is left—some traces of an amphitheatre and fragments of polygonal walls only. (T. As.)

VENDACE, the name of a British freshwater fish of the genus *Coregonus*, of which two other species are indigenous in the fresh waters of the British Islands, the gwyniad and the pollan. The vendace (*C. vandesius*) is restricted to some lochs in Dumfriesshire, Scotland; it is, however, very similar to a species (*C. albula*) which inhabits some of the large and deep lakes of northern Europe. From its general resemblance to a dace the French name of the latter, *vandoise*, was transferred to it at the period when French was the language of the court and aristocracy of Scotland. So great is the local celebrity of the fish that a story has been invented ascribing to Mary Queen of Scots the merit of having introduced it into the Lochmaben lochs. It is considered a great delicacy, and on favourable days when the shoals rise to the surface, near the edges of the loch, great numbers may be taken. It spawns in November. In length it scarcely exceeds 8 in.

VENDÉE, a maritime department of western France, formed in 1790 out of Bas-Poitou, and taking its name from an unimportant tributary of the Sèvre Niortaise. It is bounded by Loire-Inférieure and Maine-et-Loire on the N., by Deux-Sèvres on the E., by Charente-Inférieure on the S. and by the Atlantic Ocean on the W. for 93 m. Pop. (1906) 442,777. Area, 2708 sq. m. The islands of Yeu (area, 8½ sq. m.) and Noirmoutier (*q.v.*) are included. The Sèvre Nantaise on the N.E. and the Sèvre Niortaise on the S., besides other streams of minor importance, form natural boundaries. The department falls into three divisions—woodland (*Bocage*), plain (*Côte*) and marsh (*Marais*).

The highest point (748 ft.) is situated in the woodland, which occupies the greater part of Vendée, on the water-parting between the Loire and the rivers of the coast. This region, which, geologically, is composed of granite, gneiss, mica-schist, schist and lias, abounds in springs, and is fresh and verdant; the landscape is characterized by open fields surrounded by trees, which supplied ambushes and retreats to the Vendéans in the civil war at the end of the 18th century. The marshes, raised above the sea-level within historic times (four centuries ago), consist of two portions, the Breton marsh in the north and the Poitevin marsh in the south; the latter extends into the departments of Charente-Inférieure and Deux-Sèvres. The region includes productive salt marshes and fertile cultivated areas artificially drained. Its area is constantly being increased by the alluvium of the rivers and the secular elevation of the coast. The celebrated beds of sea-shells near St Michel en l'Herm—2300 ft. long, 985 ft. broad and from 30 to 50 ft. deep—show to what extent the coast has risen. The plain of Vendée lying between the Bocage and the Poitevin marsh is bare and treeless, but fertile, though poor in springs; geologically it is composed of lias and oolite. The department is drained by the Sèvre Nantaise (tributary of the Loire) and the Boulogne (a feeder of Lake Grandlieu in Loire-Inférieure), both draining into the basin of the Loire; and by the Vie, the Lay (with the Yon), and the Sèvre Niortaise (with the Autise and the Vendée), which flow into the Atlantic. The climate is that of the Girondine region, mild and damp, the temperature rarely rising above 77° or falling below 18° F.; 120 to 150 days of rain give an average annual rainfall of 25 in. The woodland is colder than the plain, and the marsh is damp and unhealthy.

The department is agriculturally prosperous. Wheat is the most important crop, oats, potatoes, clover, lucerne and mangold-wurzels ranking next. Beans, flax and colza may also be mentioned. Wine is grown in the south of the department. The rearing of live stock flourishes in the Bocage and the marsh, the pastures of the latter nourishing fine oxen and horses, and sheep famous for the excellence of their mutton. Cider-apples, pears, peaches, plums, cherries and walnuts are among the fruits grown. Coal is mined in the south-east of the department (basin of Vouvant) and antimony is found; limestone is quarried. The spinning and weaving of wool, cotton and flax is carried on, and there are potteries, paper-mills, tan-yards, dye-works, manufactories of hats, boots and shoes, glass and lampblack, flour-mills, distilleries, oil-works, tile-works and shipbuilding yards. Sardines and tinned foods are prepared. The sardine fishery is active on the coast and there are extensive oyster-beds near Sables-d'Olonne. Corn, cattle, mules, fish, salt, wine, honey, wood, glass and manure are exported; wine, wood, building material, coal, phosphates and petroleum are among the imports. Sables-d'Olonne is the principal fishing and commercial port.

Vendée is served by the Ouest-État railway and has 81 m. of navigable rivers and canals. The department forms the diocese of Luçon, has its court of appeal and educational centre at Poitiers, and is included in the district of the XI. Army Corps (headquarters at Nantes). There are three arrondissements (La Roche-sur-Yon, Fontenay-le-Comte and Sables-d'Olonne), 30 cantons, and 304 communes. The principal towns are La Roche-sur-Yon, Les Sables-d'Olonne, Fontenay-le-Comte and Luçon, which are treated under separate headings. Other places of interest are Foussais, Nieul-sur-l'Autise and Vouvant, with Romanesque churches; Pouzauges, which has a stronghold of the 13th century; Maillezais, with the ruins of its old cathedral; Talmont and Tiffauges, both possessing ruined castles; and Le Bernard with noteworthy megalithic remains.

VENDÉE, WARS OF THE, a counter-revolutionary insurrection which took place during the French Revolution (*q.v.*), not only in Vendée proper but also in Lower Poitou, Anjou, Lower Maine and Brittany. The district was mainly inhabited by peasants; it contained few important towns, and the *bourgeois* were but a feeble minority. The ideas of the Revolution were slow in penetrating to this ignorant peasant population, which had always been less civilized than the majority of Frenchmen, and in 1789 the events which roused enthusiasm throughout the rest of France left the Vendéans indifferent. Presently, too, signs of discontent appeared. The priests who had refused to submit to the Civil Constitution of the Clergy perambulated these retired districts, and stigmatized the revolutionists as heretics. In 1791 two "representatives on mission" informed the Convention of the disquieting condition of Vendée, and this news was quickly followed by the exposure of a royalist plot organized by the marquis de la Rouërie.

The signal for a widespread rising was the introduction of conscription acts for the recruiting of the depleted armies on the eastern frontiers. In February 1793 the Convention decreed a levy on the whole of France, and on the eve of the ballot the Vendée, rather than comply with this requisition, broke out in insurrection. The Vendéan peasant refused to join the republican army, not for want of fighting qualities or ardour, but because the army of the old régime was recruited from bad characters and broken men, and the peasant, ignorant of the great change that had followed the Revolution, thought that the barrack-room was no place for a good Christian. In March 1793 the officer commanding at Cholet was killed, and republicans were massacred at Machecoul and St Florent. Giving rein to their ancient antipathy, the revolted peasantry attacked the towns, which were liberal in ideas and republican in sympathies. The leaders of these first risings were men of humble birth, such as J. Cathelineau, a pedlar, J. N. Stofflet, a gamekeeper, and the barber Gaston. Cholet, Bressuire, Fontenay-le-Comte and Samur were surprised. The influence of the priests kept up the fanaticism of the peasants, and a great manifestation of religious feeling took place on Easter eve, but the republican soldiers taken prisoners were often maltreated and even tortured.

These first successes of the Vendéans coincided with grave republican reverses on the frontier—war with England, Holland and Spain, the defeat of Neerwinden and the defection of Dumouriez. The *émigrés* then began to throw in their lot with the Vendéans. Royalist nobles like the marquis de Bonchamp, F. A. Charette de la Contrie, Gigot d'Elbée, Henri de la Rochejaquelein and the marquis de Lescure placed themselves at the head of the peasants. Although several of these leaders were Voltairians, they held up Louis XVI., who had been executed in January 1793, as a martyr to Catholicism, and the Vendéans, who had hitherto styled themselves the Christian Army, now adopted the name of the Catholic and Royal Army.

The Convention took measures against the *émigrés* and the refractory priests. By a decree of the 19th of March 1793 every person accused of taking part in the counter-revolutionary revolts, or of wearing the white cockade (the royalist emblem), was declared an outlaw. The prisoners were to be tried by military commissions, and the sole penalty was death with confiscation of property. The Convention also sent representatives on mission into Vendée to effect the purging of the municipalities, the reorganization of the national guards in the republican towns, and the active prosecution of the revolutionary propaganda. These measures proving insufficient, a decree was promulgated on the 30th of April 1793 for the despatch of regular troops; but, in spite of their failure to capture Nantes (where Cathelineau was mortally wounded), the successes of the Vendéans continued. On the 31st of July, therefore, at Barère's suggestion, it was decreed that the woods of the Vendée should be burnt, the harvest carried off to safe places in rear of the army, the cattle seized, the women and children concentrated in camps in the interior, and that every male from the age of sixteen in the neighbouring regions should be called upon to take arms. Further, on the 1st of August, the troops that had formed the garrison of Mainz, which were unavailable against foreign enemies by the terms of their capitulation to the Austrians, were ordered to Vendée. The programme was carried out by the so-called "infernal columns."

At the end of August 1793, the republicans had three armies in the Vendée—the army of Rochelle, the army of Brest and the *Mayençais*; but their generals were either ciphers, like C. P. H. Ronsin, or divided among themselves, like J. A. Rossignol and J. B. C. Canclaux. They were uncertain whether to cut off the Vendéans from the sea or to drive them westwards; and moreover, their men were undisciplined. Although the peasants had to leave their chiefs and work on the land, the Vendéans still remained formidable opponents. They were equipped partly with arms supplied by England, and partly with fowling-pieces, which at that period were superior to the small-arms used by the regular troops, and their intimate knowledge of the country gave them an immense advantage. They gathered and burst like a storm on their enemies, and, if repulsed, dispersed at the famous order, "Egaillez-vous les gars," to unite again some days later.

The dissensions of the republican leaders and the demoralizing tactics of the Vendéans resulted in republican defeats at Chantonnay, Torfou, Coron, St Lambert, Montaigu and St Fulgent. The Convention resolved to bring the war to an end before October, and placed the troops under the undivided command, first of Jean Léchelle and then of Louis Turreau, who had as subordinates such men as Marceau, Kléber and Westermann. On the 7th of October the various divisions concentrated at Bressuire, took Châtillon after two bloody engagements, and defeated the Vendéans at Cholet, Beaupréau and La Tremblaye. After this repulse, the royalists, under Stofflet and La Rochejaquelein, attempted to rouse the Cotentin and crossed the Loire. Beaten back at Granville, they tried to re-enter the Vendée, but were repulsed at Angers. They re-formed at Le Mans, where they were defeated by Westermann, and the same officer definitively annihilated the main body of the insurgents at Savenay (December 1793).

Regular warfare was now at an end, although Turreau and his "infernal columns" still continued to scour the disaffected districts. After the 9th Thermidor attempts were made to pacify the country. The Convention issued conciliatory proclamations allowing the Vendéans liberty of worship and guaranteeing their property. General Hoche applied these measures with great success. He restored their cattle to the peasants who submitted, "let the priests have a few crowns," and on the 20th of July 1795 annihilated an *émigré* expedition which had been equipped in England and had seized Fort Penthièvre and Quiberon. Treaties were concluded at La Jaunaie (February 15, 1795) and at La Mabillaie, and were fairly well observed by the Vendéans; and nothing remained but to cope with the feeble and scattered remnant of the Vendéans still under arms, and with the Chouans (*q.v.*). On the 30th of July 1796 the state of siege was raised in the western departments.

During the Hundred Days there was a revival of the Vendéan war, the suppression of which occupied a large corps of Napoleon's army, and in a measure weakened him in the northern theatre of war (see WATERLOO CAMPAIGN).

In 1832 again an abortive insurrection broke out in support of the Bourbons, at the instigation of the duchess of Berry; the Vendéan hero on this occasion was the baron de Charette.

There are numerous articles on the Vendéan insurrection of 1793 in the *Revue du Bas-Poitou*, *Revue historique de l'Anjou*, *Revue de Bretagne, de Vendée et d'Anjou*, *Revue historique de l'Ouest*, *Revue historique et archéologique du Maine*, and *La Vendée historique*. See also R. Bittard des Portes, "Bibliographie historique et critique des guerres de Vendée et de la Chouannerie" in the *Revue du Bas-Poitou* (1903 seq.); C. L. Chassin, *Études sur la Vendée et la Chouannerie* (*La Préparation de la guerre—La Vendée patriote—Les Pacifications de l'Ouest*), Paris, 1892 seq., 11 vols. (the best general work on the subject); C. Port, *Les Origines de la Vendée* (Paris, 1888); C. Leroux-Cesbron, "Correspondance des représentants en mission à l'armée de l'ouest (1794–95)" in the *Nouvelle Revue rétrospective* (1898); Blachez, *Bonchamps et l'insurrection vendéenne* (Paris, 1902); P. Mautouchet, *Le Conventionnel Philippeaux* (Paris, 1901). On 1815 a modern work is *Les Cent Jours en Vendée; le général Lamarque*, by B. Lasserre (Paris, 1907); on 1832 see *La Vendée*, by Vicomte A. de Courson (1909). (R. A.*)

VENDÉMIAIRE (from Lat. *vindemia*, vintage), the name given during the French Revolution to the first month of the year in the Republican Calendar. Vendémiaire began on the 22nd, 23rd or 24th of September, and ended on the 22nd, 23rd or 24th of October according to the year, and was the season of the vintage in the wine districts of northern France. In accordance with the suggestion of Fabre d'Eglantine, each of the days of the republican year was consecrated to some useful object. For instance, 1 Vendémiaire was the festival of the grape, 10 Vendémiaire of the vat, 13 Vendémiaire of the pumpkin, 15 Vendémiaire of the ass, 20 Vendémiaire of the wine-press, and 30 Vendémiaire of the cask. The most important event in this month was the quelling of the royalist rising on 13 Vendémiaire year IV. (4th of October 1795), in which General Bonaparte (afterwards the emperor Napoleon) distinguished himself by his energy and skill in using artillery.

See Baron R. de Larcy, *Le 13 Vendémiaire* (Paris, 1872).

VENDETTA (Ital. from Lat. *vindicta*, revenge, *vindicare*, to defend oneself), the term applied to the custom of the family feud, by which the nearest kinsman of a murdered man was obliged to take up the quarrel and avenge his death. From being an obligation upon the nearest, it grew to be an obligation on all the relatives, involving families in bitter private wars among themselves. It is a development of that stage in civilization common to all primitive communities, when the injury done was held to be more than personal, a wrong done to the whole *gens*.

The term originated in Corsica, where the vendetta has long played an important part in the social life. If the murderer could not be found, his family were liable to fall victims to the vendetta. The feud was sometimes complicated by the *vendetta transversale*, when each of two branches of a family had a murder to revenge on the other. In Corsica it was regarded as the most sacred family duty. Mediators (*parolanti*) sometimes intervened successfully to end the feuds, and extort an oath to forgo vengeance. The custom still survives in Corsica in its complete form, and partially in Sardinia, Sicily, Montenegro, Afghanistan, among the Mainotes of Greece, the Albanians, Druses and Bedouins.

VENDÔME, LOUIS JOSEPH, Duc de (1654–1712), marshal of France, was the son of Louis, 2nd duke of Vendôme, and the great-grandson of Henry IV. and Gabrielle d'Estrées. Entering the army at the age of eighteen he soon distinguished himself by his vigour and personal courage in the Dutch wars, and by 1688 he had risen to the rank of lieutenant-general. In the war of the Grand Alliance he rendered conspicuous service under Luxemburg at Steinkirk and under Catinat at Marsaglia, and in 1695 he was placed in command of the army operating in Catalonia where he took Barcelona. Soon afterwards he received the marshalate. In 1702, after the first unsuccessful campaign of Catinat and Villeroi, he was placed in command of the Franco-Spanish army in Italy (see Spanish Succession War). During three campaigns in that country he proved himself a worthy antagonist to Prince Eugene, whom at last he defeated at Cassano by his magnificent courage and command over his troops, converting the defeat that his indolent brother, the Grand Prior, had incurred into a glorious success. Next year, after holding his own as before, he was sent to Flanders to repair the disaster of Ramillies with the result that his successors Marsin and Philip of Orleans were totally defeated, while in the new sphere Vendôme was merely the mentor of the pious and unenterprising duke of Burgundy, and was unable to prevent the defeat of Oudenarde. He therefore retired in disgust to his estates, but it was not long before he was summoned to take command of the army of Philip in Spain, and there he won his last victories, crowning his work with the battle of Villaviciosa. Before the end of the war he died suddenly at Vinaros on the 11th of June 1712. Vendôme was one of the most remarkable soldiers in the history of the French army, and second only to Villars amongst the generals of France of the 18th century. He had, besides the skill and the fertile imagination of the true army leader, the brilliant courage of a soldier. But the real secret of his uniform success was his extraordinary influence over his men.

VENDÔME, a town of north-central France, capital of an arrondissement in the department of Loir-et-Cher, 22 m. N.W. of Blois by rail. Pop. (1906) town, 7381; commune, 9804. Vendôme is situated on the Loir, which here divides into numerous arms intersecting the town. On the south it is overlooked by an eminence on which stand ruins of the castle of the counts of Vendôme, dating in part to the 11th century. The abbey-church of the Trinity (12th to 15th century) has a fine façade in the florid Gothic style. The belfry, surmounted by a stone steeple, stands isolated in front of the church; it belongs to the middle of the 12th century, and is one of the finest examples of Transition architecture. Abbey buildings of various periods lie round the church. The church of La Madeleine (15th century) is surmounted by a stone spire, an indifferent imitation of that of the abbey. The fine tower of St Martin (16th century) is all that remains of the church of that name. The town hall occupies the old gate of St George; its river front is composed of two large crenelated and machicolated towers, connected by a pavilion. The ancient hospital of St Jacques afterwards became a college of the Oratorians, and now serves as a lycée for boys; the charming chapel, dating from the 15th century, in the most florid Gothic style, is preserved. The town has a well-known archaeological and scientific society, and possesses a library with more than three hundred MSS., and a museum, mostly archaeological, in front of which stands a statue of the poet Ronsard. There is also a statue of Marshal Rochambeau, born at Vendôme in 1725. There are some interesting houses of the 15th and 16th centuries. Vendôme has a sub-prefecture and a tribunal of first instance. The river supplies motive power to flour-mills, and the town manufactures gloves, paper and carved mouldings, and carries on tanning and nursery-gardening together with trade in butter and cheese.

Vendôme (*Vindocinum*) appears originally to have been a Gallic oppidum, replaced later by a feudal castle, around which the modern town arose. Christianity was introduced by St Bienheuré in the 5th century, and the important abbey of the Trinity (which claimed to possess a tear shed by Christ at the tomb of Lazarus) was founded about 1030. When the reign of the Capetian dynasty began, Vendôme was the chief town of a countship belonging to Bouchard, called "the Venerable," who died in the monastery of Saint-Maur-des-Fossés in 1007. The succession passed by various marriages to the houses of Nevers, Preuilly and Montoire. Bouchard VII., count of Vendôme and Castres (d. *c.* 1374), left as his heiress his sister Catherine, the wife of John of Bourbon, count of la Marche. The countship of Vendôme was raised to the rank of a duchy and a peerage of France for Charles of Bourbon (1515); his son Anthony of Bourbon, king of Navarre, was the father of Henry IV., who gave the duchy of Vendôme in 1598 to his natural son Caesar (1594–1665). Caesar, duke of Vendôme, took part in the disturbances which went on in France under the government of Richelieu and of Mazarin, and had as his sons Louis, duke of Vendôme (1612–1669), who married a niece of Mazarin, and Francis, duke of Beaufort. The last of the family in the male line (1645–1712) was Louis XIV.'s famous general, Louis Joseph, duke of Vendôme (*q.v.*). The title of duke of Vendôme is now borne by Prince Emmanuel of Orleans, son of the duke of Alençon.

See J. de Pétigny, *Histoire archéologique du Vendômois* (2nd ed., 1882).

VENEER, a thin layer of wood, ivory, pearl or other material of high decorative value fixed to a poorer surface by glue or other adhesive to improve its appearance. Wood veneers are exceedingly common: only the best woods are used and the layer may be as thin as paper—a circumstance due to improvements in the machinery for cutting the logs. The surface to which the veneer is to be attached is prepared perfectly smooth, a film of glue applied, and then the veneer laid on. It is now ironed perfectly flat, all superfluous glue being pressed out, and then allowed to dry in a press. The surface is now ready for polishing.

VENER [*Wener* or *Väner*; often written, with the addition of the definite article, *Venern*], the largest lake in Sweden and the third largest in Europe. It has an area of 2149 sq. m.; a maximum length of 87 m.; an extreme breadth of 44 m.; a maximum depth of 292 ft.; and an altitude above sea-level of 144 ft., though the surface sometimes rises as much as 10 ft. or more, for the lake is the recipient of the waters of numerous streams, the largest being the Klar, which drains the forests of Vermland and Kopparberg to the north. It is drained by the Göta river southward to the Cattegat. It is divided into two basins by two peninsulas and a group of islands, the western half being known as Lake Dalbo. The northern shores are high, rocky and in part wooded, the southern open and low, though isolated hills occur, such as the Kinnekulle (988 ft.), an abrupt hill exhibiting a remarkable series of geological strata. Several islands fringe this shore; of these Leckö has a fine medieval castle. This lake and Lake Vetter contain degenerate species of marine fauna, left after the retreat of the sea in which both were formerly included.

By means of the Dalsland Canal from Köpmannabro, midway on the west shore of Dalbo, the lake, which is the scene of a busy traffic in timber, iron and agricultural produce, has communication with Fredrikshald in Norway; and it is traversed from Venersborg on the south to Sjötorp on the east by the Göta (*q.v.*) Canal route. The principal lake-ports are—on the north Karlstad (*q.v.*) and Kristinehamn, with iron-works and tobacco factory; on the east Mariestad, chief town of the district of Skaraborg, taking its name from the queen of Charles IX. (1599–1611); on the south Lidköping, near the Kinnekulle, and Venersborg at the outflow of the Göta, with its old bridge and canal of the 17th century, a museum, and iron foundries, tanneries and match and paper factories.

VENERABLE (Lat. *venerabilis*, worthy of reverence, *venerari*, to reverence, to worship, allied to *Venus*, love; the Indo-Germ. root is *wen-*, to desire, whence Eng. "win," properly to struggle for, hence to gain), worthy of honour, respect and reverence, especially a term applied to dignified or honourable age. It is specifically used as a title of address given to archdeacons in the Anglican Church. It was naturally a term of respectful address from early times; thus St Augustine (*Epist.* 76, 88, 139) cites it of bishops, and Philip I. of France was styled *venerabilis* and *venerandus* (see Du Cange, *Gloss.* s.v. *Venerabilitas*). In the Roman Church the granting of the title "venerable" is the first step in the long process of the canonization of saints (see CANONIZATION).

VENEREAL DISEASES (from "venery," *i.e.* the pursuit of Venus, the goddess of love), a general term for the diseases resulting from impure sexual intercourse. Three distinct affections are included under this term—gonorrhoea, local contagious ulcers, known as chancres, and syphilis. At one time these were regarded as different forms of the same disease. They are, however, three distinct diseases, due to separate causes, and have nothing in common except their habitat. The cause in each case is a definite specific virus, a micro-organism. In the case of gonorrhoea the virus attacks the mucous membranes, especially that of the urethra, the vagina and the uterus. Chancres attack the mucous membranes and the skin. In syphilis the whole system comes under the influence of the poison.

Though these three affections are generally acquired as the result of impure sexual intercourse, there are other methods of contagion, as, for example, when the accoucheur is poisoned whilst delivering a syphilitic woman, the surgeon when operating on a syphilitic patient, the wet-nurse who is suckling a syphilitic infant, and so on. An individual may be attacked by any one or any two of the three, or by all at the same time, as the result of one and the same connexion. But they do not show themselves at the same time. In other words, they have different stages of incubation. In gonorrhoea the disease appears very rapidly. So also in the case of the soft chancres, the first symptoms commencing as a rule three or four days after inoculation. It is different, however, with syphilis, the period of incubation being twenty-eight days, though it may be much longer. The length of the period of incubation, therefore, is of great diagnostic help in the case of syphilis.

For many years the term "venereal disease" was used very loosely, though the writers before the year 1786 had a tolerably clear idea that three distinct diseases were included under the term: the lues venerea, now called syphilis, gonorrhoea, and a condition leading to bubo and associated with a multiple chancre which is known at the present day as "soft sores." John Hunter, as the result of an unfortunate experiment, taught that there was but a single venereal poison which manifested itself in different ways. It took the French school many years of hard work to show that the poison of syphilis was distinct from that producing a soft sore, and that the virus of a soft sore was incapable, when pure, of causing gonorrhoea.

The evidence brought forward by Ricord, by Lancereaux and by Fournier was convincing. It has been confirmed by bacteriology, and it has happened by a remarkable coincidence that the truth of the French teaching about syphilis was first established on the firm basis of experiment in France itself, when Professor Metchnikoff at the Institut Pasteur in Paris gave in his adherence to Schaudinn's work, which showed that the *Spirochaeta pallida* germ was the cause of the disease.

A. *Gonorrhoea.*

Gonorrhoea is a specific inflammation of the mucous membrane of the urethra and other passages, by the reception into it of germs known as diplococci (διπλόος, double; κόκκος, berry—the germs being double, like the halves of a walnut). After the illustrious discoverer, the germ is often spoken of as the gonococcus of Neisser. Gonorrhoea is apt to be a very serious disease, and it sometimes ends fatally.

The germs find entrance during coitus and multiply at enormous rate, spreading to all the glands and crevices of the membrane, and setting free in their development a toxin which causes great irritation of the passage with inflammation and swelling. They remain quietly incubating for three or four days, or even longer; then acute inflammation comes on, with profuse discharge of thick yellow matter, with much scalding during micturition, and there may be so much local pain that it is difficult for the person to move about. Microscopic examination of the discharge shows abundant pus corpuscles and epithelial cells from the membrane, together with swarms of diplococci (gonococci).

The inflammatory process may extend backwards and give rise to acute prostatitis (see PROSTATE GLAND), with retention of urine; to the duct of the testes and give rise to acute epididymitis (swollen testicle); and to the bladder, causing acute cystitis. It may also cause local abscesses, or, by irritation, set up crops of warts.

The treatment of acute gonorrhoea is best carried out if the patient can lie up for a while. He must avoid all fermented drinks and rich foods, and sexual and other excitement, and he should drink freely of such things as barley-water, in order to dilute, and lessen the irritation of, the urine. Hot baths are comforting. Laxatives should be freely given. The urethra should be frequently washed out with a warm solution of permanganate of potash, a grain to the pint, and, later, a weak solution of one of the zinc or silver salts may be used as an injection.

Capsules of copaiba or oil of sandalwood, and a paste of cubebs pepper, have a beneficial influence, and, later, if the man is depressed, quinine and iron will be found useful.

In ten days or a fortnight the inflammation gradually subsides, a thin watery discharge remaining which is known as *gleet.* But inasmuch as this discharge contains gonococci it may, though scarce noticeable, set up acute specific inflammation in the opposite sex.

In the case of the female the inflammation is apt to extend to the uterus and along the Fallopian tubes, perhaps to give rise to an abscess in the tube (salpingitis) which, bursting, may cause fatal peritonitis.

A lingering gleet may be due to the presence of a definite ulceration in the urethra, as shown by examination with a slender tube illuminated by electricity—the endoscope. The ulcer having been induced to heal by the application of a nitrate of silver lotion, all discharges cease. Chronic inflammation is necessarily associated with the formation of interstitial fibrous tissue, and the contraction of this new formation causes narrowing of the urethra, or stricture. Thus gleet and stricture are often associated, and the occasional passage of a large bougie may suffice to cure both. Often, however, a stricture of the urethra proves rebellious in the extreme, and leads to diseases of the bladder and kidneys which may prove fatal.

One of the most important points in the management of a case of gonorrhoea is to prevent all risk of the septic discharge coming into contact with the eye. It sometimes happens that the patient inadvertently introduces the germs into his own eye by his finger, or that his eye, or the eye of some member of the household, becomes inoculated by the use of an infected towel. If this happen, prompt and energetic measures must be taken to save the eye.

If so be that at the time of delivery a woman be the subject of gonorrhoea, there is great probability of the eyes of the infant being affected. The symptoms appear on the third day after birth, and the disease may end in complete blindness. The name of the disease is *ophthalmia neonatorum* (see BLINDNESS).

By the term *gonorrhoeal rheumatism* it is implied that the gonococci have been carried by the blood stream to one or more joints in which an acute inflammation has been set up. It is apt to occur in the third week of the disease, and it may end in permanent stiffness of the joints or in abscess.

In rare cases the germs find their way to the pleura or pericardium, setting up an inflammation which may even end fatally.

For a man to marry whilst there is the slightest risk of his still being the subject of gonorrhoea would be to subject his wife to the probability of infection, ending with chronic inflammation of the womb or of septic peritonitis. Yet it is often extremely difficult to say when a man is *cured*. That there is no longer any discharge does not suffice to show that he has ceased to be infective. Nothing less than repeated examinations of the urethral mucus by the microscope, ending in a negative result, should be accepted as evidence of the cure being complete. And these examinations should be made after he has returned to his former ways of eating, drinking and working.

B. *Local Contagious Ulcers.*

Chancroid, *soft chancre* or *soft sore* is so named in contradistinction to the Hunterian sore of syphilitic infection, the one characteristic of which is its hardness. The soft chancre is a contagious ulcer of the genitals, due to the inoculation of a distinct form of micro-organism, the bacillus of Ducrey; and, provided that the specific germ of syphilis is not inoculated at the same time, the chancre is not followed by constitutional affection. In other words, the disease is purely local, and if some of the discharge of one of these ulcers is inoculated on another part of the body of the individual a sore of an exactly similar nature appears. This reproduction of the sore can be done over and over again on the same individual.

always with the same result. But in the case of the Hunterian sore, inoculation of the individual from the primary sore gives no result, because, as explained below, the constitutional disease has rendered the individual proof against further infection. The soft sore is often multiple. It makes its appearance about three days after the exposure, and as it increases in size free suppuration takes place. It is often of about the size of a silver threepence. Its base remains soft. In individuals broken down in health, the ulceration is apt to extend with great rapidity, and is then spoken of as *phagedaenic*.

Just as an individual may contract syphilis and gonorrhoea at the same connexion, so also he may be inoculated simultaneously with the bacilli of the soft chancre and the spirochaete of syphilis. In this case the soft chancres may make their appearance, as usual, within the first three or four days, but though passing through the customary stages they may refuse quite to heal, or, having healed, they may become indurated in the second month, constitutional symptoms following in due course.

The virulence of soft sores being due to the presence of harmful germs, the surface of the sores should be touched with pure carbolic acid, which has the effect of destroying the germs and converting the sores into healthy ulcers. Or the chancres may be treated by the application of lint soaked in weak carbolic lotion. If the sore happens to be under a tight prepuce, and the germs are of great activity—as is apt to happen in such a case—ulceration may extend with extreme rapidity. It is advisable, therefore, to remove or to lay open the prepuce, in order that the sores may be effectively dealt with.

Bubo.—The bacilli from the soft sore are apt to find their way into the lymphatic vessels, and so to reach the glands in the groin, when they set up destructive inflammation. Under the influence of rest the inflammation may subside, but if it continues and suppuration threatens, the gland had better be laid open and scraped out. If a speck of the contents of the abscess be inoculated on to the skin, a soft chancre is again produced.

C. *Syphilis.*

The cause of syphilis, whether inherited or acquired, is the presence in the blood and tissues of the same organism, which can be demonstrated in the various secondary lesions, in the blood and in the internal organs. The name of the germ is *Spirochaeta pallida*;[1] it is a protozoon of spiral form, from 4 to 20 μ in length and $\frac{1}{4}$ μ in diameter, with a flagellum at either extremity. It possesses motility of three kinds—a lashing, a corkscrew and a to-and-fro movement. It stains pale pink with Giemsa's fluid. At the time of writing (1910) it has not been found practicable to make an artificial cultivation of the spirochaete. But it may generally be found in primary and secondary syphilitic lesions by the aid of a $\frac{1}{12}$ in. oil-immersion lens—and abundant patience. The pale, spiral, hair-like germ is also found in children who inherit syphilis. Inoculations of the spirochaete in monkeys have produced the characteristic primary (Hunterian) sores, which have proved infective to other monkeys. And in the reproduced primary sores, as also in the secondary lesions following them, the same specific micro-organism has been demonstrated.

Syphilis is an infective fever, and its life-history may well be compared with that of vaccinia. A child is vaccinated on the arm with vaccine lymph—for two or three days nothing is observed; but on the fourth day redness appears, and by the eighth day a characteristic vaccine vesicle is formed, which bursts and sets free a discharge which dries into a scab. If on the eighth day the clear lymph in the vesicle is introduced at another point in the child's skin, no characteristic local effect follows. The system is "protected" by the previous inoculation; this protection will last for some years, and perhaps for life. There is, then, exposure to a poison; its introduction locally; a period of incubation; a characteristic appearance at the seat of inoculation; a change in the constitution of the individual, and protection for a variable period. So with syphilis. The syphilitic poison is introduced at the seat of an abrasion either on the genital organs or on some other part of the surface of the body. The poison lies quiescent for a variable period. The average period is four weeks. A cartilaginous, button-like hardness appears at the seat of inoculation. If this is irritated in any way, an ulceration takes place; but ulceration is an accident, not an essential. From the primary seat the system becomes infected. The virus, passing along the lymphatic vessels, attacks the nearest chain of lymphatic glands. If the original sore is in the genital organs, the glands in the groin are first attacked; if in the hand, the glands of the elbow or armpit; if on the lip, the glands below the jaw. The affected glands are indurated and painless; they may become inflamed, just as the primary lesion may, but the inflammation is an accident, not an essential. In due course the poison may affect the whole glandular system. The body generally is so altered that various skin eruptions, often symmetrical, break out. Any irritation of the mucous membrane is followed by superficial ulcerations, and in the later stages of the disease skin-eruptions, scaly, pimply, pustular or tuberculous in type, appear. These eruptions do not itch. The individual is as a general rule protected against a second attack of syphilis, although there have been rare cases recorded in which individuals have been attacked a second time. In weakly people, in severe cases, or in cases that have not been properly treated by the surgeon, syphilitic deposits termed gummata are formed, which are very apt to break down and give rise to deep ulcerations. Gummata may attack any part; the skin, muscles, liver and brain are the favourite sites.

It by no means follows that because the infecting sore is small, unimportant or quickly healed, the attack, of which the sore is the first (*primary*) symptom, will be mild. The most serious train of symptoms may follow the healing of a primary sore which has been so unimportant as scarcely to have attracted the attention of the individual, or actually to have escaped notice. Indeed, it not infrequently happens that the most serious forms of secondary or tertiary symptoms succeed a sore which was regarded as of such trivial nature that the individual declined to submit himself to treatment, or quickly withdrew himself from it to enter a fool's paradise. The advisability of ceasing from treatment should always be determined by the surgeon, never by the patient; mercurial treatment must be continued long after the disappearance of the secondary eruptions. It is the *disease* which the surgeon has to cure, not the *symptoms*. The patient is apt to think only of the symptoms.

"Is the disease curable?" This is the question constantly put by the patient on his coming for treatment. The answer is: "Yes; beyond doubt." But the individual must be made to understand the necessity of his submitting himself trustfully and patiently to a prolonged course of treatment. A second question is as to whether, in the course of the disease, his hair will fall out, his body will be covered with sores and his face with blotches, and if his bones will be attacked. Here, again, the answer will be that prompt submission to treatment will render all such calamities extremely improbable. Another question often put is as to whether the disease is contagious or infectious. Obviously, if a man has a primary sore or a secondary eruption upon the lip or tongue he should use his own glass, cup or spoon, and should refrain from kissing any one. If due care thus be taken no danger is likely to ensue.

The *diagnosis* of syphilis is often difficult. The first appearance of the sore about four weeks after exposure to the risk of infection, its hardness, the indolent enlargement of the associated lymphatic glands, and the occurrence of rash or of sore throat, are all helpful. But when the primary sore occurs on the finger, the face or, indeed, in any extra-genital region, it is apt to be lacking in the usual characteristics, and so the diagnosis may for a while be missed. In the case of doubt, the blood of the patient should be submitted to the delicate test known as the Wassermann reaction.

The General Treatment of Syphilis.—It is impracticable to lay down a hard and fast line for the treatment of the disease, for no two individuals are exactly alike, neither does the disease follow a strict path in all cases. But experience has amply shown that in the early stages of the disease, mercury, at least for the present, is the only drug on which reliance can be placed. Guaiacum was at one time extensively used, and somehow or another sarsaparilla acquired a bubble reputation; but the practical surgeon of to-day ignores these drugs in the treatment of syphilis. Still, mercury must be prescribed with great judgment. For a man worn out by alcoholic or other excesses, or with health broken down by tuberculosis or other exhausting disease, mercury must be given with great caution. In times past, its reckless administration until profuse salivation was set up, or until the teeth fell out and the very jawbones became diseased, deservedly brought the mercurial treatment into disrepute. "Better the disease than the remedy," said public opinion, and not without reason. But this miscarriage of treatment is absolutely a thing of the past. Before placing a patient under mercurial treatment it ought to be seen that there is no unwholesome condition of his gums, and that his teeth are put in a satisfactory state; unless this is done, the administration of small doses of mercury may have the effect of producing salivation, and, in consequence, a temporary cessation of the treatment. In any case the gums must be watched, and the treatment stopped if tenderness occurs.

There are several ways of giving mercury: (*a*) by the mouth; (*b*) by rubbing a mercurial ointment into the skin; (*c*) by injection into the muscles; (*d*) by inhalation of mercurial vapour. Inunction is especially suited for those whom mercury given by the mouth causes diarrhoea or other disturbance; in a private house, however, it is found "dirty" and objectionable.

The fumigation-treatment is carried out by seating the naked man on a cane-bottomed chair and covering him over with a blanket; calomel being volatilized, its fumes are carried under the blanket along with steam.

Treatment by intra-muscular injections is increasing in popularity, but in carrying it out, great care must be taken that no septic germs are introduced. The preparation of mercury is given in solution or mixed with oil, and is usually injected about once a week into the muscles of the buttock or loin. The "grey oil," which is much used for injections, consists of finely divided metallic mercury in some fluid fat. Calomel is also used suspended in olive oil. After a few months of weekly injections there should be some weeks of rest from treatment.

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[1] From χαίτη, long hair, on account of the waving, hair-like appearance of the germ.

But the most usual, and, perhaps, the most satisfactory method of administering mercury is by the mouth, in the form of pills or mixtures. The pills generally contain metallic mercury finely divided, as in "blue pill" and as in pills made of "grey powder," or as calomel, or some other salt of mercury, such as the bichloride or tannate. The preparation given in a mixture is usually a solution of perchloride of mercury.

Whilst the individual is undergoing mercurial treatment his diet must be regulated. Plain meat, roast and boiled, and vegetables which cannot cause indigestion or diarrhoea, will form his chief food. Spirits and liqueurs should be absolutely forbidden, but a glass or two of wholesome wine or beer may occasionally be allowed. If there is any secondary eruption of the tongue, mouth or throat, smoking must be forbidden. The dress must be warm, and there should be no exposure to extremes of cold or heat, nor should excessive work or amusement be undertaken. Briefly, it may be said that the subject of syphilis should live low and think high. It has been said by an English physician who delighted in epigrams, "Syphilis once, syphilis ever"; but this is not true. If the individual places himself unreservedly and continuously under the treatment of a trustworthy practitioner, he may confidently look forward to a cure; and, if so be that he is eventually married, may depend upon his children showing no sign of his unfortunate infection.

Unlike whooping-cough, smallpox or pleurisy, syphilis is not a disease which, left untreated, cures itself in the course of time. Syphilis is a disease which peculiarly calls for treatment, and that treatment, to be effectual, must be prolonged. To promote the healing of an ulcer, or to get rid of a cutaneous eruption, the result of syphilis, is not to treat syphilis. It is merely to free the patient of a symptom of the disease. To cure syphilis—and the disease is curable—the treatment must be patient and prolonged. And it must be for the surgeon to say to the individual that he may consider himself as cured, not for the patient to take upon himself the assumption that, because no secondary or tertiary symptoms have been seen for a certain number of months, he is cured.

In the midst of the uncertainties which surround the subject of syphilis, the question sometimes arises as to whether the treatment by mercury, for instance, is of the importance which is ascribed to it. Two instances may be given in proof of its undoubted value. First, a woman who has been infected and never properly treated, becomes pregnant, and though, perhaps, showing signs of good health in every other respect, has a miscarriage; pregnancy and miscarriage follow each other at short intervals, four, six or eight times. Then, at last, she is put upon mercurial treatment, and, going to her full time, bears a healthy infant. Second, an infected but healthy-looking woman, who has not been properly treated, produces a child who, in the course of a few weeks, becomes shrivelled and wan. His food does him no good, and daily he becomes more miserable. At last some mercurial ointment is spread upon his "binder," and he quickly becomes healthy and happy, and, in due course, if the treatment is persevered in, is entirely cured.

When should the Treatment of Syphilis be begun?—The answer to this important question is: "As soon as the disease is diagnosed." As soon as it is seen that the primary sore is hard, and that the glands in anatomical association with it are swollen, mercury should be administered. It may not prevent the outbreak of the secondary symptoms, but it may greatly modify them. But if a surgeon is in doubt as to whether a sore is truly an infecting one, he should wait before condemning the individual as syphilitic, and placing him under the necessity of submitting himself to perhaps a two years' treatment, which, after all, may not have been necessary. Time would quickly clear up doubt.

Abortive Treatment.—When it is remembered that the germs of syphilis have been incubating at the seat of inoculation for a month, more or less, before the primary sore or chancre makes its appearance, it may be taken for granted that the removal of the sore by wide dissection, or its destruction by cautery, will not prevent the occurrence of secondary symptoms. For during those weeks the germs were finding their way into the lymphatics and the blood vessels and were producing a general infection.

When the disease has undergone a sufficient treatment by mercury, or when a patient presents himself with lesions which denote the fact that the disease has passed into the tertiary stage, a solution of iodide of potassium is given in combination with that of perchloride of mercury, or the iodide is given by itself. In these conditions the effect of the potassium salt is often most remarkable. It is a drug of the greatest value, and, recognized as such, is apt to be found an important ingredient in popular "blood mixtures." If given, however, in doses larger than can be borne by the patient, its poisonous effects are manifested by a metallic taste, by watering of the eyes and by the breaking out on the back and shoulders of scattered pimples.

Thus, mercury in some form is the recognized and proper treatment for syphilis in the secondary stage, and iodide of potassium in the tertiary. And, for as much as one cannot say where the secondary stage ends and the tertiary begins, it is a common practice to combine the mercuric with the potash salt in the treatment of certain phases of the disease.

In 1910 attention was hopefully directed towards Professor Ehrlich's treatment of syphilis by a complex preparation of arsenic, conveniently spoken of as "606."

Gummata.—The most characteristic form of the generalized syphilitic infection, which may not manifest itself for several years after the reception of the virus, is a new growth in various organs—the liver, testes or brain, the muscles (tongue and jaw-muscles especially), the periosteum, the skin and the lungs. The deposits are called gummata from the tenacious appearance of the fresh-cut surface and of the discharge oozing from it. The structure consists of small round cells among thin fibres; it closely resembles granulation-tissue, only that the cells are smaller and the intercellular substance (fibres) denser. Molecular death, or necrosis, overtakes this ill-organized, new formation at various central points, owing to the inadequacy of the blood supply. One remarkable feature of the process is the overgrowth of cells in the inner coat of the arteries within the affected area, which may obliterate the vessel. Gummata, and the ulcers left by them, constitute the *tertiary* manifestations of syphilis.

In a large proportion of cases only the secondary symptoms occur, and not the tertiary, the virus having presumably exhausted itself or been destroyed by treatment in the earlier manifestations.

Inherited Syphilis.—In the syphilis of the offspring it is necessary to distinguish two classes of effects—there are the effects of general intra-uterine mal-nutrition, due to the placental syphilis of the mother; and there are the true specific effects acquired by inheritance from either parent and conveyed, along with all other inherited qualities, in the sperm-elements or in the ovum. These two classes of effects are commingled in such a way as not to be readily distinguished; but it is probable that the ill-organized growth of bone, at the epiphysial line in the long bones (sometimes amounting to suppuration), and on the surfaces of the membrane-bones of the skull (*Parrot's nodes*) is a result of general placental mal-nutrition, like the corresponding errors of growth in rickets. The rashes and fissures of the skin, the snuffles and such-like well-known symptoms in the offspring are characteristic effects of the specific taint; so also the peculiar overgrowth in the liver, the interstitial pneumonia alba of the lungs and the like. As in rickets, it is in many cases some months after birth before the congenital syphilitic effects show themselves, while other effects come to light during childhood and youth.

It must be remembered that the moist eruptions and ulcerations about the mouth and anus of the infant, as well as the skin affections generally, are charged with the spirochaetes and are highly contagious.

From the second to the sixth year there is commonly a rest in the symptoms that are regarded as characteristic, but the tibiae may become thickened from periostitis, or a joint may become swollen and painful, and resolve under mercurial treatment.

The characteristic physiognomy gradually manifests itself if the child is not treated with mercury—the flattened nose, the square forehead, the radiating lines from the mouth, the stunted figure and pallid face. During the second dentition, the three signs, as pointed out by Jonathan Hutchinson, may be looked for—the notched incisor teeth of the upper jaw, interstitial corneitis and syphilitic deafness. Perforation of the soft or hard palate may occur, and ulcerations of the skin and cellular tissue. Destruction of the nasal bones, caries of the forehead and skull, of the long bones, may also take place.

Colles' Law.—A woman giving birth to a syphilitic infant cannot be inoculated with syphilis by the infant when she is suckling it; in other words, though the mother may have shown no definite signs of syphilis, she is immune; whereas the syphilitic infant put to the breast of a healthy woman may inoculate her nipple and convey syphilis to her. This is known as Colles' Law, and it is explained by the theory that, the mother's blood being already infected, her skin is proof against a local cultivation of germs in the form of a Hunterian sore.

Syphilis and Marriage.—The question as to how soon it would be safe for a person with secondary syphilis to marry is of extreme importance, and the disregard of it may cause lasting mental distress to the parent and permanent physical injury to the offspring. A man who finds himself to be the subject of secondary syphilis when he is engaged to be married would do well honourably to free himself from responsibility. But should a person who has been under regular and continuous treatment desire to marry, consent may be given when he has seen no symptoms of his disease for two full years. But even then no actual promise can be made that his troubles are at an end.

The *transmission of syphilis to the third generation* is quite possible, but it is difficult of absolute proof because of the chance of there having been intercurrent infection of the offspring of the second generation.

REFERENCES.—A. Fournier, *Treatment of Syphilis*, trans. C. F. Marshall (1906); R. Clement Lucas, *Brit. Med. Journal* (1908); *A Manual of Venereal Diseases*, by Sir Alfred Keogh and others (1907); Power and Murphy, *A System of Syphilis* (1908). (E. O.*)

VENETI, the name given to two ancient European tribes. (1) A Celtic people in the N.W. of Gallia Celtica, whose territory corresponded roughly to the department of Morbihan. They were the most powerful maritime people on the Atlantic and carried on a considerable trade with Britain. Their name still remains in the town of Vannes. In the winter of 57 B.C., with some of their neighbours, they took up arms against the Romans, and in 56 were decisively defeated in a naval engagement, details of which are given in Caesar's *Bell. Gall.* iii. and Dio Cassius xxxix. 40–43.

For criticisms of these narratives, and a discussion of the question of the scene of operations, see T. R. Holmes, *Caesar's Conquest of Gaul* (1899), pp. 205, 663, 674, and for the extent of their territory, p. 509.

(2) The inhabitants of a district in the north of Italy (also called Ἐνετοί, Heneti, by the Greeks). The extent of their territory before their incorporation by the Romans is uncertain. It was at first included in Cisalpine Gaul, but under Augustus was known as the tenth region of Italy (Venetia and Histria). It was bounded on the W. by the Athesis (Adige), or, according to others, by the Addua (Adda); on the N. by the Carnic Alps; on the E. by the Timavus (Timavo) or the Formio (Risano); on the S. by the Adriatic Gulf. From the earliest times the Veneti appear to have been a peaceful people, chiefly engaged in commercial pursuits. They carried on an extensive trade in amber, which reached them overland from the shores of the Baltic. They were especially famous for their skill in the training and breeding of horses, attributed to their stay in Thrace, whence they brought the cult of Diomede into their Italian home. Homer (*Il.* ii. 85) speaks of the Paphlagonian Heneti as breeders of "wild mules," and their fondness for horses is regarded as a proof of their descent from the "horse-taming" Trojans. Dionysius, tyrant of Syracuse, who assisted them to repel the attacks of the Liburnian pirates, is said to have kept a stud in their country. Herodotus mentions a curious marriage custom, which seems of Eastern origin. Once a year the marriageable maidens of a village were collected together. Each young man chose a bride, for whom he had to pay a sum of money in proportion to her beauty. The sums thus obtained were used by the public officials to dower the less beautiful and thus afford them the chance of obtaining a husband. According to the pseudo-Scymnus of Chios (*Periegesis*, 400) the Veneti were fond of wearing black, a custom even now prevalent amongst them. They were a flourishing and wealthy people, and noted for their uprightness and morality.

The first historical mention of the Veneti occurs in connexion with the capture of Rome by the Gauls, whose retreat is said to have been caused by an irruption of the Veneti into their territory (Polybius ii. 18). At the request of the Romans they rendered them assistance in their wars against the Gauls north and south of the Po, and ever afterwards remained their loyal allies. Some time during the Second Punic War they passed, not by right of conquest but by force of circumstances, under Roman rule. At first they possessed complete autonomy in internal administration; in 89 Gnaeus Pompeius Strabo bestowed upon them the *jus Latinum*; they probably obtained the full franchise from Caesar at the same time as the Transpadane Gauls (49). Under the Empire Venetia and Istria were included in the tenth region of Italy, with capital Aquileia. Down to the time of the Antonines the country enjoyed great prosperity, which was interrupted by the invasion of the Quadi and Marcomanni and a destructive plague. From that time it was devastated at intervals by the barbarians—by the Alamanni, Franks and Juthungi in 286; by the Goths under Alaric (beginning of the 5th century); by the Huns under Attila (452), who utterly destroyed Aquileia and several other cities. Under Theodoric the Great (ruler of Italy from 493–526) the land had rest, and in 568 was occupied by the Lombards. The most important river of Venetia was the Athesis (Adige); its chief towns Patavium (see PADUA), Aquileia (*q.v.*), Altinum (Altino), Belunum (Belluno, still a considerable town).

Language.—We have nearly 100 inscriptions which record the language spoken by the tribe in pre-Roman days, the bulk of which we owe to the admirable and devoted excavations carried out at Este since 1890 by Prof. A. Prosdocimi and Sign. A. Alfonsi. But a not unimportant number have also come to light at Verona and Padua, and at different points along the great North and South route of the Brenner Pass, especially at Bozen; and there are a few more scanty and scattered monuments in the Carinthian Alps now preserved chiefly in the Museums at Klagenfurt and Vienna (the *K.K. Naturhistorisches Museum, Ethnographische Abteilung*). All but a few of these Venetic inscriptions were seen and transcribed by the present writer in the spring of 1908, and their texts with a careful collection of the local and personal names of the district made by Miss S. E. Jackson will appear as the first part of "The Pre-Italic Dialects" in the *Proceedings of the British Academy*.

The alphabet of the inscriptions, in all its varieties, is probably (in spite of Pauli, *Die Veneter*, p. 226, whose judgment seems somewhat arbitrary) either derived from or at least influenced by some form of the Etruscan alphabet, since it not merely coincides with that alphabet in several characteristic signs, such as the use of the compound symbol *vh* (𐌇𐌅) with the value of *f*, but lacks the symbols for the mediae B D G. These, or the sounds which had descended from them in Venetic, were represented by using symbols which in the Western Greek alphabets denoted kindred sounds; 𐌆 *z* where we should expect *d* (*zoto*, "he gave"), Φ *φ* where we should expect *b* (*φohιιos*, "Boius"), Ψ (*i.e.* *χ*) where we should expect *g* (*·ε·χo*, "ego"). But though we find the symbols in positions where they correspond to the mediae in kindred languages, it is uncertain what the precise variety of sound which they denoted was; thus, for example, Venetic *·ε·χo*, is certainly equivalent to the Latin *ego*, but we cannot be certain that the sound of the two words was precisely the same. The symbol for *θ* is not used to denote *d* (since that is represented by *z*). In the inscriptions of Padua and Verona the sign is O and seems there to denote some variety of sound closely akin to *t*; the word which at Padua and Verona is written *·e·kupeθari·s·* (probably meaning "charioteer") appears as *ecupetaris* in Latin alphabet in an inscription published by Elia Lattes ("Iscrizioni Inedite Venete ed Etrusche," *Rendiconti del R. Ist. Lomb. di Sc. e Lett.*, Serie II. vol. 34, 1901). The full Venetic alphabet at its best period is preserved for us on several curious and interesting dedicatory objects found at Este, which were offered to the goddess of the place called *Rehtia*, a name obviously equivalent to Latin *Rectia*, some of whose prerogatives, to judge from the long nails which are offered to her, frequently accompanied by small wedges, would seem to have been those of the goddess whom Horace calls Necessitas (*Odes*, i. 35, 17). The offerings in question are thin bronze plates of whose surface the greater part is covered by alphabetic signs, with an inscription stating that such and such a worshipper makes an offering of the plate to the Goddess Rectia. Besides the letters of the alphabet in their order, these plates contain a kind of catalogue of the most common combination of letters, and although none of the plates is now completely preserved this characteristic and their general likeness to one another provide enough material to place the alphabet of Este beyond all doubt. It is written from right to left, and the alternate lines curl round so that the letters proceed in the opposite direction and stand with their feet turned towards those in the preceding line. This characteristic, technically known as "serpentine boustrophedon," with the sign for *h* (ı|ı), points to some connexion with the alphabets of the East Italic ("Sabellic") inscriptions (see SABELLIC).

The alphabet of Este then, in what the archaeological remains show to have been the 4th and 3rd centuries B.C., was as follows:—

𐌀 *a*, 𐌄 *e*, 𐌅 *v*, 𐌆 *z*, ı|ı *h*, ⊠ *θ*, 𐌊·*k*, 𐌋 *l*, 𐌌 *m*, 𐌍 *n*, 𐌐 *p*, M *ś*, 𐌓 *r*, Ƨ and 𐌔 *s*, X *t*, Λ *u*, ◈ or ⦶ *φ*, Ψ *χ*, ◇ *o*.

Pauli (*Die Veneter*, p. 229) compares it to the Western Greek alphabet as used in Elis, but it is difficult to point to any especial mark of affinity with this particular branch of the Western alphabet, while there are some marked differences, such as X instead of Elean 𐌕, 𐌃 instead of Elean (prevailingly) 𐌐 and 𐌓. 𐌗 instead of 𐌆 and ǀǀǀ instead of the regular Western 𐌇 though the latter symbol is not quoted as occurring in Elis itself (E. S. Roberts, *Greek Epigraphy*, i. 390).

Even the few words that have already been cited from the inscriptions will have shown that the language belongs to the Indo-European group. Unfortunately the inscriptions of Este, although numerous, belong to only two classes, dedications and epitaphs; hence the forms with which they supply us, though attested by welcome repetition, are somewhat limited in number. The typical beginning for a dedication is *μεχο* . . . . *zona·s·to sahnateh rehtiiah*, *i.e.* "me dedit Rectiae Sanatrici," "so and so gave me to the Healing Goddess Rectia"; and sometimes the form of the verb is simply *z·o·to*. The correspondence of these two forms with the Greek middle aorist of the verb (ἔ-δοτο), and with the Latin *donare* is obvious, and the present writer is convinced, for reasons which it is impossible to state fully here, that the dots which, it will be observed, are placed on either side of the last sound of their syllable, denote the accent of the word; the most striking evidence being the coincidence in position of the dots with the place of the Greek accent on kindred words; for example, the cognomen *Lehvo·s·* on an inscription of Vicenza is clearly identical with the Latin *Laevus* and the Greek λαιϝός. These signs are altogether absent from some words, *e.g.* from the Accusative *μεχο* (presumably a proclitic) and syllables containing the letter ǀǀǀ, whose form would make the dots a cumbrous addition. One other inscription of special linguistic interest should be cited here; it appears to be the artist's inscription of a vase of the 6th century B.C. found recently at Padua—

voθo kluθeari·s· vhaχ·s·to,

where the first name appears to be identical with the Latin *Otho* and to explain its aspirate, and the last word appears to be the Venetic equivalent of the Latin *fecit*, but to be in the middle voice without any augment. If this interpretation be correct—and the use of ἐποίησε by Greek artists commends it strongly—the form illustrates in rather a striking way the character of the language as intermediate between Greek and Latin.[1]

In the archaeological aspect the Venetic remains are particularly interesting as representing very fully the culture of what is known as the early Iron Age, the monuments of which were discovered in the excavations at Villanova, and are now admirably exhibited in the Museum at Bologna. The earliest begin, according to the generally accepted dating, from the 11th century B.C. The remains at Este begin a very little later, but no inscriptions appear upon them until we reach the pottery of the 6th century B.C. It remains therefore to be determined whether this Venetic language was the proper speech of the people who, as it is generally supposed, brought with them the early Iron culture into Italy from north of the Alps in the 11th century B.C., or whether it was the language of the people of the soil whom they conquered. So far as the scanty linguistic evidence at present extends, in the place names and the personal names of the Ligurian and the Venetic districts, it appears to the present writer on the whole to be more in favour of the second view. This probability would become a certainty if we could accept as established the view of Professor Ridgeway and others, which identifies the authors of the early Iron culture with the Umbrians of historical times and ascribes to them the Umbro-Safine language (which with Latin constitutes the Italic division of the Indo-European languages), and which almost certainly was the language originally spoken by the patrician class at Rome (see further SABINI). Even now it must be admitted that this view possesses a high degree of probability.

The chief authority on the Venetic inscriptions published up to 1908 is Carl Pauli (*Altital. Studien*, vol. 3, "Die Veneter," Leipzig, 1891), but so far as the present writer's observation may be trusted the text which Pauli gives of the inscriptions is somewhat defective. Some were reported by Mommsen, *Die Inschriften Norditalischen Alphabets* (Zürich, 1853); the rest have been recorded in the *Notizie degli Scavi* as they appeared, by Ghirardini in the volumes for 1880 and 1888, by Prosdocimi in that for 1890. These articles contain careful accounts of the archaeological remains. (R. S. C.)

VENETIA, a territorial division of northern Italy, lying between the Alps and the Adriatic, and stretching from the frontier of Carinthia and Istria (Austria) in the north-east to the lower Po and Lombardy in the south-west. It comprises the provinces of Belluno, Padua, Rovigo, Treviso, Udine, Venice, Verona and Vicenza, and has an area of 9476 sq. m. Pop. (1881) 2,814,173; (1901) 3,192,897. The crops principally grown are maize, wheat, rice, grapes, mulberry leaves, tobacco, chestnuts, potatoes and hemp. Copper and lignite are mined, and turf is dug. The chief industries are the manufacture of woollens, cottons, silks, glass, laces, tobacco, straw-plait, paper, sugar and hemp, the breeding of silkworms, iron-founding and working, timber-cutting and shipbuilding. At Mira is a large candle factory. The peasantry suffer much from pellagra.

The territory differs much in character; the Po and other smaller rivers which fall into the Adriatic terminate in a huge and continually advancing delta which extends right along the coast, and is liable to inundation. The shore lagoons are, however, rendered healthy by the ebb and flow of the tide, which is much more considerable than elsewhere in the Mediterranean. To the north of the Po at the foot of the mountains is a fertile territory, while the mountains themselves are not productive. The chief towns in the various provinces, with their communal population in 1901, are: Belluno 19,050; total of province 214,803, number of communes 66; Padua 81,242; Monselice 11,571, Este 10,779, Piove di Sacco 10,021; total of province 444,360, number of communes, 103; Rovigo 10,735, Adria 15,711; total of province 222,057, number of communes 63; Treviso 32,793, Castelfranco Veneto 12,440, Montebelluna 10,284, Conegliano 10,252; total of province 416,945, number of communes 95; Udine 36,899, Pordenone 12,409, S. Vito al Tagliamento 10,160; total of province 614,270, number of communes 179; Venice 148,471, Chioggia 31,218, Cavarzere 16,388, Mira 12,169, Mestre 11,625; total of province 399,823, number of communes 50; Verona 73,917, Legnago 14,535; total of province 427,018, number of communes 113; Vicenza 43,703, Bassano 15,097; Schio 13,524; Arzignano 10,426, Lonigo 10,390; total of province 453,621, number of communes 123. Railway communication in Venetia is fairly good; there is a main line from Milan to Mestre (the junction for Venice) and thence to Trieste by a line near the coast, or by Treviso, Udine and Pontebba (Pontafel) into Austria. Another route into Austria, the Brenner, leaves the Milan-Venice line at Verona, which is connected with Modena (and so with central and southern Italy) by a railway through Mantua. Another main line runs from Bologna to Ferrara, Rovigo and Padua, joining the Milan-Venice line at the last-named place. Intercommunication between the main lines is secured by branch railways and steam tramways. The Po, however, forms somewhat of an obstacle, but is crossed by the main lines to Modena and Bologna near Mantua and Rovigo respectively.

The district which later bore the name of Venetia was inhabited, under the Roman Republic, by a variety of tribes—Celts, Veneti, Raeti, &c. Under Augustus, Venetia and Histria formed the tenth region of Augustus, the latter including the Istrian peninsula as far as the river Arsia, *i.e.* with the exclusion of the strip along the E. coast (Liburnia). In all directions, indeed, it extended farther than Venetia in the modern sense, being bounded on the S. by the Po and its main (north) arm, extending on the W. as far as the Adda and on the N. into a part of southern Tirol. It was thus far the largest of the regions of Italy, but possessed comparatively few towns; though such as there were, with the large territories, acquired considerable power and influence. The easiness of the Brenner pass and the abundance of communication with the sea led to the rise of such towns as Verona, Padua and Aquileia: and Milan only became more important than any of these when the German attacks on Italy were felt farther west.

When the Roman Empire fell the towns were many of them destroyed by Attila, and the inhabitants took refuge in the islands of the lagoons. It is to this that Venice owes its origin, under Byzantine protection, early in the 9th century A.D. For the gradual growth of Venetian supremacy over the whole territory, and for its subsequent history, see VENICE.

VENETTE, JEAN DE (*c.* 1307–*c.* 1370), French chronicler, was born at Venette, near Compiègne. He became prior of the Carmelite convent in the Place Maubert, Paris, in 1339, and was provincial of France from 1341 to 1366. In 1368 he was still living, but probably died within a year or two of that date. His Latin Chronicle, covering the years 1340 to 1368, was published by Achery (*Spicilegium*, vol. iii.) with the continuations of the chronicle of William of Nangis, though it has every claim to be considered as an independent work. During the years 1358 and 1359 the entries were contemporary with the events recorded; the earlier portion of the work, if it was begun as early as 1340, was subjected to revision later. Jean de Venette was a child of the people, and his sympathies were entirely with the peasants. His point of view is thus directly opposed to that of Froissart. His democratic sympathies led him to support Étienne Marcel, and though he returned to his allegiance to the kings of France he remained a severe critic. Jean de Venette also wrote a long French poem, *La Vie des trois Maries*, about 1347.

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[1] Some further details will be found in the Preliminary Report presented to the British Academy published in the *Athenaeum*, August 8th, 1908.

See Lacurne de Sainte-Palaye in *Mémoires de l'Académie*, vols. viii. and xiii.; Géraud and Déprez in *Mélanges de l'école de Rome* (1899), vol. xix.; and A. Molinier, *Les Sources de l'histoire de France* (1904), tome iv.

VENEZUELA,[1] a republic of South America, facing the Caribbean sea, and bounded E. by British Guiana and Brazil, S. by Brazil and W. by Colombia. Its boundary with Colombia is unfixed, a decision by the king of Spain, as arbitrator, in March 1891, having been rejected by Venezuela. The boundary dispute with British Guiana was settled in October 1899 by an arbitration court in Paris. The line is subject to any question between the two countries and Brazil. The boundary with Brazil was fixed by a special commission in 1880. The republic lies between lat. 1° 40′ S. and 12° 26′ N., long. 59° 40′ and 73° 31′ W., and has an area of 599,538 sq. m. according to the Venezuelan *Year Book* of 1906. This area, however, was subject to the settlement of the Colombia boundary line, and the measurement is only approximate.

Topography.—The surface of Venezuela is broken into three very irregular divisions by its mountain systems: (1) the mountainous area of the N.W. and N.; (2) the Orinoco basin with the *llanos* on its northern border and great forested areas in the S. and S.W.; and (3) the Guiana highlands. A branch of the eastern chain of the Andes enters Venezuela in the west about 7° N. lat., and under the name of the Sierra Nevada de Mérida proceeds north-eastwards towards Trieste Gulf. This branch consists of parallel chains enclosing elevated valleys, in one of which lies the town of Mérida at the height of 5410 ft., overlooked by the highest summit of the chain (Picacho de la Sierra, 15,420 ft.). The sierra contains the water-parting between the basin of the Orinoco and those of the small rivers on the north-west. Hence it may be considered to terminate where the Rio Cojedes, which drains the elevated valley in which Barquisimeto stands, after rising on its western slopes flows eastwards into the basin of the Orinoco. Beyond the Cojedes begin two parallel ranges known as the Maritime Andes of Venezuela, which stretch east and west along the coast. The valley between these two ranges is the most densely peopled part of Venezuela. Above Carácas the highest peak of the system, Silla de Carácas, rises to 8531 ft. Behind the wide bay between Cape Codera and Cumana there is an interruption in the Maritime Andes; but both ranges reappear between Cumana and the Gulf of Paria. West of the Maritime Andes low ranges (3500–5000 ft.) trend northwards from the end of the Sierra de Mérida towards the coast on the east side of the Lake of Maracaibo, while the region on the west of that lake consists of lagoon-studded lowlands. East and south of the Sierra de Mérida and the Maritime Andes the region is thinly populated and little known. It consists of two portions—a vast, hilly or mountainous area, densely wooded, in the south-east and south, and level plains in the north-west between the Orinoco and the Apuré and the mountains. The latter is known as the *llanos* of the Orinoco, a region described by Humboldt as a vast "sea of grass," with islands of wood scattered here and there. Since the time of Humboldt, however, the aspect of these plains would seem to have changed. On the occasion of Karl F. Appun's visit in 1850 trees seem still to have been comparatively rare; but a different aspect was presented when Dr P. Jonas visited the *llanos* in 1878. From the Galera, the southernmost range of hills north of the Orinoco basin, the traveller saw a vast plain thickly grown with low trees. As far as Calabozo (about one-third of the distance between the hills and the Apuré) it was now chaparros (*Curatella americana*), now mimosas, which were the prevailing feature of the landscape. But towards the south the open grass-covered spaces increased in number and area. To the south of Calabozo woods of considerable extent were seen. This change is due to the decline of horse- and cattle-rearing in the *llanos*, partly in consequence of political disturbances and partly of a murrain which broke out in 1843 among horses, mules and asses. The decline in stock-raising would also suspend the practice of burning off the dead grass to improve the new pasturage. Along the Brazilian frontier and about the sources of the Orinoco tributaries on the eastern slopes of the Andes there are extensive forests, sometimes broken with grassy *campos*. The surface of the *llanos* is almost a dead level, the general elevation varying from about 375 to 400 ft., rising almost imperceptibly to 600–800 ft. around its immediate margins. So uniform is the level over a great part of these plains that in the rainy season hundreds of square miles are submerged, and the country is covered with a network of connecting channels. When the Orinoco is reached its lower basin is contracted between the Guiana highlands and the northern sierras, and its tributaries begin to come in more nearly at right angles, showing that the margins of the actual valley are nearer and higher. About 62° 30′ the great river reaches what may be considered sea-level, and from this point numerous channels find their way across the silted-up delta plain to the sea. This region, together with that of the Guiana frontier, is heavily forested. In the extreme S. (territory of Amazonas) and S.E. the surface again rises into mountain ranges, which include the Parima and Pacaraima sierras on and adjacent to the Brazilian frontier, with a number of short spurs reaching northward toward the Orinoco, such as the Mapichi, Maraguaca, Maigualida, Matos, Rincote and Usupamo. All this region belongs to the drainage basin of the Orinoco, and rivers of large volume flow down between these spurs. Some of the culminating points in these ranges are the Cerros Yaparana (7175 ft.) and Duida (8120 ft.) in the Parima sierras near the upper Orinoco, the Sierra de Maraguaca (8228 ft.), and the celebrated flat-topped Mt Roraima (8530 ft.) in the Pacaraima sierras on the boundary line with Brazil and British Guiana. Near the Orinoco the general elevation drops to about 1500 ft. All this region is densely forested, and is inhabited only by scattered tribes of Indians.

Probably not less than four-fifths of the territory of Venezuela belong to the drainage basin of the Orinoco (*q.v.*). The Orinoco is supposed to have 436 tributaries, of which, among the largest, the Caroni-Paragua, Aro, Caura, Cuchivero, Suapure, Sipapo and Ventuari have their sources in the Guiana highlands; the Suata, Manapere and Guaritico in the northern sierras; and the Apuré, Uricana, Arauca, Capanaparo, Meta, Vichada and Guaviare (the last three being Colombian rivers) in the *llanos* and Andes. The Apuré receives two large tributaries from the northern sierras—the Guarico and Portuguesa. Apart from these, the rivers of Venezuela are small and, except those of the Maracaibo basin, are rarely navigable. The larger are the Guanipa and Guarapiche, which flow eastwards to the Gulf of Paria; the Aragua, Unare and Tuy, which flow to the Caribbean coast E. of Carácas; the Yaracui, Aroa and Tocuyo to the same coast W. of Carácas; and the Motatan, Chama, Escalante, Catatumbo, Apan and Palmar, which discharge into Lake Maracaibo. The hydrography of the region last mentioned, where the lowlands are flat and the rainfall heavy, is extremely complicated owing to the great number of small rivers and of lakes on or near the lower river courses. The deep lower courses of these streams and the small neighbouring lakes were once part of the great lake itself, which is being slowly filled by silt. The lakes of Venezuela are said to number 204. The largest are the Maracaibo (*q.v.*); El Zulia, with an area of 290 sq. m., a short distance S. of Maracaibo among a large number of lakes, lagoons and swamps; Valencia, near the city of that name, in the Maritime Andes, about 1350 ft. above sea-level, with an area of 216 sq. m.; Laguneta, in the state of Zulia; and Taciragua, a coastal lagoon in the state of Miranda. There are numerous lagoons in the *llano* districts caused by the periodical floods of the rivers, and extensive *esteros* and *cienagas*, in part due to the same causes, but these either dry up in the dry season or are greatly reduced in area.

The coast outline of Venezuela is indented with a large number of gulfs and bays, comparatively few of which, however, are open to foreign commerce. The larger indentations are the Gulf of Maracaibo, or Venezuela, which extends inland through the Lake of Maracaibo, with which it is connected by a comparatively narrow channel, and is formed by the peninsulas of Goajira and Paraguaná; the Gulf of Paria, between the peninsula of that name and the island of Trinidad; the Gulf of Coro, opening into the Gulf of Maracaibo; the Gulf of Cariaco, between the peninsula of Araya and the state of Bermúdez; the Golfo Triste, on the E. coast of the state of Lara; and the small Gulf of Santa Fé, on the northern coast of Bermúdez. Besides these there are a number of small indentations, sheltered anchorages formed by islands and reefs like that of Puerto Cabello, and estuaries and also open roadsteads, like those of La Guaira and Carúpano, which serve important ports. The islands on the coast forming part of the national territory number 71, with an aggregate area of 14,633 sq. m., according to official calculations. The largest of these is the island of Margarita, N. of the peninsula of Araya, in the vicinity of which is the island of Tortuga and several groups of islets, generally uninhabited. (A. J. L.)

Geology.—Geologically Venezuela consists of three distinct regions: (1) South of the Orinoco a great mass of granite, gneiss, pyroxenite and other crystalline rocks, continuous with that of Guiana and probably of Archean age. This mass also forms the bed of the Orinoco from its junction with the Apuré nearly to its mouth, and it probably extends northwards for some distance beneath the more recent deposits of the plain. (2) The *llanos*, covered by deposits of Quaternary or late Tertiary age. (3) The mountain ranges of the north-west and north. These ranges appear to belong to two systems. The Cordillera of Mérida is one of the branches of the Andes, and the strike of the folds which compose it is usually from south-west to north-east. The Caribbean chain along the north coast is part of the Antillean system, and here the strike of the folds is nearly west to east or west-south-west to east-north-east. The two systems of folds meet about Barquisimeto, where the structure becomes very complex and is not thoroughly understood. The rocks of Falcón are believed by Sievers to belong to the Andean system; while the outlying peninsula of Paraguaná probably belongs, geologically, to the same massif as Goajira and the Sierra Nevada de Santa Maria in Colombia. The oldest rocks in the country are the granites, gneisses, &c., of the southern massif and the crystalline schists which form the axis of the Cordillera and the Caribbean chain. In the latter range a few Ordovician fossils have been found, but in general the oldest strata which have yielded organic remains belong to the Cretaceous system. The Cretaceous beds form a band along each side of the Cordillera and along the southern flank of the Caribbean chain, and they spread over the greater part of the provinces of Falcón and Lara. The Lower Cretaceous consists chiefly of sandstones and shales and the Middle Cretaceous of very fossiliferous limestone. There is considerable difference of opinion as to the chronology of the succeeding beds, and the boundary between the Cretaceous and Tertiary systems is drawn at various horizons by different observers. The Cerro de Oro series is the most important group of these beds and takes a considerable share in the formation of the mountain ranges. It belongs either to the Upper Cretaceous or to the Lower Tertiary, or possibly in part to the one and in part to the other.[1] (P. La.)

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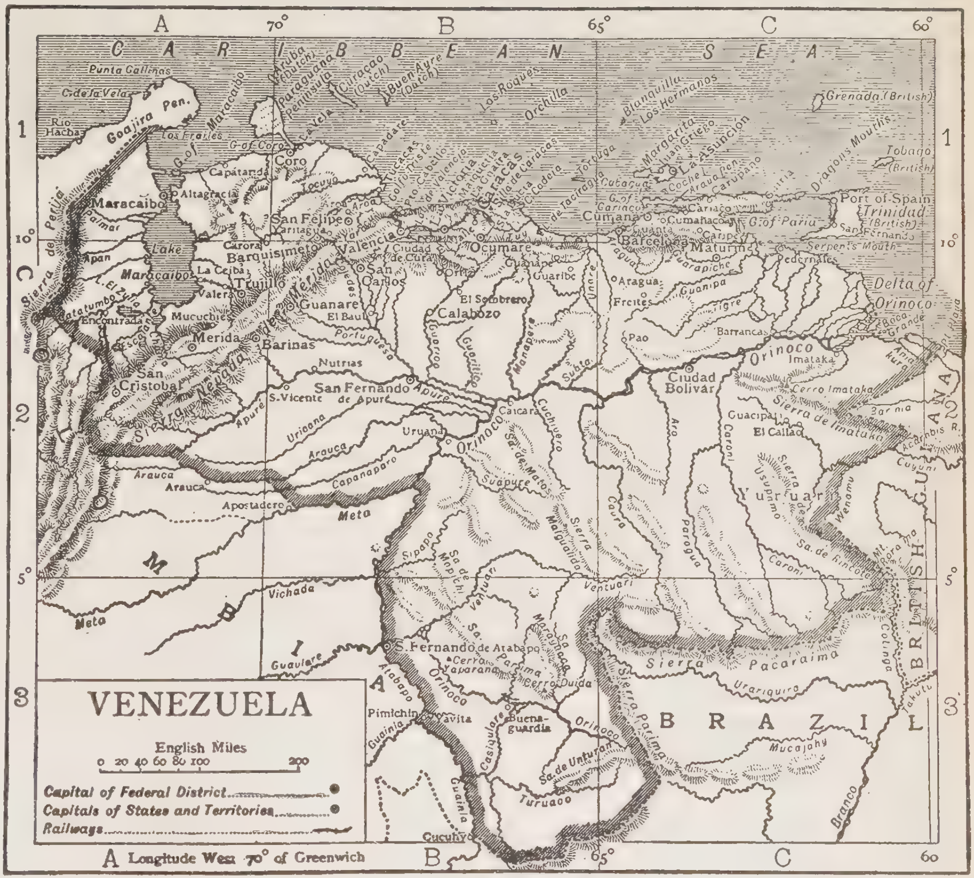
[1] The name means "little Venice," and is a modification of the name of Venecia (Venice), originally bestowed by Alonzo de Ojeda in 1499 on an Indian village, composed of pile dwellings on the shores of the Gulf of Maracaibo, which was called by him the Gulf of Venecia.



A
70°
B
65°
C
60°
C A R I B B E A N S E A
Punta Gallinas
C. de la Vela
Rio Hacha
Goajira Pen.
Los Frailes
G. of Coro
Paraguaná Peninsula
Aruba (Dutch)
Curaçao (Dutch)
Buen Ayre (Dutch)
Los Roques
Orchilla
Blanquilla
Los Hermanos
Grenada (British)
Tobago (British)
Margarita
La Asuncion
Capatarida
Coro
Altagracia
Maracaibo
Lake Maracaibo
San Felipe
Carora
Barquisimeto
Valencia
Ciudad de Cura
Ocumare
Caracas
La Guaira
Cumaná
Barcelona
Maturin
G. of Paria
Port of Spain
Trinidad (British)
Serpent's Mouth
Delta of Orinoco
La Ceiba
Trujillo
Valera
San Carlos
Guanare
El Baul
El Sombrero
Calabozo
Guarico
Aragua
Freites
Pao
Barrancas
Orinoco
Imataka
Mucuchies
Merida
Barinas
Encontrados
Nutrias
San Cristobal
S. Vicente
San Fernando de Apure
Apure
Ciudad Bolivar
Cerro Imataka
Sierra de Imataka
Guacipati
El Callao
Cuyuni
Uruana
Caicara
Arauca
Capanaparo
Apostadero
Meta
Caroni
Yuruari
Vichada
Ventuari
Guaviare
S. Fernando de Atabapo
Cerro Yapacana
Cerro Duida
Sierra Pacaraima
Uraricuera
Mucajahy
Branco
Pimichin
Avita
Buenaguardia
Casiquiare
Sa. de Unturan
Turuaco
Cucuhy
Guainia
B R A Z I L
BRITISH GUIANA
COLOMBIA
VENEZUELA
English Miles
0 20 40 60 80 100 200
Capital of Federal District
Capitals of States and Territories
Railways
A Longitude West 70° of Greenwich B 65° C 60
1
2
3
10°
5°
Emery Walker sc.

Climate.—The climate of Venezuela is everywhere tropical except where modified by altitude. In the Maritime Andes at and above the altitude of Carácas it may be described as semi-tropical, and in the still higher regions of western Venezuela it approaches the mild temperate. On the coast and the northern slopes of the Maritime Andes the tropical heat is greatly modified by the trade-winds. At La Guaira the mean temperature for the year is 85° F., at Carácas (3025 ft.) it is 71·2° (or 66·2° according to an official return), at Cumaná it is 83°, at Valencia 76°, Coro 82°, Barquisimeto 78°, Yaritagua 80·6°, Mérida 61°, Trujillo 72°, and Maracaibo 81°. South of the sierras, however, the climate is much drier and hotter. The low temperatures of the night in these regions lower the mean annual temperatures. At Calabozo, for instance, the mean is about 88°, though the maximum in summer is not far from 100°. At Ciudad Bolívar, which is less sheltered from the trade-winds, the mean is 83° and the maximum 91·4°. The lowest temperatures recorded in official reports are those of Mucuchíes, in the state of Mérida, where the maximum is 68°, the minimum 43° and the mean 56°. The year is divided into two seasons, the dry and wet, the latter occurring from April to October, when the temperature is also the highest. On the *llanos* the dry season destroys the pasturage completely, dries up the small streams and lagoons, and compels many animals of semi-aquatic habits to aestivate. At Carácas the annual rainfall ranged from 602 to 863 millimetres between 1894 and 1902. In general the climate of Venezuela is healthy wherever the ocean winds have free access. Sheltered places in the lowlands, especially near streams and lagoons, are malarial and enervating, and at some points on the coast are subject to dangerous fevers. The sanitary condition is generally bad, and many forms of disease prevail that are not due to the climate.

Fauna.—The fauna and flora of Venezuela are similar in nearly all respects to those of the neighbouring regions of Guiana, Brazil and Colombia, the open *llanos* of the Orinoco being something of a neutral district between the great forested regions on the E., S. and W. Among the animals indigenous to the country are seven species of the cat family, including the puma, the jaguar and the ocelot; the wild dog (*Canis Azarae*); several representatives of the marten family, including two species of *Galictis*, two of the otter (*Lutra brasiliensis* and *L. pteronura*) and one of the skunk; two species of bear (*Ursus ornatus* and *U. nasutus*); and the "kinkajou." There are six species of monkey corresponding to those of Guiana and the Amazon valley, the sloth and ant-eater, 12 known genera of rodents, including many species of *Mures*, the cavy, the capybara, the paca, the nutria, the agouti, the tree porcupine, *Loncheres cristata*, *Echimys cayen* and the Brazilian hare. Among the pachyderms the tapir is found in the forests of the Orinoco. There are two species of the peccary, *Dicotyles torquatus* and *D. labiatus*. There are also 2 species of deer, *Cervus rufus* and *C. simplicornis*. There are 3 species of opossum. On the coast and in the Orinoco there may be found the manatee and the dolphin. The Reptilia include 11 species of the crocodile, alligator and lizard, including the savage *jacaré* of the Amazon, several species of turtle, 4 species of batrachians, and 29 species of serpents, including the striped rattlesnake (*Crotalus durissus*), *Lachesis mutus*, and a rather rare species of *Cophias*. Among the non-venomous species, the commonest are the boa-constrictor, the anaconda (*Eunectes murinus*) and the *Coluber variabilis*. Bird life is represented chiefly by migratory species, particularly of genera that inhabit the shores of streams and lagoons. The shallow lagoons of the *llanos*, like those of the Argentine *pampas*, are favourite fishing grounds for these birds. In the *garzeros* of Venezuela are to be found nearly every kind of heron, crane, stork and ibis, together with an incredible number of Grallatores. Ducks are also numerous in species and individuals, including a small bird called the *guiriri*, in imitation of its cry. Birds of prey are numerous. One species, the guacharo (*Steatornis caripensis*), or oil-bird, is commonly said to occur only in Venezuela, though it is found in Colombia and Ecuador also. They live in caves, especially in Caripe, and are caught in large numbers for the oil extracted from them, which is commonly known as "Caripe butter." The bell-bird (*Chasmorhynchus caruncnlatus*) is common in the forests of the Orinoco. Insect life is perhaps poorer and less varied than in Brazil, but in the 14 orders of insects there are no less than 98 families, each including many genera and species. There are 8 families of Coleoptera, 6 of Orthoptera, 23 of Hymenoptera, 14 of Lepidoptera and 7 of Diptera. Locusts are very numerous in the interior, and commit great ravages. Molluscs are common on the coasts, including the pearl oyster, and in the fresh-water streams and lakes. The coral polyp is also found in Venezuelan waters. The domestic animals of Venezuela—the horse, ass, ox, sheep, goat, hog, dog, cat, &c.—are not indigenous.

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[1] See G. P. Wall, "On the Geology of a part of Venezuela and of Trinidad," *Quart. Journ. Geol. Soc. London*, vol. xvi. (1860), pp. 460–70, pl. xxi.; H. Karsten, *Géologie de la Colombie Bolivarienne* (Berlin, 1886); W. Sievers, "Karten zur physikalischen Geographie von Venezuela," *Peterm. Mittheil.* vol. xlii. (1896), pp. 125–29, pl x.

Flora.—The flora of Venezuela covers a wide range because of the vertical climatic zones. The coastal zone and lower slopes of all the mountains, including the lower Orinoco region and the Maracaibo basin, are clothed with a typical tropical vegetation. There is no seasonal interruption in vegetation. The tropical vegetation extends to an altitude of about 1300 ft., above which it may be classed as semi-tropical up to about 3500 ft., and temperate up to 7200 ft., above which the vegetation is Alpine. Palms grow everywhere; among them the coco-nut palm (*Cocos nucifera*) is the most prominent. There are some exotics in this zone, like the mango, which thrive so well that they are thought to be indigenous. The cacau is at its best in the humid forests of this region and is cultivated in the rich alluvial valleys, and the banana thrives everywhere, as well as the exotic orange and lemon. On the mountain slopes orchids are found in great profusion. Sugar-cane is cultivated in the alluvial valleys and coffee on their slopes up to a height of about 2000 ft. Among the many tropical fruits found here are bananas, guavas, mangoes, cashews, breadfruit, aguacates, papayas, zapotes, granadillas, oranges, lemons and limes. In the next zone are grown many of the cereals (including rice), beans, tobacco, sugar-cane, peaches, apricots, quinces and strawberries. The *llanos* have some distinguishing characteristics. They are extensive grassy plains, the lowest being the bed of an ancient inland lake about which is a broad terrace (*mesa*), the talus perhaps of the ancient encircling highlands. The lower level has extensive lagoons and swampy areas and suffers less from the long periodical drought. Its wild grasses are luxuriant and a shrubby growth is found along many of its streams. The decline in stock-breeding resulted in a considerable growth of trees and chaparral over the greater part of the plain. A large part of the chaparral consists of the *chaparro*, a low evergreen oak of hardy characteristics, mixed with mimosa, desmauthus, zonia and others. Much of this region is covered with *gamelote*, a tall, worthless, grass with sharp stiff blades. One of the most remarkable palms of the Orinoco region is the "moriche" (*Mauritia flexuosa*). The fruit is edible and its juice is made into beer; the sap of the tree is made into wine, and its pith into bread; the leaves furnish an excellent thatch, and the fibre extracted from their midribs is used for fish lines, cordage, hammocks, nets, &c.; and the wood is hard and makes good building material. The fruit of the *Guilielma* is also widely used for food among the natives. Among other forest trees of economic importance are the silk-cotton tree (*Bombax ceiba*), the *palo de vaca*, or cow-tree (*Brosimum galactiodendron*), whose sap resembles milk and is used for that purpose, the *Inga saman*, the *Hevea guayanensis*, celebrated in the production of rubber, and the *Attalea speciosa*, distinguished for the length of its leaves.

The principal economic plants of the country are cacau, coffee, cassava (manioc) called "mandioca" in Brazil, Indian corn, beans, sweet potatoes, taro, sugar-cane, cotton and tobacco. Of these coffee and sugar-cane were introduced by Europeans.

Population.—The population of Venezuela is largely a matter of conjecture, no census having been taken since the third general census of 1891, which gave a total population of 2,323,527, of which 1,137,139 were males and 1,186,388 females, and there were 42,898 foreign residents. The official *Handbook of Venezuela* for 1904 estimated the population for the preceding year as 2,663,671. The population consists of a small percentage of whites of European descent, chiefly Spaniards, various tribes and settlements of Indians, largely of the Arawak and Carib families, and a large percentage of *mestizos*, or mixed bloods. There is a large admixture of African blood. Hübner estimates the mixed of all races at 93%, the highest among all the South American nationalities, and the creoles at 1% only; but this is clearly incorrect. Perhaps a closer approximation would be to rate the creole element (whites of European descent) at 10%, as in Colombia, and the mixed races at 70%, the remainder consisting of Africans, Indians and resident foreigners.

Territorial Divisions.—The territorial divisions of Venezuela have been subjected to many changes. Under the constitution of the 27th of April 1904, the republic was divided into 13 states, 1 federal district and 5 territories, the names of which are as follows, those of the capital cities being given in brackets: Federal District (Carácas and La Asunción); Aragua (La Victoria); Bermúdez (Cumana); Bolívar (Ciudad Bolívar); Carabobo (Valencia); Falcón (Coro); Guárico (Calabozo); Lara (Barquisimeto); Mérida (Mérida); Miranda (Ocumare); Táchira (San Cristóbal); Trujillo (Trujillo); Zamora (San Carlós); Zulia (Maracaibo), with the following territories: Amazonas (San Fernando de Atabapo); Colón (Gran Roque); Cristobal Colón (Cristobal Colón); Delta-Amacuro (San José de Amacuro); Yaruari (Guacipati).

On the 5th of August 1909, however, a new division was promulgated, giving 20 states, 1 federal district and 2 territories. Under this division some of the recognized administrative units were greatly altered in area or even abolished, and the capital status of several cities was apparently affected. The division was as follows: Federal District (Carácas); Anzoátegui (Barcelona); Apuré (San Fernando de Apuré); Aragua (La Victoria); Bolívar (Ciudad Bolívar); Carabobo (Valencia); Cojedes (San Carlós); Falcón (Coro); Guárico (Calabozo); Lara (Barquisimeto); Mérida (Mérida); Miranda (Ocumare); Monagas (Maturín); Nueva Esparta (La Asunción); Portuguesa (Guanare); Sucre (Cumaná); Táchira (San Cristóbal); Trujillo (Trujillo); Yaracuy (San Felipe); Zamora (Barinas); Zulia (Maracaibo), with the following territories: Amazonas (San Fernando de Atabapo); Delta-Amacuro (Tucupita).

Communications and Commerce.—There has been no great development of railway construction in Venezuela, partly on account of political insecurity and partly because of the backward industrial state of the country. In 1908 there were only 13 railway lines with a mileage of about 540 m., including the short lines from Carácas to El Valle and La Guaira to Maiquetia and Macuto, and the La Vela and Coro. The longest of these is the German line from Carácas to Valencia (111 m.), and the next longest the Great Táchira, running from Encontrada on Lake Maracaibo inland to Uracá (71 m.), with a projected extension to San Cristóbal. Another line in the Lake Maracaibo region is known as the Great La Ceiba, and runs from a point near the lake to the vicinity of Valera and Trujillo. An important line connects the thriving city of Barquisimeto with the port of Tucacas. The best known of the Venezuelan railways is the short line from La Guaira to Carácas (22¾ m.), which scales the steep sides of the mountain behind La Guaira and reaches an elevation of 3135 ft. before arriving at Carácas. It is a British enterprise, and is one of the few railways in Venezuela that pay a dividend. The Puerto Cabello and Valencia line (34 m.) is another British undertaking and carries a good traffic. A part of this line is built with a central cog-rail. Probably a return to settled political and industrial conditions in Venezuela will result in a large addition to its railway mileage, as a means of bringing the fertile inland districts into direct communication with the coast.

In steamship lines the republic has almost nothing to show. A regular service is maintained on Lake Maracaibo, one on Lake Valencia, and another on the Orinoco, Apuré and Portuguesa rivers, starting from Ciudad Bolívar.

The coast of Venezuela has an aggregate length of 1876 m., and there are 32 ports, large and small, not including those of Lakes Maracaibo and Tacarigua and the Orinoco. The great majority of these have only a limited commerce, restricted to domestic exchanges. The first-class ports are La Guaira, Puerto Cabello, Ciudad Bolívar, Maracaibo and Carupano, and the second-class are Sucre, Juan Griego, Guiria, Caño Colorado, Guanta, Tucacas, La Vela and Porlamar. The commerce of these ports, both in the foreign and domestic trade, is small, tariff regulations being onerous, and the people too impoverished to be consumers of much beyond the barest necessaries of life. The total foreign trade in 1908 amounted to $9,778,810 imports and $14,560,830 exports, the values being in U.S. gold. The exports to the United States were valued at $5,550,073 and to France $5,496,627. The principal exports were coffee, cacau, divi-divi, rubber, hides and skins, cattle and asphalt. The imports include manufactured articles of all kinds, hardware and building materials, earthenware and glassware, furniture, drugs and medicines, wines, foodstuffs, coal, petroleum and many other things. The coasting trade is largely made up of products destined for exportation, or imports trans-shipped from the first-class ports to the smaller ones which have no direct relations with foreign countries. In the absence of statistical returns it is impossible to give the values of this branch of trade. The exchanges of domestic products are less important than they should be. The Orinoco trade is carried on almost wholly through Port of Spain, Trinidad, where merchandise and produce is transferred between light draught river boats and foreign ocean-going steamers. The distance from Port of Spain to Ciudad Bolívar is 299 m. and the traffic is carried by foreign-owned steamers. Under the administration of President Cipriano Castro this traffic was suspended for a long time, and trans-shipments were made at La Guaira. Above Ciudad Bolívar transportation is effected by two or three small river steamers and a great number of small craft (*lauchas, bungos, balandras*, &c.), using sails, oars and punting poles.

Agriculture.—The principal industries of Venezuela are agricultural and pastoral. Both have suffered heavily from military operations, but still they have remained the basis of Venezuelan wealth and progress. Much the greater part of the republic is fertile and adapted to cultivation. Irrigation, which has not been used to any great extent, is needed in some parts of the country for the best results, but in others, as in the valleys and on the northern slopes of the Maritime Andes, the rainfall is sufficiently well distributed to meet most requirements. The long dry season of the *llanos* and surrounding slopes, which have not as yet been devoted to cultivation, will require a different system of agriculture with systematic irrigation. In colonial times the *llanos* were covered with immense herds of cattle and horses and were inhabited by a race of hardy, expert horsemen, the *llaneros*. Both sides in the War of Independence drew upon these herds, and the *llaneros* were among the bravest in both armies. The end of the war found the *llanos* a desert, both herds and herdsmen having nearly disappeared. Successive civil wars prevented their recovery, and these great plains which ought to be one of the chief sources of meat supply for the world are comparatively destitute of stock, and the only source of revenue from this industry is the small number of animals shipped to the West Indies. The breeding of goats and swine is an important industry in some regions. The climatic conditions are not so favourable as in Argentina, but these are counterbalanced to some extent by the great river system of the Orinoco, whose large navigable tributaries cross the plains from end to end, and whose smaller streams from the surrounding highlands provide superior opportunities for water storage and irrigation. On the *mesas* alfalfa could be substituted for the native grasses and be used for stock when the pasturage of the lower plains is not available. Other industries of the colonial period were the cultivation of indigo and tobacco. The former has nearly disappeared, but the latter is still one of the more important products of the country. The best known tobacco-producing localities are Capadare, Yaritagua, Mérida, Cumanacoa, Guanape, Guaribe and Barinas. The best quality is that from the Capadare district, in the state of Falcón, which rivals that of the Vuelta Abajo of Cuba. No effort is made to improve the Venezuelan product, a part of which is exported to Cuba for cigar making. The principal agricultural products are coffee, cacau (cacao), sugar, Indian corn and beans. Coffee was introduced from Martinique in 1784 and its exportation began five years later. It is grown at elevations of 1600 to 3000 ft., and the yield is reported to be $\frac{1}{4}$ to $\frac{1}{2}$ lb per tree, which is much less than the yield in São Paulo, Brazil. An official work (Veloz Goiticoa, *Venezuela*, Washington, 1904) gives the number of coffee trees in Venezuela as 250,000,000 belonging to 33,000 estates; the output was 42,806 tons in 1907. Several grades are produced in Venezuela, determined by geographical position, altitude and method of curing and preparing for market. The Maracaibo type from the mountain-slopes of Mérida, Trujillo and Táchira is perhaps the best known and brings the best price. Cacau (*Theobroma cacao*) is an indigenous product and is extensively cultivated on the Caribbean slopes. It requires a high temperature (about 80° F.), rich soil and a high degree of humidity for the best development of the tree. The tree has an average height of 12–13 ft., begins bearing five years after planting, requires little attention beyond occasional irrigation, bears two crops a year (June and December), and produces well until it is forty years of age—the yield being from 490 to 600 lb per acre of 100 trees. There are two grades of Venezuelan cacau—the *criollo* or native, and the *trinitario*, or Trinidad, the first being superior in quality. The best cacau comes from the vicinity of Carácas and is marketed under that name. The exportation of 1907 was about 14,000 tons. Sugar-cane is not indigenous, but it is cultivated with marked success in the lowlands of Zulia, and at various points on the coast. The industry, however, has not kept pace with its development in other countries and, in great part, still employs antiquated methods and machinery. Its principal product is "papelón," or brown sugar, which is put on the market in the shape of small cylindrical and cubical masses of $1\frac{3}{4}$ to $3\frac{1}{2}$ lb weight. This quality is the only one consumed in the country, with the exception of a comparatively small quantity of granulated, and of refined sugar in tablets prepared for people of the well-to-do classes. The annual output is about 3000 tons. Cotton was produced in several places in colonial times, but the output has declined to a few thousand pounds. The plant is indigenous and grows well, but, unlike cacau, it requires much manual labour in its cultivation and picking and does not seem to be favoured by the planters. Indian corn is widely grown and provides the staple food of the people, especially in the interior. Beans also are a common food, and are universally produced, especially the black bean. Wheat was introduced by the Spaniards immediately after their occupation of Venezuela, and is grown in the elevated districts of Aragua and the western states, but the production does not exceed home consumption. Rice is a common article of food and is one of the principal imports. Several states are offering bounties to encourage its cultivation at home. Other agricultural products are sweet potatoes, cassava (manioc), yuca, yams, white potatoes, maguey, okra, peanuts, pease, all the vegetables of the hot and temperate climates, oranges, lemons, limes, bananas, plantains, figs, grapes, coco-nuts, pine-apples, strawberries, plums, guavas, breadfruit, mangoes and many others. There are also many fruits found growing wild, like those of the cactus and various palms, and these are largely consumed. The forest products, whose collection and preparation form regular industries, are rubber (called *caucho* or *goma*), tonka beans, vanilla, copaiba, chique-chique, sarsaparilla, divi-divi, dye-woods, cabinet-woods and fibres. The rubber forests are on the Orinoco and its tributaries of the Guiana highlands.

Mining.—The principal minerals are gold, copper, iron, sulphur, coal, asphalt and petroleum. Silver, tin, lead, mercury and precious stones are listed among the mineral resources of the country, but no mines have been developed, and they are possibilities only. Gold is found throughout a wide area, but chiefly in the Yuruari region, about 100 m. S.W. of the principal mouth of the Orinoco and near the borders of British Guiana, where the famous El Callao mines are. These mines have produced as much as 181,040·2 Spanish oz. in one year (1886) and a total of 1,320,929·09 oz. from 1871 to 1890, while another report gives an output valued at $23,000,000 U.S. gold in the fifteen years from 1884 to 1899. The production since then has greatly declined. There are 14 copper mines in the country, those at Aroa, 70 m. W. of Puerto Cabello and in railway communication with Tucacas (89 m.), being the most productive. They date from 1605 and now belong to an English company. The output from 1878 to 1891 was 329,218 tons of ore and 53,053 tons of regulus, valued at £2,794,986. Iron of a good quality has been found in the Imataca region, Delta-Amacuro territory, 53 m. from the "Boca Grande" of the Orinoco. The principal coal deposits developed are at Naricual, near Barcelona, and a railway has been constructed to bring the output to the port of Guanta. Asphalt is taken from several deposits—from Maracaibo, Cumaná and Pedernales in the Orinoco delta. The latter place also yields petroleum. Sulphur is mined near Carúpano, and salt in Zulia and on the peninsula of Araya. The latter is a government monopoly, and the high prices at which it is sold constitute a serious prejudice to the people and to industries like that of meat packing.

Pearl Fisheries.—One of the oldest of Venezuelan industries, the Margarita pearl fisheries, was prohibited in 1909 for an indefinite time because of the threatened extinction of the oyster beds. The industry dates from the first exploration of this coast and was probably carried on before that by the natives. The fisheries are established about the islands of Margarita, Coche and Cubagua, the best producing beds being at El Tirano and Macanao, the first N.E. and the other N.W. of Margarita. The natives engaged in the fishery used some 400 sailboats of 3 to 15 tons capacity, and the beds were raked in search of pearl oysters. In 1900 a concession was granted for an exclusive right to fish for pearls, &c., between Margarita and the coast, the contractor to use submarine apparatus.

Manufactures.—There are few manufacturing industries in Venezuela, and these usually of the parasitic type, created by official favour and protected by high tariffs on imports in competition. The manufactures of this class include aerated waters, beer, candles, chocolate, cigarettes, cotton fabrics, hats, ice, matches, boots and shoes, drugs and medicines. There are a number of electric plants, three of which use water power, one at El Encantado, 10 m. from Carácas, one at Mérida, and the third at San Cristóbal, Táchira. The plants using steam for motive power are at Carácas, Maracaibo, Valencia and Puerto Cabello. There has been some development in the manufacture of agricultural machinery and implements, vehicles, pianos and furniture, and some older industries, such as tanning leather and the manufacture of saddles and harness, the milling of wheat and Indian corn, distilling, soap-making, &c. At Guanta there is a factory for the manufacture of patent fuel from Naricual coal and asphalt. In 1901 there was one *saladero*, or meat-packing establishment, in the Orinoco-Apuré region, but it did not prove successful because of the high cost of salt.

Government.—The government of Venezuela is that of a federal republic of nominally independent, self-governing states, administered according to the provisions of the constitution of the 27th of April 1904, modified or revised on the 5th of August 1909. The legislative power is nominally vested in a national Congress of two houses—the Senate and Chamber of Deputies—which meets at Carácas every two years on the 23rd of May, the session lasting 90 days. The Senate consists of two members from each state, or 40 members, who are elected by the state legislatures for a period of four years. A senator must be a native-born citizen and not less than thirty years of age. The Chamber consists of popular representatives, elected by direct vote, in the proportion of one deputy for each 35,000 of population, each state being entitled to at least one deputy, or two in case its population exceeds 15,000, the federal district and territories being entitled to representatives on the same terms. A deputy must also be a native-born citizen, not less than twenty-one years of age, and is elected for a period of four years.

The executive power is vested by the constitution in a president, two vice-presidents and a cabinet of ministers. The president and vice-presidents, who must be Venezuelans by birth and more than thirty years old, are elected by an electoral body or council composed of members of the national Congress, one member from each state and the Federal District. This council elects by an absolute majority of votes. The presidential term is four years (it was six years under the constitution of 1904), and the president cannot succeed himself. The powers of the executive, direct and implied, are very broad and permit the exercise of much absolute authority. The president is assisted by a cabinet of seven ministers and the governor of the federal district, their respective departments being interior, foreign relations, finance and public credit, war and marine, *fomento* (promotion), public works and public instruction. The ministers are required to countersign all acts relating to their respective departments, and are held responsible both before Congress and the courts for their acts. The department of *fomento* is charged with the supervision of all matters relating to agriculture, stock-raising, mines, industries, commerce, statistics, immigration, public lands, posts, telegraphs and telephones. The department of the interior is also charged with matters relating to the administration of justice, religion and public worship.

The judicial power is vested in a supreme federal court, called the Corte Federal y de Casación, and such subordinate tribunals as may be created by law. As the laws and procedure are uniform throughout the republic and all decrees and findings have legal effect everywhere, the state judicial organizations may be considered as taking the place of district federal courts, although the constitution does not declare them so. The federal court consists of 7 members, representing as many judicial districts of the republic, who are elected by Congress for periods of six years (Const. 1904), and are eligible for re-election. It is the supreme tribunal of the republic, having original jurisdiction in cases of impeachment, the constitutionality of laws, and controversies between states or officials. It is also a court of appeal (*Casación*) in certain cases, as defined by law. The judicial organization of the states includes in each a supreme court of three members, a superior court, courts of first instance, district courts and municipal courts. The judicial terms in the states are for three years. In the territories there are civil and criminal courts of first instance, and municipal courts. The laws of Venezuela are well codified both as to law and procedure, in civil, criminal and commercial cases.

The state governments are autonomous and consist of legislative assemblies composed of deputies elected by ballot for a period of three years (Const. 1904), which meet in their respective state capitals on the 1st of December for sessions of thirty days, and for each a president and two vice-presidents chosen by the legislative assembly for a term of three years. The states are divided into districts and these into *municipios*, the executive head of which is a *jefe politico*. There is a municipal council of seven members in each district, elected by the municipios, and in each municipio a communal junta appointed by the municipal council. The governors of the federal territories are appointees of the president of the republic, and the *jefe politico* of each territorial municipio is an appointee of the governor. The Federal District is the seat of federal authority, and consists of a small territory surrounding Carácas and La Guaira, known in the territorial division of 1904 as the West district, and the island of Margarita and some neighbouring islands, known as the East district.

There are two classes of citizens in Venezuela—native-born and naturalized. The first includes the children of Venezuelan parents born in foreign countries; the latter comprises four classes: natives of Spanish-American republics, foreign-born persons, foreigners naturalized through special laws and foreign women married to Venezuelans. The power of granting citizenship to foreigners is vested in the president of the republic, who is also empowered to refuse admission to the country to undesirable foreigners, or to expel those who have violated the special law (April 11, 1903) relating to their conduct in Venezuelan territory. The right of suffrage is exercised by Venezuelan males over 21 years of age, and all electors are eligible to public office except where the constitution declares otherwise. Foreign companies are permitted to transact business in Venezuela, subject to the laws relating to non-residents and also to the laws of the country governing national companies.

Army.—The military forces of Venezuela consist nominally of about 20 battalions of infantry, of 400 men each and 8 batteries of artillery, of 200 men each. There is also a battalion of marines employed about the ports and in the arsenals. The organization and equipment is defective, and the force deficient in numbers and discipline. The police force and fire companies in the larger cities are organized on a military basis, and are sometimes used for military purposes. For a people so accustomed to revolutionary outbreaks, the Venezuelans are singularly deficient in military organization. There is no lack of officers of the highest grades, but the rank and file are not uniformed, equipped or drilled, and military campaigns are usually irregular in character and of comparatively short duration. It should be said that Venezuela has a modern military organization so far as law can make it. It is drawn in imitation of European models, and makes military service compulsory for all Venezuelans between 21 and 50 years. This national force is divided into actives and reserves, the strength of the first being fixed by Congress, and all the rest, of unknown number, belong to the latter. The provisions of the law, however have never been enforced, and the actives or regular army are recruited by impressment rather than through conscription. There is a military academy at Carácas, and battalion schools are provided for officers and privates, but they are of little value.

Education.—In popular education Venezuela has done almost nothing worthy of record. As in Chile, Peru and Colombia, the ruling classes and the Church have taken little interest in the education of the Indians and *mestizos*. Venezuela, it is true, has a comprehensive public instruction law, and attendance at the public schools is both gratuitous and nominally compulsory. But outside the cities, towns and large villages near the coast there are no schools and no teachers, nor has the government done anything to provide them. This law has been in force since about 1870, but on the 30th of June 1908 there were only 1150 public schools in the republic with a total enrolment of 35,777 pupils. There are a number of parochial and conventual schools, the church being hostile to the public-school system. An overwhelming majority of the people is illiterate and is practically unconscious of the defect. In 1908 the educational facilities provided by the republic, not including some private subventioned schools, were two universities and thirty-three national colleges. The universities are at Carácas and Mérida, the latter known as the Universidad de los Andes. The Carácas institution dates from early colonial times and numbers many prominent Venezuelans among its alumni. The national college corresponds to the lyceum and high school of other countries. There are law, medical and engineering schools in the country, but one rarely hears of them. The episcopal seminaries are usually good, especially the one at Carácas. In addition to these, there are normal, polytechnic, mining and agricultural schools, the last at Carácas and provided with a good library and museum. There are several mechanics' schools (*Artes y Oficios*) in the larger cities, and a large number of private schools. Further educational facilities are provided by a national library with about 50,000 volumes, a national museum, with a valuable historical collection, the Cajigal Observatory, devoted to astronomical and meteorological work, and the Venezuelan Academy and National Academy of History—the first devoted to the national language and literature, and the second to its history.

Religion.—The Roman Catholic is the religion of the state, but freedom of worship is nominally guaranteed by law. The president, however, is empowered to deny admission into the country of foreigners engaged in special religious work not meeting his approval. Practically no other form of worship exists in the country than that of the Roman Catholic Church, the Protestant and other denominations holding their services in inconspicuous chapels or private apartments in the larger cities, where considerable numbers of foreigners reside. The state contributes to the support of the Church, builds its churches and provides for the salaries of its clergy, and at the same time it has the right to approve or reject all ecclesiastical appointments and to permit or forbid the execution of all decrees of the Roman See relating to Venezuela. The Church hierarchy consists of one archbishop (Carácas) and four suffragan bishops (Mérida, Guáyana, Barquisimeto and Guárico).

Finance.—The financial situation in Venezuela was for a long time extremely complicated and discreditable, owing to defaults in the payment of public debts, complications arising from the guarantee of interest on railways and other public works, responsibility for damages to private property during civil wars and bad administration. To meet increasing obligations, taxation has been extended and heavily increased. The public revenues are derived from customs taxes and charges on imports and exports, transit taxes, cattle taxes, profits on coinage, receipts from state monopolies, receipts from various public services such as the post office, telegraph, Carácas waterworks, &c., and sundry taxes, fines and other sources. From 60 to 70% of the revenue is derived from the custom-house, and the next largest source is the transit tax. The official budget returns for 1904–6 show the revenues and expenditures to have been—

	1904. *Bolívares.*	1905. *Bolívares.*	1906. *Bolívares.*
Revenue	57,576,741	49,385,379	49,293,067
Expenditure	52,925,521	54,718,163	51,874,694

A considerable part of the expenditure since 1903 consists of payments on account of foreign debts which Venezuela was compelled to satisfy. To meet these, taxes were increased wherever possible, thus increasing both sides of the budget beyond its normal for those years.

The public debt of Venezuela dates back to the War of Independence, when loans were raised in Europe for account of the united colonies of Colombia, Ecuador and Venezuela. The separation of the Colombian republic into its three original parts took place in 1830, and in 1834 the foreign debt contracted was divided among the three, Venezuela being charged with 28½%, or £2,794,826, of which £906,430 were arrears of interest. Other items were afterwards added to liquidate other obligations than those included in the above, chiefly on account of the internal debt. Several conversions and compositions followed, interest being paid irregularly. In 1880–81 there was a consolidation and conversion of the republic's foreign indebtedness through a new loan of £2,750,000 at 3%, and in 1896 a new loan of 50,000,000 *bolívares* (£1,980,198) for railway guarantees and other domestic obligations. In August 1904 these loans and arrears of interest brought the foreign debt up to £5,618,725, which in 1905 was converted into a "diplomatic" debt of £5,229,700 (3%). During these years Venezuela had been pursuing the dangerous policy of granting interest guarantees on the construction of railways by foreign corporations, which not only brought the government into conflict with them on account of defaulted payments, but also through disputed interpretations of contracts and alleged arbitrary acts on the part of government officials. In the civil wars the government was also held responsible for damages to these properties and for the mistreatment of foreigners residing in the country. Some of these claims brought Venezuela into conflict with the governments of Great Britain, Germany and Italy in 1903, and Venezuelan ports were blockaded and there was an enforced settlement of the claims (about £104,417), which were to be paid from 30% of the revenues of the La Guaira and Puerto Cabello custom-houses. This settlement was followed by an adjustment of all other claims, payment to be effected through the same channels. In 1908 (July 31) the total debt of Venezuela (according to official returns) consisted of the following items:—

	Bolívares.
Consolidated internal debt	63,171,818
Diplomatic debt (Spanish, French and Dutch) .	7,014,569
" " (French, 1903–4)	5,733,490
" " of 1905	132,049,925
Unconsolidated debt in circulation	4,561,742
Total .	212,531,544
or, at 25¼ *bolívares* per £,	£8,417,091

The currency of Venezuela is on a gold basis, the coinage of silver and nickel is restricted, and the state issues no paper notes. Foreign coins were formerly legal tender in the republic, but this has been changed by the exclusion of foreign silver coins and the acceptance of foreign gold coins as a commodity at a fixed value. Under the currency law of the 31st of March 1879, the thousandth part of a kilogramme of gold was made the monetary unit and was called a *bolívar*, in honour of the Venezuelan liberator. The denominations provided for by this law are—

Gold: 100, 50, 20, 10 and 5 *bolívares*.
Silver: 5, 2, 1 *bolívares*; 50, 20 *céntimos*.
Nickel: 12½ and 5 *céntimos*.

These denominations are still in use except the silver 20-*céntimos* piece, which was replaced by one of 25 *céntimos* in 1891. The silver 5-*bolívar* piece is usually known as a "dollar," and is equivalent to 48¼ pence, or 96½ cents U.S. gold. The old "peso" is no longer used except in accounts, and is reckoned at 4 *bolívares*, being sometimes described as a "soft" dollar. Silver and nickel are legal tender for 50 and 20 *bolívares* respectively. Paper currency is issued by the banks of Venezuela, Carácas and Maracaibo under the provisions of a general banking law, and their notes, although not legal tender, are everywhere accepted at their face value.

The metric weights and measures have been officially adopted by Venezuela, but the old Spanish units are still popularly used throughout the country. (A. J. L.)

History.—The coast of Venezuela was the first part of the American mainland sighted by Columbus, who, during his third voyage in 1498, entered the Gulf of Paria and sailed along the coast of the delta of the Orinoco. In the following year a much greater extent of coast was traced out by Alonzo de Ojeda, who was accompanied by the more celebrated Amerigo Vespucci. In 1550 the territory was erected into the captain-generalcy of Carácas, and it remained under Spanish rule till the early part of the 19th century. During this period negro slaves were introduced; but less attention was given by the Spaniards to this region than to other parts of Spanish America, which were known to be rich in the precious metals.

In 1810 Venezuela rose against the Spanish yoke, and on the 14th of July 1811 the independence of the territory was proclaimed. A war ensued which lasted for upwards of ten years and the principal events of which are described under **Bolivar** (*q.v.*), a native of Carácas and the leading spirit of the revolt. It was not till the 30th of March 1845 that the independence of the republic was recognized by Spain in the treaty of Madrid. Shortly after the battle of Carabobo (June 24, 1821), by which the power of Spain in this part of the world was broken, Venezuela was united with the federal state of Colombia, which embraced the present Colombia and Ecuador; but the Venezuelans were averse to the Confederation, and an agitation was set on foot in the autumn of 1829 which resulted in the issue of a decree (December 8) by General Paez dissolving the union, and declaring Venezuela a sovereign and independent state. The following years were marked by recurring attempts at revolution, but on the whole Venezuela during the period 1830–1846 was less disturbed than the neighbouring republic owing to the dominating influence of General Paez, who during the whole of that time exercised practically dictatorial power. In 1849 a successful revolution broke out and Paez was driven out of the country. The author of his expulsion, General José Tadeo Monagas, had in 1847 been nominated, like so many of his predecessors, to the presidency by Paez, but he was able to win the support of the army and assert his independence of his patron. Paez raised the standard of revolt, but Monagas was completely victorious. For ten years, amidst continual civil war, Monagas was supreme. The chief political incident of his rule was a decree abolishing slavery in 1854. General Juan José Falcon, after some years of civil war and confusion, maintained himself at the head of affairs from 1863 to 1868. In 1864 he divided Venezuela into twenty states and formed them into a Federal republic. The twenty parties whose struggles had caused so much strife and bloodshed were the Unionists, who desired a centralized government, and the Federalists, who preferred a federation of semi-autonomous provinces. The latter now triumphed. A revolt headed by Monagas broke out in 1868, and Falcon had to fly the country. In the following year Antonio Guzman Blanco succeeded in making himself dictator, after a long series of battles in which he was victorious over the Unionists.

For two decades after the close of these revolutionary troubles in 1870 the supreme power in Venezuela was, for all practical purposes, in the hands of Guzman Blanco. He evaded the clause in the constitution prohibiting the election of a president for successive terms of office by invariably arranging for the nomination of some adherent of his own as chief of the executive, and then pulling the strings behind this figurehead. The tenure of the presidential office was for two years, and at every alternate election Guzman Blanco was declared to be duly and legally chosen to fill the post of chief magistrate of the republic. In 1889 there was an open revolt against the dictatorial system so long in vogue; and President Rojas Paul, Blanco's *locum tenens*, was forced to flee the country and take refuge in the Dutch colony of Curaçoa. A scene of riot and disorder was enacted in the Venezuelan capital Statues of Blanco, which had been erected in various places in the city of Carácas, were broken by the mob, and wherever a portrait of the dictator was found it was torn to pieces. No follower of the Blanco regime was safe. An election was held and General Andueza Palacios was nominated president. A movement was set on foot for the reform of the constitution, the principal objects of this agitation being to prolong the presidential term to four years, to give Congress the right to choose the president of the republic, and to amend certain sections concerning the rights of persons taking part in armed insurrection arising out of political issues. All might have gone well for President Palacios had he not supposed that this extension of the presidential period might be made to apply to himself.

His attempt to force this question produced violent opposition in 1891, and ended in a rising headed by General Joaquin Crespo. This revolt, which was accompanied by severe fighting, ended in 1892 in the triumph of the insurgents, Palacios and his followers being forced to leave the country to save their lives. General Crespo became all-powerful; but he did not immediately accept the position of president. The reform of the constitution was agreed to, and in 1894 General Crespo was duly declared elected to the presidency by Congress for a period of four years. One of the clauses of the reformed constitution accords belligerent rights to all persons taking up arms against the state authority, provided they can show that their action is the outcome of political motives. Another clause protects the property of rebels against confiscation. Indeed, a premium on armed insurrection is virtually granted.

In April 1895 the long-standing dispute as to the boundary between British Guiana and Venezuela was brought to a crisis by the action of the Venezuelan authorities in arresting Inspectors Barnes and Baker, of the British Guiana police, with a few of their subordinates, on the Cuyuni river, the charge being that they were illegally exercising the functions of British officials in Venezuelan territory. Messrs Barnes and Baker were subsequently released, and in due course made their report on the occurrence. For the moment nothing more was heard of this boundary question by the public, but General Crespo instructed the Venezuelan minister in Washington to ask for the assistance of the United States in the event of any demand being made by the British Government for an indemnity. Whilst this frontier difficulty was still simmering, an insurrection against General Crespo was fomented by Dr J. P. Rojas Paul, the representative of the Blanco regime, and came to a head in October 1895, risings occurring in the northern and southern sections of the republic. Some desultory fighting took place for three or four months, but the revolt was never popular, and was completely suppressed early in 1896. The Guiana boundary question began now to assume an acute stage, the Venezuelan minister in Washington having persuaded President Cleveland to take up the cause of Venezuela in vindication of the principles of the Monroe doctrine. On the 18th of December 1895 a message was sent to the United States Congress by President Cleveland practically stating that any attempt on the part of the British Government to enforce its claims upon Venezuela as regards the boundary between that country and Guiana without resort to arbitration would be considered as a *casus belli* by his government. The news of this message caused violent agitation in Carácas and other towns. A league was formed binding merchants not to deal in goods of British origin; patriotic associations were established for the purpose of defending Venezuela against British aggression, and the militia were embodied. The question was subsequently arranged in 1899 by arbitration, and by the payment of a moderate indemnity to the British officers and men who had been captured. Diplomatic relations between the two countries, which had been broken off in consequence of the dispute, were resumed in 1897.

In 1898 General Crespo was succeeded as president by Señor Andrade, who had represented Venezuela in Washington during the most acute stage of the frontier question. Towards the end of the year a revolutionary movement took place with the object of ousting Andrade from power. The insurrection was crushed, but in one of the final skirmishes a chance bullet struck General Crespo, who was in command of the government troops, and he died from the effects of the wound. A subsequent revolt overthrew President Andrade in 1900. General Cipriano Castro then became president. During 1901 and 1902 the internal condition of the country remained disturbed, and fighting went on continually between the government troops and the revolutionists.

The inhabitants of Venezuela have a right to vote for the members of Congress, but in reality this privilege is not exercised by them. Official nominees are as a rule returned without any opposition, the details of the voting having been previously arranged by the local authorities in conformity with instructions from headquarters. In these circumstances the administration of public affairs fell into the hands of an oligarchy, who governed the country to suit their own convenience. President Castro was for eight years a dictator, ruling by corrupt and revolutionary methods, and in defiance of obligations to the foreign creditors of the country. The wrongs inflicted by him on companies and individuals of various nationalities, who had invested capital in industrial enterprises in Venezuela, led to a blockade of the Venezuelan ports in 1903 by English, German and Italian warships. Finding that diplomacy was of no avail to obtain the reparation from Castro that was demanded by their subjects, the three powers unwillingly had recourse to coercion. The president, however, sheltered himself behind the Monroe doctrine and appealed to the government of the United States to intervene. The dispute was finally referred by mutual consent to the Hague Court of Arbitration. The Washington government had indeed no cause to be well disposed to Castro, for he treated the interests of Americans in Venezuela with the same high-handed contempt for honesty and justice as those of Europeans. The demand of the United States for a revision of what is known as the Olcott Award in connexion with the Orinoco Steamship Company was in 1905 met by a refusal to reopen the case. Meanwhile the country, which up to the blockade of 1903 had been seething with revolutions, now became much quieter. In 1906, the president refused to allow M. Taigny, the French minister, to land, on the ground that he had broken the quarantine regulations. In consequence, France broke off diplomatic relations. In the following year, by the decision of the Hague Tribunal, the Venezuela government had to pay the British, German and Italian claims, amounting to £691,160; but there was still £840,000 due to other nationalities, which remained to be settled. The year 1907 was marked by the repudiation of the debt to Belgium, and fresh difficulties with the United States. Finally, in 1908 a dispute arose with Holland on the ground of the harbouring of refugees in Curaçoa. The Dutch Minister was expelled, and Holland replied by the despatch of gunboats, who destroyed the Venezuelan fleet and blockaded the ports. In December General Castro left upon a visit to Europe, nominally for a surgical operation. In his absence a rising against the dictator took place at Carácas, and his adherents were seized and imprisoned. Juan Vincenti Gomez, the vice-president, now placed himself at the head of affairs and formed an administration. He was installed as president in June 1910.

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VENGURLA, a seaport on the west coast of India in Ratnagiri district, Bombay. Pop. (1901) 19,018. It was an early site of both Dutch and English factories, and was formerly the port for communication with the garrisons in the Southern Mahratta country. In the neighbourhood are the "Burnt Islands," with the Vengurla Rock lighthouse.

VENICE (*Venezia*), a city and seaport of Italy, occupying one of the most remarkable sites in the world. At the head of the Adriatic, between the mountains and the sea, lies that part of the Lombard plain known as the Veneto. The whole of this plain has been formed by the *débris* swept down from the Alps by the rivers Po, Ticino, Oglio, Adda, Mincio, Adige, Brenta, Piave, Livenza, Tagliamento and Isonzo. The substratum of the plain is a bed of boulders, covered during the lapse of ages by a deposit of rich alluvial soil. The rivers when they debouch from the mountains assume an eastern trend in their effort to reach the sea. The result is that the plain is being gradually extended in an easterly direction, and cities like Ravenna, Adria and Aquileia, which were once seaports, lie now many miles inland. The encroachment of land on sea has been calculated at the rate of about three miles in a thousand years. A strong current sets round the head of the Adriatic from east to west. This current catches the silt brought down by the rivers and projects it in long banks, or *lidi*, parallel with the shore. In process of time some of these banks, as in the case of Venice, raised themselves above the level of the water and became the true shore-line, while behind them lay large surfaces of water, called lagoons, formed partly by the fresh water brought down by the rivers, partly by the salt-water tide which found its way in by the channels of the river mouths. Along the coast-line, roughly speaking between the Apennines at Rimini and the Carnic Alps at Trieste, three main systems of lagoons were thus created, the lagoon of Grado or Marano to the east, the lagoon of Venice in the middle, and the lagoon of Comacchio to the south-west (for plan, see HARBOUR). All three are dotted with small islands, possibly the remains of some earlier *lido*. These islands are little else than low mud banks, barely rising above the water-level. On a group of these mud banks about the middle of the lagoon of Venice stands the city of Venice. It would be difficult to imagine a site less adapted for the foundation and growth of a great community. The soil is an oozy mud which can only be made capable of carrying buildings by the artificial means of pile-driving; there is no land fit for agriculture or the rearing of cattle; the sole food supply is fish from the lagoon, and there is no drinking-water save such as could be stored from the rainfall. Yet the group of islands called Rialto, in mid-Venetian lagoon, were first the asylum and then the magnificent and permanent home of a race that took a prominent part in the medieval and Renaissance history of Europe. The local drawbacks and difficulties once surmounted, Venice by her geographical position became the seaport nearest the heart of Europe.

Ethnography and Early History.—As to the ethnography of the race little is known that is certain. It has frequently been said that the lagoon population was originally composed of refugees from the mainland seeking asylum from the incursions of Huns, Goths and Lombards; but it is more probable that, long before the date of the earliest barbarian inroad, the lagoon islands already had a population of fisherfolk. In any case we may take it that the lagoon-dwellers were racially identical with the inhabitants of the neighbouring mainland, the Heneti or Veneti. That the Heneti themselves were immigrants is generally admitted. The earlier ethnographers, like Strabo, put forward three theories as to the original home of the race. Strabo himself talks of Armoric Heneti, and supposes them to have come from the neighbourhood of Brittany; another theory gives us Sarmatian Heneti, from the Baltic provinces; while the most widely accepted view was that they reached Italy from Paphlagonia. Modern scholarship has rejected these theories. Pauli and Kretschmer, proceeding on the basis of language, have reached conclusions which in the main are identical. Pauli, who has published all the known inscriptions of the Heneti, holds that the language is Illyrian, closely connected with Messapian. Kretschmer goes further and divides the Illyrian language into two sharply defined dialects, the northern dialect being represented by the Heneti. The result is that in the present condition of our knowledge we must conclude that the Heneti were a branch of the Illyrian people. The Eneti of Paphlagonia, the Veneti of Brittany and the Venedi of the Baltic, are probably quite distinct, and the similarity of name is merely a coincidence.

The dwellings of the primitive settlers in the lagoons were, in all probability, rude huts made of long reeds, such as may be seen to this day in the lagoon of Grado. A ditch was cut deep into the mud so as to retain the water at low tide, and there the boats of the fishermen lay. The ground about the hut was made solid and protected from corrosion by a palisade of wattled osiers, thus creating the earliest form of the *fondamenta*, or quay, which runs along the side of so many Venetian canals and is so prominent a feature in the construction of the city. Gradually, as time went on, and probably with the influx of refugees from the mainland, bricks made of lagoon mud came to take the place of wattle and reeds in the construction of the houses. Groups of dwellings, such as are still to be seen on some of the small canals at Burano, clustered together along the banks of the deeper channels which traverse the lagoon islands and give access to the tide. It is these channels which determined the lines of construction; the dwellings followed their windings, and that accounts for the extraordinarily complex network of calles and canals which characterizes modern Venice. The alleys or *calli* number 2327, with a total length of $89\frac{3}{4}$ m.; the canals number 177 and measure 28 m. The whole site of Venice is dominated by the existence of one great main canal, the Grand Canal, which, winding through the town in the shape of the letter S, divides it into two equal parts. This great canal was probably at one time the bed of a river flowing into the lagoons near Mestre. The smaller canals all serve as arteries to the Grand Canal. One other broad canal, once the bed of the Brenta, divides the island of the Giudecca from the rest of the city and takes its name from that island. The ordinary Venetian house was built round a courtyard, and was one storey high; on the roof was an open *loggia* for drying clothes; in front, between the house and the water, ran the *fondamenta*. The earliest churches were built with cemeteries for the dead; and thus we find the nucleus of the city of Venice, little isolated groups of dwellings each on its separate islet, scattered, as Cassiodorus[1] says, like sea-birds' nests over the face of the waters. Some of the islets were still uninhabited, covered with a dense low growth which served as cover for game and even for wolves.

With the destruction of the mainland cities by repeated barbarian invasions, and thanks to the gradual development of Venice as a centre of coasting trade in the northern Adriatic, the aspect of the city changed. Brick and more rarely stone took the place of wood and wattle. The assaults of the Dalmatian pirates, attracted by the growing wealth of the city, necessitated the building of strong castellated houses, of which no example has come down to our day, but we may gather what they were like from Petrarch's description of his house on the Riva degli Schiavoni, with its two flanking towers, probably retaining the primitive form, and also from the representations of protecting towers which occur in Carpaccio's pictures. The canals too were guarded by chains stretched across their mouths and by towers in some cases, as, for example, in the case of the Torresella Canal, which takes its name from these defence works. These houses clustered round the churches which now began to be built in considerable numbers, and formed the various *contrade* of the city. The *Cronica altinate* in the vision of Fra Mauro gives us a picturesque account of the founding of the various parishes, Olivolo or Castello, St Raffaello, St Salvadore, Sta Maria Formosa, S. Giovanni in Bragora, the Apostoli and Sta Giustina. Tradition has it that the earliest church in Venice was S. Giacomo di Rialto, said to have been founded in 432. The canals between these clusters of houses were deepened and cleared out, and in some cases trees were planted along the banks, or *fondamenta*; we hear of the cypresses on San Giorgio Maggiore, of an ancient mulberry tree at San Salvadore, of a great elder tree near the Procuratie Vecchie where the magistrates were wont to tie their horses. There were vineyards and orchards (*broli*) on land reclaimed from the sea, and lying between the various clusters of houses, which had not yet been consolidated into one continuous city. The canals were crossed by wooden bridges without steps, and in the case of the wide Grand Canal the bridge at Rialto was carried on boats. Gradually, however, stone bridges came into use. The earliest of these was the bridge of San Zaccaria, mentioned in a document of 1170. The Rialto bridge was designed in 1178 by Nicolo Barattieri, and was carried on pontoons. In 1255 and 1264 it was rebuilt, still in wood. It was carried on beams and could be raised in the middle, as we see it in Carpaccio's picture of "The Miracle of the Cross." The present bridge, the work of Antonio or Giovanni Contino, whose nickname was da Ponte, dates from 1588–91, and cost 250,000 ducats. The same architect was responsible for the lofty "Bridge of Sighs" (1595–1605), connecting the ducal palace with the state prisons (1591–97) on the opposite side of the narrow canal on the east of the Rio del Palazzo.

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[1] Secretary to Theodoric the Great, in a letter dated A.D. 523.

The early bridges were inclined planes and could easily be crossed by horses. It was not till the city became more populous and when stone-stepped bridges were introduced that the use of horses died out. As late as 1365 the Doge Lorenzo Celsi owned a famous stud of chargers, and in 1490 the Doge Michele Steno's stables, where the present Zecca stands, were famous throughout Italy. In 1392 a law put an end to riding in the Merceria, on account of the crowd, and all horses and mules were obliged to carry bells to warn foot-passengers. The lanes and alleys of the early city were unpaved and filthy with slops from the houses. But in the 13th century the Venetians began to pave the more frequented streets with brick. Ferries or *traghetti* for crossing the canals were also established as early as the 13th century; we find record of ferries at San Gregorio, San Felice, San Tomà, San Samuele, and so on, and also of longer ferries to the outlying islands like Murano and Chioggia, or to the mainland at Mestre and Fusina. The boatmen early erected themselves into gilds.

Gondolas.—The characteristic conveyances on the canals of Venice—which take the place of cabs in other cities—are the gondolas, flat-bottomed boats, some 30 ft. long by 4 or 5 ft. wide, curving out of the water at the ends, with ornamental bow and stern pieces and an iron beak (*ferro*), resembling a halberd, which is the highest part of the boat. The gondolier stands on a *poppa* at the stern with his face towards the bow, and propels the gondola with a single oar. There is a low cabin (*felze*) for passengers; the ordinary gondolas can take four or six persons, and larger ones (*barca* or *battello*) take eight. Gondolas are mentioned as far back as 1094, and, prior to a sumptuary edict passed by the great council in the 16th century, making black their compulsory colour, they were very different in appearance from now. Instead of the present boat, with its heavy black cabin and absence of colouring, the older forms had an awning of rich stuffs or gold embroideries, supported on a light arched framework open at both ends; this is the gondola still seen in Carpaccio's and Gentile Bellini's pictures (*c.* 1500). Since 1880 services of omnibus steamers (now municipal) have also been introduced.

Byzantine Architecture.—We can trace the continuous growth of Venice through the successive styles of Byzantine, Gothic, early Renaissance and late Renaissance architecture. The whole subject is magnificently treated in Ruskin's *Stones of Venice.* The two most striking buildings in Venice, St Mark's and the Doge's Palace, at once give us an example of the two earlier styles, the Byzantine and the Gothic, at least in their general design, though both are so capricious in development and in decoration that they may more justly be considered as unique specimens rather than as typical examples of their respective styles. In truth, owing to its isolated position on the very verge of Italy, and to its close connexion with the East, Venetian architecture was an independent development. Though displaying a preponderance of Oriental characteristics, it retained a quality of its own quite unlike the styles evolved by other Western countries.

The Byzantine style prevailed in Venice during the 11th and 12th centuries. The arches of this period are semicircular and usually highly stilted. Sculptured ornamentation, flowing scroll-work of semi-conventional foliage mingled with grotesque animals, birds or dragons, is freely applied to arches and string courses. The walls are built of solid brickwork and then covered with thin slabs of rich and costly marbles. Sculptured panels, with conventional motives, peacocks, eagles devouring hares, peacocks drinking from a cup on a tall pillar, are let into both exterior and interior walls, as are roundels of precious marbles, sawn from columns of porphyry, serpentine, verd antique, &c. The adoption of veneer for decoration prohibited any deep cutting, and almost all the sculpture is shallow. Only in the capitals, which are of extraordinary richness and variety, do we get any deep or bold relief. Dentil mouldings, of which examples may still be seen in the remains of the palace of Blachernae at Constantinople, are characteristic of Venetian ornamentation at this period, and remain a permanent feature in Venetian architecture down to the 11th century. The dome is the leading idea or motif in Byzantine ecclesiastical architecture; the domes are placed over square, not circular apartments, and their bases are brought to a circle by means of pendentives. In exterior elevation the chief effect is produced by the grouping of the domes. In the interior the effect is gained by broad masses of chromatic decoration in marble-veneer and mosaics on a gold ground to cover the walls and vaults, and by elaborate pavements of *opus sectile* and *opus Alexandrinum.* Owing to the marshy site the foundations of buildings in Venice offered considerable difficulties. A trench was dug in the soft upper mud until the stratum of stiff blue clay was reached. Piles of elm, oak, white poplar or larch were driven into this clay to the depth of 16 to 20 ft. or until absolute resistance was encountered. The heads of the piles were from 10 to 11 in. in diameter and they were driven in almost in contact. On this surface of pile heads was laid a platform of two layers of squared oak beams; and on this again the foundations proper were built. In some cases, however, as for example in the ducal palace itself, if the clay appeared sufficiently firm, the piles were dispensed with and the foundations went up directly from the oak platform which rested immediately on the clay. During the middle ages the walls of Venetian buildings were constructed invariably of brick. They were usually solid, but in some cases they were built *a sacco*—that is to say, two thin outer walls were built and the space between them was filled with grouted rubble. The delicate creamy Istrian stone, which is now so prominent a feature in Venetian architecture, did not come into common use till after the 11th century, when the Istrian coast became permanently Venetian. Before 1405 the mortar used in Venice was made of lime from Istria, which possessed no hydraulic qualities and was consequently very perishable, a fact which to a large extent accounts for the fall of the Campanile of San Marco. But when Venice took possession of the mainland her builders were able to employ a strong hydraulic dark lime from Albettone, which formed a durable cement, capable of resisting salt water and the corrosive sea air.

St Mark's.

The church of St Mark's, originally the private chapel of the doge, is unique among the buildings of the world in respect of its unparalleled richness of material and decoration. It grew with the growing state whose religious centre it was, and was adorned with the spoils of countless other buildings, both in the East and on the Italian mainland. A law of the republic required every merchant trading to the East to bring back some material for the adornment of the fane. Indeed, the building has been compared to the treasure den of a gang of "sea sharkers," and from a museum of sculpture of the most varied kind, nearly every century from the 4th down to the latest Renaissance being represented. The present church is the third on this site. Soon after the concentration at Rialto (see *History* below), a small wooden church was erected about the year 828 for the reception of the relics of St Mark, which had been brought from Alexandria when the Moslems pulled down the church where he was buried. St Mark then became the patron saint of Venice in place of St Theodore. This church was burned in 976 along with the ducal palace in the insurrection against the Doge Candiano IV. Pietro Orseolo and his successors rebuilt the church on a larger scale in the form of a basilica with three eastern apses and no transept, and Byzantine workmen were employed. As the state grew in wealth and importance the church grew with it. About the year 1063 the Doge Contarini resolved to remodel St Mark's. There can be no doubt that Byzantine artists had a large share in the work, but it is equally certain that Lombard workmen were employed along with the Orientals, and thus St Mark's became, as it were, a workshop in which two styles, Byzantine and Lombard, met and were fused together, giving birth to a new style, peculiar to the district, which may fairly be called Veneto-Byzantine.

In plan (see the article ARCHITECTURE) St Mark's is a Greek cross of equal arms, covered by a dome in the centre, 42 ft. in diameter, and by a dome over each of the arms. The plan is derived from the Church of the Holy Apostles at Constantinople, now covered by the mosque of Mahommed II., and bears a strong resemblance to the plan of St Front at Périgueux in France (1120). The addition of a narthex before the main front and a vestibule on the northern side brings the whole western arm of the cross to a square on plan. In elevation the façade seems to have connexion with the five-bayed façade of the Kahriyeh Jamè, or mosaic mosque, at Constantinople. The exterior façade is enriched with marble columns brought from Alexandria and other cities of the East, and bearing in many cases incised graffiti. Mosaics are employed to decorate the spandrils of the arches. Only one of the original mosaics now exists, the one over the doorway at the north-western, or St Alipio, angle. Its subject, which is of high historical value as a record of costume, represents the translation of the body of St Mark, and gives us a view of the west façade of the church as it was at the beginning of the 13th century before the addition of the ogee gables, with alternating crockets and statues, and the intermediate pinnacled canopies placed between the five great arches of the upper storey. The top of the narthex forms a wide gallery, communicating with the interior at the triforium level. In the centre of this gallery stand the four colossal bronze horses which belonged to some Graeco-Roman triumphal quadriga, and were brought to Venice by the Doge Enrico Dandolo after the fall of Constantinople in 1204; they were carried off by Napoleon to Paris in 1797, and restored by Francis of Austria in 1815.

Mosaic is the essential decoration of the church, and the architectural details are subordinated to the colour scheme. These mosaics belong to very various dates. The Doge Domenico Selvo began the decoration of the church in 1071, though it is uncertain whether any of his work can be now identified. The mosaics of the domes would seem to belong to the 12th century, probably before 1150. The mosaics of the atrium date from 1200 to 1300; the subjects are taken from Old Testament story. The baptistery mosaics represent the life of St John. The mosaics in the chapel of St Isidore (finished by Andrea Dandolo), giving us the life of the saint, were executed in 1355. In the sacristy is a series of 10th-century mosaics, and in other parts of the church are inferior and later mosaics from cartoons by later Venetian masters. Below the mosaics the walls and arches are covered with rare marbles, porphyries and alabaster from ancient columns sawn into slices and so arranged in broad bands as to produce a rich gamut of colour.

The eastern crypt, or *confessio*, extends under the whole of the choir and has three apses, like the upper church. The body of St Mark formerly rested here, but is now within the high altar. Below the nave is another crypt. The floors of both crypts have sunk considerably and are often under water; this settlement accounts for the inequalities of the pavement. The original part of the magnificent mosaic pavement probably dates from the middle of the 12th century, if we may judge from the pavement at Murano, exactly similar in style, material and workmanship, which bears the date 1140. The pavement consists partly of *opus Alexandrinum* of red and green porphyry mixed with marbles, partly of tesselated work of glass and marble tesserae.

The choir stands about 4 ft. above the nave and is separated from it by a marble rood-screen, on the architrave of which stand fourteen figures, the signed work of Jacobello and Pietro Paolo delle Masegne, 1394.

The Pala d'oro, or retable of the high altar, is one of the chief glories of St Mark's. It is one of the most magnificent specimens of goldsmiths' and jewellers' work in existence. It was ordered in 976 at Constantinople by the Doge Pietro I. Orseolo, and was enlarged and enriched with gems and modified in form, first by a Greek artificer in 1105, and then by Venetians between 1209 and 1345. It is composed of figures of Christ, angels, prophets and saints, in Byzantine enamel run into gold plates. It is about 11 ft. 6 in. wide, and about 4 ft. 8 in. high. It contains 1300 great pearls, 400 garnets, 90 amethysts, 300 sapphires, 300 emeralds, 15 rubies, 75 balas rubies, 4 topazes, 2 cameos; the gems, except where they have been replaced, are cut *en cabochon*. The treasury of St Mark's contains a magnificent collection of church plate and jewels.

Byzantine palaces.

Fine examples of Venetian Byzantine palaces—at least of the façades—are still to be seen on the Grand Canal and in some of the small canals. The interiors have been modified past recognition of their original disposition. The Byzantine palace seems to have had twin angle-towers—*geminas angulares turres*—such as those of the Ca' Molin on the Riva degli Schiavoni, where Petrarch lived. The restored (1880) Fondaco[1] dei Turchi (13th century), now the Museo Civico, also has two angle-towers. The façades presented continuous colonnades on each floor with semicircular high stilted arches, leaving a very small amount of wall space. The buildings were usually battlemented in fantastic form. A good specimen may be seen in Lazzaro Sebastiani's picture of the piazzetta, in the Museo Civico. There on the right we see the handsome building of the old bakery, occupying the site of the present library; it has two arcades of Saracenic arches and a fine row of battlements. Other specimens still in existence are the municipal buildings, Palazzo Loredan and Palazzo Farsetti—if, indeed, these are not to be considered rather as Romanesque—and the splendid Ca' da Mosto, all on the Grand Canal. The richest ornamentation was applied to the arches and string courses, while plaques of sculpture, roundels and coats of arms adorned the façades. The remains of a Byzantine façade now almost entirely built into a wall in the Rio di Ca' Foscari offer us excellent illustration of this decorative work.

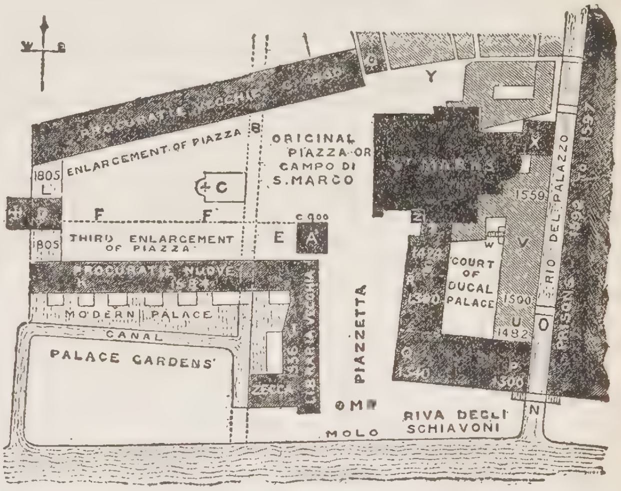

FIG. 1.—Square of St Mark and surrounding buildings. The original *campo* was bounded on the west by the canal B, with the 6th-century church of S. Geminiano, C, on its west bank. The first enlargement of the square was effected by Doge Sebastiano Ziani in 1176, when he filled up the canal and rebuilt the church on a new site at D, thus nearly doubling the size of the square. Lastly, the square was extended southwards in the 16th century, when the new palace of the procurators, K, was built by Scamozzi. Gentile Bellini's picture shows a line of houses along FF, reaching up to the great campanile, A. Napoleon I. in 1805–10 pulled down the church of S. Geminiano and built a new block at the west end of the square, L. The dates of the various parts of the existing ducal palace are indicated on the plan; the rebuilding was carried on in the following order, P, Q, R, S, T, U, V. At Z is the treasury of St Mark, which was originally one of the towers belonging to the old ducal palace; E, site of old houses; G, clock-tower; H, old palace of procurators; J, old library; M, two columns; N, Ponte della Paglia; O, Bridge of Sighs; W, Giants' Staircase; X, sacristy of St Mark; Y, Piazzetta.

Gothic Architecture.—Venetian Gothic, both ecclesiastical and domestic, shares most of the characteristics of north Italian Gothic generally, though in domestic architecture it displays one peculiarity which we shall presently note. The material, brick and terra-cotta, is the determining cause of the characteristics of north Italian Gothic

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[1] This palace was originally the property of the Pesaro family, and afterwards of the duke of Este, and finally of the republic, which used it as a dwelling-place for royal guests before letting it to Turkish merchants. The word *Fondaco* (derived through Arabic from the Greek πανδοχεῖον), as applied to some of the Venetian palaces, denotes the mercantile headquarters of a foreign trading nation. Those still existing are the Turkish and the German (*F. de' Tedeschi*), the latter now converted into the post office.

Flatness and lack of deep shadows, owing to the impossibility of obtaining heavy cornices in that material, mark the style. The prevalence of sunlight led to a restriction of the windows and exaggeration of wall space. The development of tracery was hindered both by the material and by the relative insignificance of the windows. On the other hand, the plastic quality of terracotta suggested an abundance of delicate ornamentation on a small scale, which produced its effect by its own individual beauty without broad reference to the general scheme. Coloured marbles and frescoes served a like purpose. The exteriors of the north Italian Gothic churches are characterized by the flatness of the roof; the treatment of the west façade as a mere screen wall, masking the true lines of the aisle roofs; the great circular window in the west front for lighting the nave; the absence of pinnacles owing to the unimportance of the buttresses; the west-end porches with columns resting on lions or other animals. The peculiarity of Venetian domestic Gothic to which we have referred is this: we frequently find tracery used to fill rectangular, not arched, openings. The result is that the tracery itself has to support the structure above it—is, in fact, constructional—whereas in most other countries the tracery is merely, as it were, a pierced screen filling in a constructional arch. Hence the noticeable heaviness of Venetian tracery.

The ducal palace.

The ducal palace, like St Mark's, is a symbol and an epitome of the race which evolved it. Soon after the concentration at Rialto the doge Angelo Particiaco began an official residence for the head of the state. It was probably a small, strongly fortified castle; one of its massive angle-towers is now incorporated in St Mark's and serves as the treasury. During the earlier years of the republic the ducal palace was frequently destroyed and rebuilt. It was burnt in 976 and again in 1106. At the close of the 12th century (1173–1179), Sebastian Ziani restored and enlarged the palace. Of his work some traces still remain in the richly sculptured bands built in at intervals along the 14th-century façade on the Rio, and part of the handsome larch-wood beams which formed the loggia of the piazzetta façade, still visible on the inner wall of the present loggia. The present magnificent building was a slow growth extending over three centuries and expanding gradually as the republic grew in riches.

The palace as we now see it was begun about 1300 by Doge Pietro Gradenigo, who soon after the closing of the great council gave its permanent form to the Venetian constitution. It is therefore, in a sense, contemporaneous with the early manhood of the state. Gradenigo built the façade along the Rio. About 1309 the arcaded façade along the lagoon front was taken in hand, and set the design for the whole of the external frontage of the palace. Towards the end of the 14th century, this façade, with its lower colonnade, upper loggia with handsome Gothic tracery, and the vast impending upper storey, which give to the whole building its striking appearance and audacious design, had been carried as far as the tenth column on the piazzetta side. At this point, perhaps out of regard for the remains of Ziani's palace, the work seems to have been arrested for many years, but in 1424 the building was resumed and carried as far as the north-west, or judgment, angle, near St Mark's, thus completing the sea and piazzetta façades as we now see them. The great gateway, the Porta della Carta, was added in 1439–42 from designs by Bartholomeo Buono (or Bon) and his son. The block of buildings in the interior, connecting the Porta della Carta to the Rio wing, was added about 1462 by the doge Cristoforo Moro. In 1479 a fire consumed the earlier buildings along the Rio, and these were replaced (1480–1550) by the present Renaissance structure.

The two main façades, those towards the sea and the piazzetta, consist of a repetition of the same design, that which was begun in the early years of the 14th century. The name of the architect who began the work and thus fixed the design of the whole is not certainly known, but it must have been a man of an earlier generation than that of Filippo Calendario, who is often stated to have been the chief architect of the older portion. Calendario was an accomplice in the conspiracy of Marino Faliero, and was executed together with the doge in 1355. It appears probable that a Venetian architect and sculptor named Pietro Baseggio was the chief master-builder in the first half of the 14th century. The design of these façades is very striking and unlike that of any other building in the world. It consists of two storeys with open colonnades, forming a long loggia on the ground and first floors, with seventeen arches on the sea front and eighteen on the other façade. Above this is a lofty third storey, pierced with a few large windows, with pointed arches once filled with tracery, which is now lost. The whole surface of the ponderous upper storey is covered with a diaper pattern in slabs of creamy white Istrian stone and red Verona marble, giving a delicate rosy-orange hue to the building. Very beautiful sculpture, executed with an ivory-like minuteness of finish, is used to decorate the whole building with wonderful profusion. At each of the three free angles is a large group immediately over the lower column. At the south-east angle is the "Drunkenness of Noah," at the south-west the "Fall of Man," and at the north-west the "Judgment of Solomon." Over each, at a much higher level, is a colossal figure of an archangel—Raphael, Michael and Gabriel.

The great internal court is surrounded with arcading. From the interior of the court access is given to the upper loggia by a very beautiful staircase of early Renaissance style, built in the middle of the 15th century by Antonio Rizzo. Two colossal statues of Neptune and Mars at the top of these stairs were executed by Jacopo Sansovino in 1554—hence the name "giants' staircase." Owing to a fire which gutted a great part of the palace in 1574, the internal appearance of the rooms was completely changed, and the fine series of early Paduan and Venetian paintings which decorated the walls of the chief rooms was lost. At present the magnificent council chambers for the different legislative bodies of the Venetian republic and the state apartments of the doges are richly decorated with gilt carving and panelling in the style of the later Renaissance. On the walls of the chief council chambers are a magnificent series of oil-paintings by Tintoretto and other less able Venetians—among them Tintoretto's masterpiece, "Bacchus and Ariadne," and his enormous picture of Paradise, the largest oil-painting in the world.

Gothic churches.

Among the many Gothic churches of Venice the largest are the Franciscan church of Santa Maria Gloriosa dei Frari (1250–1280), and the Dominican church of SS. Giovanni e Paolo (1260–1400). The Frari is remarkable for its fine choir-stalls and for the series of six eastern chapels which from outside give a very good example of Gothic brickwork, comparable with the even finer apse of the now desecrated church of San Gregorio. The church of SS. Giovanni e Paolo was the usual burying-place of the doges, and contains many noble mausoleums of various dates. Besides these two churches we may mention Santo Stefano, an interesting building of central Gothic, "the best ecclesiastical example of it in Venice." The apse is built over a canal. The west entrance is later than the rest of the edifice and is of the richest Renaissance Gothic, a little earlier than the Porta della Carta.

Gothic palaces.

But it is in the domestic architecture of Venice that we find the most striking and characteristic examples of Gothic. The introduction of that style coincided with the consolidation of the Venetian constitution and the development of Venetian commerce both in the Levant and with England and Flanders. The wealth which thus accrued found architectural expression in those noble palaces, so characteristic of Venice, which line the Grand and smaller canals. They are so numerous that we cannot do more than call attention to one or two.

The most striking example is undoubtedly the Ca' d' Oro, so called from the profusion of gold employed on its façade. It was built for Marino Contarini in 1421, rather a late period in the development of the style.

Marino kept a minute entry of his expenses, a document of the highest value, not merely for the history of the building, but also for the light it throws on the private life of the great patricians who gave to Venice such noble examples of art. Contarini was to some extent his own architect. He had the assistance of Marco d' Amadeo, a master-builder, and of Matteo Reverti, a Milanese sculptor, who were joined later on by Giovanni Buono and his son Bartolomeo. Other artists, of whom we know nothing else, such as Antonio Busetto, Antonio Foscolo, Gasparino Rosso, Giacomo da Como, Marco da Legno and others, were called in to help in evolving this masterpiece of decorated architecture, affording us an example of the way in which the ducal palace and other monuments of Venice grew out of the collaboration of numerous nameless artists. By the year 1431 the façade was nearly completed, and Contarini made a bargain with Martino and Giovanni Benzon for the marbles to cover what was yet unfinished. The façade is a triumph of graceful elegance; so light is the tracery, so rich the decoration, so successful the breach of symmetry which gives us a wing upon the left-hand side but none upon the right. But Contarini was not content to leave the marbles as they were. He desired to have the façade of his house in colour. The contract for this work, signed with Master Zuan de Franza, conjures up a vision of the Ca' d' Oro ablaze with colour and gleaming with the gold ornamentation from which it took its name.

Other notable examples of this style are the Palazzo Ariani at San Raffaelle, with its handsome window in a design of intersecting circles; the beautiful window with the symbols of the four Evangelists in the spandrils, in the façade of a house at San Stae; the row of three Giustinian palaces at S. Barnaba; the Palazzo Priuli at San Severo, with a remarkably graceful angle-window, where the columnar mullion carries down the angle of the wall; the flamboyant balconies of the Palazzo Contarini Fasan; the Palazzo Bernardo on a side canal near S. Polo, a late central Gothic building (1380–1400) which Ruskin describes as "of the finest kind and superb in its effect of colour when seen from the side. Taken as a whole, after the ducal palace this is the noblest effect of all in Venice."

Early Renaissance.—Towards the close of the 15th century Venetian architecture began to feel the influence of the classical revival; but, lying far from Rome and retaining still her connexion with the East, Venice did not fall under the sway of the classical ideals either so quickly or so completely as most Italian cities. Indeed, in this as in the earlier styles, Venice struck out a line for herself and developed a style of her own, known as Lombardesque, after the family of the Lombardi (Solari) who came from Carona on the Lake of Lugano and may be said to have created it.

The essential point about the style is that it is intermediary between Venetian Gothic and full Renaissance. We find it retaining some traces of Byzantine influence in the decorated surfaces of applied marbles, and in the roundels of porphyry and verd antique, while it also retained certain characteristics of Gothic, as, for instance, in the pointed arches of the Renaissance façade in the courtyard of the ducal palace designed by Antonio Rizzo (1499). Special notes of the style are the central grouping of the windows, leaving comparatively solid spaces on each side, which gives the effect of a main building with wings; the large amount of window space; the comparative flatness of the façades; the employment of a cornice to each storey; the effect of light and shade given by the balconies; and in churches by the circular pediments on the façades.

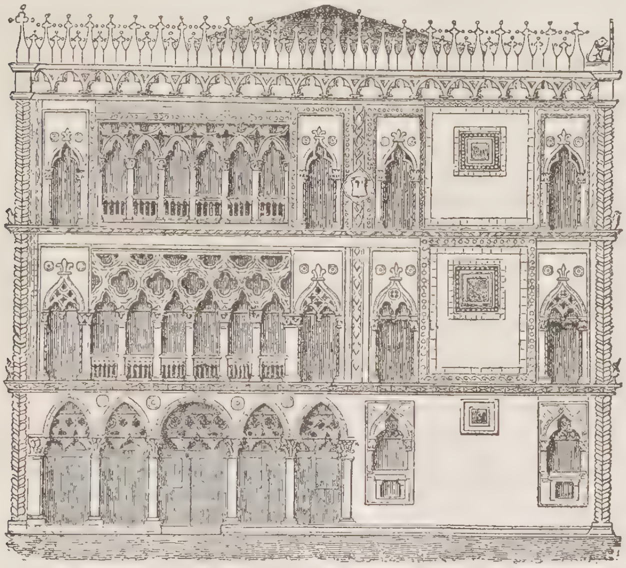

FIG. 2.—Ca' d' Oro, as originally built.

Churches.

The most perfect example of this style in ecclesiastical architecture is the little church of the Miracoli built by Pietro Lombardo in 1480. The church is without aisles, and has a semicircular roof, and the choir is raised twelve steps above the floor of the nave. The walls, both internally and externally, are encrusted with marbles. The façade has the characteristic circular pediment with a large west window surrounded by three smaller windows separated by two ornamental roundels in coloured marble and of geometric design. Below the pediment comes an arcade with flat pilasters, which runs all round the exterior of the church. Two of the bays contain round-headed windows; the other three are filled in with white marble adorned by crosses and roundels in coloured marble. The lower order contains the flat pilastered portal with two panelled spaces on each side.

Similar results are obtained in the magnificent façade of the Scuola di San Marco, at SS. Giovanni e Paolo, which has six semicircular pediments of varying size crowning the six bays, in the upper order of which are four noble Romanesque windows. The lower order contains the handsome portal with a semicircular pediment, while four of the remaining bays are filled with quaint scenes in surprisingly skilful perspective. The façade of San Zaccaria (1457–1515), the stately design of Anton Marco Gambello and Mauro Coducci, offers some slight modifications in the use of the semicircular pediment, the line of the aisle roof being indicated by quarter-circle pediments abutting on the façade of the nave. San Salvadore, the work of Tullio Lombardo (1530), is severer and less highly ornamented than the preceding examples, but its plan is singularly impressive, giving the effect of great space in a comparatively small area. In this connexion we must mention the Scuola of S. Giovanni Evangelista at the Frari, with its fore-court and screen adorned by pilasters delicately decorated with foliage in low relief, and its noble staircase whose double flights unite on a landing under a shallow cupola. This also was the work of Pietro Lombardo and his son Tullio.

Palaces.

Early Renaissance palaces occur frequently in Venice and form a pleasing contrast with those in the Gothic style. The Palazzo Dario with its dedication, *Urbis genio*, the superb Manzoni-Montecuculi-Polignac, with its friezes of spread-eagles in low relief, and the Vendramini-Calergi or *Non nobis* palace, whose façade is characterized by its round-headed windows of grouped twin lights between columns, are among the more important; though beautiful specimens, such as the Palazzo Trevisan on the Rio della Paglia, and the Palazzo Corner Reali at the Fava, are to be found all over the city.

Library of San Marco.

Later Renaissance.—When we come to the fully developed Renaissance, architecture in Venice ceases to possess that peculiarly individual imprint which marks the earlier styles. It is still characterized by great splendour; indeed, the library of San Marco, built by Jacopo Sansovino in 1536, is justly considered the most sumptuous example of Renaissance architecture in the world. It is rich, ornate, yet hardly florid, distinguished by splendid effects of light and shade, obtained by a far bolder use of projections than had hitherto been found in the somewhat flat design of Venetian façades. The columned, round-headed windows are set in deeply between the pillars which carry the massive entablature, and this again is surmounted by a balustrade with obelisks at each angle and figures marking the line of each bay. The Istrian stone of which the edifice is built has taken a fine patina, which makes the whole look like some richly embossed casket in oxidized silver.

The full meaning of the change which had come over Venetian architecture, of the gulf which lies between the early Lombardesque style, so purely characteristic of Venice, and the fully developed classical revival, which now assumed undisputed sway, may best be grasped by comparing the old and the new Procuratie. Not more than eighty years separate these two buildings; the old Procuratie were built by Bartolomeo Buono about 1500, the new by Scamozzi in 1580, yet it is clear that each belongs to an entirely different world of artistic ideas. The Procuratie Vecchie is perhaps the longest arcaded façade in the world and certainly shows the least amount of wall space; the whole design is simple, the moulding and ornamentation severe. The Procuratie Nuove, which after all is merely Scamozzi's continuation of Sansovino's library, displays all the richness of that ornate building.

Churches.

Among the churches of this period we may mention San Geminiano, designed by Sansovino, and destroyed at the beginning of the 19th century to make room for the ball-room built by Napoleon for Eugène Beauharnais. The churches of San Giorgio Maggiore and of the Redentore, a votive church for liberation from the plague, are both by Palladio. In 1632 Baldassare Longhena built the fine church of Santa Maria della Salute, also a votive church, erected by the state to commemorate the cessation of the plague of 1630. This noble pile, with a large and handsome dome, a secondary cupola over the altar, and a striking portal and flight of steps, occupies one of the most conspicuous sites in Venice on the point of land that separates the mouth of the Guidecca from the Grand Canal. In plan it is an octagon with chapels projecting one on each side. The volute buttresses, each crowned with a statue, add quaintly but happily to the general effect. After Longhena's date church architecture in Venice declined upon the dubious taste of baroque; the façades of San Moisè and of Santa Maria del Giglio are good specimens of this style.

Palaces.

The palaces of the later Renaissance are numerous and frequently grandiose though frigid in design. The more remarkable are Sansovino's Palazzo Corner, Longhena's massive and imposing Palazzo Pesaro, the Palazzo Rezzonico, from designs by Longhena with the third storey added by Massari, Sammicheli's Palazzo Corner at San Polo, and Massari's well-proportioned and dignified Palazzo Grassi at San Samuele, built in 1740.

Modern Buildings.—In recent times the general prosperity of the city, which is on the ascendant, has brought about a revival of domestic and civic architecture. The architects Rupolo and Sardi have erected a considerable number of buildings, in which they have attempted, and with considerable success, to return either to Venetian Gothic or to the early Renaissance Lombardesque style. The most striking of these modern buildings are the new wing of the Hotel d'Italie, San Moisè, and the very successful fish market at Rialto, designed by Laurenti and carried out by Rupolo, in which a happy return to early Venetian Gothic has been effected in conjunction with a skilful adaptation of one of the most famous of the old houses of Venice, the Stalòn, or palace of the Quirini family.

Gild Halls.—Among the most remarkable buildings in Venice are the *scuole*, or gild halls, of the various confraternities. They were pious foundations created for mutual benefit and for purposes of charity. The *scuole* were divided into the six *scuole grandi*, so called from their numbers, wealth and privileges, and the *scuole minori* or *fraglie*, which in most cases were associated with an art or craft. The *scuole minori* were usually attached to some church in the quarter where the particular trade flourished. They had their special altar dedicated to the patron of the gild, a private burying-place, and a room in which they held their chapter. The six *scuole grandi*, San Teodoro, S. Maria della Carità, S. Giovanni Evangelista, San Marco, della Misericordia and San Rocco, on the other hand, built themselves magnificent gild halls. We have already mentioned two of these, the Scuola di San Giovanni Evangelista and the Scuola di San Marco, both of them masterpieces of the Lombardesque style. The Scuola di San Marco is now a part of the town hospital, and besides its façade, already described, it is remarkable for the handsome carved ceiling in the main hall (1463). Other beautiful ceilings are to be found in the great hall and the hall of the Albergo in the Scuola della Carità, now the Accademia. They are the work of Marco Cozzi of Vicenza and were executed between 1461 and 1464. The design of the former is a trellis crossing the ceiling diagonally; in each of the lacunae is carved a cherubim with eight wings; the figures and the trellis are gilded; the ground is a rich ultramarine. But the most magnificent of these gild halls is the Scuola di San Rocco, designed by Bartolomeo Buono in 1517 and carried out by Scarpagnino and Sante Lombardo. The façade on the Campo is large and pure in conception. The great staircase and the lower and upper halls contain the unrivalled series of paintings by Tintoretto, which called forth such unbounded enthusiasm on the part of Ruskin.

Campanili.—Among the more striking features of Venice we must reckon the *campanili* or bell-towers (see CAMPANILE). These were at one time more numerous than at the present day; earthquakes and subsidence of foundations have brought many of them down, the latest to fall being the great tower of San Marco itself, which collapsed on July 14th, 1902. Its reconstruction was at once undertaken, and completed in 1910. In a few other cases, for example at San Giorgio Maggiore, the fallen campanili were restored; but for the most part they were not replaced. The Venetian campanile usually stands detached from the church. It is almost invariably square; the only examples of round campanili in this part of Italy are to be found at Ravenna and at Caorle to the east of Venice; while inside Venice itself the solitary exception to the square plan was the campanile of San Paternian, built in 999 and now demolished, which was a hexagon. The campanile is usually a plain brick shaft with shallow pilasters running up the faces. It has small angle-windows to light the interior inclined plane or staircase, and is not broken into storeys with grouped windows as in the case of the Lombard bell-towers. Above the shaft comes the arcaded bell-chamber, frequently built of Istrian stone; and above that again the attic, either round or square or octagonal, carrying either a cone or a pyramid or a cupola, sometimes surmounted by a cross or a gilded angel which serves as a weathercock. Cressets used to be kept burning at night on some of the campanili to serve as beacons for those at sea. Among the existing campanili the oldest are San Geremia, dating from the 11th century, San Samuele from the 12th, San Barnaba and San Zaccaria from the 13th. The campanile of S. Giovanni Elemosinario at Rialto (1398–1400) is called by Ruskin "the most interesting piece of central Gothic remaining comparatively intact in Venice."

Public Monuments.—Venetian sculpture is for the most part ancillary to architecture; for example, Antonio Rizzo's "Adam" and "Eve" (1464), which face the giants'-staircase in the ducal palace, are parts of the decorative scheme; Sansovino's splendid monument to Tomaso Rangone is an essential feature of the façade of San Giuliano. The most successful Venetian sculpture is to be found in the many noble sepulchral private monuments. The jealousy of the Venetian republic forbade the erection of monuments to her great men. The sole exception is the superb equestrian statue in honour of the General Bartolomeo Colleoni, which stands on the Campo SS. Giovanni e Paolo. By his will Colleoni left his vast fortune to Venice on condition that a monument should be raised to him at St Mark's. He meant the great piazza, but by a quibble the republic evaded the concession of so unique an honour and claimed to have fulfilled the conditions of the bequest by erecting the monument at the Scuola of St Mark. The republic entrusted the work to the Florentine Verrocchio, who dying before the statue was completed begged the government to allow his pupil Lorenzo di Credi to carry it to a conclusion. The Venetians, however, called in Alessandro Leopardi, who cast the great equestrian group and added the pure and graceful pedestal. The monument was unveiled on the 21st of March 1496. Leopardo was also the creator (1505) of the three handsome bronze sockets in front of St Mark's which held the flagstaffs of the banners of Cyprus, Morea and Crete, when the republic was mistress of those territories.

By the side of the sea in the piazzetta, on to which the west façade of the ducal palace faces, stand two ancient columns of Egyptian granite, one red and the other grey. These great monoliths were brought as trophies to Venice by Doge Domenico Michieli in 1126, after his victories in Syria. In 1180 they were set up with their present fine capitals and bases by a Lombard engineer, Niccolo de' Barattieri. The grey column is surmounted by a fine bronze lion of Byzantine style, cast in Venice for Doge Ziani about 1178 (this was carried off to Paris by Napoleon in 1797, and sent back in pieces in 1816; but in 1893 it was put together again); and in 1329 a marble statue of St Theodore, standing upon a crocodile, was placed on the other column. Among modern monuments the most successful is that to Goldoni at San Bartolomeo near the Rialto. It is the work of the sculptor dal Zotto.

The arsenal.

Institutions.—Perhaps the most famous institution of Venice is the arsenal, whose history and activity has continued unbroken from the earliest days of the republic down to the present time. The arsenal was founded about the year 1104 by the doge Ordelap Falier. Before that date Venetian shipping was built at the spot near the piazzetta, known as the *terra nova*, where the royal gardens now are. The arsenal, which was famous in Dante's day, received its first enlargement in 1304, when, on the design of Andrea Pisano, new building sheds and the rope walk or *Tana* were erected. Pisano's building sheds, nine in a row, with peculiarly shaped roofs, were still standing intact—one of the most interesting medieval monuments of Venice—until recently, but they have been modified past recognition. In 1325 the second addition, the *arsenale nuovo*, was made, and a third, the *arsenale nuovissimo*, in 1473; a fourth, the *Riparto delle Galeazze*, about 1539; and in 1564 the fifth enlargement, the *Canal delle Galeazze e Vasca*, took place. After the fall of the republic the arsenal continued to occupy the attention of the various governments. In 1810 the site of the suppressed convent and church of the Celestia was added. The entire circuit of the arsenal, about two miles in extent, is protected by a lofty wall with turrets. The main door of the arsenal is the first example in Venice of the purely classical style. It is a noble portal, erected in 1460, apparently from designs by Fra Giocondo, with the lion of St Mark in the attic. The statuary, with Sta Giustina on the summit of the tympanum, was added in 1571 and 1578. The whole design was modified in 1688 so as to represent a triumphal arch in honour of Morosini Peloponnesiaco, who brought from Athens to Venice the four lions in Pentelic marble which now stand before the gate. (On the largest of these lions is cut a runic inscription recording an attack on the Piraeus in the 11th century by Norse warriors of the Varangian guard, under Harold Hardrada, afterwards—1047—king of Norway.) The arsenal suffered frequently and severely from fires, the worst being those of 1509 and 1569; yet such was the wealth of Venice that in the following year she put upon the seas the fleet that crushed the Turks at Lepanto in 1571.

The Lido.

The Lido, which lies about 2 m. S.E. of Venice and divides the lagoon from the sea, is rapidly becoming a fashionable bathing-place. The point of San Nicolò del Lido is strongly fortified to protect the new entrance to the port (see harbour). Inside the fortress lies the old Protestant burying-ground, with tombs of Sackville, of John Murray, of Sir Francis Vincent, last ambassador but one from Great Britain to the republic, of Consul Smith, whose collection of books forms the nucleus of the King's library in the British Museum, and of Catherine Tofts, the singer, Smith's first wife. At Sant' Elisabetta is the bathing establishment.

Libraries.—The library of San Marco contains upwards of 35,000 printed volumes and about 10,000 manuscripts. The library is said to owe its origin to Petrarch's donation of his books to the republic. Most of these have now disappeared. In 1635 Fra Fortunato Olmo found in a room over the great door of St Mark's a number of books which he supposed to be Petrarch's gift. He sent a list to Tomasini, who published it in his *Petrarca Redivivus* (Patavii, 1635). These codices passed to the Marciana, and Zanetti catalogued them as the *Fondo antico*. It is very doubtful whether these books really belonged to Petrarch. We may date the true foundation of the library to the donation of Cardinal Bessarion. Bessarion had intended to bequeath his books to the Benedictines of San Giorgio Maggiore, but Pietro Morosini, Venetian ambassador at Rome, pointed out the inconvenience of housing his library on an island that could not easily be reached. The cardinal therefore obtained a bull from Pope Paul II., permitting him to recall his original donation, and in a letter dated from the baths of Viterbo, May 13th, 1468, he made over his library to the republic. The principal treasures of the collection, including splendid Byzantine book-covers, the priceless codices of Homer, the Grimani Breviary, an early Dante, &c., are exhibited under cases in the Sala Bessarione in the Zecca or mint where the library has been installed. Another library was left to the public by the munificence of Count Quirini-Stampalia, who bequeathed his collections and his house at Santa Maria Formosa to be held in trust for students. The state archives are housed in the Franciscan monastery at the Frari. They contain the voluminous and invaluable records of the Venetian republic, diplomatic, judicial, commercial, notarial, &c. Under the republic the various departments of state stored their records in various buildings, at the ducal palace, at the Scuola di San Teodoro, at the Camerlenghi. The Austrian government gathered all these into one building and arranged the vast masses of papers in fairly convenient order. Though the state papers of Venice have suffered from fire and the series begins comparatively late, yet their fullness and the world-wide sweep of Venetian interests render this collection an inexhaustible storehouse of data for students. Among other learned institutions we may mention the Ateneo Veneto, the Deputazione per la Storia Patria, and the Royal Institute of Science, Letters and Art, which has its seat in the Palazzo Loredan at Santo Stefano.

Harbour.—Under the republic commercial shipping used to enter Venice by the port of San Nicolò del Lido and lie along the quay called the Riva degli Schiavoni, in the basin of San Marco, and up the broad Giudecca Canal. But with the decline of Venice the trade of the port fell off; the mouth of the Lido entrance became gradually silted up owing to the joint action of the tide and the current, and for many years complete stagnation characterized the port. Under Austrian rule a revival began, which has been continued and intensified since Venice became part of united Italy. When the railway bridge brought Venice into touch with the mainland and the rest of Europe, it became necessary to do something to reopen the harbour to larger shipping. The Austrians, abandoning the nearer Lido entrance to the lagoons, resolved to deepen and keep open the Malamocco entrance. This is 8 m. distant from Venice, and can only be reached by a long and tortuous channel across the lagoon, whose course is marked out by those groups of piles which are so characteristic a feature of the lagoon landscape. The channel required constant dredging and was altogether inconvenient; yet for many years it remained the main sea approach to Venice. A dock was constructed at the western or farther end of the Giudecca Canal, near the railway. The unification of Italy, the growing prosperity of the country, above all the opening of the Suez Canal, which restored to Venice the full value of her position as the port farthest into the heart of Europe, brought about an immense expansion of trade. The government accordingly resolved to reopen the Lido entrance to the lagoon, and thus to afford a shorter and more commodious access from the sea. As at the Malamocco entrance so at the Lido, two moles were run out in a south-westerly direction; the westerly is about 2 m., the easterly about 3 m. in length. The natural scour thus created has given a depth of 26 ft. of water through the sand-bank. The mean rise and fall of the tide is about 2 ft., but under certain conditions of wind the variation amounts to 5 ft. and over. The health of the city depends, of course, to a large extent on this ebb and flow. The government also turned its attention to the inadequate accommodation at the docks, and proposals for a new quay on the western side of the present basin, and for a second basin 900 yds. long and 170 yds. wide, were the result.

Trade.—A comparison between the exports and imports of the years 1886 and 1905 will give an exact idea of the rate at which the port of Venice developed. In 1886 the total value of exports to foreign countries amounted to £7,239,479; of imports, £8,788,012. In 1905 the exports to foreign countries valued £11,650,932, the imports £13,659,306. As has been the case throughout her history, the trade of Venice is still mainly a transit trade. Wheat, coal, cotton, petroleum, wood, lime and cement are brought into Venice for shipment to the Levant or for distribution over Italy and Europe.

Venice became very celebrated in the 15th century for textiles. Its damasks and other silk stuffs with patterns of extraordinary beauty surpassed in variety and splendour those of the other chief centres of silk-weaving, such as Florence and Genoa. In addition to the native stuffs, an immense quantity of costly Oriental carpets, wall-hangings and other textiles was imported into Venice, partly for its own use, and partly for export throughout western Europe. On occasions of festivals or pageants the balconies, the bridges, the boats, and even the façades of the houses, were hung with rich Eastern carpets or patterned textiles in gold and coloured silk. The glass manufactory of Murano (*q.v.*), a small island about 1½ m. to the north of Venice, was a great source of revenue to the republic. Glass drinking cups and ornamental vessels, some decorated with enamel painting, and "silvered" mirrors were produced in great quantities from the 14th century downwards, and exported. Like many other arts in Venice, that of glass-making appears to have been imported from Moslem countries, and the influence of Oriental design can be traced in much of the Venetian glass. The art of making stained-glass windows was not practised by the Venetians; almost the only fine glass in Venice is that in a south transept window in the Dominican church, which, though designed by able Venetian painters, is obviously the work of foreigners.

The ancient glass-bead industry (*conterie*), which some years since suffered severely from over-production, has now regained its position through the union of the different factories, by which the output is controlled in such a way as to render trade profitable. Venetian beads are now sent in large quantities to the various colonies in Africa, and to India, Sumatra and Borneo. Similarly, the glass industry has revived. New amalgams and methods of colouring have been discovered, and fresh forms have been diligently studied. Special progress has been made in the production of mirrors, electric lamps, candelabra and mosaics. New industries are those of tapestry, brocades, imitation of ancient stuffs, cloth of silver and gold, and Venetian laces. The secret of lace-making was believed to have been lost, but the late Signor Fambri discovered at Chioggia an old woman who knew it, and placed her at the head of a lace school. Fambri was ruined by his enterprise, but other manufacturers, more expert than he, drew profit from his initiative, and founded flourishing factories at Pellestrina and Burano. Other important industries are wood-carving (of an artistic excellence long unknown), artistic iron-working, jewelling, bronze-casting, the production of steam-engines, machinery, matches (largely exported to Turkey, Egypt, Russia, Austria-Hungary and Greece), clock-making, wool-weaving and the manufacture of chemical manures.

Population.—In 1548 the population of Venice numbered 158,069; in 1607–29, 142,804; in 1706, 140,256; in 1785, 139,095; in 1881, 132,826. The municipal bulletin of the 31st of December 1906 gives a total of 169,563, not including 4835 soldiers.

Administration.—Venice is administered by a prefect representing the crown and responsible to the central government at Rome, from whom he receives orders. Under his cognizance come questions of public order, health and elections to parliament. The two arms of the police, the Carabinieri and the Publica Sicurezza, are at his disposal. Purely local matters, however, are in the hands of the municipio or town council. At the head of the town council is the Sindaco or mayor, elected by the council itself.

Under the republic, and until modern times, the water supply of Venice was furnished by the storage of rain-water supplemented by water brought from the Brenta in boats. The famous Venetian *pozzi*, or wells for storing rain-water from the roofs and streets, consisted of a closed basin with a water-tight stratum of clay at the bottom, upon which a slab of stone was laid; a brick shaft of radiating bricks laid in a permeable jointing material of clay and sand was then built. At some distance from the shaft a square water-tight wall was built, and the space between it and the shaft was filled in with sand, which was purified of all saline matter by repeated washings; on the ground-level perforated stones set at the four corners of the basin admitted the rain-water, which was discharged from the roofs by lead pipes; this water filtered through the sand and percolated into the shaft of the well, whence it was drawn in copper buckets. The present water supply, introduced in 1884, is brought from the commune of Trebaseleghe, where it is collected from 120 artesian wells. It is carried under the lagoon to Sant' Andrea, where the reservoirs are placed.

Of the 19,000 houses in Venice only 6000 have drains and sinks, all the others discharge sewage through pipes directly or indirectly into the canals. With the rise and fall of the tide the discharge pipes are flushed at the bottom. An important investigation undertaken by the Bacterioscopical Laboratory, with regard to the pollution of the Venetian canals by the city sewage, led to the discovery that the water of the lagoons possesses auto-purifying power, not only in the large canals but even in the smallest ramifications of the waterways. The investigation was carried out with scrupulous scientific rigour upon samples of water taken in every part of the city, at all states of the tide and under various atmospheric conditions.

The church is ruled by the patriarch of Venice, the metropolitan of the province formed by the Veneto. The patriarch of Venice is usually raised to the purple. The patriarchate dates from 1451, when on the death of Domenico Michiel, patriarch of Grado, the seat of that honour was transferred from desolate and insalubrious Grado to the cathedral church of Castello in Venice, and Michiel's successor, Lorenzo Giustinian, assumed the title of patriarch of Venice. On the fall of the republic St Mark's became the cathedral church of the patriarch. There are thirty parishes in the city of Venice and fifteen in the lagoon islands and on the littoral.

In recent times there has been a good deal of activity in Venice in regard to the preservation of its artistic and architectural treasures. Some of the earlier activity was unfortunately misplaced. St Mark's suffered on two occasions: first during the restoration of the north façade in 1843, and again during that of the south façade, begun in 1865 and finished in 1878. The latter façade was completely reconstructed upon 2200 piles driven to great depths, with the result that the general harmony of the monument—the effect of time and of atmospheric conditions—was completely lost. A lively agitation all over Europe, and particularly in England (conducted by Ruskin and William Morris), led the Italian government to discard the Austrian plan of restoration, at least as regards the interior of the Basilica, and to respect the ancient portions which had stood the test of time and had escaped "renewal" by man. In 1880 a Vigilance Committee was appointed to watch over the restoration of the interior. The committee secured much *verde antico* and porphyry for the restoration of the pavement, in place of the common marbles which it had been intended to use, and organized special workshops for the restoration and preservation of the ancient mosaics, which it had been intended to detach and replace. Pieces already detached were restored to their original positions, and those blackened by damp and dust were carefully cleaned. Breaks were filled up with cubes obtained from fragments of contemporary mosaics previously demolished. In this way the mosaics of the two arches of the atrium and those of the Zeno chapel were cleaned and preserved.

Contemporaneously with the restoration of the southern façade of St Mark's, the restoration of the colonnade of the ducal palace towards the Piazzetta and the Mole was undertaken at a cost of £23,000. The chief work was executed at the south-west angle, where the columns of the arcade had become so broken and distorted as to menace the safety of the whole building. The corner towards the Ponte della Paglia was also restored, and the hideous device of walling up the five last arches, adopted in the 16th century by the architect Da Ponte, was removed without prejudice to the stability of the structure. In order to lighten the palace the Venetian Institute of Science, Letters and Arts removed its headquarters and its natural history collection to Santo Stefano. For the same reason the Biblioteca Marciana with its 350,000 volumes was moved to the Old Mint, opposite the ducal palace. The space thus cleared has been used for the rearrangement of the Archaeological and Artistic Museum. Side by side with these changes has proceeded the reorganization of the Royal Gallery of Ancient Art, which, created by Napoleon I. for the students of the adjoining Academy of Fine Arts, gradually acquired such importance that in 1882 the government divided it from the academy and rendered it autonomous. The gallery now constitutes a unique collection of Venetian paintings from the most ancient artists down to Tiepolo, one hall only being reserved for other Italian schools and one for foreign schools. Altogether the gallery contains twenty rooms, one being assigned to the complete cycle of the "History of Saint Ursula," by Carpaccio; another to Giambellino and to the Celliniani; and a whole wall of a third being occupied by the famous Veronese, "Il Convito in casa di Levi." Titian's "Presentazione al Tempio," painted for the Scuola della Carita, which is now the seat of the gallery, has been placed in its original position. The hall of the Assumption has been left untouched. Nineteenth-century pictures have been eliminated as foreign to the character of the collection, and inferior works relegated to a side passage. The reorganization of the Archaeological and Artistic Museum and of the Royal Gallery of Ancient Art coincided with the inauguration in April 1895 of a series of biennial International Art Exhibitions, arranged in order to celebrate the silver wedding of the king and queen of Italy. A special brick structure was erected in the public gardens to receive the works of contemporary artists, both Italian and foreign. The selection of works was made by an international jury from which Venetian artists were excluded. The second exhibition, visited by 336,500 persons, was held in 1897, and a third in 1899. The success of this exhibition (visited by 407,930 persons) led to the organization of a fourth exhibition in 1901, largely devoted to the works of Ruskin. The institution of these exhibitions furnished Prince Giovanelli with an opportunity to found at Venice a Gallery of Modern Art, for which a home was found in the Palazzo Pesaro, bequeathed to the city by Princess Bevilacqua la Masa.

History.—It is usually affirmed that the state of Venice owes its origin to the barbarian invasions of north Italy; that it was founded by refugees from the mainland cities who sought asylum from the Huns in the impregnable shallows and mud banks of the lagoons; and that the year 452, the year when Attila sacked Aquileia, may be taken as the birth-year of Venice. That is true in a measure. Venice, like Rome and other famous cities, was an asylum city. But it is nearly certain that long before Attila and his Huns swept down upon the Venetian plain the little islands of the lagoon already had a population of poor but hardy fisherfolk living in quasi-independence, thanks to their poverty and their inaccessible site. This population was augmented from time to time by refugees from the mainland cities of Aquileia, Concordia, Opitergium Altinum and Patavium. But these did not mingle readily with the indigenous population; as each wave of barbarian invasion fell back, these refugees returned to their mainland homes, and it required the pressure of many successive incursions to induce them finally to abandon the mainland for the lagoon, a decision which was not reached till the Lombard invasion of 568. On each occasion, no doubt, some of the refugees remained behind in the islands, and gradually built and peopled the twelve lagoon townships, which formed the germ of the state of Venice and were subsequently concentrated at Rialto or in the city we now know as Venice. These twelve townships were Grado, Bibione, Caorle, Jesolo, Heraclea, Torcello, Murano, Rialto, Malamocco, Poveglia, Chioggia and Sottomarina. The effect of the final Lombard invasion is shown by the resolve to quit the mainland and the rapid building of churches which is recorded by the *Cronaca altinate*. The people who finally abandoned the mainland and took their priests with them are the people who made the Venetian republic. But they were not as yet a homogeneous population. The rivalries of the mainland cities were continued at closer quarters inside the narrow circuit of the lagoons, and there was, moreover, the initial schism between the indigenous fisher population and the town-bred refugees, and these facts constitute the first of the problems which now affronted the growing community: the internal problem of fusion and development. The second problem of prime importance was the external problem of independence. The early history of the republic is chiefly concerned with the solution of these two problems.

To take the problem of independence first. There is little doubt that the original lagoon population depended for its administration, as far as it had any, upon the larger cities of the mainland. There is a tradition that Venice was founded by "consuls from Padua"; and Padua claimed complete control of the course of the Brenta down to its mouth at Malamocco. The destruction of the mainland cities, and the flight of their leading inhabitants to the lagoons, encouraged the lagoon population to assert a growing independence, and led them to advance the doctrine that they were "born independent." Their development as a maritime people, engaged in small trading and intimately acquainted with their home waters, led Belisarius to seek their help in his task of recovering Italy from the Goths. He was successful; and the lagoons became, theoretically at least, a part of the Eastern empire. But the empire was vast and weak, and its capital lay far away; in practice, no doubt, the lagoon population enjoyed virtual independence, though later the Byzantine claim to suzerainty became one of the leading factors in the formation of the state. It was from Byzantium that the Venetian people received the first recognition of their existence as a separate community. Their maritime importance compelled Narses, the imperial commander, to seek their aid in transporting his army from Grado; and when the Paduans appealed to the Eunuch to restore their rights over the Brenta, the Venetians replied by declaring that islands of the lagoon and the river mouths that fell into the estuary were the property of those who had rendered them habitable and serviceable. Narses declined to intervene, Padua was powerless to enforce its claims and Venice established a virtual independence of the mainland. Nor was it long before Venice made a similar assertion to the imperial representative, Longinus. He was endeavouring to treat with Alboin and the Lombards, and desired to assure himself of Venetian support. He invited the Venetians to give him an escort to Constantinople, which they did, and also to acknowledge themselves subjects of the empire. But they replied that "God who is our help and protector has saved us that we might dwell upon these waters. This second Venice which we have raised in the lagoons is our mighty habitation; no power of emperor or of prince can touch us." That was an explicit statement of Venetian aims and contentions: the place and people had made each other and now belonged exclusively to each other. Longinus admitted that the Venetians were indeed "a great people with a strong habitation"; but by dint of promising large concessions and trading privileges, he induced the Venetians to make an act of submission—though not upon oath. The terms of this pact resulted in the first diploma conferred on Venice as a separate community (584). But it was inevitable that, when the barbarians, Lombard or Frank, were once established on the mainland of Italy, Venice should be brought first into trading and then into political relations with their near neighbours, who as masters of Italy also put forward a claim to sovereignty in the lagoons. It is between the two claims of east and west that Venice struggled for and achieved recognized independence.

Turning to the other problem, that of internal fusion and consolidation, we find that in 466, fourteen years after the fall of Aquileia, the population of the twelve lagoon townships met at Grado for the election of one tribune from each island for the better government of the separate communities, and above all to put an end to rivalries which had already begun to play a disintegrating part. But when the lagoon population was largely augmented in 568 as the result of Alboin's invasion, these jealousies were accentuated, and in 584 it was found expedient to appoint twelve other tribunes, known as the *Tribuni Majores*, who formed a kind of central committee to deal with all matters affecting the general weal of the lagoon communities. But the *Tribuni Majores* were equally powerless to allay the jealousies of the growing townships which formed the lagoon community. Rivalry in fishing and in trading, coupled with ancient antipathies inherited from the various mainland cities of origin, were no doubt the cause of these internecine feuds. A crisis was reached when Christopher, patriarch of Grado, convened the people of the lagoon at Heraclea, and urged them to suppress the twelve tribunes and to choose a single head of the state. To this they agreed, and in 697 Venice elected her first doge, Paulo Lucio Anafesto.

The growing importance of the lagoon townships, owing to their maritime skill, their expanding trade, created by their position between east and west, their monopoly of salt and salted fish, which gave them a strong position in the mainland markets, rendered it inevitable that a clash must come over the question of independence, when either east or west should claim that Venice belonged to them; and inside the lagoons the growing prosperity, coupled with the external threat to their liberties, concentrated the population into two well-defined parties—what may be called the aristocratic party, because it leaned towards imperial Byzantium and also displayed a tendency to make the dogeship hereditary, and the democratic party, connected with the original population of the lagoons, aspiring to free institutions, and consequently leaning more towards the church and the Frankish kingdom which protected the church. The aristocratic party was captained by the township of Heraclea, which had given the first doge, Anafesto, to the newly formed community. The democratic party was championed first by Jesolo and then by Malamocco.

The advent of the Franks determined the final solution. The emperor Leo, the Isaurian, came to open rupture with Pope Gregory II. over the question of images. The pope appealed to Liutprand, the powerful king of the Lombards, to attack the imperial possessions in Ravenna. He did so, and expelled the exarch Paul, who took refuge in Venice and was restored to his post by the doge of the Heraclean or Byzantine party, Orso, who in return for this assistance received the imperial title of *hypatos*, and trading rights in Ravenna. The pope, however, soon had cause for alarm at the spread of the Lombard power which he had encouraged. Liutprand proceeded to occupy territory in the Ducato Romano. The pope, looking about for a saviour, cast his eyes on Charles Martel, whose victory at Tours had riveted the attention of the world. Charles's son, Pippin, was crowned king of Italy, entered the peninsula at the head of the Franks, defeated the Lombards, took Ravenna and presented it to the pope, while retaining a feudal superiority. Desiderius, the last Lombard king, endeavoured to recover Ravenna. Charlemagne, Pippin's son, descended upon Italy, broke up the Lombard kingdom (774), confirmed his father's donation to the pope, and in reprisals for Venetian assistance to the exarch, ordered the pope to expel the Venetians from the Pentapolis. Venice was now brought face to face with the Franks under their powerful sovereign, who soon showed that he intended to claim the lagoons as part of his new kingdom. In Venice the result of this menace was a decided reaction towards Byzantium. In opposition to the Frankish claim, Venice resolved to affirm her dependence on the Eastern empire. But the democratic party, the Frankish party in Venice, was powerful. Feeling ran high. A crisis was rapidly approaching. The Byzantine Doge Giovanni Galbaio attacked Grado, the see of the Francophil Patriarch Giovanni, captured it, and flung the bishop from the tower of his palace. But the murdered patriarch was succeeded by his no less Francophil nephew Fortunatus, a strong partisan, a restless and indomitable man, who along with Obelerio of Malamocco now assumed the lead of the democratic party. He and his followers plotted the murder of the doge, were discovered, and sought safety at the court of Charlemagne, where Fortunatus strongly urged the Franks to attack the lagoons.

Meantime the internal politics of Venice had been steadily preparing the way for the approaching fusion at Rialto. The period from the election of the first doge to the appearance of the Franks was characterized by fierce struggles between Heraclea and Jesolo. At length the whole population agreed to fix their capital at Malamocco, a compromise between the two incompatible parties, marking an important step towards final fusion at Rialto.

That central event of early Venetian history was reached when Pippin resolved to make good his title as king of Italy. He turned his attention to the lagoon of Venice, which had been steadily growing in commercial and maritime importance, and had, on the whole, shown a sympathy for Byzantium rather than for the Franks. Pippin determined to subdue the lagoons. He gathered a fleet at Ravenna, captured Chioggia, and pushed on up the Lido towards the capital of the lagoons at Malamocco. But the Venetians, in face of the danger, once more removed their capital, this time to Rialto, that group of islands we now call Venice, lying in mid-lagoon between the *lidi* and the mainland. This step was fatal to Pippin's designs. The intricate water-ways and the stubborn Venetian defence baffled all his attempts to reach Rialto; the summer heats came on; the Lido was unhealthy. Pippin was forced to retire. A treaty between Charlemagne and Nicephorus (810) recognized the Venetians as subjects of the Eastern empire, while preserving to them the trading rights on the mainland of Italy which they had acquired under Liutprand.

The concentration at Rialto marks the beginning of the history of Venice as a full-grown state. The external menace to their independence had welded together the place and the people; the same pressure had brought about the fusion of the conflicting parties in the lagoon townships into one homogeneous whole. There was for the future one Venice and one Venetian people dwelling at Rialto, the city of compromise between the dangers from the mainland, exemplified by Attila and Alboin, and the perils from the sea, illustrated by Pippin's attack. The position of Venice was now assured. The state was a vassal of a weak and distant empire, which would leave it virtually free to pursue its own career; it was an independent tributary of a near and powerful kingdom with which it could trade, and trade between east and west became henceforth the note of its development.

The first doge elected in Rialto was Angelo Particiaco, a Heraclean noble, with a strong bias towards Byzantium, and his reign was signalized by the building of the first church of San Marco, and by the translation of the saint's body from Alexandria, as though to affirm and to symbolize the creation of united Venice.

The history of Venice during the next two hundred years is marked externally by the growth of the city, thanks to an ever-expanding trade, both down the Adriatic, which brought the republic into collision with the Dalmatian pirates and led to their final conquest, in 1000, by the doge Pietro Orseolo II., and also on the mainland, where Venice gradually acquired trading rights, partly by imperial diploma, partly by the establishment and the supply of markets on the mainland rivers, the Sile and the Brenta. Internally this period is characterized by the attempt of three powerful families, the Particiachi, the Candiani and the Orseoli, to create an hereditary dogeship, and the violent resistance offered by the people. We find seven of the Particiachi, five Candiani and three Orseoli reigning in almost unbroken succession, until, with the ostracism of the whole Orseolo family in 1032, the dynastic tendency was crushed for ever. During the same period we also note the development of certain families, thanks to the accumulation of wealth by trade, and here we get the beginnings of that commercial aristocracy whose evolution was the dominant factor in the constitutional history of the republic.

The growing wealth of Venice soon attracted the cupidity of her piratical neighbours on the coast of Dalmatia. The swift Liburnian vessels began to raid the Lido, compelling the Venetians to arm their own vessels and thus to form the nucleus of their famous fleet, the importance of which was recognized by the Golden Bull of the emperor Basil, which conferred on Venetian merchants privileges far more extensive than any they had hitherto enjoyed, on condition that the Venetian fleet was to be at the disposition of the emperor. But the Dalmatian raids continued to harass Venetian trade, till, in 1000, the great doge Pietro Orseolo II. attacked and captured Curzola and stormed the piratical stronghold of Lagosta, crushing the freebooters in their citadel. The doge assumed the title of duke of Dalmatia, and a great step was taken towards the supremacy of Venice in the Adriatic, which was essential to the free development of her commerce and also enabled her to reap the pecuniary advantages to be derived from the Crusades. She now commanded the route to the Holy Land and could supply the necessary transport, and from the Crusades her growing aristocracy reaped large profits. Orseolo's victory was commemorated and its significance affirmed by the magnificent symbolical ceremony of the "wedding of the sea" (*Sposalizio del Mar*), celebrated henceforward every Ascension day. The result of the first three Crusades was that Venice acquired trading rights, a Venetian quarter, church, market, bakery, &c., in many of the Levant cities, *e.g.* in Sidon (1102) and in Tyre (1123). The fall of Tyre marks a great advance in development of Venetian trade; the republic had now passed beyond the Adriatic, and had taken an important step towards that complete command of the Levant which she established after the Fourth Crusade.

This expansion of the trade of Venice resulted in the rapid development of the wealthier classes, with a growing tendency to draw together for the purpose of securing to themselves the entire direction of Venetian politics in order to dominate Venetian commerce. To achieve their object, a double line of conduct was imposed upon them: they had to absorb the powers of the doge, and also to deprive the people of the voice they possessed in the management of state affairs by their presence in the *concione* or general assembly of the whole community, which was still the fountain of all authority. The first step towards curtailing the power of the doge was taken in 1032, when the family of the Orseoli was finally expelled from Venice and the doge Domenico Flabianico was called to the throne. A law was then passed forbidding for the future the election of a doge-consort, a device by which the Particiachi, the Candiani and the Orseoli had each of them nearly succeeded in carrying out their dynastic ambitions. Further, two ducal councillors were appointed to assist the doge, and he was compelled, not merely permitted, to seek the advice of the more prominent citizens at moments of crisis. By this reform two important offices in the Venetian constitution—the privy council (*consiglieri ducali*) and the senate (the *pregadi* or invited)—came into being. Both were gradually developed on the lines desired by the aristocracy, till we reach the year 1171.

The growth of Venetian trade and wealth in the Levant roused the jealousy of Genoa and the hostility of the imperial court at Constantinople, where the Venetians are said to have numbered 200,000 and to have held a large quarter of the city in terror by their brawls. The emperor Manuel I., urged on by the Genoese and other rivals of Venice, seized the pretext. The Venetians were arrested and their goods confiscated. Popular feeling at Venice ran so high that the state was rashly swept into war with the empire. To provide the requisite funds for this vast undertaking, a forced loan of 1% on net incomes was raised; the money bore interest at the rate of 4%. The bonds were negotiable, and afford us the earliest instance of the issue of government stock. The doge Vitale Michiel II. led the expedition in person. It proved a disastrous failure, and on the return of the shattered remnants (1171) a great constitutional reform seemed necessary. The Venetians resolved to create a deliberative assembly, which should act with greater caution than the *concione,* which had just landed the state in a ruinous campaign. Forty members were elected in each of the six divisions of the city, giving a body of 480 members, who served for one year and on retiring named two deputies for each *sestiere* to nominate the council for the succeeding year. This was the germ of the great council, the Maggior Consiglio, which was rendered strictly oligarchic in 1296. As the duties of this council were to appoint all officers of state, including the doge, it is clear that by its creation the aristocracy had considerably curtailed the powers of the people, who had hitherto elected the doge in general assembly; and at the creation of Michiel's successor, Sebastiano Ziani (1172), the new doge was presented to the people merely for confirmation, not for election. The assembly protested, but was appeased by the empty formula, "This is your doge an it please you." Moreover, still further to limit the power of the doge, the number of ducal councillors was raised from two to six. In 1198, on the election of Enrico Dandolo, the aristocracy carried their policy one step farther, and by the *promissione ducale,* or coronation oath, which every doge was required to swear, they acquired a powerful weapon for the suppression of all that remained of ancient ducal authority. The *promissione ducale* was binding on the doge and his family, and could be, and frequently was, altered at each new election, a commission, *Inquisitori sopra il doge defunto,* being appointed to scrutinize the actions of the deceased doge and to add to the new oath whatever provisions they thought necessary to reduce the dogeship to the position of a mere figurehead in the state.

In spite of the check to their trade received from the emperor Manuel in 1171, Venetian commerce continued to flourish, the Venetian fleet to grow and the Venetians to amass wealth. When the Fourth Crusade was proclaimed at Soissons, it was to Venice that the leaders applied for transport, and she agreed to furnish transport for 4500 horses, 9000 knights, 20,000 foot, and provisions for one year: the price was 85,000 silver marks of Cologne and half of all conquests. But Zara and Dalmatia had revolted from Venice in 1166 and were as yet unsubdued. Venetian supremacy in the Adriatic had been temporarily shaken. The 85,000 marks, the price of transport, were not forthcoming, and the Venetians declined to sail till they were paid. The doge Dandolo now saw an opportunity to benefit Venice. He offered to postpone the receipt of the money if the Crusaders would reduce Zara and Dalmatia for the republic. These terms were accepted. Zara was recovered, and while still at Zara the leaders of the Crusade, supported by Dandolo, resolved for their own private purposes to attack Constantinople, instead of making for the Holy Land. Boniface, marquis of Monferrat, desired to make good the claim to Salonica, and the Venetians doubtless wished to upset the Greek empire, which had recently shown itself so friendly to their rivals the Genoese. Constantinople fell (1204), thanks chiefly to the ability of the Venetians under Dandolo. The city was sacked, and a Latin empire, with Baldwin of Flanders as emperor, was established at Constantinople (see ROMAN EMPIRE, LATER).

In the partition of the spoils Venice claimed and received, in her own phrase, "a half and a quarter of the Roman empire." To her fell the Cyclades, the Sporades, the islands and the eastern shores of the Adriatic, the shores of the Propontis and the Euxine, and the littoral of Thessaly, and she bought Crete from the marquis of Monferrat. The accession of territory was not only vast, it was of the highest importance to Venetian commerce. She now commanded the Adriatic, the Ionian islands, the archipelago, the Sea of Marmora and the Black Sea, the trade route between Constantinople and western Europe, and she had already established herself in the seaports of Syria, and thus held the trade route between Asia Minor and Europe. She was raised at once to the position of a European power. In order to hold these possessions, she borrowed from the Franks the feudal system, and granted fiefs in the Greek islands to her more powerful families, on condition that they held the trade route open for her. The expansion of commerce which resulted from the Fourth Crusade soon made itself evident in the city by a rapid development in its architecture and by a decided strengthening of the commercial aristocracy, which eventually led to the great constitutional reform—the closing of the Maggior Consiglio in 1296, whereby Venice became a rigid oligarchy. Externally this rapid success awoke the implacable hatred of Genoa, and led to the long and exhausting series of Genoese wars which ended at Chioggia in 1380.

The closing of the great council was, no doubt, mainly due to the slowly formed resolution on the part of the great commercial families to secure a monopoly in the Levant trade which the Fourth Crusade had placed definitely in their hands. The theory of the government, a theory expressed throughout the whole commercial career of the republic, the theory which made Venice a rigidly protective state, was that the Levant trade belonged solely to Venice and her citizens. No one but a Venetian citizen was permitted to share in the profits of that trade. But the population of Venice was growing rapidly, and citizenship was as yet undefined. To secure for themselves the command of trade the leading commercial families resolved to erect themselves into a close gild, which should have in its hands the sole direction of the business concern, the exploitation of the East. This policy took definite shape in 1297, when the Doge Pietro Gradenigo proposed and carried the following measure: the supreme court, the Quarantia, was called upon to ballot, one by one, the names of all who for the last four years had held a seat in the great council created in 1171. Those who received twelve favourable votes became members of the great council. A commission of three was appointed to submit further names for ballot. The three commissioners at once laid down a rule—which contains the essence of the act—that only those who could prove that a paternal ancestor had sat in the great council should be eligible for election. This measure divided the community into three great categories: (1) those who had never sat in the council themselves and whose ancestors had never sat; these were of course the vast majority of the population, and they were excluded for ever from the great council: (2) those whose paternal ancestors had sat in the council; these were eligible and were gradually admitted to a seat, their sons becoming eligible on majority: (3) those who were of the council at the passing of this act or had sat during the four preceding years; their sons likewise became eligible on attaining majority. As all offices were filled by the great council, exclusion meant political disfranchisement. A close caste was created which very seldom and very reluctantly admitted new members to its body. The Heralds' College, the *avvogadori di comun*, in order to ensure purity of blood, were ordered to open a register of all marriages and births among members of the newly created caste, and these registers formed the basis of the famous *Libro d'oro*.

The closing of the great council and the creation of the patrician caste brought about a revolution among those who suffered disfranchisement. In the year 1300 the people, led by Marin Bocconio, attempted to force their way into the great council and to reclaim their rights. The doors were opened, the ringleaders were admitted and immediately seized and hanged. Ten years later a more serious revolution, the only revolution that seriously shook the state, broke out and was also crushed. This conspiracy was championed by Bajamonte Tiepolo, and seems to have been an expression of patrician protest against the *serrata*, just as Bocconio's revolt had represented popular indignation. Tiepolo, followed by members of the Quirini family and many nobles with their followers, attempted to seize the Piazza on the 15th of June 1310. They were met by the Doge Pietro Gradenigo and crushed. Quirini was killed, and Tiepolo and his followers fled.

The chief importance of the Tiepoline conspiracy lies in the fact that it resulted in the establishment of the Council of Ten. Erected first as a temporary committee of public safety to hunt down the remnant of the conspirators and to keep a vigilant watch on Tiepolo's movements, it was finally made permanent in 1335. The secrecy of its deliberations and the rapidity with which it could act made it a useful adjunct to the constitution, and it gradually absorbed many of the more important functions of the state.

With the creation of the Council of Ten the main lines of the Venetian constitution were completed. At the basis of the pyramid we get the great council, the elective body composed of all who enjoyed the suffrage, *i.e.* of the patrician caste. Above the great council came the senate, the deliberative and legislative body *par excellence.* To the senate belonged all questions relating to foreign affairs, finance, commerce, peace and war. Parallel with the senate, but extraneous to the main lines of the constitution, came the Council of Ten. As a committee of public safety it dealt with all cases of conspiracy; for example, it tried the Doge Marino Falier and the General Carmagnola; on the same ground all cases affecting public morals came within its extensive criminal jurisdiction. In the region of foreign affairs it was in communication with envoys abroad, and its orders would override those of the senate. It also had its own departments of finance and war. Above the senate and the Ten came the *Collegio* or cabinet, the administrative branch of the constitution. All affairs of state passed through its hands. It was the initiatory body; and it lay with the *Collegio* to send matters for deliberation either before the senate or before the Ten. At the apex of the pyramid came the doge and his council, the point of highest honour and least weight in the constitution.

To turn now to the external events which followed on the Fourth Crusade. These events are chiefly concerned with the long struggle with Genoa over the possession of the Levant and Black Sea trade. By the establishment of the Latin empire Venice had gained a preponderance. But it was impossible that the rival Venetian and Genoese merchants, dwelling at close quarters in the Levant cities, should not come to blows. They fell out at Acre in 1253. The first Genoese war began and ended in 1258 by the complete defeat of Genoa. But in 1261 the Greeks, supported by the Genoese, took advantage of the absence of the Venetian fleet from Constantinople to seize the city and to restore the Greek empire in the person of Michael VIII. Palaeologus. The balance turned against Venice again. The Genoese were established in the spacious quarter of Galata and threatened to absorb the trade of the Levant. To recover her position Venice went to war again, and in 1264 destroyed the Genoese fleet off Trepani, in Sicilian waters. This victory was decisive at Constantinople, where the emperor abandoned the defeated Genoese and restored Venice to her former position. The appearance of the Ottoman Turk and the final collapse of the Latin empire in Syria brought about the next campaign between the rival maritime powers. Tripoli (1289) and Acre (1291) fell to the Mussulman, and the Venetian title to her trading privileges, her diplomas from the Latin empire, disappeared. To the scandal of Christendom, Venice at once entered into treaty with the new masters of Syria and obtained a confirmation of her ancient trading rights. Genoa replied by attempting to close the Dardanelles. Venice made this action a *casus belli.* The Genoese won a victory in the gulf of Alexandretta (1294); but on the other hand the Venetians under Ruggiero Morosini forced the Dardanelles and sacked the Genoese quarter of Galata. The decisive engagement, however, of this campaign was fought at Curzola (1299) in the Adriatic, when Venice suffered a crushing defeat. A peace, honourable to both parties, was brought about by Matteo Visconti, lord of Milan, in that same year. But the quarrel between the republics, both fighting for trade supremacy—that is to say, for their lives—could not come to an end till one or other was thoroughly crushed. The fur trade of the Black Sea furnished the pretext for the next war (1353–54), which ended in the crushing defeat of Venice at Sapienza, and the loss of her entire fleet. But though Venice herself seemed to lie open to the Genoese, they took no advantage of their victory; they were probably too exhausted. The lord of Milan again arranged a peace (1355).

We have now reached the last phase of the struggle for maritime supremacy. Under pressure from Venice the emperor John V. Palaeologus granted possession of the island of Tenedos to the republic. The island commanded the entrance to the Dardanelles. Genoa determined to oppose the concession, and war broke out. The Genoese Admiral Luciano Doria sailed into the Adriatic, attacked and defeated Vettor Pisani at Pola in Istria, and again Venice and the lagoons lay at the mercy of the enemy. Doria resolved to blockade and starve Venice to surrender. He was master of the sea, and the flow of provisions from the mainland was cut off by Genoa's ally, Francesco I. Carrara, lord of Padua. Doria seized Chioggia as a base of operations and drew his fleet inside the lagoons. The situation was extremely critical for Venice, but she rose to the occasion. Vettor Pisani was placed in command, and by a stroke of naval genius he grasped the weakness of Doria's position. Sailing to Chioggia he blocked the channel leading from the lagoon to the sea, and Doria was caught in a trap. Pisani stationed himself outside the Lido, on the open sea, to intercept relief should any appear, and Doria, instead of blockading Venice, was himself blockaded in Chioggia. For many months the siege went on; but Pisani gradually assumed the offensive as Genoese spirits and food ran low. Finally, in June 1380 the flower of the Genoese fleet surrendered at discretion. Genoa never recovered from the blow, and Venice remained undisputed mistress of the Mediterranean and the Levant trade.

The defeat of Genoa and the establishment of Venetian supremacy in the Mediterranean brought the state to a further step in its development. The undisputed mastery of the eastern trade increased its bulk in Venice. But as the city became the recognized mart for exchange of goods between east and west, the freedom of the western outlet assumed the aspect of a paramount question. It was useless for Venice to accumulate eastern merchandise if she could not freely pass it on to the west. If the various states on the immediate mainland could levy taxes on Venetian goods in transit, the Venetian merchant would inevitably suffer in profits. The geographical position of Venice and her commercial policy alike compelled her to attempt to secure the command of the rivers and roads of the mainland, at least up to the mountains, that is to say, of the north-western outlet, just as she had obtained command of the south-eastern inlet. She was compelled to turn her attention, though reluctantly, to the mainland of Italy. Another consideration drove her in the same direction. During the long wars with Genoa, after the defeats of Curzola, Sapienza, Pola, above all during the crisis of the war of Chioggia, it had been brought home to the Venetians that, as they owned no meat or corn-producing territory, a crushing defeat at sea and a blockade on the mainland exposed them to the grave danger of being starved into surrender. Both these pressing necessities, for a free outlet for merchandise and for a food-supplying area, drove Venice on to the mainland, and compelled her to initiate a policy which eventually landed her in the disastrous wars of Cambrai. The period with which we are now dealing is the epoch of the despots, the *signori,* and in pursuit of expansion on the mainland Venice was brought into collision first with the Scaligeri of Verona, then with the Carraresi of Padua, and finally with the Visconti of Milan. Hitherto Venice had enjoyed the advantages of isolation; the lagoons were virtually impregnable; she had no land frontier to defend. But when she touched the mainland she at once became possessed of a frontier which could be attacked, and found herself compelled either to expand in self-defence or to lose the territory she had acquired.

Venice had already established a tentative hold on the immediate mainland as early as 1339. She was forced into war by Mastino della Scala, lord of Padua, Vicenza, Treviso, Feltre and Belluno, as well as of Verona, who imposed a duty on the transport of Venetian goods. A league against the Scala domination was formed, and the result was the fall of the family. Venice took possession of Padua, but in the terms of the league she at once conferred the lordship on the Carraresi, retaining Treviso and Bassano for herself. But it is not till we come to the opening of the next century that Venice definitely acquired land possessions and found herself committed to all the difficulties and intricacies of Italian mainland politics. On the death of Gian Galeazzo Visconti in 1402, his large possessions broke up. His neighbours and his generals seized what was nearest to hand. Francesco II. Carrara, lord of Padua, attempted to seize Vicenza and Verona. But Venice had been made to suffer at the hands of Carrara, who had levied heavy dues on transit, and moreover during the Chioggian War had helped the Genoese and cut off the food supply from the mainland. She was therefore forced in self-defence to crush the family of Carrara and to make herself permanently mistress of the immediate mainland. Accordingly when Gian Galeazzo's widow applied to the republic for help against Carrara it was readily granted, and, after some years of fighting, the possessions of the Carraresi, Padua, Treviso, Bassano, commanding the Val Sugana route, as well as Vicenza and Verona, passed definitely under Venetian rule. This expansion of mainland territory was followed in 1420 by the acquisition of Friuli after a successful war with the emperor Sigismund, thus bringing the possessions of the republic up to the Carnic and Julian Alps, their natural frontier on the north-east.

Venice was soon made to feel the consequences of having become a mainland power, the difficulties entailed by holding possessions which others coveted, and the weakness of a land frontier. To the west the new duke of Milan, Filippo Maria Visconti, was steadily piecing together the fragments of his father's shattered duchy. He was determined to recover Verona and Vicenza from Venice, and intended, as his father had done, to make himself master of all north Italy. The conflict between Venice and Milan led to three wars in 1426, 1427 and 1429. Venice was successful on the whole. She established her hold permanently on Verona and Vicenza, and acquired besides both Brescia and Bergamo; and later she occupied Crema. The war of Ferrara and the peace of Bagnolo (1484) gave her Rovigo and the Polesine. This, with the exception of a brief tenure of Cremona (1499–1512), formed her permanent territory down to the fall of the republic. Her frontiers now ran from the seacoast near Monfalcone, following the line of the Carnic and Julian and Raetian Alps to the Adda, down the course of that river till it joins the Po, and thence along the line of the Po back to the sea. But long and exhausting wars were entailed upon her for the maintenance of her hold. The rapid formation of this land empire, and the obvious intention to expand, called the attention not only of Italy but of Europe to this power which seemed destined to become supreme in north Italy, and eventually led to the league of Cambrai for the dismemberment of Venice. Contemporaneously other events were menacing the ascendancy and exhausting the treasury of the republic. In 1453 Constantinople fell to the Ottoman Turks, and although Venice entered at once into treaty with the new power and desired to trade with it, not to fight with it, yet it was impossible that her possessions in the Levant and the archipelago should not eventually bring her into collision with the expanding energy of the Mussulman. Europe persistently refused to assist the republic to preserve a trade in which she had established a rigid monopoly, and Venice was left to fight the Turk single-handed. The first Turkish war lasted from 1464 to 1479, and ended in the loss of Negropont and several places in the Morea, and the payment by Venice of an annual tribute for trading rights. She was consoled, however, by the acquisition of Cyprus, which came into her possession (1488) on the extinction of the dynasty of Lusignan with the death of James II. and his son James III., Caterina Cornaro, James II.'s widow, ceding the kingdom of Cyprus to Venice, since she could not hope to maintain it unaided against the Turks. The acquisition of Cyprus marks the extreme limit of Venetian expansion in the Levant; from this date onward there is little to record save the gradual loss of her maritime possessions.

Exhausting as the Turkish wars were to the Venetian treasury, her trade was still so flourishing that she might have survived the strain had not the discovery of the Cape route to the Indies cut the tap-root of her commercial prosperity by diverting the stream of traffic from the Mediterranean to the Atlantic. When Diaz rounded the Cape in 1486 a fatal blow was struck at Venetian commercial supremacy. The discovery of the Cape route saved the breaking of bulk between India and Europe, and saved the dues exacted by the masters of Syria and Egypt. Trade passed into the hands of the Portuguese, the Dutch and the English. Venice lost her monopoly of oriental traffic.

To complete her misfortunes, the European powers, the church and the small states of Italy, partly from jealous greed of her possessions, partly on the plea of her treason to Christendom in making terms with Islam, partly from fear of her expansion in north Italy, coalesced at Cambrai in 1508 for the partition of Venetian possessions. The war proved disastrous for Venice. The victory of Agnadello (1510) gave the allies the complete command of Venetian territory down to the shores of the lagoon. But the mutual jealousy of the allies saved her. The pope, having recovered the Romagna and secured the objects for which he had joined the league, was unwilling to see all north Italy in the hands of foreigners, and quitted the union. The emperor Maximilian failed to make good his hold on Padua, and was jealous of the French. The league broke up, and the mainland cities of the Veneto returned of their own accord to their allegiance to St Mark. But the republic never recovered from the blow, coming as it did on the top of the Turkish wars and the loss of her trade by the discovery of the Cape route. She ceased to be a great power, and was henceforth entirely concerned in the effort to preserve her remaining possessions and her very independence. The settlement of the peninsula by Charles V.'s coronation at Bologna in 1530 secured the preponderance to Spain, and the combination of Spain and the church dominated the politics of Italy. Dread of the Turks and dread of Spain were the two terrors which haunted Venice till the republic fell. That she retained her independence so long was due to a double accident: the impregnability of the lagoons and the jealousies of the great powers.

But the decline was a slow process. Venice still possessed considerable wealth and extensive possessions. Between 1499 and 1716 she went to war four times with the Turks, emerging from each campaign with some further loss of maritime territory. The fourth Turkish war (1570–1573) was signalized by the glorious victory of Lepanto (1571), due chiefly to the prowess of the Venetians under their doge Sebastian Venier. But her allies failed to support her. They reaped no fruits from the victory, and Cyprus was taken from her after the heroic defence of Famagusta by Bragadino, who was flayed alive, and his skin, stuffed with straw, borne in triumph to Constantinople. The fifth Turkish war (1645–1668) entailed the loss of Crete; and though Morosini reconquered the Morea for a brief space in 1685, that province was finally lost to Venice in 1716.

So far as European politics are concerned, the latter years of the republic are made memorable by one important event: the resistance which Venice, under the guidance of Fra Paolo Sarpi, offered to the growing claims of the Curia Romana, advanced by Pope Paul V. Venice was placed under interdict (1606), but she asserted the rights of temporal sovereigns with a courage which was successful and won for her the esteem and approval of most European sovereigns.

But the chief glory of her declining years was undoubtedly her splendid art. Giorgione, Titian, Sansovino, Tintoret, Paolo Veronese and Palladio all lived and worked after the disastrous wars of the league of Cambrai. The chief characteristic of Venice during these years is that she became the great pleasure-city of Europe. The end of the republic came when the French Revolution burst over Europe. Napoleon was determined to destroy the oligarchical government, and seized the pretext that Venice was hostile to him and a menace to his line of retreat while engaged in his Austrian campaign of 1797. The peace of Leoben left Venice without an ally. The government resolved to offer no resistance to the conqueror, and the doge Lodovico Manin abdicated on the 12th of May 1797. On the 17th of October Napoleon handed Venice over to Austria by the peace of Campo Formio, and between 1798 and 1814 she passed from France to Austria and Austria to France till the coalition of that latter year assigned her definitely to Austria. In 1848 a revolution broke out and a provisional republican government under Daniele Manin (*q.v.*) maintained itself for a brief space. In 1866 the defeat of Austria by the Prussians led to the incorporation of Venice in United Italy.

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VENISON (pronounced *venzon*), originally a word meaning a beast of any kind killed in the chase, but now only applied to the flesh of the deer prepared for eating. The O. Fr. *veneisun*, *venoison*, &c., mod. *venaison*, meant the flesh of the deer or boar, the principal beasts of the chase (Lat. *venatio*, hunting).

VENLO, a frontier town in the province of Limburg, Holland, on the right bank of the Maas, and a junction station 43 m. by rail N.N.E. of Maastricht. Pop. 15,000. It is joined by a bridge over the Maas, with the opposite village of Blerik. Venlo, with narrow streets irregularly built, is not of the ordinary Dutch type in architectural style. The picturesque town hall (1595), the only building of special interest, contains some interesting paintings by Hubert Goltzius (1526–1583). The church dates from 1304. There is a college for the higher education of Roman Catholic priests. The leading industries are distilling, brewing, tanning, spinning, needlemaking and tobacco manufacture. There is also a considerable trade by river with Rotterdam.

VENN, HENRY (1725–1797), English evangelical divine, was born at Barnes, Surrey, and educated at Cambridge. He took orders in 1747, and was elected fellow of Queens' College, Cambridge, in 1749. After holding a curacy at Barton, Cambridgeshire, he became curate of St Matthew, Friday Street, London, and of West Horsley, Surrey, in 1750, and then of Clapham in 1754. In the preceding year he was chosen lecturer of St Swithin's, London Stone. He was vicar of Huddersfield from 1759 to 1771, when he exchanged to the living of Yelling, Huntingdonshire. Besides being a leader of the evangelical revival, he was well known as the author of *The Compleat Duty of Man* (London, 1763), a work in which he intended to supplement the teaching embodied in the anonymous *Whole Duty of Man.* His son, John Venn (1759–1813), was one of the founders of the Church Missionary Society, and his grandson, Henry Venn (1796–1873), was honorary secretary of that society from 1841 to 1873.

VENOSA (anc. *Venusia, q.v.*), a town and bishop's see of the Basilicata in the province of Potenza, Italy, on the eastern side of Mount Vulture, 52 m. by rail S.S.E. of Foggia, 1345 ft. above sea-level. Pop. (1901) 8503. The castle was built in 1470 by Pirro di Balzo, and contains four stables each for fifty horses. Many fragments of Roman workmanship are built into the walls of the cathedral, which is due to him also. The abbey church of SS. Trinità is historically interesting; it was consecrated in 1059 by Pope Nicholas II. and passed into the hands of the Knights of St John in the time of Boniface VIII. (1295–1303). In the central aisle is the tomb of Alberada, the first wife of Robert Guiscard and mother of Bohemund. An inscription on the wall commemorates the great Norman brothers William Iron Arm (d. 1046), Brogo (murdered at Venosa in 1051), Humfrey (d. 1057) and Robert Guiscard (d. at Corfu in 1085). The bones of these brothers rest together in a simple stone sarcophagus opposite the tomb of Alberada. The church also contains some 14th-century frescoes. Behind it is a larger church, which was begun for the Benedictines about 1150, from the designs of a French architect, in imitation of the Cluniac church at Paray-le-Monial, but never carried beyond the spring of the vaulting. The ancient amphitheatre adjacent furnished the materials for its walls.

See A. Avena, *Monumenti dell' Italia Meridionale* (Naples, 1902), 323 sqq.; O. de Lorenzo, *Venosa e la Regione del Vulture* (Bergamo, 1906).

VENTILATION (Lat. *ventilare*, from *ventus*, wind), the process and practice of keeping an enclosed place supplied with proper air for breathing; and so, by analogy, a term used for exposing any subject to the winds of public criticism. The air which we breathe consists chiefly of two gases, oxygen and nitrogen, with certain small proportions of other gases, such as carbonic acid (carbon dioxide), ozone and argon. Oxygen, which is the active and important constituent, and on which life and combustion depend, forms about one-fifth of the whole, while nitrogen, which is inert and acts as a diluent, forms nearly four-fifths. Of this mixture each adult person breathes some 2600 gallons or 425 cub. ft. in twenty-four hours. In air that has passed through the lungs the proportion of oxygen is reduced and that of carbon dioxide increased. Of the various impurities that are found in the air of inhabited rooms, carbonic acid gas forms the best practical index of the efficiency of the ventilation. The open air of London and other large inland towns contains about four parts by volume of the gas in 10,000 of air. In the country, and in towns near the sea, two to three and a half parts in 10,000 is a more usual proportion. Authorities on ventilation usually take four parts in 10,000 as the standard for pure air, and use the excess over that quantity in estimating the adequacy of the air supply. But they differ as to the proportion to which the carbonic acid may be allowed to rise under a good system of ventilation. It is generally admitted that the air in which people dwell and sleep should not under any circumstances be allowed to contain more than ten parts in 10,000. This has been accepted as the permissible proportion by Carnelley, Haldane and Anderson, after an extensive examination of the air of middle and lower class dwellings.

Standard of purity.

The rate at which an adult expires carbonic acid varies widely with his condition of repose, being least in sleep, greater in waking rest, and very much greater in violent exercise. As a basis on which to calculate the air necessary for proper ventilation we may take the production of carbonic acid by an adult as 0·6 cub. ft. per hour. Hence he will produce per hour, in 6000 cub. ft. of air, a pollution amounting to one part of carbonic acid in 10,000 of air. If the excess of carbonic acid were to be kept down to this figure (1 in 10,000), it would be necessary to supply 6000 cub. ft. of fresh air per hour; if the permissible excess be two parts in 10,000 half this supply of fresh air will suffice; and so on. We therefore have the following relation between (1) the quantity of air supplied per person per hour, (2) the excess of carbonic acid which results, and (3) the total quantity of carbonic acid present, on the assumption that the fresh air that is admitted contains four parts by volume in 10,000:—

Rate of consumption of air.

Air supplied per Adult per Hour.	Carbonic Acid (Parts by Volume in 10,000).	
Cubic Feet.	Excess due to Respiration.	Total Quantity.
1000	6	10
1200	5	9
1500	4	8
2000	3	7
3000	2	6

Some investigators have maintained that, in addition to an increased proportion of carbonic acid, air which has passed through the lungs contains a special poison. This view, however, is not accepted by others; J. S. Haldane and Lorrain Smith, for instance, conclude "that the immediate dangers from breathing air highly vitiated by respiration arise entirely from the excess of carbonic acid and deficiency of oxygen" (*Journ. Path. and Bact.* 1892, 1, 175). Carbonic acid, however, is not the only agent that has to be reckoned with in badly ventilated rooms, for the unpleasant effects they produce may also be due to increase of moisture and temperature and to the odours that arise from lack of cleanliness. Again, though there may be no unduly large proportion of carbonic acid present, the air of an apartment may be exceedingly impure when the criterion is the number of micro-organisms it contains. This also may be greatly reduced by efficient ventilation. Comparisons carried out by Carnelley, Haldane and Anderson (*Phil. Trans.*, 1887, 178 B, 61) between schools known to be well ventilated (by mechanical means) and schools ventilated at haphazard or not ventilated at all showed that the average number of micro-organisms was 17 per litre in the former, and in the others 152. Results of great interest were obtained by the experiment of stopping the mechanical ventilators for a few hours or days. Tested by the proportion of carbonic acid, the air of course became very bad; tested by the number of micro-organisms, it remained comparatively pure, the number being, in fact, scarcely greater than when ventilation was going on, and far less than the average in "naturally ventilated" schools. This proves in a striking way the advantage of systematic ventilation.

Ventilation of buildings.

In the ventilation of buildings four main points have to be considered: (1) the area of floor to be provided for each person; (2) the cubic capacity of the room required for each occupant; (3) the allowance to be made for the vitiation of the air by gas or oil burners; and (4) the quantity of fresh air which must be brought in and of vitiated air that must be extracted for each individual. The first will depend upon the objects to which the room is devoted, whether a ward of a hospital or a school or a place of public assembly. The purity of the air of a room depends to a great extent on the proportion of its cubic capacity to the number of inmates. The influence of capacity is, however, often overrated. Even when the allowance of space is very liberal, if no fresh air be supplied, the atmosphere of a room quickly falls below the standard of purity specified above; on the other hand, the space per inmate may be almost indefinitely reduced if sufficient means are provided for systematic ventilation. Large rooms are good, chiefly because of their action as reservoirs of air in those cases (too common in practice) where no sufficient provision is made for continuous ventilation, and where the air is changed mainly by intermittent ventilation, such as occurs when doors or windows are opened. With regard to the third point, in buildings lighted by gas or oil the calculations for the supply of fresh and the extraction of foul air must include an allowance for the vitiation of air by the products of combustion. The rate at which this takes place may be roughly estimated in the case of gas by treating each cubic foot of gas burnt per hour as equal to one person. Thus an ordinary burner giving a light of about twenty candles and burning 4 cub. ft. of gas per hour vitiates the air as much as four persons, and an incandescent burner as much as one and a half persons. A small reading-lamp burning oil uses the air of four men; a large central table lamp uses as much air as seven men.

As to the fourth point there is great diversity of opinion. To preserve the lowest standard of purity tolerated by sanitarians, ventilation must go on at the rate per person of 1000 cub. ft. per hour, and 3000 cub. ft. per hour are required to preserve the higher standard on which some authorities insist. E. A. Parkes advised a supply of 2000 cub. ft. of air per hour for persons in health and 3000 or 4000 cub. ft. for sick persons. In the case of a public assembly hall no great harm will occur to an audience occupying the room for a comparatively short time if 30 cub. ft. of air per minute are provided for each person. The United States book on school architecture gives a practical application to its remarks on this subject as follows:—

> The amount of fresh air which is allowed to hospital patients is about 2500 cub. ft. each per hour. Criminals in French prisons have to content themselves with 1500 cub. ft. per hour. Assuming that we care two-thirds as much for the health of our children as we do for that of our thieves and murderers, we will make them an allowance of 1000 cub. ft. each per hour, or about 16 cub. ft. per minute. Forty-eight children will then need an hourly supply of 48,000 cub. ft. Definite provision must therefore be made for withdrawing this quantity of foul air. No matter how many inlets there may be, the fresh air will only enter as fast as the foul escapes, and this can only find an outlet through ducts intended for that purpose, porous walls and crevices serving in cool weather only for inward flow. What, then, must be the size of the shaft to exhaust 48,000 ft. per hour? In a shaft 20 ft. high, vertical and smooth inside, with a difference in temperature of 20°, the velocity will be about $2\frac{1}{2}$ ft. per second, or 9000 ft. per hour; that is, it will carry off 9000 cub. ft. of air per hour for every square foot of its sectional area. To convey 48,000 cub. ft., it must have a sectional area of $5\frac{1}{2}$ sq. ft.

A general idea of the floor area, cubic space and fresh air supply per inmate allowed by law or by custom in certain cases is given in the table below:—

Class of Building.	Floor Area in Feet per Person.	Cubic Capacity in Feet per Person.[1]	Cubic Feet of Fresh Air supplied and Foul Air extracted per Person.
Schools	9 to 10	200	1,800
Barracks	70	720	1,800
Prisons	90	800	1,800
Concert halls and theatres	9	108	2,000
Billiard and smoke-rooms	..	..	2,000
Hospitals	120	1,440	2,000 to 3,000
Public libraries	20	2,400	2,500
Turkish baths.	70	800	5,000
Workshops	120	1,440	5,000
Cowsheds, per cow	90	1,100	10,000
Stables; per horse	120	1,600	12,000

[1] In calculating the cubic capacity per person the height should not be measured beyond 12 ft. above the floor.

The supply of fresh air indicated in the table should not be regarded as entirely satisfactory, for the standard of purity suggested is low, and ought to be exceeded, but it might deter many from moving in the matter if a proper and higher standard were to be laid down at first.

One of the most important points is the proper warming of the fresh air introduced into buildings, for unless that be done, when a cold day occurs all the ventilating arrangements will probably be closed. The fact should not be lost sight of that the air in a room may on the one hand be quite cold and yet very foul, and on the other, warm and yet perfectly fresh. To avoid draught the air should enter through a large number of small orifices, so that the currents may be thoroughly diffused. This is done by gratings. The friction of their bars, however, seriously diminishes their capacity for passing air, and careful experiments show conclusively that very ample grating area is required to deliver large volumes. The same remark applies to extracting-flues. Owing to the small size and the roughness of the surface the velocity of the upward current is small, and the quantity of air that passes out is often much less than is requisite.

Means of Ventilation.—In order that the atmosphere of a room should be changed by means of air currents, thereby securing proper ventilation, three things are necessary; (1) an inlet or inlets for the fresh air, (2) an outlet or outlets for the vitiated air, and (3) a motive force to produce and maintain the current. In systems which are distinguished by the general name of *mechanical* or *artificial* ventilation special provision is made for driving the air, by fans, or by furnaces, or by other contrivances to be described more fully below. In what is called *natural* ventilation no special appliance is used to give motive force, but the forces are made use of which are supplied by (1) the wind, (2) the elevated temperature of the room's atmosphere, and (3) the draught of fires used for heating.

Chimney draught.

Natural Ventilation.—The chief agent in domestic ventilation is the chimney; when a bright fire is burning in an open grate, it rarely happens that any other outlet for foul air from a room need be provided. The column of hot air and burnt gases in the chimney is less heavy, because of its high temperature, than an equal column of air outside; the pressure at the base is therefore less than the pressure at the same level outside. This supplies a motive force compelling air to enter at the bottom through the grate and through the opening over the grate, and causing a current to ascend. The motive force which the chimney supplies has not only to do work on the column of air within the chimney, in setting it in motion and in overcoming frictional resistance to its flow: it has also to set the air entering the room in motion and to overcome frictional resistance at the inlets. From want of proper inlets air has to be dragged in at a high velocity and against much resistance, under the doors, between the window sashes and through many other chinks and crevices. Under these conditions the air enters in small streams or narrow sheets, ill-distributed and moving so fast as to form disagreeable draughts, the pressure in the room is kept so low that an opened door or window lets in a deluge of cold air, and the current up the chimney is much reduced. If the attempt is made to stop draughts by applying sand-bags and listing to the crevices at which air streams in, matters only become worse in other respects; the true remedy of course lies in providing proper inlets. The discharge of air by an ordinary open fire and chimney varies widely, depending on the rate of combustion, the height and section and form of the chimney, and the freedom with which air is entering the room. About 10,000 cub. ft. per hour is probably a fair average, about enough to keep the air fresh for half a dozen persons. Even when no fire is burning the chimney plays an important part in ventilation; the air within an inhabited room being generally warmer than the air outside, it is only necessary that an up-current should be started in order that the chimney should maintain it, and it will usually be found that a current is, in fact, passing up.

Other outlets.

When a room is occupied for any considerable length of time by more than about half a dozen persons, the chimney outlet should be supplemented by others, which usually take the form of gratings in the ceiling or cornices in communication with flues leading to the open air. These openings should be protected from down-draught by light flap valves of oiled silk or sheet mica.

Inlets.

With regard to inlets, a first care must be to avoid such currents of cold air as will give the disagreeable and dangerous sensation of draught. At ordinary temperatures a current of outer air to which the body is exposed will be felt as a draught if its velocity exceeds 3, or even 2 ft. per second. The current entering a room may, however, be allowed to move with a speed much greater than this without causing discomfort, provided its direction keeps it from striking directly on the persons of the inmates. To secure this, it should enter, not horizontally nor through gratings on the floor, but vertically through openings high enough to carry the entering stream into the upper atmosphere of the room, where it will mix as completely as possible with warm air before its presence can be felt. A favourite form of inlet is the Sheringham (fig. 1). When opened it forms a wedge-shaped projection into the room, and admits air in an upward stream through the open top. It should be placed at a height of 5 or 6 ft. above the level of the floor. Other inlets are made by using hollow perforated blocks of earthenware, called air-bricks, built into the wall; these are often shaped on the inner

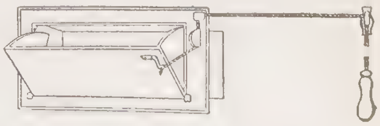

Fig. 1.—Sheringham Air Inlet.

side like an inverted louvre-board or venetian blind, with slots that slope so as to give an upward inclination to the entering stream.

Tobin tube.

In another and most valuable form of ventilator, the Tobin tube, the fresh air enters vertically upwards. The usual arrangement of Tobin tube (shown in front elevation and section in fig. 2) is a short vertical shaft of metal plate or wood which leads up the wall from the floor level to a height of 5 or 6 ft. Its lower end communicates with the outer air through an air-grating in the wall; from its upper end, which is freely open, the current of fresh air rises in a smooth stream. Various forms of section may be given to the tube: if placed in a corner it will be triangular or segmental; against a flat wall a shallow rectangular form is most usual, or it may be placed in a channel so as to be flush with the face of the wall; a lining of wood forming a dado may even be made to serve as a Tobin tube by setting it out a little way from the wall. The tube is often furnished with a regulating valve, and contrivances may be added for cleansing the entering air. A muslin or canvas bag hung in the tube, or a screen stretched diagonally across it, may be used to filter out dust; the same object is served in some degree by forcing the air, as it enters the tube at the bottom, to pass in close contact with the surface of water in a tray, by means of a deflecting plate. These complications have a double drawback: they require frequent attention to keep them in order, and by putting resistance in the way of the stream they are apt to reduce the efficiency of the ventilation.[1] The air entering by a Tobin tube may be warmed by a coil of hot pipes within the tube or by a small gas-stove (provided, of course, with a flue to discharge outside the products of combustion), or the tube may draw its supply, not directly from the outer atmosphere, but from a hot-air flue. The opening should always be about the level of a man's head, but the tube need not extend down to the floor: all that is essential is that it should have sufficient length to let the air issue in a smooth vertical current without eddies (fig. 3).

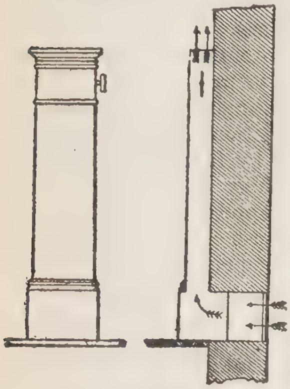

FIG. 2.—Tobin Tube.

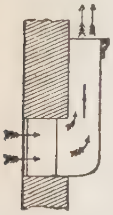

FIG. 3.—Short Tobin Tube.

Ventilation by window and door.

These inlets are at once so simple and effective that no hesitation need be felt in introducing them freely in the rooms of dwelling-houses. When no special provision is made for them in the walls, the advantage of a current entering vertically may still be in some degree secured by help of certain makeshift contrivances. One of these, suggested by Dr Hinkes Bird, is to open one sash of the window a few inches and fill up the opening by a board; air then enters in a zigzag course through the space between the meeting rails of the sashes. Still another plan is to have a light frame of wood or metal or glass made to fit in front of the lower sash when the window is opened, forming virtually a Tobin tube in front of the window.

Arrangements in barracks.

As an example of the systematic ventilation of dwelling-rooms on a large scale, the following particulars may be quoted of arrangements that have been successfully used in English barracks. One or more outlet-shafts of wood fitted with flap valves to prevent down-draught are carried from the highest part of the room, discharging some feet above the roof under a louvre. The number and size of these shafts are such as to give about 12 sq. in. of sectional area per head, and the chimney gives about 6 sq. in. more per head. About half the air enters cold through air-bricks or Sheringham valves at a height of about 9 ft. from the floor, and the other half is warmed by passing through flues behind the grate. The inlets taken together give an area of about 11 sq. in. per head. A fairly regular circulation of some 1200 cub. ft. per head per hour is found to take place, and the proportion of carbonic acid ranges from 7 to 10 parts in 10,000.

In public buildings.

In the natural ventilation of churches, halls and other large rooms we often find air admitted by gratings in the floor or near it; or the inlets may consist, like Tobin tubes, of upright flues rising to a height of about 6 ft. above the floor, from which the air proceeds in vertical streams. If the air is to be warmed before it enters, the supply may be drawn from a chamber warmed by hot-water or steam pipes or by a stove, and the temperature of the room may be regulated by allowing part of the air to come from a hot chamber and part from outside, the two currents mixing in the shaft from which the inlets to the room draw their supply. Outlets usually consist of gratings or plain openings at or near the ceiling, preferably at a considerable distance from points vertically above the inlet tubes. One of the chief difficulties in natural ventilation is to guard them against down-draught through the action of the wind. Numberless forms of cowl have been devised with this object, with the further intention of turning the wind to useful account by making it assist the up-current of foul air. Some of these exhaust cowls are of the revolving class, made to various designs and dimensions and put in rotation by the force of the wind. Revolving cowls are liable to fail by sticking, and, generally speaking, fixed cowls are to be preferred. They are designed in many forms, of which Buchan's may be cited as a good example. Fig. 4 shows this ventilator in horizontal section: *aa* is the vertical exhaust flue through which the foul air rises; near the top this expands into a polygonal chamber, *bbbb*, with vertical sides, consisting partly of perforated sheet-metal plates; outside of these are fixed vertical curved guide-plates, *c,c,c,c*; the wind, blowing between these and the polygonal chamber, sucks air from the centre through the perforated sides. The efficient working of an exhaust cowl, however, depends almost entirely upon the favourable conditions of the wind.[2] The two things that supply motive force in automatic or natural ventilation by means of exhaust cowls and similar appliances—the difference of temperature between inner and outer air, and the wind—are so variable that even the best arrangements of inlets and outlets give a somewhat uncertain result. As an example, it is evident that on a hot day with little movement in the air this mode of ventilation would be practically ineffectual. Under other conditions these automatic air-extractors not infrequently become inlets, thus reversing the whole system and pouring cold air on the heads of the inmates of the apartment or hall. To secure a strictly uniform delivery of air, unaffected by changes of season or of weather, it is necessary that the influence of these irregular motive forces be as far as possible minimized, and recourse must consequently be had to some mechanical force as a means of driving the air and securing adequate ventilation of the building.

Exhaust cowls.

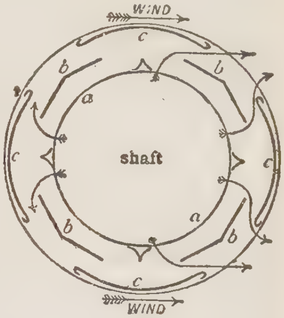

FIG. 4.—Sectional Plan of Buchan's Exhaust Cowl.

Artificial Ventilation.—Buildings may be mechanically ventilated on the vacuum system, the plenum system, or on a system combining the best points of both. In nearly every case of the application to modern buildings of mechanical means of ventilation the combined system in one form or another is adopted. In the vacuum system the motive force is applied at the outlets; the vitiated air is drawn from the rooms, and the pressure of the atmosphere in them is slightly less than the pressure outside. Upon the foul air being withdrawn fresh air finds its way in by means of conveniently placed inlets. In the plenum the motive force is applied at the inlets; fresh air is forced in and drives the vitiated air before it until it escapes at the outlets provided. The pressure within the room is greater than outside. The plenum method has distinct advantages: it makes the air escape instead of coming in as a cold draught at every crevice and casual opening to the outer air; it avoids drawing foul air from sewers and basement; and with it, more easily than with the other, one may guard against the disturbing influence of wind. In the plenum method the air is driven by fans; in the vacuum method suction is produced by fans or by heating the column of air in a long vertical shaft through which the discharge takes place. Water jets and steam jets have also been employed to impel or extract the air. Whatever system of ventilation is adopted, it is most important that windows capable of being widely opened should also be provided to aërate at frequent intervals the whole building, either as a whole or in sections, and they should be so arranged that no corner can be left stagnant or unswept by the purifying current. The Victoria Hospital at Glasgow and the Royal General Hospital at Birmingham are, however, ventilated on the plenum system without the aid of open windows, with what are said to be satisfactory results. In the case of hospitals, it is evident that aëration by means of open windows could not in Great Britain be effected except on warm and sunny days, but in the case of concert halls, theatres and similar buildings, it is possible (and most essential) thoroughly to aërate the building between each occupation.

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[1] When the air is not filtered, and when it has been warmed before entering, the vertical direction of the stream is readily traced by dust, which is deposited on the wall in a nearly upright column, spreading slightly fan-wise as it rises. With cold air the deposit of dust is comparatively slight. The difference is due to the fact, noticed and explained by Mr John Aitken, that air quickly deposits any suspended particles when it is brought into contact with a surface colder than itself, but retains them in suspension if the surface be warmer than the air. Another domestic illustration of the same fact is given by the greater dustiness of walls and furniture in a stove-heated room than in a room heated by an open fire.

[2] For an account of tests of various forms of ventilating cowls, see S. S. Hellyer, *The Plumber and Sanitary Houses.*

Extraction of vitiated air.

The extraction of foul air should in most cases be effected at the top of a room or building, so as to utilize the natural tendency of warm air to rise; but at Birmingham and elsewhere the outlets are near the floor, the fresh air being brought in half-way up the walls and directed towards the ceiling. The air inlets should be Tobin tubes or similar devices, placed some 4 or 5 ft. above the floor, and so arranged that the air should be passed in contact with radiators or pipes to warm it before entering. In the case of a building for one of the American legislatures, the warmed fresh air is allowed to enter on the level in front of the desk of each member, so that he secures a proper volume of fresh air for his own use before it is breathed by his neighbour.

Fans.

The introduction of rapidly revolving, but silent, fans, driven by electricity, is a great advance which places within the reach of the engineer or architect the means for solving the problem of ventilation of buildings, and has been to a large extent responsible for the rapid progress of the art of ventilation. The fan and motor combined extend the advantages of positive mechanical ventilation to all who have access to electric current, with the further benefit that the extreme simplicity of the electric driving of the fans greatly facilitates the control and distribution of ventilating effect. The moderate power required by these fans for a given duty has contributed greatly to their extended use. They should deliver into a chamber of considerable size, so that the velocity of the air may become reduced before it passes into the distributing flues. The question of silence in running, in such places as houses of parliament, law courts, churches and chapels, is of paramount importance, and no fan should be accepted until it is proved by actual working to be noiseless.

In some instances revolving pumps of the Root's blower type are used (see Bellows and Blowing Machines). At the Dundee College a battery of five of these blowers, each discharging over 150,000 cub. ft. of air per hour, is driven easily by a gas engine of two horse-power. The air is passed through two filters of coarsely woven fabrics which serve to remove all particles of impurity. The rooms are heated by having coils of Perkins's high-pressure hot-water pipes (see Heating) in the main distributing flues. The inlets are flat upright tubes extending up the side walls to a height of nearly 6 ft., and open at the top. Outlets are generally provided in the end walls, one group near the ceiling, another a few feet from the foot. They are fitted with doors which allow one or other to be closed; the high-level outlets are used in warm weather, when the fresh air that comes in is comparatively cool; the low-level ones are used in cold weather, when the fresh air, having been heated before it enters, would tend to rise and pass out too directly if the outlets near the ceiling were open. The outlet shafts communicate with a louvred tower or turrets on the roof. Each room receives a volume of air equal to its cubic capacity in about 12 minutes, so that the atmosphere is completely changed five times in an hour. The inlets are proportioned to do this without allowing the velocity with which air enters to exceed 6 ft. per second.

Water-spray ventilator.

The water-spray ventilator is a mechanical ventilator using a jet of water to impel the air. A nozzle at the top of a circular air-shaft delivers a conical sheet of water, which impinges on the sides of the shaft a little way below and carries down with it a considerable stream of air. This ventilator is used either to force air into rooms or to draw it out; in the former case a small stove is often added to heat the supply.

Extraction by hot-air shaft.

In the early days of mechanical ventilation extraction by a hot-air shaft was a more common mode of ventilating hospitals and other public buildings than now. The heat was applied by a furnace or stove at the bottom of the shaft, or by coils of hot-water or steam pipes. In the lecture theatre of the Paris Conservatoire des Arts A. J. Morin employed this means of extraction, and arranged that the fresh air should enter through the ceiling and the foul air be drawn off through the floor from under the seats; this reversal of the natural direction of the current is of course only possible when a sufficient external motive force is applied.

In theatres and similar buildings clusters of gas jets or sunlight burners, fixed at the ceiling level at the base of a metal shaft which is connected with the open air, serve as effective ventilating agents by extracting the foul air which collects in the upper part of the hall.

The measurement of air.

To ensure the admission of the desired amount of air into a room, and to arrive at the proper allowance of inlets and outlets, it is necessary to ascertain the direction and velocity of the movement of the air through them. The quantity of air passing through a given opening is found by multiplying the area of the opening expressed in square feet by the velocity of the current of air stated in lineal feet per minute, the product being the number of cubic feet passing per minute. Where the air is admitted through gratings only the clear area should be calculated, the amount of solid material being deducted from the gross superficies of the grating. The velocity of the air current may be determined by means of an anemometer (*q.v.*).

We may conclude with a short summary of the methods adopted of ventilating a number of typical buildings of various classes of different countries.

The Smallpox Hospital at Bradford consists of two wards, 75 ft. by 15 ft., placed back to back, with a space of about 3 ft. between them enclosed by walls forming a foul-air chamber of the same length as the wards, and reaching to the ceiling. At this level are outlets for the vitiated air—one over each bed. A furnace at the base of a tall shaft withdraws through these outlets the air which passes through the furnace on its way to the outer air. The windows are tightly closed and fresh air enters from a chamber below through gratings in the floor at the foot of each bed.

The New York General Hospital was stated in 1875 to contain 163 beds. In the wards there is one window to each bed, each pier between the windows containing a foul-air extracting flue running from the base of the building and connected in the roof with large trunks leading to an exhaust fan. The heating is by steam coils placed in the basement in such a way that by a valve the cool fresh air can be sent either through or around the heating coil. The warmed fresh air is conveyed through an air-tight iron pipe fitted in each extracting shaft and is admitted to the wards through slits in the window-sills forming a jet directed upward on the principle of Tobin tubes. The outlet openings for the foul air are placed one beneath each bed, with extra outlets for occasional use at the top and base of the external walls. The placing of the fresh-air supply pipes in an inaccessible position inside the foul air ducts cannot be approved for hospital ventilation, as it is quite possible that in time, through the decay of the pipe joints or of the pipes themselves, communication may be established between the fresh and foul air, thus entirely upsetting the system of ventilation.

The City Hospital of Hamburg, containing 130 beds, was opened in 1890. The buildings are one storey high and are heated on the ancient Roman hypocaust principle. Beneath the entire floor run longitudinally a number of brick and concrete flues about 30 in. square, covered on the top with marble tiles, forming the floor of the wards. In these flues are placed the steam heating pipes. Warmed fresh air is admitted through large radiators in the centre of the wards, the vitiated air escaping through openings in the ridge of the roof. Mr H. Percy Adams adopted a similar hypocaust method for warming the chapel and the dining-hall at the King Edward VII. Tuberculosis Sanatorium at Midhurst, Sussex, except that the radiators are omitted from the centre of the rooms and placed in recesses in the side walls.

In the Houses of Parliament at Westminster, which were designed and built for the public business in 1836, considerable attention is devoted to the question of the purification of the air, but the arrangements are lamentably antiquated and ineffectual in their working. The supply of fresh air is drawn by fans from the terrace at the river front, and, after being warmed and moistened or cooled by water-spray or blocks of ice, as the temperature may require, passes through exceedingly tortuous and restricted air passages to the various chambers, where it is admitted through large gratings in the floor, which are covered by porous matting to prevent draughts. The outlets for the vitiated air are in the ceilings of the apartments, and from these the air has to be dragged down to the base of the ventilating shaft in the Victoria tower, where an up-current is maintained by a large furnace.

The French Chamber of Deputies, according to a report made by M. Frélat in 1891, is much overcrowded, the allowance of floor space for each member being only 30 square centimetres. The apparatus is powerful enough to change the air every six minutes, but to avoid draughts it can only be worked slowly. Fresh air is driven down by a fan through openings in the ceiling, and vitiated air removed at the floor, giving a downward system of ventilation.

For the ventilation of the new Sessions House at the corner of Newgate Street and Old Bailey, London, opened in 1907, an elaborate system on the plenum downward principle was installed. The fresh air, drawn in at the basement by powerful fans, passed in turn through purifying screens, on which water was constantly playing, and over steam-heated coils, before entering the distributing trunks; into these sufficient cold air also was admitted to reduce it to the required temperature. Branch ducts conveyed this warmed fresh air to the points of inlet just below the ceiling. The outlets for the vitiated air were placed near the floor level, an electric fan drawing it up and discharging it at the roof. It was claimed that 600 tons of filtered and warmed or cooled fresh air were passed through the building every hour.

In the Capitol at Washington in America the upward system is installed. Fresh air, warmed by coils in the basement, is delivered by means of fans through openings in the floors of the various chambers and galleries, and the extractors are placed in the ceilings. This foul air passes out of the building through louvre ventilators placed on the roof ridge. Some of the vitiated atmosphere, however—that from the corridors and galleries—is drawn by means of a fan to the basement and blown up a lofty shaft.

The Grand Opera House in Vienna is ventilated on a most elaborate and complete system, the arrangements there giving excellent results. The scheme for heating and ventilating this building was designed by D. Böhm. The building measures 397 ft. by 299 ft., and the theatre will hold about 2700 persons. Ventilation is effected by two fans, the lower for propulsion, the upper for extraction. The latter is aided also by the heat produced by the great pendant which has ninety burners. The heating is effected by steam, and the air enters the hall at a temperature of from 63° to 65° F., the points of entrance being at the floor and the risers of the seating. Each gallery and compartment of the theatre, including the stage, has a separate installation of heating apparatus and supply duct so that any one portion may be warmed and ventilated independently of the rest. The velocity of the incoming air is between 1 and 2 ft. per second. The driving fan in the basement sends air into the building at the rate of 1059 cub. ft. per head per hour by means of electricity. The temperature in different parts of the house can be observed in a central control office, and here also are the levers which control the valves regulating the air supply, both hot and cold. During a performance the superintendent of heating and ventilation is on duty in this office and secures to each part of the building its proper supply of fresh air at a proper temperature.

For the ventilation of mines see MINING, and for that of railway tunnels see TUNNEL.

AUTHORITIES.—The following are the principal publications on ventilation: J. S. Billings, *Ventilation and Heating*; Leeds, *Treatise on Ventilation*; Carpenter, *Heating and Ventilating Buildings*. (J. BT.)

VENTIMIGLIA (Fr. *Vintimille*, anc. *Album Intimilium* or *Albintimilium*), a frontier fortress, seaport and episcopal see of Liguria, Italy, in the province of Porto Maurizio, 94 m. W. by S. of Genoa by rail, and 4 m. from the Franco-Italian frontier, 45 ft. above sea-level. Pop. (1901) 3452 (town); 11,468 (commune). The present Gothic cathedral is built on the ruins of an earlier Lombard church, and this again on a Roman building, possibly a temple. The ruins of the ancient town are situated in the plain of Nervia, 3 m. to the E. of the modern. It was a *municipium* with an extensive territory, and of some importance under the Empire, but was plundered by the partisans of Otho in A.D. 69. Remains of a theatre are visible, and remains of many other buildings have been discovered, among them traces of the ancient city walls, a fine mosaic, found in 1852 but at once destroyed, and a number of tombs to the west of the theatre. The caves of the Balzi Rossi have proved rich in palaeolithic remains of the Quaternary period.

See *Notizie degli Scavi*, *passim*, especially 1877, 288 (G. Rossi).

VENTNOR, a watering-place in the Isle of Wight, England, 12½ m. S. by W. of Ryde by rail. Pop. of urban district (1901) 5866. It is finely situated in the Undercliff district, at the foot of St Boniface Down, which reaches a height of 787 ft. The town is built on a succession of terraces sloping towards the sea, and from its sheltered situation, equable temperature, and comparatively dry atmosphere is regarded as one of the best resorts in England for consumptive invalids. In the middle of the 19th century it was only a small fishing hamlet, now it extends along the shore for a distance of about 2 m., including Bonchurch to the east. It possesses assembly rooms, a literary and scientific institution, an esplanade, a pier and extensive recreation grounds. The churches of Ventnor are all modern, but that of St Boniface at Bonchurch is a small Norman building, perhaps the oldest in the island. Among the benevolent and charitable institutions are the royal national hospital for consumptives (founded in 1869), the seaside home of the London city mission, the St Catherine's home for consumptives and the convalescent home of the Royal Hants Hospital.

VENTRILOQUISM (Lat. *venter*, belly, and *loqui*, to speak), the art of producing the voice in such a manner that it shall appear to proceed, not from the speaker's own mouth, but from some place altogether distant from him. The art of ventriloquism was formerly supposed to result from a peculiar use of the stomach (whence the name) during the process of inhalation. As a matter of fact, the words are formed in the normal manner, but the breath is allowed to escape very slowly, the tones being muffled by narrowing the glottis and the mouth opened as little as possible, while the tongue is retracted and only its tip moves. Gestures and facial expression are employed at the same time to assist in the deception by stimulating the imagination of the listeners and to distract their attention from the speaker. "Thus," says Huxley, "if the ventriloquist desire to create the belief that a voice issues from the bowels of the earth, he imitates, with great accuracy, the tones of such a half-stifled voice, and suggests the existence of some one uttering it by directing his answers and gestures towards the ground. The gestures and tones are such as would be produced by a given cause; and, no other cause being apparent, the mind of the bystander insensibly judges the suggested cause to exist." Ventriloquism, which is still a recognized form of conjuring entertainment, is of ancient origin. Traces of the art are found in Egyptian and Hebrew archaeology. Eurykles of Athens was the most celebrated of Greek ventriloquists, who were called after him Euryklides, and also *Engastrimanteis* (belly-prophets). It is not impossible that the priests of ancient times were masters of this art, and that to it may be ascribed such miracles as the speaking statues of the Egyptians, the Greek oracles, and the stone in the river Pactolus, the sound of which put robbers to flight. Many uncivilized races of modern times are adepts in ventriloquism, as the Zulus, the Maoris and the Eskimos. It is well known in Hindustan and China, where it is practised by travelling magicians.

See De la Chapelle, *Le Ventriloque, ou l'engastrimythe* (London, 1772); E. Schultz, *Die Kunst des Bauchredens* (Erfurt, 1895); Sievers, *Grundzüge der Phonetic* (Leipzig, 1901); Russel, *Ventriloquism* (London, 1898).

VENUE (derived through the French, from Lat. *venire*, to come), in English law the term denoting the place from which a jury must come for the trial of a case. The word occurs early in constitutional documents, for it was for a long time one of the essentials of trial by jury that the jury should belong to the neighbourhood (*vicinetum, visne*) in which the cause of action arose or the alleged crime was committed (see JURY). This was founded on the idea that the jurors were in the nature of witnesses for or against the character or innocence of the party. The phrase *duodecim legales homines de vicineto*, or its equivalent, is found in the Constitutions of Clarendon (1164), the Assize of the Forest (1184) and in Glanvill.

Civil Matters.—Civil actions came to be classified as local and transitory, the former where the cause of action could only arise in a particular county, such as trespass to land, the latter where it might have arisen in any county, such as debt. In the latter case the plaintiff might lay the venue where he pleased, *i.e.* try the cause in any part of England subject to the power of the court or a judge to change the place of trial. The law on the subject is now only of antiquarian interest, for under the rules of the Supreme Court (Ord. xxxvi. r. 1), "there shall be no local venue for the trial of any action, except where otherwise provided by statute, but in every action in every division the place of trial shall be fixed by the court or a judge." All local venues created by statutes prior to 1875 were superseded by the rules of the Supreme Court and have not been revived by the present rules; and many of such statutes have been expressly or impliedly repealed by the Public Authorities Protection Act 1893. The present practice is to fix the place of trial in the order for directions now made in every civil action in the High Court. The place is selected by reference to the wishes of the parties, the residence of the witnesses, and with a view to reducing the costs of litigation.

Criminal Matters.—Proceedings by indictment or criminal information are not affected by the changes of procedure as to civil actions; and it is necessary to ascertain in the case of each offence the venue, *i.e.* the proper place of trial, which, unless otherwise provided by statute, must be the county or other jurisdiction in which acts constituting the offence have been done. Numerous acts provide for the place of trial of offences committed partly in one county and partly in another, or on the high seas or abroad, and of special offences, such as those under the Post Office, Merchant Shipping, Slave Trade, and Foreign Enlistment Acts. The place of trial may be changed by the king's bench division, where it is probable that a fair trial could not be had in the county of the venue. Until 1825 it was necessary to have as juries in criminal cases jurors from the hundred in which the offence was said to have been committed, and to be very particular to specify the venue as to each act imputed to the accused. This strictness continued to some extent until the passing of the Criminal Procedure Act 1851, which makes it unnecessary to state any venue in the body of an indictment, and no indictment is to be held bad for want of a proper perfect venue. Since this enactment (which applies to Ireland as well as to England) it is sufficient to state the venue in the margin of the indictment in this form, "Middlesex to wit," and it is unnecessary to mention the venue in the body of the indictment or information, though in certain cases such as burglary it is usual, if not essential, to give a "local description."

Scotland.—In Scottish law venue is not used as a technical term, but there are statutory provisions for changing the place of trial in both civil and criminal cases.

United States.—In the United States venue may generally be changed by the courts; but in some states it is provided by their constitutions that provision for change of venue is to be made by the legislature. In other states the passing of local or special laws for change of venue is forbidden. (W. F. C.)

VENUS, an old Roman and Latin goddess, apparently representing beauty and growth in nature, and especially in gardens, where the Roman practical sense would most naturally see these. She had two temples in Rome, one in the grove of Libitina, with whom she was wrongly identified, and the other near the Circus Maximus, both of which had as their dedication day the 19th of August, the festival of the *Vinalia rustica*, a fact which also points in the direction of skilled cultivation as the human work of which she was protectress. But this old Latin deity was in historical times entirely absorbed by the Greek Aphrodite, and assumed the characteristics of a cult of human love, which in her original form she had never possessed. (See APHRODITE.)

VENUS, in astronomy, the second of the major planets in the order of distance from the sun, and moving next within the orbit of the earth. Its symbol is ♀. At inferior conjunction it approaches nearer to the earth than any other major planet, but in that position it is practically invisible. Its apparent motion may be described as an oscillation from one side of the sun to the other, the complete period of which is 1·6 years, and the greatest elongation about 45° on each side of the sun. When east of the latter it appears as the "evening star" in the west after sunset, while near western elongation it is seen as the "morning star" before sunrise. In these aspects it was known to the ancients as Ἕσπερος, Hesperus, and Ἑωσφόρος or Φωσφόρος, Phosphorus. The eccentricity of its orbit is smaller than that of any other planet except Neptune.

Rotation of Venus.

Notwithstanding the near approach of Venus to the earth, its situation relative to the sun is unfavourable to the study of its physical constitution. Near inferior conjunction only a narrow crescent of light is visible; and when, as the planet moves away, this crescent becomes broader, the distance of the planet constantly increases. When it appears as a half-moon it is at a distance of more than two-thirds that of the sun, and nearly double the distance of Mars in opposition. The difficulty of reaching any conclusion on the subject of its constitution is heightened by the seeming absence of any well-marked features on the visible part of its brilliant surface. In the telescope it presents much the appearance of burnished silver, without spot or blemish. It is true that observers have from time to time thought they could detect slight variations of shade indicating an axial rotation. As far back as 1667 G. D. Cassini thought he saw a bright spot near the southern horn, observations of which gave a period of about 23 hours. In 1726 Francesco Bianchini (1662–1729), a papal chamberlain, made similar observations from which he inferred a period of more than 24 days. It was shown, however, that the observations of Bianchini could be reconciled with those of Cassini by supposing that, as he observed the planet night after night, it had made one rotation and a little more. J. H. Schroeter also found a revolution of less than 24 hours. But Sir W. Herschel, as in the case of Mercury, was never able to detect any changes from which a period of rotation could be determined. During the years 1888–1890, G. Schiaparelli made an exhaustive study of the whole subject, the results of which were summed up in five brief notes, read to the Lombardian Academy of Sciences during the year 1890. His general conclusion was that Venus always presents the same face to the sun, as the moon does to the earth. The same result has been reached by the observations at the Lowell Observatory. The inference that the axial rotation is at least much slower than that of the earth is strengthened by the measures of different diameters of the planet made while it was in transit across the disk of the sun in 1874 and 1882. These show no measurable ellipticity of the disk, but they are not sufficiently accurate to lead to any more precise conclusion than that just stated. Still, the difficulty and uncertainty attending all observations hitherto made upon the disk are such that no conclusion respecting the time of rotation can be regarded as established. Against the view of Schiaparelli is to be set the great improbability that a body so distant from the sun as Venus could be permanently so acted upon as to keep its axial rotation in precise coincidence with its orbital motion. Only one way seems to be open for settling the question; this is by spectroscopic observations of the displacement of the spectral lines at the two limbs of the planet. Attempts by this method have been made by A. A. Belopolski at Pulkova, and by the astronomers of the Lowell Observatory. It is, however, found that the amount of displacement is so small that it has evaded certain detection up to the present time. Belopolski's measures were decidedly in favour of an axial rotation, while the Lowell results were not.

Atmosphere of Venus.

Other observations than those we have cited show that Venus is surrounded by an atmosphere so filled with clouds that it is doubtful whether any view of the solid body of the planet can ever be obtained. The first evidence in favour of an atmosphere was found in the fact that, when near inferior conjunction, the visible outline of the thin crescent extended through more than 180°. Most remarkable was an observation by Chester Smith Lyman at New Haven during the conjunction of 1866, when the planet was just without the sun. A thin line of light was supposed to be seen all round the limb of the planet most distant from the sun. But as no such appearance was seen during the approach of the planet to the sun at the transits of 1874 and 1882, when the conditions were much more favourable, it seems likely that such observations are the result of an optical illusion. During the latter of the two transits the phenomena of this class observed were of an unexpected character. Not a trace of the planet could be seen until it began to impinge upon the solar disk. When about half of its diameter had entered upon the sun the outline outside the disk of the sun began to be marked by broken portions of an arc of light. This did not begin at the point A (fig. 1) farthest from the sun, as it should have done if due wholly to refraction, but immediately at the sun itself, as shown in the cut at the point B. Portions of this arc were formed one by one at various other points of the dotted outline, and when the planet was about three-fourths upon the sun the arc was completed. But there was no strengthening of the line at the middle point, as there should have been if due to refraction. Yet refraction must have played some part in the phenomenon, because otherwise no illumination could have been visible under the circumstances. The most satisfactory explanation seems to be that of H. N. Russell, whose conclusion is that the atmosphere is so permeated with fine particles of vapour up to its outer limit as to be only translucent without being fully transparent. Thus what is seen is the irregular reflection of the light at an extremely small angle from the particles of vapour.

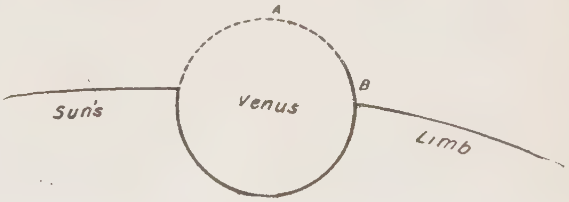

FIG. 1.

Supposed satellite.

The question whether Venus has a satellite has always interested astronomers. During the 17th and 18th centuries Cassini at Paris and James Short (1710–1768) in England, as well as other observers during the same period, saw an object which had the appearance of a satellite. But as no such object has been seen by the most careful search with the best instruments of recent times, the supposed object must be regarded as what is known to the practical astronomer as a "ghost" produced by refraction from the lenses of the eyepiece, or perhaps of the object-glass, of the telescope.

Transits of Venus.

If the orbit of Venus lay in the plane of the ecliptic, it would be seen to pass over the disk of the sun at every inferior conjunction. But the inclination of the orbit, 3° 36′, is so large that a transit is seen only when the earth and Venus pass a node of the orbit at nearly the same time. The earth passes the line of nodes about the 7th of June and the 7th of December of each year. The date of passage is about a day later in each successive century. Venus passes the node near enough to these dates to be seen against the sun only four times in a period of 243 years. The following list of dates from 1518 to 2012 shows the law of recurrence.

1518 June 2.
1526 June 1.
1631 December 7.
1639 December 4.
1761 June 6.
1769 June 3.
1874 December 9.
1882 December 6.
2004 June 8.
2012 June 6.

The first of these transits actually seen was that of 1639, which was imperfectly observed by Jeremiah Horrox (1619–1641) shortly before sunset. Special interest in them was first excited by Edmund Halley a century later, who showed that the parallax of the sun could be determined by observing transits of Venus from regions of the earth's surface where the displacement by parallax was greatest. Governments, scientific organizations and individuals fitted out expeditions on a very large scale to make the necessary observations upon the four transits which have since occurred. The disappointing character of the results so far as the solar parallax is concerned are stated in the article PARALLAX, SOLAR. It may be said in a general way that the observations, even when made by experienced astronomers, exhibited irregularities and discordances several times greater than one had a right to expect. Other methods of determining the distance of the sun have been so perfected that the results of these transits now count but little. (S. N.)

VENUSIA (mod. *Venosa, q.v.*), an ancient city of Apulia, Italy, on the Via Appia, about 6 m. S. of the river Aufidus (Ofanto), and not far from the boundary of Lucania (hence Horace describes himself as "Lucanus an Apulus anceps, nam Venusinus arat finem sub utrumque colonus"). It was taken by the Romans after the Samnite war of 291 B.C., and became a colony at once, no fewer than 20,000 men being sent there, owing to its military importance. Throughout the Hannibalic wars it remained faithful to Rome, and had a further contingent of colonists sent in 200 B.C. to replace its losses in war. Some coins of Venusia of this period exist. It took part in the Social War, and was recaptured by Quintus Metellus Pius; it then became a *municipium*, but in 43 B.C. its territory was assigned to the veterans of the triumvirs, and it became a colony once more. Horace was born here, the son of a freedman, in 65 B.C. It remained an important place under the Empire as a station on the Via Appia, though Mommsen's description of it (*Corp. Inscr. Lat.* ix. p. 45) as having branch roads to Equus Tuticus and Potentia, and Kiepert's maps annexed to the volume, do not agree with one another. Remains of the ancient city walls and of an amphitheatre still exist, and a number of inscriptions have been found there. Jewish catacombs with inscriptions in Hebrew, Greek and Latin show the importance of the Jewish population here in the 4th and 5th centuries after Christ. (T. As.)

VENUS'S FLY-TRAP (*Dionaea muscipula*), a remarkable insectivorous plant, a native of North and South Carolina, first described in 1768 by the American botanist Ellis, in a letter to Linnaeus, in which he gave a substantially correct account of the structure and functions of its leaves, and even suggested the probability of their carnivorism. Linnaeus declared it the most wonderful of plants (*miraculum naturae*), yet only admitted that it showed an extreme case of sensitiveness, supposing that the insects were only accidentally captured and subsequently allowed to escape. The insectivorous habit of the plant was subsequently fully investigated and described by Charles Darwin in his book on insectivorous plants.

The plant is a small herb with a rosette of radical leaves with broad leaf-like footstalks. Each leaf has two lobes, standing at rather less than a right angle to each other, their edges being produced into spike-like processes (fig. 1). The upper surface of each lobe is covered with minute circular sessile glands, each consisting of from 20 to 30 cells filled with purplish fluid; it bears also three fine-pointed sensitive bristles arranged in a triangle (fig. 3). These contain no fibro-vascular bundles, but present an articulation near their bases, which enables them to bend parallel to the surface of the leaf when the lobes close. When the bristles are touched by an insect the lobes close very sharply upon the hinge-like midrib, the spikes interlock, and the insect is imprisoned (fig. 2). If very minute, and so not worth digesting, it is able to escape between the interlocked spines; more usually, however, it is retained between the lobes, which gradually but firmly compress it, until its form is distinguishable from without. The leaf thus forms itself into a temporary stomach, and the glands, hitherto dry, commence, as soon as excited by the absorption of a trace of nitrogenous matter, to pour out an acid secretion containing a ferment or *enzyme*, similar to that excreted by the leaves of the sundew, which rapidly dissolves the soft parts of the insect. This is produced in such abundance that, when Darwin made a small opening at the base of one lobe of a leaf which had closed over a large crushed fly, the secretion continued to run down the footstalk during the whole time—nine days—during which the plant was kept under observation. The closing of the leaf is due to a redistribution of water in the cells brought about by a change in the protoplasm which follows the stimulation of the sensitive bristles.

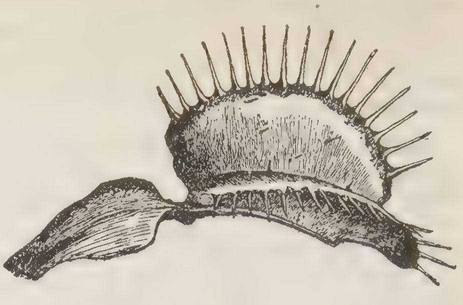

FIG. 1.—Leaf of Venus's Fly-Trap (*Dionaea muscipula*), viewed laterally in its expanded state, slightly enlarged. (After Darwin.)

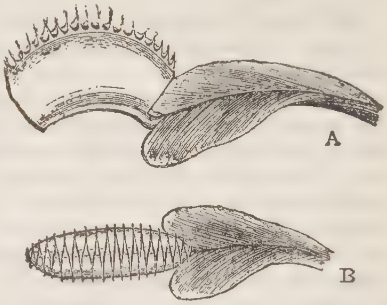

FIG. 2.—Leaf of *D. muscipula* closed over Insect. A, viewed from the side; B, from above.

Though the bristles are exquisitely sensitive to the slightest contact with solid bodies, yet they are far less sensitive than those of the sundew (*Drosera*) to prolonged pressure, a singular difference in evident relation to the habits of the two plants. Like the leaves of *Drosera*, however, those of *Dionaea* are completely indifferent to wind and rain. The surface of the blade is very slightly sensitive; it may be roughly handled or scratched without causing movement, but closes when its surface or midrib is deeply pricked or cut. Irritation of the triangular area on each lobe enclosed by the sensitive bristles causes closure. The footstalk is quite insensitive. Inorganic or non-nitrogenous bodies, placed on the leaves without touching the sensitive bristles, do not excite movement, but nitrogenous bodies, if in the least degree damp, cause after several hours the lobes to close slowly. So too the leaf which has closed over a digestible body applies a gradual pressure, which serves to bring the glands on both sides into contact with the body. Thus we see that there are two kinds of movement, adapted for different purposes, one rapid, excited mechanically, the other slow, excited chemically. Leaves made to close over insoluble bodies reopen in less than twenty-four hours, and are ready, even before being fully expanded, to shut again. But if they have closed over nitrogen-yielding bodies, they remain closely shut for many days, and after re-expanding are torpid, and never act again, or only after a considerable time. Even in a state of nature, the most vigorous leaves are very rarely able to digest more than twice, or at most thrice, during their life.

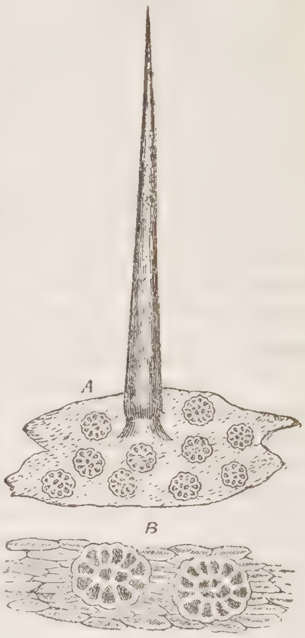

FIG. 3.—A, sensitive bristle and glands of *D. muscipula*; B, glands.

VENUS'S LOOKING GLASS, a popular garden name for *Campanula Speculum* (or *Specularia Speculum*), from the old name for the plant, *Speculum Veneris*. It is a common cornfield plant in the south of Europe, and is grown in gardens on account of its brilliant purple flowers.

VERA, AUGUSTO (1813–1885), Italian philosopher, was born at Amelia in the province of Perugia on the 4th of May 1813. He was educated in Rome and Paris, and, after teaching classics for some years in Geneva, held chairs of philosophy in various colleges in France, and subsequently was professor in Strassburg and in Paris. He left Paris after the *coup d'état* of 1851 and spent nine years in England. Attaching himself with enthusiasm to Hegel's system, Vera (who wrote fluently both in French and in English as well as in Italian) became widely influential in spreading a knowledge of the Hegelian doctrine, and became the chief representative of Italian Hegelianism. Without any marked originality, his writings are distinguished by lucidity of exposition and genuine philosophic spirit. In 1860 Vera returned to Italy, where he was made professor of philosophy in the royal academy of Milan. In the following year he was transferred to Naples as professor of philosophy in the university there. His *Prolusioni alla Storia della Filosofia* and *Lezioni sulla Filosofia della Storia* were connected with his professorial work, which was specially devoted to the history of philosophy and the philosophy of history. He held this post till his death, which took place at Naples on the 13th of July 1885.

Among his numerous works may be mentioned *Introduction à la philosophie d'Hégel* (1855; 2nd ed., 1865); *Problème de la certitude* (1845); *Le Hégelianisme et la philosophie* (1861); *Mélanges philosophiques* (1862); *Essais de philosophie Hégélienne* (1864); *Strauss, l'ancienne et la nouvelle foi* (1873), an attack upon Strauss's last "confession," written from the standpoint of an orthodox Hegelian; and a comprehensive work in Italian, *Il Problema dell' Assoluto* (Naples, 1872–82). His English works are an *Inquiry into Speculative and Experimental Science* (London, 1856); *Introduction to Speculative Logic and Philosophy* (St Louis, 1875), and a translation of Bretschneider's *History of Religion and of the Christian Church.* He published also translations into French with commentaries of Hegel's works: *Logique de Hégel* (Paris, 1859; 2nd ed., 1874); *Philosophie de la nature de Hégel* (1863–65); *Philosophie de l'esprit de Hégel* (1867–69); *Philosophie de la religion de Hégel* (1876–78, incomplete).

See R. Mariano, *Augusto Vera* (Naples, 1887) and *Strauss e Vera* (Rome, 1874); Karl Rosenkranz, *Hegel's Naturphilosophie und deren Bearbeitung durch A. Vera* (Berlin, 1868).

VERA CRUZ (officially VERA CRUZ LLAVE), a Gulf Coast state of Mexico, bounded N. by Tamaulipas, W. by San Luis Potosi, Hidalgo, Puebla and Oaxaca, and S.E. by Chiapas and Tabasco. Pop. (1900) 981,030. It is about 50 m. wide, extending along the coast, N.W. to S.E., for a distance of 435 m., with an area of 29,201 sq. m. It was the seat of an ancient Indian civilization antedating the Aztecs and is filled with remarkable and interesting ruins; it is now one of the richest states of the republic. It consists of a low, sandy coastal zone, much broken with tidewater streams and lagoons, behind which the land rises gradually to the base of the sierras and then in rich valleys and wooded slopes to their summits on the eastern margin of the great Mexican plateau, from which rise the majestic summits of Orizaba and Cofre de Perote. The climate is hot, humid and malarial, except on the higher elevations; the rainfall is heavy, and the tropical vegetation is so dense that it is practically impossible to clear it away. At Coatzacoalcos the annual precipitation ranges from 125 to 140 in., but it steadily decreases towards the N. On the higher slopes of the sierras prehistoric terraces are found, evidently constructed to prevent the washing away of the soil by these heavy rains. More than forty rivers cross the state from the sierras to the coast, the following being navigable on their lower courses—Coatzacoalcos, San Juan, Tonto, Papaloapam, Tuxpam and Casones. Several of the lagoons on the coast are also navigable, that of Tamiahua on the northern coast, about 100 m. long, being connected with the port of Tampico by inland channels. There are several ports on the coast—Coatzacoalcos, Alvarado, Vera Cruz, Nautla, Tecolutla and Tuxpam. The products of the state are chiefly agricultural—cotton, sugar, rum, tobacco, coffee, cacao, vanilla, maize, beans and fruit. Cattle-raising is followed in some districts, cattle and hides being among the exports. Among the forest products are rubber, cabinet woods, dye-woods, broom-root, chicle, jalap and orchids. Vera Cruz is one of the largest producers of sugar and rum in Mexico. There are a number of cotton factories (one of the largest in Mexico being at Orizaba), chiefly devoted to the making of coarse cloth for the lower classes. Tobacco factories are also numerous. Other manufactures include paper, chocolate, soap and matches. There are four lines of railway converging at Vera Cruz, two of which cross the state by different routes to converge again at Mexico city. Another, the Tehuantepec National railway, crosses in the south, and is connected with Vera Cruz (city) by the Vera Cruz & Pacific line, which traverses the state in a south-easterly direction. The capital is Jalapa, and its principal towns are Vera Cruz, Orizaba, Cordova and Coatzacoalcos.

VERA CRUZ, a city and seaport of Mexico, in the state of Vera Cruz, on a slight indentation of the coast of the Gulf of Mexico, in 19° 11′ 50″ N., 96° 20′ W., slightly sheltered by some small islands and reefs. Pop. (1900) 29,164. Vera Cruz is the most important port of the republic. It is 263 m. by rail E. of the city of Mexico, with which it is connected by two lines of railway. It is built on a flat, sandy, barren beach, only a few feet above sea-level. The harbour is confined to a comparatively narrow channel inside a line of reefs and small islands, which is exposed to the full force of northern storms. New port works were completed towards the end of the 19th century, which, by means of breakwaters, afford complete protection. In 1905 the four railway companies having terminal stations in Vera Cruz united in the organization of a joint terminal association, with union station, tracks, warehouses, quays, cranes, &c.

Vera Cruz dates from 1520, soon after the first landing there of Cortés. This settlement was called Villa Rica de Vera Cruz, but was soon after moved to the harbour of Bernal, in 1525 to a point now called Old Vera Cruz, and in 1599 to its present site. It was pillaged by privateers in 1653 and 1712, and this led to the erection of the celebrated fort of San Juan de Ulúa, or Ulloa, on one of the reefs in front of the city. In 1838 it was captured by the French, in 1847 (March 29) by an American army under General Winfield Scott, who made Vera Cruz a base for his march upon the city of Mexico, and in 1861 by the French.

VERANDAH, or VERANDA, a roofed gallery or portico attached to the outside of a dwelling-house or other building, usually open at the sides or partially covered by lattice-work or glass or other screens. The roofing is slanting and supported by pillars; a light rail or balustrade often surrounds it. The word in English is comparatively modern, having only been included by Todd in his edition of Johnson's *Dictionary* in 1827. But it was known earlier in India, and the occurrence of the word in modern Hindustani (*varanda*) and Malayan (*baranda*) has led some etymologists to connect the word with the Persian *barāmadan*, to climb. It is, however, certainly of European origin, and was taken to the East by the early Portuguese navigators. It is to be found as early as the end of the 15th century and the beginning of the 16th in Spanish and Portuguese (so Minsheu, "*varanda*, railes to leane the brest on"), and apparently is to be referred to Lat. *vara*, a forked pole or rod.

VERATRUM. The Greek physicians were acquainted with a poisonous herb which they called white hellebore, and which has been supposed to represent the *Veratrum album* of modern botanists. Be this as it may, in modern times the name has been applied to a genus of herbaceous plants belonging to the natural order Liliaceae. *Veratrum* is a tall-growing herb, having a fibrous root-stock, an erect stem, with numerous broad, plicated leaves placed alternately, and terminal, much-branched clusters of greenish or purplish polygamous flowers. Each perfect flower consists of six regular petals, as many stamens, whose anthers open outwardly, and a three-celled superior ovary which ripens into a three-celled, many-seeded capsule. The genus comprises about nine species, natives of the temperate regions of the northern hemisphere, generally growing in pastures or woods. *V. album* and the American species *V. viride* are commonly grown in gardens as ornamental perennials, but their poisonous qualities should be kept in mind, particularly as they bear a considerable resemblance in foliage to the harmless *Gentiana lutea*. Both contain the potent alkaloid veratrine. (See also HELLEBORE.)

VERBENA. The genus *Verbena* (vervain) in botany gives its name to the natural order (Verbenaceae) of which it is a member. The species are herbaceous or somewhat shrubby, erect or procumbent, with opposite or whorled leaves, generally deeply cut. The sessile flowers are aggregated into close spikes. Each flower has a tubular, ribbed calyx, a more or less irregular tubular two-lipped corolla, with four (didynamous) stamens springing from the interior of the corolla-tube. The anthers are two-celled, with or without a gland-like appendage at the apex. The ovary is entire or four-lobed, and always four-celled, with a single ovule in each cell; the style is unequally two-lobed at the apex. The fruit consists of four hard nutlets within the persistent calyx. There are about eighty species known, mostly natives of tropical and subtropical America, a very few species occurring also in the Old World. The vervein, or vervain, *V. officinalis*, native of central and north Asia, Europe and North Africa, and common on dry waste ground in the south of England (rarer in the north), was the object of much superstitious veneration on the part of our pagan ancestors, who attributed marvellous properties to it, provided it were gathered in a particular manner and with much complex ceremonial. The plant is now but lightly esteemed, and its medicinal virtues are wholly discredited. The garden verbenas are derivatives from various South American species, such as *V. teucrioides*, a native of southern Brazil, and *V. chamaedrifolia* from Argentina and southern Brazil. The range of colours extends from pure white to rose-coloured, carmine, violet and purple. Striped forms also are cultivated. The lemon-scented verbena of gardens, so much valued for the fragrance of its leaves, was once referred to this genus under the name *V. triphylla*, subsequently called *Aloysia*, but is now referred to the genus *Lippia* as *L. citriodora*; it differs from *Verbena* in having two, not four, nutlets in the fruit.

The garden verbenas, although somewhat misprized for some years, have once more become popular as bedding plants, and also for pot culture. They are easily raised from seeds sown in heat in February or March, but choice varieties, like Miss Willmott and others, can only be kept true when raised from cuttings. These are best secured from old plants cut down in the autumn and started into growth in gentle heat and moisture the following spring. They root readily in a compost of sandy loam and leaf soil. Besides the garden varieties, *V. venosa*, a Brazilian species with bluish-violet flowers, is a popular plant for massing in beds during the summer months.

VERBÖCZY, ISTVAN [STEPHEN WERBÖCZ] (1465?–1541), Hungarian jurist and statesman, first became known as a scholar and theologian of such eminence that he was appointed to accompany the emperor Charles V. to Worms, to take up the cudgels against Luther. He began his political career as the deputy of the county of Ugocsa to the diet of 1498, where his eloquence and scholarship had a great effect in procuring the extension of the privileges of the gentry and the exclusion of all foreign competitors for the Hungarian throne in future elections. He was the spokesman and leader of the gentry against the magnates and prelates at the diets of 1500, 1501 and 1505. At the last diet he insisted, in his petition to the king, that the law should be binding upon all the gentry alike, and firmly established in the minds of the people the principle of a national monarchy. The most striking proof of his popularity at this time is the fact that the diet voted him two *denarii* per hearth for his services in 1505, a circumstance unexampled in Hungarian history. In 1517 Verböczy was appointed the guardian of the infant Louis II., and was sent on a foreign mission to solicit the aid of Christendom against the Turks. On his return he found the strife of parties fiercer than ever and the whole country in a state of anarchy. At the diet of Hatvan, on the 25th of June 1525, he delivered a reconciliatory oration which so affected the assembly that it elected him palatine. During the brief time he held that high office he unselfishly and courageously endeavoured to serve both king and people by humbling the pride of the magnates who were primarily responsible for the dilapidation of the realm. But he was deposed at the following diet, and retired from public life till the election of János Zapolya, who realized his theory of a national king and from whom he accepted the chancellorship. He now devoted himself entirely to the study of jurisprudence, and the result of his labours was the famous *Opus tripartitum juris consuetudinarii inclyti regni hungariae*, which was the law-book of Hungary till 1848.

See Arpad Karólyi, *Verböczy's Mission to the Diet of Worms* (Hung.; Budapest, 1880); Vilmor Fraknói, *Before and after the Catastrophe of Mohács* (Hung.; Budapest, 1876); ibid., *Stephen Werböczi* (Hung.; Budapest, 1899). (R. N. B.)

VERBOECKHOVEN, EUGÈNE JOSEPH (1799–1881), Belgian painter, was born at Warneton in West Flanders, and received instruction in drawing and modelling from his father, the sculptor Barthélemy Verboeckhoven. Subsequently he settled in Brussels and devoted himself almost exclusively to animal subjects. His paintings of sheep, of horses and of cattle in landscape, somewhat after the manner of Potter, brought him universal fame, and were eagerly sought for by collectors. Precise and careful finish is the chief quality of his art, which is entirely objective and lacking in inspiration. Verboeckhoven visited England in 1826, Germany in 1828, and France and Italy in 1841, and died at Brussels in 1881. He was a member of the academies of Brussels, Ghent, Antwerp, St Petersburg and Amsterdam. Examples of his art are to be found in nearly all the important galleries of Europe and the United States, notably in Brussels, Antwerp, Amsterdam, Hamburg, Berlin, Munich, New York, Boston and Washington. His long life and ceaseless industry account for the enormous number of his pictures in public and private collections and in the art market. In addition to his painted work he executed some fifty etched plates of similar subjects.

VERBRUGGEN, SUSANNA (*c.* 1667–1703), English actress, was the daughter of an actor named Percival, and her first recorded stage appearance was in 1681 in D'Urfey's *Sir Barnaby Whig*. She played at Dorset Garden and the Theatre Royal, and in 1686 married William Mountfort (*q.v.*). By 1690 she was one of the leading actresses in Betterton's company. About a year after Mountfort's death, in 1692, she married John Verbruggen (*fl.* 1688–*c.* 1707), also an actor of considerable ability.

VERCELLI (anc. *Vercellae*), a town and archiepiscopal see of Piedmont, Italy, in the province of Novara, 13 m. S.W. of that town by rail. Pop. (1901) 17,922 (town), 30,470 (commune). It is situated 430 ft. above sea-level on the river Sesia, at its junction with the Canterana. Vercelli is a point at which railways diverge for Novara, Mortara, Casale Monferrato and Santhià (for Turin). The walls by which Vercelli was formerly surrounded have been demolished, and their place is now occupied by boulevards, from which a fine view of the Alps (especially the Monte Rosa group) is obtained. The streets are for the most part tortuous and narrow; there is a large market-place (Piazza Cavour) with a statue of Cavour (1861). The cathedral is a large building dating from the 16th century; its library contains a number of rare ancient MSS., especially the *Codex Vercellensis*, one of the most important MSS. of the old Latin version of the Gospels, written in the 4th or 5th century by Eusebius, bishop of Vercelli. A museum close by contains Roman antiquities. The churches of S. Andrea (a large and fine Romanesque Gothic building dating from 1219–1224, with an interior in the French Gothic style), S. Paolo, S. Caterina and S. Cristoforo possess valuable examples of the work of Gaudenzio Ferrari (1471–1546) and of his follower Lanini. Silk-spinning is important, and Vercelli is one of the principal Italian centres of the exportation of cereals and especially of rice. There are corn and rice mills of large size, while cotton and woollen mills and factories of artificial manure, &c., have attained importance.

Vercellae was originally the chief city of the Libici (a Ligurian tribe) and afterwards became a Roman *municipium* of some importance. It stood at the junction of roads to Eporedia, Novaria and Mediolanum, Laumellum (for Ticinum) and perhaps Hasta. No ancient remains exist above ground, but many inscriptions, tombs and other antiquities have been found. Remains of the theatre and amphitheatre were seen in the 16th century, and remains of ancient streets have more recently been found during drainage operations. There were apparently four principal streets all leading to the centre of the town where the Forum must have been situated. Of the walls, however, nothing is known except from medieval documents (cf. L. Bruzza, *Iscrizioni antiche Vercellesi*, Rome, 1874). In the neighbourhood (near Rotto on the Sesia) are the Raudii Campi where Hannibal won his first victory on Italian soil (218 B.C.), and where in 101 B.C. Marius and Catulus routed the Cimbri. From about 1228 till 1372 Vercelli was the seat of a university. (T. As.)

VERCELLI BOOK (Codex Vercellensis), an Early English MS. containing, besides homilies, a number of poetical and imaginative pieces: *Andreas*, *The Fates of the Apostles*, *Address of the Soul to the Body*, *Falseness of Men*, *Dream of the Rood*, *Elene* and a prose *Life of Guthlac*. It was found in the cathedral library of Vercelli, Piedmont, by a German jurist Friedrich Blume, in 1822, and was first described in his *Iter Italicum* (Berlin and Stettin, 4 vols., 1824–36). An untenable explanation of the presence of the MS. at Vercelli suggested that it had been brought there by Johannes Scotus Erigena. But the handwriting dates from the beginning of the 11th century, long after his death. According to Dr Wülker the MS. probably belonged to the hospice for English pilgrims, founded, together with the monastery of St Andrew, by Cardinal Jacopo Guala-Bicchieri (d. 1227), a native of Vercelli and bishop of the city, in 1219, on his return from England, where he had been papal legate from 1216 to 1218. The cardinal, a man of wide learning, possessed a large library, which he left to the monastery; and the Vercelli codex may well have been included in it.

Its contents were partially printed (by Benjamin Thorpe from Blume's transcript) in Appendix B to C. P. Cooper's *Report of Rymeri Foedera* for 1836; by J. M. Kemble, *The Poetry of the Codex Vercellensis, with an English translation* (Aelfric Soc., 1843–56), and in a better text based directly on the MS. by Wülker in his edition of C. W. M. Grein's *Bibliothek der A.S. Poesie* (Leipzig, 1894), vol. ii. *Codex Vercellensis*, by Dr Richard Wülker (Leipzig, 1894), is a facsimile of the MS.

For the description and history of the MS. see also Wülker's *Grundriss . . . der A.S. Litteratur* (1885), pp. 237–42, and A. Napier in *Zeitschrift für deutsches Altertum* (Berlin, 1889, vol. 21, new series; old series, vol. 33, p. 66), for a collation of Wülker's text with the MS. For the individual poems see also Cynewulf.

VERDEN, a town of Germany, in the Prussian province of Hanover, on the navigable Aller, 3 m. above its confluence with the Weser, 22 m. S.E. of Bremen by the railway to Hanover. Pop. (1900) 9842. The most noticeable edifices are the beautiful Gothic cathedral, the churches of St Andrew and St John, a new Roman Catholic church (1894) and the celebrated cathedral school. Its industries embrace the manufacture of agricultural machinery, cigar-making, brewing and distilling. Verden was the see of a bishopric founded in the first quarter of the 9th century, or earlier, and secularized in 1648. The duchy of Verden was then ceded to Sweden, passed in 1719 to Hanover and in 1810 to the kingdom of Westphalia. It was restored to Hanover in 1814, and was, with Hanover, annexed by Prussia in 1866.

See Ostenberg, *Aus Verden's Vergangenheit* (Stade, 1876).

VERDERER (O. Fr. *verdier*, Med. Lat. *viridarius*), a term used in English forest law for a judicial officer appointed to look after what was known as the "vert" (O. Fr. *verd*, green; Lat. *viridis*), *i.e.* the forest trees and underwood in the royal forests. It was the verderer's duty to keep the assizes and attend to all matters relating to trespasses (see Forest Law).

VERDI, GIUSEPPE FORTUNINO FRANCESCO (1813–1901), Italian composer, was born on the 10th of October 1813 at Le Roncole, a poor village near the city of Busseto. His parents kept a little inn, combined with a kind of village shop. Verdi received some instruction from the village organist, but his musical education really began with his entrance into the house of business of Antonio Barezzi, a merchant of Busseto. Barezzi was a thorough musician, and under his auspices Verdi was speedily introduced to such musical society as Busseto could boast. He studied under Giovanni Provesi, who was *maestro di cappella* of the cathedral and conductor of the municipal orchestra, for which Verdi wrote many marches and other instrumental pieces. These compositions are now the principal treasures of the library of Busseto. Among them is Verdi's first symphony, which was written at the age of fifteen and performed in 1828. In 1832 Verdi went to Milan to complete his studies. He was rejected by the authorities of the Conservatorio, but remained in Milan as a pupil of Vincenzo Lavigna, with whom he worked until the death of Provesi in 1833 recalled him to Busseto. A clerical intrigue prevented him from succeeding his old master as cathedral organist, but he was appointed conductor of the municipal orchestra, and organist of the church of San Bartolomeo. After three years in Busseto, Verdi returned to Milan, where his first opera, *Oberto, Conte di San Bonifacio*, was produced in 1839. His next work, a comic opera, known variously as *Un Giorno di Regno* and *Il Finto Stanislao*, was written in peculiarly distressing circumstances, the composer having had the misfortune to lose his wife and two children in the course of two months. *Un Giorno di Regno* was a complete failure, and Verdi, stung by disappointment, made up his mind to write no more for the stage. He kept his word for a year, but was then persuaded by Merelli, the impresario of La Scala, to look at a libretto by Solera. The poem took his fancy, in a short time the music was written, and in 1842 the production of *Nabucodonosor* placed Verdi in the front rank of living Italian composers. The success of *Nabucodonosor* was surpassed by that of its two successors, *I Lombardi* (1843) and *Ernani* (1844), the latter of which was the first of Verdi's operas to find its way to England. With *Ernani* Verdi became the most popular composer in Europe, and the incessant demands made upon him reacted upon his style. For several years after the production of *Ernani* he wrote nothing which has survived to our time—nothing which deserved to survive. In *Macbeth* (1847) there are passages of some power, and passages too which indicate an approaching transition to a less conventional method of expression. In *Luisa Miller* (1849) also there is a noticeable increase of refinement in style, which contrasts favourably with the melodramatic vulgarity of his earlier manner.

It was unfortunate that *I Masnadieri*, which was written for the English stage and produced under Lumley's management at Her Majesty's Theatre in 1847, should have been one of the worst of the many bad works which Verdi composed at this period of his career. Not the presence of the composer, who travelled to England to conduct the first performance, nor the genius of Jenny Lind, who sang the part of the heroine, could redeem it from failure. In 1851 Verdi won one of the greatest triumphs of his career with *Rigoletto*, a triumph which was fully sustained by the production two years later of *Il Trovatore* and *La Traviata*. In these works Verdi reached the culminating point of what may be called his second manner. His development had been steady though gradual, and it is only necessary to compare the treatment of voice and orchestra in *Rigoletto* with that in *Ernani* to realize how quickly his talent had developed during these seven years. The popularity of *Rigoletto*, *Il Trovatore* and *La Traviata* was enormous, and consolidated Verdi's fame outside the frontiers of Italy. In 1855 he received a commission to write an opera for the Paris Opéra, to be produced during the Universal Exhibition. He wrote *Les Vêpres Siciliennes*, a work which though temporarily successful has not retained its popularity. It contains some fine music, but suffers from the composer's perhaps unconscious attempt to adopt the grandiose manner of French opera. Of the works written during the next ten years only *Un Ballo in Maschera* (1859) has maintained a fitful hold upon public attention. *La Forza del Destino* (1862) and *Don Carlos*, the latter of which was written for the Paris Exhibition of 1867, have the faults incident to works written during a period of transition. At this point in his career Verdi was preparing to emancipate himself from the fetters of conventionality which had hitherto hindered his development. In these two works there are indications of an aspiration towards a freer method of expression, which harmonize ill with the more conventional style of the composer's earlier years. In *Aida*, an opera upon an Egyptian subject, written in response to an invitation from Ismail Pasha, and produced at Cairo in 1871, Verdi entered upon the third period of his career. In this work he broke definitely with the operatic tradition which he had inherited from Donizetti, in favour of a method of utterance, which, though perhaps affected in some degree by the influence of Wagner, still retains the main characteristics of Italian music. In *Aida* the treatment of the orchestra is throughout masterly, and shows a richness of resource which those who knew only Verdi's earlier works scarcely suspected him of possessing; nevertheless, the human voice was still the centre of Verdi's system. Verdi kept thoroughly abreast of modern musical development, but his artistic sense prevented him from falling into the excesses of the German school. In the *Requiem*, which was written in 1874 to commemorate the death of Manzoni, Verdi applied his newly found system to sacred music. His *Requiem* was bitterly assailed by pedants and purists, partly on the ground of its defiance of obsolete rules of musical grammar and partly because of its theatrical treatment of sacred subjects, but by saner and more sympathetic critics, of whom Brahms was not the least enthusiastic, it has been accepted as a work of genius. There are passages in it with which Protestant feeling can scarcely sympathize, but its passionate intensity and dramatic force, and the extraordinary musical beauty with which it abounds, amply atone for what to some may seem errors of taste. In 1881 a revised version of *Simon Boccanegra*, an earlier work which had not been successful, was produced at Milan. The libretto had been in part rewritten by Arrigo Boito, and Verdi wrote a great deal of new music for the revival, which was eminently successful. After this it was generally supposed that Verdi, who had reached an advanced age, had finally relinquished composition, but after a lapse of some years it became known that he was at work upon a new opera, and in 1887 *Otello* was produced at Milan. The libretto, a masterly condensation of Shakespeare's *Othello*, was the work of Boito. *Otello* recalls *Aida* in the general outlines of its structure, but voices and orchestra are treated with greater freedom than in the earlier work, and there is a conspicuous absence of set airs. In so far as regards the essential qualities of the music, *Otello* is an immense advance upon anything Verdi had previously written. It has a dramatic force and a power of characterization for which it would be vain to look in his earlier work, and which are all the more remarkable as appearing for the first time in this high degree of development in a work written in extreme old age. All that has been said of *Otello* may be repeated of *Falstaff*, which was produced in 1893, when the composer was in his eightieth year, with the addition that the later work contains, besides the dramatic power and musical skill of the earlier work, a fund of delicate and fanciful humour which recalls the gayest mood of Mozart. The libretto of *Falstaff*, which is the work of Boito, is an adaptation of *The Merry Wives of Windsor*, with the addition of a few passages from *Henry IV*. After the production of *Falstaff*, Verdi wrote nothing for the stage. In 1898 he produced four sacred pieces, settings of the *Ave Maria*, *Laudi alla Virgine* (words from Dante's *Paradiso*), the *Stabat Mater* and the *Te Deum*, the first two for voices alone, the last two for voices and orchestra. In these pieces Verdi abandoned to a certain extent the theatrical manner of the *Requiem* for one more restrained and more in keeping with ecclesiastical traditions. In imaginative power and musical beauty these pieces yield to none of Verdi's works. With the exception of these and the *Requiem*, Verdi has written little save for the stage. Among his minor works may be mentioned a string quartet, composed in 1873, a hymn written for the opening of the International Exhibition of 1862, two sets of songs, a *Paternoster* for five-part chorus, and an *Ave Maria* for soprano solo, with string accompaniment. The venerable composer died at Milan on the 27th of January 1901.

The following is a complete list of Verdi's operas, with the dates and places of production: *Oberto* (Milan, 1839); *Un Giorno di Regno* (Milan, 1840); *Nabucodonosor* (Milan, 1842); *I Lombardi* (Milan, 1843); *Ernani* (Venice, 1844); *I Due Foscari* (Rome, 1844); *Giovanna d'Arco* (Milan, 1845); *Alzira* (Naples, 1845); *Attila* (Venice, 1846); *Macbeth* (Florence, 1847); *I Masnadieri* (London, 1847); *Il Corsaro* (Trieste, 1848); *La Battaglia di Legnano* (Rome, 1849); *Luisa Miller* (Naples, 1849); *Stiffelio* (Trieste, 1850); *Rigoletto* (Venice, 1851); *Il Trovatore* (Rome, 1853); *La Traviata* (Venice, 1853); *Les Vêpres Siciliennes* (Paris, 1855); *Simon Boccanegra* (Venice, 1857; revised version, Milan, 1881); *Aroldo* [a revised version of *Stiffelio*] (Rimini, 1857); *Un Ballo in Maschera* (Rome, 1859); *La Forza del Destino* (St Petersburg, 1862); *Don Carlos* (Paris, 1867); *Aida* (Cairo, 1871); *Otello* (Milan, 1887); *Falstaff* (Milan, 1893). (R. A. S.)

VERDICT (O. Fr. *verdit*, Lat. *vere dictum*, truly said, used in Late Latin in one word with its present significance), the decision of a jury in a criminal or civil cause, given to the court through the foreman of the jury and recorded. In English law verdicts may be "general," *i.e.* in criminal cases "guilty" or "not guilty," or "special," when there is some question of law which the jury wish to leave to the consideration of the court; in this case the verdict is given in the form of a statement of facts as found by the jury, and the issue is left to be found by the court in accordance with the law upon such facts as found (see JURY).

VERDIGRIS, a pigment, consisting of basic copper carbonates, made by acting upon copper plates with pyroligneous acid soaked up in cloths, exposing the plates to air, then dipping in water, and finally scraping off the greenish crust; the plate is re-exposed and the operation repeated till it is used up. Another method consists in exposing thin copper sheets to the acid vapours rising from the residues or "marcs" of wine factories, the product being scraped off, and the plate re-exposed. Both processes require several weeks. The pigment appears with several shades of blue and green; blue verdigris is chiefly $CuO\cdot Cu(C_2H_3O_2)_2\cdot 6H_2O$, while light blue and green verdigris contain $2CuO\cdot Cu(C_2H_3O_2)_2\cdot 2H_2O$. Besides being used as a paint it is employed in dyeing and calico-printing, and also in the manufacture of other paints, *e.g.* Schweinfurt green, which is a double salt of the acetate and arsenite. A liniment or ointment is also used in medicine as a cure for warts. It is an irritant poison (hence the need that acid substances should never be cooked in copper utensils); the best antidote is white of egg and milk.

VERDUN, a garrison town of north-eastern France, capital of an arrondissement in the department of Meuse, on the main line of the Eastern railway between Paris and Metz, 42 m. N.N.E. of Bar-le-Duc. Pop. (1906) 12,837. In addition the population *comptée à part* (soldiers, &c.) numbers 8198. Verdun is situated in a basin surrounded by vine-clad hills on the Meuse, which here forms the Eastern Canal.

Verdun as a fortress is of first-rate importance. It lies directly opposite the frontier of German Lorraine and the great entrenched camp of Metz. At the time of the war of 1870 (when it was defended for long without hope of success by General Guérin de Waldersbach) it was still a small antiquated fortress of the Vauban epoch, but in the long line of fortifications on the Meuse created by Serré de Rivière in 1875 Verdun, forming the left of the "Meuse Line" barrier, was made the centre of an entrenched camp. The first lesson of 1870 being taken to heart, forts were placed (Belrupt S.E., St Michel N.E., Belleville N. and La Chaume and Regret W.) on all the surrounding heights that the besiegers had used for their batteries, but the designers soon extended the line of the eastern defences as far out as the sharply defined cliffs that, rising gently for some miles from the Meuse, come to an abrupt edge and overlook the plain of Woëvre. On this front, which is about 5½ m.

long, the most important works are (from right to left) Châtillon, Manezel, Moulainville, Eix, Mardi Gras, Lanfée, Vaux and Hardimont. At right angles to this line, the south front, the works of which are placed along one of the long western spurs of the line of heights, are forts Rozellier, St Symphorien and Haudainville, the last overlooking the Meuse. The north front, also on a spur of the ridge, is thickly studded with forts, these in some cases being but 200 yds. apart and the left fort overlooking the Meuse. Behind the east front, chiefly designed to close the valley by which the Metz-Verdun railway penetrates the line of heights, are Fort Tavannes with its outworks and a series of batteries on the adjacent spurs. On the left bank of the Meuse there is a complete semicircle of forts. At the northern end of this semicircle (besides some works in the valley itself), and crossing its fire with the left of the north front, is Fort Belle-Épine, then comes Marre, Bourrus and Bruyères, all four being on a single ridge facing N.W. The west front is composed of Fort Germonville, Fort Bois de Sartelles, Fort Bois du Chapitre, Fort Landrecourt and Fort Dugny, which last is within sight of Fort Haudainville over the Meuse. In second line behind these works are Fort Choisel, Chana redoubt and Fort Sartelles. In all there are 16 large forts and about 20 smaller works, the perimeter of the whole being about 30 m. and the greatest diameter of the fort-ring 9.

The chief quarter of the town lies on the slope of the left bank of the river and is dominated by the citadel which occupies the site of the old abbey of St Vanne founded in the 10th century. Several arms of the river intersect the quarter on the right bank. The whole town is surrounded by a bastioned enceinte, pierced by four gates; that to the N.E., the Porte Chaussee, flanked by two crenelated towers, is an interesting specimen of the military architecture of the 15th century. The cathedral of Notre-Dame stands on the site of two previous churches of the Romanesque period, the first of which was burnt down in 1047; a crypt and other remains of the second building consecrated in 1147 are still to be seen, but the greater part of the present church dated from subsequent periods. Built under the influence of Rhenish architecture, Notre-Dame has double transepts and, till the 18th century when the western apse was replaced by a façade, had an apse at each extremity. A fine cloister to the S.W. of the cathedral dates from the 15th century. The hôtel-de-ville (17th century) contains the museum.

Verdun is the seat of a bishop and a sub-prefect and has tribunals of first instance and of commerce, a communal college, ecclesiastical seminaries and a branch of the Bank of France. The industries include metal founding, the manufacture of sweetmeats (*dragées de Verdun*), machinery, nails, files, embroidery, linen, chairs and rope and the distillation of liqueurs. The canal port has trade in timber, agricultural produce, stone and building materials and coal.

Verdun (*Verodunum*), an important town at the time of the Roman conquest, was made a part of Belgica Prima. The bishopric, of which the most celebrated holder was St Vanne (498–525), dates from the 3rd century. Verdun was destroyed during the period of the barbarian invasions, and did not recover till towards the end of the 5th century. Clovis seized the town in 502, and it afterwards belonged to the kingdom of Austrasia. In 843 the famous treaty was signed here by the sons of Louis the Pious (see GERMANY, *History*). In the 10th century Verdun was definitively conquered by Germany and put under the temporal authority of its bishops. Together with Toul and Metz, the town and its domain formed the territory of the Trois-Évêchés. In the 11th century the burghers of the now free and imperial town began a struggle with their bishops, which ended in their obtaining certain rights in the 12th century. In 1552 Henry II. of France took possession of the Trois-Évêchés, which finally became French by the treaty of Westphalia. In 1792, after some hours of bombardment, the citizens opened their gates to the Prussians—a weakness which the Revolutionary Government punished by the execution of several of the inhabitants. In 1870 the Prussians, unable to seize the town by a *coup de main*, invested and bombarded it three different times, till it capitulated in the beginning of November.

VERDY DU VERNOIS, JULIUS VON (1832–), German general and military writer, was born in 1832 and entered the Prussian infantry in 1850. After some years of regimental service he came under the notice of Moltke, the newly appointed chief of the general staff, as an exceptionally gifted soldier, and at the outbreak of the war against Austria in 1866 he was appointed major on the staff of the II. Army (crown prince of Prussia). In this capacity he took part in the campaign on the upper Elbe and in the battle of Königgrätz. Promoted shortly after this to the rank of lieutenant-colonel, he was in 1867 placed at the head of a section of the general staff, becoming thereby one of Moltke's principal confidential assistants. In this capacity he served at the headquarters of the German army throughout the war of 1870–71, and he was frequently employed in the most important missions, as for instance on the 2nd of August, when he was sent to impress upon the III. Army headquarters the necessity of a prompt advancing into Alsace, and on the 26th of the same month, when he was sent to advise the crown prince of Saxony as to the strategical intentions of the supreme command at the crisis of the Sedan campaign. At the close of the war he continued to serve in the office of the general staff, and also lectured at the War Academy. It was in the latter position that he developed the system of thorough tactical education which is the abiding result of his work. His method may be studied in English translations of his *Studies in Troop-leading*, and may be summarized as the assumption of an actual military situation on the actual ground, followed by critical discussion of the successive measures that a commander, whether of a brigade, division or larger force, should take in the sequel, given his orders and his knowledge of the general situation. Moltke's own series of tactical problems, extending from 1859 to 1889, contributed very powerfully, of course, to the education of the selected young officers who passed through Verdy's hands, but Moltke dealt rather with a great number of separate problems, while Verdy developed in detail the successive events and ruling ideas of a whole day's or week's work in the same units. Moltke therefore may be said to have developed the art of forming correct ideas and plans, Verdy that of applying them, but these are after all merely tendencies, not sharply divided schemes, in the teaching of Prussian staff officers during the years of intellectual development between 1870 and 1888. In all this Moltke, Verdy and Bronsart von Schellendorf worked in close co-operation. In 1876 Verdy became a major-general, from 1879–1883 he held an important position in the ministry of war, and in 1881 he was promoted lieutenant-general. In 1887 he became governor of Strassburg, in 1888 general of infantry and in 1889 minister of war. He retired from the active list in 1890. In 1894 the university of Königsberg made him a Dr. Phil. *honoris causa*.

General von Verdy du Vernois's principal writings are: *Theilnahme der II. Armee am Feldzuge 1866* (Berlin, 1866); *Im Hauptquartier der II. Armee 1866* (Berlin, 1900); *Studien über den Krieg auf Grundlage . . . 1870/1* (Berlin, 1892–96); *Im grossen Hauptquartier 1870/1* (Berlin, 1895; English translation); *Studien über Truppenführung* (Berlin, 1870; new edition, 1892, English translation) and *Studien über den Krieg* (Berlin, 1901–1906).

VERE, the family of which is extolled by Macaulay as "the longest and most illustrious line of nobles that England has seen," appears to have derived the surname which the verse of Tennyson has made synonymous with ancient blood, from the little village of Ver near Bayeux. Its founder, Aubrey (Albericus) de Vere, appears in Domesday Book (1086) as the holder of a great fief in Essex, Cambridgeshire and Suffolk. His son (or grandson) and namesake was a trusted officer of Henry I., from whom he received the hereditary office of great chamberlain in 1133. It was probably he who erected the noble tower which gave name to Castle Hedingham, Essex, the head of his fief, and which stands as the finest example of a private Norman keep. Slain in 1141, he was succeeded by his son Aubrey, who had already become count of Guînes, in right of his wife, on her grandfather's death. Through the powerful influence of his sister's husband, Geoffrey, earl of Essex, he obtained from the empress Matilda, in 1142, the earldom of Oxford, which was afterwards confirmed to his house by Henry II. His younger son, Robert (*c.* 1170–1221), became 3rd earl in 1214, and, siding with the barons, became one of the twenty-five executors of Magna Carta. His marriage with a Bolebec heiress brought in what was afterwards claimed as a barony, and led to the style of Viscount Bolebec (or Bulbeck) for the earl's heirs.

Robert, the 5th earl (1240–1296), who brought into his family the chamberlainship to the queen by his marriage with the Sandford heiress, sided with Simon de Montfort, and lost for a time his earldom and offices. John, the 7th earl (1313–1360), was a distinguished soldier, fighting at Creçy and Poitiers and in all Edward III.'s wars in his time; and his marriage with a Badlesmere heiress added to the lands and titles of his house. His son, Thomas (1337–1371), also a soldier, was father of Robert, 9th earl, the famous favourite of Richard II. In spite of his attainder (1388), his uncle Aubrey (*c.* 1340–1400), a follower of the Black Prince, was restored to the earldom, by consent of parliament in 1393, but not to the great chamberlainship. As the earldom (which had been held in fee) was granted to him in tail male, this is looked on by some as a new creation. His elder son, Richard (d. 1417), the next earl, held a command at Agincourt, and was father of Earl John, who was beheaded as a Lancastrian, with his eldest son, in 1462. Their death was avenged by his younger son John, the 13th earl (1443–1513), who shared to the full in the triumph of the Red Rose. On the death of his nephew John, the next earl (d. 1526), the baronies (it was afterwards held) passed away to his sisters, but the earldom descended to his cousin John (d. 1540), though the crown resumed the great chamberlainship. This John, who was in favour with Henry VIII., was grandfather, through his younger son Geoffrey, of the celebrated "fighting Veres," Sir Francis and his brother Sir Horace. His eldest son John, 16th earl (*c.* 1512–1562), was in favour with Edward VI., Mary and Elizabeth, and contrived to recover for his family the office of great chamberlain.

Hitherto the earls, in spite of their vicissitudes, had retained possession of their ancient seat and great estates; but Edward, the son of Earl John, was a spendthrift. A brilliant, gifted courtier, in whom Elizabeth delighted, he quarrelled with his father-in-law, Burghley, "sent his patrimony flying," patronized players, poets and musicians, and wrote excellent verse himself. His son Henry, the 18th earl (1593–1625), was twice imprisoned in the Tower as an opponent of Buckingham's policy, fought in the Palatinate and the Low Countries and died on campaign at the Hague in 1625. Then ensued the great dispute for the inheritance of his title and office (Hedingham Castle having passed away) between Robert Vere, his second cousin and heir-male, and Robert, Lord Willoughby d'Eresby, son of his aunt, Lady Mary Vere. The earldom was secured by the former, a poor officer in Holland, but the office was adjudged to Lord Willoughby, in whose descendants it is now vested. Earl Robert was slain before Maestricht in 1632, leaving an only son, Aubrey (1626–1703), 20th and last earl. His marriage with a Bayning heiress restored the fortunes of his house, and his Royalist intrigues under the Commonwealth were rewarded at the Restoration by sundry favours, among them the command of a regiment of horse, known from him as "the Oxford Blues" and still familiar as "the Blues" (Royal Horse Guards). James II. deprived him of his regiment and his lieutenancy of Essex for opposing his policy, but the prince of Orange, whom he joined, restored them. His long tenure of the ancient earldom ended in 1703, when he died, the last known male descendant of the house of Vere. His daughter Diana having married the 1st duke of St Albans, their descendants are named De Vere Beauclerk, and received the barony of Vere (1705).

The halo surrounding the name of Vere is seen as early as 1626 in the stately panegyric of Chief Justice Crewe. "I suppose there is no man that hath any apprehension of gentry, or nobleness, but his affection stands to the continuance of so noble a name and house." In the great days of the house, Earl John, says Stowe, rode into London city "with eighty gentlemen in a livery of Reading tawney, and chains of gold about their necks, before him, and one hundred tall yeomen in the like livery to follow him," wearing the famous badge of the blue boar (*verres*), which is still to be seen in Essex churches and forming the sign of Essex inns. Another badge of the Veres was the mullet in the first quarter of their shield, which, at Barnet Field, by a fatal error, was taken for the sun of York. Among the offices they held were the forestership of Essex and the keepership of Colchester Castle, and they founded the Essex religious houses of Hatfield Broadoak, Hedingham and Earls Colne.

Authorities.—Domesday Book; Abingdon Chron. and Red Book of the Exchequer (Rolls Series); Pipe Roll of 1130 (Record Commission); Dugdale's *Baronage*; G. E. C(okayne)'s *Complete Peerage*; Doyle's *Official Baronage*; Collins's *Historical Precedents*; Morant's *History of Essex*; Round's *Geoffrey de Mandeville and Feudal England*; Nichols's "Descent of the Earldom of Oxford" (*Arch. Journ.* vol. ix.); Vere papers among the Round MSS. in App. ix. to *14th Report on Historical MSS.*; *Lords' Reports on the Dignity of a Peer*; Palmer's *Peerage Law in England.* The claimants' cases and the appendices of documents in the contest for the great chamberlainship (1902) are valuable for the history of the Veres. (J. H. R.)

VERE, SIR FRANCIS (1560–1609), English soldier, was the son of Geoffrey Vere of Crepping Hall, Essex, and nephew of the 16th earl of Oxford. He first went on active service under Leicester in 1585, and was soon in the thick of the war raging in the Low Countries. At the siege of Sluys young Vere greatly distinguished himself under Sir Roger Williams and Sir Thomas Baskerville. In 1588 he was in the garrison of Bergen-op-Zoom, which delivered itself from the besiegers by its own good fighting, and was knighted by Willoughby on the field of battle. In the next year Sir Francis became sergeant-major-general of the English troops in the Low Countries, and soon afterwards the chief command devolved upon him. This position he retained during fifteen campaigns, with almost unbroken success. Working in close co-operation with the Dutch forces under Maurice, he step by step secured the country for the cause of independence. Vere won the reputation of being the first soldier of the day, his English troops acquired a cohesion and training fitting them to face the best Spanish troops, and his camp became the fashionable training-ground of all aspiring soldiers, amongst others not only his brother Horace, but men of such note as Ferdinando (Lord) Fairfax, Gervase Markham and Miles Standish. Sir Francis served in the Cadiz expedition of 1596, and in 1598 was entrusted with the negotiation of the treaty whereby the Dutch agreed to take a greater share of the burden of the war than they had hitherto done. His success in this task obtained him the governorship of Brill and the rank of general. The culminating point of his career came when, in 1600, on the advice of Barneveld, the states general decided to carry the war into the enemy's country. In the battle of Nieuwport (2nd July 1600), one of the most desperately contested battles of the age, Vere and Maurice completely defeated the veteran Spanish troops of the archduke Albert. This was followed by the celebrated defence of Ostend from July 1601 to March 1602. When James I. made peace with Spain, Vere retired from active service and spent the remainder of his days in country life in England, occupying himself with the compilation of his *Commentaries of the Divers Pieces of Service wherein he had Command* (1657; reprinted in Arber's *English Garner*, 1883). He died in 1609, soon after the truce recognized the independence of the United Provinces, and was buried in Westminster Abbey.

His younger brother Sir Horace Vere, Baron Vere of Tilbury (1565–1635), began his military career as the lieutenant of Sir Francis's Company in 1590. Thenceforward he was continually on active service in the Low Countries, and, like his brother, took part in the Cadiz expedition of 1596; at Nieuwport and Ostend Sir Horace (who had been knighted at Cadiz) held command of some importance. On his brother's retirement Sir Horace, as senior colonel, assumed command of the whole English force, which he held until 1607, being opposed to Ambrosio Spinola, the most famous of the continental generals of the time, against whom he manœuvred and fought in a manner equal to the best of his brother's, or even of Parma's, work. From 1607 to 1620 he saw but little active service except the siege of Jülich (1610). In 1620 he accepted the command of the volunteers who were going to the assistance of the Elector Palatine. This famous expedition to the Rhine and the Main was from the first a forlorn hope. Opposed by his old adversary Spinola, Vere manœuvred with success for two campaigns, but he was helpless against the armies of Tilly and Cordova, and in the end he could only furnish scanty garrisons for Frankenthal, Heidelberg and Mannheim. Each of these places fell after a desperate resistance, and their garrisons returned to England. In 1624 Vere was once more on service in the United Provinces. The attempted relief of Breda in the following year was considered one of the most brilliant feats of the time, and the general was made Baron Vere of Tilbury. In 1629 the sieges of Bois-le-duc (s'Hertogenbosch) and of Maestricht closed his military career. Lord Vere died suddenly in 1635 and was buried by the side of his brother in Westminster Abbey.

See Clements C. Markham, *The Fighting Veres* (London, 1888).

VERESHCHAGIN, VASSILI VASSILIEVICH (1842–1904), Russian artist and traveller, was born at Tcherepovets, in the government of Novgorod, on the 26th of October 1842. His father was a Russian landowner of noble birth, and from his mother he inherited Tatar blood. When he was eight years old he was sent to Tsarskoe Selo to enter the Alexander cadet corps, and three years later he entered the naval school at St Petersburg, making his first voyage in 1858. He graduated first in the list from the naval school, but left the service immediately to begin the study of drawing in earnest. He won a medal two years later, in 1863, from the St Petersburg Academy for his "Ulysses slaying the Suitors." In 1864 he proceeded to Paris, where he studied under Gérôme, though he dissented widely from his master's methods. In the Salon of 1866 he exhibited a drawing of "Doukhobors chanting their Psalms," and in the next year he accompanied General Kauffmann's expedition to Turkestan, his military service at the siege of Samarkand procuring for him the cross of St George. He was an indefatigable traveller—in Turkestan in 1869, the Himalayas, India and Tibet in 1873, and again in India in 1884. After a period of hard work in Paris and Munich he exhibited some of his Turkestan pictures in St Petersburg in 1874, among them two which were afterwards suppressed on the representations of Russian soldiers—"The Apotheosis of War," a pyramid of skulls dedicated "to all conquerors, past, present and to come," and "Left Behind," the picture of a dying soldier deserted by his fellows. Vereshchagin was with the Russian army during the Turkish campaign of 1877; he was present at the crossing of the Shipka Pass and at the siege of Plevna, where his brother was killed; and he was dangerously wounded during the preparations for the crossing of the Danube near Rustchuk. At the conclusion of the war he acted as secretary to General Skobelev at San Stefano. After the war he settled at Munich, where he produced his war pictures so rapidly that he was freely accused of employing assistants. The sensational subjects of his pictures, and their didactic aim—the promotion of peace by a representation of the horrors of war—attracted a large section of the public not usually interested in art to the series of exhibitions of his pictures in Paris in 1881 and subsequently in London, Berlin, Dresden, Vienna and other cities. He aroused much controversy by his series of three pictures of a Roman execution (the Crucifixion), of sepoys blown from the guns in India, and of the execution of Nihilists in St Petersburg. A journey in Syria and Palestine in 1884 furnished him with an equally discussed set of subjects from the New Testament. The "1812" series on Napoleon's Russian campaign, on which he also wrote a book, seem to have been inspired by Tolstoi's *War and Peace*, and were painted in 1893 at Moscow, where the artist eventually settled. Vereshchagin was in the Far East during the Chino-Japanese War, with the American troops in the Philippines, and with the Russian troops in Manchuria. He perished in the sinking of the Russian flagship, "Petropavlovsk," on the 13th of April 1904. His last work, a picture of a council of war presided over by Admiral Makaroff, was recovered almost uninjured.

See E. Zabel, "Wereschtschagin" (1900), in Knackfuss's *Künstlermonographien* (Bielefeld and Leipzig). The finest collection of his pictures is in the Tretiakov gallery in Moscow.

VERGA, GIOVANNI (1840–), Italian novelist, was born at Catania, Sicily. In 1865 he published *Storia di una peccatrice* and *I Carbonari della montagna*, but his literary reputation was established by his *Eva* and *Storia di una capinera* (1869). Other novels followed, the best of which are *Malavoglia* (1881) and *Maestro Don Gesualdo* (1889). His finest work, however, is seen in his short stories and sketches of Sicilian peasantry, *Medda* (1874) and *Vita dei campi* (1880); and his *Cavalleria Rusticana* acquired new popularity from its dramatization and from Mascagni's opera on this subject. Verga and Fogazzaro between them may be said to have faithfully chronicled the inner and popular life of southern and northern Italy.

VERGE (Lat. *virga*, a rod), originally a staff denoting authority, whence (from the ceremony in swearing fealty to a lord) the sense of a measurement, and so boundary or border, of land, or generally a margin of space. In architecture, a verge is the edge of the tiling projecting over the gable of a roof; that on the horizontal portion being called "eaves." The term "verge board," generally now known as barge board, is the name given to the board under the verge of gables, sometimes moulded, and often very richly carved, perforated and cusped, and frequently having pendants and sometimes finials at the apex.

VERGENNES, CHARLES GRAVIER, Comte de (1717–1787), French statesman, was born at Dijon on the 20th of December 1717. He was introduced to the profession of diplomacy by his uncle, M. de Chavigny, under whom he saw his first service at Lisbon. His successful conduct of French interests at the court of Trier in 1750 and the following years led to his being sent to Constantinople in 1755 at first as minister plenipotentiary, then as ambassador. In 1768 he was recalled, ostensibly because of a mésalliance with Mme Testa, widow of a Pera surgeon, but really because Choiseul thought him not zealous enough in provoking a quarrel between Russia and Turkey. After Choiseul's death he was sent to Stockholm with instructions to help the aristocratic party of the "Hats" with advice and money. The revolution by which Gustavus III. (August 19, 1772) secured for himself the reality instead of the shadow of power was a great diplomatic triumph for France. With the accession of Louis XVI. Vergennes became foreign minister. His general policy was one of friendly relations with Austria, combined with the limitation of Joseph II.'s ambitious designs; the protection of Turkey; and opposition at all points to England. His hatred of England and his desire to avenge the disasters of the Seven Years' War led to his support of the American States in the War of Independence, a step of which the moral and financial results had not a little to do with the Revolution of 1789. Vergennes sought by a series of negotiations to secure the armed neutrality of the Northern Powers eventually carried out by Catherine II.; he ceded to the demands of Beaumarchais that France should secretly provide the Americans with arms and volunteers. In 1777 he informed the American commissioners that France acknowledged the Republic and was willing to form an offensive and defensive alliance with the new state. In domestic affairs Vergennes belonged to the old school. He intrigued against Necker, whom he regarded as a dangerous innovator, a republican, a foreigner and a Protestant. In 1781 he became chief of the council of finance, and in 1783 he supported the nomination of Calonne as controller general. Vergennes died on the 13th of February 1787, before the meeting of the Assembly of Notables which he is said to have suggested to Louis XVI.

See P. Fauchelle, *La Diplomatie française et la Ligue des neutres de 1780* (1776–83) (Paris, 1893); John Jay, *The Peace Negotiations of 1782–83 as illustrated by the Confidential Papers of Shelburne and Vergennes* (New York, 1888); L. Bonneville de Marsangy, *Le Chevalier de Vergennes, son ambassade à Constantinople* (Paris, 1894), and *Le Chevalier de Vergennes, son ambassade en Suède* (Paris, 1898).

VERGER (M.E. *vergere*; O. Fr. *vergier*; Med. Lat. *virgarius*, one who bears a rod or staff, an apparitor; Lat. *virga*, rod), one who carries a "verge" or staff of office. The principal use of the term is ecclesiastical, and refers to the person who carries a staff as a symbol of office before a bishop or other church dignitary when taking part in a service, especially one held in a cathedral. The word has thus come to mean in general usage an official caretaker of any place of worship whose duty it is to show the building to those who wish to view it, and to find seats for the congregation at a service.

VERGNIAUD, PIERRE VICTURNIEN (1753–1793), French orator and revolutionist, was born on the 31st of May 1753 at Limoges. He was the son of a merchant of that town who lost the greater part of his means by speculation. The boy was early sent to the college of the Jesuits at Limoges, and soon achieved distinction. Turgot was then intendant of Limousin. In his presence young Vergniaud on one occasion recited some verses of his own composition. Turgot was struck with the talent they displayed, and by virtue of his patronage Vergniaud, having gone to Paris, was admitted to the college of Plessis. It is impossible to read the speeches of Vergniaud without being convinced of the solidity of his education, and in particular of the wide range of his knowledge of the classics, and of his acquaintance—familiar and sympathetic—with ancient philosophy and history.

Duputy, president of the parlement of Bordeaux, with whom Vergniaud became acquainted, conceived the greatest admiration and affection for him and appointed him his secretary. Vergniaud was thereafter called to the bar (1782). The influence of Duputy gained for him the beginnings of a practice; but Vergniaud, though capable of extraordinary efforts, too often relapsed into reverie, and was indisposed for study and sustained exertion, even in a cause which he approved. This weakness appears equally in his political and in his professional life: he would refuse practice if his purse were moderately well filled; he would sit for weeks in the Assembly in listlessness and silence, while the policy he had shaped was being gradually undermined, and then rise, brilliant as ever, but too late to avert the calamities which he foresaw. In 1789 Vergniaud was elected a member of the general council of the department of the Gironde. Being deeply stirred by the best ideas of the Revolutionary epoch, he found a more congenial sphere for the display of his great powers in his new position. About this period he was charged with the defence of a member of the national guard of Brives, which was accused of provoking disorders in the department of La Corrèze. Abandoning all reserve, Vergniaud delivered one of the great orations of his life, depicting the misfortunes of the peasantry in language of such combined dignity, pathos and power that his fame as an orator spread far and wide.

Vergniaud was chosen a representative of the Gironde to the National Legislative Assembly in August 1791, and he forthwith proceeded to Paris. The Legislative Assembly met on the 1st of October. For a time, according to his habit, he refrained from speaking; but on the 25th of October he ascended the tribune, and he had not spoken long before the whole Assembly felt that a new power had arisen which might control even the destinies of France. This judgment was re-echoed outside, and he was almost immediately elected president of the Assembly for the usual brief term. Between the outbreak of the Revolution and his election to the Legislative Assembly the political views of Vergniaud had undergone a decided change. At first he had lauded a constitutional monarchy; but the flight of Louis XVI. filled him with distrust of the sovereign, and his views in favour of a republic were rapidly developed. The sentiments and passions which his eloquence aroused were, however, watchfully utilized by a more extreme party. It happened thus even with his first Assembly speech, on the *émigrés*. His proposal was mainly that a treble annual contribution should be levied on their property; but the Assembly confiscated their goods and decreed their deaths. One great blot on his reputation is that step by step he was led on to palliate violence and crime, to the excesses of which his eyes were only opened by the massacres of September, and which ultimately overwhelmed the party of Girondists which he led. The disgrace to his name is indelible that on the 19th of March 1792, when the perpetrators of the massacre of Avignon had been introduced to the Assembly by Collot d'Herbois, Vergniaud spoke indulgently of their crimes and lent the authority of his voice to their amnesty. In language sometimes turgid, but nearly always of pure and powerful eloquence, he worked at the theme of the *émigrés*, as it developed into that of the counter-revolution; and in his occasional appearances in the tribune, as well as in the project of an address to the French people which he presented to the Assembly on the 27th of December 1791, he shook the heart of France, and, especially by his call to arms on the 18th of January, shaped the policy which culminated in the declaration of war against the king of Bohemia and Hungary on the 20th of April. This policy in foreign affairs, which he pursued through the winter and spring of 1791–92, he combined with another—that of fanning the suspicions of the people against the monarchy, which he identified with the counter-revolution, and of forcing on a change of ministry. On the 10th of March Vergniaud delivered a powerful oration in which he denounced the intrigues of the court and uttered his famous apostrophe to the Tuileries: "In ancient times fear and terror have often issued from that famous palace; let them re-enter it to-day in the name of the law!" The speech overthrew De Lessart, whose accusation was decreed; and Roland, the nominee of the Girondists, entered the ministry. By the month of June the opposition of Vergniaud (whose voice still commanded the country) to the king rose to fever heat. On the 29th of May Vergniaud went so far as to support the disbanding of the king's guard. But he appears to have been unaware of the extent of the feelings of animosity which he had done much to arouse in the people, probably because he was wholly unconnected with the practices of the party of the Mountain as the instigators of actual violence. This party used Vergniaud, whose lofty and serene ideas they applauded and travestied in action. Then came the riot of the 20th of June and the invasion of the Tuileries. He rushed among the crowd, but was powerless to quell the tumult. Continuing for yet a little longer his course of feverous, almost frenzied, opposition to the throne, on the 3rd of July he electrified France by his bold denunciation of the king, not only as a hypocrite and a despot, but as a base traitor to the constitution. His speeches breathe the very spirit of the storm, and they were perhaps the greatest single factor in the development of the events of the time. On the 10th of August the Tuileries was stormed, and the royal family took refuge in the Assembly. Vergniaud presided. To the request of the king for protection he replied in dignified and respectful language. An extraordinary commission was appointed: Vergniaud wrote and read its recommendations that a National Convention be formed, the king be provisionally suspended from office, a governor appointed for his son, and the royal family be consigned to the Luxembourg. Hardly had the great orator attained the object of his aim—the overthrow of Louis as a sovereign—when he became conscious of the forces by which he was surrounded. He denounced the massacres of September—their inception, their horror and the future to which they pointed—in language so vivid and powerful that it raised for a time the spirits of the Girondists, while on the other hand it aroused the fatal opposition of the Parisian leaders.

The questions whether Louis XVI. was to be judged, and if so by whom, were the subject of protracted debate in the Convention. They were of absorbing interest to Paris, to France and to Europe; and upon them the Girondist leader at last, on the 31st of December 1792, broke silence, delivering one of his greatest orations, probably one of the greatest combinations of sound reasoning, sagacity and eloquence which has ever been displayed in the annals of French politics. He pronounced in favour of an appeal to the people. He pictured the consequences of that temper of vengeance which animated the Parisian mob and was fatally controlling the policy of the Convention, and the prostration which would ensue to France after even a successful struggle with a European coalition, which would spring up after the murder of the king. The great effort failed; and four days afterwards something happened which still further endangered Vergniaud and his whole party. This was the discovery of a note signed by him along with Gaudet and Gensonné and presented to the king two or three weeks before the 10th of August. It contained nothing but sound and patriotic suggestions, but it was greedily seized upon by the enemies of the Gironde as evidence of treason. On the 16th of January 1793 the vote began to be taken in the Convention upon the punishment of the king. Vergniaud voted early, and voted for death. The action of the great Girondist was and will always remain inscrutable, but it was followed by a similar verdict from nearly the whole party which he led. On the 17th Vergniaud presided at the Convention, and it fell to him, labouring under the most painful excitement, to announce the fatal result of the voting. Then for many weeks he sank, exhausted, into silence.

When the institution of a revolutionary tribunal was proposed, Vergniaud vehemently opposed the project, denouncing the tribunal as a more awful inquisition than that of Venice, and avowing that his party would all die rather than consent to it. Their death by stratagem had already been planned, and on the 10th of March they had to go into hiding. On the 13th Vergniaud boldly exposed the conspiracy in the Convention. The antagonism caused by such an attitude had reached a significant point when on the 10th of April Robespierre himself laid his accusation before the Convention. He fastened especially upon Vergniaud's letter to the king and his support of the appeal to the people as a proof that he was a moderate in its then despised sense. Vergniaud made a brilliant extemporaneous reply, and the attack for the moment failed. But now, night after night, Vergniaud and his colleagues found themselves obliged to change their abode, to avoid assassination, a price being even put upon their heads. Still with unfaltering courage they continued their resistance to the dominant faction, till on the 2nd of June 1793 things came to a head. The Convention was surrounded with an armed mob, who clamoured for the "twenty-two." In the midst of this it was forced to continue its deliberations. The decree of accusation was voted, and the Girondists were proscribed.

Vergniaud was offered a safe retreat. He accepted it only for a day, and then returned to his own dwelling. He was kept under surveillance there for nearly a month, and in the early days of July was imprisoned in La Force. He carried poison with him, but never used it. His tender affection for his relatives abundantly appears from his correspondence, along with his profound attachment to the great ideas of the Revolution and his noble love of country. On one of the walls of the Carmelite convent to which for a short time the prisoners were removed Vergniaud wrote in letters of blood: "Potius mori quam foedari." Early in October the Convention brought forward its indictment of the twenty-two Girondists. They were sent for trial to the Revolutionary tribunal, before which they appeared on the 27th of October. The procedure was a travesty of justice. Early on the morning of the 31st of October 1793 the Girondists were conveyed to the scaffold, singing on the way the Marseillaise and keeping up the strain till one by one they were guillotined. Vergniaud was executed last. He died unconfessed, a philosopher and a patriot.

See Gay de Vernon, *Vergniaud* (Limoges, 1858); and L. de Verdière, *Biographie de Vergniaud* (Paris, 1866). (T. S.)

VERHAEREN, ÉMILE (1855–   ), Belgian poet, was born at Saint-Amand, near Antwerp, on the 21st of May 1855. He was sent to school at Ghent, where he formed a friendship with Georges Rodenbach. He studied at the university of Louvain, and there started a journal, *La Semaine*, which he edited in conjunction with the operatic singer Van Dyck. *La Semaine* was suppressed by the authorities, as was its successor, *Le Type*, in which Verhaeren had as fellow-workers Max Waller, Iwan Gilkin and Albert Giraud. In 1881 he was admitted to the bar at Brussels, but he soon devoted his whole energies to literature, and especially to the organs of "young Belgium," *La Jeune Belgique* and *L'Art moderne*, making himself especially the champion of the impressionist painters. Verhaeren learnt his art of poetry from the great Flemish artists, and in his early robust works, *Les Flamandes* (1883) and *Les Moines* (1886), he displays similar qualities of strength, sometimes degenerating into violence. A period of physical weakness followed, translated into terms of poetry in three volumes of verse, *Les Soirs* (1887), *Les Débâcles* (1888) and *Les Flambeaux noirs* (1889). *Au bord de la route* (1890) and *Les Apparus dans mes chemins* (1891) followed. Verhaeren then passed from applying his pictorial method to psychological studies to the task of individualizing the towns, villages and fields of his native country, the first outcome being his *Campagnes hallucinées* (1893). In *Villages illusoires* he describes the tragedy of the fields and farms deserted by the people in their race to the towns, and in *Les Villes tentaculaires* (1895) the great industrial centres devouring the surrounding country. Later volumes of poems are *Les Heures claires* (1896), *Les Visages de la vie* (1899), *Les Petites Légendes* (1900), *Les Forces tumultueuses* (1901); *Les Tendresses premières* (1904). In 1898 he wrote a lyric drama *Les Aubes*, in 1900 a four-act piece *Le Cloître*, represented both in Brussels and Paris, and in 1901 a historical drama *Philippe II*.

The poems of Émile Verhaeren were translated into English by Alma Strettel (1899); and *Les Aubes* by Mr Arthur Symons (1898). A long list of articles dealing with Verhaeren is to be found in *Poètes d'Aujourd'hui* (1900) of A. van Bever and Paul Léautaud.

VERKHNE-UDINSK, a town of Asiatic Russia, in East Siberia, province of Transbaikalia, on the right bank of the Uda, at its confluence with the Selenga, 102 m. by rail E. of Lake Baikal, to which steamers ply. Pop. (1883) 4130; (1897) 8002. It was founded as a small fort in 1668, and is a centre for the overland trade in tea with China, and an emporium both for grain and animal products, exported, and for metals, machinery and manufactured goods, imported. Its yearly fair is of great importance.

VERLAINE, PAUL (1844–1896), French lyric poet, was born at Metz on the 30th of March 1844. He was the son of one of Napoleon's soldiers, who had become a captain of engineers. Paul Verlaine was educated in Paris, and became clerk in an insurance company. He was a member of the Parnassian circle, with Catulle Mendès, Sully Prudhomme, François Coppée and the rest. His first volume of poems, the *Poèmes saturniens* (1866), was written under Parnassian influences, from which the *Fêtes galantes* (1869), as of a Watteau of poetry, began a delicate escape; and in *La Bonne Chanson* (1870) the defection was still more marked. He married in 1870 Mlle. Mautet. During the Commune he was involved with the authorities for having sheltered his friends, and was obliged to leave France. In 1871 the strange young poet Jean Arthur Rimbaud came somewhat troublingly into his life, into which drink had already brought a lasting disturbance. With Rimbaud he wandered over France, Belgium, England, until a pistol-shot, fortunately ill-aimed, against his companion brought upon him two years of imprisonment at Mons. Solitude, confinement and thought converted a pagan into a Catholic, without, however, rooting out what was most human in the pagan; and after many years' silence he published *Sagesse* (1881), a collection of religious poems, which, for humble and passionate conviction, as well as originality of poetic beauty, must be ranked with the finest religious poems ever written. *Romances sans paroles*, composed during the intervals of wandering, appeared in 1874, and shows us Verlaine at his most perfect moment of artistic self-possession, before he has quite found what is deepest in himself. He returned to France in 1875. His wife had obtained a divorce from him, and Verlaine made another short stay in England, acting as a teacher of French. After about two years' absence Verlaine was again in France. He acted as teacher in more than one school and even tried farming. The death of his mother, to whom he was tenderly attached, dissolved the ties that bound him to "respectable" society. During the rest of his life he lived in poverty, often in hospital, but always with the heedless and unconquerable cheerfulness of a child. After a long obscurity, famous only in the Latin Quarter, among the cafés where he spent so much of his days and nights, he enjoyed at last a European celebrity. In 1894 he paid another visit to England, this time as a distinguished poet, and lectured at London and Oxford. He died in Paris on the 8th of January 1896. His eighteen volumes of verse (among which may be further mentioned *Jadis et naguère*, 1884; *Amour*, 1888; *Parallèlement*, 1889; *Bonheur*, 1891) vary greatly in quality as in substance; they are all the sincere expression, almost the instantaneous notation, of himself, of his varying moods, sensual passion, the passion of the mystic, the delight of the sensitive artist in the fine shades of sensation. He brought into French verse a note of lyrical song, a delicacy in the evocation of sound and colour, which has seemed almost to create poetry over again, as it provides a language out of which rhetoric has been cleansed and a rhythm into which a new music has come with a new simplicity. (A. Sy.)

His *Œuvres complètes* (3 vols.) were published in 1899, &c.; *Œuvres posthumes* (1903). See also *Paul Verlaine, sa vie, son œuvre*, by E. Lepelletier (1907); monographs by M. Dullaert (Ghent, 1896), C. Morice (1888); also Anatole France, *La Vie littéraire* (3rd series, 1891); J. Lemaître, *Nos contemporains* (1889), vol. iv.; E. Delille, "The Poet Verlaine," in the *Fortnightly Review* (March 1891); A. Symons, in the *National Review* (June 1892); V. Thompson, *French Portraits* (Boston, U.S.A., 1900); and the poet's own *Confessions* (1895) and his *Poètes maudits* (1888). A bibliography of Verlaine with an account of the existing portraits of him is included in the *Poètes d'Aujourd'hui* (11th ed., 1905) of MM. A. van Bever and P. Léautaud. The *Vie* by Lepelletier has been translated into English by E. M. Lang (1909).

VERLAT, MICHEL MARIE CHARLES (1824–1890), Belgian painter, was born at Antwerp on the 25th of November 1824. He was a pupil of Nicaise de Keyser, and studied at the Antwerp Academy. In 1842 appeared his first important picture, "Pippin the Short Killing a Lion." About 1849 he went to Paris, where he worked under Ary Scheffer. In 1855 he won a gold medal at the Exposition Universelle at Paris with his "Tiger Attacking a Herd of Buffaloes," and in 1858 exhibited "Le Coup de collier" (now in the Antwerp Gallery) at the Paris Salon. In 1866 he was appointed director of the Academy at Weimar, where he painted some fine portraits, notably those of the grand-duchess of Saxony and of the musician Liszt. Soon after his return to Antwerp in 1875 he visited Palestine, and brought back a large number of interesting pictures, including "Vox Populi" (Antwerp Gallery), "The Tomb of Jesus," and "The Flight into Egypt." In 1885 he was appointed director of the Antwerp Academy. Other important works by Verlat are the panoramas of the battle of Waterloo and the treaty of San Stefano, "Christ between the Two Thieves," "Defending the Flock" (Antwerp Gallery), "Oxen Ploughing in Palestine" (Antwerp Gallery), "Godfrey of Bouillon at the Siege of Jerusalem" (Brussels Gallery), and "Sheep-Dog Defending the Flock" (Brussels Gallery). He executed a series of original etchings, and published in 1879 a book on the Antwerp Academy. He died at Antwerp on the 23rd of October 1890.

VERMANDOIS, a French countship composed originally of the two burgraviates (châtellenies) of St Quentin (Aisne) and Péronne (Somme). Herbert I., the earliest of its hereditary counts, was descended in direct male line from the emperor Charlemagne, and was killed in 902 by an assassin in the pay of Baldwin II., count of Flanders. His son, Herbert II. (902–943), a man absolutely devoid of scruples, considerably increased the territorial power of the house of Vermandois, and kept the lawful king of France, the unlucky Charles the Simple, prisoner for six years. His successors, Albert I., Herbert III., Albert II., Otto and Herbert IV., were unimportant. In 1077 the last male of the first house of Vermandois, Herbert IV., received the countship of Valois in right of his wife. He died soon afterwards, leaving his inheritance to his daughter Adela, whose first husband was Hugh the Great, the brother of king Philip I. Hugh was one of the leaders of the first crusade, and died in 1102 at Tarsus in Cilicia. The eldest son of Hugh and Adela was count Raoul (Rudolph) I. (*c.* 1120–1152), who married Alix of Guyenne, sister of the queen, Eleanor, and had by her three children: Raoul (Rudolph) II., the Leper (count from 1152–67); Isabelle, who possessed from 1167 to 1183 the countships of Vermandois, Valois and Amiens conjointly with her husband, Philip of Alsace, count of Flanders; and Eleanor. By the terms of a treaty concluded in 1185 with the king, Philip Augustus, the count of Flanders kept the countship of Vermandois until his death, in 1191. At this date a new arrangement gave Eleanor (d. 1213) a life interest in the eastern part of Vermandois, together with the title of countess of St Quentin, and the king entered immediately into possession of Péronne and its dependencies.

See Anselme, *Histoire généalogique de la maison royale de France* (1726), i. 48–51 and 531–34; Colliette, *Mémoires pour l'histoire du Vermandois* (1771–72). (A. Lo.)

VERMICELLI (plural of Ital. *vermicello*, little worm, Lat. *vermicellus*, diminutive of *vermis*, worm), the name of a kind of paste, made of the granular meal of certain hard wheats, and used as a food. It is made into worm-like threads, whence its name, and differs from macaroni only in being made solid and not in hollow tubes. "Spaghetti" (dim. of *spago*, a small cord) is a larger kind of vermicelli. In Italy these various pastes form a staple article of food. In other countries "vermicelli" is used in soups and puddings, &c.

VERMIGLI, PIETRO MARTIRE, generally known as PETER MARTYR (1500–1562), born at Florence on the 8th of May 1500, was son of Stefano Vermigli, a follower of Savonarola, by his first wife, Maria Fumantina. He owed his Christian names to a vow which his father, actuated by the death of several children in infancy, had made to dedicate any that survived to the Dominican saint, Peter Martyr, who lived in the 13th century. Educated in the Augustinian cloister at Fiesole, he was transferred in 1519 to the convent of St John of Verdara near Padua, where he graduated D.D. about 1527 and made the acquaintance of the future Cardinal Pole. From that year onwards he was employed as a public preacher at Brescia, Pisa, Venice and Rome; and in his intervals of leisure he mastered Greek and Hebrew. In 1530 he was elected abbot of the Augustinian monastery at Spoleto, and in 1533 prior of the convent of St Peter *ad Aram* at Naples. About this time he read Bucer's commentaries on the Gospels and the Psalms and also Zwingli's *De vera et falsa religione*; and his Biblical studies began to affect his views. He was accused of erroneous doctrine, and the Spanish viceroy of Naples prohibited his preaching. The prohibition was removed on appeal to Rome, but in 1541 Vermigli was transferred to Lucca, where he again fell under suspicion. Summoned to appear before a chapter of his order at Genoa, he fled in 1542 to Pisa and thence to another Italian reformer, Bernardino Ochino, at Florence. Ochino escaped to Geneva, and Vermigli to Zürich, thence to Basel, and finally to Strassburg, where, with Bucer's support, he was appointed professor of theology and married his first wife, Catherine Dammartin of Metz.

Vermigli and Ochino were both invited to England by Cranmer in 1547, and given a pension of forty marks by the government. In 1548 Vermigli was appointed regius professor of divinity at Oxford, in succession to the notorious Dr Richard Smith, and was incorporated D.D. In 1549 he took part in a great disputation on the Eucharist. He had abandoned Luther's doctrine of consubstantiation and adopted the doctrine of a Real Presence conditioned by the faith of the recipient. This was similar to the view now held by Cranmer and Ridley, but it is difficult to prove that Vermigli had any great influence in the modifications of the Book of Common Prayer made in 1552. He was consulted on the question, but his recommendations seem hardly distinguishable from those of Bucer, the effect of which is itself disputable. He was also appointed one of the commissioners for the reform of the canon law.

On Mary's accession Vermigli was permitted to return to Strassburg, where, after some opposition raised on the ground that he had abandoned Lutheran doctrine, he was reappointed professor of theology. He befriended a number of English exiles, but had himself in 1556 to accept an offer of the chair of Hebrew at Zürich owing to his increased alienation from Lutheranism. He was invited to Geneva in 1557, and to England again in 1561, but declined both invitations, maintaining, however, a constant correspondence with Jewel and other English prelates and reformers until his death at Zürich on the 12th of November 1562. His first wife, who died at Oxford on the 15th of February 1553, was disinterred in 1557 and tried for heresy; legal evidence was not forthcoming because witnesses had not understood her tongue; and instead of the corpse being burnt, it was merely cast on a dunghill in the stable of the dean of Christ Church. The remains were identified after Elizabeth's accession, mingled with the supposed relics of St Frideswide to prevent future desecration, and reburied in the cathedral. Vermigli's second wife, Caterina Merenda, whom he married at Zürich, survived him, marrying a merchant of Locarno.

Vermigli published over a score of theological works, chiefly Biblical commentaries and treatises on the Eucharist. His learning was greater than his originality, and he was one of the least heterodox of the Italian divines who rejected Roman Catholicism. His views approximated most nearly to those of Martin Bucer.

Josias Simler's *Oratio*, published in 1563 and translated into English in 1583, is the basis of subsequent accounts of Vermigli. The best lives are by F. C. Schlosser (1809) and C. Schmidt (1858). See also Parker Soc. Publ. (General Index), especially the Zürich Letters; Strype's Works; Foxe's *Acts and Monuments*; Burnet's *Hist.*, ed. Pocock; Dixon's *History*; and *Dict. of Nat. Biogr.* lviii. 253–256. (A. F. P.)

VERMILION, a scarlet pigment composed of mercuric sulphide, HgS. It may be obtained direct from pure and bright coloured portions of the native ore cinnabar, or, artificially, by subliming a mixture of mercury and sulphur. The product is ground and levigated; and when dry it is ready for use. It is also prepared by digesting precipitated mercuric sulphide with an alkaline sulphide for some hours; it is said that Chinese vermilion owes its superiority to being made in this way. In addition to its brilliance, vermilion is a pigment of great intensity and durability, remaining unaffected by acid fumes. Being costly, it is much subject to adulteration; but the fraudulent additions may easily be detected by volatilization, which in the case of pure vermilion leaves no residue. See FIGMENTS and MERCURY.

VERMIN (Fr. *vermine*, formed as if from Lat. *verminus*, *vermis*, a worm), the collective name applied to various classes of objectionable, harmful or destructive animals. To gamekeepers and those interested in the preservation of game, all animals such as the pole-cat, weasel, stoat, hawks, owls, &c., which destroy the eggs or young of preserved birds, are classed as "vermin," and the same term includes rats, mice, &c. It is also the collective name given to all those disgusting and objectionable insects that infest human beings, houses, &c., when allowed to be in a filthy and unsanitary condition, such as bugs, fleas, lice, &c.

VERMONT, a North Atlantic state of the United States of America and one of the New England group, lying between latitude 42° 44′ and 45° 0′ 43″ N., and between longitudes 3° 35′ and 5° 29′ E. from Washington. It is bounded N. by the Canadian province of Quebec, E. by the Connecticut river, which separates it from New Hampshire, S. by Massachusetts, and W. by New York and Lake Champlain, which separates it in part from New York. Its total area is 9564 sq. m., and of this 440 sq. m. is water surface.

Surface.—Vermont is a portion of the plateau-like New England upland, broken by mountain ranges, individual mountains and high hills, rising above the general upland surface, and by deep narrow valleys, cut below that surface. The mean elevation of the state above the sea is about 1000 ft. Extremes range from 106 ft. at Maquam on the N.E. shore of Lake Champlain (96 ft.) to 4364 ft. at the summit of Mount Mansfield, about 25 m. E. of that lake. The most prominent feature of the surface is the Green Mountains, which extend nearly N. and S. through the state a little W. of the middle. From the Massachusetts border N. for two-thirds the length of the state the range is only slightly broken, but farther N. it is cut deep by the valleys of the Winooski and Lamoille rivers. The crest line is generally more than 2000 ft. high, considerable areas are above 2500 ft., and the following summits exceed 4000 ft.: Mount Mansfield, 4364 ft.; Killington Peak, 4241 ft.; Camel's Hump, 4088 ft.; Mount Lincoln, 4078 ft.; and Jay Peak, 4018 ft. West of the Green Mountains the Taconic Mountains form a nearly parallel (but distinct) range, extending from New York and Massachusetts N. nearly to the centre of Vermont; and a series of broken uplifts, known as the Red Sandrock Mountains, extend farther N. along the shore of Lake Champlain. The Taconic Mountains rise in very irregular masses to 1500–2000 ft., and reach their maximum elevation in Mount Equinox at 3816 ft. The Red Sandrock Mountains are similar to one another in form and structure, generally rounded on the N. and E., but with some rugged escarpments facing the lake; their highest point is Snake Mountain (1271 ft.) in Addison county. There are no mountain ranges in the state E. of the Green Mountains, but distributed along the entire E. border are a number of tall and oval or conical shaped masses known as the Granitic Mountains, and between these and the Green Mountains the country is largely occupied by high hills and deeply carved valleys. Mount Ascutney, one of the Granitic Mountains, rises abruptly from the floor of the Connecticut Valley to a height of 3320 ft. The least broken section of Vermont is on the somewhat gentle slope of the Green Mountains in the N.W. and on Grand Isle, North Hero Island, and Isle La Motte in Lake Champlain. The forms of Vermont's mountains, even to the highest summits, were to a great extent rounded by glaciation, but as the rocks vary much in texture and are often steeply inclined, stream erosion has cut valleys deep and narrow, often mere gorges.

Where the Green Mountain range is unbroken, in the S. two-thirds of the state, it forms a water-parting between the streams which flow W. or N.W. into Lake Champlain or the Hudson river and those flowing S.E. into the Connecticut river; but farther N. the line separating the Hudson-Champlain basin from the Connecticut basin runs among the Granitic Mountains; and extending 25 m. S. from the Canadian border is a small area that is drained N. into Lake Memphremagog, the waters of which, like those of Lake Champlain, are tributary to the St Lawrence river. North of Massachusetts the Connecticut river is wholly within New Hampshire—Vermont's eastern boundary is low-water mark on the W. bank of the Connecticut river. The largest and only navigable rivers of Vermont are among those flowing into Lake Champlain: the Missisquoi, the Lamoille, the Winooski and Otter Creek. The Batten Kill is the principal river flowing into the Hudson. The Deerfield, West, Williams, White, Passumpsic and Nulhegan rivers are the largest of the many streams which are tributary to the Connecticut. The Black, Barton and Clyde rivers flow into Lake Memphremagog. Vermont's rivers are generally swift, and in many places they are made very picturesque by their clear and sparkling waters, rapids, falls, gorges and wooded banks.

Lake Champlain, which lies beautifully in the valley between the Green and Adirondack mountains, belongs mostly to Vermont. The state has a shore line upon it of 150 m. or more, and in its N. portion are numerous islands which are attractive resorts during the summer season. On the N. border of the state is Lake Memphremagog with islands, a rugged prominence known as Owl's Head on its W. border, Jay Peak, farther back, and a beautiful farming country to the eastward. There are also a large number of small lakes and ponds lying wholly within the state. Of these Lake Bomoseen in Rutland county and Willoughby Lake in Orleans county are the largest. Willoughby Lake is about 6 m. long by 1–1½ m. wide, and its situation between two rugged mountains makes a scene of great natural beauty. All the lakes of the state were formed by glaciation.

Fauna.—The most common wild animals are deer, rabbits, squirrels, raccoons, skunks, woodchucks and muskrats. There are some porcupines, red foxes, minks and martens, but the moose, wolf and lynx are practically extinct. The ruffed grouse (or "partridge") is the most common of game birds, but woodcock, ducks and geese are quite common. Prominent among a great variety of song-birds and insectivorous birds are the robin, blue bird, cat bird, sparrows, meadow-lark, bobolink, thrushes, chickadee, wrens, brown thrasher, gold finch, cedar wax-wing, flycatchers, nuthatches, flicker (golden-winged woodpecker), downy and hairy woodpeckers, rose-breasted grosbeak, Baltimore oriole, barn-swallow, chimney swift, purple martin, purple finch (linnet), vireos and several species of warblers. Birds of prey comprise several species of hawks and owls, and a few eagles. A few sturgeon are taken in Lake Champlain. The lakes, ponds and streams afford some of the best trout fishing in the country, and many of them also abound in pickerel, pike, perch, black bass and land-locked salmon. There is a state fish and game commissioner, and the state has a fish hatchery at Roxbury and a forest and game farm at Sharon. There are Federal hatcheries at Swanton (for pike perch and yellow perch) and at Holden (for trout).

Flora.—Vermont (*vert mont*), the Green Mountain State, was so named from the evergreen forests of its mountains, whose principal trees are spruce and fir on the upper slopes and white pine and hemlock on the lower. Among deciduous trees the state is noted for its sugar maples; birch and beech are common on the hills, and oaks, elm, hickory, ash, poplar, basswood, willow, chestnut and butternut on the less elevated areas. Among indigenous fruit-bearing trees, shrubs, vines and plants are the plum, cherry, grape, blackberry, raspberry, cranberry and strawberry. A few of the medicinal plants are ginseng, pleurisy root, snake root, blood root, blue flag and marshmallow. Orchids are very prominent among a great variety of flowering plants. Along the shore of Lake Champlain are a few species of maritime plants that remain from the time when portions of western Vermont were covered by the sea, and on the upper slopes of some of the higher mountains are a few Alpine species; these, however, are much less numerous on the Green Mountains of Vermont than on the White Mountains of New Hampshire. The state's lumber trade was important until 1890, when the white pine was nearly exhausted, although there were still spruce and hemlock.

Climate.—The state usually has long and severe winters and cool summers, but sudden changes of temperature are common at all seasons. The mean temperature for January, the coldest month, is only 17° F.; for the three winter months it is 19° F., and for the five months from November to March inclusive it is 24·3° F. For July, the warmest month, the mean temperature is 68° F.; for the entire year it is 43° F. Extremes of temperature have ranged from −36° F. at Woodstock, Windsor county, in February 1896 to 97° F. at Cornwall, Addison county, in June 1901. The eastern section of the state is colder than the western, and the central or most mountainous section is still colder; for example, the mean annual temperature of Burlington, on Lake Champlain, is 46° F., while that of Saint Johnsbury, a little farther S. and near the E. border, is only 42° F., and that of Northfield, still farther S. but in the middle section, is only 41° F. The mean annual precipitation for the entire state is about 38·5 in.; more rain falls in summer than in any other season, and more falls in the southern section than in the northern. The average annual fall of snow throughout the state is about 90 in., but at Jacksonville near the S. border it often exceeds 110 in. More snow falls in February than in any other month. In the Connecticut and Hudson-Champlain valleys the winds blow mostly from either the N. or the S., but in several of the smaller valleys the prevailing winds are from the N.W.

Soil.—The soil is for the most part glacial drift, composed of clay, sand and gravel, and varying greatly in depth. On the higher elevations it is generally stony and sterile, but in the valleys and on many of the lower hills, where it consists largely of clay and sand, it is quite productive. The best soils are in the west section, where limestone clays or shell marls are common.

Forests.—Vermont was heavily forested with white pine, spruce and hemlock, and, in the southern part of the state and along the shore of Lake Champlain, with some hard woods. The white pine had been much cut off by 1890 and it is no longer commercially important. The woodland area of the state in 1900 was estimated to be 3900 sq. m., about 43% of the land area of the state.

Fisheries.—Lake Champlain furnishes the only commerical fishing grounds in Vermont, with the exceptions of small catches of white fish in Lake Bomoseen, Lake St Catherine in Rutland county and Lake Memphremagog. The total catch in 1895 was 208,139 ℔, valued at $7160, and in 1902 was 528,682 ℔, valued at $37,669. The capital invested in fisheries in 1902 was $9417, and the number of men employed, 145. The most valuable fish taken was wall-eyed pike, and the catch of this fish and of pickerel from Lake Champlain in 1902 exceeded in value that from any other body of fresh water in the United States excepting Lake Huron and Lake Erie. The wall-eyed pike taken in 1902 were valued at $16,915 (210,936 ℔); white fish, $5777 (80,191 ℔); pickerel, $4144 (51,711 ℔); yellow perch, $2575 (43,917 ℔); sturgeon, $2051 (15,590 ℔), and suckers, $1854 (37,375 ℔); other varieties taken in smaller quantities included smelt, sun-fish and eels.

Agriculture.—Vermont is largely an agricultural state: in 1900, out of a total of 134,933 persons engaged in gainful occupations, 49,820 were engaged in agriculture, 36,180 in manufacturing and mechanical pursuits, 23,028 in domestic and personal service, 18,889 in trade and transportation, and 7016 in professional service; and of a total land area of 9124 sq. m., 7382 sq. m. (4,724,400 acres) were included in farms. The percentage of improved farm land, as in Maine, New York and Pennsylvania, increased from 1850 until 1890 and decreased after 1890; and in 1900 out of a total acreage of 4,724,400 acres only 2,126,624 acres (45%) were improved. Of the 33,104 farms in the state in 1900, 25,982 were farmed by their owners, 1373 by part owners, 314 by owners and tenants, 2424 by cash tenants, 2396 by share tenants, and 615 by managers; 637 farms had more than 500 acres, 3431 were between 260 and 500 acres, 5512 between 175 and 260 acres, 10,215 between 100 and 175 acres, 6513 between 50 and 100 acres, 3511 between 20 and 50 acres, and 3285 less than 20 acres; and dairy produce was the principal source of income of more than one-half of these (16,700), live stock the principal source of income of 7323 farms, and hay and grain of 2519 farms. The general sterility of the soil except along rivers and the bases of hills has made intensive cultivation always necessary, and the competition of new and rich western farm lands has made the agriculture of Vermont develop further toward specialization in dairying and raising live stock. In 1910 there were 495,000 neat cattle (285,000 milch cows), 94,000 horses (average value, $106), 229,000 sheep and 95,000 swine. The horses of Vermont have been famous in the development of American racing stocks; the Morgan stock is best known, and other famous Vermont strains are Messenger and Black Hawk. Hay and forage are the most important crops, and Vermont grasses for grazing have been favourably known since the close of the 18th century. In 1909 on 879,000 acres a crop of hay (excluding forage) was raised valued at $16,155,000. The cereals are relatively unimportant. The largest cereal crop is oats, of which, in 1909, 2,608,000 bushels (valued at $1,304,000) were produced on 81,000 acres.

Mines and Quarries.—The principal mineral resource of Vermont is its building and monumental stone, including marble and granite and a small amount of limestone. The value of the total amount of stone produced in 1908 in Vermont was $7,152,624. Vermont marble is the best and most plentiful in the United States. It has been quarried since 1785; marble monuments were first manufactured about 1808; and at South Dorset in 1818 marble seems first to have been sawed in blocks, the earlier method having been chiselling. It is found generally throughout the western part of the state. The principal supply is in West Rutland, Proctor and Pittsford; this, the "Rutland marble," is a duller, less lustrous white, and of a greater durability than the Carrara marble, and is used largely for monuments and statuary. There are other large quarries at Dorset and East Dorset, Bennington county; the finest marbles from this region are the white, slightly marked with pale brown and with greenish lines; they are commonly used for building, the Harvard Medical School and the office of the U.S. Senate being examples. At Rutland, Proctor and Dorset many darker shades are found, including "moss vein," olive green and various shades of blue, green, yellow and pink, which are used for ornamental purposes. There are important quarries in Franklin county (at Swanton), the stone being a dark Chazy limestone, in which pink and red ("jasper," "lyonnaise" and "royal red") marbles of Cambrian age are found. At Monkton, Addison county, there is a quarry from which other red marbles are taken; and at Roxbury, Washington county, a fine serpentine, called "green marble," or verde antique, is quarried. On Isle La Motte, Grand Isle county, there are marble quarries, the characteristic colours of the marble being "Fisk black" and "Fisk grey." The output of marble in 1908 was valued at $4,679,960 (out of a total of $7,733,920 for the entire production of marble in the United States). Only less important and only less early to be established in Vermont was the quarrying of granite, which began in 1812, but which has been developed chiefly since 1880, largely by means of the building of "granite railroads" which connect each quarry with a main railway line—a means of transportation as important as the logging railways of the Western states and of Canada. The largest granite quarries are near Barre, Washington county, a city which owes its importance to the quarries. The Barre granites, like those of Woodbury and Calais (also in Washington county) and part of those of South Ryegate, Kirby and Newark (Caledonia county), are of the biotite type; they are grey, except the stone from Newark, which is pinkish. Of the quartz-monzonite type are the whitish granites of Bethel and Rochester (Windsor county) and Randolph (Orange county), the light grey of Dummerston (Windham county), and the darker greys of Cabot (Washington county), Derby (Orleans county), Hardwick and Groton (Caledonia county) and Topsham (Orange county). The olive green syenite found on Mount Ascutney, near the Connecticut river, in Windsor county, is a hornblende-augite. Other important granite quarries are near Williamstown, Dummerston, Berlin and Woodbury. The total value of the output of granite in the state in 1908 was $2,451,933. In 1908 the output of limestone was valued at $20,731; there are limestone quarries in Washington and Orange counties and on Isle La Motte. Slate-quarrying and cutting is carried on in the south-western part of the state, in Rutland county; there are important quarries at Fair Haven, Poultney, Castleton, Wells and Pawlet. In Washington county there are quarries near Northfield. The industry began about 1840, though one quarry had been opened as early as 1805. There are two green varieties, called in the trade "sea-green" and "unfading green," the former being used for a cheap roofing slate; and there are purplish varieties. In 1908 the value of slate produced was $1,710,491 (out of a total production for the United States of $6,316,817).

Manufactures.—The first important industry of the state was "rafting" lumber from Vermont through Lake Champlain and the Richelieu and St Lawrence rivers to Quebec. Burlington became a great lumber market for a trade moving in the direction of Boston after the Richelieu river was blocked to navigation and railway transportation began, and in 1882 Burlington was the third lumber centre in the United States. Mountain streams furnish important water-power, and the typical factory of Vermont has long been a sawmill run by a water-wheel. The value of sawmill products in 1905 was $5,888,441, and of planing-mill products $3,080,117. Closely connected with the manufacture of lumber is the making of paper and wood pulp, centralized at Bellows Falls, with water-power on the Connecticut river and with the raw materials near; the product was valued in 1905 at $3,831,448. Dairy industries have rapidly increased in value: in 1905 the value of butter and cheese was $6,416,434, more than any other single industry under the census classification. If a less arbitrary classification be followed the principal manufacturing industries would be stone manufacture and textiles. The first marble quarry was opened in Dorset in 1785 and a second at Middlebury in 1805; and the first granite was quarried in 1812. Barre is the centre of the granite business, and the region about Rutland, especially Proctor, is the principal seat of the marble industry. The product of stone manufactures in 1905 was $9,570,436. Vermont was almost the last of the New England states to develop textile manufactures, though the manufacture of woollen goods was begun in 1824. The greatest development was between 1900 and 1905; the total value of textiles in the former year was $5,407,217 (woollen goods, $2,572,646; hosiery and knit goods, $1,834,685; cotton goods, $999,886) and in the latter was $7,773,612 (woollen goods, $4,698,405; hosiery and knit goods, $1,988,685; and cotton goods, $1,086,522). Other important manufactures are: flour and grist mill products, foundry and machine-shop products, furniture, patent medicines and compounds, roofing materials, and scales and balances, manufactured especially at St Johnsbury.

Transportation and Commerce.—Railway transportation is supplied to Vermont by parallel lines crossing diagonally every part of the state at about equal intervals and running in general in a N.W. and S.E. direction, and by lines running N. and S. respectively along the eastern and western borders of the state. The railway map of the state thus has roughly the appearance of a gridiron. The principal railways are: the lines operated by the Boston & Maine system, extending along the eastern border from Brattleboro through Bellows Falls, and St Johnsbury to the Canada boundary (Vermont Valley, Sullivan County, and Connecticut & Passumpsic Rivers railways), with a line, the St Johnsbury & Lake Champlain railway, extending across the northern part of the state from Lunenburg to Maguam Bay; the Central Vermont railway (Grand Trunk system) which crosses the state diagonally from S.E. to N.W., connecting Burlington, Montpelier and St Albans and affording connexion to the north with Montreal and to the south over trackage shared with the Boston & Maine, with the New London Northern which is leased by this road, and the Rutland railway (New York Central system) extending along the western edge of the state and connecting Rutland with Burlington to the north and with Bellows Falls and Bennington to the south. These railways provide outlets for through freight and passenger traffic southward to Boston and New York, and to the north to St Johns and Montreal.

The southern part of the state was early opened to railways, the Sullivan County railway (operated by the Boston & Maine) having been opened in 1849; and in 1850 the state had 290 m. of railway; in 1870, 614 m.; in 1890, 991·42 m.; and on the 1st of January 1909, 1093·43 m. Water communication is afforded by Lake Champlain to the south, for seven months of the year, by way of the Champlain canal, via Whitehall, New York, to Troy and the Hudson river and the Atlantic coast, and to the north by way of the Richelieu river and the Chambly canal to the St Lawrence. The commerce of the lake consists principally of coal, wood pulp and building material, besides general merchandise. The only river with traffic of commercial importance is Otter Creek, flowing northwards into the southern part of Lake Champlain and having a navigable length of 8 m. to Vergennes, with a depth to this point of 8 ft. at low water. The commerce on Lake Champlain is carried on chiefly through Burlington, the port of entry for the Vermont customs district. The tonnage of the commerce of this port amounted, according to the reports of the United States army engineers, to 107,421 tons in 1904 and to 249,174 tons in 1908, of which in the latter year nearly 80% was lumber.

Population.—The population of Vermont in 1890 was 332,422; in 1900, 343,641; and in 1910, 355,956.[1] Of the total population in 1900, 298, 077 were native whites, 44,747 were foreign-born, 826 were negroes and 39 were Chinese. Of the inhabitants born in the United States, 10,074 were natives of New York, 9675 were natives of New Hampshire and 9111 were natives of Massachusetts. Of the foreign-born, 14,024 were French Canadians, 10,616 were English Canadians and 7453 were Irish. Of the total population, 117,344 were of foreign parentage (*i.e.* either one or both parents were foreign-born) and 27,226 were of French Canadian and 20,228 of Irish parentage, both on the father's and on the mother's side. Of 147,223 communicants of all churches in 1906, the largest number, 82,272, were Roman Catholics, 22,109 were Congregationalists, 17,471 Methodist Episcopalians, 8450 Baptists, 1501 Free Baptists and 5278 Protestant Episcopalians. The principal cities are Burlington, Rutland, Barre, Montpelier (the capital) and St Albans.

Administration.—Vermont has been governed under the constitution of 1777, that of 1786 and that of 1793, with twenty-eight amendments, of which the first was adopted in 1828, the second to thirteenth in 1836, the fourteenth to twenty-third in 1850, the twenty-fourth, twenty-fifth and twenty-sixth in 1870, and the twenty-seventh and twenty-eighth in 1883. The administrative officers of the state are a governor, a lieutenant-governor, a secretary of state, a state treasurer, and an auditor of accounts, elected by popular vote, and an inspector of finance, a commissioner of taxes, a superintendent of education, a fish and game commissioner, three railroad commissioners, and various boards and commissions, of whom some are elected by the General Assembly and some are appointed by the governor with the advice and consent of the Senate. All elections and appointments are biennial. The governor has limited powers of appointment and pardon and a veto power which may be overridden by a majority vote in each house.

The legislative department consists of a senate of 30 members, apportioned among the counties according to population, but with the proviso that each county must have at least one senator, and a House of Representatives of 245 members, one from each township. Since 1870 elections and legislative sessions have been biennial. The powers of the two houses are equal except that revenue measures must originate in the House of Representatives.

The judiciary is composed of a supreme court of seven members, a court of chancery, a county court in each county, a probate court in each probate district, and justices of the peace. The judges of the supreme court are elected biennially by the General Assembly, and all the other judicial officers are elected by the people. Sessions of the supreme court are held in each county once a year in addition to the general session which meets at some central place selected by the judges. The court of chancery is held by the judges of the supreme court, the county by a supreme court judge with the aid of two associates elected by the people of the county.

For the administration of local affairs the state is divided into 14 counties and 245 townships. There is no special board of commissioners or supervisors as in most of the other states, the county authority being the assistant judges of the county court. The assistant judges, the sheriff and the state's attorney are elected annually by popular vote. The county treasurer is elected by the assistant judges. The more important township officials are a moderator, a board of selectmen, a clerk, a treasurer and a superintendent of schools. Any community containing thirty or more houses may, with the approval of the selectmen of the town, receive a separate village organization. Their officials are a clerk, five trustees, a collector of taxes and a treasurer.

All citizens of the United States residing in Vermont are citizens of the state. The right of suffrage is confined by the constitution to adult male citizens who have resided in the state for one year. Women have the right to vote in all elections relating to schools and school officers in cities, towns and graded school districts, and also the right to be elected to any local school position or to the office of township clerk. The original method of revising the constitution was adopted from Pennsylvania (see *History*), and it was retained long after Pennsylvania had abandoned it. Thirteen censors chosen septennially were empowered to suggest amendments and to call a convention to pass upon them. The censors, being elected on a general ticket, were always more progressive than the convention, which was chosen on the principle of equal township representation. In spite of the repeated recommendations of the censors, the convention refused to abolish the collegiate executive and the unicameral legislative system until 1836. Propositions to establish the judiciary on a more permanent tenure were also voted down in 1814, 1822, 1857 and 1870, and the state still elects its judges for two years' terms. On its own suggestion, the council of censors was abolished in 1870 and the present method of amending the constitution was adopted. Every tenth year, beginning in 1880, the Senate is authorized to propose amendments, which proposals, if concurred in by the majority of the members of the House of Representatives, are published in the principal newspapers of the state. If they are again approved by a majority of each house in the next General Assembly, they are submitted finally to a direct popular vote, a majority of the votes cast being decisive.

Miscellaneous Laws.—A married woman may hold her separate property, carry on business, sue and be sued the same as if she were single, except that in conveying or mortgaging her real estate she must be joined by her husband. A widow has a dower interest in one-third of her husband's real estate unless barred by a jointure or an agreement. A widower is in any case entitled by courtesy to one-third of his wife's real estate, and he may choose between his rights by courtesy and the provisions of his wife's will. Where there is no issue and the deceased dies intestate the surviving spouse is entitled to the whole estate, both real and personal, if it does not exceed $2000, and if it exceeds that sum the survivor is entitled to $2000 and one-half of the remainder; if there are no kindred, the whole of the estate goes to the surviving spouse. The causes for a divorce are adultery, sentence to confinement in the state prison for three years or more and actual confinement at the time of the suit, intolerable severity, wilful desertion for three consecutive years or absence for seven years without being heard from, or wanton and cruel refusal or neglect of the husband to provide a suitable maintenance for his wife. The plaintiff must have resided in the state for at least the year preceding the application, and if the cause accrued in some other state or country before the parties lived together in Vermont and while neither party lived there, the plaintiff must have been a resident at least for two years preceding the action. When a divorce is granted, the defendant is not permitted to marry other than the plaintiff for three years, unless the plaintiff dies. The homestead of a householder or head of a family to the value of $500 is, so long as it continues to be used as the homestead, exempt from levy or attachment other than upon causes existing at the time it was acquired and for taxes. If the owner is a married man, he cannot sell or mortgage it, except for the purchase money, unless his wife joins him in the execution.

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[1] According to previous censuses, the population was as follows: (1790) 85,425; (1800) 154,465; (1810) 217,895; (1820) 235,981; (1830) 280,652; (1840) 291,948; (1850) 314,120; (1860) 315,098; (1870) 330,551; (1880) 332,286. The increase between 1850 and 1900 was remarkably small.

Education.—The public-school system is under the supervision of a state superintendent of education, elected biennially by the General Assembly, and local schools are under union superintendents and in a few cases under town superintendents. The district system was displaced in 1893 by a township system. The revenues for educational purposes are derived mainly from a state tax of 8% on the general list, from local taxes, and from the interest on the permanent school fund, which (including the money paid to Vermont by the United States government when a portion of the treasury surplus was distributed among the states in 1837) amounted in 1908 to $1,120,218. The schools are open to all children between the ages of 5 and 20, and attendance for twenty-six weeks in each year is made compulsory for those who are between the ages of 8 and 15. The average number of weeks in the "legal schools" (about 95% of the public schools) was 32 weeks in 1907–1908. The chief institutions for higher instruction are the university of Vermont and State Agricultural College (1800, 1865), a land-grant college at Burlington, Middlebury College (1800) at Middlebury, Norwich University (1819) at Northfield, and the state normal schools at Randolph (1867), Johnson (1867) and Castleton (1868).

Charitable and Penal Institutions.—The charitable and penal institutions of the state are controlled by separate boards of directors, but all are subject to the general supervision of a board of visitors composed of the governor, lieutenant-governor and speaker of the House of Representatives, and a woman appointed by the governor. There are a state prison at Windsor (1808), a house of correction at Rutland (1878), an industrial school at Vergennes (1866), and hospitals for the insane at Brattleboro (1836) and Waterbury (1891). Biennial appropriations are made for the support of the deaf and dumb, the blind and imbecile children at various institutions in Massachusetts and Connecticut.

Finance.—The chief sources of revenue for the state are a corporation tax, a collateral inheritance tax (1904) and a licence tax. There is no general property tax except a special levy of 8% on the general list for school purposes and 5% for the construction of roads. For the year ending on the 30th of June 1908 the total receipts were $1,822,390, the expenditures were $1,871,166. The state is practically free from debt, the only obligation of this character being $135,500 in 6% bonds, payable in 1910, which were issued in behalf of the Agricultural College. The banking institutions are supervised by an inspector of finance, who reports annually to the General Assembly. There were no banks in the state until 1806, when a state bank (controlled by the state) was established which was finally closed up in 1845, although as early as 1812 a law was passed to close it. The first private state bank was opened in 1817; an act of 1831 provided for a safety fund guaranteeing bank circulations and derived from a 4½% tax on capital stock and a 10% tax on profits; but this law was modified in 1842, the tax being removed from banks giving specie guarantees; and a free banking act was passed in 1851. Owing to the high rate of taxation on deposits, a considerable part of the savings of the people is sent into other states.

History.—Samuel de Champlain, as governor of Quebec, entered what is now Vermont in July 1609 in an expedition against the Iroquois, and thus laid the basis for the French claim. In 1665 the French built a fort on Isle la Motte. The first English settlement was probably made at Chimney Point, in Addison township, in 1690 by a party from Albany. The first permanent white settlement was established by Massachusetts at Fort Dummer (near the present Dummer, in the south-eastern part of the present town of Brattleboro) in 1724. Similar outposts were located during the next few years at Sartwell's Fort and Bridgman's Fort in the township of Vernon (Windham county) and at Fort Hill in the township of Putney (N. of Brattleboro, in Windham county). The territory in which these settlements had been made was involved in the boundary dispute between Massachusetts and New Hampshire, which was settled in 1741 by a decision of the king in council favourable to New Hampshire (*q.v.*). The extension of the southern boundary line by this decision due westward until it met His Majesty's other governments gave rise, however, to a controversy with New York. New Hampshire claimed that her territory extended as far to the west as those of Massachusetts and Connecticut, whereas New York, under the charter of 1664, claimed eastward to the Connecticut river. New York protested against the Bennington grant in 1749, but the question did not become serious until the chief obstacle to settlement was removed by the conquest of Canada in 1760–61. From 1761 to 1763 Governor John Wentworth of New Hampshire issued 108 grants, and settlements were established in Brattleboro, Putney, Westminster, Halifax, Marlborough, Wilmington, New Fane, Rockingham, Townshend, Vernon (Hinsdale) and Dummerston (all in Windham county, except Vernon, which is in Cheshire county). A privy council decree recognizing the claims of New York was issued on the 20th of July 1764, and the settlers were soon afterwards ordered to surrender their patents and repurchase the land from the proper authorities at Albany. Under the leadership of Ethan Allen, Seth Warner and Remember Baker (1737–1775), they refused obedience and took up arms in defence of their rights. About the close of 1771 Colonel Allen organized a regular military force among the inhabitants of the district W. of the mountains, which came to be known as the Green Mountain Boys. The trouble was soon complicated by the conflict with the mother country. On the 13th of March 1775, a riot occurred at Westminster between the people of Cumberland county and the royal authorities, in which two of the people were killed. The Green Mountain Boys, with some help from Connecticut, captured Fort Ticonderoga on the 10th of May 1775, and took part in the Canadian expedition of 1775 under Montgomery and Schuyler. Within the state itself battles were fought at Hubbardton on the 7th of July and Bennington on the 16th of August 1777. The representatives of the towns assembled in convention at Dorset and Westminster in 1776 (Jan. 16–17, July 24–25, September 25–28, October 30), and on the 15th of January 1777 adopted a declaration of independence, assumed the name New Connecticut and appointed Dr Jonas Fay (1737–1818), Thomas Chittenden (1730–1797), Hemon Allen (1740–1788), Dr Reuben Jones and Jacob Bayley a committee to submit their proceedings to the Continental Congress. The chief adviser of the committee in Philadelphia was Dr Thomas Young, a prominent physician, who had helped to draft the Pennsylvania constitution of 1776. Young advised them to call their state Vermont, and he also sent through them a circular letter, dated the 11th of April 1777, urging the people to adopt a state constitution on the Pennsylvania model. The advice was followed. A convention met at Windsor (July 2–8, 1777), and drafted a document which contained almost all of the important provisions of the constitution of Pennsylvania, such as a unicameral legislature, a plural executive and a council of censors, which was not abolished until 1870. One important variation, however, was a clause in the bill of rights providing for the abolition of slavery, Vermont being the first state in America to take such action. The first legislature of the state met at Windsor in March 1778, and voted to admit sixteen towns east of the Connecticut river which were dissatisfied with the rule of New Hampshire. As a result, New York and New Hampshire formed a secret agreement to divide the state between themselves, the mountains to be the line of division. In this crisis the British government through General Sir Frederick Haldimand offered to recognize Vermont as a separate province and to give her very liberal terms provided she would desert the other states.

Ethan Allen (*q.v.*) and some of the other leaders seemed inclined to accept these overtures, but for various reasons, the chief of which was the general success of the American cause, the scheme was soon abandoned. The difficulties with New Hampshire were adjusted in 1782, the west bank of the Connecticut being accepted as the final boundary, but New York refused to abandon her claims until 1790. In the meantime, Vermont continued as an independent state without any recognition from Congress until its admission into the Union on the 4th of March 1791. The legislature wandered about from town to town until 1808, when the capital was permanently located at Montpelier. In presidential campaigns the state has been Federalist, 1792–1800; Democratic-Republican, 1804–1820; Adams-Republican, 1824–1828; Anti-Masonic, 1832; Whig, 1836–1852; and Republican since 1856. During the War of 1812 Vermont troops took part in the battles of Chippewa, Lundy's Lane, Lake Erie and Plattsburgh; but the only engagement in the state itself was the defence of Fort Cassin (at the mouth of Otter Creek in the N.W. corner of the present Addison county) in 1813. On the 19th of October 1864 a small band of Confederate soldiers under Lieutenant B. H. Young crossed the frontier from Canada and raided the town of St Albans. A few of the inhabitants were wounded and one was killed and about $200,000 was taken from the vaults of the local banks. St Albans was also the headquarters of an attempted Fenian invasion of Canada in 1870. Since 1815 a considerable proportion of the native stock has migrated to the W., but the loss has been partially offset by an influx of French Canadians. The wool-growing industry has been almost entirely destroyed by the competition of Australia and the West, and the people are now engaged mainly in dairy-farming, timbering, granite- and marble-quarrying, and in keeping summer boarders.

GOVERNORS

Thomas Chittenden	1778–1789
Moses Robinson	1789–1790
Thomas Chittenden,[1] Federalist	1790–1797
Paul Brigham, acting-governor, Federalist	1797
Isaac Tichenor, Federalist	1797–1807
Israel Smith, Democratic-Republican	1807–1808
Isaac Tichenor, Federalist	1808–1809
Jonas Galusha, Democratic-Republican	1809–1813
Martin Chittenden, Federalist	1813–1815
Jonas Galusha, Democratic-Republican	1815–1820
Richard Skinner, ,,	1820–1823
Cornelius P. Van Ness, ,,	1823–1826
Ezra Butler, Adams-Clay	1826–1828
Samuel C. Crafts, Adams-Clay	1828–1831
William A. Palmer, Anti-Masonic Fusion	1831–1835
Silas H. Jennison,[2] acting-governor, Whig	1835–1836
Silas H. Jennison, Whig	1836–1841
Charles Paine, ,,	1841–1843
John Mattocks, ,,	1843–1844
William Slade, ,,	1844–1846
Horace Eaton, ,,	1846–1848
Carlos Coolidge, ,,	1848–1850
Charles K. Williams, ,,	1850–1852
Erastus Fairbanks, ,,	1852–1853
John S. Robinson, ,,	1853–1854
Stephen Royce, Republican	1854–1856
Ryland Fletcher, ,,	1856–1858
Hiland Hall, ,,	1858–1860
Erastus Fairbanks, ,,	1860–1861
Frederick Holbrook, ,,	1861–1863
J. Gregory Smith, ,,	1863–1865
Paul Dillingham, ,,	1865–1867
John B. Page, ,,	1867–1869
Peter T. Washburn,[3] Republican	1869–1870
George W. Hendee, acting-governor, Republican	1870
John W. Stewart, Republican	1870–1872
Julius Convers, ,,	1872–1874
Asahel Peck, ,,	1874–1876
Horace Fairbanks, ,,	1876–1878
Redfield Proctor, ,,	1878–1880
Roswell Farnham, ,,	1880–1882
John L. Barstow, ,,	1882–1884
Samuel E. Pingree, Republican	1884–1886
Ebenezer J. Ormsbee, ,,	1886–1888
William P. Dillingham, ,,	1888–1890
Carroll S. Page, ,,	1890–1892
Levi K. Fuller, ,,	1892–1894
Urban A. Woodbury, ,,	1894–1896
Josiah Grout, ,,	1896–1898
Edward C. Smith, ,,	1898–1900
William W. Stickney, ,,	1900–1902
John G. McCullough, ,,	1902–1904
Charles J. Bell, ,,	1904–1906
Fletcher D. Proctor, ,,	1906–1908
George H. Prouty, ,,	1908–1910
John A. Mead, ,,	1910–

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VERMOREL, AUGUSTE JEAN MARIE (1841–1871), French journalist, was born at Denicé, France, on the 21st of June 1841. A radical and socialist, he was attached to the staff of the *Presse* (1864) and the *Liberté* (1866). In the latter year he was appointed editor of the *Courrier Français*, and his attacks on the government in that organ led to his imprisonment. In 1869 he was editor of the *Réforme*, and was again imprisoned for denouncing the government. On the overthrow of the Empire in 1870 he was released and took an active part in the Commune. He was dangerously wounded while fighting at the barricades, taken prisoner and removed to Versailles, where he died on the 20th of June 1871.

VERMOUTH, an alcoholic beverage, the basis of which consists of a fortified and aromatized white wine. The best French vermouth is made from the white wines of the Hérault district. The wine is fortified with spirit up to a strength of about 15% of alcohol, and is then stored in casks exposed to the sun's rays for a year or two. Another portion of the wine is fortified up to a strength of about 50% of alcohol, and in this various aromatic and tonic materials are macerated, in casks which are exposed to the sun in the same way as the bulk of the wine. The two liquids are then mixed in such proportions as to make the strength of the ultimate product about 17% of alcohol by volume. Excellent vermouth is also manufactured in Italy, the produce of that country being generally of a "sweet," that made in France of a "dry" type.

VERNACULAR (Lat. *verna*, dim. *vernaculus*, a slave born in his master's house), a term meaning native or indigenous, belonging to the country where a person is born. The word is practically confined in English usage to language, whether of the country as a whole or of particular dialects or idioms.

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[1] Died in office on the 25th of August 1797; succeeded by the lieutenant-governor.

[2] As there was no governor elected by the people, Jennison as lieutenant-governor elect acted as governor.

[3] Died in office on the 7th of February 1870; succeeded by the lieutenant-governor.

VERNE, JULES (1828–1905), French author, was born at Nantes on the 8th of February 1828. After completing his studies at the Nantes lycée, he went to Paris to study for the bar. About 1848, in conjunction with Michel Carré, he wrote librettos for two operettas, and in 1850 his verse comedy, *Les Pailles rompues*, in which Alexandre Dumas fils had some share, was produced at the Gymnase. For some years his interests alternated between the theatre and the bourse, but some travellers' stories which he wrote for the *Musée des Familles* seem to have revealed to him the true direction of his talent—the delineation, viz., of delightfully extravagant voyages and adventures to which cleverly prepared scientific and geographical details lent an air of verisimilitude. Something of the kind had been done before, after kindred methods, by Cyrano de Bergerac, by Swift and Defoe, and later by Mayne Reid. But in his own particular application of plausible scientific apparatus Verne undoubtedly struck out a department for himself in the wide literary genre of *voyages imaginaires*. His first success was obtained with *Cinq semaines en ballon*, which he wrote for Hetzel's *Magazin d'Éducation* in 1862, and thenceforward, for a quarter of a century, scarcely a year passed in which Hetzel did not publish one or more of his fantastic stories, illustrated generally by pictures of the most lurid and sensational description. The most successful of these romances include: *Voyage au centre de la terre* (1864); *De la terre à la lune* (1865); *Vingt mille lieues sous les mers* (1869); *Les Anglais au pôle nord* (1870); and *Voyage autour du monde en quatre-vingts jours*, which first appeared in *Le Temps* in 1872. The adaptation of this last (produced with immense success at the Porte St Martin theatre on the 8th of November 1874) and of another excellent tale, *Michael Strogoff* (at the Châtelet, 1880), both dramas being written in conjunction with Adolphe d'Ennery, proved the most acceptable of Verne's theatrical pieces. The novels were translated into the various European languages—and some even into Japanese and Arabic—and had an enormous success in England. But after 1877, when he published *Hector Servadac*, a romance of existence upon a comet, the writer's invention began to show signs of fatigue (his kingdom had been invaded in different directions and at different times by such writers as R. M. Ballantyne, Rider Haggard and H. G. Wells), and he even committed himself, somewhat unguardedly, to very gloomy predictions as to the future of the novel. Jules Verne's own novels, however, will certainly long continue to delight readers by reason of their sparkling style, their picturesque *verve*—apparently inherited directly from Dumas—their amusing and good-natured national caricatures, and the ingenuity with which the love element is either subordinated or completely excluded. M. Verne, who was always extremely popular in society, divided his time for the most part between Paris, his home at Amiens and his yacht. He was a member of the Legion of Honour, and several of his romances were crowned by the French Academy, but he was never enrolled among its members. He died at Amiens on the 24th of March 1905. His brother, Paul Verne, contributed to the *Transactions of the French Alpine Club*, and wrote an *Ascension du Mont Blanc* for his brother's collection of *Voyages extraordinaires* in 1874.

VERNET, the name of three eminent French painters.

I. Claude Joseph Vernet (1714–1789), who was born at Avignon on the 14th of August 1714, when only fourteen years of age aided his father, a skilful decorative painter, in the most important parts of his work. But the panels of sedan chairs could not satisfy his ambition, and he started for Rome. The sight of the sea at Marseilles and his voyage thence to Civita Vecchia made a deep impression on him, and immediately after his arrival he entered the studio of a marine painter, Bernardino Fergioni. Slowly but surely Claude Joseph made his way and attracted notice. With a certain conventionality in design, proper to his day, he allied the results of constant and honest observation of natural effects of atmosphere, which he rendered with unusual pictorial art. Perhaps no painter of landscapes or sea-pieces has ever made the human figure so completely a part of the scene depicted or so important a factor in his design. "Others may know better," he said, with just pride, "how to paint the sky, the earth, the ocean; no one knows better than I how to paint a picture." For twenty years Vernet lived on in Rome, producing views of seaports, storms, calms, moonlights, &c., when he was recalled (1753) to Paris, and executed, by royal command, the remarkable series of the seaports of France (Louvre) by which he is best known. On his return he became a member of the academy, but he had previously contributed to the exhibitions of 1746 and following years, and he continued to exhibit, with rare exceptions, down to the date of his death, which took place in his lodgings in the Louvre on the 3rd of December 1789. Amongst the very numerous engravers of his works may be specially cited Le Bas, Cochin, Basan, Duret, Flipart and Le Veau in France, and in England Vivares.

II. Antoine Charles Horace Vernet (1758–1835), commonly called Carle, the youngest child of the above-named, was born at Bordeaux in 1758, where his father was painting the view from the château of La Trompette (Louvre). He showed, at the age of five, an extraordinary passion for drawing horses, but went through the regular academical course as a pupil of Lépicié. Strangely enough, on arriving in Italy after carrying off the *grand prix* (1782), he lost all ambition and interest in his profession, so that his father had to recall him to France to prevent his entering a monastery. In Paris Carle Vernet became himself again, and distinguished himself at the exhibition of 1791 by his "Triumph of Paulus Aemilius," a work in which he broke with reigning traditions in classical subjects and drew the horse with the forms he had learnt from nature in stables and riding-schools. But the Revolution drew on, and Carle Vernet's career for awhile seemed to end in the anguish of his sister's death on the scaffold. When he again began to produce, it was as the man of another era: his drawings of the Italian campaign brought him fresh laurels; his vast canvas, the "Battle of Marengo," obtained great success; and for his "Morning of Austerlitz" Napoleon bestowed on him the Legion of Honour. His hunting-pieces, races, landscapes, and work as a lithographer (chiefly under the Restoration) had also a great vogue. From Louis XVIII. he received the order of St Michael. In 1827 he accompanied his son Horace (see below) to Rome, and died in Paris on his return, on the 17th of November 1835.

III. Émile Jean Horace Vernet (1789–1863), commonly called Horace, born in Paris on the 30th of June 1789, was one of the most characteristic, if not one of the ablest, of the military painters of France. He was just twenty when he exhibited the "Taking of an Entrenched Camp"—a work which showed no depth of observation, but was distinguished by a good deal of character. His picture of his own studio (the rendezvous of the Liberals under the Restoration), in which he represented himself painting tranquilly, whilst boxing, fencing, drum- and horn-playing, &c., were going on, in the midst of a medley of visitors, horses, dogs and models, is one of his best works, and, together with his "Defence of the Barrier at Clichy" (Louvre), won for him an immense popularity. Enjoying equal favour with the court and with the opposition, he was most improperly appointed director of the school of France at Rome, from 1828 to 1835, and thither he carried the atmosphere of racket in which he habitually lived. After his return the whole of the Constantine room at Versailles was decorated by him in the short space of three years. This vast work shows Vernet at his best and at his worst: as a picture it begins and ends nowhere and the composition is all to pieces; but it has good qualities of faithful and exact representation. He died at Paris on the 17th of January 1863. The twenty works which were exhibited after his death confirmed his reputation for extraordinary facility; he had tried every sort of subject, showing affinity for all that was anecdotic rather than dramatic, failing most wherever most was demanded of him, and never reaching either beauty of colour or dignity of line. Vernet was, in short, a brilliant off-hand sketcher of all he saw, as he said himself, "from his window," and even in this work there was a good deal of affectation of the impromptu.

See Lagrange, *Joseph Vernet et la peinture au XVIIIᵉ siècle* (1861); C. Blanc, *Les Vernet* (1845); A. Dayot, *Les Vernet* (1898).

VERNEUIL, PHILLIPPE ÉDOUARD POULLETIER DE (1805–1873), French palaeontologist, was born in Paris on the 13th of February 1805. He was educated for the law, but being of independent means he was free to follow his own inclinations, and having attended lectures on geology by Élie de Beaumont he was so attracted to the subject that he devoted himself assiduously to the study of science. He spent several years in travel through various parts of Europe, specially examining the geology of the Crimea, on which he published an essay (*Mem. Soc. Géol. France*, 1837). He next investigated the Devonian rocks and fossils of the Bas-Boulonnais; and in 1839 accompanied Sedgwick and Murchison in a study of the older Palaeozoic rocks of the Rhenish provinces and Belgium, the palaeontological results being communicated to the Geological Society of London in conjunction with D'Archiac. When Murchison commenced his geological examination of the Russian empire, he requested de Verneuil to accompany him, and the researches of the latter were incorporated in the second volume of *The Geology of Russia in Europe and the Ural Mountains* (1845). Subsequently de Verneuil paid a visit to the United States to study the history of the palaeozoic rocks in that country, and the results were published in 1847 (*Bull. Soc. Géol. France*). In later years he made numerous expeditions into Spain, and his observations were embodied in *Carte géologique de l'Espagne et du Portugal* (1864), prepared in association with E. Collomb. In 1853 the Wollaston medal of the Geological Society of London was awarded to him, and in 1860 he was elected a foreign member of the Royal Society. He died in Paris on the 29th of May 1873.

VERNEUIL, a town of north-western France, in the department of Eure, 34 m. S.S.W. of Evreux by rail. Pop. (1906) 3529. Verneuil, situated on the left bank of the Avre, has a number of old houses and churches. Of the latter the most important is the church of La Madeleine (11th to 17th century), the façade of which is flanked by an imposing square tower of the first half of the 16th century, similar in origin and appearance to the Tour de Beurre of Rouen cathedral. The church contains old stained glass, an ironwork pulpit and other works of art. The church of Notre Dame (12th and 16th centuries) possesses stone carvings of the Romanesque period and good stained glass. The Tour Grise is a fine cylindrical keep built in 1120 by Henry I., who fortified Verneuil as a stronghold for the Norman frontier. The town rose to considerable importance, and is said to have numbered as many as 25,000 inhabitants.

In 1424 the French were severely defeated by John, duke of Bedford, under the walls of Verneuil, which was then surrendered to the English; this victory confirmed the supremacy of the English over the country north of the Loire. The town was recaptured in 1449. It carries on ironfounding, dyeing and the manufacture of machinery.

VERNEY, the name of an English family which settled first of all at Fleetmarston in Buckinghamshire, then at Penley in Hertfordshire, and finally at Middle Claydon in Buckinghamshire. Its pedigree goes back to Ralph de Verney (fl. 1216–1223), but the fortunes of the family were made by Sir Ralph Verney (d. 1478), who was lord mayor of London in 1465 and M.P. for the city in 1472. His eldest son, Sir John Verney, married Margaret, heiress of Sir Robert Whittingham of Penley, and the fourth Sir Ralph Verney married in 1525 Elizabeth, one of the six co-heiresses of John, Lord Braye. Sir Edmund Verney of Penley (d. 1600) left two sons, half-brothers, Sir Francis Verney (1584–1615), who became a soldier of fortune and a buccaneer, and died at Messina in hospital in extreme poverty, and Sir Edmund Verney (1590–1642) of Middle Claydon, Bucks. Sir Edmund accompanied Prince Charles and Buckingham on the abortive mission to Madrid in 1623, and was knight-marshal to King Charles I. When the Civil War broke out the royal standard was entrusted to him at Nottingham, and while defending it he was slain at Edgehill in 1642. His eldest son, Sir Ralph Verney (1613–1696), 1st baronet, sat for Aylesbury in both the Short and the Long parliaments. He took the side of the parliament at the outset of the Civil War, but went abroad in 1643 rather than sign the Covenant, and his estates were sequestrated in 1646. He returned to England in 1653, and, though he refused to act against Cromwell, was subsequently reconciled to the Restoration government. His brother, Sir Edmund (1616–1649), had taken the king's side, and was one of those murdered in cold blood by Cromwell's soldiers at the sack of Drogheda. Sir Ralph Verney's estates and honours descended to his son, Sir John (*c.* 1640–1717), who was created Viscount Fermanagh in the Irish peerage in 1703 and was father of Ralph Verney, created Earl Verney in 1743. Earl Verney's sister, Margaret Verney, by her marriage with Sir Thomas Cave, linked the Verney family a second time with the barony of Braye, and the present Lord Braye's surname is Verney-Cave. Earl Verney's eldest son, John, predeceased him in 1737, leaving a posthumous daughter, Mary (1737–1810), who was created Baroness Fermanagh in 1792. His second son, Ralph, 2nd Earl Verney (*c.* 1712–1791), was a friend of Edmund Burke, who entered parliament as Verney's nominee for Wendover. Earl Verney was an ardent supporter of the Whig interest, but received no reward from the party leaders. He rebuilt Claydon House with great splendour from the plans of John Adam, but, with his financial ventures, this brought him to bankruptcy. He died childless in March 1791 and his titles became extinct.

The present Verney family, of Claydon Hall, Buckinghamshire, is descended in the male line from Felix Calvert (1596–1674) of Little Hadham, Hertfordshire. The Right Hon. Sir Harry Verney, 2nd baronet (1801–1894), was the son of General Sir Harry Calvert, G.C.B., created a baronet in 1818. He assumed the name of Verney in compliance with the will of Mary Verney, Baroness Fermanagh, mentioned above. This lady died unmarried, leaving the paternal estates and the Verney portraits to her half-sister, Catherine Calvert (Mrs Wright), known thenceforward as Mrs Verney, on whose death in 1827 they came into the possession of her cousin, Sir Harry Calvert (Verney). Sir Harry Verney entered the House of Commons for Buckingham in 1832, and remained a member of the House with two short intervals for fifty-two years. He married in 1835 Eliza, daughter of Admiral Sir George Johnstone Hope, K.C.B., M.P., and secondly Frances Parthenope Nightingale, sister of Florence Nightingale.

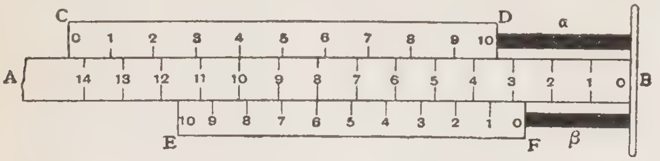
Frances, Lady Verney, collected from the mass of papers preserved at Claydon House the *Memoirs of the Verney Family during the Seventeenth Century*, which contain a charming picture of the life and manners of the country gentlemen of that day. A second edition, abridged and corrected by Margaret M. Verney, appeared in 2 vols. in 1904. See also the *Verney Papers* edited for the Camden Society in 1853–1854.

The Verneys who hold the barony of Willoughby de Broke descend from the Rev. Robert Barnard, prebendary of Winchester, who married in 1793 the Hon. Louisa Verney Peyto, daughter of John Peyto, 14th Baron Willoughby de Broke, and co-heiress of her brother Henry, 16th baron. The Peytos inherited the Verney estates in Warwickshire through Margaret Greville (d. 1631), sister and heiress of Fulke Greville, Lord Brooke (*q.v.*), who married Sir Richard Verney of Compton Murdac, Warwickshire. Robert John Barnard, 18th Baron Willoughby de Broke, who took in 1853 the surname of Verney in lieu of Barnard, was the grandfather of the 19th Lord Willoughby de Broke (Richard Greville Verney), who sat in the House of Commons from 1895 to 1900 for S.E. Warwickshire and succeeded to the title in 1902.

VERNIER, PIERRE (*c.* 1580–1637), inventor of the instrument which bears his name, was born at Ornans (near Besançon) in Burgundy about 1580. He was for a considerable time commandant of the castle in his native town. In 1631 he published at Brussels a treatise entitled *Construction, usage et propriétés du quadrant nouveau de mathématiques*, in which the instrument associated with his name is described. He died at Ornans in 1637.

The instrument invented by Vernier is frequently called a nonius, particularly in Germany, after Pedro Nuñez (1492–1577), professor of mathematics at the university of Coimbra; but this is incorrect, as the contrivance described by the latter in his work *De crepusculis* (1542) is a different one, although the principle is practically the same. Nuñez drew on the plane of a quadrant 44 concentric arcs divided respectively into 89, 88, ... 46 equal parts; and if the alidade did not coincide with one of the divisions on the principal arc, which was divided into 90 parts, the number of degrees in a quadrant, it would fall more or less accurately on a division line of one of the auxiliary arcs, from which the value of the measured angle could be made out. This instrument was, however, very difficult to make, and was but little used. Vernier proposed to attach to a quadrant divided into half-degrees a movable sector of a length equal to 31 half-degrees, but divided into 30 equal parts, whereby single minutes could be read off by seeing which division line of the "sector" coincided with a division line of the quadrant. The idea had been mentioned by Christopher Clavius (1537–1612) in his *Opera mathematica*, 1612 (ii. 5 and iii. 10), but he did not propose to attach permanently an arc divided in this way to the alidade; this happy application of the principle at all events belongs to Vernier.

The principle of the vernier is readily understood from the following account: Let AB (see fig.) be the normal scale, *i.e.* a scale graduated according to a standard of length, CD, a scale (placed in contact with AB for convenience) graduated so that 10 divisions equal 11 divisions of the scale AB, and EF a scale placed similarly and graduated so that 10 divisions equal 9 divisions of the scale AB. Consider the combination AB and CD. Obviously each division of CD is $\frac{1}{10}$th greater than the normal scale division. Let α represent a length to be measured, placed so that one end is at the zero of the normal scale, and the other end in contact with the end of the vernier CD marked 10. It is noted that graduation 4 of the vernier coincides with a division of the standard, and the determination of the excess of α over 3 scale divisions reduces to the difference of 7 divisions of the normal scale and 6 divisions of the vernier. This is ·4, since each vernier division equals 1·1 scale division. Hence the scale reading of the vernier which coincides with a graduation of the normal scale gives the decimal to be added to the normal scale reading. Now consider the scales AB and EF, and let β be the length to be measured; the scale EF being placed so that the zero end is in contact with an end of β. Obviously each division of EF is $\frac{1}{10}$th less than that of the normal scale. It is seen that division 6 of the vernier coincides with a normal scale division, and obviously the excess of β over two normal scale divisions equals the difference between 6 normal scale divisions and 6 vernier divisions, *i.e.* 0·6. Thus again in this case the vernier reading which coincides with a scale reading gives the decimal to be added to the normal scale. The second type of vernier is that more commonly adopted, and its application to special appliances is quite simple. For example, the normal scale to an English barometer is graduated in $\frac{1}{20}$ths of an inch. The vernier is such that 24 divisions of the normal scale equal 25 of the vernier; each of the latter therefore is ·002 or $\frac{1}{500}$th inch less than the normal division. In the scientific barometer, the normal scale is graduated in millimetres, and the vernier so that 20 scale divisions equal 19 mm. This combination reads to 0·05 mm.



VERNIS MARTIN, a generic name, derived from a distinguished family of French artist-artificers of the 18th century, given to a brilliant translucent lacquer extensively used in the decoration of furniture, carriages, sedan chairs and a multitude of small articles such as snuff-boxes and fans. There were four brothers of the Martin family: Guillaume (d. 1749), Simon Étienne, Julien and Robert (1706–1765), the two first-named being the elder. They were the children of Étienne Martin, a tailor, and began life as coach-painters. They neither invented, nor claimed to have invented, the varnish which bears their name, but they enormously improved, and eventually brought to perfection, compositions and methods of applying them which were already more or less familiar. Oriental lacquer speedily acquired high favour in France, and many attempts were made to imitate it. Some of these attempts were passably successful, and we can hardly doubt that many of the examples in the possession of Louis XIV. at his death were of European manufacture. Chinese lacquer was, however, imported in large quantities, and sometimes panels were made in China from designs prepared in Paris, just as English coats of arms were placed upon Chinese porcelain in its place of origin. Biographical details of the career of the brothers Martin are scanty, but we know that the eldest was already in business in 1724. Their method and work must have come rapidly into vogue, for in 1730 Guillaume and Simon Étienne Martin were granted by letters patent a twenty years' monopoly, subsequently renewed, of making "toutes sortes d'ouvrages en relief de la Chine et du Japon." At the height of their fame the brothers directed at least three factories in Paris, and in 1748 they were all classed together as a "Manufacture nationale." One of them was still in existence in 1785. The literature of their day had much to say of the frères Martin. In Voltaire's comedy of *Nadine*, produced in 1749, mention is made of a *berline* "bonne et brillante, tous les panneaux par Martin sont vernis"; also in his *Premier discours sur l'inégalité des conditions* he speaks of "des lambris dorés et vernis par Martin." The marquis de Mirabeau in *L'Ami des hommes* refers to the enamelled snuff-boxes and varnished carriages which came from the Martins' factory. It is the fate of all the great artists of the past to have had their names attached, by popular rumour or interested artifice, to a multitude of works which they never saw, and the Martins have suffered considerably in this respect. That the quality of their production varied between very wide limits is established by existing and undoubted examples; but it is extremely improbable that even their three factories could have turned out the infinite quantity of examples that has been attributed to them. Yet their production was large and exceedingly miscellaneous, for such was the rage for their lacquer that it was applied to every possible object. Nor need we be surprised at a rage which was by no means confined to France. At its best Vernis Martin has a splendour of sheen, a perfection of polish, a beauty of translucence which compel the admiration due to a consummate specimen of handiwork. Every variety of the lacquer of the Far East was imitated and often improved upon by the Martins—the black with raised gold ornaments, the red, and finally in the wonderful green ground, powdered with gold, they reached the high-water mark of their delightful art. This delicate work, *poudré* and wavy-lined with gold or *semé* with flowers overlaid with transparent enamel, is seen at its best on small boxes, fans, needle-cases and such-like. Of the larger specimens from the Martins' factories a vast quantity has disappeared, or been cut up into decorative panels. It would appear that none of the work they placed in the famous hotels of old Paris is now *in situ*, and it is to museums that we must go for really fine examples—to the Musée de Cluny for an exquisite children's sedan chair and the coach used by the French ambassador to Venice under Louis XV.; to the Wallace collection for the tables with richly chased mounts that have been attributed to Dubois; to Fontainebleau for a famous commode. Even the decorations of the apartments of the dauphin at Versailles, executed, or at least begun, in 1749, have vanished; so have those at Bellevue. It has been generally accepted that of the four brothers Robert Martin accomplished the most original and the most completely artistic work. He left a son, Jean Alexandre, who described himself in 1767 as "Vernisseur du Roi de Prusse." He was employed at Sans Souci, but failed to continue the great traditions of his father and his uncles. The Revolution finally extinguished a taste which had lasted for a large part of the 18th century. Since then the production of lacquer has, on the whole, been an industry rather than an art. (J. P.-B.)

VERNON, EDWARD (1684–1757), English admiral, was born in Westminster on the 12th of November 1684. He was the second son of James Vernon, secretary of state from 1697–1700, a scion of an ancient Staffordshire family who is best remembered by three volumes of his letters to the duke of Shrewsbury, which were published in 1841; and his mother was Mary, daughter of Sir John Buck of Lincolnshire. Edward Vernon was sent to Westminster school at the age of seven, and remained there till he was sixteen. Outside its walls he studied, with a view to his future profession, such branches of knowledge as geometry, geography and the construction of military weapons. He entered the navy in 1701, and from that time until 1707 took part in many expeditions in the Mediterranean and the West Indies. He served with Sir George Rooke at the taking of Gibraltar in July 1704; and on his return to England Queen Anne acknowledged his gallantry with the present of two hundred guineas. He next served in the West Indies with Commodore Sir Charles Wager, a brave seaman, who afterwards rose to the highest position at the admiralty in the Whig ministry of Walpole, and was pitted against Vernon both in the House of Commons and at the polling-booth. In 1715, and again in 1726, Vernon assisted in the naval operations in the Baltic, supporting Sir John Norris in the first enterprise, and on the latter serving under his old chief, Sir Charles Wager. During the long supremacy of Walpole little opportunity arose for distinction in warfare, and Vernon's energies found relief in politics. At the general election of 1722 he was returned for both Dunwich in Suffolk and Penryn in Cornwall, but chose the latter constituency. In the succeeding parliament of 1727 he was again chosen member for Penryn; but he failed to retain his seat after the dissolution in 1734. At this period the English people regarded the Spaniards as their legitimate enemies, and the ill-feeling of the two countries was fanned both in poetry and in prose. The political antagonists of Walpole charged him with pusillanimity to Spain. With Pulteney and most of his associates this battle-ground was selected rather from expediency than from principle; but Vernon represented the natural instincts of the sea-captain, and with the sailor as with the soldier the motto was "No peace with Spain." In debate he spoke often, and frequently with effect, but his language always savoured of extravagance. He pledged himself in 1739 to capture Porto Bello with a squadron of but six ships, and the minister whom he had assailed with his invectives sent him, as vice-admiral of the blue and commander of the fleet in the West Indies, to the enterprise with the force which he had himself called sufficient. Vernon weighed anchor from Spithead on the 23rd of July 1739 and arrived off Porto Bello on 20th November. Next day the combat began with a bombardment of an outlying fort which protected the mouth of the harbour, and on the 22nd of November the castle and town surrendered with a loss on the English side of only seven men. The joy of the nation knew no bounds. Vernon's birthday was celebrated in 1740 in London with public illuminations, and 130 medals were struck in his honour. In February 1741 in a by-election at Portsmouth Vernon was again sent to parliament. At the general election in the following May he was returned for Ipswich, Rochester and Penryn, and all but succeeded in winning Westminster.[1] He elected to sit for Ipswich. A larger squadron was placed under Vernon's command at the close of 1740, and with this force he resolved upon attacking Cartagena. After a fierce struggle, the castle, which stood at the harbour's entrance, was gained; but in the attack upon the city the troops and sailors failed to act in concert, and, with the numbers of his forces thinned by combat and by disease, the British admiral retired to Jamaica. The incidents of this disastrous attempt are described in Smollett's *Roderick Random*, chap. xxxi., &c. A similar enterprise in July 1741 against Santiago de Cuba met with a similar reverse, and Vernon attributed the defeat to the divided command of the British forces. During his command he did a good deal for the health of his crews. He first introduced the custom of mixing the rum served to the sailors in the West Indies with water. The word "grog" is said to be derived from the nickname of "old Grog" given him by the sailors, because he wore a peculiar grogram boat-cloak. He landed at Bristol on the 6th of January 1743, and on the 24th of January received the freedom of the city of London. When the country dreaded the march of Prince Charles to London, the fleet in the Downs was placed under the command of Vernon; but his jealous disposition brooked no interference from the admiralty, and on the 1st of January 1746 he struck his flag and handed over the command to another. His next act was to describe his grievances in a couple of angry pamphlets, revealing the communications of his official chiefs, and for this indiscretion he was struck off the list of flag officers (April 11, 1746). He continued to represent the borough of Ipswich until his death, but with this proceeding his public services practically ceased. He died suddenly at Nacton in Suffolk, the 30th of October 1757, and was buried in the church of the village.

Vernon's gallantry was unquestioned; but his valour not infrequently degenerated into foolhardiness, and he dwelt more often than is usual with British seamen on the merits of his own exploits. His politics were those of the Tory party, and his differences with the Whigs and with his colleagues in the services led to his publishing several pamphlets on his political conduct. A *Memorial of Admiral Vernon from Contemporary Authorities* was printed by W. F. Vernon for private circulation in 1861.

VERNON, a town of north-western France, in the department of Eure, 19 m. E.N.E. of Evreux by road. Pop. (1906) 7274. Vernon stands on the left bank of the Seine opposite the forest of Vernon, a stone bridge uniting it to Vernonnet on the right bank, where there are important stone quarries. The forest of Bizy lies to the south of the town. Its church is an interesting building dating from the 12th to the 15th centuries, and there is a cylindrical keep built by Henry I. of England. The port on the Seine carries on trade in stone and coal, and the town has workshops for the manufacture of army engineering material and manufactures benzine, aniline dyes, wooden shoes, liqueurs, &c.

Vernon in 1196 was ceded by its count to Philip Augustus, Richard I. resigning his suzerainty. The first Estates of Normandy were held at Vernon in 1452.

VEROLI (anc. *Verulae*), a town and episcopal see of the province of Rome, Italy, 10 m. by road N.E. of Frosinone, 1870 ft. above sea-level. Pop. (1901) 2622 (town); 12,655 (commune). The town is situated on a hill in a strong position with a fine view, on the site of the ancient Hernican town of Verulae, 7 m. S.E. of Aletrium. It retains remains of its ancient polygonal enceinte, especially near the summit of the hill, later occupied by a medieval castle. It is hardly mentioned in history: we know that it became a municipium in 90 B.C. The cathedral treasury contains the breviary of S. Louis of Toulouse, and some interesting reliquaries, one in ivory with bas-reliefs, and two in the Gothic style, of silver gilt.

VÉRON, LOUIS DÉSIRÉ (1798–1867), French publicist, was born at Paris on the 5th of April 1798. In 1829 he founded the *Revue de Paris*, and from 1838 to 1852 was owner and director of the *Constitutionnel*, in which he published in Eugène Sue's *Wandering Jew*. It was also during Véron's direction and at his suggestion that Sainte-Beuve contributed the *Causeries du lundi*. From 1831–1835 he was director of the Paris Opera. In 1852 he was elected to the Corps Législatif as an official candidate. He was the author of various books, of which the best known is *Mémoires d'un bourgeois de Paris* (1853–1855). He died in Paris on the 27th of September 1867.

VÉRON, PIERRE (1831–1900), French publicist, was born in Paris on the 19th of April 1831, and in 1854 published his first book, a volume of verse. In 1858 he joined the staff of *Charivari*, and edited that paper from 1865–99. He was the author of a large number of novels dealing with Parisian life, and for many years his rooms in the Rue de Rivoli were the meeting-place of the most famous French literary, artistic and political celebrities. He died in Paris on the 2nd of November 1900.

VERONA, a city and episcopal see of Venetia, Italy, the capital of the province of Verona, situated 194 ft. above sea-level in a loop made by the winding of the Adige (anc. *Athesis*). Pop. (1906) 61,618 (town); 79,574 (commune). It is 93 m. E. of Milan and 71 m. W. of Venice by rail, and is also the point of departure of the main lines to Mantua and Modena and to the Brenner, while a branch line runs N.W. to Caprino, another S.E.

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[1] Grego's *Parliamentary Elections* (London, 1886), pp. 95–106.

to Legnago, and steam tramways to Cologna Veneta, Coriano and S. Giacomo.

Churches.

The basilica of S. Zeno (an early bishop of Verona who became its patron saint), which stands outside the ancient city, is one of the most interesting Romanesque churches in Italy. The church was remodelled in 1139, to which period much of the existing structure belongs, including the richly sculptured west front and the open *confessio* or crypt, which occupies the eastern half of the church, raising the choir high above the nave. The nave, dating from the 11th century, is supported by alternate columns and pillars, and contains frescoes of the 11th-14th centuries. The cloisters of S. Zeno, rebuilt in 1123, are an interesting example of brick and marble construction. Like many other churches in Verona, S. Zeno is mainly built of mixed brick and stone in alternate bands: four or five courses of fine red brick lie between bands of hard cream-coloured limestone or marble, forming broad stripes of red and white all over the wall. A similarly variegated effect in red and white is produced by building the arches of windows and doors with alternating voussoirs in brick and marble. The neighbourhood of Verona is especially rich in fine limestones and marbles of many different kinds, especially a close-grained cream-coloured marble and a rich mottled red marble, which are largely used, not only in Verona, but also in Venice and other cities of the province. The same quarry produces both kinds, and indeed the same block is sometimes half red and half white. On the north side of the church is a lofty tower, called the tower of Peppin; while the slender brick campanile on the south dates from 1045 to 1178.

The cathedral, consecrated in 1187 by Pope Urban III., stands at the northern extremity of the ancient city, by the bank of the Adige; it is inferior in size and importance to S. Zeno, but has a fine 12th-century west front of equal interest, richly decorated with naïve Romanesque sculpture (1135). The rest of the exterior is built in bands of red and white, with slightly projecting pilasters along the walls; it has a noble cloister, with two storeys of arcading. The campanile by Sanmichele is unfinished. Its baptistery, rebuilt early in the 12th century, is a quite separate building, with nave and apse, forming a church dedicated to S. Giovanni in Fonte. Pope Lucius III., who held a council at Verona in 1184, is buried in the cathedral, under the pavement before the high altar. The Dominican church of S. Anastasia is a mine of wealth in early examples of painting and sculpture, and one of the finest buildings in Italy of semi-Gothic style. It consists of a nave in six bays, aisles, transepts, each with two eastern chapels, and an apse, all vaulted with simple quadripartite brick groining. It was begun in 1261, but not completed till 1422, and is specially remarkable for its very beautiful and complete scheme of coloured decoration, much of which is contemporary with the building. The vaults are gracefully painted with floreated bands along the ribs and central patterns in each "cell," in rich soft colours on a white plastered ground. The eastern portion of the vaulting, including the choir and one bay of the nave, has the older and simpler decorations; the rest of the nave has more elaborate painted ornament—foliage mixed with figures of Dominican saints, executed in the 15th century. There are many fine frescoes in the interior ranging from *c.* 1300 (knights kneeling before the Virgin) to the 15th century, including Pisanello's beautiful painting of St George (mentioned below). This church also contains a large number of fine sculptured tombs of the 14th and 15th centuries, with noble effigies and reliefs of saints and sacred subjects. It is mainly built of red brick, with fine nave columns of red and white marble and an elaborate marble pavement inlaid in many different patterns. Its general proportions are specially noble, and the exterior view is good. The church of S. Fermo Maggiore comes next in interest. With the exception of the crypt, which is older, the existing edifice was rebuilt in 1313. The façade is of brick and marble used alternately. The plan is unusual, consisting of a large nave without aisles, the span being between 45 and 50 ft.; it also has two shallow transepts and an apsidal east end. The roof, which is especially magnificent, is the finest example of a class which as a rule is only found in Venetia or in churches built by Venetian architects in Istria and other subject provinces: the framing is concealed by coving or barrel-vaulting in wood, the surface of which is divided into small square panels, all painted and gilt, giving a very rich effect. In this case the 14th and 15th century painted decorations are well preserved. Delicate patterns cover all the framework of the panelling and fill the panels themselves; at two stages, where there is a check in the line of the coving, rows of half-figures of saints are minutely painted on blue or gold grounds, forming a scheme of indescribably splendid decoration. A simpler roof of the same class exists at S. Zeno; it is trefoil-shaped in section, with a tie-beam joining the cusps. The church of S. Maria in Organo, dating from 1481, with a façade of 1592 from Sanmichele's designs, contains paintings by various Veronese masters, and some fine choir-stalls of 1499 by Fra Gioconda. Though not built till after his death, the church of S. Giorgio in Braida, on the other side of the river, was also designed by Sanmichele, and possesses many good pictures of the Veronese school. The Romanesque church of S. Lorenzo, restored in 1896–1898, contains old frescoes. S. Stefano is another Romanesque church, probably of the 11th century. There are several other fine churches in Verona, some of early date. One of the 14th century is dedicated to Thomas à Becket of Canterbury.

Bridges and fortifications.

The strongly fortified castle (Castel Vecchio) built by the Della Scala lords in the 14th century stands on the line of the wall of Theodoric, close by the river. A very picturesque battlemented bridge leads from it to the other shore, sloping down over three arches of different sizes, the largest next to the castle and the smallest at the other end. There are four other bridges across the Adige: one, the graceful Ponte di Pietra, rests upon ancient foundations, while the two arches nearest to the left bank are Roman; but it has been frequently restored. Remains of another ancient bridge were found in the river itself in 1891 behind S. Anastasia. The 16th-century lines of fortification enclose a very much larger area than the Roman city, forming a great loop to the west, and also including a considerable space on the left bank of the river. In the latter part of the city, on a steep elevation, stands the castle of St Peter, originally founded by Theodoric, on the site, perhaps, of the earliest citadel, mostly rebuilt by Gian Galeazzo Visconti in 1393, and dismantled by the French in 1801. This and the other fortifications of Verona were rebuilt or repaired by the Austrians, but are no longer kept up as military defences. Verona, which is the chief military centre of the Italian province of Venetia, is now being surrounded with a circle of forts far outside the obsolete city walls.

Palaces.

The early palaces of Verona, before its conquest by Venice, were of noble and simple design, mostly built of fine red brick, with an inner court, surrounded on the ground floor by open arches like a cloister, as, for example, the Palazzo della Ragione, an assize court, begun in the 12th century. The arches, round or more often pointed in form, were decorated with moulded terra-cotta enrichments, and often with alternating voussoirs of marble. The Scaligeri Palace is a fine example, dating from the 14th century, with, in the cortile, an external staircase leading to an upper loggia, above the usual arcade on the ground floor. It has a lofty campanile, surmounted by a graceful octagonal upper storey. This palace is said to have been mainly built by Can Signorio (Della Scala) about 1370. After the conquest by Venice the domestic buildings of Verona assumed quite a different type. They became feeble copies of Venetian palaces, in which one form of window, with an ogee arch, framed by the dentil moulding, is almost always used. The monotony and lifelessness of this form of architecture are shown in the meaningless way in which details, suited only to the Venetian methods of veneering walls with thin marble slabs, are copied in the solid marbles of Verona. From the skill of Fra Giocondo, Verona was for many years one of the chief centres in which the most refined and graceful forms of the early Renaissance were developed. The town hall, with its light open loggia of semicircular arches on the ground floor, was designed by Fra Giocondo towards the end of the 15th century; its sculptured enrichments of pilasters and friezes are very graceful, though lacking the vigorous life of the earlier medieval sculptured ornamentation. Verona contains a number of handsome palaces designed by Sanmichele in the 16th century. The finest are those of the Bevilacqua,[1] Canossa and Pompeii families. The last of these is now the property of the city, and contains a gallery with some good pictures, especially of the Verona, Padua and Venice schools. As in Venice, many of the 16th-century palaces in Verona had stuccoed façades, richly decorated with large fresco paintings, often by very able painters. Verona, perhaps, had as many of these paintings as any town in Italy, but comparatively few are preserved and those only to a small extent. The domestic architecture of Verona cannot thus be now fairly estimated, and seems monotonous, heavy and uninteresting. The house of the painter Niccolo Giolfino still has its frescoes in a good state of preservation, and gives a vivid notion of what must once have been the effect of these gorgeous pictured palaces. The episcopal palace contains the ancient and valuable chapter library, of about 12,000 volumes and over 500 MSS., among them the palimpsest of the *Institutiones* of Gaius which Niebuhr discovered. The Piazza delle Erbe (fruit and vegetable market) and the Piazza dei Signori, adjoining one another in the oldest part of the city, are very picturesque and beautiful, being surrounded by many fine medieval buildings, several of them of a public character (Palazzo dei Giureconsulti, Palazzo della Ragione and the lofty Torre Civica, 273 ft. high), while in the north-east corner of the latter Piazza is the fine early Renaissance Palazzo del Consiglio (1476–1492), probably designed by Fra Giocondo. In the former Piazza a copy of the lion of Venice has been erected.

Squares.

Roman remains.

The Roman remains of Verona surpass those of any other city of northern Italy. The most conspicuous of them is the great amphitheatre, a building perhaps of the end of the 1st century A.D., which in general form closely resembled the Colosseum in Rome. Its axes measured 505 and 404 ft. Almost the whole of its external arcades, with three tiers of arches, have now disappeared; it was partly thrown down by an earthquake in 1184, and subsequently used to supply building materials. Many of its blocks are still visible in the walls of various medieval buildings. The interior, with seats for about 25,000 people, has been frequently restored, till nothing of the old seats exists. There are also remains of a well-preserved Roman theatre, close to the left bank of the river. A number of fine sculptures were found in the square in front of the cathedral in 1890, and architectural fragments belonging to some public building. In 1884–86 portions of a number of fine mosaic pavements were discovered extending over a very large area under the cloister and other parts of the cathedral, about 7 ft. below the present ground level. They had geometric patterns with birds, trees, &c., and bore inscriptions in mosaic with the names of the donors. Parts of them had been discovered previously. They seem to belong to two different buildings, both early churches of the 5th and 6th centuries A.D. (cf. *Notizie degli Scavi*, 1884, 401). For the two triumphal arches (Porta dei Bosari and Porta dei Leoni) see below. The Museo Lapidario contains a fine collection of Roman and Etruscan inscriptions and sculpture, mostly collected and published by Scipione Maffei in the 18th century.

Veronese Art.—In many respects the resemblance between Verona and Florence is very striking; in both cases we have a strongly fortified city built in a fertile valley, on the banks of a winding river, with suburbs on higher ground, rising close above the main city. In architectural magnificence and in wealth of sculpture and painting Verona almost rivalled the Tuscan city, and, like it, gave birth to a very large number of artists who distinguished themselves in all branches of the fine arts.

Painting.

Painting in Verona may be divided into four periods. (i.) The first period is characterized by wall paintings of purely native style, closely resembling the early Christian pictures in the catacombs of Rome. Examples dating from the 10th to the 11th century have been discovered hidden by whitewash on the oldest parts of the nave walls of the church of S. Zeno. They are a very interesting survival of the almost classical Roman style of painting, and appear to be quite free from the generally prevalent Byzantine influence. (ii.) The Byzantine period seems to have lasted during the 12th and 13th centuries. (iii.) The Giottesque period begins contemporaneously with Altichiero da Zevio and Giacomo degli Avanzi, whose chief works were executed during the second half of the 14th century. These two painters were among the ablest of Giotto's followers, and adorned Verona and Padua with a number of very beautiful frescoes, rich in composition, delicate in colour, and remarkable for their highly finished modelling and detail. (iv.) To the fourth period belong several important painters. Pisanello or Vittore Pisano, a charming painter and the greatest medallist of Italy, was probably a pupil of Altichiero.[2] Most of his frescoes in Verona have perished; but one of great beauty still exists in a very perfect state in the church of S. Anastasia, high up over the arched opening into one of the eastern chapels of the south transept. The scene represents St George and the Princess after the conquest of the Dragon, with accessory figures, the sea, a mountainous landscape and an elaborately painted city in the background. The only other existing fresco by Pisanello is an Annunciation in S. Fermo Maggiore. For Pisanello's pupils and other painters of subsequent date, see PAINTING. These include Liberale da Verona, Domenico and Francesco Morone, Girolamo dai Libri (1474–1556), &c. Domenico del Riccio, usually nicknamed Brusasorci (1494–1567), was a prolific painter whose works are very numerous in Verona. Paolo Cagliari or Paul Veronese, and the Bonifagios, though natives of Verona, belong rather to the Venetian school.

Sculpture.

Verona is specially rich in early examples of decorative sculpture. (i.) The first period is that of northern or Lombardic influence, exemplified in the very interesting series of reliefs which cover the western façades of the church of S. Zeno and the cathedral, dating from the 12th century. These reliefs represent both sacred subjects and scenes of war and hunting, mixed with grotesque monsters, such as specially delighted the rude, vigorous nature of the Lombards; they are all richly decorative in effect, though strange and unskilful in detail. Part of the western bronze doors of S. Zeno are especially interesting as being among the earliest important examples in Italy of cast bronze reliefs. They are frequently stated to be of beaten bronze, but they are really castings, apparently by the *cire perdue* process. They represent scenes from the life of S. Zeno, are rudely modelled, and yet very dramatic and sculpturesque in style. Parts of these doors are covered with bronze reliefs of scenes from the Bible, which are of still earlier date, and were probably brought to Verona from the Rhine provinces. Many of the 12th century reliefs and sculptured capitals in S. Zeno are signed by the sculptor but these merely constitute lists of names about whom nothing is known. (ii.) In the 13th century the sculpture seems to have lost the Lombard vigour, without acquiring any qualities of superior grace or refinement. The font in the baptistery near the cathedral is an early example of this. Each side of the octagon is covered with a large relief of a Biblical subject, very dull in style and coarse in execution. The font itself is interesting for its early form, one common in the chief baptisteries of northern Italy: like an island in the centre of the great octagonal tank is a lobed marble receptacle, in which the officiating priest stood while he immersed the catechumens. A movable wooden bridge must have been used to enable the priest to cross the water in the surrounding tank. (iii.) The next period is that of Florentine influence. This is exemplified in the magnificently sculptured tombs of the Della Scala lords, designed with steadily growing splendour, from the simple sarcophagus of Martino I. down to the elaborate erection over the tomb of the fratricide Can Signorio, adorned with statuettes of the virtues, to the possession of which he could lay so little claim.[3] The recumbent effigies and decorative details of these tombs are very beautiful, but the smaller figures of angels, saints and virtues are rather clumsy in proportion. The latest tomb, that of Can Signorio, erected during his lifetime (*c.* 1370), is signed "Boninus de Campigliono Mediolanensis Dioecesis." This sculptor, though of Milanese origin, belongs really to the school of the Florentine Andrea Pisano. One characteristic of the 14th and 15th centuries in Verona was the custom, also followed in other Lombardic cities, of setting large equestrian statues over the tombs of powerful military leaders, in some cases above the recumbent effigy of the dead man, as if to represent him in full vigour of life as well as in death. That which crowns the canopy over the tomb of Can Grande is a very noble, though somewhat quaint, work. (iv.) In the 15th century the influence of Venice became paramount, though this was really only a further development of the Florentine manner, Venice itself having been directly influenced in the 14th century by many able sculptors from Florence.

Architecture.

The architecture of Verona, like its sculpture, passed through Lombard, Florentine and Venetian stages. (i.) The church of S. Zeno and the cathedral, both of which were mainly rebuilt in the 12th century, are noble examples of the Lombardic style, with few single-light windows, and with the walls decorated externally by series of pilasters, and by alternating bands of red and white, in stone or brick. The arches of this period are semicircular and rest on round columns and capitals, richly carved with grotesque figures and foliage. Most of the external ornamentation is usually concentrated on the western front, which often has a lofty arched porch on marble columns, resting on griffins or lions devouring their prey. (ii.) The Florentine period (*c.* 1250 to 1400) is represented by the church of S. Anastasia, and by many more or less mutilated palaces, with fine courts surrounded by arcades in one or more storeys. The arches are mostly pointed, and in other respects the influence of northern Gothic was more direct in Verona than in Florence. Solidity of mass and simplicity of detail are among the characteristics of this period. (iii.) The Venetian period (*c.* 1400–1480) was one of little originality or vigour, the buildings of this date being largely rather dull copies of those at Venice. (iv.) The early Renaissance developed into very exceptional beauty in Verona, mainly through the genius of Fra Giocondo (1435–1514), a native of Verona, who was at first a friar in the monastery of S. Maria in Organo. He rose to great celebrity as an architect, and designed many graceful and richly sculptured buildings in Venice, Rome and even in France; he used classical forms with great taste and skill, and with much of the freedom of the older medieval architects, and was specially remarkable for his rich and delicate sculptured decorations. Another of the leading architects of the next stage of the Renaissance was the Veronese Michele Sanmichele (1484–1559), a great military engineer, and designer of an immense number of magnificent palaces in Verona and other cities of Venetia. His buildings are stately and graceful in proportion, but show a tendency towards dull scholastic classicism. The façades of his palaces were in the lower storey only decorated by rustication, of which he made great use, while the upper part was intended to be decorated with frescoes, which (as we have said) have in most cases perished. To him are also due the various gates and the most important bastions in the walls of Verona. In consequence of the disastrous flood of 1882, important embankment works were executed along the Adige at a cost of £300,000. These works preclude all danger of future inundation. In addition to the Adige embankment, other hydraulic works have been either completed or undertaken. An irrigation canal, deriving water from the Sega, furnishes 11½ cubic metres per second to the fields of the upper Veronese district. The Camuzzoni industrial canal, which runs from the Chievo di S. Massimo to the suburb of Tombetta, furnishes 26 cubic metres of water per second, and generates 4000 horse-power. The cutting of this canal led to the construction of an aqueduct for drinking water, which, besides supplying the city, furnishes an ice factory with enough water to make 200 quintals of ice per day. The motive-power generated by the Camuzzoni canal is utilized by a large nail factory, flour mills, paper mills, cotton mills and works for the distribution of electric energy.

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[1] The valuable collection of works of art once preserved in the Bevilacqua Palace has long been dispersed.

[2] There is every reason to doubt Vasari's statement that Pisanello was a pupil of Andrea del Castagno.

[3] See an eloquent description by Ruskin, *Stones of Venice*, iii. pp. 70 seq.

The Adige embankment gave an impetus to building enterprise, the banks of the river being now flanked by villas and large dwelling-houses.

History.—The ancient Verona was a town of the Cenomani, a Gaulish tribe, whose chief town was Brixia. It became a Latin colony in 89 B.C. and, acquiring citizenship with the rest of Gallis Transpadana in 49 B.C., became a *municipium.* Tacitus wrongly speaks of it as a colony; but it appears to have received a new colony under Gallienus. In the time of Augustus it was inferior to Patavium in importance, but on a par with Mediolanum, and superior to Brixia and other towns of the district. Inscriptions testify to its importance—among others one which indicates that it was the headquarters of the collectors of the 5% inheritance tax under the Empire in Italy beyond the Po. Its territory stretched as far as Hostilia on the Padus (Po), 30 m. to the south, and was extensive on other sides also, though its exact limits are uncertain. It was an important point in the road system of the district, lying on that between Mediolanum and Aquileia, while here diverged to the north the roads up the Athesis valley and over the Brenner into Raetia, and to the south roads ran to Betriacum, Mantua and Hostilia. It was the birthplace of the poet Catullus. In A.D. 69 it became the headquarters of the legions which were siding with Vespasian. Its fertile surroundings, its central position at the junction of several great roads, and the natural strength of its position, defended by a river along two-thirds of its circumference, all combined to make Verona one of the richest and most important cities in northern Italy, although its extent within the walls was not large. The existing remains of walls and gates date from the period between the 3rd of April and the 4th of December of the year 265. A very handsome triumphal arch, now called the Porta de' Borsari, was restored in this year by Gallienus (as the inscription upon it, which has taken the place of an older one, cancelled to make room for it, records), and became one of the city gates. It is a double arch, and above it are two orders of smaller arcades. The same was the case with the Porta dei Leoni, another rather similar triumphal arch on the east of the city, and with a third arch, the Arco dei Gavi, demolished in 1805. This last seems to have belonged to the 1st century A.D.; remains of it are preserved in the amphitheatre. It took its name from the family in whose honour it was erected; the architect was one L. Vitruvius Cerdo, possibly a pupil and freedman of the famous writer on architecture. The Porta dei Leoni, on the other hand, bears the name of Tiberius Flavius Noricus, a *quattuorvir iure dicundo*, *i.e.* one of the four chief magistrates of the city (probably 2nd century A.D.). The original line of walls did not include the amphitheatre, but passed N.E. of it; it was, however, afterwards included in the *enceinte* as a kind of massive corner tower.[1] The emperor Constantine, while advancing towards Rome from Gaul, besieged and took Verona (312); it was here, too, that Odoacer was defeated (499) by Theodoric the Goth, Dietrich von Bern—*i.e.* Verona—of German legends, who built a castle at Verona and frequently resided there. He enlarged the fortified area by constructing a wall and ditch (now called Adigetto) straight across the loop, to the S.W. of the amphitheatre, and also built thermae and restored the acqueducts, which had long been out of use.

In the middle ages Verona gradually grew in size and importance. Alboin, the Lombard king, captured it in 568, and it was one of the chief residences of the Lombard, and later of the Frankish, monarchs; and though, like other cities of northern Italy, it suffered much during the Guelph and Ghibelline struggles, it rose to a foremost position both from the political and the artistic point of view under its various rulers of the Scaliger or Della Scala family. The first prominent member of this family and founder of his dynasty was Mastino I. della Scala, who ruled over the city from 1260 till his death in 1277. Verona had previously fallen under the power of a less able despot, Ezzelino da Romano, who died in 1259. Alberto della Scala (died in 1301) was succeeded by his eldest son Bartolomeo, who was confirmed as ruler of Verona by the popular vote, and died in 1304. It was in his time that Romeo and Juliet are said to have lived. Alboino, the second son, succeeded his brother, and died in 1311, when the youngest son of Alberto, Can Grande, who since 1308 had been joint-lord of Verona with his brother, succeeded to the undivided power. Can Grande (Francesco della Scala, d. 1329) was the best and most illustrious of his line, and is specially famous as the hospitable patron of Dante (*q.v.*). Other princes of this dynasty, which lasted for rather more than a century, were Giovanni (d. 1350), Mastino II. (d. 1351), Can Grande II. (d. 1359) and Can Signorio (d. 1375). In 1389 Gian Galeazzo Visconti, duke of Milan, became by conquest lord of Verona. Soon after his death the city fell by treacherous means into the hands of Francesco II. di Carrara, lord of Padua. In 1404–1405 Verona, together with Padua, was finally conquered by Venice, and remained subject to the Venetians till the overthrow of the republic by Napoleon in 1797, who in the same year, after the treaty of Campo Formio, ceded it to the Austrians with the rest of Venetia. They fortified it strongly in 1814, and with Peschiera, Mantua and Legnago it formed part of the famous quadrilateral which until 1866 was the chief support of their rule in Italy.

See the various works by Scipione Maffei (*Verona Illustrata*, 1728; *Museum Veronense*, 1749); and Th. Mommsen in *Corp. Inscr. Latin* (Berlin, 1883), v. p. 327 (with bibliography); A. Wiel, *The Story of Verona* (London, 1902); *Notizie degli scavi*, passim; E. Giani, *L' Antico teatro di Verona* (Verona, 1908).

(J. H. M.; T. As.)

VERONA, CONGRESS OF, the last of the series of international conferences or congresses based on the principle enunciated in Art. 6 of the treaty of Paris of November 20th, 1815 (see EUROPE, *History*). It met at Verona on the 20th of October 1822. The emperor Alexander I. of Russia was present in person. There were also present Count Nesselrode, the Russian minister of foreign affairs; Prince Metternich, representing Austria; Prince Hardenberg and Count Bernstorff, representing Prussia; MM. de Montmorency and Chateaubriand, representing France; and the duke of Wellington, representing Great Britain in place of Lord Londonderry (Castlereagh), whose tragic death occurred on the eve of his setting out to the congress.

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[1] The view of some scholars is that the original walls were earlier than the time of Gallienus, who reconstructed them on the old lines, taking in, however, the amphitheatre.

In the instructions drawn up by Londonderry for his own guidance, which had been handed to Wellington by Canning without alteration, was clearly defined the attitude of Great Britain towards the three questions which it was supposed would be discussed, viz. the Turkish Question (Greek insurrection), the question of intervention in favour of the royal power in Spain, together with that of the revolted Spanish colonies, and the Italian Question. As regards the latter it was laid down that Great Britain could not charge herself with any superintendence of a system in which she had merely acquiesced, and the duty of the British minister would be merely to keep himself informed, and to see that nothing was done "inconsistent with the European system and the treaties." To make this attitude quite clear, Wellington was further instructed not to hand in his credentials until this question had been disposed of, his place being meanwhile taken by Lord Londonderry (Stewart), Castlereagh's half-brother and successor in the title, who had fulfilled the same function at Troppau and Laibach. In the Spanish Question Wellington was to give voice to the uncompromising opposition of Great Britain to the whole principle of intervention. In the Turkish Question, the probable raising of which had alone induced the British government to send a plenipotentiary to the congress, he was to suggest the eventual necessity for recognizing the belligerent rights of the Greeks, and, in the event of concerted intervention, to be careful not to commit Great Britain beyond the limits of good offices.

The immediate problems arising out of the Turkish Question had, however, been settled between the emperor Alexander and Metternich, to their mutual satisfaction, at the preliminary conferences held at Vienna in September, and at Verona the only question raised was that of the proposed French intervention in Spain. The discussion was opened by three questions formally propounded by Montmorency: (1) Would the Allies withdraw their ministers from Madrid in the event of France being compelled to do so? (2) In case of war, under what form and by what acts would the powers give France their moral support, so as to give to her action the force of the Alliance, and inspire a salutary fear in the revolutionaries of all countries? (3) What material aid would the powers give, if asked by France to intervene, under restrictions which she would declare and they would recognize?

The reply of Alexander, who expressed his surprise at the desire of France to keep the question "wholly French," was to offer to march 150,000 Russians through Germany to Piedmont, where they could be held ready to act against the Jacobins whether in Spain or France. This solution appealed to Metternich and Montmorency as little as to Wellington; but though united in opposing it, four days of "confidential communications" revealed a fundamental difference of opinion between the representative of Great Britain and those of the continental powers on the main point at issue. Wellington, firmly based on the principle of non-intervention, refused to have anything to do with the suggestion, made by Metternich, that the powers should address a common note to the Spanish government in support of the action of France. Finally, Metternich proposed that the Allies should "hold a common language, but in separate notes, though uniform in their principles and objects." This solution was adopted by the continental powers; and Wellington, in accordance with his instructions not to countenance any intervention in Spanish affairs, took no part in the conferences that followed. On the 30th of October the powers handed in their formal replies to the French memorandum. Russia, Austria and Prussia would act as France should in respect of their ministers in Spain, and would give to France every countenance and assistance she might require, the details "being reserved to be specified in a treaty." Wellington, on the other hand, replied on behalf of Great Britain that "having no knowledge of the cause of dispute, and not being able to form a judgment upon a hypothetical case, he could give no answer to any of the questions."

Thus was proclaimed the open breach of Great Britain with the principles and policy of the Great Alliance, which is what gives to the congress its main historical interest.

See *Cambridge Modern Hist.*, chap. i. "The Congresses," by W. Alison Phillips, and for authorities, ibid. p. 787. (W. A. P.)

VERONAL, in medicine, diethylmalonyl urea or diethylbarbituric acid $(C_2H_5)_2C[CO\ NH]_2CO$, extensively used as a hypnotic. It is prepared by condensing diethylmalonic ester with urea in the presence of sodium ethylate, or by acting with ethyl iodide on the silver salt of malonyl urea; it forms a white crystalline powder, which is odourless, and has a slightly bitter taste. Its introduction followed the investigations of Emil Fischer and J. v. Merling on the pharmacological properties of certain open and closed ureides. Led thereto by the impression that hypnotic action appears to be largely dependent on the presence of ethyl groups, they prepared diethylacetyl urea, diethylmalonyl urea, and dipropylmalonyl urea. All three were found to be hypnotics: the first was about equal in power to sulphonal, whilst the third was four times as powerful, but its use was attended by prolonged after-effects. Veronal was found to be midway. It is best given in cachets (10 to 15 grains). As it does not affect the circulatory or respiratory systems, or temperature, it can be employed in many diseased conditions of the heart and lungs as well as in mental disturbances, acute alcoholism, morphinomania and kidney disease. If taken during a prolonged period it seems to lose its effect. A soluble salt of veronal has been introduced under the name of medinal. Although the toxicity of veronal is low, 135 grains having been taken in a single dose without serious results, the unreasonable consumption by persons suffering from insomnia has led to many deaths, and it has been suggested that the sale should be restricted by the Pharmacy Acts.

VERONICA, ST. According to the most recent version of the legend, Veronica was a pious woman of Jerusalem, who, moved with pity by the spectacle of Jesus carrying His cross to Golgotha, gave Him her kerchief in order that He might wipe the drops of agony from His brow. The Lord accepted the offering, and after using the napkin handed it back to her with the image of His face miraculously impressed upon it. This, however, is not the primitive form of the legend, which a close examination shows to be derived from the following story related by Eusebius in his *Historia Ecclesiastica* (vii. 18). At Caesarea Philippi dwelt the woman whom the Lord healed of an issue of blood (Matt. ix. 20), and at the door of her house stood, on one side a statue of a woman in an attitude of supplication, and on the other side that of a man stretching forth his hand to the woman. It was said that the male figure represented Christ, and that the group had been set up in recognition of the miraculous cure. Legend was not long in providing the woman of the Gospel with a name. In the West she was identified with Martha of Bethany; in the East she was called Berenike, or Beronike, the name appearing in as early a work as the *Acta Pilati*, the most ancient form of which goes back to the 4th century. Towards the 6th century the legend of the woman with the issue of blood became merged in the legend of Pilate, as is shown in the writings known in the middle ages as *Cura sanitatis Tiberii* and *Vindicta Salvatoris*. According to the former of these accounts Veronica, in memory of her cure, caused a portrait of the Saviour to be painted. The emperor Tiberius, when afflicted with a grievous sickness, commanded the woman to bring the portrait to him, worshipped Christ before her eyes, and was cured. The legend continued to gather accretions, and a miraculous origin came to be assigned to the image. It appears that in the 12th century the image began to be identified with one preserved at Rome, and in the popular speech the image, too, was called Veronica. It is interesting to note that the fanciful derivation of the same Veronica from the words *Vera icon* (εἰκὼν) "true image"—is not, as has been thought, of modern origin, since it occurs in the *Otia Imperialia* (iii. 25) of Gervase of Tilbury (fl. 1211), who says: "Est ergo Veronica pictura Domini vera." In several churches the office of St Veronica, matron, is observed on various dates.

See *Acta Sanctorum*, February, i. 449–57; L. F. C. Tischendorf, *Evangelia apocrypha* (2nd ed., Leipzig, 1877), p. 239; E. von Dobschütz, *Christusbilder* (Leipzig, 1899); H. Thurston, *The Stations of the Cross* (London, 1906). (H. De.)

VERRES, GAIUS (*c.* 120–43 B.C.), Roman magistrate, notorious for his misgovernment of Sicily. It is not known to what *gens* he belonged. He at first supported Marius and the popular party, but soon went over to the other side. Sulla made him a present of land at Beneventum, and secured him against punishment for embezzlement. In 80, Verres was quaestor in Asia on the staff of Cn. Cornelius Dolabella, governor of Cilicia. The governor and his subordinate plundered in concert, till in 78 Dolabella had to stand his trial at Rome, and was convicted, mainly on the evidence of Verres, who thus secured a pardon for himself. In 74, by a lavish use of bribes, Verres secured the city praetorship, and, as a creature of Sulla, abused his authority to further the political ends of his party. He was then sent as governor to Sicily, the richest of the Roman provinces. The people were for the most part prosperous and contented, but under Verres the island experienced more misery and desolation than during the time of the first Punic or the recent servile wars. The corn-growers and the revenue collectors were ruined by exorbitant imposts or by the iniquitous cancelling of contracts; temples and private houses were robbed of their works of art; and the rights of Roman citizens were disregarded. Verres returned to Rome in 70, and in the same year, at the request of the Sicilians, Cicero prosecuted him. Verres entrusted his defence to the most eminent of Roman advocates, Q. Hortensius, and he had the sympathy and support of several of the leading Roman nobles. The court was composed exclusively of senators, some of whom might have been his personal friends. But the presiding judge, the city praetor, M'. Acilius Glabrio, was a thoroughly honest man, and his assessors were at least not accessible to bribery. Verres vainly tried to get the trial postponed till 69 when his friend Metellus would be the presiding judge, but in August Cicero opened the case. The effect of the first brief speech was so overwhelming that Hortensius refused to reply, and recommended his client to leave the country. Before the expiration of the nine days allowed for the prosecution Verres was on his way to Massilia. There he lived in exile till 43, when he was proscribed by Antony, the reason alleged being his refusal to surrender some of his art treasures which Antony coveted. Verres may not have been quite so black as he is painted by Cicero, on whose speeches we depend entirely for our knowledge of him, but there can hardly be a doubt that he stood pre-eminent among the worst specimens of Roman provincial governors. Of the seven Verrine orations only two were actually delivered; the remaining five were compiled from the depositions of witnesses, and published after the flight of Verres.

VERRIUS FLACCUS, MARCUS (*c.* 10 B.C.), Roman grammarian and teacher, flourished under Augustus and Tiberius. He was a freedman, and his manumitter has been identified with Verrius Flaccus, an authority on pontifical law; but for chronological reasons the name of Veranius Flaccus, a writer on augury, has been suggested (Teuffel-Schwabe, *Hist. of Roman Lit.* 199, 4). He gained such a reputation by his methods of instruction that he was summoned to court to bring up Gaius and Lucius, the grandsons of Augustus. He removed there with his whole school, and his salary was greatly increased on the condition that he took no fresh pupils. He died at an advanced age during the reign of Tiberius (Suetonius, *De Grammaticis*, 17), and a statue in his honour was erected at Praeneste, in a marble recess, with inscriptions from his *Fasti*. Flaccus was also a distinguished philologist and antiquarian investigator. For his most important work (*De Verborum Significatu*) see Festus, Sextus. Of the calendar of Roman festivals (*Fasti Praenestini*) engraved on marble and set up in the forum at Praeneste, some fragments were discovered (1771) at some distance from the town itself in a Christian building of later date, and some consular *fasti* in the forum itself (1778). The collection was subsequently increased by two new fragments.

Other lost works of Flaccus were: *De Orthographia: De Obscuris Catonis*, an elucidation of obscurities in the writings of the elder Cato; *Saturnus*, dealing with questions of Roman ritual; *Rerum memoria dignarum libri*, an encyclopaedic work much used by Pliny the elder; *Res Etruscae*, probably on augury.

For the fragments of the *Fasti* see *Corpus Inscriptionum Latinarum*, i. pp. 311, 474; G. Gatti, "Due nuovi Frammenti del Calendario di Verrio Flacco," in *Atti della r. Accademia dei Lincei*, 5th ser., vol. 5, pt. 2, p. 421 (1898); Winther, *De fastis Verrii Flacci ab Ovidio adhibitis* (1885); J. E. Sandys, *Classical Scholarship* (ed. 1906), vol. i., index, *s.v.* "Verrius"; fragments of Flaccus in C. O. Müller's edition of Festus; see also H. Nettleship, *Lectures and Essays*.

VERROCCHIO, ANDREA DEL (1435–1488), Italian goldsmith, sculptor and painter, was born at Florence. He was the son of Michele di Francesco de' Cioni, and took his name from his master, the goldsmith Giuliano Verrocchi. Except through his works, little is known of his life. As a painter he occupies an important position from the fact that Leonardo da Vinci and Lorenzo di Credi worked for many years in his *bottêga* as pupils and assistants. Only one existing painting can be attributed with absolute certainty to Verrocchio's hand, the celebrated "Baptism of Christ," originally painted for the monks of Vallombrosa, and now in the academy of Florence. The figures of Christ and the Baptist are executed with great vigour and refinement of touch, but are rather hard and angular in style. The two angels are of a much more graceful cast; the face of one is of especial beauty, and Vasari is probably right in saying that this head was painted by the young Leonardo. Other pictures from Verrocchio's *bottêga* probably exist, as, for example, two in the National Gallery of London formerly attributed to Ant. Pollaiuolo—"Tobias and the Angel" (No 781) and the very lovely "Madonna and Angels" (No. 296), both very brilliant and jewel-like in colour. This exquisite painting may possibly have been painted from Verrocchio's design by Lorenzo di Credi while he was under the immediate influence of his wonderful fellow-pupil, Da Vinci.[1]

In examining Verrocchio's work as a sculptor we are on surer ground. One of his earliest works was the beautiful marble medallion of the Madonna, over the tomb of Leonardo Bruni of Arezzo in the church of Santa Croce at Florence. In 1472 Verrocchio completed the fine tomb of Giovanni and Piero de' Medici, between the sacristy and the lady chapel of San Lorenzo at Florence. This consists of a great porphyry sarcophagus enriched with magnificent acanthus foliage in bronze. Above it is a graceful open bronze grill, made like a network of cordage. In 1474 Verrocchio began the monument to Cardinal Forteguerra at the west end of Pistoia cathedral. The kneeling figure of the cardinal was never completed, and now lies in a room of La Sapienza, but the whole design is shown in what is probably Verrocchio's original clay sketch, now in the South Kensington Museum. Though this work was designed by Verrocchio, the actual execution of it was entrusted to his assistant, the Florentine Lorenzetto. In 1476 Verrocchio modelled and cast the fine but too realistic bronze statue of David, now in the Bargello (Florence); and in the following year he completed one of the reliefs of the magnificent silver altar-frontal of the Florentine baptistery, that representing the "Beheading of St John." Verrocchio's other works in the precious metals are now lost, but Vasari records that he made many elaborate pieces of plate and jewelry, such as morses for copes, as well as a series of silver statues of the Apostles for the pope's chapel in the Vatican. Between 1478 and 1483 he was occupied in making the bronze group of the "Unbelief of St Thomas," which still stands in one of the external niches of Or San Michele (Florence). He received 800 florins for these two figures, which are more remarkable for the excellence of their technique than for their sculpturesque beauty. The attitudes are rather rigid and the faces hard in expression. Verrocchio's chief masterpiece was the colossal bronze equestrian statue of the Venetian general Bartolommeo Colleoni, which stands in the piazza of SS. Giovanni e Paolo at Venice. Verrocchio received the order for this statue in 1479, but had only completed the model when he died in 1488. In spite of his request that the casting should be entrusted to his pupil Lorenzo di Credi, the work was given to Alessandro Leopardi by the Venetian senate, and the statue was gilt and unveiled in 1496.[1] There appears to be no doubt that the model was completed by Verrocchio himself, and that nothing more than its reproduction in bronze should be attributed to the much feebler hand of Leopardi, who, however, has set his own name alone on the belly-band of the horse—**ALEXANDER· LEOPARDVS V. F. OPUS.** This is perhaps the noblest equestrian statue in the world, being in some respects superior to the antique bronze of Marcus Aurelius in Rome and to that of Gattamelata at Padua by Donatello. The horse is designed with wonderful nobility and spirit, and the easy pose of the great general, combining perfect balance with absolute ease and security in the saddle, is a marvel of sculpturesque ability. Most remarkable skill is shown by the way in which Verrocchio has exaggerated the strongly marked features of the general, so that nothing of its powerful effect is lost by the lofty position of the head. According to Vasari, Verrocchio was one of the first sculptors who made a practical use of casts from living and dead subjects. He is said also to have produced plastic works in terra-cotta, wood and in wax decorated with colour. As a sculptor his chief pupil was Francesco di Simone, the son of that Simone whom Vasari wrongly calls a brother of Donatello. Another pupil was Agnolo di Polo (Paolo), who worked chiefly in terra-cotta.

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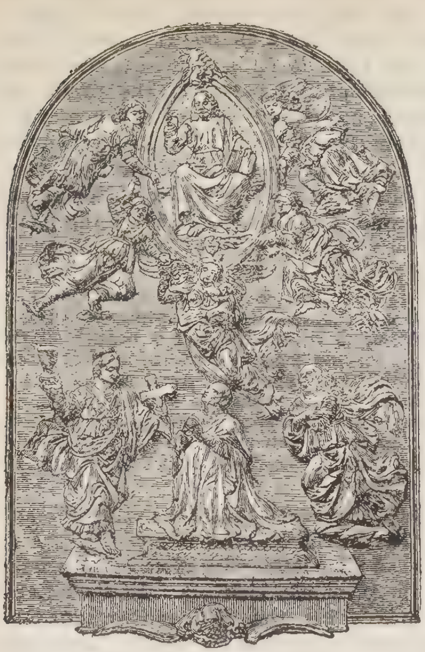
[1] See Crowe and Cavalcaselle, *Painting in Italy* (London, 1864), ii. pp. 400 seq.


Clay sketch for the monument of Cardinal Forteguerra, showing the kneeling portrait of the cardinal, which is not in the actual monument; a very poor modern figure occupies its place.

Verrocchio died in Venice in 1488, and was buried in the church of St Ambrogio in Florence.

See also Hans Mackowsky, "Verrocchio . . . Mit 80 Abbildungen" (1901), *Künster Monographien*, No. 52. (J. H. M.)

VERSAILLES, a town of northern France, capital of the department of Seine-et-Oise, 12 m. by road W.S.W. of Paris, with which it is connected by rail and tram. Pop. (1906) town, 45,246; commune, 54,820. Versailles owes its existence to the palace built by Louis XIV. It stands 460 ft. above the sea, and its fresh healthy air and nearness to the capital attract many residents. The three avenues of St Cloud, Paris and Sceaux converge in the Place d'Armes. Between them stand the former stables of the palace, now occupied by the artillery and engineers. To the south lies the quarter of Satory, the oldest part of Versailles, with the cathedral of St Louis, and to the north the new quarter, with the church of Notre Dame. To the west a gilded iron gate and a stone balustrade shut off the great court of the palace from the Place d'Armes. In this court, which slopes upwards from the gate, stand statues of Richelieu, Condé, Du Guesclin and other famous Frenchmen. At the highest point there is an equestrian statue in bronze of Louis XIV., and to the right and left of this stretch the long wings of the palace, while behind it extend the Cour Royale and the smaller Cour de Marbre, to the north, south and west of which rise the central buildings. The buildings clustered round the Cour de Marbre, which include the apartments of Louis XIV., project into the gardens on the west considerably beyond the rest of the façade. To the north the Chapel Court and to the south the Princes Court, with vaulted passages leading to the gardens, separate the side from the central buildings. On the other is the inscription, "À toutes les gloires de la France," which Louis Philippe justified by forming a collection of works of art (valued at £1,000,000), commemorating the great events and persons of French history. The palace chapel (1696–1710), the roof of which can be seen from afar rising above the rest of the building, was the last work of J. Hardouin-Mansart.

The ground-floor of the north wing on the garden side contains eleven halls of historical pictures from Clovis to Louis XVI., and on the side of the interior courts a gallery containing casts of royal funereal monuments. The Halls of the Crusades open off this gallery, and are decorated with the arms of crusaders and with modern pictures dealing with that period. On the first floor of the north wing on the garden side are ten halls of pictures commemorating historical events from 1795 to 1830; on the court side is the Gallery of Sculpture, which contains the Joan of Arc of the princess Marie of Orleans; and there are seven halls chiefly devoted to French campaigns and generals in Africa, Italy, the Crimea and Mexico, with some famous war pictures by Horace Vernet. The second storey has a portrait gallery. In the north wing is also the theatre built under Louis XV. by Jacques-Ange Gabriel, which was first used on the 16th of May 1770 on the marriage of the dauphin (afterwards Louis XVI.) and Marie Antoinette. Here, on the 2nd of October 1789, the celebrated banquet was given to the Gardes du Corps, the toasts at which provoked the riots that drove the royal family from Versailles; and here the National Assembly met from the 10th of March 1871 till the proclamation of the constitution in 1875, and the Senate from the 8th of March 1876 till the return of the two chambers to Paris in 1879. On the ground-floor of the central buildings are the halls of celebrated warriors (once the anteroom of Madame de Pompadour), marshals, constables and admirals, and the suite of rooms known as the Dauphin's Apartments, now given up to historical portraits. The Galerie Basse, once known as the Gallery of Louis XIII., leads to the rooms surrounding the Marble Court, a series of which contains many plans of battles. The lobbies of the ground-floor are full of busts, statues and tombs of kings and celebrated men. The famous staterooms are on the first floor. On the garden side, facing the north, are a series of seven halls, some of them decorated with tapestries representing the life of Louis XIV. Among them may be mentioned the Hall of Hercules, till 1710 the upper half of the old chapel, where the dukes of Chartres, Maine and Burgundy were married, and Bossuet, Massillon and Bourdaloue preached; the Hall of Mercury, where the coffin of Louis XIV. stood for eight days after his death; and the Hall of Apollo, or throne room. To the front of the palace, facing the west, are the Galleries of War and Peace, with allegorical pictures, and the Glass Gallery, built by Mansart in 1678 (235 ft. long, 35 wide and 42 high), having 34 arches, 17 of which are filled with windows looking on the gardens and 17 with large mirrors. The gallery is overloaded with ornament, and the pictures by Charles Lebrun, the trophies and figures of children by Antoine Coysevox, and the inscriptions attributed to Boileau and Racine, all glorify Louis XIV. This gallery was used by him as a throne room on state occasions. Here the king of Prussia was proclaimed emperor of Germany on the 18th of January 1871. Connected with the Gallery of Peace are the queen's apartments, occupied successively by Marie Thérèse, Marie Leczinska and Marie Antoinette, where the duchess of Angoulême was born, the duchess of Burgundy died, and Marie Antoinette was almost assassinated on the 6th of October 1789. Behind the Glass Gallery on the side of the court are the rooms of Louis XIV. The Œil de Bœuf, named from its oval window, was the anteroom where the courtiers waited till the king rose. In it is a picture representing Louis XIV. and his family as Olympian deities; and it leads to the bedroom in which Louis XIV. died, after using it from 1701, and which Louis XV. occupied from 1722 to 1738. In the south wing of the palace, on the ground-floor, is the Gallery of the Republic and the First Empire, the rooms of which contain paintings of scenes in the life of Napoleon I. A sculpture gallery contains busts of celebrated scholars, artists, generals and public men from the time of Louis XVI. onwards. In the south wing is also the room where the Chamber of Deputies met from 1876 till 1879, and where the Congress has since sat to revise the constitution voted at Versailles in 1875 and to elect the president of the republic. The first floor is almost entirely occupied by the Battle Gallery (394 ft. long and 43 wide), opened in 1836 on the site of rooms used by Monsieur the brother of Louis XIV. and the duke and duchess of Chartres. It is lighted from above, and the walls are hung with pictures of French victories. In the window openings are the names of soldiers killed while fighting for France, with the names of the battles in which they fell, and there are more than eighty busts of princes, admirals, constables, marshals and celebrated warriors who met a similar death. Another room is given up to the events of 1830 and the accession of Louis Philippe, and a gallery contains the statues and busts of kings and celebrities.

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[1] See Gay, *Cart. inéd.* i. p. 367.

The gardens of Versailles were planned by André Le Nôtre. The ground falls away on every side from a terrace adorned with ornamental basins, statues and bronze groups. Westwards from the palace extends a broad avenue, planted with large trees, and having along its centre the grass of the "Tapis Vert"; it is continued by the Grand Canal, 200 ft. wide and 1 m. long. On the south of the terrace two splendid staircases lead past the Orangery to the Swiss Lake, beyond which is the wood of Satory. On the north an avenue, with twenty-two groups of three children, each group holding a marble basin from which a jet of water rises, slopes gently down to the Basin of Neptune, remarkable for its fine sculptures and abundant water. The Orangery (built in 1685 by Mansart) is the finest piece of architecture at Versailles; the central gallery is 508 ft. long and 42 wide, and each of the side galleries is 375 ft. long. There are 1200 orange trees, one of which is said to date from 1421, and 300 other kinds of trees.

The alleys of the parks are ornamented with statues, vases and regularly cut yews, and bordered by hedges surrounding the shrubberies. Between the central terrace and the Tapis Vert is the Basin of Latona or the Frogs, with a white marble group of Latona with Apollo and Diana. Beyond the Tapis Vert is the large Basin of Apollo, who is represented in his chariot drawn by four horses; there are three jets of water, one 60, the others 50 ft. in height. The Grand Canal is still used for nautical displays; under Louis XIV. it was covered with Venetian gondolas and other boats, and the evening entertainments usually ended with a display of fireworks. Around the Tapis Vert are numerous groves, the most remarkable being the Ballroom or Rockery, with a waterfall; the Queen's Shrubbery, the scene of the intrigue of the diamond necklace; that of the Colonnade, with thirty-two marble columns and a group of Pluto carrying off Prosperine, by François Girardon; the King's Shrubbery, laid out in the English style by Louis Philippe; the beautiful Grove of Apollo, with a group of that god and the nymphs, by Girardon; and the Basin of Enceladus, with a jet of water 75 ft. high.

Among the chief attractions of Versailles are the fountains and waterworks made by Louis XIV. in imitation of those he had seen at Fouquet's château of Vaux. Owing to the scarcity of water at Versailles, the works at Marly-le-Roi were constructed in order to bring water from the Seine; but part of the supply thus obtained was diverted to the newly erected château of Marly. Vast sums of money were spent and many lives lost in an attempt to bring water from the Eure, but the work was stopped by the war of 1688. At last the waters of the plateau between Versailles and Rambouillet were collected and led by channels (total length 98 m.) to the gardens, the soil of which covers innumerable pipes, vaults and aqueducts.

Beyond the present park, but within that of Louis XIV., are the two Trianons. The Grand Trianon was originally erected as a retreat for Louis XIV. in 1670, but in 1687 Mansart built a new palace on its site. Louis XV., after establishing a botanic garden, made Gabriel build in 1766 the small pavilion of the Petit Trianon, where the machinery is still shown by which his supper-table came up through the floor. It was a favourite residence of Marie Antoinette, who had a garden laid out in the English style, with rustic villas in which the ladies of the court led a mimic peasant-life. The Grand Trianon is a one-storeyed building with two wings, and has been occupied by Monsieur (Louis XIV.'s brother), by the Great Dauphin, Napoleon I., and Louis Philippe and his court. The gardens of the Grand Trianon are in the same style as those of Versailles, and there is a museum with a curious collection of state carriages, old harness, &c.

Apart from the palace, there are no buildings of interest in Versailles; the church of Notre Dame, built by Mansart, the cathedral of St Louis, built by his grandson, the Protestant church and the English chapel being in no way remarkable. The celebrated tennis-court (Jeu de Paume) is now used as a museum. The large and sumptuous palace of the prefecture was built during the second empire, and was a residence of the president of the republic from 1871 to 1879. The library consists of 60,000 volumes; and the military hospital formerly accommodated 2000 people in the service of the palace. There are statues of General Hoche and of Abbé de l'Épée in the town. A school of horticulture was founded in 1874, attached to an excellent garden, near the Swiss Lake.

Versailles is the seat of a bishopric, a prefect and a court of assizes, and has tribunals of first instance and of commerce, a board of trade-arbitrators, a chamber of commerce and a branch of the Bank of France, and, among its educational establishments, lycées and training colleges for both sexes and a technical school. It is an important garrison town and has a school of military engineering and artillery. Distilling, boot and shoe making, and market-gardening employ many of the people, but the town has no specially characteristic industry. The links of the Paris Golf Club are at La Boulie near Versailles.

Louis XIII. often hunted in the woods of Versailles, and built a small pavilion at the corner of what is now the rue de la Pompe and the avenue of St Cloud. In 1627 he entrusted Jacques Lemercier with the plan of a château. In 1661 Louis Levau made some additions which were further developed by him in 1668. In 1678 Mansart took over the work, the Galerie des Glaces, the chapel and the two wings being due to him. In 1682 Louis XIV. took up his residence in the château. It is estimated that 20 million pounds were spent on the palace, gardens and works of art, the accounts for which were destroyed by the king. Till his time the town was represented by a few houses to the south of the present Place d'Armes; but land was given to the lords of the court and new houses sprang up, chiefly in the north quarter. Under Louis XV. the parish of St Louis was formed to the south for the increasing population, and new streets were built to the north on the meadows of Clagny, where in 1674 Mansart had built at Louis XIV.'s orders a château for Madame de Montespan, which was now pulled down. Under Louis XVI. the town extended to the east and received a municipality; in 1802 it gave its name to a bishopric. In 1783 the armistice preliminary to the treaty of peace between Great Britain and the United States was signed at Versailles. The states-general met here on the 5th of May 1789, and on the 20th of June took the solemn oath in the Tennis Court by which they bound themselves not to separate till they had given France a constitution. Napoleon neglected, and Louis XVIII. and Charles X. merely kept up, Versailles, but Louis Philippe restored its ancient splendour at the cost of £1,000,000. In 1870 and 1871 the town was the headquarters of the German army besieging Paris. After the peace Versailles was the seat of the French National Assembly while the commune was triumphant in Paris, and of the two chambers till 1879, being declared the official capital of France.

See A. P. Gille, *Versailles et les deux Trianons*, with illustrations by M. Lambert (Tours, 1899, 1900); P. de Nolhac, *La Création de Versailles* (Versailles, 1901); J. E. Farmer, *Versailles and the Court under Louis XIV.* (New York, 1905).

VERS DE SOCIÉTÉ, a term for social or familiar poetry, which was originally borrowed from the French, and has now come to rank as an English expression (see Fennell, *The Stamford Dictionary of Anglicised Words*). The use of the phrase as an English one is first met with at the opening of the 19th century. It is to be observed that it has come to bear a meaning which is not wholly equivalent to that of the French original. It was said of the blind philosopher, M. C. J. Pougens (1755–1833), that his *petits vers de société* procured great success for him in the *salons* of Paris, and several of the rhymesters of the early 18th century were prominent for their adroitness in composing *petits vers sur des sujets légers*. The prince of such graceful triflers was the Abbé de Chaulieu (1639–1720), of whom it was said that he made verses solely for the amusement of his friends, and without the smallest intention of seeing them in print. The best of his effusions have preserved a certain freshness because of the neatness with which they are turned, but it can scarcely be said that they have any pretension to be called poetry. They were inspired by incidents in the private life of the day, and were largely addressed to a few friends of exalted rank, who were hardly less witty than the author himself, such as the duc de Nevers, the marquis de Lassay, the duchesse de Bouillon and the marquis de la Fare. In the collections of Chaulieu's works, which were very often reprinted, side by side with his own pieces will be found *petits vers de société* indited by these great friends of his, and often quite as well turned as his own. To write such verses, indeed, was almost an accomplishment of good breeding. An enormous collection of them was brought together by Titon du Tillet (1676–1762), in his *Parnasse françois*, where those who are curious on the subject may observe to satiety how ingenious and artificial and trifling the *vers de société* of the French 18th century could be. The fashion for them followed upon the decline of an interest in rondeaux, ballades and villanelles, and Chaulieu himself had not a little to do with throwing those ingenuities out of fashion, his attack on Benserade, who went so far as to turn the whole of Ovid's *Metamorphoses* into rondeaux, being, according to his editor of 1732, "the first work which displayed the delicacy of the Abbé de Chaulieu's taste, and his talent for poetry." Of the writers of *vers de société* in France, J. B. Rousseau had the most poetical faculty; he was, in fact, a poet, and he wrote a "Billet à Chaulieu" which is a gem of delicate and playful charm. But, as a rule, the efforts of the French versifiers *dans les petits genres* were not of considerable poetic value.

If in England the expression *vers de société* carries with it more literary dignity, this is mainly due to the genius of one man. Prior's *Poems on Several Occasions*, collected in 1709, presents us with some of the earliest entirely characteristic specimens of *vers de société*, and with some of the best. Here the poet consciously, and openly, resigns the pretension of high effort and an appeal to Parnassus. He is paying a visit at Burghley House, where the conversation turns on the merits and adventures of Mr Fleetwood Shepherd; Prior then and there throws off, in extremely graceful verse, a piece appropriate to the occasion. He addresses it, and he dates it (May 14, 1689); and this is a typical example of *vers de société*. It will be seen that Prior, who learned much from his residence in the heart of the French world of fashion between 1711 and 1715, treats very much the same subjects as Chaulieu and La Fare were treating, but he does so with more force of style and dignity of imagination. As the 18th century progressed, the example of Prior was often followed by English poets, without, however, any general recapture of his forcible grace. The *vers de société* tended to be merged in the epistle and in the epigram. Swift, however, when he was neither coarse nor frigid, sometimes achieved a genuine success, as in the admirable verses on his own death. The odes of Ambrose Philips (1671–1749) addressed by name to various private persons, and, most happily, to children, were not understood in his own age, but possess some of the most fortunate characteristics of pure *vers de société*. In his "Welcome from Greece," a study in *ottava rima*, Gay produced a masterpiece in this delicate class, but most of his easy writings belong to a different category. Nothing of peculiar importance detains us until we reach Cowper, whose poems for particular occasions, such as those on "Mrs Throckmorton's Bullfinch" and "The Distressed Travellers," are models of the poetic use of actual circumstances treated with an agreeable levity, or an artful naïveté. In a later age, Byron, who excelled in so many departments of poetry, was an occasional writer of brilliant *vers de société*, such as the epistle "Huzza, Hodgson," but to find a direct successor to Prior it is necessary to pass Henry Luttrell (1765–1851) and W. R. Spencer (1769–1834), and to come down to W. M. Praed (*q.v.*). A certain character was given to English *vers de société* by Hood and Barham, but the former was too much addicted to a play upon words, the latter was too boisterous, to be considered as direct continuers of the tradition of Prior. That tradition, however, was revived by Frederick Locker, afterwards Locker-Lampson (1821–1895), whose *London Lyrics*, first printed in 1857 and constantly modified until 1893, is in some respects the typical modern example of pure *vers de société*. Locker was a simple, clear and easy writer; he successfully avoided the least appearance of that effort which is fatal to this kind of verse. His "Rotten Row," with its reminiscences of the early sixties,

> "But where is now the courtly troop
> That once rode laughing by?
> I miss the curls of Cantelupe,
> The laugh of Lady Di,"—

touches of real portraiture—is a perfect example of *vers de société*. Since the days of Locker, those who have attempted to strike the lighter lyre in English have been very numerous. Almost immeasurably superior to the rest has been Mr Austin Dobson, who is, however, something more than a writer of *vers de société*.

Collections of *vers de société* of much excellence have been published by J. K. Stephen (1859–92), Andrew Lang (b. 1844), A. D. Godley (b. 1856), Owen Seaman (b. 1861) and A. R. Ropes ("Adrian Ross") (b. 1859). (E. G.)

VERSE (from Lat. *versus*, literally a line or furrow drawn by turning the plough, from *vertere*, and afterwards signifying an arrangement of syllables into feet), the name given to an assemblage of words so placed together as to produce a metrical effect. The art of making, and the science of analysing, such verses is known as Versification. According to Max Müller, there is an analogy between *versus* and the Sanskrit term, *vritta*, which is the name given by the ancient grammarians of India to the rule determining the value of the quantity in vedic poetry. In modern speech, verse is directly contrasted with prose, as being essentially the result of an attention to determined rules of form. In English we speak of "a verse" or "verses," with reference to specific instances, or of "verse," as the general science or art of metrical expression, with its regulations and phenomena. A verse, which is a series of rhythmical syllables, divided by pauses, is destined in script to occupy a single line, and was so understood by the ancients (the στίχος of the Greeks). The Alexandrian scholiast Hephaestion speaks distinctly of verses that ceased to be verses because they were too long; he stigmatizes a pentameter line of Callimachus as στίχον ὑπέρμετρον. There is no danger, therefore, in our emphasizing this rule, and in saying that, even in Mr Swinburne's most extended experiments the theory is that a verse fills but one line in a supposititious piece of writing.

It is essential that the verse so limited should be a complete form in itself. It is not, like a clause or a sentence in prose, unrecurrent and unlimited, but it presents us with a successive and a continuous cadence, confined within definite bounds. There has been a constant discussion as to what it is in which this succession and this continuity consist, and here we come at once to the principal difficulty which makes the analysis of the processes of the poets so difficult. To go back to the earliest European tradition, it is universally admitted that the ancient Greeks considered the art of verse as a branch of music, and as such co-ordinated it with harmony and orchestral effect. This appears from definite statements preserved in the fragments of Aristoxenus of Tarentum, a grammarian who lived in the age of Alexander the Great, and whom we shall see to have been the first who laid down definite laws for prosody as a department of musical art (μουσική). It was found necessary, in order to compose a work of musical value, to work out a system of disciplined and linked movement. This system, or arrangement, was called rhythm, and this is common to all the arts of melody. Harmony, consisting in the reproduction of the sound of human voices or of musical instruments, and orchestrics, dealing with the movements of the human body, were expressed in metrical art by that arrangement of syllables which is known as rhythm. The science of metre is the teaching of those laws on which depends the rhythmical forms of poetry. This science has been, from the earliest ages of criticism, divided into a study of the general principles upon which all these forms are builded, and upon the special types into which they have gradually developed.

In considering ancient versification, it is necessary to give attention to Latin as well as to Greek metre, because although the Roman poets were in the main dependent upon the earlier tradition, there were several points at which they broke away, and were almost entirely independent. Roman verse, though essentially the same as Greek verse, was modified by the national development of Italian forms of poetry, by a simplified imitation of Greek measures, and by a varied intensity in the creation of new types of the old Greek artistic forms (Volkmann). In later times there was a tendency to consider the laws of metre as superior to, and almost independent of, the native impulse of the poet; and this is where the study of the old poetry itself is most salutary, as checking us in our tendency to bow too slavishly to the rules of the grammarians. No doubt, in the archaic times, theory and practice went hand in hand. The poet, held in constant check by the exigencies of music, was obliged to recognize the existence of certain rules, the necessity of which was confirmed by the delicacy of his ear. These he would pass down to his disciples, with any further discoveries which he might himself have made. For instance, what we are somewhat vaguely told of the influence of a poet like Archilochus, to whom the very invention of trochaic and iambic metre is, perhaps fabulously, attributed, points to the probability that in Archilochus the Ionian race produced a poet of extraordinary daring and delicacy of ear, who gathered the wandering rhythms that had existed, and had doubtless been used in an uncertain way before his time, into a system which could be depended upon, and not in his hands only, to produce certain effects of welcome variety. His system would engage the attention of theorists, and we learn that by the time of Plato schools of oral metrical education were already in existence, where the science of sounds and syllables was already beginning to be recognized, as may be seen in the *Cratylus*. Before long, the teachings in these peripatetic schools would be preserved, for safety's sake, in writing, and the theoretic literature of versification would begin. In fact, we read in Suidas of a certain Lasus of Hermione who wrote an *Art of Poetry*, and the age of this, the earliest of recorded authorities on the formal laws of verse, is fixed for us by the fact that he is spoken of as having been the master of Pindar. Of the writings of Lasus and his followers, however, nothing remains, and the character of their teaching is problematical. In the 3rd century B.C., however, we come upon a figure which preserves a definite character; this is Aristoxenus, the disciple of Aristotle, who gave his undivided attention to rhythm, and who lives, unfortunately only in fragments, as the most eminent musical critic of antiquity. The brief fragments of his *Elements of Rhythm* (ῥυθμικὰ στοιχεῖα), originally written in three books, are of unsurpassed value to us as illustrating the attitude of classical Greece to the interrelation of verse and music. The third book of Aristoxenus dealt specifically with λέξις, or the application of rhythm to artistically composed and written verse.

It is certain that, after the time of Alexander the Great, the theories of verse tended somewhat rapidly to release themselves from the theories of music, and when, in the successive ages of Greek criticism, much attention was given to the laws of versification, less and less was said about harmony and more and more about metre. Rules, often of a highly arbitrary nature, were drawn up by grammarians, who founded their laws on a scholiastic study of the ancient poets. The majority of the works in which these rules were collected are lost, but an enchiridion of Greek metres, by Hephaestion, a scholiast of the 2nd century A.D., has been preserved. First printed in 1526, editions and translations of Hephaestion's manual have not been infrequent.

It is from Hephaestion that most of our ideas on the subject of classical prosody are obtained. His work, as we possess it, seems to be a summary, made by himself, for use in schools, of an exhaustive treatise he had published on the Greek metrical system as a whole. in 48 books. The pre-eminent importance of Hephaestion was exposed to the learned world of Europe by Th. Gaisford, in 1810. A contemporary of Hephaestion, Herodian, who was one of the most eminent of Alexandrian grammarians, gave close attention to prosody, and was believed to have summed up everything that could be known on the subject of verse by critics of the 2nd century A.D., in his Μεγάλη προσῳδία, in twenty books. As Herodian, throughout his life, seems to have concentrated his attention on the study of Homer, it is supposed that he started with a consideration of the metre and accent of the *Iliad*. The almost complete loss of his treatises is regrettable. Philoxenus was the author of a very early work, Περὶ μέτρων; but this is entirely lost. In the musical cyclopaedia of Quintilian, there was included a chapter on the elements of the rhythmic art, and in this the metres recognized at the time were recorded and described. Among the Latin authorities on versification, the leading place is taken, in the 1st century B.C., by Terentius Varro, whose systematic treatment of metre in his works *De sermone latino* and *De lingua latina* is often referred to But we know more of Terentianus Maurus, who flourished in the second half of the 2nd century A D., since we possess from his hand a handbook to metre, written in verse, in which, in particular, the Horatian metres are carefully analysed. He follows Caesius Bassus, the friend of Nero, who had dedicated to his imperial patron a work on prosody, of which fragments exist. Three tracts, attributed to the rhetor C. Marius Victorinus (one entitled *De ratione metrorum*), belong to the 4th century, and are still quoted by scholars. Another early authority was Flavius Mallius Theodorus, whose *De Metris* has been frequently reprinted.

The metrical theory of the Byzantine grammarians was entirely in unison with the old tradition of the Alexandrian schools, and depended on the authority of Hephaestion. Michael Psellus, in the 9th century, wrote abundantly on the subject, and towards the close of the Empire the verse-handbooks of Isaac Tzetzes (d. 1138) and of his brother Joannes were in general use. A large number of other Byzantine scholiasts and theorists are mentioned in this connexion by Gleditsch. Very little attention was paid to metrical science in medieval and even Renaissance days. It is much to the honour of English scholarship that the earliest modern writer who made a rational study of ancient metre was Richard Bentley, in his *Schediasma de metris Terentianis*, printed at Cambridge in 1726. He was soon followed by the Germans, in particular by Hermann, Boeckh and J. A. Apel. To this day, German scholarship easily leads in the rational and accurate study of classical versification.

The chief principle in ancient verse was quantity, that is, the amount of time involved in the effort to express a syllable. Accordingly, the two basal types which lie at the foundation of classical metre are "longs" and "shorts." The convention was that a long syllable was equal to two short ones: accordingly there was a real truth in calling the succession of such "feet" metre, for the length, or weight, of the syllables forming them could be, and was, measured. What has to be realized in speaking of ancient metre is that the value of these feet was defined with exactitude, not left uncertain, as it is in modern European verse, when accent is almost always made the guiding principle. In Greek verse, there might be an *ictus* (stress), which fell upon the long syllable, but it could only be a regulating element, and accent was always a secondary element in the construction of Greek metre. The "feet" recognized and described by the ancient grammarians were various, and in their apparent diversity sometimes difficult to follow, but the comprehension of them is simplified if the student realizes that the names given to them are often superfluous. The main distinction between feet consists in the diversity of the relation between the strong and the weak syllables. There are naturally only two movements, the quick and the slow. Thus we have the anapaest (⏑ ⏑ —, short-short-long) and the dactyl (— ⏑ ⏑, long-short-short), which are equal, and differ only as regards the position of their parts. To these follow two feet which must be considered as in their essence non-metrical, as it is only in combination with others that they can become metrical. These are the spondee (— —, long-long) and the pyrrhic (⏑ ⏑, short-short). Of more essential character are the two descriptions of slow feet, the iamb (⏑ —, short-long) and the trochee (— ⏑, long-short). Besides these definite types, the ingenuity of formalists has invented an almost infinite number of other "feet." It is, perhaps, necessary to mention some of the principal of these, although they are, in the majority of cases, purely arbitrary. In the rapid measures we find the tribrach (⏑⏑⏑, short-short-short), the molossus (———, long-long-long), the amphibrach (⏑—⏑, short-long-short), the amphimacer (—⏑—, long-short-long), the bacchius (⏑——, short-long-long) and the antibacchius (——⏑, long-long-short). There is a foot of four syllables, the choriamb (—⏑⏑—, long-short-short-long), which is the fundamental foot in Aeolic verse—very frequently mentioned, but very seldom met with.

It must not be forgotten that the prosodical terminology of the Greeks, which is often treated by non-poetical writers as something scientific and even sacrosanct, dates from a time when ancient literature had lost all its freshness and impulse, and was exclusively the study of analysts and grammarians. Between the life of Pindar, for instance, and that of Hephaestion, the great metrical authority, there extends a longer period than between Chaucer and Professor Skeat; and to appreciate the value of the rules of Greek prosody we must recollect that those rules were invented by learned and academic men to account for phenomena which they observed, and wished to comprehend, in writings that had long been classical, and were already growing positively archaic. The fact seems to be that the combination of long and short syllables into spondees, iambs, dactyls and anapaests, forms the sole genuine basis of all classical verse.

Metre is a science which pays attention to all the possible regular arrangements which can be made of these four indispensable and indestructible types. Of the metres of the ancients by far the most often employed, and no doubt the oldest, was the dactylic hexameter, a combination of six feet, five successive dactyls and a spondee or trochee:—

—́⏑⏑ —́⏑⏑ —́⏑⏑ —́⏑⏑ —́⏑⏑ —́⏑

This was known to the ancients as "epic" verse, in contrast to the various lyrical measures. The poetry of Homer is the typical example of the use of the epic hexameter, and the character of the Homeric saga led to the fashion by which the dactylic hexameter, whatever its subject, was styled "heroic metre." The earliest epics, doubtless, were chanted to the accompaniment of a stringed instrument, on which the pulsation of the verse (ἔπη) was recorded. It was the opinion of W. Christ that the origin of the hexameter was to be sought in hieratic poetry, the fulness of the long dactylic line attracting the priests to its use in the delivery of oracles, from which it naturally passed to solemn tales of the actions of gods and heroes. It is more difficult to see how, later on, it became the vehicle for comic and satiric writing, and is found at last adopted by the bucolic poets for their amorous and pastoral dialogues. The Homeric form of the dactylic hexameter has been usually taken, and was taken in classical times, as the normal one, but there have been many variations. A hexameter found in Catullus consists exclusively of spondees, and deviation from the original heroic type could go no further. This concentration of heavy sounds was cultivated to give solemnity to the character of the line. In the whole matter, it is best to recognize that the rules of the grammarians were made after the event, to account for the fact that the poets had chosen, while adhering to the verse-structure of five rapid beats and a subsidence, to vary the internal character of that structure exactly as their ear and their passion dictated. This seems particularly true in the case of the caesura, where the question is not so much a matter of defining "male" caesura or "female" caesura, "bucolic" caesura or "trochaic," as of patiently noting instances in which the unconscious poet, led by his inspiration, has varied his pauses and his emphasis at his own free will. The critics have written much of "prosodical licence," but verse in the days of Homer, like verse now, is simply good or bad, and if it is good it may show liberty and variety, but it knows nothing of "licence."

We pass, by a natural transition, to the pentameter, which is the most frequently employed of what are known as the syncopied forms of dactylic verse. It was used with the hexameter, to produce the effect which was early called elegiac, and its form shows the appropriateness of this custom:—

"Cynthia | prima fu- | it, || Cynthia | finis e- | rit."

A hexameter, full of energy and exaltation, followed by a descending and melancholy pentameter, had an immediate tendency to take a complete form, and this is the origin of the stanza. The peculiar character of this two-line stanza has been fixed for all time by a brilliant epigram of Schiller, which is itself a specimen of the form:—

"Im Hexameter steigt des Springquells flüssige Säule,
Im Pentameter drauf fällt sie melodisch herab."

Such a distich was called an elegy, ἐλεγεῖον, as specially suitable to an ἔλεγος or lamentation. It is difficult to say with certainty whether the distich so composed was essential as an accompaniment to flute-music in the earliest times, or how soon there came to be written purely literary elegies towards which the melody stood in a secondary or ornamental relation. It has, however, been observed that even when the distich had obviously come to be a purely intellectual or lyrical thing, there remained in the sound of the pentameter the trace of lamentation, in which its primitive use at funeral services was clearly preserved. Other grammarians, however, among whom Cäsar, in his work on the origin of elegiac verse, is prominent,—do not believe in the lugubrious essence of the pentameter, and think that the elegiacal couplet was originally erotic, and was adapted to mournful themes by Simonides. If we may credit a passage in Athenaeus, it would seem that the earliest-known elegists, such as Callinus and Solon, wrote for recitation, pure and simple, without the accompaniment of any instrument.

Trochaic verse is called by the ancient grammarians headless (ἀκέφαλον), because it really consists of iambic verse deprived of its head, or opening syllable. The iambic measure (⏑—⏑—⏑—) becomes trochaic if we cut off the first "short," and make it run —⏑—⏑—⏑—. The pure trochaic trimeter and tetrameter had a character of breathless speed, and sometimes bore the name of choric (ῥυθμὸς χορεῖος), because it was peculiarly appropriate to the dance, and was used for poems which expressed a quickly stepping sentiment. It is understood that, after having been known as a musical movement, it was first employed in the composition of poetry by Archilochus of Paros, in the 7th century B.C.

Iambic metre was, next to the dactylic hexameter, the form of verse most frequently employed by the poets of Greek antiquity. Archilochus, again, who seems to have been a great initiator in the arts of versification, is credited with the invention of the iambic trimeter also, but it certainly existed before his time. Murray believes the original iambic measure, in its popular familiarity, to have sprung from the worship of the homely peasant gods, Dionysus and Demeter. It was not far removed from prose; it gave a writer opportunity for expressing popular thoughts in a manner which simple men could appreciate, being close to their own unsophisticated speech. In particular, it presented itself as a heaven-made instrument for the talent of Euripides, "who, seeing poetry and meaning in every stone of a street, found in the current iambic trimeter a vehicle of expression in some ways more flexible even than prose."

It was not, however, until the invention of the lyric proper, whether individual to the poet, or choral, that the full richness of possible rhythms became obvious to the Greeks. The lyric inspiration came originally from the island of Lesbos, and it passed down through the Asiatic archipelago to Crete before it reached the mainland of Greece. The Lesbians cultivated a monodic ode-poetry in strophes and monostrophes, the enchanting beauty of which can still be realized in measure from what remains to us of the writings of Sappho and Alcaeus There is a stanza known as the Sapphic and another as the Alcaic.

The Sapphic runs as follows:—

–́ ⏑ – ⏒ | –́ ⏑ ⏑ – | ⏑ –. ⏓
–́ ⏑ – ⏒ | –́ ⏑ ⏑ – | ⏑ –. ⏓
–́ ⏑ – ⏒ | –́ ⏑ ⏑ – | ⏑ – ⏓
– ⏑ ⏑ | – –

The stanza of Alcaeus runs:—

⏒ – ⏑ –́ | ⏒ – ⏑ ⏑ | – ⏑ –́
⏒ – ⏑ –́ | ⏒ – ⏑ ⏑ | – ⏑ –́
⏒ – ⏑ –́ | ⏒ – ⏑ – | –, –́ ⏑ ⏑
– ⏑ ⏑ –́ | ⏑ –. –

These marvellous inventions suited the different moods of these strongly contrasted lyrists, the "violet-crowned, pure, softly smiling Sappho," and the fiery, vehement soldier who was Alcaeus. We must give them peculiar attention, since they were the two earliest models for the lyric passion which has since then expressed itself in so many stanzaic forms, but in none of so faultless a perfection as the original Lesbian types.

The name of Stesichorus of Himera points to the belief of antiquity that he was the earliest poet who gave form to the choral song; he must have been called the "choir-setter" because he arranged and wrote for choirs semi-epic verse of a new kind, "made up of halves of the epic hexameter, interspersed with short variations—epitrites, anapaests or mere syncopae—just enough to break the dactylic swing, to make the verse lyrical" (Gilbert Murray). But it appears to be to Arion that the artistic form of the dithyramb is due. We are all among innovators and creators in this glorious 5th century B.C. Simonides gathered the various inventions together, and exercised his genius upon them all: he was the earliest universal lyrist of the world: he treated the styles of verse, as Shelley or as Victor Hugo did, with an impartial mastery.

After the happy event of the Persian War, Athens became the centre of literary activity in Greece, and here the great school of drama developed itself, using for its vehicle, in dialogue, monologue and chorus, nearly all the metres which earlier ages and distant provinces had invented. The verse-form which the dramatists preferred to use was almost exclusively the iambic trimeter, a form which adapted itself equally well to tragedy and to comedy. Aeschylus employed for his choruses a great number of lyric measures, which Sophocles and Euripides reduced and regulated. With the age of the dramatists the creative power of the Greeks in versification came to an end, and the revival of poetic enthusiasm in the Alexandrian age brought with it no talent for fresh metrical inventions, and the time had now arrived when the harvest of Greek prosody was completely garnered.

Latin Metre.—Very little is known about the verse-forms of the original inhabitants of Italy, before the introduction of Greek influences. The earliest use of poetry as a national art in Italy is to be judged by inscriptions in what is called the Saturnian metre. Already, the first Latin epic poets, Livius Andronicus in his *Odyssia*, Naevius in his *Bellum Punicum*, the Scipios in their *Elogia*, combined their rude national sense of folk-song with a consciousness of the quantitative rules of the Greeks. But the same writers, in their dramas, undoubtedly used Greek metres without adaptation, and it is therefore likely that the ancient Saturnian measure was already looked upon as barbarous, and it makes no further reappearance in Latin literature (cf. Gleditsch). The introduction of Greek dramatic metre marks the start of regular poetry among the Latins, which was due, not to men of Roman birth, but to poets of Greek extraction or inhabiting the Greek-speaking provinces of Italy. These writers, bearing the stamp of a widely recognized cultivation, threw the old national verse back into oblivion. Latin verse, then, began in a free but loyal modification of the principles of Greek verse. Plautus was particularly ambitious and skilful in this work, and, aided by a native genius for metre, he laid down the basis of Latin dramatic versification. Terence was a feebler and at the same time a more timid metrist. In satire, the iambic and trochaic measures were carefully adapted by Ennius and Lucilius. The dactylic hexameter followed, and Ennius, in all matters of verse a daring innovator, directly imitated in his *Annales* the epic measure of the Greeks. To him also is attributed the introduction of the elegiac distich, hexameter and pentameter. The dactylic hexameter was forthwith adopted as the leading metre of the Roman poets, and, as Gleditsch has pointed out, the basis upon which all future versification was to be erected was firmly laid down before the death of Ennius in 169 B.C. Lucilius followed, but perhaps with some tendency to retrogression, for the Latin critics seem to have looked upon his metre as wanting both in melody and elasticity. Lucretius, on the other hand, made a further advance on the labours of Ennius, in his study of

"the rise
And long roll of the Hexameter."

Lest, however, this great form of verse should take too exclusive a place in the imagination of the Romans, a younger generation, with Laevius and Terentius Varro at their head, began to imitate the lyrical measures of the Greeks with remarkable success. Varro, who has been styled the earliest metrical theorist of Rome, opened up a new field in this direction by the example of his Menippean satires. These poets left the rigid school of Ennius, and sought to emulate the Alexandrians of their own age: we see the result in the lyric measures used so gracefully and with such brilliant ease by Catullus. The versification of the Romans reached its highest point of polish in the Augustan age, in the writings of Tibullus, Propertius, Virgil and particularly Ovid, who is considered to mark the highest level of various excellence which has ever been reached by a master of Latin versification. In Horace has been traced a tendency to archaism in the study of verse, and in his odes and epodes he was not content with the soft Alexandrian models, but aimed at achieving more vigorous effects by an imitation of the older Greek models, such as Alcaeus and even Archilochus. After the Augustan age, it was no longer the Greek poets, ancient or recent, who were imitated, but the Augustans themselves were taken as the inapproachable models of Roman verse.

We have hitherto spoken of classical versification as it was regarded by those whom, without offence, we may describe as pedants. But there is precious evidence of the mode in which metre was regarded by poets, and by one of the greatest artists of antiquity. In his *Art of Poetry* Horace has been speaking of the need of method in composition—"tantum series juncturaque pollet"—and this reminds him that he has said nothing of the art of verse. The succeeding twenty-four lines contain all that this great poet thought it needful to supply on the subject with which Alexandrian grammarians could fill as many volumes. Although he is actually writing in dactylic hexameters, he does not mention this form of verse; he is chiefly occupied in describing, rather unscientifically, the iambic trimeter, and in praising the iamb, *pes citus*. He applauds, still somewhat vaguely, the stately versification of the precursors, Ennius and Accius, and blames the *immodulata poemata* of careless modern writers, whose laxity is condoned by popular ignorance. The only way to escape such faults is to study the Greeks by night and by day, but Horace evidently means by his *exemplaria Graeca*, not the scholiasts with their lists of metres and their laborious rules, but the old poets with their fine raptures. On Italian ground he points to Plautus, and laments that the Romans of his own day, fascinated by softer cadences, have lost their veneration for the vigorous beauty of the *Plautinos numeros*. And Horace closes with a queer suggestion, which may be taken as we please, that a poet in an age of flagging inspiration must trust to his fingers as well as his ears.

Modern Versification.—The main distinction between classical and modern versification consists in the negligence shown by the moderns to *quantity*, which is defined as the length or shortness of the sound of syllables, as determined by the time required to pronounce them. This dimension of sound was rigid in the case of Greek and Latin poetry, until, in what is known as the

Middle Greek period, there came in a general tendency to relax the exact value of sounds and syllables, and to introduce *accent*, which is a measure of quality rather than of quantity. A syllable, in modern verse, is heavy or light, according as it is accented or unaccented—that is to say, according as it receives stress from the voice or not. In the word "tulip," for instance, the syllables are of equal length, but the accent is strongly upon the first. It is mainly a question of force with us, not of time as with the ancients. There is, however, an element of quantity in modern verse, as there was of accent in ancient verse. The foot, in modern verse, takes a less prominent place in itself than it did in Greece, and is regarded more in relation to the whole line of which it makes a part. A mere counting of syllables is useless. In Milton's

> "From haunted spring and dale,
> Edg'd with poplar pale,"

an ancient scholiast would have found it impossible to discover any harmony, for he would have had no means of measuring the value of the heavy accent on "edg'd," followed by a pause, and would have demanded another syllable in the second line to turn the whole into verse. The first poet to whom it occurred that it was needless to attach such predominant importance to quantity was Gregory of Nazianzen (d. 389), a Christian bishop of the Greek Church. In two important poems by Gregory all prosodical discipline is found to have disappeared, and the rule of verse has come to be accentual, with a heavy stress on the penultimate syllable. About the same time, the Greek fabulist Babrius employed a choliambic metre having a strong accent on the penultimate. The poets of the transition loved to cultivate a loose iambic trimeter in twelve syllables, and shorter octosyllabic forms called "anacreontic," although they were far enough from repeating the splendid effects of Anacreon. In these the old laws of quantity were more and more generally superseded by stress, and in all this we may see the dawn of the free accentual versification of modern Europe.

Romance Languages.—The prosodies of Provence, France, Italy and Spain were derived from the decayed and simplified forms of Latin verse by a slow and sometimes almost intangible transition. In these modern metres, however, when they came to be independent, it was found that all syllables in the line were of equal value, and that the sole criterion of measure was the number of these in each case. The relics of ancient versification, deprived of all the regulated principles of rhythmical art, received in return the ornament of obligatory and difficult rhyme, without which the weak rhythm itself would practically have disappeared. A new species of rhythm, depending on the varieties of mood, was introduced, and stanzaic forms of great elaboration and beauty were invented. The earliest standard work which exhibits in full the definitions of Romance versification is the *Leys d'Amors* of an unknown Provençal grammarian, written in 1356.[1] Another medieval treatise of great importance is the *De Vulgari Eloquentia*, written by Dante in 1304. There is this difference between these two works, that the former, written long after the flourishing period of the troubadours, analyses what has been accomplished in the past, while the other, standing at the starting-point of Italian poetry, describes what has to be done in the future. Both of these authorities quote the ten-syllable line of five equal feet as most to be admired and as forming the basis of poetry. But the octosyllabic, almost in the earliest times, became a main favourite with the poets, and may be said to be the most frequently used of all lyrical measures in medieval Romance poetry. The earliest specimen of all, however, a mere refrain excepted, is the fragment of the Provençal "Boethius," and this is decasyllabic, like all French poems of the Charlemagne cycle. The typical French heroic verse, the alexandrine of six feet, is not found in the old epic poetry. In Provençal and early French the position of the caesura in each line was fixed by strict rules; in Italian these were relaxed. Dante gives very minute, although somewhat obscure, accounts of the essence and invention of stanzaic form (*cobla* in Provençal), in which the Romance poetries excelled from the first. The stanza was a group of lines formed on a regular and recurrent arrangement of rhymes. It was natural that the poets of Provence should carry to an extreme the invention of stanzaic forms, for their language was extravagantly rich in rhymes. They invented complicated poetic structures of stanza within stanza, and the *canzo* as written by the great troubadours is a marvel of ingenuity such as could scarcely be repeated in any other language. The extreme fulness and elaboration of the Provençal poets, however, has been serviceable as placing a very high ideal of structural skill before the poets of all succeeding times, and it was of immense value in directing the experiments of the earliest poet-artists of Italy and France.

In French poetry, successive masters corrected the national versification and drew closer round it the network of rules and principles. The alexandrine was invented in the 12th century, as a counterpart to the hexameter of the ancients, by Alexander de Bernay. A great part is played in French metre by masculine and feminine verse: the former is a verse which closes with a letter which is not *e mute*; the latter a verse which closes with *e mute*, or with *e mute* followed by *s*, or by the consonants *nt*. Masculine rhyme is that which combines two masculine verses, and feminine that which unites two feminine verses; and in regular verse such couplets must be alternated. Elision is the rule by which, in the scansion of a verse, the letter *e* at the end of a word is suppressed when it immediately precedes *e mute* or a non-aspirated *h*. These and other immutable rules were laid down by Malherbe, and by Boileau in his *Art Poëtique* (1674), and for more than a century they were implicitly followed by all writers of verse. It was the genius of Victor Hugo which first enfranchised the prosody of France, not by rebelling against the rules, but by widening their scope in all directions, and by asserting that, in spite of its limitations, French verse was a living thing. The richness of Hugo's rhymes is proverbial, and the boldness and flow of his alexandrines exceeded everything which had been so much as dreamed of before his time. The revolution he brought about proved universal, and disciples like Théophile Gautier could say, in the face of the critics and grammarians of the classic school, "If we suspected that Victor Hugo had written a single bad verse, we should not dare to admit it to ourselves, in a cellar, without a candle." Boileau and Hugo, therefore, have been the two lawgivers of the French Parnassus. The rules of French verse being, in fact, very severe, and weakness, excess of audacity and negligences of all sorts being very harshly repressed, it is not surprising that, as the personal authority of Hugo declined, various projects were started for lightening the burden of prosodical discipline. Since 1880 those projects have been numerous, and a great many poets of genuine inspiration have written in different forms of what is called "free verse."

Teutonic.—In very early times the inhabitants of the Germanic countries developed a prosodical system which owed nothing whatever to classical sources. The finest examples of this Teutonic verse are found in Icelandic and in Anglo-Saxon. The line consisted of two sections, each containing two strongly stressed syllables, and of these four long syllables three were alliterated. It is plain that there can be detected in ancient Teutonic verse but three severe and consistent rules, viz. that the section, the strong accentuation, and above all the alliteration must be preserved. We find this to be the case in High and Low German, Icelandic, Anglo-Saxon, and in the revived alliterative English poetry of the 14th century, such as "Piers Plowman." There are differences, however, which depend on such facts as that the Icelandic poems are mainly lyrical and the Anglo-Saxon epics are narrative. As time went on, under the pressure of south European practice, alliteration ceased to be regarded as the sole and sufficient ornament of Teutonic verse, and rhyme was occasionally used, but this was a concession which proved fatal to the type. With this use of rhyme, the High German poetry begins to cease, while England becomes the centre of

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[1] But see the article PROVENÇAL LITERATURE.

Teutonic metrical composition. In Icelandic poetry there was a highly artificial verse-system known as court-verse (*dróttkvaett*), which consisted of alliterative groups of two lines each, arranged in staves of eight lines. When we consider primitive Teutonic verse closely, we see that it did not begin with any conscious art, but, as Vigfussen has said, "was simply excited and emphatic prose" uttered with the repetition of catchwords and letters. The use of these was presently regulated. Alliteration of stressed root-syllables formed the basis of Teutonic verse, as quantity had formed the basis of Greek verse. A study of the "Heliand" and the "Lay of Hildebrand" in Old German, of the "Atli" and "Harbard" lays in Icelandic, and of the writings attributed to Beowulf, Cædmon and Cynewulf in Anglo-Saxon, will show the general unity and the local divergences of this class of verse.

English Metre.—The first writer in whom there has been discovered a distinct rebellion against the methods of Anglo-Saxon versification is St Godric, who died in 1170. Only three brief fragments of his poetry have been preserved, but there is no doubt that they show, for the first time, a regular composition in feet. A quotation will show the value of St Godric's invention:—

> "Saintë | Nicholaes, | Godes | druth,
> Tymbre us | fairë | sconë | hus,
> At thy | burth, | at thy | bare,
> Saintë | Nicholaes, | bring uswel thare."

From this difficult stanza down to the metres of modern English the transition seems gradual and direct, while the tradition of Anglo-Saxon alliterative prosody is abruptly broken. The fragments of St Godric appear to be independent of one another, and therefore indicate that the division of lines into feet is not accidental. They are much less dubious, and more firm as the basis of an hypothesis, than the famous quatrain[1] about the singing of the monks of Ely, which is perhaps a little earlier in date than the fragments of St Godric. This has much picturesque beauty, but if it is carefully examined the actual scheme of it as metre seems to evade detection. The Ely singer warbled, not knowing what he sang, but St Godric knew perfectly well, and must have been a deliberate innovator. There is still more definition of feet in the *Poema Morale*, printed by Dr Morris, which is supposed to date from about 1200. In longer pieces, and particularly in the *Ormulum*, and in the *Brut* of Layamon, which belong to the early part of the 13th century, we find, on the whole, less definite abandonment of the Anglo-Saxon system of prosody, but nevertheless a prominence given both to rhyme and to rhythm. In Layamon, particularly, the recognition of a recurrent verse of four accents is unquestionable. The place of this poet in the history of prosody is very carefully noted by Guest, who remarks that in Anglo-Saxon verse, the syllables which take the alliteration are always accented, while in the later metres, where alliteration was combined with rhyme, the former is often thrown upon an unaccented syllable. "Layamon appears to take a middle course. It would seem he gave accents both to his rhyming and his alliterative syllables; but the former were often obliged to content themselves with a false accent." An advance was made about fifty years later in *Genesis and Exodus*, a poem published by Professor Skeat, which has such great value in the proof it gives of the extension of verbal melody, that Saintsbury has said that "it contains more of the kernel of English prosody, properly so called, than any [other] single poem before Spenser." The phenomenon which we meet with in all these earliest attempts at purely English verse is the unconscious determination of writers, who had no views about prosody, to follow their national instinct in the direction of grouped feet and rhymes. This is further emphasized in *Horn* and *Havelok*, and in the smoother octosyllabics of the 14th-century metrical romances, where the rhymes become very frequent, with an occasional short line or *bob*, to prevent monotony of effect. Few of these romances have much literary value, but their prosodical value is very great, for we see in them the normal movement of English verse becoming fixed to certain principles beyond any possibility of escape:—

> "So fair | he spak- | ë him withal,
> He light- | ed down- | ë in | the hall,
> Boundë | his mare | among | them all,
> And to | the board- | ë won."

This, from *Sir Percevale*, is, it must be allowed, an unusually correct example; the uncouth 14th-century writers did not commonly arrive at their effect without much more irregularity and wavering than this, but the design is evident even in their worst examples. Between 1210 and 1340 not a single English poem of importance is known to have been written in the old alliterative measure of the Anglo-Saxons. But at the latter date there set in a singular reaction in favour of alliteration, a movement which culminated, after producing some beautiful romances, in the satires of Langland. Those writers, and they were many, who preserved foot-scansion and rhyme, during this alliterative reaction, became ever closer students of contemporary French verse, and in the favourite octosyllabic metre "the uncompromising adoption of the French, or syllabically uniform, system is the first thing noticeable" (Saintsbury). This tendency of Middle English metre culminates in the work of John Gower, which is singularly polished in its rhyming octosyllabics, although unquestionably nerveless still, and inelastic.

It is, however, to Chaucer that we turn for far greater contributions to English verse. He it was who first, with full consciousness of power as an artist, adopted the use of elaborate stanzas, always in following of the French; he it was who first gained freedom of sound by a variation of pause, and by an alternation of trochaic and iambic movement. It is the lack of these arts which keeps Gower and his predecessors so stiff. In particular Chaucer, in his first period, invented rime-royal, a stanzaic form (in seven decasyllabic lines, rhymed *a b a b b c c*), peculiarly English in character, which was dominant in our literature for more than two hundred years; it was used in the long romance of *Troilus and Creseide*, where English metre for the first time displays its beauty to the full. The importance of rime-royal is displayed in the fact that its sixth and seventh lines actually form the decasyllabic couplet, which is commonly held to be a later discovery of Chaucer's, in *The Legend of Good Women*. This is the heroic verse, in which *The Canterbury Tales* are mainly composed, and this metre of five accents, with couplet-rhyme, became so powerful in the future history of English poetry that it may almost be taken as the central and most characteristic of our verse-forms, as the alexandrine couplet is in French and Dutch prosody. It seems to have been originally called riding-rhyme, the name by which Gascoigne describes it (1575).

It is impossible here to do more than indicate very briefly those fluctuations which English prosody underwent when the learned and vivid example of Chaucer was withdrawn. The metres of Lydgate and his successors were discordant and feeble; their ears had learned but very incorrectly the lesson of the master. Lydgate, in particular, went back to an earlier type, and showed himself more skilful in the old eight-syllable measure than in the new decasyllable. More interesting to the prosodical student than the work of these or later Chaucerians is the influence exercised throughout the 15th and early 16th centuries by the popular ballads, of which "Chevy Chase" is believed to be the oldest surviving example, while "The Tale of Gamelyn" is the longest. The introduction of the loose, elastic ballad-quatrain, with its melodious tendency to refrain, was a matter of great importance in the metamorphosis of British verse. The degenerate forms employed by the English 15th-century poets in attempting more regular prosody were in some measure connected by the greater exactitude of the Scotch writers, particularly of Dunbar, who was by far the most accomplished metrist between Chaucer and Spenser.

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[1] Merie sungen ðe muneches binnen Ely,
ða Cnut ch[in]ing reu ðer by;
" Roweð, cni[h]tes, noer the land
and here we þes muneches sæng "

But Wyatt (1503–1542) was long considered the father of modern English verse, and though we now plainly enough perceive that before his day all the essential discoveries and inventions had been made, he nevertheless deserves great honour as a pioneer. He introduced, from France and Italy, the prosodical principles of the Renaissance—order and coherency, concentration and definition of sound—and that although his own powers in metre were far from being highly developed. He and his more gifted disciple Surrey introduced into English verse the sonnet (not of the pure Italian type, but as a quatorzain with a final couplet) as well as other short lyric forms. To Surrey, moreover, we owe the introduction from Italian of blank verse, the rhymeless metre of five accents, which has taken so prominent a place in subsequent English poetry.

With the heroic couplet, with blank verse, and with a variety of short lyric stanzaic measures, the equipment of British verse might now be said to be complete. For the moment, however, towards the middle of the 16th century, all these excellent metres seemed to be abandoned in favour of an awkward couplet of fourteen feet, which may have had some relation with the French alexandrine. It was always, as Saintsbury says, "a very uncertain and risky metre, settling down with a dangerous acquiescence into doggerel and sing-song." It was to break up this nerveless measure that the remarkable reforms of the close of the century were made, and the discoveries of Wyatt and Surrey were brought, long after their deaths, into general practice. In drama, the doggerel of an earlier age retired before a blank verse, which was at first entirely pedestrian and mechanical, but struck out variety and music in the hands of Marlowe and Shakespeare. But the central magician was Spenser, in whom there arose a master of pure verse whose range and skill were greater than those of any previous writer of English, and before whom Chaucer himself must withdraw. It is not too much to say that Spenser took all the elements of English verse, as they had existed in more or less timid and undeveloped shape for four centuries, and that he moulded them together into an instrument capable, for the first time, of expressing, or accompanying, every passion, every emotion, every variety of sentiment or instinct, which stirs the human breast. His great work was that of solidification and emancipation, but he also created a noble form which bears his name, that Spenserian stanza of nine lines closing with an alexandrine, which lends itself in the hands of great poets, and great poets only, to magnificent narrative effects.

It was at this moment that a final attempt was made to disestablish the whole scheme of English metre, and to substitute for it unrhymed classic measures. In the year 1579 this heresy was powerful at Cambridge, and a vigorous attempt was made to include Spenser himself among its votaries. It failed, and with this failure it may be said that all the essential questions connected with English poetry were settled.

There is enough to fill a score of volumes in the mode in which the poets from Spenser downwards have employed the laws of English verse, but he was the latest of the legislators who laid down the framework of those laws. It is not possible in this place to enter into such themes as the rise and fall of Elizabethan dramatic blank verse; the perfection of the song and the development of the sonnet; the extraordinary virtuosity of Milton; the contest between enjambement (which permits the extension of the sentence beyond the limits of the distich) and the couplet as introduced by Waller; the victory of that couplet, and its use from 1670 to 1800; the slow growth of ode, which had been one of Spenser's inventions; the revivals of prosodical taste in the 19th century; the extraordinary advance in freedom of anapaestic movement.

It may generally be remarked in connexion with the very various, copious and often chaotic criticism of English verse, that it has been a misfortune, from the earliest times, that pedantic and chimerical theories have too often invaded the study of metre. They had tended, from the times of the Alexandrian grammarians down to our own, to treat as a dead thing that vivid and elastic art of poetry whose very essence is its life. In modern times not a few theorists have allowed themselves to diverge into the most extraordinary chains of musical and even of mathematical conjecture and have been easily led, in the practice of their ingenious learning, to forget that what they are talking about is the vehicle in which tremulous and ardent thoughts are conveyed to the hearts of men. The poet knows the law by instinct, but he treats it as a living guide; he varies the pause, he manipulates the accent, he gives the vital element of freedom to the verse which he has founded upon discipline. It is extremely doubtful whether any youthful poet was even helped by prosodical instruction; his earliest measures are imitative; he does not compose consciously in "tribrachs" and "iambs"; he would gape in astonishment if asked to define the "pyrrhichian hypothesis"; his bursts of enthusiasm are not modified by a theory of "trisyllabic equivalence." The old formula of verse, "variety in unity," holds good in all languages, countries and times; the delicate rapture involved in a brilliant combination of rhyme and metre is a matter which is regulated, indeed, on a consideration of the laws of prosody, but depends on other and wider qualities of a moral and an aesthetic order.

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(E. G.)

VERSECZ (Ger. *Werschetz*), a town of Hungary, in the county of Temes, 235 m. S.S.E. of Budapest by rail. Pop. (1900) 25,199. It has a handsome parish church and is the seat of a Greek Orthodox bishop. Versecz is one of the principal wine-producing centres in Hungary, and the red wines and brandy produced here enjoy a great reputation. Near the town are remains of a Roman castle, and a Roman rampart and trench which extend for about 60 m. to the north. During the revolutionary period of 1848–49 the Hungarians defeated the Servians here on the 11th of July 1848, while on the 19th of January 1849 the town was occupied by the Austrian troops.

VERTEBRATA, a large branch of the animal kingdom, of which the characteristic members are mammals, birds, reptiles, batrachians, fish and cyclostomes, the craniate vertebrates of modern zoology. These include all the animals which possess "vertebrae," pieces of bone or cartilage jointed to form a "backbone" or spinal column (see SPINAL CORD), although in some of the lower members of the group the segmentation of the spinal column is imperfect. That such animals formed a natural group was understood from the earliest times. Aristotle placed them together as "Enaima," or sanguineous animals, distinguishing them from the "Anaima," which he believed to be bloodless. Later it was discovered that the so-called bloodless animals contained uncoloured blood, and the vertebrates were distinguished as red-blooded, until G. L. C. F. D. Cuvier showed the existence of red blood in some other animals. C. Linnaeus made Mammalia, Aves, Amphibia and Pisces the first four classes of the animal kingdom, but suggested no corporate name for them. In 1788 A. J. G. K. Batsch united them into a great division, for which he proposed the name "Knochenthiere," bony animals. J. B. P. Lamarck carried the idea further, and first clearly recognized the importance of the vertebral column in classification; to him is due the division of the animal kingdom into Vertebrata, which included all the craniate vertebrates, and Invertebrata, which included all other animals. These names and the dichotomy they imply have persisted from their convenience, although zoological science has come to recognize that the groups are not morphologically equivalent and that the division is not logical. Cuvier showed that there were four groups in the animal kingdom, each corresponding to a definite type or plan of structure, and that craniate vertebrates composed only one of these groups, invertebrates including three. In the progress of zoology it has become clear that the coelomate animals fall into a very large number of distinct groups or types, and that the vertebrates are only one class amongst many morphologically distinct classes. It has been shown further that amongst the animals that Lamarck would have placed in the Invertebrata there are several which, although devoid of vertebrae or cranium, must be associated with vertebrates in any natural system. Closer investigation of the anatomy and embryology of the craniate vertebrates showed that the possession of a jointed vertebral column was not a fundamental characteristic of the group. In some creatures, such as sturgeons and lampreys, the position of the jointed vertebral column is occupied by an unjointed rod, the so-called notochord, whilst all the Vertebrata pass through an embryonic stage in which a similar elastic unjointed notochord exists as the precursor of the jointed column. It was further found that all the vertebrates of Lamarck displayed either in the embryonic condition alone, or both in embryonic and adult conditions, a set of passages leading from the anterior-lateral portion of the body into the cavity of the pharynx, and known as gill-slits, because in those creatures in which they become functional for aquatic respiration they lodge the gills or branchial tufts. Further, it was found that in all vertebrates the great central mass of the nervous system, known as the brain and spinal cord, is in reality a hollow tube with more or less thickened walls, developed as a strand of tissue along the dorsal surface of the embryo, which sinks downwards and inwards to form a hollow tube lying dorsal to the notochord.

In 1866 A. Kowalewsky, in a memoir that is one of the classics of vertebrate morphology, worked out the development of *Amphioxus*, then recognized as the simplest of the vertebrate group, and compared it with the development of an Ascidian, one of a group then termed Tunicate Mollusca, and showed that the latter creature, in its larval stage, possessed, like *Amphioxus*, a notochord, gill-slits and a hollow dorsally placed nerve-tube. In 1877 E. Ray Lankester published a classification of the animal kingdom in which he definitely associated all the Tunicates with the vertebrates, and subdivided Vertebrata as follows: Branch A., Urochorda, which contained the Tunicates and was characterized by the limitation of the notochord to the caudal region; Branch B., Cephalochorda, containing *Amphioxus*, in which the notochord extended from the extreme tip of the tail to that of the snout; Branch C., Craniata, containing the Cyclostomes, Pisces, Batrachia, Reptilia, Aves and Mammalia, in which the anterior extremity of the notochord ended in the base of a cranium. Later, F. M. Balfour adopted the system of Lankester, but proposed to replace the term Vertebrata, which was anatomically misleading, by the new term Chordata, as the latter term laid stress on the existence of the notochord as the fundamental character of the group. A. Kowalewsky had shown as early as 1866 that the marine worm *Balanoglossus*, described by Della Chiaje at the end of the 18th century, possessed a set of gill-slits similar to those of *Amphioxus* and Tunicates. From 1884 to 1886 W. Bateson published a series of studies in which he suggested that there was present in *Balanoglossus* a representative of the notochord, and that a portion at least of its nervous system was a hollow, dorsally placed tube. On these grounds, coupled with the presence of gill-slits, he proposed to add yet a lower branch to the Chordata, to include *Balanoglossus* and to be termed Hemichorda, but neither Bateson nor zoologists who have written since have accepted the vertebrate affinities of *Balanoglossus* with complete confidence. Still more diffidently, S. F. Harmer and others have suggested that *Cephalodiscus* and *Phoronis*, still more lowly marine invertebrates, have claims to be associated with the Chordata.

It may be accepted definitely that *Amphioxus* and the Tunicates must be associated with the craniate vertebrates of Lamarck. With regard to the terms Vertebrata and Chordata, usage still differs. Those who wish to make the names of the larger groups significant labels prefer the term Chordata, and on the whole seem to be prevailing, but there remain many zoologists who prefer the designation with historical associations, and regard it as immaterial if, in the advance of knowledge, the connotation may have been so changed that the term has become conventional rather than verbally significant.

The characters and affinities of the lower groups that have been included under Chordata are discussed in the articles HEMICHORDA, BALANOGLOSSUS, PHORONIDEA, PTEROBRANCHIA, TUNICATA and AMPHIOXUS, so that it is necessary here to deal only with the general characters of the Chordata or Vertebrata Craniata, and to consider the views that have been advanced with regard to the origin of vertebrates.

The Vertebrata Craniata share with the Cephalochordata the fundamental characters of the group Chordata. They are bilaterally symmetrical animals with a well-marked metameric segmentation of the muscles and muscle septa, with a gut opening by an anterior ventral mouth, with lateral gill-slits in the embryo or adult, and with a ventro-posterior anus; with a dorsal tubular central nervous system, under which lies in the embryo or adult an unsegmented notochord of endodermal origin; with the body prolonged posteriorly to the anus to form a metamerically segmented tail containing notochord, nervous system and muscles; with a spacious coelomic cavity and separate blood-vascular system. They differ from the Cephalochordata in the extreme cephalization of the anterior segments of the body, including the formation of an enlarged brain with paired sense organs, the nose, eyes and auditory apparatus, and the formation of a cranium, and in the structure of the skeleton, heart, liver and organs of excretion and reproduction.

Evidence points to the origin of the Cephalochordata and the Craniata from a common ancestor in which metameric segmentation of the mesoblast and the nervous system was complete and regular. This condition has been retained by *Amphioxus*, but in the Craniata has been much modified. The lateral mesoblastic plates with their contained coelom are unsegmented in craniates, although traces of the primitive segmentation are visible in the development of Cyclostomes. The dorsal mesoblastic somites with the segmental musculature derived from them retain the segmental condition in *Amphioxus* and in the trunk region of craniates, but in the head region of the latter there has taken place a fusion or cephalization more pronounced in the higher forms, where the head is distinct from the trunk, than in lower forms where the head passes gradually into the trunk. The exact number of somites which have been cephalized is difficult to estimate, and certainly varies in different cases, but it appears to be certain that three, immediately anterior to the otic region, have been transformed into the optic muscles. Those behind the otic region (metaotic somites) vary from nine to eleven, and in Cyclostomes give rise to segmental muscles in series with those of the trunk. In true fish and higher Craniates the anterior one or two of these metaotic somites practically disappear, whilst of the remainder none form complete segmental muscles, but various portions of them give rise to muscles associated with the branchial apparatus (epibranchial and hypobranchial), the dorsal portions fading away. In other words, the metameric series continued from the trunk to the anterior end of the body in the ancestral form, retained by the Cephalochorda, and of which traces remain in the development of the Craniata, has been modified in the adult Craniata by the suppression of certain portions and the specialization of other portions to form an unsegmented structure. The process of cephalization, with, however, less complete destruction of the segmental arrangement, has also affected the anterior nerves of Craniata and brought about the distinction between cranial and spinal nerves which is a feature of the Craniates. The ancestral form must be supposed to have given off from its central nervous system lateral nerves segmentally arranged in pairs. Each member of each pair possessed two roots, a dorsal and a ventral root, possibly remaining separate, as in the Cephalochordata and the cranial nerves of Craniata, possibly joining to form a common trunk, as in the spinal nerves of Craniata. The ventral roots consisted of motor fibres passing straight outwards to innervate the segmental muscles derived from the dorsal somites; the dorsal roots took a longer course, arching outwards and round the body to supply the visceral muscles, the mucous membranes, the skin and the sense organs connected with these. It appears, moreover, that the ventral roots remained in strict association with the muscular somites to which they corresponded, and wandered beyond their own segmental areas only with these muscles, whereas the ramifications of the dorsal fibres had a wider range and were less closely bound to segmental regions. Such a primitive condition has been retained by *Amphioxus*, but in the case of Craniata only by the spinal nerves. Almost every great anatomist has contributed to working out the history of the cranial nerves, and it would be a hopeless task to make a just allocation of credit for the various steps which have led to our present knowledge, but the names of C. Gegenbaur, F. M. Balfour, A. M. Marshall, J. W. van Wijhe, N. K. Koltzoff, Miss J. B. Platt, J. Beard, H. V. Neal and E. S. Goodrich are conspicuous. The Craniates are characterized by the presence of ten pairs of cranial nerves, numbered usually I. to X., from before backwards, with a course and distribution fundamentally identical throughout the group from the lowest fish to man, whilst in the higher forms an additional eleventh and twelfth pair have been assumed from the trunk or neck. Pairs I. and II. are the nerves of special sense of smell and sight, and in all probability are morphologically distinct from true segmental pairs. Pairs III. to X. represent various portions of primitive segmental pairs, modified in association with the cephalization of the anterior region of the body. III., IV. and VI. innervate the muscles of the eyeball, and represent the ventral roots of the three prootic somites; the dorsal root of the anterior of these three passes to the anterior portion of the head as the so-called *nervus ophthalmicus profundus*. The V. of human anatomy, the *trigeminal*, is formed almost entirely from the dorsal root of the nerve of the second prootic somite, whilst the VII. or *facialis* of human anatomy similarly represents the greater part of the dorsal root of the third prootic somite, whilst the remaining and lesser portion of that root forms the VIII. or *auditory* nerve of human anatomy. The IX. or *glossopharyngeal* represents the dorsal root of the first metaotic somite, the ventral root of which persists in Cyclostomes but disappears together with the somite in higher Craniates. The X. or *vagus* of human anatomy represents the dorsal root of the second metaotic somite. The backward extension of the vagus to supply the regions corresponding to the posterior gill-slits and internal viscera has been interpreted variously. The explanation at first sight most probable, and that has been advocated by Gegenbaur and many other anatomists, is that the dorsal roots corresponding to a number of somites have fused to form a single system. The ventral roots of the somites in question have a varying fate, being fully represented in the Cyclostomes by nerves to musculature developed from these somites, whilst in the higher forms thay have in great part disappeared. Evidence seems to point to a similar disappearance of the dorsal roots of the branchial somites posterior to the first supplied by the vagus; but as remnants of them have been traced in the development of the various Craniates, it seems as if the vagus were not in reality a compound nerve, but the extension of the nerve arising from a single dorsal segmental root. Notwithstanding some dubiety in detail, the main proposition remains clear: the cranial nerves of Craniates have arisen, in the course of a process of cephalization, from a primitive set of segmental nerves in series with those of the trunk, by a suppression of certain portions and an expansion and specialization of other portions. The work of a large number of anatomists has shown that the fundamental morphological characters of the cranium and brain, organs in which the Craniates are most clearly marked off from Cephalochordates, are fundamentally alike throughout the group. The original crude theory of L. Oken and the poet Goethe, that the skull was composed of expanded and fused vertebrae, was disproved by T. H. Huxley and Gegenbaur. There can be little doubt, however, that the region behind the infundibulum, consisting of part of the optic capsules, the anterior extremity of the notochord, the parachordals (for details as to these see article SKELETON) and the corresponding lateral and dorsal elements with their suspended visceral arches represent at least three cephalic somites, and that the process of cephalization has played an important part in the formation of the cranium as it has in the case of the nerves and muscles of the head. The region of the cranium anterior to this is probably a forward growth of the primitive head, produced in association with the development of the organs of smell and sight, and thus is different in kind from the posterior region. But as *Amphioxus* is obviously degenerate in the region of the head, no source of information exists as to the exact mode in which the development of the head of the ancestral vertebrate took place.

It is still less possible to lay down anything definite as to how far the structure of the brain of Craniates conforms with a theory of origin by a process of cephalization of metameric segments. The minute expansion at the anterior end of the nerve tube of *Amphioxus* cannot be called a brain, whilst the brain of all the Craniates is identical in morphological type and so complex that it must have behind it a long history of development. The embryonic Craniate brain appears as three dilatations of the neural tube, respectively the posterior or hind-brain, continuous with the spinal cord, the mid-brain and the fore-brain. From the hind-brain there arises the medulla oblongata or myelencephalon behind, and the metencephalon in front, the dorsal wall of which gives rise to the cerebellum. The hind-brain is closely similar in structure to the spinal cord, and gives rise to all the segmental cranial nerves except the *patheticus* and *motor oculi*. The sides of the mid-brain thicken and give rise to the optic lobes; its floor forms the crura cerebri, whilst the *oculomotor* and *patheticus* nerves take origin from it. The fore-brain divides into a posterior thalamencephalon and an anterior telencephalon. Thickenings of the floor of the thalamencephalon give rise to the optic thalami; the paired optic lobes grow out from its sides; the pineal body, which primitively was a pair of dorsal eyes, grows from the roof and the infundibulum from the floor. The telencephalon in front grows out secondarily to an extent progressively increasing in the higher groups and forms the corpora striata, the cerebral lobes and the rhinencephalon. The most plausible interpretation is that the mid- and hind-brains represent a cephalized continuation of the spinal cord, probably originally metamerically segmented, whilst the fore brain has been developed primitively in association with the organs of smell and hearing, and secondarily in connexion with the increasing elaboration of the higher functions of the brain and the development of the association centres of which the cerebrum is the seat.

The details of the structure and development of the sense-organs, gill-slits and visceral organs of Craniates are sufficiently discussed in the articles dealing with the separate classes of the group. It is necessary to refer, however, to new light thrown on the structure and morphology of the renal excretory organs due chiefly to the investigations of Goodrich. The excretory organs of the vast majority of invertebrate coelomate animals are essentially what are known as nephridia. Nephridia in their simplest form are excretory tubules growing from the exterior inwards, and removing from the surrounding tissues or blood vessels waste matter which they discharge to the exterior. In many cases these tubules acquire secondary openings to the coelom, termed nephrostomes and serving to remove waste matter from that space. Finally, in metamerically segmented invertebrates the nephridia frequently appear in segmentally disposed pairs. Gegenbaur, C. Semper, B. Hatschek, and many other anatomists have compared the kidneys of Craniates with nephridia, supposing the segmental tubules with their coelomic apertures to represent nephridia, which, instead of discharging directly to the exterior by pores in the segments in which they are situated, have come to discharge at each side into a longitudinal common duct with a posterior aperture. The excretory system of *Amphioxus* undoubtedly consists of true nephridia, morphologically identical with those of the invertebrate coelomates. The latter, however, may also possess a different set of organs, also frequently appearing as segmentally arranged tubules. These are the genital funnels which develop outwards from the coelom, and serve for the discharge of the genital products. It is with the latter that the segmental tubules of the Craniata are to be compared, and the possession of a different type of excretory organ is one of the most vital distinctions between the Craniata and the Cephalochordata.

Origin of the Vertebrata.—The recorded fossil history carries us backwards with comparative ease from the highest mammals to the lowest members of the Craniates. Remains of the latter, abundant in the palaeozoic rocks, were undoubtedly true Craniates, allied with the Cyclostomes and the lower fishes, but showing no more than superficial and dubious resemblances to the members of any other group. We have to rely upon general inferences which lead to much ingenious argument and little certain result. The Craniates can be traced back to fishes not unlike the modern shark or dogfish with little dubiety. The Cyclostomes, although true Craniates, present an obviously simpler type of structure: the head is less cephalized and therefore less distinct from the trunk; lower jaw, true teeth and dermal armature are absent, whilst there are other simplifications in the structural type. Very general assent could be obtained for the proposition that one stage in the ancestry of the Vertebrates must have been not unlike a simplified Cyclostome, a bilaterally symmetrical coelomic animal, elongated and fish-like in shape, but without paired limbs, with a smooth, soft skin, a ventral mouth without teeth or lower jaw and probably surrounded by labial palps, with lateral gill-slits and a ventro-posterior anus; with an unsegmented notochord and a dorsal tubular nerve cord. The brain, however, must have been expanded, and there must have been paired organs of smell, two lateral eyes and probably two dorsal eyes, and a large paired auditory apparatus. The mesoblastic system of muscles and fibrous skeleton was highly and regularly segmented, but in the anterior region cephalization had proceeded to a considerable extent. The resemblances between such a creature and *Amphioxus* are so close that they cannot be dismissed. *Amphioxus* no doubt is specialized in many respects, and probably degenerate in others, just as, if we go to the other pole of the Craniates, we know that although the Anthropoid Apes are the nearest living representatives of the ancestor of man, they are specialized in many respects and almost certainly degenerate in other respects. If we carry those processes of progressive change by which the Cyclostome type has passed into the low fish type, and the low fish type into the higher Craniate type, backwards towards *Amphioxus* we reach the conception of an ancestral creature essentially a Cephalochordate, differing no doubt from *Amphioxus* in various details, as one member of a group differs from another, but specially marked by the possession of better developed cranial sense organs and by the presence of a coelomostomic instead of a nephridial excretory system. Paired sense organs of an elaborate character have arisen in many groups, and there seems to be no special difficulty in supposing that those characteristic of Craniates have arisen independently in that group, *Amphioxus*, although in that respect partly degenerate, being degenerate from a stage in which the cephalic sense organs were extremely simple. The different type of excretory system presents even less theoretical difficulty, as both types of segmental funnel exist amongst Invertebrates and may even be present in the same animal. If we follow the process of progressive change still further back, we reach a stage in which cephalization had practically disappeared, and where even metameric segmentation was in a much less advanced condition. The tadpoles of Ascidians, and still more remotely *Balanoglossus*, although still less than *Amphioxus* to be regarded as actual ancestral vertebrate types, give images of some of the many phases in which the ancestral type may have been exhibited. It is needless to say that the creatures exhibiting such a stage in the ancestry of the Vertebrates would have formed simply one in the vast series of marine coelomate types which the anatomy of the Invertebrates shows us to have existed. Its distinguishing features would have been the presence of gill-slits, of the skeletal rod, known as the notochord, and of the dorsal tubular nervous system. We cannot make even profitable guesses as to the exact conditions under which these features, or the corresponding features of other coelomate types, arose in the kaleidoscopic differentiation of form, but consideration of the general morphology of the nervous system enables us to see the Chordate ancestor in its true perspective amongst other coelomic groups. In the Coelentera the nervous system appears as a diffused layer of cells and fibres, underlying, and in close connexion with, the epidermis. This diffused layer may thicken in special regions, forming rings round apertures, radial bands, and so forth, whilst in the intervening areas it disappears. In the different groups of Coelomates specialized bands and strands have formed in this way from a primitive diffuse system, giving rise to the nervous patterns distinctive of the various groups, whilst a second process, that of inward migration from the epidermis, produces further changes. In the Turbellaria there have been formed two ventro-lateral cords with variously placed anastamoses; in the Trematodes, two ventral, two lateral and two dorsal cords with variously placed anastomoses, and in the Cestodes two lateral and in some cases one dorsal cord. In the Nemertea the primitive continuous sub-epidermal sheath is retained with two lateral and sometimes one dorsal thickening. In the Nematodes there are one dorsal, one ventral and at each side two lateral thickenings, sometimes separated cords, sometimes mere sub-epidermal bands, whilst the traces of a circum-oesophageal ring may be regarded as another specialization of the primitive complete sheath. In *Balanoglossus* there is a continuous sheath with a dorsal and ventral band, the latter in certain regions showing traces of a tubular structure. In Annelids and Arthropods there are two ventral bands tending to unite in the median ventral line, and a circum-oesophageal collar. In the Chordates there is a continuous dorsal band, which secondarily migrates inwards and becomes tubular. In almost any of these types, as the individual becomes more integrated, there is a tendency for the nervous matter of the specialized areas to become still further massed; and in bilaterally symmetrical animals with forward progression and the beginning of cephalization a specially important mass forms something comparable with a brain in special relation with the sense organs of the primitive head. If the problem of vertebrate origin be considered from the wide point of view of comparative anatomy, it becomes no more difficult nor remarkable than the differentiation of any other type amongst simple, marine, unsegmented, or little segmented, wormlike creatures. It is obvious, however, that such a theory of origin cannot expect confirmation from the geological record, as it supposes a differentiation of the main chordate characters in a stage too simple to leave fossil remains.

Reference must be made, however, to definite theories of the origin of Vertebrates which have been successively urged by anatomists. A. Dohrn, if not the inventor, was the most ingenious advocate of the Annelid theory. He recognized the fundamental importance of segmentation in vertebrate structure and sought for a highly segmented ancestor. Partly influenced by Ray Lankester's studies on degeneration, he held that the apparently simplest living members of a group may give misleading clues with respect to the ancestral line, and he devoted much brilliant anatomical and embryological work to develop the thesis that *Amphioxus* and the Tunicates were degenerate offshoots from a higher vertebrate stock. He took a Chaetopod worm as the closest living representative of the stock of all segmented animals, and in particular of the Vertebrates, laying stress on the segmentation, the large coelom, the segmental excretory tubules, the vascular system with red blood, the segmentally disposed branchiae, the lateral organs of locomotion, and the tendency to form a distinct head. The chief difficulty was the nervous system, and this he explained by accepting an idea propounded many years before by De Blainville, that the dorsal surface of Vertebrates was homologous with the ventral surface of Annelids and Arthropods. He assumed that the ancestral type was a marine creature in which reversal of surface was of little physiological moment. He supposed that a new mouth had been formed, probably by a coalescence of a pair of gill-slits on what was to be the ventral surface of the vertebrate, and that the old invertebrate mouth with the downward turn of the anterior end of the alimentary canal, between the diverging ends of the ventral nerve cords, was to be sought for in the roof of the vertebrate brain, possibly the pineal body. Dohrn's theory has failed to find acceptance for many reasons, of which the chief are the difficulty as to reversal of surfaces, the knowledge that segmentation occurs independently in many groups of animals and in different organs, greater knowledge of the vascular, excretory and nervous systems, and in particular the discovery that the pineal body was a degenerate eye. F. M. Balfour from the first refused to accept Dohrn's theory and suggested that the dorsal position of the nerve cord in Vertebrates could be accounted for by supposing that the primitive condition was a lateral cord at each side such as were then known to occur in Nemertines, and that these cords had fused dorsally in Vertebrates, ventrally in Annelids. A. A. W. Hubrecht soon afterwards discovered the existence of a continuous nerve sheath in Nemertines, and he and Ray Lankester suggested a Nemertine origin for Vertebrates, and homologized the notochord with the proboscis sheath, Ray Lankester, in particular, pointing out that the tubular condition of the vertebrate nervous system was secondary, that it consisted essentially of a dorsal band, which sank inwards, and that the canal might have been at first an epidermal water canal. These authors were emphatic in laying stress on the view that no actual Nemertine could be supposed to represent the vertebrate ancestor, but that the Nemertines were to be taken merely as showing the kind of material out of which the vertebrate structure, and in particular the vertebrate nervous system, might have arisen. The view adopted in this article as given above, is in reality an extension of the Hubrecht-Lankester theory.

The theory of vertebrate origin that has been most elaborately expounded is W. H. Gaskell's hypothesis that they are descended from Arthropods. Gaskell accepts Dohrn's view of the importance of segmentation and of the degeneracy of *Amphioxus* and Tunicates, but rejects the conception of a reversal of surfaces. He takes the larval stage of a Cyclostome as the most generalized living representative of the essential vertebrate type, and selects *Limulus*, the kingcrab, in a very general way, as the closest living representative of such an Arthropod type as might have been the vertebrate ancestor. The starting-point of Gaskell's theory is the conception of the vertebrate nervous system as a band of nervous tissue which immediately underlies and gradually grows up round a distinct epidermal tube, the tube which forms the vesicles of the brain and the central canal of the spinal cord. Ray Lankester had already applied this to the Nemertine theory, but Gaskell urges that it affords an immediate comparison with Arthropod structures. The ventral mouth of *Limulus* leads vertically upwards through a ring of nervous tissue, the circumoesophageal commissure, into an expanded stomach, and from this the digestive tube runs back to the anus immediately dorsal to the ventral nerve chain. For Gaskell the infundibulum is the Arthropod oesophagus, the ventricles of the brain are the stomach, and the spinal canal leading back to fuse with the anus at the neurenteric canal is the Arthropod digestive tract. In the Vertebrate a new digestive tract has been formed, probably from a structure corresponding to the branchial chamber of Arthropods. The lateral halves of the ventral nervous system of the Arthropod, where they diverge on either side of the oesophagus, represent the crura cerebri of Vertebrates, whilst the supra-oesophageal ganglia represent the fore-brain. Gaskell has instituted an elaborate comparison, extending to very minute details of structure, and finds remarkable analogies between the organs of Arthropods and structures in the Vertebrates. From the palaeontological side, he points out that at the time when the earliest known Craniates were abundant, large Arthropods, essentially like *Limulus*, were also abundant. He thinks it probable that Vertebrates arose from a dominant invertebrate group, and points to many resemblances in detail between the Silurian Arthropods Palaeostraca and the Craniate Ostracoderms of the same horizon.

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VERTICAL (from Lat. *vertex*, highest point), the direction of the line of action of gravity, as determined by the plumb-line. *The angle of the vertical* is the angle between the direction of the plumb-line and that of the earth's centre (see Earth, Figure of the).

VERTUE, GEORGE (1684–1756), English engraver and antiquary, was born in St Martin's-in-the-Fields, London, in 1684. At the age of thirteen he was apprenticed to an heraldic engraver, a Frenchman, who failed in three or four years. Vertue then studied drawing at home, and afterwards worked for seven years as an engraver under Michael Vandergucht. He was patronized by Sir Godfrey Kneller, and was one of the first members of the Academy of Painting which that artist instituted in 1711. His plate of Archbishop Tillotson, after Kneller, commissioned by Lord Somers, established his reputation as an engraver; and he was soon in an excellent practice, engraving portraits after Dahl, Richardson, Jervas and Gibson. In portraiture alone he executed over five hundred plates. In 1717 he was appointed engraver to the Society of Antiquaries, and his burin was employed upon many interesting statues, tombs, portraits and other subjects of an antiquarian nature. He died on the 24th of July 1756, and was buried in the cloisters of Westminster Abbey.

From the year 1713 Vertue had been indefatigable in his researches on all matters connected with the history of British art, and had accumulated about forty volumes of memoranda on the subject. These were purchased by Horace Walpole, and form the basis of that author's *Anecdotes of Painting in England*, including an account of Vertue's life and a catalogue of his engravings. Vertue's own literary works include *On Holbein and Gerard's Pictures* (1740); *Medals, Coins, Great Seals, Impressions, from the Elaborate Works of Thomas Simon* (1753); *Catalogue and Description of King Charles the First's Capital Collection of Pictures, Limnings, Statues, &c.* (1757); *Catalogue of the Collection of Pictures belonging to King James II., to which is added a Catalogue of Pictures and Drawings in the Closet of Queen Caroline* (1758); *Catalogue of the Curious Collection of Pictures of George Villiers, Duke of Buckingham* (1758); *Description of the Works of that Ingenious Delineator and Engraver, W. Hollar* (1745).

VERTUMNUS (or Vortumnus, "turning," "changing"), in Roman mythology, the god of the changing year with its seasons, flowers and fruits, probably of Italian origin. Like Proteus, he had the power of assuming any shape he pleased, which enabled him to win the love of Pomona (*q.v.*). His shrine and statue (see the well-known description in Propertius iv. 2) were in the Vicus Tuscus, and from his connexion with this busy street he was regarded as having a special interest in trade and barter. At another sanctuary on the slope of the Aventine, sacrifice was offered to him every year on the 13th of August. It is probable that he was of Etruscan origin (see Wissowa, *Religion und Kultus der Römer*, 1902, p. 233).

VERULAMIUM, a Romano-British town situated in the territory of the Catuvellauni, close to the modern St Albans (Hertfordshire). Before the Roman conquest it was probably a native capital: afterwards it received the dignity of a *municipium* (implying municipal status and Roman citizenship). Tacitus tells us that the town was burnt by Boadicea in A.D. 61, but it again rose to prosperity. Its site is still easily recognizable. Its walls of flint rubble survive in stately fragments, and enclose an area of 200 acres. Of the internal buildings little is known. A theatre was excavated in 1847, and parts of the forum were opened by Mr William Page in 1898; both indicate a civilized and cultivated town. The complete uncovering of the site was planned in 1910. (F. J. H.)

VERVET, a Central and South African monkey, known as *Cercopithecus pygerythrus*. It is nearly allied to the grivet (*q.v.*), but distinguished (as indicated by its name) by the presence of a rusty patch at the root of the tail, and by the black (instead of grey) chin, hands and feet.

VERVIERS, a town of Belgium, in the province of Liége, not far from the Prussian frontier, and on the main line from Liége to Aix-la-Chapelle and Cologne. Pop. (1904) 49,168. It is a modern town owing its prosperity to the cloth trade which began here in the 18th century. It is situated on the Vesdre, which flows into the Ourthe a few miles before its junction with the Meuse; and the water of that river is supposed to be especially good for dyeing purposes. As the river water was insufficient to maintain the local industry an artificial reservoir was constructed at La Gileppe on the Hautes Fagnes, and an imposing aqueduct conveys the water stored on these highlands into Verviers. There are also extensive glass factories, but these have suffered from German competition, and many have been closed. A monument to a local celebrity named Chapuis is interesting for the reason that his execution by order of the prince-bishop of Liége was the last act of sovereignty taken by that prelate.

VESICA PISCIS (Fr. *amande mystique*), in architecture, the term given to a pointed oval panel formed by two equal circles cutting each other in their centres; this is a common form given to a panel in which the figure of Christ is represented. It is commonly employed in medieval seals, and especially those of bishops and monastic establishments.

VESOUL, a town of eastern France, capital of the department of Haute-Saone, 236 m. E.S.E. of Paris on the Eastern railway to Belfort. Pop. (1906) 8702. Vesoul is situated between the isolated conical hill of La Motte (1263 ft.) and the river Durgeon. The vine-clad hill, from which there is a fine view of the Jura and Vosges mountains, is crowned by a votive chapel which in 1855 replaced the old fortification. The medieval walls of the town, dating from the 13th and 15th centuries, still exist on its northern side, and in the narrow and winding streets are many old buildings. The church of St George dates from the 18th century. In the pleasant south-eastern quarter are the promenade and the Place de la République, with a monument to the Gardes Mobiles who fell in the war of 1870–71. Vesoul is the seat of a prefect, a tribunal of first instance and a court of assize, and has a lycée for boys, training colleges for both sexes, and a branch of the Bank of France. Distilling and the manufacture of files and tapioca are among the industries. The town is a market for farm-produce and cattle.

Vesoul (*Vesulium Castrum, Visolium, Vesulum*) is of ancient origin, but in existing records is first mentioned in the 9th century. It was originally a fief of the church of Besançon, and passed afterwards to the house of Burgundy, becoming, in the 13th century, capital of the bailiwick of Amont. The castle was destroyed in the 17th century. The town suffered much during the wars of religion and the Thirty Years' War. Vesoul belonged temporarily to France after the death of Charles the Bold, duke of Burgundy; was returned to the empire when Charles VIII., king of France, broke off his marriage with the daughter of Maximilian, king of the Romans; and again became part of France under Louis XIV. after the peace of Nijmwegen in 1678.

VESPASIAN, in full Titus Flavius Vespasianus, Roman emperor A.D. 70–79, was born on the 18th of November, A.D. 9, in the Sabine country near Reate. His father was a tax-collector and money-lender on a small scale; his mother was the sister of a senator. After having served with the army in Thrace and been quaestor in Crete and Cyrene, Vespasian rose to be aedile and praetor, having meanwhile married Flavia Domitilla, the daughter of a Roman knight, by whom he had two sons, Titus and Domitian, afterwards emperors. Having already served in Germany, in the years 43 and 44, in the reign of Claudius, he distinguished himself in command of the 2nd legion in Britain under Aulus Plautius. He reduced Vectis (Isle of Wight) and penetrated to the borders of Somersetshire. In 51 he was for a brief space consul; in 63 he went as governor to Africa, where, according to Tacitus (ii. 97), his rule was "infamous and odious"; according to Suetonius (*Vesp.* 4), "upright and highly honourable." He went with Nero's suite to Greece, and in 66 was appointed to conduct the war in Judaea, which was threatening general commotion throughout the East, owing to a widely spread notion in those parts that from Judaea were to come the future rulers of the world. Vespasian, who had a strong vein of superstition, was made to believe that he was himself to fulfil this expectation, and all manner of omens and oracles and portents were applied to him. He also found encouragement in Mucianus, the governor of Syria; and although a strict disciplinarian and reformer of abuses, he had a soldiery thoroughly devoted to him. All eyes in the East were now upon him; Mucianus and the Syrian legions were eager to support him; and on the 1st of July 69, while he was at Caesarea, he was proclaimed emperor, first by the army in Egypt, and then by his troops in Judaea. The legions of the East at once took the customary oath of allegiance. Nevertheless, Vitellius, the occupant of the throne, had on his side the veteran legions of Gaul and Germany, Rome's best troops. But the feeling in Vespasian's favour quickly gathered strength, and the armies of Moesia, Pannonia and Illyricum soon declared for him, and made him in fact master of half of the Roman world. They entered Italy on the north-east under the leadership of Antonius Primus, defeated the army of Vitellius at Bedriacum (or Betriacum), sacked Cremona and advanced on Rome, which they entered after furious fighting and a frightful confusion, in which the Capitol was destroyed by fire. The new emperor received the tidings of his rival's defeat and death at Alexandria, whence he at once forwarded supplies of corn to Rome, which were urgently needed, along with an edict or a declaration of policy, in which he gave assurance of an entire reversal of the laws of Nero, especially those relating to treason. While in Egypt he became more and more imbued with superstition, consulting astrologers and allowing himself to be flattered into a belief that he possessed a divine power which could work miracles. Leaving the war in Judaea to his son Titus, he arrived at Rome in 70. He at once devoted his energies to repairing the evils caused by civil war. He restored discipline in the army, which under Vitellius had become utterly demoralized, and, with the co-operation of the senate, put the government and the finances on a sound footing. He renewed old taxes and instituted new, increased the tribute of the provinces, and kept a watchful eye upon the treasury officials. By his own example of simplicity of life, he put to shame the luxury and extravagance of the Roman nobles and initiated in many respects a marked improvement in the general tone of society. As censor he raised the character of the senate, removing unfit and unworthy members and promoting good and able men, among them the excellent Julius Agricola. At the same time he made it more dependent upon the emperor, by exercising an influence upon its composition. He altered the constitution of the praetorian guard, in which only Italians, formed into nine cohorts, were enrolled. In 70 a formidable rising in Gaul, headed by Claudius Civilis, was suppressed and the German frontier made secure; the Jewish War was brought to a close by Titus's capture of Jerusalem, and in the following year, after the joint triumph of Vespasian and Titus, memorable as the first occasion on which a father and his son were thus associated together, the temple of Janus was closed, and the Roman world had rest for the remaining nine years of Vespasian's reign. The peace of Vespasian passed into a proverb. In 78 Agricola went to Britain, and both extended and consolidated the Roman dominion in that province, pushing his arms into North Wales and the Isle of Anglesey. In the following year Vespasian died, on the 23rd of June.

The avarice with which both Tacitus and Suetonius stigmatize Vespasian seems really to have been an enlightened economy, which, in the disordered state of the Roman finances, was an absolute necessity. Vespasian could be liberal to impoverished senators and knights, to cities and towns desolated by natural calamity, and especially to men of letters and of the professor class, several of whom he pensioned with salaries of as much as £800 a year. Quintilian is said to have been the first public teacher who enjoyed this imperial favour. Pliny's great work, the *Natural History*, was written during Vespasian's reign, and dedicated to his son Titus. Some of the philosophers who talked idly of the good old times of the republic, and thus indirectly encouraged conspiracy, provoked him into reviving the obsolete penal laws against this class, but only one, Helvidius Priscus, was put to death, and he had affronted the emperor by studied insults. "I will not kill a dog that barks at me," were words honestly expressing the temper of Vespasian. Much money was spent on public works and the restoration and beautifying of Rome—a new forum, the splendid temple of Peace, the public baths and the vast Colosseum being begun under Vespasian. The roads and aqueducts were repaired, and the limits of the *pomerium* extended.

To the last Vespasian was a plain, blunt soldier, with decided strength of character and ability, and with a steady purpose to establish good order and secure the prosperity and welfare of his subjects. In his habits he was punctual and regular, transacting his business early in the morning, and enjoying his siesta after a drive. He had not quite the distinguished bearing looked for in an emperor. He was free in his conversation, and his humour, of which he had a good deal, was apt to take the form of rather coarse jokes. He could jest, it was said, even in his last moments. "Methinks I am becoming a god," he whispered to those around him. There is something very characteristic in the exclamation he is said to have uttered in his last illness, "An emperor ought to die standing."

See Tacitus, *Histories*; Suetonius, *Vespasian*; Dio Cassius, lxvi.; Merivale, *Hist. of the Romans under the Empire*, chs. 57–60; H. Schiller, *Geschichte der römischen Kaiserzeit*, i. pt. 2; B. W. Henderson, *Civil War and Rebellion in the Roman Empire A.D. 69–70* (1908).

VESPERS (*officium vespertinum*), in the Roman Catholic liturgy, that part of the daily office which follows none (*nona*) and precedes compline (*completorium*). In it the Pater Noster, Ave Maria, Deus in Adjutorium, &c., are followed by five psalms and five antiphons, after which come the "little chapter," the hymn and the verse, which vary according to the season, the Magnificat and its antiphon, and the appropriate collect. In its general features the use of this office can be traced back to a very early date both in the Eastern Church and in the Western. Vespers may be said or sung at any time after midday, and in some circumstances even before it. (See BREVIARY.)

VESPERS, SICILIAN, the revolution of the Sicilians against the Angevin domination, so called because it broke out at the hour of Vespers on Easter Tuesday 1282. Charles I. of Anjou had encountered more resistance in conquering Sicily than on the mainland, as the people were more independent and more strongly attached to the house of Hohenstaufen; and consequently his government was more oppressive and cruel. The officials and the insolent French nobility whom he established in the island rode rough-shod over the privileges of the native aristocracy and the customs of the people, and the natives were ground down by heavy taxes and degrading personal services. The debased currency ruined trade, and the government treated the Sicilians with the utmost contempt. "The outrage of personal service," wrote Amari (*Guerra del Vespro*, ch. iv.), "exceeded the limits of feudalism as well as of the strangest and most brutal caprices. Noble and worthy men were forced to carry viands and wine on their shoulders to the tables of the foreigner, and many young nobles were constrained to turn the spit in his kitchens like scullions or slaves." The administration was more regular, and therefore more unyielding and heartless, than that of the Hohenstaufens, and also more foreign. Hatred of Angevin rule grew day by day, until the people were driven to revolt. According to tradition, the leader of the rising was Giovanni da Procida, a Salernitan noble with Sicilian connexions, who had been in the service of Hohenstaufens, but, having lost position and property after the fall of Conradin, he had taken refuge at the court of Peter III., king of Aragon, and induced him to try to make good his claims on Sicily, which were based on the rights of his queen, Costanza, daughter of Manfred. But as a matter of fact the actual outbreak was a purely unpremeditated popular movement. Charles at that time was making preparations for an attack on the East Roman empire, and extorting more money than ever from the Sicilians in order to meet his expenses. Peter availed himself of the fears which Charles's ambitions were arousing to open negotiations with his various enemies, especially with the Greek emperor, Michael Palaeologus, the Italian Ghibellines, the discontented Sicilian nobles, and perhaps with Pope Nicholas III. Suddenly the people of Sicily, goaded beyond endurance, rose against their rulers, regardless of these various plots. On the 31st of March 1282 a riot broke out in a church near Palermo, in consequence, according to tradition, of the insults of a French soldier towards a Sicilian woman, and a general massacre of the French began. The rising spread to the city, where the republic was proclaimed, and then through the rest of the island; thousands of French men, women and children were butchered (there may be some exaggeration in the wholesale character of the slaughter), and by the end of April the whole of Sicily was in the hands of the rebels. Charles at once led an expedition against the Sicilians and besieged Messina; and although the enemy had been expelled, they would hardly have been able to withstand this new invasion successfully had they not received assistance from Peter of Aragon and their own nobility, whose conspiracy they had so unexpectedly forestalled. This intervention, however, changed the character of the movement, and the free communes which had been proclaimed throughout the island had to submit to the royal prerogatives and to a revived feudalism. Peter, having reached Palermo in September 1282, accepted the Sicilian crown voluntarily offered to him, levied recruits, and declared war on Charles. Hostilities were carried on by land and sea, and the Angevin attacks on Messina were repulsed and followed up by raids on Calabria, where Reggio and other towns declared for King Peter. Charles proposed to settle the Sicilian question by a single combat between himself and Peter; but although the duel was agreed upon it never took place, owing to the mutual distrust of the two rivals. Peter created some discontent by conferring many offices in Sicily on Aragonese and Catalans, but at the parliament of Catania (1283) he undertook at his death to leave Aragon to his son Alphonso and Sicily to his younger son James, so that the two crowns should not be united, an arrangement which fell in with the Sicilians' aspirations towards independence. Pope Martin IV., unlike Nicholas III., threw the whole weight of his authority in favour of the Angevins, excommunicated Peter and the Sicilians, declaring that the former had forfeited even his rights to Aragon, conferred on Charles's expedition to reconquer the island the privileges of a crusade, and levied dimes throughout Christendom to supply the funds. The reason for this uncompromising attitude lies in the papal claim that Sicily was a fief of the Church, a claim which could only be enforced by means of the Angevins. But Charles's fleet was completely destroyed off Malta by that of the Sicilians and Aragonese, commanded by the Calabrese Ruggiero di Lauria (June 1283), and a second fleet met with a similar fate a year later in the bay of Naples, on which occasion Charles's son (afterwards Charles II., *lo Zoppo*) was captured. The Aragonese were now masters of the sea. Risings broke out even in the mainland provinces, and while Charles was preparing for a supreme effort to re-establish his authority he died (1285). Peter died soon after, but the war went on and spread to Aragon, which the Angevins, in virtue of the pope's excommunication of Peter, were trying to conquer. In 1287 the French encountered a fresh naval disaster at the hands of Lauria, and a force which they landed in Sicily was defeated. A two years' truce was now agreed upon, and Charles II. was liberated on his promising to renounce all claims on Aragon; but the pope Nicholas IV., who was determined that no peace should be made unless the Aragonese gave up the island, absolved him from his oath and crowned him king of the Two Sicilies (1289). Alphonso died in 1291, and was succeeded by his brother James, who took possession of the Aragonese crown, leaving his brother Frederick as governor of Sicily, thus uniting the two kingdoms, in violation of King Peter's promises. He then opened negotiations with Pope Boniface VIII. (they had been begun by Alphonso and Nicholas IV.), and eventually agreed to surrender the towns captured in the Neapolitan provinces to Charles II., and hand over Sicily to the Church, actually binding himself to assist in crushing the Sicilians if they resisted; in exchange he was to marry Charles's daughter, Bianca, and to receive Sardinia and Corsica, while Charles's cousin, Charles of Valois, was to renounce his claims on Aragon (1295). This treaty aroused bitter indignation in Sicily, where all classes determined to resist its execution at all costs. They found a leader in Frederick, who, rejecting all the pope's blandishments and bribes, threw in his lot with the Sicilians. For the sequel of the war see under FREDERICK III. of Sicily. Peace was made with the treaty of Caltabellotta in 1302, which left Sicily an independent kingdom under Frederick for that prince's lifetime; and although at his death it was to have reverted to the Angevins, he was actually succeeded by his son, and the island retained its independence for a considerable period. Undoubtedly the Vespers and its consequences revived Sicilian nationalism after the period of degrading Angevin oppression, and with the new dynasty a higher civilization, nearly rivalling that which had flourished under the Hohenstaufens, an improved constitution, and fine military qualities were the outcome.

BIBLIOGRAPHY.—The standard work on the subject is Michele Amari's *Guerra del Vespro* (2 vols. 8th ed., Florence, 1876), which is based on a study of the original authorities, but is too strongly prejudiced against the French; cf. L. Cadier's *Essai sur l'administration du royaume de Sicile par Charles I. et Charles II. d'Anjou* (fasc. 59 of the *Bibliothèque des écoles françaises de Rome et d'Athènes*, Paris, 1891); A. de Saint-Priest, *Histoire de la conquête de Naples par Charles d'Anjou* (Paris, 1847–49); F. Lanzani, *Storia dei communi d'Italia*, lib. v. ch. 3 (Milan, 1882); A. Cappelli's preface to the "Leggenda di Messer Giovanni da Procida," in *Miscellanea di opuscoli inediti o rari dei secoli XIV. XV.* (Turin, 1861). Among the original authorities, Ricobaldo Ferrarese (in Muratori, *Rer. Ital. script.* tom. ix.), the two biographies of Martin IV. (ibid.), Fra Corrado (ibid. tom. i.), the Catalan author of the "Gesta comitum Barcinonensium" (in Barluzio's *Marca Hispanica*, ch. 28) should be mentioned. A considerable list is given in Amari's *Guerra del Vespro*. (L. V.*)

VESPUCCI, AMERIGO (1451–1512), merchant and adventurer, who gave his name of *Amerigo* to the new world as *America*, was born at Florence on the 9th of March 1451. His father, Nastagio (Anastasio) Vespucci, was a notary, and his uncle, Fra Giorgio Antonio Vespucci, to whom he owed his education, was a scholarly Dominican and a friend of Savonarola. As a student Amerigo is said to have shown a preference for natural philosophy, astronomy and geography. He was placed as a clerk in the great commercial house of the Medici, then the ruling family in Florence. A letter of the 30th of December 1492 shows that he was then in Seville; and till the 12th of January 1496 he seems to have usually resided in Spain, especially at Seville and Cadiz, probably as an agent of the Medici. In December 1495, on the death of a Florentine merchant, Juanoto Berardi, established at Seville, who had fitted out the second expedition of Columbus in 1493, and had also undertaken to fit out twelve ships for the king of Spain (April 9th, 1495), Vespucci was commissioned to complete the contract. As Ferdinand, on the 10th of April 1495, recalled the monopoly conceded to Columbus (this order of April 10th, 1495, was cancelled on June 2nd, 1497), "private" exploring now had an opportunity, and adventurers of all kinds were able to leave Spain for the West. Vespucci claims to have sailed with one of these "free-lance" expeditions from Cadiz on the 10th of May 1497. Touching at Grand Canary on the way, the four vessels he accompanied, going thirty-seven days on a west-south-west course, and making 1000 leagues, are said to have reached a supposed continental coast in 16° N., 70° W. from Grand Canary (June 16th, 1497). This should have brought them into the Pacific. They sailed along the coast, says Vespucci, for 80 leagues to the province of Parias (or Lariab), and then 870 leagues more, always to the north-west, to the "finest harbour in the world," which from this description should be in British Columbia or thereabouts. Thence 100 leagues more to north and north-east to the islands of the people called "Iti," from which they returned to Spain, reaching Cadiz on the 15th of October 1498. Still following Vespucci's own statement, he, on the 16th of May 1499, started on a second voyage in a fleet of three ships under Alonzo de Ojeda (Hojeda). Sailing south-west over 500 leagues they crossed the ocean in forty-four days, finding land in 5° S. Thence, encountering various adventures, they worked up to 15° N., and returned to Spain by way of Antiglia (Española, San Domingo), reaching Cadiz on the 8th of September 1500. Entering the service of Dom Manuel of Portugal, Vespucci claims to have taken part in a third American expedition, which left Lisbon on the 10th (or 15th) of May 1501. Vespucci has given two accounts of this alleged third voyage, differing in many details, especially dates and distances. From Portugal he declares that he sailed to Bezeguiche (Cape Verde), and thence south-west for 700 leagues, reaching the American coast in 5° S. on the 7th (or 17th) of August. Thence eastward for 300 (150) leagues, and south and west to 52° S. (or 73° 30′; in his own words, "13° from the antarctic pole," *i.e.* well into the antarctic continent). He returned, he adds, by Sierra Leone (June 10th), and the Azores (end of July), to Lisbon (September 7th, 1502). His second Portuguese (and fourth and last American) voyage, as alleged by him, was destined for Malacca, which he supposed to be in 33° S. (really in 2° 14′ N.). Starting from Lisbon on the 10th of May 1503, with a fleet of six ships, and reaching Bahia by way of Fernando Noronha (?), Vespucci declares that he built a fort at a harbour in 18° S., and thence returned to Lisbon (June 18th, 1504). In February 1505, being again in Spain, he visited Christopher Columbus, who entrusted to him a letter for his son Diego. On the 24th of April 1505, Vespucci received Spanish letters of naturalization; and on the 6th of August 1508 was appointed *piloto mayor* or chief pilot of Spain, an office which he held till his death, at Seville, on the 22nd of February 1512.

If his own account had been trustworthy, it would have followed that Vespucci reached the mainland of America eight days before John Cabot (June 16th against June 24th, 1497). But Vespucci's own statement of his exploring achievements hardly carries conviction. This statement is contained (i.) in his letter written from Lisbon (March or April 1503) to Lorenzo Piero Francesco di Medici, the head of the firm under which his business career had been mostly spent, describing the alleged Portuguese voyage of March 1501–September 1502. The original Italian text is lost, but we possess the Latin translation by "Jocundus interpreter," perhaps the Giocondo who brought his invitation to Portugal in 1501. This letter was printed (in some nine editions) soon after it was written, the first two issues (*Mundus Novus* and *Epistola Albericii de Novo Mundo*), without place or date, appearing before 1504, the third, of 1504 (*Mundus Novus*), at Augsburg. Two very early Paris editions are also known, and one Strassburg (*De Ora Antarctica*) of 1505, edited by E. Ringmann. It was also included in the *Paesi novamente retrovati* of 1507 (Vicenza) under the title of *Novo Mondo da Alb. Vesputio*. The connexion of the new world with Vespucci, thus expressed, is derived from the argument of this first letter, that it was right to call Amerigo's discovery a new world, because it had not been seen before by any one. This prepared the way for the American name soon given to the continent. (ii.) In Vespucci's letter, also written from Portugal (September 1504), and probably addressed to his old schoolfellow Piero Soderini, gonfaloniere of Florence 1502–1512. From the Italian original (of which four printed copies still exist, without place or date, but probably before 1507) a French version was made, and from the latter a Latin translation, published at St Dié in Lorraine in April 1507, and immediately made use of in the *Cosmographiae Introductio* (St Dié, 1507) of Martin Waldseemüller (Hylacomylus), professor of cosmography in St Dié University. Here we have perhaps the first suggestion in a printed book that the newly discovered fourth part of the world should be called "America, because Americus discovered it." Since Alexander von Humboldt discussed the subject in his *Examen critique de l'histoire de la géographie du nouveau continent* (1837), vol. iv., the general weight of opinion (in spite of F. A. de Varnhagen, *Amerigo Vespucci, son caractère, ses écrits. . . sa vie . . .*, Lima, 1865, and other pro-Vespuccian works) has been that Vespucci did not make the 1497 voyage, and that he had no share in the first discovery of the American continent.

See also R. H. Major, *Prince Henry the Navigator* (London, 1868), pp. 367–88; F. A. de Varnhagen, *Le Premier voyage de Amerigo Vespucci* (Vienna, 1869); *Nouvelles recherches sur les derniers voyages du navigateur florentin* (Vienna, 1869); *Ainda Amerigo Vespucci, Novos estudos* (Vienna, 1874); Luigi Hugues, *Il terzo viaggio di A. Vespucci* (Florence, 1878); "Alcune considerazioni sul Primo Viaggio di A. Vespucci," in the *Bolletino* of the Italian Geographical Society, series ii. vol. x. pp. 248–63, 367–80 (Rome, 1885); "Il quarto Viaggio di A. Vespucci," in the same *Bolletino*, year xx., vol. xxiii. pp. 532–54 (Rome, 1886); "Sul nome 'America'" in the same *Bolletino*, series iii. vol. i. pp. 404–27, 515–30 (Rome, 1888), and an earlier study under the same title (Turin, 1886); "Sopra due lettere di A. Vespucci," in the same, series iii. vol. iv. pp. 849–72, 929–51 (Rome, 1891); *Narrative and Critical History of America*, edited by Justin Winsor, vol. ii. pp. 129–86 (1886); *The Letters of A. Vespucci* (translation, &c., by Clements R. Markham, London, Hakluyt Society, 1894); H. Harrisse, *A. Vespuccius* (London, 1895); Jos. Fischer and F. R. von Weiser, *The Oldest Map with the Name America . . .* (Innsbruck, 1903); Angelo Maria Bandini and Gustavo Uzielli, *Vita di Amerigo Vespucci* (Florence, 1898); B. H. Soulsby in the *Journal of the Royal Geographical Society* (London, February 1902), pp. 201–9. (C. R. B.)

VESSEL (O. Fr. *vaissel*, from a rare Lat. *vascellum*, dim. of *vas*, vase, urn), a word of somewhat wide application for many objects, the meaning common to them being capacity to hold or contain something. Thus it is a general term for any utensil capable of containing liquids, and for those tubular structures in anatomy, such as the arteries, veins or lymphatics, which contain, secrete or circulate the blood or lymph. Organs or structures which are largely supplied with vessels are said to be "vascular" (Lat. *vasculum*, another diminutive of *vas*). Vessel (as in French) is also a general term for all craft capable of floating on water larger than a rowing boat. The word is also familiar in Biblical phraseology in the figurative sense of a person regarded as the recipient of some Divine dispensation, a "chosen vessel," or as one into which something is infused or poured, "vessel of wrath."

VESTA (Gr. Ἑστία), the goddess of fire and the domestic hearth. The cults of the Greek Hestia (*q.v.*) and the Latin Vesta, both of which involved the guardianship of an ever-burning sacred fire, are most probably derived from a very early custom, common to a great variety of races in different ages. Among primitive peoples it became the custom for each village to maintain a constant fire for general use, to avoid the necessity of obtaining a spark by friction in case of the accidental extinction of all the village fires.[1] This fire, the central hearth of the village (*focus publicus*), became a sacred symbol of home and family life. The form of the primitive house in which the fire was preserved, probably a round hut made of wattled osiers daubed with clay, appears to have survived both in the circular prytaneum of the Greeks and in the Aedes Vestae (Temple of Vesta) in Rome. To watch this fire would naturally be the duty of unmarried women, and hence may have arisen the Roman order of virgin priestesses, the vestals, whose chief duty it was to tend the sacred fire.

The prehistoric method of getting a spark appears to have survived in the rule that, if ever the sacred fire of Vesta did go out, the negligent vestal was to be punished by scourging (Livy xxviii. 11), and the fire rekindled either by friction of dry sticks,[2] or, in later times, by the sun's rays brought to a focus by a concave mirror (Plut. *Numa*, 9). In the prytaneum (*q.v.*) which existed in every Greek state, a different form of cult was developed, though the essential point, the sacred fire, was kept up, just as in the Latin worship of Vesta; and in both cases the fire was extinguished annually at the beginning of the new year, and solemnly rekindled by one of the primitive and hence sacred methods.[1] In Rome this was done on the first day of March, the Latin New Year's Day (Ovid, *Fasti*, iii. 137–45). Among both Greek and early Latin races, at the founding of a new colony, fire was solemnly sent from the prytaneum of the mother colony to kindle a similar sacred fire in the new settlement. Thus we find that, according to tradition, the worship of Vesta in Rome was introduced from Alba Longa (Livy i. 20, and Ovid, *Fasti*, iii. 46), which appears to have been the oldest of the Latin colonies in Latium. The most generally received Latin legend attributes the founding of the Roman temple of Vesta to Numa, who transferred the centre of the cult from Alba, together with the four vestal virgins, its priestesses (Plut. *Numa*, 10). One of the later kings, either Tarquin I. or Servius Tullius, is said to have increased the number to six (Dion. Hal. iii. 67, and Plut. *Numa*, 10), and it is not till the last years of the pagan period that we hear of a seventh vestal having been added (see Ambrose, *Epist.*, ed. Pareus, p. 477; also Plut. *Rom.* and *Cam.*).

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[1] J. G. Frazer in the *Journal of Philology* (vol. xiv. pp. 145–72), "The Worship of Vesta and its Connexion with the Greek Prytaneum," gives many examples of a similar custom still surviving among various savage races.

[2] An allusion to the earliest method of obtaining fire by rubbing two sticks together is probably contained in the myth of Prometheus, who brought fire to mortals hidden in a hollow wand.

The election (*captio*) of the vestal during the early period of Rome was in the hands of the king, and in those of the pontifex maximus under the republic and empire,[2] subject, however, to the following conditions (Aul. Gell. i. 12): (1) the candidate was to be more than six and less than ten years of age; (2) she was to be *patrima* and *matrima*, *i.e.* having both parents alive; (3) free from physical or mental defects; (4) daughter of a free-born resident in Italy. Certain details of the election were arranged subject to the provisions of the Lex Papia, now unknown. The selected child had her hair cut off, and was solemnly admitted by the pontifex maximus, who held her by the hand, and, addressing her by the name *amata*, pronounced an ancient formula of initiation, which is given by Aulus Gellius. In early times there were certain rules by which girls could be excused from serving as vestals, but the honour soon became so eagerly sought that these provisions were practically useless. Vows were taken by the vestal for a period of thirty years, after which she was free to return to private life and even to marry—which she very rarely did (Aul. Gell. vi. 7). This period of thirty years was divided into three decades: during the first the vestal learnt her duties; during the second she practised them; and during the third she instructed the young vestals. The special dignity of chief of the vestals (*virgo vestalis maxima*) was reached in order of seniority. The inscriptions on the pedestals of statues of various *vestales maximae* show that a number of different grades of honour were passed through before reaching the highest dignity or *maximatus*.[3]

The duties of the vestals, besides the chief one of tending the holy fire (Cic. *De Leg.* ii. 8), consisted in the daily bringing of water from the sacred spring of Egeria, near the Porta Capena, to be used for the ceremonial sweeping and sprinkling of the Aedes Vestae.[4] They also offered sacrifices of salt cakes—*muries* and *mola salsa*—and poured on the altar of sacred fire libations of wine and oil, as is represented on the reverses of several first brasses and medallions of the empire. The vestals were bound to offer daily prayers for the welfare of the Roman state, and more especially in times of danger or calamity (Cic. *Pro Font.* 21). They were also the guardians of the seven sacred objects on which the stability of the Roman power was supposed to depend: the chief of these was the Palladium, a rude archaic statue of Pallas, which was said to have been brought by Aeneas from the burning Troy. This sacred object was never shown to profane eyes, but it is represented on the reverse of a coin struck by Antoninus Pius in honour of his deified wife Faustina. Strict observance of the vow of chastity was one of the chief obligations of the vestals, and its breach was punished by burial alive at a place near the Porta Collina known as the Campus Sceleratus (see Livy viii. 15 and 89; Plin. *Ep.* iv. 11; and Suet. *Dom.* 8). Cases of unchastity and its punishment were rare; and, as the evidence against the vestal was usually that of slaves, given under torture, it is probable that in many instances an innocent vestal suffered this cruel death.

The privileges of the vestals and their influential position were very remarkable. They were exempt from any *patria potestas*, except that of the pontifex maximus, their religious father; they could dispose by will of their property, and were in most respects not subject to the Roman laws ("legibus non tenetur," Servius, on Virg. *Aen.* xi. 204; cf. Gaius i. 130, and Dio Cass. lvi. 10). This involved freedom from taxes, and the right to drive through the streets of Rome in carriages (*plostrum* and *currus arcuatus*). Some bronze plates have been found which were once attached to the carriages of vestals; the inscription on one of them runs thus: *Flaviae Publiciae v.v. maximae inmunis in jugo* (see *C.I.L.* vi. 2146–2148; cf. also Prudentius, *Contra Symm.* ii. 1088). They were preceded by a lictor when appearing on state occasions, and enjoyed other semi-royal honours (Plut. *Numa*, 10, and Dio Cass. xlvii. 19). At theatres and other places of amusement they occupied the best seats, except at some of the nude athletic contests, from which they were excluded; they also took an important part in all the grand religious and state ceremonies, as when the pontifex maximus offered sacrifice on the occasion of a triumph before the temple of Capitoline Jupiter. They had power to pardon any criminal they met in the street on his way to execution, provided that the meeting were accidental. The vestals alone shared with the emperors the privilege of intramural burial (Serv. on Virg. *Aen.* xi. 206). During life they were richly dowered by the state (Suet. *Aug.* 31), and had public slaves appointed to serve them (see Tac. *Hist.* i. 43). They were also the guardians of the emperor's will, and of other important documents of state (Suet. *J. Caes.* 83, and *Aug.* 101; Tac. *Ann.* i. 8; Plut. *Anton.* 58; and Appian, *Bell. Civ.* v. 73). Their influence in the appointment to many offices, both religious and secular, appears to have been very great. Many of the statues to the chief vestals which were found in the Atrium Vestae in 1883–1884 have pedestals inscribed with a dedication recording that benefits had been conferred on the donor by the vestalis maxima. Lastly, they lived in a style of very great splendour; their house, the Atrium Vestae, which stood close by the Aedes Vestae, was very large and exceptionally magnificent both in decoration and material (see ROME, *Archaeology*, § "Forum Romanum" and map).

The discovery already mentioned of a number of statues of vestales maximae has thrown new light on the dress of the vestals.[5] With one or two exceptions the costume of these statues is much the same they have a long sleeveless tunic (*stola*), girdled by the *zona* immediately below the breast. One only wears the *diploidion* over the upper part of her figure. The outer garment is an ample *pallium*, wrapped round the body in a great variety of folds, and in some cases brought over the head like a hood. All seem to have long hair, showing that the process of cutting off the hair at initiation was not repeated. One figure wears the *suffibulum*, a rectangular piece of white cloth bordered by a purple stripe, worn over the head and fastened on the breast by a *fibula*. According to Festus (ed. Müller, p. 348), this sacred garment was worn by the vestals only during the act of sacrificing (see also Varro, *De Ling. Lat.* vi. 21). In all cases the head is closely bound by *vittae*, rope-like twists of woollen cloth, the ends of which usually fall in loops on each shoulder (see Servius on Virg. *Aen.* x. 538).

The *Regia*, the official *fanum* of the pontifex maximus, was adjacent to the vestals' house:—

> "Hic locus est Vestae, qui Pallada servat et ignem;
> Hic fuit antiqui Regia parva Numae."[6]

When Augustus, after his election to the office of pontifex maximus in 12 B.C., moved his place of residence from the Regia to the Palatine, he built a new Aedes Vestae near his palace, in the magnificent Area Apollinis. This appears to have been a copy of the older temple of Vesta. No traces of it now exist; but Pirro Ligorio, in the latter part of the 16th century, made some sketches of what then existed of this second temple, to illustrate his great MS. on Roman antiquities, which is now preserved in the royal library at Turin (see Ovid, *Fasti*, iv. 949–954, and *Metam.* xv. 864). The original course of the Sacra Via passed close to the temple of Vesta; but the road was clumsily built over in the 3rd and 4th centuries.

The chief festival in honour of Vesta, the Vestalia, was held on the 9th of June (Ovid, *Fasti*, vi. 249), after which the temple was closed for five days for a ceremonial cleansing. In private houses the feast was celebrated by a meal of fish, bread and herbs, eaten, not on the usual triclinium, but by the domestic hearth, in front of the effigies of the Dii Penates (Ovid, *Fasti*, vi. 309–310). The feast, inaugurated by Augustus in honour of Vesta Palatina, was held on the 28th of April, the anniversary of its consecration.

With regard to statues of the goddess, though the Greek Hestia was frequently represented in plastic art, yet among the Romans

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[1] Fire obtained in this way, that is, "pure elemental fire," was commonly thought to possess a special sanctity. Even throughout the middle ages in Catholic countries, at Easter, when the new year began, the old pagan rite survived (see LIGHTS, CEREMONIAL USE OF.)

[2] From the time of Augustus the emperors themselves held the office of chief pontiff, and with it the privilege of electing the vestals.

[3] These inscriptions are printed in Middleton, *Ancient Rome in 1885*, pp. 200–6, and in *Archaeologia*, xlix. 414–22.

[4] The shrine of Vesta was not a *templum*, in the strict Roman sense, as it was not consecrated by the augurs, its sanctity being far above the necessity of any such ceremony. Other natural springs might be used for the daily sprinkling, but it was forbidden to use water brought in a pipe or other artificial conduit (Tac. *Hist.* iv. 53); see also Guhl and Koner, *Das Leben der Griechen und Römer* (Eng. trans. by F. Hueffer, 1875).

[5] These statues appear to have been the work of a privileged class of sculptors, who enjoyed the title of "fictores virginum vestalium"—an honour which is recorded in some of the dedicatory inscriptions on the pedestals.

[6] Ovid, *Tristia*, iii. 29.

Vesta appears to have been rarely so treated. The Athenian prytaneum contained a statue of Hestia. But there was no effigy in the Roman temple of Vesta, although one is commonly shown on reverses of coins which have a representation of the temple, and it appears to have been commonly thought in Rome that a statue of Vesta did exist inside her shrine—a mistake which Ovid corrects (*Fasti*, vi. 297–300). No Roman statue now known can be certainly considered to represent Vesta, though a very beautiful standing figure of a female with veiled head (in the Torlonia collection) has, with some probability, had this name given to it.

The worship of Vesta appears to have died out slowly in the 4th century, after the adoption of Christianity as the state religion by Constantine, and in 382 Gratian confiscated the Atrium Vestae. Zosimus (*Hist. Nov.* v. 38) tells an interesting story of a visit made to it at the end of the 4th century by Serena, the wife of the Vandal Stilicho, who took a valuable necklace from one of the statues, in spite of the remonstrances of an aged woman, the last survivor of the vestal virgins. Soon after that time the building appears to have fallen into decay, its valuable marble linings and other ornaments having been stripped from its walls.

AUTHORITIES.—For the Atrium and the Aedes Vestae see ROME, *Archaeology* (footnote *ad loc.*). See also Wissowa, *Relig. und Kultus der Römer* (1902) and authorities under HESTIA. (J. H. M.; X.)

VESTERÅS, or WESTERÅS, a town and bishop's see of Sweden, capital of the district (*län*) of Vestmanland, on a northern bay of Lake Mälar, 60 m. N.W. by W. of Stockholm by rail. Pop. (1900) 11,999. It is a considerable industrial centre and an important lake port. Its Gothic cathedral, rebuilt by Birger Jarl on an earlier site, and consecrated in 1271, was restored in 1850–1860, and again in 1896–1898. The episcopal library contains the valuable collection of books which Oxenstjerna, the chancellor of Gustavus Adolphus, brought away from Mainz near the end of the Thirty Years' War. A castle commands the town from an eminence; it was captured by Gustavus Vasa and rebuilt by him, and again in the 17th century, and remains the seat of the provincial government. Here Eric XIV., whose tomb is in the cathedral, was confined (1573–1575). Several national diets were held in this town, the most notable being those of 1527, when Gustavus Vasa formally introduced the Reformation into Sweden, and 1544, when he had the Swedish throne declared hereditary in his family. The original name of the town was Vestra Aros ("western mouth"), in distinction from Östra Aros, the former name of Upsala.

VESTIBULE (from Lat. *vestibulum*), the architectural term given to an antechamber next to the entrance and preceding the hall; it is also applied to the anteroom of any large apartment. The word is connected, like Vesta (*q.v.*), with the Sanscrit root *vas-*, to dwell, inhabit. In medieval Latin it was occasionally used, instead of *vestiarium*, for a vestry (see Du Cange, *Gloss. med. lat.*, s.v.), which is derived from Lat. *vestis*, clothing.

VESTINI, an ancient Sabine tribe which occupied the eastern and northern bank of the Aternus in central Italy, entered into the Roman alliance, retaining its own independence, in 304 B.C., and issuing coins of its own in the following century. A northerly section round Amiternum near the passes into Sabine country probably received the Caerite franchise soon after. In spite of this, and of the influence of Hadria, a Latin colony founded about 290 B.C. (Livy, *Epit.* xi.), the local dialect, which belongs to the north Oscan group, survived certainly to the middle of the 2nd century B.C. (see the inscriptions cited below) and probably until the Social War. The oldest Latin inscriptions of the district are *C.I.L.* ix. 3521, from Furfo with Sullan alphabet, and 3574, "litteris antiquissimis," but with *couraverunt*, a form which, as intermediate between *coir-* or *coer-* and *cur-*, cannot be earlier than 100 B.C. (see LATIN LANGUAGE). The latter inscription contains also the forms *magist[r]es* (nom. pl.) and *ueci* (gen. sing.), which show that the Latin first spoken by the Vestini was not that of Rome, but that of their neighbours the Marsi and Aequi (*qq.v.*). The inscription of Scoppito shows that at the time at which it was written the upper Aternus valley must be counted Vestine, not Sabine, in point of dialect.

See further PAELIGNI and SABINI, and for the inscriptions and further details, R. S. Conway, *The Italic Dialects*, pp. 258 ff., on which this article is based. (R. S. C.)

VESTMENTS. The word "vestment" (Lat. *vestimentum*, fr. *vestire*, to clothe), meaning generally simply an article of clothing, is in the usage of the present day practically confined to the ceremonial garments worn in public worship; in this sense it may be used equally of the robes or "ornaments" of the ministers or priests of any religion. Ecclesiastical vestments, with which the present article is solely concerned, are the special articles of costume worn by the officers of the Christian Church "at all times of their ministration"—to quote the Ornaments Rubric of the English Book of Common Prayer, *i.e.* as distinct from the "clerical costume" worn in everyday life. Ecclesiastical vestments may again be divided into two categories: (1) liturgical vestments, (2) non-liturgical vestments. Liturgical vestments, as their name implies, are those which are especially associated with the various functions of the liturgy. Of these again, according to the fully developed rules of the Catholic Church, there are three classes: (1) vestments worn only at the celebration of mass—chasuble, maniple, pontifical gloves, pontifical shoes, the pallium and the papal fanone and *subcinctorium*; (2) vestments never worn at mass, but at other liturgical functions, such as processions, administration of the sacraments, solemn choir services, *i.e.* cope and surplice; (3) vestments used at both—alb, amice, girdle, stole, dalmatic, tunicle. Non-liturgical vestments are those, *e.g.* cappa magna, rochet, which have no sacral character, have come into use from motives of convenience or as insignia of dignity, and are worn at secular as well as ecclesiastical functions.

In the controversies as to the interpretation of the Anglican "Ornaments Rubric" (see below) the term "vestments" has been applied particularly to those worn at the celebration of mass, which is what is meant when it is said that "the vestments" are worn at such and such a church. This restriction of the term has some historical justification: in the First Prayer Book of Edward VI. the word "vestment" is used as synonymous with but one liturgical garment—the chasuble, the "mass vestment" *par excellence*; in the Prayer Book of 1559 "vestments" are eliminated altogether, "ornaments" being substituted as a more comprehensive term. As to the use of the word, it must be further stated that it is also technically applied to altar cloths, the altar being "vested" in frontal (*antependium*) and super-frontal (see ALTAR).

The subject of ecclesiastical vestments is not only one of great interest from the point of view of archaeology and art, but is also of importance, in so far as certain "ornaments" have become historically associated with certain doctrines on which the opinion of the Christian world is sharply divided. The present article can only give a brief outline of a subject as intricate as it is vast, frequently also extremely obscure, and rendered still more obscure by the fact that those who have applied themselves to it have too often done so in anything but a scientific spirit. It will deal briefly (1) with the general idea and the historical evolution of ecclesiastical vestments, (2) with the vestments as at present worn (*a*) in the Roman Catholic Church, (*b*) in the Oriental Churches, (*c*) in the Reformed Churches, (*d*) in the Anglican Church. The more important vestments are dealt with in some detail under their separate headings; here it will only be necessary to give short descriptions of those which cannot be conveniently treated separately.

1. *The Origin and Idea of Ecclesiastical Vestments.*—The liturgical vestments of the Catholic Church, East and West, are not, as was at one time commonly supposed, borrowed from the sacerdotal ornaments of the Jewish ritual, although the obvious analogies of this ritual doubtless to a certain extent determined their sacral character; they were developed independently out of the various articles of everyday dress worn by citizens of the Graeco-Roman world under the Empire. The officers of the Church during the first few centuries of its existence were content to officiate in the dress of civil life, though their garments were expected to be scrupulously clean and of decent quality. The few scattered references in contemporary records to the dress of the clergy all point to this as the only recognized rule.

Thus in the 37th of the so-called "Canons of Hippolytus" we read: "As often as the bishops would partake of the Mysteries, the presbyters and deacons shall gather round him clad in white, quite particularly clean clothes, more beautiful than those of the rest of the people." Thus, too, St Jerome, in his commentary on Ezek. xliv. 19, says that "We, too, ought not to enter the Holy of Holies in our everyday garments . . . when they have become defiled from the use of ordinary life, but with a clean conscience, and in clean garments, hold in our hands the Sacrament of the Lord."

When, in the year 289, St Cyprian was led to martyrdom, he wore, according to Eusebius (*Hist. eccles.* iv. cap. 11), an under tunic (*linea*), an upper tunic (*dalmatica, tunica*) and mantle (*lacerna, byrrus*). This was the ordinary type of the civil costume of the time. The tunica, a loose sack-like tunic with a hole for the head, was the innermost garment worn by all classes of Roman citizens under the republic and empire. It was either sleeveless (*colobium*) or sleeved (*tunica manicata* or *manuleata*), and originally fell about to the knee, but later on reached to the ankles (*tunica talaris*). St Augustine (*De doctr. christ.* iii. cap. 10, n. 20) says that to wear *talares et tunicas manicatas* was a disgrace among the ancient Romans, but that in his own day it was no longer so considered in the case of persons of good birth. The tunica was originally of white wool, but in the 3rd century it began to be made of linen, and from the 4th century was always of linen. About the 6th century the long *tunica alba* went out of fashion in civil life, but it was retained in the services of the Church and developed into the various forms of the liturgical alb (*q.v.*) and surplice (*q.v.*). The *tunica dalmatica* was a long, sleeved upper tunic, originating, as its name implies, in Dalmatia, and first becoming fashionable at Rome in the 2nd century; it is the origin of the liturgical dalmatic and tunicle (see Dalmatic). Another over-dress of the Romans was the *paenula*, a cloak akin to the *poncho* of the modern Spaniards and Spanish Americans, *i.e.* a large piece of stuff with a hole for the head to go through, hanging in ample folds round the body. This was originally worn only by slaves, soldiers and other people of low degree; in the 3rd century, however, it was adopted by fashionable people as a convenient riding or travelling cloak; and finally, by the sumptuary law of 382 (*Cod. Theod.* xiv. 10, 1, *de habitu . . . intra urbem*) it was prescribed as the proper everyday dress of senators, instead of the military chlamys, the toga being reserved for state occasions. This was the origin of the principal liturgical vestment, the chasuble (*q.v.*).

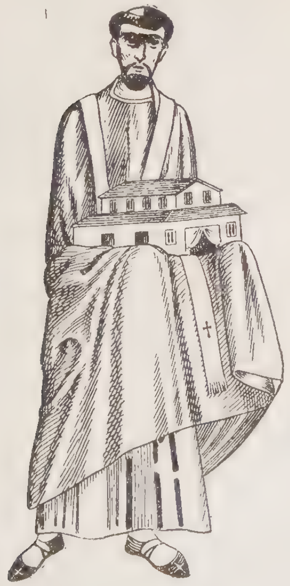

Fig. 1.—Pope Honorius (d. 638). From a mosaic in S. Agnese in Rome.

As late as the 6th century these garments were common both to the clergy and laity, and, so far as their character was concerned, were used both in the liturgy and in everyday life. Meanwhile, however, a certain development had taken place. By the 4th century the garments worn at liturgical functions had been separated from those in ordinary use, though still identical in form. It is in the 4th century, too, that the first distinctive vestment makes its appearance, the ὠμοφόριον worn by all bishops in the East; in the 5th century we find this in use at Rome under the name of *pallium* (*q.v.*), as the distinctive ornament of the pope (see fig. 1). About the same time the *orarium*, or stole (*q.v.*), becomes fixed in liturgical use. The main development and definition of the ecclesiastical vestments, however, took place between the 6th and the 9th centuries. The secular fashions altered with changes of taste; but the Church retained the dress with the other traditions of the Roman Empire. At Rome, especially, where the popes had succeeded to a share of the power and pretensions of the Caesars of the West, the accumulation of ecclesiastical vestments symbolized a very special dignity: in the second quarter of the 9th century the pope, when fully vested, wore a *camisia* girdled, an alb (*linea*) girdled, an amice (*anagolaium*), a tunicle (*dalmatica minor*), a dalmatic (*dalmatica major*), stole (*orarium*), chasuble (*planeta*) and pallium. With the exception of the pallium, this was also the costume of the Roman deacons. By this time, moreover, the liturgical character of the vestments was so completely established that they were no longer worn instead of, but over, the ordinary dress.

Hitherto the example of the Roman Church had exercised no exclusive determining influence on ritual development even in the West. The popes had, from time to time, sent the pallium or the dalmatic—specifically Roman vestments—as gifts of honour to various distinguished prelates; Britain, converted by a Roman mission, had adopted the Roman use, and English missionaries had carried this into the newly Christianized parts of Germany; but the great Churches of Spain and Gaul preserved their own traditions in vestments as in other matters. From the 9th century onwards, however, this was changed; everywhere in the West the Roman use ousted the regional uses.

This change synchronized with the revival of the Western Empire under Charlemagne, a revival which necessarily gave an impulse to the claims of the see of Rome. The adoption of the Roman liturgical dress had, however, at most an indirect connexion with these claims. Charlemagne was active in prescribing the adoption of the Roman use; but this was only as part of his general policy in the organization of his empire. A renovation of the Gallican Church was not the least crying need; and, in view of the confusion of rites (Gallican, Gothic, Roman, Ambrosian) in the Frankish empire, Charlemagne recognized that this innovation could only be effectually carried out by a closer connexion with Rome in ritual as in other matters. Charlemagne's activity in this respect was, in effect, but the completion of a process that had been going on since the 6th century. Whatever effect the reinvigoration of the papacy may have had in hastening the process, the original impulse towards the adoption of the Roman rite had proceeded, not from Rome, but from Spain and Gaul; it was the natural result of the lively intercourse between the Churches of these countries and the Holy See. Nor was the process of assimilation by any means one-sided. If Spain and Gaul borrowed from Rome, they also exercised a reciprocal influence on the Roman use; it is interesting to note in this connexion, that of the names of the liturgical vestments a very large proportion are not of Roman origin, and that the non-Roman names tended to supersede the Roman in Rome itself.[1]

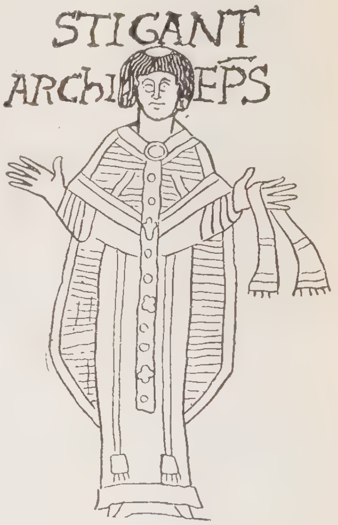

Fig. 2.—Stigand, Archbishop of Canterbury (1052–1070); from the Bayeux Tapestry. Note the absence of the mitre, the chasuble short or tucked up in front, the maniple still carried in the left hand.

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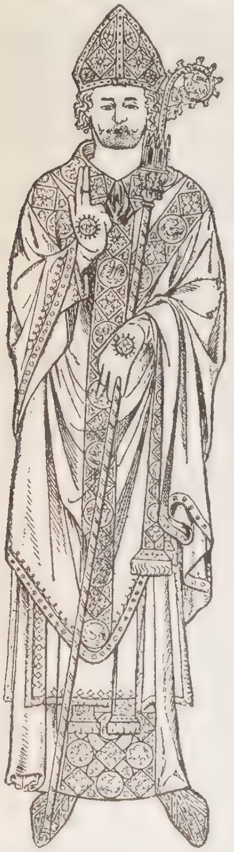
[1] Apart from the archiepiscopal pallium, the Churches of Spain and Gaul had need to borrow from Rome only the dalmatic, maniple and liturgical shoes. On the other hand, it was from Spain and Gaul that Rome probably received the *orarium* (stole) as an ensign of the major orders. Father Braun, to whose kindness the writer is indebted for the above account of the causes of the ritual changes in the Carolingian epoch, adds that the papacy was never narrow minded in its attitude towards local rites, and that it was not until the close of the middle ages, when diversity had become confusion and worse, that it began to insist upon uniformity. Even then it allowed those rites to survive which could prove a tradition of 200 years.

The period between the 9th and the 13th centuries is that of the final development of the liturgical vestments in the West. In the 9th century appeared the pontifical gloves; in the 10th, the mitre; in the 11th, the use of liturgical shoes and stockings was reserved for cardinals and bishops. By the 12th century, mitre and gloves were worn by all bishops, and in many cases they had assumed a new ornament, the *rationale*, a merely honorific decoration (supposed to symbolize doctrine and wisdom), sometimes of the nature of a highly ornamental broad shoulder collar with dependent lappets; sometimes closely resembling the pallium; rarely a "breast-plate" on the model of that of the Jewish high priest.[1] This elaboration of the pontifical vestments was contemporaneous with, and doubtless partly determined by, the assimilation of the bishops during those centuries to the type of the great feudal nobles whose ambitions and love of pomp they shared.

In an age when, with the evolution of the feudal organization of society, even everyday costume was becoming a uniform, symbolizing in material and colour the exact status of the wearer, it was natural that in the parallel organization of the Church the official vestments should undergo a similar process of differentiation and definition. With this process, which in all its essential features was completed in the 11th century, doctrinal developments had little or nothing to do, though from the 9th century onwards liturgiologists were busy expounding the mystic symbolism of garments which, until their imagination set to work, had for the most part no symbolism whatever (see below). Yet in view of later controversies, the changes made during this period, notably in the vestments connected with the mass, are not without significance. Hitherto the chasuble had been worn indifferently by all ministers at the eucharist, even by the acolytes; it had been worn also at processions and other non-liturgical functions; it was now exalted into the mass vestment *par excellence*, worn by the celebrant only, or by his immediate assistants (deacon and subdeacon) only on very special occasions. New vestments were devised to take the place, on less solemn occasions, of those hallowed by association with the holy sacrifice; thus the processional cope (*q.v.*) appeared in the 11th century and the surplice (*q.v.*) in the 12th. A change, too, came over the general character of vestments. Up to the 9th century these had been very plain, without ornament save such traditional decorations as the *clavi* of the dalmatic; what splendour they had was due to their material and the ample folds of their draperies. But from this time onwards they tend to become more and more elaborately decorated with embroidery and jeweller's work (see, *e.g.* the articles CHASUBLE and COPE).



From Braun's *Liturgische Gewandung*, by permission of B. Herder.

FIG. 3.—Monumental Figure of Bishop Johannes of Lübeck (d. 1350) in Lübeck Cathedral.

Very significant, too, is the parting of the ways in the development of liturgical vestments in the East and West. During the first centuries both branches of the Church had used vestments substantially the same, developed from common originals; the alb, chasuble, stole and pallium were the equivalents of the *στιχάριον*, *φενόλιον*, *ὠράριον* and *ὠμοφόριον*. While, however, between the 9th and 13th centuries, the Western Church was adding largely to her store of vestments, that of the East increased her list by but three, the *ἐνχείριον* and *ἐπιμανίκια* (see MANIPLE) and the *σάκκος* (see DALMATIC). The living force of development in the Latin Church was symbolized in her garments; the stereotyped orthodoxy of the Greek Church in hers. With the exception of the mitre, introduced in the 15th or 16th century, the liturgical costume of the Eastern clergy remains now practically what it was in the 9th century.

In the Western Church, though from the 9th century onwards the Roman use had been the norm, considerable alterations continued to be made in the shape and decoration of the liturgical vestments, and in this respect various Churches developed different traditions (see, *e.g.* CHASUBLE). The definition of their use by the various orders of the clergy in the several liturgical functions, however, was established by the close of the 13th century and still continues in force. Before discussing the changes made in the various Reformed Churches, due to the doctrinal developments of the 16th century, we may therefore give here a list of the vestments now worn by the various orders of clergy in the Roman Catholic Church and the Oriental Churches.

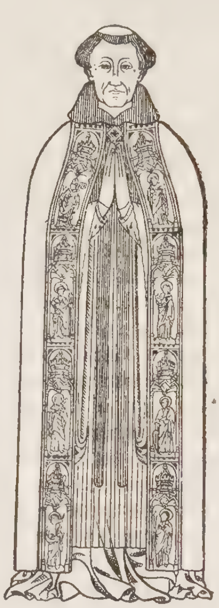


FIG. 4.—Dr Henry Sever (d. 1471). From a brass in the chapel of Merton College, Oxford. He is vested in surplice, stole and cope.

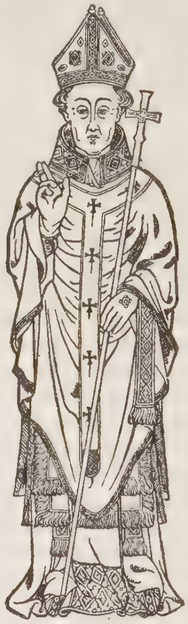


FIG. 5.—Thomas Cranley, Archbishop of Dublin (d. 1417). From a brass in New College Chapel, Oxford. In addition to the vestments shown in fig. 3 he wears the archiepiscopal pallium.

Roman Catholic Church.—As the sacrifice of the mass is the central mystery of the Catholic faith, so the seven orders of the hierarchy culminate in that of priest, who alone is empowered to work the daily miracle of the altar (see ORDER, HOLY). The vestments worn by the priest when celebrating mass are then the most important. The cassock (*q.v.*), which must always be worn under the vestments, is not itself a liturgical garment. Over this the priest, robing for mass, puts on the amice, alb, girdle (*cingulum*), stole, maniple and chasuble. Taking the other orders downwards: deacons wear amice, alb, girdle, stole, maniple[2] and dalmatic; subdeacons, amice, alb, girdle, maniple and tunicle; the vestment proper to the minor orders, formerly the alb, is now the surplice or cotta. Bishops, as belonging to the order of priesthood with completed powers, wear the same vestments as the priests, with the addition of the pectoral cross, the pontifical gloves, the pontifical ring, the liturgical sandals and caligae, a tunicle worn over the stole and under the chasuble, and the mitre (see fig. 3). Archbishops, on solemn occasions, wear the pallium over the chasuble (see fig. 5). Bishops also carry a pastoral staff (*q.v.*), as symbol of their pastoral office. Finally, the pope, when celebrating mass, wears the same vestments as an ordinary bishop, with the addition of the *subcinctorium* (see ALB), a dalmatic, worn over the tunicle and under the chasuble, and the *orale* or *fanone* (see AMICE). It should be noted that the *liturgical* head-dress of the pope is the mitre, not the tiara, which is the symbol of his supreme office and jurisdiction (see TIARA).

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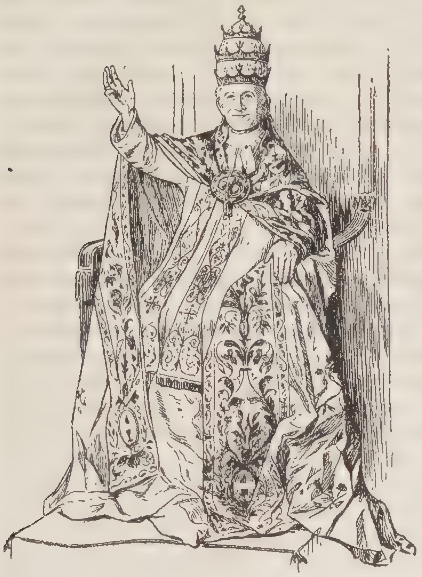
[1] The *rationale* is worn only over the chasuble. It is now used only by the bishops of Eichstätt, Cracow, Paderborn and Toul, by the special concession of various popes. See Braun, *Liturg. Gewandung*, pp. 676-700.

[2] The stole and maniple alone are symbolical of order, *i.e.* of the relation to the sacrifice of the mass.



From a photograph by Conjugi Cane, Rome.

FIG. 6.—Pope Leo XIII. in his Vestments as Supreme Pontiff.

Of the liturgical vestments not immediately or exclusively associated with the sacrifice of the mass the most conspicuous are the cope and surplice. The biretta, too, though not in its origin or in some of its uses a liturgical vestment, has developed a distinctly liturgical character (see BIRETTA). Besides the strictly liturgical vestments there are also numerous articles of costume worn at choir services, in processions, or on ceremonial occasions in everyday life, which have no sacral character; such are the almuce (*q.v.*), the *cappa* and *mozzetta* (see COPE), the rochet (*q.v.*), the *pileolus*, a skull-cap, worn also sometimes under mitre and tiara. These are generally ensigns of dignity; their form and use varies in different Churches, and they often represent special privileges conferred by the popes, *e.g.* the *cappa* of the Lateran basilica worn by the canons of Westminster cathedral, or the almuce worn, by concession of Pope Pius IX., by the members of the Sistine choir.

The character of the vestments, the method of putting them on, and the occasions on which they are severally to be worn, are regulated with the minutest care in the Missal and the *Caeremoniale*.

Oriental Churches.—As already stated, the vestments of the great historical Churches of the East are derived from the same Graeco-Roman originals as those of the West, but in contradistinction to the latter they have remained practically stereotyped, both in character and number, for a thousand years; in the East, however, even more than in the West the tendency to gorgeous ornamentation has prevailed.

An Orthodox bishop, vested for the holy liturgy, wears over his cassock—(1) the *στιχάριον*, or alb (*q.v.*); (2) the *ἐπιτραχήλιον*, or stole (*q.v.*); (3) the *ζώνη*, a narrow stuff girdle clasped behind, which holds together the two vestments above named; (4) the *ἐπιμανίκια*, liturgical cuffs, corresponding, possibly, to the pontifical gloves of the West;[1] (5) the *ἐπιγονάτιον*, a stiff lozenge-shaped piece of stuff hanging at the right side by a piece of riband from the girdle or attached to the *σάκκος*, the equivalent of the Western maniple (*q.v.*); (6) the *σάκκος*, like the Western dalmatic (*q.v.*), worn instead of the *φαινόλιον*, or chasuble; (7) the *ὠμοφόριον*, the equivalent of the Western pallium (*q.v.*). Besides these, the bishop also wears a pectoral cross (*ἐγκόλπιον*) and a medal containing a relic (*πανάγια*). He also has a mitre (*q.v.*), and carries a crozier (*δικανίκιον*), a rather short staff ending in two curved branches decorated with serpents' heads, with a cross between them.

The vestments of a priest are the sticharion, epitrachelion, girdle, epimanikia and phainolion (see CHASUBLE). He wears all these vestments only at the celebration of the eucharist and on other very solemn occasions; at other ministrations he wears only the epitrachelion and phainolion over his cassock. A dignitary in priest's orders is distinguished by wearing the epigonation; and in Russia the use of the mitre is sometimes conceded to distinguished priests by the tsar. The deacon wears the sticharion, without a girdle, the epimanikia and the orarion (*ὠράριον*, Lat. *orarium*, see STOLE) hanging over his left shoulder. The lesser orders wear a shorter sticharion and an orarion wound round it.

On less solemn occasions bishops wear the mandyas (*μανδύας*), a cope-like garment fastened at the lower corners as well as at the neck, and the kalimaukion (*καλημαύκιον*), a tall, brimless hat, with a veil hanging down behind, and, in place of the *διακόνιον* they carry a short staff with an ivory cross-piece. The kalimaukion is also worn by the other clergy in ordinary life, and with their vestments at processions, &c.

The general character of the vestments is much the same in the other Oriental rites. The sticharion answers to the Armenian *shabik*, the Nestorian *kutina*, the Coptic *tuniah* or *stoicharion*; the epimanikia to the Arm. *pasban* (which, however, resemble rather the Latin maniple), the Nestorian *zando*, and the Coptic *kiman*; the epitrachelion to the Arm. *por-urar*, Syrian *uroro*, Coptic *batrashil*; the girdle to the Arm. *kodi*, Nestorian *zunro*; the phainolion to the Nestorian *phaino* and Arm. *shurtshar*, both of which are, however, cope-shaped.[2] Armenian priests, besides, wear a mitre (see MITRE, fig. 3), and a collar-like ornament probably derived from the apparel of the Western amice (*q.v.*). The liturgical handkerchief, which in the Greek Church has become the epigonation, has retained its original form in the Armenian.

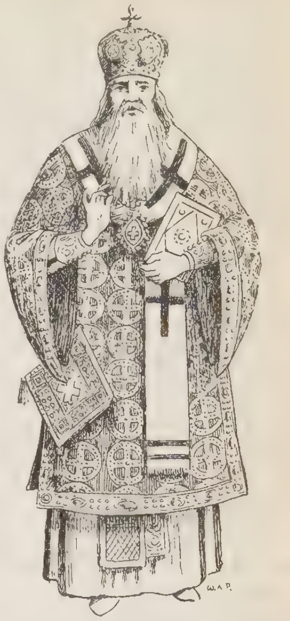


FIG. 7.—An Orthodox Eastern Patriarch in full Pontificals.

The Liturgical Colours.—In another respect the vestments of the Eastern differ from those of the Western Church. In the East there is no sequence of liturgical colours, nor, indeed, any definite sense of liturgical colour at all; the vestments are usually white or red, and stiff with gold embroidery. In the West the custom, long universal, of marking the seasons of the ecclesiastical year and the more prominent fasts and festivals by the colour of the vestments of clergy and altar dates, approximately, from the 12th century: the subject is mentioned (*c.* 1200) in the treatise of Innocent III., *De sacro altaris mysterio* (cap. 10), where the rules are laid down which are still essentially those of the Roman Church,[3] though the liturgical colours were only four, violet belonging to the category of black—as that of mourning. Custom in this respect was, however, exceedingly varied for a long time, numerous important Churches having their own "uses," and it was not until the time of the Reformation that the Roman use was fixed and became the norm of the Churches of the Roman obedience.

According to the rubric of the Roman Missal (*tit.* xviii.) the liturgical colours are five: white, red, green, violet, black. Though, in the embroidery of vestments, many colours may be used, these five above named must severally give the dominant tone of colour on the occasions for which they are appointed. Gold brocades or cloth-of-gold may, however, be substituted for red, green and white, and silver for white. The following is a list of the occasions to which the various colours are appropriated:—

White.—Trinity Sunday, all festivals of Christ (except those connected with the Passion), festivals of the Blessed Virgin, of the Holy Angels and Confessors, of holy virgins and women (not being martyrs), nativity of St John the Baptist, festivals of the chains of St Peter and of his see (*cathedra Petri*), Conversion of St Paul, All Saints, consecration of churches and altars, anniversary of election and coronation of popes, and of election and consecration of bishops. White is also worn during the octaves of these festivals, on ordinary days (for which no special colour is provided) between Easter and Whitsuntide, at certain special masses connected with the saints falling under the above category, and at bridal masses.

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[1] This is the view of Dr Adrian Fortescue (*The Orthodox Eastern Church*, p. 406); according to Braun (*Lit. Gewandung*, p. 100) they were originally merely the ornamental cuffs (*λωρία*) of the episcopal sticharion, which were detached for purposes of convenience.

[2] By the sub-committee of Convocation in their *Report* (1908) these vestments are wrongly classed as copes, *i.e.* as derived not from the *paenula* but from the *lacerna* or *birrus* (see COPE, footnote).

[3] The Church of the Holy Sepulchre at Jerusalem seems already to have had its canon of liturgical colours.

White is also the colour proper to sacramental processions, and generally to all devotions connected with the exposition of the Blessed Sacrament. At baptisms the priest wears a violet stole during the first part of the service, *i.e.* the exorcization then changes it for a white one. White is worn at the funerals of children.

Red.—Saturday before Whitsunday, Whitsunday and its octave; all festivals in commemoration of the sufferings of Christ, *i.e.* festival of the instruments of the Passion, of the Precious Blood, of the invention and elevation of the Cross; all festivals of apostles, except those above noted; festivals of martyrs; masses for a papal election; the Feast of the Holy Innocents, when it falls on a Sunday (violet if on a week-day), and its octave (always red). In England red vestments are worn at the mass (of the Holy Spirit) attended by the Roman Catholic judges and barristers at the opening of term, the so-called "Red Mass."

Green.—Sundays and week-days between Epiphany and Septuagesima, and between Trinity and Advent, except festivals and their octaves and Ember days.

Violet.—Advent; the days between Septuagesima and Maundy Thursday; vigils that fall on fast days, and Ember days, except the vigil before Whitsunday (red) and the Ember days in Whitsun week (red). Violet vestments are also worn on days of intercession, at votive masses of the Passion, at certain other masses of a pronouncedly intercessory and penitential character, at intercessory processions, at the blessing of candles on Candlemas Day, and at the blessing of the baptismal water. A violet stole is worn by the priest when giving absolution after confession, and when administering Extreme Unction.

Black.—Masses for the dead and funeral ceremonies of adults; the mass of the pre-sanctified on Good Friday.[1]

Benediction of Vestments.—In the Roman Catholic Church the amice, alb, girdle, stole, maniple, chasuble must be solemnly blessed by the bishop or his delegate, the prayers and other forms to be observed being set forth in the *Pontificale* (see BENEDICTION). Other vestments—*e.g.* dalmatic, tunicle, surplice—are sometimes blessed when used in connexion with the sacrifice of the mass, but there is no definite rule on the subject. The custom is very ancient, Father Braun giving evidence as to its existence at Rome as early as the 6th century (*Liturg. Gewandung*, p. 760, &c.).

Mystic Meaning of Vestments.—It is clear from what has been said above that the liturgical vestments possessed originally no mystic symbolic meaning whatever; it was equally certain that, as their origins were forgotten, they would develop such a symbolic meaning. The earliest record of any attempt to interpret this symbolism that we possess is, so far as the West is concerned, the short exposition in the *Explicatio Missae* of Germanus, bishop of Paris (d. 576), the earliest of any elaboration that of Hrabanus Maurus (d. 856). From the latter's time onward a host of liturgists took up the theme, arguing from the form, the material, the colour and the fashion of wearing the various garments to symbolical interpretations almost as numerous as the interpreters themselves. The *Report* of the five bishops divides them into three schools: (1) the *moralizing school*, the oldest, by which—as in the case of St Jerome's treatment of the Jewish vestments—the vestments are explained as typical of the virtues proper to those who wear them; (2) the *Christological school*, *i.e.* that which considered the minister as the representative of Christ and his garments as typical of some aspects of Christ's person or office—*e.g.* the stole is his obedience and servitude for our sakes; (3) the *allegorical school*, which treats the priest as a warrior or champion, who puts on the amice as a helmet, the alb as a breastplate, and so on. We cannot even outline here the process of selection by which the symbolic meanings now stereotyped in the Roman Pontifical were arrived at. These are taken from the various schools of interpretation mentioned above, and are now formulated in the words used by the bishop when, in ordaining to any office, he places the vestment on the ordinand with the appropriate words, *e.g.* "Take the amice, which signifies discipline in speech," while other interpretations survive in the prayers offered by the priest when vesting, *e.g.* with the amice, "Place on my head the helmet of salvation," &c. For the symbolic meanings of the various vestments see the separate articles devoted to them.

Protestant Churches.—In the Protestant Churches[2] the custom as to vestments differs widely, corresponding to a similar divergence in tradition and teaching. At the Reformation two tendencies became apparent. Luther and his followers regarded vestments as among the *adiaphora*, and in the Churches which afterwards came to be known as "Lutheran" many of the traditional vestments were retained. Calvin, on the other hand, laid stress on the principle of the utmost simplicity in public worship; at Geneva the traditional vestments were absolutely abolished, and the Genevan model was followed by the Calvinistic or "Reformed" Churches throughout Europe. The Church of England, in which the Lutheran and Calvinistic points of view struggled for the mastery, a struggle which resulted in a compromise, is separately dealt with below. At the present day the Lutheran Churches of Denmark and Scandinavia retain the use of alb and chasuble in the celebration of the eucharist (stole, amice, girdle and maniple were disused after the Reformation), and for bishops the cope and mitre. The surplice is not used, the ministers conducting the ordinary services and preaching in a black gown, of the 16th-century type, with white bands or ruff. In Germany the Evangelical Church (outcome of a compromise between Lutherans and Reformed) has, in general, now discarded the old vestments. In isolated instances (*e.g.* at Leipzig) the surplice is still worn; but the pastors now usually wear a barret cap, a black gown of the type worn by Luther himself, and white bands. In Prussia the superintendents now wear pectoral crosses (instituted by the emperor William II.). In the "Reformed" Churches the minister wears the black "Geneva" gown with bands. It is to be noted, however, that this use has been largely discontinued in the modern "Free" Churches. On the other hand, some of these have in recent times adopted the surplice, and in one at least (the Catholic Apostolic Church) the traditional Catholic vestments have been largely revived.

Anglican Church.—The subject of ecclesiastical vestments has been, ever since the Reformation, hotly debated in the Church of England. For a hundred years after the Elizabethan settlement the battle raged round the compulsory use of the surplice and square cap, both being objected to by the extreme Calvinists or Puritans. This question was settled after 1662 by the secession of the Nonconformist clergy, and no more was heard of the matter until the "Oxford movement" in the 19th century. At the outset the followers of Newman and Pusey were more concerned with doctrine than with ritual; but it was natural that a reassertion of Catholic teaching should be followed by a revival of Catholic practice, and by the middle of the century certain "Ritualists," pleading the letter of the Ornaments Rubric in the Prayer Book, had revived the use of many of the pre-Reformation vestments. Into the history of the resulting controversies it is impossible to enter. Popular passion confused the issues, and raged as violently against the substitution of the surplice for the Geneva gown in the pulpit as against the revival of the "mass vestments." The law was invoked, and, confronted for the first time with the intricacies of the Ornaments Rubric, spoke with an uncertain voice. In 1870, however, the "vestments" were definitely pronounced illegal by the Privy Council (*Hebbert* v. *Purchas*), and since the "Ritualists" refused to bow to this decision, parliament intervened with the Public Worship Regulation Act of 1874, which set up a disciplinary machinery for enforcing the law, and at the same time reconstituted the Court of Arches (*q.v.*). The recalcitrant clergy refused to obey an act passed solely by the secular authority (convocation not having been consulted) or to acknowledge the jurisdiction of a court which had been robbed of its "spiritual" character. Prosecutions

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[1] In the Anglican Church, in the numerous cases when the liturgical colours are used, these generally follow the Roman use, which was in force before the Reformation in the important dioceses of Canterbury, York, London and Exeter. Some Churches, however, have adopted the colours of the use of Salisbury (Sarum). The red hangings of the Holy Table, usual where the liturgical colours are not used, are also—like the cushions to support the service books—supposed to be a survival of the Sarum use

[2] The term "Protestant" is used here in its widest sense of those Churches which reformed their doctrine and discipline as a result of the religious revolution of the 16th century (see REFORMATION).

"on the complaint of two parishioners" (too often qualified *ad hoc* by a temporary residence) followed; and since the act had provided no penalty save imprisonment for contempt of court, there followed the scandal of zealous clergymen being lodged in gaol indefinitely "for conscience' sake." This result revolted public opinion; the bishops acquired the habit (rendered easier by the personal expense involved in setting the law in motion) of vetoing, under the power given to them in the act, all prosecutions; and the act became a dead letter. The "persecution" had meanwhile produced its natural result: the use of the forbidden vestments rapidly spread; and since there was no central authority left competent to command obedience, every incumbent—intrenched in his freehold as a "corporation sole"—became a law unto himself. The outcome has been that in the Church of England, and in many of her daughter Churches, there exists a bewildering variety of "uses," varying from that of Sarum and that of Rome down to the closest possible approximation to the Geneva model.

Some explanation of this state of things may be ventured. Apart from those clergy (still the majority) who follow in all essentials the post-Reformation traditions of the English Church, there are three schools among those who justify the use of the ancient "eucharistic"[1] vestments: (1) a small number who affect to ignore the rules of the Prayer Book altogether, on the ground that no local or national Church has the right to alter the doctrines or practice of the Catholic Church, of which they are priests in virtue of their ordination, and whose prescriptions and usages they are in conscience bound to follow; (2) those who maintain that the Ornaments Rubric, in the phrase "second year of King Edward VI.," prescribes the ornaments in use *before* the first Prayer Book; (3) those who hold that under the Rubric the ornaments prescribed in the first Prayer Book are to be "had in use." The attitude of the first group needs no comment: it makes every priest the arbiter of what is or is not "Catholic," and is destructive of that principle of definite authority which is the very foundation of Catholicism. The attitude of the second group is based on a mistake as to the technical meaning of "the second year of Edward VI.," the second Prayer Book not having come into use till the third year.[2] As to the third group, their contention seems now to be admitted, though not all its implications. What, then, are the vestments sanctioned by the Ornaments Rubric? In its present form this dates from the Prayer Book revision of 1662. It runs: "And here it is to be noted that such ornaments of the church and of the ministers thereof at all times of their ministration shall be retained and be in use, as was in the Church of England by the authority of parliament in the second year of the reign of King Edward VI." The wording of this was taken from the last section of Elizabeth's Act of Uniformity, prefixed to the Prayer Book of 1559. In the Act, however, these words were added: "until other order shall be therein taken by the authority of the Queen's Majesty, with the advice of the Commissioners appointed and authorized under the Great Seal of England, for causes ecclesiastical, or of the Metropolitan." The Rubric in the Prayer Book of 1559 ran: ". . . the minister at the time of the Communion, and at all other times in his ministration, shall use, &c. . . . according to the Act of Parliament set in the beginning of this book."[3]

Clearly it was the intention of the government, consistently with the whole trend of its policy, to cover its concession to the Protestant party dominant in the Commons by retaining some of the outward forms of the old services until such time as it should be expedient to "take other order." Then followed a period of great confusion. If the "massing vestments" continued anywhere in use, it was not for long. Whatever the letter of the law under the rubric, the Protestant bishops and the commissioners made short work of such "popish stuff" as chasubles, albs and the like. As for copes, in some places they were ordered to be worn, and were worn at the Holy Communion,[4] while elsewhere they were thrown into the bonfires with the rest.[5]

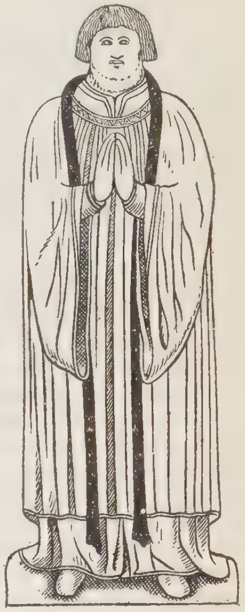

FIG. 8.—Anglican Priest in Cassock, Surplice, and Narrow Black Scarf. Brass of William Dye (d. 1567) at Westerham, Kent.

The difficulty seems to have been not to suppress the chasuble, of the use of which after 1559 not a single authoritative instance has been adduced, but to save the surplice, which the more zealous Puritans looked on with scarcely less disfavour. At last, in 1565, Queen Elizabeth determined to secure uniformity, and wrote to Archbishop Parker bidding him proceed by order, injunction or censure, "according to the order and appointment of such laws and ordinances as are provided by act of parliament, and the true meaning thereof, so that uniformity may be enforced." The result was the issue in 1566 by the archbishop of the statutory *Advertisements*, which fixed the vestments of the clergy as follows: (1) In the ministration of the Holy Communion in cathedral and collegiate churches, the principal minister to wear a cope, with gospeller and epistoler agreeably;[6] at all other prayers to be said at the Communion table, to use no copes but surplices; (2) the dean and prebendaries to wear surplice and hood; (3) every minister saying public prayers, or ministering the sacraments, to wear "a comely surplice with sleeves."

This has been decided by the judicial committee of the Privy Council (*Hebbert* v. *Purchas*, 1870; *Ridsdale* v. *Clifton*, 1877) to have been the "other order" contemplated in the Act of Uniformity of Elizabeth, and it was held that from this time the cope and surplice alone were legal vestments in the Church of England. The authority of the *Advertisements*, indeed, was and is disputed; but their lordships in their judgment pointed out that they were accepted as authoritative by the canons of 1603 (Can. 24 and 58), and argued convincingly that the revisers of the Prayer Book in 1662, in restoring the rubric of 1559, had no idea of legalizing any vestments other than those in customary use under the *Advertisements*, and the canons (cf. *Report* of sub-committee of Convocation, pp. 48, 49). The law, then, is perfectly clear, so far as two decisions of the highest court in the realm can make it so. But apart from the fact that the authority of the Privy Council, as not being a "spiritual" court, is denied by many of the clergy, no one claims that its decisions are irreversible in the light of fresh evidence.

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[1] This term is incorrect (save in the case of chasuble and maniple), but is that commonly employed by the "High Church" clergy.

[2] Edward VI. came to the throne on the 28th of January 1547; his "second year," therefore, lasted from the 28th of January 1548 to the 27th of January 1549. The first Prayer Book passed parliament on the 21st of January 1549, but did not receive the royal assent till later, probably March, and was not in *compulsory* use till Whitsunday, June 9th, 1549. The old rule, however, was that "every act of parliament in which the commencement thereof is not directed to be from a specific time, doth commence from the first day of the session of the parliament in which such act is passed" (33 Geo. III. c. 13). The evidence is now clear that the Rubric refers to the first Prayer Book. This was decided in *Liddell* v. *Westerton* (1857), and is admitted in the Report of the five bishops to Convocation on *The Ornaments of the Church and its Ministers* (1908), which adduces conclusive evidence.

[3] This was inserted, probably by the Privy Council, as a memorandum or interpretation of the clause in the Act of Uniformity. Tomlinson (*The Prayer Book, Articles and Homilies*, p. 122 seq.) argues that this was a "fraud rubric" inserted without authority, and utterly perverting the meaning of the proviso in the Act of Uniformity. This argument is dealt with in the bishop's *Report*, p. 66.

[4] *Resolutions of 1561*, "Item that there be used only but one apparel; as the cope in the ministration of the Lord's Supper." See *Report*, p. 68.

[5] See Machyn's *Diary* (Camden Soc. 42; London, 1848), p. 208, for St Bartholomew's day, 1559: "All the roods, and Maries and Johns, and many other of the church goods, both copes, crosses, censers, altar cloths, rood cloths, books, banners, . . . with much other gear about London," were "burned with great wonder."

[6] Yet later the cope seems to have been authoritatively proscribed with the rest. In the *Acts of the Privy Council* (1578–1580), p. 208, is the following entry: "A letter to Sir Walter Ashton, Knight, Mr. Deane of Lichefield, etc. . . . touching certaine copes, vestments, tunicles and such other Popishe stuffe informed by letter from the Dean of Lichefield to be within the cathedral churche of Lichefield; they . . . are required to assemble themselves together in the towne of Lichefield and to cause the said Popishe stuffe to be sought out and brought before them, and thereupon to deface the same . . . and to see the same effectuallie done, and thereof to advertise their Lordships."

Thirty years after the Ridsdale judgment, the ritual confusion in the Church of England was worse than ever, and the old ideal expressed in the Acts of Uniformity had given place to a desire to sanctify with some sort of authority the parochial "uses" which had grown up. In this respect the dominant opinion in the Church, intent on compromise, seems to have been expressed in the Report presented in 1908 to the convocation of the province of Canterbury by the sub-committee of five bishops appointed to investigate the matter, namely, that under the Ornaments Rubric the vestments prescribed in the first Prayer Book of Edward VI. are permitted, if not enjoined. Even if this be so, the question arises, what vestments were prescribed in the Prayer Book of 1549? It has been commonly assumed, and the assumption has been translated into practice, that the rubrics of 1549 prescribed the use of all the old "mass vestments." This, however, is not the case. In the short rubric before the communion service the celebrating priest is directed to "put upon him . . . a white alb plain with a vestment or cope," while the assisting priests or deacons are to wear "albs with tunicles." In the additional explanatory notes at the end of the book, after directions as to the wearing of surplice and hood in quire, in cathedral and collegiate churches (they are not made obligatory elsewhere), bishops are directed to wear, besides the rochet, a surplice or alb, and a cope or vestment, with a pastoral staff borne either by themselves or their chaplains.[1] Thus the alternative use of cope or chasuble (vestment) is allowed at the celebration of Holy Communion—an obvious compromise; of the amice, girdle (*cingulum*), maniple and stole there is not a word,[2] and the inference to be drawn is that these were now disused. The *cingulum*, indeed, which symbolized chastity (*i.e.* celibacy), would naturally have been discarded now that the clergy were allowed to marry, while the stole had become intimately associated with the doctrine of holy orders elaborated by the medieval schoolmen and rejected by the Reformers (see ORDER, HOLY). If this be so, the case is exactly parallel with that of the Lutheran Churches which, about the same time, had discarded all the "mass vestments" except the alb and chasuble. It becomes, then, a question whether the present-day practice of many of the clergy, ostensibly based on the rubric of 1549, is in fact covered by this. The revived use of the stole is the most curious problem involved; for this, originally due to a confusion of this vestment with the traditional Anglican black scarf, has now become all but universal among the clergy of all schools of thought (see STOLE).

The five bishops in their Report, tracing the various vestments to their origins, conclude that they are meaningless in themselves, and therefore things indifferent. This appears gravely to misread history. The chasuble and the rest, whatever their origin, had become associated during the middle ages with certain doctrines the rejection of which at the Reformation was symbolized by their disuse.[3] Their revival has proceeded *pari passu* with that of the doctrines with which they have long since become associated. With the truth or falsehood of these doctrines we are not here concerned; but that the revived vestments are chiefly valued because of their doctrinal significance the clergy who use them would be the last to deny. Nor is the argument that they are a visible manifestation of the continuity of the Church anything but a double-edged weapon; for, as Father Braun pertinently asks, if these be their symbolism, of what was their disuse in the Church of England for nigh on 300 years a symbol?[4]

In 1910 the question of the "permissive use of vestments," in connexion with that of the revision of the Prayer Book generally, was still under discussion in the convocations of the two provinces. But there was little chance that any change in the rubric, even in the improbable event of its receiving the sanction of parliament, would produce any appreciable effect. It is often forgotten that "extreme" ritual is no longer an "innovation" in the English Church; it has become the norm in a large number of parishes, and whole generations of Church people have grown up to whom it is the only familiar type of Christian worship. To attempt to "enforce the law" (whatever the law may be) would, therefore, seriously wound the consciences of a large number of people who are quite unconscious of having broken it. Formally to legalize the minimum enjoined by the rubrics of 1549 would, on the other hand, offend the "Protestant" section of the Church, without reconciling those who would be content with nothing short of the Catholic maximum.

AUTHORITIES.—All previous works on vestments have been largely superseded by Father Joseph Braun's *Die liturgische Gewandung* (Freiburg-im-Breisgau, 1907), a monument of careful and painstaking research, profusely illustrated. This contains a list of medieval writers on the subject, another of the inventories used by the author, and one of more modern works. W. B. Marriott's *Vestiarium Christianum* (1868), though it must now be read with caution, is still of much value, notably the second part, which gives texts (with translations) of passages bearing on the subject taken from early and medieval writers, with many interesting plates. Of other works may be mentioned Mgr. L. Duchesne's *Origines du culte chrétien* (Paris, 1903), and especially C. Rohault de Fleury's *La Messe* (Paris, 1883–89). See also F. X. Kraus, *Realencyklopädie der christlichen Altertümer* (Freiburg-i.-B., 1882, 1886); Smith and Cheetham, *Dict. of Christian Antiquities* (ed. 1893) and *The Catholic Encyclopedia* (New York, 1907 onwards).

For the vestment question in the Church of England see the Report of the sub-committee of Convocation on *The Ornaments of the Church and its Ministers* (1908); *Hierurgia Anglicana*, documents and extracts illustrative of the ceremonial of the Anglican Church after the Reformation, new ed. revised and enlarged by Vernon Staley (1902–3); J. T. Tomlinson, *The Prayer Book, Articles and Homilies* (1897), a polemical work from the Protestant point of view, but scholarly and based on a mass of contemporary authorities to which references are given; the bishop of Exeter, *The Ornaments Rubric* (London, 1901), a pamphlet. For the legal aspect of the question see G. J. Talbot, *Modern Decisions on Ritual* (London, 1894). (W. A. P.)

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[1] There is no mention of mitre, gloves, dalmatic, tunicle, sandals and caligae, which were presumably discontinued.

[2] It has been argued that the term "vestment" covers all these. The *Report* of 1908 (Appendix A, p. 109) says cautiously that the word "may perhaps in some cases stand for the chasuble with the amice, stole and fanon, the alb being mentioned separately," but adds that "very many of the instances commonly cited for this (*e.g.* those in *Essays on Ceremonial*, p. 246) are quite inconclusive, as 'vestment' is often a convertible term with 'chasuble'; and it does not seem to be at all conclusively established that 'vestment' with 'alb' mentioned separately, and 'cope' given as an alternative, in a document with the precision and directive force of a Rubric, means more than the actual chasuble." Father Braun (*Die liturg. Gewandung in der Englischen Staatskirche*) endorses this opinion. He gives reasons for believing that in the Church of England, under the first Prayer Book, as in the Lutheran Churches, while chasuble and alb were retained, stole, maniple, amice and girdle were discontinued. With this the bishop of Exeter (*Ornaments Rubric*, p. 30) would seem to agree, when he says that "the customs of the present day do not fully accord with any reasonable interpretation of the rubric. The stole, now nearly universal, is only covered by the rubric if the word 'vestment' be taken to include it (a very dubious point), and then only at Holy Communion."

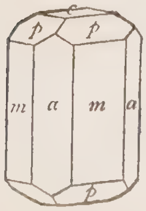
[3] This is also the view taken by Father J. Braun, S.J., in his paper on liturgical dress in the Church of England, contributed to *Stimmen aus Maria-Laach* (1910, Heft 7, Freiburg-im-Breisgau). In this he criticizes the bishops' Report in a sympathetic spirit, but points out how intimately the symbolism of the vestments had become associated with the doctrine of the Sacrifice of the Mass, and how logical was the action of the Reformers in rejecting certain of these vestments.

[4] He sees in the revival of "vestments" "an energetic condemnation of the English Reformation." He adds that this is, of course, unintentional (*allerdings ohne das sein zu wollen*). A more intimate acquaintance with the language commonly used by many of the more extreme "Ritualists" would have shown him that there has been, and is, no lack of such intention.

VESTRIS, GAETANO APPOLINO BALDASSARE (1729–1808), French ballet dancer, was born in Florence and made his *début* at the Opéra in 1749. By 1751 his success and his vanity had grown to such a point that he is reported to have said, "There are but three great men in Europe—the king of Prussia, Voltaire and I." He was an excellent mimic as well as dancer. From 1770 to 1776 he was master and composer of ballets, retiring, in favour of Noverre, with a pension. Two other pensions fell to him, when he gave up his positions of first dancer and of first dancer of court ballets, amounting in all to 9200 livres. Vestris married a dancer, Anna Heinel (1753–1808), of German origin, who had a wonderful success at the Opéra. He reappeared at the age of seventy-one on the occasion of his grandson's *début*. By the dancer Mlle. Allard, Vestris had a son, Marie Auguste Vestris Allard (1760–1842), also a ballet dancer, who surpassed his father, if possible, in both talent and vanity. His son, Auguste Armand Vestris (b. *c* 1795), who took to the same profession, made his *début* at the Opéra in 1800, but left Paris for Italy and never reappeared in France. Gaetano's brother, Angelo Vestris (1730–1809), married Marie Rose Gourgaud, the sister of the actor Dugazon (*q.v.*).

VESTRIS, LUCIA ELIZABETH (1797–1856), English actress, was born in London in January 1797, the daughter of Gaetano Stefano Bartolozzi (1757–1821) and granddaughter of Francesco Bartolozzi, the engraver. In 1813 she married Auguste Armand Vestris (see above), who deserted her four years later. With an agreeable contralto voice and a pleasing face and figure, Madame Vestris had made her first appearance in Italian opera in the title-rôle of Peter Winter's *Il ratto di Proserpina* at the King's Theatre in 1815. She had an immediate success in both London and Paris, where she played Camille to Talma's Horace in *Horace*. Her first hit in English was at Drury Lane in James Cobb's (1756–1818) *Siege of Belgrade* (1820). She was particularly a favourite in "breeches parts," like Cherubino in the *Marriage of Figaro*, and in *Don Giovanni*, and with such introduced songs as "Cherry Ripe," "Meet me by moonlight alone," "I've been roaming," etc. In 1831, having accumulated a fortune, she became lessee of the Olympic Theatre, and began the presentation of a series of burlesques and extravaganzas for which she made this house famous. She married Charles James Mathews in 1838, accompanying him to America and aiding him in his subsequent managerial ventures. Her last appearance (1854) was for his benefit in an adaptation of Madame de Girardin's *La Joie fait peur*, called *Sunshine through Clouds*, and she died in London on the 8th of August 1856. Her musical accomplishments and education were not sufficient to distinguish her in grand opera, and in high comedy she was only moderately successful. But in plays like *Loan of a Lover*, *Paul Pry*, *Naval Engagements*, etc., she was delightfully arch and bewitching.

VESTRY (O. Fr. *vestiaire*, Lat. *vestiarium*, a wardrobe), a place or room adjoining a church, where the vestments of the minister are kept. Hence the name applied to an assembly of the parishioners, usually convened in the vestry, to transact the business of the parish. In populous parishes it obtains by custom in some, and by the "Adoptive" Vestries Act 1831 in others, to choose yearly a select number of parishioners, called a "select vestry," to manage the concerns of the parish. (See Parish.)



VESUVIANITE, a rock-forming mineral of complex composition. It is a basic calcium and aluminium silicate containing small amounts of iron, magnesium, water, fluorine, etc., and sometimes boron; the approximate formula is $H_2Ca_6(Al,Fe)_3Si_5O_{18}$. It crystallizes in the tetragonal system, but often exhibits optical anomalies, and the optical sign varies from positive to negative. Well-developed crystals are of frequent occurrence. They usually have the form of four- or eight-sided prisms terminated by the basal planes (*c*) and pyramid-planes (*p* in fig.); the prism-planes are vertically striated and the basal planes smooth and bright. Crystals are transparent to translucent, vitreous in lustre and vary in colour from brown to green; a sky-blue variety, called *cyprine*, owes its colour to the presence of a trace of copper. The specific gravity is 3·4 and the hardness 6½. The name vesuvianite was given by A. G. Werner in 1795, because fine crystals of the mineral are found at Vesuvius; these are brown in colour and occur in the ejected limestone blocks of Monte Somma. Several other names have been applied to this species, one of which, *idocrase* of R. J. Haüy (1796), is now in common use.

Vesuvianite is typically a mineral of contact-metamorphic origin, occurring most frequently in crystalline limestones at their contact with igneous rock-masses; it also occurs in serpentine, chlorite-schist and gneiss, and is usually associated with garnet, diopside, wollastonite, &c. Localities which have yielded fine crystallized specimens are the Ala valley near Turin, Piedmont, Monte Somma (Vesuvius), Monzoni in the Fassa valley, Tirol, Achmatovsk near Zlatonst in the Urals, the River Wilui district near Lake Baikal in Siberia ("wiluite"), Christiansand in Norway, &c. When found in transparent crystals of a good green or brown colour it is occasionally cut as a gem-stone. A compact variety, closely resembling jade in appearance, has been used as an ornamental stone. (L. J. S.)

VESUVIUS (also *Vesevus* in ancient poets), a volcano rising from the eastern margin of the Bay of Naples in Italy, about 7 m. E.S.E. of Naples, in the midst of a region which has been densely populated by a civilized community for more than twenty-five centuries. Hence the mountain has served as a type for the general popular conception of a volcano, and its history has supplied a large part of the information on which geological theories of volcanic action have been based. The height of the mountain varies from time to time within limits of several hundred feet, according to the effects of successive eruptions, but averages about 4000 ft. above sea-level (in June 1900, 4275 ft., but after the eruption of 1906 considerably less). Vesuvius consists of two distinct portions. On the northern side a lofty semicircular cliff, reaching a height of 3714 ft., half encircles the present active cone, and descends in long slopes towards the plains below. This precipice, known as Monte Somma, forms the wall of an ancient prehistoric crater of vastly greater size than that of the present volcano. The continuation of the same wall round its southern half has been in great measure obliterated by the operations of the modern vent, which has built a younger cone upon it, and is gradually filling up the hollow of the prehistoric crater. At the time of its greatest dimensions the volcano was perhaps twice as high as it is now. By a colossal eruption, of which no historical record remains, the upper half of the cone was blown away. It was around this truncated cone that the early Greek settlers founded their little colonies.

At the beginning of the Christian era, and for many previous centuries, no eruption had been known to take place from the mountain, and the volcanic nature of the locality was perhaps not even suspected by the inhabitants who planted their vineyards along its fertile slopes, and built their numerous villages and towns around its base. The geographer Strabo, however, detected the probable volcanic origin of the cone and drew attention to its cindery and evidently fire-eaten rocks. From his account and other references in classical authors we gather that in the first century of the Christian era, and probably for hundreds of years before that time, the sides of the mountain were richly cultivated, as they are still, the vineyards being of extraordinary fertility. The wine they produce is known as *Lacrimae Christi*. But towards the top the upward growth of vegetation had not concealed the loose ashes which still remained as evidence of the volcanic nature of the place. On this barren summit lay a wide flat depression, surrounded with rugged walls of rock, which were festooned with wild vines. The present crater-wall of Monte Somma is doubtless a relic of that time. It was in this lofty rock-girt hollow that the gladiator Spartacus was besieged by the praetor Claudius Pulcher; he escaped by twisting ropes of vine branches and descending through unguarded fissures in the crater-rim. A painting found in Pompeii in 1879 represents Vesuvius before the eruption (*Notizie degli scavi*, 1880, pl. vii.).

After centuries of quiescence the volcanic energy began again to manifest itself in a succession of earthquakes, which spread alarm through Campania. For some sixteen years after 63 these convulsions continued, doing much damage to the surrounding towns. At Pompeii, for example, among other devastation, the temple of Isis was shaken into ruins, and, as an inscription records, it was rebuilt from the foundations by the munificence of a private citizen. On the 24th of August 79 the earthquakes, which had been growing more violent, culminated in a tremendous explosion of Vesuvius. A contemporary account of this event has been preserved in two letters of the younger Pliny to the historian Tacitus. He was staying at Misenum with his uncle, the elder Pliny, who was in command of the fleet. The latter set out on the afternoon of the 24th to attempt to rescue people at Herculaneum, but came too late, and went to Stabiae, where he spent the night, and died the following morning, suffocated by the poisonous fumes which were exhaled from the earth. This eruption was attended with great destruction of life and property. Three towns are known to have been destroyed—Herculaneum at the western base of the volcano, Pompeii on the south-east side, and Stabiae, still farther south, on the site of the modern Castellamare. There is no evidence that any lava was emitted during this eruption. But the abundant steam given off by the volcano seems to have condensed into copious rain, which, mixing with the light volcanic dust and ash, gave rise to torrents of pasty mud, that flowed down the slopes and overwhelmed houses and villages. Herculaneum is believed to have been destroyed by these "water lavas," and there is reason to suppose that similar materials filled the cellars and lower parts of Pompeii. Comparing the statements of Pliny with the facts still observable in the district, we perceive that this first recorded eruption of Vesuvius belongs to that phase of volcanic action known as the *paroxysmal*, when, after a longer or shorter period of comparative tranquillity, a volcano rapidly resumes its energy and the partially filled-up crater is cleared out by a succession of tremendous explosions.

For nearly fifteen hundred years after the catastrophe of 79 Vesuvius remained in a condition of less activity. Occasional eruptions are mentioned, *e.g.* in A.D. 203, 472 and 685, and nine in the middle ages down to 1500. None, however, was of equal importance with the first, and their details are given vaguely by the authors who allude to them. By the end of the 15th century the mountain had resumed much the same general aspect as it presented before the eruption described by Pliny. Its crater-walls, some 5 m. in circumference, were hung with trees and brushwood, and at their base stretched a wide grassy plain, where cattle grazed and the wild boar lurked in the thickets. The central tract was a lower plain, covered with loose ashes and marked by a few pools of hot and saline water. At length, after a series of earthquakes lasting for six months and gradually increasing in violence, the volcano burst into renewed paroxysmal activity on the 16th of December 1631. Vast clouds of dust and stones, blown out of the crater and funnel of the volcano, were hurled into the air and carried for hundreds of miles, the finer particles falling to the earth even in the Adriatic and at Constantinople. The clouds of steam condensed into copious torrents, which, mingling with the fine ashes, produced muddy streams that swept far and wide over the plains, reaching even to the foot of the Apennines. Issuing from the flanks of the mountain, several streams of lava flowed down towards the west and south, and reached the sea at twelve or thirteen different points. Though the inhabitants had been warned by the earlier convulsions of the mountain, so swiftly did destruction come upon them that 18,000 are said to have lost their lives.

Since this great convulsion, which emptied the crater, Vesuvius has never again relapsed into a condition of total quiescence. At intervals, varying from a few weeks or months to a few years, it has broken out into eruption, sometimes emitting only steam, dust and scoriae, but frequently also streams of lava. The years 1766–67, 1779, 1794, 1822, 1872 and 1906 were marked by special activity. The last completely altered the aspect of the cone, considerably reducing its height.

The modern cone of the mountain has been built up by successive discharges of lava and fragmentary materials round a vent of eruption, which lies a little south of the centre of the prehistoric crater. The southern segment of the ancient cone, answering to the semicircular wall of Somma on the north side, has been almost concealed, but is still traceable among the younger accumulations. The numerous deep ravines which indented the sides of the prehistoric volcano, and still form a marked feature on the outer slopes of Somma, have on the south side served as channels to guide the currents of lava from the younger cone. But they are gradually being filled up there and will ultimately disappear under the sheets of molten rock that from time to time rush into them from above. On one of the ridges between these radiating valleys an observatory for watching the progress of the volcano was established by the Neapolitan government, and is still supported as a national institution. A continuous record of each phase in the volcanic changes has been taken, and some progress has been made in the study of the phenomena of Vesuvius, and in prognosticating the occurrence and probable intensity of eruptions. The foot of the cone is reached from Naples by electric railway, and thence a wire-rope railway (opened in 1880) carries visitors to within 150 yds. of the mouth of the crater.

See John Phillips, *Vesuvius* (1869); *Pompei e la Regione Sotterrata dal Vesuvio nell' Anno 79* (Naples, 1879); L. Palmieri, *Vesuvio e la sua Storia* (Milan, 1880); H. J. Johnstone-Lavis, "The Geology of Monte Somma and Vesuvius" (1884), in *Quart. Journ. Geol. Soc.* vol. xl. p. 85; J. L. Lobley, *Mount Vesuvius* (London, 1889); F. Furchheim, *Bibliografia del Vesuvio* (Naples, 1897); T. McK. Hughes, "Herculaneum," in *Proc. Camb. Antiq. Soc.* No. xlviii. p. 25 (Cambridge, 1908).

(A. Ge.; T. As.)

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C. H. T.*	Crawford Howell Toy, A.M., LL.D. See the biographical article: Toy, Crawford Howell.	**Wisdom, Book of;** **Wisdom Literature.**
C. K. W.	Charles Kingsley Webster, M.A. Fellow of King's College, Cambridge. Whewell Scholar, 1907.	**Vienna, Congress of.**
C. L. K.	Charles Lethbridge Kingsford, M.A., F.R.Hist.Soc., F.S.A. Assistant-Secretary to the Board of Education. Author of *Life of Henry V*. Editor of *Chronicles of London* and Stow's *Survey of London*.	**Warwick, Richard Beauchamp, Earl of;** **Warwick, Richard Neville, Earl of;** **Whittington, Richard;** **Worcester, John Tiptoft, Earl of;** **York, Richard, Duke of.**
C. R. B.	Charles Raymond Beazley, M.A., D.Litt., F.R.G.S., F.R.Hist.S. Professor of Modern History in the University of Birmingham. Formerly Fellow of Merton College, Oxford, and University Lecturer in the History of Geography. Lothian Prizeman, Oxford, 1889. Lowell Lecturer, Boston, 1908. Author of *Henry the Navigator*; *The Dawn of Modern Geography*; &c.	**Zemarchus.**
C. W. R.	Charles Walker Robinson, C.B., D.C.L. Major-General (retired). Assistant Military Secretary, Headquarters of the Army, 1890–1892. Governor and Secretary, Royal Military Hospital, Chelsea, 1895–1898. Author of *Strategy of the Peninsular War*; &c.	**Vitoria.**
D. B. M.	David Binning Monro, M.A., Litt.D. See the biographical article: Monro, David Binning.	**Wolf, Friedrich August.**
D. F. T.	Donald Francis Tovey. Author of *Essays in Musical Analysis*: comprising *The Classical Concerto*, *The Goldberg Variations*, and analyses of many other classical works.	**Victoria, Tommasso L. da;** **Wagner:** ***Biography (in part)*** **and** ***Critical Appreciation;*** **Weber:** ***Critical Appreciation.***
D. G. H.	David George Hogarth, M.A. Keeper of the Ashmolean Museum, Oxford, and Fellow of Magdalen College. Fellow of the British Academy. Excavated at Paphos, 1888; Naucratis, 1899 and 1903; Ephesus, 1904–1905; Assiut, 1906–1907. Director, British School at Athens, 1897–1900. Director, Cretan Exploration Fund, 1899.	**Xanthus;** **Zeitun.**
D. H.	David Hannay. Formerly British Vice-Consul at Barcelona. Author of *Short History of the Royal Navy*; *Life of Emilio Castelar*; &c.	**Villeneuve;** **Zumalacárregui.**
D. H. S.	Dukinfield Henry Scott, M.A., Ph.D., LL.D., F.R.S. Professor of Botany, Royal College of Science, London, 1885–1892. Formerly President of the Royal Microscopical Society and of the Linnean Society. Author of *Structural Botany*; *Studies in Fossil Botany*; &c.	**Williamson, William Crawford.**
D. R.-M.	David Randall-MacIver, M.A., D.Sc. Curator of Egyptian Department, University of Pennsylvania. Formerly Worcester Reader in Egyptology, University of Oxford. Author of *Medieval Rhodesia*; &c.	**Zimbabwe.**

E. Ar.*	Rev. Elkanah Armitage, M.A. Trinity College, Cambridge. Professor in Yorkshire United Independent College, Bradford.	**Zwingli.**
E. C.*	Ernest Clarke, M.D., F.R.C.S. Surgeon to the Central London Ophthalmic Hospital, and Consulting Ophthalmic Surgeon to the Miller General Hospital. Vice-President of the Ophthalmological Society. Author of *Refraction of the Eye*; &c.	**Vision:** *Errors of Refraction*, &c.
E. Cu.	Edmund Curtis, M.A. Keble College, Oxford. Lecturer on History in the University of Sheffield.	**William I. and II. of Sicily.**
E. C. B.	Right Rev. Edward Cuthbert Butler, O.S.B., M.A., D.Litt. Abbot of Downside Abbey, Bath. Author of "The Lausiac History of Palladius" in *Cambridge Texts and Studies*.	**Wadding, Luke.**
E. C. S.	Edmund Clarence Stedman. See the biographical article: Stedman, Edmund Clarence.	**Whittier, John Greenleaf.**
E. G.	Edmund Gosse, LL.D. See the biographical article: Gosse, Edmund.	**Villanelle; Virelay;** **Vosmaer, Carel;** **Waller, Edmund;** **Walloons:** *Literature*; **Watson, Thomas;** **Wells, Charles Jeremiah;** **Wennerberg, Gunnar;** **Winther, Christian;** **Wordsworth, Dorothy.**
Ed. M.	Eduard Meyer, Ph.D., D.Litt., LL.D. Professor of Ancient History in the University of Berlin. Author of *Geschichte des Alterthums*; *Geschichte des alten Aegyptens*; *Die Israeliten und ihre Nachbarstämme*.	**Vologaeses; Vonones I.-II.;** **Xerxes; Yazdegerd.**
E. M. W.	Rev. Edward Mewburn Walker, M.A. Fellow, Senior Tutor and Librarian of Queen's College, Oxford.	**Xenophon** (*in part*).
E. O.*	Edmund Owen, F.R.C.S., LL.D., D.Sc. Consulting Surgeon to St Mary's Hospital, London, and to the Children's Hospital, Great Ormond Street, London. Chevalier of the Legion of Honour. Author of *A Manual of Anatomy for Senior Students*.	**Wart;** **Whitlow.**
E. O'N.	Elizabeth O'Neill, M.A. (Mrs H. O. O'Neill). Formerly University Fellow and Jones Fellow of the University of Manchester.	**Vicar.**
E. Pr.	Edgar Prestage. Special Lecturer in Portuguese Literature in the University of Manchester. Commendador, Portuguese Order of S. Thiago. Corresponding Member of Lisbon Royal Academy of Sciences and Lisbon Geographical Society; &c.	**Vicente, Gil;** **Vieira, Antonio.**
E. P. W.	Everett Pepperrell Wheeler, A.M. Formerly Chairman of the Commission on International Law, American Bar Association, and other similar Commissions. Author of *Daniel Webster*; *Modern Law of Carriers*; *Wages and the Tariff*.	**Webster, Daniel** (*in part*).
E. R. L.	Sir Edwin Ray Lankester, K.C.B., F.R.S., D.Sc., LL.D., D.C.L. Hon. Fellow of Exeter College, Oxford. President of the British Association, 1906. Professor of Zoology and Comparative Anatomy in University College, London, 1874–1890. Linacre Professor of Comparative Anatomy at Oxford, 1891–1898. Director of the Natural History Departments of the British Museum, 1898–1907. Vice-President of the Royal Society, 1896. Romanes Lecturer at Oxford, 1905. Author of *Degeneration*; *The Advancement of Science*; *The Kingdom of Man*; &c.	**Zoology.**
E. T.	Elihu Thomson, A.M., D.Sc., Ph.D. Inventor of Electric Welding. Electrician to the Thomson-Houston and General Electric Companies. Professor of Chemistry and Mechanics, Central High School, Philadelphia, 1870–1880. President of the International Electro-technical Commission, 1908.	**Welding:** *Electric*.
F. A. C.	Franklyn Arden Crallan. Formerly Director of Wood-carving, Gloucester County Council. Author of *Gothic Woodcarving*.	**Wood-Carving.**
F. C. C.	Frederick Cornwallis Conybeare, M.A., D.Th. Fellow of the British Academy. Formerly Fellow of University College, Oxford. Editor of *The Ancient Armenian Texts of Aristotle*. Author of *Myth, Magic and Morals*; &c.	**Vow.**
F. G. M. B.	Frederick George Meeson Beck, M.A. Fellow and Lecturer of Clare College, Cambridge.	**Wessex.**
F. J. H.	Francis John Haverfield, M.A., LL.D., F.S.A. Camden Professor of Ancient History in the University of Oxford. Fellow of Brasenose College. Formerly Censor, Student, Tutor and Librarian of Christ Church. Ford's Lecturer, 1906–1907. Fellow of the British Academy. Author of Monographs on Roman History, especially Roman Britain; &c.	**Watling Street.**
F. Ke.	Frank Keiper, A.M., B.L., M.E. Manager of the United States Voting Machine Company. Formerly Assistant Examiner, United States Patent Office	**Voting Machines.**

F. L. L.	Lady Lugard. See the biographical article: Lugard, Sir F. J. D.	**Zaria.**
F. N. M.	Colonel Frederic Natusch Maude, C.B. Lecturer in Military History, Manchester University. Author of *War and the World's Policy*; *The Leipzig Campaign*; *The Jena Campaign.*	**Wörth.**
F. R. C.	Frank R. Cana. Author of *South Africa from the Great Trek to the Union.*	**Victoria Falls; Victoria Nyanza** (*in part*); **Zambezi; Zululand.**
F. T. M.	Sir Frank Thomas Marzials, K.C.B. Formerly Accountant-General of the Army. Editor of the "Great Writers" Series.	**Zola, Émile.**
F. We.	Frederick Wedmore. See the biographical article: Wedmore, Frederick.	**Whistler.**
F. W. R.*	Frederick William Rudler, I.S.O., F.G.S. Curator and Librarian of the Museum of Practical Geology, London, 1879–1902. President of the Geologists' Association, 1887–1889.	**Volcano; Wolframite; Zircon.**
F. Y. P.	Frederick York Powell, D.C.L., LL.D. See the biographical article: Powell, Frederick York.	**Vígfússon, Gúdbrandr.**
G.	Lord Grimthorpe. See the biographical article: Grimthorpe, 1st Baron.	**Watch** (*in part*).
G. A. C.*	Rev. George Albert Cooke, M.A., D.D. Oriel Professor of the Interpretation of Holy Scripture in the University of Oxford, and Fellow of Oriel College. Canon of Rochester. Hon. Canon of St Mary's Cathedral, Edinburgh. Author of *Text-Book of North Semitic Inscriptions*; &c.	**Zenobia.**
G. C. L.	George Collins Levey, C.M.G. Member of the Board of Advice to the Agent-General for Victoria. Formerly Editor and Proprietor of the *Melbourne Herald.* Secretary, Colonial Committee of Royal Commission to the Paris Exhibition, 1900. Secretary, Adelaide Exhibition, 1887. Secretary, Royal Commission, Hobart Exhibition, 1894–1895. Secretary to Commissioners for Victoria at the Exhibitions in London, Paris, Vienna, Philadelphia and Melbourne.	**Victoria** (*Australia*): *History.*
G. E.	Rev. George Edmundson, M.A., F.R.Hist.S. Formerly Fellow and Tutor of Brasenose College, Oxford. Ford's Lecturer, 1909. Hon. Member, Dutch Historical Society; and Foreign Member, Netherlands Association of Literature.	**William II., King of the Netherlands; William III., King of the Netherlands; William the Silent; William II., Prince of Orange.**
G. Fl.	George Fleming, C.B., LL.D., F.R.C.V.S. Formerly Principal Veterinary Surgeon, War Office, London. Author of *Animal Plagues: their History, Nature and Prevention.*	**Veterinary Science** (*in part*).
G. F. D.	George Frederick Deacon, LL.D., M.Inst.M.E., F.R.M.S. (1843–1909). Formerly Engineer-in-Chief for the Liverpool Water Supply (Vyrnwy Scheme), and Member of the Council of the Institution of Civil Engineers. Borough and Water Engineer of Liverpool, 1871–1879. Consulting Civil Engineer, 1879–1909. Author of addresses and papers on Engineering, &c.	**Water Supply.**
G. F. R. H.	George Francis Robert Henderson. See the biographical article: Henderson, George Francis Robert.	**War.**
G. G. P.*	George Grenville Phillimore, M.A., B.C.L. Christ Church, Oxford. Barrister-at-law, Middle Temple.	**Wreck** (*in part*).
G. H. C.	George Herbert Carpenter. Professor of Zoology in the Royal College of Science, Dublin. Author of *Insects: their Structure and Life.*	**Wasp** (*in part*); **Weevil** (*in part*).
G. J.	George Jamieson, C.M.G., M.A. Formerly Consul-General at Shanghai, and Consul and Judge of the Supreme Court, Shanghai.	**Yangtsze-Kiang.**
G. J. T.	George James Turner. Barrister-at-law, Lincoln's Inn. Editor of *Select Pleas of the Forests* for the Selden Society.	**Wapentake.**
G. Sa.	George Saintsbury, D.C.L., LL.D. See the biographical article: Saintsbury, George E. B.	**Vigny, Alfred de; Villehardouin, Geoffroy de; Villon, François; Voltaire.**
G. W. P.	George Walter Prothero, M.A., Litt.D., LL.D. Editor of the *Quarterly Review.* Honorary Fellow, formerly Fellow of King's College, Cambridge. Fellow of the British Academy. Professor of History in the University of Edinburgh, 1894–1899. Author of *Life and Times of Simon de Montfort*; &c. Joint-editor of the *Cambridge Modern History.*	**William IV., King of England.**
G. W. R.	Major George William Redway. Author of *The War of Secession, 1861–1862*; *Fredericksburg: a Study in War.*	**Wilderness** (*in part*).
G. W. T.	Rev. Griffithes Wheeler Thatcher, M.A., B.D. Warden of Camden College, Sydney, N.S.W. Formerly Tutor in Hebrew and Old Testament History at Mansfield College, Oxford.	**Wahhābis; Wāqidī; Yaʿqūbī; Yāqūt; Zamakhsharī; Zuhair.**

H. Ch.	Hugh Chisholm, M.A. Formerly Scholar of Corpus Christi College, Oxford. Editor of the 11th edition of the *Encyclopaedia Britannica*. Co-editor of the 10th edition.	**Victoria, Queen;** **Walter, John;** **Ward, Mrs Humphry;** **Wilde, Oscar;** **Wordsworth, William** (*in part*)
H. C. H.	Rev. Horace Carter Hovey, A.M., D.D. Fellow of the American Association for the Advancement of Science, the Geological Society of America, the National Geographic Society and the Société de Spéléologie. Author of *Celebrated American Caverns*; *Handbook of Mammoth Cave of Kentucky*; &c.	**Wyandotte Cave.**
H. De.	Hippolyte Delehaye, S.J. Bollandist. Joint Editor of the *Acta Sanctorum*; and the *Analecta Bollandiana*	**Vincent, St; Vitus, St.**
H. E. R.*	Herbert Edward Ryle, M.A., D.D. Dean of Westminster. Bishop of Winchester, 1903–1911. Bishop of Exeter, 1901–1903. Formerly Hulsean Professor of Divinity in the University of Cambridge; and Fellow of King's College. Author of *On Holy Scripture and Criticism*; &c. &c.	**Westcott, Brooke Foss.**
H. F. G.	Hans Friedrich Gadow, M.A., Ph.D., F.R.S. Strickland Curator and Lecturer on Zoology in the University of Cambridge. Author of "Amphibia and Reptiles" in the *Cambridge Natural History*; &c.	**Viper.**
H. H. C.	Sir Henry Hardinge Cunynghame, K.C.B., M.A. Assistant Under-Secretary, Home Office, London. Vice-President, Institute of Electrical Engineers. Author of various works on Enamelling, Electric Lighting, &c.	**Watch** (*in part*).
H. H. W.	Rev. Henry Herbert Williams, M.A. Fellow, Tutor and Lecturer in Philosophy, Hertford College, Oxford. Examining Chaplain to the Bishop of Llandaff.	**Will:** *Philosophy.*
H. Ja.	Henry Jackson, M.A., Litt.D., LL.D., O.M. Regius Professor of Greek in the University of Cambridge, and Fellow of Trinity College. Fellow of the British Academy. Author of *Texts to illustrate the History of Greek Philosophy from Thales to Aristotle.*	**Xenocrates;** **Xenophanes of Colophon;** **Zeno of Elea.**
H. J. C.	Henry James Chaney, I.S.O. (1842–1906). Formerly Superintendent of the Standards Department of the Board of Trade, and Secretary to the Royal Commission on Standards. Represented Great Britain at the International Conference on the Metric System, 1901. Author of *Treatise on Weights and Measures.*	**Weights and Measures:** *Scientific* and *Commercial.*
H. Lb.	Horace Lamb, M.A., LL.D., D.Sc., F.R.S. Professor of Mathematics in the University of Manchester. Formerly Fellow and Assistant Tutor of Trinity College, Cambridge. Member of Council of the Royal Society, 1894–1896. Royal Medallist, 1902. President of London Mathematical Society, 1902–1904. Author of *Hydrodynamics*; &c.	**Wave.**
H. L. J.	Henry Lewis Jones, M.A., M.D., F.R.C.P., M.R.C.S. Medical officer in charge of the Electrical Department and Clinical Lecturer on Medical Electricity at St Bartholomew's Hospital, London. Author of *Medical Electricity*; &c.	**X-Ray Treatment.**
H. M. C.	Hector Munro Chadwick, M.A. Fellow and Librarian of Clare College, Cambridge, and University Lecturer in Scandinavian. Author of *Studies on Anglo-Saxon Institutions.*	**Woden.**
H. M. V.	Herbert Murray Vaughan, M.A., F.S.A. Keble College, Oxford. Author of *The Last of the Royal Stuarts*; *The Medici Popes*; *The Last Stuart Queen.*	**Wales:** *Geography and Statistics* and *History.*
H. R. T.	Henry Richard Tedder, F.S.A. Secretary and Librarian of the Athenaeum Club, London.	**Wood, Anthony à.**
H. St.	Henry Sturt, M.A. Author of *Idola Theatri*; *The Idea of a Free Church*; *Personal Idealism.*	**Vischer, Friedrich Theodor.**
H. Sw.	Henry Sweet, M.A., Ph.D., LL.D. University Reader in Phonetics, Oxford University. Corresponding Member of the Academies of Munich, Berlin, Copenhagen and Helsingfors. Author of *A History of English Sounds since the Earliest Period*; *A Primer of Phonetics*; &c.	**Volapuk.**
H. W. C. D.	Henry William Carless Davis, M.A. Fellow and Tutor of Balliol College, Oxford. Fellow of All Souls College, Oxford, 1895–1902. Author of *England under the Normans and Angevins*; *Charlemagne.*	**Wace, Robert;** **Walter of Coventry;** **William I., King of England;** **William II., King of England;** **William of Malmesbury;** **William of Newburgh.**
H. W. R.*	Rev. Henry Wheeler Robinson, M.A. Professor of Church History in Rawdon College, Leeds. Senior Kennicott Scholar, Oxford, 1901. Author of "Hebrew Psychology in Relation to Pauline Anthropology" in *Mansfield College Essays*; &c.	**Zechariah** (*in part*).
I. A.	Israel Abrahams, M.A. Reader in Talmudic and Rabbinic Literature in the University of Cambridge. Formerly President, Jewish Historical Society of England. Author of *A Short History of Jewish Literature*; *Jewish Life in the Middle Ages*; *Judaism*; &c.	**Wise, Isaac Mayer;** **Zunz, Leopold.**
I. J. C.	Isaac Joslin Cox, Ph.D. Assistant Professor of History in the University of Cincinnati. President of the Ohio Valley Historical Association. Author of *The Journeys of La Salle and his Companions*; &c.	**Wilkinson, James.**

J. A. E.	James Alfred Ewing, C.B., LL.D., F.R.S., M.Inst.C.E. Director of (British) Naval Education. Hon. Fellow of King's College, Cambridge. Professor of Mechanism and Applied Mechanics in the University of Cambridge, 1890–1903. Author of *The Strength of Materials*; &c.	**Watt, James.**
J. A. F.	John Ambrose Fleming, M.A., D.Sc., F.R.S. Pender Professor of Electrical Engineering in the University of London. Fellow of University College, London. Formerly Fellow of St John's College, Cambridge, and University Lecturer on Applied Mechanics. Author of *Magnets and Electric Currents*.	**Voltmeter; Wattmeter;** **Wheatstone's Bridge.**
J. A. H.	John Allen Howe. Curator and Librarian of the Museum of Practical Geology, London. Author of *The Geology of Building Stones*.	**Wealden; Wenlock Group.**
J. Bt.	James Bartlett. Lecturer on Construction, Architecture, Sanitation, Quantities, &c., at King's College, London. Member of the Society of Architects. Member of the Institute of Junior Engineers.	**Wall-coverings.**
J. Bu.	John Burroughs. See the biographical article: Burroughs, John.	**Whitman, Walt.**
J. E. O.	Julius Emil Olson, B.L. Professor of Scandinavian Languages and Literature at the University of Wisconsin. Author of *Norwegian Grammar and Reader*.	**Vinland.**
J. F.-K.	James Fitzmaurice-Kelly, Litt.D., F.R.Hist.S. Gilmour Professor of Spanish Language and Literature, Liverpool University. Norman McColl Lecturer, Cambridge University. Fellow of the British Academy. Member of the Royal Spanish Academy. Knight Commander of the Order of Alphonso XII. Author of *A History of Spanish Literature*; &c.	**Villamediana, Count de;** **Villena, Enrique de;** **Zorrilla y Moral, José.**
J. F. M'L.	John Fergusson M'Lennan. See the biographical article: M'Lennan, John Fergusson.	**Werwolf** (*in part*).
J. Ga.	James Gairdner, C.B., LL.D. See the biographical article: Gairdner, James.	**York, House of.**
J. G. H.	Joseph G. Horner, A.M.I.Mech.E. Author of *Plating and Boiler Making*; *Practical Metal Turning*; &c.	**Welding** (*in part*).
J. G. M.	John Gray McKendrick, M.D., LL.D., F.R.S., F.R.S. (Edin.). Emeritus Professor of Physiology in the University of Glasgow. Professor of Physiology, 1876–1906. Author of *Life in Motion*; *Life of Helmholtz*; &c.	**Vision;** **Voice.**
J. G. R.	John George Robertson, M.A., Ph.D. Professor of German Language and Literature, University of London. Editor of the *Modern Language Journal*. Author of *History of German Literature*; *Schiller after a Century*; &c.	**Wieland, Christoph Martin.**
J. G. Sc.	Sir James George Scott, K.C.I.E. Superintendent and Political Officer, Southern Shan States. Author of *Burma*; *The Upper Burma Gazetteer*.	**Wa.**
J. H. F.	John Henry Freese, M.A. Formerly Fellow of St John's College, Cambridge.	**Xenophon** (*in part*).
J. H. M.	John Henry Middleton, M.A., Litt.D., F.S.A., D.C.L. (1846–1896). Slade Professor of Fine Art in the University of Cambridge, 1886–1895. Director of the Fitzwilliam Museum, Cambridge, 1889–1892. Art Director of the South Kensington Museum, 1892–1896. Author of *The Engraved Gems of Classical Times*; *Illuminated Manuscripts in Classical and Mediæval Times*.	**Vitruvius;** **Wren, Sir Christopher;** **Zuccaro I.-II.**
J. J. L.*	Rev. John James Lias, M.A. Chancellor of Llandaff Cathedral. Formerly Hulsean Lecturer in Divinity and Lady Margaret Preacher, University of Cambridge. Author of *Miracles, Science and Prayer*; &c.	**Ward, William George.**
J. L. W.	Jessie Laidlay Weston. Author of *Arthurian Romances unrepresented in Malory*.	**Wolfram von Eschenbach.**
J. Mac.	James MacQueen, F.R.C.V.S. Professor of Surgery at the Royal Veterinary College, London. Editor of Fleming's *Operative Veterinary Surgery* (2nd edition); Dun's *Veterinary Medicines* (10th edition); and Neumann's *Parasites and Parasitic Diseases of the Domesticated Animals* (2nd edition).	**Veterinary Science** (*in part*).
J. Mu.*	John Muir, A.M., LL.D. Member of the American Academy of Arts and Letters. President of the Sierra Club and the American Alpine Club. Visited the Arctic regions on the United States steamer "Corwin" in search of the De Long expedition. Author of *The Mountains of California*; *Our National Parks*; &c.	**Yosemite.**
J. M. G.	John Miller Gray (1850–1894). Art Critic. Curator of the Scottish National Portrait Gallery, 1884–1894. Author of *David Scott, R.S.A.*; *James and William Tassie*.	**Wilkie, Sir David.**
J. M. J.	John Morris Jones, M.A. Professor of Welsh at the University College of North Wales, Bangor. Formerly Research Fellow of Jesus College, Oxford. Author of *The Elucidarium in Welsh*; &c.	**Wales:** *Literature* and *Language*.
J. M. M.	John Malcolm Mitchell. Sometime Scholar of Queen's College, Oxford. Lecturer in Classics, East London College (University of London). Joint-editor of Grote's *History of Greece*.	**Winckelmann** (*in part*).

J. Si.	James Sime, M.A. (1843–1895). Author of *A History of Germany*; &c.	**Winckelmann** (*in part*).
J. S. N.	Joseph Shield Nicholson, M.A., Sc.D. Professor of Political Economy at Edinburgh University. Fellow of the British Academy. Author of *Principles of Political Economy*; *Money and Monetary Problems*; &c.	**Wages;** **Wealth.**
J. S. R.	James Smith Reid, M.A., LL.M., Litt.D., LL.D. Professor of Ancient History in the University of Cambridge and Fellow and Tutor of Gonville and Caius College. Hon. Fellow, formerly Fellow and Lecturer, of Christ's College. Editor of Cicero's *Academica*; *De Amicitia*; &c.	**Wyttenbach, Daniel Albert.**
J. T.*	Rev. John Telford. Wesleyan Methodist Connexional Editor. Editor of the *Wesleyan Methodist Magazine* and the *London Quarterly Review*. Author of *Life of John Wesley*; *Life of Charles Wesley*; &c.	**Wesley** (*Family*); **Wesley, John;** **Wesleyan Methodist Church.**
J. T. Be.	John Thomas Bealby. Joint-author of Stanford's *Europe*. Formerly Editor of the *Scottish Geographical Magazine*. Translator of Sven Hedin's *Through Asia, Central Asia and Tibet*; &c.	**Vladimir:** *Government* (*in part*); **Volga** (*in part*); **Vologda:** *Government* (*in part*); **Vyatka:** *Government* (*in part*); **Warsaw:** *Poland* (*in part*); **Yakutsk** (*in part*); **Yeniseisk** (*in part*).
J. T. C.	Joseph Thomas Cunningham, M.A., F.Z.S. Lecturer on Zoology at the South-Western Polytechnic, London. Formerly Fellow of University College, Oxford, and Assistant Professor of Natural History in the University of Edinburgh. Naturalist to the Marine Biological Association.	**Whitebait.**
J. V. B.	James Vernon Bartlet, M.A., D.D. Professor of Church History, Mansfield College, Oxford. Author of *The Apostolic Age*; &c.	**Vinet, Alexandre R.**
J. W.	James Williams, M.A., D.C.L., LL.D. All Souls Reader in Roman Law in the University of Oxford, and Fellow of Lincoln College. Barrister-at-Law of Lincoln's Inn. Author of *Law of the Universities*; &c.	**Warranty; Water Rights;** **Will** (*Law*); **Women** (*Early Law*); **Writ.**
J. We.	Julius Wellhausen, D.D. See the biographical article: Wellhausen, Julius.	**Zechariah** (*in part*).
J. W. G.	John Walter Gregory, D.Sc., F.R.S. Professor of Geology in the University of Glasgow. Professor of Geology and Mineralogy in the University of Melbourne, 1900–1904. Author of *The Dead Heart of Australia*; &c.	**Victoria:** *Geology*; **Western Australia:** *Geology*.
J. W. He.	James Wycliffe Headlam, M.A. Staff Inspector of Secondary Schools under the Board of Education. Formerly Fellow of King's College, Cambridge, and Professor of Greek and Ancient History at Queen's College, London. Author of *Bismarck and the Foundation of the German Empire*; &c.	**Windthorst, Ludwig.**
K. G.	Karl Friedrich Geldner, Ph.D. Professor of Sanskrit and Comparative Philology in the University of Marburg. Author of *Vedische Studien*; &c.	**Zend-Avesta; Zoroaster.**
K. G. J.	Kingsley Garland Jayne. Sometime Scholar of Wadham College, Oxford. Matthew Arnold Prizeman, 1903. Author of *Vasco da Gama and his Successors*.	**Xavier, Francisco de.**
K. S.	Kathleen Schlesinger. Editor of *The Portfolio of Musical Archaeology*. Author of *The Instruments of the Orchestra*.	**Vielle; Viol; Virginal;** **Wind Instruments;** **Xylophone.**
L.	Count Lützow, Litt.D., D.Ph., F.R.G.S. Chamberlain of H.M. the Emperor of Austria, King of Bohemia. Hon. Member of the Royal Society of Literature. Member of the Bohemian Academy, &c. Author of *Bohemia: a Historical Sketch*; *The Historians of Bohemia* (Ilchester Lecture, Oxford, 1904); *The Life and Times of John Hus*; &c.	**Žižka, John.**
L. D.*	Louis Duchesne. See the biographical article: Duchesne, Louis M. O.	**Victor I.-II.** (*Popes*).
L. F. V.-H.	Leveson Francis Vernon-Harcourt, M.A., M.Inst.C.E. (1839–1907). Professor of Civil Engineering at University College, London, 1882–1905. Author of *Rivers and Canals*; *Harbours and Docks*; *Civil Engineering as applied in Construction*; &c.	**Weir.**
L. J. S.	Leonard James Spencer, M.A. Assistant in the Department of Mineralogy, British Museum. Formerly Scholar of Sidney Sussex College, Cambridge, and Harkness Scholar. Editor of the *Mineralogical Magazine*.	**Vivianite; Wad;** **Wavellite; Willemite;** **Witherite; Wollastonite;** **Zeolites; Zoisite.**
L. R. F.	Lewis Richard Farnell, M.A., Litt.D. Fellow and Senior Tutor of Exeter College, Oxford. University Lecturer in Classical Archaeology; and Wilde Lecturer in Comparative Religion. Author of *Cults of Greek States*; *Evolution of Religion*.	**Zeus.**
L. V.*	Luigi Villari. Italian Foreign Office (Emigration Department). Formerly Newspaper Correspondent in the East of Europe. Italian Vice-Consul in New Orleans, 1906; Philadelphia, 1907; and Boston, 1907–1910. Author of *Italian Life in Town and Country*; &c.	**Victor Emmanuel II.**

L. W.	Lucien Wolf. Vice-President, formerly President, of the Jewish Historical Society of England. Joint-editor of the *Bibliotheca Anglo-judaica.*	**Zionism.**
M. A. B.	Lady Broome (Mary Anne Broome). Author of *Station Life in New Zealand*; *Stories About*; *Colonial Memories*; &c.	**Western Australia:** *History.*
M. Be.	Malcolm Bell. Author of *Pewter Plate*; *Sir E. Burne-Jones: a Record and Review.*	**Watts, George Frederick.**
M. Br.	Margaret Bryant.	**Virgil:** *The Virgil Legend.*
M. C.	Rt. Rev. Mandell Creighton, D.C.L., LL.D. See the biographical article: Creighton, Mandell.	**Waldenses.**
M. Ca.	Moritz Cantor, Ph.D. Honorary Professor of Mathematics in the University of Heidelberg. Hofrat of the German Empire. Author of *Vorlesungen über die Geschichte der Mathematik*; &c.	**Vieta, François.**
M. H. S.	Marion H. Spielmann, F.S.A. Formerly Editor of the *Magazine of Art.* Member of Fine Art Committee of International Exhibitions of Brussels, Paris, Buenos Aires, Rome, and the Franco-British Exhibition, London. Author of *History of "Punch"*; *British Portrait Painting to the opening of the 19th Century*; *Works of G. F. Watts, R.A.*; *British Sculpture and Sculptors of To-Day*; *Henriette Ronner*; &c.	**Wauters, Emile;** **Wood-engraving** (*in part*).
N. W. T.	Northcote Whitridge Thomas, M.A. Government Anthropologist to Southern Nigeria. Corresponding Member of the Société d'Anthropologie de Paris. Author of *Thought Transference*; *Kinship and Marriage in Australia*; &c.	**Week;** **Werwolf** (*in part*); **Witchcraft.**
P. A. K.	Prince Peter Alexeivitch Kropotkin. See the biographical article: Kropotkin, Prince P. A.	**Vladimir:** *Government* (*in part*); **Volga** (*in part*); **Vologda:** *Government* (*in part*); **Vyatka:** *Government* (*in part*); **Warsaw:** *Poland* (*in part*); **Yakutsk** (*in part*); **Yeniseisk** (*in part*).
P. C. M.	Peter Chalmers Mitchell, M.A., D.Sc., LL.D., F.Z.S., F.R.S. Secretary of the Zoölogical Society of London. University Demonstrator in Comparative Anatomy and Assistant to Linacre Professor at Oxford, 1888–1891. Author of *Outlines of Biology*; &c.	**Zoological Gardens;** **Zoological Nomenclature.**
P. Gi.	Peter Giles, M.A., LL.D., Litt.D. Fellow and Classical Lecturer of Emmanuel College, Cambridge, and University Reader in Comparative Philology. Formerly Secretary of the Cambridge Philological Society. Author of *Manual of Comparative Philology.*	**W.** **X.** **Y.** **Z.**
P. G. H.	Philip Gilbert Hamerton. See the biographical article: Hamerton, Philip Gilbert.	**Wood-engraving** (*in part*).
P. G. K.	Paul George Konody. Art Critic of *The Observer* and *The Daily Mail.* Formerly Editor of *The Artist.* Author of *The Art of Walter Crane*; *Velasquez, Life and Work*; &c.	**Watteau, Antoine.**
P. S.	Philip Schidrowitz, Ph.D., F.C.S. Member of the Council, Institute of Brewing; Member of the Committee of the Society of Chemical Industry. Author of numerous articles on the Chemistry and Technology of Brewing, Distilling; &c.	**Whisky;** **Wine.**
P Vi.	Paul Vinogradoff, D.C.L., LL.D. See the biographical article: Vinogradoff, Paul.	**Village Communities;** **Villenage.**
R. A. W.	Colonel Robert Alexander Wahab, C.B., C.M.G., C.I.E. Formerly H.M. Commissioner, Aden Boundary Delimitation. Served with Tirah Expeditionary Force, 1897–1898, and on the Anglo-Russian Boundary Commission, Pamirs, 1895.	**Yemen.**
R. C. D.	Romesh Chunder Dutt, C.I.E. (1848–1909). Fellow of the Royal Society of Literature; Member of the Royal Asiatic Society. Barrister-at-Law, Middle Temple. Formerly Revenue Minister of Baroda State and Prime Minister of Baroda State. Author of *Economic History of India in the Victorian Age, 1837–1900*; &c.	**Vidyasagar, Iswar Chandra.**
R. G.	Richard Garnett, LL.D. See the biographical article: Garnett, Richard.	**Wakefield, Edward Gibbon.**
R. G. M.	Reginald Godfrey Marsden. Barrister-at-Law, Inner Temple.	**Wreck** (*in part*).
R. He.	Sir Reginald Hennell, D.S.O., C.V.O. Colonel in the Indian Army (retired). Lieutenant of the King's Body-Guard of the Yeomen of the Guard. Served in the Abyssinian Expedition, 1867–68; Afghan War, 1879–80; Burmah Campaign, 1886–87. Author of *History of the Yeomen of the Guard, 1485–1904*; &c.	**Yeomen of the Guard.**
R. J. M.	Ronald John McNeill, M.A. Christ Church, Oxford. Barrister-at-Law, Lincoln's Inn. Formerly Editor of the *St James's Gazette* (London).	**Wentworth** (*Family*).

R. K. D.	Sir Robert Kennaway Douglas. Formerly Professor of Chinese, King's College, London. Keeper of Oriental Printed Books and MSS. at the British Museum, 1892–1907. Member of the Chinese Consular Service, 1858–1865. Author of *The Language and Literature of China*; *Europe and the Far East*; &c.	**Wade, Sir Thomas F.**
R. L.*	Richard Lydekker, F.R.S., F.G.S., F.Z.S. Member of the Staff of the Geological Survey of India, 1874–1882. Author of *Catalogue of Fossil Mammals, Reptiles and Birds in the British Museum*; *The Deer of all Lands*; *The Game Animals of Africa*; &c.	**Viscacha; Vole;** **Walrus** (*in part*); **Water-Deer; Weasel;** **Whale** (*in part*); **Whale-fishery; Wolf** (*in part*); **Wombat; Zebra** (*in part*); **Zoological Distribution.**
R. L. P.	Reginald Lane Poole, M.A., Ph.D., LL.D. Keeper of the Archives of the University of Oxford and Fellow of Magdalen College. Fellow of the British Academy. Editor of the *English Historical Review*. Author of *Wycliffe and movements for Reform*; &c.	**Wycliffe** (*in part*).
R. Mu.*	Rev. Robert Munro, B.D., F.S.A. (Scot.) Barclay Manse, Old Kilpatrick, N. B.	**Vitrified Forts.**
R. N. B.	Robert Nisbet Bain (d. 1909). Assistant Librarian, British Museum, 1883–1909. Author of *Scandinavia: the Political History of Denmark, Norway and Sweden, 1513–1900*; *The First Romanovs, 1613–1725*; *Slavonic Europe: the Political History of Poland and Russia from 1469 to 1796*; &c.	**Vladimir, St;** **Voluinsky, Artemy Petrovich;** **Vorontsov** (*Family*); **Vorosmarty, Mihaly;** **Wallqvist, Olaf;** **Wesselényi, Baron;** **Wielopolski, Aleksander;** **Witowt;** **Wladislaus I.-IV. of Poland.** **Zamoyski, Jan;** **Zolkiewski, Stanislaus;** **Zrinyi, Count** (1508–1566); **Zrinyi, Count** (1620–1664).
R. P. S.	R. Phené Spiers, F.S.A., F.R.I.B.A. Formerly Master of the Architectural School, Royal Academy, London. Past President of the Architectural Association. Associate and Fellow of King's College, London. Corresponding Member of the Institute of France. Editor of Fergusson's *History of Architecture*. Author of *Architecture: East and West*; &c.	**Villa;** **Window.**
R. S. C.	Robert Seymour Conway, M.A., D.Litt. Professor of Latin and Indo-European Philology in the University of Manchester. Formerly Professor of Latin in University College, Cardiff; and Fellow of Gonville and Caius College, Cambridge. Author of *The Italic Dialects*.	**Volsci.**
R. W. F. H.	Robert William Frederick Harrison. Barrister-at-Law, Inner Temple. Assistant Secretary of the Royal Society, London.	**Violin.**
S. A. C.	Stanley Arthur Cook. Lecturer in Hebrew and Syriac, and formerly Fellow, Gonville and Caius College, Cambridge. Editor for the Palestine Exploration Fund. Author of *Glossary of Aramaic Inscriptions*; *The Laws of Moses and the Code of Hammurabi*; *Critical Notes on Old Testament History*; *Religion of Ancient Palestine*; &c.	**Zebulun;** **Zedekiah;** **Zephaniah.**
S. N.	Simon Newcomb, D.Sc., LL.D. See the biographical article: Newcomb, Simon.	**Zodiacal Light.**
S. P.	Stephen Paget, F.R.C.S. Surgeon to the Throat and Ear Department, Middlesex Hospital. Hon. Secretary, Research Defence Society. Author of *Memoirs and Letters of Sir James Paget*; &c.	**Vivisection.**
T. As.	Thomas Ashby, M.A., D.Litt. Director of the British School of Archaeology at Rome. Formerly Scholar of Christ Church, Oxford. Craven Fellow, 1897. Conington Prizeman, 1906. Member of the Imperial German Archaeological Institute. Author of *The Classical Topography of the Roman Campagna*.	**Vetulonium; Vicenza;** **Viterbo; Volci;** **Volsinii; Volterra;** **Volturno.**
T. A. A.	Thomas Andrew Archer, M.A. Author of *The Crusade of Richard I.*; &c.	**Vincent of Beauvais.**
T. A. C.	Timothy Augustine Coghlan, I.S.O. Agent-General for New South Wales. Government Statistician, New South Wales, 1886–1905. Honorary Fellow of the Royal Statistical Society. Author of *Wealth and Progress of New South Wales*; *Statistical Account of Australia and New Zealand*; &c.	**Victoria:** *Geography and Statistics*; **Western Australia:** *Geography and Statistics.*
T. Ba.	Sir Thomas Barclay. Member of the Institute of International Law. Officer of the Legion of Honour. Author of *Problems of International Practice and Diplomacy*; &c. M.P. for Blackburn, 1910.	**War:** *Laws of*; **Waters, Territorial.**
T. H. B.	Thomas Hudson Beare, M.Inst.C.E., M.Inst.M.E. Regius Professor of Engineering in the University of Edinburgh. Author of papers in the *Transactions* of the Societies of Civil and Mechanical Engineers, 1894–1902.	**Water Motors.**

T. R. G.	Terrot Reaveley Glover, M.A. Fellow and Classical Lecturer at St John's College, Cambridge. Professor of Latin, Queen's University, Kingston, Canada, 1896–1901. Author of *Studies in Virgil*; &c.	**Virgil** (*in part*).
T. W.-D.	Walter Theodore Watts-Dunton. See the biographical article: Watts-Dunton, Walter Theodore.	**Wycherley, William.**
T. W. F.	Thomas William Fox. Professor of Textiles in the University of Manchester. Author of *Mechanics of Weaving*.	**Weaving;** **Yarn.**
U. B.	Count Ugo Balzani, Litt.D. Member of the Reale Accademia dei Lincei. Sometime President of the Reale Società Romana di Storia Patria. Corresponding Member of the British Academy; Author of *The Popes and the Hohenstaufen*; &c.	**Villani, Giovanni.**
W. Ay.	Wilfrid Airy, M.Inst.C.E. Sometime Scholar of Trinity College, Cambridge. Technical Adviser to the Standards Department of the Board of Trade. Author of *Levelling and Geodesy*; &c.	**Weighing Machines.**
W. A. B. C.	Rev. William Augustus Beevoort Coolidge, M.A., F.R.G.S., Ph.D. Fellow of Magdalen College, Oxford. Professor of English History, St David's College, Lampeter, 1880–1881. Author of *Guide du Haut Dauphiné*; *The Range of the Todi*; *Guide to Grindelwald*; *Guide to Switzerland*; *The Alps in Nature and in History*; &c. Editor of the *Alpine Journal*, 1880–1881; &c.	**Vevey; Vienne:** *Town*; **Vorarlberg; Walensee;** **Winkelried, Arnold von;** **Winterthur; Zug:** *Canton*; **Zug:** *Town*; **Zug, Lake of;** **Zürich:** *Canton*; **Zürich:** *Town*; **Zürich, Lake of.**
W. A. J. F.	Walter Armitage Justice Ford. Sometime Scholar of King's College, Cambridge. Teacher of Singing at the Royal College of Music, London.	**Wolf, Hugo.**
W. A. P.	Walter Alison Phillips, M.A. Formerly Exhibitioner of Merton College and Senior Scholar of St John's College, Oxford. Author of *Modern Europe*; &c.	**Walther von der Vogelweide;** **Wycliffe** (*in part*).
W. B.*	William Burton, M.A., F.C.S. Chairman of the Joint Committee of Pottery Manufacturers of Great Britain. Author of *English Stoneware and Earthenware*; &c.	**Wedgwood, Josiah.**
W. C. U.	William Cawthorne Unwin, F.R.S., LL.D., M.Inst.C.E., M.Inst.M.E. Emeritus Professor, Central Technical College, City and Guilds of London Institute. Author of *Wrought Iron Bridges and Roofs*; *Treatise on Hydraulics*; &c.	**Windmill.**
W. E. G.	Sir William Edmund Garstin, G.C.M.G. British Government Director, Suez Canal Co. Formerly Inspector-General of Irrigation, Egypt. Adviser to the Ministry of Public Works in Egypt, 1904–1908.	**Victoria Nyanza** (*in part*).
W. F. C.	William Feilden Craies, M.A. Barrister-at-Law, Inner Temple. Lecturer on Criminal Law, King's College, London. Editor of Archbold's *Criminal Pleading* (23rd edition).	**Wager; Warrant;** **Witness.**
W. Hy.	William Henry. Founder and Chief Secretary of the Royal Life Saving Society. Associate of the Order of St John of Jerusalem. Joint Author of *Swimming* (Badminton Library); &c.	**Water Polo.**
W. H. F.	Sir William Henry Flower, F.R.S. See the biographical article: Flower, Sir W. H.	**Walrus** (*in part*); **Whale** (*in part*); **Wolf** (*in part*); **Zebra** (*in part*).
W. L. G.	William Lawson Grant, M.A. Professor of Colonial History, Queen's University, Kingston, Canada. Formerly Beit Lecturer on Colonial History, Oxford University. Editor of *Acts of the Privy Council* (Canadian Series).	**Wilson, Sir Daniel.**
W. M.	William Minto, M.A. See the biographical article: Minto, William.	**Wordsworth, William** (*in part*).
W. MacD.*	William MacDonald, LL.D., Ph.D. Professor of American History in Brown University, Providence, R.I. Formerly Professor of History and Political Science, Bowdoin. Member of the American Historical Association, &c. Author of *History and Government of Maine*; &c. Editor of *Select Charters and other documents illustrative of American History*.	**Washington, George.**
W. M. F. P.	William Matthew Flinders Petrie, F.R.S., D.C.L., Litt.D. See the biographical article: Petrie, W. M. Flinders.	**Weights and Measures:** *Ancient Historical.*
W. M. R.	William Michael Rossetti. See the biographical article: Rossetti, Dante Gabriel.	**Vivarini;** **Zurbaran, Francisco.**
W. O. S.	William Oscar Scroggs, Ph.D. Assistant Professor of History and Economics at Louisiana State University. Formerly Goodwin and Austin Fellow, Harvard University.	**Walker, William.**
W. P. C.	William Prideaux Courtney. See the biographical article: Courtney, L. H. Baron.	**Walpole, Horatio;** **Wilkes, John.**
W. P. J.	William Price James. Barrister-at-Law, Inner Temple. High Bailiff, Cardiff County Court. Author of *Romantic Professions*; &c.	**Watson, William** (*poet*).

W. P. R.	Hon. William Pember Reeves. Director of the London School of Economics. Agent-General and High Commissioner for New Zealand, 1896–1909. Minister of Education, Labour and Justice, New Zealand, 1891–1896. Author of *The Long White Cloud: a History of New Zealand*; &c.	**Vogel, Sir Julius.**
W. Ri.	William Ridgeway, M.A., D.Sc., Litt.D. Disney Professor of Archaeology, and Brereton Reader in Classics, in the University of Cambridge. Fellow of Gonville and Caius College. Fellow of the British Academy. President of the Royal Anthropological Institute, 1908. Author of *The Early Age of Greece*; &c.	**Villanova.**
W. S. R.	William Smyth Rockstro. Author of *A Great History of Music from the Infancy of the Greek Drama to the Present Period*; &c.	**Wagner:** *Biography* (*in part*); **Weber.**
W. T. Ca.	William Thomas Calman, D.Sc., F.Z.S. Assistant in charge of Crustacea, Natural History Museum, South Kensington. Author of "Crustacea," in a *Treatise on Zoology*, edited by Sir E. Ray Lankester.	**Water-flea;** **Wood-louse.**
W. Wr.	Williston Walker, Ph.D., D.D. Professor of Church History, Yale University. Author of *History of the Congregational Churches in the United States*; *The Reformation*; *John Calvin*; &c.	**Winthrop, John** (1588–1649).
W. W. F.*	William Warde Fowler, M.A. Fellow of Lincoln College, Oxford. Sub-rector, 1881–1904. Gifford Lecturer, Edinburgh University, 1908. Author of *The City-State of the Greeks and Romans*; *The Roman Festivals of the Republican Period*; &c.	**Vulcan.**
W. W. R.*	William Walker Rockwell, Lic.Theol. Assistant Professor of Church History, Union Theological Seminary, New York.	**Westminster, Synods of.**
W. Y. S.	William Young Sellar, LL.D. See the biographical article: Sellar, William Young.	**Virgil** (*in part*).

PRINCIPAL UNSIGNED ARTICLES

Vicksburg.
Vienna.
Vine.
Vinegar.
Vingt-et-Un.
Violet.
Virginia.
Viscount.
Vlachs.
Volunteers.
Vote and Voting.
Wadai.
Wagram.
Wakefield.
Waldeck-Pyrmont.
Wallingford.
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War Game.
Warrington.
Warwick.
Warwickshire.
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West Indies.
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West Virginia.
Wexford.
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Wheat.
Wheeling.
Whig and Tory.
Whist.
Whitby.
White Plains.
Whooping-Cough.
Wicklow.
Wiesbaden.
Wig.
Wigan.
Wight, Isle of.
Wigtownshire.
Wilkes-Barré.
Williamsburg (Va.).
Willow.
Wilmington (Del.).
Wilton.
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Winchester.
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Wisconsin.
Wisconsin, University of.
Woolwich.
Worcester.
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Worms.
Wrestling.
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Würzburg.
Wyoming.
Wyoming Valley.
Yale University.
Yarmouth.
Yaws.
Yellow Fever.
Yellowstone National Park.
Yew.
Yezo.
York.
Yorkshire.
Yorktown.
Ypsilanti.
Yucatan.
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Zeeland.
Zeuxis.
Zinc.
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THE
ENCYCLOPÆDIA BRITANNICA

VOLUME 28

VETCH TO ZYMOTIC DISEASES

VETCH, in botany, the English name for *Vicia sativa*, also known as tare, a leguminous annual herb with trailing or climbing stems, compound leaves with five or six pairs of leaflets, reddish-purple flowers borne singly or in pairs in the leaf-axis, and a silky pod containing four to ten smooth seeds. The wild form, sometimes regarded as a distinct species, *V. angustifolia*, is common in dry soils. There are two races of the cultivated vetch, winter and spring vetches: the former, a hardy form, capable of enduring frost, has smoother, more cylindrical pods with smaller seeds than the summer variety, and gives less bulk of stem and leaves. The spring vetch is a more delicate plant and grows more rapidly and luxuriantly than the winter variety.

The name vetch is applied to other species of the genus *Vicia*. *Vicia orobus*, bitter vetch, and *V. sylvatica*, wood vetch, are British plants. Another British plant, *Hippocrepis*, is known as horseshoe vetch from the fact of its pod breaking into several horseshoe-shaped joints. *Anthyllis vulneraria* is kidney-vetch, a herb with heads of usually yellow flowers, found on dry banks. *Astragalus* is another genus of Leguminosae, and is known as milk-vetch.

Vetches are a very valuable forage crop. Being indigenous to Britain, and not fastidious in regard to soil, they can be cultivated successfully under a great diversity of circumstances, and are well adapted for poor soils. By combining the winter and spring varieties, and making several sowings of each in its season at intervals of two or three weeks, it is practicable to have them fit for use from May till October, and thus to carry out a system of soiling by means of vetches alone. But it is usually more expedient to use them in combination with grass and clover, beginning with the first cutting of the latter in May, taking the winter vetches in June, recurring to the Italian ryegrass or clover as the second cutting is ready, and afterwards bringing the spring vetches into use. Each crop can thus be used when in its best state for cattle food, and so as gratefully to vary their dietary.

Winter Vetches.—There is no botanical difference between winter and spring vetches, and the seeds being identical in appearance, caution is required in purchasing seed to get it of the right sort. Seed grown in England is found the most suitable for sowing in Scotland, as it vegetates more quickly, and produces a more vigorous plant than that which is home-grown. As the great inducement to cultivate this crop is the obtaining of a supply of nutritious green food which shall be ready for use about the 1st of May, so as to fill up the gap which is apt to occur betwixt the root crops of the previous autumn and the ordinary summer food, whether for grazing or soiling, it is of the utmost importance to treat it in such a way that it may be ready for use by the time mentioned. To secure this, winter tares should be sown in August if possible, but always as soon as the land can be cleared of the preceding crop. They may yield a good crop though sown in October, but in this case will probably be very little in advance of early-sown spring vetches, and possess little, if any, advantage over them in any respect. The land on which they are sown should be dry and well sheltered, clean and in good heart, and be further enriched by farmyard manure. Not less than 3½ bushels of seed per acre should be sown, to which some think it beneficial to add half a bushel of wheat. Rye is frequently used for this purpose, but it gets reedy in the stems, and is rejected by the stock. Winter beans are better than either. The land having been ploughed rather deeply, and well harrowed, it is found advantageous to deposit the seed in rows, either by a drilling-machine or by ribbing. The latter is the best practice, and the ribs should be at least a foot apart and rather deep, that the roots may be well developed before top-growth takes place. As soon in spring as the state of the land and weather admits of it, the crop should be hoed betwixt the drills, a top-dressing at the rate of 40 bushels of soot or 2 cwt. of guano per acre applied by sowing broadcast, and the roller then used for the double purpose of smoothing the surface so as to admit of the free use of the scythe and of pressing down the plants which may have been loosened by frost. It is thus by early sowing, thick seeding and liberal manuring that this crop is to be forced to an early and abundant maturity. May and June are the months in which winter vetches are used to advantage. A second growth will be produced from the roots if the crop is allowed to stand; but it is much better practice to plough up the land as the crop is cleared, and to sow turnips upon it. After a full crop of vetches, land is usually in a good state for a succeeding crop. When the whole process has been well managed, the gross amount of cattle food yielded by a crop of winter vetches, and the turnip crop by which it is followed in the same summer, will be found considerably to exceed what could be obtained from the fullest crop of turnips alone, grown on similar soil, and with the same quantity of manure. It is useless to sow this crop where game abounds.

Spring vetches, if sown about the 1st of March, will be ready for use by the 1st of July, when the winter vetches are just cleared off. To obtain the full benefit of this crop, the land on which it is sown must be clean, and to keep it so a much fuller allowance of seed is required than is usually given in Scotland. When the crop is as thick set as it should be, the tendrils intertwine, and the ground is covered by a solid mass of herbage, under which no weed can live. To secure this, not less than 4 bushels of seed per acre should be used if sown broadcast, or 3 bushels if in drills. The latter plan, if followed by hoeing, is certainly the best; for if the weeds are kept in check until the crop is fairly established, they have no chance of getting up afterwards. With a thin crop of vetches, on the other hand, the land is so certain to get foul, that they should at once be ploughed down, and something else put in their place. As vetches are in the best state for use when the seeds begin to form in the pods, repeated sowings are made at intervals of three weeks, beginning by the end of February, or as early in March as the season admits, and continuing till May. The usual practice in Scotland has been to sow vetches on part of the oat break, once ploughed from lea. Sometimes this does very well, but a far better plan is to omit sowing clover and grass seeds on part of the land occupied by wheat or barley after a crop of turnips, and having ploughed that portion in the autumn to occupy it with vetches, putting them *instead of* "*seeds*" for one revolution of the course.

When vetches are grown on poor soils, the most profitable way of using them is by folding sheep upon them, a practice very suitable also for clays, upon which a root crop cannot safely be consumed in this way. A different course must, however, be adopted from that followed when turnips are so disposed of. When sheep are turned in upon a piece of tares, a large portion of the food is trodden down and wasted. Cutting the vetches and putting them into racks does not much mend the matter, as much is still pulled out and wasted, and the manure unequally distributed over the land. To avoid those evils, hurdles with vertical spars, betwixt which the sheep can reach with head and neck, are now used. These are set close up to the growing crop along a considerable stretch, and shifted forward as the sheep eat up what is within their reach. This requires the constant attention of the shepherd, but the labour is repaid by the saving of the food, which being always fresh and clean, does the sheep more good. A modification of this plan is to use the same kind of hurdles, but instead of shifting them as just described, to mow a swathe parallel to them, and fork this forward within reach of the sheep as required, repeating this as often during the day as is found necessary, and at night moving the sheep close up to the growing crop, so that they may lie for the next twenty-four hours on the space which has yielded food for the past day. During the night they have such pickings as have been left on the recently mown space and so much of the growing crop as they can get at through the spars. There is less labour by this last mode than the other, and having practised it for many years, we know that it answers well. This folding upon vetches is suitable either for finishing off for market sheep that are in forward condition, or for recently weaned lambs, which, after five or six weeks' folding on this clean, nutritious herbage, are found to take on more readily to eat turnips, and to thrive better upon them, than if they had been kept upon the pastures all the autumn. Sheep folded upon vetches must have water always at command, otherwise they will not prosper.

As spring-sown vetches are in perfection at the season when pastures usually get dry and scanty, a common practice is to cart them on to grass land and spread them out in wisps, to be eaten by the sheep or cattle. It is, however, much better either to have them eaten by sheep where they grow, or to cart them to the homestead.

VETERAN, old, tried, experienced, particularly used of a soldier who has seen much service. The Latin *veteranus* (*vetus*, old), as applied to a soldier, had, beside its general application in opposition to *tiro*, recruit, a specific technical meaning in the Roman army. Under the republic the full term of service with the legion was twenty years; those who served this period and gained their discharge (*missio*) were termed *emeriti*. If they chose to remain in service with the legion, they were then called *veterani*. Sometimes a special invitation was issued to the *emeriti* to rejoin; they were then styled *evocati*.

The base of Lat. *vetus* meant a year, as seen in the Gr. ἔτος (for Ϝετος) and Sanskrit *vatsa*; from the same base comes *vitulus*, a calf, properly a yearling, *vitellus*, a young calf, whence O. Fr. *veel*, modern, *veau*, English "veal," the flesh of the calf. The Teutonic cognate of *vitulus* is probably seen in Goth. *withrus*, lamb, English "wether," a castrated ram.

VETERINARY SCIENCE (Lat. *veterinarius*, an adjective meaning "connected with beasts of burden and draught," from *veterinus*, "pertaining to yearlings," and *vitulus*, "a calf"),[1] the science, generally, that deals with the conformation and structure of the domesticated animals, especially the horse; their physiology and special racial characteristics; their breeding, feeding and general hygienic management; their pathology, and the preventive and curative, medical and surgical, treatment of the diseases and injuries to which they are exposed; their amelioration and improvement; their relations to the human family with regard to communicable maladies; and the supply of food and other products derived from them for the use of mankind. In this article it is only necessary to deal mainly with veterinary science in its relation with medicine, as other aspects are treated under the headings for the particular animals, &c. In the present edition of the *Encyclopaedia Britannica* the various anatomical articles (see ANATOMY for a list of these) are based on the comparative method, and the anatomy of the lower animals is dealt with there and in the separate articles on the animals.

History.

There is evidence that the Egyptians practised veterinary medicine and surgery in very remote times; but it is not until we turn to the Greeks that we obtain any very definite information with regard to the state of veterinary as well as human medicine in antiquity. The writings of Hippocrates (460–377 B.C.) afford evidence of excellent investigations in comparative pathology. Diocles of Carystus, who was nearly a contemporary, was one of the first to occupy himself with anatomy, which he studied in animals. Aristotle, too, wrote on physiology and comparative anatomy, and on the maladies of animals, while many other Greek writers on veterinary medicine are cited or copied from by Varro, Columella and Galen. And we must not overlook Mago of Carthage (200 B.C.), whose work in twenty-eight books was translated into Greek and was largely used by Varro and Columella.

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[1] Regarding the origin of the word "veterinary," the following occurs in D'Arboval's *Dictionnaire de médecine et de chirurgie vétérinaires*, edited by Zundel (1877), iii. 814: "Les mots *veterinaria* et *veterinarius* étaient employés par les Romains pour désigner: le premier, la médecine des bêtes de somme; le second, pour indiquer celui qui la pratiquait; le mot *veterinae* indiquait les bêtes de somme, et était la contraction de *veheterinae*, du verbe *vehere*, porter, tirer, traîner. L'étymologie réelle du mot *vétérinaire*, ou plutôt du mot *veterinarius* des Romains, serait d'après Lenglet encore plus ancienne; elle viendrait du celtique, d'où le mot serait passé chez les Romains; cet auteur fait venir le mot de *vee*, bétail (d'où l'allemand *Vieh*), *teeren*, être malade (d'où l'allemand *Zehren*, consomption), *aerts* ou *arts*, artiste, médecin (d'où l'allemand *Arzt*)."

Amongst the Romans.

Until after the conquest of Greece the Romans do not appear to have known much of veterinary medicine. Varro (116–28 B.C.) may be considered the first Roman writer who deals with animal medicine in a scientific spirit in his *De Re Rustica*, in three books, which is largely derived from Greek writers. Celsus is supposed to have written on animal medicine, and Columella (1st century) is credited with having utilized those relating to veterinary science in the sixth and seventh parts of his *De Re Rustica*, one of the best works of its class of ancient times; it treats not only of medicine and surgery, but also of sanitary measures for the suppression of contagious diseases. From the 3rd century onwards veterinary science had a literature of its own and regular practitioners, especially in the service of the Roman armies (*mulomedici, veterinarii*). Perhaps the most renowned veterinarian of the Roman empire was Apsyrtus of Bithynia, who in 322 accompanied the expedition of Constantine against the Sarmatians in his professional capacity, and seems to have enjoyed a high and well-deserved reputation in his time. He was a keen observer; he distinguished and described a number of diseases which were badly defined by his predecessors, recognized the contagious nature of glanders, farcy and anthrax, and prescribed isolation for their suppression; he also made interesting observations on accidents and diseases of horses' limbs, and waged war against certain absurd empirical practices then prevailing in the treatment of disease, indicating rational methods, some of which are still successfully employed in veterinary therapeutics, such as splints for fractures, sutures for wounds, cold water for the reduction of prolapsed vagina, hot baths for tetanus, &c. Not less eminent was Hierocles, the successor of Apsyrtus, whose writings he largely copied, but with improvements and valuable additions, especially in the hygiene and training of horses. Pelagonius, again, was a writer of empirical tendency, and his treatment of disease in general was most irrational. Publius Vegetius (not to be confounded with Flavius Vegetius Renatus, who wrote on the military art) was a popular author of the end of the 5th century, though less distinguished than Apsyrtus, to whom and to Pelagonius he was to a great extent indebted in the preparation of his *Mulomedicina sive Ars Veterinaria*. He appears to have been more of a horse-dealer than a veterinary practitioner, and knew next to nothing of anatomy, which seems to have been but little cultivated at that period. He was very superstitious and a believer in the influence of demons and sorcerers; nevertheless, he gives some interesting observations derived from his travels. He had also a good idea of aërial infection, recognized the utility of disinfectants, and describes some operations not referred to by previous writers, such as removal of calculi from the bladder through the rectum, couching for cataract, the extirpation of certain glands, and several serious operations on the horse's foot. Though inferior to several works written by his predecessors, the *Mulomedicina* of Vegetius maintained its popularity through many centuries. Of most of the ancient veterinary writers we know little beyond what can be gathered from the citations and extracts in the two great collections of *Hippiatrica* and *Geoponica* compiled by order of Constantine Porphyrogenitus in the 10th century.

It is unnecessary to dwell here on the progress of the veterinary art during the middle ages. Towards the close of the medieval period the subject was much cultivated in the cavalry schools of Italy; and Spain also had an organized system of good practitioners in the 15th century, who have left many books still extant. Germany was far behind, and literature on the subject did not exist until the end of the 15th century, when in 1492 there was published anonymously at Augsburg a *Pferdearzneibüchlein*. In the following century the influence of the Italian writers was becoming manifest, and the works of Fugger and Fayser mark the commencement of a new era. Fayser's treatises, *Von der Gestüterei* and *Von der Zucht der Kriegs- und Bürger-Pferde* (1529–97), are remarkable for originality and good sense. In Great Britain animal medicine was perhaps in a more advanced condition than in Germany, if we accept the evidence of the *Ancient Laws and Institutes of Wales* (London, 1841); yet it was largely made up of the grossest superstitions.[1] Among the Celts the healer of horse diseases and the shoer were held in high esteem, as among the more civilized nations of Europe, and the court farrier enjoyed special privileges.[2] The earliest known works in English appeared anonymously towards the commencement of the 16th century, viz. *Propertees and Medcynes for a Horse* and *Mascal of Oxen, Horses, Sheepes, Hogges, Dogges*. The word "mascal" shows that the latter work was in its origin Italian. There is no doubt that in the 15th century the increasing taste for horses and horsemanship brought Italian riding-masters and farriers into England; and it is recorded that Henry VIII. brought over two of these men who had been trained by Grisone in the famous Neapolitan school. The knowledge so introduced became popularized, and assumed a concrete form in Blundeville's *Foure Chiefest Offices belonging to Horsemanship* (1566), which contains many references to horse diseases, and, though mainly a compilation, is yet enriched with original observations. In the 15th century the anatomy of the domesticated animals, formerly almost entirely neglected, began to receive attention. A work on comparative anatomy by Volcher Koyter was issued at Nuremberg in 1573; about the same time a writer in Germany named Copho or Cophon published a book on the anatomy of the pig, in which were many original remarks on the lymphatic vessels; and Jehan Hervard in France produced in 1594 his rather incomplete *Hippo-Ostéologie*. But by far the most notable work, and one which maintained its popularity for a century and a half, was that of Carlo Ruini, a senator of Bologna, published in 1598 in that city, and entitled *Dell' Anatomia e dell' Infirmità del Cavallo, e suoi Remedii*. Passing through many editions, and translated into French and German, this book was for the most part original, and a remarkable one for the time in which it was composed, the anatomical portion being especially praiseworthy. English books of the 17th century exhibit a strong tendency towards the improvement of veterinary medicine and surgery, especially as regards the horse. This is even more notable in the writings of the 18th century, among which may be particularized Gibson's *Farrier's New Guide* (1719), *Method of Dieting Horses* (1721) and (best of all) his *New Treatise on the Diseases of Horses*, besides Braken's, Burdon's, Bridge's and Bartlet's treatises. Veterinary anatomy was greatly advanced by the *Anatomy of an Horse* (1683) of Snape, farrier to Charles II., illustrated with copperplates, and by the still more complete and original work of Stubbs, the *Anatomy of the Horse* (1766), which decidedly marked a new era in this line of study. Of foreign works it may suffice to mention that of Solleysel, *Véritable parfait maréschal* (1664), which passed through many editions, was translated into several languages, and was borrowed from for more than a century by different writers. Sir W. Hope's *Compleat Horseman* (1696) is a translation from Solleysel by a pupil.

France and Continental Europe.

Modern Schools and Colleges.—The most important era in the history of modern veterinary science commenced with the institution of veterinary schools. France was the first to take the great initiative step in this direction. Buffon had recommended the formation of veterinary schools, but his recommendations were not attended to. Claude Bourgelat (1712–1799), an advocate at Lyons and a talented hippologist, through his influence with Bertin, prime minister under Louis XV., was the first to induce the government to establish a veterinary school and school of equitation at Lyons, in 1761. This school he himself directed for only a few years, during which the great benefits that had resulted from it justified an extension of its teaching to other parts of France. Bourgelat, therefore, founded (1766) at Alfort, near Paris, a second veterinary school, which soon became, and has remained to this day, one of the finest and most advanced veterinary schools in the world. At Lyons he was replaced by the Abbé Rozier, a learned agriculturist, who was killed at the siege of Lyons after a very successful period of school management, during which he had added largely to agricultural and physical knowledge by the publication of his *Journal de Physique* and *Cours d'Agriculture*. Twenty years later the Alfort school added to its teaching staff several distinguished professors whose names still adorn the annals of science, such as Dauberton, who taught rural economy; Vic d'Azyr, who lectured on comparative anatomy; Fourcroy, who undertook instruction in chemistry; and Gilbert, one of its most brilliant pupils, who had veterinary medicine and surgery for his department. The last-named was also a distinguished agriculturist and published many important treatises on agricultural as well as veterinary subjects. The position he had acquired, added to his profound and varied knowledge, made him most useful to France during the period of the Revolution. It is chiefly to him that it is indebted for the celebrated Rambouillet flock of Merino sheep, for the conservation of the Tuileries and Versailles parks, and for the creation of the fine experimental agricultural establishment organized in the ancient domain of Sceaux. The Alfort school speedily became the nursery of veterinary science, and the source whence all similar institutions obtained their first teachers and their guidance. A third government school was founded in 1825 at Toulouse; and these three schools have produced thousands of thoroughly educated veterinary surgeons and many professors of high scientific repute, among whom may be named Bouley, Chauveau, Colin, Toussaint, St Cyr, Goubaux, Arloing, Galtier, Nocard, Trasbot, Neumann, Cadiot and Leclainche. The opening of the Alfort school was followed by the establishment of national schools in Italy (Turin, 1769), Denmark (Copenhagen, 1773), Austria (Vienna, 1775), Saxony (Dresden, 1776), Prussia (Hanover, 1778; Berlin, 1790), Bavaria (Munich, 1790), Hungary (Budapest, 1787) and Spain (Madrid, 1793); and soon government veterinary schools were founded in nearly every European country, except Great Britain and Greece, mostly on a munificent scale. Probably all, but especially those of France and Germany, were established as much with a view to training veterinary surgeons for the army as for the requirements of civil life. In 1907 France possessed three national veterinary schools, Germany had six, Russia four (Kharkov, Dorpat, Kazan and Warsaw), Italy six, Spain five, Austria-Hungary three (Vienna, Budapest and Lemberg), Switzerland two (Zürich and Bern), Sweden two (Skara and Stockholm), Denmark, Holland, Belgium and Portugal one each. In 1849 a government veterinary school was established at Constantinople, and in 1861 the government of Rumania founded a school at Bucharest. The veterinary schools of Berlin, Hanover and Vienna have been raised to the position of universities.

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[1] See *Leechdoms, Wortcunning and Starcraft of Early England* (3 vols. 8vo, London, 1864).

[2] See Fleming, *Horse-shoes and Horse-Shoeing* (London, 1869).

United Kingdom.

In 1790 St Bel (whose real name was Vial, St Bel being a village near Lyons, where was his paternal estate), after studying at the Lyons school and teaching both at Alfort and Lyons, came to England and published proposals for founding a school in which to instruct pupils in veterinary medicine and surgery. The Agricultural Society of Odiham, which had been meditating sending two young men to the Alfort school, elected him an honorary member, and delegated a committee to consult with him respecting his scheme. Some time afterwards this committee detached themselves from the Odiham Society and formed an institution styled the Veterinary College of London, of which St Bel was appointed professor. The school was to be commenced and maintained by private subscription. In March 1792 arrangements were made for building temporary stabling for fifty horses and a forge for shoeing at St Pancras. The college made rapid progress in public estimation, notwithstanding considerable pecuniary embarrassments. As soon as the building was ready for the reception of animal patients, pupils began to be enrolled; and among the earliest were some who afterwards gained celebrity as veterinarians, as Bloxam, Blaine, R. Lawrence, Field and Bracy Clark. On the death of St Bel in August 1793 there appears to have been some difficulty in procuring a suitable successor; but at length, on the recommendation of John Hunter and Cline, two medical men were appointed, Coleman and Moorcroft, the latter then practising as a veterinary surgeon in London. The first taught anatomy and physiology, and Moorcroft, after visiting the French schools, directed the practical portion of the teaching. Unfortunately, neither of these teachers had much experience among animals, nor were they well acquainted with their diseases; but Coleman (1765–1839) had as a student, in conjunction with a fellow-student (afterwards Sir Astley Cooper), performed many experiments on animals under the direction of Cline. Moorcroft, who remained only a short time at the college, afterwards went to India, and during a journey in 1819 was murdered in Tibet. Coleman, by his scientific researches and energetic management, in a few years raised the college to a high standard of usefulness; under his care the progress of the veterinary art was such as to qualify its practitioners to hold commissions in the army; and he himself was appointed veterinary surgeon-general to the British cavalry. In 1831 he was elected a fellow of the Royal Society. Owing to the lack of funds, the teaching at the college must have been very meagre, and had it not been for the liberality of several medical men in throwing open the doors of their theatres to its pupils for instruction without fee or reward, their professional knowledge would have been sadly deficient. The board of examiners was for many years chiefly composed of eminent members of the medical profession. Coleman died in 1839, and with him disappeared much of the interest the medical profession of London took in the progress of veterinary medicine. Yet the Royal Veterinary College (first styled "Royal" during the presidentship of the duke of Kent) continued to do good work in a purely veterinary direction, and received such public financial support that it was soon able to dispense with the small annual grant given to it by the government. In the early years of the institution the horse was the only animal to which much attention was given. But at the instigation of the Royal Agricultural Society of England, which gave £200 per annum for the purpose, an additional professor was appointed to investigate and teach the treatment of the diseases of cattle, sheep and other animals; outbreaks of disease among these were also to be inquired into by the officers of the college. This help to the institution was withdrawn in 1875, but renewed and augmented in 1886. For fifteen years the Royal Agricultural Society annually voted a sum of £500 towards the expenses of the department of comparative pathology, but in 1902 this grant was reduced to £200.

As the result of representations made to the senate of the university of London by the governors of the Royal Veterinary College, the university in 1906 instituted a degree in veterinary science (B.Sc.). The possession of this degree does not of itself entitle the holder to practise as a veterinary surgeon, but it was hoped that an increasing number of students would, while studying for the diploma of the Royal College of Veterinary Surgeons, also adopt the curriculum which is necessary to qualify for the university examinations and obtain the degree of bachelor of science. To provide equipment for the higher studies required for the university degree, the Board of Agriculture and Fisheries in 1906 made a grant to the college of £800 per annum. At this school post-graduate instruction is given on the principles of bacteriological research, vaccination and protective inoculation, the preparation of toxins and vaccines and the bacteriology of the specific diseases of animals.

The London Veterinary School has been the parent of other schools in Great Britain, one of which, the first in Scotland, was founded by Professor Dick, a student under Coleman, and a man of great perseverance and ability. Beginning at Edinburgh in 1819–20 with only one student, in three years he gained the patronage of the Highland and Agricultural Society of Scotland, which placed a small sum of money at the disposal of a committee appointed by itself to take charge of a department of veterinary surgery it had formed. This patronage, and very much in the way of material assistance and encouragement, were continued to the time of Dick's death in 1866. During the long period in which he presided over the school considerable progress was made in diffusing a sound knowledge of veterinary medicine in Scotland and beyond it. For many years his examining board, which gave certificates of proficiency under the auspices of the Highland and Agricultural Society, was composed of the most distinguished medical men in Scotland, such as Goodsir, Syme, Lizars, Ballingall, Simpson and Knox. By his will Dick vested the college in the lord provost and town council of Edinburgh as trustees, and left a large portion of the fortune he had made to maintain it for the purposes for which it was founded. In 1859 another veterinary school was established in Edinburgh by John Gamgee, and the Veterinary College, Glasgow, was founded in 1863 by James McCall. Gamgee's school was discontinued in 1865; and William Williams established in 1873 the "New Veterinary College," Edinburgh. This school was transferred in 1904 to the university, Liverpool. In 1900 a veterinary school was founded in Dublin.

In 1844 the Royal College of Veterinary Surgeons (to be carefully distinguished from the Royal Veterinary College) obtained its charter of incorporation. The functions of this body were until 1881 limited almost entirely to examining students taught in the veterinary schools, and bestowing diplomas of membership on those who successfully passed the examinations conducted by the boards which sat in London and Edinburgh. Soon after the Royal College of Veterinary Surgeons obtained its charter of incorporation, a difference arose between the college and Dick, which resulted in the latter seceding altogether from the union that had been established, and forming an independent examining board, the Highland and Agricultural Society of Scotland granting certificates of proficiency to those students who were deemed competent. This schism operated very injuriously on the progress of veterinary education and on professional advancement, as the competition engendered was of a rather deteriorating nature. After the death of Dick in 1866, the dualism in veterinary licensing was suppressed and the Highland Society ceased to grant certificates. Now there is only one portal of entry into the profession, and the veterinary students of England, Ireland and Scotland must satisfy the examiners appointed by the Royal College of Veterinary Surgeons before they can practise their profession.

Before beginning their professional studies students of veterinary medicine must pass an examination in general education equivalent in every respect to that required of students of human medicine. The minimum length of the professional training is four years of three terms each, and during that course four searching examinations must be passed before the student obtains his diploma or licence to practise as a veterinary surgeon. The subjects taught in the schools have been increased in numbers conformably with the requirements of ever extending science, and the teaching is more thorough and practical. During the four years' curriculum, besides the preliminary technical training essential to every scientist, the student must study the anatomy and physiology of the domesticated animals, the pathology and bacteriology of the diseases to which these animals are exposed, medicine, surgery, hygiene, dietetics and meat inspection, and learn to know the results of disease as seen *post mortem* or in the slaughter-house.

In 1881 an act of parliament was obtained protecting the title of the graduates of the Royal College of Veterinary Surgeons and conferring other advantages, not the least of which is the power granted to the college to remove the names of unworthy members from its register. In some respects the Veterinary Surgeons Act is superior to the Medical Act, while it places the profession on the same level as other learned bodies, and prevents the public being misled by empirics and imposters.

In 1876 the college instituted a higher degree than membership—that of fellow (F.R.C.V.S.), which can only be obtained after the graduate has been five years in practice, and by furnishing a thesis and passing a severe written and oral examination on pathology and bacteriology, hygiene and sanitary science, and veterinary medicine and surgery. Only fellows can be elected members of the examining boards for the membership and fellowship diplomas. The graduates of the Royal College of Veterinary Surgeons registered from its foundation in 1844 until 1907 numbered about 6000.

In the British army a veterinary service was first instituted at the beginning of the 19th century, when veterinary surgeons with the relative rank of lieutenant were appointed to regiments of cavalry, the royal artillery and the royal wagon train. After the Crimean War, and consequent on the abolition of the East India Company (which then possessed its own veterinary service), the number of veterinary surgeons employed was increased, and in 1878 they were constituted a "department," with distinctive uniform, instead of being regimental officers as was previously the case. At the same time they were all brought on to a general roster for foreign service, so that every one in turn has to serve abroad. In 1903 the officers of the department were given substantive rank, and in 1904 were constituted a "corps," with a small number of non-commissioned officers and men under their command and specially trained by them. In 1907 the Army Veterinary Corps consisted of 167 officers and 220 non-commissioned officers and men. The men are stationed at the veterinary hospitals, Woolwich depot, Aldershot, Bulford and the Curragh, but when trained are available for duty under veterinary officers at any station, and a proportion of them are employed at the various hospitals in South Africa. Owing to their liability to service abroad in rotation, it follows that every officer spends a considerable portion of his service in India, Burma, Egypt or South Africa. Each tour abroad is five years, and the average length of service abroad is about one-half the total. This offers a wide and varied field for the professional activities of the corps, but naturally entails a corresponding strain on the individuals. Commissions as lieutenants are obtained by examination, the candidates having previously qualified as members of the Royal College of Veterinary Surgeons. Promotion to captain and major is granted at five and fifteen years' service respectively, and subsequently, by selection, to lieutenant-colonel and colonel, as vacancies occur. The director-general has the honorary rank of major-general.

India.

The Indian civil veterinary department was at first recruited from the A. V. Corps, but candidates who qualified as members of the R.C.V.S. were subsequently granted direct appointments by the India Office, by selection. The service is paid and pensioned on the lines of the other Indian civil services, and offers an excellent professional career to those whose constitution permits them to live in the tropics. The work comprises the investigation of disease in animals and the management of studs and farms, in addition to the clinical practice which falls to the share of all veterinary surgeons.

In India there are schools for the training of natives as veterinary surgeons in Bombay, Lahore, Ajmere and Bengal. The courses extend over two and three years, and the instruction is very thorough. The professors are officers of the Indian civil veterinary department, and graduates are given subordinate appointments in that service, or find ready employment in the native cavalry or in civil life.

United States.

In the United States of America, veterinary science made very slow progress until 1884, when the Bureau of Animal Industry was established in connexion with the Department of Agriculture at Washington. The immediate cause of the formation of the bureau was the urgent need by the Federal government of official information concerning the nature and prevalence of animal diseases, and of the means required to control and eradicate them, and also the necessity of having an executive agency to carry out the measures necessary to stop the spread of disease and to prevent the importation of contagion into the country, as well as to conduct investigations through which further knowledge might be obtained. In 1907 the bureau consisted of ten divisions, employing the services of 815 veterinary surgeons. It deals with the investigation, control and eradication of contagious diseases of animals, the inspection and quarantine of live stock, horse-breeding, experiments in feeding, diseases of poultry and the inspection of meat and dairy produce. It makes original investigations as to the nature, cause and prevention of communicable diseases of live stock, and takes measures for their repression, frequently in conjunction with state and territorial authorities. It prepares tuberculin and mallein, and supplies these substances free of charge to public health officers, conducts experiments with immunizing agents, and prepares vaccines, sera and antitoxins for the protection of animals against disease. It prepares and publishes reports of scientific investigations and treatises on various subjects relating to live stock. The diseases which claim most attention are Texas fever, sheep scab, cattle mange, venereal disease of horses, tuberculosis of cattle and pigs, hog cholera, glanders, anthrax, black-quarter, and parasitic diseases of cattle, sheep and horses. The effect of the work of the bureau on the health and value of farm animals and their products is well known, and the people of the United States now realize the immense importance of veterinary science.

Veterinary schools were established in New York City in 1846, Boston in 1848, Chicago in 1883, and subsequently in Kansas City and elsewhere, but these, like those of Great Britain, were private institutions. The American Veterinary College, N.Y., founded in 1875, is connected with New York University, and the N.Y. State Veterinary College forms a department of Cornell University at Ithaca. Other veterinary schools attached to state universities or agricultural colleges are those in Philadelphia, Pa.; Columbus, Ohio; Ames, Iowa; Pullman, Washington; Auburn, Alabama; Manhattan, Kansas; and Fort Collins, Colorado. Other veterinary colleges are in San Francisco; Washington, D.C. (two); Grand Rapids, Michigan; St Joseph, Missouri; and Cincinnati, Ohio.

Canada.

In Canada a veterinary school was founded at Toronto in 1862, and four years later another school was established at Montreal. For some years the Montreal school formed a department of McGill University, but in 1902 the veterinary branch was discontinued. Veterinary instruction in French is given by the faculty of comparative medicine at Laval University. The Canadian Department of Agriculture possesses a fully equipped veterinary sanitary service employing about 400 qualified veterinary surgeons as inspectors of live stock, meat and dairy produce.

Australia.

In the Australian commonwealth there is only one veterinary school, which was established in Melbourne, Victoria, in 1888. The Public Health Departments of New South Wales, Western Australia, Tasmania and the other states employ qualified veterinary surgeons as inspectors of live stock, cowsheds, meat and dairy produce.

New Zealand.

There is no veterinary school in New Zealand, but the Department of Agriculture has arranged to establish one at Wellington in connexion with the investigation laboratory and farm of the division of veterinary science at Wallaceville. The government employs about forty qualified veterinarians as inspectors of live stock, abattoirs, meat-works and dairies.

Egypt.

In Egypt a veterinary school with French teachers was founded in 1830 at Abu-Zabel, near Cairo, by Clot-Bey, a doctor of medicine. This school was discontinued in 1842. The Public Health Department in 1901 established at Cairo a new veterinary school for the instruction of natives. Ten qualified veterinary surgeons are employed in the sanitary service.

South Africa.

Each of the colonies Natal, Cape Colony, Transvaal, Orange River Colony, Swaziland, Bechuanaland and Rhodesia has a veterinary sanitary police service engaged in dealing with the contagious diseases of animals. Laboratories for the investigation of disease and the preparation of antitoxins and protective sera have been established at Grahamstown, Pretoria and Pietermaritzburg.

Characteristics of Veterinary Medicine.

Veterinary medicine has been far less exposed to the vagaries of theoretical doctrines and systems than human medicine. The explanation may perhaps be that the successful practice of this branch of medicine more clearly than in any other depends upon the careful observation of facts and the rational deductions to be made therefrom. No special doctrines seem, in later times at least, to have been adopted, and the dominating sentiment in regard to disease and its treatment has been a medical eclecticism, based on practical experience and anatomico-pathological investigation, rarely indeed on philosophical or abstract theories. In this way veterinary science has become pre-eminently a science of observation. At times indeed it has to some extent been influenced by the doctrines which have controlled the practice of human medicine—such as those of Broussais, Hahnemann, Brown, Rasori, Rademacher and others—yet this has not been for long: experience of them when tested upon dumb unimaginative animals soon exposed their fallacies and compelled their discontinuance.

Of more moment than the cure of disease is its prevention, and this is now considered the most important object in connexion with veterinary science. More especially is this the case with those contagious disorders that depend for their existence and extension upon the presence of an infecting agent, and whose ravages for so many centuries are written largely in the history of civilization. Every advance made in human medicine affects the progress of veterinary science, and the invaluable investigations of Davaine, Pasteur, Chauveau, Lister and Koch have created as great a revolution in veterinary practice as in the medicine of man. In "preventive medicine" the benefits derived from the application of the germ theory are now realized to be immense; and the sanitary police measures based on this knowledge, if carried rigorously into operation, must eventually lead to the extinction of animal plagues. Bacteriology has thrown much light on the nature, diagnosis and cure of disease both in man and animals, and it has developed the beneficent practice of aseptic and antiseptic surgery, enabling the practitioner to prevent exhausting suppuration and wound infection with its attendant septic fever, to ensure the rapid healing of wounds, and to undertake the more serious operations with greater confidence of a successful result.

The medicine of the lower animals differs from that of man in no particular so much, perhaps, as in the application it makes of utilitarian principles. The life of man is sacred; but in the case of animals, when there are doubts as to complete restoration to health or usefulness, pecuniary considerations generally decide against the adoption of remedial measures. This feature in the medicine of domesticated animals brings very prominently before us the value of the old adage that "prevention is better than cure." In Great Britain the value of veterinary pathology in the relations it bears to human medicine, to the public health and wealth, as well as to agriculture, has not been sufficiently appreciated; and in consequence but little allowance has been made for the difficulties with which the practitioner of animal medicine has to contend. The rare instances in which animals can be seen by the veterinary surgeon in the earliest stages of disease, and when this would prove most amenable to medical treatment; delay, generally due to the inability of those who have the care of animals to perceive these early stages; the fact that animals cannot, except in a negative manner, tell their woes, describe their sensations or indicate what and where they suffer; the absence of those comforts and conveniences of the sick-room which cannot be called in to ameliorate their condition; the violence or stupor, as well as the attitude and structural peculiarities of the sick creatures, which only too frequently render favourable positions for recovery impossible; the slender means generally afforded for carrying out recommendations, together with the oftentimes intractable nature of their diseases; and the utilitarian influences alluded to above—all these considerations, in the great majority of instances, militate against the adoption of curative treatment, or at least greatly increase its difficulties. But notwithstanding these difficulties, veterinary science has made greater strides since 1877 than at any previous period in its history. Every branch of veterinary knowledge has shared in this advance, but in none has the progress been so marked as in the domain of pathology, led by Nocard in France, Schütz and Kitt in Germany, Bang in Denmark, and McFadyean in England. Bacteriological research has discovered new diseases, has revolutionized the views formerly held regarding many others, and has pointed the way to new methods of prevention and cure. Tuberculosis, anthrax, black-quarter, glanders, strangles and tetanus furnish ready examples of the progress of knowledge concerning the nature and causation of disease. These diseases, formerly attributed to the most varied causes—including climatic changes, dietetic errors, peculiar condition of the tissues, heredity, exposure, close breeding, overcrowding and even spontaneous origin—have been proved beyond the possibility of doubt to be due to infection by specific bacteria or germs.

In the United Kingdom veterinary science has gained distinction by the eradication of contagious animal diseases. For many years prior to 1865, when a government veterinary department was formed, destructive plagues of animals had prevailed almost continuously in the British islands, and scarcely any attempt had been made to check or extirpate them. Two exotic bovine diseases alone (contagious pleuro-pneumonia or lung plague and foot-and-mouth disease) are estimated to have caused the death, during the first thirty years of their prevalence in the United Kingdom, of 5,549,780 cattle, roughly valued at £83,616,854; while the invasion of cattle plague (rinderpest) in 1865–66 was calculated to have caused a money loss of from £5,000,000 to £8,000,000. The depredations made in South Africa and Australia by the lung plague alone are quite appalling; and in India the loss brought about by contagious diseases among animals has been stated at not less than £6,000,000 annually. The damage done by tuberculosis—a contagious disease of cattle, transmissible to other animals and to man by means of the milk and flesh of diseased beasts—cannot be even guessed at; but it must be enormous considering how widely this malady is diffused. But that terrible pest of all ages, cattle plague, has been promptly suppressed in England with comparatively trifling loss. Foot-and-mouth disease, which frequently proved a heavy infliction to agriculture, has been completely extirpated. Rabies may now be included, with rinderpest, lung plague and sheep-pox, in the category of extinct diseases; and new measures have been adopted for the suppression of glanders and swine fever. To combat such diseases as depend for their continuance on germs derived from the soil or herbage, which cannot be directly controlled by veterinary sanitary measures, recourse has been had to protective inoculation with attenuated virus or antitoxic sera. The Board of Agriculture and Fisheries has an efficient staff of trained veterinary inspectors, who devote their whole time to the work in connexion with the scheduled diseases of animals, and are frequently employed to inquire into other diseases of an apparently contagious nature, where the circumstances are of general importance to agriculturists.

Veterinary science can offer much assistance in the study and prevention of the diseases to which mankind are liable. Some grave maladies of the human species are certainly derived from animals, and others may yet be added to the list. In the training of the physician great benefit would be derived from the study of disease in animals—a fact which has been strangely overlooked in England, as those can testify who understand how closely the health of man may depend upon the health of the creatures he has domesticated and derives subsistence from, and how much more advantageously morbid processes can be studied in animals than in our own species.

Although as yet few chairs of comparative pathology have been established in British universities, on the European continent such chairs are now looked upon as almost indispensable to every university. Bourgelat, towards the middle of the 18th century, in speaking of the veterinary schools he had been instrumental in forming, urged that "leurs portes soient sans cesse ouvertes à ceux qui, chargés par l'état de la conservation des hommes, auront acquis par le nom qu'ils se seront fait le droit d'interroger la nature, chercher des analogies, et vérifier des idées dont la conformation ne peut être qu'utile à l'espèce humaine." And the benefits to be mutually derived from this association of the two branches of medicine inspired Vicq d'Azyr to elaborate his *Nouveau plan de la constitution de la médecine en France*, which he presented to the National Assembly in 1790. His fundamental idea was to make veterinary teaching a preliminary (*le premier degré*) and, as it were, the principle of instruction in human medicine. His proposal went so far as to insist upon a veterinary school being annexed to every medical college established in France. This idea was reproduced in the *Rapport sur l'instruction publique* which Talleyrand read before the National Assembly in 1790. In this project veterinary teaching was to form part of the National Institution at Paris. The idea was to initiate students of medicine into a knowledge of diseases by observing those of animals. The suffering animal always appears exactly as it is and feels, without the intervention of mind obscuring the symptomatology, the symptoms being really and truly the rigorous expression of its diseased condition. From this point of view, the dumb animal, when it is ill, offers the same difficulties in diagnosis as does the ailing infant or the comatose adult.

Of the other objects of veterinary science there is only one to which allusion need here be made: that is the perfectioning of the domestic animals in everything that is likely to make them more valuable to man. This is in an especial manner the province of this science, the knowledge of the anatomy, physiology and other matters connected with these animals by its students being essential for such improvement.

Diseases of Domestic Animals.

Considerations of space forbid a complete or detailed description of all the diseases, medical and surgical, to which the domesticated animals are liable. Separate articles are devoted to the principal plagues, or murrains, which affect animals—RINDERPEST, FOOT-AND-MOUTH DISEASE, PLEURO-PNEUMONIA, ANTHRAX, &c. Reference will be made here only to the more important other disorders of animals which are of a communicable nature.

Diseases of the Horse.

Every horseman should know something of the injuries, lamenesses and diseases to which the horse is liable. Unfortunately not very much can be done in this direction by book instruction; indeed, there is generally too much doctoring and too little nursing of sick animals. Even in slight and favourable cases of illness recovery is often retarded by too zealous and injudicious medication; the object to be always kept in view in the treatment of animal patients is to place them in those conditions which allow nature to

Nursing.

operate most freely in restoring health. This can best be rendered in the form of nursing, which sick animals greatly appreciate. However indifferent a horse may be to caressing or kind attention during health, when ill he certainly appreciates both, and when in pain will often apparently endeavour to attract notice and seek relief from those with whom he is familiar. Fresh air and cleanliness, quiet and comfort, should always be secured, if possible. The stable or loose-box should be warm, without being close, and free from draughts. If the weather is cold, and especially if the horse is suffering from inflammation of the air-passages, it may be necessary to keep up the temperature by artificial means; but great care should be taken that this does not render the air too dry to breathe. The surface of the body can be kept warm by rugs, and the legs by woollen bandages. Yet a sick horse is easily fatigued and annoyed by too much clothing, and therefore it is better to resort to artificial heating of the stable than to overload the body or impede movement by heavy wrappings. If blankets are used, it is well to place a cotton or linen sheet under them, should the horse have an irritable skin. For bedding, long straw should be employed as little as possible, since it hampers movement. Clean old litter, sawdust or peat-moss litter is the best. If the hoofs are strong, and the horse likely to be confined for some weeks, it affords relief to take off the shoes. Tying up should be avoided, if possible, unless it is urgently required, the horse being allowed to move about or lie down as he may prefer.

Food for a sick horse.

When a sick horse has lost his appetite, he should be tempted to eat by offering him such food as will be enticing to him. It should be given frequently and in small quantities, but should not be forced on him; food will often be taken if offered from the hand, when it will not be eaten out of the manger. Whether the animal be fed from a bucket or from a manger, any food that is left should be thrown away, and the receptacle well cleaned out after each meal. As a rule, during sickness a horse requires laxative food, in order to allay fever or inflammatory symptoms, while supporting the strength. The following list comprises the usual laxative foods employed: green grass, green wheat, oats and barley, lucerne, carrots, parsnips, gruel, bran mash, linseed and bran mash, boiled barley, linseed tea, hay tea and linseed oil. Green grass, lucerne, and similar articles of food if cut when in a wet state, should be dried before being given. Boiled grain should be cooked with very little water, so that it may be floury and comparatively dry when ready; a little salt should be mixed with it. One gallon of good gruel may be made with a pound of meal and cold water, which should be stirred till it boils, and afterwards permitted to simmer over a gentle fire till the fluid is quite thick. To make a bran mash, scald a stable bucket, throw out the water, put in 3 ℔ of bran and 1 oz. of salt, add 2½ pints of boiling water, stir up well, cover over and allow the mash to stand for fifteen or twenty minutes until it is well cooked. For a bran and linseed mash, boil slowly for two or three hours 1 ℔ of linseed, so as to have about a couple of quarts of thick fluid, to which 2 ℔ of bran and 1 oz. of salt may be added. The whole should be stirred up, covered over and allowed to steam as before described. The thicker the mash the more readily will the horse eat it. Linseed tea is made by boiling 1 ℔ of linseed in a couple of gallons of water until the grains are quite soft. It may be economically made by using less water to cook the linseed, and afterwards making up the quantity of water to about a gallon and a half. Hay tea may be prepared by filling a bucket, after scalding it, with good sweet hay, pouring in as much boiling water as the bucket will hold, covering it over, and allowing it to stand until cold, when the fluid may be strained off and given to the horse. This forms a refreshing drink. Linseed oil, in quantities of from 1 oz. to 6 oz. daily, may be mixed with the food; it keeps the bowels in a lax condition, has a good effect on the skin and air-passages, and is useful as an article of diet. When debility has to be combated, as in low fever or other weakening diseases, strengthening and other easily digested food must be administered, though some of the foods already mentioned, such as boiled grain, answer this purpose to a certain extent. Milk, eggs, bread and biscuits, malt, corn, &c., are often prescribed with this object. Milk may be given skimmed or unskimmed; a little sugar may be mixed with it; and one or two gallons may be given daily, according to circumstances. One or two eggs may be given beaten up with a little sugar and mixed with milk, three or four times a day, or more frequently; or they may be boiled hard and powdered, and mixed in the milk. A quart of stout, ale or porter may be given two or three times a day, or a half to one bottle of port wine daily. Scalded oats, with a little salt added, are very useful when convalescence is nearly completed. As a rule, a sick horse should have as much water as he likes to drink, though it may be necessary in certain cases to restrict the quantity, and to have the chill taken off; but it should never be warmer than 75° to 80°.

As little grooming as possible should be allowed when a horse is very weak; it should be limited to sponging the mouth, nostrils, eyes and forehead with clean water, to which a little eucalyptus or sanitas may be added. Rub the legs and ears with the hand, take off the clothing, and shake or change it once a day, and if agreeable rub over the body with a soft cloth. Exercise is of course not required during sickness or injury, and the period at which it is allowed will depend upon circumstances. Care must be taken that it is not ordered too early, or carried too far at first.

Administration of medicine.

Much care is required in administering medicines in the form of ball or bolus; and practice, as well as courage and tact, is needed in order to give it without danger to the administrator or the animal. The ball should be held between the fingers of the right hand, the tips of the first and fourth being brought together below the second and third, which are placed on the upper side of the ball; the right hand is thus made as small as possible, so as to admit of ready insertion into the mouth. The left hand grasps the horse's tongue, gently pulls it out and places it on that part of the right side of the lower jaw which is bare of teeth. With the right hand the ball is placed at the root of the tongue. The moment the right hand is withdrawn, the tongue should be released. This causes the ball to be carried still farther back. The operator then closes the mouth and watches the left side of the neck, to note the passage of the ball down the gullet. Many horses keep a ball in the mouth a considerable time before they will allow it to go down. A mouthful of water or a handful of food will generally make them swallow it readily. It is most essential to have the ball moderately soft; nothing can be more dangerous than a hard one.

To administer a drink or drench requires as much care as giving a ball, in order to avoid choking the horse, though it is unattended with risk to the administrator. An ordinary glass or stone bottle may be used, providing there are no sharp points around the mouth; but either the usual drenching-horn or a tin vessel with a narrow mouth or spout is safer. It is necessary to raise the horse's head, so that the nose may be a little higher than the horizontal line. The drink must be given by a person standing on the right side (the attendant being in front or on the left side of the horse), the cheek being pulled out a little, to form a sack or funnel, into which the medicine is poured, a little at a time, allowing an interval now and again for the horse to swallow. If any of the fluid gets into the windpipe (which it is liable to do if the head is held too high), it will cause coughing, whereupon the head should be instantly lowered. Neither the tongue nor the nostrils should be interfered with. Powders may be given in a little mash or gruel, well stirred up, or in the drinking water.

If a wide surface is to be fomented (as the chest, abdomen or loins), a blanket or other large woollen cloth should be dipped in water as hot as the hand can comfortably bear it, moderately wrung out and applied to the part, the heat and moisture being retained by covering it with a waterproof sheet or dry rug. When it has lost some of its heat, it should be removed, dipped in warm water and again applied. In cases of acute inflammation, it may be necessary to have the water a little hotter; and, to avoid the inconvenience of removing the blanket, or the danger of chill when it is removed, it may be secured round the body by skewers or twine, the hot water being poured on the outside of the top part of the blanket by any convenient vessel. To foment the feet, they should be placed in a bucket or tub (the latter with the bottom resting wholly on the ground) containing warm water; a quantity of moss litter put in the tub or bucket prevents splashing and retains the heat longer.

Poultices.

Poultices are used for allaying pain, softening horn or other tissues, and, when antiseptic, cleansing and promoting healthy action in wounds. To be beneficial they should be large and always kept moist. For applying poultices to the feet, a piece of sacking, or better a poultice-boot, supplied by saddlers, may be used with advantage. Poultices are usually made with bran, though this has the disadvantage of drying quickly, to prevent which it may be mixed with linseed meal or a little linseed oil. Antiseptic poultices containing lysol, izal, carbolic acid or creolin, are very useful in the early treatment of foul and punctured wounds. A charcoal poultice is sometimes employed when there is an offensive smell to be got rid of. It is made by mixing linseed meal with boiling water and stirring until a soft mass is produced; with this some wood charcoal in powder is mixed, and when ready to be applied some more charcoal is sprinkled on the surface. It may be noted that, in lieu of these materials for poultices, spongiopiline can be usefully employed. A piece of sufficient size is steeped in hot water, applied to the part, covered with oiled silk or waterproof sheeting, and secured by tapes. Even an ordinary sponge, steeped in hot water and covered with waterproof material, makes a good poulticing medium; it is well adapted for the throat, the space between the branches of the lower jaw, as well as for the lower joints of the limbs.

Enemata or clysters.

Enemata or clysters are given in fevers, constipation, colic, &c., to empty the posterior part of the bowels. They can be administered by a large syringe capable of containing a quart or more of water, with a nozzle about 12 in. long, or by a large funnel with a long nozzle at a right angle. Water, soap and water, or oil may be employed. To administer an enema, one of the horse's fore feet should be held up, while the operator introduces the nozzle, smeared with oil or lard, very gently and steadily into the rectum, then injects the water. The quantity injected will depend on the nature of the malady and the size of the horse; from 2 or 3 quarts to several gallons may be used.

Epizootic and contagious diseases.

The epizootic diseases affecting the horse are not numerous, and may generally be considered as specific and infectious or contagious in their nature, circumstances of a favourable kind leading to their extension by propagation of the agent upon which their existence depends. This agent, in most of the maladies, has been proved to be a micro-organism, and there can be little doubt that it is so for all of them.

Glanders: farcy.

Glanders (*q.v.*), or *equinia*, one of the most serious maladies of the horse, ass and mule, prevails in nearly every part of the world. It is a contagious, inoculable disease, caused by the *bacillus mallei*, and specially affects the lungs, respiratory mucous membrane and the lymphatic system. The virulent agent of glanders appears to establish itself most easily among horses kept in foul, crowded, badly ventilated stables, or among such as are over-worked, badly fed or debilitated. Glanders, however, is always due to contagion, and in natural infection it may be contracted by inhalation of the bacilli, by ingestion of the virus with food or water, or by inoculation of a wound of the skin or a mucous membrane. Carnivorous animals—lions, tigers, dogs and cats—have become infected through eating the flesh of glandered horses; and men attending diseased horses are liable to be infected, especially if they have sores on the exposed parts of their bodies. Though in man infection through wounds is the readiest way of receiving the disease, the bacillus may also obtain access through the digestive organs, the lungs and mucous membranes of the eyes, nose and lips.

In descriptions of the equine disease sometimes a distinction is made between glanders with nasal ulcers and other symptoms of respiratory disease, and glanders of the skin, or *farcy*, but there is no essential difference between them. Glanders and farcy are due to the same causal organism, and both may be acute or chronic. Acute glanders is always rapidly fatal, and chronic glanders may become acute or it may terminate by apparent recovery.

The symptoms of acute glanders are initial fever with its accompaniments, thirst, loss of appetite, hurried pulse and respiration, emaciation, languor and disinclination to move. Sometimes the legs or joints are swollen and the horse is stiff; but the characteristic symptoms are a greyish-yellow viscid discharge from one or both nostrils, a peculiar enlarged and nodulated condition of one or both submaxillary lymphatic glands, which though they may be painful very rarely suppurate, and on the nasal membrane small yellow pimples or pustules, running into deep, ragged-edged ulcers, and sometimes on the septum large patches of deep ulceration. The discharge from the nose adheres to the nostrils and upper lip, and the infiltrated nasal lining, impeding breathing, causes snuffling and frequent snorting. The lymphatic vessels of the face are often involved and appear as painful subcutaneous "cords" passing across the cheek. These vessels sometimes present nodules which break and discharge a glutinous pus. As the disease progresses, the ulcers on the nose increase in number, enlarge or become confluent, extend in depth and sometimes completely perforate the septum. The nasal discharge, now more abundant and tenacious, is streaked with blood and offensive, the respiration is noisy or roaring, and there may be coughing with bleeding from the nose. Painful oedematous swellings appear on the muzzle, throat, between the fore legs, at the flank or on the limbs, and "farcy buds" may form on some of the swollen parts. Symptoms of congestion of the lungs, or pneumonia and pleurisy, with extreme prostration, diarrhoea and gasping respiration, precede death, which is due to asphyxia or to exhaustion.

Chronic or latent glanders generally presents few definite symptoms. The suspected animal may have a discharge from the nose, or an enlarged submaxillary gland, or both, and small unbroken nodules may exist on the septum, but usually there is no visible ulceration of the nasal membrane. In some horses suspicion of glanders may be excited by lameness and sudden swelling of a joint, by profuse staling, sluggishness, loss of condition and general unthriftiness, or by refusal of food, rise of temperature, swollen fetlocks, with dry hacking cough, nasal catarrh and other symptoms of a common cold. With rest in the stable the horse improves, but a one-sided nasal discharge continues, the submaxillary gland enlarges, and, after an interval, ulcers appear in the nose or "farcy buds" form on a swollen leg. In occult glanders the horse may appear to be in good health and be able to perform ordinary work. In these cases the existence of glanders can only be discovered by resorting to inoculation or the mallein test.

In cutaneous glanders, or farcy, symptoms occur on the skin of a limb, usually a hind one, or on the body, where the lymphatics become inflamed and ulcerated. The limb is much swollen, and the animal moves with pain and difficulty. The lymphatic vessels appear as prominent lines or "cords," hard and painful on manipulation, and along their course arise nodular swellings—the so-called "farcy buds." These small abscesses break and discharge a yellow, glutinous, blood-stained pus, leaving sores which heal very slowly. There is a rise of temperature with other symptoms of constitutional disturbance.

Medical treatment of glanders or farcy should not be attempted. The disease is dealt with under the Contagious Diseases (Animals) Acts. Horses which present suspicious symptoms, or those which have been in contact, or have stood in the same stable with glandered horses, should be isolated and tested with mallein. Animals which are found affected should immediately be destroyed, and their harness, clothing and the utensils employed with them thoroughly cleansed, while the stalls, horse-boxes and places which the horses have frequented should be disinfected. Forage left by glandered horses should be burned or fed to cattle.

Mallein, which is almost indispensable in the diagnosis of latent glanders, was discovered in 1888 by Helman, a Russian military veterinary surgeon, and the first complete demonstration of its diagnostic value was given in 1891 by Kalning, also of Russia. Mallein, prepared for the diagnosis of glanders in animals, is the sterilized and filtered liquid-culture of glanders bacilli. It therefore does not contain even dead bacilli, but it has in solution certain substances which are added to the liquid by the bacilli during their growth (McFadyean). Employed under proper precautions and subcutaneously injected in a glandered horse, mallein causes a marked rise of temperature and an extensive painful swelling at the seat of injection.

Epizootic lymphangitis.

Epizootic lymphangitis is a contagious eruptive disease of the horse caused by the *cryptococcus farciminosus*, and characterized by nodular swellings and suppuration of the superficial lymphatics. Infection can be transmitted by mediate or immediate contagion. The eruption usually appears on the limbs, but it may occur on the body or on the head and neck. The symptoms closely resemble those of cutaneous glanders or farcy, from which this disease may readily be distinguished by microscopic examination of the pus discharged from the sores, or by testing the horse with mallein. Glanders and epizootic lymphangitis may coexist in the same animal. It is a scheduled disease, and treatment should not be attempted.

Strangles.

Strangles is a specific contagious eruptive fever peculiar to horses, and is more especially incidental to young animals. It is particularly characterized by the formation of abscesses in the lymphatic glands, chiefly those between the branches of the lower jaw (submaxillary). Various causes have been ascribed for its production, such as change of young horses from field to stable, from grass to dry feeding, from idleness to hard work, irritation of teething, and change of locality and climate. But the sole cause is infection by the strangles *streptococcus*. Languor and feverishness, diminution of appetite, cough, redness of the nasal membrane, with discharge from the eyes and nose, and thirst are among the earliest symptoms. Then there is difficulty in swallowing, coincident with the development of swelling between the branches of the lower jaw, which often causes the water in drinking to be returned through the nose and the masticated food to be dropped from the mouth. The swelling is hot and tender, diffused, and uniformly rounded and smooth; at first it is hard, with soft, doughy margins; but later it becomes soft in the centre, where an abscess is forming, and soon "points" and bursts, giving exit to a quantity of pus. Relief is now experienced by the animal; the symptoms subside, and recovery takes place. In some cases the swelling is so great or occurs so close to the larynx that the breathing is interfered with, and even rendered so difficult that suffocation is threatened. In other cases the disease assumes an irregular form, and the swelling, instead of softening in the centre, remains hard for an indefinite time, or it may subside and abscesses form in various parts of the body, sometimes in vital organs, as the brain, lungs, liver, kidneys, &c., or in the bronchial or mesenteric glands, where they generally produce serious consequences. Not unfrequently a pustular eruption accompanies the other symptoms. The malady may terminate in ten days or be protracted for months, sometimes terminating fatally from complications, even when the animal is well nursed and kept in a healthy stable.

Good nursing is the chief part of the treatment. The strength should be maintained by soft nutritious food, and the body kept warm and comfortable; the stable or loose-box must have plenty of fresh air and be kept clean. The swelling may be fomented with warm water or poulticed. The poultice may be a little bag containing bran and linseed meal mixed with hot water and applied warm to the tumefaction, being retained there by a square piece of calico, with holes for the ears and eyes, tied down the middle of the face and behind the ears. If the breathing is disturbed and noisy, the animal may be made to inhale steam from hot water in a bucket or from bran mash. If the breathing becomes very difficult, the windpipe must be opened and a tube inserted. Instead of the swelling being poulticed, a little blistering ointment is sometimes rubbed over it, which hastens pointing of the abscess. When the abscess points, it may be lanced, though sometimes it is better to allow it to break spontaneously.

It is important to distinguish strangles from glanders, and the distinction can, with certainty, be ascertained by resorting to the mallein test for glanders, or by microscopical examination of the pus from the strangles abscess.

Influenza.

Under influenza several diseases are sometimes included, and in different invasions it may (and doubtless does) assume varying forms. It is a specific fever of a low or asthenic type, associated with inflammation of the mucous membrane lining the air-passages, and also sometimes with that of other organs. At various times it has prevailed extensively over different parts of the world, more especially during the 18th and 19th centuries. Perhaps one of the most widespread outbreaks recorded was that of 1872, on the American continent. It usually radiates from the district in which it first appears. The symptoms have been enumerated as follows: sudden attack, marked by extreme debility and stupor, with increased body-temperature, quick weak pulse, rigors and cold extremities. The head is pendent, the eyelids swollen and half closed, eyes lustreless, and tears often flowing down the face. There is great disinclination to move; the body sways on the animal attempting to walk; and the limb-joints crack. The appetite is lost and the mouth is hot and dry; the bowels are constipated and the urine scanty and high-coloured; there is nearly always a deep, painful and harassing cough; on auscultation of the chest, crepitation or harsh blowing sounds are audible; and the membrane lining the eyelids and nose assumes either a bright pink colour or a dull leaden hue. A white, yellowish or greenish-coloured discharge flows from the nostrils. In a few days the fever and other symptoms subside, and convalescence rapidly sets in. In unfavourable cases the fever increases, as well as the prostration, the breathing becomes laboured, the cough more painful and deep, and auscultation and percussion indicate that the lungs are seriously involved, with perhaps the pleura or the heart. Clots sometimes form in the latter organ, and quickly bring about a fatal termination. When the lungs do not suffer, the bowels may, and with this complication there are, in addition to the stupor and torpor, tension and tenderness of the abdominal walls when pressed upon, manifestations of colic, great thirst, a coated tongue, yellowness of the membranes of nose and eyes, high-coloured urine, constipation, and dry faeces covered with mucus. Sometimes rheumatic swelling and tenderness takes place in the muscles and joints of the limbs, which may persist for a long time, often shifting from leg to leg, and involving the sheaths of tendons. At other times acute inflammation of the eyes supervenes, or even paralysis.

In this disease good nursing is the chief factor in the treatment. Comfortable, clean and airy stables or loose-boxes should be provided, and the warmth of the body and limbs maintained. Cold and damp, foul air and uncleanliness, are as inimical to health and as antagonistic to recovery as in the case of mankind. In influenza it has been generally found that the less medicine the sick animal receives the more likely it is to recover. Nevertheless, it may be necessary to adopt such medical measures as the following. For constipation administer enemata of warm water or give a dose of linseed oil or salines. For fever give quinine or mild febrifuge diuretics (as liquor of acetate of ammonia or spirit of nitrous ether), and, if there is cough or nervous excitement, anodynes (such as extract of belladonna). When the fever subsides and the prostration is great, it may be necessary to give stimulants (carbonate of ammonia, nitrous ether, aromatic ammonia) and tonics, both vegetable (gentian, quassia, calumba) and mineral (iron, copper, arsenic). Some veterinary surgeons administer large and frequent doses of quinine from the onset of the disease, and, it is asserted, with excellent effect. If the abdominal organs are chiefly involved, demulcents may supplement the above (linseed boiled to a jelly, to which salt may be added, is the most convenient and best), and drugs to allay pain (as opium and chloral hydrate). Olive oil is a safe laxative in such cases. When nervous symptoms are manifested, it may be necessary to apply wet cloths and vinegar to the head and neck; even blisters to the neck have been recommended. Bromide of potassium has been beneficially employed. To combat inflammation of the throat, chest or abdomen, counter-irritants may be resorted to, such as mustard, soap liniment or the ordinary white liniment composed of oil of turpentine, solution of ammonia and olive oil. The food should be soft mashes and gruel of oatmeal, with carrots and green food, and small and frequent quantities of scalded oats in addition when convalescence has been established.

Dourine, or covering disease.

Dourine, *maladie du coit*, or covering disease of horses, is a contagious malady caused by the *Trypanosoma equiperdum*, and characterized by specific lesions of the male and female genital organs, the lymphatic and central nervous systems. It occurs in Arabia and continental Europe, and has recently been carried from France to the United States of America (Montana, Nebraska, the Dakotas, Iowa and Illinois) and to Canada. In some of its features it resembles human syphilis, and it is propagated in the same manner. From one to ten days after coitus, or in the stallion not unfrequently after some weeks, there is irritation, swelling and a livid redness of the external organs of generation (in stallions the penis may shrink), followed by unhealthy ulcers, which appear in successive crops, often at considerable intervals. In mares these are near the clitoris, which is frequently erected, and the animals rub and switch the tail about, betraying uneasiness. In horses the eruption is on the penis and sheath. In the milder forms there is little constitutional disturbance, and the patients may recover in a period varying from two weeks to two months. In the severe forms the local swelling increases by intermittent steps. In the mare the vulva is the seat of a deep violet congestion and extensive ulceration; pustules appear on the perinaeum, tail and between the thighs; the lips of the vulva are parted, exposing the irregular, nodular, puckered, ulcerated and lardaceous-looking mucous membrane. If the mare happen to be pregnant, abortion occurs. In all cases emaciation sets in; lameness of one or more limbs occurs; great debility is manifested, and this runs on to paralysis, when death ensues after a miserable existence of from four or five months to two years. In horses swelling of the sheath may be the only symptom for a long time, even for a year. Then there may follow dark patches of extravasated blood on or swellings of the penis; the testicles may become tumefied; a dropsical engorgement extends forward beneath the abdomen and chest; the lymphatic glands in different parts of the body may be enlarged; pustules and ulcers appear on the skin; there is a discharge from the eyes and nose; emaciation becomes extreme; a weak and vacillating movement of the posterior limbs gradually increases, as in the mare, to paralysis; and after from three months to three years death puts an end to loathsomeness and great suffering. This malady appears to be spread only by the act of coition. The indications for its suppression and extinction are therefore obvious. They are (1) to prevent diseased animals coming into actual contact, especially *per coitum*, with healthy ones; (2) to destroy the infected; and (3) as an additional precautionary measure, to thoroughly cleanse and disinfect the stables, clothing, utensils and implements used for the sick horse. Various medicines have been tried in the treatment of slowly developing cases of dourine, and the most successful remedy is atoxyl—a preparation of arsenic.

Horse-pox.

Horse-pox, which is somewhat rare, is almost, if not quite, identical with cow-pox, being undistinguishable when inoculated on men and cattle. It most frequently attacks the limbs, though it may appear on the face and other parts of the body. There is usually slight fever; then swelling, heat and tenderness are manifest in the part which is to be the seat of eruption, usually the heels; firm nodules form, increasing to one-third or one-half an inch in diameter; the hair becomes erect; and the skin, if light-coloured, changes to an intense red. On the ninth to the twelfth day a limpid fluid oozes from the surface and mats the hairs together in yellowish scabs; when one of these is removed, there is seen a red, raw depression, whereon the scab was fixed. In three or four days the crusts fall off, and the sores heal spontaneously. No medical treatment is needed, cleanliness being requisite to prevent the pocks becoming sloughs. If the inflammation runs high, a weak solution of carbolic acid may be employed.

Diseases of Cattle.

The diseases of the bovine species are not so numerous as those of the horse, and the more acute contagious maladies are dealt with under RINDERPEST and other articles already mentioned.

Tuberculosis.

Tuberculosis is a most formidable and widespread disease of cattle, and it is assuming greater proportions every year, in consequence of the absence of legislative measures for its suppression. It is a specific disease, contracted through cohabitation, and caused by the *Bacillus tuberculosis*, discovered by Koch in 1882. Infection takes place by inhalation of the bacilli or their spores, derived from the dried expectorate or other discharges of tuberculous animals; by ingestion of the bacilli carried in food, milk or water, or by inoculation of a wound of the skin or of a mucous or serous membrane. Occasionally the disease is transmitted by an infected female to the foetus *in utero*. Its infective properties and communicability to other species render it a serious danger to mankind through the consumption of the milk or flesh of tuberculous cows. The organs chiefly involved are the lymphatic glands, lungs, liver, intestine and the serous membranes—the characteristic tubercles or "grapes" varying in size from a millet seed to immense masses weighing several pounds. The large diffused nodular growths are found principally in the chest and abdomen attached to the membranes lining these cavities.

The symptoms somewhat resemble those of contagious pleuropneumonia (*q.v.*) in its chronic form, though tubercles, sometimes in large numbers, are often found after death in the bodies of cattle which exhibited no sign of illness during life and which when killed were in excellent condition. When the lungs are extensively involved there are signs of constitutional disturbance, irregular appetite, fever, difficult breathing, dry cough, diarrhoea, wasting and debility, with enlarged throat glands, and, in milch cows, variation in the quantity of milk. Auscultation of the chest discovers dullness or absence of respiratory sounds over the affected parts of the lungs. If the animal is not killed it becomes more and more emaciated from anaemia, respiratory difficulty, defective nutrition and profuse diarrhoea. Tuberculosis of the mammary glands usually begins as a slowly developing, painless, nodular induration of one quarter of the udder. The milk at first may be normal in quantity and quality, but later it becomes thin or watery and assumes a blue tint. Cattle with tubercular lesions unaltered by retrogressive changes may appear to be in an ordinary state of health, and in such animals the existence of the disease can only be discovered by resorting to the tuberculin test. Tuberculin, as prepared for the purpose of diagnosis, is a sterilized culture of tubercle bacilli, and when employed with proper precautions it causes a marked rise of temperature in affected cattle, but in non-tuberculous animals it has no appreciable action. Medical treatment is of little if any avail. Preventive measures are of the utmost importance. Animals proved free of tuberculous taint should alone be bred from, and those found diseased should be at once completely segregated or slaughtered. Before being used as food the flesh should be well cooked, and the milk from tuberculous cows should be boiled or heated to a temperature of 155° F.

Black-quarter. Black-quarter, or black-leg, is a specific, inoculable disease which occurs in young stock from a few months to two years old, in various parts of the country, and generally in low-lying damp situations. It was classed with anthrax until 1879, when its nature was investigated by Arloing, Cornevin and Thomas, who termed it symptomatic anthrax (*Charbon symptomatique*)—a misleading name for a disease which is perfectly distinct from anthrax. This disease is caused by the *Bacillus Chauvaei*, and natural infection takes place through small wounds of the legs and feet or other parts. At first it is a local disease affecting usually a hind quarter, though sometimes the characteristic swelling forms on the shoulder, neck, breast, loins or flank. The chief symptoms are sudden loss of appetite, accelerated pulse and respiration, high temperature, debility, lameness or stiffness, followed by the formation of a small, painful swelling which rapidly increases in extent, becomes emphysematous, and in the centre cold and painless. Incision of the tumour gives escape to a red, frothy, sour-smelling fluid. This disease runs its course very rapidly and nearly always terminates fatally, even when medical treatment is promptly applied. Infection can be prevented by resorting to protective inoculation by one of the methods introduced by Arloing, Kitt and others. The natural virus-muscle from the lesion, dried, reduced to powder and attenuated by heat at a high temperature, and a pure culture of the causal organism, are employed as vaccines. The vaccine is introduced subcutaneously at the tip of the tail or behind the shoulder. Immunity lasts for about twelve months.

Abortion. Abortion, or the expulsion of the foetus before viability, is a contagious disease in cows. In a herd a case of abortion or premature birth from accident or injury sometimes occurs, but when a number of pregnant females abort the cause is due to specific infection of the womb. The microbe of abortion induces catarrh of the uterus and the discharge contains the infective agent. The virus may be transmitted by the bull, by litter, attendants, utensils, or anything which has been contaminated by the discharge from an infected cow. Whenever abortion occurs in a shed the cow should be at once isolated from the others, if they are pregnant, and cleansing and disinfection immediately resorted to, or preferably the pregnant cows should be quickly removed out of the shed and every care should be taken to keep them away from the affected cow and its discharges; the litter and the aborted foetus being burned or otherwise completely destroyed, and the cowshed thoroughly disinfected with quicklime. To prevent further infection, the hinder parts of the in-calf cows should be washed and disinfected from time to time.

Contagious mammitis. Contagious mammitis is a common disease in milch cows. It has been investigated by Nocard and Mollereau, and proved to be caused by a streptococcus which is transmitted from one cow to another by the hands of the milkers. The microbe gains access to the quarter by the teat and induces catarrhal inflammation of the milk ducts and sinuses, with induration of the gland tissue. This disease develops slowly, and except in cases complicated by suppuration, there is little or no constitutional disturbance, though sometimes the affected cows lose condition. The milk at first preserves its normal appearance, but is less in quantity; it curdles quickly, is acid, and when mixed with good milk produces clotting; then it becomes thin and watery, and finally viscous, yellowish and foetid. At the base of the teat of the affected quarter induration begins and gradually extends upwards, and if not checked the disease passes from one quarter to another until the whole udder is attacked. Prevention can be secured by washing and disinfecting the udder and teats and the milkers' hands before and after milking. Diseased cows should be isolated, their milk destroyed or boiled and fed to pigs, and after each milking the teats should be injected with a warm solution of boracic acid or sodium fluoride. Infected cowsheds should be thoroughly cleansed and disinfected.

Milk fever. Parturient paralysis, or mammary toxaemia, also known as milk fever, though neither a febrile nor a contagious malady, was until quite recently a very fatal affection of dairy cows. It is caused by a nerve poison which is formed in the udder soon after parturition; and, according to Schmidt, the toxin enters the circulation and affects especially, the central nervous system and the muscles, and in a less degree all the organs of the body. This disease usually attacks good milking cows within a few days of an easy labour and seldom before the third or fourth parturition. In twenty-four to forty-eight hours after calving the cow becomes excited and restless, strikes at the abdomen with the hind feet, whisks the tail, lows, grinds the teeth, staggers, falls, makes ineffectual attempts to rise, and eventually lies comatose, stretched on her side with the head extended or inclined towards the shoulder. The eyes are dull, injected and insensitive; general sensation, voluntary motion and the power of swallowing are lost. Secretion of milk fails, digestion is suspended, fermentation of the contents of the paunch sets in, with tympany, constipation and retention of urine. The pulse becomes feeble or imperceptible. Respiration is slow, sometimes stertorous or groaning, and the temperature is low or subnormal. If not treated the animal dies in two or three days from prolonged coma or heart failure.

The curative treatment of this disease continued very unsatisfactory until 1897, when Schmidt, a veterinarian of Kolding, Denmark, introduced the method of injecting the teats with a solution of potassium iodide in conjunction with insufflation of atmospheric air. The immediate results of this line of treatment were astonishing. Rapid recovery became the rule, and in most cases the comatose condition disappeared in less than six hours, and the average mortality (40 to 60%) was reduced to 6%. Afterwards chinosol and other antiseptics were substituted for the potassium salt, and later pure oxygen or atmospheric air alone was injected into the udder, with the result of increasing the recoveries to 99%.

Cowpox. Cowpox is a contagious disease of much less frequent occurrence now than formerly, probably owing to improved hygienic management. In many localities the disease appears in all heifers which have recently calved on certain farms. There is usually a slight premonitory fever, which is generally overlooked; this is succeeded by some diminution in the quantity of the milk, with some increased coagulability, and by the appearance of the eruption or "pox" on the udder and teats. In well-observed cases the udder is hot and tender on manipulation for a day or two previous to the development of small pale-red nodules about the size of peas; these increase in dimensions to from three-fourths to one inch in diameter by the eighth or tenth day, when their contents have become fluid and they present a depressed centre. This fluid, at first clear and limpid, becomes yellowish white as it changes to pus, and soon dries up, leaving a hard, button-shaped black crust, which gradually becomes detached. On the teats, owing to the handling of the milker or to the cow lying on the hard ground or on straw, the vesicles are early ruptured and sores are formed, which often prove troublesome and may cause inflammation of the udder.

Actinomycosis. Actinomycosis, though affecting man, horses, pigs and other creatures, is far more common in the bovine species. The fungus (*Actinomyces*) may be found in characteristic nodules in various parts of the body, but it usually invades the bones of the jaws, upper and lower, or the soft parts in the neighbourhood of these, as the tongue, cheeks, face, throat and glands in its vicinity. About the head the disease appears to commence with slight sores on the gums or mucous membrane of the mouth or with ulcers alongside decaying teeth, and these extend slowly into the tissues. If the jaw is affected, a large rounded tumour grows from it, the dense outer bone becoming absorbed before the increasing soft growth within. Soon the whole becomes ulcerated and purulent discharges take place, in which are found the minute, hard, yellow granules which contain the fungus. When the tongue is affected, it becomes enlarged and rigid; hence the designation of "wooden tongue" given to it by the Germans. In the course of time the surface of the organ becomes ulcerated, and yellowish masses or nodules may be seen on the surface. Sometimes the entire face is involved, the lips and nostrils becoming swollen, hard and immovable, often rendering respiration difficult. Around the throat there are rounded dense swellings, implicating the glands. When the disease is well-defined and of slight extent, the parts involved may be removed by the knife, wholly or partially. If the latter only, then the remaining affected tissues should be dressed with tincture of iodine or iodized carbolic acid. Chromic acid has also been found useful. A course of potassium iodide internally is sometimes curative and always beneficial.

Diseases of Sheep.

The contagious diseases of the sheep (other than those of foot-and-mouth disease, anthrax, rinderpest, black-quarter) are comparatively few.

Sheep-pox. The formidable disorder of sheep-pox is confined chiefly to the continent of Europe. It is extremely contagious and fatal, and in these and some other characteristics resembles human smallpox. From three to twelve days after being exposed to infection the sheep appears dull and listless, and eats little, if anything; the temperature rises; there are frequent tremblings; tears flow from the eyes; and there is a nasal discharge. Red patches appear inside the limbs and under the abdomen; and on them, as well as on other parts where the skin is thin, dark red spots show themselves, which soon become papules, with a deep hard base. These are generally conical, and the apex quickly becomes white from the formation of pus. This eruption is characteristic and unmistakable; and the vesicles or pustules may remain isolated (discrete pox) or coalesce into large patches (confluent pox). The latter form of the disease is serious. In bad cases the eruption may develop on the eyes and in the respiratory and digestive passages. The course of the disease lasts about three weeks or a month, and the eruption passes through the same stages as that of cowpox. The mortality may extend from 10% in mild outbreaks to 90 or 95% in very virulent ones. Diseased animals should be sheltered, and fed on nourishing food, especially gruels of oatmeal flour or linseed; acidulated water may be allowed. If there is sloughing of the skin or extensive sores, oxide of zinc ointment should be applied. But treatment should not be adopted unless there is general infection over a wide extent of country. All diseased animals should be destroyed, as well as those which have been in contact with them, and thorough disinfection resorted to.

Foot-rot.

Foot-rot is a disease of the claws of sheep. It occurs most frequently in badly drained, low-lying, marshy land, and is caused by the *Bacillus necrophorus.* Infection appears to be transmitted by cohabitation, litter, manure and infected pastures. The disease begins at the sole or between the claws and gradually extends, causing changes in the bones and tendons, with suppuration, degeneration of horn and sloughing. The symptoms are lameness, foot or feet hot, tender and swollen at the coronet; the horn soft and rotten. Affected sheep when feeding may rest on the knees, or, if fore and hind feet are involved, they lie down constantly. The claws must be cleansed, loose and underrun horn removed, abscesses opened, and the foot thoroughly disinfected and protected from further infection by an appropriate bandage. Some cases require daily dressing, and all affected feet should receive frequent attention. When large numbers of sheep are attacked they should be slowly driven through a foot-bath containing an antiseptic solution. Pastures on which foot-rot has been contracted should be avoided, the feet examined every month or oftener, and where necessary pared and dressed with pine tar.

Diseases of the Pig.

The pig may become affected with anthrax, foot-and-mouth disease and tuberculosis, and it also has its own particular variola. But the contagious diseases which cause enormous destruction of pigs are swine fever and swine erysipelas in Great Britain, hog cholera and swine plague in the United States, and swine erysipelas and swine plague in France, Germany and other countries of the European continent.

Swine fever.

Swine fever is an exceedingly infectious disease, caused by a bacillus, and associated with ulceration of the intestine, enlargement of the lymphatic glands, and limited disease of other organs. It is spread with great facility by mediate as well as immediate contagion; the virus can be carried by apparently healthy pigs from an infected piggery, by litter, manure, food, attendants, dogs, cats, vermin, crates, troughs or anything which has been soiled by the discharges from a diseased pig. It is generally very rapid in its course, death ensuing in a very few days, and when the animal survives, recovery is protracted. After exposure to infection the animal exhibits signs of illness by dullness, weakness, shiverings, burying itself in the litter, disinclination to move, staggering gait, great thirst, hot dry snout, loss of appetite, and increased pulse, respiration and temperature (105° F.). Red and violet patches appear on the skin; there is a hacking cough; nausea is followed by vomiting; diarrhoea ensues; the hind legs become paralysed; stupor sets in, and the animal perishes. Treatment should not be attempted. Notification of the existence of swine fever is compulsory, and outbreaks are dealt with by the Board of Agriculture and Fisheries. To suppress the disease kill all affected pigs and those which have been in contact with them; burn or deeply bury the carcasses and litter, and cover with quicklime. Disinfect everything that may have been contaminated with the virus.

Diseases of the Dog.

Distemper.

The contagious diseases of the dog are likewise very few, but the one which attracts most attention is common and generally serious. This is what is popularly known as distemper. It is peculiar to the canine species, for there is no evidence that it can be conveyed to other animals, though the different families of Carnivora appear each to be liable to a similar disease. Distemper is a specific fever which most frequently attacks young dogs, its effects being primarily developed in the respiratory passages, though the brain, spinal chord and abdominal organs may subsequently be involved. Highly bred and pet dogs suffer more severely than the commoner and hardier kinds. It is a most infectious disease, and there is much evidence to prove that it owes its existence and prevalence solely to its virulence. One attack confers immunity from another. The symptoms are rigors, sneezing, dullness, loss of appetite, desire for warmth, and increased temperature, respiration and pulse. The eyes are red, and the nose, at first dry and harsh, becomes smeared with the discharge which soons begins to flow from the nostrils. Suppuration also begins at the eyes; vision is more or less impaired by the mucus and pus, and often the cornea becomes ulcerated, and even perforated. There is a cough, which in some cases is so violent as to induce vomiting. Debility rapidly ensues, and emaciation is soon apparent; diarrhoea in the majority of cases sets in; the body emits an unpleasant odour; ulceration of the mouth is noticed; the nostrils become obstructed by the discharge from them; convulsions generally come on; signs of bronchitis, pneumonia, jaundice or other complications manifest themselves; and in some instances there is a pustular or vesicular eruption on the skin. In fatal cases the animal dies in a state of marasmus. Many which recover are affected with chorea for a long time afterwards. Here, again, good nursing is all-important. Comfort and cleanliness, with plenty of fresh air, must be ensured. Debility being the most serious feature of the disease, the strength should be maintained or restored until the fever has run its course. Light broth, beef tea, or bread and milk, or these alternately, may be allowed as diet. Preparations of quinine, given from the commencement of the attack in a little wine, such as sherry, have proved very beneficial. Often a mild laxative is required. Complications should be treated as they arise. The disease being extremely infectious, precautions should be adopted with regard to other dogs. Protective vaccines and antidistemper sera have been introduced by Lignieres, Copeman, Phisalix and others, but their action is uncertain.

The formidable affliction known as hydrophobia (*q.v.*) or rabies is treated of under that name.

Principal Parasites of Domestic Animals.

In horse.

Perhaps the commonest worm infesting the horse is *Ascaris equorum*, or common lumbricoid. The males are from 6 to 8 in. long; females 7 to 17 in. They are found in almost every part of the intestine. When present in considerable numbers they produce slight intermittent colicky pains, an unthrifty condition of the skin, with staring coat. Although the horse feeds well, it does not improve in condition, but is "tucked up" and anaemic. Among the principal remedies is a mixture of tartar emetic, turpentine and linseed oil. Santonin, ferrous sulphate, common salt and arsenic are also employed. *Sclerostomum equinum* or palisade worm is a moderate-sized nematode, having a straight body with a somewhat globular head—males ¾ to 1½ in., females 1 in. to 2 in. long. This worm is found in the intestines, especially the double colon and caecum. The embryos are developed in the eggs after their expulsion from the host, and are lodged in moist mud, where, according to Cobbold, they change their first skin in about three weeks, after which they probably enter the body of an intermediate bearer, whence they are conveyed in food or water to the digestive canal of the horse, the ultimate host. They then penetrate the mucous membrane and enter the blood vessels, where they are sexually differentiated and give rise to aneurism. After a time they resume their wanderings and reach the large intestine, where they form small submucous cysts and rapidly acquire sexual maturity. They are most dangerous when migrating from one organ to another. They are found in the anterior mesenteric artery, but they also produce aneurism of the coeliac axis and other abdominal blood vessels, including the aorta. These parasitic aneurisms are a frequent cause of fatal colic in young horses.

Sclerostomum tetracanthum, or four-spined sclerostome, is about the same size as the palisade worm, and like it is found in the colon, caecum and small intestine. It finds its way to the bowel in water or green fodder swallowed by the horse. It is a true blood-sucker, and its development is very similar to that of the *S. equinum*, except that it directly encysts itself in the mucous membrane and does not enter the blood vessels. The symptoms of its presence are emaciation, colicky pains, harsh unthrifty coat, flabby muscles, flatulence, foetid diarrhoea, anaemia, great weakness and, sometimes, haemorrhagic enteritis. Treatment of equine sclerostomiasis frequently fails, as the remedies cannot reach the encysted parasites. As vermicides, thymol, areca, ferrous sulphate, tartar emetic, arsenic, sodium chloride, oil of turpentine, lysol, creolin and carbolic acid have been found useful.

Oxyuris curvula, or pin worm, is a common parasite of the large intestine. The anterior part of the body is curved and the tail sharply pointed. The male is seldom seen. The female measures 1 to 1½ in. in length. It is found in the caecum, colon and rectum, and it causes pruritus of the anus, from which it may be found projecting. This parasite is best treated by means of a cathartic, followed by a course of mineral tonics, and repeated rectal injections of sodium chloride solution, infusion of quassia or diluted creolin.

The cestodes or taeniae of the horse are insignificant in size and they produce no special symptoms. Three species—*Anoplocephala perfoliata* (26–28 mm. long), *A. plicata* (1½–8 cm.) and *A. mamillana* (1–3 cm.)—have been described. The first is found in the small intestine and caecum, rarely in the colon; the second occurs in the small intestine and stomach; the third in the small intestine. Generally a horse may be proved to be infested with tape-worm by finding some of the ripe segments or proglottides in the faeces. The best remedy is male fern extract with turpentine and linseed oil.

Gastrophilus equi, or the common bot-fly, is classed with the parasites on account of its larval form living as a parasite. The bot-fly deposits its eggs on the fore-arm, knee and shank of the horse at pasture. In twenty-four hours the ova are hatched and the embryo, crawling on the skin, causes itching, which induces the horse to nibble or lick the part, and in this way the embryo is carried by the tongue to the mouth and swallowed. In the stomach the embryo attaches itself to the mucous membrane, moults three times, increases in size and changes from a blood-red to a yellowish-brown colour. The bot remains in the stomach till the following spring, when it detaches itself, passes into the food and is discharged with the faeces. When very numerous, bots may cause symptoms of indigestion, though frequently their presence in the stomach is not indicated by any sign of ill-health. They are difficult to dislodge or kill. Green food, iodine, naphthalin, hydrochloric acid and vegetable bitters have been recommended; but the most effective remedy is a dose of carbon bisulphide given in a gelatin capsule, repeated in twelve hours, and followed twelve hours later by an aloetic ball.

In cattle and sheep.

Of the parasites which infest cattle and sheep mention will only be made of *Distomum hepaticum*, or common fluke, which causes liver-rot or distomiasis, a very fatal disease of lambs and sheep under two years old. It occurs most frequently after a wet season on low-lying, marshy or undrained land, but it may be carried to other pastures by sheep which have been driven through a fluke-infested country, and sheep allowed to graze along ditches by the roadside may contract the parasite. For a full description of its anatomy and development see TREMATODES. Preventive treatment comprises the destruction of flukes and snails; avoidance of low-lying, wet pastures draining infested land, and top-dressing with salt, gas-lime, lime water or soot; supplying sheep with pure drinking water; placing rock-salt in the fields, and providing extra food and a tonic lick consisting of salt, aniseed, ferrous sulphate, linseed and peas-meal.

Husk, hoose or verminous bronchitis of calves is caused by *Strongylus micrurus*, or pointed-tailed strongyle, a thread-worm 1 to 3 in. long, and *S. pulmonaris*, a similar but smaller nematode; and the corresponding disease of sheep is due to *S. filaria* and *S. rufescens*. The male *S. filaria* is 1 to 2 in., and the female 2 to 4 in. long. They are white in colour and of the thickness of ordinary sewing cotton. The *S. rufescens* is thinner and shorter than *S. filaria* and its colour is brownish red. The development of these strongyles is not accurately known. When expelled and deposited in water or moist earth, the embryos may live for many months. Hoose occurs in spring and continues until autumn, when it may be most severe. In sheep the symptoms are coughing, at first strong, with long intervals, then weak and frequent, leaving the sheep distressed and wheezing; discharge from the nose, salivation, occasional retching with expulsion of parasites in frothy mucus, advancing emaciation, anaemia and weakness. In calves the symptoms are similar but less acute. Various methods of cure have been tried. Remedies given by the mouth are seldom satisfactory. Good results have followed fumigations with chlorine, burning sulphur, tar, &c., and intra-tracheal injections of chloroform, iodine and ether, oil of turpentine, carbolic acid, and opium tincture, or chloroform, ether, creosote and olive oil. The system should be supported with as much good nourishing food as possible.

The principal parasites which infest the alimentary canal of cattle or sheep are strongyles and taeniae. The strongyles of the fourth stomach are *S. contortus*, or twisted wire-worm (male 10 to 20 mm., female 20 to 30 mm. long), *S. convolutus* (female 10 to 13 mm.), *S. cervicornis* (female 10 to 12 mm.), *S. gracilis* (female 3 to 4 mm.), and an unnamed species (female 9 mm. long) discovered by McFadyean in 1896. In the contents of the stomach the *contortus* may easily be recognized, but the other parasites, owing to their small size or situation in the mucous membrane, may be overlooked in an ordinary post-mortem examination. The *contortus*, which is best known, may serve as the type. It lives on the blood which it abstracts from the mucous membrane, and, according to the state of repletion, its body may be red or white. The ova of this worm are discharged in the faeces and spread over the pastures by infected sheep. The ova hatch in a few days, and, according to Ransom, within a fortnight embryos one-thirtieth of an inch long may be found encased in a chitinoid investment, which protects them from the effects of excessive cold, heat or moisture. When the ground is damp and the temperature not too low, the embryos creep up the leaves of grasses and other plants, but when the temperature is below 40° F. they are inactive (Ransom). Sheep feeding on infected pasture gather the young worms and convey them to the fourth stomach, where they attain maturity in two or three weeks. In wet weather the embryos may be washed into ponds and ditches, and cattle and sheep may swallow them when drinking. Strongyles cause loss of appetite, irritation and inflammation of the stomach and bowel, diarrhoea, anaemia, progressive emaciation, and, if not destroyed or expelled, a lingering death from exhaustion. The success or failure of medicinal treatment depends on the degree of infestation. A change of pasture is always desirable, and as remedies a few doses of oil of turpentine in linseed oil, or a solution of lysol or cyllin, and a powder consisting of arsenic, ferrous sulphate, areca, nux vomica and common salt may be tried. The ox may be the bearer of three and the sheep of twelve species of taeniae, and of these the commonest is *Moniezia (taenia) expansa*, which is more frequently found in sheep than in cattle. It is the longest tapeworm, being from 6 to 30 ft. in sheep and from 40 to 100 ft. in cattle. Its maximum breadth is $\frac{3}{4}$ in.; it is found in the small intestine, and sometimes in sufficient numbers in lambs to obstruct the bowel. Infested animals are constantly spreading the ripe segments over the pastures, from which the ova or embryos are gathered by sheep. The symptoms are inappetence, dry harsh wool, weakness, anaemia and diarrhoea with segments of the worms in the faeces. Various drugs have been prescribed for the expulsion of tapeworms, but the most useful are male fern extract, turpentine, kamala, kousso, aloes and linseed oil. Very young animals should be supported by dry nourishing food and tonics, including salt and ferrous sulphate.

The principal round-worms of the intestine of ruminants are *Ascaris vitulorum*, or calf ascarid, *Strongylus filicollis*, *S. ventricosus*, *Sclerostomum hypostomum*, *Anchylostomum cernuum* and *Trichocephalus affinis*, or common whip-worm, which sometimes causes severe symptoms in sheep. For a full account of the development of *Cysticercus bovis*, or beef measle, the larval form of *Taenia saginata* of the human subject, see TAPEWORMS. Another bladder-worm, found in the peritoneum of sheep and cattle, is *Cysticercus tenuicollis*, or slender-necked hydatid, the larval form of *Taenia marginata* of the dog. It seldom produces serious lesions. An important hydatid of ruminants is *Coenurus cerebralis*, which produces in sheep, cattle, goats and deer gid or sturdy, a peculiar affection of the central nervous system characterized by congestion, compression of the brain, vertigo, inco-ordination, and other symptoms of cerebrospinal paralysis. This bladder-worm is the cystic form of *Taenia coenurus* of the dog. It is found in the cranial cavity, resting on the brain, within its substance or at its base, and sometimes in the spinal canal. The symptoms vary with the position and number of the vesicles. In an ordinary case the animal feeds intermittently or not at all, appears unaccountably nervous or very dull, more or less blind and deaf, with glazed eye, dilated pupil, the head twisted or inclined always to one side—that occupied by the cyst—and when moving the sheep constantly tends to turn in the same direction. When the vesicle is deep-seated or within the cerebral lobe, the sheep carries the head low, brings the feet together and turns round and round like a dog preparing to lie down. When the developing cyst exerts pressure at the base of the cerebellum, the sheep repeatedly falls and rolls over. In other cases the chief symptoms may be frequent falling, always on the same side, high trotting action with varying length of step, advancing by rearing and leaping, complete motor paralysis, and in spinal cases posterior paralysis with dragging of the hind limbs. Medicinal treatment is of no avail, but in some cases the hydatid can be removed by trephining the skull. Gid may be prevented by attending to the treatment of dogs infested with the tapeworm.

In the pig.

The helminthes of the pig, although not very detrimental to the animal itself, are nevertheless of great importance as regards the entozoa of man. Allusion must be made to *Trichinella spiralis*, which causes trichinosis. The male is $\frac{1}{18}$th, the female $\frac{1}{8}$th in. long, and the embryos $\frac{1}{80}$th to $\frac{1}{27}$th in. The ova measure $\frac{1}{1270}$th in. in their long diameter; they are hatched within the body of the female worm. When scraps of trichinous flesh or infested rats have been ingested by the pig, the cysts enclosing the larval trichinae are dissolved by the gastric juice in about eighteen hours, and the worms are found free in the intestine. In twenty-four to forty-eight hours later these larvae, having undergone certain transformations, become sexually mature; then they copulate, and after an interval the embryos leave the body of the female worm and immediately begin to penetrate the intestinal wall in order to pass into various voluntary muscles, where they become encysted. About twelve days elapse from the time they begin their wandering. Usually each larva is enveloped in a capsule, but two or even three larvae have been found in one investment. They have been known to live in their capsules for eighteen months to two years.

Cysticercus cellulosae is the larval form of *Taenia solium* of man (see TAPEWORMS). "Measly pork" is caused by the presence in the flesh of the pig of this entozoon, which is bladder-like in form. It has also been discovered in the dog. Other important parasites of the pig are *Stephanurus dentatus*, or crown-tailed strongyle, *Echinorhynchus gigas*, or thorn-headed worm, *Ascaris suis*, or pig ascarid, and *Strongyloides suis*. For these the most useful remedies are castor oil seeds, given with the food, and oil of turpentine in milk, followed by a dose of Epsom salts.

In the dog.

Of all the domesticated animals the dog is by far the most frequently infested with worms. A very common round-worm is *Ascaris marginata* (3 to 8 in. long), a variety of the ascarid (*A. mystax*) of the cat. It occurs in the intestine or stomach of young dogs. The symptoms are emaciation, drooping belly, irritable skin, irregular appetite, vomiting the worms in mucus, colic and diarrhoea. The treatment comprises the administration of areca or santonin in milk, followed by a dose of purgative medicine. A nematode, *Filaria immitis*, inhabits the heart of the dog, and its larvae may be found in the blood, causing endocarditis, obstruction of the vessels, and fits, which often end in death. *Spiroptera sanguinolenta* may be found in the dog encysted in the wall of the stomach. Other nematodes of the dog are *Anchylostomum trigonocephalum*, which causes frequent bleeding from the nose and pernicious anaemia, and *Trichocephalus depressiusculus*, or whip-worm, which is found in the caecum. The dog harbours eight species of taeniae and five species of *Bothriocephalus*. *Taenia serrata*, about 3 ft. in length, is found in about 10% of

English dogs, most frequently in sporting dogs and those employed on farms, owing to their eating the viscera of rabbits, &c., in which the larval form (*Cysticercus pisiformis*) of this tapeworm dwells. *T. marginata* is the largest cestode of the dog. It varies in length from 5 to 8 ft., and is found in the small intestine of 30% of dogs in Great Britain; its cystic form (*C. tenuicollis*) occurs in the peritoneum of sheep. *T. coenurus* causes gid in sheep as previously stated. It seldom exceeds 3 ft. in length. Dogs contract this parasite by eating the heads of sheep infested with the bladder-worm (*Coenurus cerebralis*). *Dipylidium caninum*, *T. cucumerina*, or melon seed tapeworm, is a very common parasite of dogs. It varies in length from 3 to 15 in.; its larval form (*Cryptocystis trichodectis et pulicis*) is found in the abdomen of the dog-flea (*Pulex serraticeps*), the dog-louse (*Trichodectis latus*) and in the flea (*P. irritans*) of the human subject. The dog contracts this worm by swallowing fleas or lice containing the cryptocysts. *T. echinococcus* may be distinguished from the other tapeworms by its small size. It seldom exceeds ¼ in. in length, and consists of four segments including the head. The fourth or terminal proglottis when ripe is larger than all the rest. Its cystic form is *Echinococcus veterinorum*, which causes hydatid disease of the liver, lungs, and other organs of cattle, pigs, sheep, horses, and even man. This affection may not be discovered during life. In well-marked cases the liver is much deformed, greatly enlarged, and increased in weight; in the ox the hydatid liver may weigh from 50 to 100 lb. or more. Another tapeworm (*T. serialis*) sometimes occurs in the small intestine. Its cystic form is found in rodents. *Bothriocephalus latus*, or broad tapeworm, about 25 ft. long and 1 in. broad, is found in the intestine of the dog and sometimes in man. Its occurrence appears to be confined to certain parts of the European continent. Its larval form is met with in pike, turbot, tench, perch, and other fishes. The heart-shaped bothriocephalus (*B. cordatus*) infests the dog and man in Greenland. For the expulsion of tapeworm male fern extract has been found the most effectual agent; areca powder in linseed oil, and a combination of areca, colocynth and jalap, the dose varying according to the age, size and condition of the dog, have also proved beneficial.

Dermatozoa.

The parasites which cause numerous skin affections in the domesticated animals may be arranged in two groups, viz. animal parasites or *Dermatozoa*, and vegetable parasites or *Dermatophytes*. The dermatozoa, or those which produce pruritus, mange, scab, &c., are lice, fleas, ticks, acari or mange mites, and the larvae of certain flies. The lice of the horse are *Haematopinus macrocephalus*, *Trichodectes pilosus* and *T. pubescens*; those of cattle, *H. eurysternus*, or large ox-louse, *H. vituli*, or calf-louse, and *T. scalaris*, or small ox-louse; and sheep may be attacked by *T. sphaerocephalus*, or sheep-louse, and by the louse-like ked or fag (*Melophagus ovinus*) which belongs to the pupiparous diptera. Dogs may be infested with two species of lice, *H. piliferus* and *T. latus*, and the pig with one, *H. urius*.

Ticks belong to the family Ixodidae of the order Acarina. A few species have been proved responsible for the transmission of diseases caused by blood parasites, and this knowledge has greatly increased the importance of ticks in veterinary practice. The best known ticks are *Ixodes ricinus*, or castor-bean tick, and *I. hexagonus*, which are found all over Europe, and which attack dogs, cattle, sheep, deer and horses. *Rhipicephalus annulatus*, or Texan fever-tick of the United States, *Rh. decoloratus*, or blue-tick of South Africa, and *Rh. australis*, or scrub-tick of Australia, transmit the parasite of red water or bovine piroplasmosis. *Rh. appendiculatus* carries the germs of East Coast fever, *Rh. bursa* is the bearer of the parasite of ovine piroplasmosis, and *Rh. evertsi* distributes the germs of equine biliary fever. *Amblyomma hebraeum* conveys the parasite of "heart-water" of cattle and sheep, and *Haemaphysalis leachi* transmits the parasite of canine piroplasmosis. *Hyalomma aegyptium*, or Egyptian tick, *Rh. simus* and *Rh. capensis*, are common in most parts of Africa.

The acari of itch, scab or mange are species of *Sarcoptes*, which burrow in the skin; *Psoroptes*, which puncture the skin and live on the surface sheltered by hairs and scurf; and *Chorioptes*, which live in colonies and simply pierce the epidermis. Representatives of these three genera have been found on the horse, ox and sheep; varieties of the first genus (*Sarcoptes*) cause mange in the dog and pig; and *Chorioptes cynotis* sometimes invades the ears of the dog and cat. These parasites live on the exudation produced by the irritation which they excite. Another acarus (*Demodex folliculorum*) invades the dog's skin and sometimes occurs in other animals. It inhabits the hair follicles and sebaceous glands, and causes a very intractable acariasis—the follicular or demodecic mange of the dog (see MITE). A useful remedy for mange in the horse is a mixture of sulphur, oil of tar and whale oil, applied daily for three days, then washed off and applied again. For the dog, sulphur, olive oil and potassium carbonate, or oil of tar and fish oil, may be tried. Various approved patent dips are employed for scab in sheep. A good remedy for destroying lice may be compounded from Stavesacre powder, soft soap and hot water, applied warm to the skin. Follicular mange is nearly incurable, but recent cases should be treated by daily rubbing with an ointment of 5 parts cyllin and 100 parts of lanoline.

Dermatophytes.

The vegetable parasites, or *Dermatophytes*, which cause *tinea* or ringworm in horses, cattle and dogs, belong to five distinct genera: *Trichophyton*, *Microsporum*, *Eidamella*, *Achorion* and *Oospora*. Ringworm of the horse is either a Trichophytosis produced by one of four species of fungi (*Trichophyton mentagrophytes*, *T. flavum*, *T. equinum* and *T. verrucosum*), or a Microsporosis caused by *Microsporum audouini*. Ringworm of cattle is always a Trichophytosis, and due to *T. mentagrophytes*. Four different dermatophytes (*T. caninum*, *M. audouini* var. *caninum*, *Eidamella spinosa* and *Oospora canina*) affect the dog, producing Trichophytic, Microsporous and Eidamellian ringworm and favus. Little is known of ringworm in sheep and swine. The fungi attack the roots of the hairs, which after a time lose their elasticity and break off, leaving a greyish-yellow, bran-like crust of epidermic products, dried blood and sometimes pus. In favus the crusts are yellow, cupped, almost entirely composed of fungi, and have an odour like that of mouldy cheese. Ringworm may affect any part of the skin, but occurs principally on the head, face, neck, back and hind quarters. It is very contagious, and it may be communicated from one species to another, and from animals to man. The affected parts should be carefully scraped and the crusts destroyed by burning; then the patches should be dressed with iodine tincture, solution of copper sulphate or carbolic acid, or with oil of tar.

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(G. Fl.; J. Mac.)

VETO (Lat. for "I forbid"), generally the right of preventing any act, or its actual prohibition; in public law, the constitutional right of the competent authority, or in republics of the whole people in their primary assembly, to protest against a legislative or administrative act, and to prevent wholly, or for the time being, the validation or execution of the same.

It is generally stated that this right was called into existence in the Roman republic by the *tribunicia potestas*, because by this authority decisions of the senate, and of the consuls and other magistrates, could be declared inoperative. Such a statement must, however, be qualified by reference to the facts that *interdico, interdicimus* were the expressions used, and, in general, that in ancient Rome every holder of a magistracy would check a negotiation set on foot by a colleague, his equal in rank, by his opposition and intervention. This was a consequence of the position that each of the colleagues possessed the whole power of the magistracy, and this right of intervention must have come into existence with the introduction of colleagued authorities, *i.e.* with the commencement of the republic. In the Roman magistracy a twofold power must be distinguished: the positive management of the affairs of the state entrusted to each individual, and the power of restraining the acts of magistrates of equal or inferior rank by his protest. As the *tribuni plebis* possessed this latter negative competence to a great extent, it is customary to attribute to them the origin of the veto.

In the former kingdom of Poland the precedent first set in 1652 was established by law as a constant right, that in the imperial diet a single deputy by his protest "Nie pozwalam," *i.e.* "I do not permit it," could invalidate the decision sanctioned by the other members. The king of France received the right of a suspensory veto at the commencement of the French Revolution, from the National Assembly sitting at Versailles in 1789, with regard to the decrees of the latter, which was only to be valid for the time being against the decisions come to and during the following National Assembly, but during the period of the third session it was to lose its power if the Assembly persisted in its resolution. By this means it was endeavoured to diminish the odium of the measure; but, as is well known, the monarchy was soon afterwards entirely abolished. Similarly the Spanish Constitution of 1812 prescribed that the king might twice refuse his sanction to bills laid twice before him by two sessions of the cortes, but if the third session repeated the same he could no longer exercise the power of veto. The same was the case in the Norwegian Constitution of 1814.

In the French republic the president has no veto strictly so called, but he has a power somewhat resembling it. He can, when a bill has passed both Chambers, by a message to them, refer it back for further deliberation. The king or queen of England has the right to withhold sanction from a bill passed by both houses of parliament. This royal prerogative has not been exercised since 1692 and may now be considered obsolete. The governor of an English colony with a representative legislature has the power of veto against a bill passed by the legislative body of a colony. In this case the bill is finally lost, just as a bill would be which had been rejected by the colonial council, or as a bill passed by the English houses of parliament would be if the crown were to exert the prerogative of refusing the royal assent. The governor may, however, without refusing his assent, reserve the bill for the consideration of the crown. In that case the bill does not come into force until it has either actually or constructively received the royal assent, which is in effect the assent of the English ministry, and therefore indirectly of the imperial parliament. Thus the colonial liberty of legislation is made legally reconcilable with imperial sovereignty, and conflicts between colonial and imperial laws are prevented.[1]

The constitution of the United States of America contains in art. i., sect. 7, par. 2, the following order:—

> "Every bill which shall have passed the House of Representatives and the Senate shall, before it become a law, be presented to the president of the United States; if he approve, he shall sign it, if not, he shall return it with his objections to that house in which it shall have originated, who shall enter the objections at large on their journal and proceed to reconsider it. If, after such reconsideration, two-thirds of that house shall agree to pass the bill, it shall be sent, together with the objections, to the other house, by which it shall likewise be reconsidered, and, if approved by two-thirds of that house, it shall become a law. Every order, resolution or vote to which the concurrence of the Senate and House of Representatives may be necessary (except on a question of adjournment) shall be presented to the president of the United States, and, before the same shall take effect, shall be approved by him, or, being disapproved by him, shall be repassed by two-thirds of the Senate and House of Representatives, according to the rules and limitations prescribed in the case of a bill."

In all states of the Union except one the governors, in the same manner or to a modified extent, possess the right of vetoing bills passed by the legislature. Here, therefore, we have again a suspensory veto which is frequently exercised.

According to the constitution of the German empire of 1871, the imperial legislation is executed by the federal council and imperial diet; the emperor is not mentioned. In the federal council the simple majority of votes decides. But in the case of bills concerning the army, the navy and certain specially noted taxes, as well as in the case of decisions concerning the alteration of orders for the administration, and arrangements for the execution of the laws of customs and taxes, the proposal of the federal council is only accepted if the Prussian votes are on the side of the majority in favour of the same (art. vii., sect. 3). Prussia presides in the federal council. The state of things is therefore, in fact, as follows: it is not the German emperor, but the same monarch as king of Prussia, who has the right of veto against bills and decisions of the federal council, and therefore can prevent the passing of an imperial law. The superior power of the presidential vote obtains, it is true, its due influence only in one legislative body, but in reality it has the same effect as the veto of the head of the empire.

The Swiss federal constitution grants the president of the Confederation no superior position at all; neither he nor the federal council possesses the power of veto against laws or decisions of the federal assembly. But in some cantons, viz. St Gall (1831), Basel (1832) and Lucerne (1841), the veto was introduced as a right of the people. The citizens had the power to submit to a plebiscite laws which had been debated and accepted by the cantonal council (the legislative authority), and to reject the same. If this plebiscite was not demanded within a certain short specified time, the law came into force. But, if the voting took place, and if the number of persons voting against the law exceeded by one vote half the number of persons entitled to vote in the canton, the law was rejected. The absent voters were considered as having voted in favour of the law. An attempt to introduce the veto in Zurich in 1847 failed. Thurgau and Schaffhausen accepted it later. Meanwhile another arrangement has quite driven it out of the field. This is the so-called "referendum"—properly speaking, direct legislation by the people—which has been introduced into most of the Swiss cantons. Formerly in all cantons—with the exception of the small mountainous districts of Uri, Schwyz, Unterwalden, Zug, Glarus and Appenzell—it was not a pure democracy, but a representative constitution that prevailed: the great councillors or cantonal councillors periodically chosen by the people were the possessors of the sovereign power, and after deliberating twice passed the bills definitely. Now they have only to discuss the bills, which are printed and sent to all voters with an explanatory message; then the people on a certain day vote for the acceptance or rejection of the law by writing "yes" or "no" on a printed voting paper, which is placed in an urn under official control. In some cantons important financial resolutions involving large state expenses are also submitted to the decision of the people. In the revised federal constitution of 1874, under certain suppositions which have no further interest for us at present, a facultative referendum or *Initiative* (*i.e.* the possibility of demanding a plebiscite under exceptional circumstances) was introduced for federal laws. Since that period it has often been employed and has operated like a veto. It is evident that by the compulsory referendum in the cantons the mere veto is rendered superfluous.

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[1] A. V. Dicey, *Introduction to the Study of the Law of the Constitution*, pp. 111 seq. (6th ed., London, 1902); Sir H. Jenkyns, *British Rule and Jurisdiction beyond the Seas*, pp. 113 seq. (London, 1902).

In examining the question as to what position the veto occupies in jurisprudence, we must separate quite different conceptions which are comprised under the same name.

1. The veto may be a mere *right of intervention* on the part of a magistrate against the order of another official, or against that of an authority of equal or inferior rank. This was the case in ancient Rome. To this class belong also those cases in which, as in the French republic, the president makes his "no" valid against decisions of the general councillors, and the prefect does the same against decisions of the communal councillors. The use of the expression here is quite justifiable, and this veto is not confined to bills, but refers particularly to administrative measures. It affords a guarantee against the abuse of an official position.

2. The veto may be a safety-valve against precipitate decisions, and so a *preventive measure*. This task is fulfilled by the suspensory veto of the president of the United States. Similarly, to this class belong the above-mentioned prescriptions of the Spanish and Norwegian constitutions, and also the veto of the governor of an English colony against decisions of the legislature; for this protest is only intended to prevent a certain want of harmony between the general and the colonial legislation, by calling forth a renewed investigation. This veto is neither an interference with the competence of an authority, nor a division of the legislative power among different factors, but simply a guarantee against precipitancy in the case of a purely legislative measure. The wisdom of establishing this veto power by the constitution is thus manifest.

3. It is wrong to apply the term veto to what is merely the *negative side of the sanctioning of the laws*, in other words, an act of sovereignty. It would not be in accordance with the nature of a constitutional monarchy to declare the monarch's consent to a law unnecessary, or make it a compulsory duty; the legislative power is divided between him and the chambers. The sovereign must therefore be perfectly at liberty to say "yes" or "no" in each single case according to his opinion. If he says the latter, we speak of it as his veto, but this—if he possesses an absolute and not merely a suspensory veto—is not an intervention and not a preventive measure, but the negative side of the exercise of the legislative power, and therefore an act of sovereignty. That this right belongs fully and entirely to the holder of sovereign power—however he may be called—is self-evident. One chamber can also by protest prevent a bill of the other from coming into force. The "placet of the temporal power for church affairs—when it occurs—also involves in this manner in itself the veto or non placet." Where in pure democracies the people in their assembly have the right of veto or referendum, the exercise of it is also a result of the sovereign rights of legislature. (For the question of the conflict between the two houses of England, see REPRESENTATION.)

The peculiar power of veto possessed by the (Prussian) president of the federal council of Germany lies on the boundary between (2) and (3). (A. v. O.)

VETTER [*Vätter* or *Wetter*, often written, with the addition of the definite article, *Vettern*], a lake of southern Sweden, 80 m. long, and 18 m. in extreme breadth. It has an area of 733 sq. m., and a drainage area of 2528 sq. m.; its maximum depth in 390 ft., and its elevation above sea-level 289 ft. It drains eastward by the Motala river to the Baltic. Its waters are of remarkable transparency and blueness, its shores picturesque and steep on the east side, where the Omberg (863 ft.) rises abruptly, with furrowed flanks pierced by caves. The lake is subject to sudden storms. Its northern part is crossed from Karlsborg to Motala (W. to E.) by the Göta canal route. At the southern end is the important manufacturing town of Jönköping, and 15 m. N. of it the picturesque island of Vising, with a ruined palace of the 17th century and a fine church. Vadstena, 8 m. S. of Motala, with a staple industry in lace, has a convent (now a hospital) of St Bridget or Birgitta (1383), a beautiful monastic church (1395–1424) and a castle of King Gustavus Vasa. At Alvastra, 16 m. S. again, are ruins of a Cistercian monastery of the 11th century. Close to Motala are some of the largest mechanical workshops in Sweden, building warships, machinery, bridges, &c.

VETULONIUM, or VETULONIA (Etruscan *Veltuna*), an ancient town of Etruria, Italy, the site of which is probably occupied by the modern village of Vetulonia, which up to 1887 bore the name of Colonna. It lies 1130 ft. above sea-level, about 10 m. direct N.W. of Grosseto, on the N.E. side of the hills which project from the flat Maremma and form the promontory of Castiglione. The place is little mentioned in ancient literature, though Silius Italicus tells us that it was hence that the Romans took their magisterial insignia (fasces, curule chair, purple toga and brazen trumpets), and it was undoubtedly one of the twelve cities of Etruria. Its site was not identified before 1881, and the identification has been denied in various works by C. Dotto dei Dauli, who places it on the Poggio Castiglione near Massa Marittima, where scanty remains of buildings (possibly of city walls) have also been found. This site seems to agree better with the indications of medieval documents. But certainly an Etruscan city was situated on the hill of Colonna, where there are remains of city walls of massive limestone, in almost horizontal courses. The objects discovered in its extensive necropolis, where over 1000 tombs have been excavated, are now in the museums of Grosseto and Florence. The most important were surrounded by tumuli, which still form a prominent feature in the landscape.

See G. Dennis, *Cities and Cemeteries of Etruria* (London, 1883), ii. 263; *Notizie degli Scavi*, passim; I. Falchi, *Ricerche di Vetulonia* (Prato, 1881), and other works, especially *Vetulonia e la sua necropoli antichissima* (Florence, 1891); G. Sordini, *Vetulonia* (Spoleto, 1894) and references. (T. As.)

VEUILLOT, LOUIS (1813–1883), French journalist and man of letters, was born of humble parents at Boynes (Loiret) on the 11th of October 1813. When Louis Veuillot was five years old his parents removed to Paris. After a very slight education he entered a lawyer's office, and was sent in 1830 to serve on a Rouen paper, and afterwards to Périgueux. He returned to Paris in 1837, and a year later visited Rome during Holy Week. There he embraced extravagant ultramontane sentiments, and was from that time an ardent champion of Catholicism. The results of his conversion appeared in *Pèlerinage en Suisse* (1839), *Rome et Lorette* (1841) and other works. In 1843 he entered the staff of the *Univers religieux*. His violent methods of journalism had already provoked more than one duel, and for his polemics against the university of Paris in the *Univers* he was imprisoned for a short time. In 1848 he became editor of the paper, which was suppressed in 1860, but revived in 1867, when Veuillot recommenced his ultramontane propaganda, which brought about a second suppression of his journal in 1874. When his paper was suppressed Veuillot occupied himself in writing violent pamphlets directed against the moderate Catholics, the Second Empire and the Italian government. His services to the papal see were fully recognized by Pius IX., on whom he wrote (1878) a monograph. He died on the 7th of March 1883.

Some of his scattered papers were collected in *Mélanges religieux, historiques et littéraires* (12 vols., 1857–75), and his *Correspondance* (6 vols., 1883–85) has great political interest. His younger brother, Eugène Veuillot, published (1901–4) a comprehensive and valuable life, *Louis Veuillot*.

VEVEY [German *Vivis*], a small town in the Swiss canton of Vaud and near the eastern extremity of the Lake of Geneva. It is by rail 12 m. S.E. of Lausanne or 3½ m. N.W. of the Vernex-Montreux railway station, while it is well served by steamers plying over the Lake of Geneva. In 1900 it had a population of 11,781, of whom 8878 were French-speaking, while there were 8277 Protestants to 3424 Romanists and 56 Jews. It is the second town in point of population in the canton, coming next after Lausanne, though inferior to the "agglomeration" known as Montreux. It stands at the mouth of the Veveyse and commands fine views of the snowy mountains seen over the glassy surface of the lake. The whole of the surrounding country is covered with vineyards, which (with the entertainment of foreign visitors) occupy the inhabitants. Every twenty years or so (last in 1889 and 1905) the *Fête des Vignerons* is held here by an ancient gild of vinedressers, and attracts much attention. Besides a railway line that joins the Montreux-Bernese Oberland line at Chamby (5 m. from Vevey and 1¼ m. below Les Avants) there is a funicular railway from Vevey up the Mont Pèlerin (3557 ft.) to the north-west.

Vevey was a Roman settlement [*Viviscus*] and later formed part of the barony of Vaud, that was held by the counts and dukes of Savoy till 1536, when it was conquered by Bern. In 1798 it was freed from Bernese rule and became part of the canton du Léman (renamed canton de Vaud in 1803) of the Helvetic Republic.
(W. A. B. C.)

VEXILLUM (Lat. dim. of *velum*, piece of cloth, sail, awning, or from *vehere, vectum*, to carry), the name for a small ensign consisting of a square cloth suspended from a cross-piece fixed to a spear. The *vexillum* was strictly the ensign of the maniple, as *signum* was of the cohort, but the term came to be used for all standards or ensigns other than the eagle (*aquila*) of the legion (see FLAG). Caesar (*B.G.* ii. 20) uses the phrase *vexillum proponere* of the red flag hoisted over the general's tent as a signal for the march or battle. The standard-bearer of the maniple was styled *vexillarius*, but by the time of the Empire *vexillum* and *vexillarius* had gained a new significance. Tacitus uses these terms frequently both of a body of soldiers serving apart from the legion under a separate standard, and also with the addition of some word implying connexion with a legion of those soldiers who, after serving sixteen years with the legion, continued their service, under their own *vexillum*, with the legion. The term is also used for the scarf wrapped round a bishop's pastoral staff (*q.v.*). Modern science has adopted the word for the web or vein of a feather of a bird and of the large upper petal of flowers, such as the pea, whose corolla is shaped like a butterfly.

VEXIÖ, or WEXIÖ, a town and bishop's see of Sweden, capital of the district (*län*) of Kronoberg, 124 m. N.E. of Malmö by rail. Pop. (1900) 7365. It is pleasantly situated among low wooded hills at the north end of Lake Vexiö, and near the south end of Lake Helga. Its appearance is modern, for it was burnt in 1843. The cathedral of St Siegfrid dates from about 1300, but has been restored, the last time in 1898. The Småland Museum has antiquarian and numismatic collections, a library and a bust of Linnaeus. There are iron foundries, a match factory, &c. At Östrabo, the episcopal residence without the town, the poet Esaias Tegnér died in 1846, and he is buried in the town cemetery. On the shore of Lake Helga is the royal estate of Kronoberg, and on an island in the lake the ruins of a former castle of the same name.

VÉZELAY, a village of France, in the department of Yonne, 10 m. W.S.W. of Avallon by road. Its population, which was over 10,000 in the middle ages, was 524 in 1906. It is situated on the summit and slopes of a hill on the left bank of the Cure, and owes its renown to the Madeleine, one of the largest and most beautiful basilicas in France. The Madeleine dates from the 12th century and was skilfully restored by Viollet-le-Duc. It consists of a narthex, with nave and aisles; a triple nave, without triforium, entered from the narthex by three doorways; transepts; and a choir with triforium. The oldest portion of the church is the nave, constructed about 1125. Its groined vaulting is supported on wide, low, semicircular arches, and on piers and columns, the capitals of which are embellished with sculptures full of animation. The narthex was probably built about 1140. The central entrance, leading from it to the nave, is one of the most remarkable features of the church; it consists of two doorways, divided by a central pier supporting sculptured figures, and is surmounted by a tympanum carved with a representation of Christ bestowing the Holy Spirit upon His apostles. The choir and transepts are later in date than the rest of the church, which they surpass in height and grace of proportion. They resemble the eastern portion of the church of St Denis, and were doubtless built in place of a Romanesque choir damaged in a fire in 1165. A crypt beneath the choir is perhaps the relic of a previous Romanesque church which was destroyed by fire in 1120. The west façade of the Madeleine has three portals; that in the centre is divided by a pier and surmounted by a tympanum sculptured with a bas-relief of the Last Judgment. The upper portion of this front belongs to the 13th century. Only the lower portion of the northernmost of the two flanking towers is left, and of the two towers which formerly rose above the transept that to the north has disappeared. Of the other buildings of the abbey, there remains a chapter-house (13th century) adjoining the south transept. Most of the ramparts of the town, which have a circuit of over a mile, are still in existence. In particular the Porte Neuve, consisting of two massive towers flanking a gateway, is in good preservation. There are several interesting old houses, among them one in which Theodore of Beza was born. Of the old parish church, built in the 17th century, the clock-tower alone is left. A mile and a half from Vézelay, in the village of St Père-sous-Vézelay, there is a remarkable Burgundian Gothic church, built by the monks of Vézelay in the 13th century. The west façade, flanked on the north by a fine tower, is richly decorated; its lower portion is formed of a projecting porch surmounted by pinnacles and adorned with elaborate sculpture.

The history of Vézelay is bound up with its Benedictine abbey, which was founded in the 9th century under the influence of the abbey of Cluny. This dependence was soon shaken off by the younger monastery, and the acquisition of the relics of St Magdalen, soon after its foundation, began to attract crowds of pilgrims, whose presence enriched both the monks and the town which had grown up round the abbey and acknowledged its supremacy. At the beginning of the 12th century the exactions of the abbot Artaud, who required money to defray the expense of the reconstruction of the church, and the refusal of the monks to grant political independence to the citizens, resulted in an insurrection in which the abbey was burnt and the abbot murdered. During the next fifty years three similar revolts occurred, fanned by the counts of Nevers, who wished to acquire the suzerainty over Vézelay for themselves. The monks were, however, aided by the influence both of the Pope and of Louis VII., and the townsmen were unsuccessful on each occasion. During the 12th century Vézelay was the scene of the preaching of the second crusade in 1146, and of the assumption of the cross in 1190 by Richard Cœur de Lion and Philip Augustus. The influence of the abbey began to diminish in 1280 when the Benedictines of St Maximin in Provence affirmed that the true body of St Magdalen had been discovered in their church; its decline was precipitated during the wars of religion of the 16th century, when Vézelay suffered great hardships.

VIANDEN, an ancient town in the grand duchy of Luxemburg, on the banks of the Our, close to the Prussian frontier. Pop. (1905) 2350. It possesses one of the oldest charters in Europe, granted early in the 14th century by Philip, count of Vianden, from whom the family of Nassau-Vianden sprang, and who was consequently the ancestor of William of Orange and Queen Wilhelmina of Holland. The semi-mythical foundress of this family was Bertha, "the White Lady" who figures in many German legends. The original name of Vianden was Viennensis or Vienna, and its probable derivation is from the Celtic *Vien* (rock). The extensive ruins of the ancient castle stand on an eminence of the little town, but the chapel which forms part of it was restored in 1849 by Prince Henry of the Netherlands. The size and importance of this castle in its prime may be gauged from the fact that the Knights' Hall could accommodate five hundred men-at-arms. A remarkable feature of the chapel is an hexagonal hole in the centre of the floor, opening upon a bare subterranean dungeon. This has been regarded as an instance of the "double chapel," but it seems to have been constructed by order of the crusader Count Frederick II. on the model of the Church of the Holy Sepulchre. In the neighbourhood of Vianden are other ruined castles, notably those of Stolzemburg and Falkenstein. The little town and its pleasant surroundings have been praised by many, among others by Victor Hugo, who resided here on several occasions. During his last visit he wrote his fine work *L'Annee terrible.* In the time of the Romans the Vianden valley was covered with vineyards, but at the present day its chief source of wealth is derived from the rearing of pigs.

VIANNA DO CASTELLO, a seaport and the capital of the district of Vianna do Castello, Portugal; at the mouth of the river Lima, which is here crossed by the iron bridge of the Oporto-Valença do Minho railway. Pop. (1900) 10,000. Vianna do Castello has manufactures of lace and dairy produce. Its fisheries are important. Salmon and lampreys are exported, both fresh and preserved. The administrative district of Vianna do Castello coincides with the northern part of the ancient province of Entre Minho e Douro (*q.v.*). Pop. (1900) 215,267; area, 857 sq. m.

VIAREGGIO, a maritime town and sea-bathing resort of Tuscany, Italy, in the province of Lucca, on the Mediterranean, 13 m. N.W. of Pisa by rail, 7 ft. above sea-level. Pop. (1906) 14,863 (town); 21,557 (commune). Being sheltered by dense pine-woods on the north, and its malaria having been banished by drainage, it is frequented as a winter resort, and in summer by some thousands for its sea-bathing. In 1740 the population was only 300, and in 1841, 6549. The body of Shelley was burned on the shore near Viareggio after his death by drowning in 1822. The town possesses a school of navigation and a technical school, and carries on some shipbuilding.

VIATICUM (a Latin word meaning "provision for a journey"; Gr. τὰ ἐφόδια), is often used by early Christian writers to denote the sacrament of the Eucharist, and is sometimes also applied to baptism. Ultimately it came to be employed in a restricted sense to denote the last communion given to the dying. The 13th canon of the council of Nicaea is to the effect that "none, even of the lapsed, shall be deprived of the last and most necessary viaticum (ἐφοδίου)," and that the bishop, on examination, is to give the oblation to all who desire to partake of the Eucharist on the point of death. The same principle still rules the canon law, it being of course understood that penitential discipline, which in ordinary circumstances would have been due for their offence, is to be undergone by lapsed persons who have thus received the viaticum, in the event of recovery. In extreme cases it is lawful to administer the viaticum to persons not fasting, and the same person may receive it frequently if his illness be prolonged. The ritual to be observed in its administration does not differ from that laid down in the office for the communion of the sick, except in the words of the formula, which is "accipe, carissime frater (carissima soror), viaticum corporis nostri Jesu Christi, quod te custodiat ab hoste maligno, protegat te, et perducat te ad vitam aeternam. Amen." Afterwards the priest rinses his fingers in a little water, which the communicant drinks. The viaticum is given before extreme unction, a reversal of the medieval practice due to the importance of receiving the Eucharist while the mind is still clear. In the early centuries the sick, like those in health, generally received both kinds, though there are instances of the viaticum being given under one form only, sometimes the bread and sometimes, where swallowing was difficult, the wine. In times of persecution laymen occasionally carried the viaticum to the sick, a practice that persisted into the 9th century, and deacons continued to do so even after the Council of Ansa (near Lyons) in 990 restricted the function to priests.

VIBORG, a town of Denmark, capital of the *amt* (county) of its name, lying in the bleak midland district of Jutland, though the immediate situation, on the small Viborg lake, is picturesque. Pop. (1901) 8623. It has a station on the railway running east and west between Langaa and Vemb. The most notable building is the cathedral (1130–1169, restored 1864–1876). The Black Friars' church is of the 13th century, and the museum possesses specimens of the Stone, Bronze and Iron Ages, also medieval antiquities. The Borgevold Park borders the lake on the site of a former castle. The industries embrace distilleries, iron foundries and manufactures of cloth. The country to the south attains to a certain degree of beauty near Lake Hald, where the ground is slightly elevated.

VIBORG (Finnish *Viipuri*), capital of a province of the same name in Finland, is situated at the head of the Bay of Viborg in the Gulf of Finland, at the mouth of the Saima Canal and on the railway which connects St Petersburg with Helsingfors. Population of the town (1904) 34,672, of the province 458,269. The Saima Canal (37 m. long), a fine engineering work, connects with the sea Lake Saima—the principal lake of Finland, 249 ft. above sea-level—and a series of others, including Puruvesi, Orivesi, Höytiänen and Kallavesi, all of which are navigated by steamers, as far north as Iisalmi in 63° 30′ N. lat. Viborg is thus the seaport of Karelia and eastern Savolaks, with the towns of Vilmanstrand (2393 inhabitants in 1904), St Michel (3933), Myslott (2687), Kuopio (13,519) and Iisalmi, with their numerous saw-mills and iron-works. Viborg stands most picturesquely on the glaciated and dome-shaped granite hills surrounding the bay, which is protected at its entrance by the naval station of Björkö and at its head by several forts. The castle of Viborg, built in 1293 by Marshal Torkel Knutson, was the first centre for the spread of Christianity in Karelia, and for establishing the power of Sweden; it is now used as a prison. Its lofty and elegant tower has fallen into decay. The court-house (1839), the town-house, the gymnasium (1641; with an excellent library), and the museum are among the principal buildings of the city. There are also a lyceum and two higher schools for girls, a school of navigation and several primary schools, both public and private, a literary and an agricultural society, and several benevolent institutions. There are foundries, machine works and saw-mills, and a considerable export of timber and wood products. The coasting trade is also considerable.

The environs are most picturesque and are visited by many tourists in the summer. The park of Monrepos (Old Viborg), in a bay dotted with dome-shaped islands, is specially attractive. The scenery of the Saima Canal and of the Finnish lakes with the grand *ås* of Pungaharju; the Imatra rapids, by which the Vuoksen discharges the water of Lake Saima into Lake Ladoga, with the castle of Kexholm at its mouth; Serdobol and Valamo monastery on Lake Ladoga—all visited from Viborg—attract many tourists from St Petersburg as well as from other parts of Finland.

VIBURNUM, in medicine, the dried bark of the black haw or *Viburnum prunifolium*, grown in India and North America. The black haw contains viburnin and valerianic, tannic, gallic, citric and malic acids. The British Pharmacopoeial preparation is the *Extractum Viburni Prunifolii liquidum*; the United States preparation is the fluid extract prepared from the *Viburnum opulus.* The physiological action of viburnum is to lower the blood pressure. In overdose it depresses the motor functions of the spinal cord and so produces loss of reflex and paralysis. Therapeutically the drug is used as an antispasmodic in dysmenorrhoea and in menorrhagia.

VICAIRE, LOUIS GABRIEL CHARLES (1848–1900), French poet, was born at Belfort on the 25th of January 1848. He served in the campaign of 1870, and then settled in Paris to practise at the bar, which, however, he soon abandoned for literature. His work was twice "crowned" by the Academy, and in 1892 he received the cross of the Legion of Honour. Born in the Vosges, and a Parisian by adoption, Vicaire remained all his life an enthusiastic lover of the country to which his family belonged—La Bresse—spending much of his time at Ambérieu. His freshest and best work is his *Émaux bressans* (1884), a volume of poems full of the gaiety and spirit of the old French *chansons.* Other volumes followed: *Le Livre de la patrie, L'Heure enchantée* (1890), *À la bonne franquette* (1892), *Au bois joli* (1894) and *Le Clos des fées* (1897). Vicaire wrote in collaboration with Jules Truffier two short pieces for the stage, *Fleurs d'avril* (1890) and *La Farce du mari refondu* (1895); also the *Miracle de Saint Nicolas* (1888). With his friend Henri Beauclair he produced a parody of the Decadents entitled *Les Déliquescences* and signed Adoré Floupette. His fame rests on his *Émaux bressans* and on his Rabelaisian drinking songs; the religious and fairy poems.

charming as they often are, carry simplicity to the verge of affectation. The poet died in Paris, after a long and painful illness, on the 23rd of September 1900.

See Henri Corbel, *Un Poète, Gabriel Vicaire* (1902).

VICAR (Lat. *vicarius*, substitute), a title, more especially ecclesiastical, describing various officials acting in some special way for a superior. Cicero uses the name *vicarius* to describe an under-slave kept by another as part of his private property. The *vicarius* was an important official in the reorganized empire of Diocletian. It remained as a title of secular officials in the middle ages, being applied to persons appointed by the Roman emperor to judge cases in distant parts of the empire, or to wield power in certain districts, or, in the absence of the emperor, over the whole empire. The prefects of the city at Rome were called *Vicarii Romae*. In the early middle ages the term was applied to representatives of a count administering justice for him in the country or small towns and dealing with unimportant cases, levying taxes, &c. Monasteries and religious houses often employed a vicar to answer to their feudal lords for those of their lands which did not pass into mortmain.

The title of "vicar of Jesus Christ," borne by the popes, was introduced as their special designation during the 8th century, in place of the older style of "vicar of St Peter" (or *vicarius principis apostolorum*). In the early Church other bishops commonly described themselves as vicars of Christ (Du Cange gives an example as late as the 9th century from the capitularies of Charles the Bald); but there is no proof in their case, or indeed in that of "vicar of St Peter" given to the popes, that it was part of their formal style. The assumption of the style "vicar of Christ" by the popes coincided with a tendency on the part of the Roman chancery to insist on placing the pontiff's name before that of emperors and kings and to refuse to other bishops the right to address him as "brother" (Mas Latrie, s. "Sabinien," p. 1047). It was not till the 13th century that the alternative style "vicar of St Peter" was definitively forbidden, this prohibition thus coinciding with the extreme claims of the pope to rule the world as the immediate "vicar of God" (see INNOCENT III.).

All bishops were looked upon as in some sort vicars of the pope, but the title *vicarius sedis apostolicae* came especially to be applied as an alternative to *legatus sedis apostolicae* to describe papal legates to whom in certain places the pope delegated a portion of his authority. Pope Benedict XIV. tells us in his treatise *De synodo dioecesana* that the pope often names vicars-apostolic for the government of a particular diocese because the episcopal see is vacant or, being filled, the titular bishop cannot fulfil his functions. The Roman Catholic Church in England was governed by vicars-apostolic from 1685 until 1850, when Pope Pius IX. re-established the hierarchy. Vicars-apostolic at the present day are nearly always titular bishops taking their titles from places not acknowledging allegiance to the Roman Catholic Church. The title is generally given by the pope to bishops sent on Eastern missions.

A neighbouring bishop was sometimes appointed by the pope vicar of a church which happened to be without a pastor. A special vicar was appointed by the pope to superintend the spiritual affairs of Rome and its suburbs, to visit its churches, monasteries, &c., and to correct abuses. It became early a custom for the prebendaries and canons of a cathedral to employ "priest-vicars" or "vicars-choral" as their substitutes when it was their turn as hebdomedary to sing High Mass and conduct divine office. In the English Church these priest-vicars remain in the cathedrals of the old foundations as beneficed clergy on the foundation; in the cathedrals of the new foundation they are paid by the chapters. "Lay vicars" also were and are employed to sing those parts of the office which can be sung by laymen.

In the early Church the assistant bishops (*chorepiscopi*) were sometimes described as *vicarii episcoporum*. The employment of such vicars was by no means general in the early Church, but towards the 13th century it became very general for a bishop to employ a *vicar-general*, often to curb the growing authority of the archdeacons. In the middle ages there was not a very clear distinction drawn between the vicar and the official of the bishop. When the voluntary and contentious jurisdiction came to be distinguished, the former fell generally to the vicars, the latter to the officials. In the style of the Roman chancery, official documents are addressed to the bishops or their vicars for dioceses beyond the Alps, but for French dioceses to the bishops or their officials. The institution of *vicars-general* to help the bishops is now general in the Catholic Church, but it is not certain that a bishop is obliged to have such an official. He may have two. Such a vicar possesses an ordinary and not a delegated jurisdiction, which he exercises like the bishop. He cannot, however, exercise functions which concern the episcopal order, or confer benefices without express and particular commission. In the Anglican Church a vicar-general is employed by the archbishop of Canterbury and some other bishops to assist in such matters as ecclesiastical visitations. In the Roman Catholic Church bishops sometimes appoint lesser vicars to exercise a more limited authority over a limited district. They are called "vicars-forane" or rural deans. They are entrusted especially with the surveillance of the parish priests and other priests of their districts, and with matters of ecclesiastical discipline. They are charged especially with the care of sick priests and in case of death with the celebration of their funerals and the charge of their vacant parishes. In canon law priests doing work in place of the parish priest are called vicars. Thus in France the *curé* or head priest in a parish church is assisted by several *vicaires*.

Formerly, and especially in England, many churches were appropriated to monasteries or colleges of canons, whose custom it was to appoint one of their own body to perform divine service in such churches, but in the 13th century such corporations were obliged to appoint permanent paid vicars who were called *perpetual vicars*. Hence in England the distinction between rectors, who draw both the greater and lesser tithes, and vicars, who are attached to parishes of which the great tithes, formerly held by monasteries, are now drawn by lay rectors. (See APPROPRIATION.)

See Du Cange, *Glossarium mediae et infiniae Latinitatis*, ed. L. Favre (Niort, 1883, &c.); Migne, *Encyclopédie théologique*, series i. vol. 10 (Droit Canon); Comte de Mas Latrie, *Trésor de chronologie* (Paris, 1889); and Sir R. J. Phillimore, *Ecclesiastical Law of the Church of England* (2nd ed. 1895). (E. O'N.)

VICE. (1) (Through Fr. from Lat. *vitium*), a fault, blemish, more specifically a moral fault, hence depravity, sin, or a particular form of depravity. In the medieval morality plays a special character who acted as an attendant on the devil was styled "the Vice," but sometimes took the name of specific vices such as Envy, Fraud, Iniquity and the like. He was usually dressed in the garb that is identified with that of the domestic fool or jester, and was armed with a wooden sword or dagger. (2) (M.E. *vyce*, *vise* or *vyse*; Fr. *vis*; Lat. *vitis*, a vine, or bryony, *i.e.* something that twists or winds), a portable or fixed tool or appliance which holds or grips an object while it is being worked; a special form of clamp. The tool consists essentially of movable jaws, either jointed by a hinge or moving on slides, and the closing motion is applied by a screw, whence the name, as of something which turns or winds, or by a lever, ratchet, &c. (see TOOLS). (3) (Lat. *vice*, in place of, abl. sing. of a noun not found in the nom.), a word chiefly used as a prefix in combination with names of office-holders, indicating a position subordinate or alternative to the chief office-holder, especially one who takes second rank or acts in default of his superior, *e.g.* vice-chairman, vice-admiral, &c.

VICE-CHANCELLOR, the deputy of a chancellor (*q.v.*). In the English legal system vice-chancellors in equity were formerly important officials. The first vice-chancellor was appointed in 1813 in order to lighten the work of the lord chancellor and the master of the rolls, who were at that time the sole judges in equity. Two additional vice-chancellors were appointed in 1841. The vice-chancellors sat separately from the lord chancellor and the lords justices, to whom there was an appeal from their decisions. By the Judicature Act 1873 they became judges of the High Court of Justice, retaining their titles, but it was enacted that on the death or retirement of any one his successor was to be styled "judge." Vice-chancellor Sir J. Bacon (1798–1895) was the last to hold the office, resigning in 1886.

Vice-chancellor is also the title given to the judge of the duchy court of Lancaster. For the vice-chancellor of a university, see CHANCELLOR.

VICENTE, GIL (1470–1540), the father of the Portuguese drama, was born at Guimarães, but came to Lisbon in boyhood and studied jurisprudence at the university without taking a degree. In 1493 we find him acting as master of rhetoric to the duke of Beja, afterwards King Manoel, a post which gave him admission to the court; and the *Cancioneiro Geral* contains some early lyrics of his which show that he took part in the famous *seroes do paco*. The birth of King John III. furnished the occasion for his first dramatic essay—*The Neatherd's Monologue*, which he recited on the night of the 7th–8th June 1502 in the queen's chamber in the presence of King Manoel and his court. It was written in Spanish out of compliment to the queen, a daughter of Ferdinand and Isabella, and because that language was then the fashionable medium with the higher classes. This manger-hymn, which was a novelty in Portugal, so pleased the king's mother, the infanta D. Beatriz, that she desired Gil Vicente to repeat it the following Christmas, but he composed instead the *Castilian Pastoral Auto*, a more developed piece in which he introduced six characters. The infanta, pleased again, required a further diversion for Twelfth Day, whereupon he produced the *Auto of the Wise Kings*. He had now established his reputation as a playwright, and for the next thirty years he entertained the courts of Kings Manoel and John III., accompanying them as they moved from place to place, and providing by his autos a distraction in times of calamity, and in times of rejoicing giving expression to the feelings of the people. Though himself both actor and author, Gil Vicente had no regular company of players, but it is probable that he easily found students and court servants willing to get up a part for a small fee, especially as the plays would not ordinarily run for more than one night. The *Auto of the Sybil Cassandra* (produced at the monastery of Euxobregas at Christmas 1503), the *Auto of St Martin* (played in the church at Caldas on the feast of Corpus Christi 1504), and a mystery play, the *Auto of the Four Seasons*, all belong, like their predecessors, to the religious drama, but in 1505 Gil Vicente wrote a comedy of real life, *Who has Bran to sell?* a title given it by the public. It is a clever farce depicting an amorous poor squire and his ill-paid servants, and opens a rich portrait-gallery in which the dramatist includes every type of Portuguese society, depicting the failings of each with the freedom of a Rabelais. The next three years saw no new play, but in 1506 Gil Vicente delivered before the court at Almeirim a sermon in verse on the theme *Non volo, volo, et deficior*, in which he protested against the intolerance shown to the Jews, just as in 1531 he interfered to prevent a massacre of the "New Christians" at Santarem. The *Auto of the Soul*, a Catholic prototype of Goethe's *Faust*, containing some beautiful lyrics, appeared in 1508, and in 1509 the *Auto da India*, a farce which has the eastern enterprise of his countrymen for background, while the *Auto da Fama* (1516) and the *Exhortation to War* (1513) are inspired by the achievements that made Portugal a world-power. If the farce of *The Old Man of the Garden* (1514) breathes the influence and spirit of the *Celestina*, the popular trilogy of the *Boats of Hell, Purgatory and Glory* (1517, 1518, 1519) is at once a dance of death, full of splendid pageantry and caustic irony, and a kind of Portuguese *Divina Commedia*. The *Auto of the Fairies* (1516), the *Farce of the Doctors* (1519) and the *Comedy of Rubena* (1521) ridicule unchaste clerics and ignorant physicians with considerable freedom and a medieval coarseness of wit, and the *Farce of the Gipsies* is interesting as the first piece of the European theatre dealing professedly with that race. *Ignez Pereira*, usually held to be Gil Vicente's masterpiece, was produced in 1523 before King John III. at the convent of Christ at Thomar, and owed its origin to certain men of *bom saber*, perhaps envious partisans of the classical school. They pretended to doubt his authorship of the autos, and accordingly gave him as a theme for a fresh piece the proverb: "I prefer an ass that carries me to a horse that throws me." Gil Vicente accepted the challenge, and furnished a triumphant reply to his detractors in this comedy of ready wit and lively dialogue. *The Beira Judge* (1526), the *Forge of Love* (1525) and *The Beira Priest* (1526) satirize the maladministration of justice by ignorant magistrates and the lax morals of the regular clergy, and the *Farce of the Muleteers* (1526) dramatizes the type of poor nobleman described in Cleynart's *Letters*. The *Comedy of the Arms of the City of Coimbra* (1527) has a considerable antiquarian interest, and the facetious *Ship of Love* is full of quaint imagery, while the lengthy *Auto of the Fair* (1527), with its twenty-two characters, may be described as at once an indictment of the society of the time from the standpoint of a practical Christian and a telling appeal for the reform of the church. In an oft-quoted passage, Rome personified comes to the booth of Mercury and Time, and offers her indulgences, saying, "Sell me the peace of heaven, since I have power here below"; but Mercury refuses, declaring that Rome absolves the whole world and never thinks of her own sins. The play concludes with a dance and hymn to the Blessed Virgin. *The Triumph of Winter* (1529) exposes the unskilful pilots and ignorant seamen who cause the loss of ships and lives on the route to India, and the *Auto da Lusitania* (1532) portrays the household of a poor Jewish tailor, ending with a curious dialogue between "All the World" and "Nobody." *The Pilgrimage of the Aggrieved* (1533) is an attack on discontent and ambition, lay and clerical. After representing the *Auto da festa* for the Conde de Vimioso (1535), and dramatizing the romances of chivalry in *D. Duardos* and *Amadis de Gaula*, Gil Vicente ended his dramatic career in 1536 with a mirthful comedy, *The Garden of Deceptions*. He spent the evening of life in preparing his works for the press at the instance of King John III., and died in 1540, his wife Branca Bezerra having predeceased him. Four children were born of their union, and among them Paula Vicente attained distinction as a member of the group of cultured women who formed a sort of female academy presided over by the infanta D. Maria.

The forty-four pieces comprising the theatre of Gil Vicente fall from the point of view of language into three groups: (1) those in Portuguese only, numbering fourteen; (2) those in Spanish only, numbering eleven; and (3) the bilingual, being the remainder, nineteen in all. They are also from their nature divisible as follows: *a.* Works of a religious character or of devotion. Most of these are a development of the mystery or miracle play of the middle ages; and they may be subdivided into (1) Biblical pieces; (2) pieces founded on incidents in the life of a saint; and (3) religious allegories. In this department Gil Vicente reaches his highest poetical flights, and the *Auto of the Soul* is a triumph of elevation of idea and feeling allied to beauty of expression. *b.* Aristocratic works, or tragicomedies, the composition of which was the result of his contact with the court; these, though often more spectacular than strictly dramatic, are remarkable for opulence of invention and sweetness of versification. *c.* The popular theatre, or comedies and farces. Gil Vicente's plays contain some evidence of his knowledge and appreciation of French poetry; *e.g. The Beira Judge* wears a general likeness to the products of the Clercs de la Basoche, and his *Testament of Maria Parda* is reminiscent of the better-known work of François Villon. Most of the plays are written in the national *redondilha* verse, and are preceded by initial rubrics stating the date when, the place where, in whose presence, and on what occasion each was first performed, and these make up the annals of the first thirty-four years of the Portuguese drama. Most of them were put on the stage at the different royal palaces; some, however, were played in hospitals, and, it is said, even in churches, though this is doubtful; those of which the subjects are liturgical at the great festivals of Christmas, Epiphany and Maundy Thursday, others on the happening of some event of importance to the royal family or the nation. Many of the plays contain songs, either written and set to music by the author, or collected by him from popular sources, while at the close the characters leave the stage singing and dancing, as was the custom in the medieval comedies.

Though so large a proportion of his pieces are in Spanish, they are all eminently national in idea, texture and subject. No other Portuguese writer reflects so faithfully the language, types, customs and colour of his age as Gil Vicente, and the rudest of his dramas are full of genuine comic feeling. If they never attain to perfect art, they possess the supreme gift of life. None of them are, strictly speaking, historical, and he never attempted to write a tragedy. Himself a man of the people, he would not imitate the products of the classical theatre as did Sá de Miranda and Ferreira, but though he remained faithful to the Old or Spanish school in form, yet he had imbibed the critical spirit and mental ferment of the Renaissance without its culture or erudition. Endowed by nature with acute observation and considerable powers of analysis, Gil Vicente possessed a felicity of phrase and an unmatched knowledge of popular superstitions, language and lore. Above all, he was a moralist, with satire and ridicule as his main weapons; but if his invective is often stinging it is rarely bitter, while more than one incident in his career shows that he possessed a kindly heart as well as an impartial judgment, and a well-balanced outlook on life. If he owed his early inspiration to Juan de Encina, he repaid the debt by showing a better way to the dramatists of the neighbouring country, so that he may truly be called the father of the rich Spanish drama, of Lope de Vega and Calderon. Much of his fame abroad is due to his position as an innovator, and, as Dr Garnett truly remarked, "One little corner of Europe alone possessed in the early 16th century a drama at once living, indigenous and admirable as literature."

Gil Vicente perhaps lacks psychological depth, but he possesses a breadth of mental vision and a critical acumen unknown in any medieval dramatist. In his attitude to religion he acts as the spokesman of the better men of his age and country. A convinced but liberal-minded Catholic, he has no sympathy with attacks on the unity of the Church, but he cries out for a reform of morals, pillories the corruption and ignorance of the clergy and laity, and pens the most bitter things of the popes and their court. He strove to take a middle course at a time when moderation was still possible, though, had he lived a few years longer, in the reign of religious fanaticism inaugurated by the Inquisition, his bold stand for religious toleration would have meant his imprisonment or exile, if not a worse fate. He is a great dramatist in embryo, who, if he had been born fifty years later and preserved his liberty of thought and expression, might with added culture have surpassed Calderon and taken his place as the Latin and Catholic rival of Shakespeare.

Some of the plays were printed in Gil Vicente's lifetime, but the first collected edition, which included his lyrics, was published after his death by his son Luiz (Lisbon, 1562), with a dedication to King Sebastian. A second edition appeared in 1586, with various omissions and alterations made at the instance of the Inquisition. A critical edition of the text in 3 vols. came out at Hamburg (1834), with a glossary and introductory essay on Vicente's life and writings, and a poor reprint of this edition is dated Lisbon 1852. He has never found a translator, doubtless because of the difficulty of rendering his form and explaining his wealth of topical allusions.

Authorities.—Dr Theophilo Braga, *Gil Vicente e as origens do theatro nacional* (Oporto, 1898); J. I. de Brito Rebello, *Gil Vicente* (Lisbon, 1902); "The Portuguese Drama in the 16th Century—Gil Vicente," in the *Manchester Quarterly* (July and October 1897); introduction by the Conde de Sabugosa to his edition of the *Auto de festa* (Lisbon, 1906). (E. Pr.)

VICENZA, a town and episcopal see of Venetia, Italy, capital of the province of Vicenza, 42 m. W. of Venice by rail, 131 ft. above sea-level. Pop. (1901) 32,200 (town); 47,558 (commune). It lies at the northern base of the Monti Berici, on both sides of the Bacchiglione, at its confluence with the Retrone. It was surrounded by 13th-century walls, once about 3 m. in circumference, but these are now in great part demolished. Though many of the streets are narrow and irregular, the town has a number of fine buildings, many of them the work of Andrea Palladio. The best of these is the town hall, otherwise known as the basilica, one of the finest works of the Renaissance period, of which Palladio himself said that it might stand comparison with any similar work of antiquity. It is especially noteworthy owing to the difficulty of the task the architect had to accomplish—that of transforming the exterior of the Palazzo della Ragione, a Gothic building of the latter half of the 15th century, which the colonnades of the basilica entirely enclose. It was begun in 1549, but not finished till 1614, long after his death. He also designed many of the fine palaces which give Vicenza its individuality; only two of them, the Barbarano and Chiericati palaces (the latter containing the picture gallery), have two orders of architecture, the rest having a heavy rustica basis with only one order above it. Many palaces, however, have been wrongly attributed to him which are really the work of Scamozzi and others of his successors. The famous Teatro Olimpico was begun by him, but only finished after his death; it is a remarkable attempt to construct a theatre in the ancient style, and the stage, with the representation of streets ascending at the back, is curious. The cathedral, which is Italian Gothic, dating mainly from the 13th century, consists of a nave with eight chapels on each side, and a very high Renaissance domed choir; it contains examples of the Montagnas and of Lorenzo da Venezia. The churches of S. Lorenzo (1280–1344) and S. Corona (1260–1300), both of brick, are better examples of Gothic than the cathedral; both contain interesting works of art—the latter a very fine "Baptism of Christ," by Giovanni Bellini. In S. Stefano is an imposing altar-piece by Palma Vecchio. The church of SS. Felice e Fortunato was restored in A.D. 975, but has been much altered, and was transformed in 1613. The portal is of 1154, and the Lombardesque square brick tower of 1160. Under it a mosaic pavement with the names of the donors, belonging to the original church of the Lombard period (?), was discovered in 1895 (see F. Berchet, *III. Relazione dell' Ufficio Regionale per la conservazione dei monumenti del Veneto*, Venice, 1895, p. 111). None of the churches of Vicenza is the work of Palladio. Of the Palladian villas in the neighbourhood, La Rotonda, or Villa Palladiana, 1½ m. S.E., deserves special mention. It is a square building with Ionic colonnades and a central dome, like an ancient temple, but curiously unlike a Roman villa. Vicenza also contains some interesting remains of the Gothic period besides the churches mentioned—the lofty tower of the town hall (1174–1311–1446; the Piazza contains two columns of the Venetian period, with S. Theodore and the Lion of S. Mark on them) and several palaces in the Venetian style. Among these may be especially noted the small Casa Pigafetta dating from 1481, but still half Gothic, prettily decorated. Some of these earlier houses had painted façades. The fine picture of "Christ bearing the Cross" (wrongly ascribed to Giorgione), according to Burckhardt once in the Palazzo Loschi, is now in the Gardner collection at Boston, U.S.A. The most important manufacture is that of silk, which employs a large proportion of the inhabitants. Great numbers of mulberry trees are grown in the neighbourhood. Woollen and linen cloth, leather, earthenware, paper, and articles in gold and silver are also made in Vicenza, and a considerable trade in these articles, as well as in corn and wine, is carried on.

Vicenza is the ancient *Vicetia*, an ancient town of Venetia. It was of less importance than its neighbours Venetia and Patavium, and we hear little of it in history. It no doubt acquired Roman citizenship in 49 B.C., and became a *municipium*; and is mentioned two years later apropos of a dispute between the citizens and their slaves. Remains of a theatre and of a late mosaic pavement with hunting scenes have been found, three of the bridges across the Bacchiglione and Retrone are of Roman origin, and arches of the aqueduct exist outside Porta S. Croce. A road diverged here to Opitergium (mod. Oderzo) from the main road between Verona and Patavium (Padua): see T. Mommsen in *Corp. Inscr. Latin.* v. (Berlin, 1883), p. 304. It suffered severely in the invasion of Attila, by whom it was laid waste, and in subsequent incursions. It was for some time during the middle ages an independent republic, but was subdued by the Venetians in 1405. Towards the end of the 15th century it became the seat of a school of painting strongly influenced by Mantegna, of which the principal representatives were, besides Bartolomeo Montagna, its founder, his son Benedetto Montagna, Giovanni Speranza and Giovanni Buonconsiglio. Good altar-pieces by the former exist in S. Bartolommeo, S. Corona, and the cathedral, and several pictures also in the picture gallery; while his son Benedetto had greater merits as an engraver than a painter. Some works by both of the last two exist at Vicenza—the best is a Pietà in tempera in the gallery by Buonconsiglio, by whom is also a good Madonna at S. Rocco. Andrea Palladio (1518–1580) was a native of Vicenza, as was also a contemporary, Vincenzo Scamozzi (1552–1616), who was largely dependent on him, but is better known for his work on architecture (*Architettura universale*, 1615). Palladio inaugurated a school of followers who continued to erect similar buildings in Vicenza even down to the French Revolution. (T. As.)

See G. Pettinà, *Vicenza* (Bergamo, 1905).

VICEROY (from O. Fr. *viceroy*, mod. *viceroi*, *i.e.* Lat. *vice*, in place of, and *roy* or *roi*, king), the governor of a kingdom or colony to whom is delegated by his sovereign the power to exercise regal authority in his name. The lord-lieutenant of Ireland and the governor-general of India are frequently referred to as viceroys, but the title has no official recognition in British government.

VICH, a city of north-eastern Spain, in the province of Barcelona, on the river Gurri, a small right-hand tributary of the Ter, and on the Granollérs-Ripoll railway. Pop. (1900) 11,628. Vich is an ancient episcopal city, with narrow, ill-paved streets and many curious old houses irregularly built on the slope of a hill, which rises above one of the side valleys of the Ter basin. The cathedral, founded about 1040 and built chiefly in the 14th century, was to some extent modernized in 1803. Its Gothic cloisters (1340) are remarkable for the beautiful tracery in their windows, and there is a fine altar of sculptured marble. Some valuable manuscripts are preserved in the library of the chapter-house, and the museum contains an interesting archaeological collection, besides statuary, pictures, &c. The city is locally celebrated for the manufacture of sausages; other industries include tanning and the weaving of linen and woollen fabrics.

Vich, the Ausa of the ancient geographers, was the chief town of the Ausetani; in the middle ages it was called Ausona and Vicus Ausonensis, hence Vic de Osona, and simply Vich.

VICHY, a town of central France in the department of Allier, on the right bank of the Allier, 33 m. S. by E. of Moulins by rail. Pop. (1906) 14,520. Vichy owes its importance to its mineral waters, which were well known in the time of the Romans. They afterwards lost their celebrity and did not regain it till the 17th century, in the latter half of which they were visited and written of by Madame de Sévigné. Within the town or in its immediate vicinity there are between thirty and forty springs, twelve of which are state property, four of these having been tapped by boring. The waters of those which are outside the town are brought in by means of aqueducts. The most celebrated and frequented are the Grande Grille, L'Hôpital, the Célestins, and Lardy. The most copious of all, the Puits Carré, is reserved for the baths. All these, whether cold or hot (maximum temperature, 113° F.), are largely charged with bicarbonate of soda; some also are chalybeate and tonic. The waters, which are limpid, have an alkaline taste and emit a slight odour of sulphuretted hydrogen. They are recommended in cases of stomachic and liver complaint, also for diabetes, gravel and gout. Large quantities are bottled and exported. A luxurious bathing establishment, the property of the state, was opened in 1903. In addition to this, Vichy has the hydropathic establishments of Lardy, Larbaud and L'Hôpital, and a large military hospital, founded in 1843. A fine casino and two public parks add to its attraction. The promenade commands a splendid view of the mountains of Auvergne. Cusset, about 1 m. distant, has similar mineral waters and a bathing establishment.

VICKSBURG, a city and the county-seat of Warren county, Mississippi, U.S.A., on the Mississippi and Yazoo rivers,[1] 44 m. by rail W. of Jackson, and 236 m. N. by W. of New Orleans. Pop. (1890) 13,373; (1900) 14,834, of whom 8147 were negroes; (1910 census) 20,814, being the second largest city in Mississippi. It is served by the Alabama & Vicksburg, the Vicksburg, Shreveport & Pacific, and the Yazoo & Mississippi Valley railways, and by steamboat lines. It is built among the Walnut Hills, which rise about 260 ft. above the river. Among the principal buildings and institutions are the court-house, standing on one of the highest hills, a fine Federal building, the city hall, a state charity hospital, an infirmary, a sanatorium, a public library, the medical college of the university of Mississippi, All Saints' Episcopal College (Protestant Episcopal, 1909) for girls, Saint Francis Xavier's Academy, and Saint Aloysius College (Roman Catholic). The Civil War battle-ground has been converted into a beautiful National Military Park, embracing 1283 acres and containing numerous markers, memorials and monuments, including one (1910) to Lieut.-General Stephen Dill Lee, who was superintendent of the Military Park from 1899 until his death in 1908. On the bluffs just beyond the northern limits of the city and adjoining the Military Park is the Vicksburg National Cemetery, in which are the graves of 16,892 Federal soldiers (12,769 unknown). The principal industry of Vicksburg is the construction and repair of rolling stock for steam railways. It has also a dry dock and cotton compresses; and among its manufactures are cottonseed oil and cake, hardwood lumber, furniture, boxes and baskets. In 1905 the factory products were valued at $1,887,924. The city has a large trade in long-staple cotton grown in the surrounding country. It is a port of entry but has practically no foreign trade.

The French built Fort St Peter near the site of Vicksburg early in the 18th century, and on the 2nd of January 1730 its garrison was murdered by the Yazoo Indians. As early as 1783 the Spanish erected Fort Nogales, and in 1798 this was taken by some United States troops and renamed Fort McHenry. The first permanent settlement in the vicinity was made about 1811 by Rev. Newell (or Newit) Vick (d. 1819), a Methodist preacher. In accordance with his will a town was laid out in 1824; and Vicksburg was incorporated as a town in 1825, and was chartered as a city in 1836. The campaigns of which it was the centre in 1862 and 1863 are described below. Vicksburg was the home of Seargent Smith Prentiss from 1832 to 1845.

See H. F. Simrall, "Vicksburg: the City on the Walnut Hills," in L. P. Powell's *Historic Towns of the Southern States* (New York, 1900).

Campaign of 1862–63.—Vicksburg is historically famous as being the centre of interest of one of the most important campaigns of the Civil War. The command of the Mississippi, which would imply the severance of the Confederacy into two halves, and also the reopening of free commercial navigation from St Louis to the sea, was one of the principal objects of the Western Union armies from the time that they began their southward advance from Illinois, Missouri and Kentucky in February 1862. A series of victories in the spring and summer carried them as far as the line Memphis-Corinth, but in the autumn they came to a standstill and were called upon to repulse the counter-advance of the Southern armies. These armies were accompanied by a flotilla of thinly armoured but powerful gunboats which had been built on the upper Mississippi in the autumn of 1861, and had co-operated with the army at Fort Donelson, Shiloh and Island No. 10, besides winning a victory on the water at Memphis.

At the same time a squadron of sea-going vessels under Flag-officer Farragut had forced the defences of New Orleans (*q.v.*) and, accompanied by a very small military force, had steamed up the great river. On reaching Vicksburg the heavy vessels again forced their way past the batteries, but both at Vicksburg and at Port Hudson they had to deal, no longer with low-sited fortifications, but with inconspicuous earthworks on bluffs far above the river-level, and they failed to make any impression. Farragut then returned to New Orleans. From Helena to Port Hudson the Confederates maintained complete control of the Mississippi, the improvised fortresses of Vicksburg, Port Hudson and Arkansas Post (near the mouth of Arkansas river) being the framework of the defence. It was to be the task of Grant's army around Corinth and the flotilla at Memphis to break up this system of defences, and, by joining hands with Farragut and clearing the whole course of the Mississippi, to cut the Confederacy in half.

The long and painful operations by which this was achieved group themselves into four episodes: (*a*) the Grenada expedition of Grant's force, (*b*) the river column under McClernand and Sherman, (*c*) the operations in the bayoux, and (*d*) the final "overland" campaign from Grand Gulf. The country in which these operations took place divides itself sharply into two zones, the upland east of the river, upon which it looks down from high bluffs, and the levels west of it, which are a maze of bayoux, backwaters and side channels, the intervening land being kept dry near the river itself by artificial banks (levees) but elsewhere swampy. At Vicksburg, it is important to observe, the bluffs trend away from the Mississippi to follow the course of the Yazoo, rejoining the great river at Memphis. Thus there are two obvious lines of advance for the Northern army, on the upland (Memphis and Grand Junction on Grenada-Jackson), and downstream through the bayou country (Memphis-Helena-Vicksburg). The main army of the defenders, who were commanded by Lieut.-General J. C. Pemberton, between Vicksburg and Jackson and Grenada, could front either north against an advance by Grenada or west along the bluffs above and below Vicksburg.

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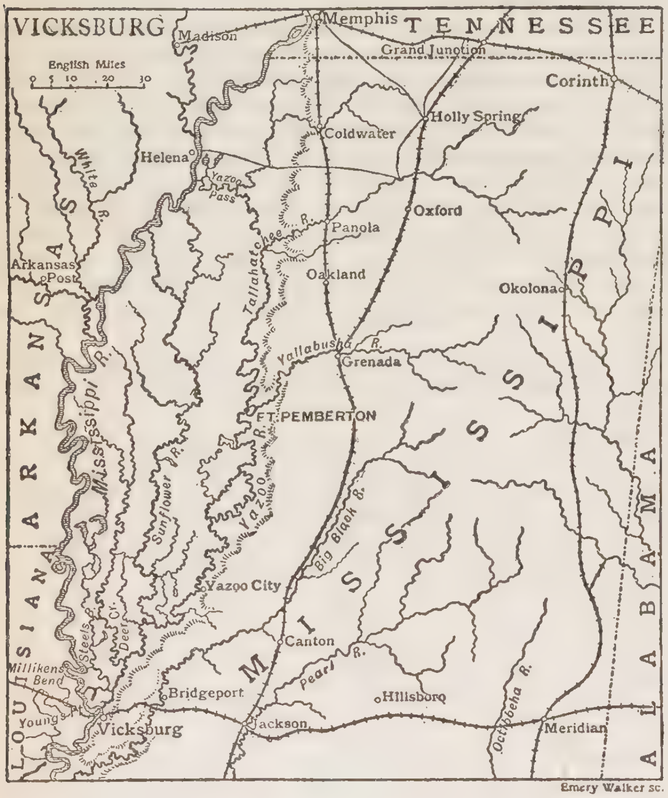
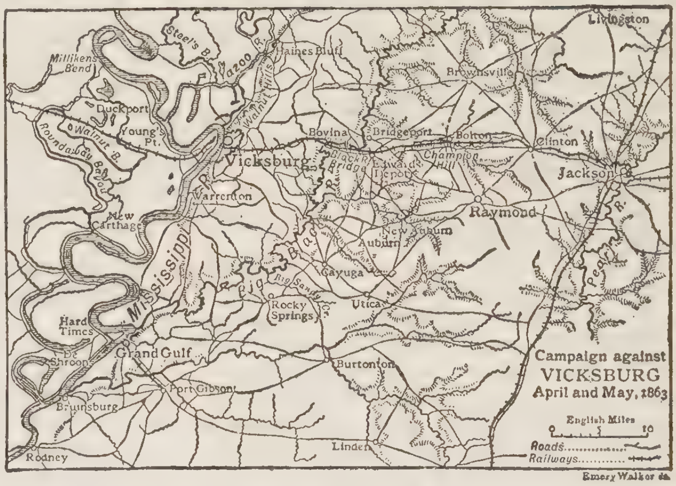
[1] The channel of the Mississippi has changed greatly: until 1876 the entire city was on the Mississippi, which made a bend forming a tongue of land opposite the city; in 1876 the river cut across this tongue and formed an island, making the northern part of the city front on the shallow "Lake Centennial." The Federal government, by turning the Yazoo through a canal across the upper end of the old channel, gave the city a river front once more.


VICKSBURG
English Miles
0 5 10 20 30
Madison
Memphis
TENNESSEE
Grand Junction
Corinth
Holly Springs
Coldwater
Helena
Yazoo Pass
White R.
Panola
Oxford
Tallahatchie R.
Arkansas Post
Oakland
Okolona
ARKANSAS
Mississippi R.
Yallabusha R.
Grenada
FT. PEMBERTON
Sunflower R.
Yazoo R.
Big Black R.
MISSISSIPPI
ALABAMA
LOUISIANA
Yazoo City
Steele's B.
Deer Cr.
Canton
Pearl R.
Milliken's Bend
Bridgeport
Hillsboro
Oktibbeha R.
Young's
Vicksburg
Jackson
Meridian
Emery Walker sc.

The first advance was made at the end of November 1862 by two columns from Grand Junction and Memphis on Grenada. The Confederates in the field, greatly outnumbered, fell back without fighting. But Grant's line of supply was one long single-line, ill-equipped railway through Grand Junction to Columbus, and the opposing cavalry under Van Dorn swept round his flank and, by destroying one of his principal magazines (at Holly Springs), without further effort compelled the abandonment of the advance. Meantime one of Grant's subordinates, McClernand, was intriguing to be appointed to command an expedition by the river-line, and Grant meeting half-way an evil which he felt himself unable to prevent, had sent Sherman with the flotilla and some 30,000 men to attack Vicksburg from the water-side, while he himself should deal with the Confederate field army on the high ground. But the scheme broke down completely when Van Dorn cut Grant's line of supply, and the Confederate army was free to turn on Sherman. The latter, ignorant of Grant's retreat, attacked the Yazoo bluffs above Vicksburg (battle of Chickasaw Bayou) on December 29th; but a large portion of Pemberton's field army had arrived to help the Vicksburg garrison, and the Federals were easily repulsed with a loss of 2000 men. McClernand now appeared and took the command out of Sherman's hands, informing him at the same time of Grant's retreat. Sherman thereupon proposed, before attempting fresh operations against Vicksburg, to clear the country behind them by destroying the Confederate garrison at Arkansas Post. This expedition was completely successful: at a cost of about 1000 men the fort and its 5000 defenders were captured on the 11th of January 1863. McClernand, elated at his victory, would have continued to ascend the Arkansas, but such an eccentric operation would have been profitless if not dangerous, and Grant, authorized by the general-in-chief, Halleck, peremptorily ordered McClernand back to the Mississippi.


Livingston
Milliken's Bend
Steele's B.
Yazoo R.
Haines Bluff
Brownsville
Duckport
Walnut B.
Young's Pt.
Roundabout B.
Bovina
Bridgeport
Bolton
Clinton
Vicksburg
Black R. Bridge
Edwards Depot
Champion Hill
Jackson
Warrenton
New Carthage
Raymond
New Auburn
Auburn
Mississippi
Big Black R.
Cayuga
Big Sandy
Rocky Springs
Utica
Pearl R.
Hard Times
De Shroon
Grand Gulf
Burtonton
Port Gibson
Bruinsburg
Linden
Rodney
Campaign against VICKSBURG April and May, 1863
English Miles
0 10
Roads
Railways
Emery Walker sc.

Retreating from the upland, Grant sailed down the river and joined McClernand and Sherman at Milliken's Bend at the beginning of February, and, superseding the resentful McClernand, assumed command of the three corps (XIII., McClernand; XV., Sherman; XVII., McPherson) available. He had already imagined the daring solution of his most difficult problem which he afterwards put into execution, but for the present he tried a series of less risky expedients to reach the high ground beyond Pemberton's flanks, without indeed much confidence in their success, yet desirous in these unhealthy flats of keeping up the spirits of his army by active work, and of avoiding, at a crisis in the fortunes of the war, any appearance of discouragement. Three such attempts were made in all, with the co-operation of the flotilla under Captain David D. Porter. First, Grant endeavoured to cut a canal across the bend of the Mississippi at Vicksburg, hoping thus to isolate the fortress, to gain a water connection with the lower river, and to land an army on the bluffs beyond Pemberton's left flank. This was unsuccessful. Next he tried to make a practicable channel from the Mississippi to the upper Yazoo, and so to turn Pemberton's right, but the Confederates, warned in time, constructed a fort at the point where Grant's advance emerged from the bayoux. Lastly, an advance through a maze of creeks (Steele's Bayou expedition), towards the middle Yazoo and Haines's Bluff, encountered the enemy, not on the bluffs, but in the low-lying woods and islands, and these so harassed and delayed the progress of the expedition that Grant recalled it. Shortly afterwards Grant determined on the manœuvre in rear of Vicksburg which established his reputation. The troops marched overland from Milliken's Bend to New Carthage, and on the 16th of April Porter's gunboat flotilla and the transports ran past the Vicksburg batteries. All this, which involved careful arrangement and hard work, was done by the 24th of April. General Banks, with a Union army from New Orleans, was now advancing up the river to invest Port Hudson, and by way of diverting attention from the Mississippi, a cavalry brigade under Benjamin Grierson rode from La Grange to Baton Rouge (600 m. in 16 days), destroying railways and magazines and cutting the telegraph wires *en route.* Sherman's XV. corps, too, made vigorous demonstrations at Haines's Bluff, and in the confusion and uncertainty Pemberton was at a loss.

On the 30th of April McClernand and the XIII. corps crossed the Mississippi 6 m. below Grand Gulf, followed by McPherson. The nearest Confederate brigades, attempting to oppose the advance at Port Gibson, were driven back. Grant had now deliberately placed himself in the middle of the enemy, and although his engineers had opened up a water-line for the barges carrying his supplies from Milliken's Bend to New Carthage, his long line of supply curving round the enemy's flank was very exposed. But his resolute purpose outweighed all text-book strategy. Having crossed the Mississippi, he collected wheeled transport for five days' rations, and on Sherman's arrival cut loose from his base altogether (May 7th). Free to move, he aimed north from the Big Black river, so as to interpose between the Confederate forces at Vicksburg and those at Jackson. A fight took place at Raymond on the 12th of May, and Jackson was captured just in time to forestall the arrival of reinforcements for Pemberton under General Joseph E. Johnston. The latter, being in supreme command of the Confederates, ordered Pemberton to come out of Vicksburg and attack Grant. But Pemberton did not do so until it was too late. On May 16th Grant, with all his forces well in hand, defeated him in the battle of Champion Hill with a loss of nearly 4000 men, and sharply pursuing him drove him into Vicksburg. By the 19th of May Vicksburg and Pemberton's army in it was invested by land and water. Grant promptly assaulted his works, but was repulsed with loss (May 19th); the assault was repeated on the 22nd of May with the same result, and Grant found himself compelled to resort to a blockade. Reinforcements were hurried up from all quarters, Johnston's force (east of Jackson), was held off by a covering corps under Blair (afterwards under Sherman), and though another unsuccessful assault was made on the 25th of June, resistance was almost at an end. On the 4th of July, the day after, far away in Pennsylvania, the great battle of Gettysburg had closed with Lee's defeat, the garrison of Vicksburg, 37,000 strong, surrendered.

VICO, GIOVANNI BATTISTA (1668–1744), Italian jurist and philosopher, was born at Naples on the 23rd of June 1668. At the university he made rapid progress, especially in jurisprudence, though preferring the study of history, literature, juridical science and philosophy. Being appointed tutor to the nephews of the bishop of Ischia, G. B. Rocca, he accompanied them to the castle of Vatolla, near Cilento, in the province of Salerno. There he passed nine studious years, chiefly devoted to classical reading, Plato and Tacitus being his favourite authors, because "the former described the ideal man, and the latter man as he really is." On his return to Naples he found himself out of touch with the prevailing Cartesianism, and lived quietly until in 1697 he gained the professorship of rhetoric at the university, with a scanty stipend of 100 scudi. On this he supported a growing family and gave himself to untiring study. Two authors exercised a weighty influence on his mind—Francis Bacon and Grotius. He was no follower of their ideas, indeed often opposed to them; but he derived from Bacon an increasing stimulus towards the investigation of certain great problems of history and philosophy, while Grotius proved valuable in his study of philosophic jurisprudence. In 1708 he published his *De ratione studiorum*, in 1710 *De antiquissima Italorum sapientia*, in 1720 *De universi juris uno principio et fine uno*, and in 1721 *De constantia jurisprudentis*. On the strength of these works he offered himself as a candidate for the university chair of jurisprudence, but as he had no personal or family influence was not elected. With calm courage he returned to his poverty and his favourite studies, and in 1725 published the first edition of the work that forms the basis of his renown, *Principii d' una scienza nuova*. In 1730 he produced a second edition of the *Scienza nuova*, so much altered in style and with so many substantial additions that it was practically a new work. In 1735 Charles III. of Naples marked his recognition of Vico's merits by appointing him historiographer-royal, with a yearly stipend of 100 ducats. Soon after his mind began to give way, but during frequent intervals of lucidity he made new corrections in his great work, of which a third edition appeard in 1744, prefaced by a letter of dedication to Cardinal Trojano Acquaviva. He died on the 20th of January of the same year. Fate seemed bent on persecuting him to the last. A fierce quarrel arose over his burial between the brotherhood of St Stephen, to which he had belonged, and the university professors, who desired to escort his corpse to the grave. Finally the canons of the cathedral, together with the professors, buried the body in the church of the Gerolimini.

Vico has been generally described as a solitary soul, out of harmony with the spirit of his time and often directly opposed to it. Yet a closer inquiry into the social conditions of Vico's time, and of the studies then flourishing, shows him to have been thoroughly in touch with them.

Owing to the historical past of Naples, and its social and economic condition at the end of the 17th century, the only study that really flourished there was that of law; and this soon penetrated from the courts to the university, and was raised to the level of a science. A great school of jurisprudence was thus formed, including many men of vast learning and great ability, although little known outside their immediate surroundings. Three men, however, obtained a wider recognition. By his exposition of the political history of the kingdom, based on a study of its laws and institutions and of the legal conflicts between the state and the court of Rome, Pietro Giannone was the initiator of what has been since known as civil history. Giovan Vincenzo Gravina wrote a history of Roman law, specially distinguished for its accuracy and elegance. Vico raised the problem to a higher plane, by tracing the origin of law in the human mind and explaining the historical changes of the one by those of the other. Thus he made the original discovery of certain ideas which constitute the modern psychologico-historic method. This problem he proceeded to develop in various works, until in his *Scienza nuova* he arrived at a more complete solution, which may be formulated as follows: If the principle of justice and law be one, eternal and immutable, why should there be so many different codes of legislation? These differences are not caused by difference of nationality only, but are to be noted in the history of the same people, even in that of the Romans. This problem is touched upon in his *Orations or Inaugural Addresses* (*Orazioni o Prolusioni*) and in his *Minor Works* (*Scritti minori*). Finally he applied himself to its solution in his *Universal Law* (*Diritto universale*), which is divided into two books. The first of these, *De uno et universi juris principio et fine uno*, was subdivided into two parts; so likewise was the second, with the respective titles of *De constantia philologiae* and *De constantia jurisprudentis*.

The following is the general idea derived from these researches. Vico held God to be the ruler of the world of nations, but ruling, not as the providence of the middle ages by means of continued miracles, but as He rules nature, by means of natural laws. If, therefore, the physicist seeks to discover the laws of nature by study of natural phenomena, so the philosopher must seek the laws of historical change by the investigation of human events and of the human mind. According to Vico, law emanates from the conscience of mankind, in whom God has infused a sentiment of justice and is therefore in close and continual relation with the human mind, and participates in its changes. This sentiment of justice is at first confused, uncertain and almost instinctive—is, as it were, a divine and religious inspiration instilled by Heaven into the primitive tribes of the earth. It is an unconscious, universal sentiment, not the personal, conscious and rational sentiment of the superior few. Hence the law to which it gives birth is enwrapped in religious forms which are likewise visible and palpable, inasmuch as primitive man is incapable of abstract, philosophical ideas. This law is not the individual work of any philosophical legislator, for no man was, or could be, a philosopher at that time. It is first displayed in the shape of natural and necessary usages consecrated by religion. The names of leading legislators, which we so often find recorded in the history of primitive peoples, are symbols and myths, merely serving to mark an historic period or epoch by some definite and personal denomination. For nations, or rather tribes, were then distinguished by personal names only. The first obscure and confused conception of law gradually becomes clearer and better defined. Its visible and religious forms then give way to abstract formulae, which in their turn are slowly replaced by the rational manifestation of the philosophic principles of law that gains the victory in the final stage of development, designated by Vico as that of civil and human law. This is the period of individual and philosophic legislators. Thus Roman law has passed through three great periods—the divine, the heroic and the human—which are likewise the three chief periods of the history of Rome, with which it is intimately and intrinsically connected. Nevertheless, on careful examination of these three successive stages, it will easily be seen that, in spite of the apparent difference between them, all have a common foundation, source and purpose. The human and civil philosophic law of the third period is assuredly very different in form from the primitive law; but in substance it is merely the abstract, scientific and philosophic manifestation of the same sentiment of justice and the same principles which were vaguely felt in primitive times. Hence one development of law may be easily translated into another. Thus in the varied manifestations of law Vico was able to discover a single and enduring principle (*De universi juris uno principio et fine uno*). On these grounds it has been sought to establish a close relation between Vico and Grotius. The latter clearly distinguished between a positive law differing in different nations and a natural law based on a general and unchanging principle of human nature, and therefore obligatory upon all. But Vico was opposed to Grotius, especially as regards his conception of the origin of society, and therefore of law. Grotius holds that its origin was not divine, but human, and neither collective, spontaneous nor unconscious, but personal, rational and conscious. He believed, moreover, that natural law and positive law moved on almost constant and immutable parallel lines. But Vico maintained that the one was continually progressing towards the other, positive law showing an increasing tendency to draw nearer to natural and rational law. Hence the conception that law is of necessity a spontaneous birth, not the creation of any individual legislator; and hence the idea that it necessarily proceeds by a natural and logical process of evolution constituting its history. Vico may have derived from Grotius the idea of natural law; but his discovery of the historic evolution of law was first suggested to him by his study of Roman law. He saw that the history of Roman jurisprudence was a continuous progress of the narrow, rigorous, primitive and almost iron law of the XII. Tables towards the wider, more general and more humane *jus gentium*. Having once derived this conception from Roman history, he was easily and indeed necessarily carried on to the next—that the positive law of all nations, throughout history, is a continual advance, keeping pace with the progress of civilization, towards the philosophic and natural law founded on the principles of human nature and human reason.

As already stated, the *Scienza nuova* appeared in three different editions. The third may be disregarded; but the first and second editions are almost distinct works. In the former the author sets forth the analytical process by which the laws he discovered were deduced from facts. In the second he not only enlarges his matter and gives multiplied applications of his ideas, but also follows the synthetic method, first expounding the laws he had discovered and then proving them by the facts to which they are applied. In this edition the fragmentary and jerky arrangement, the intricate style, and a peculiar and often purely conventional terminology seriously checked the diffusion of the work, which accordingly was little studied in Italy and remained almost unknown to the rest of Europe. Its fundamental idea consists in that which Vico, in his peculiar terminology, styles "poetical wisdom" (*sapienza poetica*) and "occult wisdom" (*sapienza riposta*), and in the historical process by which the one is merged in the other. He frequently declares that this discovery was the result of the literary labours of his whole life.

Vico was the first thinker who asked, Why have we a science of nature, but no science of history? Because our glance can easily be turned outwards and survey the exterior world; but it is far harder to turn the mind's eye inwards and contemplate the world of the spirit. All our errors in explaining the origin of human society arise from our obstinacy in believing that primitive man was entirely similar to ourselves, who are civilized, *i.e.* developed by the results of a lengthy process of anterior historic evolution. We must learn to issue from ourselves, transport ourselves back to other times, and become children again in order to comprehend the infancy of the human race. As in children, imagination and the senses prevailed in those men of the past. They had no abstract ideas; in their minds all was concrete, visible and tangible. All the phenomena, forces and laws of nature, together with mental conceptions, were alike personified. To suppose that all mythical stories are fables invented by the philosophers is to write history backwards and confound the instinctive, impersonal, poetic wisdom of the earliest times with the civilized, rational and abstract occult wisdom of our own day. But how can we explain the formation of this poetic wisdom, which, albeit the work of ignorant men, has so deep and intrinsic a philosophic value? The only possible reply is that already given when treating of the origin of law. Providence has instilled into the heart of man a sentiment of justice and goodness, of beauty and of truth, that is manifested differently at different times. The ideal truth within us, constituting the inner life that is studied by philosophers, becomes transmuted by the facts of history into assured reality. For Vico psychology and history were the two poles of the new world he discovered. After having extolled the work of God and proclaimed Him the source of all knowledge, he adds that a great truth is continually flashed on us and proved to us by history, namely, "that this world of nations is the work of man, and its explanation therefore only to be found in the mind of man." Thus poetical wisdom, appearing as a spontaneous emanation of the human conscience, is almost the product of divine inspiration. From this, by the aid of civilization, reason and philosophy, there is gradually developed the civil, occult wisdom. The continual, slow and laborious progress from the one to the other is that which really constitutes history, and man becomes civilized by rendering himself the conscious and independent possessor of all that in poetical wisdom remained impersonal, unconscious, that came, as it were, from without by divine *afflatus*.

Vico gives many applications of this fundamental idea. The religion of primitive peoples is no less mythical than their history, since they could only conceive of it by means of myths. On these lines he interprets the whole history of primitive Rome. One book of the second edition of the *Scienza nuova* is devoted to "The Discovery of the True Homer." Why all the cities of Greece dispute the honour of being his birthplace is because the *Iliad* and the *Odyssey* are not the work of one, but of many popular poets, and a true creation of the Greek people which is in every city of Greece. And because the primitive peoples are unconscious and self-ignorant Homer is represented as being blind. In all parts of history in which he was best versed Vico pursues a stricter and more scientific method, and arrives at safer conclusions. This is the case in Roman history, especially in such portions as related to the history of law. Here he sometimes attains, even in details, to divinations of the truth afterwards confirmed by new documents and later research. The aristocratic origin of Rome, the struggle between the patricians and the plebeians, the laws of the XII. Tables, not, as tradition would have it, imported from Greece, but the natural and spontaneous product of ancient Roman customs, and many other similar theories were discovered by Vico, and expounded with his usual originality, though not always without blunders and exaggerations.

Vico may be said to base his considerations on the history of two nations. The greater part of his ideas on poetical wisdom were derived from Greece. Nearly all the rest, more especially the transition from poetical to occult wisdom, was derived from Rome. Having once formulated his idea, he made it more general in order to apply it to the history of all nations. From the savage state, through the terror that gives birth to religions, through the creation of families by marriage, through burial rites and piety towards the dead, men approach civilization with the aid of poetic wisdom, and pass through three periods—the divine, heroic and human—in which they have three forms of government, language, literature, jurisprudence and civilization. The primary government is aristocratic. Patrician tyranny rouses the populace to revolt, and then democratic equality is established under a republic. Democratic excesses cause the rise of an empire, which, becoming corrupt, declines into barbarism, and, again emerging from it, retraces the same course. This is the *law of cycles*, constituting that which is designated by Vico as the "eternal ideal history, or rather course of humanity, invariably followed by all nations." It must not be held to imply that one nation imitates the course pursued by another, nor that the points of resemblance between them are transmitted by tradition from one to the other, but merely that all are subject to one law, inasmuch as this is based on the human nature common to all alike. Thus, while on the one hand the various cycles traced and retraced by all nations are similar and yet independent, on the other hand, being actually derived from Roman history, they become converted in the *Scienza nuova* into a bed of Procrustes, to which the history of all nations has to be fitted by force. And wherever Vico's historical knowledge failed he was led into increased error by this artificial and arbitrary effort.

It has been justly observed by many that this continuous cyclical movement entirely excludes the progress of humanity towards a better future. It has been replied that these cycles are similar without being identical, and that, if one might differ from another, the idea of progress was not necessarily excluded by the law of cycles. Vico undoubtedly considered the poetic wisdom of the Middle Ages to be different from that of the Greeks and Romans, and Christianity to be very superior to the pagan religion. But he never investigated the question whether, since there is a law of progressive evolution in the history of different nations, separately examined, there may not likewise be another law ruling the general history of these nations, every one of which must have represented a new period, as it were, in the history of humanity at large. Therefore, although the *Scienza nuova* cannot be said absolutely to deny the law of progress, it must be allowed that Vico not only failed to solve the problem but even shrank from attacking it.

Vico founded no school, and though during his lifetime and for a while after his death he had many admirers both in Naples and the northern cities, his fame and name were soon obscured, especially as the Kantian system dominated the world of thought. At the beginning of the 19th century, however, some Neapolitan exiles at Milan called attention to the merits of their great countryman, and his reinstatement was completed by Michelet, who in 1827 translated the *Scienza nuova* and other works with a laudatory introduction. Vico's writings suffer through their author's not having followed a regular course of studies, and his style is very involved. He was a deeply religious man, but his exemption of Jewish origins from the canons of historical inquiry which he elsewhere applied was probably due to the conditions of his age, which preceded the dawn of Semitic investigation and regarded the Old Testament and the Hebrew religion as *sui generis*.

For Vico's personal history see his autobiography, written at the request of the Conte di Porcia, and his letters; also Cantoni, *G. B. Vico, Studii Critici e Comparativi* (Turin, 1867); R. Flint, *Vico* (Edinburgh and London, 1884). For editions of Vico's own works, see *Opere*, ed. Giuseppe Ferrari, with introductory essay, "La Mente de Vico" (6 vols., Milan, 1834–35), and Michelet, *Œuvres Choisies de Vico* (2 vols., Paris, 1835). A full list is given in B. Croce, *Bibliografia Vichiana* (Naples, 1904). See also O. Klemm, *G. B. Vico als Geschichtsphilosoph und Völkerpsycholog* (Leipzig, 1906); M. H. Rafferty in *Journal of the Society of Comparative Legislation, New Series*, xvii., xx.

VICTOR, the name taken by three popes and two antipopes.

Victor I. was bishop of Rome from about 190 to 198. He submitted to the opinion of the episcopate in the various parts of Christendom the divergence between the Easter usage of Rome and that of the bishops of Asia. The bishops, particularly St Irenaeus of Lyons, declared themselves in favour of the usage of Rome, but refused to associate themselves with the excommunication pronounced by Victor against their Asiatic colleagues. At Rome Victor excommunicated Theodotus of Byzantium on account of his doctrine as to the person of Christ. St Jerome attributes to Victor some *opuscula* in Latin, which are believed to be recognized in certain apocryphal treatises of St Cyprian.

Victor II., the successor of Leo IX., was consecrated in St Peter's, Rome, on the 13th of April 1055. His father was a Swabian baron, Count Hartwig von Calw, and his own baptismal name was Gebhard. At the instance of Gebhard, bishop of Regensburg, uncle of the emperor Henry III., he had been appointed while still a young man to the see of Eichstädt; in this position his great talents soon enabled him to render important services to Henry, whose chief adviser he ultimately became. His nomination to the papacy by Henry, at Mainz, in September 1054, was made at the instance of a Roman deputation headed by Hildebrand, whose policy doubtless was to detach from the imperial interest one of its ablest supporters. In June 1055 Victor met the emperor at Florence, and held a council, which anew condemned clerical marriages, simony and the alienation of the estates of the church. In the following year he was summoned to Germany to the side of the emperor, and was with him when he died at Botfeld in the Harz on the 5th of October 1056. As guardian of Henry's infant son, and adviser of the empress Agnes, Victor now wielded enormous power, which he began to use with much tact for the maintenance of peace throughout the empire and for strengthening the papacy against the aggressions of the barons. He died shortly after his return to Italy, at Arezzo, on the 28th of July 1057. His successor was Stephen IX. (Frederick of Lorraine). (L. D.*)

Victor III. (Dauferius Epifani), pope from the 24th of May 1086 to the 16th of September 1087, was the successor of Gregory VII. He was a son of Landolfo V., prince of Benevento, and was born in 1027. After studying in various monasteries he became provost of St Benedict at Capua, and in 1055 obtained permission from Victor II. to enter the cloister at Monte Cassino, changing his name to Desiderius. He succeeded Stephen IX. as abbot in 1057, and his rule marks the golden age of that celebrated monastery; he promoted literary activity, and established an important school of mosaic. Desiderius was created cardinal priest of Sta Cecilia by Nicholas II. in 1059, and as papal vicar in south Italy conducted frequent negotiations between the Normans and the pope. Among the four men suggested by Gregory VII. on his death-bed as most worthy to succeed him was Desiderius, who was favoured by the cardinals because of his great learning, his connexion with the Normans and his diplomatic ability. The abbot, however, declined the papal crown, and the year 1085 passed without an election. The cardinals at length proclaimed him pope against his will on the 24th of May 1086, but he was driven from Rome by imperialists before his consecration was complete, and, laying aside the papal insignia at Terracina, he retired to his beloved monastery. As vicar of the Holy See he convened a synod at Capua on the 7th of March 1087, resumed the papal insignia on the 21st of March, and received tardy consecration at Rome on the 9th of May. Owing to the presence of the antipope, Clement III. (Guibert of Ravenna), who had powerful partisans, his stay at Rome was brief. He sent an army to Tunis, which defeated the Saracens and compelled the sultan to pay tribute to the papal see. In August 1087 he held a synod at Benevento, which renewed the excommunication of Guibert; banned Archbishop Hugo of Lyons and Abbot Richard of Marseilles as schismatics; and confirmed the prohibition of lay investiture. Falling ill at the synod, Vicar returned to Monte Cassino, where he died on the 16th of September 1087. He was buried at the monastery and is accounted a saint by the Benedictine order. His successor was Urban II.

Victor III., while abbot of Monte Cassino contributed personally to the literary activity of the monastery. He wrote *Dialogi de miraculis S. Benedicti*, which, along with his *Epistolae*, are in J. P. Migne, *Patrol. Lat.* vol. 149, and an account of the miracles of Leo IX. (in *Acta Sanctorum*, 19th of April). The chief sources for his life are the "Chronica monasterii Casinensis," in the *Mon. Germ. hist., Script.* vii., and the Vitae in J. P. Migne, *Patrol. Lat.* vol. 149, and in J. M. Watterich, *Pontif. Roman. Vitae.*

See J. Langen, *Geschichte der römischen Kirche von Gregor VII. bis Innocenz III.* (Bonn, 1893); F. Gregorovius, *Rome in the Middle Ages*, vol. 4, trans. by Mrs G. W. Hamilton (London, 1900–2); K. J. von Hefele, *Conciliengeschichte* (2nd ed., 1873–90), vol. 5; Hirsch, "Desiderius von Monte Cassino als Papst Victor III.," in *Forschungen zur deutschen Geschichte*, vol. 7 (Göttingen, 1867); H. H. Milman, *History of Latin Christianity*, vol. 3 (repub. London, 1899).

Victor IV. was a title taken by two antipopes. (1) Gregorio Conti, cardinal priest of Santi Dodici Apostoli, was chosen by a party opposed to Innocent II. in succession to the antipope Anacletus II., on the 15th of March 1138, but through the influence of Bernard of Clairvaux he was induced to make his submission on the 29th of May. (2) Octavian, count of Tusculum and cardinal deacon of St Nicola in carcere Tulliano, the Ghibelline antipope, was elected at Rome on the 7th of September 1159, in opposition to Alexander III., and supported by the emperor Frederick Barbarossa. Consecrated at Farfa on the 4th of October, Victor was the first of the series of antipopes supported by Frederick against Alexander III. Though the excommunication of Frederick by Alexander in March 1160 made only a slight impression in Germany, this pope was nevertheless able to gain the support of the rest of western Europe, because since the days of Hildebrand the power of the pope over the church in the various countries had increased so greatly that the kings of France and of England could not view with indifference a revival of such imperial control of the papacy as had been exercised by the emperor Henry III. He died at Lucca on the 20th of April 1164 and was succeeded by the antipope Paschal III. (1164–1168).

See M. Meyer, *Die Wahl Alexanders III. und Victors IV. 1159* (Göttingen, 1871); and A. Hauck, *Kirchengeschichte Deutschlands*, Band iv. (C. H. Ha.)

VICTOR, GAIUS JULIUS (4th cent. A.D.), Roman writer on rhetoric, possibly of Gallic origin. His extant manual (in C. Halm's *Rhetores Latini Minores*, 1863) is of some importance as facilitating the textual criticism of Quintilian, whom he closely follows in many places.

VICTOR, SEXTUS AURELIUS, prefect of Pannonia about 360 (Amm. Marc. xxi. 10), possibly the same as the consul (jointly with Valentinian) in 373 and as the prefect of the city who is mentioned in an inscription of the time of Theodosius. Four small historical works have been ascribed to him on more or less doubtful grounds—(1) *Origo Gentis Romanae*, (2) *De Viribus Illustribus Romae*, (3) *De Caesaribus*, (4) *De Vita et Moribus Imperatorum Romanorum excerpta ex Libris Sex. Aur. Victoris.* The four have generally been published together under the name *Historia Romana*, but the fourth piece is a *réchauffé* of the third. The second was first printed at Naples about 1472, in 4to, under the name of Pliny (the younger), and the fourth at Strassburg in 1505.

The first edition of all four was that of A. Schottus (8vo, Antwerp, 1579). The most recent edition of the *De Caesaribus* is by F. Pichlmayr (Munich, 1892).

VICTOR AMEDEUS II. (1666–1732), duke of Savoy and first king of Sardinia, was the son of Duke Charles Emmanuel II. and Jeanne de Savoie-Nemours. Born at Turin, he lost his father in 1675, and spent his youth under the regency of his mother, known as "Madama Reale" (madame royale), an able but ambitious and overbearing woman. He assumed the reins of government at the age of sixteen, and married Princess Anne, daughter of Philip of Orleans and Henrietta of England, and niece of Louis XIV., king of France. That sovereign was determined to dominate the young duke of Savoy, who from the first resented the monarch's insolent bearing. In 1685 Victor was forced by Louis to persecute his Waldensian subjects, because they had given shelter to the French Huguenot refugees after the revocation of the edict of Nantes. With the unwelcome help of a French army under Marshal Catinat, he invaded the Waldensian valleys, and after a difficult campaign, characterized by great cruelty, he subjugated them. Nevertheless, he became more anxious than ever to emancipate himself from French thraldom, and his first sign of independence was his visit to Venice in 1687, where he conferred on political affairs with Prince Eugène of Savoy and other personages, without consulting Louis. About this time the duke plunged into a whirl of dissipation, and chose the beautiful but unscrupulous Contessa di Verrua as his mistress, neglecting his faithful and devoted wife. Louis having discovered Victor's intrigues with the emperor, tried to precipitate hostilities by demanding his participation in a second expedition against the Waldensians. The duke unwillingly complied, but when the French entered Piedmont and demanded the cession of the fortresses of Turin and Verrua, he refused, and while still professing to negotiate with Louis, joined the league of Austria, Spain and Venice. War was declared in 1690, but at the battle of Staffarda (18th of August 1691), Victor, in spite of his great courage and skill, was defeated by the French under Catinat. Other reverses followed, but the attack on Cuneo was heroically repulsed by the citizens. The war dragged on with varying success, until the severe defeat of the allies at Marsiglia and their selfish neglect of Victor's interests induced him to open negotiations with France once more. Louis agreed to restore most of the fortresses he had captured and to make other concessions; a treaty was signed in 1696, and Victor appointed generalissimo of the Franco-Piedmontese forces in Italy operating against the imperialists. By the treaty of Ryswick (1697) a general peace was concluded. On the outbreak of the war of the Spanish Succession in 1700 the duke was again on the French side, but the insolence of Louis and of Philip V. of Spain towards him induced him, at the end of the two years for which he had bound himself to them, to go over to the imperialists (1704). At first the French were successful and captured several Piedmontese fortresses, but after besieging Turin, which was skilfully defended by the duke, for several months, they were completely defeated by Victor and Prince Eugène of Savoy (1706), and eventually driven out of the other towns they had captured. By the peace of Utrecht (1713) the Powers conferred the kingdom of Sicily on Victor Amedeus, whose government proved efficient and at first popular. But after a brief stay in the island he returned to Piedmont and left his new possessions to a viceroy, which caused much discontent among the Sicilians; and when the Quadruple Alliance decreed in 1718 that Sicily should be restored to Spain, Victor was unable to offer any opposition, and had to content himself with receiving Sardinia in exchange.

The last years of Victor Amedeus's life were saddened by domestic troubles. In 1715 his eldest son died, and in 1728 he lost his queen. After her death, much against the advice of his remaining son and heir, Carlino (afterwards Charles Emmanuel III.), he married the Contessa di San Sebastiano, whom he created Marchesa di Spigno, abdicated the crown and retired to Chambéry to end his days (1730). But his second wife, an ambitious *intrigante*, soon tired of her quiet life, and induced him to return to Turin and attempt to revoke his abdication. This led to a quarrel with his son, who with quite unnecessary harshness, partly due to his minister the Marquis d'Ormea, arrested his father and confined him at Rivoli and later at Moncalieri; there Victor, overwhelmed with sorrow, died on the 31st of October 1732.

Victor Amedeus, although accused not without reason of bad faith in his diplomatic dealings and of cruelty, was undoubtedly a great soldier and a still greater administrator. He not only won for his country a high place in the council of nations, but he doubled its revenues and increased its prosperity and industries, and he also emphasized its character as an Italian state. His infidelity to his wife and his harshness towards his son Carlino are blemishes on a splendid career, but he more than expiated these faults by his tragic end.

See D. Carutti, *Storia del Regno di Vittorio Amedeo II.* (Turin, 1856); and E. Parri, *Vittorio Amedio II. ed Eugenio di Savoia* (Milan, 1888). The Marchesa Vitelleschi's work, *The Romance of Savoy* (2 vols., London, 1905), is based on original authorities, and is the most complete monograph on the subject.

VICTOR EMMANUEL II. (1820–1878), king of Sardinia and first king of Italy, was born at Turin on the 14th of March 1820, and was the son of Charles Albert, prince of Savoy-Carignano, who became king of Sardinia in 1831. Brought up in the bigoted and chilling atmosphere of the Piedmontese court, he received a rigid military and religious training, but little intellectual education. In 1842 he was married to Adelaide, daughter of the Austrian Archduke Rainer, as the king desired at that time to improve his relations with Austria. The young couple led a somewhat dreary life, hidebound by court etiquette, which Victor Emmanuel hated. He played no part in politics during his father's lifetime, but took an active interest in military matters. When the war with Austria broke out in 1848, he was delighted at the prospect of distinguishing himself, and was given the command of a division. At Goito he was slightly wounded and displayed great bravery, and after Custozza defended the rearguard to the last (25th of July 1848). In the campaign of March 1849 he commanded the same division. After the disastrous defeat at Novara on the 23rd of March, Charles Albert, having rejected the peace terms offered by the Austrian field-marshal Radetzky, abdicated in favour of his son, and withdrew to a monastery in Portugal, where he died a few months later. Victor Emmanuel repaired to Radetzky's camp, where he was received with every sign of respect, and the field-marshal offered not only to waive the claim that Austria should occupy a part of Piedmont, but to give him an extension of territory, provided he revoked the constitution and substituted the old blue Piedmontese flag for the Italian tricolour, which savoured too much of revolution. But although the young king had not yet sworn to observe the charter, and in any case the other Italian princes had all violated their constitutional promises, he rejected the offer. Consequently he had to agree to the temporary Austrian occupation of the territory comprised within the Po, the Sesia and the Ticino, and of half the citadel of Alessandria, to disband his Lombard, Polish and Hungarian volunteers, and to withdraw his fleet from the Adriatic; but he secured an amnesty for all the Lombards compromised in the recent revolution, having even threatened to go to war again if it were not granted. It was the maintenance of the constitution in the face of the overwhelming tide of reaction that established his position as the champion of Italian freedom and earned him the sobriquet of *Rè Galantuomo* (the honest king). But the task entrusted to him was a most difficult one: the army disorganized, the treasury empty, the people despondent if not actively disloyal, and he himself reviled, misunderstood, and, like his father, accused of treachery. Parliament having rejected the peace treaty, the king dissolved the assembly; in the famous proclamation from Moncalieri he appealed to the people's loyalty, and the new Chamber ratified the treaty (9th of January 1850). This same year, Cavour (*q.v.*) was appointed minister of agriculture in D'Azeglio's cabinet, and in 1852, after the fall of the latter, he became prime minister, a post which with brief interruptions he held until his death.

In having Cavour as his chief adviser Victor Emmanuel was most fortunate, and but for that statesman's astounding diplomatic genius the liberation of Italy would have been impossible. The years from 1850 to 1859 were devoted to restoring the shattered finances of Sardinia, reorganizing the army and modernizing the antiquated institutions of the kingdom. Among other reforms the abolition of the *foro ecclesiastico* (privileged ecclesiastical courts) brought down a storm of hostility from the Church both on the king and on Cavour, but both remained firm in sustaining the prerogatives of the civil power. When the Crimean War broke out, the king strongly supported Cavour in the proposal that Piedmont should join France and England against Russia so as to secure a place in the councils of the great Powers and establish a claim on them for eventual assistance in Italian affairs (1854). The following year Victor Emmanuel was stricken with a threefold family misfortune; for his mother, the Queen Dowager Maria Teresa, his wife, Queen Adelaide, and his brother Ferdinand, duke of Genoa, died within a few weeks of each other. The clerical party were not slow to point to this circumstance as a judgment on the king for what they deemed his sacrilegious policy. At the end of 1855, while the allied troops were still in the East, Victor Emmanuel visited Paris and London, where he was warmly welcomed by the emperor Napoleon III. and Queen Victoria, as well as by the peoples of the two countries.

Victor Emmanuel's object now was the expulsion of the Austrians from Italy and the expansion of Piedmont into a North Italian kingdom, but he did not regard the idea of Italian unity as coming within the sphere of practical politics for the time being, although a movement to that end was already beginning to gain ground. He was in communication with some of the conspirators, especially with La Farina, the leader of the *Società Nazionale*, an association the object of which was to unite Italy under the king of Sardinia, and he even communicated with Mazzini and the republicans, both in Italy and abroad, whenever he thought that they could help in the expulsion of the Austrians from Italy. In 1859 Cavour's diplomacy succeeded in drawing Napoleon III. into an alliance against Austria, although the king had to agree to the cession of Savoy and possibly of Nice and to the marriage of his daughter Clothilde to Prince Napoleon. These conditions were very painful to him, for Savoy was the hereditary home of his family, and he was greatly attached to Princess Clothilde and disliked the idea of marrying her to a man who gave little promise of proving a good husband. But he was always ready to sacrifice his own personal feelings for the good of his country. He had an interview with Garibaldi and appointed him commander of the newly raised volunteer corps, the *Cacciatori delle Alpi*. Even then Napoleon would not decide on immediate hostilities, and it required all Cavour's genius to bring him to the point and lead Austria into a declaration of war (April 1859). Although the Franco-Sardinian forces were successful in the field, Napoleon, fearing an attack by Prussia and disliking the idea of a too powerful Italian kingdom on the frontiers of France, insisted on making peace with Austria, while Venetia still remained to be freed. Victor Emmanuel, realizing that he could not continue the campaign alone, agreed most unwillingly to the armistice of Villafranca. When Cavour heard the news he hurried to the king's headquarters at Monzambano, and in violent, almost disrespectful language implored him to continue the campaign at all hazards, relying on his own army and the revolutionary movement in the rest of Italy. But the king on this occasion showed more political insight than his great minister and saw that by adopting the heroic course proposed by the latter he ran the risk of finding Napoleon on the side of the enemy, whereas by waiting all might be gained. Cavour resigned office, and by the peace of Zürich (10th of November 1859) Austria ceded Lombardy to Piedmont but retained Venetia; the central Italian princes who had been deposed by the revolution were to be reinstated, and Italy formed into a confederation of independent states. But this solution was most unacceptable to Italian public opinion, and both the king and Cavour determined to assist the people in preventing its realization, and consequently entered into secret relations with the revolutionary governments of Tuscany, the duchies and of Romagna. As a result of the events of 1859–60, those provinces were all annexed to Piedmont, and when Garibaldi decided on the Sicilian expedition Victor Emmanuel assisted him in various ways. He had considerable influence with Garibaldi, who, although in theory a republican, was greatly attached to the bluff soldier-king, and on several occasions restrained him from too foolhardy courses. When Garibaldi having conquered Sicily was determined to invade the mainland possessions of Francis II. of Naples, Victor Emmanuel foreseeing international difficulties wrote to the chief of the red shirts asking him not to cross the Straits; but Garibaldi, although acting throughout in the name of His Majesty, refused to obey and continued his victorious march, for he knew that the king's letter was dictated by diplomatic considerations rather than by his own personal desire. Then, on Cavour's advice, King Victor decided to participate himself in the occupation of Neapolitan territory, lest Garibaldi's entourage should proclaim the republic or create anarchy. When he accepted the annexation of Romagna offered by the inhabitants themselves the pope excommunicated him, but, although a devout Catholic, he continued in his course undeterred by ecclesiastical thunders, and led his army in person through the Papal States, occupying the Marches and Umbria, to Naples. On the 29th of October he met Garibaldi, who handed over his conquests to the king. The whole peninsula, except Rome and Venice, was now annexed to Piedmont, and on the 18th of February 1861 the parliament proclaimed Victor Emmanuel king of united Italy.

The next few years were occupied with preparations for the liberation of Venice, and the king corresponded with Mazzini, Klapka, Türr and other conspirators against Austria in Venetia itself, Hungary, Poland and elsewhere, keeping his activity secret even from his own ministers. The alliance with Prussia and the war with Austria of 1866, although fortune did not favour Italian arms, added Venetia to his dominions.

The Roman question yet remained unsolved, for Napoleon, although he had assisted Piedmont in 1859 and had reluctantly consented to the annexation of the central and southern provinces, and of part of the Papal States, would not permit Rome to be occupied, and maintained a French garrison there to protect the pope. When war with Prussia appeared imminent he tried to obtain Italian assistance, and Victor Emmanuel was very anxious to fly to the assistance of the man who had helped him to expel the Austrians from Italy, but he could not do so unless Napoleon gave him a free hand in Rome. This the emperor would not do until it was too late. Even after the first French defeats the chivalrous king, in spite of the advice of his more prudent councillors, wished to go to the rescue, and asked Thiers, the French representative who was imploring him for help, if with 100,000 Italian troops France could be saved, but Thiers could give no such undertaking and Italy remained neutral. On the 20th of September 1870, the French troops having been withdrawn, the Italian army entered Rome, and on the 2nd of July 1871 Victor Emmanuel made his solemn entry into the Eternal City, which then became the capital of Italy.

The pope refused to recognize the new kingdom even before the occupation of Rome, and the latter event rendered relations between church and state for many years extremely delicate. The king himself was anxious to be reconciled with the Vatican, but the pope, or rather his entourage, rejected all overtures, and the two sovereigns dwelt side by side in Rome until death without ever meeting. Victor Emmanuel devoted himself to his duties as a constitutional king with great conscientiousness, but he took more interest in foreign than in domestic politics and contributed not a little to improving Italy's international position. In 1873 he visited the emperor Francis Joseph at Vienna and the emperor William at Berlin. He received an enthusiastic welcome in both capitals, but the visit to Vienna was never returned in Rome, for Francis Joseph as a Catholic sovereign feared to offend the pope, a circumstance which served to embitter Austro-Italian relations. On the 9th of January 1878, Victor Emmanuel died of fever in Rome, and was buried in the Pantheon. He was succeeded by his son Humbert.

Bluff, hearty, good-natured and simple in his habits, yet he always had a high idea of his own kingly dignity, and his really statesmanlike qualities often surprised foreign diplomats, who were deceived by his homely exterior. As a soldier he was very brave, but he did not show great qualities as a military leader in the campaign of 1866. He was a keen sportsman and would spend many days at a time pursuing chamois or steinbock in the Alpine fastnesses of Piedmont with nothing but bread and cheese to eat. He always used the dialect of Piedmont when conversing with natives of that country, and he had a vast fund of humorous anecdotes and proverbs with which to illustrate his arguments. He had a great weakness for female society, and kept several mistresses; one of them, the beautiful Rosa Vercellone, he created Countess Mirafiori e Fontanafredda and married morganatically in 1869; she bore him one son.

Bibliography.—Besides the general works on Italy and Savoy see V. Bersezio, *Il Regno di Vittorio Emanuele II.* (8 vols., Turin, 1869); G. Massari, *La Vita ed il Regno di Vittorio Emanuele II.* (2 vols., Milan, 1878); N. Bianchi, *Storia della Diplomazia Europea in Italia* (8 vols., Turin, 1865). (L. V.*)

VICTOR EMMANUEL III. (1869–), king of Italy, son of King Humbert I. and Queen Margherita of Savoy, was born at Naples on the 11th of November 1869. Carefully educated by his mother and under the direction of Colonel Osio, he outgrew the weakness of his childhood and became expert in horsemanship and military exercises. Entering the army at an early age he passed through the various grades and, soon after attaining his majority, was appointed to the command of the Florence Army Corps. During frequent journeys to Germany he enlarged his military experience, and upon his appointment to the command of the Naples Army Corps in 1896 displayed sound military and administrative capacity. A keen huntsman, and passionately fond of the sea, he extended his yachting and hunting excursions as far east as Syria and as far north as Spitsbergen. As representative of King Humbert he attended the coronation of Tsar Nicholas II. in 1896, the Victorian Jubilee celebrations of 1897, and the festivities connected with the coming of age of the German crown prince in 1900. The prince's intellectual and artistic leanings were well known; in particular, he has made a magnificent collection of historic Italian coins, on which subject he became a recognized authority. At the time of the assassination of his father, King Humbert (the 29th of July 1900), he was returning from a yachting cruise in the eastern Mediterranean. Landing at Reggio di Calabria he hastened to Monza, where he conducted with firmness and tact the preparations for the burial of King Humbert and for his own formal accession, which took place on the 9th and 11th of August 1900. On the 24th of October 1896 he married Princess Elena of Montenegro, who, on the 1st of June 1901, bore him a daughter named Yolanda Margherita, on the 19th of November 1902 a second daughter named Mafalda, and on the 15th of September 1904 a son, Prince Humbert.

VICTORIA [ALEXANDRINA VICTORIA], Queen of the United Kingdom of Great Britain and Ireland, Empress of India (1819–1901), only child of Edward, duke of Kent, fourth son of King George III., and of Princess Victoria Mary Louisa of Saxe-Coburg-Gotha (widow of Prince Emich Karl of Leiningen, by whom she already had two children), was born at Kensington Palace on the 24th of May 1819. The duke and duchess of Kent had been living at Amorbach, in Franconia, owing to their straitened circumstances, but they returned to London on purpose that their child should be born in England. In 1817 the death of Princess Charlotte (only child of the prince regent, afterwards George IV., and wife of Prince Leopold of Saxe-Coburg-Gotha, afterwards king of the Belgians), had left the ultimate succession to the throne of England, in the younger generation, so uncertain that the three unmarried sons of George III., the dukes of Clarence (afterwards William IV.), Kent and Cambridge, all married in the following year, the two elder on the same day. All three had children, but the duke of Clarence's two baby daughters died in infancy, in 1819 and 1821; and the duke of Cambridge's son George, born on the 26th of March 1819, was only two months old when the birth of the duke of Kent's daughter put her before him in the succession. The question as to what name the child should bear was not settled without bickerings. The duke of Kent wished her to be christened Elizabeth, and the prince regent wanted Georgiana, while the tsar Alexander I., who had promised to stand sponsor, stipulated for Alexandrina. The baptism was performed in a drawing-room of Kensington Palace on the 24th of June by Dr Manners Sutton, archbishop of Canterbury. The prince regent, who was present, named the child Alexandrina; then, being requested by the duke of Kent to give a second name, he said, rather abruptly, "Let her be called Victoria, after her mother, but this name must come after the other."[1] Six weeks after her christening the princess was vaccinated, this being the first occasion on which a member of the royal family underwent the operation.

In January 1820 the duke of Kent died, five days before his brother succeeded to the throne as George IV. The widowed duchess of Kent was now a woman of thirty-four, handsome, homely, a German at heart, and with little liking for English ways. But she was a woman of experience, and shrewd; and fortunately she had a safe and affectionate adviser in her brother, Prince Leopold of Coburg, afterwards (1831) king of the Belgians, who as the husband of the late Princess Charlotte had once been a prospective prince consort of England. His former doctor and private secretary, Baron Stockmar (*q.v.*), a man of encyclopaedic information and remarkable judgment, who had given special attention to the problems of a sovereign's position in England, was afterwards to play an important rôle in Queen Victoria's life; and Leopold himself took a fatherly interest in the young princess's education, and contributed some thousands of pounds annually to the duchess of Kent's income. Prince Leopold still lived at this time at Claremont, where Princess Charlotte had died, and this became the duchess of Kent's occasional English home; but she was much addicted to travelling, and spent several months every year in visits to watering-places. It was said at court that she liked the demonstrative homage of crowds; but she had good reason to fear lest her child should be taken away from her to be educated according to the views of George IV. Between the king and his sister-in-law there was little love, and when the death of the duke of Clarence's second infant daughter Elizabeth in 1821 made it pretty certain that Princess Victoria would eventually become queen, the duchess felt that the king might possibly obtain the support of his ministers if he insisted that the future sovereign should be brought up under masters and mistresses designated by himself. The little princess could not have received a better education than that which was given her under Prince Leopold's direction. Her uncle considered that she ought to be kept as long as possible from the knowledge of her position, which might raise a large growth of pride or vanity in her and make her unmanageable; so Victoria was twelve years old before she knew that she was to wear a crown. Until she became queen she never slept a night away from her mother's room, and she was not allowed to converse with any grown-up person, friend, tutor or servant without the duchess of Kent or the Baroness Lehzen, her private governess, being present. Louise Lehzen, a native of Coburg, had come to England as governess to the Princess Feodore of Leiningen, the duchess of Kent's daughter by her first husband, and she became teacher to the Princess Victoria when the latter was five years old. George IV. in 1827 made her a baroness of Hanover, and she continued as lady-in-attendance after the duchess of Northumberland was appointed official governess in 1830, but actually performed the functions first of governess and then of private secretary till 1842, when she left the court and returned to Germany, where she died in 1870. The Rev. George Davys, afterwards bishop of Peterborough, taught the princess Latin; Mr J. B. Sale, music; Mr Westall, history; and Mr Thomas Steward, the writing master of Westminster School, instructed her in penmanship.

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[1] The question of her name, as that of one who was to be queen, remained even up to her accession to the throne a much-debated one. In August 1831, in a discussion in parliament upon a grant to the duchess of Kent, Sir M. W. Ridley suggested changing it to Elizabeth as "more accordant to the feelings of the people"; and the idea of a change seems to have been powerfully supported. In 1836 William IV. approved of a proposal to change it to Charlotte; but, to the princess's own delight, it was given up.

In 1830 George IV. died, and the duke of York (George III.'s second son) having died childless in 1827, the duke of Clarence became king as William IV. Princess Victoria now became the direct heir to the throne. William IV. cherished affectionate feelings towards his niece; unfortunately he took offence at the duchess of Kent for declining to let her child come and live at his court for several months in each year, and through the whole of his reign there was strife between the two; and Prince Leopold was no longer in England to act as peacemaker.

In the early hours of the 20th of June 1837, William IV. died. His thoughts had dwelt often on his niece, and he repeatedly said that he was sure she would be "a good woman and a good queen. It will touch every sailor's heart to have a girl queen to fight for. They'll be tattooing her face on their arms, and I'll be bound they'll all think she was christened after Nelson's ship." Dr Howley, archbishop of Canterbury, and the marquis of Conyngham, bearing the news of the king's death, started in a landau with four horses for Kensington, which they reached at five o'clock. Their servants rang, knocked and thumped; and when at last admittance was gained, the primate and the marquis were shown into a lower room and there left to wait. Presently a maid appeared and said that the Princess Victoria was "in a sweet sleep and could not be disturbed." Dr Howley, who was nothing if not pompous, answered that he had come on state business, to which everything, even sleep, must give place. The princess was accordingly roused, and quickly came downstairs in a dressing-gown, her fair hair flowing loose over her shoulders. Her own account of this interview, written the same day in her journal (*Letters*, i. p. 97), shows her to have been quite prepared.

The privy council assembled at Kensington in the morning; and the usual oaths were administered to the queen by Lord Chancellor Cottenham, after which all present did homage. There was a touching incident when the queen's uncles, the dukes of Cumberland and Sussex, two old men, came forward to perform their obeisance. The queen blushed, and descending from her throne, kissed them both, without allowing them to kneel. By the death of William IV., the duke of Cumberland had become King Ernest of Hanover, and immediately after the ceremony he made haste to reach his kingdom. Had Queen Victoria died without issue, this prince, who was arrogant, ill-tempered and rash, would have become king of Great Britain; and, as nothing but mischief could have resulted from this, the young queen's life became very precious in the sight of her people. She, of course, retained the late king's ministers in their offices, and it was under Lord Melbourne's direction that the privy council drew up their declaration to the kingdom. This document described the queen as Alexandrina Victoria, and all the peers who subscribed the roll in the House of Lords on the 20th of June swore allegiance to her under those names. It was not till the following day that the sovereign's style was altered to Victoria simply, and this necessitated the issuing of a new declaration and a re-signing of the peers' roll. The public proclamation of the queen took place on the 21st at St James's Palace with great pomp.

The queen opened her first parliament in person, and in a well-written speech, which she read with much feeling, adverted to her youth and to the necessity which existed for her being guided by enlightened advisers. When both houses had voted loyal addresses, the question of the Civil List was considered, and a week or two later a message was brought to parliament requesting an increase of the grant formerly made to the duchess of Kent. Government recommended an addition of £30,000 a year, which was voted, and before the close of the year a Civil List Bill was passed, settling £385,000 a year on the queen.

The duchess of Kent and her brothers, King Leopold and the duke of Saxe-Coburg-Gotha, had always hoped to arrange that the queen should marry her cousin, Albert (*q.v.*) of Saxe-Coburg-Gotha, and the prince himself had been made acquainted with this plan from his earliest years. In 1836 Prince Albert, who was born in the same year as his future wife, had come on a visit to England with his father and with his brother, Prince Ernest, and his handsome face, gentle disposition and playful humour had produced a favourable impression on the princess. The duchess of Kent had communicated her projects to Lord Melbourne, and they were known to many other statesmen, and to persons in society; but the gossip of drawing-rooms during the years 1837–38 continually represented that the young queen had fallen in love with Prince This or Lord That, and the more imaginative babblers hinted at post-chaises waiting outside Kensington Gardens in the night, private marriages and so forth.

The coronation.

The coronation took place on the 28th of June 1838. No more touching ceremony of the kind had ever been performed in Westminster Abbey. Anne was a middle-aged married woman at the time of her coronation; she waddled and wheezed, and made no majestic appearance upon her throne. Mary was odious to her Protestant subjects, Elizabeth to those of the unreformed religion, and both these queens succeeded to the crown in times of general sadness; but the youthful Queen Victoria had no enemies except a few Chartists, and the land was peaceful and prosperous when she began to reign over it. The cost of George IV.'s coronation amounted to £240,000; that of William IV. had amounted to £50,000 only; and in asking £70,000 the government had judged that things could be done with suitable luxury, but without waste. The traditional banquet in Westminster Hall, with the throwing down of the glove by the king's champion in armour, had been dispensed with at the coronation of William IV., and it was resolved not to revive it. But it was arranged that the sovereign's procession to the abbey through the streets should be made a finer show than on previous occasions; and it drew to London 400,000 country visitors. Three ambassadors for different reasons became objects of great interest on the occasion. Marshal Soult, Wellington's old foe, received a hearty popular welcome as a military hero; Prince Esterhazy, who represented Austria, dazzled society by his Magyar uniform, which was encrusted all over, even to the boots, with pearls and diamonds; while the Turkish ambassador, Sarim Effendi, caused much diversion by his bewilderment. He was so wonder-struck that he could not walk to his place, but stood as if he had lost his senses, and kept muttering, "All this for a woman!"

The "Bedchamber Plot."

Within a year the court was brought into sudden disfavour with the country by two events of unequal importance, but both exciting. The first was the case of Lady Flora Hastings. In February 1839 this young lady, a daughter of the marquis of Hastings, and a maid of honour to the duchess of Kent, was accused by certain ladies of the bedchamber of immoral conduct. The charge having been laid before Lord Melbourne, he communicated it to Sir James Clark, the queen's physician, and the result was that Lady Flora was subjected to the indignity of a medical examination, which, while it cleared her character, seriously affected her health. In fact, she died in the following July, and it was then discovered that the physical appearances which first provoked suspicion against her had been due to enlargement of the liver. The queen's conduct towards Lady Flora was kind and sisterly from the beginning to the end of this painful business; but the scandal was made public through some indignant letters which the marchioness of Hastings addressed to Lord Melbourne praying for the punishment of her daughter's traducers, and the general opinion was that Lady Flora had been grossly treated at the instigation of some private court enemies. While the agitation about the affair was yet unappeased, the political crisis known as the "Bedchamber Plot" occurred. The Whig ministry had introduced a bill suspending the Constitution of Jamaica because the Assembly in that colony had refused to adopt the Prisons Act passed by the Imperial Legislature. Sir Robert Peel moved an amendment, which, on a division (6th May), was defeated by a majority of five only in a house of 583, and ministers thereupon resigned. The duke of Wellington was first sent for, but he advised that the task of forming an administration should be entrusted to Sir Robert Peel. Sir Robert was ready to form a cabinet in which the duke of Wellington, Lords Lyndhurst, Aberdeen and Stanley, and Sir James Graham would have served; but he stipulated that the mistress of the robes and the ladies of the bedchamber appointed by the Whig administration should be removed, and to this the queen would not consent. On the 10th of May she wrote curtly that the course proposed by Sir Robert Peel was contrary to usage and repugnant to her feelings; the Tory leader then had to inform the House of Commons that, having failed to obtain the proof which he desired of her majesty's confidence, it was impossible for him to accept office. The ladies of the bedchamber were so unpopular in consequence of their behaviour to Lady Flora Hastings that the public took alarm at the notion that the queen had fallen into the hands of an intriguing coterie; and Lord Melbourne, who was accused of wishing to rule on the strength of court favour, resumed office with diminished prestige. The Tories thus felt aggrieved; and the Chartists were so prompt to make political capital out of the affair that large numbers were added to their ranks. On the 14th of June Mr Attwood, M.P. for Birmingham, presented to the House of Commons a Chartist petition alleged to have been signed by 1,280,000 people. It was a cylinder of parchment of about the diameter of a coach-wheel, and was literally rolled up on the floor of the house. On the day after this curious document had furnished both amusement and uneasiness to the Commons, a woman, describing herself as Sophia Elizabeth Guelph Sims, made application at the Mansion House for advice and assistance to prove herself the lawful child of George IV. and Mrs Fitzherbert; and this incident, trumpery as it was, added fuel to the disloyal flame then raging. Going in state to Ascot the queen was hissed by some ladies as her carriage drove on to the course, and two peeresses, one of them a Tory duchess, were openly accused of this unseemly act. Meanwhile some monster Chartist demonstrations were being organized, and they commenced on the 4th of July with riots at Birmingham. It was an untoward coincidence that Lady Flora Hastings died on the 5th of July, for though she repeated on her deathbed, and wished it to be published, that the queen had taken no part whatever in the proceedings which had shortened her life, it was remarked that the ladies who were believed to have persecuted her still retained the sovereign's favour. The riots at Birmingham lasted ten days, and had to be put down by armed force. They were followed by others at Newcastle, Manchester, Bolton, Chester and Macclesfield.

The queen's marriage.

These troublous events had the effect of hastening the queen's marriage. Lord Melbourne ascertained that the queen's dispositions towards her cousin, Prince Albert, were unchanged, and he advised King Leopold, through M. Van der Weyer, the Belgian minister, that the prince should come to England and press his suit. The prince arrived with his brother on a visit to Windsor on the 10th of October 1839. On the 12th the queen wrote to King Leopold: "Albert's beauty is most striking, and he is so amiable and unaffected—in short, very fascinating." On the 15th all was settled; and the queen wrote to her uncle, "I love him more than I can say." The queen's public announcement of her betrothal was enthusiastically received. But the royal lovers still had some parliamentary mortifications to undergo. The government proposed that Prince Albert should receive an annuity of £50,000, but an amendment of Colonel Sibthorp—a politician of no great repute—for making the annuity £30,000 was carried against ministers by 262 votes to 158, the Tories and Radicals going into the same lobby, and many ministerialists taking no part in the division. Prince Albert had not been described, in the queen's declaration to the privy council, as a Protestant prince; and Lord Palmerston was obliged to ask Baron Stockmar for assurance that Prince Albert did not belong to any sect of Protestants whose rules might prevent him from taking the Sacrament according to the ritual of the English Church. He got an answer couched in somewhat ironical terms to the effect that Protestantism owed its existence in a measure to the house of Saxony, from which the prince descended, seeing that this house and that of the landgrave of Hesse had stood quite alone against Europe in upholding Luther and his cause. Even after this certain High Churchmen held that a Lutheran was a "dissenter," and that the prince should be asked to subscribe to the Thirty-Nine Articles.

The queen was particularly concerned by the question of the prince's future status as an Englishman. It was impracticable for him to receive the title of king consort; but the queen naturally desired that her husband should be placed by act of parliament in a position which would secure to him precedence, not only in England, but in foreign courts. Lord Melbourne sought to effect this by a clause introduced in a naturalization bill; but he found himself obliged to drop the clause, and to leave the queen to confer what precedence she pleased by letters-patent. This was a lame way out of the difficulty, for the queen could only confer precedence within her own realms, whereas an act of parliament bestowing the title of prince consort would have made the prince's right to rank above all royal imperial highnesses quite clear, and would have left no room for such disputes as afterwards occurred when foreign princes chose to treat Prince Albert as having mere courtesy rank in his wife's kingdom. The result of these political difficulties was to make the queen more than ever disgusted with the Tories. But there was no other flaw in the happiness of the marriage, which was solemnized on the 10th of February 1840 in the Chapel Royal, St James's. It is interesting to note that the queen was dressed entirely in articles of British manufacture. Her dress was of Spitalfields silk; her veil of Honiton lace; her ribbons came from Coventry; even her gloves had been made in London of English kid—a novel thing in days when the French had a monopoly in the finer kinds of gloves.

Public affairs.

From the time of the queen's marriage the crown played an increasingly active part in the affairs of state. Previously, ministers had tried to spare the queen all disagreeable and fatiguing details. Lord Melbourne saw her every day, whether she was in London or at Windsor, and he used to explain all current business in a benevolent, chatty manner, which offered a pleasant contrast to the style of his two principal colleagues, Lord John Russell and Lord Palmerston. A statesman of firmer mould than Lord Melbourne would hardly have succeeded so well as he did in making rough places smooth for Prince Albert. Lord John Russell and Lord Palmerston were naturally jealous of the prince's interference —and of King Leopold's and Baron Stockmar's—in state affairs; but Lord Melbourne took the common-sense view that a husband will control his wife whether people wish it or not. Ably advised by his private secretary, George Anson, and by Stockmar, the prince thus soon took the *de facto* place of the sovereign's private secretary, though he had no official status as such; and his system of classifying and annotating the queen's papers and letters resulted in the preservation of what the editors of the *Letters of Queen Victoria* (1907) describe as "probably the most extraordinary collection of state documents in the world"—those up to 1861 being contained in between 500 and 600 bound volumes at Windsor. To confer on Prince Albert every honour that the crown could bestow, and to let him make his way gradually into public favour by his own tact, was the advice which Lord Melbourne gave; and the prince acted upon it so well, avoiding every appearance of intrusion, and treating men of all parties and degrees with urbanity, that within five months of his marriage he obtained a signal mark of the public confidence. In expectation of the queen becoming a mother, a bill was passed through parliament providing for the appointment of Prince Albert as sole regent in case the queen, after giving birth to a child, died before her son or daughter came of age.

Attempts on the queen's life.

The Regency Bill had been hurried on in consequence of the attempt of a crazy pot-boy, Edward Oxford, to take the queen's life. On 10th June 1840, the queen and Prince Albert were driving up Constitution Hill in an open carriage, when Oxford fired two pistols, the bullets from which flew, it is said, close by the prince's head. He was arrested on the spot, and when his lodgings were searched a quantity of powder and shot was found, with the rules of a secret society, called "Young England," whose members were pledged to meet, "carrying swords and pistols and wearing crape masks." These discoveries raised the surmise that Oxford was the tool of a widespread Chartist conspiracy—or, as the Irish pretended, of a conspiracy of Orangemen to set the duke of Cumberland on the throne; and while these delusions were fresh, they threw well-disposed persons into a paroxysm of loyalty. Even the London street dogs, as Sydney Smith said, joined with O'Connell in barking "God save the Queen." Oxford seems to have been craving for notoriety; but it may be doubted whether the jury who tried him did right to pronounce his acquittal on the ground of insanity. He feigned madness at his trial, but during the forty years of his subsequent confinement at Bedlam he talked and acted like a rational being, and when he was at length released and sent to Australia he earned his living there as a house painter, and used to declare that he had never been mad at all. His acquittal was to be deprecated as establishing a dangerous precedent in regard to outrages on the sovereign. It was always Prince Albert's opinion that if Oxford had been flogged the attempt of Francis on the queen in 1842 and of Bean in the same year would never have been perpetrated. After the attempt of Bean—who was a hunchback, really insane—parliament passed a bill empowering judges to order whipping as a punishment for those who molested the queen; but somehow this salutary act was never enforced. In 1850 a half-pay officer, named Pate, assaulted the queen by striking her with a stick, and crushing her bonnet. He was sentenced to seven years' transportation; but the judge, Baron Alderson, excused him the flogging. In 1869 an Irish lad, O'Connor, was sentenced to eighteen months' imprisonment and a whipping for presenting a pistol at the queen, with a petition, in St James's Park; but this time it was the queen herself who privately remitted the corporal punishment, and she even pushed clemency to the length of sending her aggressor to Australia at her own expense. The series of attempts on the queen was closed in 1882 by Maclean, who fired a pistol at her majesty as she was leaving the Great Western Railway station at Windsor. He, like Bean, was a genuine madman, and was relegated to Broadmoor.

Birth of the princess royal.

The birth of the princess royal, on the 21st of November 1840, removing the unpopular King Ernest of Hanover from the position of heir-presumptive to the British crown, was a subject of loud congratulations to the people. A curious scare was occasioned at Buckingham Palace, when the little princess was a fortnight old, by the discovery of a boy named Jones concealed under a bed in the royal nursery. Jones had a mania for palace-breaking. Three times he effected a clandestine entry into the queen's residence, and twice he managed to spend several days there. By day he concealed himself in cupboards or under furniture, and by night he groped his way into the royal kitchen to eat whatever he could find. After his third capture, in March 1841, he coolly boasted that he had lain under a sofa, and listened to a private conversation between the queen and Prince Albert. This third time he was not punished, but sent to sea, and turned out very well. The incident strengthened Prince Albert's hands in trying to carry out sundry domestic reforms which were being stoutly resisted by vested interests. The royal residences and grounds used to be under the control of four different officials—the lord chamberlain, the lord steward, the master of the horse and the commissioners of woods and forests. Baron Stockmar, describing the confusion fostered by this state of things, said—

> "The lord steward finds the fuel and lays the fire; the lord chamberlain lights it. The lord chamberlain provides the lamps; the lord steward must clean, trim and light them. The inside cleaning of windows belongs to the lord chamberlain's department, but the outer parts must be attended to by the office of woods and forests, so that windows remain dirty unless the two departments can come to an understanding."

It took Prince Albert four years of firmness and diplomacy before in 1845 he was able to bring the queen's home under the efficient control of a master of the household.

Sir Robert Peel's ministry.

At the general election of 1841 the Whigs returned in a minority of seventy-six, and Lord Melbourne was defeated on the Address and resigned. The queen was affected to tears at parting with him; but the crisis had been fully expected and prepared for by confidential communications between Mr Anson and Sir Robert Peel, who now became prime minister (see *Letters of Queen Victoria*, i. 341 et seq.). The old difficulty as to the appointments to the royal household was tactfully removed, and Tory appointments were made, which were agreeable both to the queen and to Peel. The only temporary embarrassment was the queen's continued private correspondence with Lord Melbourne, which led Stockmar to remonstrate with him; but Melbourne used his influence sensibly; moreover, he gradually dropped out of politics, and the queen got used to his not being indispensable. On Prince Albert's position the change had a marked effect, for in the absence of Melbourne the queen relied more particularly on his advice, and Peel himself at once discovered and recognized the prince's unusual charm and capacity. One of the Tory premier's first acts was to propose that a royal commission should be appointed to consider the best means for promoting art and science in the kingdom, and he nominated Prince Albert as president. The International Exhibition of 1851, the creation of the Museum and Science and Art Department at South Kensington, the founding of art schools and picture galleries all over the country, the spread of musical taste and the fostering of technical education may be attributed, more or less directly, to the commission of distinguished men which began its labours under Prince Albert's auspices.

Birth of the prince of Wales.

The court and the country.

The queen's second child, the prince of Wales (see Edward VII.), was born on the 9th of November 1841; and this event "filled the measure of the queen's domestic happiness," as she said in her speech from the throne at the opening of the session of 1842. It is unnecessary from this point onwards to go *seriatim* through the domestic history of the reign, which is given in the article English History. At this time there was much political unrest at home, and serious difficulties abroad. As regards internal politics, it may be remarked that the queen and Prince Albert were much relieved when Peel, who had come in as the leader of the Protectionist party, adopted Free Trade and repealed the Corn Laws, for it closed a dangerous agitation which gave them much anxiety. When the country was in distress, the queen felt a womanly repugnance for festivities; and yet it was undesirable that the court should incur the reproach of living meanly to save money. There was a conversation between the queen and Sir Robert Peel on this subject in the early days of the Tory administration, and the queen talked of reducing her establishment in order that she might give away larger sums in charities. "I am afraid the people would only say that your majesty was returning them change for their pounds in halfpence," answered Peel. "Your majesty is not perhaps aware that the most unpopular person in the parish is the relieving officer, and if the queen were to constitute herself a relieving officer for all the parishes in the kingdom she would find her money go a very little way, and she would provoke more grumbling than thanks." Peel added that a sovereign must do all things in order, not seeking praise for doing one particular thing well, but striving to be an example in all respects, even in dinner-giving.

Meanwhile the year 1842 was ushered in by splendid fêtes in honour of the king of Prussia, who held the prince of Wales at the font. In the spring there was a fancy-dress ball at Buckingham Palace, which remained memorable owing to the offence

The queen's first railway journey.

which it gave in France. Prince Albert was costumed as Edward III., the queen as Queen Philippa, and all the gentlemen of the court as knights of Poitiers. The French chose to view this as an unfriendly demonstration, and there was some talk of getting up a counter-ball in Paris, the duke of Orleans to figure as William the Conqueror. In June the queen took her first railway journey, travelling from Windsor to Paddington on the Great Western line. The master of the horse, whose business it was to provide for the queen's ordinary journeys by road, was much put out by this innovation. He marched into the station several hours before the start to inspect the engine, as he would have examined a steed; but greater merriment was occasioned by the queen's coachman, who insisted that, as a matter of form, he ought to make-believe to drive the engine. After some dispute, he was told that he might climb on to the pilot engine which was to precede the royal train; but his scarlet livery, white gloves and wig suffered so much from soot and sparks that he made no more fuss about his rights in after trips. The motion of the train was found to be so pleasant that the queen readily trusted herself to the railway for a longer journey a few weeks later, when she paid her first visit to Scotland. A report by Sir James Clark led to the queen's visiting Balmoral in 1848, and to the purchase of the Balmoral estate in 1852, and the queen's diary of her journeys in Scotland shows what constant enjoyment she derived from her Highland home. Seven years before this the estate of Osborne had been purchased in the Isle of Wight, in order that the queen might have a home of her own. Windsor she considered too stately, and the Pavilion at Brighton too uncomfortable. The first stone of Osborne House was laid in 1845, and the royal family entered into possession in September 1846.

Relations with foreign sovereigns.

In August 1843 the queen and Prince Albert paid a visit to King Louis Philippe at the château d'Eu. They sailed from Southampton for Tréport in a yacht, and, as it happened to be raining hard when they embarked, the loyal members of the Southampton Corporation remembered Raleigh, and spread their robes on the ground for the queen to walk over. In 1844 Louis Philippe returned the visit by coming to Windsor. It was the first visit ever paid by a king of France to a sovereign of England, and Louis Philippe was much pleased at receiving the Order of the Garter. He said that he did not feel that he belonged to the "Club" of European sovereigns until he received this decoration. As the father of King Leopold of Belgium's consort, the queen was much interested in his visit, which went off with great success and goodwill. The tsar Nicholas had visited Windsor earlier that year, in which also Prince Alfred, who was to marry the tsar's grand-daughter, was born.

In 1846 the affair of the "Spanish marriages" seriously troubled the relations between the United Kingdom and France. Louis Philippe and Guizot had planned the marriage of the duke of Montpensier with the infanta Louisa of Spain, younger sister of Queen Isabella, who, it was thought at the time, was not likely ever to have children. The intrigue was therefore one for placing a son of the French king on the Spanish throne. (See SPAIN, *History*.) As to Queen Victoria's intervention on this question and on others, these words, written by W. E. Gladstone in 1875, may be quoted:—

> "Although the admirable arrangements of the Constitution have now shielded the sovereign from personal responsibility, they have left ample scope for the exercise of direct and personal influence in the whole work of government. . . . The sovereign as compared with her ministers has, because she is the sovereign, the advantage of long experience, wide survey, elevated position and entire disconnexion from the bias of party. Further, personal and domestic relations with the ruling families abroad give openings in delicate cases for saying more, and saying it at once more gently and more efficaciously, than could be ventured in the formal correspondence and rude contacts of government. We know with how much truth, fulness and decision, and with how much tact and delicacy, the queen, aided by Prince Albert, took a principal part on behalf of the nation in the painful question of the Spanish marriages."

The year 1848, which shook so many continental thrones, left that of the United Kingdom unhurt. Revolutions broke out in Paris, Vienna, Berlin, Madrid, Rome, Naples, Venice, Munich, Dresden and Budapest. The queen and Prince Albert were affected in many private ways by the events abroad. Panic-stricken princes wrote to them for political assistance or pecuniary aid. Louis Philippe abdicated and fled to England almost destitute, being smuggled over the Channel by the cleverness of the British consul at Havre, and the queen employed Sir Robert Peel as her intermediary for providing him with money to meet his immediate wants. Subsequently Claremont was assigned to the exiled royal family of France as a residence. During a few weeks of 1848 Prince William of Prussia (afterwards German emperor) found an asylum in England.

Irish trip, 1849.

In August 1849 the queen and Prince Albert, accompanied by the little princess royal and the prince of Wales, paid a visit to Ireland, landing at the Cove of Cork, which from that day was renamed Queenstown. The reception was enthusiastic, and so was that at Dublin. "Such a day of jubilee," wrote *The Times*, "such a night of rejoicing, has never been beheld in the ancient capital of Ireland since first it arose on the banks of the Liffey." The queen was greatly pleased and touched. The project of establishing a royal residence in Ireland was often mooted at this time, but the queen's advisers never urged it with sufficient warmth. There was no repugnance to the idea on the queen's part, but Sir Robert Peel thought unfavourably of it as an "empirical" plan, and the question of expense was always mooted as a serious consideration. There is no doubt that the absence of a royal residence in Ireland was felt as a slur upon the Irish people in certain circles.

During these years the queen's family was rapidly becoming larger. Princess Alice (afterwards grand duchess of Hesse) was born on the 25th of April 1843; Prince Alfred (afterwards duke of Edinburgh and duke of Saxe-Coburg-Gotha) on the 6th of August 1844; Princess Helena (Princess Christian) on the 25th of May 1846; Princess Louise (duchess of Argyll) on the 18th of March 1848; and Prince Arthur (duke of Connaught) on the 1st of May 1850.

The queen and Lord Palmerston.

At the end of 1851 an important event took place, which ended a long-standing grievance on the part of the queen, in Lord Palmerston's dismissal from the office of foreign secretary on account of his expressing approval of Louis Napoleon's *coup d'état* in Paris. The circumstances are of extreme interest for the light they throw on the queen's estimate of her constitutional position and authority. Lord Palmerston had never been *persona grata* at court. His Anglo-Irish nature was not sympathetic with the somewhat formal character and German training of Prince Albert; and his views of ministerial independence were not at all in accord with those of the queen and her husband. The queen had more than once to remind her foreign secretary that his despatches must be seen by her before they were sent out, and though Palmerston assented, the queen's complaint had to be continually repeated. She also protested to the prime minister (Lord John Russell) in 1848, 1849 and 1850, against various instances in which Palmerston had expressed his own personal opinions in matters of foreign affairs, without his despatches being properly approved either by herself or by the cabinet. Lord John Russell, who did not want to offend his popular and headstrong colleague, did his best to smooth things over; but the queen remained exceedingly sore, and tried hard to get Palmerston removed, without success. On the 12th of August 1850 the queen wrote to Lord John Russell the following important memorandum, which followed in its terms a private memorandum drawn up for her by Stockmar a few months earlier (*Letters*, ii. 282):—

> "With reference to the conversation about Lord Palmerston which the queen had with Lord John Russell the other day, and Lord Palmerston's disavowal that he ever intended any disrespect to her by the various neglects of which she has had so long and so often to complain, she thinks it right, in order to avoid any mistakes for the future, to explain what it is she expects from the foreign secretary.

> “She requires—
>
> “1. That he will distinctly state what he proposes in a given case, in order that the queen may know as distinctly to what she has given her royal sanction.
>
> “2. Having given her sanction to a measure, that it be not arbitrarily altered or modified by the minister. Such an act she must regard as failing in sincerity to the crown, and justly to be visited by the exercise of her constitutional right of dismissing that minister. She expects to be kept informed of what passes between him and the foreign ministers, before important decisions are taken, based upon that intercourse; to receive the foreign despatches in good time, and to have the drafts for her approval sent her in sufficient time to make herself acquainted with their contents before they must be sent off. The queen thinks it best that Lord John Russell should show this letter to Lord Palmerston.”

Lord Palmerston took a copy of this letter, and promised to attend to its direction. But the queen thoroughly distrusted him, and in October 1851 his proposed reception of Kossuth nearly led to a crisis. Then finally she discovered (December 13) at the time of the *coup d' état*, that he had, of his own initiative, given assurances of approval to Count Walewski, which were not in accord with the views of the cabinet and with the “neutrality which had been enjoined” by the queen. This was too much even for Lord John Russell, and after a short and decisive correspondence Lord Palmerston resigned the seals of office.

Death of the duke of Wellington: Prince Albert's position.

The death of the duke of Wellington in 1852 deeply affected the queen. The duke had acquired a position above parties, and was the trusted adviser of all statesmen and of the court in emergencies. The queen sadly needed such a counsellor, for Prince Albert's position was one full of difficulty, and party malignity was continually putting wrong constructions upon the advice which he gave, and imputing to him advice which he did not give. During the Corn Law agitation offence was taken at his having attended a debate in the House of Commons, the Tories declaring that he had gone down to overawe the house in favour of Peel's measures. After Palmerston's enforced resignation, there was a new and more absurd hubbub. A climax was reached when the difficulties with Russia arose which led to the Crimean War; the prince was accused by the peace party of wanting war, and by the war party of plotting surrender; and it came to be publicly rumoured that the queen's husband had been found conspiring against the state, and had been committed to the Tower. Some said that the queen had been arrested too, and the prince wrote to Stockmar: “Thousands of people surrounded the Tower to see the queen and me brought to it.” This gave infinite pain to the queen, and at length she wrote to Lord Aberdeen on the subject. Eventually, on 31st January 1854, Lord John Russell took occasion to deny most emphatically that Prince Albert interfered unduly with foreign affairs, and in both houses the statesmen of the two parties delivered feeling panegyrics of the prince, asserting at the same time his entire constitutional right to give private advice to the sovereign on matters of state. From this time it may be said that Prince Albert's position was established on a secure footing. He had declined (1850) to accept the post of commander-in-chief at the duke of Wellington's suggestion, and he always refused to let himself be placed in any situation which would have modified ever so slightly his proper relations with the queen. The queen was very anxious that he should receive the title of “King Consort,” and that the crown should be jointly borne as it was by William III. and Mary; but he himself never spoke a word for this arrangement. It was only to please the queen that he consented to take the title of Prince Consort (by letters patent of June 25, 1857), and he only did this when it was manifest that statesmen of all parties approved the change.

The Crimean War.

For the queen and royal family the Crimean War time was a very busy and exciting one. Her majesty personally superintended the committees of ladies who organized relief for the wounded; she helped Florence Nightingale in raising bands of trained nurses; she visited the crippled soldiers in the hospitals, and it was through her resolute complaints of the utter insufficiency of the hospital accommodation that Netley Hospital was built. The distribution of medals to the soldiers and the institution of the Victoria Cross (February 1857) as a reward for individual instances of merit and valour must also be noted among the incidents which occupied the queen's time and thoughts. In 1855 the emperor and empress of the French visited the queen at Windsor Castle, and the same year her majesty and the prince consort paid a visit to Paris.

The queen and her family.

The queen's family life was most happy. At Balmoral and Windsor the court lived in virtual privacy, and the queen and the prince consort saw much of their children. Countless entries in the queen's diaries testify to the anxious affection with which the progress of each little member of the household was watched. Two more children had been born to the royal pair, Prince Leopold (duke of Albany) on the 7th of April 1853, and on the 14th of April 1857 their last child, the princess Beatrice (Princess Henry of Battenberg), bringing the royal family up to nine—four sons and five daughters. Less than a year after Princess Beatrice's birth the princess royal was married to Prince Frederick William of Prussia, afterwards the emperor Frederick. The next marriage after the princess royal's was that of the princess Alice to Prince Louis (afterwards grand duke) of Hesse-Darmstadt in 1862. In 1863 the prince of Wales married the princess Alexandra of Denmark. In 1866 the princess Helena became the wife of Prince Christian of Schleswig-Holstein. In 1871 the princess Louise was wedded to the marquis of Lorne, eldest son of the duke of Argyll. In 1874 Prince Alfred, duke of Edinburgh, married Princess Marie Alexandrovna, only daughter of the tsar Alexander II. The duke of Connaught married in 1879 the princess Louise of Prussia, daughter of the soldier-prince Frederick Charles. In 1882 Prince Leopold, duke of Albany, wedded the princess Helen of Waldeck-Pyrmont. Finally came the marriage of Princess Beatrice in 1885 with Prince Henry of Battenberg.

On the occasion of the coming of age of the queen's sons and the marriages of her daughters parliament made provision. The prince of Wales, in addition to the revenues of the duchy of Cornwall, had £40,000 a year, the princess £10,000, and an addition of £36,000 a year for their children was granted by parliament in 1889. The princess royal received a dowry of £40,000 and £8000 a year for life, the younger daughters £30,000 and £6000 a year each. The dukes of Edinburgh, Connaught and Albany were each voted an income of £15,000, and £10,000 on marrying.

The American Civil War.

The dispute with the United States concerning the “Trent” affair of 1861 will always be memorable for the part played in its settlement by the queen and the prince consort. In 1861 the accession of Abraham Lincoln to the presidency of the United States of America caused the Southern States of the Union to revolt, and the war began. During November the British West India steamer “Trent” was boarded by a vessel of the Federal Navy, the “San Jacinto,” and Messrs Slidell and Mason, commissioners for the Confederate States, who were on their way to England, were seized. The British government were on the point of demanding reparation for this act in a peremptory manner which could hardly have meant anything but war, but Prince Albert insisted on revising Lord Russell's despatch in a way which gave the American government an opportunity to concede the surrender of the prisoners without humiliation. The memorandum from the queen on this point was the prince consort's last political draft.

Death of the prince consort.

The year 1861 was the saddest in the queen's life. On 16th March, her mother, the duchess of Kent, died, and on 14th December, while the dispute with America about the “Trent” affair was yet unsettled, the prince consort breathed his last at Windsor. His death left a void in the queen's life which nothing could ever fill. She built at Frogmore a magnificent mausoleum where she might be buried with him.

Never again during her reign did the queen live in London, and Buckingham Palace was only used for occasional visits of a few days.

Marriage of the prince of Wales.

At the time of the prince consort's death the prince of Wales was in his twenty-first year. He had spent several terms at each of the two universities of Oxford and Cambridge, and he had already travelled much, having visited most of Europe, Egypt and the United States. His marriage was solemnized at Windsor on the 10th of March 1863. The queen witnessed the wedding from the private pew or box of St George's Chapel, Windsor, but she wore the deep mourning which she was never wholly to put off to the end of her life, and she took no part in the festivities of the wedding.

Austro-Prussian War.

In foreign imperial affairs, and in the adjustment of serious parliamentary difficulties, the queen's dynastic influence abroad and her position as above party at home, together with the respect due to her character, good sense and experience, still remained a powerful element in the British polity, as was shown on more than one occasion. In 1866 the Austro-Prussian War broke out, and many short-sighted people were tempted to side with France when, in 1867, Napoleon III. sought to obtain a "moral compensation" by laying a claim to the duchy of Luxemburg. A conference met in London, and the difficulty was settled by neutralizing the duchy and ordering the evacuation of the Prussian troops who kept garrison there. But this solution, which averted an imminent war, was only arrived at through Queen Victoria's personal intercession. In the words of a French writer—

> "The queen wrote both to the king of Prussia and to the emperor Napoleon. Her letter to the emperor, pervaded with the religious and almost mystic sentiments which predominate in the queen's mind, particularly since the death of Prince Albert, seems to have made a deep impression on the sovereign who, amid the struggles of politics, had never completely repudiated the philanthropic theories of his youth, and who, on the battlefield of Solferino, covered with the dead and wounded, was seized with an unspeakable horror of war."

Disraeli and Gladstone.

Moreover, Disraeli's two premierships (1868, 1874–80) did a good deal to give new encouragement to a right idea of the constitutional function of the crown. Disraeli thought that the queen ought to be a power in the state. His notion of duty—at once a loyal and chivalrous one—was that he was obliged to give the queen the best of his advice, but that the final decision in any course lay with her, and that once she had decided, he was bound, whatever might be his own opinion, to stand up for her decision in public. The queen, not unnaturally, came to trust Disraeli implicitly, and she frequently showed her friendship for him. At his death she paid an exceptional tribute to his "dear and honoured memory" from his "grateful and affectionate sovereign and friend." To something like this position Lord Salisbury after 1886 succeeded. A somewhat different conception of the sovereign's functions was that of Disraeli's great rival, Gladstone, who, though his respect for the person and office of the sovereign was unbounded, not only expected all people, the queen included, to agree with him when he changed his mind, but to become suddenly enthusiastic about his new ideas. The queen consequently never felt safe with him. Nor did she like his manner—he spoke to her (she is believed to have said) as if she were a public meeting. The queen was opposed to the Disestablishment of the Irish Church (1869)—the question which brought Gladstone to be premier—and though she yielded with good grace, Gladstone was fretful and astonished because she would not pretend to give a hearty assent to the measure. Through her secretary, General Grey, the queen pointed out that she had not concealed from Gladstone "how deeply she deplored" his having felt himself under the necessity of raising the question, and how apprehensive she was of the possible consequences of the measure; but, when a general election had pronounced on the principle, when the bill had been carried through the House of Commons by unvarying majorities, she did not see what good could be gained by rejecting it in the Lords. Later, when through the skilful diplomacy of the primate the Lords had passed the second reading by a small but sufficient majority (179 to 146), and after amendments had been adopted, the queen herself wrote—

> "The queen . . . is very sensible of the prudence and, at the same time, the anxiety for the welfare of the Irish Establishment which the archbishop has manifested during the course of the debates, and she will be very glad if the amendments which have been adopted at his suggestion lead to a settlement of the question; but to effect this, concessions, the queen believes, will have to be made on *both* sides. The queen must say that she cannot view without alarm possible consequences of another year of agitation on the Irish Church, and she would ask the archbishop seriously to consider, in case the concessions to which the government may agree should not go so far as he may himself wish, whether the postponement of the settlement for another year may not be likely to result in worse rather than in better terms for the Church. The queen trusts, therefore, that the archbishop will himself consider, and, as far as he can, endeavour to induce the others to consider, any concessions that may be offered by the House of Commons in the most conciliatory spirit."

The correspondence of which this letter forms a part is one of the few published witnesses to the queen's careful and active interest in home politics during the latter half of her reign; but it is enough to prove how wise, how moderate and how steeped in the spirit of the Constitution she was. Another instance is that of the County Franchise and Redistribution Bills of 1884–85. There, again, a conflict between the two houses was imminent, and the queen's wish for a settlement had considerable weight in bringing about the curious but effective conference of the two parties, of which the first suggestion, it is believed, was due to Lord Randolph Churchill.

"Empress of India."

In 1876 a bill was introduced into parliament for conferring on the queen the title of "Empress of India." It met with much opposition, and Disraeli was accused of ministering simply to a whim of the sovereign, whereas, in fact, the title was intended to impress the idea of British suzerainty forcibly upon the minds of the native princes, and upon the population of Hindustan. The prince of Wales's voyage to India in the winter of 1875–76 had brought the heir to the throne into personal relationship with the great Indian vassals of the British crown, and it was felt that a further demonstration of the queen's interest in her magnificent dependency would confirm their loyalty.

Private life.

The queen's private life during the decade 1870–80 was one of quiet, broken only by one great sorrow when the Princess Alice died in 1878. In 1867 her majesty had started in authorship by publishing *The Early Days of the Prince Consort*, compiled by General Grey; in 1869 she gave to the world her interesting and simply written diary entitled *Leaves from the Journal of our Life in the Highlands*, and in 1874 appeared the first volume of *The Life and Letters of the Prince Consort* (2nd vol. in 1880), edited by Sir Theodore Martin. A second instalment of the Highland journal appeared in 1885. These literary occupations solaced the hours of a life which was mostly spent in privacy. A few trips to the Continent, in which the queen was always accompanied by her youngest daughter, the Princess Beatrice, brought a little variety into the home-life, and aided much in keeping up the good health which the queen enjoyed almost uninterruptedly. So far as public ceremonies were concerned, the prince and princess of Wales were now coming forward more and more to represent the royal family. People noticed meanwhile that the queen had taken a great affection for her Scottish man-servant, John Brown, who had been in her service since 1849; she made him her constant personal attendant, and looked on him more as a friend than as servant. When he died in 1883 the queen's grief was intense.

The Jubilee.

From 1880 onwards Ireland almost monopolized the field of domestic politics. The queen was privately opposed to Gladstone's Home Rule policy; but she observed in public a constitutional reticence on the subject. In the year, however, of the Crimes Act 1887, an event took place which was of more intimate personal concern to the queen, and of more attractive import to the country and the empire at large. June 20th was the fiftieth anniversary of her accession to the throne, and on the following day, for the second time in English history, a great Jubilee celebration was held to commemorate so happy an event. The country threw itself into the celebration with unchecked enthusiasm; large sums of money were everywhere subscribed; in every city, town and village something was done both in the way of rejoicing and in the way of establishing some permanent memorial of the event. In London the day itself was kept by a solemn service in Westminster Abbey, to which the queen went in state, surrounded by the most brilliant, royal, and princely escort that had ever accompanied a British sovereign, and cheered on her way by the applause of hundreds of thousands of her subjects. The queen had already paid a memorable visit to the East End, when she opened the People's Palace on the 14th of May. On the 2nd of July she reviewed at Buckingham Palace some 28,000 volunteers of London and the home counties. On the 4th of July she laid the foundation stone of the Imperial Institute, the building at Kensington to which, at the instance of the prince of Wales, it had been determined to devote the large sum of money collected as a Jubilee offering, and which was opened by the queen in 1893. On the 9th of July the queen reviewed 60,000 men at Aldershot; and, last and chief of all, on the 23rd of July, one of the most brilliant days of a brilliant summer, she reviewed the fleet at Spithead.

The queen and Bismarck.

The year 1888 witnessed two events which greatly affected European history, and in a minor, though still marked, degree the life of the English court. On the 9th of March the emperor William I. died at Berlin. He was succeeded by his son, the emperor Frederick III., regarded with special affection in England as the husband of the princess royal. But at the time he was suffering from a malignant disease of the throat, and he died on the 15th of June, being succeeded by his eldest son, the emperor William II., the grandson of the queen. Meanwhile Queen Victoria spent some weeks at Florence at the Villa Palmieri, and returned home by Darmstadt and Berlin. In spite of the illness of the emperor Frederick a certain number of court festivities were held in her honour, and she had long conversations with Prince Bismarck, who was deeply impressed by her majesty's personality. Just before, the prince, who was still chancellor, had taken a very strong line with regard to a royal marriage in which the queen was keenly interested—the proposal that Prince Alexander of Battenberg, lately ruler of Bulgaria, and brother of the queen's son-in-law, Prince Henry, should marry Princess Victoria, the eldest daughter of the emperor Frederick. Prince Bismarck, who had been anti-Battenberg from the beginning, vehemently opposed this marriage, on the ground that for reasons of state policy it would never do for a daughter of the German emperor to marry a prince who was personally disliked by the tsar. This affair caused no little agitation in royal circles, but in the end state reasons were allowed to prevail and the chancellor had his way.

1888–89.

The queen had borne so well the fatigue of the Jubilee that during the succeeding years she was encouraged to make somewhat more frequent appearances among her subjects. In May 1888 she attended a performance of Sir Arthur Sullivan's *Golden Legend* at the Albert Hall, and in August she visited Glasgow to open the magnificent new municipal buildings, remaining for a couple of nights at Blythswood, the seat of Sir Archibald Campbell. Early in 1889 she received at Windsor a special embassy, which was the beginning of a memorable chapter of English history: two Matabele chiefs were sent by King Lobengula to present his respects to the "great White Queen," as to whose very existence, it was said, he had up till that time been sceptical. Soon afterwards her majesty went to Biarritz, and the occasion was made memorable by a visit which she paid to the queen-regent of Spain at San Sebastian, the only visit that an English reigning sovereign had ever paid to the Peninsula.

Parliamentary grant to the prince of Wales's children.

The relations between the court and the country formed matter in 1889 for a somewhat sharp discussion in parliament and in the press. A royal message was brought by Mr W. H. Smith on the 2nd of July, expressing, on the one hand, the queen's desire to provide for Prince Albert Victor of Wales, and, on the other, informing the house of the intended marriage of the prince of Wales's daughter, the Princess Louise, to the earl (afterwards duke) of Fife. On the proposal of Mr Smith, seconded by Gladstone, a select committee was appointed to consider these messages and to report to the house as to the existing practice and as to the principles to be adopted for the future. The evidence laid before the committee explained to the country for the first time the actual state of the royal income, and on the proposal of Gladstone, amending the proposal of the government, it was proposed to grant a fixed addition of £36,000 per annum to the prince of Wales, out of which he should be expected to provide for his children without further application to the country. Effect was given to this proposal in a bill called "The Prince of Wales's Children's Bill," which was carried in spite of the persistent opposition of a small group of Radicals.

1890–91.

In the spring of 1890 the queen visited Aix-les-Bains in the hope that the waters of that health resort might alleviate the rheumatism from which she was now frequently suffering. She returned as usual by way of Darmstadt, and shortly after her arrival at Windsor paid a visit to Baron Ferdinand Rothschild at Waddesdon Manor. In February she launched the battleship "Royal Sovereign" at Portsmouth; a week later she visited the Horse Show at Islington. Her annual spring visit to the South was this year paid to the little town of Grasse.

Death of the duke of Clarence.

At the beginning of 1892 a heavy blow fell upon the queen in the death of the prince of Wales's eldest son Albert Victor, duke of Clarence and Avondale. He had never been of a robust constitution, and after a little more than a week's illness from pneumonia following influenza, he died at Sandringham. The pathos of his death was increased by the fact that only a short time before it had been announced that the prince was about to marry his second cousin, Princess May, daughter of the duke and duchess of Teck.

1893.

The death of the young prince threw a gloom over the country, and caused the royal family to spend the year in such retirement as was possible. The queen this year paid a visit to Costebelle, and stayed there for some quiet weeks. In 1893 the country, on the expiration of the royal mourning, began to take a more than usual interest in the affairs of the royal family. On the 19th of February the queen left home for a visit to Florence, and spent it in the Villa Palmieri. She was able to display remarkable energy in visiting the sights of the city, and even went as far afield as San Gimignano; and her visit had a notable effect in strengthening the bonds of friendship between the United Kingdom and the Italian people. On 28th April she arrived home, and a few days later the prince of Wales's second son, George, duke of York (see GEORGE V.), who by his brother's death had been left in the direct line of succession to the throne, was betrothed to the Princess May, the marriage being celebrated on 6th July in the Chapel Royal of St James's Palace.

1894.

In 1894 the queen stayed for some weeks at Florence, and on her return she stopped at Coburg to witness the marriage between two of her grandchildren, the grand duke of Hesse and the Princess Victoria Melita of Coburg. On the next day the emperor William officially announced the betrothal of the Cesarevitch (afterwards the tsar Nicholas II.) to the princess Alix of Hesse, a granddaughter whom the queen had always regarded with special affection. After a few weeks in London the queen went northwards and stopped at Manchester, where she opened the Ship Canal. Two days afterwards she celebrated her seventy-fifth birthday in quiet at Balmoral. A month later (June 23) took place the birth of a son to the duke and duchess of York, the child receiving the thoroughly English name of Edward.

In 1895 the queen lost her faithful and most efficient private secretary, General Sir Henry Ponsonby, who for many years

Death of Prince Henry of Battenberg.

had helped her in the management of her most private affairs and had acted as an intermediary between her and her ministers with singular ability and success. His successor was Sir Arthur Bigge. The following year, 1896, was marked by a loss which touched the queen even more nearly and more personally. At his own urgent request Prince Henry of Battenberg, the queen's son-in-law, was permitted to join the Ashanti expedition, and early in January the prince was struck down with fever. He was brought to the coast and put on board her majesty's ship "Blonde," where, on the 20th, he died.

The Diamond Jubilee.

In September 1896 the queen's reign had reached a point at which it exceeded in length that of any other English sovereign; but by her special request all public celebrations of the fact were deferred until the following June, which marked the completion of sixty years from her accession. As the time drew on it was obvious that the celebrations of this Diamond Jubilee, as it was popularly called, would exceed in magnificence those of the Jubilee of 1887. Mr Chamberlain, the secretary for the colonies, induced his colleagues to seize the opportunity of making the jubilee a festival of the British empire. Accordingly, the prime ministers of all the self-governing colonies, with their families, were invited to come to London as the guests of the country to take part in the Jubilee procession; and drafts of the troops from every British colony and dependency were brought home for the same purpose. The procession was, in the strictest sense of the term, unique. Here was a display, not only of Englishmen, Scotsmen, Irishmen, Welshmen, but of Mounted Rifles from Victoria and New South Wales, from the Cape and from Natal, and from the Dominion of Canada. Here were Hausas from the Niger and the Gold Coast, coloured men from the West India regiments, zaptiehs from Cyprus, Chinamen from Hong Kong, and Dyaks—now civilized into military police—from British North Borneo. Here, most brilliant sight of all, were the Imperial Service troops sent by the native princes of India; while the detachments of Sikhs who marched earlier in the procession received their full meed of admiration and applause. Altogether the queen was in her carriage for more than four hours, in itself an extraordinary physical feat for a woman of seventy-eight. Her own feelings were shown by the simple but significant message she sent to her people throughout the world: "From my heart I thank my beloved people. May God bless them." The illuminations in London and the great provincial towns were magnificent, and all the hills from Ben Nevis to the South Downs were crowned with bonfires. The queen herself held a great review at Aldershot; but a much more significant display was the review by the prince of Wales of the fleet at Spithead on Saturday, the 26th of June. No less than 165 vessels of all classes were drawn up in four lines, extending altogether to a length of 30 m.

The two years that followed the Diamond Jubilee were, as regards the queen, comparatively uneventful. Her health remained good, and her visit to Cimiez in the spring of 1898 was as enjoyable and as beneficial as before. In May 1899, after another visit to the Riviera, the queen performed what proved to be her last ceremonial function in London: she proceeded in "semi-state" to South Kensington, and laid the foundation stone of the new buildings completing the Museum—henceforth to be called the Victoria and Albert Museum—which had been planned more than forty years before by the prince consort.

The queen's last year.

Griefs and anxieties encompassed the queen during the last year of her life. But if the South African War proved more serious than had been anticipated, it did more to weld the empire together than years of peaceful progress might have accomplished. The queen's frequent messages of thanks and greeting to her colonies and to the troops sent by them, and her reception of the latter at Windsor, gave evidence of the heartfelt joy with which she saw the sons of the empire giving their lives for the defence of its integrity; and the satisfaction which she showed in the Federation of the Australian colonies was no less keen. The reverses of the first part of the Boer campaign, together with the loss of so many of her officers and soldiers, caused no small part of that "great strain" of which the *Court Circular* spoke in the ominous words which first told the country that she was seriously ill. But the queen faced the new situation with her usual courage, devotion and strength of will. She reviewed the departing regiments; she entertained the wives and children of the Windsor soldiers who had gone to the war; she showed by frequent messages her watchful interest in the course of the campaign and in the efforts which were being made throughout the whole empire; and her Christmas gift of a box of chocolate to every soldier in South Africa was a touching proof of her sympathy and interest. She relinquished her annual holiday on the Riviera, feeling that at such a time she ought not to leave her country. Entirely on her own initiative, and moved by admiration for the fine achievements of "her brave Irish" during the war, the queen announced her intention of paying a long visit to Dublin; and there, accordingly, she went for the month of April 1900, staying in the Viceregal Lodge, receiving many of the leaders of Irish society, inspecting some 50,000 school children from all parts of Ireland, and taking many a drive amid the charming scenery of the neighbourhood of Dublin. She went even further than this attempt to conciliate Irish feeling, and to show her recognition of the gallantry of the Irish soldiers she issued an order for them to wear the shamrock on St Patrick's Day, and for a new regiment of Irish Guards to be constituted.

Death of the queen.

In the previous November the queen had had the pleasure of receiving, on a private visit, her grandson, the German Emperor, who came accompanied by the empress and by two of their sons. This visit cheered the queen, and the successes of the army which followed the arrival of Lord Roberts in Africa occasioned great joy to her, as she testified by many published messages. But independently of the public anxieties of the war, and of those aroused by the violent and unexpected outbreak of fanaticism in China, the year brought deep private griefs to the queen. In 1899 her grandson, the hereditary prince of Coburg, had succumbed to phthisis, and in 1900 his father, the duke of Coburg, the queen's second son, previously known as the duke of Edinburgh, also died (July 30). Then Prince Christian Victor, the queen's grandson, fell a victim to enteric fever at Pretoria; and during the autumn it came to be known that the empress Frederick, the queen's eldest daughter, was very seriously ill. Moreover, just at the end of the year a loss which greatly shocked and grieved the queen was experienced in the sudden death, at Windsor Castle, of the Dowager Lady Churchill, one of her oldest and most intimate friends. These losses told upon the queen at her advanced age. Throughout her life she had enjoyed excellent health, and even in the last few years the only marks of age were rheumatic stiffness of the joints, which prevented walking, and a diminished power of eyesight. In the autumn of 1900, however, her health began definitely to fail, and though arrangements were made for another holiday in the South, it was plain that her strength was seriously affected. Still she continued the ordinary routine of her duties and occupations. Before Christmas she made her usual journey to Osborne, and there on the 2nd of January she received Lord Roberts on his return from South Africa and handed to him the insignia of the Garter. A fortnight later she commanded a second visit from the field-marshal; she continued to transact business, and until a week before her death she still took her daily drive. A sudden loss of power then supervened, and on Friday evening, the 18th of January, the *Court Circular* published an authoritative announcement of her illness. On Tuesday, the 22nd of January 1901, she died.

Queen Victoria was a ruler of a new type. When she ascended the throne the popular faith in kings and queens was on the decline. She revived that faith; she consolidated her throne; she not only captivated the affections of the multitude, but won the respect of thoughtful men; and all this she achieved by methods which to her predecessors would have seemed impracticable—methods which it required no less shrewdness to discover than force of character and honesty of heart to adopt steadfastly. Whilst all who approached the queen bore witness to her candour and reasonableness in relation to her ministers, all likewise proclaimed how anxiously she considered advice that was submitted to her before letting herself be persuaded that she must accept it for the good of her people.

Though richly endowed with saving common sense, the queen was not specially remarkable for high development of any specialized intellectual force. Her whole life, public and private, was an abiding lesson in the paramount importance of character. John Bright said of her that what specially struck him was her absolute truthfulness. The extent of her family connexions, and the correspondence she maintained with foreign sovereigns, together with the confidence inspired by her personal character, often enabled her to smooth the rugged places of international relations; and she gradually became in later years the link between all parts of a democratic empire, the citizens of which felt a passionate loyalty for their venerable queen.

By her long reign and unblemished record her name had become associated inseparably with British institutions and imperial solidarity. Her own life was by choice, and as far as her position would admit, one of almost austere simplicity and homeliness; and her subjects were proud of a royalty which involved none of the mischiefs of caprice or ostentation, but set an example alike of motherly sympathy and of queenly dignity. She was mourned at her death not by her own country only, nor even by all English-speaking people, but by the whole world. The funeral in London on the 1st and 2nd of February, including first the passage of the coffin from the Isle of Wight to Gosport between lines of warships, and secondly a military procession from London to Windsor, was a memorable solemnity: the greatest of English sovereigns, whose name would in history mark an age, had gone to her rest.

There is a good bibliographical note at the end of Mr Sidney Lee's article in the *National Dictionary of Biography*. See also the *Letters of Queen Victoria* (1907), and the obituary published by *The Times*, from which some passages have been borrowed above. (H. Ch.)

VICTORIA (or Vittoria), **TOMMASSO LUDOVICO DA** (*c.* 1540–*c.* 1613), Spanish musical composer, was born at Avila (unless, as Haberl conjectures, his title of *Presbyter Abulensis* refers not to his birthplace but to his parish as priest, so that his name would indicate that he was born at Vittoria). In 1573 he was appointed as Maestro di Cappella to the Collegium Germanicum at Rome, where he had probably been trained. Victoria left Rome in 1589, being then appointed vice-master of the Royal Chapel at Madrid, a post which he held until 1602. In 1603 he composed for the funeral of the empress Maria the greatest requiem of the Golden Age, which is his last known work, though in 1613 a contemporary speaks of him as still living. He was not ostensibly Palestrina's pupil; but Palestrina had the main influence upon his art, and the personal relations between the two were as intimate as were the artistic. The work begun by Morales and perfected by Palestrina left no stumbling-blocks in Victoria's path and he was able from the outset to express the purity of his ideals of religious music without having to sift the good from the bad in that Flemish tradition which had entangled Palestrina's path while it enlarged his style. From Victoria's first publication in 1572 to his last requiem (the *Officium Defunctorum* of 1605) there is practically no change of style, all being pure church music of unswerving loftiness and showing no inequality except in concentration of thought. Like his countryman and predecessor Morales, he wrote no secular music;[1] yet he differs from Morales, perhaps more than can be accounted for by his later date, in that his devotional spirit is impulsive rather than ascetic. His work is the crown of Spanish music: music which has been regarded as not constituting a special school, since it absorbed itself so thoroughly in the Rome of Palestrina. Yet, as has been aptly pointed out in the admirable article "Vittoria" in Grove's *Dictionary of Music and Musicians*, Roman music owes so much to that Spanish school which produced Guerrero, Morales and Victoria, that it might fairly be called the Hispano-Roman school. In spite of the comparative smallness of Victoria's output as compared with that of many of his contemporaries, there is no mistaking his claim to rank with Palestrina and Orlando di Lasso in the triad of supreme 16th-century masters. In any extensive anthology of liturgical polyphony such as the *Musica Divina* of Proske, his work stands out as impressively as Palestrina's and Lasso's; and the style, in spite of a resemblance to Palestrina which amounts to imitation, is as individual as only a successful imitator of Palestrina can be. That is to say, Victoria's individuality is strong enough to assert itself by the very act of following Palestrina's path. When he is below his best his style does not become crabbed or harsh, but over-facile and thin, though never failing in euphony. If he seldom displays an elaborate technique it is not because he conceals it, or lacks it. His mastery is unfailing, but his methods are those of direct emotional effect; and the intellectual qualities that strengthen and deepen this emotion are themselves innate and not sought out. The emotion is reasonable and lofty, not because he has trained himself to think correctly, but because he does not know that any one can think otherwise.

His works fill eight volumes in the complete edition of Messrs Breitkopf and Härtel. (D. F. T.)

VICTORIA, a British colonial state, occupying the south-eastern corner of Australia. Its western boundary is in 140° 58′ E.; on the east it runs out to a point at Cape Howe, in 150° E. long., being thus rudely triangular in shape; the river Murray constitutes nearly the whole of the northern boundary, its most northerly point being in 34° S. lat.; the southern boundary is the coast-line of the Southern Ocean and of Bass Strait; the most southerly point is Wilson's Promontory in 39° S. lat. The greatest length east and west is about 480 m.; the greatest width, in the west, is about 250 m. The area is officially stated to be 87,884 sq. m.

The coast-line may be estimated at about 800 m. It begins about the 141st meridian with bold but not lofty sandstone cliffs, worn into deep caves and capped by grassy undulations, which extend inland to pleasant park-like lands. Capes Bridgewater and Nelson form a peninsula of forest lands, broken by patches of meadow. To the east of Cape Nelson lies the moderately sheltered inlet of Portland Bay, consisting of a sweep of sandy beach flanked by bold granite rocks. Then comes a long unbroken stretch of high cliffs, which, owing to insetting currents, have been the scene of many calamitous wrecks. Cape Otway is the termination of a wild mountain range that here abuts on the coast. Its brown cliffs rise vertically from the water; and the steep slopes above are covered with dense forests of exceedingly tall timber and tree-ferns. Eastwards from this cape the line of cliffs gradually diminishes in height to about 20 to 40 ft. at the entrance to Port Phillip. Next comes Port Phillip Bay, at the head of which stands the city of Melbourne. When the tide recedes from this bay through the narrow entrance it often encounters a strong current just outside; the broken and somewhat dangerous sea thus caused is called "the Rip." East of Port Phillip Bay the shores consist for 15 m. of a line of sandbanks; but at Cape Schanck they suddenly become high and bold. East of this comes Western Port, a deep inlet more than half occupied by French Island and Phillip Island. Its shores are flat and uninteresting, in some parts swampy. The bay is shallow and of little use for navigation. The coast continues rocky round Cape Liptrap. Wilson's Promontory is a great rounded mass of granite hills, with wild and striking scenery, tree-fern gullies and gigantic gum-trees, connected with the mainland by a narrow sandy isthmus. At its extremity lie a multitude of rocky islets, with steep granite edges. North of this cape, and

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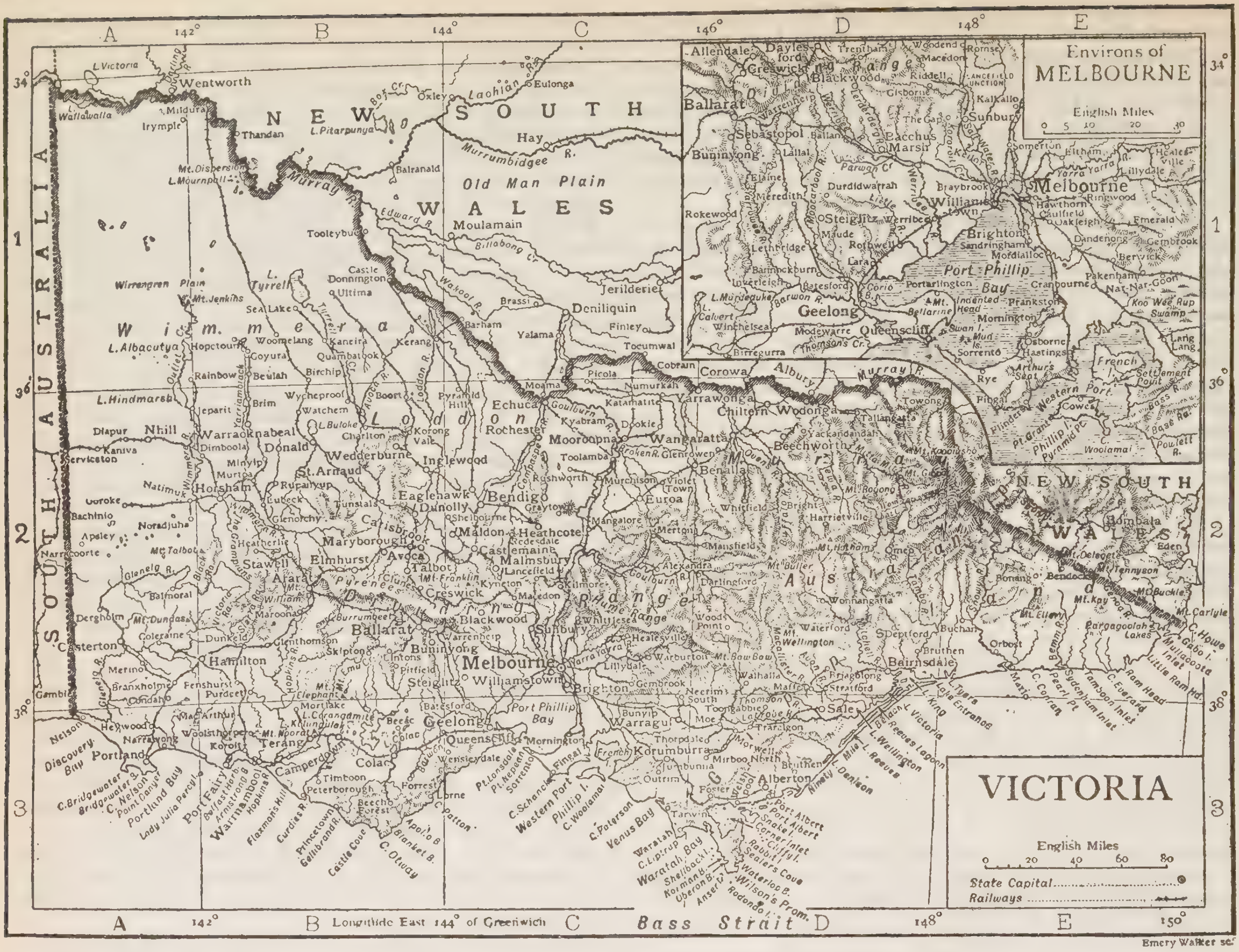
[1] One French song is mentioned by Hawkins, but no secular music appears in the prospectus of the modern complete edition of his works published by Breitkopf and Härtel.



Emery Walker sc.

opening to the east, lies Corner Inlet, which is dry at low water. The coast now continues low to the extremity of the colony. The slight bend northward forms a sort of bight called the Ninety Mile Beach, but it really exceeds that length. It is an unbroken line of sandy shore, backed by low sandhills, on which grows a sparse dwarf vegetation. Behind these hills comes a succession of lakes, surrounded by excellent land, and beyond these rise the soft blue outlines of the mountain masses of the interior. The shores on the extreme east are somewhat higher, and occasionally rise in bold points. They terminate in Cape Howe, off which lies Gabo Island, of small extent but containing an important lighthouse and signalling station.

The western half of Victoria is level or slightly undulating, and as a rule tame in its scenery, exhibiting only thinly timbered grassy lands, with all the appearance of open parks. The north-west corner of the colony, equally flat, is dry and sometimes sandy, and frequently bare of vegetation, though in one part some seven or eight millions of acres are covered with the dense brushwood known as "mallee scrub." This wide western plain is slightly broken in two places. In the south the wild ranges of Cape Otway are covered over a considerable area with richly luxurious but almost impassable forests. This district has been reserved as a state forest and its coast forms a favourite holiday resort, the scenery being very attractive. The middle of the plain is crossed by a thin line of mountains, known as the Australian Pyrenees, at the western extremity of which there are several irregularly placed transverse ranges, the chief being the Grampians, the Victoria Range and the Sierra Range. Their highest point is Mount William (3600 feet). The eastern half of the colony is wholly different. Though there is plenty of level land, it occurs in small patches, and chiefly in the south, in Gippsland, which extends from Corner Inlet to Cape Howe. But a great part of this eastern half is occupied with the complicated mass of ranges known collectively as the Australian Alps. The whole forms a plateau averaging from 1000 to 2000 ft. high, with many smaller tablelands ranging from 3000 to 5000 ft. in height. The highest peak, Bogong, is 6508 ft. in altitude. The ranges are so densely covered with vegetation that it is extremely difficult to penetrate them. About fifteen peaks over 5000 ft. in height have been measured. Along the ranges grow the giant trees for which Victoria is famous. The narrow valleys and gullies contain exquisite scenery, the rocky streams being overshadowed by groves of graceful tree-ferns, from amid whose waving fronds rise the tall smooth stems of the white gums. Over ten millions of acres are thus covered with forest-clad mountains which in due time will become a very valuable asset of the state. The Australian Alps are connected with the Pyrenees by a long ridge called the Dividing Range (1500 to 3000 ft. high).

Rivers.

Victoria is fairly well watered, but its streams are generally too small to admit of navigation. This, however, is not the case with the Murray river (*q.v.*). The Murray for a distance of 670 m. (or 1250 m. if its various windings be followed) forms the boundary between New South Wales and Victoria; it receives a number of tributaries from the Victorian side. The Mitta Mitta, which rises in the heart of the Australian Alps, is 150 m. long. The Ovens, rising among the same mountains, is slightly shorter. The Goulburn (340 m.) flows almost entirely through well-settled agricultural country, and is deep enough to be used in its lower part for navigation. The valley of this river is a fertile grain-producing district. The Campaspe (150 m.) has too little volume of water to be of use for navigation; its valley is also agricultural, and along its banks there lie a close succession of thriving townships. The Loddon (over 200 m.) rises in the Pyrenees. The upper part flows through a plain, to the right agricultural and to the left auriferous, containing nearly forty thriving towns, including Bendigo (formerly named Sandhurst) and Castlemaine. In the lower part of the valley the soil is also fertile, but the rainfall is small. To the west of the Loddon is the Avoca river with a length of 140 m.; it is of slight volume, and though it flows towards the Murray it loses itself in marshes and salt lagoons before reaching that river.

The rivers which flow southwards into the ocean are numerous. The Snowy river rises in New South Wales, and in Victoria flows entirely through wild and almost wholly unoccupied territory.

The Tambo (120 m. long), which rises in the heart of the Australian Alps, crosses the Gippsland plains and falls into Lake King, one of the Gippsland lakes; into the same lake falls the Mitchell river, rising also in the Australian Alps. The Mitchell is navigated for a short distance. The Latrobe empties itself into Lake Wellington after a course of 135 m.; it rises at Mount Baw Baw. The Yarra Yarra rises in the "Black Spur" of the Australian Alps. Emerging in a deep valley from the ranges, it follows a sinuous course through the undulating plains called the "Yarra Flats," which are wholly enclosed by hills, on whose slopes are some of the best vineyards of Australia; it finds its way out of the Flats between high and precipitous but well-wooded banks, and finally reaches Port Phillip Bay below Melbourne. Owing to its numerous windings its course through that city and its suburbs is at least thirty miles. Nearer to the sea its waterway, formerly available for vessels drawing 16 ft., has now been deepened so as to be available for vessels drawing 20 ft. The Barwon, farther west, is a river of considerable length but little volume, flowing chiefly through pastoral lands. The Hopkins and Glenelg (280 m.) both water the splendid pastoral lands of the west, the lower course of the former passing through the fertile district of Warrnambool, well known throughout Australia as a potato-growing region.

In the west there are Lakes Corangamite and Colac, due north of Cape Otway. The former is intensely salt; the latter is fresh, having an outlet for its waters. Lakes Tyrrell and Hindmarsh lie in the plains of the north-west. In summer they are dried up, and in winter are again formed by the waters of rivers that have no outlet. In the east are the Gippsland lakes, formed by the waters of the Latrobe, Mitchell and Tambo, being dammed back by the sandhills of the Ninety Mile Beach. They are connected with Bass Strait by a narrow and shifting channel through a shallow bar; the government of Victoria has done a great deal of late years to deepen the entrance and make it safer. The upper lake is called Lake Wellington; a narrow passage leads into Lake Victoria, which is joined to a wider expanse called Lake King. These are all fresh-water lakes and are visited by tourists, being readily accessible from Melbourne. (T. A. C.)

Geology.—Victoria includes a more varied and complete geological sequence than any other area of equal size in Australia. Its geological foundation consists of a band of Archean and Lower Palaeozoic rocks, which forms the backbone of the state. The sedimentary rocks in this foundation have been thrown into folds, of which the axes trend approximately north and south. The Lower Palaeozoic and Archean rocks build up the Highlands of Victoria, which occupy the whole width of the state at its eastern end, extending from the New South Wales border on the north to the shore of the Southern Ocean on the south. These Highlands constitute the whole of the mountainous country of Gippsland and the north-eastern districts. They become narrower to the west, and finally, beyond the old plateau of Dundas, disappear beneath the recent loams of the plains along the South Australian border. The Lower Palaeozoic and Archean rocks bear upon their surface some Upper Palaeozoic rocks, which occur in belts running north and south, and have been preserved by infolding or faulting; such are the Grampian Sandstones in the west; the Cathedral Mountain Sandstones to the north-east of Melbourne; the belt of Devonian and Lower Carboniferous rocks that extends across eastern Victoria, through Mount Wellington to Mansfield; and finally, far to the east, is the belt of the Snowy river porphyries, erupted by a chain of Lower Devonian volcanoes. Further Upper Palaeozoic rocks and the Upper Carboniferous glacial beds occur in basins on both northern and southern flanks of the Highlands. The Mesozoic rocks are confined to southern Victoria; they build up the hills of southern Gippsland and the Otway Ranges; and farther west, hidden by later rocks, they occur under the coast of the western district. Between the southern mountain chain and the Victorian Highlands occurs the Great Valley of Victoria, occupied by sedimentary and volcanic rocks of Kainozoic age. The North-Western Plains, occurring between the northern foot of the Highlands and the Murray, are occupied by Kainozoic sediments.

Victoria has a fairly complete geological sequence, though it is poorer than New South Wales in the Upper Carboniferous and Lower Mesozoic. The Archean rocks form two blocks of gneisses and schists, which build up the Highlands of Dundas in the west, and of the north-eastern part of Victoria. They were originally described as metamorphosed Silurian rocks, but must be of Archean age. Another series of Archean rocks is more widely developed, and forms the old framework upon which the geology of Victoria has been built up. They are known as the Heathcotian series, and consist of phyllites, schists and amphibolites; while their most characteristic feature is the constant association of foliated diabase and beds of jasperoids. Volcanic agglomerates occur in the series at the typical locality of Heathcote. The Heathcotian rocks form the Colbinabbin Range, which runs for 40 m. northward and southward, east of Bendigo. They are also exposed on the surface at the eastern foot of the Grampian Range, and at Dookie, and on the southern coast in Waratah Bay; they have been proved by bores under Rushworth, and they apparently underlie parts of the Gippsland coalfields. The Cambrian rocks have so far only been definitely proved near Mansfield. Mr A. M. Howitt has there collected some fragmentary remains of *Olenellus* and worm tubes of the Cambrian genus *Salterella*. These beds at Mansfield contain phosphatic limestones and wavellite.

The Ordovician system is well developed. It consists of slates and quartzites; and some schists around the granites of the western district, and in the Pyrenees, are regarded as metamorphic Ordovician. The Ordovician has a rich graptolitic fauna, and they have been classified into the following divisions:—

Upper Ordovician . .	Darriwill Series
Lower Ordovician . . .	Castlemaine Series Bendigo Series Lancefield Series

The Ordovician beds are best developed in a band running north-north-west and south-south-east across Victoria, of which the eastern boundary passes through Melbourne. This Ordovician band begins on the south with the block forming the plateau of Arthur's Seat and Mornington Peninsula, as proved by Ferguson. This outlier is bounded to the north by the depression of Port Phillip and the basalt plains west of Melbourne. It reappears north of them at Lancefield, whence it extends along the Highlands, past Ballarat, with southern outliers as far as Steiglitz. It forms the whole of the Ballarat Plateau, and is continued northward through the goldfields of Castlemaine, Bendigo and the Pyrenees, till it dips under the North-Western Plains. Certain evidence as to the age of the rocks in the Pyrenees has not yet been collected, and they may be pre-Ordovician. Some Upper Ordovician rocks occur in the mountains of eastern Gippsland, as near Woods Point, and in north-eastern Victoria, in Wombat Creek.

The Silurian system consists of two divisions: the lower or Melbournian, and the upper or Yeringian. Both consist in the main of sandstones, quartzites and shales; but the upper series includes lenticular masses of limestone, at Lillydale, Loyola and along the Thomson river. The limestones are rich in typical Silurian corals and bryozoa, and the shales and sandstones contain brachiopods and trilobites. The Silurian rocks are well exposed in sections near Melbourne; they occur in a belt running from the southern coast at Waratah Bay, west of Wilson's Promontory, north-north-westward across Victoria, and parallel to the Ordovician belt, which underlies them on the west. The Silurian rocks include the goldfields of the Upper Yarra, Woods Point, Walhalla and Rushworth, while the limestones are worked for lime at Lillydale and Waratah Bay. The Devonian system includes representatives of the lower, middle and upper series. The Lower Devonian series includes the porphyries and their associated igneous rocks, along the valley of the Snowy river. They represent the remains of an old chain of volcanoes which once extended north and south across Victoria. The Middle Devonian is mainly formed of marine sandstones, and limestones in eastern Gippsland. It is best developed in the valleys of the Mitchell, the Tambo and the Snowy rivers. The Upper Devonian rocks include sandstones, shales and coarse conglomerates. At the close of Middle Devonian times there were intense crustal disturbances, and the granitic *massifs*, which formed the primitive mountain axis of Victoria, were then intruded.

The Carboniferous system begins with the Avon river sandstones, containing *Lepidodendron*, and the red sandstones, with Lower Carboniferous fish, collected by Mr Geo. Sweet near Mansfield. Probably the Grampian Sandstone, the Cathedral Mountain Sandstone, and some in the Mount Wellington district belong to the same period. The Upper Carboniferous includes the famous glacial deposits and boulder clays, by which the occurrence of a Carboniferous glaciation in the Southern Hemisphere was first demonstrated. These beds occur at Heathcote, Bendigo, the Loddon Valley, southern Gippsland and the North-Eastern district. The beds comprise boulder clay, containing ice-scratched boulders, and sometimes rest upon ice-scratched, moutonné surfaces, and some lake deposits, similar to those laid down in glacial lakes. The glacial beds are overlain by sandstones containing *Gangamopteris*, and Kitson's work in Northern Tasmania leaves no doubt that they are on the horizon of the Greta or Lower Coal Measures of New South Wales.

The Mesozoic group is represented only by Jurassic rocks, which form the mountains of southern Gippsland and include its coalfields. The rocks contain fossil land plants, occasional fish remains and the claw of a dinosaur, &c. The coal is of excellent quality. The mudstones, which form the main bulk of this series, are largely composed of volcanic debris, which decomposes to a fertile soil. These rocks trend south-westward along the Bass Range, which reaches Western Port. They skirt the Mornington Peninsula underlie part of Port Phillip and the Bellarine Peninsula, and are exposed in the Barrabool Hills to the south-west of Geelong; thence they extend into the Otway Ranges, which are wholly built of these rocks and contain some coal seams. Farther west they disappear below the recent sediments and volcanic rocks of the Warrnambool district. They are exposed again in the Portland Peninsula, and rise again to form the Wannon Hills, to the south of Dundas.

The Kainozoic beds include three main series: lacustrine, marine and volcanic. The main lacustrine series is probably of Oligocene age, and is important from its thick beds of brown coal, which are thickest in the Great Valley of Victoria in southern Gippsland. A cliff face on the banks of the Latrobe, near Morwell, shows 90 ft. of it, and a bore near Morwell is recorded as having passed through 850 ft. of brown coal. Its thickness, at least in patches, is very great. The brown coals occur to the south-east of Melbourne, under the basalts between it and Geelong. Brown coal is also abundant under the Murray plains in north-western Victoria. The Kainozoic marine rocks occur at intervals along the southern coast and in the valleys opening from it. The most important horizon is apparently of Miocene age. The rocks occur at intervals in eastern Victoria, along the coast and up the river valleys, from the Snowy river westward to Alberton. At the time of the deposition of these beds Wilson's Promontory probably extended south-eastward and joined Tasmania; for the mid-Kainozoic marine deposits do not occur between Alberton and Flinders, to the west of Western Port. They extend up the old valley of Port Phillip as far as Keilor to the north of Melbourne, and are widely distributed under the volcanic rocks of the Western Plains. They are exposed on the floors of the volcanic cauldrons, and have been found by mining operations under the volcanic rocks of the Ballarat plateau near Pitfield. The Miocene sea extended up the Glenelg valley, round the western border of the Dundas Highlands, and spread over the Lower Murray Basin into New South Wales; its farthest south-eastern limit was in a valley at Stawell. Some later marine deposits occur at the Lakes Entrance in eastern Gippsland, and in the valley of the Glenelg.

The volcanic series begins with a line of great dacite domes including the geburite-dacite of Macedon, which is associated with sölvsbergites and trachy-dolerites. The eruption of these domes was followed by that of sheets of basalt of several different ages, and the intrusion of some trachyte dykes. The oldest basalts are associated with the Oligocene lake deposits; and fragments of the large lava sheets of this period form some of the table-topped mountains in the Highlands of eastern Victoria. The river gravels below the lavas have been worked for gold, and land plants discovered in the workings. At Flinders the basalts are associated with Miocene limestones. The largest development of the volcanic rocks are a series of confluent sheets of basalt, forming the Western Plains, which occupy over 10,000 sq. m. of south-western Victoria. They are crossed almost continuously by the South-Western railway for 166 m. from Melbourne to Warrnambool. The volcanic craters built up by later eruptions are well preserved: such are Mount Elephant, a simple breached cone; Mount Noorat, with a large primary crater and four secondary craters on its flanks; Mount Warrenheip, near Ballarat, a single cone with the crater breached to the north-west. Mount Franklin, standing on the Ordovician rocks north of Daylesford, is a weathered cone breached to the south-east. In addition to the volcanic craters, there are numerous volcanic cauldrons formed by subsidence, such as Bullenmerri and Gnotuk near Camperdown, Keilembete near Terang, and Tower Hill near Port Fairy. Tower Hill consists of a large volcanic cauldron, and rising from an island in a lake on its floor is a later volcanic crater.

The Pleistocene, or perhaps Upper Pliocene, deposits of most interest are those containing the bones of giant marsupials, such as the *Diprotodon* and *Palorchestes*, which have been found near Geelong, Castlemaine, Lake Kolungulak, &c.; at the last locality *Diprotodon* and various extinct kangaroos have been found in association with the dingo. There is no trace in these deposits of the existence of man, and J. W. Gregory has reasserted the striking absence of evidence of man's residence in Victoria, except for a very limited period. There is no convincing evidence of Pleistocene glacial deposits in Victoria. Of the many records, the only one that can still be regarded as at all probable is that regarding Mount Bogong.

The chief literature on the geology of Victoria is to be found in the maps and publications of the Geological Survey—a branch of the Mines Department. A map of the State, on the scale of eight inches to the mile, was issued in 1902. The Survey has published numerous quarter-sheet maps, and maps of the gold fields and parishes. The geology is described in the Reports, Bulletins and Memoirs of the Survey, and in the Quarterly Reports of the Mining Registrars. Statistics of the mining industry are stated in the Annual Report of the Secretary for Mines. See also the general summary of the geology of Victoria, by R. Murray, issued by the Mines Department in 1887 and 1895. Numerous papers on the geology of the State are contained in the *Trans. R. Soc. Victoria*, and on its mining geology in the *Trans. of the Austral. Inst. Min. Engineers*. The physical geography has been described by J. W. Gregory in the *Geography of Victoria* (1903). (J. W. G.)

Flora.—The native trees belong chiefly to the Myrtaceae, being largely composed of *Eucalypti* or gum trees. There are several hundred species, the most notable being *Eucalyptus amygdalina*, a tree with tall white stem, smooth as a marble column, and without branches for 60 or 70 ft. from the ground. It is singularly beautiful when seen in groves, for these have all the appearance of lofty pillared cathedrals. These trees are among the tallest in the world, averaging in some districts about 300 ft. The longest ever measured was found prostrate on the Black Spur: it measured 470 ft. in length; it was 81 ft. in girth near the root. *Eucalyptus globulus* or blue gum has broad green leaves, which yield the eucalyptus oil of the pharmacopoeia. *Eucalyptus rostrata* is extensively used in the colony as a timber, being popularly known as red gum or hard wood. It is quite unaffected by weather, and almost indestructible when used as piles for piers or wharves. Smaller species of eucalyptus form the common "bush." Melaleucas, also of Myrtacea kind, are prominent objects along all the coasts, where they grow densely on the sand-hills, forming "ti-tree" scrub. *Eucalyptus dumosa* is a species which grows only 6 to 12 ft. high, but with a straight stem; the trees grow so close together that it is difficult to penetrate the scrub formed by them. Eleven and a half million acres of the Wimmera district are covered with this "mallee scrub," as it is called. Recent legislation has made this land easy of acquisition, and the whole of it has been taken up on pastoral leases. Five hundred thousand acres have recently been taken up as an irrigation colony on Californian principles and laid out in 40-acre farms and orchards. The Leguminosae are chiefly represented by acacias, of which the wattle is the commonest. The black wattle is of considerable value, its gum being marketable and its bark worth from £5 to £10 a ton for tanning purposes. The golden wattle is a beautiful tree, whose rich yellow blossoms fill the river-valleys in early spring with delicious scent. The Casuarinae or she-oaks are gloomy trees, of little use, but of frequent occurrence. Heaths, grass-trees and magnificent ferns and fern-trees are also notable features in Victorian forests. But European and subtropical vegetation has been introduced into the colony to such an extent as to have largely altered the characters of the flora in many districts.

Fauna.—The indigenous animals belong almost wholly to the Marsupialia. Kangaroos are tolerably abundant on the grassy plains, but the process of settlement is causing their extermination. A smaller species of almost identical appearance called the wallaby is still numerous in the forest lands. Kangaroo rats, opossums, wombats, native bears, bandicoots and native cats all belong to the same class. The wombat forms extensive burrows in some districts. The native bear is a frugivorous little animal, and very harmless. Bats are numerous, the largest species being the flying fox, very abundant in some districts. Eagles, hawks, turkeys, pigeons, ducks, quail, snipe and plover are common; but the characteristic denizens of the forest are vast flocks of parrots, parakeets and cockatoos, with sulphur-coloured or crimson crests. The laughing jackass (giant kingfisher) is heard in all the country parts, and magpies are numerous everywhere. Snakes are numerous, but less than one-fourth of the species are venomous, and they are all very shy. The deaths from snake-bite do not average two per annum. A great change is rapidly taking place in the fauna of the country, owing to cultivation and acclimatization. Dingoes have nearly disappeared, and rabbits, which were introduced only a few years ago, now abound in such numbers as to be a positive nuisance. Deer are also rapidly becoming numerous. Sparrows and swallows are as common as in England. The trout, which has also been acclimatized, is taking full possession of some of the streams.

Climate.—Victoria enjoys an exceptionally fine climate. Roughly speaking, about one-half of the days in the year present a bright, cloudless sky, with a bracing and dry atmosphere, pleasantly warm but not relaxing. These days are mainly in the autumn and spring. During forty-eight years, ending with 1905, there have been on an average 132 days annually on which rain has fallen more or less (chiefly in winter, but rainy days do not exceed thirty in the year. The average yearly rainfall was 25·61 in. The disagreeable feature of the Victorian climate is the occurrence of north winds, which blow on an average about sixty days in the year. In winter they are cold and dry, and have a slightly depressing effect; but in summer they are hot and dry, and generally bring with them disagreeable clouds of dust. The winds themselves blow for periods of two or three days at a time, and if the summer has six or eight such periods it becomes relaxing and produces languor. These winds cease with extraordinary suddenness, being replaced in a minute or two by a cool and bracing breeze from the south. The temperature often falls 40° or 50° F. in an hour. The maximum shade temperature at Melbourne in 1905 was 108·5°, and the minimum 32°, giving a mean of 56·1°. The temperature never falls below freezing-point, except for an hour or two before sunrise in the coldest month. Snow has been known to fall in Melbourne for a few minutes two or three times during a long period of years. It is common enough, however, on the plateau; Ballarat, which is over 1000 ft. high, always has a few snowstorms, and the roads to Omeo among the Australian Alps lie under several feet of snow in the winter. The general healthiness of the climate is shown by the fact that the average death-rate for the last five years has been only 12·71 of the population.

Population.—As regards population, Victoria maintained the leading position among the Australasian colonies until the end of 1891, when New South Wales overtook it. The population in 1905 was 1,218,571, the proportion of the sexes being nearly equal. In 1860 the population numbered 537,847; in 1870, 720,599; in 1880, 860,067; and in 1890, 1,133,266. The state had gained little, if anything, by immigration during these years, for the excess of immigration over emigration from 1861 to 1870 and from 1881 to 1890 was counterbalanced by the excess of departures during the period 1871 to 1880 and from 1891 to 1905. The mean population of Melbourne in 1905 was 511,900.

The births in 1905 numbered 30,107 and the deaths 14,676, representing respectively 24·83 and 12·10 per 1000 of the population. The birth-rate has fallen markedly since 1875, as the following statement of the averages arranged in quinquennial periods shows:—

Period.	Births per 1000 of Population.	Period.	Births per 1000 of Population.
1861–65	43·30	1881–85	30·76
1866–70	39·27	1886–90	32·72
1871–75	35·69	1891–95	31·08
1876–80	31·43	1896–1900	26·20
		1901–1905	24·97

The number of illegitimate births during 1905 was 1689, which gives a proportion of 5·61 to every 100 births registered. The death-rate has greatly improved. Arranged in quinquennial periods the death-rates were:—

Period.	Deaths per 1000 of Population.	Period.	Deaths per 1000 of Population.
1861–65	17·36	1881–85	14·65
1866–70	16·52	1886–90	16·07
1871–75	15·64	1891–95	14·10
1876–80	14·92	1896–1900	13·67
		1901–1905	12·71

The marriages in 1905 numbered 8774, which represents a rate of 7·24 per 1000 persons. This was the highest number reached during a period of fourteen years, and was 564 more than in 1904 and 1169 more than in 1903. In the five years 1871–75 the marriage-rate stood at 6·38 per 1000; in 1876–80, 6·02; in 1881–85, 7·37; in 1886–90, 8·13; in 1901–5, 6·86.

Outside Melbourne and suburbs, the most important towns are Ballarat (49,648), Bendigo (43,666), Geelong (26,642), Castlemaine (8063), Warrnambool (6600), Maryborough (6000) and Stawell (5200).

Religion.—The Church of England, as disclosed at the census of 1901, had 432,704 adherents; the Roman Catholic Church came next with 263,710; the Presbyterians had 190,725; Wesleyans and Methodists, 180,272; Congregationalists, 17,141; Baptists, 32,648; Lutherans, 13,935; Jews, 5907; and the Salvation Army, whose Australian headquarters are in Melbourne, 8830.

Education.—There were in 1905 1930 state schools, in which there were 210,200 children enrolled, the teachers numbering 4689. There were also 771 private schools with 2289 teachers and a net enrolment of 43,014 children; the majority of them being connected with one or other of the principal religious denominations. The total cost of primary instruction in 1905 was £676,238, being 11s. 2d. per head of population and £4, 14s. 4d. per head of scholars in average attendance. Melbourne University maintains its high position as a teaching body. In 1905 the number of matriculants was 493 and the graduates 118.

Crime is decreasing. In 1905 the number of persons brought before the magistrates was 48,345. Drunkenness accounted for 14,458, which represents 11·92 per 1000 of the population: in 1901 the proportion was 14·43. Charges against the person numbered 1932, and against property 4032.

Administration.—As one of the six states of the Commonwealth, Victoria returns six senators and twenty-three representatives to the federal parliament. The local legislative authority is vested in a parliament of two chambers, both elective —the Legislative Council, composed of thirty-five members, and the Legislative Assembly, composed of sixty-eight members. One-half of the members of the Council retire every three years. The members of the Assembly are elected by universal suffrage for the term of three years, but the chamber can be dissolved at any time by the Governor in council. Members of the Assembly are paid £300 a year.

The whole of Victoria in 1905 was under the control of municipalities, with the exception of about 600 sq. m. in the mountainous part of Wonnangatta, and 64 sq. m. in French Island. The number of municipalities in that year was 206; they comprised 11 cities, 11 towns, 38 boroughs and 146 shires.

Finance.—The public revenue in 1905 showed an increase on that of the three previous years, being £7,515,142, equal to £6, 4s. 2d. per head of population; the expenditure amounted to £7,343,742, which also showed a slight increase and was equal to £6, 1s. 4d. per inhabitant. The public revenue in five-yearly periods since 1880 was: 1880, £4,621,282; 1885, £6,290,361; 1890, £8,519,159; 1895, £6,712,512; and 1901, £7,722,397. The chief sources of revenue in 1905 were: Customs duties (federal refunds), £2,017,378; other taxation, £979,029; railway receipts, £3,609,120; public lands, £408,836; other sources, £501,379. The main items of expenditure were: railways (working expenses), £2,004,601; public instruction, £661,794; interest and charges on public debt, £1,884,208; other services, £2,793,139. On the 30th of June 1905 the public debt of the state stood at £51,513,767, equal to £42, 9s. 7d. per inhabitant. The great bulk of the proceeds of loans was applied to the construction of revenue-yielding works, only about three millions sterling being otherwise used.

Up to 1905 the state had alienated 26,346,802 acres of the public domain, and had 17,994,233 acres under lease; the area neither alienated nor leased amounted to 11,904,725 acres.

The capital value of properties as returned by the municipalities in 1905 was £210,920,174, and the annual value £11,743,270. In 1884 the values were 104 millions and £8,099,000, and in 1891, 203 millions and £13,734,000; the year last mentioned marked the highest point of inflation in land values, and during the following years there was a vast reduction, both in capital and in annual values, the lowest point touched being in 1895; since 1895 a gradual improvement has taken place, and there is every evidence that this improvement will continue. The revenues of municipalities are derived chiefly from rates, but the rates are largely supplemented by fees and licences, and contributions for services rendered. Excluding government endowments and special grants, which in 1905 amounted to £90,572, the revenues of the municipalities in the years named were: 1880, £616,132; 1885, £789,429; 1890, £1,273,855; 1895, £1,038,720; 1900, £1,036,497; 1905, £1,345,221. In addition to the municipalities there are other local bodies empowered to levy rates; these and their revenues in 1905 were: Melbourne Harbour Trust, £189,983; Melbourne and Metropolitan Board of Works, £390,441; Fire Boards, £53,279. The Board of Works is the authority administering the metropolitan water and sewerage works. Excluding revenue from services rendered, the amount of taxation levied in Victoria reached in 1905 £4,621,608; of this the federal government levied £2,488,843, the state government £979,029, the municipalities £986,009, and the Melbourne Harbour Trust £167,727.

Productions and Industry: Minerals.—About 25,400 persons find employment in the goldfields, and the quantity of gold won in 1905 was 810,050 oz., valued at £3,173,744, a decrease of 10,967 oz. as compared with 1904. The dividends paid by gold-mining companies in 1905 amounted to £454,431, which, although about the average of recent years, showed a decline of £168,966 as compared with the sum distributed in 1904. Up to the close of 1905 the total value of gold won from the first discovery in 1851 was £273,236,500. No other metallic minerals are systematically worked, although many valuable deposits are known to exist. Brown coal, or lignite, occurs extensively, and attempts have frequently been made to use the mineral for ordinary fuel purposes, but without much success. Black coal is now being raised in increasingly large quantities. The principal collieries are the Outrim Howitt, the Coal Creek Proprietary, the Jumbunna and the Korumburra, all in the Gippsland district. The production of coal in 1905 was 155,185 tons, valued at £79,060; £4100 worth of silver and £11,159 worth of tin were raised; the value of other minerals produced was £93,392, making a total mineral production (exclusive of gold) of £187,711.

Agriculture.—Judged by the area under tillage, Victoria ranks first among the states of the Australian group. The area under crop in 1905 was 4,269,877 acres, compared with 2,116,000 acres in 1891 and 1,435,000 acres in 1881. Wheat-growing claims the chief attention, 2,070,517 acres being under that cereal in 1905. The areas devoted to other crops were as follows: maize, 11,785 acres; oats, 312,052 acres; barley, 40,938 acres; other cereals, 14,212 acres; hay, 591,771 acres; potatoes, 44,670 acres; vines, 26,402 acres; green foliage, 34,041 acres; other tillage, 73,574 acres; land in fallow comprised 1,049,915 acres. Victorian wheat is of exceptionally fine quality, and usually commands a high price in the London market. The average yield per acre in 1905 was 11·31 bushels; except for the year 1903, the total crop and the average per acre in 1905 were the highest ever obtained. The yield of oats was 23·18 bushels per acre, of barley 25·95, and of potatoes 2·58 tons. Great progress has been made in the cultivation of the grape vine, and Victoria now produces more than one-third of the wine made in Australia.

Live Stock.—The number of sheep in 1905 was 11,455,115. The quality of the sheep is steadily improving. Systematic attention to stock has brought about an improvement in the weight of the fleece, and careful observations show that between 1861 and 1871 the average weight of wool per sheep increased about one-third; between 1871 and 1881 about one pound was added to the weight per fleece, and there has been a further improvement since the year named. The following were the number of sheep depastured at the dates named: 1861, 6,240,000; 1871, 10,002,000; 1881, 10,267,000; 1891, 12,928,000; 1901, 10,841,790. The horses number 385,513, the swine 273,682, and the horned cattle 1,737,690; of these last, 649,100 were dairy cows. Butter-making has greatly increased since 1890, and a fairly large export trade has arisen. In 1905, 57,606,821 ℔ of butter were made, 4,297,350 ℔ of cheese and 16,433,665 ℔ of bacon and hams.

Manufactures.—There has been a good deal of fluctuation in the amount of employment afforded by the factories, as the following figures show: hands employed, 1885, 49,297; 1890, 56,639; 1893, 39,473; 1895, 46,095; 1900, 64,207; 1905, 80,235. Of the hands last named, 52,925 were males and 27,310 females. The total number of establishments was 4264, and the horse-power of machinery actually used, 43,492. The value of machinery was returned at £6,187,919, and of land and buildings £7,771,238. The majority of the establishments were small; those employing from 50 to 100 hands in 1905 were 161, and upwards of 100 hands, 124.

Commerce.—Excluding the coastal trade, the tonnage of vessels entering Victorian ports in 1905 was 3,989,903, or about 3¼ tons per inhabitant. The imports in the same year were valued at £22,337,886, and the exports at £22,758,828. These figures represent £18, 8s. 5d. and £18, 15s. 6d. per inhabitant respectively. The domestic produce exported was valued at £14,276,961; in 1891 the value was £13,026,426; and in 1881, £12,480,567. The comparatively small increase over the period named is due mainly to the large fall in prices of the staple articles of local production. There has, however, been some loss of trade due to the action of the New South Wales government in extending its railways into districts formerly supplied from Melbourne. The principal articles of local production exported during 1905 with their values were as follows: butter and cheese, £1,576,189; gold (coined and bullion), £1,078,560; wheat, £1,835,204; frozen mutton, £275,195; frozen and preserved rabbits and hares, £220,940; skins and hides, £535,086; wool, £2,501,990; horses, £278,033; cattle, £293,241; sheep, £326,526; oats, £165,585; flour, £590,297; hay and chaff, £97,471; bacon and ham, £89,943; jams and jellies, £73,233; fruit (dried and fresh), £125,330. The bulk of the trade passes through Melbourne, the imports in 1905 at that port being £18,112,528.

Defence.—The Commonwealth defence forces in Victoria number about 5700 men, 4360 being partially paid militia and 1000 unpaid volunteers. There are also 18,400 riflemen belonging to rifle clubs. Besides these there are 200 naval artillerymen, capable of being employed either as a light artillery land force, or on board war vessels. The total expenditure in 1905 for purposes of defence in the state was £291,577.

Railways.—The railways have a total length of 3394 m., and the cost of their construction and equipment up to the 30th of June 1905 was £41,259,387; this sum was obtained by raising loans, mostly in London, on the security of the general revenues of the state. In 1905 the gross railway earnings were £3,582,266, and the working expenses £2,222,279; so that the net earnings were £1,359,987, which sum represents 3·30% on the capital cost.

Posts and Telegraphs.—Victoria had a length of 6338 m. of telegraph line in operation in 1905; there were 969 stations, and the business done was represented by 2,256,482 telegrams. The post-offices, properly so-called, numbered 1673; during that year 119,689,000 letters and postcards and 59,024,000 newspapers and packets passed through them. The postal service is carried on at a profit; the revenue in 1905 was £708,369, and the expenditure £627,735. Telephones are widely used; in 1905 the length of telephone wire in use was 28,638 m., and the number of telephones 14,134; the revenue from this source for the year was £102,396.

Banking.—At the end of 1905 the banks of issue in Victoria, eleven in number, had liabilities to the extent of £36,422,844, and assets of £40,511,335. The principal items among the liabilities were: notes in circulation, £835,499; deposits bearing interest, £23,055,743; and deposits not bearing interest, £12,068,153. The chief assets were: coin and bullion, £8,056,666; debts due, £29,918,226; property, £1,919,230; other assets, £617,213. The money in deposit in the savings banks amounted to £10,896,741, the number of depositors being 447,382. The total sum on deposit in the state in 1905 was, therefore, £46,020,637, which represents £37, 15s. 4d. per head of population.

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(T. A. C.)

Early days.

History.—The first discoverer of Victoria was Captain Cook, in command of H.M.S. "Endeavour," who sighted Cape Everard, about half-way between Cape Howe and the mouth of the Snowy river, on the 19th of April 1770, a few days prior to his arrival at Botany Bay. The first persons to land in Victoria were the supercargo and a portion of the crew of the merchant ship "Sydney Cove," which was wrecked at the Furneaux Islands in Bass Strait on the 9th of February 1797. In the same year, Mr Bass, a surgeon in the navy, discovered the strait which bears his name and separates Victoria from Tasmania. Lieut. Grant in the "Lady Nelson" surveyed the south coast in 1800, and in 1801 Port Phillip was for the first time entered by Lieut. Murray. In 1802 that harbour was surveyed by Captain Flinders, and in the same year Mr Grimes, the surveyor-general of New South Wales, explored the country in the neighbourhood of the present site of Melbourne. In 1804 Lieut.-Colonel Collins, who had been sent from England, formed a penal settlement on the shores of Port Phillip, but after remaining a little more than three months near Indented Head, he removed his party to Van Diemen Land. Victoria was visited in 1824 by two sheep farmers named Hume and Hovell, who rode overland from Lake George, New South Wales, to the shores of Corio Bay. In 1826 a convict establishment was attempted by the government of New South Wales at Settlement Point, near French Island, Western Port Bay, but it was abandoned shortly afterwards. In 1834 Messrs Edward and Francis Henty, who had taken part in the original expedition to Swan river, West Australia, and afterwards migrated to Van Diemen Land, crossed Bass Strait, established a shore whaling station at Portland Bay, and formed sheep and cattle stations on the river Wannon and Wando rivulet, near the site of the present towns of Merino, Casterton and Coleraine. In 1835 a number of flock owners in Van Diemen Land purchased through Batman from the aborigines a tract of 700,000 acres on the shores of Port Phillip. The sale was repudiated by the British government, which regarded all unoccupied land in any part of Australia as the property of the crown, and did not recognize the title of the aborigines. Batman, however, remained at Port Phillip, and commenced farming within the boundaries of the present city of Melbourne. He was followed by John Pascoe Fawkner and other settlers from Van Diemen Land, who occupied the fertile plains of the new territory. In 1836 Captain Lonsdale was sent to Melbourne by the government of New South Wales to act as resident magistrate in Port Phillip. The first census taken in 1838 showed that the population was 3511, of whom 3080 were males and 431 females. In 1839 Mr Latrobe was appointed superintendent of Port Phillip, and a resident judge was nominated for Melbourne, with jurisdiction over the territory which now forms the state of Victoria. The years 1840 and 1841 were periods of depression owing to the decline in the value of all descriptions of live stock, for which the first settlers had paid high prices; but there was a steady immigration from Great Britain of men with means, attracted by the profits of sheep-farming, and of labourers and artisans who obtained free passages under the provisions of the Wakefield system, under which half the proceeds from the sale and occupation of crown lands were expended upon the introduction of workers. The whole district was occupied by sheep and cattle graziers, and in 1841 the population had increased to 11,738. Melbourne was incorporated as a town in 1842, and was raised to the dignity of a city in 1847. In that same year the first Anglican was ordained, and in 1848 the first Roman Catholic bishop. The third census (taken in 1846) showed a population of 32,870.

The elective element was introduced into the Legislative Council of New South Wales in 1842, in the proportion of twenty-four members to twelve nominated by the crown, and the district of Port Phillip, including Melbourne, returned six members. But the colonists were not satisfied with government from and by Sydney; an agitation in favour of separation commenced, and in 1851 Victoria was formed into a separate colony with an Executive Council appointed by the crown, and a Legislative Council, partly elective and partly nominated, on the same lines as that of New South Wales. The population at that date was 77,435. Gold was discovered a few weeks after the colony had entered upon its separate existence, and a large number of persons were attracted to the mines, first from the neighbouring colonies—some of which, such as South Australia, Van Diemen's Land and West Australia, were almost denuded of able-bodied men and women—and subsequently from Europe and America. Notwithstanding the difficulties with which the local government had to contend, the task of maintaining law and order was fairly grappled with; the foundations of a liberal system of primary, secondary and university education were laid; roads, bridges and telegraphs were constructed, and Melbourne was provided with an excellent supply of water.

Local self-government.

Local self-government was introduced in 1853, and the Legislature found time to discuss a new Constitution, which not only eliminated the nominee element from the Legislature, but made the executive government responsible to the people. The administration of the gold-fields was not popular, and the miners were dissatisfied at the amount charged for permission to mine for gold, and at there being no representation for the gold-fields in the local Legislature. The discontent culminated, at Ballarat in December 1854, in riots in which there was a considerable loss of life both amongst the miners and the troops. Eventually, an export duty on gold was substituted for the licence fee, but every miner had to take out a right which enabled him to occupy a limited area of land for mining, and also for residence. The census taken in 1854 showed a population of 236,778. The new Constitution was proclaimed in 1855, and the old Executive Council was gazetted as the first responsible ministry. It held office for about sixteen months, and was succeeded by an administration formed from the popular party. Several changes were made in the direction of democratizing the government, and vote by ballot, manhood suffrage and the abolition of the property qualification followed each other in rapid succession. To several of these changes there was strenuous opposition, not so much in the Assembly which represented the manhood, as in the Council in which the property of the colony was supreme. The crown lands were occupied by graziers, termed locally "squatters," who held them under a licence renewable annually at a low rental. These licences were very valuable, and the goodwill of a grazing farm or "run" commanded a high price. Persons who desired to acquire freeholds for the purpose of tillage could only do so by purchasing the land at auction, and the local squatters, unwilling to be deprived of any portion of a valuable property, were generally willing to pay a price per acre with which no person of small means desirous of embarking upon agricultural pursuits could compete. The result was that although the population had increased in 1861 to 540,322, the area of land under crop had not grown proportionately, and Victoria was dependent upon the neighbouring colonies and even more distant countries for a considerable portion of its food. A series of Land Acts was passed, the first in 1860, with the view of encouraging a class of small freeholders. The principle underlying all these laws was that residence by landowners on their farms, and their cultivation, were more important to the state than the sum realized by the sale of the land. The policy was only partially successful, and by a number of ingenious evasions a large proportion of the best land in the colony passed into the possession of the original squatters. But a sufficient proportion was purchased by small farmers to convert Victoria into a great agricultural country, and to enable it to export large quantities of farm and dairy produce.

The greater portion of the revenue was raised by the taxation through the customs of a small number of products, such as spirits, tobacco, wine, tea, coffee, &c. But an agitation arose in favour of such an adjustment of the import duties as would protect the manufactures which at that time were being commenced. A determined opposition to this policy was made by a large minority in the Assembly, and by a large majority in the Council, but by degrees the democratic party triumphed. The victory was not gained without a number of political crises which shook the whole fabric of society to its foundations. The Assembly tacked the tariff to the Appropriation Bill, and the Council threw out both. The result was that there was no legal means of paying either the civil servants or the contractors, and the government had recourse to an ingenious though questionable system by which advances were made by a bank which was recouped through the crown "confessing" that it owed the money, whereupon the governor issued his warrant for its payment without any recourse to parliament. Similar opposition was made by the Council to payment of members, and to a grant made to Lady Darling, the wife of Governor Sir Charles Darling, who had been recalled by the secretary of state on the charge of having shown partiality to the democratic party. Indeed on one occasion the dispute between the government and the Council was so violent that the former dismissed all the police, magistrates, county court judges and other high officials, on the ground that no provision had been made by the Council, which had thrown out the Appropriation Bill, for the payment of salaries.

Notwithstanding these political struggles, the population of the colony steadily increased, and the Legislature found time to pass some measures which affected the social life and the commercial position of the colonies. State aid to religion was abolished, and divorce was made comparatively easy. A system of free, compulsory and secular primary education was introduced. The import duties were increased and the transfer of land was simplified. In 1880 a fortnightly mail service via Suez between England and Melbourne was introduced, and in 1880 the first International Exhibition ever held in Victoria was opened. In the following year the census showed a population of 862,346, of whom 452,083 were males and 410,263 females. During the same year the lengthy dispute between the two houses of parliament, which had caused so much inconvenience, so many heartburnings and so many political crises, was brought to an end by the passage of an act which reduced the qualifications for members and the election of the Legislative Council, shortened the tenure of their seats, increased the number of provinces to fourteen and the number of members to forty-two. In 1883 a coalition government, in which the Liberal or protectionist and the Conservative or free-trade party were represented, took office, and with some changes remained in power for seven years. During this political truce several important changes were made in the Constitution. An act for giving greater facilities for divorce was passed, and with some difficulty obtained the royal assent. The Victorian railways were handed over to the control of three commissioners, who to a considerable extent were made independent of the government, and the civil service was placed under the supervision of an independent board. In 1887 the representatives of Victoria met those of the other British colonies and of the United Kingdom in London, under the presidency of Lord Knutsford, in order to discuss the questions of defence, postal and telegraphic communication, and the contribution of Australia to the Imperial navy. In 1888 a weekly mail service was established via Suez by the steamers of the P. & O. and the Orient Companies, and the second Victorian International Exhibition was opened. In 1890 all the Australian colonies, including New South Wales and New Zealand, sent representatives to a conference at Melbourne, at which resolutions were passed in favour of the establishment of a National Australian Convention empowered to consider and report upon an adequate scheme for the Federal Constitution. This Convention met in Sydney in 1891 and took the first step towards federation (see AUSTRALIA).

In 1891 the coalition government resigned and a Liberal administration was formed. An act passed in that year placed the railways again under the control of the government. Measures of a democratic and collectivist tendency have since obtained the assent of the Legislature. The franchise of property-holders not resident in an electorate was abolished and the principle of "one man one vote" was established. Acts have been passed sanctioning Old Age Pensions; prohibiting shops, except those selling perishable goods, from keeping open more than eight hours; compelling the proprietors to give their assistants one half-holiday every six days; preventing persons from working more than forty-eight hours a week; and appointing for each trade a tribunal composed of an equal number of employers and employed to fix a minimum wage. (See AUSTRALIA.)

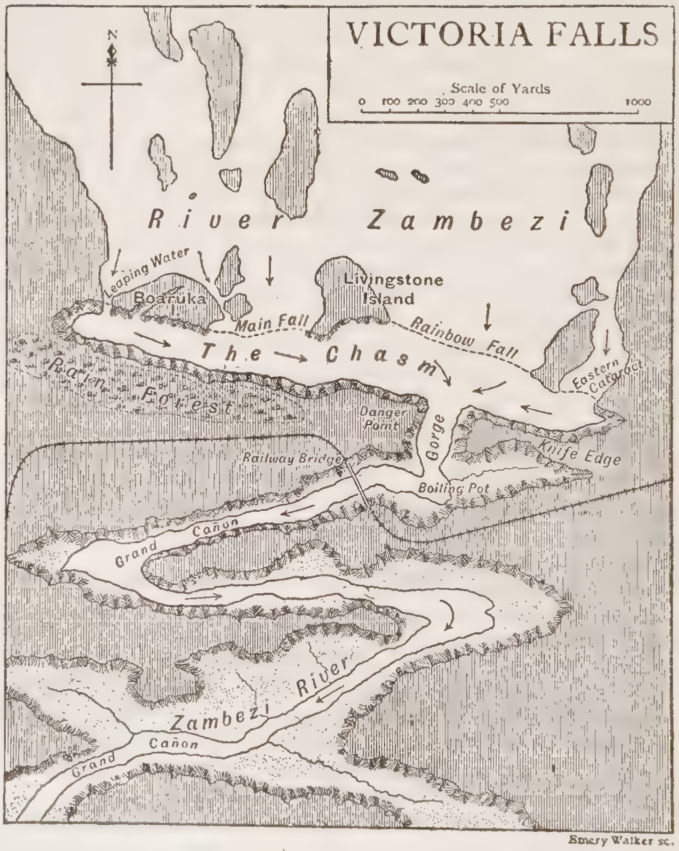
Crisis of 1892.

Victoria enjoyed a large measure of prosperity during the later 'eighties and earlier 'nineties, and its financial prosperity enabled the government to expend large sums in extending railway communication to almost every locality and to commence a system of irrigation. The soil of Victoria is on the whole more fertile than in any other colony on the mainland of Australia, and in no portion of the continent is there any locality equal in fertility to the western district and some parts of Gippsland. The rainfall is more equable than in any portion of Australia, but the northern and north-western districts, which are the most remote from the sea and the Dividing Range, are subject to droughts, which, although not so severe or so frequent as in the interior of the continent, are sufficiently disastrous in their effects. The results of the expenditure upon irrigation have not been so successful as was hoped. Victoria has no mountains covered with snow, which in Italy and South America supply with water the rivers at the season of the year when the land needs irrigation, and it was necessary to construct large and expensive reservoirs. The cost of water is therefore greater than the ordinary agriculturist who grows grain or breeds and fattens stock can afford to pay, although the price may not be too high for orchardists and vine-growers. In 1892 the prosperity of the colony was checked by a great strike which for some months affected production, but speculation in land continued for some time longer, especially in Melbourne, which at that time contained nearly half the population, 500,000 out of a total of 1,140,105. There does not seem to have been any other reasons for this increase in land values, for there was no immigration, and the value of every description of produce had fallen—except that the working classes were prosperous and well paid, and that the purchase of small allotments in the suburbs was a popular mode of investment. In 1893 there was a collapse. The value of land declined enormously, hundreds of persons believed to be wealthy were ruined, and there was a financial panic which caused the suspension of all the banks, with the exception of the Australasia, the Union of Australia, and the New South Wales. Most of them resumed payment, but three went into liquidation. It was some years before the normal condition of prosperity was restored, but the great resources of the colony and the energy of its people discovered new markets, and new products for them, and enabled them materially to increase the export trade. (G. C. L.)

VICTORIA, a city and port of Brazil, capital of the state of Espirito Santo, on the W. side of an island at the head of the Bay of Espirito Santo, 270 m. N.E. of Rio de Janeiro, in lat. 20° 18′ S., long. 40° 20′ W. Pop. (1902, estimated) 9000. The city occupies the beach and talus at the base of a high, wooded mountain. The principal streets follow the water-line, rising in terraces from the shore, and are crossed by narrow, steep, roughly paved streets. The buildings are old and of the colonial type. The governor's residence is an old convent, with its church at one side. The entrance to the bay is rather tortuous and difficult, but is sufficiently deep for the largest vessels. It is defended by five small forts. The harbour is not large, but is safe and deep, being completely shut in by hills. A large quay, pier, warehouses, &c., facilitate the handling of cargoes, which were previously transported to and from the anchorage by lighters. Victoria is a port of call for coasting steamers and a shipping port in the coffee trade. The other exports are sugar, rice and mandioca (manioc) to home ports.

Victoria was founded in 1535 by Vasco Fernando Coutinho, on the S. side and nearer the entrance to the bay, and received the name of Espirito Santo. The old site is still occupied, and is known as Villa Velha (Old Town). The name of Victoria was adopted in 1558 in commemoration of a crushing defeat inflicted by Fernando da Sa on the allied tribes of the Aimorés, Tapininguins and Goitacazes in that year. It was attacked (1592) by the freebooter Cavendish, who was repelled by one of the forts at the entrance to the bay.

VICTORIA, the capital of British Columbia and the principal city of Vancouver Island, in the S.E. corner of which it is finely situated (48° 25′ 20″ N., 123° 22′ 24″ W.), on a small arm of the sea, its harbour, however, only admitting vessels drawing 18 ft. Pop. (1906) about 25,000. It is the oldest city in the province. It has fine streets, handsome villas and public buildings, government offices and churches. The high school is affiliated with McGill University, in Montreal. Victoria is connected with the mainland by cable, and is a favourite tourist resort for the whole west coast of North America. Till 1858 Victoria was a post of the Hudson's Bay Company. The city was incorporated in 1862, and according to the census of 1886 the population was 14,000, including Chinese and Indians, spread over an area of 4 sq. m. Until the redistribution of the fleet in 1905, the headquarters of the British Pacific squadron was at Esquimalt, a fine harbour about 3 m. W. of Victoria. This harbour, though spacious, is not much used by merchant vessels. It is provided with a large dry-dock and is defended by fortifications of a modern type.



Emery Walker sc.

VICTORIA FALLS, the greatest waterfall in the world, forming the most remarkable feature of the river Zambezi, Central Africa. The falls are about midway in the course of the Zambezi in 17° 51′ S., 25° 41′ E. For a considerable distance above the falls the river flows over a level sheet of basalt, its valley bounded by low and distant sandstone hills. Its clear blue waters are dotted with numerous tree-clad islands. These islands increase in number as the river, without quickening its current, approaches the falls, whose nearness is indicated only by a veil of spray. At the spot where the Zambezi is at its widest—over 1860 yds.—it falls abruptly over the edge of an almost vertical chasm with a roar as of continuous thunder, sending up vast columns of vapour. Hence the native name *Musi-oa-tunya*, "Smoke does sound there." The chasm extends the whole breadth of the river and is more than twice the depth of Niagara, varying from 256 ft. at the right bank to 343 ft. in the centre. Unlike Niagara the water does not fall into an open basin but is arrested at a distance of from 80 to 240 ft. by the opposite wall of the chasm. Both walls are of the same height, so that the falls appear to be formed by a huge crack in the bed of the river. The only outlet is a narrow channel cut in the barrier wall at a point about three-fifths from the western end of the chasm, and through this gorge, not more than 100 ft. wide, the whole volume of the river pours for 130 yds. before emerging into an enormous zigzag trough (the Grand Cañon) which conducts the river past the basalt plateau. The tremendous pressure to which the water is subjected in the confinement of the chasm causes the perpetual columns of mist which rise over the precipice.

The fall is broken by islands on the lip of the precipice into four parts. Close to the right bank is a sloping cataract 36 yds. wide, called the Leaping Water, then beyond Boaruka Island, about 300 yds. wide, is the Main Fall, 473 yds. broad, and divided by Livingstone Island from the Rainbow Fall 535 yds. wide. At both these falls the rock is sharp cut and the river maintains its level to the edge of the precipice. At the left bank of the river is the Eastern Cataract, a millrace resembling the Leaping Water. From opposite the western end of the falls to Danger Point, which overlooks the entrance of the gorge, the escarpment of the chasm is covered with great trees known as the Rain Forest; looking across the gorge the eastern part of the wall (the Knife Edge) is less densely wooded.

At the end of the gorge the river has hollowed out a deep pool, named the Boiling Pot. It is some 500 ft. across; its surface, smooth at low water, is at flood-time troubled by slow, enormous swirls and heavy boilings. Thence the channel turns sharply westward, beginning the great zigzag mentioned. This grand and gloomy cañon is over 40 m. long. Its almost perpendicular walls are over 400 ft. high, the level of the escarpment being that of the lip of the falls. A little below the Boiling Pot, and almost at right angles to the falls, the cañon is spanned by a bridge (completed in April 1905) which forms a link in the Cape to Cairo railway scheme. This bridge, 650 ft. long, with a main arch of 500 ft. span, is slightly below the top of the gorge. The height from low-water level to the rails is 420 ft.

The volume of water borne over the falls varies greatly, the level of the river in the cañon sinking as much as 60 ft. between the full flood of April and the end of the dry season in October. When the river is high the water rolls over the main falls in one great unbroken expanse; at low water (when alone it is possible to look into the grey depths of the great chasm) the falls are broken by crevices in the rock into numerous cascades.

The falls are in the territory of Rhodesia. They were discovered by David Livingstone on the 17th of November 1855, and by him named after Queen Victoria of England. Livingstone approached them from above and gained his first view of the falls from the island on its lip now named after him. In 1860 Livingstone, with Dr (afterwards Sir John) Kirk, made a careful investigation of the falls, but until the opening of the railway from Bulawayo (1905) they were rarely visited. The land in the vicinity of the falls is preserved by the Rhodesian government as a public park.

See Livingstone's *Missionary Travels and Researches in South Africa* (London, 1857) for the story of the discovery of the falls, and the *Popular Account of Dr Livingstone's Expedition to the Zambesi and its Tributaries 1858–1864* (London, 1894) for a fuller description of the falls and a theory as to their origin. *How I crossed Africa*, by Major Serpa Pinto (English trans., London, 1881), contains a graphic account of the visit paid to the falls by the Portuguese explorer. In the *Geographical Journal* for January 1905 is an article by A. J. C. Molyneux on "The Physical History of the Victoria Falls." The article is illustrated by excellent photographs and gives a bibliography. Consult also "The Gorge and Basin of the Zambesi below the Victoria Falls," by G. W. Lamplugh in the *Geog. Jour.* (1908), vol. xxxi. (F. R. C.)

VICTORIA NYANZA, the largest lake in Africa and chief reservoir of the Nile, lying between 0° 20′ N. to 3° S. and 31° 40′ to 34° 52′ E. Among the fresh-water lakes of the world it is exceeded in size by Lake Superior only and has an area of over 26,000 sq. m., being nearly the size of Scotland. In shape it is an irregular quadrilateral, but its shores, save on the west, are deeply indented. Its greatest length, taking into account the principal gulfs, N. to S. is 250 m., its greatest breadth 200 m. Its coast-line exceeds 2000 m. It fills a depression in the central part of the great plateau which stretches between the western (Albertine) and eastern rift-valleys (see AFRICA, § 1), and has an elevation of about 3720 ft. above the sea.[1] Its greatest ascertained depth is some 270 ft., which compares with soundings of 2000 ft. on Tanganyika and 2500 ft. on Nyasa. Victoria Nyanza is remarkable for the severe and sudden storms which sweep across it, rendering navigation dangerous. It contains many groups of islands, the majority being near the coast-line. The lake is full of reefs, many just below the surface of the water, which is clear and very fresh. It is abundantly stocked with fish. Geological research shows that the land surrounding the lake consists of gneiss, quartz and schistose rocks, covered, in the higher regions, with marl and red clay, and in the valleys with a rich black loam.

Shores and Islands.—The shores of the lake present varied aspects. The western coast, which contains no large indentations, is, in its southern part, backed by precipices of 300 or more ft. high, behind which rise downs to thrice the height of the cliffs. Going north, the hills give way to papyrus and ambach swamps, which mark the delta of the Kagera. Beyond the mouth of that river the hills reappear, and increase in height, till on reaching the N.W. corner of the nyanza they rise some 500 ft. above the water. This western shore is marked by a continuous fault line which runs parallel to the lake at a short distance inland. The northern coast of the lake is very deeply indented and is marked throughout its length by rocky headlands jutting into the waters. This high land is very narrow, and the streams which rise on its northern face within a mile or two of the nyanza drain north away from the lake. On a promontory about 30 m. east of the Katonga (see below) is Entebbe, the port of Uganda and seat of the British administration. The chief indentations on the north side are Murchison Bay and Napoleon Gulf, the entrance to the last named being partly filled by the triangular-shaped island of Buvuma or Uvuma (area 160 sq. m.). Napoleon Gulf itself is deeply indented, one bay, that of Jinja, running N.W. and being the outlet of the Nile, the water here forcing its way through the rock-bound shore of the lake. The north-east corner of the lake is flat and bare. A narrow channel, partly masked by islands, leads into Kavirondo Gulf, which, with an average width of 6 m., extends 45 m. E. of the normal coast-line—a fact taken advantage of in building the railway from Mombasa to the lake. A promontory, 174 ft. above lake-level, jutting into the small bay of Ugowe, at the north-east end of Kavirondo Gulf, is the point where the railway terminates. The station is known as Port Florence. On the south side of the gulf tall hills approach, and in some cases reach, the water's edge, and behind them towers the rugged range of Kasagunga with its saw-like edge. Proceeding south the shore trends generally south-west and is marked with many deep inlets, the coast presenting a succession of bold bluffs, while inland the whole district is distinctly mountainous. At the S.E. corner of the lake Speke Gulf projects eastward, and at the S.W. corner Emin Pasha Gulf pushes southward. Here the coast is barren and hilly, while long ridges of rock run into the lake.

The largest island in the lake, Ukerewe, on the S.E. coast, immediately north of Speke Gulf, is almost a peninsula, but the strip of land connecting it with the shore is pierced by two narrow channels about ¾ of a mile long. Ukerewe is 25 m. long, and 12 broad at its greatest width. It is uninhabited, wooded and hilly, rising 650 ft. above the lake. At the N.W. corner of the nyanza is the Sessé archipelago, consisting of sixty-two islands. The largest island in this group, namely, Bugala, is narrow, resembling the letter S in shape, and is almost cut in two in the middle. Most of these islands are densely forested, and some of them attain considerable elevation. Their scenery is of striking beauty. Forty-two were inhabited.[2] Buvuma Island, at the entrance of Napoleon Gulf, has already been mentioned. Between it and as far as the mouth of Kavirondo Gulf are numerous other islands, of which the chief are Bugaïa, Lolui, Rusunga and Mfwanganu. In general characteristics and the beauty of their scenery these islands resemble those of the Sessé archipelago. The islands are of ironstone formation overlying quartzite and crystalline schists.

Rivers.—The Kagera, the largest and most important of the lake affluents, which has its rise in the hill country east of Lake Kivu, and enters the west side of the nyanza just north of 1° S., is described in the article NILE, of which it is the most remote head-stream. The other rivers entering Victoria Nyanza from the west are the Katonga and Ruizi, both north of the Kagera. The Katonga rises in the plateau east of the Dweru branch of Albert Edward Nyanza, and after a sluggish course of 155 m. enters Victoria Nyanza in a wide swamp at its N.W. corner. The Ruizi (180 m.) is a deep, wide and swift stream with sinuous course flowing in part through great gorges and in part through large swamps. It rises in the Ankole district and reaches the nyanza a little north of the Kagera. Between the Katonga and the Nile outlet, the rivers which rise close to the lake drain away northward, the watershed being the lake shore. On the N.E. side of the nyanza, however, several considerable streams reach the lake—notably the Sio, Nzoia and Lukos (or Yala). The Nzoia (150 m.), the largest of the three, rises in the foothills of the Elgeyo escarpment and flows swiftly over a rocky bed in a south-westerly direction, emptying into the lake south of Berkeley Bay. On the east side the Mara Dabagh enters the lake between 1° and 2° S. It is, next to the Kagera, the largest of the lake tributaries. All the rivers mentioned are perennial, and most of them bring down a considerable volume of water, even in the dry season. On the S., S.E. and S.W. shores a number of short rivers drain into the lake. They traverse a treeless and arid region, have but an intermittent flow, and are of little importance in the hydrography of the district. The only outlet of the lake is the Nile (*q.v.*).

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[1] For the altitude see *Geog. Jour.*, March 1907 and July 1908.

[2] To prevent the spread of sleeping sickness the inhabitants were removed to the mainland (1909).

Drainage Area, Rainfall and Lake Level.—The very important part played by the Victoria Nyanza in the Nile system has led to careful study of its drainage basin and rainfall and the perplexing variations in the level of the lake. The area drained by the lake covers, with the lake itself, 92,240 sq. m. In part it is densely forested, part consists of lofty mountains, and a considerable portion is somewhat arid tableland. According to the calculations of Sir William Garstin the rainfall over the whole area averages 50 in. a year. Allowing that as much as 25% of this amount enters the lake, this is equivalent to a total of 138,750,000,000 cub. metres in a year. Measurements at the Ripon Falls show that 18,000,000,000, or some 13% of this amount, is taken off by the Nile, and when allowance has been made for the annual rise and fall of the lake-level it is apparent that by far the greater part of the water which enters the nyanza is lost by evaporation; in fact, that the amount drawn off by the river plays a comparatively small part in the annual oscillation of the water surface. Rain falls more or less in every month, but is heaviest during March, April, May and again in September, October and November. The level of the lake is chiefly affected by the autumn rains and generally reaches its maximum in July. The annual rise and fall is on an average from 1 to 3 ft., but between November 1900 and June 1901 a difference of 42 in. was recorded. Considerable speculation was caused by the fact that whereas in 1878–79 the lake-level was high, from 1880 to 1890 the level was falling, and that after a few years (1892–95) of higher level there was, from 1896 to 1902, again a steady fall, amounting in seven years to 30 in. in the average levels of the lake. In 1903, however, the level rose and everywhere the land gained from the lake in the previous years was flooded. These variations are attributed by Sir William Garstin to deficiency or excess of rainfall. Any secular shrinking of the lake in common with the lakes of Central Africa generally must be so gradual as to have no practical importance. It must also be remembered that in such a vast sheet of water as is the nyanza the wind exercises an influence on the level, tending to pile up the water at different parts of the lake. The winds may also be the cause of the daily variation of level, which on Speke Gulf has been found to reach 20 in.; but this may also partake of the character of a "seiche." Currents setting towards the north or north-west have been observed in various parts of the lake.

Discovery and Exploration.—The quest for the Nile sources led to the discovery of the lake by J. H. Speke in 1858, and it was by him named Victoria in honour of the queen of England. In 1862 Speke and his companion, J. A. Grant, partially explored the N.W. shore, leaving the lake at the Nile outlet. Great differences of opinion existed as to its size until its circumnavigation in 1874 by H. M. Stanley, which proved it to be of vast extent. The invitation sent by King Mtesa of Uganda through Stanley to the Christian missionaries led to the despatch from England in 1876 of the Rev. C. T. Wilson, to whom we owe our first detailed knowledge of the nyanza. Mr Wilson and Lieut. Shergold Smith, R.N., made, in 1877, the first voyage across the nyanza. Lieut. Smith and a Mr O'Neill, both members of the Church Missionary Society, were in the same year murdered on Ukerewe Island. In 1889 Stanley further explored the lake, discovering Emin Pasha Gulf, the entrance to which is masked by several islands. In 1890 the ownership of the lake was divided by Great Britain and Germany, the first degree of south latitude being taken as the boundary line. The southern portion, which fell to Germany, was visited and described by scientists of that nation, whose objects, however, were not primarily geographic. At the instance of the British Foreign Office a survey of the northern shores of the lake was carried out in 1899–1900 by Commander B. Whitehouse, R.N. The same officer, in 1903, undertook, in agreement with the German government, a survey of the southern shores. Commander Whitehouse's work led to considerable modification of the previously accepted maps. He discovered numerous islands and bays whose existence had previously been unknown.

Previously to 1896 navigation was confined to Arab dhows, which trade between the south end of the lake and Uganda, and to canoes. In the year named a small steamer (the "Ruwenzori") was launched on the lake by a Zanzibar firm, while in 1900 a somewhat larger steamer (the "William Mackinnon"), built in Glasgow at the instance of Sir W. Mackinnon, and afterwards taken over by the British government, made her first trip on the lake. In 1903, the year in which the railway from Mombasa to the lake was completed, a steamer of 600 tons burden was launched at Port Florence. Since that date trade has considerably increased.

See NILE and UGANDA and the British Blue-book Egypt No. 2 (1904), which is a *Report by Sir Wm. Garstin upon the Basin of the Upper Nile*. This report, besides giving (pp. 4–24) much original information upon the Victoria Nyanza, summarizes the information of previous travellers, whose works are quoted. In 1908 the British Admiralty published a chart of the lake (scale 4 in. to the mile) from the surveys of Commander Whitehouse. Non-official books which deal with the lake include: C. T. Wilson, *Uganda and the Soudan* (London, 1882); (Sir) F. D. Lugard, *The Rise of our East African Empire*, vol. ii. (London, 1893); Franz Stuhlmann, *Mit Emin Pasha*, &c. (Berlin, 1894); Paul Kollmann, *The Victoria Nyanza* (English translation; London, 1899); E. G. Ravenstein, "The Lake-level of the Victoria Nyanza," *Geographical Journal*, October 1901; Sir H. H. Johnston, *The Uganda Protectorate* (London, 1902). In most of these publications the descriptions of the lake occupy but a small part. (W. E. G.; F. R. C.)

VICTORINUS, GAIUS MARIUS (4th century A.D.), Roman grammarian, rhetorician and neo-Platonic philosopher, an African by birth (whence his surname Afer), lived during the reign of Constantius II. He taught rhetoric at Rome (one of his pupils being Jerome), and in his old age became a convert to Christianity. His conversion is said to have greatly influenced that of Augustine. When Julian published an edict forbidding Christians to lecture on polite literature, Victorinus closed his school. A statue was erected in his honour as a teacher in the Forum Trajanum.

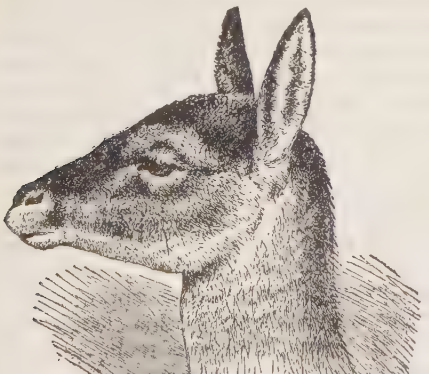
His translations of platonic writers are lost, but the treatise *De Definitionibus* (ed. T. Stangl in *Tulliana et Mario-Victoriniana*, Munich, 1888) is probably by him and not by Boëtius, to whom it was formerly attributed. His manual of prosody, in four books, taken almost literally from the work of Aphthonius, is extant (H. Keil, *Grammatici Latini*, vi.). It is doubtful whether he is the author of certain other extant treatises attributed to him on metrical and grammatical subjects, which will be found in Keil. His commentary on Cicero's *De Inventione* (in Halm's *Rhetores Latini Minores*, 1863) is very diffuse, and is itself in need of commentary. His extant theological writings, which will be found in J. P. Migne, *Cursus Patrologiae Latinae*, viii., include commentaries on *Galatians*, *Ephesians* and *Philippians*; *De Trinitate contra Arium*; *Ad Justinum Manichaeum de Vera Carne Christi*; and a little tract on "The Evening and the Morning were one day" (the genuineness of the last two is doubtful). Some Christian poems under the name of Victorinus are probably not his.

See G. Geiger, *C. Marius Victorinus Afer, ein neuplatonischer Philosoph* (Metten, 1888); G. Koffmann, *De Mario Victorino philosopho Christiano* (Breslau, 1880); R. Schmid, *Marius Victorinus Rhetor und seine Beziehungen zu Augustin* (Kiel, 1895); Gore in *Dictionary of Christian Biography*, iv.; M. Schanz, *Geschichte der römischen Litteratur*, iv. 1 (1904); Teuffel, *Hist. of Roman Literature* (Eng. tr., 1900), 408.

VICTOR-PERRIN, CLAUDE, DUKE OF BELLUNO (1764–1841), marshal of France, was born at La Marche (Vosges) on the 7th of December 1764. In 1781 he entered the army as a private soldier, and after ten years' service he received his discharge and settled at Valence. Soon afterwards he joined the local volunteers, and distinguishing himself in the war on the Alpine frontier, in less than a year he had risen to the command of a battalion. For his bravery at the siege of Toulon in 1793 he was raised to the rank of general of brigade. He afterwards served for some time with the army of the Eastern Pyrenees, and in the Italian campaign of 1796–97 he so acquitted himself at Mondovi, Roveredo and Mantua that he was promoted to be general of division. After commanding for some time the forces in the department of La Vendée, he was again employed in Italy, where he did good service against the papal troops, and he took a very important part in the battle of Marengo. In 1802 he was governor of the colony of Louisiana for a short time, in 1803 he commanded the Batavian army, and afterwards he acted for eighteen months (1805–6) as French plenipotentiary at Copenhagen. On the outbreak of hostilities with Prussia he joined the V. army corps (Marshal Lannes) as chief of the general staff. He distinguished himself at Saalfeld and Jena, and at Friedland he commanded the I. corps in such a manner that Napoleon gave him the marshalate. After the peace of Tilsit he became governor of Berlin, and in 1808 he was created duke of Belluno. In the same year he was sent to Spain, where he took a prominent part in the Peninsular War (especially at Espinosa, Talavera, Barrosa and Cadiz), until his appointment in 1812 to a corps command in the invasion of Russia. Here his most important service was in protecting the retreating army at the crossing of the Beresina. He took an active part in the wars of 1813–14, till in February of the latter year he had the misfortune to arrive too late at Montereau-sur-Yonne. The result was a scene of violent recrimination and his supersession by the emperor, who transferred his command to Gérard. Thus wounded in his amour-propre, Victor now transferred his allegiance to the Bourbon dynasty, and in December 1814 received from Louis XVIII. the command of the second military division. In 1815 he accompanied the king to Ghent, and on the second restoration he was made a peer of France. He was also president of a commission which inquired into the conduct of the officers during the Hundred Days, and dismissed Napoleon's sympathizers. In 1821 he was appointed war minister and held this office for two years. In 1830 he was major-general of the royal guard, and after the revolution of that year he retired altogether into private life. His death took place at Paris on the 1st of March 1841.

His papers for the period 1793–1800 have been published (Paris, 1846).

VICTUAL, food, provisions, most commonly in the plural, "victuals." The word and its pronunciation came into English from the O. Fr. *vitaille*. The modern French and English spelling are due to a pedantic approximation to the Latin original, *victualia*, a neuter plural substantive formed from *victualis*, *victus*, nourishment, provisions (*vivere*, to live). The most familiar use of the term is in "licensed victualler," to which the Licensing Act 1872 (§ 27) has applied the wide significance of any person selling any intoxicating liquor under a licence from a justice of the peace. Properly a "victualling house" is one where persons are provided with food and drink but not lodgings, and is thus distinct from an inn, which also provides the last.


Head of Vicugña.

VICUGÑA, one of the two wild living South American representatives of the camel-tribe, a *Camelidae* (see TYLOPODA). From its relative the guanaco the vicugña (*Lama vicunia*) differs by its inferior stature, more slender build and shorter head, as well as by the absence of bare patches or callosities on the hind limbs. The general colour of the woolly coat is orange-red. Vicugñas live in herds on the bleak and elevated parts of the mountain range bordering the region of perpetual snow, amidst rocks and precipices, occurring in various parts of Peru, in the southern part of Ecuador, and as far south as the middle of Bolivia. The wool is extremely delicate and soft, and highly valued for the purposes of weaving, but the quantity which each animal produces is not great.

VIDA, MARCO GIROLAMO (*c.* 1489–1566), Italian scholar and Latin poet, was born at Cremona shortly before the year 1490. He received the name of Marcantonio in baptism, but changed this to Marco Girolamo when he entered the order of the Canonici Regolari Lateranensi. During his early manhood he acquired considerable fame by the composition of two didactic poems in the Latin tongue, on the *Game of Chess* (*Scacchiae Ludus*) and on the *Silkworm* (*Bombyx*). This reputation induced him to seek the papal court in Rome, which was rapidly becoming the headquarters of polite learning, the place where students might expect advancement through their literary talents. Vida reached Rome in the last years of the pontificate of Julius II. Leo X., on succeeding to the papal chair (1513), treated him with marked favour, bestowed on him the priory of St Sylvester at Frascati, and bade him compose a heroic Latin poem on the life of Christ. Such was the origin of the *Christiad*, Vida's most celebrated, if not his best, performance. It did not, however, see the light in Leo's lifetime. Between the years 1520 and 1527 Vida produced the second of his masterpieces in Latin hexameters, a didactic poem on the *Art of Poetry* (see Baldi's edition, Würzburg, 1881). Clement VII. raised him to the rank of apostolic protonotary, and in 1532 conferred on him the bishopric of Alba. It is probable that he took up his residence in this town soon after the death of Clement; and here he spent the greater portion of his remaining years. Vida attended the council of Trent, where he enjoyed the society of Cardinals Cervini, Pole and Del Monte, together with his friend the poet Flaminio. A record of their conversations may be studied in Vida's Latin dialogue *De Republica*. Among his other writings should be mentioned three eloquent orations in defence of Cremona against Pavia, composed upon the occasion of some dispute as to precedency between those two cities. Vida died at Alba on the 27th of September 1566.

See the *Life* by Lancetti (Milan, 1840).

VIDAME (Lat. *vice-dominus*), a French feudal title. The vidame was originally, like the avoué (*advocatus*), an official chosen by the bishop of the diocese, with the consent of the count (see ADVOCATE). Unlike the advocate, however, the *vice-dominus* was at the outset an ecclesiastic, who acted as the bishop's lieutenant (*locum tenens*) or vicar. But the causes that changed the character of the *advocatus* operated also in the case of the vidame. During the Carolingian epoch, indeed, *advocatus* and *vice-dominus* were interchangeable terms; and it was only in the 11th century that they became generally differentiated: the title of avoué being commonly reserved for nobles charged with the protection of an abbey, that of vidame for those guarding an episcopal see. With the crystallization of the feudal system in the 12th century the office of vidame, like that of avoué, had become an hereditary fief. As a title, however, it was much less common and also less dignified than that of avoué. The *advocati* were often great barons who added their function of protector of an abbey to their own temporal sovereignty; whereas the vidames were usually petty nobles, who exercised their office in strict subordination to the bishop. Their chief functions were: to protect the temporalities of the see, to represent the bishop at the count's court of justice, to exercise the bishop's temporal jurisdiction in his name (*placitum* or *curia vice-domini*) and to lead the episcopal levies to war. In return they usually had a house near the episcopal palace, a domain within and without the city, and sometimes the right to levy certain dues on the city. The vidames usually took their title from the see they represented, but not infrequently they styled themselves, not after their official fief, but after their private *seigneuries*. Thus the vidame de Picquigny was the representative of the bishop of Amiens, the vidame de Gerberoy of the bishop of Beauvais. In many sees there were no vidames, their function being exercised by viscounts or châtelains. With the growth of the central power and of that of the municipalities the vidames gradually lost all importance, and the title became merely honorary

See A. Luchaire, *Manuel des institutions françaises* (Paris, 1892); Du Cange, *Glossarium* (ed. Niort, 1887), s. "Vice-dominus"; A. Mallet, "Étude hist. sur les avoués et les vidames," in *Position des thèses de l'École des chartes* (an. 1870–72).

VIDIN (formerly written WIDIN or WIDDIN), a fortified river-port and the capital of a department in the extreme N.E. of Bulgaria; on the right bank of the river Danube, near the Servian frontier and 151 m. W.N.W. of Sofia. Pop. (1906) 16,168, including about 3000 Turks and 1500 Spanish Jews—descendants of the refugees who fled hither from the Inquisition in the 16th century. Vidin is an episcopal see and the headquarters of a brigade; it was formerly a stronghold of some importance, and was rendered difficult to besiege by the surrounding marshes, formed where the Topolovitza and other streams join the Danube. A steam ferry connects it with Calafat, on the Rumanian bank of the Danube, and there is a branch railway to Mezdra, on the main line Sofia-Plevna. The city consists of three divisions—the modern suburbs extending beside the Danube, the citadel and the old town, still surrounded by walls, though only four of its nine towers remain standing. The old town, containing several mosques and synagogues and a bazaar, preserves its oriental appearance; the citadel is used as a military magazine. There are a modern cathedral, a school of viticulture and a high school, besides an ancient clock-tower and the palace (*Konak*) formerly occupied by the Turkish pashas. Vidin exports cereals and fruit, and is locally celebrated for its gold and silver filigree. It has important fisheries and manufactures of spirits, beer and tobacco.

Vidin stands on the site of the Roman town of Bononia in Moesia Superior, not to be confounded with the Pannonian Bononia, which stood higher up the Danube to the north of Sirmium. Its name figures conspicuously in the military annals of medieval and recent times; and it is specially memorable for the overthrow of the Turks by the imperial forces in 1689 and for the crushing defeat of the hospodar Michael Sustos by Pasvan Oglu in 1801. It was again the scene of stirring events during the Russo-Turkish Wars of 1854–55 and 1877–78, and successfully resisted the assaults of the Servians in the Servo-Bulgarian War of 1886–87.

VIDOCQ, FRANÇOIS EUGÈNE (1775–1857), French detective, was born at Arras in 1775 (or possibly 1773). After an adventurous youth he joined the French army, where he rose to be lieutenant. At Lille he was imprisoned as the result of a quarrel with a brother officer, and while in gaol became involved, possibly innocently, in the forgery of an order for the release of another prisoner. He was sentenced to eight years' hard labour, and sent to the galleys at Brest, whence he escaped twice but was recaptured. For the third time he succeeded in getting free, and lived for some time in the company of thieves and other criminals in Paris and elsewhere, making a careful study of their methods. He then offered his services as a spy to the Paris police (1809). The offer was accepted, on condition that he should extend his knowledge of the criminal classes by himself serving a further term in prison in Paris, and subsequently Vidocq was made chief of the reorganized detective department of the Paris police, with a body of ex-convicts under his immediate command. In this capacity Vidocq was extremely successful, for he possessed unbounded energy and a real genius for hunting down criminals. In 1827, having saved a considerable sum of money, he retired from his post and started a paper-mill, the work-people in which were drawn entirely from ex-convicts. The venture, however, was a failure, and in 1832 Vidocq re-entered the police service and was employed mainly in political work, though given no special office. Anxious to get back to his old detective post he himself foolishly organized a daring theft. The authorities were unable to trace the thieves, who at the proper moment were "discovered" by Vidocq. His real part in the matter became known, however, and he was dismissed from service. He subsequently started a private inquiry agency, which was indifferently successful, and was finally suppressed. Vidocq died in great poverty in 1857. Several volumes have been published under his name, the best known of which is *Mémoires de Vidocq* (1828). It is, however, extremely doubtful whether he wrote any of them.

See Charles Ledru, *La Vie, la mort et les derniers moments de Vidocq* (Paris, 1857).

VIDYASAGAR, ISWAR CHANDRA (1820–1891), writer and social reformer of Bengal, was born at Birsinha in the Midnapur district in 1820, of a Kulin Brahman family. He was removed to Calcutta at the age of nine, was admitted into the Sanskrit College, and carried on his studies in the midst of privations and extreme poverty. In 1839 he obtained the title of *Vidyasagar* (="Ocean of learning") after passing a brilliant examination, and in 1850 was appointed head pandit of Fort William College. In 1846 appeared his first work in Bengali prose, *The Twenty-Five Tales of a Betal*. This was succeeded by his *Sakuntala* in 1855, and by his greatest work, *The Exile of Sita*, in 1862. These are marked by a grace and beauty which Bengali prose had never known before. The literature of Bengal, previous to the 19th century, was entirely in verse. Ram Mohan Roy, the religious reformer of Bengal, created the literary prose of Bengal early in the 19th century by his numerous translations and religious tracts; and Iswar Chandra Vidyasagar and his fellow-worker, Akhay Kumar Datta, added to its power and beauty about the middle of that century. These three writers are generally recognized as the fathers of Bengali prose literature. As a social reformer and educationist, too, Iswar Chandra made his mark. He associated himself with Drinkwater Bethune in the cause of female education; and the management of the girls' school, called after Bethune, was entrusted to him in 1851. And when Rosomoy Datta resigned the post of secretary to the Sanskrit College of Calcutta, a new post of principal was created, and Iswar Chandra was appointed to it. Iswar Chandra's influence in the education department was now unbounded. He simplified the method of learning Sanskrit, and thus spread a knowledge of that ancient tongue among his countrymen. He was consulted in all educational matters by Sir Frederick Halliday, the first lieutenant-governor of Bengal. And when the great scheme of education under Sir Charles Wood's despatch of 1854 was inaugurated in India, Iswar Chandra established numerous aided schools under that scheme in the most advanced districts of Bengal. In 1858 he resigned his appointment under government, and shortly afterwards became manager of the Metropolitan Institution, a private college at Calcutta. But a greater task than literary work or educational reforms claimed his attention. He had discovered that the ancient Hindu scriptures did not enjoin perpetual widowhood, and in 1855 he startled the Hindu world by his work on the *Remarriage of Hindu Widows*. Such a work, from a learned and presumably orthodox Brahman, caused the greatest excitement, but Iswar Chandra remained unmoved amidst a storm of indignation. Associating himself with the most influential men of the day, like Prosonno Kumar Tagore and Ram Gopal Ghosh, he appealed to the British government to declare that the sons of remarried Hindu widows should be considered legitimate heirs. The British government responded; the act was passed in 1856, and some years after Iswar Chandra's own son was married to a widow. In the last years of his life Iswar Chandra wrote works against Hindu polygamy. He was as well known for his charity and wide philanthropy as for his educational and social reforms. His large income, derived from the sale of school-books, was devoted almost entirely to the succour of the needy; hundreds of young men owed their education to him; hundreds of widows depended on him for their daily bread. The Indian government made him a Companion of the Indian Empire in 1880. He died on the 29th of July 1891. (R. C. D.)

VIEIRA, ANTONIO (1608–1697), Portuguese Jesuit and writer, the "prince of Catholic pulpit-orators of his time," was born in Lisbon on the 6th of February 1608. Accompanying his parents to Brazil in 1615 he received his education at the Jesuit college at Bahia. He entered the Jesuit novitiate in 1625, and two years later pronounced his first vows. At the age of eighteen he was teaching rhetoric, and a little later dogmatic theology, at the college of Olinda, besides writing the "annual letters" of the province. In 1635 he received the priesthood. He soon began to distinguish himself as an orator, and the three patriotic sermons he delivered at Bahia (1638–40) are remarkable for their imaginative power and dignity of language. The sermon for the success of the arms of Portugal against Holland was considered by the Abbé Raynal to be "perhaps the most extraordinary discourse ever heard from a Christian pulpit." When the revolution of 1640 placed John IV. on the throne of Portugal, Brazil gave him its allegiance, and Vieira was chosen to accompany the viceroy's son to Lisbon to congratulate the new king. His talents and aptitude for affairs impressed John IV. so favourably that he appointed him royal preacher, gave him free access to the palace and constantly consulted him on the business of the state. Possessed of great political sagacity and knowledge of the lessons of history, Vieira used the pulpit as a tribune from which he propounded measures for improving the general and particularly the economic condition of Portugal. His pen was as busy as his voice, and in four notable pamphlets he advocated the creation of companies of commerce, the abolition of the distinction between Old and New Christians, the reform of the procedure of the Inquisition and the admission of Jewish and foreign traders, with guarantees for their security from religious persecution. Moreover, he did not spare his own estate, for in his Sexagesima sermon he boldly attacked the current style of preaching, its subtleties, affectation, obscurity and abuse of metaphor, and declared the ideal of a sermon to be one which sent men away "not contented with the preacher, but discontented with themselves." In 1647 Vieira began his career as a diplomat, in the course of which he visited England, France, Holland and Italy. In his *Papel Forte* he urged the cession of Pernambuco to the Dutch as the price of peace, while his mission to Rome in 1650 was undertaken in the hope of arranging a marriage between the heir to the throne of Portugal and the only daughter of King Philip IV. of Spain. His success, freedom of speech and reforming zeal had made him enemies on all sides, and only the intervention of the king prevented his expulsion from the Company of Jesus, so that prudence counselled his return to Brazil.

In his youth he had vowed to consecrate his life to the conversion of the negro slaves and native Indians of his adopted country, and arriving in Maranhão early in 1653 he recommenced his apostolic labours, which had been interrupted during his stay of fourteen years in the Old World. Starting from Pará, he penetrated to the banks of the Tocantins, making numerous converts to Christianity and civilization among the most savage tribes; but after two years of unceasing labour, during which every difficulty was placed in his way by the colonial authorities, he saw that the Indians must be withdrawn from the jurisdiction of the governors, to prevent their exploitation, and placed under the control of the members of a single religious society. Accordingly in June 1654 he set sail for Lisbon to plead the cause of the Indians, and in April 1655 he obtained from the king a series of decrees which placed the missions under the Company of Jesus, with himself as their superior, and prohibited the enslavement of the natives, except in certain specified cases. Returning with this charter of freedom, he organized the missions over a territory having a coast-line of 400 leagues, and a population of 200,000 souls, and in the next six years (1655–61) the indefatigable missionary set the crown on his work. After a time, however, the colonists, attributing the shortage of slaves and the consequent diminution in their profits to the Jesuits, began actively to oppose Vieira, and they were joined by members of the secular clergy and the other Orders who were jealous of the monopoly enjoyed by the Company in the government of the Indians. Vieira was accused of want of patriotism and usurpation of jurisdiction, and in 1661, after a popular revolt, the authorities sent him with thirty-one other Jesuit missionaries back to Portugal. He found his friend King John IV. dead and the court a prey to faction, but, dauntless as ever in the pursuit of his ambition, he resorted to his favourite arm of preaching, and on Epiphany Day, 1662, in the royal chapel, he replied to his persecutors in a famous rhetorical effort, and called for the execution of the royal decrees in favour of the Indians. Circumstances were against him, however, and the count of Castelmelhor, fearing his influence at court, had him exiled first to Oporto and then to Coimbra; but in both these places he continued his work of preaching, and the reform of the Inquisition also occupied his attention. To silence him his enemies then denounced him to that tribunal, and he was cited to appear before the Holy Office at Coimbra to answer points smacking of heresy in his sermons, conversations and writings. He had believed in the prophecies of a 16th-century shoemaker poet, Bandarra, dealing with the coming of a ruler who would inaugurate an epoch of unparalleled prosperity for the church and for Portugal, and in the *Quinto Imperio* or *Clavis Prophetarum* he had endeavoured to prove the truth of his dreams from passages of Scripture. As he refused to submit, the Inquisitors kept him in prison from October 1665 to December 1667, and finally imposed a sentence which prohibited him from teaching, writing or preaching. It was a heavy blow for the Company, and though Vieira recovered his freedom and much of his prestige shortly afterwards on the accession of King Pedro II., it was determined that he should go to Rome to procure the revision of the sentence, which still hung over him though the penalties had been removed. During a six years' residence in the Eternal City Vieira won his greatest triumphs. Pope Clement X. invited him to preach before the College of Cardinals, and he became confessor to Queen Christina of Sweden and a member of her literary academy. At the request of the pope he drew up a report of two hundred pages on the Inquisition in Portugal, with the result that after a judicial inquiry Pope Innocent XI. suspended it for five years (1676–81). Ultimately Vieira returned to Portugal with a papal bull exempting him from the jurisdiction of the grand inquisitor, and in January 1681 he embarked for Brazil. He resided in Bahia and occupied himself in revising his sermons for publication, and in 1687 he became superior of the province. A false accusation of complicity in an assassination, and the intrigues of members of his own Company, clouded his last months, and on the 18th of July 1697 he passed away.

His works form perhaps the greatest monument of Portuguese prose. Two hundred discourses exist to prove his fecundity, while his versatility is shown by the fact that he could treat the same subject differently on half a dozen occasions. His letters, simple and conversational in style, have a deep historical and political interest, and form documents of the first value for the history of the period. As a man, Vieira would have made a nobler figure if he had not been so great an egotist and so clever a courtier, and the readiness with which he sustained directly opposite opinions at short intervals with equal warmth argues a certain lack of sincerity. His name, however, is identified with great causes, justice to the Jews and humanity to the Indians, and the fact that he was in advance of his age led to many of his troubles, while his disinterestedness in money matters is deserving of all praise.

Principal works: *Sermoes* (Sermons) (15 vols., Lisbon, 1679–1748); there are many subsequent editions, but none complete; translations exist in Spanish, Italian, German and French, which have gone through several editions. *Historia do Futuro* (Lisbon, 1718; 2nd ed., ibid., 1755); this and the *Quinto Imperio* and the *Clavis Prophetarum* seem to be in essence one and the same book in different redactions. *Cartas* (Letters) (3 vols., Lisbon, 1735–46). *Noticias reconditas do modo de proceder a Inquisicão de Portugal com os seus presos* (Lisbon, 1821). The *Arte de Furtar* published under Vieira's name in many editions is now known not to be his. A badly edited edition of the works of Vieira in 27 volumes appeared in Lisbon, 1854–58. There are unpublished MSS. of his in the British Museum in London, and in the Bibliothèque Nationale in Paris. A bibliography of Vieira will be found in Sommervogel, *Bibliothèque de la compagnie de Jésus*, viii. 653–85.

AUTHORITIES.—André de Barros, *Vida* (Lisbon, 1746)—a panegyric by a member of the same society; D. Francisco Alexandre Lobo, bishop of Vizeu, "Historical and Critical Discourse," *Obras* (Lisbon, 1849), vol. ii.—a valuable study; João Francisco Lisboa, *Vida* (5th ed., Rio, 1891)—he is unjust to Vieira, but may be consulted to check the next writer; Abbé E. Carel, *Vieira, sa vie et ses œuvres* (Paris, 1879); Luiz Cabral, *Vieira, biog., caractère, éloquence* (Paris, 1900); idem, *Vieira pregador* (2 vols., Oporto, 1901); Sotero dos Reis, *Curso de litteratura Portugueza e Brazileira*, iii. 121–244. (E. PR.)

VIÉLÉ-GRIFFIN, FRANCIS (1864–), French poet, was born at Norfolk, Virginia, U.S.A., on the 26th of May 1864. He was educated in France, dividing his time between Paris and Touraine. His volumes include *Cueille d'avril* (1885); *Les Cygnes* (1887; new series, 1892); *La Chevauchée d'Yeldis* (1893); *Swanhilde*, a dramatic poem (1894); *Laus Veneris* (1895), a volume of translations from Swinburne; *Poèmes et Poésies* (1895), a collection containing much of his earlier work; *Phocas le jardinier* (1898); and *La Légende ailée de Wieland le Forgeron* (1899), a dramatic poem. M. Viélé-Griffin is one of the most successful writers of the *vers libre*, the theory of which he expounded, in conjunction with MM. Paul Adam and Bernard Lazare, in the pages of a periodical entitled *Entretiens politiques et littéraires* (1890–92). He is at his best in the adaptation of the symbolism of old legend to modern uses.

VIELLE, *viole*, *vièle*, a French term, derived from Lat. *fidicula*, embracing two distinct types of instruments: (1) from the 12th to the beginning of the 15th century bowed instruments having a box-soundchest with ribs, (2) from the middle or end of the 15th century, the hurdy-gurdy (*q.v.*). The medieval word *vielle* or *vièle* has often been incorrectly applied to the latter instrument by modern writers when dealing with the 13th and 14th centuries. The instruments included under the name of vielle, whatever form their outline assumed, always had the box-soundchest consisting of back and belly joined by ribs, which experience has pronounced the most perfect construction for bowed instruments. The most common shape given to the earliest vielles in France was an oval, which with its modifications remained in favour until the guitar-fiddle, the Italian lyra, asserted itself as the finest type, from which also the violin was directly evolved. (K. S.)

VIEN, JOSEPH MARIE (1716–1809), French painter, was born at Montpellier on the 18th of June 1716. Protected by Comte de Caylus, he entered at an early age the studio of Natoire, and obtained the *grand prix* in 1745. He used his time at Rome in applying to the study of nature and the development of his own powers all that he gleaned from the masterpieces around him; but his tendencies were so foreign to the reigning taste that on his return to Paris he owed his admission to the academy for his picture "Daedalus and Icarus" (Louvre) solely to the indignant protests of Boucher. When in 1776, at the height of his established reputation, he became director of the school of France at Rome, he took David with him amongst his pupils. After his return, five years later, his fortunes were wrecked by the Revolution; but he undauntedly set to work, and at the age of eighty (1796) carried off the prize in an open government competition. Bonaparte acknowledged his merit by making him a senator. He died at Paris on the 27th of March 1809, leaving behind him several brilliant pupils, amongst whom were Vincent, Regnault, Suvée, Ménageot, Taillasson and others of high merit; nor should the name of his wife, Marie Thérèse Reboul (1728–1805), herself a member of the academy, be omitted from this list. Their son, Marie Joseph, born in 1761, also distinguished himself as a painter.

VIENNA (Ger. *Wien*; Lat. *Vindobona*), the capital of the Austrian empire, the largest city in the Austro-Hungarian monarchy, and the fourth city in Europe as regards population. It is situated on the right bank of the Danube, at the base of the Wiener Wald, and at the beginning of the great plain which separates the Alps from the Carpathians. This plain is continued on the opposite bank of the Danube by the valley of the March, which constitutes the easiest access to the north. Thus Vienna forms a junction of natural ways from south to north, and from west to east. It also lies on the frontier which separates from one another three races, the German, the Slavonic and the Hungarian.

Curiously enough, Vienna has for a long time turned its back, so to speak, on the magnificent waterway of the Danube, the city being built about $1\frac{1}{2}$ m. away from the main stream. Only an arm of the river, the Danube Canal, so called because it was regulated and widened in 1598, passes through the city, dividing it into two unequal parts. It is true that the river forms at this point several arms, and the adjoining districts were subjected to periodical inundations, while navigation was by no means easy here. But in 1870 works for the regulation of the river were started with the object of making it quite safe for navigation, and of avoiding the dangers of inundation. By these magnificent works of regulation the new bed was brought nearer to the town, and the new river channel has an average width of 915 ft. and a depth of 10 ft. On its left bank stretches the so-called inundation region, 1525 ft. wide, while on the right bank quays have been constructed with numerous wharfs and warehouses. By these works of regulation over 2400 acres of ground were gained for building purposes. This new bed of the Danube was completed in 1876. In conjunction with this work the entire Danube Canal has been transformed into a harbour by the construction of a lock at its entrance, while increased accommodation for shipping has also been provided at the other end of the canal known as the winter harbour. Into the Danube Canal flows the small stream, called Wien, now arched over almost in its entirety. Vienna extends along the right bank of the Danube from the historic and legendary Kahlenberg to the point where the Danube Canal rejoins the main stream, being surrounded on the other side by a considerable stretch of land which is rather rural than suburban in character.

Vienna is officially divided into twenty-one districts or *Bezirke*. Until 1892 it contained only ten of the present districts; in that year nine outlying districts were incorporated with the town; in 1900 Brigittenau was created out of part of the old district of Leopoldstadt, and in 1905 the Floridsdorf district was made up by the incorporation of the following former suburbs: Aspern-an-der-Donau, Donaufeld, Floridsdorf, Gross Jedlersdorf, Hirschstetten, Jedlesee, Kagran, Leopoldau, Lobau-Insel and Stadlau. By the incorporation of the suburbs in 1892, the area of Vienna was more than trebled, namely, from $21\frac{1}{3}$ sq. m. to 69 sq. m.; while a new increase of about one-fifth of its total area was added by the incorporation of 1902. A feature of the new city is the unusually large proportion of woods and arable land within its bounds. These form nearly 60% of its total area, private gardens, parks and open spaces occupying a further 13%. While from the standpoint of population it takes the fourth place among European capitals, Vienna covers about three times as much ground as Berlin, which occupies the third place. But the bulk of its inhabitants being packed into a comparatively small portion of this area, the working classes suffer greatly from overcrowding, and all sections of the community from high rents.

The inner city, or Vienna proper, was formerly separated from the other districts by a circle of fortifications, consisting of a rampart, fosse and glacis. These, however, were removed in 1858–60, and the place of the glacis has been taken by a magnificent boulevard, the Ring-Strasse, 2 m. in length, and about 150 ft. in average width. Another series of works, consisting of a rampart and fosse, were constructed in 1704 to surround the whole city at that time, *i.e.* the first ten districts of modern Vienna. This second girdle of fortifications was known as the Lines (*Linien*), and a second wide boulevard (Gürtel-Strasse) follows their course round the city. This second or outer girdle of fortifications formed the boundary between the city and the outlying suburbs, but was removed in 1892, when the incorporation of the suburbs took place.

The inner town, which lies almost exactly in the centre of the others, is still, unlike the older parts of most European towns, the most aristocratic quarter, containing the palaces of the emperor and of many of the nobility, the government offices, many of the embassies and legations, the opera house and the principal hotels. Leopoldstadt which together with Brigittenau are the only districts on the left bank of the Danube Canal, is the chief commercial quarter, and is inhabited to a great extent by Jews. Mariahilf, Neubau and Margarethen are the chief seats of manufacturing industry. Landstrasse may be described as the district of officialism; here too are the British and German embassies. Alsergrund, with the enormous general hospital, the military hospital and the municipal asylum for the insane, is the medical quarter.

Near the centre of the inner city, most of the streets in which are narrow and irregular, is the cathedral of St Stephen, the most important medieval building in Vienna, dating in its present form mainly from the 14th and 15th centuries, but incorporating a few fragments of the original 12th-century edifice. Among its most striking features are the fine and lofty tower (450 ft.), rebuilt in 1860–64; the extensive catacombs, in which the emperors were formerly interred; the sarcophagus (1513) of Frederick III.; the tombs of Prince Eugene of Savoy; thirty-eight marble altars; and the fine groined ceiling. A little to the south-west of the cathedral is the Hofburg, or imperial palace, a huge complex of buildings of various epochs and in various styles, enclosing several courtyards. The oldest part of the present edifice dates from the 13th century, and extensive additions have been made since 1887. In addition to private rooms and state apartments, the Hofburg contains a library of about 800,000 volumes, 7000 incunabula and 24,000 MSS., including the celebrated "Papyrus Rainer"; the imperial treasury, containing the family treasures of the house of Habsburg-Lorraine, and other important collections.

In the old town are the two largest of the Höfe, extensive blocks of buildings belonging to the great abbeys of Austria, which are common throughout Vienna. These are the Schottenhof (once belonging to the "Scoti," or Irish Benedictines) and the Mölkerhof, adjoining the open space called the Freiung, each forming a little town of itself. As in most continental towns, the custom of living in flats is prevalent in Vienna, where few except the richer nobles occupy an entire house. Of late the so-called "Zinspaläste" ("tenement palaces") have been built on a magnificent scale, often profusely adorned without and within with painting and sculpture. Other notable buildings within the line of the old fortifications are the Gothic Augustine church, built in the 14th century, and containing a fine monument of Canova; the Capuchin church, with the burial vault of the Habsburgs; the church of Maria-Stiegen, an interesting Gothic building of the 14th century, restored in 1820; the handsome Greek church, by T. Hansen (1813–1891), finished in 1858; the Minorite church, a Gothic edifice of the 14th century, containing an admirable mosaic of Leonardo da Vinci's "Last Supper" by Raffaeli, executed in 1806–14 by order of Napoleon and placed here in 1846. Other churches worth mentioning are the Schottenkirche, built in the 13th century, reconstructed in the 17th and restored by H. von Ferstel (1828–1883), containing the tombs of the count of Starhemberg, the defender of Vienna against the Turks in 1683, and of Duke Heinrich Jasomirgott (d. 1177); the church of St Peter, reconstructed by Fischer von Erlach in 1702–13, and the University church, erected by the Jesuits in 1625–31, both in the baroque style with rich frescoes; lastly, the small church of St Ruprecht, the oldest church in Vienna, first built in 740, and several times reconstructed; and the old *Rathaus*. At the corner of the Graben, one of the busiest thoroughfares, containing the most fashionable shops in Vienna, is the *Stock im Eisen*, the stump of a tree, said to be the last survivor of a holy grove round which the original settlement of Vindomina sprang up. It is full of nails driven into it by travelling journeymen.

The Ring-Strasse ranks as one of the most imposing achievements of modern street architecture. Opposite the Hofburg, the main body of which is separated from the Ring-Strasse by the Hofgarten and Volksgarten, rise the handsome monument of the empress Maria Theresa (erected 1888) and the imperial museums of art and natural history, two extensive Renaissance edifices with domes (erected 1870–89), matching each other in every particular and grouping finely with the new part of the palace. Hans Makart's painted dome in the natural history museum is the largest pictorial canvas in the world. Adjoining the museums to the west is the palace of justice (1881), and this is closely followed by the houses of parliament (1883), in which the Grecian style has been successfully adapted to modern requirements. Beyond the houses of parliament stands the new *Rathaus*, an immense and lavishly decorated Gothic building, erected in 1873–83. It was designed by Friedrich Schmidt (1825–1891), who may be described as the chief exponent of the modern Gothic tendency as T. Hansen and G. Semper, the creators respectively of the parliament house and the museums, are the leaders of the Classical and Renaissance styles which are so strongly represented in Viennese architecture. Opposite the *Rathaus*, on the inner side of the Ring, is the new court theatre, another specimen of Semper's Renaissance work, finished in 1889. To the north stands the new building of the university, a Renaissance structure by H. von Ferstel, erected in 1873–84 and rivalling the *Rathaus* in extent. Near the university, and separated from the Ring by a garden, stands the votive church in Alsergrund, completed in 1879, and erected to commemorate the emperor's escape from assassination in 1853, one of the most elaborate and successful of modern Gothic churches (Ferstel). The other important buildings of the Ring-Strasse include the magnificent opera house, built 1861–69, by E. Van der Nüll (1812–1868) and A. von Siccardsburg (1813–1868), the sumptuous interior of which vies with that of Paris; the academy of art, built in 1872–76; the exchange, built in 1872–77, both by Hansen; and the Austrian museum of art and industry, an Italian Renaissance building erected by Ferstel in 1868–71. On the north side the Ring-Strasse gives place to the spacious Franz Josef's quay, flanking the Danube Canal. The municipal districts outside the Ring also contain numerous handsome modern buildings. Vienna possesses both in the inner city and the outlying districts numerous squares adorned with artistic monuments. One of the finest squares in the world for the beauty of the buildings which encircle it is the Rathausplatz, adjoining the Ring-Strasse.

Vienna is the intellectual as well as the material capital of Austria—emphatically so in regard to the German part of the empire. Its university, established in 1365, is now attended by nearly 6000 students, and the medical faculty enjoys a world-wide reputation. Its scientific institutions are headed by the academy of science. The academy of art was founded in 1707.

Museums.—In the imperial art-history museum are stored the extensive art-collections of the Austrian imperial family, which were formerly in the Hofburg, in the Belvedere, and in other places. It contains a rich collection of Egyptian, Greek, Roman and Etruscan antiquities; of coins and medals, and of industrial art. The last contains valuable specimens of the industrial art of the middle ages and of the Renaissance period in gold, silver, bronze, glass, enamel, ivory, iron and wood. The famous salt-cellar (*saliera*) of Benvenuto Cellini, executed in 1539–43 for Francis I. of France, is here. Then comes the collection of weapons and armour, including the famous Ambras collection, so called after the castle of Ambras near Innsbruck, where it was for a long time stored. The picture gallery, which contains the collection formerly preserved in the Belvedere palace, contains masterpieces of almost every school in the world, but it is unsurpassed for its specimens of Rubens, Dürer and the Venetian masters. Next come the imperial treasury at the Hofburg, already mentioned; the famous collection of drawings and engravings known as the Albertina in the palace of the archduke Frederick, which contains over 200,000 engravings and 16,000 drawings; the picture gallery of the academy of art; the collection of the Austrian museum of art and industry; the historical museum of the city of Vienna; and the military museum at the arsenal.

Besides, there are in Vienna a number of private picture galleries of great importance. The largest is that belonging to Prince Liechtenstein, containing about 800 paintings, and specially rich in important works by Rubens and Van Dyck; the picture gallery of Count Harrach, with over 400 paintings, possessing numerous examples of the later Italian and French schools; that of Count Czernin, with over 340 paintings; and that of Count Schönborn, with 110 pictures. The imperial natural history museum contains a mineralogical, geological and zoological section, as well as a prehistoric and ethnographical collection. Its botanic collection contains the famous Vienna herbarium, while to the university is attached a fine botanical garden. Besides the Hofburg library, there are important libraries belonging to the university and other societies, the corporation and the various monastic orders.

Parks, &c.—The Prater, a vast expanse (2000 acres) of wood and park on the east side of the city, between the Danube and the Danube Canal, is greatly frequented by all classes. The exhibition of 1873 was held in this park, and several of its buildings, including the large rotunda, have been left standing. Other parks are the Hofgarten, the Volksgarten and the Town Park, all adjoining the Ring-Strasse; the Augarten in the Leopoldstadt, the Belvedere Park in the Landstrasse, the Esterházy Park in Mariahilf, and the Türkenschanz Park in Döbling. Among the most popular resorts are the parks and gardens belonging to the imperial châteaux of Schönbrunn and Laxenburg.

Government and Administration.—Vienna is the residence of the emperor of Austria, the seat of the Austrian ministers, of the Reichsrat and of the Diet of Lower Austria. It is also the seat of the common ministries for the Austro-Hungarian monarchy, of the foreign ambassadors and general consuls and the meeting-place, alternately with Budapest, of the Austro-Hungarian delegations. It contains also the highest judicial, financial, military and administrative official authorities of Austria, and is the see of a Roman Catholic archbishop. Vienna enjoys autonomy for communal affairs, but is under the control of the governor and the Diet of Lower Austria, while the election of the chief burgomaster requires the sanction of the sovereign, advised by the prime minister. The municipal council is composed of 158 members elected for a period of six years. The long struggle between the municipality and the Austrian ministry arising out of the refusal to sanction the election (1895) of Dr Lueger, the anti-Semitic leader and champion, recalls in some respects the Wilkes incident in London. In this instance the ultimate success of the corporation greatly strengthened the Obscurantist and reactionary element throughout Austria.

The cost of the transformation of Vienna, which has been in progress since 1858, cannot be said to have fallen heavily on the population. Great part of the burden has been borne throughout by the "City Extension Fund," realized from the utilization of the ground formerly occupied by the fortifications and glacis. The subsequent regulation of the former suburbs has to a large extent covered its own expenses through the acquisition by the town of the improved area. The municipal finance has on the whole been sound, and notwithstanding the extra burdens assumed on the incorporation of the suburbs, the equilibrium of the communal budget was maintained up to the fall of the Liberal administration. In spite of shortsighted parsimony in the matter of schools, &c., and increased resources through the allocation to the municipality of a certain percentage of new state and provincial taxation, their anti-Semitic successors have been unable to avoid a deficit, and have been obliged to increase the rates. But the direct damage done in this and other ways would seem to be less than that produced by the mistrust they inspired for a time among the propertied classes, and the consequent paralysing of enterprise. Their violent anti-Magyar attitude has driven away a certain amount of Hungarian custom, and helped to increase the political difficulties of the cis-Leithan government.

Vienna is situated at an altitude of 550 ft. above the level of the sea, and possesses a healthy climate. The mean annual temperature is 48·6° F., and the range between January and July is about 40° F. The climate is rather changeable, and rapid falls of temperature are not uncommon. Violent storms occur in spring and autumn, and the rainfall, including snow, amounts to 25 in. a year. Vienna has one of the best supplies of drinking water of any European capital. The water is brought by an aqueduct direct from the Alps, viz. from the Schneeberg, a distance of nearly 60 m. to the south-west. These magnificent waterworks were opened in 1873, and their sanitary influence was soon felt, in the almost complete disappearance of typhoid fever, which had numerous victims before.

Great enlargements, by tapping new sources of supply, were made in 1891–93, while since 1902 works have been in progress for bringing a new supply of pure water from the region of the Salza, a distance of nearly 150 m. Another sanitary work of great importance was the improvement carried out in the drainage system, and the regulation of the river Wien. This river, which, at ordinary times, was little more than an ill-smelling brook at one side of an immense bed, was occasionally converted into a formidable and destructive torrent. Now half the bed of the river has been walled over for the metropolitan railway, while the other half has been deepened, and the portion of it within the town has been arched over. A beginning was thus made for a new and magnificent avenue in the neighbourhood of the Ring-Strasse.

Population.—In 1800 the population of the old districts was 231,050; in 1840, 356,870; in 1857, 476,222 (or with suburbs, 587,235); in 1869, 607,514 (with suburbs, 842,951); in 1880, 704,756 (with suburbs, 1,090,119); in 1890, town and suburbs, 1,364,548; and in 1900, 1,662,269, including the garrison of 26,629 men. Owing to the peculiarities of its situation, the population of Vienna is of a very cosmopolitan and heterogeneous character. Its permanent population (some 45·5% are born in the city) is recruited from all parts of Austria, and indeed of the entire monarchy. The German element is, of course, the most numerous, but there are also a great number of Hungarians, Czechs and other Slavs.

Previous to the loss of the Italian provinces, a considerable proportion came from Italy (30,000 in 1859), including artists, members of the learned professions and artisans who left their mark on Viennese art and taste. The Italian colony now numbers about 2500 (chiefly navvies and masons), in addition to some 1400 Austrian subjects of that nationality. At present the largest and most regular contributions to the population of Vienna come from the Czech provinces of Bohemia and Moravia, next in importance being those from Lower Austria and Styria. This steady and increasing influx of Czechs is gradually infusing a large proportion of Slav blood in what Bismarck (in 1864) described as the German capital of a Slav empire. Formerly the Czech labourers, artisans and domestic servants who came to Vienna were somewhat ashamed of their mother-tongue, and anxious to conceal that evidence of their origin as speedily as possible. The revival of the nationality agitation has produced a marked change in this respect. The Czech immigrants, attracted to Vienna as to other German towns by the growth of industry, are now too numerous for easy absorption, which is further retarded by their national organization, and the provision of separate institutions, churches, schools (thus far private) and places of resort. The consequence is that they take a pride in accentuating their national characteristics, a circumstance which threatens to develop into a new source of discord. In 1900 the population included 1,386,115 persons of German nationality, 102,974 Czechs and Slovaks, 4346 Poles, 805 Ruthenians, 1329 Slovenes, 271 Serbo-Croatians, and 1368 Italians, all Austrian subjects. To these should be added 133,144 Hungarians, 21,733 natives of Germany (3782 less than in 1890), 2506 natives of Italy, 1703 Russians, 1176 French, 1643 Swiss, &c. Of this heterogeneous population 1,461,891 were Roman Catholics, the Jews coming next in order with 146,926. Protestants of the Augsburg and Helvetic Confessions numbered 54,364; members of the Church of England, 490; Old Catholics, 975; members of the Greek Orthodox Church, 3674; Greek Catholics, 2521; and Mahommedans, 889.

As a general rule, the Viennese are gay, pleasure-loving and genial. The Viennese women are justly celebrated for their beauty and elegance; and dressing as a fine art is cultivated here with almost as great success as in Paris. As a rule, the Viennese are passionately fond of dancing; and the city of Strauss, J. F. K. Lanner (1801–1843) and J. Gungl (1810–1889) gives name to a "school" of waltz and other dance music. Opera, especially in its lighter form, flourishes, and the actors of Vienna maintain with success a traditional reputation of no mean order. Its chief place in the history of art Vienna owes to its musicians, among whom are counted Haydn, Mozart, Beethoven and Schubert. The Viennese school of painting is of modern origin; but some of its members, for instance, Hans Makart (1840–1884), have acquired a European reputation.

Trade.—Vienna is the most important commercial and industrial centre of Austria. For a long time the Austrian government, by failing to keep the Danube in a proper state for navigation, let slip the opportunity of making the city the great Danubian metropolis which its geographical position entitles it to be. But during the last quarter of the 19th century active steps were taken to foster the economic interests of the city. The regulation of the Danube, mentioned above, the conversion of the entire Danube Canal into a harbour, the construction of the navigable canal Danube-March-Oder—all gave a new impetus to the trade of Vienna. The fast-growing activity of the port of Trieste and the new and shorter railway line constructed between it and Vienna also contribute to the same effect. Vienna carries on an extensive trade in corn, flour, cattle, wine, sugar and a large variety of manufactured articles. Besides the Danube it is served by an extensive net of railways, which radiate from here to every part of the empire.

The staple productions are machinery, railway engines and carriages, steel, tin and bronze wares, pottery, bent and carved wood furniture, textiles and chemicals. In the number and variety of its leather and other fancy goods Vienna rivals Paris, and is also renowned for its manufacture of jewelry and articles of precious metals, *objets d'art*, musical instruments, physical chemicals and optical instruments, and artistic products generally. Its articles of clothing, silk goods and millinery also enjoy a great reputation for the taste with which they are manufactured. Books, artistic publications, paper and beer are amongst the other principal products. The building trade and its allied trades are also active.

History.—For several centuries Vienna filled an important rôle as the most advanced bulwark of Western civilization and Christianity against the Turks, for during the whole of the middle ages Hungary practically retained its Asiatic character. The story of Vienna begins in the earliest years of the Christian era, with the seizure of the Celtic settlement of *Vindomina* by the Romans, who changed its name to *Vindobona*, and established a fortified camp here to command the Danube and protect the northern frontier of the empire. The fortress grew in importance, and was afterwards made a municipium; and here Marcus Aurelius died in 180. On the decline of the Roman empire Vindobona became the prey of successive barbarian invaders. Attila and his Huns were among the temporary occupants of the place (5th century), and in the following century it came into the possession of the Avars, after which its name disappears from history until towards the close of the 8th century, when Charlemagne expelled the Avars and made the district between the Enns and the Wiener Wald the boundary of his empire. In the time of Otho II. (976) this "East Mark" (Ostmark, Oesterreich, Austria) was granted in fief to the Babenbergers, and in the reign of Frederick Barbarossa (1156) it was advanced to the rank of a duchy. There is no certain record that the site of Vindobona was occupied at the time of the formation of the Ostmark, though many considerations make it probable. It is not likely that the Avars, living in their "ring" encampments, destroyed the Roman municipium; and Becs, the Hungarian name for Vienna to this day, is susceptible of a Slavonic interpretation only, and would seem to indicate that the site had been occupied in Slavonic times. The frequent mention of "Wiene" in the oldest extant version of the *Nibelungenlied* points in the same direction. Passing over a doubtful mention of "Vwienni" in the annals of 1030, we find the "civitas" of Vienna mentioned in a document of 1130, and in 1156 it became the capital and residence of Duke Heinrich Jasomirgott. In 1237 Vienna received a charter of freedom from Frederick II., confirmed in 1247. In the time of the crusades Vienna increased so rapidly, in consequence of the traffic that flowed through it, that in the days of Ottacar II. of Bohemia (1251–76), the successor of the Babenbergers, it had attained the dimensions of the present inner town. A new era of power and splendour begins in 1276, when it became the capital of the Habsburg dynasty, after the defeat of Ottacar by Rudolph of Habsburg. From this time on it has shared the fortunes of the house of Austria. In 1477 Vienna was besieged unsuccessfully by the Hungarians, and in 1485 it was taken by Matthew Corvinus. Of more importance were the two sieges by the Turks (1529 and 1683), when the city was saved on the first occasion by the gallant defence of Count Niclas von Salm (1459–1530), and on the second by Rüdiger von Starhemberg (1638–1701), who held out until the arrival of the Poles and Germans under John Sobieski of Poland. The suburbs, however, were destroyed on both occasions. In 1805, and again in 1809, Vienna was for a short time occupied by the French. In 1814–15 it was the meeting-place of the congress which settled the political affairs of Europe after the overthrow of Napoleon. In 1848 the city was for a time in the hands of the revolutionary party; but it was bombarded by the imperial forces and compelled to surrender on 30th October of the same year. Vienna was not occupied by the Prussians in the war of 1866, but the invaders marched to within sight of its towers. In 1873 a great international exhibition took place here.

While Berlin and Budapest have made the most rapid progress of all European cities, having multiplied their population by nine in the period 1800–90, Vienna—even including the extensive annexations of 1892—only increased sevenfold. Many causes conspired to this end, but most of them date from the years 1859, 1866 and 1867. The combined effect of these successive blows, aggravated by the long period of decentralizing policy from Taaffe to Badeni, is still felt in the Kaiserstadt. The gaiety of Vienna had for centuries depended on the brilliancy of its court, recruited from all parts of Europe, including the nobility of the whole empire, and on its musical, light-hearted and contented population. Even before it fell from its high estate as the social centre of the German-speaking world, it had suffered severely by the crushing defeats of 1859 and the consequent exodus of the Austrian nobles. These were held responsible for the misfortunes of the army, and to escape the atmosphere of popular odium retired to their country seats and the provincial capitals. They have never since made Vienna their home to the same extent as before. The change thus begun was confirmed by the exclusion of Austria from the German Confederation and the restoration of her Constitution to Hungary, events which gave an immense impetus to the two rival capitals. Thus within eight years the range of territory from which Vienna drew its former throngs of wealthy pleasure-seeking visitors and more or less permanent inhabitants—Italian, German and Hungarian—was enormously restricted. Since then Vienna has benefited largely by the enlightened efforts of its citizens and the exceptional opportunities afforded by the removal of the fortifications. But a decline of its importance, similar to that within the larger sphere which it influenced prior to 1859, has continued uninterruptedly within the Habsburg dominions up to the present day. Its commercial classes constantly complain of the increasing competition of the provinces, and of the progressive industrial emancipation of Hungary. The efforts of the Hungarians to complete their social and economic, no less than their political, emancipation from Austria and Vienna have been unremittingly pursued. The formal recognition of Budapest as a royal residence and capital in 1892, and the appointment of independent Hungarian court functionaries in November 1893, mark new stages in its progress. It would no longer be correct to speak of Vienna as the capital of the dual monarchy. It merely shares that distinction with Budapest.

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VIENNA, CONGRESS OF (1814–1815). The fall of Napoleon was only achieved by the creation of a special alliance between Great Britain, Austria, Russia and Prussia. By the Treaty of Chaumont of March 10, 1814, these four powers bound themselves together in a bond which was not to be dissolved when peace was concluded. When Napoleon had been beaten, France conceded to these allies by a secret article of the first Treaty of Paris of May 30, 1814, the disposition of all countries which Napoleon's fall had freed from French suzerainty. This stupendous task was reserved for a general congress, and it was agreed to meet at Vienna. The visit of the allied sovereigns to England and the pressing engagements of the emperor Alexander and Lord Castlereagh delayed the congress until the autumn, when all Europe sent its representatives to accept the hospitality of the impoverished but magnificent Austrian court.

Metternich, though he had not yet completely established his position, acted as chief Austrian representative, and he was naturally in his capacity as host the president of the congress. Friedrich v. Gentz acted as secretary both to him and the congress and did much of the routine work. Alexander of Russia directed his own diplomacy, and round him he had gathered a brilliant body of men who could express but not control their master's desires. Of these the chief were foreigners, according to the traditions of Russian diplomacy. Capo d'Istria, Nesselrode, Stein, Pozzo di Borgo were perhaps the best men in Europe to manage the Russian policy, while Czartoriski represented at the imperial court the hope of Polish nationality. Frederick William III. of Prussia was a weaker character and, as will be seen, his policy was largely determined by his ally. Prince von Hardenberg, who by no means shared all the views of his master but was incapacitated by his growing infirmities, was first Prussian plenipotentiary, and assisting him was Baron von Humboldt. Great Britain was represented by Lord Castlereagh, and under him were the British diplomats who had been attached to the foreign armies since 1813, Clancarty, Stewart and Cathcart. Castlereagh brought with him decided views, which however were not altogether those of his cabinet, and his position was weakened by the fact that Great Britain was still at war with the United States, and that public opinion at home cared for little but the abolition of the slave trade. When parliamentary duties called Castlereagh home in February 1815, the duke of Wellington filled his place with adequate dignity and statesmanship until the war broke out.

France sent Prince Talleyrand to conduct her difficult affairs. No other man was so well fitted for the task of maintaining the interests of a defeated country. His rare diplomatic skill and supreme intellectual endowments were to enable him to play a deciding part in the coming congress. All the minor powers of Europe were represented, for all felt that their interests were at stake in the coming settlement. Gathered there also were a host of publicists, secretaries and courtiers, and never before had Europe witnessed such a collection of rank and talent. From the first the social side of the congress impressed observers with its wealth and variety, nor did the statesmen disdain to use the dining-table or the ballroom as the instruments of their diplomacy.

All Europe awaited with eager expectation the results of so great an assembly. The fate of Poland and Saxony hung in the balance; Germany awaited an entirely new reorganization; Italy was again ready for dismemberment; rumours went that even the pope and the sultan might be largely affected. Some there were who hoped that so great an opportunity would not be lost, but that the statesmen would initiate such measures of international disarmament as would perpetuate the blessings of that peace which Europe was again enjoying after twenty years of warfare.

It was not long, however, before the allies displayed their intention of keeping the management of affairs entirely in their own hands. At an informal meeting on the 22nd of September the four great powers agreed that all subjects of general interest were to be settled by a committee consisting of Austria, Russia, Prussia and Great Britain together with France and Spain. At the same time, however, it was decided by a secret protocol that the four powers should first settle among themselves the distribution of the conquered territories, and that France and Spain should only be consulted when their final decision was announced.

This was the situation which Talleyrand had to face when he arrived on the 24th of September. His first step when he was admitted to the European committee, which was in the plans of the allies to act so colourless a part, was to ignore the position of the Four and to assert that only the congress as a whole could give the committee full powers. This would have meant an almost indefinite delay, for how was it possible to decide the exact rights of all the different states to a voice in affairs? After some heated discussion a compromise was arrived at. The opening of the congress was postponed, and Sweden and Portugal were added to the European committee, but the Four still persisted in the informal meetings which were to decide the important questions. Meanwhile separate committees were formed for the discussion of special problems. Thus a special committee was appointed consisting of the five German powers to discuss the constitution which was to replace the Holy Roman Empire, another to settle that of Switzerland, and others for other minor questions. Talleyrand had, however, already shaken the position of the allies. He had posed as the defender of the public rights of Europe and won to his side the smaller powers and much of the public opinion of Europe, while the allies were beginning to be regarded more in the light of rapacious conquerors than as disinterested defenders of the liberties of Europe.

Had the Four remained united in their views they would still have been irresistible. But they were gradually dividing into two unreconcilable parties upon the Saxon-Polish question. Alexander, exaggerating the part he had played in the final struggle, and with some vague idea of nationality in his brain, demanded that the whole of Poland should be added to the Russian dominions. Austria was to be compensated in Italy, while Prussia was to receive the whole of Saxony, whose unfortunate monarch had been the most faithful of Napoleon's vassals.

It was Castlereagh that led the opposition to these almost peremptory demands of Alexander. A true disciple of Pitt, he came to the congress with an overwhelming distrust of the growing power of Russia, which was only second to his hatred of revolutionary France. He considered that the equilibrium of Europe would be irretrievably upset were the Russian boundaries to be pushed into the heart of Germany. Thus while willing, even anxious that Prussia should receive Saxony, in order that she might be strong to meet the danger from the East, he was prepared to go to any lengths to resist the claims of Russia. For Austria Saxony was really of more vital interest than Poland, but Castlereagh, despite a vigorous resistance from a section of the Austrian court, was able to win Metternich over to his views. He hoped to gain Prussia also to his side, and by uniting the German powers to force Alexander to retire from the position he had so uncompromisingly laid down. With the Prussian statesmen he had some success, but he could make no impression on Frederick William. Alexander used to the utmost that influence over the mind of the Prussian monarch which he had been preparing since the beginning of 1813. Against Castlereagh he entered the lists personally, and memorandum after memorandum was exchanged. Despite the warning letters of the British cabinet which, dismayed at the long continuance of the American War, counselled caution on a question in which England had no immediate interest, Castlereagh yielded no inch of his ground. But Metternich wavered on the question of Saxony, and December saw the allies hopelessly at difference. It seemed by no means unlikely that the armies which had conquered Napoleon would soon be engaged in conflict with one another.

It was Talleyrand's opportunity. As Castlereagh and Metternich began to regard the position as hopeless they began to look upon him as a possible ally. Talleyrand had constantly defended the rights of France's old ally Saxony in the name of the principle which his master Louis XVIII. represented. His passionate appeal on behalf of "legitimacy" was particularly adapted to the necessities of the situation. Alexander was driven into transports of rage by this championship of the *ancien régime* by one who had been a servant of its bitterest foe. But Castlereagh saw that war could only be avoided if one party was made stronger than the other. The reluctant consent of the British cabinet was obtained and Talleyrand was approached as an equal. He came boldly to the front in the middle of December as the champion of Saxony; and, as Russia and Prussia were still obstinate, Metternich and Castlereagh demanded the admission of France to the secret council. This was refused, and on the 3rd of January

1815 a secret treaty of defensive alliance was signed between France, Austria and Great Britain. For some time affairs hung in the balance, but Alexander could not mistake the tone of his opponents. Gradually a compromise was arranged, and by the end of the month all danger was past. Eventually Austria and Prussia retained most of their Polish dominions, and the latter power only received about two-fifths of Saxony. The rest of Poland was incorporated as a separate kingdom in the Russian dominions with a promise of a constitution of its own. Talleyrand had rescued France from its humiliating position, and set it as an equal by the side of the allies. Henceforward he made no effort for the rights of the whole congress.

Meanwhile other affairs had been progressing more harmoniously under the direction of special committees, which included representatives of the powers specially interested. Switzerland was given a constitution which led it in the direction of its later federalism. In Italy Austria retained her hold on Lombardy and Venetia, Genoa was assigned to the kingdom of Sardinia, while Parma went to Marie Louise, the legitimate heir, Carlo Ludivico, having to be content with the reversion after her death, the congress meanwhile assigning Lucca to him as a duchy; the claims of the young Napoleon to succeed his mother in Parma were only destroyed by the efforts of France and England. The other petty monarchs were restored, and Murat's rash attempt, after Napoleon's return from Elba, to make himself king of united Italy, gave back Naples to the Bourbons, an event which would have been brought about in any case in the course of the next few years (see MURAT, JOACHIM). Holland was confirmed in the possession of Belgium and Luxemburg, Limburg and Liége were added to her dominions. Sweden, who had sacrificed Finland to Russia, obtained Norway.

German affairs, however, proved too complicated for complete solution. It was difficult enough to decide the claims of the states in the scramble for territory. Eventually, however, by methods of compromise, this was adjusted fairly satisfactorily. The greater states gained largely, especially Prussia, who was given large accessions of territory on the Rhine, partly as a compensation for her disappointment in the matter of Saxony, partly that she might act as a bulwark against France. Some disputes between Baden and Bavaria remained unsettled, and many questions arising out of the new federal constitution of Germany, which had been hurriedly patched together under the influence of the news of Napoleon's return, had to be postponed for further discussion, and were not settled until the Final Act agreed upon by the conference of German statesmen at Vienna in 1821.

Other more general objects, such as the free navigation of international rivers and the regulation of the rights of precedence among diplomatists (see DIPLOMACY), were managed with much address. Castlereagh's great efforts were rewarded by a declaration that the slave trade was to be abolished, though each power was left free to fix such a date as was most convenient to itself. The Final Act, embodying all the separate treaties, was signed on the 9th of June 1815, a few days before the battle of Waterloo.

Before the work of the congress was completed Napoleon was again at Paris, and the closing stages were hurried and ill-considered. One negotiation of supreme importance was cut short for this reason. Castlereagh had left Vienna with the hope that the powers would solemnly guarantee their territorial settlement and promise to make collective war on whoever dared to disturb it. This guarantee was to include the Ottoman dominions, in whose interests, indeed, it had been brought forward. Alexander made no objection provided that the Porte would submit all outstanding claims to arbitration. The distance of Constantinople from Vienna and the obstinacy of the sultan would probably have prevented a settlement, but the return of Napoleon rendered all such proposals almost absurd, and the scheme was dropped.

Thus the congress of Vienna failed to institute any new system for securing the stability of the European polity, nor did it recognize those new forces of liberty and nationality which had really caused Napoleon's downfall. Following the tradition of all preceding congresses, it was mainly a scramble for territory and power. Territories were distributed among the powers with no consideration for the feelings of their inhabitants, and in general the right of the strongest prevailed. For this reason it has often met with a condemnation that has perhaps been unmerited. It is true that the map of Europe shows to-day but little trace of its influence; but much of its work was determined by conditions over which statesmen had little control. Europe was not ready for the recognition of nationality and liberalism. What it wanted most of all was peace, and by establishing something like a territorial equilibrium the congress did much to win that breathing space which was the cardinal need of all.

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VIENNE, a river of central France, a left-hand tributary of the Loire, watering the departments of Corrèze, Haute-Vienne, Charente, Vienne and Indre-et-Loire. Length, 219 m.; area of basin, 8286 sq. m. Rising on the plateau of Millevaches 14 m. N.W. of Ussel (department of Corrèze) at a height of 2789 ft., the Vienne flows westward, between the highlands of Limousin on the south and the plateau of Gentioux and the Blond mountains on the north. The first large town on its banks is Limoges (Haute-Vienne), below its confluence with the Taurion: in this part of its course the river supplies motive power to paper-mills and other factories. The river next reaches St Junien, below which it turns abruptly northwards to Confolens (Charente). Flowing through a picturesque and now wider valley, and passing in its course the churches and châteaux of Chauvigny, the river proceeds to the confluence of the Clain just above Châtellerault. Below that town it receives the Creuse (rising on the plateau of Millevaches and reaching the Vienne after a course of 159 m.), and turns north-west, uniting with the Loire below the historic town of Chinon. There is little river-traffic on the Vienne, and that only below its confluence with the Creuse (30 m.).

VIENNE, a department of west-central France, formed in 1790 out of Poitou (four-fifths of its present area), Touraine (one-seventh) and Berry, and bounded by Deux-Sèvres on the W., Charente on the S., Haute-Vienne on the S.E., Indre on the E., Indre-et-Loire on the N.E. and N., and Maine-et-Loire on the N.W. Pop. (1906) 333,621. Area, 2719 sq. m. The river Vienne, which gives its name to the department, with its tributaries the Creuse (subtributary the Gartempe) on the east and the Clain on the west, flows from south to north. The general slope of the department is in the same direction, the highest point (764 ft.) being in the south-east and the lowest (115 ft.) at the junction of the Vienne and the Creuse. In the south the Charente, on the north-west the Dive, and in the west some streams belonging to the basin of the Sèvre-Niortaise drain small portions of the department. The average temperature is 54° F. The prevailing winds are from the south-west and west. The annual rainfall is 24 in.

Wheat, oats and barley are the principal cereals cultivated, other important crops being lucerne, sainfoin, clover, mangelwurzels and potatoes. Colza and hemp are grown to a limited extent. The district of Poitiers grows good red wine, and the white wine of Trois-Moutiers near Loudun is well known. The breeding of live stock in all its branches is fairly active. Poitou is famous for its mules, and the geese and turkeys of the department are highly esteemed. Oak, ash, alder and birch are the principal forest trees, and among the fruit trees are the chestnut, walnut and almond. Freestone is quarried. The most important industrial establishments are the national arms manufactory at Châtellerault and the cutlery works near that town. In other parts of the department are wool-spinning mills, hemp-spinning mills, manufactories of serges and coarse cloth, vinegar, candles, goose and goat skins, leather, tiles and pottery, paper-works, breweries, distilleries, lime-kilns and numerous flour-mills. Corn, wine, brandy, vegetables, fruit, chestnuts, fodder, cattle, stone, cutlery, arms and dressed hides are exported; butcher's beasts, colonial produce and coals are imported. The department is served by the Ouest-État and Orleans railways. Vienne forms part of the diocese of Poitiers, has its court of appeal and educational centre at Poitiers, and belongs to the region of the IX. army corps. The capital is Poitiers, and the department is divided for purposes of administration into 5 arrondissements (Poitiers, Châtellerault, Civray, Loudun, Montmorillon), 31 cantons and 300 communes. The more noteworthy towns are Poitiers, Châtellerault, Loudun, Montmorillon and Chauvigny, these being separately treated. Other places of interest are St Maurice, Civray and St Savin, which have Romanesque churches, the abbey church of St Savin being remarkable for its mural paintings; Ligugé, with an abbey church of the 15th and 16th centuries; Charroux, which has a Romanesque octagonal tower and other remains of a famous abbey; and Sanxay, near which there are ruins of a theatre and other Gallo-Roman remains. Vienne is rich in megalithic monuments.

VIENNE, the chief town of an arrondissement of the department of the Isère, France. Historically the first, it is by population (24,619 in 1901) the second city of the department of the Isère, after Grenoble; and the third, after Valence, of the Dauphiné. It is situated on the left bank of the Rhone just below the junction of the Gère with the Rhone, and about 20 m. by rail S. of Lyons. On the N., E. and S. the town is sheltered by low hills, the Rhone flowing along its western side. Its site is an immense mass of ancient *débris*, which is constantly yielding interesting antiquities. On the bank of the Gère are traces of the ramparts of the old Roman city, and on the Mont Pipet (E. of the town) are the remains of an amphitheatre, while the ruined castle there was built in the 13th century on Roman substructures. Several of the ancient aqueducts (one only is now actually in use) are still to be seen, while in the neighbourhood of the city some bits of the old Roman roads may still be found.

The streets of the town are narrow and tortuous, but it possesses two Roman monuments of the first class. One is the temple of Augusta and Livia, a rectangular building of the Corinthian order, erected by the emperor Claudius, and inferior only to the Maison Carrée at Nîmes. From the 5th century to 1793 it was a church (Notre Dame de Vie), and the "festival of reason" was celebrated in it at the time of the Revolution. The other, in the more modern part of the town, is the *Plan de l'Aiguille*, a truncated quadrangular pyramid about 52 ft. in height and resting on a portico with four arches. Many theories have been advanced as to what this singular structure really was (some imagine that it was the tomb of Pontius Pilatus, who, according to the legend, died at Vienne), but it is now generally believed to have been part of the *spina* of a large circus, the outlines of which have been traced. The church of St Peter belonged to an ancient Benedictine abbey and was rebuilt in the 9th century. It is in the earliest Romanesque style, and forms a basilica, with tall square piers, reminding one of Lucca, while the two ranges of windows in the aisles, with their coupled marble columns, recall Ravenna from within and the Basse Œuvre of Beauvais from without. The porch is in the earliest Romanesque style. This church has of late years been completely restored, and since 1895 shelters the magnificent *Musée Lapidaire* (formerly housed in the temple of Augusta and Livia). The former cathedral church (primatial as well as metropolitan) of St Maurice contains some of the best forms of the true N. Gothic, and was constructed at various periods between 1052 and 1533. It is a basilica, with three aisles, but no apse or transepts. It is 315 ft. in length, 118 ft. wide and 89 in height. The most striking portion is the W. front (1533), which rises majestically from a terrace overhanging the Rhone. But the statuary was much injured by the Protestants in 1562. The church of St André le Bas was the church of a second Benedictine monastery, and later the chapel of the earlier kings of Provence. It was rebuilt in 1152, in the later Romanesque style. The town library and art museum are now in the corn hall, which has been reconstructed for that purpose. A suspension bridge leads from the city to the right bank of the Rhone, where the industrial quarter of Ste Colombe now occupies part of the ancient city. Here is a tower, built in 1349 by Philip of Valois to defend the French bank of the Rhone, as distinguished from the left bank, which, as part of the kingdom of Provence, was dependent on the Holy Roman Empire. This state of things is also recalled by the name of the village, St Romain en Gal, to the N.W. of Ste Colombe.

The Gère supplies the motive power to numerous factories. The most important are those which produce cloth (about 30 factories, turning out daily about 15,000 yds. of cloth). There are numerous other industrial establishments (paper mills, iron foundries, brick works, refining furnaces, &c.).

Vienne was originally the capital of the Allobroges, and became a Roman colony about 47 B.C. under Caesar, who embellished and fortified it. A little later these colonists were expelled by the Allobroges; the exiles then founded the colony of Lyons (Lugdunum). It was not till the days of Augustus and Tiberius that Vienne regained all its former privileges as a Roman colony. Later it became the capital of the Provincia Viennensis. In 257 Postumus was proclaimed emperor here, and for a few years from that day onwards Vienne was the capital of a short-lived provincial empire. It is said to have been converted to Christianity by Crescens, the disciple of St Paul. Certainly there were Christians here in 177, as in the Greek letter (preserved to us by Eusebius) addressed at that date by the churches of Vienne and Lyons to those of Asia and Phrygia mention is made of "the" deacon of Vienne. The first bishop certainly known is Verus, who was present at the Council of Arles in 314. About 450 Vienne became an archbishopric and continued one till 1790, when the see was suppressed. The archbishops disputed with those of Lyons the title of "Primate of All the Gauls." Vienne was conquered by the Burgundians in 438, and in 534 was taken by the Franks. Sacked in 558 by the Lombards and in 737 by the Saracens, the government of the district was given by Charles the Bald in 869 to a certain Count Boso, who in 879 was proclaimed king of Provence, and was buried on his death in 887 in the cathedral church of St Maurice. Vienne then continued to form part of the kingdom of Provence or Arles till in 1032 it reverted to the Holy Roman Empire. The sovereigns of that kingdom, as well as the emperors in the 12th century (in particular Frederick Barbarossa in 1153), recognized the rights of the archbishops as the rulers (in the name of the emperor) of Vienne. But the growing power of the counts of Albon, later Dauphins of the neighbouring county of the Viennois, was the cause of many disputes between them and the archbishops. In 1349 the reigning Dauphin sold his Dauphiné to France, but the town of Vienne was not included in this sale, and the archbishops did not give up their rights over it to France till 1449, when it first became French. In 1311–12 the fifteenth General Council was held at Vienne, when Clement V. abolished the order of the Knights Templar. Vienne was sacked in 1562 by the Protestants under the baron des Adrets, and was held for the Ligue 1590–95, when it was taken in the name of Henri IV. by Montmorency. The fortifications were demolished between 1589 and 1636. In 1790 the archbishopric was abolished, the title "Primate of All the Gauls" being attributed to the archbishops of Lyons. Among famous natives of Vienne may be mentioned St Julian (3rd century) and Nicholas Chorier (1612–1692), the historian of the Dauphiné, while Gui de Bourgogne, who was archbishop 1090–1119, became pope in 1119 as Calixtus II. (d. 1124).

See A. Allmer et A. de Terrebasse, *Inscriptions antiques et du moyen âge de Vienne en Dauphiné* (6 vols., Vienne, 1875–76); Cl. Charvet, *Fastes de la ville de Vienne* (Vienne, 1869); U. Chevalier, *Collection des Cartulaires Dauphinois*, in vol. i. (Vienne, 1869), is that of St André le Bas, and in vol. ii. (1891) a description of that of St Maurice; N. Chorier, *Recherches sur les antiquités de la ville de Vienne* (Vienne, 1658); E. A. Freeman, Article in the *Saturday Review* for Feb. 6, 1875; F. Raymond, *Le Guide Viennois* (Troyes, 1897). (W. A. B. C.)

VIENNE, COUNCIL OF, an ecclesiastical council, which in the Roman Catholic Church ranks as the fifteenth ecumenical synod. It met from October 16, 1311, to May 6, 1312, under the presidency of Pope Clement V. The transference of the Curia from Rome to Avignon (1309) had brought the papacy under the influence of the French crown; and this position Philip the Fair of France now endeavoured to utilize by demanding from the pope the dissolution of the powerful and wealthy order of the Temple, together with the introduction of a trial for heresy against the late Pope Boniface VIII. To evade the second claim, Clement gave way on the first. Legal trials and acts of violence against the Templars had begun as early as the year 1307 (see TEMPLARS); and the principal object of the council was to secure a definite decision on the question of their continuance or abolition. In the committee appointed for preliminary consultation, one section was for the immediate condemnation of the order, and declined to allow it any opportunity of defence, on the ground that it was now superfluous and simply a source of strife. The majority of the members, however, regarded the case as non-proven, and demanded that the order should be heard on its own behalf; while at the same time they held that its dissolution was unjustifiable. Under pressure from the king, who was himself present in Vienne, the pope determined that, as the order gave occasion for scandal but could not be condemned as heretical by a judicial sentence (*de jure*), it should be abolished *per modum provisionis seu ordinationis apostolicae*; in other words, by an administrative ruling based on considerations of the general welfare. To this procedure the council agreed, and on the 22nd of March the order of the Temple was suppressed by the bull *Vox clamantis*; while further decisions as to the treatment of the order and its possessions followed later.

In addition to this the discussions announced in the opening speech, regarding measures for the reformation of the Church and the protection of her liberties, took place; and a part of the Constitutions found in the *Clementinum*, published in 1317 by John XXII., were probably enacted by the council. Still it is impossible to say with certainty what decrees were actually passed at Vienne. Additional decisions were necessitated by the violent disputes which raged within the Franciscan order as to the observance of the rules of St Francis of Assisi, and by the multitude of subordinate questions arising from this. Resolutions were also adopted on the Beguines and their mode of life (see BEGUINES), the control of the hospitals, the institution of instructors in Hebrew, Arabic and Chaldaic at the universities, and on numerous details of ecclesiastical discipline and law.

See Mansi, *Collectio Conciliorum*, vol. xxv.; Hefele, *Conciliengeschichte*, vol. vi. pp. 532-54.

VIERGE, DANIEL (1851–1904), Spanish painter and draughtsman, was born in Madrid in 1851. He went to Paris in 1867 to seek his fortune, fired by the vivid energy of his national temperament. He became attached to the *Monde illustré* in 1870, just before the Franco-Prussian War broke out, and, like other artists in the paper, came under the powerful influence of Edmond Morin, the first newspaper draughtsman in France who sought to impart to drawings for journals the character of a work of art. Vierge's earlier drawings, therefore, partake greatly of Morin's style; such are, "The Shooting in the Rue de la Paix," "The Place d'Armes at Versailles," "The Loan," "The Great School-Fête of Lyons," "Anniversary of the Fight of Aydes" and "Souvenir of Coulmiers." Vierge lost no time in proving the extraordinary vigour and picturesqueness of his art. Apart from the contribution of his own original work, he was required by his paper to redraw upon the wood, for the engraver, the sketches sent in by artist-correspondents, such as Luc Ollivier Merson in Rome and Samuel Urrabieta (Vierge's brother) in Spain. From 1871 to 1878 his individuality became more and more pronounced, and he produced, among his best-known drawings, "Christmas in Spain," "The Republican Meeting in Trafalgar Square," "Attack on a Train in Andalusia," "Feast of St Rosalia in Palermo," "In the Jardin d'Acclimatation," "The Burning of the Library of the Escurial, 1872," "Grasshoppers in Algiers," "Brigandage in Sicily," "Night Fête in Constantinople," "Episode of the Civil War in Spain," "Marriage of the King of Spain" and "The Bull Fight." About this time he illustrated with remarkable dash and skill Victor Hugo's *Année terrible* (Michel Lévy, 1874, and Hugues, 1879), "*1813*" (Hugues, 1877) and *Les Misérables* (1882). His masterpiece of illustration is Michelet's *History of France* (1876), consisting of 26 volumes containing 1000 drawings. In 1879 he was drawing for *La Vie moderne*, and then proceeded to illustrate *Pablo de Segovia*. While engaged upon this work he was attacked by paralysis in the right arm, but with characteristic energy and courage he set himself to acquire the necessary skill in drawing with the left, and calmly proceeded with the illustrations to the book. In 1891 he illustrated *L'Espagnole*, by Bergerat, and in 1895 *Le Cabaret des trois vertus*. In 1898 he held, at the Pelletan Gallery in Paris, an exhibition of his drawings for Chateaubriand's *Le Dernier Abencérage* ("The Last of the Abencerrages"), and in the following year a comprehensive exhibition of his work (including the illustrations to *Don Quixote*) at the Art Nouveau Gallery, also in Paris. In 1898 Vierge contributed to *L'Image*, a magazine devoted to the encouragement of engraving upon wood; and two years later, at the International Exhibition at Paris, he was awarded a *grand prix*. In 1902 he exhibited at the New Salon a scene from the Franco-Prussian War. He died at Boulogne-sur-Seine in May 1904.

See Roger Marx, *L'Image* (1898); Béraldi, *La Gravure au 19e siècle*.

VIERSEN, a town of Germany, in the Prussian Rhine province, 11 m. by rail S.W. from Crefeld, and at the junction of lines to München-Gladbach, Venlo, &c. Pop. (1905) 27,577. It has an evangelical and four Roman Catholic churches, among the latter the handsome parish church dating from the 15th century, and various educational establishments. Viersen is one of the chief seats in the lower Rhine country for the manufacture of velvets, silks (especially umbrella covers) and plush.

VIERZON, a town of central France, in the department of Cher, 20 m. N.W. of Bourges by rail. The Cher and the Yèvre unite at the foot of the hill on which lie Vierzon-Ville (pop. (1906) town, 11,812) and Vierzon-Village (pop. town, 2026; commune, 9710); Vierzon-Bourgneuf (pop. town, 1482) is on the left bank of the Cher. The town has a port on the canal of Berry and is an important junction on the Orléans railway; there are several large manufactories for the production of agricultural machines, also foundries, porcelain, brick and tile works and glass works. A technical school of mechanics and a branch of the Bank of France are among the institutions of the town.

VIETA (or VIÈTE), **FRANÇOIS,** SEIGNEUR DE LA BIGOTIÈRE (1540–1603), more generally known as FRANCISCUS VIETA, French mathematician, was born in 1540 at Fontenay-le-Comte, in Poitou. According to F. Ritter,[1] Vieta was brought up as a Catholic, and died in the same creed; but there can be no doubt that he belonged to the Huguenots for several years. On the completion of his studies in law at Poitiers Vieta began his career as an advocate in his native town. This he left about 1567, and somewhat later we find him at Rennes as a councillor of the parlement of Brittany. The religious troubles drove him thence, and Rohan, the well-known chief of the Huguenots, took him under his special protection. He recommended him in 1580 as a "maître des requêtes" (master of requests); and Henry of Navarre, at the instance of Rohan, addressed two letters to Henry III. of France on the 3rd of March and the 26th of April 1585, to obtain Vieta's restoration to his former office, but without result. After the accession of Henry of Navarre to the throne of France, Vieta filled in 1589 the position of councillor of the parlement at Tours. He afterwards became a royal privy councillor, and remained so till his death, which took place suddenly at Paris in February 1603, but in what manner we do not know; Anderson, the editor of his scientific writings, speaks only of a "praeceps et immaturum autoris fatum."

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[1] *Bolletino Boncompagni* (Rome, 1868), vol. i. p. 227, n. 1.

We know of one important service rendered by Vieta as a royal officer. While at Tours he discovered the key to a Spanish cipher, consisting of more than 500 characters, and thenceforward all the despatches in that language which fell into the hands of the French could be easily read. His fame now rests, however, entirely upon his achievements in mathematics. Being a man of wealth, he printed at his own expense the numerous papers which he wrote on various branches of this science, and communicated them to scholars in almost every country of Europe. An evidence of the good use he made of his means, as well as of the kindliness of his character, is furnished by the fact that he entertained as a guest for a whole month a scientific adversary, Adriaan van Roomen, and then paid the expenses of his journey home. Vieta's writings thus became very quickly known; but, when Franciscus van Schooten issued a general edition of his works in 1646, he failed to make a complete collection, although probably nothing of very great value has perished.

The form of Vieta's writings is their weak side. He indulged freely in flourishes; and in devising technical terms derived from the Greek he seems to have aimed at making them as unintelligible as possible. None of them, in point of fact, has held its ground, and even his proposal to denote unknown quantities by the vowels A, E, I, O, U, Y—the consonants B, C, &c., being reserved for general known quantities—has not been taken up. In this denotation he followed, perhaps, some older contemporaries, as Ramus, who designated the points in geometrical figures by vowels, making use of consonants, R, S, T, &c., only when these were exhausted. Vieta is wont to be called the father of modern algebra. This does not mean, what is often alleged, that nobody before him had ever thought of choosing symbols different from numerals, such as the letters of the alphabet, to denote the quantities of arithmetic, but that he made a general custom of what until his time had been only an exceptional attempt. All that is wanting in his writings, especially in his *Isagoge in artem analyticam* (1591), in order to make them look like a modern school algebra, is merely the sign of equality—a want which is the more striking because Robert Recorde had made use of our present symbol for this purpose since 1557, and Xylander had employed vertical parallel lines since 1575. On the other hand, Vieta was well skilled in most modern artifices, aiming at a simplification of equations by the substitution of new quantities having a certain connexion with the primitive unknown quantities. Another of his works, *Recensio canonica effectionum geometricarum*, bears a stamp not less modern, being what we now call an algebraic geometry—in other words, a collection of precepts how to construct algebraic expressions with the use of rule and compass only. While these writings were generally intelligible, and therefore of the greatest didactic importance, the *principle of homogeneity*, first enunciated by Vieta, was so far in advance of his times that most readers seem to have passed it over without adverting to its value. That principle had been made use of by the Greek authors of the classic age; but of later mathematicians only Hero, Diophantus, &c., ventured to regard lines and surfaces as mere numbers that could be joined to give a new number, their sum. It may be that the study of such sums, which he found in the works of Diophantus, prompted him to lay it down as a principle that quantities occurring in an equation ought to be homogeneous, all of them lines, or surfaces, or solids, or supersolids—an equation between mere numbers being inadmissible. During the three centuries that have elapsed between Vieta's day and our own several changes of opinion have taken place on this subject, till the principle has at last proved so far victorious that modern mathematicians like to make homogeneous such equations as are not so from the beginning, in order to get values of a symmetrical shape. Vieta himself, of course, did not see so far as that; nevertheless the merit cannot be denied him of having indirectly suggested the thought. Nor are his writings lacking in actual inventions. He conceived methods for the general resolution of equations of the second, third and fourth degrees different from those of Ferro and Ferrari, with which, however, it is difficult to believe him to have been unacquainted. He devised an approximate numerical solution of equations of the second and third degrees, wherein Leonardo of Pisa must have preceded him, but by a method every vestige of which is completely lost. He knew the connexion existing between the positive roots of an equation (which, by the way, were alone thought of as roots) and the coefficients of the different powers of the unknown quantity. He found out the formula for deriving the sine of a multiple angle, knowing that of the simple angle with due regard to the periodicity of sines. This formula must have been known to Vieta in 1593. In that year Adriaan van Roomen gave out as a problem to all mathematicians an equation of the 45th degree, which, being recognized by Vieta as depending on the equation between sin ϕ and sin $\phi/45$, was resolved by him at once, all the twenty-three positive roots of which the said equation was capable being given at the same time (see TRIGONOMETRY). Such was the first encounter of the two scholars. A second took place when Vieta pointed to Apollonius's problem of taction as not yet being mastered, and Adriaan van Roomen gave a solution by the hyperbola. Vieta, however, did not accept it, as there existed a solution by means of the rule and the compass only, which he published himself in his *Apollonius Gallus* (1600). In this paper Vieta made use of the centre of similitude of two circles. Lastly he gave an infinite product for the number π (see CIRCLE, SQUARING OF).

Vieta's collected works were issued under the title of *Opera Mathematica* by F. van Schooten at Leiden in 1646. (M. Ca.)

VIEUXTEMPS, HENRI (1820–1881), Belgian violinist and composer, was born at Verviers, on the 20th of February 1820. Until his seventh year he was a pupil of Lecloux, but when De Bériot heard him he adopted him as his pupil, taking him to appear in Paris in 1828. From 1833 onwards he spent the greater part of his life in concert tours, visiting all parts of the world with uniform success. He first appeared in London at a Philharmonic concert on the 2nd of June 1834, and in the following year studied composition with Reicha in Paris, and began to produce a long series of works, full of formidably difficult passages, though also of pleasing themes and fine musical ideas, which are consequently highly appreciated by violinists. From 1846 to 1852 he was solo violinist to the tsar, and professor in the conservatorium in St Petersburg. From 1871 to 1873 he was teacher of the violin class in the Brussels Conservatoire, but was disabled by an attack of paralysis in the latter year, and from that time could only superintend the studies of favourite pupils. He died at Mustapha, in Algiers, on the 6th of June 1881. He had a perfect command of technique, faultless intonation and a marvellous command of the bow. His staccato was famous all over the world, and his tone was exceptionally rich and full.

VIGAN, a town and the capital of the province of Ilocos Sur, Luzon, Philippine Islands, at the mouth of the Abra river, about 200 m. N. by W. of Manila. Pop. of the municipality (1903) 14,945; after the census of 1903 was taken there were united to Vigan the municipalities of Bantay (pop. 7020), San Vicente (pop. 5060), Santa Catalina (pop. 5625) and Coayan (pop. 6201), making the total population of the municipality 38,851. Vigan is the residence of the bishop of Nueva Segovia and has a fine cathedral, a substantial court-house, other durable public buildings and a monument to Juan de Salcedo, its founder. It is engaged in farming, fishing, the manufacture of brick, tile, cotton fabrics and furniture, and the building of boats. The language is Ilocano.

VIGÉE-LEBRUN, MARIE-ANNE ELISABETH (1755–1842), French painter, was born in Paris, the daughter of a painter, from whom she received her first instruction, though she benefited more by the advice of Doyen, Greuze, Joseph Vernet and other masters of the period. When only about twenty years of age she had already risen to fame with her portraits of Count Orloff and the duchess of Orleans, her personal charm making her at the same time a favourite in society. In 1776 she married the painter and art-critic J. B. P. Lebrun, and in 1783 her picture of "Peace bringing back Abundance" (now at the Louvre) gained her the membership of the Academy. When the Revolution broke out in 1789 she escaped first to Italy, where she worked at Rome and Naples. At Rome she painted the portraits of Princesses Adelaide and Victoria, and at Naples the "Lady Hamilton as a Bacchante" now in the collection of Mr Tankerville Chamberlayne; and then journeyed to Vienna, Berlin and St Petersburg. She returned to Paris in 1781, but went in the following year to London, where she painted the portraits of Lord Byron and the prince of Wales, and in 1808 to Switzerland. Her numerous journeys, and the vogue she enjoyed wherever she went, account for the numerous portraits from her brush that are to be found in the great collections of many countries. Having returned to France from Switzerland, she lived first at her country house near Marly and then in Paris, where she died at the age of eighty-seven, in 1842, having been widowed for twenty-nine years. She published her own memoirs under the title of *Souvenirs* (Paris, 1835–37). Among her many sitters was

Marie Antoinette, of whom she painted over twenty portraits between 1779 and 1789. A portrait of the artist is in the hall of the painters at the Uffizi, and another at the National Gallery. The Louvre owns two portraits of Mme Lebrun and her daughter, besides five other portraits and an allegorical composition.

A full account of her eventful life is given in the artist's *Souvenirs*, and in C. Pillet's *Mme Vigée-Le Brun* (Paris, 1890). The artist's autobiography has been translated by Lionel Strachey, *Memoirs of Mme Vigée-Lebrun* (New York, 1903), fully illustrated.

VIGEVANO, a town and episcopal see of Lombardy, Italy, in the province of Pavia, on the right bank of the Ticino, 24 m. by rail S.W. from Milan on the line to Mortara, 381 ft. above sea-level. Pop. (1901) 18,043 (town); 23,560 (commune). It is a medieval walled town, with an arcaded market-place, a cathedral, the Gothic church of S. Francesco, and a castle of the Sforza family, dating from the 14th century and adorned with a loggia by Bramante and a tower imitating that of Filarete in the Castello Sforzesco at Milan. It is a place of some importance in the silk trade and also produces excellent macaroni. There is a steam tramway to Novara.

VÍGFÚSSON, GÚDBRANDR (1828–1889), the foremost Scandinavian scholar of the 19th century, was born of a good and old Icelandic family in Breiðafjord in 1828. He was brought up, till he went to a tutor's, by his kinswoman, Kristín Vígfussdottir, to whom, he records, he "owed not only that he became a man of letters, but almost everything." He was sent to the old and famous school at Bessastad and (when it removed thither) at Reykjavik; and in 1849, already a fair scholar, he came to Copenhagen University as a *bursarius* in the Regense College. He was, after his student course, appointed *stipendiarius* by the Arna-Magnaean trustees, and worked for fourteen years in the Arna-Magnaean Library till, as he said, he knew every scrap of old vellum and of Icelandic written paper in that whole collection. During his Danish life he twice revisited Iceland (last in 1858), and made short tours in Norway and South Germany with friends. In 1866, after some months in London, he settled down in Oxford, which he made his home for the rest of his life, only quitting it for visits to the great Scandinavian libraries or to London (to work during two or three long vacations with his fellow-labourer, F. Y. Powell), or for short trips to places such as the Isle of Man, the Orkneys and Shetlands, the old mootstead of the West Saxons at Downton, the Roman station at Pevensey, the burial-place of Bishop Brynjulf's ill-fated son at Yarmouth, and the like. He held the office of Reader in Scandinavian at the university of Oxford (a post created for him) from 1884 till his death. He was a Jubilee Doctor of Upsala, 1877, and received the Danish order of the Dannebrog in 1885. Vígfússon died of cancer on the 31st of January 1889, and was buried in St Sepulchre's Cemetery, Oxford, on the 3rd of February. He was an excellent judge of literature, reading most European languages well and being acquainted with their classics. His memory was remarkable, and if the whole of the Eddic poems had been lost, he could have written them down from memory. He spoke English well and idiomatically, but with a strong Icelandic accent. He wrote a beautiful, distinctive and clear hand, in spite of the thousands of lines of MS. copying he had done in his early life.

By his *Túnatál* (written between October 1854 and April 1855) he laid the foundations for the chronology of Icelandic history, in a series of conclusions that have not been displaced (save by his own additions and corrections), and that justly earned the praise of Jacob Grimm. His editions of Icelandic classics (1858–68), *Biskopa Sögur*, *Bardar Saga*, *Forn Sögur* (with Möbius), *Eyrbyggia Saga* and *Flateyar-bók* (with Unger) opened a new era of Icelandic scholarship, and can only fitly be compared to the Rolls Series editions of chronicles by Dr Stubbs for the interest and value of their prefaces and texts. Seven years of constant and severe toil (1866–73) were given to the Oxford Icelandic-English Dictionary, incomparably the best guide to classic Icelandic, and a monumental example of single-handed work. His later series of editions (1874–85) included *Orkneyinga* and *Háconar Saga*, the great and complex mass of Icelandic historical sagas, known as *Sturlunga*, and the *Corpus Poeticum Boreale*, in which he edited the whole body of classic Scandinavian poetry. As an introduction to the *Sturlunga*, he wrote a complete though concise history of the classic Northern literature and its sources. In the introduction to the *Corpus*, he laid the foundations of a critical history of the Eddic poetry and Court poetry of the North in a series of brilliant, original and well-supported theories that are gradually being accepted even by those who were at first inclined to reject them. His little Icelandic *Prose Reader* (with F. York Powell) (1879) furnishes the English student with a pleasant and trustworthy path to a sound knowledge of Icelandic. The *Grimm Centenary Papers* (1886) give good examples of the range of his historic work, while his Appendix on Icelandic currency to Sir G. W. Dasent's *Burnt Njal* is a model of methodical investigation into an intricate and somewhat important subject. As a writer in his own tongue he at once gained a high position by his excellent and delightful *Relations of Travel in Norway and South Germany*. In English, as his "Visit to Grimm" and his powerful letters to *The Times* show, he had attained no mean skill. His life is mainly a record of well-directed and efficient labour in Denmark and Oxford. (F. Y. P.)

VIGIL (Lat. *vigilia*, "watch"), in the Christian Church, the eve of a festival. The use of the word is, however, late, the *vigiliae* (pernoctationes, παννυχίδες) having originally been the services, consisting of prayers, hymns, processions and sometimes the eucharist, celebrated on the preceding night in preparation for the feast. The oldest of the vigils is that of Easter Eve, those of Pentecost and Christmas being instituted somewhat later. With the Easter vigil the eucharist was specially associated, and baptism with that of Pentecost (see WHITSUNDAY). The abuses connected with nocturnal vigils[1] led to their being attacked, especially by Vigilentius of Barcelona (*c.* 400), against whom Jerome fulminated in this as in other matters. The custom, however, increased, vigils being instituted for the other festivals, including those of saints.

In the middle ages the nocturnal *vigilia* were, except in the monasteries, gradually discontinued, matins and vespers on the preceding day, with fasting, taking their place. In the Roman Catholic Church the vigil is now usually celebrated on the morning of the day preceding the festival, except at Christmas, when a midnight mass is celebrated, and on Easter Eve. These vigils are further distinguished as privileged and unprivileged. The former (except that of the Epiphany) have special offices; in the latter the vigil is merely commemorated.

The Church of England has reverted to early custom in so far as only "Easter Even" is distinguished by a special collect, gospel and epistle. The other vigils are recognized in the calendar (including those of the saints) and the rubric directs that "the collect appointed for any Holy-day that hath a Vigil or Eve, shall be said at the Evening Service next before."

VIGILANCE COMMITTEE, in the United States, a self-constituted judicial body, occasionally organized in the western frontier districts for the protection of life and property. The first committee of prominence bearing the name was organized in San Francisco in June 1851, when the crimes of desperadoes who had immigrated to the gold-fields were rapidly increasing in numbers and it was said that there were venal judges, packed juries and false witnesses. At first this committee was composed of about 200 members; afterwards it was much larger. The general committee was governed by an executive committee and the city was policed by sub-committees. Within about thirty days four desperadoes were arrested, tried by the executive committee and hanged, and about thirty others were banished. Satisfied with the results, the committee then quietly adjourned, but it was revived five years later. Similar committees were common in other parts of California and in the mining districts of Idaho and Montana. That in Montana exterminated in 1863–64 a band of outlaws organized under Henry Plummer, the sheriff of Montana City; twenty-four of the outlaws were hanged within a few months. Committees or societies of somewhat the same nature were formed in the Southern states during the Reconstruction period (1865–72) to protect white families from negroes and "carpet-baggers," and besides these there were the Ku-Klux-Klan (*q.v.*) and its branches; the Knights of the White Camelia, the Pale Faces, and the Invisible Empire of the South, the principal object of which was to control the negroes by striking them with terror.

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[1] The 35th canon of the council of Elvira (305) forbids women to attend them.

See H. H. Bancroft, *Popular Tribunals* (2 vols., San Francisco, 1887); and T. J. Dimsdale, *The Vigilantes of Montana* (Virginia City, 1866).

VIGILANTIUS (fl. *c.* 400), the presbyter, celebrated as the author of a work, no longer extant, against superstitious practices, which called forth one of the most violent and scurrilous of Jerome's polemical treatises, was born about 370 at Calagurris in Aquitania (the modern Cazères or perhaps Saint Bertrand de Comminges in the department of Haute-Garonne), where his father kept a "statio" or inn on the great Roman road from Aquitania to Spain. While still a youth his talent became known to Sulpicius Severus, who had estates in that neighbourhood, and in 395 Sulpicius, who probably baptized him, sent him with letters to Paulinus of Nola, where he met with a friendly reception. On his return to Severus in Gaul he was ordained; and, having soon afterwards inherited means through the death of his father, he set out for Palestine, where he was received with great respect by Jerome at Bethlehem. The stay of Vigilantius lasted for some time; but, as was almost inevitable, he was dragged into the dispute then raging about Origen, in which he did not see fit wholly to adopt Jerome's attitude. On his return to the West he was the bearer of a letter from Jerome to Paulinus, and at various places where he stopped on the way he appears to have expressed himself about Jerome in a manner that when reported gave great offence to that father, and provoked him to write a reply (*Ep.* 61). Vigilantius now settled for some time in Gaul, and is said by one authority (Gennadius) to have afterwards held a charge in the diocese of Barcelona. About 403, some years after his return from the East, Vigilantius wrote his celebrated work against superstitious practices, in which he argued against relic worship, as also against the vigils in the basilicas of the martyrs, then so common, the sending of alms to Jerusalem, the rejection of earthly goods and the attribution of special virtue to the unmarried state, especially in the case of the clergy. He thus covers a wider range than Jovinian, whom he surpasses also in intensity. He was especially indignant at the way in which spiritual worship was being ousted by the adoration of saints and their relics. All that is known of his work is through Jerome's treatise *Contra Vigilantium*, or, as that controversialist would seem to prefer saying, "Contra Dormitantium." Notwithstanding Jerome's exceedingly unfavourable opinion, there is no reason to believe that the tract of Vigilantius was exceptionally illiterate, or that the views it advocated were exceedingly "heretical." Soon, however, the great influence of Jerome in the Western Church caused its leaders to espouse all his quarrels, and Vigilantius gradually came to be ranked in popular opinion among heretics, though his influence long remained potent both in France and Spain, as is proved by the polemical tract of Faustus of Rhegium (d. *c.* 490).

VIGILIUS, pope from 537 to 555, succeeded Silverius and was followed by Pelagius I. He was ordained by order of Belisarius while Silverius was still alive; his elevation was due to Theodora, who, by an appeal at once to his ambition and, it is said, to his covetousness, had induced him to promise to disallow the council of Chalcedon, in connexion with the "three chapters" controversy. When, however, the time came for the fulfilment of his bargain, Vigilius declined to give his assent to the condemnation of that council involved in the imperial edict against the three chapters, and for this act of disobedience he was peremptorily summoned to Constantinople, which he reached in 547. Shortly after his arrival there he issued a document known to history as his *Judicatum* (548), in which he condemned indeed the three chapters, but expressly disavowed any intentions thereby to disparage the council of Chalcedon. After a good deal of trimming (for he desired to stand well with his own clergy, who were strongly orthodox, as well as with the court), he prepared another document, the *Constitutum ad Imperatorem*, which was laid before the so-called fifth "oecumenical" council in 553, and led to his condemnation by the majority of that body, some say even to his banishment. Ultimately, however, he was induced to assent to and confirm the decrees of the council, and was allowed after an enforced absence of seven years to set out for Rome. He died, however, at Syracuse, before he reached his destination, on the 7th of June 555.

VIGINTISEXVIRI, in Roman history, the collective name given in republican times to "twenty-six" magistrates of inferior rank. They were divided into six boards, two of which were abolished by Augustus. Their number was thereby reduced to twenty and their name altered to Vigintiviri ("the twenty"). They were originally nominated by the higher magistrates, but subsequently elected in a body at a single sitting of the *comitia tributa*; under the empire they were chosen by the senate. The following are the names of the six boards: (1) *Tresviri capitales* (see Tresviri); (2) *Tresviri monetales*; (3) *Quatuorviri viis in urbe purgandis*, who had the care of the streets and roads inside the city; (4) *Duoviri viis extra urbem purgandis* (see Duoviri), abolished by Augustus; (5) *Decemviri stlitibus judicandis* (see Decemviri); (6) *Quatuor praefecti Capuam Cumas*, abolished by Augustus. The members of the last-named board were appointed by the *praetor urbanus* of Rome to administer justice in ten Campanian towns (list in Mommsen), and received their name from the two most important of these. They were subsequently elected by the people under the title of *quatuorviri jure dicundo*, but the date is not known.

See Mommsen, *Römisches Staatsrecht*, ii. (1887), p. 592.

VIGLIUS, the name taken by Wigle van Aytta van Zuichem (1507–1577), Dutch statesman and jurist, a Frisian by birth, who was born on the 19th of October 1507. He studied at various universities—Louvain, Dôle and Bourges among others—devoting himself mainly to the study of jurisprudence, and afterwards visited many of the principal seats of learning in Europe. His great abilities attracted the notice of Erasmus and other celebrated men, and his renown was soon wide and general. Having lectured on law at the universities of Bourges and Padua, he accepted a judicial position under the bishop of Münster which he resigned in 1535 to become assessor of the imperial court of justice (*Reichskammergericht*). He would not, however, undertake the post of tutor to Philip, son of the emperor Charles V.; nor would he accept any of the many lucrative and honourable positions offered him by various European princes, preferring instead to remain at the university of Ingolstadt, where for five years he occupied a professorial chair. In 1542 the official connexion of Viglius with the Netherlands began. At the emperor's invitation he became a member of the council of Mechlin, and some years later president of that body. Other responsible positions were entrusted to him, and he was soon one of the most trusted of the ministers of Charles V., whom he accompanied during the war of the league of Schmalkalden in 1546. His rapid rise in the emperor's favour was probably due to his immense store of learning, which was useful in asserting the imperial rights where disputes arose between the empire and the estates. He was generally regarded as the author of the edict against toleration issued in 1550; a charge which he denied, maintaining, on the contrary, that he had vainly tried to induce Charles to modify its rigour. When the emperor abdicated in 1555 Viglius was anxious to retire also, but at the instance of King Philip II. he remained at his post and was rewarded by being made coadjutor abbot of St Bavon, and in other ways. In 1559, when Margaret, duchess of Parma, became regent of the Netherlands, Viglius was an important member of the small circle who assisted her in the work of government. He was president of the privy council, member, and subsequently president, of the state council, and a member of the committee of the state council called the *consulta*. But his desire to resign soon returned. In 1565 he was allowed to give up the presidency of the state council, but was persuaded to retain his other posts. However, he had lost favour with Margaret, who accused him to Philip of dishonesty and simony, while his orthodoxy was suspected. When the duke of Alva arrived in the Netherlands Viglius at first assisted him; but he subsequently opposed the duke's scheme of extortion, and sought to induce Philip himself to visit the Low Countries. His health was now impaired and his work was nearly over. Having suffered a short imprisonment with the other members of the state council in 1576, he died at Brussels on the 5th of May 1577, and was buried in the abbey of St Bavon.

Viglius was an advocate of peace and moderation, and as such could not expect support or sympathy from men engaged in a life-and-death struggle for liberty, or from their relentless enemies. He was undoubtedly avaricious, and accumulated great wealth, part of which he left to found a hospital at his native place, Zwichem, and a college at the university of Louvain. He married a rich lady, Jacqueline Damant, but had no children.

He wrote a *Tagebuch des Schmalkaldischen Donaukriegs*, edited by A. von Druffel (Munich, 1877), and some of his lectures were published under the title *Commentarii in decem Institutionum titulos* (Lyons, 1564). His *Vita et opera historica* are given in the *Analecta Belgica* of C. P. Hoynck van Papendrecht (the Hague, 1743). See L. P. Gachard, *Correspondance de Philippe II. sur les affaires des Pays-Bas* (Brussels, 1848–79); and *Correspondance de Marguerite d'Autriche, duchesse de Parme, avec Philippe II.* (Brussels, 1867–81); and E. Poullet, *Correspondance de cardinal de Granvelle* (Brussels, 1877–81).

VIGNE, PAUL DE (1843–1901), Belgian sculptor, was born at Ghent. He was trained by his father, a statuary, and began by exhibiting his "Fra Angelico da Fiesole" at the Ghent Salon in 1868. In 1872 he exhibited at the Brussels Salon a marble statue, "Heliotrope" (Ghent Gallery), and in 1875, at Brussels, "Beatrix" and "Domenica." He was employed by the government to execute caryatides for the conservatoire at Brussels. In 1876 at the Antwerp Salon he had busts of E. Hiel and W. Wilson, which were afterwards placed in the communal museum at Brussels. Until 1882 he lived in Paris, where he produced the marble statue "Immortality" (Brussels Gallery), and "The Crowning of Art," a bronze group on the façade of the Palais des Beaux-Arts at Brussels. His monument to the popular heroes, Jean Breydel and Pierre de Coninck, was unveiled at Bruges in 1887. At his death he left unfinished his principal work, the Anspach monument, which was erected at Brussels under the direction of the architect Janlet with the co-operation of various sculptors. Among other notable works by De Vigne may be mentioned "Volumnia" (1875); "Poverella" (1878); a bronze bust of "Psyche" (Brussels Gallery), of which there is an ivory replica; the marble statue of Marnix de Ste Aldegonde in the Square du Sablon, Brussels; the Metdepenningen monument in the cemetery at Ghent; and the monument to Canon de Haerne at Courtrai.

See E. L. Detage, *Les Artistes Belges contemporains* (Brussels), and O. G. Destrée, *The Renaissance of Sculpture in Belgium* (London, 1895).

VIGNETTE (Fr. for "little vine"), in architecture, a running ornament, representing, as its name imports, a little vine, with branches, leaves and grapes. It is common in the Tudor period, and runs or *roves* in a large hollow or *casement*. It is also called *trayle*. From the transference of the term to book-illustration resulted the sense of a small picture, vanishing gradually at the edge.

VIGNY, ALFRED DE (1797–1863), French poet, was born at Loches (Indre-et-Loire) on the 27th of March 1797. Sainte-Beuve, in the rather ill-natured essay which he devoted to Vigny after his death, expresses a doubt whether the title of count which the poet bore was well authenticated, and hints that no very ancient proofs of the nobility of the family were forthcoming; but it is certain that in the 18th century persons of the name occupied positions which were not open to any but men of noble birth. For generations the ancestors of Alfred de Vigny had been soldiers, and he himself joined the army, with a commission in the Household Troops, at the age of sixteen. But the Revolutionary and Napoleonic wars were over, and after twelve years of life in barracks he retired, preserving, however, a very high estimate of the duties and career of the soldier. While still serving he had made his mark, if as yet unrecognized, by the publication in 1822 of a volume of poems, and in 1826 by another, together with the famous prose romance of *Cinq-Mars*. Sainte-Beuve asserts that the poet antedated some of his most remarkable work. This may or may not be the case; he certainly could not antedate the publication. And it so happens that some of his most celebrated pieces—*Eloa*, *Dolorida*, *Möïse*—appeared (1822–23) before the work of younger members of the Romantic school whose productions strongly resemble these poems. Nor is this originality limited to the point which he himself claimed in the Preface to his collected *Poems* in 1837—that they were "the first of their kind in France, in which philosophic thought is clothed in epic or dramatic form." Indeed this claim is disputable in itself, and has misled not a few of Vigny's recent critics. It is in *poetic*, not *philosophic* quality, that his idiosyncrasy and precursorship are most remarkable. It is quite certain that the other Alfred—Alfred de Musset—felt the influence of his elder namesake, and an impartial critic might discern no insignificant marks of the same effect in the work of Hugo himself. Even Lamartine, considerably Vigny's elder and his predecessor in poetry, seems rather to have been guided by Vigny than Vigny by him. No one can read *Dolorida* or *Le Cor* without seeing that the author had little to learn from any of his French contemporaries and much to teach them. At the same time Vigny, from whatever cause, hardly made any further public appearance in poetry proper during the more than thirty years of his life, and his entire poems, including posthumous fragments, form but one very small pocket volume. *Cinq-Mars*, which at least equalled the poems in popularity, will hardly stand the judgment of posterity so well. It had in its favour the support of the Royalist party, the immense vogue of the novels of Walter Scott, on which it was evidently modelled, the advantages of an exquisite style, and the taste of the day for the romance as opposed to the novel of analysis. It therefore gained a great name both in France and abroad. But any one who has read it critically must acknowledge it to be disappointing. The action is said to be dramatic; if it be so, it can only be said that this proves very conclusively that the action of drama and the action of the novel are two quite different things. To the reader who knows Scott or Dumas the story is singularly uninteresting (far less interesting than as told in history); the characters want life; and the book generally stagnates.

Its author, though always as a kind of outsider (the phrase constantly applied to him in French literary essays and histories being that he shut himself up in a *tour d'ivoire*), attached himself more or less to the Romantic movement of 1830 and the years immediately preceding and following it, and was stimulated by this movement both to drama and to novel-writing. In the year before the revolution of July he produced at the Théâtre Français a translation, or rather paraphrase, of *Othello*, and an original piece, *La Maréchale d'Ancre*. In 1832 he published the curious book *Stello*, containing studies of unlucky youthful poets—Gilbert, Chatterton, Chénier—and in 1835 he brought out his drama of *Chatterton*, which, by the hero's suicide, shocked French taste even after five years of Romantic education, but had a considerable success. The same year saw the publication of *Servitude et grandeur militaires*, a singular collection of sketches rather than a connected work in which Vigny's military experience, his idea of the soldier's duties, and his rather poetical views of history were all worked in. The subjects of *Chatterton* and *Othello* naturally suggest a certain familiarity with English, and in fact Alfred de Vigny knew English well, lived in England for some time and married in 1828 an Englishwoman, Lydia Bunbury. His father-in-law was, according to French gossip, so conspicuous an example of insular eccentricity that he never could remember his son-in-law's name or anything about him, except that he was a poet. By this fact, and the kindness of casual Frenchmen who went through the list of the chief living poets of their country, he was sometimes able to discover his daughter's husband's designation. In 1845 Alfred de

Vigny was elected to the Academy, but made no compromise in his "discourse of reception," which was unflinchingly Romantic. Still, he produced nothing save a few scraps; and, beyond the work already enumerated, little has to be added except his *Journal d'un poëte* and the poems called *Les Destinées*, edited, with a few fragments, by Louis Ratisbonne after his death. Among his dramatic work, however, should be mentioned *Quitte pour la peur* and an adaptation of the *Merchant of Venice* called *Shylock*. *Les Destinées* excited no great admiration in France, but they contain some exceedingly beautiful poetry of an austere kind, such as the magnificent speech of Nature in "La Maison du berger" and the remarkable poem entitled "La Colère de Samson." Vigny died at Paris on the 17th of September 1863.

His later life was almost wholly uneventful, and for the most part, as has been said, spent in retirement. His reputation, however, is perfectly secure. It may, and probably will, rest only on his small volume of poems, though it will not be lessened, as far as qualified literary criticism is concerned, should the reader proceed to the rest of the work. The whole of his non-dramatic verse does not amount to 5000 lines; it may be a good deal less. But the range of subject is comparatively wide, and extraordinary felicity of execution, not merely in language, but in thought, is evident throughout. Vigny, as may be seen in the speech of Nature referred to above, had the secret—very uncommon with French poets—of attaining solemnity without grandiosity, by means of an almost classical precision and gravity of form. The defect of volubility, of never leaving off, which mars to some extent his great contemporary Hugo, is never present in him, and he is equally free from the looseness and disorders of form which are sometimes blemishes in Musset, and from the effeminacy of Lamartine, while once more his nobility of thought and plentifulness of matter save him from the reproach which has been thought to rest on the technically perfect work of Théophile Gautier. The dramatic work is, perhaps, less likely to interest English than French readers, the local colour of *Chatterton* being entirely false, the sentiment conventional in the extreme, and the real pathos of the story exchanged for a commonplace devotion on the poet's part to his host's wife. In the same way, the finest passages of *Othello* simply disappear in Vigny's version. In his remaining works the defect of skill in managing the plot and characters of prose fiction, which has been noticed in *Cinq-Mars*, reappears, together (in the case of the *Journal d'un poëte* and elsewhere) with signs of the fastidious and slightly affected temper which was Vigny's chief fault as a man. In his poems proper none of these faults appears, and he is seen wholly at his best. It should be said that of his posthumous work not a little had previously appeared piecemeal in the *Revue des deux mondes*, to which he was an occasional contributor. The prettiest of the complete editions of his works (of which there are several) is to be found in what is called the *Petite bibliothèque Charpentier*. For many years the critical attention paid to him was not great. Recently there has been a revival of interest as shown by monographs: M. Paléologue's "Alfred de Vigny" in the *Grands écrivains français* (1891); L. Dorison's *Alfred de Vigny, poète-philosophe* (1892) and *Un symbole social* (1894); G. Asse's *Alfred de Vigny et les éditions originales de sa poésie* (1895); E. Dupuy's *La Jeunesse des Romantiques* (1905); and E. Lauvrière's *Alfred de Vigny* (Paris, 1910). But in most of these rather excessive attention has been paid to the "philosophy" of a pessimistic kind which succeeded Vigny's early Christian Romanticism. This, though not unnoteworthy, is separable from his real poetical quality, and concentration on it rather obscures the latter, which is of the rarest kind. It should be added that an interesting sidelight has been thrown on Vigny by the publication (1905) of his *Fragments inédits sur P. et T. Corneille*. (G. Sa.)

VIGO, a seaport and naval station of north-western Spain, in the province of Pontevedra; on Vigo Bay (Ria de Vigo) and on a branch of the railway from Tuy to Corunna. Pop. (1900) 23,259. Vigo Bay, one of the finest of the Galician fjords, extends inland for 19 m., and is sheltered by low mountains and by the islands (Islas de Cies, ancient *Insulae Siccae*) at its mouth. The town is built on the south-eastern shore, and occupies a hilly site dominated by two obsolete forts. The older streets are steep, narrow and tortuous, but there is also a large modern quarter. Vigo owes its importance to its deep and spacious harbour, and to its fisheries. It is a port of call for many lines trading between Western Europe and South America. Shipbuilding is carried on, and large quantities of sardines are canned for export. In 1909, 2041 ships of 2,710,691 tons (1,153,564 being British) entered at Vigo; the imports in that year, including tin and tinplate, coal, machinery, cement, sulphate of copper and foodstuffs, were valued at £481,752; the exports, including sardines, mineral waters and eggs, were valued at £554,824. The town contains flour, paper and sawmills, sugar and petroleum refineries, tanneries, distilleries and soap works; it has also a large agricultural trade and is visited in summer for sea-bathing.

Vigo was attacked by Sir Francis Drake in 1585 and 1589. In 1702 a combined British and Dutch fleet under Sir George Rooke and the duke of Ormonde destroyed a Franco-Spanish fleet in the bay, and captured treasure to the value of about £1,000,000; numerous attempts have been made to recover the larger quantity of treasure which was supposed, on doubtful evidence, to have been sunk during the battle. In 1719 Vigo was captured by the British under Viscount Cobham.

VIJAYANAGAR, or Bijanagar ("the city of victory"), an ancient Hindu kingdom and ruined city of southern India. The kingdom lasted from about 1336 to 1565, forming during all that period a bulwark against Mahommedan invasion from the north. Its foundation, and even great part of its history, is obscure; but its power and wealth are attested by more than one European traveller, and also by the character of the existing ruins. At the beginning of the 14th century Mahommedan raiders had effectually destroyed every Hindu principality throughout southern India, but did not attempt to occupy the country permanently. In this state of desolation Hindu nationality rose again under two brothers, named Harihara and Bukka, of whom little more can be said than that they were Kanarese by race. Hence their kingdom was afterwards known as the Carnatic. At its widest extent, it stretched across the peninsula from sea to sea, from Masulipatam to Goa; and every Hindu prince in the south acknowledged its supremacy. The site of the capital was chosen, with strategic skill, on the right bank of the river Tungabhadra, which here runs through a rocky gorge. Within thirty years the Hindu Rayas of Vijayanagar were able to hold their own against the Bahmani sultans, who had now established their independence of Delhi in the Deccan proper. Warfare with the Mahommedans across the border in the Raichur doab was carried on almost unceasingly, and with varying result. Two, or possibly three, different dynasties are believed to have occupied the throne of Vijayanagar as time went on; and its final downfall may be ascribed to the domestic dissensions thus produced. This occurred in 1565, when the confederate sultans of Bijapur, Ahmednagar and Golconda, who had divided amongst themselves the Bahmani dominions, overwhelmed the Vijayanagar army in the plain of Talikota, and sacked the defenceless city. The Raya fled south to Penukonda, and later to Chandragiri, where one of his descendants granted to the English the site of Fort St George or Madras. The city has ever since remained a wilderness of immense ruins, which are now conserved by the British government.

See R. Sewell, *A Forgotten Empire* (1900); and B. S. Row, *History of Vijayanagar* (Madras, 1906).

VIKING. The word "Viking," in the sense in which it is used to-day, is derived from the Icelandic (Old Norse) *Víkingr* (m.), signifying simply a sea-rover or pirate. There is also in Icelandic the allied word *víking* (f.), a predatory voyage. As a loan-word *víking* occurs in A.S. poetry (*vícing* or *wícing*), *e.g.* in *Widsith*, *Byrnoth*, *Exodus*. During the Saga Age (900–1050), in the beginning of Norse literature, *víkingr* is not as a rule used to designate any class of men. Almost every young Icelander of sufficient means and position, and a very large number of young Norsemen, made one or more viking expeditions. We read of such a one that he went "a-viking" (*fara i viking*, *vera i viking*, or very often *fara*, &c., *vestan i viking*). The procedure was almost a recognized part of education, and was analogous to the grand tour made by our great-grandfathers in the 18th century. But the use of *víkingr* in a more generic sense is still to be found in the Saga Age. If the designation of this or that personage as *mikill víkingr* or *rauða víkingr* (red viking) be not reckoned an instance of such use, we have it at all events in the name of a small quasi-nationality, the Jómsvíkingar, settled at Jómsborg on the Baltic (in modern Pomerania), to whom a saga is dedicated: who possessed rather peculiar institutions evidently the relic of what is now called the Viking Age, that preceded the Saga Age by a century. Another instance of such more generic use occurs in the following typical passage from the *Landnámabók* (Sturlabók), where it is recorded how Harald *Fairhair* harried the vikings of the Scottish isles—that famous harrying which led to most of the settlement of Iceland and the birth of Icelandic literature:—

> "Haraldr en harfari herjaði vestr am haf . . . Hann lagði "undir sig allar Sudreyjar. . . . En er hann fór vestann slogust "i eyjernar vikingar ok Skotar ok Irar ok herjuðu ok ræntu "viða" (*Landn.*, ed. Jónsson, 1906, p. 135).

It is in this more generic sense that the word "viking" is now generally employed. Historians of the north have distinguished as the "Viking Age" (*Vikingertiden*) the time when the Scandinavian folk first by their widespread piracies brought themselves forcibly into the notice of all the Christian peoples of western Europe. We cannot to-day determine the exact homes or *provenance* of these freebooters, who were a terror alike to the Frankish empire, to England and to Ireland and west Scotland, who only came into view when their ships anchored in some Christian harbour, and who were called now *Normanni*, now *Dacii*, now Danes, now *Lochlannoch*; which last, the Irish name for them, though etymologically "men of the lakes or bays," might as well be translated "Norsemen," seeing that *Lochlann* was the Irish for Norway. The exact etymology of *vikingr* itself is not certain: for we do not know whether *vík* is used in a general sense (bay, harbour) in this connexion, or in a particular sense as the Vík, the Skagerrack and Christiania Fjord. The reason for using "viking" in a more generic sense than is warranted by the actual employment of the word in Old Norse literature rests on the fact that we have no other word by which to designate the early Scandinavian pirates of the 9th and the beginning of the 10th century. We cannot tell for the most part whether they came from Denmark or Norway, so that we cannot give them a national name. "Normanner" is used by some Scandinavian writers (as by Steenstrup in his classical work *Normannerne*). But "Normans" has for us quite different associations. And even those who have preferred not generally to use the word "vikings" to designate the pirates and invaders, have adhered to the term "Viking Age" for the period in which they were most active (cf. Munch, *Det Norske Folks Historie*, Deel I. Bd. i. p. 356; Steenstrup and others, *Danmarks Riges Historie*, bk. ii. &c.). At the same time, the significance which the word "viking" has had in our language is due in part to a false etymology, connecting the word with "king"; the effect of which still remains in the customary pronunciation vi-king instead of vik-ing, now so much embedded in the language that it is a pedantry to try and change it.

We may fairly reckon the "Viking Age" to lie between the date of the first recorded appearance of a northern pirate fleet (A.D. 789) and the settlement of the Normans in Normandy by the treaty of St Clair-sur-Epte, A.D. 911 or 912.[1] For a few years previous to that date our chief authority for the history of the piracies and raids in the Frankish empire fails us:[2] we know that the Norsemen had a few years before that date been driven in great numbers out of Ireland; and England had been in a sense pacified through the concession of a great part of the island to the invaders by the peace of Wedmore, A.D. 878. Although, outside the information we get from Christian chroniclers, this age is for the people of the north one of complete obscurity, it is evident that the Viking Age corresponds with some universal disturbance or unrest among the Scandinavian nations, strictly analogous to the unrest among more southern Teutonic nations which many centuries before had heralded the break-up of the Roman empire, an epoch known as that of the Folk-wanderings (*Völkerwanderungen*). We judge this because we can dimly see that the impulse which was driving part of the Norse and Danish peoples to piracies in the west was also driving the Swedes and perhaps a portion of the Danes to eastward invasion, which resulted in the establishment of a Scandinavian kingdom (Garðaríki) in what is now Russia, with its capital first at Novgorod, afterwards at Kiev.[3] This was, in fact, the germ of the Russian empire. If we could know the Viking Age from the other, the Scandinavian side, it would doubtless present far more interest than in the form in which the Christian chroniclers present it. But from knowledge of this sort we are almost wholly cut off. We have to content ourselves with what is for the greater part of this age a mere catalogue of embarkations and plunderings along all the coasts of western Europe without distinctive characteristics.

The Viking Raids.—The detail of these raids is quite beyond the compass of the present article, and a summary or synopsis must suffice. For all record which we have, the Viking Age was inaugurated in A.D. 789 by the appearance in England on our Dorset coast of three pirate ships "from Haerethaland" (Hardeland or Hardyssel in Denmark or Hördeland in Norway), which are said in the *Anglo-Saxon Chronicle* to be "the first ships of the Danish men" who sought the land of England. They killed the port-reeve, took some booty and sailed away. Other pirates appeared in 793 on a different coast, Northumbria, attacked a monastery on Lindisfarne (Holy Island), slaying and capturing the monks; the following year they attacked and burnt Jarrow; after that they were caught in a storm, and all perished by shipwreck or at the hands of the countrymen. In 795 a fleet appeared off Glamorganshire. They attacked Man in 798 and Iona in 802. But after this date for the lifetime of a generation the chief scene of viking exploits was Ireland, and probably the western coasts and islands of Scotland.

The usual course of procedure among the northern adventurers remains the same to whatever land they may direct their attacks, or during whatever years of the 9th century these attacks may fall. They begin by more or less desultory raids, in the course of which they seize upon some island, which they generally use as an arsenal or *point d'appui* for attacks on the mainland. At first the raids are made in the summer: the *first wintering* in any new scene of plunder forms an epoch so far as that country or region is concerned. Almost always for a period all power of resistance on the part of the inhabitants seems after a while and for a limited time to break down, and the plunderers to have free course wherever they go. Then they show an ambition to settle in the country, and some sort of division of territory takes place. After that the northerners assimilate themselves more or less to the other inhabitants of the country, and their history merges to a less or greater extent in that of the country at large. This course is followed in the history of the viking attacks on Ireland, the earliest of their continuous series of attacks. Thus they begin by seizing the island of Rechru (now Lambay) in Dublin Bay (A.D. 795); in the course of about twenty years we have notice of them on the northern, western and southern coasts; by A.D. 825 they have already ventured raids to a considerable distance inland. And in A.D. 832 comes a large fleet ("a great royal fleet," say the Irish annals) of which the admiral's name is given, Turgesius (Thorgeis or Thorgisl?). The new invader, though with a somewhat chequered course, extended his conquests till in A.D. 842 one-half of Ireland (called Lethcuinn, or Con's Half) seems to have submitted to him; and we have the curious picture of Turgesius establishing his wife Ota as a sort of *völva*, or priestess, in what had been one of Ireland's most famous and most literary monasteries, Clonmacnoise. Turgesius was, however, killed very soon after this (in 845); and though in A.D. 853 Olaf the White was over-king of Ireland, the vikings' power on the whole diminished. In the end, territory was—if by no formal treaty—ceded to their influence; and the (Irish) kingdoms of Dublin and Waterford were established on the island.

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[1] W. Vogel gives the former date; 912 is that more commonly accepted.

[2] The *Annales Vedastini.*

[3] The word *garðr* (fort) is preserved in the "*gorod*" of Novgorod.

This brief sketch may be taken as the prototype of viking invasion of any region of western Christendom which was the object of their continuous attacks. Of such regions we may distinguish five. Almost simultaneously with the attacks on Ireland came others, probably also from Norway, on the western regions (coasts and islands) of Scotland. Plunderings of Iona are mentioned in A.D. 802, 806. In the course of a generation almost all the monastic communities in western Scotland had been destroyed. But details of these viking plunderings are wanting. On the continent there were three distinct regions of attack. First the mouth of the Scheldt. There the Danes very early settled on the island of Walcheren, which had in fact been given by the emperor Louis the Pious in fief to a Danish fugitive king, Harald by name, who sought the help of Louis, and adopted Christianity. After the partition of the territory of Charlemagne's empire among the sons of Louis the Pious, Walcheren and the Scheldt-mouth fell within the possessions of the emperor Lothair, and in the region subsequently distinguished as Lotharingia. From this centre, the Scheldt, the viking raids extended on either side; sometimes eastward as far as the Rhine, and so into Germany proper, the territory assigned to Louis the German; at other times westward to the Somme, and thus into the territory of Charles the Bald, the future kingdom of France. In the event, toward the end of the 9th century all Frisia between Walcheren and the German Ocean seems to have become the permanent possession of the invaders. In like fashion was it with the next district, that of the Seine, only that here no important island served the pirates for their first arsenal and winter quarters. The serious attacks of the pirates in any part of the empire distant from their own lands begin about the time of the battle of Fontenoy between Louis' sons (A.D. 841). The first wintering of the vikings in the Seine territory (A.D. 850) was in "Givoldi fossa," the tomb of one Givoldus, not far from the mouth of the river, but no longer exactly determinable. Their first attack on Paris was in A.D. 845: a much more important but unsuccessful one took place in A.D. 885–87, unsuccessful that is so far as the city itself was concerned; but the invaders received an indemnity for raising the siege and leave to pass beyond Paris into Burgundy. The settlement of Danes under Rollo or Rolf on the lower Seine, *i.e.* in Normandy, dates from the treaty of St Clair-sur-Epte, A.D. 912 (or 911).

The third region is the mouth of the Loire. Here the island *point d'appui* was Noirmoutier, an island with an abbey at the Loire mouth. The northmen wintered there in A.D. 843. No region was more often ravaged than that of the lower Loire, so rich in abbeys—St Martin of Tours, Marmoutiers, St Benedict, &c. But the country ceded to the vikings under Hasting at the Loire mouth was insignificant and not in permanent occupation.

Near the end of the 9th century, however, the plundering expeditions which emanated from these three sources became so incessant and so widespread that we can signalize no part of west France as free from them, at the same time that the vikings wrought immense mischief in the Rhine country and in Burgundy. The defences of west France seem quite to have broken down, as did the Irish when Turgesius took "Con's half," or when in A.D. 853 Olaf the White became over-king of Ireland. Unfortunately at this point our best authority ceases; and we cannot well explain the changes which brought about the Christianization of the Normans and their settlement in Normandy as vassals, though recalcitrant ones, of the West Frankish kings.

For the viking attacks in the 5th (or 6th) territory, our own country, the course of events is much clearer. As a part of English history it is, however, sufficiently known, and the briefest summary thereof must suffice. That will show how in its general features it follows the normal course. The first appearance of the vikings in England we saw was in A.D. 789. The first serious attacks do not begin till 838. The island of Sheppey, however, was attacked in 835, and in the following year the vikings entrenched themselves there. The first wintering of the pirates in England was on the contiguous island of Thanet in A.D. 850. The breakdown of the English defences in all parts of the country save Wessex dates from 868: in Wessex that occurs in 877-88. But the position is suddenly recovered by Alfred in 878, by the battle of Aethandune, as suddenly though not so unaccountably as it was later in West Francia. As Rollo was to do in 912, the Danish leader Guthorm received baptism, taking the name of Aethelstan, and settled in his assigned territory, East Anglia, according to the terms of the peace of Wedmore. But the forces which Alfred defeated at Aethandune represented but half of the viking army in England at the time. The other half under Halfdan (Ragnar Lodbrog's son?) had never troubled itself about Wessex, but had taken firm possession in Northumbria.

The six territories which we have signalized—Ireland, Western Scotland, England, the three in West Francia which merge into each other by the end of the 9th century—do not comprise the whole field of viking raids or attempted invasion. For farther still to the east they twice sailed up the Elbe (A.D. 851, 880) and burnt Hamburg. Southwards they plundered far up the Garonne, and in the north of Spain; and one fleet of them sailed all round Spain, plundering, but attempting in vain to establish themselves in this Arab caliphate. They plundered on the opposite African coast, and at last got as far as the mouth of the Rhone, and thence to Luna in Italy.

What we found in the case of the Irish raids, that at first they are quite anonymous, but that presently the names of the captains of the expeditions emerge, is likewise the case in all other lands. In Ireland, besides the important and successful Turgesius, we read of a Saxulf who early met his death, as well as of Ivar (Ingvar), famous also in England and called the son of Ragnar Lodbrog, and of Oisla, Ivar's comrade; finally (the vikings in Ireland being mostly of Norse descent) of the well-known Olaf the White, who became king of all the Scandinavian settlements in Ireland. In France, Oscar is one of the earliest and most successful of the invaders. Later the name of Ragnar (probably Ragnar Lodbrog) appears, along with Weland, Hasting and one of the sons of Ragnar, Björn. Farther to the east we meet the names of Rurik, Godfred and Siegfried. In the eastern region the viking leaders seem to have been closely connected with one of the Danish royal families, the kings of Jutland. The practical though short-lived conquest of England begins under Ivar, Ubbe and Halfdan, reputed sons of Ragnar, and is completed by the last of the three in conjunction with the Guthorm above mentioned. This is, of course, what we should expect, that larger acquaintance gives to the Christian chroniclers more knowledge of their enemy. Precisely the same process in a converse sense develops the casual raids of early times into a scheme of conquest. For at the outset the Christian world was wholly strange to these northmen. We have, it has been said, hardly any means of viewing these raids from the other side. But one small point of light is so suggestive that it may be cited here. The mythical saga of Ragnar Lodbrog is undoubtedly concerned with the Viking Age, though it is impossible now to identify most of the expeditions attributed to this northern hero, stories of conquest in Sweden, in Finland, in Russia and in England, which belong to quite a different age from this one. In the Christian chronicles the name of Ragnar is associated with an attack on Paris in A.D. 845, when the adventurers were (through the interposition of St Germain, say the Christians) suddenly enveloped in darkness—in a thick fog?—and fell before the arms of the defenders. In Saxo Grammaticus's account of Ragnar Lodbrog, this event seems to be reflected in the story of an expedition of Ragnar's to Bjarmaland or Perm in Russia. For Bjarmaland, though it gained a local habitation, is also in Norse tradition a wholly mythical and mythological place, more or less identical with the underworld (Niflhel, mist-heil). So it appears in the history given by Saxo Grammaticus of the voyage to Bjarmaland of one "Gorm the old." It "looks like a vaporous cloud" and is full of tricks and illusions of sense. We see then that in virtue of some quite historical misfortune to the viking invaders connected with a mist and with a great sickness which invaded the army, the place they have come to (in reality Paris) is in Scandinavian tradition identified with the mythic Bjarmaland; and later, in the history of Saxo Grammaticus, it is identified with the geographical Bjarmaland or Perm. (Saxo Grammat., *Hist. Dan.* p. 452, Gylfaginning (Edda Snorra); Acta SS. 18th May and 11th Oct.; Steenstrup, *Normannerne*, i. p. 97 seq.; Keary, *The Vikings in Western Christendom*, pp. 162, 260.)

No example could better than this bring home to us the strangeness of the Christian world to the first adventurers from the north, nor better explain the process of familiarity which gradually extended the sphere of their ambition. The expedition which we have made mention of took place almost in the middle of the 9th century, and exactly fifty years after the effective opening of the Viking Age. But after this date events developed rapidly. It was fourteen years later (in A.D. 859) that Ragnar's son Björn Ironside and Hasting made their great expedition round Spain to the Mediterranean. In 865 or 866 came to England what we know as *the* Army, or the Great Army, whose first attacks were in the north of England. Five kings are mentioned in connexion with this veritable invasion of England, and many earls. Their course was not unchequered; but it was only in Wessex that they met with any effective resistance, and the victory of Ashdown (871) put no end to their advance; for, as we know, Alfred himself had at last to wander a fugitive in the fastnesses of Selwood Forest. Much was retrieved by the victory of Aethandune; yet even after the peace of Wedmore as large a part of the land lay under the power of the Danes as of the English.

It is from this time that we discern two distinct tendencies in the viking people. While one section is ready to settle down and receive territory at the hands of the Christian rulers, with or without homage, another section still adheres to a life of mere adventure and of plunder. A large portion of the Great Army refused to be bound by the peace of Wedmore, made some further attempts on England which were frustrated by Alfred's powerful new-built fleet, and then sailed to the continent and spread devastation far and wide. We see them under command of two Danish "kings," Godfred and Siegfried, first in the country of the Rhine-mouth or the Lower Scheldt; afterwards dividing their forces and, while some devastate far into Germany, others extend their ravages on every side in northern France down to the Loire. The whole of these vast countries, Northern Francia, with part of Burgundy, and the Rhineland, seem to lie as much at their mercy as England had done before Aethandune, or Ireland before the death of Turgesius. But in every country alike the wave of viking conquest now begins to recede. The settlement of Normandy was the only permanent outcome of the Viking Age in France. In England under Edward the Elder and Aethelflaed, Mercia recovered a great portion of what had been ceded to the Danes. In Ireland a great expulsion of the invaders took place in the beginning of the 10th century. Eventually the Norsemen in Ireland contented themselves with a small number of colonies, strictly confined in territory around certain seaports which they themselves had created: Dublin, Waterford and Wexford; though as the whole of Ireland was divided into petty kingdoms, it might easily happen that the Norse king in Ireland rose to the position—not much more than nominal—of over-king (Ard-Ri) for the whole land.

Character of the Vikings.—Severe, therefore, as were the viking raids in Europe, and great as was the suffering they inflicted—on account of which a special prayer, *A furore Normannorum libera nos*, was inserted in some of the litanies of the West—if they had been pirates and nothing more their place in history would be an insignificant one. If they had been no more than what the Illyrian pirates had been in the early history of Rome, or than the Arabic corsairs were at this time in southern Europe, the disappearance of the evil would have been quickly followed by its oblivion. But even at the outset the vikings were more than isolated bands of freebooters. As we have seen, the viking outbreak was probably part of a national movement. We know that at the same time that some Scandinavian folk were harrying all the western lands, others were founding Garðaríki (Russia) in the east; others were pressing still farther south till they came in contact with the eastern empire in Constantinople, which the northern folk knew as Mikillgarðr (Mikklegard); so that when Hasting and Björn had sailed to Luna in the gulf of Genoa the northern folk had almost put a girdle round the Christian world. There is every evidence that the vikings were not a mere lawless folk—that is, in their internal relations—but that a system of laws existed among them which was generally respected. The nearest approach to it now preserved is probably the code of laws attributed to the mythic king Froði (the Wise) and preserved in the pages of Saxo Grammaticus. It contains provisions for the partition of booty, punishments for theft, desertion and treachery. But some of the clauses securing a comparative liberty for women appear less characteristic of the Viking Age (cf. Alexander Bugge, *Vikingerne*, vol. i. p. 49). Women, indeed, did not take part in their first expeditions. In the constitution of the Jómborg state and again in that of the eastern Vaerings (a Scandinavian body in the service of the East Roman Empire) we see a constitution which looks like the foretaste of that of the Templars or the Teutonic Knights. Steenstrup thinks the code cited by Saxo may be identical with the laws which Rollo promulgated for his Norman subjects. In any case, they fall more near the viking period than any other northern table of laws. A certain republicanism was professed by these adventurers. "We have no king," one body answered to some Frankish delegates. We do read frequently of kings in the accounts of their hosts; but their power may not have extended beyond the leadership of the expedition; they may have been kings *ad hoc*. On the other hand, the whole character of northern tradition (Teutonic and Scandinavian tradition alike) forbids us to suppose that any would be elected to that office who was not of noble or princely blood. They were not entirely unlettered; for the use of runes dates back considerably earlier than the Viking Age. But these were used almost exclusively for lapidary inscriptions. What we can alone describe as a literature, first the early Eddic verse, next the habit of narrating sagas: these things the Norsemen learned probably from their Celtic subjects, partly in Ireland, partly in the western islands of Scotland; and they first developed the new literature on the soil of Iceland. Nevertheless, some of the Eddic songs do seem to give the very form and pressure of the viking period.[1]

In certain material possessions—those, in fact, belonging to their trade, which was war and naval adventure—these viking folk were ahead of the Christian nations: in shipbuilding, for example. There is certainly a historical connexion between the ships which the tribes on the Baltic possessed in the days of Tacitus and the viking ships (Keary, *The Vikings in Western Europe*, pp. 108–9): a fact which would lead us to believe that the art of shipbuilding had been better preserved there than elsewhere in northern Europe. Merchant vessels must of course have plied between England and France or Frisia. But it is certain that even Charlemagne possessed no adequate navy, though a late chronicler tells us how he thought of building one. His descendants never carried out his designs. Nor was any English king before Alfred stirred up to undertake the same task. And yet the Romans, when threatened by the Carthaginian power, built in one year a fleet capable of holding its own against the, till then, greatest maritime nation in the world. The viking ships had a character apart. They may have owed their origin to the Roman galleys: they did without doubt owe their sails to them.[2] Equally certain it is that this special type of shipbuilding was developed in the Baltic, if not before

[1] More especially the beautiful series contained in book iii. of the *Corpus Poeticum Boreale*, and ascribed by the editors of that collection to one poet—"the Helgi Poet." Here vikings are mentioned by name—*e.g.*:—

"Varð ára ymr, ok iarna glymr;
Brast rönd við rönd; rero víkingar."

[2] "Sail" in every Teutonic language is practically the same word, and derived from the Latin *sagulum*.

the time of Tacitus, long before the dawn of the Viking Age. Their structure is adapted to short voyages in a sea well studded with harbours, not exposed to the most violent storms or most dangerous tides. To the last, judging by the specimens of Scandinavian boats which have come down to us, they must have been not very seaworthy; they were shallow, narrow in the beam, pointed at both ends, and so eminently suitable for manœuvring (with oars) in creeks and bays. The viking ship had but one large and heavy square sail. When a naval battle was in progress, it would depend for its manœuvring on the rowers. The accounts of naval battles in the sagas show us, too, that this was the case. The rowers in each vessel, though among the northern folk these were free men and warriors, not slaves as in the Roman and Carthaginian galleys, would yet need to be supplemented by a contingent of fighting men, marines, in addition to their crew. Naturally the shipbuilding developed: so that vessels in the viking time would be much smaller than in the Saga Age. In saga literature we read of craft (of "long ships") with 20 to 30 benches of rowers, which would mean 40 to 60 oars. There exist at the museum in Christiania the remains of two boats which were found in the neighbourhood: one, the Gókstad ship, is in very tolerable preservation. It belongs probably to the 11th century. On this boat there are places for 16 oars a side. It is not probable that the largest viking ships had more than 10 oars a side. As these ships must often, against a contrary wind, have had to row both day and night, it seems reasonable to imagine the crew divided into three shifts (as they call them in mining districts), which would give double the number of men available to fight on any occasion as to row.[1] Thus a 20-oared vessel would carry 60 men. But some 40 men per ship seems, for this period, nearer the average. In 896, toward the end of our age, it is incidentally mentioned in one place that five vessels carried 200 vikings, an average of 40 per ship. Elsewhere about the same time we read of 12,000 men carried in 250 ships, an average of 48.

The round and painted shields of the warriors hung outside along the bulwarks: the vessel was steered by an oar at the right side (as whaling boats are to-day), the steerboard or starboard side. Prow and stern rose high; and the former was carved most often into the likeness of a snake's or dragon's head: so generally that "dragon" or "worm" (snake) became synonymous with a war-ship. The warriors were well armed. The *byrnie* or mail-shirt is often mentioned in Eddic songs: so are the axe, the spear, the javelin, the bow and arrows and the sword. The Danes were specially renowned for their axes; but about the sword the most of northern poetry and mythology clings. An immense joy in battle breathes through the earliest Norse literature, which has scarce its like in any other literature; and we know that the language recognized a peculiar battle fury, a veritable madness by which certain were seized and which went by the name of "berserk's way" (*berserksgangr*).[2] The courage of the vikings was proof against anything, even as a rule against superstitious terrors. "We cannot easily realize how all-embracing that courage was. A trained soldier is often afraid at sea, a trained sailor lost if he has not the protecting sense of his own ship beneath him. The viking ventured upon unknown waters in ships very ill-fitted for their work. He had all the spirit of adventure of a Drake or a Hawkins, all the trained valour of reliance upon his comrades that mark a soldiery fighting a militia" (*The Vikings in Western Christendom*, p. 143). He was unfortunately hardly less marked for cruelty and faithlessness. Livy's words, "inhumana crudelitas, perfidia plus quam Punica," might, it is to be feared, have been applied as justly to the vikings as to any people of western Europe. It is also true, however, that they showed a great capacity for government, and in times of peace for peaceful organization. Normandy was the best-governed part of France in the 11th century; and the Danes in East Anglia and the Five Burgs were in many regards a model to their Saxon neighbours (Steenstrup, *op. cit.* iv. ch. 2). Of all European lands England is without doubt that on which the Viking Age has left most impression: in the number of original settlers after 878; in the way which these prepared for Canute's conquest; and finally in that which she absorbed from the conquering Normans. England's gain was France's loss: had the Normans turned their attention in the other direction, they might likely enough have gained the kingdom in France and saved that country from the intermittent anarchy from which it suffered from the 11th till the middle of the 15th century.

Sources of Viking History.—These are, as has been said, almost exclusively the chronicles of the lands visited by the vikings. For Ireland we have, as on the whole our best authority, the *Annales Ultonienses* (C. O'Conor, *Scr. Rev. Hib.* iv.), supplemented by the *Annals of the Four Masters* (ed. O'Donovan) and the *Chronicon Scottorum* (ed. Henessy). Finally, *The War of the Gaidhill with the Gaill* (ed. Todd); *Three Fragments of Irish History* (O'Donovan); cf. W. F. Skene, *Celtic Scotland*. For England the *Anglo-Saxon Chronicle*, *Annales Lindisfarnenses* (in Pertz, *Monumenta*, vol. xix.); Simeon of Durham, *Historia Dunelmi Ecclesiae*. For the Frankish empire the chief sources of our information are *The Annales Regni Francorum*, *Annales Bertiani* (Pertz, vol. i.) in three parts (the first anonymous, the second by Prudentius, the third by Hincmar, A.D. 830–82). *The Annales Xantenses* (A.D. 876, 873; Pertz, vol. ii.) are the authorities for the northern and eastern regions, and the *Annales Fuldenses* (which begin with Pipin of Herestel and go down to A.D. 900; Pertz, vol. i.) for Germany. Toward the end of the 9th century the *Annales Vedastini* (Pertz, vols. i, and ii.) are almost the exclusive authority for the western raids. In the historians of Normandy, especially in Dudo of St Quentin, much incidental matter may be found.

References to the Viking Age in a general way are to be found in a vast number of books, especially histories of the Scandinavian countries, of which Munch's *Det Norske Folks Historie* (1852, &c.) is the most distinguished; J. J. A. Worsaae has written *Minder om de Danske og Nord-Mændene i England, Skotland og Irland* (1851), an antiquarian rather than an historical study; G. B. Depping, *L'Histoire des expéditions maritimes des Normands* (1843), a not very critical work, and E. Mabille, "Les Invasions Normandes dans la Loire" (*École des chartes bibl.* t. 30, 1869). A completer work than either of these is W. Vogel's *Die Normannen und das Fränkische Reich* (1906). It does not, however, break any fresh ground. J. C. H. Steenstrup's *Normannerne* (1876–82), in four volumes, is not a continuous history, but a series of studies of great learning and value; C. F. Keary, *The Vikings in Western Europe* (1891) is a history of the viking raids on all the western lands, but ends A.D. 888. A. Bugge's *Vikingerne* (1904–6) is a study of the moral and social side of the vikings, or, one should rather say, of the earliest Scandinavian folk. (C. F. K.)

VIKRAMADITYA, a legendary Hindu king of Uzjain, who is supposed to have given his name to the Vikram Samvat, the era which is used all over northern India, except in Bengal, and at whose court the "nine gems" of Sanskrit literature are also supposed to have flourished. The Vikram era is reckoned from the vernal equinox of the year 57 B.C., but there is no evidence that that date corresponds with any event in the life of an actual king. As a matter of fact, all dates in this era down to the 10th century never use the word Vikram, but that of Malava instead, that being the tribe that gives its name to Malwa. The name Vikramaditya simply means "sun of power," and was adopted by several Hindu kings, of whom Chandragupta II. (Chandragupta Vikramaditya), who ascended the throne of the Guptas about A.D. 375, approaches most nearly to the legend.

See Alexander Cunningham, *Book of Indian Eras* (1883); and Vincent Smith, *Early History of India* (1904).

VILAS, WILLIAM FREEMAN (1840–1908), American political leader and lawyer, was born in Chelsea, Vermont, on the 9th of July 1840. His father, Levi B. Vilas, a lawyer and Democratic politician, emigrated in 1851 to Madison, Wisconsin. William graduated at the university of Wisconsin in 1858, and at the Albany (New York) Law School in 1860, and began to practise law in Madison with his father. In 1862 he recruited and became captain of Company A of the Twenty-Third Wisconsin

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[1] Steenstrup (*Normannerne*, i. p. 352), to get the number of men on (say) a 30-oared vessel, adds but some 20 more. This seems an unlikely limitation, throwing an impossible amount of work upon the crew, and leaving each ship terribly weak supposing a naval battle had to be undertaken—as with some rival viking fleet, even before any Christian nation possessed a fleet.

[2] Cf. Grett. S. ch. 42, Njála, ch. 104, &c., and many other sources

Volunteers, of which he was made lieutenant-colonel in 1863, and which he commanded in the siege of Vicksburg. In August 1863 he resigned his commission and resumed his law practice. He was professor of law in the university of Wisconsin in 1868–85, and again in 1889–92, and in 1875–78 was a member of the commission which revised the statutes of Wisconsin. From 1876 to 1886 he was a member of the National Democratic Committee, and virtually the leader of his party in his state; he was a delegate to the National Democratic Conventions of 1876, 1880 and 1884, and was permanent chairman of the last. In 1885 he was a member of the state Assembly. He was postmaster-general in President Grover Cleveland's cabinet from March 1885 until January 1888, and was then secretary of the interior until March 1889. From 1891 until 1897 he was a member of the United States Senate, in which, during President Cleveland's second term, he was recognized as the chief defender of the Administration, and he was especially active in securing the repeal of the silver-purchase clause of the Sherman Act. He was a delegate to the Democratic National Convention of 1896, but withdrew after the adoption of the free-silver plank. He then became one of the chief organizers of the National (or Gold) Democratic party, attended the convention at Indianapolis, and was chairman of its committee on resolutions. In 1881–85 and in 1898–1905 he was a regent of the university of Wisconsin; and he was a member (1897–1903) of the commission which had charge of the erection of the State Historical Library at Madison, and in 1906–8 of the commission for the construction of the new state capitol. He died at Madison on the 27th of August 1908.

With E. E. Bryant he edited vols. i. to xx., except vol. v., of the *Reports of the Wisconsin Supreme Court.*

VILL, the Anglicized form of the word *villa*, used in Latin documents to translate the Anglo-Saxon *tun*, township, "the unit of the constitutional machinery, the simplest form of social organization" (Stubbs, *Const. Hist.* § 39). The word did not always and at all times have this meaning in Latin-English documents, but "vill" and "township" were ultimately, in English law, treated as convertible terms for describing a village community, and they remained in use in legal nomenclature until the ecclesiastical parishes were converted into areas for civil administration under the Poor Law Acts. This technical sense is derived from the late Latin use of *villa* for *vicus*, a village. Thus Fleta (vi. c. 51), writing in the time of Edward I., distinguishes the *villa*, as a collection of habitations and their appurtenances, from the *mansio*, a single house, *nulli vicina*, and the manor, which may embrace one or more *villae*. In classical Latin *villa* had meant "country-house," "farm," "villa" (see VILLA); but the word was probably an abbreviation of *vicula*, diminutive of *vicus*, and in the sense of *vicus* it is used by Apuleius in the 2nd century. Later it even displaced *civitas*, for city; thus Rutilius Numatianus in his *Itinerarium* speaks of *villae ingentes, oppida parva*; whence the French *ville* (see Du Cange, *Glossarium lat.* s.v. Villa). In the Frankish empire *villa* was also used of the royal and imperial palaces or seats with their appurtenances. In the sense of a small collection of habitations the word came into general use in England in the French form "village." From *villa*, too, are derived villein and villenage (*q.v.*) (see also VILLAGE COMMUNITIES).

VILLA, the Latin word (diminutive of *vicus*, a village) for a country-house. This term, which in England is usually given to a small country-house detached or semi-detached in the vicinity of a large town, is being gradually superseded by such expressions as "country" or "suburban house," "bungalow," &c., but in Italy it is still retained as in Roman times and means a summer residence, sometimes being of great extent. References to the villa are constantly made by Roman writers. Cicero is said to have possessed no less than seven villas, the oldest of which was near Arpinum, which he inherited. Pliny the younger had three or four, of which the example near Laurentium is the best known from his descriptions. There is too wide a divergence in the various conjectural restorations to make them of much value, but the remains of the villa of Hadrian at Tivoli, which covered an area over seven miles long and in which reproductions were made of all the most celebrated buildings he had seen during his travels, those in Greece seeming to have had the most attraction for him, and the villas of the 16th century on similar sites, such as the Villa d'Este near Tivoli, enable one to form some idea of the exceptional beauty of the positions selected and of the splendour of the structures which enriched them. According to Pliny, there were two kinds of villas, the *villa urbana*, which was a country seat, and the *villa rustica*, the farm-house, occupied by the servants who had charge generally of the estate. The Villa Boscoreale near Pompeii, which was excavated in 1893–94, was an example of the *villa rustica*, in which the principal room was the kitchen, with the bakery and stables beyond and room for the wine presses, oil presses, hand mill, &c. The villas near Rome were all built on hilly sites, so that the laying out of the ground in terraces formed a very important element in their design, and this forms the chief attraction of the Italian villas of the 16th century, among which the following are the best known: the Villa Madama, the design of which, attributed to Raphael, was carried out by Giulio Romano in 1520; the Villa Medici (1540); the Villa Albani, near the Porta Salaria; the Borghese; the Doria Pamphili (1650); the Villa di Papa Giulio (1550), designed by Vignola; the Aldobrandini (1592); the Falconieri and the Montdragon Villas at Frascati, and the Villa d'Este near Tivoli, in which the terraces and staircases are of great importance. In the proximity of other towns in Italy there are numerous villas, of which the example best known is that of the Villa Rotunda or Capra near Vicenza, which was copied by Lord Burlington in his house at Chiswick.

The Italian villas of the 16th and 17th century, like those of Roman times, included not only the country residence, but the whole of the other buildings on the estate, such as bridges, casinos, pavilions, small temples, rectangular or circular, which were utilized as summer-houses, and these seem to have had a certain influence in England, which may account for the numerous examples in the large parks in England of similar erections, as also the laying out of terraces, grottos and formal gardens. In France the same influence was felt, and at Fontainebleau, Versailles, Meudon and other royal palaces, the celebrated Le Nôtre transformed the parks surrounding them and introduced the cascades, which in Italy are so important a feature, as at St Cloud near Paris. (R. P. S.)

VILLACH, a town in Carinthia, Austria, 24 m. W. of Klagenfurt by rail. Pop. (1900) 9690. It is situated on the Drave, near its confluence with the Gail, in a broad fertile basin at the foot of the Dobratsch or Villacher Alp (7107 ft.). The parish church is an interesting Gothic edifice of the 15th century. The principal industry of Villach consists in the fabrication of various lead wares, and is mostly dependent on the lead mines of Bleiberg, which is situated about 9 m. to the west. This village (pop. 3435) is one of the richest lead-mining centres in Europe. The ores found here comprise silver-free galena, sulphate of zinc and calamine. The mines were already worked during the middle ages. Warmbad Villach, a watering-place with hot sulphur baths, and Mittewald, a favourite summer resort, whence the ascent of the Dobratsch can be made, are in the neighbourhood of Villach. Some of the prettiest Carinthian lakes are to be found near Villach, as the Ossiacher-see, on whose southern shore stands the ruined castle of Landskron, dating from the middle of the 16th century, the Wörther-see and the small but lovely Faaker-see.

Villach is an old town, which was given by Heinrich II. to the bishopric of Bamberg in 1007. During the middle ages it was an important centre of commerce between Germany and Italy. With the advent of new trade routes at the beginning of modern times the town lost its importance, and in 1745 the citizens nearly decided to emigrate *en masse*. Its trade revived during the French occupation of 1809–13, and it continued to improve during the 19th century. The Turks were defeated here in 1492 by Maximilian I., and an engagement between the Austrians and the French took place here on the 21st of August 1813.

VILLA DEL PILAR, a city of Paraguay, 104 m. S. by E. of Asuncion, on the left bank of the navigable river Paraguay, which receives the Bermejo from the right immediately opposite. Pop. (1910) about 10,000. Villa del Pilar is a thriving modern city, containing barracks, law courts, a national college, several schools and a branch of the Agricultural Bank. It has a fine harbour, and is one of the principal centres in the republic for the exportation of oranges.

VILLAFRANCA DI VERONA, a town of Venetia, Italy, in the province of Verona, 11 m. S.S.W. of Verona, on the railway to Mantua, 174 ft. above sea-level. Pop. (1901) 5037 (town); 9635 (commune). It has considerable silk industries. Here preliminaries of peace were signed between Napoleon III. and the Austrians in 1859 after the battle of Solferino. Five miles to the N. is Custozza, where the Italians were defeated by the Austrians in 1848 and 1866. Villafranca is a common place name in Italy.

VILLAGE COMMUNITIES. The study of village communities has become one of the fundamental methods of discussing the ancient history of institutions. It would be out of the question here to range over the whole field of human society in search for communal arrangements of rural life. It will be sufficient to confine the present inquiry to the varieties presented by nations of Aryan race, not because greater importance is to be attached to these nations than to other branches of humankind, although this view might also be reasonably urged, but principally because the Aryan race in its history has gone through all sorts of experiences, and the data gathered from its historical life can be tolerably well ascertained. Should the road be sufficiently cleared in this particular direction, it will not be difficult to connect the results with similar researches in other racial surroundings.

The best way seems to be to select some typical examples, chiefly from the domain of Celtic, Slavonic and Germanic social history, and to try to interpret them in regard to the general conditions in which communal institutions originate, grow and decay. As the principal problem will consist in ascertaining how far land was held in common instead of being held, as is usual at present, by individuals, it is advisable to look out for instances in which this element of holding in common is very clearly expressed. We ought to get, as it were, acclimatized to the mental atmosphere of such social arrangements in order to counteract a very natural but most pernicious bent prompting one to apply to the conditions of the past the key of our modern views and habitual notions. A certain acquaintance with the structure of Celtic society, more especially the society of ancient Wales, is likely to make it clear from the outset to what extent the husbandry and law of an Aryan race may depend on institutions in which the individual factor is greatly reduced, while the union first of kinsmen and then of neighbours plays a most decisive part.

F. Seebohm has called our attention to the interesting surveys of Welsh tracts of country made in the 14th century, soon after these regions passed into the hands of English lords. The fragments of these surveys published by him and his commentary on them are very illuminating, but further study of the documents themselves discloses many important details and helps to correct some theories propounded on the subject. Let us take up a concrete and simple case, *e.g.* the description of Astret Canon, a trev or township (*villata*) of the honour of Denbigh, surveyed in 1334. In the time of the native Welsh princes it was occupied entirely by a kindred (*progenies*) of free tribesmen descended from a certain Canon, the son of Lawaurgh. The kindred was subdivided into four gavells or bodies of joint-tenants. On the half-gavell of Monryk ap Canon, *e.g.* there are no less than sixteen coparceners, of whom eight possess houses. The peculiarity of this system of land tenure consists in the fact that all the tenants of these gavells derive their position on the land from the occupation of the township by their kindred, and have to trace their rights to shares in the original unit. Although the village of Astret Canon was occupied under the Survey by something like fifty-four male tenants, the majority of whom were settled in houses of their own, it continued to form a unit as well in regard to the payment of tungpound, that is, of the direct land tax and other services and payments, but also in respect of the possession and usage of the soil. On the other hand, movable property is owned in severalty. Services have to be apportioned among the members of the kindreds according to the number of heads of cattle owned by them. From the description of another township—Pireyon—we may gather another important feature of this tribal tenure. The population of this village also clustered in gavells, and we hear that these gavells ought to be considered as equal shares in respect of the arable, the wood and the waste of the township. If the shares were reduced into acres there would have fallen to each of the eight gavells of Pireyon ninety-one acres, one rood and a half and six perches of arable and woodland, and fifty-three and one-third of an acre and half a rood of waste land. But as a matter of fact the land was not divided in such a way, and the rights of the tenants of the gavell were realized not through the appropriation of definite acres, but as proportionate opportunities in regard to tillage and as to usages in pasture, wood and waste. Pastoral habits must have greatly contributed to give the system of landholding its peculiar character. It was not necessary, it would have been even harmful, to subdivide sharply the area on which the herds of cows and the flocks of sheep and goats were grazing. Still Welsh rural life in the 14th century had already a definite though subordinate agricultural aspect, and it is important to notice that individual appropriation had as yet made very slight progress in it.

We do not notice any systematic equalization between members of the tribal communities of the trevs. In fact, both differences in the ownership of cattle and differences of tribal standing, established by complex reckonings of pedigree and of social rank, led to marked inequalities. But there was also the notion of birthright, and we find in the laws that every free tribesman considered himself entitled to claim from his kindred grazing facilities and five erws for tillage. Such a claim could be made unconditionally only at a time when there was a superabundance of land to dispose of. In the 14th century, to which our typical descriptions refer, this state of things had ceased to be universal. Although great tracts of Welsh land were undoubtedly still in a state of wilderness, the soil in more conveniently situated regions was beginning to be scarce, and considerable pressure of population was already felt, with a consequent transition from pastoral pursuits to agriculture. The tract appropriated to the township of Astret Canon, for instance, contained only 574 acres of land of all kinds. In this case there was hardly room for the customary five erws per head of grown-up males besides commons. And yet although the population lived on a small pittance, the system of tribal tenure was not abandoned.

Although there are no rearrangements or redivision within the tribe as a whole, inside every gavell, representing more narrow circles of kinsmen, usually the descendants of one great-grandfather, *i.e.* second cousins, the shares are shifted and readjusted according to one of two systems. In one case, that of the trevcyvriv or joint-account village, every man receives " as much as another yet not of equal value "—which means, of course, that the members of such communities were provided with equal allotments, but left to make the best of them, each according to chance and ability. This practice of reallotment was, however, restricted in the 14th century to taeog trevs, to villages occupied by half-free settlers. The free tribesmen, the *priodarii* of Wales, held by *daddenhud*, and reallotted shares within the trev on the coming of each new generation or, conversely, on the going out, the dying out, of each older generation. In other words: at the demise of the last of the grandfathers in a gavell, all the fathers took equal rank and claimed equal shares, although formerly some of the portions had been distributed equally only between the grandfathers or their offspring (*stirps*). The right to claim redivision held good only within the circle of second cousins. Members of the kindred who stood further than that from each other, that is, third cousins, were not entitled to reallotment on the strength of *daddenhud*.

Another fact which is brought out with complete evidence by the Welsh Surveys is that the tenure is ascribed to communities of kinsmen and not to chiefs or headmen. The latter certainly existed and had exerted a powerful influence on the disposal of common land as well as on government and justice. But in the view of 14th-century surveys each township is owned not by this or the other elder, but by numerous bodies of coparceners. The gavell of Owen Gogh, for instance, contained twenty-six coparceners. In this way there is a clear attribution of rights of communal ownership, if we like to use the term, and not merely of rights of maintenance. Nor is there any warrant for a construction of these arrangements on a supposed patriarchal system.

Let us now compare this description of Celtic tribal tenure with Slavonic institutions. The most striking modern examples of tribal communities settled on a territorial basis are presented by the history of the Southern Slavs in the Balkan Peninsula and in Austria, of Slovenes, Croats, Serbs and Bulgarians, but it is easy to trace customs of the same kind in the memories of Western Slavs conquered by Germans, of the Poles and of the different subdivisions of the Russians. A good clue to the subject is provided by a Serb proverb which says that *a man by himself is bound to be a martyr*. One might almost suggest that these popular customs illustrate the Aristotelian conception of the single man seeking the "autarkeia," a complete and self-sufficient existence in the society of his fellow-men, and arriving at the stage of the tribal village, the *γένος*, which is also a *κώμη*, as described in the famous introductory chapter of the Greek philosopher's *Politics*. The Slavs of the mountainous regions of the Balkans and of the Alps in their stubborn struggle with nature and with human enemies have clustered and still cluster to some extent (*e.g.* in Montenegro) in closely united and widely spreading brotherhoods (*bratstva*) and tribes (*plemena*). Some of these brotherhoods derive their names from a real or supposed common ancestor, and are composed of relatives as well as of affiliated strangers. They number sometimes hundreds of members,[1] of guns, as the fighting males are characteristically called. Such are—the Vukotići, Kovacevići, as one might say in Old English—the Vukotings or Kovachevings, of Montenegro. The dwellings, fields, and pasturages of these brotherhoods or kindreds are scattered over the country, and it is not always possible to trace them in compact divisions on the map. But there was the closest union in war, revenge, funeral rites, marriage arrangements, provision for the poor and for those who stand in need of special help, as, for instance, in case of fires, inundations and the like. And corresponding to this union there existed a strong feeling of unity in regard to property, especially property in land. Although ownership was divided among the different families, a kind of superior or eminent domain stretched over the whole of the *bratstvo*, and was expressed in the participation in common in pasture and wood, in the right to control alienations of land and to exercise pre-emption. If any of the members of the brotherhood wanted to get rid of his share he had to apply first to his next of kin within the family and then to the further kinsmen of the *bratstvo*.

As the Welsh kindred (*progenies*) were subdivided into gavells formed of extended family communities, even so the Bosnian, Montenegrin, Servian, Slovene tribes fell into house communities, *Kućas*, *Zadrugas*, which were built up on the principle of keeping blood-relatives and their property together as long as possible. They consisted generally of some 15 to 20 grown-up persons, some 6 or 7 first and second cousins with their wives and children, living in a hamlet around the central house of the *domaćin*, the house leader. In some instances the number of coparceners increased to 50 or even to 70. The members of the united house community, which in fact is a small village or hamlet, joined in meals and work. Their rights in the undivided household of the hamlet were apportioned according to the pedigree, *i.e.* this apportionment took account first of the *stirpes* or extant descendants of former scions of the family, so that, say, the offspring of each of two grandfathers who had been brothers were considered as equal sharers although the *stirps*, the stock, of one was represented only by one person, while the *stirps* of the other had grown to consist of two uncles and of three nephews all alive. There was no resettlement of shares, as in the case of Wales, but the life of the house community while it existed unbroken led to work in common, the contributions to which are regulated by common consent and supervised by the leader. Grounds, houses, implements of agriculture (ploughs, oxen, carts) and of viniculture—casks, cauldrons for the making of brandy, &c., are considered to be common capital and ought not to be sold unless by common consent. Divisions were not prohibited. Naturally a family had to divide sooner or later, and the shares have to be made real, to be converted into fields and vineyards. But this was an event which marks, as it were, the close of the regular existence of one union and the birth of similar unions derived from it. As a rule, the *kuća* kept together as long as it could, because co-operation was needed and isolation dangerous—for economic considerations as well as for the sake of defence.

Attention, however, should be called more particularly to the parallel phenomena in the social history of the Russians, where the conditions seem to stand out in specially strong contrast with those prevailing among the mountain Slavs of the Balkans and of the Alps. In the enormous extent of Russia we have to reckon with widely different geographical and racial areas, among other, with the Steppe settlements of the so-called Little Russians in the Ukraina and the forest settlements of the Great Russians in the north. In spite of great divergencies the economic history of all these branches of Slavonic stock gravitates towards one main type, viz. towards rural unions of kinsmen, on the basis of enlarged households. In the south the typical village settlement is the *dvorišće*, the big court or hamlet consisting of some four to eight related families holding together; in the north it is the *pećišće*, the big oven, a hamlet of somewhat smaller size in which three to five families are closely united for purposes of common husbandry.

It is interesting to notice that even the break-up of the joint household does not lead to an entire severance of the ties between its members. They mostly continue in another form, viz. in the shape of an open-field system with intermixture of strips, compulsory rotation of crops, commons of pasture, of wood, sometimes shifting allotments as regards meadows. There is, *e.g.* an act of division between six brothers from the north of Russia of the year 1640. They agree to divide bread and salt, house and liberties, money, cloth and stores of all kinds and to settle apart. As to arable, Shumila is to take the upper strip in the field by the settlement, and next to him Tretjak, then Maxim, then Zaviala, then Shestoy, then Luke. In the big harvest furlong likewise, and in the small likewise, and by the meadow likewise and so on through all the furlongs. So that in this case and in innumerable other cases of the same kind the open-field system with its inconvenient intermixture of plots and limited power of every husbandman to manage his land appears as a direct continuation of the joint tribal households.

Another fact to be noticed is the tendency to form artificial associations on the pattern of the prevailing unions of kinsmen. People who have no blood-relations to appeal to for clearing the waste, for providing the necessary capital in the way of cattle and plough implements, for raising and fitting out buildings, join in order to carry on these economic undertakings, and also to help each other against enemies and aggressors. The members of these voluntary associations, which at once call to mind German, Norse and English gilds, are called “ siabri,” “ skladniki,” and the gilds themselves “ spólkię,” in south Russia. In a district of the Ukraina called the “ Ratensky Sharostvo ” there were no fewer than 278 such gilds interchanging with natural kindreds. The organization of all these unions could in no way be called patriarchal. Even in cases when there is a definite elder or headman (*bolshoy*), he was only the first among equals and exercised only a limited authority over his fellows: all the important decisions had to be taken by the council of the community.

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[1] They range from 80 or 90 to 700.

In Great Russia, in the districts gathered under the sway of the Moscow tsars, the basis of the household community and of the rural settlements which sprang from it was modified in another direction. The entire agricultural population was subjected to strict supervision and coercive measures for purposes of military organization and taxation. Society was drilled into uniformity and service on the principle that every man has to serve the tsar, the upper class in war and civil administration, the lower class by agricultural labour. A consequence of the heavy burden laid on the land and of the growth of a landed aristocracy somewhat resembling the gentry and the *noblesse* of the West was a change in the management of land allotments. They became as much a badge of service and a basis for fiscal requirements as a means of livelihood. The result was the practice of reallotments according to the strength and the needs of different families. The shifting of arable (*peredel*) was not in this case a reapportionment of rights, but a consequence of the correspondence between rights and obligations. But although this admeasurement of claims appears as a comparatively recent growth of the system, the fundamental solidarity between kinsmen or neighbourly associates grouped into villages was in no way an invention of the tsars or of their officials: it was rooted in traditional customs and naturally suggested by the practices of joint households. When these households become crowded in certain areas, open-field systems arise; when they are burdened with public and private service their close co-operation produces occasional or periodical redivisions of the soil between the shareholders.

Let us now pass to village communities in Teutonic countries, including England. A convenient starting-point is afforded by the social and economic conditions of the southern part of Jutland.

Now the Saxon or Ditmarschen portion of this region gives us an opportunity of observing the effects of an extended and highly systematized tribal organization on Germanic soil. The independence of this northern peasant republic, which reminds one of the Swiss cantons, lasted until the time of the Reformation. We find the Ditmarschen organized in the 15th, as they had been in the 10th century, in a number of large kindreds, partly composed of relatives by blood and partly of “ cousins ” who had joined them. The membership of these kindreds is based on agnatic ties—that is, on relationship through males—or on affiliation as a substitute for such agnatic kinship. The families or households are grouped into brotherhoods, and these again into clans or “ Schlachten ” (*Geschlechter*), corresponding to Roman *gentes*. Some of them could put as many as 500 warriors in the field. They took their names from ancestors and chieftains: the Wollersmannen, Hennemannen, Jerremannen, &c.—that is, the men of Woll, the men of Henne, the men of Jerre. In spite of these personal names the organization of the clans was by no means a monarchical one: it was based on the participation of the full-grown fighting men in the government of each clan and on a council of co-opted elders at the head of the entire federation. We need not repeat here what has already been stated about the mutual support which such clans afforded to their members in war and in peace, in judicial and in economic matters.

Let us notice the influence of this tribal organization on husbandry and property. The regular economic arrangement was an open-field one based on a three-field and similar systems. The furlongs were divided into intermixed strips with compulsory rotation on the usual pattern. And it is interesting to notice that in these economic surroundings indivisible holdings corresponding to the organic unities required for efficient agriculture arose of themselves. In spite of the equal right of all coheirs to an estate, this estate does not get divided according to their numbers, but either remains undivided or else falls into such fractions, halves or fourths, which will enable the farming to be carried on successfully, without mischievous interruption and disruption. Gradually the people settled down into the custom of united succession for agrarian units. The Hufe or Hof, the virgate, as might have been said in England, goes mostly to the eldest son, but also sometimes to the youngest, while the brothers of the heir either remain in the same household with him, generally unmarried, or leave the house after having settled with the heir, who takes charge of the holding, as to an indemnity for their relinquished claims. This indemnity is not equivalent to the market price, but is fixed, in case of dispute or doubt, by an award of impartial and expert neighbours, who have to consider not only the claims of interested persons but also the economic quality and strength of the holding. In other words, the heir has to pay so much as the estate can conveniently provide without being wrecked by the outlay.

This evidence is of decisive importance in regard to the formation of unified holdings; we are on entirely free soil, with no vestige whatever of manorial organization or of coercion of tenants by the lord, and yet the Hufe, the normal holding, comes to the fore as a result of the economic situation, on the strength of considerations drawn from the efficiency of the farming. This “ Anerben ” system is widely spread all through Germany. The question whether the eldest or the youngest succeeds is a subordinate one. Anyhow, manorial authority is not necessary to produce the limitation of the rights of succession to land and the creation of the system of holdings, although this has been often asserted, and one of the arguments for a servile origin of village communities turns on a supposed incompatibility between unified succession and the equal rights of free coheirs.

We need not speak at any length about other parts of Germany, as space does not permit of a description of the innumerable combinations of communal and individual elements in German law, the various shapes of manorial and political institutions with which the influence of blood relationship, gild and neighbourly union had to struggle.

But we must point out some facts from the range of Scandinavian customs. In the mountainous districts of Norway we notice the same tendency towards the unification of holdings as in the plains and hills of Schleswig and Holstein. The bönder of Gudbrandsdalen and Telemarken, the free peasantry tilling the soil and pasturing herds on the slopes of the hills since the days of Harold Hárfagr to our own times, sit in *Odalgaards*, or freehold estates, from which supernumerary heirs are removed on receiving some indemnity, and which are protected from alienation into strange hands by the privilege of pre-emption exercised by relatives of the seller. Equally suggestive are some facts on the Danish side of the Straits, viz. the arrangements of the *böls* which correspond to the hides and virgates of England and to the Hufen of Germany. Here again we have to do with normal holdings independent of the number of coheirs, but dependent on the requirements of agriculture—on the plough and oxen, on certain constant relations between the arable of an estate and its outlying commons, meadows and woods. The böl does not stand by itself like the Norwegian gaard, but is fitted into a very close union with neighbouring böls of the same kind. Practices of coaration, of open-field intermixture, of compulsory rotation of lot-meadows, of stinting the commons, arise of themselves in the villages of Denmark and Sweden. Laws compiled in the 13th century but based on even more ancient customs give us most interesting and definite information as to Scandinavian practices of allotment.

We catch a glimpse, to begin with, of a method of dividing fields which was considered archaic even in those early times. The Swedish laws use the expression "forniskift," which means ancient mode of allotment, and another term corresponding to it is "hamarskift," which may possibly be connected with throwing the hammer in order to mark the boundary of land occupied by a man's strength. The two principal features of forni or hamar skift are the irregularity of the resulting shapes of plots and the temporary character of their occupation. The first observation may be substantiated by a description like that of Laasby in Jutland: "These lands are to that extent scattered and intermixed by the joint owners that it cannot be said for certain what (or how much) they are." Swedish documents, on the other hand, speak expressly of practices of shifting arable and meadows periodically, sometimes year by year.

Now the uncertainty of these practices based on occupation became in process of time a most inconvenient feature of the situation and evidently led to constant wrangling as to rights and boundaries. The description of Laasby which I have just quoted ends with the significant remark: "They should be compelled to make allotment by the cord." This making of allotments by the cord is the process of rebning, from *reb*, the surveyor's cord, and the juridical procedure necessary for it was called "solskift"—because it was a division following the course of the sun.

The two fundamental positions from which this form of allotment proceeds are: (1) that the whole area of the village is common land (*faellesjord*), which has to be lotted out to the single householders; (2) that the partition should result in the creation of equal holdings of normal size (bóls). In some cases we can actually recognize the effect of these allotments by ancient solskift in the 18th century, at a time when the Danish enclosure acts produced a second general revolution in land tenure.

The oldest twelve inhabitants, elected as sworn arbitrators for effecting the allotment, begin their work by throwing together into one mass all the grounds owned by the members of the community, including dwellings and farm-buildings, with the exception of some privileged plots. There is a close correspondence between the sites of houses and the shares in the field. The first operation of the surveyors consists in marking out a village green for the night-rest and pasture of the cattle employed in the tillage (*fortá*), and to assign sites to the houses of the coparceners with orchards appendant to them (tofts); every householder getting exactly as much as his neighbour. From the tofts they proceed to the fields on the customary notion that the toft is the mother of the field. The fields are disposed into furlongs and shots, as they were called in England, and divided among the members of the village with the strictest possible equality. This is effected by assigning to every householder a strip in every one of the furlongs constituting the arable of the village. Meadows were often treated as lot-meadows in the same way as in England. According to the account of a solrebning executed in 1513 (Oester Hoejsted), every *otting*, the eighth part of a ból (corresponding to the English oxgang or bovate), got a toft of 40 roods in length and 6 in breadth. One of the coparceners received, however, 8 roods because his land was worse than that of his neighbours. Of the arable there were allotted to each otting two roods' breadth for the plough in each furlong and appendant commons "in damp and in dry"—in meadow and pasture. After such a "solskift" the peasants held their tenements in undisturbed ownership, but the eminent demesne of the village was recognized and a revision of the allotment was possible. Many such revisions did actually take place, and in such cases all rights and claims were apportioned according to the standard of the original shares. Needless to say that these shares were subjected to all the usual limitations of champion farming.

After having said so much about different types of village communities which occur in Europe it will be easier to analyse the incidents of English land tenure which disclose the working of similar conceptions and arrangements. Features which have been very prominent in the case of the Welsh, Slavs, Germans or Scandinavians recur in the English instances sometimes with equal force and at other times in a mitigated shape.

There are some vestiges of the purely tribal form of community on English soil. Many of the place-names of early Saxon and Anglican settlements are derived from personal names with the suffix *ing*, as designations like Oakington, the town of the Hockings.

True, it is just possible to explain some of these place-names as pointing to settlements belonging to some great man and therefore taking their designation from him with the adjunct of an *ing* indicating possession. But the group of words in question falls in exactly with the common patronymics of Saxon and German families and kindreds, and therefore it is most probable, as Kemble supposed, that we have to do in most of these instances with tribal and family settlements, although the mere fact of belonging to a great landowner or a monastery may have been at the root of some cases.

A very noticeable consequence of tribal habits in regard to landownership is presented by the difficulties which stood in the way of alienation of land by the occupiers of it. The Old English legal system did not originally admit of any alienation of folkland, land held by folkright, or, in other words, of the estates owned under the ordinary customary law of the people. Such land could not be bequeathed out of the kindred and could not be sold without the consent of the kinsmen. Such complete disabilities could not be upheld indefinitely, however, in a growing and progressive community, and we find the ancient folkright assailed from different points of view. The Church insists on the right of individual possessors to give away land for the sake of their souls; the kings grant exemption from folkright and constitute privileged estates held by book and following in the main the rules of individualized Roman law; the wish of private persons to make provision for daughters and to deal with land as with other commodities produces constant collisions with the customary tribal views. Already, by the end of the Saxon period transfer and alienation of land make their way everywhere, and the Norman conquest brings these features to a head by substituting the notion of tenure—that is, of an estate burdened with service to a superior—for the ancient notion of tribal folkland.

But although the tribal basis of communal arrangements was shaken and removed in England in comparatively early times, it had influenced the practices of rural husbandry and landholding, and in the modified form of the village community it survived right through the feudal period, leaving characteristic and material traces of its existence down to the present day.

To begin with, the open-field system with intermixture of strips and common rights in pasture and wood has been the prevailing system in England for more than a thousand years. Under the name of champion farming it existed everywhere in the country until the Inclosure Acts of the 18th and 19th centuries put an end to it; it may be found in operation even now in some of its features in backward districts. It would have been absurd to build up these practices of compulsory rotation of crops, of a temporary relapse of plots into common pasture between harvest and ploughing time, of the interdependence of thrifty and negligent husbandmen in respect of weeds and times of cultivation, &c., from the point of view of individual appropriation. On the other hand, it was the natural system for the apportionment of claims to the shareholders of an organic and perpetual joint-stock company.

Practices of shifting arable are seldom reported in English evidence. There are some traces of periodical redivisions of arable land in Northumberland: under the name of runrig system such practices seem to have been not uncommon in the outer fields, the non-manured portions of townships in Scotland, both among the Saxon inhabitants of the lowlands and the Celtic population of the highlands. The joining of small tenants for the purpose of coaration, for the formation of the big, heavy ploughs, drawn by eight oxen, also produced sometimes the shifting in the possession of strips between the coparceners of the undertaking. But, as a rule, the arable was held in severalty by the different members of the township.

On the other hand, meadows were constantly owned by entire townships and distributed between the tenements entitled to shares from year to year either by lot or according to a definite order. These practices are in full vigour in some places even at the present day. Any person living in Oxford may witness the distribution by lot on Lammas day (1st of August) of the Lammas meadows, that is, the meadows inclosed for the sake of raising hay-grass in the village of Yarnton, some three miles to the north of Oxford.

Let us, however, return for a moment to the arable. Although held in severalty by different owners it was subjected to all sorts of interference on the part of the village union as represented in later ages by the manorial court framing by-laws and settling the course of cultivation. It might also happen that in consequence of encroachments, disputes and general uncertainty as to possession and boundaries, the whole distribution of the strips of arable in the various fields had to be gone over and regulated anew. In an interesting case reported from a Cartulary of Dunstable in Bedfordshire, all the possessions of the villagers in a place called Segenhoe were thrown together in the 12th century and redivided according to an award of experts chosen by a meeting of the villagers from among the oldest and wisest inhabitants.

Exactly as in the Danish examples quoted before, the strips were apportioned, not to the single owners, but to the normal holdings, the hides, and the actual owners had to take them in proportion to their several rights in the hides. This point is very important. It gives the English village community its peculiar stamp. It is a community not between single members or casual households, but between determined holdings constructed on a proportional scale. Although there was no provision for the admeasurement and equalization of the claims of Smith and of Brown, each hide or ploughland of a township took as much as every other hide, each virgate or yardland as every other yardland, each bovate or oxgang as every other oxgang. Now the proportions themselves, although varying in respect of the number of acres included in each of these units in different places, were constant in their relation to each other. The yardland was almost everywhere one-fourth of the hide or ploughland, and corresponded to the share of two oxen in an eight-oxen plough; the oxgang was reckoned at one-half of the yardland, and corresponded to the share of one ox in the same unit of work. The constant repetition of these fractions and units proves that we have to do in this case with phenomena arising not from artificial devices but from the very nature of the case. Nor can there be a doubt that both the unit and the fractions were produced by the application to land of the chief factor of working strength in agrarian husbandry, the power of the ploughteam for tillage.

The natural composition of the holdings has its counterpart, as in Schleswig-Holstein and as in the rest of Germany, in the customs of united succession. The English peasantry worked out customary rules of primogeniture or of so-called Borough English or claim of the youngest to the land held by his father. The German examples adduced in the beginning of this article teach us that the device is not suggested primarily by the interest of the landlord. Unified succession takes the place of the equal rights of sons, because it is the better method for preserving the economic efficiency of the household and of the tenement corresponding to it. There are exceptions, the most notorious being that of Kentish gavelkind, but in agricultural districts the holding remains undivided as long as possible, and if it gets divided, the division follows the lines not of the casual number of coheirs, but of the organic elements of the ploughlands. Fourths and eighths arise in connexion with natural fractions of the ploughteam of eight oxen.

One more feature of the situation remains to be noticed, and it is the one which is still before our eyes in all parts of the country, that is, the *commons* which have survived the wholesale process of inclosure. They were an integral part of the ancient village community from the first, not only because the whole ground of a township could not be taken up by arable and meadows, at a time when population was scanty, but because there existed the most intimate connexion between the agricultural and pastoral part of husbandry in the time of the open-field system. Pasture was not treated as a commodity by itself but was mostly considered as an adjunct, as appendant to the arable, and so was the use of woods and of turf. This fact was duly emphasized, *e.g.* in an Elizabethan case reported by Coke—Tyrringham's case. The problem of admeasurement of pasture was regulated in the same way as that of the apportionment of arable strips, by a reference to the proportional holdings, the hides, yardlands and oxgangs of the township, and the only question to be decided was how many heads of cattle and how many sheep each hide and yardland had the right to send to the common pasturage grounds.

When in course of time the open-field system and the tenure of arable according to holdings were given up, the right of freeholders and copyholders of the old manors in which the ancient townships were, as it were, encased, still held good, but it became much more difficult to estimate and to apportion such rights.

In connexion with the individualistic policy of inclosure the old writ of admeasurement of commons was abolished in 1837 (3 & 4 Will. IV.). The ordinary expedient is to make out how much commonable cattle could be kept by the tenements claiming commons through the winter. It is very characteristic and important that in the leading modern case on sufficiency of commons—in *Robertson* v. *Hartopp*—it was admitted by the Court of Appeal that the sufficiency has to be construed as a right of turning out a certain number of beasts on the common, quite apart from the number which had been actually turned out at any given time. Now a vested right has to be construed from the point of view of the time when it came into existence. The standards used to estimate such rights ought not to be drawn from modern practice, which might help to dispense altogether with commons of pasture by stable feeding, substitutes for grass, &c., but ought to correspond to the ordinary usages established at a time when the open-field system was in full vigour. The legal view stands thus at present, but we cannot conceal from ourselves that after all the inroads achieved by individual appropriation it is by no means certain that the reference to the rights and rules of a previous period will continue to be recognized. However this may be, in the present commons we have certainly a system which draws its roots from customs, as to the origin of which legal memory does not run.

We may, in conclusion, summarize very briefly the principal results of our inquiry as to the history of European village communities. It seems that they may be stated under the following heads: (1) Primitive stages of civilization disclose in human society a strong tendency towards mutual support in economic matters as well as for the sake of defence. (2) The most natural form assumed by such unions for defence and co-operation is that of kinship. (3) In epochs of pastoral husbandry and of the beginnings of agriculture land is mainly owned by tribes, kindreds and enlarged households, while individuals enjoy only rights of usage and possession. (4) In course of time unions of neighbours are substituted for unions of kinsmen. (5) In Germanic societies the community of the township rests on the foundation of efficient holdings—bóls, hides, hufen—kept together as far as possible by rules of united or single succession. (6) The open-field system, which prevailed in the whole of Northern Europe for nearly a thousand years, was closely dependent on the customs of tribal and neighbourly unions. (7) Even now the treatment of commons represents the last manifestations of ancient communal arrangements, and it can only be reasonably and justly interpreted by reference to the law and practice of former times.

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VILLALBA, a town of north-western Spain, in the province of Lugo; on the left bank of the river Ladra, one of the headstreams of the Miño, and at the junction of the main roads from Ferrol and Mondoñedo to the city of Lugo. Pop. (1900) 13,572. Villalba is the chief town of the district watered by the Ladra, Tamboga and other small streams—a fertile plateau 1500 ft. above sea-level. Cloth and pottery are manufactured, and there is some trade in grain and live stock. The nearest railway station is Otero, 15 m. S. by E., on the Lugo-Corunna line.

VILLAMEDIANA, COUNT DE (1582–1622), Spanish poet, was born at Lisbon towards the end of 1582. His father, a distinguished diplomatist, upon whom the dignity of count was conferred in 1603, entrusted the education of the brilliant boy (Juan de Tassis y Peralta) to Luis Tribaldos de Toledo, the future editor of Mendoza's *Guerras de Granada*, and to Bartolomé Jimenez Patón, who subsequently dedicated *Mercurius Trismegistus* to his pupil. On leaving Salamanca the youth married in 1601, and succeeded to the title on the death of his father in 1607; he was prominent in the dissipated life of the capital, acquired a bad reputation as a gambler, was forbidden to attend court, and resided in Italy from 1611 to 1617. On his return to Spain, he soon proved himself a fearless, pungent satirist. Such public men as Lerma, Rodrigo Calderón and Jorge de Tobar writhed beneath his murderous invective; the foibles of humbler private persons were exposed to public ridicule in verses furtively passed from hand to hand. So great was the resentment caused by these envenomed attacks that Villamediana was once more ordered to withdraw from court in 1618. He returned on the death of Philip III. and was appointed gentleman in waiting to Philip IV.'s young wife, Isabel de Bourbon, daughter of Henri IV. Secure in his position, he scattered his scathing epigrams in profusion; but his ostentatious attentions to the queen supplied his countless foes with a weapon which was destined to destroy him. A fire broke out while his masque, *La Gloria de Niguea*, was being acted before the court on the 15th of May 1622, and Villamediana carried the queen to a place of safety. Suspicion deepened; Villamediana neglected a significant warning that his life was in peril, and on the 21st of August 1622 he was murdered as he stepped out of his coach. The responsibility for his death was divided between Philip IV. and Olivares; the actual assassin was either Alonso Mateo or Ignacio Mendez; and naturally the crime remained unpunished.

Villamediana's works, first published at Saragossa in 1629, contain not only the nervous, blighting verses which made him widely feared and hated, but a number of more serious poems embodying the most exaggerated conceits of gongorism. But, even when adopting the perverse conventions of the hour, he remains a poet of high distinction, and his satirical verses, more perfect in form, are instinct with a cold, concentrated scorn which has never been surpassed. (J. F.-K.)

VILLANELLE, a form of verse, originally loose in construction, but since the 16th century bound in exact limits of an arbitrary kind. The word is ultimately derived from the Latin *villa*, a country house or farm, through the Italian *villano*, a peasant or farm hand, and a villanelle was primarily a round song taken up by men on a farm. The Spaniards called such a song a *villancejo* or *villancete* or a *villancico*, and a man who improvised villanelles was a *villanciquero*. The villanelle was a pastoral poem made to accompany a rustic dance, and from the first it was necessary that it should contain a regular system of repeated lines. The old French villanelles, however, were irregular in form. One of the most celebrated, the "Rosette, pour un peu d'absence" of Philippe Desportes (1545–1606), is a sort of ballade, and those contained in the *Astrée* of d'Urfé, 1610, are scarcely less unlike the villanelles of modern times. It appears, indeed, to have been by an accident that the special and rigorously defined form of the villanelle was invented. In the posthumous poems of Jean Passerat (1534–1602), which were printed in 1606, several villanelles were discovered, in different forms. One of these became, and has remained, so deservedly popular, that it has given its exact character to the subsequent history of the villanelle. This famous poem runs as follows:—

"J'ai perdu ma tourterelle:
Est-ce point celle que j'oi?
Je veux aller après elle.

Tu regrettes ta femelle?
Hélas! aussi fais-je moi:
J'ai perdu ma tourterelle.

Si ton amour est fidèle,
Aussi est ferme ma foi:
Je veux aller après elle.

Ta plainte se renouvelle?
Toujours plaindre je me dois:
J'ai perdu ma tourterelle.

En ne voyant plus la belle
Plus rien de beau je ne vois:
Je veux aller après elle.

Mort, que tant de fois j'appelle,
Prends ce qui se donne à toi:
J'ai perdu ma tourterelle,
Je veux aller après elle."

This exquisite lyric has continued to be the type of its class, and the villanelle, therefore, for the last three hundred years has been a poem, written in tercets, on two rhymes, the first and the third line being repeated alternatively in each tercet. It is usual to confine the villanelle to five tercets, but that is not essential; it must, however, close with a quatrain, the last two lines of which are the first and third line of the original tercet. The villanelle was extremely admired by the French poets of the Parnasse, and one of them, Théodore de Banville, compared it to a ribband of silver and gold traversed by a thread of rose-colour. Boulmier, who was the first to point out that Passerat was the inventor of the definite villanelle, published collections of these poems in 1878 and 1879, and was preparing another when he died in 1881. When, in 1877, so many of the early French forms of verse were introduced, or reintroduced, into English literature, the villanelle attracted a great deal of attention; it was simultaneously cultivated by W. E. Henley, Austin Dobson, Lang and Gosse. Henley wrote a large number, and he described the form itself in a specimen beginning:—

"A dainty thing's the Villanelle,
Sly, musical, a jewel in rhyme,
It serves its purpose passing well."

It has since then been very frequently used by English and American poets. There are several excellent examples in English of humorous villanelles, especially those by Austin Dobson and by Henley.

See Joseph Boulmier, *Les Villanelles* (Paris, 1878; 2nd enlarged edition, 1879). (E. G.)

VILLANI, GIOVANNI (*c.* 1275–1348), Italian chronicler, was the son of Villano di Stoldo, and was born at Florence in the second half of the 13th century; the precise year is unknown. He was of good burgher extraction, and, following the traditions of his family, applied himself to commerce. During the early years of the 14th century he travelled in Italy, France and the Netherlands, seeing men and things with the sagacity alike of the man of business and of the historian. Before leaving Florence, or rather in the interval between one journey and another, he had at least taken some part in that troubled period of civil contentions which Dino Compagni has described and which swept Dante Alighieri into banishment. In 1301 Villani saw Charles, count of Valois, ruining his country under the false name of peacemaker, and was witness of all the misery which immediately followed. Somewhat later he left Italy, and in September 1304 he visited Flanders. It is not well ascertained when he returned to his native city. He was certainly living there shortly after the emperor Henry VII. visited Italy in 1312, and probably he had been there for some time before. While still continuing to occupy himself with commerce, he now began to take a prominent part in public affairs. In 1316 and 1317 he was one of the priors, and shared in the crafty tactics whereby Pisa and Lucca were induced to conclude a peace with Florence, to which they were previously averse. In 1317 he also had charge of the mint, and during his administration of this office he collected its earlier records and had a register made of all the coins struck in Florence. In 1321 he was again chosen prior; and, the Florentines having just then undertaken the rebuilding of the city walls, he and some other citizens were deputed to look after the work. They were afterwards accused of having diverted the public money to private ends, but Villani clearly established his innocence. He was next sent with the army against Castruccio Castracani, lord of Lucca, and was present at its defeat at Altopascio. In 1328 a terrible famine visited many provinces of Italy, including Tuscany, and Villani was appointed to guard Florence from the worst effects of that distressing period. He has left a record of what was done in a chapter of his *Chronicle*, which shows the economic wisdom in which the medieval Florentines were often so greatly in advance of their age. In 1339, some time after the death of Castruccio, some rich Florentine merchants, and among them Villani, treated for the acquisition of Lucca by Florence for 80,000 florins, offering to supply the larger part of that sum out of their own private means; but the negotiations fell through, owing to the discords and jealousies then existing in the government (*Chron.* x. 143). The following year Villani superintended the making of Andrea Pisano's bronze doors for the baptistery. In the same year he watched over the raising of the campanile of the Badia, erected by Cardinal Giovanni Orsini (*Chron.* x. 177). In 1341 the acquisition of Lucca was again under treaty, this time with Martino della Scala, for 250,000 florins. Villani was sent with others as a hostage to Ferrara, where he remained for some months. He was present in Florence during the unhappy period that elapsed between the entry of Walter of Brienne, duke of Athens, and his expulsion by the Florentines (1342–43). Involved through no fault of his own in the failure of the commercial company of the Bonaccorsi, which in its turn had been drawn into the failure of the company of the Bardi, Villani, towards the end of his life, suffered much privation and for some time was kept in prison. In 1348 he fell a victim to the plague described by Boccaccio.

The idea of writing the *Chronicle* was suggested to Villani under the following circumstances: "In the year of Christ 1300 Pope Boniface VIII. made in honour of Christ's nativity a special and great indulgence. And I, finding myself in that blessed pilgrimage in the holy city of Rome, seeing her great and ancient remains, and reading the histories and great deeds of the Romans as written by Virgil, Sallust, Lucan, Livy, Valerius, Paulus Orosius and other masters of history who wrote the exploits and deeds, both great and small, of the Romans and also of strangers, in the whole world . . . considering that our city of Florence, the daughter and offspring of Rome, is on the increase and destined to do great things, as Rome is in her decline, it appeared to me fitting to set down in this volume and new chronicle all the facts and beginnings of the city of Florence, in as far as it has been possible to me to collect and discover them, and to follow the doings of the Florentines at length . . . and so in the year 1300, on my return from Rome, I began to compile this book, in honour of God and of the blessed John, and in praise of our city of Florence." Villani's work, written in Italian, makes its appearance, so to speak, unexpectedly in the historical literature of Italy, just as the history of Florence, the moment it emerges from the humble and uncertain origin assigned to it by legend, rises suddenly into a rich and powerful life of thought and action. Nothing but scanty and partly legendary records had preceded Villani's work, which rests in part on them. The *Gesta Florentinorum* of Sanzanome, starting from these vague origins, begins to be more definite about 1125, at the time of the union of Fiesole with Florence. The *Chronica de Origine Civitatis* seems to be a compilation, made by various hands and at various times, in which the different legends regarding the city's origin have been gradually collected. The *Annales Florentini Primi* (1110–1173) and the *Annales Florentini Secundi* (1107–1247), together with a list of the consuls and podestas from 1197 to 1267, and another chronicle, formerly attributed, but apparently without good reason, to Brunetto Latini, complete the series of ancient Florentine records. To these must, however, be added a certain quantity of facts which were to be found in various manuscripts, being used and quoted by the older Florentine and Tuscan writers under the general name of *Gesta Florentinorum*. Another work, formerly reckoned among the sources of Villani, is the *Chronicle of the Malespini*; but grave doubts are now entertained as to its authenticity, and many hold that at best it is merely a remodelling, posterior to Villani's time, of old records from which several chroniclers may have drawn, either without citing them at all or only doing so in a vague manner.

The *Historie Fiorentine*, or *Cronica universale*, of Villani begins with Biblical times and comes down to 1348. The universality of the narrative, especially in the times near Villani's own, while it bears witness to the author's extensive travels and to the comprehensiveness of his mind, makes one also feel that the book was inspired within the walls of the universal city. Whereas Dino Compagni's *Chronicle* is confined within definite limits of time and place, this of Villani is a general chronicle extending over the whole of Europe. Dino Compagni feels and lives in the facts of his history; Villani looks at them and relates them calmly and fairly, with a serenity which makes him seem an outsider, even when he is mixed up in them. While very important for Italian history in the 14th century, this work is the cornerstone of the early medieval history of Florence. Of contemporary events Villani has a very exact knowledge. Having been a sharer in the public affairs and in the intellectual and economic life of his native city, at a time when in both it had no rival in Europe, he depicts what he saw with the vividness natural to a clear mind accustomed to business and to the observation of mankind. He was Guelph, but without passion; and his book is much more taken up with an inquiry into what is useful and true than with party considerations. He is really a chronicler, not an historian, and has but little method in his narrative, often reporting the things which occurred long ago just as he heard them and without criticism. Every now and then he falls into some inaccuracy; but such defects as he has are largely compensated for by his valuable qualities. He was for half a century eyewitness of his history, and he provides abundant information on the constitution of Florence, its customs, industries, commerce and arts; and among the chroniclers throughout Europe he is perhaps unequalled for the value of the statistical data he has preserved. As a writer Villani is clear and acute; and, though his prose has not the force and colouring of Compagni's, it has the advantage of greater simplicity, so that, taking his work as a whole, he may be regarded as the greatest chronicler who has written in Italian. The many difficulties connected with the publication of this important text have hitherto prevented the preparation of a perfect edition. However, the *Chronicle* has been printed by L. A. Muratori in tome xiii. of the *Rerum Italicarum Scriptores* (Milan, 1728), and has been edited by I. Moutier and F. G. Dragomanni (Florence, 1844). Among other editions is one published at Trieste in 1857 and another at Turin in 1879. Selections have been translated into English by R. E. Selfe (1896).

Villani's *Chronicle* was continued by two other members of his family. (1) MATTEO VILLANI, his brother, of whom nothing is known save that he was twice married and that he died of the plague in 1363, continued it down to the year of his death. Matteo's work, though inferior to Giovanni's, is nevertheless very valuable. A more prolix writer than his brother and a less acute observer, Matteo is well informed in his facts, and for the years of which he writes is one of the most important sources of Italian history. (2) FILIPPO VILLANI, the son of Matteo, flourished in the end of the 14th and the beginning of the 15th century. In his continuation which goes down to 1364, though showing greater literary ability, he is very inferior as an historian to his predecessors. His most valuable work was a collection of lives of illustrious Florentines. Twice, in 1401 and 1404, he was chosen to explain in public the *Divina Commedia*. The year of his death is unknown.

See P. Scheffer-Boichorst, *Florentiner Studien* (Leipzig, 1874); G. Gervinus, "Geschichte der Florentinen Historiographie" in his *Historische Schriften* (1833); U. Balzani, *Le cronache Italiane nel medio evo* (Milan, 1884); A. Gaspary, *Geschichte der italienischen Literatur* (Berlin, 1885); O. Knoll, *Beiträge zur italienischen Historiographie im 14. Jahrhundert* (Göttingen 1876), and O. Hartwig, "G. Villani und die Leggenda di Messer Gianni di Procida" in Band xxv. of H. von Sybel's *Historische Zeitschrift*. (U. B.)

VILLANOVA, the name given to an ancient cemetery in the neighbourhood of Bologna, Italy, and generally applied by archaeologists to all the remains of that period, and to the period itself, owing to the discovery therein of a large number of the characteristic remains of the earliest Iron Age of Italy. The antiquities of this culture are widely spread over upper Italy and differ essentially from those of the previous epoch known as Terramara, and they have been described by some as following at a considerable interval, for they show a great advance in metal work. The chief cemeteries of the Villanova period are at Bologna, Este, Villanova, Golasecca, Trezzo, Rivoli and Oppiano. As there can be no doubt that the Terramara culture was that of the aboriginal Ligurians (see, however, TERRAMARA), so the Villanova is that of the Umbrians, who, according to the historians, were masters of all northern Italy, as far as the Alps at the time of the Etruscan conquest (*c.* 1000 B.C.). They contain cist-graves, the bottoms, sides and tops being formed of flat unhewn stones, though sometimes there are only bottom and top slabs: the dead were burnt, and the remains are usually in urns, each grave containing as a rule but one ossuary; sometimes the vessel is covered with a flat stone or a dish inverted, sometimes the urns are deposited in the ground without any protection. The vases are often hand-made and adorned with incised linear ornament, though in later times the bones were often placed in bronze urns or buckets. Though iron is steadily making its way into use, flat, flanged, and socketed and looped celts of bronze are found in considerable numbers. Brooches of many kinds, ranging from the most primitive safety-pin fashioned out of a common bronze pin (such as those found in the Bronze Age settlement at Peschiera on Lake Maggiore), through many varieties, are in universal use. Representations of the human figure are practically unknown, but models of animals of a rude and primitive kind are very common, probably being votive offerings. These are closely parallel to the bronze figures found at Olympia, where human figures were likewise rare. All these objects are decorated in *repoussé* with geometric designs. The culture of the Villanova period is part of the Hallstatt civilization, though the contents of the Hallstatt (*q.v.*) graves differ in several marked features from the antiquities of the ordinary Villanova period, there is no breach of continuity between Hallstatt and Villanova, for the types of Vadena, Este, Golasecca and Villanova are found in the Hallstatt culture. The connexion between the north and the south of the Alps is never interrupted. The chief difference lies in the fact that the Celts of the Danubian region made greater advances in the development of weapons and defensive armour than their kindred in northern Italy. The Po and Danube regions alike are characterized by bronze buckets, cists, girdles and the like, wrought in *repoussé* with animal and geometric designs; but the introduction of iron into Italy is considerably posterior to its development in the Hallstatt area.

See Montelius, *La Civilisation primitive en Italie*; Ridgeway, *Early Age of Greece*, vol. i.; Brizio, in *C. R. Acad. Inscr.* (1906), 315 sqq.; Grenier, in *Mélanges de l'école française* (1907), 325 sqq.; Pigorini and Vaglieri have contributed articles to the *Rendiconti dei Lincei* and the *Notizie degli scavi* from 1907 onwards. (W. RI.)

VILLANUEVA DE LA SERENA, a town of western Spain, in the province of Badajoz, near the left bank of the river Guadiana, and on the Madrid-Badajoz railway. Pop. (1900) 13,489. Villanueva is a clean and thriving place, with good modern public buildings—town hall, churches, convents and schools. It is the chief town of an undulating plain, La Serena, locally celebrated for red wine and melons. Grain and hemp are also cultivated, and live stock extensively reared in the neighbourhood.

VILLANUEVA Y GELTRU, a seaport of north-eastern Spain, in the province of Barcelona; on the Barcelona-Tarragona section of the coast railway. Pop. (1900) 11,850. Villanueva is a busy modern town, with manufactures of cotton, woollen and linen goods, and of paper. It has also iron foundries and an important agricultural trade. The harbour affords safe and deep anchorage; it is a lifeboat station and the headquarters of a large fishing fleet. The coasting trade is also considerable. Villanueva has a museum, founded by the Catalan poet, historian and diplomat, Vittorio Balaguer (1824–1901), which contains collections of Roman, Egyptian and prehistoric antiquities, besides paintings, engravings, sculptures, coins and a large library, including many valuable MSS.

VILLARD, HENRY (1835–1900), American journalist and financier, was born in Speyer, Rhenish Bavaria, on the 10th of April 1835. His baptismal name was Ferdinand Heinrich Gustav Hilgard. His parents removed to Zweibrücken in 1839, and in 1856 his father, Gustav Leonhard Hilgard (d. 1867), became a justice of the Supreme Court of Bavaria, at Munich. Henry was educated at the gymnasium of Zweibrücken, at the French semi-military academy in Phalsbourg in 1849–50, at the gymnasium of Speyer in 1850–52, and at the universities of Munich and Würzburg in 1852–53; and in 1853, having had a disagreement with his father, emigrated—without his parents' knowledge—to the United States. It was at this time that he adopted the name Villard. Making his way westward in 1854, he lived in turn at Cincinnati, Belleville (Illinois), Peoria (Illinois) and Chicago, engaged in various employments, and in 1856 formed a project, which came to nothing, for establishing a colony of "free soil" Germans in Kansas. In 1856–57 he was editor, and for part of the time was proprietor, of the Racine (Wis.) *Volksblatt*, in which he advocated the election of John C. Frémont (Republican). Thereafter he was associated (in 1857) with the *Staats-Zeitung*, *Frank Leslie's* and the *Tribune*, of New York, and with the Cincinnati *Commercial* in 1859–60; was correspondent of the New York *Herald* in 1861 and of the New York *Tribune* (with the Army of the Potomac) in 1862–63, and in 1864 was at the front as the representative of a news agency established by him in that year at Washington. In 1865 he became Washington correspondent of the Chicago *Tribune*, and in 1866 was the correspondent of that paper in the Prusso-Austrian War. He began to take an interest in railway financiering in 1871, was elected president of the Oregon & California railroad and of the Oregon Steamship Company in 1876, was receiver of the Kansas Pacific railway in 1876–78, organized the Oregon Railway & Navigation Company in 1879, the Oregon Improvement Company in 1880, and the Oregon & Transcontinental Company in 1881, becoming in that year president of the Northern Pacific railway, which was completed under his management, and of which he remained president until 1883. In 1887 he again became connected with the Northern Pacific, and in 1889 was chosen chairman of its finance committee. He was actively identified with the financing of other Western railway projects until 1893. In 1881 he acquired the New York *Evening Post* and the *Nation*. In 1883 he paid the debt of the state university of Oregon, and gave to the institution $50,000, and he also gave to the town of Zweibrücken, the home of his boyhood, an orphan asylum (1891). He died on the 12th of November 1900.

See *Memoirs of Henry Villard, Journalist and Financier, 1835–1900* (2 vols., Boston, 1904).

VILLA REAL, the capital of the district of Villa Real, Portugal; 10 m. N. of the river Douro and 47 m. by road E.N.E. of Oporto. Pop. (1900) 6716. The town has a large transit trade in wine, mineral waters and live stock, especially pigs. The administrative district of Villa Real corresponds with the western part of the ancient province of Traz os Montes (*q.v.*). Pop. (1900) 242,196; area, 1650 sq. m. There are alkaline waters and baths at Vidago (near Chaves) and at Pedras Salgadas (near Villa Pouca d'Aguiar). The district adjacent to the Douro is known as the *Paiz do vinho*, or "wine country"; here are the vineyards from which "port" wine is manufactured.

VILLARET DE JOYEUSE, LOUIS THOMAS (1750–1812), French admiral, was born at Auch, of a noble family of Languedoc. He was originally destined for the church, but served for some time in the royal guard, which he had to leave at the age of sixteen after killing one of his comrades in a duel. He then entered the navy, and in 1773 was lieutenant on the "Atalante" in Indian waters. In 1778 he distinguished himself at the siege of Pondicherry, and was promoted captain. He afterwards served under Suffren, took part in the battle of Cuddalore, and in 1781 was taken prisoner after a fierce encounter with an English vessel. He was released in 1783, and, unlike the majority of naval officers, did not emigrate during the Revolution. In 1791 he was in command of the "Prudente" in the waters of San Domingo, and in 1794 was appointed rear-admiral and assisted the Conventional, St André, in the reorganization of the fleet. Villaret was in command of the French fleet at the battle of the First of June. He was appointed a member of the Council of the Ancients in 1796, and was sentenced to deportation in the following year on account of his royalist sympathies. He escaped arrest, however, and until the Consulate lived in obscurity at Oléron. In 1801 he commanded the squadron which transported the French army to San Domingo, and the following year was made captain-general of Martinique, which he surrendered to the English in 1809 after a brave defence. In 1811, after some hesitation on the part of Napoleon, Villaret was rewarded for his services with the command of a military division and the post of governor-general of Venice. He died at Venice.

VILLARI, PASQUALE (1827–), Italian historian and statesman, was born at Naples on the 3rd of October 1827. He studied together with Luigi la Vista under Francesco de Sanctis. He was implicated in the riots of the 15th of May 1848 at Naples, against the Bourbon government, and had to take refuge in Florence. There he devoted himself to teaching and historical research in the public libraries, and in 1859 he published the first volume of his *Storia di Girolamo Savonarola e de' suoi tempi*, in consequence of which he was appointed professor of history at Pisa. A second volume appeared in 1861, and the work, which soon came to be recognized as an Italian classic, was translated into various foreign languages. It was followed by a work of even greater critical value, *Niccolò Machiavelli e i suoi tempi* (1877–82). In the meanwhile Villari had left Pisa and was transferred to the chair of philosophy of history at the Institute of Studii Superiori in Florence, and he was also appointed a member of the council of education (1862). He served as a juror at the international exhibition of that year in London, and contributed an important monograph on education in England and Scotland. In 1869 he was appointed under-secretary of state for education, and shortly afterwards was elected member of parliament, a position which he held for several years. In 1884 he was nominated senator, and in 1891–92 he was minister of education in the Marchese di Rudinì's first cabinet. In 1893–94 he collected a number of essays on Florentine history, originally published in the *Nuova Antologia*, under the title of *I primi due secoli della storia di Firenze*, and in 1901 he produced *Le Invasioni barbariche in Italia*, a popular account in one volume of the events following the dissolution of the Roman empire. All these works have been translated into English by the historian's wife, Linda White Villari. Another side of Villari's activity was his interest in the political and social problems of the day; and although never identified with any political party, his speeches and writings have always commanded considerable public attention.

Among his other literary works may be mentioned: *Saggi Critici* (1868); *Arte, Storia, e Filosofia* (Florence, 1884); *Scritti varii* (Bologna, 1894); another volume of *Saggi Critici* (Bologna, 1896); and a volume of *Discussioni critiche e discorsi* (Bologna, 1905), containing his speeches as president of the Dante Alighieri Society. His most important political and social essays are collected in his *Lettere Meridionali ed altri scritti sulla questione sociale in Italia* (Turin, 1885), and *Scritti sulla questione sociale in Italia* (Florence, 1902). The *Lettere Meridionali* (originally published in the newspaper *L'Opinione* in 1875) produced a deep impression, as they were the first exposure of the real conditions of southern Italy. A selection of Villari's essays, translated by his wife, has been published in England (1907).

See also Francesco Baldasseroni, *Pasquale Villari* (Florence, 1907).

VILLA RICA, the largest city in the interior of Paraguay, on the railway from Asuncion (70 m. N.W.) to Encarnacion. Pop. (1910) about 25,000. Situated in a rich agricultural region watered by the upper Tepicuary, with finely timbered mountains extending to the E. and W., Villa Rica has an important trade in tobacco and *yerba maté*. It is to a great extent modern, and contains some fine buildings, including a national college, a church, many schools, and a branch of the Agricultural Bank.

VILLARREAL, a town of eastern Spain, in the province of Castellón de la Plana; 4 m. from the Mediterranean Sea, near the right bank of the river Mijares, and on the Barcelona-Valencia railway. Pop. (1900) 16,068. Villarreal has a station on the light railway between Onda and the seaports of Castellón de la Plana and Burriana. Under Moorish rule, and up to the expulsion of the Moriscoes in 1609, it was the headquarters of a flourishing trade, and in modern times its industries have revived. Palm-groves, churches with blue-tiled cupolas, and houses with flat roofs and view-turrets (*miradores*) to some extent preserve the Moorish character of the town. There are extensive orange-groves, watered by the irrigation canal of Castellón, which is a good example of Moorish engineering skill. The local industries include manufactures of paper, woollen goods and spirits.

VILLARS, CLAUDE LOUIS HECTOR DE, Prince de Martignes, Marquis and Duc de Villars and Vicomte de Melun (1653–1734), marshal of France, one of the greatest generals of French history, was born at Moulins on the 8th of May 1653, and entered the army through the corps of pages in 1671. He served in the light cavalry in the Dutch wars, and distinguished himself by his daring and resourcefulness. But in spite of a long record of excellent service under Turenne, Condé and Luxembourg, and of his aristocratic birth, his promotion was but slow, for he had incurred the enmity of the powerful Louvois, and although he had been proprietary colonel (*mestre de camp*) of a cavalry regiment since 1674, thirteen years elapsed before he was made a *maréchal de camp*. In the interval between the Dutch wars and the formation of the League of Augsburg, Villars, who combined with his military gifts the tact and subtlety of the diplomatist, was employed in an unofficial mission to the court of Bavaria, and there became the constant companion of the elector, with whom he took the field against the Turks and fought at Mohacs. He returned to France in 1690 and was given a command in the cavalry of the army in Flanders, but towards the end of the Grand Alliance War he went to Vienna as ambassador. His part in the next war (see Spanish Succession War), beginning with Friedlingen (1702) and Höchstett (1703) and ending with Denain (1712), has made him immortal. For Friedlingen he received the marshalate, and for the pacification of the insurgent Cévennes the Saint-Esprit order and the title of duke. Friedlingen and Höchstett were barren victories, and the campaigns of which they formed part records of lost opportunities. Villars's glory thus begins with the year 1709 when France, apparently helpless, was roused to a great effort of self-defence by the exorbitant demands of the Coalition. In that year he was called to command the main army opposing Eugene and Marlborough on the northern frontier. During the famine of the winter he shared the soldiers' miserable rations. When the campaign opened the old Marshal Boufflers volunteered to serve under him, and after the terrible battle of Malplaquet (*q.v.*), in which he was gravely wounded, he was able to tell the king: "If it please God to give your majesty's enemies another such victory, they are ruined." Two more campaigns passed without a battle and with scarcely any advance on the part of the invaders, but at last Marlborough manœuvred Villars out of the famous *Ne plus ultra* lines, and the power of the defence seemed to be broken. But Louis made a last effort, the English contingent and its great leader were withdrawn from the enemy's camp, and Villars, though still suffering from his Malplaquet wounds, outmanœuvred and decisively defeated Eugene in the battle of Denain. This victory saved France, though the war dragged on for another year on the Rhine, where Villars took Landau, led the stormers at Freiburg and negotiated the peace of Rastatt with Prince Eugene.

He played a conspicuous part in the politics of the Regency period as the principal opponent of Cardinal Dubois, and only the memories of Montmorency's rebellion prevented his being made constable of France. He took the field for the last time in the War of the Polish Succession (1734), with the title "marshal-general of the king's armies," that Turenne alone had held before him. But he was now over eighty years of age, and the war was more diplomatic than earnest, and after opening the campaign with all the fire and restless energy of his youth he died at Turin on the 17th of June 1734.

Villars's memoirs show us a "fanfaron plein d'honneur," as Voltaire calls him. He was indeed boastful, with the gasconading habit of his native province, and also covetous of honours and wealth. But he was an honourable man of high courage, moral and physical, and a soldier who stands above all his contemporaries and successors in the 18th century, on the same height as Marlborough and Frederick.

The memoirs, part of which was published in 1734 and afterwards several times republished in untrustworthy versions, were for the first time completely edited by the Marquis de Voguë in 1884–92.

VILLAVICIOSA, a seaport of northern Spain, in the province of Oviedo; on the Ria de Villaviciosa, an estuary formed by the small river Villaviciosa which here enters the Bay of Biscay. Pop. (1900) 20,995. The town is the headquarters of a large fishery, and has some coasting trade. Its exports are chiefly agricultural produce. Villaviciosa suffers from the competition of the neighbouring ports of Gijón and Avilés, and from the lack of railway communication. It is connected by good roads with Siero (13 m.) and Infiesto (9 m.) on the Oviedo-Infiesto railway.

VILLEFRANCHE-DE-ROUERGUE, a town of France, capital of an arrondissement in the department of Aveyron, 36 m. W. of Rodez by road. Pop. (1906) town, 6297; commune, 3352. Villefranche, which has a station on the Orleans railway, lies amongst the hills on the right bank of the Aveyron at its junction with the Alzou. One of the three bridges that cross the river belongs to the 13th century, and the straight, narrow streets are full of gabled houses of the 13th and 14th centuries. One of the principal thoroughfares passes beneath the porch of Notre-Dame, the principal church of Villefranche. Notre-Dame was built from 1260 to 1581, the massive tower which surmounts its porch being of late Gothic architecture. The remarkable woodwork in the choir dates from the 15th century. A Carthusian monastery overlooking the town from the left bank of the Aveyron derives much interest from the completeness and fine preservation of its buildings, which date from the 15th century. They include a fine refectory and two cloisters, the smaller of which is a masterpiece of the late Gothic style. The manufacture of leather, animal-traps, hosiery, bell-founding, hemp-spinning, &c., are carried on. Quarries of phosphates and mines of argentiferous lead are worked near Villefranche.

Villefranche, founded about 1252, owes its name to the numerous immunities granted by its founder Alphonse, count of Toulouse (d. 1271), and in 1348 it was so flourishing that sumptuary laws were passed. Soon afterwards the town fell into the hands of Edward, the Black Prince, but was the first place in Guienne to rise against the English. New privileges were granted to the town by King Charles V., but these were taken away by Louis XI. In 1588 the inhabitants repulsed the forces of the League, and afterwards murdered a governor sent by Henry IV. The town was ravaged by plague in 1463, 1558 and 1628, and in 1643 a revolt, excited by the exactions of the *intendants*, was cruelly repressed.

VILLEFRANCHE-SUR-SAÔNE, a manufacturing town of east-central France, capital of an arrondissement in the department of Rhône, on the Morgon near its junction with the Saône, 21 m. N. by W. of Lyons by rail. Pop (1906) 14,794. Among its industries the chief are the manufacture of working clothes, the manufacture, dyeing and finishing of cotton fabrics, the spinning of cotton thread, copper founding and the manufacture of machinery and agricultural implements. The wines of Beaujolais, hemp, cloth, linen, cottons, drapery goods and cattle are the principal articles of trade. An old Renaissance house is used as the town hall. The church of Notre-Dame des Marais, begun at the end of the 14th and finished in the 16th century, has a tower and spire (rebuilt in 1862), standing to the right of the façade (15th century), in which are carved wooden doors. Villefranche is the seat of a sub-prefect and has tribunals of first instance and of commerce, a chamber of commerce and a communal college among its public institutions.

Founded in 1212 by Guichard IV. count of Beaujeu, Villefranche became in the 14th century capital of the Beaujolais. As a punishment for an act of violence towards the mayor's daughter, Edward II. was forced to surrender the Beaujolais to the duke of Bourbon.

VILLEGAS, ESTEBAN MANUEL DE (1589–1669), Spanish poet, was born at Matute (Logroño) on the 5th of February 1589, matriculated at Salamanca on the 20th of November 1610, and challenged attention by the mingled arrogance and accomplishment of *Las Eróticas* (1617), a collection of clever translations from Horace and Anacreon, and of original poems, the charm of which is marred by the writer's petulant vanity. Marrying in 1626 or earlier, Villegas practised law at Nájera till 1659, when he was charged with expressing unorthodox views on the subject of free will; he was exiled for four years to Santa Maria de Ribaredonda, but was allowed to return for three months to Nájera in March 1660. It seems probable that the rest of the sentence was remitted, for the report of the local inquisition lays stress on Villegas's simple piety, on the extravagance of his attire, ridiculous in a man of his age, and on the eccentricity of his general conduct and conversation, so marked as to suggest "a kind of mania or lesion of the imagination." In his version of Boetius (1665), Villegas showed that he had profited by his experience, for he made no attempt to translate the last book (in which the problem of free will is discussed), and reprinted the Latin text without comment. He died at Nájera on the 3rd of September 1669. His tragedy *El Hipólito*, imitated from Euripides, and a series of critical dissertations entitled *Variae Philologiae*, finished in 1650, are unpublished; and "a book of satires," found among his papers by the inquisitors, was confiscated.

VILLEHARDOUIN, GEOFFROY DE (*c.* 1160–*c.* 1213), the first vernacular historian of France, and perhaps of modern Europe, who possesses literary merit, is rather supposed than known to have been born at the château from which he took his name, near Troyes, in Champagne, about the year 1160. Not merely his literary and historical importance, but almost all that is known about him, comes from his chronicle of the fourth crusade, or *Conquête de Constantinople*. Nothing is positively known of his ancestry, for the supposition (originating with Du Cange) that a certain William, marshal of Champagne between 1163 and 1179, was his father appears to be erroneous. Villehardouin himself, however, undoubtedly held this dignity, and certain minute and perhaps not very trustworthy indications, chiefly of an heraldic character, have led his most recent biographers to lay it down that he was not born earlier than 1150 or later than 1164. He introduces himself to us with a certain abruptness, merely specifying his own name as one of a list of knights of Champagne who with their count, Thibault, took the cross at a tournament held at Escry-sur-Aisne in Advent 1199, the crusade in contemplation having been started by the preaching of Fulk de Neuilly, who was commissioned thereto by Pope Innocent III. The next year six deputies, two appointed by each of the three allied counts of Flanders, Champagne and Blois, were despatched to Venice to negotiate for ships. Of these deputies Villehardouin was one and Quesnes de Béthune, the poet, another. They concluded a bargain with the seigniory for transport and provisions at a fixed price. Villehardouin had hardly returned when Thibault fell sick and died; but this did not prevent, though it somewhat delayed, the enterprise of the crusaders. The management of that enterprise, however, was a difficult one, and cost Villehardouin another embassy into Italy to prevent if possible some of his fellow-pilgrims from breaking the treaty with the Venetians by embarking at other ports and employing other convoy. He was only in part successful, and there was great difficulty in raising the charter-money among those who had actually assembled (in 1202) at Venice, the sum collected falling far short of the stipulated amount. It is necessary to remember this when the somewhat erratic and irregular character of the operations which followed is judged. The defence that the crusaders were bound to pay their passage-money to the Holy Land, in one form or other, to the Venetians, is perhaps a weak one in any case for the attack on two Christian cities, Zara and Constantinople; it becomes weaker still when it is found that the expedition never went or attempted to go to the Holy Land at all. But the desire to discharge obligations incurred is no doubt respectable in itself, and Villehardouin, as one of the actual negotiators of the bargain, must have felt it with peculiar strength.

The crusaders set sail at last, and Zara, which the Venetians coveted, was taken without much trouble. The question then arose whither the host should go next. Villehardouin does not tell us of any direct part taken by himself in the debates on the question of interfering or not in the disputed succession to the empire of the East—debates in which the chief ecclesiastics present strongly protested against the diversion of the enterprise from its proper goal. It is quite clear, however, that the marshal of Champagne, who was one of the leaders and inner counsellors of the expedition throughout, sympathized with the majority, and it is fair to point out that the temptation of chivalrous adventure was probably as great as that of gain. He narrates spiritedly enough the dissensions and discussions in the winter camp of Zara and at Corfu, but is evidently much more at ease when the voyage was again resumed, and, after a fair passage round Greece, the crusaders at last saw before them the great city of Constantinople which they had it in mind to attack. When the assault was decided upon, Villehardouin himself was in the fifth "battle," the leader of which was Mathieu de Montmorency. But, though his account of the siege is full of personal touches, and contains one reference to the number of witnesses whose testimony he took for a certain wonderful fact, he does not tell us anything of his own prowess. After the flight of the usurper Alexius, and when the blind Isaac, whose claims the crusaders were defending, had been taken by the Greeks from prison and placed on the throne, Villehardouin, with Montmorency and two Venetians, formed the embassy sent to arrange terms. He was again similarly distinguished when it became necessary to remonstrate with Alexius, the blind man's son and virtual successor, on the non-keeping of the terms. Indeed Villehardouin's talents as a diplomatist seem to have been held in very high esteem, for later, when the Latin empire had become a fact, he was charged with the delicate business of mediating between the emperor Baldwin and Boniface, marquis of Montferrat, in which task he had at least partial success. He was also appointed marshal of "Romanie"—a term very vaguely used, but apparently signifying the mainland of the Balkan Peninsula, while his nephew and namesake, afterwards prince of Achaia, took a great part in the Latin conquest of Peloponnesus. Villehardouin himself before long received an important command against the Bulgarians. He was left to maintain the siege of Adrianople when Baldwin advanced to attack the relieving force, and with Dandolo had much to do in saving the defeated crusaders from utter destruction, and conducting the retreat, in which he commanded the rearguard, and brought his troops in safety to the sea of Rodosto, and thence to the capital. As he occupied the post of honour in this disaster, so he had that (the command of the vanguard) in the expedition which the regent Henry made shortly afterwards to revenge his brother Baldwin's defeat and capture. And, when Henry had succeeded to the crown on the announcement of Baldwin's death, it was Villehardouin who fetched home his bride Agnes of Montferrat, and shortly afterwards commanded under him in a naval battle with the ships of Theodore Lascaris at the fortress of Cibotus. In the settlement of the Latin empire after the truce with Lascaris, Villehardouin received the fief of Messinople (supposed to be Mosynopolis, a little inland from the modern Gulf of Lagos, and not far from the ancient Abdera) from Boniface of Montferrat, with the record of whose death the chronicle abruptly closes.

In the foregoing account only those particulars which bear directly on Villehardouin himself have been detailed; but the chronicle is as far as possible from being an autobiography, and the displays of the writer's personality, numerous as they are, are quite involuntary, and consist merely in his way of handling the subject, not in the references (as brief as his functions as chronicler will admit) to his own proceedings. The chronicle of Villehardouin is justly held to be the very best presentation we possess of the spirit of chivalry—not the designedly exalted and poetized chivalry of the romances, not the self-conscious and deliberate chivalry of the 14th century, but the unsophisticated mode of thinking and acting which brought about the crusades, stimulated the vast literary development of the 12th and 13th centuries, and sent knights-errant, principally though not wholly of French blood, to establish principalities and kingdoms throughout Europe and the nearer East. On the whole, no doubt, it is the more masculine and practical side of this enthusiastic state of mind which Villehardouin shows. No woman makes any but the briefest appearance in his pages, though in reference to this it must of course be remembered that he was certainly a man past middle life when the events occurred, and perhaps a man approaching old age when he set them down. Despite the strong and graphic touches here and there, exhibiting the impression which the beauty of sea and land, the splendour of Constantinople, the magnitude of the effete but still imposing Greek power, made on him, there is not only an entire absence of dilation on such subjects as a modern would have dilated on (that was to be expected), but an absence likewise of the elaborate and painful description of detail in which contemporary *trouvères* would have indulged. It is curious, for instance, to compare the scanty references to the material marvels of Constantinople which Villehardouin saw in their glory, which perished by sack and fire under his very eyes, and which live chiefly in the melancholy pages of his Greek contemporary Nicetas, with the elaborate descriptions of the scarcely greater wonders of fabulous courts at Constantinople itself, at Babylon, and elsewhere, to be found in his other contemporaries, the later *chanson de geste* writers and the earlier embroiderers of the Arthurian romances and *romans d'aventures*. And this later contrast is all the more striking that Villehardouin agrees with, and not impossibly borrows from, these very writers in many points of style and phraseology. The brief chapters of his work have been justly compared to the *laisses* or *tirades* of a chanson in what may be called the vignetting of the subject of each, in the absence of any attempt to run on the narrative, in the stock forms, and in the poetical rather than prosaic word-order of the sentences. Undoubtedly this half-poetic style (animated as it is and redeemed from any charge of bastardy by the freshness and vigour which pervade it) adds not a little to the charm of the book. Its succession of word pictures, conventional and yet vigorous as the illuminations of a medieval manuscript, and in their very conventionality free from all thought of literary presentation, must charm all readers. The sober lists of names with which it opens; the account of the embassy, so business-like in its estimates of costs and terms, and suddenly breaking into a fervent description of how the six deputies, "prostrating themselves on the earth and weeping warm tears, begged the doge and people of Venice to have pity on Jerusalem"; the story immediately following, how the young count Thibault of Champagne, raising himself from a sickbed in his joy at the successful return of his ambassadors, "leva sus et chevaucha, et lazl com grant domages, car onques puis ne chevaucha que cele foiz," compose a most striking overture. Then the history relapses into the business vein and tells of the debates which took place as to the best means of carrying out the vow after the count's decease, the rendezvous, too ill kept at Venice, the plausible suggestion of the Venetians that the balance due to them should be made up by a joint attack on their enemy, the king of Hungary. Villehardouin does not in the least conceal the fact that the pope ("l'apostoilles de Rome," as he calls him, in the very phrase of the *chansons*) was very angry with this; for his own part he seems to think of little or nothing but the reparation due to the republic, which had loyally kept its bargain and been defrauded of the price, of the infamy of breaking company on the part of members of a joint association, and perhaps of the unknightliness of not taking up an adventure whenever it presents itself. For here again the restoration of the disinherited prince of Constantinople supplied an excuse quite as plausible as the liquidation of the debt to Venice. A famous passage, and one short enough to quote, is that describing the old blind doge Dandolo, who had "Grant ochoison de remanoir (reason for staying at home), car viels hom ere, et si avoit les yaulx en la teste biaus et n'en véoit gote (goutte)," and yet was the foremost in fight.

It would be out of place to attempt any further analysis of the *Conquête* here. But it is not impertinent, and is at the same time an excuse for what has been already said, to repeat that Villehardouin's book, brief as it is, is in reality one of the capital books of literature, not merely for its merit, but because it is the most authentic and the most striking embodiment in contemporary literature of the sentiments which determined the action of a great and important period of history. There are but very few books which hold this position, and Villehardouin's is one of them. If every other contemporary record of the crusades perished, we should still be able by aid of this to understand and realize what the mental attitude of crusaders, of Teutonic knights, and the rest was, and without this we should lack the earliest, the most undoubtedly genuine, and the most characteristic of all such records. The very inconsistency with which Villehardouin is chargeable, the absence of compunction with which he relates the changing of a sacred religious pilgrimage into something by no means unlike a mere filibustering raid on the great scale, add a charm to the book. For, religious as it is, it is entirely free from the very slightest touch of hypocrisy or indeed of self-consciousness of any kind. The famous description of the crusades, *gesta Dei per Francos*, was evidently to Villehardouin a plain matter-of-fact description, and it no more occurred to him to doubt the divine favour being extended to the expeditions against Alexius or Theodore than to doubt that it was shown to expeditions against Saracens and Turks.

The person of Villehardouin reappears for us once, but once only, in the chronicle of his continuator, Henri de Valenciennes. There is a great gap in style, though none in subject, between the really poetical prose of the first historian of the fifth crusade and the Latin empire and the awkward mannerism (so awkward that it has been taken to represent a "disrhymed" verse chronicle) of his follower. But the much greater length at which Villehardouin appears on this one occasion shows us the restraint which he must have exercised in the passages which deal with himself in his own work. He again led the vanguard in the emperor Henry's expedition against Burilas the Bulgarian, and he is represented by the Valenciennes scribe as encouraging his sovereign to the attack in a long speech. Then he disappears altogether, with the exception of some brief and chiefly diplomatic mentions. Du Cange discovered and quoted a deed of donation by him dated 1207, by which certain properties were devised to the churches of Notre Dame de Foissy and Notre Dame de Troyes, with the reservation of life interests to his daughters Alix and Damerones, and his sisters Emmeline and Haye, all of whom appear to have embraced a monastic life. A letter addressed from the East to Blanche of Champagne is cited, and a papal record of 1212 styles him still "marshal of Romania." The next year this title passed to his son Erard; and 1213 is accordingly given as the date of his death, which, as there is no record or hint of his having returned to France, may be supposed to have happened at Messinople, where also he must have written the *Conquête*.

The book appears to have been known in the ages immediately succeeding his own; and, though there is no contemporary manuscript in existence, there are some half-dozen which appear to date from the end of the 13th or the course of the 14th century, while one at least appears to be a copy made from his own work in that spirit of unintelligent faithfulness which is much more valuable to posterity than more pragmatical editing. The first printed edition of the book, by a certain Blaise de Vigenère, dates from 1585, is dedicated to the seigniory of Venice (Villehardouin, it should be said, has been accused of a rather unfair predilection for the Venetians), and speaks of either a part or the whole of the memoirs as having been printed twelve years earlier. Of this earlier copy nothing seems to be known. A better edition, founded on a Netherlandish MS., appeared at Lyons in 1601. But both these were completely antiquated by the great edition of Du Cange in 1657, wherein that learned writer employed all his knowledge, never since equalled, of the subject, but added a translation, or rather paraphrase, into modern French which is scarcely worthy either of himself or his author. Dom Brial gave a new edition from different MS. sources in 1823, and the book figures with different degrees of dependence on Du Cange and Brial in the collections of Petitot, Buchon, and Michaud and Poujoulat. All these, however, have been superseded for the modern student by the editions of Natalis de Wailly (1872 and 1874), in which the text is critically edited from all the available MSS. and a new translation added, while there is a still later and rather handier one by E. Bouchet (2 vols., Paris, 1891), which, however, rests mainly on N. de Wailly for text. The charm of Villehardouin can escape no reader; but few readers will fail to derive some additional pleasure from the two essays which Sainte-Beuve devoted to him, reprinted in the ninth volume of the *Causeries du lundi*. See also A. Debidour, *Les Chroniqueurs* (1888). There are English translations by T. Smith (1829), and (more literally) Sir F. T. Marzials (Everyman's Library, 1908). (G. Sa.)

VILLÈLE, JEAN BAPTISTE GUILLAUME MARIE ANNE SÉRAPHIN, Comte de (1773–1854), French statesman, was born at Toulouse on the 14th of April 1773 and educated for the navy. He joined the "Bayonnaise" at Brest in July 1788 and served in the West and East Indies. Arrested in the Isle of Bourbon under the Terror, he was set free by the revolution of Thermidor (July 1794). He acquired some property in the island, and married in 1799 the daughter of a great proprietor, M. Desbassyns de Richemont, whose estates he had managed. His apprenticeship to politics was served in the Colonial Assembly of Bourbon, where he fought successfully to preserve the colony from the consequences of perpetual interference from the authorities in Paris, and on the other hand to prevent local discontent from appealing to the English for protection. The arrival of General Decaen, sent out by Bonaparte in 1802, restored security to the island, and five years later Villèle, who had now realized a large fortune, returned to France. He was mayor of his commune, and a member of the council of the Haute-Garonne under the Empire. At the restoration of 1814 he at once declared for royalist principles. He was mayor of Toulouse in 1814–15 and deputy for the Haute-Garonne in the "Chambre Introuvable" of 1815. Villèle, who before the promulgation of the charter had written some *Observations sur le projet de constitution* opposing it, as too democratic in character, naturally took his place on the extreme right with the ultra-royalists. In the new Chamber of 1816 Villèle found his party in a minority, but his personal authority nevertheless increased. He was looked on by the ministerialists as the least unreasonable of his party, and by the "ultras" as the safest of their leaders. Under the electoral law of 1817 the Abbé Grégoire, who was popularly supposed to have voted for the death of Louis XVI. in the Convention, was admitted to the Chamber of Deputies. The Conservative party gained strength from the alarm raised by this incident and still more from the shock caused by the assassination of the duc de Berri. The duc de Richelieu was compelled to admit to the cabinet two of the chiefs of the Left, Villèle and Corbière. Villèle resigned within a year, but on the fall of Richelieu at the end of 1821 he became the real chief of the new cabinet, in which he was minister of finance. Although not himself a courtier, he was backed at court by Sosthènes de la Rochefoucauld and Madame du Cayla, and in 1822 Louis XVIII. gave him the title of count and made him formally prime minister. He immediately proceeded to muzzle opposition by stringent press laws, and the discovery of minor liberal conspiracies afforded an excuse for further repression. Forced against his will into interference in Spain by Mathieu de Montmorency and Chateaubriand, he contrived to reap some credit for the monarchy from the successful campaign of 1823. Meanwhile he had consolidated the royal power by persuading Louis XVIII. to swamp the liberal majority in the upper house by the nomination of twenty-seven new peers; he availed himself of the temporary popularity of the monarchy after the Spanish campaign to summon a new Chamber of Deputies. This new and obedient legislature, to which only nineteen liberals were returned, made itself into a septennial parliament, thus providing time, it was thought, to restore some part of the *ancien régime*. Villèle's plans were assisted by the death of Louis XVIII. and the accession of his bigoted brother. Prudent financial administration since 1815 had made possible the conversion of the state bonds from 5 to 4%. It was proposed to utilize the money set free by this operation to indemnify by a milliard francs the *emigrés* for the loss of their lands at the Revolution; it was also proposed to restore their former privileges to the religious congregations. Both these propositions were, with some restrictions, secured. Sacrilege was made a crime punishable by death, and the ministry were preparing a law to alter the law of equal inheritance, and thus create anew the great estates. These measures roused violent opposition in the country, which a new and stringent press law, nicknamed the "law of justice and love," failed to put down. The peers rejected the law of inheritance and the press law; it was found necessary to disband the National Guard; and in November 1827 seventy-six new peers were created, and recourse was had to a general election. The new Chamber proved hostile to Villèle, who resigned to make way for the short-lived moderate ministry of Martignac.

The new ministry made Villèle's removal to the upper house a condition of taking office, and he took no further part in public affairs. At the time of his death, on the 13th of March 1854, he had advanced as far as 1816 with his memoirs, which were completed from his correspondence by his family as *Mémoires et correspondance du comte de Villèle* (Paris, 5 vols., 1887–90).

See also C. de Mazade, *L'Opposition royaliste* (Paris, 1894); J. G. Hyde de Neuville. *Notice sur le comte de Villèle* (Paris, 1899); and M. Chotard, "L'Œuvre financière de M. de Villèle," in *Annales des sciences politiques* (vol. v., 1890).

VILLEMAIN, ABEL FRANÇOIS (1790–1867), French politician and man of letters, was born in Paris on the 9th of June 1790. He was educated at the lycée Louis-le-Grand, and became assistant master at the lycée Charlemagne, and subsequently at the École Normale. In 1812 he gained a prize from the Academy with an *éloge* on Montaigne. Under the restoration he was appointed, first, assistant professor of modern history, and then professor of French eloquence at the Sorbonne. Here he delivered a series of literary lectures which had an extraordinary effect on his younger contemporaries. Villemain had the great advantage of coming just before the Romantic movement, of having a wide and catholic love of literature without being an extremist. All, or almost all, the clever young men of the brilliant generation of 1830 passed under his influence; and, while he pleased the Romanticists by his frank appreciation of the beauties of English, German, Italian and Spanish poetry, he had not the least inclination to decry the classics—either the classics proper of Greece and Rome or the so-called classics of France. In 1819 he published a book on *Cromwell*, and two years later he was elected to the Academy. Villemain was appointed by the restoration government "chef de l'imprimerie et de la librairie," a post involving a kind of irregular censorship of the press, and afterwards to the office of master of requests. Before the revolution of July he had been deprived of his office for his liberal tendencies, and had been elected deputy for Évreux. Under Louis Philippe he received a peerage in 1832. He was a member of the council of public instruction, and was twice minister of that department, and he also became secretary of the Academy. During the whole of the July monarchy he was thus one of the chief dispensers of literary patronage in France, but in his later years his reputation declined. He died in Paris on the 8th of May 1867.

Villemain's chief work is his *Cours de la littérature française* (5 vols., 1828–29). Among his other works are: *Tableau de la littérature du moyen âge* (2 vols., 1846); *Tableau de la littérature au XVIII^e^ siècle* (4 vols., 1864); *Souvenirs contemporains* (2 vols., 1856); *Histoire de Grégoire VII.* (2 vols., 1873; Eng. trans., 1874).

Among notices on Villemain may be cited that of Louis de Loménie (1841), E. Mirecourt (1858), J. L. Dubut (1875). See also Sainte-Beuve, *Portraits* (1841, vol. iii.), and *Causeries du lundi* (vol. xi. "Notes et pensées").

VILLENA, ENRIQUE DE (1384–1434), Spanish author, was born in 1384. Through his grandfather, Alphonso de Aragon, count de Denia y Ribagorza, he traced his descent from Jaime II. of Aragon and Blanche of Naples. He is commonly known as the marquess de Villena; but, although a marquessate was at one time in the family, the title was revoked and annulled by Henry III. Villena's father, Don Pedro de Villena, was killed at Aljubarrota; the boy was educated by his grandfather, showed great capacity for learning and was reputed to be a wizard. About 1402 he married Maria de Albornoz, señora del Infantado, who speedily became the recognized mistress of Henry III.; the complaisant husband was rewarded by being appointed master of the military order of Calatrava in 1404, but on the death of Henry at the end of 1406 the knights of the order refused to accept the nomination, which, after a long contest, was rescinded in 1415. He was present at the coronation of Ferdinand of Aragon at Saragossa in 1414, retired to Valencia till 1417, when he moved to Castile to claim compensation for the loss of his mastership. He obtained in return the lordship (*señorio*) of Miesta, and, conscious of his unsuitability for warfare or political life, dedicated himself to literature. He died of fever at Madrid on the 15th of December 1434. He is represented by a fragment of his *Arte de trobar* (1414), an indigestible treatise composed for the Barcelona Consistory of Gay Science; by *Los Trabajos de Hércules* (1417), a pedantic and unreadable allegory; by his *Tratado de la Consolación* and his handbook to the pleasures and fashions of the table, the *Arte cisoria*, both written in 1423; by a commentary on Psalm viii. ver. 4, which dates from 1424; by the *Libro de Aojamiento* (1425), a ponderous dissertation on the evil eye and its effects; and by a translation of the *Aeneid*, the first ever made, which was finished on the 10th of October 1428. His treatise on leprosy exists but has not been published. Villena's writings do not justify his extraordinary fame; his subjects are devoid of charm, and his style is so uncouth as to be almost unintelligible. Yet he has an assured place in the history of Spanish literature; he was a generous patron of letters, his translation of Virgil marks him out as a pioneer of the Renaissance, and he set a splendid example of intellectual curiosity. Moreover, there is an abiding dramatic interest in the baffling personality of the solitary high-born student whom Lope de Vega introduces in *Porfiar hasta morir*, whom Ruiz de Alarcón presents in *La Cueva de Salamanca*, and who reappears in the

19th century in Larra's *Macias* and in Hartzenbusch's play *La Redoma encantada*. (J. F.-K.)

VILLENA, a town of eastern Spain, in the province of Alicante; on the right bank of the river Vinalapo, and at the junction of railways from Valencia, Alicante, Albacete and Yecla. Pop. (1900) 14,099. Villena is a labyrinth of winding alleys, which contain some interesting examples of Moorish domestic architecture. It is dominated by a large and picturesque Moorish castle. The surrounding hills are covered with vines, and to the east there is an extensive salt lagoon. Silk, linen, flour, wine, brandy, oil, salt and soap are the chief industrial products.

VILLENAGE (Villainage, Villanage, Villeinage), a medieval term (from *villa, villanus*), pointing to serfdom, a condition of men intermediate between freedom and slavery. It occurs in France as well as in England, and was certainly imported into English speech through the medium of Norman French. The earliest instances of its use are to be found in the Latin and French versions of English documents in the 11th and 12th centuries (cf. Domesday Book; Liebermann, Glossary to the *Gesetze der Angelsachsen*, s.v. *villanus, vilain*). The history of the word and of the condition is especially instructive in English usage.

The materials for the formation of the villein class were already in existence in the Anglo-Saxon period. On the one hand, the Saxon ceorls (*twihyndemen*), although considered as including the typical freemen in the earlier laws (Æthelberht, Hlothhere and Edric, Ine), gradually became differentiated through the action of political and economic causes, and many of them had to recognize the patronage of magnates or to seek livelihood as tenants on the estates of the latter. These ceorls, sitting on gafol-land, were, though personally free, considered as a lower order of men, and lapsed gradually into more or less oppressive subjection in respect of the great landowners. It is characteristic in this connexion that the West Saxon laws do not make any distinction between ceorls and laets or half-freemen as the Kentish laws had done: this means that the half-free people were, if not Welshmen, reckoned as members of the ceorl class. Another remarkable indication of the decay of the ceorl's estate is afforded by the fact that in the treaties with the Danes the twihynde ceorls are equated with the Danish leysings or freedmen. It does not mean, of course, that their condition was practically the same, but in any case the fact testifies to the gulf which had come to separate the two principal subdivisions of the free class—the ceorl and the thane. The Latin version of the *Rectitudines Singularum Personarum*, a document compiled probably in the 11th century, not long before the Conquest, renders *geneat* (a peasant tenant of a superior kind performing lighter services than the gebur, as he was burdened with heavy week-work) by *villanus*; but the gebur came to be also considered as a *villanus* according to Anglo-Norman terminology. The group designated as *geburs* in Anglo-Saxon charters, though distinguished from mere slaves (*theow baerde-burbaerde*, Kemble, *Cod. Dipl.* 1079), undoubtedly included many freedmen who in point of services and economic subjection were not very much above the slaves. Both ceorls and geburs disappear as separate classes, and it is clear that the greater part of them must have passed into the rank of villeins.

In the terminology of the Domesday Inquest we find the villeins as the most numerous element of the English population. Out of about 240,000 households enumerated in Domesday 100,000 are marked as belonging to villeins. They are rustics performing, as a rule, work services for their lords. But not all the inhabitants of the villages were designated by that name. Villeins are opposed to socmen and freemen on one hand, to *bordarii*, cottagers and slaves on the other. The distinction in regard to the first two of these groups was evidently derived from their greater freedom, although the difference is only one in degree and not in kind. In fact, the villein is assumed to be a person free by birth, but holding land of which he cannot dispose freely. The distinction as against *bordarii* and cottagers is based on the size of the holding: the villeins are holders of regular shares in the village—that is, of the virgates, bovates or half-hides which constitute the principal subdivisions in the fields and contribute to form the ploughteams—whereas the *bordarii* hold smaller plots of some 5 acres, more or less, and *cotarii* are connected with mere cottages and crofts. Thus the terminology of Domesday takes note of two kinds of differences in the status of rustics: a legal one in connexion with the right to dispose of property in land, and an economic one reflecting the opposition between the holders of shares in the fields and the holders of auxiliary tenements. The feature of personal serfdom is also noticeable, but it provides a basis only for the comparatively small group of *servi*, of whom only about 25,000 are enumerated in Domesday Book. The contrast between this exceptionally situated class and the rest of the population shows that personal slavery was rapidly disappearing in England about the time of the Conquest. It is also to be noticed that the Domesday Survey constantly mentions the *terra villanorum* as opposed to the demesne in the estates or manors of the time, and that the land of the rustics is taxed separately for the geld, so that the distinction between the property of the lord and that of the peasant dependent on him is clearly marked and by no means devoid of practical importance.

The Domesday Survey puts before us the state of things in England as it was at the very beginning of the Norman and at the close of the Saxon period. The development of feudal society, of centralizing kingship and ultimately of a system of common law, brought about great changes which all hinge on the fundamental fact that the kings, while increasing the power of the state in other respects, surrendered it completely as regards the relations between the peasants and their lords. The protection of the assizes was tendered in civil matters to free tenants and refused to villeins. The royal courts refused to entertain suits of villeins against their lords, although there was a good deal of vacillation before this position was definitely taken up. Bracton still speaks in his treatise of the possibility for the courts to interfere against intolerable cruelty on the part of the lord involving the destruction of the villein's waynage, that is, of his ploughteam, and in the *Notebook* of Bracton there are a couple of cases which prove that 13th-century judges occasionally allowed themselves to entertain actions by persons holding in villenage against their lords. Gradually, however, the exception of villenage became firmly settled. As the historical and practical position was developing on these lines the lawyers who fashioned English common law in the 12th and 13th centuries did not hesitate to apply to it the teaching of Roman law on slavery. Bracton fits his definition of villenage into the Romanesque scheme of Azo's *Summa* of the Institutes, and the judges of the royal courts made sweeping inferences from this general position. To begin with, the relation between the villein and his lord was regarded as a personal and not a praedial one. Everyone born of villein stock belonged to his master and was bound to undertake any service which might be imposed on him by the master's or the steward's command. The distinction between villeins in gross and villeins regardant, of which much is made by modern writers, was suggested by modes of pleading and does not make its appearance in the Year-Books before the 15th century. Secondly, all independent proprietary rights were denied to the villein as against his lord, and the legal rule "quicquid servo acquiritur domino acquiritur" was extended to villeins. The fact that a great number of these serfs had been enjoying protection as free ceorls in former ages made itself felt, however, in three directions. (1) In criminal matters the villein was treated by the King's Court irrespectively of any consideration as to his debased condition. More especially the police association, organized for the keeping of the peace and the presentation of criminals—the frankpledge groups were formed of all "worthy of were and wite," villeins as well as freemen. (2) Politically the villeins were not eliminated from the body of citizens: they had to pay taxes, to serve in great emergencies in the militia, to serve on inquests, &c., and although there was a tendency to place them on a lower footing in all these respects yet the fact of their being lesser members of the commonwealth did not remove the fundamental qualification of citizenship. (3) Even in civil matters villeins were deemed free as regards third persons. They could sue and be sued in their own name, and although they were able to call in their lords as defendants when proceeded against, there was nothing in law to prevent them from appearing in their own right. The state even afforded them protection against extreme cruelty on the part of their masters in respect of life and limb, but in laying down this rule English lawyers were able to follow the precedents set by late Roman jurisprudence, especially by measures of Hadrian, Antonine and Constantine the Great.

There was one exception to this harsh treatment of villeins, namely, the rustic tenantry in manors of *ancient demesne*, that is, in estates which had belonged to the crown before the Conquest, had a standing-ground even against their lords as regards the tenure of their plots and the fixity of their services. Technically this right was limited to the inhabitants of manors entered in the Domesday Survey as *terra regis* of Edward the Confessor. On the other hand the doctrine became effective if the manors in question had been granted by later kings to subjects, because if they remained in the hand of the king the only remedy against ejectment and exaction lay in petitioning for redress without any definite right to the latter. If, however, the two conditions mentioned were forthcoming, villeins, or, as they were technically called, villein socmen of ancient demesne manors, could resist any attempt of their lords to encroach on their rights by depriving them of their holdings or increasing the amount of their customary services. Their remedy was to apply for a little writ of right in the first case and for a writ of *monstraverunt* in the second. These writs entitled them to appear as plaintiffs against the lord in his own manorial court and, eventually, to have the question at issue examined by way of appeal, on a writ of error, or by reservation on some legal points in the upper courts of the king. A number of cases arising from these privileges of the men of ancient demesne are published in the *Notebook* of Bracton and in the *Abbreviatio placitorum.* This exceptional procedure does not simply go back to the rule that persons who had been tenants of the king ought not to have their condition altered for the worse in consequence of a royal grant. If this were the only doctrine applicable in the case there would be no reason why similar protection should be denied to all those who held under grantees of manors escheated after the Conquest. A material point for the application of the privilege consists in the fact that ancient demesne has to be proved from the time before the Conquest, and this shows clearly that the theory was partly derived from the recognition of tenant right in villeins of the Anglo-Saxon period who, as we have said above, were mostly ceorls, that is, freeborn men.

In view of the great difference in the legal position of the free man and of the villein in feudal common law, it became very important to define the exact nature of the conditions on which the status of a villein depended. The legal theory as to these conditions was somewhat complex, because it had to take account of certain practical considerations and of a rather abrupt transition from a previous state of things based on different premises. Of course, persons born from villein parents in lawful wedlock were villeins, but as to the condition of illegitimate children there was a good deal of hesitation. There was a tendency to apply the rule that a bastard follows the mother, especially in the case of a servile mother. In the case of mixed marriages, the condition of the child is determined by the free or villein condition of the tenement in which it was born. This notion of the influence of the tenement is well adapted to feudal notions and makes itself felt again in the case of the pursuit of a fugitive villein. He can be seized without further formalities if he is caught in his "nest," that is, in his native place. If not, the lord can follow him in fresh pursuit for four days; once these days past, the fugitive is maintained provisionally in possession of his liberty, and the lord has to bring an action *de nativo habendo* and has to assume the burden of proof.

So much as to the proof of villenage by birth or previous condition. But there were numbers of cases when the discussion as to servile status turned not on these formal points but on an examination of the services performed by the person claimed as a villein or challenged as holding in villenage. In both cases the courts had often recourse to proof derived not from direct testimony but from indirect indications as to the kind of services that had been performed by the supposed villein. Certain services, especially the payment of *merchet*—the fine for marrying a daughter—were considered to be the badge of serfdom. Another service, the performance of which established a presumption as to villenage, was compulsory service as a reeve. The courts also tried to draw a distinction from the amount and regularity of agricultural services to which a tenant was subjected. Bracton speaks of the contrast between the irregular services of a serf, "who could not know in the evening what he would have to do in the morning," and services agreed upon and definite in their amount. The customary arrangements of the work of villeins, however, render this contrast rather fictitious. The obligations of downright villeins became to that degree settled and regular that one of the ordinary designations of the class was *custumarii.* Therefore in most cases there were no arbitrary exactions to go by, except perhaps one or the other tallage imposed at the will of the lord. The original distinction seems to have been made not between arbitrary and agreed but between occasional services and regular agricultural week-work. While the occasional services, even when agricultural, in no way established a presumption of villenage, and many socmen, freemen and holders by serjeanty submitted to them, agricultural week-work was primarily considered as a trait of villenage and must have played an important part in the process of classification of early Norman society. The villein was in this sense emphatically the man holding "by the fork and the flail."

This point brings us to consider the matter-of-fact conditions of the villeins during the feudal period, especially in the 12th, 13th and 14th centuries. As is shown by the Hundred Rolls, the Domesday of St Paul, the Surveys of St Peter, Glouc., Glastonbury Abbey, Ramsey Abbey and countless other records of the same kind, the customary conditions of villenage did not tally by any means with the identification between villenage and slavery suggested by the jurists. It is true that in nomenclature the word "*servi*" is not infrequently used (*e.g.* in the Hundred Rolls) where *villani* might have been mentioned, and the feminine *nief* (*nativa*) appears as the regular parallel of *villanus*, but in the descriptions of usages and services we find that the power of the lord loses its discretionary character and is in every respect moderated by custom. As personal dependents of the lord native villeins were liable to be sold, and we find actual sales recorded: Glastonbury Abbey *e.g.* sells a certain Philipp Hardyng for 20 shillings. But such transfers of human chattels occur seldom, and there is nothing during the English feudal period corresponding to the brisk trade in men characteristic of the ancient world. *Merchet* was regarded, as has been stated already, as a badge of serfdom in so far as it was said to imply a "buying of one's own blood" (*servus de sanguine suo emando*). The explanation is even more characteristic than the custom itself, because fines on marriage may be levied and were actually levied from people of different condition, from the free as well as from the serf. Still the tendency to treat *merchet* as a distinctive feature of serfdom has to be noted, and we find that the custom spread for this very reason in consequence of the encroachments of powerful lords: in the Hundred Rolls it is applied indiscriminately to the whole rustic population of certain hundreds in a way which can hardly be explained unless by artificial extension. *Heriot*, the surrender of the best horse or ox, is also considered as the common incident of villein tenure, although, of course, its very name proves its intimate connexion with the outfit of soldiers (*here-geatu*).

Economically the institution of villenage was bound up with the manorial organization—that is, with the fact that the country was divided into a number of districts in which central home farms were cultivated by the help of work supplied by villein households.

The most important of villein services is the *week-work* performed by the peasantry. Every virgater or holder of a bovate has to send a labourer to do work on the lord's farm for some days in the week. Three days is indeed the most common standard for service of this kind, though four or even five occur sometimes, as well as two. It must be borne in mind in the case of heavy charges, such as four or five days' week-work, that only one labourer from the whole holding is meant, while generally there were several men living on every holding—otherwise the service of five days would be impossible to perform. In the course of these three days, or whatever the number was, many requirements of the demesne had to be met. The principal of these was *ploughing the fields* belonging to the lord, and for such ploughing the peasant had not only to appear personally as a labourer, but to bring his oxen and plough, or rather to join with his oxen and plough in the work imposed on the village: the heavy, costly plough with a team of eight oxen had to be made up by several peasants contributing their beasts and implements towards its composition. In the same way the villagers had to go through the work of harrowing with their harrows, and of removing the harvest in their vans and carts. *Carriage* duties in carts and on horseback were also apportioned according to the time they took as a part of the week-work. Then came innumerable varieties of manual work for the erection and keeping up of hedges, the preservation of dykes, canals and ditches, the threshing and garnering of corn, the tending and shearing of sheep and so forth. All this hand-work was reckoned according to customary standards as day-work and week-work. But besides all these services into which the regular week-work of the peasantry was differentiated, stood some additional duties. The ploughing for the lord, for instance, was not only imposed in the shape of a certain number of days in the week, but took sometimes the shape of a certain number of acres which the village had to plough and to sow for the lord irrespectively of the time employed on it. This was sometimes termed *gafolearth*. Exceedingly burdensome services were required in the seasons when farming processes are, as it were, at their height—in the seasons of mowing and reaping, when every day is of special value and the working power of the farm hands is strained to the utmost. At that time it was the custom to call up the whole able-bodied population of the manor, with the exception of the housewives for two, three or more days of mowing and reaping on the lord's fields; to these *boon-works* the peasantry was asked or invited by special summons, and their value was so far appreciated that the villagers were usually treated to meals in cases where they were again and again called off from their own fields to the demesne. The liberality of the lord actually went so far, in exceptionally hard straits, that some ale was served to the labourers to keep them in good humour.

In the 14th century this social arrangement, based primarily on natural economy and on the feudal disruption of society, began to give way. The gradual spread of *intercourse* rendered unnecessary the natural husbandry of former times which sought to produce a complete set of *goods* in every separate locality. Instead of acting as a little world by itself for the raising of corn, the breeding of cattle, the gathering of wool, the weaving of linen and common cloths, the fabrication of necessary implements of all kinds, the local group began to buy some of these goods and to sell some others, renouncing isolation and making its destiny dependent on commercial intercourse. Instead of requiring from its population all kinds of work and reducing its ordinary occupations to a hard-and-fast routine meeting in a slow and unskilled manner all possible contingencies, the local group began to move, to call in workmen from abroad for tasks of a special nature, and to send its own workmen to look out for profitable employment in other places. Instead of managing the land by the constant repetition of the same processes, by a customary immobility of tenure and service, by communalistic restrictions on private enterprise and will, local society began to try improvements, to escape from the bounds of champion farming. Instead of producing and collecting goods for immediate consumption, local society came more and more into the habit of exchanging corn, cattle, cloth, for money, and of laying money by as a means of getting all sorts of exchangeable goods, when required. In a word, the time of *commercial*, *contractual*, *cash intercourse* was coming fast. What was exceptional and subsidiary in feudal times came to obtain general recognition in the course of the 14th and 15th centuries, and, for this very reason, assumed a very different aspect. A similar transformation took place in regard to government. The local monarchy of the manorial lords was fast giving way to a central power which maintained its laws, the circuits of its judges, the fiscal claims of its exchequer, the police interference of its civil officers all through the country, and, by prevailing over the franchises of manorial lords, gave shape to a vast dominion of legal equality and legal protection, in which the forces of commercial exchange, of contract, of social intercourse, found a ready and welcome sphere of action. In truth both processes, the economic and the political one, worked so much together that it is hardly possible to say which influenced the other more, which was the cause and which the effect. Government grew strong because it could draw on a society which was going ahead in enterprise and well-being; social intercourse progressed because it could depend on a strong government to safeguard it.

If we now turn to the actual stages by which this momentous passage from the manorial to the commercial arrangement was achieved, we have to notice first of all a rapid *development of contractual relations*. We know that in feudal law there ran a standing contrast between *tenure by custom*—villein tenure—and *tenure by contract*—free tenure. While the manorial system was in full force this contrast led to a classification of holdings and affected the whole position of people on the land. Still, even at that time it might happen that a freeholder owned some land in villenage by the side of his free tenement, and that a villein held some land freely by agreement with his lord or with a third person. But these cases, though by no means infrequent, were still exceptional. As a rule people used land as holdings, and those were rigidly classified as villein or free tenements. The interesting point to be noticed is that, without any formal break, *leasing land for life and for term of years* is seen to be rapidly spreading from the end of the 13th century, and numberless small tenancies are created in the 14th century which break up the disposition of the holdings. From the close of the 13th century downwards countless transactions on the basis of leases for terms of years occur between the peasants themselves, any suitably kept set of 14th-century court rolls containing entries in which such and such a villein is said to appear in the *halimote* and to surrender for the use of another person named a piece of land belonging to the holding. The number of years and the conditions of payment are specified. Thus, behind the screen of the normal shares a number of small tenancies arise which run their economic concerns independently from the cumbersome arrangements of tenure and service, and, needless to add, all these tenancies are burdened with money rents.

Another series of momentous changes took place in the *arrangement of services*. Even the manorial system admitted the buying off for money of particular dues in kind and of specific performance of work. A villein might be allowed to bring a penny instead of bringing a chicken or to pay a rent instead of appearing with his oxen three times a week on the lord's fields. Such rents were called *mal* or *mail* in contrast with the *gafol*, ancient rents which had been imposed independently, apart from any buying off of customary services. There were even whole bodies of peasants called *Molmen*, because they had bought off work from the lord by settling with him on the basis of money rents. As time went on these practices of *commutation* became more and more frequent. There were, for both sides, many advantages in arranging their mutual relations on this basis. The lord, instead of clumsy work, got clear money, a much-coveted means of satisfying needs and wishes of any kind—instead of cumbrous performances which did not come always at the proper moment, were carried out in a half-hearted manner, yielded no immediate results, and did not admit of convenient rearrangement. The peasant got rid of a hateful drudgery which not only took up his time and means in an unprofitable manner, but placed him under the rough control and the arbitrary discipline of stewards or reeves and gave occasion to all sorts of fines and extortions.

With the growth of intercourse and security money became more frequent and the number of such transactions increased in proportion. But it must be kept in mind that the conversion of services into rents went on very gradually, as a series of private agreements, and that it would be very wrong to suppose, as some scholars have done, that it had led to a general commutation by the middle or even the end of the 14th century. The 14th century was marked by violent fluctuations in the demand and supply of labour, and particularly the tremendous loss in population occasioned in the middle of this century by the Black Death called forth a most serious crisis. No wonder that many lords clung very tenaciously to customary services, and ecclesiastical institutions seem to have been especially backward in going over to the system of money rents. There is evidence to show, for instance, that the manors of the abbey of Ramsey were managed on the system of enforced labour right down to the middle of the 15th century, and, of course, survivals of these customs in the shape of scattered services lived on much longer. A second drawback from the point of view of the landlords was called forth by the fact that commutation for fixed rents gradually lessened the value of the exactions to which they were entitled. Money not only became less scarce but it became cheaper, so that the couple of pence for which a day of manual work was bought off in the beginning of the 13th century did not fetch more than half of their former value at its end. As quit rents were customary and not rack rents, the successors of those who had redeemed their services were gaining the whole surplus in the value of goods and labour as against money, while the successors of those who had commuted their right to claim services for certain sums in money lost all the corresponding difference. These inevitable consequences came to be perceived in course of time and occasioned a backward tendency towards services in kind which could not prevail against the general movement from natural economy to money dealings, but was strong enough to produce social friction and grave disturbances.

The economic crisis of the 14th century has its complement in the legal crisis of the 15th. At that time the courts of law begin to do away with the denial of protection to villeins which, as we have seen, constituted the legal basis of villenage. This is effected by the recognition of copyhold tenure (see Copyhold).

It is a fact of first-rate magnitude that in the 15th century customary relations on one hand, the power of government on the other, ripened, as it were, to that extent that the judges of the king began to take cognizance of the relations of the peasants to their lords. The first cases which occur in this sense are still treated not as a matter of common law, but as a manifestation of equity. As doubtful questions of trust, of wardship, of testamentary succession, they were taken up not in the strict course of justice, but as matters in which redress was sorely needed and had to be brought by the exceptional power of the court of chancery. But this interference of 15th-century chancellors paved the way towards one of the greatest revolutions in the law; without formally enfranchising villeins and villein tenure they created a legal basis for it in the law of the realm: in the formula of copyhold—*tenement held at the will of the lord and by the custom of the manor*—the first part lost its significance and the second prevailed, in downright contrast with former times when, on the contrary, the second part had no legal value and the first expressed the view of the courts. One may almost be tempted to say that these obscure decisions rendered unnecessary in England the work achieved with such a flourish of trumpets in France by the emancipating decree of the 4th of August 1789.

The personal condition of villenage did not, however, disappear at once with the rise of copyhold. It lingered through the 16th century and appears exceptionally even in the 17th. Deeds of emancipation and payments for personal enfranchisement are often noticed at that very time. But these are only survivals of an arrangement which has been destroyed in its essence by a complete change of economic and political conditions.

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VILLENEUVE, PIERRE CHARLES JEAN BAPTISTE SILVESTRE (1763–1806), French admiral, was born at Valensoles in Provence on the 31st of December 1763. He entered the French royal navy as a " garde du Pavillon." Although he belonged to the corps of " noble " officers, who were the object of peculiar animosity to the Jacobins, he escaped the fate of the majority of his comrades, which was to be massacred, or driven into exile. He sympathized sincerely with the general aims of the Revolution, and had a full share of the Provençal fluency which enabled him to make a timely and impressive display of " civic " sentiments. In the dearth of trained officers he rose with what for the French navy was exceptional rapidity, though it would have caused no surprise in England in the case of an officer who had good interest. He was named post-captain in 1793, and rear-admiral in 1796. At the close of the year he was appointed to take part in the unsuccessful expedition to Ireland which reached Bantry Bay, but the ships which were to have come to Brest from Toulon with him arrived too late, and were forced to take refuge at L'Orient. He accompanied the expedition to Egypt, with his flag in the " Guillaume Tell " (86). She was the third ship from the rear of the French line at the battle of the Nile, and escaped from the general destruction in company with the " Généreux " (78). Villeneuve reached Malta on the 23rd of August. His conduct was severely blamed, and he defended himself by a specious letter to his colleague Blanquet-Duchayla on the 12th of November 1800, when he had returned to Paris. At the time, Napoleon approved of his action. In a letter written to him on the 21st of August 1798, three weeks after the battle, Napoleon says that the only reproach Villeneuve had to make against himself was that he had not retreated sooner, since the position taken by the French commander-in-chief had been forced and surrounded. When, however, the emperor after his fall dictated his account of the expedition to Egypt to General Bertrand at St Helena, he attributed the defeat at the Nile largely to the " bad conduct of Admiral Villeneuve." In the interval Villeneuve had failed in the execution of the complicated scheme for the invasion of England in 1805. Napoleon must still have believed in the admiral's capacity and good fortune, a qualification for which he had a great regard, when he selected him to succeed Latouche Tréville upon his death at Toulon in August 1804. The duty of the Toulon squadron was to draw Nelson to the West Indies, return rapidly, and in combination with other French and Spanish ships, to enter the Channel with an overwhelming force. It is quite obvious that Villeneuve had from the first no confidence in the success of an operation requiring for its execution an amazing combination of good luck and efficiency on the part of the squadrons concerned. He knew that the French were net efficient, and that their Spanish allies were in a far worse state than themselves. It required a very tart order from Napoleon to drive him out of Paris in October 1804. He took the command in November. On the 17th of January 1805 he left Toulon for the first time, but was driven back by a squall which dismasted some of his awkwardly handled ships. On the 3rd of March he was out again, and this time he headed Nelson by some weeks on a cruise to the West Indies. But Villeneuve's success so far had not removed his fears. Though on taking up his command he had issued an order of the day in which he spoke boldly enough of the purpose of his cruise, and his determination to adhere to it, he was racked by fears of what might happen to the force entrusted to his care. For the details of the campaign see TRAFALGAR. In so far as the biography of Villeneuve is concerned, his behaviour during these trying months cannot escape condemnation. He had undertaken to carry out a plan of which he did not approve. Since he had not declined the task altogether, it was clearly his duty to execute his orders at all hazards. If he was defeated, as he almost certainly would have been, he could have left the responsibility for the disaster to rest on the shoulders of Napoleon who assigned him the task. But Villeneuve could not free himself from the conviction that it was his business to save his fleet even if he ruined the emperor's plan of invasion. Thus after he returned to Europe and fought his confused action with Sir R. Calder off Ferrol on the 22nd of July 1805, he first hesitated, and then, in spite of vehement orders to come on, turned south to Cadiz. Napoleon's habit of suggesting alternative courses to his lieutenants gave him a vague appearance of excuse for making for that port. But it was one which only a very weak man would have availed himself of, for all his instructions ought to have been read subject to the standing injunction to come on to the Channel—and in turning south to Cadiz, he was going in the opposite direction. His decision to leave Cadiz and give battle in October 1805, which led directly to the battle of Trafalgar, cannot be justified even on his own principles. He foresaw defeat to be inevitable, and yet he went out solely because he learnt from the Minister of Marine that another officer had been sent to supersede him. In fact he ran to meet the very destruction he had tried to avoid. No worse fate would have befallen him in the Channel than came upon him at Trafalgar, but it might have been incurred in a manly attempt to obey his orders. It was provoked in a spasm of wounded vanity. At Trafalgar he showed personal courage, but the helpless incapacity of the allies to manœuvre gave him no opportunity to influence the course of the battle. He was taken as a prisoner to England, but was soon released. Shortly after landing in France he committed suicide in an inn at Rennes, on the 22nd of April 1806. Among the other improbable crimes attributed to Napoleon by the fear and hatred of Europe, was the murder of Villeneuve, but there is not the faintest reason to doubt that the admiral died by his own hand.

The correspondence of Napoleon contains many references to Villeneuve. Accounts of the naval operations in which he was concerned will be found in James's *Naval History*. Troude, in his *Batailles navales de la France*, vol. iii., publishes several of his letters and orders of the day. (D. H.)

VILLENEUVE-LÈS-AVIGNON, a town of south-eastern France, in the department of Gard on the right bank of the Rhone opposite Avignon, with which it is connected by a suspension bridge. Pop. (1906) 2582. Villeneuve preserves many remains of its medieval importance. The church of Notre Dame, dating from the 14th century, contains a rich marble altar and remarkable pictures. The hospice, once a Franciscan convent, part of which is occupied by a museum of pictures and antiquities, has a chapel in which is the fine tomb of Innocent VI. (d. 1362). The church and other remains of the Carthusian monastery of Val-de-Bénédiction, founded in 1356 by Innocent VI., are now used for habitation and other secular purposes. A gateway and a rotunda, built as shelter for a fountain, both dating from about 1670, are of architectural note. On the Mont Andaon, a hill to the north-east of the town, stands the Fort of St André (14th century), which is entered by an imposing fortified gateway and contains a Romanesque chapel and remains of the abbey of St André. The other buildings of interest include several old mansions once belonging to cardinals and nobles, and a tower, the Tour de Philippe le Bel, built in the 14th century, which guarded the western extremity of the Pont St Bénézet (see AVIGNON).

In the 6th century the Benedictine abbey of St André was founded on Mount Andaon, and the village which grew up round it took its name. In the 13th century the monks, acting in concert with the crown, established a *bastide*, or "new town," which came to be called Villeneuve. The town was the resort of the French cardinals during the sojourn of the popes at Avignon, and its importance, due largely to its numerous religious establishments, did not decline till the Revolution.

VILLENEUVE-SUR-LOT, a town of south-western France, capital of an arrondissement in the department of Lot-et-Garonne, 22 m. N. by E. of Agen on a branch line of the Orleans railway. Pop. (1906) town, 6978; commune, 13,540. Villeneuve is divided into two unequal portions by the river Lot, which here runs between high banks. The chief quarter stands on the right bank and is united to the quarter on the left bank by a bridge of the 13th century, the principal arch of which, constructed in the reign of Louis XIII. in place of two older arches, has a span of 118 ft. and a height of 59 ft. On the left bank portions of the 13th century ramparts, altered and surmounted by machicolations in the 15th century, remain, and high square towers rise above the gates to the north-east and south-west, known respectively as the Porte de Paris and Porte de Pujols. On the right bank boulevards have for the most part taken the place of the ramparts. Arcades of the 13th century surround the Place La Fayette, and old houses of the 13th, 14th and 15th centuries are to be seen in various parts of the town. The church of St Étienne is in late Gothic style. On the left bank of the Lot, 2 m. S.S.W. of Villeneuve, are the 13th-century walls of Pujols. The buildings of the ancient abbey of Eysses, about a mile to the N.E., which are mainly of the 17th century, serve as a departmental prison and penitentiary settlement. The principal hospital, the hospice St Cyr, is a handsome building standing in beautiful gardens. Villeneuve has a sub-prefecture, tribunals of first instance and of commerce and communal colleges for both sexes. It is an important agricultural centre and has a very large trade in plums (*prunes d'ente*) and in the produce of the market gardens which surround it, as well as in cattle, horses and wine. The preparation of preserved plums and the tinning of peas and beans occupy many hands; there are also manufactures of boots and shoes and tin boxes. The important mill of Gajac stands on the bank of the Lot a little above the town.

Villeneuve was founded in 1254 by Alphonse, count of Poitiers, brother of Louis IX., on the site of the town of Gajac, which had been deserted during the Albigensian crusade.

VILLEROI, FRANÇOIS DE NEUFVILLE, DUC DE (1644–1730), French soldier, came of a noble family which had risen into prominence in the reign of Charles IX. His father Nicolas de Neufville, Marquis de Villeroi, marshal of France (1598–1685), created a duke by Louis XIV., was the young king's governor, and the boy was thus brought up in close relations with Louis. An intimate of the king, a finished courtier and leader of society and a man of great personal gallantry, Villeroi was marked out for advancement in the army, which he loved, but which had always a juster appreciation of his incapacity than Louis. In 1693, without having exercised any really important and responsible command, he was made a marshal. In 1695, when Luxembourg died, he obtained the command of the army in Flanders, and William III. found him a far more complaisant opponent than the "little hunchback." In 1701 he was sent to Italy to supersede Catinat and was soon beaten by the inferior army of Eugene at Chiari (see SPANISH SUCCESSION WAR). In the winter of 1701 he was made prisoner at the surprise of Cremona, and the wits of the army made at his expense the famous rhyme:

> "Par la faveur de Bellone, et par un bonheur sans égal,
> Nous avons conservé Crémone—et perdu notre général."

In the following years he was pitted against Marlborough in the Low Countries. Marlborough's own difficulties with the Dutch and other allied commissioners, rather than Villeroi's own skill, put off the inevitable disaster for some years, but in 1706 the duke attacked him and thoroughly defeated him at Ramillies (*q.v.*). Louis consoled his old friend with the remark, "At our age, one is no longer lucky," but superseded him in the command, and henceforward Villeroi lived the life of a courtier, much busied with intrigues but retaining to the end the friendship of his master. He died on the 18th of July 1730 at Paris.

VILLERS LA VILLE, a town of Belgium in the province of Brabant, 2 m. E. of Quatre Bras, with a station on the direct line from Louvain to Charleroi. Pop. (1904) 1166. It is chiefly interesting on account of the fine ruins of the Cistercian abbey of Villers founded in 1147 and destroyed by the French republicans in 1795. In the ruined church attached to the abbey are still to be seen the tombstones of several dukes of Brabant of the 13th and 14th centuries.

VILLETTE, CHARLES, Marquis de (1736–1793), French writer and politician, was born in Paris on the 4th of December 1736, the son of a financier who left him a large fortune and the title of marquis. After taking part in the Seven Years' War, young Villette returned in 1763 to Paris, where he made many enemies by his insufferable manners. But he succeeded in gaining the intimacy of Voltaire, who had known his mother and who wished to make a poet of him. The old philosopher even went so far as to call his *protégé* the French Tibullus. In 1777, on Voltaire's advice, Villette married Mademoiselle de Varicourt, but the marriage was unhappy, and his wife was subsequently adopted by Voltaire's niece, Madame Denis. During the Revolution Villette publicly burned his letters of nobility, wrote revolutionary articles in the *Chronique de Paris*, and was elected deputy to the Convention by the department of Seine-et-Oise. He had the courage to censure the September massacres and to vote for the imprisonment only, and not for the death, of Louis XVI. He died in Paris on the 7th of July 1793.

In 1784 he published his *Œuvres*, which are of little value, and in 1792 his articles in the *Chronique de Paris* appeared in book form under the title *Lettres choisies sur les principaux événements de la Révolution*.

VILLIERS, CHARLES PELHAM (1802–1898), English statesman, son of George Villiers, grandson of the 1st earl of Clarendon of the second (Villiers) creation, and brother of the 4th earl (*q.v.*), was born in London on the 3rd of January 1802, and educated at St John's College, Cambridge. He read for the bar at Lincoln's Inn, and became an associate of the Benthamites and "philosophical radicals" of the day. He was an assistant commissioner to the Poor Law Commission (1832), and in 1833 was made by the master of the Rolls, whose secretary he had been, a chancery examiner of witnesses, holding this office till 1852. In 1835 he was elected M.P. for Wolverhampton, and retained his seat till his death. He was the pioneer of the free-trade movement, and became prominent with Cobden and Bright as one of its chief supporters, being indefatigable in pressing the need for free trade on the House of Commons, by resolution and by petition. After free trade triumphed in 1846 his importance in politics became rather historical than actual, especially as he advanced to a venerable old age; but he was president of the Poor Law Board, with a seat in the Cabinet, from 1859 to 1866, and he did other useful work in the Liberal reforms of the time. Like Bright, he parted from Mr Gladstone on Home Rule for Ireland. He attended parliament for the last time in 1895, and died on the 16th of January 1898.

VILLIERS DE L'ISLE-ADAM, PHILIPPE AUGUSTE MATHIAS, Comte de (1838–1889), French poet, was born at St Brieuc in Brittany and baptized on the 28th of November 1838. He may be said to have inaugurated the Symbolist movement in French literature, and *Axël*, the play on which he was engaged during so much of his life, though it was only published after his death, is the typical Symbolist drama. He began with a volume of *Premières Poésies* (1856–58). This was followed by a wild romance of the supernatural, *Isis* (1862), and by two plays in prose, *Elën* (1866) and *Morgane* (1866). *La Révolte*, a play in which Ibsen's *Doll's House* seems to be anticipated, was represented at the Vaudeville in 1870; *Contes cruels*, his finest volume of short stories, in 1883, and a new series in 1889; *Le Nouveau Monde*, a drama in five acts, in 1880; *L'Ève future*, an amazing piece of buffoonery satirizing the pretensions of science, in 1886; *Tribulat Bonhomet* in 1887; *Le Secret de l'échafaud* in 1888; *Axël* in 1890. He died in Paris, under the care of the Frères Saint-Jean-de-Dieu, on the 19th of August 1889. Villiers has left behind him a legend probably not more fantastic than the truth. Sharing many of the opinions of Don Quixote, he shared also Don Quixote's life. He was the descendant of a Grand Master of the Knights of Malta, famous in history, and his pride as an aristocrat and as an idealist were equal. He hated mediocrity, science, progress, the present age, money and "serious" people. In one division of his work he attacked all the things which he hated with a savage irony; in another division of his work he discovered at least some glimpses of the ideal world. He remains a remarkable poet and a remarkable satirist, imperfect as both. He improvised out of an abundant genius, but the greater part of his work was no more than improvisation. He was accustomed to talk his stories before he wrote them. Sometimes he talked them instead of writing them. But he has left, at all events, the *Contes cruels*, in which may be found every classic quality of the French *conte*, together with many of the qualities of Edgar Allan Poe and Ernst Hoffman; and the drama of *Axël*, in which the stage takes a new splendour and a new subtlety of meaning. Villiers's influence on the younger French writers was considerable. It was always an exaltation. No one in his time followed a literary ideal more romantically.

(A. Sy.)

See also R. du Pontavice de Heussey, *Villiers de l'Isle-Adam* (1893), a biography, English trans. (1904) by Lady Mary Loyd; S. Mallarmé, *Les Miens. Villiers de l'Isle-Adam* (1892); R. Martineau, *Un vivant et deux morts* (1901), bibliography. A selection from his stories, *Histoires souveraines*, was made by his friends (Brussels, 1899).

VILLINGEN, a town of Germany in the grand duchy of Baden, pleasantly situated amid well-wooded hills, 52 m. by rail N. of Schaffhausen. Pop. (1905) 9582. It is in part still surrounded by walls, with ancient gate towers. It is the chief seat of the watch-making industry of the Black Forest. It also produces musical-boxes, glass and silk, and has a Gothic church of the 13th century and another of the 11th, a 15th-century town hall, with a museum of antiquities, and music, technical and agricultural schools.

VILLOISON, JEAN BAPTISTE GASPARD D'ANSSE (or Dansse) de (1750–1805), French classical scholar, was born at Corbeil-sur-Seine on the 5th of March 1750 (or 1753; authorities differ). He belonged to a noble family (De Ansso) of Spanish origin, and took his surname from a village in the neighbourhood. In 1773 he published the Homeric Lexicon of Apollonius from a MS. in the abbey of Saint Germain des Prés. In 1778 appeared his edition of Longus's *Daphnis and Chloe*. In 1781 he went to Venice, where he spent three years in examining the library, his expenses being paid by the French government. His chief discovery was a 10th-century MS. of the *Iliad*, with ancient scholia and marginal notes, indicating supposititious, corrupt or transposed verses. After leaving Venice, he accepted the invitation of the duke of Saxe-Weimar to his court. Some of the fruits of his researches in the library of the palace were collected into a volume (*Epistolae Vinarienses*, 1783), dedicated to his royal hosts. Hoping to find a treasure similar to the Venetian Homer in Greece, he returned to Paris to prepare for a journey to the East. He visited Constantinople, Smyrna, the Greek islands, and Mount Athos, but the results did not come up to his expectation. In 1786 he returned, and in 1788 brought out the Codex Venetus of Homer, which created a sensation in the learned world. When the revolution broke out, being banished from Paris, he lived in retirement at Orléans, occupying himself chiefly with the transcription of the notes in the library of the brothers Valois (Valesius). On the restoration of order, having returned to Paris, he accepted the professorship of modern Greek established by the government, and held it until it was transferred to the Collège de France as the professorship of the ancient and modern Greek languages. He died soon after his appointment, on the 25th of April 1805. Another work of some importance, *Anecdota Graeca* (1781), from the Paris and Venice libraries, contains the *Ionia* (violet garden) of the empress Eudocia, and several fragments of Iamblichus, Porphyry, Procopius of Gaza, Choricius and the Greek grammarians. Materials for an exhaustive work contemplated by him on ancient and modern Greece are preserved in the royal library of Paris.

See J. Dacier, *Notice historique sur la vie et les ouvrages de Villoison* (1806); Chardon de la Rochette, *Mélanges de critique et de philologie*, iii. (1812); and especially the article by his friend and pupil E. Quatremère in *Nouvelle biographie générale*, xiii., based upon private information.

VILLON, FRANÇOIS (1431–*c.* 1463), French poet (whose real surname is a matter of much dispute, so that he is also called De Montcorbier and Des Loges and by other names, though in literature Villon is the sole term used), was born in 1431, and, as it seems, certainly at Paris. The singular poems called *Testaments*, which form his chief if not his only certain work, are largely autobiographical, though of course not fully trustworthy. But his frequent collisions with the law have left more certain records, which have of late been ransacked with extraordinary care by students, especially by M. Longnon. It appears that he was born of poor folk, that his father died in his youth, but that his mother, for whom he wrote one of his most famous *ballades*, was alive when her son was thirty years old. The very name Villon was stated, and that by no mean authority, the president Claude Fauchet, to be merely a common and not a proper noun, signifying "cheat" or "rascal"; but this seems to be a mistake. It is, however, certain that Villon was a person of loose life, and that he continued, long after there was any excuse for it in his years, the reckless way of living common among the wilder youth of the university of Paris. He appears to have derived his surname from a friend and benefactor named Guillaume de Villon, chaplain in the collegiate church of Saint-Benoît-le-Bestourné, and a professor of canon law, who took Villon into his house. The poet became a student in arts, no doubt early, perhaps at about twelve years of age, and took the degree of bachelor in 1449 and that of master in 1452. Between this year and 1455 nothing positive is known of him, except that nothing was known against him. Attempts have been made, in the usual fashion of conjectural biography, to fill up the gap with what a young graduate of Bohemian tendencies would, could, or might have done; but they are mainly futile.

On the 5th of June 1455 the first important incident of his life that is known occurred. Being in the company of a priest named Giles and a girl named Isabeau, he met, in the rue Saint-Jacques, a certain Breton, Jean le Hardi, a master of arts, who was with a priest, Philippe Chermoye or Sermoise or Sermaise. A scuffle ensued; daggers were drawn; and Sermaise, who is accused of having threatened and attacked Villon and drawn the first blood, not only received a dagger-thrust in return, but a blow from a stone which struck him down. Sermaise died of his wounds. Villon fled, and was sentenced to banishment—a sentence which was remitted in January 1456, the formal pardon being extant, strangely enough, in two different documents, in one of which the culprit is described as "François des Loges, autrement dit Villon," in the other as "François de Montcorbier." That he is also said to have described himself to the barber-surgeon who dressed his wounds as Michel Mouton is less surprising, and hardly needs an addition to the list of his aliases. It should, however, be said that the documents relative to this affair confirm the date of his birth, by representing him as twenty-six years old or thereabouts. By the end of 1456 he was again in trouble. In his first broil "la femme Isabeau" is only generally named, and it is impossible to say whether she had anything to do with the quarrel. In the second, Catherine de Vaucelles, of whom we hear not a little in the poems, is the declared cause of a scuffle in which Villon was so severely beaten that, to escape ridicule, he fled to Angers, where he had an uncle who was a monk. It was before leaving Paris that he composed what is now known as the *Petit testament*, of which we shall speak presently with the rest of his poems, and which, it should be said, shows little or no such mark of profound bitterness and regret for wasted life as does its in every sense greater successor the *Grand testament*. Indeed, Villon's serious troubles were only beginning, for hitherto he had been rather injured than guilty. About Christmas-time the chapel of the college of Navarre was broken open, and five hundred gold crowns stolen. The robbery was not discovered till March 1457, and it was not till May that the police came on the track of a gang of student-robbers owing to the indiscretion of one of them, Guy Tabarie. A year more passed, when Tabarie, being arrested, turned king's evidence and accused Villon, who was then absent, of being the ring-leader, and of having gone to Angers, partly at least, to arrange for similar burglaries there. Villon, for this or some other crime, was sentenced to banishment: and he did not attempt to return to Paris. In fact for four years he was a wanderer; and he may have been, as each of his friends Regnier de Montigny and Colin des Cayeux certainly was, a member of a wandering thieves' gang. It is certain that at one time (in 1457), and probable that at more times than one, he was in correspondence with Charles d'Orléans, and it is likely that he resided, at any rate for some period, at that prince's court at Blois. He had also something to do with another prince of the blood, Jean of Bourbon, and traces are found of him in Poitou, in Dauphiné, &c. But at his next certain appearance he is again in trouble. He tells us that he had spent the summer of 1461 in the bishop's prison (bishops were fatal to Villon) of Meung. His crime is not known, but is supposed to have been church-robbing; and his enemy, or at least judge, was Thibault d'Aussigny, who held the see of Orleans. Villon owed his release to a general gaol-delivery at the accession of Louis XI., and became a free man again on the 2nd of October.

It was now that he wrote the *Grand testament*, the work which has immortalized him. Although he was only thirty at the date (1461) of this composition (which is unmistakable, because given in the book itself), there seems to be no kind of aspiration towards a new life, nor even any hankering after the old. Nothing appears to be left him but regret; his very spirit has been worn out by excesses or sufferings or both. Even his good intentions must have been feeble, for in the autumn of 1462 we find him once more living in the cloisters of Saint-Benoît, and in November he was in the Châtelet for theft. In default of evidence the old charge of the college of Navarre was revived, and even a royal pardon did not bar the demand for restitution. Bail was, however, accepted, but Villon fell promptly into a street quarrel, was arrested, tortured and condemned to be hanged, but the sentence was commuted to banishment by the parlement on the 5th of January 1463. The actual event is unknown: but from this time he disappears from history. Rabelais indeed tells two stories about him which have almost necessarily been dated later. One is a countryside anecdote of a trick supposed to have been played by the poet in his old age at Saint Maixent in Poitou, whither he had retired. The other, a coarse but pointed jest at the expense of England, is told as having been addressed by Villon to King Edward V. during an exile in that country. Now, even if King Edward V. were not evidently out of the question, a passage of the story refers to the well-known scholar and man of science, Thomas Linacre, as court physician to the king, and makes Villon mention him, whereas Linacre was only a young scholar, not merely at the time of Edward V.'s supposed murder, but at the extreme date (1489) which can be assigned to Villon's life. For in this year the first edition of the poet's work appeared, obviously not published by himself, and with no sign in it of his having lived later than the date (1461) of the *Grand testament.* It would be easy to dismiss these Rabelaisian mentions of Villon as mere humorous inventions, if it were not that the author of *Pantagruel* was born almost soon enough to have actually seen Villon if he had lived to anything that could be called old age, that he almost certainly must have known men who had known Villon, and that the poet undoubtedly spent much time in Rabelais's own country on the banks of the lower Loire.

The obscurity, the unhappiness and the evil repute of Villon's life would not be in themselves a reason for the minute investigation to which the events of that life have been subjected, and the result of which has been summed up here. But his poetical work, scanty as the certainly genuine part of it is, is of such extraordinary quality, and marks such an epoch in the history of European literature, that he has been at all times an interesting figure, and, like all very interesting figures, has been often praised for qualities quite other than those which he really possessed. Boileau's famous verses, in which Villon is extolled for having first known how to smooth out the confused art of the old romancers, are indeed a prodigy of blundering or ignorance or both. As far as art or the technical part of poetry goes, Villon made not the slightest advance on his predecessors, nor stood in any way in front of such contemporaries as his patron Charles d'Orléans. His two *Testaments* (so called by the application to them of a regular class-name of medieval poetry and consisting of burlesque legacies to his acquaintances) are made up of eight-line stanzas of eight-syllabled verses, varied in the case of the *Grand testament* by the insertion of ballades and rondeaux of very great beauty and interest, but not formally different in any way from poems of the same kind for more than a century past. What really distinguishes Villon is the intenser quality of his poetical feeling and expression, and what is perhaps arrogantly called the modern character of his subjects and thought. Medieval poetry, with rare exceptions, and, with exceptions not quite so rare, classical poetry, are distinguished by their lack of what is now called the personal note. In Villon this note sounds, struck with singular force and skill. Again, the simple joy of living which distinguishes both periods—the medieval, despite a common opinion, scarcely less than the ancient—has disappeared. Even the riot and rollicking of his earlier days are mentioned with far less relish of remembrance than sense of their vanity. This sense of vanity, indeed, not of the merely religious, but of the purely mundane and even half-pagan kind, is Villon's most prominent characteristic. It tinges his narrative, despite its burlesque bequests, all through; it is the very keynote of his most famous and beautiful piece, the *Ballade des dames du temps jadis,* with its refrain, " Mais où sont les neiges d'antan ? " as well as of his most daring piece of realism, the other ballade of *La Grosse Margot,* with its burden of hopeless entanglement in shameless vice. It is nowhere more clearly sounded than in the piece which ranks with these two at the head of his work, the *Regrets de la Belle Heaulmière,* in which a woman, once young and beautiful, now old and withered, laments her lost charms. So it is almost throughout his poems, including the grim *Ballade des pendus,* and hardly excluding the very beautiful *Ballade pour sa mère,* with its description of sincere and humble piety. It is in the profound melancholy which the dominance of this note has thrown over Villon's work, and in the suitableness of that melancholy to the temper of all generations since, that his charm and power have consisted, though it is difficult to conceive any time at which his poetical merit could be ignored.

His certainly genuine poems consist of the two *Testaments* with their codicil (the latter containing the *Ballade des pendus,* or more properly *Épitaphe en forme de ballade,* and some other pieces of a similarly grim humour), a few miscellaneous poems, chiefly ballades, and an extraordinary collection (called *Le Jargon ou jobelin*) of poems in *argot,* the greater part of which is now totally unintelligible, if, which may perhaps be doubted, it ever was otherwise. Besides these, several poems of no inconsiderable interest are usually printed with Villon's works, though they are certainly, or almost certainly, not his. The chief are *Les Repues Franches,* a curious series of verse stories of cheating tavern-keepers, &c., having some resemblance to those told of George Peele, but of a broader and coarser humour. These, though in many cases " common form " of the broader tale-kind, are not much later than his time, and evidence to reputation if not to fact. Another of these spurious pieces is the extremely amusing monologue of the *Franc Archier de Bagnolet,* in which one of the newly constituted archers or regularly trained and paid soldiery, who were extremely unpopular in France, is made to expose his own poltroonery. The third most important piece of this kind is the *Dialogue de Mallepaye et de Baillevent,* a dramatic conversation between two penniless spendthrifts, which is not without merit. These poems, however, were never attributed to Villon or printed with his works till far into the 16th century.

It has been said that the first dated edition of Villon is of 1489, though some have held one or more than one undated copy to be still earlier. Between the first, whenever it was, and 1542 there were very numerous editions, the most famous being that (1533) of Clément Marot, one of whose most honourable distinctions is the care he took of his poetical predecessors. The Pléiade movement and the classicizing of the *grand siècle* put Villon rather out of favour, and he was not again reprinted till early in the 18th century, when he attracted the attention of students of old French like Le Duchat, Bernard de la Monnoye and Prosper Marchand. The first critical edition in the modern sense—that is to say, an edition founded on MSS. (of which there are in Villon's case several, chiefly at Paris and Stockholm)—was that of the Abbé J. H. R. Prompsault in 1832. The next was that of the " Bibliophile Jacob " (P. Lacroix) in the *Bibliothèque Elzévirienne* (Paris, 1854). The standard edition is *Œuvres complètes de François Villon,* by M. Auguste Longnon (1892). This contains copies of the documents on which the story of Villon's life is based, and a bibliography. The late M. Marcel Schwob discovered new documents relating to the poet, but died before he could complete his work, which was posthumously published in 1905. See also A. Campaux, *F. Villon, sa vie et ses œuvres* (1859); A. Longnon, *Étude biographique* (1877); and especially G. Paris, *François Villon* (1901), a book of the first merit. A complete translation of Villon was written by Mr John Payne (1878) for the Villon Society. There are also translations of individual poems in Mr Andrew Lang's *Ballads and Lyrics of Old France* (1872) and in the works of D. G. Rossetti and Mr Swinburne. Among critical studies of Villon may be mentioned those by Sainte-Beuve in the *Causeries du lundi,* vol. xiv., by Théophile Gautier in *Grotesques,* and by R. L. Stevenson in his *Familiar Studies of Men and Books* (1882). An unedited ballad by Villon, with another by an unknown poet of the same date, was published by W. G. C. Bijvanck (1891) as *Un poète inconnu.* M. Pierre d'Alheim published (1892) an edition of *Le Jargon* with a translation into ordinary French. (G. Sa.)

VILNA, or Wilno, a Lithuanian government of West Russia, having the Polish government of Suwalki on the W., Kovno and Vitebsk on the N., and Minsk and Grodno on the E. and S. Area, 16,176 sq. m.; pop. (1906 estimate) 1,806,300. Vilna lies on the broad marshy swelling, dotted with lakes, which separates Poland from the province of East Prussia and stretches E.N.E. towards the Valdai Plateau.

Its highest parts are a little more than 1000 ft. above sea-level. On its western and eastern boundaries it is deeply trenched by the valleys of the Niemen and the S. Dvina. It is chiefly built up of Lower Tertiary deposits, but in the north Devonian sandstones appear on the surface. The Tertiary deposits consist of Eocene clay, slates, sandstones, limestones and chalk, with gypsum, and are partly of marine and partly of terrene origin. The whole is overlain with thick layers of Glacial boulder clay and post-Glacial deposits, containing remains of the mammoth and other extinct mammals. Interesting discoveries of Neolithic implements, especially of polished stone, and of implements belonging to the Bronze Age and the early years of the Christian epoch, have been made. Numerous lakes and marshes, partly covered with forests, and scarcely passable except when frozen, as well as wet meadowland, occupy a large area in the centre of the government. The Niemen, which flows along the southern and western borders for more than 200 m., is the chief artery of trade, and its importance in this respect is enhanced by its tributary the Viliya, which flows west for more than 200 m. through the central parts of Vilna, receiving many affluents on its course. Among the tributaries of the Niemen is the Berezina, which acquired renown during Napoleon's retreat in 1812; it flows in a marshy valley in the south-east. The S. Dvina for 50 m. of its course separates Vilna from Vitebsk. The climate of the government is only slightly tempered by its proximity to the Baltic Sea (January, 21°·8; July, 64°·5); the average temperature at the town of Vilna is only 43°·5. But in winter the thermometer descends very low, a minimum of −30° F. having been observed. The flora and fauna are intermediate between those of Poland and middle Russia.

The government is divided into seven districts, the chief towns of which are Vilna, Vileiki, Disna, Lida, Oshmyany, Zventsyany and Troki.

VILNA, or Wilno, a town of Russia, capital of the government of the same name, 436 m. S.S.W. of St Petersburg, at the intersection of the railways from St Petersburg to Warsaw and from Libau to the mouth of the Don. Pop. (1883) 93,760; (1900) 162,633. With its suburbs Antokol, Lukishki, Pogulyanka and Sarechye, it stands on and around a knot of hills (2450 ft.) at the confluence of the Vileika with the Viliya. Its streets are in part narrow and not very clean; but Vilna is an old town, rich in historical associations. Its imperial palace, and the cathedral of St Stanislaus (1387, restored 1801), containing the silver sarcophagus of St Casimir and the tomb of Prince Vitoft, are fine buildings. There is a second cathedral, that of St Nicholas, built in 1596–1604; also several churches dating from the 14th to the 16th centuries. The Ostra Brama chapel contains an image of the Virgin greatly venerated by Orthodox Greeks and Roman Catholics alike. The museum of antiquities has valuable historical collections. The ancient castle of the Jagellones is now a mass of ruins. The old university, founded in 1578, was restored (1803) by Alexander I., but has been closed since 1832 for political reasons; the only departments which remain in activity are the astronomical observatory and a medical academy. Vilna is an archiepiscopal see of the Orthodox Greek Church and an episcopal see of the Roman Catholic Church, and the headquarters of the governor-general of the Lithuanian provinces and of the III. army corps. The city possesses a botanical garden and a public library, and is adorned with statues to Catherine II. (1903), the poet Pushkin and Count M. Muraviev (1898). It is an important centre for trade in timber and grain, which are exported; and has theological seminaries, both Orthodox Greek and Roman Catholic, a military school, a normal school for teachers and professional schools. It is the seat of many scientific societies (geographical, medical and archaeological), and has a good antiquarian museum and a public library.

History.—The territory of Vilna has been occupied by the Lithuanians since the 10th century, and probably much earlier; their chief fortified town, Vilna, is first mentioned in 1128. A temple to the god Perkunas stood on one of its hills till 1387, when it was destroyed by Prince Jagiello, after his baptism. After 1323, when Gedymin, prince of Lithuania, abandoned Troki, Vilna became the capital of Lithuania. The formerly independent principalities of Minsk and Lidy, as well as the territory of Disna, which belonged to the Polotsk principality, were annexed by the Lithuanian princes, and from that time Vilna, which was fortified by a stone wall, became the chief city of the Lithuanian state. It was united with Poland when its prince, Casimir IV., was elected (1447) to the Polish throne. The plague of 1588, a fire in 1610 and still more the wars between Russia and Poland, which began in the 17th century, checked its further growth. The Russians took Vilna in 1655, and in the following year it was ceded to Russia. The Swedes captured it in 1702 and in 1706. The Russians again took possession of it in 1788; and it was finally annexed to Russia in 1795, after the partition of Poland. Its Polish inhabitants took an active part in the risings of 1831 and 1863, for which they were severely punished by the Russian government.

VILVORDE, a town of Belgium in the province of Brabant, 9 m. N. of Brussels and on the Senne. Pop. (1904) 14,418. The old castle of Vilvorde, which often gave shelter to the dukes of Brabant in their days of trouble, is now used as a prison. The younger Teniers lived and died at a farm outside Vilvorde, and is buried in the parish church of Dry Toren.

VINCENNES, a town of northern France, in the department of Seine, on a wooded plateau 1¼ m. E. of the fortifications of Paris, with which it is connected by rail and tram. Pop. (1906) town, 29,791; commune, 34,185. Its celebrated castle, situated to the south of the town and on the northern border of the Bois de Vincennes, was formerly a royal residence, begun by Louis VII. in 1164, and more than once rebuilt. It was frequently visited by Louis IX., who held informal tribunals in the neighbouring wood, a pyramid marking the spot where the oak under which he administered justice is said to have stood. The chapel, an imitation of the Sainte Chapelle at Paris, was begun by Charles V. in 1379, continued by Charles VI. and Francis I., consecrated in 1552 and restored in modern times. In the sacristy is the monument erected in 1816 to the memory of the duke of Enghien, who was shot in the castle moat in 1804. Louis XI. made the castle a state prison in which Henry of Navarre, the great Condé, Mirabeau and other distinguished persons were afterwards confined. Under Napoleon I. the castle became a magazine of war-material. Louis XVIII. added an armoury, and under Louis Philippe numerous casemates and a new fort to the east of the donjon were constructed. The place now serves as a fort, arsenal and barracks. It forms a rectangle 417 yds. long by 245 yds. wide. The enclosing wall was originally flanked by nine towers, which were cut down to its level between 1808 and 1811, and now serve as bastions. The donjon is a square tower, 170 ft. high, with turrets at the corners. The Bois de Vincennes, which covers about 2300 acres and stretches to the right bank of the Marne, contains a race-course, a military training-ground, a school of military explosives (pyrotechnic), several artificial lakes, an artillery polygon and other military establishments, an experimental farm, the redoubts of Gravelle and La Faisanderie and the normal school of military gymnastics. The wood, which now belongs to Paris, was laid out during the second empire on the same lines as the Bois de Boulogne. On its south border is the asylum of Vincennes, founded in 1855 for the benefit of convalescents from the hospitals. In the town there is a statue of General Daumesnil, celebrated for his defense of the castle against the allies in 1814 and 1815. Vincennes has a school of military administration and carries on horticulture and the manufacture of ironware of various kinds, rubber goods, chemicals, perfumery, mineral waters, &c.

VINCENNES, a city and the county-seat of Knox county, Indiana, U.S.A., in the S.W. part of the state, on the E. bank of the Wabash river, about 117 m. S.W. of Indianapolis. Pop. (1890) 8853; (1900) 10,249, of whom 736 were foreign-born; (1910 census) 14,895. It is served by the Baltimore & Ohio South-Western, the Cleveland, Cincinnati, Chicago & St Louis, the Evansville & Terre Haute, and the Vandalia railways. Extensive levees, 15 m. in length, prevent the overflow of the Wabash river, which for nine months in the year is navigable from this point to the Ohio. The city is level and well drained, and has a good water-supply system. In Vincennes are a Roman Catholic cathedral, erected in 1835, one of the oldest in the West, occupying the site of a church built early in the 18th century; Vincennes University (1806), the oldest educational institution in the state, which in 1910 had 14 instructors and 236 students; St Rose Female Academy, and a public library. Coal, natural gas and oil are found near Vincennes. The city is a manufacturing and railway centre, and ships grain, pork and neat cattle. The total value of the factory products in 1905 was $3,172,279. Vincennes was the first permanent settlement in Indiana. On its site François Margane, Sieur de Vincennes, established a French military post about 1731, and a permanent settlement was made about the fort in 1735. After the fall of Quebec the place remained under French sovereignty until 1777, when it was occupied by a British garrison. In 1778 an agent of George Rogers Clark took possession of the fort on behalf of Virginia, but it was soon afterwards again occupied by the British, who called it Fort Sackville and held it until February 1779, when it was besieged and was captured (on the 25th of February) by George Rogers Clark, and passed finally under American jurisdiction. The site of the fort is marked by a granite shaft erected in 1905 by the Daughters of the Revolution. Vincennes was the capital of Indiana Territory from 1800 to 1813, and was the meeting-place in 1805 of the first General Assembly of Indiana Territory. In 1839 it was incorporated as a borough, and it became a city in 1856.

See J. Law, *The Colonial History of Vincennes* (Vincennes, 1858); W. H. Smith, "Vincennes, the Key to the North-West," in L. P. Powell's *Historic Towns of the Western States* (New York, 1901); "The Capture of Vincennes by George Rogers Clark," *Old South Leaflets*, No. 43 (Boston, n.d.); also chap. ii. of J. P. Dunn's *Indiana* (Boston, 1892).

VINCENT (or VINCENTIUS), **ST,** deacon and martyr, whose festival is celebrated on the 22nd of January. In several of his discourses St Augustine pronounces the eulogy of this martyr, and refers to *Acts* which were read in the church. It is doubtful whether the *Acts* that have come down to us (*Acta Sanctorum*, January, ii. 394-397) are those referred to by St Augustine, since it is not certain that they are a contemporary document. According to this account, Vincent was born of noble parents in Spain, and was educated by Valerius, bishop of Saragossa, who ordained him to the diaconate. Under the persecution of Diocletian, Vincent was arrested and taken to Valencia. Having stood firm in his profession before Dacianus, the governor, he was subjected to excruciating tortures and thrown into prison, where angels visited him, lighting his dungeon with celestial light and relieving his sufferings. His warders, having seen these wonders through the chinks of the wall, forthwith became Christians. He was afterwards brought out and laid upon a soft mattress in order that he might regain sufficient strength for new torments; but, while Dacianus was meditating punishment, the saint gently breathed his last. The tyrant exposed his body to wild beasts, but a raven miraculously descended and protected it. It was then thrown into the sea, but was cast up on the shore, recovered by a pious woman and buried outside Valencia. Prudentius devoted one of his hymns (*Peristeph.* v.) to St Vincent, and St Augustine attests that in his lifetime the festival of the saint was celebrated throughout the Christian world (*Serm.* 276, n. 4).

See T. Ruinart, *Acta martyrum sincera* (Amsterdam, 1713), pp. 364–66; Le Nain de Tillemont, *Mémoires pour servir à l'histoire ecclésiastique* (Paris, 1701, seq.), v. 215–225, 673–675. (H. De.)

VINCENT OF BEAUVAIS, or VINCENTIUS BELLOVACENSIS (*c.* 1190–*c.* 1264), the encyclopaedist of the middle ages, was probably a native of Beauvais.[1] The exact dates of his birth and death are unknown. A tolerably old tradition, preserved by Louis a Valleoleti (*c.* 1413), gives the latter as 1264;[2] but Tholomaeus de Luca, Vincent's younger contemporary (d. 1321), seems to reckon him as living during the pontificate of Gregory X. (1271–76). If we assume 1264 as the year of his death, the immense volume of his works forbids us to think he could have been born much later than 1190. Very little is known of his career. A plausible conjecture makes him enter the house of the Dominicans at Paris between 1215 and 1220, from which place a second conjecture carries him to the Dominican monastery founded at Beauvais in 1228–29. There is no evidence to show that the Vincent who was sub-prior of this foundation in 1246 is the encyclopaedist; nor indeed is it likely that a man of such abnormally studious habits could have found time to attend to the daily business routine of a monastic establishment. It is certain, however, that he at one time held the post of "reader" at the monastery of Royaumont (*Mons Regalis*), not far from Paris, on the Oise, founded by St Louis between 1228 and 1235. St Louis read the books that he compiled, and supplied the funds for procuring copies of such authors as he required for his compilations. Queen Margaret, her son Philip and her son-in-law, Theobald V. of Champagne and Navarre, are also named among those who urged him to the composition of his "little works," especially the *De Institutione Principum.* Though Vincent may well have been summoned to Royaumont even before 1240, there is no actual proof that he lived there before the return of Louis IX. and his wife from the Holy Land, early in the summer of 1254. But it is evident that he must have written his work *De Eruditione Filiorum Regalium* (where he styles himself as "Vincentius Belvacensis, de ordine praedicatorum, qualiscumque lector in monasterio de Regali Monte") after this date and yet before January 1260, the approximate date of his *Tractatus Consolatorius.* When he wrote the latter work he must have left Royaumont, as he speaks of returning from the funeral of Prince Louis (15th January 1260) "ad nostram domum," a phrase which can hardly be explained otherwise than as referring to his own Dominican house, whether at Beauvais or elsewhere.

The *Speculum Majus*, the great compendium of all the knowledge of the middle ages, as it left the pen of Vincent, seems to have consisted of three parts only, viz. the *Speculum Naturale*, *Doctrinale* and *Historiale.* Such, at least, is Êchard's conclusion, derived from an examination of the earliest extant MSS. All the printed editions, however, consist of four parts, the additional one being entitled *Speculum Morale.* This has been clearly shown to be the production of a later hand, and is ascribed by Échard to the period between 1310 and 1325. In arrangement and style it is quite different from the other three parts, and indeed it is mainly a compilation from Thomas Aquinas, Stephen de Bourbon, and two or three other contemporary writers.

The *Speculum Naturale* fills a bulky folio volume of 848 closely printed double-columned pages. It is divided into thirty-two books and 3718 chapters. It is a vast summary of all the natural history known to western Europe towards the middle of the 13th century. It is, as it were, the great temple of medieval science, whose floor and walls are inlaid with an enormous mosaic of skilfully arranged passages from Latin, Greek, Arabic, and even Hebrew authors. To each quotation, as he borrows it, Vincent prefixes the name of the book and author from whom it is taken, distinguishing, however, his own remarks by the word "actor." The *Speculum Naturale* is so constructed that the various subjects are dealt with according to the order of their creation; it is in fact a gigantic commentary on Genesis i. Thus book i. opens with an account of the Trinity and its relation to creation; then follows a similar series of chapters about angels, their attributes, powers, orders, &c., down to such minute points as their methods of communicating thought, on which matter the author decides, in his own person, that they have a kind of intelligible speech, and that with angels to think and to speak are not the same process. The whole book, in fact, deals with such things as were with God "in the beginning." Book ii. treats of our own world, of light, colour, the four elements, Lucifer and his fallen angels, thus corresponding in the main with the sensible world and the work of the first day. Books iii. and iv. deal with the phenomena of the heavens and of time, which is measured by the motions of the heavenly bodies, with the sky and all its wonders, fire, rain, thunder, dew, winds, &c. Books v.–xiv. treat of the sea and the dry land: they discourse of the seas, the ocean and the great rivers, agricultural operations, metals, precious stones, plants, herbs, with their seeds, grains and juices, trees wild and cultivated, their fruits and their saps. Under each species, where possible, Vincent gives a chapter on its use in medicine, and he adopts for the most part an alphabetical arrangement. In book vi. c. 7 he incidentally discusses what would become of a stone if it were dropped down a hole, pierced right through the earth, and, curiously enough, decides that it would stay in the centre. Book xv. deals with astronomy—the moon, stars, and the zodiac, the sun, the planets, the seasons and the calendar. Books xvi. and xvii. treat of fowls and fishes, mainly in alphabetical order and with reference to their medical qualities. Books xviii.–xxii. deal in a similar way with domesticated and wild animals, including the dog, serpents, bees and insects; they also include a general treatise on animal physiology spread over books xxi.–xxii. Books xxiii.–xxviii. discuss the psychology, physiology and anatomy of man, the five senses and their organs, sleep, dreams, ecstasy, memory, reason, &c. The remaining four books seem more or less supplementary; the last (xxxii.) is a summary of geography and history down to the year 1250, when the book seems to have been given to the world, perhaps along with the *Speculum Historiale* and possibly an earlier form of the *Speculum Doctrinale.*

The *Speculum Doctrinale*, in seventeen books and 2374 chapters, is a summary of all the scholastic knowledge of the age and does not confine itself to natural history. It is intended to be a practical manual for the student and the official alike; and, to fulfil this object, it treats of the mechanic arts of life as well as the subtleties of the scholar, the duties of the prince and the tactics of the general. The first book, after defining philosophy, &c., gives a long Latin vocabulary of some 6000 or 7000 words. Grammar, logic, rhetoric and poetry are discussed in books ii. and iii., the latter including several well-known fables, such as the lion and the mouse. Book iv. treats of the virtues, each of which has two chapters of quotations allotted to it, one in prose and the other in verse. Book v. is of a somewhat similar nature. With book vi. we enter on the practical part of the work; it deals with the *ars oeconomica*, and gives directions for building, gardening, sowing, reaping, rearing cattle and tending vineyards; it includes also a kind of agricultural almanac for each month in the year. Books vii.–ix. have reference to the *ars politica*: they contain rules for the education of a prince and a summary of the forms, terms and statutes of canonical, civil and criminal law. Book xi. is devoted to the *artes mechanicae*, viz. those of weavers, smiths, armourers, merchants, hunters, and even the general and the sailor. Books xii.–xiv. deal with medicine both in practice and in theory: they contain practical rules for the preservation of health according to the four seasons of the year, and treat of various diseases from fever to gout. Book xv. deals with physics and may be regarded as a summary of the *Speculum Naturale.* Book xvi. is given up to mathematics, under which head are included music, geometry, astronomy, astrology, weights and measures, and metaphysics. It is noteworthy that in this book Vincent shows a knowledge of the Arabic numerals, though he does not call them by this name. With him the unit is termed "digitus"; when multiplied by ten it becomes the "articulus"; while the combination of the articulus and the digitus is the "numerus compositus." In this chapter (xvi. 9), which is superscribed "actor," he clearly explains how the value of a number increases tenfold with every place it is moved to the left. He is even acquainted with the later invention of the "cifra" or cipher

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[1] He is sometimes styled Vincentius Burgundus; but, according to M. Daunou, this appellation cannot be traced back further than the first half of the 15th century.

[2] Apparently confirmed by the few enigmatical lines preserved by Échard from his epitaph—

> "Pertulit iste necem post annos mille ducentos,
> Sexaginta decem sex habe, sex mihi retentos."

The last book (xvii.) treats of theology or (as we should now say) mythology, and winds up with an account of the Holy Scriptures and of the Fathers, from Ignatius and Dionysius the Areopagite to Jerome and Gregory the Great, and even of later writers from Isidore and Bede, through Alcuin, Lanfranc and Anselm, down to Bernard of Clairvaux and the brethren of St Victor.

As the fifteenth book of the *Speculum Doctrinale* is a summary of the *Speculum Naturale*, so the *Speculum Historiale* may be regarded as the expansion of the last book of the same work. It consists of thirty-one books divided into 3793 chapters. The first book opens with the mysteries of God and the angels, and then passes on to the works of the six days and the creation of man. It includes dissertations on the various vices and virtues, the different arts and sciences, and carries down the history of the world to the sojourn in Egypt. The next eleven books (ii.–xii.) conduct us through sacred and secular history down to the triumph of Christianity under Constantine. The story of Barlaam and Josaphat occupies a great part of book xv.; and book xvi. gives an account of Daniel's nine kingdoms, in which account Vincent differs from his professed authority, Sigebert of Gembloux, by reckoning England as the fourth instead of the fifth. In the chapters devoted to the *origines* of Britain he relies on the Brutus legend, but cannot carry his catalogue of British or English kings further than 735, where he honestly confesses that his authorities fail him. Seven more books bring us to the rise of Mahomet (xxiii.) and the days of Charlemagne (xxiv.). Vincent's Charlemagne is a curious medley of the great emperor of history and the champion of romance. He is at once the gigantic eater of Turpin, the huge warrior eight feet high, who could lift the armed knight standing on his open hand to a level with his head, the crusading conqueror of Jerusalem in days before the crusades, and yet with all this the temperate drinker and admirer of St Augustine, as his character had filtered down through various channels from the historical pages of Einhard. Book xxv. includes the first crusade, and in the course of book xxix., which contains an account of the Tatars, the author enters on what is almost contemporary history, winding up in book xxxi. with a short narrative of the crusade of St Louis in 1250. One remarkable feature of the *Speculum Historiale* is Vincent's constant habit of devoting several chapters to selections from the writings of each great author, whether secular or profane, as he mentions him in the course of his work. The extracts from Cicero and Ovid, Origen and St John, Chrysostom, Augustine and Jerome are but specimens of a useful custom which reaches its culminating point in book xxviii., which is devoted entirely to the writings of St Bernard. One main fault of the *Speculum Historiale* is the unduly large space devoted to miracles. Four of the medieval historians from whom he quotes most frequently are Sigebert of Gembloux, Hugh of Fleury, Helinand of Froidmont, and William of Malmesbury, whom he uses for Continental as well as for English history.

Vincent has thus hardly any claim to be reckoned as an original writer. But it is difficult to speak too highly of his immense industry in collecting, classifying and arranging these three huge volumes of 80 books and 9885 chapters. The undertaking to combine all human knowledge into a single whole was in itself a colossal one and could only have been born in a mind of no mean order. Indeed more than six centuries passed before the idea was again resuscitated; and even then it required a group of brilliant Frenchmen to do what the old Dominican had carried out unaided. The number of writers quoted by Vincent is almost incredible: in the *Speculum Naturale* alone no less than 350 distinct works are cited, and to these must be added at least 100 more for the other two *Specula*. His reading ranges from Arabian philosophers and naturalists to Aristotle, Eusebius, Cicero, Seneca, Julius Caesar (whom he calls Julius Celsus), and even the Jew, Peter Alphonso. But Hebrew, Arabic and Greek he seems to have known solely through one or other of the popular Latin versions. He admits that his quotations are not always exact, but asserts that this was the fault of careless copyists.

A list of Vincent's works, both MS. and printed, will be found in the *Histoire littéraire de France*, vol. xviii., and in Jacques Échard's *Scriptores ordinis praedicatorum* (1719–21). The *Tractatus consolatorius pro morte amici* and the *Liber de eruditione filiorum regalium* (dedicated to Queen Margaret) were printed at Basel in December 1480. The *Liber de Institutione Principum*, a treatise on the duties of kings and their functionaries, has never yet been printed, and the only MS. copy the writer of this article has been able to consult does not contain in its prologue all the information which Échard seems to imply is to be found there. The so-called first edition of the *Speculum Majus*, including the *Speculum Morale*, ascribed to Johann Mentelin and long celebrated as the earliest work printed at Strassburg, has lately been challenged as being only an earlier edition of Vincent's three genuine *Specula* (*c.* 1468–70), with which has been bound up the *Speculum Morale* first printed by Mentelin (*c.* 1473–76). The edition most frequently quoted is that by the Jesuits (4 vols., Douai, 1624).

See J. B. Bourgeat, *Études sur Vincent de Beauvais, théologien, philosophe, encyclopédiste* (Paris, 1856); E. Boutaric, *Examen des sources du Speculum historiale de Vincent de Beauvais* (Paris, 1863), and in tome xvii. of the *Revue des questions historiques* (Paris, 1875); W. Wattenbach, *Deutschlands Geschichtsquellen*. vol. ii. (1894 B. Hauréau, *Notices . . . de MSS. latins de la Bibliothèque Nationale*, tome v. (1892); and E. Mâle, *L'art religieux du XIII^e siècle en France*. (T. A. A.)

VINCENT, GEORGE (1796–1831?), English landscape and marine painter, was born at Norwich in June 1796. He studied art under "Old" Crome, and at the age of fifteen began to contribute to the Norwich exhibition. From 1814 till 1823 he exhibited occasionally at the Royal Academy, and also in the Water-Colour Exhibition and the British Institution. In 1819 he removed from Norwich to London, and he was a contributor to the Suffolk Street gallery from its foundation in 1824 till 1830. He possessed great artistic abilities; but he fell into dissipation, and his works became slight and hastily executed. Finally he dropped out of sight, and he is believed to have died about 1831. His most important work, a "View of Greenwich Hospital," was shown in the International Exhibition of 1862. His "London from the Surrey Side of Waterloo Bridge" is also a fine work.

VINCENT, MARY ANN (1818–1887), American actress, was born in Portsmouth, England, on the 18th of September 1818, the daughter of an Irishman named Farlin. Left an orphan at an early age, she turned to the stage, making her first appearance in 1834 as Lucy in *The Review*, at Cowes, Isle of Wight. The next year she married J. R. Vincent (d. 1850), an actor, with whom she toured England and Ireland for several years. In 1846 Mrs J. R. Vincent went to America to join the stock company of the old National theatre in Boston. Here she became a great favourite. No actress in America, except Mrs Gilbert, has ever been such "a dear old lady" to so wide a circle of constant admirers. She died in Boston on the 4th of September 1887. Her memory is honoured by the Vincent Memorial Hospital, founded in that city in 1890 by popular subscription, and formally opened on the 6th of April 1891, by Bishop Phillips Brooks, as a hospital for wage-earning women and girls.

VINCENT DE PAUL, ST (1576–1660), French divine, founder of the "Congregation of Priests of the Mission," usually known as Lazarites (*q.v.*), was born on the 24th of April 1576 at Pouy, near Dax, in Gascogne, and was educated by the Franciscans at Dax and at Toulouse. He was ordained priest in 1600. Voyaging from Toulouse to Narbonne, he was captured by Barbary pirates, who took him to Tunis and sold him as a slave. He converted his third master, a renegade Italian, and escaped with him to Aigues-Mortes near Marseilles in June 1607. After short stays at Avignon and Rome, Vincent found his way to Paris, where he became favourably known to Monsieur (afterwards Cardinal) de Bérulle, who was then founding the congregation of the French Oratory. At Bérulle's instance he became curate of Clichy near Paris (1611); but this charge he soon exchanged for the post of tutor to the count of Joigny at Folleville, in the diocese of Amiens, where his success in dealing with the spiritual needs of the peasants led to the "missions" with which his name is associated. In 1617 he accepted the curacy of Châtillon-lès-Dombes (or sur-Chalaronne), and here he received from the countess of Joigny the means by which he was enabled to found his first "confrérie de charité," an association of women who ministered to the poor and the sick. In 1619 Louis XIII. made him royal almoner of the galleys. Among the works of benevolence with which his name is associated are the establishment of a hospital for galley slaves at Marseilles, the institution of two establishments for foundlings at Paris, and the organization of the "Filles de la Charité," to supplement the work of the *confréries*, whose members were mainly married women with domestic duties. He died at Paris on the 27th of September 1660, and was buried in the church of St Lazare. He was beatified by Benedict XIII. in 1729, and canonized by Clement XII. in 1737, his festival (duplex) being observed on the 19th of July. The Society of St Vincent de Paul was founded by Frederic Ozanam and others in 1833, in reply to a charge brought by some free-thinking contemporaries that the church no longer had the strength to inaugurate a practical enterprise. In a variety of ways it does a great deal of social service similar to that of gilds of help. Its administration has always been in the hands of laymen, and it works through local "conferences" or branches, the general council having been suspended because it declined to accept a cardinal as its official head.

Lives by Maynard (4 vols., Paris, 1860); Bougaud (2 vols., Paris, 1891); E. de Broglie (5th edition, Paris, 1899); *Letters* (2 vols., Paris, 1882); A. Loth (Paris, 1880); H. Simard (Lyons, 1894).

VINCENT OF LERINS, ST, or VINCENTIS LERINENSIS (d. *c.* A.D. 450), an ecclesiastical writer of the Western Church of whose personal history hardly anything is known, except that he was a native of Gaul, possibly brother of St Loup, bishop of Troyes, that he became a monk and priest at Lerinum, and that he died in or about 450. Lerinum (Lerins, off Cannes) had been made by Honoratus, afterwards bishop of Arles, the seat of a monastic community which produced a number of eminent churchmen, among them Hilary of Arles. The school did not produce an extensive literature, but it played an important part in resisting an exaggerated Augustinianism by reasserting the freedom of the will and the continued existence of the divine image in human nature after the fall. As regards Vincent he himself tells us that only after long and sad experience of worldly turmoil did he betake himself to the haven of a religious life. In 434, three years after the council of Ephesus, he wrote the *Commonitorium adversus profanas omnium haereticorum novitates*, in which he ultimately aims at Augustine's doctrine of grace and predestination. In it he discusses the "notes" which distinguish Catholic truth from heresy, and (cap. 2) lays down and applies the famous threefold test of orthodoxy—*quod ubique, quod semper, quod ab omnibus creditum est.* It is very striking that in his appeal to tradition Vincent assigns no part to the bishops as such—apart from the council; he appeals to the ancient "teachers," not to any apostolic succession. His "semi-Pelagian" opposition to Augustine is dealt with by Prosper of Aquitania in his *Pro Augustini doctrina responsiones ad capitula objectionum Vincentiarnarium.* It explains why the *Commonitorium* has reached us only in a mutilated form.

The *Commonitorium* has been edited by Baluze (Paris, 1663, 1669 and 1684) and by Klüpfel (Vienna, 1809). It also occurs in vol. l. of Migne's *Patrol. Ser. Lat.* (1846). A full summary is given in A. Harnack's *History of Dogma*, iii. 230 ff. See also F. H. Stanton, *Place of Authority in Religion*, pp. 167 ff.; A. Cooper-Marsdin, *The School of Lerins* (Rochester, 1905).

VINCENT FERRER, ST (1355–1419), Spanish Dominican preacher, was born of respectable parentage at Valencia on the 23rd of January 1355. In February 1374 he took the Dominican habit, and after spending some years in teaching, and in completing his theological studies, he was licensed to preach. He graduated as doctor of theology at Lerida in 1374, and his sermons in the cathedral of Valencia from 1385 onwards soon became famous. Cardinal Peter de Luna took him with him to Paris in 1391; and on his own election to the pontificate as antipope Benedict XIII. made Ferrer his confessor and master of the sacred palace. Finding, however, the ecclesiastical atmosphere of Avignon an uncongenial one, he in 1397 resumed his work as a preacher, and Spain, France, Italy, Germany and Great Britain and Ireland were successively visited by him; and in every case numerous conversions were the result of his eloquence, which is described as having been singularly powerful and moving. In 1412 he was delegated by his native city to take part in the election of a successor to the vacant crown of Aragon; and in 1416 he received a special invitation to attend the council of Constance, where he supported the cause of the Flagellants (*q.v.*). He died at Vannes on the 5th of April 1419, and was canonized by Calixtus III. in 1455, his festival (duplex) being observed on the 5th of April.

See A. Sorbelli, *Il trattato di S. Vincenzo Ferrer intorno al Grande Scisma d' Occidente* (Bologna, 1906).

VINCI, LEONARDO (1690–1730), Italian musical composer, was born at Strongoli in Calabria in 1690 and educated at Naples under Gaetano Greco in the Conservatorio dei Poveri di Gesù Cristo. He became known first by his comic operas in Neapolitan dialect in 1719; he also composed many serious operas. He was received into the Congregation of the Rosary at Formiello in 1728 and died by poisoning in 1730, not 1732, as is generally stated. His comic operas, of which *Le Zite 'n Galera* (1722) is the best, are full of life and spirit; in his serious operas, of which *Didone Abbandonata* (Rome, 1728) and *Artaserse* (Rome, 1730) are the most notable, have an incisive vigour and directness of dramatic expression deservedly praised by Burney. The well-known air "Vo solcando," from *Artaserse*, is a good example of his style.

VINDELICIA, in ancient geography, a country bounded on the S. by Raetia, on the N. by the Danube and the Vallum Hadriani, on the E. by the Oenus (Inn), on the W. by the territory of the Helvetii. It thus corresponded to the N.E. portion of Switzerland, the S.E. of Baden, and the S. of Württemberg and Bavaria. Together with the neighbouring tribes it was subjugated by Tiberius in 15 B.C., and towards the end of the 1st century A.D. was made part of Raetia (*q.v.*). Its chief town was Augusta Vindelicorum (Augsburg). Its inhabitants were probably of Celtic origin (cf. the recurrence of *Vind-* in other Celtic names—Vindobona, Vindonissa); some authorities, however, regard them as German. According to Dio Cassius (liv. 22) they were an agricultural people, and later writers (*e.g.* Isidorus, *Origines*, i. 4), describe the country as very fertile.

VINDHYA, a range of mountains in Central India. It forms a well-marked, though not quite continuous, chain across India, separating the Ganges basin from the Deccan. Starting on the west in Gujarat, the Vindhyas cross Malwa and the central portions of India, until their easternmost spurs abut on the valley of the Ganges at Rajmahal. They thus roughly form the northern side of the triangle, of which the other two sides are the Eastern and Western Ghats. They have an elevation of 1500 to 4500 ft., nowhere exceeding 5000 ft. Geologically they give their name to the "Vindhyan formation," one of the recognized rock systems of India. In legendary tradition they formed the demarcating line between the Madyadesha or middle land of the Sanskrit invaders and the non-Aryan Deccan, and they are still largely inhabited by aboriginal races such as the Bhils.

VINE. The grape-vine, botanically *Vitis*, is a genus of about thirty species, widespread in the north temperate zone, but richest in species in North America. The best known and longest cultivated species is the old-world grape-vine, *Vitis vinifera*; a variety of this, *silvestris*, occurs wild in the Mediterranean region, spreading eastwards towards the Caucasus and northwards into southern Germany, and may be regarded as the parent of the cultivated vine. It is of interest to note that grape-stones have been found with mummies in Egyptian tombs of not later age than 3000 years. The seeds have the characteristics of those of *V. vinifera*, but show some very slight variations from the type of seed now prevalent. Among the Greeks in the time of Homer wine was in general use. The cultivation of the vine must also have been introduced into Italy at a very early period. In Virgil's time the varieties in cultivation seem to have been exceedingly numerous; and the varied methods of training and culture now in use in Italy are in many cases identical with those described by Columella and other Roman writers. Grape-stones have been found among the remains of Swiss and Italian lake dwellings of the Bronze period, and others in tufaceous volcanic deposits near Montpellier, not long before the historic era.

The old-world species is also extensively cultivated in California, but the grape industry of the eastern United States has been developed from native species, chiefly *V. Labrusca* and *V. aestivalis* and their hybrids with *V. vinifera.* Some of the American varieties have been introduced into France and other countries infested with *Phylloxera*, to serve as stocks on which to graft the better kinds of European vines, because their roots, though perhaps equally subject to the attacks of the insects, do not suffer so much injury from them as the European species.

The vine requires a high summer temperature and a prolonged period in which to ripen its fruit. Where these are forthcoming, it can be profitably cultivated, even though the winter temperature be very low. Tchihatchef mentions that at Erivan in Russian Armenia the mean winter temperature is 7°·1 C. and falls in January to −30° C., and at Bokhara the mean temperature of January is 4° C. and the minimum −22° C., and yet at both places the vine is grown with success. In the Alps it is profitably cultivated up to an altitude of 1870 ft., and in the north of Piedmont as high as 3180 ft. At the present time the limit of profitable cultivation in Europe passes from Brittany, lat. 47° 30′, to beyond the Rhine by Liége and through Thuringia to Silesia in lat. 51° 55′. In former centuries vines were cultivated to the north of this region, as, for instance, in Holland, in Belgium largely, and in England, where they might still be grown. Indeed, experiments have been made in this direction near Cardiff in South Wales. The yield is satisfactory, and the wine made, the variety known as Gamay noir, is described as being like still champagne. In the middle ages, owing to various causes, the better wines of France and Germany could not be obtained in England except at prohibitive prices; but when this state of things ceased, and foreign wine could be imported, the English consumers would no longer tolerate the inferior productions of their own vineyards. It is also probable that the English mixed sugar or honey with the wine and thus supplied artificially that sweetness which the English sun denied. It is a curious fact that at the present day much or even most of the wine of finest quality is made at or near to the northern limits of possible cultivation with profit. This circumstance is probably explained by the greater care and attention bestowed both on the cultivation of the vine and on the manufacture of the wine in northern countries than in those where the climate is more propitious. The relative inferiority of the wines made at the Cape of Good Hope and in Australia is partly due to variations of climate, the vine not yet having adapted itself to the new conditions, and partly to the deficient skill of the manufacturers. That such inferiority may be expected to disappear is suggested by the success of vine-culture in Madeira and the Canary Islands.

The development of other species of *Vitis*, such as the curious succulent species of the Soudan and other parts of equatorial Africa, or the numerous kinds in India and Cochin China, is of course possible under suitable conditions; but it is obvious that an extremely long period must elapse before they can successfully compete with the product of many centuries.

[See also generally the article WINE. For currants and raisins, both produced by varieties of the grape-vine, see the respective articles.]

Apart from their economic value, vines are often cultivated for purely ornamental purposes, owing to the elegance of their foliage, the rich coloration they assume, the shade they afford, and their hardihood.

Vines have woody climbing stems, with alternate, entire or palmately lobed leaves, provided at the base with small stipules. Opposite some of these leaves springs a tendril, by aid of which the plant climbs. There are numerous transitional states between the ordinary form of tendril and the inflorescence. The flowers are small, green and fragrant, and are arranged in dense clusters. Each has a small calyx in the form of a shallow rim, sometimes five-lobed or toothed; five petals, which cohere by their tips and form a cap or hood, which is pushed off when the stamens are ripe; and five free stamens, placed opposite the petals and springing from a fleshy ring or disk surrounding the ovary; each bears a two-celled anther. The anomalous position of the stamens in front of the petals is explained by the abortion or non-development of an outer row of stamens, indications of which are sometimes seen on the hypogynous disk encircling the ovary. The ovary bears a sessile stigma and is more or less completely two-celled, with two erect ovules in each cell. This ripens into the berry and seed. The cultivated vine has usually hermaphrodite flowers; but as it occurs in a wild state, or as an escape from cultivation, the flowers manifest a tendency towards unisexuality: that is, one plant bears flowers with stamens only, or only the rudiments of the pistil, while on another plant the flowers are bisexual. Exclusively female flowers without stamens do not appear to have been observed. Seedling plants from the cultivated vines often produce unisexual flowers, thus reverting to the feral type. Perhaps the explanation of the fact that some of the cultivated varieties are, as gardeners say, "bad setters," —*i.e.* do not ripen their fruit owing to imperfect fertilization,—is to be sought in this natural tendency to dioecism.

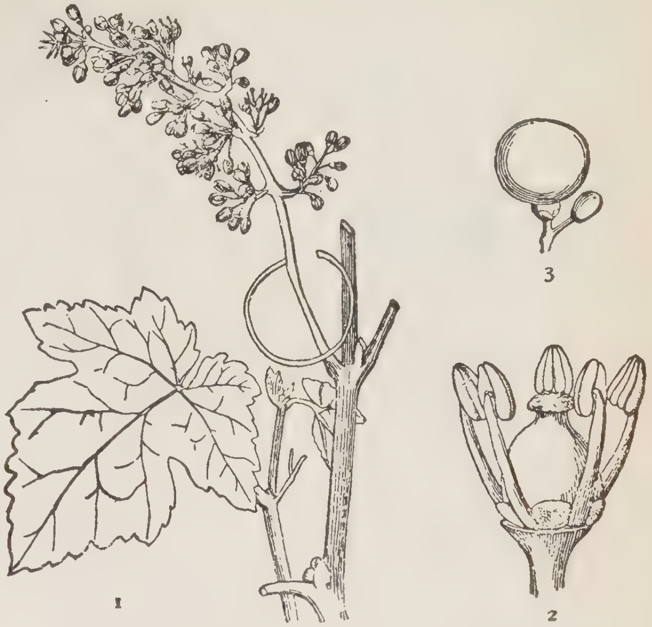


FIG. 1.—Vine.
1. Foliage, tendril and inflorescence, reduced.
2. Flower after fall of petals, magnified.
3. Fruit, reduced.

The conformation of the vine stem has elicited a vast amount of explanatory comment. The most generally accepted explanation is the "sympodial" one. According to this, the shoot of the vine is a "sympodium," consisting of a number of "podia" placed one over the other in longitudinal series. Each podium consists of a portion of the stem bearing one or more leaves, each with an axillary bud or buds, and terminating in a tendril or an inflorescence. In *V. Labrusca* there is a tendril opposite to each leaf, so that the podium bears only a single leaf. In other species there is a definite arrangement of the leaves, some with and others without tendrils opposite to them, the numerical order remaining constant or nearly so. These arrangements have doubtless some reference to climatic phenomena, continuity of growth being arrested by cold and promoted by warmth. In any case, it is obvious that these facts might be turned to practical ends in cultivation. A vine, for instance, that produces bunches of grapes at each joint is preferable to one in which there are several barren joints, as a larger quantity can be grown within a smaller area. The practice of pruning or "stopping" is, consciously or unconsciously, regulated by the mode of growth. The tendril or inflorescence, according to the views above explained, though in reality terminal, is bent to one side; hence it appears to be lateral and opposite to the leaf. While the tendril is thus diverted from its original direct course, the axillary bud of the leaf opposite the tendril begins a new podium, by lengthening into a shoot which assumes the direction the tendril had prior to its deflexion. This new podium, now in a direct line with its predecessor, produces leaves and ends in its turn in a tendril or inflorescence. A third podium succeeds the second, and so on. Other authorities explain the formation of the tendril and its anomalous position opposite to a leaf by supposing that the end of the stem bifurcates during growth, one division forming the shoot, the other the tendril or inflorescence. It is not possible within the limits at our command to specify the facts and arguments by which these theories are respectively supported. Practically the tendrils assist the plant in its native state to scramble over rocks or trees. As in the case of similar formations generally, they are endowed with a sensitiveness to touch which enables them to grasp and coil themselves round any suitable object which comes in their way, and thus to support the plant. The seeds or grape-stones are somewhat club-shaped, with a narrow neck-like portion beneath, which expands into a rounded and thickened portion above. On the inner or central side of the seed is a ridge bounded on either side by a shallow groove. This ridge indicates the point of union of the "raphe" or seed-stalk with the seed; it serves to distinguish the varieties of *V. vinifera* from those of other species. In endeavouring to trace the filiation and affinities of the vine, the characters afforded by the seed are specially valuable, because they have not been wittingly interfered with by human agency. Characters derived from the size, colour or flavour of the berry are of less value for historical or genealogical purposes than those which are the outcome of purely natural conditions.

The vine is hardy in Britain so far as regards its vegetation, but not hardy enough to bring its fruit to satisfactory maturity, so that for all practical purposes the vine must be regarded as a tender fruit. Planted against a wall or a building having a south aspect, or trained over a sunny roof, such sorts as the Black Cluster, Black Prince, Pitmaston White Cluster, Royal Muscadine, Sweetwater, &c., will ripen in the warmest English summers so as to be very pleasant eating; but in cold summers the fruit is not eatable in the raw state, and can only be converted into wine or vinegar. For outdoor culture the long-rod system is generally preferred.

When the plant is grown under glass, the vine border should occupy the interior of the house and also extend outwards in the front, but it is best made by instalments of 5 or 6 ft. as fast as the previous portions become well filled with roots, which may readily be done by packing up a turf wall at the extremity of the portion to be newly made; an exterior width of 15 ft. will be sufficient. If the soil beyond this is very unfavourable, the roots should be prevented from entering it by building a wall at the extreme edge of the border. Inside borders require frequent and thorough waterings. In well-drained localities the border may be partially below the ground level, but in damp situations it should be made on the surface; in either case the firm solid bottom should slope outwards towards an efficient drain. A good bottom may be formed by chalk rammed down close. On this should be laid at least a foot thick of coarse, hard, rubbly material, a layer of rough turf, grass side downwards, being spread over it to prevent the compost from working down. The soil itself, which should be 2½ or 3 ft. deep, never less than 2 ft., should consist of five parts rich turfy loam, one part old lime rubbish or broken bricks, including a little wood ashes or burnt earth (ballast), one part broken charcoal, and about one part of half-inch bones, the whole being thoroughly mixed, and kept dryish till used. It is well after the borders are completed to remove the top soil, in which no roots are to be found, every two or three years, and to replace it with a mixture of good loam, rotten manure, lime rubbish and bone meal, to the depth of 6 or 7 in. A mulch of half-decayed stable litter is useful to prevent loss of moisture in summer.

Young vines raised from eyes, *i.e.* buds having about ¼ in. wood above and 1 in. below, are generally preferred for planting. The eyes being selected from well-ripened shoots of the previous year are planted about the end of January, singly, in small pots of light loamy compost, and after standing in a warm place for a few days should be plunged in a propagating bed, having a bottom heat of 75°, which should be increased to 85° when they have produced several leaves, the atmosphere being kept at about the same temperature or higher by sun heat during the day, and at about 75° at night. As soon as roots are freely formed the plants must be shifted into 6-inch pots, and later on into 12-inch ones. The shoots are trained up near the glass, and, with plenty of heat (top and bottom) and of water, with air and light, and manure water occasionally, will form firm, strong, well-ripened canes in the course of the season. To prepare the vine for planting, it should be cut back to within 2 ft. of the pot early in the season, and only three or four of the eyes at the base should be allowed to grow on. The best time for planting is in spring, when the young shoots have just started. The vines should be planted inside the house, from 1 to 2 ft. from the front wall, and from 6 ft. to 8 ft. apart, the roots being placed an inch deeper in the soil than before, carefully disentangled and spread outwards from the stem, and covered carefully and firmly with friable loam, without manure. When the shoots are fairly developed, the two strongest are to be selected and trained in. When forcing is commenced, the vinery is shut up for two or three weeks without fire heat, the mean temperature ranging about 50°. Fire heat must be at first applied very gently, and may range about 55° at night, and from 65° to 70° by day, but a few degrees more may be given them as the buds break and the new shoots appear. When they are in flower, and onwards during the swelling of the berries, 85° may be taken as a maximum, running up to 90° with sun heat and the temperature may be lowered somewhat when the fruit is ripe. The temperature must, however, be regulated according to the variety, Muscats requiring a higher temperature from the time their bunches show than Hamburghs. As much ventilation as the state of the weather will permit should be given. A moist growing atmosphere is necessary both for the swelling fruit and for maintaining the health of the foliage. A due amount of moisture may be kept up by the use of evaporating troughs and by syringing the walls and pathways two or three times a day, but the leaves should not be syringed. When the vines are in flower, and when the fruit is colouring, the evaporating troughs should be kept dry, but the aridity must not be excessive, lest the red spider and other pests should attack the leaves. In the course of the season the borders (inside) will require several thorough soakings of warm water—the first when the house is shut up, this being repeated when the vines have made young shoots a few inches long, again when the vines are in flower, and still again when the berries are taking the second swelling after stoning. Outside borders require watering in very dry summer weather only.

There are three principal systems of pruning vines, termed the *long-rod*, the *short-rod* and the *spur* systems, and good crops have been obtained by each of them. It is admitted that larger bunches are generally obtained by the long-rod than by the spur system. The principle of this mode of pruning is to train in at considerable length, according to their strength, shoots of the last year's growth for producing shoots to bear fruit in the present; these rods are afterwards cut away and replaced by young shoots trained up during the preceding summer; and these are in their turn cut out in the following autumn after bearing, and replaced by shoots of that summer's growth. By the short-rod system, short instead of long rods are retained; they are dealt with in a similar manner. The spur system has, however, become the most general. In this case the vines are usually planted so that one can be trained up under each rafter, or up the middle of the sash, the latter method being preferable. The shoots are cut back to buds close to the stem, which should be encouraged to form alternately at equal distances right and left, by removing those buds from the original shoot which are not conveniently placed. The young shoots from these buds are to be gently brought to a horizontal position, by bending them a little at a time, and tied in, and usually opposite about the fourth leaf the rudiments of a bunch will be developed. The leaf directly opposite the bunch must in all cases be preserved, and the young shoot is to be topped at one or two joints beyond the incipient fruit, the latter distance being preferable if there is plenty of room for the foliage to expand; the lateral shoots, which will push out after the topping, must be again topped above their first or second joints. If the bunches are too numerous they must be thinned before the flowers expand, and the berries also must be properly thinned out and regulated as soon as they are well set, care being taken, in avoiding overcrowding, that the bunches be not made too thin and loose.

The cultivation of vines in pots is very commonly practised with good results, and pot-vines are very useful to force for the earliest crop. The plants should be raised from eyes, and grown as strong as possible in the way already noted, in rich turfy loam mixed with about one-third of horse dung and a little bone dust. The temperature should be gradually increased from 60° to 80°, or 90° by sun heat, and a bottom heat a few degrees higher must be maintained during their growth. As the roots require more room, the plants should be shifted from 3-inch pots into those of 6, 12 or 15 in. in diameter, in any of which larger sizes they may be fruited in the following season, but, to be successful in this, the young rod produced must be thoroughly matured after it has reached its limit of growth. The periodical thorough cleansing of the vine stems and every part of the houses is of the utmost importance.

The number of varieties of grapes possessing some merit is considerable, but a very few of them will be found sufficient to supply all the wants of the cultivator. For general purposes nothing approaches the Black Hamburgh (including Frankenthal) in merit.

Fungoid Diseases.—The most destructive form of fungoid disease which attacks the vine is caused by a mildew, *Uncinula necator* (*Erysiphe Tuckeri*) (fig. 2). The disease was first noticed in England in

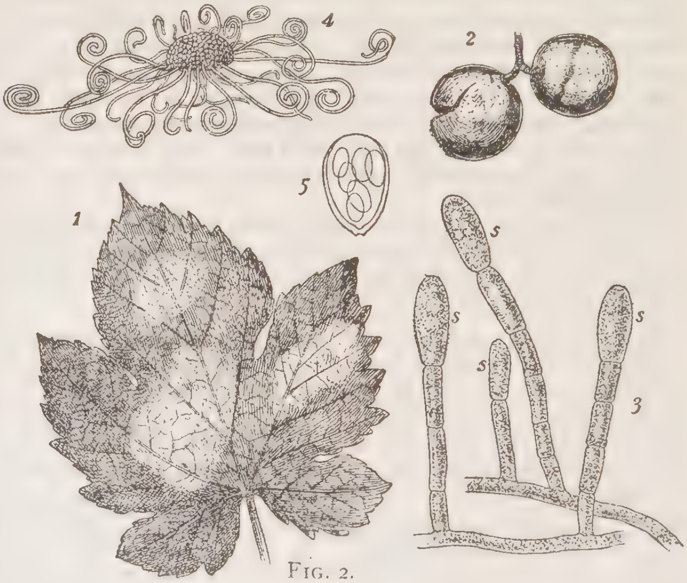


Fig. 2.

1. Vine leaf attacked by mildew, *Uncinula necator* (*Erysiphe Tuckeri*), which forms white patches on the upper face, reduced.
2. Grapes similarly attacked.
3. Portion of the mycelium of the fungus bearing spores (conidia). *s*, on erect branches,
4. Perithecium or "fruit" of the fungus with its curled appendages.
5. Ascus from perithecium containing six spores.

1845; in 1848 it appeared at Versailles; by 1851 it had spread through all the wine-producing countries of Europe, being specially virulent in the lands bordering on the Mediterranean; and in the following year it made its appearance in Madeira. Like the *Phylloxera* (*q.v.*; also WINE), the mildew is in its origin probably American. The disease is characterized by the appearance of a mycelium forming white or greyish-white patches on the young leaves; this spreads quickly and attacks the older leaves and branches, and ultimately reaches the grapes. At first these are marked only by small brown spots; but the spots spread and fuse together, the skin of the grape is destroyed, and the flesh decays, the seed only remaining apparently untouched. The disease spreads by the mycelium growing over the epidermis of the plant. The hyphae composing the mycelium are provided with haustoria which project into the cells of the affected part (fig. 3). Some of the hyphae which project from the leaf bear spores (conidia), which are constricted off one at a time, and by their means the fungus is distributed (fig. 2, 3). The perithecia are only produced exceptionally in Europe, but this stage of the life-history is common in the United States and causes a widely spread disease among the American vines. The mildew is in its turn attacked by a fungus of the same tribe, *Cicinnobolus Cesatii*, which lives parasitically within the hyphae of its host, and at times even succeeds in destroying it. The means which have proved most efficacious, both as a remedy and a preventive of this disease, is to scatter flowers of sulphur over the vines, before the morning dew has evaporated. Another method is to boil one part of lime with three parts of sulphur, and to sprinkle the mixture over the affected plants.

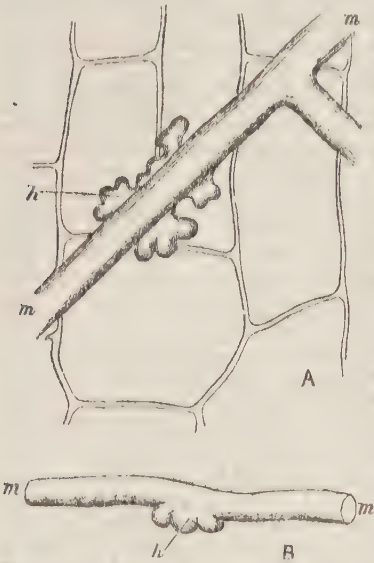


FIG. 3.—*Uncinula necator* (*Erysiphe Tuckeri*). A and B, mycelium (*m*), with haustoria (*h*). (After de Bary.) In A several cells of the epidermis are indicated.

Another fungus which attacks vines, especially those of America, is *Plasmopara viticola*, which has also been introduced from America to Europe. The mycelium spreads through the green parts of the plant, attacking the leaves, twigs and unripe grapes. On the upper side of the leaf, where it is first visible, it forms pale green irregular spots, which become darker in colour. On the under side of the leaf these patches are white and are composed of the spore-bearing hyphae. The leaf ultimately becomes dried up and brittle. The grapes which are attacked cease to grow, turn brown or white, and ultimately dry up and fall off. This disease has been successfully treated with a spray of copper sulphate and lime, or sulphate of iron; solutions of these salts prevent the conidia from germinating.

Anthracnose is the name usually given to a disease which was formerly known as "charbon," "pech" or "brenner." This disease is caused by the parasitism of *Sphaceloma ampelinum*, one of the Pyrenomycetous fungi (fig. 4). The fungus assails all the green parts of the vine, and injures the leaves and young shoots as much as it does the grape itself. The first sign of its presence is the appearance of a minute spot, which is greyish in the centre, with a brown border. This spot increases in size; in the stalks it assumes an oval shape, with its long axis parallel to the stalk, whilst in the leaves and grapes it is more or less circular in outline. The centre of the spots on the grapes becomes darker as the disease advances, and a red line appears dividing the dark brown border into an outer and an inner rim and giving a very characteristic appearance to the diseased plant. The surrounding tissue enlarges, so that the spots appear as if sunk in depressions, and bear a considerable resemblance to hailstone wounds. Later the spots on the leaves often drop out. The berries do not shrivel up as those do that are affected by the black rot. The mycelium of *Sphaceloma* grows just beneath the cuticle of the vine, through which it soon bursts, giving rise to a number of minute hyphae, which bear conidia. These are minute, oval, colourless spores, which serve to spread the disease over the vineyard and from place to place. The complete life-history of this form is at present unknown; and information as to where the fungus passes the winter, and in what form, would probably afford some useful indications as to the method that should be adopted to combat the disease. Anthracnose has been known in Europe for many years, but has only been observed in America since 1881, whither it was probably imported from the old world. As a preventive to its attacks the copper sulphate sprays and a solution (50%) of iron sulphate have been found very useful, as well as care in planting on well-drained soil that does not lie too low, the disease seldom appearing in dry, well-exposed vineyards. A great deal of confusion still exists with regard to this disease. A similar disease which of late has frequently been found in England, and which is ascribed to the fungus *Gloeosporium ampelophagum*, is very similar to it. In their mode of attack, in the symptoms they produce, and in the result upon the grapes and the vine the two fungi are so much alike that for practical purposes they may be regarded as identical. Massee recommends that the shoots should be dredged with flowers of sulphur at intervals of ten days, while the disease continues to spread, a small quantity of quicklime in a finely powdered condition being added and the quantity of lime being increased at every application, not so as to exceed the sulphur, however. The iron sulphate solution should be used while the vines are in a dormant condition, and diseased parts should be cleared away and burned.

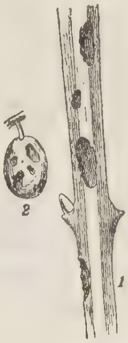


FIG. 4.—Charbon or Anthracnose of Vine, caused by *Sphaceloma ampelinum*.

1. Portion of twig with discoloured patches, caused by the fungus.
2. Fruit attacked by the fungus (reduced).

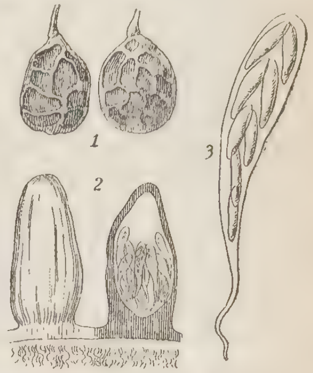
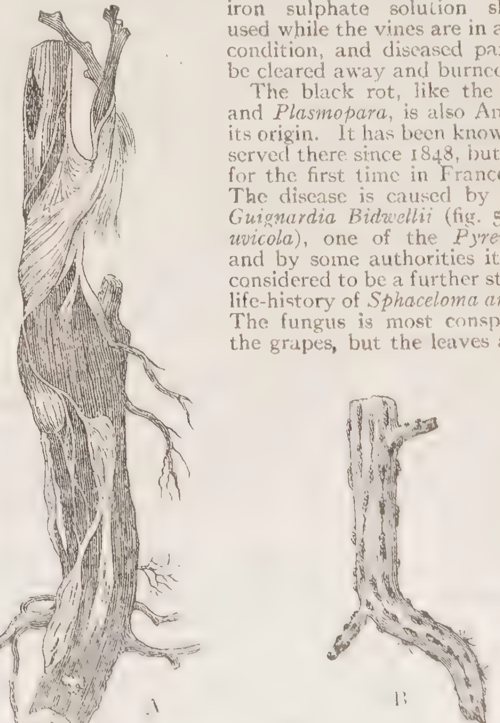


FIG. 5.—Black Rot of Grapes, *Guignardia Bidwellii*.

1. Grapes attacked by the fungus; the fruit becomes black, hard and shrivelled.
2. Fructification of the fungus, entire and in section; the latter shows the asci containing ascospores, much enlarged.
3. Single ascus, more enlarged, showing the eight contained spores.

The black rot, like the *Uncinula* and *Plasmopara*, is also American in its origin. It has been known and observed there since 1848, but appeared for the first time in France in 1885. The disease is caused by a fungus, *Guignardia Bidwellii* (fig. 5) (*Phoma uvicola*), one of the *Pyrenomycetes*, and by some authorities it has been considered to be a further stage in the life-history of *Sphaceloma ampelinum*. The fungus is most conspicuous on the grapes, but the leaves and stems are also affected. The grapes are not assailed until nearly full-grown, when a brownish spot appears, which spreads over the



From Hartig's *Lehrbuch der Pflanzenkrankheiten*, by permission of Julius Springer.

FIG. 6.—*Rosellinia* (*Dematophora*) *necatrix*.

A. Mycelium of the fungus attacking root of vine (reduced).
B. Portion of vine root, showing masses of fructification (*perithecia*) of the fungus (reduced).

whole grape. The latter for a time retains its plumpness, but on the appearance of little black pustules, which first occur on the part primarily affected, the grape begins to shrivel. This continues until the grape is reduced to a black hard mass, with the folds of skin pressed closely against the seed. The disease spreads from grape to grape, so that as a rule many of the grapes in a bunch are destroyed. The hyphae of the mycelium of this fungus are septate, with numerous short branches. The pustules on the surface are due to fructifications, pycnidia and spermagonia. The fungus passes the winter in the withered grapes which fall to the ground, and on these the mature form of the fungus (fig. 5, 2 and 3) is produced; hence every care should be taken to collect these and burn them. The use of the copper solutions mentioned above may also be recommended as a preventive.

Among the other fungi which infest the vine may be mentioned *Phyllosticta viticola* and *Ph. Labruscae*, which, when the attack is severe, cause the destruction of the leaves, the only part they assail. These, like the foregoing, are members of the *Pyrenomycetes*, while many other allied fungi have been described as causing spots on the leaves. *Cercospora Vitis* (*Cladosporium viticolum*), which has club-shaped spores of a green-brown colour, also attacks the leaves; but, unless the season is extremely unfavourable, it does little harm.

A very disastrous root-disease of the vine is due to the ravages of another pyrenomycetous fungus, *Rosellinia* (*Dematophora*) *necatrix* (fig. 6), which forms subterranean strings of mycelium—so-called rhizomorphs. The diseased roots have been confounded with those attacked by *Phylloxera*. The only mode of combating the malady seems to be to uproot the plants and burn them. Isolation of the diseased areas by means of trenches has also been practised.

VINEGAR, a dilute solution of impure acetic acid, prepared by the acetous fermentation of alcohol or of substances which yield alcohol when suitably decomposed (ordinary vinegar), or obtained from the products resulting on the dry distillation of wood (wood vinegar). Ordinary or table vinegars, which contain, in addition to acetic acid, small quantities of alcohol, higher acids such as tartaric and succinic, various esters, albuminous substances, &c., are produced solely by acetous fermentation, wood vinegar being only employed in certain arts. Ordinary vinegar has been known from the earliest times, and its power of combining with or dissolving mineral substances caused the alchemists to investigate its preparation and properties. They failed, however, to obtain pure acetic acid, although by distillation they prepared more concentrated solutions (*spiritus Veneris*). In 1697 Stahl showed that vinegar could be concentrated by freezing out part of the water, and, better, in 1702, by neutralizing the acid with an alkali and distilling the salt with oil of vitriol. A notable improvement was made in 1789 by Löwitz, who showed that the dilute acid could be concentrated by repeatedly passing it over charcoal powder, and by cooling he obtained a crystalline substance named in 1777 by Durande, "glacial acetic acid." The presence of an acid substance in the products of the dry distillation of wood was mentioned by Glauber in 1648 and received the name of pyroligneous acid. Its identity with acetic acid was demonstrated by Vauquelin in 1800.

The mechanism of acetous fermentation is described under FERMENTATION; here we only treat of the actual processes. There are two methods in use: the "quick" process, proposed in 1720 by Boerhaave and introduced by Schützenbach in 1823 (analogous processes were proposed at about the same time by Wagmann in Germany and by Ham in England), and the older or "slow" process.

In the "quick" process advantage is taken of the fact that the fermentation proceeds more quickly when a large surface of the liquid is exposed to air. Any alcoholic liquid can be treated. The apparatus consists essentially of a vat divided into three portions: the lowest, which is separated from the one above by a grid or false bottom, serves for the collection of the vinegar; the central portion, which is by far the largest, is the chamber wherein the fermentation is effected; and it is separated from the topmost section by a disk perforated with holes about the size of quills through which thin strings lead into the upper part of the central section. The purpose of this disk is to subdivide the liquid placed upon it into drops so as to increase the surface of the liquid. The sides of the vat enclosing the lowest portion are provided with a ring of holes to admit air to the tub; and the vat is enclosed with a tightly fitting lid perforated by a hole through which the liquor to be fermented is admitted and the air drawn upwards from the base escapes. The central chamber is filled with some material of large surface. The commonest are beech-wood shavings, which, before use, must be carefully freed from all extractives by washing and steaming, then dried, and finally soured by immersion in hot vinegar for twenty-four hours. The fermented wort, prepared in various ways and of varying composition, or wine, is warmed to about 38° C. and then fed into the upper chamber. Falling on to the shavings, the surface is largely increased, and the fermentation which ensues maintains the temperature at about 37°, and draws a current of air upwards through the shavings, which after a time become covered with the so-called mother of vinegar. If the liquid contains only 4% of alcohol, it is completely converted into acetic acid, but stronger liquors require to be passed through the vat three or four times. Some of the alcohol (and consequently some acetic acid) is carried away by the air which escapes to the top of the vat; this is avoided in some factories by leading the air over or into water, whereby the alcohol and aldehyde are recovered. The same is effected in Singer's generators, which are coupled together in tiers.

For making wine-vinegar by the slow process, full-bodied wines about one year old and containing 10% of alcohol (this amount being obtained, when necessary, by blending) are preferred; and they are clarified by standing with beech shavings upon which the lees deposit. The fermentation is carried out in casks holding from 50 to 100 gallons; these casks are repeatedly extracted with water in order to prevent any impurity finding its way into the vinegar; also it is found that the casks foul after about six years' use, when it is necessary to remove the deposits of argol, yeast sediments, &c., and re-extract with water, after which they are again fit for use. In conducting the fermentation the cask is one-third filled with boiling strong vinegar and allowed to stand for eight days. Nine pints of the wine are now added every day until the cask is two-thirds full, and the mixture is allowed to stand for fourteen days. After this interval from 10 gallons to half the contents of the cask are drawn off, and more wine added. The working temperature is about 25°. The progress of the operation is shown by the white froth which appears on a spatula after immersion in the liquid; if it be reddish, more wine must be added. In certain parts of France, Holland and of the Rhine district a different procedure is adopted. Two casks, fitted with false bottoms on which are placed vine cuttings, are taken; one cask is completely filled with the wine, whilst the other is only half filled. The acetification proceeds more rapidly in the second cask, and after twenty-four hours half the contents of the first cask are transferred to it, and the process repeated. The product is settled in casks containing birch wood, and after fourteen days it is put upon the market.

In preparing malt vinegar, an infusion of malt is prepared by extracting it with water at 72°, then at a higher temperature and finally at the boiling-point. After cooling the extracts are fermented with yeast, and the product kept for some months before acetification. This step can be effected by the quick process as described above, or by the slow process. In the latter the liquid at 25° is transferred to barrels lying on their sides and the fermentation allowed to proceed. When the process is complete the product is filtered through rapes in a fining tun. This is a cask fitted with a false bottom in which are placed spent tanner's wood, shavings, or, better, the pressed stalks and skins of grapes and raisins from wine manufacture. Household vinegar is made in upright casks; after twenty-four hours it is transferred to a similar cask, and the process repeated in a third and fourth cask. Malt vinegar is sold in four strengths designated 18, 20, 22, 24, the last being "proof" vinegar, containing 6% of acetic acid and having a specific gravity of 1·019. These numbers represent the grains of dry pure sodium carbonate, which are neutralized by one fluid ounce of the vinegar.

Several other vinegars are made. Crystal vinegar is ordinary vinegar decolorized by treatment with animal charcoal. Ale vinegar is prepared from strong sour pale ale; it has a tendency to putrefy. Glucose or sugar vinegar is made by first fermenting amylaceous substances to alcohol, and then acetifying the alcohol. Compound table vinegars are made by digesting ordinary vinegar with condiments such as pepper, garlic, capers, &c.; whilst aromatic vinegars popularly used in vinaigrettes on account of their refreshing, stimulating pungency are obtained by distilling ordinary vinegar with plants, perfumes and aromatic substances. Medicinal vinegars are prepared either by digestion or distillation of vinegar with various drugs. Vinegar, however, is not now much used in medicine, although occasionally taken, under a false impression, in order to reduce obesity.

Wood vinegar is not used in cooking, as it lacks those substances which render ordinary vinegar palatable. It is largely manufactured for conversion into pure acetic acid and acetone; and also for use as an antiseptic and wood preservative. (See ACETIC ACID.)

VINELAND, a borough of Cumberland county, New Jersey, U.S.A., in the southern part of the state, about 34 m. S. of Philadelphia and about 115 m. S.W. of New York. Pop. (1890) 3822; (1900) 4370, including 590 foreign-born; (1905 state census) 4593; (1910) 5282. Area, 1 sq. m. It is served by the Central of New Jersey and the West Jersey & Seashore railways, and by electric railway to Millville and Bridgeton. Vineland is situated at an altitude of 90–118 ft. above the sea, on a generally level or slightly undulating plain, and has unusually broad, straight and well-shaded streets. The borough maintains a public library, a public park of 40 acres, artesian waterworks, a sewerage system and an electric lighting plant. It is the seat of the New Jersey Training School for Feeble-Minded Girls and Boys (1888), the State Home for the Care and Training of Feeble-Minded Women (1888), and the State Home for Disabled Soldiers, Sailors, Marines and their Wives. The Vineland Historical and Antiquarian Society (organized in 1864) has a library (8000 volumes in 1909) housed in the Society's building, and it maintains a free lecture course. Saloons for the sale of intoxicating liquors have never been allowed in Vineland. The surrounding country is largely devoted to the growing of small fruits, grapes, peaches, pears and apples, and the raising of sweet potatoes; and within the borough are manufactured unfermented grape juice wine, boots and shoes, clothing, carpets, rugs, chenille curtains, pearl buttons, flint-glass tubes and bottles, and iron castings.

Vineland was founded in 1861 by Charles K. Landis (1835–1900), who conceived the idea of creating a settlement in the almost uninhabited "Pines" of Southern New Jersey; and after purchasing a large tract he laid out a village with small farms adjoining. The settlers, largely from New England and the Middle States, received the land at moderate prices on agreeing to make certain stipulated improvements. The township of Landis (pop. in 1910, 6435), named in honour of the founder of the settlement, was incorporated in 1864, having formerly been a part of Millville; from it Vineland was separated and was incorporated as a borough in 1880.

See *The Founder's Own Story of the Founding of Vineland* (Vineland, 1903), a pamphlet published by the Vineland Historical and Antiquarian Society.

VINER, SIR ROBERT (1631–1688), lord mayor of London, was born in Warwick, but migrated in early life to London, where he was apprenticed to his uncle, Sir Thomas Viner (1558–1665), a goldsmith, who was lord mayor of London in 1653–54, and who was created a baronet in 1661. Soon Robert became a partner in his kinsman's business, and in 1666 an alderman of the city of London; in 1665 he was made a knight, and in the following year a baronet. He was sheriff during the year of the great fire in London, and was chosen lord mayor in 1674. Combining like his uncle the business of a banker with that of a goldsmith, Viner was brought much into contact with Charles II. and with the court. The king attended his mayoral banquet, and the lord mayor erected an equestrian statue in his honour on a spot now covered by the Mansion House. Having been appointed the king's goldsmith in 1661, Sir Robert was one of those who lent large sums of money for the expenses of the state and the extravagances of the court; over £400,000 was owing to him when the national exchequer suspended payment in 1672, and he was reduced to the necessity of compounding with his creditors. He obtained from the state an annuity of £25,000. Viner died at Windsor on the 2nd of September 1688.

See *Viner: a Family History*, published anonymously (1885).

VINET, ALEXANDRE RODOLPHE (1797–1847), French critic and theologian, of Swiss birth, was born near Lausanne on the 17th of June 1797. He was educated for the Protestant ministry, being ordained in 1819, when already teacher of the French language and literature in the gymnasium at Basel; and during the whole of his life he was as much a critic as a theologian. His literary criticism brought him into contact with Sainte-Beuve, for whom he procured an invitation to lecture at Lausanne, which led to his famous work on Port-Royal. Vinet's *Chrestomathie française* (1829), his *Études sur la littérature française au XIX*^{me} *siècle* (1849–51), and his *Histoire de la littérature française au XVIII*^{me} *siècle*, together with his *Études sur Pascal*, *Études sur les moralistes aux XVI*^{me} *et XVII*^{me} *siècles*, *Histoire de la prédication parmi les Réformés de France* and other kindred works, gave evidence of a wide knowledge of literature, a sober and acute literary judgment and a distinguished faculty of appreciation. He adjusted his theories to the work under review, and condemned nothing so long as it was good work according to the writer's own standard. His criticism had the singular advantage of being in some sort foreign, without the disadvantage which attaches in French eyes to all criticism of things French written in a foreign language. As theologian he gave a fresh impulse to Protestant theology, especially in French-speaking lands, but also in England and elsewhere. Lord Acton classed him with Rothe. He built all on conscience, as that wherein man stands in direct personal relation with God as moral sovereign, and the seat of a moral individuality which nothing can rightly infringe. Hence he advocated complete freedom of religious belief, and to this end the formal separation of church and state (*Mémoire en faveur de la liberté des cultes* (1826), *Essai sur la conscience* (1829), *Essai sur la manifestation des convictions religieuses* (1842). Accordingly, when in 1845 the civil power in the canton of Vaud interfered with the church's autonomy, he led a secession which took the name of *L'Église libre.* But already from 1831, when he published his *Discours sur quelques sujets religieux* (*Nouveaux discours*, 1841), he had begun to exert a liberalizing and deepening influence on religious thought far beyond his own canton, by bringing traditional doctrine to the test of a living personal experience (see also FROMMEL, GASTON). In this he resembled F. W. Robertson, as also in the change which he introduced into pulpit style and in the permanence of his influence. Vinet died on the 4th of May 1847 at Clarens (Vaud). A considerable part of his works was not printed till after his death.

His life was written in 1875 by Eugène Rambert, who re-edited the *Chrestomathie* in 1876. See also L. M. Lane, *Life and Writings of A. Vinet* (1890); L. Molines, *Étude sur Alexandre Vinet* (Paris, 1890); V. Rossel, *Hist. de la litt. française hors de France* (Lausanne, 1895); V. Rivet, *Études sur les origines de la pensée religieuse de Vinet* (Paris, 1896); A. Schumann, *Alex. Vinet* (1907). A uniform edition of his works was begun in 1908, see *Revue de théologie et philosophie* (Lausanne, 1908, 234 sqq.). (J. V. B.)

VINGT-ET-UN (colloquially, "Van John"), a round game of cards, at which any number of persons may play, though five or six are enough. The right to deal having been decided, the dealer gives one card face downwards to each person, including himself. The others thereupon look at their cards and declare their stakes—one, two, three or more counters or chips—according to the value of their cards. When all have staked, the dealer looks at his own card and can double all stakes if he chooses. The amount of the original stake should be set by each player opposite his card. Another card is then dealt, face downwards, all round; each player looking at his own. The object of the game is to make 21, by the pips on the cards, an ace counting as 1 or 11, and the court cards as 10 each. Hence a player who receives an ace and a ten-card scores 21 at once. This is called a "natural"; the holder receives twice—sometimes thrice—the stake or the doubled stake. If the dealer has a natural too, the usual rule is that the other natural pays nothing, in spite of the rule of "ties pay the dealer." The deal passes to the player who turns up the natural, unless it occurs in the first round of a deal or the dealer has a natural too. If the dealer has not a natural, he asks each player in turn, beginning with the player on his left, if he wishes for another card or cards, the object still being to get to 21, or as near up to it as possible. The additional cards are given him one by one, face upwards, though the original cards are not exposed. If he requires no additional card, or when he has drawn sufficient, he says, "Content," or "I stand." If a player overdraws, *i.e.* if his cards count more than 21, he pays the dealer at once. When all are either overdrawn or content, the dealer may "stand" on his own hand, or draw cards, till he is overdrawn or stands. All the hands are then shown, the dealer paying those players whose cards are nearer to 21 than his own, and receiving from *all* the others, as "ties pay the dealer." If the dealer's cards, with the additions, make exactly 21, he receives double the stake, or doubled stake; if a player holds 21, he receives double likewise, but ties still pay the dealer. If a player receives two similar cards he *may* put his stake on each and draw on them separately, receiving or paying according as he stands successfully or overdraws, but the two cards must be similar, *i.e.* he cannot draw on both a knave and a queen, or a king and a ten, though their values are equal for the purpose of counting. A natural drawn in this way, however, only counts as 21, and does not turn out the dealer. Similarly a player may draw on three cards, or even four, should they be dealt him. A player who overdraws on one of such cards must declare and pay immediately, even though he stands on another. After a hand is played, the "pone" (Latin for "behind")—the player on the dealer's right—collects and shuffles the cards played, the dealer dealing from the remainder of the pack, till it is exhausted, when he takes the cards the pone holds, after the pone has cut them. It is a great advantage to deal, as the dealer receives from all who have already withdrawn, even if he overdraws himself.

French Vingt-et-un, or *vingt-et-un with variations*, is played by any number of persons. The first deal is played as in the ordinary game. In the second ("Imaginary Tens") each player is supposed to hold a ten-card and receives one card from the dealer, face downwards; he is then considered to hold a ten-card *plus* the one dealt, and stands or draws, receives or pays, as in the ordinary game. If he receives an ace he holds a natural. In the third deal ("Blind *Vingt-et-un*") each player receives two cards, and draws or stands without looking at either. The fourth deal is "Sympathy and Antipathy," each player staking, and declaring which of the two he backs: two cards are then dealt to him: if they are of the same colour, it is "sympathy"; if of different colours, "antipathy." At the fourth deal (*Rouge-et-noir*), each player, having received three cards, bets that the majority will be either black or red, as he chooses. In "Self and Company" every one stakes but the dealer, who then sets out two cards, face upwards, one for himself and one for the players. If the two cards are pairs, the dealer wins; if not, he deals till one of the cards exposed is paired, paying or receiving according as that card belongs to himself or the "company." The seventh deal is "Paying the difference." Each player receives two cards, face upwards. The dealer pays or receives a stake for the difference in number between the pips on his own cards and those of each player. The ace counts as one. The eighth deal is "Clock." The stakes are pooled. The dealer deals the cards out, face upwards, calling "one" for the first, "two" for the second, and so on, the knave being 11, queen 12, and king 13. If any of the cards dealt correspond to the number called, the dealer takes the pool; if none correspond, he forfeits that amount. At the end of this (the eighth) deal, the next player deals.

VINITA, a city and the county-seat of Craig county, Oklahoma, U.S.A., in the N.E. part of the state, about 135 m. E.N.E. of Guthrie. Pop. (1900) 2339; (1907) 3157, including 624 Indians and 479 negroes; (1910) 4082. Vinita is served by the Missouri, Kansas & Texas and the St Louis & San Francisco railways. In the city are the Sacred Heart Institute (Roman Catholic), and a hospital for masons. Vinita is situated in an agricultural and stock-raising region, and lead, zinc, oil and natural gas are found in the vicinity; the city's water supply is obtained from artesian wells. Bricks are manufactured. The first settlement was made here in 1870 and Vinita was chartered as a city in 1898.

VINLAND (Old Norse, *Vínland*, *i.e.* Vineland or Wineland), some region on the eastern coast of North America, visited and named by the Norsemen in the beginning of the 11th century. The word first appeared in print in Adam of Bremen's *Descriptio Insularum Aquilonis*, an appendix to his *Gesta Hammaburgensis Ecclesiae Pontificum*, published by Lindenbrog in 1595. In pursuit of historical study, Adam visited the Danish court during the reign of the well-informed monarch Svend Estridsson (1047–1076), and writes that the king "spoke of an island (or country) in that ocean discovered by many, which is called Vinland, because of the wild grapes [*vites*] that grow there, out of which a very good wine can be made. Moreover, that grain unsown grows there abundantly [*fruges ibi non seminatas abundare*] is not a fabulous fancy, but is based on trustworthy accounts of the Danes." This passage offers important corroboration of the Icelandic accounts of the Vinland voyages, and is, furthermore, interesting "as the only undoubted reference to Vinland in a medieval book written beyond the limits of the Scandinavian world" (Fiske). Adam's information concerning Vinland did not, however, impress his medieval readers, as he placed the new land somewhere in the Arctic regions: "All those regions which are beyond are filled with insupportable ice and boundless gloom." These words show the futility of ascribing to Adam's account Columbus's knowledge of lands in the West, as many overzealous advocates of the Norse discoveries have done. The importance of the information, meagre as it is, lies in the fact that Adam received from the lips of kinsmen of the explorers (as the Danes in a sense were) certain characteristic facts (the finding of grapes and unsown grain) that support the general reliability of the Icelandic sagas which tell of the Vinland voyages (in which these same facts are prominent), but which were not put into writing by the Norsemen until later—just how much later it is not possible to determine. The fact that the Icelandic sagas concerning Vinland are not contemporaneous written records has caused them to be viewed by many with suspicion; hence such a significant allusion as that by Adam of Bremen is not to be overlooked. To the student of the Norse sources, Adam's reference is not so important, as the internal evidence of the sagas is such as to give easy credence to them as records of exploration in regions previously unknown to civilization. The contact with savages would alone prove that.

During the middle ages the Scandinavians were the first to revive geographical science and to practise pelagic navigation. For six centuries previous to about 800, European interest in practical geographical expansion was at a standstill. During the 6th and 7th centuries, Irish anchorites, in their "passion for solitude," found their way to the Hebrides, Orkneys, Shetlands, Faroes and Iceland, but they were not interested in colonization or geographical knowledge. The discovery of new lands in the West by the Norsemen came in the course of the great Scandinavian exodus of the 9th, 10th and 11th centuries—the Viking Age—when Norsemen, Swedes and Danes swarmed over all Europe, conquering kingdoms and founding colonies. The main stream of Norsemen took a westerly course, striking Great Britain, Ireland and the Western Isles, and ultimately reached Iceland (in 874), Greenland (in 985) and Vinland (in 1000). This western migration was due mainly to political dissatisfaction in Norway, doubtless augmented by a restless spirit of adventure. The chiefs and their followers that settled Iceland were "picked men," the flower of the land, and sought a new home from other motives than want or gain. They sought political freedom. In Iceland they lived active, not to say tumultuous, lives, and left fine literary records of their doings and achievements. The Icelandic colony was an interesting forerunner of the American republic, having a prosperous population living under a republican government, and maintaining an independent national spirit for nearly four centuries.

Geographically Iceland belongs to America, and its colonization meant, sooner or later, the finding of other lands to the West. A century later Greenland was peopled from Iceland, and a colony existed for over four hundred years, when it was snuffed out, doubtless by hostile Eskimos. Icelandic records, among them the Vinland sagas, also a Norwegian work of the 13th century, called *Speculum regale* (The King's Mirror), and some papal letters, give interesting glimpses of the life of this colony. It was from the young Greenland colony that an attempt was made to establish a new outpost in Vinland, but plans for permanent settlement were given up on account of the hostility of the natives, with whom the settlers felt powerless to grapple. Gunpowder had not yet been invented.

Icelandic literature consists mainly of the so-called "sagas," or prose narratives, and is rich in historical lore. In the case of the Vinland sagas, however, there are two independent narratives of the same events, which clash in the record of details. Modern investigators have been interested in establishing the superiority of one over the other of the two narratives. One of them is the "Saga of Eric the Red" as found in the collection known as *Hauk's Book*, so called because the manuscript was made by Hauk Erlendsson, an Icelander who spent much of his life in Norway. It was copied, in part by Hauk himself, between the years 1305 and 1334, the date of his death, and probably during the period 1310–20. It is No. 544 of the Arne-Magnaean collection in Copenhagen. Another manuscript that tells the same story, with only verbal variations, is found in No. 557 of the same collection. This manuscript was made later than Hauk's, probably in the early part of the 15th century, but it is not a copy of Hauk's. Both were made independently from earlier manuscripts. The story as found in these two manuscripts has been pronounced by competent critics, especially Professor Gustav Storm of the university of Christiania, as the best and the most trustworthy record.

The other saga, which by chance came to be looked upon as the chief repository of facts concerning the Vinland voyages, is found in a large Icelandic work known as the *Flatey Book*, as it was once owned by a man who lived on Flat Island (Flatey), on the north-western coast of Iceland. This collection of sagas, completed in about 1380, is "the most extensive and most perfect of Icelandic manuscripts," and was sent to Denmark in 1662 as a gift to the king. It was evidently the general excellence of this collection that gave the version of the Vinland story that it contained precedence, in the works of early investigators, over the Vinland story of *Hauk's Book*. (Reeves's *Finding of Wineland* contains fine photographs of all the vellum pages that give the various Vinland narratives.)

According to *Flatey Book* saga, Biarni Heriulfsson, on a voyage from Iceland to Greenland in the early days of the Greenland colony, was driven out of his course and sighted new lands to the south-west. He did not go ashore (which seems strange), but sailed northward to Greenland. Fifteen years later, according to this account, Leif Ericsson set out from Greenland in search of the lands that Biarni had seen, found them and named them—Helluland (Flat-stone-land), Markland (Forestland) and Vinland. After his return to Greenland, several successive expeditions visited the new lands, none of which (strangely enough) experienced any difficulty in finding Leif's hut in the distant Vinland.

According to the Vinland saga in *Hauk's Book*, Leif Ericsson, whose father, Eric the Red, had discovered and colonized Greenland, set out on a voyage, in 999, to visit Norway, the native land of his father. He visited the famous King Olaf Tryggvason, who reigned from 995 to 1000, and was bending his energies toward Christianizing Norway and Iceland. He immediately saw in Leif a likely aid in the conversion of the Greenlanders. Leif was converted and consented to become the king's emissary to Greenland, and the next year (1000) started on his return voyage. The saga says that he was "tossed about" on this long voyage, and came upon an unknown country, where he found "self-sown wheatfields, and vines," and also some trees called "mösur," of which he took specimens. Upon his arrival in Greenland, Leif presented the message of King Olaf, and seems to have attempted no further expeditions. But his visits to the new lands aroused much interest, and his brother Thorstein made an unsuccessful attempt to find them. Later, in 1003, an Icelander, Thorfinn Karlsefni, who was visiting the Greenland colony, and who had married Gudrid, the widow of Leif's brother Thorstein, set out with four vessels and 160 followers to found a colony in the new lands. Here they remained three years, during which time a son, Snorri, was born to Thorfinn and Gudrid. This expedition, too, found "grapes and self-sown wheat," though seemingly not in any great abundance. Concerning the southernmost region of Vinland, the saga says: "They found self-sown wheatfields in the lowlands, but vines everywhere on higher places. . . . There were great numbers of wild animals in the woods." Then the saga relates that one morning a large number of men in skin canoes came paddling toward them and landed, staring curiously at them: "They were swarthy men and ill-looking, and the hair of their heads was ugly; they had large eyes and broad cheeks." Later the saga says: "No snow came there, and all of their live stock lived by grazing, and thrived." The natives appeared again the next spring, and a clash occurred. Fearing continued trouble with them, Karlsefni resolved to return to Greenland. This he did a year later, and spent the winter of 1006–7 there, whereupon he settled in Iceland. From him and Gudrid a number of prominent ecclesiastics claimed descent, and also Hauk Erlendsson. The Vinland story was doubtless a cherished family possession, and was put into writing, when *writing* sagas, instead of *telling* them, came into fashion. And here it is important to remember that before the age of writing in Iceland there was a saga-telling age, a most remarkable period of intellectual activity, by the aid of which the deeds and events of the seething life of the heroic age was carried over into the age of writing. "Among the medieval literatures of Europe, that of Iceland is unrivalled in the profusion of detail with which the facts of ordinary life are recorded, and the clearness with which the individual characters of numberless real persons stand out from the historic background" (*Origines Islandicae*). Icelandic literary history says that Ari the Learned (born in 1067) was "the first man in this land who wrote in the Norse tongue history relating to times ancient and modern." Among his works is the *Book of Settlements*, "a work of thorough and painstaking research unequalled in medieval literature" (Fiske). His work *The Book of Icelanders* is unfortunately lost, but an abridgment of it, *Libellus Islandorum*, made by Ari himself, contains a significant reference to Vinland. It tells that the colonists in Greenland found "both broken cayaks (canoes) and stone implements, whereby it may be seen that the same kind of folk had been there as they which inhabited Vinland, and whom the men of Greenland (*i.e.* the explorers) called the 'skrælings' (*i.e.* inferior people)." From this allusion one cannot but think that so keen and alert a writer as Ari had given some attention to Vinland in the lost work. But of this there is no other proof. We are left to affirm, on account of definite references in various sagas and annals to Leif Ericsson and the discovery of Vinland, that the saga as preserved in *Hauk's Book* (and also in No. 557) rested on a strong *viva voce* tradition that was early put into writing by a competent hand. Dr Finnur Jonsson of Copenhagen says: "The classic form of the saga and its vivid and excellent tradition surely carry it back to about 1200." This conservative opinion does not preclude the possibility, or even probability, that written accounts of the Vinland voyages existed before this date. Vigfusson, in speaking of the sagas in general, says: "We believe that when once the first saga was written down, the others were in quick succession committed to parchment, some still keeping their form through a succession of copies, other changed. . . . That which was not written down quickly, in due time, was lost and forgotten for ever."

The fact that there are discrepancies between the two versions as they appear in the *Hauk's Book* and in the *Flatey Book* does not justify the overthrow of both as historical evidence. The general truth of the tradition is strengthened by the fact that it has come down from two independent sources. One of them must be the better, however, and this it is the province of competent scholars to determine. The best modern scholarship gives the precedence to the *Hauk's Book* narrative, as it harmonizes better with well-established facts of Scandinavian history, and is besides a more plausible account. In accordance with this decision, Biarni Heriulfson's adventure should be eliminated, the priority of discovery given to Leif Ericsson, and the honour of being the first European colonists on the American continent awarded to Thorfinn Karlsefni and his followers. This was evidently the only real attempt at colonization, despite the numerous contentions to the contrary. Under date of 1121 the Icelandic annals say: "Bishop Eric of Greenland went in search of Vinland." Nothing further is recorded. The fact that his successor as bishop was appointed in 1123 would seem to indicate that the Greenlanders had information that Eric had perished.

The only important phase of the Vinland voyages that has not been definitely settled is the identifications of the regions visited by Leif and Thorfinn. The Danish antiquarian Rafn, in his monumental *Antiquitates Americanae*, published in 1837, and much discussed in America at that time, held for Rhode Island as Leif's landfall and the locality of Thorfinn's colony. Professor E. N. Horsford, in a number of monographs (unfortunately of no historical or scientific value), fixed upon the vicinity of Boston, where now stand a Leif Ericsson statue and Horsford's Norumbega Tower as testimonials to the Norse explorers. But in 1887 Professor Storm announced his conviction that the lands visited by the Norsemen in the early part of the 11th century were Labrador, Newfoundland and Nova Scotia. And a careful reading of the *Hauk's Book* narrative seems to show that the numerous details of the saga fit Nova Scotia remarkably well, and much better than any other part of the continent. This view has in recent years been quite generally accepted by American scholars. But in 1910 Professor M. L. Fernald, a botanist of Harvard University, published a paper in *Rhodora*, vol. 12, No. 134, in which he contends that it is most probable that the "vinber" of the sagas were not "grapes," but "wine-berries," also known as the mountain or rock cranberries. The "self-sown wheat" of the sagas he identifies as strand wheat, instead of Indian corn, or wild rice, and the mösur trees as the canoe birch. He thinks the natives were Eskimos, instead of American Indians, as stoutly maintained by John Fiske. Professor Fernald concludes his paper by saying that: "The mass of evidence which the writer has in hand, and which will soon be ready for publication, makes it clear that, if we read the sagas in the light of what we know of the abundant occurrence north of the St Lawrence of the 'vinber' (*Vaccinium Vitis-Idaea* or possibly *Ribes triste*, *R. prostratum*, or *R. lacustre*), 'hveiti' (*Elymus arenarius*), and 'mösur' (*Betula alba*, i.e. *B. papyrifera* of many botanists), the discrepancies in geography, ethnology and zoology, which have been so troublesome in the past, will disappear; other features, usually considered obscure, will become luminous; and the older and less distorted sagas, at least in their main incidents, will become vivid records of actual geographic exploration."

It is possible that Professor Fernald may show conclusively that Leif's landfall was north of the St Lawrence. That the "vinber" were mountain cranberries would explain the fact, mentioned in the *Flatey Book* saga, that Leif filled his after-boat with "vinber" *in the spring*, which is possible with the cranberries, as they are most palatable after having lain under the snow for the winter. But Thorfinn Karlsefni found no abundance of "vinber," in fact one of his followers composed some verses to express his disappointment on this score. "Vines" were found only in the southernmost regions visited by Karlsefni. It is to be noted that the word "vines" is more prominent in the *Hauk's Book* narrative than the word "vinber." At present it does not seem likely that Professor Fernald's argument will seriously affect Professor Storm's contention that Thorfinn's colony was in Nova Scotia. At any rate, the incontrovertible facts of the Vinland voyages are that Leif and Thorfinn were historical characters, that they visited, in the early part of the 11th century, some part of the American continent south-west of Greenland, that they found natives whose hostility prevented the founding of a permanent settlement, and that the sagas telling of these things are, on the whole, trustworthy descriptions of actual experience.

Bibliography.—The bibliography of this subject is large, but adequate documents, accounts and discussions may be found in the following modern works: Gustav Storm, *Studies on the Vineland Voyages* (Copenhagen, 1889); Arthur M. Reeves, *The Finding of Wineland, the Good* (London, 1890 and 1895); John Fiske, *The Discovery of America*, vol. i. (Boston, 1892); Juul Dieserud, "Norse Discoveries in America," in *Bulletin of the American Geographical Society*, vol. xxxiii. (New York, 1901); Gudbrandr Vigfússon and F. Yorke Powell, *Origines Islandicae* (Oxford, 1905); and Julius E. Olson and others, *The Northmen, Columbus and Cabot, 985–1503* (New York, 1906), the first volume of Original Narratives of Early American History. (J. E. O.)

VINOGRADOFF, PAUL (1854–), Anglo-Russian jurist, was born at Kostroma in Russia. He became professor of history in the university of Moscow, but his zeal for the spread of education brought him into conflict with the authorities, and consequently he was obliged to leave Russia. Having settled in England, Vinogradoff brought a powerful and original mind to bear upon the social and economic conditions of early England, a subject which he had already begun to study in Moscow. His *Villainage in England* (1892) is perhaps the most important book written on the peasantry of the feudal age and the village community in England; it can only be compared for value with F. W. Maitland's *Domesday Book and Beyond*. In masterly fashion Vinogradoff here shows that the villein of Norman times was the direct descendant of the Anglo-Saxon freeman, and that the typical Anglo-Saxon settlement was a free community, not a manor, the position of the freeman having steadily deteriorated in the centuries just around the Norman Conquest. The status of the villein and the conditions of the manor in the 12th and 13th centuries are set forth with a legal precision and a wealth of detail which shows its author, not only as a very capable historian, but also as a brilliant and learned jurist. Almost equally valuable was Vinogradoff's essay on "Folkland" in vol. viii. of the *English Historical Review* (1893), which proved for the first time the real nature of this kind of land. Vinogradoff followed up his *Villainage in England* with *The Growth of the Manor* (1905) and *English Society in the 11th Century* (1908), works on the lines of his earlier book. In 1903 he was appointed Corpus professor of jurisprudence in the university of Oxford, and subsequently became a fellow of the British Academy. He received honorary degrees from the principal universities, was made a member of several foreign academies and was appointed honorary professor of history at Moscow.

VINOY, JOSEPH (1803–1880), French soldier, was originally intended for the Church, but, after some years at a seminary, he decided upon a military career, and entered the army in 1823. When he was a sergeant in the 14th line infantry, he took part in the Algerian expedition of 1830. He won his commission at the capture of Algiers, and during the subsequent campaigns he rose by good service to the rank of colonel. He returned to France in 1850, and in the Crimean War served under Canrobert as general of brigade. For his brilliant conduct at the Malakoff he was promoted general of division, and he led a division of Niel's corps in the campaign of Solferino. Retired on account of age in 1865, he was recalled to active service on the outbreak of the war of 1870, and after the early reverses was put at the head of the XIII. army corps, which, fortunately for France, did not arrive at the front in time to be involved in the catastrophe of Sedan. By a skilful retreat he brought his corps intact to Paris on September 7th. Vinoy during the siege commanded the III. army operating on the south side of the capital and took part in all the actions in that quarter. On Trochu's resignation he was appointed to the supreme command, in which capacity he had to negotiate the surrender. During the commune he held important commands in the army of Versailles, and occupied the burning Tuileries and the Louvre on May 23rd. He was in the same year made grand chancellor of the Legion of Honour.

Vinoy wrote several memoirs on the war of 1870–71: *Opérations de l'armée pendant le siège de Paris* (1872), *L'Armistice et la commune* (1872), *L'Armée française* (1873).

VINT, a Russian card-game. It is generally considered as the immediate ancestor of Bridge (*q.v.*). *Vint* means in Russian "screw," and is given to the game because the four players, each in turn, propose, bid and overbid each other until one, having bid higher than the others care to follow, makes the trump, his *vis-à-vis* becoming his partner. It has many points of resemblance to Bridge. The cards have the same rank; the score of tricks is entered under the line, and points for *slam*, penalties and honours above the line; while the value of the different suits is the same as in Bridge: spades, clubs, diamonds, hearts and "no trumps." In a "no trump" declaration aces only count as honours; in a suit declaration both the aces and the five next highest cards. During the progress of the bidding and declaring, opportunity is taken by the players to indicate by their calls their strength in the various suits and the high cards they hold, so that, when the playing begins, the position of the best cards and the strength of the different hands can often be fairly accurately estimated.

The leads are subject to much the same rules as those in Bridge.

See *The Laws and Principles of Vint*, edited by Frank W. Haddan (London, 1900).

VINTON, FREDERIC PORTER (1846–), American portrait painter, was born at Bangor, Maine, on the 29th of January 1846. He was a pupil of Duveneck, of William M. Hunt in Boston, of Léon Bonnat and Jean Paul Laurens in Paris, and of the Royal Academy of Munich. In 1891 he was elected a full member of the National Academy of Design, New York.

VIOL, a generic term for the bowed precursors of the violin (*q.v.*), but in England more specially applied to those immediate predecessors of the violin which are distinguished in Italy and Germany as the *Gamba* family. The chief characteristics of the viols were a flat back, sloping shoulders, "c"-shaped sound-holes, and a short finger-board with frets. All these features were changed or modified in the violin, the back becoming delicately arched, the shoulders reverting to the rounded outline of the guitar or troubadour fiddle, the shape of the sound-holes changing from "c" to "f," and the finger-board being carried considerably nearer the bridge. The viols, of which the origin may be traced to the 13th and 14th century German Minnesinger fiddle, characterized also by sloping shoulders, can hardly be said to have evolved into the violin. The latter was derived from the guitar-fiddle through the Italian lyre or viol-lyra family, distinguished as *da braccio* and *da gamba*, and having early in the 17th century the outline and "f" sound-holes of the violin. The viol family consisted of treble, alto, tenor and bass instruments, being further differentiated as *da braccio* or *da gamba* according to the position in which they were held against the arm or between the knees. The favourite viol da gamba, or division viol, frequently had a man or a woman's head instead of the scroll finish to the peg-box, and sometimes a few fine wire sympathetic strings tuned an octave higher than the strings in the bridge.

Michael Praetorius mentions no less than five sizes of the viol da gamba, the largest corresponding to the double bass, and in a table he notes the various accordances in use for each. He carefully distinguishes these instruments as *violen* and the viole da braccio (our violin family) as *geigen*. Of the latter he gives six sizes, the highest being the *pochette* with vaulted back, a rebec in fact, and the lowest corresponding to the violoncello, which he calls bass viol or geige da braccio.

The viols were very popular in England in the 16th and 17th centuries, holding their own for a long time after the introduction of the louder-toned violin; they are fully described and figured in the musical works of the period, and more especially in Christopher Simpson's *Division Viol* (1667), Thomas Mace's *Musick's Monument* (1676) and John Playford's *Introduction to the Skill of Music*.

(K. S.)

VIOLA [Fr. *viole*, Ger. *Bratsche*, Ital. *viola*, *alto*], the tenor member of the violin family. The construction of the viola is the same, but on a larger scale, as that of the violin (*q.v.*). The instrument is pitched a perfect fifth below the violin.

VIOLET. The violets comprise a large botanical genus (*Viola*)—in which more than 200 species have been described—found principally in temperate or mountain regions of the northern hemisphere; they also occur in mountainous districts of South America and South and Tropical Africa, while a few are found in Australasia. The species are mostly low-growing herbs with alternate leaves provided with large leafy stipules (fig. 1). The flowers, which are solitary, or rarely in pairs, at the end of slender axillary flower-stalks, are very irregular in form, with five sepals prolonged at the base, and five petals, the lowest one larger than the others and with a spur, in which collects the honey secreted by the spurs of the two adjoining stamens. The five anthers are remarkable for the coloured processes which extend beyond the anther cells and form a sort of cone around the style (fig. 2). The ovary is superior and one-celled, with three parietal placentas and numerous ovules; it bears a single style, which ends in a dilated or hood-like stigma (fig. 3). The fruit is a capsule bursting loculicidally, *i.e.* through the centre of each of the three valves. By the contraction of the valves the small smooth seeds, which form a row down the centre, are shot out to some little distance from the parent plant. The irregular construction of the flower is connected with fertilization by insect agency. To reach the honey in the spur of the flower, the insect must thrust its proboscis into the flower close under the globular head of the stigma. This lies in the anterior part of a groove fringed with hairs on the inferior petal. The anthers shed their pollen into this groove, either of themselves or when the pistil is shaken by the insertion of the bee's proboscis. The proboscis, passing down this groove to the spur, becomes dusted with pollen; as it is drawn back, it presses up the lip-like valve of the stigma so that no pollen can enter the stigmatic chamber; but as it enters the next flower it leaves some pollen on the upper surface of the valve, and thus cross-fertilization is effected. In the sweet violet, *V. odorata* and other species, inconspicuous permanently closed or "cleistogamic" flowers (fig. 4) occur of a greenish colour, so that they offer no attractions to insect visitors and their form is correspondingly regular. The anthers are so situated that the pollen on escaping comes into contact with the stigma; in such flowers self-fertilization is compulsory and very effectual, as seeds in profusion are produced.

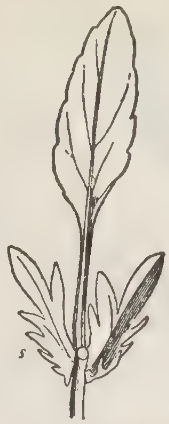


FIG. 1.—Leaf of *Viola tricolor* (Pansy) showing the large leafy stipules (*s*).

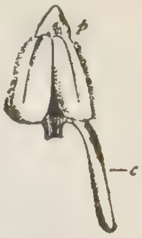


FIG. 2.—Two Stamens of *Viola tricolor* (Pansy), with their two anther lobes and the process *p* extending beyond them. One of the stamens has been deprived of its spur; the other shows its spur, *c*.

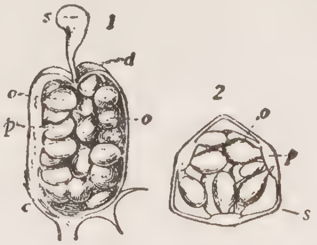


FIG. 3.—Pistil of *Viola tricolor* (Pansy). 1. Vertical section to show the ovules *o*, attached to the parietes. Two rows of ovules are seen, one in front and the other in profile. *p*, a thickened line on the walls forming the placenta; *c*, calyx; *d*, ovary; *s*, hooded stigma terminating the short style. 2. Horizontal section of the same. *p*, placenta; *o*, ovules; *s*, suture, or median line of carpel.

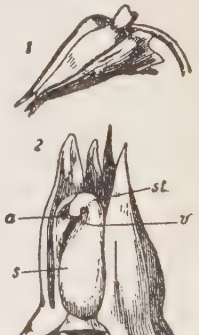


FIG. 4.—Cleistogamic Flower of *Viola sylvatica*. 1. Flower. 2. Flower more highly magnified and cut open. *a*, anther; *s*, pistil; *st*, style; *v*, stigmatic surface.

Several species of *Viola* are native to Great Britain. *Viola canina* (fig. 5) is the dog violet, many forms or subspecies of which are recognized; *V. odorata*, sweet violet, is highly prized for its fragrance, and in cultivation numerous varieties have originated. The Neapolitan or Parma violet (var. *pallida plena*) is a form with very sweet-scented, double, pale lavender flowers; var. *sulphurea* has shining deep green leaves and lemon-yellow flowers, deeper yellow in the centre, and with a pale-violet spur. Sweet violets like a rich, fairly heavy soil, with a north or north-west aspect if possible;

they are readily increased by dividing the crowns after flowering. Other species known in gardens are: *V. altaica*, flowers yellow or violet with yellow eye; *V. biflora*, a pretty little species 3–4 in. high with small yellow flowers, the large petal being streaked with black; *V. calcarata*, flowers light blue or white, or yellow in var. *flava*; *V. cornuta*, flowers pale blue—there are a few good varieties of this, including one with white flowers; *V. cucullata*, a free-flowering American species with violet-blue or purple flowers; *V. Munbyana*, a native of Algeria, with large violet or yellow flowers; *V. pedata*, the bird's-foot violet, with pedately divided leaves and usually bright blue flowers; *V. rothomagensis*, a native of western Europe, with flowers bright blue striped with black, and sometimes called the Rouen violet; and *V. suavis*, a native of Asia Minor, the Russian violet, with pale-blue sweet-scented flowers. The garden pansies or heartseases are derivatives from *V. tricolor*, a cornfield weed, or *V. altaica*, a native of the Altai mountains. (See PANSY.) "Bedding violas," which differ from pansies in some slight technical details, have been raised from *V. cornuta* and *V. lutea* by crossing with the show pansies. The application of an infusion of violet leaves was at one time believed to have the power of reducing the size of cancerous growths, but its use is now discredited.

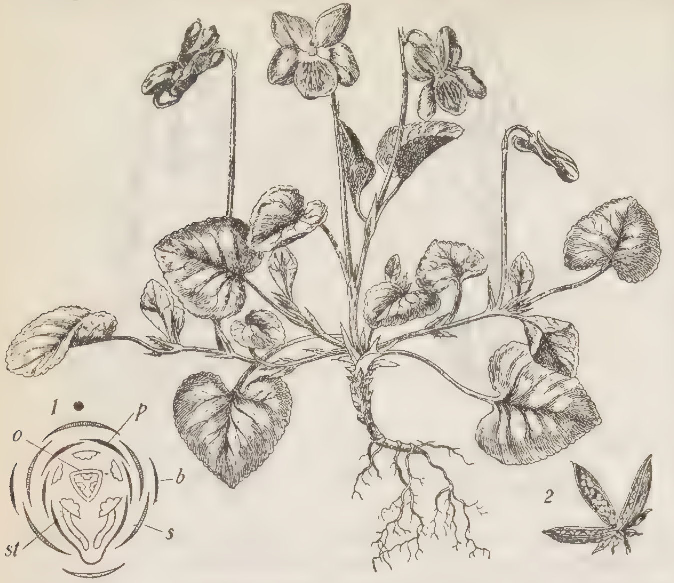
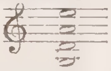
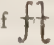


FIG. 5.—Dog Violet (*Viola canina*).

1. Floral diagram of *Viola*, showing arrangement of parts in horizontal plan. *b*, pair of bracteoles below the flower; *s*, sepals; *p*, petals; *st*, stamens; *o*, ovary.
2. Fruit, split open.

VIOLIN, a musical instrument consisting essentially of a resonant box of peculiar form, over which four strings of different thicknesses are stretched across a bridge standing on the box, in such a way that the tension of the strings can be adjusted by means of revolving pegs to which they are severally attached at one end. The strings are tuned, by means of the pegs, in fifths, from the second or A string, which is tuned to a fundamental note of about 435 vibrations per second at the modern normal pitch: thus giving  as the four open notes. To produce other notes of the scale the length of the strings is varied by stopping them with the fingers on a finger-board, attached to a "neck" at the end of which is the "head" in which the pegs are inserted. The strings are set in vibration by drawing across them a bow strung with horse-hair, which is rosined to increase adhesion.

The characteristic features which, in combination, distinguish the violin (including in that family name its larger brethren the viola and the violoncello) from other stringed instruments are: the restriction of the strings to four, and their tuning in fifths; the peculiar form of the body, or resonating chamber, especially the fully moulded back as well as front, or belly; the shallow sides or "ribs" bent into characteristic curves; the acute angles of the corners where the curves of the ends and middle "bouts" or waist ribs meet; and the position and shape of the sound-holes, cut in the belly. By a gradual process of development in all these particulars the modern violin was evolved from earlier bowed instruments, and attained its highest perfection at the hands of the great Italian makers in the 16th, 17th and early 18th centuries, since which time, although many experiments have been made, no material improvement has been effected upon the form and mode of construction then adopted.

The *body*, or sounding-box, of the violin is built up of two arched plates of thin wood, the belly and the back, united by side pieces or ribs to form a shallow box. The belly is cut from soft elastic wood, pine being universally used for this purpose, while the back is made of a close-grained wood, generally sycamore or maple. Both back and belly are carved to their model from the solid, but for utilitarian reasons are generally, though not always, built up of two longitudinal sections; while the sides or ribs, of very thin sycamore or maple, usually in six sections, are bent on a mould, by the aid of heat, to the required form. Into the corners are glued corner-blocks of soft wood, which help to retain the ribs in their sharply recurved form, and materially strengthen the whole structure. Into the angle of the joints between the sides and the back and belly are glued thin lining strips, bent to the mould, giving a bearing surface for the glued joint along the whole outline of the instrument; while, in addition, end blocks are inserted at the head and bottom of the body, the former to receive the base of the neck, and the latter the "tail pin" to which is attached the tail-piece, carrying the lower (fixed) ends of the strings. The belly is pierced with two sound-holes in the form of  near, and approximately parallel to, the "bouts." The size, shape and position of these holes have an important influence on the character of the tone of the instrument, and present distinctive variations in the instruments of the different great makers.

The *neck*, made of maple, is glued and now always mortised into the block at the upper end of the body,[1] bearing against a small semicircular projection of the back, and is inclined at such an angle that the finger-board, when glued on to its upper surface, may lie clear of the belly, over which it projects, but in such relation to the height of the bridge as to allow the strings to be stretched nearly parallel to, and at a convenient distance above, its own surface.

The *bridge*, cut out of maple, in the peculiar form devised by Stradivari in the 17th century, and not since materially departed from, is in the violin about 1¼ in. high by 1¾ in. wide, and tapers in thickness from about ⅛ in. at the base to $\frac{1}{16}$ at the crown; but the dimensions of this very important member vary for different instruments according to the arch of the belly, the strength of the wood and other considerations. It is placed on the belly exactly midway between the sound-holes and in such a position as to stand on a transverse line dividing the surface into two approximately equal areas, that is, about 1½ in. below the middle, the lower end of the body being wider than the upper part or shoulders; whereby a greater length is rendered available for the vibrating portion of the strings.

A short distance behind the right foot of the bridge, the *sound-post*, a rod of soft pine about ¼ in. thick, is fixed inside the body in contact with the belly and the back, and serves directly, not only to sustain the belly against the pressure of the bridge under the tension of the strings, but to convey vibrations to the back. It also exercises a very important influence on the nodal arrangement of these vibrating plates. The pressure of the other foot of the bridge, where the tension of the fourth string is far less than that of the first string, is partly sustained by the *bass-bar*—a strip of wood tapering from the middle to both ends, which is glued underneath the belly and extends to within rather less than 2 in. of the ends of the instrument. This fitting not only serves to strengthen the belly mechanically, but exerts a profound effect upon the vibrations of that plate.

The fixed structure is completed by the *head*, which surmounts the neck and consists primarily of a narrow box into the sides of which are inserted the pegs round which the free ends of the strings are wound. The head is finished by an ornamentation which in the hands of the Italian makers followed the traditional pattern of a scroll, or volute, offering the skilled craftsmen infinite scope for boldness and freedom in its execution; but sometimes, especially in the Tirolean instruments, it was carved in the form of an animal's head, usually a lion's.

The *strings*, fastened at one end to an ebony *tail-piece* or tongue, which is itself attached by a gut loop to the pin at the base of the instrument, pass over the bridge, along the finger board and over the *nut* (a dwarf bridge forming the termination of the finger-board) to the pegs. The effective vibrating portion of the strings is accordingly the length between the nut and the bridge, and measures now in an ordinary full-sized violin about 13 in. The portion of the strings to which the bow is applied lies over the space, measuring about $2\frac{1}{4}$ in., between the bridge and the free end of the finger-board. The strings are manufactured from so-called catgut, made from the intestines of lambs, and range in thickness from the first to the third or D string from ·026 to ·046 in. more or less. The necessary weight is given to the string of lowest pitch, G, without unduly sacrificing its elasticity, by winding a thin gut string with fine silver wire to about the same thickness as the A string.

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[1] Up to about the year 1800 the old Italian makers, including Stradivari (in his earlier instruments), usually strengthened the attachment of the neck by driving nails, frequently three and sometimes four, through the top block into the base of the neck, which was not mortised into the block.

An ornamental feature characteristic of nearly all violins is the *purfling*, a very thin slip of wood with margins of ebony or (rarely) whalebone, inlaid in thin strips close to the edge of both plates, and following the entire outline of the instrument. In some instruments, especially of the Brescian school, a double line of purfling was inserted.

The total number of pieces of wood of which the violin is composed amounts to about 70, varying, as the plates are made in one piece or built together, and with the number of sections in which the ribs are put together. Of this number 57 pieces are built into the permanent structure, while 13 may be described as fittings. The whole of the permanent structure is cemented together with glue alone, and it is a striking testimony to the mechanical conditions satisfied by the design, that the instrument built of such slender material withstands without deformation the considerable stresses applied to it. It is worthy of remark that after the lapse of so many years, since it attained perfect musical efficiency, no unessential adjunct has entered into the construction of this instrument. No play of fancy has grafted anything beyond quite minor ornamentation on a work of art distinguished by its simplicity of pure outline and proportion.

The following are the exact principal dimensions of a very fine specimen of Stradivari's work, which has been preserved in perfect condition since the latter end of the 17th century:—

Length of body	= 14 in. full.
Width across top	= $6\frac{11}{16}$ in. bare.
Width across bottom	= $8\frac{1}{4}$ in.
Height of sides (top)	= $1\frac{3}{16}$,,
Height of sides (bottom)	= $1\frac{7}{32}$,,

The back is in one piece, supplemented a little in width at the lower part, after a common practice of the great makers, and is cut from very handsome wood; the ribs are of the same wood, while the belly is formed of two pieces of soft pine of rather fine and beautifully even grain. The sound-holes, cut with perfect precision, exhibit much grace and freedom of design. The scroll, which is very characteristic of the maker's style and beautifully modelled, harmonizes admirably with the general modelling of the instrument. The model is flatter than in violins of the earlier period, and the design bold, while displaying all Stradivari's microscopic perfection of workmanship. The whole is coated with a very fine orange-red-brown varnish, untouched since it left the maker's hand in 1690, and the only respects in which the instrument has been altered since that date are in the fitting of the longer neck and stronger bass-bar necessitated by the increased compass and raised pitch of modern violin music.

The measurements given above are the same as those of a well-known Stradivari of later date (1714).

Acoustics.

The acoustics of the violin are extremely complex, and notwithstanding many investigations by men of science, and the enunciation of some plausible hypotheses with regard to details of its operation as a musical instrument, remain as a whole obscure. So far as the elementary principles which govern its action are concerned, the violin follows familiar laws (see SOUND). The different notes of the scale are produced by vibrating strings differing in weight and tension, and varying in length under the hand of the player. The vibrations of the strings are conveyed through the bridge to the body of the instrument, which fulfils the common function of a resonator in reinforcing the notes initiated by the strings. So far first principles carry us at once. But when we endeavour to elucidate in detail the causes of the peculiar character of tone of the violin family, the great range and variety in that character obtained in different instruments, the extent to which those qualities can be controlled by the bow of the player, and the mode in which they are influenced by minute variations in almost every component part of the instrument, we find ourselves faced by a series of problems which have so far defied any but very partial solution.

The distinctive quality of the musical tones of the violin is generally admitted to be due largely to its richness in the upper harmonic or partial tones superimposed on the fundamental notes produced by the simple vibrations of the strings.

The characteristic tone and its control by the player are undoubtedly conditioned in the first place by the peculiar path of the vibrating string under the action of the rosined bow. This takes the form not of a symmetrical oscillation but of a succession of alternating bound and free movements, as the string adheres to the bow according to the pressure applied and, releasing itself by its elasticity, rebounds.

The lightness of the material of which the strings are made conduces to the production of very high upper partial tones which give brilliancy of sound, while the low elasticity of the gut causes these high constituents to be quickly damped, thus softening the ultimate quality of the note.

In order that the resonating body of the instrument may fulfil its highest purpose in reinforcing the complex vibrations set up by the strings vibrating in the manner above described, not only as a whole, but in the number of related segments whose oscillations determine the upper partial tones, it is essential that the plates, and consequently the body of air contained between them, should respond sensitively to the selective impulses communicated to them. It is the attainment of this perfect selective responsiveness which marks the construction of the best instruments. Many factors contribute to this result. The thickness of the plates in different parts of their areas, the size and form of the interior of the body, the size and shape of the sound-holes through which the vibrations of the contained air are communicated to the external air, and which also influence the nodal points in the belly, according to the number of fibres of the wood cut across, varying with the angle at which the sound-holes cross the grain of the wood. Their position in this respect also affects the width of the central vibrating portion of the belly under the bridge.

All these important factors are influenced by the quality and elasticity of the wood employed.

Much has been written and many speculations have been advanced with regard to the superiority in tone of the old Italian instruments over those of modern construction. This superiority has sometimes been disputed, and, judging from the many examples of second-rate instruments which have survived from the 17th and 18th centuries, it is certain that antiquity alone does not confer upon violins the merits which have frequently been claimed for it. When, however, we compare the comparatively few really fine specimens of the Italian school which have survived in good condition, with the best examples of modern construction in which the proportions of the older masterpieces have been faithfully followed, and in which the most careful workmanship of skilled hands has been embodied, it cannot be denied that the former possess a superiority in the quality of their tone which the musical ear immediately recognizes. After taking into account the practical identity in dimensions and construction between the classical and many of the best modern models, the conclusion suggests itself that the difference must be attributed to the nature of the materials used, or to the method of their employment, as influenced by local conditions and practice. The argument, not infrequently advanced, that the great makers of Italy had special local sources of supply, jealously guarded, for wood with exceptional acoustical properties, can hardly be sustained. Undoubtedly they exercised great care in the selection of sound and handsome wood; but there is evidence that some of the finest wood they used was imported from across the Adriatic in the ordinary course of trade; and the matter was for them, in all probability, largely one of expense. There is good reason to suppose that a far larger choice of equally good material is accessible to modern makers.

There remains the varnish with which the completed instrument is coated. This was an item in the manufacture which received most careful attention at the hands of the great makers, and much importance has been attached to the superiority of their varnish over that used in more recent times—so much so that its composition has been attributed to secret processes known only to themselves. The probability is that they were able to exercise more personal selection of the materials used than has been generally practised by makers dependent upon commercial products under modern conditions, and the general result has been analogous to that seen in the pigments employed by modern painters as compared with those made up for themselves by the old masters who could ensure perfect purity in their ingredients. But that the Italian makers individually or collectively attempted, or were able, to preserve as a secret the composition of the varnish they used is unlikely. Instruments exhibiting similar excellence in this respect were too widespread in their range, both of period and locality, to justify the assumption that the general composition of the finest varnish of the early makers was not a matter of common knowledge in an industry so flourishing as that of violin-making in the 17th and early 18th centuries. The excellence of an instrument in respect of its varnish depended on the quality of the constituent materials, on the proportions in which they were combined, and, perhaps mainly, on the method of its application. The most enduring and perfect varnish used for violins is an oil varnish, and the best results therewith can only be obtained under the most advantageous conditions for the drying process. In this respect there can be no doubt that the southern climate placed the makers whose work lies in higher latitudes at a disadvantage. In a letter to Galileo in 1638 concerning a violin he had ordered from Cremona, the writer states that "it cannot be brought to perfection without the strong heat of the sun"; and all recorded experience indicates the great importance of slow drying of the varnish under suitable conditions. Stradivari himself wrote to account for delay in the delivery of an instrument because of the time required for the drying of the varnish.

That a perfect varnish conduces to the preservation of a fine tone in the instrument is generally admitted; and its operation in this respect is due, not merely to the external protection of the wood from deterioration, but especially to its action, when supplied under favourable conditions to wood at a ripe stage of seasoning (when that process has proceeded far enough, but not so far as to allow the fibres to become brittle), in soaking into the pores of the wood and preserving its elasticity. This being so, successful varnishing will be seen to be an operation of great delicacy, and one in which the old masters found full scope for their skill and large experience. The effects, upon the vibrational qualities of the wood, of thickness of coat, texture and gradual absorption into the pores of the wood under favourable conditions of drying, are great and far-reaching, as is proved in the survival through two centuries of the great qualities of the specimens most fittingly treated in this respect.

After the early part of the 18th century the use of the fine oil varnish employed by the great makers was gradually abandoned, concurrently with the decline of the instrument maker's art in Italy. Except in the hands of the fast-diminishing band of craftsmen trained in the old traditions, its place was taken by the newer spirit varnishes which, with their quick-drying qualities and ease of application, satisfied the requirements of the more cheaply manufactured instruments of the period following the death of Stradivari; and before the end of the century these inferior varnishes had quite supplanted the old recipes.

Having regard to all these considerations it is not unreasonable to conclude that the varnish of the old instruments contributed probably the most important single element of their superiority in tone to their more modern copies. It must, however, be borne in mind that the instrument makers of the 16th and 17th centuries carried on a great and flourishing and a highly developed craft; and that their best creations owe their distinction largely to causes similar to those which produced the great art works of the same period. The violin makers had a lifelong training in their craft. The productions of the famous among them were eagerly sought after. Throughout western Europe the highest in the land were true amateurs of music and vied with one another to secure the masterpieces of Brescia and Cremona. In such circumstances the trained judgment and wide experience of the craftsman were naturally concentrated upon securing the preliminary conditions of high excellence in his work: the choice of sound and handsome wood; perfection of design and workmanship; the composition of his varnish, and the utmost care and skill in applying it under the best conditions; and, not least important, time for deliberate and thoughtful production. The masterpieces of that period were not constructed upon any exact or scientific system, but were the products of development of a traditional craft working on empirical lines. Such theories of their construction as have been propounded are based on analysis of an already perfected organism; and careful historical research has revealed no record or trace of laws or rules by which the great makers worked.

Elaborate attempts have been made, notably by Savart early in the 19th century, to educe from experiments on the elasticities and vibration periods of various specimens of wood used in some of the older instruments an exact system for the adjustment of these factors to the production of the best results; but data obtained by experiments with test specimens of regular shape do not carry us very far when applied to so complex and irregular a structure as the violin. The vibrating plates of the violin are neither symmetrical nor uniform in dimensions. They are not free plates, but are fixed round the whole edge of a very irregular outline; and these conditions, taken together with their unsymmetrically arched form, held under pressure by the tension of the strings, establish a state of complex stresses under vibration which have so far escaped analysis. Their vibratory movements are moreover influenced by so many accessory features of the instrument, such as the bass-bar, already described, the reaction of the sound-post, and the different pressures by the two feet of the bridge, that it is impossible to figure closely the vibrations of any given area of the instrument. It is certainly very remarkable that so precise a pattern of irregular form should have been arrived at empirically, and should have survived as the standard, apparently for all time. Not only is the arch of the plates unsymmetrical in its longitudinal section, but, as is less commonly noticed, the upper bouts, especially in violins of the Cremona school, are slightly shallower than the lower; so that the edges of the belly are not strictly parallel to those of the back, but the two plates converge in the direction of the head. Probably the most successful attempts at analysing the vibrations of the violin have been those made by Sir William Huggins, by means of direct tactile observation with the finger holding a small rod of soft wood upon various spots on the surface of the vibrating plates. By this method he made a number of observations partially confirming, and in part correcting the determinations of previous investigators. He found that the position of maximum vibration of the belly is close to the foot of the bridge, under the fourth string, while that of least vibration is exactly over the top of the sound-post. The back, which is strongly agitated, also has its point of least vibration where the sound-post rests upon it. With the sound-post removed the belly vibrated almost equally on both sides of its area, while the vibration of the back was very feeble, and the tone became very poor; supporting the view that in the complete instrument the vibrations of the back are derived from the belly mainly through the sound-post. Pressure on that point in the belly normally in contact with the top of the sound-post partially restored the proper character though not the power of the tone; indicating the important function of the sound-post in establishing a nodal point which largely determines the normal vibration of the belly. Modifications of the material of which the sound-post was made produced a profound effect upon the quality, but comparatively small effect upon the power of the tone. Of the part played by the sides in transmitting vibrations from belly to back, the most important share is borne by the middle bouts, or incurved sides at the waist of the instrument.

Experiments made lately afford some interesting evidence as to the nature of the vibrations set up in a sounding-box in response to those of a string at various pitches and under various conditions of bowing. These observations were made on a monochord and restricted to one portion of a sounding-board of regular shape. Experiments on similar lines made with an actual violin body might throw further light upon the behaviour of that instrument as a resonator; but such researches entail prolonged investigation.

Two phenomena, familiar to violin players, are suggestive of further lines of research that may help to elucidate the problems of the localization of the principal responses in the body of the violin, and of the action of the wood under vibration. Many violins, especially old and inferior ones, fail to resonate clearly and fully to particular notes, the sounds produced being commonly known as "Wolf" notes; and these notes are, certainly sometimes and possibly always, associated with particular spots in the body of the instrument; for, if pressure be applied at these spots, the resonance of the respective "Wolf" notes is improved. This observation suggests that the region concerned has been cut, or has become disproportionately thin in relation to the normal thickness of the plate; and, when stimulated by the appropriate note, sets up a local system of vibrations, which interfere with, instead of sharing, the proper vibrations of the plate as a whole; this interfering vibration being damped by local pressure. These defects are said to develop with age and constant use, and to be minimized by the use of thin strings but aggravated by thick ones; a circumstance which tends to support the hypothesis of thin regions in the plate, which might be expected to respond more truly to the vibrations of lighter, than to those of heavier strings. Detailed investigation of these phenomena on the lines of the experiments already referred to may have valuable results. Another well-known characteristic of the violin is that a new instrument, or one that has been long in disuse, is found to be "sleepy," that is, it fails to speak readily in response to the bow, a defect which gradually disappears with use. Experiments made to test the effect of prolonged transverse vibrations upon strips of suitable wood have shown that such treatment increases the flexibility of the wood, which returns to its normal degree of rigidity after a period of rest. No conclusive interpretation of these experiments has yet been offered; but they indicate the probability of modifications of the internal viscosity of the wood, by molecular changes under the influence of continued vibratory movement.

The function of the bridge, as above mentioned, is to communicate the vibrations of the strings to the resonating body of the violin. This communication is made mainly, though not entirely, through the left foot of the bridge, which under the comparatively low tension of the G string rests with light pressure upon the belly, which at that point has accordingly greater freedom of movement than under the other foot, in proximity to which the sound-post, extending from back to belly, maintains that region of the plates in a state of relative rigidity, under the high tension of the E string. The view, however, maintained by some writers that the right foot of the bridge communicates no vibrations directly to the belly is inaccurate. The main object of placing the sound-post some distance behind, instead of immediately under, the bridge foot is to allow the belly under that foot to vibrate with some freedom. This has been proved by the destructive effect produced upon the tone by fixing the sound-post immediately under the foot of the bridge.

The form into which the bridge is fretted after the pattern devised by Stradivari has given rise to some speculation; but the justification of this form is probably to be found in the explanation propounded by Sir William Huggins, namely, that the strings, when agitated by the bow, vibrate in a plane oblique to the vertical axis of the bridge; the vibrations may be accordingly resolved into two components, one horizontal along the length of the bridge, the other vertical—that is, in a direction favourable for setting the belly into vibration across its lines of support.

It is advantageous to maintain simplicity in direction of the vibrations communicated to the body, and therefore to eliminate the transverse vibrations before they reach the belly. This is accomplished by a certain lateral elasticity of the bridge itself, attained by under-cutting the sides so as to allow the upper half of the bridge to oscillate or rock from side to side upon its central trunk; the work done in setting up this oscillation absorbing the transverse vibrations above mentioned.

The function of the sound-post is on the one hand mechanical, and on the other acoustical. It serves the purpose of sustaining the greater share of the pressure of the strings, not so much to save the belly from yielding under that pressure, as to enable it to vibrate more freely in its several parts than it could do, if unsupported, under the stresses which would be set up in its substance by that pressure. The chosen position of the post, allowing some freedom of vibration under the bridge, ensures the belly's proper vibrations being directly set up before the impulses are transmitted to the back through the sound-post: this transmission being, as already shown, its principal function. The post also by its contact with both vibrating plates is, as already shown, a governing factor in determining the nodal division of their surfaces, and its position therefore influences fundamentally the related states of vibration of the two plates of the instrument, and the compound oscillations set up in the contained body of air. This is an important element in determining the tone character of the instrument.

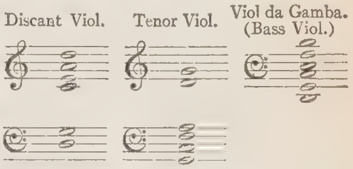
History.

The immediate ancestors of the violins were the viols, which were the principal bowed instruments in use from the end of the 15th to the end of the 17th century, during the latter part of which period they were gradually supplanted by the violins; but the bass viol did not go out of use finally until towards the later part of the 18th century, when the general adoption of the larger pattern of violoncello drove the viol from the field it had occupied so long. The sole survivor of the viol type of instrument, although not itself an original member of the family, is the double bass of the modern orchestra, which retains many of the characteristic features of the viol, notably the flat back, with an oblique slope at the shoulders, the high bridge and deep ribs. Excepting the marine trumpet or bowed monochord, we find in Europe no trace of any large bowed instruments before the appearance of the viols; the bowed instruments of the middle ages being all small enough to be rested on or against the shoulder during performance. The viols probably owe their origin directly to the minnesinger fiddles, which possessed several of the typical features of the violin, as distinct from the guitar family, and were sounded by a bow. These in their turn may be traced to the "guitar fiddle" (*q.v.*), a bowed instrument of the 13th century, with five strings, the lowest of which was longer than the rest, and was attached to a peg outside the head so as to clear the nut and finger-board, thus providing a fixed bass, or *bourdon*. This instrument had incurved sides, forming a waist to facilitate the use of the bow, and was larger than its descendants the fiddles and violins. None of these earlier instruments can have had a deeper compass than a boy's voice. The use of the fidel in the hands of the troubadours, to accompany the adult male voice, may explain the attempts which we trace in the 13th century to lengthen the oval form of the instrument. The parentage of the fiddle family may safely be ascribed to the rebec, a bowed instrument of the early middle ages, with two or three strings stretched over a low bridge, and a pear-shaped body pierced with sound-holes, having no separate neck, but narrowed at the upper end to provide a finger-board, and (judging by pictorial representations, for no actual example is known) surmounted by a carved head holding the pegs, in a manner similar to that of the violin. The bow, which was short and clumsy, had a considerable curvature. So far it is justifiable to trace back the descent of the violin in a direct line; but the earlier ancestry of this family is largely a matter of speculation. The best authorities are agreed that stringed instruments in general are mainly of Asiatic origin, and there is evidence of the mention of bowed instruments in Sanskrit documents of great antiquity. Too much genealogical importance has been attached by some writers to similarities in form and construction between the bowed and plucked instruments of ancient times. They probably developed to a great extent independently; and the bow is of too great and undoubted antiquity to be regarded as a development of the plectrum or other devices for agitating the plucked string. The two classes of instrument no doubt were under mutual obligations from time to time in their development. Thus the stringing of the viols was partly adapted from that of the lute; and the form of the modern Spanish guitar was probably derived from that of the fidel.

The Italian and Spanish forms (ribeba, rabe) of the French name rebec suggest etymologically a relationship, which seems to find confirmation in the striking similarity of general appearance between that instrument and the Persian rebab, mentioned in the 12th century, and used by the Arabs in a primitive form to this day. The British crwth, which has been claimed by some writers as a progenitor of the violin, was primarily a plucked instrument, and cannot be accepted as in the direct line of ancestry of the viols.

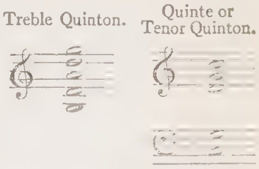
Discant viol.

The viol was made in three main kinds—discant, tenor and bass—answering to the cantus, medius and bassus of vocal music. Each of these three kinds admitted of some variation in dimensions, especially the bass, of which three distinct sizes ultimately came to be made—(1) the largest, called the concert bass viol; (2) the division or solo bass viol, usually known by its Italian name of viola da gamba; and (3) the lyra or tablature bass viol. The normal tuning of the viols, as laid down in the earliest books, was adapted from the lute to the bass viol, and repeated in higher intervals in the rest. The fundamental idea, as in the lute, was that the outermost strings should be two octaves apart—hence the intervals of fourths with a third in the middle. The highest, or discant viol, is not a treble but an alto instrument, the three viols answering to the three male voices. As a treble instrument, not only for street and dance music, but in orchestras, the rebec or geige did duty until the invention of the violin, and long afterwards. The discant viol first became a real treble instrument in the hands of the French makers, who converted it into the quinton.



Development of the viols.

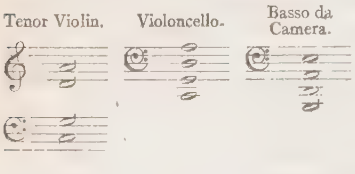
The earliest use of the viols was to double the parts of vocal concerted music; they were next employed in special compositions for the viol trio written in the same compass. Many such works in the form of "fantasies" or "fancies," and preludes with suites in dance form, by the masters of the end of the 16th and 17th centuries, exist in manuscript; a set by Orlando Gibbons, which are good specimens, has been published by the English Musical Antiquarian Society. Later, the viols, especially the bass, were employed as solo instruments, the methods of composition and execution being based on those of the lute. Most lute music is in fact equally adapted for the bass viol, and vice versa. In the 17th century, when the violin was coming into general use, constructive innovations began which resulted in the abandonment of the trio of pure six-stringed viols. Instruments which show these innovations are the quinton and the viola d'amore. The first-mentioned is of a type intermediate between the viol and the violin. In the case of the discant and tenor viol the lowest string, which was probably found to be of little use, was abandoned, and the pressure on the bass side of the belly thus considerably lightened. The five strings were then spread out, as it were, to the compass of the six, so as to retain the fundamental principle of the outer strings being two octaves apart. This was effected by tuning the lower half of the instrument in fifths, as in the violin, and the upper half in fourths. This innovation altered the tuning of the treble and tenor viols, thus—One half of the instrument was therefore tuned like a viol, the other half as in a violin, the middle string forming the division. The tenor viol thus improved was called in France the quinte, and the treble corresponding to it the quinton. From the numerous specimens which survive it must have been a popular instrument, as it is undoubtedly a substantially excellent one. The



relief in the bass, and the additional pressure caused by the higher tuning in the treble, gave it greater brilliancy, without destroying the pure, ready and sympathetic tone which characterizes the viol. While the tendency in the case of the discant and tenor was to lighten and brighten them, the reverse process took place in that of the bass. The richer and more sonorous tones of the viola da gamba were extended downwards by the addition of a string tuned to double bass A. Marais, a French virtuoso, is usually credited with this improvement; and this extended compass is recognized in the classical viola da gamba writings of Sebastian Bach and De Caix d'Hervelois. The result, however, was not universally satisfactory, for Abel used the six-stringed instrument; and the seven strings never came into general use in England, where the viola da gamba was more generally employed and survived longer than elsewhere.

The chief defect of the viols was their weakness of tone; this the makers thought to remedy in two ways: first by additional strings in unisons, fifths and octaves; and secondly by sympathetic strings of fine steel wire, laid under the fingerboard as close as possible to the belly, and sounding in sympathy with the notes produced on the bowed strings. The sympathetic strings were attached to ivory pegs driven into the bottom block, and, passing through the lower part of the bridge, or over a very low bridge of their own, were stretched to pitch either by means of additional pegs or by wrest pins driven into the sides of the head, and tuned with a key. Originally six, seven or eight wire strings were used, tuned to the diatonic scale of the piece to be performed. Later on a chromatic set of twelve was employed, and occasionally viols were made with twenty-four wire strings, two for each semitone in the scale. This system of reinforcement was applied to all the various sizes of viols in use during that period.

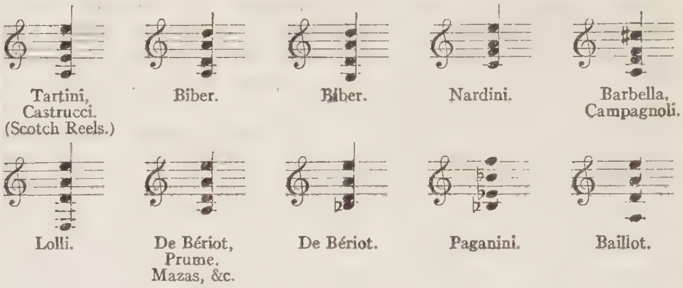
The improvements which resulted in the production of the violin proceeded on different lines. They consisted in increasing the resonance of the body of the instrument, by making it lighter and more symmetrical, and by stringing it more lightly. These changes transformed the body of the viol into that of the violin, and the transformation was completed by rejecting the lute tuning with its many strings, and tuning the instrument by fifths, as the fiddle had been tuned. The tenor viol appears to have been the first instrument in which the change was made, and thus the viola or tenor may probably be claimed as the father of the modern violin family. Violas were used in church music before the modern violin period, and violins as we know them were at first called "Piccoli Violini" to distinguish them from the earlier and larger instruments. A tenor viol of date 1500 is still extant, bearing in general outline the typical features of the violin, as distinct from the viol family. This instrument was exhibited in 1872 in the Loan Exhibition of Musical Instruments at South Kensington with the label "Pietro Zanure, Brescia, 1509." From existing specimens we know that a bass violin, precursor of the violoncello, with a tuning an octave below the tenor, appeared shortly after that instrument. A double bass violin, tuned a fourth below the violoncello and usually known as the "basso da camera," completed the set of instruments in violin shape; but from the difficulty attending its manipulation it never came into general use. The celebrated double bass player, Dragonetti, occasionally used the basso da camera, and an English player named Hancock, who dispensed with the highest or E string, is still remembered for his performances on this unusual instrument.



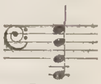
Tenor violin and violoncello.

The tenor and violoncello are made on the same general model and principles as the violin, but with modifications. Both are, relatively to their pitch, made in smaller proportions than the violin, because, if they were constructed to dimensions having the same relation to pitch and tension of strings as the violin, they would not only have an overpowering tone but would be unmanageable from their size. These relatively diminished dimensions, both in the size of the instrument and in the thickness of the wood and strings, give to the tenor and violoncello a graver and more sympathetic tone. To some extent the reduced size is compensated by giving them a greater proportional height in the ribs and bridge; an increase hardly perceptible in the tenor, but very noticeable in the violoncello. To lighten the tension and thus allow greater freedom of vibration to the belly on the bass side, as with the lowest string of the violin, the two lowest of the tenor and violoncello are made of thin gut, covered with fine metal wire; thus providing the necessary weight without inconvenient thickness. If the tension of the lowest string, or the two lowest strings, be increased, not only will they be elevated in pitch, but the violin will produce a more powerful tone; if the bass string be lowered, the contrary will take place. By adapting the music to this altered tuning (*scordatura*) some novel effects are produced. The following are the principal *scordature* which have been occasionally employed by various players:—

Scordatura.



The violoncello is less amenable to the *scordatura* than the violin; the only classical instance is the tuning employed by Bach in his fifth sonata, which consists in lowering the first string by a tone.



Early Italian makers.

The early Italian school is chiefly represented by the Brescian makers, Gaspar da Salò, Giovanni Paolo Maggini, Giovita Rodiani and Zanetto Peregrino. It is, however, somewhat misleading to denominate it the Brescian school, for its characteristics are shared by the earliest makers of Cremona and Venice. To eyes familiar with the geometrical curves of the later Cremona school, most of the violins of these makers have a rude and uncouth appearance. The height of the model varies; the pattern is attenuated; the *f*-holes share the general rudeness of design, and are set high in the pattern. Andreas Amati of Cremona, the eldest maker of that name, effected some improvements on this primitive model; but the violin owes most to his sons, Antonio and Geronimo, who were partners. They introduced the substantial improvements which developed the Brescian violin into the modern instrument. These improvements were in their inception probably of an artistic rather than a scientific nature. Painting and inlaying had long been employed in the decoration of stringed instruments; but the brothers Amati were the first who applied to the violin the fundamental law of decorative art, that the decorative and constructive elements should be blended in their conception: in other words, the construction should be itself decorative and the decoration itself constructive. Nicholas Amati (1596–1684), son of Geronimo, made some slight improvements in the model, and his pupil Antonio Stradivari (1644–1737) finally settled the typical Cremona pattern, which has been generally followed; for the majority of violins since made, whether by good or bad makers, are copies of Stradivari. Besides the last-named, the following makers worked generally on the Amati model—Cappa, Gobetti, the Grancino family, Andreas Guarnieri and his son Giuseppe, the Ruggieri family and Serafin of Venice. The Bergonzi family, Alessandro Gagliano, the earlier members of the Guadagnini family, and Panormo were either pupils or followers of Stradivari. But excepting Carlo Bergonzi and Stradivari's two sons, Omobono and Francesco, there is no evidence of any having actually worked with or for him. Landolfi, Storioni, and Carlo Giuseppe Testore, a pupil of Giovanni Grancino, leaned to the model of Giuseppe Guarnieri del Gesù. Some resemblances, especially in the matter of the varnish, are traceable between the works of makers who lived contemporaneously in the same town, *e.g.* in Naples, Milan and Venice.

German, English and French makers.

A high model was adopted by Jacob Stainer of Absam, near Hall in Tirol, whose well-known pattern was chiefly followed by the makers of England, Tirol and Germany, down to the middle of the 18th century. It thenceforward fell into disuse, owing to the superior musical qualities of the Cremona violin. The school of Stainer is represented by Albani, Hornsteiner, the Klotz family (who made large numbers of instruments excellent in their kind), Schorn of Salzburg and Withalm of Nuremberg, and others. The English makers may be divided into three successive groups: (1) an antique English school, having a character of its own (Rayman, Urquhart, Pamphilon, Barak Norman, Duke, of Oxford, &c.); (2) imitators of Stainer, at the head of whom stands Peter Wamsley (Smith, Barrett, Cross, Hill, Aireton, Norris, &c.); (3) a later school who leaned to the Cremona model (Banks, Duke, of Holborn, Betts, the Forsters, Gilkes, Carter, Fendt, Parker, Harris, Matthew Hardie of Edinburgh, &c.). The early French makers have little merit or interest (Bocquay, Gavinies, Pierray, Guersan, &c.), but the later copyists of the Cremona models (Lupot, Aldric, Chanot the elder, Nicholas, Pique, Silvestre, Vuillaume, &c.) produced admirable instruments, some of which rank next in merit to the first-rate makers of Cremona.

The general form of the violin, as finally developed under the hands of the leading makers, resolved itself into two main types, the high and the flat models, of which the latter, on the lines ultimately adopted by Stradivari, has survived as the most efficient pattern for all modern instruments. The distinction is one of degree only, the maximum difference of actual measurement in extreme cases amounting to little more than a quarter of an inch in the convexity of the belly above the top line of the ribs; but the difference in character of tone of the two types is, in the main, well marked. Speaking generally, the tone of the high-built instrument is less powerful and sweeter, and it speaks more readily, but responds less completely to gradations of tone under the action of the bow than the flatter type, which yields a tone of greater carrying power and flexibility, susceptible to more subtle variation by the player, and with a peculiar penetrating quality lacking in the highly arched model. These differences in tone probably depend less upon any direct effect of variations in depth of the sounding-box than on the incidental effects of cutting the wood to the higher or lower arch; for it would seem that the best results in tone have been attained in instruments with a fairly constant volume of contained air, the depth of the sides being roughly in inverse proportion to the height of arch in the best examples of the different models. In the high-cut arch the fibres of the wood on the upper surface are necessarily cut shorter, with the result that the plate as a whole does not vibrate so perfectly as in the flatter model, and this has a weakening effect on the tone. Again, the higher arch, with steeper curves towards the sides, necessitates the inclination of the sound-holes at a considerable angle to the main horizontal plane of the instrument; and it is conceivable that, under such conditions, the vibrations of the upper layer of air within the body are dissipated too readily, before the composite vibrations of the whole mass of air inside the instrument have attained their full harmonic value. Apart from these acoustical considerations, the question is probably one of material, the flatter construction demanding the use of a very strong and elastic wood in relation to the most suitable thickness, in order to withstand the pressure of the bridge, a resistance which the higher arch renders possible with a stiffer and more brittle material; and the effect of these qualities upon tone must be taken into account in estimating the tone characters of the two types of instrument.

Broadly speaking, the higher-arched type found favour with the earlier makers up to the end of the Amati period. Stainer in Tirol inclined particularly in the direction of this model, which he appears to have developed on independent lines, the tradition that he learnt his craft from the Amati being no longer tenable. The flatter model was gradually evolved by Stradivari as he outgrew the immediate influence of the Amati and developed on his own incomparable lines a somewhat larger and more powerful instrument, adapted to the requirements of the increasing class of solo players.

The bow.

The violins as a distinctive family of instruments cannot be fully discussed without reference to the bow (*q.v.*) as an essential adjunct, on account of the very important part taken by the bow in determining, as already mentioned, the peculiar form of the vibrations of the string, and in controlling, in the hand of a skilled player, the subtle gradations of tone produced from the instrument. The evolution of the modern bow has taken place almost entirely since the violin attained its final form, and has followed, more completely perhaps than the instrument itself, the development of violin music and the requirements of the player. It reached its highest perfection at the hands of the celebrated François Tourte of Paris, about 1780, whose bows have served as a model for all succeeding makers, even more exclusively than the violins of Stradivari controlled the pattern of later instruments; and at the present time Tourte bows are valued beyond any others.

For more than 250 years the violin and its larger brethren have held the leading position among musical instruments. For them have been written some of the most inspired works of the great musicians. Famous composers, such as Tartini, Corelli, Spohr and Viotti have been great violinists, and by their compositions, as much as by their talents as virtuosi, have largely developed the capacity of the violin as a vehicle of profound musical expression. To the listener the violin speaks with an intensity, a sympathy, and evokes a thrill of the senses such as no other instrument can produce. For the player it seems to respond to every pulse of his emotions.

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VIOLLET, PAUL MARIE (1840–   ), French historian, was born at Tours on the 24th of October 1840. After serving his native city as secretary and archivist, he became archivist to the national archives in Paris in 1866, and later librarian to the faculty of law. In 1890 he was appointed professor of civil and canon law at the école des chartes. His work mainly concerns the history of law and institutions, and on this subject he published two valuable and scholarly books—*Droit public: Histoire des institutions politiques et administratives de la France* (1890–98), and *Précis de l'histoire du droit français* (1886).

VIOLLET-LE-DUC, EUGÈNE EMMANUEL (1814–1879), French architect and writer on archaeology, was born in Paris on the 21st of January 1814. He was a pupil of Achille Leclère, and in 1836–37 spent a year studying Greek and Roman architecture in Sicily and Rome. His chief interest was, however, in the art of the Gothic period, and, like Sir Gilbert Scott in England, he was employed to "restore" some of the chief medieval buildings of France, his earliest works being the abbey church of Vézelay, various churches at Poissy, St Michel at Carcassonne, the church of Semur in Côte-d'Or, and the fine Gothic town halls of Saint-Antonin and Narbonne, all carried out between 1840 and 1850. From 1845 to 1856 he was occupied on the restoration of Notre Dame in Paris in conjunction with Lassus,[1] and also with that of the abbey of St Denis. In 1849 he began the restoration of the fortifications of Carcassonne and of Amiens cathedral; and in later years he restored Laon cathedral, the château of Pierrefonds, and many other important buildings. He was an intimate friend of Napoleon III., and during the siege of Paris (1871) gave valuable help as an engineer to the beleaguered army. He held many important offices, both artistic and political, and was for many years inspector-general of the ancient buildings throughout a large part of France. His last work was the general scheme for the Paris exhibition buildings in 1878. He died on the 17th of September 1879 at Lausanne.

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[1] He published in 1867–69 a fine work showing his not very successful coloured decoration applied to the chapels of Notre Dame.

As a designer Viollet-le-Duc occupied only a secondary place; but as a writer on medieval architecture and the kindred arts he takes the highest rank. His two great dictionaries are the standard works in their class, and are most beautifully illustrated with very skilful drawings by his own hand. Viollet-le-Duc was a man of the most varied and brilliant abilities, endowed with a power of work which has seldom been equalled. He was at once an artist, a man of science, a learned archaeologist and a scholar. The map in his *Le Massif du Mont Blanc*, showing the rock contours and the glaciers of Mont Blanc, is a model of its kind, which combines great artistic beauty with the accuracy of the most skilful engineer. His strong poetical fancy enabled him to reconstruct the life and buildings of the middle ages in the most vivid way.

His principal literary works were the *Dictionnaire de l'architecture française du XI. au XVI. siècle* (1854–68); *Dictionnaire du mobilier français* (1858–75); *L'Architecture militaire au moyen âge* (1854); *Entretiens sur l'architecture* (1863–72); *Cités et ruines américaines* (1863); *Mémoire sur la défense de Paris* (1871); *Habitations modernes* (1874–77); *Histoire d'une maison* (1873); *Histoire d'une forteresse* (1874); *Histoire de l'habitation humaine* (1875); *Le Massif du Mont Blanc* (1876); *L'Art russe* (1877); *Histoire d'un hôtel-de-ville et d'une cathédrale* (1878); *La Décoration appliquée aux édifices* (1879); as well as many minor works dealing with separate buildings.

VIOLONCELLO (Fr. *violoncelle*, Ger. *Violoncell*, Ital. *violoncello*), the bass member of the violin family. Although the word violoncello is a diminutive, signifying "small violone," or double bass, the instrument is really a bass violin, formed on a different model from the violone, which has the sloping shoulders and flat back of the viol family, whereas those of the violoncello are rounded as in the violin. The construction of the violoncello is therefore the same as that of the violin (*q.v.*) but on a much larger scale. It is either held, on account of its size, between the performer's knees, or rests on the floor supported on a foot or spike.

VIONVILLE, a village of Lorraine, between Metz and the French frontier, celebrated as the scene of the battle of Vionville (Rezonville or Mars-la-Tour), fought on the 16th of August 1870 between the French and the Germans (see METZ and FRANCO-GERMAN WAR).

VIOTTI, GIOVANNI BATTISTA (1753–1824), Italian violinist and musical composer, was born at Fontanetto in the province of Turin on the 23rd of May 1753. He learned the rudiments of music from his father, a blacksmith who played the horn; and in 1764 Giovannini taught him the violin for a year. Two years later he was placed at the cost of the prince de la Cisterne under the violinist G. Pugnani at Turin, where he became violinist in the court chapel. In 1780 Viotti, having already made himself a name, travelled through Germany and Poland to Russia, where the empress Catherine honoured him with marks of extraordinary favour. He next appeared in London, in company with Pugnani, and at once achieved a brilliant and lasting reputation. In 1782 he was equally successful in Paris. Two years later he was appointed leader of the prince de Soubise's private orchestra; and in 1788 he undertook the direction of the opera, raising the performances, with Cherubini's assistance, to a very high level. He had also started an Italian opera in co-operation with the barber Léonard, which was opened in 1789 in the Tuileries, being subsequently amalgamated with the Théâtre de la Foire St Germain in 1790 and finally merged in the new Théâtre Feydeau in 1791. In 1791 the Revolution compelled Viotti to fly to London, where he took part in the Hanover Square concerts; but being suspected to be an agent of the Revolutionary Committee in Paris he was compelled to retire for a time to the neighbourhood of Hamburg, which he subsequently quitted, although the date of his departure, often given as 1795, does not seem probable. It is possible that he was already in 1794 in London, where he took shares in a wine business, and he resided almost uninterruptedly there until 1819, when he once more settled in Paris, resumed the direction of the opera, and retired in 1822 with a pension. He died in London on the 10th (or 3rd) of March 1824.

Viotti's playing was distinguished by an extreme purity of style, a magnificent tone, and an inexhaustible variety of poetical and imaginative expression. Among his works are 29 violin concertos, a series of symphonies concertantes for two violins, 45 duos, 18 trios and 21 quartets, and a great number of sonatas, notturnos and other instrumental works. His school was worthily perpetuated by his pupil Rode.

VIPER. The vipers constitute a family of Old-World poisonous snakes, with a pair of poisonous fangs in the maxillary bones, which are short and movable. The main anatomical features are described in the article SNAKES. In the present article only the *Viperinae*, namely those without an external pit between the eye and the nose, are described. Pit vipers, or *Crotalinae*, are treated under SNAKES, and those which are possessed of a rattle under RATTLESNAKE. The true vipers comprise about nine genera with some forty species, which can be distinguished as follows:—

Causus in Africa, and *Azemiophis feae* in Burma, are the only vipers which have the head covered with large symmetrical shields, while in the other genera the head shields are broken up into small shields, or into still more numerous scales. *C. rhombeatus*, common from the Gambia to the Cape.

Atractaspis, small burrowing snakes in Africa, without postfrontal bones.

Echis and *Atheris* have only one row of subcaudal shields. *E. carinata*, scarcely exceeding 20 in. in length, is very poisonous and easily overlooked on account of its light brown coloration, with pale spots and delicate markings on the keels of the scales of the back. It is a desert type, having the lateral scales strongly keeled and directed downwards, by means of which it shuffles itself into the sand; by folding itself and rubbing the scales together it produces a rustling sound. It ranges from India, where it is known as the "Krait," called "Kuppur" in Sind, through North Africa. This desert type is replaced farther south in Africa, where vegetation flourishes, by the closely allied genus, *Atheris*, which, however, possesses a prehensile tail and vivid coloration and has assumed truly arboreal habits.

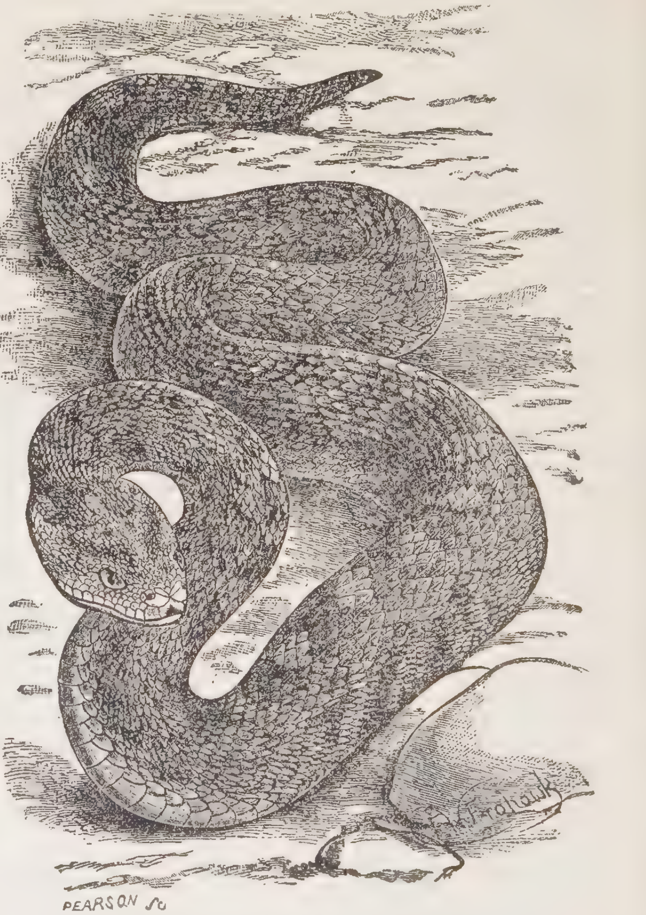

FIG. 1.—*Echis carinata*. The "Krait" of India.

Cerastes is another desert form, but is restricted to Africa; the arrangement of the scales of the sides of the body is similar to that of

Echis, but it has two rows of subcaudals. *C. cornutus*, the "horned viper" of North Africa, from Algeria to Palestine, has a large horny spike above each eye. This, the "Efa" of the Arabs, buries itself in the sand, with only the eyes, nostrils and the horns appearing above the surface. It attains a length of 2½ ft. *C. vipera* is hornless.

Bitis s. *Echidna* s. *Clotho* has two rows of shields on the underside of the very short tail; the thick head is much depressed, like the body. The nasal shields are separated from the rostral by small scales, otherwise much resembling the genus *Vipera*. *B. arietans*, the "puff-adder" of nearly the whole of Africa, an ugly, very dangerous brute growing to a length of 4 or 5 ft. *B. nasicornis*, the West African nose-horned viper, has a pair of erectile scales on the nose. Scarcely smaller and less bulky than the puff-adder and just as poisonous, it is yet very handsomely marked with a series of large pale, dark-edged spots and oblique crosses on a purplish or reddish brown ground. Especially handsome are the young, which at birth are as much as 1 ft. in length. On one occasion one of these snakes, after giving birth to twenty-one young (which bit and killed mice within five minutes of being born), became very ill-tempered, and when two adult males were placed in her cage she bit one with such violence as to break off one of her fangs, which she left, about three-quarters of an inch in length, sticking in his back. He, however, appeared not to suffer the slightest inconvenience, and was never the worse for it (see *Proc. Zool. Soc.* 1871, p. 638).

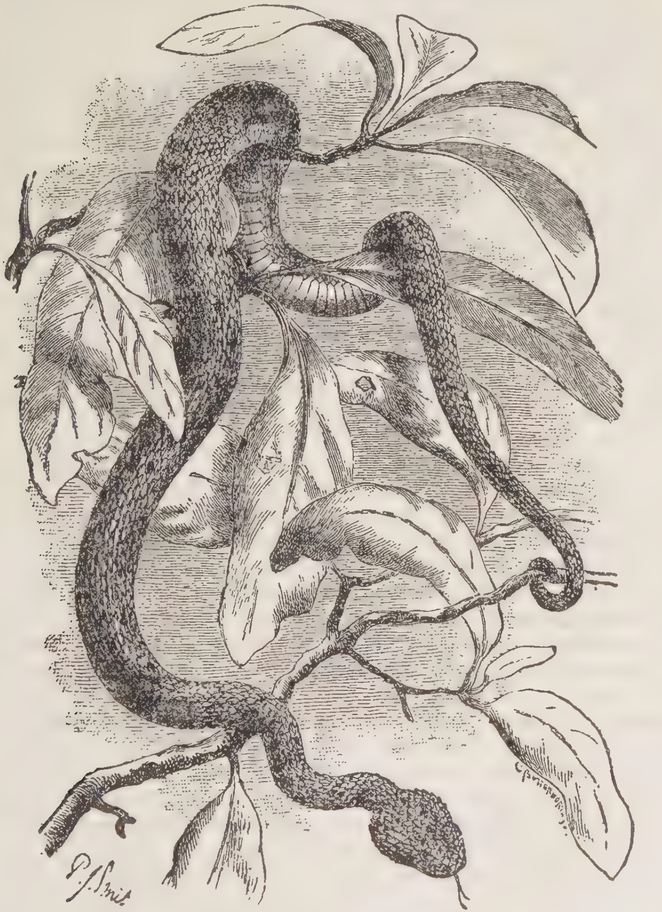

FIG. 2.—*Atheris burtoni*. (Length, 12 in.)

Vipera.—The head is covered with small scales and a few larger shields. The eye is separated from the labials by small scales; the nasals are in contact with the rostral shield or separated by one naso-rostral. The scales of the body are strongly keeled; two rows of subcaudals on the short tail. This genus of about ten species with numerous local varieties ranges over Europe, Asia and the greater part of Africa.

V. berus, the common European viper, ranging from Wales to Saghalien Island and from Caithness to the north of Spain, from the northern boundary of Persia to beyond the Arctic circle in Scandinavia. It inhabits all sorts of situations, but prefers heaths, moors and mixed woods with sunny slopes. It ascends the Alps up to 6000 or 7000 ft. The coloration is very variable, grey, brown, reddish or entirely black specimens occurring in the same country. The much-spoken-of black zigzag line along the back is so often indistinct, that it cannot be relied upon as a safe character. The full-grown males are smaller than the females, and have usually darker markings and a lighter ground colour. A specimen which is 2 ft. long is rare, and is invariably a female. The chief food is mice, which are hunted after sunset. They cannot climb and they avoid going into water. The pairing takes place from March to May and the young are born about four months later. During the pairing, and for hibernation, they often collect in considerable numbers. Whilst most snakes readily take proper food in captivity, these vipers prefer starving themselves to death, a feat which they accomplish within six to nine months according to conditions. As a rule their bite is not fatal to man, but the consequences are often serious and protracted. For treatment see SNAKES.

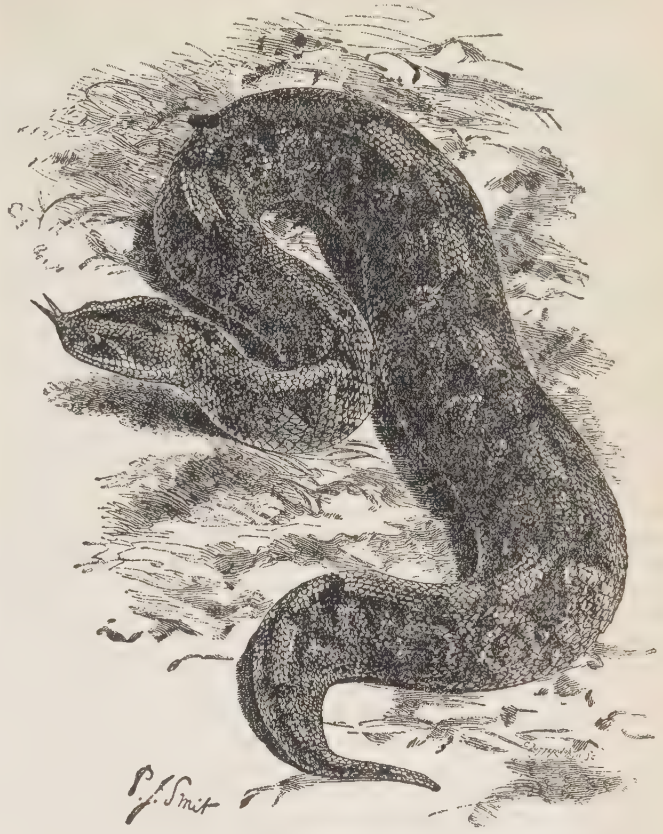

FIG. 3.—*Bitis nasicornis*.

V. aspis is the more southern and western continental European viper; it is slightly snub-nosed, and this feature is still more pronounced in *V. latastei* of Spain and Portugal. In *V. ammodytes* of south-eastern Europe the raised portion is produced into a soft, scaly appendage.

V. russelli, the "Daboia," is one of the most poisonous snakes of India, Ceylon, Java, Burma and Siam. It is pale brown with three longitudinal series of black, light-edged rings which sometimes encircle reddish spots. It grows to a length of about 5 ft.

(H. F. G.)

VIRBIUS, an old Italian divinity, associated with the worship of Diana at Aricia (see DIANA). Under Greek influence, he was identified with Hippolytus (*q.v.*), who after he had been trampled to death by the horses of Poseidon was restored to life by Asclepius and removed by Artemis to the grove at Aricia, which horses were not allowed to enter. Virbius was the oldest priest of Diana, the first "king of the grove" (*Rex Nemorensis*). He is said to have established the rule that any candidate for the office should meet and slay in single combat its holder at the time, who always went about armed with a drawn sword in anticipation of the struggle. Candidates had further to be fugitives (probably slaves), and as a preliminary had to break off a bough from a specified tree. By the eponymous nymph Aricia, Virbius had a son of the same name, who fought on the side of the Rutulian Turnus against Aeneas. J. G. Frazer formerly held Virbius to be a wood and tree spirit, to whom horses, in which form tree spirits were often represented, were offered in sacrifice. His identification with Hippolytus and the manner of the latter's death would explain the exclusion of horses from his grove. This spirit might easily be confounded with the sun, whose power was supposed to be stored up in the warmth-giving tree. Sauer (in Roscher's *Lexikon*) also identifies

Hippolytus with the "health-giving sun," and Virbius with a healing god akin to Asclepius. Frazer's latest view is that he is the old cult associate of Diana of Aricia (to whom he is related as Attis to Cybele or Adonis to Venus), the mythical predecessor or archetype of the kings of the grove. This grove was probably an oak grove, and the oak being sacred to Jupiter, the king of the grove (and consequently Virbius) was a local form of Jupiter. A. B. Cook suggests that he may be the god of the stream of Nemi.

See Virgil, *Aen.* vii. 761 and Servius, *ad loc.*; Ovid, *Fasti*, iii. 265, vi. 737, *Metam.* xv. 497; Suetonius, *Caligula*, 35; Strabo, v. p. 239; G. Wissowa, *Religion und Kultus der Römer* (1902), according to whom Virbius was a divinity who assisted at childbirth (cp. the *nixi di*); J. G. Frazer, *Golden Bough* (1900), ii. p. 313, iii. p. 456, and *Early History of the Kingship* (1905), pp. 24, 281; A. B. Cook in *Classical Review*, xvi. p. 372.

VIRCHOW, RUDOLF (1821–1902), German pathologist and politician, was born on the 13th of October 1821 at Schivelbein, in Pomerania, where his father was a small farmer and shopkeeper. As a boy he attended the *Volksschule* of his native village, and at the age of seventeen, having passed through the gymnasium of Köslin, went to Berlin to study medicine. He took his doctor's degree in 1843, and almost immediately received an appointment as assistant-surgeon at the Charité Hospital, becoming pro-rector three years later. In 1847 he began to act as *Privatdozent* in the university, and founded with Reinhardt the *Archiv für pathologische Anatomie und Physiologie*, which, after his collaborator's death in 1852, he carried on alone, and in 1848 he went as a member of a government commission to investigate an outbreak of typhus in upper Silesia. About the same time, having shown too open sympathy with the revolutionary or reforming tendencies of 1848, he was for political reasons obliged to leave Berlin and retire to the seclusion of Würzburg, the medical school of which profited enormously by his labours as professor of pathological anatomy, and secured a wide extension of its reputation. In 1856 he was recalled to Berlin as ordinary professor of pathological anatomy in the university, and as director of the Pathological Institute formed a centre for research whence has flowed a constant stream of original work on the nature and processes of disease. On the 14th of October 1901 his eightieth birthday was celebrated in Berlin amid a brilliant gathering of men of science, part of the ceremonies taking place in the new Pathological Museum, near the Charité, which owes its existence mainly to his energy and powers of organization. On that occasion all Europe united to do him honour, many learned societies sent delegates to express their congratulations, the king of Italy gave him his own portrait on a gold medallion, and among the numerous addresses he received was one from Kaiser Wilhelm II., who took the opportunity of presenting him with the Grand Gold Medal for Science. In the early part of 1902 he slipped from a tramcar in Berlin and fractured his thigh; from this injury he never really recovered, and his death occurred in Berlin on the 5th of September 1902.

Wide as were Virchow's studies, and successful as he was in all, yet the foremost place must be given to his achievements in pathological investigation. He may, in fact, be called the father of modern pathology, for his view, that every animal is constituted by a sum of vital units, each of which manifests the characteristics of life, has almost uniformly dominated the theory of disease since the middle of the 19th century, when it was enunciated. The beginnings of his doctrine of cellular pathology date from the earliest period in his career. When, towards the end of his student-days in Berlin, he was acting as clinical assistant in the eye department of the Berlin Hospital, he noticed that in keratitis and corneal wounds healing took place without the appearance of plastic exudation. This observation led him to further work, and he succeeded in showing that in vascular organs the presence of cells in inflammatory exudates is not the result of exudation but of multiplication of pre-existing cells. Eventually he was able to prove that the biological doctrine of *omnis cellula e cellula* applies to pathological processes as well as to those of normal growth, and in his famous book on *Cellular-pathologie*, published at Berlin in 1858, he established what Lord Lister described as the "true and fertile doctrine that every morbid structure consists of cells which have been derived from pre-existing cells as a progeny." But in addition to bringing forward a fundamental and philosophical view of morbid processes, which probably contributed more than any other single cause to vindicate for pathology the place which he claimed for it among the biological sciences, Virchow made many important contributions to histology and morbid anatomy and to the study of particular diseases. The classification into epithelial organs, connective tissues, and the more specialized muscle and nerve, was largely due to him; and he proved the presence of neuroglia in the brain and spinal cord, discovered crystalline haematoidine, and made out the structure of the umbilical cord. Medical science further owes to him the classification of new growths on a natural histological basis, the elucidation of leucaemia, glioma and lardaceous tumours, and detailed investigations into many diseases—tuberculosis, pyaemia, diphtheria, leprosy, typhus, &c. Among the books he published on pathological and medical subjects may be mentioned *Vorlesungen über Pathologie*, the first volume of which was the *Cellular-pathologie* (1858), and the remaining three *Die Krankhaften Geschwülste* (1863–67); *Handbuch der speziellen Pathologie und Therapie* (3 vols., 1854–62), in collaboration with other German surgeons; *Gesammelte Abhandlungen zur wissenschaftlichen Medizin* (1856); *Vier Reden über Leben und Kranksein* (1862); *Untersuchungen über die Entwicklung des Schädelgrundes* (1857); *Lehre von den Trichinen* (1865); *Ueber den Hunger-typhus* (1868); and *Gesammelte Abhandlungen aus dem Gebiete der öffentlichen Medizin und der Seuchenlehre* (1879). In England his pathological work won general recognition. The Royal Society awarded him the Copley medal in 1892, and selected him as Croonian lecturer in the following year, his subject being the position of pathology among the biological sciences; and in 1898 he delivered the second Huxley memorial lecture at Charing Cross Hospital.

Another science which Virchow cultivated with conspicuous success was anthropology, which he did much to put on a sound critical basis. At the meeting of the Naturforscherversammlung at Innsbruck in 1869, he was one of the founders of the German Anthropological Society, of which he became president in the following year; and from 1869 onwards he presided over the Berlin Anthropological Society, also acting as editor of its proceedings in the *Zeitschrift für Ethnologie*. In ethnology he published a volume of essays on the physical anthropology of the Germans, with special reference to the Frisians; and at his instance a census, which yielded remarkable results, was carried out among school children throughout Germany, to determine the relative distribution of blondes and brunettes. His archaeological work included the investigation of lake dwellings and other prehistoric structures; he went with Schliemann to Troy in 1879, fruits of the expedition being two books, *Zur Landeskunde der Troas* (1880) and *Alt-trojanische Gräber und Schädel* (1882); in 1881 he visited the Caucasus, and on his return published *Das Gräberfeld von Koban im Lande der Osseten*; and in 1888 he accompanied Schliemann to Egypt, Nubia and the Peloponnese.

As a politician Virchow had an active career. In 1862 he was elected a member of the Prussian Lower House. Professing advanced Liberal and democratic views, he was a founder and leader of the Fortschrittspartei, and the expression *Kulturkampf* had, it is believed, its origin in one of his electoral manifestoes. For many years he was chairman of the finance committee, and in that capacity may be looked upon as a chief founder of the constitutional Prussian Budget system. In 1880 he entered the Reichstag as representative of a Berlin constituency, but was ousted in 1893 by a Social Democrat. In the Reichstag he became the leader of the Opposition, and a vigorous antagonist to Bismarck. In the local and municipal politics of Berlin again he took a leading part, and as a member of the municipal council was largely responsible for the transformation which came over the city in the last thirty years of the 19th century. That it has become one of the healthiest cities in the world from being one of the unhealthiest is attributable in great measure to his insistence on the necessity of sanitary reform, and it was his unceasing efforts that secured for its inhabitants the drainage system, the sewage farms and the good water-supply, the benefits of which are reflected in the decreased death-rate they now enjoy. In respect of hospitals and the treatment of the sick his energy and knowledge were of enormous advantage to his country, both in times of peace and of war, and the unrivalled accommodation for medical treatment possessed by Berlin is a standing tribute to his name, which will be perpetuated in one of the largest hospitals of the city.

Of his writings on social and political questions may be mentioned *Die Erziehung des Weibes* (1865); *Ueber die nationale Entwicklung und Bedeutung der Naturwissenschaften* (1865); *Die Aufgaben der Naturwissenschaften in dem neuen nationalen Leben Deutschlands* (1871); *Die Freiheit der Wissenschaft im modernen Staat* (1877), in which he opposed the idea of Haeckel—that the principles of evolution should be taught in elementary schools—on the ground that they were not as yet proved, and that it was mischievous to teach a hypothesis which still remained in the speculative stage.

See *Lives* by Becher (Berlin, 1894) and Pagel (Leipzig, 1906); *Rudolf Virchow als Patholog* by Marchand (Munich, 1902): *Rudolf Virchow als Arzt* by Ebstein (Stuttgart, 1903); *Gedächtnisrede auf R. Virchow* (Berlin, 1903); and *Briefe Virchows an seine Eltern 1839–1864*, by Marie Rabl (Leipzig, 1907). A bibliography of his works was published at Berlin in 1901.

VIRE, a town of north-western France, capital of an arrondissement in the department of Calvados, 47 m. S.W. of Caen by rail. Pop. (1906) 6228. Vire stands on an eminence surrounded on three sides by the Vire and crowned by the remains of a 12th-century château. The church of Notre Dame (13th to 15th century), and the picturesque Tour de l'Horloge (13th century), beneath which runs the chief street, are the principal buildings. A library and a small museum with good collections of porcelain, pictures and curiosities, are installed in the town hall (17th and 18th centuries). In the public garden there is a statue of Marshal Jacques Goyon, comte de Matignon (1525–1597); and the native poets C. J. L. Chênedollé and P. L. R. Castel are represented, the former by a marble bust, the latter by a bronze statue. Vire grew up around a castle built in the 12th century by Henry I. of England, and in the middle ages was one of the important strongholds of Normandy. South-west of the town is the gorge called Vaux-de-Vire, in which was situated the mill of Olivier Basselin (15th century), the fuller and reputed author of the satiric songs, hence known as "vaudevilles" (see BASSELIN, OLIVIER).

VIRELAY, the title applied to more than one fixed form of verse, from the French *virer*, to turn or veer. The history and exact character of the virelay are more obscure than those of any other of the old French forms. It is possible that it is connected with the Provençal *ley*. Historians of poetry have agreed in stating that it is a modification of the medieval *lai*, but it is curious that no example of the lai is forthcoming, except the following, which was first printed by the Père Mourgues in his *Traité de la Poësie*:—

"Sur l'appui du Monde
Que faut-il qu'on fonde
D'espoir?
Cette mer profonde
Et débris féconde
Fait voir
Calme au matin l'onde
Et l'orage y gronde
Le Soir."

But this appears to be, not a complete poem, but a fragment of a virelay, which proceeds by shifting or "veering" the two rhymes to an extent limited only by the poet's ingenuity. This is the Old Virelay (*virelai ancien*), of which examples have been rare in recent literature. There is, however, a New Virelay (*virelai nouveau*), the newness of which is merely relative, since it was used by Alain Chartier in the 15th century. In French the old and popular verses beginning—

"Adieu vous dy triste Lyre,
C'est trop apprêter à rire,"

form a perfect example of the New Virelay, and in English we have at least one admirable specimen in Mr Austin Dobson's "July"—

"Good-bye to the Town! good-bye!
Hurrah! for the sea and the sky!"

The New Virelay is entirely written on two rhymes, and begins with two lines which are destined to form recurrent refrains throughout the whole course of the poem, and, reversed in order, to close it with a couplet. The virelay is a vaguer and less vertebrate form of verse than the sonnet, the ballad or the villanelle, and is of less importance than these in the history of prosody. (E. G.)

VIRGIL (PUBLIUS VERGILIUS MARO), the great Roman poet, was born on the 15th of October in the year 70 B.C., on a farm on the banks of the Mincio, in the district of Andes, not far from the town of Mantua. In the region north of the Po a race of more imaginative susceptibility than the people of Latium formed part of the Latin-speaking population. It was favourable to his development as a national poet that he was born and educated during the interval of comparative calm between the first and second civil wars, and that he belonged to a generation which, as the result of the social war, first enjoyed the sense of an Italian nationality. Yet it was only after Virgil had grown to manhood that the province to which he belonged obtained the full rights of Roman citizenship. It is remarkable that the two poets whose imagination seems to have been most powerfully possessed by the spell of Rome—Ennius and Virgil—were born outside the pale of Roman citizenship.

The scenery familiar to his childhood, which he recalls with affection both in the *Eclogues* and the *Georgics*, was that of the green banks and slow windings of the Mincio and the rich pastures in its neighbourhood. Like his friend and contemporary Horace, he sprung from the class of yeomen, whose state he pronounces the happiest allotted to man and most conducive to virtue and piety. Virgil, as well as Horace, was fortunate in having a father who, though probably uneducated himself, discerned his genius and spared no pains in giving it the best culture then obtainable in the world. At the age of twelve he was taken for his education to Cremona, and from an expression in one of the minor poems attributed to him, about the authenticity of which there cannot be any reasonable doubt, it may be inferred that his father accompanied him. Afterwards he removed to Milan, where he continued engaged in study till he went to Rome two years later. The time of his removal to Rome must have nearly coincided with the publication of the poem of Lucretius and of the collected poems of Catullus.

After studying rhetoric he began the study of philosophy under Siron the Epicurean. One of the minor poems written about this time in the scazon metre tells of his delight at the immediate prospect of entering on the study of philosophy, and of the first stirring of that enthusiasm for philosophical investigation which haunted him through the whole of his life. At the end of the poem, the real master-passion of his life, the charm of the Muses, reasserts itself (*Catalepton* v.).

Our next knowledge of him is derived from allusions in the *Eclogues*, and belongs to a period nine or ten years later. Of what happened to him in the interval, during which the first civil war took place and Julius Caesar was assassinated, we have no indication from ancient testimony or from his own writings. In 42 B.C., the year of the battle of Philippi, we find him "cultivating his woodland Muse" under the protection of Asinius Pollio, governor of the district north of the Po. In the following year the famous confiscations of land for the benefit of the soldiers of the triumvirs took place. Of the impression produced on Virgil by these confiscations, and of their effect on his fortunes, we have a vivid record in the first and ninth eclogues. Mantua, in consequence of its vicinity to Cremona, which had been faithful to the cause of the republic, was involved in this calamity; and Virgil's father was driven from his farm. By the influence of his powerful friends, and by personal application to the young Octavian, Virgil obtained the restitution of his land. In the meantime he had taken his father and family with him to the small country house of his old teacher Siron (*Catalepton* x.).

Soon afterwards we hear of him living in Rome, enjoying, in addition to the patronage of Pollio, the favour of Maecenas, intimate with Varius, who was at first regarded as the rising poet of the new era, and later on with Horace. His friendship with Gallus, for whom he indicates a warmer affection and more enthusiastic admiration than for any one else, was formed before his second residence in Rome, in the Cisalpine province, with which Gallus also was connected both by birth and office. The pastoral poems, or "eclogues," commenced in his native district, were finished and published in Rome, probably in 37 B.C. Soon afterwards he withdrew from habitual residence in Rome, and lived chiefly in Campania, either at Naples or in the neighbourhood of Nola. He was one of the companions of Horace in the famous journey to Brundisium; and it seems not unlikely that, some time before 23 B.C., he made the voyage to Athens which forms the subject of the third ode of the first book of the *Odes* of Horace.

The seven years from 37 to 30 B.C. were devoted to the composition of the *Georgics*. In the following year he read the poem to Augustus, on his return from Asia. The remaining years of his life were spent on the composition of the *Aeneid*. In 19 B.C., after the *Aeneid* was finished but not finally corrected, he set out for Athens, intending to pass three years in Greece and Asia and to devote that time to perfecting the poem. At Athens he met Augustus, and was persuaded by him to return with him to Italy. While visiting Megara under a burning sun, he was seized with illness, and, as he continued his voyage without interruption, he grew rapidly worse, and died on the 21st of September, in his fifty-first year, a few days after landing at Brundisium. In his last illness he called for the cases containing his manuscripts, with the intention of burning the *Aeneid*. He had previously left directions in his will that his literary executors, Varius and Tucca, should publish nothing of his which had not already been given to the world by himself. This pathetic desire that the work to which he had given so much care, and of which such great expectations were formed, should not survive him has been used as an argument to prove his own dissatisfaction with the poem. A passage from a letter of his to Augustus is also quoted, in which he speaks as if he felt that the undertaking of the work had been a mistake. This dissatisfaction with his work may be ascribed to his passion for perfection of workmanship, which death prevented him from attaining. The command of Augustus overrode the poet's wish and rescued the poem.

Virgil was buried at Naples, where his tomb was long regarded with religious veneration. Horace is our most direct witness of the affection which he inspired among his contemporaries. The qualities by which he gained their love were, according to his testimony, *candor*—sincerity of nature and goodness of heart—and *pietas*—the union of deep affection for kindred, friends and country with a spirit of reverence. The statement of his biographer, that he was known in Naples by the name "Parthenias," is a testimony to the exceptional purity of his life in an age of licence. The seclusion of his life and his devotion to his art touched the imagination of his countrymen as the finer qualities of his nature touched the heart of his friends. It had been, from the time of Cicero,[1] the ambition of the men of finest culture and most original genius in Rome to produce a national literature which might rival that of Greece; and the feeling that at last a poem was about to appear which would equal or surpass the greatest among all the works of Greek genius found a voice in the lines of Propertius—

> "Cedite Romani scriptores, cedite Graii;
> Nescio quid majus nascitur Iliade."

The feeling of his countrymen and contemporaries seems justified by the personal impression which he produces on modern readers—an impression of sanctity, as of one who habitually lived in a higher and serener sphere than that of this world. The veneration in which his name was held during the long interval between the overthrow of Western civilization and the revival of letters affords testimony of the depth of the impression which he made on the heart and imagination of the ancient world. The traditional belief in his pre-eminence has been on the whole sustained, though not with absolute unanimity, in modern times. By the scholars and men of letters of the 16th, 17th and 18th centuries it was never seriously questioned. During the first half of the 19th century his right to be ranked among the great poets of the world was disputed by some German and English critics.

The effect of this was a juster estimate of Virgil's relative position among the poets of the world. It may still be a matter of individual opinion whether Lucretius himself was not a more powerful and original poetical force, whether he does not speak more directly to the heart and imagination of our own time. But it can hardly be questioned, on a survey of Roman literature, as a continuous expression of the national mind, from the age of Naevius to the age of Claudian, that the position of Virgil is central and commanding, while that of Lucretius is in a great measure isolated. If we could imagine the place of Virgil in Roman literature vacant, it would be much the same as if we imagined the place of Dante vacant in modern Italian, and that of Goethe in German literature. The serious efforts of the early Roman literature—the efforts of the older epic and tragic poetry—found their fulfilment in him. The revelation of the power and life of Nature, first made to Lucretius, was able to charm the Roman mind, only after it had passed into the mind of Virgil.

Virgil is the only complete representative of the deepest sentiment and highest mood of his countrymen and of his time. In his pastoral and didactic poems he gives a living voice to the whole charm of Italy, in the *Aeneid* to the whole glory of Rome. He was in the maturity of his powers at the most critical epoch of the national life, one of the most critical epochs in the history of the world. Keeping aloof from the trivial daily life of his contemporaries, he was moved more profoundly than any of them by the deeper currents of emotion in the sphere of government, religion, morals and human feeling which were then changing the world; and in uttering the enthusiasm of the hour, and all the new sensibilities that were stirring in his own heart and imagination, he had, in the words of Sainte-Beuve, "divined at a decisive hour of the world what the future would love." He was also by universal acknowledgment the greatest literary artist whom Rome produced. Virgil had a more catholic sympathy with the whole range of Greek poetry, from Homer and Hesiod to Theocritus and the Alexandrians, than any one else at any period of Roman literature. The effort of the preceding generation to attain to beauty of form and finish of artistic execution found in him, at the most susceptible period of his life, a ready recipient of its influence. The rude dialect of Latium had been moulded into a powerful and harmonious organ of literary expression by a long series of orators; the Latin hexameter, first shaped by Ennius to meet the wants of his own spirit and of his high argument, had been smoothed and polished by Lucretius, and still more perfected by the finer ear and more careful industry of Catullus and his circle; but neither had yet attained their final development. It was left for Virgil to bring both diction and rhythm to as high a pitch of artistic perfection as has been attained in any literature. This great work was accomplished by the steady devotion of his genius to his appointed task. For the first half of his life he prepared himself to be the poet of his time and country with a high ambition and unresting industry. The second half of his career was a religious consecration of all his powers of heart, mind and spirit to his high office.

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[1] Cf. *Tusc. Disp.* ii. 2: "Quamobrem hortor omnes qui facere id possunt, ut hujus quoque generis laudem jam languenti Graeciae eripiant," &c. These words apply specially to philosophical literature, but other passages in the same and in other works imply that Cicero thought that the Romans had equal aptitudes for other departments of literature; and the practice of the Augustan poets in each appropriating to himself a special province of Greek literary art seems to indicate the same ambition.

Virgil's fame as a poet rests on the three acknowledged works of his early and mature manhood—the pastoral poems or *Eclogues*, the *Georgics* and the *Aeneid*—all written in that hexameter verse which Tennyson has called

"The stateliest measure ever moulded by the lips of man."

Eclogues.

The pastoral poems or *Eclogues*—a word denoting short selected pieces—were composed between the years 42 and 37 B.C., when Virgil was between the age of twenty-eight and thirty-three. By his invocation to the "Sicelides Musae" and "Arethusa," and by many other indications, he avows the purpose of eliciting from the strong Latin language the melody which the "Sicilian shepherd" drew out of the "Doric reed," and of expressing that tender feeling for the beauty of Italian scenes which Theocritus had expressed for the beauty of Sicily.

The earliest poems in the series were the second, third and fifth; and these, along with the seventh, are the most purely Theocritean in character. The first and ninth, which probably were next in order, are much more Italian in sentiment, are much more an expression of the poet's own feelings, and have a much more direct reference both to his own circumstances and the circumstances of the time. The first is a true poetical reflex of the distress and confusion which arose out of the new distribution of lands, and blends the poet's own deep love of his home, and of the sights and sounds familiar to him from childhood, with his Italian susceptibility to the beauty of nature. The ninth is immediately connected in subject with the first. It contains the lines which seem accurately to describe the site of Virgil's farm, at the point where the range of hills which accompany the river for some distance from the foot of the Lago di Garda sinks into the plain about 14 or 15 m. above Mantua. The sixth is addressed to Varus, who succeeded Pollio as governor of the Cisalpine district. Its theme is the creation of the world (according to the Epicurean cosmogony), and the oldest tales of mythology.[1] The fourth and eighth are both closely associated with the name of Virgil's earliest protector, Pollio. The fourth celebrates the consulship of his patron in 40 B.C., and also the prospective birth of a child, though it was disputed in antiquity, and still is disputed, who was meant by this child whose birth was to be coincident with the advent of the new era, and who, after filling the other great offices of state, was to "rule with his father's virtues the world at peace."[2] The main purpose of the poem, however, is to express the longing of the world for a new era of peace and happiness, of which the treaty of Brundisium seemed to hold out some definite hopes. There is no trace in this poem of Theocritean influence. The ideas are derived partly from Greek representations of the Golden Age, and partly, it is supposed, from the later Sibylline prophecies, circulated after the burning in the time of Sulla of the old Sibylline books, and possibly tinged with Jewish ideas. Some of the phraseology of the poem led to a belief in the early Christian church that Virgil had been an unconscious instrument of inspired prophecy. The date of the eighth is fixed by a reference to the campaign of Pollio against the Dalmatians in 39 B.C. It is founded on the Φαρμακευτρία of Theocritus, but brings before us, with Italian associations, two love tales of homely Italian life. The tenth reproduces the Daphnis of Theocritus, and is a dirge over the unhappy love of Gallus and Lycoris. As in the other poems, the second and eighth, of which love is the burden, it is to the romantic and fantastic melancholy which the passion assumes in certain natures that Virgil gives a voice.

There is no important work in Latin literature, with the exception of the comedy of Terence, so imitative as the *Eclogues*. But they are not, like the comedies of Terence, purely exotic as well as imitative. They are rather composite, partly Greek and partly Italian, and, as a vehicle for the expression of feeling, hold an undefined place between the objectivity of the Greek idyll and the subjectivity of the Latin elegy. For the most part, they express the sentiment inspired by the beauty of the world, and the kindred sentiment inspired by the charm of human relationships. Virgil's susceptibility to the beauty of nature appears in the truth with which his work suggests the charm of Italy—the fresh life of an Italian spring, the delicate hues of the wild flowers and the quiet beauty of the pastures and orchards of his native district. The representative character of the poems is enhanced by the fidelity and grace with which he has expressed the Italian peasant's love of his home and of all things associated with it. The supreme charm of the diction and rhythm is universally recognized. The power of varied harmony is as conspicuous in Virgil's earliest poems as in the maturer and more elaborate workmanship of the *Georgics* and *Aeneid*. The Italian language, without sacrifice of the fulness, strength and majesty of its tones, acquired a more tender grace and more liquid flow from the gift—the "molle atque facetum"—which the Muses of country life bestowed on Virgil.

Georgics.

But these Muses had a more serious and dignified function to fulfil than that of glorifying the picturesque pastime, the "otia dia," of rural life. The Italian imagination formed an ideal of the happiness of a country life nobler than that of passive susceptibility to the sights and sounds of the outward world. It is stated that Maecenas, acting on the principle of employing the poets of the time in favour of the conservative and restorative policy of the new government, directed the genius of Virgil to the subject of the *Georgics*. No object could be of more consequence in the eyes of a statesman whose master inherited the policy of the popular leaders than the revival of the great national industry, associated with happier memories of Rome, which had fallen into abeyance owing to the long unsettlement of the revolutionary era as well as to other causes. Virgil's previous life and associations made it natural for him to identify himself with this object, while his genius fitted him to enlist the imagination of his countrymen in its favour. It would be a most inadequate view of his purpose to suppose that, like the Alexandrian poets or the didactic poets of modern times, he desired merely to make useful information more attractive by the aid of verse. His aim was rather to describe with realistic fidelity, and to surround with an atmosphere of poetry, the annual round of labour in which the Italian yeoman's life was passed; to bring out the intimate relation with nature into which man was brought in the course of that life, and to suggest the delight to heart and imagination which he drew from it; to contrast the simplicity, security and sanctity of such a life with the luxury and lawless passions of the great world; and to associate the ideal of a life of rustic labour with the beauties of Italy and the glories of Rome. This larger conception of the dignity of his subject separates the didactic poem of Virgil from all other didactic, as distinct from philosophic, poems. He has produced in the *Georgics* a new type of didactic, as in the *Aeneid* he has produced a new type of epic, poetry.

The subject is treated in four books, varying in length from 514 to 566 lines. The first treats of the tillage of the fields, of the constellations, the rise and setting of which form the farmer's calendar, and of the signs of the weather, on which the success of his labours largely depends. The second treats of trees, and especially of the vine and olive, two great staples of the national wealth and industry of Italy; the third of the rearing of herds and flocks and the breeding of horses; the fourth of bees.

As he had found in Theocritus a model for the form in which his idler fancies were expressed, he turned to an older page in Greek literature for the outline of the form in which his graver interest in rural affairs was to find its outlet. The *Works and Days* of Hesiod could not supply an adequate mould for the systematic treatment of all the processes of rural industry, and still less for the treatment of the larger ideas to which this was subsidiary, yet that Virgil considered him as his prototype is shown by the line which concludes one of the cardinal episodes of the poem—

"Ascraeumque cano Romana per oppida carmen."

Virgil accepts also the guidance of the Alexandrian poets who treated the science of their day—astronomy, natural history and geography—in the metre and diction of epic poetry. But, in availing himself of the work of the Alexandrians, Virgil is like a great master making use of mechanical assistants. A more powerful influence on the form, ideas, sentiment and diction of the *Georgics* was exercised by the great philosophical poem of Lucretius, of which Virgil had probably been a diligent student since the time of its first appearance, and with which his mind was saturated when he was engaged in the composition of the *Georgics*. Virgil is at once attracted and repelled by the genius and attitude of the philosophic poet. He is possessed by his imaginative conception of nature, as a living, all-pervading power; he shares his Italian love of the beauty of the world, and his sympathy with animal as well as human life. He recognizes with enthusiasm his contemplative elevation above the petty interests and passions of life. But he is repelled by his apparent separation from the ordinary beliefs, hopes and fears of his fellow-men. Virgil is in thorough sympathy with the best restorative tendencies—religious, social and national—of his time; Lucretius was driven into isolation by the anarchic and dissolving forces of his.

So far as any speculative idea underlying the details of the *Georgics* can be detected, it is one of which the source can be traced to Lucretius—the idea of the struggle of human force with the forces of nature. In Virgil this idea is modified by Italian piety and by the Italian delight in the results of labour. In the general plan of the poem Virgil follows the guidance of Lucretius rather than that of any Greek model. The distinction between a poem addressed to national and one addressed to philosophical sympathies is marked by the prominence assigned in the one poem to Caesar as the supreme personality of the age, in the other to Epicurus as the supreme master in the realms of mind. The invocation to the "Di agrestes," to the old gods of mythology and art, to the living Caesar as the latest power added to the pagan Pantheon, is both a parallel and a contrast to the invocation to the all-pervading principle of life, personified as "Alma Venus." In the systematic treatment of his materials, and the interspersion of episodes dealing with the deeper poetical and human interest of the subject, Virgil adheres to the practice of the older poet. He uses his connecting links and formulas, such as "principio," "nunc age," &c., but uses them more sparingly, so as to make the logical mechanism of the poem less rigid, while he still keeps up the liveliness of a personal address. All his topics admit of being vitalized by attributing to natural processes the vivacity of human relationships and sensibility, and by association with the joy which the ideal farmer feels in the results of his energy. Much of the argument of Lucretius, on the other hand, is as remote from the genial presence of nature as from human associations. Virgil makes a much larger use than Lucretius of ornament borrowed from older poetry, art, science and mythology. There is uniformity of chastened excellence in the diction and versification of the *Georgics*, contrasting with the imaginative force of isolated expressions and the majesty of isolated lines and passages in Lucretius. The "vivida vis" of imagination is more apparent in the older poet; the artistic perfection of Virgil is even more conspicuous in the *Georgics* than in the *Eclogues* or the *Aeneid*.

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[1] In the *Georgics* also Virgil attempts to combine science with the poetic fancies which filled its place in older times.

[2] See *Virgil's Messianic Eclogue: Its Meaning, Occasion and Sources*, three studies by J. B. Mayor, W. Warde Fowler and R. S. Conway (1907).

The principal episodes of the poem, in which the true dignity and human interest of the subject are brought out, occur in the first and second books. Other shorter episodes add variety to the different books. These episodes are not detached or isolated ornaments, but give a higher unity to the poem, and are the main ground of its permanent hold upon the world. There is indeed one marked exception to this rule. The long episode with which the whole poem ends—the tale of the shepherd Aristaeus, with which is connected the more poetical fable of Orpheus and Eurydice—has only the slightest connexion with the general ideas and sentiment of the poem. It is altogether at variance with the truthful realism and the Italian feeling which pervade it. But we are distinctly told that the original conclusion had contained the praises of Gallus, the friend of Virgil's youth, who, about the time when Virgil was finishing the poem, had gained distinction in the war against Cleopatra, and had in consequence been made the first governor of the new province of Egypt. Such a conclusion might well have been in keeping with the main purpose of the poem. After the fall of Gallus, owing to his ambitious failure in his Egyptian administration, and his death in 26 B.C., the poet, according to the story, in obedience to the command of the emperor, substituted for this encomium the beautiful but irrelevant fable of Orpheus and Eurydice, in which he first displayed the narrative skill, the pathos and the magical power of making the mystery of the unseen world present to the imagination which characterize the *Aeneid*.

The cardinal episodes of the poem, as it now stands, are the passages in bk. i. from line 464 to the end, and in bk. ii. from 136 to 176 and from 475 to 542. The first, introduced in connexion with the signs of the weather, recounts the omens which accompanied the death of Julius Caesar, and shows how the misery of Italy and the neglected state of the fields are the punishment for the great sin of the previous generation. In the second of these passages the true keynote of the poem is struck in the invocation to Italy—

> "Salve, magna parens frugum, Saturnia tellus,
> Magna virum."

The thought of the beauties of the land, of the abundance and variety of its products, of its ancient cities and mighty works of man, its brave and hardy races, the great men who had fought for her in old times, and of him, the greatest among her sons, who was then defending Rome against her enemies in the farthest East, inspires the poet, and gives dignity to the trivial details of farm life. But a still higher and more catholic interest is given to the subject in the greatest of the episodes—the most perfect passage in all Latin poetry—that from line 458, "O fortunatos nimium," to the end. The subject is there glorified by its connexion not only with the national well-being but with the highest life and purest happiness of man. The old delight in the labours of the field blends with the new delight in the beauty of nature, and is associated with that purity and happiness of family life which was an Italian ideal, and with the poetry of those religious beliefs and observances which imparted a sense of security, a constantly recurring charm, and a bond of social sympathy to the old rustic life.

The *Georgics* is not only the most perfect, but the most native of all the works of the ancient Italian genius. Even where he borrows from Greek originals, Virgil makes the Greek mind tributary to his national design. The *Georgics*, the poem of the land, is as essentially Italian as the *Odyssey*, the poem of the sea, is essentially Greek. Nature is presented to us as she is revealed in the soft luxuriance of Italian landscape, not in the clearly defined forms of Greek scenery. The poem shows the Italian susceptibility to the beauty of the outward world, the dignity and sobriety of the Italian imagination, the firm and enduring structure of all Roman workmanship, while it is essentially Italian in its religious and ethical feeling.

Aeneid.

The work which yet remained for Virgil to accomplish was the addition of a great Roman epic to literature. This had been the earliest effort of the national imagination, when it first departed from the mere imitative reproduction of Greek originals. The work which had given the truest expression to the genius of Rome before the time of Virgil had been the *Annales* of Ennius. This had been supplemented by various historical poems but had never been superseded. It satisfied the national imagination as an expression of the national life in its vigorous prime, but it could not satisfy the newly developed sense of art; and the expansion of the national life since the days of Ennius, and the changed conditions into which it passed after the battle of Actium, demanded a newer and ampler expression. It had been Virgil's earliest ambition to write an heroic poem on the traditions of Alba Longa; and he had been repeatedly urged by Augustus to celebrate his exploits. The problem before him was to compose a work of art on a large scale, which should represent a great action of the heroic age, and should at the same time embody the most vital ideas and sentiment of the hour—which in substance should glorify Rome and the present ruler of Rome, while in form it should follow closely the great models of epic poetry and reproduce all their sources of interest. It was his ambition to be the Homer, as he had been the Theocritus and Hesiod, of his country.

Various objects had thus to be combined in a work of art on the model of the Greek epic: the revival of interest in the heroic foretime; the satisfaction of national sentiment; the expression of the deeper currents of emotion of the age; the personal celebration of Augustus. A new type of epic poetry had to be created. It was desirable to select a single heroic action which should belong to the cycle of legendary events celebrated in the Homeric poems, and which could be associated with Rome. The only subject which in any way satisfied these conditions was that of the wanderings of Aeneas and of his final settlement in Latium. The story, though not of Roman origin but of a composite growth, had long been familiar to the Romans, and had been recognized by official acts of senate and people. The subject enabled Virgil to tell again of the fall of Troy, and to weave a tale of sea-adventure similar to that of the wanderings of Odysseus. It was also recommended by the claim which the Julii, a patrician family of Alban origin, made to descent from Iulus, the supposed son of Aeneas and founder of Alba Longa.

The *Aeneid* is thus at once the epic of the national life under its new conditions and an epic of human character. The true keynote of the poem is struck in the line with which the proem closes—

> "Tantae molis erat Romanam condere gentem."

The idea which underlies the whole action of the poem is that of the great part played by Rome in the history of the world, that part being from of old determined by divine decree, and carried out through the virtue of her sons. The idea of universal empire is thus the dominant idea of the poem. With this idea that of the unbroken continuity of the national life is intimately associated. The reverence for old customs and for the traditions of the past was a large element in the national sentiment, and has a prominent place in the *Aeneid*. So too has the feeling of local attachment and of the power of local association over the imagination. The poem is also characteristically Roman in the religious belief and observances which it embodies. Behind all the conventional machinery of the old Olympic gods there is the Roman apprehension of a great inscrutable power, manifesting itself by arbitrary signs, exacting jealously certain observances, working out its own secret purposes through the agency of Roman arms and Roman counsels.

The poem is thus a religious as well as a national epic, and this explains the large part played in the development of the action by special revelation, omens, prophecies, ceremonial usages and prayer. But, while the predominant religious idea of the poem is that of a divine purpose carried out regardlessly of human feeling, in other parts of the poem, and especially in that passage of the sixth book in which Virgil tries to formulate his deepest convictions on individual destiny, the agency of fate seems to yield to that of a spiritual dispensation, awarding to men their portions according to their actions.

The idealization of Augustus is no expression of servile adulation. It is through the prominence assigned to him that the poem is truly representative of the critical epoch in human affairs at which it was written. The cardinal fact of that epoch was the substitution of personal rule for the rule of the old commonwealth over the Roman world. Virgil shows the imaginative significance of that fact by revealing the emperor as chosen from of old in the counsels of the supreme ruler of the world to fulfil the national destiny, as the descendant of gods and of heroes of old poetic renown; as one, moreover, who, in the actual work done by him, as victor in a great decisive battle between the forces of the Western and the Eastern world, as the organizer of empire and restorer of peace, order and religion, had rendered better service to mankind than any one of the heroes who in an older time had been raised for their great deeds to the company of the gods.

Virgil's true and yet idealizing interpretation of the imperial idea of Rome is the basis of the greatness of the *Aeneid* as a representative poem. It is on this representative character and on the excellence of its artistic execution that the claim of the *Aeneid* to rank as one of the great poems of the world mainly rests. The inferiority of the poem to the *Iliad* and the *Odyssey* as a direct representation of human life is so unquestionable that we are in danger of underrating the real though secondary interest which the poem possesses as an imitative epic of human action, manners and character. In the first place it should be remarked that the action is chosen not only as suited to embody the idea of Rome, but as having a peculiar nobleness and dignity of its own. It brings before us the spectacle of the destruction of the city of greatest name in poetry or legend, of the foundation of the imperial city of the western seas, in which Rome had encountered her most powerful antagonist in her long struggle for supremacy, and that of the first rude settlement on the hills of Rome itself. The scenes through which the action is carried are familiar, yet full of great memories and associations—Troy and its neighbourhood, the seas and islands of Greece, the coasts of Epirus, familiar to all travellers between Italy and the East, Sicily, the site of Carthage, Campania, Latium, the Tiber, and all the country within sight of Rome. The personages of the action are prominent in poetry and legend, or by their ethnical names stir the sentiment of national enthusiasm—Aeneas and Anchises, Dido, Acestes, Evander, Turnus. The spheres of activity in which they are engaged are war and sea-adventure. The passion of love is a powerful addition to the older sources of interest. The *Aeneid* revives, by a conventional compromise between the present and the remote past, some image of the old romance of Greece; it creates the romance of "that Italy for which Camilla the virgin, Euryalus, and Turnus and Nisus died of wounds." It might be said of the manner of life represented in the *Aeneid*, that it is no more true to any actual condition of human society than that represented in the *Eclogues*. But may not the same be said of all idealizing restoration of a remote past in an age of advanced civilization? The life represented in the *Oedipus Tyrannus* or in *King Lear* is not the life of the Periclean nor of the Elizabethan age, nor is it conceivable as the real life of a prehistoric age. The truth of such a representation is to be judged, not by its relation to any actual state of things ever realized in the world, but by its relation to an ideal of the imagination—the ideal conception of how man, endowed with the gifts and graces of a civilized time, but yet not without the buoyancy of a more primitive age, might play his part under circumstances which would afford scope for the passions and activities of a vigorous personality, and for the refined emotions and subtle reflection of an era of high intellectual and moral cultivation. The verdict of most readers of the *Aeneid* will be that Virgil does not satisfy this condition as it is satisfied by Sophocles and Shakespeare. Yet there is a courtesy, dignity and consideration for the feelings of others in the manners of his chief personages, such as might be exhibited by the noblest in an age of chivalry and in an age of culture. The charm of primitive simplicity is present in some passages of the *Aeneid*, the spell of luxurious pomp in others. The delight of voyaging past beautiful islands is enhanced by the suggestion of the adventurous spirit which sent the first explorers abroad. Where Virgil is least real, and most purely imitative, is in the battle-scenes of the later books. They afford scope, however, to his patriotic desire to do justice to the martial energy of the Italian races; and some of them have a peculiar beauty from the pathos with which the deaths of some of the heroes are described.

But the adverse criticisms of the *Aeneid* are chiefly based on Virgil's supposed failure in the crucial test of the creation of character. And his chief failure is pronounced to be the "pious Aeneas." Is Aeneas a worthy and interesting hero of a great poem of action? Not, certainly, according to the ideals realized in Achilles and Odysseus, nor according to the modern ideal of heroism. Virgil wishes to hold up in Aeneas an ideal of pious obedience and persistent purpose—a religious ideal belonging to the ages of faith combined with the humane and self-sacrificing qualities belonging to an era of moral enlightenment. His own sympathy is with his religious ideal rather than with that of chivalrous romance. Yet that there was in his own imagination a chord responsive to the chivalrous emotion of a later time is seen in the love and pathos which he has thrown into his delineations of Pallas, Lausus and Camilla. But he felt that the deepest need of his time was not military glory, but peace, reconciliation, the restoration of law, order and piety.

In Dido Roman poetry has added to the great gallery of men and women, created by the imaginative art of different times and peoples, the ideal of a true queen and a true woman. On the episode of which she is the heroine the most passionate human interest is concentrated. It has been objected that Virgil does not really sympathize with his own creation, that he gives his approval to the cold desertion of her by Aeneas. But if he does not condemn his hero, he sees in the desertion and death of Dido a great tragic issue in which a noble and generous nature is sacrificed to the larger purpose of the gods. But that Virgil really sympathized with the creation of his imagination appears, not only in the sympathy which she still inspires, but in the part which he assigns to her in that shadowy realm—

> "Conjunx ubi pristinus illi
> Respondet curis, aequatque Sychaeus amorem."

Even those who have been insensible to the representative and to the human interest of the *Aeneid* have generally recognized the artistic excellence of the poem. This is conspicuous both in the conception of the action and the arrangement of its successive stages and in the workmanship of details. Each of the first eight books has a large and distinct sphere of interest, and they each contribute to the impression of the work as a whole. In the first book we have the storm, the prophecy of Jove and the building of Carthage; in the second the destruction of Troy; in the third the voyage among the islands and coasts of the Mediterranean; in the fourth the tragedy of Dido; in the fifth the rest in the Sicilian bay, at the foot of Mount Eryx; in the sixth the revelation of the spiritual world of Virgil's imagination, and of the souls of those who built up the greatness of Rome in their pre-existent state; in the seventh the arrival of the Trojans at the mouth of the Tiber and the gathering of the Italian clans; in the eighth the first sight of the hills of Rome, and the prophetic representation of the great crises in Roman history, leading up to the greatest of them all, the crowning victory of Actium. Among these books we may infer that Virgil assigned the palm to the second, the fourth and the sixth, as he selected them to read to Augustus and the imperial family. The interest is generally thought to flag in the last four books; nor is it possible to feel that culminating sympathy with the final combat between Turnus and Aeneas that we feel with the combat between Hector and Achilles. Yet a personal interest is awakened in the adventures and fate of Pallas, Lausus and Camilla. Virgil may himself have become weary of the succession of battle-scenes—"eadem horrida bella"—which the requirements of epic poetry called upon him to portray. There is not only a less varied interest, there is greater inequality of workmanship in the later books, owing to the fact that they had not received their author's final revisal. Yet in them there are many lines and passages of great power, pathos and beauty. Virgil brought the two great instruments of varied and continuous harmony and of a rich, chastened and noble style to the highest perfection of which the Latin tongue was capable. The rhythm and style of the *Aeneid* is more unequal than the rhythm and style of the *Georgics*, but is a larger and more varied instrument. The note of his supremacy among all the poetic artists of his country is that subtle fusion of the music and the meaning of language which touches the deepest and most secret springs of emotion. He touches especially the emotions of reverence and of yearning for a higher spiritual life, and the sense of nobleness in human affairs, in great institutions, and great natures; the sense of the sanctity of human affections, of the imaginative spell exercised by the past, of the mystery of the unseen world. This is the secret of the power which his words have had over some of the deepest and greatest natures in all ages. (W. Y. S.; T. R. G.)

BIBLIOGRAPHY

Appendix Vergiliana.—Under this collective name there are current several poems of some little length and some groups of shorter pieces, all attributed to Virgil in antiquity. Virgil wrote a *Culex*, but not the *Culex* now extant, though it passed for his half a century after his death. The *Aetna*, the *Ciris* and the *Copa* are clearly not Virgil's. The *Moretum* is said to have been translated by him from a Greek poem by his teacher Parthenius; it is an exquisite piece of work, familiar perhaps to English readers in Cowper's translation. The case of the *Catalepton* (κατὰ λεπτὸν) is peculiar. Two of these little poems (*Ite hinc indnes* and *Villula quae Sironis*) are generally accepted as Virgil's; opinion varies as to the rest, with very little to go upon, but generally rejecting them. The whole are printed in the larger editions of Virgil. For English readers the most obvious edition is that of Robinson Ellis (1907), who has also edited the *Aetna* separately.

Manuscripts.—Gellius (*Noctes Atticae*, ix. 14, 7) tells us of people who had inspected *idiographum librum Vergilii*, but this has of course in all probability long since perished. There are, however, seven very ancient MSS. of Virgil. (1) The Mediceus at Florence, with a note purporting to be by a man, who was consul in 494, to say he had read it. (2) The Palatinus Vaticanus of the 4th or 5th century. (3) The Vaticanus of the same period. (4) The "Schedae Vaticanae." (5) The "Schedae Berolinenses," perhaps of the 4th century. (6) The "Schedae Sangallenses." (7) The "Schedae rescriptae Veronenses"—the last three of insignificant extent. For a full account of the MSS., see Henry, *Aeneidea*, i., and Ribbeck, *Prolegomena ad Verg.*

Ancient Commentators.—Commentaries on Virgil began to be written at a very early date. Suetonius, *V. Verg.* 44, mentions an *Aeneidomastix* of Carvilius Pictor and other works on Virgil's "thefts" and "faults," besides eight "volumina" of Q. Octavius Avitus, setting out in parallel passages the "likenesses" (ὁμοιότητες was the name of the work) between Virgil and more ancient authors. M. Valerius Probus (latter part of 1st century A.D.) wrote a commentary, but it is doubtful for how much of what passes under his name he is responsible, if for any of it. At the end of the 4th century come the commentaries of Tiberius Claudius Donatus and of Servius, the former writing as a teacher of rhetoric, the latter of style and grammar. The work of Servius was afterwards expanded by another scholar, whose additions greatly added to its worth, as they are drawn from older commentators and give us very valuable information on the old Roman religion and constitution, Greek and Latin legends, old Latin and linguistic usages. In this enlarged form the commentary of Servius and the *Saturnalia* of Macrobius (also of the end of the 4th century) are both of great interest to the student of Virgil. There are, further, sets of Scholia in MSS at Verona and Bern, which draw their material from ancient commentaries. See H. Nettleship, *Essays in Latin Literature*, xi., and Comparetti, *Vergil in the Middle Ages*, ch. 5.

Editions.—The editions of Virgil are innumerable; Heyne (1767–1800), Forbiger (1872–75) and Ribbeck (1859–66) in Germany, Benoist (1876) in France, and Conington (completed by Nettleship, and edited by Haverfield) in England, are perhaps the most important. Good school editions in English have been produced by Page, Sidgwick and Papillon. Conington's work, however, is without question the best in English.

Translations.—Famous English translations have been made by Dryden and by a host of others since his day. Since the middle of the 19th century the most important are Conington (*Aeneid* in verse, whole works in prose); J. W. Mackail (*Aeneid* and *Georgics* in prose); William Morris (*Aeneid* in verse); Lord Justice Bowen (*Eclogues* and *Aeneid*, i.–vi. in verse); Canon Thornhill (verse); C. J. Billson (verse, 1906); J. Rhoades (verse, new ed., 1907). For essays on translating Virgil, see Conington, *Miscellaneous Works*, vol. i.; R. Y. Tyrrell, *Latin Poetry* (appendix).

AUTHORITIES.—For full bibliographies of Virgil consult Schanz, *Gesch. der Römischen Litteratur* (1899) (in Iwan von Müller's series, *Handbuch der Klassischen Altertums-Wissenschaft*), and Teuffel, *History of Roman Literature*, edited by L. Schwabe and tr. by G. C. W. Warr (1900). On the life of Virgil: Nettleship's *Ancient Lives of Vergil* (1879) discusses the authorities, printing one of the lives, which he shows to be by Suetonius. On the *Eclogues*: Glaser, *V. als Naturdichter u. Theist* (1880); Cattault, *Étude sur les Bucoliques de V.* (1897). On the *Georgics*: Morsch, *De Graecis in Georgicis a V. expressis* (1878); Norden, "V.-studien" (in *Hermes*, vol. 28, 1893) (Norden has little patience with "aesthetic criticism"). On the *Aeneid*: Schwegler, *Röm. Gesch.* vol. i. (1853); Cauer, *De fabulis Graecis ad Romam conditam pertinentibus*; Hild, *La Légende d'Énée avant V.* (1883); Förstemann, *Zur Gesch. des Aeneasmythus*; H. de la Ville de Mirmont, *Apollonios de Rhodes et Virgile* (1894) (rather too long); Plüss, *V. u. die epische Kunst* (1884); Georgii, *Die politische Tendenz der Aen.* (1880); Boissier, *Nouvelles promenades archéologiques* (1886) (trans. under title *The Country of Horace and Virgil*, by D. Havelock Fisher, 1895); Gibbon, *Critical Observations on the Sixth Book of the Aeneid* (1770); Boissier, *La Religion romaine d'Auguste aux Antonins* (1884) (with section on sixth *Aeneid*); Ettig, *Acheruntica* (Leipziger Studien, 1891); Norden, "V.-studien" (in *Hermes*, vol. 28, 1893), on sixth *Aeneid*, and papers in *Neue Jahrbücher für kl. Altertum* (1901); Dieterich, *Nekyia* (1893) (on Apocalypse of Peter and ancient teaching on the other life—a valuable book); Henry, *Aeneidea* (1873–79) (a book of very great learning, wit, sense and literary judgment; the author, an Irish physician, gave twenty years to it, examining MSS., exploring Virgil's country, and reading every author whom Virgil could have used and nearly every ancient writer who used Virgil).

Virgil-literature: Sainte-Beuve, *Étude sur Virgile* (one of the great books on Virgil); Comparetti, *Virgilio nel medio Evo* (1872)—Eng. tr., *Vergil in the Middle Ages*, by E. F. M. Benecke (1895) (a book of very great and varied interest); Heinze, *Virgil's epische Technik* (1902); W. Y. Sellar, *Roman Poets of the Augustan Age: Virgil* (2nd ed. 1883); Glover, *Studies in Virgil* (1904). Essays in the following: F. W. H. Myers, *Essays* [*Classical*] (1883), the most famous English essay on Virgil; J. R. Green, *Stray Studies* (1876) (an excellent study of Aeneas); W. Warde Fowler, *A Year with the Birds* (on Virgil's bird-lore); Nettleship, *Essays in Latin Literature* (1884); Tyrrell, *Latin Poetry* (1898); Patin, *Essais sur la poésie Latine* (4th ed. 1900) (one of the finest critics of Latin literature); Goumy, *Les Latins* (1892) (a volume of very bright essays); J. W. Mackail, *Latin Literature* (3rd ed. 1899). (T. R. G.)

The Virgil Legend.

Virgil's great popularity in the middle ages is to be partly explained by the fact that he was to a certain extent recognized by the Church. He was supposed to have prophesied the coming of Christ in the fourth *Eclogue*, and by some divines the *Aeneid* was held to be an allegory of sacred things. This position was sufficiently emphasized by Dante when he chose him from among all the sages of antiquity to be his guide in the *Divina Commedia*. Ancient poets and philosophers were commonly transformed by medieval writers into necromancers; and Virgil and Aristotle became popularly famous, not for poetry and science, but for their supposed knowledge of the black art. Naples appears to have been the home of the popular legend of Virgil, which represented him as the special protector of the city, but was probably never quite independent of learned tradition.

One of the earliest references to the magical skill of Virgil[1] occurs in a letter of the imperial chancellor Conrad of Querfurt (1194), reproduced by Arnold of Lübeck in the continuation of the *Chronica Slavorum* of Helmold. John of Salisbury alludes to the brazen fly fabricated by Virgil; Hélinand (d. 1227) speaks of similar marvels in a work from which Vincent of Beauvais has borrowed; and Gervase of Tilbury, in his *Otia Imperialia* (1212), and Alexander of Neckam (d. 1217), in *De Naturis Rerum*, have reproduced these traditions, with additions. German and French poets did not overlook this accessory to their repertory. The *Roman de Cléomadès* of Adenés li rois (12th century) and the *Image du Monde* of Gauthier de Metz (1245) contain numerous references to the prodigies of the enchanter. Reynard the Fox informs King Lion that he had from the wise Virgil a quantity of valuable receipts. He also plays a considerable part in the popular folk-tale *The Seven Wise Masters*, and appears in the *Gesta Romanorum* and that curious guidebook for pilgrims, the *Mirabilia Romae*. He is to be found in John Gower's *Confessio Amantis* and in John Lydgate's *Bochas*. A Spanish romance, *Vergilios*, is included by E. de Ochoa in his *Tesoro* (Paris, 1838), and Juan Ruiz, archpriest of Hita (d. *c.* 1360), also wrote a poem on the subject. Many of the tales of magic throughout Europe were referred to Virgil, and gradually developed into a completely new life, strangely different from that of the real hero. They were collected in French under the title of *Les Faitz Merveilleux de Virgille* (*c.* 1499), a quarto chapbook of ten pages, which became extremely popular, and was printed, with more or less additional matter, in other languages. The English version, beginning "This is resonable to wryght the mervelus dedes done by Virgilius," was printed about 1520. We are told how Virgil beguiled the devil at a very early age, in the same fashion as the fisherman persuaded the jinnee in the *Arabian Nights* to re-enter Solomon's casket. Another reproduction of a widely spread tale was that of the lady who kept Virgil suspended in a basket. To revenge the affront the magician extinguished all the fires in the city, and no one could rekindle them without subjecting the lady to an ordeal highly offensive to her modesty. Virgil made for the emperor a castle in which he could see and hear everything done or said in Rome, an ever-blooming orchard, statues of the tributary princes which gave warning of treason or rebellion, and a lamp to supply light to the city. He abducted the soldan's daughter, and built for her the city of Naples upon a secure foundation of eggs. At last, having performed many extraordinary things, he knew that his time was come. In order to escape the common lot he placed all his treasures in a castle defended by images unceasingly wielding iron flails, and directed his confidential servant to hew him in pieces, which he was to salt and place in a barrel in the cellar, under which a lamp was to be kept burning. The servant was assured that after seven days his master would revive, a young man. The directions were carried out; but the emperor, missing his medicine-man, forced the servant to divulge the secret and to quiet the whirling flails. The emperor and his retinue entered the castle and at last found the mangled corpse. In his wrath he slew the servant, whereupon a little naked child ran thrice round the barrel, crying, "Cursed be the hour that ye ever came here," and vanished.

For the legends connected with Virgil see especially D. Comparetti, *Virgilio nel medio evo* (2nd ed., Florence, 1896; English trans., E. F. M. Benecke, 1895). The chief original source for the Neapolitan legends is the 14th-century *Cronica di Partenope*. See further W. J. Thoms, *Early Eng. Prose Romances* (1858); G. Brunet, *Les Faitz merveilleux de Virgile* (Geneva, 1867); E. Duméril, "Virgile enchanteur" (*Mélanges archéologiques*, 1850); Gervase of Tilbury, *Otia Imper.* (ed. Liebrecht, 1856); P. Schwubbe, *Virgilius per mediam aetatem* (Paderborn, 1852); Siebenhaar, *De fabulis quae media aetate de Virgilio circumf.* (Berlin, 1837); J. G. T. Graesse, *Beiträge zur Litt. u. Sage des Mittelalters* (1850); Bartsch, "Gedicht auf. d. Zaub. Virgil" (Pfeiffer's *Germania*, iv. 1859); F. Liebrecht, "Der Zauberer Virgilius" (ibid. x. 1865); K. L. Roth, "Über d. Zaub. Virgilius" (ibid. iv. 1859); W. Victor, "Der Ursprung der Virgilsage" (*Zeit. f. rom. Phil.* i. 1877); A. Graf, *Roma nella memoria e nelle imaginazioni del medio evo* (Turin, 1882); F. W. Genthe, *Leben und Fortleben des Publius Virgilius Maro als Dichter und Zauberer* (2nd ed., Magdeburg, 1857). (M. BR.)

VIRGIL, POLYDORE (*c.* 1470–1555), English historian, of Italian extraction, otherwise known as P. V. CASTELLENSIS, was a kinsman of Cardinal Hadrian Castellensis, a native of Castro in Etruria. His father's name is said to have been George Virgil; his great-grandfather, Anthony Virgil, "a man well skilled in medicine and astrology," had professed philosophy at Paris, as did Polydore's own brother and protégé John Matthew Virgil, at Pavia, in 1517. A third brother was a London merchant in 1511. Polydore was born at Urbino, is said to have been educated at Bologna, and was probably in the service of Guido Ubaldo, duke of Urbino, before 1498, as in the dedication of his first work, *Liber Proverbiorum* (April 1498), he styles himself this prince's client. Polydore's second book, *De Inventoribus Rerum*, is dedicated to Guido's tutor,

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[1] The Irish apostle to Carinthia, St Virgilius, bishop of Salzburg (d. 784), who held original views on the subject of antipodes, may have been the real eponym of the legend.

Ludovicus Odaxius, from Urbino, in August 1499. After being chamberlain to Alexander VI. he came to England in 1501 as deputy collector of Peter's pence for the cardinal. As Hadrian's proxy, he was enthroned bishop of Bath and Wells in October 1504. It was at Henry VII.'s instance that he commenced his *Historia Anglica*—a work which, though seemingly begun as early as 1505, was not completed till August 1533, the date of its dedication to Henry VIII., nor published till 1534. In May 1514 he and his patron the cardinal are found supporting Wolsey's claims to the cardinalship, but he had lost the great minister's favour before the year was out. A rash letter, reflecting severely on Henry VIII. and Wolsey, was intercepted early in 1515, after which Polydore was cast into prison and supplanted in his collectorship (March and April). He was not without some powerful supporters, as both Catherine de' Medici and Leo X. wrote to the king on his behalf. From his prison he sent an abject and almost blasphemous letter to the offended minister, begging that the fast approaching Christmas—a time which witnessed the restitution of a world—might see his pardon also. He was set at liberty before Christmas 1515, though he never regained his collectorship. In 1525 he published the first edition of *Gildas*, dedicating the work to Tunstall, bishop of London. Next year appeared his *Liber de Prodigiis*, dedicated from London (July) to Francesco Maria, duke of Urbino. Somewhere about 1538 he left England, and remained in Italy for some time. Ill-health, he tells us, forbade him on his return to continue his custom of making daily notes on contemporary events. About the end of 1551 he went home to Urbino, where he appears to have died in 1555. He had been naturalized an Englishman in October 1510, and had held several clerical appointments in England. In 1508 he was appointed archdeacon of Wells, and in 1513 prebendary of Oxgate in St Paul's cathedral, both of which offices he held after his return to Urbino.

The first edition of the *Historia Anglica* (twenty-six books) was printed at Basel in 1534; the twenty-seventh book, dealing with the reign of Henry VIII. down to the birth of Edward VI. (October 1536), was added to the third edition of 1555. Polydore claims to have been very careful in collecting materials for this work, and takes credit for using foreign historians as well as English; for which reason, he remarks, the English, Scotch and French will find several things reported in his pages far differently from the way in which they are told in current national story. In his search after information he applied to James IV. of Scotland for a list of the Scottish kings and their annals; but not even his friendship for Gavin Douglas could induce him to give credit to the historical notions of this accomplished bishop, who traced the pedigree of the Scots down from the banished son of an Athenian king and Scotta the daughter of the Egyptian tyrant of the Israelites. A similar scepticism made him doubt the veracity of Geoffrey of Monmouth, and thus called forth Leland's *Defensio Gallofridi* and *Assertio Incomparabilis Arturii*. This doubting instinct led to his being accused of many offences against learning, such as that of burning cartloads of MSS. lest his errors should be discovered, of purloining books from libraries and shipping them off by the vesselful to Rome. As a matter of fact, it is of course mainly from the time of Henry VI., where our contemporary records begin to fail so sadly, that Polydore's work is useful. He must have been personally acquainted with many men whose memories could carry them back to the beginning of the Wars of the Roses. Dr Brewer speaks somewhat harshly of him as an authority for the reign of Henry VIII., and indeed his spite against Wolsey is evident; but it is impossible to read his social and geographical accounts of England and Scotland without gratitude for a writer who has preserved so many interesting details. Polydore's *Adagia* (Venice, April 1498) was the first collection of Latin proverbs ever printed; it preceded Erasmus's by two years, and the slight misunderstanding that arose for the moment out of rival claims gave place to a sincere friendship. A second series of Biblical proverbs (553 in number) was dedicated to Wolsey's follower, Richard Pace, and is preceded by an interesting letter (June 1519), which gives the names of many of Polydore's English friends, from More and Archbishop Warham to Linacre and Tunstall. The *De Inventoribus*, treating of the origin of all things whether ecclesiastical or lay (Paris, 1499), originally consisted of only seven books, but was increased to eight in 1521. It was exceedingly popular, and was early translated into French (1521), German (1537), English (1546) and Spanish (1551). All editions, however, except those following the text sanctioned by Gregory XIII. in 1576, are on the Index Expurgatorius. The *De Prodigiis* also achieved a great popularity, and was soon translated into Italian (1543), English (1546) and Spanish (1550). This treatise takes the form of a Latin dialogue between Polydore and his Cambridge friend Robert Ridley. It takes place in the open air, at Polydore's country house near London. Polydore's duty is to state the problems and supply the historical illustrations; his friend's to explain, rationalize and depreciate as best he can. Here, as in the *Historia Anglica*, it is plain that the writer plumes himself specially on the excellence of his Latin, which in Sir Henry Ellis's opinion is purer than that of any of his contemporaries.

VIRGINAL, or Pair of Virginals, a name applied in England, and also recognized on the continent of Europe, to the spinet, and more especially to the small pentagonal and to the rectangular models. The word virginal, bestowed because it was pre-eminently the instrument for girls, denotes before all a keyboard instrument, having for each note one string only, plucked by means of a quill attached to a jack.[1] The fine instrument in the Victoria and Albert Museum, known as Queen Elizabeth's virginal, is an Italian pentagonal spinet, elaborately emblazoned with the coat of arms of the queen, and having a compass of just over four octaves. King Henry VIII. and his daughters, Queen Mary and Queen Elizabeth, were all accomplished performers on the virginal. (K. S.)

VIRGINIA, or Verginia, in Roman legendary history, daughter of L. Virginius, a plebeian centurion. Her beauty attracted the notice of the decemvir Appius Claudius, who instructed Marcus Claudius, one of his clients, to claim her as his slave. Marcus accordingly brought her before Appius, and asserted that she was the daughter of one of his female slaves, who had been stolen and passed off by the wife of Virginius as her own child. Virginius presented himself with his daughter before the tribunal of Appius, who, refusing to listen to any argument, declared Virginia to be a slave and the property of Marcus. Virginius thereupon stabbed her to the heart in the presence of Appius and the people. A storm of popular indignation arose and the decemvirs were forced to resign. The people for the second time "seceded" to the Sacred Mount, and refused to return to Rome until the old form of government was re-established.

See Livy iii. 44–58; Dion. Halic. xi. 28–45, whose account differs in some respects from Livy's; Cicero, *De finibus*, ii. 20; Val. Max. vi. 1. 2; for a critical examination of the story and its connexion with the downfall of the decemvirs, see Sir G. Cornewall Lewis, *Credibility of Early Roman History*, ii.; Schwegler, *Römische Geschichte*, bk. xxx. 4, 5; also E. Pais, *Ancient Legends of Roman History* (Eng. trans. 1906), p. 185, according to whom the legends of Virginia and Lucretia (two different versions of one and the same story, connecting the history of Roman liberty with the martyrdom of a woman) are nothing but late elaborations of legends connected with the cults of Ardea.

VIRGINIA, one of the more N. of the S.E. Atlantic states of the United States of America, lying between latitudes 36° 30′ and 39° 30′ N., and longitude 75° 15′ and 83° 40′ W. It is bounded on the N.W. by Kentucky and West Virginia, the irregular boundary line following mountain ridges for a part of its course; on the N.E. by Maryland, from which it is separated by the Potomac river; on the S. by North Carolina and Tennessee, the boundary line being nominally a parallel of latitude, but actually a more irregular line. Virginia has an area of 42,627 sq. m., of which 2365 sq. m. are water surface, including land-locked bays and harbours, rivers and Lake Drummond. The state has a length of about 440 m. E. and W., measured along its S. boundary; and an extreme breadth N. and S. of about 200 m.

Physical Features.—Virginia is crossed from N. to S. or N.E. to S.W. by four distinct physiographic provinces. The easternmost is the Coastal Plain Province, and forms a part of the great Coastal Plain bordering the S.E. United States from New York Harbour to the Rio Grande. This province occupies about 11,000 sq. m. of the state, and is known as "Tidewater Virginia." After the plain had been raised above sea-level to a higher elevation than it now occupies, it was much dissected by streams and then depressed, allowing the sea to invade the stream valleys. Such is the origin of the branching bays or "drowned river valleys," among which may be noted the lower Potomac, Rappahannock, York and James rivers. Chesapeake Bay itself is the drowned lower course of the Susquehanna river, to which the other streams mentioned were tributary previous to the depression which transformed them into bays. The land between the drowned valleys is relatively flat, and varies in height from sea-level on the E. to 150–300 ft. on the W. border. Passing westward across the "fall-line," the next province is the Piedmont, a part of the extensive Piedmont Belt reaching from Pennsylvania to Alabama. This is the most extensive of the subdivisions of Virginia, comprising 18,000 sq. m. of its area, and varying in elevation from 150–300 ft. on the E. to 700–1200 ft. along the foot of the Blue Ridge at the W. The sloping surface is gently rolling, and has resulted from the uplift and dissection of a nearly level plain of erosion developed on folded, crystalline rocks. Occasional hard rock ridges rise to a moderate elevation above the general level, while areas of unusually weak Triassic sandstones have been worn down to form lowlands. W. of the Piedmont, and like it consisting of crystalline rocks, is the Blue Ridge, a mountain belt from 3 to 20 m. in breadth, narrowing toward the N., where it passes into Maryland, and broadening southward toward its great expansion in W. North Carolina and E. Tennessee, where it is transformed into massive mountain groups. In elevation the Blue Ridge of Virginia varies from 1460 ft. at Harper's Ferry, where the Potomac river breaks through it in a splendid water-gap, to 5719 ft. in Mt. Rogers, Grayson county. About 2500 sq. m. of the state are comprised in this province. W. of the Blue Ridge is the Newer Appalachian or Great Valley Province, characterized by parallel ridges and valleys developed by erosion on folded beds of sandstone, limestone and shales, and comprising an area of about 10,400 sq. m. in Virginia. The belts of non-resistant rock have been worn away, leaving longitudinal valleys separated by hard rock ridges. A portion of this province in which weak rocks predominate gives an unusually broad valley region, known as the Valley of Virginia, drained by the Shenandoah river, and the headwaters of the James, Roanoke, New, and Holston rivers, which dissect the broad valley floor into gently rolling low hills. At the N., near the mouth of the Shenandoah, the valley is about 250 ft. above sea-level, but rises south-westward to an elevation of more than 1600 ft. at the S. boundary of the state.

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[1] The mechanism is described under Pianoforte and Spinet.

The rivers of the state flow in general from N.W. to S.E., across the Blue Ridge, the Piedmont and the Coastal Plain, following courses which were established before erosion had produced much of the present topography. But in the Newer Appalachians the streams more often follow the trend of the structure until they empty into one of the larger, transverse streams. Thus the Shenandoah flows N.E. to the Potomac, the Holston S.W. toward the Tennessee. A part of this same province, in the S.W. part of the state, is drained by the New river, which flows N.W. across the ridges to the Kanawha and Ohio rivers in the Appalachian Plateau. In the limestone regions caverns and natural bridges occur, among which Luray Cavern and the Natural Bridge are well known. The drowned lower courses of the S.E. flowing streams are navigable, and afford many excellent harbours. Chesapeake Bay covers much land that might otherwise be agriculturally valuable, but repays this loss, in part at least, by its excellent fisheries, including those for oysters. In the S.E., where the low, flat Coastal Plain is poorly drained, is the Great Dismal Swamp, a fresh-water marsh covering 700 sq. m., in the midst of which is Lake Drummond, 2 m. or more in diameter. Along the shores of Chesapeake Bay and the Atlantic Ocean are low, sandy beaches, often enclosing lagoons or salt marshes.

Fauna.—Till about the middle of the 18th century the bison and the elk roamed the W. part of the state. The Virginia deer is common in the bottomlands; a few beaver still frequent the remoter streams; in the higher portions are still a few black bears and pumas, besides the lynx, the Virginia varying hare, the woodchuck, the red and the fox squirrel and flying squirrels. The grey squirrel is plentiful in wooded districts. On the Coastal Plain are the musk-rat, the eastern cotton-tail, chipmunk, grey fox, common mole and Virginia opossum. In colonial times the Atlantic right-whale was killed in some numbers off the coast.

Many species of water and shore birds migrate along the coast, where also others breed, as the royal, common and least terns and black skimmer; practically all the ducks are migrant species, though the wood-duck breeds. Swan, geese and brant winter on the coast. The yellow-crowned night-heron and the little blue heron nest rarely. The turkey-buzzard and the barn-owl are resident. Red-headed and red-bellied woodpeckers, orchard orioles, yellow-winged sparrows, the cardinal, the blue grosbeak, the Carolina wren and the mocking-bird are characteristic of the lower elevations. The ruffed grouse and wild turkey are found in the wooded mountainous districts, while the quail (here called "partridge") is a game bird of the open stubble fields.

Of reptiles, the rattlesnake and copperhead are the only poisonous species, but numerous harmless varieties are common. In the salt marshes of the coast occurs the diamond-backed terrapin. Trout abound in the mountain streams, and black bass in the rivers of the interior. The cat-fish grows to a large size in the sluggish rivers. On the coast, the striped bass, sea-bass, drum, sheepshead, weakfish, bluefish and Spanish mackerel are important as food fishes. There are valuable oyster fisheries in Chesapeake Bay.

Flora.—The Coastal Plain of Virginia is covered with pine forests which merge westward with the hard woods of the Piedmont Belt, where oaks formerly prevailed, but where a second growth of pine now constitutes part of the forest. Even on the Coastal Plain the Jersey and oldfield pines of to-day replace more valuable species of the original growth. The Blue Ridge and Newer Appalachian regions are covered with pine, hemlock, white oak, cherry and yellow poplar; while that portion of these provinces lying in the S.W. part of the state still contains valuable forests of hickory and walnut, besides oak and cherry. On the Coastal Plain the cypress grows in the Dismal Swamp, river birch along the streams, and sweet gum and black gum in swampy woods. Other characteristic plants of the Coastal Plain are the cranberry, wild rice, wild yam, wax myrtle, wistaria, trumpet flower, passion flower, holly and white alder. Many of these species spread into the Piedmont Belt. Rhododendron, mountain laurel and azaleas are common in the mountains. The blackberry, black raspberry, huckleberry, blueberry, wild ginger and ginseng are widely distributed.

Climate.—The climate of Virginia is generally free from extremes of heat and cold. In the Coastal Plain region the temperature is quite stable from day to day, as a result of the equalizing effect of the numerous bays which indent this province. The mean winter temperature is 39·8°, the mean summer temperature 77·2°, with a mean annual of 58·6°. Killing frosts do not occur before the middle of October, nor later than the last part of April. In the Piedmont Province temperature conditions are naturally less stable, owing to the distance from the sea and to the greater inequality of surface topography. In autumn and winter sudden temperature changes are experienced, though not frequently. The mean winter temperature of this province is 35·8°; mean summer temperature, 75°; mean annual, 55·9°. Killing frosts may occur as early as the first of October and as late as the last of May. The greatest variability in temperature conditions in the state occurs in the Blue Ridge, Newer Appalachian Provinces, where the most rugged and variable topography is likewise found. The mean winter temperature for this section is 33·8°; mean summer temperature, 71·3°; mean annual, 53·2°.

Soil.—Marshy soils are found along the lowest portions of the Coastal Plain, and are exceedingly productive wherever reclaimed by draining, as in portions of the Dismal Swamp. Other portions of the Coastal Plain afford more valuable soils, sandy loams overlying sandy clays. On the higher elevations the soil is light and sandy, and such areas remain relatively unproductive. The crystalline rocks of the Piedmont area are covered with residual soils of variable composition and moderate fertility. Passing the high and rugged Blue Ridge, which is infertile except in the intervening valleys of its S.W. expansion, we reach the Newer Appalachians, where fertile limestone soils cover the valley floors. The Valley of Virginia is the most productive part of the state.

Forests.—The woodland area of Virginia was estimated in 1900 at 23,400 sq. m., or 58% of the area of the state. The timber area originally comprised three divisions: the mountain regions growing pine and hard woods and hemlock; the Piedmont region producing chiefly oaks with some pine; and the lands below the "Fall Line," which were forested with yellow pine. Most of the pine of the mountain region has been cut, and the yellow pine and hard woods have also largely disappeared. The production of timber has, however, steadily increased. In 1900 the value of the product was $12,137,177, representing chiefly yellow pine.

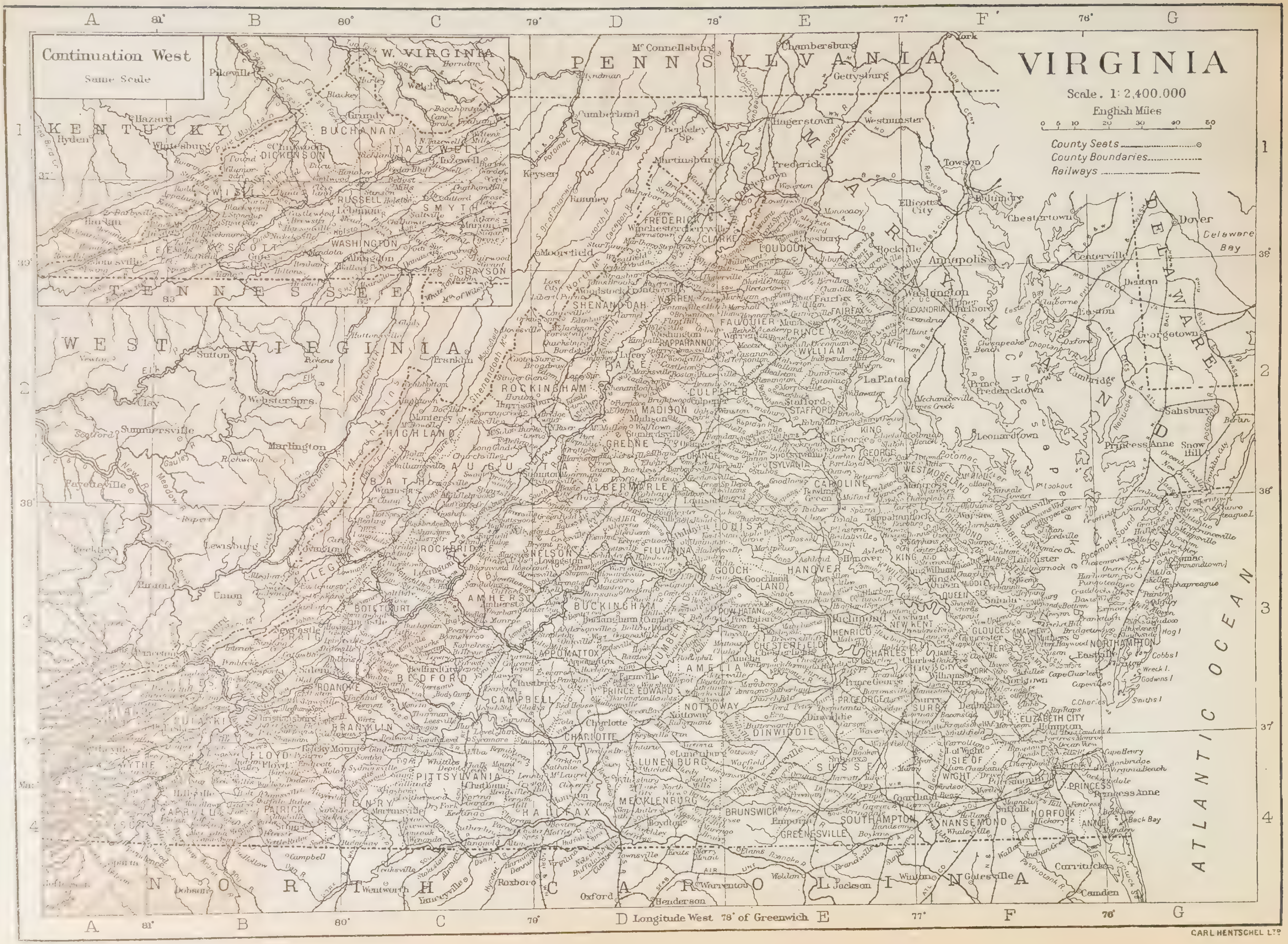
Fisheries.—Oysters are by far the most valuable of the fisheries products, but, of the 400,000 acres of waters within the state suitable for oyster culture, in 1909 only about one-third was used for that purpose. Next in importance were the catches of menhaden, shad, clams, squeteague and alewives; while minor catches were made of crabs, croaker, bluefish, butterfish, catfish, perch and spotted and striped bass.

Agriculture.—Tobacco was an important crop in the earlier history of the colony, and Virginia continued to be the leading tobacco-producing state of the Union (reporting in 1850 28·4% of the total crop) until after the Civil War, which, with the division of the state, caused it to fall into second place, Kentucky taking the lead; and in 1900 the crop of North Carolina also was larger. The state's production of tobacco in 1909 was 120,125,000 ℔, valued at $10,210,625.

The production of Indian corn in 1909 was 47,328,000 bus., valued at $35,023,000; of wheat, 8,848,000 bus., valued at $10,175,000; of oats, 3,800,000 bus., valued at $2,052,000; of rye, 184,000 bus., valued at $155,000; of buckwheat, 378,000 bus., valued at $287,000; the hay crop was valued at $8,060,000 (606,000 tons). The amount of the cotton crop in 1909 was 10,000 500-℔ bales.

The value of horses in 1910 was $34,561,000 (323,000 head); of mules, $7,020,000 (54,000 head); of neat cattle, $20,034,000 (875,000 head); of swine, $5,031,000 (774,000 head); of sheep, $2,036,000 (522,000 head).

Minerals.—The value of all mineral products in 1908 was $13,127,395. By far the most valuable single product was bituminous coal ($3,868,524; 4,259,042 tons). The existence of this mineral in the vicinity of Richmond was known as early as 1770, and the mining of it there began in 1775, but it was practically


VIRGINIA
Scale. 1: 2,400,000
English Miles
0 5 10 20 30 40 50
County Seats
County Boundaries
Railways
Continuation West
Same Scale
PENNSYLVANIA
MARYLAND
DELAWARE
WEST VIRGINIA
W. VIRGINIA
KENTUCKY
TENNESSEE
NORTH CAROLINA
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discontinued about the middle of the 19th century. The most important coalfields of the state lie in the Appalachian regions in the S.W. part of the state, though there are also rich deposits in the counties of Henrico, Chesterfield and Goochland, and in parts of Powhatan and Amelia counties. In the S.E. portion of the Kanawha basin, including Tazewell, Russell, Scott, Buchanan, Wise and Lee counties, occur rich deposits of coal, which are of great value because of their proximity to vast deposits of iron ores. In Tazewell county is the famous Pocahontas bed, which produces one of the most valuable grades of coking and steam coal to be found in the United States. There are remarkably rich deposits of iron ore in the Alleghanies, and the W. foothills of the Blue Ridge, from which most of the iron ore of the state is procured, are lined with brown hematite. Iron-mining—perhaps the first in the New World—was begun in Virginia in 1608, when the Virginia Company shipped a quantity of ore to England; and in 1619 the Company established on Falling Creek, a tributary of the James river, a colony of about 150 iron-workers from Warwickshire, Staffordshire and Sussex, who had established there several ore-reducing plants under the general management of John Berkeley of Gloucester, England, when on the 22nd of March 1622 the entire colony, excepting a girl and a boy, were massacred by the Indians. The first blast-furnace in the colony seems to have been owned by Governor Spotswood, and was built and operated at the head of the Rappahannock river about 1715 by a colony of German Protestants. Immediately after the War of Independence Virginia became an important iron-producing state. The industry waned rapidly toward the middle of the 19th century, but was renewed upon the discovery of the high-grade ores in the S.W. part of the state and the development of railway facilities. The product of iron ore in 1908 was 692,223 long tons, valued at $1,465,691. The product of pig-iron in 1908 was 320,458 long tons, valued at $4,578,000.

Manganese ore-mining began in Virginia in 1857 in the Shenandoah Valley, and the product increased from about 100 tons in that year to about 5000 tons (mined near Warminster, Nelson county) in 1868 and 1869. Thereafter Virginia and Georgia supplied most of this mineral produced in the United States, and the greater part of it has been shipped to England. Between 1885 and 1891 the average annual production was about 15,000 tons, the greatest output—20,567 tons—being mined in 1886. After 1891 the product declined rapidly, amounting in 1907 to 800 tons valued at $4800.

In the production of pyrite, which is found in Louisa county and is used for the manufacture of sulphuric acid employed in the treatment of wood pulp for paper-making and in the manufacture of superphosphates from phosphate rock, Virginia took first rank in 1902 with an output valued at $501,642, or 64·7 % of the total yield of this mineral in the United States; and this rank was maintained in 1908, when the product was 116,340 long tons, valued at $435,522. Limestone is found in the region west of the Blue Ridge, and has been quarried extensively, the product, used chiefly for flux, being valued in 1908 at $645,385.

Virginia was by far the most important state in 1908 in the production of soapstone, nearly the whole product being taken from a long narrow belt running north-east from Nelson county into Albemarle county; more than 90 % of the output was sawed into slabs for laundry and laboratory appliances. The product of talc and soapstone in 1908 was 19,616 short tons, valued at $458,252.

The value of mineral waters produced in 1908 was $207,115. The state has many mineral springs occurring in connexion with faults in the Appalachian chain of mountains; in 1908, 46 were reported, making the state third among the states of the United States in number of springs, and of these several have been in high medical repute. At 18 of these resorts are situated, some of which have at times had considerable social vogue. White Sulphur Springs, in Greenbrier county, impregnated with sulphur, with therapeutic application in jaundice, dyspepsia, &c.; Alleghany Springs, in Montgomery county, calcareous and earthy, purgative and diuretic; Rawley Springs in Rockingham county, Sweet Chalybeate Springs in Alleghany county, and Rockbridge Alum Springs in Rockbridge county, classed as iron springs and reputed of value as tonics, and the thermal springs, Healing Springs (88° F.) and Hot Springs (110 F.), both in Bath county are noted medicinal springs.

The value of metals produced in 1908 was as follows: gold (which is found in a belt that extends from the Potomac river to Halifax county and varies from 15 to 25 in. in width), $3600 (174 fine oz. troy); copper, $3312 (25,087 lb); and lead, $1092 (13 short tons). Minerals produced in small quantities include gypsum, millstones, salt and sandstone, and among those found but not produced (in 1902) in commercial quantities may be mentioned allanite, alum, arsenic, bismuth, carbonite, felspar, kaolin, marble, plumbago, quartz, serpentine and tin. Asbestos was formerly mined in the western and south-western parts of the state. Barytes is mined near Lynchburg; the value of the output in 1907 was $32,833, since which date the output has decreased.

Manufactures.—Virginia's manufacturing establishments increased very rapidly in number and in the value of their products during the last two decades of the 19th century. The number of all establishments increased from 5710 in 1880 to 8248 in 1900; the capital invested from $26,968,990 to $103,670,988, the average number of wage-earners from 40,184 to 72,702, the total wages from $7,425,261 to $22,445,720, and the value of products from $51,770,992 to $132,172,910. The number of factories[1] increased from 3186 in 1900 to 3187 in 1905, the capital invested from $92,299,589 to $147,989,182, the average number of wage-earners from 66,223 to 80,285, the total wages from $20,269,026 to $27,943,058, and the value of products from $108,644,150 to $148,856,525. The manufacture of all forms of tobacco is the most important industry; the value of its products in 1905 was $16,768,204. Since 1880 there has been a rapid development in textile manufacture, for which the water power of the Piedmont region is used. A peculiar industry is the grading, roasting, cleaning and shelling of peanuts.

Transportation and Commerce.—Four large railway systems practically originate in the state and radiate to the S. and W.: the Southern railway, with its main line traversing the state in the direction of its greatest length leaving Washington to run south-west through Alexandria, Charlottesville, Lynchburg and Danville to the North Carolina line, with connexions to Richmond and a line to Norfolk on the east; the Atlantic Coast line with its main lines running S. from Richmond and Norfolk; the Seaboard Air line, having its main lines also running to the S. from Richmond and Norfolk; the Norfolk & Western crossing the state from east to west in the southern part with Norfolk its eastern terminus, passing through Lynchburg and leaving the state at the south-western corner at Bristol, and the Chesapeake & Ohio crossing the state from east to west farther north than the Norfolk & Western from Newport News on the coast through Richmond to the West Virginia line. Of more recent construction is the Virginian railway, a project of H. H. Rogers, opened for traffic in 1909, which connects the coal region of West Virginia with Norfolk, crossing the southern part of the state from E. to W., and is designed chiefly for heavy freight traffic. The N. W. part of the state is entered by the Baltimore & Ohio, which has a line down the Shenandoah Valley to Lexington. Connexion between Richmond and Washington is by a union line (Richmond, Fredericksburg & Potomac and Washington Southern railways) operated jointly by the Southern, Atlantic Coast line, Seaboard Air line, Chesapeake & Ohio, Pennsylvania, and Baltimore & Ohio railways. In 1850 there were 384 m. of railway in Virginia; in 1880, 1839 m., and in 1890 it had nearly doubled, having increased to 3,359·54 m., a gain coincident with the newly awakened industrial activity of the Southern States and an era of railway building throughout this section. The railway mileage in 1900 was 3,789·58, and in January 1909 it was 4,348·53.

Hampton Roads at the mouth of the James river, which forms the harbour for the leading ports of the state, Norfolk and Newport News, affords one of the best anchorages of the Atlantic coast. It gives shelter not only to vessels plying to its adjoining ports but serves as a harbour of refuge for shipping bound up or down the Atlantic coast, and is frequently used for the assembling of naval fleets. There is a large foreign trade and a regular steamship service to Boston, Providence, New York, Philadelphia and Savannah from Norfolk, and there is a considerable traffic on Chesapeake Bay, the Rappahannock, York, James and Elizabeth rivers. Fredericksburg at the head of navigation on the Rappahannock and West Point on the York have traffic of commercial importance in lumber and timber, oysters and farm produce, cotton and tobacco especially being shipped in coastwise vessels from West Point. Petersburg and Richmond on the James are connected with regular steamship lines with Norfolk, Richmond's water trade being chiefly in coal, oil, logs and fertilizer. Steamboats plying on Chesapeake Bay connect Alexandria with Norfolk. From the Elizabeth river on which Norfolk is situated lead the Albemarle & Chesapeake Canal and the Dismal Swamp Canal, which connect with the waters of Albemarle Sound. Traffic through these canals consists chiefly of forest products, logs, lumber and shingles.

Population.—The population of Virginia in 1890 was 1,655,980; in 1900, 1,854,184; and in 1910, 2,061,612.[2] Of the total population in 1900, 1,173,787 were native whites, 19,461 were foreign-born, 660,722 (or 35·7 % of the total population) were negroes, 354 were Indians, 243 were Chinese and 10 were Japanese. The state was fifth among the states and Territories in the number of negro inhabitants, but showed a marked decrease in the ratio of negroes to the total population in the decade from 1890 to 1900, the percentage of the total population in 1890 having been 38·4.

Of the inhabitants born in the United States 53,235 were natives of North Carolina, 12,504 were natives of Maryland, and 10,273 were natives of Pennsylvania. Of the foreign-born 4504 were

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[1] Statistics for 1890 represent the value of all manufactures; those for 1900 (from this point) and 1905 show values under the factory system, excluding neighbourhood industries and hand trades.

[2] According to previous censuses the population was as follows: (1790), 747,610; (1800), 880,200; (1810), 974,600; (1820), 1,065,366; (1830), 1,211,405; (1840), 1,239,797; (1850), 1,421,661; (1860), 1,596,318; (1870), 1,225,163; (1880), 1,512,565.

Germans, 3534 were natives of Ireland and 3425 of England. Of the total population 52,264 were of foreign parentage (*i.e.* either one or both parents were foreign-born) and 9769 were of German, 8235 of Irish and 4792 of English parentage, both on the father's and on the mother's side. Out of the total of 793,546 members of religious denominations in 1906, more than half, 415,987, were Baptists; the Methodists numbered 200,771; and there were 39,628 Presbyterians, 28,700 Roman Catholics, 28,487 Protestant Episcopalians, 26,248 Disciples of Christ, and 15,010 Lutherans. Virginia in 1900 had 46·2 inhabitants to the square mile. The principal cities of the state are: Richmond (the capital), Norfolk, Petersburg, Roanoke, Newport News, Lynchburg, Portsmouth and Danville.

Government.—Virginia has had six state constitutions: the first was adopted in 1776, the second in 1830, the third in 1851, the fourth in 1864, the fifth in 1869, and the sixth, the present, in 1902. Amendments to the present constitution may be proposed in either house of the General Assembly, and if they pass both houses of that and the succeeding General Assembly by a majority of the members elected to each house and are subsequently approved by a majority of the people who vote on the question at the next general election they become a part of the constitution. A majority of the members in each house of the General Assembly may at any time propose a convention to revise the constitution and, if at the next succeeding election a majority of the people voting on the question approve, the General Assembly must provide for the election of delegates. To be entitled to vote one must be a male citizen of the United States and twenty-one years of age; have been a resident of the state for two years, of the county, city, or town for one year, and of the election precinct for thirty days next preceding the election; have paid, at least six months before the election, all state poll taxes assessed against him for three years next preceding the election, unless he is a veteran of the Civil War; and have registered after the adoption of the constitution (1902). For registration prior to 1904 one of four additional qualifications was required: service in the army or navy of the United States, of the Confederate States, or of some state of the United States or of the Confederate States; direct descent from one who so served; ownership of property upon which state taxes amounting to at least one dollar were paid in the preceding year; or ability to read the constitution or at least to show an understanding of it. And to qualify for registration after 1904 one must have paid all state poll taxes assessed against him for the three years immediately preceding his application, unless he is a veteran of the Civil War; and unless physically unable he must "make application in his own handwriting, without aid, suggestion or memorandum, in the presence of the registration officers, stating therein his name, age, date and place of birth, residence and occupation at the time and for two years next preceding, whether he has previously voted, and, if so, the state, county and precinct in which he voted last"; and must answer questions relating to his qualifications.

Executive.—The governor, lieutenant-governor, attorney-general, secretary of the commonwealth, treasurer, superintendent of public instruction and commissioner of agriculture are elected for a term of four years, every fourth year from 1905, and each new administration begins on the 1st of February. The governor must be at least thirty years of age, a resident of the state for five years next preceding his election; and, if of foreign birth, a citizen of the United States for ten years. He appoints numerous officers with the concurrence of the Senate, has the usual power of vetoing legislative bills, and has authority to inspect the records of officers, or to employ accountants to do so, and to suspend, during a recess of the General Assembly, any executive officer at the seat of government except the lieutenant-governor; he must, however, report to the General Assembly at its next session the cause of any suspension and that body determines whether the suspended officer shall be restored or removed.

Legislature.—The General Assembly consists of a Senate and a House of Delegates. The Constitution provides that the number of senators shall not be more than forty nor less than thirty-three, and that the number of delegates shall not be more than one hundred nor less than ninety. Senators and delegates are elected by single districts (into which the state is apportioned once every ten years, according to population), the senators for a term of four years, the delegates for a term of two years. The only qualifications for senators and delegates are those required of an elector and residence in their districts; there are, however, a few disqualifications, such as holding certain offices in the state or a salaried Federal office. The General Assembly meets regularly at Richmond on the second Wednesday in January of each even-numbered year, and the governor must call an extra session on the application of two-thirds of the members of both houses, and may call one whenever he thinks the interests of the state require it. The length of a regular session is limited to sixty days unless three-fifths of the members of each house concur in extending it, and no extension may exceed thirty days. Senators and delegates are paid $500 each for each regular session and $250 for each extra session. Any bill may originate in either house, but a bill of special, private or local interest must be referred to a standing committee of five members appointed by the Senate and seven members appointed by the House of Delegates, before it is referred to the committee of the house in which it originated. The governor's veto power extends to items in appropriation bills, and to overcome his veto, whether of a whole bill or an item of an appropriation bill, a two-thirds vote in each house of the members present is required, and such two-thirds must include in each house a majority of the members elected to that house. Whenever the governor approves of the general purpose of a bill, but disapproves of some portion or portions, he may return the bill with his recommendations for amendment, and when it comes back to him, he may, whether his recommendations have been adopted or not, treat it as if it were before him for the first time.

Judiciary.—The administration of justice is vested principally in a supreme court of appeals, circuit courts, city courts and courts of a justice of the peace. The supreme court of appeals consists of five judges, but any three of them may hold a court. They are chosen for a term of twelve years by a joint vote of the Senate and the House of Delegates. The court sits at Richmond, Staunton and Wytheville. The concurrence of at least three judges is necessary to the decision of a case involving the constitutionality of a law. Whenever the docket of this court is crowded, or there is a case upon it in which it is improper for a majority of the judges to sit, the General Assembly may provide for a special court of appeals, to be composed of not more than five nor less than three judges of the circuit courts and city courts, in cities having a population of 10,000 or more. The state is divided into thirty judicial circuits and in each of these a circuit judge is chosen for a term of eight years by a joint vote of the Senate and the House of Delegates. The jurisdiction of the circuit courts was extended by the present Constitution to include that which, under the preceding Constitution, was vested in county courts, and the principal restriction is that they shall not have original jurisdiction in civil cases for the recovery of personal property amounting to less than $20. Similar to the circuit court is the corporation court in each city having a population of 10,000 or more; the judge of each of these corporation courts is chosen for a term of eight years by a joint vote of the Senate and the House of Delegates, and he may hold a circuit as well as a corporation court. Circuit courts and corporation courts appoint the commissioners in chancery. Three justices of the peace are elected in each magisterial district for a term of four years. There are also justices of the peace (elected) and police justices (appointed) in cities, and in various minor cases a justice's court has original jurisdiction, either exclusive or concurrent with the circuit and corporation courts. In each city having a population of 70,000 or more a special justice of the peace, known as a civil justice, is elected by a joint vote of the Senate and the House of Delegates for a term of four years.

Local Government.—Each county is divided into magisterial districts, varying in number from three to eleven. Each district elects a supervisor for a term of four years, and the district supervisors constitute a county board of supervisors, which represents the county as a corporation, manages the county property and county business, levies the county taxes, audits the accounts of the county, and recommends for appointment by the circuit court a county surveyor and a county superintendent of the poor. Each county also elects a treasurer, a sheriff, an attorney and one or more commissioners of the revenue, each for a term of four years, and a clerk, who is clerk of the circuit court, for a term of eight years. The coroner is appointed by the circuit court for a term of two years. Each magisterial district elects, besides a supervisor and justices of the peace, a constable and an overseer of the poor, each for a term of four years. The Constitution provides that all "communities" with a population less than 5000, incorporated after its adoption, shall be known as towns, and that those with a population of 5000 or more shall be known as cities. In each city incorporated after its adoption, the Constitution requires the election in each of a mayor, a treasurer and a sergeant, each for a term of four years, and the election or appointment of a commissioner of the revenue for an equal term; that in cities having a population of 10,000 or more the council shall be composed of two branches; that the mayor shall have a veto on all acts of the council and on items of appropriation, ordinances or resolutions, which can be overridden only by an affirmative vote of two-thirds of the members elected to each branch; and that no city shall incur a bonded indebtedness exceeding 18% of the assessed value of its real estate.

Miscellaneous Laws.—A married woman may manage her separate property as if she were single, except that she cannot by her sole act deprive her husband of his courtesy in her real estate. A widow is entitled to a dower in one-third of the real estate of which her husband was seized at any time during coverture If the husband dies intestate, leaving no descendants and no paternal or maternal kindred, the whole of his estate goes to his widow absolutely. If the husband dies intestate, leaving a widow and issue, either by her or by a former marriage, the widow is entitled to at least one-third of his personal estate; if he leaves no issue by her, she is entitled to so much of his personal estate as was acquired by him by virtue of his marriage with her prior to the 4th of April 1877; if he leaves no issue whatever, she is entitled to one-half of his personal estate. A widower is entitled by courtesy to a life interest in all his wife's real estate; if she dies intestate, he is entitled to all her personal estate; if she dies intestate, leaving no descendants and no paternal or maternal kindred, he is entitled to her whole estate absolutely. The causes for an absolute divorce are adultery; impotency; desertion for three years; a sentence to confinement in the penitentiary; a conviction of an infamous offence before marriage unknown to the other; or, if one of the parties is charged with an offence punishable with death or confinement in the penitentiary, and has been a fugitive from justice for two years; pregnancy of the wife before marriage unknown to the husband, or the wife's being a prostitute before marriage unknown to the husband. One party must be a resident of the state for one year preceding the commencement of a suit for a divorce. When a divorce is obtained because of adultery, permission of the guilty party to marry again is in the discretion of the court. Marriages between whites and negroes and bigamous marriages are void. The homestead of a householder or head of a family to the value of $2000 and properly recorded is exempt from levy, seizure, garnishment or forced sale, except for purchase money, for services of a labouring person or mechanic, for liabilities incurred by a public officer, fiduciary or attorney for money collected, for taxes, for rent or for legal fees of a public officer. If the owner is a married man his homestead cannot be sold except by the joint deed of himself and his wife; neither can it be mortgaged without his wife's consent except for purchase money or for the erection or repair of buildings upon it. The exemption continues after his death so long as there is an unmarried widow or an unmarried minor child. The family library, family pictures, school books, a seat or pew in a house of worship, a lot in a burial ground, necessary wearing apparel, a limited amount of furniture and household utensils, some of a farmer's domestic animals and agricultural implements, and the wages of a labouring man who is a householder are exempt from levy or distress. A law enacted in 1908 forbids the employment of children under fourteen years of age in any factory, workshop, mercantile establishment, or mine within the state, except that orphans or other children dependent upon their own labour for support or upon whom invalid parents are dependent may be so employed after they are twelve years of age, and that a parent may work his or her own children in his or her own factory, workshop, mercantile establishment or mine.

Charitable and Penal Institutions.—Virginia has four hospitals for the insane: the Eastern State Hospital (1773), at Williamsburg; the South-Western State Hospital (1887), at Marion; the Western State Hospital (1828), with an epileptic colony, at Staunton; and the Central State Hospital (1870; for negroes), at Petersburg. For the care of the deaf and blind there is the Virginia School for Deaf and Blind (1839), at Staunton, and the Virginia School for Coloured Deaf and Blind Children (1908), at Newport News. The State Penitentiary is at Richmond. The Prison Association of Virginia with an Industrial School (1890) at Laurel Station, the Negro Reformatory Association of Virginia with a Manual Labour School (1897) at Broadneck Farm, Hanover, and the Virginia Home and Industrial School for white girls (1910) at Bon Air take care of juvenile offenders; these are all owned and controlled by self-perpetuating boards of trustees, but are supported by the state, receiving an allowance *per capita*. For each state hospital for the insane there is a special board of directors consisting of three members appointed by the governor with the concurrence of the Senate, one every two years, and over them all is the commissioner of state hospitals for the insane, who is appointed by the governor with the concurrence of the Senate for a term of four years. The members of the special boards under the chairmanship of the commissioner constitute a general board for all the hospitals, and the superintendent of each hospital is appointed by the general board. Each school for the deaf and blind is managed by a board of visitors appointed by the governor with the concurrence of the Senate. About five-sixths of the convicts are negroes. Some of them are employed on a state farm at Lassiter, Goochland county, on which there is a tuberculosis hospital, and some of them on the public roads; in 1909 there were 350 men at the state farm, 14 road camps with about 630 men, and 1273 men and 96 women in the penitentiary at Richmond. When a prisoner has served one-half of his term and his conduct has been good for two years (if he has been confined for that period) the board of directors may parole him for the remainder of his term, provided there is satisfactory assurance that he will not be dependent on public charity. The Prison Association of Virginia, the Negro Reformatory Association of Virginia and the Virginia Home and Industrial School for girls are each under a board of trustees appointed by the General Assembly, and each is authorized to establish houses of correction, reformatories and industrial schools. A general supervision of all state, county, municipal and private charities and corrections is vested by a law enacted in 1908 in a board of charities and corrections consisting of five members appointed by the governor with the concurrence of the Senate.

Education.—The public free school system is administered by a state board of education, a superintendent of public instruction, division superintendents, and district and county school boards. The state board of education consists of the governor; the attorney-general; the superintendent of public instruction, who is *ex officio* its president; three experienced educators chosen quadrennially by the Senate from members of the faculties of the University of Virginia, the Virginia Military Institute, the Virginia Polytechnic Institute, the State Female Normal School at Farmville, the School for the Deaf and Blind, and the College of William and Mary; and two division superintendents, one from a county and one from a city, chosen biennially by the other members of the board. This board prescribes the duties of the superintendent of public instruction and decides appeals from his decisions; keeps the state divided into school divisions, comprising not less than one county or city each; appoints quadrennially, with the concurrence of the Senate, one superintendent for each school division and prescribes his powers and duties; selects textbooks; provides for examination of teachers; and appoints school inspectors. In each county an electoral board, consisting of the attorney for the Commonwealth, the division superintendent and one member appointed by the judge of the circuit court, appoints a board of three school trustees for each district, one each year. The division superintendent and the school trustees of the several districts constitute a county school board. The elementary schools are maintained from the proceeds of the state school funds, consisting of interest on the literary fund, a portion of the state poll tax, a property tax not less than one mill nor more than five mills on the dollar, and special appropriations; county funds, consisting principally of a property tax; and district funds, consisting principally of a property tax and a dog tax. A law enacted in 1908 encourages the establishment of departments of agriculture, domestic economy and manual training in at least one high school in each congressional district. A law enacted in 1910 provides a fund for special aid from the state to rural graded schools with at least two rooms. With state aid normal training departments are maintained in several of the high schools in counties which adopt the provisions of the statute. All children between the ages of eight and twelve years are required to attend a public school at least twelve weeks in a year (six weeks consecutively) unless excused on account of weakness of mind or body, unless the child can read and write and is attending a private school, or unless the child lives more than two miles from the nearest school and more than one mile from an established public school wagon route. The State Female Normal School, at Farmville, is governed by a board consisting of the state superintendent and thirteen trustees appointed by the governor with the concurrence of the Senate for a term of four years. The Virginia Normal and Industrial Institute, at Petersburg, is governed by a board of visitors consisting of the superintendent of public instruction and four other members appointed by the governor with the concurrence of the Senate for four years. In 1908 the General Assembly made an appropriation for establishing two state normal and industrial schools for women, one at Harrisonburg and the other at Fredericksburg, both under a board of trustees consisting of the superintendent of public instruction and ten other members appointed by the governor with the concurrence of the Senate. The Virginia Agricultural and Mechanical College and Polytechnic Institute, at Blacksburg, is governed by a board consisting of the state superintendent and eight visitors appointed by the governor with the concurrence of the Senate. The Virginia Military Institute, at Lexington, is governed by a board of visitors consisting of the adjutant general, the superintendent of public instruction and nine other members appointed by the governor with the concurrence of the Senate. The University of Virginia (*q.v.*), at Charlottesville, was founded in 1817 and opened in 1825. The College of William and Mary (1693), at Williamsburg, became a state institution in 1906 and is likewise governed under a board appointed by the governor. Other institutions of higher learning which are not under state control are: Washington and Lee University (non-sectarian, 1749), at Lexington; Hampden-Sidney College (Presbyterian, 1776), at Hampden-Sidney; Richmond College (Baptist, 1832), at Richmond; Randolph-Macon College (Methodist Episcopal, 1832), at Ashland; Emory and Henry College (Methodist Episcopal, 1838), at Emory; Roanoke College (Lutheran, 1853), at Salem; Bridgewater College (German Baptist, 1879), at Bridgewater; Fredericksburg College (Presbyterian, 1893), at Fredericksburg; Virginia Union University (Baptist, 1899), at Richmond; and Virginia Christian College (Christian, 1903), at Lynchburg.

Finance.—Revenue for state, county and municipal purposes is derived principally from taxes on real estate, tangible personal property, incomes in excess of $1000, wills and administrations, deeds, seals, lawsuits, banks, trust and security companies, insurance companies, express companies, railway and canal corporations, sleeping-car, parlour-car and dining-car companies, telegraph and telephone companies, franchise taxes, poll taxes, an inheritance tax and taxes on various business and professional licences. The tax laws require that property shall be assessed at its full value by commissioners of the revenue elected by counties and cities. The revenue is collected by county and city treasurers, clerks of courts, and the state corporation commission, consisting of three members appointed by the governor with the concurrence of the General Assembly in joint session. The total receipts in the fiscal year 1908–1909 amounted to $5,536,510 and the total disbursements to $5,796,980. By the 1st of January 1861 Virginia had incurred a debt amounting to nearly $39,000,000, principally in aid of internal improvements. She was unable to pay the interest on this during the Civil War, and in March 1871 the principal together with the overdue interest amounted to about $47,000,000. The General Assembly passed an act at that time for refunding two-thirds of it, claiming that the other third should be paid by West Virginia. But the advocates of a "forcible readjustment" of the debt carried the election in 1879 with the aid of the negro vote, and after prolonged negotiations in 1892 a settlement was effected under which a debt amounting to about $28,000,000 was again refunded. In 1908 this had been reduced to about $24,000,000. The sinking fund consists of damages recovered against defaulting revenue collectors, railway stock and appropriations from time to time by the legislature.

History.—Virginia was the first permanent English settlement in North America. From 1583 to 1588 attempts had been made by Sir Walter Raleigh and others to establish colonies on the coast of what is now North Carolina. The only result was the naming of the country Virginia in honour of Queen Elizabeth. But glowing accounts were brought back by the early adventurers, and in 1606 an expedition was sent out by the London Company, which was chartered with rights of trade and settlement between 34° and 41° N. lat. It landed, at a place which was called Jamestown, on the 13th of May 1607, and resulted in the establishment of many plantations along the James river. The purpose of the company was to build up a profitable commercial and agricultural community; but the hostility of the natives, unfavourable climatic conditions and the character of the colonists delayed the growth of the new community. John Smith became the head of the government in September 1608, compelled the colonists to submit to law and order, built a church and prepared for more extensive agricultural and fishing operations. In 1609 the London Company was reorganized, other colonists were sent out and the boundaries of the new country were fixed, according to which Virginia was to extend from a point 200 m. south of Old Point Comfort, at the mouth of Chesapeake Bay, to another point 200 m. north, "west and northwest to the South Sea."

The government of the country was in the hands of the London Company, which in turn committed administrative and local affairs to a governor and council who were to reside in the colony. Before the arrival of the "government" and their shiploads of settlers the original colony was reduced to the direst straits. Captain Christopher Newport (d. 1618), Sir Thomas Gates and Sir George Somers, the new authorities, reached Jamestown at last with 150 men, but finding things in such a deplorable state all agreed (June 10, 1610) to give up the effort to found a colony on the James and set sail for Newfoundland. At the mouth of the river they met Lord Delaware, however, who brought other colonists and plentiful supplies; and they returned, set up a trading post at what is now Hampton and undertook to bring the hostile natives to subjection. In 1611, 650 additional colonists landed, the James and Appomattox rivers were explored and "plantations" were established at Henrico and New Bermuda. In 1617 Virginia fell into the hands of a rigid Puritan, Captain Samuel Argall. The colonists were compelled on pain of death to accept the doctrine of the trinity, respect the authority of the Bible and attend church. This rigid régime was superseded in 1619 by a milder system under Sir George Yeardley (d. 1627). Twelve hundred new colonists arrived in 1619. At the same time negro slaves and many "indentured" servants were imported as labourers.

At the beginning Virginia colonists had held their land and improvements in common. But in 1616 the land was parcelled out and the settlers were scattered along the shores of the James and Appomattox rivers many miles inland. Twenty thousand pounds of tobacco were exported in 1619. The community had now become self-supporting, and the year that witnessed these changes witnessed also the first representative assembly in North America, the Virginia House of Burgesses, a meeting of planters sent from the plantations to assist the governor in reforming and remaking the laws of the colony. In 1621 a constitution was granted whereby the London Company appointed the governor and a council, and the people were to choose annually from their counties, towns, hundreds and plantations delegates to the House of Burgesses. The popular assembly, like the English House of Commons, granted supplies and originated laws, and the governor and Council enjoyed the right of revision and veto as did the king and the House of Lords at home. The Council sat also as a supreme court to review the county courts. This system remained unchanged until the revolution of 1776. But in 1624 the king took the place and exercised the authority of the London Company.

Before 1622 there was a population of more than 4000 in Virginia, and the many tribes of Indians who were still the proprietors of the soil over a greater portion of the country naturally became jealous, and on the 22nd of March of that year fell upon the whites and slew 350 persons. Sickness and famine once again visited the colony, and the population was reduced by nearly one-half. These losses were repaired, however; the tobacco industry grew in importance, and the settlers built their cabins far in the interior of lowland Virginia. This rapid growth was scarcely retarded by a second Indian attack, in April 1641, which resulted in the death of about 350 settlers. By 1648 the population had increased to 15,000.

Virginia was neither cavalier nor roundhead, but both. Sir William Berkeley had been the governor since 1641, and though he was loyal enough to the crown, it was without difficulty that his authority was overthrown in March 1652 and that of Cromwell proclaimed in its stead. Richard Bennett, a Puritan from Maryland, now ruled the province. Bennett and his Puritan successors, Edward Digges and Samuel Mathews, made no serious change in the administration of the colony except to extend greatly the elective franchise. But this policy was reversed in 1660, when Berkeley was restored to power. The return of Berkeley was the beginning of a reaction which concentrated authority, both in the House of Burgesses and in the Council, in the hands of the older families, and thus created a privileged class. The governor, supported by the great families, retained the same House of Burgesses for sixteen years lest a new one might not be submissive. The increasing mass of the population dwelt along the western border or on the less fertile ridges which make up the major part of the land even in tide-water Virginia. These poorer people—who were not, however, "poor whites"—developed an abiding hostility towards the oligarchy. They desired a freer land-grant system, protection against the inroads of the Indians along the border, and frequent sessions of an assembly to be chosen by all the freeholders. But a new code of laws outlawed many of these people as dissenters, and in 1676 a burdensome tax was laid by the unrepresentative assembly. The Indians had again attacked the border farmers, and the governor had refused assistance, being willing, it was generally believed, that the border population should suffer while he and his adherents enjoyed a lucrative fur trade with the Indians. Under these circumstances, Nathaniel Bacon (1647–1676), whose grandfather was a cousin of Francis Bacon, took up the cause of the borderers and severely punished the Indians at the battle of Bloody Run. But Berkeley meanwhile had outlawed Bacon, whose forces now marched on the capital demanding recognition as the authorized army of defence. This was refused, and civil war began, in which the governor was defeated and Jamestown was burned. But Bacon fell a victim to malaria and died in October in Gloucester county. Berkeley closed the conflict with wholesale executions and confiscations. Censured by the king, he sailed to England to make his defence, but died in London in 1677 without having seen Charles. Virginia remained in the hands of the reactionary party and was governed by men whose primary purpose was to "make their fortunes" at the expense of the colonials. Even the accession of William and Mary scarcely affected the fortunes of the "fifth kingdom," though Middle Plantation, a hamlet not far from Jamestown, became Williamsburg and the capital of the province in 1691, and the clergy received a head, though not a bishop, in the person of James Blair (1656–1743), an able Scottish churchman, who as commissary of the bishop of London became a counterpoise to the arbitrary governors, and who as founder and head of the College of William and Mary (established at Williamsburg in 1693) did valiant service for Virginia. Under the stimulus of Blair's activity religion and education prospered as never before. The powers and duties of the vestry were defined, the position of the parish priest was fixed and his salary was regularly provided for at the public expense, and pedagogues were brought over from Scotland.

By 1700 the population of Virginia had reached 70,000, of whom 20,000 were negro slaves. The great majority of whites were small farmers whose condition was anything but desirable and who constantly encroached upon the Indian lands in the Rappahannock region or penetrated the forests south of the James, several thousand having reached North Carolina. Between 1707 and 1740 many Scottish immigrants, traders, teachers and tobacco-growers settled along the upper Rappahannock, and, uniting with the borderers in general, they offered strong resistance to the older planters on the James and the York.

Tobacco-growing was the one vocation of Virginia, and many of the planters were able to spend their winters in London or Glasgow and to send their sons and daughters to the finishing schools of the mother country. Negro slavery grew so rapidly during the first half of the eighteenth century that the blacks outnumbered the whites in 1740. The master of slaves set the fashion. Handsome houses were built along the banks of the sluggish rivers, and numerous slaves were employed. There was as great a social distance between the planters and their families on the one side and the masses of people in Virginia on the other as that which separated the nobles from the yeomanry in Europe; and there was still another chasm between the small farmers and the negroes.

In 1716 an expedition of Governor Alexander Spotswood over the mountains advertised to the world the rich back-country, now known as the Valley of Virginia; a migration thither from Pennsylvania and from Europe followed which revolutionized the province. The majority of blacks over whites soon gave way before the influx of white immigrants, and in 1756 there was a population of 292,000, of whom only 120,000 were negroes, and the small farmer class had grown so rapidly that the old tide-water aristocracy was in danger of being overwhelmed. The "West" had now appeared in American history. This first West, made up of the older small farmers, of the Scottish settlers, of the Germans from the Palatinate and the Scottish-Irish, far outnumbering the people of the old counties, demanded the creation of new counties and proportionate representation in the Burgesses. They did not at first succeed, but when the Seven Years' War came on they proved their worth by fighting the battles of the community against the Indians and the French. When the war was over the prestige of the up-country had been greatly enhanced, and its people soon found eastern leaders in the persons of Richard Henry Lee and Patrick Henry. In 1763–1765 an investigation of the finances of the colony, forced by the up-country party, showed widespread corruption, and resulted in the collapse of the tide-water oligarchy, which had been in power since 1660. In the meantime the Presbyterians, who had been officially recognized in Virginia under the Toleration Act in 1699, and had been guaranteed religious autonomy in the Valley by Governor Gooch in 1738, had sent missionaries into the border counties of eastern Virginia. The Baptists about the same time entered the colony both from the north and the south and established scores of churches. The new denominations vigorously attacked the methods and immunities of the established church, whose clergy had grown lukewarm in zeal and lax in morals. When the clergy, refusing to acknowledge the authority of the Burgesses in reducing their stipends, and, appealing to the king against the Assembly, entered the courts to recover damages from the vestries, Patrick Henry at Hanover court in 1763 easily convinced the jury and the people that the old church was well-nigh worthless. From this time the old order was doomed, for the up-country, the dissenters and the reformers had combined against it. But the passage of the Stamp Act hastened the catastrophe and gave the leaders of the new combination, notably Henry, an opportunity to humiliate the British ministry, whom not even the tide-water party could defend. The repeal of the Stamp Act, followed as it was by the Townshend scheme of indirect taxation, displeased Virginia quite as much as had the former more direct system of taxation. When the Burgesses undertook in May 1769 to declare in vigorous resolutions that the right and power of taxation, direct and indirect, rested with the local assembly, the governor hastily dissolved them, but only to find the same men assembling in the Raleigh tavern in Williamsburg and issuing forth their resolutions in defiance of executive authority. Patrick Henry and Richard Henry Lee, with Thomas Jefferson, a new up-country leader of great ability, were the leaders.

In 1774 Lord Dunmore, the governor, led an army to the Ohio river to break an Indian coalition which had been formed to check the rapid expansion of Virginia over what is now Kentucky and West Virginia. The up-country again furnished the troops and did the fighting at Point Pleasant (*q.v.*), where on the 10th of October the power of the Indians was completely broken. But the struggle with England had reached a crisis, and Virginia supported with zeal the revolutionary movement and took the lead in the Continental Congresses which directed the succeeding war (see UNITED STATES). In 1775 Patrick Henry organized a regiment of militia and compelled the governor to seek safety on board an English man-of-war in Chesapeake Bay. The war now assumed continental proportions, and the Virginia leaders decided in May 1776 that a declaration of independence was necessary to secure foreign assistance. When the Continental Congress issued the famous Declaration Virginia had already assembled in convention to draft a new Constitution. Although Henry, Lee and Jefferson exercised great power, they were unable to secure a Constitution which embodied the demands of their party: universal suffrage, proportional representation and religious freedom. A draft for such a Constitution was submitted by Jefferson, but the Conservatives rejected it. The system which was adopted allowed the older counties, which must be conciliated, a large majority of the representatives in the new Assembly, on the theory that the preponderance of property (slavery) in that section required this as security against the rising democracy. In place of the former governor, there was to be an executive chosen annually by the Assembly; the old Council was to be followed by a similar body elected by the Assembly; and the judges were likewise to be the creatures of the legislature. The Assembly was divided into two bodies, a Senate and a House of Delegates. The legislature would be all-powerful, and yet representation was so distributed that about one-third of the voters living in the tide-water region would return nearly two-thirds of the members of the legislature. The franchise, though not universal, was generously bestowed; it was a very liberal freehold system.

The recruiting ground for the American army in Virginia was the up-country among the Scottish-Irish and the Germans who had long fought the older section of the colony. In 1779 Norfolk was again attacked, and great damage was also done to the neighbouring towns. In January 1781 Benedict Arnold captured Richmond and compelled governor and legislature to flee beyond the Blue Ridge mountains, where one session of the Assembly was held. The last campaign of the war closed at Yorktown on the 19th of October 1781.

Virginia leaders, including Henry, were the first to urge the formation of a national government with adequate powers to supersede the lame confederacy. In 1787, under the presidency of Washington, the National Convention sat in Philadelphia, with the result that the present Federal Constitution was submitted to the states for ratification during 1787–1789. In Virginia the tide-water leaders urged adoption, while the up-country men, following Henry, opposed; but after a long and a bitter struggle, in the summer of 1788 the new instrument was accepted, the low-country winning by a majority of ten votes, partly through the influence of James Madison. Thus the eastern men, who had reluctantly supported the War of Independence, now became the sponsors for the national government, and Washington was compelled to rely on the party of slavery, not only in Virginia but in the whole South, in order to administer the affairs of the nation.

In 1784, Virginia, after some hesitation, ceded to the Federal government the north-west territory, which it held under the charter of 1609; in 1792 another large strip of the territory of Virginia became an independent state under the name of Kentucky. But the people of these cessions, especially of Kentucky, were closely allied to the great up-country party of Virginia, and altogether they formed the basis of the Jeffersonian democracy, which from 1794 opposed the chief measures of the Washington administration, and which on the passage of the Alien and Sedition laws in 1798 precipitated the first great constitutional crisis in Federal politics by the adoption in the Kentucky and Virginia legislatures of the resolutions, known by the names of those states, strongly asserting the right and duty of the states to arrest the course of the national government whenever in their opinions that course had become unconstitutional. Jefferson was the author of the Kentucky resolutions, and his friend Madison prepared those passed by the Virginia Assembly. But these leaders restrained their followers sharply whenever the suggestion of secession was made, and the question of what was meant by arresting the course of Federal legislation was left in doubt. The election of 1800 rendered unnecessary all further agitation by putting Jefferson in the President's chair. The up-country party in Virginia, with their allies along the frontiers of the other states, was now in power, and the radical of 1776 shaped the policy of the nation during the next twenty-five years. Virginia held the position of leadership in Congress, controlled the cabinet and supplied many justices of the Supreme Court.

Virginia played a leading rôle in the War of 1812, and up to 1835 her influence in the new Western and North-Western states was overwhelming. But the steady growth of slavery in the East and of a virile democracy in the West neutralized this influence and compelled the assembling of the constitutional convention of 1829, whose purpose was to revise the fundamental law in such a way as to give the more populous counties of the West their legitimate weight in the legislature. The result was failure, for the democracy of small farmers which would have taxed slavery out of existence was denied proportionate representation. The slave insurrection under Nat Turner (*q.v.*) in 1831 led to a second abortive effort, this time by the legislature, to do away with the fateful institution. The failure of these popular movements led to a sharp reaction in Virginia, as in the whole South, in favour of slavery. From 1835 to 1861 many leading Virginians defended slavery as a blessing and as part of a divinely established order.

In 1850 a third Convention undertook to amend the Constitution, and now that the West yielded its bitter hostility to slavery, representation was so arranged that the more populous section was enabled to control the House while the East still held the Senate; the election of judges was confided to the people; and the suffrage was broadened. Although the West was not pleased, the leaders of the slave-holding counties threatened secession.

In the national elections of 1860 Virginia returned a majority of unionist electors as against the secession candidates, Breckinridge and Lane, many of the large planters voting for the continuance of the Union, and many of the smaller slave-owners supporting the secessionists. The governor called an extra session of the legislature soon after the Federal election, and this in turn called a Convention to meet on the 13th of February 1861. The majority of this body consisted of Unionists, but the Convention passed the ordinance of secession when the Federal government (April 17) called upon the state to supply its quota of armed men to suppress "insurrection" in the lower Southern states. An alliance was made with the provisional government of the Confederate States, on April 25, without waiting for the vote of the people on the ordinance. The Convention called out 10,000 troops and appointed Colonel Robert E. Lee of the United States army as commander-in-chief. On the 23rd of May the people of the eastern counties almost unanimously voted approval of the acts of the Convention, and the western counties took steps to form the state of West Virginia (*q.v.*). Richmond soon became the capital of the Confederacy.

The Civil War was already begun, and Virginia was of necessity the battle-ground. Of the six great impacts made upon the Confederacy, four were upon Virginian soil: the first Manassas campaign (1861), the Peninsular battles (1862), second Manassas (1862), Fredericksburg, Chancellorsville (1862–63) and the great Wilderness-Petersburg series of attacks (1864–65). About 50,000 men were killed in Virginia, and probably 100,000 died of wounds and disease. The principal battles were: the first Manassas, or Bull Run (July 21, 1861); those around Richmond (June 26–July 2, 1861); second Manassas (August 29–30); Fredericksburg (December 12, 1862); Mechanicsville (May 2 and 3, 1863); the Wilderness (May 5 and 6); Spottsylvania (May 8); North Anna and Bethesda church (May 29–30); Cold Harbor (June 3); the battles around Petersburg (June 15, July 30 and November 1, 1864); and Five Forks (April 1) and Appomattox (April 8–9, 1865).

With the surrender of the Confederate army under General Lee to Grant at Appomattox the task of reconstruction began. President Lincoln offered a very liberal plan of re-establishing the civil authority over the counties east of the Alleghany mountains, and Governor Francis H. Pierpont set up in Richmond a government, based upon the Lincoln plan and supported by President Johnson, which continued till the 2nd of March 1867, when the famous reconstruction order converting the state into Military District No. 1 was issued. General John M. Schofield was put in charge, and under his authority a constitutional Convention was summoned which bestowed the suffrage upon the former slaves, who, led by a small group of whites, who had come into the state with the invading armies, ratified the 14th and 15th amendments to the Federal Constitution and governed the community until 1869. Then the secessionists and Union men of 1861 united and regained control. Virginia was readmitted to the Union on the 26th of January 1870. The Constitution of the reconstruction years was unchanged until 1902, when the present fundamental law was adopted.

In national elections the state has supported the Democratic party, except in 1860, when its vote was cast for John Bell, the candidate of the Constitutional Union party.

GOVERNORS OF VIRGINIA

Under the Company

Edward Maria Wingfield, President of the Council	1607 (April to Sept.)
John Ratcliffe, President of the Council	1607–1608
John Smith, ,, ,, ,,	1608–1609
George Percy, ,, ,, ,,	1609–1610
Thomas West, Lord Delaware, "Governor and Captain General"	1610–1618
George Percy, Deputy Governor	1611 (March to May)
Sir Thomas Dale, "High Marshal" and Deputy Governor	1611 (May to Aug.)
Sir Thomas Gates, Acting Governor	1611–1612
Sir Thomas Dale, ,, ,,	1612–1616
George Yeardley, Lieutenant or Deputy Governor	1616–1617
Samuel Argall, Lieutenant or Deputy Governor	1617–1619
Nathaniel Powell, Acting Governor	1619 (April 9 to 19)
Sir George Yeardley, Governor	1619–1621
Sir Francis Wyatt, ,,	1621–1624

Under the Crown

Sir Francis Wyatt, Governor	1624–1626
Sir George Yeardley, ,,	1626–1627
Francis West (elected by Council)	1627–1628
John Pott ,,	1628–1629
Sir John Harvey, Governor	1629–1635
John West (elected by Council)	1635–1636
Sir John Harvey, Governor	1636–1639
Sir Francis Wyatt, ,,	1639–1641
Sir William Berkeley, ,,	1641–1644
Richard Kemp (elected by Council)	1644–1645
Sir William Berkeley, Governor	1645–1652

Under the Commonwealth

Richard Bennett (elected by General Assembly)	1652–1655
Edward Digges (elected by House of Burgesses)	1655–1657
Samuel Mathews (elected by House of Burgesses)	1657–1660

Under the Crown

Sir William Berkeley, Governor	1660–1677
Francis Morrison (or Moryson), Deputy Governor	1661–1662
Herbert Jeffreys, Lieutenant Governor	1677–1678
Sir Henry Chicheley, Deputy Governor	1678–1680
Thomas, Lord Culpeper, Governor	1680–1683
Nicholas Spencer, President of the Council	1683–1684
Francis, Lord Howard of Effingham, Lieutenant Governor	1684–1687
Nathaniel Bacon, President of the Council	1687–1690
Francis Nicholson, Lieutenant Governor	1690–1692
Sir Edmund Andros, Governor	1692–1698
Francis Nicholson, Lieutenant Governor	1698–1704
George Hamilton Douglas, Earl of Orkney, Governor-in-Chief	1704–1737
Edward Nott, Lieutenant Governor	1705–1706
Edmund Jenings, President of the Council	1706–1710
Robert Hunter, Lieutenant Governor[1]	1707
Alexander Spotswood, Lieutenant Governor	1710–1722
Hugh Drysdale, ,, ,,	1722–1726
Robert Carter, President of the Council	1726–1727
William Gooch, Lieutenant Governor	1727–1740
William Anne Keppel, Earl of Albemarle, Governor-in-Chief[1]	1737–1754
James Blair, President of the Council	1740–1741
Sir William Gooch, Governor	1741–1749
John Robinson, President of the Council	1749 (June to Sept.)
Thomas Lee, ,, ,, ,,	1749–1750
Lewis Burwell, ,, ,, ,,	1750–1751
Robert Dinwiddie, Lieutenant Governor	1751–1758
John Campbell, Earl of Loudon, Governor General of the American Colonies[1]	1756–1763
John Blair, President of the Council	1758 (Jan. to June)
Francis Fauquier, Lieutenant Governor	1758–1768
Sir Jeffrey Amherst, Governor-in-Chief[1]	1763–1768
John Blair, President of the Council	1768 (March to Oct.)
Norborne Berkeley, Baron de Botetourt, Governor-in-Chief	1768–1770
William Nelson, President of the Council	1770–1771
John Murray, Earl of Dunmore, Governor-in-Chief	1771–1775

State

Patrick Henry	1776–1779
Thomas Jefferson	1779–1781
Thomas Nelson, jun.	1781
Benjamin Harrison	1781–1784
Patrick Henry	1784–1786
Edmund Randolph	1786–1788
Beverley Randolph	1788–1791
Henry Lee	1791–1794
Robert Brooke	1794–1796
James Wood, Democratic-Republican	1796–1799
James Monroe, ,, ,,	1799–1802
John Page, ,, ,,	1802–1805
William H. Cabell, ,, ,,	1805–1808
John Tyler, sen., ,, ,,	1808–1811
James Monroe, ,, ,,	1811
George Wm. Smith (acting), Democratic Republican	1811
Peyton Randolph (acting)	1811–1812
James Barbour, Anti-Democrat	1812–1814
Wilson Cary Nicholas, Republican	1814–1816
James Patton Preston, ,,	1816–1819
Thomas Mann Randolph, ,,	1819–1822
James Pleasants, jun., ,,	1822–1825
John Tyler, State Rights Democrat	1825–1827
William Branch Giles, Democrat	1827–1830
John Floyd, Democrat	1830–1834
Littleton Waller Tazewell, Democrat	1834–1836
Wyndham Robertson (acting), Democrat	1836–1837
David Campbell, Whig	1837–1840
Thomas W. Gilmer, Whig	1840–1841
John M. Patton (acting), ,,	1841
John Rutherford (acting), ,,	1841–1842
John Munford Gregory (acting), Whig	1842–1843
James McDowell, ,,	1843–1846
William Smith, Democrat	1846–1849
John Buchanan Floyd, Democrat	1849–1852
Joseph Johnson, ,,	1852–1856
Henry Alexander Wise, ,,	1856–1860
John Letcher, ,,	1860–1864
William Smith, ,,	1864–1865
Francis H. Pierpont (provisional), Republican	1865–1867
Henry Horatio Wells, ,, ,,	1868–1870
Gilbert Carlton Walker, ,,	1870–1874
James Lawson Kemper, Conservative	1874–1878
Frederick Wm. Mackey Holliday, "Debt-Paying"	1878–1882
William Ewan Cameron, Readjuster	1882–1886
Fitzhugh Lee, Democrat	1886–1890
Philip W. McKinney, Democrat	1890–1894
Charles Triplett O'Ferrall, Democrat	1894–1898
James Hoge Tyler, ,,	1898–1902
Andrew Jackson Montague, ,,	1902–1906
Claude Augustus Swanson, ,,	1906–1910
William Hodges Mann, ,,	1910

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VIRGINIA, UNIVERSITY OF, a state institution for higher education, situated at Charlottesville among the foot-hills of the Blue Ridge Mountains. Its buildings, arranged around a large rectangular lawn and erected from a plan prepared by Thomas Jefferson, are noted for their architectural effect. At the head of the lawn is the Rotunda, modelled after the Roman Pantheon and now containing the university library; and at the foot of the lawn are three modern recitation and laboratory buildings. On the sides are grouped buildings for each individual professor and dormitories for students. There are also a chapel, a gymnasium, a hospital, and on the summit of Mount Jefferson Hill, a mile south-west of the campus, is the M'Cormick Observatory. The university comprises twenty-six independent schools, but the courses of instruction given in these are so co-ordinated as to form six departments: two academic—the college and the department of graduate studies; and four professional—law, medicine, engineering and agriculture. The institution owns 522 acres of land, has productive endowment funds amounting to $1,978,000, and receives from the state an annual appropriation of $80,000. It is governed by a rector, chosen by and from nine visitors, and a board of visitors appointed by the governor and two visitors *ex officio*, the state superintendent of public instruction and the president of the university; and the corporate name of the university is "The Rector and Visitors of the University of Virginia." In 1904 Edwin Anderson Alderman (b. 1861) was elected president. In 1910 the faculty and officers numbered 110, the students (men only) 803, and the number of volumes in the libraries 88,000.

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[1] Never in Virginia.

The university traces its beginning to an act of the legislature in January 1803 for incorporating the "Trustees of Albemarle Academy." In 1814, before the site of this proposed institution had been chosen, Thomas Jefferson was elected a trustee, and under his influence the legislature, in February 1816, authorized the establishment of Central College in lieu of Albemarle Academy. The corner-stone of Central College was laid in October 1817, and Jefferson, who was rector of its board of trustees, evolved a plan for its development into the university of Virginia. The legislature, thanks to the efforts of Joseph Carrington Cabell, a close personal friend of Jefferson, adopted the plan in 1818 and 1819, and seven independent schools—ancient languages, modern languages, mathematics, natural philosophy, moral philosophy, chemistry and medicine—were opened to students in March 1825; a school of law was opened in 1826. In 1837 the School of Medicine became a department of three individual schools; and in 1850 the School of Law became a department of two schools. After the gift of $500,000 by Andrew Carnegie there were established in 1909 the Andrew Carnegie School of Engineering, the James Madison School of Law, the James Monroe School of International Law, the James Wilson School of Political Economy, the Edgar Allan Poe School of English and the Walter Reed School of Pathology.

Under Jefferson's plan only two degrees were granted: "Graduate," to any student who had completed the course of any one school; and "Doctor" to a graduate in more than one school who had shown powers of research. But in 1831 for the Doctor's degree the faculty substituted, following British custom, the degree of Master of Arts. The college now grants the degrees of "Bachelor of Arts," "Cultural Bachelor of Science" and "Vocational Bachelor of Science"; the Department of Graduate Studies, the degrees of "Graduate in a School," "Master of Arts," "Master of Science" and "Doctor of Philosophy"; the Department of Law, the degree of "Bachelor of Laws"; the Department of Medicine, the degree of "Doctor of Medicine"; the Department of Engineering, the degrees of "Civil Engineer," "Mechanical Engineer," "Electrical Engineer," "Mining Engineer" and "Chemical Engineer"; and the Department of Agriculture, the degree of "Bachelor of Science in Agriculture."

See J. S. Patton, *Jefferson, Cabell and the University of Virginia* (New York, 1906).

VIRGIN ISLANDS, a group of small islands in the West Indies, about 100 in number, for the most part uninhabited. They extend E. from Puerto Rico, lying between 17° and 18° 50′ N., and 64° 10′ and 65° 30′ W., their total area being about 465 sq. m. The islands are mostly rocky, or sandy and barren, but such portions as are under cultivation yield sugar, maize, coffee, cotton and indigo. Guinea grass grows abundantly on the hillsides, affording excellent pasturage; the forests, though few, include the mahogany and other useful trees. The coasts abound with fish. The climate is more healthy than that of the other West Indian islands, and the heat is not so great. Some of the islands belong to the United States, some to Denmark and some to Great Britain. The United States' possessions (once dependencies of Puerto Rico, but ceded by Spain in 1898) have an area of about 150 sq. m. and include Culebra or Snake Island, and Vieques or Crab Island. The chief Danish islands are St Thomas (*q.v.*), St Croix (*q.v.*) and St John (*q.v.*), the total area being about 240 sq. m. Of the British portion of the group the principal are Tortola, Anegada, Virgin Gorda, Jost van Dyke, Peter's Island and Salt Island, in all numbering 32, with an area of 58 sq. m. With the exception of the island of Sombrero they form one of the five presidencies in the colony of the Leeward Islands. The inhabitants are peasant proprietors, mainly engaged in raising cattle and in burning charcoal, but some are fishermen and boatmen. The chief town is Roadtown (pop. 400) at the head of a splendid harbour on the S. of Tortola, and what trade there is is mostly with St Thomas. Sombrero is maintained as a lighthouse by the British government. Population of the presidency, mostly negroes (1891) 4639; (1901) 4908.

The Virgin Islands were discovered by Columbus in his second voyage, in 1494, and named Las Virgenes, in honour of St Ursula and her companions. In 1666 the British established themselves on Tortola, which has ever since remained in their possession. In the 17th century the Virgin Islands were favourite resorts of the buccaneers. The Danish islands of St Thomas and St John were taken by the British in 1801, but restored in the following year. In 1807 they surrendered to the British, and continued in their hands till 1815, when they were again restored.

VIRGINIUS RUFUS, LUCIUS (A.D. 15–97), Roman patriot and soldier, three times consul (A.D. 63, 69, 97), was born near Comum, the birthplace of the two Plinys. When governor of upper Germany under Nero (68), after he had put down the revolt of Julius Vindex in Gaul, he was more than once urged by his troops to assume the supreme power; but he firmly refused, and further declared that he would recognize no one as emperor who had not been chosen by the senate. Galba, on his accession, aware of the feelings of the German troops and uncertain as to the intentions of Virginius, induced him to accompany him to Rome. But Virginius, as always, remained loyal to the head of the state. After the death of Otho, the soldiers again offered the throne to Virginius, but he again refused it. Considering themselves slighted, they drew their swords upon him, and he only saved himself from their hands by making his escape through the back of the tent. But the soldiers never forgave the fancied insult. Under Vitellius, during a military disturbance at Ticinum, one of Virginius's slaves was arrested and charged with the design of murdering the emperor. Virginius was accused of being implicated in the conspiracy, and his death was loudly demanded by the soldiers. To his credit Vitellius refused to sacrifice so valuable a servant, on whose loyalty he could depend, to the vengeance of a capricious army. Virginius subsequently lived in retirement, chiefly in his villa at Alsium, on the coast of Etruria, till his death in 97, in which year he held the consulship, together with the emperor Nerva. At the public burial with which he was honoured, the historian Tacitus (then consul) delivered the funeral oration. The younger Pliny, his neighbour and ward, has recorded the lines which Virginius had ordered to be engraved upon his tomb:

> "Hic situs est Rufus, pulso qui Vindice quondam
> Imperium asseruit non sibi sed patriae."

See Tacitus, *Hist.* i. ii.; Dio Cassius lxiii. 24–27, lxiv. 4, lxviii. 2; Pliny, *Epp.* ii. 1, vi. 10; Juvenal viii. 221, with Mayor's note; L. Paul in *Rheinisches Museum* (1899), liv. pp. 602–30.

VIRGO ("the Virgin"), in astronomy, the sixth sign of the zodiac (*q.v.*), denoted by the symbol ♍. It is also a constellation mentioned by Eudoxus (4th century B.C.) and Aratus (3rd century B.C.); Ptolemy catalogued 32 stars, Tycho Brahe 33, Hevelius 50. The Greeks represented this constellation as a virgin, but different fables are current as to the identity of the maid. She is variously considered to be: Justitia, daughter of Astraeus and Ancora, who lived before man sinned, and taught him his duty, and when the golden age ended she returned to heaven; according to Hesiod the virgin is the daughter of Jupiter and Themis; others make her to be Erigone, daughter of Icarius, or Parthene, daughter of Apollo. The most interesting stars of this constellation are: *α Virginis*, or Spica, a star of the first magnitude with a very faint companion; and *γ Virginis*, a binary star, having components of the third magnitude.

VIRUÉS, CHRISTÓBAL DE (1550?–1615?), Spanish dramatist and poet, was born at Valencia about the middle of the 16th century, joined the army, fought at Lepanto, and retired to his native place with the rank of captain shortly before 1586. The first-fruit of his leisure was *El Monserrate* (1587), a dull poem on a repulsive subject which had the honour of being praised by Cervantes, and of being reprinted in 1601. Shortly afterwards Virués returned to Italy and issued a recast of his poem entitled *El Monserrate segundo* (1602). His *Obras trágicas y líricas* (1609) include five tragedies: *La Gran Semíramis*, *La Cruel Casandra*, *Atila furioso*, *La Infelice Marcela* and *Elisa Dido*. The date of his death is unknown, but he is conjectured to have been alive as late as 1614. Virués belongs to the school of dramatists displaced by Lope de Vega, and his methods were out of fashion before his plays were printed; yet he is an interesting figure, chiefly because of the very extravagances which destroy the effect of his best scenes.

VISBY, or WISBY, the capital of the Swedish island and administrative district (*län*) of Gotland, in the Baltic Sea. Pop. (1900) 8376. It is the seat of a bishop, the port of the island, and a favourite watering-place. It is picturesquely situated on the west coast, 150 m. S. by E. of Stockholm by sea. The houses cluster beneath and above a cliff (*klint*) 100 ft. high, and the town is thoroughly medieval in appearance. The remains from its period of extraordinary prosperity from the 11th to the 14th century are of the highest interest. Its walls date from the end of the 13th century, replacing earlier fortifications, and enclose a space much larger than that now covered by the town. Massive towers rise at close intervals along them, and nearly forty are in good preservation. Between them are traces of bartizans. The cathedral church of St Mary dates from 1190–1225, but has been much altered in later times: it has a great square tower at the west end and two graceful octagonal towers at the east, and contains numerous memorials of the 17th century. There are ten other churches, in part ruined, none of which is used for service. Among those of chief interest St Nicholas', of the early part of the 13th century, formerly belonged to a Dominican monastery. It retains two beautiful rose-windows in the west front. The church of the Holy Ghost (*Helgeands-Kyrka*) in a late Romanesque style (*c.* 1250) is a remarkable structure with a nave of two storeys. The Romanesque St Clement's has an ornate south portal, and the churches of St Drotten and St Lars, of the 12th century, are notable for their huge towers. St Catherine's, of the middle of the 13th century, is Gothic, with a pentagonal apse. It belonged to a Franciscan convent, of the buildings of which there are slight ruins. Among ancient remains in the vicinity may be mentioned Galgberget, the place of execution, with tall stone pillars still standing; and the remarkable stone labyrinth of Tröjeborg. Modern buildings include the Gotland museum of antiquities, and the high school, with a museum and library. The artificial harbour, somewhat exposed, lies south of the ancient Hanseatic harbour, now filled up and covered with gardens. The town is the terminus of railways to north and south. It is the headquarters of the army division of Gotland troops, and there are some modern forts.

The name Visby is derived from the old Norse *ve* (sanctuary) and *by* (town). This was no doubt a place of religious sacrifice in heathen times. At any rate it was a notable trading-place and emporium as early as the Stone Age, and continued to enjoy its importance as such through the Bronze and Iron Ages, as is proved, *inter alia*, by the large number of Arabic, Anglo-Saxon and other coins which have been found on the island. See GOTLAND and SEA LAWS.

VISCACHA, or BISCACHA, a large South American burrowing rodent mammal belonging to the family Chinchillidae and commonly known as *Lagostomus trichodactylus*, although some writers prefer the name *Viscacia*. With the cheek-teeth formed of a number of parallel plates in the manner characteristic of the family, the viscacha is distinguished from the other members of that group by having only three hind toes; while it is also the heaviest-built and largest member of the group, with smaller ears than the rest. It has a long tail and shaggy fur; the general colour of the latter being dark grey, with conspicuous black and white markings on the face. Viscachas inhabit the South American pampas between the Uruguay river and the Rio Negro in Patagonia, where they dwell in warrens covering from 100 to 200 sq. ft. and forming mounds penetrated by numerous burrows. The ground around the "viscachera" is cleared from vegetation, the refuse of which is heaped upon the mound. Anything the rodents may meet with on their journeys, such as thistle-stalks or bones, are collected and deposited on the viscachera. Deep down in the burrows dwell the viscachas, from which in frequented districts they seldom emerge till evening, unless to drink after a shower. Their chief food is grass and seeds, but they also consume roots. When alarmed, they rush to their burrows, and if these are disturbed utter a growling sound. A pair of prairie burrowing owls (*Speotyto*) are almost invariably inhabitants of a viscachera (see RODENTIA). (R. L.*)

VISCHER, the name of a family of Nuremberg sculptors, who contributed largely to the masterpieces of German art in the 15th and 16th centuries.

1. HERMANN, the elder, came to Nuremberg as a worker in brass in 1453 and there became a "master" of his gild. There is only one work that can be ascribed to him with certainty, the baptismal font in the parish church of Wittenberg (1457). This is decorated with figures of the Apostles.

2. His son, PETER, the elder, was born about 1455 in Nuremberg, where he died on the 7th of January 1529. He became "master" in 1489, and in 1494 was summoned by the Electoral Prince Philipp of the Palatinate to Heidelberg. He soon returned, however, to Nuremberg, where he worked with the help of his five sons, Hermann, Peter, Hans, Jakob and Paul. His works are: the tomb of Bishop Johannes IV., in the Breslau cathedral (1496); the tomb of Archbishop Ernest, in Magdeburg cathedral (1497); the shrine of Saint Sebald in the Sebalduskirche at Nuremberg, between 1508 and 1519; a large grille ordered by the Fugger brothers in Augsburg (lost); a relief of the "Crowning of the Blessed Virgin" in the Erfurt cathedral (a second example in the Wittenberg Schlosskirche, 1521); the tombstones for Margareta Tucherin in the Regensburg cathedral (1521), and for the Eisen family in the Ägidienkirche at Nuremberg (1522); the epitaph for the cardinal Albrecht of Brandenburg in the collegiate church at Aschaffenburg (1525); the tomb of the electoral prince Frederick the Wise in the Schlosskirche at Wittenberg (1521); the epitaph of the duchess Helene of Mecklenburg in the cathedral at Schwerin. Besides these works there are a number of others ascribed to Peter the elder with less certainty. In technique few bronze sculptors have ever equalled him, but his designs are marred by an excess of mannered realism and a too exuberant fancy. His chief early work, the tomb of Archbishop Ernest in Magdeburg cathedral (1495), is surrounded with fine statuettes of the Apostles under semi-Gothic canopies; it is purer in style than the magnificent shrine of St Sebald, a tall canopied bronze structure, crowded with reliefs and statuettes in the most lavish way. The general form of the shrine is Gothic,[1] but the details are those of the 16th-century Italian Renaissance treated

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[1] This great work is really a canopied pedestal to support and enclose the shrine, not the shrine itself, which is a work of the 14th century, having the gabled form commonly used in the middle ages for metal reliquaries.

with much freedom and originality. Some of the statuettes of saints attached to the slender columns of the canopy are modelled with much grace and even dignity of form. A small portrait figure of Peter himself, introduced at one end of the base, is a marvel of clever realism: he has represented himself as a stout, bearded man, wearing a large leathern apron and holding some of the tools of his craft. This gorgeous shrine is a remarkable example of the uncommercial spirit which animated the artists of that time, and of the evident delight which they took in their work. Dragons, grotesques and little figures of boys, mixed with graceful scroll foliage, crowd every possible part of the canopy and its shafts, designed in the most free and unconventional way and executed with an utter disregard of the time and labour which were lavished on them.

See R. Bauer, *Peter Vischer und das alte Nürnberg* (1886); C. Headlam, *Peter Vischer* (1901).

VISCHER, FRIEDRICH THEODOR (1807–1887), German writer on the philosophy of art, was born at Ludwigsburg on the 30th of June 1807, and was the son of a clergyman. He was educated at Tübingen, and began life in his father's profession. In 1835 he became *Privatdozent* in aesthetics and German literature at his old university, was advanced in 1837 to extraordinary professor, and in 1844 to full professor. In consequence, however, of his outspoken inaugural address, he was suspended for two years by the Württemberg government, and in his enforced leisure wrote the first two volumes of his *Aesthetik, oder Wissenschaft des Schönen* (1846), the fourth and last volume of which did not appear 'till 1857. Vischer threw himself heartily into the great German political movement of 1848–49, and shared the disappointment of patriotic democrats at its failure. In 1855 he became professor at Zürich. In 1866, his fame being now established, he was invited back to Germany with a professorship at Tübingen combined with a post at the Polytechnikum of Stuttgart. He died at Gmunden on the 14th of September 1887. His writings include literary essays collected under the titles *Kritische Gänge* and *Altes und Neues*, poems, an excellent critical study of Goethe's *Faust* (1875), and a successful novel, *Auch Einer* (1878; 25th ed., 1904). Vischer was not an original thinker, and his monumental *Aesthetik*, in spite of industry and learning, has not the higher qualities of success. He attempts the hopeless task of explaining art by the Hegelian dialectic. Starting with the definition of beauty as "the idea in the form of limited appearance," he goes on to develop the various elements of art (the beautiful, sublime and comic), and the various forms of art (plastic art, music and poetry) by means of the Hegelian antitheses—form and content, objective and subjective, inner conflict and reconciliation. The shape of the work also is repellently Hegelian, consisting of short highly technical paragraphs containing the main argument, followed by detailed explanations printed in different type. Still, Vischer had a thorough knowledge of every branch of art except music, and much valuable material is buried in his volumes. In later life Vischer moved considerably away from Hegelianism, and adopted the conceptions of sensuous completeness and cosmic harmony as criteria of beauty; but he never found time to rewrite his great book. His own work as a literary artist is of high quality; vigorous, imaginative and thoughtful without academic technicality.

See O. Keindl, *F. T. Vischer, Erinnerungsblätter* (1888); J. E. von Günthert, *F. T. Vischer, ein Charakterbild* (1888); I. Frapan, *Vischer-Erinnerungen* (1889); T. Ziegler, *F. T. Vischer* (*Vortrag*) (1893); J. G. Oswald, *F. T. Vischer als Dichter* (1896). (H. St.)

VISCONTI, the name of a celebrated Italian family which long ruled Milan; they claimed descent from King Desiderius, and in the 11th century possessed estates on Lakes Como and Maggiore. A certain OTTONE, who distinguished himself in the First Crusade, is mentioned in 1078 as viscount of Milan. The real basis for the family's dominion was laid, however, by another OTTONE, a canon of Desio, appointed archbishop of Milan by Pope Urban IV. in 1262 through the influence of Cardinal Ubaldini. The Della Torre family, who then controlled the city, opposed the appointment, and not until his victory at Desic in 1277 was Ottone able to take possession of his see. He imprisoned Napoleone Della Torre and five of his relatives in iron cages, and directed his later efforts toward the advancement of his nephew Matteo. He died on the 18th of August 1295, aged eighty years. MATTEO, born at Invorio on the 15th of August 1255, succeeded his uncle as political leader of Milan, and although an uprising of the Della Torre in 1302 compelled him to take refuge at Verona, his steadfast loyalty to the imperial cause in Italy earned him the gratitude of Henry VII., who restored him to Milan in 1310 and made him imperial vicar of Lombardy. He brought under his rule Piacenza, Tortona, Pavia, Bergamo, Vercelli, Cremona and Alessandro. An able general, he yet relied for his conquests more on diplomacy and bribery, and was esteemed as a model of the prudent Italian despot. Persevering in his Ghibelline policy, and quarrelling with Pope John XXII. over an appointment to the archbishopric of Milan, he was excommunicated by the papal legate Bertrand du Puy in 1322. He at once abdicated in favour of his son Galeazzo, and died at Crescenzago on the 24th of June of the same year. He left besides Galeazzo several sons: Marco, Lucchino, Giovanni and Stefano. GALEAZZO I. (1277–1328), who ruled at Milan from 1322 to 1328, met the Holy Army which the pope had sent against the Visconti at Vaprio on the Adda (1324), and defeated it with the aid of the emperor Louis the Bavarian. In 1327 he was imprisoned by the emperor at Monza because he was thought guilty of making peace with the church, and was released only on the intercession of his friend Castruccio Castracane. By his wife Beatrice d'Este he had the son Azzo who succeeded him. His brother MARCO commanded a band of Germans, conquered Pisa and Lucca and died in 1329. AZZO (1302–1339), who succeeded his father in 1328, bought the title of imperial vicar for 25,000 florins from the same Louis who had imprisoned Galeazzo I. He conquered ten towns, murdered his uncle Marco (1329), suppressed a revolt led by his cousin Lodrisio, reorganized the administration of his estates, built the octagonal tower of S. Gottardo, and was succeeded in turn by his uncles Lucchino and Giovanni. LUCCHINO made peace with the church in 1341, bought Parma from Obizzo d'Este and made Pisa dependent on Milan. Although he showed ability as general and governor, he was jealous and cruel, and was poisoned in 1349 by his wife Isabella Fieschi. GIOVANNI, brother of the preceding, archbishop of Milan and lord of the city from 1349 to 1354, was one of the most notable characters of his time. He befriended Petrarch, extended the Visconti sway over Bologna (1350), defied Pope Clement VI., annexed Genoa (1353), and died on the 5th of October 1354 after having established the rule of his family over the whole of northern Italy except Piedmont, Verona, Mantua, Ferrara and Venice. The Visconti from the time of Archbishop Giovanni were no longer mere rivals of the Della Torre or dependants on imperial caprice, but real sovereigns with a recognized power over Milan and the surrounding territory. The state was partitioned on the death of Giovanni among his brother Stefano's three sons, Matteo II., Galeazzo II. and Bernabo. MATTEO II., who succeeded to Bologna, Lodi, Piacenza and Parma, abandoned himself to the most revolting immorality, and was assassinated in 1355 by direction of his brothers, who thenceforth governed the state jointly and with considerable ability. GALEAZZO II., who held his court at Pavia, was handsome and distinguished, the patron of Petrarch, the founder of the university of Pavia and a gifted diplomat. He married his daughter Violante to the duke of Clarence, son of Edward III. of England, giving a dowry of 200,000 gold florins; and his son Gian Galeazzo to Isabella, daughter of King John of France. He died in 1378. BERNABO, who held his court at Milan, was involved in constant warfare, to defray the expenses of which he instituted very oppressive taxes. He fought Popes Innocent VI. and Urban V., who proclaimed a crusade against him. He fought the emperor Charles IV., who declared the forfeiture of his fief. He endeavoured to exercise sole power in the state after the death of his brother, but his young nephew Gian Galeazzo plotted against him and put him to death (1385). GIAN GALEAZZO, the most powerful of the Visconti, became joint ruler of the Milanese territories on the death of his father in 1378 and sole ruler on the death of his uncle seven years later. He founded the cathedral of Milan, built the Certosa and the bridge across the Ticino at Pavia, improved the university of Pavia and established the library there, and restored the university at Piacenza. His bureaucratic government was excellent; he was an able and economical administrator, and was reputed to be one of the wealthiest princes of his time. He was ambitious to reduce all Italy under the sway of the Visconti. He conquered Verona in 1387; and in the following year, with the aid of the Venetians, took Padua. He plotted successfully against the rulers of Mantua and Ferrara, and now that the whole of Lombardy lay prostrate before him he turned his attention to Tuscany. In 1399 he bought Pisa and seized Siena. The emperor Wenceslaus had already conferred on him the title of duke of Milan for 100,000 florins, reserving only Pisa, and refused to take arms against him. Gian Galeazzo took Perugia, Lucca and Bologna (1400–1), and was besieging Florence when he died of the plague (3rd of September 1402) at the age of fifty-five years. His sons, Giovanni Maria and Filippo Maria, were mere boys at the time of his death, and were taken under the protection of the celebrated condottiere Facino Cane de Cesale; but most of Gian Galeazzo's conquests were lost to his self-seeking generals. GIOVANNI MARIA was proclaimed duke of Milan in 1402, displayed an insane cruelty, and was killed in 1412 by Ghibelline partisans. FILIPPO MARIA, who became nominal ruler of Pavia in 1402, succeeded his brother as duke of Milan. Cruel and extremely sensitive about his personal ugliness, he nevertheless was a great politician, and by employing such powerful condottieri as Carmagnola, Piccinino and Francesco Sforza he managed to recover the Lombard portion of his father's duchy. From his marriage with the unhappy widow of the abovementioned Facino Cane he received a dowry of nearly half a million florins. He died in 1447, the last of the Visconti in direct male line, and was succeeded in the duchy, after the shortlived Ambrosian republic, by Francesco Sforza, who had married his daughter Bianca in 1441 (see SFORZA). VALENTINA (1366–1408), a daughter of Gian Galeazzo and a sister of the preceding, married Louis of Orleans in 1387, and it was from her that Louis XII. of France derived his claims to the duchy of Milan. GABRIELE, an illegitimate brother, gained possession of Pisa and other towns, but was despoiled and beheaded (1407) by Charles VI.'s governor of Genoa, under whose protection he had placed himself. Among collateral branches of the Visconti family were the counts of Saliceto, counts of Zagnano, lords of Brignano, marquis of San Giorgio di Borgoratto, marquis of Invorio and Marquis Della Motta. Other branches attained to some prominence in the local history of Bari and of Tarento. Tebaldo Visconti of Piacenza became Pope Gregory X. in 1271. Among the Visconti lords of Fontaneto was Gasparo, who died in 1595 archbishop of Milan. An Ignatius Visconti was sixteenth general of the Jesuits (1751–55).

There is a contemporary history of the principal members of the family by Paolo Giovio, bishop of Nocera, which may be had in several editions. See J. Burckhardt, *The Civilization of the Renaissance in Italy*, trans. by S. G. C. Middlemore (London, 1898); J. A. Symonds, *Age of the Despots* (New York, 1888); C. Magenta, *I Visconti e gli Sforza nel Castello di Pavia* (1883); A. Medin, *I Visconti nella poesia contemporanea* (Milan, 1891); F. Mugnier, "Lettres des Visconti de Milan" in *Mémoires et documents de la société savoisienne d'histoire et d'archéologie*, vol. x. of the second series (1896). (C. H. HA.)

VISCONTI-VENOSTA, EMILIO, MARQUIS (1829–), Italian statesman, was born at Milan on the 22nd of January 1829. A disciple of Mazzini, he took part in all the anti-Austrian conspiracies until the ineffectual rising at Milan on the 6th of February 1853, of which he had foretold the failure, induced him to renounce his Mazzinian allegiance. Continuing, nevertheless, his anti-Austrian propaganda, he rendered good service to the national cause, but being molested by the Austrian police, was obliged in 1859 to escape to Turin, and during the war with Austria of that year was appointed by Cavour royal commissioner with the Garibaldian forces. Elected deputy in 1860, he accompanied Farini on diplomatic missions to Modena and Naples, and was subsequently despatched to London and Paris to acquaint the British and French governments with the course of events in Italy. As a recompense for the tact displayed on this occasion, he was given by Cavour a permanent appointment in the Italian foreign office, and was subsequently appointed under-secretary of state by Count Pasolini. Upon the latter's death he became minister of foreign affairs (24th March 1863) in the Minghetti cabinet, in which capacity he negotiated the September Convention for the evacuation of Rome by the French troops. Resigning office with Minghetti in the autumn of 1864, he was in March 1866 sent by La Marmora as minister to Constantinople, but was almost immediately recalled and reappointed foreign minister by Ricasoli. Assuming office on the morrow of the second battle of Custozza, he succeeded in preventing Austria from burdening Italy with a proportion of the Austrian imperial debt, in addition to the Venetian debt proper. The fall of Ricasoli in February 1867 deprived him for a time of his office, but in December 1869 he entered the Lanza-Sella cabinet as foreign minister, and retained his portfolio in the succeeding Minghetti cabinet until the fall of the Right in 1876. During this long period he was called upon to conduct the delicate negotiations connected with the Franco-German War, the occupation of Rome by the Italians, and the consequent destruction of the temporal power of the pope, the Law of Guarantees and the visits of Victor Emmanuel II. to Vienna and Berlin. Upon the occasion of his marriage with the daughter of the marquis Alfieri di Sostegno, grandniece of Cavour, he was created marquis by the king. For a time he remained a member of the parliamentary opposition, and in 1886 was nominated senator. In 1894, after eighteen years' absence from active political life, he was chosen to be Italian arbitrator in the Bering Sea question, and in 1896 once more accepted the portfolio of foreign affairs in the Di Rudini cabinet at a juncture when the disasters in Abyssinia and the indiscreet publication of an Abyssinian Green Book had rendered the international position of Italy exceedingly difficult. His first care was to improve Franco-Italian relations by negotiating with France a treaty with regard to Tunis. During the negotiations relating to the Cretan question and the Graeco-Turkish War, he secured for Italy a worthy part in the European Concert and joined Lord Salisbury in saving Greece from the loss of Thessaly. Resigning office in May 1898, on a question of internal policy, he once more retired to private life, but in May 1899 again assumed the management of foreign affairs in the second Pelloux cabinet, and continued to hold office in the succeeding Saracco cabinet until its fall in February 1901. During this period his attention was devoted chiefly to the Chinese problem and to the maintenance of the equilibrium in the Mediterranean and the Adriatic. In regard to the Mediterranean he established an Italo-French agreement by which France tacitly undertook to leave Italy a free hand in Tripoli, and Italy not to interfere with French policy in the interior of Morocco; and, in regard to the Adriatic, he came to an understanding with Austria guaranteeing the *status quo* in Albania. Prudence and sagacity, coupled with unequalled experience of foreign policy, enabled him to assure to Italy her full portion of influence in international affairs, and secured for himself the unanimous esteem of European cabinets. In recognition of his services he was created Knight of the Annunziata by Victor Emmanuel III. on the occasion of the birth of Princess Yolanda Margherita of Savoy (1st of June 1901). In February 1906 he was Italian delegate to the Morocco conference at Algeciras.

An account of Visconti-Venosta's early life (down to 1859) is given in an interesting volume by his brother Giovanni Visconti-Venosta, *Ricordi di Gioventù* (Milan, 1904).

VISCOUNT (through O. Fr. *viscomte*, mod. *vicomte*, from Low Lat. *vice-comes*, cf. Portug. *visconde*, Ital. *visconte*), the title of the fourth rank of the European nobility. In the British peerage it intervenes between the dignities of earl and baron. The title is now purely one of honour, having long been dissociated from any special office or functions.

In the Carolingian epoch the *vice-comites*, or *missi comitis*, were the deputies or vicars of the counts, whose official powers they exercised by delegation, and from these the viscounts of the feudal period were undoubtedly derived. Soon after the counts became hereditary the same happened in the case of their lieutenants; *e.g.* in Narbonne, Nîmes and Alby the viscounts had, according to A. Molinier, acquired hereditary rights as early as the beginning of the 10th century. Viscountcies thus developed into actual fiefs, with their own jurisdiction, domain and seigniorial rights, and could be divided or even transmitted to females. Viscounts, however, continued for some time to have no more than the status of lieutenants, calling themselves either simply *vice-comites*, or adding to this title the name of the countship from which they derived their powers. It was not till the 12th century that the universal tendency to territorialize the feudal dominions affected the viscountcies with the rest, and that the viscounts began to take the name of the most important of their patrimonial domains. Thus the viscounts of Poitiers called themselves viscounts of Thouars, and those of Toulouse viscounts of Bruniquel and Montelar. From this time the significance of the title was extremely various. Some viscounts, notably in the duchy of Aquitaine and the county of Toulouse, of which the size made an effective centralized government impossible, were great barons, whose authority extended over whole provinces, and who disputed for power on equal terms with counts and dukes. Elsewhere, on the other hand, *e.g.* in the Île de France, Champagne, and a great part of Burgundy, the *vicomtes* continued to be half feudatories, half officials of the counts, with the same functions and rank in the feudal hierarchy as the chatelains; their powers were jealously limited and, with the organization of the system of *prévôts* and *baillis* in the 12th century, practically disappeared. In the royal domains especially, these petty feudatories could not maintain themselves against the growing power of the crown, and they were early assimilated to the *prévôts*; thus there is no record of a *vicomte* at Paris after 1027.

In Normandy, where from the first the central power had been strong, *vicomtes* appeared at a very early date as deputies of the counts (afterwards dukes) of the Normans: "They are both personal companions and hereditary nobles." When local Norman counts began in the 11th century, some of them had *vicomtes* under them, but the normal *vicomte* was still a deputy of the duke, and Henry I. largely replaced the hereditary holders of the *vicomtés* by officials. "By the time of the Conqueror the judicial functions of the viscount were fully recognized, and extended over the greater part of Normandy." Eventually almost the whole of Normandy was divided into administrative viscountcies or bailiwicks by the end of the 12th century. When the Normans conquered England, they applied the term *viscounte* or *vicecomes* to the sheriffs of the English system (see SHERIFF), whose office, however, was quite distinct and was hardly affected by the Conquest.

Nearly four centuries later "viscount" was introduced as a peerage style into England, when its king was once more lord of Normandy. John, Lord Beaumont, K.G., who had been created count of Boulogne in 1436, was made Viscount Beaumont, February 12, 1440, and granted precedence over all barons, which was doubtless the reason for his creation. Within a year the feudal *vicomté* of Beaumont in Normandy was granted to him and the heirs male of his body on the ground that he traced his descent from that district. In 1446 Lord Bourchier, who held the Norman countship of Eu, was similarly made a viscount. The oldest viscountcy now on the roll is that of Hereford, created in 1550; but the Irish viscountcy of Gormanston is as old as 1478. The dignity was sparingly conferred in the peerage of England till recent times, when the number of viscounts was increased by bestowing the dignity on retiring speakers (*e.g.* Viscounts Canterbury, Hampden, Peel, Selby) and ministers who accepted peerages (*e.g.* Viscounts Melville, Halifax, Knutsford, Llandaff, Cross, Ridley, Goschen, St Aldwyn, Morley of Blackburn, Wolverhampton).

A viscount is "Right Honourable," and is styled "My Lord." His wife, also "Right Honourable," is a "viscountess," and is styled "My Lady." All their sons and daughters are "Honourable." The coronet first granted by James I. has on the golden circlet a row of fourteen small pearls set in contact, of which number in representations nine are shown. The scarlet parliamentary robe of a viscount has two and a half doublings of ermine.

See A. Luchaire, *Manuel des institutions françaises* (Paris, 1892), bibliography on p. 282; Stapleton's *Rotuli Scaccarii Normanniae*; Powicke's "The Angevin Administration of Normandy" (*Eng. Hist. Rev.* vols. xxi., xxii.); *Lords' Reports on the Dignity of a Peer*; Courthope Nicolas's *Historic Peerage*.

VISHNU (Sanskrit, "the worker," from root *vish*, "to work"), a solar deity, in later Hindu mythology a god of the first importance, one of the supreme trinity with Brahma and Siva, but in the Rig Veda only a minor deity. In the Vedic scriptures his only anthropomorphic characteristics are the frequently mentioned strides that he takes, and his being a youth vast in body. His essential feature is the three strides (*vi-kram*) with which he traverses the universe. Two of these steps are visible to men, but the third or highest is beyond mortal sight. These steps are symbolic of the rising, culminating and setting of the sun, or alternatively the course of the solar deity through the three divisions of the universe. To-day Vishnu is adored by the Vishnavite sects as the equal or even the superior of Brahma, and is styled the Preserver. He is represented with four arms, and black in colour; in one hand he holds a club and in the others a shell, a discus and a lotus respectively. He rides on the Garuda, half man and half bird, having the head, wings, beak and talons of an eagle, and human body and limbs, its face being white, its wings red and its body golden. In his character as preserver of men Vishnu has from time to time become incarnate to rid the world of some great evil (see also BRAHMANISM and HINDUISM).

See A. A. Macdonell, *Vedic Mythology* (Strassburg, 1897); Sir W. Muir, *Original Sanskrit Texts*, iv. 63–298; Sir M. Monier-Williams, *Brahmanism and Hinduism*, iii. v. vi.

VISION (from Lat. *videre*, to see), or SIGHT, the function, in physiology, of the organ known as the eye (*q.v.*). The sense of vision is excited by the influence of light on the retina, the special terminal organ connected with the optic nerve. By excitation of the retina, a change is induced in the optic nerve fibres, and is conveyed by these to the brain, the result being a luminous perception, or what we call a sensation of light or colour. If light were to act uniformly over the retina, there would be no image of the source of the light formed on that structure, and consequently there would be only a general consciousness of light, without reference to any particular object. One of the first conditions, therefore, of vision for useful purposes is the formation of an image on the retina. To effect this, just as in a photographic camera, refractive structures must be placed in front of the retina which will so bend luminous rays as to bring them to a focus on the retina, and thus produce an image. Throughout the animal kingdom various arrangements are found for this purpose; but they may be all referred to three types, namely—(1) eye-specks or eye-dots, met with in Medusae, Annelidae, &c.; (2) the compound eye, as found in insects and crustaceans; and (3) the simple eye, common to all vertebrates. The *eye-specks* may be regarded simply as expansions of optic nerve filaments, covered by a transparent membrane, but having no refractive media, so that the creature would have the consciousness of light only, or a simple luminous impression, by which it might distinguish light from darkness. The *compound eye* consists essentially of a series of transparent cone-like bodies, arranged in a radiate manner against the inner surface of the cornea, with which their bases are united, while their apices are connected with the ends of the optic filaments. As each cone is separated from its neighbours, it admits only a ray of light parallel with its axis, and its apex represents only a portion of the image, which must be made up, like a mosaic-work, of as many parts as there are cones in the eye. When the cones are of considerable length, it is evident, from their form and direction, their apices being directed inwards, that the oblique rays emanating from a luminous surface will be cut off, and that only those rays proceeding along the axis of the cone will produce an effect. Thus distinctness or sharpness of definition will be secured. The size of the visual field will depend on the form of the eye, the outermost cones marking its limits. Consequently the size of the visual field will depend on the size of the segment of the sphere forming its surface. The eyes of many insects have a field of about half a sphere, so that the creature will see objects before and behind it as well as those at the side. On the other hand, in many the eyes have scarcely any convexity, so that they must have a narrow field of vision. For anatomical details, and diseases of the eye, see EYE; the pathological aspects of vision itself are treated at the end of this article.

1. PHYSICAL CAUSES OF VISION

A luminous sensation may be excited by various modes of irritation of the retina or of the optic nerve. Pressure, cutting or electrical shocks may act as stimuli, but the normal excitation is the influence of light on the retina. From a physical point of view, light is a mode of movement occurring in a medium, termed the aether, which pervades all space; but the physiologist studies the operation of these movements on the sentient organism as resulting in consciousness of the particular kind which we term a luminous impression. Outside of the body, such movements have been studied with great accuracy; but the physiological effects depend upon such complex conditions as to make it impossible to state them in the same precise way. Thus, when we look at the spectrum, we are conscious of the sensations of red and violet, referable to its two extremities: the physicist states that red is produced by 392 billions of impulses on the retina per second, and that violet corresponds to 757 billions per second; but he has arrived at this information by inductive reasoning from facts which have not at present any physiological explanation. We cannot at present trace any connexion, as cause and effect, between 392 billions of impulses on the retina per second and a sensation of red. Below the red and above the violet ends of the spectrum there are vibrations which do not excite luminous sensations. In the first case, below the red, the effect as a sensation is heat; and above the violet the result is that of chemical activity. Thus the method of dispersion of light, as is followed in passing a ray through a prism, enables us to recognize these general facts: (1) rays below the red excite thermal impressions; (2) from the lower red up to the middle of the violet, the thermal rays become gradually weaker until they have no effect; (3) from the lower red to the extreme violet, they cause luminous impressions, which reach their greatest intensity in the yellow; and (4) from about the end of the yellow to far beyond the extreme violet, the rays have gradually a less and less luminous effect, but they have the power of exciting such chemical changes as are produced in photography. In general terms, therefore, the lower end of the spectrum may be called thermal, the middle luminous, and the upper actinic or chemical; but the three merge into and overlap one another. It may be observed that the number of vibrations in the extreme violet is not double that of the low red, so that the sensibility of the eye to vibrations of light does not range through an octave. The ultra-violet rays may act on the retina in certain conditions, as when they are reflected by a solution of sulphate of quinine, constituting the phenomenon of fluorescence. Far above the violet are the Röntgen radiations and probably others.

2. OPTICAL ARRANGEMENTS OF THE EYE

1. *General.*—When light traverses any homogeneous transparent medium, such as the air, it passes on in a straight course with a certain velocity; but if it meet with any other transparent body of a different density, part of it is reflected or returned to the first medium, whilst the remainder is propagated through the second medium in a different direction and with a different velocity. Thus we may account for the phenomena of reflection of light (*q.v.*) and of refraction (*q.v.*). Let *ab*, in fig. 1, be a plane surface of some transparent substance, say a sheet of glass; a ray, *cd*, perpendicular to the surface, will pass through without refraction; but an oblique ray, *ef*, will be sent in the direction *eh*. If the ray *eh* had passed from a dense into a rarer medium, then the direction would have been *eg*. It might also be shown that the sine of the angle of incidence always bears a certain ratio to the sine of the angle of refraction; this ratio is termed the *index of refraction*. Thus, if a ray pass from air into water, the sine of the angle of incidence will have to the sine of the angle of the refraction the ratio of 4:3, or $\frac{4}{3}$.

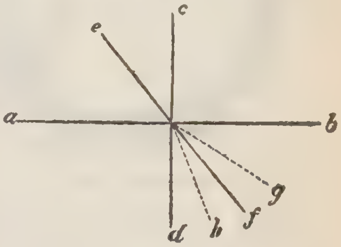

FIG. 1.—Refraction of Light.

Before a ray of light can reach the retina, it must pass through a number of transparent and refractive surfaces. The eye is a nearly spherical organ, formed of transparent parts situated behind each other, and surrounded by various membranous structures, the anterior part of which is also transparent. The transparent parts are—(1) the *cornea*; (2) the *aqueous humour*, found in the anterior chamber of the eye; (3) the *crystalline lens*, formed by a transparent convex body, the anterior surface of which is less convex than the posterior; and (4) the *vitreous humour*, filling the posterior chamber of the eye. The ray must therefore traverse the cornea, aqueous humour, lens and vitreous humour. As the two surfaces of the cornea are parallel, the rays practically suffer no deviation in passing through that structure, but they are bent or refracted during their transmission through the other media.

From the optical point of view, the eye may be regarded as a *dioptric system* consisting of various refractive media. In such a system, as shown by K. F. Gauss, there are six cardinal points, which have a certain relation to each other. These are—

(1) *Two focal points*: every ray passing through the *first* focal point becomes, after its refraction, parallel to the axis, and every ray which before refraction is parallel to the axis passes after its refraction to the *second* focal point; (2) *two principal points*: every ray which passes through the first point before refraction passes after refraction through the second, and every ray which passes through any point of a plane elevated on a perpendicular axis from the first principal point (the *first principal plane*) passes through the corresponding point of an analogous plane raised upon the axis at the second principal point (the *second principal plane*); and (3) *two nodal points*, which correspond to the optical centres of the two principal planes just alluded to. The distance of the first principal point from the first focal point is called the *anterior focal length*, and the term *posterior focal length* is applied to the distance of the posterior focal point from the second principal point. Listing has given the following measurements in millimetres from the centre of the cornea for the cardinal points in an ideal eye:—

Anterior focal point .	12·8326	First nodal point .	7·2420
Posterior focal point .	22·6470	Second nodal point .	7·6398
First principal point .	2·1746	Anterior focal length .	15·0072
Second principal point.	2·5724	Posterior focal length .	20·0746

A view of such an ideal eye is shown in fig. 2.

The remaining measurements of such an eye are as follows:—

Radii of Curvature

Of *anterior* face of cornea = 8 millimetres.
Of *anterior* face of lens = 10 ,,
Of *posterior* face of lens = 6 ,,

Indices of Refraction

Aqueous humour	$\frac{103}{77}$ = 1·3379
Crystalline lens	$\frac{16}{11}$ = 1·4545
Vitreous humour	$\frac{103}{77}$ = 1·3379

The optical constants of the human eye may be still further simplified by assuming that the two principal points and the two nodal points respectively are identical. Thus we may construct a *reduced eye*, in which the principal point is 2·3448 mm. behind the cornea and the single nodal point is 1·4764 mm. in front of the posterior surface of the lens. The refracting surface, or lens, has a radius of 5 mm. and is 3 mm. behind the cornea; and the index of refraction is that of the aqueous humour, or $\frac{103}{77}$, or 1·3379.

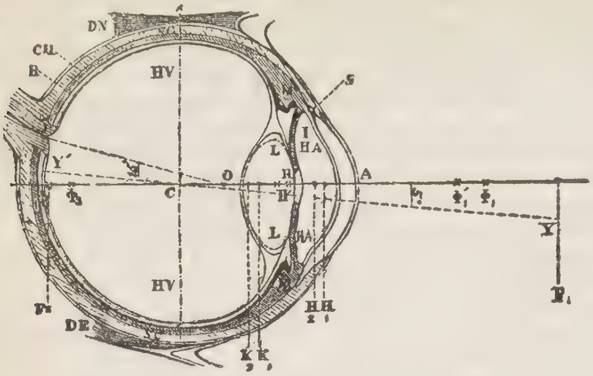

FIG. 2.—Transverse Section of an Ideal or Schematique Eye.

A, summit of cornea; SC, sclerotic; S, Schlemm's canal; CH, choroid; I, iris; M, ciliary muscle; R, retina; N, optic nerve; HA, aqueous humour; L, crystalline lens, the anterior of the double lines on its face showing its form during accommodation; HV, vitreous humour; DN, internal rectus muscle; DE, external rectus; YY', principal optical axis; ΦΦ, visual axis, making an angle of 5° with the optical axis; C, centre of the ocular globe. *The cardinal points of Listing*: H_1H_2, principal points; K_1K_2, nodal points; F_1F_2, principal focal points. *The dioptric constants according to Giraud-Teulon*: H, principal points united; $\Phi_1\Phi_2$, principal foci during the repose of accommodation; $\Phi'_1\Phi'_2$, principal foci during the maximum of accommodation; O, fused nodal points.

2. *The Formation of an Image on the Retina.*—This may be well illustrated with the aid of a photographic camera. If properly focused, an inverted image will be seen on the glass plate at the back of the camera. It may also be observed by bringing the eyeball of a rabbit near a candle flame. The action of a lens in forming an inverted image is illustrated by fig. 3, where the pencil of rays proceeding from *a* is brought to a focus at *a'*, and those from *b* at *b'*; consequently the image of *ab* is inverted as at *b'a'*. The three characteristic features of the retinal image are: (1) it is reversed; (2) it is sharp and well defined if it be accurately focused on the retina; and (3) its size depends on the visual angle. If we look at a distant object, say a star, the rays reaching the eye are parallel, and in passing through the refractive media they are focused at the posterior focal point—that is, on the retina. A line from the luminous point on the retina passing through the nodal point is called the *line of direction*. If the luminous object be not nearer than, say, 60 yds. the image is still brought to a focus on the retina without any effort on the part of the eye. Within this distance, supposing the condition of the eye to be the same as in looking at a star, the image would be formed somewhat behind the posterior focal point, and the effect would be an indistinct impression on the retina. To obviate this, for near distances, accommodation, so as to adapt the eye, is effected by a mechanism to be afterwards described.

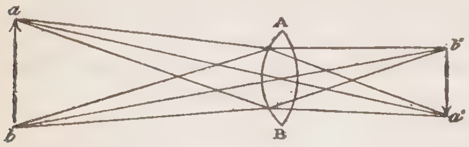

FIG. 3.—Inversion by Action of a Lens.

When rays, reflected from an object or coming from a luminous point, are not brought to an accurate focus on the retina, the image is not distinct in consequence of the formation of *circles of diffusion*, the production of which will be rendered evident by fig. 4. From the point A luminous rays enter the eye in the form of a cone, the kind of which will depend on the pupil. Thus it may be circular, or oval, or even triangular. If the pencil is focused in front of the retina, as at *d*, or behind it as at *f*, or, in other words, if the retina, in place of being at F, be in the positions G or H, there will be a luminous circle or a luminous triangular space, and many elements of the retina will be affected. The size of these diffusion circles depends on the distance from the retina of the point where the rays are focused: the greater the distance, the more extended will be the diffusion circle. Its size will also be affected by the greater or less diameter of the pupil. Circles of diffusion may be studied by the following experiment, called the experiment of Scheiner:—

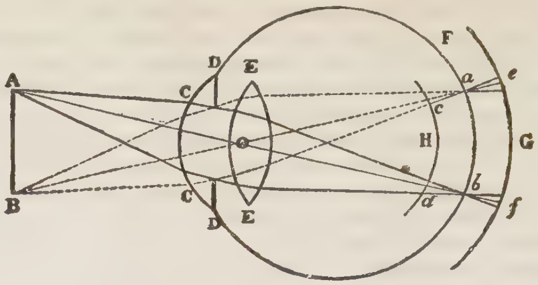

FIG. 4.—Formation of Circles of Diffusion.

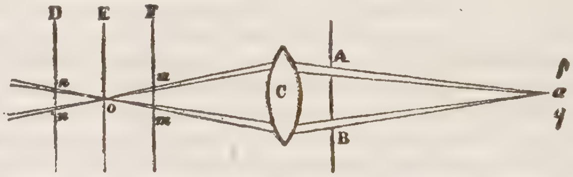

FIG. 5.—Diagram illustrating the Experiment of Scheiner.

Let C be a lens, and DEF be screens placed behind it. Hold in front of the lens a card perforated by two holes A and B, and allow rays from a luminous point *a* to pass through these holes. The point *o* on the screen E will be the focus of the rays emanating from *a*; if *a* were removed farther from the lens, the focus would be on F, and if it were brought near to C, the focus would then be on D. The screens F and D show two images on the point *a*. If, then, we close the upper opening in AB, the *upper* image *m* on F and the *lower* image *n* on D disappear. Suppose now that the retina be substituted for the screens D and F, the contrary will take place, in consequence of the reversal of the retinal image. If the eye be placed at *o*, only one image will be seen; but if it be placed either in the plane of F or D, then two images will be seen, as at *mm*, or *nn*; consequently, in either of these planes there will be circles of diffusion and indistinctness, and only in the plane E will there be sharp definition of the image.

To understand the formation of an image on the retina, suppose a line drawn from each of its two extremities to the nodal point and continued onwards to the retina, as in fig. 6, where the visual angle is *x*. It is evident that its size will depend on the size of the object and the distance of the object from the eye. Thus, also, objects of different sizes, *c*, *d*, *e* in fig. 6, may be included in the same visual angle, as they are at different distances from the eye. The size of the retinal image may be calculated if we know the size of the object, its distance from the nodal point *o*, and the distance of the nodal point from the posterior focus. Let A be the size of the object, B its distance from the nodal point, and C the distance of *o* from the retina, or 15 mm.; then the size of the retinal image $x=(A+15)/B$. The smallest visual angle in which two distinct points may be observed is 60 seconds; below this, the two sensations fuse into one; and the size of the retinal image

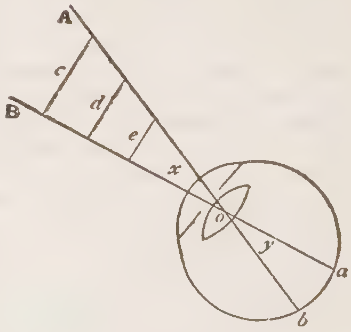

FIG. 6.—The Visual Angle.

corresponding to this angle is ·004 mm., nearly the diameter of a single retinal rod or cone. Two objects, therefore, included in a visual angle of less than 60 seconds, appear as one point. A small visual angle is in most eyes a condition of sharpness of definition. With a large angle, objects appear less sharply marked. Acuteness is determined by a few retinal elements, or even only one, being affected. A very minute image, if thrown on a single retinal element, is apparently sufficient to excite it. Thus it is possible to see a brilliant point in an angle even so small as $\frac{1}{4}$ of a second, and a sharp eye can see a body the $\frac{1}{50}$th of a line in diameter—that is, about the $\frac{1}{600}$th part of an inch.

3. *The Optical Defects of the Eye.*—As an optical instrument, the eye is defective; but from habit, and want of attention, its defects are not appreciated, and consequently they have little or no influence on our sensations. These defects are chiefly of two kinds—(1) those due to the curvature of the refractive surfaces, and (2) those due to the dispersion of light by the refractive media.

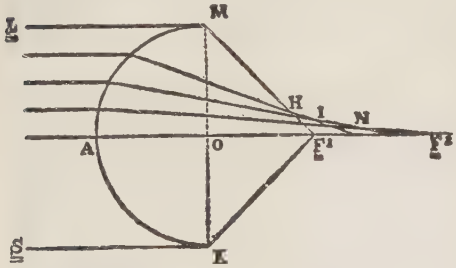

FIG. 7.—Spherical Aberration.

(*a*) *Aberration of Sphericity.*—Suppose, as in fig. 7, M A K to be a refractive surface on which parallel rays from L to S impinge, it will be seen that those rays passing near the circumference are brought to a focus at F¹, and those passing near the centre at F²—intermediate rays being focused at N. Thus on the portion of the axis between F¹ and F² there will be a series of focal points, and the effect will be a blurred and bent image. In the eye this defect is to a large extent corrected by the following arrangements: (1) the iris cuts off the outer and more strongly refracted rays; (2) the curvature of the cornea is more ellipsoidal than spherical, and consequently those farthest from the axis are least deviated; (3) the anterior and posterior curvatures of the lens are such that the one corrects, to a certain extent, the action of the other; and (4) the structure of the lens is such that its power of refraction diminishes from the centre to the circumference, and consequently the rays farthest from the axis are less refracted.

(*b*) *Astigmatism.*—Another defect of the eye is due to different meridians having different degrees of curvature. This defect is known as *astigmatism.* It may be thus detected. Draw on a sheet of white paper a vertical and a horizontal line with ink, crossing at a right angle; at the point of distinct vision, it will be found impossible to see the lines with equal distinctness at the same time; to see the horizontal line distinctly the paper must be brought near the eye, and removed from it to see the vertical. In the cornea the vertical meridian has generally a shorter radius of curvature, and is consequently more refractive than the horizontal. The meridians of the lens may also vary; but, as a rule, the asymmetry of the cornea is greater than that of the lens. The optical explanation of the defect will be understood with the aid of fig. 8. Thus, suppose the vertical meridian C A D to be more strongly curved than the horizontal F A E, the rays which fall on C A D will be brought to a focus G, and those falling on F A E at B. If we divide the pencil of rays at successive points, G, H, I, K, B, by a section perpendicular to A B, the various forms it would present at these points are seen in the figures underneath, so that if the eye were placed at G, it would see a horizontal line *a a′*; if at H, an ellipse with the long axis *a a′* parallel to A B; if at I, a circle; if at K, an ellipse, with the long axis, *b c*, at right angles to A B; and if at B, a vertical line *b c*. The degree of astigmatism is ascertained by measuring the difference of refraction in the two chief meridians; and the defect is corrected by the use of cylindrical glasses, the curvature of which, added to that of the minimum meridian, makes its focal length equal to that of the maximum meridian.

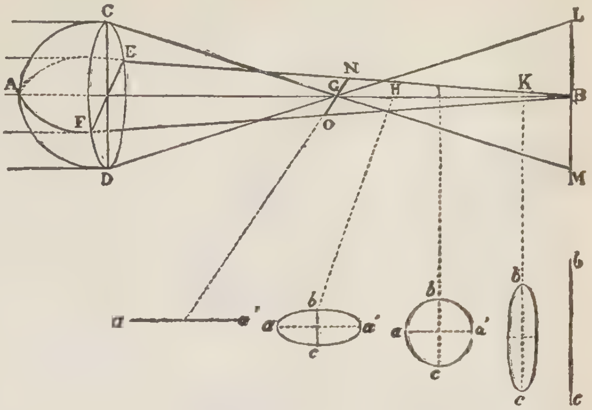

FIG. 8.—Diagram illustrating Astigmatism.

(*c*) *Aberration of Refrangibility.*—When a ray of white light traverses on a lens, the different rays composing it, being unequally refrangible, are dispersed: the violet rays (see fig. 9), the most refrangible, are brought to a focus at *e*, and the red rays, less refrangible, at *d*. If a screen were placed at *e*, a series of concentric coloured circles would be formed, the central being of a violet, and the circumference of a red colour. The reverse effect would be produced if the screen were placed at *d*. Imagine the retina in place of the screen in the two positions, the sensational effects would be those just mentioned. Under ordinary circumstances, the error of refrangibility due to the optical construction of the eye is not observed, as for vision at near distances the interval between the focal point of the red and violet rays is very small. If, however, we look at a candle flame through a bit of cobalt blue glass, which transmits only the red and blue rays, the flame may appear violet surrounded by blue, or blue surrounded by violet, according as we have accommodated the eye for different distances. Red surfaces always appear nearer than violet surfaces situated in the same plane, because the eye has to be accommodated more for the red than for the violet, and consequently we imagine them to be nearer. Again, if we contemplate red letters or designs on a violet ground the eye soon becomes fatigued, and the designs may appear to move.

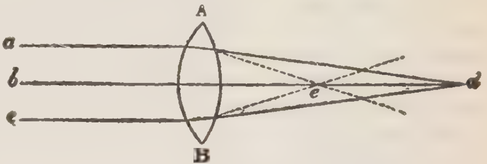

FIG. 9.—Diagram illustrating the Dispersion of Light by a Lens.

(*d*) *Defects due to Opacities, &c., in the Transparent Media.*—When small opaque particles exist in the transparent media, they may cast their shadow on the retina so as to give rise to images which are projected outwards by the mind into space, and thus appear to exist outside of the body. Such phenomena are termed entoptic. They may be of two kinds: (1) *extra-retinal*, that is, due to opaque or semi-transparent bodies in any of the refractive structures anterior to the retina, and presenting the appearance of drops, striae, lines, twisted bodies, forms of grotesque shape, or minute black dots dancing before the eye; and (2) *intra-retinal*, due to opacities, &c., in the layers of the retina, in front of Jacob's membrane. The intra-retinal may be produced in a normal eye in various ways. (1) Throw a strong beam of light on the edge of the sclerotic, and a curious branched figure will be seen, which is an image of the retinal vessels. The construction of these images, usually called *Purkinje's figures*, will be understood from fig. 10. Thus, in the figure to the left, the rays passing through the sclerotic at *b″*, in the direction *b″ c*, will throw a shadow of a vessel at *c* on the retina at *b′*, and this will appear as a dark line at B. If the light move from *b″* to *a″*, the retinal shadow will move from *b′* to *a′*, and the line in the field of vision will pass from B to A.

It may be shown that the distance *c b′* corresponds to the distance of the retinal vessels from the layer of rods and cones.

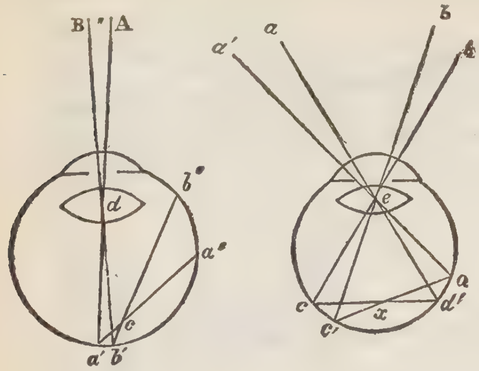

FIG. 10.—Purkinje's Figures.

In the eye to the right the illumination is through the sclerotic, and in the one to the left through the cornea.

If the light enter the cornea, as in the figure to the right, and if the light be moved, the image will be displaced in the same direction as the light; if the movement does not extend beyond the middle of the cornea, but in the opposite direction to the light when the latter is moved up and down. Thus, if *a* be moved to *a′*, *d* will be moved to *d′*, the shadow on the retina from *c* to *c′*, and the image *b* to *b′*. If, on the other hand, *a* be moved above the plane of the paper, *d* will move below, consequently *c* will move above, and *b′* will appear to sink. (2) The retinal vessels may also be seen by looking at a strong light through a minute aperture, in front of which a rapid to-and-fro movement is made. Such experiments prove that the sensitive part of the retina is its deepest and most external layer (Jacob's membrane).

4. *Accommodation, or the Mechanism of Adjustment for Different Distances.*—When a camera is placed in front of an object, it is necessary to focus accurately in order to obtain a clear and distinct image on the sensitive plate. This may be done by moving either the lens or the sensitive plate backwards or forwards so as to have the posterior focal point of the lens corresponding with the sensitive plate. For similar reasons, a mechanism of adjustment, or accommodation for different distances, is necessary in the human eye. In the normal eye, any number of parallel rays, coming from a great distance, are focused on the retina. Such an eye is termed *emmetropic* (fig. 11, A). Another form of eye (B) may be such that parallel rays are brought to a focus *in front of* the retina. This form of eye is *myopic* or short-sighted, inasmuch as, for distinct vision, the object must be brought near the eye, so as to catch the divergent rays, which are then focused on the retina. A third form is seen in C, where the focal point, for ordinary distances, is *behind* the retina, and consequently the object must be held far off, so as to allow only the less divergent or parallel rays to reach the eye. This kind of eye is called *hypermetropic*, or far-sighted. For ordinary distances, at which objects must be seen distinctly in everyday life, the fault of the myopic eye may be corrected by the use of concave and of the hypermetropic by convex glasses. In the first case, the concave glass will move the posterior focal point a little farther back, and in the second the convex glass will bring it farther forwards; in both cases, however, the glasses may be so adjusted, both as regards refractive index and radius of curvature, as to bring the rays to a focus on the retina, and consequently secure distinct vision.

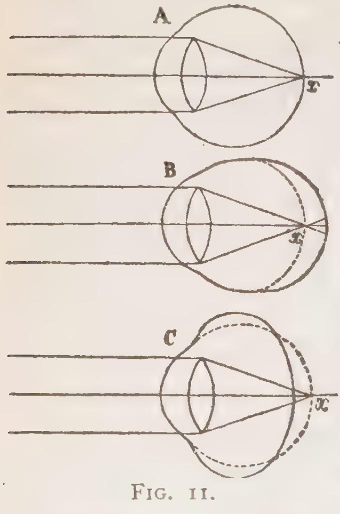

FIG. 11.

A, Emmetropic or normal eye; B, Myopic or short-sighted eye; C, Hypermetropic or long-sighted eye.

From any point 65 metres distant, rays may be regarded as almost parallel, and the point will be seen without any effort of accommodation. This point, either at this distance or in infinity, is called the *punctum remotum*, or the most distant point seen without accommodation. In the myopic eye it is much nearer, and for the hypermetropic there is really no such point, and accommodation is always necessary. If an object were brought too close to the eye for the refractive media to focus it on the retina, circles of diffusion would be formed, with the result of causing indistinctness of vision, unless the eye possessed some power of adapting itself to different distances. That the eye has some such power of accommodation is proved by the fact that, if we attempt to look through the meshes of a net at a distant object, we cannot see both the meshes and the object with equal distinctness at the same time. Again, if we look continuously at very near objects, the eye speedily becomes fatigued. Beyond a distance of 65 metres, no accommodation is necessary; but within it, the condition of the eye must be adapted to the diminished distance until we reach a point near the eye which may be regarded as the limit of visibility for near objects. This point, called the *punctum proximum*, is usually 12 centimetres (or 4·8 inches) from the eye. The range of accommodation is thus from the *punctum remotum* to the *punctum proximum*.

The mechanism of accommodation has been much disputed, but there can be no doubt it is chiefly effected by a change in the curvature of the anterior surface of the crystalline lens. If we hold a lighted candle in front and a little to the side of an eye to be examined, three reflections may be seen in the eye, as represented in fig. 12. The first, *a*, is erect, large and bright, from the anterior surface of the cornea; the second, *b*, also erect, but dim, from the anterior surface of the crystalline lens; and the third, *c*, inverted, and very dim, from the posterior surface of the lens, or perhaps the concave surface of the vitreous humour to which the convex surface of the lens is adapted. Suppose the three images to be in the position shown in the figure for distant vision, it will be found that the middle image *b* moves towards *a*, on looking at a *near* object. The change is due to an alteration of the curvature of the lens, as shown in fig. 13. The changes occurring during accommodation are: (1) the curvature of the anterior surface of the crystalline lens increases, and may pass from 10 to 6 mm.; (2) the pupil contracts; and (3) the intraocular pressure increases in the posterior part of the eye. An explanation of the increased curvature of the anterior surface of the lens during accommodation has been thus given by H. von Helmholtz. In the normal condition, that is, for the emmetropic eye, the crystalline lens is flattened anteriorly by the pressure of the anterior layer of the capsule; during accommodation, the radiating fibres of the ciliary muscles pull the ciliary processes forward, thus relieving the tension of the anterior layer of the capsule, and the lens at once bulges forward by its elasticity.

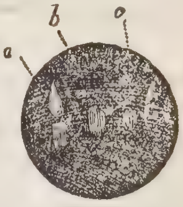

FIG. 12.—Reflected Images in the Eye.

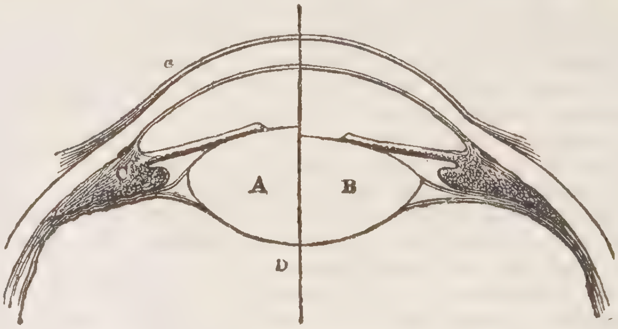

FIG. 13.—Mechanism of Accommodation.

A, The lens during accommodation, showing its anterior surface advanced; B, The lens as for distant vision; C, Position of the ciliary muscle.

By this mechanism the radius of curvature of the anterior surface of the lens, as the eye accommodates from the far to the near point, may shorten from 10 mm. to 6 mm. The ciliary muscle, however, contains two sets of fibres, the longitudinal or meridional, which run from before backwards, and the circular or equatorial (Müller's muscle), which run, as their name indicates, around the band of longitudinal fibres forming the muscle. Direct observation on the eye of an animal immediately after death shows that stimulation of the ciliary nerves actually causes a forward movement of the ciliary processes, and there can be little doubt that the explanation above given applies to man, probably most mammals, and to birds and most reptiles. In birds, which are remarkable for acuteness of vision, the mechanism is somewhat peculiar. In them the fibres of the ciliary muscle have a strong attachment posteriorly, and when these contract they pull back the inner posterior layers of the cornea, and thus relax that part of the ciliary zone called the ligamentum pectinatum. In a state of rest this structure in the bird's eye is tense, but in accommodation it becomes relaxed. Thus by a somewhat different mechanism in the bird, accommodation consists in allowing the anterior surface of the lens to become more and more convex. In reptiles generally the mechanism resembles that of the bird; but it is said that in snakes and amphibia there is a movement forwards of the lens as a whole, so as to catch rays at a less divergent angle. When the eye is directed to a distant object, such as a star, the mechanism of accommodation is at rest in mammals, birds, reptiles and amphibia, but in fishes and cephalopods the eye at rest is normally adjusted for near vision. Consequently accommodation in the latter is brought about by a mechanism that carries the lens as a whole backwards. There is still some difficulty in explaining the action of the equatorial (circular) fibres. Some have found that the increased convexity of the anterior surface of the lens takes place only in the central portions of the lens, and that the circumferential part of the lens is actually flattened, presumably by the contraction of the equatorial fibres. Seeing, however, that the central part of the lens is the portion used in vision, as the pupil contracts during accommodation, a flattening of the margins of the lens can have no optical effect. Further, another explanation can be offered of the flattening. As just stated, during accommodation the pupil contracts, and the pupillary edge of the iris, thinned out, spreads over the anterior surface of the capsule of the lens, which it actually touches, and this part of the iris, along with the more convex central part of the lens, bulges into the anterior chamber, and must thus displace some of the aqueous humour. To make room for this, however, the circumferential part of the iris, related to the ligamentum pectinatum, moves backwards very slightly, while the flattening of the circumferential part of the lens facilitates this movement.

Helmholtz succeeded in measuring with accuracy the sizes of these reflected images by means of an instrument termed an *ophthalmometer*, the construction of which is based on the following optical principles: When a luminous ray traverses a plate of glass having parallel sides, if it fall perpendicular to the plane of the plate, it will pass through without deviation; but if it fall obliquely on the plate (as shown in the left-hand diagram in fig. 14) it undergoes a lateral deviation, but in a direction parallel to that of the incident ray, so that to an eye placed behind the glass plate, at the lower A, the luminous point, upper A, would be in the direction of the prolonged emergent ray, and thus there would be an apparent lateral displacement of the point, the amount of which would increase with the obliquity of the incident ray. If, instead of one plate, we take two plates of equal thickness, one placed above the other, two images will be seen, and by turning the one plate with reference to the other, each image may be displaced a little to one side. The instrument consists of a small telescope (fig. 14) T, the axis of which coincides with the plane separating the two glass plates C C and B B. When we look at an object X Y, and turn the plates till we see two objects *xy*, *xy* touching each other, the size of the image X Y will be equal to the distance the one object is displaced to the one side and the other object to the other side. Having thus measured the size of the reflection, it is not difficult, if we know the size of the object reflecting the light and its distance from the eye, to calculate the radius of the curved surface (Appendix to M'Kendricks's *Outlines of Physiology*, 1878). The general result is that, in accommodation for near objects, the middle reflected image becomes smaller, and the radius of curvature of the anterior surface of the lens becomes shorter.

5. *Absorption and Reflection of Luminous Rays from the Eye.*—When light enters the eye, it is partly absorbed by the black pigment of the choroid and partly reflected. The reflected rays are returned through the pupil, not only following the same direction as the rays entering the eye, but uniting to form an image at the same point in space as the luminous object. The pupil of an eye appears black to an observer, because the eye of the observer does not receive any of those reflected rays. If, however, we strongly illuminate the retina, and hold a lens in front of the eye, so as to bring the reflected rays to a focus nearer the eye, then a virtual and erect, or a real and reversed, image of the retina will be seen. Such is the principle of the ophthalmoscope, invented by Helmholtz in 1851. Eyes deficient in pigment, as in albinos, appear luminous, reflecting light of a red or pink colour; but if we place in front of such an eye a card perforated by a round hole of the diameter of the pupil, the hole will appear quite dark, like the pupil of an ordinary eye. In many animals a portion of the fundus of the eyeball has no pigment, and presents an iridescent appearance. This is called a *tapetum*. It probably renders the eye more sensitive to light of feeble intensity.

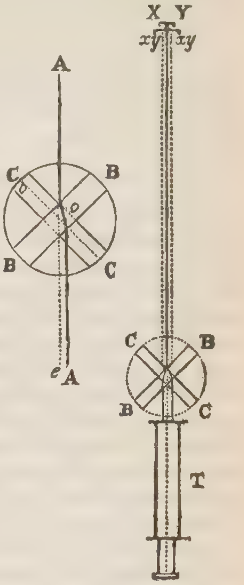

Fig. 14.—Diagrammatic View of the Ophthalmometer of Helmholtz.

6. *Functions of the Iris.*—The iris constitutes a diaphragm which regulates the amount of light entering the eyeball. The aperture in the centre, the *pupil*, may be dilated by contraction of a system of radiating fibres of involuntary muscle, or contracted by the action of another system of fibres, forming a sphincter, at the margin of the pupil. The radiating fibres are controlled by the sympathetic, while those of the circular set are excited by the third cranial nerve. The variations in diameter of the pupil are determined by the greater or less intensity of the light acting on the retina. A strong light causes contraction of the pupil; with light of less intensity, the pupil will dilate. In the human being, a strong light acting on one eye will often cause contraction of the pupil, not only in the eye affected, but in the other eye. These facts indicate that the phenomenon is of the nature of a reflex action, in which the fibres of the optic nerve act as sensory conductors to a centre in the encephalon, whence influences emanate which affect the pupil. It has been ascertained that if the fibres of the optic nerve be affected in any way, contraction of the pupil follows. The centre is in the anterior pair of the corpora quadrigemina, as destruction of these bodies causes immobility of the pupil. On the other hand, the dilating fibres are derived from the sympathetic; and it has been shown that they come from the lower part of the cervical, and upper part of the dorsal, region of the cord. But the iris seems to be directly susceptible to the action of light. Thus the pupil of the eye of a dead animal will contract if exposed to light for several hours, whereas, if the eye on the opposite side be covered, its pupil will remain widely dilated, as at the moment of death.

The pupil *contracts* under the influence—(1) of an increased intensity of light; (2) of the effort of accommodation for near objects; (3) of a strong convergence of the two eyes; and (4) of such active substances as nicotine, morphia and physostigmine; and it *dilates* under the influence—(1) of a diminished intensity of light; (2) of vision of distant objects; (3) of a strong excitation of any sensory nerve; (4) of dyspnoea; and (5) of such substances as atropine and hyoscyamine. The chief function of the iris is to so moderate the amount of light entering the eye as to secure sharpness of definition of the retinal image. This it accomplishes by (1) diminishing the amount of light reflected from near objects, by cutting off the more divergent rays and admitting only those approaching a parallel direction, which, in a normal eye, are focused on the retina; and (2) preventing the error of spherical aberration by cutting off divergent rays which would otherwise impinge near the margins of the lens, and would thus be brought to a focus in front of the retina.

3. Specific Influence of Light on the Retina

The retina is the terminal organ of vision, and all the parts in front of it are optical arrangements for securing that an image will be accurately focused upon it. The natural stimulus of the retina is light. It is often said that it may be excited by mechanical and electrical stimuli; but such an observation really applies to the stimulation of the fibres of the optic nerve. It is well known that such stimuli applied to the optic nerve behind the eye produce always a luminous impression; but there is no proof that the retina, strictly speaking, is similarly affected. Pressure or electrical currents may act on the eyeball, but in doing so they not only affect the retina, consisting of its various layers and of Jacob's membrane, but also the fibres of the optic nerve. It is possible that the retina, by which is meant all the layers except those on its surface formed by the fibres of the optic nerve, is affected only by its *specific* kind of stimulus, light. This stimulus so affects the terminal apparatus as to set up actions which in turn stimulate the optic fibres. The next question naturally is—What is the specific action of light on the retina? A. F. Holmgren, and also J. Dewar and J. G. M'Kendrick, have shown that when light falls on the retina it excites a variation of the electrical current obtained from the eye by placing it on the cushions of a sensitive galvanometer. One electrode touches the vertex of the cornea and the other the back of the eyeball. The corneal vertex is positive to the back of the eye, or to the transverse section of the optic nerve. Consequently a current passes through the galvanometer from the cornea to the back. Then the *impact* of light causes an increase in the natural electrical current—during the *continuance* of light the current diminishes slowly and falls in amount even below what it was before the impact—and the *withdrawal* of light is followed by a rebound, or second increase, after which the current falls in strength, as if the eye suffered from fatigue.

It was also observed in this research that the amount of electrical variation produced by light of various intensities corresponded pretty closely to the results expressed by G. T. Fechner's law, which regulates the relation between the stimulus and the sensational effect in sensory impressions. This law is, that the sensational effect does not increase proportionally to the stimulus, but as the logarithm of the stimulus. Thus, supposing the stimulus to be 10, 100 or 1000 times increased, the sensational effect will not be 10, 100 or 1000 times, but only 1, 2 and 3 times greater.

Such electrical phenomena probably result either from thermal or chemical changes in the retina. Light produces chemical changes in the retina. If a frog be killed in the dark, and if its retina be exposed only to *yellow* rays, the retina has peculiar purple colour, which is at once destroyed by exposure to ordinary light. The purple matter apparently is decomposed by light. An image may actually be *fixed* on the retina by plunging the eye into a solution of alum immediately after death. Thus it would appear that light affects the purple-matter of the retina, and the result of this chemical change is to stimulate the optic filaments; if the action be arrested, we may have a picture on the retina, but if it be not arrested, the picture is evanescent; the purple-matter is used up, and new matter of a similar kind is formed to take its place. The retina might, therefore, be compared to a sensitive photographic plate having the sensitive matter quickly removed and replaced; and it is probable that the electrical expression of the chemical changes is what has been above described.

(*a*) *Phosgenes.*—Luminous impressions may also be produced by pressure on the eyeball. Such impressions, termed *phosgenes*, usually appear as a luminous centre surrounded by coloured or dark rings. Sometimes they seem to be small bright scintillations of various forms. Similar appearances may be observed at the moments of opening or of closing a strong electrical current transmitted through the eyeball.

(*b*) *The Retina's Proper Light.*—The visual field, even when the eyelids are closed in a dark room, is not absolutely dark. There is a sensation of faint luminosity which may at one moment be brighter than at another. This is often termed the *proper light of the retina*, and it indicates a molecular change, even in darkness.

(*c*) *The Excitability of the Retina.*—The retina is not equally excitable in all its parts. At the entrance of the optic nerve, as was shown by E. Mariotte in 1668, there is no sensibility to light. Hence, this part of the retina is called the *blind spot.* If we shut the left eye, fix the right eye on the cross seen in fig. 15, and move the book towards and away from the eye, a position will be found when the round spot disappears, that is when its image falls on the entrance of the optic nerve. There is also complete insensibility to colours at that spot. The diameter of the optic papilla is about 1·8 mm., giving an angle of 6°; this angle determines the apparent size of the blind spot in the visual field, and it is sufficiently large to cause a human figure to disappear at a distance of two metres.

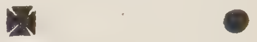

Fig. 15.—Diagram for the Study of the *Blind Spot.*

The *yellow spot* in the centre of the retina is the most sensitive to light, and it is chiefly employed in direct vision. Thus, if we fix the eye on a word in the centre of this line, it is distinctly and sharply seen, but the words towards each end of the line are vague. If we wish to see each word distinctly, we "run the eye" along the line—that is, we bring each successive word on the yellow spot. This spot has a horizontal diameter of 2 mm., and a vertical diameter of ·8mm.; and it corresponds in the visual field to an angle of from 2 to 4°. The fossa in the spot, where there are no retinal elements except Jacob's membrane, consisting here entirely of cones (2000 in number), is the area of most acute sensibility. This fossa has a diameter of only ·2 mm., which makes the angle ten times smaller. Thus the field of distinct vision is extremely limited, and at the same moment we see only a very small portion of the visual field. Images of external objects are brought successively on this minute sensitive area, and the different sensations seem to be fused together, so that we are conscious of the object as a whole.

Towards the anterior margin of the retina sensitiveness to light becomes diminished; but the diminution is not uniform, and it varies in different persons.

(*d*) *Duration and Persistence of Retinal Impressions.*—To excite the retina, a feeble stimulus must act for a certain time; when the retina is excited, the impression lasts after the cessation of the stimulus; but if the stimulus be strong, it may be of very short duration. Thus the duration of an electrical spark is extremely short, but the impression on the retina is so powerful, and remains so long, as to make the spark visible. If we rotate a disk having white and black sectors we see continuous dark bands. Even if we paint on the face of the disk a single large round red *spot*, and rotate rapidly, a continuous red *band* may be observed. Here the impressions of red on the same area of retina succeed each other so rapidly that before one disappears another is superadded, the result being a fusion of the successive impressions into one continuous sensation. This phenomenon is called the *persistence of retinal impressions.* An impression lasts on the retina from $\frac{1}{50}$ to $\frac{1}{30}$ of a second. The cinematograph owes its effects to persistence of retinal impressions.

(*e*) *The Phenomena of Irradiation.*—If we look at fig. 16, the white square in the black field appears to be larger than the black square in the white field, although both are of precisely the same size. This is due to *irradiation.* The borders of clear surfaces advance in the visual field and encroach on obscure surfaces. Probably, even with the most exact accommodation, diffusion images form round the image of a white surface on a black ground, forming a kind of penumbra, thus causing it to appear larger than it really is.

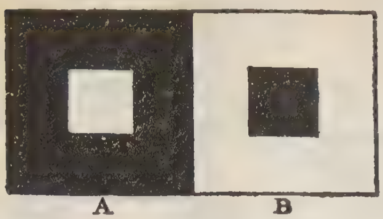

FIG. 16.—Illustrating the Effect of Irradiation.

(*f*) *Intensity of Light required to excite the Retina.*—Light must have a certain intensity to produce a luminous impression. It is impossible to fix the minimum intensity necessary, as the effect will depend, not only on the intensity of the stimulus, but on the degree of retinal excitability at the time. Thus, after the retina has been for some time in the dark, its excitability is increased; on the other hand, it is much diminished by fatigue. Aubert has stated that the minimum intensity is about 300 times less than that of the full moon. The sensibility of the eye to light is measured by the *photometer.*

(*g*) *Consecutive Retinal Images.*—Images which persist on the retina are either positive or negative. They are termed *positive* when the bright and obscure parts of the image are the same as the bright and obscure parts of the object; and *negative* when the bright parts of the object are dark in the image, and vice versa. Positive images are strong and sharply marked when an intense light has acted for not less than $\frac{1}{3}$ of a second. If the excitation be continued much longer, a negative and not a positive image will be seen. If, when the positive image is still visible, we look on a very brilliantly illuminated surface, a negative image appears. Negative images are seen with greatest intensity after a strong light has acted for a considerable time. These phenomena may be best studied when the retina is very excitable, as in the morning after a sound sleep. On awakening, if we look steadily *for an instant* at the window and then close the eyes, a *positive* image of the window will appear; if we then gaze fixedly at the window for one or two minutes, close the eyes two or three times, and then look at a dark part of the room, a *negative* image will be seen floating before us. The positive image is due to excitation of the retina, and the negative to fatigue. If we fatigue a small area of the retina with white light, and then allow a less intense light to fall on it, the fatigued area responds feebly, and consequently the object, such as the window pane, appears to be dark.

4. SENSATIONS OF COLOUR

1. *General Statement.*—Colour (*q.v.*) is a special sensation excited by the action on the retina of rays of light of a definite wave-length. On the most likely hypothesis as to the physical nature of light, colour depends on the rate of vibration of the luminiferous aether, and white light is a compound of all the colours in definite proportion. When a surface reflects solar light into the eye without affecting this proportion, it is white, but if it absorbs all the light so as to reflect nothing, it appears to be black. If a body held between the eye and the sun transmits light unchanged, and is transparent, it is colourless, but if translucent it is white. If the medium transmits or reflects some rays and absorbs others, it is coloured. Thus, if a body absorbs all the rays of the spectrum but those which cause the sensation of green, we say the body is green in colour; but this green can only be perceived if the rays of light falling on the body contain rays having the special rate of vibration required for this special colour. For if the surface be illuminated by any other pure ray of the spectrum, say red, these red rays will be absorbed and the body will appear to be black. As a white surface reflects all the rays, in red light it will be seen to be red, and in a green light, green. Colour depends on the nature of the body and on the nature of the light falling on it, and a *sensation of colour* arises when the body reflects or transmits the special rays to the eye. If two rays of different rates of vibration, that is to say, of different colours, affect a surface of the retina at the same moment, the effects are fused together and we have the sensation of a third colour different from its cause. Thus, if red be removed from the solar spectrum, all the other colours combined cause a sensation of greenish yellow. Again red and violet give purple, and yellow and blue, white. Yellow and blue, however, only give white when pure spectral colours are mixed. It is well known that a mixture of yellow and blue *pigments* do not produce white, but green; but, as was explained by Helmholtz, this is because the blue pigment absorbs all the rays at the red end of the spectrum up to the green, while the yellow pigment absorbs all the rays at the violet end down to the green, and as the only rays reflected into the eye are the green rays, the substance appears green. Finally, if colours are painted on a disk in due proportions and in a proper order, the disk will, when quickly rotated, appear white, from the rapid fusion of colour effects.

When we examine a spectrum, we see a series of colours merging by insensible gradations the one into the other, thus:—red, orange, yellow, green, blue and violet. These are termed *simple* colours. If two or more coloured rays of the spectrum act simultaneously on the same spot of the retina, they may give rise to sensations of *mixed colours.* These mixed colours are of two kinds: (1) those which do not correspond to any colour in the spectrum, such as purple and white, and (2) those which do exist in the spectrum. White may be produced by a mixture of two simple colours, which are then said to be *complementary.* Thus, red and greenish blue, orange and cyanic blue, yellow and indigo blue, and greenish yellow and violet all produce white. Purple is produced by a mixture of red and violet, or red and bluish violet. The following table by Helmholtz shows the compound colours produced by mixing other colours:—

	Violet	Indigo blue	Cyanic blue	Greenish blue	Green	Yellowish green	Yellow
Red	Purple	Deep rose	White rose	*White*	Whitish yellow	Golden yellow	Orange
Orange	Deep rose	White rose	*White*	Whitish yellow	Yellow	Yellow	
Yellow	White rose	*White*	Whitish green	Whitish green	Yellowish green		
Yellowish green	*White*	Green	Green	Green			
Green	Blue	Water blue	Greenish blue				
Greenish blue	Water blue	Water blue					
Cyanic blue	Indigo blue						

This table shows that if we mix two simple colours not so far separated in the spectrum as the complementary colours, the mixed colour contains more white as the interval between the colours employed is greater, and that if we mix two colours farther distant in the spectrum than the complementary colours, the mixture is whiter as the interval is smaller. By mixing more than two simple colours, no new colours are produced, but only different *shades* of colour.

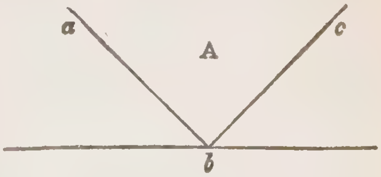

FIG. 17.—Form of Double Slit for the Partial Superposition of Two Spectra.

2. *Modes of Mixing Colour Sensations.*—Various methods have been adopted for studying the effect of mixing colours.

(*a*) *By Superposing Two Spectra.*—This may be done in a simple way by having a slit in the form of the letter V (see fig. 17), of which the two portions *ab* and *bc* form a right angle; behind this slit is placed a vertical prism, and two spectra are obtained, as seen in fig. 18, in which *bfea* is the spectrum of the slit *ab*, and *cefd* that of the slit *cd*; the coloured spectra are contained in the triangle *gef*, and, by arrangement, the effects of mixture of any two simple colours may be observed.

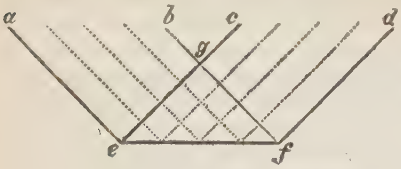

FIG. 18.—Diagram of Double Spectrum partially superposed.

(*b*) *By Method of Reflection.*—Place a red wafer on *b*, in fig. 19, and a blue wafer on *d*, and so angle a small glass plate *a* as to transmit to the eye a reflection of the blue wafer on *d* in the same line as the rays transmitted from the red wafer on *b*. The sensation will be that of purple; and by using wafers of different colours, many experiments may thus be performed.

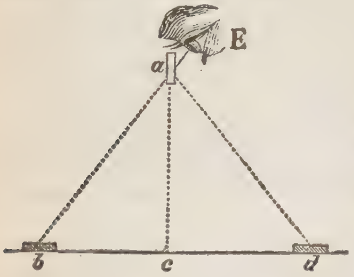

FIG. 19.—Diagram showing Lambert's Method of mixing Sensations of Colour.

(*c*) *By Rotating Disks which quickly superpose on the same Area of Retina the Impressions of Different Wave-lengths.*—Such disks may be constructed of cardboard, on which coloured sectors are painted, as shown in fig. 20, representing diagrammatically the arrangement of Sir Isaac Newton. The angles of the sectors were thus given by him:—

Red	60° 45·5′	Green	60° 45·5′
Orange	34° 10·5′	Blue	54° 41′
Yellow	54° 41′	Indigo	34° 10·5′
Violet	60° 45·5′		

With sectors of such a size, *white* will be produced on rotating the disk rapidly. This method has been carried out with great efficiency by the colour-top of J. Clerk-Maxwell. It is a flat top, on the surface of which disks of various colours may be placed. Dancer has added to it a method by which, even while the top is rotating rapidly and the sensation of a mixed colour is strongly perceived, the eye may be able to see the *simple* colours of which it is composed. This is done by placing on the handle of the top, a short distance above the coloured surface, a thin black disk, perforated by holes of various size and pattern, and weighted a little on one side. This disk vibrates to and fro rapidly, and breaks the continuity of the colour impression; and thus the constituent colours are readily seen.

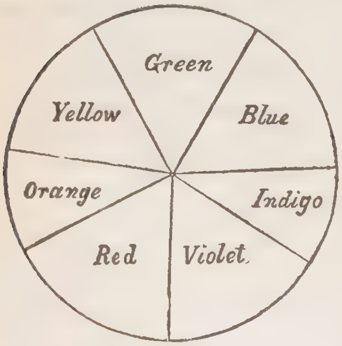

FIG. 20.—Diagram of the Colour Disk of Sir Isaac Newton.

3. *The Geometric Representation of Colours.*—Colours may be arranged in a linear series, as in the solar spectrum. Each point of the line corresponds to a determinate impression of colour; the line is not a straight line, as regards luminous effect, but is better represented by a curve, passing from the red to the violet. This curve might be represented as a circle in the circumference of which the various colours might be placed, in which case the complementary colours would be at the extremities of the same diameter. Sir Isaac Newton arranged the colours in the form of a triangle, as shown in fig. 21. If we place three of the spectral colours at three angles, thus—green, violet and red—the sides of the triangle include the intermediate colours of the spectrum, except purple.

The point S corresponds to white, consequently, from the intersection of the lines which join the complementary colours, the straight lines from green to S, RS and VS represent the amount of green, red and violet necessary to form white; the same holds good for the complementary colours; for example, for blue and red, the line SB = the amount of blue, and the line SR = the amount of red required to form white. Again, any point, say M, on the surface of the triangle, will represent a mixed colour, the composition of which may be obtained by mixing the three fundamental colours in the proportions represented by the length of the lines M to green, MV and MR. But the line VM passes on to the yellow Y; we may then replace the red and green by the yellow, in the proportion of the length of the line MY, and mix it with violet in the proportion of SV. The same colour would also be formed by mixing the amount MY of yellow with MS of white, or by the amount RM of red with the amount MD of greenish blue.

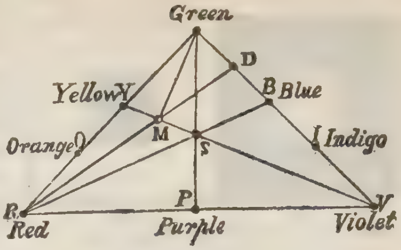

FIG. 21.—Geometrical Representation of the Relations of Colours as shown by Newton.

The following list shows characteristic complementary colours, with their wave-lengths (λ) in millionths of a millimetre:—

Red, λ 656.	Blue-green, λ 492.
Orange, λ 608.	Blue, λ 490.
Gold-yellow, λ 574.	Blue, λ 482.
Yellow, λ 567.	Indigo-blue, λ 464.
Greenish yellow, λ 564.	Violet, λ 433.

By combining colours at opposite ends of the spectrum, the effect of the intermediate colours may be produced; but the lowest and the highest, red and violet, cannot thus be formed. These are therefore fundamental or primary colours, colours that cannot be produced by the fusion of other colours. If now to red and violet we add green, which has a rate of vibration about midway between red and violet, we obtain a sensation of white. Red, green and violet are therefore the three fundamental colours.

4. *Physiological Characters of Colours.*—Colour physiologically is a sensation, and it therefore does not depend only on the physical stimulus of light, but also on the part of the retina affected. The power of distinguishing colours is greatest when they fall on, or immediately around, the yellow spot, where the number of cones is greatest. In these regions more than two hundred different tints of colour may be distinguished. Outside of this area lies a middle zone, where fewer tints are perceived, mostly confined to shades of yellow and blue. If intense coloured stimuli are employed, colours may be perceived even to the margin of the periphery of the retina, but with weak stimuli coloured objects may seem to be black, or dark like shadows. In passing a colour from the periphery to the centre of the yellow spot, remarkable changes in hue may be observed. Orange is first grey, then yellow, and it only appears as orange when it enters the zone sensitive to red. Purple and bluish green are blue at the periphery, and only show the true tint in the central region. Four tints have been found which do not thus change: a red obtained by adding to the red of the spectrum a little blue (a purple), a yellow of 574·5 λ, a green of 495 λ and a blue of 471 λ.

The question now arises, How can we perceive differences in colour? We might suppose a molecular vibration to be set up in the nerve-endings synchronous with the undulations of the luminiferous aether, without any change in the chemical constitution of the sensory surface, and we might suppose that where various series of waves in the aether corresponding to different colours act together, these may be fused together, or to interfere so as to give rise to a vibration of modified form or rate that corresponded in some way to the sensation. Or, to adopt another line of thought, we might suppose that the effect of different rays (rays differing in frequency of vibration and in physiological effect) is to promote or retard chemical changes in the sensory surface, "which again so affect the sensory nerves as to give rise to differing states in the nerves and the nerve centres, with differing concomitant sensations." The former of these thoughts is the foundation of the Young-Helmholtz theory, while the latter is applicable to the theory of E. Hering.

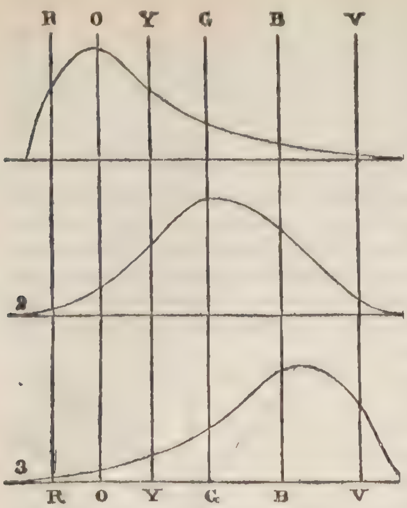

FIG. 22.—Diagram showing the Irritability of the Three Kinds of Retinal Elements.
1, red; 2, green; 3, violet. R, O, Y, G, B, V, initial letters of colours.

5. *Theories of Colour-Perception.*—A theory widely accepted by physicists was first proposed by Thomas Young and afterwards revived by Helmholtz. It is based on the assumption that three kinds of nervous elements exist in the retina, the excitation of which give respectively sensations of red, green and violet. These may be regarded as fundamental sensations. Homogeneous light excites all three, but with different intensities according to the length of the wave. Thus long waves will excite most strongly fibres sensitive to red, medium waves those sensitive to green, and short waves those sensitive to violet. Fig. 22 shows graphically the irritability of the three sets of fibres. Helmholtz thus applies the theory:—

> "1. Red excites strongly the fibres sensitive to red and feebly the other two—sensation: *Red.*
> 2. Yellow excites moderately the fibres sensitive to red and green, feebly the violet—sensation: *Yellow.*
> 3. Green excites strongly the green, feebly the other two—sensation: *Green.*
> 4. Blue excites moderately the fibres sensitive to green and violet, and feebly the red—sensation: *Blue.*
> 5. Violet excites strongly the fibres sensitive to violet, and feebly the other two—sensation: *Violet.*
> 6. When the excitation is nearly equal for the three kinds of fibres, then the sensation is *White.*"

The Young-Helmholtz theory explains the appearance of the consecutive coloured images. Suppose, for example, that we look at a red object for a considerable time; the retinal elements sensitive to red become fatigued. Then (1) if the eye be kept in *darkness*, the fibres affected by red being fatigued do not act so as to give a sensation of red; those of green and of violet have been less excited, and this excitation is sufficient to give the sensation of pale greenish blue; (2) if the eye be fixed on a *white* surface, the red fibres, being fatigued, are not excited by the red rays contained in the white light; on the contrary, the green and violet fibres are strongly excited, and the consequence is that we have an intense complementary image; (3) if we look at a *bluish green* surface, the complementary of red, the effect will be to excite still more strongly the green and violet fibres, and consequently to have a still more intense complementary image; (4) if we regard a *red* surface, the primitive colour, the red fibres are little affected in consequence of being fatigued, the green and violet fibres will be only feebly excited, and therefore only a very feeble complementary image will be seen; and (5) if we look at a surface of a *different* colour altogether, this colour may combine with that of the consecutive image, and produce a mixed colour; thus, on a yellow surface, we will see an image of an orange colour.

Every colour has three qualities: (1) *hue*, or tint, such as red, green, violet; (2) *degree of saturation*, or purity, according to the amount of white mixed with the tint, as when we recognize a red or green as pale or deep; and (3) *intensity*, or luminosity, or brightness as when we designate the tint of a red rose as dark or bright. Two colours are identical when they agree as to these three qualities. Observation shows, however, that out of one hundred men ninety-six agree in identifying or in discriminating colours, while the remaining four show defective appreciation. These latter are called *colour-blind*. This defect is about ten times less frequent in women. Colour-blindness is congenital and incurable, and it is due to an unknown condition of the retina or nerve centres, or both, and must be distinguished from transient colour-blindness, sometimes caused by the excessive use of tobacco and by disease. When caused by tobacco, the sensation of blue is the last to disappear. Absolute inability to distinguish colour is rare, if it really exists; in some rare cases there is only one colour sensation; and in a few cases the colour-blind fails to distinguish blue from green, or there is insensibility to violet. Daltonism, or red-green blindness, of which there are two varieties, the red-blind and the green-blind, is the more common defect. Red appears to a red-blind person as a dark green or greenish yellow, yellow and orange as dirty green, and green is green and brighter than the green of the yellow and orange. To a green-blind person red appears as dark yellow, yellow is yellow, except a little lighter in shade than the red he calls dark yellow, and green is pale yellow.

According to the Young-Helmholtz theory, there are three fundamental colour sensations, red, green and violet, by the combination of which all other colours may be formed, and it is assumed that there exist in the retina three kinds of nerve elements, each of which is specially responsive to the stimulus of waves of a certain frequency corresponding to one colour, and much less so to waves of other frequencies and other colours. If waves corresponding to pure red alone act on the retina, only the corresponding nerve element for red would be excited, and so with green and violet. But if waves of different frequencies are mixed (corresponding to a mixture of colours), then the nerve elements will be set in action in proportion to the amount and intensity of the constituent excitant rays in the colour. Thus if all the nerve elements were simultaneously set in action, the sensation is that of white light; if that corresponding to red and green, the resultant sensation will be orange or yellow; if mainly the green and violet, the sensation will be blue and indigo. Then red-blindness may be explained by supposing that the elements corresponding to the sensation of red are absent; and green-blindness, to the absence of the elements sensitive to green. If to a red-blind person the green and violet are equal, and when to a green-blind person the red and violet are equal, they may have sensations which to them constitute white, while to the normal eye the sensation is not white, but bluish green in the one case and green in the other. In each case, to the normal eye, the sensation of green has been added to the sensations of red and blue. It will be evident, also, that whiteness to the colour-blind eye cannot be the same as whiteness to the normal eye. No doubt this theory explains certain phenomena of colour-blindness, of after-coloured images, and of contrast of colour, but it is open to various objections. It has no anatomical basis, as it has been found to be impossible to demonstrate the existence of three kinds of nerve elements, or retinal elements, corresponding to the three fundamental colour sensations. Why should red to a colour-blind person give rise to a sensation of something like green, or why should it give rise to a sensation at all? Again, and as already stated, in cases of colour-blindness due to tobacco or to disease, only blue may be seen, while it is said that the rest of the spectrum seems to be white. It is difficult to understand how *white* can be the sensation if the sensations of red and green are lost. On the other hand, it may be argued that such colour-blind eyes do not really see white as seen by a normal person, and that they only have a sensation which they have been accustomed to call white. According to this theory, we never actually experience the primary sensations. Thus we never see primary red, as the sensation is more or less mixed with primary green, and even with primary blue (violet). So with regard to primary green and primary violet. Helmholtz, in his last work on the subject, adopted as the three primary colours a red bluer than spectral red, (*a*) a green lying between 540 λ and 560 λ (*b*, like the green of vegetation), and a blue at about 470 λ (*c*, like ultramarine), all, however, much more highly saturated than any colours existing in the spectrum.

In *Handbuch der Physiologischen Optik* (Hamburg and Leipzig, 1896) Helmholtz pointed out that luminosity or brightness plays a more important part in colour perception than has been supposed. Each spectral colour is composed of certain proportions of these fundamental colours, or, to put it in another way, a combination of two of them added to a certain amount of white.

Hering's theory proceeds on the assumption of chemical changes in the retina under the influence of light. It also assumes that certain fundamental sensations are excited by light or occur during the absence of light. These fundamental sensations are white, black, red, yellow, green and blue. They are arranged in pairs, the one colour in each pair being, in a sense, complementary to the other, as white to black, red to green, and yellow to blue. Hering also supposes that when rays of a certain wave-length fall on visual substances assumed to exist in the retina, destructive or, as it is termed, katabolic changes occur, while rays having other wave-lengths cause constructive or anabolic changes. Suppose that in a red-green substance katabolic and anabolic changes occur in equal amount, there may be no sensation, but when waves of a certain wave-length or frequency cause katabolic changes in excess, there will be a sensation of red, while shorter waves and of greater frequency, by exciting anabolic changes, will cause a sensation of green. In like manner, katabolism of a yellow-blue visual substance gives rise to a sensation we call yellow, while anabolism, by shorter waves acting on the same substance, causes the sensation of blue. Again, katabolism of a white-black visual substance gives white, while anabolism, in the dark, gives rise to the sensation of blackness. Thus blackness is a sensation as well as whiteness, and the members of each pair are antagonistic as well as complementary. In the red end of the spectrum the rays cause katabolism of the red-green substance, while they have no effect on the yellow-blue substance. Here the sensation is red. The shorter waves of the spectral yellow cause katabolism of the yellow-blue material, while katabolism and anabolism of the red-green substance are here equal. Here the sensation is yellow. Still shorter waves, corresponding to green, now cause anabolism of the red-green substance, while their influence on the yellow-blue substance, being equal in amount as regards katabolism and anabolism, is neutral. Here the sensation is green. Short waves of the blue of the spectrum cause anabolism of the yellow-blue material, and as their action on the red-green matter is neutral, the sensation is blue. The very short waves at the blue end of the spectrum excite katabolism of the red-green substance, and thus give violet by adding red to blue. The sensation orange is experienced when there is excess of katabolism, and greenish blue when there is excess of anabolism in both substances. Again, when all the rays of the spectrum fall on the retina, katabolism and anabolism in the red-green and yellow-blue matters are equal and neutralize each other, but katabolism is great in the white-black substance, and we call the sensation white. Lastly, when no light falls on the retina, anabolic changes are going on and there is the sensation of black.

Hering's theory accounts satisfactorily for the formation of coloured after-images. Thus, if we suppose the retina to be stimulated by red light, katabolism takes place, and if the effect continues after withdrawal of the red stimulus, we have a positive after-image. Then anabolic changes occur under the influence of nutrition, and the effect is assisted by the anabolic effect of shorter wave-lengths, with the result that the negative after-image, green, is perceived. Perhaps the distinctive feature of Hering's theory is that white is an independent sensation, and not the secondary result of a mixture of primary sensations, as held by the Young-Helmholtz view. The greatest difficulty in the way of the acceptance of Hering's theory is with reference to the sensation of black. Black is held to be due to anabolic changes occurring in the white-black substance. Suppose that anabolism and katabolism of the white-black substance are in equilibrium, unaccompanied by stimulation of either the red-green or the yellow-blue substances, we find that we have a sensation of darkness, but not one of intense blackness. This "darkness" has still a certain amount of luminosity, and it has been termed the "intrinsic light" of the retina. Sensations of black differing from this darkness may be readily experienced, as when we expose the retina to bright sunshine for a few moments and then close the eye. We then have a sensation of intense blackness, which soon, however, is succeeded by the darkness of the "intrinsic light." The various degrees of blackness, if it is truly a sensation, are small compared with the degrees in the intensity of whiteness. In the consideration of both theories changes in the cerebral centres have not been taken into account, and of these we know next to nothing.

6. *The Contrast of Colours.*—If we look at a small white, grey or black object on a coloured ground, the object appears to have the colour complementary to the ground. Thus a circle of grey paper on a *red* ground appears to be of a greenish-blue colour, whilst on a blue ground it will appear pink. This effect is heightened if we place over the paper a thin sheet of tissue paper; but it disappears at once if we place a black ring or border round the grey paper. Again, if we place two complementary colours side by side, both appear to be increased in intensity. Various theories have been advanced to explain these facts. Helmholtz was of opinion that the phenomena consist rather in modifications of judgment than in different sensory impressions; J. A. F. Plateau, on the other hand, attempted to explain them by the theory of consecutive images.

5. THE MOVEMENTS OF THE EYE

1. *General Statement.*—The globe of the eye has a *centre of rotation*, which is not exactly in the centre of the optic axis, but a little behind it. On this centre it may move round *axes of rotation*, of which there are three—an antero-posterior, a vertical and a transverse. In normal vision, the two eyes are always placed in such a manner as to be fixed on one point, called the *fixed point* or the *point of regard*. A line passing from the centre of rotation to the point of regard is called the *line of regard*. The two lines of regard form an angle at the point of regard, and the base is formed by a line passing from the one centre of rotation to the other. A plane passing through both lines of regard is called the *plane of regard*. With these definitions, we can now describe the movements of the eyeball, which are of three kinds: (1) *First position.* The head is erect, and the line of regard is directed towards the distant horizon. (2) *Second position.* This indicates all the movements round the transverse and horizontal axes. When the eye rotates round the first, the line of regard is displaced above or below, and makes with a line indicating its former position an angle termed by Helmholtz the angle of vertical displacement, or the *ascensional angle*; and when it rotates round the vertical axis, the line of regard is displaced from side to side, forming with the median plane of the eye an angle called the *angle of lateral displacement.* (3) *Third order of positions.* This includes all those which the globe may assume in performing a rotatory movement along with lateral or vertical displacements. This movement of rotation is measured by the angle which the plane of regard makes with the transverse plane, an angle termed the *angle of rotation* or of *torsion*.

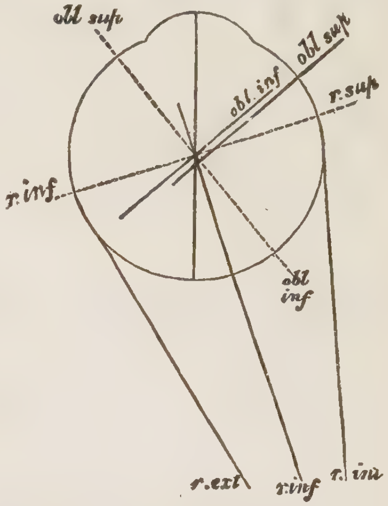

FIG. 23.—Diagram of the Attachments of the Muscles of the Eye and of their Axes of Rotation, the latter being shown by dotted lines. (Fick.) The axis of rotation of the rectus internus and rectus externus being vertical, that is, perpendicular to the plane of the paper, cannot be shown.

The two eyes move together as a system, so that we direct the two lines of regard to the same point in space.

The eyeball is moved by six muscles, which are described in the article EYE (*Anatomy*). The relative attachments and the axes of rotation are shown in fig. 23.

The term *visual field* is given to the area intercepted by the extreme visual lines which pass through the centre of the pupil, the amount of dilatation of which determines its size. It follows the movements of the eye, and is displaced with it. Each point in the visual field has a corresponding point on the retina, but the portion, as already explained, which secures our attention is that falling on the yellow spot.

2. *Simple Vision with Two Eyes.*—When we look at an object with both eyes, having the optic axes parallel, its image falls upon the two yellow spots, and it is seen as one object. If, however, we displace one eyeball by pressing it with the finger, then the image in the displaced eye does not fall on the yellow spot, and we see two objects, one of them being less distinct than the other. It is not necessary, however, in order to see a single object with two eyes that the two images fall on the two yellow spots; an object is always single if its image fall on *corresponding points* in the two eyes.

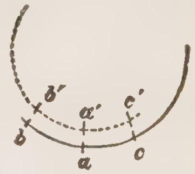

FIG. 24.—Diagram to illustrate the Physiological Relations of the two Retinae.

The eye may rotate round three possible axes, a vertical, horizontal and antero-posterior. These movements are effected by four straight muscles and two oblique. The four straight muscles arise from the back of the orbit, and pass forward to be inserted into the front part of the eyeball, or its equator, if we regard the anterior and posterior ends of the globe as the poles. The two obliques (one originating at the back of the orbit) come, as it were, from the nasal side—the one goes above the eyeball, the other below, while both are inserted into the eyeball on the temporal side, the superior oblique above and the inferior oblique below. The six muscles work in pairs. The internal and external recti turn the eye round the vertical axis, so that the line of vision is directed to the right or left. The superior and inferior recti rotate the eye round the horizontal axis, and thus the line of vision is raised or lowered. The oblique muscles turn the eye round an axis passing through the centre of the eye to the back of the head, so that the superior oblique muscle lowers, while the inferior oblique raises, the visual line. It was also shown by Helmholtz that the oblique muscles sometimes cause a slight rotation of the eyeball round the visual axis itself. These movements are under the control of the will up to a certain point, but there are slighter movements that are altogether involuntary. Helmholtz studied these slighter movements by a method first suggested by F. C. Donders. By this method the apparent position of after-images produced by exhausting the retina, say with a red or green object, was compared with that of a line or fixed point gazed at with a new position of the eyeball. The ocular spectra soon vanish, but a quick observer can determine the coincidence of lines with the spectra. After producing an after-image with the head in the erect position, the head may be placed into any inclined position, and if the attention is then fixed on a diagram having vertical lines ruled upon it, it can easily be seen whether the after-image coincides with these lines. As the after-image must remain in the same position on the retina, it will be evident that if it coincides with the vertical lines there must have been a slight rotation of the eyeball. Such a coincidence always takes place, and thus it is proved that there is an involuntary rotation. This minute rotation enables us to judge more accurately of the position of external objects.

3. The *horopter* is the locus of those points of space which are projected on retinal points. While geometrically it may be conceived as simple, as a matter of fact it is generally a line of double curvature produced by the intersection of two hyperboloids, or, in other words, it is a twisted cubic curve formed by the intersection of two hyperboloids which have a common generator. The curves pass through the nodal point of both eyes. An infinite number of lines may be drawn from any point of the horopter, so that the point may be seen as a single point, and these lines lie on a cone of the second order, whose vertex is the point. When we gaze at the horizon, the horopter is really a horizontal plane passing through our feet. The horopter in this instance is the ground on which we stand. Experiments show "that the forms and the distances of these objects which are situated in, or very nearly in, the horopter, are perceived with a greater degree of accuracy than the same forms and distances would be when not situated in the horopter" (M'Kendrick, *Life of Helmholtz*, 1899, p. 172 *et seq*.).

An object which is not found in the horopter, or, in other words, does not form an image on corresponding points of the retinae, is seen double. When the eyeballs are so acted upon by their muscles as to secure images on non-corresponding points, and consequently double vision, the condition is termed *strabismus*, or squinting, of which there are several varieties treated of in works on ophthalmic surgery. It is important to observe that in the fusion of double images we must assume, not only the correctness of the theory of corresponding points of the retina, but also that there are corresponding points in the brain, at the central ends of the optic fibres. Such fusion of images may occur without consciousness—at all events, it is possible to imagine that the cerebral effect (except as regards consciousness) would be the same when a single object was placed before the two eyes, in the proper position, whether the individual were conscious or not. On the other hand, as we are habitually conscious of a single image, there is a psychical tendency to fuse double images when they are not too dissimilar.

4. *Binocular Perception of Colour*.—This may be studied as follows. Take two No. 3 eye-pieces of a Hartnack's microscope, or two eye-pieces of the same optical value from any microscope, place one in front of each eye, direct them to a clear window in daylight, keep them parallel, and two luminous fields will be seen, one corresponding to each eye. Then converge the two eye-pieces, until the two luminous circles cross, and the central part, like a bi-convex lens, will appear clear and bright, while the outer segments will be much less intense, and may appear even of a dim grey colour. Here, evidently, the sensation is due to a fusion of impressions in the brain. With a similar arrangement, blue light may be admitted by the one eye-piece and red by the other; and on the convergence of the two, a resultant colour, purple, will be observed. This may be termed the binocular vision of colours. It is remarkable that by a mental effort this sensation of a compound colour may be decomposed into its constituents, so that one eye will again see blue and the other red.

6. The Psychical Relations of Visual Perceptions

1. *General Characters of Visual Perceptions*.—All visual perceptions, if they last for a sufficient length of time, appear to be external to ourselves, erect, localized in a position in space and more or less continuous.

(*a*) *Visual Sensations are referred to the Exterior*.—This appears to be due, to a large extent, to habit. Those who have been born blind, on obtaining eyesight by an operation, have imagined objects to be in close proximity to the eye, and have not had the distinct sense of exteriority which most individuals possess. Slowly, and by a process of education, in which the sense of touch played an important part, they gained the knowledge of the external relations of objects. Again, phosgenes, when first produced, appear to be in the eye, but when conscious of them, by an effort of imagination, we may transport them into space, although they never appear very far off.

(*b*) *Visual Sensations are referred to Erect Objects*.—Although the images of objects are *inverted* on the retina we see them erect. The explanation of the effect is that we are conscious not of the image on the retina, but of the luminous object from which the rays proceed, and we refer the sensation in the *direction* of these rays. Again, in running the eye over the object, say a tall pole, from base to apex, we are not conscious of the different images on the retina, but of the muscular movements necessary to bring the parts successively on the yellow spot.

(*c*) *Visual Sensations are referred to a Position in Space*.—The localization of a luminous point in space can only be determined by observing its relations to other luminous points with a given position of the head and of the eye. For example, in a perfectly dark room, if we look at a single luminous point, we cannot fix its exact position in space, but we may get some information of a vague character by moving the head or the eye. If, however, a second luminous point appears in the darkness, we can tell whether it is nearer or farther distant, above or below the first. So with regard to other luminous points we observe their reciprocal relations, and thus we localize a number of visual impressions. There are three principal directions in space: the *transverse* (breadth), the *vertical* (height) and the *sagittal* (depth). Luminous points may be localized either in the transverse or vertical directions. Here we have to do simply with localization on a surface. A number of points may be observed simultaneously (as when the eye is fixed) or successively (as when the eye moves). If the movement of the eye be made rapidly, the series of impressions from different points may be fused together, and we are conscious of a *line*, the direction of which is indicated chiefly by the muscular sensations felt in following it. The case is different as regards points in the sagittal direction. We see only a single point of this line at a time; it may be a transverse series of retinal elements, A B, and each of these formed by a number of smaller elements, 1, 2, 3, 4, situated in the axis of each principal element; it may be, on the other hand, the transverse line *a b* situated in space and formed by a series of points in juxtaposition.

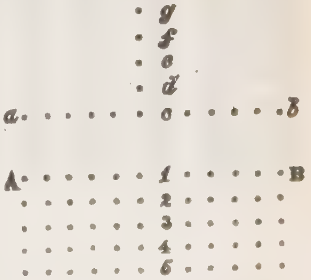

Fig. 25.—Diagram illustrating the Localization of Visual Perceptions.

Each of these points will impress a retinal element, and the result will be the perception of a transverse line; but this will not be the same for the points *c, d, e, f, g*, situated in space in a linear series, in the sagittal direction; only one of those points, *c*, will impress the corresponding retinal element, and we can see only *one* point at a time in the line *cg*. By accommodating successively, however, for the various points at different and considerable distances along the line *cg*, we may excite retinal elements in rapid succession. Thus, partly by the fusion of the successive impressions on the retina, and partly from the muscular sensations caused by repeated accommodations and possibly of ocular movements, we obtain a notion of *depth* in space, even with the use of only one eye. It is, however, one of the chief effects of binocular vision to give precision to the notion of space in the sagittal direction.

(*d*) *Visual Sensations are Continuous.*—Suppose the image of a luminous line falls on the retina, it will appear as a line although it is placed on perhaps 200 cones or rods, each of which may be separately excited, so as to cause a *distinct* sensation. Again, on the same principle, the impression of a superficial surface may be regarded as a kind of *mosaic*, made up of individual portions corresponding to the rods or cones on which the image of the surface falls. But in both cases the sensation is continuous, so that we see a line or a surface. The individual images are fused together.

2. *Notions derived from Visual Perceptions.*—When we look at any object, we judge of its size, the direction of its surfaces (unless it be a point), its distance from the eye, its apparent movement or fixedness and its appearance of solidity.

(*a*) *Apparent Size.*—This, so far as regards a comparatively small object, depends on the size of the retinal image, as determined by the visual angle. With a very large object, there is an appreciation of size from the muscular sensations derived from the movements of the eyeball as we "range" the eye over it. It is difficult to appreciate the distance separating two points between which there are other points, as contrasted with an apparently similar distance without intermediate points. For example, the distance A to B appears to be greater than from B to C, in fig. 26.

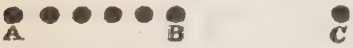

Fig. 26.—Diagram to illustrate Illusions of Size and Distance.

(*b*) *Direction.*—As the retina is a curved surface, a long straight line, especially when seen from a distance, appears curved. In fig. 27 a curious illusion of direction, first shown by J. K. F. Zoellner, is depicted. If these lines be looked at somewhat obliquely, say from one corner, they will appear to converge or diverge, and the oblique lines, on each side of the vertical lines, will appear not to be exactly opposite each other. But the vertical lines are parallel, and the oblique lines are continuous across them. The effect is evidently due to an error of judgment, as it may be controlled by an intense effort, when the lines will be seen as they really are.

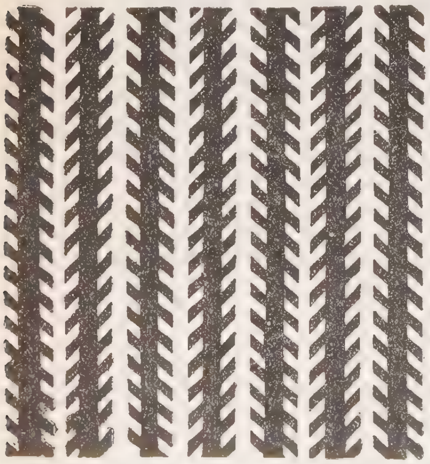

Fig. 27.—Zoellner's Figure showing an Illusion of Direction.

(*c*) *Apparent Distance.*—We judge of distance, as regards large objects at a great distance from the eye—(1) from their apparent size, which depends on the dimensions of the visual angle, and (2) from the interposition of other objects between the eye and the distant object. Thus, at sea, we cannot form, without great experience, an accurate estimate of how many miles we are off the coast, and all know how difficult it is to estimate accurately the width of a river. But if objects be interposed between the eye and the distant object, say a few vessels at different distances at sea, or a boat in the river, then we have certain materials on which to form a judgment, the accuracy of which, however, even with these aids, will depend on experience. When we look at a near object, we judge of its distance chiefly by the sense of effort put forth in bringing the two lines of regard to converge upon it.

(*d*) *The Movement of a Body.*—If the eye be fixed, we judge of movement by successive portions of the retina being affected, and possibly also by a feeling of an *absence* of muscular contractions necessary to move the eyeballs. When the eye moves, so as to "follow" the object, there is a sense of muscular effort, which is increased when, in addition, we require to move the head.

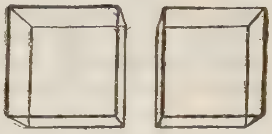

Fig. 28.—Illustrating Stereoscopic Vision.

(*e*) *The Apparent Solidity of an Object.*—If we look at an object, say a cube, first with the right eye and then with the left, it will be found that the two images of the object are somewhat different, as in fig. 28. If, then, by means of a stereoscope, or by holding a card between the two eyes, and causing a slight convergence of the eyes, the two images are brought upon corresponding points of the two retinae, the image will at once be seen in relief.

See also article "Vision" by W. H. R. Rivers in Schäfer's *Text-Book of Physiology*, vol. ii. p. 1026. (J. G. M.)

7. Errors of Refraction and Accommodation and their Curative Treatment

The following is a classification of the diseases of vision, from a medical point of view (see also Eye: *diseases*):—

a. Errors of refraction: hyperopia, myopia, astigmatism, anisometropia, aphakia.
b. Errors of accommodation:—
- (1) Loss of accommodation
  - (*a*) From advancing years (presbyopia), or from debility.
  - (*b*) From paralysis (cycloplegia) due to—
    - 1. Drugs such as atropine.
    - 2. Systemic poisons: diphtheria, influenza, syphilis, &c.
    - 3. Diseases of the nervous system, concussion of the brain.
- (2) Spasm of accommodation.
- (3) Meridional asymmetrical accommodation by means of which low errors of astigmatism are corrected, producing *eye-strain*.

Hyperopia or Hypermetropia (H.) (Far-sight; German = *Uebersicht*).—This is a condition of the refraction of the eye in which, with the eye at rest, parallel rays of light focus beyond the retina, which means that the image of a distant object is not in focus when it meets the retina, because the eye is too short antero-posteriorly. Most eyes at birth are hyperopic, but as the child grows the eye also grows; when, however, this does not take place, or does not take place sufficiently, normal development is thus arrested. There are other conditions that cause hyperopia, but this shortening of the antero-posterior axis is by far the commonest.

Hyperopia is corrected by convex glasses (fig. 29), and the measurement of the hyperopia is that convex glass which enables the hyperopic eye, at rest, to see distinctly objects at a distance. When the hyperopia is not too high it can also be corrected by the eye itself by means of the ciliary muscle (muscle of accommodation) which causes the crystalline lens to become more convex, and thus brings about the same result as placing a convex glass before the eye.

In young people when the error is not too high this work is done unconsciously, vision appears to be perfect, and it is only by placing the eye under the influence of atropine that the defect is revealed. In the normal eye distant objects are focused on the retina without the use of the ciliary muscle, which is only employed when looking at near objects; but the hyperope has to use this muscle all his waking hours for both near and distant vision, so that his eyes are never at rest. Fortunately he has some compensation for this extra work, for in most hyperopes the ciliary muscle becomes more or less hypertrophied; but even so, if near work is at all excessive, or if the defect is associated with astigmatism or anisometropia, symptoms of eye-strain will sooner or later show themselves (see *Eye-strain*, below).

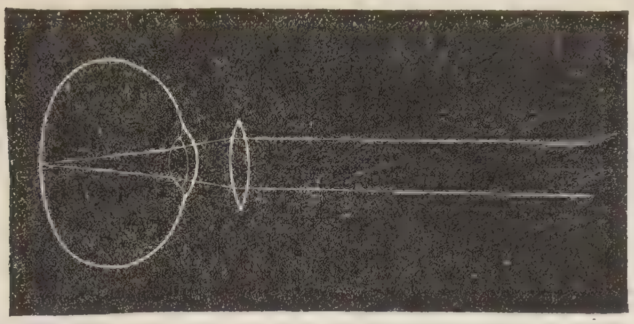

FIG. 29.—Showing Parallel Rays focused on the Retina of a Hyperopic Eye by means of a Convex Lens.

In older people a very common symptom is blurring of the type while reading; the book has to be put down and the eyes rested for some minutes before reading can be resumed. This is due to the fatigued ciliary muscle giving way and becoming unable to focus.

As we advance in years we lose accommodation power (see *Presbyopia*, below), so that the time comes to every hyperope, if he live long enough, when he not only has to use glasses for reading (at an earlier period than the normal person), but he also finds that he is gradually losing his distant vision. This is very alarming to many, until it is explained that all that has happened is the loss of power to correct the defect, which defect, of course, has always existed, and which in future will have to be corrected by suitable glasses. The higher the hyperopia the sooner will these symptoms manifest themselves.

In quite young children, sometimes the earliest sign of the presence of hyperopia is a convergent strabismus (internal squint). As a rule, this squint is nothing more than an over-convergence brought about by over-accommodation in those who cannot dissociate their convergence and accommodation; if we remove the necessity for over-accommodation by correcting the defect with suitable glasses, the over-convergence disappears and the squint is cured.

The total hyperopia of the eye is divided into manifest hyperopia and latent hyperopia. Manifest hyperopia is expressed in amount by the strongest convex glass that allows clear distant vision when the eye is not under atropine. Latent hyperopia is the additional hyperopia which is revealed under atropine. With advancing years the latent hyperopia becomes more and more manifest, and between the ages of 45 and 50 the total hyperopia is entirely manifest.

In addition to the symptoms already described, a very common one among young hyperopes is *spasm of the ciliary muscle*. This cramp of the muscle causes distant objects to be very indistinct, improvement only taking place with a *concave* glass, and near work has to be approached very close to the eyes, thus giving a wrong idea that the child is suffering from myopia; by paralysing the ciliary muscle with atropine the spasm disappears and the true nature of the defect is revealed.

The treatment essentially consists in ascertaining the total hyperopia of the eye, and this can only be done satisfactorily, when latent hyperopia is present, by paralysing the accommodation, using atropine for those under 25, and homatropine for those between the ages of 25 and 35 or 40. Over 40 (and when the hyperopia is high, even at an earlier age) no cycloplegic is necessary—in fact it is in many cases dangerous, as an attack of glaucoma may be induced. (See EYE: *diseases*.)

Having found the total hyperopia, we learn the amount of the latent hyperopia, and, roughly speaking, the convex glass required is equal to the whole of the manifest hyperopia added to, from one-third to a half, of the latent; but the treatment varies with the age of the individual and the amount of the hyperopia, and is too complicated to be detailed here.

Myopia (M.) (Short-sight).—Typical myopia is due to an elongation of the antero-posterior diameter of the eye, so that the retina is situated behind the principal focus, and only divergent rays of light from a near point (fig. 30), or parallel rays made divergent by a concave glass (fig. 31), can come to a focus on the retina. In other words, the far point of a myope is at a short distance in front of the eye, the distance being the measure of the myopia.

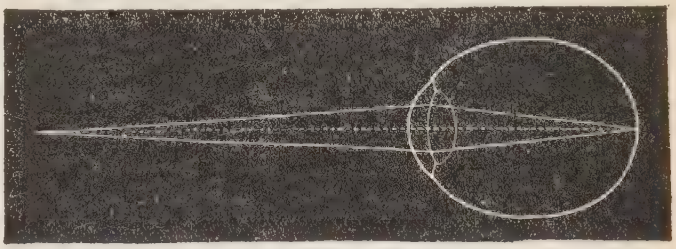

FIG. 30.

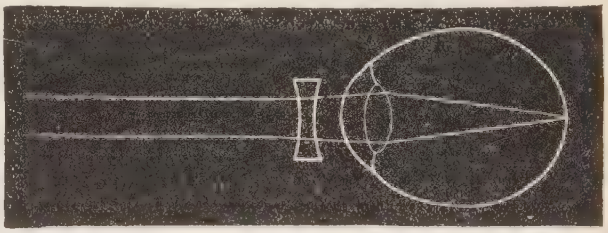

FIG. 31.

A myope can see distinctly at a distance when the eye is at rest (*i.e.* when accommodation is not being used), with that concave glass whose focal length is equal to the distance of the far point from the eye, and the converse is true; the measurement of myopia is that concave glass with which the myopic eye sees distinctly objects at a distance, and its focal length is equal to the distance of the myope's far point from the eye.

The Causes of Myopia.—Although myopia is hereditary, it is, with few exceptions, not congenital. We have seen that almost all eyes are hyperopic at birth. The savage is rarely myopic: it is civilization that is responsible for it; the necessity for constantly adapting the eye for near objects means undue convergence. We find that myopia generally first shows itself at the age of 8 to 10, when school work begins in earnest—that is, when convergence is first used in excess—and there is no doubt that it is excessive convergence that is mostly responsible for the development of myopia. The over-used internal recti constantly pulling at the sclerotic tend to lengthen the antero-posterior diameter of the eye, and as this lengthening of the antero-posterior axis necessitates greater convergence still, a vicious circle is produced, and the myopia gradually increases. The hereditary character of myopia is explained by the existence in such eyes of an " anatomical predisposition " to myopia. The sclera is unusually thin, and consequently less able to resist the pull of the internal recti, and the relative position of the recti and the position of the optic nerve, both of which may be hereditary, may be factors in the production of this defect. Anything which causes young subjects to approach their work too near the eyes may be the starting-point. Bad illumination, or the light coming from the wrong direction (for instance, in front), or defective vision produced by corneal nebulae, or lamellar cataract, &c., all necessitate over-convergence in order to obtain clearer images, and myopia may be produced.

It is interesting to note that when the work is approached very near the eye, but convergence is not used, as in the case of watchmakers, who habitually use a strong convex glass in one eye, there is no special tendency to myopia.

Some of the more common *symptoms* of myopia are:—(1) Distant objects are seen indistinctly. (2) Near objects are seen distinctly, and the near point is much nearer than in the normal eye. (3) Acuteness of vision is often lowered, and especially is this the case in high myopia. (4) Eye-strain is often present, due to overuse of the muscles of convergence, and this may lead to (5) an external or divergent squint. (6) Floating black specks are often complained of, these are generally muscae volitantes, but often, especially in high myopia, may be actual opacities floating in the vitreous. (7) Myopes often stoop and become "round shouldered" from their habit of poring over their work.

A small amount of myopia, if it is stationary, is in no sense a serious defect of the eye, the possessors of it are often quite unconscious of any deficiency in vision, and in fact brag that they have better vision than their fellows. The reason of this is that they learn in early life to recognize indistinct distant objects by the aid of other senses in a way that the ordinary individual can hardly understand, and in later life they can postpone the wearing of glasses for near work for many years, and sometimes until extreme old age. Unfortunately myopia is, as a rule, *not* stationary; it almost always tends to increase, and if this increase leads to very high myopia such serious changes may occur in the eyes as to lower the visual acuity enormously and sometimes lead to total loss of vision.

The treatment of myopia is general and local.

General Treatment.—The most important part of this is the preventive treatment (prophylaxis), especially in its application to children. All children who have one or both parents myopic are specially "marked down" for this defect, for they have probably inherited an anatomical predisposition. Bearing in mind that excessive convergence is the most potent cause of myopia, the most rigid attention should be paid to the ophthalmic hygiene of the schoolroom. This room should be large, lofty and well ventilated, and have good-sized high windows on one wall, preferably on the north side. Each scholar should have an adjustable seat and desk so arranged that his head is upright and the work not too near his eyes. These desks should be arranged in rows so placed that the pupils sit with the light on their left. Schoolbooks must be clearly printed and the type should not be too small. The school work that needs close application of the eyes should be continued only for a short period at a time, the period alternating with other work which does not require the use of the eyes, such as mental arithmetic, black-board demonstrations, recitation, or play. Schoolmasters should teach more—that is, they should explain and impart knowledge by demonstrations and simple lectures, and reduce as much as possible the time spent in "home preparations," which is usually work done by bad light and when the student is physically and mentally tired. Even in the nursery the greatest care should be taken. The little ones should be supplied with large toys, a large box of plain wooden bricks being the best form; picture books should be discouraged, and close work that entails undue convergence, such as sewing, threading beads, &c., ought to be forbidden. The nursery governess can teach the alphabet, small words and even simple arithmetic with the bricks. No child with a tendency to myopia, or with a myopic family history should be allowed to learn to write or draw until at least seven years old. The child's bed should not be allowed to face the window, preferably it should be back to the light. Students, or those engaged in literary or other work which entails close application for many hours a day, should be advised to regulate their work, if they are free to do so, by working for shorter periods and taking longer intervals of rest, they should be specially careful not to approach their work too near to the eyes and they should always work in a good light.

Local Treatment.—This consists in correcting the error with a concave glass. The testing must be done when the eye is under *atropine* in all those under 25, and under homatropine between the ages of 25 and 35 or 40. Over 40 no cycloplegic is required. Except when playing rough games the glasses must be worn always. The wearing of glasses for near work produces at first considerable rebellion in children, because they can see near work so much better without a glass. The object of enforcing this treatment is to make the muscle of accommodation do its proper work, and not only do we do this, but we also do away with the excess of convergence over accommodation, and lastly, make excessive convergence impossible, because, with the glasses on, the near work has to be held at some considerable distance from the eyes. In other words, we have practically made the eyes normal, and it is only by doing this that we can prevent the increase of myopia. Adults who have never worn their correction (especially if the myopia is high) must have a weaker glass for near work. Each case must be treated on its own merits. So-called malignant myopia, which is high myopia with serious changes in the eye, must be treated in a special manner and with the greatest care.

Astigmatism.[1]—The principal seat of astigmatism is the cornea, the curvature of one meridian being greater than that of the other. In regular astigmatism, which is the only form that can as a rule be treated by glasses, the meridians of greatest and least curvature are at right angles to each other, and the intermediate meridians pass by regular gradations from one to the other. Rays of light passing through such an astigmatic surface do not focus at one point, but form many points, with the result that the image is more or less indistinct according to the amount of the error. In uncorrected astigmatism a clock-face viewed at a distance of 4 or 5 yds. will appear to have certain figures distinct, and others (at right angles) indistinct; for instance, figures **XI** and **V** may appear quite black, while figures **II** and **VIII** are grey and indistinct. If one of the principal meridians be emmetropic the astigmatism is *simple*; if both be hyperopic, or if both be myopic, it is compound; and if one meridian be hyperopic and the other myopic, it is styled *mixed* astigmatism. Generally the vertical meridian or one near it is the most convex, and this is called *direct* astigmatism (astigmatism "according to the rule"). When the horizontal meridian or one near it is the most convex, the term *inverse* astigmatism is used (astigmatism "against the rule"). When the meridians are oblique, that is, about 45°, it is called *oblique* astigmatism. Low degrees of astigmatism (of the cornea) are corrected by the ciliary muscle, producing an astigmatism of the crystalline lens, the opposite of that of the cornea, and so neutralizing the defect. This work is done unconsciously, vision is generally quite good and no suspicion is entertained of anything wrong until some symptom of eye-strain shows itself (see *Eye-strain*, below), and the detection of it is one of the most important duties of the oculist. The only certain method of detecting and consequently correcting a low error of astigmatism, in all below the age of 50, is by paralysing the ciliary muscle with atropine or homatropine and thus preventing it from correcting the defect, and revealing the true refraction of the eye. Astigmatism is corrected by cylindrical glasses combined with spherical convex or concave glasses if hyperopia or myopia co-exist, and the correction must be worn always in the form of rigid pince-nez or spectacles.

Presbyopia (Old Sight).—A normal-sighted child at the age of ten has his near point of accommodation 7 cms. from the eye, and as age advances this near point recedes gradually. At the age of 40 it has receded to 22 cms., in other words at this age fine print cannot be read nearer to the eye than 22 cms. Between the ages of 45 and 50 the person who has apparently enjoyed good sight up till then, both for distance and near, finds that by artificial light he cannot read the newspaper unless he holds it some distance from the eyes, and he has to give up consulting "Bradshaw" because he cannot distinguish between 3's and 8's. Another symptom often complained of is the "running together of letters," so that the book has to be closed and the eyes rested before work can be resumed. This loss of accommodation power is due to the gradual hardening of the crystalline lens from age, and convex glasses have to take its place, in order to make reading possible and comfortable. In hyperopia the presbyopic period is earlier, and in myopia it is later than normal (see above).

It is unwise for the presbyope to select the glasses for himself, as astigmatism or anisometropia may be present and must, of course, be corrected; the eyes should be properly tested, and this testing should be repeated every two or three years, as, not only does the old sight increase, but changes in the static refraction of the eyes are probably taking place. When an error of refraction exists with the presbyopia, glasses for distance, as well as reading, have to be worn, and to avoid the trouble of constantly changing, the two should be combined as bi-focal glasses. The upper portion of the bi-focal corrects the distant, and the lower the near vision, and in the best form the division between the two is invisible. When properly fitted these bi-focals prove the greatest boon to the presbyope.

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[1] See also § *Astigmatism*, above.

Anisometropia (Odd Sight) is a condition in which the refraction of the two eyes is different. There are three varieties. (1) Binocular vision exists. As a rule a very small difference is present, and the difference is generally in the astigmatism; consequently eye-strain is very commonly manifested, and the correction by suitable glasses is imperative. (2) The eyes are used alternately. For instance, one eye may be hyperopic or emmetropic, and the other myopic; in such a case the former will be used for distant and the latter for near vision, and although binocular or stereoscopic vision is lost, glasses may never be required and any attempt at a correction of the defect may be useless. However, if eye-strain is present, the attempt should be made. (3) One of the eyes is permanently excluded. When the difference between the eyes is great the most defective eye is little used and tends to become amblyopic (partially blind), if it is not so already. This condition is very common in squint, and the treatment in such cases consists in providing the defective eye with its correcting glass, completely covering up the good eye and practising for certain periods every day, and thus forcing the defective eye to work. This eye may never take its share in binocular vision, but it may become very useful, especially if disease or damage should affect the good eye; and the improvement of the vision of the eye materially assists the treatment of the squint. When one eye is irremediably lost, the other should be very carefully tested, and if any error exists it ought to be corrected and the glass worn always.

Aphakia is the absence of the crystalline lens through dislocation, or removal by operation, or injury. A strong convex glass has to be worn in front of such an eye in order to obtain clear vision even for distance, and a still stronger one for near vision; after cataract operation astigmatism is generally present and the convex glass must be combined with a cylinder: these glasses are best worn in the form of bi-focals (see *Presbyopia*, above).

Eye-Strain.—Eye-strain is a symptom, or group of symptoms, produced by the correction, or attempt at correction, by the ciliary muscle of an error of refraction, or a want of balance between the external muscles of the eye (heterophoria). Where gross errors exist either in the refraction or in the muscular equilibrium, the correction cannot be made, and consequently no attempt is made to correct the defect, and eye-strain is not produced. The smaller the error the more likely is the eye-strain to be present, and also, unfortunately, the more likely is it to be overlooked. It is important to recognize what may be the different manifestations of eye-strain. They may be grouped under three headings: (1) manifestations on the eye and lids, such as conjunctivitis, blepharitis, iritis, cyclitis, glaucoma and cataract. (2) Peripheral irritation: (*a*) with pain: headaches and megrim; (*b*) without pain: epileptic attacks and choreiform movements of the facial muscles: vertigo, nausea, vomiting. (3) Nerve waste: nerve exhaustion, neurasthenia, brain-fag. This last form of eye-strain is as common as it is subtle. It is subtle because the sufferer never suspects the eyes to be at fault; all his waking hours he is unconsciously correcting a low degree of astigmatism, or anisometropia, or heterophoria, which means a constant nerve waste; and when he begins near work he starts with a big deficit, and further strain results.

Insomnia is a prominent symptom of eye-strain; this leads to depression, which in its turn may lead to the alcoholic or morphia habit. There is no form of functional nerve disorder that may not be caused by, or aggravated by, eye-strain.

The treatment of eye-strain consists in correcting all errors of refraction (and in the case of astigmatism and anisometropia, even the smallest) and in wearing the correction always. A small amount of heterophoria will generally, in a short time, disappear when the error is corrected; if not, it must be corrected by prisms or decentring. (E. C.*)

VISITATION (Lat. from *visitare*, frequentative form of *visere*, to look at, go to see, visit, *videre*, to see), an act of visiting, or going to see, a formal visit. The use of the word for an act of divine retributive justice, or generally of an occurrence of grave import, such as a plague or famine, is due mainly to Biblical phraseology, as in "the day of visitation" (Isa. x. 3). For the duty of bishops of the Roman Church to visit periodically the tombs of the apostles Peter and Paul at Rome, the *Visitatio Liminium Apostolorum*, see BISHOP. The specific application of the term is to a formal periodical visit paid by a superior authority to an institution or to a district for the purpose of investigation, examination or the like. There are three classes of such visitations: ecclesiastical, charitable and heraldic. Ecclesiastical visitations, originally the periodical journeys of personal inspection to ascertain the temporal and spiritual condition of each parish, form part of the functions of an archbishop, a bishop and an archdeacon. All charitable corporations are at law subject to visitation; the functions of the "visitors" have been largely taken over by the Board of Charity Commissioners. Colleges at a university are regarded in law as charitable institutions, and each college has a "visitor" whose duty it is to represent the founder and see that his wishes are carried out. Heraldic visitations were perambulations made by a king-at-arms or other high heraldic officer with a commission under the Great Seal to examine into pedigrees and claims to bear arms. The results of these visitations were entered in "Visitation Books," which are in the nature of official records; their admissibility as evidence, though claimed, is judicially questioned as containing merely experts' statements from the families to whom they refer (D'Arcy de Knayth Peerage Case, 1901). These heraldic visitations ceased about 1686.

In addition to these specific meanings may be mentioned the festival of the "Visitation of Mary," in commemoration of the visit of the Virgin to Elizabeth, mother of St John the Baptist, celebrated in the Roman, Greek and other churches on the 2nd of July, and the office of the English Church, the "Visitation of the Sick," ordered for the spiritual comfort and benefit of sick persons.

For the international law relating to the right of belligerent vessels to "visit and search" neutral vessels in time of war, see SEARCH, RIGHT OF.

VISITING CARDS. The use of cards of personal identification for social purposes is generally supposed to have had its origin at the court of Louis XIV. of France, that centre of the etiquette of the 17th century. But there appears to be little doubt that, in a rougher and ruder form, this mark of intercourse dates from much earlier times, and that the Chinese, and possibly other Oriental nations also, had in bygone ages employed such mediums of communication on calling at the houses of absent friends. When and where visiting cards first came into vogue in Europe is a matter of some uncertainty. It is probable, however, that they were first used in Germany—and as early as the 16th century. A German visiting card recently discovered in Venice bears this inscription: *Johannes Westerholt Wesiphalus scribebat, Patavii, 4 Martii 15 x 60.* Concerning this, Professor Dr Kirmis (*Daheim*, September 30th, 1905) remarks that the German students in Padua were wont, on quitting the university, to pay farewell calls at the houses of the professors, and, in the event of not finding them within, to leave their names on paper billets; and he adds that the custom must, until that time, have been unknown in Italy, for this card of the student Westerholt was sent by Professor Giacomo Contarini on the 15th of January 1572 to Venice as a curiosity. Under the reign of Louis XIV., however, the fashion appears to have become firmly established in France. Small strips of paper were at first employed for the purpose of the communication; but gradually they attained a more elaborate finish and execution. Ladies especially seem to have been the pioneers in this direction, and to have embellished their cards with hand drawings, sometimes taking the form of "hearts" and other amorous tokens of affection. Under Louis XV., the reign of exquisite extravagance and refined taste, visiting cards were furnished with delicate engravings, frequently masterpieces of that art, showing some fanciful landscape, or a view of the town or place where the person resided. A further stage in the development of this custom was the autograph signature at the foot of the card beneath the engraved view. England followed the lead of France, and visiting cards became a universal fashion in Europe towards the close of the 18th century. But though in almost every European country there are variations in the size and shape of the card and the way of describing the quality of the person whom it represents, the modern tendency is everywhere in favour of simplicity and the avoidance of ostentation.

A valuable collection of visiting cards is that of the Gabinetto della Stampe in Rome and the Museo Civico in Venice.

VISOKO (or VISOKI), a town of Bosnia, on the river Bosna, 15 m. N.W. of Serajevo by rail. Pop. (1895), about 5000. Visoko has a brisk trade in leather, carpets and tobacco.

Between the 13th and 16th centuries Visoko was only second to Jajce as a stronghold of the Bosnian rulers. There were fortified palaces at Sutječka, and Bobovac, among the mountains on the north. Bobovac, which had withstood many previous assaults, was betrayed to the Turks in 1463; at Sutječka there is a Franciscan monastery, founded in 1391, often razed by the Turks, and finally rebuilt in 1821. Just below Visoko lay the town of Podvisoko, called *Sotto Visochi* by the Ragusans, which was the chief mart of the country from 1348 to 1430.

VISOR (also spelled viser, vizor, vizard or visard), a term now used generally of the various forms of movable face-guards in the helmet of medieval and later times. It meant properly a mask for the face, and is an adaptation of the O.Fr. *visiere*, mod. *visière*, as is seen by the M.E. forms *viser*, *visere*. It is thus to be referred to the Fr. *vis*, face, Lat. *visus*, from *videre*, to see. In this sense the word "visor" is modern, the movable guard for the upper part of the face being known as an "aventail" or "ventail," and that for the lower part a "beaver" (see HELMET).

VISTULA (Ger. *Weichsel*, Polish *Wisla*), one of the chief rivers of Europe, rising in Austria and flowing first through Russian and then through Prussian territory. Its source is in Austrian Silesia on the northern slopes of the West Beskiden range of the Carpathian mountains.

The stream runs through a mountain valley, in a N.N.W. direction to Schwarzwasser, where it leaves the mountains, turns E. and N.E., and forms part of the Austro-German frontier. Returning within Austrian territory (Galicia), it passes Cracow, and thereafter forms a long stretch of the frontier with Russia (Poland), bending gradually towards the north, until at Zawichost it runs due N. and enters Poland. Here it at first bisects the high-lying plateau of southern Poland, but leaves this near Jozefow, and flows as far as the junction with the Pilica in a broad valley between wooded bluffs. Crossing the plain of central and northern Poland, it passes Warsaw, and at the junction of the Bug sweeps W. and N.W. to pass Plock and Wloclawek (see further POLAND for its course within this territory). It enters Prussia 10 m. above Thorn, turns N.E. on receiving the Brahe, passes Graudenz and turns towards the north. From this point it throws off numerous branches and sweeps from side to side of a broad valley, having steep banks on the side upon which it impinges, and on the other being bordered by extensive flat lands. Nearing the Baltic Sea it forms a delta, dividing into two main arms, the left or western of which bears the name of Vistula, and flows directly to Danzig Bay, while the right is called the Nogat, and flows into the Frisches Haff. The enclosed deltaic tract is very fertile. Parts of it are known as *Werder* (cf. the English "islands" or "holms" in the Fens and other low-lying tracts of the east). In the lower part of the delta the Haff Canal leads from the main river to the Frisches Haff; there are also various natural channels in that direction, but the main river passes on towards the N.W., having a tendency to run parallel to the coast, and reaching Danzig Bay with a direct course only through an artificial cut constructed in 1888–96. The river broke a new channel into the bay, at a point between this cut and the old mouth at Neufahrwasser, on the night of the 1st–2nd of February 1840. The important seaport of Danzig, however, is on the old channel, and this channel is used by shipping, which enters it by a canal at Neufahrwasser. The Nogat, formerly inconsiderable, had become so much deepened and broadened by natural means in the early part of the 19th century that it carried more water than the Vistula itself (*i.e.* the other main deltaic branch). In 1845–57 the outflow of the Nogat was stopped and an artificial channel was formed for it, so as to restore the proper head of water to the Vistula.

Shifting banks form a serious impediment to navigation, and these and floods (principally in spring and midsummer) necessitate careful works of regulation. The river is ice-bound at Warsaw, on an average, from about the 20th of December to the 10th of March. The navigation of the Vistula is considerable up to Cracow, and the river forms a very important highway of commerce in Poland (*q.v.*) and Prussia. For small craft it is navigable above Cracow up to the Austro-German frontier, where the Przemsa enters it. This river and the Pilica, Bzura, Brahe, Schwarzwasser and Ferse are the chief left-bank tributaries; on the right the Vistula receives the Skawa, Raba, Dunajec, Wisloka and San before reaching Poland, the Wieprz and Bug in Poland, and the Drewenz in Prussia. The Brahe and the Bromberg Canal give access from the Vistula to the Netze and so to the Oder. The river is rich in fish. Its total length is about 650 m., and its drainage area approaches 74,000 sq. m.

See H. Keller, *Memel-, Pregel- und Weichselstrom, ihre Stromgebiete*, &c., vols. iii. and iv. (Berlin, 1900).

VITALIANUS, bishop of Rome from 657 to 672, succeeded Eugenius I. and was followed by Adeodatus. In the monothelite controversy then raging he acted with cautious reserve, refraining at least from express condemnation of the *Typus* of Constans II. The chief episode in his uneventful pontificate was the visit of Constans to Rome; the pope received him "almost with religious honours," a deference which he requited by stripping all the brazen ornaments of the city—even to the tiles of the Pantheon—and sending them to Constantinople. Archbishop Theodore was sent to Canterbury by Vitalian.

VITEBSK, a government of western Russia, with the government of Pskov on the N., Smolensk on the E., Mogilev, Minsk and Vilna on the S., and Courland and Livonia on the W., having an area of 16,978 sq. m. Except on its south-eastern and northern borders, where there are low hills, deeply eroded by the rivers, its surface is mostly flat, or slightly undulating, and more than a million acres are occupied by immense marshes, while there are as many as 2500 small lakes. It is mainly built up of Devonian red sandstones and red clays, but the Carboniferous formations—both the Lower, characterized by layers of coal, and the Upper—crop out in the east. The whole is covered with Glacial and post-Glacial formations, in which remains of extinct mammals and stone implements are found in large quantities. There are numerous burial-mounds containing bones and iron implements and ornaments. The soil is for the most part unproductive. The W. Dvina rises not far from the north-eastern angle of the government, and flows through it, or along its southern boundary, for 530 m. From its confluence with the Kasplya, *i.e.* for more than 450 m., it is navigable; and, through a tributary, the Ulyanka, it is connected with the Dnieper by the Berezina Canal. The Mezha and Kasplya, tributaries of the W. Dvina, are navigable in spring. The climate is relatively mild, the average yearly temperature at the city of Vitebsk being 40° F. (January 16°·4; July 64°·3). The population was estimated at 1,740,700 in 1906. The government is divided into eleven districts, the chief towns of which are Vitebsk, Drisa, Dvinsk, formerly Dünaburg, Gorodok, Lepel, Lyutsyn, Nevel, Polotsk, Ryezhitsa, Sebezh and Velizh.

VITEBSK, a town of Russia, capital of the government of the same name, on both banks of the W. Dvina, and on the railway from Smolensk to Riga, 85 m. N.W. from the former. Pop. (1885) 54,676; (1897) 65,871. It is an old town, with decaying mansions of the nobility, and dirty Jewish quarters, half of its inhabitants being Jews. There are two cathedrals, founded in 1664 and 1777 respectively. The church of St Elias, a fine example of the Old Russian style of architecture, founded in 1643, was burned down in 1904. The manufactures are insignificant, and the poorer classes support themselves by gardening, boat-building and the flax trade, while the merchants carry on an active business with Riga in corn, flax, hemp, tobacco, sugar and timber.

Vitebsk (Dbesk, Vitbesk and Vitepesk) is mentioned for the first time in 1021, when it belonged to the Polotsk principality. Eighty years later it became the chief town of a separate principality, and so continued until 1320, when it came under the dominion of the Lithuanians. In the 16th century it fell to Poland. Under the privileges granted to the city by the Polish sovereigns it flourished, but it soon began to suffer from the wars between Russia and Poland, during which it was thrice taken by the Russians and burned. Russia annexed it finally in 1772.

VITELLI, VITELLOZZO (?–1502), Italian *condottiere*. Together with his father, Niccolò, tyrant of Città di Castello, and his brothers, who were all soldiers of fortune, he instituted a new type of infantry armed with sword and pike to resist the German men-at-arms, and also a corps of mounted infantry armed with arquebuses. Vitellozzo took service with Florence against Pisa, and later with the French in Apulia (1496) and with the Orsini faction against Pope Alexander VI. In 1500 Vitellozzo and the Orsini made peace with the pope, and the latter's son Cesare Borgia, being determined to crush the petty tyrants of Romagna and consolidate papal power in that province, took the *condottieri* into his service. Vitellozzo distinguished himself in many engagements, and in 1501 he advanced against Florence, moved as much by a desire to avenge his brother Paolo, who while in the service of the republic had been suspected of treachery and put to death (1499), as by Cesare's orders. In fact, while the latter was actually negotiating with the republic, Vitelli seized Arezzo. Forced by Borgia and the French, much against his will, to give up the city, he began from that moment to nurture hostile feelings towards his master and to aspire to independent rule. He took part with the Orsini, Oliverotto da Fermo and other captains in the conspiracy of La Magione against the Borgia; but mutual distrust and the incapacity of the leaders before Cesare's energy and the promise of French help, brought the plot to naught, and Vitelli and other *condottieri*, hoping to ingratiate themselves with Cesare once more, seized Senigallia in his name. There they were decoyed by him and arrested while their troops were out of reach, and Vitelli and Oliverotto were strangled that same night (31st of December 1502).

See vol. iii. of E. Ricotti's *Storia della compagnie di ventura* (Turin, 1845), in which Domenichi's MS. *Vita di Vitellozzo Vitelli* is quoted; C. Yriarte, *César Borgia* (Paris, 1889); P. Villari, *Life and Times of N. Machiavelli* (English ed., London, 1892); see also under ALEXANDER VI. and CESARE BORGIA.

VITELLIUS, AULUS, Roman emperor from the 2nd of January to the 22nd of December A.D. 69, was born on the 24th of September A.D. 15. He was the son of Lucius Vitellius, who had been consul and governor of Syria under Tiberius. Aulus was consul in 48, and (perhaps in 60–61) proconsul of Africa, in which capacity he is said to have acquitted himself with credit. Under Galba, to the general astonishment, at the end of 68 he was chosen to command the army of Lower Germany, and here he made himself popular with his subalterns and with the soldiers by outrageous prodigality and excessive good nature, which soon proved fatal to order and discipline. Far from being ambitious or scheming, he was lazy and self-indulgent, fond of eating and drinking, and owed his elevation to the throne to Caecina and Valens, commanders of two legions on the Rhine. Through these two men a military revolution was speedily accomplished, and early in 69 Vitellius was proclaimed emperor at Colonia Agrippinensis (Cologne), or, more accurately, emperor of the armies of Upper and Lower Germany. In fact, he was never acknowledged as emperor by the entire Roman world, though at Rome the senate accepted him and decreed to him the usual imperial honours. He advanced into Italy at the head of a licentious and ruffianly soldiery, and Rome became the scene of riot and massacre, gladiatorial shows and extravagant feasting. As soon as it was known that the armies of the East, Dalmatia and Illyricum had declared for Vespasian, Vitellius, deserted by many of his adherents, would have resigned the title of emperor. It was said that the terms of resignation had actually been agreed upon with Primus, one of Vespasian's chief supporters, but the praetorians refused to allow him to carry out the agreement, and forced him to return to the palace, when he was on his way to deposit the insignia of empire in the temple of Concord. On the entrance of Vespasian's troops into Rome he was dragged out of some miserable hiding-place, driven to the fatal Gemonian stairs, and there struck down. "Yet I was once your emperor," were the last and, as far as we know, the noblest words of Vitellius. During his brief administration Vitellius showed indications of a desire to govern wisely, but he was completely under the control of Valens and Caecina, who for their own ends encouraged him in a course of vicious excesses which threw his better qualities into the background.

See Tacitus, *Histories*; Suetonius, *Vitellius*; Dio Cassius lxv.; Merivale, *Hist. of the Romans under the Empire*, chs. 56, 57; H. Schiller, *Geschichte der römischen Kaiserzeit*, i. pt. 1; W. A. Spooner's ed. of the *Histories* of Tacitus (introduction); B. W. Henderson, *Civil War and Rebellion in the Roman Empire, A.D. 69–70* (1908).

VITERBO, a city and episcopal see of the province of Rome, Italy, 54 m. by rail N.N.W. of Rome, 1073 ft. above sea-level. Pop. (1901) 17,344 (town), 21,258 (commune). It lies on the old high road between Florence and Rome, and besides the railway to Rome it has a branch line (25 m.) going N.E. to Attigliano, on the railway from Rome to Florence. It is picturesquely surrounded by luxuriant gardens, and enclosed by walls and towers, which date partly from the Lombard period. The streets are paved with large lava blocks, of which the town is also built. It has many picturesque medieval towers and other edifices (the Palazzo degli Alessandri is perhaps the most interesting), for which indeed it is one of the best towns in central Italy, and some elegant fountains; among the latter may be mentioned the Gothic Fontana Grande (1279, restored in 1424) and Fontana della Rocca by Vignola (1566). The citadel (Rocca) itself, erected by Cardinal Albornoz in 1345, is now a barrack. The Palazzo Patrizi is a building of the early Renaissance in the Florentine style. The cathedral, a fine basilica, of the 12th (?) century, with columns and fantastic capitals of the period, originally flat-roofed and later vaulted, with 16th-century restorations, contains the tomb of Pope John XXI., and has a Gothic campanile in black and white stone. It is more probable that it was S. Silvestro (now Chiesa del Gesù) and not the cathedral that, in 1271, was the scene of the murder, on the steps of the high altar, during public worship, of Henry, son of Richard of Cornwall, by Guy de Montfort (see Dante, *Inf.* xii. 118). In front of the cathedral Pope Adrian IV. (Nicholas Breakspear) compelled the emperor Frederick I. to hold his stirrup as his vassal. The old episcopal palace with a double loggia built on to it (recently restored to its original form) is a Gothic building of the 13th century, in which numerous conclaves have been held. The church of S. Rosa exhibits the embalmed body of that saint, a native of Viterbo, who died in her eighteenth year, after working various miracles and having distinguished herself by her invectives against Frederick II. (1251), some ruins of whose palace, destroyed after his death, exist. S. Francesco, a Gothic church (before 1256), contains the fine Gothic tombs of Popes Clement IV. and Adrian V., and has an external pulpit of the 15th century. The town also contains a few small Romanesque churches (S. Maria Nuova, S. Andrea, S. Giovanni in Zoccoli, S. Sisto, &c.) and several other Gothic churches. S. Maria della Cella is noteworthy among the former as having one of the earliest campanili of any size in Italy (9th century). The town hall, with a medieval tower and a 15th-century portico, contains some Etruscan sarcophagi from sites in the neighbourhood, and a few good paintings. At one corner of the picturesque square in front of it is a Roman sarcophagus with a representation of the hunt of Meleager, with an inscription in honour of the fair Galiana, to win whom, it is said, a Roman noble laid siege to Viterbo in 1135. Close by is the elegant Gothic façade of S. Maria della Salute, in white and red marble with sculptures. The Gothic cloisters of S. Maria della Verità just outside the town are strikingly beautiful. The church contains frescoes by Lorenzo da Viterbo (1469) and a fine majolica pavement. A mile and a half to the north-east is the handsome early Renaissance pilgrimage church of the Madonno della Quercia; the façade is adorned with three lunettes by Andrea della Robbia. The fine wooden roof of the interior is by Antonio da Sangallo the younger (1519–25). The adjoining monastery has a pleasing cloistered court. A mile and a quarter farther is the town of Bagnaia, with the Villa Lante, still belonging to the family of that name, with fine fountains and beautiful trees, ascribed to Vignola. The inhabitants of Viterbo are chiefly dependent on agriculture; hemp is a specialty of the district, and tobacco and various grains are largely grown, as well as the olive and the vine. There are in the vicinity numerous mineral springs; the warm sulphur spring of Bollicame, about 2 m. off, is alluded to by Dante (*Inf.* xiv. 79).

Viterbo is by some identified with *Surrina nova*, which is only mentioned in inscriptions, while some place it at the sulphur springs, called the Bollicame, to the west of Viterbo on the line of the Via Cassia, where Roman remains exist. This might well be the site of the Roman town. Here the Via Cassia was joined by the Via Ciminia, passing east of the Lacus Ciminius, while a road branched off to Ferentum. See E. Bormann in *Corp. Inscr. Lat.* xi. (Berlin, 1888), p. 454; H. Nissen, *Italische Landeskunde* (Berlin, 1902), ii. 343. The forgeries of the Dominican Annio da Viterbo (d. 1502) were directed to prove that Viterbo was the site of the Fanum Voltumnae (see, however, MONTEFIASCONE). There are no archaeological remains in Viterbo itself, except a few courses of masonry under the bridge which connects the cathedral with the city, near the cathedral, possibly the pier of an older bridge. But the site is not unreasonably considered to be ancient, and the name to be derived from *Vetus urbs*; tombs, too, have been found in the neighbourhood, and it is not an unlikely assumption that here, as elsewhere, the medieval town occupies the Etruscan site. It was fortified by the Lombard king Desiderius (the decree ascribed to him, now in the municipal palace, has long been recognized as a forgery of Annio). It is the centre of the territory of the "patrimony of Peter," which the countess Matilda of Tuscany gave to the papal see in the 12th century; in the 13th century it became a favourite papal residence. Popes Urban IV. (1261), Gregory X. (1271), John XXI. (1276), Nicholas III. (1277) and Martin IV. (1281) were elected here, and it was at Viterbo that Alexander IV. (1261), Clement IV. (1268), Adrian V. (1276) and John XXI. (1277) died. (T. As.)

VITET, LUDOVIC (1802–1873), French dramatist and politician, was born in Paris on the 18th of October 1802. He was educated at the École Normale. His politics were liberal, and he was a member of the society "Aide-toi, le ciel t'aidera." On the triumph of liberal principles in 1830 Guizot created an office especially for Vitet, who became inspector-general of historical monuments. In 1834 he entered the Chamber of Deputies, and two years later was made a member of the Council of State. He was consistent in his monarchist principles, and abstained from taking any part in politics during the second empire. The disasters of 1870–71 reawakened Vitet's interest in public affairs, and he published in the *Revue des deux mondes* his optimistic "Lettres sur le siège de Paris." He died in 1873.

Vitet was the author of some valuable works on the history of art, and his *Monographie de l'Église Notre Dame de Noyon* (1845) especially did much to awaken popular interest in architecture. In the early days of the Romantic movement he wrote some vivid dramatic sketches of the time of the League. They are: *Les Barricades, scènes historiques* (1826), *Les États de Blois, scènes* (1827), and *La Mort de Henri III.* (1829), all three being published together in 1844 with the title of *La Ligue*. The best of these is the *États de Blois*, in which the murder of the duke of Guise is described in the most convincing manner.

VITORIA, an episcopal city of northern Spain, and capital of the province of Álava; on the Miranda de Ebro-Alsasua section of the Northern railways, among the southern outliers of the Cantabrian mountains, and on the left bank of the river Zadorra, a left-hand tributary of the Ebro. Pop. (1900) 30,701. The city is built on a hill 1750 ft. high, and overlooks the plain of Álava. Its oldest part, the Campillo or Villa-Suso, occupies the top of the hill; some of the walls and towers by which it was formerly defended still remain. Below it is Vitoria Antigua, with narrow tortuous lanes; on the still lower level ground is the modern town, with wide streets, an arcaded market-place and shady promenades. The cathedral of Santa Maria in the Campillo dates from 1181, but has been considerably spoiled by late additions: the church of San Miguel also dates from the 12th century; it has an exceptionally beautiful altar, carved in wood by J. Velazquez and G. Hernandez, in the 16th century. The town hall and the palace of the provincial assembly contain some fine paintings and interesting relics connected with the history of Álava. Vitoria, from its favourable position on the main lines from Madrid to France and to the port of San Sebastian, is an important centre of trade in wine, wool, horses, mules and hardware; other industries are paper-making, carriage-building, cabinet-making, tanning and the manufacture of earthenware. There is a branch railway from Vitoria to Villarreal. The city is lighted by electricity; its trade and population have largely increased since 1875.

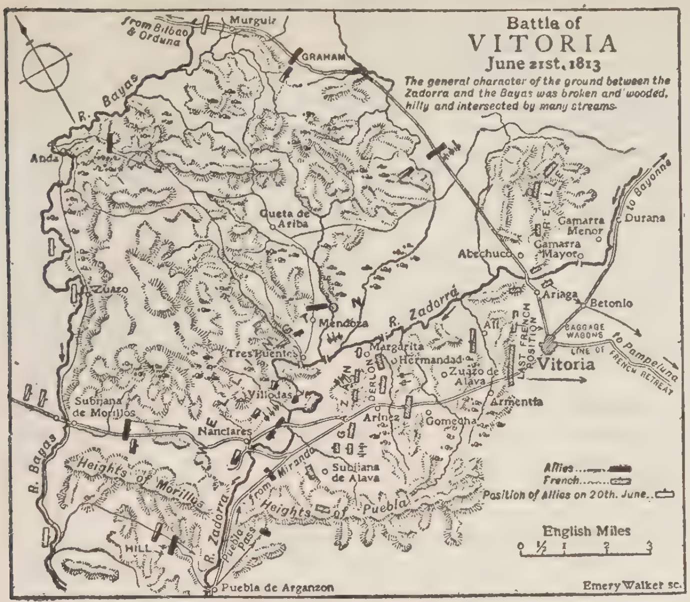
Vitoria was founded in 581 by Leovigild, king of the Visigoths; but its importance dates from the 10th century. In 1181 Sancho the Wise of Navarre granted it a charter and fortified it.

Battle of Vitoria.—For the operations which preceded the battle of Vitoria see PENINSULAR WAR. On June 21st, 1813, the French army in Spain (about 65,000 men with 150 guns), under King Joseph Bonaparte, held an extended position in the basin of Vitoria, south (with the exception of the extreme right) of the river Zadorra. The left rested on the heights of Puebla, north of the Puebla Pass, and Puebla de Arganzon, through which ran the Miranda-Vitoria-Bayonne road, Joseph's line of communication with France. Thence the line stretched to the ridge of Margarita, the troops so far being under General Gazan, with a second supporting line under D'Erlon between Arinez and Hermandad and a reserve behind Arinez. The right under Reille guarded the Bilbao-Vitoria road, occupying heights on the north bank of the Zadorra, and also the villages and bridges of Abechuco and Gamarra Mayor, as well as a ridge near Ariaga on the south bank.

There were no troops between Hermandad and Ariaga, except a mass of cavalry near Ali. The Zadorra, fordable in certain spots only, was spanned by bridges at Puebla de Arganzon, Nanclares, Villodas, Tres Puentes, Mendoza, Abechuco and Gamarra Mayor, which French guns commanded; but, for some reason, none of these had been destroyed. The faults of the French position and their occupation of it were its extension; that it was in prolongation of and (on the right especially) very close to their line of retreat, so that if the right were driven back this line could be at once seized; that the centre was not strongly held; and that all bridges were left intact.

The Allies (nearly 80,000, with 90 guns), under Wellington, had moved from the river Bayas at daylight to attack Joseph, in four columns, the right being under Hill (20,000, including Morillos's Spaniards), the right centre and left centre under Wellington (30,000) and the left under Graham (20,000, including Longa's Spaniards). As the columns marched across the intersected country between the Bayas and Zadorra, extending from near Puebla de Arganzon to the Bilbao-Vitoria road, they kept touch with each other; and as they neared the Zadorra the battle opened all along the line soon after 10 a.m. Wellington's instructions to Graham were to undertake no manœuvre which would separate his column from those on the right; but, with this proviso, to seize the Vitoria-Bayonne road if the enemy appeared decidedly in retreat. Hill after a sharp contest gained the Puebla heights, too weakly held; and pushing through the pass carried the village of Subijana de Álava. The right centre column having reached Villodas, was waiting for Hill to gain further ground, when the bridge at Tres Puentes was observed to be unguarded, probably because it was commanded from the south bank; and, the French attention being now turned towards their flanks, it was surprised and rushed by Wellington with the

Light division, supported quickly by cavalry and other troops, who maintained themselves on the south bank. Joseph's centre was partially forced, while his left was hard pressed by Hill; and, fearing that Gazan and D'Erlon might be cut off from Reille, he ordered them to withdraw to a ridge farther back, which they did, holding Arinez in front. Here there was no hard fighting; but, as Wellington had now passed three divisions, many guns and the cavalry (which, however, from the nature of the ground could be but little used) across the Zadorra, Margarita, Hermandad and Arinez soon fell to the Allies.



Redrawn from Major-General C. W. Robinson's *Wellington's Campaigns*, by permission of Hugh Rees, Ltd.

On the left, Graham, having turned the heights north of Zadorra with Longa's Spaniards, seized Gamarra Menor close to the Bayonne road. He also with heavy loss carried Gamarra Mayor and Abechuco, but the bridges south of these villages, though more than once taken, were always recaptured by Reille. At length, when a brigade from the Allied centre had been pushed up from Hermandad against Reille's flank, he withdrew from the obstinately defended bridges, and before this Gazan and D'Erlon had also fallen back, fighting, to a third position on a ridge between Armentia and Ali west of Vitoria. Here, at about 6 p.m., they made a last stand, being compelled in the end to yield; and as Graham having now crossed the bridges was close to the Bayonne road, the main body of Joseph's army fled by a bad cross road towards Pampeluna, abandoning artillery, vehicles and baggage (of which an enormous quantity was parked near Vitoria), Reille afterwards joining it through Betonia. The Allies then occupied Vitoria and pursued the French until nightfall. All Joseph's equipages, ammunition and stores, 143 guns, a million sterling in money, and various trophies fell into Wellington's hands, the French loss in men being nearly 7000, that of the Allies over 5000, of whom 1600 were Portuguese and Spaniards. This decisive victory practically freed Spain from French domination. (C. W. R.)

VITRÉ, a town of north-western France, capital of an arrondissement in the department of Ille-et-Vilaine, situated on a hill rising from the left bank of the Vilaine, 24 m. E. of Rennes by rail. Pop. (1906) town, 7106; commune, 10,092. The town largely retains its feudal aspect. The ramparts on the north side and on the west, consisting of a machicolated wall with towers at intervals, are still standing. Only one gateway remains of the original castle, founded towards the end of the 11th century; the rest was rebuilt in the 14th and 15th centuries (the best period of Breton military architecture) and restored in recent times. It is now occupied by a prison, a museum of natural history and painting and the town library. The church of Notre-Dame, formerly a priory of the abbey of St Mélaine of Rennes, dates from the 15th and 16th centuries. An outside stone pulpit is a fine example of 16th-century sculpture. The church possesses a fine enamelled triptych of the 16th century. A tower of the 16th century is all that remains of the church of St Martin. The château of Les Rochers 3 m. from Vitré was the residence of Madame de Sévigné.

Vitré was formerly a Breton barony, and belonged in the 10th century to the younger branch of the counts of Rennes. In 1295 it passed to Guy IX., baron of Laval, on his marriage with the heiress, and afterwards successively belonged to the families of Rieux, Coligny and La Trémoille. The town was seized by Charles VIII. in 1488. Protestantism spread under the rule of the houses of Rieux and Coligny; Vitré became a Huguenot stronghold; and a Protestant church was established, which was not suppressed till the revocation of the edict of Nantes in 1685. Philip Emmanuel, duke of Mercœur, the head of the members of the League in Brittany, besieged the town in vain for five months in 1589. The estates of Brittany, over which the barons of Vitré and of Léon alternately presided, met here several times.

VITRIFIED FORTS, the name given to certain rude stone enclosures whose walls have been subjected in a greater or less degree to the action of fire. They are generally situated on hills offering strong defensive positions. Their form seems to have been determined by the contour of the flat summits which they enclose. The walls vary in size, a few being upwards of 12 ft. high, and are so broad that they present the appearance of embankments. Weak parts of the defence are strengthened by double or triple walls, and occasionally vast lines of ramparts, composed of large blocks of unhewn and unvitrified stones, envelop the vitrified centre at some distance from it. No lime or cement has been found in any of these structures, all of them presenting the peculiarity of being more or less consolidated by the fusion of the rocks of which they are built. This fusion, which has been caused by the application of intense heat, is not equally complete in the various forts, or even in the walls of the same fort. In some cases the stones are only partially melted and calcined; in others their adjoining edges are fused so that they are firmly cemented together; in many instances pieces of rock are enveloped in a glassy enamel-like coating which binds them into a uniform whole; and at times, though rarely, the entire length of the wall presents one solid mass of vitreous substance.

Since John Williams—one of the earliest of British geologists, and author of *The Mineral Kingdom*—first described these singular ruins in 1777, about fifty examples have been discovered in Scotland. The most remarkable are Dun Mac Uisneachain (Dun Macsnoichan), the ancient Beregonium, about 9 m. N.N.E. of Oban; Tap o' Noth, in Aberdeenshire; Craig Phadraic, or Phadrick, near Inverness; Dun Dhardhail (Dunjardil) in Glen Nevis; Knockfarrail, near Strathpeffer; Dun Creich, in Sutherland; Finhaven, near Aberlemno; Barryhill, in Perthshire; Laws, near Dundee; Dun Gall and Burnt Island, in Buteshire; Anwoth, in Kirkcudbright; and Cowdenknowes, in Berwickshire. Dun Mac Uisneachain is the largest in area, being 250 yds. long by 50 yds. broad. In the Tap o' Noth the walls are about 8 ft. high and between 20 and 30 ft. thick. In Dun Mac Uisneachain, Barryhill and Laws the remains of small rectangular dwellings have been found.

For a long time it was supposed that these forts were peculiar to Scotland; but they are found also in Londonderry and Cavan, in Ireland; in Upper Lusatia, Bohemia, Silesia, Saxony and Thuringia; in the provinces on the Rhine, especially in the neighbourhood of the Nahe; in the Ucker Lake, in Brandenburg, where the walls are formed of burnt and smelted bricks; in Hungary; and in several places in France, such as Châteauvieux, Peran, La Courbe, Sainte Suzanne, Puy de Gaudy and Thauron. They have not been found in England or Wales.

In some continental forts the vitrified walls are supported by masses of unvitrified stone built up on each side. This, in all probability, constituted an essential feature in the Scottish forts. Except on the hypothesis of buttresses of a similar kind, it is impossible to explain the vast quantities of loose stones which are found both inside and outside many of the vitrified walls.

The method by which the fusion of such extensive fortifications was produced has excited much conjecture. Williams maintained that the builders found out, either during the process of smelting bog-ore, or whilst offering sacrifices, the power of fire in vitrifying stone, and that they utilized this method to cement and strengthen their defences. This view has been keenly controverted, and it has been suggested that the vitrified summits were not forts but the craters of extinct volcanoes, an hypothesis long since abandoned; that they are not so much forts as vitrified sites, and that the vitrescence was produced by fires lighted during times of invasion, or in religious celebrations; and, lastly, that if they were forts they must originally have been built of wood and stone, and that their present appearance is due to their being set on fire by a besieging enemy. The theory of Williams has, with modifications, been accepted by the principal authorities. It is supported by the following facts:—

(1) The idea of strengthening walls by means of fire is not singular, or confined to a distinct race or area, as is proved by the burnt-earth enclosure of Aztalan, in Wisconsin, and the vitrified stone monuments of the Mississippi valley. (2) Many of the Primary rocks, particularly the schists, gneisses and traps, which contain large quantities of potash and soda, can be readily fused in the open air by means of wood fires—the alkali of the wood serving in some measure as a flux. (3) The walls are chiefly vitrified at the weakest points, the naturally inaccessible parts being unvitrified. (4) When the forts have been placed on materials practically infusible, as on the quartzose conglomerates of the Old Red Sandstone, as at Craig Phadraic, and on the limestones of Dun Mac Uisneachain, pieces of fusible rocks have been selected and carried to the top from a considerable distance. (5) The vitrified walls of the Scottish forts are invariably formed of small stones which could be easily acted upon by fire, whereas the outer ramparts, which are not vitrified, are built of large blocks. (6) Many of the continental forts are so constructed that the fire must have been applied internally, and at the time when the structure was being erected. (7) Daubrée, in an analysis which he made on vitrified materials taken from four French forts, and which he submitted to the Academy of Paris in February 1881, found the presence of natron in such great abundance that he inferred that sea-salt was used to facilitate fusion. (8) In Scandinavia, where there are hundreds of ordinary forts, and where for centuries a system of signal fires was enforced by law, no trace of vitrifaction has yet been detected.

A great antiquity has been assigned to vitrified forts, without sufficient proof. Articles of bronze and iron have been found in the Scottish forts, while in Puy de Gaudy a Roman tile has been discovered soldered to a piece of vitrified rock. In a few of the German forts Professor Virchow found some of the logs used as fuel in vitrifying the walls, and he concluded from the evenness of their cut surfaces that iron and not stone implements must have been used. These results indicate that these structures were possibly in use as late as the early centuries of the Christian era. It has been suggested that they were built as refuges against the Norsemen. Much in the situation and character of the forts favours this supposition. This is especially the case with reference to the Scottish forts. Here the vitrified summits are invariably so selected that they not only command what were the favourite landing-places of the vikings, but are the best natural defences against attacks made from the direction of the seacoast. In Saxony and Lusatia the forts are known as *Schwedenburgen*, and in the Highlands of Scotland as the fortresses of the *Feinne*—designations which also seem to point to an origin dating back to the times of the vikings.

Authorities.—John Williams, *An Account of some Remarkable Ancient Ruins* (1777); A. Fraser Tytler, *Edin. Phil. Trans.* vol. ii.; Sir George Mackenzie, *Observations on Vitrified Forts*; Hibbert, *Arch. Scot.* vol. iv.; J. MacCulloch, *Highlands and Western Islands* (1824), vol. i.; Hugh Miller, *Rambles of a Geologist* (1858), chap. ix.; Sir Daniel Wilson, *Archaeology and Prehistoric Annals of Scotland* (1851), vol. ii.; J. H. Burton, *History of Scotland* (1867), vol. i.; R. Angus Smith, *Loch Etive and the Sons of Uisneach* (1879); J. Anderson, *Scotland in Pagan Times* (1886); C. MacLagan, *The Hill Forts of Ancient Scotland*; Thomas Aitken, *Trans. Inverness Scientific Soc.* vol. i.; Charles Proctor, *Chemical Analysis of Vitrified Stones from Tap o' Noth and Dunideer* (Huntly Field Club); various papers in *Proceedings of Soc. Antiq. Scot.* (since 1903 *The Scottish Historical Review*) and *Proceedings of Royal Irish Academy*; R. Munro, *Prehistoric Scotland* (1899); G. Chalmers, *Caledonia* (new ed., 7 vols., Paisley, 1887–94); Murray's *Handbook to Scotland* (1903 ed.); Leonhard, *Archiv für Mineralogie*, vol. i.; Virchow, *Ztschr. für Ethnologie*, vols. iii. and iv.; Schaaffhausen, *Verhandlungen der deutsch. anthrop. Gesellschaft* (1881); Köhl, *Verhand. d. deutsch. anthrop. Gesellschaft* (1883); Thuot, *La Forteresse vitrifiée du Puy de Gaudy, &c.*; De Nadaillac, *Les Premiers Hommes*, vol. i.; *Mémoires de la Soc. Antiq. de France*, vol. xxxviii.; Hildebrand, *De förhistoriska folken i Europa* (Stockholm, 1880); Behla, *Die vorgeschichtlichen Rundwälle im östlichen Deutschland* (Berlin, 1888); Oppermann and Schuchhardt, *Atlas vorgeschichtlicher Befestigungen in Niedersachen* (Hanover, 1888–98); Zschiesche, *Die vorgeschichtlichen Burgen und Wälle im Thüringer Zentralbecken* (Halle, 1889); Bug, *Schlesische Heidenschanzen* (Grottkau, 1890); Gohausen, *Die Befestigungsweisen der Vorzeit und des Mittelalters* (Wiesbaden, 1898).

(R. Mu.*)

VITRIOL, a name given to sulphuric acid and to certain sulphates. Oil of vitriol is concentrated sulphuric acid. Blue or Roman vitriol is copper sulphate; green vitriol, ferrous sulphate (copperas); white vitriol, zinc sulphate; and vitriol of Mars is a basic iron sulphate.

VITRUVIUS (Marcus Vitruvius Pollio), Roman architect and engineer, author of a celebrated work on architecture. Nothing is known concerning him except what can be gathered from his own writings. Owing to the discovery of inscriptions relating to the Gens Vitruvia at Formiae in Campania (Mola di Gaeta), it has been suggested that he was a native of that city, and he has been less reasonably connected with Verona on the strength of an existing arch of the 3rd century, which is inscribed with the name of a later architect of the same family name—"Lucius Vitruvius Cerdo, a freedman of Lucius." From Vitruvius himself we learn that he was appointed, in the reign of Augustus, together with three others, a superintendent of *balistae* and other military engines, a post which, he says, he owed to the friendly influence of the emperor's sister, probably Octavia (*De Architectura*, i. pref.). In another passage (v. 1) he describes a basilica and adjacent aedes Augusti, of which he was the architect. From viii. 3 it has been supposed that he had served in Africa in the time of Julius Caesar, probably as a military engineer, but the words hardly bear this interpretation. He speaks of himself as being low in stature, and at the time of his writing bowed down by age and ill-health (ii. pref.). He appears to have enjoyed no great reputation as an architect, and, with philosophic contentment, records that he possessed but little fortune. Though a great student of Greek philosophy and science, he was unpractised in literature, and his style is very involved and obscure. To a great extent the theoretical and historical parts of his work are compiled from earlier Greek authors, of whom he gives a list at i. 1 and viii. 3. The practical portions, on the contrary, are evidently the result of his own professional experience, and are written with much sagacity, and in a far clearer style than the more pedantic chapters, in which he gives the somewhat fanciful theories of the Greeks. Some sections of the latter, especially those on the connexion between music and architecture, the scale of harmonic proportions, and the Greek use of bronze vases to reverberate and strengthen the actors' voices in the theatre, are now almost wholly unintelligible. Vitruvius's name is mentioned by Frontinus in his work on the aqueducts of Rome; and most of what Pliny says (*Hist. Nat.* xxxv. and xxxvi.) about methods of wall-painting, the preparation of the stucco surface, and other practical details in building is taken almost word for word from Vitruvius, especially from vi. 1, though without any acknowledgment of the source.

The treatise *De Architectura Libri Decem* is dedicated to Augustus. Lost for a long time, it was rediscovered in the 15th century at St Gall; the oldest existing MS. dates from the 10th century. From the early Renaissance down to a comparatively recent time the influence of this treatise has been remarkably great. Throughout the period of the classical revival

Vitruvius was the chief authority studied by architects, and in every point his precepts were accepted as final. In some cases a failure to understand his meaning led to curious results; for example, the medieval custom, not uncommon in England, of placing rows of earthenware jars under the floor of the stalls in church choirs, appears to have been an attempt to follow out suggestions raised by Vitruvius as to the advantages of placing bronze vases round the auditorium of theatres. Bramante, Michelangelo, Palladio, Vignola and earlier architects were careful students of the work of Vitruvius, which through them has largely influenced the architecture of almost all European countries.

Bk. i. opens with a dedication to Augustus. C. 1 is on the science of architecture generally, and the branches of knowledge with which the trained architect ought to be acquainted, viz. grammar, music, painting, sculpture, medicine, geometry, mathematics and optics; c. 2 is on the general principles of architectural design; c. 3 on the considerations which determine a design, such as strength, utility, beauty; c. 4 on the nature of different sorts of ground for sites; c. 5 on walls of fortification; c. 6 on aspects towards the north, south and other points; c. 7 on the proper situations of temples dedicated to the various deities.

Bk. ii. relates to materials (preface about Dinocrates, architect to Alexander the Great). C. 1 is on the earliest dwellings of man; c. 2 on systems of Thales, Heraclitus, Democritus, &c.; c. 3 on bricks; c. 4 on sand; c. 5 on lime; c. 6 on pozzolana; c. 7 on kinds of stone for building; c. 8 on methods of constructing walls in stone, brick, concrete and marble, and on the materials for stucco; c. 9 on timber, time for felling it, seasoning, &c.; and c. 10 on the fir trees of the Apennines.

Bk. iii., on styles, has a preface on ancient Greek writers. C. 1 is on symmetry and proportion; c. 2 on various forms of Greek temples, *e.g.* in antis, prostyle, peripteral, dipteral, hypaethral;[1] c. 3 on inter-columniation—pycnostyle, systyle, eustyle, &c.; c. 4 on foundations, steps and stylobates; c. 5 on the Ionic order, its form and details.

Bk. iv., on styles and orders, has a preface to Augustus on the scope of the work. The subjects of its nine chapters are—(1) the Corinthian, Ionic and Doric orders; (2) the ornaments of capitals, &c.; (3) the Doric order; (4) proportions of the cella and pronaos; (5) sites of temples; (6) doorways of temples and their architraves; (7) the Etruscan or Tuscan order of temples; (8) circular temples; (9) altars.

Bk. v., on public buildings, has a preface on the theories of Pythagoras, &c. Its twelve chapters treat—(1) of fora and basilicae, with a description of his own basilica at Fanum; (2) of the adjuncts of a forum (aerarium, prison and curia); (3) of theatres, their site and construction; (4) of laws of harmonics; (5) of the arrangement of tuned bronze vases in theatres for acoustic purposes; (6) of Roman theatres; (7) of Greek theatres; (8) of the selection of sites of theatres according to acoustic principles; (9) of porticus and covered walks; (10) of baths, their floors, hypocausts, the construction and use of various parts; (11) of palaestrae, xysti and other Greek buildings for the exercise of athletes; (12) of harbours and quays.

Bk. vi. is on sites and planning, and the preface treats of various Greek authors. C. 1 is on selection of sites; c. 2 on the planning of buildings to suit different sites; c. 3 on private houses, their construction and styles, the names of the different apartments; c. 4 on the aspects suited for the various rooms; c. 5 on buildings fitted for special positions; c. 6 on farms and country houses; c. 7 on Greek houses and the names of various parts; c. 8 on construction of houses in wood, stone, brick or concrete.

Bk. vii., mostly on methods of decoration, has a preface (as usual) on the opinions of ancient Greek writers, with lists of Greek sculptors, architects and writers on architecture, and of Roman architects. C. 1 has for its subject pavements and roads, their construction, mosaic floors; c. 2 is on white stucco for walls (*opus albarium*); c. 3 on concrete vaults, gypsum mouldings, stucco prepared for painting; c. 4 on building of hollow walls to keep out the damp, wall decoration by various processes; c. 5 on methods and styles of wall painting, the debased taste of his time; c. 6 on fine stucco made of pounded marble—three coats to receive wall paintings; c. 7 on colours used for mural decoration; c. 8 on red lead (*minium*) and mercury, and how to use the latter to extract the gold from worn-out pieces of stuff or embroidery; c. 9 on the preparation of red lead and the method of encaustic painting with hot wax, finished by friction; cc. 10–14 on artificial colours—black, blue, purple; c. 10 white lead and *ostrum*, *i.e.* murex purple and imitations of murex dye.

Bk. viii. is on hydraulic engineering, and the preface on theories of the ancients. C. 1 treats of the finding of good water; c. 2 of rain-water and rivers—rivers in various countries; c. 3 of hot springs, mineral waters, with an account of the chief medicinal springs of the world; c. 4 of selection of water by observation and experiment; c. 5 of instruments for levelling used by aqueduct engineers; c. 6 of construction of aqueducts, pipes of lead, clay, &c., and other matter on the subject of water-supply.

Bk. ix. is on astronomy. The preface treats of Greek sciences, geometry, the discovery of specific gravity by Archimedes, and other discoveries of the Greeks, and of Romans of his time who have vied with the Greeks—Lucretius in his poem *De Rerum Natura*, Cicero in rhetoric, and Varro in philology, as shown by his *De Lingua Latina*.[2] The subjects of the eight chapters are—(1) the signs of the zodiac and the seven planets; (2) the phases of the moon; (3) the passage of the sun through the zodiac; (4) and (5) various constellations; (6) the relation of astrological influences to nature; (7) the mathematical divisions of the gnomon; (8) various kinds of sundials and their inventors.

Bk. x. is on machinery, with a preface concerning a law at ancient Ephesus compelling an architect to complete any public building he had undertaken; this, he says, would be useful among the Romans of his time.[3] The chapters are—(1) on various machines, such as scaling-ladders, windmills, &c.; (2) on windlasses, axles, pulleys and cranes for moving heavy weights, such as those used by Chersiphron in building the great temple of Diana at Ephesus, and on the discovery by a shepherd of a quarry of marble required to build the same temple; (3) on dynamics; (4) on machines for drawing water; (5) on wheels for irrigation worked by a river; (6) on raising water by a revolving spiral tube; (7) on the machine of Ctesibius for raising water to a height; (8) on a very complicated water engine, the description of which is not intelligible, though Vitruvius remarks that he has tried to make the matter clear; (9) on machines with wheels to register the distance travelled, either by land or water; (10) on the construction of *scorpiones* for hurling stones, (11) and (12) on *balistae* and catapults; (13) on battering-rams and other machines for the attack of a fortress; (14) on shields (*testudines*) to enable soldiers to fill up the enemy's ditches; (15) on other kinds of *testudines*; (16) on machines for defence, and examples of their use in ancient times. (J. H. M.)

The best edition is by Rose (2nd ed., Leipzig, 1899); see also Nohl, *Index Vitruvianus* (1876); Jolles, *Vitruvs Aesthetik* (1906); Sontheimer, *Vitruv und seine Zeit* (1908). There is a good translation by Gwilt (1826; reprinted, 1874).

The name of Vitruvius has been given to several works on modern architecture, such as Campbell, *Vitruvius Britannicus* (London, 1715–71), a series of illustrations of the chief buildings of the 18th century in England, including many works of the brothers Adam; one of these brothers, William Adam, produced a similar work illustrating the buildings which he had designed for Scotland, under the title of *Vitruvius Scoticus* (Edinburgh, 1790). Thurah, *Le Vitruve danois* (Copenhagen, 1746–49), is a similar collection of modern buildings in Denmark.

VITRY-LE-FRANÇOIS, a town of north-eastern France, capital of the department of Marne, on the right bank of the Marne, 20 m. S.E. of Châlons, on the railway from Paris to Strassburg. Pop. (1906) 7985. The Marne-Rhine canal, the Haute-Marne canal, and the lateral canal of the Marne unite at Vitry. Its church of Notre-Dame is a 17th-century building with fine 18th-century monuments. A convent of the Récollets now contains the town hall, the court-house, a library and a small museum. There is a bronze statue of P. P. Royer-Collard (1763–1845), the politician and philosopher, a native of the district. The industrial establishments include important cement works and the manufacture of faïence is carried on. The present town was built in 1545 on a uniform plan by Francis I. to replace the older one of Vitry-en-Perthois, 2½ m. to the north-east, burned in the previous year by Charles V.

VITTEL, a watering-place of north-eastern France, in the department of Vosges, 31 m. W. of Epinal by rail. Pop. (1906) 1954. The waters resemble those of Contrexéville, but are lighter in character; they are bottled and exported in large quantities. They are prescribed in cases of gravel, gout, &c. Vittel has been considerably developed in recent years, and is well supplied with hotels, a fine casino and park, &c.

VITTORIA, a town of Sicily in the province of Syracuse, 95 m. W.S.W. of Syracuse by rail (42 m. direct), founded in 1605 by Giovanni Alphonso Henriquez, who named it after his mother, the famous Vittoria Colonna. It is a prosperous town in the centre of a fertile district, with the largest wine trade in Sicily. Pop. (1901) 30,832 (town), 32,219 (commune).

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[1] The excavations made in 1887 have shown that Vitruvius was right in describing the great temple of Olympian Zeùs at Athens as being octastyle. The previously almost universal opinion that it was decastyle had led to the needless theory that the passage containing this statement was corrupt.

[2] Vitruvius names Cicero and Lucretius as *post nostram memoriam nascentes*.

[3] The architect being at that time also the contractor.

VITTORIO, a town and episcopal residence of the province of Treviso, Venetia, Italy, 25 m. by rail N. of Treviso, 466 ft. above sea-level. Pop. (1901) 2977 (town), 19,133 (commune). It is a summer resort, with sulphur and saline springs (51·8° to 59° F.), and was formed in 1879 by the union of Ceneda (the episcopal see) and Serravalle. The cathedral contains paintings by Pomponio Amalteo (a pupil of Pordenone) and others. At Serravalle is a church with a fine altar-piece (1547) by Titian. It is a seat of the silkworm breeding and silk-throwing industries.

VITUS, ST (German, Veit; French, Guy). According to the legend, where he is associated with Modestus and Crescentia, by whom he had been brought up, St Vitus suffered martyrdom at a very early age under the emperor Diocletian. Son of a Sicilian nobleman who was a worshipper of idols, Vitus was converted to the Christian faith without the knowledge of his father, was denounced by him and scourged, but resisted all attacks on his profession. Admonished by an angel, he crossed the sea to Lucania and went to Rome, where he suffered martyrdom. His festival is celebrated on the 15th of June. The *Passion* of St Vitus has no historical value, but his name occurs in the *Martyrologium hieronymianum*. In 836 the abbey of Corvey, in Saxony, received his relics, and became a very active centre of his cult. In the second half of the 9th century the monks of Corvey, according to Helmold's *Chronica Slavorum*, evangelized the island of Rügen, where they built a church in honour of St Vitus. The islanders soon relapsed, but they kept up the superstitious cult of the saint (whom they honoured as a god), returning to Christianity three centuries later. At Prague, too, there are some relics of the saint, who is the patron of Bohemia and also of Saxony, and one of the fourteen "protectors" (*Nothhelfer*) of the church in Germany. Among the diseases against which St Vitus is invoked is chorea, also known as St Vitus's Dance.

See *Acta sanctorum*, June, iii. 1013–42 and vi. 137–40; *Bibliotheca hagiographica Latina* (Brussels, 1899), n. 8711–23; J. H. Kessel, "St Veit, seine Geschichte, Verehrung und bildliche Darstellungen," in *Jahrbücher des Vereins von Alterthumsfreunden im Rheinlande* (1867), pp. 152–83. (H. De.)

VIVALDO, UGOLINO and **SORLEONE DE** (fl. 1291–1315), Genoese explorers, connected with the first known expedition in search of an ocean way from Europe to India. Ugolino, with his brother Guido or Vadino Vivaldo, was in command of this expedition of two galleys, which he had organized in conjunction with Tedisio Doria, and which left Genoa in May 1291 with the purpose of going to India "by the Ocean Sea" and bringing back useful things for trade. Planned primarily for commerce, the enterprise also aimed at proselytism. Two Franciscan friars accompanied Ugolino. The galleys were well armed and sailed down the Morocco coast to a place called Gozora (Cape Nun), in 28° 47′ N., after which nothing more was heard of them. Early in the next (14th) century, Sorleone de Vivaldo, son of Ugolino, undertook a series of distant wanderings in search of his father, and even penetrated, it is said, to Magadoxo on the Somali coast. In 1455 another Genoese seaman, Antoniotto Uso di Mare, sailing with Cadamosto in the service of Prince Henry the Navigator of Portugal, claimed to have met, near the mouth of the Gambia, with the last descendant of the survivors of the Vivaldo expedition. The two galleys, he was told, had sailed to the Sea of Guinea; in that sea one was stranded, but the other passed on to a place on the coast of Ethiopia-Mena or Amenuan, near the Gihon (here probably meaning the Senegal)—where the Genoese were seized and held in close captivity.

See Jacopo Doria, "Annales" (under A.D. 1291) in Pertz, *Monumenta Germaniae historica. Scriptores*, xviii. 335 (1863); the "Conoçimiento de todos los Reinos," ed. Marcos Jimenez de la Espada in the *Boletin* of the Geographical Society of Madrid, vol. ii., No. 2, pp. 111, 113, 117–18 (Madrid, February, 1877); Canale, *Degli antichi navigatori e scopritori Genovesi* (Genoa, 1846); G. H. Pertz, *Der älteste Versuch zur Entdeckung des Seeweges nach Ostindien* (Berlin, 1859); *Annali di Geografia e di Statistica composti . . da Giacomo Gråberg* (Genoa, 1802); Belgrano, ". . . Annali . . . di Caffaro," in *Archiv. Stor. Ital.*; 3rd series, ii. 124, &c., and in *Atti della Soc. Lig. di Storia Patria*, xv. 320 (1881); W. Heyd, *Histoire du commerce du Levant* (the improved French edition of the *Geschichte des Levantehandels*), ii. 140–43 (Paris, 1886); C. R. Beazley, *Dawn of Modern Geography*, iii. 413–19, 551 (Oxford, 1906).

VIVARINI, the surname of a family of painters of Murano (Venice), who produced a great quantity of work in Venice and its neighbourhood in the 15th century, leading on to that phase of the school which is represented by Carpaccio and the Bellinis.

Antonio Vivarini (Antonio of Murano) was probably the earliest of this family. He came from the school of Andrea da Murano, and his works show the influence of Gentile da Fabriano. The earliest known date of a picture of his, an altar-piece in the Venetian academy, is 1440; the latest, in the Lateran museum, 1464, but he appears to have been alive in 1470. He worked in company with a certain "Joannes de Alemania," who has been (with considerable doubt) regarded as a brother (Giovanni of Murano), but no trace of this painter exists of a date later than 1447. After 1447 Antonio painted either alone or in combination with his younger brother Bartolommeo. The works of Antonio are well drawn for their epoch, with a certain noticeable degree of softness, and with good flesh and other tints. Three of his principal paintings are the "Virgin Enthroned with the Four Doctors of the Church," the "Coronation of the Virgin," and "Sts Peter and Jerome." The first two (in which Giovanni co-operated) are in the Venetian academy, the third in the National Gallery, London. This gallery contains also specimens of the two under-named painters.

Bartolommeo Vivarini is known to have worked from 1450 to 1499. He learned oil-painting from Antonello da Messina, and is said to have produced, in 1473, the first oil picture done in Venice. This is in the church of S. Giovanni e Paolo—a large altar-piece in nine divisions, representing Augustine and other saints. Most of his works, however, including one in the National Gallery, are in tempera. His outline is always hard, and his colour good; the figures have much dignified and devout expression. As "vivarino" means in Italian a goldfinch, he sometimes drew a goldfinch as the signature of his pictures.

Luigi or Alvise Vivarini, born about 1446, painted in 1475 and on to 1502, when he died. It has sometimes been supposed that, besides the Luigi who was the latest of this pictorial family, there had also been another Luigi who was the earliest, this supposition being founded on the fact that one picture is signed with the name, with the date 1414. There is good ground, however, for considering this date to be a forgery of a later time. The works of Luigi show an advance on those of his predecessors, and some of them are productions of high attainment; one of the best was executed for the Scuola di S. Girolamo in Venice, representing the saint caressing his lion, and some monks decamping in terror. The architecture and perspective in this work are superior. Other works by Luigi are in Treviso and in Milan. He painted some remarkable portraits. (W. M. R.)

VIVERO, a town of north-western Spain, in the province of Lugo; on the Ria de Vivero, an estuary formed by the river Landrove, which here enters the Bay of Biscay. Pop. (1900) 12,843. Vivero is an old-fashioned and picturesque town, connected with the opposite bank of the estuary by a bridge of twelve arches and a causeway. Its fishing fleet, its coasting trade and the agricultural products of the fertile country around are important. The only means of communication with the interior is by the road to Cabreiros, for Lugo and Ferrol.

VIVES, JUAN LUIS (1492–1540), Spanish scholar, was born at Valencia on the 6th of March 1492. He studied at Paris from 1509 to 1512, and in 1519 was appointed professor of humanities at Louvain. At the instance of his friend Erasmus he prepared an elaborate commentary on Augustine's *De Civitate Dei*, which was published in 1522 with a dedication to Henry VIII. Soon afterwards he was invited to England, and is said to have acted as tutor to the princess Mary, for whose use he wrote *De ratione studii puerilis epistolae duae*

(1523). While in England he resided at Corpus Christi College, Oxford, where he was made doctor of laws and lectured on philosophy. Having declared himself against the king's divorce from Catherine of Aragon, he lost the royal favour and was confined to his house for six weeks. On his release he withdrew to Bruges, where he devoted himself to the composition of numerous works, chiefly directed against the scholastic philosophy and the preponderant authority of Aristotle. The most important of his treatises is the *De Caucis corruptarum Artium*, which has been ranked with Bacon's *Organon*. He died at Bruges on the 6th of May 1540.

A complete edition of his works was published by Gregorio Mayáns y Siscar (Valencia, 1782). Adolfo Bonilla y San Martin's *Luis Vives y la filosofía del renacimiento* (Madrid, 1903) is a valuable and interesting study which includes an exhaustive bibliography of Vives's writings and a critical estimate of previous monographs. The best of these are A. J. Namèche, "Mémoire sur la vie et les écrits de Jean Louis Vives" in *Mémoires couronnés par l'Académie Royale des sciences et belles-lettres de Bruxelles* (Brussels, 1841), vol. xv.; A. Lange's article in the *Encyklopädie des gesammten Erziehungs- und Unterrichtswesens* (Leipzig, 1887), vol. ix.; Berthe Vadier, *Un Moraliste du XVI^{me} siècle: Jean-Louis Vives et son livre de l'éducation de la femme chrétienne* (Geneva, 1892); G. Hoppe, *Die Psychologie von Juan Luis Vives* (Berlin, 1901).

VIVIAN, RICHARD HUSSEY VIVIAN, 1st Baron (1775–1842), British cavalry leader, came of a Cornish family. Educated at Harrow and Exeter College, Oxford, Vivian entered the army in 1793, and less than a year later became a captain in the 28th foot. Under Lord Moira he served in the campaign of 1794 in Flanders and Holland. At the end of the expedition, the 28th bore a distinguished part in Lord Cathcart's action of Gueldermalsen. In 1798 Vivian was transferred to the 7th Light Dragoons (now Hussars), and in Sir Ralph Abercromby's division was present at the battles of Bergen and Alkmaar (19th September to 6th October 1799). In 1800 he received his majority, and in 1804 he became lieut.-colonel of the 7th. In command of this regiment he sailed to join Baird at Corunna in 1808, and took part in Lord Paget's cavalry fights at Sahagun and Benavente. During the retreat of Moore's army the 7th were constantly employed with the rearguard. Vivian was present at Corunna, and returned with the remainder of the army to England. It was not until late in 1813 that the 7th returned to the Peninsula, and Vivian (now colonel and A.D.C. to the prince regent) was soon taken away to command a cavalry brigade under Hill. With this corps he served throughout the fighting on the Nive (9th–13th December). At the beginning of 1814 he was transferred to a cavalry brigade of Beresford's corps, and took a marked part in the action of Gave de Pau and the battle of Orthes. In the advance on Toulouse Vivian fought a brilliant action at Crois d'Orade on the Ers (8th April), when he was very severely wounded. At the beginning of 1815 he was made K.C.B.; he had been a major-general for several months. In April Sir Hussey Vivian was appointed to command a brigade of Uxbridge's cavalry, and at Waterloo his regiments, with those of Vandeleur's brigade, made the final charge of the day between Hougoumont and La Haye Sainte, sweeping everything before them. This service was rewarded by the thanks of both houses of parliament, the K.C.H. and the orders of Maria Theresa and St Vladimir from the emperors of Austria and Russia. He sat in the House of Commons as member for Truro from 1821 to 1831; he was then made commander of the forces in Ireland, and given the G.C.H. In 1835 he became master-general of the ordnance. In 1837 he received the G.C.B., and in 1841, being then M.P. for East Cornwall, was created Baron Vivian in the English peerage. A year later he died at Baden-Baden. He was twice married (first in 1804), and the title descended in the direct line. His natural son, Sir Robert John Hussey Vivian (1802–1887), was a famous soldier in India, who in 1857 was made K.C.B. and in 1871 G.C.B., having previously attained the rank of general.

VIVIANITE, a mineral consisting of hydrated iron phosphate $Fe_3(PO_4)_2+8H_2O$, crystallizing in the monoclinic system. The crystals possess a perfect cleavage parallel to the plane of symmetry and are usually bladed in habit; they are soft $(H=\frac{1}{2})$, flexible and sectile. The specific gravity is 2·6. When unaltered and containing no ferric oxide, the mineral is colourless, but on exposure to the light it very soon becomes of a characteristic indigo-blue colour. Crystals were first found in Cornwall (at Wheal Jane, near Truro, associated with pyrrhotite) by J. G. Vivian, after whom the species was named by A. G. Werner in 1817. The mineral had, however, been earlier known as a blue powdery substance, called "blue iron-earth," met with in peat-bogs, in bog iron-ore, or with fossil bones and shells. (L. J. S.)

VIVISECTION, literally the cutting (*sectio*) of living (*vivus*) animals, a word which might be applied to all surgical operations whether practised upon the lower animals or on man. As conventionally used, however, it has exclusive reference to experiments upon the lower animals undertaken for the advancement of medical sciences. There are a number of people who, calling themselves anti-vivisectionists, strongly object to these experiments on the lower animals; and it must be conceded that the humane reasons which they advance against it can only be set aside as "sentimental" if considerations of a wider humanity can show that the arguments of the anti-vivisectionists really run counter to human progress. The supporters of vivisection, properly considered, must not be confused with those who would make a barbarous use of this means of research. What is at stake here is the right to use it properly and at all. It would be possible for cruelty of an unnecessary kind to result if the practice of vivisection were unrestricted; and the purpose of this article is to give some account of the method of experiments on animals as sanctioned by law in the United Kingdom, and to justify that method by setting forth the chief historical discoveries that have been made by the help of vivisection. Such experiments have for their object the advancement of the sciences of physiology and pathology. From the earliest periods experimental vivisections have occasionally been practised, but before the days of anaesthetics it was difficult to execute them, and not less difficult to draw conclusions. The invention of anaesthetics has greatly extended the scope of the experimental method, because an animal can be kept unconscious and quiet, without even a quiver of a muscle, during prolonged operations. Further, the introduction of the antiseptic method has made it possible to subject all tissues and regions of the body to surgical interference, and this has also had the effect of increasing the possibilities of experimental research.

In 1906 a British Royal Commission was appointed to inquire into the whole subject under the chairmanship of Lord Selby, on whose death Mr A. J. Ram, K.C., took the chair. The Commission sat from October 1906 to March 1908, and heard no fewer than 21,761 questions and answers. In view of attempts on the part of the anti-vivisectionists to misrepresent the nature of the evidence given before the Commission, in January 1908 the supporters of experiments on animals founded the Research Defence Society, under the presidency of Lord Cromer; by July 1910 this society had some 3500 members. Its official address is 21 Ladbroke Square, London, W.

I. Methods Employed.—The present act relating to experiments on animals was passed in 1876. At that time the majority of these experiments were physiological. There was, it may be fairly said, no such thing as bacteriology, no general following up of Pasteur's work. A few experiments were made in pathology, for instance in tubercle; and a few in surgery, in pharmacology, and in the action of poisons, especially snake venom. But the chief use of experiments on animals was for the advancement of physiology. The evidence given before the Royal Commission (1875) was almost entirely on physiological matters, on the discoveries of Harvey, Bell, Magendie and Claude Bernard, on the *Handbook for the Physiological Laboratory*, and so forth. The act, therefore, was drafted with a view to physiology, without much concern for pathology, and without foreknowledge of bacteriology. At the time of writing (1910), 95% of the experiments are inoculations. Every experiment must be made in a registered place open to government inspection. But inoculation experiments are sometimes permitted in non-registered places, for the immediate study of outbreaks of disease, or in circumstances which render it impracticable to use a registered place. Every experiment must be made under a licence; and every application for a licence must be recommended by the signatures of two out of a small body of authorities specified in the act—presidents of certain learned societies and professors of certain universities and colleges. The word "experiment" is not allowed to cover the use of more than one animal.

Most experiments are made not under a licence alone, but under a licence *plus* one or more certificates, and the wording and working of these certificates must be clearly understood, because it is over them that the question arises as to the amount of pain inflicted by these experiments. Under the licence alone, the animal must be kept under an anaesthetic during the whole of the experiment; and "if the pain is likely to continue after the effect of the anaesthetic has ceased, or if any serious injury has been inflicted on the animal," it must be killed forthwith under the anaesthetic. Thus, under the licence alone, it is impossible to make an inoculation; for the experiment consists, not in the introduction of the needle under the skin, but in the observation of the results of the inoculation. A guinea-pig inoculated with tubercle cannot be kept under an anaesthetic till the disease appears. The disease is the experiment, and it is therefore an experiment made without an anaesthetic, and not authorized by the licence alone. Again, under the licence alone it would have been impossible to work out the thyroid treatment of myxoedema, or the facts of cerebral localization. For to remove the thyroid gland, or to remove a portion of the surface of the brain, is to inflict a serious injury on the animal. The operation is done under profound anaesthesia—it would be impracticable otherwise; the wound is treated and dressed by the antiseptic method—suppuration would invalidate the result. But a serious injury has been inflicted. Nevertheless, the animal must not be killed forthwith: the result must be watched. These and the like experiments cannot therefore be made under the licence alone. For the removal of such disabilities as these, the act empowers the home secretary to allow certain certificates, to be held with the licence. They must be recommended by two signatures, and various restrictions are put upon them by the home secretary. On July 11, 1898, the home secretary was asked, in the House of Commons, what were the conditions and regulations attached by the Home Office to licences and certificates; and he answered—

> "The conditions are not always the same, but may vary according to the nature of the investigation. It is hardly possible, therefore, for me to state all the conditions attached to licences and certificates. The most important conditions, however (besides the limitations as to place, time and number of experiments), and the conditions most frequently imposed, are those as to reporting and the use of antiseptics. The latter condition is that the animals are to be treated with strict antiseptic precautions, and if these fail and pain results, they are to be killed immediately under anaesthetics. The reporting conditions are, in brief, that a written record, in a prescribed form, is to be kept of every experiment, and is to be open for examination by the inspector; that a report of all experiments is to be forwarded to the inspector; and that any published account of an experiment is to be transmitted to the secretary of state. Another condition requires the immediate destruction under anaesthetics of an animal in which severe pain has been induced, after the main result of the experiment has been attained."

The home secretary attaches to licences and certificates such endorsements as he thinks fit. The bare text of the act, now thirty-four years old, is a very different thing from the administration of the act; and the present writer is in a position to say that the act is administered with great strictness, under a careful system of inquiry and reference.

The certificates are distinguished as A, B, C, E, EE and F. Certificate D, which permitted the testing, by experiments, of "former discoveries alleged to have been made," has fallen into disuse. Certificate C permits experiments to be made by way of illustration of lectures. They must be made under the provisions contained in the act as to the use of anaesthetics. Certificates E and EE permit experiments on dogs or cats; certificate F permits experiments on horses, asses or mules. These certificates are linked with Certificate A or Certificate B. It is round these two certificates, A and B, that the controversy as to the pain caused by experiments on animals is maintained.

Certificate A permits experiments to be made without anaesthesia. It is worded as follows: "Whereas A. B. of [*here insert address and profession*] has represented to us (*i.e.* two authorities) that he proposes, if duly authorized under the above-mentioned act, to perform on living animals certain experiments described below: We hereby certify that, in our opinion, insensibility in the animal on which any such experiment may be performed cannot be produced by anaesthetics without necessarily frustrating the object of such experiment." All inoculations under the skin, all feeding experiments and the like, are scheduled under this certificate. They must be scheduled somehow: they cannot legally be made under a licence alone. Though the only instrument used is a hypodermic needle, yet every inoculation is officially returned as an experiment, calculated to give pain, performed without an anaesthetic. It is for inoculations and the like experiments, and for them alone, and for nothing else, that Certificate A is allowed (or A linked with E or F). This want of a special certificate for inoculations, and this wresting of Certificate A for the purpose, have led to an erroneous belief that "cutting operations" are permitted by the act without an anaesthetic. But, as the home secretary said in parliament, in March 1897, "Certificate A is never allowed except for inoculations and similar trivial operations, and in every case a condition is attached to prevent unnecessary pain." And again he wrote in 1898, "Such special certificates (dispensing with anaesthetics) are granted only for inoculations, feeding and similar procedures involving no cutting. The animal has to be killed under anaesthetics if it be in pain, so soon as the result of the experiment is ascertained."

Certificate B permits the keeping alive of the animal after the initial operation of an experiment. It is worded as follows: "Whereas A. B. of [*here insert address and profession*] has represented to us (*i.e.* two authorities) that he proposes, if duly authorized under the above-mentioned act, to perform on living animals certain experiments described below, such animals being, during the whole of the initial operation of such experiments, under the influence of some anaesthetic of sufficient power to prevent their feeling pain: We hereby certify that, in our opinion, the killing of the animal on which any such experiment is performed before it recovers from the influence of the anaesthetic administered to it would necessarily frustrate the object of such experiment." Certificate B (or B linked with EE or F) is used for those experiments which consist in an operation *plus* subsequent observation of the animal. The section of a nerve, the removal of a secretory organ, the establishment of a fistula, the plastic surgery of the intestine, the sub-dural method of inoculation—these and the like experiments are made under this certificate. We may take, to illustrate the use of Certificate B, Horsley's observations on the thyroid gland. The removal of the gland was the initial operation; and this was performed under an anaesthetic, and with the antiseptic method. Then the animal was kept under observation. The experiment is neither the operation alone nor the observation alone, but the two together. The purpose of this certificate is set forth in the inspector's report for 1909. "In the experiments performed under Certificate B, or B linked with EE, 1704 in number, the initial operations are performed under anaesthetics from the influence of which the animals are allowed to recover. The operations are required to be performed antiseptically, so that the healing of the wounds shall, as far as possible, take place without pain. If the antiseptic precautions fail, and suppuration occurs, the animal is required to be killed. It is generally essential for the success of these experiments that the wounds should heal cleanly, and the surrounding parts remain in a healthy condition. After the healing of the wounds the animals are not necessarily, or even generally, in pain, since experiments involving the removal of important organs, including portions of the brain, may be performed without giving rise to pain after the recovery from the operation; and after the section of a part of the nervous system, the resulting degenerative changes are painless. In the event of a subsequent operation being necessary in an experiment performed under Certificate B, or B linked with EE, a condition is attached to the licence requiring all operative procedures to be carried out under anaesthetics of sufficient power to prevent the animal feeling pain; and no observations or stimulations of a character to cause pain are allowed to be made without the animals being anaesthetized. In no case has a cutting operation more severe than a superficial venesection (the opening of a vein just under the skin) been allowed to be performed without anaesthetics."

From this brief account of the chief provisions of the act, we come to consider the general method of experiments on animals in the United Kingdom, and the question of the infliction of pain on them. The figures for a representative year may be given. The total number of licensees in 1909, in England and Scotland, was 483: of whom 135 performed no experiments during the year. The total number of experiments was 86,277, being 2357 less than in 1908. They were made as follows:—

Under Licence alone	1,980
„ Certificate C	196
„ Certificate A	81,566
„ Certificates A+E	595
„ Certificates A+F	228
„ Certificate B	1,385
„ Certificates B+EE	319
„ Certificate F	8

The experiments performed under Certificate A (or A+E, or A+F) were mostly inoculations; but a few were feeding experiments, or the administration of various substances by the mouth or by inhalation, or the abstraction of blood by puncture or by simple venesection. Inoculations into deep parts, involving a preliminary incision, are required to be performed under anaesthetics (Certificate B).

> "It will be seen," says the report for 1909, "that the operative procedures in experiments performed under Certificate A, without anaesthetics, are only such as are attended by no considerable, if appreciable, pain. The certificate is, in fact, not required to cover these proceedings, but to allow of the subsequent course of the experiment."

The animals most used for inoculations are mice, rats, guinea-pigs and rabbits. It is not once in a thousand times that a dog or a cat is used for inoculation. The act of inoculation is not in itself painful. A small area of the skin is carefully shaved and cleansed, that it may be aseptic, the hypodermic needle is sterilized and the method of hypodermic injection or of vaccination is the same as it is in medical practice. "A guinea-pig that will rest quietly in your hands before you commence to inject it, will remain perfectly quiet during the introduction of the needle under the skin; and the moment it is returned to the cage it resumes its interrupted feeding. Arteries, veins and most of the parts of the viscera are without the sense of touch. We have actual proof of this in what takes place when a horse is bled for the purpose of obtaining curative serum. With a sharp lance a cut may be made in the skin so quickly and easily that the animal does nothing more than twitch the skin-muscle of the neck, or give his head a shake, while of the further proceeding of introducing a hollow needle into the vein, the animal takes not the slightest notice. Some horses, indeed, will stand perfectly quiet during the whole operation, munching a carrot, nibbling at a wisp of hay, or playing with a button on the vest of the groom standing at its head." These sentences, written in the *Medical Magazine* (June 1898) by Dr Sims Woodhead, Professor of Pathology at Cambridge, are sufficient evidence that inoculations and the like experiments are not painful at the time. In a few instances cultures of micro-organisms have been made in the anterior chamber of the eye, by the introduction of a needle behind the cornea. This might be thought painful, but cocaine renders the surface of the eye wholly insensitive. Many operations of ophthalmic surgery are done under cocaine alone, and the anterior chamber of the eye is so far insensitive that a man may have blood or pus (*hypopyon*) in it, and hardly be conscious of the fact. The results of inoculation are in some cases negative, in others positive; the positive results are, in the great majority of cases, not a local change, but a general infection which may end in recovery, or in death. The diseases thus induced may, in many cases, fairly be called painless—such are septicaemia in a mouse, snake-venom in a rat, and malaria in a sparrow. Rabbits affected with rabies do not suffer in the same way as dogs and some other animals, but become subject to a painless kind of paralysis. It is probable that animals kept for inoculation have, on the whole, less pain than falls to the lot of a like number of animals in a state of nature or in subjection to work: they are well fed and sheltered, and escape the rapacity of larger animals, the inevitable cruelties of sport, and the drudgery and sexual mutilation that man inflicts on the higher domestic animals.

The present writer has, of course, seen the mice that are used for the study of cancer (Imperial Cancer Research Fund), and the guinea-pigs that are used at the Lister Institute for the testing of the London milk-supply, lest the milk should convey tubercle. He did not see, among all the many animals, one that appeared to be suffering: save that a very few of the mice were incommoded, or, if the word be applicable to mice, distressed, by large tumours. Of the guinea-pigs that had been inoculated, not one seemed to be in any pain. A nodule of tubercle, or a tuberculous gland, is painless in us, and therefore cannot be painful in a guinea-pig. It is not denied that the study of some diseases (plague, tetanus) causes some pain to rats and rabbits; but this pain is hardly to be compared with the pain and horror of these diseases in man.

We come now to Certificate B. If it were lawful, under Certificate B, to make an incision under an anaesthetic, to call this the "initial operation," and then, without an anaesthetic, to make painful experiments, through the incision, on the deeper structures, doubtless much pain might be inflicted under this certificate. But experiments of this kind can be, and are, made under the licence alone, the animal being kept under an anaesthetic all the time, and killed under it. "No experiments requiring anything of the nature of a surgical operation, or that would cause the infliction of an appreciable amount of pain, are allowed to be performed without an anaesthetic" (Inspector's Report for 1899). "These certificates (B) are granted on condition that antiseptic precautions are used; and if these fail, and pain continues after the anaesthetics have ceased to operate, the animal is immediately killed painlessly" (Letter from the Home Secretary, 1898).

Of experiments made under this certificate (which must be linked with Certificate EE for any experiment on a dog or a cat), three instances may be given here: an operation on the brain, a removal of part or the whole of a secreting gland, and the establishment of a fistula. It is to be noted that, for these and the like operations, profound anaesthesia and the strict observance of the antiseptic method are matters of absolute necessity for the success of the experiment: the operation could not be performed without anaesthesia; and the experiment would come to nothing if the wound suppurated. It is to be noted, also, that these operations are such as are performed in surgery for the saving of life or for the relief of pain.

As to operations on the brain, it must be remembered that the surface of the brain is not sensitive. Therefore the removal or destruction of a portion of the surface of the brain, or the division of some tract of central nervous tissue, though it might entail some loss of power or of control, does not cause pain: a wound of the brain is painless. Tension within the cranial cavity, as in cases of cerebral tumour or cerebral abscess, may indeed cause great pain; and, if the aseptic method failed in an experiment, inflammation and tension would ensue: in that case the animal must be killed.

The removal of part or the whole of a secreting gland (*e.g.* the thyroid, the spleen, the kidney) is performed by the same methods, and with the same precautions, as in human surgery. Profound anaesthesia, and the use of a strict antiseptic procedure, are of absolute necessity. The skin over the part to be removed must be shaved and carefully cleansed for the operation; the instruments, sponges and ligatures must be sterile, not capable of infecting the wound; and when the operation is over, the wound must be carefully closed with sutures, and left to heal under a proper surgical dressing.

The establishment of a fistula, again, is an operation practised, as a matter of course, in large numbers of surgical cases. The stomach, the gall-bladder, the large intestine, are opened for the relief of obstruction, and kept open, either for a time or permanently, according to the nature of the case. Under anaesthesia, the organ that is to be opened is exposed through an incision made through the structures overlying it, and is secured in the wound by means of fine sutures. Then, when it has become adherent there, it is opened by an incision made into it; no anaesthetic is needed for this purpose, because these internal organs are so unlike the skin in sensitiveness that an incision is hardly felt: the patient may say that he "felt a prick," or he may be wholly unconscious that anything has been done. A fistula thus established is not afterward painful, though there may be some discomfort now and again.

The classical instance is the case of Alexis St Martin, who was shot in the stomach in 1822, and recovered, but with a fistula. He let Dr Beaumont make experiments on him for nine years: "During the whole of these periods, from the spring of 1824 to the present time (1833), he has enjoyed general good health . . . active, athletic and vigorous; exercising, eating and drinking like other healthy and active people. For the last four months he has been unusually plethoric and robust, though constantly subjected to a continuous series of experiments on the interior of the stomach; allowing to be introduced or taken out at the aperture different kinds of food, drinks, elastic catheters, thermometer tubes, gastric juice, chyme, &c., almost daily, and sometimes hourly. Such have been this man's condition and circumstances for several years past; and he now enjoys the most perfect health and constitutional soundness, with every function of the system in full force and vigour" (Beaumont, *Experiments and Observations on the Gastric Juice*, 1838).

We come now to the question, What anaesthetics are used in these experiments, and are they properly administered? The anaesthetics used are—(1) chloroform, ether, or a mixture containing chloroform and ether; (2) morphia, chloral, urethane. It is sometimes said that morphia is not an anaesthetic. That depends on the quantity given. Not a month passes in this country without somebody killing himself or herself with morphia or chloral. They die profoundly anaesthetized: they cannot be roused; even the pain of a strong electric shock is not enough to rouse them. So it is with animals. The doses given to them are enormous and produce complete insensibility. On this point the evidence given before the Royal Commission of 1906–8 by Mr Thane, Professor Schäfer, Sir Lauder Brunton, Sir Henry Morris, Professor Dixon, Dr Dudley Buxton and Professor Starling is absolutely conclusive. "As to the statements," says Sir Lauder Brunton, "that chloral and opium or morphia are not narcotics, and do not remove pain, there is no other word for it, it is simply a lie; you may as well say that chloroform does not remove pain. If you give any animal a sufficiently large dose of chloral or opium, you so completely abolish sensibility that there is nothing you can do that will awaken its sensibility. The animal is as senseless as a piece of board."

With regard to chloroform, ether and the A.C.E. mixture (alcohol, chloroform and ether) it is absolutely certain that animals can be kept, with these anaesthetics, profoundly unconscious for three or four or more hours. Nothing on this point is more worthy of consideration than the evidence in veterinary surgery, given before the Royal Commission by Mr Hobday, one of the very foremost veterinary surgeons in this country (*Reports of Evidence*, vol. iv. Q. 16284–16523). The opponents of all experiments on animals are apt to believe that dogs and cats must be bound and fastened on boards, and then have the anaesthetic given to them. That is not the case. They can take the anaesthetic first, and then be put in position; just as we, for many of the operations of surgery, are bound in position. And, of course, dogs and cats cannot lie on their backs as we can. "The usual thing we do," said Professor Starling, in his evidence before the Royal Commission, "is to give the animal, half an hour before the experiment, a hypodermic injection of morphia, of about a quarter of a grain—from a quarter to a third. The effect of that is, that the dog becomes sleepy and stupid, and then sometimes it will lie down quietly, and if it is very sleepy you can put a mask over its nose containing the chloroform, alcohol and ether mixture, which it takes quite quietly. If, at the time one wants to begin the operation, the animal is not fully under the influence of morphia—if it still seems restless—it is put in a box, and there it has some wool saturated with the A.C.E. mixture put in the box. The air gradually gets saturated, the dog gets more and more sleepy, and finally subsides at the bottom of the box."

A few words must be said here about curare. It was said, some years ago, by an opponent of experiments on animals, that "curare is used daily throughout England," whereas, it is seldom used at all, and is never used alone in any sort or kind of operation on any animal in this country: in every such case a recognized anaesthetic must be given, and is given. In large doses curare not only abolishes the movement of the voluntary muscles, but also acts as an anaesthetic: in small doses it acts only on the voluntary muscles, *i.e.* on the endings of the motor nerves going to these muscles. For example, suppose that the object of the experiment is to observe and record the action of a nerve on the contraction of certain blood vessels. The nerve gives off some branches to muscles, and other branches to blood vessels. If the animal be anaesthetized, and the nerve stimulated, muscles and vessels will both contract; but, if curare be given, as well as an anaesthetic, the vessels alone will contract, without the muscles: for curare does not act on the endings of motor nerves going to blood vessels. But, as a practical matter, curare is very hard to obtain, and is often impure, and is very seldom used. One of the inspectors said to the Royal Commission that he had once seen it used, fifteen years ago. Professor Gotch said that he had not used it, in his own work, for twenty years. Professor Schäfer said that he had not used it for years. And Sir Lauder Brunton said that he did not think he had used it at all since the passing of the act of 1876. The fear that, in a case where curare was being used, the effect of the anaesthetic might "pass off," and the animal be left under curare alone, is not reasonable. The dosage and administration of anaesthetics is not left to chance. If, for example, an animal is receiving a definite percentage of chloroform vapour, it is of necessity under the influence of the chloroform: and the anaesthesia will gradually become not less but more profound. (See the evidence given before the Royal Commission by Professor Langley and Professor Waller.)

It may be interesting to compare the pain, or death, or discomfort among 86,277 animals used for experiments in Great Britain in 1909, with the pain, or death, or discomfort of an equal number of the same kinds of animals, either in a state of nature, or kept for sport, or used for the service of human profit or amusement. But it would be outside the purpose of this article to describe the cruelties which are inseparable from sport, and from the killing of animals for food, and from fashion; neither is this the place to describe the millions of mutilations which are practised on domestic animals by farmers and breeders. As one of the Royal Commissioners recently said, the farmyards, at certain times of the year, simply "seethe with vivisection." The number of animals wounded in sport, or in traps, cannot be guessed. Against this vast amount of suffering we have to put an estimate of the condition of 86,277 animals used for medical science. Ninety-five per cent. of them were used for inoculation. In many of these inoculations the result was negative: the animal did not take any disease, and thus did not suffer any pain. In many more, *e.g.* cancer in mice, tubercle in guinea-pigs, the pain or discomfort, if any, may fairly be called trivial or inconsiderable. It could hardly be said that these small animals suffer much more than an equal number of the same kind of animals kept in little cages to amuse children. There remain 3888 animals which were submitted to operation under an anaesthetic. In the greater number of these cases the animal was killed then and there under the anaesthetic, without recovering consciousness. In the remaining cases the animal was allowed to recover, and to be kept for observation; but no further observation of any kind, which could cause pain, was allowed to be made on it, unless it were again placed under an anaesthetic. Many of these cases, thus allowed to recover after an operation, may fairly be compared to an equal number of domestic animals after one of the formal operations of veterinary surgery. These observations made under Certificate B form but a very small proportion of the total number of experiments on animals in the United Kingdom; and they have led, in recent years, to discoveries of the very utmost importance for human life and health.

II. Scientific Results.—We come now to consider the results of experiments on animals, but we must remember that not we alone, but animals also, owe a great debt to them. Great epizootic diseases like anthrax, swine-fever, chicken cholera, silkworm disease, pleuro-pneumonia, glanders, Texas cattle fever, blackleg, tuberculosis in cattle, have killed yearly millions of animals, and have been brought under better control by these experiments. The advantages that have been obtained for man may be arranged under two heads—(A) Physiology, (B) Pathology, Bacteriology and Therapeutics.

A. Physiology

1. *The Blood.*—Galen (A.D. 131) confuted the doctrine of Erasistratus, that the arteries contained πνεῦμα, the breath of life, proving

by experiment that they contain blood. "Ourselves, having tied the exposed arteries above and below, opened them, and showed that they were indeed full of blood." Realdus Columbus (1559), though he did not discover the general or "systematic" circulation of the blood, yet seems to have discovered, by experiment, the pulmonary circulation. "The blood is carried through the pulmonary artery to the lung, and there is attenuated; thence, mixed with air, it is carried through the pulmonary vein to the left side of the heart. Which thing no man hitherto has noted or left on record, though it is most worthy of the observance of all men. . . . And this is as true as truth itself; for if you will look not only in the dead body but also in the living animal, you will always find this pulmonary vein full of blood, which assuredly it would not be if it were designed only for air and vapours. . . . Verily I pray you, O candid reader, studious of authority, but more studious of truth, to make experiment on animals. You will find the pulmonary vein full of blood, not air or *fuligo*, as these men call it, God help them." Harvey's treatise *De Motu Cordis et Sanguinis in Animalibus* was published at Frankfort in 1621. It begins thus: "When by many dissections of living animals, as they came to hand,—*Cum multis vivorum dissectionibus, uti ad manum dabantur*,—I first gave myself to observing how I might discover, with my own eyes, and not from books and the writings of other men, the use and purpose of the movement of the heart in animals, forthwith I found the matter hard indeed and full of difficulty; so that I began to think, with Frascatorius, that the movement of the heart was known to God alone. . . . At last, having daily used greater disquisition and diligence, by frequent examination of many and various living animals—*multa frequenter et varia animalia viva introspiciendo*—I came to believe that I had succeeded, and had escaped and got out of this labyrinth, and therewith had discovered what I desired, the movement and use of the heart and the arteries. And from that time, not only to my friends but also in public in my anatomical lectures, after the manner of the Academy, I did not fear to set forth my opinion in this matter." Here, and again at the end of the Preface, and again in the eighth chapter of the *De Motu*, he puts his experiments in the very foreground of the argument. Take the headings of his first four chapters: 1. *Causae, quibus ad scribendum auctor permotus fuerit.* 2. *Ex vivorum dissectione, qualis fit cordis motus.* 3. *Arteriarum motus qualis, ex vivorum dissectione.* 4. *Motus cordis et auricularum qualis, ex vivorum dissectione.* He had, of course, help from other sources—from anatomy and from physics; but it is certain, from his own words, that he attributed his discovery, in a very great measure, to experiments on animals. Malpighi (1661), professor of medicine at Bologna, by examining with a microscope the lung and the mesentery of the live frog, made out the capillary vessels. He writes to Borelli, professor of mathematics at Pisa, that he has failed in every attempt to discover them by injecting fluids into the larger vessels, but has succeeded by examining the tissues with the microscope: "Such is the divarication of these little vessels coming off from the vein and the artery, that the order in which a vessel ramifies is no longer preserved, but it looks like a network woven from the offshoots of both vessels" (*De Pulmonibus*, 1661). Stephen Hales (1733), rector of Farringdon and minister of Teddington, and a Fellow of the Royal Society, made the first exact estimates of the blood pressure, the real force of the blood, by inserting one end of a vertical glass tube into the crural artery of a mare, and noting the rise of the blood in the tube (*Statical Essays, containing Haemostaticks, &c., 1733*). John Hunter, born 1738, made many observations on the nature and processes of the blood; and, above all, he discovered the facts of collateral circulation. These facts were fresh in his mind when he first ventured, in December 1785, to tie the femoral artery in "Hunter's canal" for the cure of aneurism in the popliteal space. The experiment that gave him his knowledge of the collateral circulation was made on one of the deer in Richmond Park: he tied its external carotid artery, to see what effect would be produced on the shedding of the antler. Some days later he found that the circulation had returned in the antler. He had the buck killed, and found that the artery had been completely closed by the ligature, but the small branches coming from it, between the heart and the ligature, were enlarged and were in communication with others of its branches beyond the ligature; and by this collateral circulation the flow of blood to the antler had been restored. Among later observations on the circulation must be mentioned the use of the mercurial manometer by Poiseuille (1828) and Ludwig (1849), the study of the blood pressure within the heart by Hering (1849) and the permanent tracing of the pressure curves by Chauveau and Marey (1863). Finally came the study of those more abstruse problems of the circulation that the older physiologists had left alone—the influences of the central nervous system, the relations between blood pressure and secretion, the automatism of the heart-beat, and the influence of gravitation. Professor Starling, in 1906, writes as follows of this part of physiology: "Among the researches of the last thirty years, those bearing on the circulation of the blood must take an important place, both for their physiological interest and for the weighty influence they have exerted on our knowledge and treatment of disorders of the vascular system, such as heart disease. We have learned to measure accurately the work done by the great heart-pump; and by studying the manner in which this work is affected by different conditions, we are enabled to increase or diminish it, according to the needs of the organ. Experiments in what is often regarded as the most transcendental department of physiology—*i.e.* that which treats of muscle and nerve—have thrown light on the wonderful process of 'compensation' by which a diseased heart is able to keep up a normal circulation." And Dr James Mackenzie, writing in 1910 of certain irregularities of the circulation during pregnancy (venous pulse in the neck and irregular beat of the heart), says, very emphatically, that these conditions in patients have been interpreted by experiments on animals. "The outcome of these researches [Wenckebach's clinical studies], as well as those of a great number of other observers, has been to elucidate the nature and meaning of a great number of abnormal conditions of the heart. It might be said with truth that, whereas a few years ago irregular action of the heart was one of the most obscure symptoms in clinical medicine, it is now one of the best understood. It is needless to repeat that this advance would have been absolutely impossible without the knowledge gained by experiment" (Research Defence Society, May 1910).

2. *The Lacteals.*—Asellius (1622) by a single experiment demonstrated the flow of chyle along the lacteals. The existence of these minute vessels had been known even to Galen and Erasistratus, but they had made nothing of their knowledge. Asellius says: "I observed that the nerves of the intestines were quite distinct from these white threads, and ran a different course. Struck with this new fact, I was silent for a time, thinking of the bitter warfare of words among anatomists as to the mesenteric veins and their purposes. When I came to myself, to satisfy myself by an experiment, I pierced one of the largest cords with a scalpel. I hit the right point, and at once observed a white liquid like milk flowing from the divided vessel." Jehan Pecquet (1647), in the course of an experiment on the heart, observed the flow of chyle into the subclavian vein, and its identity with the chyle in the lacteals; and by further experiment found the thoracic duct, and the chyle flowing up it: "I perceived a white substance, like milk, flowing from the vena cava ascendens into the pericardium, at the place where the right auricle had been. . . . . I found these vessels (the thoracic duct) all along the dorsal vertebrae, lying on the spine, beneath the aorta. They swelled below a ligature; and when I relaxed it, I saw the milk carried to the orifices that I had observed in the subclavian vein." The existence of this duct, which is empty and collapsed after death, had been overlooked by Vesalius and all the great anatomists of his time.

3. *The Gastric Juice.*—Our knowledge about digestion dates back to the end of the 17th century, when Valisnieri first observed that the stomach of a dead animal contained a fluid which acted on certain bodies immersed in it—"a kind of *aqua fortis*." In 1752 Réaumur began his observations on this fluid, making birds swallow fine fenestrated tubes containing grain or meat, or sponges with threads attached; and observed that digestion consists in the dissolution of food, not in any sort of mechanical action or trituration. His observations were extended and perfected by Spallanzani (1777). Then came a period of uncertainty, without further advance; until in 1823 the French Academy offered a prize for the best work on the subject, and Tiedemann and Gmelin submitted their observations to them: "The work of Tiedemann and Gmelin is of especial interest to us on account of the great number of their experiments, from which came not only the absolute proof of the existence of the gastric juice, but also the study of the transformation of starch into glucose. Thus the theory of digestion entered a new phase: it was finally recognized, at least for certain substances, that digestion is not simply dissolution, but a true chemical transformation" (Claude Bernard, *Physiologie opératoire*, 1879). Beaumont's experiments on Alexis St Martin (*vide supra*) were published in 1838. They were, of course, based on the work of the physiologists: "I make no claim to originality in my opinions as respects the existence and operation of the gastric juice. My experiments confirm the doctrines (with some modifications) taught by Spallanzani and many of the most enlightened physiological writers" (Beaumont's preface to his book). Eberlé, in 1834, showed how this knowledge of the gastric juice might be turned to a practical use, by extracting it from the mucous membrane of the stomachs of animals after death: hence came the invention of the various preparations of pepsin. Later, Blondlot of Nancy, in 1842, studied the gastric juice by the method of a fistula, like that of St Martin. More recent observations have been made on the movements of the stomach during digestion, and on the influences of the nervous system on the process.

The stomach is, of course not the only organ of digestion: the liver, the pancreas and the intestinal glands, all are concerned. The recent work of Pawlow and of Starling has greatly advanced our knowledge of the actions of the secretions from these organs. The whole chain of processes, nervous and chemical, psychical and physical, from the taking of food into the mouth to the expulsion of the waste residue, is now viewed in its entirety; and especial study has been given to the influences, nervous or chemical, which are exercised, as it were, on a particular tract of the digestive system, at the bidding of another tract. Pawlow, recognizing the importance of keeping the animals under the most normal conditions that were possible, and of studying the different tracts of the digestive system in animals not anaesthetized, yet free from pain or distress, made use of fistulae established at different points of the digestive canal, and was able to study the digestive juices at different stages during digestion, without causing pain to the animals. The work of Pawlow has been further developed by Professor Starling's recent work on the chemical substances produced in the body, during the act of digestion, to promote digestion.

4. *Glycogen.*—Claude Bernard's work on the assimilation and destruction of sugar in the body was begun in 1843. His discovery of the glycogenic action of the liver was made by keeping two dogs on different diets, one with sugar, the other without it, then killing them during digestion, and testing the blood in the veins coming from the liver: "What was my surprise when I found a considerable quantity of sugar in the hepatic veins of the dog that had been fed on meat only, and had been kept for eight days without sugar! . . . Finally, after many attempts—*après beaucoup d'essais et plusieurs illusions que je fus obligé de rectifier par des tâtonnements*—I succeeded in showing, that in dogs fed on meat the blood passing through the portal vein (from the stomach) does not contain sugar before it reaches the liver; but when it leaves the liver and comes by the hepatic veins into the inferior vena cava, this same blood contains a considerable quantity of a sugary substance (glucose)" (*Nouvelle fonction du foie*, Paris, 1853).

5. *The Pancreas.*—The 17th century was a time of very fanciful theories about the pancreas (Lindanus, Wharton, Bartholini), which need not be recalled here. But Sylvius (François de Bois) had the wisdom to see that the pancreas must be estimated, not according to its position, but according to its structure, as of the nature of the salivary glands. He urged his pupil, Regnier de Graaf, to study it by experiment, and de Graaf says: "I put my hand to the work; and though many times I despaired of success, yet at last, by the blessing of God on my work and prayers, in the year 1662 I discovered a way of collecting the pancreatic juice." By the method of a fistula he collected and studied the secretion of the pancreas; and by further experiment he refuted Bartholini's theory that the pancreas was a sort of appanage or "biliary vesicle" of the spleen. But he got no help from the chemistry of his time; he could no more discover the amylolytic action of the pancreatic secretion than Galvani could discover wireless telegraphy. Still, he did good work; and Claude Bernard, 180 years later, went back to de Graaf's method of the fistula. His observations, begun in 1846, received a prize from the French Academy in 1850. Sir Michael Foster says of them: "Valentin, it is true, had in 1844 not only inferred that the pancreatic juice had an action on starch, but confirmed his view by actual experiment with the juice expressed from the gland; and Eberlé had suggested that the juice had some action on fat; but Bernard at one stroke made clear its threefold action. He showed that it on the one hand emulsified, and on the other hand split up into fatty acids and glycerine, the neutral fats; he clearly proved that it had a powerful action on starch, converting it into sugar; and lastly, he laid bare its remarkable action on proteid matters." At a later date it was discovered that the pancreas, beside its work in digestion, has an "internal secretion": that it, like the thyroid gland and the suprarenal capsules, helps to keep the balance of the general chemistry of the whole body. Professor Schäfer, writing in 1894, says on this subject: "It was discovered a few years ago by von Mering and Minkowski that if, instead of merely diverting its secretion, the pancreas is bodily removed, the metabolic processes of the organism, and especially the metabolism of carbo-hydrates, are entirely deranged, the result being the production of permanent diabetes. But if even a very small part of the gland is left within the body, the carbo-hydrate metabolism remains unaltered, and there is no diabetes. The small portion of the organ which has been allowed to remain (and which need not even be left in its proper place, but may be transplanted under the skin or elsewhere) is sufficient, by the exchanges which go on between it and the blood generally, to prevent those serious consequences to the composition of the blood, and the general constitution of the body, which result from the complete removal of this organ." This fact, that complete removal of the pancreas, in a cat or a dog, may cause fatal diabetes, is of importance, because the pancreas in some cases of diabetes in man is diseased: but, at present, experiments on animals have not led to any certain or specific cure of diabetes in man.

6. *The Growth of Bone.*—The experiments made by du Hamel (1739–1843) on the growth of bone by deposit from the periosteum (the thin membrane ensheathing each bone) rose out of Belchier's observation (1735) that the bones take up the stain of madder mixed with the food. Du Hamel studied the whole subject very carefully, and discovered this bone-producing power of the periosteum, which is an important fact in all operations on the bones. As he puts it, in the title of one of his own memoirs, *Les os croissent en grosseur par l'addition de couches osseuses qui tirent leur origine du périoste, comme le corps ligneux des Arbres augmente en grosseur par l'addition de couches ligneuses qui se forment dans l'écorce.* By feeding pigs at one time with dyed food, at another with undyed food, he obtained their bones in concentric layers alternately stained and unstained. His facts were confirmed by Bazan (1746) and Boehmer (1751); but his conclusions, unfortunately, were opposed by Haller. Still, he brought men to study the whole subject of the growth of bones, in length as well as in thickness, and the whole modelling of the bones, in adult life, by deposit and absorption. Bichat, John Hunter, Troja and Cruveilhier took up his work in physiology and in surgery. Later, from the point of view of surgery, Syme (1837) and Stanley (1849) made experiments on the growth of bone, and on the exfoliation of dead bone; and, after them, Ollier, whose influence on this part of surgical practice has been of the very highest value.

7. *The Nervous System.*—*A.* The Nerve-Roots.—Through all the centuries between Galen, who lived in the time of Commodus, and Sir Charles Bell, who lived in the time of George III., no great advance was made in our knowledge of the nervous system. The way of experiment, which had led Galen far ahead of his age, was neglected, and everything was overwhelmed by theories. Bell in London and Magendie in Paris took up the experimental study of the nervous system about where Galen had left it. The question of priority of discovery does not concern us here: we may take Sir Michael Foster's judgment, that Magendie brought exact and full proof of the truth which Bell had divined rather than demonstrated, that the anterior and posterior roots of spinal nerves have essentially different functions—"a truth which is the very foundation of the physiology of the nervous system." The date of Bell's work is 1811, *An Idea of a New Anatomy of the Brain, submitted for the Observation of the Author's Friends.* In it he says: "Considering that the spinal nerves have a double root, and being of opinion that the properties of the nerves are derived from their connexions with the parts of the brain, I thought that I had an opportunity of putting my opinion to the test of experiment, and of proving at the same time that nerves of different endowments were in the same cord (the same nerve-trunk) and held together by the same sheath. On laying bare the roots of the spinal nerves I found that I could cut across the posterior fasciculus of nerves, which took its origin from the spinal marrow, without convulsing the muscles of the back; but that on touching the anterior fasciculus with the point of the knife, the muscles of the back were immediately convulsed. Such were my reasons for concluding that the cerebrum and cerebellum were parts distinct in function, and that every nerve possessing a double function obtained that by having a double root. I now saw the meaning of the double connexion of the nerves with the spinal marrow, and also the cause of that seeming intricacy in the connexions of nerves throughout their course, which were not double at their origins." His other work, on the cranial nerves, which are "not double at their origins," bore fruit at once in surgery. Sir John Erichsen says of it: "Up to the time that Sir Charles Bell made his experiments on the nerves of the face, it was the common custom of surgeons to divide the facial nerve for the relief of neuralgia, *tic douleureux*; whereas it exercises, and was proved by Sir Charles Bell to exercise, no influence over sensation, and its division consequently for the relief of pain was a useless operation."

B. Reflex Action.—The observations made by Sir Robert Boyle, Redi, Le Gallois and others on the reflex movements of decapitated vipers, frogs, eels and butterflies were of no great use from the point of view of physiology; but they led toward the discovery that nerve-power is stored in the spinal cord, and is liberated thence in action independent of the higher cerebral centres. Marshall Hall (1832–1837) discovered, by his experiments, that reflex actions are the work of definite groups of cells, set at certain points or levels in the cord; he proved the segmental structure of the cord, the existence of nerve-centres in it, and thus foreshadowed the discovery of the like centres in the brain. In his earlier writings (1832–33) he extended the principles of the doctrines of reflex action to the larynx, the pharynx and the sphincter muscles; later, in 1837, he demonstrated the course of nerve-impulses within the cord, from one level to another, and the effects of direct stimulation of the cord. Also he noted the effects of opium and of strychnine on reflex action; and the reflex character of the convulsions that occur in certain diseases.

C. The Medulla Oblongata and the Cerebellum.—Flourens, who was among the earliest students of the use of chloroform, is best known for his experiments on the respiratory centre and the cerebellum. He localized the cells in the medulla that govern the reflex movement of respiration. Afterward came the discovery of cardiac and other centres in the neighbourhood of the respiratory centre. He showed also that the cerebellum is concerned with the equilibration and co-ordination of the muscles; that an animal, a few days old, deprived of sensation and consciousness by removal of the cerebral hemispheres, was yet able to stand and to move forward, but when the cerebellum also was removed, lost all power of co-ordination (*Recherches expérimentales*, Paris, 1842). And from the observations made by him and by others, it was found that the semicircular canals of the internal ears are the terminal organs of the sense of equilibration.

D. The Vaso-Motor Nerves.—Claude Bernard, studying the sympathetic nervous system, discovered the vaso-motor nerves that control the calibre of the arteries. The question of priority between him and Brown Séquard need not be considered here. His first account of his work was communicated to the *Société de Biologie* in December 1851. The following account of it is from his *Leçons de physiologie opératoire* (1879):—

"Let me remind you how I was led to discover the vaso-motor nerves. Starting from the clinical observation, made long ago, that in paralysed limbs you find at one time an increase of cold and at another an increase of heat, I thought that this contradiction might be explained by supposing that, side by side with the general action of the nervous system, the sympathetic nerve might have the function of presiding over the production of heat; that is to say, that in the case where the paralysed limb was chilled, I supposed the sympathetic nerve to be paralysed, as well as the motor nerves; while in the paralysed limbs that were not chilled the sympathetic nerve had retained its function, the systematic nerves alone having been attacked. This was a theory, that is to say, an idea, leading me to make experiments; and for these experiments I must find a sympathetic nerve-trunk of sufficient size, going to some organ that was easy to observe; and must divide the trunk to see what would happen to the heat-supply of the organ. You know that the rabbit's ear, and the cervical sympathetic of this animal, offered us the required conditions. So I divided this nerve; and, at once, the experiment gave the lie direct to my theory—*Je coupai donc ce filet et aussitôt l'expérience donna à mon hypothèse le plus éclatant démenti.* I had thought that the section of the nerve would suppress the function of nutrition, of calorification, over which the sympathetic system had been supposed to preside, and would cause the hollow of the ear to become chilled; and here was just the opposite, a very warm ear, with great dilatation of its vessels." The experiments of Budge and Waller (1853) and of Schiff (1856) threw light on the action of these vaso-motor nerves, and on the place of the vaso-motor centre in the cord; and in 1858 Claude Bernard, by his experiments on the chorda tympani and the submaxillary gland, demonstrated their twofold influence, either to dilate or to constrict the vessels. "It is almost impossible to exaggerate the importance of these labours of Bernard on the vaso-motor nerves, since it is almost impossible to exaggerate the influence which our knowledge of the vaso-motor system, springing as it does from Bernard's researches as from its fount and origin, has exerted, is exerting, and in widening measure will continue to exert, on all our physiological and pathological conceptions, on medical practice, and on the conduct of human life. There is hardly a physiological discussion of any width in which we do not sooner or later come on vaso-motor questions" (Foster, *Life of Claude Bernard*).

E. Cerebral Localization.—The study of the motor and sensory centres of the cerebral hemispheres began in clinical observation. Observation of cases, and examination of the brain after death (Bouillard, 1825, Dax, 1836, Broca, 1861), led men to believe that a particular area of the left frontal lobe of the brain did indeed govern and permit the use of speech. Physiological experiments had nothing to do with the discovery of the speech centres. "Bouillard in 1825 collected a series of cases to show that the faculty of speech resided in the frontal lobes. In 1861 his views were brought by Aubertin before the notice of the Anthropological Society of Paris. Broca, who was present at the meeting, had a patient under his care who had been aphasic for twenty-one years, and who was in an almost moribund state. The autopsy proved of great interest, as it was found that the lesion was confined to the left side of the brain, and to what we now call the third frontal convolution. . . . In a subsequent series of fifteen typical cases examined, it was found that the lesion had destroyed, among other parts, the posterior part of the third frontal in fourteen" (Hamilton, *Text-Book of Pathology*). From this clinical fact, that the movements of speech depend on the integrity of a special area of the brain's surface, and from the facts of "Jacksonian epilepsy," and similar observations in medicine and surgery, began the experimental work of cerebral localization, by Hitzig, Goltz, Schiff, Ferrier, Yeo, Horsley, Beevor and many more. It would be hard to find a more striking instance of the familiar truth that science and practice work hand in hand.

Again, the experimental method has thrown a flood of light on the minute anatomy of the central nervous system. For example, we have what is called Marchi's method; it was described to the Royal Commission (1906–8) by Dr Head and Sir Victor Horsley. It was found, by Professor Waller, that nerve-fibres, separated from the nerve-cells which nourish them, degenerate in a definite way. The application of this law experimentally has been of great value. "Let me," says Dr Head, "just take a simile. Imagine a wall covered with creepers arising from several stems. If we wished to know from which of these stems any one branch takes its origin, we could cut one stem, and every leaf arising from it would die, marking out among the healthy foliage the offshoots of the divided stem. This is the principle that has been used in tracing the paths in the nervous system. Gowers, by applying this method, discovered the ascending tracts in the lateral columns of the spinal cord." If a microscopic section of a spinal cord, containing some fibres thus degenerate, be treated with osmic acid (Marchi's method), the degenerate fibres show dark: and in this way their course may be traced at all levels of the cord.

Indeed, it may truly be said that, alike in anatomy and in physiology, the whole present knowledge of the brain, the spinal cord and the nerves, is in great measure due to the use of experiments on animals. And this knowledge is daily applied to the diagnosis and treatment of diseases and injuries of the central nervous system. "In the case of operations on the brain, you have to form your opinion as to what is going on entirely from your knowledge of the physiology of the brain: and that we owe, of course, in the greatest measure to the discoveries of Hitzig and Fritsch and Ferrier. That has all happened since 1870; and we are now able to cure epilepsy, we are able to cure abscess of the brain, and we are able to cure tumours of the brain. Then, in operations on the spinal cord, the same thing prevails. In fact, the first operation on the spinal cord I am responsible for, so that I know the history of the subject. The technique of that operation I owe entirely to experiments on animals. As regards operations on the peripheral nerves, Bell's operative treatment of neuralgia was guided entirely by his experiments on animals. Then we come to the great subject of nerve suture. The initial work bearing upon that subject was carried out by Flourens, who was the first, to my knowledge, to make experiments on animals, to suture nerves together, to investigate their function" (Sir Victor Horsley, evidence before the Royal Commission, vol. iv. p. 124).

[These notes cover a part only of the results that have been obtained in physiology by the help of experiments on animals. The work of Boyle, Hunter, Lavoisier, Despretz, Regnault and Haldane, on animal heat and on respiration; of Petit, Dupuy, Breschet and Reid, on the sympathetic system; of Galvani, Volta, Haller, du Bois-Reymond and Pflüger, on muscular contraction—all these subjects have been left out, and many more. In his evidence before the Royal Commission (1875), Mr Darwin said: "I am fully convinced that physiology can progress only by the aid of experiments on living animals. I cannot think of any one step which has been made in physiology without that aid."]

B. PATHOLOGY, BACTERIOLOGY AND THERAPEUTICS

1. *Inflammation.*—Pathology is so intimately associated with the work of the microscope that it is a new study, in comparison with physiology. In 1850 the microscope was not in general use as it is now; nor did men have the lenses, microtomes and staining fluids that are essential to modern histology. Bacteriology, again, is even younger than pathology. In 1875 it had hardly begun to exist. For example, in the evidence before the Royal Commission (1875) one of the witnesses said that they "believed they were beginning to get an idea of the nature of tubercle." Anthrax was the first disease studied by the methods of bacteriology; and in his evidence concerning this disease, Sir John Simon speaks of bacteriology as of a discovery wholly new and unexplored. Then, in 1881, came Koch's discovery of the bacillus of tubercle. But a great advance was made, in days before 1875, by the more general use of the microscope. Every change in the tissues during inflammation—the slowing of the blood stream in the capillary vessels, the escape of the leucocytes through their walls into the surrounding tissues, the stagnation of the blood in the affected part—all these were observed in such transparent structures as the web or the mesentery of the frog, the bat's wing, or the tadpole's tail, irritated by a drop of acid, or a crystal of salt, or a scratch with a needle. It was in the course of observations of this kind that Wharton Jones observed the rhythmical contraction of veins, and Waller and Cohnheim observed the escape of the leucocytes, *diapedesis*, through the walls of the capillaries. From these simple experiments under the microscope arose all our present knowledge of the minute processes of inflammation. Later came the work of Metschnikoff and others, showing the importance of *diapedesis* in relation to the presence of bacteria in the tissues.

2. *Suppuration and Wound-Infection.*—Practically every case of suppuration, wound-infection or "blood-poisoning," all abscesses, boils, carbuncles, and all cases of puerperal fever, septicaemia, or pyaemia, are due to infection, either from without or from within the body, by various forms of micro-organisms. The same is true of every case of erysipelas, or cellulitis, or acute gangrene—in short, of the whole multitude of "septic" diseases. The work done on these micrococci, and on other pathogenic micro-organisms, involved the study of the phases, antagonisms and preferences of each kind, their range of variation and of virulence, their products, and the influences on them of air, light, heat and chemical agents. The beginning of Lister's work was in Pasteur's study of the souring of milk, about 1856. Pasteur's discovery, that lactic fermentation was due to a special micro-organism, opened the way for modern surgery. Lister had been long studying the chemical changes in decomposing blood and other animal fluids; now he brought these studies into line with Pasteur's work. Thus, in 1867, in his first published writing on the antiseptic treatment of compound fractures, he speaks as follows: "We find that a flood of light has been thrown upon this most important subject by the philosophic writing of M. Pasteur, who has demonstrated, by thoroughly convincing evidence, that it is not to its oxygen, or to any of its gaseous constituents, that the air owes this property (of producing decomposition), but to minute particles suspended in it, which are the germs of various low forms of life long since revealed by the microscope, and regarded

as merely accidental concomitants of putrescence; but now shown by Pasteur to be its essential cause." The present antiseptic method includes the aseptic method. That is to say, the instruments and other accessories of an operation are "sterilized", by heat; and, where heat cannot be applied, as to the patient's skin and the surgeon's hands, antiseptics are used. Modern surgery is both antiseptic and aseptic.

3. *Anthrax.* — The bacillus of anthrax (charbon, malignant pustule, wool-sorter's disease) was the first specific micro-organism discovered. Rayer and Davaine (1850) observed the *petits bâtonnets* in the blood of sheep dead of the disease; and in 1863, when Pasteur's observations on lactic-acid fermentation were published, Davaine recognized that the *bâtonnets* were not blood crystals, but living organisms. Koch afterward succeeded in cultivating the bacillus, and in reproducing the disease in animals by inoculation from these cultures. Pasteur's discovery of preventive inoculation of animals against the disease was communicated to the Académie des Sciences in February 1881; and in May of that year he gave his public demonstration at Pouilly-le-Fort. Two months later, at the International Medical Congress in London, he spoke as follows of this discovery: " . . . La méthode que je viens de vous exposer pour obtenir des vaccins du charbon était à peine connue qu'elle passait dans la grande pratique pour prévenir l'affection charbonneuse. La France perd chaque année pour une valeur de plus de vingt millions d'animaux frappés du charbon, plus de 30 millions, m'a dit une des personnes autorisées de notre Ministère de l'Agriculture; mais des statistiques exactes font encore défaut. On me demanda de mettre à l'épreuve les résultats qui précèdent par une grande expérience publique, à Pouilly-le-Fort, près de Melun. . . . Je la résume en quelques mots; 50 moutons furent mis à ma disposition, nous en vaccinâmes 25, les 25 autres ne subirent aucun traitement. Quinze jours après environ, les 50 moutons furent inoculés par le microbe charbonneux le plus virulent. Les 25 vaccinés résistèrent; les 25 non-vaccinés moururent, tous charbonneux, en cinquante heures. Depuis lors, dans mon laboratoire, on ne peut plus suffire à préparer assez de vaccin pour les demandes des fermiers. En quinze jours, nous avons vacciné dans les départements voisins de Paris près de 20,000 moutons et un grand nombre de bœufs, de vaches et de chevaux." The extent of this preventive vaccination may be judged from the fact that a single institute, the Sero-Therapeutic Institute of Milan, in a single year (1897–98) sent out 165,000 tubes of anti-charbon vaccine, enough to inoculate 33,734 cattle and 98,792 sheep. In France, during the years 1882–93, more than three million sheep and nearly half a million cattle were inoculated. In the *Annales de l'Institut Pasteur*, March 1894, M. Chamberland published the results of these twelve years in a paper entitled "Résultats pratiques des vaccinations contre le charbon et le rouget en France." The mortality from charbon, before vaccination, was 10% among sheep and 5% among cattle, according to estimates made by veterinary surgeons all over the country. With vaccination, the whole loss of sheep was about 1%; the average for the twelve years was 0·94. The loss of vaccinated cattle was still less; for the twelve years it was 0·34, or about one-third %. The annual reports sent to M. Chamberland by the veterinary surgeons represent not more than half of the work. "A certain number of veterinary surgeons neglect to send their reports at the end of the year. The number of reports that come to us even tends to become less each year. The fact is, that many veterinary surgeons who perform vaccinations every year content themselves with writing, 'The results are always very good; it is useless to send you reports that are always the same.' We have every reason to believe, as a matter of fact, that those who send no reports are satisfied; for if anything goes wrong with the herds, they do not fail to let us know it at once by special letters."

The following tables, from M. Chamberland's paper, give the results of Pasteur's treatment against *charbon* during 1882–93, and against *rouget* (swine-measles) during 1886–92. It is to be noted that the mortality from *rouget* among swine, in years before vaccination, was much higher than that from *charbon* among sheep and cattle: "It was about 20%; a certain number of reports speak of losses of 60 and even 80%; so that almost all the veterinary surgeons are loud in their praises of the new vaccination."

It would be too much to say that every country, in every year, has obtained results with this anthrax-vaccine equal to those which have been obtained in France. Nor would it be reasonable to advocate the compulsory or wholesale use of the vaccine in the British Islands, where anthrax is rare. For the general value of the vaccine, however, we have this striking fact, that the use of it has steadily increased year by year. A note from the Pasteur Institute, dated November 29, 1909, says: "Depuis 1882 jusqu'au 1^{er} Janvier 1909, il a été expédié, pour la France, 8,400,000 doses de vaccin anti-charbonneux pour moutons, 1,300,000 pour bœufs. Pour l'étranger, 8,500,000 doses pour moutons, 6,200,000 pour bœufs. Le nombre de doses augmente d'année en année, de sorte que pour l'année 1908 seule il faut compter en tout 1,500,000 doses pour moutons (France et étranger) 1,100,000 pour bœufs." (Two doses are used for each animal.) It remains to be added that a serum-treatment, introduced by Sclavo, has been found of considerable value in cases of anthrax (malignant pustule) occurring in man.

Vaccination against Charbon (France)

Years.	Total Number of Animals Vaccinated.	Number of Reports.	Animals Vaccinated according to Reports received.	Mortality.			Total.	Total Loss per 100.	Average Loss before Vaccination.
				After First Vaccination.	After Second Vaccination.	During the Rest of the Year.			
				Sheep.					
1882	270,040	112	243,199	756	847	1037	2,640	1·08	10%
1883	268,505	103	193,119	436	272	784	1,492	0·77	,,
1884	316,553	109	231,693	770	444	1033	2,247	0·97	,,
1885	342,040	144	280,107	884	735	990	2,609	0·93	,,
1886	313,288	88	202,064	652	303	514	1,469	0·72	,,
1887	293,572	107	187,811	718	737	968	2,423	1·29	,,
1888	269,574	50	101,834	149	181	300	630	0·62	,,
1889	239,974	43	88,483	238	285	501	1,024	1·16	,,
1890	223,611	69	69,865	331	261	244	836	1·20	,,
1891	218,629	65	53,640	181	102	77	360	0·67	,,
1892	259,696	70	63,125	319	183	126	628	0·99	,,
1893	281,333	30	73,939	234	56	224	514	0·69	,,
Total:	3,296,815	990	1,788,879	5668	4406	6798	16,872	0·94	,,
				Cattle.					
1882	35,654	127	22,916	22	12	48	82	0·35	5%
1883	26,453	130	20,501	17	1	46	64	0·31	,,
1884	33,900	139	22,616	20	13	52	85	0·37	,,
1885	34,000	192	21,073	32	8	67	107	0·50	,,
1886	39,154	135	22,113	18	7	39	64	0·29	,,
1887	48,484	148	28,083	23	18	68	109	0·39	,,
1888	34,464	61	10,920	8	4	35	47	0·43	,,
1889	32,251	68	11,610	14	7	31	52	0·45	,,
1890	33,965	71	11,057	5	4	14	23	0·21	,,
1891	40,736	68	10,476	6	4	4	14	0·13	,,
1892	41,609	71	9,757	8	3	15	26	0·26	,,
1893	38,154	45	9,840	4	1	13	18	0·18	,,
Total:	438,824	1255	200,962	177	82	432	691	0·34	,,

Vaccination against Rouget (France)

Years.	Total Number of Animals Vaccinated.	Number of Reports.	Animals Vaccinated according to Reports received.	Mortality.			Total.	Total Loss per 100.	Average Loss before Vaccination.
				After First Vaccination.	After Second Vaccination.	During the Rest of the Year.			
1886	For these two years France and other countries are put together.	49	7,087	91	24	56	171	2·41	20%
1887		49	7,467	57	10	23	90	1·21	,,
1888	15,958	31	6,968	31	25	38	94	1·35	,,
1889	19,338	41	11,257	92	12	40	144	1·28	,,
1890	17,658	41	14,992	118	64	72	254	1·70	,,
1891	20,583	47	17,556	102	34	70	206	1·17	,,
1892	37,900	38	10,128	43	19	46	108	1·07	,,
Total:	111,437	296	75,455	534	188	345	1067	1·45	,,

4. *Tubercle.*—Laennec, who in 1816 invented the stethoscope, recognized the fact that tubercle is a specific disease, not a simple degeneration of the affected tissues. Villemin, in 1865, communicated to the Académie des Sciences the fact that he had produced the disease in rabbits by inoculating them with tuberculous matter; and he appealed to these inoculations—*en voici les preuves*—to show that *La tuberculose est une affection spécifique: Sa cause réside dans un agent inoculable: L'inoculation se fait très-bien de l'homme au lapin: La tuberculose appartient donc à la classe des maladies virulentes.* In 1868 Chauveau produced the disease not by inoculation but by admixture of tuberculous matter with the animals' food. In 1880, after a period of some uncertainty and confusion

of doctrines, Cohnheim reaffirmed the infectivity of the disease, and even made the proof of tubercle depend on inoculation alone: "everything is tuberculous that can produce tuberculous disease by inoculation in animals that are susceptible to the disease; and nothing is tuberculous that cannot do this." In 1881 Koch discovered the tubercle bacillus, and, in spite of the tragic failure of his tuberculin in 1890–91, a vast amount of practical advantage has already issued out of Koch's discovery, both by way of cure and by way of prevention. It has been proved, by experiment on animals, that the sputa of phthisical patients are infective; and this and the like facts have profoundly influenced the nursing and general care of such cases. Bacteriology has brought about (under the safeguard of modern methods of surgery) a thorough and early surgical treatment of all primary tuberculous sores or deposits—the excision of tuberculous ulcers, the removal of tuberculous glands and the like. It has helped us to make an early diagnosis, in obscure cases, by finding tubercle bacilli in the sputa, or in the discharges, or in a particle of the tissues. It has proved, past all reasonable doubt, that *tabes mesenterica*, a disease that kills every year in England alone many thousands of children, may arise from infection of the bowels by the milk of tuberculous cows. And it has helped to bring about the present rigorous control of the milk trade and the meat trade.

The "new tuberculin," now that the use of the opsonic index has guided physicians to a better understanding of the tuberculin treatment, has been found of great value, and is giving excellent results in suitable cases. Moreover, tuberculin is used, because of the reaction that it causes in tuberculous animals, as a test for the detection of latent tuberculosis in cattle. An injection of one to two cubic centimetres under the skin of the neck is followed by a high temperature if the animal be tuberculous. If it be not, there is no rise of temperature, or only a very slight rise. For example, in 1899 this test was applied to 270 cows on farms in Lancashire: 180 reacted to the test, 85 did not, 5 were "doubtful." Tuberculous disease was actually found in 175 out of the 180. Eber of Dresden used the test on 174 animals, of whom 136 reacted, 32 did not react and 6 were doubtful. Of the 136, 22 were slaughtered, and were all found to have tubercle; of the 32, 3 were slaughtered, and were found free. The opinion of Professor M'Fadyean, one of the highest authorities on the subject, is as follows: "I have most implicit faith in tuberculin as a test for tuberculosis when it is used on animals standing in their own premises and undisturbed. It is not reliable when used on animals in a market or slaughter-house. A considerable number of errors at first were found when I examined animals in slaughter-houses after they had been conveyed there by rail, &c. Since that, using it on animals in their own premises, I have found that it is practically infallible. I have notes of one particular case where 25 animals in one dairy were tested, and afterwards all were killed. There was only one animal which did not react, and it was the only animal not found to be tuberculous when killed." This test has now been in regular use for many years in many countries, and it is accepted everywhere as of national importance.

5. *Diphtheria.*—The *Bacillus diphtheriae* (Klebs-Löffler bacillus) was described by Klebs in 1875, and obtained in pure culture by Löffler in 1884. Behring and Kitasato, in 1890, succeeded in immunizing animals against the disease. The first cases treated with diphtheria antitoxin were published in 1893 by Behring, Kossel and Hübner. In England the antitoxin treatment was begun in the latter part of 1894. Besides its curative use, the antitoxin has also been used as a preventive, to stop an outbreak of diphtheria in a school or institute or hospital or village, and with admirable success. (See DIPHTHERIA.)

6. *Tetanus* (lock-jaw).—Experiments on animals have taught us the true nature of this disease, and have led to the discovery of an antitoxin which has given fairly good results. We possess, moreover, a preventive treatment against the disease; though, unfortunately, the time of latency, when the antitoxin is most needed, cannot be recognized. The old, mischievous doctrine that tetanus was due to acute inflammation of a nerve, tracking up from a wound to the central nervous system, was abolished once and for ever by Sternberg (1880), Carle and Rattone (1884) and Nicolaier (1884), who proved that the disease is due to infection by a specific flagellate organism in superficial soil. "It is said to be present in almost all rich garden soils, and that the presence of horse-dung favours its occurrence. There seems to be no doubt as to the ubiquity of the tetanus germ" (Poore, *Milroy Lectures*, 1899). The work of discovering and isolating the bacillus was full of difficulty. Nicolaier, starting from the familiar fact that the disease mostly comes from wounds or scratches contaminated with earth, studied the various microbes of the soil, and inoculated rabbits with garden mould. He produced the disease, and succeeded in finding and cultivating the bacillus, but failed to obtain a pure culture. Kitasato, in 1899, obtained a pure culture. Others studied the chemical products of the bacillus, and were able to produce the symptoms of the disease by injection of these chemical products obtained from cultures, or from the tissues in cases of tetanus. It has been proved that the infection tends to remain local; that the bacilli in and near the wound pour thence into the blood their chemical products, and that these have a selective action, like strychnine, on the cells of the central nervous system. Therefore the rule that the wounded tissues should be at once excised, in all cases where this can possibly be done, has received confirmation. Before Nicolaier, while men were still free to believe that tetanus was the result of an acute ascending neuritis, this rule was neither enforced nor explained.

As a preventive against tetanus, in man or in animals, the antitoxin has proved of the very utmost value. This has been shown in a striking way in America. "One of the wounds most commonly followed by lock-jaw is the blank-cartridge wound of the hand common on the glorious Fourth of July. The death-rate from these wounds is appalling. An active campaign has been conducted throughout the medical profession to reduce this mortality. All over the country, surgeons and medical journals have advised the injection of tetanus antitoxin in every case of blank-cartridge wound. The American Medical Association has compiled statistics of Fourth of July fatalities for the past six years. In 1903, the Fourth of July tetanus cases numbered 416. Then physicians began a more general use of antitoxin in all cases of blank-cartridge and common cracker wounds. As a result of this campaign of prophylaxis by antitoxin injections, from 416 cases of tetanus in 1903 the number dropped to 105 cases in 1904, 104 cases in 1905, 89 cases in 1906, 73 cases in 1907 and 55 cases in 1908. This reduction in the number of tetanus cases took place while the number of accidents remained practically the same each year, and while the number of deaths from causes other than tetanus was steadily rising from 60 in 1903 to 108 in 1908. It is thus evident that the saving of at least 300 lives from tetanus has been accomplished each year through the prophylactic use of antitoxin in the cases of Fourth of July wounds alone" (James P. Warbasse, M.D., *The Conquest of Disease through Animal Experimentation*, Appleton & Co., 1910).

The preventive use of the serum in veterinary practice has yielded admirable results. In some parts of the world tetanus is terribly common among horses. Nocard of Lille has reported as follows: "The use of anti-tetanus serum as a preventive has been in force for some years in veterinary practice in cases of wounds or surgical procedures. To this end the Pasteur Institute has supplied 7000 doses of anti-tetanus serum, a dose being 10 cubic centimetres; a quantity which has sufficed to treat preventively 3100 horses in those parts of the country where tetanus is endemic. Among these there has been no death from tetanus. In the case of one horse, injected five days after receiving a wound, tetanus developed, but the attack was slight. During the same time that these animals were injected, the same veterinary surgeon observed, among animals not treated by injection, 259 cases of tetanus" (*Lancet*, August 7, 1897).

7. *Rabies* (hydrophobia).—The date of the first case treated by Pasteur's preventive method—Joseph Meister, an Alsatian shepherd-boy—is July 1885. The existence of a specific micro-organism of rabies was a matter of inference. The incubation period of the disease is so variable that no preventive treatment was possible unless this incubation period could be regulated. Inoculations of the saliva of a rabid animal, introduced under the skin of animals, sometimes failed; and if they succeeded, the incubation period of the disease thus induced was hopelessly variable. Next, Pasteur used not saliva, but an emulsion of the brain or the spinal cord; because the central nervous system is the chief seat of the poison. But this emulsion, introduced under the skin, was also uncertain in action, and gave no fixed incubation period. Therefore, he argued, as the poison has a selective action on the nerve cells of the central nervous system, and a sort of natural affinity with them, it must be introduced directly into them, where it will have its proper environment; the emulsion must be put not under the skin, but under the *dura mater* (the membrane enveloping the brain). These subdural inoculations were the turning-point of his work. By transmitting the poison through a series of rabbits, by subdural inoculation of each rabbit with a minute quantity of nerve tissue from the rabbit that had died before it, he was able to intensify the poison, to shorten its period of incubation, and to fix this period at six days. Thus he obtained a poison of exact strength, a definite standard of virulence, *virus fixe*: the next rabbit inoculated would have the disease in six days, neither more nor less. By gradual drying, after death, of the cords of rabid animals, he was able to attenuate the poison contained in them. The spinal cord of a rabbit that has died of rabies slowly loses virulence by simple drying. A cord dried for four days is less virulent than a cord dried for three, and more virulent than a cord dried for five. A cord dried for a fortnight has lost all virulence; even a large dose of it will not produce the disease. By this method of drying, Pasteur was able to keep going one or more series of cords, of known and exactly graduated strengths, according to the length of time they had been dried, ranging from absolute non-virulence through every shade of virulence.

As with fowl cholera and anthrax, so with rabies: the poison, attenuated till it is innocuous, can yet confer immunity against a stronger dose of the same poison. A man, bitten by a rabid animal, has at least some weeks of respite before the disease can break out; and during that time of respite he can be immunized against the disease, while it is still dormant. He begins with a dose of poison attenuated past all power of doing harm, and advances day by day to more active doses, guarded each day by the dose of the day before, till he has manufactured within himself enough antitoxin to make him proof against any outbreak of the disease. (See HYDROPHOBIA.)

8. *Cholera.*—The specific organism of Asiatic cholera, the "comma-bacillus," was discovered by Koch in 1883; but such a multitude of difficulties arose over it that it was not universally recognized as the real cause of the disease before 1892, the year of the epidemic at Hamburg. The discovery of preventive inoculation was the work of many men, but especially of Haffkine, one of Pasteur's pupils. Ferran's earlier inoculations in Spain (1885) were a failure. Haffkine's first inoculations were made in 1893. At Agra, in April 1893, he vaccinated over 900 persons; and from Agra went to many other cities of India. Altogether, in twenty-eight months (April 1893–July 1895) no less than 42,179 persons were vaccinated (many of them twice) in towns, cantonments, gaols, tea estates, villages, schools, &c., "without having to record a single instance of mishap or accident of any kind produced by our vaccines." (See CHOLERA.)

9. *Bubonic Plague.*—The *Bacillus pestis* was discovered in 1894 by Kitasato and Yersin, working independently. The preventive treatment was worked out by Haffkine in 1896: "Twenty healthy rabbits were put in cages. Ten of them were inoculated with Haffkine's plague vaccine. Then both the vaccinated rabbits and the other ten rabbits that had not been vaccinated were infected with plague. The unprotected rabbits all died of the disease, and in their bodies innumerable quantities of the microbes were found. But the vaccinated rabbits remained in good health. Professor Haffkine then vaccinated himself and his friends. This produced some fever, from which, after a day or two, they recovered. Plague broke out in Byculla Gaol, in Bombay, in January 1897. About half the prisoners volunteered to be inoculated. Of these, 3 developed plague on the day of inoculation, and it is probable that they had already plague before the treatment was carried out. Of the remaining 148 who were inoculated, only 2 were afterwards attacked with plague, and both of them recovered. At the same time, of the 173 who had not been vaccinated, 12 were attacked, and out of these 6 died." (See PLAGUE.)

10. *Typhoid Fever.*—The *Bacillus typhosus* was discovered by Klebs, Eberth and Koch in 1880–81. The first protective inoculations in England were made at Netley Hospital in 1896 by Sir Almroth Wright and Surgeon-Major Semple: 16 medical men and 2 others offered themselves as subjects. The first use of the vaccine during an actual outbreak of typhoid was in October 1897 at the Kent County Asylum: "All the medical staff and a number of attendants accepted the offer. Not one of those vaccinated—84 in number—contracted typhoid fever; while of those unvaccinated, and living under similar conditions, 16 were attacked. This is a significant fact, though it should in fairness be stated that the water was boiled after a certain date, and other precautions were taken, so that the vaccination cannot be said to be altogether responsible for the immunity. Still, the figures are striking" (*Lancet*, March 1898). In 1899 Wright vaccinated against typhoid more than 3000 of the Indian army, at Bangalore, Rawal Pindi and Lucknow. Government has now sanctioned voluntary inoculation against typhoid, at the public expense, among the British troops. "All regiments leaving for the tropics are offered this inoculation, and each year a larger percentage of the soldiers are accepting it. Here are some of the statistics: In August and September 1905, 150 men of a single regiment were inoculated: of these, 23 refused to accept a second inoculation. The regiment reached India, September 28. A month later, typhoid fever broke out; and during the following few months 63 cases were observed in the regiment. With but two exceptions, the disease attacked only the men who had not been inoculated, and both of these exceptions were men who had refused a second inoculation. Careful experiments were made with the second battalion of Royal Fusiliers in India in 1905 and 1906. The average strength of this regiment was 948 men. During the two years, 284 were inoculated with Wright's anti-typhoid vaccine. The regiment had a total of 46 cases of typhoid. Thirty-five of these were men who had not been inoculated; 9 had been inoculated. Five of the uninoculated died; none of the inoculated died. Another Indian regiment, the 17th Lancers, in 1905, 1906 and 1907 inoculated about one-third of its men. During the three years it had 293 cases of typhoid fever. There were 44 deaths, with not a single death of an inoculated man. During the first half of 1908, in the largest seven Indian stations where careful records were kept, out of a total of 10,420 soldiers, 2207 volunteered for inoculation. Typhoid developed in 2% of the uninoculated, and in less than 1% of the inoculated men. Forty-five deaths occurred. Five per cent of these deaths were among the uninoculated and 1% was among the inoculated men. . . . In the United States army, a medical board has strongly recommended anti-typhoid vaccinations, and vaccination is now offered to those who desire it. Already 2000 soldiers have voluntarily received inoculation. The German army has adopted the same means of prophylaxis, and is pushing it vigorously" (Warbasse, *loc. cit.*).

Beside the preventive treatment, bacteriology has given us "Widal's reaction" for the early diagnosis of the disease—a matter of the very highest practical importance. A drop of blood, from the finger of a patient suspected to be suffering from typhoid fever, is diluted fifty or more times, that the perfect delicacy of the test may be ensured; a drop of this dilution is mixed with a nutrient fluid containing living bacilli of typhoid, and a drop of this mixture is observed under the microscope. The motility of the bacilli is instantaneously or very quickly arrested, and in a few minutes the bacilli begin to aggregate together into clumps. This "clumping" is also made visible to the naked eye by the subsidence of the agglutinated bacilli to the bottom of the containing vessel. The amazing delicacy of "Widal's test" is but a part of the wonder. Long after recovery, a fiftieth part of a drop of the blood will still cause clumping: it has even been obtained from an infant whose mother had typhoid shortly before the child was born. A drop of blood from a case suspected to be typhoid can now be sent by post to be tested a hundred miles away, and the answer telegraphed back.

11. *Malta Fever* (Mediterranean fever).—The *Micrococcus Melitensis* was discovered in 1887 by Sir David Bruce. The work of discovering and preparing an immunizing serum was done at Netley Hospital. In this fever, as in typhoid and some others, Widal's test is of great value: "The diagnosis of Malta fever from typhoid is, of course, a highly important practical matter. It is exceedingly difficult in the early stages" (Manson). Even in a dilution of 1 in 1000, the blood of Malta fever can give the typical reaction with the *Micrococcus Melitensis*; and this occurred in a case at Netley of accidental inoculation with Malta fever: one of three cases that have happened there. The case is reported in the *British Medical Journal*, October 16, 1897: "It appears that he had scratched his hand with a hypodermic needle on September 17, when immunizing a horse for the preparation of serum-protective against Malta fever; and his blood, when examined, had a typical reaction with the micrococcus of Malta fever in 1000-fold dilution. The horse, which has been immunized for Malta fever for the last eight months, was immediately bled, and we are informed that the patient has now had two injections, each of 30 cub. cm. of the serum. He is doing well, and it is hoped that the attack has been cut short." About 50 cases of the fever, by April 1899, had been treated at Netley. The *Lancet*, April 15, 1899, says that the treatment was "with marked benefit: whereas they found that all drug treatment failed, the antitoxin treatment had been generally successful." Happily, it has now been proved that the usual source of infection with Malta fever is the drinking of the milk of infected goats: thus, by the avoidance, or by the careful and thorough boiling of the milk, the fever may be prevented: and prevention is better than cure. In 1904 a commission was sent out to Malta by the Royal Society, at the request of our government, to discover how the fever is conveyed to man. They found that it is not conveyed by air, or by drinking-water, or by pollution of sewage, or by contact; nor are its germs carried, like those of malaria, yellow fever and sleeping sickness, by insects. They found that it might be conveyed in food. Therefore Bruce examined the milch-goats, since goats' milk is universally drunk in Malta. The goats looked healthy enough, but it was found that the blood of 50% of them gave the Widal reaction, and that some 10% of them were actively poisonous: monkeys fed on milk from one of them, even for one day, almost invariably got the disease. On the 1st of July 1906, an official order was issued forbidding the supply of goats' milk to our garrison. The year before, there had been 643 cases among our soldiers alone. In 1906, up to the 1st of July, there were 123 cases. During the rest of the year, including the three worst months for the fever, there were 40 cases. In 1907 there were 11 cases; in 1908 there were 5 cases; in 1909 there was 1 case; in 1910, by latest accounts, none.

12. *Epidemic Meningitis.*—The history of the serum treatment of epidemic meningitis affords an admirable example of the place of experiments on animals in the advancement of medical practice. This form of meningitis is one of the worst ways in which a man can die. Dr Robb, who had charge of the Belfast fever hospitals during an epidemic in Belfast, calls it "the most terrible in its manifestations, and the most disastrous in its death-rate, of all the epidemic diseases met with in English-speaking countries." Very little is known as to the way in which it spreads, and the public health authorities cannot prevent its sudden appearance in a town. "Many of those attacked," says Dr Robb, "died within a few hours of the onset, and that after terrible suffering; while many of those who survived the acute attack lingered on for weeks and months, going steadily downhill in spite of every effort to save them. Again, many of those who did survive were left permanently maimed." That is the usual picture of the disease when it is left to the older methods of treatment.

By means of inoculation experiments, Dr Flexner and Dr Jobling, of the Rockefeller Institute, proved that the disease is due to a particular kind of germ, diplococcus intracellularis. They obtained these germs from the bodies of patients who had died of the disease; they cultivated the germs all by themselves, in test tubes, apart from all other kinds of germs; and they were able to reproduce the disease in monkeys by injecting under the skin a minute quantity of this pure culture of the germs. It may be worth noting that the disease in monkeys is less violent and less painful than it is in man. By the help of these experiments, Flexner and Jobling were able to prepare a serum for the treatment of the disease, in the same way as the serum is prepared which has been such a blessing to the world in cases of diphtheria. This serum for the treatment of epidemic meningitis was first used in the spring of 1907.

The contrast between cases without serum treatment and cases with serum treatment is very plain. We may first give the records before the use of the serum. Of 4000 cases in New York in 1904, 75% died; Baker reports from Greater New York 2113 cases with 1636 deaths, giving 77·4% mortality; Chalmers reports from Glasgow (1907) 998 cases with 683 deaths, giving 68·4% mortality; Bailie reports in Belfast (1907) 623 cases with 493 deaths, giving 79·2% mortality; Ker reports that in the Edinburgh epidemic there was 78% mortality; Robertson reports from Leith (1907) 62 cases with 74·4% mortality; Turnour reports from the Transvaal 200 cases with 74% mortality. Amongst patients treated in hospitals the death-rate was no better. Of 202 cases in Ruchill Hospital, Glasgow, 79·2% died; of 108 cases in Edinburgh Fever Hospital, 80·5% died; of 275 cases in Belfast Fever Hospital, 72·3% died; and Dunn reports that in the Boston Children's Hospital, during the eight years 1899–1907, the mortality varied from 69% to 80%. Contrast with these the results in cases treated with Flexner's and Jobling's Serum:—

	Cases.	Died.	Mortality per cent.
City Hospital, Cincinnati	45	14	31·1
Dr Dunn, Boston	40	9	22·5
Johns Hopkins Hospital, Baltimore	22	4	18·1
Rhode Island Hospital	17	6	35·2
Lakeside Hospital, Cleveland	29	11	37·7
Edinburgh Fever Hospital	33	13	43·3
Mount Sinai Hospital (Children)	15	2	13·3
Municipal Hospital, Philadelphia	21	9	42·7
Belfast Fever Hospital	98	29	29·6

These figures speak for themselves. Similar results have been obtained with similar treatment in France and Germany. "From these figures," says Dr Robb, "it will be seen that the death-rate in cases not treated with serum averaged some 75%. This has been reduced in cases treated with the serum to less than half, and in many instances much below that figure." "My own experience has been that of 275 cases under my care in hospital, before the use of the serum was commenced, 72·3% died; while of the 98 cases treated with serum 29·6% died. No selection of cases was made: every case sent into hospital since September 1907 has been treated in this way. No change in the severity of the attack was observed: in the three months immediately before the serum arrived with us 45 cases came under treatment, of whom 37, or 82%, died; and in the first four months after we began its use in hospital 30 cases were treated, of whom 8 died, a mortality of 26·6%; while of the 34 cases occurring in the city in the same period, but not sent into hospital, and not treated with the serum, over 80% died. Great as this change in the death-rate has been, it is not more striking than the improvement in the course run by the cases; for whereas it was common to have cases running on into weeks and even months, such cases are no longer met with" (R. D. S. pamphlet, 1909).

13. *Malaria.*—Laveran, in 1880, discovered the *Plasmodium malariae*, an amoeboid organism, in the blood of malarial patients. In 1894 Manson took, as a working theory of malaria, the old belief that the mosquito is the intermediate host of the parasite. In 1895 came MacCullum's observations on an allied organism, *Halteridium.* In 1897, after two years' work, Ross found bodies, pigmented like the *Plasmodium*, in the outer coat of the stomach of the grey or "dapple-winged" mosquito, after it had been fed on malarial blood. In February 1898 he started work in Calcutta: "Arriving there at a non-fever season, he took up the study of what may be called 'bird malaria.' In birds, two parasites have become well known—(1) the *Halteridium*, (2) the *Proteosoma* of Labbé. Both have flagellate forms, and both are closely allied to the *Plasmodium malariae*. Using grey mosquitoes and proteosoma-infected birds, Ross showed by a large number of observations that it was only from blood containing the proteosoma that pigmented cells in the grey mosquito could be got; therefore that this cell is derived from the proteosoma, and is an evolutionary stage of that parasite" (Manson, 1898). These pigmented cells give issue to innumerable swarms of spindle-shaped bodies, "germinal rods"; and in infected mosquitoes Ross found these rods in the glands of the proboscis. Finally, he completed the circle of development, by infecting healthy sparrows by causing mosquitoes to bite them. It would be hard to surpass Ross's work, and that done in Italy by Grassi and others, for fineness and carefulness. He says, for instance, "out of 245 grey mosquitoes fed on birds with proteosoma, 178, or 72%, contained pigmented cells; out of 249 fed on blood containing halteridium, immature proteosoma, &c., not one contained a single pigmented cell. . . . Ten mosquitoes fed on the sparrow with numerous proteosoma contained 1009 pigmented cells, or an average of 101 each. Ten mosquitoes fed on the sparrow with moderate proteosoma contained 292 pigmented cells, or an average of 29 each. Ten mosquitoes fed on the sparrow with no proteosoma contained no pigmented cells."

By these and the like observations it was made practically certain that malaria is transmitted from man to man by a special kind of mosquito. Then came the final experiments on man. In 1900 Sambon, Low and Terzi made their famous experiment on themselves in the neighbourhood of Ostia. They put up a little mosquito-proof hut in a neighbourhood "saturated with malaria." In this little hut they lived through the whole of the malaria season, without taking a grain of quinine, and not one of them had a touch of the fever. Then another experiment was made. A consignment of mosquitoes containing blood from a case of malaria was sent from Rome to the London School of Tropical Medicine. Dr Manson and Dr Warren then submitted themselves to being bitten by these mosquitoes, and in due time suffered malarial fever. On these proven facts was founded the whole plan of campaign against malaria. The nature, habits and breeding-places of the mosquito of malaria (*Anopheles maculipennis*) have been studied with infinite care, and are now thoroughly recognized. The task is to destroy its eggs and its larvae, to break the cycle of its life, and to do away with its favourite breeding-places.

14. *Yellow Fever.*—A special mosquito (*Stegomyia*) conveys yellow fever from man to man. The germ, like the germ of rabies, has not yet been made visible under the microscope. It is probably a very minute spirochaete, which undergoes a slow evolution in the body of the mosquito told off for that purpose. The earlier experiments (1810–20) made on themselves by Chervin, Potter, Firth and others were truly heroic, but proved nothing. Finlay (1880–1900) experimented with mosquitoes on himself and other volunteers, and certainly proved the transmissibility of the fever through mosquitoes. Sanarelli (1898) prepared an immunizing serum which gave good results: but the germ which he took to be the specific cause of the fever, having found it in cases of the fever, is not now accepted by bacteriologists as specific. But the great work, which proved to the world the way of infection of yellow fever, was done by the Army Commission of the United States (1900). This Commission was sent to Havana, and the experiments were carried out by Drs Walter Reed, Carrol, Lazear and Agramonte in the Army Camp in Havana. A hut was constructed with two compartments, divided from each other by a wire mosquito-proof screen. In one compartment they placed infected mosquitoes, which had bitten a yellow fever patient within the first three days of the fever. More than twenty volunteers offered themselves for experiment. In one set of experiments, clothing and other material, soiled by the vomit or blood or excretions from cases of the fever, were placed in one of the rooms, and some of the experimenters slept for 21 consecutive nights in contact with these materials, and in some cases in the very sheets on which yellow fever patients had died. Not one of these experimenters took the fever. In another set of experiments, 22 of the experimenters submitted themselves to be bitten by the infected mosquitoes, and in each instance they took the disease. It was thus proved, past all reasonable doubt, that yellow fever cannot be conveyed by ordinary infection, but must be transmitted from man to man through the agency of the mosquito. It might be said, by the opponents of all experiments on animals, that the discovery of these facts has nothing to do with "vivisection." But, as Professor Osler said in his evidence before the Royal Commission (vol. iv. p. 158), these experiments would never have been thought of if it had not been for previous experiments on animals. "The men who made these investigations spent their lives in laboratories, and their whole work has been based on experimentation on animals. They could not otherwise, of course, have ventured to devise a series of experiments of this sort." Out of this work came the wiping out of yellow fever (*q.v.*) from Cuba after the Spanish-American War, and from the area of the Panama Canal.

15. *Sleeping-Sickness.*—Experiments on animals have proved that sleeping-sickness is due to specific germs carried by tse-tse flies from man to man. By measures taken to prevent this way of infection, legions of human lives have been saved or safeguarded.

16. *Infantile Paralysis.*—Flexner, of the Rockefeller Institute, has proved, by experiments on animals, the infective nature of this disease, and its transmissibility by inoculation: a discovery of the very utmost value and significance.

17. *Myxoedema.*—Our knowledge of myxoedema, like our knowledge of cerebral localization, began not in experimental science but in clinical observation (Gull, 1873; Ord, 1877). In 1882–1883 Reverdin and Kocher published cases where removal of the thyroid gland for disease (goître) had been followed by symptoms such as Gull and Ord had described. In 1884 Horsley, by removal of the thyroid gland of monkeys, produced in them a chronic myxoedema, a cretinoid state, the exact image of the disease in man: the same symptoms, course, tissue-changes, mental and physical hebetude, the same alterations of the excretions, the temperature and the voice. In 1888 the Clinical Society of London

published an exhaustive report, of 215 pages, on 119 cases of the disease, giving all historical, clinical, pathological, chemical and experimental facts; but out of 215 pages there is but half a page about treatment, of the useless old-fashioned sort. In 1890 Horsley published the suggestion that a graft of thyroid gland from a newly killed animal should be transplanted beneath the skin in cases of myxoedema: "The justification of this procedure rested on the remarkable experiments of Schiff and von Eisselsberg. I only became aware in April 1890 that this proposal had been in fact forestalled in 1889 by Dr Bircher in Aarau. Kocher had tried to do the same thing in 1883, but the graft was soon absorbed; but early in 1889 he tried it again in five cases, and one greatly improved." In 1891 George Murray published his *Note on the Treatment of Myxoedema by Hypodermic Injections of an Extract of the Thyroid Gland of a Sheep*. Later, the gland was administered in food. At the present time tabloids of thyroid extract are given. We could not have a better example how experiments on animals are necessary for the advancement of medicine. Now, with little bottles of tabloids, men and women are restored to health who had become degenerate in body and mind, disfigured and debased. The same treatment has given back mental and bodily growth to countless cases of sporadic cretinism. Moreover, the action of the thyroid gland has been made known, and the facts of "internal secretion" have been in part elucidated. (Claude Bernard, speaking of the thyroid, the thymus and the suprarenal capsules, said: "We know absolutely nothing about the functions of these organs; we have not so much as an idea what use and importance they may possess, because experiments have told us nothing about them, and anatomy, left to itself, is absolutely silent on the subject.")

18. *The Action of Drugs.*—Even in the 18th century medicine was still tainted with magic and with gross superstition: the 1721 Pharmacopoeia contains substances that were the regular stock-in-trade of witchcraft. Long after 1721 neither clinical observation, nor anatomy, nor pathology brought about a reasonable understanding of the action of drugs: it was the physiologists, more than the physicians, who worked the thing out—Bichat, Magendie, Claude Bernard. Magendie's study of upas and strychnine, Bernard's study of curare and digitalis, revealed the *selective* action of drugs: the direct influence of strychnine on the central nerve-cells, of curare on the terminal filaments of motor nerves.

Two instances may be given how experiments on animals have elucidated the action of drugs. A long list might be made—aconite, belladonna, chloride of calcium, cocain, chloral, ergot, morphia, salicylic acid, strophanthus, the chief diuretics, the chief diaphoretics—all these and many more have been studied to good purpose by this method; but it must suffice to quote here (1) Sir Thomas Fraser's account of digitalis, and (2) Sir Thomas Lauder Brunton's account of nitrite of amyl:—

"1. Digitalis was introduced as a remedy for dropsy; and on the applications which were made of it for the treatment of that disease, a slowing action upon the cardiac movements was observed, which led to its acquiring the reputation of a cardiac sedative. . . . It was not until the experimental method was applied in its investigation, in the first instance by Claude Bernard, and subsequently by Dybkowsky, Pelikan, Meyer, Böhm and Schmiedeberg, that the true action of digitalis upon the circulation was discovered. It was shown that the effects upon the circulation were not in any exact sense sedative, but, on the contrary, stimulant and tonic, rendering the action of the heart more powerful, and increasing the tension of the blood vessels. The indications for its use in disease were thereby revolutionized, and at the same time rendered more exact; and the striking benefits which are now afforded by the use of this substance in most (cardiac) diseases were made available to humanity."

"2. In the spring of 1867 I had opportunities of constantly observing a patient who suffered from angina pectoris, and of obtaining from him numerous sphygmographic tracings, both during the attack and during the interval. These showed that during the attack the pulse became quicker, the blood-pressure rose and the arterioles contracted. . . . It occurred to me that if it was possible to diminish the tension by drugs instead of by bleeding, the pain would be removed. I knew from unpublished experiments on animals by Dr A. Gamgee that nitrite of amyl had this power, and therefore tried it on the patient. My expectations were perfectly answered."

19. *Snake Venom.*—Sewall (1887) showed that animals could be immunized, by repeated injection of small doses of rattlesnake's venom, against a sevenfold fatal dose. Kanthack (1891) immunized animals against cobra venom: afterward Fraser, Calmette and many others worked at the subject. Fraser's work on the antidotal properties of the bile of serpents is of the very highest interest and value, both in physiology and in sero-therapy. Calmette's work is an admirable instance of the delicacy and accuracy of the experimental method. The different venoms were measured in decimal milligrammes, and their action was estimated by the body-weights of the animals inoculated; but of course this estimate of virulence was checked according to the susceptibility of the animals; guinea-pigs, rabbits and especially rats being more susceptible than dogs.

"The following table gives the relative toxicity, for 1 kilogramme of rabbit, of the different venoms that I have tested":—

1. Venom of *Naja* . . . . 0·25 milligramme per kilogramme of rabbit. One gramme of this venom kills 4000 kilogrammes of rabbit: activity = 4,000,000.
2. Venom of *Hoplocephalus* . . 0·29 . 3,450,000.
3. Venom of *Pseudechis* . . . 1·25 . 800,000.
4. Venom of *Pelias herus* . . 4·00 : 250,000.

By experiments *in vitro* Calmette studied the influence of heat and chemical agents on these venoms; and, working by various methods, was able to immunize animals:—

"I have got to immunizing rabbits against doses of venom that are truly colossal. I have several, vaccinated more than a year ago, that take without the least discomfort so much as forty milligrammes of venom of *Naja tripudians* at once. Five drops of serum from these rabbits wholly neutralize *in vitro* the toxicity of one milligramme of *Naja* venom. . . . It is not even necessary that the serum should come from an animal vaccinated against the same sort of venom as that in the mixture. The serum of a rabbit immunized against the venom of the cobra or the viper acts indifferently on all the venoms that I have tested."

In 1895 he had prepared a curative serum: "If you first inoculate a rabbit with such a dose of venom as kills the control-animals in three hours; and then, an hour after injecting the venom, inject under the skin of the abdomen four to five cubic centimetres of serum, recovery is the rule. When you interfere later than this, the results are uncertain; and out of all my experiments the delay of an hour and a half is the most that I have been able to reach."

In 1896 four successful cases were reported in the *British Medical Journal*. In 1898 Calmette reports:—

"It is now nearly two years since the use of my antivenomous serum was introduced in India, in Algeria, in Egypt, on the West Coast of Africa, in America, in the West Indies, Antilles, &c. It has been very often used for men and domestic animals (dogs, horses, oxen), and up to now none of those that have received an injection of serum have succumbed. A great number of observations have been communicated to me, and not one of them refers to a case of failure" (*Brit. Med. Journ.*, May 14, 1898; see also *Boston Medical and Surgical Journal*, April 7, 1898).

It is of course impossible that "antivenene" should be always at hand, or that it should bring about any great decrease in the number of deaths from snake-bite, which in India alone are 30,000 annually; but at least something has been accomplished with it.

The account given above of the chief discoveries that have been made by the help of experiments on animals, in physiology, pathology, bacteriology and therapeutics, might easily have been lengthened if we added to it other methods of treatment that owe less, but yet owe something, to these experiments. Nevertheless the facts quoted in this article are sufficient to indicate the great debt that medicine owes to the employment of vivisection. (S. P.)

VIZAGAPATAM, a town and district of British India, in the Madras presidency. The town stretches 3 m. along the coast, and has a station on a short branch of the East Coast railway, 484 m. N.E. of Madras. Pop. (1901) 40,892. It lies on a small bay, the south extremity of which is bounded by a promontory known as the Dolphin's Nose, and its northern extremity by the suburb of Waltair. The town or fort, as it is called, is separated from the Dolphin's Nose by a small river, which forms a bar where it enters the sea, but is passable for vessels of 300 tons during spring tides. An English factory was established here early in the 17th century, which was captured by the French in 1757, but shortly afterwards recovered. The town owes much to the munificence of the neighbouring raja of Vizianagram. A water supply has been provided at a cost of £30,000. Waltair is the European quarter. There is a considerable Roman Catholic population and a branch of the London Mission. The exports by sea include manganese ore, rice and sugar. Some weaving is carried on, and there is a speciality of ornamental boxes, &c., carved out of sandalwood, horn, ivory, porcupine quills and silver.

The DISTRICT OF VIZAGAPATAM has an area of 17,222 sq. m., being one of the largest districts in India. It is a picturesque and hilly country, but for the most part unhealthy. The surface is generally undulating, rising towards the interior, and crossed by streams, which are dry except during the rainy season. The main portion is occupied by the Eastern Ghats. The slopes of these mountains are clothed with luxuriant vegetation, amid which rise many tall forest trees, while the bamboo grows profusely in the valleys. The drainage on the east is carried by numerous streams direct to the sea, and that to the west flows into the Godāvari through the Indravati or through the Sabari and Siller rivers. To the west of the range is situated the greater portion of the extensive zamindari of Jāipur, which is for the most part very hilly and jungly. In the extreme north a remarkable mass of hills, called the Nimgiris, rise to a height of 5000 ft. The plain along the Bay of Bengal is a vast sheet of cultivation, green with rice fields and gardens of sugar-cane and tobacco. There are great varieties of climate in the district. Along the coast the air is soft and relaxing, the prevailing winds being south-easterly. The average annual rainfall at Vizagapatam exceeds 40 in. Pop. (1901) 2,933,650, showing an increase of 4·7% in the decade. The principal crops are rice, millets, pulses and oil-seeds, with some sugar-cane, cotton and tobacco. The coast portion of the district is traversed throughout by the East Coast railway, opened from Madras to Calcutta in 1904; and a line through the hills from Vizianagram to Raipur in the Central Provinces has been sanctioned. The chief seaports are Bimlipatam and Vizagapatam.

On the dissolution of the Mogul empire Vizagapatam formed part of the territory known as the Northern Circars, which were ceded to the East India Company by treaties in 1765 and 1766. It was long before British authority was established over the hilly tract inland, inhabited by aboriginal tribes, and still administered under a peculiar system, which vests in the collector the powers of a political agent. This tract, forming more than two-thirds of the whole district, is known as the Agency.

See *The Vizagapatam District Gazetteer* (Madras, 1907).

VIZETELLY, HENRY (1820–1894), English publisher, was born in London on the 30th of July 1820, the son of a printer. He was early apprenticed as a wood engraver, and one of his first blocks was a portrait of "Old Parr." Encouraged by the success of the *Illustrated London News*, Vizetelly in 1843, with his brother James Thomas Vizetelly (1817–1897) and Andrew Spottiswoode (1787–1866), started the *Pictorial Times*, which was published successfully for several years. In 1855, in partnership with Boyne, he started a threepenny paper called the *Illustrated Times*, which four years later was merged in the *Penny Illustrated Paper*. In 1865 Vizetelly became Paris correspondent for the *Illustrated London News*. During the years he remained in Paris he published several books—*Paris in Peril* (1882), *The Story of the Diamond Necklace* (1867) and a free translation of Topin's *Man in the Iron Mask*. In 1872 he was transferred to Berlin, where he wrote *Berlin under the New Empire* (1879). In 1887 he established a publishing house in London, issuing numerous translations of French and Russian authors. In 1888 he was prosecuted for publishing a translation of Zola's *La Terre*, and was fined £100; and when he reissued Zola's works in 1889 he was again prosecuted, fined £200 and imprisoned for three months. In 1893 he wrote a volume of autobiographical reminiscence called *Glances Back through Seventy Years*, a graphic picture of literary Bohemia in Paris and London between 1840 and 1870. He died on the 1st of January 1894. His younger brother, Frank Vizetelly (1830–1883), was a clever artist and journalist; he went to Egypt as war correspondent for the *Illustrated London News* and was never heard of after the massacre of Hicks Pasha's army in Kordofan.

VIZEU, or Viseu, an episcopal city and the capital of the district of Vizeu, Portugal, at the terminus of a branch of the Figueira da Foz-Guarda railway, and on the Ribeira d'Asnos, a sub-tributary of the Mondego. Pop. (1900) 8057. The cathedral, which was founded in the 12th century, contains pictures by the native artist Grão Vasco (16th century). The city stands near the ruins of the ancient *Vacca*, or *Cava de Viriato*, a Roman military colony founded by Decius Brutus and captured by Viriathus (2nd century B.C.). The administrative district of Vizeu coincides with the central and northern parts of the ancient province of Beira (*q.v.*). Pop. (1900) 402,259; area, 1937 sq. m.

VIZIADRUG, Vijayadurg or Gheria, a port on the W. coast of India in Ratnagiri district, Bombay, 170 m. S. of Bombay city. Pop. (1901) 2339. It is one of the best harbours on the west coast, being without any bar, and may be entered in all weathers; even to large ships it affords safe shelter during the south-west monsoon. At the beginning of the 18th century the pirate chief Angria made Viziadrug the capital of a territory stretching for 150 m. along the coast and from 30 to 60 m. inland. The fort was taken by Admiral Watson and Colonel Clive in 1756.

VIZIANAGRAM, a town of British India, in the Vizagapatam district of Madras, 17 m. from the seaport of Bimlipatam, on the East Coast railway, 522 m. N.E. of Madras. Pop. (1901) 37,270. It has a small military cantonment. It contains the residence of a *zamindar* of the same name, who ranks as the first Hindu nobleman of Madras. His estate covers about 3000 sq. m., with a population of 900,000. The estimated income is £180,000, paying a permanent land revenue of £34,000. The town possesses many fine buildings, entirely supported by the raja. It has a college and two high schools.

The ruling family, which claims descent from a high official at the court of Golconda, established itself in Vizagapatam in the 17th century. In 1754 Viziarama Raz made an alliance with the French, but his son, on succeeding, fell out with them, captured Vizagapatam from them and ceded it to the British in 1758. The next raja, another Viziarama, was entirely under the influence of his half-brother Sita Ram, whose power, however, became so great a menace that he was forced to retire in 1793. A period of decay now set in. The raja was incompetent, and, his estate having been sequestrated for debt, revolted and was defeated and killed in 1794. The next raja, Narayana Babu, was no more successful, and his estate had been long under the management of the British government when he died in 1845. Viziarama Gajapati Raz, who succeeded him and took over full powers in 1852, was a man of ability, and received the titles of maharaja and K.C.S.I.; as also was his son, the maharaja Ananda Raz, G.C.I.E. He died in 1897, and was succeeded by Raja Pusapati Viziarama Gajapati Raz, during whose minority (till 1904) the estate was again under government administration.

VIZIER, more correctly Vizir (Arabic *Wazīr*), literally "burden-bearer" or "helper," originally the chief minister or representative of the Abbasid caliphs. The office of vizier, which spread from the Arabs to the Persians, Turks, Mongols, and other Oriental peoples, arose under the first Abbasid caliphs (see Mahommedan Institutions, and Caliphate, C § 1) and took shape during its tenure by the Barmecides (*q.v.*). The vizier stood between sovereign and subjects, representing the former in all matters touching the latter. This withdrawal of the head of the state from direct contact with his people was unknown to the Omayyads, and was certainly an imitation of Persian usage; it has even been plausibly conjectured that the name is but the Arabic adaptation of a Persian title. In modern usage the term is used in the East generally for any important official under the sovereign.

VIZZOLA TICINO, a village of Lombardy, Italy, in the province of Milan, 6 m. W. of Gallarate and 31 m. N.W. of Milan, 725 ft. above sea-level. Pop. (1901) 469. It is situated on the Ticino, and is remarkable as having one of the largest electric works in Europe, worked by water-power from the Ticino brought by a canal 4½ m. long, constructed in 1889–91 by the Società Lombarda per Distribuzione di Energia Elettrica. Gallarate, Sesto Calende, Saronno and other neighbouring places are supplied from here with electricity.

VLAARDINGEN, a river port of Holland, in the province of South Holland, on the Maas, 6 m. by rail W. of Rotterdam. Pop. 17,000. A very old town and the seat of a former margraviate belonging to the counts of Holland, Vlaardingen is now chiefly important as the centre of the great herring and cod fisheries of the North Sea. Its only ornaments are the old market-place and the gardens formed by the purchase in 1825 of a seat called the Hof. The chief industries are those connected with the large fishing trade.

Distribution of the Vlach race.

VLACHS. The Vlach (Vlakh, Wallach) or Ruman race constitutes a distinct division of the Latin family of peoples, widely disseminated throughout south-eastern Europe, both north and south of the Danube, and extending sporadically from the Russian river Bug to the Adriatic. The total numbers of the Vlachs may be estimated at 10,000,000 or 11,000,000. North of the Danube, 5,400,000 dwell in Rumania; 1,250,000 are settled in Transylvania, where they constitute a large majority of the population; and a still greater number are to be found in the Banat and other Hungarian districts west and north of Transylvania. Close upon 1,000,000 inhabit Bessarabia and the adjoining parts of South Russia, and about 230,000 are in the Austrian province of Bukovina. South of the Danube, about 500,000 are scattered over northern Greece and European Turkey, under the name of Kutzo-Vlachs, Tzintzars or Aromani. In Servia this element is preponderant in the Timok valley, while in Istria it is represented by the Cici, at present largely Slavonized, as are now entirely the kindred Morlachs of Dalmatia. Since, however, it is quite impossible to obtain exact statistics over so wide an area, and in countries where politics and racial feeling are so closely connected, the figures given above can only be regarded as approximately accurate; and some writers place the total of the Vlachs as low as 9,000,000. It is noteworthy that the Rumans north of the Danube continually gain ground at the expense of their neighbours; and even the long successful Greek propaganda among the Kutzo-Vlachs were checked after 1860 by the labours of Apostolu Margaritis and other nationalists.

A detailed account of the physical, mental and moral characteristics of the Vlachs, their modern civilization and their historical development, will be found under the headings RUMANIA and MACEDONIA.

All divisions of the race prefer to style themselves *Romani*, *Romeni*, *Rumeni* or *Aromani*; and it is from the native pronunciation of this name that we have the equivalent expression *Ruman*, a word which must by no means be confined to that part of the Vlach race inhabiting the present kingdom of Rumania.

Its name.

The name "Vlachs," applied to the Rumans by their neighbours but never adopted by themselves, appears under many allied forms, the Slavs saying *Volokh* or *Woloch*, the Greeks *Vlachoi*, the Magyars *Olóh*, and the Turks, at a later date, *Ifflók*. In its origin identical with the English *Wealh* or *Welsh*, it represents a Slavonic adaptation of a generic term applied by the Teutonic races to all Roman provincials during the 4th and 5th centuries. The Slavs, at least in their principal extent, first knew the Roman empire through a Teutonic medium, and adopted their term *Volokh* from the Ostro-Gothic equivalent of the Anglo-Saxon Wealh. It thus finds its analogies in the German name for Italy—*Welschland* (*Wälischland*), in the *Walloons* of the Low Countries and the *Wallgau* of Tirol. An early instance of its application to the Roman population of the Eastern empire is found (*c.* 550–600) in the *Traveller's Song*, where, in a passage which in all probability connects itself with the early trade-route between the Baltic staple of Wollin and Byzantium, the gleeman speaks of Caesar's realm as *Walaric*, "Welshry." In verse 140 he speaks of the *Rum-walas*, and it is to be observed that *Rum* is one of the words by which the Vlachs of eastern Europe still know themselves.

Its Latin character.

The Vlachs claim to be a Latin race in the same sense as the Spaniards or Provençals—Latin by language and culture, and, in a smaller degree, by descent. Despite the long predominance of Greek, Slavonic and Turkish influence, there is no valid objection to this claim, which is now generally accepted by competent ethnologists. The language of the Vlachs is Latin in structure and to a great extent in vocabulary; their features and stature would not render them conspicuous as foreigners in south Italy; and that their ancestors were Roman provincials is attested not only by the names "Vlach" and "Ruman" but also by popular and literary tradition. In their customs and folk-lore both Latin and Slavonic traditions assert themselves. Of their Roman traditions the Trajan saga, the celebration of the Latin festivals of the Rosalia and Kalendae, the belief in the *striga* (witch), the names of the months and days of the week, may be taken as typical examples. Some Roman words connected with the Christian religion, like *biserica* (*basilica*) = a church, *botez* = *baptizo*, *duminica* = Sunday, *preot* (*presbyter*) = priest, point to a continuous tradition of the Illyrian church, though most of their ecclesiastical terms, like their liturgy and alphabet, were derived from the Slavonic. In most that concerns political organization the Slavonic element is also preponderant, though there are words like *impărat* = *imperator*, and *domn* = *dominus*, which point to the old stock. Many words relating to kinship are also Latin, some, like *vitrig* (*vitricus*) = father-in-law, being alone preserved by this branch of the Romance family. But if the Latin descent of the Vlachs may be regarded as proven, it is far less easy to determine their place of origin and to trace their early migrations.

Its original home.

The centre of gravity of the Vlach or Ruman race is at present unquestionably north of the Danube in the almost circular territory between the Danube, Theiss and Dniester; and corresponds roughly with the Roman province of Dacia, formed by Trajan in A.D. 106. From this circumstance the popular idea has arisen that the race itself represents the descendants of the Romanized population of Trajan's Dacia, which was assumed to have maintained an unbroken existence in Walachia, Transylvania and the neighbour provinces, beneath the dominion of a succession of invaders. The Vlachs of Pindus, and the southern region generally, were, on this hypothesis, to be regarded as later immigrants from the lands north of the Danube. In 1871, E. R. Roesler published at Leipzig, in a collective form, a series of essays entitled *Romänische Studien*, in which he absolutely denied the claim of the Rumanian and Transylvanian Vlachs to be regarded as autochthonous Dacians. He laid stress on the statements of Vopiscus and others as implying the total withdrawal of the Roman provincials from Trajan's Dacia by Aurelian, in A.D. 272, and on the non-mention by historians of a Latin population in the lands on the left bank of the lower Danube, during their successive occupation by Goths, Huns, Gepidae, Avars, Slavs, Bulgars and other barbarian races. He found the first trace of a Ruman settlement north of the Danube in a Transylvanian diploma of 1222. Roesler's thesis has been generally regarded as an entirely new departure in critical ethnography. As a matter of fact, his conclusions had to a great extent been already anticipated by F. J. Sulzer in his *Geschichte des Transalpinischen Daciens*, published at Vienna in 1781, and at a still earlier date by the Dalmatian historian G. Lucio (Lucius of Traü) in his work *De Regno Dalmatiae et Croatiae*, Amsterdam, 1666.

The theory of the later immigration of the Rumans into their present abodes north of the Danube, as stated in its most extreme form by Roesler, commanded wide acceptance, and in Hungary it was politically utilized as a plea for refusing parity of treatment to a race of comparatively recent intruders. In Rumania itself Roesler's views were resented as an attack on Ruman nationality. Outside Rumania they found a determined opponent in Dr J. Jung, of Innsbruck, who upheld the continuity of the Roman provincial stock in Trajan's Dacia, disputing from historic analogies the total withdrawal of the provincials by Aurelian; and the reaction against Roesler was carried still farther by J. L. Pič, Professor A. D. Xenopol of Jassy, B. P. Hasdeu, D. Onciul and many other Rumanian writers, who maintain that, while their own race north of the Danube represents the original Daco-Roman population of this region, the Vlachs of Turkey and Greece are similarly descended from the Moeso-Roman and Illyro-Roman inhabitants of the provinces lying south of the river. On this theory the entire Vlach race occupies almost precisely the same territories to-day as in the 3rd century.

On the whole it may be said that the truth lies between the two extremes. Roesler is no doubt so far right that after 272, and throughout the early middle ages, the bulk of the Ruman people lay south of the Danube. Pič's view that the population of the Roman provinces of Moesia and Illyria were Hellenized rather than Romanized, and that it is to Trajan's Dacia alone that we must look for the Roman source of the Vlach race, conflicts with what we know of the Latinizing of the Balkan lands from inscriptions, martyrologies, Procopius's list of Justinian's Illyrian fortresses and other sources. This Roman element south of the Danube had further received a great increase at the expense of Trajan's colonial foundation to the north when Aurelian established his New Dacia on the Moesian side of the river. On the other hand, the analogy supplied by the withdrawal of the Roman provincials from Riparian Noricum tells against the assumption that the official withdrawal of the Roman colonists of Trajan's Dacia by Aurelian entailed the entire evacuation of the Carpathian regions by their Latin-speaking inhabitants. As on the upper Danube the continuity of the Roman population is attested by the *Vici Romanisci* of early medieval diplomas and by other traces of a Romanic race still represented by the Ladines of the Tirol, so it is reasonable to suppose a Latin-speaking population continued to exist in the formerly thickly colonized area embracing the present Transylvania and Little Walachia, with adjoining Carpathian regions. Even as late as Justinian's time (483–565), the official connexion with the old Dacian province was not wholly lost, as is shown by the erection or restoration of certain fortified posts on the left bank of the lower Danube.

Early migrations.

We may therefore assume that the Latin race of eastern Europe never wholly lost touch of its former trans-Danubian strongholds. It was, however, on any showing greatly diminished there. The open country, the broad plains of what is now the Rumanian kingdom, and the Banat of Hungary were in barbarian occupation. The centre of gravity of the Roman or Romance element of Illyricum had now shifted south of the Danube. By the 6th century a large part of Thrace, Macedonia and even of Epirus had become Latin-speaking.

What had occurred in Trajan's Dacia in the 3rd century was consummated in the 6th and 7th throughout the greater part of the South-Illyrian provinces, and the Slavonic and Avar conquests severed the official connexion with eastern Rome. The Roman element was uprooted from its fixed seats, and swept hither and thither by the barbarian flood. Nomadism became an essential of independent existence, while large masses of homeless provincials were dragged as captives in the train of their conquerors, to be distributed in servile colonies. They were thus in many cases transported by barbarian chiefs—Slav, Avar and Bulgarian—to trans-Danubian and Pannonian regions. In the *Acts* of St Demetrius of Thessalonica (d. A.D. 306) we find an account of such a Roman colony, which, having been carried away from South-Illyrian cities by the Avar *khagan* (prince), and settled by him in the Sirmian district beyond the Save, revolted after seventy years of captivity, made their way once more across the Balkan passes, and finally settled as an independent community in the country inland from Salonica. Others, no doubt, thus transported northwards never returned. The earliest Hungarian historians who describe the Magyar invasion of the 9th century speak of the old inhabitants of the country as Romans, and of the country they occupied as *Pascua Romanorum*; and the Russian Nestor, writing about 1100, makes the same invaders fight against Slavs and Vlachs in the Carpathian Mountains. So far from the first mention of the Vlachs north of the Danube occurring only in 1222, as Roesler asserts, it appears from a passage of Nicetas of Chonae that they were to be found already in 1164 as far afield as the borders of Galicia; and the date of a passage in the *Nibelungenlied*, which mentions the Vlachs, under their leader Râmunc, in association with the Poles, cannot well be later than 1200.

Nevertheless, throughout the early middle ages the bulk of the Ruman population lay south of the Danube. It was in the Balkan lands that the Ruman race and language took their characteristic mould. It is here that this new Illyrian Romance first rises into historic prominence. Already in the 6th century, as we learn from the place-names, such as Sceptecasas, Burgualtu, Clisura, &c., given by Procopius, the Ruman language was assuming, so far as its Latin elements were concerned, its typical form. In the somewhat later campaigns of Commentiolus (587) and Priscus, against the Avars and Slavs, we find the Latin-speaking soldiery of the Eastern emperor making use of such Romance expressions as *torna frate!* (turn, brother!), or *sculca* (out of bed) applied to a watch (cf. Ruman *a se culca*=Italian *coricarsi*+*ex*-(*s*-) privative). Next we find this warlike Ruman population largely incorporated in the Bulgarian kingdom, and, if we are to judge from the names Paganus and Sabinus, already supplying it with rulers in the 8th century. The blending and close contact during this period of the surviving Latin population with the Slavonic settlers of the peninsula impregnated the language with its large Slavonic ingredient. The presence of an important Latin element in Albanian, the frequent occurrence of Albanian words in Rumanian, and the remarkable retention by both languages of a suffix article, may perhaps imply that both alike took their characteristic shapes in the same region. The fact that these peculiarities are common to the Rumans north of the Danube, whose language differs dialectically from that of their southern brothers, shows that it was this southern branch that throughout the early periods of Ruman history was exercising a dominating influence. Migrations, violent transplantation, the intercourse which was kept up between the most outlying members of the race, in its very origin nomadic, at a later period actual colonization and the political influence of the Bulgaro-Vlachian empire, no doubt contributed to propagate these southern linguistic acquisitions throughout that northern area to which the Ruman race was destined almost imperceptibly to shift its centre of gravity.

Byzantium, which had ceased to be Roman, and had become Romanic, renewed its acquaintance with the descendants of the Latin provincials of Illyricum through a Slavonic medium, and applied to them the name of Vlach, which the Slav himself had borrowed from the Goth. The first mention of Vlachs in a Byzantine source is about the year 976, when Cedrenus (ii. 439) relates the murder of the Bulgarian tsar Samuel's brother "by certain Vlach wayfarers," at a spot called the Fair Oaks, between Castoria and Prespa. From this period onwards the Ruman inhabitants of the Balkan peninsula are constantly mentioned by this name, and we find a series of political organizations and territorial divisions connected with the name of *Vlachia*. A short synopsis may be given of the most important of these, outside the limits of Rumania itself.

Political and territorial divisions.

1. *The Bulgaro-Vlach Empire.*—After the overthrow of the older Bulgarian tsardom by Basil Bulgaroktonos (976–1025), the Vlach population of Thrace, Haemus and the Moesian lands passed once more under Byzantine dominion; and in 1185 a heavy tax, levied in kind on the cattle of these warlike mountain shepherds, stirred the Vlachs to revolt against the emperor Isaac Angelus, and under the leadership of two brothers, Peter and Asen, to found a new Bulgaro-Vlachian empire, which ended with Kaliman II. in 1257. The dominions of these half-Slavonic half-Ruman emperors extended north of the Danube over a great deal of what is now Rumania, and it was during this period that the Vlach population north of the river seems to have been most largely reinforced. The 13th-century French traveller Rubruquis speaks of all the country between Don and Danube as *Asen's land* or *Blakia*.

2. *Great Walachia* (Μεγάλη Βλαχία).—It is from Anna Comnena, in the second half of the 11th century, that we first hear of a Vlach settlement, the nucleus of which was the mountainous region of Thessaly. Benjamin of Tudela, in the succeeding century, gives an interesting account of this Great Walachia, then completely independent. It embraced the southern and central ranges of Pindus, and extended over part of Macedonia, thus including the region in which the Roman settlers mentioned in the *Acts* of St Demetrius had fixed their abode. After the Latin conquest of Constantinople in 1204, Great Walachia was included in the enlarged despotate of Epirus, but it soon reappears as an independent principality under its old name, which, after passing under the yoke

of the Serb emperor Dushan, was finally conquered by the Turks in 1393. Many of their old privileges were accorded to the inhabitants, and their taxes were limited to an annual tribute. Since this period the Megalovlachites have been largely Hellenized, but they are still represented by the flourishing Tzintzar settlements of Pindus and its neighbourhood (see MACEDONIA).

3. *Little Walachia* (Μικρά Βλαχία) was a name applied by Byzantine writers to the Ruman settlements of Aetolia and Acarnania, and with it may be included "Upper Walachia," or Ανώβλαχα. Its inhabitants are still represented by the Tzintzars of the Aspropotamo and the Karaguni (Black Capes) of Acarnania.

4. *The Morlachs* (*Mavrovlachi*) *of the West.*—These are already mentioned as *Nigri Latini* by the presbyter of Dioclea (*c.* 1150) in the old Dalmatian littoral and the mountains of what is now Montenegro, Herzegovina and North Albania. Other colonies extended through a great part of the old Servian interior, where is a region still called Stara Vlaška or "Old Walachia." The great commercial staple of the east Adriatic shores, the republic of Ragusa, seems in its origin to have been a Ruman settlement, and many Vlach traces survived in its later dialect. Philippus de Diversis, who described the city as it existed in 1440, says that "the various officers of the republic do not make use either of Slav or Italian, with which they converse with strangers, but a certain other dialect only partially intelligible to us Latins," and cites words with strong Ruman affinities. In the mountains above Ragusa a number of Vlach tribes are mentioned in the archives of that city, and the original relationship of the Ragusans and the nomadic Alpine representatives of the Roman provincials, who preserved a traditional knowledge of the old lines of communication throughout the peninsula, explains the extraordinary development of the Ragusan commerce. In the 14th century the Mavrovlachi or Morlachs extended themselves towards the Croatian borders, and a large part of maritime Croatia and northern Dalmatia began to be known as *Morlacchia.* A *Major Vlachia* was formed about the triple frontier of Bosnia, Croatia and Dalmatia, and a "Little Walachia" as far north as Požega. The Morlachs have now become Slavonized (see DALMATIA).

5. *Cici of Istria.*—The extreme Ruman offshoot to the north-west is still represented by the Cici of the Val d'Arsa and adjoining Istrian districts. They represent a 15th-century Morlach colony from the Isles of Veglia, and had formerly a wider extension to Trieste and the counties of Gradisca and Gorz. The Cici have almost entirely abandoned their native tongue, which is the last remaining representative of the old Morlach, and forms a connecting link between the Daco-Roman (or Rumanian) and the Illyro- or Macedo-Roman dialects.

6. *Rumans of Transylvania and Hungary.*—As already stated, a large part of the Hungarian plains were, at the coming of the Magyars in the 9th century, known as *Pascua Romanorum.* At a later period privileged Ruman communities existed at Fogaras, where was a *Silva Vlachorum*, at Marmaros, Deva, Hatzeg, Hunyad and Lugos, and in the Banat were seven Ruman districts. Two of the greatest figures in Hungarian history, the 15th-century rulers John Corvinus of Hunyad and his son King Matthias, were due to this element. For its later history see TRANSYLVANIA.

See, in addition to the books already mentioned, J. L. Pič, *Über die Abstammung der Rumänen* (Leipzig, 1880); A. D. Xenopol, *Les Roumains au moyen âge* (Jassy, 1886); B. P. Hasdeu, "Stratŭ şi Substratŭ: Genealogia poporelorŭ balcanice," in *Annalele Academieĭ*, ser. II, vol. 14 (Bucharest, 1893); D. Onciul, "Românii in Dacia Traiana," &c., in *Enciclopedia Românа*, vol. iii. (Bucharest, 1902).

VLADIKAVKAZ, a town and fortress of Russia in northern Caucasia, the capital of the province of Terek. Pop. (1900) 49,924. It stands on a plateau, at an altitude of 2345 ft., on both banks of the Terek, where that river issues from the Darial gorge. It is 434 m. by rail S.E. from Rostov-on-the-Don, and has regular communication with Tiflis (133 m.) by coach through the Darial Pass (Georgian military road) of the Caucasus. Moreover, a line of railway, running eastwards to the Caspian ports of Petrovsk and Baku, connects Vladikavkaz, or rather the station Beslan, 14 m. N. of it, with the Transcaucasian railway, *i.e.* with Tiflis, Poti and Batum. Russians, Armenians and Jews constitute the bulk of the population, which also contains Ossetes, Chechens, Ingushes and others. There are distilleries and a number of smaller factories. The fort, around which the town has grown up, was built in 1784. The town is an episcopal see of the Orthodox Greek Church.

VLADIMIR, ST (*c.* 956–1015), grand duke of Kiev and of all Russia, was the youngest son of Svyatoslav I. and his mistress Malushka. In 970 he received Great Novgorod as his apanage. On the death of Svyatoslav in 972, a long civil war took place between his sons Yaropolk and Oleg, in which Vladimir was involved. From 977 to 984 he was in Scandinavia, collecting as many of the viking warriors as he could to assist him to recover Novgorod, and on his return marched against Yaropolk. On his way to Kiev he sent ambassadors to Ragvald, prince of Polotsk, to sue for the hand of his daughter Ragnilda. The haughty princess refused to affiance herself to "the son of a bondswoman," but Vladimir attacked Polotsk, slew Ragvald, and took Ragnilda by force. Subsequently (980) he captured Kiev also, slew Yaropolk by treachery, and was proclaimed prince of all Russia. In 981 he conquered the Chervensk cities, the modern Galicia; in 983 he subdued the heathen Yatvyags, whose territories lay between Lithuania and Poland; in 985 he led a fleet along the central rivers of Russia to conquer the Bulgarians of the Kama, planting numerous fortresses and colonies on his way. At this time Vladimir was a thoroughgoing pagan. He increased the number of the *trebishcha*, or heathen temples; offered up Christians (Theodore and Ivan, the protomartyrs of the Russian Church) on his altars; had eight hundred concubines, besides numerous wives; and spent his whole leisure in feasting and hunting. He also formed a great council out of his boyars, and set his twelve sons over his subject principalities. In the year 987, as the result of a consultation with his boyars, Vladimir sent envoys to study the religions of the various neighbouring nations whose representatives had been urging him to embrace their respective faiths. The result is amusingly described by the chronicler Nestor. Of the Mussulman Bulgarians of the Volga the envoys reported "there is no gladness among them; only sorrow and a great stench; their religion is not a good one." In the temples of the Germans they saw "no beauty"; but at Constantinople, where the full festival ritual of the Orthodox Church was set in motion to impress them, they found their ideal. "We no longer knew whether we were in heaven or on earth, nor such beauty, and we know not how to tell of it." If Vladimir was impressed by this account of his envoys, he was yet more so by the offer of the emperor Basil II. to give him his sister Anna in marriage. In 988 he was baptized at Kherson in the Crimea, taking the Christian name of Basil out of compliment to his imperial brother-in-law; the sacrament was followed by his marriage with the Roman princess. Returning to Kiev in triumph, he converted his people to the new faith with no apparent difficulty. Crypto-Christians had been numerous in Kiev for some time before the public recognition of the Orthodox faith. The remainder of the reign of Vladimir was devoted to good works. He founded numerous churches, including the splendid *Desyatinnuy Sobor* or "Cathedral of the Tithes" (989), established schools, protected the poor and introduced ecclesiastical courts. With his neighbours he lived at peace, the incursions of the savage Petchenegs alone disturbing his tranquillity. His nephew Svyatpolk, son of his brother and victim Yaropolk, he married to the daughter of Boleslaus of Poland. He died at Berestova, near Kiev, while on his way to chastise the insolence of his son, Prince Yaroslav of Novgorod. The various parts of his dismembered body were distributed among his numerous sacred foundations and were venerated as relics. The university of Kiev has rightly been named after the man who both civilized and Christianized ancient Russia. His memory was also kept alive by innumerable folk ballads and legends. With him the Varangian period of Russian history ceases and the Christian period begins.

See *Memorials* (Rus.) published by the Commission for the examination of ancient documents (Kiev, 1881, &c.); I. Komanin and M. Istomin, *Collection of Historical Materials* (Rus.) (Kiev, 1890, &c.); O. Partitsky, *Scandinavianism in Ancient Russia* (Rus.) (Lemberg, 1897); A. Lappo-Danilevsky, *Scythian Antiquities* (Rus.) (Petersburg, 1887); J. Macquart, *Osteuropäische u. ostasiatische Streifzüge* (Leipzig, 1903); L. C. Goetz, *Das Kiever Höhlenkloster als Kulturzentrum des vormongolischen Russlands* (Passau, 1904).

(R. N. B.)

VLADIMIR, a government of middle Russia, bounded W. by the governments of Moscow and Tver, N. by Yaroslav and Kostroma, E. by Nizhniy-Novgorod, S. by Tambov and Ryazañ, with an area of 18,815 sq. m. It belongs to the eastern part of the central plateau of middle Russia, which has an average elevation of 800 to 950 ft., and is grooved by river valleys to a depth of

300 ft. to 450 ft. below the general level, so that the country has a hilly appearance.

The lacustrine depression of the middle Volga and Oka extends into the east of the government. The Upper Carboniferous limestones, of which it is mostly built up, are overlain by Permian sandstones towards the east, and patches of Jurassic clays—denuded remnants of formerly extensive deposits—are scattered over its surface. The whole is covered with a thick sheet of boulder clay, considered to be the bottom moraine of the North-European ice-sheet, and overlaid, in its turn, in the depressions, by extensive lacustrine clays and sands. The geology, especially of the western parts, has been investigated by Professor Nikitin, who has ascertained that under the Glacial and post-Glacial deposits—the lower strata of which contain remains of the mammoth and rhinoceros and the upper fossils of extensive prehistoric forests—occur Lower Cretaceous deposits and deposits intermediate between the Cretaceous and the Jurassic ("Volga" deposits). Upper Jurassic (Kellaway and Oxford) and Upper Carboniferous deposits are also found, and at Gorbatov Permian marls.

The soil is for the most part unfertile, save in the district of Yuriev, where are patches of black earth, which have occasioned a good deal of discussion among Russian geologists. Iron ore is widely diffused, and china clay and gypsum are met with in several places. Peat is of common occurrence. Forests cover extensive tracts in the south-east. The climate resembles that of Moscow, but is a little colder, and still more continental: the average yearly temperature at the city of Vladimir is 38° F. (January, 16°; July, 66.5°).

The Oka flows through the government for 85 m., and is navigable throughout. Of its tributaries, the Klyazma is navigable to Kovrov, and even to Vladimir in summer; and timber is floated on the Teza. Small lakes are numerous; that of Pleshcheyevo or Pereyaslavl (5 m. in length) has historical associations, Peter the Great having there acquired in his boyhood his first experiences in navigation. The marshes extend to more than half a million acres.

The population was estimated in 1906 as 1,730,400. It is thoroughly Great Russian. The Finnish tribes, Muroma and Merya, which formerly inhabited the region, have been absorbed by the Slavs, as also have the Karelians, who are supposed to have formerly inhabited the territory. The descendants of the few hundred Karelian families, which were settled by Peter the Great on the shores of Lake Pereyaslavl, still, however, preserve their own language. The government is divided into thirteen districts, the chief towns of which are Vladimir, Alexandrov, Gorokhovets, Kovrov, Melenki, Murom, Pereyaslavl Zalyeskiy, Pokrov, Shuya, Sudogda, Suzdal, Vyazniki and Yuriev Polskiy. Ivanovo-Voznesensk, Gusevsk and Kholui are important industrial towns. The *zemstvos* (district councils) make considerable efforts to foster education and improve the sanitary arrangements.

The soil is not very fertile, and the standard of agriculture is low, the inhabitants being largely engaged in manufactures. In 1900 1,908,200 acres (15.8% of the entire area) were under cereals. Cherries and apples are exported in considerable quantities.

The cultivation of flax, both for local manufactures and for export—especially about Melenki—is important; so also is that of hemp. Natural pastures are numerous, and support large herds of cattle. The principal crops are rye, oats, wheat, barley and potatoes. The peasants hold 5,591,000 acres in communal ownership: of this 60% is arable land, 3,802,800 acres belong to private owners, 552,300 acres to the crown and 370,000 acres to the imperial family. The only important mineral is alabaster.

Vladimir ranks third among the governments of European Russia for manufactures. It has some 500 large factories, which employ over 100,000 persons (one-third women); the principal establishments are cotton, linen and silk mills, dye-works, and rope, paper, cardboard, oil, chemical, machinery, glass and iron works, tanneries and distilleries. Wood, coal, petroleum and peat are all used as fuel.

A distinctive feature of Vladimir is the great variety of petty trades carried on by peasants who still continue to cultivate their allotments. While in some villages almost all the male population leave their homes and travel all over Russia as carpenters, masons, iron-roof makers, or as pedlars or travelling merchants, other villages have their specialties in some branch of manufactured produce. Nearly 30,000 carpenters leave Vladimir every year. Whole villages are engaged in painting sacred pictures or ikons; and although the ikons are sold at a shilling the hundred, the aggregate trade is valued at £150,000 a year; and the Vladimir (or rather Suzdal) pictures are sold all over Russia and the Balkan peninsula. In other villages some 1200 men are employed in making sickles, knives and locks. Wooden vessels, boxes and baskets, *lapti* (shoes made of lime-tree bark, which are worn in Great Russia and are produced by the million), wheels and sledges, sieves, combs, woollen stockings and gloves, sheep-skins and sheep-skin gloves, felt, toys, earthenware, and all kinds of woven fabrics, are specialties of other villages. In these petty trades Vladimir occupies the first rank in Russia, the annual production being one-third of the total output for the whole country.

The movement of shipping on the Volga and its tributaries and sub-tributaries, the Oka, Klyazma and Teza, is considerable. The principal ports are Murom on the Volga and Kovrov and Vyazniki on the Klyazma. Timber, wood for fuel and manufactured goods are the chief exports.

Numbers of Palaeolithic stone implements, intermingled with bones of the mammoth and the rhinoceros, and still greater numbers of Neolithic stone implements, have been discovered. There are a great number of burial-mounds belonging to the Bronze and Iron periods, and containing decorations in amber and gold; nearly 2000 such burial-mounds are scattered round Lake Pleshcheyevo, some of them belonging to the pagan period and some to the early Christian. Coins from Arabia, Bokhara, Germany and Anglo-Saxon lands are found in great quantities. (P. A. K.; J. T. Be.)

VLADIMIR, a town of Russia, capital of the government of the same name known in history as Vladimir-on-the-Klyazma, to distinguish it from Vladimir in Volhynia. It is picturesquely situated on the Klyazma and Lybed, 118 m. by rail E.N.E. of Moscow. Pop. (1884) 18,420; (1900) 32,029. The city is an archiepiscopal see of the Orthodox Greek church. The Lybed divides it into two parts. Extensive cherry orchards occupy the surrounding slopes, and in each is a small watch-tower, with cords drawn in all directions to be shaken by the watcher when birds alight. The kreml stands on a hill and contains two very old cathedrals—the Uspenskiy (1150; restored in 1891), where all the princes of Vladimir have been buried, and the Dmitrievskiy (1197; restored in 1834–1835). Several churches date from the 12th century, including one dedicated to the Birth of Christ, in which St Alexander Nevski was buried. The "Golden Gate"—a triumphal gate surmounted by a church—was built by the grand duke Andrei Bogolyubskiy in 1158.

Vladimir was founded in the 12th century. It first comes into notice in 1151, when Andrei Bogolyubskiy secretly left Vyshgorod—the domain of his father in the principality of Kiev—and migrated to the newly settled land of Suzdal, where he became (1157) grand prince of the principalities of Vladimir, Suzdal and Rostov. In 1242 the principality was overrun by the Mongols under Batu Khan, and he and his successors asserted their suzerainty over it until 1328. During this period Vladimir became the chief town of the Russian settlements in the basin of the Oka, and it disputed the superiority with the new principality of Moscow, to which it finally succumbed in 1328. In the 14th century it began to decay.

VLADIMIR-VOLHYNSKIY, a town of Russia, in the government of Volhynia, 19 m. N.N.E. of the spot where the frontiers of Russia, Poland and Galicia meet and 300 m. W.N.W. of Kiev. Pop. (1885) 8752; (1897) 9695, three-fourths Jews. Though not mentioned in the annals before 988, Vladimir was probably in existence in the 9th century under the name of Ladomir. In the 10th century it was the capital of the principality of Volhynia. The Tatars and the Lithuanians destroyed it several times, but it always recovered, and only fell into decay in the 17th century. It was finally annexed to Russia after the first division of Poland (1772). The ruins in and near the town include remains of a church supposed to have been built by Vladimir, grand duke of Kiev, in the 10th–11th centuries, and of another built in 1160 by his descendant Mstislav. This latter was apparently very well built, and its length exceeded that of the temple of St Sophia at Kiev. The town contains a good archaeological museum.

VLADIVOSTOK, the chief Russian seaport and naval station on the Pacific Ocean, situated at the southern extremity (43° 7′ N. and 131° 55′ E.) of the Maritime Province, not far from the point where that government touches both Manchuria and Korea (Cho-sen). It is connected by rail with Khabarovsk (479 m. N.N.E.), the capital of the Amur region, and with Chita in Transbaikalia (1362 m.) via Ninguta, Kharbin, Tsitsikar and Khailar. Pop. (1900) 38,000. The town stands on Peter the Great Gulf, occupying the northern shore of one of its horn-like expansions, which the Russians have called the Golden Horn. The depth of the Eastern Bosporus ranges from 13 to 20 fathoms, and that of the Golden Horn from 5 to 13, the latter affording a spacious harbour. The hills are covered with forests of oak, lime, birch, maple, cork, walnut, acacia, ash, aspen, poplar, elm, apple, pear and wild cherry, with a rich undergrowth of the most varied shrubs. Excellent timber is supplied by oak and cedar forests not far off. The climate, however, is severe, as compared with that of corresponding latitudes in Europe. Though standing in almost the same parallel as Marseilles, Vladivostok has an average annual temperature of only 40° F., and, although the gulf itself never freezes, a thin ice-crust forms along the shores in December and remains until April. The town has several handsome buildings, a monument to Admiral Nevelskiy (1897), a cathedral, a museum, an observatory, an Oriental institute (opened in 1899), professional schools, a naval hospital, mechanical and naval works, steam saw-mills and flour-mills. The drawback of Vladivostok is that it has not, and cannot have, a well-developed hinterland, despite the great efforts which have been made by the Russian government to supply the Usuri region (to the north of Vladivostok) with Russian settlers. The town of Vladivostok was founded in 1860–1861, and from 1865 to 1900 was a free port.

VODENA (Turk. and Bulg. *Voden*, anc. *Edessa*, *q.v.*), a city of European Turkey, in the vilayet of Salonica, western Macedonia; at the source of the small river Bistritza, which flows east and south into Lake Yenije, and on the railway from Salonica to Monastir. Pop. (1905) about 25,000, consisting of Turks, Slavs and Greeks. The town stands on a rocky height commanding views of Pindus and Olympus; the approaching slopes are richly wooded, and traversed by picturesque waterfalls, from which the name of Vodena (Slav. *voda*, water) is probably derived. Vodena is the see of a Greek archbishop, and possesses numerous churches and mosques, besides unimportant remains of Roman and Byzantine buildings. It has manufactures of cotton, tobacco and leather, and a large trade in wine, silk cocoons and red pepper.

VODEYSHANKAR, GOWRISHANKAR (1805–1892), native minister of the state of Bhaunagar in Kathiawar, Bombay, was born on the 21st of August 1805, of a family of Nagar Brahmins. He rose from being a revenue officer to be state minister in 1847. His success in this capacity was such that on the death of the reigning chief, in 1870, he was appointed joint administrator in concert with a British official. The experiment was in every respect successful. Under the simple and economical forms used in native states, improvements suggested by British experience were introduced. The land revenue was based on a cash system, the fiscal and customs systems were remodelled and tree planting was encouraged. The town of Bhaunagar received the great boon of the Gowrishankar Waterworks, on which six lakhs of rupees were spent. The Bhaunagar state also warmly pressed for railway communication with the continent of India, and thus began a movement which has spread a network of railway lines over the peninsula of Kathiawar. The British government rewarded these many services of Gowrishankar with the distinction of C.S.I. in 1877. He helped to establish the Rajkumar College at Rajkot, for the education of native princes, and also the Rajasthanik Court, which, after settling innumerable disputes between the land-owning classes and the chiefs, has since been abolished. In 1879 Gowrishankar resigned office, and devoted himself to the study of the higher literature of that Vedanta philosophy which through his whole life had been to him a solace and a guide. In 1884 he wrote a work called *Svarupanusandhan*, on the union of the soul with Deity, which led to a letter of warm congratulation from Max Müller, who also published a short biography of him. In 1887 he put on the robe of the *Sanyasi* or ascetic, the fourth stage, according to the Hindu Shastras, in the life of the twice-born man, and in this manner passed the remainder of his life, giving above ten hours each day to Vedantic studies and holy contemplation. He died, revered by all classes, in December 1892.

See Javerital U. Yajnik, *Gowrishankar Udayashankar* (Bombay, 1889).

VODKA, VODKI or WODKY, the Russian national spirituous beverage. Originally vodka was made almost entirely from rye, barley malt to the extent of 15 to 20% being used to effect saccharification (see SPIRITS), but at the present day potatoes and maize are the staple raw materials from which this spirit is manufactured, and, as a rule, green rye malt is now used instead of barley. The distillation is conducted by means of live steam in a double still of the "patent" type. Vodka as manufactured contains from 90 to 96% of alcohol, but it is diluted, previous to retailing, to a strength of 60 to 40%. It is illegal to sell it with less than 40% of alcohol.

VOETIUS (VOET), **GYSBERTUS** (1588–1676), Dutch theologian, was born at Heusden, Holland. He studied at Leiden, and in 1611 became pastor of Blymen, whence in 1617 he returned to Heusden. In 1619 he played an influential part in the Synod of Dort, and in 1634 was made professor of theology and Oriental science at Utrecht. Three years later he became pastor of the Utrecht congregation. He was an advocate of the extremest form of Calvinism against the Arminians; but his personal influence was good, and the city of Utrecht perpetuated his memory by giving his name to the street in which he had lived.

VOGEL, EDUARD (1829–1856), German traveller in Central Africa, was born at Krefeld on the 7th of March 1829. He studied mathematics and astronomy at Leipzig and Berlin, and in 1851 engaged in astronomical work in London. In 1853 he was chosen by the British government to take supplies to Heinrich Barth, then in the western Sudan; and Vogel met Barth at Kuka in Bornu (1854). During 1854 and 1855 he explored the countries round Lake Chad and the upper course of the Benue. On the 1st of December 1855 he left Kuka for the Nile Valley, and nothing further was heard of him. Several search expeditions were organized to ascertain his fate and to recover his papers; it was not until 1873 that Gustav Nachtigal on reaching Wadai learnt that Vogel had been murdered in that country in February 1856.

See *Erinnerungen an einen Verschollenen* (Leipzig, 1863), by Vogel's sister, E. Polko, and *Der Afrikaforscher Eduard Vogel* (Hamburg, 1889).

VOGEL, SIR JULIUS (1835–1899), British colonial statesman, son of Albert Leopold Vogel, was born in London on the 24th of February 1835, was educated at University College school, London, and emigrated to Victoria during the exciting years which followed the discovery of goldfields there. He became editor of a newspaper at Maryborough, stood for the Legislative Assembly and was defeated, and in 1861 left Victoria, carried in the mining rush to Otago, New Zealand, where much gold had just been found. Settling in Dunedin, he bought a half-share in the *Otago Daily Times*, and was soon its editor and a member of the Otago Provincial Council. He made his paper the most influential in the colony, and was returned to the House of Representatives. In 1866 he was head of the Otago Provincial Executive; by 1869 he had made his mark in the New Zealand parliament, and was treasurer in the ministry of Sir William Fox. Without delay he brought forward a scheme for the construction of trunk railways and other public works, the purchase of land from the Maori tribes, and the introduction of immigrants, all to be done with money borrowed in London. At that time New Zealand hardly contained a quarter of a million of white settlers, was exhausted by the ten years' struggle with the Maori, not then ended, and was depressed by the low price of her staple product, wool, and the abatement of a gold-fever. Yet Vogel's sanguine, energetic appeals and remarkable gift of persuasion induced the House of Assembly to adopt a modified version of his scheme. For the next six years he was the most powerful man in the colony. Millions were borrowed, railways were pushed on, immigrants—state and voluntary—streamed in. Lasting peace was made with the Maori, a telegraph line laid to Australia, a steam mail service secured across the Pacific to San Francisco; a government life insurance office, and a public trust office, were established, both of which proved useful and were well-managed. During a visit to London on the colony's financial business, Vogel succeeded in arranging for the inscription of colonial loans at the Bank of England, an arrangement afterwards confirmed by the imperial parliament. In 1875 he was knighted.

In 1874 Vogel, until that time a supporter of the Provincial system, decided to abolish it. In this, with the aid of Sir E. W. Stafford and Sir H. A. Atkinson, he succeeded. In the struggle, however, he broke with many of his old allies, and in 1876 suddenly quitted New Zealand to take the post of agent-general in London. This he held until 1880, and while holding it negotiated a loan for five millions. Having become connected with certain public companies, and the New Zealand government objecting thereto, he had to resign his position. An attempt, too, which he made in 1880 to enter the House of Commons as Conservative member for Penryn was unsuccessful. In 1884 he returned to New Zealand, was at once elected to parliament, and formed a coalition ministry with the Radical leader, Sir R. Stout. They held office for three years, but though Vogel showed some of his old financial skill, they were not years of prosperity for the colony, or triumph for the government. A deficit, a rejected scheme of taxation and a crushing defeat at the polls ended Vogel's career as a minister. After a few months of failure as leader of an outnumbered Opposition he gave up the contest, left New Zealand for the last time, and for the last eleven years of his life lived quietly near London. Throughout his life he had from time to time to struggle with deafness, lameness and acute bodily pain, while an impulsive, speculative nature led him once and again into financial difficulties. The persistency with which he faced trouble and embarrassment, the hopefulness he showed under stress of ill fortune, the sympathy and pleasantness of manner which won him friends at all times, were elements in his curious and interesting character no less remarkable than the fertility and imaginative power of his busy brain.

Vogel was among the pioneers of Imperial Federation; he would have extended Great Britain's influence in the Pacific Ocean had he been allowed. He was the first minister to secure the second reading of a Women's Franchise Bill in New Zealand. As long ago as 1874 he endeavoured to save the New Zealand forests from the reckless destruction by axe and fire which has since gone on. In 1889 a novel from his pen, *Anno Domini 2000*, was published, and reached a second edition. He died at East Molesey on the 13th of March 1899. His wife, who was the daughter of William Clayton, government architect, New Zealand, two sons and a daughter survived him. Another son had been killed in the Matabele War in South Africa. Vogel was a Jew of the Ashkenazi rite. (W. P. R.)

VOGHERA (anc. *Iria*), a town of Lombardy, Italy, in the province of Pavia, and 19 m. by rail S.S.W. of that city, 305 ft. above sea-level, on the Staffora (a tributary of the Po). Pop. (1901) 14,453 (town); 20,442 (commune). The fortifications erected by the Visconti in the middle ages have given place to shady promenades. The large church of San Lorenzo dates from the 11th century, but was remodelled in the baroque style about the beginning of the 17th. The suppressed church of S. Ilario (Chiesa Rossa), so called from the red colour of the brick of which it is built, dates from the 10th century. The neighbourhood produces much silk, in which, as well as in corn and wine, an active trade is carried on. The ancient Iria took its name from the river on which it was situated. It was on the road from Placentia to Dertona, and was made a colony by Augustus (*colonia Forum Iulium Iriensium*).

VOGLER, GEORG JOSEPH (1749–1814), usually known as Abbé or Abt (Abbot) Vogler, German organist and composer, was born at Pleichach in Würzburg on the 15th of June 1749. His father, a violin maker, while educating him in the Jesuit college, encouraged his musical talent, which was so marked that at ten years old he could not only play the organ well, but had also acquired a fair command of the violin and some other instruments. In 1771 he went to Mannheim, where he composed a ballet for the elector Karl Theodor, who sent him to Bologna in 1774 to study under the Padre Martini. Dissatisfied with the method of that learned theorist, he studied for five months under Valotti at Padua, and afterwards proceeded to Rome, where, having been ordained priest, he was admitted to the famous academy of Arcadia, made a knight of the Golden Spur, and appointed protonotary and chamberlain to the pope.

On his return to Mannheim in 1755 Vogler was appointed court chaplain and second "maestro di cappella." He now established his first great music school. His pupils were devoted to him, but he made innumerable enemies, for the principles upon which he taught were opposed to those of all other teachers. He had invented a new system of fingering for the harpsichord, a new form of construction for the organ, and a new system of musical theory founded upon that of Valotti. Mozart condemned the fingering as "miserable," and many rumours to his discredit have survived to this day owing to Mozart's share in the prejudice felt against him. The proposed change in the construction of the organ consisted in simplifying the mechanism, introducing free-reeds in place of ordinary reed-stops, and substituting unisonous stops for the great "mixtures" then in vogue. The theoretical system, though professedly based upon Valotti's principles, was to a great extent empirical. Nevertheless, in virtue of a certain substratum of truth which seems to have underlain his new theories, Vogler undoubtedly exercised a powerful influence over the progress of musical science, and numbered among his disciples some of the greatest geniuses of the period.

In 1778 the elector removed his court to Munich. Vogler followed him thither in 1780, but, dissatisfied with the reception accorded to his dramatic compositions, soon quitted his post. He went to Paris, where after much hostility his new system was recognized as a continuation of that started by Rameau. His organ concerts in the church of St Sulpice attracted considerable attention. At the request of the queen, he composed the opera *Le Patriotisme*, which was produced before the court at Versailles. His travels were wide, and extended over Spain, Greece, Armenia, remote districts of Asia and Africa, and even Greenland, in search of uncorrupted forms of national melody. In 1786 he was appointed "kapellmeister," to the king of Sweden, founded his second music school at Stockholm, and attained extraordinary celebrity by his performances on an instrument called the "orchestrion"—a species of organ invented by himself.[1] In 1790 he brought this instrument to London, and performed upon it with great effect at the Pantheon, for the concert-room of which he also constructed an organ upon his own principles. The abbé's pedal-playing excited great attention. His most popular pieces were a fugue on themes from the "Hallelujah Chorus," composed after a visit to the Handel festival at Westminster Abbey, and *A Musical Picture for the Organ*, by Knecht, containing the imitation of a storm.

From London Vogler proceeded to Rotterdam and the chief towns on the Rhine. At Esslingen he was presented with the "wine of honour," reserved for the use of sovereigns. At Frankfort he attended the coronation of the emperor Leopold II. He then visited Stockholm, and after a long residence there, interrupted by endless wanderings, once more established himself in Germany, where his compositions, both sacred and dramatic, received at last full credit. We hear of him at Berlin in 1800, at Vienna in 1804 and at Munich in 1806. While at Frankfort in 1807 he received an invitation from Louis I., grand duke of Hesse-Darmstadt, offering him the appointment of "kapellmeister," with the order of merit, the title of privy councillor, a salary of 3000 florins, a house, a table supplied from the duke's own kitchen, and other privileges, which determined him to bring his wanderings at last to a close.

At Darmstadt he opened his third and most famous music school, the chief ornaments of which were Gänsbacher, Weber and Meyerbeer, whose affection for their old master was unbounded. One of Vogler's latest exploits was a journey to Frankfort in 1810, to witness the production of Weber's *Sylvana*. He continued to work hard to the last, and died suddenly of apoplexy at Darmstadt on the 6th of May 1814. He was a brilliant and accomplished performer, and an excellent if an eccentric teacher; but his own compositions have not survived.

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[1] Robert Browning's poem on "Abt Vogler extemporizing on an instrument of his own invention" has made his name familiar to the literary public.

VOGT, KARL CHRISTOPH (1817–1895), German naturalist and geologist, was born at Giessen on the 5th of July 1817. In 1847 he became professor of zoology at Giessen, and in 1852 professor of geology and afterwards also of zoology at Geneva, where he died on the 5th of May 1895. His earlier publications were on zoology; he dealt with the Amphibia (1839), Reptiles (1840), with Mollusca and Crustacea (1845) and more generally with the invertebrate fauna of the Mediterranean (1854).

His separate works include *Im Gebirg und auf den Gletschern* (1843); *Physiologische Briefe* (1845–46); *Grundriss der Geologie* (1860); and *Lehrbuch der Geologie und Petrefactenkunde* (2 vols., 1846–47; ed. 4, 1879). An English version of his *Lectures on Man: his Place in Creation and in the History of the Earth* was published by the Anthropological Society of London in 1864.

VOGTLAND, or VOIGTLAND, a district of Germany, forming the S.W. corner of the kingdom of Saxony, and also embracing parts of the principality of Reuss and of the duchies of Saxe-Altenburg and Saxe-Weimar. It is bounded on the N. by the principalities of Reuss, in the S.E. by Bohemia, and on the S.W. and W. by Bavaria. Its character is generally mountainous, and geologically it belongs to the Erzgebirge range. It is extremely rich in mineral ores—silver, copper, lead and bismuth. The name denoted the country governed for the emperor by a *Vogt* (bailiff or steward), and was, in the middle ages, known as *terra advocatorum*. The Vögte are first met with in the country in the 10th century, and the office shortly afterwards appears to have become hereditary in the princely line of Reuss. But this house was not in undivided possession, rival claims being raised from time to time; and after being during the middle ages a bone of contention between Bohemia, the burgraves of Nuremberg and the Saxon house of Wettin, it passed gradually to the Wettins, falling by the division of 1485 to the Ernestine branch of the family. The elector Augustus I. made it one of the circles of his dominions.

See Limmer, *Geschichte des Vogtlandes* (Gera, 1825–28, 4 vols.); Simon, *Das Vogtland* (Meissen, 1904); C. F. Collmann, *Das Vogtland im Mittelalter* (Greiz, 1892); and Metzner, *Vogtländische Wanderungen* (Annaberg, 1902).

VOGÜÉ, EUGÈNE MELCHIOR, COMTE DE (1848–), French author, was born at Nice on the 25th of February 1848. He served in the campaign of 1870, and on the conclusion of the war entered the diplomatic service, being appointed successively attaché to the legations at Constantinople and Cairo and secretary at St Petersburg. He resigned in 1882, and from 1893 to 1898 was deputy for Ardèche. His connexion with the *Revue des deux mondes* began in 1873 with his *Voyage en Syrie et en Palestine*, and subsequently he was a frequent contributor. He did much to awaken French interest in the intellectual life of other countries, especially of Russia, his sympathy with which was strengthened by his marriage in 1878 with a Russian lady, the sister of General Annenkov. De Vogüé was practically the first to draw French attention to Dostoievski and his successors. He became a member of the French Academy in 1888.

His works include: *Histoires orientales* (1879); *Portraits du siècle* (1883); *Le Fils de Pierre le Grand* (1884); *Histoires d'hiver* (1885); *Le Roman russe* (1886); *Regards historiques et littéraires* (1892); *Cœurs russes* (1894); *Devant le siècle* (1896); *Jean d'Agrève* (1898); *Le Rappel des ombres* (1900); *Le Maître de la mer* (1903); *Maxime Gorky* (1905).

VOICE (Fr. *voix*, from Lat. *vox*), the sound produced by the vibrations of the vocal cords, two ligaments or bands of fibrous elastic tissue situated in the larynx. It is to be distinguished from *speech*, which is the production of articulate sounds intended to express ideas. Many of the lower animals have voice, but none has the power of speech in the sense in which man possesses that faculty. There may be speech without voice, as in whispering, whilst in singing a scale of musical tones we have voice without speech. (See SONG; and for speech see PHONETICS; also the articles on the various letters of the alphabet.)

1. *Physiological Anatomy.*—The organ of voice, the *larynx*, is situated in man in the upper and fore part of the neck, where it forms a well-known prominence in the middle line (see details under RESPIRATORY SYSTEM). It opens below into the trachea or windpipe, and above into the cavity of the pharynx, and it consists of a framework of cartilages, connected by elastic membranes or ligaments, two of which constitute the true vocal cords. These cartilages are movable on each other by the action of various muscles, which thus regulate the position and the tension of the vocal cords. The trachea conveys the blast of air from the lungs during expiration, and the whole apparatus may be compared to an acoustical contrivance in which the lungs represent the wind chest and the trachea the tube passing from the wind chest to the sounding body contained in the larynx. Suppose two tight bands of any elastic membrane, such as thin sheet india-rubber, stretched over the end of a wide glass tube so that the margins of the bands touched each other, and that a powerful blast of air is driven through the tube by a bellows. The pressure would so distend the margins of the membrane as to open the aperture and allow the air to escape; this would cause a fall of pressure, and the edges of the membrane would spring back by their elasticity to their former position; again the pressure would increase, and again the edges of the membrane would be distended, and those actions would be so quickly repeated as to cause the edges of the membrane to vibrate with sufficient rapidity to produce a musical tone, the pitch of which would depend on the number of vibrations executed in a second of time. In other words, there would be a rapid succession of puffs of air. The condensation and rarefaction of the air thus produced are the chief cause of the tone, as H. von Helmholtz has pointed out, and in this way the larynx resembles the siren in its mode of producing tone. It is evident also that the intensity or loudness of the tone would be determined by the amplitude of the vibrations of the margins of the membrane, and that its pitch would be affected by any arrangements effecting an increase or decrease of the tension of the margins of the membrane. The pitch might also be raised by the strength of the current of air, because the great amplitude of the vibrations would increase the mean tension of the elastic membrane. With tones of medium pitch, the pressure of the air in the trachea is equal to that of a column of mercury of 160 mm.; with high pitch, 920 mm.; and with notes of very high pitch, 945 mm.; whilst in whispering it may fall as low

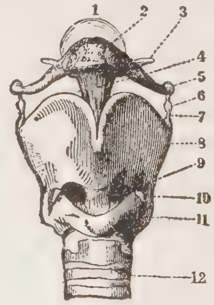


FIG. 1.

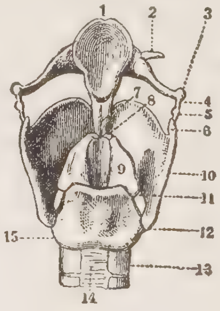


FIG. 2.

FIG. 1.—Cartilages and Ligaments of the Larynx, seen from the front; abt. half nat. size. 1, epiglottis; 2, hyoid bone; 3, small cornu of hyoid bone; 4, middle thyro-hyoid ligament; 5, great cornu of hyoid bone; 6, small nodules of cartilage (*cartilago triticea*); 7, the lateral thyro-hyoid ligament; 8, left lamina or wing of thyroid cartilage; 9, cricoid cartilage; 10, lower cornu of thyroid cartilage; 11, part of cricoid united to the thyroid by the middle crico-thyroid ligament; 12, second ring of trachea. (From Krause.)

FIG. 2.—Cartilages and Ligament of Larynx, seen from behind; half natural size. 1, epiglottis; 2, lesser cornu of hyoid bone; 3, greater cornu of hyoid; 4, lateral thyro-hyoid ligament; 5, cartilago triticea; 6, upper cornu of thyroid; 7, thyro-epiglottic ligament; 8, cartilages of Santorini; 9, arytenoid cartilages; 10, left lamina of thyroid; 11, muscular process of arytenoid cartilage; 12, inferior cornu of thyroid; 13, first ring of trachea; 14, posterior membranous wall of trachea; 15, lamina of cricoid cartilage. (From Krause.)

as that represented by 30 mm. of water. Such is a general conception of the mechanism of voice.

The *cartilages* form the framework of the larynx. They consist of three single pieces (the thyroid, the cricoid and the cartilage of the epiglottis) and of three pairs (two arytenoids, two cornicula laryngis or cartilages of Santorini, and two cuneiform cartilages or cartilages of Wrisberg), see figs. 1 and 2. The epiglottis, the cornicula laryngis, the cuneiform cartilages and the apices of the arytenoids are composed of yellow or elastic fibro-cartilage, whilst the cartilage of all the others is of the hyaline variety, resembling that of the costal or rib cartilages. These cartilages are bound together by ligaments, some of which are seen in figs. 1 and 2, whilst the remainder are represented in fig. 3. The ligaments specially concerned in the production of voice are the *inferior thyro-arytenoid ligaments*, or true vocal cords. These are composed of fine elastic fibres attached behind to the anterior projection of the base of the arytenoid cartilages, *processus vocalis*, 3 in fig. 3, and in front to the middle of the angle between the wings or laminae of the thyroid cartilage. They are practically continuous with the lateral crico-thyroid ligaments, 6 in fig. 3.

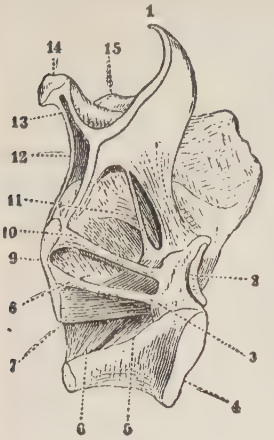


Fig. 3.—Right Half of the Larynx, from a vertical and slightly oblique section; abt. two-thirds nat. size. 1, epiglottis; 2, arytenoid cartilage; 3, processus vocalis of arytenoid; 4, cricoid cartilage; 5, capsular thyro-hyoid ligament; 6, lateral crico-thyroid ligament; 7, posterior crico-thyroid ligament; 8, inferior thyro-arytenoid ligament, or true vocal cord; 9, thyroid cartilage; 10, superior thyro-arytenoid ligament, or false vocal cord; 11, thyro-ary-epiglottideus muscle; 12, middle thyro-hyoid ligament; 13, hyo-epiglottic ligament; 14, body of hyoid bone; 15, smaller cornu of hyoid bone. (From Krause.)

The *cavity* of the larynx is divided into an upper and lower portion by the narrow aperture of the *glottis* or chink between the edges of the true vocal cords, the *rima glottidis*. Immediately above the true vocal cords, between these and the false vocal cords, there is on each side a recess or pouch termed the *ventricle* of Morgagni, and opening from each ventricle there is a still smaller recess, the *laryngeal pouch*, which passes for the space of half an inch between the superior vocal cords inside and the thyroid cartilage outside, reaching as high as the upper border of that cartilage at the side of the epiglottis. The ventricles no doubt permit a free vibration of the true vocal cords. The upper aperture of the glottis is triangular, wide in front and narrow behind; and, when seen from above by means of the laryngoscope, it presents the view represented in fig. 4. The aperture is bounded in front by the epiglottis, *e*, behind by the summits of the arytenoid cartilages, *ar*, and on the sides by two folds of mucous membrane, the aryteno-epiglottic folds, *ae*. The rounded elevations corresponding to the cornicula laryngis and cuneiform cartilages, *c*, and also the cushion of the epiglottis, *e*, are readily seen in the laryngoscopic picture. The glottis, *o*, is seen in the form of a long narrow fissure, bounded by the true vocal cords, *ti*, whilst above them we have the false vocal cords, *ts*, and between the true and false cords the opening of the ventricle, *v*. The *rima glottidis*, between the true vocal cords, in the adult male measures about 23 mm., or nearly an inch from before backwards, and from 6 to 12 mm. across its widest part, according to the degree of dilatation. In females and in males before puberty the antero-posterior diameter is about 17 mm. and its transverse diameter about 4 mm. The vocal cords of the adult male are in length about 15 mm., and of the adult female about 11 mm. The larynx is lined with a layer of epithelium, which is closely adherent to underlying structures, more especially over the true vocal cords. The cells of the epithelium, in the greater portion of the larynx, are of the columnar ciliated variety, and by the vibratory action of the cilia mucus is driven upwards, but over the true vocal cords the epithelium is squamous. Patches of squamous epithelium are also found in the ciliated tract above the glottis, on the under surface of the epiglottis, on the inner surface of the arytenoid cartilages, and on the free border of the upper or false cords. Numerous mucous glands exist in the lining membrane of the larynx, more especially in the epiglottis. In each laryngeal pouch there are sixty to seventy such glands, surrounded by fat.

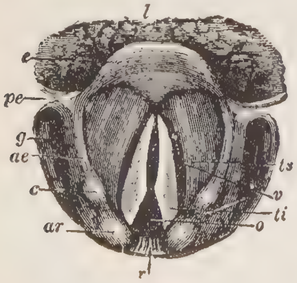


Fig. 4.—Laryngoscopic View of the Glottis. *l*, tongue; *e*, epiglottis; *pe*, pharyngo-epiglottic fold; *g*, pharyngo-laryngeal groove; *ae*, aryteno-epiglottic fold; *c*, cuneiform cartilage, or cartilage of Wrisberg; *ar*, arytenoid cartilage; *r*, inter-arytenoid fold; *o*, glottis; *v*, ventricle; *ti*, inferior or true vocal cord; *ts*, superior or false vocal cord. (From Mandl.)

We are now in a position to understand the action of the *muscles* of the larynx by which the vocal cords, forming the *rima glottidis*, can be tightened or relaxed, and by which they can be approximated or separated. Besides certain extrinsic muscles — sterno-hyoid, omohyoid, sterno-thyroid and thyro-hyoid—which move the larynx as a whole, there are *intrinsic* muscles which move the cartilages on each other. Some of these are seen in fig. 5. These muscles are (*a*) the crico-thyroid, (*b*) the posterior crico-arytenoid, (*c*) the lateral crico-arytenoid, (*d*) the thyro-arytenoid, (*e*) the arytenoid, and (*f*) the aryteno-epiglottidean. Their actions will be readily understood with the aid of the diagrams in fig. 6. (1) The *crico-thyroid* is a short thick triangular muscle, its fibres passing from the cricoid cartilage obliquely upwards and outwards to be inserted into the lower border of the thyroid cartilage and to the outer border of its lower horn. When the muscle contracts, the cricoid and thyroid cartilages are approximated. In this action, however, it is not the thyroid that is depressed on the cricoid, as is generally stated, but, the thyroid being fixed in position by the action of the extrinsic muscles, the anterior border of the cricoid is drawn upwards, whilst its posterior border, in consequence of a revolution around the axis uniting the articulations between the lower cornua of the cricoid and the thyroid, is depressed, carrying the arytenoid cartilages along with it. Thus the vocal cords are stretched. (2) The *thyro-arytenoid* has been divided by anatomists into two parts—one, the internal, lying close to the true vocal cord, and the other, external, immediately within the ala of the thyroid cartilage. Many of the fibres of the anterior portion pass from the thyroid cartilage with a slight curve (concavity inwards) to the processus vocalis at the base of the arytenoid cartilage. They are thus parallel with the true vocal cord, and when they contract the arytenoids are drawn forwards, carrying with them the posterior part of the cricoid and relaxing the vocal cords. Thus the thyro-arytenoids are the antagonists of the crico-thyroids. K.F.W. Ludwig has pointed out that certain fibres (*portio-ary-vocalis*) arise from the side of the cord itself and pass obliquely back to the processus vocalis. These will tighten the parts of the cord in front and relax the parts behind their points of attachment. Some of the fibres of the outer portion run obliquely upwards from the side of the crico-thyroid membrane, pass through the antero-posterior fibres of the inner portion of the muscle, and finally end in the tissue of the false cord. These fibres have been supposed to render the edge of the cord more prominent. Other fibres inserted into the processus vocalis will rotate slightly the arytenoid outwards, whilst a few passing up into the aryteno-epiglottidean folds may assist in depressing the epiglottis (Quain). (3) The *posterior* and *lateral crico-arytenoid* muscles have antagonistic actions, and may be considered together. The *posterior* arise from the posterior surface of the cricoid cartilage, and passing upwards and outwards are attached to the outer angle of the base of the arytenoid. On the other hand, the *lateral* arise from the upper border of the cricoid as far back as the articular surface for the arytenoid, pass backwards and upwards, and are also inserted into the outer angle of the base of the arytenoid before the attachment of the posterior crico-arytenoid. Imagine the pyramidal form of the arytenoid cartilages. To the inner angle of the triangular base are attached, as already described, the true vocal cords; and to the outer angle the two muscles in question. The posterior crico-arytenoids draw the outer angles backwards and inwards, thus rotating the inner angles, or processus vocalis, outwards, and, when the two muscles act, widening the rima glottidis. This action is opposed by the lateral crico-thyroids, which draw the outer angle forwards and outwards. rotate the inner angles inwards,

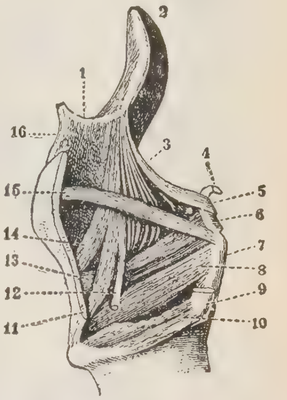


Fig. 5.—Muscles of the left side of the larynx, seen from within; abt. two-thirds nat. size. 1, hyo-epiglottic ligament, seen in profile; 2, epiglottis; 3, aryteno-epiglottic muscle; 4, Santorini's cartilage; 5, oblique arytenoid muscle; 6, transverse arytenoid muscle, seen in profile; 7, posterior crico-arytenoid; 8, lateral crico-arytenoid; 9, lower cornu of thyroid cartilage cut through; 10, insertion of posterior portion of crico-thyroid muscle; 11, left lamina of thyroid cartilage cut through; 12, long thyro-epiglottic muscle (a variety); 13, inferior thyro-arytenoid; 14, thyro-epiglottic; 15, superior thyro-arytenoid; 16, median thyro-hyoid ligament. (From Krause.)

and thus approximate the cords. (4) The *arytenoids* pass from the one arytenoid cartilage to the other, and in action these cartilages will be approximated and slightly depressed. (5) The *aryteno-epiglottidean* muscles arise near the outer angles of the arytenoid; their fibres pass obliquely upwards, decussate and are inserted partly into the outer and upper border of the opposite cartilage, partly into the aryteno-epiglottic fold, and partly join the fibres of the thyro-arytenoids. In action they assist in bringing the arytenoids together, whilst they also draw down the epiglottis, and constrict the upper aperture of the larynx. The vocal cords will be also relaxed by the elasticity of the parts.

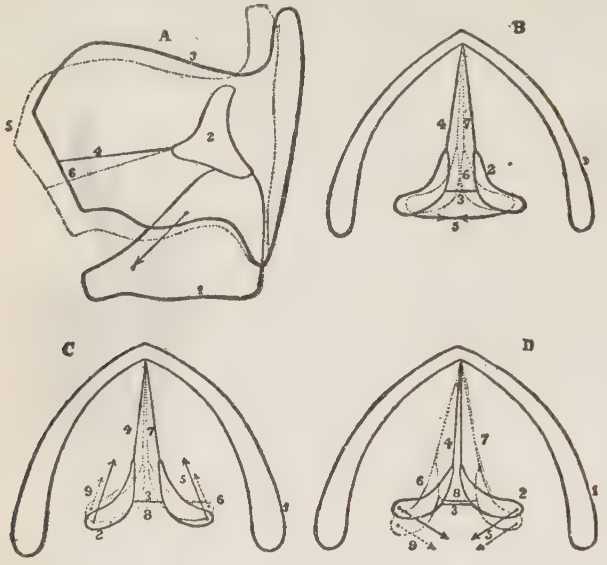


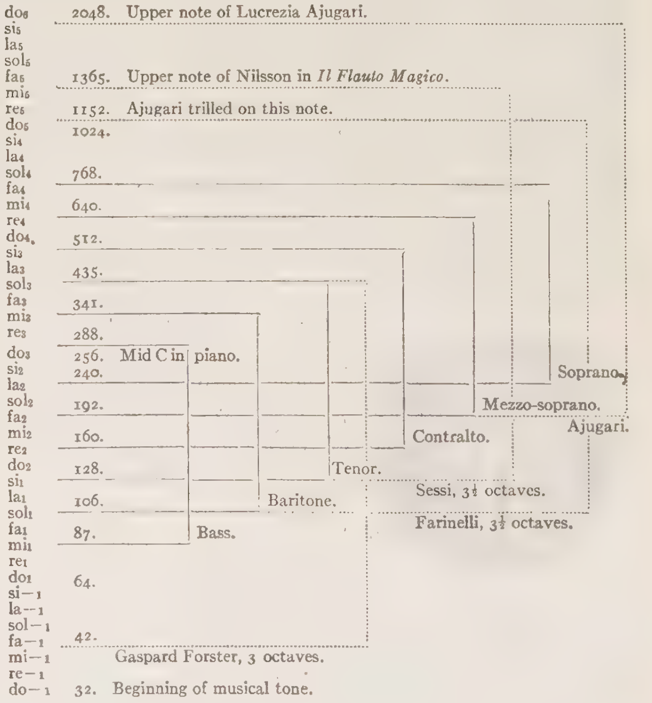
Fig. 6.—Diagrams explaining the action of the muscles of the larynx. The dotted lines show the positions taken by the cartilages and the true vocal cords by the action of the muscle, and the arrows show the general direction in which the muscular fibres act. A, Action of crico-thyroid: 1, cricoid cartilage; 2, arytenoid cartilage; 3, thyroid cartilage; 4, true vocal cord; 5, thyroid cartilage, new position; 6, true vocal cord, new position. B, Action of arytenoid: 1, section of thyroid; 2, arytenoid; 3, posterior border of epiglottis; 4, true vocal cord; 5, direction of muscular fibres; 6, arytenoid, new position; 7, true vocal cord, new position. C, Action of lateral crico-arytenoid; same description as for A and B; 8, posterior border of epiglottis, new position; 9, arytenoid in new position. D, Action of posterior crico-arytenoid; same description. (From Beaunis and Bouchard.)

Muscular mechanisms.

2. *Physiology of Voice Production.*—The vocal cords are tightened by the action of the crico-thyroid, or, as it might be more appropriately termed, the thyro-cricoid muscle. It stretches the thyro-arytenoid ligaments, the free edges of which, covered by mucous membrane, form the vocal cords. The adductors of the cords are the lateral crico-arytenoids, while the posterior crico-arytenoids are the abductors. The arytenoid muscle brings the cords together. Many of the fibres of the thyro-arytenoid are inserted obliquely into the sides of the cord, and in contraction they tighten the cord by pulling on the edge and making it curved instead of straight. Some such action is indicated by the elliptical shape of the rima glottidis in passing from the chest register to the middle register. Other fibres, however, running parallel with the cord may tend to relax it in certain circumstances. All the muscles except the thyro-cricoid (which is innervated by the superior laryngeal) receive nerve filaments from the inferior laryngeal branch of the vagus, the fibres being derived from the accessory roots. Both the abductor and adductor nerves come therefore from the inferior laryngeal. When an animal is deeply anaesthetized stimulation of the inferior laryngeal nerve causes abduction of the cord, but if the anaesthesia is slight, then we have adduction. The tonic contraction of the abductors is stronger than that of the adductors, so in a state of rest the glottis is slightly open. The centre of innervation is in the medulla oblongata, and this is dominated by a centre in the Rolandic region of the cerebral cortex.

The *intensity* or *loudness* of voice depends on the amplitude of the movement of the vocal cords. *Pitch* depends on the number of vibrations per second; and the length, size and degree of tension of the cords will determine the number of vibrations. The more tense the cords the higher the pitch, and the greater the length of the cords the lower will be the pitch. The *range* of the human voice is about three octaves—that is, from fa$_1$ (87 vibrations per second) to sol$_4$ (768 vibrations). In men, by the development of the larynx, the cords become more elongated than in women, in the ratio of 3 to 2, so that the male voice is of lower pitch and is usually stronger. At the age of puberty the larynx grows rapidly, and the voice of a boy "breaks" in consequence of the lengthening of the cords, generally falling an octave in pitch. A similar change, but very much less in amount, occurs at the same period in the female. At puberty in the female there is an increase of about one-third in the size of the glottis, but it is nearly doubled in the male, and the adult male larynx is about one-third greater than that of the female. In advanced life the upper notes of the register are gradually weakened and ultimately disappear, whilst the character of the voice also changes, owing to loss of elasticity caused by ossification, which first begins about middle life in the thyroid cartilage, then appears in the cricoid, and much later in the arytenoid. Eunuchs retain the voices of childhood; and by careful training it is possible in normal persons to arrest the development of the larynx so that an adult male can still sing the soprano parts sometimes used in cathedral choirs. The ranges of the different varieties of voice are shown in the following diagram, where the dotted lines give the range of certain remarkable voices, and the figures represent vibrations per second, taking the middle C of the piano as 256 vibrations per second.

General physiological characters.



A basso named Gaspard Forster passed from fa$_{-1}$ to la$_3$; the younger of the sisters Sessi had a contralto voice from do$_2$ to fa$_5$; the voice of Catalani ranged three and a half octaves; a eunuch singer, Farinelli, passed from la$_1$ to re$_5$; Nilsson, in *Il Flauto Magico*, could take fa$_5$; and Mozart states that he heard in Parma in 1770 a singer, Lucrezia Ajugari, range from sol$_2$ to do$_6$, which she gave purely, whilst she could execute trills on re$_5$. The latter is the most highly pitched voice referred to in musical literature, an octave and a half above the highest ordinary soprano. It will be observed that the lowest note of Gaspard Forster's voice is not much above the pitch at which the perception of musical tone begins, and that from this note to the upper note of Lucrezia Ajugari there is a range of nearly six octaves, whilst the extreme range of ordinary voices, from the lowest bass to the highest soprano, is a little over three octaves. It is also interesting to observe that the range of the human ear for the perception of musical tone is from do$_{-1}$ to do$_{10}$, or from about 32 to 32,768 vibrations per second—eleven octaves.

3. *The Voice Registers.*—The voice has been divided by writers into three registers—the lower or chest, the middle and the small or head register. In singing, the voice changes in volume and in quality in passing from one register into another. There is remarkable diversity of opinion as to what happens in the larynx in passing through the various registers. There has also been much discussion as to the production of falsetto tones. Lehfeldt and Johannes Müller held that a weak blast of air caused only a portion of the cords, as regards length, to vibrate; M. J. Örtel noticed that when a falsetto tone is produced nodal lines are formed in the cords parallel to their edges, an observation supporting the first contention; M. Garcia was of opinion that as the voice rose in pitch into falsetto only the ligamentous edges of the cords vibrated; and W. R. E. Hodgkinson showed, by dusting finely powdered indigo into the larynx and observing the blue specks with the laryngoscope, that "in the deeper note of the lower register the vibrating margin extended from the thyroid cartilage in front to a point behind the junction of the ligamentous and cartilaginous portions of the cord." In singing falsetto tones these additional parts are not thrown into action. Some remarkable and instructive photographs obtained by French show that in proceeding from the lowest to the highest notes of the lower register the cords became lengthened by one-eighth of an inch in a contralto singer's larynx; the same singer, in passing into the middle register, showed a shortening of the cords by one-sixteenth of an inch, and another increase in length when the upper part of the middle register was reached.

4. *Condition of the Larynx in the Various Registers.*—In singing, one can readily observe that the tone may appear to come chiefly from the chest, from the throat or from the head, or it may show the peculiar quality of tone termed falsetto. Authorities differ much in the nomenclature applied to these varieties of the voice. Thus the old Italian music masters spoke of the voce di petto, voce di gola and voce di testa. Madame Seiler describes five conditions, viz. the first series of tones of the chest register, the second series of tones of the chest register, the first series of tones of the falsetto register, the second series of tones of the falsetto register, and the head register. French writers usually refer to two registers only, the chest and the head; whilst Behnke gives three registers for male voices (lower thick, upper thick and upper thin) and five for the voices of women and children (lower thick, upper thick, lower thin, upper thin and small). These distinctions are of more importance practically than as implying any marked physiological differences in the mechanism of the larynx during the production of the tones in the different registers. By means of the laryngoscope it is possible to see the condition of the rima glottidis and the cords in passing through all the range of the voice.

In 1807 Bozzini first showed that it was possible to see into the dark cavities of the body by illumining them with a mirror, and in 1829 W. Babington first saw the glottis in this way. In 1854 Garcia investigated his own larynx and that of other singers, and three years later Türck, and especially J. N. Czermak, perfected the construction of the laryngoscope. In 1883 Lennox Browne and Emil Behnke obtained photographs of the glottis in the living man. The laryngoscope is a small mirror, about the diameter of a shilling, fixed to the end of a long handle at an angle of 125° to 130°. This mirror is gently pushed towards the back of the throat, and if sufficient light be thrown into the mouth from a lamp, and if the eye of the observer be in the proper position, by angling the small mirror it is not difficult to get a view of the glottis. The light from the lamp is reflected by the mirror down on the glottis; from this it is reflected back to the mirror, and then by the mirror it is finally reflected to the eye of the observer. Usually the observer has in front of his eye a mirror by which a powerful beam of light can be thrown from a lamp into the mouth and throat. In the centre of the mirror there is a small hole through which the eye of the observer sees the image in the small mirror at the back of the throat. By placing a second plane mirror in front of the face, an observer can easily study the mechanism of his own larynx.

Suppose the picture of the larynx to be examined in the small mirror at the back of the throat, an image will be seen as in fig. 4. During calm breathing, the glottis is lance-shaped, between the yellowish white cords. A deep inspiration causes the glottis to open widely, and in favourable circumstances one may look into the trachea. When a sound is to be made, the vocal cords are brought close together, either along their whole length, as in fig. 7, or only along the ligamentous portion, the space between the arytenoids being still open, as in fig. 8. Then when the sound begins the glottis opens (fig. 4), the form of the opening influencing the kind of voice, whilst the degree of tension of the cords will determine the pitch.

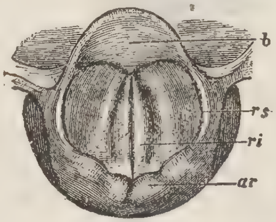


FIG. 7.

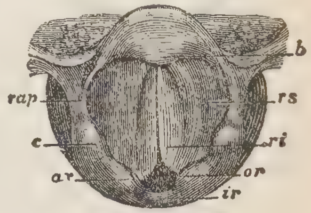


FIG. 8.

FIG. 7.—Arrangement of Glottis previous to Emission of a Sound. *b*, epiglottis; *rs*, false cord; *ri*, true vocal cord; *ar*, arytenoid cartilages. (From Mandl.)

FIG. 8.—Closure of the Ligamentous Portion of Glottis. *b*, epiglottis; *rs*, false cord; *ri*, true vocal cord; *or*, space between arytenoids; *ar*, arytenoid cartilages; *c*, cuneiform cartilages; *rap*, ary-epiglottic fold; *ir*, inter-arytenoid fold. (From Mandl.)

During inspiration the edges of the true vocal cords may occasionally be close together, as in sobbing, and during inspiration the false cords are easily separated, even when they touch, and during expiration, owing to dilatation of the ventricles, they come together and may readily close. Thus, from the plane of the cords, the true cords are most easily closed during inspiration and the false cords during expiration. J. Wyllie clearly showed in 1865 that the false vocal cords play the chief part in closure of the glottis during expiration. Lauder Brunton and Cash have confirmed J. Wyllie's results, and have shown further that the function of the false cords is to close the glottis and thus fix the thorax for muscular effort.

During the production of the *chest* voice, the space between the arytenoid cartilages is open, and between the vocal cords there is an ellipsoidal opening which gradually closes as the pitch of the sound rises (see figs. 9, 10, 11). During *head* voice, the opening between the arytenoids is completely closed; the portion between the vocal cords is open, but in place of being almost a narrow straight slit as in chest voice, it is wide open so as to allow an escape of more air (see fig. 12). Paralysis of the motor fibres causes aphonia, or loss of voice. If one cord is paralysed the voice may be lost or become falsetto in tone. Sometimes the cords may move in breathing or during coughing, but be motionless during an attempt at the production of voice. Rarely, incomplete unilateral paralysis of the recurrent nerve, or the existence of a tumour on each cord, thus making them unequal in length, may cause a double tone, or *diphthongia*. Hoarseness is caused by roughness or swelling of the cords.

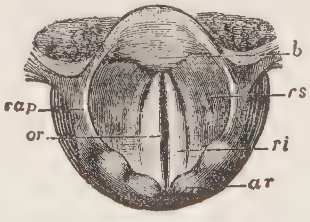


FIG. 9.

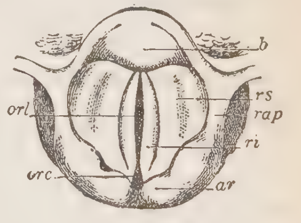


FIG. 10.

FIG. 9.—Chest Voice, Deep Tone. *b*, epiglottis; *or*, glottis; *rs*, false vocal cord; *ri*, true vocal cord; *rap*, ary-epiglottidean fold; *ar*, arytenoid cartilages. (From Mandl.)

FIG. 10.—Chest Voice, Medium Tone. *orl*, ligamentous portion of glottis; *orc*, portion of glottis between arytenoids; remaining description as in fig. 7. (From Mandl.)

5. The *quality* of the human voice depends on the same laws that determine the quality, clang-tint or timbre of the tones produced by any musical instrument. Musical tones are formed by the vibrations of the true vocal cords. These tones may be either pure or mixed, and in both cases they are

strengthened by the resonance of the air in the air-passages and in the pharyngeal and oral cavities. If mixed—that is, if the tone is compounded of a number of partials—one or more of these will be strengthened by the cavities above the cords acting as a resonator; and so strongly may these partials be thus reinforced that the fundamental one may be obscured, and a certain quality or timbre will be communicated to the ear. Further, Helmholtz has shown that special forms of the oral cavity reinforce in particular certain partials, and thus give a character to vowel tones,—indeed to such an extent that each vowel tone may be said to have a fixed pitch. This may be proved by putting the mouth in a certain form, keeping the lips open, and bringing various tuning forks sounding feebly in front of the opening. When a fork is found to which the resonant cavity of the mouth corresponds, then the tone of the fork is intensified, and by thus altering the form and capacity of the oral cavity its pitch in various conditions may be determined. Thus, according to Helmholtz, the pitch corresponding to the vowels may be expressed:—

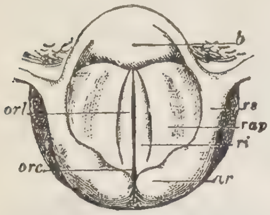


FIG. 11.

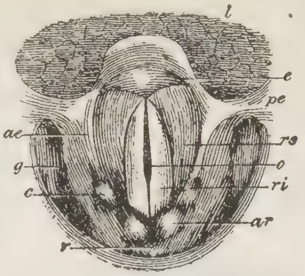


FIG. 12.

FIG. 11.—Chest Voice, High Tone. Description same as for figs. 7 and 8. (From Mandl.)

FIG. 12.—Head Voice, Deep Tones. *l*, tongue; *e*, epiglottis; *pe*, pharyngo-epiglottidean folds; *ae*, ary-epiglottic folds; *rs*, false cords; *ri*, true vocal cords; *g*, pharyngo-laryngeal groove; *ar*, arytenoid cartilages; *c*, cuneiform cartilages; *o*, glottis; *r*, inter-arytenoid folds. (From Mandl.)

Vowels . . .	OU	O	A	AI	E	I	EU	U
Tone . . .	fa$_2$	si$\flat_3$	si$\flat_4$	sol$_5$ or re$_4$	si$\flat_5$ or fa$_3$	re$_6$ or fa$_2$	do$_5$ or fa$_3$	sol$_5$ or fa$_2$
No. of vibrations .	170	470	940	1536 or 576	1920 or 341	2304 or 170	1024 or 341	1536 or 170

R. Koenig has fixed the pitch of the vowels differently, thus:

Vowels . .	OU	O	A	E	I
Tone . .	si$\flat_2$	si$\flat_3$	si$\flat_4$	si$\flat_5$	si$\flat_6$
No. of vibrations .	235	470	940	1880	3760

F. C. Donders has given a third result, differing from each of the above; and there is little doubt that much will depend on the quality of tone peculiar to different nationalities. By means of Koenig's manometric flames with revolving mirror the varying quality of tone may be illustrated: with a pure tone, the teeth in the flame-picture are equal, like the serrations of a saw, whilst usually the tone is mixed with partials which show themselves by the unequal serrations. Thus quality of voice depends, not merely on the size, degree of elasticity and general mobility of the vocal cords, but also on the form of the resonating cavities above, and very slight differences in these may produce striking results.

6. *Vowel Tones.*—A vowel is a musical tone produced by the vibrations of the vocal cords. The tone produced by the vocal cords is a mixed one, composed of a fundamental and partials, and certain of the partials are strengthened by the resonance of the air in the air-passages and in the pharyngeal and oral cavities. In this respect the quality of the human voice depends on the same laws as those determining the quality or timbre of the tones produced by any musical instrument. The pitch of the note of a musical instrument, however, depends on the pitch of the first or fundamental tone, while the partials are added with greater or less intensity so as to give a special character to the sound; and in the case of a vowel tone the pitch does not appear to depend on that of the fundamental tone but on the pitch of the resonance cavity, as adjusted for the sounding of any particular vowel. When we wish to pronounce or sing a vowel the oral cavity must be adjusted to a certain form, and it is only when it has that form that the vowel can be sounded. The nature of vowel tones has been investigated by means of the phonograph by Fleeming Jenkin and Ewing, L. Hermann, Pipping, Boeke, Lloyd, McKendrick and others. E. W. Scripture has worked with the gramophone. These observers may be ranged in two divisions—those who uphold the theory of relative as opposed to those who contend for the theory of fixed pitch. Assuming that a vowel is always a compound tone, composed of a fundamental and partials, those who uphold the relative pitch theory state that if the pitch of the fundamental is changed the pitch of the partials must undergo a relative change, while their opponents contend that whatever may be the pitch of the tone produced by the larynx, the pitch of the partials that gives quality or character to a vowel is always the same, or, in other words, vowel tones have a fixed pitch. Helmholtz held that all the partials in a vowel tone were harmonic to the fundamental tone, that is that their periods were simple multiples of the period of the fundamental tone. Hermann, however, has conclusively shown that many of the partials are inharmonic to the fundamental. This practically upsets the theory of Helmholtz. The methods by which this problem can be investigated are mainly two. The pitch of the oral cavity for a given vowel may be experimentally determined, or an analysis may be made of the curve-forms of vowels on the wax cylinder of the phonograph or the disk of the gramophone. By such an analysis, according to Fourier's theorem, the curve may be resolved into the partials that take part in its formation, and the intensity of those partials may be thus determined. The observations of Donders, Helmholtz, König and others as to the pitch of the resonating cavities gave different results. Greater success has followed the attempts made by Hermann, Boeke, McKendrick, Lloyd and Marichelle to analyse the curves imprinted on the phonograph. (Examples of such phonograms are given by McKendrick in the article on "Vocal Sounds" in Schäfer's *Physiology*, ii. 1228; see also PHONOGRAPH.)

The following is an instructive analysis by Boeke of the curves representing the tones of a cornet, and it illustrates the laws that govern the production of quality in such an instrument:—

Note . .	1	2	3	4	5	6	7	8	9	10	Partials.
f =170 vibs. .	1	1·05	1·22	1·15	1·01	0·80	0·53	0·28	0·13	0·10	,,
c′ =256 ,, .	1	0·92	0·81	0·53	0·39	0·20	0·07	0·04	0·06	0·04	,,
g′ =384 ,, .	1	0·76	0·46	0·14	0·09	0·06	0·07	0·02	0·01	0·01	,,
c″ =512 ,, .	1	0·92	0·30	0·14	0·15	0·09	0·07	0·06	0·03	0·02	,,

These figures represent the relative intensities of the partials entering into the formation of the note, and it will be observed that the intensity gradually diminishes. This analysis may be contrasted with that of the vowel *āā* sung by Boeke (aet. 50) on the notes *f* and *c′*, and the same vowel sung on the notes *g′* and *e″* by his son (aet. 12).

Man, aet. 50, singing *āā*.

Pitch . .	1	2	3	4	5	6	7	8	9	10	Partials.
f =170·6 vibs.	1	0·86	0·46	1·74	1·90	1·55	0·51	0·54	0·43	0·44	,,
c′ =256 ,,	1	0·49	1·96	1·25	0·60	0·56	0·23	0·05	0·06	0·10	,,

Boy, aet. 12, singing *āā*.

Pitch . .	1	2	3	4	5	6	Partials.
g′ =384 vibs. .	1	1·22	2·67	0·45	0·17	0·06	,,
e″ =640 ,, .	1	8·09	1·45	0·53	..	..	,,

It will be observed that in both these cases the intensity of the partials does not fade away gradually as we proceed from the lower to the higher partials, as with the cornet, but that certain partials are intensified more than others, namely, those printed in black. In other words, the *form* of the resonating cavity develops particular partials, and these modify the quality of the tone. If we multiply the vibrational number of the fundamental tone by the number of the partial we obtain the pitch of the resonance cavity; or if we take the mean of the partials reinforced we obtain the pitch of the mean resonance. Lloyd applies this method to the foregoing figures as follows:—

	Partials. Reinforced.	Mean Partial.	Pitch in Complete Vibration.
Man's *āā*.			
$f = 170{\cdot}6$ vibs.	4–6	4·96	846
$c' = 256$,,	3–4	3·39	868
Boy's *āā*.			
$g' = 384$ vibs.	2–4	2·82	1084
$c'' = 640$,,	1–3	2·04	1307

This analysis shows: (1) that the man's resonance rises slightly (half-semitone) in ascending seven semitones in the middle of his register; (2) that the boy's resonance rises three semitones in ascending nine semitones in the upper half of his register; and (3) in the mid-register the boy's resonance is to the man's as 5:4. Thus, as we sing a vowel in an ascending scale the pitch of the oral cavity slightly changes, or, in other words, the pitch of the resonating cavity for a given vowel may be slightly altered.

It would appear that both theories are partially true; they are not mutually exclusive. The view of Donders that each vowel has an oral cavity of unchangeable and fixed pitch is too exclusive, and, on the other hand, it cannot be denied that each vowel has a predominant partial or predominant partials which give it a definite character, and which must be produced by the oral cavity as a whole, or by the double resonance of portions of the cavity, as suggested by Lloyd. As we sing a vowel in an ascending scale the form of the resonance cavity may slightly change, but not sufficiently to alter the quality of the vowel. Thus we still detect the vowel tone. A singer almost instinctively chooses such vowels as best suit the resonating arrangements of his or her voice, and avoids vowels or words containing vowels that would lead to the production of notes of inferior quality.

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VOIRON, a town of France in the department of the Isère. Pop. (1901) 12,625. It stands at a height of 950 ft., on the Morge (a tributary of the Isère). It is a manufacturing town, and contains numerous factories which produce a sort of cloth named after the town, and also silk-weaving factories (2000 looms, with an annual output of eight to nine million yards). There are also paper-making factories in the town. The fine church of St Bruno was built 1864–73 at the expense of the monks of the Grande Chartreuse. Voiron is the starting-point of the steam tramways to St Laurent du Pont, 12 m. (for the Grande Chartreuse), and to Charavines, $10\frac{1}{2}$ m. (for the Lac de Paladru). Voiron long formed part of Savoy, but in 1355 was exchanged (with the rest of the region between the Rhone and the Isère, watered by the Guiers Mort) by the count with France for Faucigny and Gex.

VOISENON, CLAUDE HENRI DE FUZÉE, ABBÉ DE (1708–75), French dramatist and man of letters, was born at the château of Voisenon near Melun, on the 8th of July 1708. At the age of ten he addressed an epistle in verse to Voltaire, who asked the boy to visit him. From this introduction dated a friendship that lasted for fifty years. Voisenon made his début as a dramatist with *L'Heureuse ressemblance* in 1728, followed in 1739 by a three-act comedy *L'École du monde* at the Théâtre français. This was preceded by a verse prologue, *L'Ombre de Molière*, and a month later Voisenon produced a criticism on his own piece in *Le Retour de l'ombre de Molière*. A duel in which he was the aggressor inspired him with remorse, and he entered the priesthood, becoming vicar-general to the bishop of Boulogne. He received the abbey of Jard, which made no demands on him. He became closely attached to Madame du Châtelet, the mistress of Voltaire (*q.v.*), and was intimate with the comte de Caylus and Mademoiselle Quinault Dufresne. He made witty but by no means edifying contributions to the *Étrennes de Saint-Jean*, the *Bals de Bois*, &c. In 1744 he produced the *Mariages assortis* and in 1746 his masterpiece, the *Coquette fixée*. He lived on terms of the closest intimacy with Charles Simon Favart and his wife. His pen was always at the service of any of his friends, and it was generally supposed, though on insufficient grounds, that he had a considerable share in Favart's most successful operas. Voisenon had, strange to say, scruples all his life about the incongruity between his way of living and his profession, but he continued to write indecent stories for private circulation, and wrote verses in honour of Madame du Barry, as he had done for Madame de Pompadour. He was elected to the Academy in 1762. On the disgrace of his patron, the duc de Choiseul, he lost his pensions and honours, but soon recovered his position. He was intimate with the chancellor Maupeou, and was suspected of writing on his behalf in defence of the abolition of the parlement. This and some other incidents brought him into general disgrace. Early in 1775 he retired to the château de Voisenon, where he died on the 22nd of November of the same year.

His *Œuvres complètes* were published by his executrix, Madame de Turpin, in 1781.

VOITURE, VINCENT (1598–1648), French poet, was the son of a rich merchant of Amiens. He was introduced by a schoolfellow, the comte d'Avaux, to Gaston d'Orléans, and accompanied him to Brussels and Lorraine on diplomatic missions. Although a follower of Gaston, he won the favour of Richelieu, and was one of the earliest academicians. He also received appointments and pensions from Louis XIII. and Anne of Austria. He published nothing in book form, but his verses and his prose letters were the delight of the coteries, and were copied, handed about and admired more perhaps than the work of any contemporary. He had been early introduced to the Hôtel de Rambouillet, where he was the especial friend of Julie d'Angennes, who called him her "dwarf king." His ingenuity in providing amusement for the younger members of the circle ensured his popularity, which was never seriously threatened except by Antoine Godeau, and this rivalry ceased when Richelieu appointed Godeau bishop of Grasse. When at the desire of the duc de Montausier nineteen poets contributed to the *Guirlande de Julie*, which was to decide the much-fêted Julie in favour of his suit, Voiture refused to take part. The quarrel between the Uranistes and the Jobelins arose over the respective merits of a sonnet of Voiture addressed to a certain Uranie, and of another composed by Isaac de Benserade, till then unknown, on the subject of Job. Another famous piece of his of the same kind, *La Belle Matineuse*, is less exquisite, but still very admirable, and Voiture stands in the highest rank of writers of *vers de société*. His prose letters are full of lively wit, and, in some cases, as in the letter on Richelieu's policy (Letter LXXIV.), show considerable political penetration. He ranks with Jean de Balzac as the chief director of the reform in French prose which accompanied that of Malherbe in French verse. Voiture died at the outbreak of the Fronde, which killed the society to which he was accustomed, on the 26th of May 1648.

[1] See A. Roux, *Œuvres de M. de Voiture* (Paris, 1856); and C. A. Sainte-Beuve, *Causeries du lundi*, vol. xii.

VOIVODE (also *Vaivode, Vayvode, Wayvode*, &c., Med. Gr. *βοεβόδος*), a title in use among certain Slavonic peoples, meaning literally "leader of an army" (Sl. *voi*, host, army; *voiditi*, to lead), and so applied at various periods and in various eastern European countries to rulers, governors or officials of varying degree. It is best known as the title of the princes of Moldavia and Wallachia. In these states the title remained in use from the earliest times until 1658 in the case of the first state, and until 1716 in that of the second, when it gave way to Hospodar (*q.v.*). During the period of Hungarian domination of Transylvania (1004–1526) it was governed by a voivode as an Hungarian province, the last voivode raising himself to the position of an independent prince. In Poland the title was used of certain administrative officials; Polish historians latinized it by *palatinus*. At the present day voivode is used, in its original sense of a high military officer, in the Montenegrin army, where it corresponds to the general officer in other European armies.

VOKES, the name of a family of English actors. FREDERICK MORTIMER VOKES (1846–1888), the son of a costumier, made his first appearance on the stage in 1854. In 1861 he, his sisters Jessie (1851–1884), Victoria (1853–1894) and Rosina (1858–1894), and Walter Fawdon (Vokes), first as the "Vokes Children" and then as the "Vokes Family," began to perform at music halls and at the pantomimes, and by their agility and humour made the name well known to English and American theatre-goers. Fred Vokes was a man of real inventiveness as well as rare acrobatic skill.

VOLAPÜK, the first artificial language (see UNIVERSAL LANGUAGES) to attain any measure of practical success. First published in 1880, it was the work of J. M. Schleyer (b. 1839), a south-German priest. Volapük is not, like the earliest attempts of the kind, an a priori language, but is based mainly on English, the rest of the vocabulary being made up from Latin and the Romance languages. The borrowed words are reduced to a monosyllabic form and are often altered in a very arbitrary manner. Thus the name Volapük itself is made up of the two English words, *world* and *speak*, the first in the genitive, the three vowels, *a, e, i*, being used to express the three cases, genitive, dative and accusative respectively; the nominative is expressed by the bare root, and *s* is added to form the plural. The grammar of Volapük is therefore partly borrowed, like the vocabulary, partly original. Adjectives end in *-ik*. The persons of the verb are indicated by adding the pronouns *ob* "I," *ol* "thou," *om* "he," &c., plural *obs* "we," &c.; the tenses and the passive are indicated by prefixes, the moods by suffixes following the person-endings, many other inflections being used as well, so that the Volapük verb boasts of no less than 505,440 different forms.

Although founded on English, Volapük is mainly German in structure. It gets rid of the German word-order and the irregularities of German grammar, but it is often impossible to understand a Volapük text without thinking in German. The following is a specimen of the language:—

> Löfob kemenis valik vola lolik, patiko etis pekulivöl, kels konfidoms Volapüke, as bale medas gletikün netasfetana.
>
> "I love all my fellow-creatures of the whole world, especially those cultivated (ones) who believe in Volapük as (being) one of the greatest means of nation-binding."

Here *konfid* governs the dative just as its German equivalent does, and "cultivated" is used in the sense of the German *gebildeter*.

The history of Volapük has an interest greater than that of the language itself. It has proved (1) that people in general are ready to adopt an artificial language, and (2) that an artificial language is easier to learn than any national language, and supplies an efficient means of communication between those who have no other language in common. Volapük had no special philological merits to recommend it; yet, after a few years' incubation in south Germany, it spread, first to France (about 1885) and then in a few years over the whole civilized world, so that in 1889, when the third Volapük congress met at Paris, there were 283 Volapük societies all over the world, and the total number of Volapük students was estimated at over a million. At this congress every one—even the waiters—spoke Volapük, and the permanent triumph of the language seemed certain. But the year of its zenith was the beginning of a decline even more rapid than its rise. It fell to pieces through dissensions in its own camp, the first cause of which was the opposition of the inventor to those of his disciples who aimed at making the language mainly an instrument of commercial correspondence, and advocated the greatest possible simplification of grammar and vocabulary. The divergence of views between the inventor and his colleagues became more and more marked; and after the third congress the breach between M. Schleyer and the Volapük Academy (founded at the second congress in 1887) became a definite one: the director of the Academy proposed a totally new scheme of grammar, and other members proposed others, although one of the objects of the foundation of the Academy was the preservation of the integrity of the language. A new director, M. Rosenberger of St Petersburg, was elected in 1893; and from this moment the Academy dissociated itself from Volapük and began to construct a new international language, Idiom Neutral (see UNIVERSAL LANGUAGES). (H. Sw.)

VOLCAE, a Celtic people in the province of Gallia Narbonensis, who occupied the district between the Garumna (Garonne), Cerbenna mons (Cévennes), and the Rhodanus (or even farther to the east in earlier times), corresponding roughly to the old province of Languedoc. They were divided into two tribes, the Arecomici on the east and the Tectosages (whose territory included that of the Tolosates) on the west, separated by the river Arauris (Hérault) or a line between the Arauris and Orbis (Orbe). The Volcae were free and independent, had their own laws, and possessed the *jus Latii*. The chief town of the Tectosages was Tolosa (Toulouse); of the Arecomici, Nemausus (Nîmes); the capital of the province and residence of the governor was Narbo Martius (Narbonne). It was said that there was an early settlement of Volcae Tectosages near the Hercynia Silva in Germany; Tectosages was also the name of one of the three great communities of Gauls who invaded and settled in Asia Minor in the country called after them Galatia.

See A. Holder, *Altceltischer Sprachschatz*, i. ii. (1896, 1904), *s.vv.* "Arecomici" and "Tectosagi"; T. R. Holmes, *Caesar's Conquest of Gaul* (1899) p. 513; A. Desjardins, *Géographie de la Gaule romaine*, i. (1876).

VOLCANO, an opening in the earth's crust, through which heated matter is brought, permanently or temporarily, from the interior of the earth to the surface, where it usually forms a hill, more or less conical in shape, and generally with a hollow or crater at the top. This hill, though not an essential part of the volcanic mechanism, is what is commonly called the volcano. The name seems to have been applied originally to Etna and some of the Lipari Islands, which were regarded as the seats of Hephaestus, a Greek divinity identified with Vulcan, the god of fire in Roman mythology. All the phenomena connected directly or indirectly with volcanic activity are comprised under the general designation of *vulcanism* or *vulcanicity*—words which are also written less familiarly as volcanism and volcanicity; whilst the study of the phenomena forms a department of natural knowledge known as *vulcanology*. Vulcanicity is the chief superficial expression of the earth's internal igneous activity.

It may happen that a volcano will remain for a long period in a state of moderate though variable activity, as illustrated by the normal condition of Stromboli, one of the Lipari Islands; but in most volcanoes the activity is more decidedly intermittent, paroxysms of greater or less violence occurring after intervals of comparative, or even complete, repose. If the period of quiescence has been very protracted, the renewed activity is apt to be exceptionally violent. Thus, Krakatoa before the great eruption of 1883 had been dormant for something like two centuries, and it is believed that the Japanese volcano Bandaisan previously to the gigantic outburst of 1888 had been silent for more than a thousand years. A volcano may indeed remain so long dormant as to be mistaken for one completely extinct. The volcanoes of central France are regarded as extinct, inasmuch as no authentic historical record of any eruption is known, but there are not wanting signs that in some parts of this volcanic region the subterranean forces may yet be slumbering rather than dead.

Premonitory Symptoms.—A volcanic eruption is usually preceded by certain symptoms, of which the most common are local earthquakes. The mountain, or other eruptive centre, may be thrown by internal activity into a state of tremor; the tremors perhaps continuing intermittently for months or even years, and becoming more frequent and violent as the crisis approaches. At first they are usually confined to the volcano and its immediate neighbourhood, but may subsequently extend to a considerable distance, though probably never developing into earthquakes of the first magnitude. The sudden opening of a subterranean crack, by rupture of a rock under strain, or the rapid injection of lava into such a fissure, will tend to produce a jar at the surface. For at least sixteen years before the first recorded eruption of Vesuvius in A.D. 79 earthquakes had been frequent in the Campania and had wrought havoc in the cities of Herculaneum and Pompeii. Again, the formation of Monte Nuovo, near Pozzuoli, in 1538, was heralded by local earthquakes beginning several years in advance of the eruption. So too in recent years many volcanic outbursts have been preceded by a succession of earthquakes; but as volcanoes are frequently situated in areas of marked seismic activity, the shocks antecedent to an eruption may not, unless exceptionally violent, receive much attention from local observers.

It commonly happens that a volcanic outburst is announced by subterranean roaring and rumbling, often compared to thunder or the discharge of artillery underground. Other precursory symptoms may be afforded by neighbouring springs, which not unusually flow with diminished volume, or even fail altogether. Possibly fissures open underground and drain off the water from the springs and wells in the immediate locality. Occasionally, however, an increased flow has been recorded. In some cases thermal springs make their appearance, whilst the temperature of any existing warm springs may be increased, and perhaps carbon dioxide be evolved. A disturbed state of the atmosphere is by no means a constant forerunner of an eruption, some of the greatest outbursts having occurred in a period of atmospheric stability: indeed the air is often felt to be close and still.

Immediately before a renewed outburst in an old volcano, the floor of the crater is generally upheaved to a greater or less extent, whilst the discharge of vapour from any fumaroles is increased. Where a crater has been occupied by water, forming a crater-lake, the water on the approach of an eruption becomes warm, evolves visible vapour, and may even boil. In the case of cones which are capped with snow, the internal heat of the rising lava usually causes a rapid melting of the snow-cap, resulting perhaps in a disastrous deluge.

It seems probable that by attention to the premonitory symptoms a careful local observer might in many cases foretell an eruption.

It generally happens that a great eruption is preceded by a preliminary phase of feeble activity. Thus, the gigantic catastrophe at Krakatoa on the 27th of August 1883, so far from having been a sudden outburst, was the culmination of a state of excitement, sometimes moderate and sometimes violent, which had been in progress for several months.

Emission of Vapour.—Of all volcanic phenomena the most constant is the emission of vapour. It is one of the earliest features of an eruption; it persists during the paroxysms, attaining often to prodigious volume; and it lingers as the last relic of an outburst, so that long after the ejection of ashes and lava has ceased an occasional puff of vapour may be the only memento of the disturbance.

By far the greatest proportion of the vapour is steam, which sometimes occurs almost to the exclusion of other gaseous products. Such, at least, is the usual and probably correct view, though it is opposed by A. Brun, who regards the volcanic vapours as chiefly composed of chlorides with steam in only subordinate amount. In the case of a mild eruption, like that occurring normally at Stromboli, the vapours may be discharged in periodical puffs, marking the explosion of bubbles rising more or less rhythmically from the seething lava in the volcanic cauldron. S. Wise observed at the volcano of Sangay, in Ecuador, no fewer than 267 explosions in the course of an hour, the vapour here being associated, as is so often the case, with ashes. During a violent eruption the vapour may be suddenly shot upwards as a vertical column of enormous height, penetrating the passing clouds. For a short distance above the vent the superheated steam sometimes exists as a transparent vapour, but it soon suffers partial condensation, forming clouds, which, if not dispersed by winds, accumulate over the mountain. When the vapour is free from ash it forms rolling balls of fleecy cloud, but usually it carries in mechanical association more or less finely divided lava as volcanic dust and ashes, whereby it becomes yellow, brown, or even black, sometimes as foul as the densest smoke. In a calm atmosphere the dust-laden vapour may rise in immense rings with a rotatory movement, like that of vortex-rings. Frequently the vapours, emitted in a rapid succession of jets, form cumulus clouds, or are massed together in cauliflower-like forms. The well-known "pine-tree appendage" of Vesuvius (*pino vulcanico*), noted by the younger Pliny in his first letter to Tacitus on the eruption in the year 79, is a vertical shaft of vapour terminating upwards in a canopy of cloud, and compared popularly with the trunk and spreading branches of the stone-pine. Whilst in some cases the cloud resembles a gigantic expanded umbrella, in others it is more mushroom-shaped. In a great eruption, the height of the mountain itself may appear dwarfed by comparison with that of the column of vapour. During the eruption of Vesuvius in April 1906, the steam and dust rose to a height of between 6 and 8 m. At Krakatoa in 1883 the column of vapour and ashes reached an altitude of nearly 20 m.; whilst it was estimated by some authorities that during the most violent explosions the finely divided matter must have been carried to an elevation of more than 30 m. The emission of vast volumes of vapour at high tension naturally produces much atmospheric disturbance, often felt at great distances from the centre of eruption.

Electrical Excitement.—It is probably to the uprushing current of vapour that much of the electrical excitement which invariably accompanies an eruption may be referred. The friction of the steam rushing in jets through the volcanic vent must produce electrical disturbance, and indeed an active volcano has been aptly compared to a hydroelectric machine of gigantic power. Another cause of excitement may be found in the mutual friction of the ejected cinders and ashes as they rise and fall in showers through the air. Much trituration of volcanic material may go on in the crater and elsewhere during the eruption, whereby the solid lava is reduced to a fine dust. Other means of generating electricity are found in the chemical reactions effected in the volcano and in the sudden condensation of the emitted vapour. L. Palmieri, in the course of his investigations at the observatory on Vesuvius, found that the vapours free from cinders carried a positive charge, whilst the cinders were negative.

The electrical phenomena attending an eruption are often of great intensity and splendour. The dark ash-laden clouds of vapour are shot through and through by volcanic lightning, sometimes in rapid horizontal flashes, then in oblique forked streaks, or again in tortuous lines compared to fiery serpents, whilst the borders of the cloud may be brilliant with electric scintillations, often forming balls and stars of fire. During the great eruption of Krakatoa remarkable phenomena were observed by ships in the Strait of Sunda, luminous balls like "St Elmo's fire" appearing at the mast-heads and the yard-arms, whilst the volcanic mud which fell upon rigging and deck was strongly phosphorescent.

Quite distinct from any electrical phenomena is that intermittent reddish glare which is often seen at night in clouds hanging over an active crater, and which is simply a glow due to reflection from the incandescent lava and stones in the volcanic cauldron below.

Volcanic Rain and Mud.—The condensation of the vast volumes of steam exhaled during an eruption produces torrents of rain, which, mingling to a greater or less extent with the volcanic ashes, forms a hot muddy stream known in Italy as *lava d'acqua* and *lava di fango*, and in South America as *moya.* Deluges of such mud-lava may rush violently down the mountain-side and spread over the neighbouring country with terribly destructive effect, whence they are greatly dreaded by those who dwell at the base of a volcano. The solidified volcanic mud, often mingled with larger fragments of lava, is known as *tuff* or *tufa.* Herculaneum was buried beneath a flood of mud swept down from Vesuvius during the Plinian eruption of 79, and the hard tufaceous crust which thus sealed up the ill-fated city came in turn to be covered by lava-flows from subsequent eruptions: hence the difficulty of excavating at Herculaneum compared with similar work at Pompeii, where there was probably much less mud, since the city, having been at a greater distance from the volcanic centre, was overwhelmed in great measure by loose ashes, capable of removal with comparative ease.

It sometimes happens that volcanic mud is formed by the mingling of hot ashes not directly with rain but with water from streams and lakes, or even, as in Iceland, with melted snow. A torrent of mud was one of the earliest symptoms of the violent eruption of Mont Pelé in Martinique in 1902. This mud had its source in the Étang Sec, a crater-basin high up on the S.W. side of the mountain. By the explosive discharge of ashes and vapours mingled with the water of the tarn there was produced a vast volume of hot muddy matter which on the 5th of May suddenly escaped from the basin, when a huge torrent of boiling black mud, charged with blocks of rock and moving with enormous rapidity, rolled like an avalanche down the gorge of the Rivière Blanche. If a stream of lava obstructs the drainage of a volcano, it may give rise to floods.

Ejected Blocks.—When a volcano after a long period of repose starts into fresh activity, the materials which have accumulated in the crater, including probably large blocks from the disintegration of the crater-walls, have to be ejected. If the lava from the last eruption has consolidated as a plug in the throat of the volcano, the conduit may be practically closed, and hence the first effort of the renewed activity is to expel this obstruction. The hard mass becomes shattered by the explosions, and the angular fragments so formed are hurled forth by the outrushing stream of vapour. When the discharge is violent, the vapour, as it rushes impetuously up the volcanic duct, may tear fragments of rock from its walls and project them to a considerable distance from the vent. Such ejected blocks, by no means uncommon in the early stages of an eruption, are often of large size and naturally vary according to the character of the rocks through which the duct has been opened. They may be irregular masses of igneous rocks, possibly lavas of earlier eruptions, or they may be stratified, sedimentary and fossiliferous rocks representing the platform on which the volcano has been built, or the yet more deeply seated fundamental rocks. By Dr H. J. Johnston-Lavis, who specially studied the ejected blocks of Vesuvius, the volcanic materials broken from the cone are termed "accessory" ejecta, whilst other fragmentary materials he conveniently calls "accidental" products, leaving the term "essential" ejecta for plastic lava, ashes, crystals, &c. Masses of Cretaceous or Apennine limestone ejected from Somma are scattered through the tuffs on the slopes of Vesuvius; and objects carved in such altered limestone are sold to tourists as "lava" ornaments. Under the influence of volcanic heat and vapours, the ejected blocks suffer more or less alteration, and may contain in their cavities many crystallized minerals. Certain blocks of sandstone ejected occasionally at Etna are composed of white granular quartz, permeated with vitreous matter and encased in a black scoriaceous crust of basic lava.

A rock consisting of an irregular aggregation of coarse ejected materials, including many large blocks, is known as a "volcanic agglomerate." Any fragmental matter discharged from a volcano may form rocks which are described as "pyroclastic."

Cinders, Ashes and Dust.—After the throat of a volcano has been cleared out and a free exit established, the copious discharge of vapour is generally accompanied by the ejection of fresh lava in a fragmentary condition. If the ejected masses bear obvious resemblance to the products of the hearth and the furnace, they are known as "cinders" or "scoriae," whilst the small cinders not larger than walnuts often pass under their Italian name of "lapilli" (*q.v.*). When of globular or ellipsoidal form, the ejected masses are known as "bombs" (*q.v.*) or "volcanic tears." Other names are given to the smaller fragments. If the lava has become granulated it is termed "volcanic sand"; when in a finer state of division it is called ash, or if yet more highly comminuted it is classed as dust; but the latter terms are sometimes used interchangeably. The pulverized material, consisting of lava which has been broken up by the explosion, or triturated in the crater, is often discharged in prodigious quantity, so that after an eruption the country for miles around the volcano may be covered with a coating of fine ash or dust, sometimes nearly white, like a fall of snow, but often of greyish colour, looking rather like Portland cement, and in many cases becoming reddish by oxidation of the ferruginous constituents. Even when first ejected the ash is sometimes cocoa-coloured. This finely divided lava insinuates itself into every crack and cranny, reaching the interior of houses even when windows and doors are closed. A heavy fall of ash or cinders may cause great structural damage, crushing the roofs of buildings by sheer weight, as was markedly the case at Ottajano and San Guiseppe during the eruption of Vesuvius in April 1906. On this occasion the dry ashes slipped down the sides of the volcanic cone like an avalanche, forming great ash-slides with ridges and furrows rather like barrancos, or ravines, caused by rain. The burial of Ottajano and San Ginseppe in 1906 by Vesuvian ejecta, mostly lapilli, has been compared with that of Pompeii in 79.

Deposits of volcanic sand and ashes retain their heat long after ejection, so that rain will cause them to evolve steam, and if the rain be heavy and sudden it may produce explosions with emission of great clouds of vapour. The fall of ash is at first prejudicial to vegetation, and is often accompanied or followed by acid rain; but ultimately the ash may prove beneficial to the soil, chiefly in consequence of the alkalis which it contains. The "May dust" of Barbados was a rain of volcanic ash which fell in May 1812 from the eruption of the Soufrière in St Vincent. It is estimated that the amount of dust which during this eruption fell on the surface of Barbados, 100 m. distant from the eruptive centre, was about 3,000,000 tons. The distance to which ash is carried depends greatly on the atmospheric conditions at the time of the eruption. Ashes from Vesuvius in an eruption in the year 472 were carried, it is said, as far as Constantinople. During an eruption of Cotopaxi, on the 3rd of July 1880, observed by E. Whymper, an enormous black column of dust-laden vapour was shot vertically upwards with such rapidity that in less than a minute it rose to a height estimated at 20,000 ft. above the crater-rim, or nearly 40,000 ft. above sea-level, when it was dispersed by the wind over a very wide area. It is believed that the amount of dust in this discharge must have been more than 2,000,000 tons. Enormous quantities of dust ejected from Krakatoa in 1883 were carried to prodigious distances, samples having been collected at more than a thousand miles from the volcano; whilst the very fine material in ultra-microscopic grains which remained suspended for months in the higher regions of the atmosphere seems to have enjoyed an almost world-wide distribution, and to have been responsible for the remarkable sunsets at that period.

The ash falling in the immediate vicinity of a volcanic vent will generally be coarser than that carried to a distance, since the particles as they are wafted through the air undergo a kind of sifting. Professor J. W. Judd, who made an exhaustive examination of the products of the eruption of Krakatoa, found that the dust near the volcano was comparatively coarse, dense and rather dark-coloured, in consequence of the presence of numerous fragments of heavy, dark, crystalline minerals, whilst the dust at a distance was excessively fine and perfectly white. According to this observer, the particles tended to fall in the following order: magnetite, pyroxenes, felspar, glass. The finely comminuted material, carried to a great height in the atmosphere, consisted largely of delicate threads and attenuated plates of vitreous matter, in many cases hollow and containing air-bubbles. The greater part of the dust was formed by the mutual attrition of fragments of brittle pumice as they rose and fell in the crater, which thus became a powerful "dust-making mill." By this trituration of the pumiceous lava, carried on for a space of three months during which the eruption lasted, the quantity of finely pulverized material must have been enormous; yet the amount of ejected matter was probably very much less than that extruded during some other historical eruptions, such as that of Tomboro in Sumbawa, in 1815. The explosions at Krakatoa were, however, exceptionally violent, having been sufficient to project some of the finely pulverized lava to an altitude estimated to have been at least 30 m. It is usually impossible during a great eruption to determine the height of the column of "smoke," since it hangs over the country as a pall of darkness.

The great black cloud, which was so characteristic a feature in the terrible eruptions in the West Indies in 1902, was formed of steam with sulphur dioxide and other gases, very heavily charged with incandescent sand or dust, forming a dense mixture that in some respects behaved like a liquid. Unlike the Krakatoa dust, which was derived from a vitreous pumice, the solid matter of the black cloud was largely composed of fragments of crystalline minerals. According to Drs Anderson and Flett it is not impossible that on the afternoon of the 17th of May 1902, the solid matter ejected from the Soufrière of St Vincent amounted to several billions of tons, and that some of the dust fell at distances more than 2000 m. east of the centre of eruption.

In Mexico and Central America, under the favourable influence of warmth and moisture, rich soils are rapidly formed by the decomposition of finely divided volcanic ejecta. Vast areas in North America, especially in Nebraska and Kansas, are covered with thick deposits of volcanic dust, partly from recent eruptions but principally from volcanic activity in geologic time. The dust is used in the arts as an abrasive agent.

Lava.—The volcanic cinders, sand, ashes and dust described above are but varied forms of solidified lava. Lava is indeed the most characteristic product of volcanic activity. It consists of mineral matter which is, or has been, in a molten state; but the liquidity is not due to simple dry fusion. The magma, or subterranean molten matter, may be regarded as composed essentially of various silicates, or their constituents, in a state of mutual solution, and heavily charged with certain vapours or gases, principally water-vapour, superheated and under pressure. In consequence of the peculiar constitution of the magma, the order in which minerals separate and solidify from it on cooling does not necessarily correspond with the inverse order of their relative fusibility. The lava differs from the magma before eruption, inasmuch as water and various volatile substances may be expelled on extrusion. The rapid escape of vapour from the lava contributes to the explosive phenomena of an eruption, whilst the rate at which the vapour is disengaged depends largely on the viscosity of the magma.

The lava on its immediate issue from the volcanic vent is probably at a white heat, but the temperature is difficult of determination since the molten matter is usually not easy of approach, by reason of the enshrouding vapour. Determinations of temperature are generally made at a short distance from the exit, when the lava has undergone more or less cooling, or on a small stream from a subordinate vent. A. Bartoli, using a platinum electric resistance pyrometer, found that a stream of lava near a *bocca*, or orifice of emission, on Etna, in the eruption of 1892, had at a depth of one foot a temperature of 1060° C. In the lavas of Vesuvius and Etna thin wires of silver and of copper have frequently been melted. Probably the lava at the surface of the stream has a temperature of something like 1100° C., but this must not be assumed to be its temperature at the volcanic focus. C. Doelter, in some experiments on the melting-point of lava by means of an electric furnace, found that a lava from Etna softened at from 962° to 970° C. and became fluid at 1010° to 1040°, whilst a Vesuvian lava softened at 1030° to 1060° and acquired fluidity at 1080° to 1090°. These results were obtained at ordinary atmospheric pressure, but it has been assumed that the melting-point of lava at a great depth would, through pressure alone, exceed that obtained in the laboratory. On the other hand the presence of water and of certain volatile fluxes in the magma lowers the fusing-point, and hence the extruded lava from which these have largely escaped may be much less fusible than the original magma.

Determinations of the melting-points of various glasses formed by the fusion of certain igneous rocks have been made by J. A. Douglas, with the meldometer of Professor J. Joly. The results give temperatures ranging from 1260° C. for rhyolite to 1070° for dolerite from the Clee Hills in Shropshire. The melting-points of the rocks in a glassy condition as here given are, however, lower than those of the corresponding rocks in a crystalline state.

It should be noted that all determinations of the melting-points of minerals and rocks involving ocular inspection of the physical state of the material are liable to considerable error, and the only accurate method seems to be that of determining the point at which absorption of heat abruptly occurs—the latent heat of fusion. This has been done in the refined investigations by Mr A. L. Day and his colleagues in the Geophysical Laboratory of the Carnegie Institution at Washington.

It is believed that the temperature of lava in the volcanic conduit may be in some cases sufficiently high to fuse the neighbouring rocks, and so melt out a passage through them in its ascent. The wall-rock thus dissolved in the magma will not be without influence on the composition of the lava with which it becomes assimilated.

Many interesting observations are on record with regard to the heating effect of lava on metals and other objects with which it may have come in contact. Thus, after the destruction of Torre del Greco by a current of lava from Vesuvius in 1794, it was found that brass in the houses under the lava had suffered decomposition, the copper having become crystallized; whilst silver had been not only fused but sublimed. This indicates a temperature of upwards of 1000° C. Panes of glass in the windows at Torre del Greco on the same occasion suffered devitrification.

Notwithstanding the high temperature of lava on emission, it cools so rapidly, and the consolidated lava conducts heat so slowly, that vegetable structures may be involved in a lava-flow without being entirely destroyed. A stream of lava on entering a wood, as in the sylvan region on Etna, may burn up the undergrowth but leave many of the larger trees with their trunks merely carbonized. On Vesuvius a lava-flow has been observed to surround trees while the foliage has been apparently uninjured. A vertical trunk of a coniferous tree partially enveloped in Tertiary basalt occurs at Gribon in the Isle of Mull, as described by Sir A. Geikie and others; plant-remains in basalt from the Bo'ness coalfield in Linlithgowshire have been noticed by H. M. Cadell; and attention has been called by B. Hobson to a specimen of scoriaceous basalt, from Mexico, which shows the impression of ears of maize and even relics of the actual grains. In consequence of the slow transmission of heat by solid lava, the crust on the surface of a stream may be crossed with impunity whilst the matter is still glowing at a short distance below. Lichens may indeed grow on lava which remains highly heated in the interior.

The solidified surface of a sheet of lava may be smooth and shining, sometimes quite satiny in sheen, though locally wrinkled and perhaps even ropy or hummocky, the irregularities being mainly due to superficial movement after partial solidification. The "corded lava" has a surface similar to that often seen on blast-furnace slag, and is suggestive of a tranquil flow. After a lava stream has become crusted over on cooling, the subjacent lava, still moving in a viscous condition, tends to tear the crust, forming irregular blocks, or clinkers, which are carried forward by the flow and ultimately left in the form of confused heaps, perhaps of considerable magnitude. The front of a stream may present a wall of scoriaceous fragments looking like a huge pile of coke. As the clinkers are carried along, on the surface of the lava, they produce by mutual friction a crunching noise; and the sluggish flow of the lava-stream laden with its burden has been compared with that of a glacier. Since the upper part of the stream moves more rapidly than the lower, which is retarded by cooling in contact with the bed-rock, the superficial clinkers are carried forward and, rolling over the end, may become embedded in the lava as it advances. Scoriae formed on the top of a stream may thus find their way to the base. Rock-fragments or other detrital matter occurring in the path of the lava will be caught up by the flow and become involved in the lower part of the molten mass; whilst the rocks over which the lava travels may suffer more or less alteration by the heat of the stream.

The rapidity of a lava flow is determined partly by the slope of the bed over which it moves and partly by the consistency of the lava, this being dependent on its chemical composition and on the conditions of cooling. In an eruption of Mauna Loa, in Hawaii, in 1855, the lava was estimated to flow at a rate of 40 m. an hour; and at an eruption of Vesuvius in 1805 a velocity of more than 50 m. an hour, at the moment of emission, was recorded. The rapidity of flow is, however, rapidly checked as the stream advances, the retardation being very marked in small flows. Where lava travels down a steep incline there is naturally a great tendency to form a rugged surface, whilst a quiet flow over a flat plane favours smoothness. If the lava meet a precipice it may form a cascade of great beauty, the clinkers rapidly rolling down with a clatter, as described by Sir W. Hamilton in the eruption of Vesuvius in 1771, when the fiery torrent had a perpendicular fall of 50 ft.

In Hawaii the smooth shining lava, often superficially waved and lobed, is known as *pahoehoe*, whilst the rugged clinker beds are termed *aa*. These terms are now used in general terminology, having been introduced by American geologists. The fields of aa often contain lava-balls and bombs. It may be said that the pahoehoe corresponds practically with the *Fladen lava* of German vulcanologists, and the aa with their *Schollen lava.* Rugged flows are known in Auvergne as *cheires.* The surface of a clinker-field has often a horribly jagged character, being covered with ragged blocks bristling with sharp points. In the case of an obsidian-flow a most dangerous surface is produced by the keen edges and points of the fragmentary volcanic glass.

If, after a stream of lava has become crusted over, the underlying magma should flow away, a long cavern or tunnel may be formed. Should the flow be rapid the roof may collapse and the fragments, falling on to the stream, may be carried forward or become absorbed in the fused mass. The walls and roof of a lava-cave are occasionally adorned with stalactites, whilst the floor may be covered with stalagmitic deposits of lava. The volcanic stalactites are slender, tubular bodies, extremely fragile, often knotted and rippled. Beautiful examples of lava stalactites from Hawaii have been described by Professor E. S. Dana. Caverns may also be formed in lava-flows by the presence of large bubbles, or by the union of several bubbles. It may happen, too, that certain monticules thrown up on the surface of the lava are hollow, of which a famous example is furnished by the Caverne de Rosemond, at the base of Piton Barry, in the Isle of Réunion.

It is of great interest to determine whether molten lava contracts or expands on solidification, but the experimental evidence on this subject is rather conflicting. According to some observers a piece of solid lava thrown on to the surface of the same lava in a liquid state will sink, while according to others it floats. It has often been observed that cakes formed by the natural fracture of the crust on the lava of Kilauea sink in the liquid mass, but it has been suggested that the fragments are drawn down by convection-currents. On the other hand a solid piece, though denser than the corresponding liquid, may be buoyed up for a time by the viscous condition of the molten lava. Moreover, the presence of minute vesicles may lighten the mass. Although the minerals of a rock-magma may separately contract on crystallization it does not follow that the magma itself, in which they probably exist in a state of solution, will undergo on crystallization a similar change of volume. On the whole, however, there seems reason to believe that lava on solidifying almost always diminishes in volume and consequently increases in density.

According to the experiments of C. Doelter the specific gravity of molten lava is invariably less than that of the same lava when solid, though in some cases the difference is but slight. In a vitreous or isotropic condition the lava has a lower density than when crystalline. The differences are illustrated by the following table, where the figures give the specific gravity:—

	Natural solid lava.	Liquid.	Rapidly cooled, glassy.	Slowly cooled, crystalline.
Lava of Etna	2·83	2·58–2·74	2·71–2·75	2·81–2·83
,, Vesuvius	2·83–2·85	2·68–2·74	2·69–2·75	2·77–2·81

Experiments by Dr C. Barus showed that a diabase of specific gravity 3·017 formed a glass of sp. gr. 2·717, and melted to a liquid of sp. gr. 2·52. J. A. Douglas on examining various igneous rocks found that in all cases the rock in a vitreous state had a lower sp. gr. than in a crystalline condition, the difference being greatest in the acid plutonic rocks. A. Harker, however, has called attention to the fact that the glassy selvage of certain basic dykes in Scotland is denser than the same rock in a crystalline condition in the interior of the dykes.

Physical Structure of Lavas.—An amorphous vitreous mass may result from the rapid cooling of a lava on its extrusion from the volcanic vent. The common type of volcanic glass is known as obsidian (*q.v.*). Microscopic examination usually shows that even in this glass some of the molecules of the magma have assumed definite orientation, forming the incipient crystalline bodies known as microlites, &c. By the increase of these minute enclosures, in number and magnitude, the lava may become devitrified and assume a lithoidal or stony structure. If the molten magma consolidate slowly, the various silicates in solution tend to separate by crystallization as their respective points of saturation are reached. Should the process be arrested before the entire mass has crystallized, the crystals that have been developed will be embedded in the residual magma, which may, on consolidation, form a vitreous base. It is believed that in many cases the lava brings up, through its conduit, myriads of crystals that have been developed during slow solidification in the heart of the volcanic apparatus. Showers of crystals of leucite have occurred at Vesuvius, of labradorite at Etna, and of pyroxene at Vesuvius, Etna and Stromboli. These "intratelluric crystals" were probably floating in the molten magma, and had they remained in suspension, this magma might on consolidation have enveloped them as a ground-mass or base. A rock so formed is generally known as a "porphyry," and the structure as porphyritic. In such a lava the large crystals, or phenocrysts, evidently represent an early phase of consolidation, and the minerals of the matrix a later stage. It is notable that the intratelluric crystals often lack sharpness of outline, as though they had suffered corrosion by attack of the molten magma, whilst they may contain vitreous enclosures, suggesting that the surrounding mass was liquid during their consolidation. It is believed that the more slowly consolidation has occurred, the larger generally are the crystals; and the higher the temperature of the magma the greater the corrosion or resorption. Possibly under certain conditions the phenocrysts and the ground-mass may have solidified simultaneously.

In some cases the entire igneous mass assumes a crystalline structure, or becomes "holocrystalline." Such a structure is well displayed when the magma has consolidated at considerable depths, cooling slowly under great pressure, and forming rocks which are termed "plutonic" or "abyssal" to distinguish them from rocks truly volcanic, or those which, if not effusive, like lava-flows, have at least solidified very near to the surface as dykes and sills. Volcanic and plutonic rocks pass, however, into each other by gradual transition. The dyke-rocks, or intrusive masses, form an intermediate group sometimes distinguished under the name of "hypabyssal" rocks, as suggested by W. C. Brögger. Lavas extruded in submarine eruptions may have solidified under a great weight of sea-water, and therefore to that extent rather under plutonic conditions.

Chemical Composition of Lavas.—Lavas are usually classified roughly, from a chemical point of view, in broad groups according to the proportion of silica which they contain. Those in which the proportion of silica reaches 66 % or upwards are said to be acid or acidic, whilst those in which it falls to 55 % or below are called basic lavas. The two series are connected by a group of intermediate composition, whilst a small number of igneous rocks of exceptional type are recognized as ultrabasic. Professor F. W. Clarke has suggested a grouping of igneous rocks as per-silicic, medio-silicic and sub-silicic, in which the proportion of silica is respectively more than 60, between 50 and 60, or less than 50 %.

By far the greater part of all lavas consists of various silicates, either crystallized as definite minerals or unindividualized as volcanic glass. In addition, however, to the mineral silicates, a volcanic rock may contain a limited amount of free acid and basic oxides, represented by such minerals as quartz and magnetite. Rhyolite may be cited as a typical example of an acid lava, andesite as an intermediate and basalt as a basic lava. The various volcanic rocks are described under their respective headings, so that it is needless to refer here to their chemical or mineralogical composition. It may, however, be useful to cite a few selected analyses of some recent lavas and ashes:—

	I.	II.	III.	IV.	V.	VI.
Silica	48·28	49·73	50·00	68·99	61·88	49·20
Alumina	18·39	18·46	13·99	16·07	18·30	14·90
Ferric oxide	1·12	6·95	5·13	2·63	1·97	4·51
Ferrous oxide	7·88	5·59	9·10	1·10	4·32	12·75
Manganous oxide	..	..	..	0·28	..	0·28
Magnesia	3·72	3·99	4·06	1·08	2·71	3·90
Lime	9·20	10·71	10·81	3·16	6·32	9·20
Soda	2·84	3·50	3·02	4·04	3·17	1·96
Potash	7·25	1·07	2·87	1·83	1·09	0·95
Titanium dioxide	1·28	..	..	0·82	0·31	1·72
Phosphorus pentoxide	0·51	..	..	..	0·09	0·42
Loss on ignition	0·62	..	0·24	..	0·19	0·10
	100·96	100·00	99·22	100·00	100·35	99·89

I. From Vesuvius, eruption of 1906; by M. Pisani.
II. ,, Etna. Mean of several analyses by Silvestri and Fuchs (Mercalli).
III. ,, Stromboli, 1891; by Ricciardi.
IV. ,, Krakatoa eruption of 1883; by C. Winkler.
V. ,, Mont Pelé, Martinique, eruption of 1902; by M. Pisani.
VI. ,, Kilauea, Hawaii; by O. Silvestri.

In the course of the life of a volcano, the lava which it emits may undergo changes, within moderate limits, being at one time more acid, at another more basic. Such changes are sometimes connected with a shifting of the axis of eruption. Thus at Etna the lavas from the old axis of Trifoglietto in the Valle del Bove were andesites, with about 55 % of silica, but those rising in the present conduit are doleritic, with a silica-content of only about 50 %. It seems probable that, to a limited extent, changes in the character of a lava may sometimes be due to contact of the magma with different rocks underground: if these are rich in silica, the acidity of the lava will naturally increase; while if they are rich in calcareous and ferromagnesian constituents, the basicity will increase: the variation is consequently apt to be only local, and probably always slight.

By von Richthofen and some others it has been held that during a long period of igneous activity a definite order in the succession of the erupted rocks is everywhere constant; but though some striking coincidences may be cited, it can hardly be said that this generalization has been satisfactorily established. It has, however, often been observed, as emphasized by Professor Iddings, that a volcanic centre will start with the emission of lavas of neutral or intermediate type, followed in the course of a geological period by acid and basic lavas, and ending with those of extreme composition, indicating progressive change in the magma.

The old idea of a universal magma, or continuous pyrosphere, has been generally abandoned. Whatever may have been the case in a primitive condition of the interior of the earth, it seems necessary to admit that the magma must now exist in separate reservoirs. The independent activity of neighbouring volcanoes strikingly illustrated in Kilauea and Mauna Loa in Hawaii, only 20 m. apart, suggests a want of communication between the conduits; and though the lavas are very similar at these two centres, it would seem that they can hardly be drawn from a common source. Again, the volcanoes of southern Italy and the neighbouring islands exhibit little or no sympathy in their action, and emit lavas of diverse type. The lavas of Vulcano, one of the Lipari Isles, are rhyolitic, whilst those of Stromboli, another of the group, are basaltic.

It is believed that the magma in a subterranean reservoir, though originally homogeneous, may slowly undergo certain changes, whereby the more basic constituents migrate to one quarter whilst the acid segregate in another, so that the canal, at successive periods, may bring up material of different types. The cause of this "magmatic differentiation," which has been the subject of much discussion, is of fundamental importance in any broad study of the genetic relations of igneous rocks.

It has often been observed that all the rocks from a definite igneous centre have a general similarity in chemical and mineralogical characters. This relationship is called, after Professor Iddings, "consanguinity," and appears to be due to the fact that the rocks are drawn from a common source. Professor Judd pointed out the existence of distinct "petrographical provinces," within which the eruptive rocks during a given geological period have a certain family likeness and have appeared in definite succession. Thus he recognized a Brito-Icelandic petrographical province of Tertiary and recent lavas. It has been shown by A. Harker that alkali igneous rocks are generally associated with the Atlantic type of coast-line and sub-alkali rocks with the Pacific type.

Although changes in the character of an erupted product from a given centre are usually brought about very slowly, it has often been supposed that even in the course of a single prolonged eruption, or series of eruptions, the character of the lava may vary to some extent. That this is not, however, usually the case has been repeatedly proved. M. H. Arsandaux, for instance, analysed the bombs of augite-andesite thrown out from Santorin at the beginning of the eruption of 1866, others ejected in 1867, and others again at the close of the eruption in 1868; and he found no important variation in the composition of the magma during these successive stages. Moreover, Professor A. Lacroix found that the material extruded from Vesuvius in 1906 remained practically of the same composition from the beginning to the end of the eruption, and further, that it presented great analogy to that of 1872 and even to that of 1631.

All the Vesuvian lavas are of the type of rock known as leucotephrite or leucitetephrite, or they pass, by the presence of a little olivine, into leucite-basanite. Leucite is characteristic of the lavas of Vesuvius, whilst it is excessively rare in those of Etna, where a normal doleritic type prevails. Nepheline, a felspathoid related to leucite, is characteristic of certain lavas, such as those of the Canary Islands, which comprise nepheline-tephrites and nepheline-basanites. Most of the lavas from the volcanoes of South America consist of hypersthene-andesite, and it is notable that the fragmental ejectamenta from the eruptions of St Vincent and Martinique in 1902 and from Krakatoa in 1883 were evidently derived from a magma of this Pacific type.

It commonly happens that acid lavas are paler in colour, less dense and less fusible than basic lavas, and they are probably drawn in some cases from shallower depths. As a consequence of the ready fusibility of many basic lavas, they flow freely on emission, running to great distances and forming far-spreading sheets, whilst the more acid lavas rapidly become viscid and tend to consolidate nearer to their origin, often in hummocky masses. The shape of a volcanic mountain is consequently determined to a large extent by the chemical character of the lavas which it emits. In the Hawaiian Islands, for instance, where the lavas are highly basic and fluent, they form mountains which, though lofty, are flat domes with very gently sloping sides. Such is the fluidity of the lava on emission that it flows freely on a slope of less than one degree. In consequence, too, of this mobility, it is readily thrown into spray and even projected by the expansive force of vapour into jets, which may rise to the height of hundreds of feet and fall back still incandescent, producing the appearance of "fire fountains." The emission is not usually accompanied, however, by violent explosions, such as are often associated with the eruption of magmas of less basic and more viscous nature. The viscosity of the lava at Kilauea was estimated by G. F. Becker to be about fifty times as great as that of water. It may be pointed out that the fusibility of a lava depends not on the mere fact that it is basic, but rather on the character of the bases. A lava from Etna or Vesuvius may be really as basic as one from Hawaii.

Capillary Lava.—A filamentous form of lava well known at Kilauea, in Hawaii, is termed *Pele's hair*, after Pele, the reputed goddess of the Hawaiian volcanoes. It resembles the capillary slag much used in the arts under the name of "mineral wool"—a material formed by injecting steam into molten slag from an iron blast-furnace. It is commonly supposed that Pele's hair has been formed from drops of lava splashed into the air and drawn out by the wind into fine threads. According, however, to Major C. E. Dutton, the filaments are formed on the eddying surface of the lava by the elongation of minute vesicles of water-vapour expelled from the magma. C. F. W. Krukenberg, who examined the hair microscopically, figured a large number of fibres, some of which showed the presence of minute vesicles and microscopic crystals, the former when drawn out rendering the thread tubular. In a spongy vitreous scoria from Hawaii, described as "thread-lace," a polygonal network of delicate fibres forms little skeleton cells. Capillary lava is not confined to the Hawaiian volcanoes: it is known, for example, in Réunion, and may be formed even at Vesuvius.

Pumiceous Lava.—The copious disengagement of vapour in a glassy lava gives rise to the light cellular or spongy substance, full of microscopic pores, known as pumice (*q.v.*). It is usually, though not invariably, produced from an acid lava, and may sometimes be regarded as the solidified foam of an obsidian. During the eruption of Krakatoa in 1883 enormous quantities of pumice were ejected, and were carried by the sea to vast distances, until they ultimately became water-logged and sank. Professor Judd found the pumice to consist of a vitreous lava greatly inflated by imprisoned vapours; the walls of the air-cells were formed of the lava drawn out into thin plates and threads, often with delicate fibres running across the cavities. Having been suddenly cooled, it was extremely brittle, and its ready pulverization gave rise to much of the ash ejected during this eruption. It has been shown by Dr Johnston-Lavis that a bed of pumiceous lava, especially if basic, is generally vitreous towards the base, becoming denser, darker and more crystalline upwards, until it may pass superficially into scoria. The change is explicable by reduction in the temperature of the magma consequent on the conversion of water into steam.

Water in Lavas.—Whether an eruption is of an explosive or a tranquil character must depend largely, though not wholly, on the chemical composition of the magma, especially on the extent to which it is aquiferous. By relief of pressure on the rise of the column in the volcanic channel, or otherwise, more or less steam will be disengaged, and if in large quantity this must become, with other vapours, a projectile agency of enormous power. The precise physical condition in which water exists in the magma is a matter of speculation, and hence Johnston-Lavis proposed to designate it simply as H_2O. Water above its critical point, which is about 370° C. or 698° F., cannot exist as a liquid, whatever be the pressure, neither is it an ordinary vapour. It has been estimated that the critical point would probably be reached at a depth of about 7 m. At very high temperatures the elements of water may exist in a state of dissociation.

Much discussion has arisen as to the origin of the volcanic water, but probably it is not all attributable to a single source. Some may be of superficial origin, derived from rain, river or sea; whilst the upward passage of lava through moist strata must generate large volumes of steam. It has often been remarked that wet weather increases the activity of a volcano, and that in certain mountains the eruptions are more frequent in winter. According, however, to Professor A. Riccò's prolonged study of Etna, rain has no apparent influence on the activity of this mountain, and indeed the number of eruptions in winter, when rains are abundant, seems rather less than in summer.

The popular belief that explosive action is due to the admission of water to the volcanic focus is founded mainly on the topographic relation of volcanoes to large natural bodies of water, many being situated near the shore of a continent or on islands or even on the sea-floor. Salt water gaining access to heated rocks, through fissures or by capillary absorption, would give rise not only to water-vapour but to the volatile chlorides so common in volcanic exhalations. Yet it is notable that comparatively little chlorine is found among the products exhaled by the volcanoes of Hawaii, though these are typically insular. L. Palmieri, however, described certain sublimates on lava at Vesuvius after the eruption of 1872 as deposits of "sea-salt," to show that they were not simply sodium chloride, but contained other constituents found in sea-water. Professor T. J. J. See believes that sea-water gains access to the heated rocks of the earth's interior by leakage through the floor of the ocean, the bottom never being water-tight, and Arrhenius supposes that it reaches the magma by capillarity through this floor.

It has been supposed that water on reaching the hot walls of a subterranean cavity would pass into the spheroidal state, and on subsequent reduction of temperature might come into direct contact with the heated surface, when it would flash with explosive violence into steam. Such catastrophes probably occur in certain cases. When, for example, a volcano becomes dormant, water commonly accumulates in the crater, and on a renewal of activity this crater-lake may be absorbed through fissures in the floor leading to the reopened duct, and thus become rapidly, even suddenly, converted into vapour. But such incidents are accidental rather than normal, and seem incompetent to account for volcanic activity in general.

The effect of the contact of lava with water is often misunderstood.

When a stream of lava flows into the sea it no doubt immediately generates a prodigious volume of steam; but this is only a temporary phenomenon, for the lava rapidly becomes chilled by the cold water, with formation of a superficial solid layer, which by its low thermal conductivity allows the internal mass to cool slowly and quietly. In the great eruption of Krakatoa in 1883 the sea-water gained occasional access to the molten lava, and by its cooling effect checked the escape of vapour, thus temporarily diminishing the volcanic activity. But Judd compares this action to that of fastening down the safety-valve of a steam-boiler. The tension of the elastic fluids being increased by this repression would give rise subsequently to an explosion of greater violence; and hence the short violent paroxysms characteristic of the Krakatoa eruption were due to what he calls a "check and rally" of the subterranean forces. The action in the volcanic conduit has, indeed, been compared with that of a geyser.

The downward passage of water through fissures must be confined to the upper portion of the earth's crust known as the "zone of fracture," for it is there only that open channels can exist. Water might also percolate through the pores of the rocks, but even the pores are closed at great depths. It was shown many years ago by G. A. Daubrée that water could pass to a limited extent through a heated rock against the pressure of steam in the opposite direction. According to S. Arrhenius, water may pass inwards through the sea-bottom by osmotic pressure.

As the melting points of various silicates are lowered by admixture with water, it appears that the access of surface-waters to heated rocks must promote their fusibility. Judd has suggested that the proximity of large bodies of water may be favourable to volcanic manifestations, because the hydrated rocks become readily melted by internal heat and thus yield a supply of lava.

Whilst some of the water-vapour exhaled from a volcano is undoubtedly derived from superficial sources, notably in such insular volcanoes as Stromboli, the opinion has of late years been gaining ground, through the teaching of Professor E. Suess and others, that the volcanic water must be largely referred to a deep-seated subterranean origin—that it is, in a word, "hypogene" or magmatic rather than meteoric. It is held that the magma as it rises through the volcanic conduit brings up much water-vapour and other gaseous matters derived from original sources, perhaps a relic of what was present in the earth in its molten condition, having possibly been absorbed from a dense primordial atmosphere, or, as suggested by Professor T. C. Chamberlin, entrapped by the globe during its formation by accretion of planetesimal matter.

Water brought from magmatic depths to the surface, and appearing there for the first time, has been termed "juvenile," and it has been assumed that such water may be seen in hot springs like those at Carlsbad. Professor J. W. Gregory has suggested that certain springs in the interior of Australia may derive part of their supply from juvenile or plutonic waters.

According to A. Gautier, the origin of volcanic water may be found in the oxidation of hydrogen, developed from masses of crystalline rock, which by subsidence have been subjected to the action of subterranean heat.

Volcanic Vapours.—It seems not unlikely that the vapours and gases exist in the volcanic magma in much the same way that they can exist in molten metal. It is a familiar fact that certain metals when melted can absorb large volumes of gases without entering into chemical combination with them. Molten silver, for example, is capable of absorbing from the atmosphere more than twenty times its volume of oxygen, which it expels on solidification, thus producing what is called the "spitting of silver." Platinum again can absorb and retain when solid, or occlude, a large volume of hydrogen, that can be expelled by heating the metal in vacuo. In like manner molten rock under pressure can absorb much steam. It appears that many igneous rocks contain gases locked up in their pores, not set free by pulverization, yet capable of expulsion by strong heat. The gases in rocks have been the subject of elaborate study by R. T. Chamberlin, whose results appear in Publication No. 106 of the Carnegie Institution of Washington.

Sir W. A. Tilden has found that granite, gabbro, basalt and certain other igneous rocks enclose many times their volume of gases, chiefly hydrogen and carbon dioxide, with carbon monoxide, methane and nitrogen. Thus, the basalt of Antrim in Ireland, which is a Tertiary lava, yielded eight times its volume of gas having the following percentage composition: hydrogen 36·15, carbon dioxide 32·08, carbon monoxide 20·08, methane 10, nitrogen 1·61. No doubt some of the gases evolved on heating rocks may be generated by reactions during the experiment, as shown by M. W. Travers, and also by Armand Gautier. It has been pointed out by Gautier that the gas exhaled from Mont Pelé during the eruption of 1902 had practically the same composition as that which he obtained on heating granite and certain other rocks. According to this authority a cubic kilometre of granite heated to redness would yield not less than 26,000,000 tons of water-vapour, besides other gases. If then a mass of granite in the earth's crust were subject to a great local accession of heat it might evolve vast volumes of gaseous matter, capable of producing an eruption of explosive type. Judd found that the little balls of Siberian obsidian called marekanite threw off, when strongly heated, clouds of finely divided particles formed by rupture of the distended mass through the escape of vapour. Pitchstone when ignited loses in some cases as much as 10% of its weight, due to expulsion of water.

Much of the steam and other vapour brought up from below by the lava may be evolved on mere exposure to the air, and hence a stream freshly extruded is generally beclouded with more or less vapour. Gaseous bubbles in the body of the lava render it vesicular, especially in the upper part of a stream, where the pressure is relieved, and the vesicles by the onward flow of the lava tend to become elongated in the direction of movement. Vesiculation, being naturally resisted by cohesion, is not common in very viscid lavas of acid type, nor is it to be expected where the lava has been subject to great pressure, but it is seen to perfection in surface-flows of liquid lavas of basaltic character. A vesicular structure may sometimes be seen even in dykes, but the cavities are usually rounded rather than elongated, and are often arranged in bands parallel to the walls of the dyke. A very small proportion of water in a lava suffices to produce vesiculation. Secondary minerals developed in a cellular lava may be deposited in the steam-holes, thus producing an amygdaloidal rock.

After the surface of a lava-stream has become crusted over, vapour may still be evolved in the interior of the mass, and in seeking release may elevate or even pierce the crust. Small cones may thus be thrown up on a lava-flow, and when vapour escapes from terminal or lateral orifices they are known as "spiracles." The steam may issue with sufficient projectile force to toss up the lava in little fountains. When the lava is very liquid, as in the Hawaiian volcanoes, it may after projection from the blow-hole fall back in drops and plastic clots, which on consolidation form, by their union, small cones.

Vapour-vents on lava are often known as fumaroles (*q.v.*). The character of the gaseous exhalations varies with the temperature, and the following classification was suggested by C. Sainte-Claire Deville: (1) Dry or white fumaroles having a temperature above 500° C. and evolving compounds of chlorine, and perhaps fluorine. (2) Acid fumaroles, exhaling much steam, with hydrocholoric acid and sulphur dioxide. (3) Alkaline fumaroles, at a temperature of about 100°, with much steam and ammonium chloride and some sulphuretted hydrogen. (4) Cold fumaroles, below 100°, with aqueous vapour, carbon dioxide and sulphuretted hydrogen. (5) Mofettes, indicating the expiring phase of vulcanism. A similar sequence of emanations, following progressive cooling of the lava, has been noted by other observers. During an eruption, the gaseous products may vary considerably. Johnston-Lavis found at Vesuvius that the vapour which first escaped from the boiling lava contained much sulphurous acid, and that hydrochloric acid and other chlorides appeared later.

If the vapours exhaled from volcanoes were derived originally from superficial sources, the lava would, of course, merely return to the surface of the earth what it had directly or indirectly absorbed. But if, as is now rather generally believed, much if not most of the volcanic vapour is derived from original subterranean sources, it must form a direct contribution from the interior of the earth to the atmosphere and hydrosphere, and consequently becomes of extreme geological interest.

Description of Special Gases and Vapours.—Hydrochloric acid, HCl, escapes abundantly from many vents, often accompanied with the vapours of certain metallic chlorides, and is responsible for much of the acrid effects of volcanic exhalations. To avoid dangerous vapours an active volcano should be ascended on the windward side. Free hydrofluoric acid, HF, has sometimes been detected with the hydrochloric acid among Vesuvian vapours, and silicon fluoride, SiF_4, has also been reported. Sulphuretted hydrogen, H_2S, is a frequent emanation, and being combustible may contribute to the lambent flames seen in some eruptions. It readily suffers oxidation, giving rise to sulphur dioxide and water. By the interaction of hydrogen sulphide and carbon dioxide, water and carbon oxysulphide, COS, are formed; whilst by reaction with sulphur dioxide, water and free sulphur are produced, such being no doubt the origin of many deposits of volcanic sulphur. Hydrogen sulphide may be formed by the decomposition of certain metallic sulphides, like that of calcium, in the presence of moisture, as suggested by Anderson and Flett with regard to certain muds at the Soufrière of St Vincent. Sulphur dioxide, SO_2, is one of the commonest exhalations, especially at acid fumaroles. It may be detected by its characteristic smell, that of burning brimstone, even when present in very small proportion and in the presence of an excess of hydrochloric acid. By hydration it readily forms sulphurous acid, which may be further oxidized to sulphuric acid. J. B. Boussingault found free sulphuric acid (with hydrochloric acid) in the water of the Rio Vinagre which issues from the volcano of Puracé in the Andes of Colombia; and it occurs also in certain other volcanic waters. Carbon dioxide, CO_2, is generally a product of the later stages of an eruption, and is often evolved after all other gases have ceased to escape. Although it may sometimes be due to the decomposition of limestone, it seems to be mostly of true magmatic origin. At the well-known Grotta del Cane, at Lake Agnano, in the Phlegraean Fields near Naples, there has been for ages a copious discharge, and analyses of the air of the cave by T. Graham Young showed the presence of from 61·5 to 71 % of carbon dioxide. Gautier, in 1907, found 96 to 97 % of this gas in the vapours (excluding water-vapour) emitted from the Solfatara near Pozzuoli in the Bay of Naples. The gas by its density tends to accumulate in depressed areas, as in the Death Gulch in the Yellowstone Park and in the Upas Valley of Java. In the Eifel, in the Auvergne and in many other volcanic regions it is discharged at temperatures not above that of the atmosphere. This natural carbonic acid gas is now utilized industrially at many localities. In the gases of the fumaroles of Mont Pelé, carbon monoxide, CO, was detected by H. Moissan. Probably certain hydrocarbons, notably methane or marsh-gas, CH_4, often exist in volcanic gases. They might be formed by the action of water on natural carbides, such as that of magnesium, calcium, &c. Moissan found 5·46 % of methane in vapour from a fumarole on Mont Pelé in 1902. Free hydrogen was detected by R. Bunsen as far back as 1846 in vapours from volcanoes in Iceland. In 1861 Deville and Fouqué found it, with hydrocarbons, at Torre del Greco near Naples; and in 1866 Fouqué discovered it at Santorin, where some of the vapour at the immediate focus of eruption contained as much as 30 % of hydrogen. It is notable that at Santorin free oxygen was also found. The elements of water may possibly exist, at the high temperature of the magma, in a state of dissociation, and certain volcanic explosions have sometimes been attributed to the combination of these elements. Oxygen is not infrequently found among volcanic emanations, but may perhaps be derived in most cases from superficial air and ground-water; and in like manner the nitrogen, often detected, may be sometimes of atmospheric origin, though in other cases derived from nitrides in the lava. In the vapours emitted by Mont Pelé in 1902 argon was detected by H. Moissan, to the extent of 0·71 %; and in those from Vesuvius in 1906 argon and neon were found by Gautier. The collection of volcanic vapours offers difficulty, and it is not easy to avoid admixture with the atmosphere. F. A. Perret has successfully collected gases on Vesuvius.

Volcanic Flames.—Although the incandescence of the lava and stones projected during an eruption, and the reflection from incandescent matter in the crater have often been mistaken for red flames, there can be no doubt that true combustion, though generally feeble, does occur during volcanic outbursts. Among the gases cited above, hydrogen, hydrogen sulphide and the hydrocarbons are inflammable. The flames seen in volcanoes are generally pale and of bluish, greenish or yellowish tint. They were first examined spectroscopically by J. Janssen, who in 1867 detected the lines of burning hydrogen at Santorin. Subsequently he proved the presence of hydrogen, sodium and hydrocarbons in the volcanic flames of Kilauea. During the eruption of Vulcano, in the Lipari Isles, in 1888, flames with a bluish or greenish tinge were seen by A. E. Narlian, an experienced observer resident in the island. These, however, were referred to the kindling of sulphur deposited around the fumaroles, the flames being coloured by the presence of boric acid and arsenic sulphide.

When a stream of lava flows over vegetation the combustion of the leaves and wood may be mistaken for flames issuing from the lava. In like manner brushwood may grow in the crater of a dormant volcano and be ignited by a fresh outburst of lava, thus producing flames which, from their position in the crater, may readily deceive an observer.

Volcanic Sublimates.—Certain mineral substances occur as sublimates in and around the volcanic vents, forming incrustations on the lava. They are either deposited directly from the effluent vapours, which carry them in a volatile condition, or are produced by interaction of the vapours among themselves; whilst some of the incrustations, rather loosely called sublimates, are due to reaction of the vapours on the constituents of the lava. Possibly at the temperature of the magma-reservoirs even silica and various silicates may be volatilized, and might thus yield sublimation products. Many of the volcanic sublimates occur at first as incandescent crusts on the lava. Being generally unstable they are difficult of preservation, and are not usually well represented in collections.

Among the commonest sublimates is halite, or sodium chloride, NaCl, occurring as a white crystalline incrustation, sometimes accompanied, as at Vesuvius, by sylvite, or potassium chloride, KCl, which forms a similar sublimate. The two chlorides may be intimately associated. Sal ammoniac, or ammonium chloride, NH_4Cl, is not uncommon, especially at Etna, as a white crystalline crust, probably formed in part by the reaction of hydrochloric acid with nitrogen and hydrogen in the vapours. Bunsen, on finding it in Iceland, regarded it as a product of the distillation of organic matter. At the Solfatara, near Pozzuoli, sal ammoniac was formerly collected as a sublimate on tiles placed round a bocca or vapour-vent. Ferric chloride, $FeCl_3$, not infrequently occurs as a reddish or brownish yellow deliquescent incrustation, and because it thus colours the lava it has received the name of molysite (from Gr. μόλυσις, stain). The action of hydrochloric acid on the iron compounds in the lava may readily yield this chloride, which from its yellowish colour has sometimes been mistaken for sulphur. A crystalline sublimate from the fumaroles on Vesuvius, containing ferric and alkaline chlorides, $KCl{\cdot}NH_4Cl{\cdot}2FeCl_3+6H_2O$, is known as kremersite, after P. Kremers. From a scoriaceous lava found on Vesuvius after the eruption of 1906, Johnston-Lavis procured a yellow rhombohedral sublimate, which he proved to be a chloride of manganese and potassium, whence he proposed for it the name chlormanganokalite. It was studied by L. J. Spencer, and found to contain $4KCl{\cdot}MnCl_2$. Chlorocalcite, or native calcium chloride, $CaCl_2$, has been found in cubic crystals on Vesuvian lava. Fluorite, or calcium fluoride, CaF_2, is also known as a volcanic product. Lead chloride, $PbCl_2$, a rare Vesuvian mineral, was named cotunnite, after Dr Cotugno of Naples. The action of hydrogen sulphide on this chloride may give rise to galena, PbS, found by A. Lacroix on Vesuvius in 1906. Atacamite, or cupric oxychloride, $CuCl_2{\cdot}3Cu(OH)_2$, occurs as a green incrustation on certain Vesuvian lavas, notably those of 1631. Another green mineral from Vesuvius was found by A. Scacchi to be a sulphate containing copper, with potassium and sodium, which he named from its fine colour *euclorina*—a word which has been written in English as euchlorinite. The copper in the sublimates on Vesuvius will sometimes plate the iron nails of a traveller's boots when crossing the newly erupted lava. Cupric oxide, CuO, occurs in delicate crystalline scales termed tenorite, after Professor G. Tenore of Naples; whilst cupric sulphide, CuS, forms a delicately reticulated incrustation known as covellite, after N. Covelli, its discoverer at Vesuvius.

A sublimate not infrequently found in feathery crystalline deposits on lava at Vesuvius, and formerly called "Vesuvian salt," is a potassium and sodium sulphate, $(K{\cdot}Na)_2SO_4$, known as aphthitalite (from Gr. ἄφθιτος, imperishable, and ἅλς, salt). A sulphate with the composition $PbSO_4{\cdot}(K{\cdot}Na)_2SO_4$, found in the fumaroles at Vesuvius after the eruption of 1906, was named by A. Lacroix palmierite, after L. Palmieri, who was formerly director of the observatory on Vesuvius. Various sulphites are formed on lavas by the sulphurous acid of the vapours. Ferric oxide, Fe_2O_3, which occurs in beautiful metallic scales as specular iron-ore, or as an amorphous reddish incrustation on the lava, is probably formed in most cases by the interaction of vapour of ferric chloride and steam at a high temperature. Less frequently, magnetite, Fe_3O_4, and magnesioferrite, $MgFe_2O_4$, are found in octahedral crystals on lava. An iron nitride (Fe_5N_2) was detected thinly incrusting a lava erupted at Etna in 1874, and was named by O. Silvestri, who examined it, siderazote.

Boric acid, H_3BO_3, occurs in the crater of Vulcano so abundantly that it was at one time collected commercially. It has also led to the foundation of an industry in Tuscany, where it is obtained from the soffioni (*q.v.*) of the Maremma. From Sasso in Tuscany it has received the name of sassolin or sassolite. Realgar, or arsenic sulphide, As_2S_2, occurs in certain volcanic exhalations and is deposited as an orange-red incrustation, often associated with sulphur, as at the Solfatara, where orpiment, As_2S_3, has also been found.

Of all volcanic products, sulphur (*q.v.*) is in some respects the most important. It may occur in large quantity lining the walls of the crater, as at Popocatepetl in Mexico, where it was formerly worked by the Indian "volcaneros," or on the other hand it may be a rare product, as at Vesuvius. Sulphur appears generally to owe its origin in volcanic areas to the interaction of sulphur dioxide and sulphuretted hydrogen, or to the action of water on the latter. A volcanic vent where sulphur is deposited is truly a solfatara (*solfo terra*) or a soufrière, but all volcanoes which have passed into that stage in which they emit merely heated vapours now pass under this name (see SOLFATARA). The famous Solfatara, an old crater in the Phlegraean Fields, exhales sulphurous vapours, especially at the Bocca Grande, from which sulphur is deposited. In the orange-coloured sulphur of the Solfatara, realgar may be present to the extent of as much as 18 %. A brown seleniferous sulphur occurring at Vulcano, one of the Lipari Islands, was termed by W. Haidinger volcanite, but it should be noted that Professor W. H. Hobbs has applied this name to an anorthoclase-augite rock ejected as bombs at Vulcano. Sulphur containing selenium is known as a volcanic product in Hawaii, whilst in Japan not only selenium but tellurium occurs in certain kinds of sulphur.

At the Solfatara, near Pozzuoli, the hot sulphurous vapours attack the trachytic rocks from which they issue, giving rise to such products as alum, kaolin and gypsum. To some of these products, including alunogen and mendozite (soda-alum), the name solfatarite was given by C. W. Sheppard in 1835. By prolonged action of the acid vapours on lava, the bases of the silicates may be removed, leaving the silica as a soft white chalk-like substance. The occurrence of kaolin and other white earthy alteration-products led to the hills around the Solfatara being known to the Romans as the *Colli leucogei*.

The Hot Dust Cloud and Avalanche of Pelé.—The terrific eruptions in the islands of Martinique and St Vincent in the West Indies in 1902, furnished examples of a type of activity not previously recognized by vulcanologists, though, as Professor A. Lacroix has pointed out, similar phenomena have no doubt occurred elsewhere, especially in the Azores. By Drs Tempest Anderson and J. S. Flett, who were commissioned by the Royal Society to report on the phenomena, this type of explosive eruption is distinguished as the "Peléan type." Its distinctive character is found in the sudden emission of a dense black cloud of superheated and suffocating gases, heavily charged with incandescent dust, moving with great velocity and accompanied by the discharge of immense volumes of volcanic sand, which are not rained down in the normal manner, but descend like a hot avalanche. The cloud, with the avalanche, is called by Lacroix a *nuée Peléenne*, or *nuée ardente*, the latter term having been applied to the fatal cloud in the eruptions at San Jorge in the Azores in 1818. In its typical form, the cloud seen at Pelé appeared as a solid bank, opaque and impenetrable, but having the edge in places hanging like folds of a curtain, and apparently of brown or purplish colour. Rolling along like an inky torrent, it produced in its passage intense darkness, relieved by vivid lightning. So much solid matter was suspended in the cloud, that it became too dense to surmount obstacles and behaved rather like a liquid. It has, however, been suggested that its peculiar movement as it swept down the mountain was due not simply to its heavy charge of solids, but partly to the oblique direction of the initial explosion. After leaving the crater, it underwent enormous expansion, and Anderson and Flett were led to suggest that possibly at the moment of emission it might have been partly in the form of liquid drops, which on solidifying evolved large volumes of gas held previously in occlusion. The deadly effect of the blast seems to have been mostly due to the irritation of the mucous membrane of the respiratory passages by the fine hot dust, but suffocating gases, like sulphur dioxide and sulphuretted hydrogen, were associated with the water-vapour. Possibly the incandescent dust was even hotter than the surrounding vapour, since the latter might be cooled by expansion.

It is said that the black cloud as it swept along was accompanied by an indraught of air, not however sufficiently powerful to check its rapid advance. The current of air was likened by Anderson and Flett to the inrush of air at a railway station as an express train passes. An attempt was made to determine the temperature of the fatal blast which destroyed St Pierre, but without very definite results. Thus it was assumed that as the telephone wires were not melted the temperature was below the fusing-point of copper: possibly, however, the blast may have passed too rapidly to produce the effects which might normally be due to its temperature.

Shape of Volcanic Cones.—Those volcanic products which are solid when ejected, or which solidify after extrusion, tend to form by their accumulation around the eruptive vent a hill, which, though generally more or less conical, is subject to much variation in shape. It occasionally happens that the hill is composed wholly of ejected blocks, not themselves of volcanic origin. In this case an explosion has rent the ground, and the effluent vapours have hurled forth fragments of the shattered rock through which the vent was opened, but no ash or other fragmentary volcanic material has been ejected, nor has any lava been poured forth. This exceptional type is represented in the Eifel by certain monticules which consist mainly of fragments of Devonian slate, more or less altered. In some cases the area within a ring of such rocky materials is occupied by a sheet of water, forming a crater-lake, known in the Eifel as a *maar*. Piles of fragmentary matter of this character, though containing neither cinders nor lava, may be fairly regarded as volcanic, inasmuch as they are due to the explosive action of hot subterranean vapours.

In the ordinary paroxysmal type of eruption, however, cinders and ashes are shot upwards by the explosion and then descend in showers, forming around the orifice a mound, in shape rather like the diminutive cone of sand in the lower lobe of an hour-glass. Little cinder-cones of this character may be formed within the crater of a large volcano during a single eruption; whilst large cones are built up by many successive discharges, each sheet of fragmentary material mantling more or less regularly round the preceding layer. The symmetry of the hill is not infrequently affected by disturbing influences—a strong wind, for example, blowing the loose matter towards one side. The sides of a cinder cone have generally a steep slope, varying from 30° to 45°, depending on the angle of repose of the ejectamenta. Excellent examples of small scoria-cones are found among the puys of Auvergne in central France, whilst a magnificent illustration of this type of hill is furnished by Fusiyama, in Japan, which reaches an altitude of 12,000 ft. How such a cone may be rapidly built up was well shown by the formation of Monte Nuovo, near Pozzuoli—a hill 400 ft. high and a mile and a half in circumference, which is known from contemporary evidence to have been formed in the course of a few days in September 1538. The shape of a cinder cone may be retained for ages, since it is not liable to suffer greatly by denudation, as the rain soaks into the loose porous mass instead of running down the outside. If lava rises in the duct of a cinder cone, it may, on accumulation in the crater, break down the wall, and thus effect its escape as a stream. Cones breached in this way are not uncommon in Auvergne.

It often happens that the cinders and ashes ejected from a volcano become mixed with water, and so form a paste, which sets readily as a hard tufaceous mass. Such natural tuff is indeed similar to the hydraulic cement known as pozzolana, which is formed artificially from volcanic ashes, and is renowned for durability. Although streams of volcanic mud are commonly associated with the ashes of a cinder-cone they may also form independent structures or tuff-cones. These are generally broad-topped hills, having sides with an angle of slope as low in some cases as 15°.

Lava-cones are built up of streams of lava which have consolidated around the funnel of escape. Associated with the lava, however, there is usually more or less fragmentary matter, so that the cones are composite in structure and consequently more acute in shape than if they were composed wholly of lava. As the streams of lava in a volcano run at different times in different directions, they radiate from the centre, or flow from lateral or eccentric orifices, as irregular tongues, and do not generally form continuous sheets covering the mountain.

When lava is the sole or chief element in the cone, the shape of the hill is determined to a great extent by the chemical composition and viscosity of the lava, its copiousness and the rapidity of flow. If the lava be highly basic and very mobile, it may spread to a great distance before solidifying, and thus form a hill covering a large area and rising perhaps to a great height, but remarkably flat in profile. Were the lava perfectly liquid, it would indeed form a sheet without any perceptible slope of surface. As a matter of fact, some lavas are so fluent as to run down an incline of 1°, and flat cones of basalt have in some cases a slope of only 10° or even less. The colossal mass of Mauna Loa, in Hawaii, forms a remarkably flat broad cone, spreading over a base of enormous area and rising to a height of 13,900 ft. Major Dutton, writing in 1883, said that "a moderate eruption of Mauna Loa represents more material than Vesuvius has emitted since the days of Pompeii." Yet the lava is so mobile that it generally wells forth quietly, without explosive demonstration, and therefore unaccompanied by fragmentary ejectamenta. Fluent lavas like those of Hawaii are also poured forth from the volcanoes and volcanic fissures of Iceland.

If the lava be less basic and less fusible, the hill formed by its accumulation instead of being a low dome will take the shape of a cone with sides of higher gradient: in the case of andesite cones, for instance, the slope may vary from 25° to 35°. Acid rocks, or those rich in silica, such as rhyolites and trachytes, may be emitted as very viscous lavas tending to form dome-shaped or bulbous masses. Experiment shows that such lavas may persist for a considerable time in a semi-solid condition. It is possible for a dome to increase in size not by the lava running over the crater and down the sides but by injection of the pasty magma within the expanding bulb while still soft; or if solidified, the crust yields by cracking. Such a mode of growth, in which the dome consists of successive sheets that have been compared to the skins of an onion, has been illustrated by the experiments of Dr A. Reyer, and the structure is typically represented by the mamelons or steep-sided domes of the Isle of Bourbon. The Puy-de-Dôme in Auvergne is an example of a cone formed of the trachytic rock called from its locality domite, whilst the Grand Sarcoui in the same region illustrates the broad dome-shaped type of hill. Such domes may have no summit-crater, and it is then usually assumed that the top with the crater has been removed by denudation, but possibly in some cases such a feature never existed. The "dome volcano" of von Seebach is a dome of acid lava extruded as a homogeneous mass, without conspicuous chimney or crater. Although domes are usually composed of acid rocks, it seems possible that they may be formed also of basic lavas, if the magma be protruded slowly at a low temperature so as to be rapidly congealed.

The Spine of Pelé.—A peculiar volcanic structure appeared at Mont Pelé in the course of the eruption of 1902, and was the subject of careful study by Professor A. Lacroix, Dr E. A. Hoovey, A. Heilprin and other observers. It appears that from fissures in the floor of the Étang Sec a viscous andesitic lava, partly quartziferous, was poured forth and rapidly solidified superficially, forming a dome-shaped mass invested by a crust or carapace. According to Lacroix, the crust soon became fractured, partly by shrinkage on consolidation and partly by internal tension, and the dome grew rapidly by injection of molten matter. Then there gradually rose from the dome a huge monolith or needle, forming a terminal spine, which in the course of its existence varied in shape and height, having been at its maximum in July 1903, when its absolute height was about

5276 ft. above sea-level. The walls of the spine, inclined at from 75° to 90° to the horizon, were apparently slickensided, or polished and scratched by friction: masses were occasionally detached and vapours were continually escaping. Several smaller needles were also formed. Some observers regarded the great spine as a solidified plug of lava from a previous outburst, expelled on a renewal of activity. Lacroix, however, believed that it was formed by the extrusion of an enormous mass of highly viscid magma, perhaps partly solidified before emission, and he compared the formation of the dome in the crater to the structure on Santorin in 1866, described by Fouqué as a "cumulo-volcano." Professor H. F. Cleland has suggested a comparison with the cone of andesite in the crater of the volcano of Toluca in Mexico, and it is said that similar formations have been observed in the volcanoes of the Andes. Dr Tempest Anderson, on visiting Pelé in 1907, found a stump of the spine, consisting of a kind of volcanic agglomerate, rising from a cone of talus formed of its ruins.

The Crater.—The eruptive orifice in normal volcano—the *bocca* of Italian vulcanologists—is usually situated at the bottom of a depression or cup, known as the crater. This hollow is formed and kept open by the explosive force of the elastic vapours, and when the volcano becomes dormant or extinct it may be closed, partly by rock falling from its crumbling walls and partly by the solidification of the lava which it may contain. If a renewed outburst occurs, the floor of the old crater may reopen or a new outlet may be formed at some weak point on the side of the mountain: hence a crater may, with regard to position, be either terminal or lateral. The position of the crater will evidently be also changed on any shifting of the general axis of eruption. In shape and size the crater varies from time to time, the walls being perhaps breached or even blown away during an outburst. Hence the height of a volcanic mountain in activity, measured to the rim of the crater or the terminal peak, is not constant. Vesuvius, for example, suffered a reduction of several hundred feet during the great eruption of 1906, the east side of the cone having lost, according to V. R. Matteucci, 120 metres.

Whilst in many cases the crater is a comparatively small circular hollow around the orifice of discharge, it forms in others a large bowl-like cavity, such as is termed in some localities a "caldera." In the Sandwich Islands the craters are wide pits bounded by nearly vertical walls, showing stratified and terraced lavas and floored by a great plain of black basalt, sometimes with lakes of molten lava. Professor W. H. Pickering compares the lava-pits of Hawaii to the crater-rings in the moon. Some of the pit-craters in the Sandwich Islands are of great size, but none comparable with the greatest of the lunar craters. Dr G. K. Gilbert, however, has suggested that the ring-shaped pits on the moon are not of volcanic origin, but are depressions formed by the impact of meteorites. Similarly the "crater" of Coon Butte, near Canyon Diablo, in Arizona, which is 4000 ft. in diameter and 500 ft. deep, has been regarded as a vast pit due to collision of a meteorite of prodigious size. Probably the largest terrestrial volcanic crater is that of Aso-san, in the isle of Kiushiu (Japan), which is a huge oval depression estimated by some observers to have an area of at least 100 sq. m. Some of the large pit-craters have probably been formed by subsidence, the cone of a volcano having been eviscerated by extravasation of lava, and the roof of the cavity having then subsided by loss of support. The term caldera has sometimes been limited to craters formed by such collapse.

On the floor of the crater, ejected matter may accumulate as a conoidal pile; and if such action be repeated in the crater of the new cone, a succession of concentric cones will ultimately be formed. The walls of a perfect crater form a ring, giving the cone a truncated appearance, but the ring may suffer more or less destruction in the course of the history of the mountain. A familiar instance of such change is afforded by Vesuvius. The mountain now so called, using the term in a restricted sense, is a huge composite cone built up within an old crateral hollow, the walls of which still rise as an encircling rampart on the N. and N.E. sides, and are known as Monte Somma; but the S. and S.W. sides of the ancient crater have disappeared, having been blown away during some former outburst, probably the Plinian eruption of 79. In like manner the relics of an old crater form an amphitheatre partially engirdling the Soufrière in St Vincent, and other examples of "Somma rings" are known to vulcanologists.

Much of the fragmental matter ejected from a volcano rolls down the inside of the crater, forming beds of tuff which incline towards the central axis, or have a centroclinal dip. On the contrary, the sheets of cinder and lava which form the bulk of the cone slope away from the axis, or have a dip that is sometimes described as pericentric or qua-qua-versal. According to the old "crater-of-elevation theory," held especially by A. von Humboldt, L. von Buch and Élie de Beaumont, this inclination of the beds was regarded as mainly due to upheaval. It was contended that the volcanic cone owed its shape, for the most part, to local distension of the ground, and was indeed comparable to a huge blister of the earth's crust, burst at the summit to form the "elevation crater." Palma, in the Canary Islands, was cited as a typical example of such a formation. This view was opposed mainly by Poulett-Scrope, Sir Charles Lyell and Constant Prévost, who argued that the volcano, so far from being bladder-like, was practically a solid cone of erupted matter: hence this view came to be known as the "crater-of-eruption theory." Its general soundness has been demonstrated whenever an insight has been obtained into the internal structure of a volcano. Thus, after the eruption of Krakatoa in 1883 a magnificent natural section of the great cone of Rakata, at the S. end of the island, was exposed—the northern half having been blown away— and it was then evident that this mountain was practically a solid cone, built up of a great succession of irregular beds of tuff and lava, braced together by intersecting dykes. The internal architecture of a volcano is rarely so well displayed as in this case, but dissections of cones, more or less distinct, are often obtained by denudation. It should be mentioned that, in connexion with the structures called *laccoliths*, there may have been an elevation, or folding, and even faulting, of the superficial rocks by subterranean intrusion of lava; but this is different from the local expansion and rupture of the ground required by the old theory. It may be noted, however, that in recent years the view of elevation, in a modified form, has not been without supporters.

Where the growth of a volcanic mound takes place from within, as in certain steep-sided trachytic cones, there may be no perceptible crater or external outlet. Again, there are many volcanoes which have no crater at the summit, because the eruptions always take place from lateral outlets. Even when a terminal pit is present, the lava may issue from the body of the mountain, and in some cases it exudes from so many vents or cracks that the volcano has been described as "sweating fire."

Parasitic Cones.—In the case of a lofty volcano the column of lava may not have sufficient ascensional force to reach the crater at the summit, or at any rate it finds easier means of egress at some weak spot, often along radial cracks, on the flanks of the mountain. Thus at Etna, which rises to a height of more than 10,800 ft., the eruptions usually proceed from lateral fissures, sometimes at least half-way down the mountain-side. When fragmental materials are ejected from a lateral vent a cinder-cone is formed, and by frequent repetition of such ejections the flanks of Etna have become dotted over with hundreds of scoria-cones much like the puys of Auvergne, the largest (Monte Minardo) rising to a height of as much as 750 ft. Hills of this character, seated on the parent mountain, are known as parasitic cones, minor cones, lateral cones, &c.

Such subordinate cones often show a tendency to a linear arrangement, rising from vents or *bocche* along the floor of a line of fissure. Thus in 1892 a chain of five cones arose from a rift on the S. side of Etna, running in a N. and S. direction, and the hills became known as the Monti Silvestri, after Professor Orazio Silvestri of Catania. This rift, however, was but a continuation of a fissure from which there arose in 1886 the series of cones called the Monti Gemmellaro, while this in turn was a prolongation of a rent opened in 1883. The eruption on Etna in the spring of 1910 took place along the same general direction, but at a much higher elevation. The tendency for eruptions to be renewed along old lines of weakness, which can be readily opened afresh and extended, is a feature well known to vulcanologists.

The small cones which are frequently thrown up on lava streams were admirably exemplified on Vesuvius in the eruption of 1855 and figured by J. Schmidt. The name of "driblet cones" was given by J. D. Dana to the little cones and pillars formed by jets of lava projected from blowing holes at Kilauea, the drops of lava remaining plastic and cohering as they fell. Such clots may form columns and pyramids, with almost vertical sides. Steep-sided cones more or less of this character occur elsewhere, but are usually built up around spiracles. Small cones formed by mere dabs of lava are known trivially as "spatter cones."

Fissure Eruptions.—In certain parts of the world there are vast tracts of basaltic lava with little or no evidence of cones or of pyroclastic accompaniment. To explain their formation, Baron F. von Richthofen suggested that they represent great floods of lava which were poured forth not from ordinary volcanic craters with more or less explosive violence, but from great fissures in the earth's crust, whence they may have quietly welled forth and spread as a deluge over the surface of the country. The eruptions were thus effusive rather than explosive. Such phenomena, constituting a distinct type of vulcanism, are distinguished as fissure eruptions or massive eruptions—terms which suggest the mode of extrusion and the character of the extruded matter. As the lava in such outflows must be very fusible, it is generally of basaltic type, like that of Hawaii: indeed, the Hawaiian volcanoes, with their quiet emission of highly fluent lavas, connect the fissure eruptions with the "central eruptions," which are usually regarded as representing the normal type of activity. At the present day true fissure eruptions seem to be of rather limited occurrence, but excellent examples are furnished by Iceland. Here there are vast fields of black basalt, formed of sheets of lava which have issued from long chasms, studded in most cases with rows of small cones, but these generally so insignificant that they make no scenic features and might be readily obliterated by denudation. Dr T. Thoroddsen enumerates 87 great rifts and lines of cones in Iceland, and even the larger cones of Vesuvian type are situated on fissures.

It is believed that fissure eruptions must have played a far more important part in the history of the earth than eruptions of the familiar cone-and-crater type, the latter representing indeed only a declining phase of vulcanism. Sir Archibald Geikie, who has specially studied the subject of fissure eruptions, regards the Tertiary basaltic plateaus of N.E. Ireland and the Inner Hebrides as outflows from fissures, which may be represented by the gigantic system of dykes that form so marked a feature in the geological structure of the northern part of Britain and Ireland. These dykes extend over an area of something like 40,000 sq. m., while the outflows form an aggregate of about 3000 ft. in thickness. In parts of Nevada, Idaho, Oregon and Washington, sheets of late Tertiary basalt from fissure eruptions occupy an area of about 200,000 sq. m., and constitute a pile at least 2000 ft. thick. In India the "Deccan traps" represent enormous masses of volcanic matter, probably of like origin but of Cretaceous date, whilst South Africa furnishes other examples of similar outflows. Professor J. W. Gregory recognized in the Kapte plains of East Africa evidence of a type of vulcanism, which he distinguished as that of "plateau eruptions." According to him a number of vents opened at the points of intersection of lines of weakness in a high plateau, giving rise to many small cones, and the simultaneous flows of lava from these cones united to form a far-spreading sheet.

Extrusive and Intrusive Magmas.—When the molten magma in the interior of the earth makes its way upwards and flows forth superficially as a stream of lava, the product is described as extrusive, effusive, effluent or eruptive; but if, failing to reach the surface, the magma solidifies in a fissure or other subterranean cavity, it is said to be intrusive or irruptive. Rocks of the former group only are sometimes recognized as strictly "volcanic," but the term is conveniently extended, at least in certain cases, to igneous rocks of the latter type, including therefore certain hypabyssal and even plutonic rocks.

When the intrusive magma has been forced into narrow irregular crevices it forms "veins," which may exhibit complex ramifications, especially marked in some acid rocks; but when injected into a regularly shaped fissure, more or less parallel-sided, and cutting across the planes of bedding, it forms a wall-like mass of rock termed a "dyke." Most dykes are approximately vertical, or at least highly inclined in position. The inclination of a dyke to a vertical plane is termed its "hade." In a cinder-cone, the lava as it rises may force its way into cracks, formed by pressure of the magma and tension of the vapours, and will thus form a system of veins and dykes, often radiating from the volcanic axis and strengthening the structure by binding the loose materials together. Thus, in the Valle del Bove, a huge cavity on the east side of Etna, the walls exhibit numerous vertical dykes, which by their hardness stand out as rocky ribs, forming a marked feature in the scenery of the valley. In a similar way dykes traverse the walls of the old crater of Monte Somma at Vesuvius. Exceptionally a dyke may be hollow, the lava having solidified as a crust at the margin of the fissure but having escaped from the interior while still liquid.

When molten matter is thrust between beds of tuff or between successive lava-flows or even ordinary sedimentary strata, it forms an intrusive sheet of volcanic rock known as a "sill." A sill may sometimes be traced to its connexion with a dyke, which represents the channel up which the lava rose, but instead of reaching the surface the fluid found an easier path between the strata or perhaps along a horizontal rent. Although a dyke may represent a conduit for the ascent of lava which has flowed out superficially, yet if the lava has been removed at the surface by denudation the dyke terminates abruptly, so that its function as the former feeder of a lava-current is not evident. In other cases a dyke may end bluntly because the crack which it occupies never reached the surface.

Lava which has insinuated itself between planes of stratification may, instead of spreading out as a sheet or sill, accumulate locally as a lenticular mass, known as a *laccolith* or *laccolite* (*q.v.*). Such a mass, in many cases rather mushroom-shaped, may force the superincumbent rocks upwards as a dome, and though at first concealed may be ultimately exposed by removal of the overlying burden by erosion. The term *phacolite* was introduced by A. Harker to denote a meniscus-shaped mass of lava intruded in folded strata, along a crest or a trough. The *bysmalith* of Professor Iddings is a *laccolith* of rather plug-like shape, with a faulted roof. An intrusive mass quite irregular in shape has been termed by R. A. Daly a *chonolith* (Gr. χώνη, a mould), whilst an intrusion of very great size and ill-defined form is sometimes described as a *bathylith* or *batholite*.

Structural Peculiarities in Lava.—Many of the structures exhibited by lava are due to the conditions under which solidification has been effected. A dyke, for example, may be vitreous at the margin where it has been rapidly chilled by contact with the walls of the fissure into which it was injected, whilst the main body may be lithoidal or crystalline: hence a basalt dyke will sometimes have a selvage formed of the basaltic glass known as tachylyte. A similar glass may form a thin crust on certain lava-flows. In a homogeneous vitreous lava, contraction on solidification may develop curved fissures, well seen in the delicate "perlitic" cracks of certain obsidians, indicating a tendency to assume a globular structure. This structure becomes very distinct by the development of "spherulites," or globular masses with a radiating fibrous structure, sometimes well seen in devitrified glass. Occasionally the spherulitic bodies in lava are hollow, when they are known as lithophyses, of which excellent examples occur at Obsidian Cliff in the Yellowstone National Park, as described by Professor Iddings. Globular structure on a large scale is sometimes displayed by lavas, expecially those of basic type, such as the basalt of Aci Castello in Sicily, which was probably formed, according to Professor Gaetano Platania, by flow of the lava into submarine silt, relics of which still occur between the spheroids. Ellipsoidal or pillow-shaped masses are not infrequently developed in ancient lava-flows, and Sir A. Geikie has suggested the term "pillow-structure" for such formations. Dr T. Anderson has observed them in the recent lavas of Savaii.

Joints, or cracks formed by shrinkage on solidification, may divide a sheet of lava into columns, as familiarly seen in basalt, where the rock often consists of a close mass of regular polygonal prisms, mostly hexagonal. Each prism is divided at intervals by transverse joints, more or less curved, so that the portions are united by a slight ball-and-socket articulation. As the long axes of the columns lie at right angles to the cooling surface they are vertical in a horizontal sheet of lava, horizontal in a vertical dyke, and inclined or curved in other cases. It sometimes happens that in a basaltic dyke the formation of the prisms, having started from the opposite walls as chilling surfaces, has not been completed; and hence the prisms fail to meet in the middle. A spheroidal structure is often developed in basalt columns by weathering, the rock exfoliating in spherical shells, rather like the skins of an onion: such a structure is characteristically shown at the Käsekellar, known also as the Elfen Grotto, at Bertrich, near Alf on the Mosel, where the pillars of the lava are broken into short segments which suggest by their flattened globular shape a pile of Dutch cheeses. Although prismatic jointing, or columnar structure, is most common in basalt, it occurs also in other volcanic rocks. Fine columns of obsidian, for instance, are seen at Obsidian Cliff in the Yellowstone Park, where the pillars may be 50 ft. or more in height. Such an occurrence, however, is exceptional.

Vitreous lavas often show fluxion structure in the form of streaks, bands or trains of incipient crystals, indicating the flow of the mass when viscous. The character of this structure is related to the viscosity of the lava. Those structural peculiarities which depend mainly on the presence of vapour, such as vesiculation, have been already noticed, and the porphyritic structure has likewise been described.

Submarine Volcanoes.

Considering how large a proportion of the face of the earth is covered by the sea, it seems likely that volcanic eruptions must frequently occur on the ocean-floor. When, as occasionally though not often happens, the effects of a submarine eruption are observed during the disturbance, it is seen that the surface of the sea is violently agitated, with copious discharge of steam; the water passes into a state of ebullition, perhaps throwing up huge fountains; shoals of dead fishes, with volcanic cinders, bombs and fragments of pumice, float around the centre of eruption, and ultimately a little island may appear above sea-level. This new land is the peak of a volcanic cone which is based on the sea-floor, and if in deep water the submarine mountain must evidently be of great magnitude. Christmas Island in the Indian Ocean, described by Dr C. W. Andrews, appears to be a volcanic mountain, with Tertiary limestones, standing in water more than 14,000 ft. deep. Many volcanic islands, such as those abundantly scattered over the Pacific, must have started as submarine volcanoes which reached the surface either by continued upward growth or by upheaval of the sea-bottom. Etna began its long geological history by submarine eruptions in a bay of the Mediterranean, and Vesuvius in like manner represents what was originally a volcano on the sea-floor. As the ejectamenta from a submarine vent accumulate on the sea-bottom they become intermingled with relics of marine organisms, and thus form fossiliferous volcanic tuffs. By the distribution of the ashes over the sea-floor, through the agency of waves and currents, these tuffs may pass insensibly into submarine deposits of normal sedimentary type.

One of the best examples of a submarine eruption resulting in the formation of a temporary island occurred in 1831 in the Mediterranean between Sicily and the coast of Africa, where the water was known to have previously had a depth of 100 fathoms. After the usual manifestations of volcanic activity an accumulation of black cinders and ashes formed an island which reached at one point a height of 200 ft., so that the pile of erupted matter had a thickness of about 800 ft. The new island, which was studied by Constant Prévost, became known in England as Graham's Island, in France as Île Julie and in Italy by various names as Isola Ferdinandea. Being merely a loose pile of scoriae, it rapidly suffered erosion by the sea, and in about three months was reduced to a shoal called Graham's

Reef. In 1891 a submarine eruption occurred near the isle of Pantellaria in the same waters, and the eruptive centre was termed by Professor H. S. Washington and Foerstner volcano, but it gave rise to no island. A well-known instance of a temporary volcanic island was furnished by Sabrina—an islet of cinders thrown up by submarine eruptions in 1811, off the coast of St Michael's, one of the Azores. The island of Bogosloff, or Castle Island, in Bering Sea, about 40 m. W. of Unalaska Island, is a volcanic mass which was first observed in 1796 after an eruption. In 1883 another eruption in the neighbouring water threw up a new volcanic cone of black sand and ashes, known as New Bogosloff or Fire Island, situated about half a mile to the N.W. of Old Bogosloff, with which it was connected by a low beach. Another island, called Perry Island, larger than either of the others, made its appearance in the neighbourhood about the time of the great earthquake in California in 1906. It is reported that some of these islands have since disappeared.

Mud Volcanoes.

Mud volcanoes are small conical hills of clay which discharge, more or less persistently, streams of fine mud, sometimes associated with naphtha or petroleum, and usually with bubbles of gas. As the mud is generally saline, the hills are known also as "salses." The gases are chiefly hydrocarbons, often with more or less sulphuretted hydrogen and carbon dioxide, and sometimes with nitrogen. Though generally less than a yard in height, the cones may in exceptional cases rise to an elevation of as much as 500 ft. The mud oozes from the top and spreads over the sides, or is spurted forth with the gases. Occasionally the discharge is vigorous, mud and stones being thrown up to a considerable height, sometimes accompanied by flames due to combustion of the hydrocarbons.

Mud volcanoes occur in groups, and have a wide distribution. They are known in Iceland; in Modena; at Taman and Kertch, in the Crimea; at Baku on the Caspian; in Java and in Trinidad: Humboldt described those near Turbaco, in Colombia. In Sicily they occur near Girgenti, and a group is known at Paterno on Etna. By the Sicilians they are termed, *maccalube*, a word of Arabic origin. The "paint-pots" of the Yellowstone National Park are small mud volcanoes.

Many so-called mud volcanoes appear to be due to the derangement of subterranean water-flow or to landslips in connexion with earthquakes, whilst others may be referable to certain chemical reactions going on underground; but there are others again which seem to be truly of volcanic origin. Hot water and steam escaping through clays, or crumbling tuffs reduced to a clayey condition, may form conical mounds of pasty material, through which mud oozes and water escapes.

Geysers are closely related to volcanoes, but in consequence of their special interest they are treated separately (see GEYSER). For natural steam-holes and other phenomena connected with declining vulcanicity, see SOFFIONI, SOLFATARA and MOFETTA.

Geographical Distribution of Volcanoes.

It is matter of frequent observation that volcanoes are most abundant in regions marked by great seismic activity. Although the volcano and the earthquake are not usually connected in the direct relation of cause and effect, yet in many cases they seem referable to a common origin. Both volcanic extrusion and crustal movement may be the means of relieving local strains in the earth's crust, and both are found to occur, as might reasonably be expected, in many parts of the earth where folding and fracture of the rocks have frequently happened and where mountain-making appears to be still in progress. Thus, volcanoes may often be traced along zones of crustal deformation, or folded mountain-chains, especially where they run near the borders of the oceanic basins. They are frequently associated with the Pacific type of coast-line.

The most conspicuous example of linear distribution is furnished by the great belt of volcanoes, coinciding for the most part with a band of seismic disturbance, which engirdles intermittently the huge basin of the Pacific; though here, as elsewhere in studying volcanic topography, regard must be paid to dormant and extinct centres as well as to those that are active at the present time. As volcanoes are in many cases ranged along what are commonly regarded as lines of fracture, it is not surprising that the centres of most intense vulcanicity are in many cases situated at the intersection of two or more fracture-lines. On the eastern side of the Pacific Ocean the great volcanic ring may be traced, though with many and extensive interruptions, from Cape Horn to Alaska. In South America the chain of the Andes between Corcovado in the south and Tolima in the north is studded at irregular intervals with volcanoes, some recent and many more extinct, including the loftiest volcanic mountains in the world. The grandest group of South American volcanoes, though mostly quiescent, is in Ecuador. Cotopaxi, seen in activity by E. Whymper in 1880, has, according to him, a height of 19,613 ft., whilst Sangay is said to be one of the most active volcanoes in the world. The linear arrangement, often a marked feature in the distribution of volcanoes, is well exemplified in the general north-and-south trend of the Andean ranges, the volcanoes being situated along the orographic axis. These folded mountains with their volcanoes also illustrate the close relationship to the sea so frequently observed in volcanic topography, a relationship, however, not without many exceptions. The volcanic rock called andesite was so named by L. von Buch from its characteristic occurrence in the Andes. It is notable that the volcanic rocks throughout the great Pacific belt present much similarity in composition. The volcanoes of Ecuador have been described in detail by A. Stübel and others (see ANDES).

Central America contains a large number of active volcanoes and solfataras, many of which are located in the mountains parallel to the western coast. Conseguina, on the south side of the Gulf of Fonseca, is remarkable for its eruption in 1835, when an enormous volume of ash was ejected and the summit of the mountain blown away. Izalco, in San Salvador, came into existence in 1770, and is habitually active. In the centre of Lake Ilopango in Salvador, which possibly occupies an ancient crater, a volcanic island arose in 1880 and attained a height of 160 ft. Guatemala is peculiarly rich in volcanoes, as described by Dr Tempest Anderson, who visited the country in 1907. The Cerro Quemado, or the Volcano of Quezaltenango, was the scene of a great eruption in 1785. At the Volcano of Santa Maria there was an outburst in 1902 more violent than the simultaneous eruptions in the Lesser Antilles. The cones of Guatemala include the Volcan de Fuego and the Volcan de Agua, the former often active in historic times, whilst the latter is notable for the flood which in 1541 swept down from the mountain and destroyed Old Guatemala, but this flood was probably not of volcanic origin.

The plateau of Mexico is the seat of several active volcanoes which occur in a band stretching across the country from Colima in the west to Tuxtla near Vera Cruz. The highest of these volcanic mountains is Orizaba, or Cithaltepetl, rising to an altitude of 18,200 feet, and known to have been active in the 16th century. Popocatepetl ("the smoking mountain") reaches a height of about 17,880 ft., and from its crater sulphur was at one time systematically collected. The famous volcano of Jorullo, near Toluca, at a distance of about 120 m. from the sea, has been the centre of much scientific discussion since it was regarded by Humboldt, who visited it in 1803, as a striking proof of the elevation theory. It came into existence rapidly during an eruption which began in September 1759, when it was said by unscientific observers that the ground became suddenly inflated from below. The cone, though not of exceptional magnitude, is situated in an elevated district, and its summit rises to about 4330 ft. above sea-level. In the neighbourhood of Jorullo there are three subordinate cones of similar character known as *volcancitos*, with great numbers of small mounds of cinder and ash formed around fumaroles on the lava, and locally called *hornitos*, or "little ovens." The streams of basaltic lava from Jorullo form rough barren surfaces, which pass under the name of *malpays*, or bad lands.

In the United States very few volcanoes are active at the present day, though many have become extinct only in times that are geologically recent. An eruption occurred in 1857 at Tres Virgines, in the south of California, and the cinder cone on Lassen's Peak (California) was also active in the middle of the 19th century. The Mono Valley craters and Mount Shasta, in California, are extinct. The Cascade Range contains numerous volcanic peaks, but only few show signs of activity. Mount Hood, in Oregon, exhales vapour, as also does Mount Rainier in Washington. Mount St Helens (Washington) was in eruption in 1841 and 1842; and Mount Baker (Washington), the most northern of the volcanoes connected with the Cascade Range, is said to have been active in 1843. Few volcanic peaks occur in the Rocky Mountains, but evidence of lingering activity is very marked in the geysers and hot springs of the Yellowstone National Park. The earth's internal heat is also manifested at many points elsewhere, as at Steamboat Springs on the Virginia Range, an offshoot of the Sierra Nevada, and in the Comstock Lode.

Volcanic activity is prominent in Alaska, along the Coast Range and in the neighbouring islands. The crater of Mount Edgecumbe, in Lazarus Island, is said to have been active in 1796, but this is doubtful. Mount Fairweather has probably been in recent activity, and the lofty cone of Mount Wrangell, on Copper river, is reported to have been in eruption in 1819. In the neighbourhood of Cook's Inlet there are several volcanoes, including the island of St Augustine. Unimak Island has two volcanoes, which have supplied the natives with sulphur and obsidian; one of these volcanoes being Mount Shishaldin, a cone rivalling Fusiyama in graceful contour. The

Aleutian volcanic belt is a narrow, curved chain of islands, extending from Cook's Inlet westwards for nearly 1600 m. It is notable that the convexity of the curve faces the great ocean, as has been observed in other cases, the arcs following the direction of the rock-folds. According to Professor I. C. Russell, an authority on the volcanoes of N. America, there are in the Aleutian Islands and in the peninsula no fewer than 57 craters, either active or recently extinct.

From the Aleutian Islands the volcanic band of the Pacific changes its direction, and passing to the peninsula of Kamschatka, where 14 volcanoes are said to be active, turns southwards and forms the festoon of the Kurile Islands. Here again the convexity of the insular arc is directed towards the ocean. This volcanic archipelago leads on to the great islands of Japan, where the volcanoes have been studied by Professor J. Milne, who also described those of the Kuriles. Of the 54 volcanoes recognized as now active or only recently extinct in Japan, the best known is the graceful cone of the sacred mountain Fusiyama, but others less pretentious are far more dangerous. The great eruption of Bandaisan, about 120 m. N. of Tokio, which occurred in 1888, blew off one side of the peak called Kobandai, removing, according to Professor Sekiya's estimate, about 2982 million tons of material. Aso-san in Kiushui, the southernmost large island of Japan, is notable for the enormous size of its crater. In the Bonin group of islands volcanic activity is indicated by such names as Volcano Island and Sulphur Island.

South of the Japanese archipelago the train of volcanoes passes through some small islands in or near the Loo Choo (Liu Kiu) group and thence onwards by Formosa to the Philippine Islands, where subterranean activity finds abundant expression in earthquakes and volcanoes. After leaving this region the linear arrangement of the eruptive centres becomes less distinctly marked, for almost every island in the Moluccas and the Sunda Archipelago teems with volcanoes, solfataras and hot springs. Possibly, however, a broken zone may be traced from the Moluccas through New Guinea and thence to New Zealand, perhaps through eastern Australia (for though no active volcanoes are known there, relics of comparatively recent activity are abundant); or again by way of the Bismarck Archipelago, the Solomon Islands, the New Hebrides, the Fiji Islands and Kermodoc Island.

The great volcanic district in New Zealand is situated in the northern part of North Island, memorable for the eruption of Tarawera in 1886. This three-peaked mountain on the south side of Lake Tarawera, not previously known to have been active, suddenly burst into action; a huge rift opened, and Lake Rotomahana subsided, with destruction of the famous sinter terraces. The crater of Tongariro is in the solfatara stage, whilst Mount Ruapehu is regarded as extinct. On White Island in the Bay of Plenty the cone of Wharkari is feebly active.

Far to the south, on Ross Island, off South Victoria Land, in Antarctica, are the volcanoes of Erebus and Terror, the former of which is active. These are often regarded as remotely related to the Pacific zone, but Dr G. T. Prior has shown that the Antarctic volcanic rocks which he examined belonged to the Atlantic and not the Pacific type.

Within the great basin of the Pacific, imperfectly surrounded by its broken girdle of volcanoes, there is a vast number of scattered islands and groups of islands of volcanic origin, rising from deep water, and having in many cases active craters. The most important group is the Hawaiian Archipelago, where there is a chain of at least fifteen large volcanic mountains—all extinct, however, with the exception of three in Hawaii, namely Mauna Loa, Kilauea and Hualalai; and of these Hualalai has been dormant since 1811. It is notable that the two present gigantic centres of activity, though within 20 m. of each other, appear to be independent in their eruptivity. Several of the Hawaiian Islands, as pointed out by J. D. Dana, who was a very high authority on this group, consist of two volcanoes united at the base, forming volcanic twins or doublets.

The volcanic regions of the Pacific are connected with those of the Indian Ocean by a grand train of islands rich in volcanoes, stretching from the west of New Guinea through the Moluccas and the Sunda Islands, where they form a band extending axially through Java and Sumatra. Here is situated the principal theatre of terrestrial vulcanicity, apparently representing an enormous fissure, or system of fissures, in the earth's crust, sweeping in a bold curve, with its convexity towards the Indian Ocean.

Numerous volcanic peaks occur in the string of small islands to the east of Java—notably in Flores, Sumbawa, Lombok and Bali; and one of the most terrific eruptions on record in any part of the world occurred in the province of Tomboro, in the island of Sumbawa, in the year 1815. Java contains within its small area as many as 49 great volcanic mountains—active, dormant and extinct. The largest is Smerin, about 12,000 ft. high, but the most regularly active is said to be Gownong Lamongang, which is in almost uninterrupted activity, emitting usually only ashes and vapour, though in 1883 lava streamed forth. Many of the Javanese volcanoes present marked regularity of contour, with the sides of the cones rather symmetrically furrowed by tropical rains and probably ridged by ash-slides. The radial furrows on volcanic cones are sometimes known as "barrancos."

The little uninhabited island of Krakatoa in the Strait of Sunda appears to be situated at a volcanic node, or the intersection of two curved fissures, and it is believed that the island itself represents part of the basal wreck of what was once a volcano of gigantic size. After two centuries of repose, a violent catastrophe occurred in 1883, whereby the greater part of the island was blown away. This eruption and its effects were made the subject of careful study by Verbeek, Bréon and Judd.

Through the great island of Sumatra, a chain of volcanoes runs longitudinally, and may possibly be continued northwards in the Bay of Bengal by Barren Island and Norcondam—the former an active and the latter an extinct volcano. On the western side of the Indian Ocean a small volcanic band may be traced in the islands of the Mascarene group, several craters in Réunion (Bourbon) being still active. Far south in the Indian Ocean are the volcanic islands of New Amsterdam and St Paul. The Comoro Islands in the channel of Mozambique exhibit volcanic activity, whilst in East and Central Africa there are several centres, mostly extinct but some partially active, associated with the Rift Valleys. The enormous cones of Kenia and Kilimanjaroo are extinct, but on Kibo, one of the summits of the latter, a crater is still preserved. The Mfumbiro volcanoes, S. of Lake Edward, rise to a height of more than 14,700 feet. Kirunga, N. of Lake Kivu, is still partially active. Elgon is an old volcanic peak, but Ruwenzori is not of volcanic origin. On the west side of Africa, the Cameroon Peak is a volcano which was active in 1909, and the island of Fernando Po is also volcanic. Along the Red Sea there are not wanting several examples of volcanoes, such as Jebel Teir. Aden is situated in an old crater.

Passing to the Atlantic, a broken band of volcanoes, recent and extinct, may be traced longitudinally through certain islands, some of which rise from the great submarine ridge that divides the ocean, in part of its length, into an eastern and a western trough. The northern extremity of the series is found in Jan Mayen, an island in the Arctic Ocean, where an eruption occurred in 1818. Iceland, however, with its wealth of volcanoes and geysers, is the most important of all the Atlantic centres. According to Dr T. Thoroddsen there are in Iceland about 130 post-glacial volcanoes, and it is known that from 25 to 30 have been in eruption during the historic period. Many of the Icelandic lava-flows, such as the immense flood from Laki (Skapta Jökull) in 1783, are referable to fissure eruptions, which are the characteristic though not the exclusive form of activity in this island. Probably this type was also responsible for the sheets of old lava in the terraced hills of the Faroe Islands, to which may have been related the Tertiary volcanoes of the west of Scotland and the north of Ireland.

An immense gap separates the old volcanic area of Britain from the volcanic archipelagoes of the Azores, the Canaries and the Cape Verd Islands. Palma—a little island in the Canary group, with a caldera or large crater at its summit, from which fissures or barrancos radiate—is famous in the history of vulcanology, in that it furnished L. von Buch with evidence on which he founded the "crater-of-elevation" theory. The remaining volcanic islands of the Atlantic chain, all now cold and silent, include Ascension, St Helena and Tristan da Cunha, whilst in the western part of the South Atlantic are the small volcanic isles of Trinidad and Ferdinando do Noronha. St Paul's rocks appear also to be of volcanic origin.

One of the most important volcanic regions of the world is found in the West Indies, where the Lesser Antilles—the scene of the great catastrophes of 1902—form a string of islands, stretching in a regular arc that sweeps in a N. and S. direction across the eastern end of the Caribbean Sea. Subject to frequent seismic disturbance, and rich in volcanoes, solfataras and hot springs, these islands seem to form the summit of a great earth-fold which, rising as a curved ridge from deep water, separates the Caribbean Sea from the Atlantic. The volcanoes are situated on the inner border of the curve. It is notable that the Antilles and the Sunda Islands, two of the grandest theatres of vulcanicity on the face of the earth, are situated at the antipodes of each other—one being apparently an eastern and the other a western offshoot of the great Pacific girdle.

The European volcanoes, recent and extinct, may be regarded as representing rather ill-defined branches thrown off eastwards from the Atlantic band. Vesuvius is the only active volcano on the mainland, but in the Mediterranean there are Etna on the coast of Sicily; the Lipari Islands, with Stromboli and Vulcano in chronic activity; and farther to the east the archipelago of Santorin, where new islands have appeared in historic times. Submarine eruptions have occurred also between Sicily and the coast of Africa; one in 1831 having given rise temporarily to Graham's Island, and another in 1891 appearing near Pantellaria, itself a volcanic isle. Of the extinct European volcanoes, some of the best known are in Auvergne, in the Eifel, in Bohemia and in Catalonia, whilst the volcanic land of Italy includes the Euganean hills, the Alban hills, the Phlegraean Fields, &c. The great lakes of Bolsena and Bracciano occupy old craters, and many smaller sheets of water are on similar sites. The volcanic islands no longer active include Ischia, with the great cone of Epomeo which was in a state of eruption in 1301; the Ponza Islands, Nisida, Vivera and others near Naples; and several in the Greek archipelago, such as Milos, Kimolos and Polinos.

From the eastern end of the Mediterranean evidence of former volcanic activity may be traced into Asia Minor and thence to Armenia and the Caucasus. East of Smyrna there is a great desolate tract which the ancients recognized as volcanic and termed the Catacecaumene (burnt country). The volcanic districts of Lydia were studied by Professor H. S. Washington. In the plateau of Armenia there are several extinct volcanic mountains, more or less destroyed, of which the best known is Ararat. Nimrud Dagh on the shore of Lake Van is said to have been in eruption in the year 1441. Dr F. Oswald has described the volcanoes of Armenia. Of the volcanoes in Persian territory not now active, Demavend, south of the Caspian, is an important example. Elburz is also described as an old volcano. It has been said that in Central Asia there are certain vents still active, and recent volcanic rocks are known from the Przhevalsky chain and other localities.

The number of volcanoes known to be actually active on the earth is generally estimated at between 300 and 400, but there is reason to believe that this estimate is far too low. If account be taken of those volcanic cones which have not been active in historic time, the total will probably rise to several thousands. The distribution of volcanoes at various periods of the earth's history, as revealed by the local occurrence of volcanic rocks at different horizons in the crust of the earth, is discussed under GEOLOGY. Periods of great earth-movement have been marked by exceptional volcanic activity.

Causes of Vulcanicity.

In discussing the cause of vulcanicity two problems demand attention: first the origin of the heat necessary for the manifestation of volcanic phenomena, and secondly the nature of the force by which the heated matter is raised to the surface and ejected. According to the old view, which assumed that the earth was a spheroid of molten matter invested by a comparatively thin crust of solid rock, the explanation of the phenomena appeared fairly simple. The molten interior supplied the heated matter, while the shrinkage of the cooling crust produced fractures that formed the volcanic channels through which it was assumed the magma might be squeezed out in the process of contraction. When physicists urged the necessity of assuming that the globe was practically solid, vulcanologists were constrained to modify their views. Following a suggestion of W. Hopkins of Cambridge, they supposed that the magma, instead of existing in a general central cavity, was located in comparatively small subterranean lakes. Some authorities again, like the Rev. O. Fisher, regarded the magma as constituting a liquid zone, intermediate between a solid core and a solid shell.

If solidification of the primitive molten globe proceeded from the centre outwards, so as to form a sphere practically solid, it is conceivable that portions of the original magma might nevertheless be retained in cavities, and thus form "residual lakes." Although the mass might be for the most part solid, the outer portion, or "crust," could conceivably have a honeycombed structure, and any magma retained in the cells might serve indirectly to feed the volcanoes. Neighbouring volcanoes seem in some cases to draw their supply of lava from independent sources, favouring the idea of local cisterns or "intercrustal reservoirs." It is probable, however, that subterranean reservoirs of magma, if they exist, do not represent relics of an original fluid condition of the earth, but the molten material may be merely rock which has become fused locally by a temporary development of heat or more likely by a relief of pressure. It should be noted that the quantity of magma required to supply the most copious lava-flows is comparatively small, the greatest recorded outflow (that of Tomboro in Sumbawa, in 1815) not having exceeded, it is said, six cubic miles; and even this estimate is probably too high. Whilst in many cases the magma-cisterns may be comparatively small and temporary, it must be remembered that there are regions where the volcanic rocks are so similar throughout as to suggest a common origin, thus needing intercrustal reservoirs of great extent and capacity. It has been suggested that comparatively small basins, feeding individual volcanoes, may draw their supply from more extensive reservoirs at greater depths.

Much speculation has been rife as to the source of the heat required for the local melting of rock. Chemical action has naturally been suggested, especially that of superficial water, but its adequacy may be doubted. After Sir Humphry Davy's discovery of the metals of the alkalis, he thought that their remarkable behaviour with water might explain the origin of subterranean heat; and in more recent years others have seen a local source of heat in the oxidation of large deposits of iron, such as that brought up in the basalt of Disco Island in Greenland. It has been assumed by Moissan and by Gautier that water might attack certain metallic carbides, if they occur as subterranean deposits, and give rise to some of the products characteristic of volcanoes. But it seems that all such action must be very limited, and utterly inadequate to the general explanation of volcanic phenomena. At the same time it must be remembered that access of water to a rock already heated may have an important physical effect by reducing its melting point, and may thus greatly assist in the production of a supply of molten matter. The admission of surface-waters to heated rocks is naturally regarded as an important source of motive power in consequence of the sudden generation of vapour, but it is doubtful to what extent it may contribute, if at all, to the origin of volcanic heat.

According to Robert Mallet a competent source of subterranean heat for volcanic phenomena might be derived from the transformation of the mechanical work of compressing and crushing parts of the crust of the earth as a consequence of secular contraction. This view he worked out with much ingenuity, supporting it by mathematical reasoning and an appeal to experimental evidence. It was claimed for the theory that it explained the linear distribution of volcanoes, their relation to mountain chains, the shallow depth of the foci and the intermittence of eruptive activity. A grave objection, however, is the difficulty of conceiving that the heat, whether due to crushing or compression, could be concentrated locally so as to produce a sufficient elevation of temperature for melting the rocks. According to the calculations of Rev. O. Fisher, the crushing could not, under the most favourable circumstances, evolve heat enough to account for volcanic phenomena.

Since pressure raises the melting-point of any solid that expands on liquefaction, it has been conjectured that many deep-seated rocks, though actually solid, may be potentially liquid; that is, they are maintained in a solid state by pressure only. Any local relief of pressure, such as might occur in the folding and faulting of rocks, would tend, without further accession of heat, to induce fusion. But although moderate pressure raises the fusing-point of most solids, it is believed, from modern researches, that very great pressures may have a contrary effect.

It is held by Professor S. Arrhenius that at great depths in the earth the molten rock, being above its critical point, can exist only in the gaseous condition; but a gas under enormous pressure may behave, so far as compressibility is concerned, like a rigid solid. He concludes, from the high density of the earth as a whole and from other considerations, that the central part of our planet consists of gaseous iron (about 80% of the earth's diameter) followed by a zone of rock magma in a gaseous condition (about 15%), which passes insensibly outwards into liquid rock (4%), covered by a thin solid crust (less than 1% of diameter). If water from the crust penetrates by osmosis through the sea-floor to the molten interior, it acts, at the high temperature, as an acid, and decomposes the silicates of the magma. The liquid rock, expanded and rendered more mobile by this water, rises in fissures, but in its ascent suffers cooling, so that the water then loses its power as an acid and is displaced by silicic acid, when the escaping steam gives rise to the explosive phenomena of the volcano. The mechanism of the volcano is therefore much like that of a geyser, a comparison long ago suggested by Rev. O. Fisher and other geologists.

According to the "planetesimal theory" of Professor T. C. Chamberlin and Dr F. R. Moulton, which assumes that the earth was formed by the accretion of vast numbers of small cosmical bodies called planetesimals, the original heat of the earth's interior was due chiefly to the compression of the growing globe by its own gravity. The heat, proceeding from the centre outwards, caused local fusion of the rocks, though without forming distinct reservoirs of molten magma, and the fused matter charged with gases rose in liquid threads or tongues, which worked their way upwards, some reaching the superficial part of the earth and escaping through fissures in the zone of fracture, thus giving rise to volcanic phenomena. It is held that the explosive activity of a volcano is due to the presence of gases which have been brought up from the interior of the earth, whilst only a small and perhaps insignificant part is played by water of superficial origin.

Entirely new views of the origin of the earth's internal heat have resulted from the discovery of radioactivity. It has been shown by the Hon. R. J. Strutt, Professor J. Joly and others that radium is present in all igneous rocks, and it is estimated that the quantity in the crust of the earth is amply sufficient to maintain its temperature. An ingenious hypothesis was enunciated by Major C. E. Dutton, who found in the radioactivity of the rocks a sufficient source of heat for the explanation of all volcanic phenomena. He believes that the development of heat arising from radioactivity may gradually bring about the local melting of the rocks so as to form large subterranean pools of magma, from which the volcanoes may be supplied. The supply is usually drawn from shallow sources, probably, according to Dutton, from a depth of not more than three or rarely four miles, and in some cases at not more than a mile from the surface. If the water in the local magma should attain sufficient expansive power, it will rupture the overlying rocks and thus give rise to a volcanic eruption. When the reservoir becomes exhausted the eruption ceases, but if more heat be generated by continued radioactivity further fusion may ensue, and in time the eruption be repeated. According, however, to Professor Joly, it is improbable that sufficient heat for the manifestation of volcanic phenomena could be developed by the local radioactivity of the rocks in the upper part of the earth's crust.

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VOLCANO ISLANDS, three small islands in the western Pacific Ocean, S. of the Bonin Islands, forming part of the Japanese empire (annexed in 1891). They are also known as the Magellan Archipelago, and in Japan as Kwazan-retto (series of volcanic islands). They are situated between 24° and 26° N. and 141° and 142° E. Their names are Kita-iwo-jima (Santo Alessandro), Iwo-jima (Sulphur) and Minami-iwo-jima (Santo Agostino). Kita-iwo-jima—which, as its name (*kita*) implies, is the most northerly of the three—rises 2520 ft. above the water, and Minami-iwo-jima, the most southerly, to a height of 3021 ft. The islands are not inhabited. With this group is sometimes included another island, Arzobispo, nearer the Bonin group.

VOLCEI (mod. Buccino), an ancient town of Lucania, 2128 ft. above sea-level, the chief town of the independent tribe of the Volceiani, Vulcientes or Volcentani, whose territory was bounded N. by that of the Hirpini, W. and S. by Lucania and E. by the territory of Venusia. Some pre-Roman ruins still exist (*Not. Scav.*, 1884, 115). It became a *municipium*, and in A.D. 323 had an extensive territory attached to it, including the town of Numistro, the large Cyclopean walls of which may still be seen, 2½ m. below Muro Lucano. Below the town is a well-preserved Roman bridge over the Tanager (mod. Tanagro).

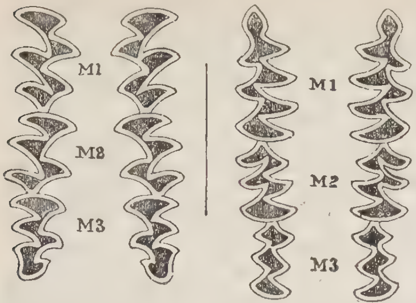
See G. Patroni in *Notizie degli scavi* (1897), 183.

VOLCI, or Vulci, an ancient town of Etruria. The circuit of the walls measures about 4 m., and scanty traces of them and of Roman buildings within them still exist. The Ponte della Badia over the Fiora, a bridge with a main arch of 66 ft. span, 98 ft. above the stream, is also Roman. An aqueduct passes over it. The former wealth of the town is mainly proved by the discoveries made in its extensive necropolis from 1828 onwards—Greek vases, bronzes and other remains—many of which are now in the Vatican. By 1856 over 15,000 tombs had, it was calculated, been opened. These were entirely subterranean, and little is now to be seen on the site but a great tumulus, the Cucumella, and a few smaller ones. The frescoes from the François tomb, discovered in 1857, illustrating Greek and Etruscan myths, are now in the Museo Torlonia at Rome. Volci was one of the twelve towns of Etruria. Coruncanius triumphed over the people of Vulsinii and Volci in 280 B.C., and the colony of Cosa was founded in their territory. This seems to have led to the decline of the city, and it does not seem to have been of great importance in the Roman period, though it became an episcopal see.

See G. Dennis, *Cities and Cemeteries of Etruria* (London, 1883), i. 437, ii. 503; S. Gsell, *Fouilles dans la nécropole de Vulci* (Paris, 1891), for the excavations of 1889 (with copious references to earlier publications). (T. As.)

VOLE, a book-name (invented by Dr J. Fleming, author of a work on British animals) for the water-rat and those species of field-mice which have cheek-teeth of the same general type. Although the British representatives of this group should undoubtedly retain their vernacular designations of water-rat and short-tailed field-mouse, the term "vole" is one of great convenience in zoology as a general one for all the members of the group. Systematically voles are classed in the mammalian order Rodentia, in which they constitute the typical section of the subfamily Microtinae in the Muridae, or mouse-group. As a group, voles are characterized by being more heavily built than rats and mice, and by their less brisk movements. They have very small eyes, blunt snouts, inconspicuous ears and short limbs and tails, in all of which points they are markedly contrasted with true rats and mice. In common with lemmings and other representatives of the Microtinae, voles are, however, broadly distinguished from typical rats and mice by the structure of their three pairs of molar teeth. These, as shown in the figure, are composed of a variable number of vertical triangular prisms, in contact with one another by two (or one) of their angles. On the number and relations of these prisms the voles, which form an exceedingly large group, ranging all over Europe and Asia north of (and inclusive of) the

Himalaya, and North America, are divided into genera and subgenera. Examples of some of these are afforded by the English representatives of the group.



Upper and Lower Molars of the Water-Rat (or Water-Vole), *Microtus amphibius*.

The first of these is the common short-tailed field-mouse, or "field-vole," *Microtus agrestis*, which belongs to the typical section of the type genus, and is about the size of a mouse, with a short stumpy body, and a tail about one-third the length of the head and body. The hind feet have six pads on their inferior surfaces, and the colour is dull grizzled brown above and greyish white below. The molar teeth have respectively 5, 5 and 6 prisms above, and 9, 5 and 3 below. This rodent is one of the commonest of British mammals, and frequents fields, woods and gardens in numbers, often doing considerable damage owing to its fondness for garden produce. It is spread over the whole of Great Britain (exclusive of the Orkneys), while on the continent of Europe its range extends from Finland to North Italy and from France and Spain to Russia.

The second and larger species is the water-rat, or "water-vole," which belongs to a second section of the genus, and is commonly known as *Microtus* (*Arvicola*) *amphibius*, although some writers employ the inappropriate specific name *terrestris*. It is about the size of a rat, and has long soft thick fur, of a uniform grizzled brown, except when (as is not uncommon) it is black. The tail is about half the length of the head and body, and the hind feet are long and powerful, although not webbed, and have five rounded pads on their lower surfaces. In the upper jaw the first molar has 5, the second 4 and the third 4 prisms, of which the last is irregular and sometimes divided into two, making 5. In the lower jaw the first molar has 7 prisms, of which the 3 anterior are generally not fully separated from one another, the second 5 and the third 3. The water-rat is perhaps the most often seen of all English mammals, owing to its diurnal habits. It frequents rivers and streams, burrowing in the banks, and often causing considerable damage. Its food consists almost wholly of water-weeds, rushes and other vegetable substances, but it will also eat animal food on occasion, in the shape of insects, mice or young birds. The female has during the summer three or four litters, each of from two to seven young. The range of the water-rat extends over Europe and North Asia from England to China, but the species is not found in Ireland, where no member of the group is native.

The red-backed field-mouse or "bank-vole" may be distinguished externally from the first species by its more or less rusty or rufous-coloured back, its larger ears and its comparatively longer tail, which attains to about half the length of the head and body. On account of an important difference in the structure of its molars, it is now very generally referred to a distinct genus, under the name of *Evotomys glareolus*; these teeth developing roots at a certain stage of existence, instead of growing permanently. Their prisms number respectively 5 and 4 and 5 above, and 7, 3 and 3 below. The habits of this species are in every way similar to those of the one first on the list. Its range in Great Britain extends northwards to Morayshire, but it is represented in an island off the Pembroke coast by a distinct form; on the continent of Europe it extends from France and Italy to southern Russia, while it is represented in northern Asia and North America by closely allied species. Fossil voles from the Pliocene of England and Italy with molars which are rooted as soon as developed form the genus *Mimomys*.

(R. L.*)

VOLGA (known to the Tatars as *Etil*, *Itil* or *Atel*; to the Finnish tribes as *Rau*, and to the ancients as *Rha* and *Oarus*), the longest and most important river of European Russia. It rises in the Valdai plateau of Tver and, after a winding course of 2325 m. (1070 in a straight line), falls into the Caspian at Astrakhan. It is by far the longest river of Europe, the Danube, which comes next to it, being only 1775 m., while the Rhine (760 m.) is shorter even than two of the chief tributaries of the Volga—the Oka and the Kama. Its drainage area, which includes the whole of middle and eastern as well as part of south-eastern Russia, amounts to 563,300 sq. m., thus exceeding the aggregate superficies of Germany, France and the United Kingdom, and containing a population of fifty millions. Its tributaries are navigable for an aggregate length of nearly 20,000 m. The "basin" of the Volga is not limited to its actual catchment area. By a system of canals which connect the upper Volga with the Neva, the commercial mouth of the Volga has been transferred, so to speak, from the Caspian to the Baltic, thus making St Petersburg, the capital and chief seaport of Russia, the chief port of the Volga basin as well. Other less important canals connect it with the Western Dvina (Riga) and the White Sea (Archangel); while a railway only 45 m. in length joins the Volga with the Don and the Sea of Azov, and three great trunk lines bring its lower parts into connexion with the Baltic and western Europe.

The upper river.

The Volga rises in extensive marshes on the Valdai plateau, where the W. Dvina also has its origin. Lake Seliger was formerly considered to be the principal source; but that distinction is now given to a small spring issuing beneath a chapel (57° 15′ N.; 32° 30′ E.) in the midst of a large marsh to the west of Seliger. The honour has also been claimed, not without plausibility, for the Runa rivulet. Recent exact surveys have shown these originating marshes to be no more than 665 ft. above sea-level. The stream first traverses several small lakes, all having the same level, and, after its confluence with the Runa, enters Lake Volga. A dam erected a few miles below that lake, with a storage of nearly 10,000 million cub. ft. of water, makes it possible to raise the level of the Volga as far down as the Sheksna, thus rendering it navigable, even at low water, from its 65th mile onwards.

From its confluence with the Sheksna the Volga flows with a very gentle descent towards the south-east, past Yaroslavl and Kostroma, along a broad valley hollowed to a depth of 150–200 ft. in the Permian and Jurassic deposits. In fact, its course lies through a string of depressions formerly filled with wide lakes, all linked together. When the Volga at length assumes a due south-east direction it is a large river (8250 cub. ft. per second, rising occasionally in high flood to as much as 178,360 cub. ft.); of its numerous tributaries, the Unzha (365 m., 330 navigable), from the north, is the most important.

Confluence with the Oka.

The next great tributary is the Oka, which comes from the south-west after having traversed, on its course of 950 m., all the Great Russian provinces of central Russia. It rises in the government of Orel, among hills which also send tributaries to the Dnieper and the Don, and receives on the left the Upa, the Zhizdra, the Ugra (300 m.), the Moskva, on which steamers ply up to Moscow, the Klyazma (395 m.), on whose banks arose the middle-Russian principality of Suzdal, and on the right the navigable Tsna (255 m.) and Moksha. Every one of these tributaries is connected with some important event in the history of Great Russia. The drainage area of the Oka is a territory of 97,000 sq. m. It has been maintained that, of the two rivers which unite at Nizhniy-Novgorod, the Oka, not the Volga, is the chief; the fact is that both in length (818 m.) and in drainage area above the confluence (89,500 sq. m.), as well as in the aggregate length of its tributaries, the Volga is the inferior stream.

Lacustrine depressions.

At its confluence with the Oka the Volga enters the broad lacustrine depression which must have communicated with the Caspian during the post-Pliocene period by means of at least a broad strait. Its level at low water is only 190 ft. above that of the ocean. Immediately below the confluence the breadth of the river ranges from 350 to 1750 yds. There are many islands which change their appearance and position after each inundation. On the right the Volga is joined by the Sura, which drains a large area and brings a volume of 2700 to 22,000 cub. ft. of water per second, the Vetluga (465 m. long, of which 365 are navigable), from the forest-tracts of Yaroslavl, and many smaller tributaries. Then the stream turns south-east and descends into another lacustrine depression, where it receives the Kama, below Kazañ. Remains of molluscs still extant in the Caspian occur extensively throughout this depression and up the lower Kama.

The Kama,[1] which brings to the Volga a contribution ranging from 52,500 to 144,400 cub. ft. and occasionally reaching 515,000 cub. ft. per second, might again be considered as the more important of the two rivers. It rises in Vyatka, takes a wide sweep towards the north and east, and then flows south and south-west to join the Volga after a course of no less than 1150 m.

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[1] To the Votyaks it is known as the Budzhim-Kam, to the Chuvashes as the Shoiga-adil and to the Tatars as the Cholman-idel or Ak-idel, all words signifying "White river."

The Samara bend.

Along the next 738 m. of its course the Volga—now 580 to 2600 yds. wide—flows south-south-west, with but one great bend at Samara. At this point, where it pierces a range of limestone hills, the course of the river is very picturesque, fringed as it is by cliffs which rise 1000 ft. above the level of the stream (which is only 54 ft. above the sea at Samara). Along the whole of the Samara bend the Volga is accompanied on its right bank by high cliffs, which it is constantly undermining, while broad lowland areas stretch along the left or eastern bank, and are intersected by several old beds of the Volga.

The lower river and delta.

At Tsaritsyn the great river reaches its extreme south-western limit, and is there separated from the Don by an isthmus only 45 m. in width. The isthmus is too high to be crossed by means of a canal, but a railway to Kalach brings the Volga into some sort of connexion with the Don and the Sea of Azov. At Tsaritsyn the river takes a sharp turn in a south-easterly direction towards the Caspian; it enters the Caspian steppes, and a few miles above Tsaritsyn sends off a branch—the Akhtuba—which accompanies it for 330 m. before falling into the Caspian. Here the Volga receives no tributaries; its right bank is skirted by low hills, but on the left it anastomoses freely with the Akhtuba when its waters are high, and floods the country for 15 to 35 m. The width of the main stream ranges from 520 to 3500 yds. and the depth exceeds 80 ft. The delta proper begins 40 m. above Astrakhan, and the branches subdivide so as to reach the sea by as many as 200 separate mouths. Below Astrakhan navigation is difficult, and on the sand-bars at the mouth the maximum depth is only 12 ft. in calm weather.

The figures given show how immensely the river varies in volume, and the greatness of the changes which are constantly going on in the channel and on its banks. Not only does its level occasionally rise in flood as much as 50 ft. and overflow its banks for a distance of 5 to 15 m.; even the level of the Caspian is considerably affected by the sudden influx of water brought by the Volga. The amount of suspended matter brought down is correspondingly great. All along its course the Volga is eroding and destroying its banks with great rapidity; towns and loading ports have constantly to be shifted farther back.

The question of the gradual desiccation of the Volga, and its causes, has often been discussed, and in 1838 a committee which included Karl Baer among its members was appointed by the Russian academy of sciences to investigate the subject. No positive result was, however, arrived at, principally on account of the want of regular measurements of the volume of the Volga and its tributaries—measurements which began to be made on scientific principles only in 1880. Still, if we go back two or three centuries, it is indisputable that rivers of the Volga basin which were easily navigable then are now hardly accessible to the smallest craft. The desiccation of the rivers of Russia has been often attributed to the steady destruction of its forests. But it is obvious that there are other general causes at work, which are of a much more important character—causes of which the larger phenomena of the general desiccation of Eastern and Western Turkestan are contemporaneous manifestations. The gradual elevation of the whole of northern Russia and Siberia, and the consequent draining of the marshes, is one of these deeper-seated, ampler causes; another is the desiccation of the lakes all over the northern hemisphere.

Fisheries.—The network of shallow and still *limans* or "cut-offs" in the delta of the Volga and the shallow waters of the northern Caspian, freshened as these are by the water of the Volga, the Ural, the Kura and the Terek, is exceedingly favourable to the breeding of fish, and as a whole constitutes one of the most productive fishing grounds in the world. As soon as the ice breaks up in the delta innumerable shoals of roach (*Leuciscus rutilus*) and trout (*Luciotrutta leucichthys*) rush up the river. They are followed by the great sturgeon (*Acipenser huso*), the pike, the bream and the pike perch (*Leucioperca sandra*). Later on appears the Caspian herring (*Clupea caspia*), which formerly was neglected, but has now become more important than sturgeon; the sturgeon *A. stellatus* and "wels" (*Silurus glanis*) follow, and finally the sturgeon *Acipenser güldenstadtii*, so much valued for its caviare. In search of a gravelly spawning-ground the sturgeon go up the river as far as Sarepta (250 m.). The lamprey, now extensively pickled, the sterlet (*A. ruthenus*), the tench, the gudgeon and other fluvial species also appear in immense numbers. It is estimated that 180,000 tons of fish of all kinds, of the value of considerably over £1,500,000, are taken annually in the four fishing districts of the Volga, Ural, Terek and Kura. Seal-hunting is carried on off the Volga mouth, and every year about 40,000 of *Phoca vitulina* are killed to the north of the Manghishlak peninsula on the east side of the Caspian.

Ice Covering.—In winter the numberless tributaries and subtributaries of the Volga become highways for sledges. The ice lasts 90 to 160 days, and breaks up earlier in its upper course than in some parts lower down. The average date of the break-up is April 11th at Tver, and 14 days later about Kostroma, from which point a regular acceleration is observed (April 16th at Kazañ, April 7th at Tsaritsyn, and March 17th at Astrakhan).

Traffic.—The greater part of the traffic is up river, the amount of merchandise which reaches Astrakhan being nearly fifteen times less than that reaching St Petersburg by the Volga canals. The goods transmitted in largest quantity are fish, metals, manufactured wares, hides, flax, timber, cereals, petroleum, oils and salt. The down-river traffic consists chiefly of manufactured goods and timber, the latter mostly for the treeless governments of Samara, Saratov and Astrakhan, as well as for the region adjacent to the lower course of the Don. Dredging machines are kept constantly at work, while steamers are stationed near the most dangerous sandbanks to assist vessels that run aground. The following table shows the principal river ports, with the movement of shipping in an average year:—

Chief River Ports on the Volga.	Vessels.			Tons.		Approximate Value.
	Entered.	Cleared.	Imported.	Exported.	Total.	
						£
Astrakhan	2,724	3,228	938,000	3,734,000	4,672,000	7,812,000
Tsaritsyn.	6,412	1,482	1,152,000	462,000	1,614,000	5,000,000
Rybinsk .	3,760	6,295	590,000	172,000	762,000	3,573,000
Nizhniy-Novgorod	12,960	7,585	4,092,000	84,000	4,176,000	2,727,000
Saratov .	1,639	1,738	923,000	128,000	1,051,000	1,882,000

Formerly tens of thousands of *burlaki*, or porters, were employed in dragging boats up the Volga and its tributaries, but this method of traction has disappeared unless from a few of the tributaries. Horse-power is still extensively resorted to along the three canal systems. The first large steamers of the American type were built in 1872. Thousands of steamers are now employed in the traffic, to say nothing of smaller boats and rafts. Many of the steamers use as fuel *mazut* or petroleum refuse. Large numbers of the boats and rafts are broken up after a single voyage.

History.—The Volga was not improbably known to the early Greeks, though it is not mentioned by any writer previous to Ptolemy. According to him, the Rha is a tributary of an interior sea, formed from the confluence of two great rivers, the sources of which are separated by twenty degrees of longitude, but it is scarcely possible to judge from his statements how far the Slavs had by that time succeeded in penetrating into the basin of the Volga. The Arab geographers throw little light on the condition of the Volga during the great migrations of the 3rd century, or subsequently under the invasion of the Huns, the growth of the Khazar empire in the southern steppes and of that of Bulgaria on the middle Volga. But we know that in the 9th century the Volga basin was occupied by Finnish tribes in the north and by Khazars and various Turkish races in the south. The Slavs, driven perhaps to the west, had only the Volkhov and the Dnieper, while the (Mahommedan) Bulgarian empire, at the confluence of the Volga with the Kama, was so powerful that for some time it was an open question whether Islam or Christianity would gain the upper hand among the Slav idolaters. But, while the Russians were driven from the Black Sea by the Khazars, and later on by a tide of Ugrian migration from the north-east, a stream of Slavs moved slowly towards the north-east, down the upper Oka, into the borderland between the Finnish and Turkish regions. After two centuries of struggle the Russians succeeded in colonizing the fertile valleys of the Oka basin; in the 12th century they built a series of fortified towns on the Oka and Klyazma; and finally they reached the mouth of the Oka, there founding (in 1222) a new Novgorod—the Novgorod of the Lowlands, now Nizhniy-Novgorod. The great lacustrine depression of the middle Volga was thus reached; and when the Mongol invasion of 1239-42 came, it encountered in the Oka basin a dense agricultural population with many fortified and wealthy towns—a population which the Mongols found they could conquer, indeed, but were unable to drive before them as they had done so many of the Turkish tribes.

This invasion checked but did not stop the advance of the Russians down the Volga. Two centuries elapsed before the Russians covered the 300 m. which separate the mouths of the Oka and the Kama and took possession of Kazañ. But in the meantime a flow of Novgorodian colonization had moved eastward, along the upper portions of the left-bank tributaries of the Volga, and had reached the Urals.

With the capture of Kazañ (1552) the Russians found the lower Volga open to their boats, and eight years afterwards they were masters of the mouth of the river at Astrakhan. Two centuries more elapsed before the Russians secured a free passage to the Black Sea and became masters of the Sea of Azov and the Crimea; the Volga, however, was their route. During these two centuries they fortified the lower river, settled it, and penetrated farther eastward into the steppes towards the upper Ural and thence to the upper parts of the Tobol and other great Siberian rivers.

Bibliography.—P. P. Semenov's *Geographical and Statistical Dictionary* (5 vols., St Petersburg, 1863–85) contains a full bibliography of the Volga and tributaries. See also V. Ragozin's *Volga* (3 vols., St Petersburg, 1880–81, with atlas; in Russian); N. Bogolyubov, *The Volga from Tver to Astrakhan* (Russian, 1876); H. Roskoschny, *Die Wolga und ihre Zuflüsse* (Leipzig, 1887, vol. i.), history, ethnography, hydrography and biography, with rich bibliographical information; N. Boguslavskiy, *The Volga as a Means of Communication* (Russian, 1887), with detailed profile and maps; Peretyatkovich, *Volga Region in the 15th and 16th Centuries* (1877); and Lender, *Die Wolga* (1889).

(P. A. K.; J. T, Be.)

VOLHYNIA, a government of south-western Russia, bounded by the Polish governments of Lublin and Siedlce on the W., Grodno and Minsk on the N., Kiev on the E. and Podolia and Galicia (Austria) on the S., with an area of 27,690 sq. m. A broad, flat spur of the Carpathians—the Avratynsk plateau—which enters from the west and stretches out eastward towards the Dnieper occupies its southern portion, reaching a maximum elevation of 1200 ft.; another branch of the Carpathians in the west of the government ranges between 700 and 900 ft. at its highest points. Both are deeply grooved in places, and the crags give a hilly aspect to the districts in which they occur. The remainder of the government, which is quite flat, with an imperceptible slope towards the marshes of Pinsk, is known as the Polyesie (see Minsk).

The population in 1906 was estimated at 3,547,500. Some three-fourths of the population are Little Russians; the other elements are White and Great Russians, Poles (5·2%), Jews (13·2%) and Germans (5·7 %). The government is divided into twelve districts, the chief towns of which are Zhitomir, the capital, Dubno, Kovel, Kremenets, Lutsk, Novograd Volhynskiy, Ostrog, Ovruch, Vladimir Volhynskiy, Rovno, Staro-Konstantinov and Zaslavl. The conditions of peasant ownership differ from those which prevail in other parts of Russia, and of the total area the peasants hold approximately one-half; 42% of the total is in the hands of private owners, a considerable number of Germans having settled and bought land in the government.

Forests cover nearly 50% of the area in the north (that is, in the Polyesie) and 15% elsewhere. Agriculture is well developed in the south, and in 1900 there were 4,222,400 acres (24%) under cereal crops alone. In the Polyesie the principal occupations are connected with the export of timber and firewood, the preparation of pitch, tar, potash and wooden wares, and boat-building. Lignite and coal, some graphite and kaolin, are mined, as also amber, which is often found in big lumps. Manufacturing industries are not very highly developed. The factories are confined to sugar works, distilleries, woollen mills, and candle, tobacco, glass, cloth and agricultural machinery works. Domestic industry in the villages is chiefly limited to the making of wooden goods, including parquetry. The exports of grain and timber, chiefly to Germany and Great Britain, and of wool and cattle, are considerable.

Volhynia has been inhabited by Slavs from a remote antiquity. In Nestor's *Annals* its people are mentioned under the name of Dulebs, and later in the 12th century they were known as Velhynians and Buzhans (dwellers on the Bug). From the 9th century the towns of Volhynia-Vladimir, Ovruch, Lutsk and Dubno were ruled by descendants of the Scandinavian or Varangian chief Rurik, and the land of Volhynia remained independent until the 14th century, when it fell under Lithuania. In 1569 it was annexed to Poland, and so remained until 1795, when it was taken possession of by Russia.

VOLK, LEONARD WELLS (1828–1895), American sculptor, was born at Wellstown (now Wells), Hamilton county, New York, on the 7th of November 1828. He first followed the trade of a marble cutter with his father at Pittsfield, Massachusetts. In 1848 he opened a studio at St Louis, Missouri, and in 1855 was sent by his wife's cousin, Stephen A. Douglas, to Rome to study. Returning to America in 1857, he settled in Chicago, where he helped to establish an Academy of Design and was for eight years its head. Among his principal works are the Douglas monument at Chicago and the Soldiers' and Sailors' monument at Rochester, New York, and statues of President Lincoln and Stephen A. Douglas (in the Illinois State Capitol at Springfield, Ill.), and of General James Shields (in Statuary Hall, Capitol, Washington), Elihu B. Washburn, Zachariah Chandler and David Davis. In 1860 he made a life-mask (now in the National Museum, Washington) of Lincoln, of whom only one other, by Clark Mills in 1865, was ever made. His son, Douglas Volk (b. 1856), figure and portrait painter, who studied under J. L. Gérôme in Paris, became a member of the Society of American Artists in 1880 and of the National Academy of Design in 1899.

VOLKSRUST, a town of the Transvaal, 175 m. S.E. of Johannesburg and 308 m. N.N.W. of Durban. Pop. (1904) 2382, of whom 1342 were whites. The town lies at an elevation of 5429 ft. just within the Transvaal frontier and 4 m. N. of the pass through the Drakensberg known as Laing's Nek. It is the centre of a rich agricultural district. It was founded by the Boer government in 1888. As a customs port of entry it was of some importance, and it maintains its position as a distributing depot. It was created a municipality in 1903. Sandstone is quarried in the district.

VOLLENDAM, a small fishing village of Holland in the province of North Holland, adjoining Edam on the shores of the Zuider Zee. It is remarkable for the quaintness of the buildings and the picturesque costume of the villagers, who are of a singularly dark and robust type. Many artists have been attracted to settle here. Vollendam has its origin in the building of the great sea-dam for the new waterway to Edam in the middle of the 14th century. On the seaward side of the dike are some houses built on piles in the style of lake dwellings.

VOLLMAR, GEORG HEINRICH VON (1850–), German Socialist, was born at Munich in 1850. He was educated in a school attached to a Benedictine monastery at Augsburg, and in 1865 entered the Bavarian army as a lieutenant in a cavalry regiment. He served in the campaign of 1866, and then entered the papal army as a volunteer. In 1869 he returned to Germany, and during the war with France served in the army railway department. He was severely wounded at Blois and pensioned. Permanently crippled by his wounds, he devoted himself to political and social studies. In 1872 he was converted to the principles of Social Democracy, and threw himself with great energy into political agitation. In 1877 he became editor of the party organ at Dresden, and under the Socialist law was repeatedly condemned to various terms of imprisonment, and was also expelled from that city. From 1879 to 1882 he lived at Zürich, then the headquarters of Social Democracy, when, besides attending the university, he took part in editing the *Social Demokrat.* In 1881 he was elected member of the Reichstag, and from 1883 to 1889 was a member of the Saxon diet. After 1885 he resided in Bavaria, and it was to him that was chiefly due the great success of the Socialists in the older Bavarian provinces. He identified himself with the more moderate and opportunist section of the Socialist party, decisively dissociating himself from the doctrine of a sudden and violent overthrow of society, and urging his associates to co-operate in bringing about a gradual development towards the Socialistic state. He refused to identify Social Democracy with the extreme views as to religion and the family advocated by Bebel, and successfully resisted attempts made in 1891 to expel him from the party in consequence of his opinions. He became a member of the Bavarian Diet in 1893.

In addition to a couple of books on the preservation of forests, he published *Der isolierte Soziale Staat* (Zürich, 1880).

VOLNEY, CONSTANTIN FRANÇOIS CHASSEBŒUF, COMTE DE (1757–1820), French *savant*, was born at Craon (Maine-et-Loire) on the 3rd of February 1757, of good family; he was at first surnamed Boisgirais from his father's estate, but afterwards assumed the name of Volney. He spent some four years in Egypt and Syria, and published his *Voyage en Egypte et en Syrie* in 1787, and *Considérations sur la guerre des Turcs et de la Russie* in 1788. He was a member both of the States-General and of the Constituent Assembly. In 1791 appeared *Les Ruines, ou méditations sur les révolutions des empires*, an essay on the philosophy of history, containing a vision which predicts the final union of all religions by the recognition of the common truth underlying them all. Volney tried to put his politico-economic theories into practice in Corsica, where in 1792 he bought an estate and made an attempt to cultivate colonial produce. He was thrown into prison during the Jacobin triumph, but escaped the guillotine. He was some time professor of history at the newly founded École Normale. In 1795 he undertook a journey to the United States, where he was accused in 1797 of being a French spy sent to prepare for the reoccupation of Louisiana by France. He was obliged to return to France in 1798. The results of his travels took form in his *Tableau du climat et du sol des États-Unis* (1803). He was not a partisan of Napoleon, but, being a moderate man, a *savant* and a Liberal, was impressed into service by the emperor, who made him a count and put him into the senate. At the restoration he was made a peer of France. He became a member of the Institute in 1795. He died in Paris on the 25th of April 1820.

VOLO, a town and seaport of Greece, on the east coast of Thessaly, at the head of the gulf to which it gives its name. Pop. (1907) 23,319. It is the chief seaport and second industrial town of Thessaly, connected by rail with the town of Larissa. The anchorage is safe, vessels loading and discharging by means of lighters. The port has a depth of 23 to 25 ft.

The *Kastro*, or citadel, of Volo stands on or close to the site of Pagasae, whence the gulf took the name of Sinus Pagasaeus or Pagasicus, and which was one of the oldest places of which mention occurs in the legendary history of Greece. From this port the Argonautic expedition was said to have sailed, and it was already a flourishing place under the tyrant Jason, who from the neighbouring Pherae ruled over all Thessaly. Two miles farther south stand the ruins of Demetrias, founded (290 B.C.) by Demetrius Poliorcetes, and for some time a favourite residence of the Macedonian kings. On the opposite side of the little inlet at the head of the gulf rises the hill of Episcopi, on which stood the ancient city of Iolcus. At Dimini, about 3 m. W. of Volo, several tombs have been found which yielded remains of the later Mycenean Age.

VOLOGAESES (Vologaesus, Vologases; on the coins *Ologases*; Armen. *Valarsh*; Mod. Pers. *Balash*), the name of five Parthian kings.

(1) VOLOGAESES I., son of Vonones II. by a Greek concubine (Tac. *Ann.* xii. 44), succeeded his father in A.D. 51 (Tac. *Ann.* xii. 14; cf. Joseph. *Ant.* xx. 3, 4). He gave the kingdom of Media Atropatene to his brother Pacorus, and occupied Armenia for another brother, Tiridates (Tac. *Ann.* xii. 50, xv. 2; Joseph. *Ant.* xx. 3, 4). This led to a long war with Rome (54–63), which was ably conducted by the Roman general Corbulo. The power of Vologaeses was weakened by an attack of the Dahan and Sacan nomads, a rebellion of the Hyrcanians, and the usurpation of Vardanes II. (Tac. *Ann.* xiii. 7, 37; xiv. 25; xv. 1; cf. Joseph. *Ant.* xx. 4, 2, where he is prevented from attacking the vassal king of Adiabene by an invasion of the eastern nomads). At last a peace was concluded, by which Tiridates was acknowledged as king of Armenia, but had to become a vassal of the Romans; he went to Rome, where Nero gave him back the diadem (Tac. *Ann.* xv. 1 ff.; Dio Cass. lxii. 19 ff., lxiii. 1 ff.); from that time an Arsacid dynasty ruled in Armenia under Roman supremacy. Vologaeses was satisfied with this result, and honoured the memory of Nero (Suet. *Nero*, 57), though he stood in good relations with Vespasian also, to whom he offered an army of 40,000 archers in the war against Vitellius (Tac. *Hist.* iv. 51; Suet, *Vespas.* 6; cf. Joseph. *Ant.* vii. 5, 2, 7, 3; Dio Cass. lxvi. 11). Soon afterwards the Alani, a great nomadic tribe beyond the Caucasus, invaded Media and Armenia (Joseph. *Bell.* vii. 7, 4); Vologaeses applied in vain for help to Vespasian (Dio Cass. lxvi. 11; Suet. *Domitian*, 2). It appears that the Persian losses in the east also could not be repaired; Hyrcania remained an independent kingdom (Joseph. *Bell.* vii. 7, 4; Aurel. Vict. *Epit.* 15, 4). Vologaeses I. died about A.D. 77. His reign is marked by a decided reaction against Hellenism; he built Vologesocerta (Balashkert) in the neighbourhood of Ctesiphon with the intention of drawing to this new town the inhabitants of the Greek city Seleucia (Plin. vi. 122). Another town founded by him is Vologesias on a canal of the Euphrates, south of Babylon (near Hira; cf. Nöldeke in *Zeitschrift der deutschen-morgenl. Gesellschaft*, xxviii. 93 ff.). On some of his coins the initials of his name appear in Aramaic letters.

(2) VOLOGAESES II., probably the son of Vologaeses I., appears on coins, which bear his proper name, in 77–79, and again 121–47. During this time the Parthian kingdom was torn by civil wars between different pretenders, which reached their height during the war of Trajan, 114–17. Besides Vologaeses II. we find on coins and in the authors Pacorus (78–*c.* 105), Artabanus III. (80–81), Osroes (106–29), Mithradates V. (*c.* 129–47) and some others; thus the Parthian empire seems during this whole time to have been divided into two or three different kingdoms. By classic authors Vologaeses II. is mentioned in the time of Hadrian (*c.* 131), when Cappadocia, Armenia and Media were invaded by the Alani (Dio Cass. lxix. 15).

(3) VOLOGAESES III., 147–91. Under him, the unity of the empire was restored. But he was attacked by the Romans under Marcus Aurelius and Verus (162–65). In this war Seleucia was destroyed and the palace of Ctesiphon burnt down by Avidius Cassius (164); the Romans even advanced into Media. In the peace, western Mesopotamia was ceded to the Romans (Dio Cass. lxxi. 1 ff.; Capitolin. *Marc. Aur.* 8 f.; Verus 8, &c.). Vologaeses III. is probably the king Volgash of the Parsee tradition, preserved in the *Dinkart*, who began the gathering of the writings of Zoroaster.

(4) VOLOGAESES IV., 191–209. He was attacked by Septimius Severus in 195, who advanced into Mesopotamia, occupied Nisibis and plundered Ctesiphon (199), but attempted in vain to conquer the Arabic fortress Atra; in 202 peace was restored.

(5) VOLOGAESES V., 209–*c.* 222, son of Vologaeses IV. Soon after his accession his brother Artabanus IV., the last Arsacid king, rebelled against him, and became master of the greater part of the empire (Dio Cass. lxxvii. 12). But Vologaeses V. maintained himself in a part of Babylonia; his dated coins reach down to A.D. 222. (ED. M.)

VOLOGDA, a government of north-eastern Russia, having the government of Archangel on the N., Tobolsk on the E., Perm, Vyatka, Kostroma and Yaroslavl on the S., Novgorod, Olonetz and Archangel on the W. This immense government, which comprises an area of 155,218 sq. m., stretches in a north-easterly direction for 800 m., from Novgorod to the Urals, and includes the broad depression drained by the Sukhona from the S.W., and the Vychegda from the N.E., both head-waters of the N. Dvina. From the basin of the Volga it is separated by a flat, swampy, wooded swelling, where the heads of tributaries belonging to both Arctic and Caspian drainage-areas are closely intermingled. The eastern boundary of Vologda follows the main water-parting of the Urals, which has but few points over 3000 ft.; wide *parmas*, or woody plateaus, fill up the space between the main chain of the Urals and the southern spurs of the Timan Mountains, in the upper basin of the Pechora. It is above the *parmas*—especially over those which are nearest the Urals proper—that the highest summits of the Urals rise in the form of dome-shaped mountains (Töll-poz-iz, 5535 ft.; Kozhem-iz, 4225 ft.; Shadmaha, 4115 ft.). The Timan

Mountains are a swampy plateau, where the rivers flowing to the N. Dvina or to the Pechora take their rise in common marshes; so that on the Mylva portage boats have to be dragged a distance of only 3 m. to be transported from one system to the other.

Permian sandstones and cupriferous slates cover most of the territory; only a few patches of Jurassic clays overlie them; in the east, in the Ural *parmas*, coal-bearing Carboniferous, Devonian and Silurian slates and limestones appear, wrapping the crystalline slates of the main ridge. Vast layers of boulder clay and Lacustrine deposits overlie the whole. Rock-salt and salt springs, iron ore, millstones and grindstones are the chief mineral products; but mining is in its infancy.

The river Sukhona, which rises in the south-west and flows north-east, is navigable for 375 m. After its confluence with the Yug (390 m. long), which flows from the south, it becomes the N. Dvina, which proceeds north-west, and receives the Vychegda, 740 m. long and navigable for 570 m., though it passes through a nearly uninhabited region. The Luza, a tributary of the Yug, is also navigated for more than 250 m. The Pechora, which flows through eastern Vologda, is an artery for the export of corn and the import of fish. The Pinega, the Mezeñ and the Vaga, all belonging to the Arctic basin, rise in northern Vologda. In the south-west the Sukhona is connected by means of Lake Kubina and the canal of Alexander von Württemberg with the upper Volga. Numberless smaller lakes occur, and marshes cover a considerable part of the surface.

The climate is severe, the average yearly temperature being 36° F. at Vologda (Jan., 10°·7; July, 63°·5) and 32°·5 at Ust-Sysolsk (Jan., 4°·8; July, 61°·7).

The flora and the physical aspects vary greatly as the traveller moves north-east down the Sukhona and up the Vychegda, towards the *parmas* of the Pechora. In the south-west the forests are cleared, and the dry slopes of the hills have been converted into fields and meadows; the population is relatively dense, and nearly one-quarter of the area is under crops. There is a surplus of grain, which is used for distilleries, and apples are extensively cultivated. The flora is middle-Russian. Farther north-east the climate grows more severe; but still, until the Dvina is reached, corn succeeds well, and there is no lack of excellent meadows on the river-terraces. Flax is cultivated for export; but only 4% of the area is tilled, the remainder being covered with thick fir forests with occasional groups of deciduous trees (birch, aspen, elder). At about 46° E. the larch appears and soon supersedes the fir. Several plants unknown in western Russia make their appearance (*Silene tartarica*, *Anthyllis vulneraria*, *Euphorbia palustris*, *Filago arvensis*, *Lycopodium complanatum*, *Sanguisorba officinalis*). The *Veratrum* is especially characteristic; it sometimes encroaches on the meadows to such an extent as to compel their abandonment. The region of the upper Mezeñ (the Udora) again has a distinctive character. The winter is so protracted, and the snowfall so copious, that the Syryenians are sometimes compelled to clear away the snow from their barley-fields. But the summer is so hot (a mean of 54° for the three summer months) that barley ripens within forty days after being sown. The Timan plateaus are a marked boundary for the middle-Russian flora. Those to the east of them are uninhabitable; even on the banks of the rivers the climate is so severe, especially on account of the icy northern winds, that rye and barley are mostly grown only in orchards. The whole is covered with quite impenetrable forests, growing on a soil saturated with water. Mosquitoes swarm in the forests; birds are rare. The Siberian cedar begins and the lime tree disappears. Fir, cedar, pine and larch compose the forests, with birch and aspen on their outskirts. Hunting is the chief occupation of the Syryenian inhabitants.

The population was estimated in 1906 at 1,517,500, of whom 57,407 lived in towns; 90% were Great Russians and 8·4% Syryenians (*q.v.*). The government is divided into ten districts, the chief towns of which are Vologda, Gryazovets, Kadnikov, Nikolsk, Solvychegodsk, Totma or Totyma, Ustyug Velikiy, Ust-Sysolsk, Velsk and Yarensk. Agriculture thrives in the three south-western districts. Live-stock breeding occupies considerable numbers of people. A little salt is raised, and there are a few ironworks, but manufacturing industries are in their infancy; the chief branch is the weaving of linen in the villages. (P. A. K.; J. T. Be.)

VOLOGDA, a town of Russia, capital of the government of the same name, situated in its south-western corner on the river Vologda, above its confluence with the navigable Sukhona, 127 m. by rail N. of Yaroslavl. Pop. (1881) 17,025; (1897) 27,822. It is an old town, having many ancient churches, including one which dates from the 12th century, and the cathedral, founded in 1568. Vologda is a considerable commercial centre—flax, linseed, oats, hemp, butter and eggs being exported to both St Petersburg and Archangel. It has distilleries, tanneries, and oil, soap, tobacco, candle and fur-dressing works.

Vologda existed as a trading town as early as the 12th century. It was a colony of Novgorod, and was founded in 1147, and carried on a brisk trade in flax, tallow, furs, corn, leather and manufactured goods. In 1273 it was plundered by the prince of Tver in alliance with the Tatars, but soon recovered. Moscow disputed its possession with Novgorod until the 15th century; the Moscow princes intrigued to find support amidst the poorer inhabitants against the richer Novgorod merchants, and four successive times Vologda had to fight against its metropolis. It was definitely annexed to Moscow in 1447. When Archangel was founded, and opened for foreign trade in 1553, Vologda became the chief depot for goods exported through that channel. Polish bands plundered it in 1613, and the plague of 1648 devastated it; but it maintained its commercial importance until the foundation of St Petersburg, when Russian foreign trade took another channel.

VOLSCI, an ancient Italian people, well known in the history of the first century of the Roman Republic. They then inhabited the partly hilly, partly marshy district of the S. of Latium, bounded by the Aurunci and Samnites on the S., the Hernici on the E., and stretching roughly from Norba and Cora in the N. to Antium in the S. They were among the most dangerous enemies of Rome, and frequently allied with the Aequi, whereas the Hernici from 486 B.C. onwards were the allies of Rome. In the Volscian territory lay the little town of Velitrae (Velletri), the birthplace of Augustus. From this town we have a very interesting though brief inscription dating probably from early in the 3rd century B.C.; it is cut upon a small bronze plate (now in the Naples Museum), which must have once been fixed to some votive object, dedicated to the god *Declunus* (or the goddess *Decluna*).

The language of this inscription is clear enough to show the very marked peculiarities which rank it close beside the language of the Iguvine Tables (see IGUVIUM). It shows on the one hand the labialization of the original velar *q* (Volscian *pis*=Latin *quis*), and on the other hand it palatalizes the guttural *c* before a following *i* (Volscian *façia*=Latin *faciat*). Like Umbrian also, but unlike Latin and Oscan, it has degraded all the diphthongs into simple vowels (Volscian *se* parallel to Oscan *svai*; Volscian *deue*, Old Latin and Oscan *deiuai* or *deiuoi*). This phenomenon of what might have been taken for a piece of Umbrian text appearing in a district remote from Umbria and hemmed in by Latins on the north and Oscan-speaking Samnites on the south is a most curious feature in the geographical distribution of the Italic dialects, and is clearly the result of some complex historical movements.

In seeking for an explanation we may perhaps trust, at least in part, the evidence of the Ethnicon itself. The name *Volsci* belongs to what may be called the -CO- group of tribal names in the centre, and mainly on the west coast, of Italy, all of whom were subdued by the Romani before the end of the 4th century B. C.; and many of whom were conquered by the Samnites about a century or more earlier. They are, from south to north, *Osci*, *Aurunci*, *Hernici*, *Marruci*, *Falisci*; with these were no doubt associated the original inhabitants of *Aricia* and of *Sidici-num*, of *Vescia* among the *Aurunci*, and of *Labici* close to Hernican territory. The same formative element appears in the adjective *Mons Massicus*, and the names *Glanica* and *Marica* belonging to the Auruncan district, with *Graviscae* in south Etruria, and a few other names in central Italy (see "I due strati nella popolazione Indo-Europea dell' Italia Antica," in the *Atti del Congresso Internazionale di Scienze Storiche*, Rome, 1903, p. 17). With these names must clearly be judged the forms *Tusci* and *Etrusci*, although these forms must not be regarded as anything but the names given to the Etruscans by the folk among whom they settled. Now the historical fortune of these tribes is reflected in several of their names (see SABINI). The Samnite and Roman conquerors tended to impose the form of their own Ethnicon, namely the suffix -NO-, upon the tribes they conquered; hence the *Marruci* became the *Marrucini*, the **Arici* became *Aricini*, and it seems at least probable that the forms *Sidicini*, *Carecini*, and others of this shape are the results of this same process. The conclusion suggested is that these -CO- tribes occupied the centre and west coast of Italy at the time of the Etruscan invasion (see Etruria: *Language*); whereas the -NO- tribes only reached this part of Italy, or at least only became dominant there, long after the Etruscans had settled in the Peninsula.

It remains, therefore, to ask whether any information can be had about the language of this primitive -CO- folk, and whether they can be identified as the authors of any of the various archaeological strata now recognized on Italian soil. If the conclusions suggested under Sabini may be accepted as sound we should expect to find the Volsci speaking a language similar to that of the Ligures, whose fondness for the suffix *-sco-* we have noticed (see Ligures), and identical with that spoken by the plebeians of Rome, and that this branch of Indo-European was among those which preserved the original Indo-European Velars from the labialization which befell them in the speech of the Samnites. The language of the inscription of Velitrae offers at first sight a difficulty from this point of view, in the conversion which it shows of *q* to *p*; but it is to be observed that the Ethnicon of Velitrae is *Veliternus*, and that the people are called on the inscription itself *Velestrom* (genitive plural); so that there is nothing to prevent our assuming that we have here a settlement of Sabines among the Volscian hills, with their language to some extent (*e.g.* in the matter of the diphthongs and palatals) corrupted by that of the people round about them; just as we have reason to suppose was the case with the Safine language of the *Iguvini*, whose very name was later converted into *Iguvinates*, the suffix *-ti-* being much more frequent among the -CO- tribes than among the Safines (see Sabini).

The name *Volsci* itself is significant not merely in its suffix; the older form *Volusci* clearly contains the word meaning "marsh" identical with Gr. ἕλος, since the change of **velos-* to **volus-* is phonetically regular in Latin. The name *Marīca* ("goddess of the salt-marshes") among the Aurunci appears also both on the coast of Picenum and among the Ligurians; and Stephanus of Byzantium identified the Osci with the Siculi, whom there is reason to suspect were kinsmen of the Ligures. It is remarkable in how many marshy places this *-co-* or *-ca-* suffix is used. Besides the *Aurunci* and the *dea Marica* and the *intempestaeque Graviscae* (Virg. *Aen.* x. 184), we have the *Ustica cubans* of Horace (*Odes* i. 17, 11), the *Hernici* in the Trerus valley, *Satricum* and *Glanica* in the Pomptine marshes.

For the text and fuller account of the Volscian inscription, and for other records of the dialect, see R. S. Conway, *The Italic Dialects*, pp. 267 sqq. (R. S. C.)

VOLSINII, an ancient town of Etruria, Italy. The older Volsinii occupied in all probability the isolated tufa rock, so strongly defended by nature, upon which in Roman times stood the town which Procopius (*B.G.* ii. 11 seq.) calls Οὐρβιβεντός (*Urbs vetus*, the modern Orvieto). This conjecture, first made by O. Müller, has been generally accepted by modern archaeologists; and it is a strong point in its favour that the bishop of Orvieto in 595 signs himself *episcopus civitatis Bulsiniensis* (Gregor. Magn. *Registr*. v. 57*a*; cf. ii. 11, vi. 27). It had, and needed, no outer walls, being surrounded on all sides except the S.W. by abrupt tufa cliffs; but a massive wall found by excavation on the S.W. side of the town may have belonged to the acropolis. No remains of antiquity are to be seen within the city; but at the foot of the hill on the N. a large Etruscan necropolis was found in 1874, dating from the 5th century B.C. The tombs, constructed of blocks of stone and arranged in rows divided by passages (like houses in a town), often had the name of the deceased on the façade. Many painted vases, &c., were found; some of the best are in the Museo Civico at Orvieto. Tombs with paintings have also been found to the W. of the town on the way to Bolsena.

Volsinii was reputed the richest of the twelve cities of Etruria. Wars between Volsinii and Rome are mentioned in 392, 308 and 294 B.C., and in 265–64 B.C. the Romans assisted the inhabitants against their former slaves, who had successfully asserted themselves against their masters and took the town. Fulvius Flaccus gained a triumph for his victory, and it was probably then that the statue of Vertumnus which stood in the Vicus Tuscus at Rome was brought from Volsinii. Zonaras states that the city was destroyed and removed elsewhere, though the old site continued apparently to be inhabited, to judge from the inscriptions found there. The new city was certainly situated on the hills on the N.E. bank of the Lake of Bolsena (*Lacus Volsiniensis*), 12 m. W.S.W. of Orvieto, where many remains of antiquity have been found, on and above the site of the modern Bolsena (*q.v.*). These remains consist of Etruscan tombs, the sacred enclosure of the goddess Nortia, with votive objects and coins ranging from the beginning of the 3rd century B.C. to the middle of the 3rd century A.D., remains of Roman houses, &c., and an amphitheatre of the imperial period (E. Gabrici in *Monumenti dei Lincei*, xvi., 1906, 169 sqq., and in *Notizie degli Scavi*, 1906, 59 sqq.).

The history of the new Volsinii is somewhat scanty. Sejanus, the favourite of Tiberius, and Musonius Rufus the Stoic were natives of the place. The earliest dated inscription from the cemetery of S. Christina (discovered with its subterranean church in 1880–81) belongs to A.D. 376 and the first known bishop of Volsinii to A.D. 499. In the next century, however, the see was transferred to Orvieto. Etruscan tombs have been found on the Isola Bisentina, in the lake; and on the west bank was the town of Visentium, Roman inscriptions belonging to which have been found. The site is marked by a medieval castle bearing the name Bisenzo.

See E. Bormann in *Corp. Inscr. Latin.* xi., 1888, pp. 423 sqq.; *Notizie degli Scavi*, *passim*; G. Dennis, *op. cit.* (ii. 18 sqq.). (T. As.)

VOLTA, ALESSANDRO (1745–1827), Italian physicist, was born at Como on the 18th of February 1745. He is celebrated as a pioneer of electrical science, after whom the "volt" is named. In 1774 he was appointed professor of physics in the gymnasium of Como, and in 1777 he travelled through Switzerland, where he formed an intimate friendship with H. B. de Saussure. In 1779 a chair of physics was founded in Pavia, and Volta was chosen to occupy it. In 1782 he journeyed through France, Germany, Holland and England, and became acquainted with many scientific celebrities. In 1791 he received the Copley medal of the Royal Society. In 1801 Napoleon called him to Paris, to show his experiments on contact electricity, and a medal was struck in his honour. He was made a senator of the kingdom of Lombardy. In 1815 the emperor of Austria made him director of the philosophical faculty of Padua. In 1819 he retired and settled in his native town, where he died on the 5th of March 1827. For Volta's electrical work, and his place in the history of discovery (see Electricity; also Voltmeter).

VOLTA, the largest river of the coast of Upper Guinea, between the Gambia and the Niger, with a length of about 900 m. Its mouth and the greater part of its course are in British territory. Its lower course had been known since the discoveries of the Portuguese, from whom it received (15th century) its name on account of the winding nature of its stream. It was not, however, until the last fifteen years of the 19th century that the extent of its basin—extending far north within the bend of the Niger—was made known.

There are two main upper branches, the Black and the White Volta. Their sources lie on the grassy plateaus north of the forest belt of the Guinea coast, the Black Volta rising (as the Baule) in about 11° N. 4° 50′ W. Its course is at first E. and N.E., to 12° 25′ N., at which point, after receiving a tributary from nearly 14° N.—the most northerly point of the basin,—it turns sharply south. From the eleventh to the ninth parallel the river forms the boundary between the Northern Territories of the Gold Coast (British) and the French Ivory Coast colony. The southerly course of the stream ceases at 8° 15′ N. where it is deflected E., and even N., by a mountain range composed of sandstone and granite, which it finally breaks through by a narrow pass, in which its width is only some 60 yds. Elsewhere it has a general width of 150 to 200 yds. In 0° 50′ W. it receives the White Volta, which flows generally south from about 13° N. and likewise breaks through a narrow gap in the plateau escarpment. Both rivers shrink greatly in the dry season, reaching their lowest level at the end of January. Below the junction the Volta flows S.E. and S., turning, however, E. for 40 m. just north of 6°. In 7° 37′ N. it receives on the left bank a large tributary, the Oti, coming from 12° N. In its lower course, through the forest belt, the river has often a width of over half a mile, with a depth in places of 40 to 50 ft. in the rains, but in 6° 18′ N. it traverses a pass in which its width is narrowed to 30 yds. Its use as a waterway is limited by a number of rapids, the lowest of which occur in 6° 7′ N., above the trading port of Akuse. Its mouth is also obstructed during the greater part of the year by a bar. The river is usually navigable by small vessels from its mouth for about 60 m.

The lower Volta was explored by M. J. Bonnat in 1875, but the upper basin was first traversed by the German traveller G. A. Krause (1886–87) and the French captain L. G. Binger (1888). It has since been explored by a number of colonial officials—German, French and British. Between 6° 41′ and 8° 8′ N. the Volta forms the boundary between the Gold Coast and Togoland.

VOLTAIRE, FRANÇOIS MARIE AROUET DE (1694–1778), French philosopher, historian, dramatist and man of letters, whose real name was François Marie Arouet simply, was born on the 21st of November 1694 at Paris, and was baptized the next day. His father was François Arouet, a notary; his mother was Marie Marguerite Daumart or D'Aumard. Both father and mother were of Poitevin extraction, but the Arouets had been for two generations established in Paris, the grandfather being a prosperous tradesman. The family appear to have always belonged to the yeoman-tradesman class; their special home was the town of Saint-Loup. Voltaire was the fifth child of his parents—twin boys (of whom one survived), a girl, Marguerite Catherine, and another boy who died young, having preceded him. Not very much is known of the mother, who died when Voltaire was but seven years old. She pretty certainly was the chief cause of his early introduction to good society, the abbé de Châteauneuf (his sponsor in more ways than one) having been her friend. The father appears to have been somewhat peremptory in temper, but neither inhospitable nor tyrannical. Marguerite Arouet, of whom her younger brother was very fond, married early, her husband's name being Mignot; the elder brother, Armand, was a strong Jansenist, and there never was any kind of sympathy between him and François.

The abbé de Châteauneuf instructed him early in belles-lettres and deism, and he showed when a child the unsurpassed faculty for facile verse-making which always distinguished him. At the age of ten he was sent to the Collège Louis-le-Grand, which was under the management of the Jesuits, and remained there till 1711. It was his whim, as part of his general liberalism, to depreciate the education he received; but it seems to have been a very sound and good education, which formed the basis of his extraordinarily wide, though never extraordinarily accurate, collection of knowledge subsequently, and (a more important thing) disciplined and exercised his literary faculty and judgment. Nor can there be much doubt that the great attention bestowed on acting—the Jesuits kept up the Renaissance practice of turning schools into theatres for the performance of plays both in Latin and in the vernacular—had much to do with Voltaire's lifelong devotion to the stage. It must have been in his very earliest school years that the celebrated presentation of him by his godfather to Ninon de Lenclos took place, for Ninon died in 1705. She left him two thousand francs "to buy books with." He worked fairly, played fairly, lived comfortably, made good and lasting friends. Some curious traits are recorded of this life—one being that in the terrible famine year of Malplaquet a hundred francs a year were added to the usual boarding expenses, and yet the boys had to eat *pain bis*.

In August 1711, at the age of seventeen, he came home, and the usual battle followed between a son who desired no profession but literature and a father who refused to consider literature a profession at all. For a time Voltaire submitted, and read law at least nominally. The abbé de Châteauneuf died before his godson left school, but he had already introduced him to the famous and dissipated coterie of the Temple, of which the grand prior Vendôme was the head, and the poets Chaulieu and La Fare the chief literary stars. It does not appear that Voltaire got into any great scrapes; but his father tried to break him off from such society by sending him first to Caen and then, in the suite of the marquis de Châteauneuf, the abbé's brother, to the Hague. Here he met a certain Olympe Dunoyer ("Pimpette"), a girl apparently of respectable character and not bad connexions, but a Protestant, penniless, and daughter of a literary lady whose literary reputation was not spotless. The mother discouraged the affair, and, though Voltaire tried to avail himself of the mania for proselytizing which then distinguished France, his father stopped any idea of a match by procuring a *lettre de cachet*, which, however, he did not use. Voltaire, who had been sent home, submitted, and for a time pretended to work in a Parisian lawyer's office; but he again manifested a faculty for getting into trouble—this time in the still more dangerous way of writing libellous poems—so that his father was glad to send him to stay for nearly a year (1714–15) with Louis de Caumartin, marquis de Saint-Ange, in the country. Here he was still supposed to study law, but devoted himself in part to literary essays, in part to storing up his immense treasure of gossiping history. Almost exactly at the time of the death of Louis XIV. he returned to Paris, to fall once more into literary and Templar society, and to make the tragedy of *Œdipe*, which he had already written, privately known. He was now introduced to a less questionable and even more distinguished coterie than Vendôme's, to the famous "court of Sceaux," the circle of the beautiful and ambitious duchesse du Maine. It seems that Voltaire lent himself to the duchess's frantic hatred of the regent Orleans, and helped to compose lampoons on that prince. At any rate, in May 1716 he was exiled, first to Tulle, then to Sully. Allowed to return, he again fell under suspicion of having been concerned in the composition of two violent libels—one in Latin and one in French—called from their first words the *Puero Regnante* and the *J'ai vu*, was inveigled by a spy named Beauregard into a real or burlesque confession, and on the 16th of May 1717 was sent to the Bastille. He there recast *Œdipe*, began the *Henriade* and determined to alter his name. Ever after his exit from the Bastille in April 1718 he was known as Arouet de Voltaire, or simply Voltaire, though legally he never abandoned his patronymic. The origin of the famous name has been much debated, and attempts have been made to show that it actually existed in the Daumart pedigree or in some territorial designation. Some are said to maintain that it was an abbreviation of a childish nickname, "*le petit volontaire*." The balance of opinion has, however, always inclined to the hypothesis of an anagram on the name "Arouet le jeune," or "Arouet l. j.," *u* being changed to *v* and *j* to *i* according to the ordinary rules of the game.

A further "exile" at Châtenay and elsewhere succeeded the imprisonment, and though Voltaire was admitted to an audience by the regent and treated graciously he was not trusted. *Œdipe* was acted at the Théâtre Français on the 18th of November of the year of release, and was very well received, a rivalry between parties not dissimilar to that which not long before had helped Addison's *Cato* assisting its success. It had a run of forty-five nights, and brought the author not a little profit. With these gains Voltaire seems to have begun his long series of successful financial speculations. But in the spring of next year the production of Lagrange-Chancel's libels, entitled the *Philippiques*, again brought suspicion on him. He was informally exiled, and spent much time with Marshal Villars, again increasing his store of "reminiscences." He returned to Paris in the winter, and his second play, *Artémire*, was produced in February 1720. It was a failure, and though it was recast with some success Voltaire never published it as a whole, and used parts of it in other work. He again spent much of his time with Villars, listening to the marshal's stories and making harmless love to the duchess. In December 1721 his father died, leaving him property (rather more than four thousand livres a year), which was soon increased by a pension of half the amount from the regent. In return for this, or in hopes of more, he offered himself as a spy—or at any rate as a secret diplomatist—to Dubois. But meeting his old enemy Beauregard in one of the minister's rooms and making an offensive remark, he was waylaid by Beauregard some time after in a less privileged place and soundly beaten.

His visiting espionage, as unkind critics put it—his secret diplomatic mission, as he would have liked to have it put himself—began in the summer of 1722, and he set out for it in company with a certain Madame de Rupelmonde, to whom he as usual made love, taught deism and served as an amusing travelling companion. He stayed at Cambrai for some time, where European diplomatists were still in full session, journeyed to Brussels, where he met and quarrelled with Jean Baptiste Rousseau, went on to the Hague, and then returned. The *Henriade* had got on considerably during the journey, and, according to his lifelong habit, the poet, with the help of his friend Thiériot and others, had been "working the oracle" of puffery. During the late autumn and winter of 1722–23 he abode chiefly in Paris, taking a kind of lodging in the town house of M. de Bernières, a nobleman of Rouen, and endeavouring to procure a "privilege" for his poem. In this he was disappointed, but he had the work printed at Rouen nevertheless, and spent the summer of 1723 revising it. In November he caught smallpox and was very seriously ill, so that the book was not given to the world till the spring of 1724 (and then of course, as it had no privilege, appeared privately). Almost at the same time, the 4th of March, his third tragedy, *Mariamne* appeared, was well received at first, but underwent complete damnation before the curtain fell. The regent had died shortly before, not to Voltaire's advantage; for he had been a generous patron. Voltaire had made, however, a useful friend in another *grand seigneur*, as profligate and nearly as intelligent, the duke of Richelieu, and with him he passed 1724 and the next year chiefly, recasting *Mariamne* (which was now successful), writing the comedy of *L'Indiscret*, and courting the queen, the ministers, the favourites and everybody who seemed worth. The end of 1725 brought a disastrous close to this period of his life. He was insulted by the chevalier de Rohan, replied with his usual sharpness of tongue, and shortly afterwards, when dining with the duke of Sully, was called out and bastinadoed by the chavelier's hirelings, Rohan himself looking on. Nobody would take his part, and at last, nearly three months after the outrage, he challenged Rohan, who accepted the challenge, but on the morning appointed for the duel Voltaire was arrested and sent for the second time to the Bastille. He was kept in confinement a fortnight, and was then packed off to England in accordance with his own request. Voltaire revenged himself on the duke of Sully for his conduct towards his guest by cutting Maximilien de Béthune's name out of the *Henriade*.

No competent judges have ever mistaken the importance of Voltaire's visit to England, and the influence it exercised on his future career. In the first place, the ridiculous and discreditable incident of the beating had time to blow over; in the second, England was a very favourable place for Frenchmen of note to pick up guineas; in the third, and most important of all, his contact with a people then far more different in every conceivable way from their neighbours than any two peoples of Europe are different now, acted as a sovereign tonic and stimulant on his intellect and literary faculty. Before the English visit Voltaire had been an elegant trifler, an adept in the forms of literature popular in French society, a sort of superior Dorat or Boufflers of earlier growth. He returned from that visit one of the foremost literary men in Europe, with views, if not profound or accurate, yet wide and acute on all *les grands sujets*, and with a solid stock of money. The visit lasted about three years, from 1726 to 1729; and, as if to make the visitor's luck certain, George I. died and George II. succeeded soon after his arrival. The new king was not fond of "boetry," but Queen Caroline was, and international jealousy was pleased at the thought of welcoming a distinguished exile from French illiberality. The Walpoles, Bubb Dodington, Bolingbroke, Congreve, Sarah, duchess of Marlborough, Pope, were among his English friends. He made acquaintance with, and at least tried to appreciate, Shakespeare. He was much struck by English manners, was deeply penetrated by English toleration for personal freethought and eccentricity, and gained some thousands of pounds from an authorized English edition of the *Henriade*, dedicated to the queen. But he visited Paris now and then without permission, and his mind, like the mind of every exiled Frenchman, was always set thereon. He gained full licence to return in the spring of 1729.

He was full of literary projects, and immediately after his return he is said to have increased his fortune immensely by a lucky lottery speculation. The *Henriade* was at last licensed in France; *Brutus*, a play which he had printed in England, was accepted for performance, but kept back for a time by the author; and he began the celebrated poem of the *Pucelle*, the amusement and the torment of great part of his life. But he had great difficulties with two of his chief works which were ready to appear, *Charles XII.* and the *Lettres sur les Anglais*. With both he took all imaginable pains to avoid offending the censorship; for Voltaire had, more than any other man who ever lived, the ability and the willingness to stoop to conquer. At the end of 1730 *Brutus* did actually get acted. Then in the spring of the next year he went to Rouen to get *Charles XII.* surreptitiously printed, which he accomplished. In 1732 another tragedy, *Ériphile*, appeared, with the same kind of halting success which had distinguished the appearance of its elder sisters since *Œdipe*. But at last, on the 13th of August 1732, he produced *Zaïre*, the best (with *Mérope*) of all his plays, and one of the ten or twelve best plays of the whole French classical school. Its motive was borrowed to some extent from *Othello*, but that matters little. In the following winter the death of the comtesse de Fontaine-Martel, whose guest he had been, turned him out of a comfortable abode. He then took lodgings with an agent of his, one Demoulin, in an out-of-the-way part of Paris, and was, for some time at least, as much occupied with contracts, speculation and all sorts of means of gaining money as with literature.

In the middle of this period, however, in 1733, two important books, the *Lettres philosophiques sur les Anglais* and the *Temple du goût* appeared. Both were likely to make bad blood, for the latter was, under the mask of easy verse, a satire on contemporary French literature, especially on J. B. Rousseau, and the former was, in the guise of a criticism or rather panegyric of English ways, an attack on everything established in the church and state of France. It was published with certain "remarks" on Pascal, more offensive to orthodoxy than itself, and no mercy was shown to it. The book was condemned (June 10th, 1734), the copies seized and burnt, a warrant issued against the author and his dwelling searched. He himself was safe in the independent duchy of Lorraine with Émilie de Breteuil, marquise du Châtelet,[1] with whom he began to be intimate in 1733; he had now taken up his abode with her at the château of Cirey.

If the English visit may be regarded as having finished

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[1] Gabrielle Émilie Le Tonnelier de Breteuil, marquise du Châtelet (1706–1749), was the daughter of the baron de Breteuil, and married the marquis du Châtelet-Lomont in 1725. She was an accomplished linguist, musician and mathematician, and deeply interested in metaphysics. When she first became intimate with Voltaire she was practically separated from her husband, though he occasionally visited Cirey. She is only important from her connexion with Voltaire, though an attempt has been made to treat her as an original thinker; see F. Hamel, *An Eighteenth Century Marquise* (1910). She wrote *Institutions de physique* (1740), *Dissertation sur la nature et la propagation du feu* (1744), *Doutes sur les religions reculées* (1792), and in 1756 published a translation of Newton's *Principia*.

Voltaire's education, the Cirey residence may be justly said to be the first stage of his literary manhood. He had written important and characteristic work before; but he had always been in a kind of literary *Wanderjahre*. He now obtained a settled home for many years and, taught by his numerous brushes with the authorities, he began and successfully carried out that system of keeping out of personal harm's way, and of at once denying any awkard responsibility, which made him for nearly half a century at once the chief and the most prosperous of European heretics in regard to all established ideas. It was not till the summer of 1734 that Cirey, a half-dismantled country house on the borders of Champagne and Lorraine, was fitted up with Voltaire's money and became the headquarters of himself, of his hostess, and now and then of her accommodating husband. Many pictures of the life here, some of them not a little malicious, survive. It was not entirely a bed of roses, for the "respectable Emily's" temper was violent, and after a time she sought lovers who were not so much *des cérébraux* as Voltaire. But it provided him with a safe and comfortable retreat, and with every opportunity for literary work. In March 1735 the ban was formally taken off him, and he was at liberty to return to Paris, a liberty of which he availed himself sparingly.

At Cirey he wrote indefatigably and did not neglect business. The principal literary results of his early years here were the *Discours en vers sur l'homme*, the play of *Alzire* and *L'Enfant prodigue* (1736), and a long treatise on the Newtonian system which he and Madame du Châtelet wrote together. But, as usual, Voltaire's extraordinary literary industry was shown rather in a vast amount of fugitive writings than in substantive works, though for the whole space of his Cirey residence he was engaged in writing, adding to, and altering the *Pucelle*. In the very first days of his sojourn he had written a pamphlet with the imposing title of *Treatise on Metaphysics*. Of metaphysics proper Voltaire neither then nor at any other time understood anything, and the subject, like every other, merely served him as a pretext for laughing at religion with the usual reservation of a tolerably affirmative deism. In March 1736 he received his first letter from Frederick of Prussia, then crown prince only. He was soon again in trouble, this time for the poem of *Le Mondain*, and he at once crossed the frontier and then made for Brussels. He spent about three months in the Low Countries, and in March 1737 returned to Cirey, and continued writing, making experiments in physics (he had at this time a large laboratory), and busying himself with iron-founding, the chief industry of the district. The best-known accounts of Cirey life, those of Madame de Grafigny, date from the winter of 1738–39; they are somewhat spiteful but very amusing, depicting the frequent quarrels between Madame du Châtelet and Voltaire, his intense suffering under criticism, his constant dread of the surreptitious publication of the *Pucelle* (which nevertheless he could not keep his hands from writing or his tongue from reciting to his visitors), and so forth. The chief and most galling of his critics at this time was the Abbé Desfontaines, and the chief of Desfontaines's attacks was entitled *La Voltairomanie*, in reply to a libel of Voltaire's called *Le Préservatif*. Both combatants had, according to the absurd habit of the time, to disown their works, Desfontaines's disavowal being formal and procured by the exertion of all Voltaire's own influence both at home and abroad. For he had as little notion of tolerance towards others as of dignity in himself. In April 1739 a journey was made to Brussels, to Paris, and then again to Brussels, which was the headquarters for a considerable time, owing to some law affairs, of the Du Châtelets. Frederick, now king of Prussia, made not a few efforts to get Voltaire away from Madame du Châtelet, but unsuccessfully, and the king earned the lady's cordial hatred by persistently refusing or omitting to invite her. At last, in September 1740, master and pupil met for the first time at Cleves, an interview followed three months later by a longer visit. Brussels was again the headquarters in 1741, by which time Voltaire had finished the best and the second or third best of his plays, *Mérope* and *Mahomet*. *Mahomet* was played first at Lille in that year; it did not appear in Paris till August next year, and *Mérope* not till 1743. This last was, and deserved to be, the most successful of its author's whole theatre. It was in this same year that he received the singular diplomatic mission to Frederick which nobody seems to have taken seriously, and after his return the oscillation between Brussels, Cirey and Paris was resumed. During these years much of the *Essai sur les mœurs* and the *Siècle de Louis XIV*. was composed. He also returned, not too well-advisedly, to the business of courtiership, which he had given up since the death of the regent. He was much employed, owing to Richelieu's influence, in the fêtes of the dauphin's marriage, and was rewarded through the influence of Madame de Pompadour on New Year's Day 1745 by the appointment to the post of historiographer-royal, once jointly held by Racine and Boileau. The situation itself and its accompanying privileges were what Voltaire chiefly aimed at, but there was a salary of two thousand livres attached, and he had the year before come in for three times as much by the death of his brother. In the same year he wrote a poem on Fontenoy, he received medals from the pope and dedicated *Mahomet* to him, and he wrote court *divertissements* and other things to admiration. But he was not a thoroughly skilful courtier, and one of the best known of Voltairiana is the contempt or at least silence with which Louis XV.—a sensualist but no fool—received the maladroit and almost insolent inquiry *Trajan est-il content?* addressed in his hearing to Richelieu at the close of a piece in which the emperor had appeared with a transparent reference to the king. All this assentation had at least one effect. He, who had been for years admittedly the first writer in France, had been repeatedly passed over in elections to the Academy. He was at last elected in the spring of 1746, and received on the 9th of May. Then the tide began to turn. His favour at court had naturally exasperated his enemies; it had not secured him any real friends, and even a gentlemanship of the chamber was no solid benefit, except from the money point of view. He did not indeed hold it very long, but was permitted to sell it for a large sum, retaining the rank and privileges. He had various proofs of the instability of his hold on the king during 1747 and in 1748. He once lay in hiding for two months with the duchesse du Maine at Sceaux, where were produced the comedietta of *La Prude* and the tragedy of *Rome sauvée*, and afterwards for a time lived chiefly at Lunéville; here Madame du Châtelet had established herself at the court of King Stanislaus, and carried on a liaison with Saint-Lambert, an officer in the king's guard. In September 1749 she died after the birth of a child.

The death of Madame du Châtelet is another turning-point in the history of Voltaire. He was fifty-five, but he had nearly thirty years more to live, and he had learnt much during what may be called his Cirey cohabitation. For some time, however, after Madame du Châtelet's death he was in a state of pitiable unsettlement. At first, after removing his goods from Cirey, he hired the greater part of the Châtelet town house, and then the whole. He had some idea of settling down in Paris, and might perhaps have done so if mischief had not been the very breath of his nostrils. He went on writing satiric tales like *Zadig*. He engaged in a foolish and undignified struggle with Crébillon *père* (not *fils*), a rival set up against him by Madame de Pompadour, but a dramatist who, in part of one play, *Rhadamiste et Zénobie*, has struck a note of tragedy in the grand Cornelian strain, which Voltaire could never hope to echo. *Semirame* (1748), *Oreste* (1750) and *Rome sauvée* itself were all products of this rivalry. He used the most extraordinary efforts to make himself more popular than he was, but he could not help being uncomfortable.

All this time Frederick of Prussia had been continuing his invitations. Voltaire left Paris on the 15th of June 1751, and reached Berlin on the 10th of July. This Berlin visit is more or less familiar to English readers from the two great essays of Macaulay and Carlyle as well as from the *Frederick* of the latter. But these two masters of English were not perhaps the best qualified to relate the story. Both were unjust to Voltaire, and Macaulay was unjust to Frederick as well. It is certain that at first the king behaved altogether like a king to his guest. He pressed him to remain; he gave him (the words are Voltaire's own) one of his orders, twenty thousand francs a year, and four thousand additional for his niece, Madame Denis, in case she would come and keep house for her uncle. But Voltaire's conduct was from the first Voltairian. He insisted on the consent of his own king, which was given without delay. But Frenchmen, always touchy on such a point, regarded Voltaire as something of a deserter; and it was not long before he bitterly repented his desertion, though his residence in Prussia lasted nearly three years. It was quite impossible that Voltaire and Frederick should get on together for long. Voltaire was not humble enough to be a mere butt, as many of Frederick's led poets were; he was not enough of a gentleman to hold his own place with dignity and discretion; he was constantly jealous both of his equals in age and reputation, such as Maupertuis, and of his juniors and inferiors, such as Baculard D'Arnaud. He was greedy, restless, and in a way Bohemian. Frederick, though his love of teasing for teasing's sake has been exaggerated by Macaulay, was a martinet of the first water, had a sharp though one-sided idea of justice, and had not the slightest intention of allowing Voltaire to insult or to tyrannize over his other guests and servants. If he is to be blamed in this particular matter, the blame must be chiefly confined to his imprudence in inviting Voltaire at the beginning and to the brutality of his conduct at the end. Within Voltaire there was always a mischievous and ill-behaved child; and he was never more mischievous, more ill-behaved and more childish than in these years. He tried to get D'Arnaud exiled, and succeeded. He got into a quite unnecessary quarrel with Lessing. He had not been in the country six months before he engaged in a discreditable piece of financial gambling with Hirsch, the Dresden Jew. He was accused of something like downright forgery—that is to say, of altering a paper signed by Hirsch after he had signed it. The king's disgust at this affair (which came to an open scandal before the tribunals) was so great that he was on the point of ordering Voltaire out of Prussia, and Darget the secretary had no small trouble in arranging the matter (February 1751). Then it was Voltaire's turn to be disgusted with an occupation he had undertaken himself—the occupation of "buckwashing" the king's French verses. However, he succeeded in finishing and printing the *Siècle de Louis XIV.*, while the *Dictionnaire philosophique* is said to have been devised and begun at Potsdam. But Voltaire's restless temper was brewing up for another storm. In the early autumn of 1751 La Mettrie, one of the king's parasites, and a man of much more talent than is generally allowed, horrified Voltaire by telling him that Frederick had in conversation applied to him (Voltaire) a proverb about "sucking the orange and flinging away its skin," and about the same time the dispute with Maupertuis, which had more than anything else to do with his exclusion from Prussia, came to a head. Maupertuis got into a dispute with one König. The king took his president's part; Voltaire took König's. But Maupertuis must needs write his *Letters*, and thereupon (1752) appeared one of Voltaire's most famous, though perhaps not one of his most read works, the *Diatribe du Docteur Akakia*. Even Voltaire did not venture to publish this lampoon on a great official of a prince so touchy as the king of Prussia without some permission, and if all tales are true he obtained this by another piece of something like forgery—getting the king to endorse a totally different pamphlet on its last leaf, and affixing that last leaf to *Akakia*. Of this Frederick was not aware; but he did get some wind of the *Diatribe* itself, sent for the author, heard it read to his own great amusement, and either actually burned the MS. or believed that it was burnt. In a few days printed copies appeared. Frederick did not like disobedience, but he still less liked being made a fool of, and he put Voltaire under arrest. But again the affair blew over, the king believing that the edition of *Akakia* confiscated in Prussia was the only one. Alas! Voltaire had sent copies away; others had been printed abroad; and the thing was irrecoverable. It could not be proved that he had ordered the printing, and all Frederick could do was to have the pamphlet burnt by the hangman. Things were now drawing to a crisis. One day Voltaire sent his orders, &c., back; the next Frederick returned them, but Voltaire had quite made up his mind to fly. A kind of reconciliation occurred in March, and after some days of good-fellowship Voltaire at last obtained the long-sought leave of absence and left Potsdam on the 26th of the month (1753). It was nearly three months afterwards that the famous, ludicrous and brutal arrest was made at Frankfort, on the persons of himself and his niece, who had met him meanwhile. There was some faint excuse for Frederick's wrath. In the first place, the poet chose to linger at Leipzig. In the second place, in direct disregard of a promise given to Frederick, a supplement to *Akakia* appeared, more offensive than the main text. From Leipzig, after a month's stay, Voltaire moved to Gotha. Once more, on the 25th of May, he moved on to Frankfort. Frankfort, nominally a free city, but with a Prussian resident who did very much what he pleased, was not like Gotha and Leipzig. An excuse was provided in the fact that the poet had a copy of some unpublished poems of Frederick's, and as soon as Voltaire arrived hands were laid on him, at first with courtesy enough. The resident, Freytag, was not a very wise person (though he probably did not, as Voltaire would have it, spell "poésie" "poéshie"); constant references to Frederick were necessary; and the affair was prolonged so that Madame Denis had time to join her uncle. At last Voltaire tried to steal away. He was followed, arrested, his niece seized separately, and sent to join him in custody; and the two, with the secretary Collini, were kept close prisoners at an inn called the Goat. This situation was at last put an end to by the city authorities, who probably felt that they were not playing a very creditable part. Voltaire left Frankfort on the 7th of July, travelled safely to Mainz, and thence to Mannheim, Strassburg and Colmar. The last-named place he reached (after a leisurely journey and many honours at the little courts just mentioned) at the beginning of October, and here he proposed to stay the winter, finish his *Annals of the Empire* and look about him.

Voltaire's second stage was now over. Even now, however, in his sixtieth year, it required some more external pressure to induce him to make himself independent. He had been, in the first blush of his Frankfort disaster, refused, or at least not granted, permission even to enter France proper. At Colmar he was not safe, especially when in January 1754 a pirated edition of the *Essai sur les mœurs*, written long before, appeared. Permission to establish himself in France was now absolutely refused. Nor did an extremely offensive performance of Voltaire's—the solemn partaking of the Eucharist at Colmar after due confession—at all mollify his enemies. His exclusion from France, however, was chiefly metaphorical, and really meant exclusion from Paris and its neighbourhood. In the summer he went to Plombières, and after returning to Colmar for some time journeyed in the beginning of winter to Lyons, and thence in the middle of December to Geneva. Voltaire had no purpose of remaining in the city, and almost immediately bought a country house just outside the gates, to which he gave the name of Les Délices. He was here practically at the meeting-point of four distinct jurisdictions—Geneva, the canton Vaud, Sardinia and France, while other cantons were within easy reach; and he bought other houses dotted about these territories, so as never to be without a refuge close at hand in case of sudden storms. At Les Délices he set up a considerable establishment, which his great wealth made him able easily to afford. He kept open house for visitors; he had printers close at hand in Geneva; he fitted up a private theatre in which he could enjoy what was perhaps the greatest pleasure of his whole life—acting in a play of his own, stage-managed by himself. His residence at Geneva brought him into correspondence (at first quite amicable) with the most famous of her citizens, J. J. Rousseau. His *Orphelin de la Chine*, performed at Paris in 1755, was very well received; the notorious *La Pucelle* appeared in the same year. The earthquake at Lisbon, which appalled other people, gave Voltaire an excellent opportunity for ridiculing the beliefs of the orthodox, first in verse (1756) and later in the (from a literary point of view) unsurpassable tale of *Candide* (1759). All was, however, not yet quite smooth with him. Geneva had a law expressly forbidding theatrical performances in any circumstances whatever. Voltaire had infringed this law already as far as private performances went, and he had thought of building a regular theatre, not indeed at Geneva but at Lausanne. In July 1755 a very polite and, as far as Voltaire was concerned, indirect resolution of the Consistory declared that in consequence of these proceedings of the Sieur de Voltaire the pastors should notify their flocks to abstain, and that the chief syndic should be informed of the Consistory's perfect confidence that the edicts would be carried out. Voltaire obeyed this hint as far as Les Délices was concerned, and consoled himself by having the performances in his Lausanne house. But he never was the man to take opposition to his wishes either quietly or without retaliation. He undoubtedly instigated D'Alembert to include a censure of the prohibition in his *Encyclopédie* article on "Geneva," a proceeding which provoked Rousseau's celebrated *Lettre à D'Alembert sur les spectacles*. As for himself, he looked about for a place where he could combine the social liberty of France with the political liberty of Geneva, and he found one.

At the end of 1758 he bought the considerable property of Ferney, on the shore of the lake, about four miles from Geneva, and on French soil. At Les Délices (which he sold in 1765) he had become a householder on no small scale; at Ferney (which he increased by other purchases and leases) he became a complete country gentleman, and was henceforward known to all Europe as squire of Ferney. Many of the most celebrated men of Europe visited him there, and large parts of his usual biographies are composed of extracts from their accounts of Ferney. His new occupations by no means quenched his literary activity. He did not make himself a slave to his visitors, but reserved much time for work and for his immense correspondence, which had for a long time once more included Frederick, the two getting on very well when they were not in contact. Above all, he now, being comparatively secure in position, engaged much more strongly in public controversies, and resorted less to his old labyrinthine tricks of disavowal, garbled publication and private libel. The suppression of the *Encyclopédie*, to which he had been a considerable contributor, and whose conductors were his intimate friends, drew from him a shower of lampoons directed now at "l'infâme" (see *infra*) generally, now at literary victims, such as Le Franc de Pompignan (who had written one piece of verse so much better than anything serious of Voltaire's that he could not be forgiven), or Palissot (who in his play *Les Philosophes* had boldly gibbeted most of the persons so termed, but had not included Voltaire), now at Fréron, an excellent critic and a dangerous writer, who had attacked Voltaire from the conservative side, and at whom the patriarch of Ferney, as he now began to be called, levelled in return the very inferior farce-lampoon of *L'Écossaise*, of the first night of which Fréron himself did an admirably humorous criticism.

How he built a church and got into trouble in so doing at Ferney, how he put "Deo erexit Voltaire" on it (1760–61) and obtained a relic from the pope for his new building, how he entertained a grand-niece of Corneille, and for her benefit wrote his well-known "commentary" on that poet, are matters of interest, but to be passed over briefly. Here, too, he began that series of interferences on behalf of the oppressed and the ill-treated which, whatever mixture of motives may have prompted it, is an honour to his memory. Volumes and almost libraries have been written on the Calas affair, and we can but refer here to the only less famous cases of Sirven (very similar to that of Calas, though no judicial murder was actually committed), Espinasse (who had been sentenced to the galleys for harbouring a Protestant minister), Lally (the son of the unjustly treated but not blameless Irish-French commander in India), D'Étalonde (the companion of La Barre), Montbailli and others. In 1768 he entered into controversy with the bishop of the diocese; he had differences with the superior landlord of part of his estate, the president De Brosses; and he engaged in a long and tedious return match with the republic of Geneva. But the general events of this Ferney life are somewhat of that happy kind which are no events.

In this way Voltaire, who had been an old man when he established himself at Ferney, became a very old one almost without noticing it. The death of Louis XV. and the accession of Louis XVI. excited even in his aged breast the hope of re-entering Paris, but he did not at once receive any encouragement, despite the reforming ministry of Turgot. A much more solid gain to his happiness was the adoption, or practical adoption, in 1776 of Reine Philiberte de Varicourt, a young girl of noble but poor family, whom Voltaire rescued from the convent, installed in his house as an adopted daughter, and married to the marquis de Villette. Her pet name was "Belle et Bonne," and nobody had more to do with the happiness of the last years of the "patriarch" than she had. It is doubtful whether his last and fatal visit to Paris was due to his own wish or to the instigation of his niece, Madame Denis; but this lady—a woman of disagreeable temper, especially to her inferiors—appears to have been rather hardly treated by Voltaire's earlier, and sometimes by his later, biographers. The suggestion which has been made that the success of Beaumarchais piqued him has nothing impossible in it. At any rate he had, at the end of 1777 and the beginning of 1778, been carefully finishing a new tragedy—*Irène*—for production in the capital. He started on the 5th of February, and five days later arrived at the city which he had not seen for eight-and-twenty years.

He was received with immense rejoicings, not indeed directly by the court, but by the Academy, by society and by all the more important foreign visitors. About a fortnight after his arrival, age and fatigue made him seriously ill, and a confessor was sent for. But he recovered, scoffed at himself as usual, and prepared more eagerly than ever for the first performance of *Irène*, on the 16th of March. At the end of the month he was able to attend a performance of it, which was a kind of apotheosis. He was crowned with laurel in his box, amid the plaudits of the audience, and did not seem to be the worse for it. He even began or proceeded with another tragedy—*Agathocle*—and attended several Academic meetings. But such proceedings in the case of a man of eighty-four were impossible. To keep himself up, he exceeded even his usual excess in coffee, and about the middle of May he became very ill. On the 30th of May the priests were once more sent for—to wit, his nephew, the abbé Mignot, the abbé Gaultier, who had officiated on the former occasion, and the parish priest, the curé of St Sulpice. He was, however, in a state of half-insensibility, and petulantly motioned them away, dying in the course of the night. The legends about his death in a state of terror and despair are certainly false; but it must be regarded as singular and unfortunate that he, who had more than once gone out of his way to conform ostentatiously and with his tongue in his cheek, should have neglected or missed this last opportunity. The result was a difficulty as to burial, which was compromised by hurried interment at the abbey of Scellières in Champagne, anticipating the interdict of the bishop of the diocese by an hour or two. On the 10th of July 1791 the body was transferred to the Pantheon, but during the Hundred Days it was once more, it is said, disentombed, and stowed away in a piece of waste ground. His heart, taken from the body when it was embalmed, and given to Madame Denis and by her to Madame de Villette, was preserved in a silver case, and when it was proposed (in 1864) to restore it to the other remains, the sarcophagus at Sainte Geneviève (the Pantheon) was opened and found to be empty.

In person Voltaire was not engaging, even as a young man. His extraordinary thinness is commemorated, among other things, by the very poor but well-known epigram attributed to Young, and identifying him at once with "Satan, Death and Sin." In old age he was a mere skeleton, with a long nose and eyes of preternatural brilliancy peering out of his wig. He never seems to have been addicted to any manly sport, and took little exercise. He was sober enough (for his day and society) in eating and drinking generally; but drank coffee, as his contemporary, counterpart and enemy, Johnson, drank tea, in a hardened and inveterate manner. It may be presumed with some certainty that his attentions to women were for the most part platonic; indeed, both on the good and the bad side of him, he was all brain. He appears to have had no great sense of natural beauty, in which point he resembled his generation (though one remarkable story is told of his being deeply affected by Alpine scenery); and, except in his passion for the stage, he does not seem to have cared much for any of the arts. Conversation and literature were, again as in Johnson's case, the sole gods of his idolatry. As for his moral character, the wholly intellectual cast of mind just referred to makes it difficult to judge that. His beliefs or absence of beliefs emancipated him from conventional scruples; and he is not a good subject for those who maintain that a nice morality may exist independently of religion. He was good-natured when not crossed, generous to dependents who made themselves useful to him, and indefatigable in defending the cause of those who were oppressed by the systems with which he was at war. But he was inordinately vain, and totally unscrupulous in gaining money, in attacking an enemy, or in protecting himself when he was threatened with danger. His peculiar fashion of attacking the popular beliefs of his time has also failed to secure the approval of some who had very little sympathy with those beliefs. The only excuse made for the alternate cringing and insult, the alternate abuse and lying, which marked his course in this matter, has been the very weak plea that a man cannot fight with a system—a plea which is sufficiently answered by the retort that a great many men have so fought and have won. Voltaire's works, and especially his private letters, constantly contain the word "l'infâme" and the expression (in full or abbreviated) "écrasez l'infâme." This has been misunderstood in many ways—the mistake going so far as in some cases to suppose that Voltaire meant Christ by this opprobrious expression. No careful and competent student of his works has ever failed to correct this gross misapprehension. "L'infâme" is not God; it is not Christ; it is not Christianity; it is not even Catholicism. Its briefest equivalent may be given as "persecuting and privileged orthodoxy" in general, and, more particularly, it is the particular system which Voltaire saw around him, of which he had felt the effects in his own exiles and the confiscations of his books, and of which he saw the still worse effects in the hideous sufferings of Calas and La Barre.

Vast and various as the work of Voltaire is, its vastness and variety are of the essence of its writer's peculiar quality. The divisions of it have long been recognized, and may be treated regularly.

The first of these divisions in order, not the least in bulk, and, though not the first in merit, inferior to none in the amount of congenial labour spent on it, is the *theatre*. Between fifty and sixty different pieces (including a few which exist only in fragments or sketches) are included in his writings, and they cover his literary life. It is at first sight remarkable that Voltaire, whose comic power was undoubtedly far in excess of his tragic, should have written many tragedies of no small excellence in their way, but only one fair second-class comedy, *Nanine*. His other efforts in this latter direction are either slight and almost insignificant in scope, or, as in the case of the somewhat famous *Écossaise*, deriving all their interest from being personal libels. His tragedies, on the other hand, are works of extraordinary merit in their own way. Although Voltaire had neither the perfect versification of Racine nor the noble poetry of Corneille, he surpassed the latter certainly, and the former in the opinion of some not incompetent judges, in playing the difficult and artificial game of the French tragedy. *Zaïre*, among those where love is admitted as a principal motive, and *Mérope*, among those where this motive is excluded and kept in subordination, yield to no plays of their classe in such interest as is possible on the model, in stage effect and in uniform literary merit. Voltaire knew that the public opinion of his time reserved its highest prizes for a capable and successful dramatist, and he was determined to win those prizes. He therefore set all his wonderful cleverness to the task, going so far as to adopt a little even of that Romantic disobedience to the strict classical theory which he condemned, and no doubt sincerely, in Shakespeare.

As regards his *poems* proper, of which there are two long ones, the *Henriade* and the *Pucelle*, besides smaller pieces, of which a bare catalogue fills fourteen royal octavo columns, their value is very unequal. The *Henriade* has by universal consent been relegated to the position of a school reading book. Constructed and written in almost slavish imitation of Virgil, employing for medium a very unsuitable vehicle—the Alexandrine couplet (as reformed and rendered monotonous for dramatic purposes)—and animated neither by enthusiasm for the subject nor by real understanding thereof, it could not but be an unsatisfactory performance. The *Pucelle*, if morally inferior, is from a literary point of view of far more value. It is desultory to a degree; it is a base libel on religion and history; it differs from its model *Ariosto* in being, not, as *Ariosto* is, a mixture of romance and burlesque, but a sometimes tedious tissue of burlesque pure and simple; and it is exposed to the objection—often and justly urged—that much of its fun depends simply on the fact that there were and are many people who believe enough in Christianity to make its jokes give pain to them and to make their disgust at such jokes piquant to others. Nevertheless, with all the *Pucelle's* faults, it is amusing. The minor poems are as much above the *Pucelle* as the *Pucelle* is above the *Henriade*. It is true that there is nothing, or hardly anything, that properly deserves the name of poetry in them—no passion, no sense of the beauty of nature, only a narrow "criticism of life," only a conventional and restricted choice of language, a cramped and monotonous prosody, and none of that indefinite suggestion which has been rightly said to be of the poetic essence. But there is immense wit, a wonderful command of such metre and language as the taste of the time allowed to the poet, occasionally a singular if somewhat artificial grace, and a curious felicity of diction and manner.

The third division of Voltaire's works in a rational order consists of his *prose romances* or *tales*. These productions—incomparably the most remarkable and most absolutely good fruit of his genius—were usually composed as pamphlets, with a purpose of polemic in religion, politics, or what not. Thus *Candide* attacks religious and philosophical optimism, *L'Homme aux quarante écus* certain social and political ways of the time, *Zadig* and others the received forms of moral and metaphysical orthodoxy, while some are mere lampoons on the Bible, the unfailing source of Voltaire's wit. But (as always happens in the case of literary work where the form exactly suits the author's genius) the purpose in all the best of them disappears almost entirely. It is in these works more than in any others that the peculiar quality of Voltaire—ironic style without exaggeration—appears. That he learned it partly from Saint Evremond, still more from Anthony Hamilton, partly even from his own enemy Le Sage, is perfectly true, but he gave it perfection and completion. If one especial peculiarity can be singled out, it is the extreme restraint and simplicity of the verbal treatment. Voltaire never dwells too long on this point, stays to laugh at what he has said, elucidates or comments on his own jokes, guffaws over them or exaggerates their form. The famous "pour encourager les autres" (that the shooting of Byng did "encourage the others" very much is not to the point) is a typical example, and indeed the whole of *Candide* shows the style at its perfection.

The fourth division of Voltaire's work, the *historical*, is the bulkiest of all except his correspondence, and some parts of it are or have been among the most read, but it is far from being even among the best. The small treatises on Charles XII. and Peter the Great are indeed models of clear narrative and ingenious if somewhat superficial grasp and arrangement. The so-called *Siècle de Louis XIV.* and *Siècle de Louis XV.* (the latter inferior to the former but still valuable) contain a great miscellany of interesting matter, treated by a man of great acuteness and unsurpassed power of writing, who had also had access to much important private information. But even in these books defects are present, which appear much more strongly in the singular olla podrida entitled *Essai sur les mœurs*, in the *Annales de l'empire* and in the minor historical works. These defects are an almost total absence of any comprehension of what has since been called the philosophy of history, the constant presence of gross prejudice, frequent inaccuracy of detail, and, above all, a complete incapacity to look at anything except from the narrow standpoint of a half-pessimist and half self-satisfied *philosophe* of the 18th century.

His work in *physics* concerns us less than any other here; it is, however, not inconsiderable in bulk, and is said by experts to give proof of aptitude.

To his own age Voltaire was pre-eminently a poet and a philosopher; the unkindness of succeeding ages has sometimes questioned whether he had any title to either name, and especially to the latter. His largest *philosophical* work, at least so called, is the curious medley entitled *Dictionnaire philosophique*, which is compounded of the articles contributed by him to the great *Encyclopédie* and of several minor pieces. No one of Voltaire's works shows his anti-religious or at least anti-ecclesiastical animus more strongly. The various title-words of the several articles are often the merest stalking-horses, under cover of which to shoot at the Bible or the church, the target being now and then shifted to the political institutions of the writer's country. his personal foes, &c., and the whole being largely seasoned with that acute, rather superficial, common-sense, but also commonplace, ethical and social criticism which the 18th century called philosophy. The book ranks perhaps second only to the novels as showing the character, literary and personal, of Voltaire; and despite its form it is nearly as readable. The minor philosophical works are of no very different character. In the brief *Traité de métaphysique* the author makes his grand effort, but scarcely succeeds in doing more than show that he had no real conception of what metaphysic is.

In general *criticism* and *miscellaneous* writing Voltaire is not inferior to himself in any of his other functions. Almost all his more substantive works, whether in verse or prose, are preceded by prefaces of one sort or another, which are models of his own light pungent *causerie*; and in a vast variety of nondescript pamphlets and writings he shows himself a perfect journalist. In literary criticism pure and simple his principal work is the *Commentaire sur Corneille*, though he wrote a good deal more of the same kind—sometimes (as in his *Life* and notices of Molière) independently sometimes as part of his *Siècles*. Nowhere, perhaps, except when he is dealing with religion, are Voltaire's defects felt more than here. He was quite unacquainted with the history of his own language and literature, and more here than anywhere else he showed the extraordinarily limited and conventional spirit which accompanied the revolt of the French 18th century against limits and conventions in theological, ethical and political matters.

There remains only the huge division of his *correspondence*, which is constantly being augmented by fresh discoveries, and which, according to Georges Bengesco, has never been fully or correctly printed, even in some of the parts longest known. In this great mass Voltaire's personality is of course best shown, and perhaps his literary qualities not worst. His immense energy and versatility, his adroit and unhesitating flattery when he chose to flatter, his ruthless sarcasm when he chose to be sarcastic, his rather unscrupulous business faculty, his more than rather unscrupulous resolve to double and twist in any fashion so as to escape his enemies, —all these things appear throughout the whole mass of letters.

Most judgments of Voltaire have been unduly coloured by sympathy with or dislike of what may be briefly called his polemical side. When sympathy and dislike are both discarded or allowed for, he remains one of the most astonishing, if not exactly one of the most admirable, figures of letters. That he never, as Carlyle complains, gave utterance to one great thought is strictly true. That his characteristic is for the most part an almost superhuman cleverness rather than positive genius is also true. But that he was merely a mocker, which Carlyle and others have also said, is not strictly true or fair. In politics proper he seems indeed to have had few or no constructive ideas, and to have been entirely ignorant or quite reckless of the fact that his attacks were destroying a state of things for which as a whole he neither had nor apparently wished to have any substitute. In religion he protested stoutly, and no doubt sincerely, that his own attitude was not purely negative; but here also he seems to have failed altogether to distinguish between pruning and cutting down. Both here and elsewhere his great fault was an inveterate superficiality. But this superficiality was accompanied by such wonderful acuteness within a certain range, by such an absolutely unsurpassed literary aptitude and sense of style in all the lighter and some of the graver modes of literature, by such untiring energy and versatility in enterprise, that he has no parallel among ready writers anywhere. Not the most elaborate work of Voltaire is of much value for matter; but not the very slightest work of Voltaire is devoid of value in form. In literary craftsmanship, at once versatile and accomplished, he has no superior and scarcely a rival.

BIBLIOGRAPHY.—The bibliography of Voltaire is a very large subject, and it has been the special occupation of a Rumanian diplomatist of much erudition and judgment, Georges Bengesco, *Bibliographie de Voltaire* (4 vols., Paris, 1882–90). The best edition of the works is that by Louis Moland in 52 volumes (Paris, Garnier); the handiest and most compact is that issued in 13 volumes royal octavo by Furne, and kept in print by the house of Didot. Of the earlier editions, though their bulk is an objection, several are interesting and valuable. Especially may be noticed the so-called edition of Kehl, in which Voltaire himself, and later Beaumarchais, were concerned (70 vols., 1785–89); those of Dalibon and Baudouin, each in 97 volumes (from which "the hundred volumes of Voltaire" have become a not infrequent figure of speech); and the excellent edition of Beuchot (1829) in 72 volumes. Editions of separate or selected works are innumerable, and so are books upon Voltaire. There is no really good detailed life of him, with complete examination of his work, in any language, though the works containing materials for such are numerous (the first of importance being that of T. J. Duvernet in 1797), and sometimes (especially in the case of M. Desnoiresterres, *Voltaire et la société française*, 1867 and others) excellent. In English the essays of Carlyle and Viscount Morley (1872) are both in their way invaluable, and to a great extent correct one another. The principal detailed life in English is that of an American writer, James Parton (1881), which gives the facts with very considerable detail and fair accuracy, but with little power of criticism. That of Mr S. G. Tallentyre (London, 1903, 2 vols.) is gossiping and popular. Francis Espinasse's *Voltaire* (1882), which contains a useful bibliography, J. Churton Collins's *Voltaire in England* (1886), and J. R. Lounsbury's *Shakespeare and Voltaire* (1902) may also be specified. (G. SA.)

VOLTERRA (anc. *Volaterrae*), a town and episcopal see of Tuscany, Italy, in the province of Pisa, from which it is 51 m. by rail S.E., and 35 by road W.N.W. from Siena. Pop. (1901) 5522 (town); 14,207 (commune). It stands on a commanding olive-clad eminence 1785 ft. above sea-level, with a magnificent view over mountains and sea (the latter some 20 m. distant), and is surrounded by the massive remains of its ancient walls of large, roughly-rectangular blocks of stone, some 4½ m. in circuit, enclosing an area which must have been larger than was actually needed for habitation. Tombs of the pre-Etruscan or Villanova period have been found within its circuit, but only at the north-west extremity near S. Giusto. Here the clay of which the hill is formed is gradually giving way, causing landslips and the collapse of buildings, notably of the abbey church of S. Salvatore (1030). The medieval town occupies only the southern portion of this area. The most important relic of its Etruscan period is the Porta dell' Arco, an archway of dark greystone, about 20 ft. high, the corbels of which are adorned with almost obliterated heads, probably representing the guardian deities of the city. There are remains of baths and a cistern of Roman date. Volterra preserves its medieval character, having suffered little modification since the 16th century. The town contains many picturesque medieval towers and houses. The Palazzo dei Priori (1208–54), now the municipal palace, is especially fine, and the piazza in which it stands most picturesque. The museum contains a very valuable collection of Etruscan antiquities, especially cinerary urns from the ancient tombs N. and E. of the town. The urns themselves are of alabaster, with the figure of the deceased on the lid, and reliefs from Greek myths on the front. They belong to the 3rd–2nd centuries B.C. A tomb outside the town of the 6th century B.C., discovered in 1898, consisted of a round underground chamber, roofed with gradually projecting slabs of stone. The roof was supported in the centre by a massive square pillar (E. Petersen in *Römische Mitteilungen*, 1898, 409; cf. id. ibid., 1904, 244 for a similar one near Florence). There are also in the museum Romanesque sculptures from the old church of S. Giusto, &c. The cathedral, consecrated in 1120 (?), but enlarged and adorned by Niccolo Pisano (?) in 1254, has a fine pulpit of that period, and on the high altar are sculptures by Mino da Fiesole; it contains several good pictures—the best is an "Annunciation" by Luca Signorelli. The sacristy has fine carvings. The baptistery belongs to the 13th century; the font is by Andrea Sansovino, and the ciborium by Mino da Fiesole. Both these buildings are in black and white marble. S. Francesco has frescoes of 1410, and S. Girolamo terra-cottas and pictures. The citadel, now a house of correction, consists of two portions, the Rocca Vecchia, built in 1343 by Walter de Brienne, duke of Athens, and the Rocca Nuova, built by the Florentines (1472). The inhabitants are chiefly employed in the manufacture of vases and other ornaments from alabaster, of good quality, found in the vicinity. There are also in the neighbourhood rock-salt works and mines, as well as boracic acid works. This acid is exhaled in volcanic gas, which is passed through water tanks. The acid is deposited in the water and afterwards evaporated. It is sent to England, and used largely in the manufacture of pottery glaze.

Volaterrae (Etruscan *Velathri*) was one of the most powerful of the twelve confederate cities of Etruria. During the war between Marius and Sulla it withstood the latter's troops for two years in

82–80 B.C. As a result of its resistance Sulla carried a law for the confiscation of the land of those inhabitants of Volaterrae who had had the privileges of Roman citizenship. This, however, does not seem to have been carried out until Caesar as dictator divided some of the territory of Volaterrae among his veterans. Among its noble families the chief was that of the Caecinae, who took their name from the river which runs close to Volaterrae and still retains the name Cecina. Cicero defended one of its members in an extant speech. It is included by Pliny among the municipal towns of Etruria. In the 12th and 13th centuries it enjoyed free institutions; in 1361 it fell under the power of Florence. It rebelled, but was retaken and pillaged in 1472. Persius the satirist and the painter Daniele da Volterra were both natives of the town. Several works of the latter are preserved there.

See C. Ricci, *Volterra* (Bergamo, 1905); E. Bormann in *Corp. Inscr. Latin.* xi. (Berlin, 1888), p. 324; G. Dennis, *Cities and Cemeteries of Etruria* (London, 1883), ii. 136. (T. As.)

VOLTMETER, an instrument for measuring difference of electric potential (see ELECTROSTATICS) in terms of the unit called a volt. The volt (so called after A. Volta) is defined to be difference of potential which acting between the terminals of a resistance of one ohm sends through it a continuous current of one ampere. A voltmeter is therefore one form of electrometer (*q.v.*), but the term is generally employed to describe the instrument which indicates on a scale, not merely in arbitrary units but directly in volts, the potential difference of its terminals. Voltmeters may be divided into two classes, (*a*) electrostatic, (*b*) electrokinetic.

Electrostatic voltmeters are based on the principle that when two conductors are at different potentials they attract one another with a force which varies as the square of the potential difference (P. D.) between them. This mechanical stress may be made the measure of the P. D. between them, if one of the conductors is fixed while the other is movable, this last being subject to a constraint due to a spring or to gravity, means being also provided for measuring either the displacement of the movable conductor against the constraint or the force required to hold it in a fixed position relatively to the fixed conductor. One large class of electrostatic voltmeters consists of a fixed metal plate or plates and a movable plate or plates, the two sets of plates forming a condenser (see LEYDEN JAR). The movable system is suspended or pivoted, and when a P. D. is created between the fixed and movable plates, the latter are drawn into a new position which is resisted by the torque of a wire or by the force due to a weight. Utilizing this principle many inventors have devised forms of electrostatic voltmeter. One of the best known of these is Lord Kelvin's multicellular voltmeter. In this instrument (fig. 1) there are two sets of fixed metal plates, connected together and having a quadrantal shape, that is, approximately the shape of a quarter of a circular disk. In the space between them is suspended a "needle" which consists of a light aluminium axis, to which are affixed a number of paddle-shaped aluminium blades. This needle is suspended by a fine platinum silver wire, and its normal position is such that the aluminium paddle blades are just outside the quadrantal-shaped plates. If the needle is connected to one terminal of a circuit, and the fixed plates or cells to the other member of the circuit, and a difference of potential is created between them, then the movable needle is drawn in so that the aluminium blades are more included between the fixed plates. This movement is resisted by the torsional elasticity of the suspending wire, and hence a fixed indicating needle attached to the movable system can be made to indicate directly on a scale the difference of potential between the terminals of the instrument in volts. Instruments of this kind have been constructed not only by Lord Kelvin, but also by W. E. Ayrton and others, for measuring voltages from 10,000 volts down to 1 volt. In other types of electrostatic instruments the movable system rotates round a horizontal axis or rests upon knife edges like a scale beam; in others again the movable system is suspended by a wire. In the former case the *control* is generally due to gravity, the plates being so balanced on the knife edge that they tend to take up a certain fixed position from which they are constrained when the electric forces come into play, their displacement relatively to the fixed plates being shown on a scale and thus indicating the P. D. between them. In the case of high tension voltmeters, the movable plate takes the form of a single plate of paddle shape, and for extra high tensions it may simply be suspended from the end of a balanced arm; or the movable system may take the form of a cylinder which is suspended within, but not touching, another fixed cylinder, the relative position being such that the electric forces draw the suspended cylinder more into the fixed one. Electrostatic voltmeters are now almost entirely used for the measurement of high voltages from 2000 to 50,000 volts employed in electrotechnics. For such purposes the whole of the working parts are contained in a metal case, the indicating needle moving over a divided scale which is calibrated to show directly the potential difference in volts of the terminals of the instrument. One much-used electrostatic voltmeter of this type is the Kelvin multicellular vertical pattern voltmeter (fig. 2). For use at the switch-boards of electric supply stations the instrument takes another form known as the "edge-wise" pattern.

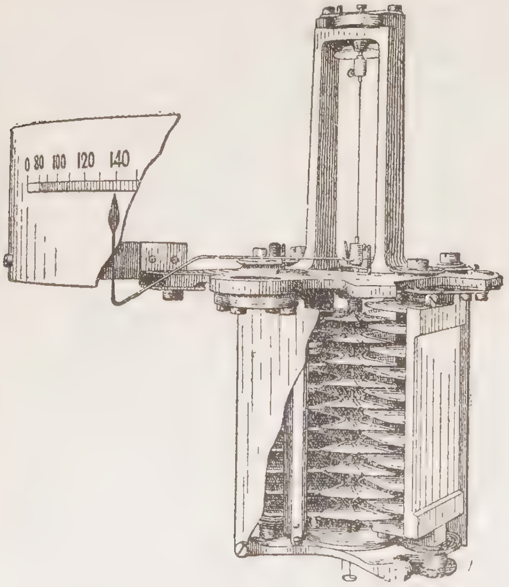

FIG. 1.—Lord Kelvin's Multicellular Electrostatic Voltmeter.

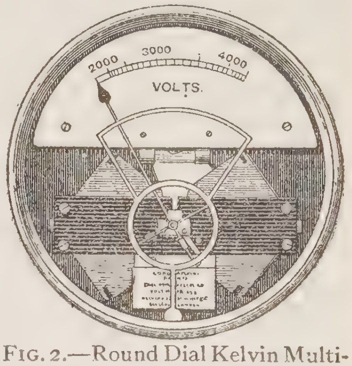

FIG. 2.—Round Dial Kelvin Multicellular Electrostatic Voltmeter, 5-in. scale. For high pressure.

Another class of voltmeters comprises the *electrokinetic voltmeters*. In these instruments the potential difference between two points is measured by the electric current produced in a wire connecting to two points. In any case of potential difference measurement it is essential not to disturb the potential difference being measured; hence it follows that in electrokinetic voltmeters the wire connecting the two points of which the potential difference is to be measured must be of very high resistance. The instrument then simply becomes an ammeter of high resistance, and may take any of the forms of practically used ammeters (see AMPEREMETER). Electromagnetic voltmeters may therefore be *thermal*, *electromagnetic* or *electrodynamic*.

As a rule, electromagnetic voltmeters are only suitable for the measurement of relatively small potentials—0 to 200 or 300 volts. Numerous forms of hot-wire or thermal voltmeter have been devised. In that known as the Cardew voltmeter, a fine platinum-silver wire, having a resistance of about 300 ohms, is stretched in a tube or upon a frame contained in a tube. This frame or tube is so constructed of iron and brass (one-third iron and two-thirds brass) that its temperature coefficient of linear expansion is the same as that of the platinum-silver alloy. The fine wire is fixed to one end of the tube or frame by an insulated support and the other end is attached to a motion-multiplying gear. As the frame has the same linear expansion as the wire, external changes of the temperature will not affect their relative length, but if the fine wire is heated by the passage of an electric current, its expansion will move the indicating needle over the scale, the motion being multiplied by the gear. In the Hartmann and Braun form of hot-wire voltmeter, the fine wire is fixed between two supports and the expansion produced when a current is passed through it causes the wire to sag down, the sag being multiplied by a gear and made to move an indicating needle over a scale. In this case, the actual working wire, being short, must be placed in series with an additional high resistance. Hot wire voltmeters, like electrostatic voltmeters, are suitable for use with alternating currents of any frequency as well as with continuous currents, since their indications depend upon the heating power of the current, which is proportional to the square of the current and therefore to the square of the difference of potential between the terminals.

Electromagnetic voltmeters consist of a coil of fine wire connected to the terminals of the instrument, and the current produced in that wire by a difference of potential between the terminals creates a magnetic field proportional at any point to the strength of the current. This magnetic field may be made to cause a displacement in a small piece of soft iron, as in the case of the corresponding ammeters, and this in turn may be made to displace an indicating needle over a scale so that corresponding to every given potential difference between the terminals of the instrument there is a corresponding fixed position of the needle on the scale. One of the most useful forms of electromagnetic voltmeter is that generally known as a *movable coil* voltmeter (fig. 3). In this instrument there is a fixed permanent magnet, producing a constant magnetic field, and in the interspace between the poles is fixed a delicately pivoted coil of wire carried in jewelled bearings. The normal position of this coil is with its plane parallel to the lines of force of the field. The current is got in and out of the movable coil by means of fine flexible wires. The movable coil has attached to it an index needle moving over a scale, and a fixed coil of high-resistance wire is included in series with the movable coil between the terminals of the instrument. When a difference of potential is made between the terminals, a current passes through the movable coil, which then tends to place itself with its plane more at right angles to the lines of force of the field. This motion is resisted by the torsion of a spiral spring resembling the hair-spring of a watch having one end fixed to the coil axis, and there is therefore a definite position of the needle on the scale corresponding to each potential difference between the terminals, provided it is within the range of the control. These instruments are only adapted for the measurement of continuous potential difference, that is to say, unidirectional potential difference, but not for alternating voltages. Like the corresponding ammeters, they have the great advantage that the scales are equidivisional and that there is no dead part in the scale, whereas both the electrostatic and electrothermal voltmeters, above described, labour under the disadvantage that the scale divisions are not equal but increase with rise of voltages, hence there is generally a portion of the scale near the zero point where the divisions are so close as to be useless for reading purposes and are therefore omitted. For the measurement of voltages in continuous current generating stations, movable coil voltmeters are much employed, generally constructed then in the "edgewise" pattern (fig. 4).

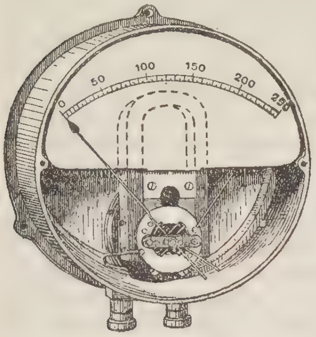

Fig. 3.—Round Dial Voltmeter of Kelvin Siphon Recorder, dead beat moving coil type, with front removed.

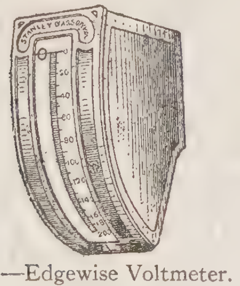

Fig. 4.—Edgewise Voltmeter. Stanley D'Arsonval type.

Electrodynamic Voltmeters.—A high-resistance electrodynamometer may be employed as a voltmeter. In this case both the fixed and movable circuits consist of fine wires, and the instrument is constructed and used in a manner similar to the Siemens dynamometer employed for measuring continuous alternating current (see AMPEREMETER). Another much-used method of measuring continuous current voltages or unidirectional potential difference employs the principle of potentiometer (*q.v.*). In this case a high-resistance wire is connected between the points of which the potential difference is required, and from some known fraction of this resistance wires are brought to an electrostatic voltmeter, or to a movable coil electromagnetic voltmeter, according as the voltage to be measured is alternating or continuous. This measurement is applicable to the measurement of high potentials, either alternating or continuous, provided that in the case of alternating currents the high resistance employed is wound non-inductively and an electrostatic voltmeter is used. The high-resistance wire should, moreover, be one having a negligible change of resistance with temperature. For this purpose it must be an alloy such as manganin or constantan. It is always an advantage, if possible, to employ an electrostatic voltmeter for measuring potential difference if it is necessary to keep the voltmeter permanently connected to the two points. Any form of electrokinetic voltmeter which involves the passage of a current through the wire necessitates the expenditure of energy to maintain this current and therefore involves cost of production. This amount may not by any means be an insignificant quantity. Consider, for instance, a hot-wire instrument, such as a Cardew's voltmeter. If the wire has a resistance of 300 ohms and is connected to two points differing in potential by 100 volts, the instrument passes a current of one-third of an ampere and takes up 33 watts in power. Since there are 8760 hours in a year, if such an instrument were connected continuously to the circuit it would take up energy equal to 263,000 watt-hours, or 260 Board of Trade units per annum. If the cost of production of this energy was only one penny per unit, the working expenses of keeping such a voltmeter in connexion with a circuit would therefore be more than £1 per annum, representing a capitalized value of, say, £10. Electrostatic instruments, however, take up no power and hence cost nothing for maintenance other than wear and tear of the instrument.

The qualities required in a good voltmeter are:—(i.) It should be quick in action, that is to say, the needle should come quickly to a position giving immediately the P.D. of the terminals of the instrument. (ii.) The instrument should give the same reading for the same P.D. whether this has been arrived at by increasing from a lower value or decreasing from a larger value; in other words, there should be no instrumental hysteresis. (iii.) The instrument should have no temperature correction; this is a good quality of electrostatic instruments, but in all voltmeters of the electrokinetic type which are wound with copper wire an increase of one degree centigrade in the average temperature of that wire alters the resistance by 0·4%, and therefore to the same extent alters the correctness of the indications. (iv.) It should, if possible, be available both for alternating and continuous currents. (v.) It should be portable and work in any position. (vi.) It should not be disturbed easily by external electric or magnetic fields. This last point is important in connexion with voltmeters used on the switchboards of electric generating stations, where relatively strong electric or magnetic fields may be present, due to strong currents passing through conductors near or on the board. It is therefore always necessary to check the readings of such an instrument *in situ*. Electrostatic voltmeters are also liable to have their indications disturbed by electrification of the glass cover of the instrument; this can be avoided by varnishing the glass with a semi-conducting varnish so as to prevent the location of electrostatic charges on the glass.

See J. A. Fleming, *Handbook for the Electrical Laboratory and Testing-Room* (London, 1903); G. Aspinall Parr, *Electrical Engineering Measuring Instruments* (London, 1903); K. Edgecumbe and F. Punga, "On Direct Reading Measuring Instruments for Switchboard Use," *Journ. Inst. Elec. Eng.* (London, 1904), 33, 620.
(J. A. F.)

VOLTURNO (anc. *Volturnus*, from *volvere*, to roll), a river of central Italy, which rises in the neighbourhood of Alfedena in the central Apennines of Samnium, runs S. as far as Venafro, and then S.E. After a course of some 75 m. it receives, about 5 m. E. of Caiazzo, the Calore, only 3 m. less in length, which runs first N. and then W., and after 37 m. reaches Benevento, near which it receives several tributaries; then curves round the mountain mass to the N. of the Caudine Forks, and so beyond Telese joins the Volturno. The united stream now flows W.S.W. past Capua (anc. *Casilinum*), where the Via Appia and Latina joined just to the N. of the bridge over it, and so through the Campanian plain, with many windings, into the sea. The direct length of the lower course is about 31 m., so that the whole is slightly longer than that of the Liri, and its basin far larger. The river has always had considerable military importance, and the colony of Volturnum (no doubt preceded by an older port of Capua) was founded in 194 B.C. at its mouth on the S. bank by the Romans; it is now about one mile inland. A fort had already been placed there during the Roman siege of Capua, in order, with Puteoli, to serve for the provisioning of the army. Augustus placed a colony of veterans here. The Via Domitiana from Sinuessa to Puteoli crossed the river at this point, and some remains of the bridge are visible. The river was navigable as far as Capua.

On the 1st of October 1860 the Neapolitan forces were defeated on the S. bank of the Volturno, near S. Maria di Capua Vetere, by the Piedmontese and Garibaldi's troops, a defeat which led to the fall of Capua. (T. As.)

VOLUINSKY, ARTEMY PETROVICH (1689–1740), Russian general and statesman, son of Peter Voluinsky, one of the dignitaries at the court of Theodore III., came of an ancient family. He entered a dragoon regiment in 1704 and rose to the rank of captain; then, exchanging the military service for diplomacy, he was attached to the suite of Vice-Chancellor Shafirov. He was present during the campaign of the Pruth, shared Shafirov's captivity in the Seven Towers and in 1715 was sent by Peter the Great to Persia to promote Russian influence there, and if possible to find an outlet to India. In 1718 Peter made him one of his six adjutant-generals, and governor of Astrakhan. In this post Voluinsky displayed distinguished administrative and financial talents. In 1723 he married Alexandra Naruishkina, Peter's cousin. The same year he was accused of peculation and other offences to the emperor, who caned him severely and deprived him of his plenipotentiary powers, despite his undeniable services in Persia, but for which Peter could never have emerged so triumphantly from the difficult Persian war of 1722–23. Catherine I. made Voluinsky governor of Kazan for a short time, and he held the same post for two years (1728–30) under Peter II. But his incurable corruption and unbridled temper so discredited the government that he was deprived of the post shortly after the accession of Anne. From 1730 to 1736 Voluinsky served in the army under Münnich. In 1737 he was appointed the second Russian plenipotentiary at the abortive congress of Nemirov held for the conclusion of peace with the Porte. In 1738 he was introduced into the Russian cabinet by Biren as a counterpoise against Andrei Osterman. Voluinsky, however, now thought himself strong enough to attempt to supersede Biren himself, and openly opposed the favourite in the Council of State in the debates as to the indemnity due to Poland for the violations of her territory during the war of the Polish Succession, Biren advising that a liberal indemnity should be given, whereas Voluinsky objected to any indemnity at all. Biren thereupon forced Anne to order an inquiry into Voluinsky's past career, with the result that he was tried before a tribunal of Biren's creatures and condemned to be broken on the wheel and then beheaded. On the scaffold, "by the clemency of the empress," his punishment was mitigated to the severing of his right hand followed by decapitation. The whole business seems to have been purely a piece of vindictiveness on the part of Biren.

See R. N. Bain, *The Pupils of Peter the Great* (London, 1897); D. A. Korsakov, *From the Lives of Russian Statesmen of the XVIIIth Century* (Rus.) (Kazan, 1891). (R. N. B.)

VOLUNTEERS, a general term for soldiers who are not professionals nor permanently embodied under arms in peace. Although it would be difficult to say when the principle of volunteer organization for national defence was first adopted in England, it is certain that voluntary military societies existed in various parts of the country in the reign of Henry VIII., who in fact granted a charter in 1537 to the "Fraternity or Guylde of Saint George: Maisters and Rulars of the said Science of Artillary as aforesaid rehearsed for long-bowes Cros-bowes and Hand-Gonnes." This ancient corps is now the Honourable Artillery Company of London. Although the Honourable Artillery Company has always been a distinct association, it was at one time (notably during the Great Rebellion) a centre of instruction for the City-trained bands, and in later times the H.A.C., divided into artillery and infantry units, has been assimilated as regards training and obligations to the Volunteer or Territorial Forces. Charters of a similar kind were granted to a Colchester society in 1619 and to one at Bury St Edmunds in 1628. In the 16th and 17th centuries also various temporary corps outside the militia or trained-band organization were called volunteers. At Boston, Massachusetts, there is established a corps bearing the name of the "Antient and Honorable Artillery Company of Massachusetts." This company was formed in 1638 after its London prototype.

The notion of a large organized Volunteer Force, however, seems to have originated in England at the time of the Militia Bill of 1757, which was amended in 1758 so as to allow the militia captains to accept volunteers instead of the ordinary militiamen who were compulsorily furnished *pro rata* by each parish. In 1778 the volunteers were still voluntary substitutes for militiamen, though formed in separate companies of the militia unit, but volunteer corps soon began to form themselves independently of the militia. In the meantime a large volunteer force had sprung up in Ireland. In 1779, Ireland being threatened with foreign invasion, a levy of 20,000 Protestants was made by the gentry in the north. The 20,000 Protestants had grown in 1782 to 100,000 of all arms and both creeds, and they used their strength effectively for political purposes. After the establishment of the parliament at Dublin, and the general peace of 1783, attempts were made to use this army for party purposes, and the moderate men in parliament therefore hastened to disband it. But this military *coup d'état* was not forgotten in England. Ireland indeed supplied 70,000 volunteers during the Napoleonic wars, practically in place of her militia quota. But the rebellion of 1798 kept alive the memory of 1782, and about 1804 the government disarmed and disbanded them.

The English and Scottish volunteers, disbanded in 1783, were promptly revived when the French Revolutionary Wars produced a new and more formidable enemy. Volunteer corps, some dependent as companies upon the militia, others independent units, were raised in 1794, volunteer service counting as militia service for the purposes of raising the county, town or parish quota. This was followed in 1798 by the formation, for purely local defence, of the Armed Associations, the equivalent of the modern "rifle clubs." At the peace of Amiens the 340,000 volunteers then serving were nearly all disbanded, but one or two crops passed into the regular army as entire regiments, and some others managed to avoid disbandment until the renewal of the war revived the whole force. The danger of invasion was then at its height, and in a few months the force numbered 380,000 men, or 3½% of a population which already kept up a regular army and a militia. But the training of this mass was very unequal; the numbers fell off as the likelihood of invasion decreased, and in the reaction from the first enthusiasm it began to be questioned whether the volunteers could be of much value under the easy conditions of service prevailing. In 1808, therefore, the Local Militia was formed, in which the terms of enlistment and training liabilities were both stricter and better defined. The greater part of the volunteers transferred themselves to the Local Militia, which by 1812 (aided by the ballot) had reached a strength of 215,000 as against the 70,000 of the remaining volunteers. With the general peace of 1814 all these forces except the H.A.C. and the Yeomanry (*q.v.*) disappeared.

After an interval of nearly half a century the warlike attitude of France caused British citizens once more to arm for the protection of their country. The British army and navy had declined in strength and efficiency; France, on the other hand, by the energetic development of her military and naval power and the early application of steam to ships of war, brought the possibilities of the invasion of England in 1846 within measurable distance. England at this time was awakened to the gravity of the situation by the publication of a letter from Wellington to Sir John Burgoyne,[1] followed by a well-timed pamphlet by Sir Charles Napier, entitled *The Defence of England by Volunteer Corps and Militia.* The French danger, in abeyance during the Crimean War, was revived in 1857, when the tone of the French press became more and more menacing. The war in China, the Indian Mutiny and difficulties with the United States taxed the regular army to the utmost; while at home, besides the actual garrisons, there were barely 36,000 militia. This threatening condition of affairs tended to aggravate, if not to produce, a serious commercial panic. It was then that the volunteer movement began, and the Orsini episode and the openly expressed threats of French officers were all that was necessary to free the pent-up enthusiasm.

A few rifle clubs were already in existence, and two of these, working as military bodies from the outset (1852–53), became the two senior volunteer battalions—1st V.B. (now 4th Bn.) Devonshire Regt., and Victoria Rifles (now 9th Bn. London Regt.). But it was not until the situation became acute that the War Office took the step of raising the "Volunteer Force." A circular letter, dated 12th May 1859, from the secretary for war to the lords-lieutenant of counties in Great Britain authorized the formation of volunteer corps. The general enrolment took place at first under the old statute (44 Geo. III.). The main provisions of that act, however, were found inapplicable to the altered conditions under which invasion was now possible, and they failed also to provide for the maintenance of the volunteer force on a permanent footing in peace. A new act (Volunteer Act 1863) was therefore passed, the most important provision of which was that apprehended invasion should constitute a sufficient reason for the sovereign to call out the volunteers, in lieu of the old condition which required the actual appearance of the enemy. The volunteers were, when called out, bound to serve in Great Britain until released by a proclamation declaring the occasion to have passed. This was modified in 1900 during the South African War, a new enactment allowing the authorities to call them out at times of "imminent national danger and great emergency." In 1871 the volunteers were removed from the control of the lords-lieutenant and placed under the War Office. In 1881 the infantry battalions were affiliated to the various line regiments.

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[1] See *Life and Letters of Field-Marshal Sir John Burgoyne.*

The force thus brought into existence was composed of corps of light horse, mounted rifles, garrison and heavy artillery, engineers and rifle volunteers.[1] Later there existed also in connexion with the admiralty a corps of "Royal Naval Artillery Volunteers" for the coast defences. The terms of service and training liabilities underwent no alteration of principle during the forty-eight years of the force's existence. The property belonging to the corps was vested in the commanding officer and administered by a committee of officers under the rules of the corps. These rules were in the first instance agreed on at a general meeting of officers and men, and, having received the queen's approval, became legal, and could be enforced. The commanding officer could dismiss a man from the corps, and a volunteer not on actual service could terminate his engagement at fourteen days' notice. But, as it became the almost universal practice for the government or the regimental commander to issue clothing and equipment free, the volunteers contracted in return to serve for three, four or five years, and, if they exercised their statutory rights, were obliged to refund part of the cost. Further, when capitation grants were given for the maintenance of the corps, the volunteer had either to earn this by continued service or repay the sum lost to the corps by his resignation. These conditions materially modified the statute law in practice, and in fact the term of four years exacted from the Territorial to-day differs in little more than name from the requirements of the former "corps rules." Military law was applicable to officers and men when training with regulars.

The formation of volunteer corps was so rapid that in the course of a few months in 1859–60 a force of 119,000 was created. More, however, remained to be done to put an end to the ever-recurring commercial panics. The government, which in the beginning had tolerated rather than encouraged the movement, and had required the volunteer to serve and to equip himself entirely at his own expense, now followed the lead of public opinion, and decided on maintaining the volunteer force as a part of the regular defensive system. The *personnel* of the volunteer corps (with a few exceptions) thereupon underwent a change. The wealthy and professional classes, who had at first joined the ranks in anticipation of war, cared no longer to bear arms. Their places were taken by the artisan class, which added materially to the number and permanence of the force. But, as contributions and subscriptions now flagged, it became evident that public grants would have to be voted for its maintenance, and a scale of capitation allowances, subject to regulation, was fixed, on the recommendation of a Royal Commission. This capitation allowance per efficient volunteer was thenceforward the basis of all regimental finance and administration.

The turning-point in the history of the volunteers was the South African War. In January 1900, and on several subsequent occasions, the volunteers were invited to supply service companies for South Africa, to be incorporated in the regular battalions to which the volunteer battalions were affiliated. About one-third of the whole force volunteered for service in South Africa, and some 20,000 served in the volunteer companies with the line and in the "City Imperial Volunteers," besides a great number of volunteers whom the higher pay, easier conditions and better prospects of active employment in the mounted guerrilla warfare tempted into the ranks of the yeomanry. The return of these companies infused into the force a leaven of officers and men who had been through an experience of constant small skirmishes and prolonged marching and bivouacking. Meantime the force as a whole had been subjected to a more earnest and vigorous training than it had ever had before. The establishment was greatly increased, and 24 battalions were selected for special training and included with the regular home army in the field force. Various partial reorganizations followed in 1902–5, and at last, in 1907–8, the whole force was re-cast, re-enlisted upon somewhat different terms, and organized along with the yeomanry into the new Territorial Force (see UNITED KINGDOM: *Army*).

STRENGTH OF THE VOLUNTEER FORCE
(*From the Territorial Year Book 1909*).

Year.	Establishment.	Strength.	Classed as Efficient.
1861 . .	211,961	161,239	140,100
1870 . .	244,966	193,893	170,671
1880 . .	243,546	206,537	196,938
1885 . .	250,967	224,012	218,207
1890 . .	260,310	221,048	212,293
1895 . .	260,968	231,704	224,962
1899 . .	263,416	229,854	223,921
1900 . .	339,511	277,628	270,369
1901 . .	342,003	288,476	281,062
1902 . .	345,547	268,550	256,451
1903 . .	346,171	253,281	242,104
1904 . .	343,246	253,909	244,537
1905 . .	341,283	249,611	241,549
1906 . .	338,452	255,854	246,654
1907 . .	335,849	252,791	244,212

VOLUSENUS, FLORENTIUS [FLORENCE WOLSON, or WOLSEY, in later writers WILSON, though in letters in the vernacular he writes himself VOLUSENE] (*c.* 1504–*c.* 1547), Scottish humanist, was born near Elgin about 1504. He studied philosophy at Aberdeen, and in the dialogue *De Animi Tranquillitate* says that the description of the abode of tranquillity was based on a dream that came to him after a conversation with a fellow-student on the banks of his native Lossie. He was then a student of philosophy of four years' standing. Proceeding to Paris, he became tutor to Thomas Wynter, reputed son of Cardinal Wolsey. He paid repeated visits to England, where he was well received by the king, and, after Wolsey's fall, he acted as one of Cromwell's agents in Paris. He was in England as late as 1534, and appears to have been rector of Speldhurst in Kent. In Paris he knew George Buchanan, and found patrons in the cardinal Jean de Lorraine and Jean du Bellay. He was to have gone with du Bellay on his mission to Italy in 1535, but illness kept him in Paris. As soon as he recovered he set out on his journey, but at Avignon, by the advice of his friend Antonio Bonvisi (d. 1558), he sought the patronage of the bishop of the diocese, the learned and pious Paul Sadolet, who made him master in the school at Carpentras, with a salary of seventy crowns. Volusenus paid frequent visits to Lyons (where Conrad Gesner saw him, still a young man, in 1540), probably also to Italy, where he had many friends, perhaps even to Spain. A letter addressed to him by Sadolet from Rome in 1546 shows that he had then resolved to return to Scotland, and had asked advice on the attitude he should adopt in the religious dissensions of the time. He died on the journey, however, at Vienne in Dauphiné, in 1546, or early in the next year.

Volusenus's linguistic studies embraced Hebrew as well as Greek and Latin. His reputation, however, rests on the beautiful dialogue, *De Animi Tranquillitate*, first printed by S. Gryphius at Lyons in 1543. From internal evidence it appears to have been composed about that time, but the subject had exercised the writer for many years. The dialogue shows us Christian humanism at its best. Volusenus is a great admirer of Erasmus, but he criticizes the purity of his Latin and also his philosophy. His own philosophy is Christian and Biblical rather than classical or scholastic. He takes a fresh and independent view of Christian ethics, and he ultimately reaches a doctrine as to the witness of the Spirit and the assurance of grace which breaks with the traditional Christianity of his time and is based on ethical motives akin to those of the German Reformers. The verses which occur in the dialogue, and the poem which concludes it, give Volusenus a place among Scottish Latin poets, but it is as a Christian philosopher that he attains distinction.

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[1] The light horse and mounted rifles disappeared in the end, or else were converted into yeomanry. The "rifles" title was maintained even after the infantry had been assimilated in drill, uniform and other respects to the line battalions. For this reason even scarlet-clothed battalions had no colours, pouch-belts instead of sashes, &c.

The dialogue was reissued at Leiden in 1637 by the Scots writer David Echlin, whose poems, with a selection of three poems from the dialogue of Volusenus, appear, with others, in the famous Amsterdam collection *Delitiae Poetarum Scotorum hujus aevi*, printed by Blaev in 2 vols. in 1637. Later editions of the dialogue appeared at Edinburgh in 1707 and 1751 (the latter edited by G. Wishart). All the reissues contain a short life of the author by Thomas Wilson, advocate, son-in-law and biographer of Archbishop Patrick Adamson. Supplementary facts are found in the letters and state papers of the period, and in Sadolet's *Letters*.

VOLUTE (Lat. *volutum*, *volvere*, to roll up), in architecture, the spiral scroll of the capital of the Ionic order. As in the earliest example known, that of the archaic temple of Diana at Ephesus, the width of the abacus is twice that of the depth, constituting therefore a bracket-capital; it is probable that at first it consisted of an oblong block of timber, which, raised on a vertical post or column, lessened the bearing of the architrave or beam, and the first volutes or scrolls were painted on. In votive columns carrying a sphinx, as at Delphi, or statues, the oblong form of capital with largely developed volutes was long retained, but in the porticoes of the Greek temples the abacus was made square and the volute diminished in projection on each side. In the side elevation the portion of the capital which joins the two volutes is known as the cushion, and when the Ionic column was used in porticoes in the capitals of the angle columns the volute was brought out on the diagonal, so as to present the same design on front and side; this, however, at the back led to a very awkward arrangement with two half volutes at right angles to one another, which was not of much importance under the portico, but when, in the open peristyle of the Pompeian house, it faced the open court, another design was necessary, and the angle volute was employed on all four sides. A similar arrangement was devised by Ictinus for the capitals in the interior of the temple at Bassae (430 B.C.), and was employed in the semi-detached columns of the raised stage at Epidaurus. The Romans adopted the angle volute in the temple of Fortuna Virilis at Rome, but, except in their porticoes and as semi-detached between arches, the Ionic order was rarely employed by them, and few Roman examples are known.

The architects of the Revival in the 16th century entirely misunderstood the origin and meaning of the volutes (the upper fillet of which was always carried horizontally across under the abacus in Greek and Roman work), and mistook them for horns, which they turned down into the echinus moulding.

VONDEL, JOOST VAN DEN (1587–1679), Dutch poet, was born at Cologne on the 17th of November 1587. His father, a hatter, was an exile from Antwerp on account of his Anabaptist opinions; but he returned to Holland when Joost was about ten years old, and settled in Amsterdam, where he carried on a hosiery business. Joost was the eldest son, and was expected to succeed to his father's shop. He was early introduced to the chamber of the Eglantine, however, and devoted most of his time to poetry and study. When the elder Vondel died he married Maria de Wolff, and seems to have left the management of his affairs in her capable hands. He read the French contemporary poets, and was especially influenced by the *Divine Sepmaine* of Du Bartas; he made some translations from the German; he was soon introduced to the circle gathered in the house of Roemer Visscher, and with these friends began to make a close study of classical writers. His first play, *Het Pascha*, was printed in 1612, and proved to be the beginning of a long and brilliant literary career (see DUTCH LITERATURE). After the production of his political drama of *Palamedes, or Murdered Innocence* (1625), which expressed his indignation at the judicial murder of Oldenbarneveldt in 1619, Vondel had to go into hiding, but the Amsterdam magistrates eventually satisfied themselves with exacting a small fine. In the following years he issued a number of stinging satires against the extreme Calvinists, and he entered into close relationship with Hugo Grotius, another sufferer for his liberal opinions. Vondel had long been attracted by the aesthetic side of the Roman Catholic Church, and this inclination was perhaps strengthened by his friendship with Marie Tesselschade Visscher, for the Visscher household had been Catholic and liberal. Tesselschade's husband died in 1634; Vondel's wife died in 1635; and the ties between the two were strengthened by time. Vondel eventually showed his revolt against the Calvinist tyranny by formally embracing the Roman Catholic faith in 1640. The step was ill-received by many of his friends, and Hooft forbade him the hospitality of his castle at Muiden. In 1657 his only surviving son, who was entrusted with the hosiery business, mismanaged affairs to such an extent that he had to take ship for the East Indies, leaving his father to face the creditors. Vondel had to sacrifice the whole of his small fortune, and became a government clerk. He was pensioned after ten years' service, and died on the 5th of February 1679.

The more important of his thirty-two dramas are: *Hierusalem Verwoest* ("Jerusalem laid desolate") (1620); *Palamedes, of Vermoorde onnooselheyd* ("Palamedes, or Murdered Innocence") (1625); *Gijsbreght van Aemstel* (1637); *De Gebroeders* (1640), the subject of which is the ruin of the sons of Saul; *Joseph in Egypten* (1640), *Maria Stuart, of gemartelde majesteit* (1646); the pastoral of *De Leeuwendalers* (1648); *Lucifer* (1654); *Salmoneus* (Solomon) (1657); *Jephtha* (1659); *Koning David in ballingschap* ("King David in banishment"), *Koning David hersteld* ("King David restored") and *Samson* (1660); *Batavische Gebroeders*, the subject of which is the story of Claudius Civilis (1663); *Adam in ballingschap* ("Adam in exile") (1664), after the Latin tragedy of Hugo Grotius. He also wrote translations from the tragedies of Seneca, Euripides and Sophocles; didactic poems, and much lyrical poetry beside what is to be found in the choruses of his dramas.

His complete works were edited by van Lennep (12 vols., 1850–1869). A bibliography (1888) was published by J. H. W. Unger, who revised van Lennep's edition in 1888–94. *Lucifer* was translated into English verse by L. C. van Noppen (New York, 1898). See also E. Gosse, *Studies in Northern Literature* (1879); G. Edmundson, *Milton and Vondel* (1885), where Milton's supposed indebtedness to Vondel is discussed; and critical studies by A. Baumgartner, S. J. (Freiburg, 1882); C. Looten (Lille, 1889), by J. A. Alberdingk Thijm (*Portretten van Joost van den Vondel*, 1876); and especially the chapters on Vondel (pp. 133–325) in W. J. A. Jonckbloet's *Geschiedenis der nederlandsche letterkunde* (vol. iv. 1890).

VON HOLST, HERMANN EDUARD (1841–1904), German-American historian, was born at Fellin in the province of Livonia, on the 19th of June 1841. He was educated at the universities of Dorpat and Heidelberg, receiving his doctor's degree from the latter in 1865. He emigrated to America in 1867, remaining there until 1872. He was professor of history in the newly reorganized university of Strassburg from 1872 to 1874, and at Freiburg in Baden from 1874 to 1892, and for ten years he was a member of the Baden *Herrenhaus*, and vice-president for four. He revisited the United States in 1878–79 and in 1884, and in 1892 he became head of the department of history at the university of Chicago. Retiring on account of ill-health in 1900, he returned to Germany and died at Freiburg on the 20th of January 1904. Both through his books and through his lectures at the university of Chicago, Von Holst exerted a powerful influence in encouraging American students to follow more closely the German methods of historical research. His principal work is his *Constitutional and Political History of the United States* (German ed., 5 vols., 1873–91; English trans. by Lalor and Mason, 8 vols., 1877–92), which covers the period from 1783 to 1861, though more than half of it is devoted to the decade 1850–60; it is written from a strongly anti-slavery point of view. Among his other writings are *The Constitutional Law of the United States of America* (German ed., 1885; English trans., 1887); *John C. Calhoun* (1882), in the American Statesmen Series; *John Brown* (1888), and *The French Revolution Tested by Mirabeau's Career* (1894).

See the *Political Science Quarterly*, v. 677–78; the *Nation*, lxxviii. 65–67.

VONNOH, ROBERT WILLIAM (1858–), American portrait and landscape painter, was born in Hartford, Connecticut, on the 17th of September 1858. He was a pupil of Boulanger and Lefebvre in Paris; became an instructor at the Cowles Art School, Boston (1884–85), at the Boston

Museum of Fine Art Schools (1885–87), and in the schools of the Pennsylvania Academy of the Fine Arts, Philadelphia (1891–96), and a member of the National Academy of Design, New York (1906), and of the Secessionists, Munich. His wife, Bessie Potter Vonnoh (b. 1872), a sculptor, was a pupil of the Art Institute, Chicago, and became a member of the National Sculpture Society.

VONONES (on coins ONONES), the name of two Parthian kings.

(1) VONONES I., eldest son of Phraates IV. After the assassination of Orodes II. (*c.* A.D. 7), the Parthians applied to Augustus for a new king from the house of Arsaces. Augustus sent them Vonones (*Mon. Anc.* 5, 9; Tac. *Ann.* ii. 1 f.; Joseph. *Ant.* xviii. 2, 4), who was living as a hostage in Rome. But Vonones could not maintain himself; he had been educated as a Roman, and was despised as a slave of the Romans. Another member of the Arsacid house, Artabanus II., who was living among the Dahan nomads, was invited to the throne, and defeated and expelled Vonones. The coins of Vonones (who always uses his proper name) date from A.D. 8–12, those of Artabanus II. begin in A.D. 10. Vonones fled into Armenia and became king here. But Artabanus demanded his deposition, and as Augustus did not wish to begin a war with the Parthians he removed Vonones into Syria, where he was kept in custody (Tac. *Ann.* ii. 4). When he tried to escape, A.D. 19, he was killed by his guards (Tac. *Ann.* ii. 58, 68).

(2) VONONES II., governor of Media, was raised to the throne after the death of Gotarzes in A.D. 51 (perhaps he was his brother, cf. Joseph. *Ant.* xx. 3, 4). But he died after a few months, and was succeeded by his son Vologaeses I. (Tac. *Ann.* xii. 14). (ED. M.)

VOODOO or VAUDOUX (Creole Fr. *vaudoux*, a negro sorcerer, probably originally a dialectic form of Fr. *Vaudois*, a Waldensian), the name given to certain magical practices, superstitions and secret rites prevalent among the negroes of the West Indies, and more particularly in the Republic of Haiti.

VOORHEES, DANIEL WOLSEY (1827–1897), American lawyer and political leader, was born in Butler county, Ohio, on the 26th of September 1827, of Dutch and Irish descent. During his infancy his parents removed to Fountain county, Indiana, near Veedersburg. He graduated at Indiana Asbury (now De Pauw) University, Greencastle, Indiana, in 1849; was admitted to the bar in 1850, and began to practise in Covington, Indiana, whence in 1857 he removed to Terre Haute. In 1858–60 he was U.S. district-attorney for Indiana; in 1861–66 and in 1869–73 he was a Democratic representative in Congress; and in 1877–97 he was a member of the U.S. Senate. During the Civil War he seems to have been affiliated with the Knights of the Golden Circle, but he was not so radical as Vallandigham and others. He was a member of the committee on finance throughout his service in the Senate, and his first speech in that body was a defence of the free coinage of silver and a plea for the preservation of the full legal tender value of greenback currency, though in 1893 he voted to repeal the silver purchase clause of the Sherman Act. He had an active part in bringing about the building of the new Congressional Library. He was widely known as an effective advocate, especially in jury trials. In allusion to his unusual stature he was called "the Tall Sycamore of the Wabash." He died in Washington, D.C., on the 10th of April 1897.

Some of his speeches were published under the title, *Forty Years of Oratory* (2 vols., Indianapolis, Indiana, 1898), edited by his three sons and his daughter, Harriet C. Voorhees, and with a biographical sketch by T. B. Long.

VORARLBERG, the most westerly province of the Austrian empire, extending S. of the Lake of Constance along the right bank of the Rhine valley. It consists of three districts, Bregenz, Bludenz and Feldkirch, which are under the administrative authority of the *Statthalter* (or prefect) at Innsbruck, but possess a governor and a diet of their own (twenty-one members), and send four members to the imperial parliament. Vorarlberg is composed of the hilly region of the Bregenzerwald, and, to its south, of the mountain valley of Montafon or of the upper Ill, through which an easy pass, the Zeinisjoch (6076 ft.), leads to the Tirolese valley of Paznaun, and so to Landeck. Near Bludenz the Kloster glen parts from the Ill valley, through the latter runs the Arlberg railway (1884)—beneath the pass of that name (5912 ft.)—to Landeck and Innsbruck. The Ill valley is bounded south by the snowy chain of the Rhätikon (highest point, the Scesaplana, 9741 ft., a famous view-point), and of the Silvretta (highest point, Gross Piz Buin, 10,880 ft.), both dividing Vorarlberg from Switzerland; slightly to the north-east of Piz Buin is the Dreiländerspitze (10,539 ft.), where the Vorarlberg, Tirolese and Swiss frontiers unite.

The total area of Vorarlberg is 1004·3 sq. m. Of this $88\frac{1}{4}$%, or about 886 sq. m., is reckoned "productive," 30% of this limited area being occupied by forests, while 118 sq. m. rank as "unproductive." In 1900 the total population was 129,237, all but wholly German-speaking and Romanist. The largest town is Dornbirn (pop. 13,052), but Bregenz (pop. 7595) is the political capital; Feldkirch has about 4000 inhabitants, while Bludenz has rather more (see the separate articles on the three former). In the hilly districts the inhabitants mainly follow pastoral pursuits, possessing much cattle of all kinds. In the towns the spinning and weaving of cotton (introduced towards the end of the 18th century) is very flourishing. Forests cover about one-sixth of the district, and form one of the principal sources of its riches. But the Vorarlberg is predominantly an Alpine region, though its mountains rarely surpass the snow-level. Ecclesiastically it is in the diocese of Brixen, whose vicar-general (a suffragan bishop) resides at Feldkirch.

The name of the district means the "land that is beyond the Arlberg Pass," that is, as it seems to one looking at it from the Tirol. This name is modern and is a collective appellation for the various counties or lordships in the region which the Habsburgs (after they secured Tirol in 1363) succeeded in purchasing or acquiring—Feldkirch (1375, but Hohenems in 1765 only), Bludenz with the Montafon valley (1394), Bregenz (in two parts, 1451 and 1523) and Sonnenberg (1455). After the annexation of Hohenems (its lords having become extinct in 1759), Maria Theresa united all these lordships into an administrative district of Hither Austria, under the name Vorarlberg, the governor residing at Bregenz. In 1782 Joseph II. transferred the region to the province of Tirol. The lordship of Blumenegg was added in 1804, but in 1805 all these lands were handed over, by virtue of the peace of Pressburg, to Bavaria, which in 1814 gave them all back, save Hoheneck. In 1815 the present administrative arrangements were made.

See A. Achleitner and E. Ubl, *Tirol und Vorarlberg* (Leipzig, 1895); J. R. von Bergmann, *Landeskunde v. Vorarlberg* (Innsbruck, 1868); Max Haushofer, *Tirol und Vorarlberg* (Bielefeld and Leipzig, 1899); J. C. Heer, *Vorarlberg und Liechtenstein—Land und Leute* (Feldkirch, 1906); O. von Pfister, *Das Montavon* (Augsburg, 1884); J. Staffler, *Tirol und Vorarlberg* (5 vols., Innsbruck, 1839–46); A. Steinitzer, *Geschichtliche und Kulturgeschichtliche Wanderungen durch Tirol und Vorarlberg* (Innsbruck, 1905); A. Waltenberger, *Algäu, Vorarlberg und Westtirol* (10th edition, Innsbruck, 1906). See also the list of books at the end of TIROL, and especially vol. xiii. ("Tirol u. Vorarlberg") (Vienna, 1893) of the great official work entitled *Die oesterreichisch-ungarische Monarchie in Wort und Bild.* (W. A. B. C.)

VORONEZH, a government of southern Russia, bounded N. by the government of Tambov, E. by Saratov and the Don Cossacks, S. by Kharkov and W. by Kursk and Orel; area, 25,435 sq. m. It occupies the southern slopes of the middle-Russian plateau, and its average elevation is from 450 to 700 ft. The surface is hilly, and intersected by ravines in the west (where two ranges of chalk hills separated by a broad valley run north and south), but flat and low east of the Don. Devonian sandstones crop out in the north; further south these are covered with Cretaceous deposits. Glacial clays with northern erratic boulders extend as far south as Voronezh, and extensive areas are covered with Lacustrine clays and sands. The soil is very fertile, owing to the prevalence of black earth; it becomes, however, sandy towards the east.

Voronezh lies on the border between the forest and meadow region of middle Russia and the southern steppes; the forests disappear rapidly towards the south, and those which in the time of Peter the Great stood on the upper tributaries of the Don, and were used for shipbuilding, have now been almost entirely destroyed. Less than one-tenth of the entire area is under wood.

The Don traverses Voronezh from N. to S.E., draining it for more than 400 m.; it is an important channel for the export of corn, tallow and other raw produce, as well as for the import of wood, floated down from the north. Its tributary the Voronezh is also navigated, and the Bityug and Khoper, both left-hand affluents of the Don, flow in part through the government. Many other small streams flowing into the Don intersect the territory, but the influence of the dry steppes begins to make itself felt; there are no lakes, and marshes persist only in the valleys. The climate is continental, and although the mean temperature at the town of Voronezh is 42·7° F., that of January is as low as 8·3°, and that of July as high as 74·2°.

The estimated pop. in 1906 was 3,097,700. The inhabitants consist in nearly equal parts of Great Russians in the north and Little Russians in the south, but there are a few Poles, Germans and Jews, both Orthodox and Karaites. The government is divided into twelve districts, the chief towns of which are Voronezh, Biryuch, Bobrov, Boguchar, Korotoyak, Nizhne-Dyevitsk, Novo-Khopersk, Ostrogozhsk, Pavlovsk, Valuiki, Zadonsk and Zemlyansk. Agriculture is the chief occupation, and grain is exported to a considerable amount. The peasants own 67% of the land, the crown and the imperial domains 3% and private owners 30%.

The principal crops are rye, wheat, oats, barley and potatoes. Aniseed, sunflowers, tobacco and beetroot are extensively cultivated, and much attention is paid to the growth of the pineapple. There are large tracts of excellent pasture land, on which cattle are bred; good breeds of cart-horses and trotting-horses are obtained. There are nearly two hundred breeding establishments, those at Hrenovoye and Chesmenka being the most important. In many villages the inhabitants are engaged in the making of wooden wares. There are flour-mills, distilleries, oil, sugar and woollen mills, iron works and tobacco factories.

VORONEZH, a town of Russia, capital of the government of the same name, on the river Voronezh, 5 m. above its confluence with the Don and 367 m. by rail S.S.E. of Moscow. Pop. (1901) 84,146. It is one of the best-built and most picturesque provincial towns of Russia, and is situated on the steep bank of the river, surrounded by three large suburbs—Troitskaya, Yamskaya and Chizhovka. It has a military school of cadets, two museums, a monument (1860) to Peter the Great, a railway college, a pilgrimage church, and a theatre which figures in the history of the Russian stage. It was the birthplace of two peasant poets, who wrote some of the finest examples of Russian poetry—A. V. Koltsov (1809–1842) and I. S. Nikitin (1824–1861). A memorial to the former was erected in 1868. There are factories for cleansing wool and for the preparation of linens, woollens, bells, tallow and oil, as well as some distilleries. Voronezh is an important entrepôt for corn, flax, tallow, hides, sugar, wood and coal from the Don.

The city was founded in 1586, as a fort against Tatar raids, on a site which had been occupied from the 11th century by a Khazar town, but had been deserted during the 14th and 15th centuries. Four years afterwards it was burned by the Tatars, but again rebuilt, and soon became an important trading place. Peter the Great recognized its importance, and in 1695 built here a flotilla of boats for the conquest of Azov. The town was almost completely destroyed by fire in 1703, 1748 and 1773, but was always rebuilt.

VORONTSOV (or Woronzoff), the name of a Russian family, various members of which are distinguished in Russian history.

Mikhail Illarionovich Vorontsov (1714–1767), Russian imperial chancellor, was the first to become prominent. At the age of fourteen he was appointed a Kammer junker at the court of the cesarevna Elizabeth Petrovna, whom he materially assisted during the famous *coup d'état* of the 6th of December 1741, when she mounted the Russian throne on the shoulders of the Preobrazhensky Grenadiers. On the 3rd of January 1742 he married Anna Skavronskaya, the empress's cousin; and in 1744 was created a count and vice-chancellor. His jealousy of Alexis Bestuzhev induced him to participate in Lestocq's conspiracy against that statesman. The empress's affection for him (she owed much to his skilful pen and still more to the liberality of his rich kinsfolk) saved him from the fate of his accomplices, but he lived in a state of semi-eclipse during the domination of Bestuzhev (1744–1758). On the disgrace of Bestuzhev, Vorontsov was made imperial chancellor in his stead. Though well-meaning and perfectly honest, Vorontsov as a politician was singularly timorous and irresolute, and always took his cue from the court. Thus, under Elizabeth he was an avowed enemy of Prussia and a warm friend of Austria and France; yet he made no effort to prevent Peter III. from reversing the policy of his predecessor. Yet he did not lack personal courage, and endured torture after the Revolution of the 9th of July 1762 rather than betray his late master. He greatly disliked Catherine II., and at first refused to serve under her, though she reinstated him in the dignity of chancellor. When he found that the real control of foreign affairs was in the hands of Nikita Panin, he resigned his office (1763). Vorontsov was a generous protector of the nascent Russian literature, and, to judge from his letters, was a highly cultivated man.

Alexander Romanovich Vorontsov (1741–1805), Russian imperial chancellor, nephew of the preceding and son of Count Roman Vorontsov, began his career at the age of fifteen in the Izmailovsky regiment of the Guards. In 1759, his kinsman, the grand chancellor Mikhail Illarionovich, sent him to Strassburg, Paris and Madrid to train him in diplomacy. Under Peter III. he represented Russia for a short time at the court of St James's. Catherine II. created him a senator and president of the Board of Trade; but she never liked him, and ultimately (1791) compelled him to retire from public life. In 1802 Alexander I. summoned him back to office and appointed him imperial chancellor. This was the period of the triumph of the Vorontsovs, who had always insisted on the necessity of a close union with Austria and Great Britain, in opposition to Panin and his followers, who had leaned on France or Prussia till the outbreak of the Revolution made friendship with France impossible. Vorontsov was also an implacable opponent of Napoleon, whose "topsy-turvyness" he was never weary of denouncing. The rupture with Napoleon in 1803 is mainly attributable to him. He also took a leading part in the internal administration and was in favour of a thorough reform of the senate and the ministries. He retired in 1804. He possessed an extraordinary memory and a firm and wide grasp of history.

His "Memoirs of my Own times" (Rus.) is printed in vol. vii. of the *Vorontsov Archives.*

Semen Romanovich Vorontsov (1744–1832), Russian diplomatist, brother of Alexander Romanovich, distinguished himself during the first Turkish War of Catherine II. at Larga and Kagula in 1770. In 1783 he was appointed Russian minister at Vienna, but in 1785 was transferred to London, where he lived for the rest of his life. Vorontsov enjoyed great influence and authority in Great Britain. Quickly acquainting himself with the genius of English institutions, their ways and methods, he was able to render important services to his country. Thus during Catherine's second Turkish War he contributed to bring about the disarmament of the auxiliary British fleet which had been fitted out to assist the Turks, and in 1793 obtained a renewal of the commercial treaty between Great Britain and Russia. Subsequently, his extreme advocacy of the exiled Bourbons, his sharp criticism of the Armed Neutrality of the North, which he considered disadvantageous to Russia, and his denunciation of the partitions of Poland as contrary to the first principles of equity and a shock to the conscience of western Europe, profoundly irritated the empress. On the accession of Paul he was raised to the rank of ambassador extraordinary and minister plenipotentiary, and received immense estates in Finland. Neither Vorontsov's detention of the Russian squadron under Makarov in British ports nor his refusal, after the death of Bezborodko, to accept the dignity of imperial chancellor could alienate the favour of Paul. It was only when the emperor himself began to draw nearer to France that he began to consider Vorontsov as incompetent to serve Russia in England, and in February 1800 all the count's estates were confiscated. Alexander I. on his accession at once reinstated him, but ill-health and family affairs induced him to resign his post in 1806. From that time till his death in 1832 he continued to live in London.

Besides his valuable *Note on the Russian War* (Rus.) and numerous letters, Vorontsov was the author of an autobiography (in *Russky Arkhiv*, Petersburg, 1881) and "Notes on the Internal Government of Russia" (Rus.) (in *Russky Arkhiv*, 1881).

Mikhail Semenovich Vorontsov (1782–1856), Russian prince and field-marshal, son of the preceding, spent his childhood and youth with his father in London, where he received a brilliant education. During 1803–4 he served in the Caucasus under Tsitsianov and Gulyakov, and was nearly killed in the Zakatahko disaster (January 15, 1804). From 1805 to 1807 he served in the Napoleonic wars, and was present at the battles of Pultusk and Friedland. From 1809 to 1811 he participated in the Turkish War and distinguished himself in nearly every important action. He was attached to Bagration's army during the war of 1812, was seriously wounded at Borodino, sufficiently recovering, however, to rejoin the army in 1813. In 1814, at Craonne, he brilliantly withstood Napoleon in person. He was the commander of the corps of occupation in France from 1815 to 1818. On the 7th of May 1823 he was appointed governor-general of New Russia, as the southern provinces of the empire were then called, which under his administration developed marvellously. He may be said to have been the creator of Odessa and the benefactor of the Crimea. He was the first to start steamboats on the Black Sea (1828). The same year he succeeded the wounded Menshikov as commander of the forces besieging Varna, which he captured on the 28th of September. In the campaign of 1829 it was through his energetic efforts that the plague, which had broken out in Turkey, did not penetrate into Russia. In 1844 Vorontsov was appointed commander-in-chief and governor of the Caucasus with plenipotentiary powers. For his brilliant campaign against Shamyl, and especially for his difficult march through the dangerous forests of Ichkerinia, he was raised to the dignity of prince, with the title of Serene Highness. By 1848 he had captured two-thirds of Daghestan, and the situation of the Russians in the Caucasus, so long almost desperate, was steadily improving. In the beginning of 1853 Vorontsov was allowed to retire because of his increasing infirmities. He was made a field-marshal in 1856, and died the same year at Odessa. Statues have been erected to him both there and at Tiflis.

See V. V. Ogarkov, *The Vorontsovs* (Rus.) (Petersburg, 1892); *Vorontsov Archives* (Rus. and Fr.) (Moscow, 1870, &c.); M. P. Shelverbinin, *Biography of Prince M. S. Vorontsov* (Rus.) (Petersburg, 1858). (R. N. B.)

VÖRÖSMARTY, MIHÁLY (1800–1855), Hungarian poet, was born at Puszta-Nyék on the 1st of December 1800, of a noble Roman Catholic family. His father was a steward of the Nadasdys. Mihály was educated at Székesfejérvár by the Cistercians and at Pest by the Piarists. The death of the elder Vörösmarty in 1811 left his widow and numerous family extremely poor. As tutor to the Perczel family, however, Vörösmarty contrived to pay his own way and go through his academical course at Pest. The doings of the diet of 1825 first enkindled his patriotism and gave a new direction to his poetical genius (he had already begun a drama entitled *Salamon*), and he flung himself the more recklessly into public life as he was consumed by a hopeless passion for Etelka Perczel, who socially was far above him. To his unrequited love we owe a whole host of exquisite lyrics, while his patriotism found expression in the heroic epos *Zalán futása* (1824), gorgeous in colouring, exquisite in style, one of the gems of Magyar literature. This new epic marked a transition from the classical to the romantic school. Henceforth Vörösmarty was hailed by Kisfaludy and the Hungarian romanticists as one of themselves. All this time he was living from hand to mouth. He had forsaken the law for literature, but his contributions to newspapers and reviews were miserably paid. Between 1823 and 1831 he composed four dramas and eight smaller epics, partly historical, partly fanciful. Of these epics he always regarded *Cserhalom* (1825) as the best, but modern criticism has given the preference to *Két szomséd vár* (1831), a terrible story of hatred and revenge. When the Hungarian Academy was finally established (November 17, 1830) he was elected a member of the philological section, and ultimately succeeded Károly Kisfaludy as director with an annual pension of 500 florins. He was one of the founders of the Kisfaludy Society, and in 1837 started the *Athenaeum* and the *Figyelmezö*, the first the chief bellettristic, the second the best critical periodical of Hungary. From 1830 to 1843 he devoted himself mainly to the drama, the best of his plays, perhaps, being *Vérnász* (1833), which won the Academy's 100-gulden prize. He also published several volumes of poetry, containing some of his best work. *Szózat* (1836), which became a national hymn, *Az elhagyott anya* (1837) and *Az úri hölgyhöz* (1841) are all inspired by a burning patriotism. His marriage in 1843 to Laura Csajághy inspired him to compose a new cycle of erotics. In 1848, in conjunction with Arany and Petöfi, he set on foot an excellent translation of Shakespeare's works. He himself was responsible for *Julius Caesar* and *King Lear*. He represented Jankovics at the diet of 1848, and in 1849 was made one of the judges of the high court. The national catastrophe profoundly affected him. For a short time he was an exile, and when he returned to Hungary in 1850 he was already an old man. A profound melancholy crippled him for the rest of his life. In 1854 he wrote his last great poem, the touching *A vén cigány*. He died at Pest in 1855 in the same house where Károly Kisfaludy had died twenty-five years before. His funeral, on the 21st of November, was a day of national mourning. His penniless children were provided for by a national subscription collected by Ferencz Deák, who acted as their guardian.

The best edition of Vörösmarty's collected works is by Pál Gyulai (Budapest, 1884). Some of them have been translated into German, *e.g. Gedichte* (Pest, 1857); *Ban Marot*, by Mihály Ring (Pest, 1879); *Ausgewählte Dichte*, by Paul Hoffmann (Leipzig, 1895). See Pál Gyulai, *The Life of Vörösmarty* (Hung.) (3rd ed., Budapest, 1890), one of the noblest biographies in the language; Brajjer, *Vörösmarty, sein Leben und seine Werke* (Nagy-Becskerek, 1882). (R. N. B)

VORTICELLA, the Bell-Animalcule, a genus of Peritrichous Infusoria (*q.v.*) characterized by the bell-shaped body, with short oral disk and collar, attached by a hollow stalk, inside and around which passes, attached spirally, a contractile bundle of myonemes. By their contraction the stalk is brought into the form of a corkscrew, the thread being now on the shorter, *i.e.* the inner, side of the turns; and the animal is jerked back near to the base of the stalk. As soon as the contraction of the thread ceases, the elasticity of the stalk extends the animal to its previous position. On fission, one of the two animals swims off by the development of the temporary posterior girdle of membranelles, the disk being retracted and closed over by the collar, so that the cell is ovoid: on its attachment the posterior girdle of cilia disappears and a stalk forms. The other cell remains attached to the old stalk. In the allied genera *Carchesium* and *Zoothamnium* the two produced by fission remain united, so that a branching colony is ultimately produced. The genus is a large one, and many species are epizoic on various water animals.

VORTIGERN (Guorthigirnus, Wyrtgeorn), king of the Britons at the time of the arrival of the Saxons under Hengest and Horsa. The records do not agree as to the date of the arrival of these chieftains or the motives which led them to come to Britain. It seems clear, however, that Vortigern made use of them to protect his kingdom against the Picts and Scots, and rewarded them for their services with a grant of land. Later we find the Britons at war with the new-comers, now established in Kent, and four battles are fought, in the last of which, according to the *Historia Brittonum*, the king's son Vortemir, their leading opponent, is slain. The *Historia Brittonum* is our only authority for the marriage of Vortigern with the daughter of Hengest before the war. It also records the massacre of the British nobles after the death of Vortemir and the subsequent grant of Essex and Sussex to the invaders by Vortigern.

See *Historia Brittonum*, ed. Th. Mommsen in *Mon. Hist. Germ.* xiii.; *Anglo-Saxon Chronicle*, ed. Earle and Plummer (Oxford, 1899); Bede, *Hist. Eccl.*, ed. C. Plummer (Oxford, 1896).

VOSGES, a frontier department of eastern France, formed in 1790 chiefly of territory previously belonging to Lorraine, together with portions of Franche-Comté and Champagne, and bounded N. by the department of Meurthe-et-Moselle, E. by Alsace, S.E. by the territory of Belfort, S. by the department of Haute-Saône, W. by Haute-Marne and N.W. by Meuse. Pop. (1906) 429,812; area, 2279 sq. m. The Vosges mountains (see below) form a natural boundary on the east, their highest French eminence, the Hohneck, attaining 4482 ft. The Monts Faucilles traverse the south of the department in a broad curve declining on the north into elevated plateaus, on the south encircling the upper basin of the Saône. This chain, dividing the basins of the Rhone and the Rhine, forms part of the European watershed between the basins of the Mediterranean and Atlantic. The Moselle and the Meuse, tributaries of the Rhine, have the largest drainage areas in the department; a small district in the N.W. sends its waters to the Seine, the rest belongs to the basin of the Rhone. The Moselle rises in the Col de Bussang in the extreme south-east, and in a N.N.W. course of about 70 m. in the department receives the Moselotte and the Vologne on the right; the Mortagne and Meurthe on the right and the Madon on the left bank also belong to this department though they join the Moselle outside its borders. The source of the Saône is on the southern slope of the Faucilles. On the shore of Lake Gérardmer lies the beautifully situated town of Gérardmer, a well-known centre for mountain excursions.

The elevation and the northward exposure of the valleys make the climate severe, and a constant dampness prevails, owing both to the abundance of the rainfall and to the impermeability of the subsoil. The average temperature at Épinal (1070 ft.) is 49° F. The annual rainfall at Épinal is 28 in., at St Dié 32 in. and in the mountains more. Arable farming flourishes in the western districts where wheat, oats and potatoes are largely grown. The vine is cultivated on the river banks, to best advantage on those of the Moselle. Pasture is abundant in the mountainous region, where cheese-making is carried on to some extent, but the best grazing is in the central valleys. Forests, which occupy large tracts on the flanks of the Vosges, cover about one-third of the department, and are a principal source of its wealth. Sawmills are numerous in the Vosges and the manufacture of furniture, sabots, brushes and wood-working in general are prominent industries. The department has mines of lignite and stone quarries of various kinds. There are numerous mineral springs, of which those of Contrexéville, Plombières, Vittel, Bains-les-Bains, Martigny-les-Bains and Bussang may be named. The manufacture of textiles is the chief industry, comprising the spinning and weaving of cotton, wool, silk, hemp and flax, and the manufacture of hosiery and of embroidery and lace, Mirecourt (pop. 5092) being an important centre for the two last. The department forms the diocese of St Dié (province of Besançon), has its court of appeal and educational centre at Nancy, and belongs to the district of the XX. Army Corps. It is divided into the arrondissements of Épinal, Mirecourt, Neufchâteau, Remiremont and St Dié, with 29 cantons and 530 communes.

VOSGES (Lat. *Vogesus* or *Vosagus*, Ger. *Wasgau* or *Vogesen*), a mountain range of central Europe, stretching along the west side of the Rhine valley in a N.N.E. direction, from Basel to Mainz, for a distance of 150 m. Since 1871 the southern portion, from the Ballon d'Alsace to Mont Donon, has been the frontier between France and Germany. There is a remarkable similarity between the Vosges and the corresponding range of the Black Forest on the other side of the Rhine: both lie within the same degrees of latitude and have the same geological formation; both are characterized by fine forests on their lower slopes, above which are open pasturages and rounded summits of a uniform altitude; both have a steep fall to the Rhine and a gradual descent on the other side. The Vosges in their southern portion are mainly of granite, with some porphyritic masses, and of a kind of red sandstone (occasionally 1640 ft. in thickness) which on the western versant bears the name of "grès Vosgien."

Orographically the range is divided south to north into four sections: the Grandes Vosges (62 m.), extending from Belfort to the valley of the Bruche; the Central Vosges (31 m.), between the Bruche and the Col de Saverne; the Lower Vosges (30 m.), between the Col de Saverne and the source of the Lauter; and the Hardt (*q.v.*). The rounded summits of the Grandes Vosges are called "ballons." The departments of Vosges and Haute Saône are divided from Alsace and the territory of Belfort by the Ballon d'Alsace or St Maurice (4100 ft.). Thence northwards the average height of the range is 3000 ft., the highest point, the Ballon de Guebwiller (Gebweiler), or Soultz, rising to the east of the main chain to 4680 ft. The Col de Saales, between the Grandes Vosges and the central section, is nearly 1900 ft. high; the latter is both lower and narrower than the Grandes Vosges, the Mont Donon (3307 ft.) being the highest summit. The railway from Paris to Strassburg and the Rhine and Marne Canal traverse the Col de Saverne. No railway crosses the Vosges between Saverne and Belfort, but there are carriage roads over the passes of Bussang from Remiremont to Thann, the Schlucht (3766 ft.) from Gérardmer to Munster, the Bonhomme from St Dié to Colmar, and the pass from St Dié to Ste Marie-aux-Mines. The Lower Vosges are a sandstone plateau ranging from 1000 to 1850 ft. high, and are crossed by the railway from Hagenau to Sarreguemines, defended by the fort of Bitche.

Meteorologically the difference between the eastern and western versants of the range is very marked, the annual rainfall being much higher and the mean temperature being much lower in the latter than in the former. On the eastern slope the vine ripens to a height of 1300 ft.; on the other hand, its only rivers are the Ill and other shorter streams. The Moselle, Meurthe and Sarre all rise on the Lorraine side. Moraines, boulders and polished rocks testify the existence of the glaciers which formerly covered the Vosges. The lakes, surrounded by pines, beeches and maples, the green meadows which provide pasture for large herds of cows, and the fine views of the Rhine valley, Black Forest and snow-covered Swiss mountains combine to make the district picturesque. On the lower heights and buttresses of the main chain on the Alsatian side are numerous castles, generally in ruins. At several points on the main ridge, especially at St Odile above Ribeauville (Rappoltsweiler), are the remains of a wall of unmortared stone with tenons of wood, 6 to 7 ft. thick and 4 to 5 ft. high, called the pagan wall (Mur Payen). It was used for defence in the middle ages, and archaeologists are divided as to whether it was built for this purpose by the Romans, or before their arrival.

VOSMAER, CAREL (1826–1888), Dutch poet and art-critic, was born at the Hague on the 20th of March 1826. He was trained to the law, and held various judiciary posts, but in 1873 withdrew entirely from legal practice. His first volume of poems, 1860, did not contain much that was remarkable. His temperament was starved in the very thin air of the intellectual Holland of those days, and it was not until after the sensational appearance of Multatuli (Edward Douwes-Dekker) that Vosmaer, at the age of forty, woke up to a consciousness of his own talent. In 1869 he produced an exhaustive monograph on Rembrandt, which was issued in French. Vosmaer became a contributor to, and then the leading spirit and editor of, a journal which played an immense part in the awakening of Dutch literature; this was the *Nederlandsche Spectator*, in which a great many of his own works, in prose and verse, originally appeared. The remarkable miscellanies of Vosmaer, called *Birds of Diverse Plumage*, appeared in three volumes, in 1872, 1874 and 1876. In 1879 he selected from these all the pieces in verse, and added other poems to them. In 1881 he published an archaeological novel called *Amazone*, the scene of which was laid in Naples and Rome, and which described the raptures of a Dutch antiquary in love. Vosmaer undertook the gigantic task of translating Homer into Dutch hexameters, and he lived just long enough to see this completed and revised. In 1873 he came to London to visit his lifelong friend, Sir (then Mr) Lawrence Alma-Tadema, and on his return published *Londinias*, an exceedingly brilliant mock-heroic poem in hexameters. His last poem was *Nanno*, an idyll on the Greek model. Vosmaer died, while travelling in Switzerland, on the 12th of June 1888. He was unique in his fine sense of plastic expression; he was eminently tasteful, lettered, refined. Without being a genius, he possessed immense talent, just of the order to be useful in combating the worn-out rhetoric of Dutch poetry. His verse was modelled on Heine and still more on the Greeks; it is sober, without colour, stately and a little cold. He was a curious student in versification, and it is due to him that hexameters were introduced and the sonnet reintroduced into Holland. He was the first to repudiate the traditional, wooden alexandrine. In prose he was greatly influenced by Multatuli, in praise of whom he wrote an eloquent treatise, *Een Zaaier* (*A Sower*). He was also somewhat under the influence of English prose models. (E. G.)

VOSS, JOHANN HEINRICH (1751–1826), German poet and translator, was born at Sommersdorf in Mecklenburg-Strelitz on the 20th of February 1751, the son of a farmer. After attending (1766–69) the gymnasium at Neubrandenburg, he was obliged to accept a private tutorship in order to earn money to enable him to study at a university. At the invitation of H. C. Boie, whose attention he had attracted by poems contributed to the Göttingen *Musenalmanach*, he went to Göttingen in 1772. Here he studied philology and became one of the leading spirits in the famous *Hain* or *Dichterbund*. In 1775 Boie made over to him the editorship of the *Musenalmanach*, which he continued to issue for several years. He married Boie's sister Ernestine in 1777 and in 1778 was appointed rector of the school at Otterndorf in Hanover. In 1782 he accepted the rectorship of the gymnasium at Eutin, where he remained until 1802. Retiring in this year with a pension of 600 thalers he settled at Jena, and in 1805, although Goethe used his utmost endeavours to persuade him to stay, accepted a call to a professorship at Heidelberg. Here, in the enjoyment of a considerable salary, he devoted himself entirely to his literary labours, translations and antiquarian research until his death on the 29th of March 1826.

Voss was a man of a remarkably independent and vigorous character. In 1785–95 he published in two volumes a collection of original poems, to which he afterwards made many additions. The best of these works is his idyllic poem *Luise* (1795), in which he sought, with much success, to apply the style and methods of classical poetry to the expression of modern German thought and sentiment. In his *Mythologische Briefe* (2 vols., 1794), in which he attacked the ideas of Christian Gottlob Heyne, in his *Antisymbolik* (2 vols., 1824–26), written in opposition to Georg Friedrich Creuzer (1771–1858), and in other writings he made important contributions to the study of mythology. He was also prominent as an advocate of the right of free judgment in religion, and at the time when some members of the Romantic school were being converted to the Roman Catholic church he produced a strong impression by a powerful article, in *Sophronizon*, on his friend Friedrich von Stolberg's repudiation of Protestantism (1819). It is, however, as a translator that Voss chiefly owes his place in German literature. His translations indicate not only sound scholarship but a thorough mastery of the laws of German diction and rhythm. The most famous of his translations are those of Homer. Of these the best is the translation of the *Odyssey*, as originally issued in 1781. He also translated Hesiod, Theocritus, Bion and Moschus, Virgil, Horace, Tibullus, Propertius and other classical poets, and he prepared a critical edition of Tibullus. In 1818–29 was published, in 9 vols., a translation of Shakespeare's plays, which he completed with the help of his sons Heinrich and Abraham, both of whom were scholars and writers of considerable ability.

J. H. Voss's *Sämtliche poetische Werke* were published by his son Abraham in 1835; new ed. 1850. A good selection is in A. Sauer, *Der Göttinger Dichterbund*, vol. i. (Kürschner's *Deutsche Nationalliteratur*, vol. 49, 1887). His Letters were also published by his son in 4 vols. (1829–33). Voss left a short autobiography, *Abriss meines Lebens* (1818). See also W. Herbst, *J. H. Voss* (3 vols., 1872–76); A. Heussner, *J. H. Voss als Schulmann in Eutin* (1882).

VOSS, RICHARD (1851–), German dramatist and novelist, was born at Neugrape, in Pomerania, on the 2nd of September 1851, the son of a country squire. Though intended for the life of a country gentleman, he showed no inclination for outdoor life, and on his return from the war of 1870–71, in which he was wounded, he studied philosophy at Jena and Munich, and then settled at Berchtesgaden. In 1884 Voss was appointed by the grand duke of Weimar librarian of the Wartburg, but, in consequence of illness, he resigned the post.

Chief among his dramas are *Savonarola* (1878); *Magda* (1879); *Die Patricierin* (1880); *Der Mohr des Zaren* (1883); *Unehrlich Volk* (1885); *Alexandra* (1888); *Eva* (1889); *Wehe dem Besiegten* (1889); *Die neue Zeit* (1891); *Schuldig* (1892). Among his novels may be mentioned *San Sebastian* (1883); *Der Sohn der Volskerin* (1885); *Die Sabinerin* (1888); *Der Mönch von Berchtesgaden* (1891); *Der neue Gott* (1898); *Die Rächerin* (1899); *Allerlei Erlebtes* (1902); and *Die Leute von Valdaré* (1902).

See M. Goldmann, *Richard Voss, ein literarisches Charakterbild* (1900).

VOSSEVANGEN, or Voss, a village and favourite tourist-centre of Norway, in South Bergenhus *amt* (county), 67 m. N.W. of Bergen by rail. It was the terminus of the finely engineered Bergen & Vossevangen railway, which, however, forms part of the projected trunk line between Christiania and Bergen. Vossevangen is pleasantly situated on the Vangsvand, in fertile upland, and has a stone church of the 13th century, and a *finneloft* or two-storeyed timber house of the 14th century, with an outside stair. Driving roads run N.E. and S.E. from Vossevangen. The former, passing Stalheim, descends into the sombre Naerödal, a precipitous valley terminating in the Naerö Fjord, a head-branch of the Sogne Fjord. The latter route follows the deep but gentler valley of the Skjerve, whence from Övre Vasenden roads continue to Eide (18 m.) and to Ulvik (32 m.), both on branches of the Hardanger Fjord.

VOSSIUS [Voss], **GERHARD JOHANN** (1577–1649), German classical scholar and theologian, was the son of Johannes Voss, a Protestant of the Netherlands, who fled from persecution into the Palatinate and became pastor in the village near Heidelberg where Gerhard was born. Johannes was a Calvinist, however, and the strict Lutherans of the Palatinate caused him once more to become a wanderer; in 1578 he settled at Leiden as student of theology, and finally became pastor at Dort, where he died in 1585. Here the son received his education, until in 1595 he entered the university of Leiden, where he became the lifelong friend of Hugo Grotius, and studied classics, Hebrew, church history and theology. In 1600 he was made rector of the high school at Dort, and devoted himself to philology and historical theology. From 1614 to 1619 he was director of the theological college at Leiden. Meantime he was gaining a great reputation as a scholar, not only in the Netherlands, but also in France and England. But in spite of the moderation of his views and his abstention from controversy, he came under suspicion of heresy, and escaped expulsion from his office only by resignation (1619). The year before he had published his valuable history of Pelagian controversies, which his enemies considered favoured the views of the Arminians or Remonstrants. In 1622, however, he was appointed professor of rhetoric and chronology, and subsequently of Greek, in the university. He declined invitations from Cambridge, but accepted from Archbishop Laud a prebend in Canterbury cathedral without residence, and went to England to be installed in 1629, when he was made LL.D. at Oxford. In 1632 he left Leiden to take the post of professor of history in the newly founded Athenaeum at Amsterdam, which he held till his death on the 19th of March 1649.

His son ISAAK (1618–1689), after a brilliant career of scholarship in Sweden, became residentiary canon at Windsor in 1673. He was the author of *De septuaginta interpretibus* (1661), *De poematum cantu et viribus rhythmi* (1673), and *Variarum observationum liber* (1685).

Vossius was amongst the first to treat theological dogmas and the heathen religions from the historical point of view. His principal works are *Historia Pelagiana sive Historiae de controversiis quas Pelagius ejusque reliquiae moverunt* (1618); *Aristarchus, sive de arte grammatica* (1635 and 1695; new ed. in 2 vols., 1833–35); *Etymologicum linguae Latinae* (1662; new ed. in two vols., 1762–63);

Commentariorum Rhetoricorum oratoriarum institutionum Libri VI. (1606 and often); *De Historicis Graecis Libri III.* (1624); *De Historicis Latinis Libri III.* (1627); *De Theologia Gentili* (1642); *Dissertationes Tres de Tribus Symbolis, Apostolico, Athanasiano et Constantinopolitano* (1642). Collected works published at Amsterdam (6 vols., 1695–1701).

See P. Niceron, *Mémoires pour servir à l'histoire des hommes illustres*, vol. xiii. (Paris, 1730); Herzog's *Realencyklopädie*, art. "Vossius"; and the article in the *Allgemeine Deutsche Biographie.*

VOTE and **VOTING.** The Latin *votum*, derived from *vovere*, to vow, meant a solemn promise, hence a wish, desire or prayer, in which senses the doublet "vow," derived through French, is used now chiefly. "Vote" is specially employed in the sense of a registering of one's choice in elections or on matters of debate, and the political meaning is the only one which requires comment.

Ancient.—In ancient Greece and Italy the institution of suffrage already existed in a rudimentary form at the outset of the historical period. In the primitive monarchies it was customary for the king to invite pronouncements of his folk on matters in which it was prudent to secure its assent beforehand. In these assemblies the people recorded their opinion by clamouring (a method which survived in Sparta as late as the 4th century B.C.), or by the clashing of spears on shields. This latter practice may be inferred to have obtained originally in Rome, the word *suffragium* meaning literally a responsive crash. Owing to the lack of routine in the early monarchies and aristocracies of Greece and Italy the vote as yet lacked importance as an instrument of government. But in the days of their full political development the communities of these countries had firmly established the principle of government according to the will of majorities, and their constitutions required almost every important act to be directed by a formal vote. This rule applied equally to the decisions of general assemblies, administrative councils and law courts, and obtained alike in states where suffrage was universal and where it was restricted.

In every case the taking of votes was effected in the form of a poll. The practice of the Athenians, which is shown by inscriptions to have been widely followed in the other states of Greece, was to hold a show of hands (χειροτονία), except on questions affecting the status of individuals: these latter, which included all lawsuits and proposals of ostracism (*q.v.*), were determined by secret ballot (ψήφισμα, so called from the ψῆφοι or pebbles with which the votes were cast). At Rome the method which prevailed up to the 2nd century B.C. was that of division (*discessio*). But the economic and social dependence of many voters on the nobility caused the system of open suffrage to be vitiated by intimidation and corruption. Hence a series of laws enacted between 139 and 107 B.C. prescribed the use of the ballot ("tabella," a slip of wood coated with wax) for all business done in the assemblies of the people.

For the purpose of carrying resolutions a simple majority of votes was deemed sufficient. Regulations about a *quorum* seem to have been unusual, though a notable exception occurs in the case of motions for ostracism at Athens. As a general rule equal value was made to attach to each vote; but in the popular assemblies at Rome a system of voting by groups was in force until the middle of the 3rd century B.C. by which the richer classes secured a decisive preponderance (see COMITIA).

As compared with modern practice the function of voting was restricted in some notable ways. (1) In the democracies of Greece the use of the lot largely supplanted polling for the election of magistrates: at Athens voting was limited to the choice of officers with special technical qualifications. (2) In accordance with the theory which required residence at the seat of government as a condition of franchise, the suffrage could as a rule only be exercised in the capital town. The only known exception under a centralized government was a short-lived experiment under the emperor Augustus, who arranged for polling stations to be opened at election-time in the country towns of Italy. In federal governments the election of deputies to a central legislature seems to be attested by the practice of the Achaean League, where the federal Council was probably elected in the several constituent towns. But little is known as to ancient methods of electing delegates to representative institutions, and in general it may be said that the function of suffrage in Greece and Italy throws no light upon contemporary problems, such as the use of single-area constituencies and proportional representation.

Modern.—The modern method of obtaining a collective expression of opinion of any body of persons may be either "open" or secret. An open expression of opinion may be by some word of assent or negation, or by some visible sign, as the holding up of a hand. Indeed any method of voting which does not expressly make provision for concealing the identity of the person registering the vote is "open." Some methods of voting still employed (as in the case of parliamentary elections for some of the English universities, where votes may be sent by post) must necessarily reveal the manner in which the elector has recorded his vote. It is in connexion with the election of members of representative bodies—especially legislative bodies—that the qualifications for and methods of voting become especially important. Practically every civilized country has accepted and put in force some form of representation, which may be defined as the theory and principles on which the obtaining of a vote is founded. These are dealt with in the article REPRESENTATION, and it will be sufficient to give here the various qualifications which are considered by different countries as sufficient to give effect to the principle of representation and the methods of recording votes. In detail these are given for the United Kingdom and the United States in the articles REGISTRATION of Voters and ELECTIONS, and for other countries under their respective titles in the sections dealing with the Constitution.

The first consideration is the age at which a person should be qualified for a vote. This in a large number of countries is fixed at the age of manhood, namely, twenty-one years of age, but in Hungary the age is fixed at twenty years, in Austria twenty-four years, while in Belgium, Baden, Bavaria, Hesse, Prussia, Saxony, Japan, the Netherlands and Norway the age is twenty-five years, and in Denmark thirty years. Some countries (*e.g.* Austria, Germany, France) have adopted the principle of what is often termed "manhood or universal suffrage," *i.e.* every male adult, not a criminal or a lunatic, being entitled to a vote, but in all cases some further qualifications than mere manhood are required, as in Austria a year's residence in the place of election, or in France a six months' residence. A common qualification is that the elector should be able to read and write. This is required in Italy and Portugal and some of the smaller European states, in some states of the United States (see ELECTIONS) and in many of the South American republics. But the most universal qualification of all is some outward visible sign of a substantial interest in the state. The word "substantial" is used here in a comparative sense, as opposed to that form of suffrage which requires nothing more for its exercise than attainment of manhood and perhaps a certain qualifying period of residence. This tangible sign of interest in the state may take the form of possession of property, however small in amount, or the payment of some amount of direct taxation, indeed in some cases, as will be seen, this is rewarded by the conferring of extra votes.

In the United Kingdom possession of freehold or leasehold property of a certain value or occupation of premises of a certain annual value gives a vote. This qualification of property may be said to be included in what is termed the "lodger" vote, given to the occupier of lodgings of the yearly value unfurnished of not less than £10. In Hungary, the payment of a small direct tax on house property or land or on an income varying with occupation is necessary. So in Prussia, Saxony, Bavaria, Hesse, Italy (unless a certain standard in elementary education has been reached), Japan, the Netherlands, Portugal (unless the elector is able to read and write) and Russia. Some of the states in the United States also require the payment of a poll tax. On the other hand, in Russia, students, soldiers, governors of provinces and police officers are disqualified from voting; in Portugal, bankrupts, beggars, domestic servants, workmen in government service and non-commissioned officers are not electors; it must be noted, however, that the government of the new Portuguese republic promised in 1910 a drastic revision of the existing franchise. Italy disfranchises non-commissioned officers and men in the army while under arms, as do France and Brazil. The United Kingdom and Denmark disqualify those in actual receipt of parish relief, while in Norway, apparently, receipt of parish relief at any time is a disqualification, which, however, may be removed by the recipient paying back the sums so received. In some countries, *e.g.* Brazil, the suffrage is refused to members of monastic orders, &c., under vows of obedience. Apart from those countries where a modicum of education is necessary as a test of right to the franchise, there are others where education is specially favoured in granting the franchise. In the United Kingdom the members of eight universities (Oxford, Cambridge, London, Dublin University, Glasgow, Edinburgh, Aberdeen and St Andrews) send nine members to parliament; in Hungary members of the professional, scientific, learned and other classes (over 80,000) are entitled to vote without any other qualification; in Brunswick the scientific classes elect three members to the legislative chamber; in Saxony, members of scientific or artistic professions have extra votes; in Italy, members of academies and professors are qualified to vote by their position; while in the Netherlands legal qualifications for any profession or employment give a vote.

Many objections have been urged of late years to the principle of according a plurality of votes to one individual on account of superior qualifications over others which he may be considered to possess. In the United Kingdom, where, roughly speaking, the principle of representation is that of taxation, the possession of qualifying property in any number of electoral districts will give a vote in each of those districts. Whether those votes can be actually registered will of course depend on certain circumstances, such as the distance of the districts apart and whether the elections are held on the same day or not. The Radical party in the United Kingdom have of late years been hostile to any system of plurality of votes (whether gained by educational, property or other qualifications), though it may be said that the tendency of some recent electoral systems has been to introduce a steadying principle of this nature. In 1906 a bill was introduced for reducing the system of plural voting in the United Kingdom; it passed through the House of Commons, but was rejected by the House of Lords. The most remarkable system of plural voting was that introduced in Belgium by the electoral law of 1894. Under it, every citizen over thirty-five years of age with legitimate issue, and paying at least 5 francs a year in house tax, has a supplemental vote, as has every citizen over twenty-five owning immovable property to the value of 2000 francs, or having a corresponding income from such property, or who for two years has derived at least 100 francs a year from Belgian funds either directly or through the savings bank. Two supplementary votes are given to citizens over twenty-five who have received a diploma of higher instruction, or a certificate of higher secondary instruction, or who fill or have filled offices, or engaged in private professional instruction, implying at least average higher instruction. Three votes is the highest number allowed, while failure to vote is punishable as a misdemeanour. In 1908–9 the number of electors in Belgium was 1,651,647, of whom 981,866 had one vote, 378,264 two votes and 291,517 three votes. In some other countries weight is given to special qualifications. In the town of Bremen the government is in the hands of a senate of 16 members and a Convent of Burgesses (Bürgerschaft) of 150 members. These latter are elected by the votes of all the citizens divided into classes. University men return 14 members, merchants 40 members, mechanics and manufacturers 20 members, and the other inhabitants the remainder. So in Brunswick and in Hamburg legislators are returned by voters representing various interests. In Prussia, representatives are chosen by direct electors who in their turn are elected by indirect electors. One direct elector is elected from every complete number of 250 souls. The indirect electors are divided into three classes, the first class comprising those who pay the highest taxes to the amount of one-third of the whole; the second, of those who pay the next highest amount down to the limits of the second third; the third, of all the lowest taxed. In Italy electors must either have attained a certain standard of elementary education, or pay a certain amount of direct taxation, or if peasant farmers pay a certain amount of rent, or if occupants of lodgings, shops, &c., in towns, pay an annual rent according to the population of the commune. In Japan, voters must pay either land tax of a certain amount for not less than a year or direct taxes other than land tax for more than two years. In the Netherlands, householders, or those who have paid the rent of houses or lodgings for a certain period, are qualified for the franchise, as are owners or tenants of boats of not less than 24 tons capacity, as well as those who have been for a certain period in employment with an annual wage of not less than £22, 18s. 4d., have a certificate of state interest of not less than 100 florins or a savings bank deposit of not less than 50 florins.

The method now adopted in most countries of recording votes is that of secret voting or ballot (*q.v.*). This is carried out sometimes by a machine (see VOTING MACHINES). The method of determining the successful candidate varies greatly in different countries. In the United Kingdom the candidate who obtains a relative majority is elected, *i.e.* it is necessary only to obtain more votes than any other candidate (see REPRESENTATION).

VOTING MACHINES. The complications in the voting at American elections have resulted in the invention of various machines for registering and counting the ballots. These machines are in fact mechanical Australian ballots. The necessity for them has been emphasized by election practice in many parts of the United States, where in a single election there have been from five to ten parties on the ballot, with an aggregate of four hundred or five hundred candidates, making the paper ballots large and difficult to handle. The objections to the paper ballot are further emphasized in the results obtained. The number of void and blank ballots is seldom less than 5% of the number of voters voting, and is often as high as 40%. This lost vote is often greater than the majority of the successful candidate. In close elections there is an endless dispute as to whether the disputed ballots do or do not comply with the law. The election contest and recount expenses frequently exceed the cost of holding the election, and the title of the candidates to the office is frequently held in abeyance by a protracted contest until after the term of office has expired. A number of ways have been devised for marking the Australian ballot for identification without destroying its legality. The X is a very simple and well-known mark, yet in the case of *Coulehan* v. *White*, before the Supreme Court of Maryland, twenty-seven different ways of making the mark "X" were shown in the ballots in controversy, and all of them were a subject for judicial consideration, on which the judges of even the highest court could find room for disagreement. Wigmore in his book on the Australian ballot system points out thirteen ways of wrongly placing the mark, and forty-four errors in the style of the mark, besides many other errors tending to invalidate the ballot, all of them having frequently occurred in actual practice. These errors are not confined to the illiterates, but are just as common among the best-educated people. The ballots can and have frequently been altered or miscounted by unscrupulous election officers, and the detection of the fraud is frequently difficult and always expensive.

Voting machines were devised first by English, and later with more success by American inventors. The earlier machines of Vassie, Chamberlain, Sydserff (1869) and Davie (1870) were practically all directed toward voting for the candidates of a single office by a ball, the ball going into one compartment or the other according to the choice of the voter. The use of the ball is in accordance with the original idea of ballot, which means "a little ball"; and because of the requirement of many of the constitutions of the states of the United States, that "elections shall be by ballot," many American inventors follow this idea of using balls to indicate their votes. Others, however, maintaining that secrecy was the essential idea of voting by ballot, and that the form of the ballot was immaterial, worked on the idea of using a key and a counter for each candidate, the counter registering the successive impulses given to it by the key, the machine preventing the voter from giving the key more than one impulse, and preventing the voter from operating more keys than he is entitled to vote. The highest courts of four different American states have ruled that any form of voting machine that secured secrecy would be constitutional.

The first voting machine used in an election was the Myers Ballot Machine used at Lockport, New York, in 1892. This machine had a vertical keyboard with columns of push keys thereon, each column representing a party, and each key belonging to a candidate of that party, the keys of each horizontal line belonging to the candidates of the various parties for a particular office. The voter pushed one of the knobs in each office line, which knob operated its counter and locked all other possible votes for the same office until the voter left the booth. The operated keys were released by the operation of the second booth door as the voter left the machine, and they were then reset by springs. The doors were so arranged that the voter must first pass through one and lock it behind him before he could open the second one to get out. This both preserved secrecy and prevented repeating. Some sixty-five or more of these machines were used in the election in the city of Rochester, N.Y., in November 1896, and with marked success.

The McTammany Machine, operated by keys which punched holes in a web of paper. On this web the votes of each candidate were all punched in a single column, each separate column representing a separate candidate. The voter does not see the web, which is removed from the machine by the election officers after the election is over, and the vote thereon is canvassed by passing the web through a pneumatic counting machine. The paper web makes a separate record of each man's ballot that can be identified by a person skilled in the use of the machine. The machine is also slow in giving returns, due to the fact that the vote has to be counted after the election.

In other types of machines each candidate had a separate receptacle, into which the machine dropped a ball for each vote that was cast for the candidate. These machines have so far not been successful. The whole development of practical voting machines has been limited to those machines in which a separate counter is provided for each candidate, the counter being operated either directly or indirectly by the voter. Of this type is the Myers machine, as well as the other machines mentioned here.

The Bardwell Votometer had a separate counter for each candidate, with a single key for operating all the counters on the machine. A keyhole was provided in each counter, in which the key could be inserted, and by turning it 180° the counter was operated and the key could be removed for use in another counter. The voter could operate but one counter at a time, and could not operate the counters in very rapid succession. The limited use of this machine can be attributed principally to the slowness with which it can be worked. The voter enters this machine by raising a bar at one end, which unlocks the counters for voting operation. Raising a similar bar at the other end as the voter passes out resets the machine for the next voter and locks it.

The Abbott Machine has attained considerable use in the state of Michigan. In this machine the counters for each office are carried on a separate slide, and the voter moves these slides for the various offices from left to right, until the counter carrying the name of the candidate of his choice in each office row is lined up with the operating bar. The vertical movement of the operating bar counts the vote on each of these slides, rings a bell, which notifies the election officer that a vote has been cast, and locks the machine against further voting. The election officer then moves a slide which resets the machine for the next voter. The machine is limited in its application because two or more candidates on the same office line cannot be voted for by the same voter, although the voter may be entitled to vote for more than one candidate.

The U.S. Standard Voting Machine has had the most extensive use of any. A separate key is provided for each candidate, which keys are arranged on the keyboard of the machine in horizontal party rows and vertical office lines. Each key is shaped like a small pointer, which extends to the right from its pivot, and passes through the keyboard. The key swings downward from horizontal position and points to the name of the candidate below it. The keys are lettered consecutively by party rows, and numbered by office rows, so that each key bears a number and a letter distinguishing it from all others. At the left of each party row is a party lever, by the movement of which all of the keys in that party row are simultaneously placed in voted position. In states that do not have party circles on the ballot these levers are omitted. Extending outward from the top of the machine is a rail, from which is suspended a curtain. Pivoted in the middle of the top of the machine is a lever, which extends outwardly and has a loose connexion with a curtain. The operation of the lever by a convenient handle enables the voter to close the curtain and unlock the machine for voting, after which the voter cannot retire from the machine until he has voted on the machine to a certain extent. The operation of any one of the party levers rings a bell to show that he has voted, and permits the reverse movement of the curtain lever, which counts the vote, resets the machine for the next voter and opens the curtain. Before opening the curtain the vote is not counted, and the voter can take back or change his vote. Repeating is prevented by a knob on the end of the machine, which locks the curtain lever against a second movement until it is released by the election officer. At the top of the machine is a paper roll on which the voter can write the names of candidates whose names do not appear on the machine in connexion with keys. This roll is concealed by slides, one for each office line of keys, which slides must be lifted to expose the paper. An interlocking mechanism controls all the voting devices so that the voter cannot vote more than he is entitled to vote. These machines have been built large enough to provide for seven parties of sixty candidates each, and for thirty questions and amendments, a machine of such size carrying 480 counters, besides the total vote and protective counters.

The Dean Machine has its keyboard placed horizontally, the keys being push buttons, which are arranged in party columns and transverse office rows. Party levers are provided by which the keys of the party are moved to voted position. Considerable stress is laid on the small keyboard of this machine, the peculiar type of counter used on it, and the separate card ballot for voting for unnominated candidates.

Each state that adopts voting machines first enacts a law specifying the requirements that must be met in the construction of the machines. These requirements are substantially the same in all the states, the laws being copied largely from the New York Voting Machine Law. The laws require in general that the machine shall give the voter all the facilities for expressing his choice which the Australian ballot gives him, and further require that the machine shall prevent those mistakes or frauds, which if made on an Australian ballot would invalidate it.

Many of the states have special requirements, to meet which many ingenious features have been provided on the various machines. Among these is the group of 18 supervisors in San Francisco, for which office as many as 108 candidates have appeared upon one ballot, out of which the machine must permit the voter to vote any 18 and no more, regardless of the sequence in which they are selected, or the position in which they occur.

Another of these local features is the primary election feature required by Minnesota, in which state the various parties must hold their primary election at the same time and on the same machine. The voter announcing the party of his preference finds the voting devices on the machine of all other parties locked against him, but the voting devices of his own party are open to his use.

Still another is the lockout, by which the voter of limited voting franchises is prevented from voting for the candidates of certain offices. Another is the endorsed candidate in a group. Here the same candidate's name is provided with two or more voting devices in a group wherein the voter is allowed to vote for two or more candidates. Special provision must then be made to keep voters from voting twice for the same candidate.

As to the important benefits attending the use of machines, there can be mentioned accuracy both in the casting and the counting of the vote, speed in getting in returns, and economy in holding elections. The improvement in accuracy is shown by the fact that the vote for each office usually runs 99% or more of the highest possible vote that could be registered by the number of voters that have voted. Speed is shown by the fact that in the city of Buffalo, with 60,000 voters voting on election day, the complete returns, including the vote on over 100 candidates for the whole city, have been collected, tabulated and announced within 75 minutes from the closing of the polls. Economy is shown by the fact that although these machines are used but one or two days in each year, election expenses are reduced to such an extent that the machines pay for themselves in five or six elections. This is partly due to the smaller number of precincts necessary and the smaller number of election officers in each precinct and the shorter hours that they must work. The city of Buffalo has a dozen or more precincts, in each of which 800 voters or more are voted in an election day of ten hours, and in that city as many as 1041 voters have voted in one election day on one machine. (F. Ke.)

VOTKINSK, a town and iron-works, in the Russian government of Vyatka, 40 m. N. of Sarapul and 8 m. W. from the Kama, founded in 1756. Pop. 21,000. Votkinsk was formerly one of the chief government establishments for the construction of steamers for the Caspian, as well as of locomotives for the Siberian railway, and it has long been renowned for its excellent tarantasses (driving vehicles) and other smaller iron-wares, as well as for its knitted goods. Its agricultural machinery is known throughout Russia.

VOUCHER (from "to vouch," to warrant, answer for, O. Fr. *voucher*, to cite, call in aid, Lat. *vocare*, to call, summon), any document in writing which confirms the truth of accounts or establishes other facts, more particularly a receipt or other evidence in writing which establishes the fact of the payment of money.

VOUET, SIMON (1590–1649), French painter, was born at Paris on the 9th of January 1590. He passed many years in Italy, where he married, and established himself at Rome, enjoying there a high reputation as a portrait painter. Louis XIII. recalled him to France and lodged him in the Louvre with the title of First Painter to the Crown. All royal work for the palaces of the Louvre and the Luxembourg was placed in his hands; the king became his pupil; he formed a large school, and renewed the traditions of that of Fontainebleau. Among his scholars was the famous Le Brun. Vouet was an exceedingly skilful painter, especially in decoration, and executed important works of this class for Cardinal Richelieu (Rueil and Palais Royal) and other great nobles. His better easel pictures bear a curious resemblance to those of Sassoferrato. Almost everything he did was engraved by his sons-in-law Tortebat and Dorigny.

VOUSSOIR (Ger. *Wölbestein*), the French term used by architects for the wedge-shaped stones or other material with which the arch (*q.v.*) is constructed; the lowest stone on each side is termed the springer (Fr. *coussinet sommier*) and the upper one at the crown of the arch the keystone (Fr. *claveau*).

VOW (Lat. *votum*, vow, *promise*: cf. VOTE), a transaction between a man and a god, whereby the former undertakes in the future to render some service or gift to the god or devotes something valuable now and here to his use. The god on his part is reckoned to be going to grant or to have granted already some special favour to his votary in return for the promise made or service declared. Different formalities and ceremonies may in different religions attend the taking of a vow, but in all the wrath of heaven or of hell is visited upon one who breaks it. A vow has to be distinguished, firstly, from other and lower ways of persuading or constraining supernatural powers to give what man desires and to help him in time of need; and secondly, from the ordered ritual and regularly recurring ceremonies of religion. These two distinctions must be examined a little more at length.

It would be an abuse of language to apply the term vow to the uses of imitative magic, *e.g.* to the action of a barren woman among the Battas of Sumatra, who in order to become a mother makes a wooden image of a child and holds it in her lap. For in such rites no prominence is given to the idea—even if it exists—of a personal relation between the petitioner and the supernatural power. The latter is, so to speak, mechanically constrained to act by the spell or magical rite; the forces liberated in fulfilment, not of a petition, but of *a wish* are not those of a conscious will, and therefore no thanks are due from the wisher in case he is successful. The deities, however, to whom vows are made or discharged are already personal beings, capable of entering into contracts or covenants with man, of understanding the claims which his vow establishes on their benevolence, and of valuing his gratitude; conversely, in the taking of a vow the petitioner's piety and spiritual attitude have begun to outweigh those merely ritual details of the ceremony which in magical rites are all-important.

Sometimes the old magical usage survives side by side with the more developed idea of a personal power to be approached in prayer. For example, in the Maghrib (in North Africa), in time of drought the maidens of Mazouna carry every evening in procession through the streets a doll called *ghonja*, really a dressed-up wooden spoon, symbolizing a pre-Islamic rain-spirit. Often one of the girls carries on her shoulders a sheep, and her companions sing the following words:—

> "Rain, fall, and I will give you my kid.
> He has a black head; he neither bleats
> Nor complains; he says not, 'I am cold.'
> Rain, who fillest the skins,
> Wet our raiment.
> Rain, who feedest the rivers,
> Overturn the doors of our houses."

Here we have a sympathetic rain charm, combined with a prayer to the rain viewed as a personal goddess and with a promise or vow to give her the animal. The point of the promise lies of course in the fact that water is in that country stored and carried in sheep-skins.[1]

Secondly, the vow is quite apart from established cults, and is not provided for in the religious calendar. The Roman vow (*votum*), as W. W. Fowler observes in his work *The Roman Festivals* (London, 1899), p. 346, "was the exception, not the rule; it was a promise made by an individual at some critical moment, not the ordered and recurring ritual of the family or the State." The vow, however, contained so large an element of ordinary prayer that in the Greek language one and the same word (*εὐχή*) expressed both. The characteristic mark of the vow, as Suidas in his lexicon and the Greek Church fathers remark, was that it was a promise either of things to be offered to God in the future and at once consecrated to Him in view of their being so offered, or of austerities to be undergone. For offering and austerity, sacrifice and suffering, are equally calculated to appease an offended deity's wrath or win his goodwill.

The Bible affords many examples of vows. Thus in Judges xi. Jephthah "vowed a vow unto the Lord, and said, If thou wilt indeed deliver the children of Ammon into my hand, then it shall be that whosoever cometh forth out of the doors of my house to meet me, when I return in peace from the children of Ammon, it shall be the Lord's, and I will offer it up for a burnt-offering." In the sequel it is his own daughter who so meets him, and he sacrifices her after a respite of two months granted her in order to "bewail her virginity upon the mountains." A thing or person thus vowed to the deity became holy or *taboo*; and for it, as the above story indicates, nothing could be substituted. It belonged to once to the sanctuary or to the priests who represented the god. In the Jewish religion, the latter, under certain conditions, defined in Leviticus xxvii., could permit it to be redeemed. But to substitute an unclean for a clean beast which had been vowed, or an imperfect victim for a flawless one, was to court with certainty the divine displeasure.

It is often difficult to distinguish a vow from an oath. Thus in Acts xxiii. 21, over forty Jews, enemies of Paul, bound themselves, under a curse, neither to eat nor to drink till they had slain him. In the Christian Fathers we hear of vows to abstain from flesh diet and wine. But of the abstentions observed by votaries, those which had relation to the barber's art were the commonest. Wherever individuals were concerned to create or confirm a tie connecting them with a god, a shrine or a particular religious circle, a hair-offering was in some form or other imperative. They began by polling their locks at the shrine and left them as a soul-token in charge of the god, and never polled them afresh until the vow was fulfilled. So Achilles consecrated his hair to the river Spercheus and vowed not to cut it till he should return safe from Troy; and the Hebrew Nazarite, whose strength resided in his flowing locks, only cut them off and burned them on the altar when the days of his vow were ended, and he could return to ordinary life, having achieved his mission. So in Acts xviii. 18 Paul "had shorn his head in Cenchreae, for he had a vow." In Acts xxi. 23 we hear of four Jews who, having a vow on them, had their heads shaved at Paul's expense. Among the ancient Chatti, as Tacitus relates (*Germania*, 31), young men allowed their hair and beards to grow, and vowed to court danger in that guise until they each had slain an enemy. Robertson Smith (*Religion of the Semites*, ed. 1901, p. 483) with much probability explains such usages from the widespread primitive belief that a man's life lurks in his hair, so that the devotee being consecrated or *taboo* to a god, his hair must be retained during the period of *taboo* or purification (as it is called in Acts xxi. 26) lest it be dissipated and profaned. The hair being part and parcel of the votary, its profanation would profane him and break the *taboo*. The same author remarks that this is why, when the hair of a Maori chief was cut, it was, being like the rest of his person sacred or *taboo*, collected and buried in a sacred place or hung on a tree. And we meet with the same scruple in the initiation rite, called *σχῆμα*, of Eastern monks. First, the novice is carefully denuded of the clothes, shoes and headgear, which he wore in the world, and which, being profane or unclean, would violate the *taboo* about to be set on him. His hair is then polled crosswise by way of consecrating it; and in some forms of the rite the presiding monk, called "the father of the hair," collects the shorn locks and deposits them under the altar or in some other safe and sacred place. Greek nuns used to keep the hair thus shorn off, weave it into girdles, and wear it for the rest of their lives round their waists, where close to their holy persons there was no risk of its being defiled by alien contact. The rest of this rite of *σχῆμα*, especially as it is preserved in the old Armenian versions, smacks no less of the most primitive *taboo*. For the novice, after being thus tonsured, advances to the altar holding a taper in either hand, just as tapers were tied to the horns of an animal victim; the new and sacred garb which is to demarcate him henceforth from the unclean world is put upon him, and the presiding father laying his right hand upon him devotes him with a prayer which begins thus:—

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[1] Professor A. Bel in paper *Quelque rites pour obtenir la pluie*, in xiv^{me} *Congrès des Orientalistes* (Alger, 1905).

> "To thee, O Lord, as a rational whole burnt-offering, as mystic frankincense, as voluntary homage and worship, we offer up this thy servant N. or M."

From the same point of view is to be explained the prohibition to one under a vow of flesh diet and fermented drinks; for it was believed that by partaking of these a man might introduce into his body the unclean spirits which inhabited them—the brute soul which infested meat, especially when the animal was strangled, and the cardiac demon, as the Rabbis called it, which harboured in wine.

The same considerations help to explain the custom of votive offerings. Any popular shrine in Latin countries is hung with wax models of limbs that have been healed, of ships saved from wreck, or with pictures representing the votary's escape from perils by land and sea. So Cicero (*de Deorum Natura*, iii. 37) relates how a friend remarked to Diagoras the Atheist when they reached Samothrace: "You who say that the gods neglect men's affairs, do you not perceive from the many pictures how many have escaped the force of the tempest and reached harbour safely." Diagoras's answer, that the many more who had suffered shipwreck and perished had no pictures to record their fate does not concern us here. It is only pertinent to remark that these *votivae tabellae* and offerings may have had originally another significance than that of merely recording the votary's salvation and of marking his gratitude. The model ship may be a substitute for the entire ship which is become sacred to the god, but cannot be deposited in the shrine; the miniature limbs of wax are substitutes for the real limbs which now belong to the god. In other cases the very objects which are *taboo* are given to the god as when a sailor deposits his salt-stained suit before the idol.

The general idea, then, involved in vows, whether ancient or modern, is that to express which the modern anthropologist borrows the Polynesian word *taboo*. The votary desirous to "antedate his future act of service and make its efficacy begin at once,"[1] formally dedicates through spoken formula and ritual act a lifeless object such as a ring, an animal, his hair or his entire person to the god. He so either makes sure of future blessings, or shows gratitude for those already conferred. Most of the ritual prescriptions that accompany vows are intended to guard inviolate the sanctity or *taboo*, the atmosphere of holiness or ritual purity, which envelops the persons or objects vowed or reserved to the god, and thereby separated from ordinary secular use.

The consideration of the moral effect of vows upon those who take them belongs rather to the history of Christian asceticism. It may, however, be remarked here that monkish vows, while they may lend to a man's life a certain fixity of aim and moral intensity, nevertheless tend to narrow his interests, and paralyse his wider activities and sympathies. In particular a monk binds himself to a lifelong and often morbid struggle against the order of nature; and motives become for him not good or bad according to the place they occupy in the living context of social life, but according as they bear upon an abstract and useless ideal. (F. C. C.)

VOZNESENSK, a town of Russia, in the government of Kherson, on the left bank of the river Bug, at the head of navigation, 55 m. N.W. from Nikolayev, to which steamers ply regularly. Pop. 14,178. It is a river port of some importance, and holds four large fairs annually. It contains a cathedral, a public garden and distilleries and breweries.

VRANCX, SEBASTIAN, born about 1572, was a painter of the Antwerp school, of very moderate ability. Most of his pictures represent scenes of war, such as the sack of towns, cavalry combats and the like. Though occasionally vigorous in drawing, his paintings are dull and heavy in tone. The date of his death is uncertain.

VRANYA, or VRANYÉ, the most southerly town of the kingdom of Servia, 7½ m. from the Macedonian frontier, on a slope descending from Mount Placevitza to the plain of the Upper Morava, in a picturesque and fertile country. Pop. (1900) 11,921. In the Russo-Turkish War of 1877 it was captured by the Servian army from the Turks, and subsequently was incorporated in the kingdom. It is the capital of a department of the same name, and is an important station on the railway from Nish to Salonica, with a custom house, principally for merchandise imported into Servia via Salonica. Its inhabitants are employed chiefly in the cultivation of flax and hemp, and in the making of ropes. There is a much frequented summer resort 4½ m. E., called Vranyska Banya, with baths of hot sulphurous mineral water.

VRATZA, the capital of the department of Vratza, Bulgaria, on the northern slope of the Stara Planina and on a small subtributary of the Danube. Pop. (1906) 14,832. Vratza is an archiepiscopal see and the headquarters of a military division. Wine, leather and gold and silver filigree are manufactured, and there is a school of sericulture.

VRIENDT, JULIAEN JOSEPH DE (1842–), and **ALBRECHT FRANÇOIS LIEVEN DE** (1843–1900), Belgian painters, both born at Ghent, sons of a decorative painter. The two brothers were close friends, and their works show marked signs of resemblance. Having received their early training from their father at Ghent, they removed to Antwerp, where they soon yielded to the influence of the painter Baron Henri Leys. Albrecht became director of the Academy of Fine Arts at Antwerp and was succeeded by his brother. Albrecht's principal works are "Jacqueline of Bavaria imploring Philip the Good to pardon her Husband" (1871, Liége Gallery), "The Excommunication of Bouchard d'Avesnes" (1877, Brussels Gallery), "The Angelus" (1877, acquired by Leopold II., king of the Belgians), "Pope Paul III. before Luther's Portrait" (1883, Antwerp Gallery), "The Citizens of Ghent paying homage to the child Charles V." (1885, Brussels Gallery), "Philip the Handsome swearing fidelity to the privileges of the Town of Furnes" (1893, Furnes town hall), "The Virgin of St Luc" (1894, triptych in Antwerp Cathedral), and the decoration of the municipal hall at Bruges, which was completed by his brother. Among Juliaen's more notable works are "The Citizens of Eisenach driving out St Elizabeth of Hungary" (1871, Liége Gallery), "Jairus's Daughter" (1888, Antwerp Gallery), mural paintings in the Palais de Justice at Antwerp (1893), and "The Christmas Carol" (1894, Brussels Gallery).

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[1] *Religion of the Semites*, Lect. ix.

VRYHEID, a town of northern Natal, 291 m. by rail N. by W. of Durban. Pop. (1904) 2287, of whom 1344 were whites. It is the chief town of a district, of the same name, rich in mineral wealth, including copper, coal and gold. The coalfields of Hlobane are S.E. of the town. Originally part of Zululand the district of Vryheid was ceded by Dinizulu to a party of Boers under Lucas Meyer, who aided him to crush his opponents, and was proclaimed an independent state under the title of the New Republic in 1884. In 1888 it was incorporated with the Transvaal and in 1903 annexed to Natal (see TRANSVAAL, § *History*; and ZULULAND, § *History*).

V-SHAPED DEPRESSION, in meteorology, a narrow area of low pressure usually occurring between two adjacent anticyclones, and taking the form of a V or tongue, as do the isobars representing it on a weather-chart. Such a depression may be regarded as a projection from a cyclonic system lying to one side of the two anticyclones. A similar depression, however, is frequently formed within a larger area of depression, *i.e.* an ordinary cyclone, and sometimes develops so far as to have a complete circulation of its own; it is then known as a "secondary." The line of lowest depression following the axis of the V brings with it heavy squalls and a sudden change of wind from one direction almost to the opposite. It is preceded by signs of break in the weather such as usually herald the approach of an ordinary cyclone, and is followed by the usual signs of clearance. The occurrence of a V-depression or secondary within an ordinary cyclonic system intensifies, often to a dangerous degree, the usual disturbances in the weather accompanying that system. Conditions exactly opposite to those accompanying a V-shaped depression are provided by a "wedge" (*q.v.*).

VULCAN (*Volcanus*), the Roman god of fire, and more especially of devouring flame (Virg. *Aen.* 5. 662). Whether he was also, like Hephaestus, the deity of smiths, is very doubtful; his surname *Mulciber* may rather be referred to his power to allay conflagrations. In the Comitium was an "area Volcani," also called "Volcanal"; and here on the 23rd of August (Volcanalia) the Flamen Volcanalis sacrificed, and the heads of Roman families threw into the fire small fish, which the Tiber fishermen sold on the spot. This flamen also sacrificed on the 1st of May to Maia, who in an old prayer formula (Gellius 13. 23) was coupled with Volcanus as Maia Volcani. It is not easy to explain these survivals of an old cult. But in historical times the association of this god with conflagrations becomes very apparent; when Augustus organized the city in *regiones* and *vici* to check the constant danger from fires, the *magistri vicorum* (officers of administrative districts) worshipped him as *Volcanus quietus augustus* (*C.I.L.* vi. 801 and 802) and on the 23rd of August there was a sacrifice to him together with Ops Opifera and the Nymphae, which suggests the need of water in quenching the flames. At Ostia, where much of the corn was stored which fed the Roman population, the cult of this god became famous; and it is probable that the fixing of his festival in August by the early Romans had some reference to the danger to the newly harvested corn from fire in that month. (W. W. F.*)

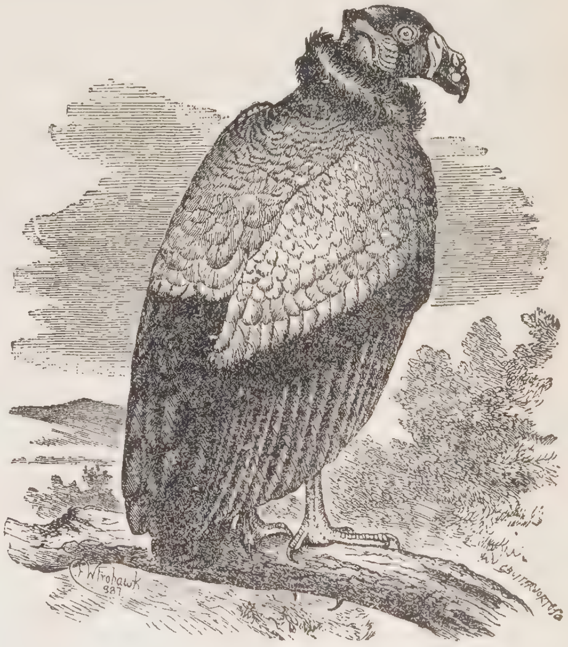
VULGATE (from Lat. *vulgus*, the common people), a Latin version of the Bible prepared in the 4th century by St Jerome, and so called from its common use in the Roman Catholic Church (see BIBLE: *Texts and Versions*). Pius X. in 1908 entrusted to the Benedictine Order the task of revising the text, beginning with the Old Testament.

VULPECULA ET ANSER ("THE FOX AND GOOSE"), in astronomy, a modern constellation of the northern hemisphere, introduced by Hevelius, who catalogued twenty-seven stars. Interest is attached to *Nova Vulpeculae*, a "new" star discovered by Anthelm in 1670; *T Vulpeculae*, a short period variable; and the famous "Dumb-bell" nebula.

VULPIUS, CHRISTIAN AUGUST (1762–1827), German author, was born at Weimar on the 23rd of January 1762, and was educated at Jena and Erlangen. In 1790 he returned to Weimar, where Goethe, who had entered into relations with Vulpius's sister Christine (1765–1816), whom he afterwards married, obtained employment for him. Here Vulpius began, in imitation of Christian Heinrich Spiess, to write a series of romantic narratives. Of these (about sixty in number) his *Rinaldo Rinaldini* (1797), the scene of which is laid in Italy during the middle ages, is the best. In 1797 Vulpius was given an appointment on the Weimar library, of which he became chief librarian in 1806. He died at Weimar on the 25th of June 1827.

VULTURE, the name of certain birds whose best-known characteristic is that of feeding upon carcases. The genus *Vultur*, as instituted by Linnaeus, is now restricted by ornithologists to a single species, *V. monachus*. The other species included therein by him, or thereto referred by succeeding systematists, being elsewhere relegated (see LÄMMERGEYER). A most important taxonomic change was introduced by T. H. Huxley (*Proc. Zool. Society*, 1867, pp. 462–64), who pointed out the complete structural difference between the vultures of the New World and those of the Old, regarding the former as constituting a distinct family, Cathartidae (which, however, would be more properly named Sarcorhamphidae), while he united the latter with the ordinary diurnal birds of prey as Gypaetidae.

The American vulture may be said to include four genera: (1) *Sarcorhamphus*, the gigantic condor, the male distinguished by a large fleshy comb and wattle; (2) *Gypagus*, the king-vulture, with its gaudily coloured head and nasal caruncle; (3) *Catharista*, containing the so-called turkey-buzzard with its allies; and (4) *Pseudogryphus*, the great Californian vulture—of very limited range on the western slopes of North America. Though all these birds are structurally different from the true vultures of the Old World, in habits the Vulturidae and Sarcorhamphidae are much alike.



King-Vulture (*Gypagus papa*).

The true vultures of the Old World, Vulturidae in the restricted sense, are generally divided into five or six genera, of which *Neophron* has been separated as forming a distinct subfamily, Neophroninae—its members, of comparatively small size, differing both in structure and habit considerably from the rest. One of them is the so-called Egyptian vulture or Pharaoh's hen, *N. percnopterus*, a remarkably foul-feeding species, living much on ordure. It is a well-known species in some parts of India,[1] and thence westward to Africa, where it has an extensive range. It also occurs on the northern shores of the Mediterranean, and has strayed to such a distance as to have suffered capture in England and even in Norway. Of the genera composing the other subfamily, Vulturinae, *Gyps* numbers seven or eight local species and races, on more than one of which the English name griffon has been fastened. The best known is *G. fulvus*, which by some authors is accounted "British" from an example having been taken in Ireland, though under circumstances which suggest its appearance so far from its nearest home in Spain to be due to man's intervention. The species, however, has a wider distribution on the European continent (especially towards the north-east) than the Egyptian vulture, and in Africa nearly reaches the Equator, extending also in Asia to the Himalaya; but both in the Ethiopian and Indian regions its range inosculates with that of several allied forms or species. *Pseudogyps* with two forms—one Indian, the other African—differs from *Gyps* by having 12 instead of 14 rectrices. Of the genera *Otogyps* and *Lophogyps* nothing here need be said; and then we have *Vultur*, with, as mentioned before, its sole representative, *V. monachus*, commonly known as the cinereous vulture, a bird which is found from the Straits of Gibraltar to the sea-coast of China. Almost all these birds inhabit rocky cliffs, on the ledges of which they build their nests.

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[1] In the eastern part of the Indian peninsula it is replaced by a smaller race or (according to some authorities) species, *N. ginginianus*, which has a yellow instead of a black bill.

The question whether vultures in their search for food are guided by sight of the object or by its scent has excited much interest. It seems to be now generally admitted that the sense of sight is in almost every case sufficient to account for the observed facts. (A. N.)

VURJEEVANDAS MADHOWDAS (1817–1896), Hindu merchant of Bombay, of the Kapole Bania caste, was born on the 28th of January 1817 at Gogla, in Kathiawar, whence his father came to Bombay with Sheth Manoredas for trading purposes. Vurjeevandas was educated in Bombay, started a new firm under the name of Vurjeevandas & Sons, and soon became one of the wealthiest merchants in Bombay. He was appointed a justice of the peace and a member of the Bombay Port Trust. He took a keen interest in the Royal Asiatic Society and the Bombay university, where a prize has been established to commemorate his name. He constructed the Madhow Bang in memory of his father, and gave it to the use of poor Hindus, endowing it with nearly five lakhs of rupees. He built a rest-house in Bombay in memory of his brother Mooljibhoy, and another one at Nasik. The sanatorium which he built in memory of his youngest son Rumhoredas at Sion Hill is a great boon to the poor people of his community. He also established a dispensary at Matoonga and a fund for the relief of indigent Hindus. He died on the 12th of January 1896.

VYATKA, or VIATKA, a government of N.E. Russia, with the government of Vologda on the N., Perm on the E., Ufa and Kazan on the S. and Nizhniy-Novgorod and Kostroma on the W., having an area of 59,100 sq. m. It has on its northern boundary the flat water-parting which separates the basins of the Northern Dvina and the Volga, and its surface is an undulating plateau 800 to 1400 ft. above sea-level, deeply grooved by rivers and assuming a hilly aspect on their banks. The Kama rises in the N.E., and, after making a wide sweep through Perm, flows along its S.E. boundary, while the rest of the government is drained by the Vyatka and its numerous tributaries. Both the Kama and the Vyatka are navigable, as also are several tributaries; the Izh and Votka, which flow into the Vyatka, have important ironworks on their banks. The only railway is one from Perm to Archangel, through the town of Vyatka; the government is traversed by the great highway to Siberia, and by two other roads by which goods from the south are transported to loading-places on the Vychegda and the Yug to be shipped to Archangel. Lakes are numerous, and vast marshes exist everywhere, especially in the north. The climate is very severe, the average yearly temperature being 36° F. at Vyatka (January, 8·2°; July, 67·0°) and 35° at Slobodsk (January, 3·5°; July, 65·3°).

The estimated pop. in 1906 was 3,532,600. The bulk of the inhabitants (78 %) are Russians; Votyaks make 12·2 %, Cheremisses 5 %, and Tatars 3¾ %, the remainder being Bashkirs, Teptyars and Permyaks. The Votyaks (Otyaks), a Finnish tribe, call themselves Ot, Ut or Ud, and the Tatars call them Ar, so that they may possibly be akin to the Ars of the Yenisei. They are middle-sized, with fair hair and eyes, often red-haired; and the general structure of the face and skull is Finnish. By their dialect they belong to the same branch as the Permyaks.

The government is divided into eleven districts, the chief towns of which are Vyatka, Elabuga, Glazov, Kotelnich, Malmyzh, Nolinsk, Orlov, Sarapul, Slobodsk, Urzhum and Yaransk. Izhevsk and Votkinsk, or Kamsko-Votkinsk, have important ironworks. Some 55 % of the surface is covered with forests, two-thirds of which belong to the crown, and hunting (especially squirrel-hunting) and fishing are of commercial importance. The peasants, who form 89 % of the population, own 44 % of the whole government, the crown 53 % and private persons 2 %. The soil is fertile, especially in the valleys of the south. Vyatka is one of the chief grain-producing governments of Russia. The principal crops are rye, wheat, oats, barley and potatoes. Flax and hemp are extensively cultivated, and large numbers of cattle are kept, but they are mostly of inferior breed. The government has a race of good ponies that are widely exported. Domestic industries occupy large numbers of the inhabitants. The principal manufacturing establishments are tanneries, distilleries, ironworks, chemical works, glass factories, cotton and steam flour-mills, and hardware, machinery, paper and fur-dressing works. (P. A. K.; J. T. BE.)

VYATKA, a town of Russia, capital of the government of the same name, on the Vyatka river, 304 m. by rail W.N.W. of Perm. Pop. 24,782. It is built on the steep hills which rise above the river and at their base. Its old walls have been demolished, and its old churches built anew. It is an episcopal see and has a fine cathedral. Its manufactures include silver and copper wares, and ecclesiastical ornaments, and it has an important trade in corn, leather, tallow, candles, soap, wax, paper and furs (exported), and in manufactured and grocery wares (imported). Vyatka was founded in 1181 by the Novgorodians, as Khlynov. In 1391 it was plundered by the Tatars, and again in 1477. Moscow annexed Khlynov in 1489. It received the name of Vyatka in 1780.

VYAZMA, a town of Russia, in the government of Smolensk, 109 m. by rail E.N.E. of the town of Smolensk. Pop. 15,676. It was a populous place as early as the 11th century, and carried on a lively trade with Narva on the Gulf of Finland. In the 15th century it fell under the dominion of Lithuania, but was retaken by the Russians. The Poles took it again in 1611, and kept it till the peace of 1634. It is now an important centre for trade. It has a cathedral, dating from 1596.

VYERNYI (formerly ALMATY), a town and fort of Asiatic Russia, capital of the province of Semiryechensk, 50 m. N. of Lake Issyk-kul, at the northern foot of the Trans-Ili Ala-tau Mountains, at an altitude of 2440 ft. Pop. 24,798. Founded in 1854, it is well-built, provided with boulevards and surrounded by luxuriant gardens. It has a cathedral, being an archiepiscopal see of the Orthodox Greek Church, a school of gardening and sericulture, a public library, and a few distilleries, tanneries and oil works. Situated at the intersection of two roads—from Kulja to Tashkent, and from Semipalatinsk to Kashgar—Vyernyi carries on an active trade in wheat, rice, corn, tea, oil and tobacco. It was the centre of a remarkable earthquake on the 9th of June 1887.

VYRNWY (*Fyrnwy*), an artificial lake or reservoir in the north-west of Montgomeryshire, N. Wales, constructed for the Liverpool water-supply. It was formed by damming the river Vyrnwy, which runs through Montgomeryshire and joins the Severn above Shrewsbury (see WATER-SUPPLY).

VYSHNIY-VOLOCHOK, a town of Russia, in the government of Tver, 74 m. by rail N.W. of the city of Tver. Pop. 16,722. The place owes its importance to its situation in the centre of the Vyshne-Volotsk navigation system (540 m. long, constructed by Peter the Great in 1703–9), which connects the upper Volga with the Neva. The portage (*volok*) is less than 17 m. between the Tvertsa, a tributary of the Volga, and the Tsna, which flows into the Msta and the Volkhov (Lake Ladoga); but boats now prefer the Mariinsk system.

W the twenty-third letter of the English alphabet, shows its origin in its name; it is but VV, and, as the name shows, V had the vowel value of *u*, while the "double *u*" was employed for the consonant value. In German the same symbol *w* is called *Vey*, because in that language it has the value of the English *v*, while the German *v* (*Vau*, *fow* in pronunciation) is used with the same value as *f*. In the English of the 9th century the *uu* of the old texts (and the *u* of the Northern) was found not to represent the English *w* satisfactorily, and a symbol ƿ was adopted from the Runic alphabet. This survived sporadically as late as the end of the 13th century, but long before that had been generally again replaced by *uu* (*vv* only in Early Middle English) and by *w*. For *w* the earliest English printers had a type, but French printers had not; hence a book like the Roman Catholic version of the New Testament printed at Rheims in 1582 prints *w* with two *v*'s set side by side. Throughout the history of English the sound seems to have remained the same—the consonantal *u*. For this value as well as for *u* Latin always used only V; in Greek, except in a few dialects, the consonant value was early lost (see under F). *W* is produced by leaving a very small opening between the slightly protruded lips while the back of the tongue is raised towards the soft palate and the nasal passage closed. The ordinary *w* is voiced, but according to some authorities the *w* in the combination *wh* (really *hw*) is not, in *when*, *what*, &c., even when the *h* is no longer audible. The combination WH (*hw*) represents the Indo-European q^{*} when changed according to Grimm's law from a stop to a spirant. Thus *what* corresponds philologically to the Latin *quod* and the first syllable of the Greek *ποδ-απός*. In Southern English the *h* sound has now been generally dropped. In Scotland, along the line of former contact with Gaelic, it changes into *f*: *fite*=*white*, *forl*=*whorl*; but before *ī* (*ee*) it remains in *wheel*. In Early English *w* appeared not only before *r* as in *write*, but also before *l* in *wlisp* (*lisp*). In *write*, *wring*, &c., the *w* is now silent, though dialectically, *e.g.* in Aberdeenshire, it has changed to *v* and is still pronounced, *vreet*, *vring*, &c. In English and in other languages there is considerable difficulty in pronouncing *w* before long *u* sounds: hence it has disappeared in pronunciation in *two* (*tū*), but survives in Scotch *twa*, though otherwise the difficulty is more noticeable in Scottish dialects than in literary English, as in "*oŏ*"=*wool* and in the Scottish pronunciation of English words like *wood* as *'ood*. (P. Gi.)

WA, a wild tribe inhabiting the north-east frontier of Upper Burma. Their country lies to the east of the Northern Shan States, between the Salween river and the state of Kēng-Tūng, extending for about 100 m. along the Salween and for considerably less than half that distance inland to the watershed between that river and the Mekong. The boundaries may be roughly said to be the Salween on the W., the ridge over the Namting valley on the N., the hills E. of the Nam Hka on the eastern and southern sides, while the country ends in a point formed by the junction of the Nam Hka with the Salween. The Was claim to have inhabited the country where they now are since the beginning of time; but it appears more probable that they were the aborigines of the greater part of northern Siam at least, if not of Indo-China, since old records and travellers (*e.g.* Captain McLeod in 1837) speak of their having been the original inhabitants with small communities left behind from Kēng Tūng down to Chiengmai; while the state of Kēng Tūng, just S.E. of the Wa country, has still scattered villages of Was and traditions that they were once spread all over the country. Their fortified village sites too are still to be found covered over with jungle. The people are short and dark-featured, with negritic features, and some believe that they are allied to the Andamanese and the Selungs inhabiting the islands of the Mergui archipelago, who have been driven back, or retreated, northwards to the wild country they now inhabit; but their language proves them to belong to the Môn-Khmer family. They are popularly divided into Wild Was and Tame Was. The Wild Was are remarkable as the best authenticated instance of head-hunters in the British Empire. They were formerly supposed to be also cannibals; but it is now known that they are not habitual cannibals, though it is possible that human flesh may be eaten as a religious function at the annual harvest feast. Their head-hunting habits have an animistic basis. In the opinion of the Wa the ghost of a dead man goes with his skull and hangs about its neighbourhood, and so many skulls posted up outside his village gate mean so many watch-dog *umbrae* attached to the village, jealous of their own preserves and intolerant of interlopers from the invisible world. Thus every addition to the collection of skulls is an additional safeguard against ill-affected demons, and a head-hunting expedition is not undertaken, as was once thought, from motives of cannibalism or revenge, but solely to secure the very latest thing in charms as a protection against the powers of darkness. Outside every village is an avenue of human skulls, amid groves conspicuous from long distances. These consist of strips of the primeval jungle, huge forest trees left standing where all the remaining country is cleared for cultivation. The undergrowth is usually cut away, and these avenues are commonly but not always in deep shade. Along one side (which side apparently does not matter) is a line of posts with skulls fitted into niches facing towards the path. The niche is cut sometimes in front, sometimes in the back of the post. In the latter case there is a round hole in front, through which sometimes only the teeth and empty eye-sockets, sometimes the whole skull, grins a ghastly smile. Most villages count their heads by tens or twenties, but some of them have hundreds, especially when the grove lies between several large villages, who combine or run their collections into one another. The largest known avenue is that between Hsüng Ramang and Hsan Htung. Here there must be a couple of hundred or more skulls; but it is not certain that even this is the largest. It is thought necessary to add some skulls to this pathway every year if the crops are to be good. The heads of distinguished and pious men and of strangers are the most efficacious. The head-hunting season lasts through March and April, and it is when the Wa hill fields are being got ready for planting that the roads in the vicinity become dangerous to the neighbouring Shans. The little that is known of the practice seems to hint at the fact that the victim selected was primarily a harvest victim. A Wild Wa village is a very formidable place to attack, except for civilized weapons of offence. All the villages are perched high up on the slope of the hills, usually on a knoll or spine-like spur, or on a narrow ravine near the crest of the ridge. The only entrance is through a long tunnel. There is sometimes only one, though usually there are two, at opposite sides of the village. This tunnelled way is a few inches over 5 ft. high and not quite so wide, so that two persons cannot pass freely in it, and it sometimes winds slightly, so that a gun cannot be fired up it; moreover, the path is frequently studded with pegs in a sort of dice arrangement, to prevent a rush. None of the tunnels is less than 30 yds. long, and some are as much as 100 yds. Round each village is carried an earthen rampart, 6 to 8 ft. high and as many thick, and this is overgrown with a dense covering of shrubs, thin bushes and cactuses, so as to be quite impenetrable. Outside this is a deep ditch which would effectually stop a rush. These preparations indicate the character of the inhabitants, which is so savage and suspicious that the Wa country is still unadministered and naturally does not appear in the 1901 census returns. The total number of the Wa race is estimated at more than 50,000. (J. G. Sc.)

WAAGEN, GUSTAV FRIEDRICH (1794–1868), German art historian, was born in Hamburg, the son of a painter and nephew of the poet Ludwig Tieck. Having passed through the college of Hirschberg, he volunteered for service in the Napoleonic campaign of 1813–1814, and on his return attended the lectures at Breslau University. He devoted himself to the study of art, which he pursued in the great European galleries, first in Germany, then in Holland and Italy. A pamphlet on the brothers Van Eyck led to his appointment to the directorship of the newly founded Berlin Museum in 1832. The result of a journey to London and Paris was an important publication in three volumes, *Kunstwerke und Künstler in England und Paris* (Berlin, 1837–1839), which became the basis for his more important *The Treasures of Art in Great Britain* (London, 1854 and 1857). In 1844 he was appointed professor of art history at the Berlin University, and in 1861 he was called to St Petersburg as adviser in the arranging and naming of the pictures in the imperial collection. On his return he published a book on the Hermitage collection (Munich, 1864). Among his other publications are some essays on Rubens, Mantegna and Signorelli; *Kunstwerke und Künstler in Deutschland* and *Die vornehmsten Kunstdenkmäler in Wien*. He died on a visit to Copenhagen in 1868. In the light of more recent research his writings are not of much value as regards trustworthy criticism, though they are useful as catalogues of art treasures in private collections at the time when they were compiled. His opinions were greatly respected in England, where he was invited to give evidence before the royal commission inquiring into the condition and future of the National Gallery.

WAAGEN, WILHELM HEINRICH (1841–1900), German palaeontologist, was born at Munich on the 23rd of June 1841. He was educated at Munich and Zurich, and through the influence of A. Oppel he commenced to study the rocks and fossils of the Jurassic system, and published an essay in 1865, *Versuch einer Allgemeinen Classification der Schichten des oberen Jura*. In 1870 he joined the staff of the Geological Survey of India, and was appointed palaeontologist in 1874, but was obliged to retire through ill-health in 1875. He published important monographs in the *Palaeontologia Indica* on the palaeontology of Cutch (1873–1876) and the Salt Range (1879–1883), dealing in the last-named work with fossils from the Lower Cambrian to the Trias. In 1879 he was appointed professor of mineralogy and geology in the German technical high school at Prague, and he became a contributor to the continuation of Barrande's great work on the *Système Silurien de Bohême*. In 1890 he became professor of palaeontology at the university of Vienna, and in 1898 the Lyell medal was awarded to him by the Geological Society of London. He died in Vienna on the 24th of March 1900.

WABASH, a city and the county-seat of Wabash county, Indiana, U.S.A., about 42 m. S.W. of Fort Wayne. Pop. (1890) 5105, (1900) 8618, of whom 498 were foreign-born and 134 negroes; (1910 U.S. census) 8687. It is served by the Cleveland, Cincinnati, Chicago & St Louis railway (which has extensive shops here), by the Wabash railway, and by interurban electric lines. It has a public library, a Memorial Hall (1897), erected to the memory of Federal soldiers in the Civil War and occupied by the local "camp" of the Grand Army of the Republic, a Masonic temple, a county hospital and two parks. The city is in a fertile agricultural region, and has a considerable trade in grain and produce. Among its manufactures are furniture, agricultural implements and foundry and machine-shop products. In 1905 the factory products were valued at $2,202,932 (31·2 % more than in 1900). Wabash was settled about 1834, incorporated as a village in 1854, and first chartered as a city in 1866. It was one of the first cities in the world to be lighted with electricity, a lighting plant being established in February 1880.

WACE, HENRY (1836–   ), English divine, was born in London on the 10th of December 1836, and educated at Marlborough, Rugby, King's College, London, and Brasenose College, Oxford. He was ordained in the Church of England in 1861, and held various curacies in London, being chaplain at Lincoln's Inn in 1872 and preacher in 1880. From 1875 to 1896 he was prominently connected with King's College, London, where he was professor of ecclesiastical history, and subsequently (1883) principal. Both as preacher and writer Dr Wace, who took his D.D. degree in 1883, became conspicuous in the theological world. He was Boyle lecturer in 1874 and 1875, and Bampton lecturer in 1879; and besides publishing several volumes of sermons, he was co-editor of the *Dictionary of Christian Biography* (1877–1887), and editor of *The Speaker's Commentary on the Apocrypha*. He took a leading part as the champion of historic orthodoxy in the controversies with contemporary Rationalism in all its forms, and firmly upheld the importance of denominational education and of the religious test at King's College; and when the test was abolished in 1902 he resigned his seat on the council. In 1881 he was given a prebendal stall at St Paul's, and in 1889 was appointed a chaplain-in-ordinary to Queen Victoria. When he resigned the principalship of King's College in 1896 he was made rector of St Michael's, Cornhill; and in 1903 he became dean of Canterbury, in succession to Dr Farrar.

WACE, (?) **ROBERT** (1100?–1175?), Anglo-Norman chronicler, was born in Jersey. He studied at Caen; he became personally known to Henry I., Henry II., and the latter's eldest son, Prince Henry; from Henry II. he received a prebend at Bayeux and other gifts. Except for these facts he is known to us only as the author of two metrical chronicles in the Norman-French language. Of these the earlier in date is the *Roman de Brut*, completed in 1155, which is said to have been dedicated to Eleanor of Aquitaine (ed. A. J. V. Le Roux de Lincy, 2 vols., Rouen, 1836–1838). This is a free version of the Latin *Historia Britonum* by Geoffrey of Monmouth, in rhyming octosyllables; it was rendered into English, shortly after 1200, by Layamon, a mass-priest of Worcestershire, and is also largely used in the rhymed English chronicle of Robert Mannyng. Wace's second work, the *Roman de Rou*, written between 1160 and 1174, has a less fabulous character than the *Brut*, being a chronicle of the Norman dukes from Rollo to Robert Curthose. It has been ably dissected by Gustav Körting (*Über die Quellen des Roman de Rou*, Leipzig, 1867), who shows that it is mainly based upon Dudo and William of Jumièges. There is also reason for thinking that Wace used the *Gesta regum* of William of Malmesbury. Where Wace follows no ascertainable source he must be used with caution. Undoubtedly he used oral tradition; but he also seems to have given free play to his imagination.

The *Roman de Rou* is written in rhyming octosyllables, varied by assonanced alexandrines. It has been edited by F. Pluquet (2 vols. and supplement, Rouen, 1827–1829) and more completely by H. Andresen (2 vols., Heilbronn, 1877–1879). (H. W. C. D.)

WACHSMUTH, CHARLES (1829–1896), American palaeontologist, was born in Hanover, Germany, on the 13th of September 1829. Educated as a lawyer in his native city, he abandoned the profession on account of ill-health, and in 1852 went to New York as agent for a Hamburg shipping house. Two years later, for reasons of health, he removed to Burlington, Iowa, U.S.A., where he settled. Here he was attracted by the fossils, and especially the crinoids, of the Burlington Limestone, and in a few years possessed a fine collection. In 1864 he made acquaintance with L. Agassiz, and in the following year paid a visit to Europe, where he studied the crinoids in the British Museum and other famous collections. He now decided to devote all his energies to the elucidation of the crinoidea, and with signal success. He made further extensive collections, and supplied specimens to the Agassiz museum at Cambridge, U.S.A., and the British Museum. Becoming acquainted with Frank Springer (1848–   ), a lawyer at Burlington, he stirred up his enthusiasm in the subject, and together they continued the study of crinoids and published a series of important papers. These include "Discovery of the Ventral Structure of Taxocrinus and Haplocrinus, and Consequent Modifications in the Classification of the Crinoidea" (*Proc. Acad. Nat. Sci.*, Philadelphia, 1889); "The Perisomic Plates of the Crinoids" (*Ibid.*, 1891); and a monograph on "The North American Crinoidea Camerata," published, after the death of Wachsmuth, in the *Memoirs of the Museum of Comparative Zoology* at Harvard (1897). Of this last-named work a detailed review and analysis was published by F. A. Bather, of the British Museum, in the *Geol. Mag.* for 1898–1899. Wachsmuth died on the 7th of February 1896.

Obituary (with portrait) by F. A. Bather, *Geol. Mag.* (April 1896).

WACO, a city and the county-seat of McLennan county, Texas, nearly in the centre of the state, on both sides of the Brazos river, about 100 m. S. by W. of Dallas. Pop. (1890) 14,445; (1900) 20,686, of whom 5826 were negroes; (1910 census) 26,425. Waco is served by the Missouri, Kansas & Texas, and by other railways. Waco is the seat of Baylor University (co-educational) and of the Texas Christian University (Christian; co-educational). Baylor University was founded at Independence, Texas, by the Texas Union Baptist Association, in 1845, and was consolidated in 1886 with Waco University (Baptist, 1861, founded by Dr Rufus C. Burleson, a former president of Baylor University). It was named in honour of Robert E. B. Baylor (1793–1874), a representative in Congress from Alabama in 1830–1831, and one of its founders. In 1908–1909 it had 40 instructors and 1296 students (664 women), of whom 647 were in the college. The Texas Christian University was founded in 1873 at Thorp's Springs as a private school, chartered as Add Ran College, transferred to the Christian Churches of Texas in 1889, and removed to Waco in 1895. Its present name was adopted in 1902, the name Add Ran College being retained for the college of arts and sciences. In 1908–1909 the university had 26 instructors and 379 students (279 in the college of arts and sciences). Waco is situated in a fertile farming region. In 1905 the factory products were valued at $2,979,800. The city was named after the Waco (or Hueco) Indians (Caddoan stock), who had a large village here until 1830, when they were nearly exterminated by the Cherokees; in 1855 they removed to a reservation, and after 1859 became incorporated with the Wichita. The first white settlement was made in 1849. Waco was incorporated as a town in 1856; in 1909 the administration was entrusted to a mayor and four commissioners.

WAD, a black, earthy mineral consisting mainly of hydrated manganese dioxide; of importance as an ore. Being an amorphous substance, it varies considerably in chemical composition, and contains different impurities often in large amount. A variety containing much cobalt oxide is called "asbolite," while "lampadite" is a cupriferous variety. It is very soft, readily soiling the fingers, and may be considered as an earthy form of psilomelane (*q.v.*). It results from the decomposition of other manganese minerals, and is often deposited in marshes ("bog manganese") or by springs. The name wad is of uncertain origin, and has been applied also to graphite. (L. J. S.)

WADAI, a country of north central Africa, bounded N. by Borku and Enndi, S. by the Ubangi sultanates, W. and S.W. by Kanem and Bagirmi, and E. by Darfur. Formerly an independent Mahommedan sultanate, it was in 1909 annexed to French Equatorial Africa (French Congo). Wadai has an area estimated at 150,000 sq. m., and a population of 3,000,000 to 4,000,000.

The general level of the country is about 1500 ft. North, north-east, south-west and in the centre are ranges of hills rising another 1000 ft. West and north-west the fall to the Sahara is gradual. Here occur remarkable sand-ridges of fantastic shape—hollow mounds, pyramids, crosses, &c.—which are characteristic of the Libyan desert. There are also sandstone rocks of varying colours—red, blue, white, black, &c.—presenting the aspect of ruined castles, ramparts and churches. North-west is a wide district of dreary plain—part of the clay zone which stretches from the middle Niger to the Nile—covered with thorn bush and dum palms. The central and eastern regions are the most fertile, and contain large forest areas. The country belongs to the Chad drainage area, though it is possible that the Bahr-el-Ghazal (of the Chad system) may afford a connexion with the Nile (see SHARI). The streams which rise in the north-eastern districts, of which the Batha (over 300 m. long) is the largest, flow west, the Batha ending in a depression, some 200 m. E. of Lake Chad, called Fittri. Another stream, the Wadi Rime, with a more northerly course than the Batha, goes in the direction of Chad, but ends in swamps in the clayey soil. These rivers are intermittent, and after seasons of drought Fittri is completely dry. In the dry season water is obtained from wells 250 to 300 ft. deep. The rivers of Dar Runga flow westward towards the Shari, but, save the Bahr Salamat, none reaches it. They only contain water in the rainy season. About 100 m. above the Salamat-Shari confluence is Lake Iro, joined to the Salamat by a short channel. In the forests are large herds of elephants, and hippopotami abound along the river-beds. In the north are the camel and the ostrich. Among the trees is a species of wild coffee which reaches 50 to 60 ft. and yields berries of excellent quality. The cotton plant is indigenous.

Inhabitants and Trade.—The inhabitants consist of negroid and negro tribes, Arabs, Fula, Tibbu and half-castes. The Maba, the dominant race, are said to be of Nubian origin; they are believed not to number more than 750,000, and live chiefly in the north-eastern district. They are in political alliance with the Arab tribes, known in Wadai as Zoruk (dark) and Homr (red). The Maba have a reputation for pride, valour, cruelty, drunkenness and barbaric splendour.

The capital, Abeshr, is in the N.E., in about 21° E., 13° 50′ N. Thence a caravan route crosses the Sahara via the Kufra oases to Benghazi in Barca. Another trade route goes east through Darfur to Khartum. The people possess large numbers of horses, cattle, sheep and goats. Maize, durra, cotton and indigo are cultivated, and cloth is woven. Ivory and ostrich feathers, the chief articles of export, are taken to Tripoli by the desert route, together with small quantities of coffee and other produce. There is a trade in cattle, horses and coffee with the countries to the south. Until the French conquest Wadai was a great centre of the slave trade. Slaves were obtained by raiding and in the form of tribute from Bagirmi, Kanem and other countries once dependent on Wadai. The slaves were sent chiefly to Barca. Wadai was also notorious for its traffic in eunuchs.

History.—Situated between the Sahara and the dense forest lands of equatorial Africa, Wadai early became a meeting ground of negro and Arab culture. Eastern influences and the Mahommedan religion ultimately obtained predominance, though the sovereignty of the country reverted to the negro race. It was sometimes tributary to and sometimes the overlord of the neighbouring countries, such as Bagirmi and Kanem. It was made known to Europe by the writings of the Arab geographers, but it was not until Nachtigal's visit in 1873 that accurate knowledge of the land and people was obtained. About 1640 a Maba chieftain named Abd-el-Kerim conquered the country, driving out the Tunjur, a dynasty of Arabian origin. Thereafter Wadai, notorious as a great slave-raiding state, suffered from many civil and foreign wars. Mahommed Sherif, sultan from 1838 to 1858, introduced Senussiism into the country.

In the last decade of the 19th century the French advancing from the Congo and from the Niger made their influence felt in Wadai, and by the Anglo-French declaration of the 21st of March 1899 Wadai was recognized as within the French sphere. That state was then torn by civil wars. The Sultan Ibrahim (see SENUSSI) was murdered in 1900, and Ahmed Ghazili became sultan. He was warned by the Sheikh Senussi el Mahdi of the danger arising from the approach of the Christians (*i.e.* the French), but he had to meet the opposition of the princes Doud Murra (a brother of Ibrahim) and Acyl. Ahmed Ghazili and Doud Murra, though of the royal family, had non-Maba mothers; Acyl, a grandson of the Sultan Mahommed Sherif, was of pure Maba descent. Acyl, ordered to be blinded by Ahmed Ghazili, fled to Kelkélé, west of Lake Fittri, and entered into friendly relations with the French. A few months later (Dec. 1901) Ahmed was dethroned. With Doud Murra, who then became sultan, the French endeavoured to come to an understanding, and in November 1903 the Wadaians agreed to recognize the possession of Bagirmi, Kanem, &c., by France. However, in the spring of 1904, acting, it is believed, at the instigation of the Senussites, the Wadaians attacked French posts in the Shari region and carried off many slaves. At Tomba (13th of May 1904) they suffered a severe defeat, but they renewed their raids, and there was continual fighting on the west and south-west borders of Wadai during 1905–1907. The fighting resulted in strengthening the position of the French and of their ally Acyl, and in 1908 Doud Murra, again, it is stated, at the instigation of the Senussites, proclaimed the *jihad*. His army was split up under *aguids* (feudal lords), and was beaten in detail by the French. At Joue in the Batha valley (June 16, 1908) Commandant Julien inflicted enormous losses on the enemy. In May

1909 Captain Fiegenschuh, with a small force of tirailleurs, and Acyl's contingents, advanced up the Batha to a place within 15 m. of Abeshr, where, on the 1st of June, the enemy were defeated. The next day another fight took place close to Abeshr. The Wadaians were again put to flight and the town bombarded with cannon. Doud Murra with a small following fled north, and Abeshr was occupied by the French. The prince Acyl was subsequently placed on the throne, and, under French guidance, governed Wadai proper, Dar Sila, Dar Runga and other tributary states being directly governed by French residents.

The war was not, however, ended by the occupation of Abeshr. Captain Fiegenschuh's column, operating south-east of Abeshr, was cut off by the Massalit Arabs near the Darfur frontier, but a punitive force retrieved this disaster in April following. While these operations were in progress, Lieut. Boyd Alexander (b. 1873), who had previously crossed from the Niger to the Nile, the first British explorer to enter Wadai, passed through Abeshr on his way to Darfur. At the station of Nyeri, in Dar Tama, on the Darfur border, he was murdered on the 2nd of April 1910.

In November 1910 a French column, 300 strong, under Colonel Moll, while operating in the Massalit country was attacked by 5000 men under Doud Murra and the sultan of the Massalit. The enemy was beaten off, but the French had over 100 casualties, including Colonel Moll killed.

See G. Nachtigal, *Sahara und Sudan* (3 vols., Berlin, 1879–1889); Captain Julien, "Le Dar Ouadai," *Renseign. colon. comité de l'Afrique française* (1904); J. van Vollenhoven, "Le Voyage de Nachtigal au Ouadai," *Renseign. colon.* (1903); Captain Repoux, "Le Ouadai," *B.S.G. Com. Bordeaux* (1909); Commandant Bordeaux, "Deux Contre-rezzous dans l'Ouaddai," *La Géog. B.S.G. Paris* (1908); A. Ferrier, "La Prise d'Abecher," *L'Afrique française* (1909); A. H. Keane, "Wadai," *Travel and Exploration* (July 1910); Sir H. H. Johnston, "Lieutenant Boyd Alexander," *Geog. Jour.* (July 1910); *The Times*, July 21st, 1910 (details of Boyd Alexander's murder). See also SENUSSI.

WADDING, LUKE (1588–1657), Irish Franciscan friar and historian, was born in Waterford in 1588 and went to study at Lisbon. He became a Franciscan in 1607, and in 1617 he was made president of the Irish College at Salamanca. The next year he went to Rome and stayed there till his death. He collected the funds for the establishment of the Irish College of St Isidore in Rome, for the education of Irish priests, opened 1625, and for fifteen years he was the rector. A voluminous writer, his chief work was the *Annales Minorum* in 8 folio vols. (1625–1654), re-edited in the 18th century and continued up to the year 1622; it is the classical work on Franciscan history. He published also a *Bibliotheca* of Franciscan writers, an edition of the works of Duns Scotus, and the first collection of the writings of St Francis of Assisi. (E. C. B.)

WADDINGTON, WILLIAM HENRY (1826–1894), French statesman, was born at St Remi-sur-l'Avre (Eure-et-Loir) on the 11th of December 1826. He was the son of a wealthy Englishman who had established a large spinning factory in France and had been naturalized as a French subject. After receiving his early education in Paris, he was sent to Rugby, and thence proceeded to Trinity College, Cambridge, where he was second classic and chancellor's medallist, and rowed for the university in the winning boat against Oxford. Returning to France, he devoted himself for some years to archaeological research. He undertook travels in Asia Minor, Greece and Syria, the fruits of which were published in two *Mémoires*, crowned by the Institute, and in his *Mélanges de numismatique et de philologie* (1861). Except his essay on "The Protestant Church in France," published in 1856 in *Cambridge Essays*, his remaining works are likewise archaeological. They include the *Fastes de l'empire romain*, and editions of Diocletian's edict and of Philippe Lebas's *Voyage archéologique* (1868–1877). He was elected in 1865 a member of the Académie des Inscriptions et Belles-Lettres.

After standing unsuccessfully for the department of the Aisne in 1865 and 1869, Waddington was returned by that constituency at the election of 1871. He was minister of public instruction in the short-lived cabinet of the 19th of May 1873, and in 1876, having been elected senator for the Aisne, he was again entrusted by Dufaure with the ministry of public instruction, with which, as a Protestant, he was not permitted to combine the ministry of public worship. His most important project, a bill transferring the conferment of degrees to the state, passed the Chamber, but was thrown out by the Senate. He continued to hold his office under Jules Simon, with whom he was overthrown on the famous *seize mai* 1877. The triumph of the republicans at the general election brought him back to power in the following December as minister of foreign affairs under Dufaure. He was one of the French plenipotentiaries at the Berlin Congress. The cession of Cyprus to Great Britain was at first denounced by the French newspapers as a great blow to his diplomacy, but he obtained, in a conversation with Lord Salisbury, a promise that Great Britain in return would allow France a free hand in Tunis.

Early in 1879 Waddington succeeded Dufaure as prime minister. Holding office by sufferance of Gambetta, he halted in an undetermined attitude between the radicals and the reactionaries till the delay of urgent reforms lost him the support of all parties. He was forced on the 27th of December to retire from office. He refused the offer of the London embassy, and in 1880 was reporter of the committee on the adoption of the *scrutin de liste* at elections, on which he delivered an adverse judgment. In 1883 he accepted the London embassy, which he continued to hold till 1893, showing an exceptional tenacity in defence of his country's interests. He died on the 13th of January 1894. His wife, an American lady, whose maiden name was Mary A. King, wrote some interesting recollections of their diplomatic experiences—*Letters of a Diplomatist's Wife, 1883–1900* (New York, 1903), and *Italian Letters* (London, 1905).

WADE, BENJAMIN FRANKLIN (1800–1878), American statesman, was born near Springfield, Massachusetts, on the 27th of October 1800, of Puritan ancestry. He was reared on a farm, receiving little systematic education, and in 1821 he removed with his family to Andover, in the Western Reserve of Ohio. Here he spent two more years on a farm, and then, securing employment as a drover, worked his way to Philadelphia and finally to Albany, New York, where for two years he taught school, studied medicine, and was a labourer on the Erie Canal. Returning to Ohio in 1825, he studied law at Canfield, was admitted to the bar in 1827, and began practice at Jefferson, Ashtabula county, where from 1831 to 1837 he was a law partner of Joshua R. Giddings, the anti-slavery leader. During 1837–1839 and 1841–1843 he was a Whig member of the Ohio State Senate. From 1847 until 1851 he was a state district judge, and from 1851 until 1869 was a member of the United States Senate, first as an anti-slavery Whig and later as a Republican. In the Senate Wade was from the first an uncompromising opponent of slavery, his bitter denunciations of that institution and of the slaveholders receiving added force from his rugged honesty and sincerity. His blunt, direct style of oratory and his somewhat rough manners were characteristic. After the outbreak of the Civil War he was one of the most vigorous critics of the Lincoln administration, whose Ohio member, Salmon P. Chase, had long been a political rival. He advocated the immediate emancipation and arming of the slaves, the execution of prominent Southern leaders, and the wholesale confiscation of Confederate property. During 1861–1862 he was chairman of the important joint-committee on the conduct of the war, and in 1862, as chairman of the Senate Committee on Territories, was instrumental in abolishing slavery in the Federal Territories. In 1864, with H. W. Davis (*q.v.*), he secured the passage of the Wade-Davis Bill (for the reconstruction of the Southern States), the fundamental principle of which was that reconstruction was a legislative, not an executive, problem. This bill was passed by both houses of Congress, just before their adjournment, but President Lincoln withheld his signature, and on the 8th of July issued a proclamation explaining his course and defining his position. Soon afterward (Aug. 5) Wade and Davis published in the New York *Tribune* the famous "Wade-Davis Manifesto," a vituperative document impugning the President's honesty of purpose and attacking his leadership. As long as President Johnson promised severe treatment of the conquered South, Wade supported him, but when the President definitively adopted the more lenient policy of his predecessor, Wade became one of his most bitter and uncompromising opponents. In 1867 he was elected president *pro tem.* of the Senate, thus becoming acting vice-president. He voted for Johnson's conviction on his trial for impeachment, and for this was severely criticized, since, in the event of conviction, he would have become president; but Wade's whole course before and after the trial would seem to belie the charge that he was actuated by any such motive. After leaving the Senate he resumed his law practice, becoming attorney for the Northern Pacific railway, and in 1871 he was a member of President Grant's Santo Domingo Commission. He died at Jefferson, Ohio, on the 2nd of March 1878. His son, James Franklin Wade (b. 1843), was colonel of the 6th United States (coloured) cavalry during the Civil War, and attained the rank of major-general in the regular army in 1903, commanding the army in the Philippines in 1903-1904.

See A. G. Riddle, *Life of Benjamin F. Wade* (Cleveland, Ohio, 1886).

WADE, GEORGE (1673–1748), British field marshal, was the son of Jerome Wade of Kilavally, Westmeath, and entered the British army in 1690. He was present at Steinkirk in 1692, and in 1695 he became captain. In 1702 he served in Marlborough's army, earning particular distinction at the assault on the citadel of Liége, and in 1703 he became successively major and lieutenant-colonel in his regiment (later the 10th Foot). In 1704, with the temporary rank of colonel, he served on Lord Galway's staff in Portugal. Wade distinguished himself at the siege of Alcantara in 1706, in a rearguard action at Villa Nova in the same autumn (in which, according to Galway, his two battalions repulsed twenty-two allied squadrons), and at the disastrous battle of Almanza on the 25th of April 1707. He had now risen to the command of a brigade, and on the following 1st of January (1707/8) he was promoted brigadier-general in the British army. His next service was as second in command to James (1st earl) Stanhope in the expedition to Minorca in 1708. In 1710 he was again with the main Anglo-allied army in Spain, and took part in the great battle of Saragossa on the 20th of August, after which he was promoted major-general and given a command at home. The Jacobite outbreak of 1715 brought him into prominence in the new rôle of military governor. He twice detected important Jacobite conspiracies, and on the second occasion procured the arrest of the Swedish ambassador in London, Count Gyllenborg. In 1719 he was second in command of the land forces in the successful "conjunct" military and naval expedition to Vigo. In 1724 he was sent to the Highlands to make a thorough investigation of the country and its people, and two years later, having meantime been appointed commander-in-chief to give effect to his own recommendations, he began the system of metalled roads which is his chief title to fame, and is commemorated in the lines—

> "Had you seen these roads before they were made,
> You would lift up your hands and bless General Wade."

In the course of this engineering work Wade superintended the construction of no less than 40 stone bridges. At the same time, slowly and with the tact that came of long experience, he disarmed the clans. In 1742 he was made a privy councillor and lieutenant-general of the ordnance, and in 1743 field marshal. In this year he commanded the British contingent in Flanders, and was associated in the supreme command with the duke d'Aremberg, the leader of the Austrian contingent. The campaign, as was to be expected when the enemy was of one nation, superior in numbers and led by Saxe, was a failure, and Wade, who was seventy years of age and in bad health, resigned the command in March 1744. George II. promptly made him commander-in-chief in England, and in that capacity Field Marshal Wade had to deal with the Jacobite insurrection of 1745, in which he was utterly baffled by the perplexing rapidity of Prince Charles Edward's marches. On the appointment of the duke of Cumberland as commander-in-chief of the forces, Wade retired. He died on the 14th of March 1748.

WADE, THOMAS (1805–1875), English poet and dramatist, was born at Woodbridge, Suffolk, in 1805. He early went to London, where he began to publish verse of considerable merit under the inspiration of Byron, Keats and especially Shelley. He wrote some plays that were produced on the London stage with a certain measure of success, owing more perhaps to the acting of Charles and Fanny Kemble than to the merits of the dramatist. Wade frequently contributed verses to the magazines, and for some years he was editor as well as part-proprietor of *Bell's Weekly Messenger*. This venture proving financially unsuccessful, he retired to Jersey, where he edited the *British Press*, continuing to publish poetry from time to time until 1871. He died in Jersey on the 19th of September 1875. His wife was Lucy Eager, a musician of some repute.

The most notable of Wade's publications were: *Tasso and the Sisters* (1825), a volume of poems, among which "The Nuptials of Juno" in particular showed rare gifts of imagination, though like all Wade's work deficient in sense of melody and feeling for artistic form; *Woman's Love* (1828), a play produced at Covent Garden; *The Phrenologists*, a farce produced at Covent Garden in 1830; *The Jew of Arragon*, a play that was "howled from the stage" at Covent Garden in 1830 owing to its exaltation of the Jew; *Mundi et cordis carmina* (1835), a volume of poems, many of which had previously appeared in the *Monthly Repository*; *The Contention of Death and Love, Helena* and *The Shadow Seeker*—these three being published in the form of pamphlets in 1837; *Prothanasia and other Poems* (1839). Wade also wrote a drama entitled *King Henry II.*, and a translation of Dante's "Inferno" in the metre of the original, both of which remain in manuscript; and a series of sonnets inspired by his wife, some of which have been published.

See Alfred H. Mills, *The Poets and Poetry of the Century*, vol. iii. (10 vols., London, 1891–1897); *Literary Anecdotes of the 19th Century*, edited by Sir W. Robertson Nicoll and T. J. Wise (2 vols., London, 1895–1896), containing a number of Wade's sonnets, a specimen of his Dante translation and a reprint of two of his verse pamphlets.

WADE, SIR THOMAS FRANCIS (1818–1895), British diplomatist, born in London on the 25th of August 1818, was the son of Major Wade of the Black Watch, by his wife Anne, daughter of William Smythe of Barbavilla, Westmeath. In 1838 his father purchased for him a commission in the 81st Regiment. Exchanging (1839) into the 42nd Highlanders, he served with his regiment in the Ionian Islands, devoting his leisure to the congenial study of Italian and modern Greek. On receiving his commission as lieutenant in 1841 he exchanged into the 98th Regiment, then under orders for China, and landed in Hong-Kong in June 1842. The scene of the war had at that time been transferred to the Yangtze-kiang, and thither Wade was ordered with his regiment. There he took part in the attack on Chin-kiang-fu and in the advance on Nanking. In 1845 he was appointed interpreter in Cantonese to the Supreme Court of Hong-Kong, and in 1846 assistant Chinese secretary to the superintendent of trade, Sir John Davis. In 1852 he was appointed vice-consul at Shanghai. The Tai-ping rebellion had so disorganized the administration in the neighbourhood of Shanghai that it was considered advisable to put the collection of the foreign customs duties into commission, a committee of three, of whom Wade was the chief, being entrusted with the administration of the customs. This formed the beginning of the imperial maritime customs service. In 1855 Wade was appointed Chinese secretary to Sir John Bowring, who had succeeded Sir J. Davis at Hong-Kong. On the declaration of the second Chinese War in 1857, he was attached to Lord Elgin's staff as Chinese secretary, and with the assistance of H. N. Ley he conducted the negotiations which led up to the treaty of Tientsin (1858). In the following year he accompanied Sir Frederick Bruce in his attempt to exchange the ratification of the treaty, and was present at Taku when the force attending the mission was treacherously attacked and driven back from the Peiho. On Lord Elgin's return to China in 1860 he resumed his former post of Chinese secretary, and was mainly instrumental in arranging for the advance of the special envoys and the British and French forces to Tientsin, and subsequently towards Peking. For the purpose of arranging for a camping ground in the neighbourhood of Tungchow he accompanied Mr (afterwards Sir) Harry Parkes on his first visit to that city, where on the next day Parkes with

Mr Loch and others was by an act of shameless treachery made prisoner. In the succeeding negotiations Wade took a leading part, and on the establishment of the legation at Peking he took up the post of Chinese secretary of legation. In 1862 he was made a Companion of the Bath. On the return of Sir Frederick Bruce to England in 1864 he remained as *chargé d'affaires*, and again from 1869 to 1871, when he was appointed minister, he filled the acting post. The Tientsin massacre in 1870 entailed long and difficult negotiations, which were admirably conducted by Wade. On the assumption of power by the emperor T'ung-chih he, in common with his colleagues, requested an audience in accordance with the treaties, which was for the first time granted as a right. The murder of A. R. Margary near Manwyne in Yunnan in 1875 threatened at one time to cause a rupture with the Chinese government, and as a matter of fact Wade did leave Peking. But the Chinese, finding that he was in earnest, despatched Li Hung-Chang after him to Chefoo, where the two diplomatists arranged the penalties which were to be paid for the crime, and concluded a convention which, after a considerable interval, was ratified by the governments. Wade was then made K.C.B., and in 1883 retired from the service. On his return to England the attractions of his old university induced him to take up his residence at Cambridge, where he was appointed the first professor of Chinese. He died there on the 31st of July 1895. In 1889 he was made G.C.M.G. In 1868 he had married Amelia, daughter of Sir John Herschel. (R. K. D.)

WADE (or Waad), **SIR WILLIAM** (1546–1623), English statesman and diplomatist, was the eldest son of Armagil Wade (d. 1568), the traveller, who sailed with a party of adventurers for North America in 1536, and later became (1547) one of the clerks of the privy council in London and a member of parliament. William Wade obtained his entrance into official life by serving William Cecil, Lord Burghley, sending information to this statesman from Paris and from Italy. He also passed some time in Strassburg; then in 1581 he became secretary to Sir Francis Walsingham and in 1583 a clerk of the privy council. He visited Vienna, Copenhagen and Madrid on public business, and in 1585 he went to Paris, being waylaid and maltreated on his return near Amiens by influential personages who disliked the object of his mission. In 1586 he went to Chartley and took possession of Mary Stuart's papers, and in 1587 was again in France. During the remainder of Elizabeth's reign Wade was much occupied in searching for Jesuits and in discovering plots against the life of the queen. James I., who knighted him in 1603, employed him in similar ways, and he was fully occupied in unravelling the plots which marked the early years of the new reign. For some time Wade was a member of parliament. He retired from public life in 1613, and died on the 21st of October 1623. Sir William was a shareholder in the Virginia company, and the Wades of Virginia claim descent from his father.

WADEBRIDGE, a market town and seaport in the St Austell parliamentary division of Cornwall, England, on the Great Western and London & South-Western railways, 38 m. W.N.W. of Plymouth. Pop. of urban district (1901), 2186. It is picturesquely situated at the head of the estuary of the river Camel, 7 m. from its mouth in Padstow Bay on the north coast. A stone bridge, consisting of seventeen arches, was built in 1485 over the river, and made a county bridge under James I. The parish church of Egloshayle, nearly 2 m. from the town, is in the main Perpendicular, with a beautiful tower; but part of the fabric is Early English. The neighbouring church of St Breock is Decorated and Perpendicular, with a fine font of the earlier period. An ancient round-headed cross stands near the town. There is considerable agricultural trade, and iron founding is carried on; while in the neighbourhood some copper, lead, granite and slate are worked and exported in small vessels; coal, timber and general merchandise being imported.

WADELAI, a station on the east bank of the Upper Nile in the British protectorate of Uganda, in 2° 50′ N., 31° 35′ E., 200 m. in a direct line N.N.W. of Entebbe on Victoria Nyanza, and 72 m. by river below Butiaba on Albert Nyanza. The government station was built on a hill 160 to 200 ft. above the Nile at a spot where the river narrows to 482 ft. and attains a depth of 30 ft. At this place was a gauge for measuring the discharge of the river. Wadelai was first visited by a European, Lieut. H. Chippendall, in 1875, and was named after a chieftain who, when visited by Gessi Pasha (on the occasion of that officer's circumnavigation of Albert Nyanza), ruled the surrounding district as a vassal of Kabarega, king of Unyoro. The region was annexed to the Egyptian Sudan and Wadelai's village chosen as a government post. This post was on the western bank of the Nile, 1¼ m. below the existing station. Here for some time Emin Pasha had his headquarters, evacuating the place in December 1888. Thereafter, for some years, the district was held by the Mahdists. In 1894 the British flag was hoisted at Wadelai, on both banks of the Nile, by Major E. R. Owen. Some twelve years later the government post was withdrawn. There is a native village at the foot of the hill.

WADHWAN, a town of India, in Kathiawar, Bombay, the capital of a petty state of the same name, and the junction of the Kathiawar railway system with the Bombay and Baroda line, 389 m. N. of Bombay. Pop. (1901) 16,223. It has considerable trade and manufactures. There is a school for *girasias* or subordinate chiefs. The civil station, under British administration, had a population in 1901 of 11,255. The state of Wadhwan has an area of 236 sq. m.; pop. (1901), 34,851; revenue, £25,000. Cotton trade and stone-quarrying are important, and there are manufactures of soap and saddlery.

WADI, also written wady, in some dialects wad; Arabic for a "valley," hence a stream or river flowing through a valley, as well as the valley itself. It is a common term in place names.

WADI HALFA, or Halfa, a town of the Anglo-Egyptian Sudan, in 21° 55′ N., 31° 19′ E., on the right bank of the Nile, 5 m. S. of the northern frontier of the Sudan. It is the chief town of the Halfa mudiria, is 770 m. S. of Cairo by rail and steamer, and 575 m. N.N.W. of Khartum by rail. Some 6 m. above the town is the second cataract, and on the west bank of the Nile opposite Halfa are the ruins of the ancient Egyptian city of Buhen (Bohon). Halfa is the northern terminus of the Sudan railway and the southern terminus of a steamboat service on the Nile, which, running to Shellal (Assuan), connects there with the Egyptian railways.

Wadi Halfa is a general designation including the native village of that name, the camp, founded by the British in 1884 as their base in the operations for the relief of General Gordon, and the civil cantonment established at the same time. This cantonment occupies the site of a Nubian village, and round it has grown a thriving town, at first named Taufikia, but now called Halfa. It has a population (1907) of about 3000. The camp is 1½ m. S. of Halfa. Here are the barracks, officers' quarters, railway works, and an esplanade along the river front. The village of Wadi Halfa is 3 m. S. of the camp.

WAD MEDANI, a town of the Anglo-Egyptian Sudan, capital of the Blue Nile mudiria, in 14° 24′ N., 33° 31′ E., on the left bank of the Blue Nile, 110 m. by rail and 147 m. by river, S.E. of Khartum. Pop. about 20,000. It is the chief depot for grain raised in the Gezira, has oil and soap works, and is a thriving commercial centre, being on the main trade route between Khartum and Abyssinia. The town, which is of considerable antiquity, contains some fine buildings, the chief mosque having a conspicuous tower. Wad Medani was almost destroyed during the *Mahdia*, but its return to prosperity under Anglo-Egyptian rule was rapid. In 1909 it was connected by railway with Khartum, and thus the hindrance to trade through the Blue Nile being scarcely navigable between January and June was overcome. In 1910 railway communication between the town and Kordofan was established. (See Sudan, § *Anglo-Egyptian*.)

WAFER, a thin flat cake or sheet of paste, usually circular in shape. The derivation of the word, which is the same as "waffle," a batter-cake cooked in waffle-irons and served hot, is given under "Goffer," which is adapted from the French form of the Teutonic original. As articles of stationery, wafers consist of thin brittle, adhesive disks, used for securing papers together, and for forming a basis for impressed official seals. They are made of a thin paste of very fine flour, baked between "wafer irons" over a charcoal fire till the thin stratum of paste becomes dry and brittle and the flour starch is partly transformed into glutinous adhesive dextrin. The cake is cut into round disks with suitable steel punches. Bright non-poisonous colouring matter is added to the paste for making coloured wafers. They are also made of gelatin. Wafers of dry paste are used in medical practice to enclose powders or other forms of drugs, thus rendering them easy to swallow.

In ecclesiastical usage the term "wafer" is applied to the thin circular disk of unleavened bread, stamped with a cross, the letters I.H.S. or the Agnus Dei, which is the form of the consecrated bread as used in the service of the Eucharist by the Roman Catholic Church.

WAGER (derived, through Fr. *wagier*, *gagier*, from Lat. *vadium*, a pledge), a bet or stake. Wagers in the ordinary sense of the term are dealt with under the headings Gaming and Betting; but the method of wagering—in principle the putting of a decision to the hazard—has had extended employment in various cases which may be noticed here. The determination of cases, civil and criminal, by means of wager or analogous forms of procedure, was a characteristic feature of ancient law. The *legis actio sacramenti* at Rome—at first a real, then a fictitious, wager—and the wagers "of battle" and "of law" in England, of the highest antiquity in their origin, survived up to a comparatively late period in the history of both legal systems. The form of the wager survived long after its reason had been forgotten. The general prevalence of the wager form of proceeding is perhaps to be attributed to the early conception of a judge as a mere referee who decided the dispute submitted to him, not as an executive officer of the state, but as an arbitrator casually called in (see Maine, *Ancient Law*, c. x.).

"Wager of battle" in England was a mode of trial allowed in certain cases, viz. on a civil writ of right for recovery of land (see Writ), and on criminal appeals of treason and felony (see Appeal). Trial by battle, or single combat, was a common Teutonic custom in days when criminal "appeal" was really a prosecution by a private individual; and it remained in vogue on the continent of Europe (where hired champions were allowed) to a much greater extent than in England, where after the Conquest it was to some extent substituted for trial by ordeal (*q.v.*). It was an institution suited to the days of chivalry, and may be regarded as the parent of the duel (*q.v.*). In England the "appellant" first formulated his charge, which was proclaimed at five successive county courts. If the "appellee" did not appear he was outlawed; if he did he could plead various exemptions; and unless the court upheld them he was obliged to offer battle by throwing down his glove as gage. When an ordinary court ordered the battle, it was fought on foot with staves and leather shields; but when a court of chivalry[1] ordered it, on horse with spear and sword. If defeated, the appellee was liable to sentence of death by hanging, and an undecided fight still left him liable, though acquitted on the appeal, to trial by indictment; if the appellant yielded, the appellee was free. The right of "wager of battle" was claimed as late as 1818 by a man named Thornton, who had been acquitted at assizes of a charge of murdering a girl named Ashford; her brother brought an "appeal," and the judges upheld Thornton's claim, but the appellant then withdrew. Next year appeals for felony or treason were abolished by statute.[2]

"Wager of law" (*vadiatio legis*) was a right of a defendant in actions of simple contract, debt and detinue. It superseded the ordeal (itself called *lex* in the Assize of Clarendon and other ancient constitutional records). The procedure in a wager of law is traced by Blackstone to the Mosaic law, Ex. xxii. 10; but it seems historically to have been derived from the system of compurgation, introduced into England from Normandy, a system which is now thought to have had an appreciable effect on the development of the English jury (*q.v.*). It also has some points of resemblance, perhaps some historical connexion, with the *sponsio* and the decisory oath of Roman law, and the reference to oath of Scots law (see Oath). The use of the oath instead of the real or feigned combat—real in English law, feigned in Roman law—no doubt represents an advance in legal development. The technical term *sacramentum* is the bond of union between the two stages of law. In the wager of law the defendant, with eleven compurgators, appeared in court, and the defendant swore that he did not owe the debt, or (in detinue) that he did not detain the plaintiff's chattel; while the compurgators swore that they believed that he spoke the truth. It was an eminently unsatisfactory way of arriving at the merits of a claim, and it is therefore not surprising to find that the policy of the law was in favour of its restriction rather than of its extension. Thus it was not permitted where the defendant was not a person of good character, where the king sued, where the defendant was the executor or administrator of the person alleged to have owed the debt, or in any form of action other than those named, even though the cause of action were the same. No wager of law was allowed in *assumpsit*, even though the cause of action were a simple debt. This led to the general adoption of *assumpsit*—proceeding originally upon a fictitious averment of a promise by the defendant—as a means of recovering debts. Where a penalty was created by statute, it became a common form to insert a proviso that no wager of law was to be allowed in an action for the penalty. Wager of law was finally abolished in 1833 (3 & 4 William IV. c. 42).

Another form of judicial wager in use up to 1845 was the feigned issue, by which questions arising in the course of chancery proceedings were sent for trial by jury in a common law court. The plaintiff averred the laying of a wager of £5 with the defendant that a certain event was as he alleged; the defendant admitted the wager, but disputed the allegation; on this issue was joined. This procedure was abolished by s. 19 of the Gaming Act 1845. (W.F.C.)

WAGES (the plural of "wage," from Late Lat. *wadium*, a pledge, O. Fr. *wagier*, *gagier*). Wages, although one of the most common and familiar terms in economic science, is at the same time one of the most difficult to define accurately. The natural definition is that wages is the "reward for labour," but then we are at once confronted with the difficulty so well stated by Adam Smith: "The greater part of people understand better what is meant by a quantity of a particular commodity than by a quantity of labour; the one is a plain palpable object, the other an abstract notion, which, though it can be made sufficiently intelligible, is not altogether so natural and obvious." If we regard wages as the reward for a quantity of labour, it is clear that to make the meaning precise we must give a precise meaning to this abstract notion of Adam Smith. From the point of view of the labourer the quantity of labour refers not so much to the work accomplished (*e.g.* raising so many foot-pounds) as to "all the feelings of a disagreeable kind, all the bodily inconvenience or mental annoyance, connected with the employment of one's *thoughts* or muscles or both in a particular occupation" (J. S Mill). But this analysis seems only to make the task of definition more difficult, for the class of labourers, in this wide sense of the term labour, would include the capitalist who racks his brains in making plans just as much as the navvy who digs with the sweat of his brow. Thus "profits," in the ordinary sense of the term, instead of being contrasted, would to a large extent be classified with wages, and in fact the wages of superintendence or of management is one of the recognized elements in the classical analysis of profits. It is only when we refer to the list of "occupations" in any civilized country that we can really form an adequate idea of the variety of classes to which the term labour, as defined by Mill, may be extended.

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[1] The medieval court of chivalry had both civil and criminal jurisdiction, and was held jointly by the lord high constable and the earl marshal. The last sitting of a court of chivalry for criminal business in England was in 1631; and as a civil court (for cases of honour and questions of precedence) it gradually decayed through want of power to enforce its decisions. There is an interesting account of the rules of battle ordered by a court of chivalry in Ashmolean MSS. 856 of the Bodleian Library (transcribed in *Illustrations of Ancient State and Chivalry*, Roxburghe Club, 1840).

[2] See G. Neilson, *Trial by Combat* (Glasgow, 1891).

It may be granted that in certain economic inquiries it is extremely useful to bring out the points of resemblance between "workers" at the various stages of the social scale, and it is especially serviceable in showing that the opposition between "employer" and the "employed," and the "classes" and the "masses," is often exaggerated. At the same time the differences, if not in kind at any rate in degree, are so great that if the analogy is carried very far it becomes misleading. Accordingly it seems natural to adopt as the preliminary definition of "wages" something equivalent to that of Francis Walker in his standard work on the *Wages Question*, viz. "the reward of those who are employed in production with a view to the profit of their employers and are paid at stipulated rates."

It may be observed that by extending the meaning of production, as is now done by most economists, to include all kinds of labour, and by substituting benefit for profit, this definition will include all grades of wages.

Nominal and real wages.

Having thus limited the class of those who earn "wages," the next point is to consider the way in which the wages ought to be measured. The most obvious method is to take as the rate of *time-wages* the amount of *money* earned in a certain *time*, and as the rate of *task-wages* the amount of *money* obtained for a given amount of *work* of a given quality; and in many inquiries this rough mode of measurement is sufficient. But the introduction of money as the measure at once makes it necessary to assume that for purposes of comparison the value of the money to the wage-earners may be considered constant. This supposition does not hold good even between different places in the same country at the same time, and still less with variations in time as well as place. To the labourers, however, the amount of money they obtain is only a means to an end, and accordingly economists have drawn a sharp distinction between *nominal* and *real* wages. "Labour, like commodities," says Adam Smith, "may be said to have a real and a nominal price. Its real price may be said to consist in the quantity of the necessaries and conveniences of life which are given for it; its nominal price in the quantity of money. The labourer is rich or poor, is well or ill rewarded, in proportion to the real not to the nominal price of his labour."

Variations in real wages.

Walker (*op. cit.* pp. 12 sqq.) has given a full analysis of the principal elements which ought to be taken into account in estimating the *real* wages of labour. They may be classified as follows. (1) Variations in the purchasing power of money may be due in the first place to causes affecting the general level of prices in a country. Such, for instance, is a debasement of the coinage, of which a good example is furnished in English history in the reigns of Henry VIII. and Edward VI. Thorold Rogers has ascribed much of the degradation of labour which ensued to this fact; and Macaulay has given a graphic account of the evils suffered by the labouring classes prior to the recoinage of 1696. The issues of inconvertible paper notes in excess have frequently caused a disturbance of real wages, and it is generally asserted that in this case wages as a rule do not rise so quickly as commodities. A general rise in prices due to great discoveries of the precious metals would, if nominal wages remained the same, of course cause a fall in real wages. There are, however, good grounds for supposing that the stimulus given to trade in this case would raise wages at least in proportion; and certainly the great gold discoveries in Australia and California raised wages in England, as is shown in Tooke's *History of Prices*, vol. v. p. 284. Similarly it is possible that a general fall in prices, owing to a relative scarcity of the precious metals, may lower the prices of commodities before it lowers the price of labour, in which case there is a rise in real wages. In the controversy as to the possible advantages of bimetallism this was one of the points most frequently discussed. It is impossible to say a priori whether a rise or fall in general prices, or a change in the value of money, will raise or lower real wages, since the result is effected principally by indirect influences. But, apart from these general movements in prices, we must, in order to find the real value of nominal wages, consider variations in local prices, and in making this estimate we must notice the principal items in the expenditure of the labourers. Much attention has been given recently by statisticians to this subject, with the view of finding a good "index number" for real wages. (2) Varieties in the form of payment require careful attention. Sometimes the payment is only partly in money, especially in agriculture in some places. In many parts of Scotland the labourers receive meal, peats, potatoes, &c. (3) Opportunities for extra earnings are sometimes of much importance, especially if we take as the wage-earning unit the family and not the individual. At the end of the 18th century Arthur Young, in his celebrated tours, often calls attention to this fact. In Northumberland and other counties a "hind" (*i.e.* agricultural labourer) is more valued if he has a large working family, and the family earnings are relatively large. (4) Regularity of employment is always, especially in modern times, one of the most important points to be considered. Apart from such obvious causes of fluctuation as the nature of the employment, *e.g.* in the case of fishermen, guides, &c., there are various social and industrial causes (for a particular and able investigation of which the reader may consult Professor Foxwell's essay on the subject). Under the system of production on a large scale for foreign markets, with widely extended division of labour, it seems impossible to adjust accurately the supply to the demand, and there are in consequence constant fluctuations in the employment of labour. A striking example, happily rare, is furnished by the cotton famine during the American Civil War. (5) In forming a scientific conception of real wages we ought to take into account the longer or the shorter duration of the power to labour: the man whose employment is healthy and who lives more comfortably and longer at the same nominal rate of wages may be held to obtain a higher real wage than his less fortunate competitor. It is worth noting, in this respect, that in nearly every special industry there is a liability to some special form of disease: *e.g.* lace-workers often suffer from diseases of the eyes, miners from diseases of the lungs, &c. Thus, in attempting to estimate real wages, we have to consider all the various discomforts involved in the "quantity of labour" as well as all the conveniences which the nominal wages will purchase and all the supplements in kind.

General rate of wages in any country at any time.

In a systematic treatment of the wages question it would be natural to examine next the causes which determine the general rate of wages in any country at any time. This is a problem to which economists have given much attention, and is one of great complexity. It is difficult, when we consider the immense variety of "occupations" in any civilized country and the constant changes which are taking place, even to form an adequate conception of the general rate of wages. There are thousands of occupations of various kinds, and at first sight it may seem impossible to determine, in a manner sufficiently accurate for any useful purpose, an average or general rate of wages, especially if we attempt to take real and not merely nominal wages. At the same time, in estimating the progress of the working-classes, or in comparing their relative positions in different countries, it is necessary to use this conception of a general rate of wages in a practical manner. The difficulties presented are of the same kind as those met with in the determination of the value of money or the general level of prices, and may be overcome to some extent by the same methods. An "index number" may be formed by taking various kinds of labour as fair samples, and the nominal wages thus obtained may be corrected by a consideration of the elements in the real wages to which they correspond. Care must be taken, however, that the quantity and quality of labour taken at different times and places are the same, just as in the case of commodities similar precautions are necessary. Practically, for example, errors are constantly made by taking the rate of wages for a short time (say an hour), and then, without regard to regularity of employment, constructing the annual rate on this basis; and again, insufficient attention is paid to Adam Smith's pithy caution that "there may be more labour in an hour's hard work than in two hours' easy business." But, however difficult it may be to obtain an accurate measure of the general rate of wages for practical purposes, there can be no doubt as to the value and necessity of the conception in economic theory. For, as soon as it is assumed that industrial competition is the principal economic force in the distribution of the wealth of a community—and this is in reality the fundamental assumption of modern economic science,—a distinction must be drawn between the most general causes which affect all wages and the particular causes which lead to differences of wages in different employments. In other words, the actual rate of wages obtained in any particular occupation depends partly on causes affecting that group compared with others, and partly on the general conditions which determine the relations between labour, capital and production over the whole area in which the industrial competition is effective. (See A. L. Bowley's *Wages in the United Kingdom in the Nineteenth Century* (1900), § 3, for an account of the meaning and use of the average wage.)

Wages-fund theory. Thus the theory of the wages question consists of two parts, or gives the answers to two questions: (1) What are the causes which determine the general rate of wages? (2) Why are wages in some occupations and at some times and places above or below this general rate?

With regard to the first question, Adam Smith, as in almost every important economic theory, gives an answer which combines two views which were subsequently differentiated into antagonism. "The produce of labour constitutes the natural recompense or wages of labour," is the opening sentence of his chapter on wages. But then he goes on to say that "this original state of things, in which the labourer enjoyed the whole produce of his own labour, could not last beyond the first introduction of the appropriation of land and the accumulation of stock." And he thus arrives at the conclusion that "the demand for those who live by wages, it is evident, cannot increase but in proportion to the increase of the *funds* which are *destined* to the payment of wages." This is the germ of the celebrated wages-fund theory which was carried to an extreme by J. S. Mill and others; and, although Mill abandoned the theory some time before his death, he was unable to eradicate it from his systematic treatise and to reduce it to its proper dimensions. It is important to observe that in the hands of Mill this theory was by no means, as was afterwards maintained by Elliot Cairnes, a mere statement of the problem to be solved. According to Cairnes (*Leading Principles of Political Economy*, bk. ii.), the wages-fund theory, as given in Mill's *Principles* (bk. ii. ch. xi. § 1), embraces the following statements: (1) the wages-fund is a general term used to express the aggregate of all wages at any given time in possession of the labouring population; (2) the average wage depends on the proportion of this fund to the number of people; (3) the amount of the fund is determined by the amount of general wealth applied to the direct purchase of labour. These propositions Cairnes easily reduces to mere verbal statements, and he then states that the real difficulty is to determine the causes which govern the demand and supply of labour. But the most superficial glance, as well as the most careful survey, will convince the reader of Mill's chapters on wages that he regarded the theory not as the statement but as the solution of the problem. For he applies it directly to the explanation of movements in wages, to the criticism of popular remedies for low wages, and to the discovery of what he considers to be legitimate and possible remedies. In fact, it was principally on account of the application of the theory to concrete facts that it aroused so much opposition, which would have been impossible if it had been a mere statement of the problem.

The wages-fund theory as a real attempt to solve the wages question may be resolved into three propositions, which are very different from the verbal truisms of Cairnes. (1) In any country at any time there is a determinate amount of capital unconditionally destined for the payment of labour. This is the wages-fund. (2) There is also a determinate number of labourers who must work independently of the rate of wages—that is, whether the rate is high or low. (3) The wages-fund is distributed amongst the labourers solely by means of competition, masters competing with one another for labour, and labourers with one another for work, and thus the average rate of wages depends on the proportion between wage-capital and population. It follows then, according to this view, that wages can only rise either owing to an increase of capital or a diminution of population, and this accounts for the exaggerated importance attached by Mill to the Malthusian theory of population. It also follows from the theory that any restraint of competition in one direction can only cause a rise of wages by a corresponding fall in another quarter, and in this form it was the argument most frequently urged against the action of trade unions. It is worth noting, as showing the vital connexion of the theory with Mill's principles, that it is practically the foundation of his propositions on capital in his first book, and is also the basis of the exposition in his fourth book of the effects of the progress of society on the condition of the working-classes.

It has often been remarked that, in economics as in other sciences, what eventually assumes the form of the development of or supplement to an old theory at first appears as if in direct antagonism to it, and there is reason to think that the criticism of the wages-fund theory was carried to an extreme, and that the essential elements of truth which it contains were overlooked. In many respects the theory may be regarded as a good first approximation to the complete solution of the problem. The plan favoured by some modern economists of regarding wages simply as the price of labour determined as in the case of other prices simply by demand and supply, though of advantage from some points of view, is apt to lead to a maladjustment of emption in other directions. The supply of labour, for example, is in many ways on a different footing from the supply of commodities. The causes which the wages-fund theory emphasizes too exclusively are after all *verae causae*, and must always be taken into account. There can be no doubt, for example, that under certain conditions a rapid increase in the labouring population may cause wages to fall, just as a rapid decline may make them rise. The most striking example of a great improvement in the condition of the labouring classes in English economic history is found immediately after the occurrence of the Black Death in the middle of the 14th century. The sudden and extensive thinning of the ranks of labour was manifestly the principal cause of the great improvement in the condition of the survivors.

Again, as regards the amount of capital competing for labour, the reality of the cause admits of no dispute, at any rate in any modern society. The force of this element is perhaps best seen by taking a particular case and assuming that the general wages-fund of the country is divided into a number of smaller wages-funds. Take, for example, the wages of domestic servants when the payment of wages is made simply for the service rendered. We may fairly assume that the richer classes of the community practically put aside so much of their revenue for the payment of the wages of their servants. The aggregate of these sums is the domestic wages-fund. Now, if owing to any cause the amount available for this purpose falls off, whilst the number of those seeking that class of employment remains the same, the natural result would be a fall in wages. It may of course happen in this as in other cases that the result is not so much a direct fall in the rate of wages as a diminution of employment—but even in this case, if people employ fewer servants, they must do more work. Again, if we were to seek for the reason why the wages of governesses are so low, the essence of the answer would be found in the excessive supply of that kind of labour compared with the funds destined for its support. And similarly through the whole range of employments in which the labour is employed in perishable services and not in material products, the wages-fund theory brings into prominence the principal causes governing the rate of wages, namely, the number of people competing, the amount of the fund competed for, and the effectiveness of the competition. This view also is in harmony with the general principles of demand and supply. If we regard labour as a commodity and wages as the price paid for it, then we may say that the price will be so adjusted that the quantity demanded will be made equal to the quantity offered at that price,—the agency by which the equation is reached being competition.

But when we turn to other facts for the verification of the theory we easily discover apparent if not real contradictions. The case of Ireland after the potato famine affords an instance of a rapidly declining population without any corresponding rise in wages, whilst in new countries we often find a very rapid increase of population accompanied by an increase in wages. In a similar manner we find that the capital of a country may increase rapidly without wages rising in proportion—as, for example, seems to have been the case in England after the great mechanical improvements at the end of the 18th century up to the repeal of the Corn Laws—whilst in new countries where wages are the highest there are generally complaints of the scarcity of capital. But perhaps the most striking conflict of the theory with facts is found in the periodical inflations and depressions of trade. After a commercial crisis, when the shock is over and the necessary liquidation has taken place, we generally find that there is a period during which there is a glut of capital and yet wages are low. The abundance of capital is shown by the low rate of interest and the difficulty of obtaining remunerative investments. Accordingly this apparent failure of the theory, at least partially, makes it necessary to examine the propositions into which it was resolved more carefully, in order to discover, in the classical economic phraseology, the "disturbing causes." As regards the first of these propositions—that there is always a certain amount of capital destined for the employment of labour—it is plain that this destination is not really unconditional. In a modern society whether or not a capitalist will supply capital to labour depends on the rate of profit expected, and this again depends proximately on the course of prices. But the theory as stated can only consider profits and prices as acting in an indirect roundabout manner upon wages. If profits are high then more capital can be accumulated and there is a larger wages-fund, and if prices are high there may be some stimulus to trade, but the effect on real wages is considered to be very small. In fact Mill writes it down as a popular delusion that high prices make high wages. And if the high prices are due purely to currency causes the criticism is in the main correct, and in some cases, as was shown above, high prices may mean real low wages. If, however, we turn to the great classes of employments in which the labour is embodied in a material product, we find on examination that wages vary with prices in a real and not merely in an illusory sense. Suppose, for example, that, owing to a great increase in the foreign demand for British produce, a rise in prices takes place, there will be a corresponding rise in nominal wages, and in all probability a rise in real wages. Such was undoubtedly the case in Great Britain on the conclusion of the Franco-German War.

On the other hand, if prices fall and profits are low, there will so far be a tendency to contract the employment of labour. At the same time, however, to some extent the capital is applied unconditionally—in other words, without obtaining what is considered adequate remuneration, or even at a positive loss. The existence of a certain amount of fixed capital practically implies the constant employment of a certain amount of labour.

Nor is the second proposition perfectly true, namely, that there are always a certain number of labourers who must work independently of the rate of wages. For the returns of pauperism and other statistics show that there is always a proportion of "floating" labour sometimes employed and sometimes not. Again, although, as Adam Smith says, man is of all luggage the most difficult to be transported, still labour as well as capital may be attracted to foreign fields. The constant succession of strikes resorted to in order to prevent a fall in wages shows that in practice the labourers do not at once accept the "natural" market rate. Still, on the whole, this second proposition is a much more adequate expression of the truth than the first; for labour cannot afford to lie idle or to emigrate so easily as capital.

The third proposition, that the wages-fund is distributed solely by competition, is also found to conflict with facts. Competition may be held to imply in its positive meaning that every individual strives to attain his own economic interests regardless of the interests of others. But in some cases this end may be attained most effectively by means of combination, as, for example, when a number of people combine to create a practical monopoly. Again, the end may be attained by leaving the control to government, or by obeying the unwritten rules of long-established custom. But these methods of satisfying economic interests are opposed to competition in the usual sense of the term, and certainly as used in reference to labour. Thus on the negative side competition implies that the economic interests of the persons concerned are attained neither by combination, nor by law, nor by custom. Again, it is also assumed, in making competition the principal distributing force of the national income, that every person knows what his real interests are, and that there is perfect mobility of labour both from employment to employment and from place to place. Without these assumptions the wages-fund would not be evenly distributed according to the quantity of labour. It is, however, obvious that, even in the present industrial system, competition is modified considerably by these disturbing agencies; and in fact the tendency seems to be more and more for combinations of masters on one side and of men on the other to take the place of the competition of individuals.

Wages paid from the produce of labour.

The attempted verification of the wages-fund theory leads to so many important modifications that it is not surprising to find that in recent times the tendency has been to reject it altogether. And thus we arrive at the development of Adam Smith's introductory statement, namely, that the produce of labour constitutes the natural recompense or wages of labour. The most important omission of the wages-fund theory is that it fails to take account of the quantity produced and of the price obtained for the product. If we bring in these elements, we find that there are several other causes to be considered besides capital, population and competition. There are, for example, the various factors in the efficiency of labour and capital, in the organization of industry, and in the general condition of trade. To some extent these elements may be introduced into the old theory, but in reality the point of view is quite different. This is made abundantly clear by considering Mill's treatment of the remedies for low wages. His main contention is that population must be rigidly restrained in order that the average rate of wages may be kept up. But, as several American economists have pointed out, in new countries especially every increase in the number of labourers may be accompanied by a more than proportionate increase in the produce and thus in the wages of labour. Again, the older view was that capital must be first accumulated in order afterwards to be divided up into wages, as if apparently agriculture was the normal type of industry, and the workers must have a store to live on until the new crop was grown and secured. But the "produce" theory of wages considers that wages are paid continuously out of a continuous product, although in some cases they may be advanced out of capital or accumulated stores. According to this view wages are paid out of the annual produce of the land, capital and labour, and not out of the savings of previous years. There is a danger, however, of pushing this theory to an untenable extreme, and overlooking altogether the function of capital in determining wages; and the true solution seems to be found in a combination of the "produce" theory with the "fund" theory.

An industrial society may be regarded, in the first place, as a great productive machine turning out a vast variety of products for the consumption of the members of the society. The distribution of these products, so far as it is not modified by other social and moral conditions, depends upon the principle of "reciprocal demand." In a preliminary rough classification we may make three groups—the owners of land and natural agents, the owners of capital or reserved products and instruments, and the owners of labour. To obtain the produce requisite even for the necessary wants of the community a combination of these three groups must take place, and the relative reward obtained by each will vary in general according to the demands of the others for its services. Thus, if capital, both fixed and circulating, is scanty, whilst labour and land are both abundant, the reward of capital will be high relatively to rent and wages. This is well illustrated in the high rate of profits obtained in early societies. According to this view of the question the aggregate amount paid in wages depends partly on the general productiveness of all the productive agents and partly on the relative power of the labourers as compared with the owners of land and capital (the amount taken by government and individuals for taxes, charity, &c., being omitted). Under a system of perfect industrial competition the general rate of wages would be so adjusted that the demand for labour would be just equal to the supply at that rate. (Compare Marshall's *Principles of Economics*, bk. vi. ch. ii.)

Relative wages.

If all labour and capital were perfectly uniform it would not be necessary to carry the analysis further, but as a matter of fact, instead of two great groups of labourers and capitalists, we have a multitude of subdivisions all under the influence of reciprocal demand. Every subgroup tries to obtain as much as possible of the general product, which is practically always measured in money. The determination of relative wages depends on the constitution of these groups and their relations to one another. Under any given social conditions there must be differences of wages in different employments, which may be regarded as permanent until some change occurs in the conditions; in other words, certain differences of wages are stable or normal, whilst others depend simply on temporary fluctuations in demand and supply. A celebrated chapter in the *Wealth of Nations* (bk. i. ch. x.) is still the best basis for the investigation of these normal differences—which, as stated above, is the *second* principal problem of the wages question. First of all, a broad distinction may be drawn between the natural and artificial causes of difference, or, in Adam Smith's phraseology, between those due to the nature of the employments and those due to the policy of Europe. In the former division we have (1) the agreeableness or disagreeableness of the employment, illustrated by two classical examples—" honour makes a great part of the reward of all honourable professions," and " the most detestable of all employments—that of public executioner—is, in proportion to the work done, better paid than any common trade whatever." There is, however, much truth in Mill's criticism, that in many cases the worst paid of all employments are at the same time the most disagreeable, simply because those engaged in them have practically no other choice. (2) The easiness and cheapness or the reverse of learning the business. This factor operates in two ways. A difficult business implies to some extent peculiar natural qualifications, and it also involves the command of a certain amount of capital to subsist on during the process of learning, and thus in both respects the natural supply of labour is limited. (3) The constancy or inconstancy in the employment—a point already noticed under real wages. (4) The great or small trust reposed in the workmen, an important consideration in all the higher grades of labour, *e.g.* bankers, lawyers, doctors, &c. (5) The chance of success or the reverse. Here it is to be observed that, owing to the hopefulness of human nature and its influence on the gambling spirit, the chance of success is generally overestimated, and therefore that the wages in employments where the chance of success is really small are lower than they ought to be. The most striking instance is furnished by the labour in gold mines, diamond fields, and the like, and the same cause also operates in many of the professions.

Natural causes of difference.

All these causes of differences of wages in different employments may be explained by showing the way in which they operate on the demand and supply of labour in the particular group. If the " net advantages," to adopt Marshall's phraseology, of any group are relatively high, then labour will be directly attracted to that group, and the children born in it will be brought up to the same occupation, and thus in both ways the supply of labour will be increased. But the " net advantages " embrace the conditions just enumerated. Again, if the other members of the community require certain forms of labour to a greater extent, there is an increase in the demand and a rise in their price.

Artificial causes of difference.

In addition to these so-called natural causes of difference, there are those arising from law, custom, or other so-called artificial causes. They may be classified under four headings. (1) Certain causes artificially restrain industrial competition by limiting the number of any particular group. Up to the close of the 18th century, and in many instances to a much later date, the regulations of gilds and corporations limited the numbers in each trade (cf. Brentano, *Gilds and Trade Unions*). This they did by making a long apprenticeship compulsory on those wishing to learn the craft, by restricting the number of apprentices to be taken by any master, by exacting certain qualifications as to birth or wealth, by imposing heavy entrance fees, either in money or in the shape of a useless but expensive masterpiece. Some of these regulations were originally passed in the interests of the general public and of those employed in the craft, but in the course of time their effect was, as is stated by Adam Smith, simply to unduly restrain competition. The history of the craft-gilds is full of instructive examples of the principles governing wages. No doubt the regulations tended to raise wages above the natural rate, but as a natural consequence industry migrated to places where the oppressive regulations did not exist. In the time of the Tudors the decay of many towns during a period of rapid national progress was largely due to those " fraternities in evil," as Bacon called the gilds. At present one of the best examples of the survival of this species of artificial restriction is the limitation of the number of teachers qualifying for degrees in certain universities. (2) In some employments, however, law and custom tend unduly to increase the amount of competition. This was to a great extent the case in the church and the scholastic professions owing to the large amount of charitable education. Adam Smith points out that even in his day a curate was " passing rich on forty pounds a year," whilst many only obtained £20—below the wages earned by a journeyman shoemaker. In the same way state-aided education of a commercial and technical kind may result in lowering the rates (relatively) of the educated business classes. It is said that one reason why the Germans replace Englishmen in many branches is that, having obtained their education at a low rate, there are more of them qualified, and consequently they accept lower wages. The customary idea that the position of a clerk is more genteel than that of an artisan accounts largely for the excessive competition in the former class, especially now that education is practically universal. (3) In some cases law and custom may impede or promote the circulation of labour. At the time Adam Smith wrote the laws of settlement were still in full operation. " There is not a man of forty who has not felt most cruelly oppressed by this ill-contrived law of settlement." Differences in wages in different parts of the same country and in different occupations are still largely due to impediments in the way of the movement of labour, which might be removed or lessened by the government making provisions for migration or emigration. (4) On many occasions in the past the law often directly interfered to regulate wages. The Statute of Labourers, passed immediately after the Black Death, was an attempt in this direction, but it appears to have failed, according to the investigations of Thorold Rogers. The same writer, however, ascribes to the celebrated Statute of Apprentices (5th of Elizabeth) the degradation of the English labourer for nearly three centuries (*Agriculture and Prices*, vol. v.). This, he asserts, was due to the wages being fixed by the justices of the peace. It is, however, worth noting that Brentano, who is equally sympathetic with the claims of labour, asserts that so long as this statute was actually enforced, or the customs founded upon it were observed, the condition of the labourers was prosperous, and that the degradation only began when the statute fell into disuse (*Origin of Gilds and Trade Unions*. For a full account of the effect of the Statute of Apprentices see W. Cunningham's *Growth of English Industry and Commerce*, vol. ii.).

State regulation of wages.

Something must be said as to the power of the state to regulate wages. As far as any direct regulation is concerned, it seems to be only possible within narrow limits. The state might of course institute certain complex sliding-scales for different classes of labour and make them compulsory, but this would rather be an official declaration of the natural market rate than a direct regulation. Any rate which the state of trade and prices would not bear could not be enforced: masters could not be compelled to work at a loss or to keep their capital employed when it might be more advantageously transferred to another place or occupation. Thus the legal rate could not exceed to any considerable extent the market rate. Nor, on the other hand, could a lower rate in general be enforced, especially when the labourers have the right of combination and possess powerful organizations. And even apart from this the competition of capitalists for labour would tend to raise wages above the legal rate, and evasion would be extremely easy.

Poor relief in aid of wages.

The best illustration of the failure to raise the rate of wages directly by authority is found in the English poor law system between 1796 and 1834. "In the former year (1796) the decisively fatal step of legalizing out-relief to the able-bodied, and *in aid of wages*, was taken," and "in February 1834 was published perhaps the most remarkable and startling document to be found in the whole range of English, perhaps indeed of all social history" (Fowle's *Poor Law*). The essence of the system was in the justices determining a natural rate of wages, regard being paid to the price of necessaries and the size of the labourer's family, and an amount was given from the rates sufficient to make up the wages received to this natural level. The method of administration was certainly bad, but the best administration possible could only have kept the system in existence a few years longer. In one parish the poor-rate had swallowed up the whole value of the land, which was going out of cultivation, a fact which has an obvious bearing on land nationalization as a remedy for low wages. The labourers became careless, inefficient and improvident. Those who were in regular receipt of relief were often better off (in money) than independent labourers. But the most important consequence was that the real wages obtained were, in spite of the relief, lower than otherwise they would have been, and a striking proof was given that wages are paid out of the produce of labour. The *Report of the Poor Law Commissioners* (1834) states emphatically (p. 48) that "the severest sufferers are those for whose benefit the system is supposed to have been introduced and to be perpetuated, the labourers and their families." The independent labourers suffered directly through the unfair competition of the pauper labour, but, as one of the sub-reporters stated, in every district the general condition of the independent labourer was strikingly distinguishable from that of the pauper and superior to it, though the independent labourers were commonly maintained upon less money. In New Zealand and Australia in recent years a great extension has been made of the principle of state intervention in the regulation of wages.

Factory legislation.

But, although the direct intervention of the state, with the view of raising the nominal rates of wages, is, according to theory and experience, of doubtful advantage, still, when we consider real wages in the evident sense of the term, there seems to be an almost indefinite scope for state interference. The effect of the Factory Acts and similar legislation has been undoubtedly to raise the real wages of the working-classes as a whole, although at first the same arguments were used in opposition to these proposals as in the case of direct relief from the poor-rates. But there is a vital difference in the two cases, because in the former the tendency is to increase whilst in the latter it is to diminish the energy and self-reliance of the workers. An excellent summary of the results of this species of industrial legislation is given by John Morley (*Life of Cobden*, vol. i. p. 303):—

"We have to-day a complete, minute; and voluminous code for the protection of labour: buildings must be kept pure of effluvia; dangerous machinery must be fenced; children and young persons must not clean it while in motion; their hours are not only limited but fixed; continuous employment must not exceed a given number of hours, varying with the trade but prescribed by the law in given cases; a statutable number of holidays is imposed; the children must go to school, and the employer must have every week a certificate to that effect; if an accident happens notice must be sent to the proper authorities; special provisions are made for bakehouses, for lace-making, for collieries, and for a whole schedule of other special callings; for the due enforcement and vigilant supervision of this immense host of minute prescriptions there is an immense host of inspectors, certifying surgeons, and other authorities whose business it is to 'speed and post o'er land and ocean' on sullen guardianship of every kind of labour, from that of the woman who plaits straw at her cottage door to the miner who descends into the bowels of the earth and the seaman who conveys the fruits and materials of universal industry to and fro between the remotest parts of the globe."

The analysis previously given of real wages shows that logically all these improvements in the conditions of labour, by diminishing the "quantity of labour" involved in work, are equivalent to a real rise in wages. Experience has also shown that the state may advantageously interfere in regulating the methods of paying wages. A curious poem, written about the time of Edward IV., on England's commercial policy (*Political Songs and Poems*, Rolls Series, ii. 282), shows that even in the 15th century the "truck" system was in full operation, to the disadvantage of the labourers. The cloth-makers, in particular, compelled the workers to take half of their wages in merchandise which they estimated at higher than its real value. The writer proposes that the "wyrk folk be paid in good moné," and that a sufficient ordinance be passed for the purpose, and a law to this effect was enacted in the 4th year of Edward IV. The Truck Acts have since been much further extended. Again, the legislation directed against the adulteration of all kinds of goods, which also finds its prototypes in the middle ages, is in its effects equivalent to a rise in real wages.[1]

Trade unions and wages.

The power of trade unions in regulating wages is in most respects analogous in principle to that of legislation just noticed. Nominal wages can only be affected within comparatively narrow limits, depending on the condition of trade and the state of prices, whilst in many cases a rise in the rate in some trades or places can only be accomplished by a corresponding depression elsewhere. At the same time, however, it can hardly be questioned that through the unions nominal wages have on the whole risen at the expense of profits—that is to say, that combinations of labourers can make better bargains than individuals. But the debatable margin which may make either extra profits or extra wages is itself small, and the principal direct effect of trade unions is to make wages fluctuate with prices, a rise at one time being compensated by a fall at another. The unions can, however, look after the interests of their members in many ways which improve their general condition or raise the real rate of wages, and when nominal wages have attained a natural maximum, and some method of arbitration or sliding-scale is in force, this indirect action seems the principal function of trade unions. The effects of industrial partnership (cf. Sedley Taylor's *Profit Sharing*) and of productive co-operation (cf. Holyoake's *History of Co-operation*) are small in amount (compared with the total industry of any country) though excellent in kind, and there seem to be no signs of the decay of the *entrepreneur* system.

Effects of machinery on wages.

The industrial revolution which took place about the end of the 18th century, involving radical changes in production, destroyed the old relations between capital and labour, and perhaps the most interesting part of the history of wages is that covered by the 19th century. For fifty years after the introduction of production on a large scale, the condition of the working-classes was on the whole deplorable, but great progress has since been made. The principal results may be summed up under the effects of machinery on wages—taking both words in their widest sense. Machinery affects the condition of the working-classes in many ways. The most obvious mode is the direct substitution of machinery for labour. It is clear that any sudden and extensive adoption of labour-saving machinery may, by throwing the labourers out of employment, lower the rate of wages, and it is easy to understand how riots arose repeatedly owing to this cause. But as a rule the effect of labour-saving machinery in diminishing employment has been greatly exaggerated, because two important practical considerations have been overlooked. In the first place, any radical change made in the methods of production will be only gradually and continuously adopted throughout the industrial world; and in the second place these radical changes, these discontinuous leaps, tend to give place to advances by small *increments* of *invention.* We have an instance of a great radical change in the steam-engine. Watt's patent for "a method of lessening" the consumption of steam and fuel in fire-engines was published on January 5, 1769, and the movement for utilizing steam-power still found room for extension for a century or more afterwards. The history of the power-loom again shows that the adoption of an invention is comparatively slow. In 1813 there were not more than 2400 power-looms at work in England. In 1820 they increased to 14,150. In 1853 there were 100,000, but the curious thing is that during this time the number of hand-looms had actually *increased* to some extent (Porter's *Progress of the Nation*, p. 186). The power-loom also illustrates the gradual continuous growth of improvements. This is clearly shown by Porter. A very good hand-weaver, twenty-five or thirty years of age, could weave two pieces of shirting per week. In 1823 a steam-loom weaver, about fifteen years of age, attending two looms, could weave nine similar pieces in a week. In 1826 a steam-loom weaver, about fifteen, attending to four looms, could weave twelve similar pieces a week. In 1833 a steam-loom weaver, from fifteen to twenty, assisted by a girl of twelve, attending to four looms, could weave eighteen pieces. This is only one example, for, as Porter remarks, it would fill many large volumes to describe the numerous inventions which during the 19th century imparted facility to manufacturing processes, and in every case we find a continuity in the improvements. This two-fold progressive character of invention operates in favour of the labourer—in the first place, because in most cases the increased cheapness of the commodity consequent on the use of machinery causes a corresponding extension of the market and the amount produced, and thus there may be no actual diminution of employment even temporarily; and secondly, if the improvement takes place slowly, there is time for the absorption of the redundant labour in other employments. It is quite clear that on balance the great increase in population in the 19th century was largely caused, or rather rendered possible, by the increased use of labour-saving machinery. The way in which the working-classes were at first injured by the adoption of machinery was not so much by a diminution in the number of hands required as by a change in the nature of the employment. Skilled labour of a certain kind lost its peculiar value, and children and women were able to do work formerly only done by men. But the principal evils resulted from the wretched conditions under which, before the factory legislation, the work was performed; and there is good reason to believe that a deterioration of the type of labourer, both moral and physical, was effected. It is, however, a mistake to suppose that on the whole the use of machinery tends to dispense with skill. On the contrary, everything goes to prove that under the present system of production on a large scale there is on the whole far more skill required than formerly—a fact well brought out by Sir Robert Giffen in his essay on the progress of the working-classes (*Essays on Finance*, vol. ii. p. 365), and expressed by the official reports on wages in different countries. (J. S. N.)

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[1] On this subject compare Jevons, *The State in Relation to Labour*, new edition by F. A. Hirst.

Progress of the working-classes.

WAGGA-WAGGA, a town of Wynyard county, New South Wales, Australia, on the left bank of the river Murrumbidgee, 309 m. by rail W.S.W. of Sydney and 267 m. N.E. of Melbourne. Pop. (1901) 5114. The Murrumbidgee is here spanned by a steel viaduct, the approaches of which are formed by heavy embankments. Wagga-Wagga has a school of art with a library attached, a fine convent picturesquely situated on Mount Erin, a good racecourse and agricultural show-grounds. There is a considerable amount of gold-mining in the district, which, however, is chiefly pastoral, although cereals, tobacco and wine are produced in considerable quantities.

WAGNER, ADOLF (1835–   ), German economist, was born at Erlangen on the 25th of March 1835. Educated at Göttingen and Heidelberg, he was professor of political science at Dorpat and Freiburg, and after 1870 at Berlin. A prolific writer on economic problems, he brought out in his study of the subject the close relation which necessarily exists between economics and jurisprudence. He ranks without doubt as one of the most eminent German economists and a distinguished leader of the historical school. His leanings towards Christian socialism made him one of those to whom the appellation of "Katheder-Socialisten" or "socialists of the (professional) chair" was applied, and he was one of the founders of the *Verein für Social-politik.* In 1871 he undertook, in conjunction with Professor E. Nasse (1829–1890), a new edition of Rau's *Lehrbuch der politischen Ökonomie*, and his own special contributions, the *Grundlegung* and *Finanzwissenschaft*, afterwards published separately, are probably his most important works. He approaches economic studies from the point of view that the doctrine of the *jus naturae*, on which the physiocrats reared their economic structure, has lost its hold on belief, and that the old a priori and absolute conceptions of personal freedom and property have given way with it. He lays down that the economic position of the individual, instead of depending merely on so-called natural rights or even on his natural powers, is conditioned by the contemporary juristic system, which is itself an historical product. These conceptions, therefore, of freedom and property, half economic, half juristic, require a fresh examination. Wagner accordingly investigates, before anything else, the conditions of the economic life of the community, and in subordination to this, determines the sphere of the economic freedom of the individual. Among his works are *Beiträge zur Lehre von den Banken* (1857), *System der deutschen Zettelbankgesetzgebung* (1870–1873) and *Agrar- und Industriestaat* (1902).

His brother, HERMANN WAGNER (1840–   ), a distinguished geographer, joined the Geographical Institute of Justus Perthes in 1868, and was editor of the statistical section of the *Gothaer Almanack* up to 1876. In 1872 he founded *Die Bevölkerung der Erde*, a critical review of area and population, and in 1880 he was appointed professor of geography at Göttingen. He was editor of the *Geographisches Jahrbuch* from 1880 to 1908. His publications include *Lehrbuch der Geographie* (7th ed., 1903) and *Methodischer Schulatlas* (12th ed., 1907).

WAGNER, RUDOLPH (1805–1864), German anatomist and physiologist, was born on the 30th of June 1805 at Bayreuth, where his father was a professor in the gymnasium. He began the study of medicine at Erlangen in 1822, and finished his curriculum in 1826 at Würzburg, where he had attached himself mostly to J. L. Schönlein in medicine and to K. F. Heusinger in comparative anatomy. Aided by a public *stipendium*, he spent a year or more studying in the Jardin des Plantes, under the friendly eye of Cuvier, and in making zoological discoveries at Cagliari and other places on the Mediterranean. On his return he set up in medical practice at Augsburg, whither his father had been transferred; but in a few months he found an opening for an academical career, on being appointed prosector at Erlangen. In 1832 he became full professor of zoology and comparative anatomy there, and held that office until 1840, when he was called to succeed J. F. Blumenbach at Göttingen. At the Hanoverian university he remained till his death, being much occupied with administrative work as pro-rector for a number of years, and for nearly the whole of his residence troubled by ill-health (phthisis). In 1860 he gave over the physiological part of his teaching to a new chair, retaining the zoological, with which his career had begun. While at Frankfurt, on his way to examine the Neanderthal skull at Bonn, he was struck with paralysis, and died at Göttingen a few months later on the 13th of May 1864.

Wagner's activity as a writer and worker was enormous, and his range extensive, most of his hard work having been done at Erlangen while his health was good. His graduation thesis was on the ambitious subject of "the historical development of epidemic and contagious diseases all over the world, with the laws of their diffusion," which showed the influence of Schönlein. His first treatise was *Die Naturgeschichte des Menschen* (in 2 vols., Kempten, 1831). Frequent journeys to the Mediterranean, the Adriatic, and the North Sea gave him abundant materials for research on invertebrate anatomy and physiology, which he communicated first to the Munich academy of sciences, and republished in his *Beiträge zur vergleichenden Physiologie des Blutes* (Leipzig, 1832–1833), with additions in 1838). In 1834–1835 he brought out a text-book on the subject of his chair (*Lehrbuch der vergleichenden Anatomie*, Leipzig), which recommended itself to students by its clear and concise style. A new edition of it appeared in 1843 under the title of *Lehrbuch der Zootomie*, of which only the vertebrate section was corrected by himself. The precision of his earlier work is evidenced by his *Micrometric Measurements of the Elementary Parts of Man and Animals* (Leipzig, 1834). His zoological labours may be said to conclude with the atlas *Icones zootomicae* (Leipzig, 1841). In 1835 he communicated to the Munich academy of sciences his researches on the physiology of generation and development, including the famous discovery of the germinal vesicle of the human ovum. These were republished under the title *Prodromus historiae generationis hominis atque animalium* (Leipzig, 1836). As in zoology, his original researches in physiology were followed by a students' text-book, *Lehrbuch der speciellen Physiologie* (Leipzig, 1838), which soon reached a third edition, and was translated into French and English. This was supplemented by an atlas, *Icones physiologicae* (Leipzig, 1839). To the same period belongs a very interesting but now little known work on medicine proper, of a historical and synthetic scope, *Grundriss der Encyklopädie und Methodologie der medicinischen Wissenschaften nach geschichtlicher Ansicht* (Erlangen, 1838), which was translated into Danish. About the same time he worked at a translation of J. C. Prichard's *Natural History of Man*, and edited various writings of S. T. Sömmerring, with a biography of that anatomist (1844), which he himself fancied most of all his writings. In 1843, after his removal to Göttingen, he began his great *Handwörterbuch der Physiologie, mit Rücksicht auf physiologische Pathologie*, and brought out the fifth (supplementary) volume in 1852; the only contributions of his own in it were on the sympathetic nerve, nerve-ganglia and nerve-endings, and he modestly disclaimed all merit except as being the organizer. While resident in Italy for his health from 1845 to 1847, he occupied himself with researches on the electrical organ of the torpedo and on nervous organization generally; these he published in 1853–1854 (*Neurologische Untersuchungen*, Göttingen), and therewith his physiological period may be said to end. His next period was stormy and controversial. He entered the lists boldly against the materialism of "Stoff und Kraft," and avowed himself a Christian believer, whereupon he lost the countenance of a number of his old friends and pupils, and was unfeelingly told that he was suffering from an "atrophy of the brain." His quarrel with the materialists began with his oration at the Göttingen meeting of the Naturforscher-Versammlung in 1854, on "Menschenschöpfung und Seelensubstanz." This was followed by a series of "Physiological Letters" in the *Allgemeine Zeitung*, by an essay on "Glauben und Wissen," and by the most important piece of this series, "Der Kampf um die Seele" (Göttingen, 1857). Having come to the consideration of these philosophical problems late in life, he was at some disadvantage; but he endeavoured to join as he best could in the current of contemporary German thought. He had an exact knowledge of classical German writings, more especially of Goethe's, and of the literature connected with him. In what may be called his fourth and last period, Wagner became anthropologist and archaeologist, occupied himself with the cabinet of skulls in the Göttingen museum collected by Blumenbach and with the excavation of prehistoric remains, corresponded actively with the anthropological societies of Paris and London, and organized, in co-operation with the veteran K. E. von Baer, a successful congress of anthropologists at Göttingen in 1861. His last writings were memoirs on the convolutions of the human brain, on the weight of brains, and on the brains of idiots (1860–1862).

See memoir by his eldest son in the *Göttinger gelehrte Anzeigen*, "Nachrichten" for 1864.

WAGNER, WILHELM RICHARD (1813–1883), German dramatic composer, poet and essay-writer, was born at Leipzig on the 22nd of May 1813. In 1822 he was sent to the Kreuzschule at Dresden, where he did so well that, four years later, he translated the first twelve books of the *Odyssey* for amusement. In 1828 he was removed to the Nicolaischule at Leipzig, where he was less successful. His first music master was Gottlieb Müller, who thought him self-willed and eccentric; and his first production as a composer was an overture, performed at the Leipzig theatre in 1830. In that year he matriculated at the university, and took lessons in composition from Theodor Weinlig, cantor at the Thomasschule. A symphony was produced at the Gewandhaus concerts in 1833, and in the following year he was appointed conductor of the opera at Magdeburg. The post was unprofitable, and Wagner's life at this period was very unsettled. He had composed an opera called *Die Feen* adapted by himself from Gozzi's *La Donna Serpente*, and another, *Das Liebesverbot*, founded on Shakespeare's *Measure for Measure*, but only *Das Liebesverbot* obtained a single performance in 1836.

In that year Wagner married Wilhelmina Planer, an actress at the theatre at Königsberg. He had accepted an engagement there as conductor; but, the lessee becoming bankrupt, the scheme was abandoned in favour of a better appointment at Riga. Accepting this, he remained actively employed until 1839, when he made his first visit to Paris, taking with him an unfinished opera based on Bulwer Lytton's *Rienzi*, and, like his earlier attempts, on his own libretto. The venture proved most unfortunate. Wagner failed to gain a footing, and *Rienzi*, destined for the Grand Opera, was rejected. He completed it, however, and in 1842 it was produced at Dresden, where, with Madame Schroeder Devrient and Herr Tichatschek in the principal parts, it achieved a success which went far to make him famous.

But though in *Rienzi* Wagner had shown energy and ambition, that work was far from representing his preconceived ideal. This he now endeavoured to embody in *Der fliegende Holländer*, for which he designed a libretto quite independent of any other treatment of the legend. The piece was warmly received at Dresden on the 2nd of January 1843; but its success was by no means equal to that of *Rienzi*. Spohr, however, promptly discovered its merits, and produced it at Cassel some months later, with very favourable results.

On the 2nd of February 1843 Wagner was formally installed as Hofkapellmeister at the Dresden theatre, and he soon set to work on a new opera. He chose the legend of Tannhäuser, collecting his materials from the ancient *Tannhäuser-Lied*, the *Volksbuch*, Tieck's poetical *Erzählung*, Hoffmann's story of *Der Sängerkrieg*, and the medieval poem on *Der Wartburgkrieg*. This last-named legend introduces the incidental poem of "Loherangrin," and so led Wagner to the study of Wolfram von Eschenbach's *Parzival* and *Titurel*, with great results later on. But for the present he confined himself to the subject in hand; and on the 19th of October 1845 he produced his *Tannhäuser*, with Schroeder Devrient, Johanna Wagner,[1] Tichatschek and Mitterwurzer in the principal parts. Notwithstanding this powerful cast, the success of the new work was not brilliant, for it carried still further the principles embodied in *Der fliegende Holländer*, and the time was not ripe for them. But Wagner boldly fought for them, and might have prevailed earlier had he not taken part in the political agitations of 1849, after which his position in Dresden became untenable. In fact, after the flight of the king and the subsequent suppression of the riots, a warrant was issued for his arrest; and he had barely time to escape to Weimar, where Liszt was at that moment engaged in preparing *Tannhäuser* for performance, before the storm burst upon him with alarming violence. In all haste Liszt procured a passport and escorted his guest as far as Eisenach. Wagner fled to Paris and thence to Zürich, where he lived in almost unbroken retirement until the autumn of 1859. During this period most of his prose works—including *Oper und Drama*, *Über das Dirigieren*, *Das Judentum in der Musik*—were given to the world.

The medieval studies which Wagner had begun for his work at the libretto of *Tannhäuser* bore rich fruit in his next opera *Lohengrin*, in which he also developed his principles on a larger scale and with a riper technique than hitherto. He had completed the work before he fled from Dresden, but could not get it produced. But he took the score with him to Paris, and, as he himself tells us, "when ill, miserable and despairing, I sat brooding over my fate, my eye fell on the score of my *Lohengrin*, which I had totally forgotten. Suddenly I felt something like compassion that the music should never sound from off the death-pale paper. Two words I wrote to Liszt; his answer was the news that preparations were being made for the performance of the work, on the grandest scale that the limited means of Weimar would permit. Everything that care and accessories

[1] The composer's niece.

could do was done to make the design of the piece understood. Liszt saw what was wanted at once, and did it. Success was his reward; and with this success he now approaches me, saying "See, we have come thus far; now create us a new work, that we may go further."

Lohengrin was, in fact, produced at Weimar under Liszt's direction on the 28th of August 1850. It was a severe trial to Wagner not to hear his own work, but he knew that it was in good hands, and he responded to Liszt's appeal for a new creation by studying the *Nibelungenlied* and gradually shaping it into a gigantic tetralogy. At this time also he first began to lay out the plan of *Tristan und Isolde*, and to think over the possibilities of *Parsifal*.

During his exile Wagner matured his plans and perfected his musical style; but it was not until some considerable time after his return that any of the works he then meditated were placed upon the stage. In 1855 he accepted an invitation to London, where he conducted the concerts of the Philharmonic Society with great success. In 1857 he completed the libretto of *Tristan und Isolde* at Venice, adopting the Celtic legend modified by Gottfried of Strasburg's medieval version. But the music was delayed until the strange incident of a message from the emperor of Brazil encouraged Wagner to complete it in 1859. In that year Wagner visited Paris for the third time; and after much negotiation, in which he was nobly supported by the Prince and Princess Metternich, *Tannhäuser* was accepted at the Grand Opera. Magnificent preparations were made; it was rehearsed 164 times, 14 times with the full orchestra; and the scenery and dresses were placed entirely under the composer's direction. More than £8000 was expended upon the venture; and the work was performed for the first time in the French language and with the new Venusberg music on the 13th of March 1861. But, for political reasons, a powerful clique was determined to suppress Wagner. A scandalous riot was inaugurated by the members of the Parisian Jockey Club, who interrupted the performance with howls and dog-whistles; and after the third representation the opera was withdrawn. Wagner was broken-hearted. But the Princess Metternich continued to befriend him, and by 1861 she had obtained a pardon for his political offences, with permission to settle in any part of Germany except Saxony. Even this restriction was removed in 1862.

Wagner now settled for a time in Vienna, where *Tristan und Isolde* was accepted, but abandoned after fifty-seven rehearsals, through the incompetence of the tenor. *Lohengrin* was, however, produced on the 15th of May 1861, when Wagner heard it for the first time. His circumstances were now extremely straitened; it was the darkness before dawn. In 1863 he published the libretto of *Der Ring des Nibelungen.* King Ludwig of Bavaria was much struck with it, and in 1864 invited Wagner, who was then at Stuttgart, to come to Munich and finish his work there. Wagner accepted with rapture. The king gave him an annual grant of 1200 gulden (£120), considerably enlarging it before the end of the year, and placing a comfortable house in the outskirts of the city at his disposal. The master expressed his gratitude in a "Huldigungsmarsch." In the autumn he was formally commissioned to proceed with the tetralogy and to furnish proposals for the building of a theatre and the foundation of a Bavarian music school. All promised well, but no sooner did his position seem assured than a miserable court intrigue was formed against him. His political indiscretions at Dresden were made the excuse for bitter persecutions: scandalmongers made his friendship with the ill-fated king a danger to both; and Wagner was obliged to retire to Triebschen near Lucerne for the next six years.

On the 10th of June 1865 at Munich, *Tristan und Isolde* was produced for the first time, with Herr and Frau Schnorr in the principal parts. *Die Meistersinger von Nürnberg*, first sketched in 1845, was completed in 1867 and first performed at Munich under the direction of Hans von Bülow on the 21st of June 1868. The story, though an original one, is founded on the character of Hans Sachs, the poet-shoemaker of Nuremberg. The success of the opera was very great; but the production of the Nibelung-tetralogy as a whole still remained impracticable, though *Das Rheingold* and *Die Walküre* were performed, the one on the 22nd of September 1869 and the other on the 26th of June 1870. The scheme for building a new theatre at Munich having been abandoned, there was no opera-house in Germany fit for so colossal a work. A project was therefore started for the erection of a suitable building at Bayreuth (*q.v.*). Wagner laid the first stone of this in 1872, and the edifice was completed, after almost insuperable difficulties, in 1876.

After this Wagner resided permanently at Bayreuth, in a house named Wahnfried, in the garden of which he built his tomb. His first wife, from whom he had parted since 1861, died in 1865; and in 1870 he was united to Liszt's daughter Cosima, who had previously been the wife of von Bülow. Meantime *Der Ring des Nibelungen* was rapidly approaching completion, and on the 13th of August 1876 the introductory portion, *Das Rheingold*, was performed at Bayreuth for the first time as part of the great whole, followed on the 14th by *Die Walküre*, on the 16th by *Siegfried* and on the 17th by *Götterdämmerung*. The performance, directed by Hans Richter, excited extraordinary attention; but the expenses were enormous, and burdened the management with a debt of £7500. A small portion of this was raised (at great risk) by performances at the Albert Hall in London, conducted by Wagner and Richter, in 1877. The remainder was met by the profits upon performances of the tetralogy at Munich.

Wagner's next and last work was *Parsifal*, based upon the legend of the Holy Grail, as set forth, not in the legend of the *Morte d'Arthur*, but in the versions of Chrestien de Troyes and Wolfram von Eschenbach and other less-known works. The libretto was complete before his visit to London in 1877. The music was begun in the following year, and completed at Palermo on the 13th of January 1882. The first sixteen performances took place at Bayreuth, in July and August 1882, under Wagner's own directing, and fully realized all expectations.

Unhappily the exertion of directing so many consecutive performances seems to have been too much for the veteran master's strength, for towards the close of 1882 his health began to decline rapidly. He spent the autumn at Venice, and was well enough on Christmas Eve to conduct his early symphony (composed in 1833) at a private performance given at the Liceo Marcello. But late in the afternoon of the 13th of February 1883 his friends were shocked by his sudden death from heart-failure.

Wagner was buried at Wahnfried in the tomb he had himself prepared, on the 18th of February; and a few days afterwards King Ludwig rode to Bayreuth alone, and at dead of night, to pay his last tribute to the master of his world of dreams.

(W. S. R.; D. F. T.)

In the articles on MUSIC and OPERA, Wagner's task in music-drama is described, and it remains here to discuss his progress in the operas themselves. This progress has perhaps no parallel in any art, and certainly none in music, for even Beethoven's progress was purely an increase in range and power. Beethoven, we know, lost sympathy with his early works as he grew older; but that was because his later works absorbed his interest, not because his early works misrepresented his ideals. Wagner's earlier works have too long been treated as if they represented the pure and healthy childhood of his later ideal; as if *Lohengrin* stood to *Parsifal* as Haydn, Mozart and early Beethoven stand to Beethoven's last quartets. But Wagner never thus represented the childhood of an ideal, though he attained the manhood of the most comprehensive ideal yet known in art. To change the metaphor—the ideal was always in sight, and Wagner never swerved from his path towards it; but that path began in a blaze of garish false lights, and it had become very tortuous before the light of day prevailed. Beethoven was trained in the greatest and most advanced musical tradition of his time. For all his Wagnerian impatience, his progress was no struggle from out of a squalid environment; on the contrary, one of his latest discoveries was the greatness of his master Haydn. Now Wagner's excellent teacher Weinlig did certainly, as Wagner himself testifies, teach him more of good music than Beethoven, Haydn and Mozart could have seen in their youth; for he showed him Beethoven. But this would not help Wagner to feel that contemporary music was really a great art; indeed it could only show him that he was growing up in a pseudo-classical time, in which the approval of persons of "good taste" was seldom directed to things of vital promise. Again, he began with far greater facility in literature than in music, if only because a play can be copied ten times faster than a full score. Wagner was always an omnivorous reader, and books were then, as now, both cheaper than music and easier to read. Moreover, the higher problems of rhythmic movement in the classical sonata forms are far beyond the scope of academic teaching, which is compelled to be contented with a practical plausibility of musical design; and the instrumental music which was considered the highest style of art in 1830 was as far beyond Wagner's early command of such plausibility as it was obviously already becoming a mere academic game. Lastly, the rules of that game were useless on the stage, and Wagner soon found in Meyerbeer a master of grand opera who was dazzling the world by means which merely disgusted the more serious academic musicians of the day.

In *Rienzi* Wagner would already have been Meyerbeer's rival, but that his sincerity, and his initial lack of that musical *savoir faire* which is prior to the individual handling of ideas, put him at a disadvantage. Though Meyerbeer wrote much that is intrinsically more dull and vulgar than the overture to *Rienzi*, he never combined such serious efforts with a technique so like that of a military bandmaster. The step from *Rienzi* to *Der fliegende Holländer* is without parallel in the history of music, and would be inexplicable if *Rienzi* contained nothing good and if *Der fliegende Holländer* did not contain many reminiscences of the decline of Italian opera; but it is noticeable that in this case the lapses into vulgar music have a distinct dramatic value. Though Wagner cannot as yet be confidently credited with a satiric intention in his bathos, the fact remains that all the Rossinian passages are associated with the character of Daland, so as to express his vulgar delight at the prospect of finding a rich son-in-law in the mysterious Dutch seaman. Meanwhile the rest of the work (except in the prettily scored "Spinning Song," and other harmless and vigorous tunes) has more affinity with Wagner's mature style than the bulk of its much more ambitious successors, *Tannhäuser* and *Lohengrin*. The wonderful overture is more highly organized and less unequal than that of *Tannhäuser*; and although Wagner uses less *Leit-motif* than Weber (see OPERA, *ad fin.*) and divides the piece into "numbers" of classical size, the effect is so continuous that the divisions could hardly be guessed by ear. Moreover, the work was intended to be in one act, and is now so performed at Bayreuth; and, although it is very long for a one-act opera, this is certainly the only form which does justice to Wagner's conception.[1]

Spohr's appreciation of *Der fliegende Holländer* is a remarkable point in musical history; and his criticism that Wagner's style (in *Tannhäuser*) "lacked rounded periods" shows the best effect of that style on a well-disposed contemporary mind. Of course, from Wagner's mature point of view his early style is far too much cut up by periods and full closes; and its prophetic traits are so incomparably more striking than its resemblance to any earlier art that we often feel that only the full closes stand between it and the true Wagner. But Spohr would feel Wagner's works to be an advance upon contemporary romantic opera rather than a foreshadowing of an unknown future. When we listen to the free declamation of the singers at the outset of *Der fliegende Holländer*—a declamation which is accompanied by an orchestral and thematic texture as far removed from that of mere recitative as it is from the forms of the classical aria—the repetition of a whole sentence in order to form a firm musical close has almost as quaint a ring as a Shakespearean rhymed tag would have in a prose drama of Ibsen. To Spohr the frequency of these incidents must have produced the impression that Wagner was perpetually beginning arias and breaking them off at once. With all its defects, *Der fliegende Holländer* is the most masterly and the least unequal of Wagner's early works. As drama it stood immeasurably above any opera since Cherubini's *Medée*. As a complete fusion between dramatic and musical movement, its very crudities point to its immense advance towards the solution of the problem, propounded chaotically at the beginning of the 17th century by Monteverde, and solved in a simple form by Gluck. And as the twofold musical and dramatic achievement of one mind, it already places Wagner beyond parallel in the history of art.

Tannhäuser is on a grander scale, but its musical execution is disappointing. The weakest passages in *Der fliegende Holländer* are not so helpless as the original recitatives of Venus in the first act; or Tannhäuser's song, which was too far involved in the whole scheme to be ousted by the mature "New Venusberg music" with which Wagner fifteen years later got rid both of the end of the overture and what he called his "Palais-Royal" Venus. It is really very difficult to understand Schumann's impression that the musical technique of *Tannhäuser* shows a remarkable improvement. Not until the third act does the great Wagner arbitrate in the struggle between amateurishness and theatricality in the music, though at all points his epoch-making stagecraft asserts itself with a force that tempts us to treat the whole work as if it were on the Wagnerian plane of Tannhäuser's account of his pilgrimage in the third act. But the history of mid-19th-century music is unintelligible until we face the fact that, when the anti-Wagnerian storm was already at its height, Wagner was still fighting for the recognition of music which was most definite just where it realized with ultra-Meyerbeerian brilliance all that Wagner had already begun to detest. No contemporary, unaided by personal knowledge, could be expected to trust in Wagner's purity of ideal on the strength of *Tannhäuser*, which actually achieved popularity by such coarse methods of climax as the revivalistic end of the overture, by such maudlin pathos as *O du mein holder Abendstern*, and by the amiably childish grand-opera skill with which half the action is achieved by processions and a considerable fraction of the music is represented by fanfares. These features established the work in a position which it will always maintain by its unprecedented dramatic qualities and by the glory reflected from Wagner's later achievements; but we shall not appreciate the marvel of its nobler features if we continue at this time of day to regard the bulk of the music as worthy of a great composer.

After even the finest things in *Tannhäuser*, the *Vorspiel* to *Lohengrin* comes as a revelation, with its quiet solemnity and breadth of design, its ethereal purity of tone-colour, and its complete emancipation from earlier operatic forms. The suspense and climax in the first act is so intense, and the whole drama is so well designed, that we must have a very vivid idea of the later Wagner before we can see how far the quality of musical thought still falls short of his ideals. The elaborate choral writing sometimes rises to almost Hellenic regions of dramatic art; and there is no crudeness in the passages that carry on the story quietly in reaction from the climaxes—a test far too severe for *Tannhäuser* and rather severe for even the mature works of Gluck and Weber. The orchestration is already almost classically Wagnerian; though there remains an excessive amount of tremolo, besides a few lapses into comic violence, as in the yelpings which accompany Ortrud's rage in the night-scene in the second act. But the mere tone-colours of that scene are enough to make a casual listener imagine that he is dealing with the true Wagner: the variety of tone never fails, and depends on no immoderate paraphernalia; for, far-reaching as are the results of the systematic increase of the classical pairs of wind-instruments to groups of three, this is a very modest reform compared to the banausic "extra attractions" of every new production of Meyerbeer's.

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[1] The subsequent division into three acts, as given in all the published editions, has been effected in the crudest way by inserting a full close in the orchestral interludes at the changes of scene, and then beginning the next scene by taking up the interludes again. The true version can be recovered from the published score as follows: In act 1 skip from the last bar but four to the 41st bar of the introduction to the 2nd act; and at the end of the 2nd act skip from the last bar but five to the 8th bar of the entr'acte to the 3rd act.

But there is another side to the picture. With the growing certainty of touch a stiffness of movement appears which gradually disturbs the listener who can appreciate freedom, whether in the classical forms which Wagner has now abolished, or in the majestic flow of Wagner's later style. Full closes and repeated sentences no longer confuse the issue, but in their absence we begin to notice the incessant squareness of the ostensibly free rhythms. The immense amount of pageantry, though (as in *Tannhäuser*) good in dramatic motive and executed with splendid stage-craft, goes far to stultify Wagner's already vigorous attitude of protest against grand-opera methods; by way of preparation for the ethereally poetic end he gives us a disinfected present from Meyerbeer at the beginning of the last scene, where mounted trumpeters career round the stage in full blast for three long minutes; and the prelude to the third act is an outburst of sheer gratuitous vulgarity. Again, the anti-Wagnerians were entirely justified in penetrating below the splendidly simple and original orchestration of the night-scene between Ortrud and Telramund, and pointing out how feebly its music drifts among a dozen vague keys by means of the diminished 7th; a device which teachers have tried to weed out of every high-flown exercise since that otiose chord was first discovered in the 17th century. The mature Wagner would not have carried out twenty bars in his flattest scenes with so little musical invention. We must not forget that these boyish demerits belong to the work of a man of thirty-five whose claims and aspirations already purported to dwarf the whole record of the classics. And the defects are in all respects commonplace; they have no resemblance to that uncanny discomfort which often warns the wise critic that he is dealing with an immortal.

The crowning complication in the effect of *Der fliegende Holländer*, *Tannhäuser* and *Lohengrin* on the musical thought of the 19th century was that the unprecedented fusion of their musical with their dramatic contents revealed some of the meaning of serious music to ears that had been deaf to the classics. Wagnerism was henceforth proclaimed out of the mouths of babes and sucklings; learned musicians felt that it had an unfair advantage; and by the time Wagner's popularity began to thrive as a persecuted heresy he had left it in the lurch.

Wagner had hardly finished the score of *Lohengrin* before he was at work upon the poem of *Der Ring des Nibelungen*. And with this he suddenly became a mature artist. On a superficial view this is a paradox, for there are many more violations of probability and much graver faults of structure in the later works than in the earlier. Every critic could recognize the structural merits of the earlier plays, for their operatic conventionalities and abruptness of motive are always intelligible as stage devices. Jealousy might prompt a doubt whether these plays were within the scope of "legitimate" music; but they were obviously stories of exceptional musical and romantic beauty, presented with literary resources unprecedented in operatic libretti. Now the later dramas are often notoriously awkward and redundant; while the removal of those convenient operatic devices which symbolize situations instead of developing them, does not readily appear to be compensated for by any superior artistic resource. But there is a higher point of view than that of story-telling. In the development of characters and intellectual ideas Wagner's later works show a power before which his earlier stagecraft shrinks into insignificance. It would not have sufficed even to indicate his later ideas. To handle these so successfully that we can discriminate defects from qualities at all, is proof of the technique of a master, even though the faults extend to whole categories of literature. The faults make analysis exceptionally difficult, for they are no longer commonplace; indeed, the gravest dangers of modern Wagnerism arise from the fact that there is hardly any non-musical aspect in which Wagner's later work is not important enough to produce a school of essentially non-musical critics who have no notion how far Wagner's mature music transcends the rest of his thought, nor how often it rises where his philosophy falls. Thus the prominent school of criticism which appraised Wagner in the 19th century by his approximation to Darwin and Herbert Spencer, appraises him in the 20th by his approximation to Bernard Shaw; with the absurd result that *Götterdämmerung* is ruled out as a reactionary failure. It is true that its only conceivable moral is flatly the opposite of that "redemption by love" which Wagner strenuously preaches in a passage at the end which remained unset because he considered it already expressed by the music. Indeed, though Wagner's later treatment of love is perhaps the main source of his present popularity it seldom rises to his loftiest regions except where it is thwarted. The love that is disguised in the deadly feud between Isolde and Tristan, before the drinking of the fatal potion, rises even above the music; the love-duet in the second act depends for its greatness on its introduction, before the lovers have met, and its wonderful slow movement (shortly before the catastrophe) where they are almost silent and leave everything to the music: the intervening twenty minutes is an exhausting storm in which the words are the sophisticated rhetoric of a 19th-century novel of passion, translated into terribly turgid verse and set to music that is more interesting as an intellectual ferment than effective as a representation of emotions which previous dramatists have wisely left to the imagination. But so long as we treat Wagner like a prose philosopher, a librettist, a poet, a mere musician, or anything short of the complex and many-sided artist he really is, we shall find insuperable obstacles to understanding or enjoying his works. A true work of art is incomparably greater than the sum of its ideas; apart from the fact that, if its ideas are innumerable and various, prose philosophers are apt to complain that it has none. And every additional idea that does not merely derange an art enlarges it as it were by a new dimension in space. Wagner added all the arts to each other, and in one of them he attained so consummate a mastery that we can confidently turn to it when his words and doctrines fail us. Even when we treat him merely as a dramatist our enjoyment of his later works gains enormously if we take them as organic wholes, and not as mere plots dressed up in verse and action. It matters little that *Parsifal* requires two nameless attendant characters in a long opening scene, for the sole purpose of telling the antecedents of the story, when a situation is thereby revealed which for subtlety and power has hardly a parallel since Greek tragedy. The vast myth of the *Ring* is related in full several times in each of the three main dramas, with ruthless disregard for the otherwise magnificent dramatic effect of the whole; hosts of original dramatic and ethical ideas, with which Wagner's brain was even more fertile than his voluminous prose works would indicate, assert themselves at all points, only to be thwarted by repeated attempts to allegorize the philosophy of Schopenhauer; all efforts to read a consistent scheme, ethical or philosophical, into the result are doomed to failure; but all this matters little, so long as we have Wagner's unfailing later resources in those higher dramatic verities which present to us emotions and actions, human and divine, as things essentially complex and conflicting, inevitable as natural laws, incalculable as natural phenomena.

Wagner's choice of subjects had from the outset shown an imagination far above that of any earlier librettist; yet he had begun with stories which could attract ordinary minds, as he dismally realized when the libretto of *Der fliegende Holländer* so pleased the Parisian wire-pullers that it was promptly set to music by one of their friends. But with *Der Ring des Nibelungen* Wagner devoted himself to a story which any ordinary dramatist would find as unwieldy as, for instance, most of Shakespeare's subjects; a story in which ordinary canons of taste and probability were violated as they are in real life and in great art. Wagner's first inspiration was for an opera (*Siegfried's Tod*, projected in 1848) on the death of Germany's mythical hero; but he found that the story needed a preliminary drama to convey its antecedents. This preliminary drama soon proved to need another to explain it, which again finally needed a short introductory drama. Thus the plan of the *Ring* was sketched in reverse order; and it has been remarked that *Götterdämmerung* shows traces of the fact that Wagner had begun his scheme in the days when French grand opera, with its ballets and pageantry, still influenced him. There is little doubt that some redundant narratives in the *Ring* were of earlier conception than the four complete dramas, and that their survival is due partly to Wagner's natural affection for work on which he had spent pains, and partly to a dim notion that (like Browning's method in *The Ring and the Book*) they might serve to reveal the story afresh in the light of each character. Be this as it may, we may confidently date the purification of Wagner's music at the moment when he set to work on a story which carried him finally away from that world of stereotyped operatic passions into which he had already breathed so much disturbing life.

The disturbing life already appears in *Der fliegende Holländer*, at the point where Senta's father enters with the Dutchman, and Senta (who is already in an advanced state of *Schwärmerei* over the legend of the Flying Dutchman) stands rooted to the spot, comparing the living Dutchman with his portrait which hangs over the door. The conflict between her passionate fascination and her disgust at her father's vulgarity is finely realized both in music and drama; but, if we are able to appreciate it, then the operatic convention by which Senta avows her passion becomes crude. Ethical and operatic points of view are similarly confused when it is asserted that the Flying Dutchman can be saved by a faithful woman, though it appears from the relations between Senta and Erik that so long as the woman is faithful to the Dutchman it does not matter that she jilts some one else. Erik would not have been a sufficiently pathetic operatic tenor if his claim on Senta had been less complete. In *Tannhäuser* and *Lohengrin* Wagner's intellectual power develops far more rapidly in the drama than in the music. The *Sängerkrieg*, with its disastrous conflict between the sincere but unnatural asceticism of the orthodox Minnesingers and the irrepressible human passion of Tannhäuser, is a conception the vitality of which would reduce Tannhäuser's repentance to the level of *Robert le Diable*, were it not that the music of the *Sängerkrieg* has no structural power, and little distinction beyond a certain poetic value in the tones of violas which had long ago been fully exploited by Mozart and Méhul, while the music of Tannhäuser's pilgrimage ranks with the *Vorspiel* to *Lohengrin* as a wonderful foreshadowing of Wagner's mature style. Again, the appeal to "God's judgment" in the trial by battle in *Lohengrin* is a subject of which no earlier librettist could have made more than a plausible mess—which is the best that can be said for the music as music. But as dramatist Wagner compels our respect for the power that without gloss or apology brings before us the king, a model of royal fair-mindedness and good-nature, acquiescing in Telramund's monstrous claim to accuse Elsa without evidence, simply because it is a hard and self-evident fact that the persons of the drama live in an age in which such claims seemed reasonable. Telramund, again, is no ordinary operatic villain; there is genuine tragedy in his moral ruin; and even the melodramatic Ortrud is a much more life-like *intrigante* than might be inferred from Wagner's hyperbolical stage-directions, which almost always show his manner at its worst.

In *Lohengrin* we take leave of the early music that obscured Wagner's ideals, and in the *Ring* we come to the music which transcends all other aspects of Wagnerism. Had Wagner been a man of more urbane literary intellect he might have been less ambitious of expressing a world-philosophy in music-drama; and it is just conceivable that the result might have been a less intermittent dramatic movement in his later works, and a balance of ethical ideas at once more subtle and more orthodox. But it is much more likely that Wagner would then have found his artistic difficulties too formidable to let the ideas descend to us from Walhalla and the Hall of the Grail at all. More than a modicum of rusticity is needed as a protection to a man who attempts such colossal reforms. This necessity had its consequences in the disquieting inequalities of Wagner's early work, and the undeniable egotism that embittered his fiery nature throughout his life; while the cut-and-dried system of culture of later Wagnerian discipleship has revenged him in a specially sacerdotal type of tradition, which makes progress even in the study of his works impossible except through revolt. Such are the penalties exacted by the irony of fate for the world's persecution of its prophets.

Genuinely dramatic music, even if it seem as purely musical as Mozart's, must always be approached through its drama; and Wagner's masterpieces demand that we shall use this approach; but, as with Mozart, we must not stop on the threshold. With Mozart there is no temptation to do so. But with Wagner, just as there are people who have never tried to follow a sonata but who have been awakened by his music-dramas to a sense of the possibilities of serious music, so there are lovers of music who avow that they owe to Wagner their appreciation of poetry. But people whose love of literature is more independent find it hard to take Wagner's poetry and prose seriously, unless they have already measured him by his music. He effected no reform in literature; his meticulous adherence to the archaic alliteration of the *Nibelungenlied* is not allied with any sense of beauty in verbal sound or verse-rhythm; and his ways of expressing emotion in language consist chiefly in the piling-up of superlatives. Yet he was too full of dramatic inspiration to remain perpetually victimized by the conscientious affectations of the amateur author; and, where dramatic situations are not only poetical but (as in the first act of *Die Walküre* and the *Waldweben* scene in *Siegfried*) too elemental for strained language, Wagner is often supremely eloquent simply because he has no occasion to try to write poetry. Sometimes, too, when a great dramatic climax has given place to a lyrical anticlimax, retrospective moods, subtleties of emotion and crowning musical thoughts press in upon Wagner's mind with a closeness that determines every word; and thus not only is the whole third act of *Tristan*, as Wagner said when he was working at it, of "overwhelming tragic power," but Isolde's dying utterances (which occupy the last five minutes and are, of course, totally without action or dramatic tension) were not unlike fine poetry even before the music was written. But, as a rule, Wagner's poetic diction must simply be tolerated by the critic who would submit himself to Wagner's ideas.

If we wish to know what Wagner means, we must fight our way through his drama to his music; and we must not expect to find that each phrase in the mouth of the actor corresponds word for note with the music. That sort of correspondence Wagner leaves to his imitators; and his views on "Leit-motif-hunting," as expressed in his prose writings and conversation, are contemptuously tolerant. We shall indeed find that his orchestra interprets the dramatic situations which his poetry roughly outlines. But we shall also find that, even if we could conceive the poetry to be a perfect expression of all that can be given in words and actions, the orchestra will express something greater; it will not run parallel with the poetry; the *Leitmotif* system will not be a collection of labels; the musical expression of singer and orchestra will not be a mere heightened resource of dramatic declamation. All that kind of pre-established harmony Wagner left behind him the moment he deserted the heroes and villains of romantic opera for the visionary and true tragedy of gods and demi-gods, giants and gnomes, with beauty, nobility and love in the wrong, and the forces of destruction and hate set free by blind justice.

Let us illustrate Wagner's mature use of *Leitmotif* by the theme which happens to be associated with Alberich's ring. The fact that this theme is commonly called the "Ring-motif" is a glaring instance of what Wagner has had to endure from his friends. Important as the ring is throughout the tetralogy, Wagner would no more think of associating a theme with it for its own sake than he would think of associating a theme with Wotan's hat. Why should a Ring-motif be transformed into the theme representing Walhalla? Are we to guess that the connexion of ideas is that Wotan had eventually to pay for Walhalla by the ring? But if we attend to the circumstances under which this theme arises, its purport and development become deep and natural. The Rhine-daughters have been teasing the Nibelung Alberich, and are rejoicing in the light of the Rhine-gold which shines at the top of a rock as the sun strikes it through the water. Alberich does not think much of the gold if its only use is for these water-children's games. But one of the Rhine-daughters tells him that "he who could make the gold into a ring would become master of the world," and to these words the so-called Ring-motif is first sung (see MELODY, Example 11). The Rhine-daughter sings it in a childlike, indolently graceful way which well expresses the kind of toy the ring or the world itself would be to her. One of her sisters bids her be careful, but they reassure themselves with the thought that the Rhine-gold is safe, since no one can win it who does not renounce love. Alberich broods over what he hears, and already the theme changes its character as he thinks of such mastery of the world as he might gain by it (MELODY, Ex. 12). He curses love and grasps the gold. The theme of world-mastery grows dark with the darkness of the Nibelung's mind. The waters of the Rhine change into black mists which grow grey and thin, while the now sinister theme becomes softer and smoother. Then it breaks gently forth in a noble, swinging rhythm and massively soft brazen tones, as Wotan awakes on a mountain height and gazes upon Walhalla, his newly finished palace which he has bid the giants build, so that from it he may rule the world (MELODY, Ex. 13). The theme thus shows no trivial connexion with a stage-property, mechanically important in the plot; but it represents the desire for power, and what that desire means to each different type of mind. The gods, as the giants plaintively admit, "rule by beauty"; hence the "Walhalla-motif." What it becomes in the mind of the Nibelung is grimly evident when Alberich uses his ring in Nibelheim. The Rhine-daughters' exultant cry of "Rhine-gold" is there tortured in an extremely remote modulation at the end of a very sinister transformation of the theme; and the orchestration, with its lurid but smothered brass instruments, its penetrating low reed tones and its weird drum-roll beaten on a suspended cymbal, is more awe-inspiring than anything dreamed of by the cleverest of those composers who do not create intellectual causes for their effects.

A famous and typical instance of Wagner's use of *Leitmotif* in tragic irony is the passage where Hagen gives Siegfried friendly welcome, to the melody of the curse which Alberich pronounced on the ring and all who approached it. The more subtle examples are inexhaustible in variety and resource; and perhaps the climax of subtlety is the almost entire absence of *Leitmotif* in the first scene of the third act of *Götterdämmerung*, when Siegfried throws away his last chance of averting his doom. The Rhine-daughters appear to him, and ask him to give them the ring that is on his finger. Siegfried refuses. They laugh at his stinginess and disappear. Siegfried is piqued, and calls them back to offer them the ring. Unfortunately they tell him of its curse, and prophesy death to him if he keeps it. This arouses his spirit of contradiction; and he tells them that they might have won it from him by coaxing, but never by threats, and that he values his life no more than the stone he tosses away as he speaks to them. In spite of the necessary allusions to the ominous theme of the curse, which would give any less great composer ample excuse for succumbing to the listener's sense of impending doom, Wagner's music speaks to us through the child-minds of the Rhine-daughters and terrifies us with the ruthless calm of Nature.

Almost as subtle, and much more directly impressive, is the pathos of the death of Siegfried, which is heightened by an unprecedented appeal to a sense of musical form on the scale of the entire tetralogy. Siegfried's whole character and career is, indeed, annihilated in the clumsy progress towards this consummation; but Shakespeare might have condoned worse plots for the sake of so noble a result; and indeed Wagner's awkwardness arises mainly from fear of committing oversights. Hagen, the Nibelung's son, has managed to make Siegfried unwittingly drink a love-potion with Gutrune, which causes him to forget his own bride, Brünnhilde. Siegfried is then persuaded to transform himself by his magic Tarnhelm into the likeness of his host, Gutrune's brother Gunther, in order to bring Brünnhilde (whose name is now quite new to him) from her fire-encircled rock, so that Gunther may have her for his bride and Siegfried may wed Gutrune. This is achieved; and Brünnhilde's horror and bewilderment at meeting Siegfried again as a stranger in his own shape creates a situation which Siegfried cannot understand, and which Hagen pretends to construe as damning evidence that Siegfried has betrayed Gunther's honour as well as Brünnhilde's. Hagen, Gunther and Brünnhilde therefore agree that Siegfried must die. In order to spare Gutrune's feelings it is arranged that his death shall appear as an accident in a hunting party. While the hunting party is resting Siegfried tells stories of his boyhood, thus recalling the antecedents of this drama with a charming freshness and sense of dramatic and musical repose. When he comes to the point where his memory has been clouded by Hagen's spells, Hagen restores his memory with another magic potion. Siegfried calmly continues to tell how he found Brünnhilde asleep on the fiery mountain. Hagen affects to construe this as a confession of guilt, and slays him as if in righteous wrath. The dying Siegfried calls on Brünnhilde to awaken, and asks "Who hath locked thee again in sleep?" He believes that he is once more with Brünnhilde on the Valkyries' mountain height; and the harmonies of her awakening move in untroubled splendour till the light of life fades with the light of day and the slain hero is carried to the Gibichung's hall through the moonlit mists, while the music of love and death tells in terrible triumph more of his story than he ever knew.

The bare conception of such art as this shows how perfect is the unity between the different elements in Wagner's later music-drama. If the music of *Tristan* is more polyphonic than that of *Lohengrin*, it is because it is hardly figurative to call its drama polyphonic also. Compare the mere fairy-tale mystery of Lohengrin's command that Elsa shall never ask to know his name, with the profound fatalism of Isolde's love-potion. Apart from the gain in tragic force resulting from Wagner's masterly development of the character of Brangaene, the raw material of the story was already suggestive of that astounding combination of the contrasted themes of love and death, the musical execution of which involves a harmonic range almost as far beyond that of its own day as the ordinary harmonic range of the 19th century is beyond that of the 16th. In his next work, *Die Meistersinger*, Wagner ingeniously made poetry and drama out of an explicit manifesto to musical critics, and proved the depth of his music by developing its everyday resources and so showing that its vitality does not depend on that extreme emotional force that makes *Tristan und Isolde* almost unbearably poignant. Few things are finer in music or literature than the end of the second act of *Die Meistersinger*, from the point where Sachs's apprentice begins the riot, to the moment when the watchman, frightened at the silence of the moonlit streets so soon after he has heard all that noise, announces eleven o'clock and bids the folk pray for protection against evil spirits, while the orchestra tells us of the dreams of Walther and Eva and ends by putting poetry even into the pedantic ineptitudes of the malicious Beckmesser. *Die Meistersinger* is perhaps Wagner's most nearly perfect work of art; and it is a striking proof of its purity and greatness that, while the whole work is in the happiest comic vein, no one ever thinks of it as in any way slighter than Wagner's tragic works. The overwhelming love-tragedy of *Tristan und Isolde* is hardly less perfect, though the simplicity of its action exposes its *longueurs* to greater notoriety than those which may be found in *Die Meistersinger*.

These two works interrupted the execution of the *Ring* and formed the stepping-stones to *Parsifal*, a work which may perhaps be said to mark a further advance in that subtlety of poetic conception which, as we have seen, gave the determining impulse to Wagner's true musical style. But in music he had no more to learn, and *Parsifal*, while the most solemn and concentrated of all Wagner's dramas, is musically not always unsuggestive of old age. Its harmonic style is, except in the Grail music, even more abstruse than in *Tristan*; and the intense quiet of the action is far removed from the forces which in that tumultuous tragedy carry the listener through every difficulty. Again, while the Eucharistic features in *Parsifal* attract some listeners, the material effect of their presentation on the stage has been known to repel others who are beyond suspicion of prejudice. But the greatness of the art is, like its subject, worlds away from material impressions; and a wide consensus regards Wagner's last work as his loftiest, both in music and poetry. Certainly no poet would venture to despise Wagner's imaginative conception of Kundry. In his letters to his friend Mathilde Wesendonck, it appears that while he was composing *Tristan* he already had the inspiration of working out the identification of Kundry, the messenger of the Grail, with the temptress who, under the spell of Klingsor, seduces the knights of the Grail; and he had, moreover, thought out the impressively obscure suggestion that she was Herodias, condemned like the wandering Jew to live till the Saviour's second coming. The quiet expression of these startling ideas is more remarkable than their adoption; for smaller artists live on still more startling ideas; but most remarkable of all is the presentation of Parsifal, both in his foolishness and in the widsom which comes to him through pity. The chief excuse for doubting whether Wagner's last work is really his greatest is that most of its dramatic subtleties are beyond musical expression, since they do not lead to definite conflicts and blendings of emotion. Where the orchestra shows that Parsifal is becoming half-conscious of his quest while Kundry is beguiling him with memories of his mother,—and also during the two changes of scene to the Hall of the Grail, where the orchestra mingles the agony of Amfortas and the sorrow of the knights with the tolling of the great bells,—the polyphony is almost as dramatic as in *Tristan*; while the prelude and the *Charfreitagszauber* are among the clearest examples of the sublime since Beethoven. But elsewhere there are few passages in which the extremely recondite harmonic style can be with certainty traced to anything but habit. This style originated, indeed, in a long experience of the profoundest dramatic impulses; but as a habit it does not seem, like the greatest things in art, the one inevitable treatment of the matter in hand. But, whatever our doubts, we may safely regard *Parsifal* as a work which, like Beethoven's last fugues, invites attack rather from those critics who demand what flatters their own vanity than from those who wish to be inspired by what they could never have foreseen for themselves.

In Wagner's harmonic style we encounter the entire problem of modern musical texture. Wagner effected vast changes in almost every branch of his all-embracing art, from theatre-building and stage-lighting to the musical declamation of words. Most of his reforms have since been intelligently carried out as normal principles in more arts than one; but, shocking as the statement may seem to 20th-century orthodoxy, Wagnerian harmony is a universe as yet unexplored, except by the few composers who are so independent of its bewildering effect on the generation that grew up with it, that they can use Wagner's resources as discreetly as he used them himself. The last two examples at the end of the article on HARMONY show almost all that is new in Wagner's harmonic principles. The peculiar art therein is that while the discords owe their intelligibility and softness to the smooth melodic lines by which in "resolving" they prove themselves but transient rainbow-hues on or below the surface, they owe their strangeness to the intense vividness with which at the moment of impact they suggest a mysteriously remote foreign key. Wagner's orthodox contemporaries regarded such mixtures of key as sheer nonsense; and it would seem that the rank and file of his imitators agree with that view, since they either plagiarize Wagner's actual progressions or else produce such mixtures with no vividness of key-colour and little attempt to follow those melodic trains of thought by which Wagner makes sense of them. There is far more of truly Wagnerian harmony to be found before his time than since. It was so early recognized as characteristic of Chopin that a magnificent example may be seen at the end of Schumann's little tone-portrait of him in the *Carnaval*: a very advanced Wagnerian passage on another principle constitutes the bulk of the development in the first movement of Beethoven's sonata *Les Adieux*; while even in the "Golden Age" of music, and within the limits of pure diatonic concord, the unexpectedness of many of Palestrina's chords is hardly less Wagnerian than the perfect smoothness of the melodic lines which combine to produce them.

Wagnerian harmony is, then, neither a side-issue nor a progress *per saltum*, but a leading current in the stream of musical evolution. That stream is sure sooner or later to carry with it every reality that has been reached by side-issues and leaps; and of such things we have important cases in the works of Strauss and Debussy. Strauss makes a steadily increasing use of avowedly irrational discords, in order to produce an emotionally apt physical sensation. Debussy has this in common with Strauss, that he too regards harmonies as pure physical sensations; but he differs from Strauss firstly in systematically refusing to regard them as anything else, and secondly in his extreme sensibility to harshness. We have seen (in the articles on HARMONY and MUSIC) how harmonic music originated in just this habit of regarding combinations of sound as mere sensations, and how for centuries the habit opposed itself to the intellectual principles of contrapuntal harmony. These intellectual principles are, of course, not without their own ground in physical sensation; but it is evident that Debussy appeals beyond them to a more primitive instinct; and on it he bases an almost perfectly coherent system of which the laws are, like those of 12th-century music, precisely the opposite of those of classical harmony. The only illogical point in his system is that the beauty of his dreamlike chords depends not only on his artful choice of a timbre that minimizes their harshness, but also on the fact that they enter the ear with the meaning they have acquired through centuries of harmonic evolution on classical lines. There is a special pleasure in the subsidence of that meaning beneath a soothing sensation; but a system based thereon cannot be universal. Its phenomena are, however, perfectly real, and can be observed wherever artistic conditions make the tone of a mass of harmony more important than the interior threads of its texture. This is of constant occurrence in classical pianoforte music, in which thick chords are subjected to polyphonic laws only in their top and bottom notes, while the inner notes make a solid mass of sound in which numerous consecutive fifths and octaves are not only harmless but essential to the balance of tone. In Debussy's art the top and bottom are also involved in the antipolyphonic laws of such masses of sound, thus making these laws paramount.

The irrational discords of Strauss are also real phenomena in musical aesthetics. They are an extension of the principle on which gongs and cymbals and all instruments without notes of determinate pitch are employed in otherwise polyphonic music.

But it is important to realize that both these types of modern harmony are radically non-Wagnerian. Haydn uses a true Straussian discord in *The Seasons*, in order to imitate the chirping of a cricket; but the harshest realism in *Götterdämmerung* (the discord produced by the horns of Hagen and his churls in the mustering-scene in the second act) has a harmonic logic which would have convinced Corelli. And of Debussy's antipolyphonic art there is less in Wagner than in Beethoven. The present influence of Wagnerian harmony is, then, somewhat indefinite, since the most important real phenomena of later music indicate a revolt both from it and from earlier classical methods. It has had, however, a marked effect on weaker musical individualities. Musical public opinion now puts an extraordinary pressure on the young composer, urging him at all costs to abandon "out-of-date" styles however stimulating they may be to his invention. It is no exaggeration to say that a parallel condition in literature would be produced by a strong public opinion to the effect that any English style was hopelessly out of date unless it consisted exclusively of the most difficult types of phrase to be found in the works of Browning and Meredith. The brilliant success of Humperdinck's *Hänsel und Gretel*, in which Wagnerian technique is applied to the diatonic style of nursery songs with a humorous accuracy undreamed of by Wagner's imitators, points a moral which would have charmed Wagner himself; but until the revival of some rudiments of musical common sense becomes widespread, there is little prospect of the influence of Wagner's harmonic style being productive of anything better than nonsense.

The very sense of dramatic fitness has temporarily vanished from public musical opinion, together with the sense of musical form, in consequence of another prevalent habit, that of presenting shapeless extracts from Wagner's operas as orchestral pieces without voices or textbooks or any hint that such adjuncts are desirable. But this vandalism, which Wagner condoned with a very bad grace, now happily begins to give way to the practice of presenting long scenes or entire acts, with the singers, on the concert-platform. This has the merit of bringing the real Wagner to ears which may have no other means of hearing him, and it fosters no delusion as to what is missing in such a presentation. The guidance of Hans Richter has given us a sure bulwark against the misrepresentation of Wagner; and so there is hope that Wagner may yet be saved from such an oblivion in fetish-worship as has lost Handel to us for so long. As with Shakespeare and Beethoven, the day will never come when we can measure the influence of so vast a mind upon the history of art. Smaller artists can make history; the greatest absorb it into that daylight which is its final cause.

List of Wagner's Works

The following are Wagner's operas and music-dramas, apart from the unpublished *Die Hochzeit* (three numbers only), *Die Feen*, and *Das Liebesverbot* (*Das Liebesverbot* was disinterred in 1910).

1. *Rienzi, der letzte der Tribunen: grosse tragische Oper*; 5 acts (1838–1840).
2. *Der fliegende Holländer: romantische Oper*; 1 act, afterwards cut into 3 (1841).
3. *Tannhäuser und der Sängerkrieg auf Wartburg: romantische Oper*; 3 acts (libretto, 1843; music, 1844–1845; new Venusberg music, 1860–1861).
4. *Lohengrin: romantische Oper*; 3 acts (libretto, 1845; music, 1846–1848). This is the last work Wagner calls by the title of Opera.
5. *Das Rheingold*, prologue in 4 scenes to *Der Ring des Nibelungen; ein Bühnenfestspiel* (poem written last of the series, which was begun in 1848 and finished in 1851–1852; music, 1853–1854).
6. *Die Walküre: der Ring des Nibelungen, erster Tag*; 3 acts (score finished, 1856).
7. *Tristan und Isolde*; 3 acts (poem written in 1857; music, 1857–1859).
8. *Siegfried: der Ring des Nibelungen, zweiter Tag*; 3 acts, the first two nearly finished before *Tristan*, the rest between 1865 and 1869.
9. *Die Meistersinger von Nürnberg*; 3 acts (sketch of play, 1845; poem, 1861–1862; music, 1862–1867).
10. *Götterdämmerung: der Ring des Nibelungen, dritter Tag*; introduction and 3 acts (*Siegfried's Tod* already sketched dramatically in 1848; music, 1870–1874).
11. *Parsifal: ein Bühnenweihfestspiel* (a solemn stage festival play), 3 acts (poem, 1876–1877; music, 1877–1882, *Charfreitagszauber* already sketched in 1857).

As regards other compositions, the early unpublished works include a symphony, a cantata, some incidental music to a pantomime, and several overtures, four of which have recently been discovered and produced. The important small published works are *Eine Faust Overture* (1839–1840; rewritten, 1855); the *Siegfried Idylle* (an exquisite serenade for small orchestra on themes from the finale of *Siegfried*, written as a surprise for Frau Wagner in 1870); the *Kaisermarsch* (1871), the *Huldigungsmarsch* (1864) for military band (the scoring of the concert-version finished by Raff); *Fünf Gedichte* (1862), a set of songs containing two studies for *Tristan*; and the early quasi-oratorio scene for male-voice chorus and full orchestra, *Das Liebesmahl der Apostel* (1843). Wagner's retouching of Gluck's *Iphigenie en Aulide* and his edition of Palestrina's *Stabat Mater* demand mention as important services to music, by no means to be classified (as in some catalogues) with the hack-work with which he kept off starvation in Paris.

The collected literary works of Wagner in German fill ten volumes, and include political speeches, sketches for dramas that did not become operas, autobiographical chapters, aesthetic musical treatises and polemics of vitriolic violence. Their importance will never be comparable to that of his music; but, just as the reaction against Ruskin's ascendancy as an art-critic has coincided with an increased respect for his ethical and sociological thought, so the rebellious forces that are compelling Wagnerism to grant music a constitution coincide with a growing admiration of his general mental powers. The prose works have been translated into English by W. A. Ellis (8 vols., 1892–1899). The translation by F. Jameson (1897) of the text of the *Ring* (first published in the pocket edition of the full scores) is the most wonderful *tour de force* yet achieved in its line. A careful reading of the score to this English text reveals not a single false emphasis or loss of rhetorical point in the fitting of words to notes, nor a single extra note or halt in the music; and wherever the language seems stilted or absurd the original will be found to be at least equally so, while the spirit of Wagner's poetry is faithfully reflected. Such work deserves more recognition than it is ever likely to get. Rapidly as the standard of musical translations was improving before this work appeared, no one could have foreseen what has now been abundantly verified, that the *Ring* can be performed in English without any appreciable loss to Wagner's art. The same translator has also published a close, purely literary version.

Literature.—The Wagner literature is too enormous to be dealt with here. The standard biography is that of Glasenapp (6 vols., of which five appeared between 1894 and 1909). Of readable English books we may cite Ernest Newman, *A Study of Wagner* (1899); H. E. Krehbiel, *Studies in the Wagnerian Drama* (1891); Jessie L. Weston, *Legends of the Wagner Dramas* (1906). *The Perfect Wagnerite*, by G. Bernard Shaw, though concerned mainly with the social philosophy of the *Ring*, gives a luminous account of Wagner's mastery of musical movement. The highest English authority on Wagner is his friend Dannreuther, whose article in *Grove's Dictionary* is classical.

See also Aria, Harmony, Instrumentation, Music, Opera, and Overture. (D.F.T.)

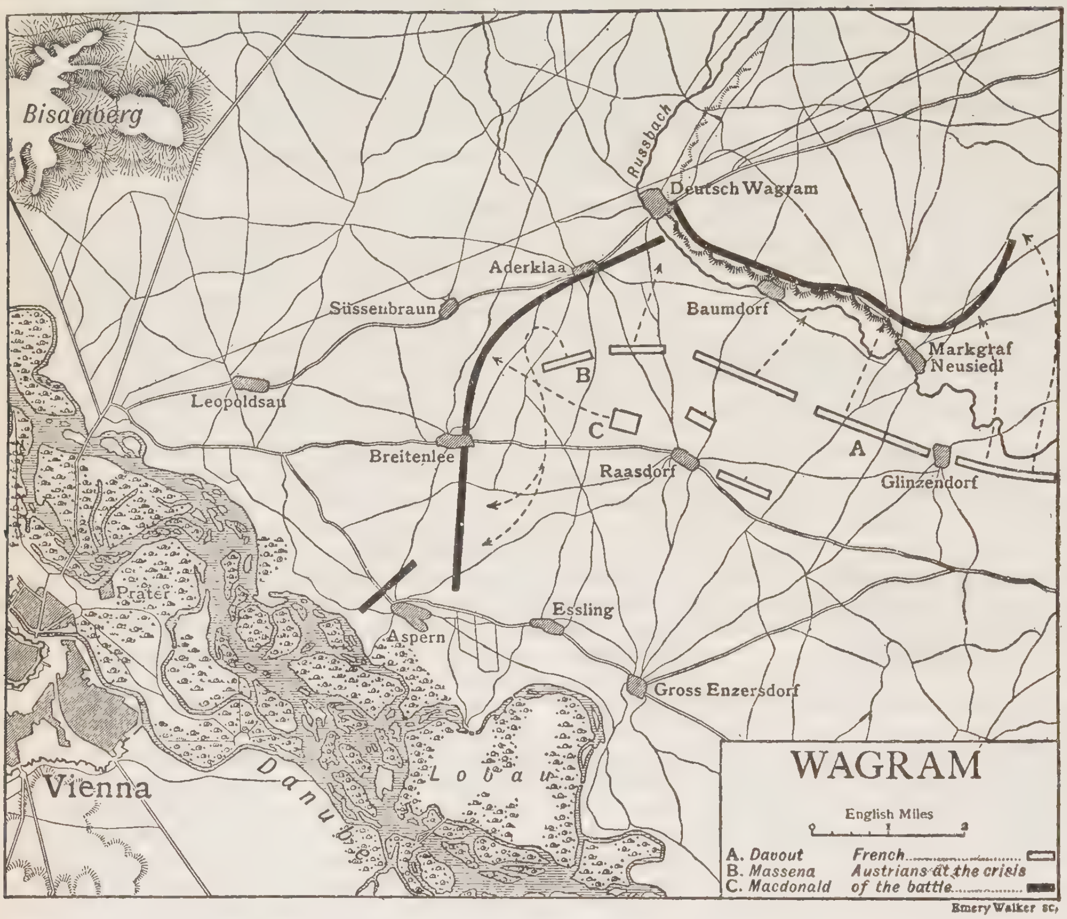
WAGON, or Waggon, a large four-wheeled vehicle for the carriage of heavy loads, and drawn by two or more horses. This is the general English use of the term, where it is more particularly confined to the large vehicles employed in the carrying of agricultural produce. It is also used of the uncovered heavy rolling stock for goods on railways. In America the term is applied also to lighter vehicles, such as are used for express delivery, police work, &c., and to various forms of four-wheeled vehicles used for driving, to which the English term "cart" would be given. The word "wagon" appears to be a direct adaptation of Du. *Wagen* (cf. Ger. *Wagen*, Swed. *Vagn*, &c.). Skeat finds the earliest use of the word in Lord Berner's translation of Froissart (1523–1525), so that it is by no means an early word. The O.E. cognate word was *wægn*, later *wæn*, by dropping of *g* (cf. *regn*, *ren*, *rain*), modern "wain." The root of all these cognate words, meaning to carry, is seen in Lat. *vehere*. The term "wagon" or "waggon" is applied technically in bookbinding to a frame of cane used for trimming the edges of gold leaf. In architecture a "wagon-ceiling" is a boarded roof of the Tudor time, either of semicircular or polygonal section. It is boarded with thin panels of oak or other wood ornamented with mouldings and with loops at the intersections.

WAGRAM (Deutsch-Wagram), a village of Austria situated in the plain of the Marchfeld, $11\frac{1}{2}$ m. N.E. of Vienna. It gives its name to the battle of the 5th and 6th of July 1809, in which the French army under Napoleon defeated the Austrians commanded by the archduke Charles. On the failure of his previous attempt to pass his whole army across the Danube at Aspern (see Napoleonic Campaigns and Aspern), Napoleon set himself to accumulate, around Vienna and the island of Lobau, not only his own field forces, but also every man, horse and gun available from Italy and South Germany for a final effort. Every detachment was drawn in within forty-eight hours' call, his rearward communications being practically denuded of their covering troops. The island of Lobau itself was converted practically into a fortress, and 150 heavy guns were mounted on its banks to command the Austrian side of the stream. Giving up, in face of this artillery, the direct defence of the river-side, the Austrians drew up in a great arc of about 6 m. radius extending from the Bisamberg, overlooking the Danube, in the west, to Markgrafneusiedl on the east. From this point to the Danube below Lobau a gap was left for the deployment of the archduke Johann's army from Pressburg. This army, however, arrived too late. Their total front, therefore, was about 12 m. for 120,000 men, which by a forward march of a couple of hours could be reduced to about 6 m.—giving a density of occupation of about 20,000 men to the mile.

Meanwhile Napoleon reconstructed the bridge over the main stream (see Aspern) more solidly, protecting it by palisades of piles and floating booms, and organized an armed flotilla to command the waterway. On the island itself preparations were made to throw three bridges across the Lobau arm of the stream opposite Aspern and Essling, and seven more on the right, facing east between Gross Enzersdorf and the main river.

For several days previous to the great battle the French had sent across small detachments, and hence when, on the afternoon of the 4th of July, an advanced guard was put over near Gross

Enzersdorf, the attention of the Austrians was not particularly attracted and they did not interfere. The emperor, however, had now men available for the battle, and under cover of this detachment his pontoniers made the seven bridges. Long before daylight on the 6th the troops began to stream across, and about 9 A.M. the three corps destined for the first line (Davout, Oudinot and Masséna) had completed their deployment on a front of some 6000 yds. and were moving forward to make way for the second line (Eugene and Bernadotte) and the third line (Bessières and the guard). About noon the general advance began, the French opening outwards like a fan to obtain space for manœuvre, Davout direct on Markgrafneusiedl and the Austrian left, Masséna (slightly refused to cover the French left) by Breitenlee on Süssenbrunn.



The Austrians held a strong position along the line of the Russbach from Deutsch-Wagram to Markgrafneusiedl with their left, whilst their right was held ready for a counter-attack intended to roll up the French attack from left to right when the proper moment should come. The movements of the great French masses in the confined space were slow, and the attack on the line of the Russbach did not declare itself till 8 P.M.; the corps did not attack simultaneously, and failed altogether to make any serious impression on the Austrian position. Masséna on the left was scarcely engaged.

But, hearing of the success of his left wing on the Russbach, the archduke determined to anticipate the French next morning on that side, and four corps were directed upon Masséna, who had bivouacked his troops overnight on the line Leopoldsau-Süssenbrunn-Aderklaa, the latter, a strongly built village, forming, as it were, a bridge-head to the passages of the Russbach at Deutsch-Wagram. Another corps with a strong cavalry force was also directed to pivot round Markgrafneusiedl and to attack Davout on his right; on this flank also the arrival of the archduke Johann was expected later in the day.

The Austrian movements were somewhat ill-connected; nevertheless, by 11 A.M. Masséna's left had been driven back almost to Aspern, and his right, though aided by Bernadotte, had failed to recapture Aderklaa, from which the Austrians had driven his advanced posts early in the morning. The situation for the French looked very serious, for their troops were not fighting with the dash and spirit of former years. But Napoleon was a master in the psychology of the battlefield, and knew that on the other side things were much the same. He therefore sent orders along the whole line for a gigantic counter-stroke. Davout on the right was to attack Markgrafneusiedl again. Masséna was to move against the troops immediately to his front; Bernadotte and Marmont to advance respectively against Breitenlee and Aderklaa, whilst in the gap which would thus open between them marched the 5th corps (Macdonald) on Süssenbrunn, covered by a battery of 104 guns and followed by the guard and reserve cavalry.

Macdonald formed his 30,000 men in a gigantic hollow square—on a front of one battalion, fourteen battalions deployed at six paces distance leading, whilst the remainder of the infantry marched in column of sections on either flank, and cavalry closed the rear. The idea was to compel even the weakest to go on, on pain of being trampled to death under the feet of the following men and horses, but the terror caused by the Austrian round-shot tearing huge gaps through the mass proved enough to counteract even this danger, and the men in the advance threw themselves down wholesale. It is admitted by French authors (Ardant du Picq) that of the 30,000 only 3000 actually delivered the attack, about 3000 were killed or wounded, but 24,000 evaded their duty somehow, and the trail of the column appeared one mass of dead and dying, creating a terrible impression on all who saw it. Nevertheless, Macdonald reached his destination, for the guns had literally torn a gap in the opposing line, and the guards and cavalry then followed intact. At the same time Davout also had made progress, and, learning that the archduke Johann could not be counted on for that day, the archduke Charles issued orders for a retreat. The whole Austrian army was gradually withdrawn, unbeaten and still available for a renewed offensive if necessary the following day.

The French, however, were in no condition to follow up their advantage. They had seen more of the slaughter than their adversaries, and except the emperor and Davout all seem to have been completely shaken. Even in Davout's command, always the steadiest in danger, the limit of endurance had been passed, for when about 5 P.M. the advanced patrols of the archduke Johann's force appeared on their flank, panic on a scale hitherto unknown in the *Grande Armée* seized the whole right wing, and Napoleon had to confess that no further advance was possible with these men for several days.

Berndt (*Zahl im Kriege*) gives the following figures. French, 181,700 (including 29,000 cavalry) and 450 guns engaged, of whom 23,000 men were killed and wounded, 7000 missing (16%); 11 guns and 12 eagles and colours were lost. **Austrians,** 128,600 (including 14,600 cavalry) men and 410 guns engaged; losses, 19,110 killed and wounded, and 6740 missing (20%); 9 guns and one colour were lost. The casualties in general officers were unusually severe, 21 French and 15 Austrians being killed and wounded.

WAGTAIL (*Wagsterd* and *Wagstyrt*, 15th century *fide* T. Wright, *Vol. Vocabularies*, ii. 221, 253; *Uuagtale*, Turner, 1544, p. 53), the popular name for birds of the subfamily *Motacillinae*, which, together with the *Anthinae* (see PIPIT), form the passerine family *Motacillidae*.

The pied wagtail *Motacilla lugubris* is a common and generally distributed species in the British Islands, and common throughout northern Europe, but migrating southwards over a relatively narrow range in winter. The white wagtail, *M. alba* of Linnaeus, has a wide range in Europe, Asia and Africa, visiting England almost yearly, and chiefly differing from the ordinary British in its lighter-coloured tints—the cock especially having a clear grey instead of a black back. Three other species occur in England, but the subfamily with several genera and very many species ranges over the Old World, except Australia and Polynesia, whilst the Asiatic species reach North-West America.

Wagtails are generally parti-coloured birds, frequenting streams and stagnant water, and feeding on seeds, insects, worms, small molluscs and crustaceans. The bill is thin and elongated, and the tail is very long. The nests are made of moss, grass and roots, with a lining of hair and feathers; four to six eggs are laid, bluish white or brown, or yellowish with spots and markings.

The genus *Motacilla* (an exact rendering of the English "wagtail," the Dutch *Kwikstaart*, the Italian *Codatremola* and other similar words), which, as originally founded by Linnaeus, contained nearly all the "soft-billed" birds of early English ornithologists, was restricted by various authors in succession, following the example set by Scopoli in 1769, until none but the wagtails remained in it. (A. N.)

WAHHĀBIS, a Mahommedan sect, the followers of Ibn ʿAbd ul-Wahhāb, who instituted a great reform in the religion of Islam in Arabia in the 18th century. Mahommed ibn ʿAbd ul-Wahhāb was born in 1691 (or 1703) at al-Ḥauṭa of the Nejd in central Arabia, and was of the tribe of the Bani Tamīm. He studied literature and jurisprudence of the Hanifite school. After making the pilgrimage with his father, he spent some further time in the study of law at Medina, and resided for a while at Isfahan, whence he returned to the Nejd to undertake the work of a teacher. Aroused by his studies and his observation of the luxury in dress and habits, the superstitious pilgrimages to shrines, the use of omens and the worship given to Mahomet and Mahommedan saints rather than to God, he began a mission to proclaim the simplicity of the early religion founded on the Koran and *Sunna* (*i.e.* the manner of life of Mahomet). His mission in his own district was not attended by success, and for long he wandered with his family through Arabia, until at last he settled in Daraʿīyya, or Deraiya (in the Nejd), where he succeeded in converting the greatest notable, Mahommed ibn Saʿud, who married his daugther, and so became the founder of an hereditary Wahhābite dynasty. This gave the missionary the opportunity of following the example of Mahomet himself in extending his religious teaching by force. His instructions in this matter were strict. All unbelievers (*i.e.* Moslems who did not accept his teaching, as well as Christians, &c.) were to be put to death. Immediate entrance into Paradise was promised to his soldiers who fell in battle, and it is said that each soldier was provided with a written order from Ibn ʿAbd ul-Wahhāb to the gate-keeper of heaven to admit him forthwith. In this way the new teaching was established in the greater part of Arabia until its power was broken by Mehemet Ali (see ARABIA: *History*). Ibn ʿAbd ul-Wahhāb is said to have died in 1791.

The teaching of ul-Wahhāb was founded on that of Ibn Taimīyya (1263–1328), who was of the school of Aḥmad ibn Hanbal (*q.v.*). Copies of some of Ibn Taimīyya's works made by ul-Wahhāb are now extant in Europe, and show a close study of the writer. Ibn Taimīyya, although a Hanbalite by training, refused to be bound by any of the four schools, and claimed the power of a *mujtahid*, *i.e.* of one who can give independent decisions. These decisions were based on the Koran, which, like Ibn Hazm (*q.v.*), he accepted in a literal sense, on the *Sunna* and *Qiyās* (analogy). He protested strongly against all the innovations of later times, and denounced as idolatry the visiting of the sacred shrines and the invocation of the saints or of Mahomet himself. He was also a bitter opponent of the Ṣufīs of his day. The Wahhābites also believe in the literal sense of the Koran and the necessity of deducing one's duty from it apart from the decisions of the four schools. They also pointed to the abuses current in their times as a reason for rejecting the doctrines and practices founded on *Ijmāʿ*, *i.e.* the universal consent of the believer or their teachers (see MAHOMMEDAN RELIGION). They forbid the pilgrimage to tombs and the invocation of saints. The severe simplicity of the Wahhābis has been remarked by travellers in central Arabia. They attack all luxury, loose administration of justice, all laxity against infidels, addiction to wine, impurity and treachery. Under ʿAbd ul-Azīz they instituted a form of Bedouin (Bedawi) commonwealth, insisting on the observance of law, the payment of tribute, military conscription for war against the infidel, internal peace and the rigid administration of justice in courts established for the purpose.

It is clear that the claim of the Wahhābis to have returned to the earliest form of Islam is largely justified; Burckhardt (vol. ii. p. 112) says, "The only difference between his (*i.e.* ul-Wahhāb's) sect and orthodox Turks, however improperly so termed, is that the Wahabys rigidly follow the same laws which the others neglect or have ceased altogether to observe." Even orthodox doctors of Islam have confessed that in Ibn ʿAbd ul-Wahhāb's writings there is nothing but what they themselves hold. At the same time the fact that so many of his followers were rough and unthinking Bedouins has led to the over-emphasis of minor points of practice, so that they often appear to observers to be characterized chiefly by a strictness (real or feigned) in such matters as the prohibition of silk for dress, or the use of tobacco, or of the rosary in prayer.

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WAI, a town in Satara district, Bombay, on the Kistna river. Pop. (1901) 13,989. It is a place of Hindu pilgrimage, with a large Brahman population, the river being lined with temples and bathing *ghats*. In the neighbourhood are Buddhist caves.

WAIBLINGEN, a town of Germany, in the kingdom of Württemberg, in the centre of a fruitful vine-growing district on the Rems, 10 m. N.E. from Stuttgart by the main line of railway to Nuremberg via Nördlingen and at the junction of a branch to Hessenthal. Pop. (1905) 5997. It has two Evangelical churches, one of which is a fine Gothic structure of the 15th century, restored in 1866, a Roman Catholic church and a modern town hall. Its industries, which include the making of pottery and silk and the cultivation of fruit and vines, are considerable. Waiblingen is mentioned in the 9th century, when it had a palace of the Carolingian sovereigns. Subsequently it belonged to the dukes of Franconia, and gave a surname to the emperor Conrad II. It was in this way that the Hohenstaufen family, which was descended in the female line from Conrad, received the name of Waiblingen, corrupted by the Italians into Ghibelline.

WAILLY, NOËL FRANÇOIS DE (1724–1801), French grammarian and lexicographer, was born at Amiens on the 31st of July 1724. His life was spent in Paris, where for many years he carried on a school which was extensively patronized by foreigners who wished to learn French. In 1754 he published *Principes généraux de la langue française*, which revolutionized the teaching of grammar in France. The book was adopted as a textbook by the university of Paris and generally used throughout France, an abstract of it being prepared for primary educational purposes.

In 1771 de Wailly published *Moyens simples et raisonnés de diminuer les imperfections de notre orthographe*, in which he advocated phonetic spelling. He was a member of the Institute from its foundation (1795), and took an active part in the preparation of the *Dictionnaire de l'Académie*. His works, in addition to those cited, include *L'Orthographe des dames* (1782) and *Le Nouveau Vocabulaire français, ou abrégé du dictionnaire de l'Académie* (1801). He died in Paris on the 7th of April 1801.

WAINEWRIGHT, THOMAS GRIFFITHS (1794–1852), English journalist and subject-painter, was born at Chiswick in October 1794. He was educated by his distant relative Dr Charles Burney, and served as an orderly officer in the guards, and as cornet in a yeomanry regiment. In 1819 he entered on a literary life, and began to write for *The Literary Pocket-Book*, *Blackwood's Magazine* and *The Foreign Quarterly Review*. He is, however, most definitely identified with *The London Magazine*, to which, from 1820 to 1823, he contributed some smart but flippant art and other criticisms, under the signatures of "Janus Weathercock," "Egomet Bonmot" and "Herr Vinkbooms." He was a friend of Charles Lamb—who thought well of his literary productions, and in a letter to Bernard Barton, styles him the "kind, light-hearted Wainewright"—and of the other brilliant contributors to the journal. He also practised as an artist, designing illustrations to Chamberlayne's poems, and from 1821 to 1825 exhibiting in the Royal Academy figure pictures, including a "Romance from Undine," "Paris in the Chamber of Helen" and the "Milkmaid's Song." Owing to his extravagant habits, Wainewright's affairs became deeply involved. In 1830 he insured the life of his sister-in-law in various offices for a sum of £18,000, and when she died, in the December of the same year, payment was refused by the companies on the ground of misrepresentation. Wainewright retired to France, was seized by the authorities as a suspected person, and imprisoned for six months. He had in his possession a quantity of strychnine, and it was afterwards found that he had destroyed, not only his sister-in-law, but also his uncle, his mother-in-law and a Norfolkshire friend, by this poison. He returned to London in 1837, but was at once arrested on a charge of forging, thirteen years before, a transfer of stock, and was sentenced to transportation for life. He died of apoplexy in Hobart Town hospital in 1852.

The *Essays and Criticisms* of Wainewright were published in 1880, with an account of his life, by W. Carew Hazlitt; and the history of his crimes suggested to Dickens his story of *Hunted Down* and to Bulwer Lytton his novel of *Lucretia*. His personality, as artist and poisoner, has interested latter-day writers, notably Oscar Wilde in "Pen, Pencil and Poison" (*Fortnightly Review*, Jan. 1889), and A. G. Allen, in T. Seccombe's *Twelve Bad Men* (1894).

WAINGANGA, a river of India, flowing through the Central Provinces in a very winding course of about 360 m. After joining the Wardha the united stream, known as the Pranhita, ultimately falls into the Godavari.

WAINSCOT, properly a superior quality of oak, used for fine panel work, hence such panel-work as used for the lining or covering of the interior walls of an apartment. The word appears to be Dutch and came into use in English in the 16th century, and occurs in lists of imported timber. The Dutch word *wagenschot*, adapted in English as *waynskott*, *weynskott* (Hakluyt, *Voyages*, i. 173, has "boords called *waghenscot*"), was applied to the best kind of oak, well-grained, not liable to warp and free from knots. The form shows that it was, in popular etymology, formed from *wagen* (*i.e.* wain, wagon) and *schot*, a term which has a large number of meanings, such as shot, cast, partition, an enclosure of boards, cf. "sheet," and was applied to the fine wood panelling used in coach-building. This is, however, doubted, and relations have been suggested with Dutch *weeg*, wall, cognate with O. Eng. *wah*, wall, or with M. Dutch *waeghe*, Ger. *Wage*, wave, the reference being to the grain of the wood when cut. The term "wainscot" is sometimes wrongly applied to a "dado," the lining, whether of paper, paint or wooden panelling, of the lower portion of the walls of a room. A "dado" (Ital. *dado*, die, cube; Lat. *datum*, something given, a die for casting lots; cf. O. Fr. *det*, mod. *dé*, Eng. "die") meant originally the plane-faced cube on the base of a pedestal between the mouldings of the base and the cornice, hence the flat surface between the plinth and the capping of the wooden lining of the lower part of a wall, representing a continuous pedestal.

WAIST, the middle part of the human body, the portion lying between the ribs and the hip-bones, comprising the compressible parts of the trunk. The word is also applied to the central portion of other objects, particularly to the narrowest portion of musical instruments of the violin type and to the centre of a ship. The word appears in the M. Eng. as *waste*, "waste of a mannys' myddel" (*Prompt. parv. c.* 1440), and is developed from the O. Eng. *wæstm*, growth, the "waist" being the part where the growth of a man is shown and developed; cf. Icel. *vöxtr*, stature, shape; Dan. *vaext*, size, growth, &c. It is thus to be derived from the O. Eng. *weaxan*, to grow, wax.

WAITE, MORRISON REMICK (1816–1888), American jurist, was born at Lyme, Connecticut, on the 29th of November 1816, the son of Henry Matson Waite (1787–1869), who was judge of the superior court and associate judge of the supreme court of Connecticut in 1834–1854 and chief justice of the latter in 1854–1857. He graduated at Yale in 1837, and soon afterwards removed to Maumee City, Ohio, where he studied law in the office of Samuel L. Young and was admitted to the bar in 1839. In 1850 he removed to Toledo, and he soon came to be recognized as a leader of the state bar. In politics he was first a Whig and later a Republican, and in 1849–1850 he was a member of the state senate. In 1871, with William M. Evarts and Caleb Cushing, he represented the United States as counsel before the "Alabama" Tribunal at Geneva, and in 1874 he presided over the Ohio constitutional convention. In the same year he was appointed by President U. S. Grant to succeed Judge Salmon P. Chase as chief-justice of the United States Supreme Court, and he held this position until his death at Washington, D.C., on the 23rd of March 1888. In the cases which grew out of the Civil War and Reconstruction, and especially in those which involved the interpretation of the Thirteenth, Fourteenth and Fifteenth amendments, he sympathized with the general tendency of the court to restrict the further extension of the powers of the Federal government. He concurred with the majority in the Head Money Cases (1884), the Ku-Klux Case (*United States* v. *Harris*, 1882), the Civil Rights Cases (1883) and the *Juillard* v. *Greenman* (legal tender) Case (1883). Among his own most important decisions were those in the Enforcement Act Cases (1875), the Sinking Fund Case (1878), the Railroad Commission Cases (1886) and the Telephone Cases (1887).

WAITHMAN, ROBERT (1764–1833), Lord Mayor of London, was born at Wrexham in 1764. After being employed for some time in a London linen draper's, he opened, about 1786, a draper's shop of his own, and made a considerable fortune. In 1818 he was returned to parliament, as a liberal, for the city of London. He lost his seat at the election of 1820, but regained it in 1826, and retained it till his death, taking part vigorously in the parliamentary debates, and strenuously supporting reform. In 1823 he was Lord Mayor of London. Waithman died in London on the 6th of February 1833. An obelisk erected by his friends in Ludgate Circus, London, adjoining the site of his first shop, commemorates his memory.

WAITS (A.S. *wacan*, to "wake" or "watch,"), the carol-singers and itinerant musicians who parade the streets at night at Christmas time. The earliest waits (those of the 14th and 15th centuries) were simply watchmen who sounded horns or even played a tune on a flute or flageolet to mark the hours. This appears to have been known as "piping the watch." The black book of the royal household expenses of Edward IV., under date 1478, provides for "a wayte, that nyghtely from Mychelmas to Shreve Thorsdaye pipe the watch within this courte fowere tymes; in the somere nightes three tymes and maketh bon gayte at every chambre doare and offyce, as well as for feare of pyckeres and pilfers." Elaborate orders as to his housing occur. Thus he was to eat in the hall with the minstrels and was to sup off half a loaf and half a gallon of ale. During his actual attendance at court he was to receive fourpence halfpenny a day or less in the discretion of the steward of the household. He had a livery given him and during illness an extra allowance of food. Besides "piping the watch" and guarding the palace against thieves and fire, this wait had to attend at the installation of knights of the Bath. London and all the chief boroughs had their corporation waits certainly from the early 16th century, for in the privy purse accounts of Henry VIII. occurs (1532) the entry "Item, the XI daye (of October) paied to the waytes of Canterbery in rewarde . . . vijs. vjd." In 1582 Dudley, earl of Leicester, writes to the corporation of London asking that a servant of his should be admitted to the city waits. These borough waits appear, however, to have been more nearly akin to the medieval troubadours or minstrels who played to kings and nobles at and after the evening meal. The duties of the London waits, which included playing before the mayor during his annual progress through the streets and at city dinners, seem to have been typical of all 16th- and 17th-century city waits. The London waits had a special uniform of blue gowns with red sleeves and caps, and wore a silver collar or chain round the neck. In the 18th and early 19th century the ordinary street watchmen appear to have arrogated to themselves the right to serenade householders at Christmas time, calling round on Boxing Day to receive a gratuity for their tunefulness as well as their watchfulness. When in 1829 their place as guardians of the city's safety was taken by police, it was left for private individuals to keep up the custom.

WAITZ, GEORG (1813–1886), German historian, was born at Flensburg, in the duchy of Schleswig, on the 9th of October 1813. He was educated at the Flensburg gymnasium and the universities of Kiel and Berlin. The influence of Ranke early diverted him from his original purpose of studying law, and while still a student he began that series of researches in German medieval history which was to be his life's work. On graduating at Berlin in August 1836, Waitz went to Hanover to assist Pertz in the great national work of publishing the *Monumenta Germaniae historica*; and the energy and learning he displayed in that position won him a summons to the chair of history at Kiel in 1842. The young professor soon began to take an interest in politics, and in 1846 entered the provincial diet as representative of his university. His leanings were strongly German, so that he became somewhat obnoxious to the Danish government, a fact which made an invitation in 1847 to become professor of history at Göttingen peculiarly acceptable. The political events of 1848–1849, however, delayed his appearance in his new chair. When the German party in the northern duchies rose against the Danish government, Waitz hastened to place himself at the service of the provisional government. He was sent to Berlin to represent the interests of the duchies there, and during his absence he was elected by Kiel as a delegate to the national parliament at Frankfort. Waitz was an adherent of the party who were eager to bring about a union of the German states under a German emperor; and when the king of Prussia declined the imperial crown the professor withdrew from the assembly in disappointment, and ended his active share in public life. In the autumn of 1849 Waitz began his lectures at Göttingen. His style of speaking was dry and uninteresting; but the matter of his lectures was so practical and his teaching so sound that students were attracted in crowds to his lecture-room, and the reputation of the Göttingen historical school spread far and wide. At the same time Waitz's pen was not idle, and his industry is to be traced in the list of his works and in the *Proceedings* of the different historical societies to which he belonged. In 1875 Waitz removed to Berlin to succeed Pertz as principal editor of the *Monumenta Germaniae historica*. In spite of advancing years the new editor threw himself into the work with all his former vigour, and took journeys to England, France and Italy to collate works preserved in these countries. He died at Berlin on the 24th of May 1886. He was twice married—in 1842 to a daughter of Schelling the philosopher, and in 1858 to a daughter of General von Hartmann.

Waitz is often spoken of as the chief disciple of Ranke, though perhaps in general characteristics and mental attitude he has more affinity with Pertz or Dahlmann. His special domain was medieval German history, and he rarely travelled beyond it.

Waitz's chief works, apart from his contributions to the *Monumenta*, are:—*Deutsche Verfassungsgeschichte* (8 vols., Kiel, 1844–1878; 2nd ed., 2 vols. only, 1865–1870); *Schleswig-Holsteins Geschichte* (2 vols., Göttingen, 1851–1854; the 3rd vol. was never published); *Lübeck unter Jürgen Wullenwever und die europäische Politik* (3 vols.; Berlin, 1855–1856); and *Grundzüge der Politik* (Kiel, 1862). Among his smaller works, which, however, indicate the line of his researches, are the following:—*Jahrbücher des deutschen Reichs unter Heinrich I.* (Berlin, 1837, 3rd ed., 1885); *Über das Leben und die Lehre des Ulfila* (Hanover, 1840); *Das alte Recht der salischen Franken* (Kiel, 1846); and *Deutsche Kaiser von Karl dem Grossen bis Maximilian* (Berlin, 1872). In conjunction with other scholars Waitz took a leading part in the publication of the *Forschungen zur deutschen Geschichte* (Munich, 1862 seq.), and in the *Nordalbingische Studien*, published in the *Proceedings* of the Schleswig-Holstein Historical Society (Kiel, 1844–1851). A *Bibliographische Übersicht über Waitz's Werke* was published by E. Steindorff at Göttingen in 1886.

Obituary notices of Waitz are to be found in the *Historische Zeitschrift*, new series, vol. xx.; in the publications for 1886 of the Berlin Akademie der Wissenschaften, the Göttingen Gesellschaft der Wissenschaften, and the Hansischer Geschichtsverein; in the *Historisches Jahrbuch der Görres Gesellschuft*, vol. viii.; and in the *Revue historique*, vol. xxxi.

WAITZ, THEODOR (1821–1864), German psychologist and anthropologist, was born at Gotha on the 17th of March 1821. Educated at Leipzig and Jena, he made philosophy, philology and mathematics his chief studies, and in 1848 he was appointed professor of philosophy in the university of Marburg. He was a severe critic of the philosophy of Fichte, Schelling and Hegel, and considered psychology to be the basis of all philosophy. His researches brought him into touch with anthropology, and he will be best remembered by his monumental work in six volumes, *Die Anthropologie der Naturvölker*. He died on the 21st of May 1864 at Marburg.

In addition to his *Anthropologie*, the first four volumes of which appeared at Leipzig, 1859–1864, the last two posthumously, he published *Grundlegung der Psychologie* (1846); *Lehrbuch der Psychologie als Naturwissenschaft* (1849); *Allgemeine Pädagogik* (1852); and a critical edition of the *Organon of Aristotle* (1844).

WAKE, THOMAS (1297–1349), English baron, belonged to a Lincolnshire family which had lands also in Cumberland, being the son of John Wake (d. 1300), who was summoned to parliament as a baron in 1295, and the grandson of Baldwin Wake (d. 1282), both barons and warriors of repute. Among Thomas Wake's guardians were Piers Gaveston and Henry, earl of Lincoln, whose daughter Blanche (d. 1357) he married before 1317. This lady was the niece of Thomas, earl of Lancaster, and her husband was thus attached to the Lancastrian party, but he did not follow Earl Thomas in the proceedings which led to his death in 1322. Hating the favourites of Edward II. Wake joined Queen Isabella in 1326 and was a member of the small council which advised the young king, Edward III.; soon, however, he broke away from the queen and her ally, Roger Mortimer, and in conjunction with his father-in-law, now earl of Lancaster, he joined the malcontent barons. He was possibly implicated in the plot which cost his brother-in-law, Edmund, earl of Kent, his life in 1330, and he fled to France, returning to England after the overthrow of Isabella and Mortimer. Edward III. made him governor of the Channel Islands and he assisted Edward Bruce to invade Scotland, being afterwards sent on an errand to France. In 1341 he incurred the displeasure of the king and was imprisoned, but he had been restored and had been employed in Brittany and elsewhere when he died childless on the 31st of May 1349. His estates passed to his sister Margaret (d. 1349), widow of Edmund, earl of Kent, and her son John (d. 1352), and later to the Holand family. Wake established a house for the Austin canons at Newton near Hull; this was afterwards transferred to Haltemprice in the same neighbourhood.

WAKE, WILLIAM (1657–1737), English archbishop, was born at Blandford, Dorset, on the 26th of January 1657, and educated at Christ Church, Oxford. He took orders, and in 1682 went to Paris as chaplain to the ambassador Richard Graham, Viscount Preston (1648–1695). Here he became acquainted with many of the savants of the capital, and was much interested in French clerical affairs. He also collated some Paris manuscripts of the Greek Testament for John Fell, bishop of Oxford. He returned to England in 1685; in 1688 he became preacher at Gray's Inn, and in 1689 he received a canonry of Christ Church, Oxford. In 1693 he was appointed rector of St James's, Westminster. Ten years later he became dean of Exeter, and in 1705 he was consecrated bishop of Lincoln. He was translated to the see of Canterbury in 1716 on the death of Thomas Tenison. During 1718 he negotiated with leading French churchmen about a projected union of the Gallican and English churches to resist the claims of Rome (see J. H. Lupton, *Archbishop Wake and the Project of Union*, 1896). In dealing with nonconformity he was tolerant, and even advocated a revision of the Prayer Book if that would allay the scruples of dissenters. His writings are numerous, the chief being his *State of the Church and Clergy of England . . . historically deduced* (London, 1703). He died at Lambeth on the 24th of January 1736/7.

Sir Isaac Wake (*c.* 1580–1632), the diplomatist, was a kinsman of the archbishop. He commenced his diplomatic career in Venice, and then he represented his county for sixteen years at Turin; he was knighted in 1619, and after being sent on various special missions by James I. he was British ambassador in Paris from 1630 until his death in June 1632. Among Sir Isaac's writings is *Rex platonicus*, a description of the entertainment of James I. at Oxford in 1605; this was published in 1607 and has often been reprinted.

WAKE (A.S. *wacan*, to "wake" or "watch"), a term now restricted to the Irish custom of an all-night "waking" or watching round a corpse before burial, but anciently used in the wider sense of a vigil kept as an annual church celebration in commemoration of the completion or dedication of the parish church. This strictly religious wake consisted in an all-night service of prayer and meditation in the church. These services, popularly known as "wakes," were officially termed *Vigiliae* by the church, and appear to have existed from the earliest days of Anglo-Saxon Christianity. Tents and booths were set up in the churchyard before the dawn which heralded in a day devoted to feasting, dancing and sports, each parish keeping the morrow of its vigil as a holiday. Wakes soon degenerated into fairs; people from neighbouring parishes journeyed over to join in the merry-making, and as early as Edgar's reign (958–975) the revelry and drunkenness had become a scandal. The *vigiliae* usually fell on Sundays or saints' days, those being the days oftenest chosen for church dedications, and thus the abuse was the more scandalous. In 1445 Henry VI. attempted to suppress markets and fairs on Sundays and holy days. In 1536 an Act of Convocation ordered that the yearly "wake" should be held in every parish on the same day, viz. the first Sunday in October, but this regulation was disregarded. Wakes are specially mentioned in the *Book of Sports* of James I. and Charles I. among the feasts which should be observed.

Side by side with these church wakes there existed from the earliest times the custom of "waking" a corpse. The custom, as far as England was concerned, seems to have been older than Christianity, and to have been at first essentially Celtic. Doubtless it had a superstitious origin, the fear of evil spirits hurting or even removing the body, aided perhaps by the practical desire to keep away rats and other vermin. The Anglo-Saxons called the custom lich-wake or like-wake (A.S. *lic*, a corpse). With the introduction of Christianity the offering of prayer was added to the mere vigil, which until then had been characterized by formal mourning chants and recitals of the life story of the dead. As a rule the corpse, with a plate of salt on its breast, was placed under the table, on which was liquor for the watchers. These private wakes soon tended to become drinking orgies, and during the reign of Edward III. the provincial synod held in London proclaimed by its 10th canon the object of wakes to be the offering of prayer for the dead, and ordered that in future none but near relatives and friends of the deceased should attend. The penalty for disobedience was excommunication. With the Reformation and the consequent disuse of prayers for the dead the custom of "waking" in England became obsolete and died out. Many countries and peoples have been found to have a custom equivalent to "waking," which, however, must be distinguished from the funeral feasts pure and simple.

For detailed accounts of Irish wakes see Brand's *Antiquities of Great Britain* (W. C. Hazlitt's edition, 1905) under "Irish Wakes."

WAKEFIELD, EDWARD GIBBON (1796–1862), British colonial statesman, was born in London on the 20th of March 1796, of an originally Quaker family. His father, Edward Wakefield (1774–1854), author of *Ireland, Statistical and Political* (1812), was a surveyor and land agent in extensive practice; his grandmother, Priscilla Wakefield (1751–1832), was a popular author for the young, and one of the introducers of savings banks. Wakefield was for a short time at Westminster School, and was brought up to his father's profession, which he relinquished on occasion of his elopement at the age of twenty with Miss Pattle, the orphan daughter of an Indian civil servant. The young lady's relatives ultimately became reconciled to the match, and procured him an appointment as attaché to the British legation at Turin. He resigned this post in 1820, upon the death of his wife, to whom he was fondly attached, and, though making some efforts to connect himself with journalism, spent the years immediately succeeding in idleness, residing for the most part in Paris. In 1826 he appeared before the public as the hero of a most extraordinary adventure, the abduction of Miss Ellen Turner, daughter of William Turner, of Shrigley Park, Cheshire. Miss Turner was decoyed from school by means of a forged letter, and made to believe that she could only save her father from ruin by marrying Wakefield, whom she accordingly accompanied to Gretna Green. This time the family refused to condone his proceedings; he was tried with his confederates at Lancaster assizes, March 1827, convicted, and sentenced to three years' imprisonment in Newgate. The marriage, which had not been consummated, was dissolved by a special act of parliament. A disgrace which would have blasted the career of most men made Wakefield a practical statesman and a benefactor to his country. Meditating, it is probable, emigration upon his release, he turned his attention while in prison to colonial subjects, and acutely detected the main causes of the slow progress of the Australian colonies in the enormous size of the landed estates, the reckless manner in which land was given away, the absence of all systematic effort at colonization, and the consequent discouragement of immigration and dearth of labour. He proposed to remedy this state of things by the sale of land in small quantities at a sufficient price, and the employment of the proceeds as a fund for promoting immigration. These views were expressed with extraordinary vigour and incisiveness in his *Letter from Sydney* (1829), published while he was still in prison, but composed with such graphic power that it has been continually quoted as if written on the spot. After his release Wakefield seemed disposed for a while to turn his attention to social questions at home, and produced a tract on the *Punishment of Death*, with a terribly graphic picture of the condemned sermon in Newgate, and another on incendiarism in the rural districts, with an equally powerful exhibition of the degraded condition of the agricultural labourer. He soon, however, became entirely engrossed with colonial affairs, and, having impressed John Stuart Mill, Colonel Torrens and other leading economists with the value of his ideas, became a leading though not a conspicuous manager of the South Australian Company, by which the colony of South Australia was ultimately founded. In 1833 he published anonymously *England and America*, a work primarily intended to develop his own colonial theory, which is done in the appendix entitled "The Art of Colonization." The body of the work, however, is fruitful in seminal ideas, though some statements may be rash and some conclusions extravagant. It contains the distinct proposal that the transport of letters should be wholly gratuitous—the precursor of subsequent reform—and the prophecy that, under given circumstances, "the Americans would raise cheaper corn than has ever been raised." In 1836 Wakefield published the first volume of an edition of Adam Smith, which he did not complete. In 1837 the New Zealand Association was established, and he became its managing director. Scarcely, however, was this great undertaking fairly commenced when he accepted the post of private secretary to Lord Durham on the latter's appointment as special commissioner to Canada. The Durham Report, the charter of constitutional government in the colonies, though drawn up by Charles Buller, embodied the ideas of Wakefield, and the latter was the means of its being given prematurely to the public through *The Times*, to prevent its being tampered with by the government. He acted in the same spirit a few months later, when (about July 1839), understanding that the authorities intended to prevent the despatch of emigrants to New Zealand, he hurried them off on his own responsibility, thus compelling the government to annex the country just in time to anticipate a similar step on the part of France. For several years Wakefield continued to direct the New Zealand Company, fighting its battles with the colonial office and the missionary interest, and secretly inspiring and guiding many parliamentary committees on colonial subjects, especially on the abolition of transportation. The company was by no means a financial success, and many of its proceedings were wholly unscrupulous and indefensible; its great object, however, was attained, and New Zealand became the Britain of the south. In 1846 Wakefield, exhausted with labour, was struck down by apoplexy, and spent more than a year in complete retirement, writing during his gradual recovery his *Art of Colonization*. The management of the company had meanwhile passed into the hands of others, whose sole object was to settle accounts with the government, and wind up the undertaking. Wakefield seceded, and joined Lord Lyttelton and John Robert Godley in establishing the Canterbury settlement as a Church of England colony. A portion of his correspondence on this subject was published by his son as *The Founders of Canterbury* (Christchurch, 1868). As usual with him, however, he failed to retain the confidence of his coadjutors to the end. In 1853, after the grant of a constitution to New Zealand, he took up his residence in the colony, and immediately began to act a leading part in colonial politics. In 1854 he appeared in the first New Zealand parliament as extra-official adviser of the acting governor, a position which excited great jealousy, and as the mover of a resolution demanding the appointment of a responsible ministry. It was carried unanimously, but difficulties, which will be found detailed in W. Swainson's *New Zealand and its Colonization* (ch. 12), prevented its being made effective until after the mover's retirement from political life. In December 1854, after a fatiguing address to a public meeting, followed by prolonged exposure to a south-east gale, his constitution entirely broke down. He spent the rest of his life in retirement, dying at Wellington on the 16th of May 1862. His only son, Edward Jerningham Wakefield (1820–1879), was a New Zealand politician. Three of Wakefield's brothers were also interested in New Zealand. After serving in the Spanish army William Hayward Wakefield (1803–1848) emigrated to New Zealand in 1839. As an agent of the New Zealand Land Company he was engaged in purchasing enormous tracts of land from the natives, but the company's title to the greater part of this was later declared invalid. He remained in New Zealand until his death on the 19th of September 1848. Arthur Wakefield (1799–1843), who was associated with his brother in these transactions about land, was killed during a fight with some natives at Wairau on the 17th of June 1843. The third brother was Felix Wakefield (1807–1875), an engineer.

Wakefield was a man of large views and lofty aims, and in private life displayed the warmth of heart which commonly accompanies these qualities. His main defect was unscrupulousness: he hesitated at nothing necessary to accomplish an object, and the conviction of his untrustworthiness gradually alienated his associates, and left him politically powerless. Excluded from parliament by the fatal error of his youth, he was compelled to resort to indirect means of working out his plans by influencing public men. But for a tendency to paradox, his intellectual powers were of the highest order, and as a master of nervous idiomatic English he is second to Cobbett alone. After every deduction it remains true that no contemporary showed equal genius as a colonial statesman, or in this department rendered equal service to his country.

For an impartial examination of the Wakefield system, see Leroy-Beaulieu, *De la colonisation chez les peuples modernes* (3rd ed. pp. 562-575 and 696-700). See also R. Garnett's *Life of Wakefield* (1898). (R. G.)

WAKEFIELD, GILBERT (1756–1801), English classical scholar and politician, was born at Nottingham on the 22nd of February 1756. He was educated at Jesus College, Cambridge (fellow, 1776). In 1778 he took orders, but in the following year quitted the church and accepted the post of classical tutor at the Nonconformist academy at Warrington, which he held till the dissolution of the establishment in 1783. After leaving Warrington, he took private pupils at Nottingham and other places, and also occupied himself with literary work. His most important production at this period was the first part of the *Silva critica*, the design of which was the "illustration of the Scriptures by light borrowed from the philology of Greece and Rome." In 1790 he was appointed professor of classics at the newly-founded Unitarian college at Hackney, but his proposed reforms and his objection to religious observances led to unpleasantness and to his resignation in the following year. From this time he supported himself by his pen. His edition of *Lucretius*, a work of high pretensions and little solid performance, appeared in 1796–1799, and gained for the editor a very exaggerated reputation (see Munro's *Lucretius*, i. pp. 19, 20). His light-hearted criticism of Porson's edition of the *Hecuba* was avenged by the latter's famous toast: "Gilbert Wakefield; what's Hecuba to him or he to Hecuba?" About this time Wakefield, who hated Pitt and condemned war as utterly unchristian, abandoned literature for political and religious controversy. After assailing with equal bitterness writers so entirely opposed as William Wilberforce and Thomas Paine, in January 1798 he "employed a few hours" in drawing up a reply to Bishop Watson's *Address to the People of Great Britain*, written in defence of Pitt and the war and the new "tax upon income." He was charged with having published a seditious libel, convicted in spite of an eloquent defence, and imprisoned for two years in Dorchester gaol. A considerable sum of money was subscribed by the public, sufficient to provide for his family upon his death, which took place on the 9th of September 1801. While in prison he corresponded on classical subjects with Charles James Fox, the letters being subsequently published.

See the second edition of his *Memoirs* (1804). The first volume is autobiographical; the second, compiled by J. T. Rutt and A. Wainewright, includes several estimates of his character and performances from various sources, the most remarkable being one by Dr Parr; see also *Gentleman's Magazine* (September 1801); Henry Crabb Robinson's *Diary* (3rd ed., 1872); John Aikin in Aikin's *General Biography* (1799–1815).

WAKEFIELD, a city and municipal and parliamentary borough in the West Riding of Yorkshire, England, 175½ m. N.N.W. from London. Pop. (1901) 41,413. It is served by the Great Northern, Midland and Great Central railways (Westgate station), and the Lancashire and Yorkshire and North-Eastern railways (Kirkgate station), the Great Northern Company using both stations. It lies on the river Calder, mainly on the north bank, in a pleasant undulating country, towards the eastern outskirts of the great industrial district of the West Riding. The river is crossed by a fine bridge of eight arches on which stands the chapel of St Mary, a beautiful structure 50 ft. long by 25 wide, of the richest Decorated character. Its endowment is attributed to Edward IV., in memory of his father Richard, duke of York, who fell at the battle of Wakefield (1460). It was completely restored in 1847. In 1888 the bishopric of Wakefield was formed, almost entirely from that of Ripon, having been sanctioned in 1878. The diocese includes about one-seventh of the parishes of Yorkshire, and also covers a very small portion of Lancashire. The cathedral church of All Saints occupies a very ancient site, but only slight traces of buildings previous to the 14th century can be seen. In the early part of that century the church was almost rebuilt, and was consecrated by Archbishop William de Melton in 1329. Further great alterations took place in the 15th century, and the general effect of the building as it stands is Perpendicular. The church consists of a clerestoried nave and choir, with a western tower; the eastward extension of the choir, the construction of the retrochoir and other works were undertaken in 1900 and consecrated in 1905 as a memorial to Dr Walsham How, the first bishop. During restoration of the spire (the height of which is 247 ft.) in 1905, records of previous work upon it were discovered in a sealed receptacle in the weather-vane. Among the principal public buildings are the town hall (1880), in the French Renaissance style; the county hall (1898), a handsome structure with octagonal tower and dome over the principal entrance; the large corn exchange (1837, enlarged 1862), including a concert-room; the market house, the sessions house, the county offices (1896) and the prison for the West Riding; the mechanics' institution with large library, church institute and library, and the fine art institution. A free library was founded in 1905, and a statue of Queen Victoria unveiled in the Bull Ring at the same time. Benevolent institutions include the Clayton hospital (1879), on the pavilion system, and the West Riding pauper lunatic asylum with its branches. The Elizabethan grammar school, founded in 1592, is the principal educational establishment. Among several picturesque old houses remaining, that known as the Six Chimneys, an Elizabethan structure, is the most striking.

Formerly Wakefield was the great emporium of the cloth manufacture in Yorkshire, but in the 19th century it was superseded in this respect by Leeds. Foreign weavers of cloth were established at Wakefield by Henry VII.; and Leland, writing in the time of Henry VIII., states that its "whole profit standeth by coarse drapery." During the 18th century it became noted for the manufacture of worsted yarn and woollen stuffs. Although its manufacturing importance is now small in comparison with that of several other Yorkshire towns, it possesses mills for spinning worsted and carpet yarns, coco-nut fibre and China grass. It has also rag-crushing mills, chemical works, soap-works and iron-works; and there are a number of collieries in the neighbourhood. Wakefield is the chief agricultural town in the West Riding, and has one of the largest corn markets in the north of England. It possesses agricultural implement and machine works, grain and flour mills, malt-works and breweries. A large trade in grain is carried on by means of the Calder, and the building of boats for inland navigation is a considerable industry. There are extensive market-gardens in the neighbourhood. In the vicinity of Wakefield is Walton Hall, the residence of the famous naturalist Charles Waterton (1782–1865). The parliamentary borough returns one member. The municipal borough is under a mayor, 9 aldermen and 27 councillors. Area, 4060 acres.

In the reign of Edward the Confessor, Wakefield (*Wachefeld*) was the chief place in a large district belonging to the king and was still a royal manor in 1086. Shortly afterwards it was granted to William, Earl Warenne, and his heirs, under whom it formed an extensive baronial liberty, extending to the confines of Lancashire and Cheshire. It remained with the Warenne family until the 14th century, when John Warenne, earl of Warenne and Surrey, having no legitimate heir, settled it on his mistress, Maud de Keirford and her two sons. They, however, predeceased him, and after Maud's death in 1360 the manor fell to the crown. Charles I. granted it to Henry, earl of Holland, and after passing through the hands of Sir Gervase Clifton and Sir Christopher Clapham, it was purchased about 1700 by the duke of Leeds, ancestor of the present duke, who is now lord of the manor. In 1203–1204 William Earl Warenne received a grant of a fair at Wakefield on the vigil, day and morrow of All Saints' day. As early as 1231 the town seems to have had some form of burghal organization, since in that year a burgage there is mentioned in a fine. In 1331, at the request of John de Warenne, earl of Surrey, the king granted the "good men" of the town pavage there for three years, and in the same year the earl obtained a grant of another fair there on the vigil, day and morrow of St Oswald. There is no other indication of a borough. The battle of Wakefield was fought in 1460 on the banks of the river Calder just outside the town.

Leland gives an interesting account of the town in the 16th century, and while showing that the manufacture of clothing was the chief industry, says also that Wakefield is "a very quik market town and meatly large, well served of flesh and fish both from sea and by rivers . . . so that all vitaile is very good and chepe there. A right honest man shall fare well for 2d. a meal. . . . There be plenti of se coal in the quarters about Wakefield." The corn market, held on Fridays, is of remote origin. A cattle market is also held on alternate Wednesdays under charter of 1765. The town was enfranchised in 1832, and was incorporated in 1848 under the title of the mayor, aldermen and councillors of the borough of Wakefield. Before this date it was under the superintendence of a constable appointed by the steward of the lord of the manor.

See *Victoria County History, Yorkshire*; W. S. Banks, *History of Wakefield* (1871); E. Parsons, *History of Leeds, &c.* (1834); T. Taylor, *History of Wakefield* (1886).

WAKEFIELD, a township of Middlesex county, Massachusetts, U.S.A., about 10 m. N. of Boston. Pop. (1890) 6982; (1900) 9290, of whom 2347 were foreign-born; (1910, census) 11,404. Wakefield is served by three branches of the Boston & Maine railway and by electric interurban railway to neighbouring towns and cities. It contains the outlying villages of Greenwood, Montrose and Boyntonville; and, larger than these, Wakefield, near the centre of the township. In this village is the town hall, the gift of Cyrus Wakefield (1811–1873), and the Beebe Town Library, founded in 1856 as the Public Library of South Reading, and later renamed in honour of Lucius Beebe, a generous patron. The town park (about 25 acres), shaded by some fine old elms, extends to the S. shore of Lake Quannapowitt and contains a soldiers' monument; and in the S. part of the township are Crystal Lake and Hart's Hill (30 acres), a public park. In the township is the Wakefield Home for Aged Women, and a Y.M.C.A. building. Manufacturing is the principal industry; and among the manufactures are rattan goods, hosiery, stoves and furnaces, boots and shoes, and pianos. The value of the factory products increased from $2,647,130 in 1900 to $4,807,728 in 1905, or 81·6 %. The township owns and operates the electric lighting and gas plants and the water-works.

Within the present limits of Wakefield the first settlement was made, in 1639, in that part of the old township of Lynn which in 1644 was incorporated as Reading. In 1812 the southern or "Old Parish" of Reading, which was strongly Democratic-Republican while the other two parishes were strongly Federalist, was set apart and incorporated as the town of South Reading. In 1868 the present name was adopted in honour of Cyrus Wakefield, who established the rattan works here. A portion of Stoneham was annexed to Wakefield in 1889.

See C. W. Eaton, "Wakefield," in S. A. Drake's *History of Middlesex County* (Boston, 1880).

WAKKERSTROOM, a town and district of the Transvaal. The district occupies part of the S.E. of the Transvaal, being bounded S. by the Orange Free State and Natal. The frontier line is in part the crest of the Drakensberg. The town of Wakkerstroom, pop. (1904) 1402, lies 18 m. E. of Volksrust and 4 m. N. of the Natal frontier. It is built on the high veld, at an elevation of 5900 ft., and possesses a bracing climate. The neighbouring hills rise over 7000 ft. The plain on which the town stands is drained by the Slang and other tributaries of the Buffalo affluent of the Tugela. The district, a fertile agricultural region, was organized as one of the divisions of the Transvaal in 1859 by President M. W. Pretorius, and after his Christian names the town was called Marthinus-Wessel-Stroom, an unwieldy designation dropped in favour of Wakkerstroom. During the war of 1880–81 the town was unsuccessfully besieged by the Boers. In 1903 a small portion of the district was annexed to Natal.

WAKLEY, THOMAS (1795–1862), English medical and social reformer, was born in Devonshire, and was early apprenticed to a Taunton apothecary. He then went to London and qualified as a surgeon, setting up in practice in Regent Street, and marrying (1820) Miss Goodchild, whose father was a merchant and a governor of St Thomas's Hospital. All through his career Wakley proved to be a man of aggressive personality, and his experiences in this respect had a sensational beginning. In August 1820 a gang of men who had some grievance against him burnt down his house and severely wounded him in a murderous assault. The whole affair was obscure, and Wakley was even suspected, unjustly, of setting fire to his house himself; but he won his case against the insurance company which contested his claim. He became a friend of William Cobbett, with whose radicalism he was in sympathy. In 1823 he started the well-known medical weekly paper, the *Lancet*, and began a series of attacks on the jobbery in vogue among the practitioners of the day, who were accustomed to treat the medical profession as a close borough. In opposition to the hospital doctors he insisted on publishing reports of their lectures and exposing various malpractices, and he had to fight a number of lawsuits, which, however, only increased his influence. He attacked the whole constitution of the Royal College of Surgeons, and obtained so much support from among the general body of the profession, now roused to a sense of the abuses he exposed, that in 1827 a petition to parliament resulted in a return being ordered of the public money granted to it. But reform in the college was slow, and Wakley now set himself to rouse the House of Commons from within. He became a radical candidate for parliament, and in 1835 was returned for Finsbury, retaining his seat till 1852. In this capacity, and also as coroner for West Middlesex—an appointment he secured in 1839—he was indefatigable in upholding the interests of the working classes and advocating humanitarian reforms, as well as in pursuing his campaign against medical restrictions and abuses; and he made the *Lancet* not only a professional organ but a powerful engine of social reform. He died on the 16th of May 1862, leaving three sons, the proprietorship of the *Lancet* remaining in the family.

See Samuel Squire Sprigge, *Life and Times of Thomas Wakley* (1897).

WALACHIA, or WALLACHIA, a former principality of south-eastern Europe, constituting, after its union with Moldavia on the 9th of November 1859, a part of Rumania (*q.v.*).

WALAFRID[1] **STRABO** (or Strabus, *i.e.* "squint-eyed") (d. 849), German monk and theological writer, was born about 808 in Swabia. He was educated at the monastery of Reichenau, near Constance, where he had for his teachers Tatto and Wettin, to whose visions he devotes one of his poems. Then he went on to Fulda, where he studied for some time under Hrabanus Maurus before returning to Reichenau, of which monastery he was made abbot in 838. There is a story—based, however, on no good evidence—that Walafrid devoted himself so closely to letters as to neglect the duties of his office, owing to which he was expelled from his house; but, from his own verses, it seems that the real cause of his flight to Spires was that, notwithstanding the fact that he had been tutor to Charles the Bald, he espoused the side of his elder brother Lothair on the death of Louis the Pious in 840. He was, however, restored to his monastery in 842, and died on the 18th of August 849, on an embassy to his former pupil. His epitaph was written by Hrabanus Maurus, whose elegiacs praise him for being the faithful guardian of his monastery.

Walafrid Strabo's works are theological, historical and poetical. Of his theological works the most famous is the great exegetical compilation which, under the name of *Glosa ordinaria* or the *Glosa*, remained for some 500 years the most widespread and important quarry of medieval biblical science, and even survived the Reformation, passing into numerous editions as late as the 17th century (see *Hist. littéraire de la France*, t. v. p. 59 ff.). The oldest known copy, in four folio volumes, of which the date and origin are unknown, but which is certainly almost entirely Walafrid's work, gives us his method. In the middle of the pages is the Latin text of the Bible; in the margins are the "glosses," consisting of a very full collection of patristic excerpts in illustration and explanation of the text. There is also an exposition of the first twenty psalms (published by Pez in *Anecdota nova*, iv.) and an epitome of Hrabanus Maurus's commentary on Leviticus. An *Expositio quatuor Evangeliorum* is also ascribed to Walafrid. Of singular interest also is his *De exordiis et incrementis rerum ecclesiasticarum*, written between 840 and 842 and dedicated to Regenbert the librarian. It deals in 32 chapters with ecclesiastical usages, churches, altars, prayers, bells, pictures, baptism and the Holy Communion. Incidentally he introduces into his explanations the current German expressions for the things he is treating of, with the apology that Solomon had set him the example by keeping monkeys as well as peacocks at his court. Of special interest is the fact that Walafrid, in his exposition of the Mass, shows no trace of any belief in the doctrine of transubstantiation as taught by his famous contemporary Radbertus (*q.v.*); according to him, Christ gave to his disciples the sacraments of his Body and Blood in the substance of bread and wine, and taught them to celebrate them as a memorial of his Passion.

Walafrid's chief historical works are the rhymed *Vita sancti Galli*, which, though written nearly two centuries after this saint's death, is still the primary authority for his life, and a much shorter life of St Othmar, abbot of St Gall (d. 759).[2] A critical edition of them by E. Dummler is in the *Monumenta Germaniae hist. Poëtae Latini*, ii. (1884), p. 259 ff. Walafrid's poetical works also include a short life of St Blaithmaic, a high-born monk of Iona, murdered by the Danes in the first half of the 9th century; a life of St Mammas; and a *Liber de visionibus Wettini*. This last poem, like the two preceding ones written in hexameters, was composed at the command of "Father" Adalgisus, and based upon the prose narrative of Heto, abbot of Reichenau from 806 to 822. It is dedicated to Wettin's brother Grimald. At the time he sent it to Grimald Walafrid had, as he himself tells us, hardly passed his eighteenth year, and he begs his correspondent to revise his verses, because, "as it is not lawful for a monk to hide anything from his abbot," he fears he may be beaten with deserved stripes. In this curious vision Wettin saw Charles the Great suffering purgatorial tortures because of his incontinence. The name of the ruler alluded to is not indeed introduced into the actual text, but "Carolus Imperator" form the initial letters of the passage dealing with this subject. Many of Walafrid's other poems are, or include, short addresses to kings and queens (Lothair, Charles, Louis, Pippin, Judith, &c.) and to friends (Einhard, Grimald, Hrabanus Maurus, Tatto, Ebbo, archbishop of Reims, Drogo, bishop of Metz, &c.). His most famous poem is the *Hortulus*, dedicated to Grimald. It is an account of a little garden that he used to tend with his own hands, and is largely made up of descriptions of the various herbs he grows there and their medicinal and other uses. Sage holds the place of honour; then comes rue, the antidote of poisons; and so on through melons, fennel, lilies, poppies, and many other plants, to wind up with the rose, "which in virtue and scent surpasses all other herbs, and may rightly be called the flower of flowers." The curious poem *De Imagine Tetrici* takes the form of a dialogue; it was inspired by an equestrian statue of Theodoric the Great which stood in front of Charlemagne's palace at Aix-la-Chapelle.

For a bibliography of Walafrid's historical works, and of writings dealing with them, see Potthast, *Bibliotheca hist. med. aevi* (Berlin, 1894), p. 1102 ff. Walafrid's works are published in Migne's *Patrologia Latina*, vols. cxiii. and cxiv. For further references see the article by Eduard Reuss and A. Hauck in Herzog-Hauck, *Realencyklopädie* (Leipzig, 1908), xx. 790.

WALCH, JOHANN GEORG (1693–1775), German theologian, was born on the 17th of June 1693 at Meiningen, where his father, Georg Walch, was general superintendent. He studied at Leipzig and Jena, amongst his teachers being J. F. Buddeus (1667–1729), whose only daughter he married. He published in 1716 a work, *Historia critica Latinae linguae*, which soon came into wide use. Two years later he became professor extraordinarius of philosophy at Jena. In 1719 he was appointed professor ordinarius of rhetoric, in 1721 of poetry, and in 1724 professor extraordinarius of theology. In 1728 he became professor ordinarius of theology, and in 1750 professor primarius. His theological position was that of a very moderate orthodoxy, which had been influenced greatly by the philosophy and controversies of the Deistic period. His university lectures and published works ranged over the wide fields of church history in its various branches, particularly the literature and the controversies of the church, dogmatics, ethics and pastoral theology. He died on the 13th of January 1775.

Of his works the most valuable were *Bibliotheca theologica* (1757–1765); *Bibliotheca patristica* (1770, new ed. 1834); his edition of Luther's works in 24 vols. (1740–1752); *Historische und theologische Einleitung in die religiösen Streitigkeiten, welche sonderlich ausser der ev.-lutherischen Kirche entstanden* (5 vols., 1733 ff.); the companion work to this, *Einleitung in die Religionsstreitigkeiten der evangel. luth. Kirche* (1730–1739), and *Philosophisches Lexikon* (1726, 4th ed. 1775). His life, with a complete list of his writings, which amounted to 287, *Leben und Charakter des Kirchenraths J. G. Walch*, was published anonymously by his son C. W. F. Walch (Jena, 1777). Cf. Wilhelm Gass, *Protestantische Dogmatik*, iii. p. 205 sq.

His son, JOHANN ERNST IMMANUEL (1725–1778), studied Semitic languages at Jena, and also natural science and mathematics. In 1749 he published *Einleitung in die Harmonie der*

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[1] In the oldest MSS. this is always spelt "Walahfrid."

[2] Walafrid also edited Thetmar's *Life of Louis the Pious*, prefixing a preface and making a few additions, and divided Einhard's *Vita Caroli* into chapters, adding an introduction.

Evangelisten, and in 1750 was appointed professor extraordinarius of theology. Five years later he became professor ordinarius of logic and metaphysics; in 1759 he exchanged this for a professorship of rhetoric and poetry. Amongst other theological works he published *Dissertationes in Acta Apostolorum* (1756–1761); *Antiquitates symbolicae* (1772); and after his death appeared *Observationes in Matthaeum ex Graecis inscriptionibus* (1779). He also published a periodical *Der Naturforscher* (1774–1778), and during the years 1749–1756 took an active part in editing the *Zeitungen von gelehrten Sachen.*

See article in *Allgemeine deutsche Biographie;* also *Lebensgeschichte J. E. I. Walch* (Jena, 1880), and J. G. Meusel's *Lexikon der verstorbenen teutschen Schriftsteller*, vol. xiv.

Another son, Christian Wilhelm Franz (1726–1784), was educated at Jena under his father's direction, and as early as 1745–1747 lectured in the university in branches of exegesis, philosophy and history. He then travelled with his brother, J. E. I. Walch, for a year in Holland, France, Switzerland and Italy. On his return he was in 1750 made professor extraordinarius of philosophy in Jena, but in 1753 he accepted an invitation to become professor ordinarius at Göttingen. Here in 1754 he became professor extraordinarius of theology, and three years later received an ordinary professorship. He lectured on dogmatics, church history, ethics, polemics, natural theology, symbolics, the epistles of Paul, Christian antiquities, historical theological literature, ecclesiastical law and the fathers, and took an active interest in the work of the *Göttinger Societät der Wissenschaften.* In 1766 he was appointed professor primarius. His permanent place amongst learned theologians rests on his works on church history. Semler was much his superior in originality and boldness, and Mosheim in clearness, method and elegance. But to his wide, deep and accurate learning, to his conscientious and impartial examination of the facts and the authorities at first hand, and to "his exact quotation of the sources and works illustrating them, and careful discussion of the most minute details," all succeeding historians are indebted. His method is critical and pragmatic, "pursuing everywhere the exact facts and the supposed causes of the outward changes of history," leaving wholly out of sight the deeper moving principles and ideas which influence its course. He died on the 10th of March 1784.

His principal work was his *Entwurf einer vollständigen Historie der Ketzereien, Spaltungen, und Religionsstreitigkeiten, bis auf die Zeit der Reformation* (11 vols., Leipzig, 1762–1785). Of his other valuable works may be mentioned *Geschichte der evangelisch-lutherischen Religion, als ein Beweis, dass sie die wahre sei* (1753), *Entwurf einer vollständigen Historie der römischen Päpste* (1756, 2nd ed. 1758; Eng. trans. 1759), *Entwurf einer vollständigen Historie der Kirchenversammlungen* (1759), *Grundsätze der Kirchengeschichte des Neuen Testaments* (1761, 2nd ed. 1773, 3rd ed. 1792), *Bibliotheca symbolica vetus* (1770), *Kritische Untersuchung vom Gebrauch der heiligen Schrift unter den alten Christen* (1779), occasioned by the controversy between G. E. Lessing and J. M. Goeze, and to which Lessing began an elaborate reply just before his death.

On C. W. F. Walch as historian see F. Baur, *Epochen der kirchlichen Geschichtsschreibung* (1852), p. 145 sq., and *Dogmengeschichte*, p. 38 sq. (1867, 3rd ed.); W. Gass, *Geschichte der protestantischen Dogmatik*, iii. p. 267 sq.; J. G. Meusel, *Lexicon verstorbener teutschen Schriftsteller*, vol. xiv. For his life, see the article in the *Allgemeine deutsche Biographie.*

A third son, Karl Friedrich (1734–1799), devoted himself to the study of law, and became professor of law at Jena in 1759. His most important works were *Introductio in controversias juris civilis recentioris* (Jena, 1771) and *Geschichte der in Deutschland geltenden Rechte* (Jena, 1780). He died on the 20th of July 1799.

WALCOTT, CHARLES DOOLITTLE (1850–), American geologist, was born at the village of New York Mills, New York, on the 31st of March 1850. He received a school education at Utica. In 1876 he was appointed assistant on the New York State Survey, and in 1879 assistant geologist on the United States Geological Survey; in 1888 he became one of the palaeontologists in charge of the invertebrata, in 1893 chief palaeontologist, and in 1894 director of the Geological Survey. In 1907 he was appointed Secretary of the Smithsonian Institution. As president of the Geological Society of Washington he delivered in 1894 an important address on *The United States Geological Survey.* He added largely to contemporary knowledge of the fauna of the Older Palaeozoic rocks of North America, especially with reference to the crustacea and brachiopoda; he dealt also with questions of ancient physical geography and with mountain structure.

His more important works include "Palaeontology of the Eureka district" (*Mon. U.S. Geol. Survey*, 1884); "Cambrian faunas of North America" (*Bull. U.S. Geol. Survey*, 1884); *Fauna of the Lower Cambrian or Olenellus Zone* (1890, issued 1891), and *Fossil Medusae* (*Mon. U.S. Geol. Survey*, 1898).

WALDECK-PYRMONT, a principality of Germany and a constituent state of the German empire, consisting of two separate portions lying about 30 m. apart, viz. the county of Waldeck, embedded in Prussian territory between the provinces of Westphalia and Hesse-Nassau, and the principality of Pyrmont, farther to the north, between Lippe, Brunswick, Westphalia and Hanover. Waldeck comprises an area of 407 sq. m., covered for the most part with hills, which culminate in the Hegekopf (2775 ft.). The centre is occupied by the plateau of Corbach. The chief rivers are the Eder and the Diemel, both of which eventually find their way into the Weser. Pyrmont, only 26 sq. m. in extent, is also mountainous. The Emmer, also belonging to the Weser system, is its chief stream. The united area is thus 433 sq. m., or about half the size of Cambridgeshire in England, and the united population in 1905 was 59,127, showing a density of 138 to the square mile. The population is almost wholly Protestant. In consequence of the comparatively high elevation of the country—the lowest part being 540 ft. above the sea-level—the climate is on the whole inclement. Agriculture and cattle-rearing are the main resources of the inhabitants in both parts of the principality, but the soil is nowhere very fertile. Only 57% of the area is occupied by arable land and pasture; forests, one-tenth of which are coniferous, occupy 38%. Oats is the principal crop, but rye, potatoes and flax are also grown in considerable quantities. Fruit is also cultivated in the principality. Iron mines, slate and stone quarries are worked at various points, and, with live stock, poultry, wool and timber form the chief exports. A few insignificant manufactures are carried on in some of the little towns, but both trade and manufactures are much retarded by the comparative isolation of the country from railways. Wildungen, in the extreme south of Waldeck, is the terminus of a branch line from Wabern, and a light railway runs from Warburg to Marburg; Pyrmont is intersected by the trunk line running from Cologne, via Paderborn, to Brunswick and Berlin.

The capital and the residence of the prince is Arolsen (pop. 2811 in 1905) in Waldeck; twelve smaller townships and about one hundred villages are also situated in the county. The only town in Pyrmont is Bad Pyrmont, with about 1500 inhabitants, a highly fashionable watering-place with chalybeate and saline springs. The annual number of visitors is about 23,000. Wildungen is also a spa of repute. The inhabitants to the north of the Eder are of Saxon stock, to the south of Franconian, a difference which is distinctly marked in dialect, costumes and manners.

Waldeck-Pyrmont has one vote in the federal council (Bundesrat) and one in the Reichstag. The constitution, dating from 1852, is a reactionary modification of one carried in 1849, which had been a considerable advance upon one granted in 1816. The Landtag of one chamber consists of fifteen members, three of whom represent Prymont, elected indirectly for three years. In the event of the male line of the present ruling family becoming extinct, the female line will succeed in Waldeck, but Pyrmont will fall to Prussia. In terms of a treaty concluded in 1867 for ten years, renewed in 1877 for a similar period, and continued in 1887 with the proviso that it should be terminable on two years' notice, the finances and the entire government of Waldeck-Pyrmont are managed by Prussia, the little country having found itself unable to support unassisted the military and other burdens involved by its share in the North German Confederation of 1867–1871 and subsequently as a constituent state of the German empire. The government is conducted in the name of the prince by a Prussian

"Landesdirector," while the state officials take the oath of allegiance to the king of Prussia. The prince of Waldeck reserves his whole rights as head of the church, and also the right of granting pardons, and in certain circumstances may exercise a veto on proposals to alter or enact laws. Education and similar matters are thus all conducted on the Prussian model; a previous convention had already handed over military affairs to Prussia. The budget for 1910 showed a revenue of £57,000 and a like expenditure. The public debt was £79,710, paying interest at 3½%. The prince is supported by the income derived from crown lands. As regards the administration of justice, Waldeck and Pyrmont belong to the districts of Cassel and Hanover respectively.

The princes of Waldeck-Pyrmont are descendants of the counts of Schwalenberg, the earliest of whom known to history was one Widukind (d. 1137). His son Volkwin (d. 1178) acquired by marriage the county of Waldeck, and his line was divided into two branches, Waldeck and Landau, in 1397. In 1438 the landgrave of Hesse obtained rights of suzerainty over Waldeck, and the claims arising from this action were not finally disposed of until 1847, when it was decided that the rights of Hesse over Waldeck had ceased with the dissolution of the Holy Roman Empire. The Landau branch of the family became extinct in 1495, and in 1631 Waldeck inherited the county of Pyrmont, which had originally belonged to a branch of the Schwalenberg family. For a few years Waldeck was divided into Wildungen and Eisenberg, but in 1692, when the Wildungen branch died out with George Frederick, the imperial field-marshal, the whole principality was united under the rule of Christian Louis of Eisenberg. From 1692 the land has been undivided with the exception of a brief period from 1805 to 1812, when Waldeck and Pyrmont were ruled by two brothers. Frederick Anthony Ulrich (d. 1728), who succeeded his father, Christian Louis, in 1706, was made a prince of the empire in 1712. In 1807 Waldeck joined the confederation of the Rhine, and in 1815 entered the German confederation. Its first constitution was granted in 1816 by Prince George II. (d. 1845). Prince Frederick (b. 1865) succeeded his father, George Victor (1831–1893), as ruler on the 12th of May 1893. The most important fact in the recent history of the principality is its connexion with Prussia, to which reference has already been made.

See Curtze, *Geschichte und Beschreibung des Fürstentums Waldeck* (Arolsen, 1850); Löwe, *Heimatskunde von Waldeck* (Arolsen, 1887); J. C. C. Hoffmeister, *Historisch-genealogisches Handbuch über alle Grafen und Fürsten von Waldeck seit 1228* (Cassel, 1883); Böttcher, *Das Staatsrecht des Fürstentums Waldeck* (Freiburg, 1884); A. Wagner, *Die Geschichte Waldecks und Pyrmonts* (Wildungen, 1888), and the *Geschicktsblätter für Waldeck und Pyrmont* (Mengeringhausen, 1901, fol.).

WALDECK-ROUSSEAU, PIERRE MARIE RENÉ ERNEST (1846–1904), French statesman, was born at Nantes on the 2nd of December 1846. His father, René Valdec-Rousseau (1809–1882), a barrister at Nantes and a leader of the local republican party, figured in the revolution of 1848 as one of the deputies returned to the Constituent Assembly for Loire Inférieure. With Jules Simon, Louis Blanc and others he sat on the commission appointed to inquire into the labour question, making many important proposals, one of which, for the establishment of national banks, was partially realized in 1850. After the election of Louis Napoleon to the presidency he returned to his practice at the bar, and for some time after the *coup d'état* was in hiding to escape arrest. He came back to political life in the crisis of 1870, when he became mayor of Nantes in August and proclaimed the third republic there on the 4th of September. He shortly afterwards resigned municipal office in consequence of differences with his colleagues on the education question.

The son was a delicate child whose defective eyesight forbade him the use of books, and his early education was therefore entirely oral. He studied law at Poitiers and in Paris, where he took his licentiate in January 1869. His father's record ensured his reception in high republican circles. Jules Grévy stood sponsor for him at the Parisian bar, and he was a regular visitor at the houses of Stanislas Dufaure and of Jules Simon. After six months of waiting for briefs in Paris, he decided to return home and to join the bar of St Nazaire, where he inscribed his name early in 1870. In September he became, in spite of his youth, secretary to the municipal commission temporarily appointed to carry on the town business. He organized the National Defence at St Nazaire, and himself marched out with the contingent, though no part of the force saw active service owing to lack of ammunition, their private store having been commandeered by the state. In 1873 he removed to the bar of Rennes, and six years later was returned to the Chamber of Deputies. In his electoral programme he had stated that he was prepared to respect all liberties except those of conspiracy against the institutions of the country and of educating the young in hatred of the modern social order. In the Chamber he supported the policy of Gambetta. The Waldeck-Rousseau family was strictly Catholic in spite of its republican principles; nevertheless Waldeck-Rousseau supported the anti-clerical education law submitted by Jules Ferry as minister of education in the Waddington cabinet. He further voted for the abrogation of the law of 1814 forbidding work on Sundays and fête days, for compulsory service of one year for seminarists and for the re-establishment of divorce. He made his reputation in the Chamber by a report which he drew up in 1880 on behalf of the committee appointed to inquire into the French judicial system. But then as later he was chiefly occupied with the relations between capital and labour. He had a large share in 1884 in securing the recognition of trade unions. In 1881 he became minister of the interior in Gambetta's *grand ministère*, and he held the same portfolio in the Jules Ferry cabinet of 1883–1885, when he gave proof of great administrative powers. He sought to put down the system by which civil posts were obtained through the local deputy, and he made it clear that the central authority could not be defied by local officials. He had begun to practise at the Paris bar in 1886, and in 1889 he did not seek re-election to the Chamber, but devoted himself to his legal work. The most famous of the many noteworthy cases in which his cold and penetrating intellect and his power of clear exposition were retained was the defence of M. de Lesseps in 1893. In 1894 he returned to political life as senator for the department of the Loire, and next year stood for the presidency of the republic against Félix Faure and Henri Brisson, being supported by the Conservatives, who were soon to be his bitter enemies. He received 184 votes, but retired before the second ballot to allow Faure to receive an absolute majority. During the political anarchy of the next few years he was recognized by the moderate republicans as the successor of Jules Ferry and Gambetta, and at the crisis of 1899 on the fall of the Dupuy cabinet he was asked by President Loubet to form a government. After an initial failure he succeeded in forming a coalition cabinet which included such widely different politicians as M. Millerand and General de Galliffet. He himself returned to his former post at the ministry of the interior, and set to work to quell the discontent with which the country was seething, to put an end to the various agitations which under specious pretences were directed against republican institutions, and to restore independence to the judicial authority. His appeal to all republicans to sink their differences before the common peril met with some degree of success, and enabled the government to leave the second court-martial of Captain Dreyfus at Rennes an absolutely free hand, and then to compromise the affair by granting a pardon to Dreyfus. Waldeck-Rousseau won a great personal success in October by his successful intervention in the strikes at Le Creusot. With the condemnation in January 1900 of Paul Déroulède and his monarchist and nationalist followers by the High Court the worst of the danger was past, and Waldeck-Rousseau kept order in Paris without having recourse to irritating displays of force. The Senate was staunch in support of M. Waldeck-Rousseau, and in the Chamber he displayed remarkable astuteness in winning support from various groups. The Amnesty Bill, passed on 19th December, chiefly through his unwearied advocacy, went far to smooth down the acerbity of the preceding years. With the object of aiding the industry of wine-producing, and of discouraging the consumption of spirits and other deleterious liquors, the government passed a bill suppressing the *octroi* duties on the three "hygienic" drinks—wine, cider and beer. The act came into force at the beginning of 1901. But the most important measure of his later administration was the Associations Bill of 1901. Like many of his predecessors, he was convinced that the stability of the republic demanded some restraint on the intrigues of the wealthy religious bodies. All previous attempts in this direction had failed. In his speech in the Chamber M. Waldeck-Rousseau recalled the fact that he had endeavoured to pass an Associations Bill in 1882, and again in 1883. He declared that the religious associations were now being subjected for the first time to the regulations common to all others, and that the object of the bill was to ensure the supremacy of the civil power. The royalist bias given to the pupils in the religious seminaries was undoubtedly a principal cause of the passing of this bill; and the government further took strong measures to secure the presence of officers of undoubted fidelity to the republic in the higher positions on the staff. His speeches on the religious question were published in 1901 under the title of *Associations et congrégations*, following a volume of speeches on *Questions sociales* (1900). As the general election of 1902 approached all sections of the Opposition united their efforts, and M. Waldeck-Rousseau's name served as a battle-cry for one side, and on the other as a target for the foulest abuse. The result was a decisive victory for republican stability. With the defeat of the machinations against the republic M. Waldeck-Rousseau considered his task ended, and on the 3rd of June 1902 he resigned office, having proved himself the "strongest personality in French politics since the death of Gambetta." He emerged from his retirement to protest in the Senate against the construction put on his Associations Bill by M. Combes, who refused in mass the applications of the teaching and preaching congregations for official recognition. His health had long been failing when he died on the 10th of August 1904.

His speeches were published as *Discours parlementaires* (1889); *Pour la république, 1883–1903* (1904), edited by H. Leyret; *L'État et la liberté* (1906); and his *Plaidoyers* (1906, &c.) were edited by H. Barboux. See also H. Leyret, *Waldeck-Rousseau et la troisième république* (1908), and the article FRANCE: *History*.

WALDEGRAVE, the name of an English family, taken from its early residence, Walgrave in Northamptonshire. Its founder was SIR RICHARD WALDEGRAVE, or WALGRAVE, who was member of parliament for Lincolnshire in 1335; his son, Sir Richard Waldegrave (d. 1402), was speaker of the House of Commons in 1402. One of Sir Richard's descendants was Sir Edward Waldegrave (*c.* 1517–1561) of Borley, Essex, who was imprisoned during the reign of Edward VI. for his loyalty to the princess, afterwards Queen Mary. By Mary he was knighted, and he received from her the manor of Chewton in Somerset, now the residence of Earl Waldegrave. He was a member of parliament and chancellor of the duchy of Lancaster. After Mary's decease he suffered a reverse of fortune, and he was a prisoner in the Tower of London when he died on the 1st of September 1561. Sir Edward's descendant, another Sir Edward Waldegrave, was created a baronet in 1643 for his services to Charles I.; and his descendant, Sir Henry Waldegrave, Bart. (1660–1689), was created Baron Waldegrave of Chewton in 1686. Sir Henry married Henrietta (d. 1730), daughter of King James II. and Arabella Churchill, and their son was James, 1st Earl Waldegrave (1684–1741).

Educated in France, James Waldegrave soon crossed over to England, and under George I. he declared himself a Protestant and took his seat as Baron Waldegrave in the House of Lords. Having become friendly with Sir Robert Walpole, he was sent to Paris as ambassador extraordinary in 1725, and from 1727 to 1730 he was British ambassador at Vienna. In 1729 he was created Viscount Chewton and Earl Waldegrave, and in 1730 he succeeded Sir Horatio Walpole as ambassador in Paris, filling this post during ten very difficult years. He died on the 11th of April 1741. Much of his diplomatic correspondence is in the British Museum.

His son JAMES, the 2nd earl (1715–1763), was perhaps the most intimate friend of George II., and was for a time governor of his grandson, the future king George III. He was very much in evidence during the critical years 1755–1757, when the king employed him to negotiate in turn with Newcastle, Devonshire, Pitt and Fox about the formation of a ministry. Eventually, in consequence of a deadlock, Waldegrave himself was first lord of the treasury for five days in June 1757. He died on the 28th of April 1763, leaving some valuable and interesting *Memoirs*, which were published in 1821.

His brother JOHN, the 3rd earl (1718–1784), was a soldier, who distinguished himself especially at the battle of Minden and became a general in 1772. He was a member of parliament from 1747 to 1763. His younger son, William Waldegrave (1753–1825), entered the British navy in 1766, and after many years of service was third in command at the battle of Cape St Vincent in 1797. In 1800 he was created an Irish peer as Baron Radstock, and in 1802 he became an admiral. His son, George Granville, 2nd Baron Radstock (1786–1857), followed in his father's footsteps, and was made a vice-admiral in 1851. In 1857 his son, Granville Augustus William (b. 1833), became 3rd Baron Radstock.

GEORGE, 4th Earl Waldegrave (1751–1789), the eldest son of the 3rd earl, was a soldier and a member of parliament. His sons, GEORGE (1784–1794) and JOHN JAMES (1785–1835), were the 5th and 6th earls. In 1797 the 6th earl inherited from Horace Walpole his famous residence, Strawberry Hill, Twickenham, but his son, GEORGE EDWARD, the 7th earl (1816–1846), was obliged in 1842 to sell the valuable treasures collected there. His wife, Frances, Countess Waldegrave (1821–1879), a daughter of the singer John Braham, was a prominent figure in society. He was her second husband, and after his death she married George Granville Vernon Harcourt of Nuneham Park, Oxfordshire, and later Chichester Fortescue, Baron Carlingford.

The 7th earl was succeeded by his uncle William (1788–1859), a son of the 4th earl, and in 1859 William's grandson, WILLIAM FREDERICK (b. 1851), became the 9th earl.

WALDEN, ROGER (d. 1406), English prelate, was a man of obscure birth, little or nothing, moreover, being known of his early years. He had some connexion with the Channel Islands, and resided for some time in Jersey; and he held livings in Yorkshire and in Leicestershire before he became archdeacon of Winchester in 1387. His days, however, were by no means fully occupied with his ecclesiastical duties, and in 1387 also he was appointed treasurer of Calais, holding about the same time other positions in this neighbourhood. In 1395, after having served Richard II. as secretary, Walden became treasurer of England, adding the deanery of York to his numerous other benefices. In 1397 he was chosen archbishop of Canterbury in succession to Thomas Arundel, who had just been banished from the realm, but he lost this position when the new king Henry IV. restored Arundel in 1399, and after a short imprisonment he passed into retirement, being, as he himself says, "in the dust and under feet of men." In 1405, through Arundel's influence, he was elected bishop of London, and he died at Much Hadham in Hertfordshire on the 6th of January 1406. An *Historia Mundi*, the manuscript of which is in the British Museum, is sometimes regarded as the work of Walden; but this was doubtless written by an earlier writer.

See J. H. Wylie, *History of England under Henry IV.* vol. iii. (1896).

WALDENBURG, a town of Germany, in the Prussian province of Silesia, 39 m. S.W. of Breslau by the line to Hirschberg and Görlitz Pop. (1905) 16,435. It contains a handsome town hall, three Protestant and two Roman Catholic churches. Waldenburg lies in the centre of the productive coal district of the Waldenburger Gebirge, a branch of the Sudetic chain, and its inhabitants are largely occupied in the mining industry. Among other industrial establishments are a large porcelain and earthenware factory, extensive fireclay works, glassworks and a china-painting establishment; there are also numerous flax-spinneries and linen-factories in the neighbourhood. Adjoining the town on the south is the village of Oberwaldenburg, pop. (1905)

4758, with a château and some coal mines. Waldenburg became a town in 1426.

WALDENSES. The Waldensian valleys lie to the south-west of Turin, in the direction of Monte Viso, but include no high or snowy mountains, while the glens themselves are (with one or two exceptions) fertile and well wooded. The principal town near the valleys is Pinerolo (Pignerol). Just to its south-west there opens the chief Waldensian valley, the Val Pellice, watered by the stream of that name, but sometimes called inaccurately the Luserna valley, Luserna being simply a village opposite the capital, Torre Pellice; near Torre Pellice the side glens of Angrogna and Rora join the Pellice valley. To the north-west of Pinerolo, up the Chisone valley, there opens at Perosa Argentina the valley of St Martin, another important Waldensian valley, which is watered by the Germanasca torrent, and at Perrero splits into two branches, of which the Prali glen is far more fertile than that of Massello, the latter being the wildest and most savage of all the Waldensian valleys.

The name Waldenses was given to the members of an heretical Christian sect which arose in the south of France about 1170. The history of the sects of the middle ages is obscure, because the earliest accounts of them come from those who were concerned in their suppression, and were therefore eager to lay upon each of them the worst enormities which could be attributed to any. In later times the apologists of each sect reversed the process, and cleared that in which they were interested at the expense of others. In early times these sectaries produced little literature of their own; when they produced a literature at the beginning of the 15th century they attempted to claim for it a much earlier origin. Hence there is confusion on every side; it is difficult to distinguish between various sects and to determine their exact opinions or the circumstances under which they came into being. The polemical conception which has done much to perpetuate this confusion is that of the historical continuity of Protestantism from the earliest times. According to this view the church was pure and uncorrupt till the time of Constantine, when Pope Sylvester gained the first temporal possession for the papacy, and so began the system of a rich, powerful and worldly church, with Rome for its capital. Against this secularized church a body of witnesses silently protested; they were always persecuted but always survived, till in the 13th century a desperate attempt was made by Innocent III. to root them out from their stronghold in southern France. Persecution gave new vitality to their doctrines, which passed on to Wycliffe and Huss, and through these leaders produced the Reformation in Germany and England.

This view rests upon a series of suppositions, and is entirely unhistorical. So far as can be discovered the heretical sects of the middle ages rested upon a system of Manichaeism which was imported into Europe from the East (see Manichaeism). The Manichaean system of dualism, with its severe asceticism, and its individualism, which early passed into antinomianism, was attractive to many minds in the awakening of the 11th century. Its presence in Europe can be traced in Bulgaria soon after its conversion in 862,[1] where the struggle between the Eastern and Western churches for the new converts opened a way for the more hardy speculations of a system which had never entirely disappeared, and found a home amongst the Paulicians (*q.v.*) in Armenia. The name of Cathari (see Cathars), taken by the adherents of this new teaching, sufficiently shows the Oriental origin of their opinions, which spread from Bulgaria amongst the Slavs, and followed the routes of commerce into central Europe. The earliest record of their presence there is the condemnation of ten canons of Orleans as Manichees in 1022, and soon after this we find complaints of the prevalence of heresy in northern Italy and in Germany. The strongholds of these heretical opinions were the great towns, the centres of civilization, because there the growing sentiment of municipal independence, and the rise of a burgher class through commerce, created a spirit of criticism which was dissatisfied with the worldly lives of the clergy and their undue influence in affairs

The system of Catharism recognized two classes of adherents, *credentes* and *perfecti*. The *perfecti* only were admitted to its esoteric doctrines and to its superstitious practices. To the ordinary men it seemed to be a reforming agency, insisting on a high moral standard, and upholding the words of Scripture against the traditions of an overgrown and worldly church. Its popular aim and its rationalistic method made men overlook its real contents, which were not put clearly before them. It may be said generally that Catharism formed the abiding background of medieval heresy. Its dualistic system and its anti-social principles were known only to a few, but its anti-ecclesiastical organization formed a permanent nucleus round which gathered a great deal of political and ecclesiastical discontent. When this discontent took any independent form of expression, zeal, which was not always accompanied by discretion, brought the movement into collision with the ecclesiastical authorities, by whom it was condemned as heretical. When once it was in conflict with authority it was driven to strengthen its basis by a more pronounced hostility against the system of the church, and generally ended by borrowing something from Catharism. The result was that in the beginning of the 13th century there was a tendency to class all bodies of heretics together: partly their opinions had coalesced; partly they were assumed to be identical.

Most of these sects were stamped out before the period of the middle ages came to a close. The Waldenses, under their more modern name of the Vaudois, have survived to the present day in the valleys of Piedmont, and have been regarded as at once the most ancient and the most evangelical of the medieval sects. It is, however, by no means easy to determine their original tenets, as in the 13th and 14th centuries they were a body of obscure and unlettered peasants, hiding themselves in a corner, while in the 16th century they were absorbed into the general movement of the Reformation. As regards their antiquity, the attempts to claim for them an earlier origin than the end of the 12th century can no longer be sustained. They rested upon the supposed antiquity of a body of Waldensian literature, which modern criticism has shown to have been tampered with. The most important of these documents, a poem in Provençal, "La Nobla Leyczon," contains two lines which claimed for it the date of 1100:—

> Ben ha mil e cent anez compli entierament
> Que fo scripta l' ora, car sen al derier temp.

But it was pointed out[2] that in the oldest MS. existing in the Cambridge university library the figure 4 had been imperfectly erased before the word "cent," a discovery which harmonized with the results of a criticism of the contents of the poem itself. This discovery did away with the ingenious attempts to account for the name of Waldenses from some other source than from the historical founder of the sect, Peter Waldo or Valdez. To get rid of Waldo, whose date was known, the name Waldenses or Vallenses was derived from Vallis, because they dwelt in the valleys, or from a supposed Provençal word Vaudes, which meant a sorcerer.

Putting these views aside as unsubstantial, we will consider the relation of the Waldenses as they appear in actual history with the sects which preceded them. Already in the 9th century there were several protests against the rigidity and want of spirituality of a purely sacerdotal church. Thus Berengar of Tours (999–1088) upheld the symbolic character of the Eucharist and the superiority of the Bible over tradition. The Paterines in Milan (1045) raised a protest against simony and other abuses of the clergy, and Pope Gregory VII. did not hesitate to enlist their Puritanism on the side of the papacy and make them his allies in imposing clerical celibacy. In 1110 an apostate monk in Zeeland, Tanchelm, carried their views still farther, and asserted that the sacraments were only valid through the merits and sanctity of the ministers. In France, at Embrun, Peter de Bruys founded a sect known as Petrobrusians, who denied infant baptism, the need of consecrated churches, transubstantiation, and masses for the dead. A follower of his, a monk, Henry, gave the name to another body known as Henricians, who centred in Tours. The teachers of these new opinions were men of high character and holy lives, who in spite of persecution wandered from place to place, and made many converts from those who were dissatisfied at the want of clerical discipline which followed upon the struggle for temporal supremacy into which the reforming projects of Gregory VII. had carried the church.

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[1] Schmidt, *Histoire des Cathares*, i. 7.

[2] Bradshaw, in *Transactions of Cambridge Antiquarian Society* (1842). The text edited by Montet, 4to (1887).

It was at this time (1170) that a rich merchant of Lyons, Peter Waldo, sold his goods and gave them to the poor; then he went forth as a preacher of voluntary poverty. His followers, the Waldenses, or poor men of Lyons, were moved by a religious feeling which could find no satisfaction within the actual system of the church, as they saw it before them. Like St Francis, Waldo adopted a life of poverty that he might be free to preach, but with this difference that the Waldenses preached the doctrine of Christ while the Franciscans preached the person of Christ, Waldo reformed teaching while Francis kindled love; hence the one awakened antagonisms which the other escaped. For Waldo had a translation of the New Testament made into Provençal, and his preachers not only stirred up men to more holy lives but explained the Scriptures at their will. Such an interference with the ecclesiastical authorities led to difficulties. Pope Alexander III., who had approved of the poverty of the Waldensians, prohibited them from preaching without the permission of the bishops (1179). Waldo answered that he must obey God rather than man. The result of this disobedience was excommunication by Lucius III. in 1184. Thus a reforming movement became heresy through disobedience to authority, and after being condemned embarked on a course of polemical investigation how to justify its own position. Some were readmitted into the Catholic Church, and one, Durandus de Osca (1210), attempted to found an order of Pauperes Catholici, which was the forerunner of the order of St Dominic. Many were swept away in the crusade against the Albigenses (*q.v.*). Others made an appeal to Innocent III., protesting their orthodoxy. Their appeal was not successful, for they were formally condemned by the Lateran council of 1215.

The earliest definite account given of the Waldensian opinion is that of the inquisitor Sacconi about 1250.[1] He divides them into two classes: those north of the Alps and those of Lombardy. The first class hold (1) that oaths are forbidden by the gospel, (2) that capital punishment is not allowed to the civil power, (3) that any layman may consecrate the sacrament of the altar, and (4) that the Roman Church is not the Church of Christ. The Lombard sect went farther in (3) and (4), holding that no one in mortal sin could consecrate the sacrament, and that the Roman Church was the scarlet woman of the Apocalypse, whose precepts ought not to be obeyed, especially those appointing fast-days. This account sufficiently shows the difference of the Waldenses from the Cathari: they were opposed to asceticism, and had no official priesthood; at the same time their objection to oaths and to capital punishment are closely related to the principles of the Cathari. Their other opinions were forced upon them by their conflict with the authority of the Church. When forbidden to preach without the permission of the bishop, they were driven to assert the right of all to preach, without distinction of age or sex. This led to the further step of setting up personal merit rather than ecclesiastical ordination as the ground of the priestly office. From this followed again the conclusion that obedience was not due to an unworthy priest, and that his ministrations were invalid.

These opinions were subversive of the system of the medieval church, and were naturally viewed with great disfavour by its officials; but it cannot fairly be said that they have much in common with the opinions of the Reformers of the 16th century. The medieval church set forth Christ as present in the orderly community of the faithful; Protestantism aimed at setting the individual in immediate communion with Christ, without the mechanical intervention of the officers of the community; the Waldenses merely set forward a new criterion of the orderly arrangement of the church, according to which each member was to sit in judgment on the works of the ministers, and consequently on the validity of their ministerial acts. It was a rude way of expressing a desire for a more spiritual community. The earliest known document proceeding from the Waldensians is an account of a conference held at Bergamo in 1218 between the Ultramontane and the Lombard divisions, in which the Lombards showed a greater opposition to the recognized priesthood than did their northern brethren.[2]

As these opinions became more pronounced persecution became more severe, and the breach between the Waldenses and the church widened. The Waldenses withdrew altogether from the ministrations of the church, and chose ministers for themselves whose merits were recognized by the body of the faithful. Election took the place of ordination, but even here the Lombards showed their difference from the Ultramontanes, and recognized only two orders, like the Cathari, while the northern body kept the old three orders of bishops, priests and deacons. Gradually the separation from the church became more complete: the sacraments were regarded as merely symbolical; the priests became helpers of the faithful; ceremonies disappeared; and a new religious society arose equally unlike the medieval church and the Protestantism of the 16th century.

The spread of these heretical sects led to resolute attempts at their suppression. The crusade against the Albigensians could destroy prosperous cities and hand over lands from a heedless lord to one who was obedient to the church; but it could not get rid of heresy. The revival of preaching, which was the work of the order of St Dominic, did more to combat heresy, especially where its persuasions were enforced by law. The work of inquisition into cases of heresy proceeded slowly in the hands of the bishops, who were too busy with other matters to find much time for sitting in judgment on theological points about which they were imperfectly informed. The greatest blow struck against heresy was the transference of the duty of inquiry into heresy from the bishops to Dominican inquisitors. The secular power, which shared in the proceeds of the confiscation of those who were found guilty of heresy, was ready to help in carrying out the judgments of the spiritual courts. Everywhere, and especially in the district round Toulouse, heretics were keenly prosecuted, and before the continued zeal of persecution the Waldenses slowly disappeared from the chief centres of population and took refuge in the retired valleys of the Alps. There, in the recesses of Piedmont, where the streams of the Pelice, the Angrogne, the Clusone and others cleave the sides of the Alps into valleys which converge at Susa, a settlement of the Waldensians was made who gave their name to these valleys of the Vaudois. In the more accessible regions north and south heresy was exposed to a steady process of persecution, and tended to assume shifting forms. Among the valleys it was less easily reached, and retained its old organization and its old contents. Little settlements of heretics dispersed throughout Italy and Provence looked to the valleys as a place of refuge, and tacitly regarded them as the centre of their faith. At times attempts were made to suppress the sect of the Vaudois, but the nature of the country which they inhabited, their obscurity and their isolation made the difficulties of their suppression greater than the advantages to be gained from it. However, in 1487 Innocent VIII. issued a bull for their extermination, and Alberto de' Capitanei, archdeacon of Cremona, put himself at the head of a crusade against them. Attacked in Dauphiné and Piedmont at the same time, the Vaudois were hard pressed; but luckily their enemies were encircled by a fog when marching upon their chief refuge in the valley of the Angrogne, and were repulsed with great loss. After this Charles II., duke of Piedmont, interfered to save his territories from further confusion, and promised the Vaudois peace. They were, however, sorely reduced by the onslaught which had been made upon them, and lost their ancient spirit of independence. When the Lutheran movement began they were ready to sympathize with it, and ultimately to adapt their old beliefs to those of the rising Protestantism. Already there were scattered bodies of Waldenses in Germany who had influenced, and afterwards joined, the Hussites and the Bohemian Brethren.

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[1] D'Argentré, *Collectio judiciorum de novis erroribus*, i. 50, &c.

[2] Preger, *Beiträge zur Geschichte der Waldesier*.

The last step in the development of the Waldensian body was taken in 1530, when two deputies of the Vaudois in Dauphiné and Provence, Georges Morel and Pierre Masson, were sent to confer with the German and Swiss Reformers. A letter addressed to Oecolampadius[1] gives an account of their practices and beliefs at that time, and shows us a simple and unlettered community, which was the survival of an attempt to form an esoteric religious society within the medieval church. It would appear that its members received the sacraments of baptism and the holy communion from the regular priesthood, at all events sometimes, but maintained a discipline of their own and held services for their own edification. Their ministers were called *barba*, a Provençal word meaning *guide*. They were chosen from among labouring men, who at the age of twenty-five might ask the body of ministers to be admitted as candidates. If their character was approved they were taught during the winter months, when work was slack, for a space of three or four years; after that they were sent for two years to serve as menial assistants at a nunnery for women, which curiously enough existed in a recess of the valleys. Then they were admitted to office, after receiving the communion, by the imposition of hands of all ministers present. They went out to preach two by two, and the junior was bound absolutely to obey the senior. Clerical celibacy was their rule, but they admit that it created grave disorders. The ministers received food and clothing from the contributions of the people, but also worked with their hands; the result of this was that they were very ignorant, and also were grasping after bequests from the dying. The affairs of the church were managed by a general synod held every year. The duties of the barbas were to visit all within their district once a year, hear their confessions, advise and admonish them; in all services the two ministers sat side by side, and one spoke after the other. In point of doctrine they acknowledged the seven sacraments, but gave them a symbolical meaning; they prayed to the Virgin and saints, and admitted auricular confession, but they denied purgatory and the sacrifice of the mass, and did not observe fasts or festivals. After giving this account of themselves they ask for information about several points in a way which shows the exigencies of a rude and isolated society, and finally they say that they have been much disturbed by the Lutheran teaching about freewill and predestination, for they had held that men did good works through natural virtue stimulated by God's grace, and they thought of predestination in no other way than as a part of God's foreknowledge.

Oecolampadius gave them further instruction, especially emphasizing the wrongfulness of their outward submission to the ordinances of the church: "God," he said, "is a jealous God, and does not permit His elect to put themselves under the yoke of Antichrist." The result of this intercourse was an alliance between the Vaudois and the Swiss and German Reformers. A synod was held in 1532 at Chanforans in the valley of the Angrogne, where a new confession of faith was adopted, which recognized the doctrine of election, assimilated the practices of the Vaudois to those of the Swiss congregations, renounced for the future all recognition of the Roman communion, and established their own worship no longer as secret meetings of a faithful few but as public assemblies for the glory of God.

Thus the Vaudois ceased to be relics of the past, and became absorbed in the general movement of Protestantism. This was not, however, a source of quiet or security. In France and Italy alike they were marked out as special objects of persecution, and the Vaudois church has many records of martyrdom. The most severe trial to which the Vaudois of Piedmont were subjected occurred in 1655. The Congregation *de Propaganda Fide* established, in 1650, a local council in Turin, which exercised a powerful influence on Duke Charles Emmanuel II., who ordered that the Vaudois should be reduced within the limits of their ancient territory. Fanaticism took advantage of this order; and an army, composed partly of French troops of Louis XIV., partly of Irish soldiers who had fled before Cromwell, entered the Vaudois valleys and spread destruction on every side. They treated the people with horrible barbarity, so that the conscience of Europe was aroused, and England under Cromwell called on the Protestant powers to join in remonstrance to the duke of Savoy and the French king. The pen of Milton was employed for this purpose, and his famous sonnet is but the condensation of his state papers. Sir Samuel Morland was sent on a special mission to Turin, and to him were confided by the Vaudois leaders copies of their religious books, which he brought back to England, and ultimately gave to the university library at Cambridge. Large sums of money were contributed in England and elsewhere, and were sent to the suffering Vaudois.

By this demonstration of opinion peace was made for a time between the Vaudois and their persecutors; but it was a treacherous peace, and left the Vaudois with a hostile garrison established among them. Their worship was prohibited, and their chief pastor, Leger, was obliged to flee, and in his exile at Leiden wrote his *Histoire générale des églises vaudoises* (1684). The revocation of the edict of Nantes in 1685 began a new period of persecution, which aimed at entire extermination. This was found so difficult that the remnant of the Vaudois, to the number of 2600, were at last allowed to withdraw to Geneva. But the love of their native valleys was strong among the exiles, and in 1689 one of their pastors, Henri Arnaud, led a band of 800 men to the reconquest of their country. His first attempts against the French were successful; and the rupture between Victor Amadeus, duke of Savoy, and Louis XIV. brought a sudden change of fortune to the Vaudois. They were recognized once more as citizens of Savoy, and in the war against France which broke out in 1696 the Vaudois regiment did good service for its duke. The peace of Utrecht saw the greater part of the French territory occupied by the Vaudois annexed to Savoy, and, though there were frequent threatenings of persecution, the idea of toleration slowly prevailed in the policy of the house of Savoy. The Vaudois, who had undergone all these vicissitudes, were naturally reduced to poverty, and their ministers were partially maintained by a subsidy from England, which was granted by Queen Anne. The 18th century, however, was a time of religious decadence even among the Alpine valleys, and the outbreak of the French Revolution saw the Vaudois made subjects of France. This led to a loss of the English subsidy, and they applied to Napoleon for an equivalent. This was granted, and their church was organized by the state. On the restoration of the house of Savoy in 1816 English influence was used on behalf of the Vaudois, who received a limited toleration. From that time onwards the Vaudois became the objects of much interest in Protestant countries. Large sums of money were collected to build hospitals and churches among their valleys, and they were looked upon as the possible centre of a Protestant church in Italy. Especially from England did they receive sympathy and help. An English clergyman, Dr Gilly, visited the valleys in 1823, and by his writings on the Vaudois church attracted considerable attention, so that he was enabled to build a college at La Torre. Moreover, Dr Gilly's book (*A Visit to the Valleys of Piedmont*), chancing to fall into the hands of an officer who had lost his leg at Waterloo, Colonel Beckwith, suggested an object for the energies of one who was loth at the age of twenty-six to sink into enforced idleness. Beckwith visited the valleys, and was painfully struck by the squalor and ignorance of a people who had so glorious a past. He settled among them, and for thirty-five years devoted himself to promote their welfare. During this period he established no fewer than 120 schools; moreover he brought back the Italian language which had been displaced by the French in the services of the Vaudois church, and in 1849 built a church for them in Turin. He lived in La Torre till his death in 1862, and the name of the English benefactor is still revered by the simple folk of the valleys. (M. C.)

The parent church in the valleys is ecclesiastically governed by a court for internal affairs called the "Table," after the old stone table round which the ancient barbas used to sit, and a mission board, with an annual synod to which both the home and mission boards are subject. The total population of the Waldensian valleys (for they also contain Roman Catholics in no small number) amounts to about 20,000 all told. In 1900 there were 16 parishes, with 18 pasteurs and 22 temples, and also 2 Sunday schools (3017 children) and 194 day schools (with 4218 children); the full members (*i.e.* communicants) of the Waldensian faith amounted to 12,695. There were, besides, branches at Turin (1 temple, 2 pasteurs and 750 members), in other parts of Italy, including Sicily (46 temples and as many pasteurs, while the number of members was 5613, of day scholars 2704, and of Sunday school scholars 3707). It is also reckoned that in Uruguay and the Argentine Republic there are about 6000 Waldensians; of these 1253 were in 1900 full members, while the day scholars numbered 364 and the Sunday school children 670.

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[1] Scultetus, *Annales*, ii. 294, &c.

The literature on the subject of the Waldensian and other sects is copious. For their rise the most important authorities are to be found in Moneta, *Adversus Catharos et Waldenses*; D'Argentré, *Collectio judiciorum de novis erroribus*; Alanus, *Adversus haereticos*; D'Achery, *Spicilegia*, vol. i.; Gretser, *Opera*, vol. x.; Limborch, *Historia Inquisitionis*, at the end of which is the *Liber sententiarum* of the Inquisition of Toulouse from 1307–1322. Of modern books may be mentioned Schmidt, *Histoire des Cathares*; Hahn, *Geschichte der neumanichäischen Ketzer*; Dieckhoff, *Die Waldenser im Mittelalter*; Preger, *Beiträge zur Geschichte der Waldesier*; Cantù, *Gli Eretici in Italia*; Comba, *Storia della Riforma in Italia*, and *Histoire des Vaudois d'Italie*; Tocco, *L'Eresia nel medio evo*; Montet, *Histoire littéraire des Vaudois*; Lea, *History of the Inquisition of the Middle Ages.* Amongst books dealing with the more modern history of the Vaudois specially are Léger, *Histoire des églises vaudoises*; Arnaud, *Histoire de la rentrée des Vaudois*; Perrin, *Histoire des Vaudois*; Monastier, *Histoire de l'église vaudoise*; Muston, *L'Israel des Alpes*; Gilly, *Excursion to the Valleys of Piedmont*, and *Researches on the Waldensians*; Todd, *The Waldensian Manuscripts*; Melia, *Origin, Persecution and Doctrines of the Waldensians*; Jules Chevalier, *Mémoires sur les hérésies en Dauphiné avant le XVI*^{e} *siècle, accompagnés de documents inédits sur les sorciers et les Vaudois* (Valence, 1890); J. A. Chabrand, *Vaudois et Protestants des Alpes: recherches historiques* (Grenoble, 1886); H. Haupt, article in Von Sybel's *Historische Zeitschrift* (1889), pp. 39-68; W. A. B. Coolidge, articles in the *Guardian* for 18th August 1886 and 4th December 1889.

WALDERSEE, ALFRED, COUNT (1832–1904), Prussian general field marshal, came of a soldier family. Entering the Guard Artillery of the Prussian army in 1850, he soon attracted the favourable notice of his official superiors, and he made his first campaign (that of 1866) as aide-de-camp to General of Artillery Prince Charles of Prussia, with whom he was present at Königgrätz. In the course of this campaign Count Waldersee was promoted major and placed on the general staff, and after the conclusion of peace he served on the staff of the X. Army Corps (newly formed from the conquered kingdom of Hanover). In January 1870 he became military attaché at Paris and aide-de-camp to King William. In the Franco-German War Lieut.-Colonel Count Waldersee, on account of both his admitted military talents and his recent experience of the enemy's army, proved a most useful assistant to the "supreme War-Lord." He was present at the great battles around Metz, in which he played more than an orderly officer's part, and in the war against the republic he was specially sent to the staff of the grand duke of Mecklenburg-Schwerin, who was operating against Chanzy's army on the Loir. The grand duke was a good soldier, but not a brilliant strategist, and the fortunate outcome of the western campaign was largely due to his adviser. At the end of the war Waldersee received the First Class of the Iron Cross, and was entrusted with the exceedingly delicate and difficult post of German representative at Paris, in which his tact and courtesy were very marked. At the end of 1871 Waldersee took over the command of the 13th Uhlans at Hanover, and two years later he became chief of the staff of the Hanoverian army corps, in which he had served before 1870. In 1881 he became Moltke's principal assistant on the great general staff at Berlin, and for seven years was intimately connected with the great field marshal's work, so that, when Moltke retired in 1888, Waldersee's appointment to succeed him was a foregone conclusion. Three years later the chief of the general staff was sent to command the IX. Corps at Altona, an appointment which was interpreted as indicating that his close and intimate friendship with Bismarck had made him, at this time of the chancellor's dismissal, a *persona non grata* to the young emperor. In 1898, however, he was appointed inspector-general of the III. "Army Inspection" at Hanover, the order being accompanied by the most eulogistic expressions of the kaiser's goodwill. On the despatch of European troops to quell the Boxer insurrection in China in 1900, it was agreed that Count Waldersee should have the supreme command of the joint forces. The preparations for his departure from Germany caused a good deal of satirical comment on what was known as the "Waldersee *Rummel*" or "theatricals." He arrived at the front, however, too late to direct his troops in the fighting before Peking. At the end of the war he returned to Europe. He resumed at Hanover his duties of inspector-general, which he performed almost to his death, which took place on the 5th of March 1904.

WALDO, SAMUEL LOVETT (1783–1861), American artist, was born in Windham, Connecticut, on the 6th of April 1783. He had a studio in Charleston, South Carolina. In 1806 he went to London, where he painted portraits for some years with success. In 1809 he returned to New York, and was a conspicuous figure in the city's art life until his death there on the 16th of February 1861. He became an associate of the National Academy in 1847. Among his works are a series of portraits of the early mayors of New York, now in the New York City Hall, a portrait of Peter Remsen, in possession of the New York Historical Society, and two portraits of John Trumbull.

WALENSEE, also called the LAKE OF WALENSTADT, a Swiss lake between the basins of the Rhine and the Linth (Limmat), lying S.E. of the Lake of Zürich. It is formed by the Seez river (descending from the Weisstannen glen), which once certainly sent its waters to the Rhine, but now enters the lake at its eastern end. Near its western end the Linth has been diverted through the Escher canal (completed in 1811) into the lake, from which it soon again issues in order, by means of the Linth canal (completed in 1816), to flow into the Lake of Zürich. The Walensee has an area of 9 sq. m., is about 9 m. in length, $1\frac{1}{4}$ m. wide and 495 ft. deep, while its surface is 1388 ft. above sea-level. It forms part of the Canton of St Gall, save $1\frac{3}{4}$ sq. m. towards its west end, which are in that of Glarus. It lies in a deep trench between two comparatively lofty ranges of mountains, so that its scenery is more gloomy than is usual with Swiss lakes. On the north shore there is but a single village of any size (Quinten), while above it rise the cliffs of the seven-peaked range of the Kurfürsten (7576 ft.), at the west end of which the village of Amden nestles in a hollow high above the lake. On the south side the hills rise less steeply from the shore (on which are Mühlehorn and Murg) towards the fine terrace of the Kerenzenberg, on which are the frequented summer resorts of Obstalden and Filzbach, backed on the south by the singularly imposing crags of the Mürtschenstock (8012 ft.). The small towns of Weesen and Walenstadt are situated respectively at the western and the eastern extremities of the lake, a railway along the south shore of which connects them with each other (11 m.). Since the construction of this line no steamers ply on the lake. (W. A. B. C.)

WALES (*Cymru*, *Gwalia*, *Cambria*), a Principality occupying the extreme middle-west of the southern part of the island of Great Britain, bounded E. by the English counties of Cheshire, Shropshire, Herefordshire and Monmouthshire; S. by the Bristol Channel; W. by St George's Channel; and N. by the Irish Sea. (For map see ENGLAND, V.) Its area is 7467 sq. m. Its greatest length from N. to S. (from the Point of Air in Flint to Barry Island on the Glamorgan coast) is 136 m., while its breadth varies from 92 m. (from St Davids Head to the English border beyond Crickhowell) to 37 m. (the distance between Aberystwyth and the Shropshire boundary at Clun Forest). Its total circuit is about 540 m., of which 390 consist of coast-line. The principal headlands are Great Ormes Head in Carnarvonshire; Braich-y-Pwll, the most westerly point of

Carnarvonshire; St Davids Head, the most westerly point of South Wales; Worms Head, the western extremity of Gower; and Lavernock Point to the W. of Cardiff. The principal islands are Holy Island, off the W. coast of Anglesea; Bardsey (Ynys Enlli), near Braich-y-Pwll; and the islands of Ramsey, Grassholm, Skomer, Skokholm and Caldy (Ynys Pyr) off the Pembrokeshire coast. The chief inlets are the mouth of the Dee, dividing Flint from Cheshire; the Menai Straits, separating Anglesea from the mainland; Carnarvon Bay; Cardigan Bay, stretching from Braich-y-Pwll to St Davids Head; St Brides Bay; Milford Haven; Carmarthen Bay; and Swansea Bay.

In common parlance, as well as for judicial purposes of circuits, the Principality is divided into North Wales and South Wales, each of which consists of six counties.

North Wales.

	Acreage.	Population (1901).
Anglesea (Ynys Fôn)	176,630	50,606
Carnarvon (Sîr Arfon)	361,156	126,883
Denbigh (Sîr Dinbych)	423,499	129,942
Flint (Sîr Fflint)	164,744	81,700
Merioneth (Sîr Feirîonydd)	427,810	49,149
Montgomery (Sîr Drefaldwyn)	510,111	54,901

South Wales.

	Acreage.	Population (1901).
Brecon or Brecknock (Sîr Frycheiniog)	475,224	59,907
Cardigan (Sîr Aberteifi)	440,630	60,240
Carmarthen (Sîr Gaerfyrddin)	587,816	135,328
Glamorgan (Sîr Forganwg)	518,863	859,931
Pembroke (Sîr Benfro)	395,151	88,732
Radnor (Sîr Faesyfed)	301,164	23,281

Mountains.—Almost the whole surface of Wales is mountainous or undulating. The most important hill system is that of the North Wales mountains, covering the county of Carnarvon and parts of Merioneth and Denbigh, wherein the Snowdonian range reaches the height of 3571 ft. in Snowdon itself; of 3484 ft. in Carnedd Llywelyn; and of 3426 ft. in Carnedd Dafydd. South of this system, and separated from it by the upper valley of the Dee, the Berwyn range extends from N.E. to S.E., and is itself adjacent to Aran-fawddy (2970 ft.), the highest point in the Cader Idris group. The system of Mid-Wales or Powys stretches from Cardigan Bay to the English border, and contains Plinlimmon (2462 ft.) in north Cardigan; Drygarn Fawr (2115 ft.) in north Brecon; and Radnor Forest (2163 ft.) in mid-Radnor. From Plinlimmon a range of hills runs in a south-westerly direction towards St Davids, terminating in the Preselly range of north Pembroke (1760 ft.) and dividing the broad valleys of the Teifi and Towy. The three combined ranges of the Black Mountains, the Brecknock Beacons and the Black Forest sweep across south Brecon from W. to E., the chief elevations being the Carmarthen Van (2632 ft.), the Brecon Beacon (2862 ft.) and Pen-y-gader fawr (2660 ft.) near the English border.

Lakes and Rivers.—Small lakes, such as Llyn Ogwen, Llyn Safaddan (Llangorse Lake), Talyllyn, the Teifi Pools, &c., are fairly numerous in the mountainous districts, but the only natural lake of importance is Bala Lake, or Llyn Tegid, in Merionethshire, 4 m. long and about 1 m. wide. But the great reservoir known as Lake Vyrnwy, which supplies Liverpool with water, is equal in size to Bala; and the chain of four artificial lakes constructed by the Birmingham corporation in the valleys of the Elan and Claerwen covers a large area in west Radnorshire. The longest river in Wales is the Severn (180 m.), in Welsh Hafren, which rises in Plinlimmon, and takes a north-easterly direction through Montgomeryshire before reaching the English border. The Wye (130 m.) also rises in Plinlimmon, and forms for some 30 m. the boundary between the counties of Radnor and Brecon before encountering English soil near Hay. The Usk (56 m.) flows through Breconshire, and joins the Bristol Channel at Newport in Monmouthshire. The Dee (70 m.) traverses Bala Lake, and drains parts of the counties of Merioneth, Denbigh and Flint. The Towy (68 m.) flows through Carmarthenshire, entering Carmarthen Bay at Llanstephan; the Teifi (50 m.) rises near Tregaron and falls into Cardigan Bay below the town of Cardigan. The Taff (40 m.), rising amongst the Brecon Beacons, enters the Bristol Channel at Cardiff. Other rivers are the Dovey (30 m.), falling into Cardigan Bay at Aberdovey; the Tâf (25 m.), entering Carmarthen Bay at Laugharne; and the broad navigable Conway (24 m.), dividing the counties of Carnarvon and Denbigh.

Welsh Place-Names.—The place-names throughout the Principality may be said to group themselves roughly into four divisions: (i.) Pure and unaltered Celtic names; (ii.) Corrupted or abbreviated Celtic names; (iii.) English names; (iv.) Scandinavian and foreign names. To the first division belong the vast majority of place-names throughout the whole of Wales and Monmouthshire. Except in some districts of the Marches and in certain tracts lying along the South Wales coast, nearly all parishes, villages, hamlets, farms, houses, woods, fields, streams and valleys possess native appellations, which in most cases are descriptive of natural situation, *e.g. Nantyffin*, the boundary brook; *Aberporth*, mouth of the harbour; *Talybont*, end of the bridge; *Troedyrhiw*, foot of the hill; *Dyffryn*, a valley, &c. Other place-names imply a personal connexion in addition to natural features, *e.g. Nantygôf*, the blacksmith's brook; *Trefecca*, the house of Rebecca; *Llwyn Madoc*, Madoc's grove; *Pantsaeson*, the Saxons' glen, &c. An historical origin is frequently commemorated, notably in the many foundations of the Celtic missionaries of the 5th, 6th and 7th centuries, wherein the word *llan* (church) precedes a proper name; thus every *Llanddewi* recalls the early labours of Dewi Sant (St David); every *Llandeilo*, those of St Teilo; and such names as *Llandudno*, *Llanafan*, *Llanbadarn* and the like commemorate SS. Tudno, Afan, Padarn, &c. To the second division—those place-names which have been corrupted by English usage—belong most of the older historic towns, in striking contrast with the rural villages and parishes, which in nearly all cases have retained unaltered their original Celtic names. Anglicized in spelling and even to some extent changed in sound are *Carmarthen* (Caerfyrddin); *Pembroke* (Penfro); *Kidwelly* (Cydweli); *Cardiff* (Caerdydd); *Llandovery* (Llanymddyfri); while *Lampeter*, in Welsh Llanbedr-pont-Stephan, affords an example of a Celtic place-name both Anglicized and abbreviated. In not a few instances modern English nomenclature has supplanted the old Welsh place-names in popular usage, although the town's original appellation is retained in Welsh literature and conversation, *e.g. Holyhead* is Caergybi (fort of Cybi, a Celtic missionary of the 6th century); *Presteign* is Llanandras (church of St Andrew, or Andras); *St Asaph* is Llanelwy; the English name commemorating the reputed founder of the see, and the Welsh name recalling the church's original foundation on the banks of the Elwy. *Cardigan*, in Welsh Aberteifi, from its situation near the mouth of the Teifi, and *Brecon*, in Welsh Aberhonddu, from its site near the confluence of the Usk and Honddu, are examples of corrupted Welsh names in common use—Ceredigion, Brychan—which possess in addition pure Celtic forms. In the third division, English place-names are tolerably frequent everywhere and predominate in the Marches and on the South Wales coast. Even in so thoroughly Welsh a county as Cardiganshire, English place-names are often to be encountered, *e.g.* New Quay, High Mead, Oakford, &c.; but many of such names are of modern invention, dating chiefly from the 18th and 19th centuries. Of the many English names occurring in south Pembroke and south Glamorgan, some are exact or fanciful translations of the original Welsh, *e.g. Cowbridge* (Pontyfon) and *Ludchurch* (Eglwys Llwyd), others are of direct external origin, as Bishopstone, Flemingstone, Butter Hill, Briton Ferry, Manselfield, &c. Names derived straight from an Anglo-Norman source are rare; Beaupré, Beaumaris, Beaufort, Fleur-de-Lis, Roche, may be cited as examples of such. Scandinavian influence can easily be traced at various points of the coast-line, but particularly in south Pembrokeshire, wherein occur such place-names as Caldy, Tenby, Goodwick, Dale, Skokholm, Hakin and Milford Haven. Specimens of Latinized names in connexion with ecclesiastical foundations are preserved in Strata Florida and Valle Crucis Abbeys. Hybrid place-names are occasionally to be met with in the colonized portions of Wales, as in Gelliswick (a combination of the Celtic *gelli*, a hazel grove, and the Norse *wick*, a haven), and in Fletherhill, where the English suffix *hill* is practically a translation of the Celtic prefix. A striking peculiarity of the Principality is the prevalence of Scriptural place-names; a circumstance due undoubtedly to the popular religious movements of the 19th century. Not only are such names as Horeb, Zion, Penuel, Siloh, &c., bestowed on Nonconformist chapels, but these Biblical terms have likewise been applied to their surrounding houses, and in not a few instances to growing towns and villages. A notable example of this curious nomenclature occurs in Bethesda, Carnarvonshire, where the name of the Congregational chapel erected early in the 19th century has altogether supplanted the original Celtic place-name of Cilfoden. But although English and foreign place-names are fairly numerous throughout Wales, yet the vast majority remain Celtic either in a pure or in a corrupted form, so that some knowledge of the Celtic language is essential to interpret their meaning.

A small glossary of some of the more common component words is appended below.

Aber, the mouth or estuary of a river—Aberystwyth, Abergwili.

Ach, water—Clydach, Clarach.

Afon, a river—a word which retains its primitive meaning in Wales, whilst it has become a proper name in England—Glanafon, Manorafon.

Bettws, a corrupt form of the English " bead-house," or possibly of the Latin " beatus "—Bettws-y-coed, Bettws Ifan.

Blaen, the top—Blaendyffryn, Blaencwm.

Bod, house or abode—Bodfuan, Hafod.

Bron, the human breast, hence breast of hill—Brongest, Cilbronnau.

Bryn, a hill—Brynmawr, Penbryn.

Bwlch, a gap—Bwlchbychan, Tanybwlch.

Cae, a field—Caeglas, Tynycae.

Caer, a fortress or fortified camp—Caerlleon, Caersws.

Capel, a corrupt form of the Latin " capella " applied to chapels, ancient and recent—Capel Dewi, Capel-issaf, Parc-y-capel.

Carn, a cairn or heap of stones—Moel-trigarn.

Carnedd, a tumulus—Carnedd Llywelyn.

Cefn, a ridge—Cefn-Mably, Cefn-y-bedd.

Cil, a retreat, said to be akin to the Goidelic *kil*—Ciliau-Aeron, Cilcennin.

Cnwc, a knoll or mound—Cnwcglas (Anglicized into Knucklas, in Radnorshire).

Coed, a wood—Coedmawr, Penycoed.

Craig, a rock or crag—Pen-y-graig.

Crûg, a heap or barrow—Crûg Mawr, Trichrûg.

Cwm, a low valley, Anglicized into " coomb "—Cwm Gwendraeth, Blaencwm.

Din, a fortified hill, hence *Dinas*, a fortified town—Dinefawr, Pen Dinas.

Dol, a meadow—Dolwilym, Dolau.

Dwr, *Dwfr*, water—Glyndwrdu, the patrimony of the celebrated Owen Glendower, of which his Anglicized name is a corruption.

Eglwys, a corruption of the Latin " ecclesia," a church—Eglwyswrw, Tanyreglwys.

Gallt, in North Wales a steep slope; in South Wales a hanging wood—Galltyfyrddin, Penyrallt.

Gelli, a grove—Gellideg, Pengelly Forest.

Glan, a bank—Glanymôr, Glandofan.

Glyn, a glen or narrow valley—Glyncothi, Tyglyn.

Llan, a sacred enclosure, hence a church—a most interesting and important Celtic prefix—Llandeilo, Llansaint.

Llech, a stone—Llechryd, Trellech.

Llwyn, a grove—Penllwyn, Llwynybrân.

Llys, a court or palace—Henllys, Llysowen.

Maes, open land, or battlefield—Maesyfed (the Welsh name for Radnorshire), Maesllwch.

Moel, bald, hence a bare hill-top—Moelfre.

Môr, the sea—Brynmôr, Glanymôr.

Mynydd, mountain—Llanfynydd, Mynydd Dû.

Nant, a ravine, hence also a brook—Nantgwyllt, Nannau, Nantgaredig.

Pant, a glen or hollow—Pantycelyn, Blaenpant.

Parc, an enclosed field—Parc-y-Marw, Penparc.

Pen, a summit—Penmaenmawr, Penmark.

Pont, a bridge, a corruption of the Latin " pons"— Ponthirwen, Talybont.

Porth, a gate or harbour—perhaps a corrupt form of the Latin " porta "—Aberporth, Pump Porth (" the Five Gates ").

Rhiw, ascent or slope—Troedyrhiw, Rhiwlas.

Rhos, a moor—Rhosllyn, Tyr'hos.

Rhyd, a ford—Rhydyfuwch, Glanrhyd.

Sarn, a causeway, generally descriptive of the old Roman paved roads—Talsarn, Sarnau, Sarn Badrig.

Tal, an end, also head—Taliaris, Talyllyn.

Tref, a homestead, hence *cantref*, a hundred—Hendref, Cantref-y-gwaelod.

Troed, a base —Troed-y-bryn.

Ty, a house, a cottage—Tynewydd, Mynachty.

Wy, or *gwy*, an obsolete Celtic word for water, preserved in the names of many Welsh rivers—Elwy, Gwili, Wye or Gwy.

Ynys, an island, or hill in the midst of a bog—Ynys Enlli (the Welsh name for Bardsey Islands), Ynyshir, Clynrynys.

Yspytty, *spite*, a corrupt form of the Latin " hospitium," often used of the guest-house of an abbey—Yspytty Ystwyth, Tafarn Spite.

Ystrad, a meadow or rich lowland—Ystrad Mynach, Llanfihangel Ystrad.

Population.—The total population of the twelve counties of the Principality was: 1,360,513 (1881), 1,519,035 (1891), 1,720,600 (1901). These figures prove a steady upward tendency, but the increase itself is confined entirely to the industrial districts of the Principality, and in a special degree to Glamorganshire; while the agricultural counties, such as Pembroke, Merioneth, Cardigan or Montgomery, present a continuous though slight decrease owing to local emigration to the centres of industry. The whole population of Wales in Tudor, Stuart and early Georgian times can scarcely have exceeded 500,000 souls, and was probably less. But with the systematic development of the vast mineral resources of the South Wales coalfield, the population of Glamorganshire has increased at a more rapid rate than that of any other county of the United Kingdom, so that at present this county contains about half the population of all Wales. It will be noted, therefore, that the vast mass of the inhabitants of Wales are settled in the industrial area which covers the northern districts of Glamorganshire and the south-eastern corner of Carmarthenshire; whilst central Wales, comprising the four counties of Cardigan, Radnor, Merioneth and Montgomery, forms the least populous portion of the Principality. The following towns had each in 1901 a population exceeding 10,000: Cardiff, Ystradyfodwg, Swansea, Merthyr Tydfil, Aberdare, Pontypridd, Llanelly, Ogmore and Garw, Pembroke, Caerphilly, Maesteg, Wrexham, Penarth, Neath, Festiniog, Bangor, Holyhead, Carmarthen. Only four towns in North Wales are included in these eighteen, and the combined populations of these four—Wrexham (14,966), Festiniog (11,435), Bangor (11,269) and Holyhead (10,079)—fall far below that of Merthyr Tydfil (69,228), the fourth largest town in Glamorganshire.

Industries.—The chief mineral product of the Principality is coal, of which the output amounts to over 23,000,000 tons annually. The great South Wales coalfield, one of the largest in the kingdom, covers the greater part of Monmouthshire and Glamorganshire, the south-eastern corner of Carmarthenshire, and a small portion of south Pembrokeshire, and the quality of its coal is especially suitable for smelting purposes and for use in steamships. The supply of limestone and ironstone in Glamorganshire is said to be practically unlimited. About 400,000 tons of pig iron are produced yearly, and some of the largest iron-works in the world are situated at Merthyr Tydfil and Dowlais. Copper, tin and lead works are everywhere numerous in the busy valleys of north Glamorgan and in the neighbourhoods of Swansea, Neath, Cardiff and Llanelly. In North Wales, Wrexham, Ruabon and Chirk are centres of coal-mining industry. There are valuable copper mines in Anglesea, and lead mines in Flint and in north Cardiganshire, which also yield a certain deposit of silver ore. Gold has been discovered and worked, though only to a small extent, in Merionethshire and Carmarthenshire. Slate quarries are very numerous throughout the Principality, the finest quality of slate being obtained in the neighbourhood of Bangor and Carnarvon, where the Penrhyn and Bethesda quarries give employment to many thousands of workmen.

By far the larger portion of Wales is purely agricultural in character, and much of the valley land is particularly fertile, notably the Vale of Glamorgan, the Vale of Clwyd and the valleys of the Towy, the Teifi, the Usk and the Wye, which have long been celebrated for their rich pastures. The holdings throughout Wales are for the most part smaller in extent than the average farms of England. Stock-raising is generally preferred to the growing of cereals, and in western Wales the oat crops exceed in size those of wheat and barley. The extensive tracts of unenclosed and often unimprovable land, which still cover a large area in the Principality, especially in the five counties of Cardigan, Radnor, Brecon, Montgomery and Merioneth, support numerous flocks of the small mountain sheep, the flesh of which supplies the highly prized Welsh mutton. The wool of the sheep is manufactured into flannel at numberless factories in the various country towns, and the supply meets an important local demand. The upland tracts also afford good pasturage for a number of cobs and ponies, which obtain high prices at the local fairs, and Pembrokeshire and Cardiganshire have long been famous for their breed of horses and ponies. The cattle of Wales present all varieties of race, the Hereford breed prevailing in the eastern counties, and Shorthorns and the black Castlemartins in the south-western parts. The great herds of goats, which in medieval times subsisted on the Welsh hills, have entirely disappeared since the general adoption of the sheep-farming industry.

The deep-sea fisheries on the south-western coasts are of some importance; the Mumbles, Tenby and Milford Haven being the chief centres of this industry. Lobsters and crabs are caught in Cardigan Bay, and oysters are found at various points of the Pembrokeshire coast. The large rivers produce salmon, which are usually sent to the great towns for sale. The Wye, the Usk, the Dee, the Dovey, the Teifi, the Towy and most of the Welsh rivers and lakes are frequented by anglers for salmon and trout.

Communications.—The two principal railways serving the Principality are the London & North-Western, which passes along the North Wales coast-line by way of Conway and Bangor, crosses the Menai Strait and has its terminus at Holyhead; and the Great Western, which traverses South Wales by way of Cardiff, Landore, Llanelly and Carmarthen, and has its principal terminal station at Fishguard Harbour. The lines of the Cambrian railway serve North and Mid-Wales, and branches of the London & North-Western and the Midland penetrate into South Wales as far as Swansea. A network of lines connects the great industrial districts of Glamorganshire with the main line of the Great Western railway. There are steamship services between Holyhead and Dublin in connexion with the trains of the London & North-Western railway; and an important traffic for dairy produce, live-stock and passengers between Fishguard and Rosslare on the Irish coast was opened in 1906 in connexion with the Great Western railway. There is also a boat service between Holyhead and Greenore on the Ulster coast. Steamboats likewise ply between Milford, Tenby, Swansea and Cardiff and Bristol; also between Swansea and Cardiff and Dublin; and there is a regular service between Swansea and Ilfracombe. The principal canals are the Swansea, the Neath, the Aberdare & Glamorgan, and the Brecon & Abergavenny, all worked in connexion with the industrial districts of north Glamorganshire.

Government.—In all acts of parliament Wales is invariably included under the term of "England and Wales," and whenever an act, or any section of an act, is intended to apply to the Principality alone, then Wales is always coupled with Monmouthshire. The extinction of the Welsh Court of Great Sessions in 1830 served to remove the last relic of separate jurisdiction in Wales itself, but in 1881 special legislation was once more inaugurated by the Welsh Sunday Closing Act (46 Victoria), forbidding the sale of spirituous liquors by all inn-keepers on Sundays to any but bona fide travellers throughout Wales and Monmouthshire. A separate act on behalf of Welsh education was likewise passed in 1889, when the Welsh Intermediate Education Act made special provision for intermediate and technical education throughout the Principality and Monmouthshire. Except for the administration of these two special acts, the system of government in Wales is identical in every respect with that of England (see ENGLAND and UNITED KINGDOM). Royal commissions dealing with questions peculiar to Wales have been issued from time to time, notably of recent years, in the Welsh Land Tenure Commission of 1893, and the Welsh Church Commission of 1906 (see *History*).

Religion.—Ecclesiastically, the whole of Wales lies within the province of Canterbury. The four Welsh sees, however, extend beyond the borders of the twelve counties, for they include the whole of Monmouthshire and some portions of the English border shires; on the other hand, the sees of Hereford and Chester encroach upon the existing Welsh counties. The diocese of St Davids (Tyddewi), the largest, oldest and poorest of the four Cambrian sees, consists of the counties of Pembroke, Carmarthen and Cardigan, almost the whole of Brecon, the greater part of Radnor, and west Glamorgan with Swansea and Gower. The cathedral church of St Davids is situated near the remote headland of St Davids in Pembrokeshire, but the episcopal residence has been fixed ever since the Reformation at Abergwili near Carmarthen, the most central spot in this vast diocese. The see of Llandaff comprises Monmouthshire, all Glamorganshire as far west as the Tawe, and some parishes in Brecon and Hereford. The diocese of Bangor consists of the counties of Anglesea, Carnarvon and large portions of Merioneth and Montgomery. The diocese of St Asaph (Llanelwy) consists of the county of Denbigh, nearly the whole of Flint, with portions of Montgomery, Merioneth and Shropshire.

Since the beginning of the 19th century dissent has been strongly represented in the Principality, the combined numbers of the various Nonconformist bodies far outstripping the adherents of the Church. Universally accepted statistics as to the various religious bodies it has been found impossible to obtain, but the Report (1910) of the Welsh Church Commission stated that, exclusive of Roman Catholics, there were 743,361 communicants or fully admitted members of some denomination, of whom 193,081 were Churchmen and 550,280 Nonconformists. The gentry and landowners are all, broadly speaking, members of the established Church, but it is impossible to name any other class of society as belonging definitely either to "Church" or "Chapel." According to the above Report, the three most powerful dissenting bodies in Wales are the Congregationalists or Independents, whose members number 175,147 throughout Wales and Monmouthshire; the Calvinistic Methodists—a direct offshoot of the Church since the schism of 1811—with a membership of 170,617; and the Baptists, 143,835. Wesleyan and Presbyterian chapels are likewise numerous, and the Unitarian or Socinian body has long been powerful in the valley of the Teifi. Nearly every existing sect is represented in Wales, including Swedenborgians and Moravians. The Roman Catholic Church has many followers amongst the labouring population of Irish descent in the industrial districts. The diocese of Newport (known till 1896 as Newport and Menevia) consists of the counties of Monmouth, Glamorgan and Hereford; whilst the remaining eleven counties were in 1895 formed into the Vicariate of Wales, which in 1898 was erected into a diocese under a bishop with the title of Menevia. Since the expulsion of the religious orders from France in 1903 several communities of French monks and nuns have taken up their abode in the Principality.

History.—At the time of the Roman invasion of Britain, 55 B.C., four distinct dominant tribes, or families, are enumerated west of the Severn, viz. the Decangi, owning the island of Anglesea (Ynys Fôn) and the Snowdonian district; the Ordovices, inhabiting the modern counties of Denbigh, Flint and Montgomery; the Dimetae, in the counties of Cardigan, Carmarthen and Pembroke; and the Silures, occupying the counties of Glamorgan, Brecknock, Radnor and Monmouth. It is interesting to note that the existing four Welsh sees of Bangor, St Asaph, St Davids and Llandaff correspond in the main with the limits of these four tribal divisions. On the advance of Ostorius into western Britain, he met with considerable resistance from Caractacus (Caradog), king of the Silures, but after some encounters this prince was eventually captured and sent in chains to Rome. The partial conquest by Ostorius was completed under Julius Frontinus by the year 78, after which the Romans set to work in order to pacify and develop their newly annexed territory. At this period the copper mines of Mona or Anglesea, the silver mines near Plinlimmon and the gold mines in the valley of the Cothi in Carmarthenshire were exploited and worked with some success by the conquerors. In spite of the mountainous and boggy character of the country, roads were now constructed in all directions. Of these the most important are the military road leading S. from Deva (Chester) by way of Uriconium (Wroxeter) and Gobannium (Abergavenny) to Isca Silurum (Caerleon-on-Usk) and Venta Silurum (Caerwent); another from Deva to Conovium (Conway), whence a road, the Sarn Helen, extended due S. to Carmarthen (Maridunum), by way of Loventium (Pont Llanio), which was also connected with Gobannium; from Maridunum a road led E. through the modern county of Glamorgan by way of Leucarum (Loughor) and Nidum (Neath) to Venta Silurum. With the accession of Constantine, Christianity was introduced by the Romans into the parts of Wales already colonized, and the efforts of the Roman priests were later supplemented during the 5th, 6th and 7th centuries by the devoted labours of Celtic missionaries, of whom nearly five hundred names still remain on record. Foremost in the work of preaching and educating were SS. David, Teilo, Illtyd and Cadoc in Dyfed, Morganwg, Gwent and Brycheiniog, comprising South Wales; Cynllo, Afan and Padarn in Ceredigion and Maesyfed, or Mid-Wales; and Deiniol, Dunawd, Beuno, Kentigern and Asaph in North Wales. To this period succeeding the fall of the Roman power is also ascribed the foundation of the many great Celtic monasteries, of which Bangor-Iscoed on the Dee, Bardsey Island, Llancarvan and Llantwit Major in the Vale of Glamorgan, Caerleon-on-Usk and St Davids are amongst the most celebrated in early Welsh ecclesiastical annals. With the withdrawal of the Roman legions, the recognized powers of the *Dux Britanniarum*, the Roman official who governed the upper province of Britain, were in the 5th century assumed by the Celtic prince Cunedda under the title of Gwledig (the Supreme), who fixed his court and residence at Deganwy, near the modern Llandudno. During the 6th century the battle of Deorham gained by the West Saxons in 577 cut off communication with Cornwall, and in 613 the great battle of Chester, won by King Ethelfrith, prevented the descendants of Cunedda from ever again asserting their sovereignty over Strathclyde; the joint effect, therefore, of these two important Saxon victories was to isolate Wales and at the same time to put an end to all pretensions of its rulers as the inheritors of the ancient political claims of the Roman governors of the northern province of Britain. The 8th century saw a further curtailment of the Welsh territories under Offa, king of Mercia, who annexed Shrewsbury (Amwythig) and Hereford (Henfordd) with their surrounding districts, and constructed the artificial boundary known as Offa's Dyke running due N. and S. from the mouth of the Dee to that of the Wye. It was during these disastrous Mercian wars that there first appeared on the Welsh coasts the Norse and Danish pirates, who harried and burnt the small towns and flourishing monasteries on the shores of Cardigan Bay and the Bristol Channel. In the 9th century, however, the Welsh, attacked by land and sea, by Saxons and by Danes, at length obtained a prince capable of bringing the turbulent chieftains of his country into obedience, and of opposing the two sets of invaders of his realm. This was Rhodri Mawr, or Roderick the Great, a name always cherished in Cymric annals. Like Alfred of Wessex, Rhodri also built a fleet in order to protect Anglesea, "the mother of Wales," so called on account of its extensive cornfields which supplied barren Gwynedd with provisions. In 877 Rhodri, after many vicissitudes, was slain in battle, and his dominions of Gwynedd (North Wales), Deheubarth (South Wales) and Powys (Mid Wales) were divided amongst his three sons, Anarawd, Cadell and Mervyn. Consolidation of Cambro-British territory was found impossible; there was no settled capital; and the three princes fixed their courts respectively at Aberffraw in Anglesea, at Dynevor (Dinefawr) near Llandilo in Deheubarth, and at Mathrafal in Powys. Howel, son of Cadell, commonly known as Howel Dda the Good, is ever celebrated in Welsh history as the framer, or rather the codifier, of the ancient laws of his country, which were promulgated to the people at his hunting lodge, Ty Gwyn ar Tâf, near the modern Whitland. In Howel's code the prince of Gwynedd with his court at Aberffraw is recognized as the leading monarch in Wales; next to him ranks the prince of Deheubarth, and third in estimation is the prince of Powys. The laws of Howel Dda throw a flood of interesting light upon the ancient customs and ideas of early medieval Wales, but as their standard of justice is founded on a tribal and not a territorial system of society, it is easy to understand the antipathy with which the Normans subsequently came to regard this famous code. The dissensions of the turbulent princes of Gwynedd, Powys and Deheubarth, and of their no less quarrelsome chieftains, now rent the country, which was continually also a prey to Saxon incursions by land and to Scandinavian attacks by sea. Some degree of peace was, however, given to the distracted country during the reign of Llewelyn ap Seissyllt, the husband of Angharad, heiress of Gwynedd, who at length secured the overlordship or sovereignty of all Wales, and reigned till 1022. His son, Griffith ap Llewelyn, who, after having been driven into exile, recovered his father's realm in the battle of Pencader, Carmarthenshire, in 1041, for many years waged a war of varying success against Harold, earl of Wessex, but in 1062 he was treacherously slain, and Harold placed Wales under the old king's half-brothers, Bleddyn and Rhiwallon.

With the advent of the Normans, William the Conqueror, with the object of placing a firm feudal barrier between Wales and the earldom of Mercia, erected three palatine counties along the Cymric frontier. Thus Hugh the Wolf was placed in Chester (Caer), Roger de Montgomery at Shrewsbury and William Fitz-Osbern at Hereford. In 1081 William himself visited the Principality, and even penetrated as far west as St Davids. But the most important result of this first Norman invasion was to be found in the marvellous and rapid success of Robert Fitz-Hamon, earl of Gloucester, who, accompanied by a number of knightly adventurers, quickly overran South Wales, and erected a chain of castles stretching from the Wye to Milford Haven. The rich low-lying lands of Morganwg and Gwent were thus firmly occupied, nor were they ever permanently recovered by the Welsh princes; and such natives as remained were kept in subjection by the almost impregnable fortresses of stone erected at Caerphilly, Cardiff, Cowbridge, Neath, Kidwelly and other places. The important castles of Carmarthen and Pembroke were likewise built at this period. At the accession of William Rufus the domain of Gwynedd had been reduced to Anglesea and the Snowdonian district, and that of South Wales, or Deheubarth, to the lands contained in the basins of the rivers Towy and Teifi, known as Ystrad Tywi and Ceredigion. Griffith ap Cynan, of the royal house of Gwynedd, who had been first an exile in Ireland, and later a prisoner at Chester, once more returned to his native land, and defied the Norman barons with success, whilst Henry I. vainly endeavoured to make his liege and follower, Owen of Powys, ruling prince in Wales. Meanwhile the house of Dynevor once more rose to some degree of power under Griffith ap Rhys, whose father, Rhys ap Tudor, had been slain in 1093. The confused reign of Stephen was naturally favourable to the development of Cymric liberty, and with such strong princes as Owen, son of Griffith ap Cynan, heir to the throne of Gwynedd, and with Griffith ap Rhys ruling at Dynevor, the prospects of the Cymry grew brighter. In 1136 the army of Griffith ap Rhys met with a large English force near Cardigan, composed of the denizens of the South Wales castles and of the hated Flemish colonists, who had been lately planted by Henry I. in Dyfed. A fierce engagement took place wherein the Norman and Flemish troops were utterly routed, and the victorious Cymry slew thousands of their fugitives at the fords of the Teifi close to the town of Cardigan. The following year (1137) saw the deaths of the two powerful princes, Griffith ap Cynan, "the sovereign and protector and peacemaker of all Wales," and Griffith ap Rhys, "the light and the strength and the gentleness of the men of the south." With the accession of Henry II. peace was made with Owen of Gwynedd, the successor of Griffith ap Cynan, and with Rhys ap Griffith of South Wales. In 1169 Owen Gwynedd died and was buried in Bangor cathedral after a reign of 33 years, wherein he had successfully defended his own realm and had done much to bring about that union of all Wales which his grandson was destined to complete. On the other hand, "The Lord Rhys," as he is usually termed, did homage to Henry II. at Pembroke in 1171, and was appointed the royal justiciar of all South Wales. At the castle of Cardigan in 1176, Prince Rhys held a historic bardic entertainment, or *eisteddfod*, wherein the poets and harpists of Gwynedd and Deheubarth contended in amicable rivalry. This enlightened prince died in 1196, and as at his death the house of Dynevor ceased to be of any further political importance, the overlordship of all Wales became vested indisputably in the house of Gwynedd, which from this point onwards may be considered as representing in itself alone the independent principality of Wales. The prince of Gwynedd henceforth considered himself as a sovereign, independent, but owing a personal allegiance to the king of England, and it was to obtain a recognition of his rights as such that Llewelyn ap Iorwerth, "the Great," consistently strove under three English kings, and though his resources were small, it seemed for a time as though he might be able by uniting his countrymen to place the recognized autonomy of Gwynedd on a firm and enduring basis. By first connecting himself with John through his marriage with the English king's daughter Joan, by straining every nerve to repress dissensions and enforce obedience amongst the Welsh chieftains, and later by allying himself with the English barons against his suzerain, this prince during a reign of 44 years was enabled to give a considerable amount of peace and prosperity to his country, which he persistently sought to rule as an independent sovereign, although acknowledging a personal vassalage to the king of England.

The close of the 12th century saw the final and complete subjection of the ancient Cambro-British Church to the supremacy of Canterbury. As part of the Roman Upper Province of Britain, Wales would naturally have fallen under the primacy of York, but the Welsh sees had continued practically independent of outside control during Saxon times. The bishops of St Davids had from time to time claimed metropolitan rights over the remaining sees, but in 1115 St Anselme's appointment of the monk Bernard (d. 1147) to St Davids, in spite of the opposition of the native clergy, definitely marked the end of former Welsh ecclesiastical independence. In 1188 Archbishop Baldwin with a distinguished train, whilst preaching the Third Crusade, made an itinerary of the Welsh sees and visited the four cathedral churches, thereby formally asserting the supremacy of Canterbury throughout all Wales. But in 1199 the celebrated Gerald de Barri (Giraldus Cambrensis), archdeacon of Brecon and a member of the famous Norman baronial house of de Barri, and also through his grandmother Nesta a great-grandson of Prince Rhys ap Tudor of Deheubarth, was elected bishop by the chapter of St Davids. This enthusiastic priest at once began to re-assert the ancient metropolitan claims of the historic Welsh see, and between the years 1199–1203 paid three visits to Rome in order to obtain the support of Pope Innocent III. against John and Archbishop Hubert, who firmly refused to recognize Gerald's late election. Innocent was inclined to temporize, whilst the Welsh chieftains, and especially Gwenwynwyn of Powys, loudly applauded Gerald's action, but Llewelyn ap Iorwerth himself prudently held aloof from the controversy. Finally, in 1203, Gerald was compelled to make complete submission to the king and archbishop at Westminster, and henceforth Canterbury remained in undisputed possession of the Welsh sees, a circumstance that undoubtedly tended towards the later union of the two countries.

In 1238 Llewelyn, growing aged and infirm, summoned all his vassals to a conference at the famous Cistercian abbey of Strata Florida, whereat David, his son by the Princess Joan of England, was acknowledged his heir by all present. Two years later Llewelyn, the ablest and most successful of all the Welsh princes, expired and was buried in the monastery of his own foundation at Aberconway. He was succeeded by David II., at whose death without children in 1246 the sovereignty of Gwynedd, and consequently of Wales, reverted to his three nephews, sons of his half-brother Griffith, who had perished in 1244 whilst trying to escape from the Tower of London, where Henry III. was holding him as hostage for the good behaviour of Prince David. Of Griffith's three sons, Owen, Llewelyn and David, the most popular and influential was undoubtedly Llewelyn, whose deeds and qualities were celebrated in extravagant terms by the bards of his own day, and whose evil fate has ever been a favourite theme of Welsh poets. Though to this, the last prince of Wales, political sagacity and a firm desire for peace have often been ascribed, it must be admitted that he showed himself both turbulent and rash at a time when the most cautious diplomacy on his part was essential for his country's existence. For Edward, Henry III.'s son and heir, who had been created earl of Chester by his father and put in possession of all the royal claims in Wales, was generally credited with a strong determination to crush for ever Welsh independence, should a fitting opportunity to do so present itself. Nevertheless, the hostile policy of Llewelyn, who had closely associated himself with the cause of Simon de Montfort and the barons, was at first successful. For after the battle of Evesham a treaty was concluded between the English king and the Welsh prince at Montgomery, whereby the latter was confirmed in his principality of Gwynedd and was permitted to receive the homage of all the Welsh barons, save that of the head of the house of Dynevor, which the king reserved to himself; whilst the four fertile *cantrefs* of Perfeddwlad, lying between Gwynedd and the earldom of Chester, were granted to the prince. Llewelyn was, however, foolish enough to lose the results of this very favourable treaty by intriguing with the de Montfort family, and in 1273 he became betrothed to Eleanor de Montfort, the old Earl's only daughter, a piece of political folly which may possibly in some degree account for Edward's harsh treatment of the Welsh prince. In 1274 Llewelyn refused to attend at Edward's coronation, although the Scottish king was present. In 1276 Edward entered Wales from Chester, and after a short campaign brought his obstinate vassal to submit to the ignominious treaty of Conway, whereby Llewelyn lost almost all the benefits conferred on him by the compact of Montgomery ten years before. Llewelyn, utterly humbled, now behaved with such prudence that Edward at last sanctioned his marriage with Eleanor de Montfort (although such an alliance must originally have been highly distasteful to the English king), and the ceremony was performed with much pomp in Worcester Cathedral in 1278. In 1281 discontent with the king and his system of justice had again become rife in Wales, and at this point the treacherous Prince David, who had hitherto supported the king against his own brother, was the first to proclaim a national revolt. On Palm Sunday 1282, in a time of peace, David suddenly attacked and burnt Hawarden Castle, whereupon all Wales was up in arms. Edward, greatly angered and now bent on putting an end for ever to the independence of the Principality, hastened into Wales; but whilst the king was campaigning in Gwynedd, Prince Llewelyn himself was slain in an obscure skirmish on the 11th of December 1282 at Cefn-y-bedd, near Builth on the Wye, whither he had gone to rouse the people of Brycheiniog. Llewelyn's head was brought to Edward at Conway Castle, who ordered it to be exhibited in the capital, surrounded by a wreath of ivy, in mocking allusion to an ancient Cymric prophecy concerning a Welsh prince being crowned in London. His body is said, on doubtful authority, to have been buried honourably by the monks of Abbey Cwm Hir, near Rhayader. Llewelyn's brother, now David III., designated by the English "the last survivor of that race of traitors," for a few months defied the English forces amongst the fastnesses of Snowdon, but ere long he was captured, tried as a disloyal English baron by a parliament at Shrewsbury, and finally executed under circumstances of great barbarity on the 3rd of October 1283. With David's capture practically all serious Welsh resistance to the English arms ceased, if we except the unsuccessful attempt made to rouse the crushed nation in 1293 by Llewelyn's natural son, Madoc, who ended his days as a prisoner in the Tower of London.

Having suppressed the independence of Wales, Edward now took steps to keep Gwynedd itself in permanent subjection by building the castles of Conway, Carnarvon, Criccieth and Harlech within the ancient patrimony of the princes of North Wales, whose legitimate race was now extinct save for Llewelyn's daughter Gwenllian, who had entered the convent of Sempringham. In April 1284 Queen Eleanor, who had meanwhile joined her husband in Wales, gave birth to a son in the newly built castle of Carnarvon, and this infant the victorious king, half in earnest and half in jest, presented to the Welsh people for a prince who could speak no word of English. On the 7th of February 1301, Edward of Carnarvon was formally created "prince of Wales" by his father, and henceforward the title and honours of Prince of Wales became associated with the recognized heir of the English crown.

By the Statute, or rather Ordinance of Rhuddlan, promulgated in 1284, many important changes were effected in the civil administration of Wales. Glamorgan and the county palatine of Pembroke had hitherto been the only portions of the country subject to English shire law, but now Edward parcelled out the ancient territory of the princes of Gwynedd and of Deheubarth into six new counties, with sheriffs, coroners and bailiffs. Thus Anglesea, Carnarvon, Merioneth and Flint were erected in North Wales; whilst out of the districts of Ystrad Tywi and Ceredigion in South Wales, the old dominions of the house of Dynevor, the counties of Carmarthen and Cardigan were formed. The old Welsh land tenure by gavelkind was, however, still permitted to remain in force amongst the natives of all Wales, whilst it was henceforth arranged to administer justice in the eight counties by special royal judges, and in the Marches by the officers appointed by the various lords-marchers according to the terms of their tenure. Another distinguishing mark of Edward's policy towards Wales is to be found in the commercial and administrative powers given to the fortified towns, inhabited solely by people of English birth and by Welshmen who acquiesced in English rule. Municipal charters and market privileges were now granted to such towns as Cardiff, Carmarthen, Builth, Cardigan, Montgomery, Aberystwith, Newborough, &c., and this wise policy was continued under Edward II. and Edward III. Many of the turbulent Welsh warriors having now become mercenaries on the continent or else enlisted under the English king, and the whole of the land west of Severn at last enjoying internal peace, the commercial resources of Wales were developed in a manner that had hitherto not been possible. Coal, copper, timber, iron, and especially wool, were exported from the Principality, and by the Statute Staple of 1353 Carmarthen was declared the sole staple for the whole Welsh wool trade, every bale of wool having first to be sealed or "cocketed" at this important town, which during the 14th century may almost be accounted as the English capital of the Principality, so greatly was it favoured by the Plantagenet monarchs. A natural result of this partial treatment of the towns by the king and his vassals was that the English tongue and also English customs became prevalent if not universal in all the towns of Wales, whilst the rural districts remained strongly Cymric in character, language and sympathy.

After more than a century of enforced repose in the land and of prosperity in the towns, all Wales was suddenly convulsed by a wide-spread revolt against the English crown, which reads more like a tale of romance than a piece of sane history. The deposition of Richard II. and the usurpation of Henry IV., combined with the jealousy of the rural inhabitants of Wales against the privileged dwellers of the towns, seem to have rendered the country ripe for rebellion. Upon this troubled scene now appeared Owen Glendower (Owain Glyndwfrdwy: died ? 1415), a descendant of the former princes of Powys and a favourite courtier of the late King Richard, smarting under the effect of personal wrongs received from Henry of Lancaster. With a success and speed that contemporary writers deemed miraculous, Owen stirred up his countrymen against the king, and by their aid succeeded in destroying castle after castle, and burning town after town throughout the whole length and breadth of the land between the years 1401 and 1406. In 1402 he routed the forces of the Mortimers at Bryn Glas near Knighton in Maesyfed, where he captured Sir Edmund Mortimer, the uncle and guardian of the legitimate heir to the English throne, the young earl of March. The aims of Owen were described by himself in a letter addressed to Charles VI., king of France, who had hastened to acknowledge the upstart as Prince of Wales and had sent 12,000 troops on his behalf to Milford Haven. In this letter Owen, who was holding his court in Llanbadarn near Aberystwith, demands his own acknowledgment as sovereign of Wales; the calling of a free Welsh parliament on the English model; the independence of the Welsh Church from the control of Canterbury; and the founding of national colleges in Wales itself. An assembly of Welsh nobles was actually summoned to meet in 1406 at Machynlleth in an ancient building still standing and known to this day as "Owen Glendower's Parliament House." In vain did Henry and his lords-marchers endeavour to suppress the rebellion, and to capture, by fair means or foul, the person of Glendower himself; the princely adventurer seemed to bear a charmed existence, and for a few years Owen was practically master of all Wales. Nevertheless, his rule and power gradually declined, and by the year 1408 Owen himself had disappeared as suddenly and mysteriously as he had arisen, and the land once more fell into undisputed possession of the king and his chosen vassals. For Owen's brilliant but brief career and ruthless treatment of English settlers and Anglophil Welshmen, his countrymen had not unnaturally to pay a heavy penalty in the severe statutes which the affrighted parliaments of Henry IV. framed for the protection of the English dwellers in Wales and the border counties, and which were not repealed until the days of the Tudors. Of the part played by the Cymry during the wars of the Roses it is needless to speak, since the period forms a part of English rather than of Welsh history. The Yorkist faction seems to have been strongest in the eastern portion of the Principality, where the Mortimers were all-powerful, but later the close connexion of the house of Lancaster with Owen Tudor, a gentleman of Anglesea (beheaded in 1461) who had married Catherine of France, widow of Henry V., did much to invite Welsh sympathy on behalf of the claims of Henry Tudor his grandson, who claimed the English throne by right of his grandmother. Through the instrumentality of the celebrated Sir Rhys ap Thomas (1451–1527), the wealthiest and the most powerful personage in South Wales, Henry Tudor, earl of Richmond, on his landing at Milford Haven in 1485 found the Welsh ready to rise in his behalf against the usurper Richard III. With an army largely composed of Sir Rhys's adherents, Henry was enabled to face Richard III. at Bosworth, and consequently to obtain the crown of England. Thus did a Welshman revenge the ignominious deaths of Prince Llewelyn and Prince David by becoming two centuries later king of England and prince of Wales.

With the Tudor dynasty firmly seated on the throne, a number of constitutional changes intended to place Welsh subjects on a complete social and political equality with Englishmen have to be recorded. The all-important Act of Union 1536 (27 Henry VIII.), converted the whole of the Marches of Wales into shire ground, and created five new counties: Denbigh, Montgomery, Radnor, Brecknock, or Brecon and Monmouth. At the same time the remaining lordships were added to the English border counties of Gloucester, Shropshire and Hereford, and also to the existing Welsh shires of Cardigan, Carmarthen, Glamorgan and Pembroke, all of which found their boundaries considerably enlarged under this statute. Clause 26 of the same act likewise enacted that the 12 Welsh counties should return 24 members to the English parliament: one for each county, one for the boroughs in each county (except Merioneth), and one for the town and county of Haverfordwest. It is probable that Welsh members attended the parliaments of 1536 and 1539, and certain it is that they were present at the parliament of 1541 and every parliament subsequently held. This act of union was followed in 1542 by an "Act for certain Ordinances in the King's Majesty's Dominion and Principality of Wales" (34 & 35 Henry VIII.), which placed the court of the president and council of Wales and the Marches on a legal footing. This court, with a jurisdiction somewhat similar to that of the Star Chamber, had originally been called into being under Edward IV. with the object of suppressing private feuds and other illegalities amongst the lords-marchers and their retainers. This council of Wales, the headquarters of which had been fixed at Ludlow, undoubtedly did good service on behalf of law and order under such capable presidents as Bishop Rowland Lee and William Herbert, earl of Pembroke; but it had long ceased to be of any practical use, and had in fact become an engine of oppression by the time of the Commonwealth, although it was not definitely abolished till the revolution of 1688. The act of 1542 also enacted that courts of justice under the name of "The King's Great Sessions in Wales" should sit twice a year in every one of the counties of Wales, except Monmouth, which was thus formally declared an English shire. For this purpose four circuits, two for North and two for South Wales, each circuit containing a convenient group of three counties, were created; whilst justices of the peace and *custodes rotulorum* for each shire were likewise appointed. At the same time all ancient Welsh laws and customs, which were at variance with the recognized law of England, were now declared illegal, and Cymric land tenure by gavelkind, which had been respected by Edward I., was expressly abolished and its place taken by the ordinary practice of primogeniture. It was also particularly stated that all legal procedure must henceforth be conducted in the English tongue, an arrangement which fell very heavily on poor monoglot Welshmen and appears an especially harsh and ungracious enactment when coming from a sovereign who was himself a genuine Welshman by birth. Under the system of the Great Sessions justice was administered throughout the twelve counties of Wales for nearly three hundred years, and it was not until 1830 that this system of jurisdiction was abolished (not without some protest from Welsh members at Westminster), and the existing North and South Wales circuits were brought into being.

With the peaceful absorption of the Principality into the realm of the Tudor sovereigns, the subsequent course of Welsh history assumes mainly a religious and educational character. The influence of the Renaissance seems to have been tardy in penetrating into Wales itself, nor did the numerous ecclesiastical changes during the period of the Reformation cause any marked signs either of resentment or approval amongst the mass of the Welsh people, although some of the ancient Catholic customs lingered on obstinately. As early as the reign of Henry VIII. there were, however, to be found at court and in the universities a number of ardent and talented young Welshmen, adherents mostly of the reforming party in Church and State, who were destined to bring about a brilliant literary revival in their native land during the reigns of Elizabeth and James I. Of this distinguished band the most memorable names are those of Bishop Richard Davies (*c.* 1501–1581) and of William Salesbury, the squire-scholar of Llanrwst (*c.* 1520–*c.* 1600) in Denbighshire, who is commonly credited with the honour of having produced the first printed book in the Welsh language, a small volume of proverbs published in London about the year 1545. With the accession of Elizabeth a novel and vigorous ecclesiastical policy on truly national lines was now inaugurated in Wales itself, chiefly through the instrumentality of Richard Davies, nominated bishop of St Asaph in 1559 and translated thence to St Davids in 1561, who was mainly responsible for the act of parliament of 1563, commanding the bishops of St Davids, Llandaff, Bangor, St Asaph and Hereford to prepare with all speed for public use Welsh translations of the Scriptures and the Book of Common Prayer. Of the five prelates thus named, Davies alone was competent to undertake the task, and for assistance in the work of translation he called upon his old friend and former neighbour, William Salesbury, who like the bishop was an excellent Greek and Hebrew scholar. The pair laboured with such diligence that before the close of the year 1567 the required translations of the Liturgy and the New Testament were published in London; the former being the exclusive work of the bishop, whilst the latter was principally the product of Salesbury's pen, although some portions of it were contributed by Bishop Davies and by Thomas Huet, or Hewett, precentor of St Davids (d. 1591). Having accomplished so much in so small a space of time, the two friends were next engaged upon a translation of the Old Testament, but owing to a quarrel, the cause of which remains obscure, this interesting literary partnership was brought to an abrupt ending about 1570. The honour of presenting his countrymen with a complete Welsh version of the Bible was reserved for William Morgan (*c.* 1547–1604), vicar of Llanrhayader, in Denbighshire, and afterwards bishop successively of Llandaff and of St Asaph. For eight years Morgan was busied with his self-imposed task, being greatly encouraged thereto by Archbishop Whitgift, by Bishop William Hughes (d. 1600) of St Asaph, and by other leading dignitaries of the Church both in England and in Wales. In December 1588 the first complete Welsh Bible, commonly known as "Bishop Morgan's Bible," was issued from the royal press at Westminster under the patronage of queen and primate, about 800 copies being supplied for distribution amongst the parish churches of Wales. This famous *editio princeps* of the Welsh Bible, first and foremost of Welsh classics, was further supplemented under James I. by the Authorized Version, produced by Richard Parry (1560–1623), bishop of St Asaph, with the help of Dr John Davies of Mallwyd (1570–1644), the first great Welsh lexicographer. At the tercentenary of "Bishop Morgan's Bible" in 1888 a national movement of appreciation was set on foot amongst Welshmen of all denominations both at home and abroad, with the result that a memorial cross was erected in the cathedral close of St Asaph in order to perpetuate the names and national services of the eight leading Welsh translators of the Scriptures:—Bishops Davies, Morgan and Parry; William Salesbury; Thomas Huet; Dr Davies of Mallwyd; Archdeacon Edmund Prys (1541–1624), author of a popular Welsh metrical version of the Psalter; and Gabriel Goodman, dean of Westminster (1528–1601), a native of Ruthin, who greatly assisted Bishop Morgan in his task. Two circumstances attending the production of these Welsh translations should be noted:—(1) That the leaders of this remarkable religious, literary and educational revival within the Principality were chiefly natives of North Wales, where for many years St Asaph was regarded as the chief centre of Cambro-British intellectual life; and (2) that all these important works in the Welsh tongue were published of necessity in London, owing to the absence of an acknowledged capital, or any central city of importance in Wales itself.

It would be well-nigh impossible to exaggerate the services rendered to the ancient British tongue, and consequently to the national spirit of Wales, by these Elizabethan and Jacobean translations, issued in 1567, 1588 and 1620, which were able definitely to fix the standard of classical Welsh, and to embody the contending dialects of Gwynedd, Dyfed and Gwent for all time in one literary storehouse. But for this sudden revival of Cymric literature under the patronage of Elizabeth (for the obtaining of which Wales must ever owe a deep debt of gratitude to Bishop Richard Davies, "her second St David"), there is every reason to believe that the ancient language of the Principality must either have drifted into a number of corrupt dialects, as it then showed symptoms of doing, or else have tended to ultimate extinction, much as the Cornish tongue perished in the 17th century.

The growth of Puritanism in Wales was neither strong nor speedy, although the year 1588, which witnessed the appearance of Bishop Morgan's Bible, also gave birth to two fierce appeals to the parliament, urging a drastic Puritanical policy in Wales, from the pen of the celebrated John Penry, a native of Brecknockshire (1559–1593). Far more influential than Penry amongst the Welsh were Rhys Prichard (? 1579–1644), the famous vicar of Llandovery,[1] Carmarthenshire, and William Wroth (d. 1642), rector of Llanfaches, Monmouthshire. Of these two Puritan divines, Vicar Prichard, who was essentially orthodox in his behaviour, forms an interesting connecting link between the learned Elizabethan translators of the Bible and the great revivalists of the 18th century, and his moral rhymes in the vernacular, collected and printed after his death under the title of *The Welshman's Candle* (Canwyll y Cymry), still retain some degree of popularity amongst his countrymen. Although a strong opponent of Laud's and Charles's ecclesiastical policy, Prichard lived unmolested, and even rose to be chancellor of St Davids; but the indiscreet Wroth, "the founder and father of nonconformity in Wales," being suspended in 1638 by Bishop Murray of Llandaff, founded a small community of Independents at Llanfaches, which is thus commonly accounted the first Nonconformist chapel in Wales. During the years prior to the Great Rebellion, however, in spite of the preaching and writings of Vicar Prichard, Wroth and others, the vast mass of Welshmen of all classes remained friendly to the High Church policy of Laud and staunch supporters of the king's prerogative. Nor were the effects of the great literary revival in Elizabeth's reign by any means exhausted, for at this time Wales undoubtedly possessed a large number of native divines that were at once active parish priests and excellent scholars, many of whom had been educated at Jesus College, Oxford, the Welsh college endowed by Dr Hugh Price (d. 1574) and founded under Elizabeth's patronage in 1573. So striking was the devotion shown throughout the Principality to the king, who fought his last disastrous campaign in the friendly counties of Wales and the Marches, that on the final victory of the parliament there was passed within a month of Charles's execution in 1649 (perhaps as a special measure of punishment) an "Act for the better Propagation and Preaching of the Gospel in Wales," by the terms of which a packed body of seventy commissioners was presented with powers that were practically unlimited to deal with all matters ecclesiastical in Wales. To assist these commissioners in their task of inquiry and ejectment, a body of twenty-five "Approvers" was likewise constituted, with the object of selecting itinerant preachers to replace the dismissed incumbents; and amongst the Approvers are conspicuous the names of Walter Cradock (d. 1659), a suspended curate of St Mary's, Cardiff, and a follower of Wroth's; and of Vavasor Powell (1617–1670), an honest but injudicious zealot. Some 330 out of a possible total of 520 incumbents were now ejected in South Wales and Monmouthshire, and there is every reason to suppose that the beneficed clergy of North Wales suffered equally under the new system. The greed and tyranny of several of the commissioners, and the bigotry and mismanagement of well-meaning fanatics such as Cradock and Powell, soon wrought dire confusion throughout the whole Principality, so that a monster petition, signed alike by moderate Puritans and by High Churchmen, was prepared for presentation to parliament in 1652 by Colonel Edward Freeman, attorney-general for South Wales. Despite the fierce efforts of Vavasor Powell and his brother itinerant preachers to thwart the reception of this South Wales petition at Westminster, Colonel Freeman was able to urge the claims of the petitioners, or "Anti-Propagators" as they were termed, at the bar of the House of Commons, openly declaring that by the late policy of ejectment and destruction "the light of the Gospel was almost extinguished in Wales." A new commission was now appointed to inquire into alleged abuses in Wales, and the existing evidence clearly shows how harsh and unfair was the treatment meted out to the clergy under the act of 1649, and also how utterly subversive of all ancient custom and established order were the reforms suggested by the commissioners and approvers. At the Restoration all the ejected clergy who survived were reinstated in their old benefices under the Act of Uniformity of 1662, whilst certain Puritan incumbents were in their turn dismissed for refusing to comply with various requirements of that act. Amongst these Stephen Hughes of Carmarthen (1623–1688), a devoted follower of Vicar Prichard and an editor of his works, was ejected from the living of Mydrim in Carmarthenshire, whereby the valuable services of this eminent divine were lost to the Church and gained by the Nonconformists, who had increased considerably in numbers since the Civil Wars. The old ecclesiastical policy of Elizabeth, which had hitherto borne such good fruit in Wales, was now gradually relaxed under the later Stuarts and definitely abandoned under Anne, during whose reign only Englishmen were appointed to the vacant Welsh sees. From 1702 to 1870, a period of nearly 170 years, no Welsh-speaking native bishop was nominated (with the solitary exception of John Wynne, consecrated to St Asaph in 1715), and it is needless to point out that this selfish and unjust policy was largely responsible for the neglect and misrule which distinguished the latter half of the 18th and the early part of the 19th centuries. The Church, which had so long played a prominent and valuable part in the moral and literary education of the Welsh people, was now gradually forced out of touch with the nation through the action of alien and unsympathetic Whig prelates in Wales itself, which still remained mainly High Church and Jacobite in feeling.

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[1] Sometimes known as vicar of Llandingat, his church being in that parish.

All writers agree in stating that the mass of the Welsh people at the close of the 17th century were illiterate, and many divines of Cymric nationality charge their countrymen also with immorality and religious apathy. English was little spoken or understood amongst the peasant population, and there was a great dearth of Welsh educational works. Some efforts to remedy this dark condition of things had already been made by Thomas Gouge, with the assistance of Stephen Hughes, and also by the newly founded "Society for the Promotion of Christian Knowledge"; but it was Griffith Jones (1683–1761), rector of Llanddowror in south Carmarthenshire, who was destined to become the true pioneer of Welsh education, religious and secular. Early in the reign of George I. this excellent man, whose name and memory will ever be treasured so long as the Welsh tongue survives, began a system of catechizing in the vernacular amongst the children and adults of his own parish. With the cordial help of Sir John Philipps (d. 1736) of Picton Castle, the head of an ancient family in Dyfed, and of Mrs Bridget Bevan of Laugharne (d. 1779), who is still affectionately remembered in Wales as the donor of "Madam Bevan's Charity," Griffith Jones was enabled to extend his scheme of educating the people throughout South Wales, where numerous "circulating charity schools," as they were called, were set up in many parishes with the approval of their incumbents. The results obtained by the growth of these schools were speedy and successful beyond the wildest hopes of their founder. This educational system, invented by Griffith Jones and supported by the purse of Mrs Bevan, in 1760 numbered 215 schools, with a total number of 8687 contemporary scholars; and by the date of Jones's death in 1761 it has been proved that over 150,000 Welsh persons of every age and of either sex, nearly a third of the whole population of Wales at that time, were taught to read the Scriptures in their own language by means of these schools. With this newly acquired ability to read the Bible in their own tongue, the many persons so taught were not slow to express a general demand for Cymric literature, which was met by a supply from local presses in the small country towns; the marvellous success of the Welsh circulating charity schools caused in fact the birth of the Welsh vernacular press. In spite, however, of the marked improvement in the conditions and behaviour of the Welsh people, owing to this strictly orthodox revival within the pale of the Church, Griffith Jones and his system of education were regarded with indifference by the English prelates in Wales, who offered no preferment and gave little encouragement to the founder of the circulating schools. Meanwhile the writings and personal example of the pious rector of Llanddowror were stirring other Welshmen in the work of revival, chief amongst them being Howell Harris of Trevecca (1713–1773), a layman of brilliant abilities but erratic temperament; and Daniel Rowland (1713–1790), curate of Llangeitho in Mid-Cardiganshire, who became in time the most eloquent and popular preacher throughout all Wales. Two other clergymen, who figure prominently in the Methodist movement, and whose influence has proved lasting, were Peter Williams of Carmarthen (1722–1796), the Welsh Bible commentator, and William Williams of Pantycelyn (1717–1791), the celebrated Welsh hymn-writer. Incidentally, it will be noticed that this important Methodist revival had its origin and found its chief supporters and exponents in a restricted corner of South Wales, of which Carmarthen was the centre, in curious contrast with the literary movement in Elizabeth's reign, which was largely confined to the district round St Asaph.

During the lifetime of Griffith Jones the course of Welsh Methodism had run in orthodox channels and had been generally supported by the Welsh clergy and gentry; but after his death the tendency to exceed the bounds of conventional Church discipline grew so marked as to excite the alarm of the English bishops in Wales. Nevertheless, the bulk of the Methodists continued to attend the services of the Church, and to receive the sacraments from regularly ordained parish priests, although a schism was becoming inevitable. Towards the close of the 18th century the Methodist revival spread to North Wales under the influence of the celebrated Thomas Charles, commonly called Charles of Bala (1755–1814), formerly curate of Llanymowddwy and the founder of Welsh Sunday schools. So strained had the relations between the English rulers of the Church and the Methodists themselves now grown, that in 1811 the long-expected schism took place, much to the regret of Charles of Bala himself, who had ever been a devoted disciple of Griffith Jones. The great bulk of the farming and labouring members of the Church now definitely abandoned their "Ancient Mother," to whom, however, the Welsh gentry still adhered. The Great Schism of 1811 marks in fact the lowest point to which the fortunes of the once powerful and popular Church in Wales had sunk;—in 1811 there were only English-speaking prelates to be found, whilst the abuses of non-residence, pluralities and even nepotism were rampant everywhere. As instances of this clerical corruption then prevailing in Wales, mention may be made of the cases of Richard Watson (d. 1816), the non-resident bishop of Llandaff, who rarely visited his diocese during an episcopate of thirty years; and of another English divine who held the deanery, the chancellorship and nine livings in a North Welsh see, his curates-in-charge being paid out of Queen Anne's Bounty, a fund expressly intended for the benefit of impoverished livings. An honourable exception to the indolent and rapacious divines of this stamp was Thomas Burgess (bishop of St Davids), to whose exertions is mainly due the foundation of St David's College at Lampeter in 1822, an institution erected to provide a better and cheaper education for intending Welsh clergymen. The foundation of Lampeter College was one of the earliest signs of a new era of revived vigour and better government within the Church, although it was not till 1870 that, by Mr Gladstone's appointment of Dr Joshua Hughes to the see of St Asaph, the special claims of the Welsh Church were officially recognized, and the old Elizabethan policy was one more reverted to after a lapse of nearly two hundred years. After 1870 Welsh ecclesiastical appointments were made in a more truly national spirit, and this official acknowledgment of the peculiar duties and claims of the Church in Wales largely helped to win back no small amount of the strength and popularity that had been lost during Georgian times.

With the old national Church enthralled by English political prelates, and consequently hindered from ministering to the special needs of the people, the progress of dissent throughout the Principality was naturally rapid. Although primary education was largely supplied by the many Church schools in all parts of Wales, yet it was in the three most important denominations—the Congregationalists, the Baptists and the Calvinistic Methodists (that new-born sect of which the Church herself was the unwilling parent)—that almost all Welsh spiritual development was to be found during the first half of the 19th century. Thus between the year 1811 (the date of the Methodist secession) and 1832 (the year of the great Reform Bill), the number of dissenting chapels had risen from 945 to 1428: a truly marvellous increase even allowing for the speedy growth of population, since every chapel so built had of necessity to be well attended in order to render it self-supporting. From this religious guidance of the people by the well-organized forces of dissent, it was but a step to political ascendancy, and as the various constitutional changes from the Reform Bill onward began to lower the elective franchise, and thus to throw more and more power into the hands of the working classes, that spirit of radicalism, which is peculiarly associated with political dissent, began to assert itself powerfully throughout the country. As early as the reign of William IV. there appeared the weekly *Times of Wales* (Amserau Cymry), founded and edited by the able William Rees, who may be styled the father of the Welsh political press; and the success of Rees's venture was so marked that other journals, arranged to suit the special tenets of each sect, speedily sprang into existence. In the year 1870—a date that for many reasons marks the opening of an important era in modern Welsh history—the dissenting bodies of Wales were supporting two quarterly, sixteen monthly and ten weekly papers, all published in the vernacular and all read largely by peasants, colliers and artisans. With so powerful a press behind it, it is no wonder that Welsh political dissent was largely responsible for the changed attitude of the Imperial government in its treatment of the Principality—as evinced in the Sunday Closing Act of 1881, a measure which was very dear to the strong temperance party in Wales, and in the Welsh Intermediate Education Act, granted by Lord Salisbury's government in 1889. It was certainly owing to the pressure of Welsh political dissent that Lord Rosebery's cabinet issued the Welsh Land Tenure Commission in 1893—an inquiry which did much to exonerate the Welsh squirearchy from a number of vague charges of extortion and sectarian oppression; and that Sir H. Campbell-Bannerman's cabinet appointed the Welsh Church Commission (21st June 1906). This Commission was authorized to "inquire into the origin, nature, amount and application of the temporalities, endowments and other properties of the Church of England in Wales and Monmouthshire; and into the provision made and the work done by the Churches of all denominations in Wales and Monmouthshire for the spiritual welfare of the people, and the extent to which the people avail themselves of such provision." The Report and Memoranda of the Commission were published on the 2nd of December 1910.

Mention must be made of the Rebecca riots in 1843–1844 in South Wales, wherein many toll gates were destroyed by mobs of countrymen dressed in female garb, "as the daughters of Rebecca about to possess the gates of their enemies"; and the Anti-Tithe agitation of 1885–1886—largely traceable to the inflammatory language used concerning clerical tithe by certain organs of the vernacular press—which led to some disorderly scenes between distraining parties of police and crowds of excited peasants in the more remote rural districts. There have been occasional strikes accompanied by acts of lawlessness in the industrial and mining districts of Glamorganshire, and also amongst the workmen employed in the quarries of Gwynedd.

The University College of Wales was founded at Aberystwyth in 1872; that of South Wales at Cardiff in 1883; and of North Wales at Bangor in 1884. In 1889 the system of intermediate schools, arranged to form an educational link between the primary schools and the colleges, was inaugurated. In November 1893 the University of Wales was incorporated by royal charter, with Lord Aberdare (d. 1895) as its first chancellor. All the religious bodies, including the Church, have been extremely active in educational and pastoral work; whilst the peculiar religious movement known as a revival (Diwygiad) has occurred from time to time throughout the Principality, notably in the years 1859 and 1904.

But the most remarkable phenomenon in modern Wales has been the evident growth of a strong national sentiment, the evolution of a new Welsh Renaissance, which demanded special recognition of the Principality's claims by the Imperial parliament. This revived spirit of nationalism was by outsiders sometimes associated, quite erroneously, with the aims and actions of the Welsh parliamentary party, the spokesmen of political dissent in Wales; yet in reality this sentiment was shared equally by the clergy of the Established Church, and by a large number of the laity within its fold. Nor is the question of the vernacular itself of necessity bound up with this new movement, for Wales is essentially a bi-lingual country, wherein every educated Cymro speaks and writes English with ease, and where also large towns and whole districts—such as Cardiff, south Monmouth, the Vale of Glamorgan, Gower, south Glamorgan, south Pembroke, east Flint, Radnorshire and Breconshire—remain practically monoglot English-speaking. Nor are the Welsh landowners and gentry devoid of this new spirit of nationalism, and although some generations ago they ceased as a body to speak the native tongue, they have shown a strong disposition to study once more the ancient language and literature of their country. It is true that a Young Wales party has arisen, which seeks to narrow this movement to the exclusion of English ideas and influences; and it is also true that there is a party which is abnormally suspicious of and hostile to this Welsh Renaissance; but in the main it is correct to say that the bulk of the Welsh nation remains content to assert its views and requirements in a reasonable manner. How wide-spread and enthusiastic is this true spirit of nationalism amongst all classes and sects of Welsh society to-day may be observed at the great meetings of the National Eisteddfod, which is held on alternate years in North and South Wales at some important centre, and at which the immense crowds collected and the interest displayed make a deep impression on the Anglo-Saxon or foreign visitors. The sincere, if somewhat narrow-minded religious feelings; the devotion manifested by all classes towards the land of their fathers; the extraordinary vitality of the Cambro-British tongue—these are the main characteristics of modern Wales, and they seem to verify the terms of Taliesin's ancient prophecy concerning the early dwellers of Gwalia:—

> "Their Lord they shall praise;
> Their Tongue they shall keep;
> Their Land they shall lose
> Except Wild Wales." (H. M. V.)

Welsh Literature.—The Welsh language possesses an extensive literature, ranging from the 9th century to the present day. A detailed account of it will be found in the article CELT: *Celtic Literature*, § iv.

Welsh Language.—Welsh, the Celtic language spoken by the ancient Britons (see CELT: *Language*), is the domestic tongue of the majority of the inhabitants of the Principality. With the final destruction of Welsh independence under Edward I. the Cambro-British language, in spite of the disappearance of a court, continued to be spoken by Welshmen of all classes residing west of Severn, and the 14th and 15th centuries are remarkable for producing some of the finest Welsh bards and historians. With the union of Wales with England by the Act of 27 Henry VIII. (1536) the subsequent administration of all law and justice in the English tongue throughout the Principality threatened for a time the ancient language of the people with practical extinction. From such a fate it was largely preserved by the various translations of the Scriptures, undertaken at the command of Queen Elizabeth and performed by a number of native scholars and divines, amongst whom appear prominent the names of Bishops Davies, Morgan and Parry, and of William Salesbury of Llanrwst. Although the assertion of the celebrated Rhys Prichard of Llandovery that in his time (*c.* 1630) only 1% of the people of Wales could read the native language is probably an exaggeration, yet the number of persons who could read and write Welsh must have been extremely small outside the ranks of the clergy. During the earlier half of the 17th century the number of Welsh Bibles distributed throughout the Principality could hardly have exceeded 8000 in all, and except the Bible there was scarcely any Welsh work of importance in circulation. The system of the Welsh circulating charity schools, set up by Griffith Jones, rector of Llanddowror, in the 18th century, undoubtedly gave an immense impetus to the spread of popular education in Wales, for it has been stated on good authority that about one-third of the total population was taught to read and write Welsh by means of this system. As a result of Griffith Jones's efforts there quickly arose a vigorous demand for Welsh books of a pious and educational character, which was largely supplied by local Welsh printing-presses. The enthusiastic course of the Methodist movement under Howell Harris, Daniel Rowland and William Williams; the establishment of Welsh Sunday Schools; the founding of the Bible Society under Thomas Charles of Bala; and the revival early in the 19th century of the *Eisteddfodau* (the ancient bardic contests of music, poetry and learning), have all contributed to extend the use of the Welsh language and to strengthen its hold as a popular medium of education throughout the Principality. In 1841 the Welsh-speaking population was computed at 67% of the total, and in 1893 Welsh was understood or spoken by over 60% of the inhabitants in the twelve Welsh counties with the exception of the following districts, wherein English is the prevailing or the sole language employed:—viz. nearly the whole of Radnorshire; east Flint, including the neighbouring districts of Ruabon and Wrexham in Denbighshire; east Brecknock; east Montgomery; south Pembroke, with the adjoining district of Laugharne in Carmarthenshire; and the districts of Gower, Vale of Glamorgan and Cardiff in south Glamorgan. In Monmouth, the eastern portion of the county is purely English-speaking, and in the western districts English also prevails (J. E. Southall, *Linguistic Map of Wales*).

Before tracing the history of Welsh sounds, it will be convenient to give the values of the letters in the modern alphabet:—

Tenues: *p*; *t*; *c* (=Eng. *k*).

Mediae: *b*; *d*; *g* (=Eng. hard *g*).

Voiceless spirants: *ff* or *ph* (=Eng. *f*); *th* (=Eng. *th* in *thick*); *ch* (=Scottish *ch* in *loch*).

Voiced spirants: *f* (=Eng. *v*); *dd* (=Eng. *th* in *this*); the guttural voiced spirant (γ) disappeared early in Welsh.

Voiceless nasals: *mh*; *nh*; *ngh*.

Voiced nasals: *m*; *n*; *ng*.

Voiceless liquids: *ll* (unilateral voiceless *l*); *rh* (voiceless *r*).

Voiced liquids: *l*; *r*.

Sibilant: *s* (Welsh has no *z*).

Aspirate: *h*.

Semi-vowels: *i* (=Eng. *y* in *yard*); *w* (=Eng. *w*).

The sounds of *t* and *d* are more dental than in English, though they vary; the voiced spirants are very soft; the voiceless nasals are aspirated, thus *nh* is similar to Eng. *nh* in *inhale*; *r* is trilled as in Italian.

Vowels: *a*, *e*, *i*, *o* have the same values as in Italian; *w* as a vowel=north Eng. *oo* in *book* or Italian *u*; *y* has two sounds—(1) the clear sound resembling the Eng. *i* in *bit*, but pronounced farther back; (2) the obscure sound=Eng. *i* in *fir*; *u* in Med. Welsh had the sound of French *u*, but now has the clear sound of *y* described above, which is similar to the ear, and has the same pitch.

The Welsh language belongs to the Celtic branch of the Aryan or Indo-European family of languages. Primitive Celtic split up, as already shown, into two dialects, represented in modern times by two groups of languages—(1) the *Goidelic* group, comprising Irish, Scottish, Gaelic and Manx. (2) The *Brythonic* or Brittonic[1] group, comprising Welsh, Breton and Cornish. In the Goidelic group *qu* appears as *c*, thus Irish *cethir*, "four"; in the Brythonic group it is changed into *p*, as in Welsh *pedwar*, "four." Gaulish, which was supplanted in France by Latin, had *p*, as in *petor-ritum*, "four-wheeled car," and is thus allied to the Brythonic group; but it is believed that remains of a continental Celtic *qu-* dialect appear in such names as *Sequani*, and in some recently discovered inscriptions. The sounds of parent Aryan appeared in Primitive Celtic with the following modifications:—*p* disappeared, thus Aryan **peter*, which gave Latin *pater*, Eng. *father*, gave in Irish *athir*; corresponding to Eng. *floor*, we have Irish *lár*, Welsh *llawr*. The velar tenuis *q*, when labialized, became *qu*, without labialization became *k*; the velar media ***g*** became *b* or *g*. The aspirated mediae *bh*, *dh*, *gh*, ***g**h* were treated as unaspirated *b*, *d*, *g*, ***g***; probably also the rare aspirated tenues fell together with the unaspirated. The other Aryan consonants seem generally to have remained. Aryan *ā*, *ī*, *ū* remained. Aryan *ē* became *î*, as in Irish *fír*, Welsh *gwîr*, "true," cognate with Latin *vēr-us*. Aryan *ō* became *ā*, as in Irish *lár*, cognate with Anglo-Saxon *flōr*, Eng. *floor*. The short vowels remained, except that Aryan *ə* became *a*, as in the other European branches.

In Brythonic, primitive Celtic *qu* became *p*, as above noted. Probably also Celtic *ū* was advancing or had advanced to a forward position, for it appears in Welsh as *ī*, as in *dîn*, "stronghold," from Celtic **dūn-on*, cognate with Eng. *town*, while Latin *u*, borrowed in the Brythonic period, gives *u* with its Welsh sound above described, as in *mūr*, "wall," from Latin *mur-us*.

The Aryan system of inflexion was preserved in Celtic, as may be seen in Stokes's restoration of Celtic declension (*Trans. Philol. Soc.*, 1885–1886, pp. 97-201); and Brythonic was probably as highly inflected as Latin. The development of Brythonic into Welsh is analogous to that of Latin into French. Unfortunately, the extant remains of Brythonic are scanty; but in the Roman period it borrowed a large number of Latin words, which, as we know their original forms, and as they underwent the same modifications as other words in the language, enable us to trace the phonetic changes by which Brythonic became Welsh.

These changes are briefly as follows:—

1. *Loss of Syllables.*—The last syllable of every word of more than one syllable was dropped; thus Latin *termĭn-us* gives in Welsh *terfyn*; the name *Sabrĭn-a*[2] "Severn" became *Hafren*. The loss extends to the stem-ending of the first element of a compound, thus the personal name *Maglo-cŭnos* became *Maelgwn*; and generally to unaccented syllables, thus *episcopus* became **epscop*, whence *esgob*; *trīnitāt-em* gives *trindod*. The accusative is often the case represented in Welsh; but we have also the nominative, and sometimes both, as in *ciwed* from *cīvit-as*, and *ciwdod* from *cīvitāt-em*, now two words, not two cases of the same word. Aryan declension naturally disappeared with the loss of final syllables.

2. *Consonant Changes.*—(1) Between two vowels, or a vowel and a liquid, the seven consonants *p*, *t*, *c*, *b*, *d*, *g*, *m*, became respectively *b*, *d*, *g*, *f*, *dd*, -, *f*, where "-" represents the lost voiced spirant γ. Examples: Latin *cupidus* gave *cybydd*; *Tacitus* gave

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[1] The Bretons call their language *Brezonek*; the Welsh bards sometimes call Welsh *Brythoneg*: both forms imply an original **Brittonica*.

[2] The *i* was short: *Sabrīna* would have given *Hefrin* in Welsh.

Tegyd; *labōrem* gave *llafur*; *sagitta* gave *saeth*; *rēmus* gave *rhwyf*. This change is called the "soft mutation." (2) After nasals *p*, *t*, *c*, *b*, *d*, *g* became respectively *mh*, *nh*, *ngh*, *m*, *n*, *ng*; thus *imperātor* gave *ymherawdr*, and *ambactos* (evidently a Brythonic as well as a Gaulish word) gave *amaeth* (*m*, though etymologically double, is written single). This change is called the "nasal mutation." (3) *pp*, *tt*, *cc* became respectively *ph* or *ff*, *th*, *ch*; thus *peccātum* gave *pechawd*, later *pechod*; and *Brittones* gave *Brython*. This change is called the "spirant mutation." The tenuis becomes a spirant also after *r* or *l*, as in *corff* from *corpus*, and *Elffin* from *Alpīnus*; but *lt* gives *llt* or *ll*. The combinations *act*, *ect*, *oct*, *uct* gave *aeth*, *aith*, *oeth*, *wyth*, respectively; as in *doeth*, "wise," from Lat. *doctus*, *ffrwyth* from *fructus*. (4) Original *s* between vowels (but not Latin *s*) became *h*, and disappeared; initially it generally appears as *h*, as in *halen*, "salt," sometimes as *s*, as in *saith*, "seven." Initial *l* and *r* became *ll* and *rh*, as seen in examples in (1) above; but between vowels they remained. Similarly initial *v* became *gw*, as in *gwîn*, from Latin *vīnum*, remaining between vowels, though now written *w*, as in *ciwed* from *cīvitas*.

A consonant occurring medially is, generally speaking, invariable in the present language; thus the *p* and *d* of *cupidus* are *b* and *dd* in *cybydd*; but with the initial consonant the case is different. In one combination the initial may remain; thus **oinos cupidus* gave *un cybydd*, "one miser"; in another combination it may have originally stood between vowels, and so is mutated, as in **duō cupidō*, which gave *dau gybydd*, "two misers." Thus arose the system of "initial mutation": an initial consonant may retain its original form, or may undergo any of the changes to which it is subject. The names given above to these changes are those by which they are known when they occur initially the unchanged form being called the "radical." The liquids *l* and *r* were brought into the system, the initial forms *ll* and *rh* being regarded as "radical." The initial mutations, then, are as follows:—

Radical .	*p*	*t*	*c*	*b*	*d*	*g*	*m*	*ll*	*rh*
Soft . .	*b*	*d*	*g*	*f*	*dd*	—	*f*	*l*	*r*
Nasal .	*mh*	*nh*	*ngh*	*m*	*n*	*ng*	No change.		
Spirant .	*ph*	*th*	*ch*	No change.			No change.		

The initial mutation of any word depends upon its position in the sentence, and is determined by a grammatical rule which can ordinarily be traced to a generalization of the original phonetic conditions. Thus the second element of a compound word, even though written and accented as a separate word, has a soft initial, because in Brythonic the first element of a compound generally ended in a vowel, as in the name *Maglo-cunos*. The more important rules for initial mutation are the following: the soft mutation occurs in a feminine singular noun after the article, thus *y fam*, "the mother" (radical *mam*); in an adjective following a feminine singular noun, as in *mam dda*, "a good mother" (*da*, "good"); in a noun following a positive adjective, as in *hên ddŷn*, "old man," because this order represents what was originally a compound; in a noun following *dy*, "thy," and *ei*, "his," thus *dy ben*, "thy head," *ei ben*, "his head" (*pen*, "head"); in the object after a verb; in a noun after a simple preposition; in a verb after the relative *a*. The nasal mutation occurs after *fy*, "my," and *yn*, "in"; thus *fy mhen*, "my head" (*pen*, "head"), *yn Nhalgarth*, "at Talgarth." The spirant mutation occurs after *a*, "and," "with," *ei*, "her"; thus *a phen*, "and a head," *ei phen*, "her head."

3. *Vowel Changes.*—(1) Long *ā*, whether from Aryan *ā* or *ō* or from Latin *ā*, becomes *aw* in monosyllables, as in *brawd*, "brother" from **brāter*; in the penult it is *o*, as in *broder*, "brothers," in the ultima *aw*, later *o*, as in *pechawd*, now *pechod*, from *peccātum*. Long *ī*, whether from Aryan *ē* or *ī*, or from Latin *ī*, remains as *i*, see examples above. Latin *ē* was identified with a native diphthong *ei*, and becomes *ŵy*, as in *rhwyf* from *rēmus*. Latin *ō* and *ū* appear as *u*; see examples above. A long vowel when unaccented counts short, thus *peccātórem* treated as **peccătórem*, gave *pechadur*. (2) Short *ă*. *ĕ*. *ŏ* remain; short *ĭ* became *y*; and *ŭ* became *y* (with its obscure sound) in the penult, remaining in the ultima, though now written *w*. But short vowels have been affected by vowels in succeeding syllables. These "affections" of vowels are as follows:—(*a*) I-affection, caused by *i* in a lost termination: *ă* becomes *ai* or *ei*, and *ĕ*, *ŏ*, *ŭ* became *y*, more rarely *ai* or *ei*. Thus **bardos* gave *bardd*, but pl. **bardī* gave *beirdd*; *episcopī* gave *esgyb*, "bishops." This change is also caused by *-ō*, as in *lleidr*, "thief," from *latrō*. (*β*) A-affection, caused by *a* in a lost ending: *ĭ* becomes *e* (instead of *y*); *ŭ* becomes *o*. Thus *cīvĭtas* gave *ciwed*; *colŭmna* gave *colofn*. (*γ*) Penultimate affection: *i* or *y* in the ultima causes several changes in the penult, as *arch*, "order," *erchi*, "to bid"; *saer*, "carpenter," pl. *seiri*; *caer*, "fort," pl. *ceyrydd*. (3) In the modern language other vowel changes occur by a change of position; thus *ai*, *au*, *aw* in the ultima become *ei*, *eu*, *o* respectively in the penult, as *dail*, "leaves," *deilen*, "leaf"; *haul*, "sun," *heulog*, "sunny"; *brawd*, "brother," pl. *broder* or *brodyr*. The last is an old interchange of sounds, and probably the others are older than their first appearance in writing (15th century) suggests.

Accidence.—Welsh has a definite article *yr*, "the," which becomes *'r* after a vowel, and *y* before a consonant unless already reduced to *'r*. Thus *yr oen*, "the lamb," *i'r ty*, "into the house," *yn y ty*, "in the house."

The noun has two numbers, and two genders, masculine and feminine. A plural noun is formed from the singular by *i*-affection: thus *bardd*, "bard," pl. *beirdd*; *ffon*, "stick," pl. *ffyn*; or by adding a termination as *ffenestr*, "window," pl. *ffenestri*, with any consequent vowel change, as *brawd*, "brother," pl. *brodyr*; *gwlad*, "country," pl. *gwledydd*. The terminations chiefly used are *-au*, *-ion*, *-on*, *-i*, *-ydd*, *-oedd*. These are old stem endings left after the loss of the original *-es*; thus *latrō* gives *lleidr*, *latrones* gives *lladron*; the forms having *dd* represent *i̯* stems, *i̯* becoming *dd* in certain positions.

In some cases the singular is formed from the plural by the addition of *-yn* or *-en*; thus *sér*, "stars," *seren*, "star."

Feminine names of living things are formed from the masculine by the addition of *-es*, as *brenin*, "king," *brenhines*, "queen"; *llew*, "lion," *llewes*, "lioness." It is difficult to lay down rules for the determination of the gender of names of inanimate objects.

Adjectives are inflected for number and gender. Plural adjectives are formed from the singular by *i*-affection or by adding the termination *-ion* or *-on*; thus *hardd*, "beautiful," pl. *heirdd*; *glas*, "blue," pl. *gleision*.

Adjectives having *y* or *w* are made feminine by *a*-affection, due to the lost feminine ending *-a*; thus *gwyn*, "white," fem. *gwen*; *trwm*, "heavy," fem. *trom*.

The adjective has *four* degrees of comparison—positive, equative, comparative, superlative; as *glân*, "clean," *glaned*, "as clean (as)," *glanach*, "cleaner," *glanaf*, "cleanest." A few adjectives are compared irregularly.

The personal pronouns are: simple sing. 1. *mi*, 2. *ti*, 3. masc. *ef*, fem. *hi*; pl. 1. *ni*, 2. *chwi*, 3. *hwy*, *hwynt*; reduplicated, *myfi*, *tydi*, &c.; conjunctive, *minnau*, *tithau*, &c. Prefixed genitive: sing. 1. *fy*, "my," 2. *dy*, 3. *i*, *ei*; pl. 1. *yn*, *ein*, 2. *ych*, *eich*, 3. *eu*. Infixed genitive and accusative: sing. 1. *'m*, 2. *'th*, 3. *'i*; pl. 1. *'n*, 2. *'ch*, 3. *'u*. Affixed: sing. 1. *i*, 2, *di*, 3. *ef*, &c., like the simple forms.

The demonstrative pronouns are *hwn*, "this," *hwnnw*, "that," fem. *hon*. *honno*, pl. *hyn*, *hynny*.

The relative pronouns are nominative and accusative *a*, oblique cases *ydd*, *yr*, *y*. The expressions *yr hwn*, *y neb*, "the one," are mistaken for relatives by the old grammarians; the true relative follows: *yr hwn a* = "the one who."

The interrogative pronouns are substantival *pwy ?* = "who ?". adjectival *pa ?* Substantival "what ?" is expressed by *pa beth ?* "what thing ?" or shortly *beth ?*

The verb has four tenses in the indicative, one in the subjunctive, and one in the imperative. The old passive voice has become an impersonal active, each tense having one form only. The regular verb *caraf*, "I love," is conjugated thus:—

Indicative—Pres. (and fut.) sing. 1. *caraf*, 2. *ceri*, 3. *câr*; pl. 1. *carwn*, 2. *cerwch*, 3. *carant*; impers. *cerir*. Imperfect sing. 1. *carwn*, 2. *carit*, 3. *carai*; pl. 1. *carem*, 2. *carech*, 3. *cerynt*, *carent*; impers. *cerid*. Aorist sing. 1. *cerais*, 2. *ceraist*, 3. *carodd*; pl. 1. *carasom*, 2. *carasoch*, 3. *carasant*; impers. *carwyd*. Pluperfect sing. 1. *caraswn*, 2. *carasit*, 3. *carasai*; pl. 1. *carasem*, 2. *carasech*, 3. *caresynt*, *-asent*; impers. *caresid*.

Subjunctive—Pres. sing. 1. *carwyf*, 2. *cerych*, 3. *caro*; pl. 1. *carom*, 2. *caroch*, 3. *caront*; impers. *carer*.

Imperative—Pres. sing. 2. *câr*, 3. *cared*; pl. 1. *carwn*, 2. *cerwch*, 3. *carent*; impers. *carer*.

Verbal noun, *caru*, "to love." Verbal adjectives, *caredig*, "loved," *caradwy*, "lovable."

As in other languages the verb "to be" and its compounds are irregular; the number of other irregular verbs is comparatively small.

Prepositions also are "conjugated" in Welsh, their objects, if pronominal, being expressed by endings. Thus *ar*, "on," *arnaf*, "on me," *arnat*, "on thee," *arno*, "on him," *arni*, "on her," *arnom*, "on us," *arnoch*, "on you," *arnynt*, "on them." The second conjugation has for endings *-of*, *-ot*, *-ddo*, *-ddi*; *-om*, *-och*, *-ddynt*; the third *-yf*, *-yt*, *-ddo*, *-ddi*; *-ym*, *-ych*, *-ddynt*.

The negative adverbs are *ni*, *nid*, conjunctive *na*, *nad*. Interrogative particles: *a*, *ai*. Affirmative particles: *yr*, *fe*.

The commoner conjunctions are *a*, *ac*, "and"; *ond*, *eithr*, "but"; *o*, *os*, "if"; *pan*, "when"; *tra*, "while."

Syntax.—A qualifying adjective follows its noun, and agrees with it in gender and generally in number. It may, however, precede its noun, and a compared adjective generally does so.

In a simple sentence the usual order of words is the following:—verb, subject, object, adverb; as *prynodd Dafydd lyfr yno*, "David bought a book there." The verb may be preceded by an affirmative, a negative, or an interrogative particle.

When a noun comes first, it is followed by a relative pronoun, thus, *Dafydd a brynodd lyfr yno*, which really means "(it is) David who bought a book there," and is never used in any other sense in the spoken language, though in literary Welsh it is used rhetorically for the simple statement which is properly expressed by putting the verb first. In negative and interrogative sentences this rhetorical use does not occur.

In a simple interrogative sentence the introductory particle before the verb is *a*, and the positive answer consists in a repetition of the verb; *a ddaw Dafydd? Daw.* "Will David come? Yes." If the verb is aorist the answer is *do* for all verbs. In negative answers *na* precedes the verb. In sentences in which a noun comes first, the interrogative particle is *ai*, and the answer is always, positive *ïe*, negative *nage*; as *ai Dafydd a ddaw? ïe.* "Is it David who will come? Yes."

A relative pronoun immediately precedes its verb and can only be separated from it by an infixed pronoun, thus *Dafydd a'i prynodd*, "(it is) David who bought it," *yno y'm gweli*, "(it is) there that thou wilt see me." If the relative is the object of a preposition, the latter is put at the end of the clause, and has a personal ending, thus *y ty y bûm ynddo*, literally, "the house which I-was in-it."

The verb does not agree with its subject unless the latter is a personal pronoun; when the subject is a noun the verb is put in the third person singular; thus *carant*, "they love," can take a pronominal subject—*carant hwy*, "they love"; but "the men love" is *câr y dynion* (not *carant y dynion*, which can only mean "they love the men"). In relative clauses the verb is sometimes made to agree; but in the oldest poetry we generally find the singular verb, as in the oft-repeated *Gododin* phrase *Gwyr a aeth Gatraeth*, "men who went (to) Catraeth" (not *Gwŷr a aethant*).

AUTHORITIES.—J. D. Rhys, *Cambrobrytannicae Cymraecaeve lingvae institvtiones* (1592); John Davies, *Antiqae lingvae Britannicae . . . rvdimenta* (1621); *Antiquae linguae Britannicae . . . dictionarium duplex* (1632); Edward Lhuyd, *Archaeologia Britannica* (1707); W. O. Pughe, *Grammar and Dictionary* ^{2} (1832), vitiated by absurd etymological theories; J. C. Zeuss, *Grammatica Celtica* (2nd ed. by H. Ebel, 1871)—an index to the O Welsh glosses cited in this work was compiled by V. Tourneur in *Archiv für celt. Lexikographie*, iii. 109-137; T. Rowland, *Grammar of the Welsh Language* ^{4} (1876), containing a large collection of facts about the modern language, badly arranged and wholly undigested; Rhys, *Lectures on Welsh Philology* ^{2} (1879); J. Strachan, *An Introduction to Early Welsh*, with a Reader (Manchester, 1909); Stokes, "Urkeltischer Sprachschatz," in Fick's *Vergleichendes Wörterbuch der idg. Sprachen* ^{4}, ii. (1894); E. Anwyl, *Welsh Grammar for Schools*, i. (1898), ii. (1899); J. Morris Jones, *Historical Welsh Grammar*, i. (1911); W. Spurrek, *Welsh-English and English-Welsh Dictionary* (Carmarthen ^{5}, 1904); D. Silvan Evans, *Welsh Dictionary*, A-E (1888–1906). The last-named received a subsidy from the British government. Some corrections and additions to the early volumes, by J. Loth, will be found in *Arch. f. celt. Lex.* vol. i. See also H. Sweet, "Spoken N. Welsh," in *Trans. of the London Phil. Soc.*, 1882–1884; T. Darlington, "Some Dialectal Boundaries in Mid-Wales," in *Trans. of the Hon. Soc. of Cymmrodorion*, 1900–1901; and M. Nettlau, *Beiträge zur cymrischen Grammatik* (Leipzig, 1887), also in *Rev. celt.* vol. ix. (J. M. J.)

WALEWSKI, ALEXANDRE FLORIAN JOSEPH COLONNA, COMTE (1810–1868), French politician and diplomatist, was born at Walewice near Warsaw on the 4th of May 1810, the son of Napoleon I. and his mistress Marie, Countess Walewski. At fourteen Walewski refused to enter the Russian army, escaping to London and thence to Paris, where the French government refused his extradition to the Russian authorities. Louis Philippe sent him to Poland in 1830, and he was then entrusted by the leaders of the Polish revolution with a mission to London. After the fall of Warsaw he took out letters of naturalization in France and entered the French army, seeing some service in Algeria. In 1837 he resigned his commission and began to write for the stage and for the press. He is said to have collaborated with the elder Dumas in *Mademoiselle de Belle-Isle*, and a comedy of his, *L'École du monde*, was produced at the Théâtre Français in 1840. In that year his paper, *Le Messager des chambres*, was taken over by Thiers, who sent him on a mission to Egypt, and under the Guizot ministry he was sent to Buenos Aires to co-operate with the British minister Lord Howden (Sir J. Caradoc). The accession of Louis Napoleon to the supreme power in France guaranteed his career. He was sent as envoy extraordinary to Florence, to Naples and then to London, where he announced the *coup d'état* to Palmerston (*q.v.*). In 1855 Walewski succeeded Drouyn de Lhuys as minister of foreign affairs, and acted as French plenipotentiary at the Congress of Paris next year. When he left the Foreign Office in 1860 it was to become minister of state, an office which he held until 1863. Senator from 1855 to 1865, he entered the Corps Législatif in 1865, and was installed, by the emperor's interest, as president of the Chamber. A revolt against his authority two years later sent him back to the Senate. He died at Strassburg on the 27th of October 1868. He had been created a duke in 1866, was a member of the Academy of Fine Arts and a grand cross of the Legion of Honour.

WALFISH BAY, a harbour of South-West Africa with a coast-line of 20 m. terminated southward by Pelican Point in 22° 54′ S., 14° 27′ E. It belongs to Great Britain, together with a strip of territory extending 15 m. along the coast south of Pelican Point and with a depth inland from 10 to 15 m. The total area is 430 sq. m. Except seaward Walfish Bay is surrounded by German South-West Africa. The northern boundary is the Swakop river; east and south there are no natural frontiers. The coast district, composed of sand dunes, is succeeded by a plateau covered in part with sparse vegetation. The river Kuisip, usually dry, has its mouth in the bay—which forms the finest harbour along a coast-line of over 1000 m. The harbour is provided with a pier 200 yds. long and is safe in all weathers. It was formerly frequented by whaling vessels (hence its name). The town has a small trade with the Hereros of the adjoining German protectorate. A tramway, 11 m. long, runs inland to Rooikop on the German frontier. Pop. (1904), 997, including 144 whites.

Walfish Bay forms a detached portion of the Cape province of the Union of South Africa. It was proclaimed British territory on the 12th of March 1878, and was annexed to Cape Colony on the 7th of August 1884 (see AFRICA, § 5). The delimitation of the southern frontier was in 1909 referred to the king of Spain as arbitrator between Great Britain and Germany.

WALKER, FRANCIS AMASA (1840–1897), American soldier and economist, was born in Boston, Massachusetts, on the 2nd of July 1840. His father, Amasa Walker (1799–1875), was also a distinguished economist, who, retiring from commercial life in 1840, lectured on political economy in Oberlin College from 1842 to 1848, was examiner in the same subject at Harvard from 1853 to 1860, and lecturer at Amherst from 1859 to 1869. He was a delegate to the first international peace congress in London 1843, and in 1849 to the peace congress in Paris. He was secretary of state of Massachusetts from 1851 to 1853 and a representative in Congress 1862–1863. His principal work, *The Science of Wealth*, attained great popularity as a textbook. Francis Walker graduated at Amherst College in 1860, studied law, and fought in the Northern army during the whole of the Civil War of 1861–65, rising from the rank of sergeant-major to that of brevet brigadier-general of volunteers—awarded him at the request of General Winfield S. Hancock. As a soldier he excelled in analysis of the position and strength of the enemy. In 1864 he was captured and detained for a time in the famous Libby Prison, Richmond. After the war he became editorial writer on the Springfield (Massachusetts) *Republican*, and in 1869 was made chief of the government bureau of statistics. He was superintendent of the ninth and tenth censuses (those of 1870 and 1880), and (1871–72) commissioner of Indian affairs. From 1873 to his death his work was educational, first as professor (1873–1881) of political economy in the Sheffield Scientific School at Yale, and then as president of the Massachusetts Institute of Technology, Boston. While superintendent of the census he increased the scope and accuracy of the records; and at the Institute of Technology he enlarged the resources and numbers of the institution, which had 302 students when he assumed the presidency and 1198 at his death. In other fields he promoted common-school education (especially in manual training), the Boston park system, and the work of the public library, and took an active part in the discussion of monetary, economic, statistical and other public questions, holding many offices of honour and responsibility. As an author he wrote on governmental treatment of the Indians, *The Wages Question* (1876), *Money* (1878), *Land and its Rent* (1883) and general political economy (1883 and 1884), besides producing monographs on the life of General Hancock (1884) and the history of his own *Second Army Corps* (1886). As an economist, from the time of the appearance of his book on the subject, he so effectively combated the old theory of the "wage-fund" as to lead to its abandonment or material modification by American students; while in his writings on finance, from 1878 to the end of his life, he advocated international bimetallism, without, however, seeking to justify any one nation in the attempt to maintain parity between gold and silver. A collection of posthumously published *Discussions in Education* (1899) was made up of essays and addresses prepared after his taking the presidency of the Institute of Technology: their most noteworthy argument is that chemistry, physics and the other sciences promote a more exact and more serviceable mental training than metaphysics or rhetoric. Walker's general tendency was towards a rational conservatism. On the question of rent he called himself a "Ricardian of the Ricardians." To his *Wages Question* is due in great part the conception formed by English students of the place and functions of the employer in modern industrial economics. A remarkable feature of his writings is his treatment of economic tendencies not as mere abstractions, but as facts making for the happiness or misery of living men. General Walker died in Boston on the 5th of January 1897.

WALKER, FREDERICK (1840–1875), English subject painter, the son of a designer of jewelry, was born in Marylebone, London, on the 24th of May 1840. When very young he began to draw from the antique in the British Museum, and at the age of sixteen he was placed in the office of an architect named Baker. The occupation proved uncongenial; at the end of eighteen months he resumed his work from the Elgin marbles at the British Museum, and attended Leigh's life school in Newman Street. In March 1858 he was admitted a student of the Royal Academy. But his study in the academy schools was disconnected, and ceased before he reached the life class, as he was anxious to begin earning his own living. As a means to this end, he turned his attention to designing for the wood-engravers, and worked three days a week for about two years in the studio of J. W. Whymper, under whose tuition he quickly mastered the technicalities of drawing on wood. His earliest book illustrations appeared in 1860 in *Once a Week*, a periodical to which he was a prolific contributor, as also to the *Cornhill Magazine*, where his admirable designs appeared to the works of Thackeray and those of his daughter. These woodcuts, especially his illustrations to Thackeray's *Adventures of Philip* and *Denis Duval*, are among the most spirited and artistic works of their class, and entitle Walker to rank with Millais at the very head of the draughtsmen who have dealt with scenes of contemporary life. Indeed, by his contributions to *Once a Week* alone he made an immediate reputation as an artist of rare accomplishment, and although he was associated on that periodical with such men as Millais, Holman Hunt, Leech, Sandys, Charles Keene, Tenniel, and Du Maurier, he more than held his own against all competitors. In the intervals of work as a book illustrator he practised painting in water-colours, his subjects being frequently more considered and refined repetitions in colour of his black-and-white designs. Among the more notable of his productions in water-colour are "Spring," "A Fishmonger's Shop," "The Ferry," and "Philip in Church," which gained a medal in the Paris International Exhibition of 1867. He was elected an associate of the Society of Painters in Water Colours in 1864 and a full member in 1866; and in 1871 he became an associate of the Royal Academy. In this same year he was made an honorary member of the Belgian Society of Painters in Water Colours. His first oil picture, "The Lost Path," was exhibited in the Royal Academy in 1863, where it was followed in 1867 by "The Bathers," one of the artist's finest works, in 1868 by "The Vagrants," now in the National Gallery of British Art, in 1869 by "The Old Gate," and in 1870 by "The Plough," a powerful and impressive rendering of ruddy evening light, of which the landscape was studied in Somerset. In 1871 he exhibited his tragic life-sized figure of "A Female Prisoner at the Bar," a subject which now exists only in a finished oil study, for the painter afterwards effaced the head, with which he was dissatisfied, but was prevented by death from again completing the picture. The last of his fully successful works was "A Harbour of Refuge," shown in 1872 (also in the National Gallery of British Art); for "The Right of Way," exhibited in 1875, bears evident signs of the artist's failing strength. He had suffered indeed for some years from a consumptive tendency; in 1868 he made a sea voyage, for his health's sake, to Venice, where he stayed with Orchardson and Birket Foster, and at the end of 1873 he went for a while to Algiers with J. W. North, in the hope that he might derive benefit from a change of climate. But, returning in the bitter English spring, he was again prostrated; and on the 5th of June 1875 he died of consumption at St Fillan's, Perthshire.

The works of Frederick Walker are thoroughly original and individual, both in the quality of their colour and handling and in their view of nature and humanity. His colour, especially in his water-colours, is distinctive, powerful and full of delicate gradations. He had an admirable sense of design, and the figures of his peasants at their daily toil show a grace and sweeping largeness of line in which can be plainly traced the effect produced upon his taste by his early study of the antique; at the same time the sentiment of his subjects is unfailingly refined and poetic. His vigour of design may be seen in his poster for Wilkie Collins's *The Woman in White*, now in the National Gallery of British Art.

See *Life and Letters of Frederick Walker, A.R.A.*, by John George Marks (1896), a full biography of a personal rather than a critical kind. *Frederick Walker and his Works*, by Claude Phillips (1897), should be consulted as an excellent critical supplement to the larger volume. See also *Essays on Art*, by J. Comyns Carr, which includes a judicious essay on Walker.

WALKER, GEORGE (*c.* 1618–1690), hero of the siege of Londonderry, was the son of George Walker, rector of Kilmore and chancellor of Armagh (d. 1677), and of Ursula, daughter of Sir John Stanhope of Melwood, and is said to have been born in 1618 in Tyrone. He was educated at Glasgow University, and appointed to the livings of Lessan and Desertlyn, in the diocese of Armagh, near Londonderry, in 1669. In 1674 he obtained that of Donaghmore, which he held with Lessan. At the outbreak of the Civil War in Ireland towards the close of 1688, Walker, though in Holy Orders and advanced in years, raised a regiment and endeavoured to concert measures with Robert Lundy, the acting governor of Londonderry, for the defence of Dungannon. But Lundy, after having sent some troops to his support, ordered their withdrawal and the abandonment of the place on the 14th of March 1689. On the 17th of March Walker marched with his men to Strabane, and subsequently was ordered by Lundy to move to Rash and then to St Johnstown, 5 m. from Londonderry. On the approach of the enemy (April 13th) Walker rode hastily to Londonderry to inform Lundy, but was unable to convince him of his danger. He returned to his men at Lifford, where, on the 14th, he took part in a brush with the enemy, afterwards following the retreat of the army to Londonderry. The town was in great confusion, and Walker found the gates shut against him and his regiment. He was forced to pass the night outside, and only entered the next day "with much difficulty and some violence upon the Centry." Immediately on his arrival he urged Lundy to take the field and refused the demand to disband his own soldiers. On the 17th of April Lundy determined to give up the town to James, and called a council from which Walker and others were especially excluded; but the next day the king and his troops, who had advanced to receive the surrender, were fired upon from the walls contrary to Lundy's orders, and the arrival of Captain Adam Murray with a troop of horse saved the situation. Lundy was deprived of all power, and was allowed to escape in disguise from the town. On the 19th of April Walker and Baker were chosen joint-governors. Walker commanded fifteen companies, amounting to 900 men, and to him was also entrusted the supervision of the commissariat. He showed great energy, courage and resource throughout the siege, and led several successful sallies. Meanwhile his duties as a clergyman were not neglected. The Nonconformists were allowed the use of the cathedral on Sunday afternoons, but in the morning Walker preached. Those few of his sermons which remain, though simple in their language, are eloquent and inspiring. Meanwhile he had to contend with jealousies and suspicions within the town; but he succeeded in dispelling all misgivings and in reaffirming his credit with the garrison. At the close of the siege, which lasted 150 days, the town was at the last extremity; but at length, on the 30th of July, Walker preached the last of the sermons by which he had helped to inspire its defence. An hour afterwards the ships were seen approaching, and the town was relieved.

As regards the general course of the war the importance of the successful resistance at Londonderry can hardly be exaggerated. It was the first open act of hostility in Ireland against James, and the disaster to his arms not only embarrassed his campaign in Ireland but prevented the expeditions to Scotland and England, and Walker's share in it was abundantly recognized. He sailed for Scotland and England on the 9th of August, and was everywhere welcomed with immense public enthusiasm. On the 29th of August he was graciously received at Hampton Court by William and Mary, before whom he had with good sense refused to appear in his military costume, and delivered to them the petition from Londonderry. William presented him with £5000, part of which he appears to have given to the widow of Baker, his fellow-governor, who died during the siege. Shortly afterwards he was nominated bishop of Londonderry, but as Bishop Hopkins, whom it was determined to remove, only died three weeks before Walker, the latter was never consecrated. Walker succeeded in obtaining a grant of £1200 for Londonderry from the city companies, and on the 18th of November his petition to the House of Commons for relief for the widows, orphans, clergy and dissenting ministers was read, and the king was asked to distribute £10,000 among them (House of Commons Journals, vol. x. p. 288). On the following day Walker was called in, received the thanks of the House, and made a short and dignified reply. On the 8th of October he had been granted the degree of D.D. at Cambridge in his absence, and on his return journey to Ireland he received the same diploma at Oxford (Feb. 1690). Walker met William on his arrival in Ireland on the 14th of June 1690 at Belfast, and followed his army. He was present at the battle of the Boyne on the 1st of July, but in what capacity, whether as spectator, as combatant or as minister to tend the wounded, is uncertain.[1] He was shot through the body at the passage of the river, according to one account, while he was going to the aid of the wounded Schomberg (G. Story, *A True . . . History of the Affairs in Ireland*, p. 82), and died almost immediately. His remains, or what were supposed to be such, were afterwards transferred from the battlefield and buried in his own church at Donaghmore, where a monument and inscription were placed to his memory. A more conspicuous memorial was erected in Londonderry itself.

Walker married Isabella Maxwell of Finnebrogue, and left several sons, four of whom during his lifetime were in the king's service, and from one of whom at least there are descendants at the present day.

While in London Walker had published *A True Account of the Siege of Londonderry* (1689), dedicated to the king, which went through several editions and was translated for perusal abroad. This pamphlet, and the ovations received by Walker in London, excited fierce jealousies, which had been subdued in the hour of peril, but which were now formulated in the *Narrative* (1698) of John Mackenzie, a dissenting minister who had been present during the siege. Walker was charged with having taken too much credit to himself, and of having passed over the services and names of the nonconformists. Base insinuations were added and it was declared that Walker had never even held the post of governor. These accusations fall by the weight of their own exaggeration. On the other hand, Walker's *Account*, though doubtless incomplete, is written with candour and simplicity and is free from any touch of egotistical self-consciousness; and both this tract and his subsequent *Vindication* (1689) are greatly superior, in their dignity and restraint, to the pamphlets of his opponents. His character was proof against the perils which attend a sudden rise to fame and popularity, and his "modesty" is especially observed by several of his contemporaries. There exists also too much positive and independent evidence to permit any doubt whatever as to the greatness of Walker's services. Burnet, in a passage which was not included in his published history perhaps because of the controversy, says: "There was a minister in the place, Dr Walker, who acted a very noble part in the government and defence of the town; he was but a man of ordinary parts, but they were suited to his work, for he did wonders in this siege" (Harleian MSS., 6584 *f*, 292 *b*, printed by H. C. Foxcroft. Supplement to Burnet's *Hist. of His Own Times*, 1902, p. 321).

In the *Siege of Derry* (1893) the Rev. Philip Dwyer has collected the most essential facts and materials relating to Walker and the siege, and has reprinted in his volume Walker's *True Account* and *Vindication*, together with Walker's sermons, various other documents and valuable notes.

WALKER, HENRY OLIVER (1843–   ), American artist, was born at Boston, Massachusetts, on the 14th of May 1843. He was a pupil of Léon Bonnat, Paris, and painted the figure and occasional portraits, but later devoted himself almost exclusively to mural decoration. His paintings symbolizing lyric poetry, for the Congressional Library, Washington; and his decorations for the Appellate Court House, New York; Bowdoin College, Maine; the enlarged State House, Boston; the Court House, Newark, New Jersey, and the Capitol at Saint Paul, Minnesota, are among his most important works. He became a member of the National Academy of Design, New York, in 1902.

WALKER, HORATIO (1858–   ), American artist, was born at Listowel, Ontario, Canada, on the 12th of May 1858. When he was a child his family settled at Rochester, New York. Although entirely self-taught, he became a distinguished painter of animals, the figure and landscape. His pictures, principally of Canadian peasant life and scenes, show the influence of Troyon and Millet, mainly in their feeling for largeness of composition, in solidity of painting and in the choice of theme. He became a member of the National Academy of Design, New York, in 1891; of the American Water Color Society and of the Royal Institute of Painters in Water Colours, London. He received a medal and a diploma at Chicago, 1893; and medals at Buffalo, 1901; Charleston, 1902; and St. Louis, 1904. In 1888 he won the Evans prize of the American Water Color Society, New York.

WALKER, JOHN (1732–1807), English actor, philologist and lexicographer, was born at Colney Hatch, Middlesex, on the 18th of March 1732. Early in life he became an actor, his theatrical engagements including one with Garrick at Drury Lane, and a long season in Dublin. In 1768 he left the stage. After some experience in conducting a school at Kensington he commenced to teach elocution, and in this found his principal employment for the rest of his life. In 1775 he published his *Rhyming Dictionary*, which achieved a great success and has been repeatedly reprinted, and in 1791 his *Critical Pronouncing Dictionary*, which achieved an even greater reputation, and has run into some forty editions. He was the friend of the leading literary men of his time, including Johnson and Burke. He died in London on the 1st of August 1807.

WALKER, OBADIAH (1616–1699), master of University College, Oxford, was born at Darfield near Barnsley, Yorkshire, and was educated at University College, Oxford, becoming a fellow and tutor of this society and a prominent figure in university circles. In July 1648 the action of parliament deprived him of his academic appointments, and he passed some years in teaching, studying and travelling, returning to Oxford at the restoration of 1660, and beginning a few years later to take a leading part in the work of University College. In June 1676 he was elected to the headship of this foundation, and in this capacity he collected money for some rebuilding, and forwarded the preparation of a Latin edition of Sir John Spelman's *Life of Alfred the Great*, published by the college. This was the time of Titus Oates and the popish plots, and some of Walker's writings made him suspect; however, no serious steps were taken against him, although Oxford booksellers were forbidden to sell his book, *The benefits of our Saviour Jesus Christ to mankind*, and he remained a Protestant, in name at least, until the accession of James II. Soon after this event he came forward as a Roman Catholic, and he advised the new king with regard to affairs in Oxford, being partly responsible for the tactless conduct of James in forcing a quarrel with the fellows of Magdalen College. Mass was said in his residence, and later a chapel was opened in the college for the worship of the Roman Church; he and others received a royal licence to absent themselves from the services of the English Church, and he obtained another to supervise the printing of Roman Catholic books. In spite of growing unpopularity he remained loyal to James, and when the king fled from England Walker left Oxford, doubtless intending to join his master abroad. But in December 1688 he was arrested at Sittingbourne and was imprisoned; then, having lost his mastership, he was charged at the bar of the House of Commons with changing his religion and with other offences. Early in 1690 he was released from his confinement, and after subsisting for some years largely on the charity of his friend and former pupil, Dr John Radcliffe, he died on the 21st of January 1699.

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[1] Luttrell writes in his diary, vol. 2, p. 17 (Feb. 20, 1689–1690), "Mr Walker of Londonderry has taken his leave of the king to go to Ireland on some special command," and again, vol. 2, p. 44 (May 19, 1690), "Letters from Ireland say that Dr Walker, late governor of Londonderry, had a regiment of foot given him," but there appears to be no official record of his having received a commission at this time.

Walker's principal writings are: *Of education, especially of young gentlemen* (Oxford, 1673, and six other editions); *Ars rationis ad mentem nominalium libri tres* (Oxford, 1673); and *Greek and Roman History illustrated by Coins and Medals* (London, 1692).

WALKER, ROBERT (d. *c.* 1658), British painter, was a contemporary and to a slight extent a follower of Van Dyck. The date of his birth is uncertain, and no details are known of his early life. Although influenced by Van Dyck's art, he had still a considerable degree of individuality and developed a sound style of his own which was more severe and restrained than that of the greater master. His greatest vogue was at the time of the Commonwealth, for in addition to several portraits of Cromwell he painted other portraits of Lambert, Ireton, Fleetwood, and many more members of the Parliamentarian party. In 1652 he was given rooms in Arundel House in the Strand, London, where he resided for the rest of his life. He died either in 1658 or in 1660, the authority for the earlier date being an inscription on an engraved portrait by Lombart. His work had much merit; it was vigorous and showed sound study of character. Several of his paintings, among them the portrait of William Faithorne the elder, are in the National Portrait Gallery, and there are others of notable importance at Hampton Court and in the University Galleries at Oxford. One of his portraits of Cromwell is in the Pitti Palace, where it is ascribed to Lely; it was bought in the artist's lifetime, but after the Protector's death, by the grand duke Ferdinand II. of Tuscany. Another is at Warwick Castle.

Walker painted also Robert Cromwell and his wife Elizabeth Steward, parents of the Protector. The portrait of the latter, attended by a page who is fastening his sash at the waist (now in the National Portrait Gallery, transferred from the British Museum, to which it was bequeathed by Sir Robert Rich, Bart., descendant of Cromwell's friend, Nathaniel Rich) was called by Walpole "Cromwell and Lambert"; but it is now certain that the page represents Cromwell's son Richard. Elizabeth Cromwell, afterwards Mrs Claypole, the Protector's daughter, also sat to him. As no complete account of Walker's work is in existence (that of Walpole being very incomplete, while Cunningham passes him over entirely), it may be added that the artist twice painted John Evelyn, in different sizes, as well as Bradshaw, John Hampden, Colonel Thomas Sanders, Cornet Joyce, and Speaker Lenthall, as well as Sir William and Lady Waller, Mrs Thomas Knight, and General George Monk, duke of Albemarle, and Sir Thomas Fairfax (engraved by Faithorne). A portrait of Secretary Thurlow, which was in the Lord Northwick Collection, was attributed to him. As Walker was in the camp of the Parliamentarians and Dobson was the court painter at Oxford, few aristocratic persons sat to the former. Exceptions are Mary Capel, duchess of Beaufort (engraved by J. Nutting), Aubrey, last earl of Oxford, and James Graham, marquess of Montrose; even a portrait of Charles I. in armour, with his hand on his helmet, is credited to Walker. Two versions, of a like size, of his own portrait exist, one at the National Portrait Gallery and the other at Oxford, engraved by Peter Lombart, and again, later, by T. Chambars. The Cromwell in the Scottish National Portrait Gallery is a copy. Walker's copy of Titian's famous "Venus at her Toilet," highly esteemed by Charles I., is considered a work of great merit.

WALKER, ROBERT JAMES (1801–1869), American political leader and economist, was born in Northumberland, Pennsylvania, on the 23rd of July 1801. He graduated from the University of Pennsylvania in 1819 and practised law in Pittsburg from 1822 to 1826, when he removed to Mississippi. Though living in a slave state he was consistently opposed to slavery, but he favoured gradual rather than immediate emancipation, and in 1838 he freed his own slaves. He became prominent, politically, during the nullification excitement of 1832–1833, as a vigorous opponent of nullification, and from 1836 to 1845 he sat in the United States Senate as a Unionist Democrat. Being an ardent expansionist, he voted for the recognition of the independence of Texas in 1837 and for the joint annexation resolution of 1845, and advocated the nomination and election of James K. Polk in 1844. He was secretary of the treasury throughout the Polk administration (1845–1849) and was generally recognized as the most influential member of the cabinet. He financed the war with Mexico and drafted the bill (1849) for the establishment of the department of the interior, but his greatest work was the preparation of the famous treasury report of the 3rd of December 1845. Although inferior in intellectual quality to Alexander Hamilton's *Report on Manufactures*, presenting the case against free trade, it is regarded as the most powerful attack upon the protection system which has ever been made in an American state paper. The "Walker Tariff" of 1846 was based upon its principles and was in fact largely the secretary's own work. Walker at first opposed the Compromise of 1850, but was won over later by the arguments of Stephen A. Douglas. He was appointed territorial governor of Kansas in the spring of 1857 by President Buchanan, but in November of the same year resigned in disgust, owing to his opposition to the Lecompton Constitution. He did not, however, break with his party immediately, and favoured the so-called English Bill (see KANSAS); in fact it was partly due to his influence that a sufficient number of anti-Lecompton Democrats were induced to vote for that measure to secure its passage. He adhered to the Union cause during the Civil War and in 1863–1864 as financial agent of the United States did much to create confidence in Europe in the financial resources of the United States, and was instrumental in securing a loan of $250,000,000 in Germany. He practised law in Washington, D.C., from 1864 until his death there on the 11th of November 1869. Both during and after the Civil War he was a contributor to the *Continental Monthly*, which for a short time he also, with James R. Gilmore, conducted.

For the tariff report see F. W. Taussig, *State Papers and Speeches on the Tariff* (Cambridge, Mass., 1892).

WALKER, SEARS COOK (1805–1853), American astronomer, was born at Wilmington, Massachusetts, on the 28th of March 1805. Graduating at Harvard in 1825, he was a teacher till 1835, was an actuary in 1835–1845, and then became assistant at the Washington observatory. In 1847 he took charge of the longitude department of the United States Coast Survey, where he was among the first to make use of the electric telegraph for the purpose of determining the difference of longitude between two stations, and he introduced the method of registering transit observations electrically by means of a chronograph. He also investigated the orbit of the newly discovered planet Neptune. He died near Cincinnati on the 30th of January 1853. His brother Timothy (1802–1856) was a leader of the Ohio bar.

See *Memoirs of the Roy. Astr. Soc.* vol. xxiii.

WALKER, THOMAS (1784–1836), English police magistrate, best known as author of *The Original*, was born on the 10th of October 1784 at Charlton-cum-Hardy, near Manchester, where his father was a prosperous cotton merchant and an active Whig politician. He was educated at Cambridge and called to the bar, and after devoting some years mainly to the study of the Poor Law was made police magistrate in Lambeth in 1829. In 1835 he started his weekly publication *The Original*, containing his reflections on various social subjects and especially on eating and drinking; and it is in the history of gastronomy, and the art of dining, that this curious and amusing work is famous. The weekly numbers continued for six months, and subsequently were republished, after Walker's death on the 20th of January 1836, in an American selection (1837), in editions by W. B. Jerrold (with memoir) (1874), W. A. Guy (1875), and Henry Morley (1887), and in another selection of Sir Henry Cole ("Felix Summerley"), called *Aristology* (1881).

WALKER, WILLIAM (1824–1860), American adventurer, was born in Nashville, Tennessee, on the 8th of May 1824. After graduating from the university of Nashville in 1838, he studied law, was admitted to the bar, and subsequently spent a year in the study of medicine at Edinburgh and Heidelberg. He practised medicine for a few months in Philadelphia and then removed to New Orleans, where he engaged in journalism. In 1850 he migrated to California and engaged in newspaper work at San Francisco and later at Marysville, where he also practised law. On the 15th of October 1853 he sailed from San Francisco with a filibustering force for the conquest of Mexican territory. He landed in Lower California, and on the 18th of January 1854 he proclaimed this and the neighbouring State of Sonora an independent republic. Starvation and Mexican attacks led to the abandonment of this enterprise, and Walker resumed his journalistic work in California. On the 4th of May 1855, with fifty-six followers, Walker again sailed from San Francisco, this time for Nicaragua, where he had been invited by one of the belligerent factions to come to its aid. In October Walker seized a steamer on Lake Nicaragua belonging to the Accessory Transit Company, a corporation of Americans engaged in transporting freight and passengers across the isthmus, and was thus enabled to surprise and capture Granada, the capital and the stronghold of his opponents, and to make himself master of Nicaragua. Peace was then made; Patricio Rivas, who had been neutral, was made provisional president, and Walker secured the real power as commander of the troops. At this time two officials of the Transit Company determined to use Walker as their tool to get control of that corporation, then dominated by Cornelius Vanderbilt, and they advanced him funds and transported his recruits from the United States free of charge. In return for these favours, Walker seized the property of the company, on the pretext of a violation of its charter, and turned over its equipment to the men who had befriended him. On the 20th of May 1856 the new government was formally recognized at Washington by President Pierce, and on the 3rd of June the Democratic national convention expressed its sympathy with the efforts being made to "regenerate" Nicaragua. In June Walker was chosen president of Nicaragua, and on the 22nd of September, from alleged economic necessity, and also to gain the sympathy and support of the slave states in America, he repealed the laws prohibiting slavery.

Walker managed to maintain himself against a coalition of Central American states, led by Costa Rica, which was aided and abetted by agents of Cornelius Vanderbilt, until the 1st of May 1857, when, to avoid capture by the natives, he surrendered to Commander Charles Henry Davis, of the United States navy, and returned to the United States. In November 1857 he sailed from Mobile with another expedition, but soon after landing at Punta Arenas he was arrested by Commodore Hiram Paulding of the American navy, and was compelled to return to the United States as a paroled prisoner. On his arrival he was released by order of President Buchanan. After several unsuccessful attempts to return to Central America, Walker finally sailed from Mobile in August 1860 and landed in Honduras. Here he was taken prisoner by Captain Salmon, of the British navy, and was surrendered to the Honduran authorities, by whom he was tried and condemned to be shot. He was executed on the 12th of September 1860.

See Walker's own narrative, accurate as to details, *The War in Nicaragua* (Mobile, 1860); William V. Wells, *Walker's Expedition to Nicaragua* (New York, 1856); Charles William Doubleday, *Reminiscences of the "Filibuster" War in Nicaragua* (New York, 1886), and James Jeffrey Roche, *The Story of the Filibusters* (London, 1891), revised and reprinted as *Byways of War* (Boston, 1901). (W. O. S.)

WALKING RACES, a form of athletic sports, either on road or track. Road walking is the older form of the sport. The records for the chief walking distances were as follows in 1910:—

Distance.	Name.	Time.			Date.	Place.
		hr.	min.	sec.		
1 mile	A. T. Yeomans. .		6	19⅗	1906	Bath
2 miles	A. T. Yeomans. .		12	53⅕	1906	Swansea
3 ,,	J. W. Raby (professional) . . .		20	21½	1883	Lillie Bridge
4 ,,	G. E. Larner . .		27	14	1905	Brighton
5 ,,	J. W. Raby . .		35	10	1883	Lillie Bridge
10 ,,	J. W. Raby . .	1	14	45	1883	Lillie Bridge
15 ,,	J. W. Raby . .	1	55	56	1883	Lillie Bridge
20 ,,	W. Perkins . .	2	39	57	1877	Lillie Bridge
30 ,,	J. Butler . . .	4	29	52	1905	Putney
40 ,,	J. Butler . . .	6	11	17	1905	Putney
50 ,,	J. Butler . . .	7	52	27	1905	Putney
100 ,,	T. E. Hammond .	17	25	22	1907	London to Brighton and back

The record distance walked in 1 hour was 8 m. 339 yds. by the English amateur G. E. Larner in 1905; in 8 hours, 50 m. 1190 yds. by another English amateur, J. Butler, in 1905; in 24 hours, 131 m. 580¾ yds. by T. E. Hammond in 1908.

About the year 1875 there was a revival of interest in professional walking, which took the form of "go-as-you-please" competitions, extending over several days, usually six. These may be classed as walking contests, for, although running was allowed, it was seldom practised, excepting for a few moments at a time, for the purpose of relief from cramped muscles. The great difficulty in competitive walking is to keep within the rules. A "fair gait" is one in which one foot touches the ground before the other leaves it, only one leg being bent in stepping, namely, that which is being put forward.

WALL, RICHARD (1694–1778), diplomatist and minister in the Spanish service, belonged to a family settled in Waterford. As he was a Roman Catholic he was debarred from public service at home, and like many of his countrymen he sought his fortune in Spain. He served, probably as a soldier in one of the Irish regiments of the Spanish army, during the expedition to Sicily in 1718, and was present at the sea fight off Cape Passaro. During the following years he continued to be employed as an officer, but in 1727 he was appointed secretary to the duke of Liria, son of the duke of Berwick, and Spanish ambassador at St Petersburg. Wall's knowledge of languages, his adaptability, his quick Irish wit and ready self-confidence made him a great favourite, not only with the duke of Liria, but with other Spanish authorities. Spain was at that time much dependent on the ability of foreigners, and for a man of Wall's parts and character there were ample openings for an important and interesting career. The climate of St Petersburg seems to have been too much for him, and he soon returned to military service in Italy. It is said that when he was presented to the duke of Montemar, the Spanish general, and was asked who he was, he replied, "The most important person in the army after your excellency, for you are the head of the serpent, and I am the tail." He became known to Don José Patiño, the most capable minister of King Philip V., and was sent by him on a mission to Spanish America—a very rare proof of confidence towards a man of foreign origin. He is also said to have laid a plan for retaking Jamaica from the English. In 1747 he was employed in the negotiations for the peace of Aix-la-Chapelle, and in 1748 was named minister in London. In England he made himself very popular. Though an exile through the operation of the Penal Laws, and though he proved loyal to his adopted country, he was a constant partisan of an English alliance. His views recommended him to the favour of King Ferdinand VI. (1746–1759), whose policy was resolutely peaceful. In 1752 Wall was recalled from London to assist in completing a treaty of commerce with England, which was then being negotiated in Madrid. Wall now became the candidate of the English party in the Spanish court for the post of Minister of Foreign Affairs, in opposition to the leader of the French party, the marquis de la Ensenada. He obtained the place in 1752, and in 1754 he had a large share in driving Ensenada from office. He retained his position till 1764. The despatches of the English minister, Sir Benjamin Keene, and of his successor, Lord Bristol, contain many references to Wall. They are creditable to him. Though a constant partisan of peace and good relations with England, Wall was firm in asserting the rights of the government he served. During the early stages of the Seven Years' War (1756–1763) he insisted on claiming compensation for the excesses of English privateers in Spanish waters. He frequently complained to the English ministers of the difficulties which the violence of these adventurers put in his way. As a foreigner he was suspected of undue favour to England, and was the object of incessant attacks by the French party. The new king, Charles III. (1759–1788), continued Wall in office. When war was declared by Spain in 1761 the minister carried out the policy of the king, but he confessed to the English ambassador, Lord Bristol, that he saw the failure of his efforts to preserve peace with grief. The close relations of Charles III. with the French branch of the House of Bourbon made Wall's position as foreign minister very trying. Yet the king, who detested changing his ministers, refused all his requests to be allowed to retire, till Wall extorted leave in 1764 by elaborately affecting a disease of the eyes which was in fact imaginary. The king gave him handsome allowances, and a grant for life of the crown land known as the Soto de Roma, near Granada, which was afterwards conferred on Godoy, and finally given to the duke of Wellington. Wall lived almost wholly at or near Granada, exercising a plentiful hospitality to all visitors, and particularly to English travellers, till his death in 1778. He left the reputation of an able minister and a very witty talker.

A full account will be found in volume iv. of Coxe's *Memoirs of the Kings of Spain of the House of Bourbon* (London, 1815). Further details of his early career can be gathered from the *Diario del viaje a Moscovia, 1727–1730*, of the duke of Liria (vol. xiii. of the *Documentos inéditos para la historia de España*), (Madrid, 1842, et seq.).

WALL (O. Eng. *weal*, *weall*, Mid. Eng. *wal*, *walle*, adapted from Lat. *vallum*, rampart; the original O. Eng. word for a wall was *wág* or *wáh*), a solid structure of stone, brick or other material, used as a defensive, protecting, enclosing or dividing fence, or as the enclosing and supporting sides of a building, house or room. The Roman *vallum* was an earth rampart with stakes or palisades (*vallus*, stake; Gr. ἧλος, nail) and the Old English word was particularly applied to such earth walls; for the remains of the Roman walls in Britain see BRITAIN. The word, however, was also applied to stone defensive walls, for which the Latin word was *murus*. The history of the wall as a means of defence will be found in the article FORTIFICATION AND SIEGECRAFT, the architectural and constructional side under the headings ARCHITECTURE, MASONRY and BRICKWORK. In anatomy and zoology the term "wall," and also the Latin term *paries*, is used for an investing or enclosing structure, as in "cell-walls," walls of the abdomen, &c. In the days when footpaths were narrow and ill-paved or non-existent in the streets of towns and when the gutters were often overflowing with water and filth, the side nearest to the wall of the bordering houses was safest and cleanest, and hence to walk on that side was a privilege, hence the expressions "to take" or "to give the wall." The term "wall-rib" is given in architecture to a half-rib bedded in the wall, to carry the web or shell of the vault. In Roman and in early Romanesque work the web was laid on the top of the stone courses of the wall, which had been cut to the arched form, but as this was often irregularly done, and as sometimes the courses had sunk owing to the drying of the mortar, it was found better to provide an independent rib to carry the web; half of this rib was sunk in the wall and the other half moulded like the transverse and diagonal ribs, so that if the wall sank, or if it had to be taken down from any cause, the vault would still retain its position.

The word "wall eye" or "wall-eyed" is applied to a condition of the eye, particularly of a horse, in which there is a large amount of white showing or there is absence of colour in the iris, or there is leucoma of the cornea. It is also applied to the white staring eyes of certain fishes. The word has no connexion with "wall" as above, but is from the Icelandic *vagl-eygr*, *vagl*, a beam, sty in the eye, and *eygr*, eyed.

WALLABY, a native name, used in literature for any member of a section of the zoological genus *Macropus*, with naked muffle, frequenting forests and dense scrubs. With respect to their size they are distinguished as large wallabies and small wallabies, some of the latter being no bigger than a rabbit. From the localities in which they are found they are also called brush kangaroos. See KANGAROO.

WALLACE, ALFRED RUSSEL (1823–   ), British naturalist, was born at Usk, in Monmouthshire, on the 8th of January 1823. After leaving school he assisted an elder brother in his work as a land surveyor and architect, visiting various parts of England and Wales. Living in South Wales, about 1840 he began to take an interest in botany, and began the formation of a herbarium. In 1847 he took his first journey out of England, spending a week in Paris with his brother and sister. In 1844–1845, while an English master in the Collegiate School at Leicester, he made the acquaintance of H. W. Bates, through whose influence he became a beetle collector, and with whom he started in 1848 on an expedition to the Amazon. In about a year the two naturalists separated, and each wrote an account of his travels and observations. Wallace's *Travels on the Amazon and Rio Negro* was published in 1853, a year in which he went for a fortnight's walking tour in Switzerland with an old school-fellow. On his voyage home from South America the ship was burnt and all his collections lost, except those which he had despatched beforehand. After spending a year and a half in England, during which time, besides his book on the Amazon, he published a small volume on the *Palm Trees of the Amazon*, he started for the Malay Archipelago, exploring, observing and collecting from 1854 to 1862. He visited Sumatra, Java, Borneo, Celebes, the Moluccas, Timor, New Guinea and the Aru and Ké Islands. His deeply interesting narrative, *The Malay Archipelago*, appeared in 1869, and he also published many important papers through the London scientific societies. The chief parts of his vast insect collections became the property of the late W. W. Saunders, but subsequently some of the most important groups passed into the Hope Collection of the university of Oxford and the British Museum. He discovered that the Malay Archipelago was divided into a western group of islands, which in their zoological affinities are Oriental, and an eastern, which are Australian. The Oriental Borneo and Bali are respectively divided from Celebes and Lombok by a narrow belt of sea known as "Wallace's Line," on the opposite sides of which the indigenous mammalia are as widely divergent as in any two parts of the world. Wallace became convinced of the truth of evolution, and originated the theory of natural selection during these travels. In February 1855, staying at Sarawak, in Borneo, he wrote an essay "On the Law which has regulated the Introduction of New Species" (*Ann. and Mag. Nat. Hist.*, 1855, p. 184). He states the law as follows: "Every species has come into existence coincident both in time and space with a pre-existing closely allied species." He justly claims that such a law connected and explained a vast number of independent facts. It was, in fact, a cautious statement of a belief in evolution, and for three years from the time that he wrote the essay he tells us that "the question of *how* changes of species could have been brought about was rarely out of my mind." Finally, in February 1858, when he was lying muffled in blankets in the cold fit of a severe attack of intermittent fever at Ternate, in the Moluccas, he began to think of Malthus's *Essay on Population*, and, to use his own words, "there suddenly flashed upon me the *idea* of the survival of the fittest." The theory was thought out during the rest of the ague fit, drafted the same evening, written out in full in the two succeeding evenings, and sent to Darwin by the next post. Darwin in England at once recognized his own theory in the manuscript essay sent by the young and almost unknown naturalist in the tropics, then a stranger to him. "I never saw a more striking coincidence," he wrote to Lyell on the very day, on the 18th of June, when he received the paper: "if Wallace had my MS. sketch written out in 1842, he could not have made a better short abstract! Even his terms now stand as heads of my chapters." Under the advice of Sir Charles Lyell and Sir Joseph Hooker, the essay was read, together with an abstract of Darwin's own views, as a joint paper at the Linnean Society on the 1st of July 1858. The title of Wallace's section was "On the Tendency of Varieties to depart indefinitely from the Original Type." The "struggle for existence," the rate of multiplication of animals, and the dependence of their average numbers upon food supply are very clearly demonstrated, and the following conclusion was reached: "Those that prolong their existence can only be the most perfect in health and vigour; . . . the weakest and least perfectly organized must always succumb." The difference between Lamarck's theory and natural selection is very clearly pointed out. "The powerful retractile talons of the falcon and the cat tribes have not been produced or increased by the volition of those animals; but among the different varieties which occurred in the earlier and less highly organized forms of these groups, *those always survived longest which had the greatest facilities for seizing their prey.* Neither did the giraffe acquire its long neck by desiring to reach the foliage of more lofty shrubs, and constantly stretching its neck for the purpose, but because any varieties which occurred among its antitypes with a longer neck than usual *at once secured a fresh range of pasture over the same ground as their shorter-necked companions, and on the first scarcity of food were thereby enabled to outlive them.*" With such clear statements as these in the paper of the 1st of July 1858, it is remarkable that even well-known naturalists should have failed to comprehend the difference between Lamarck's and the Darwin-Wallace theory. Wallace also alluded to the resemblance of animals, and more especially of insects, to their surroundings, and points out that "those races having colours best adapted to concealment from their enemies would inevitably survive the longest." In 1871 Wallace's two essays, written at Sarawak and Ternate, were published with others as a volume, *Contributions to the Theory of Natural Selection.* Probably, next to the *Origin of Species*, no single work has done so much to promote clear understanding of natural selection and confidence in its truth; for in addition to these two historic essays, there are others in which the new theory is applied to the interpretation of certain classes of facts. Thus one treats of "Mimicry" in animals, another on "Instinct," another on "Birds' Nests." Each of these served as an example of what might be achieved in the light of the new doctrine, which, taught in this way and in an admirably lucid style, was easily absorbed by many who found the more complete exposition in the *Origin* very hard to absorb. In this work, and in many of his subsequent publications, Wallace differs from Darwin on certain points. Thus the two concluding essays contend that man has not, like the other animals, been produced by the unaided operation of natural selection, but that other forces have also been in operation. We here see the influence of his convictions on the subject of "spiritualism." More recently he expressed his dissatisfaction with the hypothesis of "sexual selection" by which Darwin sought to explain the conspicuous characters which are displayed during the courtship of animals. The expression of his opinion on both these points of divergence from Darwin will be found in *Darwinism* (1889), a most valuable and lucid exposition of natural selection, as suited to the later period at which it appeared as the *Essays* were to the ealier. Darwin died some years before the controversy upon the possibility of the hereditary transmission of acquired characters arose over the writings of Weismann, but Wallace has freely accepted the general results of the German zoologist's teaching, and in *Darwinism* has presented a complete theory of the causes of evolution unmixed with any trace of Lamarck's use or disuse of inheritance, or Buffon's hereditary effect of the direct influence of surroundings. *Tropical Nature and other Essays* appeared in 1878, since republished combined with the 1871 *Essays*, of which it formed the natural continuation. One of the greatest of his publications was the *Geographical Distribution of Animals* (1876), a monumental work, which every student will maintain fully justifies its author's hope that it may bear "a similar relation to the eleventh and twelfth chapters of the *Origin of Species* as Mr Darwin's *Animals and Plants under Domestication* bears to the first." *Island Life*, which may be regarded as a valuable supplement to the last-named work, appeared in 1880.

Turning to his other writings, Wallace published *Miracles and Modern Spiritualism* in 1881. Here is given an account of the reasons which induced him to accept beliefs which are shared by so small a proportion of scientific men. These reasons are purely experimental, and in no way connected with Christianity, for he had long before given up all belief in revealed religion. In 1882 he published *Land Nationalization*, in which he argued the necessity of state ownership of land, a principle which he had originated long before the appearance of Henry George's work. In *Forty-five Years of Registration Statistics* (1885) he maintained that vaccination is useless and dangerous. Wallace also published an account of what he held to be the greatest discoveries as well as the failures of the 19th century, *The Wonderful Century* (1899). His later works include *Studies, Scientific and Social* (1900), *Man's Place in the Universe* (1903) and his *Autobiography* (1905). Possessed of a bold and intensely original mind, his activities radiated in many directions, apparently rather attracted than repelled by the unpopularity of a subject. A non-theological *Athanasius contra mundum*, he has the truest missionary spirit, an intense faith which would seek to move the mountains of apathy and active opposition. Whatever may be the future history of his other views, he will always be remembered as an originator of a principle more illuminating than any which has appeared since the days of Newton, as one of its two discoverers whose scientific rivalry was only the beginning of a warm and unbroken friendship.

Wallace was married in 1866 to the eldest daughter of the botanist, Mr William Mitten, of Hurstpierpoint, Sussex. In 1871 he built a house at Grays, Essex, in an old chalk-pit, and after living there four years, moved successively to Dorking (two years) and Croydon (three years). In 1880 he built a cottage at Godalming near the Charterhouse school, and grew nearly 1000 species of plants in the garden which he made. In 1889 he moved to Dorsetshire. After his return to England in 1862 Wallace visited the continent, especially Switzerland, for rest and change (1866, 1896) and the study of botany and glacial phenomena (August 1895). He also visited Spa, in Belgium, about 1870, and in October 1887 went for a lecturing tour in the United States. He delivered a course of six Lowell lectures in Boston, and visited New York, New Haven, Baltimore, &c., spending the winter at Washington. The following March he went to Canada and Niagara, and then made his way westwards. He saw the Yosemite Valley, the Big Trees, and botanized in the Sierra Nevada and at Gray's Peak. In July he returned to Liverpool by way of Chicago and the St Lawrence.

The first Darwin medal of the Royal Society was awarded to A. R. Wallace in 1890, and he had received the Royal medal in 1868. A pension was awarded him by Mr Gladstone at the beginning of 1881. He received the degree of D.C.L. from Oxford in 1889, and of LL.D. from the university of Dublin in 1882. He was president of the Entomological Society of London in 1870–1871.

Apart from Wallace's own *Autobiography*, a good deal of useful information is given in the biographical introduction to Wallace's *Narrative of Travels on the Amazon and Rio Negro* by the editor, Mr G. T. Bettany.

WALLACE, LEWIS [LEW] (1827–1905), American soldier and author, was born at Brookville, Indiana, on the 10th of April 1827, and received an academic education. He abandoned temporarily the study of law in Indianapolis to recruit a company of volunteers (of which he was made second lieutenant) for the Mexican War, and served in 1846–1847 in the First Indiana Battery. He returned to the law, but at the beginning of the Civil War became colonel of the Eleventh Indiana Infantry, served in the West Virginia campaign, and on the 3rd of September 1861 was appointed brigadier-general. After the capture of Fort Donelson (February 16, 1862) he was promoted to major-general (March 21, 1862), was engaged at Shiloh (April 7, 1862), and afterwards commanded the Eighth Corps with headquarters at Baltimore. By delaying the Confederate general J. A. Early at Monocacy (July 9, 1864) he saved Washington from almost certain capture. General Wallace served as president of the court of inquiry (November 1862) which investigated the conduct of General D. C. Buell, and of the court which in 1865 tried and condemned Henry Wirz, commander of the Confederate prison at Andersonville, Ga. He was also a member of the court which tried the alleged conspirators against President Lincoln. He resigned from the army in 1865 to return to the bar. He served as governor of New Mexico Territory (1878–1881) and as minister to Turkey (1881–1885). Though exceedingly popular as a lecturer, his literary reputation rests upon three historical romances: *The Fair God* (1873), a story of the conquest of Mexico; *Ben Hur* (1880), a tale of the coming of Christ, which was translated into several languages and dramatized; and *The Prince of India* (1893), dealing with the Wandering Jew and the Byzantine empire.

WALLACE, SIR RICHARD, Bart. (1818–1890), English art collector and philanthropist, was born in London on the 26th of July 1818. According to Sir Walter Armstrong (see *Dict. of National Biography*, art. " Wallace "), he was a natural son of Maria, marchioness of Hertford (wife of the third marquess), under whose auspices the boy was educated, mainly at Paris; but it was generally supposed in his lifetime that he was a son of the fourth marquess (his elder by only eighteen years), and therefore her grandson. At Paris he was well known in society, and became an assiduous collector of all sorts of valuable *objets d'art*, but in 1857 these were sold and Wallace devoted himself to assisting the fourth marquess, who left London to reside entirely in Paris, to acquire a magnificent collection of the finest examples of painting, armour, furniture and *bric-à-brac*. In 1870 the marquess of Hertford died unmarried, bequeathing to Wallace an enormous property, including Hertford House and its contents, the house in Paris, and large Irish estates. Pending the reopening of Hertford House, which had been shut up since the marquess had gone to live in Paris, Wallace sent some of the finest of his pictures and other treasures to the Bethnal Green Museum for exhibition; they were then transferred to Hertford House, which had been largely transformed in order to receive them. In 1871 he was created a baronet for his services during the siege of Paris, when he equipped several ambulances, founded the Hertford British hospital, and spent money lavishly in relief. This munificence endeared Sir Richard Wallace to the French people. From 1873 to 1885 he had a seat in parliament for Lisburn, but he lived mostly in Paris, where, in the Rue Laffitte and in his villa in the Bois de Boulogne, he dwelt among art treasures not inferior to those at Hertford House. In 1878 he was made one of the British commissioners at the Paris Exhibition, and he was also a trustee of the National Gallery and a governor of the National Gallery of Ireland. He died in Paris on the 20th of July 1890. He had married in 1871 the daughter of a French officer, by whom he had a son, who, however, died in 1887; and Lady Wallace, who died in 1897, bequeathed his great art collection to the British nation. It is now housed in Hertford House, Manchester Square, which was acquired and adapted by the government for the purpose.

WALLACE, SIR WILLIAM (*c.* 1270–1305), the popular national hero of Scotland, is believed to have been the second son of Sir Malcolm Wallace of Elderslie and Auchinbothie, in Renfrewshire. The date of his birth is not certainly ascertained, but is usually given as 1270. The only authority for the events of his early life is the metrical history of Blind Harry. That authority cannot be implicitly relied on, though we need not conclude that the minstrel invented the stories he relates. He lived about two centuries later than Wallace, during which a considerable body of legend had probably gathered round the name, and these popular " gestis " he incorporates in his narrative. At the same time he professes to follow as his " autour " an account that had been written in Latin by John Blair, the personal friend and chaplain of Wallace himself. As Blair's account has perished, we cannot tell how far the minstrel has faithfully followed his authority, but some comparatively recent discoveries have confirmed the truth of portions of the narrative which had previously been doubted. At best, however, his authority must be regarded with suspicion, except when it is confirmed by other and more trustworthy evidence.

Only for a period of less than two years in his life—from the beginning of the insurrection in 1297 to the battle of Falkirk—does Wallace come before us in the clearest historical light. With the exception of one or two glimpses of him that we obtain from authentic historical documents, the recorded events of his later as of his earlier life rest on no more certain authority than that of Blind Harry.

In his boyhood, according to the usual accounts, he resided for some time at Dunipace, in Stirlingshire, with an uncle, who is styled " parson " of the place. By this uncle he was partially educated, and from him he imbibed an enthusiastic love of liberty. His education was continued at Dundee, where he made the acquaintance of John Blair. On account of an incident that happened at Dundee—his slaughter of a young Englishman named Selby, for an insult offered to him—he is said to have been outlawed, and so driven into rebellion against the English. Betaking himself to the wilds of the country, he gradually gathered round him a body of desperate men whom he led in various attacks upon the English. In consequence of the success of these early enterprises his following largely increased, several of the more patriotic nobles—including the steward of Scotland, Sir Andrew Moray, Sir John de Graham, Douglas the Hardy, Wishart, bishop of Glasgow, and others—having joined him. His insurrection now became more open and pronounced, and his enterprises of greater importance. An attack was made upon the English justiciar, Ormsby, who was holding his court at Scone. The justiciar himself escaped, but many of his followers were captured or slain. The burning of the Barns of Ayr, the quarters of English soldiers, in revenge for the treacherous slaughter of his uncle, Sir Ronald Crawford, and other Scottish noblemen, followed. The success of these exploits induced the English king to take measures for staying the insurrection. A large army, under the command of Sir Henry Percy and Sir Robert Clifford, was sent against the insurgents, and came up with them at Irvine. Dissensions broke out among the Scottish leaders, and all Wallace's titled friends left him and made submission to Edward, except the ever faithful Sir Andrew Moray. The treaty of Irvine, by which these Scottish nobles agreed to acknowledge Edward as their sovereign lord, is printed in Rymer's *Foedera*. It is dated the 9th of July 1297, and is the first public document in which the name of Sir William Wallace occurs. Wallace retired to the north, and although deserted by the barons was soon at the head of a large army. The vigour and success of his operations was such that in a short time he succeeded in recovering almost all the fortresses held by the English to the north of the Forth. He had begun the siege of Dundee when he received information that an English army, led by the earl of Surrey and Cressingham the treasurer, was on its march northward. Leaving the citizens of Dundee to continue the siege of the castle, he made a rapid march to Stirling. Encamping in the neighbourhood of the Abbey Craig—on which now stands the national monument to his memory—he watched the passage of the Forth. After an unsuccessful attempt to bring Wallace to terms, the English commander, on the morning of the 11th of September 1297, began to cross the bridge. When about one half of his army had crossed, and while they were still in disorder, they were attacked with such fury by Wallace, that almost all—Cressingham among the number—were slain, or driven into the river and drowned. Those on the south side of the river were seized with panic and fled tumultuously, having first set fire to the bridge. The Scots, however, crossed by a ford, and continued the pursuit of the enemy as far as Berwick. Sir Andrew Moray fell in this battle. The results of it were important. The English were everywhere driven from Scotland. To increase the alarm of the English, as well as to relieve the famine which then prevailed, Wallace organized a great raid into the north of England, in the course of which he devastated the country to the gates of Newcastle. On his return he was elected guardian of the kingdom. In this office he set himself to reorganize the army and to regulate the affairs of the country. His measures were marked by much wisdom and vigour, and for a short time succeeded in securing order, even in the face of the jealousy and opposition of the nobles. Edward was in Flanders when the news of this successful revolt reached him. He hastened home, and at the head of a great army entered Scotland in July 1298. Wallace was obliged to adopt the only plan of campaign which could give any hope of success. He slowly retired before the English monarch, driving off all supplies and wasting the country. The nobles as usual for the most part deserted his standard. Those that remained thwarted his councils by their jealousies. His plan, however, came very near being successful. Edward, compelled by famine, had already given orders for a retreat when he received information of Wallace's position and intentions. The army, then at Kirkliston, was immediately set in motion, and next morning (July 22, 1298) Wallace was brought to battle in the vicinity of Falkirk. After an obstinate fight the Scots were overpowered and defeated with great loss. Among the slain was Sir John de Graham, the bosom friend of Wallace, whose death, as Blind Harry tells, threw the hero into a frenzy of rage and grief. The account of his distress is one of the finest and most touching passages in the poem. With the remains of his army Wallace found refuge for the night in the Torwood—known to him from his boyish life at Dunipace. He then retreated to the north, burning the town and castle of Stirling on his way. He resigned the office of guardian, and betook himself again to a wandering life and a desultory and predatory warfare against the English. At this point his history again becomes obscure. He is known to have paid a visit to France, with the purpose of obtaining aid for his country from the French king. This visit is narrated with many untrustworthy details by Blind Harry; but the fact is established by other and indisputable evidence. When in the winter of 1303–1304 Edward received the submission of the Scottish nobles, Wallace was expressly excepted from all terms. And after the capture of Stirling Castle and Sir William Oliphant, and the submission of Sir Simon Fraser, he was left alone, but resolute as ever in refusing allegiance to the English king. A price was set upon his head, and the English governors and captains in Scotland had orders to use every means for his capture. On the 5th of August 1305 he was taken—as is generally alleged, through treachery—at Robroyston, near Glasgow, by Sir John Menteith, carried to the castle of Dumbarton, and thence conveyed in fetters and strongly guarded to London. He reached London on the 22nd of August, and next day was taken to Westminster Hall, where he was impeached as a traitor by Sir Peter Mallorie, the king's justice. To the accusation Wallace made the simple reply that he could not be a traitor to the king of England, for he never was his subject, and never swore fealty to him. He was found guilty and condemned to death. The sentence was executed the same day with circumstances of unusual cruelty.

The cause of national independence was not lost with the life of Wallace. Notwithstanding the cruelty and indignity amid which it terminated, that life was not a failure. It has been an inspiration to his countrymen ever since. The popular ideas regarding his stature, strength, bodily prowess and undaunted courage are confirmed by the writers nearest his own time—Wyntoun and Fordun. And indeed no man could in that age have secured the personal ascendancy which he did without the possession of these qualities. The little we know of his statesmanship during the short period he was in power gives proof of political wisdom. His patriotism was conspicuous and disinterested. He was well skilled in the modes of warfare that suited the country and the times. That he failed in freeing his country from the yoke of England was due chiefly to the jealousy with which he was regarded by the men of rank and power. But he had a nobler success in inspiring his countrymen with a spirit which made their ultimate conquest impossible.

For bibliography see the article in the *Dict. Nat. Biog.* The principal modern lives are James Moir's (1886), and A. F. Murison's (1898). (A. F. H.)

WALLACE, WILLIAM (1768–1843), Scottish mathematician, was born on the 23rd of September 1768 at Dysart in Fifeshire, where he received his school education. In 1784 his family removed to Edinburgh, where he himself was set to learn the trade of a bookbinder; but his taste for mathematics had already developed itself, and he made such use of his leisure hours that before the completion of his apprenticeship he had made considerable acquirements in geometry, algebra and astronomy. He was further assisted in his studies by John Robison (1739–1805) and John Playfair, to whom his abilities had become known. After various changes of situation, dictated mainly by a desire to gain time for study, he became assistant teacher of mathematics in the academy of Perth in 1794, and this post he exchanged in 1803 for a mathematical mastership in the Royal Military College at Great Marlow (afterwards at Sandhurst). In 1819 he was chosen to succeed John Leslie in the chair of mathematics at Edinburgh, and in 1838, when compelled by ill-health to retire, he received a government pension for life. He died in Edinburgh on the 28th of April 1843.

In his earlier years Wallace was an occasional contributor to Leybourne's *Mathematical Repository* and the *Gentleman's Mathematical Companion.* Between 1801 and 1810 he contributed articles on "Algebra," "Conic Sections," "Trigonometry," and several others in mathematical and physical science to the fourth edition of the *Encyclopaedia Britannica*, and some of these were retained in subsequent editions from the fifth to the eighth inclusive. He was also the author of the principal mathematical articles in the *Edinburgh Encyclopaedia*, edited by David Brewster (1808–1830). He also contributed many important papers to the *Transactions* of the Royal Society of Edinburgh.

See *Transactions of the Roy. Ast. Soc.*, 1844.

WALLACE, WILLIAM (1844–1897), Scottish philosopher, was born at Cupar-Fife on the 11th of May 1844, the son of a housebuilder. Between the ages of sixteen and twenty-two he was educated at St Andrews, whence he proceeded as an exhibitioner in 1864 to Balliol College, Oxford. He took a first class in Moderations, and in Lit. Hum. (1867), was Gaisford prizeman in 1867 (Greek prose) and Craven Scholar in 1869. Three years later he was appointed fellow, and in 1871 librarian, of Merton College. In 1882 he was elected Whyte's professor of moral philosophy in succession to T. H. Green, and retained the position until his death. He died on the 18th of February 1897 from the effects of a bicycle accident near Oxford. His manner was somewhat brusque and sarcastic, and on this account, in his undergraduate days at Balliol, he was known as "The Dorian." But he was greatly respected both as a man and as a lecturer. His philosophical works are almost entirely devoted to German, and especially to Hegelian, doctrines, which he expounded and criticized with great clearness and literary skill. In dealing with Hegel he was, unlike many other writers, successful in expressing himself in a lucid literary manner, without artificial and incomprehensible terminology.

His principal works were *The Logic of Hegel* (1873), which contains a translation of the *Encyklopädie* with an introduction, a second edition of which, with a volume entitled *Prolegomena*, appeared in 1892; *Epicureanism* (1880); *Kant* (Blackwood's Philosophical Classics, 1882); *Life of Arthur Schopenhauer* (1890); *Hegel's Philosophy of Mind* (translated from the *Encyklopädie*, with five introductory essays); *Lectures and Essays on Natural Theology and Ethics*, being a selection from his papers edited with a biographical introduction by Edward Caird. He wrote several important articles for the 9th edition of the *Ency. Brit.*, which, with some revision, have been repeated in the present work.

WALLACE, WILLIAM VINCENT (1814–1865), British composer, was born at Waterford, Ireland, his father, of Scottish family, being a regimental bandmaster. Vincent Wallace learnt as a boy to play several instruments, and became a leading violinist in Dublin. But in 1835 he married and went off to Australia, sheep farming. A concert in Sydney revived his musical passion; and having separated from his wife, he began a roving career, which had many romantic episodes, in Australia, the South Seas, India and South America. He returned to London in 1845 and made various appearances as a pianist; and in November of that year his opera *Maritana* was performed at Drury Lane with great success. This was followed by *Matilda of Hungary* (1847), *Lurline* (1860), *The Amber Witch*

(1861), *Love's Triumph* (1862) and *The Desert Flower* (1863). He also published a number of compositions for the piano, &c. Vincent Wallace was a cultivated man and an accomplished musician, whose *Maritana* still holds the stage, and whose work as an English operatic composer, at a period by no means encouraging to English music, has a distinct historical value. Like Balfe, he was born an Irishman, and his reputation as one of the few composers known beyond the British Isles at that time is naturally coupled with Balfe's. But he was a finer artist and a more original musician. In later years he became almost blind; and he died in poor circumstances on the 12th of October 1865, leaving a widow and two children.

WALLACK, JAMES WILLIAM (*c.* 1794–1864), Anglo-American actor and manager, was born in London, his parents being actors. He made his first stage appearance at Drury Lane in 1807. After three years in Dublin he was again at Drury Lane until he went to America in 1818. He settled in New York permanently in 1852, the first Wallack's theatre being an old one renamed at the corner of Broome Street and Broadway. The second, at 13th Street and Broadway, he built himself. Wallack was an actor of the old school. Thackeray praises his Shylock, Joseph Jefferson his Don Caesar de Bazan. He married the daughter (d. 1851) of John Henry Johnstone (1749–1828), a popular tenor and stage Irishman. Their son, John Lester Wallack (1820–1888), was born in New York on the 1st of January 1820. At one time in the English army, then on the Dublin and London stage, he made his first stage appearance in New York in 1847 under the name of John Lester as Sir Charles Coldstream, in Boucicault's adaptation of *Used Up*. He was manager, using the name Wallack, of the second Wallack's theatre from 1861, and in 1882 he opened the third at 30th Street and Broadway. His greatest successes were as Charles Surface, as Benedick, and especially as Elliot Grey in his own play *Rosedale*, and similar light comedy and romantic parts, for which his fascinating manners and handsome person well fitted him. He married a sister (d. 1909) of Sir John Millais. He wrote his own *Memories of Fifty Years*.

WALLAROO, a seaport of Daly county, South Australia, situated in Wallaroo Bay, on the Spencer Gulf, 123 m. by rail N.W. by N. of Adelaide. It is connected by rail with the celebrated Wallaroo copper mines (near Kadina, at a distance of 6 m. from the port). At Wallaroo Bay are the largest smelting works in the state, ranking among the largest in the world. Gold, silver and concentrated ores are received from other parts of the continent and from Tasmania for smelting at these works, which have ample facilities for shipment. Population of town (1901) 2920; of town and mines, 4866.

WALLASEY, an urban district in the Wirral parliamentary division of Cheshire, England, 2 m. N.W. of Birkenhead, of which it forms a suburb. Pop. (1901) 53,579. The former marshy estuary called Wallasey Pool is occupied by the Great Float, forming an immense dock (see Birkenhead). The church of St Hilary, to which is assigned a foundation in the 10th century, was rebuilt in the 18th century, with the exception of the tower bearing the date 1536. It was gutted by fire in 1857, and the whole was again rebuilt in the Early English style. On the shore of the Irish Sea is Leasowe Castle, once known as Mock-Beggar Hall, and supposed to have been erected by the earls of Derby in the reign of Elizabeth, in order to witness the horse-races held here. Under Wallasey Pool are remains of a submerged forest, in which various animal skeletons have been found.

At the Conquest Wallasey formed part of the possessions of Robert de Rhuddlan, and on his decease became part of the fee of Halton. In the reign of Elizabeth it had a small port, to which there belonged three barques and fourteen men. In 1668 the manor was possessed by the earl of Derby, but various parts afterwards became alienated. For a considerable time the horse-races held on what was then a common had considerable reputation, but they were discontinued in 1760. At these races the duke of Monmouth, son of Charles II., once rode his own horse and won the plate.

WALLA WALLA, a city and the county-seat of Walla Walla county, Washington, U.S.A., in the S.E. part of the state, on Mill Creek, about 200 m. S. by W. of Spokane. Pop. (1880) 3588; (1890) 4709; (1900) 10,049, of whom 1522 were foreign-born; (1910 census) 19,364. Walla Walla is served by the Northern Pacific and the Oregon Railroad & Navigation Co.'s (Union Pacific) railways, and by an interurban electric line. In the city are a state penitentiary, Fort Walla Walla (a U.S. cavalry post), a Federal Land Office, a Young Men's Christian Association building, a Carnegie library, the State Odd Fellows' Home, and the Stubblefield Home for Widows and Orphans. Sessions of Federal District and Circuit courts are held here. Walla Walla is the seat of Whitman College (chartered, 1859; opened, 1866; rechartered, 1883), originally Congregational, but now non-sectarian, which was founded by the Rev. Cushing Eells and was named in honour of Marcus Whitman, and includes a college, a conservatory of music and a preparatory academy, and occupies a campus of 30 acres; and of Walla Walla College (Adventist). Here are also St Paul's School (Protestant Episcopal) for girls, and St Vincent's Academy for girls and De La Salle Academy for boys (both Roman Catholic). The city is situated in a farming (especially wheat-growing), stock-raising and fruit-growing region, is a distributing centre for the adjacent territory in Washington, Oregon and Idaho, and has a large wholesale business. Among its manufactures are flour and grist-mill products, agricultural implements, lumber, foundry and machine-shop products, leather and malted liquors. The value of the factory product in 1905 was $1,485,791, 54·1% more than in 1900. The municipality owns its waterworks. In 1836 the famous missionary, Marcus Whitman, established at Waiilatpu, about 5 m. W. of the present Walla Walla, a mission of the American Board (Congregational), which in 1847 was broken up by an Indian attack, Whitman, his wife and twelve others being massacred, and the other residents being carried off as prisoners. In 1857 Fort Walla Walla was built by the United States government on the site of the present city, and about it a settlement grew up in 1857–1858. Walla Walla was laid out and organized as a town, and became the county seat in 1859; in 1862 it was chartered as a city. The name "Walla Walla" is said to be a Nez Percé Indian term meaning "a rapid stream."

See W. D. Lyman, *An Illustrated History of Walla Walla County, State of Washington* (1901).

WALL-COVERINGS. The present article deals with this subject (see Mural Decoration for art and archaeology) from the practical point of view in connexion with house-furnishing. In selecting a wall-covering, the chief factors to be borne in mind are the conditions of the room, viz. the use to which it is to be put, and its lighting, aspect and outlook.

Marble wall-lining.

Marble is one of the most beautiful materials that can be chosen for covering a wall. The variety of its natural markings and colour gives a wide choice that enables it to be employed in practically any scheme of colouring and for rooms of any aspect and of any description. The working up of the marble is done mostly by machinery; the saws used are flat strips of steel set in the frame of a machine and worked to and fro, sand and water being constantly supplied to assist in the work of cutting. Mouldings are worked to the desired profile by rapidly revolving carborundum wheels, and are afterwards polished by hand. Marble wall-slabbing needs very careful fixing, and should be well supported by a sufficient number of cramps at a little distance from the wall, leaving a space of about half an inch at the back of the slab. Non-rusting cramps should be used, such as those made of copper or bronze. A cement made of plaster of Paris and marble dust mixed in the proportion of two parts to one should be used for fixing, as pure plaster, especially if new, is liable to swell and cause the marble to crack. *Marezzo* and *Scagliola* are imitation marbles and are described in Plasterwork.

Mosaic.

Well-designed and properly executed mosaic is a very beautiful decorative medium, and ranks among the most permanent as well as most pleasing wall-coverings. With *glass mosaic* great ranges both of colour and of texture of surface can be obtained, different methods of preparing the glass giving a brilliant granular or quite dull surface as desired to suit the particular position of the work. *Marble mosaic* is used more for floors and pavings than for vertical surfaces. Most mosaic is now put together in the studio and pasted upon sheets of tough paper to which the design has previously been transferred. The whole section can thus be bedded on the prepared wall-surface with the least amount of trouble and without any danger of its sagging. When the cement has properly set, the paper is washed off from the face of the work.

Tiles.

Much improvement has been effected in the design and manufacture of wall-tiles. Especially has the design of tiles reached a very high level of excellence, and as a material which combines the qualities of being hard in wear, durable, damp-resisting and easily washable, with beauty of design, colouring and surface, tiling may perhaps be placed next in order of merit as a wall-covering to mosaic. A thin, opaque glass material, manufactured under various trade names, is now much used, especially for tiling existing walls. It has all the sanitary qualities of tiles, but is perhaps somewhat more fragile and liable to be damaged under hard wear. It is made in opal and other colours and is usually fixed with a special cement or mastic which allows for slight movements of expansion and contraction. The thickness of the material varies with different makers from ⅛ to ⅜ in.

Metal sheeting.

Metal sheeting, though somewhat inartistic in appearance, is useful where a durable, waterproof and sanitary wall protection is needed, and is therefore often used for sculleries, wash-houses and lavatories. Thin sheets of zinc with slightly embossed patterns and enamelled in colours can be hung upon the wall with a composition of white lead (one part) and whiting (two parts) mixed to a thick paste with varnish or gold size. Sheets of iron or steel can be more elaborately embossed and fixed to the wall with nails or screws; they are either previously enamelled or are painted after being fixed. They are used more for ceilings than for wall-coverings, but are adapted for use in either position.

Tapestry.

Tapestry of good design and workmanship is a really beautiful wall-covering. It is usually hung upon frames fitted to the wall, and may either cover the entire wall surface or be fixed in the form of panels, friezes, dados or fillings. It is not at all a sanitary covering, for it harbours a very large quantity of dust and dirt. The same remark applies, but perhaps in a less degree, to *brocades* of silk and *damask*. These materials are of a delicate nature and become easily soiled by the fumes of gas or oil lamps. Substitutes for these materials on stout paper and on cotton are made with a prepared back to facilitate pasting and hanging, and are a very good imitation of the better material.

A coarse canvas, specially prepared with a smooth back for pasting, and stained in several plain colours, can now be purchased. Having a rough surface it naturally holds the dust, but this can easily be brushed off without damaging the material. It is a pleasing wall-covering, which will stand hard wear, and it forms a good background for pictures and furniture.

Wall-papers.

The term "wall-paper" embraces a very large variety of materials of many kinds, designs and qualities, ranging from the cheapest machine-printed papers of the most flimsy description and often hideous design, to the Japanese and similar leather papers, skilfully modelled in relief and richly decorated in gold and colours. The design of the paper, of whatever description it may be, should preferably be of a conventional pattern, unobtrusive and restful to the eye, and presenting no strong contrasts of colour. The wall must be treated as a background, consisting of a plane surface, and no attempt made to introduce a pictorial element into the decoration. The wall surface, regarded from the paper-hanger's point of view, is often divided into three sections, the *dado* or *base*, the *field* or *filling*, and the *frieze* at the top immediately beneath the cornice. This subdivision is not always adhered to, and a wall may be papered uniformly all over its surface, or may consist of dado and filling without the frieze, or frieze and filling without the dado. The division between the sections is usually formed, in the case of the frieze and filling, with a wood picture rail, and between the filling and dado with a moulded dado or chair rail.

Wall-papers may be printed either in *distemper* colours or *oil* colours, and the patterns upon them are printed either by hand or by machine. There are also *self-coloured* papers which have different kinds of surface finish, and with some of these a pattern is formed by contrasting a smooth with a rough or granulated surface or vice versa. Typical of such papers are the *ingrain papers*, which have the colour penetrating through their substance. Plain filling papers are often used in conjunction with a boldly designed and strongly coloured frieze of considerable depth. The dado is either of similar plain paper or of an unobtrusive pattern. Often the filling is taken down to the skirting without the intervention of a dado rail. Papers printed in oil colours can be sized and varnished, and when treated in this way can be washed repeatedly and are very durable. This treatment gives an unpleasant glazed surface to the wall, but in spite of this it is often adopted for bathrooms, kitchens and in similar positions, because it is economical.

The best papers are printed from blocks manipulated by hand. The pattern, or as much of it as is to be printed in one colour, is carved upon a pear-wood board, small and delicate members being represented by strips and dots of copper inserted in the block. With large blocks a treadle and pulley arrangement gives the workman assistance in applying and removing the pattern, which is first fed with colour by being pressed on a felt blanket soaked in pigment and then applied to the surface of the paper to be decorated. One tint is applied at a time, and this when dry is followed by others necessary to complete the design. This drying of the previous colour ensures sharpness of outline and accuracy of colour. Designs are sometimes worked on the paper with *stencil patterns* cut out of zinc sheets. These are laid upon the paper and thick colour applied through the perforations with a stiff brush.

The cheaper wall-papers are printed by machinery. The paper is made to travel round a large drum around which are grouped the printing cylinders, each with its separate inking roller to supply the special colour for its use. On each of the wooden printing rollers is set copper "type," representing as much of the pattern as is to be printed in one colour. It is a difficult and tedious matter to get all the rollers to work together to form one perfect pattern, and when printing in several colours it may take a skilled workman a week or more to "set" his machine, a very large quantity of paper being spoilt during the process.

The colours used for hand-printed work, whether applied with blocks or stencil plates, are much thicker in consistency than those for machine work. One advantage of hand-worked paper is the comparative ease with which a paper can be matched even after it has gone out of stock. At a slight extra cost the manufacturer will print a few pieces for his customer from the blocks he has retained. With machine-printed paper this, from a practical point of view, is impossible, for it would necessitate the printer's going through the long and costly process of "setting" the machine.

Wall-papers are sold in rolls called "pieces." In England the standard size for a piece of paper is 12 yds. long and 21 in. wide. The printed surface is only 20 in. in width, as a margin of half an inch is left on each edge. One or both of these plain margins must be removed prior to hanging. French wall-papers are 9 yds. long and 18 in. wide and only contain 40½ sq. ft. compared with 63 ft. in a piece of English paper. To ascertain the number of pieces required for a room take the superficies in feet of the surface to be covered (deduction being made for the doors, windows, &c.) and divide by 60. This gives the net amount required; an allowance of about one-seventh must be added to allow for waste in matching patterns and of odd lengths. If French papers are to be used the division should be 38 instead of 60, these figures representing in feet the area of the printed surface in each roll. The surface of the wall should before papering be carefully prepared so as to be quite smooth and regular. If the wall has been previously papered it should be stripped, and any irregularities filled in with stopping. To remove varnished paper use hot water to which borax has been added in the proportions of 2 oz. to each pint of water. In selecting a paper for a newly plastered wall the colour chosen should be capable of withstanding the bleaching action of the lime in the plaster. Greens, blues and pinks especially are affected in this manner. For heavy papers glue paste should be used. Papering which has become dirty may be effectually cleaned with new bread or stiff dough; when gently rubbed over the surface in one direction this speedily removes the dirt. When the wall is damp, tinfoil, pitch-coated paper or Willesden waterproofed paper is used behind the paper to prevent the paper from becoming damaged by the wet. (J. Bt.)

WALLENSTEIN (properly WALDSTEIN), **ALBRECHT WENZEL EUSEBIUS VON,** duke of Friedland, Sagan and Mecklenburg (1583–1634), German soldier and statesman, was born of a noble but by no means wealthy or influential family at Herrmanic, Bohemia, on the 15th of September 1583. His parents were Lutherans, and in early youth he attended the school of the Brothers of the Common Life at Koschumberg. After the death of his parents he was sent by his uncle, Slawata, to the Jesuit college of nobles at Olmütz, after which he professed, but hardly accepted, the Roman Catholic faith. In 1599 he went to the university of Altdorf, which he had to leave in consequence of some boyish follies. Afterwards he studied at Bologna and Padua, and visited many places in southern and western Europe. While in Padua he gave much attention to astrology, and during the rest of his life he never wavered in the conviction that he might trust to the stars for indications as to his destiny. For some time Wallenstein served in the army of the emperor Rudolph II. in Hungary, which was commanded by a methodical professional soldier, Giorgio Basta. His personal gallantry at the siege of Gran won for him a company without purchase. In 1606 he returned to Bohemia, and soon afterwards he married an elderly widow, Lucretia Nikossie von Landeck, whose great estates in Moravia he inherited after her death in 1614. His new wealth enabled him to offer two hundred horse, splendidly equipped, to the archduke Ferdinand for his war with Venice in 1617. Wallenstein commanded them in person, and from that time he enjoyed both favour at court and popularity in the army. His wealth and influence were further increased by his marriage with Isabella Katharina, daughter of Count Harrach, a confidential adviser of the emperor Matthias.

In the disturbances which broke out in Bohemia in 1618 and proved to be the beginning of the Thirty Years' War, advances were made to Wallenstein by the revolutionary party; but he preferred to associate himself with the imperial cause, and he carried off the treasure-chest of the Moravian estates to Vienna, part of its contents being given him for the equipment of a regiment of cuirassiers. At the head of this regiment Wallenstein won great distinction under Buquoy in the war against Mansfeld. He was not present at the battle of the Weisser Berg, but he did brilliant service as second-in-command of the army which opposed Gabriel Bethlen in Moravia, and recovered his estates which the nationalists had seized. The battle of the Weisser Berg placed Bohemia at the mercy of the emperor Ferdinand, and Wallenstein turned the prevailing confusion to his own advantage. He secured the great estates belonging to his mother's family, and the emperor sold to him on easy terms vast tracts of confiscated lands. His possessions he was allowed to form into a territory called Friedland, and he was raised in 1622 to the rank of an imperial count palatine, in 1623 to that of a prince. In 1625 he was made duke of Friedland. Meantime he fought with skill and success against Gabriel Bethlen, and so enhanced his reputation at the dark moment when Vienna was in peril and the emperor's general Buquoy dead on the field of battle. At this stage in his life the enigma of his personality is complicated by the fact that he was not only the cold, detached visionary with vast ambitions and dreams, but also the model ruler of his principality. In everyday matters of administration he displayed vigour and foresight. He not only placed the administration of justice on a firm basis and founded schools, but by many wise measures developed agriculture and mining and manufacturing industries. At the same time he enlisted in the service of his ambition and his authority a pomp and refinement in his court which contrasted forcibly with the way of life of the smaller established rulers.

When the war against the Bohemians had become a widespread conflagration, Ferdinand found he had no forces to oppose to the Danes and the Northern Protestants other than the Army of the League, which was not his, but the powerful and independent Maximilian's, instrument. Wallenstein saw his opportunity and early in 1626 he offered to raise not a regiment or two, but a whole army for the imperial service. After some negotiations the offer was accepted, the understanding being that the troops were to be maintained at the cost of the countries they might occupy. Wallenstein's popularity soon brought great numbers of recruits to his standard. He soon found himself at the head of 30,000 (not long afterwards of 50,000) men. The campaigns of this army in 1625, 1626 and 1627, against Mansfeld, the Northern Protestants and Gabriel Bethlen, are described under THIRTY YEARS' WAR.

Having established peace in Hungary, Wallenstein proceeded, in 1627, to clear Silesia of some remnants of Mansfeld's army; and at this time he bought from the emperor the duchy of Sagan, his outlay in the conduct of the war being taken into account in the conclusion of the bargain. He then joined Tilly in the struggle with Christian IV., and afterwards took possession of the duchy of Mecklenburg, which was granted to him in reward for his services, the hereditary dukes being displaced on the ground that they had helped the Danish king. He failed to capture Stralsund, which he besieged for several months in 1628. This important reverse caused him bitter disappointment, for he had hoped that by obtaining free access to the Baltic he might be able to make the emperor as supreme at sea as he seemed to be on land. It was a part of Wallenstein's scheme of German unity that he should obtain possession of the Hanseatic towns, and through them destroy or at least defy the naval power of the Scandinavian kingdom, the Netherlands and England. This plan was completely frustrated by the resistance of Stralsund, and even more by the emperor's "Edict of Restitution" that not only rallied against him all the Protestants but brought in a great soldier and a model army, Gustavus and the Swedes.

At the same time the victory of the principles of the League involved the fall of Wallenstein's influence. By his ambitions, his high dreams of unity and the incessant exactions of his army, he had made for himself a host of enemies. He was reported to have spoken of the arrogance of the princes, and it appeared probable that he would try to bring them, Catholics and Protestants alike, into rigid subjection to the crown. Again and again the emperor was advised to dismiss him. Ferdinand was very unwilling to part with one who had served him so well; but the demand was pressed so urgently in 1630 that he had no alternative, and in September of that year envoys were sent to Wallenstein to announce his removal. Had the emperor declined to take this course, the princes would probably have combined against him; and the result would have been a civil war even more serious than that which had already brought so many disasters upon the country. Wallenstein perfectly understood this, and he therefore accepted the emperor's decision calmly, gave over his army to Tilly, and retired to Gitschin, the capital of his duchy of Friedland. There, and at his palace in Prague, he lived in an atmosphere of mysterious magnificence, the rumours of which penetrated all Germany. The enigma of his projects was intensified, and the princes who had secured his disgrace became more suspicious than ever. But ere long the emperor was forced by events to call him into the field again.

Shortly before the dismissal of Wallenstein, Gustavus Adolphus had landed in Germany, and it soon became obvious that he was far more formidable than the enemies with whom the emperor had yet had to contend. Tilly was defeated at Breitenfeld and on the Lech, where he received a mortal wound, and Gustavus advanced to Munich, while Bohemia was occupied by his allies the Saxons. The emperor entreated Wallenstein to come once more to his aid. Wallenstein at first declined; he had, indeed, been secretly negotiating with Gustavus Adolphus, in the hope of destroying the League and its projects and of building his new Germany without French assistance. However, he accepted Ferdinand's offers, and in the spring of 1632 he raised a fresh army as strong as the first within a few weeks and took the field. This army was placed absolutely under his control, so that he assumed the position of an independent prince rather than of a subject. His first aim was to drive the Saxons from Bohemia—an object which he accomplished without serious difficulty. Then he advanced against Gustavus Adolphus, whom he opposed near Nuremberg and after the battle of the Alte Veste dislodged. In November came the great battle of Lützen (*q.v.*), in which the imperialists were defeated, but Gustavus Adolphus was killed.

To the dismay of Ferdinand, Wallenstein made no use of the opportunity provided for him by the death of the Swedish king, but withdrew to winter quarters in Bohemia. In the campaign of 1633 much astonishment was caused by his apparent unwillingness to attack the enemy. He was in fact preparing to desert the emperor. In the war against the Saxons he had offered them as terms of peace the revocation of the Edict. Religious toleration and the destruction of the separatist régime, as well as not inconsiderable aggrandisements for his own power, formed his programme, so far as historians have been able to reconstruct it, and becoming convinced from Ferdinand's obstinacy that the Edict would never be rescinded, he began to prepare to "force a just peace on the emperor in the interests of united Germany." With this object he entered into negotiations with Saxony, Brandenburg, Sweden and France. He had vast and vague schemes for the reorganization of the entire constitutional system of the empire, and he himself was to have supreme authority in determining the political destinies of his country. But as the mere commander of mercenaries he was trusted by no one, and could only play the part of Cassandra to the end.

Irritated by the distrust excited by his proposals, and anxious to make his power felt, he at last assumed the offensive against the Swedes and Saxons, winning his last victory at Steinau on the Oder in October. He then resumed the negotiations. In December he retired with his army to Bohemia, fixing his headquarters at Pilsen. It had soon been suspected in Vienna that Wallenstein was playing a double part, and the emperor, encouraged by the Spaniards at his court, anxiously sought for means of getting rid of him. Wallenstein was well aware of the designs formed against him, but displayed little energy in his attempts to thwart them. This was due in part, no doubt, to ill-health, in part to the fact that he trusted to the assurances of his astrologer, Battista Seni. He also felt confident that when the time came for his army to decide between him and the emperor the decision would be in his own favour.

His principal officers assembled around him at a banquet on the 12th January 1634, when he submitted to them a declaration to the effect that they would remain true to him. This declaration they signed. More than a month later a second paper was signed; but on this occasion the officers' expression of loyalty to their general was associated with an equally emphatic expression of loyalty to their emperor. By this time Wallenstein had learned that he must act warily. On the 24th of January the emperor had signed a secret patent removing him from his command, and imperial agents had been labouring to undermine Wallenstein's influence. On the 7th two of his officers, Piccolomini and Aldringer, had intended to seize him at Pilsen; but finding the troops there loyal to their general, they had kept quiet. But a patent charging Wallenstein and two of his officers with high treason, and naming the generals who were to assume the supreme command of the army, was signed on the 18th of February, and published in Prague.

When Wallenstein heard of the publication of this patent and of the refusal of the garrison of Prague to take his orders, he realized the full extent of his danger, and on the 23rd of February, accompanied by his most intimate friends, and guarded by about 1000 men, he went from Pilsen to Eger, hoping to meet the Swedes under Duke Bernhard, who, at last convinced of his sincerity, were marching to join him. After the arrival of the party at Eger, Colonel Gordon, the commandant, and Colonels Butler and Leslie agreed to rid the emperor of his enemy. On the evening of the 25th of February Wallenstein's supporters Illo, Kinsky, Terzky and Neumann were received at a banquet by the three colonels, and then murdered. Butler, Captain Devereux and a number of soldiers hurried to the house where Wallenstein was staying, and broke into his room. He was instantly killed by a thrust of Devereux's partisan. Wallenstein was buried at Gitschin, but in 1732 the remains were removed to the castle chapel of Münchengrätz.

No direct orders for the murder had been issued, but it was well understood that tidings of his death would be welcome at court. The murderers were handsomely rewarded, and their deed was commended as an act of justice.

Wallenstein was tall, thin and pale, with reddish hair, and eyes of remarkable brilliancy. He was of a proud and imperious temper, and was seldom seen to laugh. He worked hard and silently. In times of supreme difficulty he listened carefully to the advice of his counsellors, but the final decision was always his own, and he rarely revealed his thoughts until the moment for action arrived. Few generals have surpassed him in the power of quickly organizing great masses of men and of inspiring them with confidence and enthusiasm. But it is as a statesman that Wallenstein is immortal. However much or little motives of personal aggrandisement influenced his schemes and his conduct, "Germany turns ever to Wallenstein as she turns to no other amongst the leaders of the Thirty Years' War. . . . Such faithfulness is not without reason. . . . Wallenstein's wildest schemes, impossible of execution by military violence, were always built upon the foundation of German unity. In the way in which he walked that unity was doubtless unobtainable. . . . But during the long dreary years of confusion which were to follow it was something to think of the last supremely able man whose life had been spent in battling against the great evils of the land, against the spirit of religious intolerance and the spirit of division."

See Förster, *Albrecht von Wallenstein* (1834); Aretin, *Wallenstein* (1846); Helbig, *Wallenstein und Arnim, 1632-1634* (1850), and *Kaiser Ferdinand und der Herzog von Friedland, 1633-1634* (1853); Hurter, *Zur Geschichte Wallensteins* (1855); Fiedler, *Zur Geschichte Wallensteins* (1860); L. von Ranke, *Geschichte Wallensteins* (3rd ed., 1872); Gindely, *Geschichte des dreissigjährigen Kriegs* (1869); J. Mitchell, *Wallenstein* (1840); S. R. Gardiner, *Thirty Years' War*.

WALLER, EDMUND (1606–1687), English poet, was the eldest son of Robert Waller of Coleshill (then in Herts, now in Buckinghamshire) and Anne Hampden, his wife. He was first cousin to the celebrated patriot John Hampden. He was born on the 9th of March 1606, and baptized in the parish church of Amersham. Early in his childhood his father sold his house at Coleshill and migrated to Beaconsfield. Of Waller's early education all we know is his own account that he "was bred under several ill, dull and ignorant schoolmasters, till he went to Mr Dobson at Wickham, who was a good schoolmaster and had been an Eton scholar." His father died in 1616, and the future poet's mother, a lady of rare force of character, sent him to Eton and to Cambridge. He was admitted a fellow-commoner of King's College on the 22nd of March 1620. He left without a degree, and it is believed that in 1621, at the age of only sixteen, he sat as member for Agmondesham (Amersham) in the last parliament of James I. Clarendon says that Waller was "nursed in parliaments." In that of 1624 he represented Ilchester, and in the first of Charles I. Chipping Wycombe. The first act by which Waller distinguished himself, however, was his surreptitious marriage with a wealthy ward of the Court of Aldermen, in 1631. He was brought before the Star Chamber for this offence, and heavily fined. But his own fortune was large, and all his life Waller was a wealthy man. After bearing him a son and a daughter at Beaconsfield, Mrs Waller died in 1634. It was about this time that the poet was elected into Falkland's "Club."

It is supposed that about 1635 he met Lady Dorothy Sidney, eldest daughter of the earl of Leicester, who was then eighteen years of age. He formed a romantic passion for this girl, whom he celebrated under the name of Sacharissa. She rejected him, and married Lord Spencer in 1639. Disappointment, it is said, rendered Waller for a time insane, but this may well be doubted. He wrote, at all events, a long, graceful and eminently sober letter on the occasion of the wedding to the bride's sister. In 1640 Waller was once more M.P. for Amersham, and made certain speeches which attracted wide attention; later, in the Long Parliament, he represented St Ives. Waller had hitherto supported the party of Pym, but he now left him for the group of Falkland and Hyde. His speeches were much admired, and were separately printed; they are academic exercises very carefully prepared. Clarendon says that Waller spoke "upon all occasions with great sharpness and freedom." An extraordinary and obscure conspiracy against Parliament, in favour of the king, which is known as "Waller's Plot," occupied the spring of 1643, but on the 30th of May he and his friends were arrested. In the terror of discovery, Waller was accused of displaying a very mean poltroonery, and of confessing "whatever he had said, heard, thought or seen, and all that he knew . . or suspected of others." He certainly cut a poor figure by the side of those of his companions who died for their opinions. Waller was called before the bar of the House in July, and made an abject speech of recantation. His life was spared and he was committed to the Tower, whence, on paying a fine of £10,000, he was released and banished the realm in November 1643. He married a second wife, Mary Bracey of Thame, and went over to Calais, afterwards taking up his residence at Rouen. In 1645 the *Poems* of Waller were first published in London, in three different editions; there has been much discussion of the order and respective authority of these issues, but nothing is decidedly known. Many of the lyrics were already set to music by Henry Lawes. In 1646 Waller travelled with Evelyn in Switzerland and Italy. During the worst period of the exile Waller managed to "keep a table" for the Royalists in Paris, although in order to do so he was obliged to sell his wife's jewels. At the close of 1651 the House of Commons revoked Waller's sentence of banishment, and he was allowed to return to Beaconsfield, where he lived very quietly until the Restoration.

In 1655 he published *A Panegyric to my Lord Protector*, and was made a Commissioner for Trade a month or two later. He followed this up, in 1660, by a poem *To the King, upon his Majesty's Happy Return*. Being challenged by Charles II. to explain why this latter piece was inferior to the eulogy of Cromwell, the poet smartly replied, "Sir, we poets never succeed so well in writing truth as in fiction." He entered the House of Commons again in 1661, as M.P. for Hastings, and Burnet has recorded that for the next quarter of a century "it was no House if Waller was not there." His sympathies were tolerant and kindly, and he constantly defended the Nonconformists. One famous speech of Waller's was: "Let us look to our Government, fleet and trade, 'tis the best advice the oldest Parliament man among you can give you, and so God bless you." After the death of his second wife, in 1677, Waller retired to his house called Hall Barn at Beaconsfield, and though he returned to London, he became more and more attached to the retirement of his woods, "where," he said, "he found the trees as bare and withered as himself." In 1661 he had published his poem, *St James' Park*; in 1664 he had collected his poetical works; in 1666 appeared his *Instructions to a Painter*; and in 1685 his *Divine Poems*. The final collection of his works is dated 1686, but there were further posthumous additions made in 1690. Waller bought a cottage at Coleshill, where he was born, meaning to die there; "a stag," he said, "when he is hunted, and near spent, always returns home." He actually died, however, at Hall Barn, with his children and his grandchildren about him, on the 21st of October 1687, and was buried in woollen (in spite of his expressed wish), in the churchyard of Beaconsfield.

Waller's lyrics were at one time admired to excess, but with the exception of "Go, lovely Rose" and one or two others, they have greatly lost their charm. He was almost destitute of imaginative invention, and his fancy was plain and trite. But he resolutely placed himself in the forefront of reaction against the violence and "conceit" into which the baser kind of English poetry was descending. A great deal of discussion, some of it absurdly violent in tone, has been expended on the question how far Waller was or was not the pioneer in introducing the classical couplet into English verse. It is, of course, obvious that Waller could not "introduce" what had been invented, and admirably exemplified, by Chaucer. But those who have pointed to smooth distichs employed by poets earlier than Waller have not given sufficient attention to the fact (exaggerated, doubtless, by critics arguing in the opposite camp) that it was he who earliest made writing in the serried couplet the habit and the fashion. Waller was writing in the regular heroic measure, afterwards carried to so high a perfection by Dryden and Pope, as early as 1623 (if not, as has been supposed, even in 1621).

The only critical edition of Waller's *Poetical Works* is that edited, with a careful biography, by G. Thorn-Drury, in 1893. (E. G.)

WALLER, LEWIS (1860–), English actor, was born in Spain, his father being a civil engineer. He first appeared on the London stage in 1883, at Toole's, and for some years added to his reputation as a capable actor in London and the provinces. He came more particularly to the front by a fine performance as Buckingham in *The Three Musketeers* under Mr Beerbohm Tree's management at His Majesty's in 1895, and soon afterwards organized a company of his own, first at the Haymarket and afterwards at the Shaftesbury, Imperial, Apollo and other theatres. His fine voice and vigorous acting were well suited in his memorable production of *Henry V.*, and he had a great success with *Monsieur Beaucaire* and similar plays. His wife, Mrs Lewis Waller (Florence West), also became well known as a powerful and accomplished actress.

WALLER, SIR WILLIAM (*c.* 1597–1668), English soldier, was the son of Sir Thomas Waller, lieutenant of Dover, and was born about 1597. He was educated at Magdalen Hall, Oxford, and served in the Venetian army and in the Thirty Years' War. He was knighted in 1622 after taking part in Vere's expedition to the Palatinate. Little is known of his life up to 1640, when he became member of parliament for Andover. Being a strict Presbyterian by religion, and a member of the opposition in politics, he naturally threw himself with the greatest ardour into the cause of the parliament when the Civil War broke out in 1642. He was at once made a colonel, and conducted to a speedy and successful issue the siege of Portsmouth in September; and later in the year captured Farnham, Winchester and other places in the south-west. At the beginning of 1643 Waller was made a major-general and placed in charge of operations in the region of Gloucester and Bristol (see GREAT REBELLION), and he concluded his first campaign with a victory at Highnam and the capture of Hereford. He was then called upon to oppose the advance of Sir Ralph Hopton and the Royalist western army, and though more or less defeated in the hard-fought battle of Lansdown (near Bath) he shut up the enemy in Devizes. However, Hopton and a relieving force from Oxford inflicted a crushing defeat upon Waller's army at Roundway Down. Hopton was Waller's intimate personal friend, and some correspondence passed between the opposing generals, a quotation from which (Gardiner, *Civil War*, i. 168) is given as illustrative of "the temper in which the nobler spirits on either side had entered on the war." "That great God," wrote Waller, "who is the searcher of my heart knows with what a sad sense I go upon this service, and with what a perfect hatred I detest this war without an enemy; but I look upon it as sent from God . . . God. . . in his good time send us the blessing of peace and in the meantime assist us to receive it! We are both upon the stage and must act such parts as are assigned us in this tragedy, let us do it in a way of honour and without personal animosities."

The destruction of his army at Roundway scarcely affected Waller's military reputation, many reproaching Essex, the commander-in-chief, for allowing the Oxford royalists to turn against Waller. The Londoners, who had called him "William the Conqueror," recognized his skill and energy so far as willingly to raise a new army for him in London and the south-eastern counties. But from this point Waller's career is one of gradual disillusionment. His new forces were distinctively local, and, like other local troops on both sides, resented long marches and hard work far from their own counties. Only at moments of imminent danger could they be trusted to do their duty. At ordinary times, *e.g.* at the first siege of Basing House, they mutinied in face of the enemy, deserted and even marched home in formed bodies under their own officers, and their gallantry at critical moments, such as the surprise of Alton in December 1643 and the recapture of Arundel in January 1644, but partially redeemed their general bad conduct. Waller himself, a general of the highest skill,—"the best shifter and chooser of ground" on either side,—was, like Turenne, at his best at the head of a small and highly-disciplined regular army. Only a Condé or a Cromwell could have enforced discipline and soldierly spirit in such men, ill-clad and unpaid as they were, and the only military quality lacking to Waller was precisely this supreme personal magnetism. In these circumstances affairs went from bad to worse. Though successful in stopping Hopton's second advance at Cheriton (March 1644), he was defeated by Charles I. in the war of manœuvre which ended with the action of Cropredy Bridge (June), and in the second battle of Newbury in October his tactical success at the village of Speen led to nothing. His last expeditions were made into the west for the relief of Taunton, and in these he had Cromwell as his lieutenant-general. By this time the confusion in all the armed forces of the parliament had reached such a height that reforms were at last taken in hand. The original suggestion of the celebrated "New Model" army came from Waller, who wrote to the Committee of Both Kingdoms (July 2, 1644) to the effect that "an army compounded of these men will never go through with your service, and till you have an army merely your own that you may command, it is in a manner impossible to do anything of importance." Simultaneously with the New Model came the Self-Denying Ordinance, which required all members of parliament to lay down their military commands. Waller did so gladly—the more as he had already requested to be relieved—and his active military career came to an end. But the events of 1643–1644 had done more than embitter him. They had combined with his Presbyterianism to make him intolerant of all that he conceived to be licence in church, state or army, and after he ceased to exercise command himself he was constantly engaged, in and out of parliament, in opposing the Independents and the army politicians, and supporting the cause of his own religious system, and later that of the Presbyterian-Royalist opposition to the Commonwealth and Protectorate régime. He was several times imprisoned between 1648 and 1659. In the latter year he was active in promoting the final negotiations for the restoration of Charles II. and reappeared in the House of Commons. He sat in the Convention Parliament, but soon retired from political life, and he died on the 19th of September 1668.

See Wood's *Athenae Oxonienses*, ed. Bliss, iii. 812, and two partial autobiographies, "Recollections by General Sir William Waller" (printed in *The Poetry of Anna Matilda*, 1788), and *Vindication of the Character*, &c. (1797).

Sir William Waller's cousin, SIR HARDRESS WALLER (*c.* 1604–1666) was also a parliamentarian of note. Knighted by Charles I. in 1629, he gained military experience in serving against the rebels in Ireland; then from 1645 to the conclusion of the Civil War he was in England commanding a regiment in the new model army. He was Colonel Pride's chief assistant when the latter "purged" the House of Commons in 1648, and he was one of the king's judges and one of those who signed the death warrant. During the next few years Waller served in Ireland, finally returning to England in 1660. After the restoration he fled to France, but soon surrendered himself to the authorities as a regicide, his life being spared owing to the efforts of his friends. He was, however, kept in prison and was still a captive when he died.

See M. Noble, *Lives of the Regicides* (1798).

WALLINGFORD, a township of New Haven county, Connecticut, U.S.A., S.W. of the centre of the state, in the valley of the Quinnipiac river. It contains the villages of East Wallingford, Tracy and Yalesville, and the borough of Wallingford. Pop. of the township (1900) 9001, (1910) 11,155; of the borough (1900) 6737, of whom 1796 were foreign-born and 21 were negroes, (1910) 8690. Area of the township, about 38 sq. m. The borough is 12 m. N.E. of New Haven, on a hill about 1½ m. long, and is served by the New York, New Haven & Hartford railway (which has stations also at East Wallingford and Yalesville) and by an interurban electric line connecting with Meriden and New Haven. The borough has a public library (1881), a Masonic Home, the Gaylord Farm Sanatorium of the New Haven County Anti-Tuberculosis Association, the Phelps School (for girls) and the Choate School (1896, for boys). Among the manufactures of the borough are sterling silver articles, plated and britannia ware, brass ware, rubber goods, cutlery and edge tools. The township of Wallingford was settled in 1670. At a meeting held in January 1766, in protest against the Stamp Act, it was declared, that "Whereas it appears from ancient Records and other Memorials of Incontestible Validity that our Ancestors with a great Sum Purchased said township, with great Peril possessed and Defended the Same, we are Born free (having never been in bondage to any), an inheritance of Inestimable Value," and a penalty of 20s. was imposed upon any one who should introduce or use stamped paper or parchment. During the War of Independence patriotic sentiment here was strong and Loyalists were sometimes exiled to Wallingford, where they could have no effective influence. The borough of Wallingford was incorporated in 1853 and re-incorporated in 1868. From 1851 to 1880 there was a communistic settlement, a branch of the Oneida Community, here; its property was bought by the Masonic Order and made into the Masonic Home.

See C. H. S. Davis's *History of Wallingford* (Meriden, 1870).

WALLINGFORD, a market town and municipal borough in the Abingdon parliamentary division of Berkshire, England, 51 m. W. by N. of London by the Great Western railway. Pop. (1901) 2808. It is pleasantly situated in the flat valley of the Thames, on the west (right) bank. The railway station is the terminus of a branch line from Cholsey. Of the churches only St Leonard's, retaining some Norman work and rebuilt approximately on its original plan, with an eastern apse, is of interest. The ancient castle has left only its mound and earthworks, and other works may be traced surrounding the town on the landward side. The town hall, raised on arches, dates from 1670. The large grammar school was founded in 1659. The trade of the town is principally agricultural; and malting is carried on. The borough is under a mayor, 4 aldermen and 12 councillors. Area, 380 acres.

The site of Wallingford (*Warengeford*, *Walynford*, *Walyngforth*) was occupied by a Romano-British settlement, though the imposing earthworks are of uncertain date—they may be of post-Roman British origin. Wallingford was a fortified town before the Conquest, and, though burned by Sweyn in 1006, was much the largest and most important borough in Berkshire at the time of the Domesday Survey. The new castle was so extensive that eight houses had been demolished to make room for it; the market was already in existence, and perhaps also the gild merchant, which in a charter of Henry II. is said to date back to the reign of the Confessor. In the reign of Henry I. the beginning of decay is marked by the inability of the town "through poverty" to pay its aid. It is said to have suffered greatly from the Black Death, and its decline was accelerated by the building, in the early 15th century, of two bridges near Abingdon, which diverted the main road between London and Gloucester from Wallingford. Periodical reductions in the fee farm show the gradual impoverishment of the town, and in 1636 its assessment for ship-money was only £20, while that of Reading was £220. Wallingford was a royal borough held in the reign of Henry III. by Richard, king of the Romans. Edward III. granted the fee farm to the Black Prince and his successors in the duchy of Cornwall. The earliest charters were given by Henry I. and Henry II., the latter confirming the ancient privileges of the borough, which were to be held as the citizens of Winchester held theirs, and granting to the burgesses freedom from toll throughout his dominions. These charters were confirmed and enlarged by Henry III. in 1267 and by Philip and Mary in 1557–1558. In 1648 the corporation consisted of a mayor, three aldermen, a chamberlain and sixteen burgesses. This constitution was remodelled in 1650 by a charter from Cromwell, but the governing charter until the passing of the Municipal Corporations Act of 1835 was that given by Charles II. in 1663, incorporating the town under the style of a mayor, recorder, town clerk, six aldermen, two burgesses, a chamberlain and eighteen assistants of the better sort of the inhabitants. In 1571 Elizabeth issued letters patent empowering the burgesses of Wallingford to take toll of all carts passing over their bridge, in order to provide for its repair and maintenance. Wallingford sent two members to parliament from 1295 to 1832, and one from 1832 to 1885, when its representation was merged in that of the county: before 1832 the franchise was vested in the inhabitants paying scot and lot. The empress Maud took refuge at Wallingford after her escape from Oxford Castle (1142), and here peace was made between her and Stephen (1153). Wallingford Castle was one of the last fortresses to hold out for Charles I., and during the Commonwealth it was demolished by order of the government. In 1205 the king commanded the sheriff of Oxford to cause a fair to be held at Wallingford at Whitsun for four days, to be continued for three years. In 1227 Swyncombe fair was transferred from the feast of St Botolph to the feast of St Mark in order not to interfere with Wallingford fair. Fairs on the days of St Nicholas and of St John the Baptist were granted by Henry VII. in 1500, and the charter of 1663 provided for two markets and four annual fairs. All the latter have fallen into disuse except the Michaelmas fair, which is principally for hiring servants. During the 18th century the town was fairly prosperous and had a good trade in grain and malt.

See *Victoria County History*, *Berks*; T. K. Hedges, *The History of Wallingford* (London, 1881).

WALLIS, JOHN (1616–1703), English mathematician, logician and grammarian, was born on the 23rd of November 1616 at Ashford, in Kent, of which parish his father, Rev. John Wallis (1567–1622), was incumbent. After being at school at Ashford, Tenterden and Felsted, and being instructed in Latin, Greek and Hebrew, he was in 1632 sent to Emmanuel College, Cambridge, and afterwards was chosen fellow of Queens' College. Having been admitted to holy orders, he left the university in 1641 to act as chaplain to Sir William Darley, and in the following year accepted a similar appointment from the widow of Sir Horatio Vere. It was about this period that he displayed surprising talents in deciphering the intercepted letters and papers of the Royalists. His adherence to the parliamentary party was in 1643 rewarded by the living of St Gabriel, Fenchurch Street, London. In 1644 he was appointed one of the scribes or secretaries of the Assembly of Divines at Westminster. During the same year he married Susanna Glyde, and thus vacated his fellowship; but the death of his mother had left him in possession of a handsome fortune. In 1645 he attended those scientific meetings which led to the establishment of the Royal Society. When the Independents obtained the superiority Wallis adhered to the Solemn League and Covenant. The living of St Gabriel he exchanged for that of St Martin, Ironmonger Lane; and, as rector of that parish, he in 1648 subscribed the Remonstrance against putting Charles I. to death. Notwithstanding this act of opposition, he was in June 1649 appointed Savilian professor of geometry at Oxford. In 1654 he there took the degree of D.D., and four years later succeeded Gerard Langbaine (1609–1658) as keeper of the archives. After the restoration he was named one of the king's chaplains in ordinary. While complying with the terms of the Act of Uniformity, Wallis seems always to have retained moderate and rational notions of ecclesiastical polity. He died at Oxford on the 28th of October 1703.

The works of Wallis are numerous, and relate to a multiplicity of subjects. His *Institutio logicae*, published in 1687, was very popular, and in his *Grammatica linguae Anglicanae* we find indications of an acute and philosophic intellect. The mathematical works are published, some of them in a small 4to volume (Oxford, 1657) and a complete collection in three thick folio volumes (Oxford, 1693–1699). The third volume includes, however, some theological treatises, and the first part of it is occupied with editions of treatises on harmonics and other works of Greek geometers, some of them first editions from the MSS., and in general with Latin versions and notes (Ptolemy, Porphyrius, Briennius, Archimedes, Eutocius, Aristarchus and Pappus). The second and third volumes include also his correspondence with his contemporaries; and there is a tract on trigonometry by Caswell. Excluding all these, the mathematical works contained in the first and second volumes occupy about 1800 pages. The titles in the order adopted, but with date of publication, are as follows: "Oratio inauguralis," on his appointment (1649) as Savilian professor (1657); "Mathesis universalis, seu opus arithmeticum philologice et mathematice traditum, arithmeticam numerosam et speciosam aliaque continens" (1657); "Adversus Meibomium, de proportionibus dialogus" (1657); "De sectionibus conicis nova methodo expositis" (1655); "Arithmetica infinitorum, sive nova methodus inquirendi in curvilineorum quadraturam aliaque difficiliora matheseos problemata" (1655); "Eclipsis solaris observatio Oxonii habita 2° Aug. 1654" (1655); "Tractatus duo, prior de cycloide, posterior de cissoide et de curvarum tum linearum εὐθύνσει tum superficierum πλατυσμῷ" (1659); "Mechanica, sive de motu tractatus geometricus" (three parts, 1669–1670–1671); "De algebra tractatus historicus et practicus, ejusdem originem et progressus varios ostendens" (English, 1685); "De combinationibus alternationibus et partibus aliquotis tractatus" (English, 1685) "De sectionibus angularibus tractatus" (English, 1685); "De angulo contactus et semicirculi tractatus" (1656); "Ejusdem tractatus defensio" (1685); "De postulato quinto, et quinta definitione, lib. VI. Euclidis, disceptatio geometrica" (? 1663); "cunocuneus, seu corpus partim conum partim cuneum representans geometrice consideratum" (English, 1685); "De gravitate et gravitatione disquisitio geometrica" (1662; English, 1674); "De aestu maris hypothesis nova" (1666–1669).

The *Arithmetica infinitorum* relates chiefly to the quadrature of curves by the so-called method of indivisibles established by Bonaventura Cavalieri in 1629 (see INFINITESIMAL CALCULUS). He extended the "law of continuity" as stated by Johannes Kepler; regarded the denominators of fractions as powers with negative exponents; and deduced from the quadrature of the parabola $y=x^m$, where m is a positive integer, the area of the curves when m is negative or fractional. He attempted the quadrature of the circle by interpolation, and arrived at the remarkable expression known as *Wallis's Theorem* (see CIRCLE, SQUARING OF). In the same work Wallis obtained an expression for the length of the element of a curve, which reduced the problem of rectification to that of quadrature.

The *Mathesis universalis*, a more elementary work, contains copious dissertations on fundamental points of algebra, arithmetic and geometry, and critical remarks.

The *De algebra tractatus* contains (chapters lxvi.-lxix.) the idea of the interpretation of imaginary quantities in geometry. This is given somewhat as follows: the distance represented by the square root of a negative quantity cannot be measured in the line backwards or forwards, but can be measured in the same plane above the line, or (as appears elsewhere) at right angles to the line either in the plane, or in the plane at right angles thereto. Considered as a history of algebra, this work is strongly objected to by Jean Etienne Montucla on the ground of its unfairness as against the early Italian algebraists and also Franciscus Vieta and René Descartes and in favour of Harriot; but Augustus De Morgan, while admitting this, attributes to it considerable merit. The symbol for infinity, ∞, was invented by him.

The two treatises on the cycloid and on the cissoid, &c., and the *Mechanica* contain many results which were then new and valuable. The latter work contains elaborate investigations in regard to the centre of gravity, and it is remarkable also for the employment of the principle of virtual velocities.

Among the letters in volume iii., we have one to the editor of the *Acta Leipsica*, giving the decipherment of two letters in secret characters. The ciphers are different, but on the same principle: the characters in each are either single digits or combinations of two or three digits, standing some of them for letters, others for syllables or words,—the number of distinct characters which had to be deciphered being thus very considerable.

For the prolonged conflict between Hobbes and Wallis, see HOBBES, THOMAS.

WALLIS ARCHIPELAGO, UVEA, or UEA, a group of islands in the Pacific Ocean, N.E. of Fiji, about 13° S., 176° W., with a land area of 40 sq. m., belonging to France. It was placed under the French protectorate on the 5th of April 1887, and connected for administrative purposes with New Caledonia by decree of the 27th of November 1888. There is a French Resident in the islands, which are connected by a regular service with Nouméa, New Caledonia. The principal islands are Uvea, of volcanic formation and surrounded with coral, and Nukuatea. The islands were discovered by Samuel Wallis in 1767, and it was a missionary, Father Bataillon, who in 1837 first brought the influence of France to bear on the natives. These, about 4500 in number, are of Polynesian race, gentle and industrious. The trade of the islands is mainly with Samoa, whence cottons and iron goods are imported, and to which copra and roots are exported. The Horne Islands (Fotuna and Alofa), S.W. of the Wallis Islands, were discovered by Jacob Lemaire and Willem Cornelis Schouten in 1616, and placed under the French protectorate by decree of the 16th of February 1888. They have 1500 inhabitants.

WALLON, HENRI ALEXANDRE (1812–1904), French historian and statesman, was born at Valenciennes on the 23rd of December 1812. Devoting himself to a literary career, he became in 1840 professor at the École Normale Supérieure under the patronage of Guizot, whom he succeeded as professor at the Faculté des Lettres in 1846. His works on slavery in the French colonies (1847) and on slavery in antiquity (1848; new edition in 3 vols., 1879) led to his being placed, after the Revolution of 1848, on a commission for the regulation of labour in the French colonial possessions, and in November 1849 he was elected to the Legislative Assembly by the department of the Nord. He resigned in 1850, disapproving of the measure for the restriction of the suffrage adopted by the majority. In the same year he was elected a member of the Académie des Inscriptions, of which he became perpetual secretary in 1873. Under the empire he withdrew altogether from political life, and occupied himself entirely with his duties as a professor of history and with historical writings, the most original of which is a biography, *Richard II, épisode de la rivalité de la France et de l'Angleterre* (2 vols., 1864). Although remaining a republican, he exhibited decided clerical leanings in his *Jeanne d'Arc* (2 vols., 1860; 2nd ed., 1875); *La Vie de Notre Seigneur Jésus* (1865)—a reply to the *Vie de Jésus* of E. Renan; and *Saint Louis et son temps* (1871; 4th ed., 1892), which still ranks among hagiographical works. Returning to politics after the Franco-German War, Wallon was re-elected by the department of the Nord in 1871, took an active part in the proceedings of the Assembly, and finally immortalized himself by carrying his proposition for the establishment of the Republic with a president elected for seven years, and then eligible for re-election, which, after violent debates, was adopted by the Assembly on the 30th of January 1875. "Ma proposition," he declared, "ne proclame pas la République, elle la fait." Upon the definitive establishment of the Republic, Wallon became Minister of Public Instruction, and effected many useful reforms, but his views were too conservative for the majority of the Assembly, and he retired in May 1876. He had been chosen a life senator in December 1875. Returning to his historical studies, Wallon produced four works of great importance, though less from his part in them as author than from the documents which accompanied them: *La Terreur* (1873); *Histoire du tribunal* *révolutionnaire de Paris avec le journal de ses actes* (6 vols., 1880–1882); *La Révolution du 31 mai et le fédéralisme en 1793* (2 vols., 1886); *Les Représentants du peuple en mission et la justice révolutionnaire dans les départements* (5 vols., 1880–1890). Besides these he published a number of articles in the *Journal des savants*; for many years he wrote the history of the Académie des Inscriptions in the collection of *Memoirs* of this Academy, and he composed obituary notices of his colleagues, which were inserted in the *Bulletin*. He died at Paris on the 13th of November 1904.

WALLOONS (*Wallons*, from a common Teut. word meaning "foreign," cf. Ger. *welsch*, Du. *waalsch*, Eng. *Welsh*), a people akin to the French, but forming a separate branch of the Romance race, inhabiting the Belgian provinces of Hainaut, Namur, Liége, parts of Luxemburg and southern Brabant, parts of the French departments of Nord and Ardennes, and a few villages in the neighbourhood of Malmedy in Rhenish Prussia. The Walloons are descended from the ancient Gallic Belgi, with an admixture of Roman elements. They are in general characterized by greater vivacity and adaptability than their Flemish neighbours, while they excel their French neighbours in endurance and industry. Their numbers are reckoned in Belgium at between 2,000,000 and 3,000,000. The Walloon dialect is a distinct branch of the Romance languages, with some admixture of Flemish and Low German. It was used as a literary language until the 15th century, when it began to be assimilated to French, by which it was ultimately superseded.

Grandgagnage, *De l'origine des Wallons* (Liége, 1852), *Vocabulaire des noms wallons, &c.* (2nd ed., 1857), and *Dict. étymol. de la langue wallonne* (t. i. and ii., 1845–1851; t. iii., by Scheler, 1880); J. Dejardin, *Dict. des "spots" ou proverbes wallons* (1863); Van der Kindere, *Recherches sur l' ethnologie de la Belgique* (Brussels, 1872); Demarteau, *Le Flamand, le Wallon, &c.* (Liége, 1889); M. Wilmotte, *Le Wallon, Histoire et littérature* (Brussels, 1893); Monseur, *Le Folklore wallon* (Brussels, 1892). [X.]

Walloon Literature.—In medieval times various local documents in prose and verse were written by inhabitants of Liége and its diocese in a dialect of French which contained many Walloon words and phrases. It is supposed that as early as the 12th century the idiom of the people may have been used in songs which are now lost, unless echoes of them are preserved in the curious *Noëls*, partly in French, partly in patois, which were orally collected by M. Doutrepont and published in 1888. Several Flemish works in old French, containing Walloon expressions, and in particular the so-called *Poème moral* of the 13th century, have been claimed as precursors of a local literature, but they are really to be considered as composed in French with a certain admixture of Liégeois phrases. The earliest existing specimen of pure Walloon literature is the *Ode* in praise of Liége, dated 1620, and attributed to Mathias Navaeus; this was first printed in 1857 in the transactions of the Société Liégeoise. Except a few very flat popular songs, there is nothing more until the end of the 17th century, when we find *Lis Aiwes di Tongue* (The Waters of Tongres), an amusing lyrical satire on the pretensions of that town to be considered a Roman spa. Fifty years later the opening of a popular theatre at Liége led to the creation of a class of farces, written in Walloon; of these *Li Voëge di Chaudfontaine* (The Journey to Chaudfontaine) (1757), by Jean Noël Hamal, has considerable humour and vigour in its rhymed dialogue. Other successful comedies were *Li Fiesse di Hoûte s'i plou*, *Li Ligeois égagi*, and, above all, *Lis Hypocondes*, the liveliest specimen of old Walloon literature which has survived. This diverting farce describes the adventures of a party of mock-invalids, who pursue a series of intrigues at a spa. This class of dramatic literature closed with *Li Malignant* in 1789. In these early songs and plays the Walloon humour is displayed with great crudity; anything like sentiment or elevated feeling is unknown.

The Revolution of 1789 inspired numerous Liégeois patriots with popular songs; of these *pasquêyes*, as they are styled, Albin Body collected more than 250, but they are almost entirely devoid of literary merit. Under their new government, Liége and Namur allowed the national patois to withdraw into the background, and it was not until the middle of the 19th century that Walloon literature began seriously to be cultivated. Its only expression, for a long time, was in lyrical poetry in the form of satires and the humorous songs, called *pasquêyes* and *crâmignons*. The earliest of the modern Walloon writers was Charles Nicolas Simonon (1774–1847), who celebrated in *Li Côparèy* the ancient clock-tower of the cathedral of St Lambert, an object of reverence to the inhabitants of Liége. His poems were collected in 1845. Henri Joseph Forir (1784–1862) was the first president of the Société Liégeoise, and one of the protagonists of Walloon literature. He published a valuable dictionary of the patois. The Curé C. E. E. Du Vivier de Streel (1799–1863) was the author of *Li Pantalon trawê* (The Torn Trowsers), a *pasquêye* which still enjoys an enormous popularity among the Walloon population. The first Walloon writer of high merit, however, was Nicolas Defrecheux (1825–1874), who is the most distinguished poet whom the patois has hitherto produced. His *Leyîz-m' plorer* (Let me cry), when it appeared in 1854, made a wide sensation, and was the earliest expression of what is serious and tender in the Walloon nature. His *Chansons wallonnes* appeared in 1860. Defrecheux stands almost alone among the Walloon poets as an artist and not merely an improvisatore. His poetical works were posthumously collected in 1877.

For many years, in spite of the efforts of such scholars as MM. Alphonse Le Roy and H. Gaidoz, a taste for Walloon literature remained strictly circumscribed, and was limited to a small circle of enthusiasts in Liége and Namur. In 1872 a literary club was formed, entitled the Caveau Liégeois, and this gave a very great stimulus to the cultivation of the Walloon letters. The national drama, which had been entirely neglected for more than a century, once more was called into existence through the exertions of the theatrical club, called Les Wallons. The comedies of A. M. J. Delchef (b. 1835) were acted with success, and led the way for the most important patois dramatist that Liége has produced, Édouard Remouchamps (b. 1836), who is the author of *Tâtî l'Perriquî* (1884), perhaps the most entertaining farce in Walloon, and certainly the most popular. Remouchamps was for thirty years a prolific writer of short pieces for the stage, sentimental and farcical. After the success of this play, according to an enthusiastic chronicler, "the writers of Wallonia became legion." Their style, however, was not greatly varied, and they have mainly confined themselves to songs, satirical lampoons and farces. The founder of the Société Liégeoise was J. F. E. Bailleux (1817–1860), to whom the revival of an interest in early Walloon literature is mainly due; in conjunction with J. V. F. J. Dehin (1809–1871) he published a translation of Lafontaine into patois. Among writers of the younger generation, special credit must be given to Henri Simon (b. 1856), for his humoristic tales and sketches; to Julien Delaite (b. 1868), for his amusing lyrics; and to Zephir Henin (b. 1866), for his prose, prose being much rarer than verse in Walloon. It would be possible to add very largely to this list, but the most notable names have been mentioned. A certain monotonous fluency is the fault of Walloon literature, which repeats its effects too constantly, and is confined within too narrow limits. A few writers, among whom Isidore Dory (b. 1833) is prominent, have endeavoured to enlarge the scope of the patois writers, but their suggestions have met with little response. When the Walloon writer desires to impart serious information or deep feeling, he resorts to the use of French. The *pasquêye*, which is the characteristic form of Walloon verse, is a kind of semi-comic and extremely familiar lyric, humorous and extravagant, a survival of the influence of Béranger on taste three-quarters of a century ago; the facility with which these songs are composed is betrayed by the enormous number of them which exist in Liége and Namur. The difficulties of Walloon literature are increased by the unfixed character of its phonetic and often extravagant orthography.

Authorities.—H. Gaidoz, *La Société liégeoise de littérature wallonne* (Liége, 1890); Alphonse Le Roy, *Littérature wallonne* (Brussels, 1875); Charles Defrecheux, Joseph Defrecheux et Charles Gothier, *Anthologie des poètes wallons* (Liége, 1895); Maurice Wilmotte, *Le Wallon* (Brussels, 1894). (E. G.)

WALLOP, SIR HENRY (*c.* 1540–1599), English statesman, was the eldest son of Sir Oliver Wallop (d. 1566), of Farleigh Wallop, Hampshire. Having inherited the estates of his father and of his uncle, Sir John Wallop (*q.v.*), he was knighted in 1569 and was chosen member of parliament for Southampton in 1572. His connexion with Ireland, where the quarter part of his public life was passed, began in 1579, when he was appointed vice-treasurer of that country; this position was a very thankless and difficult one, and Wallop appears to have undertaken it very unwillingly. However, he reached Dublin and was soon immersed in the troubles caused by the rebellion of Gerald Fitzgerald, earl of Desmond, finding, in his own words, it was "easier to talk at home of Irish wars than to be in them." In July 1582 he and Adam Loftus, archbishop of Dublin, were appointed lords justices, and they were responsible for the government of Ireland for just two years, after which they were succeeded by Sir John Perrot. Sir Henry continued to fill the office of vice-treasurer, and at Enniscorthy, where he had secured a lease of lands, he set up a colony of Englishmen and opened up a trade with Madeira. As a member of the Irish council he quarrelled with Perrot, and then from 1589 to 1595 he was in England, entertaining the queen at Farleigh Wallop in 1591. Having returned to Ireland he was sent to Dundalk to attempt to make peace with Hugh O'Neill, earl of Tyrone, but this proved a vain errand. At length, after many entreaties, he was allowed to resign the treasurership, but before he could arrange to leave Ireland he died on the 14th of April 1599.

Wallop's eldest son, Sir Henry Wallop (1568–1642), who acted as his father's deputy in Ireland, left an only son, Robert Wallop (1601–1667). A member of parliament for nearly forty years, and a supporter of the parliamentary party, Robert was one of the judges of Charles I., although he did not sign the death warrant. He was active under the Commonwealth, being a member of nearly all the councils of state. At the restoration he was deprived of his estates and was imprisoned, and he died in the Tower of London on the 19th of November 1667. Robert's son Henry (d. 1673) was the grandfather of John Wallop, 1st earl of Portsmouth.

WALLOP, SIR JOHN (*c.* 1490–1551), English soldier and diplomatist, belonged to an old Hampshire family. Adopting the profession of arms, he commanded ships which took part in the war between England and France in 1513 and 1514; later he served the king of Portugal against the Moors, and then he fought for his own sovereign in Ireland and in France. In 1526 Wallop began his diplomatic career, being sent on an errand to Germany by Henry VIII., and from 1532 to 1541 he passed much of his time in Paris and elsewhere in France as the representative of the English king. He filled several other public positions, including that of lieutenant of Calais, before January 1541, when he was suddenly arrested on a charge of treason; his offence, however, was not serious and in the same year he was made captain of Guînes. In 1543 he led a small force to help the emperor Charles V. in his invasion of France, and he remained at his post at Guînes until his death there on the 13th of July 1551.

WALLQVIST, OLAF (1755–1800), Swedish statesman and ecclesiastic, was ordained in 1776, became doctor of philosophy in 1779, court preacher to Queen Louisa Ulrica in 1780, and bishop of Vexiö in 1787. He attracted the attention of Gustavus III. by his eloquent preaching at the fashionable St Clara church at Stockholm. Gustavus at once took the young priest by the hand, appointed him, at twenty-five, one of his chaplains; made him a canon before he was thirty and a bishop at thirty-two, and finally placed him at the head of the newly appointed commission for reforming the ecclesiastical administration of the country. Thus at thirty-four Wallqvist had nothing more to hope for but the primacy, which would infallibly have been his also had the archbishop died during the king's lifetime. Wallqvist was, however, much more of a politician than a churchman. His knowledge of human nature, inexhaustible energy, dauntless self-confidence and diplomatic finesse made him indispensable to Gustavus III. His seductive manners too often won over those whom his commanding eloquence failed to convince. His political career began during the mutinous *riksdag* of 1786, when he came boldly forward as one of the royalist leaders. But it was at the stormy *riksdag* of 1789 that Wallqvist put forth all his powers. The retirement of the timid primate left him without an equal in the Estate of Clergy, and it was very largely due to his co-operation that the king was able to carry through the famous "Act of Unity and Security" which converted Sweden from a constitutional into a semi-absolute monarchy. Nevertheless, even the combative Wallqvist was appalled when on the 16th of February 1789 the king privately informed him that he meant on the following day soundly to trounce the Estate of Nobles in the presence of the three other estates and bend them to his royal will. A friend of compromise, like most of the men of his cloth, Wallqvist dissuaded all revolutionary expedients at the outset, though when the king proved immovable the bishop materially smoothed the way before him. At this memorable *riksdag* Wallqvist exhibited, moreover, financial ability of the highest order, and, as president of the ecclesiastical commission, assisted to equilibrate the budget and find the funds necessary for resuming the war with Russia. During the brief *riksdag* of 1792, as a member of the secret committee, Wallqvist was at the very centre of affairs and rendered the king essential services. Indeed it may be safely said that Gustavus III., during the last six years of his reign, mainly depended upon Wallqvist and his clerical colleague, Carl Gustaf Nordin (*q.v.*), who were patriotic enough to subordinate even their private enmity to the royal service. During the Reuterholm (*q.v.*) administration, Wallqvist, like the rest of the Gustavians, was kept remote from court. In 1800 he was recalled to the political arena. But his old rivalry with Nordin was resumed at the same time, and when the latter defeated a motion of the bishop's in the Estate of Clergy, at the diet of Norrköping, Wallqvist from sheer vexation had a stroke of apoplexy and died the same day (30th of April 1800).

As bishop of Vexiö, Wallqvist was remarkable for his extraordinary administrative ability. He did much for education and for the poorer clergy, and endowed the library of the gymnasium with 6000 volumes. As an author also he was more than distinguished. His *Ecclesiastica Samlingar* testify to his skill and diligence as a collector of MSS., while his *Minnen och Bref*, ed. E. V. Montan (Stockholm, 1878), is one of the most trustworthy and circumstantial documents relating to the Gustavian era of Swedish history.

See R. N. Bain, *Gustavus III. and his Contemporaries* (London, 1895, vol. ii.); *O. Wallqvists Själfiografiska anteckningar* (Upsala, 1850); and J. Rosengren, *Om O. Wallqvist såsom Biskop och Eforus* (Vexiö, 1901). (R. N. B.)

WALLSEND, a municipal borough in the Tyneside parliamentary division of Northumberland, England, on the north bank of the Tyne, 3¾ m. E.N.E. of Newcastle by a branch of the North-Eastern railway. Pop. (1891) 11,257; (1901) 20,918. The church of St Peter dates from 1809. There are remains of the church of the Holy Cross in transitional Norman style. At an early period Wallsend was famous for its coal, but the name has now a general application to coal that does not go through a sieve with meshes five-eighths of an inch in size. The colliery, which was opened in 1807, has frequently been the scene of dreadful accidents, notably on the 23rd of October 1821, when 52 lives were lost. There are ship and boat building yards, engineering works, lead and copper smelting works, cement works and brick and tile works. In the river are two pontoon docks and an immense dry dock. Wallsend was incorporated in 1901, and the corporation consists of a mayor, 6 aldermen and 18 councillors. Area, 1202 acres.

Wallsend derives its modern name from its position at the eastern extremity of the Roman Hadrian's Wall; and there was a Roman fort here. It had a quay, of which remains have been discovered, and possessed a magazine of corn and other provisions for the supply of the stations in the interior.

WALMER, a watering-place, and member of the Cinque Port of Sandwich, in the St Augustine's parliamentary division of

Kent, England, 2 m. S. of Deal, on the South-Eastern & Chatham railway. Pop. of urban district (1901) 5248. Lower Walmer, the portion most frequented by visitors, extends northward along the coast, so as to be contiguous with Deal. Upper Walmer is a short distance inland, and below it Walmer Castle lies close to the sea. This was a blockhouse built for coast defence by Henry VIII., but became the official residence of the Lords Warden of the Cinque Ports, and was in consequence much altered from its original condition. It ceased to be the official residence in 1905, when the prince of Wales (afterwards George V.) was appointed Lord Warden, and the public was given access to those rooms which possess historical associations with former holders of the office, such as the duke of Wellington, who died here in 1852, William Pitt and others. Kingsdown, 1 m. south, is a decayed member of the Cinque Port of Dover.

WALMISLEY, THOMAS ATTWOOD (1814–1856), English musician, was born in London, his father Thomas Forbes Walmisley (1783–1866) being a well-known organist and composer of church music and glees. Thomas Attwood (*q.v.*) was his godfather, and the boy was educated in music under their tuition. He became organist at Trinity College, Cambridge, in 1833, and there he soon became prominent by his anthems and other compositions. He not only took the degrees of Mus.Bac. and Mus.Doc., but also graduated at Jesus College as B.A. and M.A. In 1836 he was made professor of music. His *Cathedral Music* was edited after his death by his father.

WALNUT (*Juglans*), a botanical genus of about ten species (nat. ord. *Juglandaceae*), natives of the temperate regions of the northern hemisphere, extending into Mexico, the West Indies and tropical South America. They are all trees, usually of large size, with alternate stalked, unequally pinnate leaves, and abounding in an aromatic resinous juice. The scars left by the fallen leaves are unusually large and prominent. The buds are not unlike those of the ash; and it frequently happens that in the axils of the leaves, instead of one, several buds may be formed. The utility of this is seen in seasons when the shoot produced from the first bud is killed by frost; then one of the supplementary buds starts into growth, and thus replaces the injured shoot. The flowers are unisexual and monoecious, the numerous males borne in thick catkins proceeding from the side of last year's shoot. The female flowers are solitary or few in number, and borne on short terminal spikes of the present season's growth. In the male flower the receptacle is "concrescent" or inseparate from the bract in whose axil it originates. The receptacle is, in consequence, extended more or less horizontally so that the flowers appear to be placed on the upper surface of horizontally spreading stalks. The perianth consists of five or six oblong greenish lobes, within which is found a tuft, consisting of a large number of stamens, each of which has a very short filament and an oblong two-lobed anther bursting longitudinally, and surmounted by an oblong lobe, which is the projecting end of the connective. There is usually no trace of ovary in the male flowers, though by exception one may occasionally be formed.

The female flower consists of a cup-like receptacle, inseparate from the ovary, and bearing at its upper part a bract and two bracteoles. From the margin springs a perianth of four short lobes. The one-celled ovary is immersed within the receptacular tube, and is surmounted by a short style with two short ribbon-like stigmatic branches. The solitary ovule springs erect from the base of the ovarian cavity. The fruit is a kind of drupe, the fleshy husk of which is the dilated receptacular tube, while the two-valved stone represents the two carpels. The solitary seed has no perisperm or albumen, but has two large and curiously crumpled cotyledons concealing the plumule, the leaves of which, even at this early stage, show traces of pinnae.

The species best known is *J. regia*, the common walnut, a native of the mountains of Greece, of Armenia, of Afghanistan and the north-west Himalayas. Traces of the former existence of this or of a very closely allied species are found in the Post-Tertiary deposits of Provence and elsewhere, proving the former much wider extension of the species. At the present day the tree is largely cultivated in most temperate countries for the sake of its timber or for its edible nuts. The timber is specially valued for furniture and cabinet work and for gunstocks, the beauty of its markings rendering it desirable for the first-named purpose, while its strength and elasticity fit it for the second. The leaves and husk of the fruit are resinous and astringent, and are sometimes used medicinally as well as for dyeing purposes. A *Spiritus Nucis Juglandis* is given as an antispasmodic. It doubtless owes its properties to the alcohol which it contains. Sugar is also prepared from the sap in a similar manner to that obtained from the maple. The young fruits are used for pickling. When ripe the seeds are much esteemed as a delicacy, while in France much oil of fine quality is extracted from them by pressure. There are several varieties in cultivation, varying in the degree of hardihood, time of ripening, thickness of shell, size and other particulars. In the climate of Great Britain a late variety is preferable, as securing the young shoots against injury from frost, to which otherwise they are very subject. The kernel of the large-fruited variety is of very indifferent quality, but its large shells are made use of by the French as trinket cases.

The walnut is mentioned in the earliest British botanical writings, and is supposed to have been introduced by the Romans. It grows well, and ripens its fruit in the southern and midland counties of England; but large trees may be seen as far north as Ross-shire in sheltered places. The tree succeeds in deep, sandy or calcareous loams, and in stiff loams resting on a gravelly bottom. It requires free exposure to air and light. It is propagated by seeds, and occasionally by budding, grafting or inarching for the perpetuation of special varieties. Seedlings should be protected from frost during the first winter. The trees form their heads naturally, and therefore little pruning is required, it being merely necessary to cut off straggling growths, and to prevent the branches from interlacing. The best time for performing this is in the autumn, just after the fall of the leaf. Plants raised from the seed seldom become productive till they are twenty years old. The fruit is produced at the extremities of the shoots of the preceding year; and therefore, in gathering the crop, care should be taken not to injure the young wood. In some parts of England the trees are thrashed with rods or poles to obtain the nuts, but this is not a commendable mode of collecting them.

Among the American species *J. nigra*, the black walnut, is especially noteworthy as a very handsome tree, whose timber is of great value for furniture purposes, but which is now becoming scarce. In Britain it forms a magnificent tree. The white walnut or butternut, *J. cinerea*, is a smaller tree, though it sometimes reaches 100 ft. in height; its inner bark yields an extractive, *juglandin*, given as an hepatic stimulant and cathartic in doses of 2-5 grains.

Closely allied to the walnuts, and sometimes confounded with them, are the hickories.

WALPOLE, HORATIO or HORACE (1717–1797), English politician and man of letters, 4th earl of Orford—a title to which he only succeeded at the end of his life, and by which he is little known—was born in Arlington Street, London, on the 24th of September 1717. He was the youngest of the five children of the 1st earl of Orford (Sir Robert Walpole) by Catherine Shorter, but by some of the scandal-mongers of a later age, Carr, Lord Hervey, half-brother of John, Lord Hervey, afterwards second earl of Bristol, has been called his father. If this rumour be correct, no such suspicion ever entered into the mind of Horace Walpole. To his mother he erected a monument, with an inscription couched in terms of sincere affection, in the chapel of Henry VII. in Westminster Abbey, and from the beginning to the end of his public life his sarcasms never spared the Newcastles and the Hardwickes, who had shown, as he thought, lukewarmness in support of his father's ministry. On the 26th of April 1727 he was sent to Eton, where he formed what was known as the "Quadruple Alliance" with Thomas Gray, Richard West and Thomas Ashton, and became very intimate with Henry Seymour Conway, George Augustus Selwyn and the two Montagus, and in 1735 matriculated at King's College, Cambridge. Two years (1739–1741) were spent in Gray's company in the recognized grand tour of France and Italy. They stopped a few weeks in Paris, and lingered for three months at Rheims, on the pretence of learning the French language. Henry Seymour Conway, whose mother was a sister of Lady Walpole, shared their society in the French city. The other two members of this little circle next proceeded to Florence, where Walpole rested for more than a year in the villa of Horace Mann, the British envoy-extraordinary for forty-six years to the court of Tuscany. Mann's family had long been on terms of the closest intimacy with his guests, and they continued correspondents until 1786. As they never met again, their friendship, unlike most of Walpole's attachments, remained unbroken. After a short visit to Rome (March-June 1740), and after a further sojourn at Florence, Walpole and Gray parted in resentment at Reggio. Walpole in after years took the blame of this quarrel on himself, and it is generally believed that it arose from his laying too much stress on his superiority in position. In 1744 the two friends were nominally reconciled, but the breach was not cemented.

Walpole came back to England on the 12th of September 1741. He had been returned to parliament on the 14th of May 1741 for the Cornish borough of Callington, over which his elder brother, through his marriage with the heiress of the Rolles, exercised supreme influence. He represented three constituencies in succession, Callington 1741–1754, the family borough of Castle Rising from 1754 to 1757, and the more important constituency of King's Lynn, for which his father had long sat in parliament, from the latter date until 1768. In that year he retired, probably because his success in political life had not equalled his expectations, but he continued until the end of his days to follow and to chronicle the acts and the speeches of both houses of parliament. Through his father's influence he had obtained three lucrative sinecures in the exchequer, and for many years (1745–1784) he enjoyed a share, estimated at about £1500 a year, of a second family perquisite, the collectorship of customs. These resources, with a house in Arlington Street, which was left to him by his father, enabled him, a bachelor all his days, to gratify his tastes. He acquired in 1747 the lease and in the next year purchased the reversion of the charmingly situated villa of Strawberry Hill, near Twickenham, on the banks of the Thames. Six years later he began a series of alterations in the Gothic style, not completed for nearly a quarter of a century later, under which the original cottage became transformed into a building without parallel in Europe. On the 25th of June 1757 he established a printing-press there, which he called "Officina Arbuteana," and many of the first editions of his own works were struck off within its walls. Through Walpole's influence Dodsley published in 1753 the clever, if eccentric, designs of Richard Bentley (the youngest child of the great scholar, and for some time a *protégé* of Horace Walpole) for the poems of Gray. The first work printed at Strawberry Hill was two odes of Gray (8th of August 1757), and among the reprints were the *Life of Lord Herbert of Cherbury*, *Memoirs of Grammont*, Hentzner's *Journey into England*, and Lord Whitworth's *Account of Russia*. The rooms of this whimsical edifice were crowded with curiosities of every description, and the house and its contents were shown, by tickets to admit four persons, between 12 and 3 from May to October, but only one party was admitted on each day, and the owner, although enamoured of notoriety, simulated discontent at this limited intrusion into his privacy. Walpole paid several visits to Paris, where he made the acquaintance of Madame du Deffand (*q.v.*) in 1765, and they corresponded until her death in 1780. His nephew, the reckless 3rd earl, died on the 5th of December 1791, and Horace succeeded to the peerage, but he never took his place in the House of Lords, and sometimes signed his name as "the uncle of the late earl of Orford." All his life long he was a victim of the gout, but he lived to extreme old age, and died unmarried, in Berkeley Square, London, to which he had removed in October 1779, on the 2nd of March 1797. He was buried privately at Houghton. The family estate descended to the earl of Cholmondeley, whose ancestor had married Horace Walpole's younger sister. All Walpole's printed books and manuscripts were left to Robert Berry (d. 19th of May 1817) and his two daughters, Mary (1763–1852) and Agnes (1764–1852), and Mary Berry edited the five volumes of Walpole's works which were published in 1798. Their friendship had been very dear to the declining days of Walpole, who, it has even been said, wished to marry Mary Berry. By his will each of the ladies obtained a pecuniary legacy of £4000, and for their lives the house and garden, formerly the abode of his friend Kitty Clive, which adjoined Strawberry Hill. Strawberry Hill went to Mrs Anne Damer, daughter of his lifelong friend General Conway, for her life, but it was entailed on his niece the countess dowager of Waldegrave and her heirs. The collections of Strawberry Hill, which he had spent nearly fifty years in amassing, were dispersed under the hammer of George Robins in 1842. They are described in a catalogue of that date, and in a series of articles in the *Gentleman's Magazine* for that year.

The pen was ever in Horace Walpole's hands, and his entire compositions would fill many volumes. His two works of imagination, the romance of the *Castle of Otranto* (1764) and the tragedy of the *Mysterious Mother* (1768), are now all but forgotten. The *Castle of Otranto*, purporting to be a story translated by William Marshal, gent., from the original Italian of Onuphrio Muralto, canon of the church of St Nicholas at Otranto, was often reprinted in England, and was translated into both French and Italian. By Sir Walter Scott it was lauded to the skies for its power in raising the passions of fear and pity, but from Hazlitt it met with intense condemnation; its real importance, however, lies in the fact that it started the romantic revival. The *Mysterious Mother*, a tragedy too horrible for representation on any stage, was never intended for performance in public, and only fifty copies of it were printed at Strawberry Hill. By Byron, who, like Horace Walpole, affected extreme liberalism, and like him never forgot that he was born within the purple, this tragedy was pronounced "of the highest order." Several of Walpole's antiquarian works merit high praise. The volume of *Historic Doubts on the Life and Reign of King Richard the Third* (1760), one of the earliest attempts to rehabilitate a character previously stamped with infamy, showed acuteness and research. These doubts provoked several answers, which are criticized in a supplement edited by Dr E. C. Hawtrey for the Philobiblon Society (1854). A work of more lasting reputation, which has retained its vitality for more than a century, is entitled *Anecdotes of Painting in England, with some Account of the Principal Artists; collected by George Vertue, and now digested and published from his original manuscripts by Horace Walpole* (4 vols., 1762–1771). Its value to art students and to admirers of biographical literature demanded its frequent reproduction, and it was re-edited with additions by the Rev. James Dallaway in five volumes (1826–1828), and then again was revised and edited by R. N. Wornum in 1849. A cognate volume, also based on the materials of Vertue, is entitled the *Catalogue of Engravers Born and Resident in England* (1763), which, like its more famous predecessor, often passed through the press. On the *Catalogue of Royal and Noble Authors of England* (1758) Walpole spent many hours of toilsome research. The best edition is that which appeared in five volumes, in 1806, under the competent editorship of Thomas Park, who carefully verified and diligently augmented the labours of the original author. As a senator himself, or as a private person following at a distance the combats of St Stephen's, Walpole recorded in a diary the chief incidents in English politics. For twenty-seven years he studied, a silent spectator for the most part, the characters of the chief personages who trod the stage of politics, and when he quitted the scene he retained the acquaintance of many of the chief actors. If he was sometimes prejudiced, he rarely distorted the acts of those whom he disliked; and his prejudices, which lie on the surface, were mainly against those whom he considered traitors to his father. These diaries extend from 1750 to 1783, and cover a period of momentous importance in the annals of the national history. The *Memoirs of the Last Ten Years of the Reign of George II.* was edited by Lord Holland (1846); its successor, *Memoirs of the Reign of King George III.*, was published under the editorial care of Sir Denis Le Marchant (4 vols., 1845), and re-edited in 1894 by Mr G. F. Russell Barker; the last volumes of the series, *Journal of the Reign of George III. from 1771 to 1783*, were edited and illustrated by John Doran (2 vols., 1859), and were edited with an introduction by A. F. Steuart (London, 1909). To these works should be added the *Reminiscences* (2 vols., 1819), which Walpole wrote in 1788 for the gratification of the Misses Berry. These labours would in themselves have rendered the name of Horace Walpole famous for all time, but his delightful *Letters* are the crowning glory of his life. His correspondents were numerous and widespread, but the chief of them were William Cole (1714–1782), the clerical antiquary of Milton; Robert Jephson, the dramatist; William Mason, the poet; Lord Hertford during his embassy in Paris; the countess of Ossory; Lord Harcourt; George Montagu, his friend at Eton; Henry Seymour Conway (1721–1795) and Sir Horace Mann. With most of these friends he quarrelled, but the friendship of the last two, in the former case through genuine liking, and in the latter through his fortunate absence from England, was never interrupted. The *Letters* were published at different dates, but the standard collection is that by Mrs Paget Toynbee (1903–1905), and to it should be added the volumes of the letters addressed to Walpole by his old friend Madame du Deffand (4 vols., 1810). Dr Doran's publication, *Mann and Manners at the Court of Florence* (1876), is founded on the epistles sent in return to Walpole by the envoy-extraordinary. Other works relating to him are *Horace Walpole and his World*, by L. B. Seeley (1884); *Horace Walpole*, a memoir by Austin Dobson (1890 and 1893); *Horace Walpole and the Strawberry Hill Press*, by M. A. Havens (1901). Walpole has been called "the best letter-writer in the English language"; and few indeed are the names which can compare with his. In these compositions his very foibles are penned for our amusement, and his love of trifles —for, in the words of another Horace, he was ever "nescio quid meditans nugarum et totus in illis"—ministers to our instruction. To these friends he communicated every fashionable scandal, every social event, and the details of every political struggle in English life. The politicians and the courtiers of his day were more akin to his character than were the chief authors of his age, and the weakness of his intellectual perceptions stands out most prominently in his estimates of such writers as Johnson and Goldsmith, Gibbon and Hume. On many occasions he displayed great liberality of disposition, and he bitterly deplored for the rest of his days his neglect of the unhappy Chatterton. Chatterton wrote to Walpole in 1769, sending some prose and verse fragments and offering to place information on English art in Walpole's hands. Encouraged by a kindly reply, Chatterton appealed for help. Walpole made inquiries and came to the conclusion that he was an imposter. He finally returned the manuscripts in his possession, and took no notice of subsequent letters from Chatterton.

Abundant information about Horace Walpole will be found in the *Memoirs* of him and of his contemporaries edited by Eliot Warburton (1851), J. H. Jesse's *George Selwyn and his Contemporaries* (4 vols., 1843–1844) and the extracts from the journals and correspondence of Miss Berry (3 vols., 1866); and it would be unpardonable to omit mention of Macaulay's sketch of Walpole's life and character.

(W. P. C.)

WALPOLE, SIR SPENCER (1839–1907), English historian and civil servant, was born on the 6th of February 1839. He came of the younger branch of the family of the famous Whig prime minister, being descended from his brother, the 1st lord Walpole of Wolterton. He was the son of the latter's great-grandson, the Right Hon. Spencer Horatio Walpole (1807–1898), thrice home secretary under Lord Derby, and through his mother was grandson of Spencer Perceval, the Tory prime minister who was murdered in the House of Commons. He was educated at Eton, and from 1858 to 1867 was a clerk in the War Office, then becoming an inspector of fisheries. In 1882 he was made lieutenant-governor of the Isle of Man, and from 1893 to 1899 he was secretary to the Post Office. In 1898 he was created K.C.B. Although well known as a most efficient public servant, and in private life as the most amiable of men, Sir Spencer Walpole's real title to remembrance is as an historian. His family connexions gave him a natural bent to the study of public affairs, and their mingling of Whig and Tory in politics contributed, no doubt, to that quality of judicious balance—inclining, however, to the Whig or moderate Liberal side—which, together with his sanity and accuracy, is so characteristic of his writings. His principal work, the *History of England from 1815* (1878–1886), in six volumes, was carried down to 1858, and was continued in his *History of Twenty-Five Years* (1904). Among his other publications come his lives of Spencer Perceval (1894) and Lord John Russell (1889), and a volume of valuable *Studies in Biography* (1906); and he wrote the section of the article ENGLISH HISTORY, dealing in detail with the reign of Queen Victoria, for the *Encyclopaedia Britannica*. He died on the 7th of July 1907.

WALPOLE OF WOLTERTON, HORATIO, 1ST BARON (1678–1757), English diplomatist, was a son of Robert Walpole of Houghton, Norfolk, and a younger brother of the great Sir Robert Walpole. The Walpoles owned land in Norfolk in the 12th century and took their name from Walpole, a village in the county. An early member of the family was Ralph de Walpole, bishop of Norwich from 1288 to 1299, and bishop of Ely from 1299 until his death on the 20th of March 1302. Among its later members were three brothers, Edward (1560–1637), Richard (1564–1607) and Michael (1570–*c.* 1624), all members of the Society of Jesus. Another Jesuit in the family was Henry Walpole (1558–1595), who wrote *An Epitaph of the life and death of the most famous clerk and virtuous priest Edmund Campion.* After an adventurous and courageous career in the service of the order, he was arrested on landing in England, was tortured and then put to death on the 17th of April 1595.[1]

Born at Houghton on the 8th of December 1678 and educated at Eton and King's College, Cambridge, Horatio Walpole became a fellow of King's and entered parliament in 1702, remaining a member for fifty-four years. In 1715, when his brother, Sir Robert, became first lord of the treasury, he was made secretary to the treasury, and in 1716, having already had some experience of the kind, he went on a diplomatic mission to The Hague. He left office with his brother in 1717, but he was soon in harness again, becoming secretary to the lord-lieutenant of Ireland in 1720 and secretary to the treasury a second time in 1721. In 1722 he was again at The Hague, and in 1723 he went to Paris, where in the following year he was appointed envoy extraordinary and minister plenipotentiary. He got on intimate terms with Fleury and seconded his brother in his efforts to maintain friendly relations with France; he represented Great Britain at the congress of Soissons and helped to conclude the treaty of Seville (November 1729). He left Paris in 1730 and in 1734 went to represent his country at The Hague, where he remained until 1740, using all his influence in the cause of European peace. After the fall of Sir Robert Walpole in 1742 Horatio defended his conduct in the House of Commons and also in a pamphlet, *The Interest of Great Britain steadily pursued.* Later he wrote an *Apology*, dealing with his own conduct from 1715 to 1739, and an *Answer to the latter part of Lord Bolingbroke's letters on the study of history* (printed 1763). In 1756 he was created Baron Walpole of Wolterton, this being his Norfolk seat, and he died on the 5th of February 1757. His eldest son, Horatio, the 2nd baron (1723–1809), was created earl of Orford in 1806, and one of his sons was Major-General George Walpole (1758–1835), under-secretary for foreign affairs in 1806.

See W. Coxe, *Memoirs of Horatio, Lord Walpole* (2nd ed., 1808); the same writer, *Memoirs of Sir Robert Walpole* (1816); and Charles, comte de Baillon, *Lord Walpole à la cour de France* (1867).

WALPURGIS (WALPURGA or WALBURGA),[2] **ST** (d. *c.* 780), English missionary to Germany, was born in Sussex at the beginning of the 8th century. She was the sister of Willibald, the first bishop of Eichstätt in Bavaria, and Wunnibald, first abbot of Heidenheim. Her father, Richard, is thought to have been a son of Hlothere, 9th king of Kent; her mother, Winna or Wuna, a sister of St Boniface. At the instance of Boniface and Willibald she went about 750 with some other nuns to found religious houses in Germany. Her first settlement was at Bischofsheim in the diocese of Mainz, and two years later (754) she became abbess of the Benedictine nunnery at Heidenheim in the diocese of Eichstätt. On the death of Wunnibald in 760 she succeeded him in his charge also, retaining the superintendence of both houses until her death. Her relics were translated to Eichstätt, where she was laid in a hollow rock, from which exuded a kind of bituminous oil afterwards known as Walpurgis oil, and regarded as of miraculous efficacy against disease. It is still said to exude from the saint's bones (especially from October to February) and was chosen by Cardinal Newman as an example of a credible miracle. The cave became a place of pilgrimage, and a fine church was built over the spot. Walpurgis is commemorated at various times, but principally on the 1st of May, her day taking the place of an earlier heathen festival which was characterized by various rites marking the beginning of summer. She is regarded as the protectress against magic arts (cf. the Walpurgis-Nacht dance in Goethe's *Faust*). In art she is represented with a crozier, and bearing in her hand a flask of balsam.

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[1] The *Letters of Henry Walpole, S.J.*, from the original manuscripts at Stonyhurst College, were edited by the Rev. Augustus Jessopp for private circulation (1873). See the Rev. A. Jessopp, *One Generation of a Norfolk House* (1878).

[2] French forms of the name are Gualbourg, Falbourg, Vaubourg and Avougourg.

Her life was written by the presbyter Wolfhard and dedicated to Erkenbald, bishop of Eichstätt (884–916). See the Bollandist *Acta sanctorum*, vol. iii. February 25. On Walpurgis, Willibald and Wunnibald see G. F. Browne, *Boniface of Crediton and his Companions* (London, 1910), vii.

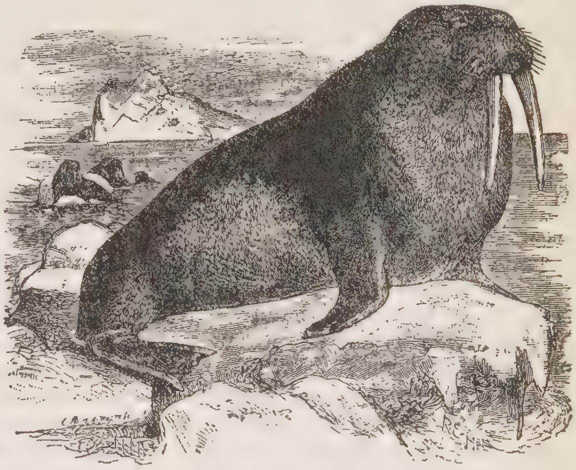
WALRAS, MARIE ESPRIT LÉON (1834–1910), French economist, was born at Évreux in 1834. From 1866 to 1868 he edited a journal called *Le Travail*, to which he contributed many valuable sociological articles. In 1870 he was appointed professor of political economy at Lausanne, a post which he retained until his retirement in 1892. He died on the 4th of January 1910. Walras is best known for his mathematical treatment of economics, and the extreme care he has shown in his works in distinguishing theory and practice. His most important works are *Éléments d'économie politique pure* (1874–1877) and *Théorie mathématique de la richesse sociale* (1883).

Of his many valuable papers contributed to various periodicals a good bibliography will be found in the *Dict. Pol. Econ.* iii. 654. See biographical notice in *Economic Journal* (March, 1910) by Vilfredo Pareto, his successor in the chair of political economy at Lausanne.

WALRUS, or MORSE (*Odobaenus rosmarus*), a large marine mammal allied to the seals, representing a family by itself. The former word is a modification of the Scandinavian *vallross* or *hvalros* ("whale-horse"), the latter an adaptation of the Russian name for the animal. A full-grown male walrus measures from 10 to 11 ft. from the nose to the end of the short tail, and is a heavy, bulky animal, especially thick about the shoulders. The head is rounded, the eyes are rather small, and there are no external ears. The muzzle is short and broad, with, on each side, a group of stiff, bristly whiskers, which become stouter and shorter in old animals. The tail scarcely projects beyond the skin. The fore-limbs are free only from the elbow; the fore-flipper is broad, flat and webbed, the five digits being of nearly equal length, but the first slightly the longest. Each digit has a small flattened nail, situated on the inner surface at a considerable distance from the end. The hind-limbs are enclosed in the skin of the body, almost to the heel. The free portion when expanded is fan-shaped, the two outer toes (first and fifth) being the longest, especially the latter. Flaps of skin project considerably beyond the bones of the toes. The nails of the first and fifth toes are minute and flattened; those of the second, third and fourth elongated, sub-compressed and pointed. The soles of both fore and hind feet are bare, rough and warty. The surface of the skin generally is covered with short, adpressed hair of a light yellowish-brown colour, which, on the under parts of the body and base of the flippers, passes into dark reddish-brown or chestnut. In old animals the hair becomes more scanty, sometimes almost disappearing, and the skin shows evidence of the rough life and pugnacious habits of the animal in the scars with which it is usually covered. It is everywhere more or less wrinkled, especially over the shoulders, where it is thrown into deep and heavy folds.

One of the most striking characteristics of the walrus is the pair of tusks which descend almost directly downwards from the upper jaw, sometimes attaining a length of 20 in. or more. In the female they are as long or sometimes longer than in the male, but less massive. In the young of the first year they are not visible. These tusks correspond to the canine teeth of other mammals. All the other teeth, including the lower canines, are much alike—small, simple and one-rooted, and with crowns, rounded at first, but wearing to a flat or concave surface. Many of the teeth are lost early, or remain through life in a rudimentary state concealed beneath the gum. The tusks are formidable weapons of defence, but their principal use seems to be scraping and digging among sand and shingle for the molluscs and crustaceans on which the walrus feeds. They are said also to aid in climbing up the slippery rocks and ledges of ice on which so much of the animal's life is passed.

Walruses are more or less gregarious in their habits, being met with generally in companies or herds of various sizes. They are only found near the coast or on large masses of floating ice, and rarely far out in the open sea; and, though often moving from one part of their feeding-ground to another, have no regular migrations. Their young are born between April and June, usually but one at a time, never more than two. Their strong affection for their young, and their sympathy for each other in danger, have been noticed by all who have had the opportunity of observing them in their haunts. When one is wounded the whole herd usually join in defence. Although harmless and inoffensive when not molested, they exhibit considerable fierceness when attacked, using their tusks with tremendous effect either on human enemies who come into too close quarters or on polar bears, the only other adversary they can meet with in their own natural territory. The voice, a loud roaring, which can be heard at a great distance, is described by Dr Kane as "something between the mooing of a cow and the deepest baying of a mastiff, very round and full, with its bark or detached notes repeated rather quickly seven or nine times in succession."



The Atlantic Walrus (*Odobaenus rosmarus*).

The principal food of the walrus consists of bivalve molluscs, especially *Mya truncata* and *Saxicava rugosa*, two species very abundant in the Arctic regions, which it digs up from the mud and sand in which they lie buried at the bottom of the sea by means of its tusks. It crushes and removes the shells by the aid of its grinding teeth and tongue, and swallows only the soft parts of the animal. It also feeds on other molluscs, sand-worms, star-fishes and shrimps. Portions of various kinds of seaweed have been found in its stomach, but whether swallowed intentionally or not is doubtful.

The commercial products of the walrus are its oil, hide (used to manufacture harness and sole-leather and twisted into tiller-ropes) and tusks. The ivory of the latter is, however, inferior in quality to that of the elephant. Its flesh forms an important article of food to the Eskimo and Chukchi. Of the coast tribes of the last-named people the walrus formed the chief means of support.

Walruses are confined to the northern circumpolar regions, extending apparently as far north as explorers have penetrated. On the Atlantic coast of America the Atlantic species was met with in the 16th century as low as the southern coast of Nova Scotia, and in the last century was common in the Gulf of St Lawrence and on the shores of Labrador. It still inhabits the coast round Hudson's Bay, Davis Strait and Greenland, where, however, its numbers are decreasing. It is not found on the Arctic coast of America between the 97th and 158th meridians. In Europe, occasional stragglers have reached the British Isles; and it was formerly abundant on the coasts of Finmark. It is rare in Iceland, but Spitzbergen, Novaia Zemblia and the western part of the north coast of Siberia are constant places of resort. The North Pacific, including both sides of Bering Strait, northern Kamchatka, Alaska and the Pribyloff Islands are also the haunts of numerous walruses, which are isolated from those of the North Atlantic by long stretches of coast in Siberia and North America where they do not occur. The Pacific walrus appears to be as large as, if not larger than, that of the Atlantic; its tusks are longer and more slender, and curved inwards; and the whiskers are smaller, and the muzzle relatively deeper and broader. These and certain other differences have led to its being considered specifically distinct, under the name of *Odobaenus obesus*. Its habits appear to be similar to those of the Atlantic form. Though formerly found in immense herds, it is becoming scarce, as the methods of destruction used by American whalers are more certain than those of the Chukchi, to whom the walrus long afforded the principal means of subsistence.

Fossil remains of walruses and closely allied animals have been found in the United States, and in England, Belgium and France, in deposits of late Tertiary age. (W. H. F.; R. L.*)

WALSALL, a market town and municipal, county and parliamentary borough of Staffordshire, England, on the northern edge of the Black Country, and on a tributary stream of the Tame. Pop. (1891) 71,789; (1901) 86,430. It is 120½ m. N.W. from London by the London & North-Western railway, on which system it is a centre of several branches, and is served by the Birmingham-Wolverhampton branch of the Midland railway and by canals. The town, though of ancient foundation, is modern in appearance. The central part stands high on a ridge at the northward termination of which is the church of St Matthew, dating in part from the 15th century, but almost wholly rebuilt. The council house and town hall was completed in 1905; there are two theatres, a free library and museum, and an institute of science and art. Recreation grounds include a picturesque arboretum, Reed's Wood and Palpey Park. Queen Mary's Schools are a foundation of 1554; here are believed to have been educated John Hough (1651–1743), the president of Magdalen College, Oxford, whom James II. sought to eject from office, afterwards bishop of Oxford, Lichfield, and Worcester; and John, Lord Somers (1651–1716), Lord Keeper and Lord Chancellor of England. There are large charities, and Walsall was the scene of the charitable work of Sister Dora (Miss Pattison) whom a statue commemorates. Coal, limestone and ironstone are mined in the neighbourhood. The most important products are saddlery and leather-work, horses' bits and all metal harness fittings; there are iron and brass foundries, and locks, keys, bolts and other hardware are made, both in Walsall and at Bloxwich, a large industrial suburb. Three annual fairs are held. The parliamentary borough returns one member. The town is governed by a mayor, 8 aldermen and 24 councillors. Area, 7480 acres.

Walsall (*Waleshales*, *Walshall*, *Walsaler*) is included in the list of lands given in 996 to the church of Wolverhampton, which, however, did not retain it long. It was granted by Henry II. to Herbert Ruffus, and Henry III. confirmed it to his grandson (1227). Later the manor passed to the Bassets and the Beauchamps, and Warwick the King-maker held it in right of his wife. Henry VIII. granted it (1538) to Dudley, afterwards duke of Northumberland. William Ruffus in the reign of John granted to the burgesses, in consideration of a fine of 12 marks silver and of a rent of 12d. for every burgage, all services, customs and secular demands belonging to him and his heirs, except tallage. Henry IV. confirmed to the burgesses a grant of freedom from toll on the ground that Walsall was ancient demesne of the Crown. A mayor and twenty-four brethren who formed the council of the borough are mentioned in 1440, but the earliest charter of incorporation is that of Charles I. (1627), confirmed in 1661, incorporating it under the title of "the Mayor and Commonalty of the Borough and Foreign of Walsall": under the act of 1835 the town was governed by a mayor, six aldermen and eighteen town councillors. It was not represented in parliament till 1832. Walsall had a merchant gild in 1390; in the 17th century it was already known for its manufacture of iron goods and nail-making. In the 18th century the staple industry was the making of chapes and shoe-buckles, and the town suffered when the latter went out of fashion. Two fairs, on Michaelmas day and September 21, were granted in 1399. The Tuesday market, which is still held, and two fairs on October 28 and May 6, were granted in 1417 to Richard Beauchamp, earl of Warwick.

See *Victoria County History, Stafford*; E. L. Glew, *History of the Borough and Foreign of Walsall* (1856).

WALSH, JOHN HENRY (1810–1888), English writer on sport under the pseudonym of "Stonehenge," was born at Hackney, London, on the 21st of October 1810. He was educated at private schools, and became a fellow of the Royal College of Surgeons in 1844. For several years he followed his profession of surgeon, but gradually abandoned it on account of the success of his works on the subject of sport. He removed from the country to London in 1852, and the following year brought out his first important book, *The Greyhound* (3rd ed. 1875), a collection of papers originally contributed to "Bell's Life." In 1856 appeared his *Manual of British Rural Sports*, which enjoyed many editions. During the same year he joined the staff of *The Field*, and became its editor at the close of 1857. Among his numerous books published under the name of "Stonehenge" are *The Shot-Gun and Sporting Rifle* (1859), *The Dog in Health and Disease* (1859; 4th ed. 1887), *The Horse in the Stable and in the Field* (1861; 13th ed. 1890), *Dogs of the British Isles* (1867; 3rd ed. 1885), *The Modern Sportsman's Gun and Rifle* (1882–1884). While editor of *The Field* Walsh instituted a series of trials of guns, rifles and sporting powders extending over a period of many years, which greatly tended to the development of sporting firearms; and his influence upon all branches of sport was stimulating and beneficial. He died at Putney on the 12th of February 1888.

WALSH, PETER [VALESIUS] (*c.* 1618–1688), Irish politician and controversialist, was born at Mooretown, co. Kildare, and studied at Louvain, where he joined the Franciscans and acquired Jansenist sympathies. In 1646 he went to Kilkenny, then in the hands of the rebel "confederate Catholics," and, in opposition to the papal nuncio Rinuccini, urged, and in 1649 helped to secure, peace with the viceroy Ormonde. Persecuted from this time by the irreconcilable supporters of the papal claims, and even in danger of death, after Cromwell's conquest of Ireland he lived obscurely in London and abroad. On the restoration he urged his patron Ormonde to support the Irish Roman Catholics as the natural friends of royalty against the sectaries, and endeavoured to mitigate their lot and efface the impression made by their successive rebellions by a loyal remonstrance to Charles II., boldly repudiating papal infallibility and interference in public affairs, and affirming undivided allegiance to the crown. For eight years he canvassed for signatures to this address, but in spite of considerable support the strenuous opposition of the Jesuits and Dominicans deterred the clergy and nearly wrecked the scheme. From 1669 until his death he lived in London, much respected for his honesty, loyalty and learning. Excommunicated by the Franciscan chapter-general in 1670, he remained a devout adherent of his church, although he maintained friendly relations with the Anglicans, accepting their orders and attending their churches. He made a full submission to Rome before his death, though the fact has been questioned. He wrote (1672–1684) a series of controversial letters against Pope Gregory VII.'s doctrine of papal supremacy over princes;

a voluminous *History of the Remonstrance* (1674); *Hibernica* (1682), a worthless history of Ireland; in 1686 a reply to the *Popery* of Thomas Barlow (1607–1691), bishop of Lincoln; and other works. In these writings he consistently upheld the doctrine of civil liberty against the pretensions of the papacy.

See S. R. Gardiner, *History of the Great Civil War*; G. Burnet, *History of his own Times*, i. 195; T. Carte, *Life of Ormonde* (new ed. 1851); *Dict. Nat. Biog.* lix.

WALSH, WILLIAM (1663–1708), English poet and critic, son of Joseph Walsh of Abberley, Worcestershire, was born in 1663. He entered Wadham College, Oxford, as a gentleman commoner in 1678. Leaving the university without a degree, he settled in his native county, and was returned M.P. for Worcester in 1698, 1701 and 1702. In 1705 he sat for Richmond, Yorkshire. On the accession of Queen Anne he was made "gentleman of the horse," a post which he held till his death, noted by Narcissus Luttrell on the 18th of March 1708. He wrote a *Dialogue concerning Women, being a Defence of the Sex* (1691), addressed to "Eugenia"; and *Letters and Poems, Amorous and Gallant* (preface dated 1692, printed in Jonson's *Miscellany*, 1716, and separately, 1736); love lyrics designed, says the author, to impart to the world "the faithful image of an amorous heart." It is not as a poet, however, but as the friend and correspondent of Pope that Walsh is remembered. Pope's *Pastorals* were submitted for his criticism by Wycherley in 1705, and Walsh then entered on a direct correspondence with the young poet. The letters are printed in Pope's *Works* (ed. Elwin and Courthope, vi. 49-60). Pope, who visited him at Abberley in 1707, set great value upon his opinion. "Mr Walsh used to tell me," he says, "that there was one way left of excelling; for though we had several great poets, we never had any one great poet that was correct, and he desired me to make that my study and my aim." The excessive eulogy accorded both by Dryden and Pope to Walsh must be accounted for partly on the ground of personal friendship. The life of Virgil prefixed to Dryden's translation, and a "Preface to the Pastorals with a short defence of Virgil, against some of the reflections of Monsieur Fontenella," both ascribed at one time to Walsh, were the work of Dr Knightly Chetwood (1650–1720). In 1704 Walsh collaborated with Sir John Vanbrugh and William Congreve in *Monsieur de Pourceaugnac, or Squire Trelooby*, an adaptation of Molière's farce.

Walsh's Poems are included in Anderson's and other collections of the British poets. See *The Lives of the Poets*, vol. iii. pp. 151 et seq., published 1753 as by Theophilus Cibber.

WALSINGHAM, SIR FRANCIS (*c.* 1530–1590), English statesman, was the only son of William Walsingham, common sergeant of London (d. March 1534), by his wife Joyce, daughter of Sir Edmund Denny of Cheshunt. The family is assumed to have sprung from Walsingham in Norfolk, but the earliest authentic traces of it are found in London in the first half of the 15th century; and it was one of the numerous families which, having accumulated wealth in the city, planted themselves out as landed gentry and provided the Tudor monarchy with its justices of the peace and main support. To this connexion may also be attributed much of the influence which London exerted over English policy in the 16th century. Sir Francis's great-great-great-grandfather, Alan, was a cordwainer of Gracechurch Street; Alan's son Thomas, a vintner, purchased Scadbury in Chislehurst, and Thomas's great-grandson William bought Foot's Cray, where Francis may have been born. His uncle Sir Edmund was lieutenant of the Tower, and his mother was related to Sir Anthony Denny, a member of Henry VIII.'s privy council who attended him on his death-bed.

Francis matriculated as a fellow-commoner of King's College, Cambridge, of which Sir John Cheke was provost, in November 1548; and he continued studying there amid strongly Protestant influences until Michaelmas 1550, when he appears, after the fashion of the time, to have gone abroad to complete his education (Stählin, p. 79). Returning in 1552 he was admitted at Gray's Inn on January 28, 1553, but Edward VI.'s death six months later induced him to resume his foreign travels. In 1555–1556 he was at Padua, where he was admitted a "consiliarius" in the faculty of laws. Returning to England after Elizabeth's accession he was elected M.P. for Banbury to her first parliament, which sat from January to May 1559. He married in January 1562 Anne, daughter of George Barnes, Lord Mayor of London and widow of Alexander Carleill, whose son-in-law Christopher Hoddesdon was closely associated with maritime and commercial enterprise. He was elected to represent Lyme Regis in Elizabeth's second parliament of 1563 as well as for Banbury, and preferred to sit for the former borough. He may have owed his election to Cecil's influence, for to Cecil he subsequently attributed his rise to power; but his brother-in-law Sir Walter Mildmay was well known at court and in 1566 became chancellor of the exchequer. In that year Walsingham married a second time, his first wife having died in 1564; his second was also a widow, Ursula, daughter of Henry St Barbe and widow of Sir Richard Worsley of Appuldurcombe, captain of the Isle of Wight. Her sister Edith married Robert Beale, afterwards the chief of Walsingham's henchmen. By his second wife Walsingham had a daughter who married firstly Sir Philip Sidney, secondly Robert Devereux, second earl of Essex, and thirdly Richard de Burgh, earl of Clanricarde.

Walsingham's earliest extant communications with the government date from 1567; and in that and the following two years he was supplying Cecil with information about the movements of foreign spies in London. The Spanish ambassador in Paris declared in 1570 that he had been for two years engaged in collecting contributions from English churches for the assistance of the Huguenots in France; and he drew up a memorial depicting the dangers of Mary Stuart's presence in England and of the project for her marriage with Norfolk. Ridolfi, the conspirator, was committed to his custody in October 1569, and seems to have deluded Walsingham as to his intentions; but there is inadequate evidence for the statement (*Dict. Nat. Biog.*) that Walsingham was already organizing the secret police of London. In the summer of 1570 he was, in spite of his protestations, designated to succeed Norris as ambassador at Paris. La Mothe Fénelon, the French ambassador in England, wrote that he was thought a very able man, devoted to the new religion, and very much in Cecil's secrets. Cecil had in 1569 triumphed over the conservative and aristocratic party in the council; and Walsingham was the ablest of the new men whom he brought to the front to give play to the new forces which were to carve out England's career.

An essential element in the new policy was the substitution of an alliance with France for the old Burgundian friendship. The affair of San Juan de Ulua and the seizure of the Spanish treasure-ships in 1568 had been omens of the inevitable conflict with Spain; Ridolfi's plot and Philip II.'s approaches to Mary Stuart indicated the lines upon which the struggle would be fought; and it was Walsingham's business to reconcile the Huguenots with the French government, and upon this reconciliation to base an Anglo-French alliance which might lead to a grand attack on Spain, to the liberation of the Netherlands, to the destruction of Spain's monopoly in the New World, and to making Protestantism the dominant force in Europe. Walsingham threw himself heart and soul into the movement. He was the anxious fanatic of Elizabeth's advisers; he lacked the patience of Burghley and the cynical coolness of Elizabeth. His devotion to Protestantism made him feverishly alive to the perils which threatened the Reformation; and he took an alarmist view of every situation. Ever dreading a blow, he was always eager to strike the first; and alive to the perils of peace, he was blind to the dangers of war. He supplied the momentum which was necessary to counteract the caution of Burghley and Elizabeth; but it was probably fortunate that his headstrong counsels were generally overruled by the circumspection of his sovereign. He would have plunged England into war with Spain in 1572, when the risks would have been infinitely greater than in 1588, and when the Huguenot influence over the French government, on which he relied for support, would probably have broken in his hands. His clear-cut, strenuous policy of open hostilities has always had its admirers; but it is difficult to see how England could have secured from it more than she actually did from Elizabeth's more Fabian tactics. War, declared before England had gained the naval experience and wealth of the next fifteen years, and before Spain had been weakened by the struggle in the Netherlands and the depredations of the sea-rovers, would have been a desperate expedient; and the ideas that any action on Elizabeth's part could have made France Huguenot, or prevented the disruption of the Netherlands, may be dismissed as the idle dreams of Protestant enthusiasts.

Walsingham, however, was an accomplished diplomatist, and he reserved these truculent opinions for the ears of his own government, incurring frequent rebukes from Elizabeth. In his professional capacity, his attitude was correct enough; and, indeed, his anxiety for the French alliance and for the marriage between Elizabeth and Anjou led him to suggest concessions to Anjou's Catholic susceptibilities which came strangely from so staunch a Puritan. Elizabeth did not mean to marry, and although a defensive alliance was concluded between England and France in April 1572, the French government perceived that public opinion in France would not tolerate an open breach with Spain in Protestant interests. Coligny's success in captivating the mind of Charles IX. infuriated Catherine de Médicis, and the prospect of France being dragged at the heels of the Huguenots infuriated the Catholics. The result was Catherine's attempt on Coligny's life and then the massacre of St Bartholomew, which placed Walsingham's person in jeopardy and ruined for the time all hopes of the realization of his policy of active French and English co-operation.

He was recalled in April 1573, but the queen recognized that the failure had been due to no fault of his, and eight months later he was admitted to the privy council and made joint secretary of state with Sir Thomas Smith. He held this office jointly or solely until his death; in 1577 when Smith died, Dr Thomas Wilson was associated with Walsingham; after Wilson's death in 1581 Walsingham was sole secretary until July 1586, when Davison began his brief and ill-fated seven months' tenure of the office. After Davison's disgrace in February 1587 Walsingham remained sole secretary, though Wolley assisted him as Latin secretary from 1588 to 1590. He was also returned to parliament at a by-election in 1576 as knight of the shire for Surrey in succession to Charles Howard, who had become Lord Howard of Effingham, and he was re-elected for Surrey in 1584, 1586 and 1588. He was knighted on December 1, 1577, and made chancellor of the order of the Garter on April 22, 1578.

As secretary, Walsingham could pursue no independent policy; he was rather in the position of permanent under-secretary of the combined home and foreign departments, and he had to work under the direction of the council, and particularly of Burghley and the queen. He continued to urge the necessity of more vigorous intervention on behalf of the Protestants abroad, though now his clients were the Dutch rather than the Huguenots. In June 1578 he was sent with Lord Cobham to the Netherlands, mainly to glean reliable information on the complicated situation. He had interviews with the prince of Orange, with Casimir who was there in the interests of Protestant Germany, with Anjou who came in his own interests or in those of France, and with Don John, who nominally governed the country in Philip's name; the story that he instigated a plot to kidnap or murder Don John is without foundation. His letters betray discontent with Elizabeth's reluctance to assist the States; he could not understand her antipathy to rebellious subjects, and he returned in October, having accomplished little.

In August 1581 he was sent on a second and briefer mission to Paris. Its object was to secure a solid Anglo-French alliance against Spain without the condition upon which Henry III. insisted, namely a marriage between Elizabeth and Anjou. The French government would not yield, and Walsingham came back, to be followed by Anjou who sought in personal interviews to overcome Elizabeth's objections to matrimony. He, too, was unsuccessful; and a few months later he was dismissed with some English money and ostensible assurances of support. But secretly Elizabeth countermined his plans; unlike Walsingham, she would sooner have seen Philip remain master of the Netherlands than see them fall into the hands of France. His final embassy was to the court of James VI. in 1583, and here his vehement and suspicious Protestantism led him astray and provoked him into counterworking the designs of his own government. He was convinced that James was as hostile to Elizabeth as Mary herself, and failed to perceive that he was as inimical to popery as he was to presbyterianism. Elizabeth and Burghley were inclined to try an alliance with the Scottish king, and the event justified their policy, which Walsingham did his best to frustrate, although deserted on this occasion by his chief regular supporter, Leicester.

For the rest of his life Walsingham was mainly occupied in detecting and frustrating the various plots formed against Elizabeth's life; and herein he achieved a success denied him in his foreign policy. He raised the English system of secret intelligence to a high degree of efficiency. At one time he is said to have had in his pay fifty-three agents at foreign courts, besides eighteen persons whose functions were even more obscure. Some of them were double spies, sold to both parties, whose real sentiments are still conjectural; but Walsingham was more successful in seducing Catholic spies than his antagonists were in seducing Protestant spies, and most of his information came from Catholics who betrayed one another. In his office in London men were trained in the arts of deciphering correspondence, feigning handwriting, and of breaking and repairing seals in such a way as to avoid detection. His spies were naturally doubtful characters, because the profession does not attract honest men; morality of methods can no more be expected from counterplotters than from plotters; and the prevalence of political or religious assassination made counterplot a necessity in the interests of the state.

The most famous of the plots frustrated by Walsingham was Anthony Babington's, which he detected in 1586. Of the guilt of the main conspirators there is no doubt, but the complicity of Mary Stuart has been hotly disputed. Walsingham had long been convinced, like parliament and the majority of Englishmen, of the necessity of removing Mary; but it was only the discovery of Babington's plot that enabled him to bring pressure enough to bear upon Elizabeth to ensure Mary's execution. This circumstance has naturally led to the theory that he concocted, if not the plot, at least the proofs of Mary's connivance. Undoubtedly he facilitated her self-incrimination, but of her active encouragement of the plot there can be little doubt after the publication of her letters to Mendoza, in which she excuses her complicity on the plea that no other means were left to secure her liberation. Considering the part he played in this transaction, Walsingham was fortunate to escape the fate which the queen with calculated indignation inflicted upon Davison.

Walsingham died deeply in debt on April 6, 1590. Since 1579 he had lived mainly at Barn Elms, Barnes, maintaining an adequate establishment; but his salary did not cover his expenses, he was burdened with his son-in-law Sir Philip Sidney's debts, and he obtained few of those perquisites which Elizabeth lavished on her favourites. He had little of the courtier about him; his sombre temperament and directness of speech irritated the queen, and it says something for both of them that he retained her confidence and his office until the end of his life.

Dr Karl Stählin's elaborate and scholarly *Sir Francis Walsingham und seine Zeit* (Heidelberg, vol. i., 1908) supersedes all previous accounts of Walsingham so far as it goes (1573); Dr Stählin has also dealt with the early history of the family in his *Die Walsingham bis zur Mitte des 16. Jahrhunderts* (Heidelberg, 1905). Vast masses of Walsingham's correspondence are preserved in the Record Office and the British Museum; some have been epitomized in the *Foreign Calendar* (as far as 1582); and his correspondence during his two embassies to France was published *in extenso* by Sir Dudley Digges in 1655 under the title *The Compleat Ambassador*, possibly, as has been suggested by Dr Stählin, to give a fillip to the similar policy then being pursued by Oliver Cromwell. The ascription to Sir Francis of *Arcana Aulica: or Walsingham's Manual of Prudential Maxims for the Statesman and the Courtier* is erroneous; the book is really the translation of a French treatise by one Edward Walsingham who flourished *c.* 1643–1659. See also Webb, Miller and Beckwith's *History of Chislehurst* (1899) and *Dict. Nat. Biog.* lix. 231-240.

Mr Conyers Read, who edited the *Bardon Papers* ("Camden" ser. 1909), relating to Mary's trial, was in 1910 engaged on an elaborate life of Walsingham, part of which the present writer was able to see in MS. (A. F. P.)

WALSINGHAM, THOMAS (d. *c.* 1422), English chronicler, was probably educated at the abbey of St Albans and at Oxford. He became a monk at St Albans, where he appears to have passed the whole of his monastic life except the six years between 1394 and 1400 during which he was prior of another Benedictine house at Wymondham, Norfolk. At St Albans he was in charge of the scriptorium, or writing room, and he died about 1422. Walsingham's most important work is his *Historia Anglicana*, a valuable piece of work covering the period between 1272 and 1422. Some authorities hold that Walsingham himself only wrote the section between 1377 and 1392, but this view is controverted by James Gairdner in his *Early chroniclers of Europe* (1879).

The *Historia*, which from the beginning to 1377 is largely a compilation from earlier chroniclers, was published by Matthew Parker in 1574 as *Historia Angliae brevis*. For the "Rolls" series it has been edited in two volumes by H. T. Riley (1863–1864). Covering some of the same ground Walsingham wrote a *Chronicon Angliae*; this deals with English history from 1328 to 1388 and has been edited by Sir E. M. Thompson for the "Rolls" series (1874). His other writings include the *Gesta abbatum monasterii S. Albani* and the *Ypodigma Neustriae*. The *Gesta* is a history of the abbots of St Albans from the foundation of the abbey to 1381. The original work of Walsingham is the period between 1308 and 1381, the earlier part being merely a compilation; it has been edited for the "Rolls" series by H. T. Riley (1867–1869). The *Ypodigma* purports to be a history of the dukes of Normandy, but it also contains some English history and its value is not great. Compiled about 1419, it was dedicated to Henry V. and was written to justify this king's invasion of France. It was first published by Matthew Parker in 1574, and has been edited for the "Rolls" series by H. T. Riley (1876). Another history of England by Walsingham dealing with the period between 1272 and 1393 is in manuscript in the British Museum. This agrees in many particulars with the *Chronicon Angliae*, but it is much less hostile to John of Gaunt, duke of Lancaster. Walsingham is the main authority for the history of England during the reigns of Richard II., Henry IV. and Henry V., including the rising under Wat Tyler in 1381. He shows considerable animus against John Wycliffe and the Lollards.

WALTER, HUBERT (d. 1205), chief justiciar of England and archbishop of Canterbury, was a relative of Ranulf de Glanvill, the great justiciar of Henry II., and rose under the eye of his kinsman to an important position in the Curia Regis. In 1184 and in 1185 he appears as a baron of the exchequer. He was employed, sometimes as a negotiator, sometimes as a justice, sometimes as a royal secretary. He received no clerical promotion from Henry II., but Richard I. appointed him bishop of Salisbury, and by Richard's command he went with the third crusade to the Holy Land. He gained the respect of all the crusaders, and acted as Richard's principal agent in all negotiations with Saladin, being given a place in the first band of pilgrims that entered Jerusalem. He led the English army back to England after Richard's departure from Palestine; but in Sicily he heard of the king's captivity, and hurried to join him in Germany. In 1193 he returned to England to raise the king's ransom. Soon afterwards he was elected archbishop of Canterbury and made justiciar. He was very successful in the government of the kingdom, and after Richard's last visit he was practically the ruler of England. He had no light task to keep pace with the king's constant demand for money. He was compelled to work the administrative machinery to its utmost, and indeed to invent new methods of extortion. To pay for Richard's ransom, he had already been compelled to tax personal property, the first instance of such taxation for secular purposes. The main feature of all his measures was the novel and extended use of representation and election for all the purposes of government. His chief measures are contained in his instruction to the itinerant justices of 1194 and 1198, in his ordinance of 1195 for the conservation of the peace, and in his scheme of 1198 for the assessment of the carucage. The justices of 1194 were to order the election of four coroners by the suitors of each county court. These new officers were to "keep," *i.e.* to register, the pleas of the crown, an important duty hitherto left to the sheriff. The juries, both for answering the questions asked by the judges and for trying cases under the grand assize, were to be chosen by a committee of four knights, also elected by the suitors of each county court for that purpose. In 1195 Hubert issued an ordinance by which four knights were to be appointed in every hundred to act as guardians of the peace, and from this humble beginning eventually was evolved the office of justice of the peace. His reliance upon the knights, or middle-class landowners, who now for the first time appear in the political foreground, is all the more interesting because it is this class who, either as members of parliament or justices of the peace, were to have the effective rule of England in their hands for so many centuries. In 1198, to satisfy the king's demand for money, Hubert demanded a carucage or plough-tax of five shillings on every plough-land (carucate) under cultivation. This was the old tax, the Danegeld, in a new and heavier form and there was great difficulty in levying it. To make it easier, the justiciar ordered the assessment to be made by a sworn jury in every hundred, and one may reasonably conjecture that these jurors were also elected. Besides these important constitutional changes Hubert negotiated a peace with Scotland in 1195, and in 1197 another with the Welsh. But Richard had grown dissatisfied with him, for the carucage had not been a success, and Hubert had failed to overcome the resistance of the Great Council when its members refused to equip a force of knights to serve abroad. In 1198 Hubert, who had inherited from his predecessors in the primacy a fierce quarrel with the Canterbury monks, gave these enemies an opportunity of complaining to the pope, for in arresting the London demagogue, William Fitz Osbert, he had committed an act of sacrilege in Bow Church, which belonged to the monks. The pope asked Richard to free Hubert from all secular duties, and he did so, thus making the demand an excuse for dismissing Hubert from the justiciarship. On the 27th of May 1199 Hubert crowned John, making a speech in which the old theory of election by the people was enunciated for the last time. He also took the office of chancellor and cheerfully worked under Geoffrey Fitz Peter, one of his former subordinates. In 1201 he went on a diplomatic mission to Philip Augustus of France, and in 1202 he returned to England to keep the kingdom in peace while John was losing his continental possessions. In 1205 he died. Hubert was an ingenious, original and industrious public servant, but he was grasping and perhaps dishonest.

See W. Stubbs, *Constitutional History*, vol. i. (1897); Miss K. Norgate's *England under the Angevin Kings*, vol. ii. (1887); W. Stubbs, preface to vol. iv. of Roger of Hoveden's *Chronicle* ("Rolls" series, 1868–1871).

WALTER, JOHN (1738/9–1812), founder of *The Times* newspaper, London, was born in 1738/9, probably in London, and from the death of his father, Richard Walter (about 1755/6), until 1781 was engaged in a prosperous business as a coal merchant. He played a leading part in establishing a Coal Exchange in London; but shortly after 1781, when he began to occupy himself solely as an underwriter and became a member of Lloyd's, he over-speculated and failed. In 1782 he bought from one Henry Johnson a patent for a new method of printing from "logotypes" (*i.e.* founts of words or portions of words, instead of letters), and made some improvements in it. In 1784 he acquired an old printing office in Blackfriars, which formed the nucleus of the Printing-house Square of a later date, and established there his "Logographic Office." At first he only undertook the printing of books, but on 1st January 1785 he started a small newspaper called *The Daily Universal Register*, which on reaching its 940th number on 1st January 1788 was renamed *The Times*. The printing business developed and prospered, but the newspaper at first had a somewhat chequered career. In 1789 Mr Walter was tried for a libel in it on the duke of York, and was sentenced to a fine of £50, a year's imprisonment in Newgate, to stand in the pillory for an hour and to give surety for good behaviour for seven years; and for further libels the fine was increased by £100, and the imprisonment by a second year. On 9th March 1791, however, he was liberated and pardoned. In 1799 he was again convicted for a technical libel, this time on Lord Cowper. He had then given up the management of the business to his eldest son, William, and had (1795) retired to Teddington, where he died, 16th November 1812. In 1759 he had married Frances Landen (died 1798), by whom he had six children. William Walter very soon gave up the duties he undertook in 1795, and in 1803 transferred the sole management of the business to his younger brother, John.

John Walter (2) (1776–1847), who really established the great newspaper of which his father had sown the seed, was born on the 23rd of February 1776, and was educated at Merchant Taylors' School and Trinity College, Oxford. About 1798 he was associated with his elder brother in the management of his father's business, and in 1803 became not only sole manager but also editor of *The Times*. The second John Walter was a very remarkable man, the details of whose practice would be extremely interesting if we could recover them. But the conditions of newspaper work at that time, together with the natural reticence of one born to do, not to talk about doing, drew over his operations a veil of secrecy which there are now no means of penetrating. His greatness must be measured by the work he did. He found *The Times* one of a number of unconsidered journals whose opinions counted for little, and whose intelligence lagged far behind official reports, the accuracy of which they had no independent means of checking. He found it unregarded by the great except when a stringent law of libel enabled them to inflict vindictive punishment in the pillory and in prison for what in our days is ordinary political criticism. He left it in 1847 a great organ of public opinion, deferred to and even feared throughout Europe, consulted and courted by cabinet ministers at home, and in intimate relations with the best sources of independent information in every European capital. The man who, alone among contemporaries of older standing and with better opportunities, raised a struggling newspaper to a position such as no other journal has ever attained or is likely to attain in future, needs no further attestation of his exceptional ability and character. The secret of an achievement of that unique kind is incommunicable. Yet we may note some at least of the elements of John Walter's monumental success. From his father he inherited a fearless and perhaps slightly aggressive independence, to which he joined a steady and tireless energy and a concentration of purpose which are less conspicuous in his father's career. He had been associated with his brother in the management of the paper for five years before he took entire control and became his own editor in 1803. In the same year he signalized the new spirit of the direction by his opposition to Pitt, which cost him the withdrawal of government advertisements and the loss of his appointment as printer to the Customs, besides exposing him to the not too scrupulous hostility of the official world. These were undoubtedly serious discouragements in the circumstances of that day. In John Walter's way of meeting them we find a principle upon which he consistently acted through life, and which goes far to explain his success. He never allowed himself to be diverted from the pursuit of a great though distant object by any petty calculation of immediate gain or loss. He had set himself to build up a journal which all the world should recognize as independent of government favour, and which governments themselves should be compelled to respect and reckon with. He was not going to barter that splendid inheritance for to-day's mess of pottage, so he let the government do its worst and held on his way. At times the way must have been hard and the anxiety great, but great also was the reward. For the public in ever-widening circles received assurance, in an age of considerable literary and political servility, of a man who could not be bought, and a newspaper that could be neither hoodwinked nor terrorized. His determination to avoid even the appearance of being amenable to influence was forcibly illustrated when the king of Portugal sent him, through the Portuguese ambassador, a service of gold plate. It was a princely gift, and a flattering testimony to the European reputation and authority of his newspaper. Mr Walter promptly returned it, courteously recognizing the honourable motives of the giver, but stating that to accept the gift would place him under a sense of obligation incompatible with the perfect independence of thought and action which he desired to maintain. It was the same jealous regard for the complete independence of *The Times* that led him to insist, as he did with remarkable success, upon the strict anonymity of the able men whom he selected with the eye of a general to act as his coadjutors. From about 1810 he delegated to others editorial supervision (first to Sir John Stoddart, then to Thomas Barnes, and in 1841 to J. T. Delane), though never the supreme direction of policy. Their influence was essentially due to the fact that they had a great newspaper behind them, and behind the great newspaper was the remarkable man who made it, and never ceased from giving it inspiration and direction. To unassailable independence, inflexible integrity and sure sagacity he added complete business knowledge of details, a sound judgment of men and things, and untiring energy in the pursuit of excellence in literary quality, in typography (see Printing), in mechanical appliances, and in the organization for the collection of news. These are the things that went to the making of *The Times*, and the measure of the greatness of the second John Walter is that he supplied them all. In 1832 Mr Walter, who had purchased an estate called Bear Wood, in Berkshire (where his son afterwards built the present house), was elected to Parliament for that county, and retained his seat till 1837. In 1841 he was returned to Parliament for Nottingham, but was unseated next year on petition. He was twice married, and by his second wife, Mary Smythe, had a family. He died in London on the 28th of July 1847.

John Walter (3) (1818–1894), his eldest son, was born at Printing-house Square in 1818, and was educated at Eton and Exeter College, Oxford, being called to the bar in 1847. On leaving Oxford he took part in the business management of *The Times*, and on his father's death became sole manager, though he devolved part of the work on Mr Mowbray Morris. He was a man of scholarly tastes and serious religious views, and his conscientious character had a marked influence on the tone of the paper. It was under him that the successive improvements in the printing machinery, begun by his father in 1814, at last reached the stage of the "Walter Press" in 1869, the pioneer of modern newspaper printing-presses. In 1847 he was elected to Parliament for Nottingham as a moderate Liberal, and was re-elected in 1852 and in 1857. In 1859 he was returned for Berkshire, and though defeated in 1865, was again elected in 1868, and held the seat till he retired in 1885. He died on the 3rd of November 1894. He was twice married, first in 1842 to Emily Frances Court (d. 1858), and secondly in 1861 to Flora Macnabb. His eldest son by the first marriage, John, was accidentally drowned at Bear Wood in 1870; and he was succeeded by Mr Arthur Fraser Walter (1846–1910), his second son by the first marriage. Mr A. F. Walter remained chief proprietor of *The Times* till 1908, when it was converted into a company. He then became chairman of the board of directors, and on his death was succeeded in this position by his son John.

See Newspapers: *Modern London Newspapers* (*The Times*), for the history of the paper. (H. Ch.)

WALTER, LUCY (*c.* 1630–1658), mistress of the English king Charles II. and reputed mother of the duke of Monmouth (*q.v.*), is believed to have been born in 1630, or a little later, at Roch Castle, near Haverfordwest. The Walters were a Welsh family of good standing, who declared for the king during the Civil War. Roch Castle having been captured and burned by the parliamentary forces in 1644, Lucy Walter found shelter first in London and then at the Hague. There, in 1648, she met the future king, possibly renewing an earlier acquaintance. There is little reason for believing the story that she was his first mistress; it is certain that he was not her first lover. The intimacy between him and this "brown, beautiful, bold but insipid creature," as John Evelyn calls her, who chose to be known as Mrs Barlow (Barlo) lasted with intervals till the autumn of 1651, and Charles claimed the paternity of a child born in 1649, whom he subsequently created duke of Monmouth. A daughter, Mary (b. 1651), of whom the reputed father was Henry Bennet, earl of Arlington, married William Sarsfield, brother of Patrick Sarsfield, earl of Lucan. On the termination of her connexion with Charles II., Lucy Walter abandoned herself to a life of promiscuous immorality, which resulted in her premature death, at Paris, in 1658. Her name is often wrongly written Walters or Waters.

See Steinmann, *Althorp Memoirs* (1869), pp. 77 seq. and *Addenda* (1880); J. S. Clarke, *Life of James II.* (2 vols., 1816); *Clarendon State Papers*, vol. iii. (Oxford, 1869–1876); and John Evelyn, *Diary*, edited by W. Bray (1890).

WALTER OF COVENTRY (fl. 1290), English monk and chronicler, who was apparently connected with a religious house in the province of York, is known to us only through the historical compilation which bears his name, the *Memoriale fratris Walteri de Coventria*. The word *Memoriale* is usually taken to mean "commonplace book." Some critics interpret it in the sense of "a souvenir," and argue that Walter was not the author but merely the donor of the book; but the weight of authority is against this view. The author of the *Memoriale* lived in the reign of Edward I., and mentions the homage done to Edward as overlord of Scotland (1291). Since the main narrative extends only to 1225, the *Memoriale* is emphatically a second-hand production. But for the years 1201–1225 it is a faithful transcript of a contemporary chronicle, the work of a Barnwell canon. A complete text of the Barnwell work is preserved in the College of Arms (Heralds' College, MS. 10) but has never yet been printed, though it was collated by Bishop Stubbs for his edition of the *Memoriale*. The Barnwell annalist, living in Cambridgeshire, was well situated to observe the events of the barons' war, and is our most valuable authority for that important crisis. He is less hostile to John than are Ralph of Coggeshall, Roger of Wendover and Matthew Paris. He praises the king's management of the Welsh and Scotch wars; he is critical in his attitude towards the pope and the English opposition; he regards the submission of John to Rome as a skilful stroke of policy, although he notes the fact that some men called it a humiliation. The constitutional agitation of 1215 does not arouse his enthusiasm; he passes curtly over the Runnymede conference, barely mentions Magna Carta, and blames the barons for the resumption of war. It may be from timidity that the annalist avoids attacking John, but it is more probable that the middle classes, whom he represents, regarded the designs of the feudal baronage with suspicion.

See W. Stubbs's edition of Walter of Coventry ("Rolls" series, 2 vols., 1872–1873); R. Pauli, in *Geschichte von England* (Hamburg, 1853), iii. 872. (H. W. C. D.)

WALTERSHAUSEN, WOLFGANG SARTORIUS, Baron von (1809–1876), German geologist, was born at Göttingen, on the 17th of December 1809, and educated at the university in that city. There he devoted his attention to physical and natural science, and in particular to mineralogy. During a tour in 1834–1835 he carried out a series of magnetic observations in various parts of Europe. He then gave his attention to an exhaustive investigation of Etna, and carried on the work with some interruptions until 1843. The chief result of this undertaking was his great *Atlas des Ätna* (1858–1861), in which he distinguished the lava streams formed during the later centuries. After his return from Etna he visited Iceland, and subsequently published *Physisch-geographische Skizze von Island* (1847), *Über die vulkanischen Gesteine in Sicilien und Island* (1853), and *Geologischer Atlas von Island* (1853). Meanwhile he was appointed professor of mineralogy and geology at Göttingen, and held this post for about thirty years, until his death. In 1866 he published an important essay entitled *Recherches sur les climats de l'époque actuelle et des époques anciennes*; in this he expressed his belief that the Glacial period was due to changes in the configuration of the earth's surface. He died at Göttingen on the 16th of October 1876

WALTHAM, a city of Middlesex county, Massachusetts, U.S.A., on both banks of the Charles river, about 10 m. W. of Boston. Pop. (1890) 18,707; (1900) 23,481, of whom 6695 were foreign-born; (1910 census) 27,834. Waltham is served by the Boston & Maine railway, and by electric interurban lines connecting with Boston, Lowell, Lexington, Watertown and Newton. It is situated on a series of rugged hills rising from the river. Prospect Hill (482 ft.) commands a magnificent view. A tract of 100 acres, comprising this hill and an adjoining elevation, has been set aside as a public park by the city; and there are four playgrounds (total area, 62¾ acres) and, in the centre of the city, a large common. In Waltham are some 43 acres of the Beaver Brook Reservation and 40 acres of the Charles River Reservation of the Metropolitan park system; in the former are the famous "Waverley Oaks." The Gore Mansion, erected towards the close of the 18th century by Christopher Gore (1758–1829), a prominent lawyer and Federalist leader, governor of Massachusetts in 1809–1810, and a member of the United States Senate in 1814–1817, is a stately country house surrounded by extensive grounds in which are fine old oaks and elms. Above the city the Charles river is famous as a canoeing ground, and there is an annual canoe carnival between Waltham and Riverside, one of the most popular resorts in the neighbourhood of Boston. The city has a good public library (about 35,000 volumes in 1910). Its principal buildings are a state armoury, and the First Parish (Unitarian), Christ (Protestant Episcopal), the Swedenborgian, the First Baptist and Beth Eden (Baptist) churches. Waltham is the seat of the Massachusetts School for the Feeble-minded (established in Boston in 1848), the first institution of its sort in the country, and of the Waltham Training School for Nurses (1885), the first school to undertake the training of nurses for "day nursing" (outside of hospital wards) on the present plan, of the Convent of Notre Dame and the Notre Dame Normal Training School (Roman Catholic), of the New Church School (New Jerusalem Church), of two business schools, and the Waltham Horological School (1870), a school for practical watchmaking and repairing; here also are the Waltham Hospital (1885), the Baby Hospital (1902) and the Leland Home (1879) for aged women. In 1905 the city's factory product was valued at $7,149,697 (21·4% more than in 1900). The largest single establishment was that of the American Waltham Watch Company, which has here the largest watch factory in the world, with an annual production of about a million watches. Watch and clock materials were valued at $123,885 in 1905. In 1905 cotton goods were second in value to watches; and third were foundry and machine-shop products ($516,067). Other products are automobiles, wagons and carriages, bicycles, canoes, organs and enamelled work.

The first white settlement was made about 1640 and in 1691 became the Middle Precinct of Watertown. In 1738 the township of Waltham was separately organized. At various times it was increased in area, part of Cambridge being added in 1755 and part of Newton in 1849. In 1859 one of its precincts was set off to form part of the new township of Belmont. In 1884 Waltham was chartered as a city. The first power mill for the manufacture of cotton cloth in the United States was established here in 1814 as an experiment by the company which built the mills and the city of Lowell. Waltham became an important manufacturing city in the decade before the American Civil War, when the company which in 1853 made the first American machine-made watches moved hither from Roxbury and established the Waltham watch industry. This watch company, before the establishment of the U.S. Observatory at Washington and the transmission thence of true time throughout the country by electric telegraph, had an elaborate observatory for testing and setting its watches.

WALTHAM ABBEY, or Waltham Holy Cross, a market town in the Epping parliamentary division of Essex, England, on the Lea, and on the Cambridge branch of the Great Eastern railway, 13 m. N. by E. from London. Pop. of urban district of Waltham Holy Cross (1901) 6549. The neighbouring county of the Lea valley is flat and unlovely, but to the E. and N.E. low hills rise in the direction of Hainault and Epping Forests. Of the former magnificent cruciform abbey church the only portion of importance now remaining is the nave, forming the present parish church, the two easternmost bays being converted into the chancel. It is a very fine specimen of ornate Norman. Only the western supports of the ancient tower now remain. A tower corresponding with the present size of the church was erected in 1556 and restored in 1798. On the south side of the church is a lady chapel dating from the end of the reign of Edward II. or the beginning of that of Edward III., containing some good Decorated work, with a crypt below. Of the monastic buildings there remain only a bridge and gateway and other slight fragments. Bishop Hall became curate of Waltham in 1612, and Thomas Fuller was curate from 1648 to 1658. At Waltham Cross, about 1 m. W. of Waltham in Hertfordshire, is the beautiful cross erected (1291–1294) by Edward I. at one of the resting-places of the corpse of Queen Eleanor on its way to burial in Westminster Abbey. It is of Caen stone and is supposed to have been designed by Pietro Cavallini, a Roman sculptor. It is hexagonal in plan and consists of three stages, decreasing towards the top, which is finished by a crocketed spirelet and cross. The lower stage is divided into compartments enclosing the arms of England, Castile and Leon, and Ponthieu. Its restoration has not been wholly satisfactory. The royal gunpowder factory is in the immediate vicinity; government works were built in 1890 at Quinton Hill, ½ m. W. of the town, for the manufacture of cordite; and the town possesses gun-cotton and percussion-cap factories, flour-mills, malt kilns and breweries. Watercresses are largely grown in the neighbourhood, and there are extensive market gardens and nurseries.

The town probably grew up round the church, which was built early in the 11th century to contain a portion of the true cross. The manor was held by the abbot and convent of the Holy Cross from the reign of Henry I. to that of Henry VIII. The town was never more than a market town until 1894. In 1845 a local board of twelve members was formed to govern it; in 1894, under the Local Government Act, it was brought under an urban district council. The market of Waltham was granted to the abbey by Richard I. and confirmed in 1227 by Henry III., who also conceded two fairs in 1251: one for ten days following the Invention of the Holy Cross, the other on the vigil of the Exaltation of the Cross and for seven days after. The charter from which the present market appears to be derived was granted by Queen Elizabeth in 1560, and gave a Tuesday market for miscellaneous stock. The fairs have died out, although as late as 1792 they were held on the 14th of May and the 25th and 26th of September. The fisheries in the river Lea appear in records from 1086 onwards. At the end of the 17th century a fulling mill is mentioned, and by the year 1721 three powder mills were in existence.

WALTHAMSTOW, a suburb of London in the Walthamstow parliamentary division of Essex, England, a short distance E. of the river Lea, with several stations on a branch of the Great Eastern railway, 6 m. N. of Liverpool Street station. Pop. of urban district (1891) 46,346; (1901) 95,131. It is sheltered on the north and east by low hills formerly included in Epping Forest. The church of St Mary existed at a very early period, but the present building, chiefly of brick, was erected in 1535 by Robert Thorne, a merchant, and Sir George Monoux, lord mayor of London, and has undergone frequent alteration. Besides other old brasses it contains in the north aisle the effigies in brass of Sir George Monoux (d. 1543) and Anne his wife. There are a number of educational institutions, including a school of art; Forest School, founded in 1834 in connexion with King's College, now ranks as one of the well-known English public schools. Brewing is extensively carried on.

In the reign of Edward the Confessor Walthamstow belonged to Waltheof, son of Siward, earl of Northumberland, who married Judith, niece of William the Conqueror, who betrayed him to his death in 1075. The estate subsequently passed in 1309 to Guy de Beauchamp, earl of Warwick, and on the attainder of Earl Thomas in 1396 reverted to the crown. Afterwards it came into the possession of Edmund Beaufort, duke of Somerset; from the Somersets it passed to Sir George Rodney, and in 1639 came to the Maynard family. It is supposed to have been the birthplace of George Gascoigne the poet (d. 1577). Sir William Batten, commissioner of the navy (d. 1667), the friend of Pepys, had his seat at Walthamstow, and was frequently visited here by Pepys.

WALTHARIUS, a Latin poem founded on German popular tradition, relates the exploits of the west Gothic hero Walter of Aquitaine. Our knowledge of the author, Ekkehard, a monk of St Gall, is due to a later Ekkehard, known as Ekkehard IV. (d. 1060), who gives some account of him in the *Casus Sancti Galli* (cap. 80). The poem was written by Ekkehard. generally distinguished as Ekkehard I., for his master Geraldus in his schooldays, probably therefore not later than 920, since he was probably no longer young when he became deacon (in charge of ten monks) in 957. He died in 973. *Waltharius* was dedicated by Geraldus to Erchanbald, bishop of Strassburg (fl. 965–991), but MSS. of it were in circulation before that time. Ekkehard IV. stated that he corrected the Latin of the poem, the Germanisms of which offended his patron Aribo, archbishop of Mainz. The poem was probably based on epic songs now lost, so that if the author was still in his teens when he wrote it he must have possessed considerable and precocious powers.

Walter was the son of Alphere, ruler of Aquitaine, which in the 5th century, when the legend developed, was a province of the west Gothic Spanish kingdom. When Attila invaded the west the western princes are represented as making no resistance. They purchased peace by offering tribute and hostages. King Gibich, here described as a Frankish king, gave Hagen as a hostage (of Trojan race, but not, as in the *Nibelungenlied*, a kinsman of the royal house) in place of his infant son Gunther; the Burgundian king Heririh, his daughter Hiltegund; and Alphere, his son Walter. Hagen and Walter became brothers in arms, fighting at the head of Attila's armies, while Hiltegund was put in charge of the queen's treasure. Presently Gunther succeeded his father and refused to pay tribute to the Huns, whereupon Hagen fled from Attila's court. Walter and Hiltegund, who had been betrothed in childhood, also made good their escape during a drunken feast of the Huns, taking with them a great treasure. The story of their flight forms one of the most charming pictures of old German story. They were recognized at Worms, however, where the treasure excited the cupidity of Gunther. Taking with him twelve knights, among them the reluctant Hagen, he pursued them, and overtook them at the Wasgenstein in the Vosges mountains. Walter engaged the Nibelungen knights one at a time, until all were slain but Hagen, who held aloof from the battle, and was only persuaded by Gunther to attack his comrade in arms on the second day. He lured Walter from the strong position of the day before, and both Gunther and Hagen attacked at once. All three were incapacitated, but their wounds were bound up by Hiltegund and they separated friends.

The essential part of this story is the series of single combats. The occasional incoherences of the tale make it probable that many changes have been introduced in the legend. The *Thidreks Saga* (chaps. 241-244) makes the story more probable by representing the pursuers as Huns. There is reason to believe that Hagen was originally the father of Hiltegund, and that the tale was a variant of the saga of Hild as told in the *Skaldskaparmál.* Hild, daughter of King Högni, was carried off by Hedinn, son of Hjarrandi (A.S. Heorrenda). The fight between the forces of father and lover only ceased at sundown, to be renewed on the morrow, since each evening Hild raised the dead by her incantations. This is obviously a form of the old myth of the daily recurring struggle between light and darkness. The songs sung by Hiltegund in *Waltharius* during her night watches were probably incantations, a view strengthened by the fact that in a Polish version the glance of Helgunda is said to have inspired the combatants with new strength. Hiltegund has retained nothing of Hild's fierceness, but the fragment of the Anglo-Saxon *Waldere* shows more of the original spirit. In *Waltharius* Hiltegund advises Walter to fly; in *Waldere* she urges him to the combat.

BIBLIOGRAPHY.—*Waltharius* was first edited by Fischer (Leipzig, 1780). Later and more critical editions are by Jacob Grimm (*Lat. Gedichte des Mittelalters* (Göttingen, 1838); R. Peiper (Berlin, 1873); V. Scheffel and A. Holder (Stuttgart, 1874); there are German translations by F. Linnig (Paderborn, 1885), and H. Althof (Leipzig, 1896). See also Scheffel's novel of *Eckehard* (Stuttgart, 1887). The A.S. fragments of *Waldere* were first edited by G. Stephens (1860), afterwards by R. Wülker in *Bibl. der angel-sächs. Poesie* (vol. i.,

Cassel, 1881); by F. Holthausen in *Göteborgs Högskolas Årsskrift* (vol. v., 1899), with autotype reproductions of the two leaves which have been preserved. See also A. Ebert, *Allg. Gesch. der Lit. des Mittelalters im Abendlande* (Leipzig, 1874–1887); R. Koegel, *Gesch. der deutschen Literatur bis zum Ausgange des Mittelalters* (vol. i., pt. ii., Strassburg, 1897); M. D. Larned, *The Saga of Walter of Aquitaine* (Baltimore, 1892); B. Symons, *Deutsche Heldensage* (Strassburg, 1905). With *Waltharius* compare the Scottish ballads of "Earl Brand" and "Erlinton" (F. J. Child's *English and Scottish Popular Ballads*, i. 88 seq.).

WALTHEOF (d. 1076), earl of Northumbria, was a son of Earl Siward of Northumbria, and, although he was probably educated for a monastic life, became earl of Huntingdon and Northampton about 1065. After the battle of Hastings he submitted to William the Conqueror; but when the Danes invaded the north of England in 1069 he joined them and took part in the attack on York, only, however, to make a fresh submission after their departure in 1070. Then, restored to his earldom, he married William's niece, Judith, and in 1072 was appointed earl of Northumbria. In 1075 Waltheof joined the conspiracy against the king arranged by the earls of Norfolk and Hereford; but soon repenting of his action he confessed his guilt to Archbishop Lanfranc, and then to William, who was in Normandy. Returning to England with William he was arrested, and after being brought twice before the king's court was sentenced to death. On the 31st of May 1076 he was beheaded on St Giles's Hill, near Winchester. Weak and unreliable in character, Waltheof, like his father, is said to have been a man of immense bodily strength. Devout and charitable, he was regarded by the English as a martyr, and miracles were said to have been worked at his tomb at Crowland. The earl left three daughters, the eldest of whom, Matilda, brought the earldom of Huntingdon to her second husband, David I., king of Scotland. One of Waltheof's grandsons was Waltheof (d. 1159), abbot of Melrose.

See E. A. Freeman, *The Norman Conquest*, vols. ii., iii. and iv. (1870–1876).

WALTHER, BERNHARD (1430–1504), German astronomer, was born at Nuremberg in 1430. He was a man of large means, which he devoted to scientific pursuits. When Regiomontanus (*q.v.*) settled at Nuremberg in 1471, Walther built for their common use an observatory at which in 1484 clocks driven by weights were first used in astronomical determinations. He further brought into prominence the effects of refraction in altering the apparent places of the heavenly bodies, and substituted Venus for the moon as a connecting-link between observations of the sun and stars. Walther established a printing-press, from which some of the earliest editions of astronomical works were issued. His observations, begun in 1475 and continued until his death in May 1504, were published by J. Schöner in 1544, and by W. Snell in 1618, as an appendix to his *Observationes Hassiaceae*.

See J. G. Doppelmayr, *Hist. Nachricht von den nürnbergischen Mathematicis*, p. 23 (1730); G. A. Will, *Nürnbergisches Gelehrten-Lexikon*, vii. 381 (1806); J. F. Montucla, *Hist. des mathématiques*, i. 546; J. S. Bailly, *Hist. de l'astr. moderne*, i. 319; E. F. Apelt, *Die Reformation der Sternkunde*, p. 54; J. P. von Wurzelbaur, *Uranies Noricae basis astronomica* (1719); J. F. Weidler, *Hist. astronomiae*, p. 322; A. G. Kästner, *Geschichte der Mathematik*, ii. 324; *Mitteilungen des Vereins für Gesch. der Stadt Nürnberg*, vii. 237 (1888) (H. Petz); R. Wolf, *Gesch. der Astr.* p. 92, &c.

WALTHER VON DER VOGELWEIDE (*c.* 1170–*c.* 1230), the most celebrated of medieval German lyric poets. For all his fame, Walther's name is not found in contemporary records, with the exception of a solitary mention in the travelling accounts of Bishop Wolfger of Passau—"Walthero cantori de Vogelweide pro pellicio V. solidos longos"—"To Walther the singer of the Vogelweide five shillings to buy a fur coat," and the main sources of information about him are his own poems and occasional references by contemporary Minnesingers. It is clear from the title *hêr* (Herr, Sir) these give him, that he was of noble birth; but it is equally clear from his name Vogelweide (Lat. *aviarium*, a gathering place or preserve of birds) that he belonged not to the higher nobility, who took their titles from castles or villages, but to the nobility of service (*Dienstadel*), humble retainers of the great lords, who in wealth and position were little removed from non-noble free cultivators. For a long time the place of his birth was a matter of dispute, until Professor Franz Pfeiffer established beyond reasonable doubt that he was born in the Wipthal in Tirol, where, not far from the little town of Sterzing on the Eisak, a wood—called the Vorder- und Hintervogelweide—preserves at least the name of his vanished home. This origin would account for what is known of Walther's early life. Tirol was at this time the home of several noted Minnesingers; and the court of Vienna, under the enlightened duke Frederick I. of the house of Babenberg, had become a centre of poetry and art. Here it was that the young poet learned his craft under the renowned master Reinmar the Old, whose death he afterwards lamented in two of his most beautiful lyrics; and in the open handed duke he found his first patron. This happy period of his life, during which he produced the most charming and spontaneous of his love-lyrics, came to an end with the death of Duke Frederick in 1198. Henceforward Walther was a wanderer from court to court, singing for his lodging and his bread, and ever hoping that some patron would arise to save him from this "juggler's life" (*gougelfuore*) and the shame of ever playing the guest. For material success in this profession he was hardly calculated. His criticism of men and manners was scathing; and even when this did not touch his princely patrons, their underlings often took measures to rid themselves of so uncomfortable a censor. Thus he was forced to leave the court of the generous duke Bernhard of Carinthia (1202–1256); after an experience of the tumultuous household of the landgrave of Thuringia he warns those who have weak ears to give it a wide berth; and after three years at the court of Dietrich I. of Meissen (reigned 1195–1221) he complains that he had received for his services neither money nor praise. Walther was, in fact, a man of strong views; and it is this which gives him his main significance in history, as distinguished from his place in literature. From the moment when the death of the emperor Henry VI. (1197) opened the fateful struggle between empire and papacy, Walther threw himself ardently into the fray on the side of German independence and unity. Though his religious poems sufficiently prove the sincerity of his catholicism, he remained to the end of his days opposed to the extreme claims of the popes, whom he attacks with a bitterness which can only be justified by the strength of his patriotic feelings. His political poems begin with an appeal to Germany, written in 1198 at Vienna, against the disruptive ambitions of the princes:—

> "Crown Philip with the Kaiser's crown
> And bid them vex thy peace no more."

He was present, on the 8th of September, at Philip's coronation at Mainz, and supported him till his victory was assured. After Philip's murder in 1209, he "said and sang" in support of Otto of Brunswick against the papal candidate Frederick of Staufen; and only when Otto's usefulness to Germany had been shattered by the battle of Bouvines (1212) did he turn to the rising star of Frederick II., now the sole representative of German majesty against pope and princes. From the new emperor his genius and his zeal for the empire at last received recognition; and a small fief in Franconia was bestowed upon him, which, though he complained that its value was little, gave him the home and the fixed position he had so long desired. That Frederick gave him an even more signal mark of his favour by making him the tutor of his son Henry VII., is more than doubtful. The fact, in itself highly improbable, rests only upon the evidence of a single poem, which is capable of another interpretation. Walther's restless spirit did not suffer him to remain long on his new property. In 1217 we find him once more at Vienna, and again in 1219 after the return of Duke Leopold VI. from the crusade. About 1224 he seems to have settled on his fief near Würzburg. He was active in urging the German princes to take part in the crusade of 1228, and may have accompanied the crusading army at least as far as his native Tirol. In a beautiful and pathetic poem he paints the change that had come over the scenes of his childhood and made his life seem a thing dreamed. He died about 1230, and was buried at Würzburg, after leaving directions, according to the story, that the birds were to be fed at his tomb daily. The original gravestone with its Latin inscription has disappeared; but in 1843 a new monument was erected over the spot. There is also a fine statue of the poet at Bozen, unveiled in 1877.

Historically interesting as Walther's political verses are, their merit has been not a little exaggerated by modern German critics, who saw their own imperial aspirations and anti-papal prejudices reflected in this patriotic poet of the middle ages. Of more lasting value are the beautiful lyrics, mainly dealing with love, which led his contemporaries to hail him as their master in song (*unsers sanges meister*). He is of course unequal. At his worst he does not rise above the tiresome conventionalities of his school. At his best he shows a spontaneity, a charm and a facility which his rivals sought in vain to emulate. His earlier lyrics are full of the joy of life, of feeling for nature and of the glory of love. Greatly daring, he even rescues love from the convention which had made it the prerogative of the nobly born, contrasts the titles "woman" (*wîp*) and "lady" (*froûwe*) to the disadvantage of the latter, and puts the most beautiful of his lyrics—*Unter der linden*—into the mouth of a simple girl. A certain seriousness, which is apparent under the joyousness of his earlier work, grew on him with years. Religious and didactic poems become more frequent; and his verses in praise of love turn at times to a protest against the laxer standards of an age demoralized by political unrest. Throughout his attitude is healthy and sane. He preaches the crusade; but at the same time he suggests the virtue of toleration, pointing out that in the worship of God

> "Christians, Jews and heathen all agree."

He fulminates against "false love"; but pours scorn on those who maintain that "love is sin." In an age of monastic ideals and loose morality there was nothing commonplace in the simple lines in which he sums up the inspiring principle of chivalry at its best:—

> "Swer guotes wîbes liebe hât
> Der schamt sich ieder missetât."[1]

Altogether Walther's poems give us the picture not only of a great artistic genius, but of a strenuous, passionate, very human and very lovable character.

The *Gedichte* were edited by Karl Lachmann (1827). This edition of the great scholar was re-edited by M. Haupt (3rd ed., 1853). *Walther v. d. Vogelweide*, edited by Franz Pfeiffer, with introduction and notes (4th edition, by Karl Bartsch, Leipzig, 1873). *Glossarium zu d. Gedichten Walther's, nebst e. Reimverzeichnis*, by C. A. Hornig (Quedlinburg, 1844). There are translations into modern German by B. Obermann (1886), and into English verse *Selected poems of Walter von der Vogelweide* by W. Alison Phillips, with introduction and notes (London, 1896). The poem *Unter der Linden*, not included in the latter, was freely translated by T. L. Beddoes (*Works*, 1890), more closely by W. A. Phillips in the *Nineteenth Century* for July 1896 (ccxxxiii. p. 70). *Leben u. Dichten Walther's von der Vogelweide*, by Wilhelm Wilmanns (Bonn, 1882), is a valuable critical study of the poet's life and works. (W. A. P.)

WALTON, BRIAN (1600–1661), English divine and scholar, was born at Seymour, in the district of Cleveland, Yorkshire, in 1600. He went to Cambridge as a sizar of Magdalene College in 1616, migrated to Peterhouse in 1618, was bachelor in 1619 and master of arts in 1623. After holding a school mastership and two curacies, he was made rector of St Martin's Orgar in London in 1628, where he took a leading part in the contest between the London clergy and the citizens about the city tithes, and compiled a treatise on the subject, which is printed in Brewster's *Collectanea* (1752). His conduct in this matter displayed his ability, but his zeal for the exaction of ecclesiastical dues was remembered in 1641 in the articles brought against him in parliament, which appear to have led to the sequestration of his very considerable preferments.[2] He was also charged with Popish practices, but on frivolous grounds, and with aspersing the members of parliament for the city. In 1642 he was ordered into custody as a delinquent; thereafter he took refuge in Oxford, and ultimately returned to London to the house of William Fuller (1580?–1659), dean of Ely, whose daughter Jane was his second wife. In this retirement he gave himself to Oriental studies and carried through his great work, a Polyglot Bible which should be completer, cheaper and provided with a better critical apparatus than any previous work of the kind (see POLYGLOT). The proposals for the Polyglot appeared in 1652, and the book itself came out in six great folios in 1657, having been printing for five years. Nine languages are used: Hebrew, Chaldee, Samaritan, Syriac, Arabic, Persian, Ethiopic, Greek and Latin. Among his collaborators were James Ussher, John Lightfoot and Edward Pococke, Edmund Castell, Abraham Wheelocke and Patrick Young, Thomas Hyde and Thomas Greaves. The great undertaking was supported by liberal subscriptions, and Walton's political opinions did not deprive him of the help of the Commonwealth; the paper used was freed from duty, and the interest of Cromwell in the work was acknowledged in the original preface, part of which was afterwards cancelled to make way for more loyal expressions towards that restored monarchy under which Oriental studies in England immediately began to languish. To Walton himself, however, the Reformation brought no disappointment. He was consecrated bishop of Chester in December 1660. In the following spring he was one of the commissioners at the Savoy Conference, but took little part in the business. In the autumn of 1661 he paid a short visit to his diocese, and returning to London he died on the 29th of November.

However much Walton was indebted to his helpers, the Polyglot Bible is a great monument of industry and of capacity for directing a vast undertaking, and the *Prolegomena* (separately reprinted by Dathe, 1777, and by Francis Wranghan, 1825) show judgment as well as learning. The same qualities appear in Walton's *Considerator Considered* (1659), a reply to the *Considerations* of John Owen, who thought that the accumulation of material for the revision of the received text tended to atheism. Among Walton's works must also be mentioned an *Introductio ad lectionem linguarum orientalium* (1654; 2nd ed., 1655), meant to prepare the way for the Polyglot.

See Henry J. Todd, *Memoirs of the Life and Writings of Walton* (London, 1821), in 2 vols., of which the second contains a reprint of Walton's answer to Owen.

WALTON, IZAAK (1593–1683), English writer, author of *The Compleat Angler*, was born at Stafford on the 9th of August 1593; the register of his baptism gives his father's name as Jervis, and nothing more is known of his parentage. He settled in London as an ironmonger, and at first had one of the small shops, 7½ ft. by 5 ft., in the upper storey of Gresham's Royal Burse or Exchange in Cornhill. In 1614 he had a shop in Fleet Street, two doors west of Chancery Lane. Here, in the parish of St Dunstan's, he gained the friendship of Dr John Donne, then vicar of that church. His first wife, married in December 1626, was Rachel Floud, a great-great-niece of Archbishop Cranmer. She died in 1640. He married again soon after, his second wife being Anne Ken—the pastoral "Kenna" of *The Angler's Wish*—step-sister of Thomas Ken, afterwards bishop of Bath and Wells. After the Royalist defeat at Marston Moor, he retired from business. He had bought some land near his birthplace, Stafford, and he went to live there; but, according to Wood, spent most of his time "in the families of the eminent clergymen of England, of whom he was much beloved"; and in 1650 he was again living in Clerkenwell. In 1653 came out the first edition of his famous book, *The Compleat Angler*. His second wife died in 1662, and was buried in Worcester cathedral church, where there is a monument to her memory. One of his daughters married Dr Hawkins, a prebendary of Winchester. The last forty years of his long life seem to have been spent in ideal leisure and occupation, the old man travelling here and there, visiting his "eminent clergymen" and other brethren of the angle, compiling the biographies of congenial spirits, and collecting here a little and there a little for the enlargement of his famous treatise. After 1662 he found a home at Farnham Castle with George Morley, bishop of Winchester, to whom he dedicated his *Life* of George Herbert and also that of Richard Hooker; and from time to time he visited Charles Cotton in his fishing house on the Dove. He died in his daughter's house at Winchester on the 15th of December 1683, and was buried in the cathedral. It is characteristic of his kindly nature that he left his property at Shalford for the benefit of the poor of his native town.

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[1] "He who has the love of a good woman
Is ashamed of every misdeed."

[2] He was from January 1635–1636 rector of Sandon, in Essex, where his first wife, Anne Claxton, is buried. He appears to have also been a prebendary of St Paul's, and for a very short time he had held the rectory of St Giles in the Fields.

Walton hooked a much bigger fish than he angled for when he offered his quaint treatise, *The Compleat Angler*, to the public. There is hardly a name in English literature, even of the first rank, whose immortality is more secure, or whose personality is the subject of a more devoted cult. Not only is he the *sacer vates* of a considerable sect in the religion of recreation, but multitudes who have never put a worm on a hook—even on a fly-hook—have been caught and securely held by his picture of the delights of the gentle craft and his easy leisurely transcript of his own simple, peaceable, lovable and amusing character. *The Compleat Angler* was published in 1653, but Walton continued to add to its completeness in his leisurely way for a quarter of a century. It was dedicated to John Offley, his most honoured friend. There was a second edition in 1655, a third in 1661 (identical with that of 1664), a fourth in 1668 and a fifth in 1676. In this last edition the thirteen chapters of the original have grown to twenty-one, and a second part was added by his loving friend and brother angler Charles Cotton, who took up "Venator" where Walton had left him and completed his instruction in fly-fishing and the making of flies. Walton did not profess to be an expert with the fly; the fly-fishing in his first edition was contributed by Thomas Barker, a retired cook and humorist, who produced a treatise of his own in 1659; but in the use of the live worm, the grasshopper and the frog "Piscator" himself could speak as a master. The famous passage about the frog—often misquoted about the worm—"use him as though you loved him, that is, harm him as little as you may possibly, that he may live the longer"—appears in the original edition. The additions made as the work grew were not merely to the technical part; happy quotations, new turns of phrase, songs, poems and anecdotes were introduced as if the leisurely author, who wrote it as a recreation, had kept it constantly in his mind and talked it over point by point with his numerous brethren. There were originally only two interlocutors in the opening scene, "Piscator" and "Viator"; but in the second edition, as if in answer to an objection that "Piscator" had it too much in his own way in praise of angling, he introduced the falconer, "Auceps," changed "Viator" into "Venator" and made the new companions each dilate on the joys of his favourite sport.

Although *The Compleat Angler* was not Walton's first literary work, his leisurely labours as a biographer seem to have grown out of his devotion to angling. It was probably as an angler that he made the acquaintance of Sir Henry Wotton, but it is clear that Walton had more than a love of fishing and a humorous temper to recommend him to the friendship of the accomplished ambassador. At any rate, Wotton, who had intended to write the life of John Donne, and had already corresponded with Walton on the subject, left the task to him. Walton had already contributed an *Elegy* to the 1633 edition of Donne's poems, and he completed and published the life, much to the satisfaction of the most learned critics, in 1640. Sir Henry Wotton dying in 1639, Walton undertook his life also; it was finished in 1642 and published in 1651. His life of Hooker was published in 1662, that of George Herbert in 1670 and that of Bishop Sanderson in 1678. All these subjects were endeared to the biographer by a certain gentleness of disposition and cheerful piety; three of them at least—Donne, Wotton and Herbert—were anglers. Their lives were evidently written with loving pains, in the same leisurely fashion as his *Angler*, and like it are of value less as exact knowledge than as harmonious and complete pictures of character. Walton also rendered affectionate service to the memory of his friends Sir John Skeffington and John Chalkhill, editing with prefatory notices Skeffington's *Hero of Lorenzo* in 1652 and Chalkhill's *Thealma and Clearchus* a few months before his own death in 1683. His poems and prose fragments were collected in 1878 under the title of *Waltoniana*.

The best-known old edition of the *Angler* is J. Major's (2nd ed., 1824). The book was edited by Andrew Lang in 1896, and various modern editions have appeared. The standard biography is that by Sir Harris Nicolas, prefixed to an edition of the *Angler* (1836). There are notices also, with additional scraps of fact, annexed to two American editions, Bethune's (1847) and Dowling's (1857). An edition of Walton's *Lives*, by G. Sampson, appeared in 1903. See also *Izaak Walton and his Friends*, by S. Martin (1903).

WALTON-LE-DALE, an urban district in the Darwen parliamentary division of Lancashire, England, on the S. bank of the Ribble, immediately above Preston. Pop. (1901) 11,271. The church of St Leonard, situated on an eminence to the east of the town, was originally erected in the 11th century. The earliest portions of the present building are the Perpendicular chancel and tower, the nave having been rebuilt in 1798, while the transepts were erected in 1816. There are a number of interesting old brasses and monuments. Cotton-spinning is carried on, and there are market-gardens in the vicinity. Roman remains have been found here, and there was perhaps a roadside post on the site. The manor of Walton was granted by Henry de Lacy about 1130 to Robert Banastre. It afterwards passed by marriage to the Langtons, and about 1592 to the Hoghtons of Hoghton. Walton was the principal scene of the great battle of Preston, fought on the 17th of August 1648 between Cromwell and the duke of Hamilton. In 1701 the duke of Norfolk, the earl of Derwentwater and other Jacobites incorporated the town by the style of the "mayor and corporation of the ancient borough of Walton." In 1715 the passage of the Ribble was bravely defended against the Jacobites by Parson Woods and his parishioners of Atherton (*q.v.*).

WALTON-ON-THAMES, an urban district in the Epsom parliamentary division of Surrey, England, pleasantly situated on the right bank of the Thames, 17 m. W.S.W. from London by the London & South-Western railway. Pop. (1901) 10,329. The church of St Mary has late Norman portions, and contains numerous memorials, including examples of the work of Chantrey and Roubiliac. A verse inscribed upon a pillar is reputed to be Queen Elizabeth's profession of faith as regards transubstantiation. The queen was a frequent resident at Henry VIII.'s palace of Oatlands Park, which was destroyed during the civil wars of the 17th century. The property subsequently passed through various hands, and the park is reduced in extent by the modern growth of villas surrounding it. It contains, however, a remarkable grotto built of mineral and stalactitic rock, shells and other similar materials, by one of the earls of Lincoln when owner. Ashley Park, a Tudor mansion (in the main modernized), attributed to Cardinal Wolsey, was at times the residence of Cromwell; while John Bradshaw, who, as lord president of the court, sentenced Charles I. to death, occupied the old manor house of Walton. Walton is a favourite resort of anglers and boating parties.

WALTON-ON-THE-NAZE (or Walton-le-Soken), a watering-place in the Harwich parliamentary division of Essex, England, the terminus of a branch of the Great Eastern railway from Colchester, 71½ m. E.N.E. from London. Pop. of urban district (1901) 2014. This portion of the coast has suffered from encroachment of the sea, and a part of the old village of Walton, with the church, was engulfed towards the end of the 18th century. A prebendary stall at St Paul's Cathedral, London, was endowed with the lands thus consumed (*praebenda consumpta per mare*). On the E. side of the town is the open North Sea, with a fine stretch of sand and shingle, affording good bathing. To the west is an irregular inlet studded with low islands, known as Hanford Water. The Naze is a promontory 2 m. N. by E. of the town, and in the vicinity of Walton are low cliffs exhibiting the fossiliferous red crag formation. The church of All Saints is a brick building dating mainly from 1804. Walton has a public hall, several hotels and a small theatre; and iron foundries and brick works. Services of passenger steamers in connexion with Harwich, Clacton-on-Sea, and London are maintained in the summer.

WALTZING MOUSE (or Japanese Waltzing Mouse), a pied race of the house mouse (*Mus musculus*), or one of its allies, originally bred in China, and known in Japan as the Nankin mouse. The habit of these mice of spinning round and round after their tails is highly developed, and continually exercised. In Japan, where there were originally two breeds, a grey and a white, these mice are kept in cages on account of their dancing propensities. The dancing was at one time supposed to be due to a disease of the labyrinth of the ear; but Dr K. Kishi, in a paper in the *Zeitschrift für wissenschaftliche Zoologie* (vol. xxi. pt. 3), concludes that it is the effect of confinement for untold centuries in small cages.

WALWORTH, SIR WILLIAM (d. 1385), lord mayor of London, belonged to a good Durham family. He was apprenticed to John Lovekyn, a member of the Fishmongers' Gild, and succeeded his master as alderman of Bridge ward in 1368, becoming sheriff in 1370 and lord mayor in 1374. He is said to have suppressed usury in the city during his term of office as mayor. His name frequently figures as advancing loans to the king, and he supported John of Gaunt, duke of Lancaster, in the city, where there was a strong opposition to the king's uncle. His most famous exploit was his encounter with Wat Tyler in 1381, during his second term of office as lord mayor. In June of that year, when Tyler and his followers entered south London, Walworth defended London Bridge against them; he was with Richard II. when he met the insurgents at Smithfield, and assisted in slaying their leader (see TYLER, WAT), afterwards raising the city bodyguard in the king's defence; for which service he was rewarded by knighthood and a pension. He subsequently served on two commissions to restore the peace in the county of Kent. He died in 1385, and was buried in the church of St Michael, Crooked Lane, of which he was a considerable benefactor. Sir William Walworth was the most distinguished member of the Fishmongers' Gild, and he invariably figured in the pageants prepared by them when one of their members attained the mayoralty. He became a favourite hero in popular tales, and appeared in Richard Johnson's *Nine Worthies of London* in 1592.

See William Herbert, *The History . . . of St Michael, Crooked Lane, London . . .* (1831); W. and R. Woodcock, *Lives of Illustrious Lord Mayors* (1846); an account of Wat Tyler's rebellion in a fragmentary chronicle printed by G. H. Trevelyan in the *English Historical Review* (July 1898).

WAMPUM, or WAMPUM-PEAGE (Amer. Ind. *wampam*, "white"; *peag*, "bead"), the shell-money of the North American Indians. It consisted of beads made from shells, and, unlike the cowry-money of India and Africa (which was the shell in its natural state), required a considerable measure of skill in its manufacture. Wampum was of two colours, dark purple and white, of cylindrical form, averaging a quarter of an inch in length, and about half that in diameter. Its colour determined its value. The term wampum or wampum-peage was apparently applied to the beads only when strung or woven together. They were ground as smooth as glass and were strung together by a hole drilled through the centre. Dark wampum, which was made from a "hard shell" clam (*Venus mercenaria*), popularly called quahang or quahog, a corruption of the Indian name, was the most valuable. White wampum was made from the shell of whelks, either from the common whelk (*Buccinum undatum*), or from that of *Pyrula canaliculata* and *Pyrula carica*. Wampum was employed most in New England, but it was common elsewhere. By the Dutch settlers of New York it was called *seawan* or *zeewand*, and *roenoke* in Virginia, and perhaps farther south, for shell-money was also known in the Carolinas, but whether the *roenoke* of the Virginian Indians was made from the same species of shell as wampum is not clear. Cylindrical shell-beads similar to the wampum of the Atlantic coast Indians were made to some extent by the Indians of the west coast. This was manufactured from the *Mytilus californianus*, a mussel which abounds there.

In the trading between whites and Indians, wampum so completely took the place of ordinary coin that its value was fixed by legal enactment, three to a penny and five shillings a fathom. The fathom was the name for a count, and the number of shells varied according to the accepted standard of exchange. Thus where six wampum went to the penny, the fathom consisted of 360 beads; but where four made a penny, as under the Massachusetts standard of 1640, then the fathom counted 240. The beads were at first worth more than five shillings per fathom, the price at which they passed current in 1643. A few years before the fathom had been worth nine or ten shillings. Connecticut received wampum for taxes in 1637 at four a penny. In 1640 Massachusetts adopted the Connecticut standard, "white to pass at four and bleuse at two a penny." There was no restriction on the manufacture of wampum, and it was made by the whites as well as the Indians. The market was soon flooded with carelessly made and inferior wampum, but it continued to be circulated in the remote districts of New England through the 17th century, and even into the beginning of the 18th. It was current with silver in Connecticut in 1704.

Wampum was also used for personal adornment, and belts were made by embroidering wampum upon strips of deerskin. These belts or scarves were symbols of authority and power and were surrendered on defeat in battle. Wampum also served a mnemonic use as a tribal history or record. "The belts that pass from one nation to another in all treaties, declarations and important transactions are very carefully preserved in the chiefs' cabins, and serve not only as a kind of record or history but as a public treasury. According to the Indian conception, these belts could tell by means of an interpreter the exact rule, provision or transaction talked into them at the time and of which they were the exclusive record. A strand of wampum, consisting of purple and white shell-beads or a belt woven with figures formed by beads of different colours, operated on the principle of associating a particular fact with a particular string or figure, thus giving a serial arrangement to the facts as well as fidelity to the memory. These strands and belts were the only visible records of the Iroquois, but they required the trained interpreters who could draw from their strings and figures the acts and intentions locked up in their remembrance" (Major Rogers, *Account of North America*, London, 1765).

See Holmes, "Art in Shell of the Ancient Americans" in *Annual Report of Bureau of Ethnology, Washington, for 1880–1881*; W. B. Weeden, *Indian Money as a Factor in New England Civilization* (Baltimore, 1884); E. Ingersoll, "Wampum and its History," in *American Naturalist*, vol. xvii. (1883); Horatio Hale, "On the Origin and Nature of Wampum," in *American Naturalist*, vol. xviii. (1884); C. L. Norton, "The Last Wampum Coinage," in *American Magazine* for March 1888.

WANA, a valley and frontier outpost of Waziristan in the North-West Frontier Province of India. It lies to the west of the Mahsud country, and to the north of the Gomal river, and is inhabited by the Waziri tribe. Lying on the border of Afghanistan, it is conveniently placed for dominating Waziristan on the north and the Gomal Pass on the south, and occupies very much the same strategic position as the Zhob valley holds in Baluchistan. It forms the end of the chain of outposts extending from Quetta to Waziristan, and can be supported either from India by the Gomal Pass or from Quetta by the Zhob valley. In 1894, when the Indo-Afghan boundary commission was delimiting the Waziri border, the Mahsud Waziris, thinking their independence to be threatened, made a night attack on the camp of the commission at Wana. The result was the Waziristan Expedition of the same year, and the occupation of Wana by British troops. On the formation of the North-West Frontier Province in 1901 it was decided to replace the troops by militia, and Wana was handed over to them in 1904. It is now the headquarters of the political agency of Southern Waziristan.

WANAMAKER, JOHN (1838–   ), American merchant, was born, of Palatine-Huguenot stock, in Philadelphia, Pennsylvania, on the 11th of July 1838. He attended a public school in that city until he was fourteen, then became an errand boy for a book store, and was a retail clothing salesman from 1856 until 1861, when he established with Nathan Brown (who afterward became his brother-in-law) the clothing house of Wanamaker & Brown, in Philadelphia, the partnership continuing until the death of Brown in 1868. In 1869 Wanamaker founded the house of John Wanamaker & Company; and in 1875 bought the

Pennsylvania Railroad Company's freight depot at Thirteenth and Market streets, and in the following year opened it as a dry goods and clothing store, subsequently much enlarged. In September 1896 he acquired from Hilton, Hughes & Company the former New York store of A. T. Stewart, and thereafter greatly enlarged it and added a new building; this, and the Philadelphia store, are among the largest department stores in the United States. Mr Wanamaker was postmaster-general in President Benjamin Harrison's cabinet in 1889–1893, and brought about the establishment of post-offices on ocean-going vessels. He early identified himself with religious work in Philadelphia; was the first paid secretary, in 1857–1861, of that city's Young Men's Christian Association, of which he was president in 1870–1883, and in 1858 founded, and thereafter served as superintendent of, the Bethany (Presbyterian) Sunday School, one of the largest in the world. He took an active part in the movement which resulted in the formation of the United States Christian Commission in 1861.

WANDERU (Wanderoo), the native name for the species of langur monkeys (*Semnopithecus*) inhabiting the island of Ceylon; but in India commonly misapplied to the lion-tailed macaque, *Macacus silenus* (see Primates).

WANDESFORD, CHRISTOPHER (1592–1640), lord deputy of Ireland, was the son of Sir George Wandesford (1573–1612) of Kirklington, Yorkshire, and was born on the 24th of September 1592. Educated at Clare College, Cambridge, he entered parliament in 1621, and his rise to importance was due primarily to his friendship with Sir Thomas Wentworth, afterwards earl of Strafford. Although at first hostile to Charles I., this being evidenced by the active part he took in the impeachment of Buckingham, Wandesford soon became a royalist partisan, and in 1633 he accompanied Wentworth to Ireland, where he was already master of the rolls. His services to his chief were fully recognized by the latter, whom in 1640 he succeeded as lord deputy, but he had only just begun to struggle with the difficulties of his new position when he died on the 3rd of December 1640.

His son Christopher (1628–1687), created a baronet in 1662, was the father of Sir Christopher Wandesford (d. 1707), who was created an Irish peer as Viscount Castlecomer in 1707, Castlecomer in Kilkenny having been acquired by his grandfather when in Ireland. Christopher, the 2nd viscount (d. 1719), was secretary-at-war in 1717–1718. In 1758 John, 5th viscount, was created Earl Wandesford, but his titles became extinct when he died in January 1784.

For Wandesford's life see Thomas Comber, *Memoirs of the Life and Death of the Lord Deputy Wandesford* (Cambridge, 1778); T. D. Whitaker, *History of Richmondshire,* vol. ii. (1823); and the *Autobiography* of his daughter, Alice Thornton, edited by Charles Jackson for the Surtees Society (Durham, 1875).

WANDIWASH, a town in the North Arcot district of Madras, India. Pop. (1901) 5971. It is notable as the scene of the victory of Sir Eyre Coote in 1760, the most important ever won by the British over the French in India.

WANDSBEK, a town of Germany, in the Prussian province of Schleswig-Holstein, practically forming a populous suburb of Hamburg, with which it is connected by a railway and an electric tramway. Pop. (1905) 31,563. It is best known as the place of residence of the poet Johann Heinrich Voss and of Matthias Claudius, who here issued (1771–1775) the *Wandsbecker Boten*. There is a monument to Claudius in the town. Its leading manufactures are spirits, tobacco, beer, leather and confectionery; other industries are machine building and gardening.

WANDSWORTH, a south-western metropolitan borough of London, England, bounded N. by the river Thames and Battersea, and E. by Lambeth, and extending S. and W. to the boundary of the county of London. Pop. (1901) 232,034. The name, which occurs in Domesday, indicates the position of the village on the river Wandle, a small tributary of the Thames. Wandsworth is the largest in area of the metropolitan boroughs, including the districts of Putney by the river, part of Clapham in the north-east, Streatham in the south-east, Balham and Upper and Lower Tooting in the centre and south. These are mainly residential districts, and the borough is not thickly populated. Towards the west, along the Upper Richmond and Kingston roads, there is considerable open country, undulating and well wooded. It is to a great extent preserved in the public grounds of Putney Heath, which adjoins Wimbledon Common, outside the borough, on the north; and Richmond Park and Barnes Common, parts of which are in the borough. Other public grounds are parts of Wandsworth Common (193 acres) and Clapham Common, both extending into Battersea, Tooting Bec (147 acres) and Streatham Common (66 acres), and Wandsworth Park bordering the Thames. The borough is connected with Fulham across the Thames by Wandsworth and Putney bridges. The annual Oxford and Cambridge boat-race starts from above Putney Bridge, finishing at Mortlake; and the club-houses of the principal rowing clubs of London are situated on the Putney shore. Putney Heath was formerly notorious as a resort of highwaymen and duellists. Among the institutions of Wandsworth are the Royal Hospital for Incurables, Putney; the Fountain and the Grove fever hospitals, Lower Tooting; the Clapham School of Art, Wandsworth Technical Institute; the Roman Catholic Training College for Women, West Hill; and Wandsworth Prison, Heathfield Road. The parliamentary borough of Wandsworth returns one member, but the municipal borough also includes part of the Clapham division of the parliamentary borough of Battersea and Clapham, and part of the Wimbledon division of Surrey. The borough council consists of a mayor, 10 aldermen and 60 councillors. Area, 9129·7 acres.

WANGANUI, the principal port on the west coast of North Island, New Zealand, in the Waitotara county, at the mouth of the Wanganui river, 134 m. by rail N. of Wellington. Pop. (1906) 8175. The town is laid out in rectangular blocks at the foot of low hills, from the summit of which (as in Queen's Gardens) a splendid panorama is seen, including the snow-clad Mount Ruapehu to the north-east. The river bar obstructs navigation, the depth not exceeding 14 ft., so that large vessels must lie outside. The district is agricultural and pastoral, and wool and grain are exported, as well as meat and dairy produce, for which there are large refrigerating works. The Wanganui Collegiate School (Church of England) is one of the largest boarding schools in Australasia. The district was the scene of conflicts with the natives in 1847, 1864 and 1868, and in the beautiful Moutoa gardens a monument commemorates the battle of that name (May 14th, 1864). The settlement was founded in 1842.

WANGARA, the Hausa name for the Mandingo (*q.v.*), a people of West Africa; used also as the name of districts in the western and central Sudan. The Wangara are also known as Wangarawa, Wongara, Ungara, Wankoré and Wakore. According to Idrisi (writing in the 12th century), the Wangara country was renowned for the quantity and the quality of the gold which it produces. The country formed an island about 300 m. long by 150 in breadth, which the Nile (*i.e.* Niger) surrounded on all sides and at all seasons. This description corresponds fairly accurately with the tract of country between the Niger and its tributary the Bani. Idrisi's account of the annual inundation of the land by the rising of the Niger agrees with the facts. He states that on the fall of the waters natives from all parts of the Sudan assembled to gather the gold which the subsiding waters left behind. In the closing years of the 18th and the opening years of the 19th century the discoveries of Hornemann, Mungo Park and others revived the stories of Wangara and its richness in gold. Geographers of that period (*e.g.* Major Rennell) shifted the Wangara country far to the east and confused Idrisi's description with accounts which probably referred to Lake Chad. Gradually, however, as knowledge increased, the Wangara territory was again moved westward, and was located within the Niger bend. The name has now practically disappeared from the maps save that a town in the hinterland of Dahomey is named Wangara (French spelling Ouangara). Idrisi's account as to the richness in gold of the upper Niger regions has basis in fact; though the gold brought in considerable quantities to the European trading stations on the Gambia and Senegal in the 16th, 17th and 18th centuries appears to have come largely from Bambuk.

WANGARATTA, a town of Victoria, Australia, in the counties of Moira, Delatite and Bogong, at the junction of the Ovens and King rivers, 145½ m. by rail N.E. of Melbourne. Pop. (1901) 2621. It is a prosperous little town in an agricultural district and is the see of an Anglican bishop. It has numerous industries, including flour-milling, tanning, fellmongery, brewing, coach-building, bacon-curing, and bicycle and butter making. Important stock sales are held fortnightly, and there is an annual agricultural exhibition.

WANSTEAD, an urban district in the Romford parliamentary division of Essex, England, forming a residential suburb of London, on a branch of the Great Eastern railway, 8 m. N.E. of Liverpool Street station. Pop. (1901) 9179. Wanstead Park, 184 acres in extent, was opened in 1882. Northward extend the broken fragments of Epping Forest. Wanstead Flats, adjoining the Park, form another open ground. At Lake House Thomas Hood wrote the novel *Tylney Hall*. At Snaresbrook in the parish of Wanstead are the Infant Orphan Asylum, founded in 1827, and the Royal Merchant Seamen's Orphan Asylum, established in London in 1817 and refounded here in 1861. In Snaresbrook is Eagle Pond or Lake, 10½ acres in extent.

Wanstead is mentioned in Domesday, and the name is considered by some to be derived from Woden's stead or place, indicating a spot dedicated to the worship of Woden. It belonged before the time of Edward the Confessor to the monks of St Peter's, Westminster, and afterwards to the bishop of London, of whom it was held at the time of the Domesday Survey by Ralph Fitz Brien. In the reign of Henry VIII. it came into the possession of the crown, and in 1549 it was bestowed by Edward VI. on Lord Rich, whose son sold it in 1577 to Robert Dudley, earl of Leicester. The original manor house was rebuilt by Lord Chancellor Rich, who was here visited by Queen Elizabeth in 1561, and for her entertainment Sir Philip Sidney wrote a dramatic interlude which was played before the queen at Wanstead garden, and is printed at the end of the *Arcadia*. Sir Richard Child, afterwards earl of Tylney, built the splendid mansion of Wanstead House in 1715 (demolished in 1822), in which the prince of Condé and others of the Bourbon family resided during the reign of the first Napoleon.

WANTAGE, a market town in the Abingdon parliamentary division of Berkshire, England. Pop. of urban district (1901), 3766. It lies in the richly wooded Vale of White Horse, in a hollow at the foot of the steep hills which border the Vale on the south, 2 m. S. of Wantage Road station on the Great Western railway, with which a steam tramway connects it. The church of St Peter and St Paul is cruciform, and as a whole Perpendicular in appearance, but retains a nave arcade and ornate tower-arches of the Early English period. The font is a fine specimen of the same style; and there is beautiful woodwork in the chancel. An altar-tomb in alabaster of 1361, and a fine brass of 1414, commemorate members of the family of Fitzwarren. There are other brasses of the 15th and 16th centuries. The neighbouring building of the grammar school preserves a Norman door from another church, which formerly stood in the same churchyard with St Peter's. In the broad market-place is a great statue of King Alfred, executed by Count Gleichen and unveiled in 1877; for Wantage is famous as the birthplace of the king in 849. The town has a large agricultural trade and ironworks.

The title of Baron Wantage of Lockinge was taken in 1885 by Sir Robert Loyd-Lindsay (b. 1832) on his elevation to the peerage. He was the son of General James Lindsay of Balcarres, but took the additional surname of Loyd in 1858 on marrying the heiress of Lord Overstone, the banker; he fought with his regiment the Scots Fusilier Guards in the Crimea and won the V.C., retiring as lieutenant-colonel. He was M.P. for Berks from 1865 to 1885, and was financial secretary to the War Office in 1877–1880. The title became extinct at his death in 1900.

WAPENSHAW (M.E. for "weapon-show"), a periodical muster or review of troops formerly held in every district in Scotland, the object having been to satisfy the military chiefs that the arms of their retainers were in good condition. Scott's *Old Mortality* gives a description of one. The name is still given to rifle meetings held annually at Aberdeen and other places in Scotland.

WAPENTAKE, anciently the principal administrative division of the counties of York, Lincoln, Leicester, Nottingham, Derby and Rutland, corresponding to the hundred in the southern counties of England. In many cases, however, ancient wapentakes are now called hundreds. North of the Tees, Sadberg in Durham is the only district which was called a wapentake, and the rest of the ancient administrative divisions of the three northern counties were called wards. The word wapentake seems to have been first applied to the periodical meetings of the magnates of a district; and, if we may believe the 12th century compilation known as the *Leges Edwardi*, it took its name from the custom in accordance with which they touched the spear of their newly-appointed magistrate with their own spears and so confirmed his appointment. Probably it was also usual for them to signify their approval of a proposal by the clash of their arms, as was the practice among the Scandinavian peoples. Wapentakes are not found outside the parts of England which were settled by the Danes. They varied in size in different counties; those of Yorkshire, for instance, being very much larger than those of Lincolnshire. As a general rule each wapentake had its own court, which had the same jurisdiction as the hundred courts of the southern counties. In some cases, however, a group of wapentakes had a single court. It should be noticed that the court was styled *wapentagium* simply, and not *curia wapentagii*.

See Sir Henry Ellis, *General Introduction to Domesday Book*; W. W. Skeat, *Etymological English Dictionary*; W. Stubbs, *Constitutional History*; and H. M. Chadwick, *Studies on Anglo-Saxon Institutions* (1905). (G. J. T.)

WAPPERS, EGIDE CHARLES GUSTAVE, Baron (1803–1874), Belgian painter, was born at Antwerp on the 23rd of August 1803. After studying at the Antwerp Academy he went to Paris in 1826. The Romantic movement was then astir in France, and in that vehement struggle towards a new ideal artists and political men were thrown together. Wappers was the first Belgian artist to take advantage of this state of affairs, and his first exhibited picture, "The Devotion of the Burgomaster of Leiden," appearing at the appropriate moment, had a marvellous success in the Brussels Salon of 1830. The picture, although political, was in fact a remarkable work, which revolutionized the taste of Flemish painters. Wappers was invited to the court of Brussels, and was favoured with commissions. In 1832 the city of Antwerp appointed him professor of painting, and his triumph was complete when he exhibited at the Antwerp Salon of 1834 his masterpiece, "An Episode of the Belgian Revolution of 1830" (Brussels Gallery). He was subsequently appointed painter to the king of the Belgians, and at the death of Matthieu van Brée he was made director of the Antwerp Academy. Of his very numerous works we may name "Christ Entombed," "Charles I. taking leave of his Children," "Charles IX.," "Camöens," "Peter the Great at Saardam," and "Boccaccio at the Court of Joanna of Naples." Louis Philippe gave him a commission to paint a large picture for the gallery at Versailles, "The Defence of Rhodes by the Knights of St John of Jerusalem," a work finished in 1844, when he received from the king of the Belgians the title of baron. After retiring from the post of director of the Antwerp Academy, he settled in 1853 in Paris, where he died on the 6th of December 1874.

See J. du Jardin, *L'Art flamand*; Camille Lemonnier, *Histoire des beaux arts en Belgique*; E. Fétis, "Notice sur Gustave Wappers," *Annuaire de l'académie royale de Belgique* (1884).

WĀQIDĪ [Abū 'Abdallah Mahommed ibn 'Umar ul-Wāqidī] (747–823), Arabian historian, was born at Medina, where he became a corn-dealer but was compelled to flee from his creditors (owing largely to his generosity) to Bagdad. Here the Barmecide vizier Yaḥyā b. Khālid (see Barmecides) gave him means and made him cadi in the western district of the city. In 819 he was transferred to Rosafa (Rusāfa) on the east side. His greatest work is the *Kitāb ul-Maghāzi*, or history of Mahomet's campaigns.

The first third of the *Kitab ul-Maghāzi* (one leaf missing) was published by A. von Kremer from a Damascus MS. (Calcutta, 1856). Sprenger in his *Leben Muhammad's* used a British Museum MS. containing the first half, all but one leaf. J. Wellhausen published an abridged German translation from another British Museum MS. under the title *Muhammad in Medina* (Berlin, 1882).

Ascribed to Wāqidī, but probably written at the time of the Crusades to incite the Moslems against the Christians, are several works on the conquests of Islam. One of the best known is the *Futūḥ ush-Shām*, edited by W. Nassau Lees (Calcutta, 1854–1862; Cairo, 1865). M. J. de Goeje, in his *Mémoires sur la conquête de la Syrie* (Leiden, 1900), holds that this work is founded on that of Abu Hudhaifa ul-Bukhārī, which in turn is an edition of the real Wāqidī. See ARABIA, *Literature*, section "History." (G. W. T.)

WAR (O. Eng. *werre*, Fr. *guerre*, of Teutonic origin; cf. O.H.G. *werran*, to confound), the armed conflict of states, in which each seeks to impose its will upon the other by force. War is the opposite of Peace (*q.v.*), and is the subject of the military art. In separate sections below the general principles of the art of war are discussed, and the laws which have gradually become accepted among civilized peoples for the regulation of its conditions. The details concerning the history of individual wars, and the various weapons and instruments of war, are given in separate articles.

See ARMY, NAVY, CONSCRIPTION, STRATEGY, TACTICS, INFANTRY, CAVALRY, ARTILLERY, ENGINEERS, FORTIFICATION, COAST DEFENCE, OFFICERS, STAFF, GUARDS, SUPPLY AND TRANSPORT, UNIFORMS, ARMS AND ARMOUR, GUN, RIFLE, PISTOL, SWORD, LANCE, ORDNANCE, MACHINE GUNS, SUBMARINE MINES, TORPEDO, &C. The important wars are dealt with under the names commonly given to them; *e.g.* AMERICAN CIVIL WAR, AMERICAN WAR OF INDEPENDENCE, AMERICAN WAR OF 1812, CRIMEAN WAR, DUTCH WARS, FRANCO-GERMAN WAR, FRENCH REVOLUTIONARY WARS, GREAT REBELLION, GREEK WAR OF INDEPENDENCE, ITALIAN WARS, NAPOLEONIC CAMPAIGNS, PELOPONNESIAN WAR, PENINSULAR WAR, PUNIC WARS, RUSSO-JAPANESE WAR, RUSSO-TURKISH WARS, SERVO-BULGARIAN WAR, SEVEN WEEKS' WAR, SEVEN YEARS' WAR, SPANISH-AMERICAN WAR, SPANISH SUCCESSION WAR, THIRTY YEARS' WAR. Important campaigns and battles are also separately treated (*e.g.* WATERLOO, TRAFALGAR, SHENANDOAH VALLEY, WILDERNESS, METZ, &C.).

I. GENERAL PRINCIPLES

Modern conditions.

It is not easy to determine whether industrial progress, improved organization, the spread of education or mechanical inventions have wrought the greater change in the military art. War is first and foremost a matter of movement; and as such it has been considerably affected by the multiplication of good roads, the introduction of steam transport, and by the ease with which draught animals can be collected. In the second place, war is a matter of supply; and the large area of cultivation, the increase of live-stock, the vast trade in provisions, pouring the food-stuffs of one continent into another, have done much to lighten the inevitable difficulties of a campaign. In the third place, war is a matter of destruction; and while the weapons of armies have become more perfect and more durable, the modern substitutes for gunpowder have added largely to their destructive capacity. Fourthly, war is not merely a blind struggle between mobs of individuals, without guidance or coherence, but a conflict of well-organized masses, moving with a view to intelligent co-operation, acting under the impulse of a single will and directed against a definite objective. These masses, however, are seldom so closely concentrated that the impulse which sets them in motion can be promptly and easily communicated to each, nor can the right objective be selected without some knowledge of the enemy's strength and dispositions. Means of intercommunication, therefore, as well as methods of observation, are of great importance; and with the telegraph, the telephone, visual signalling, balloons, airships and improved field-glasses, the armies of to-day, so far as regards the maintenance of connexion between different bodies of troops, and the diffusion, if not the acquiring, of information, are at a great advantage compared with those of the middle of the 19th century.

War, then, in some respects has been made much simpler. Armies are easier to move, to feed and to manœuvre. But in other respects this very simplicity has made the conduct of a campaign more difficult. Not only is the weapon wielded by the general less clumsy and more deadly than heretofore, less fragile and better balanced, but it acts with greater rapidity and has a far wider scope. In a strong and skilful hand it may be irresistible; in the grasp of a novice it is worse than useless. In former times, when war was a much slower process, and armies were less highly trained, mistakes at the outset were not necessarily fatal. Under modern conditions, the inexperienced commander will not be granted time in which to correct his deficiencies and give himself and his troops the needful practice. The idea of forging generals and soldiers under the hammer of war disappeared with the advent of "the nation in arms." Military organization has become a science, studied both by statesmen and soldiers. The lessons of history have not been neglected. Previous to 1870, in one kingdom only was it recognized that intellect and education play a more prominent part in war than stamina and courage. Taught by the disasters of 1806, Prussia set herself to discover the surest means of escaping humiliation for the future. The shrewdest of her sons undertook the task. The nature of war was analysed until the secrets of success and failure were laid bare; and on these investigations a system of organization and of training was built up which, not only from a military, but from a political, and even an economical point of view, is the most striking product of the 19th century. The keynote of this system is that the best brains in the state shall be at the service of the war lord. None, therefore, but thoroughly competent soldiers are entrusted with the responsibility of command; and the education of the officer is as thorough, as systematic and as uniform as the education of the lawyer, the diplomatist and the doctor. In all ages the power of intellect has asserted itself in war. It was not courage and experience only that made Hannibal, Alexander and Caesar the greatest names of antiquity. Napoleon, Wellington and the Archduke Charles were certainly the best-educated soldiers of their time; while Lee, Jackson and Sherman probably knew more of war, before they made it, than any one else in the United States. But it was not until 1866 and 1870 that the preponderating influence of the trained mind was made manifest. Other wars had shown the value of an educated general; these showed the value of an educated army. It is true that Moltke, in mental power and in knowledge, was in no wise inferior to the great captains who preceded him; but the remarkable point of his campaigns is that so many capable generals had never before been gathered together under one flag. No campaigns have been submitted to such searching criticism. Never have mistakes been more sedulously sought for or more frankly exposed. And yet, compared with the mistakes of other campaigns, even with that of 1815, where hardly a superior officer on either side had not seen more battles than Moltke and his comrades had seen field-days, they were astonishingly few. It is not to be denied that the foes of Prussia were hardly worthy of her steel. Yet it may be doubted whether either Austria or France ever put two finer armies into the field than the army of Bohemia in 1866 and the army of the Rhine in 1870. Even their generals of divisions and brigades had more actual experience than those who led the German army corps. Compared with the German rank and file, a great part of their non-commissioned officers and men were veterans, and veterans who had seen much service. Their chief officers were practically familiar with the methods of moving, supplying and manœuvring large masses of troops; their marshals were valiant and successful soldiers. And yet the history of modern warfare records no defeats so swift and so complete as those of Königgrätz and Sedan. The great host of Austria was shattered to fragments in seven weeks; the French Imperial army was destroyed in seven weeks and three days; and to all intent and purpose the resistance they had offered was not much more effective than that of a respectable militia. But both the Austrian and the French armies were organized and trained under the old system. Courage, experience and professional pride they possessed in abundance. Man for man, in all virile qualities, neither officers nor men were inferior to their foes. But one thing their generals lacked, and that was education for war. Strategy was almost a sealed book to them; organization a matter of secondary importance. It was no part of their duty, they declared, to train the judgment of their subordinates; they were soldiers, and not pedagogues. Knowledge of foreign armies and their methods they considered useless; and of war prepared and conducted on "business principles" they had never even dreamt.

Statesmen and war.

The popular idea that war is a mere matter of brute force, redeemed only by valour and discipline, is responsible for a greater evil than the complacency of the amateur. It blinds both the people and its representatives to their bounden duties. War is something more than a mere outgrowth of politics. It is a political act, initiated and controlled by the government, and it is an act of which the issues are far more momentous than any other. No branch of political science requires more careful study. It is not pretended that if military history were thoroughly studied all statesmen would become Moltkes, or that every citizen would be competent to set squadrons in the field. War is above all a practical art, and the application of theory to practice is not to be taught at a university or to be learned by those who have never rubbed shoulders with the men in the ranks. But if war were more generally and more thoroughly studied, the importance of organization, of training, of education and of readiness would be more generally appreciated; abuses would no longer be regarded with lazy tolerance; efficiency would be something more than a political catchword, and soldiers would be given ample opportunities of becoming masters of every detail of their profession. Nor is this all. A nation that understood something about war would hardly suffer the fantastic tricks which have been played so often by the best-meaning statesmen. And statesmen themselves would realize that when war is afoot their interference is worse than useless; that preparation for defence, whether by the multiplication of roads, the construction of railways, of arsenals, dockyards, fortresses, is not the smallest of their duties; and lastly, that so far as possible diplomacy and strategy should keep step. Each one of these is of far greater importance than in the past. In the wars of the 18th century, English cabinets and Dutch deputies could direct strategical operations without bringing ruin on their respective countries. The armies of Austria in 1792–1795, controlled as they were by the Aulic Councils, were more formidable in the field than those of the French Republic. In the campaigns of 1854 and 1859 the plans of Newcastle and Napoleon III. worked out to a successful issue; and if Lincoln and Stanton, his Secretary of War, imperilled the Union in 1862, they saw the downfall of the Southern Confederacy in 1865. But in every case amateur was pitted against amateur. The Dutch deputies were hardly less incapable of planning or approving a sound plan of campaign than Louis XIV. The Aulic Council was not more of a marplot than the Committee of Public Safety. Newcastle was not a worse strategist than the tsar Nicholas I. Napoleon III. and his advisers were quite a match for the courtier generals at Vienna; while Lincoln and Stanton were not much more ignorant than Jefferson Davis. The amateur, however, can no longer expect the good fortune to be pitted against foes of a capacity no higher than his own. The operations of Continental armies will be directed by soldiers of experience whose training for war has been incessant, and who will have at their command troops in the highest state of efficiency and preparation. It is not difficult to imagine, under such conditions, with what condign punishment mistakes will be visited. Napoleon III. in 1859 committed as many blunders as he did in 1870. But the Austrians had no Moltke to direct them; their army corps were commanded by men who knew less of generalship than a Prussian major, and their armament was inferior. Had they been the Austrians of to-day, it is probable that the French and the allies would have been utterly defeated. And to come to more recent campaigns, while American officers have not hesitated to declare that if the Spaniards at Santiago had been Germans or French, the invasion would have ended in disastrous failure, it is impossible to doubt that had the Boers of 1899 possessed a staff of trained strategists, they would have shaken the British Empire to its foundations. The true test of direction of war is the number of mistakes. If they were numerous, although the enemy may not have been skilful enough to take advantage of them, the outlook for the future under the same direction, but against a more practised enemy, is anything but bright.

Preparation for defence.

As regards preparation for defence, history supplies us with numerous illustrations. The most conspicuous, perhaps, is the elaborate series of fortifications which were constructed by Vauban for the defence of France; and there can be no question that Louis XIV., in erecting this mighty barrier against invasion, gave proof of statesmanlike foresight of no mean order. An instance less familiar, perhaps, but even more creditable to the brain which conceived it, was Wellington's preparation of Portugal in 1809–1811. Not only did the impregnable stronghold of Torres Vedras, covering Lisbon, and securing for the sea-power an open door to the continent of Europe, rise as if by magic from the earth, but the whole theatre of war was so dealt with that the defending army could operate wherever opportunity might offer. No less than twenty supply depots were established on different lines of the advance. Fortifications protected the principal magazines. Bridges were restored and roads improved. Waterways were opened up, and flotillas organized; and three auxiliary bases were formed on the shores of the Atlantic. Again, the famous "quadrilaterals" of Lombardy and Rumelia have more than fulfilled the purpose for which they were constructed; and both Austria and Turkey owe much to the fortresses which so long protected their vulnerable points. Nor has the neglect of preparation failed to exert a powerful effect. Moltke has told us that the railway system of Germany before 1870 had been developed without regard to strategical considerations. Yet the fact remains that it was far better adapted both for offence and defence than those of Austria and France; and, at the same time, it can hardly be denied that the unprovided state of the great French fortresses exercised an evil influence on French strategy. Both Metz and Strassburg were so far from forming strong pivots of manœuvres, and thus aiding the operations of the field armies, that they required those armies for their protection; and the retreat on Metz, which removed Bazaine's army from the direct road to Paris and placed it out of touch with its supports, was mainly due to the unfinished outworks and deficient armament of the virgin city. Since 1870 it has been recognized that preparation of the theatre of war is one of the first duties of a government. Every frontier of continental Europe is covered by a chain of entrenched camps. The great arsenals are amply fortified and strongly garrisoned. Strategy has as much to say to new railways as trade; and the lines of communication, whether by water or by land, are adequately protected from all hostile enterprises.

Concert between diplomacy and strategy.

We now come to the importance of close concert between strategy and diplomacy. On the continent of Europe they can easily keep pace, for the theatre of war is always within easy reach. But when the ocean intervenes between two hostile states it is undoubtedly difficult to time an ultimatum so that a sufficient armed force shall be at hand to enforce it, and it has been said in high places that it is practically impossible. The expedition to Copenhagen in 1807, when the British ultimatum was presented by an army of 27,000 men carried on 300 transports, would appear to traverse this statement. But at the beginning of the 20th century an army and a fleet of such magnitude could neither be assembled nor despatched without the whole world being cognizant. It is thus perfectly true that an appreciable period of time must elapse between the breaking off of negotiations and the appearance on the scene of an invading army. Events may march so fast that the statesman's hand may be forced before the army has embarked. But because a powerful blow cannot at once be struck, it by no means follows that the delivery or the receipt of an ultimatum should at once produce a dangerous situation. Dewey's brilliant victory at Manila lost the greater part of its effect because the United States Government was unable to follow up the blow by landing a sufficient force. Exactly the same thing occurred in Egypt in 1882. The only results of the bombardment of Alexandria were the destruction of the city, the massacre of the Christian inhabitants, the encouragement of the rebels, who, when the ships drew off, came to the natural conclusion that Great Britain was powerless on land. Again, in 1899 the invading Boers found the frontiers unfortified and their march opposed by an inadequate force. It is essential, then, that when hostilities across the sea are to be apprehended, the most careful precautions should be taken to ward off the chance of an initial disaster. And such precautions are always possible. It is hardly conceivable, for instance, that a great maritime power, with Cyprus as a *place d'armes*, could not have placed enough transports behind the fleet to hold a sufficient garrison for Alexandria, and thus have saved the city from destruction. Nor in the case of a distant province being threatened is there the smallest reason that the garrison of the province should be exposed to the risk of a reverse before it is reinforced. It may even be necessary to abandon territory. It will certainly be necessary to construct strong places, to secure the lines of communication, to establish ample magazines, to organize local forces, to assemble a fleet of transports, and to keep a large body of troops ready to embark at a moment's notice. But there is no reason, except expense, that all this should not be done directly it becomes clear that war is probable, and that it should not be done without attracting public attention. In this way strategy may easily keep pace with diplomacy; and all that is wanted is the exercise of ordinary foresight, a careful study of the theatre of war, a knowledge of the enemy's resources and a resolute determination, despite some temporary inconvenience and the outcry of a thoughtless public, to give the enemy no chance of claiming first blood. The Franco-German War supplies a striking example. Moltke's original intention was to assemble the German armies on the western frontier. The French, he thought, inferior in numbers and but half prepared, would probably assemble as far back as the Moselle. But, as so often happens in war, the enemy did what he was least expected to do. Hastily leaving their garrisons, the French regiments rushed forward to the Saar. The excitement in Germany was great; and even soldiers of repute, although the mobilization of the army was still unfinished, demanded that such troops as were available should be hurried forward to protect the rich provinces which lie between the Saar and Rhine. But the chief of the staff became as deaf as he was silent. Not a single company was despatched to reinforce the slender garrisons of the frontier towns; and those garrisons were ordered to retire, destroying railways and removing rolling-stock, directly the enemy should cross the boundary. Moltke's foresight had embraced every possible contingency. The action of the French, improbable as it was deemed, had still been provided against; and, in accordance with time-tables drawn up long beforehand, the German army was disentrained on the Rhine instead of on the Saar. Ninety miles of German territory were thus laid open to the enemy; but the temporary surrender of the border provinces, in the opinion of the great strategist, was a very minor evil compared with the disasters, military and political, that would have resulted from an attempt to hold them.

Duties of the War Minister.

It is hardly necessary to observe that no civilian minister, however deeply he might have studied the art of war, could be expected to solve for himself the strategic problems which come before him. In default of practical knowledge, it would be as impossible for him to decide where garrisons should be stationed, what fortifications were necessary, what roads should be constructed, or how the lines of communication should be protected, as to frame a plan of campaign for the invasion of a hostile state. His foresight, his prevision of the accidents inevitable in war, would necessarily be far inferior to those of men who had spent their lives in applying strategical principles to concrete cases; and it is exceedingly unlikely that he would be as prolific of strategical expedients as those familiar with their employment. Nevertheless, a minister of war cannot divest himself of his responsibility for the conduct of military operations. In the first place, he is directly responsible that plans of campaign to meet every possible contingency are worked out in time of peace. In the second place, he is directly responsible that the advice on which he acts should be the best procurable. It is essential, therefore, that he should be capable of forming an independent opinion on the merits of the military projects which may be submitted to him, and also on the merits of those who have to execute them. Pitt knew enough of war and men to select Wolfe for the command in Canada. Canning and Castlereagh, in spite of the opposition of the king, sent Wellington, one of the youngest of the lieutenant-generals, to hold Portugal against the French. The French Directory had sufficient sense to accept Napoleon's project for the campaign of Italy in 1796. In the third place, strategy cannot move altogether untrammelled by politics and finance. But political and financial considerations may not present themselves in quite the same light to the soldier as to the statesman, and the latter is bound to make certain that they have received due attention. If, however, modifications are necessary, they should be made before the plan of campaign is finally approved; and in any case the purely military considerations should be most carefully weighed. It should be remembered that an unfavourable political situation is best redeemed by a decisive victory, while a reverse will do more to shake confidence in the Government than even the temporary surrender of some portion of the national domains. "Be sure before striking" and *Reculer pour mieux sauter* are both admirable maxims; but their practical application requires a thorough appreciation of the true principles of war, and a very large degree of moral courage, both in the soldier who suggests and in the statesman who approves. If, however, the soldier and the statesman are supported by an enlightened public, sufficiently acquainted with war to realize that patience is to be preferred to precipitation, that retreat, though inglorious, is not necessarily humiliating, their task is very considerably lightened. Nothing is more significant than a comparison between the Paris press in 1870 and the American Confederate press in 1864. In the one case, even after the disastrous results of the first encounters had proved the superior strength and readiness of the enemy, the French people, with all the heat of presumptuous ignorance, cried out for more battles, for an immediate offensive, for a desperate defence of the frontier provinces. So fierce was their clamour that both the generals and the government hesitated, until it was too late, to advise the retreat of Bazaine's army; and when that army had been cut off at Metz, the pressure of public opinion was so great that the last reserve of France was despatched to Sedan on one of the maddest enterprises ever undertaken by a civilized state. In 1864, on the other hand, while Lee in Virginia and Johnston in the west were retreating from position to position, and the huge hosts of the Union were gradually converging on the very heart of the Confederacy, the Southern press, aware that every backward step made the Federal task more difficult, had nothing but praise for the caution which controlled the movements of their armies. But the Southern press, in three crowded years of conflict, had learned something of war. In 1866 and 1870 the German press was so carefully muzzled that even had there been occasion it could have done nothing to prejudice public opinion. Thus both the sovereign and the generals were backed by the popular support that they so richly merited; but it may be remarked that the relations between the army and the government were characterized by a harmony which has been seldom seen. The old king, in his dual capacity as head of the state and commander-in-chief, had the last word to say, not only in the selection of the superior officers, but in approving every important operation. With an adviser like Moltke at his elbow, it might appear that these were mere matters of form. Moltke, however, assures us that the king was by no means a figurehead. Although most careful not to assert his authority in a way that would embarrass his chief of staff, and always ready to yield his own judgment to sound reasons, he expressed, nevertheless, a perfectly independent opinion on every proposal placed before him, and on very many occasions made most useful suggestions. And at the same time, while systematically refraining from all interference after military operations had once begun, he never permitted military considerations to override the demands of policy. In 1866, when it was manifestly of the first importance, from a military point of view, that the Prussian army should be concentrated in a position which would enable it to cross the border immediately war was declared, the political situation was so strained that it was even more important to prevent the enemy from setting foot at any single point on Prussian territory. The army, in consequence, was dispersed instead of being concentrated, and the ultimate offensive became a difficult and hazardous operation. It is true that the king was an able and experienced soldier. Nevertheless, the wise restraint he displayed in the course of two great campaigns, as well as the skill with which he adjusted conflicting factors, are an admirable example of judicious statesmanship.

Moral effect of fire.

The duration of a campaign is largely affected by the deadly properties of modern firearms. It is true that the losses in battle are relatively less that in the days of Brown Bess and the smooth-bore cannon, and almost insignificant when compared with the fearful carnage wrought by sword and spear. The reason is simple. A battlefield in the old days, except at close quarters, was a comparatively safe locality, and the greater part of the troops engaged were seldom exposed for a long time together to a hot and continuous fire. To-day death has a far wider range, and the strain on the nerves is consequently far more severe. Demoralization, therefore, sets in at an earlier period, and it is more complete. When troops once realize their inferiority, they can no longer be depended on. It is not the losses they have actually suffered, but those that they expect to suffer, that affect them. Unless discipline and national spirit are of superior quality, unless the soldier is animated by something higher than the mere habit of mechanical obedience, panic, shirking and wholesale surrender will be the ordinary features of a campaign. These phenomena made themselves apparent, though in a less degree, as long ago as the American Civil War, when the weapon of the infantry was the muzzle-loading rifle, firing at most two rounds a minute, and when the projectiles of the artillery were hardly more destructive than the stone shot of Mons Meg. With the magazine rifle, machine guns, shrapnel and high explosives they have become more pronounced than even at Vionville or Plevna. "The retreat of the 38th (Prussian) Brigade," writes Captain Hoenig, an eye-witness of the former battle, "forms the most awful drama of the great war. It had lost 53% of its strength, and the proportion of killed to wounded was as 3 to 4. Strong men collapsed inanimate. . . . I saw men cry like children, others fell prone without a sound; in most the need of water thrust forth all other instincts; the body demanded its rights. 'Water, water,' was the only intelligible cry that broke from those moving phantoms. The enemy's lead poured like hail upon the wretched remnant of the brigade; yet they moved only slowly to the rear, their heads bent in utter weariness; their features distorted under the thick dust that had gathered on faces dripping with sweat. The strain was beyond endurance. The soldier was no longer a receptive being; he was oblivious of everything, great or small. His comrades or his superiors he no longer recognized; and yet he was the same man who but a short time before had marched across the battlefield shouting his marching chorus. A few active squadrons, and not a man would have escaped! Only he who had seen men in such circumstances, and observed their bearing, knows the dreadful imprint that their features leave upon the memory. Madness is there, the madness that arises from bodily exhaustion combined with the most abject terror. . . . I do not shrink," he adds, "from confessing that the fire of Mars-la-Tour affected my nerves for months."

If such are the results of ill-success, a whole army might be reduced to the condition of the 38th Brigade in the first month of the campaign, and it is thus perfectly clear that some small mistake in conduct, some trifling deficiency in preparation, an ill-conceived order or a few hours' delay in bringing up a reinforcement may have the most terrible consequences.

The importance, nay the necessity, that the people, as a governing body, should keep as watchful an eye on its armed forces and the national defences as on diplomacy or legislation is fully realized naturally enough, only by those nations whose instincts of self-preservation, by reason of the configuration of their frontiers or their political situation, are strongly developed. Yet even to maritime empires, to Great Britain or indeed to the United States, an efficient army is of the first necessity.

Naval and military force.

Their land frontiers are vulnerable. They may have to deal with rebellion, and a navy is not all-powerful, even for the defence of coasts and commerce. It can protect, but it cannot destroy. Without the help of an army, it can neither complete the ruin of the enemy's fleet nor prevent its resuscitation. Without the help of an army it can hardly force a hostile power to ask for terms. Exhaustion is the object of its warfare; but exhaustion, unless accelerated by crushing blows, is an exceedingly slow process. In the spring of 1861 the blockade was established in American waters along the coasts of the Southern Confederacy, and maintained with increasing stringency from month to month. Yet it was not till the spring of 1865 that the colours of the Union floated from the capitol of Richmond, and it was the army which placed them there. A state, then, which should rely on naval strength alone, could look forward to no other than a protracted war, and a protracted war between two great powers is antagonistic to the interests of the civilized world. With the nations armed to the teeth, and dominated to a greater or smaller extent by a militant spirit; with commerce and finance dependent for health and security on universal peace, foreign intervention is a mere question of time. Nor would public opinion, either in Great Britain or America, be content with a purely defensive policy, even if such policy were practicable. Putting aside the tedium and the dangers of an interminable campaign, the national pride would never be brought to confess that it was incapable of the same resolute effort as much smaller communities. "An army, and a strong army," would be the general cry. Nor would such an army be difficult to create. Enormous numbers would not be needed. An army supported by an invincible navy possesses a strength which is out of all proportion to its size. Even to those who rely on the big battalions and huge fortresses, the amphibious power of a great maritime state, if intelligently directed, may be a most formidable menace; while to the state itself it is an extraordinary security. The history of Great Britain is one long illustration. Captain Mahan points out that there are always dominant positions, outside the frontiers of a maritime state, which, in the interests of commerce, as well as of supremacy at sea, should never be allowed to pass into the possession of a powerful neighbour. Great Britain, always dependent for her prosperity on narrow seas, has long been familiar with the importance of the positions that command these waterways. In one respect at least her policy has been consistent. She has spared no effort to secure such positions for herself, or, if that has been impracticable, at least to draw their teeth. Gibraltar, Malta, St Lucia, Aden, Egypt, Cyprus are conspicuous instances; but above all stands Antwerp. In perhaps the most original passage of Alison's monumental work the constant influence of Antwerp on the destinies of the United Kingdom is vividly portrayed. "Nature has framed the Scheldt to be the rival of the Thames. Flowing through a country excelling even the midland counties of England in wealth and resources, adjoining cities equal to any in Europe in arts and commerce; the artery at once of Flanders and Holland, of Brabant and Luxemburg, it is fitted to be the great organ of communication between the fertile fields and rich manufacturing towns of the Low Countries and other maritime states of the world." Antwerp, moreover, the key of the great estuary, is eminently adapted for the establishment of a vast naval arsenal, such as it became under Philip II. of

Spain and again under the first Napoleon. "It is the point," continues the historian, "from which in every age the independence of these kingdoms has been seriously menaced. Sensible of her danger, it had been the fixed policy of Great Britain for centuries to prevent this formidable outwork from falling into the hands of her enemies, and the best days of her history are chiefly occupied with the struggle to ward off such a disaster." In ascribing, however, every great war in which Great Britain has been engaged to this cause alone he has gone too far. The security of India has been a motive of equal strength. Nevertheless, it was to protect Antwerp from the French that Charles II. sided with the Dutch in 1670; that Anne declared war on Louis XIV. in 1704; that Chatham supported Prussia in 1742; that Pitt, fifty years later, took up arms against the Revolution.

Interactions of naval and military operations.

The trophies of the British army in the great war with France were characteristic of the amphibious power. The troops took more battleships than colours, and almost as many naval arsenals as land fortresses. Many were the blows they struck at the maritime strength of France and her allies; but had the expedition which landed on the Isle of Walcheren in 1809 been as vigorously conducted as it was wisely conceived, it would have hit Napoleon far harder than even the seizure of the Danish fleet at Copenhagen. The great dockyard that the emperor had constructed on the Scheldt held the nucleus of a powerful fleet. Eight line-of-battle ships and ten frigates lay in mid-channel. Twenty vessels of different classes were on the slips, and in the magazines and storehouses had been accumulated sufficient material to equip all these and twenty more. The destruction of Antwerp—and for a full week it was at Lord Chatham's mercy—would have freed scores of British frigates to protect British commerce; Wellington, in his great campaign of 1813, could not have had to complain that, for the first time, the communication by sea of a British army was insecure; the Americans, in the war which broke out in 1812, would have been more vigorously opposed; and Napoleon, who, while Antwerp was his, never altogether abandoned hope of overmastering Great Britain on her own element, might, on his own confession, have relinquished the useless struggle with the great sea power. The expedition failed, and failed disastrously. But for all that, fulfilling as it did the great maxim that the naval strength of the enemy should be the first objective of the forces of the maritime power, both by land and sea, it was a strategical stroke of the highest order.

The predominant part played by the army under Wellington in Spain and Belgium has tended to obscure the principle that governed its employment in the war of 1793–1815. The army, in the opinion of the country, was first and foremost the auxiliary of the fleet; and only when the naval strength of the enemy had been destroyed was it used in the ordinary manner, *i.e.* in the invasion of the hostile territory and in lending aid to the forces of confederate powers. Events proved that these principles were absolutely sound. It was not in the narrow seas alone that the army rendered good service to the navy. Depriving France of her colonies, occupying her ports in foreign waters, ousting her from commanding posts along the trade routes, it contributed not only to her exhaustion, but to the protection of British commerce and to the permanent establishment of maritime supremacy. Few of these operations are of sufficient magnitude to attract much notice from the ordinary historian, yet it is impossible to overrate their effect. To the possession of the dominant positions that were captured by the army, Great Britain, in no small degree, is indebted for the present security of her vast dominions. The keynote of the fierce struggle with the French Empire was the possession of India. Before he became First Consul, Napoleon had realized that India was the throne of Asia; that whoever should sit on that throne, master of the commerce of the East, of the richest and most natural market for the products of the West, and of the hardiest and most enlightened nations of the golden hemisphere, would be master of more than half the globe. But his prescience was not surer than the instinct of the British people. Vague and shadowy indeed were their dreams of empire, yet the presentiment of future greatness, based on the foothold they had already gained in Hindustan, seems always to have controlled the national policy. They knew as well as Napoleon that Malta and Egypt, to use his own phrase, were merely the outworks of their stronghold in the East; and that if those outworks fell into the hands of France, a great army of warlike Mahommedans, led by French generals, stiffened by a French army corps, and gathering impetus from the accession of every tribe it passed through, might march unopposed across the Indus. So, from first to last, the least threat against Egypt and Malta sufficed to awaken their apprehensions; and in their knowledge that India was the ultimate objective of all his schemes is to be found the explanation of the stubbornness with which they fought Napoleon. It is not to be denied that in thwarting the ambition of their mighty rival, or perhaps in furthering their own, the navy was the chief instrument; but in thrusting the French from Egypt, in adding Ceylon, Mauritius and Cape Colony to the outworks, the army, small as it was then, compared with the great hosts of the Continent, did much both for the making and the security of the British Empire.

But the scope of the military operations of a maritime state is by no means limited to the capture of colonies, naval arsenals and coaling-stations. Timely diversions, by attracting a large portion of the enemy's fighting strength on the mainland, may give valuable aid to the armies of an ally. The Peninsular War is a conspicuous example. According to Napoleon, the necessity of maintaining his grip on Spain deprived him of 180,000 good soldiers during the disastrous campaign of 1813; and those soldiers, who would have made Dresden a decisive instead of a barren victory, were held fast by Wellington. Again, it was the news of Vittoria that made it useless for the emperor to propose terms of peace, and so escape from the coils that strangled him at Leipzig.

Nor is the reinforcement supplied by a small army based upon the sea to be despised. In 1793 a British contingent under the duke of York formed part of the allied forces which, had the British government forborne to interfere, would in all probability have captured Paris. Twenty-two years later, under wiser auspices, another contingent, although numbering no more than 30,000 men, took a decisive part in the war of nations, and the blunders of the older generation were more than repaired at Waterloo. Nevertheless, the strength of the amphibious power has been more effectively displayed than in the campaign of 1815. Intervention at the most critical period of a war has produced greater results than the provision of a contingent at the outset. In 1781 the disembarkation of a French army at Yorktown, Virginia, rendered certain the independence of the United States; and in 1878, when the Russian invaders were already in sight of Constantinople, the arrival of the British fleet in the Dardanelles, following the mobilization of an expeditionary force, at once arrested their further progress. Had the British Cabinet of 1807 realized the preponderating strength which even a small army, if rightly used, draws from the command of the sea, the campaign of Eylau would in all probability have been as disastrous to Napoleon as that of Leipzig. The presence of 20,000 men at the great battle would have surely turned the scale in favour of the allies. Yet, although the men were available, although a few months later 27,000 were assembled in the Baltic for the coercion of Denmark, his Majesty's ministers, forgetful of Marlborough's glories, were so imbued with the idea that the British army was too insignificant to take part in a Continental war, that the opportunity was let slip. It is a sufficiently remarkable fact that the successive governments of that era, although they realized very clearly that the first duty of the army was to support the operations and complete the triumph of the navy, never seemed to have grasped the principles which should have controlled its use when the command of the sea had been attained. The march of the Allies on Paris in 1793 was brought to a standstill because the British Cabinet considered that the contingent would be better employed in besieging Dunkirk. After the failure of the expedition under Sir John Moore to achieve the impossible, and in conjunction with the Spaniards drive the French from the Peninsula, the ministry abandoned all idea of intervention on the main theatre, although, as we have seen, had such intervention been well timed, it might easily have changed the current of events. It is true that when the main theatre is occupied by huge armies, as was the case during the whole of the Napoleonic conflict, the value of a comparatively small force, however sudden its appearance, is by no means easily realized. For instance, it would seem at first sight that a British contingent of 100,000 men would be almost lost amid the millions that would take part in the decisive conflicts of a European war. It is remembered, however, that with enormous masses of men the difficulties of supply are very great. Steam has done much to lighten them, and the numbers at the point of collision will be far greater than it was possible to assemble in the days of Napoleon. Nevertheless, the lines of communication, especially railways, will require more men to guard them than heretofore, for they are far more vulnerable. The longer, therefore, the lines of communication, the smaller the numbers on the field of battle. Moreover, the great hosts of the Continent, not only for convenience of supply, but for convenience of manœuvre, will deploy several armies on a broad front. At some one point, then, a reinforcement of even one or two army corps might turn the scale.

Weakness of allied armies.

The objections, however, to intervention of this character are numerous. Between allied armies, especially if one is far larger than the other, there is certain to be friction, as was the case in the Crimea; and the question of supply is not easily settled. If, however, the decisive point is near the coast, as in the campaign of Eylau, the army of the maritime power, possessing its own base, can render effective aid without embarrassment either to itself or its ally. But, under all other conditions, independent operations of a secondary nature are distinctly to be preferred. Such was clearly the opinion of the British ministries during the war with France. They recognized that by giving vitality and backbone to popular risings even a small army might create useful diversions. But their idea of a diversion was a series of isolated efforts, made at far-distant points; and even so late as 1813 they were oblivious of the self-evident facts that for a diversion to be really effective it must be made in such strength as to constitute a serious threat, and that it should be directed against some vital point. Fortunately for Europe, Wellington foresaw that the permanent occupation of Portugal, and the presence of a British army in close proximity to the southern frontier of France, would be a menace which it would be impossible for Napoleon to disregard. Yet with what difficulty he induced the government to adopt his views, and how lukewarm was their support, is exposed in the many volumes of his despatches. In all history there are few more glaring instances of incompetent statesmanship than the proposal of the cabinet of 1813, at the moment Wellington was contemplating the campaign that was to expel the French from Spain, and was asking for more men, more money and more material, to detach a large force in the vague hope of exciting a revolution in southern Italy. Whether the improvement in communications, as well as the increase in the size of armies, have not greatly weakened the value of diversions on the mainland, it is difficult to say. Railways may enable the defender to concentrate his forces so rapidly that even the landing may be opposed, and with the enormous numbers at his command he may well be able to spare a considerable force from the main theatre. It is possible to conceive that a small army, even if it completed its embarkation, might find itself shut up in an entrenched position by a force little larger than itself. If, however, the diversion were made at a crisis of the campaign, the sudden appearance of a new army might be decisive of the war. Otherwise, the army would probably do more good if it refrained from landing and confined itself to threats. So long as it was hidden by the horizon, it would be invested with the terrors of the unknown. The enemy's knowledge that at any moment a well-equipped force, supported by a powerful fleet, might suddenly descend upon some prosperous port or important arsenal, would compel him to maintain large garrisons along the whole seaboard. The strength of these garrisons, in all probability, would be much larger in the aggregate than the force which menaced them, and the latter would thus exercise a far greater disintegrating effect on the enemy's armed strength than by adding a few thousand men to the hosts of its ally. On theatres of war which are only thinly populated or half civilized, a descent from the sea might easily produce a complete change in the situation. The occupation of Plevna, in close proximity to the Russian line of communications and to the single bridge across the Danube, brought the Russian advance through Bulgaria to a sudden stop, and relieved all pressure on Turkey proper. The deadlock which ensued is suggestive. Let us suppose that the invaders' line of communications had been a railway, and Plevna situated near the coast. Supplied from the sea, with unlimited facilities for reinforcement, Osman's ring of earthworks would have been absolutely impregnable; and had the ring been pushed so far inland as to secure scope for offensive action, the Russians, in all human probability, would never have crossed the Balkans. It is perfectly possible, then, that if an army lands within reach of a precarious line of communications it may compel the enemy, although far superior in numbers, to renounce all enterprises against distant points.

Railways.

Railways in war are good servants, but bad masters. In some respects they are far superior to a network of highroads. Two trains will supply the daily needs of 100,000 men several hundred miles distant from their base. But the road-bed is easily destroyed; the convoy system is impracticable, and the regular course of traffic is susceptible to the slightest threat. So, when railways become the principal factors, as when an army finds itself dependent on a long and exposed line, a powerful aggressive combination becomes a matter of the utmost difficulty. The whole attention of the commander will be given to the security of his supplies, and even if he is not thrown on the defensive by the enemy's activity, his liberty of action will be exceedingly circumscribed. The relative values of the different kinds of communications have a most important bearing on the art of war. A great waterway, such as the Nile, the Mississippi, the Danube or the Ganges, is safer and surer than a railway. But railways are far more numerous than navigable rivers, and a series of parallel lines is thus a better means of supplying a large army. But neither railways nor waterways as lines of supply or of operation are to be compared with the sea. Before the war of 1870, for instance, a study of the French railway system enabled Moltke to forecast, with absolute accuracy, the direction of Napoleon's advance, the distribution of his forces, and the extent of front that they would occupy. In a war, therefore, between two Continental powers, the staff on either side would have no difficulty in determining the line of attack; the locality for concentration would be at once made clear; and as the carrying capacity of all railways is well known, the numbers that would be encountered at any one point along the front might be easily calculated. But if the enemy's army, supported by a powerful fleet, were to advance across blue water, the case would be very different. Its movements would be veiled in the most complete secrecy. It would be impossible to do more than guess at its objective. It might strike at any point along hundreds of miles of coast, or it might shift from one point to another, perhaps far distant, in absolute security; it could bewilder the enemy with feints, and cause him to disperse his forces over the whole seaboard. Surprise and freedom of movement are pre-eminently the weapons of the power that commands the sea. Witness the War of Secession. McClellan, in 1862, by the adroit transfer of 120,000 men down the reaches of Chesapeake to the Virginia Peninsula, had Richmond at his mercy. Grant in 1864, by continually changing his line of communication from one river to another, made more progress in a month than his predecessors had done in two years. Sherman's great march across Georgia would have been impossible had not a Federal fleet been ready to receive him when he reached

The sea as a line of operation.

the Atlantic; and, throughout the war, the knowledge that at any moment a vast fleet of transports might appear off any one of the ports on their enormous seaboard prevented the Confederates, notwithstanding that the garrisons were reduced to a most dangerous extent, from massing their full strength for a decisive effort.

Amphibious power.

The power of striking like "a bolt from the blue" is of the very greatest value in war. Surprise was the foundation of almost all the grand strategical combinations of the past, as it will be of those to come. The first thought and the last of the great general is to outwit his adversary, and to strike where he is least expected. And the measures he adopts to accomplish his purpose are not easily divined. What soldier in Europe anticipated Marlborough's march to the Danube and Blenheim field? What other brain besides Napoleon's dreamt of the passage of the Alps before Marengo? Was there a single general of Prussia before Jena who foresaw that the French would march north from the Bavarian frontier, uncovering the roads to the Rhine, and risking utter destruction in case of defeat? Who believed, in the early June of 1815, that an army 130,000 strong would dare to invade a country defended by two armies that mustered together over 200,000 unbeaten soldiers? To what Federal soldier did it occur, on the morning of Chancellorsville, that Lee, confronted by 90,000 Northerners, would detach the half of his own small force of 50,000 to attack his enemy in flank and rear? The very course which appeared to ordinary minds so beset by difficulties and dangers as to be outside the pale of practical strategy has, over and over again, been that which led to decisive victory; and if there is one lesson more valuable than another as regards national defence, it is that preparation cannot be too careful or precautions overdone. Overwhelming numbers, adequately trained, commanded and equipped, are the only means of ensuring absolute security. But a numerical preponderance, either by land or sea, over all possible hostile combinations, is unattainable, and in default the only sound policy is to take timely and ample precautions against all enterprises which are even remotely possible. There is nothing more to be dreaded in war than the combined labours of a thoroughly well-trained general staff, except the intellect and audacity of a great strategist. The ordinary mind, even if it does not shrink from great danger, sees no way of surmounting great difficulties; and any operation which involves both vast dangers and vast difficulties it scoffs at as chimerical. The heaven-born strategist, on the other hand, "takes no counsel of his fears." Knowing that success is seldom to be won without incurring risks, he is always greatly daring; and by the skill with which he overcomes all obstacles, and even uses them, as Hannibal and Napoleon did the Alps, and as some great captain of the future may use the sea, to further his purpose and surprise his adversary, he shows his superiority to the common herd. It is repeated *ad nauseam* that in consequence of the vastly improved means of transmitting information, surprise on a large scale is no longer to be feared. It is to be remembered, however, that the means of concentrating troops and ships are far speedier than of old; that false information can be far more readily distributed; and also, that if there is one thing more certain than another, it is that the great strategist, surprise being still the most deadly of all weapons, will devote the whole force of his intellect to the problem of bringing it about.

Importance of strategy.

Nor is it to be disguised that amphibious power is a far more terrible weapon than even in the days when it crushed Napoleon. Commerce has increased by leaps and bounds, and it is no longer confined within territorial limits. The arteries vital to the existence of civilized communities stretch over every ocean. States which in 1800 rated their maritime traffic at a few hundred thousand pounds sterling, value it now at many millions. Others, whose flags, fifty years ago, were almost unknown on the high seas, possess to-day great fleets of merchantmen; and those who fifty years ago were self-dependent, rely in great part, for the maintenance of their prosperity, on their intercourse with distant continents. There is no great power, and few small ones, to whom the loss of its sea-borne trade would be other than a most deadly blow; and there is no great power that is not far more vulnerable than when Great Britain, single-handed, held her own against a European coalition. Colonies, commercial ports, dockyards, coaling-stations are so many hostages to fortune. Year by year they become more numerous. Year by year, as commercial rivalry grows more acute, they become more intimately bound up with the prosperity and prestige of their mother-countries. And to what end? To exist as pledges of peace, *auspicia melioris aevi*, or to fall an easy prey to the power that is supreme at sea and can strike hard on land?

Value of unprofessional troops.

Even the baldest and briefest discussion of the vast subject of war would be incomplete without some reference to the relative merits of professional and unprofessional soldiers. Voluntary service still holds its ground in the Anglo-Saxon states; and both the United Kingdom and America will have to a great extent to rely, in case of conflicts which tax all their resources, on troops who have neither the practice nor the discipline of their standing armies. What will be the value of these amateurs when pitted against regulars? Putting the question of *moral* aside, as leading us too far afield, it is clear that the individual amateur must depend upon his training. If, like the majority of the Boers, he is a good shot, a good scout, a good skirmisher and, if mounted, a good horseman and horsemaster, he is undeniably a most useful soldier. But whether amateurs *en masse*, that is, when organized into battalions and brigades, are thoroughly trustworthy, depends on the quality of their officers. With good officers, and a certain amount of previous training, there is no reason why bodies of infantry, artillery or mounted infantry, composed entirely of unprofessional soldiers, should not do excellent service in the field. Where they are likely to fail is in discipline; and it would appear that at the beginning of a campaign they are more liable to panic, less resolute in attack, less enduring under heavy losses and great hardships, and much slower in manœuvre than the professionals. To a certain extent this is inevitable; and it has a most important bearing on the value of the citizen soldier, for the beginning of a campaign is a most critical phase. In short, troops who are only half-trained or have been hastily raised may be a positive danger to the army to which they belong; and the shelter of stout earthworks is the only place for them. Yet the presence of a certain number of experienced fighting men in the ranks may make all the difference; and, in any case, it is probable that battalions composed of unprofessional soldiers, the free citizens of a free and prosperous state, are little if at all inferior, as fighting units, to battalions composed of conscripts. But it is to be understood that the men possess the qualifications referred to above, that the officers are accustomed to command and have a good practical knowledge of their duties in the field. A mob, however patriotic, carrying small-bore rifles is no more likely to hold its own to-day against well-led regulars than did the mob carrying pikes and flint-locks in the past. A small body of resolute civilians, well-armed and skilful marksmen, might easily on their own ground defeat the same number of trained soldiers, especially if the latter were badly led. But in a war of masses, the power of combination, of rapid and orderly movement, and of tactical manœuvring is bound to tell. (G.F.R.H.)

LITERATURE.—On the general principles of War, see C. v. Clausewitz, *Vom Kriege* (Eng. trans. *On War*, new ed. 1906); C. v. B(inder)-K(rieglstein), *Geist und Stoff im Kriege* (1895); Ardant du Picq, *Études sur le combat*; W. Bagehot, *Physics and Politics*; G. le Bon, *Psychologie des foules* and *Psychologie de l'éducation*; F. N. Maude, *War and the World's Life* (1907); Berndt, *Zahl im Kriege* (statistical tables); Biottot, *Les Grands Inspirés—Jeanne d'Arc*; C. W. C. Oman, *Art of War*; M. Jähns, *Gesch. der Kriegswissenschaften*; v. der Goltz, *Volk in Waffen* (Eng. trans., *Nation in Arms*); A. T. Mahan, *Influence of Sea Power on History*; C. E. Callwell, *Military Operations and Maritime Preponderance*; P.H. Colomb, *Naval Warfare*; Stewart Murray, *Future Peace of the Anglo-Saxons*; H. Spenser Wilkinson, *The Brain of an Army*, *War and Policy*, &c.; and works mentioned in the bibliography to the article ARMY.

II. Laws of War

Civil war as distinguished from rebellion.

The law of war, in strict usage, does not apply to all armed conflicts, but only to such conflicts as, by the usage of states, constitute war. War exists when the organized armed forces of one state are opposed to the organized armed forces of another state. War also exists within the bounds of a single state when organized armed forces, of sufficient power to make the issue doubtful, place themselves in opposition to the armed forces of the existing government. If the disaffected forces are in a state of flagrant inferiority in comparison with those of the existing government there is not a state of war but of rebellion. The combatants in civil war are entitled to treatment in accordance with the law of war. Rebels, as outlaws, have no rights. In the South African campaign (1899–1902) the question arose whether the manifest inferiority of the Boer forces, the possession by the British forces of the seats of government, and their practical occupation of the whole country, did not put an end to the state of war and constitute the Boer fighting forces rebels against a new existing government which had proclaimed annexation of the conquered states. The action of the British commanders is a precedent in favour of the view that the fighting forces of an invaded state are entitled to belligerent rights, though in a state of hopeless inferiority, so long as they remain in the field in organized bands. In this, as in many cases which have formed international usage, the danger of reprisals more than the logic of principles has dictated a different line of conduct from that which the strict principles of law suggested. A somewhat similar, but more complicated situation, arose out of the cession by Spain to the United States of the Philippine Islands. The insurgents being in possession of them at the time, Spain ceded what she did not in fact possess. Thus it has been contended that the position of the insurgents became that of belligerents defending their country against conquest by invading forces.

Neutral interest.

Wars have been classed in different ways—wars of intervention, wars of conquest, wars of defence, wars of independence, just wars, unjust wars, and so on; but the law of war applies to them all without distinction. States do not sit as judges over each other, but treat war, subject to their own interest, as a fact. Interest, however, with the increasing development of international relations is becoming a more important factor in the determination of the attitude of the neutral onlooker (see NEUTRALITY).

War with barbarous peoples.

In the Chino-Japanese War (1894–95) the Japanese had to decide whether the Chinese were entitled to treatment under the European law of war. Japan had acceded to the Geneva Convention (see below) in 1886, and to the Declaration of Paris (see below) in 1887. China was a party to neither, and observed the provisions of neither. Japan, nevertheless, as related by her learned judicial advisers, Professors Ariga and Takahashi, observed towards the Chinese forces, combatant and non-combatant, all the rules of European International Law without resorting to the reprisals to which Chinese barbarities provoked her.

Neutral position towards insurgents.

The position of neutral governments towards insurgent forces is always a delicate one. If they are not recognized as belligerents by the state against which they are arrayed, the state in question theoretically accepts responsibility for the consequences of their acts in respect of neutral states. A neutral state may be satisfied with this responsibility, or it may recognize the belligerent character of the insurgents. If, however, it does not, the insurgent forces cannot exercise rights of war against neutral property without exposing themselves to treatment as outlaws and pirates. A case of such treatment occurred in September 1902 in connexion with a then pending revolution in Hayti. A German cruiser, the "Panther," treated an insurgent gunboat, the "Crête-à-Pierrot," as a pirate vessel,[1] and sank her for having stopped and confiscated arms and ammunition found among the cargo of the German steamer "Markomannia" on the ground that they were contraband destined for the armed forces of the existing Haytian government. The "Crête-à-Pierrot" had for some years formed part of the Haytian navy, and was commanded by Admiral Killick, who had been an admiral of that navy. There had been no recognition of the belligerency of the insurgents. No state seems to have made any observations on the incident, which may be taken to be in accordance with current international usage.

British recognition of the Confederates.

A well-known instance of a neutral government recognizing insurgent forces as belligerent, in spite of the denial of that character to them by the state against which they are carrying on hostilities, occurred in the North American Civil War. The right asserted by Great Britain to recognize the belligerency of the Confederate forces was based on the contention that British commercial interests were very largely affected by the blockade of the Southern ports. It is agreed, however, among jurists that, where the interests of neighbouring states are not affected, the recognition of an insurgent's belligerency is needless interference.[2]

Effect of recognition of belligerency.

The recognition of belligerency does not entail recognition of the belligerent as a sovereign state. It goes no farther than its immediate purpose. The belligerent armies are lawful combatants, not bandits. Supplies taken from invaded territory are requisitions, not robbery. The belligerent ships of war are lawful cruisers, not pirates; and their captures, made in accordance with maritime law, are good prize; and their blockades, if effectual, must be respected by neutrals. But this does not suffice to invest the belligerent with the attributes of independent sovereignty for such objects as negotiation of treaties, and the accrediting of diplomatic and consular agents. This was the attitude of Great Britain and France towards the Confederates in the American Civil War.

The position of a vassal state or a colony carrying on foreign war without the consent of the suzerain or parent state might involve still more complicated issues.[3]

Regular forces and civilians.

Civilized warfare, the textbooks tell us, is confined, as far as possible, to disablement of the armed forces of the enemy; otherwise war would continue till one of the parties was exterminated. "It is with good reason," observes Vattel, "that this practice has grown into a custom with the nations of Europe, at least with those that keep up regular standing armies or bodies of militia. The troops alone carry on war, while the rest of the nation remain in peace" (*Law of Nations*, iii. 226). Modern notions of patriotism do not, however, view this total and unconditional abstention of the civilian population as any longer possible. They have found, to some extent, expression in the following Articles of the Hague War-Regulations:—

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[1] *The Times* (9th September 1902).

[2] It is also agreed that, as the existence of belligerency imposes burdens and liabilities upon neutral subjects, a state engaged in civil war has no right, in endeavouring to effect its warlike objects, to employ measures against foreign vessels, which, though sanctioned in time of peace, are not recognized in time of war. In other words, it cannot enjoy at one and the same moment the rights of both peace and war. Thus, in 1861, when the government of New Granada, during a civil war, announced that certain ports would be closed, not by blockade, but by order, Lord John Russell said that "it was perfectly competent to the government of a country in a state of tranquillity to say which ports should be open to trade, and which should be closed; but in the event of insurrection, or civil war in that country, it was not competent for its government to close ports which were *de facto* in the hands of the insurgents; and that such a proceeding would be an invasion of international law relating to blockade" (*Hansard*, clxiii., 1846). Subsequently the government of the United States proposed to adopt the same measure against the ports of the Southern States, upon which Lord John Russell wrote to Lord Lyons that "Her Majesty's government entirely concur with the French government in the opinion that a decree closing the Southern ports would be entirely illegal, and would be an evasion of that recognized maxim of the law of nations that the ports of a belligerent can only be closed by an effective blockade" (*State Papers*, North America, No. 1, 1862). In neither case was the order carried out. When in 1885 the President of Colombia, during the existence of civil war, declared several ports to be closed without instituting a blockade, Mr T. F. Bayard, Secretary of State of the United States, in a despatch of 24th April of that year, fully acknowledged the principle of this contention by refusing to acknowledge the closure.

[3] In the Servo-Bulgarian War of 1885 the Sultan, though suzerain of Bulgaria, was unmoved by the invasion of his vassal's dominions.

> "Art. 1. The laws, rights and duties of war apply not only to an army, but also to militia and volunteer corps fulfilling the following conditions: (*a*) To be commanded by a person responsible for his subordinates; (*b*) to have a fixed distinctive emblem recognizable at a distance; (*c*) to carry arms openly; and (*d*) to conduct their operations in accordance with the laws and customs of war. In countries where militia or volunteer corps constitute the army, or form part of it, they are included under the denomination 'army.'
>
> "Art. 2. The population of a territory not under occupation, who, on the enemy's approach, spontaneously take up arms to resist the invading troops without having had time to organize themselves in accordance with Article 1, shall be regarded as belligerent if they *carry arms openly, and if they* respect the laws and customs of war."[1]

The only alteration made by the revised Convention of Nov. 27th, 1907, as compared with that of 1899 is the insertion in Art. 2 of the words in italics.

By these provisions, irregular combatants whom both the government of the United States in the American Civil War and the German government in the Franco-German War refused to regard as legitimate belligerents, are now made legally so.[2]

Enemy property on invaded territory.

Connected with the position of private persons in time of war is that of their property in invaded territory, a subject which has often been misunderstood. Assertions as to its immunity from capture in warfare on land have been made which are historically inaccurate and are not borne out by contemporary usage. No doubt contemporary usage is an improvement on older usage. An invading army, before the practice of war became more refined, lived by foraging and pillage in the invaded country; pillage, in fact, being one of the inducements held out to the adventurers who formed part of the fighting forces either as officers or as common soldiers, and this continued down to comparatively recent times. Attenuations followed from the rise of standing and regular armies, and the consequent more marked distinction between soldier and civilian. They have now taken the form of systematic requisitions and contributions, the confining of the right of levying these to generals and commanders-in-chief, the institution of quittances or bills drawn by the belligerent invader on the invaded power and handed in payment to the private persons whose movable belongings have been appropriated or used, and of war indemnities. These are methods of lessening the hardships of war as regards the private property on land of the subjects of belligerent states. Their object and effect have by no means been to arrive at immunity, but to develop an organized system by which damage and losses to individuals, whom the fortune of war has brought into immediate contact with the enemy, are spread over the whole community. There is thus no immunity of private property in warfare on land, and the Hague War-Regulations, far from declaring the contrary, have ratified the right of appropriation of private property in the following Article:—

> "Neither requisitions in kind nor services can be demanded from communes or inhabitants except for the necessities of the army of occupation. They must be in proportion to the resources of the country, and of such a nature as not to involve the population in the obligation of taking part in military operations against their country.
>
> "These requisitions and services shall only be demanded on the authority of the Commander in the locality occupied.
>
> "The contributions in kind shall, as far as possible, be paid for in ready money; if not, their receipt shall be acknowledged and the payment of the amounts due shall be made as soon as possible" (Article 52).

In another Article provision, moreover, is made for the utilization of property in kind belonging to private persons:—

> "An army of occupation can only take possession of the cash, funds and property liable to requisition belonging strictly to the state, depots of arms, means of transport, stores and supplies, and, generally, all movable property of the state which may be used for military operations.
>
> "All appliances, whether on land, at sea, or in the air adapted for the transmission of news, or for the transport of persons or things, exclusive of cases governed by naval law, depots of arms, and generally, all kinds of ammunition of war, may be seized, even if they belong to private individuals, but must be restored and compensation fixed when peace is made."

Utilizable neutral rolling-stock is not excepted, Article 19 of the Convention on the rights and duties of neutral powers and persons in war on land only providing that—

> "The plant of railways coming from neutral states, whether the property of those states, or of companies, or of private persons, and recognizable as such, shall be sent back as soon as possible to the country of origin."

Enemy property at sea.

Enemy property at sea is subject to different rules from those which govern it on land. It is liable to capture and confiscation wherever found on the high seas or in enemy waters. The United States has made strenuous efforts to get this rule of maritime warfare altered, and immunity from capture accepted as the law of the sea. It has even made this a condition of its accession to the Declaration of Paris (see NEUTRALITY). But thus far other powers have shown no disposition to agree to any alteration. At the Hague Conferences the United States raised the question again, but thus far all that has been done has been to ratify existing exemptions. The considerations which have led mankind to systematize the practice of war in regard to private property on land do not arise in the same form in connexion with private property at sea. Here there is no question of seizing the live stock, or the bedding, or the food, or the utensils of the private citizen. If ship and cargo are captured, it may be hard upon the merchant, but such captures do not directly deprive him of the necessaries of life. Yet, as in the case of war on land, its hardships have been attenuated, and progress has been made by developing a more systematic procedure of capture of private property at sea. Thus exemption from capture is now allowed by belligerents to enemy merchant ships which, at the outbreak of war, are on the way to one of their ports, and they also allow enemy merchantmen in their ports at its outbreak a certain time to leave them. This is confirmed by the Hague Convention of 1907 on the status of enemy ships on the outbreak of hostilities. A somewhat similar practice exists as regards pursuit of merchant ships which happen to be in a neutral port at the same time with an enemy cruiser. Under the Hague Convention of 1907 respecting the rights and duties of neutral powers in naval war (Art. 16), this, too, is confirmed. Lastly, there has grown up, on grounds similar to those which have led to the indulgence shown to private property on land, a now generally recognized immunity from capture of small vessels engaged in the coast fisheries, provided they are in no wise made to serve the purposes of war, which also has been duly confirmed in the Hague Conventions of 1907 by Art. 3 of the convention relative to certain restrictions on the exercise of the right of capture in maritime war. This has all been done with the object of making the operations of war systematic, and enabling the private citizen to estimate his risks and take the necessary precautions to avoid capture, and of restricting acts of war to the purpose of bringing it to a speedy conclusion.

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[1] The preamble of the Convention refers specially to Articles 1 and 2 in the following terms: "In the view of the High Contracting Parties, these provisions, the drafting of which has been inspired by the desire to diminish the evils of war so far as military necessities permit, are destined to serve as general rules of conduct for belligerents in their relations with each other and with populations;

"It has not, however, been possible to agree forthwith on provisions embracing all the circumstances which occur in practice;

"On the other hand, it could not be intended by the High Contracting Parties that the cases not provided for should, for want of a written provision, be left to the arbitrary judgment of the military commanders;

"Until a more complete code of the laws of war is issued, the High Contracting Parties think it expedient to declare that in cases not included in the Regulations adopted by them, populations and belligerents remain under the protection and empire of the principles of international law, as they result from the usages established among civilized nations, from the laws of humanity, and the requirements of the public conscience;

"They declare that it is in this sense especially that Articles 1 and 2 of the regulations adopted must be understood."

[2] The instructions for the government of armies of the United States in the field, issued in 1863, provided:—

> "Men or squads of men who commit hostilities, whether by fighting or inroads for destruction or plunder, or by raids of any kind, without commission, without being part and portion of the organized hostile army, and without sharing continuously in the war, but who do so with intermitting returns to their homes and avocation, or with the occasional assumption of the semblance of peaceful pursuits, divesting themselves of the character or appearance of soldiers—such men or squads of men are not public enemies, and therefore, if captured, are not entitled to the privilege of prisoners of war, but shall be treated summarily as highway robbers or pirates."

Germany seven years later declined to recognize the regular bands of *francs-tireurs* unless each individual member of them had been personally called out by legal authority, and wore a uniform or badge, irremovable and sufficient to distinguish him at a distance. The older publicists were, on the whole, strongly opposed to the legalization of irregular troops. Hallock settles the question in a summary way by calling those who engage in partisan warfare, robbers and murderers, and declaring that when captured they are to be treated as criminals (*International Law*, chap. xviii. s. 8). It is easy to understand the unfavourable opinion of partisan bands usually expressed by the military authorities when the enormous power for damage of modern arms is considered. At the Brussels Conference of 1874 the representatives of the great military Powers of the Continent naturally desired to keep spontaneous movements within the narrowest possible bounds, while the delegates from the secondary states, who have to rely for their defence chiefly upon the patriotism of their people, endeavoured to widen the right of resistance to an invader. Finally the Conference adopted the provisions which were later formally recognized at the Hague Conference (see *British State Papers Miscellaneous*, No. 1, 1875, pp. 252–257). It is noteworthy that both at the Brussels and the Hague Conferences the British delegate ranged himself on the side of the smaller states in favour of the recognition of guerrilla bands. At the Hague Conference Sir John Ardagh gave notice of his intention to propose an additional Article, to the effect that nothing in the Regulations should "be considered as tending to diminish or suppress the right which belongs to the population of an invaded country patriotically to oppose the most energetic resistance by every legitimate means." The upshot of this notice was to cause the insertion of a proviso in the preamble of the Convention denying the right of military commanders to act according to their own arbitrary judgment (*Parliamentary Papers*, No. 1, 1899, c. 9534).

We have seen that the only immunity of private property yet known to the laws of war is a limited one at sea. War, by its very nature, seems to prevent the growth of any such immunity. The tendency in war on land has been to spread its effects over the whole community, to keep a faithful record on both sides of all confiscations, appropriations and services enforced against private citizens; beyond this, protection has not yet been extended. There is good reason for this. The object of each belligerent being to break the enemy's power and force him to sue for peace, it may not be enough to defeat him in the open field; it may be necessary to prevent him from repairing his loss both in men and in the munitions of war. This may imply crippling his material resources, trade and manufactures. It has been contended that "to capture at sea raw materials used in the manufacturing industry of a belligerent state, or products on the sale of which its prosperity, and therefore its taxable sources depend, is necessarily one of the objects, and one of the least cruel, which the belligerents pursue. To capture the merchant vessels which carry these goods, and even to keep the seamen navigating them prisoners, is to prevent the employment of the ships by the enemy as transports or cruisers, and the repairing from among the seamen of the mercantile marine of losses of men in the official navy."[1]

The question of reform of the existing practice would naturally be viewed in different countries according to their respective interests. The United States has obviously an interest in the exemption of its merchant vessels and cargoes from capture, a small official navy being sufficient for the assertion of its ascendancy on the American continent. It may also be presumed to be in the interest of Italy, who, in a treaty with the United States in 1871, provided for mutual recognition of the exemption.

In the Austro-Prussian war of 1866 the principle of inviolability was adhered to by both parties. Germany proclaimed the same principle in 1870, but afterwards abandoned it.

There is a strong movement in Great Britain in favour of the general adoption of immunity. Whether it may now be expedient for her to agree to such immunity is an open question. It is quite conceivable, however, that different considerations would weigh with her in a war with the United States from those which would arise in a war with France or Germany. In the case of the United States it might be in the interest of both parties to localize the operations of war, and to interfere as little as possible, perhaps for the joint exclusion of neutral vessels, with the traffic across the Atlantic. In the case of a war with France or Germany, Great Britain might consider that the closing of the high sea to all traffic by the merchantmen of the enemy would be very much in her own interest.

Enemy subjects—their property on hostile territory.

The converse subject of the treatment of subjects of the one belligerent who remain in the country of the other belligerent also was not dealt with at the Hague. British practice in this matter has always been indulgent, the protection to the persons and property of non-combatant enemies on British soil dating back to Magna Carta (s. 48), and this is still the law of England. The practice on the continent of Europe varies according to circumstances, to which no doubt, in the event of the invasion of Great Britain, British practice would also have to adapt itself.

Prisoners of war.

The Hague War-Regulations deal fully with the treatment of prisoners, and though they add nothing to existing practice, such treatment is no longer in the discretion of the signatory Powers, but is binding on them. They provide as follows:—

Prisoners of war are in the power of the hostile government, but not in that of the individuals or corps who captured them. They must be humanely treated. All their personal belongings, except arms, horses and military papers, remain their property (Article 4). Prisoners of war may be interned in a town, fortress, camp or any other locality, and bound not to go beyond certain fixed limits; but they can only be confined as an indispensable measure of safety, and only so long as circumstances necessitating this measure shall endure (Article 5). The state may utilize the labour of prisoners of war according to their rank and aptitude, with the exception of officers. Their tasks shall not be excessive, and shall have nothing to do with the military operations. Prisoners may be authorized to work for the public service, for private persons, or on their own account. Work done for the state shall be paid for according to the tariffs in force for soldiers of the national army employed on similar tasks, or if there are none in force, then according to a tariff suitable to the work executed. When the work is for other branches of the public service or for private persons, the conditions shall be settled in agreement with the military authorities. The wages of the prisoners shall go towards improving their position, and the balance shall be paid them at the time of their release, after deducting the cost of their maintenance (Article 6). The government into whose hands prisoners of war have fallen is bound to maintain them. Failing a special agreement between the belligerents, prisoners of war shall be treated, as regards food, quarters and clothing, on the same footing as the troops of the government which has captured them (Article 7). Prisoners of war shall be subject to the laws, regulations and orders in force in the army of the state into whose hands they have fallen. Any act of insubordination warrants the adoption, as regards them, of such measures of severity as may be necessary. Escaped prisoners, recaptured before they have succeeded in rejoining their army, or before quitting the territory occupied by the army that captured them, are liable to disciplinary punishment. Prisoners who, after succeeding in escaping, are again taken prisoners, are not liable to any punishment for the previous flight (Article 8). Every prisoner of war, if questioned, is bound to declare his true name and rank, and if he disregards this rule, he is liable to a curtailment of the advantages accorded to the prisoners of war of his class (Article 9). Prisoners of war may be set at liberty on parole if the laws of their country authorize it, and, in such a case, they are bound, on their personal honour, scrupulously to fulfil, both as regards their own government and the government by whom they were made prisoners, the engagements they have contracted. In such cases, their own government shall not require of nor accept from them any service incompatible with the parole given (Article 10). A prisoner of war cannot be forced to accept his liberty on parole; similarly the hostile government is not obliged to assent to the prisoner's request to be set at liberty on parole (Article 11). Any prisoner of war who is liberated on parole and recaptured, bearing arms against the government to whom he had pledged his honour or against the allies of that government, forfeits his right to be treated as a prisoner of war, and can be brought before the courts (Article 12).

Journalists.

An interesting provision in the Regulations assimilates individuals who, following an army without directly belonging to it, such as newspaper correspondents and reporters, sutlers, contractors, fall into the enemy's hands, to prisoners of war, provided they can produce a certificate from the military authorities of the army they were accompanying.

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[1] Barclay, "Proposed Immunity of Private Property at Sea from Capture by Enemy," *Law Quarterly Review* (January 1900).

Information office as to prisoners.

A new departure is made by clauses providing for the institution of a bureau for information relative to prisoners of war. This is to be created at the commencement of hostilities, in each of the belligerent states and, when necessary, in the neutral countries on whose territory belligerents have been received. It is intended to answer all inquiries about prisoners of war, and is to be furnished by the various services concerned with all the necessary information to enable it to keep an individual return for each prisoner of war. It is to be kept informed of internments and changes, liberations on parole, evasions, admissions into hospital, deaths, &c. It is also the duty of the bureau to receive and collect all objects of personal use, valuables, letters, &c., found on the battlefields or left by prisoners who have died in hospital or ambulance, and to transmit them to those interested. Letters, money orders and valuables, as well as postal parcels destined for the prisoners of war or despatched by them, are to be free of all postal duties both in the countries of origin and destination, as well as in those they pass through. Gifts and relief in kind for prisoners of war are to be admitted free of all duties of entry, as well as of payments for carriage by the government railways.

Relief societies.

Furthermore, relief societies for prisoners of war, regularly constituted with the object of charity, are to receive every facility, within the bounds of military requirements and administrative regulations, for the effective accomplishment of their task. Delegates of these societies are to be admitted to the places of internment for the distribution of relief, as also to the halting-places of repatriated prisoners, "if furnished with a personal permit by the military authorities, and on giving an engagement in writing to comply with all their regulations for order and police."

Sick and wounded.

The obligations of belligerents with regard to sick and wounded in war on land are now governed by the Geneva Convention of July 6th, 1906. By this Convention ambulances and military hospitals, their medical and administrative staff and chaplains are "respected and protected under all circumstances," and the use of a uniform flag and arm-badge bearing a red cross are required as a distinguishing mark of their character. A Convention, accepted at the Peace Conferences, has now adapted the principles of the Geneva Convention to maritime warfare. This new Convention provides that—

Military hospital-ships, that is to say, ships constructed or assigned by states specially and solely for the purpose of assisting the wounded, sick or shipwrecked, and the names of which have been communicated to the belligerent powers at the commencement or during the course of hostilities, and in any case before they are employed, are to be respected and cannot be captured while hostilities last.

As regards hospital-ships equipped wholly or in part at the cost of private individuals or officially recognized relief societies, they likewise are to be respected and exempt from capture, provided the belligerent or neutral power to which they belong shall have given them an official commission and notified their names to the hostile power at the commencement of or during hostilities, and in any case before they are employed.

The belligerents have the right to control and visit them; they can refuse to help them, order them off, make them take a certain course, and put a commissioner on board; they can even detain them, if important circumstances require it.

The religious, medical or hospital staff of any captured ship is inviolable, and its members cannot be made prisoners of war.

Lastly, neutral merchantmen, yachts or vessels, having, or taking on board, sick, wounded or shipwrecked of the belligerents, cannot be captured for so doing.

The following prohibitions are also placed by the Hague Regulations on the means of injuring the enemy:—

Injuring enemy, siege, bombardments.

To employ poison or poisoned arms.

To kill or wound treacherously individuals belonging to the hostile nation or army.

To kill or wound an enemy who, having laid down arms or having no longer means of defence, has surrendered at discretion.

To declare that no quarter will be given.

To employ arms, projectiles or material of a nature to cause superfluous injury.

To make improper use of a flag of truce, the national flag or military ensigns and the enemy's uniform, as well as the distinctive badges of the Geneva Convention.

To destroy or seize the enemy's property, unless such destruction or seizure be imperatively demanded by the necessities of war; to attack or bombard towns, villages, habitations or buildings which are not defended.

To pillage a town or place, even when taken by assault.

Ruses of war.

Ruses of war and the employment of methods necessary to obtain information about the enemy and the country, on the contrary, are considered allowable.

Spies.

A spy is one who, acting clandestinely, or on false pretences, obtains, or seeks to obtain, information in the zone of operations of a belligerent, with the intention of communicating it to the hostile party (the Hague War-Regulations, Art. 29). Thus, soldiers not in disguise who have penetrated into the zone of operations of a hostile army to obtain information are not considered spies. Similarly, the following are not considered spies: soldiers or civilians, carrying out their mission openly, charged with the delivery of despatches destined either for their own army or for that of the enemy. To this class belong likewise individuals sent in balloons to deliver despatches, and generally to maintain communication between the various parts of an army or a territory (*ib.*). A spy taken in the act cannot be punished without previous trial, and a spy who, after rejoining the army to which he belongs, is subsequently captured by the enemy, is a prisoner of war, and not punishable for his previous acts of espionage.[1]

In sieges and bombardments all necessary steps are to be taken to spare as far as possible buildings devoted to religion, art, science and charity, hospitals and places where the sick and wounded are collected, provided they are not used at the same time for military purposes; but the besieged are to indicate these buildings or places by some particular and visible signs and notify them to the assailants.

A new Convention respecting bombardments by naval forces was adopted by the Hague Conference of 1907, forbidding the bombardment of undefended "ports, towns, villages, dwellings or buildings," unless after a formal summons the local authorities decline to comply with requisitions for provisions or supplies necessary for the immediate use of the naval force before the place in question. But they may not be bombarded on account of failure to pay money contributions. On the other hand, the prohibition does not apply to military works, depots of arms, &c., or ships of war in a harbour.

Another new Convention adopted at the Hague in 1907 dealt with the laying of automatic submarine contact mines. Its main provisions are as follows:—

It is forbidden:

1. To lay unanchored automatic contact mines, except when they are so constructed as to become harmless one hour at most after the person who laid them ceases to control them;
2. To lay anchored automatic contact mines which do not become harmless as soon as they have broken loose from their moorings;
3. To use torpedoes which do not become harmless when they have missed their mark (Art. 1).

It is forbidden to lay automatic contact mines off the coast and ports of the enemy, with the sole object of intercepting commercial shipping (Art. 2).

When anchored automatic contact mines are employed, every possible precaution must be taken for the security of peaceful shipping.

The belligerents undertake to do their utmost to render these mines harmless within a limited time, and, should they cease to be under surveillance, to notify the danger zones as soon as military exigencies permit, by a notice addressed to shipowners, which must also be communicated to the Governments through the diplomatic channel. (Art. 3.)

Neutral Powers which lay automatic contact mines off their coasts must observe the same rules and take the same precautions as are imposed on belligerents.

The neutral Power must inform shipowners, by a notice issued in advance, where automatic contact mines have been laid. This notice must be communicated at once to the Governments through the diplomatic channel. (Art. 4.)

At the close of the war the Contracting Powers undertake to do their utmost to remove the mines which they have laid, each Power removing its own mines.

As regards anchored automatic contact mines laid by one of the belligerents off the coast of the other, their position must be notified to the other party by the Power which laid them, and each Power must proceed with the least possible delay to remove the mines in its own waters. (Art. 5.)

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[1] See, as to *Flags of Truce*, Art. 32 of the Hague Regulations.

The Contracting Powers which do not at present own perfected mines of the pattern contemplated in the present Convention, and which, consequently, could not at present carry out the rules laid down in Articles 1 and 3, undertake to convert the *matériel* of their mines as soon as possible so as to bring it into conformity with the foregoing requirements. (Art. 6.)

Occupation of hostile territory.

Territory is considered as occupied when it is actually under the authority of the hostile army. The authority having passed into the hands of the occupant, the latter takes all possible steps to re-establish public order and safety. Compulsion of the population of occupied territory to take part in military operations against their own country, or even give information respecting the army of the other belligerent and pressure to take the oath to the hostile power are prohibited. Private property must be respected, save in case of military necessity (Arts. 46 and 52). The property of religious, charitable and educational institutions, and of art and science, even when state property, are assimilated to private property, and all seizure of, and destruction or intentional damage done to such institutions, to historical monuments, works of art or science is prohibited (Art. 56).

Declaration of war.

Modern practice.

Practice as regards declarations of war has hitherto varied. The Franco-Prussian War of 1870 was preceded by a deliberate declaration. In the war between Japan and China there was no declaration. (See Ariga, *La Guerre sino-japonaise*, Paris, 1896). The delivery of an ultimatum specifying those terms, the compliance with which is demanded within a specified time, is practically a conditional declaration of war which becomes absolute in case of non-compliance. Thus the note communicated by the United States to Spain on 20th April 1898 demanded the "immediate withdrawal of all the land and sea forces from Cuba," and gave Spain three days to accept these terms. On the evening of 22nd April the United States seized several Spanish vessels, and hostilities were thus opened. In the case of the Transvaal War, the declaration also took the form of an ultimatum. A special Hague convention adopted at the Conference of 1907 now provides that hostilities "must not commence without previous and explicit warning in the form of a reasoned declaration of war or of an ultimatum with conditional declaration of war." It also provides that the existence of a state of war must be notified to the neutral powers and shall not take effect in regard to them until after the receipt of the notification which may be given by telegraph. Most of the good effect of the provision, however, is negatived by the qualification that neutral powers cannot rely on the absence of notification if it is clearly established that they were in fact aware of the existence of a state of war.

Future of law of war.

Too much confidence must not be placed in regulations concerning the conduct of war. Military necessity, the heat of action, the violence of the feelings which come into play will always at times defeat the most skilfully-combined rules diplomacy can devise. Still, such rules are a sign of conditions of public opinion which serve as a restraint upon the commission of barbarities among civilized peoples. The European operations in China consequent on the "Boxer" rising showed how distance from European criticism tends to loosen that restraint. On the other hand, it was significant that both the United States and Spain, who were not parties to the Declaration of Paris, found themselves, in a war confined to them, under the necessity of observing provisions which the majority of civilized states have agreed to respect. (T. Ba.)

WARANGAL, an ancient town of India, in the Nizam's Dominions or Hyderabad state, 86 m. N.E. of Hyderabad city. It was the capital of a Hindu kingdom in the 12th century, but little remains to denote its former grandeur except a fort and four gateways of a temple of Siva. Warangal has given its name to a district and a division of the state.

WARASDIN (Hungarian, *Varasd*; Croatian, *Varaždin*), a royal free town of Hungary, and capital of the county of Warasdin, in Croatia-Slavonia; on the right bank of the Drave, 62 m. by rail N.N.E. of Agram. Pop. (1900) 12,930. Warasdin is the seat of a district court, and possesses an old castle, a cathedral and several churches, monasteries and schools. It carries on a brisk trade in timber, wine, fruit, tobacco, spirits, stoneware and silk. Coal is also mined in the Warasdin Mountains. The celebrated sulphur baths of Constantins-Bad or Töplitz, known to the Romans as *Thermae Constantianae*, lie about 10 m. S.

WARBECK, PERKIN (*c.* 1474–1499), pretender to the throne of England, was the son of Jehan de Werbecque, a poor burgess of Tournay in Flanders and of his wife Katherine de Faro. The exact date of his birth is unknown, but as he represented himself as having been nine years old in 1483, it must have taken place in, or close on, 1474. His confession made at the end of his life was an account of his early years which is to some extent supported by other testimony. The names of his father and other relations whom he mentions have been found in the municipal records of Tournay, and the official description of them agrees with his statements. According to this version, which may be accepted as substantially true, he was brought up at Antwerp by a cousin Jehan Stienbecks, and served a succession of employers as a boy servant. He was for a time with an Englishman John Strewe at Middleburg, and then accompanied Lady Brampton, the wife of an exiled partisan of the house of York, to Portugal. He was for a year employed by a Portuguese knight whom he described as having only one eye, and whom he names Vacz de Cogna (Vaz da Cunha?). In 1491 he was at Cork as the servant of a Breton silk merchant Pregent (Pierre Jean) Meno. Ireland was strongly attached to the house of York, and was full of intrigue against King Henry VII. Perkin says that the people seeing him dressed in the silks of his master took him for a person of distinction, and insisted that he must be either the son of George, duke of Clarence, or a bastard of Richard III. He was more or less encouraged by the earls of Desmond and Kildare. The facts are ill recorded, but it is safe to presume that intriguers who wished to disturb the government of Henry VII. took advantage of a popular delusion, and made use of the lad as a tool. At this time he spoke English badly. By 1492 he had become sufficiently notorious to attract the attention of King Henry's government and of foreign sovereigns. He was in that year summoned to Flanders by Margaret, the widowed duchess of Burgundy, and sister of Edward IV., who was the main support of the Yorkist exiles, and who was the enemy of Henry VII. for family reasons and for personal reasons also, for she wished to extort from him the payment of the balance of her dowry. She found the impostor useful as a means of injuring the king of England. Several European sovereigns were moved to help him by the same kind of reason. The suppositions that he was the son of Clarence or of Richard III. were discarded in favour of the more useful hypothesis that he was Richard, duke of York, the younger of the two sons of Edward IV., murdered in the Tower. Charles VIII., king of France, the counsellors of the youthful duke of Burgundy, the duke's father Maximilian, king of the Romans, and James IV. of Scotland, none of whom can have been really deceived, took up his cause more or less actively. He was entertained in France, and was taken by Maximilian to attend the funeral of the emperor Frederick III. in 1493. At Vienna he was treated as the lawful king of England. He was naturally the cause of considerable anxiety to the English government, which was well acquainted with his real history, and made attempts to get him seized. His protectors entered into negotiations which in fact turned on the question whether more was to be gained by supporting him, or by giving him up. An appeal to Isabella, queen of Castile, met with no response. In July 1495 he was provided with a few ships and men by Maximilian, now emperor, and he appeared on the coast of Kent. No movement in his favour took place. A few of his followers who landed were cut off, and he went on to Ireland to join the earl of Desmond in Munster. After an unsuccessful attack on Waterford in August, he fled to Scotland. Here King James IV. showed him favour, and arranged a marriage for him with Catherine Gordon, daughter of the earl of Huntly. He was helped to make a short inroad into Northumberland, but the intervention of the Spanish government brought about a peace between England and Scotland. In 1497 Perkin was sent on his travels again with two or three small vessels, and accompanied by his wife, who had borne him one or two children. After some obscure adventures in Ireland, he landed at Whitesand Bay, near the Land's End, on the 7th of September, and was joined by a crowd of the country people, who had been recently in revolt against excessive taxation. He advanced to Exeter, but was unable to master the town. On the approach of the royal troops he deserted his followers, and ran for refuge to the sanctuary of Beaulieu in Hampshire. He then surrendered. His wife was kindly treated and placed in the household of Henry's queen Elizabeth. Perkin was compelled to make two ignominious public confessions at Westminster, and in Cheapside on the 15th and 19th of June 1498. On the 23rd of November 1499 he was hanged on a charge of endeavouring to escape from the Tower with the imprisoned earl of Warwick.

See James Gairdner, *Richard the Third, and the Story of Perkin Warbeck* (Cambridge, 1898).

WARBLER, in ornithology, the name bestowed in 1773 by T. Pennant (*Genera of Birds*, p. 35) on the birds removed, in 1769, by J. A. Scopoli from the Linnaean genus *Motacilla* (cf. WAGTAIL) to one founded and called by him *Sylvia*—the last being a word employed by several of the older writers in an indefinite way—that is to say, on all the species of *Motacilla* which were not wagtails. "Warbler" has long been used by English technical writers as the equivalent of *Sylvia*, and is now applied to all members of the sub-family Sylviinae of the thrushes (*q.v.*), and in the combination "American warblers" to the distinct passerine family Mniotiltidae. The true warblers (*Sylviinae*) are generally smaller than the true thrushes *Turdinae* (see THRUSHES), with, for the most part, a weak and slender bill. They seldom fly far, except when migrating, but frequent undergrowth and herbage, living on insects, larvae and fruit. The song is unusually clear and very sweet, with frequently a metallic sound, as in the grasshopper warbler. The nest is usually cup-shaped and well lined, and from three to six eggs (twelve in *Regulus*), usually spotted, are laid.

The true warblers are chiefly Old World, visiting the southern Old World in winter, but members of the sub-family occur in New Zealand, Polynesia and Panama. Amongst the commonest in England is the well-known sedge-bird or sedge-warbler, *Acrocephalus schoenobaenus*, whose chattering song resounds in summer-time from almost every wet ditch in most parts of Britain. As is the case with so many of its allies, the skulking habits of the bird cause it to be far more often heard than seen; but, with a little patience, it may be generally observed flitting about the uppermost twigs of the bushes it frequents, and its mottled back and the yellowish-white streak over its eye serve to distinguish it from its ally the reed-wren or reed-warbler, *A. streperus*, which is clad in a wholly mouse-coloured suit. But this last can also be recognized by its different song, and comparatively seldom does it stray from the reed-beds which are its favourite haunts. In them generally it builds one of the most beautiful of nests, made of the seed-branches of the reed and long grass, wound horizontally round and round so as to include in its substance the living stems of three or four reeds, between which it is suspended at a convenient height above the water, and the structure is so deep that the eggs do not roll out when its props are shaken by the wind. Of very similar habits is the reed-thrush or great reed-warbler, *A. arundinaceus*, a loud-voiced species, abundant on the Continent but very rarely straying to England. Much interest also attaches to the species known as Savi's warbler, *Locustella luscinioides*, which was only recognized as a constant inhabitant of the Fen district of England a few years before its haunts were destroyed by drainage. The last example known to have been obtained in this country was killed in 1856. The nest of this species is peculiar, placed on the ground and formed of the blades of a species of *Glyceria* so skilfully entwined as to be a very permanent structure, and it is a curious fact that its nests were well known to the sedge-cutters of the district which it most frequented, as those of a bird with which they were unacquainted, long before the builder was recognized by naturalists. In coloration the bird somewhat resembles a nightingale (whence its specific name), and its song differs from that of any of those before mentioned, being a long smooth trill, pitched higher but possessing more tone than that of the grasshopper-warbler *Locustella naevius*—which is a widely-distributed species throughout the British Isles, not only limited to marshy sites, but affecting also dry soils, inhabiting indifferently many kinds of places where there is tangled and thick herbage, heather or brushwood. In those parts of England where it was formerly most abundant it was known as the reeler or reel-bird, from its song resembling the whirring noise of the reel at one time used by the spinners of wool. The precise determination of this bird—the grasshopper lark, as it was long called in books, though its notes if once heard can never be mistaken for those of a grasshopper or cricket, and it has no affinity to the larks—as an English species is due to the discernment of Gilbert White in 1768. In its habits it is one of the most retiring of birds, keeping in the closest shelter, so that it may be within a very short distance of an eager naturalist without his being able to see it—the olive-colour, streaked with dark brown, of its upper plumage helping to make it invisible. The nest is very artfully concealed in the thickest herbage. The foreign forms of aquatic warblers are far too numerous to be here mentioned.

The members of the typical genus *Sylvia*, which includes some of the sweetest singers, are treated of under WHITETHROAT; and the willow- and wood-wrens under WREN. The Australian genus *Malurus*, to which belong the birds known as "superb warblers," not inaptly so named, since in beauty they surpass any others of their presumed allies, is now placed in with the Old World fly-catchers in the family Musicapidae. Part of the plumage of the cocks in breeding-dress is generally some shade of intense blue, and is so glossy as to resemble enamel, while black, white, chestnut or scarlet, as well as green and lilac, are also present in one species or another, so as to heighten the effect. But, as already stated, there are systematists who would raise this genus, which contains some 15 species, to the rank of a distinct family, though on what grounds it is hard to say.

The birds known as "American warblers," forming what is now recognized as a distinct family, Mniotiltidae, remain for consideration. They possess but nine instead of ten primaries, and are peculiar to the New World. More than 130 species have been described, and these have been grouped in 20 genera or more, of which members of all but three are at least summer-visitants to North America. As a whole they are much more brightly coloured than the Sylviinae, for, though the particular genus *Mniotilta* (from which the family takes its name) is one of the most abnormal—its colours being plain black and white, and its habits rather resembling those of a Tree-creeper (*q.v.*)—in other groups chestnut, bluish-grey and green appear, the last varying from an olive to a saffron tint, and in some groups the yellow predominates to an extent that has gained for its wearers, belonging to the genus *Dendroeca*, the name of "golden" warblers. In the genus *Setophaga*, the members of which deserve to be called "fly-catching" warblers, the plumage of the males at least presents yellow, orange, scarlet or crimson.

The Mniotiltidae contain forms exhibiting quite as many diverse modes of life as do the Sylviinae. Some are exclusively aquatic in their predilections, others affect dry soils, brushwood, forests and so on. Almost all the genera are essentially migratory, but a large proportion of the species of *Dendroeca*, *Setophaga*, and especially *Basileuterus*, seem never to leave their Neotropical home; while the genera *Leucopeza*, *Teretristis* and *Microligia*, comprising in all but 5 species, are peculiar to the Antilles. The rest are for the most part natives of North America, where a few attain a very high latitude,[1] penetrating in summer even beyond the Arctic Circle, and thence migrate southward at the end of summer or in the fall of the year, some reaching Peru and Brazil, but a few, as, for instance, *Parula pitiayumi* and *Geothlypis velata*, seem to be resident in the country last named. (A. N.)

WARBURTON, BARTHOLOMEW ELLIOTT GEORGE (1810–1852), usually known as Eliot Warburton, British traveller and novelist, was born in 1810 near Tullamore, Ireland. He was educated at Trinity College, Cambridge, and was called to the Irish bar in 1837. He contracted lasting friendships with Monckton Milnes (Lord Houghton) and A. W. Kinglake, and gave up his practice as a barrister for travel and literature. He made a hit with his first book, *The Crescent and the Cross*. It was an account of his travels in 1843 in Turkey, Syria, Palestine and Egypt, and fairly divided public attention with Kinglake's *Eothen*, which appeared in the same year, 1844. Interest was centred in the East at the time, and Warburton had popular sympathy with him in his eloquent advocacy of the annexation of Egypt; but, apart from this consideration, the spirited narrative of his adventures and the picturesque sketches of Eastern life and character were more than sufficient to justify the success of the book. His most substantial work was a *Memoir of Prince Rupert and the Cavaliers* (1849), enriched with original documents, and written with eloquent partiality for the subject. This was followed in 1850 by *Reginald Hastings*, a novel, the scenes of which were laid in the same period of civil war, and, in 1851, by another historical novel, *Darien, or The Merchant Prince*. He was sent by the Atlantic and Pacific Junction Company to explore the isthmus of Darien and to negotiate a treaty with the Indian tribes. He sailed on this mission in the "Amazon," which perished by fire with nearly all on board on the 4th of January 1852.

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[1] Seven species have been recorded as wandering to Greenland, and one, *Dendroeca virens*, is said to have occurred in Europe (*Naumannia*, 1858, p. 425).

His brother, Major George Warburton (1816–1857), wrote *Hochelaga, or England in the New World* (1846), and *The Conquest of Canada* (1849).

WARBURTON, COLONEL SIR ROBERT (1842–1899), Anglo-Indian soldier and administrator, was the son of an artillery officer who had been taken prisoner at Kabul in 1842, and escaped through the good offices of an Afghan princess. He married this lady, and she transmitted to their son that power of exercising influence over the tribes of the north-west frontier which stood him in good stead during his long service in India. Warburton entered the Royal Artillery in 1861, took part in the Abyssinian War of 1867–68, and then joined the Bengal Staff Corps. He served with distinction in the expedition against the Utman Khel in 1878 and in the Afghan War of 1878–80. Very soon after the British government had made permanent arrangements for keeping open the Khyber Pass, Warburton was appointed to take charge of it as political officer. This post he held, discharging its duties with conspicuous ability, between 1879 and 1882 with intervals of other duty, and continuously from 1882 until 1890. He turned the rude levies which formed the Khyber Rifles into a fine corps, ready to serve the Indian government wherever they might be required. He made the road safe, kept the Afridis friendly, and won the thanks of the Punjab government, expressed in a special order upon his retirement, for his good work. When the Afridis began to cause anxiety in 1897, Colonel Warburton was asked by the government of India if he would assist in quieting the excitement amongst them. He declared himself ready to do so, but in the meantime the trouble had come to a head. Colonel Warburton took part in the campaign which followed; at its close his active career ended. He occupied his leisure in retirement by writing his memoirs, *Eighteen Years in the Khyber* (1900). He died at Kensington on the 22nd of April 1899.

WARBURTON, WILLIAM (1698–1779), English critic and divine, bishop of Gloucester, was born at Newark on the 24th of December 1698. His father belonged to an old Cheshire family and was town clerk of Newark. William was educated at Oakham and Newark grammar schools, and in 1714 he was articled to Mr Kirke, attorney at East Markham, in Nottinghamshire. After serving his time he returned to Newark with the intention of practising as a solicitor; but, having given some time to the study of Latin and Greek, he left the law and was ordained deacon by the archbishop of York in 1723, and in 1727 received priest's orders from the bishop of London. He had occupied the interval in various literary labours, the most important being the notes he contributed to Theobald's edition of Shakespeare, and an anonymous share in a pamphlet on the jurisdiction of the Court of Chancery, *The Legal Judicature in Chancery stated* (1727). This was an answer to another anonymous pamphlet, written by Philip Yorke, afterwards Lord Chancellor Hardwicke, who replied in an enlarged edition (1728) of his original *Discourse of the Judicial Authority . . . of Master of the Rolls*. Warburton now received from Sir Robert Sutton the small living of Greasley, in Nottinghamshire, exchanged next year for that of Brant Broughton, Lincolnshire. He held in addition, from 1730, the living of Frisby in Lincolnshire. In 1728 he was made an honorary M.A. of Cambridge. At Brant Broughton for eighteen years he spent his time in study, the first result of which was his treatise on the *Alliance between Church and State* (1736). The book brought Warburton into favour at court, and he probably only missed immediate preferment by the death of Queen Caroline. His next and best-known work, *Divine Legation of Moses demonstrated on the Principles of a Religious Deist* (2 vols., 1737–1741), preserves his name as the author of the most daring and ingenious of theological paradoxes. The deists had made the absence of any inculcation of the doctrine of a future life an objection to the divine authority of the Mosaic writings. Warburton boldly admitted the fact and turned it against the adversary by maintaining that no merely human legislator would have omitted such a sanction of morality. The author's extraordinary power, learning and originality were acknowledged on all hands, though he excited censure and suspicion by his tenderness to the alleged heresies of Conyers Middleton. The book aroused much controversy. In a pamphlet of "Remarks" (1742), he replied to John Tillard, and *Remarks on Several Occasional Reflections* (1744–1745) was an answer to Akenside, Conyers Middleton (who had up to this time been his friend), Richard Pococke, Nicholas Mann, Richard Grey, Henry Stebbing and other of his critics. As he characterized his opponents in general as the "pestilent herd of libertine scribblers with which the island is overrun," it is no matter of surprise that the book made him many bitter enemies.

Either in quest of paradox, or actually unable to recognize the real tendencies of Pope's *Essay on Man*, he entered upon its defence against the *Examen* of Jean Pierre de Crousaz, in a series of articles (1738–1739) contributed to *The Works of the Learned*. Whether Pope had really understood the tendency of his own work has always been doubtful, but there is no question that he was glad of an apologist, and that Warburton's *jeu d'esprit* in the long run did more for his fortunes than all his erudition. It occasioned a sincere friendship between him and Pope, whom he persuaded to add a fourth book to the *Dunciad*, and encouraged to substitute Cibber for Theobald as the hero of the poem in the edition of 1743 published under the editorship of Warburton. Pope bequeathed him the copyright and the editorship of his works, and contributed even more to his advancement by introducing him to Murray, afterwards Lord Mansfield, who obtained for him in 1746 the preachership of Lincoln's Inn, and to Ralph Allen, who, says Johnson, "gave him his niece and his estate, and, by consequence, a bishopric." The marriage took place in 1745, and from that time Warburton resided principally at his father-in-law's estate at Prior Park, in Gloucestershire, which he inherited on Allen's death in 1764. In 1747 appeared his edition of Shakespeare, into which, as he expressed it, Pope's earlier edition was melted down. He had previously entrusted notes and emendations on Shakespeare to Sir Thomas Hanmer, whose unauthorized use of them led to a heated controversy. As early as 1727 Warburton had corresponded with Theobald on Shakespearean subjects. He now accused him of stealing his ideas and denied his critical ability. Theobald's superiority to Warburton as a Shakespearean critic has long since been acknowledged. Warburton was further kept busy by the attacks on his *Divine Legation* from all quarters, by a dispute with Bolingbroke respecting Pope's behaviour in the affair of Bolingbroke's *Patriot King*, by his edition of Pope's works (1751) and by a vindication in 1750 of the alleged miraculous interruption of the rebuilding of the temple of Jerusalem undertaken by Julian, in answer to Conyers Middleton. Warburton's manner of dealing with opponents was both insolent and rancorous, but it did him no disservice. He became prebendary of Gloucester in 1753, chaplain to the king in 1754, prebendary of Durham in 1755, dean of Bristol in 1757, and in 1759 bishop of Gloucester. He continued to write so long as the infirmities of age allowed, collecting and publishing his sermons, and toiling to complete the *Divine Legation*, further fragments of which were published with his posthumous *Works*. He wrote a defence of revealed religion in his *View of Lord Bolingbroke's Philosophy* (1754), and Hume's *Natural History of Religion* called forth some *Remarks* . . . "by a gentleman of Cambridge" from Warburton, in which his friend and biographer, Richard Hurd, had a share (1757). He made in 1762 a vigorous attack on Methodism under the title of *The Doctrine of Grace*. He also engaged in a keen controversy with Robert Lowth, afterwards bishop of London, on the book of Job, in which Lowth brought home charges of lack of scholarship and of insolence that admitted of no denial. His last important act was to found in 1768 the Warburtonian lecture at Lincoln's Inn, "to prove the truth of revealed religion . . . from the completion of the prophecies of the Old and New Testament which relate to the Christian Church, especially to the apostacy of Papal Rome." He died at Gloucester on the 7th of June 1779. Warburton was undoubtedly a great man, but his intellect, marred by wilfulness and the passion for paradox, effected no result in any degree adequate to its power. He was a warm and constant friend, and gave many proofs of gratitude to his benefactors.

Warburton's works were edited (7 vols., 1788) by Bishop Hurd with a biographical preface, and the correspondence between the two friends—an important contribution to the literary history of the period—was edited by Dr Parr in 1808. Warburton's life was also written by John Selby Watson in 1863, and Mark Pattison made him the subject of an essay in 1889. See also I. D'Israeli, *Quarrels of Authors* (1814); and especially John Nichols, *Literary Anecdotes* (1812–1815), vol. v., and *Illustrations* (1817–1858), vol. ii., for his correspondence with William Stukeley, Peter des Maizeaux, Thomas Birch, John Jortin and Lewis Theobald.

WARD, ADOLPHUS WILLIAM (1837–), English historian and man of letters, was born at Hampstead, London, on the 2nd of December 1837, and was educated in Germany and at the university of Cambridge. In 1866 he was appointed professor of history and English literature in Owens College, Manchester, and was principal from 1890 to 1897, when he retired. He took an active part in the foundation of Victoria University, of which he was vice-chancellor from 1886 to 1890 and from 1894 to 1896. In 1897 the freedom of the city of Manchester was conferred upon him, and in 1900 he was elected master of Peterhouse, Cambridge. His most important work is his standard *History of English Dramatic Literature to the Age of Queen Anne* (1875), re-edited after a thorough revision in three volumes in 1899. He also wrote *The House of Austria in the Thirty Years' War* (1869), *Great Britain and Hanover* (1899), *The Electress Sophia and the Hanoverian Succession* (1903); he edited Crabbe's *Poems* (2 vols., 1905–1906) and Pope's *Poetical Works* (1869); he wrote the volumes on Chaucer and Dickens in the "English Men of Letters" series, translated Curtius's *History of Greece* (5 vols., 1868–1873); he was one of the editors of the *Cambridge Modern History*, and with A. R. Waller edited the *Cambridge History of English Literature* (1907, &c.). For the 9th edition of the *Ency. Brit.* he wrote the article DRAMA, and biographies of Ben Jonson and other dramatists; and he became an important contributor to the present work.

WARD, ARTEMUS, the pen-name of Charles Farrar Browne (1834–1867), American humorous writer, was born in Waterford, Maine. He began life as a compositor and became an occasional contributor to the daily and weekly journals. In 1858 he published in the Cleveland *Plain Dealer* the first of the "Artemus Ward" series, which attained great popularity both in America and England. His separate publications were: *Artemus Ward: his Book* (New York, 1862); *Artemus Ward: his Travels* (New York, 1865); *Artemus Ward among the Fenians* (1865); *Betsey Jane Ward: hur Book of Goaks* (New York, 1866), generally attributed to him; *Artemus Ward in London, and other Papers* (New York, 1867). *Artemus Ward's Lecture at the Egyptian Hall . . . and other Relics of the Humourist* (London, 1869), edited by T. W. Robertson and J. C. Hotten, was published posthumously (New York, 1869). His wit largely relied on the drollery of strange spelling. In 1860 he became editor of *Vanity Fair*, a humorous New York weekly, which proved a failure. About the same time he began to appear as a lecturer, and his eccentric humour attracted large audiences. In 1866 he visited England, where he became exceedingly popular both as a lecturer and as a contributor to *Punch*. In the spring of the following year his health gave way, and he died of consumption at Southampton on the 6th of March 1867.

His *Complete Works*, with memoir by E. P. Hingston, were published in London in the same year, and *Sandwiches* at New York in 1870.

WARD, EDWARD MATTHEW (1816–1879), English historical and *genre* painter, was born at Pimlico, London, in 1816. Among his early boyish efforts in art was a series of clever illustrations to the *Rejected Addresses* of his uncles Horace and James Smith, which was followed soon afterwards by designs to some of the papers of Washington Irving. In 1830 he gained the silver palette of the Society of Arts; and in 1835, aided by Wilkie and Chantrey, he entered the schools of the Royal Academy, having in the previous year contributed to its exhibition his portrait of Mr O. Smith, the comedian, in his character of Don Quixote. In 1836 he went to Rome, where in 1838 he gained a silver medal from the Academy of St Luke for his "Cimabue and Giotto," which in the following year was exhibited at the Royal Academy. The young artist now turned his thoughts to fresco-painting, which he studied under Cornelius at Munich. In 1843 he forwarded his "Boadicea Animating the Britons previous to the Last Battle against the Romans" to the competition for the decoration of the Houses of Parliament—a work upon which he was afterwards engaged, having in 1853 been directed by the fine art commissioners to execute eight subjects in the corridor of the House of Commons. The success of his "Dr Johnson in Lord Chesterfield's Ante-Room"—now in the National Gallery, along with the "Disgrace of Lord Clarendon" (the smaller picture) (1846), the "South Sea Bubble" (1847), and "James II. Receiving the News of the Landing of the Prince of Orange" (1850)—secured his election as an associate of the Royal Academy in 1847, and in 1855 he gained full academic honours. Among the more important of his other works may be named "Charlotte Corday Led to Execution" (1852), the "Last Sleep of Argyll" (1854), the "Emperor of the French Receiving the Order of the Garter" (1859), painted for the queen, the "Ante-Chamber at Whitehall during the Dying Moments of Charles II." (1861), "Dr Johnson's First Interview with John Wilkes" (1865), and the "Royal Family of France in the Temple," painted in 1851, and usually considered the artist's masterpiece. He died at Windsor, on the 15th of January 1879. In 1848 he had married Henrietta Ward (b. 1832), who, herself an admirable artist, was a granddaughter of James Ward, R.A. (1769–1859), the distinguished animal painter. Their son, Leslie Ward (b. 1851), became well known as "Spy" of *Vanity Fair* (from 1873 to 1909), and later of the *World*, with his character portraits of contemporary celebrities.

WARD, ELIZABETH STUART PHELPS (1844–1911), American author and philanthropist, was born in Boston, Massachusetts, on the 31st of August 1844. She was the granddaughter of the Rev. Moses Stuart, and the daughter of the Rev. Austin Phelps (1820–1890) who became a professor in the Andover Theological Seminary in 1848, and Elizabeth Stuart Phelps (1815–1852), who wrote *Sunnyside* (1851), a popular book in its day, and other works. In 1848 she removed with her parents to Andover, where she attended private schools. When she was in her teens she wrote short stories for the *Youth's Companion, The Atlantic Monthly* and *Harper's Magazine*. She wrote many juveniles, especially Sunday-School books, such as the Tiny and the Gypsy series. In 1868 appeared in *The Atlantic Monthly* her short story, *The Tenth of January*, a narrative of the falling and burning of a cotton-mill at Lawrence, Mass., in 1860. In the same year appeared *The Gates Ajar* (1868), her first novel, a realistic study of life after death, which was widely read and was translated into several European languages. Her *Beyond the Gates* (1883), *The Gates Between* (1887) and *Within the Gates* (1901) are in the same vein. She was actively interested in charitable work, in the advancement of women and in temperance reform. In 1888 she married Herbert Dickinson Ward (b. 1861), son of the Rev. William Hayes Ward.

Among Mrs Ward's books, in addition to those already mentioned, are: *Men, Women and Ghosts* (1869); *The Trotty Book* (1869), juvenile; *Hedged in* (1870); *The Silent Partner* (1871); *Trotty's Wedding Tour and Story Book* (1873), juvenile; *What to Wear* (1873), essays; *Poetic Studies* (1875), poems; *The Story of Avis* (1877), *Sealed Orders, and Other Stories* (1879); *Friends: a Duet* (1881); *Doctor Zay* (1882); *Songs of the Silent World, and Other Poems* (1884); *Old Maids, and Burglars in Paradise* (1885); *The Madonna of the Tubs* (1886), a short story; *Jack the Fisherman* (1887), a Gloucester tragedy; *The Struggle for Immortality* (1889), essays; *Fourteen to One, and Other Stories* (1891); *Austin Phelps: a Memoir* (1891); *Donald Marcy* (1893); *A Singular Life* (1894), one of her best-known novels; *The Supply at Saint Agatha's* (1896); *Chapters from a Life* (1896); *The Story of Jesus Christ: an Interpretation* (1897); *The Successors of Mary the First* (1901); *Avery* (1902), first issued serially in *Harper's Magazine* as *His Wife; Trixy* (1904); *The Man in the Case* (1906); *Walled In* (1907); and *Though Life Do Us Part* (1908). In collaboration with her husband, she wrote two novels founded on Biblical scenes and characters, *The Master of the Magicians* (1890), and *Come Forth* (1890). Among Mr Ward's books are *The New Senior at Andover* (1890); *The Republic without a President, and Other Short Stories* (1891); *The Captain of the Kittiwink*

(1892); *A Dash to the Pole* (1893); *The White Crown, and Other Stories* (1894); *The Burglar who moved Paradise* (1897): and *The Light of the World* (1901).

WARD, JAMES (1769–1859), English animal painter and engraver, was born in Thames Street, London, on the 23rd of October 1769. At the age of twelve he was bound apprentice with J. Raphael Smith, but he received little attention and learnt nothing from this engraver. He was afterwards instructed for over seven years by his elder brother, William Ward, and he engraved many admirable plates, among which his "Mrs Billington," after Reynolds, occupies a very high place. He presented a complete set of his engravings, in their various states, numbering three hundred impressions, to the British Museum. While still a youth he made the acquaintance of George Morland, who afterwards married his sister; and the example of this artist's works induced him to attempt painting. His early productions were rustic subjects in the manner of Morland, which were frequently sold as the work of the more celebrated painter. His "Bull-Bait," an animated composition, introducing many figures, attracted much attention in the Royal Academy of 1797. A commission from Sir John Sinclair, president of the new agricultural society, to paint an Alderney cow, led to much similar work, and turned Ward's attention to animal-painting, a department in which he achieved his highest artistic successes. His "Landscape with Cattle," acquired for the National Gallery at a cost of £1500, was painted in 1820–1822 at the suggestion of West, in emulation of the "Bull of Paul Potter" at the Hague. His "Boa Serpent Seizing a Horse" was executed in 1822, and his admirable "Grey Horse," shown in the Old Masters' Exhibition of 1879, dates from 1828. Ward also produced portraits, and many landscapes like the "Gordale Scar" and the "Harlech Castle" in the National Gallery. Sometimes he turned aside into the less fruitful paths of allegory, as in his unsuccessful "Pool of Bethesda" (1818), and "Triumph of the Duke of Wellington" (1818). He was a frequent contributor to the Royal Academy and the British Institution, and in 1841 he collected one hundred and forty examples of his art, and exhibited them in his house in Newman Street. He was elected an associate of the Royal Academy in 1807, and a full member in 1811, and died at Cheshunt on the 23rd of November 1859.

Ward compiled an autobiography, of which an abstract was published in the *Art Journal* in 1849.

WARD, JAMES (1843–), English psychologist and metaphysician, was born at Hull on the 27th of January 1843. He was educated at the Liverpool Institute, at Berlin and Göttingen, and at Trinity College, Cambridge; he also worked in the physiological laboratory at Leipzig. He studied originally for the Congregational ministry, and for a year was minister of Emmanuel Church, Cambridge. Subsequently he devoted himself to psychological research, became fellow of his college in 1875 and university professor of mental philosophy in 1897. He was Gifford lecturer at Aberdeen in 1895–1897, and at St Andrews in 1908–1910. His work shows the influence of Leibnitz and Lotze, as well as of the biological theory of evolution. His psychology marks the definite break with the sensationalism of the English school; experience is interpreted as a *continuum* into which distinctions are gradually introduced by the action of selective attention; the implication of the subject in experience is emphasized; and the operation in development of subjective, as well as natural, selection is maintained. In his metaphysical work the analysis of scientific concepts leads to a criticism of naturalism and of dualism, and to a view of reality as a unity which implies both subjective and objective factors. This view is further worked out, through criticism of pluralism and as a theistic interpretation of the world, in his St Andrews Gifford Lectures (the *Realm of Ends*).

Beside the article "Psychology" in the *Ency. Brit.* (9th, 10th and 11th ed.) he has published *Naturalism and Agnosticism* (1899, 3rd ed. 1907), besides numerous articles in the *Journal of Physiology*, *Mind*, and the *British Journal of Psychology*.

WARD, JOHN QUINCY ADAMS (1830–1910), American sculptor, was born in Urbana, Ohio, on the 29th of June 1830. His education was received in the village schools. He studied under Henry K. Brown, of New York, in 1850–1857, and by 1861, when he opened a studio in New York, he had executed busts of Joshua R. Giddings, Alexander H. Stephens, and Hannibal Hamlin, prepared the first sketch for the "Indian Hunter," and made studies among the Indians themselves for the work. In 1863 he became a member of the National Academy of Design (New York), and he was its president in 1872–1873. Among his best-known statues are the "Indian Hunter," finished in 1864 (Central Park, New York); Washington, heroic size (on the steps of the U.S. Sub-Treasury, Wall Street, New York); Henry Ward Beecher (Brooklyn); an equestrian statue of General George H. Thomas (Washington); Israel Putnam (Hartford); and the seated statue of Horace Greeley, the founder of the New York *Tribune*, in front of the office of that newspaper. In 1896 he was elected president of the newly organized National Sculpture Society (New York). Unlike his fellow-countryman, W. W. Story, he acquired his training, his inspiration and his themes from his own country. He died in New York on the 1st of May 1910.

WARD, LESTER FRANK (1841–), American geologist and sociologist, was born in Joliet, Illinois, on the 18th of June 1841. He graduated at Columbian (now George Washington) University in 1869 and from the law school of the same university in 1871, his education having been delayed by his service in the Union army during the Civil War. In 1865–1872 he was employed in the United States Treasury Department, and became assistant geologist in 1881 and geologist in 1888 to the U.S. Geological Survey. In 1884–1886 he was professor of botany in Columbian University. He wrote much on paleobotany, including *A Sketch of Paleobotany* (1885), *The Geographical Distribution of Fossil Plants* (1888) and *The Status of the Mesozoic Floras of the United States* (1905). He is better known, however, for his work in sociology, in which, modifying Herbert Spencer and refuting the Spencerian individualism, he paralleled social with psychological and physical phenomena. His more important works are: *Dynamic Sociology* (1883, 2nd ed. 1897), *Psychic Factors of Civilization* (1897), *Outlines of Sociology* (1898), *Sociology and Economics* (1899), *Pure Sociology* (1903), and, with J. Q. Dealy, *Text-Book of Sociology* (1905).

See an appreciation by L. Gumplowicz, in *Die Zeit* (Vienna, 20th Aug. 1904); reprinted in English in vol. x. of *The American Journal of Sociology*.

WARD, MARY AUGUSTA [Mrs Humphry Ward] (1851–), British novelist, was born on the 11th of June 1851 at Hobart, Tasmania, where her father, Thomas Arnold (1824–1900), was then an inspector of schools. Thomas Arnold was a son of Arnold of Rugby, and a brother of the poet Matthew Arnold. As a scholar of University College, Oxford, at the crisis of the Oxford Movement, he had begun life as a Liberal of the school of Jowett, Stanley and Clough. In 1856 he became a Roman Catholic, relinquished his inspectorship of schools in Tasmania, and was appointed professor of English literature at Dublin, thence following Newman to Birmingham, where he published his *Manual of English Literature*. After a brief period of unrest he reverted to the English Church, and went to Oxford, where he lived twenty years, editing *The Select Works of Wyclif* and *Beowulf* for the Clarendon Press, *Henry of Huntingdon* and *Symeon of Durham* for the "Rolls" series, and, with W. E. Addis, the *Catholic Dictionary*. In 1877 he reverted once more to the Roman Catholic Church, and was appointed fellow of the new Royal University of Ireland, dying in Dublin on the 12th of November 1900. His daughter was brought up mainly at Oxford, and her early associations with a life of scholarship and religious conflict are deeply marked in her own later literary career. She was brought into close connexion during this period with Edward Hartopp Cradock, who was principal of Brasenose College from 1853 till his death in 1886, and some of whose characteristics went to the portrait of the "Squire" in *Robert Elsmere*. In 1872 she married Thomas Humphry Ward (b. 1845), then fellow and tutor of Brasenose, and one of the authors of the *Oxford Spectator*. Mr Humphry Ward, a son of the

Rev. Henry Ward, Vicar of St Barnabas, King's Square, London, E.C., remained at Oxford till 1880, and then went to London to take up literary work; with the help of the chief critics of the day he brought out the important selections of English verse called *The English Poets* (4 vols., 1880–1881). He joined the staff of *The Times* and wrote much for that paper, becoming its principal art critic. He also published *Humphry Sandwith, a Memoir* (1884); and he edited *Men of the Reign* (1885), *English Art in the Public Galleries of London* (1886), *Men of the Time* (1887), and, with the help of Matthew Arnold, Huxley, Lord Wolseley, H. S. Maine and others, *The Reign of Queen Victoria: a Survey of Fifty Years of Progress* (1887).

Mrs Humphry Ward at first devoted herself to Spanish literature, and contributed articles on Spanish subjects to the *Dictionary of Christian Biography*, edited by Dr William Smith and Dr Henry Wace. She wrote also for *Macmillan's Magazine*. In 1881 she published her first book, *Milly and Olly*, a child's story illustrated by Lady (then Mrs) Alma-Tadema. This was followed in 1884 by a more ambitious, though slight, study of modern life, *Miss Bretherton*, the story of an actress. In 1885 Mrs Ward published an admirable translation of the *Journal* of the Swiss philosopher Amiel, with a critical introduction, which showed her delicate appreciation of the subtleties of speculative thought. It was no bad preparation for her next book, which was to make her famous. In February 1888 appeared *Robert Elsmere*, a powerful novel, tracing the mental evolution of an English clergyman, of high character and conscience and of intellectual leanings, constrained to surrender his own orthodoxy to the influence of the "higher criticism." The character of Elsmere owed much to reminiscences both of T. H. Green, the philosopher, and of J. R. Green, the historian. Largely in consequence of a review by W. E. Gladstone in the *Nineteenth Century* (May 1888, "Robert Elsmere and the Battle of Belief"), the book became the talk of the civilized world. It ran in five months through seven editions in three-volume form, and the cheap American editions had an enormous sale. It was translated into several European languages, and was the subject of articles in learned foreign reviews. *Robert Elsmere* is in itself a fine story, notably in its picture of the emotional conflict between Elsmere and his wife, whose over-narrow orthodoxy brings her religious faith and their mutual love to a terrible *impasse*; but it was the detailed discussion of the "higher criticism" of the day, and its influence on Christian belief, rather than its power as a piece of dramatic fiction, that gave the book its exceptional vogue. It started, as no academic work could have done, a popular discussion on historic and essential Christianity. In 1890 Mrs Ward took a prominent part in founding University Hall, an "Elsmerian" settlement for working and teaching among the poor. Her next novel, *David Grieve*, was published in 1892. In *Marcella* (1894), and its sequel *Sir George Tressady* (1896), she broke new ground in the novel of modern politics and socialism, the fruit of observation and reflection at University Hall. In 1895 had appeared the short tragedy, the *Story of Bessie Costrell*. Mrs Ward's next long novel, *Helbeck of Bannisdale* (1898), treated of the clash between the ascetic ideal of Roman Catholicism and modern life. The element of Catholic and humanistic ideals entered also into *Eleanor* (1900), in which, however, the author relied less on the interest of a thesis and more on the ordinary arts of the novelist. *Eleanor* was dramatized and played at the Court Theatre in 1902. In *Lady Rose's Daughter* (1903)—dramatized as *Agatha* in 1905—and *The Marriage of William Ashe* (1905), modern tales founded on the stories respectively of Mlle de Lespinasse and Lady Caroline Lamb, she relied entirely and with success upon social portraiture. Later novels were *Fenwick's Career* (1906), *Diana Mallory* (1908), *Daphne* (1909) and *Canadian Born* (1910).

Mrs Ward's eminence among latter-day women-novelists arises from her high conception of the art of fiction and her strong grasp of intellectual and social problems, her descriptive power (finely shown in the first part of *Robert Elsmere*) and her command of a broad and vigorous prose style. But her activities were not confined to literature. She was the originator in England of the Vacation Schools, which have done much to educate the poorest children of the community upon rational lines. She also took a leading part in the movement for opposing the grant of the parliamentary suffrage to women, whilst encouraging their active participation in the work of local government. She was one of the founders of the Women's National Anti-Suffrage League in 1908, and both spoke and wrote repeatedly in support of its tenets.

See for bibliography up to June 1904, *English Illustrated Magazine*, vol. xxxi. (N.S.) pp. 294 and 299. (H. Ch.)

WARD, SETH (1617–1689), English bishop, was born in Hertfordshire, and educated at Sidney Sussex College, Cambridge, where he became fellow in 1640. In 1643 he was chosen university mathematical lecturer, but he was deprived of his fellowship next year for opposing the Solemn League and Covenant. In 1649 he became Savilian professor of astronomy at Oxford, and gained a high reputation by his theory of planetary motion, propounded in the works entitled *In Ismaelis Bullialdi astronomiae philolaicae fundamenta inquisitio brevis* (Oxford, 1653), and *Astronomia geometrica* (London, 1656). About this time he was engaged in a philosophical controversy with Thomas Hobbes. He was one of the original members of the Royal Society. In 1659 he was appointed master of Trinity College, Oxford, but not having the statutory qualifications he resigned in 1660. Charles II. appointed him to the livings of St Lawrence Jewry in London, and Uplowman, Devonshire, in 1661. He also became dean of Exeter (1661) and rector of Breock, Cornwall (1662). In the latter year he was consecrated bishop of Exeter, and in 1667 he was translated to the see of Salisbury. The office of chancellor of the Order of the Garter was conferred on him in 1671. In his diocese he showed great severity to nonconformists, and rigidly enforced the act prohibiting conventicles. He spent a great deal of money on the restoration of the cathedrals of Worcester and Salisbury. He died at Knightsbridge on the 6th of January 1688/1689.

WARD, WILLIAM (1766–1826), English mezzotint-engraver, an elder brother of James Ward (*q.v.*), was born in London in 1766. He was the most distinguished pupil of J. Raphael Smith, and executed a great part of many of the plates which bear the name of that excellent engraver. In 1795 he began to exhibit in the Royal Academy, of which in 1814 he was elected an associate engraver. He also held the appointment of mezzotint-engraver to the prince regent and the duke of York. He executed six plates after Reynolds, engraved many of the works of his brother-in-law, George Morland, and his mezzotints after Andrew Geddes, which include the full-lengths of Sir David Wilkie and of Patrick Brydone, are of great merit. His engravings are full of artistic spirit, and show fine feeling for colour; and they are excellently tender and expressive in their rendering of flesh. He died in London on the 1st of December 1826.

WARD, WILLIAM GEORGE (1812–1882), English Roman Catholic theologian, was born on the 21st of March 1812. His career is extremely interesting as illustrating the development of religious opinion at a remarkable crisis in the history of English religious thought. Ward is described by his son and biographer as somewhat unequally gifted by nature. For pure mathematics he had a special gift—almost a passion. For history, applied mathematics—for anything, in fact, outside the exact sciences—he felt something approaching to contempt. He was endowed with a strong sense of humour and a love of paradox carried to an extreme. He went up to Christ Church, Oxford, in 1830, but his father's subsequent pecuniary embarrassments compelled him in 1833 to try for a scholarship at Lincoln College, which he succeeded in obtaining. His examination for mathematical honours exhibited some of the peculiarities of his character and mental powers. Four out of his five papers on applied mathematics were sent up absolutely blank. Honours, however, were not refused him, and in 1834 he obtained an open fellowship at Balliol. In the previous year the Tractarian movement had commenced, and Ward's relations with that movement were as original as the rest of his life. He was attracted to it by his hatred of moderation and what he called "respectability" in any shape—a characteristic of which some amusing instances have been handed down. He was repelled from it by the conception he had formed of the character of Newman, whom he regarded as a mere antiquary. When, however, he was at length persuaded by a friend to go and hear Newman preach, he at once became a disciple. But he had, as Newman afterwards said of him, "struck into the movement at an angle." He had no taste for historical investigations. He treated the question at issue as one of pure logic, and disliking the Reformers, the right of private judgment which Protestants claimed, and the somewhat prosaic uniformity of the English Church, he flung himself into a general campaign against Protestantism in general and the Anglican form of it in particular. He nevertheless took deacon's orders in 1838 and priest's orders in 1840.

In 1839 Ward became the editor of the *British Critic*, the organ of the Tractarian party, and he excited suspicion among the adherents of the Tractarians themselves by his violent denunciations of the Church to which he still belonged. In 1841 he urged the publication of the celebrated "Tract XC.," and wrote in defence of it. From that period Ward and his associates worked undisguisedly for union with the Church of Rome, and in 1844 he published his *Ideal of a Christian Church*, in which he openly contended that the only hope for the Church of England lay in submission to the Church of Rome. This publication brought to a height the storm which had long been gathering. The university of Oxford was invited, on the 13th of February 1845, to condemn "Tract XC.," to censure the *Ideal*, and to degrade Ward from his degrees. The two latter propositions were carried and "Tract XC." only escaped censure by the *non placet* of the proctors, Guillemard and Church. The condemnation precipitated an exodus to Rome. Ward left the Church of England in September 1845, and was followed by many others, including Newman himself. After his reception into the Church of Rome, Ward gave himself up to ethics, metaphysics and moral philosophy. He wrote articles on free will, the philosophy of theism, on science, prayer and miracles for the *Dublin Review*. He also dealt with the condemnation of Pope Honorius, carried on a controversial correspondence with John Stuart Mill, and took a leading part in the discussions of the Metaphysical Society, founded by Mr James Knowles, of which Tennyson, Huxley and Martineau were also prominent members. He was a vehement opponent of Liberal Catholicism. In 1851 he was made professor of moral philosophy at St Edmund's College, Ware, and was advanced to the chair of dogmatic theology in 1852. In 1868 he became editor of the *Dublin Review*. He gave a vigorous support to the promulgation of the dogma of Papal Infallibility in 1870. After his admission into the Roman Catholic Church he had, rather to the dismay of his friends, entered the married state, and for a time had to struggle with poverty. But his circumstances afterwards improved. He died on the 6th of July 1882. (J. J. L.*)

See *William George Ward and the Oxford Movement* (1889); and *William George Ward and the Catholic Revival* (1893), by his son, Wilfrid Philip Ward (b. 1856), who has also written the *Life and Times of Cardinal Wiseman*; and *Ten Personal Studies* (1908).

WARD, that which guards or watches and that which is guarded or watched. The word is a doublet of "guard," which was adapted from the French comparatively late into English. Both are to be referred to the Teutonic root *war-*, to protect, defend, cf. "wary," "warn," "beware," O. Eng. *weard*, Ger. *warten*, &c., and the English "guardian," "garrison," &c. The principal applications of the term are, in architecture, to the inner courts of a fortified place; at Windsor Castle they are called the upper and lower wards (see Bailey, Castle); to a ridge of metal inside a lock blocking the passage of any key which has not a corresponding slot into which the ridge fits, the slot in the key being also called "ward" (see Locks). Another branch of meaning is to be found in the use of the word for a division into which a borough is divided for the purpose of election of councillors, or a parish for election of guardians. It was also the term used as equivalent to "hundred" in Northumberland and Cumberland. To this branch belongs the use for the various large or small separate rooms in a hospital, asylum, &c., where patients are received and treated. The most general meaning of the word is for a minor or person who is under a guardianship (see Infant, Marriage and Roman Law).

WARDEN, a custodian, defender, guardian (see Guardian, a word with which it is etymologically identical). The word is frequently employed in the ordinary sense of a watchman or guardian, but more usually in England in the sense of a chief or head official. The lords wardens of the marches, for example, were powerful nobles appointed to guard the borders of Scotland and of Wales; they held their lands *per baroniam*, the king's writ not running against them, and they had extensive rights of administrating justice. The chief officer of the ancient stannaries of Cornwall has the title of lord warden (see Stannaries), as has also the governor of Dover Castle (see Cinque Ports). Warden was until 1870 the alternative title of the master of the mint, and "warden of the standards" the title of the head of the Standards office (see Standards). The principal or head of several of the colleges of Oxford University is also termed warden.

WARDHA, a town and district of British India, in the Nagpur division of the Central Provinces, which take their name from the Wardha river. The town is situated 49 m. S.W. of Nagpur by rail. Pop. (1901) 9872. It was laid out in 1866, shortly after the district was first constituted. It is an important centre of the cotton trade.

The District of Wardha has an area of 2428 sq. m. It is hilly in the north, and intersected by spurs from the Satpura range. The central portion includes the three peaks of Malegaon (1726 ft.), Nandgaon (1874 ft.), and Jaitgarh (2086 ft.). From this cluster of hills numerous small streams lead to the Wardha river on the one side, while on the other the Dham, Bor, and Asoda flow down the length of the district in a south-easterly direction. The Wardha, and its affluent the Wanna, are the only rivers of any importance. To the south the country spreads out in an undulating plain, intersected by watercourses, and broken here and there by isolated hills rising abruptly from the surface. In general the lowlands are well wooded. Leopards, hyenas, wolves, jackals and wild hog abound in the district; other animals found are the spotted deer, *nilgai* and antelope. The district is subject to great variations of climate, and the rainfall at Wardha town averages 41 in. In 1901 the population was 385,103, showing a decrease of 4% in the decade. The principal crops are cotton, millet, wheat and oil-seeds. This region supplies the cotton known in the market as Hinganghat. There are cotton-mills at Hinganghat and Palgaon, and many factories for ginning and pressing cotton. The district is traversed by the Nagpur line of the Great Indian Peninsula railway. A branch runs from Wardha town past Hinganghat to the Warora coal-field in the district of Chanda. The history of Wardha forms part of that of Nagpur district, from which it was separated in 1862 for administrative purposes.

See *Wardha District Gazetteer* (Allahabad, 1906).

WARDLAW, ELIZABETH, Lady (1677–1727), reputed author of *Hardyknute*, second daughter of Sir Charles Halket, was born in April 1677. She married in 1696 Sir Henry Wardlaw, Bart., of Pitreavie. The ballad of *Hardyknute*, published in 1719 as an old poem, was supposed to have been discovered by her in a vault at Dunfermline, but no MS. was ever produced; and in the 1767 edition of Percy's *Reliques* the poem was ascribed to her. The beautiful ballad of *Sir Patrick Spens* (F. J. Child, *English and Scottish Popular Ballads*, ii. 17) has been also asserted to be her work, one of the supporters of the theory being Robert Chambers (*Remarks on Scottish Ballads*, 1859). The level of accomplishment in *Hardyknute*, however, gives no reason for supposing that Lady Wardlaw was capable of producing *Sir Patrick Spens*.

See Norval Clyne, *The Romantic Scottish Ballads and the Lady Wardlaw Heresy* (1859), and J. H. Watkins, *Early Scottish Ballads* (Glasgow, 1867).

WARDLAW, HENRY (d. 1440), Scottish prelate, was a son of Sir Andrew Wardlaw and a nephew of Walter Wardlaw (d. 1390), bishop of Glasgow, who is said to have been made a cardinal by the anti-pope Clement VII. in 1381. Educated at the universities of Oxford and of Paris, Henry Wardlaw returned to Scotland about 1385, and owing to his influential connexions received many benefices in the Church. He passed some time at Avignon, and it was whilst he was residing at the papal court that he was chosen bishop of St Andrews, being consecrated in 1403. Returning to Scotland he acted as tutor to the future king, James I., and finished the work of restoring his cathedral. Then having helped to bring about the release of James from his captivity in England, he crowned this king in May 1424, and afterwards acted as one of his principal advisers. He appears to have been an excellent bishop, although he tried to suppress the teaching of John Wycliffe by burning its advocates. He died on the 6th of April 1440. Wardlaw's chief title to fame is the fact that he was the founder of the university of St Andrews, the first Scottish university. He issued the charter of foundation in February 1411, and the privileges of the new seat of learning were confirmed by a bull of Pope Benedict XIII., dated the 28th of August 1413. The university was to be "an impregnable rampart of doctors and masters to resist heresy."

WARDROBE, a portable upright cupboard for storing clothes. The earliest wardrobe was a chest, and it was not until some degree of luxury was attained in regal palaces and the castles of powerful nobles that separate accommodation was provided for the sumptuous apparel of the great. The name of wardrobe was then given to a room in which the wall-space was filled with cupboards and lockers—the drawer is a comparatively modern invention. From these cupboards and lockers the modern wardrobe, with its hanging spaces, sliding shelves and drawers, was slowly evolved. In its movable form as an oak "hanging cupboard" it dates back to the early 17th century. For probably a hundred years such pieces, massive and cumbrous in form, but often with well-carved fronts, were made in fair numbers; then the gradual diminution in the use of oak for cabinet-making produced a change of fashion. Walnut succeeded oak as the favourite material for furniture, but hanging wardrobes in walnut appear to have been made very rarely, although clothes presses, with drawers and sliding trays, were frequent. During a large portion of the 18th century the tallboy (*q.v.*) was much used for storing clothes. Towards its end, however, the wardrobe began to develop into its modern form, with a hanging cupboard at each side, a press in the upper part of the central portion and drawers below. As a rule it was of mahogany, but so soon as satinwood and other hitherto scarce finely grained foreign woods began to be obtainable in considerable quantities, many elaborately and even magnificently inlaid wardrobes were made. Where Chippendale and his school had carved, Sheraton and Hepplewhite and their contemporaries obtained their effects by the artistic employment of deftly contrasted and highly polished woods. The first step in the evolution of the wardrobe was taken when the central doors, which had hitherto enclosed merely the upper part, were carried to the floor, covering the drawers as well as the sliding shelves, and were fitted with mirrors.

WARD-ROOM (*i.e.* the room of the guard), the cabin occupied by the commissioned officers, except the captain, in a man-of-war. In the wooden line-of-battle ships it was above the gun-room.

WARE, a market town in the Hertford parliamentary division of Hertfordshire, England, on the river Lea, 22 m. N. of London by a branch of the Great Eastern railway. Pop. of urban district (1901) 5573. The church of St Mary is a cruciform Decorated and Perpendicular building of flint and stone, consisting of chancel (built, it is supposed, by Lady Margaret Beaufort, countess of Richmond, and mother of Henry VII.), lady chapel to the south (*c.* 1380), nave of five bays of the time of Richard II., transepts, aisles, south porch and embattled tower of the time of Edward III. There is an elaborate Perpendicular font. The modern mansion of The Priory, to the west of the town, occupies the site of a priory of the order of St Francis, founded, according to Dugdale, by Hugh de Grantmaisnil, lord of Ware. A portion of the original building is incorporated in the modern one. Among public buildings are the corn exchange and the town-hall, which includes a literary institute and library. The famous "Great Bed of Ware," referred to in Shakespeare's *Twelfth Night*, which formerly was at the Saracen's Head in Ware, has been removed to Rye House, 2 m. distant, the scene of the Rye House plot of 1683 against Charles II. The town possesses breweries and brick-fields, and there is a large trade in malt, assisted by the navigation of the Lea to London. Near the village of Great Amwell (1 m. S.E.) are the sources of the New river, formed in 1606–1612 to supply London with water; and on a small island in the stream stands a monument to Sir Hugh Myddleton, through whose exertions this work was carried out.

WARE, a township of Hampshire county, Massachusetts, U.S.A., traversed by the Ware river, and about 25 m. E.N.E. of Springfield. Pop. (1880) 4817, (1890) 7329, (1900) 8263, of whom 3263 were foreign-born, (1910 census) 8774. Area 29·3 sq. m. The township is served by the Boston & Albany and Boston & Maine railways, and by two interurban electric lines. Its average elevation is about 550 ft. above sea-level. There is a public library (14,225 volumes in 1910). In 1905 the value of the factory products was $3,783,696, 23·2% more than in 1900. Among the manufactures are cotton and woollen goods, and boots and shoes. The township owns and operates its waterworks. Because of its hard and rough soil, Ware was not settled as early as the surrounding townships, the first permanent settlement being made in 1730. It was incorporated in 1742 as a precinct, in 1761 as a district (formed from parts of Brookfield, Palmer and Western, now Warren, and certain common lands), and in 1775 as a separate township. In 1823 additions were made from Brookfield and Western.

WAREHAM, a market town and municipal borough in the eastern parliamentary division of Dorsetshire, England, 121½ m. S.W. by W. from London by the London & South-Western railway. Pop. (1901) 2003. It lies between the rivers Frome and Piddle, 1½ m. above their outflow into Poole harbour. The town is of high antiquity, and is partially surrounded by earthworks probably of British construction. The church of St Mary contains a chapel dedicated to St Edward, commemorating that Edward who was murdered at Corfe Castle in this neighbourhood, whose body lay here before its removal to Shaftesbury. It also possesses a remarkable Norman font of lead. Two other ancient churches remain, but are not used for worship. There are ruins of a priory dedicated to SS. Mary, Peter and Ethelwold, and the site of the old castle may be traced. The town and neighbourhood have been long noted for their lime and cement, and large quantities of potters', pipe, fire and other kinds of clay are sent to Staffordshire and to foreign countries. The borough is under a mayor, 4 aldermen, and 12 councillors. Area 251 acres.

Owing to its situation as a key of Purbeck, the site of Wareham (*Werham, Warham*) has been occupied from early times. The earthworks, of British origin, were modified in almost every successive age. That Wareham was a pre-Saxon town is evident from Asser's statement that its British name was *Durngueir.* The early chroniclers declare that St Aldhelm founded a church near Wareham about 701, and perhaps the priory, which is mentioned as existing in 876, when the Danes retired from Cambridge to a strong position in this fort. Their occupation was not lengthy. Having made terms with Alfred, they broke the conditions and returned to Cambridge. In the following year they were again at Wareham, which they made their headquarters. Beorhtric, the immediate predecessor of Ecgbert, was buried here. Further incursions made by the Danes in 998 and in 1015 under Canute probably resulted in the destruction of the priory, on the site of which a later house was founded in the 12th century as a cell of the Norman abbey of Lysa, and in the decayed condition of Wareham in 1086, when 203 houses were ruined or waste, the result of misfortune, poverty and fire. The early castle, which existed before 1086, was important during the civil wars of Stephen's reign; in 1142 Robert, earl of Gloucester, on his departure for France, committed it to his son's charge. Stephen, however, surprised and took it, but it surrendered to the earl in the same year on the king's refusal to send it aid. John fortified it against Louis of France in 1216, and during the civil wars it was the scene of much fighting, being stormed by the parliamentary forces in 1644. Wareham was accounted a borough in Domesday Book, and the burgesses in 1176 paid 20 marks for a default. In 1180–1181 they rendered account of 5 marks for erecting a gild without licence. The fee-farm of the borough was obtained in 1211, on a fine of 100 marks. The constitution of Wareham underwent a change during the years 1326–1338, when the governing body of the bailiffs and commonalty were replaced by the mayor and bailiffs. In 1587 Elizabeth granted certain privileges to Wareham, but it was not incorporated until 1703, when the existing fairs for April 6 and August 23 were granted. The port was important throughout the middle ages, and was required to furnish four ships for the French war in 1334. Considerable trade was carried on with France and Spain, cloth, Purbeck stone and, later, clay being largely exported.

WARENNE, EARLS. The Warennes derived their surname from the river of Guarenne or Varenne and the little town of the same name near Arques in Normandy. William de Warenne, who crossed with William I. in 1066, was a distant cousin of the Conqueror, his grandmother having been the sister of Gunnora, wife of Richard I. of Normandy. De Warenne received as his share of English spoil some 300 manors in Yorkshire, Norfolk, Surrey and Sussex, including Lewes Castle. He was wounded at the siege of Pevensey and died in 1089, a year after he had received the title of earl of Surrey. Both he and his successors were more commonly styled Earl Warenne than earl of Surrey. His wife Gundrada, described on her monument as *stirps ducum*,[1] appears to have been a sister of Gharbod, earl of Chester.

Their son William, 2nd earl (*c.* 1071–1138), was a suitor for the hand of Matilda of Scotland, afterwards queen of Henry I. He was temporarily deprived of his earldom in 1101 for his support of Robert, duke of Normandy, but he commanded at the battle of Tenchebrai (1106), and was governor of Rouen in 1135. He carried off Elizabeth of Vermandois, granddaughter of Henry I. of France, and wife of Robert, count of Meulan, and married her in 1118 after her husband's death.

William de Warenne, 3rd earl (d. 1148), was, with his half-brother, Robert de Beaumont, early of Leicester, present at the battle of Lincoln, where his flight early in the day contributed to Stephen's defeat. He remained faithful to the queen during Stephen's imprisonment, and in 1146 he took the cross, and was killed near Laodicea in January 1148.

His daughter and heiress, Isabel, married in 1153 William de Blois, second son of King Stephen and Matilda of Boulogne, and in 1163 Hamelin Plantagenet, natural son of Geoffrey, count of Anjou. Both Isabel's husbands appear to have borne the title of Earl Warenne. Earl Hamelin was one of those who at the council of Northampton denounced Becket as a traitor; he remained faithful to his half-brother, Henry II., during the trouble with the king's sons, and in Richard I.'s absence on the crusade he supported the government against the intrigues of Prince John.

William de Warenne (d. 1240), son of Isabel and Hamelin, who succeeded to the earldom in 1202, enjoyed the special confidence of King John. In 1212, when a general rebellion was apprehended, John committed to him the custody of the northern shires; and he remained faithful to his master throughout the troubles which preceded the signing of the Charter. In 1216, as the king's situation became desperate, the earl repented of his loyalty, and, shortly before the death of John, made terms with Prince Louis. He returned, however, to his lawful allegiance immediately upon the accession of Henry III., and was, during his minority, a loyal supporter of the crown. He disliked, however, the royal favourites who came into power after 1227, and used his influence to protect Hubert de Burgh when the latter had been removed from office by their efforts (1232). Warenne's relations with the king became strained in course of time. In 1238 he was evidently regarded as a leader of the baronial opposition, for the great council appointed him as one of the treasurers who were to prevent the king from squandering the subsidy voted in that year. His son John de Warenne (*c.* 1231–1304) succeeded in 1240, and at a later date bore the style of earl of Surrey and Sussex. In the battle of Lewes (1264) he fought under Prince Edward, and on the defeat of the royal army fled with the queen to France. His estates were confiscated but were subsequently restored. He served in Edward I.'s Welsh campaigns, and took a still more prominent part in Scottish affairs, being the king's lieutenant in Scotland in 1296–1297. In September 1297 he advanced to Stirling, and, giving way to the clamour of his soldiers, was defeated by William Wallace on the 11th. He invaded Scotland early the next year with a fresh army, and, joining Edward in the second expedition of that year, commanded the rear at Falkirk

By his first wife, Alice of Lusignan, half-sister of Henry III., Earl Warenne had three children—Alice, who married Henry Percy, father of the 1st baron Percy; Isabella, who married John Baliol, afterwards king of Scots; and William, who predeceased his father, leaving a son John.

John de Warenne (1286–1347) succeeded his grandfather in 1304, and was knighted along with the prince of Wales in 1306, two days after his marriage with the prince's niece, Joanna, daughter of Eleanor of England, countess of Bar. From that time onwards he was much engaged in the Scottish wars, in which he had a personal interest, since John Baliol was his cousin and at one time his ward. As there were no children of his marriage, his nephew, Richard Fitzalan II., earl of Arundel (*c.* 1307–1376), became heir to his estates and the earldom of Surrey. His northern estates reverted to the crown, and the southern estates held by Joanna of Bar during her lifetime passed to Fitzalan. The Warrens of Poynton, barons of Stockport, descended from one of Earl Warenne's illegitimate sons by Isabella de Holland. Earl Warenne had received from Edward Baliol the Scottish earldom of Strathearn, but seems never to have established effective possession.

See G. E. C(okayne), *Complete Peerage*, vol. vii. (1896); and John Watson, *Memoirs of the Ancient Earls of Warren or Surrey* (2 vols., Warrington, 1782).

WAR GAME, or (in its German form) KRIEGSPIEL, a scientific game, played by representing the positions and movements of troops on a map. Kriegspiel is, as the name indicates, of German origin. A form of it, invented by Marshal Keith, and called Kriegs-schachsspiel (War Chess), was in vogue in the 18th century. In its present form it was invented by von Reisswitz (1794–1827), a Prussian officer, in 1824. As a game it quickly became fashionable at the German courts, and as a means of instruction it was promptly introduced into the Prussian army, whence it has spread to all the armies of the world. The idea of it has been applied also to naval warfare in recent times, the most usual form of naval war game being that designed by F. T. Jane about 1898.

In the military game the positions of troops are marked on maps, movements are made under regulations and the whole or portions of past campaigns can be reproduced in outline of fair accuracy, or more usually hypothetical manœuvres may be formulated for study and instruction. The materials required are at least three copies of the same map, drawn to such scale as may be suitable to the magnitude of the operations to be represented. If the scheme is one for small numbers of troops, maps of large scale are essential, as small features of the ground largely influence the action of small bodies, and it is only on large-scale maps that the real influence of small features can readily be appreciated. Conversely, with large bodies, maps on a diminished scale are convenient. A great amount of detail is necessary in all maps drawn for military purposes; heights, roads, buildings, water-courses, fences and the nature of the ground, all enter into the question of the feasibility or the reverse of military operations; and where the map is the actual field of manœuvre, the features of the natural field must be adequately supplied. Blocks, cut or moulded to scale, represent the different units of the combatants; and are coloured (generally red and blue) to distinguish the opposing forces. Some pairs of dividers and a few measures of the same scale as the maps employed complete the material outfit. Printed regulations for the conduct of kriegspiel are of small value; and although rules have been drafted at various times and in many languages, they have generally been allowed to lapse, practice having proved that the decision of a competent umpire is of more value, as to the soundness or unsoundness of a military manœuvre, than a code of regulations which inevitably lack elasticity.

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[1] See R. E. Chester Watson, "Gundrada," in the *Jnl. of the Arch. Inst.*, xli. p. 108.

The usual course of procedure varies but little in the different countries in which the system has been employed. The central map screened from the view of the combatants is used by the umpire, who places on it the forces of both sides; copies are on either hand behind screens or in adjoining rooms, and on them representative blocks are placed in positions which agree with the information possessed by each respective commander. A scheme is formulated such as may occur in war, and a "General Idea" or "Narrative" is the common property of both sides. This contains those items of common knowledge which would be in the possession of either commander in the field. The General Idea is supplemented by "special ideas," issued one to each of the combatants, supplying the information which a commander might reasonably be expected to have of the details of his own force. A third series of instructions is issued, entitled "Orders," which define to each commander the object to be attained; and on receipt of these he is required to draft specific orders, such as, in manœuvre or in war, would be considered necessary for issue to field units in the assumed circumstances. Then the game begins. The units of artillery, cavalry, infantry or train-wagons advance or retreat at a rate approximately regulated to their normal pace. Information gained by advancing patrols is brought at realistic speed to its destination; and no alteration in the ordered movements of a unit is allowed, till expiration of the calculated time for the transmission of the intelligence and for the issue of fresh orders. So the exercise progresses, each movement is marked, and periodically the blocks on the three maps are placed as they would be at a simultaneous moment. Smaller units yield to larger ones of the enemy; equal forces, if unassisted by superiority of position, "contain" one another, and are practically neutralized till reinforcements arrive and equilibrium is overthrown.

The decisions of the umpire are all-important, and it is he who makes or mars the value of the instruction. Some axioms must be universally accepted for the guidance both of himself and of the players. A force arrayed within effective range on the flank of an equal and hostile force has the better position of the two. Artillery in position with an unimpeded glacis is a terrible task for a frontal attack. Cavalry, as such, is ineffective in woodlands, marshes or a country broken up by cross hedges or wire fencing. Infantry in masses is an ideal target for efficient artillery, and in scattered bodies affords opportunities for attack by well-handled cavalry. The just application of the ideas contained in these few sentences to the varying stages of a combat is no mean task for a cultured soldier.

One of many difficulties encountered in war is the lack of accurate information. Any one man's view of details spread over large areas of country is extremely limited; and even with the greatest precautions against unreality, a commander's information is vastly more accurate over the extended units of his mimic force at kriegspiel than when the forces so represented are men, horses and machines, wrapped in dust or in smoke, and partially obscured by accidents of the ground too insignificant for reproduction on the map. Yet whilst accepting a certain unreality in kriegspiel, and to a less degree in field manœuvres, both by one and the other military training and education are furthered. The framing of orders follows identical lines at kriegspiel, at manœuvres or in war. The movement of troops in mimic warfare should be brought to harmonize as far as possible with reality. Up to a point this is relatively easy, and depends chiefly on the quality of the umpiring. But directly the close contact of important bodies of troops is represented on paper, imagination, not realism, governs the results. Even this, however, can be tempered, as regards the larger problems of the tactical grouping of forces, by the wisdom and experience of the umpire. It is true that military history teems with tactical events that no map can reproduce and no seer could have prophesied. But the greater an officer's familiarity with military history, the more likely he is to provide the margin of safety against such incidents in his dispositions, and thus kriegspiel, even in the domain of general tactics, is of invaluable assistance as a means of applying sound principles, learned in other ways, to concrete cases.

WARGLA, a town in the Algerian Sahara, 175 m. S.W. of Biskra on the caravan route to the Niger countries, and a starting-point for the exploration of the southern part of the Sahara. Pop. (1906) 3579, the majority of mixed Berber and negro blood. The town is walled and is entered by six gateways, which are fortified. The French fort, barracks, hospital and other buildings are south of the native town. Wargla lies in an oasis containing many palm trees. It claims to be the oldest town in the Sahara, and was for a long time self-governing, but eventually placed itself under the protection of the sultan of Morocco. The sultan, however, had ceased to have any power in the town some time previous to the French occupation. Wargla was first occupied for the French in 1853 by native allies, but it was not until 1872 that the authority of France was definitely established. The importance of the town as a trans-Saharan trade centre has greatly declined since the suppression of slave-trading by the French. The oasis in which Wargla is situated contains two or three other small fortified *ksurs* or villages, the largest and most picturesque being Ruissat. The total population of the oasis is about 12,000.

WARHAM, WILLIAM (*c.* 1450–1532), archbishop of Canterbury, belonged to a Hampshire family, and was educated at Winchester and New College, Oxford, afterwards practising and teaching law both in London and Oxford. Later he took holy orders, held two livings, and became master of the rolls in 1494, while Henry VII. found him a useful and clever diplomatist. He helped to arrange the marriage between Henry's son, Arthur, and Catherine of Aragon; he went to Scotland with Richard Foxe, then bishop of Durham, in 1497; and he was partly responsible for several commercial and other treaties with Flanders, Burgundy and the German king, Maximilian I. In 1502 Warham was consecrated bishop of London and became keeper of the great seal, but his tenure of both these offices was short, as in 1504 he became lord chancellor and archbishop of Canterbury. In 1509 the archbishop married and then crowned Henry VIII. and Catherine of Aragon, but gradually withdrawing into the background he resigned the office of lord chancellor in 1515, and was succeeded by Wolsey, whom he had consecrated as bishop of Lincoln in the previous year. This resignation was possibly due to his dislike of Henry's foreign policy. He was present at the Field of the Cloth of Gold in 1520, and assisted Wolsey as assessor during the secret inquiry into the validity of Henry's marriage with Catherine in 1527. Throughout the divorce proceedings Warham's position was essentially that of an old and weary man. He was named as one of the counsellors to assist the queen, but, fearing to incur the king's displeasure and using his favourite phrase *ira principis mors est*, he gave her very little help; and he signed the letter to Clement VII. which urged the pope to assent to Henry's wish. Afterwards it was proposed that the archbishop himself should try the case, but this suggestion came to nothing. He presided over the Convocation of 1531 when the clergy of the province of Canterbury voted £100,000 to the king in order to avoid the penalties of *praemunire*, and accepted Henry as supreme head of the church with the saving clause "so far as the law of Christ allows." In his concluding years, however, the archbishop showed rather more independence. In February 1532 he protested against all acts concerning the church passed by the parliament which met in 1529, but this did not prevent the important proceedings which secured the complete submission of the church to the state later in the same year. Against this further compliance with Henry's wishes Warham drew up a protest; he likened the action of Henry VIII. to that of Henry II., and urged Magna Carta in defence of the liberties of the church. He died on the 22nd of August 1532 and was buried in Canterbury cathedral. Warham, who was chancellor of Oxford University from 1506 until his death, was munificent in his public, and moderate in his private life. As archbishop he seems to have been somewhat arbitrary, and his action led to a serious quarrel with Bishop Foxe of Winchester and others in 1512.

See W. F. Hook, *Lives of the Archbishops of Canterbury* (1860–1876); J. Gairdner in *Dict. Nat. Biog.*, vol. lix. (1899), and *The English Church in the 16th Century* (1902); J. S. Brewer, *Reign of Henry VIII.* (1884); and A. F. Pollard, *Henry VIII.* (1905).

WARKWORTH, a small town in the Wansbeck parliamentary division of Northumberland, England, 32 m. N. of Newcastle-upon-Tyne by the North-Eastern railway. Pop. (1901) 712. It is beautifully situated in a hollow of the river Coquet, 1½ m. above its mouth, where on the S. bank is Amble, an urban district (pop. 4428), with a harbour. An ancient bridge of two arches crosses the river, with a fortified gateway on the road mounting to the castle, the site of which is surrounded on three sides by the river. Of this Norman stronghold there are fine remains, including walls, a gateway and hall; while the remainder, including the Lion tower and the keep, is of the 13th and 14th centuries. Roger Fitz-Richard held the manor and probably built the earliest parts of the castle in the reign of Henry II. The lordship came to the Percies in Edward III.'s reign and is still held by their descendants the dukes of Northumberland, though it passed from them temporarily after the capture of the castle by Henry IV. in 1405, and again on the fall of the house of Lancaster. The foundation of Warkworth church is attributed to Ceolwulf, king of Northumbria (*c.* 736), who subsequently became a monk. It was the scene of a massacre by a Scottish force sent by William the Lion in 1174. The church is principally of Norman and Perpendicular work, but remains of the Saxon building have been discovered. In the vicinity are remains of a Benedictine priory of the 13th century. By the side of the Coquet above the castle is the Hermitage of Warkworth. This remarkable relic consists of an outer portion built of stone, and an inner portion hewn from the steep rock above the river. This inner part comprises a chapel and a smaller chamber, both having altars. There is an altar-tomb with a female effigy in the chapel. From the window between the inner chamber and the chapel, and from other details, the date of the work may be placed in the latter part of the 14th century, the characteristics being late Decorated. The traditional story of the origin of the hermitage, attributing it to one of the Bertrams of Bothal Castle in this county, is told in Bishop Percy's ballad *The Hermit of Warkworth* (1771). At Amble are ruins of a monastic toll-house, where a tax was levied on shipping; and Coquet Island, 1 m. off the mouth of the river, was a monastic resort from the earliest times, like the Farne and Holy Islands farther north. The harbour at Amble has an export trade in coal and bricks, coal and fireclay being extensively worked in the neighbourhood, and an import trade in timber.

WARLOCK, a wizard, sorcerer or magician (see Magic). The word in O. Eng. is *wǽrloga*, literally "a liar against the truth," from *wǽr*, truth, cognate with Lat. *verum* (cf. Ger. *wahr*), and *loga*, liar, from *léogan*, to lie (cf. Ger. *lügen*). It was thus used with the meaning of a traitor, deceiver, a breaker of a truce. In M. Eng. it is found as a name for the devil (*warloghe*), the arch liar and deceiver. The use of the word for a sorcerer or wizard, one whose magic powers are gained by his league with the devil, seems to be a northern English or Scottish use.

WARMINSTER, a market town in the Westbury parliamentary division of Wiltshire, England, 100¼ m. W. by S. of London by the Great Western railway. Pop. of urban district (1901) 5547. Its white stone houses form a long curve between the uplands of Salisbury Plain, which sweep away towards the north and east, and the tract of park and meadow land lying south and west. The cruciform church of St Denys has a 14th-century south porch and tower. St Lawrence's chapel, a chantry built under Edward I., was bought by the townsfolk at the Reformation. Warminster has also a free school established in 1707, a missionary college, a training home for lady missionaries and a reformatory for boys. Besides a silk mill, malthouses and engineering and agricultural implement works, there is a brisk trade in farm produce.

Warminster appears in Domesday, and was a royal manor whose tenant was bound to provide, when required, a night's lodging for the king and his retinue. This privilege was enforced by George III. when he visited Longleat. The meeting of roads from Bath, Frome, Shaftesbury and Salisbury made Warminster a busy coaching centre. Eastward, within 2 m., there are two great British camps: Battlesbury, almost impregnable save on the north, where its entrenchments are double; and Scratchbury, a line of outworks encircling an area of some 40 acres, with three entrances and a citadel in the midst. Barrows are numerous. Longleat, a seat of the marquesses of Bath, lies 5 m. S.E., surrounded by its deer park, crossed from N. to S. by a long and narrow mere. The house is one of the largest and most beautiful examples in the county, dating from the close of the 16th century. Its name is derived from the "leat" or conduit which conveyed water from Horningsham, about 1 m. south, to supply the mill and Austin priory founded here late in the 13th century. The monastic estates passed at the Dissolution to the Thynne family, who built Longleat. Sir Christopher Wren added certain staircases and a doorway. In 1670 the owner was the celebrated Thomas Thynne satirized in Dryden's *Absalom and Achitophel*, and Bishop Ken found a home at Longleat for twenty years after the loss of his bishopric.

WARNER, CHARLES DUDLEY (1829–1900), American essayist and novelist, was born of Puritan ancestry, in Plainfield, Massachusetts, on the 12th of September 1829. From his sixth to his fourteenth year he lived in Charlemont, Mass., the scene of the experiences pictured in his delightful study of childhood, *Being a Boy* (1877). He removed thence to Cazenovia, New York, and in 1851 graduated from Hamilton College, Clinton, N.Y. He worked with a surveying party in Missouri; studied law at the university of Pennsylvania; practised in Chicago (1856–1860); was assistant editor (1860) and editor (1861–1867) of *The Hartford Press*, and after *The Press* was merged into *The Hartford Courant*, was co-editor with Joseph R. Hawley; in 1884 he joined the editorial staff of *Harper's Magazine*, for which he conducted "The Editor's Drawer" until 1892, when he took charge of "The Editor's Study." He died in Hartford on the 20th of October 1900. He travelled widely, lectured frequently, and was actively interested in prison reform, city park supervision and other movements for the public good. He was the first president of the National Institute of Arts and Letters, and, at the time of his death, was president of the American Social Science Association. He first attracted attention by the reflective sketches entitled *My Summer in a Garden* (1870; first published in *The Hartford Courant*), popular for their abounding and refined humour and mellow personal charm, their wholesome love of out-door things, their suggestive comment on life and affairs, and their delicately finished style, qualities that suggest the work of Washington Irving. Among his other works are *Saunterings* (descriptions of travel in eastern Europe, 1872) and *Back-Log Studies* (1872); *Baddeck, and That Sort of Thing* (1874), travels in Nova Scotia and elsewhere; *My Winter on the Nile* (1876); *In the Levant* (1876); *In the Wilderness* (1878); *A Roundabout Journey*, in Europe (1883); *On Horseback*, in the Southern States (1888); *Studies in the South and West, with Comments on Canada* (1889); *Our Italy*, southern California (1891); *The Relation of Literature to Life* (1896); *The People for Whom Shakespeare Wrote* (1897); and *Fashions in Literature* (1902). He also edited "The American Men of Letters" series, to which he contributed an excellent biography of *Washington Irving* (1881), and edited a large "Library of the World's Best Literature." His other works include his graceful essays, *As We Were Saying* (1891) and *As We Go* (1893); and his novels, *The Gilded Age* (in collaboration with Mark Twain, 1873); *Their Pilgrimage* (1886); *A Little Journey in the World* (1889); *The Golden House* (1894); and *That Fortune* (1889).

See the biographical sketch by T. R. Lounsbury in the *Complete Writings* (15 vols., Hartford, 1904) of Warner.

WARNER, OLIN LEVI (1844–1896), American sculptor, was born at West Suffield, Connecticut, on the 9th of April 1844. In turn an artisan and a telegraph operator, by 1869 he had earned enough money to support him through a course of study in Paris under Jouffroy and Carpeaux. He was in France when the Republic was proclaimed in 1870 and enlisted in the Foreign Legion, resuming his studies at the termination of the siege. In 1872 he removed to New York, where, however, he met with little success; he then went to his father's farm in Vermont, and worked for manufacturers of silver and plated ware as well as makers of mantel ornaments. He attracted the attention of Daniel Cottier, of the Cottier Art Galleries of New York, where Warner's work was exhibited, and some commissions gradually secured for him recognition. They were followed by busts of Alden Weir, the artist, and of Maud Morgan, the musician; some decorations for the Long Island Historical Society; statues of Governor Buckingham at the State Capitol, Hartford, Conn.; William Lloyd Garrison and General Charles Devens, at Boston; reliefs of several striking North American Indian types; a fountain for Portland, Oregon, and the designs for the bronze doors, "Tradition" and "Writing," of the Congressional Library at Washington, of which he lived to complete only the former, which contains the beautiful figures of "Imagination" and "Memory." Warner died in New York City on the 14th of August 1896. He was one of the five charter members of the Society of American Artists (1877), and in 1889 became an academician, National Academy of Design, New York. One of his best-known works is a "Diana." He designed the souvenir silver half-dollar piece for the Columbia Fair at Chicago, in 1893, making also some colossal heads of great artists for the art palace, and busts of Governors Clinton and Flower, of New York State.

WARNER, SETH (1743–1784), American Revolutionary soldier, was born in Roxbury, Connecticut, on the 17th of May 1743. He removed with his father to the "New Hampshire Grants" in 1763, and became prominent among the young men who forcibly resisted New York's claim to the territory (see VERMONT). At the outbreak of the War of Independence, he led the detachment of "Green Mountain Boys" which captured Crown Point (*q.v.*) on the 11th of May 1775, and took part in the unsuccessful expedition against Quebec later in the year. In July 1776 he became colonel in the Continental Army, and served throughout the war. He retired in 1782, and returned to Roxbury, where he died in 1784.

See Daniel Chipman, *Life* (Burlington, Vt., 1858).

WARNER, WILLIAM (1558?–1609), English poet, was born in London about 1558. He was educated at Magdalen Hall, Oxford, but left the university without taking a degree. He practised in London as an attorney, and gained a great reputation among his contemporaries as a poet. His chief work is a long poem in fourteen-syllabled verse, entitled *Albion's England* (1586), and dedicated to Henry Carey, 1st Baron Hunsdon. His history of his country begins with Noah, and is brought down to Warner's own time. The chronicle is by no means continuous, and is varied by fictitious episodes, the best known of which is the idyll in the fourth book of the loves of Argentille, the daughter of the king of Deira, and the Danish prince, Curan. Here Warner's simple art shows itself at its best. His book, perhaps on account of its patriotic subject, was very popular, but it is difficult to understand how Francis Meres came to rank him with Spenser as the chief heroical poets of the day, and to institute a comparison between him and Euripides. Warner died suddenly at Amwell in Hertfordshire on the 9th of March 1609.

His other works are *Pan his Syrinx, or Pipe, Compact of Seven Reedes* (1585), a collection of prose tales; and a translation of the *Menaechmi* of Plautus (1595). *Albion's England* consisted originally of four "books," but the number was increased in successive issues, and a posthumous edition (1612) contains sixteen books. It was reprinted (1810) in Alexander Chalmers's *English Poets.*

WARNSDORF, a town of Bohemia, Austria, 124 m. N.E. of Prague by rail. Pop. (1900) 21,150. Warnsdorf was formed in 1870 by uniting seven separate village communities, and is now one of the largest towns in Bohemia. It is a great industrial centre, especially for textiles.

WARORA, a town of British India, in Chanda district of the Central Provinces, on a branch of the Great Indian Peninsula railway. Pop. (1901) 10,626. Warora gives its name to a coalfield, which was worked by the government from 1871 to 1906; a fire-clay industry under the same management also raised fire-clay for bricks and tiles. The ginning and pressing of cotton is an important industry.

WARRANT (Med. Lat. *warantum*; O. Fr. *garant, warant*, derived from O.H.G. root represented in modern German by *gewähren*), in English law, an authority in writing empowering a person to do an act or to execute an office. The procedure known as *quo warranto* (*q.v.*) is used to determine the right to hold certain kinds of public office. The term "warrant" occurs very early in constitutional documents: it is found in the Assize of Clarendon and the Assize of the Forest, both in the reign of Henry II., but in neither case in its modern meaning. The original meaning seems to have been more akin to guarantee (*q.v.*), warranty or security; and to some extent the term implies something in the nature of a guarantee or representation by the person issuing the warrant that the person who acts on it can do so without incurring any legal penalty. The term is applied to a great variety of documents of very different kinds, which may be classified as (1) executive or administrative, (2) judicial or quasi-judicial and (3) financial or commercial.

1. *Executive and Administrative.*—While the royal prerogative was insufficiently defined and limited, a great many executive acts were authorized by royal warrant (*per speciale mandatum regis*), which now either depend on statute or are dealt with by departments of state without the need of recourse to the personal authority of the sovereign. Under present constitutional practice royal warrants are as a general rule countersigned by a member of the cabinet or other responsible officer of state. By an act of 1435 (18 Hen. VI. c. 1) letters patent under the great seal must bear the date of the royal warrant delivered to the chancellor for their issue. This act still applies to all patents, except for inventions. The form and countersignature of warrants for affixing the great seal is regulated by the Great Seal Act 1884. Pardon, which was granted for centuries only by letters patent under the great seal, has since 1827 in England and 1828 in Ireland been granted in case of felony by warrant under the royal sign manual countersigned by a secretary of state (7 & 8 Geo. IV. c. 28, s. 13; 9 Geo. IV. c. 54, s. 33). The prerogative of the crown with reference to the control of the navy and army is largely exercised by the issue of warrants. In 1871 the purchase of commissions in the army was abolished by royal warrant, said to have been authorized by statute (49 Geo. III. c. 126), but afterwards confirmed by parliament (34 & 35 Vict. c. 86). Under existing legislation for the government of the military forces of the crown royal warrants are used to form army corps, to deal with certain details as to pay and regimental debts, and with the militia and reserve forces. The convocation of naval courts-martial and the appointment of judge-advocate and provost-marshal at such court is by warrant of the Admiralty or of the officer on foreign or detached service who by his commission is entitled to convene such a court (see Naval Discipline Act 1866, s. 58; Army Act 1881, s. 179). A general court-martial for the army is constituted by royal warrant or convened by an officer authorized to convene such court, or his lawful delegate (Army Act 1881, s. 48). Appointments to certain offices under the crown are made by warrant of the king or of the appropriate department of state. In the navy and army the officers called warrant officers are so styled because they are appointed by warrant and do not hold commissions. In 1602 the censorship of the stage was committed to the poet Daniel by royal warrant (see THEATRE), and certain tradesmen to the court are described as "warrant holders," because of the mode of their appointment. Abuses of claims to this distinction are punishable (Merchandise Marks Act 1887, s. 20; Patents Act 1883, s. 107). Warrants under the royal sign manual are subject to a ten-shilling stamp duty (Stamp Act 1891). The issue of warrants under the hand of a secretary of state, so far as they affect personal liberty, depends in every case on statute, *e.g.* as to the surrender of fugitive criminals (EXTRADITION), or the deportation of undesirable aliens (see ALIEN), or the bringing up prisoners as witnesses in courts of justice. The right of a secretary of state or the lord-lieutenant in Ireland by express warrant in writing to detain or open letters in the post office was recognized by orders in council and proclamations in the 17th century and by various post office acts, and is retained in the Post Office Act 1836 (s. 25). The right was challenged, but was finally established by the reports of committees of both Houses appointed in 1844 on a complaint by Mazzini and others that Sir James Graham, then home secretary, had opened their letters. It was exercised as recently as 1881 over the letters of persons suspected of treasonable correspondence in Ireland. The warrant of a law officer of the crown for sealing letters patent for inventions (necessary under the old patent law) has been superseded by other procedure since the Patents Act 1883.

2. *Judicial and Quasi-Judicial Warrants.*—Unless a statute otherwise provides a judicial warrant must be in writing under the seal, if any, of the court, or under the hand and (or) seal of the functionary who grants it. Committal for breach of privilege of the House of Commons is by warrant of the Speaker. During the Tudor and Stuart reigns frequent attempts were made by the crown and great officers of state to interfere with personal liberty, especially as to offences of state. The legality of these proceedings was challenged by the judges in Elizabeth's reign. On the abolition of the Star Chamber it was enacted (16 Car. I. c. 10) that if any person

be imprisoned by warrant of the king in person, of the council board, or any of the privy council, he is entitled to a writ of *habeas corpus*, and the courts may examine into the legality of the cause of detention. This enactment, and the Habeas Corpus Act 1679, put an end to the interference of the executive with matters belonging to the judicature; but until 1763 there survived a practice by which a secretary of state issued warrants to arrest individuals for state offences, and to search or seize the books and papers of the accused. The latter practice was examined and declared illegal in the famous case of *Entick* v. *Carrington* (19 How. St. Tr. 1030). All privy councillors are included in the commission of the peace for every county. The council itself is said to have power to issue warrants of arrest for high treason, but the power, if it exists, is in abeyance in England. The special powers given to the lord-lieutenant of Ireland in 1881 (44 & 45 Vict. c. 5) expired in 1906. As a result of the gradual restriction of the royal prerogative, the term warrant has come in modern times oftenest to be used of documents issuing from courts of justice. Few documents issuing from the superior courts are called warrants. In these courts writs and orders are more generally used. In courts of record which try indictments a "bench warrant" is sometimes used for the arrest of an absent defendant, but the word warrant has for judicial purposes become most closely associated with the jurisdiction of justices of the peace. As a general rule no one can be arrested without warrant. To this rule there are certain exceptions either at common law or by statute. At common law a justice of the peace, a sheriff, a coroner, a constable and even a private person, may arrest any one without warrant for a treason, felony or breach of the peace committed, or attempted to be committed, in his presence. A constable (whether a constable at common law or a police constable appointed under the Police Acts) may arrest a person indicted for felony; a constable or a private person may arrest on reasonable suspicion that he who is arrested has committed a felony. But in the latter case he does so at his peril, for he most prove (what the constable need not) that there has been an actual commission of the crime by some one, as well as a reasonable ground for suspecting the particular person. What is a reasonable ground it is of course impossible to define, but, in the case of a constable, a charge by a person not manifestly unworthy of credit is generally regarded as sufficient. An accused person who has been bailed may be arrested by his bail, and the police may assist in the arrest. In neither case is a warrant necessary. Nor is it necessary for the apprehension of one against whom the hue and cry is raised. The king cannot arrest in person or by verbal command, as no action would lie against him for wrongful arrest. Statutory powers of arrest without warrant are given to both constables and private persons by many statutes, *e.g.* the Night Poaching Act 1828, certain of the Criminal Law Consolidation Acts of 1861, the Prevention of Crime Act 1871 and Police Acts. In those cases in which arrest without warrant is illegal or is found inexpedient, information in writing or on oath is laid before a justice of the peace setting forth the nature of the offence charged and to some extent the nature of the evidence implicating the accused; and upon this information, if sufficient in the opinion of the justice applied to, he issues his warrant for the arrest of the person incriminated. The warrant, if issued by a competent court as to a matter over which it has jurisdiction, becomes a judicial authority to the person who executes it, and resistance to such a warrant is a criminal offence. The possession of a legal warrant by a peace officer on arrest is of great importance in determining whether a person resisting apprehension is justified or not in his resistance. Should the officer attempt to apprehend him on a warrant manifestly illegal on its face, or without a warrant in a case where a warrant is necessary, and be killed in the attempt, the killing would probably be held to be manslaughter and not murder. Before bringing an action against constables for alleged illegal arrest under a justice's warrant the complainant must apply for the perusal and a copy of the warrant (24 Geo. II. c. 44, s. 6; Pollock, *Torts*, 6th ed., 117). Entry upon the land or seizure of property cannot as a rule be justified except under judicial warrant. The only common law warrant of this kind is the search warrant, which may be granted for the purpose of searching for stolen goods. Special powers for issuing such warrants are given by the Army, Merchant Shipping, Customs, Pawnbrokers and Stamp Acts, and for the discovery of explosives or appliances for coining and forgery. The Criminal Law Amendment Act 1885 allows the issue of search warrants where it is suspected that a female is unlawfully detained for immoral purposes. Execution of the decisions of a court of summary jurisdiction is secured by warrants, part of the process of the court, such as warrants of distress or commitment. A warrant may also issue for the apprehension of a witness whose attendance cannot be otherwise assured. The forms of warrants used by justices in indictable cases are scheduled to the Indictable Offences Act 1848. Those used for summary jurisdiction are contained in the Summary Jurisdiction Rules of 1886.

As a general rule, warrants must be executed within the local jurisdiction of the officer who issued them. Warrants, &c., issued by a judge of the High Court run through England, in criminal as well as in civil cases: and the same rule applies as to courts having bankruptcy jurisdiction. The warrants of justices of the peace can be executed on fresh pursuit within 7 m. of the boundary of the jurisdiction, and if properly backed by a local justice or officer in any other part of the British islands (see SUMMARY JURISDICTION). There is also a special provision as to executing warrants in the border counties of England and Scotland. Under the Extradition Acts and Fugitive Offenders Act 1881 provision is made for the issue of warrants in aid of foreign and colonial justice; but the foreign and colonial warrants have no force in the United Kingdom.

The word "warrant" is used as to a few judicial or quasi-judicial matters of civil concern, *e.g.* warrant to arrest a ship in an admiralty action *in rem*; and in the county courts warrants to the bailiffs of the court are used where in the High Court a writ to the sheriff would be issued, *e.g.* for attachment, execution, possession and delivery (see County Court Rules, 1903, scheduled forms). A warrant of distress for rent issued by a landlord to a bailiff is sometimes described as a private warrant, but it is in reality a peculiar quasi-judicial remedy derived from feudal relations between lord and vassal. Arrest in civil or quasi-civil proceedings is in certain cases effected under warrant, *e.g.* where a bankrupt fails to obey orders of the court for his attendance (Bankruptcy Act 1883, s. 25), and in certain cases where justices have summary jurisdiction.

Financial and Commercial.—Payment out of the treasury is generally made upon warrant. Treasury warrants are regulated by many of the acts dealing with the national debt.

Payment of dividends by trading corporations and companies is generally made by means of dividend warrants. Mercantile warrants are instruments giving a right to the delivery of goods, generally those deposited at a dock or warehouse, and by mercantile custom regarded as documents of title to the goods to which they relate. They have been recognized by the legislature, especially in the Factors Acts. Thus the interpretation clause of the Factors Act 1889 includes under the head of documents of title, dock warrants and warrants for the delivery of goods, and a fuller definition is given by s. 111 of the Stamp Act 1891, which imposes on such documents a stamp duty of 3d. Warrants of attorney are instruments authorizing an attorney to appear for the principal in an action and to consent to judgment. They must now be attested by a solicitor and registered in the Bill of Sale Office under the Debtors Act 1869. They are now little used. The forgery of any warrant of this kind or of any endorsement or assignment thereof is punishable under the Forgery Act 1861.

Scotland.—By art. xxiv. of the Articles of Union royal warrants were to continue to be kept as before the union. The Secretary for Scotland Act 1885 enabled the crown by royal warrant to appoint the secretary to be vice-president of the Scotch Education Department. The lord advocate's warrant runs throughout the whole of Scotland. Warrants issued by courts of summary jurisdiction agree in the main with those in use in England, though their names are not the same (see SUMMARY JURISDICTION). There are numerous statutory provisions as to warrants of other kinds. By the Debtors (Scotland) Act 1838 (1 & 2 Vict. c. 114) warrants for diligence, and to charge the debtor under pain of imprisonment, may be inserted in an extract of decree; and in a summons concluding for payment of money a warrant to arrest the movables, debts and money of the defender may be included. By the Court of Session Act 1868 (31 & 32 Vict. c. 100) a warrant of inhibition may be inserted in the will of a summons. A crown writ is a warrant for infeftment (31 & 32 Vict. c. 101). The same act gives forms of warrants of registration. The procedure of the sheriff court in its civil jurisdiction as to warrants of citation is regulated by the Sheriff Courts (Scotland) Act 1907 (7 Edw. VII. c. 51). The practice as to warrants of citation and commitment in the High Court of Justiciary and the sheriff court in its criminal jurisdiction now depends chiefly on the Criminal Procedure Act 1887 (50 & 51 Vict. c. 35). The *meditatio fugae* warrant is a judicial warrant on which imprisonment may follow until the debtor give *cautio judicio sisti*. It corresponds to some extent to the writ *ne exeat regno* of English practice, but it may be issued by a sheriff (1 & 2 Vict. c. 119, s. 25). Another kind of judicial warrant is a border warrant for arresting a debtor on the English side of the border. The warrant of attorney is not known in Scotland, its place being taken by the clause of registration, which is not avoided by the death of the person giving it.

United States.—By the constitutions of the United States and of almost all the states, warrants are not to issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched and the persons or thing to be seized. These provisions have been held not to mean that there shall be no arrest without warrant, but to confine the right of arrest to circumstances similar to those which justify it in English law. The constitutions of some states forbid general warrants. A warrant is generally necessary for the payment of money out of the United States or a state treasury. (W. F. C.)

WARRANT OF ATTORNEY. A warrant of attorney to confess judgment is a security for money (now practically obsolete) in the form of an authority to a solicitor named by a creditor, empowering him to sign judgment in an action against the debtor for the sum due, with a defeasance, or clause that the warrant shall not be put into force in case of due payment of the money secured. It was often used as a collateral security, either for the payment of an annuity or with mortgages, in order that the mortgagee, by entering up judgment, might obtain priority in the administration of the assets of the mortgagor. The Debtors Act 1869 contained various provisions for making known to the debtor the extent of the liability incurred by him, among others that the warrant must be executed in the presence of a solicitor named by the debtor, and that it and the defeasance must be written on the same paper. A warrant of attorney must be duly stamped, generally as a mortgage (*q.v.*), and must be registered as a judgment in the central office of the Supreme Court.

WARRANT-OFFICER, in the British navy, the name given to officers who rank next to those who hold commissions, being appointed by warrant. They include the master, purser, surgeon, gunner, boatswain and carpenter, the first three being of "ward-room rank," *i.e.* messing with the lieutenants. In the military forces a warrant-officer is appointed by a secretary of state's warrant, and ranks below the commissioned officers and above the non-commissioned officers. A warrant-officer often holds an honorary commission.

WARRANTY, etymologically, another form of GUARANTEE (*q.v.*). It is used, however, in a rather different sense. The sense common to both words is that of a collateral contract, under which responsibility for an act is incurred, and for the breach of which an action for damages lies. Warranty generally expresses the responsibility of the person doing the act, guarantee the responsibility of some other person on his behalf. A warranty may be defined, in the words of Lord Abinger, as "an express or implied statement of something which the party undertakes shall be part of the contract, and, though part of the contract, collateral to the express object of it" (*Chanter* v. *Hopkins*, 1838, 4 M. & W. 404). It differs from a condition in that a condition forms the basis of the contract and a breach of it discharges from the contract, and from a representation in that the latter does not affect the contract unless made a part of it expressly, or by implication as in contracts of insurance and other contracts *uberrimae fidei*, or unless it be fraudulent. These distinctions are not always accurately maintained. Thus in the Real Property Act 1845, § 4, condition seems to be used for warranty.

Warranty as it affected the law of real property was, before the passing of the Real Property Limitation Act 1833 and the Fines and Recoveries Act 1833, a matter of the highest importance. A warranty in a conveyance was a covenant real annexed to an estate of freehold, and either expressed in a clause of warranty or implied in cases where a feudal relation might exist between feoffor and feoffee. The warranty, as described by Littleton, § 697, was an outgrowth of feudalism, and something very like it is to be found in the *Liber Feudorum*. At the time of Glanvill the heir was bound to warrant the reasonable donations of his ancestor. Warranty was one of the elements in Bracton's definition of homage, 78*b*, "juris vinculum quo quis astringitur ad warrantizandum defendendum et acquietandum tenentem suum in seisina versus omnes." For an express warranty the word *warrantizo* or warrant was necessary. The word "give" implied a warranty, as did an exchange and certain kinds of partition. In order to bind heirs a clause of warranty was required. This was either lineal, collateral or commencing by disseisin. The differences between the three kinds were very technical, and depended on abstruse and obsolete learning. They are treated at great length in old works on real property, especially Coke upon Littleton by Butler, 364*b*. The feoffor or his heirs were bound by voucher to warranty or judgment in a writ of *warrantia chartae* to yield other lands to the feoffee in case of the eviction of the latter. Vouching to warranty was a part of the old fictitious proceedings in a common recovery in use for the purpose of barring an entail before the Fines and Recoveries Act. Warranty of this nature, as far as it relates to the conveyance of real estate, though not actually abolished in all possible cases, is now superseded by covenants for title. The more usual of these are now by the Conveyancing Act 1881 deemed to be implied in conveyances. For the implied warranties of title and quality see SALE OF GOODS. Vouching to warranty was at one time important in the law of personality as well as of reality. The procedure is fully described in Glanvill. The right of calling on the holder of lost or stolen goods to vouch to warranty (*interciare*), *i.e.* to give up the name of the person from whom he received them, under pain of forfeiture, was often granted under the name of *theam* as a local franchise. Warranty, as it exists at present in the law of personality, is either express or implied. There is no general rule as to what constitutes a warranty. It is not necessary that an express warranty should be in writing, the law being that every affirmation at the time of sale of personal chattels is a warranty, provided that it appears to have been so intended. The principal cases of implied warranty occur in the contracts of sale and insurance. There is also an implied warranty in other kinds of contract, *e.g.* of seaworthiness by the shipowner in a contract between him and a charterer for the hire of a ship. In all cases of implied warranty the warranty may be excluded by the special terms of the contract. For breach of warranty an action may be brought directly, or the breach may be used as ground for a counter claim or for reduction of damages, but the breach will not in the case of a warranty proper entitle the person suffering by it to a rescission of the contract. Thus in a sale the property passes although the warranty be broken. In some cases warranties on sale are the subject of statutory enactments, as the Merchandise Marks Acts and the Sale of Food and Drugs Acts. In some other acts, such as the Bills of Exchange Act 1882, the term warranty does not occur, but the practical effect is the same.

Scotland.—The term corresponding to warranty in the law of heritable property is "warrandice." Warranty, strictly speaking, seems confined to movables. Warrandice appears early in Scots law, the heir by *Regiam Majestatem* being bound to warrant the reasonable donations of his ancestor. Warrandice in the existing law is either real or personal. Real warrandice is that whereby warrandice lands are made over, as indemnity for those conveyed, to assure the person to whom they were conveyed from loss by the appearance of a superior title. Real warrandice is implied in excambion. Its effect is that the excamber, in case of eviction, may recover possession of his original lands. This is not in accordance with the English law in exchange. Personal warrandice is either express or implied. There is an implied warrandice in every onerous deed, and an absolute warrandice presumes an onerous consideration. Express warrandice is either simple, against the future acts of the vendor, from fact and deed, against acts whether past or future, or absolute, or against all deadly, that is, on any ground existing before the sale. A clause of warrandice is the Scottish equivalent of the English covenants for title. By the Titles to Land Consolidation (Scotland) Amendment Act 1869 a clause of warrandice in the form given in the schedule to the act imports absolute warrandice as regards the lands and the title-deeds thereof, and warrandice from fact and deed as regards the rents.

United States.—Warranty in conveyances of real estate is expressly abolished by statute in many states. In some states warranty is implied on the transfer and indorsement of negotiable instruments. (J. W.)

WARREN, GOUVERNEUR KEMBLE (1830–1882), American soldier, was born at Coldspring, New York, on the 8th of January 1830, and entered West Point in 1846, graduating in 1850. He was assigned to the engineers, and for several years was employed in survey work in the West, where he took part in some expeditions against the Indians. In 1859 he was made assistant instructor in mathematics at West Point. But two years later, at the outbreak of the Civil War, the scientific subaltern was made lieutenant-colonel of volunteers and posted to the newly raised 5th New York Volunteer Infantry. He was fully equal to the task, for his regiment was very soon brought into a state of marked efficiency. In August he was promoted colonel. He commanded a brigade of the V. corps at Gaines's Mill, Second Bull Run and Antietam, and was shortly afterwards promoted brigadier-general of Volunteers. During the Fredericksburg campaign he was on the engineer staff of the Army of the Potomac, but after Chancellorsville he was appointed chief of engineers in that army, and in that capacity rendered brilliant services at Gettysburg (*q.v.*), his reward being promotion to major-general U.S.V. and the brevet of colonel in the regular army. When the Army of the Potomac was reorganized in the spring of 1864 Warren returned to the V. corps as its commander.

His services in the Wilderness (*q.v.*) and Petersburg (*q.v.*) campaigns proved his fitness for this large and responsible command, but his naturally lively imagination and the engineer's inbred habit of caution combined to make him a brilliant but somewhat unsafe subordinate. He would have become one of the great chiefs of staff of history, or even a successful army commander, but he sometimes failed where a less highly gifted man would have succeeded. He was at his best when the military situation depended on his exercising his initiative, as on the first day in the Wilderness, in which his action saved the army, at his worst when, as on the 10th of May before Spottsylvania, he was ordered to attempt the impossible. On the latter occasion both Grant and Meade threatened to relieve him of his command, and Humphreys, the chief of staff of the army, was actually sent to control the movements of the V. corps. Similar incidents took place in the later stages of the campaign, and at last, at the critical moment preceding the battle of Five Forks, Sheridan, who was in charge of the operations, was authorized by Grant to relieve Warren of his command if he thought fit. The thoughtful Warren and the eager, violent Sheridan were ill-matched. At the outset the V. corps, being no longer composed of the solid troops of 1862 and 1863, fell into confusion, which Warren exerted himself to remedy, and in the event the battle was an important Union victory. But after it had ended Sheridan sent for Warren and, with no attempt to soften the blow, relieved him of his command. A court of inquiry was subsequently held, which entirely exonerated Warren from the reckless charges of apathy, almost of cowardice, which Sheridan brought against him. Shortly after Five Forks Warren resigned his volunteer commission, and received the brevet of brigadier-general in the regular army. After the war he was employed, in the substantive rank of major (1879 lieutenant-colonel) of engineers, in survey work and harbour improvements. General Warren died on the 8th of August 1882 at Newport, R.I. A statue to his memory was erected at Round Top, on the field of Gettysburg, on the sixth anniversary of his death.

WARREN, SIR JOHN BORLASE, Bart. (1753–1822), English admiral, was born at Stapleford, Nottinghamshire, on the 2nd of September 1753, being the son and heir of John Borlase Warren (d. 1775) of Stapleford and Little Marlow. He was educated at Emmanuel College, Cambridge, and in 1771 entered the navy as an able seaman; in 1774 he became member of parliament for Marlow; and in 1775 he was created a baronet, the baronetcy held by his ancestors, the Borlases, having become extinct in 1689. His career as a seaman really began in 1777, and two years later he obtained command of a ship. In April 1794, in charge of a squadron of frigates, Warren captured three French frigates, and in similar ways he did excellent service for some time in protecting British trade. In 1796 he is said to have captured or destroyed 220 vessels. Perhaps his best deed in the service was the defeat in October 1798 of a French fleet, carrying 5000 men, which it was intended to land in Ireland, a plan which he completely frustrated. In 1802 he was sent to St Petersburg as ambassador extraordinary, but he did not forsake the sea, and in 1806 he captured a large French warship, the "Marengo." He became an admiral in 1810, and was commander-in-chief on the North American station in 1813–1814. He died on the 27th of February 1822. His two sons predeceased their father, and his daughter and heiress, Frances Maria (1784–1837), married George Charles Venables-Vernon, 4th Lord Vernon (1779–1835). Their son was George John Warren Vernon, 5th Lord Vernon (1803–1866).

WARREN, JOSEPH (1741–1775), American politician, was born at Roxbury, Massachusetts, on the 11th of June 1741. He graduated from Harvard College in 1759, taught in a school at Roxbury in 1760–1761, studied medicine, and began to practise in Boston in 1764. The Stamp Act agitation aroused his interest in public questions. He soon became associated with Samuel Adams, John Adams and Josiah Quincy, Jr., as a leader of the popular party, and contributed articles and letters to the Boston *Gazette* over the signature "True Patriot." The efforts of Samuel Adams to secure the appointment of committees of correspondence met with his hearty support, and he and Adams were the two leading members of the first Boston committee of correspondence, chosen in 1772. As chairman of a committee appointed for the purpose, he drafted the famous "Suffolk Resolves," which were unanimously adopted by a convention at Milton (*q.v.*) on the 9th of September 1774. These "resolves" urged forcible opposition to Great Britain if it should prove to be necessary, pledged submission to such measures as the Continental Congress might recommend, and favoured the calling of a provincial congress. Warren was a member of the first three provincial congresses (1774–1775), president of the third, and an active member of the committee of public safety. He took an active part in the fighting on the 19th of April, was appointed major-general of the Massachusetts troops, next in rank to Artemas Ward, on the 14th of June 1775; and three days later, before his commission was made out, he took part as a volunteer, under the orders of Putnam and Prescott, in the battle of Bunker Hill (Breed's Hill), where he was killed. Next to the Adamses, Warren was the most influential leader of the extreme Whig faction in Massachusetts. His tragic death strengthened their zeal for the popular cause, and helped to prepare the way for the acceptance of the Declaration of Independence. Warren's speeches are typical examples of the old style of American political eloquence. His best-known orations were those delivered in Old South Church on the second and fifth anniversaries (1772 and 1775) of the "Boston Massacre."

The standard biography is Richard Frothingham's *Life and Times of Joseph Warren* (Boston, 1865).

WARREN, MERCY (1728–1814), American writer, sister of James Otis (*q.v.*), was born at Barnstable, Mass., and in 1754 married James Warren (1726–1808) of Plymouth Mass., a college friend of her brother. Her literary inclinations were fostered by both these men, and she began early to write poems and prose essays. As member of the Massachusetts House of Representatives (1766–1774) and its speaker (1776–1777 and 1787–1788), member (1774 and 1775) and president (1775) of the Provincial Congress, and paymaster-general in 1775, James Warren took a leading part in the events of the American revolutionary period, and his wife followed its progress with keen interest. Her gifts of satire were utilized in her political dramas, *The Adulator* (1773) and *The Group* (1775); and John Adams, whose wife Abigail was Mercy Warren's close friend, encouraged her to further efforts. Her tragedies, "The Sack of Rome" and "The Ladies of Castile," were included in her *Poems, Dramatic and Miscellaneous* (1790), dedicated to General Washington. Apart from their historical interest among the beginnings of American literature, Mercy Warren's poems have no permanent value. In 1805 she published a *History of the American Revolution,* which was coloured by somewhat outspoken personal criticism and was bitterly resented by John Adams (see his correspondence, published by the Massachusetts Historical Society, 1878). James Warren died in 1808, and his wife followed him on the 19th of October 1814.

See Elizabeth F. Ellet, *Women of the Revolution* (1856; new ed., 1900); an article by Annie Russell Marble in the *New England Magazine* (April 1903); Alice Brown, *Mercy Warren* (New York, 1896).

WARREN, MINTON (1850–1907), American classical scholar, was born at Pawtucket, Rhode Island, on the 29th of January 1850, a descendant of Richard Warren, who sailed in the "Mayflower" in 1620. He was educated at Tufts College and subsequently at Yale. After three years as a schoolmaster, he went to Germany to complete his studies in comparative philology and especially in Latin language and literature. Having taken the degree of doctor of philosophy at Strassburg in 1879, he returned to the United States as Latin professor at Johns Hopkins University. In 1899 he was appointed Latin professor at Harvard. His life-work was a new edition of Terence, which, however, he left unfinished at his death. He was director of the American School of Classical Studies in Rome (1897–1899), and president of the American Philological Association (1898). Among his publications are: "Enclitic *Ne* in Early Latin" (Strassburg dissert., reprinted in *Amer. Journ. of Philol.*, 1881); *On Latin Glossaries, with especial reference to the Codex Sangallensis* (St Gall Glossary) (Cambridge, U.S.A., 1885); *The Stele Inscription in the Roman Forum* (*Amer. Journ. of Philol.*, vol. xxviii. No. 3, and separately in 1908). He died on the 26th of November 1907.

See *Harvard Magazine* (Jan. 1908) and W. M. Lindsay in *Classical Review* (Feb. 1908).

WARREN, SAMUEL (1807–1877), English lawyer and author, son of Dr Samuel Warren, rector of All Souls', Ancoats, Manchester, was born near Wrexham in Denbighshire on the 23rd of May 1807. The elder Samuel Warren (1781–1862) became a Wesleyan minister, but was expelled by Conference in 1835 on account of his attitude towards proposals for the establishment of a theological training college at Manchester. He formed a new association, the members of which were nicknamed Warrenites, and this developed into the United Methodist Free Churches. Warren himself took orders in the Church of England. His son, the younger Samuel Warren, studied medicine at the University of Edinburgh, but abandoned this to study for the English bar. He entered the Inner Temple in 1828, and was successful in his profession. He took silk in 1851, was made recorder of Hull in 1852, represented Midhurst in parliament for three years (1856–1859) and was rewarded in 1859 with a mastership in lunacy. He had already written a good deal on the subject of insanity in its legal aspects, and he was always a determined opponent of the rising school of medical alienists who were more and more in favour of reducing certain forms of crime to a state of mental aberration which should not be punished outside of asylums. Meantime he had made much more brilliant success in fiction. Very early in his career he had begun to write for *Blackwood*. His *Passages from the Diary of a Late Physician* were published in that magazine between August 1830 and August 1837, and appeared in collected form in 1838. These realistic short stories, with a somewhat morbid interest shielded under a moral purpose, were extremely popular. Warren's brief experience as a medical student thus stood him in good stead. But his great success was *Ten Thousand a Year*, which ran in *Blackwood* from October 1839 to August 1841, and was published separately immediately on its conclusion. Critics complained of the coarse workmanship, the banality of the moralizing, the crudeness of the pathos, the farcical extravagance of the humour; but meantime the work proved one of the most popular novels of the century. Of the higher qualities of imagination and passion Warren was destitute, but his sketches of character, especially farcical character—Tittlebat Titmouse, Oily Gammon, Mr Quicksilver (an open caricature of Lord Brougham)—are bold and strong, forcibly imprinted on the memory, and the interest of the story is made to run with a powerful current. For several years Warren was known as the author of *Ten Thousand a Year*, and many tales were told of his open pride in the achievement. In 1847 he made another venture, but *Now and Then* was not a success. *The Lily and the Bee*, a squib on the Crystal Palace, published in 1851, though it had the honour of translation into Italian, was a signal failure. A pessimistic dissertation on *The Intellectual and Moral Development of the Age*, published in 1853, also fell flat, and thenceforth Warren, after publishing his *Works: Critical and Imaginative*, in four volumes in 1854, retired on his laurels. He died in London on the 29th of July 1877.

Warren also wrote several legal works of repute—*Introduction to Law Studies* (1835), *Extracts from Blackstone* (1837), *Manual of Parliamentary Law* (1852).

WARREN, WILLIAM (1812–1888), American actor, was born in Philadelphia on the 17th of November 1812, the son of an English actor (1767–1832) of the same name. His first stage appearance was made there as Young Norval in Home's *Douglas* in 1832. A dozen years of wandering theatrical life followed, giving him a wide experience in every kind of part, the last few in comedy in a company headed by his brother-in-law, J. B. Rice. In 1846 he made his first appearance in Boston as Sir Lucius O'Trigger in *The Rivals* at the Howard Athenaeum, and in the next season he became a member of the Boston Museum, in which stock company he remained for thirty-five years. Here he held his "Golden Jubilee" on the 28th of October 1882. He died on the 21st of September 1888.

WARREN, a city and the county-seat of Trumbull county, Ohio, U.S.A., in the N.E. part of the state, on the Mahoning river, about 50 m. S.E. of Cleveland, and 14 m. N.W. of Youngstown. Pop. (1890) 5973, (1900) 8529 (1161 foreign-born); (1910) 11,081. Warren is served by the Erie, the Pennsylvania, and the Baltimore & Ohio railways. The city has a public library and a hospital. The surrounding country is devoted to farming, dairying and coal and iron mining. The total value of the factory products in 1905 was $2,414,379. The first permanent white settlement on the site of Warren (then owned by Connecticut) was made in 1799 by settlers from Washington county, Pennsylvania. Warren was named in honour of a surveyor—Moses Warren, of New Lyme, Connecticut—employed by the Connecticut Land Company, which sold the land to the first settlers. The county was named in honour of Governor Jonathan Trumbull of Connecticut. Warren was chartered as a city in 1834. For several years before September 1909 Warren was the national headquarters of the National American Woman's Suffrage Association.

See *History of Trumbull and Mahoning Counties* (2 vols., Cleveland, Ohio, 1882), and H. T. Upton, *History of Trumbull County* (Chicago, 1909).

WARREN, a borough and the county-seat of Warren county, Pennsylvania, U.S.A., on the N. side of the Allegheny river at the mouth of the Conewango river, about 35 m. N.E. of Titusville. Pop. (1880) 2810; (1890) 4332; (1900) 8043, of whom 1529 were foreign-born; (1910 census) 11,080. The foreign element is largely Swedish, Danish and Slavish. Warren is served by the Pennsylvania and the Dunkirk, Allegheny Valley & Pittsburg railways, and by electric railway to Jamestown, New York. Among the public buildings and institutions are the county court house, a state hospital for the insane (established 1873), a Y.M.C.A. building and a state armoury. Warren is situated at the southern foot of a high sheer ridge, in a region rich in oil and natural gas; the borough ships and refines oil, and has various manufactures. The total value of its factory product in 1905 was $5,976,905 (62·4% more than in 1900), of which $3,038,894 was the value of refined oil and $1,220,165 the value of foundry and machine-shop products. The borough owns and operates the water-works and the electric lighting plant. The town site of Warren was laid out by commissioners appointed by Governor Thomas Mifflin in 1795, and Warren was incorporated as a borough in 1832; it was named in honour of Joseph Warren, the American patriot. In 1895 part of Glade township was annexed.

See J. S. Schenck and W. S. Rann, *History of Warren County, Pennsylvania* (Syracuse, N.Y., 1887).

WARREN, properly an old term of the English forest law, derived from the O. Fr. *warenne, varenne, garenne* (med. Lat. *warenna, warir*, to guard, cf. "ward"), and applied to one of the three lesser franchises, together with "chase" and "park," included under the highest franchise, the "forest," and ranking last in order of importance. The "beasts of warren" were the hare, the coney (*i.e.* rabbit), the pheasant and the partridge. The word thus became used of a piece of ground preserved for these beasts of warren. It is now applied loosely to any piece of ground, whether preserved or not, where rabbits breed (see Forest Laws).

WARRENPOINT, a seaport and watering-place of county Down, Ireland, the terminus of a branch of the Great Northern railway, by which it is 50¾ m. S.S.W. of Belfast. Pop. (1901) 1817. It lies on the northern shore of the beautiful Carlingford Lough; behind it rise the Mourne Mountains, while across the lough are the Carlingford Hills, with Slieve Gullion. These hills afford shelter from inclement winds, and give Warrenpoint and other neighbouring watering-places on the lough a climate which renders them as popular in winter as in summer. There is a quay here where large vessels can discharge, and agricultural produce is exported. The shores of the lough are studded with country seats lying picturesquely on the well-wooded hill slopes; and nearly 3 m. E. of Warrenpoint (connected by tramway) is Rosstrevor, one of the most noted watering-places in Ireland, charmingly situated in a position open to the sea, but enclosed on the north and east.

WARRENSBURG, a city and the county-seat of Johnson county, Missouri, U.S.A., on a hilly site near the Blackwater Fork of the La Mine river, in the west central part of the state, about 65 m. S.E. of Kansas City. Pop. (1890) 4706; (1900) 4724, including 556 negroes and 127 foreign-born; (1910) 4689. It is served by the Missouri Pacific railway. The city is the seat of a state normal school (opened in 1872), and among the prominent buildings are the court house and the railway station, both built of local sandstone. Pertle Springs, about 1½m. S., is a summer resort. Warrensburg is a shipping and supply point for a rich farming region. In the immediate vicinity there are extensive quarries of a blue sandstone, one of the best building stones of the state. Warrensburg was made the county-seat in 1836. Its settlement dates from a little earlier. The present city is not on the site of the original settlement, but is near it; the old town was abandoned in 1857, when the railway passed by it. During the Civil War Warrensburg was a Union post.

WARRINGTON, a market town and municipal, county and parliamentary borough of Lancashire, England, on the river Mersey, midway between Manchester and Liverpool, and 182 m. N.W. by N. from London by the London & North-Western railway. Pop. (1891) 52,288; (1901) 64,242. It has extensive local connexions by way of the Cheshire lines. The church of St Elphin is a fine cruciform building with lofty central tower and spire. The style is Decorated, but restoration has been heavy. A much earlier church formerly occupied the site, and of this the crypt remains beneath the existing chancel. The town hall, a classical building of the 18th century, was formerly a residence, and was purchased by the corporation in 1872, while the park in which it stands was devoted to public use. The other chief buildings are the museum and free library, with technical institute and the market hall. The educational institutions include a free grammar school, founded by one of the Boteler family in 1526, and a blue-coat school (1665). A few half-timbered houses of the 17th century remain in the streets. A wide system of electric tramways and district light railways is maintained by the borough. Warrington and the neighbourhood are an important centre of the tanning industry. There are also iron bar, hoop and wire works, tool, soap, glass and chemical works, foundries and cotton mills. Considerable agricultural markets and fairs are held. The parliamentary borough (1832), returning one member, extends into Cheshire. The town was incorporated in 1847, and the corporation consists of a mayor, 9 aldermen and 27 councillors. Area 3058 acres.

Warrington (otherwise Walintune, Werinton, Werington) is supposed to be of British origin, and the great Roman road from Chester to the north passed through it. There was a Romano-British village—perhaps also a military post—at Wilderspool. It is mentioned in Domesday Book as the head of a hundred. After the Conquest it became one of the possessions of Roger de Poictou. In Henry I.'s reign a barony was formed for Pain de Vilars, of which Warrington was the head and to which it gave the name, and from that family both manor and barony passed to the Botelers or Butlers, who first established their residence on the mote hill and before 1280 built Bewsey in Burton wood. The Butlers held both barony and manor till 1586, when the barony lapsed and the manor passed after some vicissitudes to the Irelands of Bewsey, then to the Booths and in 1769 to the Blackburns. In 1255 William le Boteler obtained a charter from Henry III. for an annual fair to last three days from the eve of St Thomas the Martyr (18th July). In 1277 Edward I. granted a charter for a weekly market on Friday and an annual fair of eight days beginning on the eve of St Andrew (30th Nov.), and in 1285 another charter changing the market day from Friday to Wednesday and extending the summer fair to eight days. The market and fairs had, however, existed before the granting of these charters. Blome in 1673 speaks of Warrington market as an important one "for linen cloth, corn, cattle, provisions and fish, being much resorted to by the Welshmen," and in 1730 Defoe says the market was especially famous for "a sort of table linen called Huk-a-back or Huk-a-buk." The fairs are still held, as well as the Wednesday chartered market, besides a Saturday market which is probably customary. In the 18th and early 19th centuries the chief industries were huckabacks and coarse cloths, canvas, fustians, pins, glass, sugar-refining and copper. During the Civil War the inhabitants embraced the royalist cause and the earl of Derby occupied the town and made it for some time his headquarters in order to secure the passage of the Mersey. In April 1643 the parliamentary forces attacked it, but had to raise the siege, as Lord Derby began to set the town on fire. Lord Derby left Colonel Edward Norris in command and in May the parliamentarians again attacked the town, which was forced to surrender after a six days' siege owing to lack of provisions. In 1648, after the royalist defeat at Winwick by Cromwell, part of the royal forces under General Baillie rallied at Warrington, hoping to effect the passage of the bridge, but failed, and the general with 4000 men capitulated. In August 1659 Sir George Booth, lord of the manor, was defeated at Winnington, and part of his forces surrendered at Warrington to the parliamentary garrison. During the Rebellion of 1745, on the approach of Prince Charles Edward from Manchester, the bridge was cut down and the few stragglers who ventured that way seized. A borough was created by William le Boteler about 1230 by a charter which has not been preserved; but its growing strength alarmed the lord who contrived to repress it before 1300, and for over 500 years Warrington was governed by the lord's manor court. A charter of incorporation was granted in 1847. By the Reform Act of 1832 the town returns one member to parliament. The church dedicated to St Elphin is mentioned in Domesday Book, and was in early times head of the ancient deanery of Warrington. There was a friary of Augustine or Hermit Friars here founded apparently about 1280.

WARRISTON, ARCHIBALD JOHNSTON, Lord (1611–1663), Scottish judge and statesman, son of James Johnstone (d. 1617), a merchant burgess of Edinburgh, was baptized on the 28th of March 1611, educated at Glasgow, and passed advocate at the Scottish bar in 1633. He first came into public notice in 1637, during the attempt of Charles I. to force the English liturgy upon Scotland, when as the chief adviser of the Covenanting leaders he drew up their remonstrances. On the 28th of February 1638, in reply to a royal proclamation, he read to an enormous multitude assembled in Greyfriars churchyard at Edinburgh and in presence of the heralds, a strong protestation, and together with Alexander Henderson was a principal author of the National Covenant of 1638, drawing up himself the second part, which consisted in a recapitulation of all the acts of parliament condemning "popery" and asserting the liberties of the Scottish church. He was appointed clerk to the tables, and also clerk and afterwards procurator or counsel to the general assembly held at Glasgow the same year, when he was the means of restoring several missing volumes of records. In June 1639 he took part in the negotiations leading to the treaty of Berwick, when his firm attitude was extremely displeasing to the king. He urged Charles to refrain from annulling the acts of the assembly since this would restrict all future assemblies, to which Charles replied "that the devil himself could not make a more uncharitable construction or give a more bitter expression," and on Johnston's continuing his speech ordered him to be silent and declared he would speak to more reasonable men.[1] In August he read a paper before the Scottish parliament, strongly condemning its prorogation. In the following year he was appointed to attend the general of the army and the committee, and on the 23rd of June, when the Scottish forces were preparing to invade England, he wrote to Lord Savile asking for definite support from the leading opposition peers in England and their acceptance of the National Covenant, which drew from the other side at first nothing but vague assurances and subsequently the engagement forged by Lord Savile with the signatures of the peers. In October he was a commissioner for negotiating the treaty of Ripon and went to London. He continued after the peace to urge the punishment of the incendiaries, and especially of Traquair, and in a private interview with the king strongly opposed the proposed act of general oblivion. On the king's arrival in Scotland in 1641 he led the opposition on the important constitutional point of the control of state appointments, supporting the claims of the parliament by an appeal to the state records, which he had succeeded in recovering.

In September Johnston received public thanks for his services from the Scottish parliament, and, in accordance with the policy of conciliation then pursued for a short time by the king, was appointed on the 13th of November 1641 a lord of session, with the title of Lord Warriston (a name derived from an estate purchased by him near Edinburgh in 1636), was knighted, and was given a pension of £200 a year. The same month he was appointed a commissioner at Westminster by the parliament for settling the affairs of Scotland. He was a chief agent in concluding the treaty with the English parliament in the autumn of 1643, and was appointed a member of the committee of both kingdoms in London which directed the military operations, and in this capacity went on several missions to the parliamentary generals. He took his seat early in 1644 in the Assembly of Divines, to which he had been nominated, and vehemently opposed measures tolerating independency or giving powers to laymen in ecclesiastical affairs. The articles of the unsuccessful treaty of Uxbridge were, for the most part, drawn up by him the same year. Besides his public duties in England he sat in the Scottish parliament for the county of Edinburgh from 1643 till 1647, was speaker of the barons, and served on various committees. After the final defeat of Charles, when he had surrendered himself to the Scots, Johnston was made in October 1646 king's advocate, and the same year was voted £3000 by the estates for his services. He continued to oppose unwise concessions to Charles, and strongly disapproved of the "engagement" concluded in 1648 by the predominant party with Charles at Carisbrooke, which, while securing little for Presbyterianism, committed the Scots to hostilities with the followers of Cromwell. He now became the leader of the "remonstrants," the party opposed to the "engagement," and during the ascendancy of the engagers retired to Cantyre as the guest of Argyll. He returned again after the Whiggamore Raid,[1] met Cromwell at Edinburgh in October after the defeat of the engagers at Preston, and in conjunction with Argyll promoted the act of Classes, passed on the 23rd of January 1649, disqualifying the royalists. The good relations now formed with Cromwell, however, were soon broken off by the king's execution, and Johnston was present officially at the proclamation of Charles II. as king at Edinburgh, on the 5th of February 1649. On the 10th of March he was appointed lord clerk register. In May he pronounced the vindictive sentence on Montrose, and he is said to have witnessed with Argyll the victim being drawn to the place of execution. He was present at the battle of Dunbar (3rd of September 1650) as a member of the committee of estates, to which body is ascribed the responsibility for Leslie's fatal abandonment of his position on Doon Hill. After the defeat he urged the removal of David Leslie, afterwards Lord Newark, from the command, and on the 21st of September delivered a violent speech in Charles's presence, attributing all the late misfortunes to the Stuarts and to their opposition to the Reformation.

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[1] Johnston's "Diary" in *Scottish Hist. Soc. Publ.*, xxvi. 84.

His first object in life being the defence of Presbyterianism, Johnston could join neither of the two great parties, and now committed himself to the faction of the remonstrants who desired to exclude the king, in opposition to the resolutioners who accepted Charles. The latter for some time maintained their superiority in the kingdom, Johnston being reduced to poverty and neglect. In the autumn of 1656 Johnston went to London as representative of the remonstrants; and soon afterwards, on the 9th of July 1657, he was restored by Cromwell to his office of lord clerk register, and on the 3rd of November was appointed a commissioner for the administration of justice in Scotland, henceforth remaining a member of the government till the Restoration. In January 1658 he was included by Cromwell in his new House of Lords, and sat also in the upper chamber in Richard Cromwell's parliament. On the latter's abdication and the restoration of the Rump, he was chosen a member of the council of state, and continued in the administration as a member of the committee of public safety, maintaining consistently his attitude against religious toleration. At the Restoration he was singled out for punishment. He avoided capture, escaping to Holland and thence to Germany, and was condemned to death in his absence on the 13th of May 1661. In 1663, having ventured into France, he was discovered at Rouen, and with the consent of Louis XIV. was brought over and imprisoned in the Tower of London. In June he was taken to Edinburgh and confined in the Tolbooth. He was hanged on the 22nd of July at the Market Cross, Edinburgh, the scene of many of his triumphs, and a few yards from his own house in High Street, which stood on the east side of what is now known as Warriston's Close. His head was exposed on the Netherbow and afterwards buried with his body in Greyfriars churchyard.

Johnston was a man of great energy, industry and ability, and the successful defence of their religion by the Scots was probably owing to him more than to any other man. He is described by his contemporary Robert Baillie as "one of the most faithful and diligent and able servants that our church and kingdom has had all the tymes of our troubles."[2] He was learned in the Scottish law, eloquent and deeply religious. His passionate devotion to the cause of the Scottish church amounted almost to fanaticism. According to the *History* by his nephew Bishop Burnet, "he looked on the Covenant as the setting Christ on his throne." He had by nature no republican leanings; "all the Royalists in Scotland," writes Baillie as late as 1646, "could not have pleaded so much for the crown and the king's just power as the chancellor and Warriston did for many days together." When, however, Presbyterianism was attacked and menaced by the sovereign, he desired, like Pym, to restrict the royal prerogative by a parliamentary constitution, and endeavoured to found his arguments on law and ancient precedents. His acceptance of office under Cromwell hardly deserves the severe censure it has received. He stood nearer both in politics and religion to Cromwell than to the royalists, and was able in office to serve usefully the state and the church, but his own scrupulous conscience caused him to condemn in his dying speech, as a betrayal of the cause of Presbyterianism, an act which he regarded as a moral fault committed in order to provide for his numerous family, and the remembrance of which disturbed his last hours. Johnston was wanting in tact and in consideration for his opponents, confessing himself that his "natural temper (or rather distemper) hath been hasty and passionate." He was hated by Charles I., whose statecraft was vanquished by his inflexible purpose, and by Charles II., whom he rebuked for his dissolute conduct; but he was beloved by Baillie, associated in private friendship and public life with Argyll, and lamented by the nation whose cause he had championed.

He had a large family, the most famous of his sons being James Johnston (1655–1737), called "secretary Johnston." Having taken refuge in Holland after his father's execution, Johnston crossed over to England in the interests of William of Orange just before the revolution of 1688. In 1692 he was appointed one of the secretaries for Scotland, but he was dismissed from office in 1696. Under Anne, however, he began again to take part in public affairs, and was made lord clerk register. Johnston's later years were passed mainly at his residence, Orleans House, Twickenham, and he died at Bath in May 1737.

See W. Morison, *Johnston of Warriston* (1901).

WARRNAMBOOL, a seaport of Villiers county, Victoria, Australia, 166 m. by rail W.S.W. of Melbourne. Pop. (1901) 6410. The town lies on an eminence, on the shores of Warrnambool Bay, in a rich pastoral and agricultural district. Race meetings are held here, and the steeplechase course is considered the finest in the colony. Warrnambool has a fine port with a viaduct and breakwater pier 2400 ft. in length, and a jetty 860 ft. in length, on to which the railway runs. Large quantities of dairy produce, wool and live stock are exported; and there are a number of flourishing industries in the town, including brewing, flour-milling, tanning and boot and biscuit manufacturing. Sandstone abounds in the district and is extensively quarried. The summer climate is the coolest in the Australian states.

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[1] This was the name given to a successful raid on Edinburgh by a band of Argyll's partisans gathered mainly from the west of Scotland. It took place in September 1648, just after the defeat of Hamilton at Preston. The term Whiggamore is said to be derived from *Whiggam*, a word used by the ploughmen in the west of Scotland to encourage their horses. See S. R. Gardiner, *Great Civil War*, vol. iii. (1891).

[2] Baillie, *Letters and Journals* (Bannatyne Club, 1841).

WARSAW, a government of Russian Poland, occupying a narrow strip of land west of the lower Bug and west of the Vistula from its confluence with the Bug to the Prussian frontier. It is bounded by the Polish governments of Plock and Lomza on the N., Siedlce on the E., and Radom, Piotrkow and Kalisz on the S. Area 5605 sq. m.; estimated pop. (1906) 2,269,000. It occupies the great plain of central Poland, and is low and flat, with only a few hills in the south, and along the course of the Vistula in the north-west, where the terraces on the left bank descend by steep slopes to the river. Terrible inundations often devastate the region adjacent to the confluence of the Vistula with the Narew and Bug, and marshes gather in the low-lying grounds. The soil, which consists chiefly of boulder clay, lacustrine clays, and sandy fluviatile deposits, is not particularly fertile. The government is divided into thirteen districts, the chief towns of which are Warsaw, Blonie, Gostynin, Grojec, Kutno, Lowicz, Neszawa, Novo-Minsk, Plonsk, Radzymin, Skierniewice, Sochaczew and Wloclawek. In spite of the unfertile soil, agriculture is prosecuted with considerable success. Manufacturing industries have also greatly developed.

WARSAW (Polish *Warszawa*, Ger. *Warschau*, Fr. *Varsovie*), the capital of Poland and chief town of the government of Warsaw. It is beautifully situated on the left bank of the Vistula, 387 m. by rail E. of Berlin, and 695 m. S.W. of St Petersburg. It stands on a terrace 120 to 130 ft. above the river, to which it descends by steep slopes, leaving a broad bench at its base. The suburb of Praga on the right bank of the Vistula, here 450 to 660 yds. broad, is connected with Warsaw by two bridges—the railway bridge which passes close under the guns of the Alexander citadel to the north, and the Alexander bridge (1666 ft. long; built in 1865 at a cost of £634,000) in the centre of the town. With its large population, its beautiful river, its ample communications and its commerce, its university and scientific societies, its palaces and numerous places of amusement, Warsaw is one of the most pleasant as well as one of the most animated cities of eastern Europe. From a military point of view Warsaw is the chief stronghold for the defence of Poland; the Alexander citadel has been much improved, and the bridge across the Vistula is defended by a strong fort, Sliwicki.

Situated in a fertile plain, on a great navigable river, below its confluence with the Pilica and Wieprz, which drain southern Poland, and above its confluence with the Narew and Bug, which tap a wide region in the east, Warsaw became in medieval times the chief entrepôt for the trade of those fertile and populous valleys with western Europe. Owing to its position in the territory of Mazovia, which was neither Polish nor Lithuanian, and, so to say, remained neutral between the two rival powers which constituted the united kingdom, it became the capital of both, and secured advantages over the purely Polish Cracow and the Lithuanian Vilna. And now, connected as it is by six trunk lines with Vienna, Kiev and south-western Russia, Moscow, St Petersburg, Danzig and Berlin, it is one of the most important commercial cities of eastern Europe. The south-western railway connects it with Lodz, the Manchester of Poland, and with the productive mineral region of Piotrkow and Kielce, which supply its steadily growing manufactures with coal and iron, so that Warsaw and its neighbourhood have become a centre for all kinds of manufactures. The iron and steel industry has greatly developed, and produces large quantities of rails. The machinery works have suffered to some extent from competition with those of southern Russia, and find the high price of land a great obstacle in the way of extension. But the manufactures of plated silver, carriages, boots and shoes (annual turnover £8,457,000), millinery, hosiery, gloves, tobacco, sugar, and all sorts of small artistic house decorations, are of considerable importance, chiefly owing to the skill of the workers. Trade is principally in the goods enumerated above, but the city is also a centre for trade in corn, leather and coal, and its two fairs (wool and hops) have a great reputation throughout western Russia. The wholesale deportations of Warsaw artisans after the Polish insurrections of 1794, 1831 and 1863 considerably checked, but by no means stopped, the industrial progress of the town. The barrier of custom-houses all round Poland, and the Russian rule, which militates against the progress of Polish science, technology and art, are so many obstacles to the development of its natural resources. The population has nevertheless grown rapidly, from 161,008 in 1860, 276,000 in 1872 and 436,750 in 1887, to 756,426 in 1901; of these more than 25,000 are Germans, and one-third are Jews. The Russian garrison numbers over 30,000 men. Warsaw is an archiepiscopal see of the Greek Orthodox and Roman Catholic churches, and the headquarters of the V., VI. and XV. Army Corps.

The streets of Warsaw are adorned with many fine buildings, partly palaces exhibiting the Polish nobility's love of display, partly churches and cathedrals, and partly public buildings erected by the municipality or by private bodies. Fine public gardens and several monuments further embellish the city. The university (with 1500 students), founded in 1816 but closed in 1832, was again opened in 1869 as a Russian institution, the teaching being in Russian; it has a remarkable library of more than 500,000 volumes, rich natural history collections, a fine botanic garden and an astronomical observatory. The medical school enjoys high repute in the scientific world. The school of arts, the academy of agriculture and forestry, and the conservatory of music are all high-class institutions. The association of the friends of science and the historical and agricultural societies of Warsaw were once well known, but were suppressed after the insurrections, though they were subsequently revived.

The theatre for Polish drama and the ballet is a fine building, which includes two theatres under the same roof; but the pride of Warsaw is its theatre in the Lazienki gardens, which were laid out (1767–1788) in an old bed of the Vistula by King Stanislaus Poniatowski, and have beautiful shady alleys, artificial ponds, an elegant little palace with ceilings painted by Bacciarelli, several imperial villas and a monument (1788) to John Sobieski, king of Poland, who delivered Vienna from the Turks in 1683. Here an artificial ruin on an island makes an open-air theatre. Two other public gardens, with alleys of old chestnut trees, are situated in the centre of the city. One of these, the Saski Ogrod, or Saxon garden (17 acres), which has a summer theatre and fine old trees, is one of the most beautiful in Europe; it is the resort of the Warsaw aristocracy. The Krasinski garden is the favourite promenade of the Jews.

The central point of the life of Warsaw is the former royal castle (Zamek Krolewski) on Sigismund Square. It was built by the dukes of Mazovia, enlarged by Sigismund III. (whose memorial stands opposite) and Ladislaus IV., and embellished by John Sobieski and Stanislaus Poniatowski. At present it is inhabited by the "governor-general of the provinces on the Vistula" (*i.e.* Poland), and by the military authorities. Most of its pictures and other art treasures have been removed to St Petersburg and Moscow. Four main thoroughfares radiate from it; one, the Krakowskie Przedmiescie, the best street in Warsaw, runs southward. It is continued by the Nowy Swiat and the Ujazdowska Aleja avenue, which leads to the Lazienki gardens. Many fine buildings are found in and near these two streets: the church of St Anne (1454), which belonged formerly to a Bernardine monastery; the agricultural and industrial museum, with an ethnographical collection; the monument (1898) to the national poet Adam Mickiewicz (1798–1855); the Alexander Nevski cathedral of the Orthodox Greek Church, built in 1894 and following years on the Saxon Square in the Byzantine style, with five gilded cupolas and a detached campanile, 238 ft. high; close beside it the former Saxon palace, once the residence of the Polish kings but now used as military administrative offices; the Lutheran church, finished in 1799, one of the most conspicuous in Warsaw; a monument (1841) to the Polish generals who held with Russia in 1830 and were therefore shot by their compatriots, removed to the Zielony Square in 1898; the buildings of the Art Association, erected in 1898–1900; the university (see above); the church of the Holy Ghost (1682–1696), with the heart and monument of the musician F. F. Chopin; a monument (1830) to the astronomer N. Kopernicus (1473–1543); the palaces of the families Zamoyski and Ordynacki (now the conservatory of music); the building of the Philharmonic Society (1899–1901); and the church of St Alexander, built in 1826 and splendidly restored in 1891. The Ujazdowska Aleja avenue, planted with lime-trees and bordered with cafés and places of amusement, is the Champs Elysées of Warsaw It leads to the Lazienki park and to the Belvedere palace (1822) now the summer residence of the governor-general, and farther wes to the Mokotowski parade ground, which is surrounded on the south and west by the manufacturing district. Another principal street, the Marszalkowska, runs parallel to the Ujazdowska from the Saxon garden to this parade ground, on the south-east of which are the Russian barracks. The above-mentioned streets are crossed by another series running west and east, the chief of them being the Senators, which begins at Sigismund Square and contains the best shops. The palace of the archbishop of Warsaw, the Imperial (Russian) Bank, formerly the Bank of Poland; the town hall (1725), burned in 1863, but rebuilt in 1870; the small Pod Blacha palace, now occupied by a chancery; the theatre (1833); the old mint; the beautiful Reformed church (1882); the Orthodox Greek cathedral of the Trinity, rebuilt in 1837; the Krasinski palace (1692), burned in 1782 but rebuilt; the place of meeting of the Polish diets, now the Supreme Court; the church of the Transfiguration, a thank-offering by John Sobieski for his victory of 1683, and containing his heart and that of Stanislaus Poniatowski; and several palaces are grouped in or near Senators' Street and Miodowa Street.

To the west Senators' Street is continued by Electors' Street, where is the very elegant church (1849) of St Charles Borromeo, and the Chlodna Street leading to the suburb of Wola, with a large field where the kings of Poland used to be elected. In Leshno Street, which branches off from Senators' Street, are the Zelazna Brama, or Iron Gate; in the market-place the bazaar, the arsenal and the Wielopoiski barracks.

To the north of Sigismund Square is the old town—Stare Miasto—the Jewish quarter, and farther north still the Alexander citadel. The old town very much recalls old Germany by its narrow streets and antique buildings, the cathedral of St John, the most ancient church in Warsaw, having been built in the 13th century and restored in the 17th. The citadel, erected in 1832–1835 as a punishment for the insurrection of 1831, is of the old type, with six forts too close to the walls of the fortress to be useful in modern warfare.

The suburb of Praga, on the right bank of the Vistula, is poorly built and often flooded; but the bloody assaults which led to its capture in 1794 by the Russians under Suvarov, and in 1831 by Paskevich, give it a name in history.

In the outskirts of Warsaw are various more or less noteworthy villas, palaces and battlefields. Willanow, the palace of John Sobieski, afterwards belonging to Count X. Branicki, was partly built in 1678–1694 by Turkish prisoners in a fine Italian style, and is now renowned for its historical relics, portraits and pictures. It is situated to the south of Warsaw, together with the pretty pilgrimage church of Czerniakow, built by Prince Stanislaus Lubomirski in 1691, and many other fine villas (Morysinek, Natolin, Krolikarnia, which also has a picture gallery, Wierzbno and Mokotow). Marymont, an old country residence of the wife of John Sobieski, and the Kaskada, much visited by the inhabitants of Warsaw, in the north, the Saska Kempa on the right bank of the Vistula, and the castle of Jablona down the Vistula are among others that deserve mention. The castle and forest of Bielany (4½ m. N.), on the bank of the Vistula, are a popular holiday resort in the spring.

Among the battlefields in the neighbourhood is that of Grochow where the Polish troops were defeated in 1831, and Wawer in the same quarter (E. of Praga), where Prince Joseph Poniatowski defeated the Austrians in the war of 1809; at Maciejowice, 50 m. up the Vistula, Kosciuszko was wounded and taken by the Russians in 1794; and 20 m. down the river stands the fortress of Modlin, now Novogeorgievsk.

History.—The history of Warsaw from the 16th century onwards is intimately connected with that of Poland. The precise date of the foundation of the town is not known; but it is supposed that Conrad, duke of Mazovia, erected a castle on the present site of Warsaw as early as the 9th century. Casimir the Just is supposed to have fortified it in the 11th century, but Warsaw is not mentioned in annals before 1224. Until 1526 it was the residence of the dukes of Mazovia, but when their dynasty became extinct it was annexed to Poland. When Poland and Lithuania were united, Warsaw was chosen as the royal residence. Sigismund Augustus (Wasa) made it (1550) the real capital of Poland, and from 1572 onwards the election of the kings of Poland took place on the field of Wola, on the W. outskirts of the city. From the 17th century possession of it was continually disputed between the Swedes, the Russians, the Brandenburgers and the Austrians. Charles Gustavus of Sweden took it in 1655 and kept it for a year; the Poles retook it in July 1656, but lost it again almost immediately. Augustus II. and Augustus III. did much for its embellishment, but it had much to suffer during the war with Charles XII. of Sweden, who captured it in 1702; but in the following year peace was made, and it became free again. The disorders which followed upon the death of Augustus III. in 1763 opened a field for Russian intrigue, and in 1764 the Russians took possession of the town and secured the election of Stanislaus Poniatowski, which led in 1773 to the first partition of Poland. In November 1794 the Russians took it again, after the bloody assault on Praga, but next year, in the third partition of Poland, Warsaw was given to Prussia. In November 1806 the town was occupied by the troops of Napoleon, and after the peace of Tilsit (1807) was made the capital of the independent duchy of Warsaw; but the Austrians seized it on the 21st of April 1809, and kept possession of it till the 2nd of June, when it once more became independent. The Russians finally took it on the 8th of February 1813. On the 29th of November 1830, Warsaw gave the signal for the unsuccessful insurrection which lasted nearly one year; the city was captured after great bloodshed by Paskevich, on the 7th of September 1831. Deportations on a large scale, executions, and confiscation of the domains of the nobility followed, and until 1856 Warsaw remained under severe military rule. In 1862 a series of demonstrations began to be made in Warsaw in favour of the independence of Poland, and after a bloody repression a general insurrection followed in January 1863, the Russians remaining, however, masters of the situation. Executions, banishment to the convict prisons of Siberia, and confiscation of estates followed. Deportation to Siberia and the interior of Russia was carried out on an unheard-of scale. Scientific societies and high schools were closed; monasteries and nunneries were emptied. Hundreds of Russian officials were called in to fill the administrative posts, and to teach in the schools and the university; the Russian language was made obligatory in all official acts, in all legal proceedings, and even, to a great extent, in trade. The very name of Poland was expunged from official writings, and, while the old institutions were abolished, the Russian tribunals and administrative institutions were introduced. The serfs were liberated. Much rioting and lawless bloodshed took place in the city in 1905–1906. (P. A. K.; J. T. Be.)

WARSAW, a city and the county-seat of Kosciusko county, Indiana, U.S.A., on the Tippecanoe river, about 110 m. E. of Chicago. Pop. (1890) 3547; (1900) 3987, including 102 foreign-born; (1910) 4430. Warsaw is served by the Pittsburg, Fort Wayne & Chicago (Pennsylvania system) and the Cleveland, Cincinnati, Chicago & St Louis railways, and by interurban electric lines. It is picturesquely situated in the lake country of Indiana on Center, Pike and Winona lakes. Immediately E. of the city, on Winona (formerly Eagle) Lake, which is about 2 by 3 m. and has an average depth of 30 ft., is Winona (formerly Spring Fountain) Park (incorporated 1895 largely by Presbyterians), which primarily aims to combine the advantages of Northfield, Massachusetts, and Chautauqua, New York. There is excellent boating and bathing here, and there are mineral springs in the Park, where in the summer there are a Chautauqua course lasting for six weeks, a normal school, a Bible school, a Bible conference, a school of missions, an International Training School for Sunday School Workers, a conference of temperance workers and nature study and other regular summer school courses; and in other months of the year courses are given here by the Winona Normal School and Agricultural Institute, Winona Academy (for boys) and Winona Conservatory of Music, and the Winona Park School for Young Women. The control of the Park is inter-denominational—the Winona Federated Church was organized in 1905. Under practically the same control is the Winona Technical Institute in Indianapolis. The surrounding country is devoted to farming and stock raising. Warsaw was first platted in 1836, and became a city in 1875.

WART (Lat. *verruca*), a papillary excrescence of the skin, or mucous membrane. The ordinary flat warts of the skin occur mostly upon the hands of children and young persons; a long pendulous variety occurs about the chin or neck of delicate children, and on the scalp in adults. Warts are apt to come out in numbers at a time; a crop of them suddenly appears, to disappear after a time with equal suddenness. Hence the supposed efficacy of charms. A single wart will sometimes remain when the general eruption has vanished. The liability of crops of warts runs in families. In after life a wart on the hands or fingers is usually brought on by some irritation, often repeated, even if it be slight. Warts often occur on the wrists and knuckles of slaughter-house men and of those much occupied with anatomical dissection; they are often of tuberculous origin (butchers' warts). Chimney-sweeps and workers in coal-tar, petroleum, &c., are subject to warts, which often become cancerous. Warts occur singly in later life on the nose or lips or other parts of the face, sometimes on the tongue; they are very apt to become malignant. Towards old age broad and flattened patches of warts of a greasy consistence and brownish colour often occur on the back and shoulders. They also are apt to become malignant. Indeed, warts occurring on the lip or tongue, or on any part of the body of a person advanced in life, should be suspected of malignant associations and dealt with accordingly. Venereal warts occur as the result of gonorrhoeal irritation or syphilitic infection.

A wart consists of a delicate framework of blood-vessels supported by fibrous tissue, with a covering of epidermic scales. When the wart is young, the surface is rounded; as it gets rubbed it is cleft into projecting points. The blood-vessels, whose outgrowth from the surface really makes the wart, may be in a cluster of parallel loops, as in the common sessile wart, or the vessels may branch from a single stem, making the long, pendulous warts of the chin and neck. The same kinds of warts also occur on mucous surfaces. It is owing to its vascularity that a wart is liable to come back after being shaved off; the vessels are cut down to the level of the skin, but the blood is still forced into the stem, and the branches are thrown out beyond the surface as before. This fact has a bearing on the treatment of warts, if they are snipped off, the blood-vessels of the stem should be destroyed at the same time by a hot wire or some other caustic, or made to shrivel by an astringent. The same end is served by a gradually tightening ligature (such as a thread of elastic) round the base of the wart. Glacial acetic or carbolic acid may be applied on the end of a glass rod, or by a camel-hair brush, care being taken not to touch the adjoining skin. A solution of perchloride of iron is also effective in the same way. Nitrate of silver is objectionable, owing to the black stains left by it. A simple domestic remedy, often effectual, is the astringent and acrid juice of the common stonecrop (*Sedum acre*) rubbed into the wart, time after time, from the freshly gathered herb. The result of these various applications is that the wart loses its firmness, shrivels up, and falls off. Malignant and tuberculous warts should be removed by the scalpel or sharp spoon, their bases, if thought advisable, being treated by pure carbolic acid.

A peculiar form of wart, known as *verrugas*, occurs endemically in the Andes. It is believed to have been one of the causes of the excessive mortality from haemorrhages of the skin among the troops of Pizarro. Attention was called to it by Dr Archibald Smith in 1842; in 1874, during the making of the Trans-Andean railway, it caused considerable loss of life among English navvies and engineers. (E. O.*)

WARTBURG, THE, a castle near Eisenach in the grand-duchy of Saxe-Weimar. It is magnificently situated on the top of a precipitous hill, and is remarkable not only for its historical associations but as containing one of the few well-preserved Romanesque palaces in existence. The original castle, of which some parts—including a portion of the above-mentioned palace (Landgrafenhaus)—still exist, was built by the landgrave Louis "the Springer" (d. 1123), and from his time until 1440 it remained the seat of the Thuringian landgraves. Under the landgrave Hermann I., the Wartburg was the home of a boisterous court to which minstrels and "wandering folk" of all descriptions streamed;[1] and it was here that in 1207 took place the minstrels' contest (*Sängerkrieg*) immortalized in Wagner's *Tannhäuser*. Some years later it became the home of the saintly Elizabeth of Hungary (*q.v.*) on her marriage to Louis the Saint (d. 1227), to whom she was betrothed in 1211 at the age of four.[2] It was to the Wartburg, too, that on the 4th of May 1521, Luther was brought for safety at the instance of Frederick the Wise, elector of Saxony, and it was during his ten months' residence here (under the *incognito* of Junker Jörg) that he completed his translation of the New Testament.

From this time the castle was allowed gradually to decay. It was restored in the 18th century in the questionable taste of the period; but its present magnificence it owes to the grand-duke Charles Alexander of Saxe-Weimar, with whom at certain seasons of the year it was a favourite residence.

The most interesting part of the castle is the Romanesque *Landgrafenhaus*. This, besides a chapel, contains two magnificent halls known as the *Sängersaal* (hall of the minstrels)—in which Wagner lays one act of his opera—and the *Festsaal* (festival hall). The *Sängersaal* is decorated with a fine fresco, representing the minstrels' contest, by Moritz von Schwind, who also executed the frescoes in other parts of the building illustrating the legends of St Elizabeth and of the founding of the castle by Louis the Springer. The *Festsaal* has frescoes illustrating the triumphs of Christianity, by Welter. In the buildings of the outer court of the castle is the room once occupied by Luther, containing a much mutilated four-post bed and other relics of the reformer. The famous blot caused by Luther's hurling his ink-pot at the devil has long since become a mere hole in the wall, owing—it is said—to the passion of American tourists for "souvenirs."

The armoury (*Rüstkammer*) contains a fine collection of armour, including suits formerly belonging to Henry II. of France, the elector Frederick the Wise and Pope Julius II. The great watch-tower of the castle commands a magnificent view of the Thuringian forest on the one side and the plain on the other.

WARTHE (Polish, *Warta*), a river of Poland and Germany, and the chief affluent of the Oder. It rises on the north slope of the Carpathian Mountains N.W. of Cracow, flows north as far as Radomsk, then west, then north again past Sieradz, until it reaches Kola, where it again turns west, crosses the frontier into the Prussian province of Posen, where it takes a northerly direction past the town of Posen. Then once more bending west, it flows past Schwerin and Landsberg and enters the Oder from the right at Cüstrin. Its total length is 445 m. of which 215 are in Poland and 230 in Prussia; it is navigable up to Konin in West Poland, a distance of 265 m. Its banks are mostly low and flat, its lower course especially running through drained and cultivated marshes. It is connected with the Vistula through its tributary the Netze and the Bromberg canal. The area of its drainage basin is 17,400 sq. m.

WART-HOG, the designation of certain hideous African wild swine (see SWINE), characterized by the presence of large warty protuberances on the face, the large size of the tusks in both sexes, especially the upper pair, which are larger and stouter than the lower ones and are not worn at their summits, and the complexity and great size of the last pair of molar teeth in each jaw. The adults have frequently no teeth except those just mentioned, and nearly bare skins; and the young are uniformly coloured. Two nearly allied species are recognized, namely, the southern *Phacochoerus aethiopicus*, which formerly ranged as far south as the Cape, and the northern *P. africanus*, which extends to the mountains of Abyssinia, where it has been found at a high elevation. In South and East Africa wart-hogs frequent more or less open country, near water, and dwell in holes, generally those of the aard-vark. In Abyssinia, on the other hand, they spend the day among bushes, or in ravines, feeding at night.

WARTON, JOSEPH (1722–1800), English critic and poet, eldest son of Thomas Warton (see below), was baptized at Dunsfold, Surrey, on the 22nd of April 1722, and entered Winchester school on the foundation in 1735. William Collins was already there, and the two formed a friendship which was maintained through their Oxford career. They read Milton and Spenser together, and wrote verses, which, published in the *Gentleman's Magazine*, attracted the attention of Dr Johnson. Warton went to Oriel College, Oxford, in 1740, and took his B.A. degree in 1744. He took holy orders, and during his father's lifetime acted as his curate at Basingstoke. He then went to Chelsea, London; but eventually returned to Basingstoke. He married, became rector of Winslade (1748), of Tunworth (1754); in 1755 he was appointed a master in Winchester school, and headmaster in 1766. He was not a successful schoolmaster, and when the boys mutinied against him for the third time he wisely resigned his position (1793).

His leisure was devoted to literature. Warton was far from having the genius of Collins, but they were at one in their impatience under the prevailing taste for moral and ethical poetry. Whoever wishes to understand how early the reaction against Pope's style began should read Warton's *The Enthusiast*,

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[1] Walther von der Vogelweide (ed. F. Pfeiffer 1880, No. 99) and Wolfram von Eschenbach (Parzival vi. 526 and *Willehalm* 417, 26) both refer to the noise and constant crush of crowds passing in and out at the Wartburg "night and day."

[2] Wagner, with a poet's licence, has placed the *Sängerkrieg* during Elizabeth's residence at the Wartburg.

or The Lover of Nature, and remember that it was printed in 1744, the year of Pope's death. "As he is convinced," he wrote in the preface (1746) to his *Odes on Several Subjects*, "that the fashion of moralizing in verse has been carried too far, and as he looks upon invention and imagination to be the chief faculties of a poet, so he will be happy if the following odes may be looked upon as an attempt to bring back poetry into its right channel." He published an edition (1753) in Latin and English of Virgil. This contained Christopher Pitt's version of the *Aeneid*, his own rendering of the *Eclogues* and *Georgics* in the heroic measure, and essays by Warburton and others. Warton himself appended essays on epic and didactic poetry, a life of Virgil and notes. He made the acquaintance of Dr Johnson, and wrote papers on Shakespeare and Homer in *The Adventurer*; and in 1757 he published the first part of an *Essay on the Genius and Writings of Pope*, an essay regarded at the time as revolutionary, by Johnson at least, because it put Pope in the second rank to Shakespeare, Spenser and Milton, on the ground that moral and ethical poetry, however excellent, is an inferior species. He held his own against Johnson in the Literary Club; and after enduring many jests about the promised second part of the essay and the delay in its appearance, published it at last, retracting nothing, in 1782. Warton's edition of Pope was published in 1797. An edition of Dryden, for which he had collected materials, was completed and published by his son in 1811. Warton was a prebendary of St Paul's and of Winchester Cathedrals, and held the livings of Upham and of Wickham, Hampshire, where he died on the 23rd of February 1800.

See *Biographical Memoirs of the Late Rev. Joseph Warton*, by John Wooll (vol. i., 1806, no more published).

WARTON, THOMAS (c. 1688–1745), English author, professor of poetry at Oxford, son of Anthony Warton, was born at Godalming about 1688. He was educated at Hart Hall and Magdalen College, Oxford. He was satirized for his incompetence as professor of poetry by Nicholas Amhurst in *Terrae filius* as "squinting Tom of Maudlin." He was vicar of Basingstoke, Hampshire, and master of the grammar-school of the town, where he had among his pupils Gilbert White, the naturalist. He received further preferments in the church, and died at Basingstoke on the 10th of September 1745. He published nothing during his lifetime, but after his death his son Joseph published some of his poetry under the title of *Poems on Several Occasions* (1748).

WARTON, THOMAS (1728–1790), English poet-laureate and historian of poetry, younger son of Thomas Warton (see above), was born at Basingstoke on the 9th of January 1728. He was still more precocious as a poet than his brother—translated one of Martial's epigrams at nine, and wrote *The Pleasures of Melancholy* at seventeen—and he showed exactly the same bent, Milton and Spenser being his favourite poets, though he "did not fail to cultivate his mind with the soft thrillings of the tragic muse" of Shakespeare.

In a poem written in 1745 he shows the delight in Gothic churches and ruined castles which inspired so much of his subsequent work in romantic revival. Most of Warton's poetry, humorous and serious—and the humorous mock-heroic was better within his powers than serious verse—was written before the age of twenty-three, when he took his M.A. degree and became a fellow of his college (Trinity, Oxford). He did not altogether abandon verse; his sonnets, especially, which are the best of his poems, were written later. But his main energies were given to omnivorous poetical reading and criticism. He was the first to turn to literary account the medieval treasures of the Bodleian Library. It was through him, in fact, that the medieval spirit which always lingered in Oxford first began to stir after its long inaction, and to claim an influence in the modern world. Warton, like his brother, entered the church, and held one after another, various livings, but he did not marry. He gave little attention to his clerical duties, and Oxford always remained his home. In 1749 he published an heroic poem in praise of Oxford, *The Triumph of Isis*. He was a very easy and convivial as well as a very learned don, with a taste for pothouses and crowds as well as dim aisles and romances in manuscript and black letter. The first proof that he gave of his extraordinarily wide scholarship was in his *Observations on the Poetry of Spenser* (1754). Three years later he was appointed professor of poetry, and held the office for ten years, sending round, according to the story, at the beginning of term to inquire whether anybody *wished* him to lecture. The first volume of his monumental work, *The History of English Poetry*, appeared twenty years later, in 1774, the second volume in 1778, and the third in 1781. A work of such enormous labour and research could proceed but slowly, and it was no wonder that Warton flagged in the execution of it, and stopped to refresh himself with annotating (1785) the minor poems of Milton, pouring out in this delightful work the accumulated suggestions of forty years.

In 1785 he became Camden professor of history, and was made poet-laureate in the same year. Among his minor works were an edition of Theocritus, a selection of Latin and Greek inscriptions, the humorous Oxford *Companion to the Guide* and *Guide to the Companion* (1762); *The Oxford Sausage* (1764); an edition of Theocritus (1770); lives of Sir Thomas Pope and Ralph Bathurst, college benefactors; a *History of the Antiquities of Kiddington Parish*, of which he held the living (1781); and an *Inquiry into the Authenticity of the Poems attributed to Thomas Rowley* (1782). His busy and convivial life was ended by a paralytic stroke in May 1790.

Warton's poems were first collected in 1777, and he was engaged at the time of his death on a corrected edition, which appeared in 1791, with a memoir by his friend and admirer, Richard Mant. They were edited in 1822 for the *British Poets*, by S. W. Singer.

The History of English Poetry from the close of the 11th to the Commencement of the 18th Century, to which are prefixed two Dissertations: I. On the Origin of Romantic Fiction in Europe; II. On the Introduction of Learning into England (1774–1781) was only brought down to the close of the 16th century. It was criticized by J. Ritson in 1782 in *A Familiar Letter to the Author*. A new edition came out in 1824, with an elaborate introduction by the editor, Richard Price, who added to the text comments and emendations from Joseph Ritson, Francis Douce, George Ashby, Thomas Park and himself. Another edition of this, stated to be "further improved by the corrections and additions of several eminent antiquaries," appeared in 1840. In 1871 the book was subjected to a radical revision by Mr W. C. Hazlitt. He cut out passages in which Warton had been led into gross errors by misreading his authorities or relying on false information, and supplied within brackets information on authors or works omitted. Warton's matter, which was somewhat scattered, although he worked on a chronological plan, was in some cases rearranged and the mass of profuse and often contradictory notes was cut down, although new information was added by the editor and his associates, Sir Frederick Madden, Thomas Wright, W. Aldis Wright, W. W. Skeat, Richard Morris and F. J. Furnivall. When all criticism has been allowed for the inaccuracies of Warton's work, and the unsatisfactory nature of his general plan, the fact remains that his book is still indispensable to the student of English poetry. Moreover, much that may seem commonplace in his criticism was entirely fresh and even revolutionary in his own day. Warton directed the attention of readers to early English literature, and, in view of the want of texts, rendered inestimable service by transcribing large extracts from early writers. Of the poets of the 16th century he was an extremely sympathetic critic and has not been superseded.

See "T. Warton and Machyn's Diary," by H. E. D. Blakiston in the *English Historical Review* (April 1896) for illustrations of his inaccurate methods.

WARWICK, EARLS OF. John Rous (*c.* 1411–1491), the historian of the earls of Warwick, gives an account of them from Brutus their founder through many mythical ancestors, among whom is the Guy of romance. The 1st earl of Warwick was Henry de Newburgh (d. 1123), lord of Newbourg in Normandy and son of Roger de Beaumont. He became constable of Warwick Castle in 1068, and, though there is no proof that he actually came over with the Conqueror, his elder brother Robert de Beaumont, comte de Meulan, fought at Hastings. He apparently spent most of his time in Normandy, and was a baron of the Norman exchequer. He was created earl of Warwick early in the reign of William II. receiving a grant of the great estates of the Saxon, Thurkill of Arden, in Warwickshire. He was attached throughout his life to Henry I., and both the Beaumont brothers were faithful to the king at the time of the conspiracy of the Norman nobles in 1101. By his wife Margaret, daughter of Geoffrey II., count of Perche, he had five sons and two daughters. He died on the 20th of June 1123, and was buried in the Norman abbey of Préaux, near Pont-Audemer, a family foundation of which he and his brother were patrons. At Warwick he founded the priory of the Austin Canons, and endowed the church of St Mary.

Of his sons Roger de Newburgh became 2nd earl of Warwick and died in 1153; Rotrou (d. 1139) became archbishop of Rouen; and Robert, seneschal and justiciar of Normandy, died in 1185 in the abbey of Bec, of which he was a benefactor. The 2nd earl was followed by his two sons in succession, William (d. 1184) and Waleran (d. 1204). Henry de Newburgh, 5th earl of Warwick (1192–1229), took the royal side in the civil wars of the reigns of John and Henry III. The 6th earl, Thomas de Newburgh (*c.* 1213–1297), left no heirs, and was succeeded by his sister Margaret, countess of Warwick in her own right, who was twice married, but left no heirs. Her second husband, John du Plessis, assumed the title of earl of Warwick in 1245, and in 1250 received a grant of his wife's lands for life. He was succeeded in 1263 by Countess Margaret's cousin and heir, Sir William Mauduit (1220–1268), 8th earl of Warwick. Mauduit's sister and heiress, Isabel de Beauchamp, had apparently adopted the religious life at the time of her brother's death, and her son William de Beauchamp became 9th earl of Warwick.

His son Guy de Beauchamp, 10th earl of Warwick (1278–1315), received grants of land in Scotland for his services at Falkirk, and in 1301 was one of the signatories of the letter to the pope denying the papal right to interfere in Scottish affairs. He was with Edward I. at the time of his death, and is said to have been warned by him against Piers Gaveston. He was one of the lords ordainers of 1310, and was concerned in the capture of Gaveston, though he declined to countenance his execution. He died on the 10th of August 1315. His son, Thomas de Beauchamp, 11th earl (1313–1369), was marshal of England in 1344, and of the English army in France in 1346. He fought at Crecy and Poitiers, and was one of the original knights of the Garter.

Thomas de Beauchamp, 12th earl (*c.* 1345–1401), was about twenty-four years old when he succeeded his father. He served on the lords' committee of reform in the Good Parliament in 1376, and again in 1377, and was a member of the commission of inquiry in 1379. Appointed governor to Richard II. in February 1381, he joined the nobles who sought to impose their authority on the king, and was one of the lords appellant in 1388. After the overthrow of his party in 1389 Warwick lived in retirement, but although he had for the moment escaped Richard's vengeance he was not forgiven. Being invited with Gloucester and Arundel to a banquet at court on the 10th of July 1397 he alone of the three was imprudent enough to obey the summons. He was immediately arrested and imprisoned in the Tower of London, in that part of the fortress since known as the Beauchamp Tower. Warwick made a full confession in parliament; his honours were forfeited and he himself banished. He was again in the Tower in 1398, but was liberated and restored to his honours on the accession of Henry IV. His son Richard Beauchamp, 13th earl of Warwick, is separately noticed.

Henry, 14th earl of Warwick (1423–1445), Earl Richard's son, a descendant, through his mother Constance le Despenser, of Edmund, duke of York, fifth son of Edward III., received a patent making him premier earl in 1444. A year later he was created duke of Warwick with precedence next after the duke of Norfolk, a rank disputed by the duke of Buckingham. The assertion that he was crowned king of the Isle of Wight seems to have no foundation in fact. The 14th earl, whose honours were probably due to his father's services, died in his twenty-second year, leaving a daughter Anne, who died in 1449. On her death the earldom lapsed to the crown. The estates passed to Sir Richard Neville (see Warwick, Richard Neville, earl of), in right of his wife Anne, sister of Henry Beauchamp, duke of Warwick. He and his wife were created earl and countess of Warwick each for life in 1450, with remainder to Anne's heirs, and, these failing, to Margaret, countess of Shrewsbury, half-sister of the countess Anne. After the death of her husband, the Kingmaker, at Barnet in 1471, the rights of the countess, heiress of the Beauchamp estates, were set aside "as if the seid countes were nowe naturally dede" (act of 13 Edward IV. 1473) in favour of her daughters, Isabel, wife of George, duke of Clarence, and Anne, who, after the murder of her first husband Edward prince of Wales in 1471, married Richard, duke of Gloucester, afterwards Richard III. Their mother was allowed to resume her estates in 1487, but only to settle them on the crown. She was succeeded in 1493 in the earldom by her grandson Edward Plantagenet, 18th earl of Warwick (1475–1499), son of the duke of Clarence, and therefore the Yorkist heir to the crown. He was imprisoned in 1484, his sole offence being his birth, and was executed in 1499 on a charge of conspiracy with his fellow-prisoner, Perkin Warbeck. He was the last representative of the male line of the Plantagenets. His honours were forfeited, and his estates passed to his sister Margaret, countess of Salisbury in her own right, the unfortunate lady who was executed in 1541.

The next bearer of the title was John Dudley, Viscount Lisle, afterwards duke of Northumberland (*q.v.*), who was created earl of Warwick in 1547, on account of his descent from Margaret, countess of Shrewsbury, daughter of Richard Beauchamp, earl of Warwick. The earldom became extinct with his son John Dudley, 20th earl of Warwick (*c.* 1528–1554), who was condemned to death for having signed the letters patent making his sister-in-law, Lady Jane Grey, heir apparent. He was released from prison in October 1554, but died in the same month. His brother, Ambrose Dudley (*c.* 1528–1590), who fought at St Quentin in 1557, secured the reversal of the attainder of himself and his brother consequent on the attempt to place Lady Jane Grey on the throne, and in 1561 was created Baron Lisle and earl of Warwick. He was in high favour with Elizabeth, as was his third wife Anne, daughter of Francis Russell, 2nd earl of Bedford. His brother Robert, earl of Leicester, having predeceased him his honours became extinct on his death in 1590.

The earldom was revived in 1618 in favour of Robert Rich, 3rd Baron Rich (*c.* 1560–1619), grandson of Lord Chancellor Rich, who died shortly after his elevation. His wife Penelope, Lady Rich, is separately noticed. He was succeeded in 1619 by his eldest son Robert Rich, 2nd or 23rd earl of Warwick (*q.v.*), whose two sons Robert (1611–1659) and Charles (1619–1673) succeeded him in the earldom and died leaving no male issue. The 5th or 26th earl of Warwick was their cousin Robert Rich (1620–1675), eldest son of Henry, 1st earl of Holland. His grandson, the 7th or 28th earl, left no issue, and the title became extinct on the death, on the 15th of September 1759, of his kinsman Edward Rich, 8th or 29th earl. It was revived two months later, when Francis Greville, Baron Brooke of Beauchamps Court (1719–1773), who had in 1746 been created Earl Brooke of Warwick Castle, became earl of Warwick. Greville was descended from Robert Greville, the 2nd baron, who was killed at Lichfield during the civil war and he represented a cadet branch of the Beauchamp family. His son George (1746–1816) became the 2nd earl of this line, and the earldom has remained with his descendants, Francis Richard (b. 1853) becoming the 5th earl in 1893. His wife, Frances Evelyn, countess of Warwick, daughter of Colonel the Hon. C. H. Maynard (d. 1865), inherited the estates of her grandfather, Henry Maynard, 5th and last Viscount Maynard (1788–1865). She became well known in society, and later for her interest in social questions.

WARWICK, SIR PHILIP (1609–1683), English writer and politician, was the son of Thomas Warwick, or Warrick, a musician, and was born in Westminster on the 24th of December 1609. Educated at Eton, he travelled abroad for some time and in 1636 became secretary to the lord high treasurer, William Juxon; later he was a member of the Long Parliament, being one of those who voted against the attainder of Strafford and who followed Charles I. to Oxford. He fought at Edgehill and was one of the king's secretaries during the negotiations with the parliament at Hampton Court, and also during those at Newport, Charles speaking very highly of his services just before his execution. Remaining in England, Warwick was passively loyal to Charles II. during the Commonwealth and enjoyed the confidence of the royalist leaders. In 1660 the king made him a knight, and in 1661 he became a member of parliament and secretary to another lord treasurer, Thomas Wriothesley, earl of Southampton, retaining this post until the treasury was put into commission on Southampton's death in May 1667. He died on the 15th of January 1683. Warwick's only son, the younger Philip Warwick (d. 1683), was envoy to Sweden in 1680.

Warwick is chiefly known for his *Memoirs of the reigne of King Charles I., with a continuation to the happy restauration of King Charles II.*, written between 1675 and 1677 and published in London in 1701.

WARWICK, RICHARD BEAUCHAMP, Earl of (1382–1439), son of Thomas Beauchamp, was born at Salwarp in Worcestershire on the 28th of January 1382, and succeeded his father in 1401. He had some service in the Welsh War, fought on the king's side at the battle of Shrewsbury on the 22nd of July 1403, and at the siege of Aberystwith in 1407. In 1408 he started on a pilgrimage to the Holy Land, visiting on his way Paris and Rome, and fighting victoriously in a tournament with Pandolfo Malatesta at Verona. From Venice he took ship to Jaffa, whence he went to Jerusalem, and set up his arms in the temple. On his return he travelled through Lithuania, Prussia and Germany, and reached England in 1410. Two years later he was fighting in command at Calais. Up to this time Warwick's career had been that of the typical knight errant. During the reign of Henry V. his chief employment was as a trusted counsellor and diplomatist. He was an ambassador to France in September 1413, and the chief English envoy to the coronation of Sigismund at Aix-la-Chapelle, and to the council of Constance in the autumn of 1414. During the campaign of Agincourt he was captain of Calais, where in April 1416 he received Sigismund with such courtly magnificence as to earn from him the title of the "Father of Courtesy." In the campaigns of 1417–18 Warwick took a prominent part, reducing Domfront and Caudebec. Then he joined the king before Rouen, and in October 1418 had charge of the negotiations with the dauphin and with Burgundy. Next year he was again the chief English spokesman in the conference at Meulan, and afterwards was Henry's representative in arrangeing the treaty of Troyes. At the sieges of Melun in 1420, and of Mantes in 1421–22 he held high command. Warwick's sage experience made it natural that Henry V. should on his death-bed appoint him to be his son's governor. For some years to come he was engaged chiefly as a member of the council in England. In 1428 he received formal charge of the little king's education. He took Henry to France in 1430, and whilst at Rouen had the superintendence of the trial of Joan of Arc. In 1431 he defeated Pothon de Xaintrailles at Savignies. Next year he returned to England. The king's minority came nominally to an end in 1437. Warwick was then not unnaturally chosen to succeed Richard of York in the government of Normandy. He accepted loyally a service "full far from the ease of my years," and went down to Portsmouth in August, but was long detained by bad weather, "seven times shipped or ever he might pass the sea," and only reached Honfleur on the 8th of November. In Normandy he ruled with vigour for eighteen months, and died at his post on the 30th of April 1439. His body was brought home and buried at Warwick. His tomb in St Mary's church is one of the most splendid specimens of English art in the 15th century. Warwick married (1) Elizabeth Berkeley, (2) Isabella Despenser. By his second wife he left an only son Henry, afterwards duke of Warwick, who died in 1445, and a daughter Anne, who as her brother's sister of the whole blood brought the title and chief share of the estates to her husband Richard Neville, the king-maker. By his first wife he had three daughters, of whom the eldest, Margaret, married John Talbot, earl of Shrewsbury.

Bibliography.—John Rous (d. 1491) wrote a life of Warwick, illustrated with over fifty drawings, now at the British Museum (Cotton MS. Julius E. iv.). They have been reproduced in Strutt's *Manners and Customs*; new edition by Mr Emery Walker, with notes by Lord Dillon and Mr W. St John Hope. More authoritative material must be sought in strictly contemporary chronicles, and especially in the *Vita Henrici Quinti* ascribed to Elmham, Monstrelet; *Chronicles of London* (ed. C. L. Kingsford) and J. Stevenson, *Letters, &c. illustrative of the English Wars in France* ("Rolls" series). For modern accounts consult J. H. Wylie, *Henry IV.*; C. L. Kingsford, *Henry V.*; and Sir James Ramsay, *Lancaster and York*. (C. L. K.)

WARWICK, RICHARD NEVILLE, Earl of (1428–1471), called "the king-maker," was eldest son of Richard Neville, earl of Salisbury, by Alice, only daughter and heiress of Thomas, the last Montacute earl of Salisbury. He was born on the 22nd of November 1428, and whilst still a boy betrothed to Anne, daughter of Richard Beauchamp, earl of Warwick. When her brother's daughter died in 1449, Anne, as only sister of the whole blood, brought her husband the title and chief share of the Warwick estates. Richard Neville thus became the premier earl, and both in power and position excelled his father. Richard, duke of York, was his uncle, so when York became protector in 1453, and Salisbury was made chancellor, it was natural that Warwick should be one of the council. After the king's recovery in 1455 Warwick and his father took up arms in York's support. Their victory at St Albans on the 22nd of May was due to the fierce energy with which Warwick assaulted and broke the Lancastrian centre. He was rewarded with the important office of captain of Calais; to his position there he owed his strength during the next five years. Even when York was displaced at home, Warwick retained his post, and in 1457 was also made admiral. He was present in February 1458 at the professed reconciliation of the two parties in a loveday at St Paul's, London. During the previous year he had done some good fighting on the march of Calais by land, and kept the sea with vigour; now on his return he distinguished himself in a great fight with Spanish ships off Calais on the 28th of May, and in the autumn by capturing a German salt-fleet on its way to Lübeck. These exploits brought him a prestige and popularity that were distasteful to the home government. Moreover, England was at war neither with Castile nor with the Hanse. Warwick's action may possibly have formed part of some Yorkist design for frustrating the foreign policy of their rivals. At all events there was pretext enough for recalling him to make his defence. Whilst he was at the court at Westminster a brawl occurred between his retainers and some of the royal household. Warwick himself escaped with difficulty, and went back to Calais, alleging that his life had been deliberately attempted. When in the following year a renewal of the war was imminent, Warwick crossed over to England with his trained soldiers from Calais under Sir Andrew Trollope. But at Ludlow on the 12th of October Trollope and his men deserted, and left the Yorkists helpless. Warwick, with his father, his cousin the young Edward of York, and only three followers, made his way to Barnstaple. There they hired a little fishing vessel. The master pleaded that he did not know the Channel, but Warwick resourcefully took command and himself steered a successful course to Calais. He arrived just in time to anticipate the duke of Somerset, whom the Lancastrians had sent to supersede him. During the winter Warwick held Calais against Somerset, and sent out a fleet which seized Sandwich and captured Lord Rivers. In the spring he went to Ireland to concert plans with Richard of York. On his return voyage he encountered a superior Lancastrian fleet in the Channel. But Exeter, the rival commander, could not trust his crews and dared not fight.

From Calais Warwick, Salisbury and Edward of York crossed to Sandwich on the 26th of June. A few days later they entered London, whence Warwick at once marched north. On the 10th of July he routed the Lancastrians at Northampton, and took the king prisoner. For the order to spare the commons and slay the lords Warwick was responsible, as also for some later executions at London. Yet when Richard of York was disposed to claim the crown, it was, according to Waurin, Warwick who decided the discussion in favour of a compromise, perhaps from loyalty to Henry, or perhaps from the wish not to change a weak sovereign for a strong. Warwick was in charge of London at the time when Richard and Salisbury were defeated and slain at Wakefield. The Lancastrians won a second victory at St Albans on the 17th of February 1461, possibly through lack of generalship on Warwick's part. But in his plans to retrieve the disaster Warwick showed skill and decision. He met Edward of York in Oxfordshire, brought him in triumph to London, had him proclaimed king, and within a month of his defeat at St Albans was marching north in pursuit of the Lancastrians. The good generalship which won the victory of Towton may have been due to Edward rather than to Warwick, but the new king was of the creation of the powerful earl, who now had his reward. For four years the government was centred undisputedly in the hands of Warwick and his friends. The energy of his brother John, Lord Montagu, frustrated the various attempts of the Lancastrians in the north. In another sphere Warwick himself was determining the lines of English policy on the basis of an alliance with France. The power of the Nevilles seemed to be completed by the promotion of George, the third brother, to be archbishop of York. The first check came with the announcement in September 1464 of the king's secret marriage to Elizabeth Woodville. This was particularly distasteful to Warwick, who had but just pledged Edward to a French match. For the time, however, there was no open breach. The trouble began in 1466, when Edward first made Rivers, the queen's father, treasurer, and afterwards threw obstacles in the way of an intended marriage between Warwick's daughter Isabel and George of Clarence, his own next brother. Still in May 1467 Warwick went again with the king's assent to conclude a treaty with France. He returned to find that in his absence Edward, under Woodville's influence, had committed himself definitely to the Burgundian alliance. Warwick retired in dudgeon to his estates, and began to plot in secret for his revenge. In the summer of 1469 he went over to Calais, where Isabel and Clarence were married without the king's knowledge. Meantime he had stirred up the rebellion of Robin of Redesdale in Yorkshire; and when Edward was drawn north Warwick invaded England in arms. The king, outmarched and outnumbered, had to yield himself prisoner, whilst Rivers and his son John were executed. Warwick was apparently content with the overthrow of the Woodvilles, and believed that he had secured Edward's submission. In March 1470 a rebellion in Lincolnshire gave Edward an opportunity to gather an army of his own. When the king alleged that he had found proof of Warwick's complicity, the earl, taken by surprise, fled with Clarence to France. There, through the instrumentality of Louis XI., he was with some difficulty reconciled to Margaret of Anjou, and agreed to marry his second daughter to her son. In September Warwick and Clarence, with the Lancastrian lords, landed at Dartmouth. Edward in his turn had to fly oversea, and for six months Warwick ruled England as lieutenant for Henry VI., who was restored from his prison in the Tower to a nominal throne. But the Lancastrian restoration was unwelcome to Clarence, who began to intrigue with his brother. When in March 1471 Edward landed at Ravenspur, Clarence found an opportunity to join him. Warwick was completely outgeneralled, and at Barnet on the 14th of April was defeated and slain.

Warwick has been made famous by Lytton as "The Last of the Barons." The title suits him as a great feudal lord, who was a good fighter but a poor general, who had more sympathy with the old order than with the new culture. But he was more than this. He had some of the qualities of a strong ruler, and the power to command popularity. He was a skilled diplomatist and an adroit politician. These qualities, with his position as the head of a great family, the chief representative of Beauchamp, Despenser, Montacute and Neville, made him during ten years "the king-maker."

Warwick's only children were his two daughters. Anne, the younger, was married after his death to Richard of Gloucester, the future Richard III. Their husbands shared his inheritance and quarrelled over its division.

BIBLIOGRAPHY.—Warwick of course fills a great place in contemporary authorities; for a note on the chief of them see under EDWARD IV. For modern authorities see especially C. W. Oman's brilliant but enthusiastic *Warwick the King-Maker*, Sir James Ramsay's *Lancaster and York*, and Stubbs's *Constitutional History*. (C. L. K.)

WARWICK, SIR ROBERT RICH, 2ND EARL OF (1587–1658), colonial administrator and admiral, was the eldest son of Robert Rich, earl of Warwick (see above) and his wife Penelope Rich (*q.v.*), and succeeded to the title in 1619. Early interested in colonial ventures, he joined the Bermudas, Guinea, New England and Virginia companies. His enterprises involved him in disputes with the East India Company (1617) and with the Virginia Company, which in 1624 was suppressed through his action. In 1627 he commanded an unsuccessful privateering expedition against the Spaniards. His Puritan connexions and sympathies, while gradually estranging him from the court, promoted his association with the New England colonies. In 1628 he indirectly procured the patent for the Massachusetts colony, and in 1631 he granted the "Saybrook" patent in Connecticut. Compelled the same year to resign the presidency of the New England Company, he continued to manage the Bermudas and Providence Companies, the latter of which, founded in 1630, administered Old Providence on the Mosquito coast. Meanwhile in England Warwick opposed the forced loan of 1626, the payment of ship-money and Laud's church policy, and with his brother the first lord Holland (*q.v.*) came to be recognized as one of the heads of the Puritans. In March 1642 the Commons, in spite of the king's veto, appointed him admiral of the fleet, and in July he gained the whole navy for the parliament. He raised forces in Norfolk and Essex on the outbreak of the war, and as lord high admiral (1643–1645) he did good service in intercepting the king's ships and relieving threatened ports. In 1643 he was appointed head of a commission for the government of the colonies, which the next year incorporated Providence Plantations, afterwards Rhode Island, and in this capacity he exerted himself to secure religious liberty. Reappointed lord high admiral in May 1648, in the vain hope that his influence with the sailors would win back the nine ships which had revolted to the king, he collected a new fleet and blockaded them at Helvoetsluys. Dismissed from office on the abolition of the House of Lords in 1649, he retired from public life, but was intimately associated with Cromwell, whose daughter Frances married his grandson and heir Robert Rich in 1657. He died on the 19th of April 1658. The suspicions cast by his enemies on his religious sincerity and political fidelity appear to be baseless.

WARWICK, a town of Merivale county, Queensland, Australia, 169 m. by rail S.W. of Brisbane. Pop. (1901) 3836. It lies on the bank of the river Contadamine, in the heart of one of the best agricultural districts in Queensland, and is perhaps the most attractive inland town in the colony. It is well laid out with many substantial public and private buildings, and has two large parks, besides smaller recreation grounds. The district is famous for its vineyards, and quantities of excellent wine are made; wheat and maize are the principal crops, but tobacco, oats and lucerne are largely grown. Coal is found near the town, as are also marble, good building stone and brick clay.

WARWICK, a municipal and parliamentary borough, and the county town of Warwickshire, England; finely situated on the river Avon, the Warwick & Napton and Birmingham canals, 98 m. N.W. from London. Pop. (1901) 11,889. It is served by the Great Western and the London & North-Western railways. The parliamentary borough was united with that of Leamington in 1885, and returns one member. Leamington lies 2 m. E., and the towns are united by the suburb of New Milverton.

The magnificent castle of the earls of Warwick stands in a commanding and picturesque position on a rocky eminence above the river. Its walls, enclosing a lovely lawn and gardens, are flanked by towers, of which Caesar's tower, 147 ft. high, the Gateway tower and Guy's tower are the chief, dating from the 14th century. The residential portion lies on the river side. Excepting a few traces of earlier work, its appearance is that of a princely mansion of the 17th century. There is a famous collection of pictures. The Great Hall and other apartments suffered from fire in 1871, but were restored. A vase of marble attributed to the 4th century B.C. is preserved here; it was discovered near Hadrian's Villa at Tivoli in Italy. Below the castle the Avon, with thickly wooded banks, affords one of the most exquisite reaches of river scenery in England. The church of St Mary is principally, as it stands, a rebuilding of the time of Queen Anne, after a fire in 1694. It appears from Domesday that a church existed before the Conquest. It was made collegiate by Roger de Newburgh, the second Norman earl, in 1123. At the Dissolution Henry VIII. granted the foundation to the burgesses of the town. The Beauchamp Chapel survived the fire; it is a beautiful example of Perpendicular work, founded by the will of Earl Richard Beauchamp, and built between 1443 and 1464. The fine tomb of the earl stands in the centre. There are only scanty traces of the old town walls, but the east and west gates remain, rendered picturesque by chapels built above them. The priory of St Sepulchre was founded by Henry de Newburgh and completed in the reign of Henry I., on the site of an ancient church, for a society of canons regular. It is now a private residence. Leicester Hospital, established by Robert Dudley, earl of Leicester, is a picturesque example of half-timber building. It was originally used as the hall of the united gilds of the Holy Trinity, the Blessed Virgin and St George the Martyr. The earl of Leicester, by an act of incorporation obtained in 1571, founded the hospital for the reception of twelve poor men possessing not more than £5 a year, and a master. The first master, appointed by the earl himself, was the famous Puritan, Thomas Cartwright. St John's Hospital, a foundation of the time of Henry II., is represented by a beautiful Jacobean mansion. There are numerous charities in the town, the principal being those of Henry VIII., Sir Thomas White and Thomas Oken. The first is devoted to ecclesiastical and municipal stipends and to the King's School. By the charity of Sir Thomas White, the sum of £100 is lent, without interest, to young tradesmen for a period of nine years. The King's School, an important foundation for boys, dates from the reign of Edward the Confessor. It occupies modern buildings. Upon the same foundation are the high school for girls and the King's middle school. Among public buildings are a shire hall, free library and museum. Industries include gelatine- and brick-making, and there are ironworks. The parliamentary borough returns one member. Area, 5613 acres.

A famous site in the vicinity of Warwick is Guy's Cliffe, where a modern mansion, embodying ancient remains, crowns the precipitous rocky bank of the Avon. Here was the hermitage of the first Guy, earl of Warwick. Blacklow Hill in the vicinity was the scene of the execution of Piers Gaveston, the favourite courtier of Edward II., in 1312.

Warwick (*Warwic, Warrewici, Warrewyk*) is said to have been a Roman station, and was later fortified by Æthelflæd, the lady of Mercia, against the Danes. At the time of the Domesday Survey, Warwick was a royal borough, containing 261 houses, of which 130 were in the king's hands, while 19 belonged to burgesses who enjoyed all the privileges they had had in the time of Edward the Confessor. The Conqueror granted the borough to Henry of Newburgh, who was created earl of Warwick, and in all probability built the castle on the site of Æthelflæd's fortification. The Beauchamps, successors of Henry of Newburgh as earls of Warwick, held the borough of the king in chief. Although the borough owed its early importance to the castle of the earls of Warwick as well as to its position, and received a grant of a fair from John, earl of Warwick, in 1261, it seems to have developed independently of them, and received no charter until it was incorporated under the title of the burgesses of Warwick in 1546 after it had come into the king's hands by the attainder of Edward, earl of Warwick, in 1499. Other charters were granted in 1553, 1665, 1684 and 1694, of which that of 1553 allowed the appointment of assistant burgesses, though this was discontinued in 1698 because through their means a candidate for the borough was elected who was not supported by the recorder and aldermen. The charter of 1694 conferred the title of "Mayor, Aldermen and Burgesses" on the corporation, and appointed the offices of the borough. The mayor, aldermen and assistant burgesses were to assemble yearly at Michaelmas, and in the presence of all the burgesses nominate two aldermen, who should elect the new mayor and other officers. A mayor refusing office was to be fined £20, an alderman £10 and an assistant burgess £5. In 1882 the borough was divided into three wards, and the corporation consists of a mayor, 6 aldermen and 18 town councillors. Warwick returned two members to parliament from 1295, but in 1885 the number was reduced to one. In addition to the fair granted by the earl to the burgesses in 1261, he himself held by prescriptive right a yearly fair in August and a market every Wednesday. Another fair was granted in 1290, and in 1413 the fair held at Michaelmas was changed to the feast of St Bartholomew. Fairs are now held on the 12th of October and on the Monday before St Thomas's day. A market is held every Saturday, the first charter for this being granted in 1545. A gaol is mentioned here as early as 1200 in a pipe roll of that year.

WARWICK, a township of Kent county, Rhode Island, U.S.A., about 5 m. S. of Providence, on the W. side of Narragansett Bay (here called Providence river) and crossed by the Pawtuxet river, which is in its lower course a part of the township's northern boundary. Pop. (1890) 17,761; (1900) 21,316, of whom 7792 were foreign-born; (1910 census) 26,629. The township is crossed by the New York, New Haven & Hartford railway, and electric lines serve most of its twenty-seven rather scattered villages. The larger villages are: on the river, Pontiac, Natick, River Point (at the junction of the two upper branches of the Pawtuxet), Phoenix, Centreville and Crompton; on Greenwich Bay, Apponaug and Warwick; and on Providence river, Shawomet, Warwick Neck, Oakland Beach, Buttonwoods, Conimicut and Long Meadow, which are summer resorts. Water power is provided by the Pawtuxet river, and much cotton and some woollen and print goods are manufactured. The value of the factory product in 1905 was $7,051,971 (17·1% more than in 1900); of the total, nine-tenths was the value of textile products. Warwick, originally called Shawomet (Shawmut), its Indian name, was settled in 1643 by Samuel Gorton (*q.v.*) and a few followers. Gorton quarrelled with the Indians, was carried off to Boston, was tried there for heresy, was convicted, and was imprisoned; was released with orders to leave the colony in March 1644, went to England, and under the patronage of the earl of Warwick returned to his settlement in 1648 and renamed it in honour of the earl. In 1647 the settlement entered into a union with Providence, Newport and Portsmouth under the Warwick (or Williams) charter of 1644, but during 1651–1654 Warwick and Providence were temporarily separated from the other two towns. Warwick was the birthplace of General Nathanael Greene.

WARWICKSHIRE, a midland county of England, bounded N. by Staffordshire, E. by Leicestershire and Northamptonshire, S. by Oxfordshire and Gloucestershire, and W. by Worcestershire. The area is 902·3 sq. m. The river Avon, watering a rich valley on a line from N.E. to S.W., divides the county into two unequal parts. The greater, lying to the N.W., drains principally to the Trent through the rivers Cole, Blythe, Rea, Anker and minor streams. Between these valleys, and dividing the system from that of the Avon, the land rises in gentle undulations, and is of plateau-like character, generally between 400 and 600 ft. in elevation. There are considerable tracts of this nature on the western boundary, both north and south of Birmingham, on the eastern boundary north of Rugby, and in the centre between the Blythe, the Anker and the Avon. From this side the Avon receives the Swift, the Sowe and the Alne. The northern district was distinguished by Camden as the Woodland, as opposed to the southern or Feldon, "a plain champain." The northern woodland embraced the ancient forest of Arden (*q.v.*) and it is this district which gave to the county the common epithets of "woody" or "leafy." The Feldon or south-eastern district is almost wholly in the Avon valley. From this side the Avon receives the Leam, the Itchen and the Stour. Along the south-eastern boundary runs the highest line of hills in the county, reaching some 800 ft., and including Edge Hill (which gives name to the battle of 1642), and the Brailes, Dassett, Napton and Shuckburgh hills. The county boundary here extends across the highest line of hills, to include the headwaters of some of the feeders of the Cherwell, and thus a small part of the drainage area of the Thames. These hills rise abruptly, and command wide views over the champaign. The finest silvan scenery is found on the banks of the Avon; the position of Guy's Cliffe and of Warwick Castle are well-known examples. It is not difficult to trace the influence of the scenic characteristics of the county in the writings of its most famous son, William Shakespeare.

Geology.—The Archean rocks are represented by some volcanic ashes and intrusive dykes (the Caldecote Series), which are exposed north-west of Nuneaton. They dip south-westward under the Cambrian beds—Hartshill Quartzite and Stockingford Shales—which give rise to higher ground; the quartzite, which is opened up in numerous large roadstone quarries, contains towards its summit a fauna suggesting that of the *Olenellus* zone, one of the oldest faunas known. The quartzite as well as the overlying shales is seamed with intrusive dykes of diorite. A small inlier of the same shales occurs at Dosthill, south of Tamworth. The Coal Measures of the Warwickshire coalfield crop out in the north of the county between Nuneaton and Tamworth and contain valuable coal-seams; they pass conformably under the so-called Permian red sandstones and marls which are apparently the equivalents of the Keele Beds of Staffordshire, and like them should be grouped with the Coal Measures; they occupy a considerable area north and west of Coventry, and at Corley form high ground (625 ft.); in several places shafts have been sunk through them to the productive Coal Measures below. The rest of the county is occupied in the northern half by the Triassic red rocks, and in the south-east by the Lias. Of the Trias the Bunter (soft red sandstones with pebble-beds) is represented only between Birmingham and Sutton Coldfield, where it is succeeded by the Keuper Sandstone, which is occasionally exposed also around the edge of the coalfield (Tamworth, Coventry, Warwick, Maxstoke); the Keuper Marls occupy a large area in the centre of the county, while some sandstones in them form picturesque scarps near Henley-in-Arden. The highly fossiliferous Rhaetic beds which introduce the Lias are seldom exposed. The Lower Lias limestones are worked for cement (as near Rugby) and abound in ammonites. The Middle Lias sands and limestones follow, and form escarpments (as at Edge Hill, 710 ft.); but these and the lowest members of the Oolite series scarcely cross the county boundary from Oxfordshire. Glacial drifts—boulder-clay, sand and gravel—overspread large areas of the older rocks; their composition shows them to have been deposited from glaciers or ice-sheets which entered the district from the Irish Sea, from North Wales and from the North Sea. Later fluvio-glacial gravels of the Avon valley have yielded mammalian remains (hippopotamus, mammoth, &c.), while palaeolithic implements of quartzite have been found in the old gravels of the Rea near Birmingham. Coal, ironstone, lime and cement are the chief mineral products; manganese ore was formerly got from the Cambrian rocks.

Climate and Agriculture.—The climate is generally mild and healthy. The soil is on the whole good, and consists of various loams, marls, gravels and clays, well suited for most of the usual crops. It is rich in pasture-land, and dairy-farming is increasing. It has excellent orchards and market-gardens, and possesses some of the finest woodlands in England. About five-sixths of the total area, a high proportion, is under cultivation, and of this about two-thirds is in permanent pasture. Oats and wheat occupy the greater part of the area under grain crops. In connexion with the cattle-rearing and dairy-farming, over half the acreage under green crops is occupied by turnips, swedes and mangolds.

Industries.—The industrial part of the county is the northern. Warwickshire includes the greatest manufacturing centre of the Midlands—Birmingham, though the suburbs of that city extend into Staffordshire and Worcestershire. Metal-working in all branches is prosecuted here, besides other industries. Coventry is noted for cycle-making, and, with Bedworth and Nuneaton and the intervening villages, is a seat of the ribbon- and tape-makers. A small rich coalfield occurs in the north-east, extending outside the county northward from Coventry. Clay, limestone and other stone are quarried at various points, and an appreciable amount of iron ore is raised.

Communications.—The main line of the London & North-Western railway runs within the county near the N.E. boundary, by Rugby, Nuneaton and Tamworth, with branches to Leamington and Warwick, Coventry and Birmingham, and cross-branches. The northern line of the Great Western railway runs through Leamington and Warwick to Birmingham, with branches to Stratford-on-Avon and Henley-in-Arden. The Leicester and Birmingham branch of the Midland railway crosses the north of the county by Nuneaton, and the Birmingham-Evesham line of this company serves Alcester. The East and West Junction railway, from Blisworth in Northamptonshire, serves Stratford-on-Avon and terminates at Broom Junction on the Evesham line of the Midland. Water communication through the east of the county is afforded by the Oxford and Coventry canals. The Warwick & Napton canal joins the Oxford at Napton; the Warwick & Birmingham joins these towns, and the Stratford-on-Avon is a branch from it. The Fazeley canal runs N.E. from Birmingham. None of the rivers is of commercial value for navigation.

Population and Administration.—The area of the ancient county is 577,462 acres, with a population in 1891 of 805,072, and in 1901 of 897,835, the chief centres of increase lying naturally in the parts about Birmingham and Coventry. The area of the administrative county is 579,885 acres. The municipal boroughs are: Aston Manor (pop. 77,326), Birmingham (522,204), Coventry (69,978), Leamington, officially Royal Leamington Spa (26,888), Nuneaton (24,996), Stratford-on-Avon (8310), Sutton Coldfield (14,264) and Warwick (11,889), the county town. The urban districts are: Bulkington (1548), Erdington (16,368), Kenilworth (4544) and Rugby (16,830). Among the towns not appearing in these lists there should be mentioned: Alcester (2303), Atherstone (5248), Bedworth (7169), Coleshill (2593), Foleshill (5514) and Solihull (7517). Warwickshire is in the midland circuit, and assizes are held at Warwick. It has one court of quarter sessions, and is divided into 14 petty sessional divisions. The boroughs of Birmingham, Coventry, Royal Leamington Spa, Stratford-on-Avon, Sutton Coldfield and Warwick have separate commissions of the peace, and the boroughs of Birmingham and Warwick have, in addition, separate courts of quarter sessions. The total number of civil parishes is 267. The county, which is mostly in the diocese of Worcester, but also extends into those of Lichfield, Gloucester, Peterborough and Oxford, contains 297 ecclesiastical parishes or districts, wholly or in part. Warwickshire has four parliamentary divisions—Northern or Tamworth, North-eastern or Nuneaton, South-eastern or Rugby, and South-western or Stratford-on-Avon, each returning one member. The parliamentary boroughs of Aston Manor, Coventry and Warwick return one member each, and that of Birmingham has seven divisions, each returning one member.

Birmingham is the seat of a university, of the large grammar school of King Edward VI., and of other important educational institutions. At Rugby is one of the most famous of English public schools. The King's School, Warwick, is a large boys' school, and the Leamington High School is for girls. There is a day training college for schoolmasters and schoolmistresses in connexion with Mason University College, Birmingham. Among other institutions there may be mentioned the Lady Warwick College for the instruction of women in the higher branches of agriculture, &c., founded by Frances, countess of Warwick, at Reading in 1898, and subsequently removed to Studley Castle in western Warwickshire, where there is accommodation for 50 students.

History.—The earliest English settlers in the district now known as Warwickshire were a tribe of Hwiccas who, pushing up the Severn valley in the 6th century, made their way along the passages afforded by the Avon valley and the Roman Fosse Way, the extent of their settlement being indicated by the ancient limits of the diocese of Worcester. The vast forest of Arden, stretching from the Avon to the site of the modern Birmingham, barred any progress northwards, at the same time affording protection from the Anglian tribes who were already settled about Atherstone, and it was only after the battle of Cirencester in 628 that the whole of the Hwiccan territory was comprised in Mercia. In 675 Cosford was included in the endowment of Peterborough, and in 757 Æthelbald was slain at Seckington in a battle with the West Saxons. The shire of Warwick originated in the 10th century about Æthelflæd's new burgh at Warwick, and is mentioned by name in the *Saxon Chronicle* in 1016, when it was harried by Canute. The Danes made frequent incursions in the district in the 10th and 11th centuries, but no traces of their settlements occur south of Rugby.

The shire offered little resistance to the Conqueror, who was at Warwick in 1068, and Thurkill the sheriff was one of the few Englishmen to retain large estates which he had held before the conquest, his family long continuing in the county under the name of Arden. The fortification which he had raised at Warwick William entrusted to Henry, son of Roger de Beaumont, afterwards earl of Warwick, and Robert, count of Meulan, Henry's elder brother, had an important fief. Coventry Minster was richly endowed, and in 1285 the prior claimed among other privileges to have an independent coroner and to hold two courts a year. The earldom and castle of Warwick subsequently passed to the Beauchamps, and in the reign of Henry VI. to the Nevilles. The Clintons, founders of the castles and priories at Maxstoke and Kenilworth, enjoyed large estates in the county during the Norman period.

The ten Domesday hundreds of Warwickshire are now reduced to four, all of which are mentioned in the 12th century. Hemlingford represents the Domesday hundred of Coleshill; Knightlow, the Domesday hundreds of Bomelau, Meretone and Stanlei; Kineton, the Domesday hundreds of Tremelau, Honesberie, Fexhole and Berricestone; Barlichway, the Domesday hundreds of Fernecumbe and Patelau. Coleshill took its name from Coleshill, a town near the junction of the Cole and the Blythe; Hemlingford from a ford over the Tame near Kingsbury; Knightlow from a hill on Dunsmore Heath; Meretone and Stanlei from the villages of Marton and Stoneleigh; Berricestone from Barcheston on the Stour; Barlichway from a plot of ground on a hill between Haselor and Burton. Patelau hundred, which derived its name from a tumulus between Wootton Wawen and Stratford-on-Avon, was a liberty of the bishops of Worcester, and in the 17th century, though reckoned part of Barlichway hundred, possessed a court leet and court baron. The boundaries of Warwickshire have remained practically unchanged since the Domesday Survey, but Spilsbury, now in Oxfordshire, Romsley, Shipley, Quat and Rudge, now in Shropshire, and Chillington, now in Staffordshire, were assessed under this county, while Sawbridge, Berkswell, Whitacre, Over and Whichford, now in this county, were assessed under Northamptonshire. Warwickshire was united with Leicestershire under one sheriff until 1566, the shire court for the former being held at Warwick.

In the 13th century Warwickshire included the deaneries of Warwick and Kineton within the archdeaconry and diocese of Worcester; the rest of the county constituting the archdeaconry of Coventry within the Lichfield diocese, with the deaneries of Coventry, Stoneley, Merton and Arden. In 1836 the archdeaconry of Coventry was annexed to the diocese of Worcester, and in 1854 its deaneries were entirely reconstituted and made thirteen in number. In 1861 the deanery of Alcester was formed within the archdeaconry of Worcester, and Kineton was divided into North Kineton and South Kineton. In 1894 the deaneries of Aston, Birmingham, Coleshill, Northfield, Polesworth, Solihull and Sutton Coldfield were formed into the archdeaconry of Birmingham, the archdeaconry of Coventry now including the deaneries of Atherstone, Baginton, Coventry, Dassett Magna, Dunchurch, Leamington, Monks Kirby, Rugby and Southam.

In the wars of the reign of Henry III. Simon de Montfort placed Kenilworth Castle in charge of Sir John Giffard, who in 1264 attacked Warwick Castle and took prisoner the earl and countess of Warwick, who had supported the king. During the Wars of the Roses the Nevilles, represented by the earl of Warwick, supported the Yorkist cause, while Coventry was a Lancastrian stronghold. On the outbreak of the Civil War of the 17th century Warwickshire and Staffordshire were associated for the parliament under Lord Brooke. The battle of Edgehill was fought in 1642, and in 1643 Birmingham, then a small town noted for its Puritanism, was sacked by Prince Rupert. Coventry endured a siege in 1642, and skirmishes took place at Southam and Warwick.

At the time of the Domesday Survey the industries of Warwickshire were almost exclusively agricultural, the extensive woodlands north of the Avon affording pasturage for sheep, while meadows and water-mills were numerous in the river valleys. The woollen industry flourished in Norman times, and Coventry was famed for its wool and broadcloths in the reign of Edward III. Coal was probably dug at Griff in the 12th century, but the Warwickshire collieries only came into prominence in the 17th century, when John Briggs of Bedworth made an attempt to monopolize the coal trade. Birmingham was already famous for its smiths and cutlers in the 16th century. In the early 17th century the depopulation and distress caused by the enclosures of land for pasture led to frequent riots. The silk industry at Coventry and the needle industry about Alcester both flourished in the 18th century.

Warwickshire returned two members to the parliament of 1290, and in 1295 Coventry and Warwick were each represented by two members. Tamworth returned two members in 1584. Under the Reform Act of 1832 the county returned four members in two divisions; Birmingham was represented by two members, and Tamworth was disfranchised. Under the act of 1868 the representation of Birmingham was increased to three members.

Antiquities.—Of pre-Norman architecture some traces appear in the fine church of Wootton Wawen in the Arden (western) district. Otherwise the type is scarce, but Saxon remains, such as burial urns and jewelry, have been found in several places, as near Bensford Bridge on Watling Street. For ecclesiastical architecture Coventry with its three spires is famous, and among village churches there are many fine examples. Of those retaining Norman portions may be mentioned: Wolston and Berkswell in the Coventry district; Polesworth, formerly conventual, and Curdworth in the north; and in the south, in the neighbourhood of Edgehill, Burton Dassett, a very noteworthy building, and Warmington, where there is a remarkable specimen of *domus inclusi* or anchorite's chamber. There are also fine examples of Decorated work, such as Knowle, Solihull and Temple Balsall in Arden, and Brailes under the southern hills. Among the numerous religious houses in the county several have left remains. Such are the Cistercian foundations of Coombe Abbey near Coventry, of the 12th century, adjoining the mansion of that name in a beautiful park; of Merevale near Atherstone; and of Stoneleigh near Kenilworth, also adjoining a famous mansion. This abbey was a 12th-century foundation, but a majestic gatehouse of the 14th century also stands. Maxstoke Priory, in Arden, was a foundation for Augustinian canons of the 14th century. Wroxall Abbey was a Benedictine nunnery of the 12th century; but the name is given to a modern mansion. In view of the large share the county has had in war, it is not surprising to find many examples of great fortified houses or castles. Warwick Castle and Kenilworth Castle, the one still a splendid residence, the other a no less splendid ruin, are described under those towns. At Hartshill (the birthplace of Michael Drayton the poet) there is a fragment of a Norman castle. Among fortified mansions Maxstoke Castle is of the 14th century; Baddesley Clinton Hall is of the 15th as it stands, but is an earlier foundation; Astley Castle is another good specimen of the period. Compton Wyniates, once fortified, is a beautiful Elizabethan house of brick, so remarkably hidden in a hollow of the southern hills as to be visible only from the closest proximity on all sides; Charles I. lodged here during the Civil Wars. Charlecote Park is a modernized Elizabethan hall in an exquisite situation on the Avon above Stratford. Of more modern mansions Arbury Hall, Astley Castle, Newnham Paddox, Ragley Hall and Walton Hall may be mentioned.

See *Victoria County History, Warwickshire*; Sir William Dugdale, *The Antiquities of Warwickshire* (London, 1656; 2nd ed., 2 vols., London, 1730); W. Smith, *A History of the County of Warwick* (Birmingham, 1830); J. T. Burgess, *Historic Warwickshire* (London, 1876); *Early Earthworks in Warwickshire* (Birmingham, 1884); S. Timmins, *History of Warwickshire* ("Popular County History" series) (London, 1889); J. Hannet, *The Forest of Arden* (London, 1863).

WASH, THE, a shallow bay of the North Sea, on the Lincolnshire and Norfolk coast of England. It is roughly square in shape, penetrating the land for 22 m., and being 20 m. wide at the head and 12 at the mouth. Through the sandbanks which form its bed there are two main channels into deep water; one, Boston Deeps, is kept open by the waters of the Witham and Welland; the other, Lynn Deeps, gives passage to those of the Nene and the Great Ouse. The Wash is the remnant of a much larger bay, which covered a large part of the Fens which now border it; it is gradually filling with the deposits of the rivers, and from time to time small portions are reclaimed (see FENS). The flat bordering lands are protected by sea-walls. The formerly dangerous passage of the marsh-lands, which were liable to irruptions of the tide, is illustrated by the accident to

King John in 1216 shortly before his death. Passing over the Cross Keys Wash, near Sutton Bridge, his baggage and treasure wagons were engulfed and he himself barely escaped with life.

WASHBURN, CADWALLADER COLDEN (1818–1882), American soldier and politician, was born at Livermore, Maine, on the 22nd of April 1818. He was admitted to the bar in 1842, and removed to Mineral Point, Wisconsin, where he practised law, speculated in land and engaged in banking. He became prominent in the Republican party, and was a member (1855–1861) of the U.S. House of Representatives, of which his brother Israel (1813–1883) was a member from Maine in 1851–1861; his brother Elihu Benjamin (see below) changed the spelling of the family surname to Washburne. At the beginning of the Civil War he became colonel of the Second Wisconsin Cavalry, was promoted to brigadier-general on the 16th of July 1862 and to major-general on the 29th of November 1862, and assisted in the capture of Vicksburg (4th July 1863), after which he served in Texas and West Tennessee. Resigning from the army in 1865, he became extensively interested in flour-milling and lumbering in Wisconsin. From 1867 to 1871 he was again a member of the U.S. House of Representatives, and subsequently served one term (1872–1874) as governor of Wisconsin.

WASHBURN, a city and the county-seat of Bayfield county, Wisconsin, U.S.A., about 52 m. E. of Superior, Wis., and about 6 m. N. of Ashland, on Chequamegon Bay, an arm of Lake Superior. Pop. (1910) 3830. Washburn is served by the Northern Pacific and the Chicago & North-Western railways, and by several lines of lake steamships. The city is finely situated on high land above the bay, and is a popular summer resort, being especially well known for its boating and fishing. It has a Carnegie library. Among its manufactures are staves, shingles, lumber, wooden ware and bricks. There is a powder and dynamite plant in the vicinity. In the city there are also grain elevators and large coal docks, and in the neighbourhood are valuable stone quarries. In 1659 Radisson and Groseilliers touched here on their trip along the south shore of Lake Superior. In 1665 Father Claude Allouez, the Jesuit, established on the shore of the bay, a short distance south of the present city, the first French mission in Wisconsin, which he named "La Pointe du Saint Esprit," and which in 1669 was placed in charge of Father Jacques Marquette. The place was visited by Du Luth in 1681–1682, and here in 1693 Le Sueur, a fur trader, built a stockaded post. In 1718 a fort was erected and a French garrison placed in it. About 1820–1821 a trading post of the American Fur Company was established in the neighbourhood. The present city, named in honour of Governor C. C. Washburn, dates from about 1879, but its growth was slow until after 1888. It was chartered as a city in 1904.

WASHBURNE, ELIHU BENJAMIN (1816–1887), American statesman, born in Livermore, Maine, on the 23rd of September 1816. He was one of seven brothers, of whom four sat in Congress from as many different states. He received a common school education, graduated at the Harvard Law School in 1839, and was soon afterwards admitted to the bar. In 1840 he removed to Galena, Illinois. He was elected to Congress in 1852, where, first as a Whig and afterwards as a Republican, he represented his district continuously until 1869, taking a prominent part in debate, and earning the name "watch-dog of the Treasury" by his consistent and vigorous opposition to extravagant and unwise appropriations. He contributed much to aid General Grant during the Civil War, and the latter on becoming President made Washburne secretary of state. On account of ill-health, however, he served only twelve days, and was then appointed minister to France, where during the Franco-Prussian War and the Commune he won much distinction as protector of German and other foreign citizens in Paris. He was the only foreign minister who remained at his post during the Commune. In 1877 he retired from public life, and died in Chicago, Ill., on the 22nd of October 1887. He published *Recollections of a Minister to France* (2 vols., 1887), and edited *The Edwards Papers* (1884).

WASHINGTON, BOOKER TALIAFERRO (*c.* 1859–   ), American negro teacher and reformer, was born on a plantation near Hale's Ford, Franklin county, Virginia. Soon after the Civil War he went to Malden, West Virginia, where he worked in a salt furnace and then in a coal mine. He obtained an elementary education at night school, and worked as a house servant in a family where his ambition for knowledge was encouraged. In 1872 "by walking, begging rides both in wagons and in the cars" he travelled 500 m. to the Hampton (Virginia) Normal and Agricultural Institute, where he remained three years, working as janitor for his board and education, and graduated in 1875. For two years he taught at Malden, West Virginia, and studied for eight months (1878–1879) at the Wayland Seminary in Washington, D.C. In 1879 he became instructor at the Hampton Institute, where he trained about seventy-five American Indians with whom General S. C. Armstrong was carrying on an educational experiment, and he developed the night school, which became one of the most important features of the institution. In 1881 he was appointed organizer and principal of a negro normal school at Tuskegee, Alabama (*q.v.*), for which the state legislature had made an annual appropriation of $2000. Opened in July 1881 in a little shanty and church, the Tuskegee Normal and Industrial Institute became, under Washington's presidency, the foremost exponent of industrial education for the negro. To promote its interests and to establish better understanding between whites and blacks, Washington delivered many addresses throughout the United States, notably a speech in 1895 at the opening of the Atlanta Cotton States and International Exposition. In 1900 at Boston, Massachusetts, he organized the National Negro Business League. Harvard conferred upon him the honorary degree of A.M. in 1896, and Dartmouth that of LL.D. in 1901.

Among his publications are a remarkable autobiography, *Up from Slavery* (1901), *The Future of the American Negro* (1899), *Sowing and Reaping* (1900), *Character Building* (1902), *Working with the Hands* (1904), *Tuskegee and its People* (1905), *Putting the most into Life* (1906), *Life of Frederick Douglass* (1907), *The Negro in Business* (1907) and *The Story of the Negro* (1909).

WASHINGTON, BUSHROD (1762–1829), American jurist, nephew of George Washington, was born in Westmoreland county, Virginia, on the 15th of June 1762. He graduated in 1778 at the College of William and Mary, where he was an original member of the Phi Beta Kappa Society; was a member of a volunteer cavalry troop in 1780; studied law in Philadelphia in 1781, and began practice in his native county. He served in the House of Delegates in 1787, and in the following year sat in the convention which ratified for Virginia the Federal Constitution. After living in Alexandria for a short time he removed to Richmond and in 1798 was appointed an associate justice of the United States Supreme Court by President John Adams. He was George Washington's literary executor, and supervised the preparation of John Marshall's *Life of Washington* (5 vols., 1804–1807); and on Mrs Washington's death in 1802 he inherited Mount Vernon and a part of the estate. He died in Philadelphia on the 26th of November 1829.

WASHINGTON, GEORGE (1732–1799), the first president of the United States, was born at Bridges Creek, Westmoreland county, Virginia, on the 22nd (Old Style 11th) of February 1732. The genealogical researches of Mr Henry E. Waters seem to have established the connexion of the family with the Washingtons of Sulgrave, Northamptonshire, England. The brothers John and Lawrence Washington appear in Virginia in 1658. John took up land at Bridges Creek, became a member of the House of Burgesses in 1666, and died in 1676. His eldest son, Lawrence, married Mildred Warner, by whom he had three children—John, Augustine (1694–1743) and Mildred. Augustine Washington married twice. By the first marriage, with Jane Butler, there were four children, two of whom, Lawrence and Augustine, grew to manhood. By the second marriage, in 1730, with Mary Ball, descendant of a family which migrated to Virginia in 1657, there were six children—George, Betty, Samuel, John, Charles and Mildred. Upon the death of the father, Lawrence inherited the estate at Hunting Creek, on the Potomac.

later known as Mount Vernon, and George the estate on the Rappahannock, nearly opposite Fredericksburg, where his father usually lived.

Of Washington's early life little is known, probably because there was little unusual to tell. The story of the hatchet and the cherry-tree, and similar tales, are undoubtedly apocryphal, having been coined by Washington's most popular biographer, Mason Weems (d. 1825).[1] There is nothing to show that the boy's life was markedly different from that common to Virginia families in easy circumstances; plantation affairs, hunting, fishing, and a little reading making up its substance. From 1735 to 1739 he lived at what is now called Mount Vernon, and afterwards at the estate on the Rappahannock. His education was only elementary and very defective, except in mathematics, in which he was largely self-taught; and although at his death he left a considerable library, he was never an assiduous reader. Although he had throughout his life a good deal of official contact with the French, he never mastered their language. Some careful reading of good books there must have been, however, for in spite of pervading illiteracy, common in that age, in matters of grammar and spelling, he acquired a dignified and effective English style. The texts of his writings, as published by Jared Sparks, have been so "edited" in these respects as to destroy their value as evidence; but the edition of Mr Worthington C. Ford restores the original texts. Washington left school in the autumn of 1747, and from this time we begin to know something of his life. He was then at Mount Vernon with his half-brother Lawrence, who was also his guardian. Lawrence was a son-in-law of William Fairfax, proprietor of the neighbouring plantation of Belvoir, and agent for the extensive Fairfax lands in the colony. Lawrence had served with Fairfax at Cartagena, and had made the acquaintance of Admiral Edward Vernon, from whom Mount Vernon was named. The story that a commission as midshipman was obtained for George through the good offices of the admiral, but that the opposition of the boy's mother put an end to the scheme, seems to lack proof. In 1748, however, through the influence of Thomas, Lord Fairfax, the head of the family, who had come to America to live, Washington, then only sixteen years of age, was appointed surveyor of the Fairfax property; and an appointment as public surveyor soon followed. The next three years were spent in this service, most of the time on the frontier. He always retained a disposition to speculate in western lands, the ultimate value of which he early appreciated; many of his later investments of this character are treated in C. W. Butterfield's *Washington-Crawford Letters* (1877). He seems, too, to have impressed others already with his force of mind and character. In 1751 he accompanied his half-brother Lawrence, who was stricken with consumption, to the West Indies, where he had an attack of small-pox which left him marked for life. Lawrence died in the following year, making George executor under the will and residuary heir of Mount Vernon; and the latter estate became his in 1761.

In October 1753, on the eve of the last French and Indian war, Washington was chosen by Governor Robert Dinwiddie as the agent to warn the French away from their new posts on the Ohio, in western Pennsylvania. He accomplished the winter journey safely, though with considerable danger and hardship; and shortly after his return was appointed lieutenant-colonel of a Virginia regiment, under Colonel Joshua Fry. In April 1754 he set out with two companies for the Ohio, defeated (28th May) a force of French and Indians at Great Meadows (in the present Fayette county, Pennsylvania), but at Fort Necessity in this vicinity was forced to capitulate (3rd July), though only after a vigorous defence. For his services he received the thanks of the House of Burgesses. When General Edward Braddock arrived in Virginia in February 1755, Washington wrote him a diplomatically worded letter, and was presently made a member of the staff, with the rank of colonel. His personal relations with Braddock were friendly throughout, and in the calamitous defeat he showed for the first time that fiery energy which always lay hidden beneath his calm and unruffled exterior. He ranged the whole field on horseback, making himself the most conspicuous target for Indian bullets, and, in spite of what he called the "dastardly behaviour" of the regular troops, saved the expedition from annihilation, and brought the remnant of his Virginians out of action in fair order. In spite of his reckless exposure, he was one of the few unwounded officers. In August, after his return, he was commissioned commander of the Virginia forces, being then twenty-three years old. For about two years his task was that of "defending a frontier of more than 350 m. with 700 men," a task rendered the more difficult by the insubordination and irregular service of his soldiers, and by irritating controversies over official precedence. To settle the latter question he made a journey to Boston, in 1756, to confer with Governor William Shirley. In the winter of 1757 his health broke down, but in the next year he had the pleasure of commanding the advance guard of the expedition under General John Forbes which occupied Fort Duquesne and renamed it Fort Pitt. (See PITTSBURG: *History*.) At the end of the year he resigned his commission, the war in Virginia being at an end, and in January 1759 married Martha Dandridge (1732–1802), widow of Daniel Parke Custis.

For the next fifteen years Washington's life at Mount Vernon, where he made his home after his marriage, was that of a typical Virginia planter of the more prosperous sort, a consistent member and vestryman of the Established (Episcopal) Church, a large slave-holder, a strict but considerate master, and a widely trusted man of affairs. His extraordinary escape in Braddock's defeat had led a colonial preacher to declare in a sermon his belief that the young man had been preserved to be "the saviour of his country"; but if there was any such impression it soon died away, and Washington gave his associates no reason to consider him a man of uncommon endowments. His marriage brought him an increase of about $100,000 in his property, making him one of the richest men in the colonies; and he was able to develop his plantation and enlarge its extent. His attitude towards slavery has been much discussed, but it does not seem to have been different from that of many other planters of that day: he did not think highly of the system, but had no invincible repugnance to it, and saw no way of getting rid of it. In his treatment of slaves he was exacting, but not harsh, and was averse to selling them save in case of necessity. His diaries show a minutely methodical conduct of business, generous indulgence in hunting, comparatively little reading and a wide acquaintance with the leading men of the colonies, but no marked indications of what is usually considered to be "greatness." As in the case of Lincoln, he was educated into greatness by the increasing weight of his responsibilities and the manner in which he met them. Like others of the dominant planter class in Virginia, he was repeatedly elected to the House of Burgesses, but the business which came before the colonial assembly was for some years of only local importance, and he is not known to have made any set speeches in the House, or to have said anything beyond a statement of his opinion and the reasons for it. He was present on the 29th of May 1765, when Patrick Henry introduced his famous resolutions against the Stamp Act. That he thought a great deal on public questions, and took full advantage of his legislative experience as a means of political education, is shown by his letter of the 5th of April 1769 to his neighbour, George Mason, communicating the Philadelphia non-importation resolutions, which had just reached him. In this he considers briefly the best means of peaceable resistance to the policy of the ministry, but even at that early date faces frankly and fully the probable final necessity of resisting by force, and endorses it, though only as a last resort. In May following, when the House of Burgesses was dissolved, he was among the members who met at the Raleigh tavern and adopted a non-importation agreement; and he himself kept the agreement when others did not. Though on friendly terms with Governor Norborne Berkeley, Baron

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[1] Weems was a Protestant Episcopal clergyman, who first published a brief biography of Washington in 1800, and later (1806) considerably expanded it and introduced various apocryphal anecdotes. The biography, though worthless, had an immense circulation, and is to a considerable degree responsible for the traditional conception of Washington.

Botetourt and his successor, John Murray, earl of Dunmore, he nevertheless took a prominent part, though without speechmaking, in the struggles of the Assembly against Dunmore, and his position was always a radical one. As the breach widened, he even opposed petitions to the king and parliament, on the ground that the claims to taxation and control had been put forward by the ministry on the basis of right, not of expediency, that the ministry could not abandon the claim of right and the colonies could not admit it, and that petitions must be, as they already had been, rejected. "Shall we," he writes in a letter, "after this whine and cry for relief?"

On the 5th of August 1774 the Virginia convention appointed Washington as one of seven delegates to the first Continental Congress, which met at Philadelphia on the 5th of September, and with this appointment his national career, which was to continue with but two brief intervals until his death, begins. His letters during his service in Congress show that he had fully grasped the questions at issue, that he was under no delusions as to the outcome of the struggle over taxation, and that he expected war. "More blood will be spilled on this occasion," he wrote, "if the ministry are determined to push matters to extremity, than history has ever yet furnished instances of in the annals of North America." His associates in Congress at once recognized his military ability, and although he was not a member of any of the committees of the Congress, he seems to have aided materially in securing the endorsement by Congress of the Suffolk county, Massachusetts, resolves (see MILTON, Mass.) looking towards organized resistance. On the adjournment of the Congress he returned to Virginia, where he continued to be active, as a member of the House of Burgesses, in urging on the organization, equipment and training of troops, and even undertook in person to drill volunteers. His attitude towards the mother country at this time, however, must not be misunderstood. Much as he expected war, he was not yet ready to declare in favour of independence, and he did not ally himself with the party of independence until the course of events made the adoption of any other course impossible. In March 1775 he was appointed a delegate from Virginia to the second Continental Congress, where he served on committees for fortifying New York, collecting ammunition, raising money and formulating army rules. It seems to have been generally understood that, in case of war, Virginia would expect him to act as her commander-in-chief, and it was noticed that, in the second Congress, he was the only member who habitually appeared in uniform. History, however, was to settle the matter on broader lines. The two most powerful colonies were Virginia and Massachusetts. The war began in Massachusetts, troops from New England flocking to the neighbourhood of Boston almost spontaneously; but the resistance, if it was to be effective, must have the support of the colonies to the southward, and the Virginia colonel who was serving on all the military committees of Congress, and whose experience in the Braddock campaign had made his name favourably known in England, was the obvious as well as the politic choice. When Congress, after the fights at Lexington and Concord, resolved that the colonies ought to be put in a position of defence, the first practical step was the unanimous selection (June 15), on motion of John Adams of Massachusetts, of Washington as commander-in-chief of the armed forces of the United Colonies. Refusing any salary and asking only the reimbursement of his expenses, he accepted the position, asking "every gentleman in the room," however, to remember his declaration that he did not believe himself to be equal to the command, and that he accepted it only as a duty made imperative by the unanimity of the call. He reiterated this belief in private letters even to his wife; and there seems to be no doubt that, to the day of his death, he was the most determined sceptic as to his fitness for the positions to which he was successively called. He was commissioned on the 17th of June 1775, set out at once for Cambridge, Mass., and on the 3rd of July took command of the levies there assembled for action against the British garrison in Boston. The battle of Bunker Hill had already taken place, news of it reaching him on the way north. Until the following March, Washington's work was to bring about some semblance of military organization and discipline, to collect ammunition and military stores, to correspond with Congress and the colonial authorities, to guide military operations in widely separate parts of the country, to create a military system for a people entirely unaccustomed to such a thing and impatient and suspicious under it, and to bend the course of events steadily towards driving the British out of Boston. He planned the expeditions against Canada under Richard Montgomery and Benedict Arnold, and sent out privateers to harass British commerce. It is not easy to see how Washington survived the year 1775; the colonial poverty, the exasperating annoyances, the outspoken criticism of those who demanded active operations, the personal and party dissensions in Congress, the selfishness or stupidity which cropped out again and again among some of the most patriotic of his coadjutors were enough to have broken down most men. They completed his training. The change in this one winter is very evident. If he was not a great man when he went to Cambridge, he was both a general and a statesman in the fullest sense when he drove the British out of Boston in March 1776. From that time until his death he was admittedly the foremost man of the continent.

The military operations of the remainder of the War of Independence are described elsewhere (see AMERICAN WAR OF INDEPENDENCE). Washington's retreat through New Jersey; the manner in which he turned and struck his pursuers at Trenton and Princeton, and then established himself at Morristown, so as to make the way to Philadelphia impassable; the vigour with which he handled his army at the Brandywine and Germantown; the persistence with which he held the strategic position of Valley Forge through the dreadful winter of 1777–1778, in spite of the misery of his men, the clamours of the people and the impotence and meddling of the fugitive Congress—all went to show that the fibre of his public character had been hardened to its permanent quality. "These are the times that try men's souls," wrote Thomas Paine at the beginning of 1776, and the words had added meaning in each year that followed; but Washington had no need to fear the test. The spirit which culminated in the treason of Benedict Arnold was a serious addition to his burdens; for what Arnold did others were almost ready to do. Many of the American officers, too, had taken offence at the close personal friendship which had sprung up between the marquis de La Fayette and Washington, and at the diplomatic deference which the commander-in-chief felt compelled to show to other foreign officers. Some of the foreign volunteers were eventually dismissed politely by Congress, on the ground that suitable employment could not be found for them. The name of one of them, Thomas Conway, an Irish soldier of fortune from the French service, is attached to what is called "Conway's Cabal," a scheme for superseding Washington by General Horatio Gates, who in October 1777 succeeded in forcing Burgoyne to capitulate at Saratoga, and who had been persistent in his depreciation of the commander-in-chief and in intrigues with members of Congress. A number of officers, as well as of men in civil life, were mixed up in the plot, while the methods employed were the lowest forms of anonymous slander; but at the first breath of exposure every one concerned hurried to cover up his part in it, leaving Conway to shoulder both the responsibility and the disgrace. The treaty of alliance of 1778 with France, following the surrender of Burgoyne, put an end to all such plans. It was absurd to expect foreign nations to deal with a second-rate man as commander-in-chief while Washington was in the field, and he seems to have had no further trouble of this kind. The prompt and vigorous pursuit of Sir Henry Clinton across New Jersey towards New York, and the battle of Monmouth, in which the plan of battle was thwarted by Charles Lee, another foreign recruit of popular reputation, closed the military record of Washington, so far as active campaigning was concerned, until the end of the war. The British confined their operations to other parts of the continent, and Washington, alive as ever to the importance of keeping up connexion with New England, devoted himself to watching the British in and about New York City. It was in every way fitting, however, that he who had been the mainspring of the war from the beginning, and had borne far more than his share of its burdens and discouragements, should end it with the campaign of Yorktown, conceived by himself, and the surrender of Cornwallis (October 1781). Although peace was not concluded until September 1783, there was no more important fighting. Washington retained his commission until the 23rd of December 1783, when, in a memorable scene, he returned it to Congress, then in session at Annapolis, Md., and retired to Mount Vernon. His expenses during the war, including secret service money, aggregated about $64,000; in addition he expended a considerable amount from his private fortune, for which he made no claim to reimbursement.

By this time the popular canonization of Washington had fairly begun. He occupied a position in American public life and in the American political system which no man could possibly hold again. He may be said to have become a political element quite apart from the Union, or the states, or the people of either. In a country in which newspapers had at best only a local circulation, and where communication was still slow and difficult, the knowledge that Washington favoured anything superseded, with very many men, both argument and the necessity of information. His constant correspondence with the governors of the states gave him a quasi-paternal attitude towards government in general. On relinquishing his command, for example, he was able to do what no other man could have done with either propriety or safety: he addressed a circular letter to the governors, pointing out changes in the existing form of government which he believed to be necessary, and urging "an indissoluble union of the states under one federal head," "a regard to public justice," the adoption of a suitable military establishment for a time of peace, and the making of "those mutual concessions which are requisite to the general prosperity." His refusal to accept a salary, either as commander-in-chief or as president, might have been taken as affectation or impertinence in any one else; it seemed natural and proper enough in the case of Washington, but it was his peculiar privilege. It is even possible that he might have had a crown, had he been willing to accept it. The army, at the end of the war, was justly dissatisfied with its treatment. The officers were called to meet at Newburgh, and it was the avowed purpose of the leaders of the movement to march the army westward, appropriate vacant public lands as part compensation for arrears of pay, leave Congress to negotiate for peace without an army, and "mock at their calamity and laugh when their fear cometh." Less publicly avowed was the purpose to make their commander-in-chief king, if he could be persuaded to aid in establishing a monarchy. Washington put a summary stop to the whole proceeding. A letter written to him by Colonel Lewis Nicola, on behalf of this coterie, detailed the weakness of a republican form of government as they had experienced it, their desire for "mixed government," with him at its head, and their belief that "the title of king" would be objectionable to but few and of material advantage to the country. His reply was peremptory and indignant. In plain terms he stated his abhorrence of the proposal; he was at a loss to conceive what part of his conduct could have encouraged their address; they could not have found "a person to whom their schemes were more disagreeable"; and he charged them, "if you have any regard for yourself or posterity, or respect for me, to banish these thoughts from your mind, and never communicate, as from yourself or any one else, a sentiment of the like nature." His influence, and his alone, secured the quiet disbanding of the discontented army. That influence was as powerful after he had retired to Mount Vernon as before the resignation of his command. The Society of the Cincinnati, an organization composed of officers of the late war, chose him as its first president; but he insisted that the Society should abandon its plan of hereditary membership, and change other features of the organization against which there had been public clamour. When the legislature of Virginia gave him 150 shares of stock in companies formed for the improvement of the Potomac and James rivers, and he was unable to refuse them lest his action should be misinterpreted, he extricated himself by giving them to educational institutions. His voluminous correspondence shows his continued concern for a standing army and the immediate possession of the western military posts, and his interest in the development of the western territory. From public men in all parts of the country he received such a store of suggestions as came to no other man, digested it, and was enabled by means of it to speak with what seemed infallible wisdom. In the midst of a burden of letter-writing, the minute details in his diaries of tree-planting and rotation of crops, and his increasing reading on the political side of history, he found time to entertain a stream of visitors from all parts of the United States and from abroad. Among these, in March 1785, were the commissioners from Virginia and Maryland, who met at Alexandria (*q.v.*) to form a commercial code for Chesapeake Bay and the Potomac, and made an opportunity to visit Mount Vernon. From that moment the current of events, leading into the Annapolis Convention (see ANNAPOLIS, Md.) of 1786 and the Federal Convention of the following year, shows Washington's close supervision at every point.

When the Federal Convention met at Philadelphia in May 1787 to frame the present constitution, Washington was present as a delegate from Virginia, though much against his will; and a unanimous vote at once made him the presiding officer. Naturally, therefore, he did not participate in debate; and he seems to have spoken but once, and then to favour an amendment reducing from 40,000 to 30,000 the minimum population required as a basis of representation in the House. The mere suggestion, coming from him, was sufficient, and the change was at once agreed to. He approved the constitution which was decided upon, believing, as he said, "that it was the best constitution which could be obtained at that epoch, and that this or a dissolution awaits our choice, and is the only alternative." As president of the convention he signed the constitution, and kept the papers of the convention until the adoption of the new government, when they were deposited in the Department of State. All his vast influence was given to secure the ratification of the new instrument, and his influence was probably decisive. When enough states had ratified to assure the success of the new government, and the time came to elect a president, there was no hesitation. The office of president had been "cut to fit the measure of George Washington," and no one thought of any other person in connexion with it. The unanimous vote of the electors made him the first president of the United States; their unanimous vote elected him for a second time in 1792–1793; and even after he had positively refused to serve for a third term, two electors voted for him in 1796–1797. The public events of his presidency are given elsewhere (see UNITED STATES, § *History*). While the success of the new government was the work of many men and many causes, one cannot resist the conviction that the factor of chief importance was the existence, at the head of the executive department, of such a character as Washington. It was he who gave to official intercourse formal dignity and distinction. It was he who secured for the president the power of removal from office without the intervention of the Senate. His support of Hamilton's financial plans not only insured a speedy restoration of public credit, but also, and even more important, gave the new government constitutional ground on which to stand; while his firmness in dealing with the "Whisky Insurrection" taught a much-needed and wholesome lesson of respect for the Federal power. His official visits to New England in 1789, to Rhode Island in 1790 and to the South in 1791 enabled him to test public opinion at the same time that they increased popular interest in the national government. Himself not a political partisan, he held the two natural parties apart, and prevented party contest, until the government had become too firmly established to be shaken by them. Perhaps the final result would not in any case have failed, even had "blood and iron" been necessary to bring it about; but the quiet attainment of the result was due to the personality of Washington, as well as to the political sense of the American people.

It would be a great mistake to suppose, however, that the influence of the president was fairly appreciated during his term of office, or that he himself was uniformly respected. Washington seems never to have understood fully either the nature, the significance, or the inevitable necessity of party government in a republic. Instead, he attempted to balance party against party, selected representatives of opposing political views to serve in his first cabinet, and sought in that way to neutralize the effects of parties. The consequence was that the two leading members of the cabinet, Alexander Hamilton and Thomas Jefferson, exponents for the most part of diametrically opposite political doctrines, soon occupied the position, to use the words of one of them, of "two game-cocks in a pit." The unconscious drift of Washington's mind was toward the Federalist party; his letters to La Fayette and to Patrick Henry, in December 1798 and January 1799, make that evident even without the record of his earlier career as president. It is inconceivable that, to a man with his type of mind and his extraordinary experience, the practical sagacity, farsightedness and aggressive courage of the Federalists should not have seemed to embody the best political wisdom, however little he may have been disposed to ally himself with any party group or subscribe to any comprehensive creed. Accordingly, when the Democratic-Republican party came to be formed, about 1793, it was not to be expected that its leaders would long submit with patience to the continual interposition of Washington's name and influence between themselves and their opponents; but they maintained a calm exterior. Some of their followers were less discreet. The president's proclamation of neutrality, in the war between England and France, excited them to anger; his support of Jay's treaty with Great Britain roused them to fury. His firmness in thwarting the activities of Edmond Charles Edouard Genet, minister from France, alienated the partisans of France; his suppression of the "Whisky Insurrection" aroused in some the fear of a military despotism. Forged letters, purporting to show his desire to abandon the revolutionary struggle, were published; he was accused of drawing more than his salary; his manners were ridiculed as "aping monarchy"; hints of the propriety of a guillotine for his benefit began to appear; he was spoken of as the "stepfather of his country." The brutal attacks, exceeding in virulence anything that would be tolerated to-day, embittered his presidency, especially during his second term: in 1793 he is reported to have declared, in a cabinet meeting, that "he would rather be in his grave than in his present situation," and that "he had never repented but once the having slipped the moment of resigning his office, and that was every moment since." The most unpleasant portions of Jefferson's *Anas* are those in which, with an air of psychological dissection, he details the storms of passion into which the president was driven by the newspaper attacks upon him. There is no reason to believe, however, that these attacks represented the feeling of any save a small minority of the politicians; the people never wavered in their devotion to the president, and his election would have been unanimous in 1796, as in 1792 and 1789, had he been willing to serve.

He retired from the presidency in 1797,[1] and returned to Mount Vernon, his journey thither being marked by popular demonstrations of affection and esteem. At Mount Vernon, which had suffered from neglect during his absence, he resumed the plantation life which he loved, the society of his family, and the care of his slaves. He had resolved some time before never to obtain another slave, and "wished from his soul" that Virginia could be persuaded to abolish slavery; "it might prevent much future mischief"; but the unprecedented profitableness of the cotton industry, under the impetus of the recently invented cotton gin, had already begun to change public sentiment regarding slavery, and Washington was too old to attempt further innovations. Visitors continued to flock to him, and his correspondence, as always, took a wide range. In 1798 he was made commander-in-chief of the provisional army raised in anticipation of war with France, and was fretted almost beyond endurance by the quarrels of Federalist politicians over the distribution of commissions. In the midst of these military preparations he was struck down by sudden illness, which lasted but for a day, and died at Mount Vernon on the 14th of December 1799. His disorder was an oedematous affection of the wind-pipe, contracted by exposure during a long ride in a snowstorm, and aggravated by neglect and by such contemporary remedies as bleeding, gargles of "molasses, vinegar and butter" and "vinegar and sage tea," which "almost suffocated him," and a blister of cantharides on the throat. He died as simply as he had lived; his last words were only business directions, affectionate remembrances to relatives, and repeated apologies to the physicians and attendants for the trouble he was giving them. Just before he died, says his secretary, Tobias Lear, he felt his own pulse; his countenance changed; the attending physician placed his hands over the eyes of the dying man, "and he expired without a struggle or a sigh." The third of the series of resolutions introduced in the House of Representatives five days after his death, by John Marshall of Virginia, later chief-justice of the Supreme Court, states exactly, if somewhat rhetorically, the position of Washington in American history: "first in war, first in peace, and first in the hearts of his countrymen."[2] His will contained a provision freeing his slaves, and a request that no oration be pronounced at his funeral. His remains rest in the family vault at Mount Vernon (*q.v.*), which since 1860 has been held by an association, practically as national property.

All contemporary accounts agree that Washington was of imposing presence. He measured just 6 ft. when prepared for burial; but his height in his prime, as given in his orders for clothes from London, was 3 in. more. La Fayette says that his hands were "the largest he ever saw on a man." Custis says that his complexion was "fair, but considerably florid." His weight was about 220 lb. Evidently it was his extraordinary dignity and poise, forbidding even the suggestion of familiarity, quite as much as his stature, that impressed those who knew him. The various and widely-differing portraits of him find exhaustive treatment in the seventh volume of Justin Winsor's *Narrative and Critical History of America.* Winsor thinks that "the favourite profile has been unquestionably Houdon's, with Gilbert Stuart's canvas for the full face, and probably John Trumbull's for the figure." Stuart's face, however, with its calm and benign expression, has fixed the popular notion of Washington.

Washington was childless: the people of his time said he was the father only of his country. Collateral branches of the family have given the Lees, the Custises, and other families a claim to an infusion of the blood.

BIBLIOGRAPHY.—A complete bibliography of books relating to Washington would be very voluminous. The best edition of his *Writings* is that of W. C. Ford (14 vols., New York, 1889–1893). Sparks's edition (12 vols., Boston, 1837) has in the main been superseded, though it contains some papers not included by Ford, and the *Life*, which comprises vol. i., still has value. J. D. Richardson's *Messages and Papers of the Presidents* (vol. i., Washington, 1896) collects the presidential messages and proclamations, with a few omissions. A descriptive list of biographies and biographical sketches is given in W. S. Baker's *Bibliotheca Washingtoniana* (Philadelphia, 1889). The most important lives are those of John Marshall (Philadelphia, 1804–1807), David Ramsay (New York, 1807), Washington Irving (New York, 1855–1859), E. E. Hale (New York, 1888), H. C. Lodge (Boston, 1889; rev. ed., 1898), B. T. Thayer (New York, 1894) and Woodrow Wilson (New York, 1897). Valuable for their presentation of differing aspects of Washington's career are: W. S. Baker's *Itinerary of Washington* (Philadelphia, 1892), H. B. Carrington's *Washington the Soldier* (New York, 1899), G. W. P. Custis's *Recollections and Private Memoirs of Washington* (New York, 1860), P. L. Ford's *True George Washington* (Philadelphia, 1896) and R. Rush's *Washington in Domestic Life* (Philadelphia 1857). The larger comprehensive histories of the United States by Bancroft, Hildreth, Winsor, McMaster, Von Holst, Schouler and Avery, the biographies in the "American Statesmen" series, and Hart's "American Nation" series, are indispensable. There is an interesting attempt to make a composite portrait of Washington in *Science* (December 11, 1885). (W.MACD.*)

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[1] He had previously, under date of the 17th of September 1796, issued a notable "Farewell Address" to the American people.

[2] This characterization originated with Henry Lee.

WASHINGTON, a city and the capital of the United States of America, coterminous with the District of Columbia, on the north-east bank of the Potomac river at the head of tide and navigation, 40 m. S.W. of Baltimore, 135 m. S.W. of Philadelphia, and 225 m. S.W. of New York. Area, 60 sq. m. (exclusive of 10 sq. m. of water surface). Pop. (1890) 230,392; (1900) 278,718, of whom 20,119 were foreign-born and 87,186 were negroes; (1910) 331,069. The city proper covers only about 10 sq. m. lying between the Anacostia river and Rock Creek, and rising from the low bank of the Potomac, which is here nearly 1 m. wide; above are encircling hills and a broken plateau, which rise to a maximum height of 420 ft. and contain the former city of Georgetown, the villages of Anacostia, Brightwood, Tennallytown, and other suburban districts.

Streets and Parks.—The original plan of the city, which was prepared by Major Pierre Charles L'Enfant (1755–1825), under the supervision of President Washington and Thomas Jefferson,[1] was a masterpiece in landscape architecture and in the main it has been preserved. Besides streets running east and west, which are named by the letters of the alphabet, and streets running north and south, which are numbered, there are avenues named for various states, which radiate from two foci—the Capitol and the White House—or traverse the city without any fixed plan. North and south of the Capitol they are numbered; east and west from it streets are lettered, but streets are distinguished by annexing to the name or letter the name of the quarter: N.W., S.W., N.E. or S.E.—the city is divided into these four parts by North Capitol, East Capitol and South Capitol streets, which intersect at the Capitol. The width of the avenues is from 120 to 160 ft. and the width of the streets from 80 to 120 ft. More than one-half the area of the city is comprised in its streets, avenues and public parks. Among the principal residence streets are Massachusetts, especially between Dupont and Sheridan circles, New Hampshire, Connecticut and Vermont Avenues and 16th Street, all in the N.W. quarter of the city. The principal business streets are Pennsylvania Avenue (especially between the Capitol and the White House) and 7th, 9th, 14th and F streets. Streets and avenues for the most part are paved with a smooth asphalt pavement, and many of them have two and occasionally four rows of overarching shade trees and private lawns on either side. At nearly every intersection of two avenues is a circle or square in which is the statue of some notable American whose name the square bears. At the intersection of a street with an avenue there is usually the reservation of a small triangular grass plot at least. In L'Enfant's plan a park or mall was to extend from the Capitol to the White House. Instead of this the mall extends from the Capitol to Washington Monument, which stands near the intersection of lines west from the Capitol and south from the White House. In 1901, however, a commission (Daniel Hudson Burnham, C. F. McKim, Augustus St Gaudens and F. L. Olmsted, Jr.) was appointed by authority of the United States Senate to prepare plans for the beautification of the city and this body, seeking in the main to return to L'Enfant's plan, has submitted a design for a park-like treatment of the entire district between Pennsylvania and Maryland avenues from the Capitol to the White House and between lower New York Avenue and the Potomac, with an elm-shaded mall 300 ft. wide bisecting the park from the Capitol to the Monument, with a group of official and scientific buildings fronting the mall on either side, with a group of municipal buildings between the mall and Pennsylvania Avenue, and with a Lincoln memorial on the bank of the Potomac. Potomac Park (740 acres), a portion of which is embraced in this design, has already been reclaimed from the Potomac river. On Rock Creek, above Georgetown, is the National Zoological Park (under the control of the Smithsonian Institution), embracing 170 acres in a picturesque site. North of this and extending to the boundary of the District, and including both banks of Rock Creek, with its wild and picturesque beauty, is a tract of 1600 acres, known as Rock Creek Park.

Climate.—The climate of Washington is characterized by great humidity, long-continued and somewhat oppressive heat in summer, and mild winters. During a period of thirty-three years ending December 1903 the mean winter temperature (December, January and February) was 35° F. and the mean summer temperature (June, July and August) 75°; the mean of the winter minima was 27°, and the mean of the summer maxima 85°. Extremes ranged, however, from an absolute maximum of 104° to an absolute minimum of −15°. There is an average annual precipitation of 43·1 in., which is quite evenly distributed throughout the year. Although snowstorms are infrequent and snow never lies long on the ground, the average fall of snow for the year amounts to 22·5 in.

Buildings.—In a dignified landscape setting on the brow of a hill that is itself nearly 100 ft. above the Potomac stands the Capitol[2] (built 1793–1827; architect, William Thornton (d. 1827), superintendent of the Patent Office, whose designs were modified by B. H. Latrobe and Charles Bulfinch; wings and dome added 1851–1865). It consists of a central building of Virginia sandstone, painted white, and two wings of white Massachusetts marble. Its length is 751 ft., and its breadth ranges in different parts from 121 to 324 ft. The main building is surmounted with an iron dome, designed by Thomas Ustic Walter, which rises to a height of 268½ ft., and on the dome is a statue of Liberty (1863; 19½ ft. high) by Thomas Crawford. The Capitol faces east, and on this side is a richly sculptured[3] portico with Corinthian columns leading to the rotunda under the dome, a sculptured Corinthian portico leading to the Senate Chamber in the north wing, and a plain Corinthian portico leading to the Hall of Representatives in the south wing; there is also a portico at each end and on the west side of each wing. The rotunda, 96 ft. in diameter and 180 ft. high, is decorated with eight historical paintings: "Landing of Columbus" (1492), by John Vanderlyn; "De Soto discovering the Mississippi" (1541), by William Henry Powell; "Baptism of Pocahontas" (1613), by John Gadsby Chapman; "Embarkation of the Pilgrims from Delft-Haven" (1620), by Robert Walter Weir; "Signing the Declaration of Independence" (1776), by John Trumbull; "Surrender of Burgoyne at Saratoga" (1777), by Trumbull; "Surrender of Cornwallis at Yorktown" (1781), by Trumbull; and "Washington resigning his Commission at Annapolis" (1783), by Trumbull. Between the rotunda and the Hall of Representatives is the National Hall of Statuary (formerly the Hall of Representatives), in which each state in the Union may erect statues of two "of her chosen sons"; and between the rotunda and the Senate Chamber is the room of the Supreme Court, which until 1859 was the Senate Chamber.[4]

The Executive Mansion, more commonly called the White House, the official residence of the president, is a two-storey building of Virginia freestone, painted white since 1814 to hide the marks of fire—only the walls were left standing after the capture of the city by the British in that year. It is 170 ft. long and 86 ft. deep. It is simple but dignified; the principal exterior ornaments are an Ionic portico and a balustrade. The White House was built in 1792–1799 from designs by James Hoban, who closely followed the plans of the seats of the dukes of Leinster, near Dublin, and in 1902–1903, when new executive offices and a cabinet room were built and were connected with the White House by an esplanade, many of the original features of Hoban's plan were restored. East of the White House and obstructing the view from it to the Capitol stands the oldest of the departmental buildings, the Treasury Building (architect, Robert Mills (1781–1855), then U.S. architect), an imposing edifice mainly of granite, 510 ft. long and 280 ft. wide; on the east front is a colonnade of thirty-eight Ionic columns, and on each of the other three sides is an Ionic portico. On the opposite side of the White House is a massive granite building of the State, War and Navy Departments, 567 ft. long and 342 ft. wide. The Library of Congress (1889–1897; cost, exclusive of site, over $6,000,000), south-east of the Capitol, was designed by Smithmeyer & Pelz, and the designs were modified by Edward Pearce Casey (b. 1864), the architect; it is in the Italian Renaissance style, is 340 by 470 ft., and encloses four courts and a central rotunda surmounted by a flat black copper dome, with gilded panels and a lantern. The exterior walls are of white New Hampshire granite, and the walls of the interior courts are of Maryland granite and white enamelled bricks. There are numerous sculptural adornments without, and there is elaborate interior decoration with paintings, sculpture, coloured marbles and gilding.[1] Two squares north of the Senate office-building is the Union Railway Station (1908; 343 by 760 ft.; cost, $4,000,000), designed by Daniel Hudson Burnham, consisting of a main building of white granite (from Bethel, Vermont) and two wings, and facing a beautiful plaza. On Pennsylvania Avenue, nearly midway between the Capitol and the White House, is the nine-storey Post Office (1899; with a tower 300 ft. high), housing the United States Post Office Department and the City Post Office. A few squares north-west of it are the General Land Office, the headquarters of the Department of the Interior (commonly called the Patent Office), with Doric portico; the Pension Office, in which the Inauguration Ball is held on the evening of each president's taking office; the Government Printing Office (twelve storeys—one of the few tall office-buildings in the city); the City Hall, or District Court House; and the District Building (1908), another building of the local government. On the heights north of Georgetown is the United States Naval Observatory, one of the best-equipped institutions of the kind; from it Washington time is telegraphed daily to all parts of the United States. Near Rock Creek, west of Georgetown, is the Signal Office and headquarters of the United States Weather Bureau. In the Mall are the building of the Department of Agriculture, the Smithsonian Institution (*q.v.*), the National Museum (1910), the Army Medical Museum and the Bureau of Fisheries, and here a building for the Department of Justice is to be erected. Facing the Mall on the south is the home of the Bureau of Engraving and Printing, in which the United States paper money and postage stamps are made. Not far from the White House is the Corcoran Gallery of Art (1894–1897; architect, Ernest Flagg), of white Georgia marble in a Neo-Grecian style, housing a collection of paintings (especially American portraits) and statuary; the gallery was founded and endowed in 1869 by William Wilson Corcoran (1798–1888) "for the perpetual establishment and encouragement of the Fine Arts." The Public Library, a gift of Andrew Carnegie, is a white marble building in the Mount Vernon Square, at the intersection of Massachusetts and New York avenues. A prominent building, erected with money given mainly by Mr Carnegie, is that of the Pan-American Union (formerly Bureau of American Republics). The old Ford's Theatre, in which President Lincoln was assassinated, is on Tenth Street N.W. between E and F. The house in which Lincoln died is on the opposite side of the street, and contains relics of Lincoln collected by O. H. Oldroyd.

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[1] The actual surveying and laying out of the city was done by Andrew Ellicott (1754–1820), a civil engineer, who had been employed in many boundary disputes, who became surveyor-general of the United States in 1792, and from 1812 until his death was professor of mathematics at the United States Military Academy at West Point.

[2] See Glenn Brown, *The History of the United States Capitol* (2 vols., 1900–1903).

[3] The allegorical decorations here are by Persico and Horatio Greenough; those on the Senate portico are by Thomas Crawford, who designed the bronze doors at the entrances to the Senate and House wings. At the east door of the rotunda is the bronze door (1858; modelled by Randolph Rogers). At the west entrance are elaborate bronze doors (1910) by Louis Amateis (b. 1855).

[4] Connected with the Capitol by subways, immediately S.E. and N.E. of the Capitol respectively, are the marble office buildings (1908) of the House of Representatives and of the Senate. The Capitol is connected by subways with the Library of Congress also.

Monuments.—Foremost among the city's many monuments is that erected to the memory of George Washington. It is a plain obelisk of white Maryland marble, 55 ft. square at the base and 555 ft. in height; it was begun in 1848, but the work was abandoned in 1855–1877, but was completed in 1884 at a cost of $1,300,000.[2] Among statues of Washington are the half-nude seated figure (1843) by Greenough in the Smithsonian Institution, and an equestrian statue (1860) of Washington at the Battle of Princeton, by Clark Mills in Washington Circle. Among the other prominent statues are: the equestrian statue (1908) of General Philip Sheridan in Sheridan Circle, by Gutzon Borglum; an equestrian statue of General Sherman near the Treasury Building, by Carl Rohl-Smith; a statue of Frederick the Great (by T. Uphues; presented to the United States by Emperor William II. of Germany) in front of the Army War College at the mouth of the Anacostia river; a statue of General Nathanael Greene (by H. K. Brown) in Stanton Square; statues of General Winfield Scott in Scott Square (by H. K. Brown) and in the grounds of the Soldiers' Home (by Launt Thompson); a statue of Rear-Admiral S. F. Du Pont in Dupont Circle (by Launt Thompson); of Rear-Admiral D. G. Farragut (by Vinnie Ream Hoxie); an equestrian statue of General George H. Thomas (by J. Q. A. Ward), erected by the Society of the Army of the Cumberland; one of General George B. McClellan, by Frederick Macmonnies; and statues of Lincoln,[3] by Scott Flannery and (in Lincoln Park) by Thomas Ball, of Joseph Henry (by W. W Story) in the grounds of the Smithsonian Institution, of John Marshall (by Story) on the west terrace of the Capitol, of General Andrew Jackson (by Clark Mills) and, in Lafayette Square, of the Marquis de Lafayette (by Falguière and Mercié), of the Comte de Rochambeau (by F. Hamar) and of Baron von Steuben (1910). In Pennsylvania Avenue, at the foot of Capitol Hill, is a Monument of Peace (by Franklin Simmons) in memory of officers, seamen and marines of the U.S. Navy killed in the Civil War.

Cemeteries.—On the opposite side of the Potomac, in Virginia, and adjoining Fort Myer, a military post (named in honour of General Albert James Myer (1827–1880), who introduced in 1870 a system of meteorological observations at army posts) with reservation of 186 acres, is Arlington, a National Cemetery (of 408·33 acres), in which lie buried 21,106 soldiers killed in the Civil War and in the war with Spain; among the distinguished officers buried here are General Philip Henry Sheridan, Admiral David Dixon Porter, General Joseph Wheeler and General Henry W. Lawton; there is a Spanish War Monument; the grounds are noted for their natural beauty, and on the brow of a hill commanding a magnificent view of the city is Arlington House (1802), the residence of George Washington Parke Custis (1781–1857), grandson of Martha Washington, and afterwards of General Robert E. Lee, Custis's son-in-law; the estate was seized by Federal troops early in the Civil War, and was bought by the United States in 1864; there was a military hospital here throughout the Civil War. Adjoining the grounds of the Soldiers' Home (3 m. N. of the Capitol) is a National Military Cemetery containing the graves of 7220 soldiers. On the bank of the Anacostia river, east of the Capitol, is the Congressional Cemetery containing the graves of many members of Congress. North of Georgetown is Oak Hill Cemetery, and in the vicinity of the Soldiers' Home are Rock Creek, Glenwood, Harmony, Prospect Hill and St Mary's Cemeteries. A crematorium was completed in 1909, and cremation instead of interment has since been urged by the District commissioners.

Charities, &c.—The National Soldiers' Home (1851), founded by General Winfield Scott, comprises five buildings, with accommodations for 800 retired or disabled soldiers, and 512 acres of beautiful grounds. The charitable and correctional institutions of the District of Columbia are the following government institutions, under the control of the United States or of the District of Columbia: Freedmen's Hospital (1862), United States Naval Hospital (1866), an Insane Asylum on the S. side of the Anacostia river, the District of Columbia Industrial Home School (1872), a Municipal Lodging House (1892), a Soldiers' and Sailors' Temporary Home (1888), Workhouse, Reform School for Boys, Reform School for Girls and Industrial Home School (1872). Among many private institutions are the Washington City Orphan Asylum (1815); Lutheran Eye, Ear and Throat Infirmary (1889); Episcopal Eye, Ear and Throat Hospital (1897); Providence Hospital (1861; Sisters of Charity); George Washington University Hospital (1898); Georgetown University Hospital (1898); Columbia Hospital for Women (1866); Children's Hospital (1871); Washington Hospital for Foundlings (1887); Children's Temporary Home (1899; for negroes); a German Orphan Asylum (1879); Washington Home for Incurables (1889); Home for the Aged (1871); the National Lutheran Home (1890); the Methodist Home (1890) and Baptist Home (1880). A "non-support law," which went into effect in 1906, enacts that a man who refuses to provide for his family when able to do so shall be committed to the workhouse for hard labour, and that fifty cents a day shall be paid to his family. A Juvenile Court and a Board of Children's Guardians have extensive jurisdiction over dependent and delinquent children, and a general supervision of all charities and corrections is vested in a Board of Charities, consisting of five members appointed by the president of the United States.

Education.—Washington is one of the leading educational centres of the United States. The public school system, under the control of a Board of Education of six men and three women appointed by the supreme court judges of the District of Columbia, embraces kindergartens, primary schools, grammar schools, high schools, a business high school, manual training schools, normal schools and night schools. The schools are open nine months in the year, and all children between eight and fourteen years of age are required to attend some public, private or parochial school during these months unless excused because of some physical or mental disability. George Washington University, in the vicinity of the White House, is a non-sectarian institution (opened in 1821 under the auspices of the Baptist General Convention as "The Columbian College in the District of Columbia"; endowed by W. W. Corcoran in 1872, organized as the Columbian University in 1873, organized under its present name[4] in 1904), and comprises Columbian College of Arts and Sciences with a graduate department (1893), a College of the Political Sciences (1907), Washington College of Engineering, divisions of architecture and education (1907), a Department of Law (first organized in 1826; closed in 1827; reorganized in 1865), a Department of Medicine (1821; since 1866 in a building given by W. W. Corcoran), with several affiliated hospitals, a Department of Dentistry (1887), the National College of Pharmacy (united with the university in 1906), and a College of Veterinary Medicine (1908). In 1909 this University had 185 instructors and 1520 students. Georgetown University is in Georgetown (*q.v.*). The Catholic University of America (incorporated 1887; opened 1889), with buildings near the Soldiers' Home, stands at the head of Roman Catholic schools in America. Although designed especially for advanced theological studies, it comprises a School of the Sacred Sciences, a School of Philosophy, a School of Letters, a School of Physical Sciences, a School of Biological Sciences, a School of Social Sciences, a School of Jurisprudence, a School of Law and a School of Technological Sciences. In 1909 its faculty numbered 42 and its students 225. A Franciscan convent, Dominican, Paulist and Marist houses, and Trinity College for girls are affiliated with the Catholic University. The American University (chartered 1893), under Methodist Episcopal control, designed to bear a relation to the Protestant churches similar to that of the Catholic University to the Catholic Church, with a campus of 94 acres at the north-west end of the city, in 1910 had not been opened to students. Howard University (1867), for the higher education of negroes, is situated south-west of the Soldiers' Home; it was named in honour of General Oliver Otis Howard, one of its founders and (in 1869–1873) its president; it has a small endowment, and is supported by Congressional appropriations which are administered by the Secretary of the Interior; it comprises an academy, a college of arts and sciences, a teachers' college, a school of theology, a school of law, a school of medicine, a pharmaceutic college, a dental college, a school of manual arts and applied sciences, and a commercial college; in 1909 it had 121 instructors and 1253 students.

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[1] A bronze fountain, "The Court of Neptune," in front of the Library, is by Hinton Perry. Granite portrait busts of great authors occupy niches in windows near the entrance; these are by J. S. Hartley, Herbert Adams and F. W. Ruckstuhl. The allegorical figures over the entrance are by Bela L. Pratt. There are fine bronze doors by Olin Warner and Frederick Macmonnies. Among the mural paintings are series by John W. Alexander, Kenyon Cox, E. H. Blashfield, Henry Oliver Walker (b. 1843), Walter McEwen, Elihu Vedder, Charles Sprague Pearce (b. 1851), Edward Simmons (b. 1852), George Willoughby Maynard (b. 1843), Robert Reid (b. 1862), George R. Barse, Jr. (b. 1861), W. A. Mackay, F. W. Benson (b. 1862), Walter Shirlaw (b. 1838), Gari Melchers (b. 1860), W. De L. Dodge (b. 1867) and others.

[2] The site is said to have been chosen by Washington himself—Congress had planned a marble monument in 1783. In 1833 the Washington National Monument Society was formed and a popular subscription was taken. The obelisk was designed by Robert Mills, whose original plan included a "Pantheon" 100 ft. high with a colonnade and a colossal statue of Washington. After 1877 the work was carried on by an appropriation made by Congress. See Frederick L. Harvey, *History of the Washington Monument and the National Monument Society* (Washington, 1903).

[3] A Lincoln memorial is to be erected on the Mall W. of the Washington monument.

[4] The name was changed when the offer of the George Washington Memorial Association to build a $500,000 memorial building was accepted.

The Columbia Institution for the Deaf and Dumb (see DEAF AND DUMB), on Kendall Green, in the north-eastern part of the city, is composed of Kendall school (a secondary school) and of Gallaudet College (called in 1864–1893 the National Deaf Mute College; the present name is in honour of Dr T. H. Gallaudet); it was the first institution to give collegiate courses to the deaf, and it has received Congressional appropriations, though it is a private foundation. Washington has also several academies, seminaries and small colleges; among the latter are St John's College (Roman Catholic, 1870) and Washington Christian College (non-sectarian, 1902). The Washington College of Law (1896) is an evening school especially for women. A School of Art is maintained in the Corcoran Gallery of Art.

The Carnegie Institution of Washington, founded by Andrew Carnegie in 1902 and endowed by him with $22,000,000 ($10,000,000 in 1902; $12,000,000 later), is designed "to encourage in the broadest and most liberal manner, investigation, research and discovery, and the application of knowledge to the improvement of mankind; and in particular to conduct, endow and assist investigation in any department of science, literature or art, and to this end to co-operate with governments, universities, colleges, technical schools, learned societies and individuals; to appoint committees of experts to direct special lines of research; to publish and distribute documents; and to conduct lectures, hold meetings and acquire and maintain a library." It is under the control of a board of twenty-four trustees, vacancies in which are filled by the remaining members. In 1908 ten departments had been organized: Botanical Research, with a "desert laboratory" (1903) at Tucson, Arizona; Economics and Sociology (1904); Experimental Evolution, with a station (1904) at Cold Spring Harbor, New York (see HUNTINGTON, N.Y.); Geophysical Research, with a laboratory (1906–1907) at Washington—investigations have been carried on by the U.S. Geological Survey and at McGill University, Toronto; Historical Research (1903); Marine Biology, with a laboratory (1904) at Tortugas, Florida; Meridian Astrometry (1906; work is carried on especially at Dudley Observatory, Albany, New York); Research in Nutrition, with a laboratory (1906) at Boston, Massachusetts—investigations (since 1904) had been carried on at Yale and Wesleyan universities; Solar Physics, with observatory (1905) on Mount Wilson, California, and workshops at Pasadena, California, and Terrestrial Magnetism (1903; headquarters in Washington); the institution had assisted Luther Burbank in his horticultural experiments since 1905, and had published the *Index Medicus* since 1903; and it makes occasional grants for minor research and tentative investigations.

The learned societies of Washington are to a large degree more national than local in their character; among them are: the Washington Academy of Sciences (1898), a "federal head" of most of the societies mentioned below; the Anthropological Society (founded 1879; incorporated 1887), which has published *Transactions* (1879 sqq., with the co-operation of the Smithsonian Institution) and *The American Anthropologist* (1888–1898; since 1898 published by the American Anthropological Association); the National Geographic Society (1888), which since 1903 has occupied the Hubbard Memorial Building, which sent scientific expeditions to Alaska, Mont Pelée and La Souffrière, and which publishes the *National Geographic Magazine* (1888 sqq.), *National Geographic Monographs* (1895) and various special maps; the Philosophical Society of Washington (1871; incorporated 1901), devoted especially to mathematical and physical sciences; the Biological Society (1880), which publishes *Proceedings* (1880 sqq.); the Botanical Society of Washington (1901); the Geological Society of Washington (1893); the Entomological Society of Washington (1884), which publishes *Proceedings* (1884 sqq.); the Chemical Society (1884); the Records of the Past Exploration Society (1901), which publishes *Records of the Past* (1902 sqq.); the Southern History Association (1896), which issues *Publications* (1897 sqq.); the Society for Philosophical Inquiry (1893), which publishes *Memoirs* (1893 sqq.); the Society of American Foresters (1900), which publishes *Proceedings* (1905 sqq.); and the Cosmos Club. The libraries and scientific collections of the Federal government and its various bureaus and institutions afford exceptional opportunities for students and investigators (see LIBRARIES: § *United States*). The Library of Congress contains more than 1,800,000 volumes and 100,000 manuscripts, and large collections of maps and pieces of music. In the library of the State Department are 70,000 volumes of documents. The library of the Surgeon-General's Office contains 200,000 volumes, and is the largest medical library in the world. Besides these there is a vast amount of material in the collections of the Bureau of Education, the Bureau of Ethnology, the Smithsonian Institution, the National Museum, the House of Representatives, the Patent Office, the Department of Agriculture, the Botanic Gardens, the Bureau of Fisheries, the Naval Observatory, the Geological Survey and the Coast and Geodetic Survey. The Public Library, containing about 110,000 volumes, is a circulating library.

Communications.—Seven railways enter the city: the Philadelphia, Baltimore & Washington division of the Pennsylvania System, the Baltimore & Ohio, the Southern, the Chesapeake & Ohio, the Washington, Baltimore & Annapolis, the Washington Southern and the Washington, Alexandria & Mt Vernon. Steamboats ply daily from the foot of Seventh Street to Alexandria, Mt Vernon, Old Point Comfort and Norfolk, and at Old Point Comfort there is connexion with boats for New York. There is also an hourly ferry service to Alexandria, and at irregular intervals there are boats direct to Baltimore, Philadelphia, New York and Boston. The street railways, underground trolley in the urban district and overhead trolley in the suburbs, connect at several points with interurban railways in Maryland and Virginia.

Industries.—The city's manufactures and commerce are of little importance in proportion to its population. Only government manufactures and manufactures for local consumption are at all large. In 1905 the government's printing and publishing cost $5,999,996; its ordnance and ordnance stores (in the Navy Yard on the bank of the Anacostia river), $5,331,459; and its engraving and plate printing, $3,499,517. The total value of the products of all the factories in the District which were operated under private ownership amounted to $18,359,159, and $9,575,971, or 52% of this was the value of printing and publishing, bread and other bakery products, gas and malt liquors.

Government.—Washington is the seat of the Federal government of the United States and as such is not self-ruled, but governed by the Federal Congress. The city was chartered in 1802, with a mayor appointed annually by the president of the United States and an elective council of two chambers. The mayor was elected by the council from 1812 to 1820, and by the people (biennially) from 1820 to 1871. In 1871 the Federal Congress repealed the charters of Washington and Georgetown and established a new government for the entire District, consisting of a governor, a secretary, a board of public works, a board of health and a council appointed by the president with the concurrence of the Senate, and a House of Delegates and a delegate to the National House of Representatives elected by the people. In 1874 Congress substituted a government by three commissioners appointed by the president with the concurrence of the Senate, and in 1878 the government by commissioners was made permanent. Two of the commissioners must be residents of the District, and the third commissioner must be an officer of the Corps of Engineers of the United States Army. The people of the District have no voice in its government, have no representation in Congress and do not vote for the president of the United States. The District commissioners are the chief executive officers. Congress and the commissioners legislate for the District; the president, the commissioners and the supreme court of the District appoint the administrative officers and boards; and the president appoints the judges of the District courts, viz. a court of appeals, a supreme court, a municipal court, a police court, a probate court and a juvenile court. One-half the expenses of the government of Washington is paid by the District of Columbia and one-half by the United States. The revenue of the District, which is derived from a property tax and from various licences, is paid into the United States Treasury; appropriations, always specific and based on estimates prepared by the commissioners, are made only by Congress; and all accounts are audited by the Treasury Department. The government owns the waterworks, by which an abundant supply of water is taken from the Potomac at the Great Falls, conducted for 12 m. through an aqueduct 9 ft. in diameter and filtered through a sand filtration plant.

The government of the District has been uniformly excellent, and the laws therefor have been modern in their tendency. The employment of children under fourteen years of age in any factory, workshop, mercantile establishment, store, business office, telegraph or telephone office, restaurant, hotel, apartment house, club, theatre, bootblack stand, or in the distribution or transmission of merchandise or messages is forbidden, except that a child between twelve and fourteen years of age may with the permission of the judge of the juvenile court be employed at an occupation not dangerous or injurious to his health or morals if necessary for his support or for the assistance of a disabled, ill or invalid parent, a younger brother or sister, or a widowed mother. No child under fourteen years of age may be employed in any work whatever before six o'clock in the morning, after seven o'clock in the evening, or during the hours when the public schools are in session.

History.—During the War of Independence Philadelphia was the principal seat of the Continental Congress, but it was driven thence in 1783 by mutinous soldiers, and for the succeeding seven years the discussion of a permanent site for the national capital was characterized by sectional jealousy, and there was a strong sentiment against choosing a state capital or a large city lest it should interfere with the Federal government. The Constitution, drafted in 1787, authorized Congress " to exercise exclusive legislation in all cases whatsoever, over such district (not exceeding 10 sq. m.) as may, by cession of particular states, and the acceptance of Congress, become the seat of government of the United States." Virginia and Maryland promised such a cession; President Washington was known to be in favour of a site on the Potomac, and in July 1790 Alexander Hamilton, in return for Thomas Jefferson's assistance in passing the bill for the assumption of the state war debts by the Federal government, helped Jefferson to pass a bill for establishing the capital on the Potomac, by which the president was authorized to select a site anywhere along the Potomac between the Eastern Branch (Anacostia) and the Conococheague river, a distance of about 80 m., and to appoint three commissioners who under his direction should make the necessary surveys and provide accommodations for the reception of Congress in 1800. The commissioners—Thomas Johnson (1732–1819) and Daniel Carroll (1756–1829) of Maryland and Dr David Stuart of Virginia—gave the city its name; Major L'Enfant drew its plan, and Andrew Ellicott laid it out. When, in 1800, the government was removed to Washington it was " a backwoods settlement in the wilderness "; as a city it existed principally on paper, and the magnificence of the design only served to emphasize the poverty of the execution. One wing of the Capitol and the President's House were nearly completed, but much of the land surrounding the Capitol was a marsh; there were no streets worthy of the name, the roads were very bad, and the members of Congress were obliged to lodge in Georgetown. For many years such characterizations as " Wilderness City," " Capital of Miserable Huts," " City of Streets without Houses," " City of Magnificent Distances " and " A Mudhole almost Equal to the Great Serbonian Bog " were common. Resolutions were frequently offered by some disgusted member of Congress for the removal of the capital. In 1814, during the second war with Great Britain, the British, after defeating on the 24th of August an American force at Bladensburg, Prince George county, Maryland, about 6 m. N.E. of Washington, occupied the city and burned the Capitol, the President's House, some of the public offices, and the Navy Yard. In the following year when a bill appropriating $500,000 for rebuilding was before Congress it met with formidable opposition from the " capital movers." The question of removal was again to the front when, in 1846, the Virginia portion of the District was retroceded to that state in response to the appeal of Alexandria, which had suffered from the neglect of Congress. The lethargy of the nation toward its capital suddenly vanished at the outbreak of the Civil War. At the close of the first day's bombardment of Fort Sumter (April 12th, 1861) Leroy P. Walker (1817–1884), the Confederate Secretary of War, boasted that before the 1st of May the Confederate flag would float over the Capitol. The North, alarmed at the threat, speedily transformed Washington into a great military post and protected it on all sides with strong earthworks. Throughout the war it was the centre of the military operations of the North: here the armies were officered and marshalled, from here they marched on their campaigns against the South, here was the largest depot of military supplies, and here were great hospitals for the care of the wounded. Although several times threatened by the South, Washington was never really in danger except in July 1864 when General Jubal A. Early advanced against it with 12,000 veterans, defeated General Lew Wallace with about 3500 men at Monocacy Bridge on the 6th, and on the 11th appeared before the fortifications, which were at the time defended by only a few thousand raw troops; the city was saved by the timely arrival of some of Grant's veterans. In the city, on the 23rd and 24th of May 1865, President Andrew Johnson reviewed the returning soldiers of the Union Army.

The population of Washington increased from 61,122 to 109,199 or 78·6% in the decade from 1860 to 1870, and the stirring effects of the Civil War were far-reaching. The city had been founded on too elaborate and extensive a plan to be left to the initiative and unaided resources of its citizens. But under the new form of government which was instituted in 1871 a wonderful transformation was begun under the direction of Alexander R. Shepherd (1835–1902), the governor of the District and president of the board of public works. Temporary financial embarrassment followed, but when the Federal government had taken upon itself half the burden and established the economic administration of the commissioners, the problem of beautifying the nation's capital was solved.

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WASHINGTON, a city and county-seat of Daviess county, Indiana, U.S.A., about 50 m. N.E. of Evansville. Pop. (1890) 6064, (1900) 8551, of whom 391 were foreign born and 255 negroes, (1910 census) 11,404. It is served by the Baltimore & Ohio South Western (which has repair shops here) and the Evansville & Indianapolis railways. The city has a public library and a city park of 45 acres. It is the shipping point of the surrounding farming, stock-raising and coal-mining region, and there are deposits of kaolin and fireclay in the vicinity. The total value of the factory product in 1905 was $1,166,749 (48·6% more than in 1900). The municipality owns and operates the electric lighting plant. Washington was settled in 1816 and chartered as a city in 1870.

WASHINGTON (or Washington Court House), a city and the county-seat of Fayette county, Ohio, U.S.A., on Paint Creek, 35 m. S.E. of Springfield. Pop. (1880) 3798, (1890) 5742, (1900) 5751 (708 negroes); (1910) 7277. It is served by the Baltimore & Ohio, the Cincinnati & Muskingum Valley (Pennsylvania Lines), the Detroit, Toledo & Ironton, and the Cincinnati, Hamilton & Dayton railways. It is in a rich farming and stock and poultry-raising region, has a large poultry-packing house and various manufactures. Washington, or Washington Court House as it is often called to distinguish it from the village of Washington in Guernsey county, Ohio, was laid out in 1810 and was chartered as a city in 1888.

WASHINGTON, a borough and the county-seat of Washington county, Pennsylvania, U.S.A., about 25 m. S.W. of Pittsburg and about 30 m. N.E. of Wheeling, West Virginia, on Chartiers Creek. Pop. (1900) 7670, of whom 465 were foreign born and 984 were negroes; (1910) 18,778. Washington is served by the main line of the Baltimore & Ohio, the Chartiers Valley branch of the Pittsburg, Cincinnati, Chicago & St Louis (Pennsylvania system) and the Waynesburg & Washington railways and a connecting line for freight service, and by electric railway to Pittsburg. Among its public buildings and institutions are the county court-house (in which are the rooms of the Washington County Historical Society), the Federal building, two hospitals, a Y.M.C.A. building and a public library. It is the seat of Washington and Jefferson College, of Washington Seminary (1836) for girls and of a school of business. Washington and Jefferson College was incorporated, in 1865, by the consolidation of two rival institutions, Washington Academy and Jefferson College. Washington Academy (incorporated in 1787 and endowed by the legislature of Pennsylvania), which was opened in 1789, was incorporated as Washington College in 1806, and in 1852 became a synodical college of the Presbyterian Church, under the direction of the synod of Wheeling. Jefferson College, which was an outgrowth of Canonsburg Academy at Canonsburg, 7 m. from Washington, was chartered in 1794, and incorporated as Jefferson College in 1802; from 1826 until 1838 the Jefferson Medical College of Philadelphia was its medical department. In 1869, by an act of the legislature, all departments were located at Washington. In 1872 a chair of engineering and applied mathematics and one of biology were established with an endowment of $40,000, the gift of Dr Francis J. LeMoyne, and the chairs of Greek and of Latin were endowed by the Rev. C. C. Beatty with $60,000. In 1909–1910 Washington and Jefferson College (including Washington and Jefferson Academy) had 29 instructors, 413 students, about 20,000 volumes in its library and an endowment of $630,000. Washington is in a bituminous coal and natural gas region, and there are manufactories of glass, iron tubing and pipe, tin plate, steel, &c. The site was part of a tract bought in 1771 by David Hoge and was known at first as Catfish camp after an Indian chief, Tingooqua or Catfish. It was platted in October 1781 and called Bassettown in honour of Richard Bassett (d. 1815), a member of the Federal constitutional convention of 1787 and of the United States Senate in 1789–1793, and governor of Delaware in 1798–1801. The village was replatted in November 1784 and renamed in honour of General Washington, to whom a large part of the site had belonged. The early settlers were chiefly Scotch-Irish. At first a part of Strabane township, one of the original thirteen townships of Washington county, in February 1786 Washington was made a separate election district; it was incorporated as a town in 1810; was chartered as a borough and enlarged in 1852, and its limits were extended in 1854 and 1855. Since 1900 there have been added to the borough North and South Washington and the industrial suburb of Tylerdale, East and West Washington, although practically one with the borough, remaining under separate administration. The location of Washington on the old "National Road" gave it importance before the advent of railways. At the LeMoyne crematory established here by Dr Francis Julius LeMoyne,[1] on the 6th of December 1876, took place the first public cremation in the United States; the body burned was that of Baron Joseph Henry Louis de Palm (1809–1876), a Bavarian nobleman who had emigrated to the United States in 1862 and had been active in the Theosophical Society in New York.

See Boyd Crumrine (ed.), *The History of Washington County, Pennsylvania* (Philadelphia, 1882); and Alfred Creigh, *The History of Washington County from its First Settlement to the Present Time* (Harrisburg, 1871).

WASHINGTON, the most north-westerly state of the United States of America. It lies between latitudes 45° 32′ and 49° N. and between longitudes 116° 57′ and 124° 48′ W. On the N. it is bounded by British Columbia, along the 49th parallel as far W. as the middle of the Strait of Georgia and then down the middle of this strait and Haro Strait, and along the middle of the channel the Strait of Juan de Fuca, which separate it from Vancouver Island; on the E. the south portion of its boundary is the Snake river, which separates it from Idaho, but from the confluence of the Snake and Clearwater rivers (a little W. of 117°) the E. boundary line between Washington and Idaho runs directly N.; on the S. the Columbia river separates it from Oregon from the mouth of that river to the point of the upper intersection with the 46th parallel of N. latitude, but from thence eastward the S. boundary line between Washington and Oregon is the 46th parallel; on the W. the state is bounded by the Pacific Ocean. The state has a maximum length, from E. to W., of 360 m. and a maximum width of 240 m.; area, 69,127 sq. m., of which 2291 sq. m. are water surface.

Physical Features.—The western half of Washington lies in the Pacific Mountains province, consisting of the Coast range and the Cascade range, separated by a broad basin known as the Sound Valley The eastern half of the state is occupied in the north by a westward extension of the Rocky Mountains, and in the centre and south by the north-western portion of the Columbia Plateau province. The most prominent physical feature of the state is the Cascade mountain range, which with a N.N.E. and S.S.W. trend crosses the state 30 to 40 m. W. of the middle. On the S. border this mountain range occupies a tract about 50 m. in width, and to the northward it widens to 100 m. or more. The general height of the ridges and peaks is about 8000 ft. above the sea, but there are five ancient snow-capped volcanoes which equal or exceed 10,000 ft. These are Mount Rainier or Tacoma (14,363 ft.), Mount Adams (12,470 ft.), Mount Baker (10,827 ft.), Glacier Peak (10,436 ft.) and Mount St Helens (10,000 ft.). Glaciers are common both in the N. and in the S. region, even on the higher elevations. Both slopes of the Cascades are cut deep by valleys. Along the Pacific Coast the ridges of the Coast range are only about 1500 ft. in height in the S. part of the state, but they rise northward in the Olympic Mountains and reach a maximum of elevation on Mount Olympus of 8150 ft. The Olympics meet the ocean along a rather straight line, but farther S. the coast line is broken by Gray's Harbour and Willapa Bay, the drowned lower portions of river valleys. The upheaval of the Cascade Mountains on the E. and the Olympic Mountains and Coast range on the W. left between them the Puget Sound Basin, the gently sloping sides of which descend in the central portion to less than 100 ft. from sea-level. A still greater subsidence farther north produced Puget Sound. East of the Cascade Mountains the Columbia and Spokane rivers mark the boundary between the Okanogan Highlands to the northward and the Columbia plateau to the southward. The Okanogan Highlands, an outlier of the Rocky Mountains extending westward from the Cœur d'Alene Mountains in Idaho, reach heights of 5000 to 6000 ft. above the sea, but are characterized by long gentle slopes, rounded divides and wide stream basins. In some of the larger valleys there are glacial terraces. The Columbia plateau consists of horizontal beds of lava having a total thickness of several thousand feet, and its surface has a general elevation of 1000 to 2000 ft. above sea-level. West of the Columbia river the plain is broken by several monoclinal ridges rising 2000 to 3000 ft. above it and extending eastward 50 to 75 m. from the foothills of the Cascades. In some parts, especially (in Douglas and Grant counties) within the Big Bend of the Columbia, the plain is frequently cut by coulées, or abandoned river channels, some of them 500 to 600 ft. deep and with very precipitous walls. The Grand Coulée represents the course of the Columbia river during the glacial period, when its regular channel was blocked with ice. There are also deep canyons which have been cut by the rivers in their present courses, especially by the Snake river and its tributaries. The S.W. corner of the state is occupied by the Blue Mountains, which rise about 7000 ft. above the sea and are cut deep by canyons. About 11,000 sq. m. in Washington have a minimum elevation exceeding 3000 ft.; an approximately equal area has a maximum elevation less than 500 ft., and the mean elevation of the entire state is 1700 ft.

The Okanogan Highlands, the Columbia plain, the E. slope of the Cascade Mountains and the S. portion of the Puget Sound Basin are drained by the Columbia and its tributaries. This large river enters the N.E. corner of the state from the N., traverses it in a winding course from N. to S., forms the greater portion of its S. boundary, and discharges into the Pacific Ocean. The Snake (in the S.E., a little W. of the 119th parallel), the Spokane (in the east central part) and the Pend Oreille (on the N. boundary) are its principal tributaries from the E.; the Yakima (a little above the mouth of the Snake) from the W.; and the Okanogan (in the north central part of the state), from the N. A portion of the Puget Sound Basin and a portion of the Coast range are drained by the Chehalis river, which has cut a channel through the Coast range and discharges into Gray's Harbour. The W. slope of the Cascades, most of the E. slope of the Olympics and the N. portion of the Puget Sound Basin are drained by a great number of small rivers into the Puget Sound; and the W. slope of the Olympics and Coast range is drained by several other small rivers into the Pacific. On the Cascade Mountains, at the heads of streams, are a number of lakes of glacial origin, the largest of which is Lake Chelan on the E. slope in Chelan county. This is nearly 60 m. in length, and from 1 to 4 m. wide. At the upper end it is about 1400 ft. deep, but it is shallow at the lower end where the water is held back by a morainal dam, and where only 3½ m. from the Columbia river it is about 400 ft. above the level of the river. There are also several alkali lakes or chains of alkali lakes in the coulées on the Columbia plateau.

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[1] LeMoyne (1798–1879) was the son of a French refugee, and was an ardent abolitionist. In 1840 he was the Liberty party's candidate for the vice-presidency. He built a normal school for negroes near Memphis, Tennessee, and gave money to Washington College, at which he had graduated in 1815. Largely through LeMoyne's influence Washington became an important point on the "underground railway" for assisting runaway slaves to Canada.

Fauna.—Many species of wild animals still inhabit the state, but the number of each species has been much reduced. The caribou, moose, antelope, mountain sheep, beaver, otter and mink are scarce. Few elk are found except in the inaccessible districts on the Olympic Mountains. White- and black-tailed deer and black bear inhabit the densest forests. Mountain goats are quite numerous on the Cascades. The destruction of cougars, lynx ("wildcats"), coyotes and wolves is encouraged by bounties. Coyotes and jack-rabbits are the most numerous denizens of the Columbia plain. Musk-rats and skunks are numerous west of the Cascades. The blue grouse and partridge are the principal game birds. The sage-hen is common on the Columbia plain. The Japanese pheasant and the California quail have increased in numbers under the protection of the state. Among other game birds are prairie-chickens, ducks, geese, swan, brant, sandhill crane and snipe. The speckled trout, which abounds in nearly all of the mountain streams and lakes, is the principal game fish. Other freshwater fish are the perch, black bass, pike, pickerel and white fish. There are large quantities of salmon in the lower Columbia river, in Gray's and Willapa harbours, and in Puget Sound; oyster fisheries in Gray's and Willapa harbours and in Puget Sound; cod, perch, flounders, smelt, herring and sardines in these and other salt waters. For all the more desirable game a close season has been established by the state.

Flora.—The Puget Sound Basin and the neighbouring slopes of the Cascade and Olympic Mountains are noted for their forests, consisting mainly of giant Douglas fir or Oregon pine (*Pseudotsuga Douglasii*), but containing also some cedar, spruce and hemlock, a smaller representation of a few other species and a dense undergrowth. Near the Pacific Coast the forests consist principally of hemlock, cedar and Sitka spruce. At an elevation of about 3000 ft. on the W. slope of the Cascades the red fir ceases to be the dominant tree, and between this elevation and the region of perpetual snow, on a few of the highest peaks, rise a succession of forest zones containing principally: (1) yellow pine, red and yellow fir, white fir and cedar; (2) lodgepole pine, white pine, Engelmann spruce and yew; (3) subalpine fir, lovely fir, noble fir, Mertens hemlock, Alaska cedar and tamarack; (4) white-bark pine, Patton hemlock, alpine larch and creeeping juniper. Deciduous trees and shrubs are represented in western Washington by comparatively small numbers of maple, alder, oak, cottonwood, willow, ash, aspen, birch, dogwood, sumach, thornapple, wild cherry, chokecherry, elder, huckleberry, blueberry, blackberry, raspberry, gooseberry and grape. The E. slope of the Cascades and most of the Okanogan Highlands are clothed with light forests consisting chiefly of yellow pine, but containing also Douglas fir, cedar, larch, tamarack and a very small amount of oak. In the eastern part of the Okanogan Highlands there is some western white pine, and here, too, larch is most abundant. The Columbia plain is for the most part treeless and, except where irrigated, grows principally bunch-grass or, in its lower and more arid parts, sagebrush. In the forest regions of eastern Washington the underbrush is light, but grasses and a great variety of flowering plants abound.

Climate.—In western Washington, where the ocean greatly influences the temperature and the mountains condense the moisture of vapour-bearing winds, the climate is equable and moist. Eastern Washington, too, usually has a mild temperature, but occasionally some regions in this part of the state are visited by a continental extreme, and as the winds from the ocean lose most of their moisture in passing over the Cascades, the climate is either dry or arid according to elevation. Along the coast the temperature is rarely above 92° F. or below 10° F.; the mean temperature for July is about 60°, for January 40°, and for the entire year 50°. In the Puget Sound Basin an occasional cold east wind during a dry period in winter causes the temperature to fall below zero. At Centralia, in the Chehalis Valley, the temperature has risen as high as 102°. But the mean temperature for January is 34° in the N. portion of the basin and 40° in the S. portion; for July it is 60° in the north and 65° in the south; and for the entire year it is 46° in the north and 52° in the south. During April and October the temperatures in eastern Washington are nearly the same as those in western Washington, but during July the temperatures in eastern Washingto are subject to a range from 40° to 110°, and during January fro 65° to −30°. However, the climate is so dry in eastern Washingto that the "sensible" variations are much less than those recorde by the thermometer. In the south-eastern counties the winte are mild, with the exception of an occasional cold period, and th summers are hot. The rainfall on the W. slope of the Olympi Coast range and Cascade Mountains is from 60 to 120 in. annually and in the Puget Sound Basin it is from 25 to 60 in., it bein least on the N.E. or leeward side of the Olympics. About three fourths of the rain in western Washington falls during the we season from November to April inclusive. On the Okanogan Highlands, on the eastern foothills of the Cascade Mountains, on th Blue Mountains and on the elevated portion of the Columbia Plai which comprises the E. border counties, the annual rainfall and melte snow amount to from 12 to 24 in., but in the southern half of easter Washington the Columbia river flows through a wide district of low elevation, where the rainfall and melted snow amount to only 6 to 12 in. a year, and where there is scarcely any precipitation during the summer months. There is a heavy snowfall in winter on the mountains, and in a large portion of eastern Washington the average annua snowfall is 40 in. or more. Along the coast the prevailing winds blow from the west or south; in the Puget Sound Basin from the south, and in eastern Washington from the south-west, except in the Yakima and Wenatchee valleys, where they are north-west. During summer the winds are very moderate in western Washington, but during winter they occasionally blow with great violence. In eastern Washington hot winds from the north or east are occasionally injurious to the growing wheat in June or July. Light hailstorms are not uncommon, but tornadoes are unknown in the state.

Soils.—The soils of western Washington are chiefly glacial, those of eastern Washington chiefly volcanic. In the low tidewater district of the Puget Sound Basin an exceptionally productive soil has been made by the mixture of river silt and sea sand. In numerous depressions, some of which may have been the beds of lakes formed by beaver dams, the soil is deep and largely of vegetable formation. In the valleys of rivers which have overflowed their banks and on level bench lands there is considerable silt and vegetable loam mixed with glacial clay; but on the hills and ridges of western Washington the soil is almost wholly a glacial deposit consisting principally of clay but usually containing some sand and gravel. On the Columbia plateau the soil is principally volcanic ash and decomposed lava; it is almost wholly volcanic ash in the more arid sections, but elsewhere more decomposed lava or other igneous rocks, and some vegetable loam is mixed with the ash. On the E. slope of the Cascades and on the Okanogan Highlands glacial deposits of clay, gravel or sand, as well as vegetable loam, are mixed with the volcanic substances.

Fisheries.—Washington's many waterways, both fresh and salt, and especially those which indent or are near the coast, make the fisheries resources of great value. The catch and canning of salmon are particularly important. In 1905 the value of canned salmon was $2,431,605 (26,601,429 ℔).

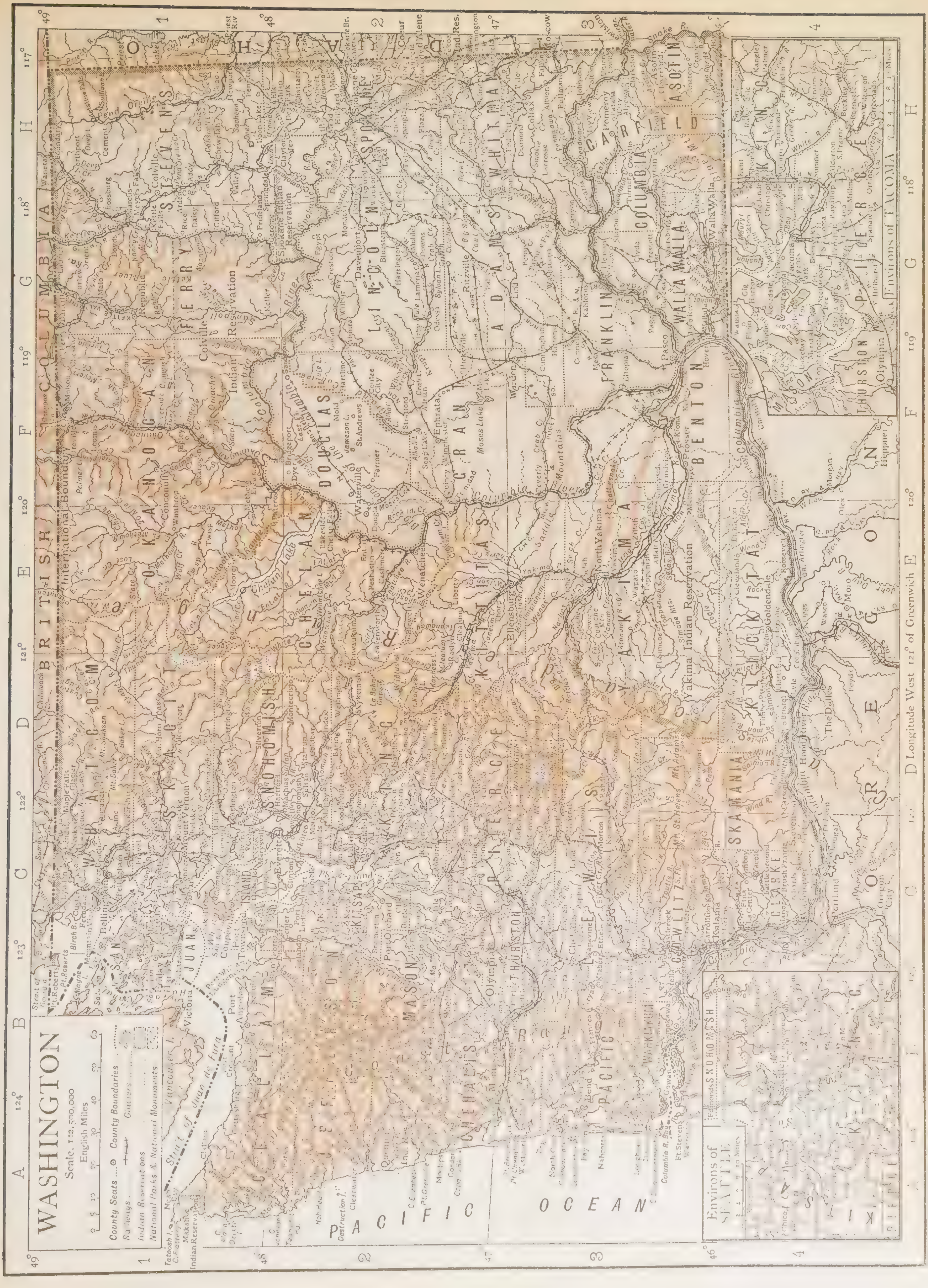
Forests.—In 1907 the estimated area of standing timber in Washington was 11,720 sq. m. besides that included in national forest reserves. The forest reserves are included in ten national parks, named the Chelan, Columbia, Colville, Kaniksu, Olympic, Ranier, Snoqualmie, Washington, Wanaha and Wenatchee, the Chelan being the largest, with an area of 2,492,500 acres. The aggregate area of these parks (all of which were opened in 1907 and 1908) is 18,850·7 sq. m., or about three-elevenths of the total area of the state.

Irrigation.—The principal Federal irrigation undertakings in 1910 were known as the "Okanogan project" and the "Yakima project." The former (authorized in 1905) provided for the irrigation of about 10,000 acres in Okanogan county by means of two reservoirs of an aggregate area of 650 acres, main canals and main laterals 20 m. long and small laterals 30 m. long, the water being taken from the Salmon river. In 1909 about 3000 acres in this project were watered and under cultivation. The Yakima project involved the irrigation of about 600,000 acres by means of five reservoirs of an aggregate area of 804,000 acre-feet, and was undertaken by the United States government in 1905.

Agriculture.—The development of the agricultural resources of Washington was exceedingly rapid after 1880. The wheat crop in 1909 was 35,780,000 bushels, valued at $33,275,000; oats, 9,898,000 bushels, valued at $4,751,000; barley, 7,189,000 bushels, valued at $4,601,000; rye, 84,000 bushels, valued at $79,000; Indian corn, 417,000 bushels, valued at $359,000. The principal wheat-producing region is the south-eastern part of the state. Western Washington has large hay crops; in the E. part of the state much alfalfa is grown, especially in Yakima county. In W. Washington peas are raised for forage.

Vegetable crops are successfully grown in low alluvial lands of the W. part of the state, and on the irrigated volcanic ash lands E. of the mountains. Apple-growing and the raising of other fruits have increased rapidly. Small fruits are more successful in the W. part of the state. Grapes are grown on the mountain sides, cranberries on the bog lands near the coast, and nuts in the S.E. parts.

Live-stock and dairy products are important factors in the


WASHINGTON
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English Miles
0 5 10 20 30 40 50 60
County Seats
County Boundaries
Railways
Glaciers
Indian Reservations
National Parks & National Monuments
BRITISH COLUMBIA
International Boundary
IDAHO
OREGON
PACIFIC OCEAN
Strait of Juan de Fuca
Vancouver I.
Victoria
SAN JUAN
WHATCOM
OKANOGAN
FERRY
STEVENS
PEND OREILLE
SKAGIT
CHELAN
DOUGLAS
LINCOLN
SPOKANE
SNOHOMISH
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KITTITAS
GRANT
ADAMS
WHITMAN
GARFIELD
COLUMBIA
ASOTIN
WALLA WALLA
FRANKLIN
BENTON
YAKIMA
KLICKITAT
SKAMANIA
CLARKE
COWLITZ
LEWIS
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THURSTON
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JEFFERSON
CLALLAM
CHEHALIS
PACIFIC
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Olympia
Tacoma
Seattle
Everett
Bellingham
Walla Walla
North Yakima
Ellensburg
Wenatchee
Colville
Yakima Indian Reservation
Colville Indian Reservation
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Environs of SEATTLE
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agricultural wealth of Washington, but the raising of live-stock on ranges is less common than when large herds grazed free on government lands. Dairying, as distinct from grazing, has much increased in importance in recent years.

Minerals.—The mineral wealth of Washington is large, but its resources have been only slightly developed, and had hardly begun before the first decade of the 20th century: in 1902 the total value of all mineral products was $5,393,659; in 1907 it was $11,617,706 and in 1908 $11,610,224.

The coal deposits of Washington are the only important ones in the Pacific states, and in Washington only, of the Pacific states, is there any coking coal. In the Cowlitz Valley an inferior coal was found in 1848. The first important coal-mining was near Bellingham Bay, in Whatcom county, where coal was discovered in 1852 and where 5374 tons were mined in 1860. Between 1850 and 1860 coal was found on the Stilaguamish river (Snohomish county) and on the Black river (near Seattle) and in 1863 at Gilman (King county); but it was not until between 1880 and 1885, when the Green river field in King county and the Roslyn mines in Kittitas county were opened, that commercial production became important: the output was 3,024,943 tons (valued at $6,690,412) in 1908, when nearly one-half (1,414,621 tons) of the total was from Kittitas county and most of the remainder from the counties of King (931,643 tons) and Pierce (551,678 tons). There are large deposits of glacial and residual clays and clay shales throughout the state.

Serpentine marble with seamed markings has been found in Adams and Stevens counties. Granite is found about Puget Sound and in the extreme eastern part of the state; it is largely used in riprap or rough foundations. Sandstone is found especially in the N.W. in Whatcom and San Juan counties; it is used for paving blocks. Limestone also is found most plentifully in the north and north-western parts of the state.

Gold, silver, copper, lead and a little iron (almost entirely brown ore) are the principal ores of commercial importance found in Washington. The total value of gold, silver, copper and lead in 1908 was $378,816 (gold $242,234, silver $47,076, copper $41,188, lead $48,318). The largest output of each of these ores in 1908 was in Stevens county; Ferry, King and Okanogan counties ranked next in the output of gold; Okanogan and Ferry counties in the output of silver; Okanogan in the output of copper; and King in the output of lead. About nine-tenths of the gold was got from dry or siliceous ores and about 8 % from placer mines; about two-thirds of the silver from dry or siliceous ores, about two-ninths from copper ores, and most of the other ninth from lead ores. The only lead ore is galena. The copper is mostly a copper glance passing into chalcopyrite; it is found in fissure veins with granite. A small quantity of zinc (7 tons in 1906) is occasionally produced. Tungsten is found as wolframite in Stevens county near Deer Trail and Bissell, in Okanogan county near Loomis, in Whatcom county near the international boundary, and (with some scheelite) at Silver Hill, near Spokane. Nickel has been found near Keller in Ferry county, and molybdenum near Davenport, Lincoln county. There is chromite in the black sands of the sea-coast and the banks of the larger rivers. Antimony deposits were first worked in 1906. Arsenic is found.

Manufactures.—There was remarkable growth in the manufacturing industries of Washington between 1880 and 1905, due primarily to the extraordinary development of its lumber industry. In 1870 the value of lumber products was $1,307,585, and the Territory ranked thirty-first among the states and territories in this industry, and in 1880 the value of the product was $1,734,742; by 1905 the value had increased to $49,572,512, and Washington now ranked first. The manufacture of planing mill products, including sashes, doors and blinds, was an important industry, the products being valued in 1905 at $5,173,422.

Next in commercial importance to lumber and timber products are flour and grist mill products, valued in 1905 at $14,663,612. Other important manufactures are: slaughtering and meat packing (wholesale), $6,251,705 in 1905; malt liquors, $4,471,777; and foundry and machine shop products, $3,862,279.

Transportation and Commerce.—Puget Sound has formed a natural terminus for several transcontinental railways, the cities of Seattle and Tacoma on its shores affording outlets to the commerce of the Pacific for the Northern Pacific, the Great Northern and the Chicago, Milwaukee & Puget Sound transcontinental lines, which enter these cities with their own tracks. The Union Pacific and the Canadian Pacific reach Seattle over the tracks of other roads. The Northern Pacific and the Great Northern enter the state near the middle of its eastern boundary at Spokane, which is a centre for practically all the railway lines in the eastern part of the state. The Northern Pacific, the first of the transcontinental roads to touch the Pacific north of San Francisco, reaches Seattle with a wide sweep to the south, crossing the Columbia river about where it is entered by the Yakima and ascending the valley of the latter to the Cascade Mountains. The Great Northern, running west from Spokane, crosses the state in nearly a straight line, and between this road and the Northern Pacific, and paralleling the Great Northern, runs the recently constructed Chicago, Milwaukee & Puget Sound, the westward extension of the Chicago, Milwaukee & St Paul. The Northern Pacific sends a branch line south from Tacoma parallel with the coast to Portland on the Columbia river, where it meets the Southern Pacific and the Oregon Railroad & Navigation Company's line (a subsidiary of the Union Pacific), thus affording communication southwards, and up the valley of the Columbia to the east. Entering the south-east corner of the state, the Oregon Railroad & Navigation Company extends a line northwards to Spokane, and a branch of the Great Northern, leaving the main line at this city, runs north-westward into British Columbia. The Spokane, Portland & Seattle railway connects the three cities named by way of the Columbia Valley; and the Spokane & Inland Empire sends a line eastward into Idaho to the Cœur d'Alene country and another through the south-eastern part of the state into Nevada. In 1880 the railway mileage was 289 m.; in 1890, 2012·05 m.; in 1900, 2888·44 m.; and on the 1st of January 1909, 4180·32 m.

Seattle and Tacoma are among the four leading ports of the United States on the Pacific. Other harbours on Puget Sound of commercial importance are Olympia, Everett and Bellingham. Port Townsend is the port of entry for Puget Sound. Gray's Harbour, on the western coast, is of importance in lumber traffic.

Population.—The population in 1860 was 11,594; in 1870, 23,955; in 1880, 75,116; in 1890, 349,390, an increase within the decade of 365·1%; in 1900, 518,103, an increase of about 45%. In 1910, according to the U.S. census returns, the total population of the state reached 1,141,990. Of the total population in 1900, 394,179 were native whites, 111,364 or 21·5% were foreign-born, 10,139 (of whom 2531 were not taxed) were Indians, 5617 were Japanese, 3629 were Chinese, and 2514 were negroes. The Indians on reservations in 1909 were chiefly those on Colville Reservation (1,297,000 acres unallotted), in the N.E. part of the state, and the Yakima Reservation (837,753 acres unallotted), in the S. part; they belonged to many small tribes chiefly of the Salishan, Athapascan, Chinookan and Shahaptian stocks. Of the foreign-born, 18,385 were English-Canadians, 16,686 Germans, 12,737 Swedes, 10,481 natives of England, 9891 Norwegians and 7262 Irish. Of the total population 241,388 were of foreign parentage (*i.e.* either one or both parents were foreign-born), and of those having both parents of a given nationality 34,490 were of German, 19,359 of Swedish, 17,456 of Irish, 16,959 of Norwegian and 16,835 of English parentage. The Roman Catholic Church in 1906 had more members than any other religious denomination, 74,981 out of the total of 191,976 in all denominations; there were 31,700 Methodists, 13,464 Lutherans, 11,316 Baptists, 10,628 Disciples of Christ, 10,025 Congregationalists and 6780 Protestant Episcopalians.

Government.—Washington is governed under its original constitution, which was adopted on the 1st of October 1889. An amendment may be proposed by either branch of the legislature; if approved by two-thirds of the members elected to each branch and subsequently, at the next general election, by a majority of the people who vote on the question it becomes a part of the constitution. Five amendments have been adopted: one in 1894, one in 1896, one in 1900, one in 1904, and one in 1910. Suffrage is conferred upon all adult citizens of the United States (including women, 1910) who have lived in the state one year, in the county ninety days, and in the city, town, ward or precinct thirty days immediately preceding the election, and are able to read and speak the English language; Indians who are not taxed, idiots, insane persons and convicts are debarred. General elections are held biennially, in even-numbered years, on the first Tuesday after the first Monday in November, and candidates, except those for the supreme court bench and a few local offices, are nominated at a direct primary election, held the second Tuesday in September.

The governor, lieutenant-governor, secretary of state, treasurer, auditor, attorney-general, superintendent of public instruction and commissioner of public lands are elected for a term of four years; and each new administration begins on the second Monday in January. The governor's salary is $6000 a year, which is the maximum allowed by the constitution.

The legislature consists of a Senate and a House of Representatives, and the constitution provides that the number of representatives shall not be less than sixty-three nor more than ninety-nine, and the number of senators not more than one-half nor less than one-third the number of representatives. Senators are elected by single districts for a term of four years, a portion retiring every two years; representatives are elected, one, two or three from a district, for a term of two years. Regular sessions of the legislature are held biennially, in odd-numbered years, and begin on the second Monday in January. Any bill or any item or items of any bill which has passed both houses may be vetoed by the governor, and to override a veto a two-thirds vote of the members present in each house is required. No law other than appropriation bills can go into effect until ninety days after the adjournment of the legislature, except in case of an emergency, by a vote in each house of two-thirds of all its members. The members of the legislature are paid $5 for each day's attendance during the session, besides an allowance for travelling expenses.

Justice is administered principally by a supreme court, superior courts and justices of the peace. The supreme court consists of nine judges elected for a term of six years, one of those whose term next expires being chosen chief justice, and is divided into two departments. The presence of at least three judges in each department is required, and the concurrence of at least three judges is necessary to a decision. In case of a disagreement the case may be heard again in the same department, transferred to the other department, or to the court *en banc*. The chief justice or any four of his associates may at any time convene the court *en banc*, and if so convened at least five of the judges must be present, and the concurrence of at least five is necessary to a decision. The supreme court has original jurisdiction in *habeas corpus*, *quo warranto* and *mandamus* proceedings against all state officers; and it has appellate jurisdiction except in civil actions for the recovery of money or personal property, in which the original amount in controversy does not exceed $200, and which at the same time do not involve the legality of a tax, impost, assessment, toll or municipal fine, or the validity of a statute. Judges of the superior courts (one or more for each county, or one for two or more counties jointly) are elected for a term of four years. They have original jurisdiction in all cases in equity, in all cases at law which involve the title or possession of real property, or the legality of a tax, impost, assessment, toll or municipal fine, and in all other cases at law in which the amount in controversy is $100 or more, in nearly all criminal cases, in matters of probate, in proceedings for divorce, and in various other cases; and they have appellate jurisdiction of cases originally tried before a justice of the peace or other inferior courts where the amount in controversy is more than $20. Justices of the peace, one or more in each election precinct, are elected for a term of two years. They have jurisdiction of various civil actions in which the amount in controversy is less than $100, and concurrent jurisdiction with the superior courts in all cases of misdemeanours, but punishment by a justice of the peace is limited in cities of the first class to a fine of $500, or imprisonment for six months, and elsewhere to a fine of $100 or imprisonment for thirty days.

Local Government.—The government of each county is vested principally in a board of three commissioners elected by a county at large, some for two and some for four years. The other county officers are a clerk, a treasurer, an auditor, an assessor, an attorney, an engineer, a sheriff, a coroner and a superintendent of public schools, each elected for a term of two years. Township organization is in force only when adopted by a particular county at a county election; in 1910 only one county (Spokane) had the township organization. Each township is governed by the electors assembled annually (the first Tuesday in March) in town meeting and by three supervisors, a clerk, a treasurer, an assessor, a justice of the peace and a constable, and an overseer of highways for each road district, all elected at the town meeting, justice of the peace and a constable for a term of two years, the other officers for a term of one year; each overseer of highways is chosen by the electors of his district. Municipalities are incorporated under general laws, and cities are divided into three classes, the first class including those having a population of 20,000 or more, the second class those having a population between 10,000 and 20,000, the third class those having a population between 1500 and 10,000. When a community has a population between 300 and 1500 within an area of 1 sq. m., it may be incorporated as a town. A city of the first class is permitted to frame its own charter, but its general powers are prescribed by statute. A city of the second class must elect a mayor and twelve councilmen, and its mayor must appoint a police judge, an attorney, a street commissioner and a chief of police. A city of the third class must elect a mayor, seven councilmen, a treasurer, a health officer, a clerk and an attorney, and its mayor must apoint a marshal, a police justice and as many policemen as the council provides for. An incorporated town must elect a mayor, five councilmen and a treasurer, and its mayor must appoint a marshal and a clerk.

Miscellaneous Laws.—Either husband or wife may hold, manage and dispose of his or her separate property independent of the other, but property which they hold in common is under the management and control of the husband except that he cannot devise by will more than one-half of the community real or personal property, or convey, mortgage or encumber any of the community real estate unless his wife joins him. When either husband or wife dies intestate one-third of the separate real estate of the deceased goes to the survivor if there are two or more children, one-half of it if there is only one child, the whole of it if there are no children, no issue of children, and no father, mother, brother or sister. One-half of the community property goes to the survivor in any case, and the whole of it if there is no will and neither children nor the issue of children. Where there is no will one-half of the residue of the separate personal estate goes to the survivor if there are issue, and the whole of it if there are no issue. A law enacted in 1909 forbids a marriage in which either of the parties is a common drunkard, habitual criminal, epileptic, imbecile, feeble-minded person, idiot or insane person, a person who has been afflicted with hereditary insanity, a person who is afflicted with pulmonary tuberculosis in its advanced stages, or a person who is afflicted with any contagious venereal disease, unless the woman is at least forty-five years of age. A plaintiff must reside in the state one year before filing an application for a divorce. Neither party is permitted to marry a third party until six months after the divorce has been obtained. Washington has a state board consisting of three members appointed by the governor to confer with commissioners from other states upon such matters as marriage and divorce, insolvency, descent and distribution of property, the execution and probate of wills, for the purpose of promoting uniformity of legislation respecting them. A homestead to the value of $1000 which is owned and occupied by the head of a family is exempt from attachment or forced sale except for debts secured by mechanics', labourers', materialmen's or vendors' liens upon the premises. If the owner is a married man the homestead may be selected from the community property but not the wife's separate property without her consent, and when it has been selected, even if from the husband's separate property, it cannot be encumbered or conveyed without the wife's consent. Personal property is exempt from execution or attachment as follows: all wearing apparel of every person and family; private libraries to the value of $500; all family pictures; household goods to the value of $500; certain domestic animals or $250 worth of other property chosen instead; firearms kept for the use of a person or family; certain articles (within specified values) necessary to the occupations of farmers, physicians, and other professional men, teamsters, lightermen, &c., and the proceeds of all life and accident insurance. By a law enacted in 1909 the licensing of the sale of intoxicating liquors, other than for medical purposes by druggists and pharmacists, is left to the option of counties and cities.

Charities, &c.—The state charitable and penal institutions consist of the Western Washington Hospital for the Insane at Fort Steilacoom, the Eastern Washington Hospital for the Insane at Medical Lake, the State School for the Deaf and the State School for the Blind at Vancouver, the State Institution for Feeble-minded near Medical Lake, the Washington Soldiers' Home and Soldiers' Colony at Orting, the Veterans' Home at Port Orchard, the State Penitentiary at Walla Walla, the State Reformatory at Monroe and the State Training School at Chehalis. All of these institutions are under the management of a bi-partisan State Board of Control which consists of three members appointed by the governor for a term of six years, one every two years, and also removable by the governor in his discretion. Each member receives a salary of $3000 a year. The same board together with the superintendent of the penitentiary constitute a prison board. The State Training School is for the reformatory training of children between eight and eighteen years of age who have been found guilty of any crime other than murder, manslaughter or highway robbery, or who for some other cause have been committed to it by a court of competent jurisdiction.

Education.—The public school system is administered by a state superintendent of public instruction, a state board of education, regents or trustees of higher institutions of learning, a superintendent of the common schools and a board of education in each county, and a board of directors in each school district. The state superintendent is elected for a term of four years. The state board of education consists of the state superintendent, the president of the University of Washington, the president of the State College of Washington, the principal of one of the state normal schools chosen biennially by the principals of the state normal schools, and three other members appointed biennially by the governor, one of whom must be a superintendent of a district of the first class, one a county superintendent and one a principal of a high school. This body very largely determines the course of study in the elementary schools, high schools, normal school and the normal departments of the University and the State College, approves the requirements for entrance to the University and the State College, and prepares the questions for the examination of teachers. Each county superintendent is elected for a term of two years. The county board of education consists of the county superintendent and four other members appointed by him for a term of two years; one of its principal duties is to adopt the text-books for schools in districts in which there is no four-year accredited high school. In a school district which maintains a four-year accredited high school there is a text-book commission consisting of the city superintendent or the principal of the high school, two members of the board of directors designated by the board, and two teachers appointed by the board. All children between eight and fifteen years of age, and all between fifteen and sixteen years of age who are not regularly employed in some useful or remunerative occupation, must attend the public school all the time it is in session or a private school for the same time unless excused by the city or the county superintendent because of mental or physical disability or because of proficiency in the branches taught in the first eight grades. Washington has three state normal schools: one at Cheney, one at Bellingham, and one at Ellensburg, and each of them is under the management of a board of three trustees appointed by the governor with the concurrence of the Senate for a term of six years, one every two years. The State College of Washington (1890) at Pullman, for instruction in agriculture, mechanical arts and natural sciences, includes an agricultural college, an experiment station and a school of science. The University of Washington (1862) at Seattle embraces a college of liberal arts, a college of engineering and schools of law, pharmacy, mines and forestry. Whitman College (Congregational, 1866) at Walla Walla, Gonzaga College (Roman Catholic, 1887) at Spokane, Whitworth College (Presbyterian, 1890) at Tacoma and the University of Puget Sound (Methodist Episcopal, 1903) at Tacoma are institutions of higher learning maintained and controlled by their respective denominations.

Finance.—The revenue for state, county and municipal purposes is derived principally from a general property tax, a privilege tax levied on the gross receipts of express companies and private car companies, an inheritance tax and licence fees for the sale of intoxicating liquors. Real property is assessed biennially; personal property, annually. For the two years ending the 1st of October 1908 the total receipts into the state treasury amounted to $10,854,281·42 and the total disbursements amounted to $11,053,375·13. The net state debt on the 1st of October 1908 amounted to $967,576·38.

History.—The early exploration of the western coast of North America grew out of the search for a supposed passage, sometimes called the "Strait of Anian" between the Pacific and the Atlantic. In *Purchas his Pilgrimmes* (1625) was published the story of Juan de Fuca, a Greek mariner whose real name was Apostolos Valerianos, who claimed to have discovered the passage and to have sailed in it more than twenty days. Though the story was a fabrication, the strait south of Vancouver Island was given his name. An account of the various Spanish and English explorers has already been given under Oregon and need not be repeated at length here.

In 1787 a company of Boston merchants sent two vessels, the "Columbia" and the "Washington" under John Kendrick and Robert Gray (1755–1806) to investigate the possibility of establishing trading posts. They reached Nootka Sound in September 1788, and in July 1789 Captain Gray in the "Columbia" began the homeward voyage by way of China. Captain Kendrick remained, erected a fort on Nootka Sound, demonstrated that Vancouver was an island and in 1791 purchased from the Indians large tracts of land between 47° and 51° N. lat. for his employers. On the homeward voyage he was accidentally killed and his vessel was lost. Meanwhile Captain Gray in September 1790 sailed from Boston on a second voyage. During the winter of 1791–1792 he built another fort on Nootka Sound and mounted four cannon from the ship. With the coming of spring he sailed southward, determined to settle definitely the existence of the great river, which he had vainly attempted to enter the previous summer. Captain George Vancouver (1758–1798), in charge of a British exploring expedition then engaged in mapping the coast (1792–1794), was sceptical of the existence of the river, but Captain Gray, undiscouraged, persisted in the search and on the 11th of May 1792 anchored in the river which he named Columbia in honour of his ship. The later claim of the United States to all the territory drained by the river was based chiefly upon this discovery by Captain Gray, who had succeeded where Spanish and British had failed. The territory became known as Oregon (*q.v.*).

The first white man certainly known to have approached the region from the east was Alexander Mackenzie of the North-west Fur Company, who reached the coast at about lat. 52° in July 1793. With the purchase of Louisiana (30th April 1803) the United States gained a clear title to the land between the Mississippi and the Rocky Mountains as far north as 49° and, because of contiguity, a shadowy claim to the region west of the mountains. In 1819 Spain specifically renounced any claim she might have to the coast north of 42°, strengthening thereby the position of the United States. Just before the purchase of Louisiana, President Jefferson had recommended to Congress (18th January 1803) the sending of an expedition to explore the headwaters of the Missouri, cross the Rockies and follow the streams to the Pacific. In accordance with the recommendation Meriwether Lewis (*q.v.*) and William Clark, both officers of the United States Army, with a considerable party left St Louis on the 14th of May 1804, ascended the Missouri to the headwaters, crossed the Rockies and, following the Columbia river, reached the ocean in November 1805. The return journey over nearly the same route was begun on the 23rd of March 1806, and on the 23rd of September they reached St Louis.

The story of the struggle of the rival British and American companies to control the fur trade, with the final dominance of the Hudson's Bay Company has been told under Oregon and need not be repeated. Since the country was considered to be of little value the question of boundaries was not pressed either by Great Britain or the United States after the War of 1812, and by a treaty concluded on the 20th of October 1818 it was agreed that "any country that may be claimed by either party on the north-west coast of North America, westward of the Stony (Rocky) Mountains shall be free and open for the term of ten years from the date of the signature of the present convention to the vessels, citizens and subjects of the two powers." On the 6th of August 1827 the convention was continued in force indefinitely with the proviso that either party might abrogate the agreement on twelve months' notice. Meanwhile Russia (17th April 1824) agreed to make no settlement south of 54° 40′ and the United States agreed to make none north of that line. In February 1825 Great Britain and Russia made a similar agreement. This left only Great Britain and the United States as the contestants for that territory west of the Rocky Mountains between 42° and 54° 40′, which by this time was commonly known as the Oregon country. American settlers in considerable numbers soon began to enter the region south of the Columbia river, and in 1841, and again in 1843, these settlers attempted to form a provisional government. A fundamental code was adopted in 1845 and a provisional government was established, to endure until "the United States of America extend their jurisdiction over us." North of the river, the Hudson's Bay Company discouraged settlement, believing that the final determination of the boundary controversy would make that stream the dividing line. Though there were a few mission stations in the eastern part of the present state of Washington (see Whitman, Marcus), the first permanent American settlement north of the Columbia was made in 1845 on the Des Chutes river, at the head of Puget Sound at the present Tumwater. Others soon followed in spite of the efforts of the chief factor of the Hudson's Bay Company, Dr John M'Loughlin, and these permanent settlers finally carried the day.

Interest in the Oregon country developed with the increase of settlers and of knowledge and a demand for the settlement of the boundary dispute arose. The report of Captain Charles Wilkes, who visited the coast in 1841–1842 in charge of the United States exploring expedition helped to excite this interest. In the presidential campaign of 1844 one of the Democratic demands was "Fifty-four forty or fight." By a treaty negotiated by James Buchanan, on the part of the United States, and Richard Pakenham, on the part of Great Britain, and ratified on the 17th of July 1846, the boundary was fixed at 49° to the middle of the channel separating the continent from Vancouver Island and thence "southerly through the middle of the said channel and of Fuca's Straits to the Pacific Ocean." A dispute later arose over this water-line. The act establishing a territorial government for Oregon was approved on the 14th of August 1848, and the first governor, Joseph Lane (1801–1881), assumed the government on the 3rd of March 1849. Following the increase of population north of the Columbia, the territory was divided, and Washington Territory was established on the 2nd of March 1853, with the river as the southern boundary to the point where it is intersected by the forty-sixth parallel, and thence along that parallel to the summit of the Rocky Mountains, thereby including portions of the present states of Idaho and Montana. The first governor, Major Isaac I. Stevens, of the United States Army, took charge on the 29th of September 1853, and a census indicated a population of 3965, of whom 1682 were voters. Olympia was chosen as the temporary seat of government, and Governor Stevens at once set to work to extinguish the Indian titles to land and to survey a route for a railway, which was later to become the Northern Pacific. The Indians, alarmed by the rapid growth of the white population, attempted to destroy the scattered settlements and the wandering prospectors for gold, which had been discovered in eastern Washington in 1855. Between 1855 and 1859, after many sharp contests, the Indians were partially subdued.

Shortly after 1846, the British began to assert that the Rosario Strait and not Haro Strait (as the Americans held) was the channel separating the mainland and Vancouver Island, thus claiming the Haro Archipelago of which San Juan was the principal island. Conflict of authority arose, and in 1859 San Juan was occupied by U.S. troops commanded by Captain George E. Pickett (1825–1875), and for a time hostilities seemed imminent. By agreement joint occupation followed until, by the Treaty of Washington (May 8, 1871), the question was left to the German emperor, who decided (October 21, 1872) in favour of the United States. Meanwhile Oregon was admitted as a state (February 14, 1859) with the present boundaries, and the remnant of the territory, including portions of what are now Idaho and Wyoming, was added to Washington. The discovery of gold in this region, however, brought such a rush of population that the Territory of Idaho was set off (March 3, 1863) and Washington was reduced to its present limits. Rapid growth in population and wealth led to agitation for statehood, and a constitution was adopted in 1878, but Congress declined to pass an enabling act. The development of Alaska and the completion of the Northern Pacific Railroad to the coast (1883) brought a great increase in population. A large number of Chinese coolies who had been introduced to construct the railway congregated in the towns on the completion of the work, and in 1885 serious anti-Chinese riots led to the declaration of martial law by the governor and to the use of United States troops. Finally the long-desired admission to statehood was granted by Congress (February 22, 1889) and President Benjamin Harrison (November 11, 1889) formally announced the admission complete.

Since admission the progress of the state has continued with increasing rapidity. The Alaska-Yukon Exposition, designed to exhibit the resources of western America, held at Seattle June–October 1909, was a complete success. In politics the state has been Republican in national elections, except in 1896, when it was carried by a fusion of Democrats and Populists. A Populist was elected governor and was re-elected in 1900.

GOVERNORS OF WASHINGTON

Territorial.		
Isaac I. Stevens		1853–1857
C. H. Mason (acting)		1857
Fayette McMullen		1857–1858
C. H. Mason (acting)		1858–1859
Richard D. Gholson		1859–1860
Henry M. McGill (acting)		1860–1861
Wm. H. Wallace		1861
L. J. S. Turney (acting)		1861–1862
Wm. Pickering[1]		1862–1866
George E. Cole		1866–1867
E. L. Smith (acting)		1867
Marshall F. Moore		1867–1869
Alvin Flanders		1869–1870
Edward S. Salmon		1870–1872
Elisha P. Ferry		1872–1880
W. A. Newell		1880–1884
Watson C. Squire		1884–1887
Eugene Semple		1887–1889
Miles C. Moore		1889
State.		
Elisha P. Ferry	Republican	1889–1893
John H. McGraw	,,	1893–1897
J. R. Rogers	Populist	1897–1901
Henry C. McBride[2]	Republican (acting)	1901–1905
Albert E. Mead	Republican	1905–1909
Samuel G. Cosgrove[3]	,,	1909
M. E. Hay	Republican (acting)	1909–

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WASHSTAND, a table or stand containing conveniences for personal ablutions. In its 18th-century form it was called a "basin stand" or "basin frame," and is still sometimes described as a "washhand stand." Its direct, but remote, ancestor was the monastic *lavabo*, ranges of basins of stone, lead or marble fed from a cistern. They were usually of primitive conception, and a trough common to all was probably more frequent than separate basins. Very occasionally they were of bronze adorned with enamels and blazoned with heraldry. Very similar usages obtained in castles and palaces, fixed lavatories being constructed in the thickness of the walls for the use of their more important residents. These arrangements were obviously intended only for the summary ablutions which, until a very late date, sufficed to even the high-born. By degrees the *lavabo* became portable, and a "basin frame" is mentioned as early as the middle of the 17th century. Examples of earlier date than the third or fourth decade of the 18th century are, however, virtually unknown. Thenceforward, until about the end of that century, this piece of furniture was usually literally a "stand." It was supported upon a tripod; a circular orifice in the top received the basin, and smaller ones were provided for a soap dish and a water-bottle. Sometimes a stand for the water-jug when the basin was in use was provided below, and very commonly there was a drawer, sometimes even two drawers, below the basin. Great numbers of these stands were made to fit into corners, and a "corner wash-stand" is still one of the commonest objects in an old furniture shop. Chippendale designed such stands in an elaborate rococo fashion, as well as in simpler form. As the 18th century drew to its close the custom of using the same apartment as reception room by day and sleeping room by night produced a demand for what was called "harlequin furniture"—pieces which were contrived a double or triple debt to pay. Thus a variety of complicated combination washstands and dressing tables were made, and fitted with mirrors and sometimes with writing conveniences and drawers for clothes. Sheraton developed astonishing ingenuity in devising a type of furniture which, if we may judge by the large number of examples still existing, must have become highly popular. With the beginning of the 19th century and the expansion of ideals of personal cleanliness, the washstand grew in size and importance. It acquired the form of an oblong wooden table provided, like its smaller predecessors, with orifices for basins and fitted with a broad shelf-like stretcher upon which the jugs were placed when they were removed from the basins. Ample space was provided for soap-dishes and water-bottles. These tables were single or double, for the use of one or two persons. The washstand, as we know it in the 20th century, took its final form when the wooden top was replaced by marble, unpierced, the basins being placed upon the slab, which, in the beginning almost invariably white, is now often of red or other warm-tinted marble.

WASP (Lat. *vespa*), the common name for a well-known sort of stinging insect. The order Hymenoptera is divided into two sub-orders, the Symphyta and the Apocrita. The latter is subdivided into several sections, one of which, the Vespoidea, includes all the true wasps; in addition to the ruby wasps and many of the "Fossores" or digging wasps.

The true wasps (forming the old section Diploptera) are in their turn divided into three families—(1) the Vespidae, (2) the

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[1] Absent from the Territory during the greater part of 1865, during which time Elwood Evans acted as governor.

[2] In place of J. R. Rogers, deceased.

[3] Died 28th March 1909.

Eumenidae, and (3) the Masaridae, which together comprise some 1500 different species. They are characterized by their wings, which are present in both sexes and also in the modified females or workers, being longitudinally folded when at rest, except in the Masaridae. The antennae are usually elbowed, and contain twelve or thirteen joints; in some cases they are clavate. A pair of notched faceted eyes are present, and three ocelli in the top of the head. The mouth-parts are arranged for sucking, but have not reached that degree of perfection found amongst the bees. Hence wasps cannot obtain the sugary secretion from deeply-seated nectaries, and their visits to flowers are confined to such as are shallow or widely opened; they particularly frequent the Umbelliferae. The maxillae are elongated, and compressed, the maxillary palp six-jointed. The labium is prolonged centrally into a "tongue," which is glandular at the tip; the paraglossae are linear. The labial palp has three or four joints. The pro-thorax is oval, and its sides are prolonged backward to the base of the wings. The fore wing has two or three submarginal cells. The legs are not provided with any adaptations for collecting pollen. The abdomen is sometimes pedunculate, its second (apparently first) segment being drawn out into a long stalk, which connects it with the alitrunk, made up of the thorax and the first abdominal segment. The queens and the workers are armed with a powerful sting. The usual colour of these insects is black, relieved to a greater or less degree by spots and patches of yellow or buff.

The Diploptera may be subdivided into two groups in accordance with the habits of life of the insects comprising the section. One of the groups includes the family Vespidae, which is composed of social wasps, and includes the hornet (*Vespa crabro*) and the common wasp (*V. vulgaris*). The other group contains two smaller families, the Eumenidae and the Masaridae, the members of which are solitary in their mode of life.

Family 1. *Vespidae.*—In addition to their social habits the members of this family are characterized by certain structural features. The anterior wings have three submarginal cells. The antennae have thirteen joints in the males and twelve in the females; the claws of the tarsi are simple; the anterior four tibiae have two spines at the tip; the abdomen is but rarely pedunculated, and the posterior segments are often very contractile.

The members of this family approximate very closely to bees in their social manner of life. The communities are composed of males, fertile females and workers. The latter are females in which the ovary remains undeveloped; they resemble the perfect female in external appearance, but are slightly smaller. It has been shown by P. Marchal that a clear line of distinction between queen and worker cannot always be drawn. Unlike the hive bees', the wasps' community is annual, existing for one summer only. Most of the members die at the approach of autumn, but a few females which have been fertilized hibernate through the winter, sheltered under stones or in hollow trees. In the spring and with the returning warm weather the female regains her activity and emerges from her hiding-place. She then sets about finding a convenient place for building a nest and establishing a new colony. The common wasp (*V. vulgaris*) usually selects some burrow or hole in the ground, which, if too small, she may enlarge into a chamber suitable for her purpose. She then begins to build the nest. This is constructed of small fibres of old wood, which the wasp gnaws, and kneads, when mixed with the secretion from the salivary glands, into a sort of papier-mâché pulp. Some of this is formed into a hanging pillar attached to the roof of the cavity, and in the lower free end of this three shallow cup-like cells are hung. In each of these an egg is laid. The foundress of the society then continues to add cells to the comb, and as soon as the grubs appear from the first-laid eggs she has in addition to tend and feed them. The development within the egg takes eight days.

The grubs are apodal, thicker in the middle than at either end; the mandibles bear three teeth; the maxillae and labium are represented by fleshy tubercles. The body, exclusive of the head, consists of thirteen segments, which bear lateral tubercles and spiracles. The larva has no anus. The larvae are suspended with the head downwards in the cells, and require a good deal of attention, being fed by their mother upon insects which are well chewed before they are given to the larvae, or upon honey. At the same time the mother is enlarging and deepening the cells in which they live, building new cells, and laying more eggs, which are usually suspended in the same angle of each cell.

After about a fortnight the grubs cease to feed, and, forming a silky cover to their cells, become pupae. This quiescent stage lasts about ten days, at the end of which period they emerge as the imago or perfect insect. The silky covering of the cell is round or convex outwards; and to leave the cell the insect either pushes it out, when it opens like a box lid, or gnaws a round hole through it. As soon as the cell is vacated it is cleaned out and another egg deposited. In this way two or three larvae occupy successively the same cell during the summer. The first wasps that appear in a nest are workers, and these at once set to work to enlarge the comb, and feed the larvae, &c.

The material of the nest, as before stated, is usually dried wood, worked by the mandibles of the wasp, with the addition of its salivary secretion, into a pulp, which can easily be moulded whilst moist; it dries into a substance of a papery appearance, but possessing considerable tenacity. Sometimes paper itself, such as old cartridge cases, is used. The combs are arranged horizontally; each contains a single layer of cells opening downwards. The second comb is suspended from the first by a number of hanging pillars which are built from the point of union of three cells. The space between two combs is just sufficient to allow the wasps to cross each other. The combs are roughly circular in outline, and increase in size for the first four or five layers, after which they begin to decrease; the whole is covered by a roughly made coating consisting of several layers of the same papery substance which composes the combs. This is continued down until it forms a roughly spherical covering for the whole, but not giving any support to the combs, which are independent of it. As the nest increases in size, the covering needs to be repeatedly pulled to pieces and reconstructed, its inner layer being cut away as the combs are enlarged. The covering is pierced by apertures for the passage of the wasps. The cells are hexagonal at their mouths, but above become more rounded in their cross section.

During the first half of the summer workers only are produced, but, as fruit ripens and food becomes more abundant, fully developed females and males appear, the latter often from parthenogenetically developed eggs of the later broods of workers. The males and females are larger than the workers, and require larger cells for their development; these are usually kept apart from one another and from those of the workers. The males may be distinguished by their longer antennae, by the more elongated outline of their body, and by the absence of a sting.

In a favourable season, when the weather is warm and food plentiful, a nest may contain many thousands of cells full of wasps in various stages of development; and, as each cell is occupied two or three times in the course of a summer, those authorities who put the number of the members of the community as high as 30,000 are probably not far wrong.

At the approach of autumn the society begins to break up; the males fertilize the females whilst flying high in the air. They then die, often within a few hours. The workers leave the nest, carrying with them any grubs that remain in the cells, and both soon perish. The nest is entirely deserted. The fertilized females, it has been seen, creep into crevices under stones or trees, or hide amongst moss, and hibernate until the warmth of the following spring induces them to leave their hiding-places and set about founding a new community.

There are altogether seven species of *Vespa* met with in Britain. *V. vulgaris*, the common or ground wasp, *V. rufa*, the red wasp, distinguished by its reddish-yellow abdomen, and *V. germanica*, the German wasp, with three black spots upon its first abdominal segment, are classed together as ground wasps. They build their nests in burrows in the ground, but this is not an invariable rule; they may be distinguished from the tree wasps by their shorter cheeks and usually by the first joint in the antennae of the female being black. *Vespa austriaca* (*arborea*) is a race of *V. rufa*, in whose nest it sometimes lives as an inquiline. The tree wasps build stouter nests upon branches of trees; the first joint of the antennae of the females is yellow in front. The tree wasps are *V. sylvestris*, *norvegica* and *crabro*.

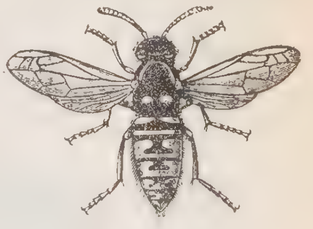

Fig. 1.—*Vespa rufa.*

The hornet, *V. crabro*, is the largest species occurring in Great Britain. They have a more distinctly red colour than the common wasp, and a row of red spots upon each side of the abdomen. They occur much more rarely than the common wasp, and appear to be almost confined to the southern half of England. Their nests resemble those described above, but are larger; they are found in hollow trees or deserted out-houses. Their communities are smaller in number than those of the other wasps.

The hornet, where it occurs in any number, does a considerable amount of damage to forest trees, by gnawing the bark off the younger branches to obtain material for constructing its nest. It usually selects the ash or alder, but sometimes attacks the lime, birch and willow. Like the wasp, it does much damage to fruit, upon the juices of which it lives. On the other hand, the wasp is useful by keeping down the numbers of flies and other insects. It catches these in large numbers, killing them with its jaws and not with its sting. It then tears off the legs and wings, and bears the body back to its nest as food for the larvae. Wasps also act to some extent as flower fertilizers, but in this respect they cannot compare with bees; they visit fewer flowers, and have no adaptations on their limbs for carrying off the pollen.

The genus *Vespa* is very widely spread; it contains over forty species, distributed all over the world. Some of the largest and handsomest come from eastern Asia. *V. mandarina* of China and Japan, and *V. magnifica* of the East Indies and Nepal, measure 2 in. across the wings; *V. orientalis*, found in Greece, Egypt and the East, builds its nest of clay.

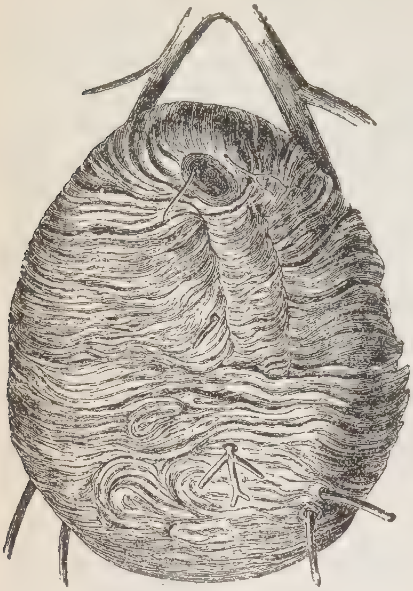

FIG. 2.—Nest of *Vespa sylvestris*.

The only other genus of Vespidae which is found in Europe is *Polistes*, which occurs in the countries bordering the Mediterranean. The colonies of this genus are much smaller than those of *Vespa*. Each nest consists of a single tier of cells in the form of a round plate, supported in the middle by a single stalk. This comb is sometimes vertical, the cells then being horizontal or slightly oblique. Some of the members of this genus store up honey, which in the case of a South American species is poisonous, from the nature of the flowers from which it is gathered. The members of this genus have a slender body; the thorax is more oblong than in the genus *Vespa*, the palps are stouter and the abdomen is more distinctly pedunculate.

The genus *Ischnogaster*, from the East Indies, has many structural features in common with the Eumenidae, but the character of its communities, and its nest, which is very small, justify its position amongst the social wasps.

The genus *Icaria*, common in Australia and the East Indies, builds very small nests, of two or three rows of cells, hanging on one side from a stalk.

Synaeca is a South American genus, which builds large nests, sometimes 3 ft. in length, closely applied to the branch of a tree; they never contain more than one layer of cells, which are horizontally placed. The whole nest is built of coarse material, chiefly small pieces of bark; and there is only one opening, at the lower end.

Another South American genus, *Chartergus*, makes a tough nest, pendent from boughs of trees, and opening to the exterior below by a median aperture. The combs are arranged, somewhat like funnels, inside one another, but with spaces between. The apex of each comb is pierced by a hole for the wasps to pass from one gallery to another.

The nest of *Tatua*, which occurs in Mexico and South America, is also pendent, but the combs are horizontal; the opening from the exterior is at the side, and the passage from one gallery to another is also lateral.

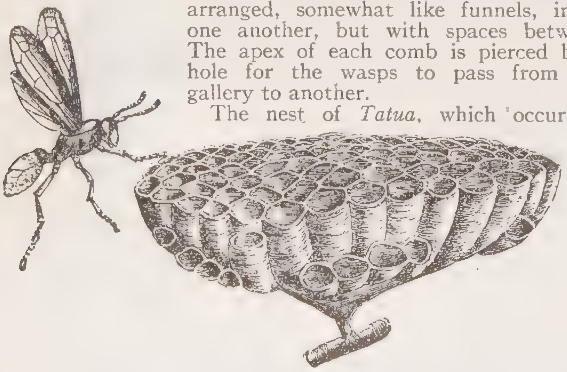

FIG. 3.—*Polistes tepidus* and nest.

The external appearance of the nest of *Nectarina*, found in Brazil and other parts of South America, resembles that of the common wasp, but is rougher. Internally the combs are arranged concentrically, more or less parallel with the external covering which affords them support.

The members of the two remaining families, the Eumenidae and the Masaridae, resemble one another in their solitary mode of life; only males and normal females exist—no workers being found.

Family 2. *Eumenidae*.—Solitary species, with three submarginal cells in the fore wing; antennae with thirteen joints in the male, twelve in the female; abdomen sometimes pedunculate, posterior segments contractile. In the foregoing structural features the Eumenidae resemble the Vespidae, but they differ in having bifid claws on their tarsi, and the two anterior tibiae have but one spine at the tip. The mandibles are elongated, and form a kind of rostrum, in this respect approaching the *Fossores*.

Eumenes coarctata is the only British species of this genus. The female is ½ in. long, the male somewhat shorter. The abdomen is connected with the thorax by a long peduncle. The colour is black, relieved by spots of yellow. It constructs small spherical cells of mud, which are found attached to stems of plants, very generally to the heath. At first the cell opens to the exterior by means of a round pore; one egg is deposited in each cell, and a store of honey as food for the larva when hatched: the cell is then closed with mud. The larvae of some species are carnivorous, and then the food-supply stored up in the cell consists of caterpillars and other insect larvae which have been paralysed by the parent wasp stinging them through the cerebral ganglion; when the larva of the *Eumenes* emerges from the egg it sets upon these and devours them.

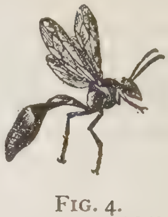

FIG. 4. *Eumenes smithii*.

The genus *Odynerus* contains a very large number of species, found in all parts of the world. The members of this genus are about the size of a fly, and they differ from *Eumenes* in having a sessile abdomen. Some of the species construct their cells in sand-heaps, lining them with agglutinated grains of sand; others live in cavities of trees lined with the same material, whilst others build their nests of mud. Like some of the species of *Eumenes*, they store up paralysed Lepidopterous and Chrysomeleous larvae as food for their carnivorous grubs.

Family 3. *Masaridae*.—The members of the third family, the Masaridae, are sharply distinguished by the possession of only two submarginal cells in the fore wing, which folds imperfectly or not at all when at rest. Their antennae are frequently clavate, particularly so in the genus *Celonites*; they are twelve-jointed, but as the terminal joints are almost fused they appear to be composed of only eight joints. The wings are not so completely folded as in the other two families, and the abdomen is but slightly contractile. The maxillae are short and their palps very small, with but three or four joints.

The number of genera comprised in this family is small; none occur in Britain, but in southern Europe some species are found. They make their nest in cavities in the earth, generally in a bank, and construct an irregular gallery leading down to it.

During hot fine summers wasps cause a good deal of loss to market gardeners and fruit growers. During this time of year they live almost exclusively upon the sweet juices of ripe fruit, occasionally carrying off small particles of the flesh. At the same time they have not entirely lost their carnivorous tastes, for they frequently attack the meat in butcher's shops, but render compensation by killing and carrying off to feed their grubs considerable numbers of blow-flies. Wasps also perform an important service in keeping down the numbers of caterpillars. The larvae are almost exclusively carnivorous, living upon insects captured by their parents and reduced by them to a pulp before being given to the young. During the spring the first broods that appear live largely upon honey; and this forms the staple food of the genus *Polistes* throughout their whole life.

In attempting to rid a district of wasps, unless the nest can be taken, there is little good in killing stray members of the community. On the other hand, the killing of queen-wasps in early spring probably means that the formation of a nest and the production of a society whose members are counted by thousands is in each case prevented.

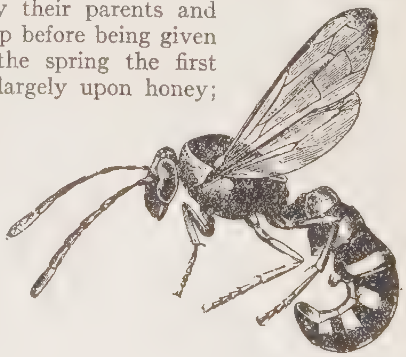

FIG. 5.—*Masaris vespiformis*.

The number of wasps is kept down by numerous enemies. The most effective of these live in the nests and devour the larvae; among them are two species of beetle, *Rhipiphorus paradoxus* and *Lebia linearis*. Two species of *Ichneumon*, and a species of *Anthomyia*, also infest the nests of wasps and prey upon the grubs. The larvae of the syrphid flies *Volucella*, found in the nests of both wasps and bees, are now believed to be scavengers rather than parasites. In the tropics some species are attacked by fungi, the hyphae of which protrude between the segments of the abdomen, and give the wasp a very extraordinary appearance.

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(A. E. S.; G. H. C.)

WASSAIL (O. Eng. *wæs hál*, "be whole," "be well"), primarily the ancient form of "toasting," the term being applied later to the Christmas feasting and revelries and particularly to the bowl of spiced ale or wine which was a feature of the mediéval Christmas. One of the earliest references to the wassail-bowl in English history is in the description of the reception of King Vortigern by Hengist, when Rowena "came into the king's presence, with a cup of gold filled with wine in her hand, and making a low reverence unto the king said, 'Waes hael hlaford Cyning,' which is 'Be of health, Lord King.'" In a collection of ordinances for the regulations of the royal household in Henry VII.'s reign, the steward on Twelfth Night was to cry "wassail" three timés on entering with the bowl, the royal chaplain responding with a song. Wassailing was as much a custom in the monasteries as in laymen's houses, the bowl being known as *poculum Caritatis.* What was popularly known as wassailing was the custom of trimming with ribbons and sprigs of rosemary a bowl which was carried round the streets by young girls singing carols at Christmas and the New Year. This ancient custom still survives here and there, especially in Yorkshire, where the bowl is known as "the vessel cup," and is made of holly and evergreens, inside which are placed one or two dolls trimmed with ribbons. This cup is borne on a stick by children who go from house to house singing Christmas carols. In Devonshire and elsewhere it was the custom to wassail the orchards on Christmas and New Year's eve. Pitchers of ale or cider were poured over the roots of the trees to the accompaniment of a rhyming toast to their healths.

WASTE (O. Fr. *wast*, *guast*, *gast*, *gaste*; Lat. *vastus*, vast, desolate), a term used in English law in several senses, of which four are the most important. (1) "Waste of a manor" is that part of a manor subject to rights of common, as distinguished from the lord's demesne (see Commons, Manor). (2) "Year, day, and waste" was a part of the royal prerogative, acknowledged by a statute of Edward II., *De Praerogativa Regis.* The king had the profits of freehold lands of those attainted of felony and petit treason, and of fugitives for a year and a day with a right of committing waste in sense (3) thereon. After the expiration of a year and a day the lands returned to the lord of the fee. This species of waste was abolished by the Corruption of Blood Act 1814 (see Felony, Treason). (3) The most usual signification of the word is "any unauthorized act of a tenant, for a freehold estate not of inheritance, or for any lesser interest, which substantially alters the permanent character of the thing demised (i.) by diminishing its value, (ii.) by increasing the burden on it, (iii.) by impairing the evidence of title and thereby injuring the "inheritance" (*West Ham Charity Board* v. *East London W.W.*, 1900, 1 Ch. 624, 637; cf. Pollock, *Law of Torts*, 7th ed., 345).

Waste in sense (3) is either *voluntary* or *permissive.* Voluntary waste is by act of commission, as by pulling down a house, wrongfully removing fixtures (*q.v.*), cutting down timber trees, *i.e.* oak, ash, elm, twenty years old, and such other trees, *e.g.* beech, as by special custom are counted timber, in the district, opening new quarries or mines (but not continuing the working of existing ones), or doing anything which may—for this is the modern test—alter the nature of the thing demised, such as conversion of arable into meadow land. Although an act may technically be waste, it will not as a rule constitute actionable waste, or be restrained by injunction, in the absence of some prohibitive stipulation if it is "ameliorating," *i.e.* if it improves the value of the land demised (see *Meux* v. *Cobley*, 1892, 2 Ch. 253, 263). In the case of "timber estates" upon which trees of various kinds are cultivated solely for their produce and the profit gained from their periodical felling and cutting, the timber is not considered as part of the inheritance but as the annual fruits of the estate, and an exception arises in favour of the tenant for life (see *Dashwood* v. *Magniac*, 1891, 3 Ch. 306). Under the Settled Land Act 1882 a tenant for life may grant building, mining and other leases for the prescribed terms "for any purpose whatever, whether involving waste or not." *Permissive* waste is by act of omission, such as allowing buildings to fall out of repair. A "fermor"—a term which here includes "all who held by lease for life or lives, or for years by deed or without deed" by the statute of Marlborough (1267)—may not commit waste without licence in writing from the reversioner. In case a tenant for life or for any smaller interest holds (as is often the case by the terms of a will or settlement) "without impeachment of waste" (*sauns impeachment de wast*, *i.e.* without liability to have his waste challenged or impeached), his rights are considerably greater, and he may use the profits *salva rerum substantia* (to use the language of Roman law, from which the English law of waste is in great measure derived). For instance, he may cut timber in a husband-like manner and open mines; but he may not commit what is called *equitable* waste, that is, pull down or deface the mansion or destroy timber planted or left for ornament or shelter (*Weld-Blundell* v. *Wolseley*, 1903, 2 Ch. 664). Acts of equitable waste were, before 1875, not cognizable in courts of common law, but by the Judicature Act 1873, s. 25 (3), in the absence of special provisions to that effect an estate for life without impeachment of waste does not confer upon the tenant for life any legal right to commit equitable waste. A copy-holder may not commit waste unless allowed to do so by the custom of the manor. The penalty for waste is forfeiture of the copyhold; *Galbraith* v. *Foynton*, 1905, 2 K.B. 258 (see Copyhold). The Agricultural Holdings Acts 1900 and 1906, by reason of their provisions giving compensation for improvement, as regards the holdings to which they apply, override some of the old common law doctrines as to waste. The act of 1900 provides (s. 2 [3]) that where a tenant, who claims compensation for improvements, has wrongfully been guilty of waste, either voluntary or permissive, the landlord shall be entitled to set off the sums due to him in respect of such waste, and to have them assessed by arbitration in manner provided by the acts of 1900 and 1906. Under the act of 1906 the tenant is permitted to disregard the terms of his tenancy as to the mode of cropping on arable land, but if he exercises his statutory freedom of cropping in such a manner as to injure or deteriorate his holding, the landlord is entitled to recover damages for such injury, &c. (s. 3).

Remedies for Waste.—Various remedies for waste have been given to the reversioner at different periods in the history of English law. At common law only *single* damages seem to have been recoverable. This was altered by the legislature, and for some centuries waste was a criminal or quasi-criminal offence. Magna Carta enacted that a guardian committing waste of the lands in his custody should make amends and lose his office. The statute of Marlborough (1267) made a "fermor" (as above defined) committing waste liable to grievous amercement as well as to damages, and followed Magna Carta in forbidding waste by a guardian. The statute of Gloucester (1278) enacted that a writ of waste might be granted against a tenant for life or years or in courtesy or dower, and on being attainted of waste the tenant was to forfeit the land wasted and to pay thrice the amount of the waste. This statute was repealed by the Civil Procedure Acts Repeal Act 1879. In addition to the writ of waste the writ of *estrepement* (said to be a corruption of *exstirpamentum*, and to be connected with the French *estropier*, to lame) lay to prevent injury to an estate to which the title was disputed. This writ has long been obsolete. Numerous other statutes dealt with remedies for waste. The writ of waste was superseded at common law by the "mixed action" of waste (itself abolished by the Real Property Limitation Act 1833), and by the action of trespass on the case (see Tort, Trespass). The court of chancery also intervened by injunction to restrain equitable waste. At present proceedings may be taken either by action for damages, or by application for an injunction, or by both combined, and either in the king's bench or in the chancery divisions. By the Judicature Act 1873, s. 25 (8), the old jurisdiction to grant injunctions to prevent threatened waste is considerably enlarged. The Rules of the Supreme Court, Ord. xvi. r. 37, enable a representative action to be brought for the prevention of waste. In order to obtain damages or an injunction, substantial injury or danger of it must be proved. In England only the high court (unless by agreement of the parties) has jurisdiction in questions of waste, but in Ireland, where the law of waste is similar to English law, county courts and courts of summary jurisdiction have co-ordinate authority to a limited extent (cf. Land Act 1860, ss. 35-39).

The law of waste as it affects ecclesiastical benefices will be found under Dilapidations.

(4) "Waste of assets" or "*devastavit*" is a squandering and misapplication of the estate and effects of a deceased person by his executors or administrators, for which they are answerable out of their own pockets as far as they have or might have had assets of the deceased (see Executors and Administrators). Executors and administrators may now be sued in the county court for waste of assets (County Courts Act 1888, s. 95).

Scotland.—In Scots law "waste" is not used as a technical term, but the respective rights of fiar and life-renter are much the same as in England. As a general rule, a life-renter has no right to cut timber, even though planted by himself. An exception is admitted in the case of coppice wood, which is cut at regular intervals and allowed to grow again from the roots. Grown timber is also available to the life-renter for the purpose of keeping up the estate or repairing buildings. Before making use of mature timber for estate purposes, the life-renter should give notice to the fiar. He is also entitled to the benefit of ordinary windfalls. Extraordinary windfalls are treated as grown timber. Life-renters by "constitution" (*i.e.* by grant from the proprietor) as opposed to life-renters by "reservation" (where the proprietor has reserved the life-rent to himself in conveying the fee to another) have, as a rule, no right to coals or minerals underground if they are not expressed in the grant or appear to have been intended by a testator to pass by his settlement, for they are *partes soli.* Where coals or minerals are expressed in the grant, and also in cases of life-rent by "reservation," the life-renter may work any mine which had been opened before the beginning of his right, provided he does not employ a greater number of miners, or bring up a greater quantity of minerals, than the unburdened proprietor did. All life-renters are entitled to such minerals as are required for domestic use and estate purposes.

British Possessions.—French law is in force in Mauritius, and has been followed in substance in the civil codes of Quebec (art. 455) and St Lucia (art. 406). In most of the other colonies the rules of English law are followed, and in many of them there has been legislation on the lines of the English Settled Land Acts. In India the law as to waste is included to some extent in the Transfer of Property Act (No. IV. of 1882) and its amendments. Section 108 deals with the liabilities of lessees for waste, which may be varied by the terms of the lease or by local usage. The liabilities for waste of persons having under Hindu or Mahommedan law limited interests in reality depend in the main upon those laws and not on Indian statute law.

United States.—"In the United States, especially in the Western states, many acts are held to be only in a natural and reasonable way of using and improving the land—clearing wild woods, for example—which in England, or even in the Eastern states, would be manifest waste" (Pollock, *Torts*, 7th ed., 345). Thus Virginia, North Carolina, Vermont and Tennessee have deviated in favour of the tenant from English rules, while Massachusetts has adhered to them (*Ruling Cases*, tit. "Waste," xxv. 380, American notes). In certain states, *e.g.* Minnesota, Oregon and Washington (ibid., p. 381), the action of waste is regulated by statute.

Europe.—The French Civil Code provides (art. 591) that the usufructuary may cut timber in plantations that are laid out for cutting, and are cut at regular intervals, although he is bound to follow the example of former proprietors as to quantity and times. This provision is in force in Belgium (Civil Code, art. 591). Analogous provisions are to be found in the civil codes of Holland (art. 814), Spain (art. 485), Italy (art. 486), and cf. the German Civil Code, art. 1036.

AUTHORITIES.—English law: Bewes, *Law of Waste*; Fawcett, *Law of Landlord and Tenant*; Foa, *Law of Landlord and Tenant*; Woodfall, *Law of Landlord and Tenant.* Scots law: Erskine, *Principles* (Edinburgh). Irish law: Nolan and Kane, *Statutes relating to the Law of Landlord and Tenant in Ireland* (Dublin); Wylie, *Judicature Acts* (Dublin). American law: Bouvier, *Law Dict.* (Boston and London). Indian law: Shepherd and Brown, *Indian Transfer of Property Act 1882.* (A. W. R.)

WATCH (in O. Eng. *wæcce*, a keeping guard or watching, from *wacian*, to guard, watch, *wacan*, to wake), a portable timepiece. This is the most common meaning of the word in its substantival form, and is the subject of the present article. The word, by derivation, means that which keeps watchful or wakeful observation or attention over anything, and hence is used of a person or number of persons whose duty it is to protect anything by vigilance, a guard or sentry; it is thus the term for the body of persons who patrolled the streets, called the hours, and performed the duties of the modern police. The application of the term to a period of time is due to the military division of the night by the Greeks and Romans into "watches" (φυλακαί, *vigiliae*), marked by the change of sentries; similarly, on shipboard, time is also reckoned by "watches," and the crew is divided into two portions, the starboard and port watches, taking duty alternately.[1] The transference of the word to that which marks the changing hours is easy.

The invention of portable timepieces dates from the end of the 15th century, and the earliest manufacture of them was in Germany. They were originally small clocks with mainsprings enclosed in boxes; sometimes they were of a globular form and were often called "Nuremberg eggs." Being too large for the pocket they were frequently hung from the girdle. The difficulty with these early watches was the inequality of action of the mainspring. An attempt to remedy this was provided by a contrivance called the stack-freed, which was little more than a sort of rude auxiliary spring. The problem was solved about the years 1525–1540 by the invention of the fusee. By this contrivance the mainspring is made to turn a barrel on which is wound a piece of catgut, which in the latter part of the 16th century was replaced by a chain. The other end of the catgut band is wound upon a spiral drum, so contrived that as the spring runs down and becomes weaker the leverage on the axis of the spiral increases, and thus gives a stronger impulse to the works (fig. 1).

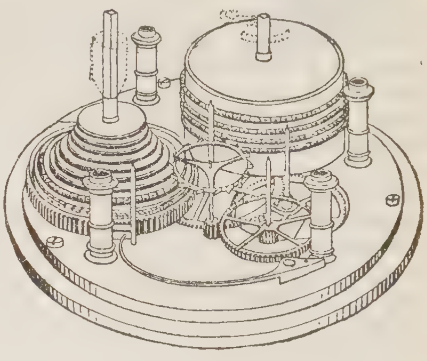

FIG. 1.

In early watches the escapement was the same as in early clocks, namely, a crown wheel and pallets with a balance ending in small weights. Such an escapement was, of course, very imperfect, for since the angular force acting on the balance does not vary with the displacement, the time of oscillation varies with the arc, and this again varies with every variation of the driving force. An immense improvement was therefore effected when the hair-spring was added to the balance, which was replaced by a wheel. This was done about the end of the 17th century. During the 18th century a series of escapements were invented to replace the old crown wheel, ending in the chronometer escapement, and though great improvements in detail have since been made, yet the watch, even as it is to-day, may be called an 18th-century invention.

The watches of the 16th century were usually enclosed in cases ornamented with the beautiful art of that period. Sometimes the case was fashioned like a skull, and the watches were made in the form of octagonal jewels, crosses, purses, little books, dogs, sea-shells, &c., in almost every instance being finely engraved. Queen Elizabeth was very fond of receiving presents, and, as she was also fond of clocks, a number of the gifts presented to her took the form of jewelled watches.

The man to whom watch-making owes perhaps most was Thomas Tompion (1639–1713), who invented the first dead-beat escapement for watches (fig. 2). It consisted of a balance-wheel mounted on an axis of semi-cylindrical form with a notch in it, and a projecting stud. When the teeth of the scape-wheel came against the cylindrical part of the axis they were held from going forward, but when the motion of the axis was reversed, the teeth slipped past the notch and struck the projection, thus giving an impulse. This escapement was afterwards developed by George Graham (1673–1751) into the horizontal cylindrical escapement and into the well-known dead-beat escapement for clocks.

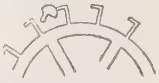

FIG. 2.

The development of escapements in the 18th century greatly improved watches. But a defect still remained, namely, the influence of temperature upon the hair-spring of the balance-wheel. Many attempts were made to provide a remedy. John Harrison proposed a curb, so arranged that alterations of temperature caused unequal expansion in two pieces of metal, and thus actuated an arm which moved and mechanically altered the length of the hair-spring, thus compensating the effect of its altered elasticity. But the best solution of the problem was ultimately proposed by Pierre le Roy (1717–1785) and perfected by Thomas Earnshaw (1749–1829). This was to diminish the inertia of the balance-wheel in proportion to the increase of temperature, by means of the unequal expansion of the metals composing the rim.

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[1] In the British navy the twelve hours of the night are divided into three watches of four hours—from eight to twelve the first watch, from twelve to four the middle watch, and from four to eight the morning watch. The twelve hours of the day are divided into four watches, two of four hours—eight to midday, midday to four P.M.—and two of two hours, from four to six and six to eight. These are the "dog watches," and their purpose is to change the turn of the watches every twenty-four hours, so that the men who watch from eight to midnight on one night, shall watch from midnight till 4 A.M. on the next. The "watch bill" is the list of the men appointed to the watch, who are mustered by the officers. Time was originally kept by an hour-glass, every half-hour; the number of the half-hour is shown by striking the watch bell, hanging on a beam of the forecastle, or by the mainmast, with the clapper. One stroke is given for each half-hour. Thus 12.30 A.M. is one bell in the middle watch, and 3 A.M. is six bells. The bell was also used to indicate the course of a ship in a fog. A vessel on the starboard tack tolled the bell, a vessel on the port tack beat a drum. The watch guns were fired when setting the watch in the evening and relieving it in the morning. The gun is now only fired at sundown.

Invention in watches was greatly stimulated by the need of a good timepiece for finding longitudes at sea, and many successive rewards were offered by the government for watches which would keep accurate time and yet be able to bear the rocking motion of a ship. The difficulty ended by the invention of the chronometer, which was so perfected towards the early part of the 19th century as to have even now undergone but little change of form. In fact the only great triumph of later years has been the invention of watch-making machinery, whereby the price is so lowered that an excellent watch (in a brass case) can now be purchased for about £2 and a really accurate time-keeper for about £18.

A modern watch consists of a case and framework containing the four essential parts of every timepiece, namely, a mainspring and apparatus for winding it up, a train of wheels with hands and a face, an escapement and a balance-wheel and hair-spring. We shall describe these in order.

The Mainspring.—As has been said, the mainspring of an old-fashioned watch was provided with a drum and fusee so as to equalize its action on the train. An arrangement was provided to prevent overwinding, consisting of a hook which when the chain was nearly wound up was pushed aside so as to engage a pin, and thus prevent further winding (see fig. 1). Another arrangement for watches without a fusee, called a Geneva stop, consists of a wheel with one tooth affixed to the barrel arbour, working into another with only four or five teeth. This allows the barrel arbour only to be turned round four or five times.

The "going-barrel," which is fitted to most modern watches, contains no fusee, but the spring is delicately made to diminish in size from one end to the other, and it is wound up for only a few turns, so that the force derived from it does not vary very substantially. The unevenness of drive is in modern watches sought to be counteracted by the construction of the escapement and balance-wheel.

Watches used formerly to be wound with a separate key. They are now wound by a key permanently fixed to the case. The depression of a small knob gears the winding key with the hands so as to enable them to be set. With this contrivance watches are well protected against the entry of dust and damp.

Watch Escapements.—The escapements that have come into practical use are—(1) the old *vertical* escapement, now disused; (2) the *lever*, very much the most common in English watches; (3) the *horizontal* or *cylinder*, which is equally common in foreign watches, though it was of English invention; (4) the *duplex*, which used to be more in fashion for first-rate watches than it is now; and (5) the *detached* or *chronometer* escapement, so called because it is always used in marine chronometers.

The *vertical* escapement is simply the original clock escapement adapted to the position of the wheels in a watch and the balance, in the manner exhibited in fig. 3. As it requires considerable thickness in the watch, is inferior in going to all the others and is no cheaper than the level escapement can now be made, it has gone out of use.

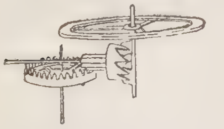


FIG. 3.

The *lever* escapement, as it is now universally made, was brought into use late in the 18th century by Thomas Mudge. Fig. 4 shows its action. The position of the lever with reference to the pallets is immaterial in principle, and is only a question of convenience in the arrangement; but it is generally such as we have given it. The principle is the same as in the dead-beat clock escapement, with the advantage that there is no friction on the dead faces of the pallets beyond what is necessary for locking. The reason why this friction cannot be avoided with a pendulum is that its arc of vibration is so small that the requisite depth of intersection cannot be got between the two circles described by the end S of the lever and any pin in the pendulum which would work into it; whereas, in a watch, the pin P, which is set in a cylinder on the verge of the balance, does not generally slip out of the nick in the end of the lever until the balance has got 15° past its middle position. The pallets are undercut a little, as it is called, *i.e.* the dead faces are so sloped as to give a little recoil the wrong way, or slightly to resist the unlocking, because otherwise there would be a risk that a shake of the watch would let a tooth escape while the pin is disengaged from the lever. There is also a further provision added for safety. In the cylinder which carries the impulse pin P there is a notch just in front of P, into which the other pin S on the lever fits as they pass; but when the notch has got past the cylinder it would prevent the lever from returning, because the safety-pin S cannot pass except through the notch, which is only in the position for letting it pass at the same time that the impulse-pin is engaged in the lever. The pallets in a lever escapement (except bad and cheap ones) are always jewelled, and the scape-wheel is of brass. The staff of the lever also has jewelled pivot-holes in expensive watches, and the scape-wheel has in all good ones. The holes for the balance-pivots are now always jewelled. The scape-wheel in this and most of the watch escapements generally beats five times in a second, in large chronometers four times; and the wheel next to the scape-wheel carries the seconds-hand.

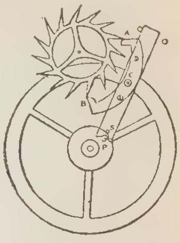


FIG. 4.

Fig. 5 is a plan of the *horizontal* or *cylinder* escapement, cutting through the cylinder, which is on the verge of the balance, at the level of the tops of the teeth of the escape-wheel; for the triangular pieces A, B are not flat projections in the same plane as the teeth, but are raised on short stems above the plane of the wheel; and still more of the cylinder than the portion shown at ACD is cut away where the wheel itself has to pass. The author of this escapement was G. Graham, and it resembles his dead escapements in clocks in principle more than the lever escapement does, though much less in appearance, because in this escapement there is the dead friction of the teeth against the cylinder, first on the outside, as here represented, and then on the inside, as shown by the dotted lines, during the whole vibration of the balance, except that portion which belongs to the impulse. The impulse is given by the oblique outside edges A*a*, B*b* of the teeth against the edges A, D of the cylinder alternately. The portion of the cylinder which is cut away at the point of action is about 30° less than the semicircle. The cylinder itself is made either of steel or ruby, and, from the small quantity of it which is left at the level of the wheel, it is very delicate; and probably this has been the main reason why, although it is an English invention, it has been most entirely abandoned by the English watchmakers in favour of the lever, which was originally a French invention, though very much improved by Mudge, for before his invention the lever had a rack or portion of a toothed wheel on its end, working into a pinion on the balance verge, and consequently it was affected by the dead friction, and that of this wheel and pinion besides. This used to be called the rack lever, and Mudge's the detached lever; but, the rack lever being now quite obsolete, the word "detached" has become confined to the chronometer, to which it is more appropriate, as will be seen presently. The Swiss watches have almost universally the horizontal escapement. It is found that—for some reason which is apparently unknown, as the rule certainly does not hold in cases seemingly analogous—a steel scape-wheel acts better in this escapement than a brass one, although in some other cases steel upon steel, or even upon a ruby, very soon throws off a film of rust, unless they are kept well oiled, while brass and steel, or stone, will act with scarcely any oil at all, and in some cases with none.

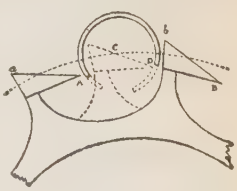


FIG. 5.

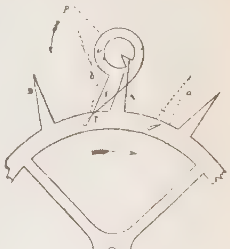


FIG. 6.

The *duplex* escapement (fig. 6) is probably so called because there is a double set of teeth in the scape-wheel—the long ones (like those of the lever escapement in shape) for locking only, and short ones (or rather upright pins on the rim of the wheel) for giving the impulse to the pallet P on the verge of the balance. It is a single-beat escapement; *i.e.* the balance only receives the impulse one way, or at every alternate beat, as in the chronometer escapement. When the balance is turning in the direction marked by the arrow, and arrives at the position in which the dotted tooth *b* has its point against the triangular notch V, the tooth end slips into the notch, and, as the verge turns farther round, the tooth goes on with it till at last it escapes when the tooth has got into the position A; and by that time the long tooth or pallet which projects from the verge has moved from *p* to P, and just come in front of the pin T, which stands on the rim of the scape-wheel, and which now begins to push against P, and so gives the impulse until it also escapes when it has arrived at *t*; and the wheel is then stopped by the next tooth B having got into the position *b*, with its point resting against the verge, and there is dead friction between them, and this friction is lessened by the distance of the points of the long teeth from the centre of the scape-wheel. As the balance turns back, the nick V goes past the end of the tooth *b*, and in consequence of its smallness it passes without visibly affecting the motion of the scape-wheel, though of course it does produce a very slight shake in passing. It is evident that, if it did not pass, the tooth could not get into the nick for the next escape. The objection to this escapement is that it requires very great delicacy of adjustment, and the watch also requires to be worn carefully; for, if by accident the balance is once stopped from swinging back far enough to carry the nick V past the tooth end, it will stop altogether, as it will lose still more of its vibration the next time from receiving no impulse. The performance of this escapement, when well made, and its independence of oil, are nearly equal to those of the detached escapement; but, as lever watches are now made sufficiently good for all but astronomical purposes, for which chronometers are used, and they are cheaper both to make and to mend than duplex ones, the manufacture of duplex watches has almost disappeared.

The *chronometer* or *detached* escapement is shown at fig. 7 in the form to which it was brought by Earnshaw, and in which it has remained ever since, with the very slight difference that the pallet P, on which the impulse is given (corresponding exactly to the pallet P in the duplex escapement), is now generally set in a radial direction from the verge, whereas Earnshaw made it sloped backward, or undercut, like the scape-wheel teeth. The early history of escapements on this principle does not seem to be very clear. They appear to have originated in France; but there is no doubt that they were considerably improved by the first Arnold (John), who died in 1799. Earnshaw's watches, however, generally beat his in trials.

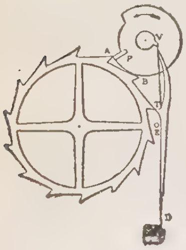


FIG. 7.

In fig. 7 the small tooth or cam V, on the verge of the balance, is just on the point of unlocking the detent DT from the tooth T of the scape-wheel; and the tooth A will immediately begin to give the impulse on the pallet P, which, in good chronometers, is always a jewel set in the cylinder; the tooth V is also a jewel. This part of the action is so evident as to require no further notice. When the balance returns, the tooth V has to get past the end of the detent, without disturbing it; for, as soon as it has been unlocked, it falls against the banking-pin E, and is ready to receive the next tooth B, and must stay there until it is again unlocked. It ends, or rather begins, in a stiffish spring, which is screwed to the block D on the watch frame, so that it moves without any friction of pivots, like a pendulum. The passing is done by means of another spring VT, called the passing spring, which can be pushed away from the body of the detent towards the left, but cannot be pushed the other way without carrying the detent with it. In the back vibration, therefore, as in the duplex escapement, the balance receives no impulse, and it has to overcome the slight resistance of the passing spring besides; but it has no other friction, and is entirely *detached* from the scape-wheel the whole time, except when receiving the impulse. That is also the case in the lever escapement; but the impulse in that escapement is given obliquely, and consequently with a good deal of friction; and, besides, the scape-wheel only acts on the balance through the intervention of the lever, which has the friction of its own pivots and of the impulse pin. The locking-pallet T is undercut a little for safety, and is also a jewel in the best chronometers; and the passing spring is usually of gold. In the duplex and detached escapements, the timing of the action of the different parts requires great care, *i.e.* the adjusting them so that each may be ready to act exactly at the right time; and it is curious that the arrangement which would be geometrically correct, or suitable for a very slow motion of the balance, will not do for the real motion. If the pallet P were really set so as just to point to the tooth A in both escapements at the moment of unlocking (as it has been drawn, because otherwise it would look as if it could not act at all), it would run away some distance before the tooth could catch it, because in the duplex escapement the scape-wheel is then only moving slowly, and in the detached it is not moving at all, and has to start from rest. The pallet P is therefore, in fact, set a little farther back, so that it may arrive at the tooth A just at the time when A is ready for it, without wasting time and force in running after it. The detached escapement has also been made on the duplex plan of having long teeth for the locking and short ones or pins nearer the centre for the impulse; but the advantages do not appear to be worth the additional trouble, and the force required for unlocking is not sensibly diminished by the arrangement, as the spring D must in any case be fairly stiff, to provide against the watch being carried in the position in which the weight of the detent helps to unlock it.

An escapement called the *lever chronometer* has been several times reinvented, which implies that it has never come into general use. It is a combination of the lever as to the locking and the chronometer as to the impulse. It involves a little drop and therefore waste of force as a tooth of the wheel just escapes at the "passing" beat where no impulse is given. But it should be understood that a single-beat escapement involves no more loss of force and the escape of no more teeth than a double one, except the slight drop in the duplex and this lever chronometer or others on the same principle.

There have been several contrivances for *remontoire* escapements; but there are defects in all of them; and there is not the same advantage to be obtained by giving the impulse to a watch-balance by means of some other spring instead of the mainspring as there is in turret-clocks, where the force of the train is liable to very much greater variations than in chronometers or small clocks.

The balance-wheel and hair-spring consist of a small wheel, usually of brass, to which is affixed a spiral, or in chronometers a helical, spring. This wheel swings through an angle of from 180° to 270° and its motions are approximately isochronous. The time of the watch can be regulated by an arm to which is attached a pair of pins which embrace the hair-spring at a point near its outer end, and by the movement of which the spring can be lengthened or shortened. The first essential in a balance-wheel is that its centre of gravity should be exactly in the axis, and that the centre of gravity of the hair-spring should also be in the axis of the balance-wheel. True isochronism is disturbed by variations in the driving force of the train or by variations in temperature, and also by variations in barometric pressure. Isochronism is produced in the first place by a proper shape of the spring and its overcoil. It is usual to time the watch's going when the mainspring is partly wound up, as well as when it is fully wound up, and then by removing parts of the hair-spring to get such an adjustment that the rate is not influenced by the lesser or greater extent to which the watch has been wound. The variations in length and still more in elasticity caused in a hair-spring by changes of temperature were for long not only a trouble to watchmakers but a bar to the progress of the art. A pendulum requires scarcely any compensation except for its own elongation by heat; but a balance requires compensation, not only for its own expansion, which increases its moment of inertia just like the pendulum, but far more on account of the decrease in the strength of the spring under increased heat. E. G. Dent, in a pamphlet on compensation balances, gave the following results of some experiments with a glass balance, which he used for the purpose on account of its less expansibility than a metal one: at 32° F., 3606 vibrations in an hour; at 66°, 3598·5; and at 100°, 3599. If therefore it had been adjusted to go right (or 3600 times in an hour) at 32°, it would have lost $7\frac{1}{2}$ and $8\frac{1}{2}$ seconds an hour, or more than three minutes a day, for each successive increase of 34°, which is about fifteen times as much as a common wire pendulum would lose under the same increase of heat; and if a metal balance had been used instead of a glass one the difference would have been still greater.

The necessity for this large amount of compensation having arisen from the variation of the elasticity of the spring, the first attempts at correcting it were by acting on the spring itself in the manner of a common regulator. Harrison's compensation consisted of a compound bar of brass and steel soldered together, having one end fixed to the watch-frame and the other carrying two curb pins which embraced the spring. As the brass expands more than the steel, any increase of heat made the bar bend; and so, if it was set the right way, it carried the pins along the spring, so as to shorten it. This contrivance is called a *compensation curb*; and it has often been reinvented, or applied in a modified form. But there are two objections to it: the motion of the curb pins does not correspond accurately enough to the variations in the force of the spring, and it disturbs the isochronism, which only subsists at certain definite lengths of the spring.

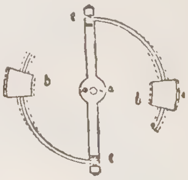


FIG. 8.

The compensation which was next invented left the spring untouched, and provided for the variations of temperature by the construction of the balance itself. Fig. 8 shows the plan of the ordinary compensation balance. Each portion of the rim of the balance is composed of an inner bar of steel with an outer one of brass soldered, or rather melted, upon it, and carrying the weights *b*, *b*, which are screwed to it. As the temperature increases, the brass expanding must bend the steel inwards, and so carries the weights farther in, and diminishes the moment of inertia of the balance, the decrease of rate being inversely as the diameter of the balance-wheel. The metals are generally soldered together by pouring melted brass round a solid steel disk, and the whole is afterwards turned and filed away till it leaves only the crossbar in the middle lying flat and the two portions of the rim standing edgeways. The first person to practise this method of uniting them appears to have been either Thomas Earnshaw or Pierre le Roy.

The adjustment of a balance for compensation can only be done by trial, and requires a good deal of time. It must be done independently of that for time—the former by shifting the weights, because the nearer they are to the crossbar the less distance they will move over as the rim bends with them. The timing is done by screws with heavy heads (*t*, *t*, fig. 8), which are just opposite to the ends of the crossbar, and consequently not affected by the bending of the rim; other screws are also provided round the rim for adjusting the moment of inertia and centre of gravity of the balance-wheel. The compensation may be done approximately by the known results of previous experience with similar balances; and many watches are sold with compensation balances which have never been tried or adjusted, and sometimes with a mere sham compensation balance, not even cut through.

Secondary Compensation.—When chronometers had been brought to great perfection it was perceived that there was a residuary error, which was due to changes of temperature, but which no adjustment of the compensation would correct. The cause of the secondary error is that as the temperature rises the elasticity of the spring decreases, and therefore its accelerating force upon the balance-wheel diminishes. Hence the watch tends to go slower.

In order to compensate this the split rim of the balance-wheel is made with the more expansible metal on the outside, and therefore tends to curl inwards with increase of temperature, thus diminishing the moment of inertia of the wheel. Now the rate of error caused by the increase of temperature of the spring varies approximately with the temperature according to a certain law, but the rate of correction due to the diminution of the moment of inertia caused by the change of form of the rim of the wheel does not alter proportionally, but according to a more complex law of its own, varying more rapidly with cold than with heat, so that if the rate of the chronometer is correct, say, at 30° F. and also at 90° F., it will gain at all intermediate temperatures, the spring being thus under-corrected for high temperatures and over-corrected for low. Attempts have been made by alterations of shape of the balance-wheel to harmonize the progress of the error with the progress of the correction, but not with very conspicuous success.

We shall give a short description of the principal classes of inventions for this purpose. The first disclosed was that of J. S. Eiffe (sometimes attributed to Robert Molyneux), which was communicated to the astronomer-royal in 1835. In one of several methods proposed by him a compensation curb was used; and though, for the reasons given before, this will not answer for the primary compensation, it may for the secondary, where the motion required is very much smaller. In another the primary compensation bar, or a screw in it, was made to reach a spring set within it with a small weight attached at some mean temperature, and, as it bent farther in, it carried this secondary compensation weight along with it. The obvious objection to this is that it is discontinuous; but the whole motion is so small, not more than the thickness of a piece of paper, that this and other compensations on the same principle appear to have been on some occasions quite successful.

Another large class of balances, all more or less alike, may be represented by E. J. Dent's, which came next in order of time. He described several forms of his invention; the following description applies to the one he thought the best. In fig. 9 the flat crossbar *rr* is itself a compensation bar which bends upwards under increased heat; so that, if the weights *v*, *v* were merely set upon upright stems rising from the ends of the crossbar, they would approach the axis when that bar bends upwards. But, instead of the stems rising from the crossbar, they rise from the two secondary compensation pieces *stu*, in the form of staples, which are set on the crossbar; and, as these secondary pieces themselves also bend upwards, they make the weights approach the axis more rapidly as the heat increases; and by a proper adjustment of the height of the weights on the stems the moment of inertia of the balance can be made to vary in the proper ratio to the variation of the intensity of the spring. The cylindrical spring stands above the crossbar and between the staples.

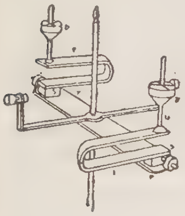


FIG. 9.

Fig. 10 represents E. T. Loseby's mercurial compensation balance. Besides the weights D, D, set near the end of the primary compensation bars B, B, there are small bent tubes FE, FE with mercury in them, like a thermometer, the bulbs being at F, F. As the heat increases, not only do the primary weights D, D and the bulbs F, F approach the centre of the balance, but some of the mercury is driven along the tube, thus carrying some more of the weight towards the centre, at a ratio increasing more rapidly than the temperature. The tubes are sealed at the thin end, with a little air included. The action is here equally continuous with Dent's, and the adjustments for primary and secondary compensation are apparently more independent of each other; and this modification of Le Roy's use of mercury for compensated balances (which does not appear to have answered) is certainly very elegant and ingenious. Nevertheless an analysis of the Greenwich lists for seven years of Loseby's trials proved that the advantage of this method over the others was more theoretical than practical; Dent's compensation was the most successful of all in three years out of the seven, and Loseby's in only one. Loseby's method has never been adopted by any other chronometer-maker, whereas the principles both of Eiffe's and of Dent's methods have been adopted by several other makers.

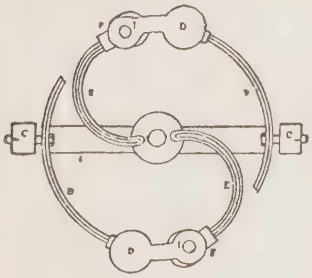


FIG. 10.

A few chronometers have been made with glass balance-springs, which have the advantage of requiring very little primary and no secondary compensation, on account of the very small variation in their elasticity, compared with springs of steel or any other metal.

One of the most important and interesting attempts to correct the temperature errors of a hair-spring by a series of corresponding temperature changes in the moment of inertia of the balance-wheel has been made by means of the use of the nickel-steel compound called invar, which, on account of its very small coefficient of expansion, has been of great use for pendulum rods. In a memoir published in 1904 at Geneva, Dr Charles Guillaume, the inventor of invar, shows that in order to get a true secondary compensation what is wanted is a material having the property of causing the curve of the rim of the wheel to change at an increasing rate as compared with changes in the temperature. This is found in those specimens of invar in which the second coefficient of expansion is negative, *i.e.* which are less dilatable at higher temperatures than at lower ones. It is satisfactory to add that such balance-wheels have been tried successfully on chronometers, and notably in a deck watch by Paul Ditisheim of Neuchâtel, who has made a chronometer with a tourbillon escapement and an invar balance-wheel, which holds the highest record ever obtained by a watch of its class.

It is obvious that in order that a watch may keep good time the centre of gravity of the balance-wheel and hair-spring must be exactly in the axis; for if this were not the case, then the wheel would act partly like a pendulum, so that the time would vary according as the watch was placed in different positions. It is exceedingly difficult to adjust a watch so that these "position errors" are eliminated. Accordingly it has been proposed to neutralize their effect by mounting the balance-wheel and hair-spring upon a revolving carriage which shall slowly rotate, so that in succession every possible position of the balance-wheel and spring is assumed, and thus errors are averaged and mutually destroy one another. This is called the tourbillon escapement. There are several forms of it, and watches fitted with it often keep excellent time.

Stop watches or chronographs are of several kinds. In the usual and simplest form there is a centre seconds hand which normally remains at rest, but which, when the winding handle is pressed in, is linked on to the train of the watch and begins to count seconds, usually by fifths. A second pressure arrests its path, enabling the time to be taken since the start. A third pressure almost instantaneously brings the seconds hand back to zero, this result being effected by means of a heart-shaped cam which, when a lever presses on it instantaneously, flies round to zero position. The number of complete revolutions of the seconds hand, *i.e.* minutes, is recorded on a separate dial.

Calendar work on watches is, of course, fatal to great accuracy of time-keeping, and is very complicated. A watch is made to record days of the week and month, and to take account of leap years usually by the aid of star-wheels with suitable pauls and stops. The type of this mechanism is to be found in the calendar motion of an ordinary grandfather's clock.

Watches have also been made containing small musical boxes and arranged with performing figures on the dials. Repeaters are striking watches which can be made at will to strike the hours and either the quarters or the minutes, by pressing a handle which winds up a striking mechanism. They were much in vogue as a means of discovering the time in the dark before the invention of lucifer matches, when to obtain a light by means of flint and steel was a troublesome affair.

From what has been said it will be seen that for many years the form of escapements and balance-wheels has not greatly altered. The great improvements which modern science has been able to effect in watches are chiefly in the use of new metals and in the employment of machinery, which, though they have altered the form but little, have effected an enormous revolution in the price. The cases of modern watches are made sometimes of steel, artificially blackened, sometimes of compounds of aluminium and copper, known as aluminium gold. Silver is at present being less employed than formerly. The hair-springs are often of palladium in order to render the watch non-magnetizable. An ordinary watch, if the wearer goes near a dynamo, will probably become magnetized and quite useless for time-keeping. One of the simplest cures for this accident is to twirl it rapidly round while retreating from the dynamo and to continue the motion till at a considerable distance. The use of invar has been already noticed.

It would be impossible to enumerate, still more to describe, the vast number of modern machines that have been invented for making watches. It may be said briefly that every part, including the toothed wheels, is stamped out of metal. The stamped pieces are then finished by cutters and with milling machinery. Each machine as a rule only does one operation, so that a factory will contain many hundreds of different sorts of machines. The modern watchmaker therefore is not so much of a craftsman as an engineer. The effect of making all the parts of a watch by machinery is that each is interchangeable, so that one part will fit any watch. It is not an easy thing to secure this result, for as the machines are used the cutting edges wear down and require regrinding and resetting. Hence a tool is not allowed to make more than a given quantity of parts without being examined and readjusted, and from time to time the pieces being put out are tested with callipers. The parts thus made are put in groups and sorted into boxes, which are then given over to the watch-adjusters, who put the parts together and make the watch go. The work of adjustment for common watches is a simple matter. But expert adjusters select their pieces, measure them and correct errors with their tools. The finest watches are thus largely machine-made, but hand-finished. The prejudice against machine-made watches has been very strong in England, but is dying out—not, unfortunately, before much of the trade has been lost. A flourishing watch industry exists in Switzerland in the neighbourhood of Neuchâtel. A watch in a stamped steel case can now be made for about five shillings. There is no reason why in such a neighbourhood as Birmingham the English watch industry should not revive.

The use of jewelled bearings for watch pivots was introduced by Nicholas Facio about the beginning of the 18th century. Diamonds and sapphires are usually employed and pierced either by diamond drills or by drills covered with diamond dust. Rubies are not a very favourite stone for jewels, but as they and sapphires can now be made artificially for about two shillings a carat the difficulty of obtaining material for watch jewelling has nearly disappeared.

Watches have also been fitted with machinery whereby electric contacts are made by them at intervals, so that if wires are led to and away from them, they can be made to give electric signals and thus mark dots at regular intervals on a moving strip of paper.

As in the case of clocks, the accuracy of going of a watch is estimated by observation of the variations of its mean daily rate. This is officially done at Kew Observatory, near Richmond, and also for admiralty purposes at Greenwich. At Richmond watches are divided into two classes, A and B. For an A certificate the trials last for forty-five days, and include tests in temperatures varying from 40° to 90° F., going in every position with dial vertical, face up and face down. The average daily departure from the mean daily rate, that is the average error due to irregular departures from the average going rate, must not exceed 2 seconds a day except where due to position, when it may amount to 5 seconds. The errors should not increase more than 0·3 seconds a day for each 1° F. The trial for the B certificate is somewhat similar but less severe. Chronometers are put through trials lasting 55 days, and their average error from mean rate is expected not to exceed 0·5 seconds per diem. The fees for these tests are various sums from two guineas downwards. In estimating the time-keeping qualities of a watch or clock, the error of rate is of no consequence. It is simply due to the time-keeper going too fast or too slow, and this can easily be corrected. What is wanted for a good watch is that the rate, whatever it is, shall be constant. The daily error is of no account provided it is a uniform daily error and not an irregular one. Hence the object of the trials is to determine not merely the daily rate but the variations of the daily rate, and on the smallness of these the value of the watch as a time-keeper depends. (G.; H. H. C.)

WATER. Strictly speaking, water is the oxide of hydrogen which is usually stated to have the formula H_2O (see below), but in popular use the term is applied to a great variety of different substances, all of which agree, however, in being the water of the chemist modified differently in the several varieties by the nature or proportion of impurities. In all ordinary waters, such as are used for primary purposes, the impurities amount to very little by weight—as a rule to less than $\frac{1}{10}$th of 1 %.

Of all natural stores of water the *ocean* is by far the most abundant, and from it all other water may be said to be derived. From the surface of the ocean a continuous stream of vapour is rising up into the atmosphere to be recondensed in colder regions and precipitated as rain, snow or sleet, &c. Some $\frac{8}{11}$ths of these precipitates of course return directly to the ocean; the rest, falling on land, collects into pools, lakes, rivers, &c., or else penetrates into the earth, perhaps to reappear as springs or wells. As all the saline components of the ocean are non-volatile, rain water, in its natural state, can be contaminated only with the ordinary atmospheric gases—oxygen, nitrogen and carbon dioxide. Rain water also contains perceptible traces of ammonia, combined as a rule, at least partly, with the nitric acid, which is produced wherever an electric discharge pervades the atmosphere.

Lake waters, as a class, are relatively pure, especially if the mountain slopes over which the rain collects into a lake are relatively free of soluble components. For example, the water of Loch Katrine (Scotland) is almost chemically pure, apart from small, but perceptible, traces of richly carboniferous matter taken up from the peat of the surrounding hills, and which impart to it a faint brownish hue, while really pure water is blue when viewed through a considerable thickness.

River water varies very much in composition even in the same bed, as a river in the course of its journey towards the ocean passes from one kind of earth to others; while, compared with spring waters, relatively poor in dissolved salts, rivers are liable to be contaminated with more or less of suspended matter.

Spring waters, having been filtered through more or less considerable strata of earth, are, as a class, clear of suspended, but rich in dissolved, mineral and organic matter, and may also contain gases in solution. Of ordinarily occurring minerals only a few are perceptibly soluble in water, and of these calcium carbonate and sulphate and common salt are most widely diffused. Common salt, however, in its natural occurrence, is very much localized; and so it comes that spring and well waters are contaminated *chiefly* with calcium carbonate and sulphate. Of these two salts, however, the former is held in solution only by the carbonic acid of the water, as calcium bicarbonate. But a carbonate-of-lime water, if exposed to the atmosphere, even at ordinary temperatures, loses its carbonic acid, and the calcium carbonate is precipitated. The stalactites (*q.v.*) which adorn the roofs and sides of certain caverns are produced in this manner. Many waters are valuable medicinal agents owing to their contained gases and salts (see MINERAL WATERS).

In addition to its natural components, water is liable to be contaminated through accidental influxes of foreign matter. Thus, for instance, all the Scottish Highland lochs are brown through the presence in them of dissolved peaty matter. Rivers flowing through, or wells sunk in, populous districts may be contaminated with excrementitious matter, discharges from industrial establishments, &c. The presence of especially nitrogenous organic matter is a serious source of danger, inasmuch as such matter forms the natural food or soil for the development of micro-organisms, including those kinds of bacteria which are now supposed to propagate infectious diseases. Happily nature has provided a remedy. The nitrogenous organic matter dissolved in (say) a river speedily suffers disintegration by the action of certain kinds of bacteria, with formation of ammonia and other (harmless) products; and the ammonia, again, is no sooner formed than, by the conjoint action of other bacteria and atmospheric oxygen, it passes first into (salts of) nitrous and then nitric acid. A water which contains combined nitrogen in the form of nitrates only is, as a rule, safe organically; if nitrites are present it becomes liable to suspicion; the presence of ammonia is a worse symptom; and if actual nitrogenous organic matter is found in more than microscopic traces the water is possibly (not necessarily) a dangerous water to drink.

All waters, unless very impure, become safe by boiling, which process kills any bacteria or germs that may be present.

Of the ordinary saline components of waters, soluble magnesium and calcium salts are the only ones which are objectionable sanitarily if present in relatively large proportion. Calcium carbonate is harmless; but, on the other hand, the notion that the presence of this component adds to the value of a water as a drinking water is a mistake. The farinaceous part of food alone is sufficient to supply all the lime the body needs; besides, it is questionable whether lime introduced in any other form than that of phosphate is available for the formation of, for instance, bone tissue.

The fitness of a water for washing is determined by its degree of softness. A water which contains lime or magnesia salts decomposes soap with formation of insoluble lime or magnesia salts of the fatty acids of the soap used. So much of the soap is simply wasted; only the surplus can effect any detergent action. Several methods for determining the hardness of a water have been devised. The most exact method is to determine the lime and magnesia gravimetrically or by alkalimetry; or by Clark's soap test, but this process frequently gives inaccurate results. In this method, which, however, is largely used, a measured volume of the water is placed in a stoppered bottle, and a standard solution of soap is then dropped in from a graduated vessel, until the mixture, by addition of the last drop of soap, has acquired the property of throwing up a peculiar kind of creamy froth when violently shaken, which shows that all the soap-destroying components have been precipitated. The volume of soap required measures the hardness of the water. The soap-solution is referred to a standard by means of a water of a known degree of hardness prepared from a known weight of carbonate of lime by converting it into neutral chloride of calcium, dissolving this in water and diluting to a certain volume. The hardness is variously expressed. On Clark's scale it is the grains of calcium carbonate per gallon of 70,000 grains; in Germany the parts of lime per 100,000 of water, and in France the parts of calcium carbonate per 100,000.

On the English scale, a water of 15° and over is hard, between 5° and 15° moderately hard, and of less than 5° soft.

That part of the hardness of a water which is actually owing to carbonate of lime (or magnesia) can easily be removed in two ways, (1) By boiling, the free carbonic acid goes off with the steam, and the carbonate of lime, being bereft of its solvent, comes down as a precipitate which can be removed by filtration, or by allowing it to settle, and decanting off the clear supernatant liquor. (2) A method of Clark's is to mix the water with just enough of milk of lime to convert the free carbonic acid into carbonate. Both this and the original carbonate of lime are precipitated, and can be removed as in the first case.

From any uncontaminated natural water pure water is easily prepared. The dissolved salts are removed by distillation; if care be taken that the steam to be condensed is dry, and if its condensation be effected within a tube made of a suitable metal (platinum or silver are best, but copper or block tin work well enough for ordinary purposes), the distillate can contain no impurities except atmospheric gases, which latter, if necessary, must be removed by boiling the distilled water in a narrow-necked flask until it begins to "bump," and then allowing it to cool in the absence of air. This latter operation ought, strictly speaking, to be performed in a silver or platinum flask, as glass is appreciably attacked by hot water. For most purposes distilled water, taken as it comes from the condenser, is sufficiently pure. The preparation of absolutely pure water is a matter of great difficulty. Stas, in his stoichiometric researches, mixed water with potassium manganate, and distilled after twenty-four hours; the product being redistilled and condensed in a platinum tube just before it was required.

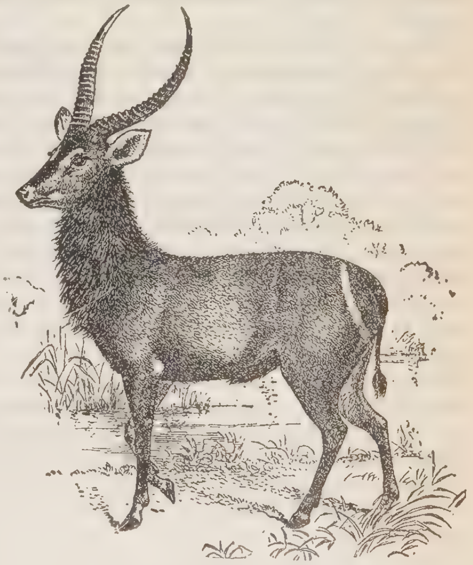
Pure water, being so easily procured in any quantity, is used largely as a standard of reference in metrology and in the quantitative definition of physical properties. Thus a "gallon" is defined as the volume at 62° F. of a quantity of water whose uncorrected mass, as determined by weighing in air of 30-in. pressure and 62° F. of temperature, is equal to 10 lb avoirdupois. The kilogramme in like manner is defined as the mass of 1 cubic decimetre of water, measured at the temperature corresponding to its maximum density (4° C.). The two fixed points of the thermometer correspond—the lower (0° C., or 32° F.) to the temperature at which ice melts, the upper (100° C., or 212° F.) to that at which the maximum tension of steam, as it rises from boiling water, is equal to 760 mm. or 30-in. mercury pressure. 30 in. being a little more than 760 mm., 212° F. is, strictly speaking, a higher temperature than 100° C., but the difference is very trifling. Specific heats are customarily measured by that of water, which is taken as $=1$. All other specific heats of liquids or solids (with one exception, formed by a certain strength of aqueous methyl alcohol) are less than 1. The temperate character of insular climates is greatly owing to this property of water. Another physiographically important peculiarity of water is that it expands on freezing (into ice), while most other liquids do the reverse. 11 volumes of ice fuse into only 10 volumes of water at 0° C.; and the ice-water produced, when brought up gradually to higher and higher temperatures, again exhibits the very exceptional property that it contracts between 0° and 4° C. (by about $\frac{1}{10000}$ of its volume) and then expands again by more and more per degree of increase of temperature, so that the volume at 100° C. is 1·043 times that at 4° C.

In former times water was viewed as an "element," and the notion remained in force after this term (about the time of Boyle) had assumed its present meaning, although cases of decomposition of water were familiar to chemists. In Boyle's time it was already well known that iron, tin and zinc dissolve in aqueous hydrochloric or sulphuric acid with evolution of a stinking inflammable gas. Even Boyle, however, took this gas to be ordinary air contaminated with inflammable stinking oils. This view was held by all chemists until Cavendish, before 1784, showed that the gas referred to, if properly purified, is free of smell and constant in its properties, which are widely different from those of air—the most important point of difference being that the gas when kindled in air burns with evolution of much heat and formation of water. Cavendish, however, did not satisfy himself with merely proving this fact qualitatively; he determined the quantitative relations, and found that it takes very nearly 1000 volumes of air to burn 423 volumes of "hydrogen" gas; but 1000 volumes of air, again, according to Cavendish, contain 210 volumes of oxygen; hence, very nearly, 2 volumes of hydrogen take up 1 volume of oxygen to become water. This important discovery was only confirmed by the subsequent experiments of Humboldt and Gay-Lussac, which were no more competent than Cavendish's to prove that the surplus of 3 units (423 volumes instead of 420) of hydrogen was an observational error. More recent work, *e.g.* of Morley, Leduc and Scott, has shown that the ratio is not exactly 2·1. The gravimetric composition was determined by Berzelius and Dulong, and later by Dumas by passing pure hydrogen over red-hot copper oxide. It has also been determined by several other variations and methods (see HYDROGEN).

The molecular weight of liquid water has attracted much attention, for it was perceived long ago that its high boiling point, refractive index and other properties were not consistent with the simple formula H_2O. Cryoscopic measurements led to the probable formula $(H_2O)_2$, whilst the surface tension leads to $(H_2O)_4$. The question has been considered by H. E. Armstrong, who suggests that the simple molecule, H_2O, which he calls hydrone, condenses in liquid water to form cyclic or chained compounds, containing tetravalent oxygen, resembling in structure the polymethylenes or paraffins.

WATER-BOATMAN, an aquatic hemipterous insect of the family *Notonectidae*, of which the best known species (*Notonecta glauca*) is a prominent feature in the pond-life of Great Britain. The technical name, *Notonecta*, meaning "back-swimmer," alludes to the habit of the insect of swimming upside down, the body being propelled through the water by powerful strokes of the hind legs, which are fringed with hair and, when at rest, are extended laterally like a pair of sculls in a boat. As is the case with other water-bugs, this insect is predaceous and feeds upon aquatic grubs or worms. The body is richly supplied with long hairs, which serve to entangle bubbles of air for purposes of respiration. The eggs are laid in the stems of water plants.

WATERBUCK (*Wasserbok*), the name of a large South African antelope (*Cobus ellipsiprymnus*) belonging to the subfamily *Cervicaprinae*, characterized by the white elliptical ring on the buttocks, and the general reddish grey colour of the long and coarse hair. They have heavily fringed necks and tufted tails; the bucks carry long sub-lyrate and heavily ringed horns, but the does are hornless. They seek refuge from pursuit in the water. The name is extended to include the sing-sing or defassa waterbuck (*C. defassa*), a widespread species, without the white ring on the buttocks, and represented by several local races, one of which is foxy red while a second is greyish. Both species equal in size the red deer. The smaller members of the genus *Cobus* (which is exclusively African) are generally called kobs. (See ANTELOPE.)



Waterbuck.

WATERBURY, a city and one of the county-seats of New Haven county, Connecticut, U.S.A., since 1900 coextensive with the township of Waterbury, on the Naugatuck river, in the west central part of the state, about 32 m. S.W. of Hartford. Pop. (1900) 51,139, of whom 15,368 were foreign-born (5866 being Irish, 2007 Italian, 1777 French Canadian, 1265 Russian, 1195 French, and 938 English); (1910 census) 73,141. Area 29 sq. m. Waterbury is served by the New York, New Haven & Hartford railway, and is connected by electric lines with New Haven, Bridgeport, Thomaston, Woodbury and Watertown. It has four public parks (the Green, Chase, Hamilton and Forest), with a total acreage of 80 acres, and a Soldiers' and Sailors' Monument, designed by George E. Bissell. The most important public buildings are the Federal building, the county court house, a state armoury, the Silas Bronson Public Library (1870; with an endowment of $200,000 and with 81,500 volumes in 1910), the Odd Fellows Temple, a Y.M.C.A. building and the Buckingham Music Hall (1907); and among the charitable institutions are the Southmayd Home (1898) for aged women, the Waterbury hospital (1890) and the St Mary's hospital (1908). In the city are the St Margaret's Diocesan School for Girls (Protestant Episcopal, 1875), the Waterbury Industrial School and the Academy of Notre Dame (1868). There is good water power here from the Naugatuck river and its tributaries Mad river and Great Brook. In 1905 Waterbury ranked third among the manufacturing cities of Connecticut (being surpassed only by

Bridgeport and New Haven), with a factory product valued at $32,367,359 (6·7% more than in 1900). The most important manufactures are rolled brass and copper (value in 1905, $12,599,736, or 24·3% of the total for the United States), brass-ware (value in 1905, $7,387,228, or 42·2% of the total for the United States), clocks and watches—over a million watches are made here each year—and stamped ware (value in 1905, $1,037,666). The manufacture of brass-ware originated here in 1802 with the making of brass buttons; iron buttons covered with silver were first made here about 1760, block tin and pewter buttons about 1800, bone and ivory buttons about 1812, sheet brass in 1830, and pins and plated metals for daguerreotypes in 1842. Old-fashioned tall wooden clocks were made in Waterbury in the latter part of the 18th century, and cheap watches were first made here in 1879; these were long distinctive of Waterbury, and were often called "Waterbury watches." The manufacture of cloth dates from 1814, and broadcloth was first made here in 1833. The city has a large wholesale trade and is a shipping point for dairy products. The municipality owns and operates the waterworks.

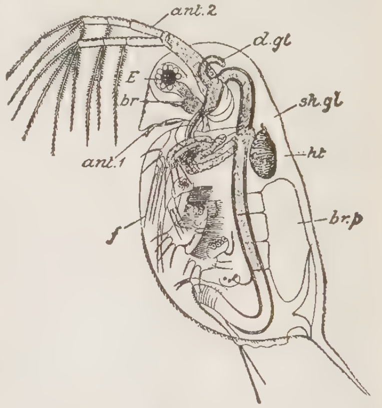
The township of Waterbury was incorporated in 1686, having been since its settlement in 1677 a part of Farmington township known as Mattatuck. The city of Waterbury was first chartered in 1853. The city and the township were consolidated in 1901. City elections are held biennially and the mayor, city clerk, treasurer, comptroller, city sheriff and aldermen hold office for two years. With the consent of the Board of Aldermen the mayor appoints five electors who with the mayor constitute a department of public works; appoints three electors who with the mayor, comptroller, and president of the Board of Aldermen constitute a department of finance; appoints five electors who with the mayor constitute a department of public safety; and appoints five electors who constitute a department of public health. In 1902 there was a destructive fire in the business district of the city, and during a strike of street railway employees in 1903 state troops were called out to maintain order.

WATER-DEER, a small member of the deer-tribe from northern China differing from all other *Cervidae* except the musk-deer (with which it has no affinity) by the absence of antlers in both sexes. To compensate for this deficiency, the bucks are armed with long sabre-like upper tusks (see DEER). The species typifies a genus, and is known as *Hydrelaphus* (or *Hydropotes*) *inermis*; but a second form has been described from Hankow under the name of *H. kreyenbergi*, although further evidence as to its claim to distinction is required. Water-deer frequent the neighbourhood of the large Chinese rivers where they crouch amid the reeds and grass in such a manner as to be invisible, even when not completely concealed by the covert. When running, they arch their backs and scurry away in a series of short leaps. In captivity as many as three have been produced at a birth.

This is one of the few deer in which there are glands neither on the hock nor on the skin covering the cannon-bone. These glands probably enable deer to ascertain the whereabouts of their fellows by the scent they leave on the ground and herbage. The sub-aquatic habits of the present species probably render such a function impossible, hence the absence of the glands. The tail is represented by a mere stump. (R. L.*)

WATERFALL, a point in the course of a stream or river where the water descends perpendicularly or nearly so. Even a very small stream of water falling from any considerable height is a striking object in scenery. Such falls, of small volume though often of immense depth, are common, for a small stream has not the power to erode a steady slope, and thus at any considerable irregularity of level in its course it forms a fall. In many mountainous districts a stream may descend into the valley of the larger river to which it is tributary by way of a fall, its own valley having been eroded more slowly and less deeply than the main valley. Mechanical considerations apart, the usual cause of the occurrence of a waterfall is a sudden change in geological structure. For example, if there be three horizontal strata, so laid down that a hard stratum occurs between two soft ones, a river will be able to grade its course through the upper or lower soft strata, but not at the same rate through the intermediate hard stratum, over a ledge of which it will consequently fall. The same will occur if the course of the river has been interrupted by a hard barrier, such as an intrusive dyke of basalt, or by glacial or other deposits. Where a river falls over an escarpment of hard rock overlying softer strata, it powerfully erodes the soft rock at the base of the fall and may undermine the hard rock above so that this is broken away. In this way the river gradually cuts back the point of fall, and a gorge is left below the fall. The classic example of this process is provided by the most famous falls in the world—Niagara.

WATER-FLEA, a name given by the earlier microscopists (Swammerdam, 1669) to certain minute aquatic Crustacea of the order Cladocera, but often applied also to other members of the division Entomostraca (*q.v.*). The Cladocera are abundant everywhere in fresh water. One of the commonest species, *Daphnia pulex*, found in ponds and ditches, is less than one-tenth of an inch in length and has the body enclosed in a transparent bivalved shell. The head, projecting in front of the shell, bears a pair of branched feathery antennae which are the chief swimming organs and propel the animal, in a succession of rapid bounds, through the water. There is a single large black eye. In the living animal five pairs of leaf-like limbs acting as gills can be observed in constant motion between the valves of the shell, and the pulsating heart may be seen near the dorsal surface, a little way behind the head. The body ends behind in a kind of tail with a double curved claw which can be protruded from the shell. The female carries the eggs in a brood-chamber between the back of the body and the shell until hatching takes place. Throughout the greater part of the year only females occur and the eggs develop "parthenogenetically," without fertilization. When the small males appear, generally in the autumn, fertilized "winter" or "resting eggs" are produced which are cast adrift in a case of "ephippium" formed by a specially modified part of the shell. These resting eggs enable the race to survive the cold of winter or the drying up of the water.



Parker and Haswell's *Text-Book of Zoology*, by permission of Macmillan & Co.

Daphnia (after Claus).

ant. 1.	antennule.	*d.gl.*	Digestive gland.
ant. 2.	Antenna.		
br.	Brain.	*f.*	Swimming-feet.
br.p.	Brood-pouch.	*ht.*	Heart.
E.	Eye.	*sh.gl.*	Shell-gland.

For a fuller account of the Cladocera and of other organisms which sometimes share with them the name of "water-fleas," see the article ENTOMOSTRACA. (W. T. CA.)

WATERFORD, a county of Ireland in the province of Munster, bounded E. by Waterford Harbour, separating it from Wexford, N. by Kilkenny and by Tipperary, W. by Cork, and S. by the Atlantic. The area is 458,108 acres, or about 716 sq. m. The coast line is in some parts bold and rocky, and is indented by numerous bays and inlets, the principal being Waterford Harbour; Tramore Bay, with picturesque cliffs and some extensive caves, and noted for its shipwrecks, on account of the rocky character of its bed; Dungarvan Harbour, much frequented for refuge in stormy weather; and Youghal Harbour, partly separating county Waterford from county Cork. The surface of the county is to a large extent mountainous, providing beautiful inland scenery, especially towards the west and northwest. The Knockmealdown Mountains, which attain a height of 2609 ft., form the northern boundary with Tipperary. A wide extent of country between Clonmel and Dungarvan is occupied by the two ranges of the Comeragh and Monavallagh

Mountains, reaching a height of 2504 ft. To the south of Dungarvan there is a lower but very rugged range, called the Drum Hills. The south-eastern division of the county is for the most part level. Though Waterford benefits in its communications by the important rivers in its vicinity, the only large river it can properly claim as belonging to it is the Blackwater. This river is famous for salmon fishing, and, particularly in the stretch between Cappoquin and Lismore, flows between high, well-wooded banks, contrasting beautifully with the background of mountains. It enters the county east of Fermoy, and flows eastward to Cappoquin, the head of navigation, where it turns abruptly southward, to fall into the sea at Youghal Harbour. Waterford Harbour may be called the estuary of three important rivers, the Suir, the Nore and the Barrow, but neither of the two last touches the county. The Suir reaches it about 8 m. from Clonmel, and thence forms its northern boundary with Tipperary and Kilkenny. It is navigable to Clonmel, but the traffic lies mainly on the left bank, outside the county.

Geology.—The Knockmealdown Mountains are an anticline of Old Red Sandstone, cut away at the eastern end to expose Silurian strata, which are associated with an extensive series of volcanic and intrusive rocks, often crushed by earth-movement. The impressive scarp formed by the Old Red Sandstone conglomerate above this lower ground is called the Comeragh Mountains. The moraine-dammed cirque of Lough Coumshingaun lies in these, with a precipice 1000 ft. in height. The unconformity of the Old Red Sandstone on the greenish and yellowish Silurian shales is excellently seen on the north bank of the Suir at Waterford. Carboniferous Limestone is found in the floor of the synclinals on either side of the great anticline, that is, in the Suir valley on the north, and in the green and richly-wooded hollow of the Blackwater on the south. Rapidly repeated anticlinal and synclinal folds continue this structure across the country between Dungarvan and Youghal. Rich copper-mines were worked, mainly in the 19th century, in the Silurian area near Bonmahon, and the region remains full of mineral promise.

Industries.—The land is generally better adapted for pasturage than for tillage, although there are considerable tracts of rich soil in the south-eastern districts. The proportion of tillage to pasture is, however, roughly as 1 to 3½, though the acreage under the principal crops of oats, potatoes and turnips is on the whole fairly maintained. The numbers of cattle, sheep and poultry increase steadily, and pigs are extensively reared. The woollen manufacture, except for home use, is practically extinct, but the cotton manufacture is still of some importance. There are also breweries, distilleries and a large number of flour-mills. The valuable deep sea and coast fisheries have distinct headquarters at Waterford, and the noted salmon fisheries of the Suir and Blackwater have theirs at Waterford and Lismore respectively. Railway communication is provided by the Waterford, Dungarvan, Lismore and Co. Cork branch of the Great Southern and Western railway, traversing the county from E. to W.; and by the Waterford and Tramore railway, while the city of Waterford is approached by lines of the first-named company from the N. (from Dublin) and W. (from Limerick).

Population and Administration.—The population (95,702 in 1891; 87,187 in 1901) decreases at a rate about equal to the average of the Irish counties, and emigration is considerable. Nearly 95% of the total are Roman Catholics, and about 74% constitute the rural population. The chief towns are the city of Waterford (pop. 26,769), Dungarvan (4850), and Lismore (1583); Portlaw and Tramore, and Cappoquin are lesser towns. The county is divided into eight baronies. Down to the Union in 1800 the county returned two members, and the boroughs of Dungarvan, Lismore and Tallow two each. Thereafter, and before the Redistribution Act of 1885, the county returned two members, the borough of Waterford two, and Dungarvan one. The county now returns two members, for the east and west divisions respectively, while the county of the city of Waterford returns one member. Assizes are held at Waterford, and quarter sessions at Lismore, Dungarvan, and Waterford. The county is mainly in the Protestant diocese of Ossory, and the Roman Catholic diocese of Waterford and Lismore.

History and Antiquities.—In the 9th century the Danes landed in the district, and afterwards made a permanent settlement. Waterford was one of the twelve counties into which King John is stated to have divided that part of Ireland which he nominally annexed to the English crown. On account of the convenience of the city as a landing place, many subsequent expeditions passed through the county, directed against disaffected or rebellious tribes. In 1444 the greater part of it was granted to James, earl of Desmond, and in 1447 it was bestowed on John Talbot, earl of Shrewsbury, who was created earl of Waterford. The county suffered severely during the Desmond rebellion, in the reign of Elizabeth, as well as in the rebellion of 1641 and during the Cromwellian period. There are in the county a considerable number of barrows, duns, cromlechs and similar relics of the ancient inhabitants. At Ardmore, overlooking the sea from Ram Head, there is a round tower 95 ft. in height, and near it a huge rath and a large number of circular entrenchments. Among the old castles special mention may be made of Lismore, originally erected in 1185, but now in great part comparatively modern. The chief ecclesiastical remains are those of the chancel and nave of the cathedral of Ardmore, where a monastery and oratory were founded by St Declan in the 7th century. The see of Ardmore was abolished in the 12th century. Here are also remains of a church and oratory, and a holy well. Mention should be made of the existing monastery of Mount Melleray, a convent of Trappists founded near Cappoquin in 1830, on the expulsion of the foreign members of this order from France. Schools, both free and boarding, are maintained; and there is a branch of the order at Roscrea (Co. Tipperary).

WATERFORD, a city, county of a city, parliamentary borough, seaport, and the chief town of Co. Waterford, Ireland. Pop. (1901) 26,769. It is finely situated on the south bank of the Suir 4 m. above its junction with the Barrow, at the head of the tidal estuary called Waterford Harbour, 111 m. S.S.W. from Dublin by the Great Southern and Western railway. This is the principal railway serving the city, having lines from Dublin and from the north-west, besides the trunk line between Rosslare, Waterford and Cork. Waterford is also, however, the terminus of the Dublin and South-Eastern line from Dublin via New Ross, and for the Waterford and Tramore line, serving the seaside resort of Tramore, 7 m. S. The Suir is crossed by a wooden bridge of thirty-nine arches, and 832 ft. long, connecting Waterford with the suburb of Ferrybank. The city is built chiefly along the banks of the river, occupying for the most part low and level ground except at its western extremity, and excepting the quay and the Mall, which connects with the southern end of the quay, its internal appearance is hardly of a piece with the beauty of its environs. The modern Protestant cathedral of the Holy Trinity, generally called Christ Church, a plain structure with a lofty spire, occupies the site of the church built by the Danes in 1096, in the Mall. Near it are the episcopal palace and deanery. There is a handsome Roman Catholic cathedral, and the training seminary for priests called St John's College deserves notice. The principal secular buildings are the town-hall, the county and city courts and prisons, the custom-house and the barracks. At the extremity of the quay is a large circular tower, called Reginald's Tower, forming at one time a portion of the city walls, and occupying the site of the tower built by Reginald the Dane in 1003. Near the summit one of the balls shot from the cannon of Cromwell while besieging the city is still embedded in the wall. Other remains of the fortifications, consisting of towers and bastions, are to be seen as in the Tramore railway sidings and in Castle Street. There are a number of hospitals and similar benevolent institutions, including the leper house founded in the reign of King John, now used practically as an infirmary. The town possesses breweries, salt-houses, foundries and flour mills; and there is a large export trade in cattle, sheep and pigs, and in agricultural produce. It is the headquarters of extensive salmon and sea fisheries. Waterford is second in importance to Cork among the ports of the south coast of Ireland. There is regular communication by steamer with Cork, with Dublin and Belfast, with Fishguard, Glasgow, Liverpool, Bristol, Plymouth, Southampton, London and other ports. Local steamers ply to Duncannon, New Ross and other places on the neighbouring estuaries.

Waterford Harbour is a winding and well-sheltered bay formed by the estuary of the river Suir, and afterwards by the joint estuary of the Nore and Barrow. Its length to the sea is about 15 m. Its entrance is 3 m. wide, and is lighted by a fixed light on the ancient donjon of Hook Tower (139 ft. in height) and others. The quay, at which there is a depth of 22 ft. of water at low tide, was enlarged in 1705 by the removal of the city walls, and is about 1¼ m. in length. At Ferrybank, on the Kilkenny side of the river, there is a shipbuilding yard with patent slip and graving dock. By the Suir there is navigation for barges to Clonmel, and for sailing vessels to Carrick-on-Suir; by the Barrow for sailing vessels to New Ross and thence for barges to Athy, and so to Dublin by a branch of the Grand Canal; and by the Nore for barges to Inistioge. The shores of the harbour are picturesque and well-wooded, studded with country residences and waterside villages, of which Passage and Duncannon are popular resorts of the citizens of Waterford.

Anciently Waterford was called *Cuan-na-groith*, the haven of the sun. By early writers it was named Menapia. It is supposed to have existed in very early times, but first acquired importance under the Danes, of whom it remained one of the principal strongholds until its capture by Strongbow in 1171. On the 18th of October 1172 Henry II. landed near Waterford, and he here received the hostages of the people of Munster. It became a cathedral city in 1096. The Protestant dioceses of Cashel, Emly, Waterford and Lismore were united in 1833. Prince John, afterwards king of England, who had been declared lord of Ireland in 1177, landed at Waterford in 1185. After ascending the English throne he granted it a fair in 1204, and in 1206 a charter of incorporation. He landed at Waterford in 1210, in order to establish within his nominal territories in Ireland a more distinct form of government. The city received a new charter from Henry III. in 1232. Richard II. landed at Waterford in October 1394 and again in 1399. In 1447 it was granted by Henry VI. to John Talbot, earl of Shrewsbury, who was created earl of Waterford. In 1497 it successfully resisted an attempt of Perkin Warbeck to capture it, in recognition of which it received various privileges from Henry VII., who gave it the title of *urbs intacta*. In 1603, after the accession of James I. to the English crown, the city, along with Cork, took a prominent part in opposition to the government and to the Protestant religion, but on the approach of Mountjoy it formally submitted. From this time, however, the magistrates whom it elected refused to take the oath of supremacy, and, as by its charter it possessed the right to refuse admission to the king's judges, and therefore to dispense with the right of holding assizes, a rule was obtained in the Irish chancery for the seizure of its charter, which was carried into effect in 1618. In 1619 an attempt was made to induce Bristol merchants to settle in the city and undertake its government, but no one would respond to the invitation, and in 1626 the charter was restored. The city was unsuccessfully attacked by Cromwell in 1649, but surrendered to Ireton on the 10th of August 1650. After the battle of the Boyne James II. embarked at it for France (July 1690). Shortly afterwards it surrendered to William, who sailed from it to England. It sent two members to parliament from 1374 to 1885, when the number was reduced to one. In 1898 it was constituted one of the six county boroughs having separate county councils.

WATERFORD, a village of Saratoga county, New York, U.S.A., on the W. bank of the Hudson river, near the mouth of the Mohawk river, and about 10 m. N. of Albany. Pop. (1900) 3146, of whom 474 were foreign-born; (1905) 3134; (1910) 3245. Waterford is served by the Delaware & Hudson railway, and is at the junction of the Erie and the Champlain divisions of the great barge canal connecting Lake Erie and Lake Champlain. There was a settlement here probably as early as 1630, and Waterford was laid out in 1784, and was incorporated as a village in 1794.

WATERHOUSE, ALFRED (1830–1905), English architect, was born at Liverpool on the 19th of July 1830, and passed his professional pupilage under Richard Lane in Manchester. His earliest commissions were of a domestic nature, but his position as a designer of public buildings was assured as early as 1859 by success in the open competition for the Manchester assize courts. This work marked him not only as an adept in the planning of a complicated building on a large scale, but also as a champion of the Gothic cause. Nine years later, in 1868, another competition secured for Waterhouse the execution of the Manchester town-hall, where he was able to show a firmer and perhaps more original handling of the Gothic manner. The same year brought him the rebuilding of part of Caius College, Cambridge, not his first university work, for Balliol, Oxford, had been put into his hands in 1867. At Caius, out of deference to the Renaissance treatment of the older parts of the college, the Gothic element was intentionally mingled with classic detail, while Balliol and Pembroke, Cambridge, which followed in 1871, may be looked upon as typical specimens of the style of his mid career—Gothic tradition (European rather than British) tempered by individual taste and by adaptation to modern needs. Girton College, Cambridge, a building of simpler type, dates originally from the same period (1870), but has been periodically enlarged by further buildings. Two important domestic works were undertaken in 1870 and 1871 respectively—Eaton Hall for the duke, then marquis, of Westminster, and Heythrop Hall, Oxfordshire, the latter, a restoration, being of a fairly strict classic type. Iwerne Minster for Lord Wolverton was begun in 1877. In 1865 Waterhouse had removed his practice from Manchester to London, and he was one of the architects selected to compete for the Royal Courts of Justice. He received from the government, without competition, the commission to build the Natural History Museum, South Kensington, a design which marks an epoch in the modern use of terra-cotta. The new University Club—a Gothic design—was undertaken in 1866, to be followed nearly twenty years later by the National Liberal Club, a study in Renaissance composition. Waterhouse's series of works for Victoria University, of which he was made LL.D. in 1895, date from 1870, when he was first engaged on Owens College, Manchester. Yorkshire College, Leeds, was begun in 1878; and Liverpool University College in 1885. St Paul's School, Hammersmith, was begun in 1881, and in the same year the Central Technical College in Exhibition Road, London. Waterhouse's chief remaining works in London are the new Prudential Assurance Company's offices in Holborn; the new University College Hospital; the National Provincial Bank, Piccadilly, 1892; the Surveyors' Institution, Great George Street, 1896; and the Jenner Institute of Preventive Medicine, Chelsea, 1895. For the Prudential Company he designed many provincial branch offices, while for the National Provincial Bank he also designed premises at Manchester. The Liverpool Infirmary is Waterhouse's largest hospital; and St. Mary's Hospital, Manchester, the Alexandra Hospital, Rhyl, and extensive additions at the general hospital, Nottingham, also engaged him. Among works not already mentioned are the Salford gaol; St Margaret's School, Bushey; the Metropole Hotel, Brighton; Hove town-hall; Alloa town-hall; St Elizabeth's church, Reddish; the Weigh House chapel, Mayfair; and Hutton Hall, Yorks. He died on the 22nd of August, 1905.

Waterhouse became a fellow of the Royal Institute of British Architects in 1861, and president from 1888 to 1891. He obtained a *grand prix* for architecture at the Paris Exposition of 1867, and a "Rappel" in 1878. In the same year he received the Royal gold medal of the Royal Institute of British Architects, and was made an associate of the Royal Academy, of which body he became a full member in 1885 and treasurer in 1898. He became a member of the academies of Vienna (1869), Brussels (1886), Antwerp (1887), Milan (1888) and Berlin (1889), and a corresponding member of the Institut de France (1893). After 1886 he was constantly called upon to act as assessor in architectural competitions, and was a member of the international jury appointed to adjudicate on the designs for the west front of Milan Cathedral in 1887. In 1890 he served as architectural member of the Royal Commission on the proposed enlargement of Westminster Abbey as a place of burial. From 1891 to 1902, when he retired, his work was conducted in partnership with his son, Paul Waterhouse.

WATERHOUSE, JOHN WILLIAM (1847–   ), English painter, was the son of an artist, by whom he was mainly trained. As a figure-painter he shows in his work much imaginative power and a very personal style, and his pictures are for the most part illustrations of classic myths treated with attractive fantasy. An able draughtsman and a fine colourist, he must be ranked among the best artists of the British school. He was elected an associate of the Royal Academy in 1885 and academician in 1895. Four of his paintings, "Consulting the Oracle," "St Eulalia," "The Lady of Shalott" and "The Magic Circle," are in the National Gallery of British Art.

See "J. W. Waterhouse and his Work," by A. L. Baldry, *Studio*, vol. iv.

WATER-LILY, a name somewhat vaguely given to almost any floating plant with conspicuous flowers, but applying more especially to the species of *Nymphaea*, *Nuphar*, and other members of the order Nymphaeaceae. These are aquatic plants with thick fleshy rootstocks or tubers embedded in the mud, and throwing up to the surface circular shield-like leaves, and leafless flower-stalks, each terminated by a single flower, often of great beauty, and consisting of four or five sepals, and numerous petals gradually passing into the very numerous stamens without any definite line of demarcation between them. The ovary consists of numerous carpels united together and free, or more or less embedded in the top of the flower-stalk. The ovary has many cavities with a large number of ovules attached to its walls, and is surmounted by a flat stigma of many radiating rows as in a poppy. The fruit is berry-like, and the seeds are remarkable for having their embryo surrounded by an endosperm as well as by a perisperm. The anatomical construction of these plants presents many peculiarities which have given rise to discussion as to the allocation of the order among the dicotyledons or among the monocotyledons, the general balance of opinion being in favour of the former view. The leaf-stalks and flower-stalks are traversed by longitudinal air-passages, whose disposition varies in different species. The species of *Nymphaea* are found in every quarter of the globe. Their flowers range from white to rose-coloured, yellow and blue. Some expand in the evening only, others close soon after noon. *Nymphaea alba* (*Castalia alba*) is common in some parts of Britain, as is also the yellow *Nuphar luteum* (*Nymphaea lutea*). The seeds and the rhizomes contain an abundance of starch, which renders them serviceable in some places for food.

Of recent years great strides have been made in the culture of new varieties of water-lilies in the open air. Many beautiful *Nymphaea* hybrids have been raised between the tender and hardy varieties of different colours, and there are now in commerce lovely forms having not only white, but also yellow, rose, pink and carmine flowers. In many gardens open-air tanks have been fitted up with hot-water pipes running through them to keep the water sufficiently warm in severe weather. The open-air water-lily tank in the Royal gardens, Kew, is one of the latest and most up-to-date in construction. These coloured hybrids were originated by M. Latour Marliac, of Temple-sur-Lot, France, some of the most favoured varieties being *carnea*, *chromatella*, *flammea*, *ignea*, *rosea*, *Robinsoni*, *Aurora*, *blanda*, &c.

Amongst hardy species of *Nymphaea* now much grown are *candida*, *nitida*, *odorata*, *pygmaea* and *tuberosa*, all with white, more or less sweet-scented flowers; *flava*, yellow, and *sphaerocarpa*, rose-carmine. Amongst the tender or hothouse *Nymphaeas* the following are most noted: *blanda*, white; *devoniensis*, scarlet (a hybrid between *N. Lotus* and *N. rubra*); *edulis*, white; *elegans*, yellowish white and purple; *gigantea*, blue; *kewensis*, rose-carmine (a hybrid between *N. devoniensis* and *N. Lotus*); *Lotus*, red, white; *pubescens*, white; *scutifolia*, bright blue; *stellata*, blue, with several varieties; and *Sturtevanti*, a pale-rose hybrid.

Under the general head of water-lily are included the lotus of Egypt, *Nymphaea Lotus*, and the sacred lotus of India and China, *Nelumbium speciosum*, formerly a native of the Nile, as shown by Egyptian sculptures and other evidence, but no longer found in that river. The gigantic *Victoria regia*, with leaves 6 to 7 ft. in diameter and flowers 8 to 16 in. across, also belongs to this group. It grows in the backwaters of the Amazon, often covering the surface for miles; the seeds are eaten under the name water maize.

WATERLOO, a city and the county-seat of Black Hawk county, Iowa, U.S.A., on the Cedar river, about 90 m. W. of Dubuque and about 275 m. W. of Chicago. Pop. (1890) 6674; (1900) 12,580, of whom 1334 were foreign-born; (1910 census) 26,693. It is served by the Illinois Central (which has large construction and repair shops here), the Chicago, Rock Island & Pacific, the Chicago Great Western, and the Waterloo, Cedar Falls & Northern (from Cedar Falls to Sumner) railways. The city has several public parks, a public library (1879) with two buildings, a Y.M.C.A. building, and a good public school system, including a manual training school. There is a Chautauqua park. The river here is 700 to 900 ft. wide; its clear water flows over a limestone bed through a rather evenly sloping valley in the middle of the city with enough fall to furnish valuable water power. The value of the factory product in 1905 was $4,693,888. The city is situated in a rich agricultural, dairying and poultry-raising region, and is an important shipping point. Waterloo was first settled about 1846, was laid out in 1854, first chartered as a city in 1868, and became a city of the first class in 1905.

WATERLOO CAMPAIGN, 1815. On February 27, 1815, Napoleon set sail from Elba with his force of 1000 men and 4 guns, determined to reconquer the throne of France. On March 1 he landed near Cannes, and proceeded at once to march on Paris. He deliberately chose the difficult route over the French Alps because he recognized that his opponents would neither expect him by this route nor be able to concert combined operations in time to thwart him. Events proved the wisdom of his choice. His advance to Paris was a series of triumphs, his power waxing with every league he covered, and when he reached Paris the Bourbons had fled. But he had soon to turn his attention to war. His sudden return, far from widening the breaches between the allies, had fused them indissolubly together, and the four powers bound themselves to put 150,000 men apiece under arms and to maintain them in the field until Napoleon had been utterly crushed. So, from the first, France was faced with another war against an affrighted and infuriated Europe, a war in which the big battalions would be on the side of the Seventh Coalition; and to oppose their vast armies Napoleon only had in March the 150,000 men he had taken over from Louis XVIII. when the Bourbon hurriedly quitted the throne. Of this force the emperor could have drawn together some 50,000 men within ten days and struck straight at the small allied forces that were in Belgium at the moment. But he wisely refrained from taking the immediate offensive. Such an act would have proved that he desired, nay provoked a war; and further, the engagement of such small forces could lead to no decisive results. Napoleon therefore stayed his hand and proceeded to hasten forward the organization, almost the creation of an army, with which he could confront the coalition. Meanwhile he sought to detach Great Britain and Austria from the alliance. But he did not permit his political enterprise to stay his military preparations; and, by constant attention to the minutest details, by June 1 he had got together an army of 360,000 for the defence of France, one half of which was available for field service. In this army was comprised his whole means of defence; for he had no allies. On his return from Elba it is true that Murat, the king of Naples, took his side; but recklessly opening an offensive campaign, Murat was beaten at Tolentino (May 2–3), and he found himself compelled to fly in disguise to France, where the emperor refused him an audience or employment. Herein Napoleon wronged France, for he deprived her of the most brilliant cavalry soldier of the period. Shorn thus of his single ally, the emperor realized that the whole eastern land-frontier of France was open to invasion, from the North Sea to the Mediterranean. By the end of May he had placed his forces as follows to protect his empire.

Napoleon's preparations.

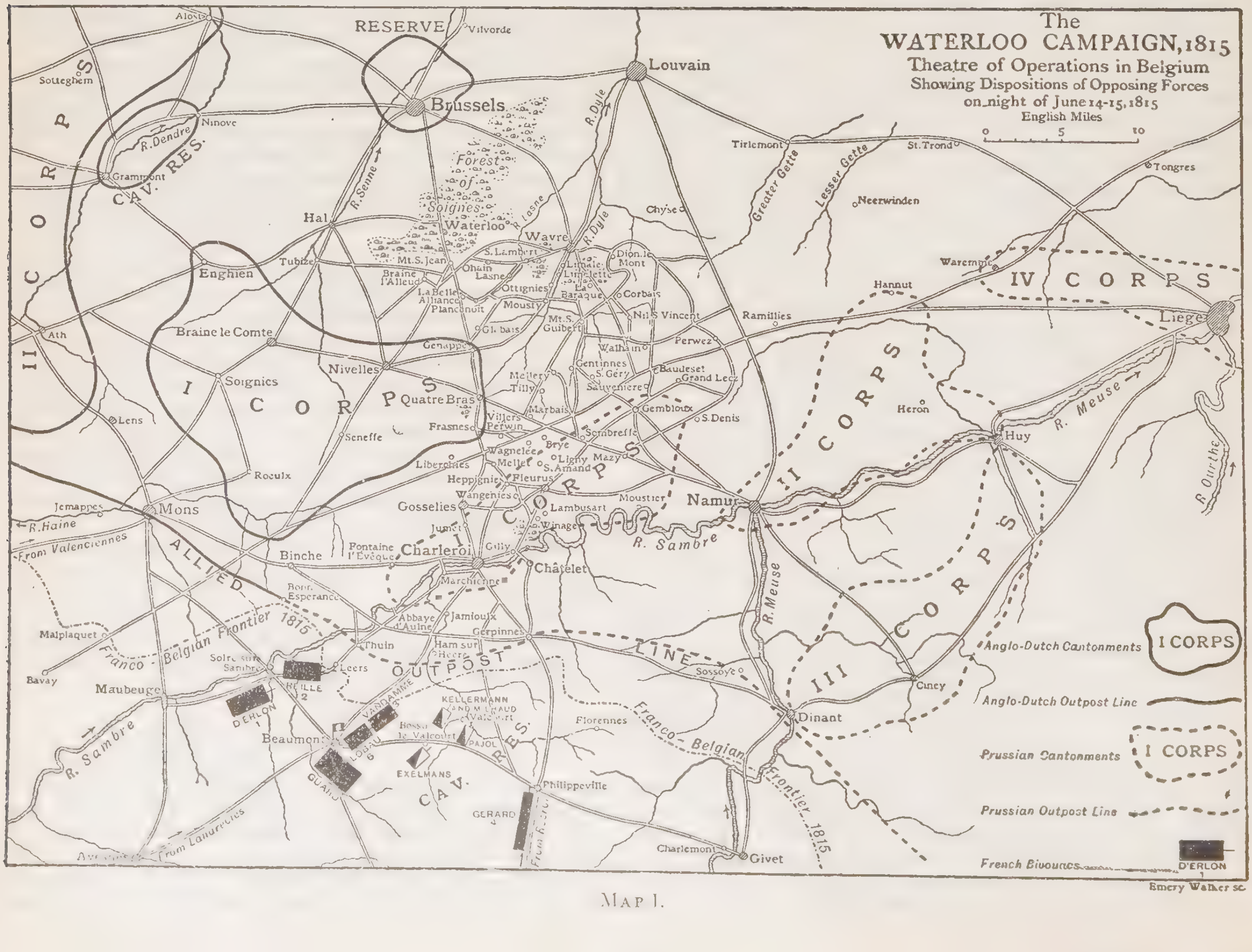
D'Erlon's I. Corps cantoned between Lille and Valenciennes.
Reille's II. Corps cantoned between Valenciennes and Avesnes.
Vandamme's III. Corps cantoned around Rocroi.
Gérard's IV. Corps cantoned at Metz.
Lobau's VI. Corps cantoned at Laon.
Grouchy's Cavalry Reserve at Guise.
Marshal Mortier with the Imperial Guard at Paris.
Rapp with the V. Corps (20,000) near Strassburg.

18,500 more troops under Suchet, Brune and Lecourbe guarded the S.E. frontier from Basel to Nice, and covered Lyons; 8000 men under Clausel and Decaen guarded the Pyrenean frontier; whilst Lamarque led 10,000 men into La Vendée to quell the insurrection in that quarter. In 1815 Napoleon was not supported by a united and unanimous France; the country was weakened by internal dissensions at the very moment when it was needful to put every man in line to meet the rising tide of invasion surging against the long curving eastern frontier.

Napoleon now pondered over his plan of campaign. In Belgium, across an almost open frontier, lay an ever-increasing force of Anglo-Dutch and Prussian troops under Wellington and Blücher. The Rhine frontier was threatened by Schwarzenberg's Austrians (210,000); Barclay de Tolly's Russians (150,000) were slowly coming up; and another Austrian force menaced the S.E. frontier of France. The allies determined that they would wage a war without risks, and they were particularly anxious to avoid the risk of defeat in detail. It was accordingly arranged that Wellington and Blücher should await in Belgium the arrival of the Austrian and Russian masses on the Rhine, about July 1, before the general invasion of France was begun. Thereafter, whatever befell, the allied armies would resolutely press forward towards Paris, affording each other mutual support, and with the tremendous weight of troops at their disposal thrust back Napoleon upon his capital, force him to fight in front of it, and drive him when defeated within its works. The end would then be in sight. Thus they had planned the campaign, but Napoleon forestalled them. In fact, the threatening danger forced his hand and compelled him to strike before he had collected a sufficient army for his defensive needs. Consequently he determined to advance swiftly and secretly against Wellington and Blücher, whose forces, as Napoleon knew, were dispersed over the country of their unenthusiastic ally. Thus he designed to crush a part of the coalition before the Russians and Austrians poured over the eastern frontier. Once Wellington and Blücher were destroyed he would move southwards and meet the other allies on the Rhine. He might thus compensate for his numerical inferiority by superior mobility and superior leadership.

Napoleon's plans. His information showed that Wellington held the western half of Belgium from the Brussels-Charleroi road to the Scheldt, that his base of operations was Ostend, and that his headquarters were at Brussels. Blücher, based on the Rhine at Coblentz, held the eastern half from the Brussels-Charleroi road to the Meuse, and had his headquarters at Namur. The emperor was convinced that nothing could be gained by invading Belgium from the S.E. or W.; such a stroke would surely drive the allies together, and that was never Napoleon's custom. On the other hand, if he struck straight at Charleroi—the allied junction point—he would drive the "Armée du Nord" like an armoured wedge between the allies, if only he caught them unsuspicious and unready. Forced asunder at the outset, each would (in all probability) fall back along his own line of communication, and the gap thus made between the allies would enable the emperor to manœuvre between them and defeat them in turn. To gain the best chance of success he would have to concentrate his whole army almost within gunshot of the centre of the enemies' outposts without attracting their attention; otherwise he would find the allies concentrated and waiting for him.

Wellington and Blücher were disposed as follows in the early days of June (Map I.). The Anglo-Dutch army of 93,000 with headquarters at Brussels were cantoned: I. Corps (Prince of Orange), 30,200, headquarters Braine-le-Comte, disposed in the area Enghien-Genappe-Mons; II. Corps (Lord Hill), 27,300, headquarters Ath, distributed in the area Ath-Oudenarde-Ghent; reserve cavalry (Lord Uxbridge) 9900, in the valley of the Dendre river, between Grammont and Ninove; the reserve (under Wellington himself) 25,500, lay around Brussels. The frontier in front of Leuze and Binche was watched by the Dutch-Belgian light cavalry.


The WATERLOO CAMPAIGN, 1815
Theatre of Operations in Belgium
Showing Dispositions of Opposing Forces on night of June 14-15, 1815
English Miles
0
5
10
RESERVE
Vilvorde
Alost
Sotteghem
Louvain
Brussels
R. Dyle
Forest of Soignes
Ninove
R. Dendre
Grammont
CAV. RES.
II CORPS
R. Senne
Hal
Waterloo
Lasne
Wavre
S. Lambert
Mt. S. Jean
Ohain
Braine l'Alleud
La Belle Alliance
Plancenoit
Ottignies
Mousty
Limale
Limelette
Dion le Mont
Corbais
Tubize
Enghien
Ath
Braine le Comte
Genappe
Gl. bais
Mt. S. Guibert
Nil S. Vincent
Walhain
Perwez
Ramillies
Tirlemont
Greater Gette
Lesser Gette
St. Trond
Tongres
Neerwinden
Chyse
Waremme
Hannut
IV CORPS
Liege
Nivelles
Soignies
I CORPS
Quatre Bras
Mellery
Tilly
Gentinnes
S. Géry
Sauvenière
Baudeset
Grand Leez
Marbais
Villers Perwin
Frasnes
Gembloux
S. Denis
II CORPS
Heron
Huy
R. Meuse
R. Ourthe
Lens
Seneffe
Brye
Ligny
Mazy
S. Amand
Wagnelée
Mellet
Sombreffe
Liberchies
Heppignies
Fleurus
Wangenies
Roeulx
Jemappes
R. Haine
Mons
Gosselies
Lambusart
Moustier
Namur
Jumet
I CORPS
Wanfercée
R. Sambre
From Valenciennes
Binche
Fontaine l'Évêque
Charleroi
Gilly
Châtelet
ALLIED
Bonr. Espérance
Marchienne
Abbaye d'Aulne
Jamioulx
Gerpinnes
R. Meuse
III CORPS
Malplaquet
Franco-Belgian Frontier 1815
Thuin
Ham sur Heure
OUTPOST LINE
Solre sur Sambre
Leers
REILLE 2
Bavay
Maubeuge
D'ERLON 1
VANDAMME 3
KELLERMANN AND MILHAUD
Vaicourt
Sossoye
Ciney
Dinant
Florennes
Beaumont
LOBAU 6
Bossu le Valcourt
PAJOL
Franco-Belgian Frontier 1815
R. Sambre
GUARD
EXELMANS
CAV. RES.
Philippeville
GERARD 4
From Landrecies
Avesnes
Charlemont
Givet
Anglo-Dutch Cantonments
I CORPS
Anglo-Dutch Outpost Line
Prussian Cantonments
I CORPS
Prussian Outpost Line
French Bivouacs
D'ERLON 1
Emery Walker sc.

MAP I.

Blücher's Prussian army of 116,000 men, with headquarters at Namur, was distributed as follows:—

I. Corps (Zieten), 30,800, cantoned along the Sambre, headquarters Charleroi, and covering the area Fontaine l'Évêque-Fleurus-Moustier.

II. Corps (Pirch I.), 31,000, headquarters at Namur, lay in the area Namur-Hannut-Huy.

III. Corps (Thielemann), 23,900, in the bend of the river Meuse, headquarters Ciney, and disposed in the area Dinant-Huy-Ciney.

IV. Corps (Bülow), 30,300, with headquarters at Liége, around that place.

The frontier in front of Binche, Charleroi and Dinant was watched by the Prussian outposts.

Thus the allied front extended for nearly 90 m. across Belgium, and the mean depth of their cantonments was 30 m. To concentrate the whole army on either flank would take six days, and on the common centre, about Charleroi, three days.

The allies had foreseen the very manœuvre that Napoleon designed to put into execution, and had decided that if an attempt were made to break their centre they would concentrate forwards and on their inner flanks, the Anglo-Dutch army forming up at Gosselies and the Prussians at Fleurus. Here they would be in contact, and ready to act united against Napoleon with a numerical superiority of two to one. The necessary three days' warning of the French concentration they felt certain they would obtain, for Napoleon's troops were at this juncture distributed over an area (Lille-Metz-Paris) of 175 m. by 100 m.; and to concentrate the French army unknown to, and unobserved by, the allies, within striking distance and before they had moved a man to meet the onrush of the foe, was unthinkable. But, as in 1800, it was the unthinkable that happened.

It will be seen that Blücher covered Fleurus, his concentration point, by Zieten's corps, in the hope of being able to collect his army round Fleurus in the time that Zieten would secure for him by a yielding fight. Wellington on the other hand was far less satisfactorily placed; for in advance of Gosselies he had placed only a cavalry screen, which would naturally be too weak to gain him the requisite time to mass there. Hence his ability to concentrate hung on the mere good luck of obtaining timely information of Napoleon's plans, which in fact he failed to obtain. But the two tracts of country covered by the allies differed vastly in configuration. Blücher's left was protected by the difficult country of the Ardennes. On the other hand, the duke's whole section lay close to an open frontier across which ran no fewer than four great roads, and the duke considered that his position "required, for its protection, a system of occupation quite different from that adopted by the Prussian army." He naturally relied on his secret service to warn him in such time as would enable him to mass and meet the foe. His reserve was well placed to move rapidly and promptly in any direction and give support wherever required.

The emperor made his final preparations with the utmost secrecy. The Army of the North was to concentrate in three fractions—around Solre, Beaumont and Philippeville—as close to Charleroi as was practicable; and he arranged to screen the initial movements of the troops as much as possible, so as to prevent the allies from discovering in time that their centre was aimed at. He directed that the movements of the troops when they drew near the allied outposts should be covered as far as possible by accidents of ground, for there was no great natural screen to cover his strategical concentration.

The French concentration.

Gérard and the IV. Corps from Metz, having the longest distance to go, started first (on June 6), and soon the whole army was in motion for the selected points of concentration, every effort being made to hide the movements of the troops. On June 11 Napoleon himself left Paris for the front, and by June 14 he had achieved almost the impossible itself; for there, at Solre, Beaumont and Philippeville, lay his mass of men, 124,000 strong, concentrated under his hand without rousing the enemy's suspicions, and ready to march across the frontier at dawn. Far different were things on the other side of the Sambre. The allies were still resting in fancied security, dispersed throughout widely distant cantonments; for nothing but vague rumours had reached them, and they had not moved a man to meet the enemy.

The opposing armies were of very different quality. Wellington's was a collection of many nationalities; the kernel being composed of his trusty and tenacious British and King's German Legion troops, numbering only 42,000 men. Of the remainder many were far from enthusiastic in the cause for which they had perforce to take up arms, and might prove a source of weakness should victory incline to the French eagles. Blücher's army was undoubtedly more homogeneous, and though it is doubtful if he possessed any troops of the same quality as Wellington's best, on the other hand he had no specially weak elements.

Napoleon was at the head of a veteran army of Frenchmen, who worshipped their leader and were willing to die for France if necessity demanded. But there were lines of weakness, too, in his army. He had left Marshal Davout behind in Paris, and Murat in disgrace; Suchet was far off on the eastern frontier, and Clausel was in the south of France. The political reasons for these arrangements may have been cogent, but they injured France at the very outset. Marshal Soult was appointed chief of the staff, a post for which he possessed very few qualifications; and, when the campaign began, command of the left and right wings had perforce to be given to the only two marshals available, Ney and Grouchy, who did not possess the ability or strategic skill necessary for such positions. Again, the army was morally weakened by a haunting dread of treason, and some of the chiefs, Ney for example, took the field with disturbing visions of the consequences of their late betrayal of the Bourbon cause, in case of Napoleon's defeat. Finally, the army was too small for its object. Herein Napoleon showed that he was no longer the Napoleon of Austerlitz; for he left locked up in far-distant secondary theatres no less than 56,500 men, of whom he could have collected some 30,000 to 36,000 for the decisive campaign in Belgium. Had he made in 1815 the wise distribution of his soldiers in the theatre of war which he made in his former immortal campaigns, he would have concentrated 155,000 to 160,000 of his available force opposite to Charleroi on June 14, and the issue of the campaign would hardly have been in doubt. But he failed to do so, and by taking the field with such inferior numbers he left too much to Fortune.

For his advance into Belgium in 1815 Napoleon divided his army into two wings and a reserve. As the foe would lie away to his right and left front after he had passed the Sambre, one wing would be pushed up towards Wellington and another towards Blücher; whilst the mass of the reserve would be centrally placed so as to strike on either side, as soon as a force of the enemy worth destroying was encountered and gripped. To this end he had, on the 14th, massed his left wing (Reille and D'Erlon) around Solre, and his right wing (Gérard) at Philippeville; whilst the central mass (Vandamme, Lobau, the Guard and the Cavalry Reserve) lay around Beaumont.

The orders for the French advance next day, among the finest ever issued, directed that the army should march at dawn and move to the Sambre at Marchienne and Charleroi. By evening it was expected that the whole would have crossed the Sambre, and would bivouac between the sundered allies.

The passage of the Sambre.

But at the very outset delays occurred. Owing to an accident that befell the single orderly despatched with orders for Vandamme, the III. Corps remained without other definite orders than those issued on June 13, warning them to be ready to move at 3 A.M. The corps therefore stood fast on the morning of June 15, awaiting further instructions. This was the more unfortunate as Vandamme was destined to lead the advance on Charleroi by the centre road. But the emperor regarded it merely as "an unfortunate accident," nothing more, and the advance in two wings and a reserve continued, undisturbed by such occurrences.

Gérard, too, was late in starting, for his corps had not been fully concentrated over-night. Zieten's outposts on the right bank of the Sambre gained still further time, for they fought stubbornly to retard the French advance on Marchienne and Charleroi. But Zieten declined, and very wisely, to fight on the right bank, and he made the most of the screen afforded by the little river. He had to delay the French advance for 24 hours and give time for Blücher's concentration, at the same time retaining his own freedom of manœuvre, and this in spite of the great length of the summer day, the short distance that he lay in front of Fleurus, the tremendous numerical superiority of the French and Napoleon's personal presence at their head.

When the French left wing and centre reached the Sambre bridges, at Marchienne and Charleroi, they found them held and strongly barricaded, and the cavalry were powerless to force the passage. It was nearing noon when the emperor reached the front with the Young Guard, whom he had personally hurried forward. He immediately took action, and under his direction the bridge at Charleroi was stormed shortly after noon. Almost at the same time Reille forced the passage at Marchienne. Instead of drawing his corps together and retreating *en masse* up the Fleurus road, Zieten wisely withdrew on two roads, using those to Quatre Bras and Fleurus. The defenders of Marchienne used the former, while the brigade which had held Charleroi fell back by the latter. The emperor at once began the advance along both the roads. The left wing was directed to push up the Gosselies-Quatre Bras road, and Pajol's cavalry followed the Prussians who retired along the Gilly-Fleurus road. The emperor took post at Charleroi. About 3 P.M. Marshal Ney joined the army, was given the command of the left wing, and ordered to drive the Prussians out of Gosselies, and clear the road northward of that place. Ney took over his command just when the attack on Gosselies was impending. The Prussians were driven from the town, but they managed to effect a roundabout retreat to Ligny, where they rallied. Ney pushed on his advance up the Brussels road. When he had left for the front, the emperor proceeded with Grouchy to reconnoitre the Prussian position at Gilly; and handing over the command of the right wing to the marshal, whom he ordered to capture Gilly, Napoleon returned to Charleroi, to hasten the passage of the French army across the Sambre and mass it in the gap between the allies. But the head of Vandamme's corps had by this time crossed the river, and the emperor ordered it to assist Grouchy.

What meanwhile were the allies doing? There is no doubt that, surprised by the suddenness of the French advance, they were caught unprepared. But on the 15th the critical nature of the situation dawned on them, and naturally on Blücher first, as his headquarters were nearer to the frontier than Wellington's, and Blücher had had previous experience of Napoleon's powers. As soon as the Prussian marshal got the first real warning of imminent danger, he ordered (in accordance with the pre-arranged plan) an immediate concentration of his army on his inner flank at Sombreffe. Unfortunately for him the first orders sent to Bülow by Gneisenau, chief of the staff, at midnight June 14–15, were written in so stilted and hazy a style that Bülow did not consider any especial display of energy was required. Hence the IV. Corps was neutralized until after the 16th. The other two corps commanders (Pirch I. and Thielemann) received clearer orders, and acted promptly enough. They concentrated their scattered men and hastened to march to the appointed rendezvous. By nightfall Pirch I. had bivouacked the II. Corps at Mazy, only 4 m. short of Sombreffe, and Thielemann and the III. Corps had reached Namur, within easy distance of the Ligny battlefield. Blücher wisely shifted his own headquarters to Sombreffe on the afternoon of the 15th.

Wellington's position at nightfall was very different, and can hardly be termed safe or even satisfactory. Definite news of the French advance only reached Brussels about 3 P.M. on the 15th; and even then the duke was by no means certain of the direction of Napoleon's main stroke. Hence the first orders he issued were for his divisions to concentrate at their respective alarm-posts, intending later to send them further orders when the situation had somewhat cleared up. For whatever reasons, Wellington thought Napoleon would attempt to turn his right and cut his line of communications. Had Napoleon attempted this he would (if successful) have driven the Anglo-Dutch army back upon the Prussians, instead of separating the allies, as he actually tried to do and very nearly succeeded in doing. Failing to appreciate this fully, Wellington omitted to order an immediate concentration on his inner (left) flank as Blücher had done, and the danger of Blücher's position was thus enormously increased.

Curiously enough, the allies do not appear to have decided upon the course to be taken in case they were surprised, as they virtually were, and their system of intercommunication—if system it can be called—was most imperfect. They ought to have arranged loyally and promptly to let each other know every move it was proposed to make and the reasons for moving, for thus only could concerted action be ensured when confronted with Napoleon, "in whose presence it was so little safe to make . . . a false movement."

Wellington's subordinates at the critical point, however, acted with admirable boldness. Prince Bernard, in command of a brigade at Quatre Bras and Frasnes, recognizing the pressing danger that threatened on the Brussels road, retained his position there to check the French advance, instead of drawing off westwards and massing with the rest of his division at Nivelles; and in this action he was firmly supported by his immediate superiors. It was due to their presence of mind that Wellington maintained his hold on the important strategical point of Quatre Bras on June 15 and 16. Consequently, as Ney's wing advanced northward from Gosselies along the Brussels road, it came upon an advanced detachment of this force at Frasnes. The detachment was quickly forced to retire on its supports at the cross-roads, but here Prince Bernard firmly held his position; and by his skilful use of cover and the high standing corn he prevented the French gauging the weakness of the small force that barred their way. The day was now drawing to a close, and Ney decided wisely not to push his advance any farther. He was in front of a force of unknown strength which appeared resolved to stand its ground, his men were tired, and the cannon-thunder to his right rear proclaimed clearly that Grouchy had not made much headway on the Fleurus road. To push on farther might isolate the left wing among a host of allies. He therefore halted his command, and, later, made a report to the emperor.

Meanwhile two long hours had been wasted on the right whilst Grouchy and Vandamme deliberated over their plan of action in front of the Prussian brigade at Gilly; and it was not until the emperor himself again reached the front, about 5.30 P.M., that vigour replaced indecision. There was a brief bombardment, and then Vandamme's corps was sent forward with the bayonet to drive out the foe. The shock was too great; the Prussians gave way immediately and were chased back into the woods by cavalry. Grouchy now pushed on towards Fleurus, which was still held by Blücher's troops, and there the advance came to a halt, as the light was failing and the troops exhausted.

Thus, thanks to Zieten's fine delaying action, Blücher by nightfall on June 15 had secured most of the ground requisite for his pre-arranged concentration; for one corps was in position, and two others were at hand. Bülow's corps was unavailable, for the reason already given, but of this fact Blücher was still necessarily ignorant. Wellington, owing to his original dispositions and the slowness of his concentration, had only retained a grip on Quatre Bras thanks to the boldness of his subordinates on the spot. His other troops were assembling: I. Corps, Nivelles, Braine-le-Comte and Enghien; II. Corps, Ath, Grammont and Sotteghem; heavy cavalry at Ninove; Reserve at Brussels. During the night of the 15th orders were sent for the divisions to move eastwards towards Nivelles, and at dawn the Reserve marched for Mt. S. Jean. Thus Wellington did not even yet realize the full significance of the emperor's opening moves.

But if the intelligence which the duke rightly relied on had come to hand on the 15th, it cannot be doubted that he would have effected a more expeditious concentration on his inner flank. His trusted intelligence officer, Colonel Colquhoun Grant, was at this time in France, and it had been arranged that his reports should be received at the duke's outposts by General Dörnberg, for transmission to the duke. On June 15 Grant wrote to Wellington stating that the French were advancing, and that French officers spoke freely about a decisive action being fought within three days. But Dörnberg, arrogating to himself the right of selecting the reports which were worth forwarding, sent it back, saying that, so far from convincing him that the emperor was advancing to give battle, it assured him of the contrary. Owing to this officer's presumptuous folly Grant's information only reached the duke on June 18, too late to be of use.

The Army of the North on this night was disposed as follows:—The left wing stretched from Frasnes back to the Sambre at Marchienne and Thuin. Reille's corps was to the front and was covered by the light cavalry of the Guard and Piré's lancers. Ney's headquarters were at Gosselies; one division (Girard's) was at Wangenies and acted as a link between the two wings. The right wing, under Grouchy, had come to a halt in front of Fleurus. It was covered by Pajol's and Exelmans' cavalry corps. Vandamme's was the leading infantry corps, and it bivouacked with its head at Winage. Gérard's corps (with which was Kellermann's cuirassier corps) halted astride the Sambre at Chatelet. Gérard's advance had been delayed owing to the commander of his leading division deserting with his staff to the Prussians. Consequently the IV. Corps had not assisted at all in the passage of the river; though had it only been present, it would have been magnificently placed to co-operate with Grouchy in the action of Gilly. Thus each of these strategical covering forces was itself protected by an adequate tactical advanced guard, to perform the service of local protection. The centre (or reserve) was meanwhile disposed as follows: The Guard was halted between Gilly and Charleroi; the emperor's headquarters being at the latter place. Milhaud's Cuirassier corps and Lobau's (VI.) corps were south of the Sambre, between Charleroi and Jamioulx. In this particular the execution on June 15 fell short of the original conception, for at nightfall about one-third of the French army was still on the right bank of the river. This, however, signified little, for the emperor still occupied a dominant strategical position.

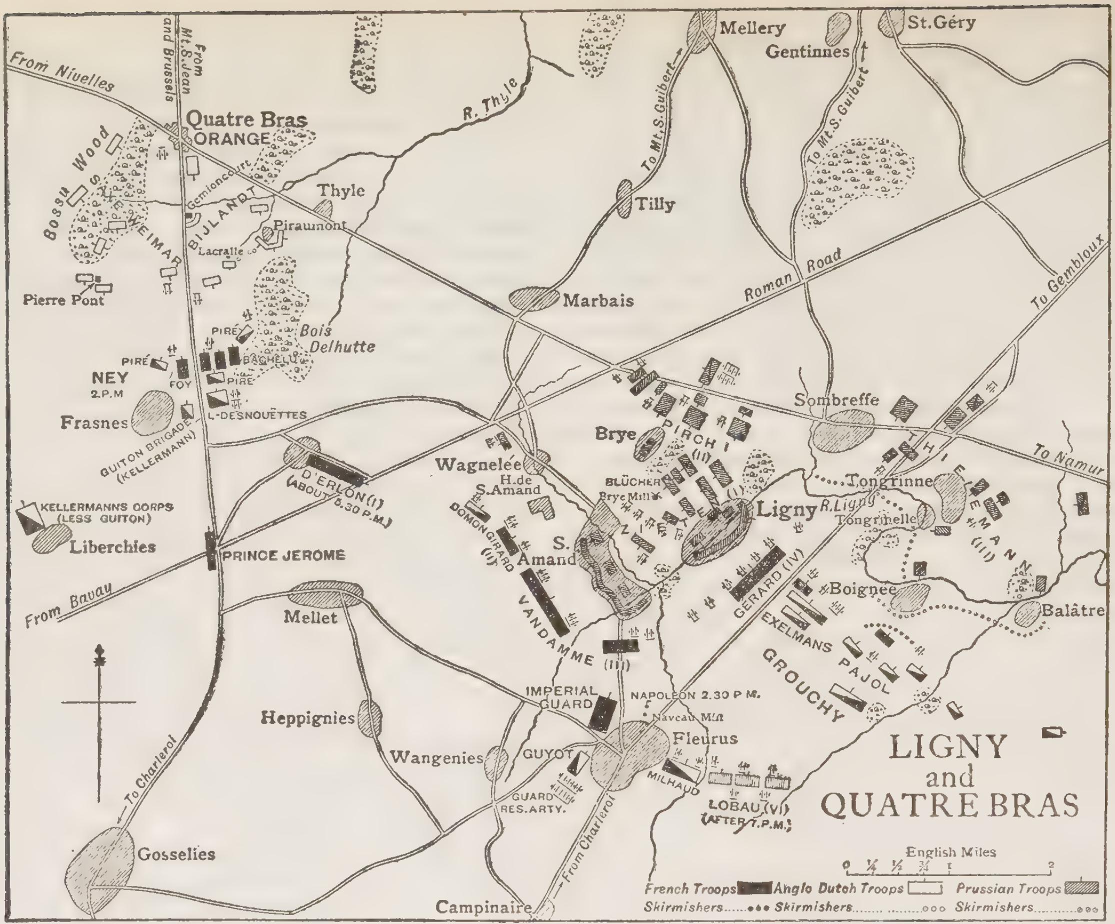
Napoleon had now perfected his arrangements for the invasion of Belgium, and his army was organized definitely in two wings and a reserve; the latter being so placed that it could be brought "into action on either wing as circumstances dictated." As circumstances dictated, either wing would fasten upon one of the allied armies and detain it until the reserve had time to come up and complete its destruction; the other wing meantime detaining the other allied army and preventing its commander from coming to his colleague's assistance. The emperor was not in possession of the Namur-Nivelles road. The allies were thus afforded an opportunity of committing the very blunder which Napoleon longed for, namely to attempt a risky forward concentration. His dispositions on the night of the 15th–16th were skilfully calculated to encourage the allies to mass at Quatre Bras and Sombreffe, and his covering force were pushed sufficiently forward—to Frasnes and Fleurus—to grip whichever ally adventured his army first. At nightfall the Army of the North lay concentrated "in a square whose sides measured 12 m. each; and it could with equal facility swing against the Prussians or the Anglo-Dutch, and was already placed between them."

Early on the morning of June 16 Prince Bernard was reinforced at Quatre Bras by the rest of his division (Perponcher's); and Wellington's other troops were now all on the march eastward except the reserve, who were heading southwards and halted at the cross-road of Mt. S. Jean until the duke had resolved that their objective should be Quatre Bras. They then marched in that direction. Blücher meanwhile was making his arrangements to hold a position to the south of the Namur-Nivelles road and thus maintain uninterrupted communication with Wellington at Quatre Bras. In this way he would keep open the Namur road, and also that from Gembloux for Bülow's arrival.

Napoleon spent the early morning in closing up his army, and writing what proved to be the most important letter of the campaign to Ney (Charleroi, about 8 A.M.): "I have adopted as the general principle for this campaign to divide my army into two wings and a reserve. . . . The Guard will form the reserve, and I shall bring it into action on either wing just as circumstances dictate. . . . According to circumstances I shall weaken one wing to strengthen my reserve. . . ." Here, in its simplest form, is the principle that underlies Napoleon's strategy in 1815. Only on the wing on which the reserve is brought into action will a decisive result be aimed at. The other is to be used exclusively to neutralize the other enemy, by holding him at bay.

Napoleon's original plan for the 16th was based on the assumption that the allies, who had been caught napping, would not attempt a risky forward concentration; and he intended therefore to push an advanced guard as far as Gembloux, for the purpose of feeling for and warding off Blücher. To assist this operation the reserve would move at first to Fleurus to reinforce Grouchy, should he need assistance in driving back Blücher's troops; but, once in possession of Sombreffe, the emperor would swing the reserve westwards and join Ney, who, it was supposed, would have in the meantime mastered Quatre Bras. In pursuance of this object Ney, to whom Kellermann was now attached, was to mass at Quatre Bras and push an advanced guard 6 m. northward of that place, with a connecting division at Marbais to link him with Grouchy. The centre and left wing together would then make a night-march to Brussels. The allies would thus be irremediably sundered, and all that remained would be to destroy them in detail. Napoleon now awaited further information from his wing commanders at Charleroi, where he massed the VI. Corps (Lobau), to save it, if possible, from a harassing countermarch, as it appeared likely that it would only be wanted for the march to Brussels. Ney spent the morning in massing his two corps, and in reconnoitring the enemy at Quatre Bras, who, as he was informed, had been reinforced. But up till noon he took no serious step to capture the cross-roads, which then lay at his mercy. Grouchy meantime reported from Fleurus that Prussian masses were coming up from Namur, but Napoleon does not appear to have attached much importance to this report. He was still at Charleroi when, between 9 and 10 A.M., further news reached him from the left that considerable hostile forces were visible at Quatre Bras. He at once wrote to Ney saying that these could only be some of Wellington's troops, and that Ney was to concentrate his force and crush what was in front of him, adding that he was to send all reports to Fleurus. Then, keeping Lobau provisionally at Charleroi, Napoleon hastened to Fleurus, arriving about 11. He found that Grouchy had made little progress beyond the town. As he surveyed the field from the windmill north of Fleurus it struck him as significant that Blücher's troops were disposed parallel to the Namur road, as if to cover a forward concentration, and not at right angles to it, as they would be had they been covering a retreat. Still, at the moment, only one corps was showing. Possibly, however, the decisive day of the campaign had come. By the emperor's arrangements Vandamme, Gérard, Pajol and Exelmans would be available after 2 P.M. to attack whatever force Blücher might command, and the Guard and Milhaud would be at hand to act as reserve. The wonder is that he did not now order Lobau to move to some intermediate position, such as Wangenies, where he would be available for either wing as circumstances dictated. At 2 P.M. Napoleon ordered Ney to master Quatre Bras, and added that the emperor would attack the corps which he saw in front of him. Whichever wing succeeded first would then wheel inwards and help the other. Not yet had Napoleon grasped the full significance of the allied movements, for the decisive flank had not yet become clear.

Blücher had already determined to fight. Meanwhile, Wellington, having reached Quatre Bras in the morning, wrote to him to concert the day's operations; then, as all was quiet in his front, he rode over to meet Blücher at Brye. The two chiefs, surveying the French army in their front, considered that no serious force was in front of Quatre Bras, and Wellington terminated the interview with the conditional promise that he would bring his army to Blücher's assistance at Ligny, if he was not attacked himself. This promise, of course, was never fulfilled, for Ney employed the duke all day at Quatre Bras; and, furthermore, the duke's tardy concentration made it quite impossible for him to help Blücher directly on the Ligny battlefield. On his return to Quatre Bras he found that a crisis had already been reached.


LIGNY
and
QUATRE BRAS
From Nivelles
From Mt. S. Jean and Brussels
Quatre Bras
ORANGE
Bossu Wood
S. WEIMAR
BIJLANDT
Gemioncourt
Thyle
R. Thyle
Piraumont
Lacralle
Pierre Pont
PIRÉ
Bois Delhutte
BACHELU
NEY
2.P.M
FOY
Frasnes
L-DESNOUËTTES
GUITON BRIGADE (KELLERMANN)
KELLERMANNS CORPS (LESS GUITON)
Liberchies
D'ERLON (I) (ABOUT 6.30 P.M.)
PRINCE JEROME
From Bavay
Mellet
Heppignies
Wangenies
Gosselies
To Charleroi
Mellery
Gentinnes
St. Géry
To Mt. S. Guibert
Tilly
Marbais
Roman Road
To Gembloux
Sombreffe
To Namur
Brye
PIRCH I (II)
Wagnelée
H. de S. Amand
BLÜCHER
Brye Mill
ZIETEN (I)
Ligny
R. Ligny
Tongrinne
Tongrinelle
THIELMANN (III)
DOMONGIRARD (II)
S. Amand
VANDAMME (III)
GERARD (IV)
Boignée
Balâtre
EXELMANS
PAJOL
GROUCHY
IMPERIAL GUARD
NAPOLEON 2.30 P.M.
Naveau Mill
Fleurus
GUYOT
GUARD RES. ARTY.
MILHAUD
LOBAU (VI) (AFTER 7 P.M.)
From Charleroi
Campinaire
English Miles
0 ¼ ½ ¾ 1 2
French Troops
Anglo Dutch Troops
Prussian Troops
Skirmishers
Emery Walker sc.

Map II.

Quatre Bras. Ney had allowed the valuable hours to slip away when he could have stormed Quatre Bras with ease and ensured co-operation with his master. Remembering the surprises that the battles in Spain had provided for the marshals opposed to the duke, he massed nearly the whole of Reille's corps before he advanced. The prince of Orange, in command at Quatre Bras, had only 7500 troops. But by boldly scattering his force and by making use of the Bossu wood and the farms, he covered the cross-roads and showed a firm front to the very superior force which Ney commanded. It was then 2 P.M. The Dutch-Belgian troops to the east of the Brussels highway were at once forced back by the mass of men moved against them, and it looked as if the whole defence would crumple up. But about 3 P.M. timely succour reached the field—Van Merlen's cavalry from Nivelles, Picton and the 5th division from Brussels—and Wellington returned and took over the command. Picton at once stopped the victorious French advance to the east of the road, but the remaining division (Jérôme) of Reille's corps now reached the front and Ney flung it into the Bossu wood to clear that place and keep his left flank free. A fierce fight now broke out all along the line, in which Jérôme steadily made ground in the Bossu wood, while Picton showing a dauntless front maintained his position. The Brunswick contingent now reached the field, but their duke whilst leading a charge received a mortal wound and the attack failed. It was nearly 4.15 P.M. when Ney received Napoleon's 2 P.M. order, and in obedience to it he made another attack, in which the Bossu wood was virtually cleared of its defenders. However, about 5 P.M. further reinforcements reached Wellington, Alten's (3rd) division coming in from Nivelles. Ney now realized that he could only capture Quatre Bras with D'Erlon's help.

But shortly afterwards (about 5.15) he heard that the I. Corps, without his direct order or knowledge, had moved eastwards to assist in the battle of Ligny. Immediately afterwards (about 5.30) he received an order from Napoleon to seize Quatre Bras and then turn eastwards to crush Blücher, who was caught at Ligny. Napoleon added, "The fate of France is in your hands." Ney's duty was merely to hold Wellington for certain at Quatre Bras and allow D'Erlon to carry out the movement which must ensure a decisive result at Ligny, in accordance with Napoleon's plan of campaign. In any case D'Erlon could not come back in time to give him effectual help. But incapable of grasping the situation, and beside himself with rage, Ney sent imperative orders to D'Erlon to return at once, and immediately afterwards he ordered Kellermann to lead his one available cuirassier brigade and break through Wellington's line. The charge was admirably executed; it overthrew one British regiment which it caught in line, but being unsupported it achieved nothing further of importance, and was beaten back. When this attempt to master the cross-roads had ended in failure, Ney received a verbal message from the emperor, enjoining him that, whatever happened at Quatre Bras, D'Erlon must be allowed to carry out the movement ordered by the emperor. The bearer, Major Baudus, knowing the importance of the manœuvre which the I. Corps was carrying out, strove to induce Ney to reconsider D'Erlon's recall; but the marshal refused and ended the discussion by plunging into the fight. Shortly afterwards (about 7 P.M.) Wellington received further reinforcements (Cooke's division of the British Guards), which brought his force up to 33,000 against Ney's 22,000 men. The duke then attacked strenuously all along the line, and before darkness stopped the fight he drove back the French to their morning position at Frasnes. The losses were as follows: Anglo-Dutch 4700, and French 4300. At 9 P.M., when the battle was lost and won, D'Erlon's corps arrived. It had already reached the edge of the Ligny battlefield when the counter-order arrived, and conceiving that he was still under Marshal Ney (for the officer who bore the pencil-note directing Ney to detach

D'Erlon, had on his own initiative ordered the I. Corps to the eastward) the general considered he ought to return to the left wing, and leaving one division at Wagnelée he withdrew his force. The incident was immeasurably unfortunate for the French. Had the I. Corps been thrown into the doubtful struggle at Quatre Bras, it must have crushed Wellington; had it been used at Ligny it would have entailed Blücher's annihilation. But oscillating between the two fields, it took part in neither. When the fighting was over, at 10 P.M., Ney wrote a short and somewhat one-sided account of the action to Soult.

Ligny.

On the other flank there had meanwhile been waged the bitterly fought battle of Ligny. As Blücher's dispositions gradually became clearer the emperor realized that the first decisive day of the campaign had actually come, and he promptly made arrangements for defeating the Prussian army in his front. Blücher, to cover the Namur road, held with the I. Corps the villages of Brye, St Amand and Ligny, whilst behind his centre was massed the II. Corps, and on his left was placed the III. Corps. Wellington and Bülow on arrival would act as general reserve. Blücher's army, as he finally disposed it, was quite visible to Napoleon on the bare open slopes which it occupied above St Amand and Ligny, the II. Corps being especially exposed. The emperor decided to bear down Blücher's centre and right with the corps of Vandamme and Gérard and with Girard's division which he had drawn into his operations, containing the Prussian left meanwhile with the squadrons of Pajol and Exelmans, assisted by a few infantry. The Guard and Milhaud were in hand at Fleurus. Further, he could order up Lobau, and direct Ney to move his rearward corps across and form it up behind Blücher's right. When the battle was ripe, he would crush the Prussian centre and right between the Guard and D'Erlon's corps. It was a somewhat complicated manœuvre; for he was attempting to outflank his enemy with a corps that he had subordinated to Marshal Ney. Much depended on whether Ney would grasp the full purport of his orders; in a similar case at Bautzen he had failed to do so, and he failed as badly now. The usual Napoleonic simplicity was wanting at Ligny, and he paid in full for the want.

It was just after 2·30 P.M. when Napoleon, hearing the sound of Ney's cannon to the westward and realizing that Wellington was attacked and neutralized, commenced the battle at Ligny. Blücher's force was numerically very superior. The Prussians numbered about 83,000 men to Napoleon's 71,000 (including Lobau, who only came up at the end of the day). A fierce fight was soon raging for the villages. Vandamme and Girard attacked S. Amand, whilst Gérard attempted to storm Ligny; on the right Grouchy held Thielemann in play, and in the centre near Fleurus were the Guard and Milhaud in reserve, close to the emperor's headquarters on the mill. At 3.15 P.M., when the battle was in full swing, Napoleon wrote in duplicate to Ney, saying, "The fate of France is in your hands," and ordering the marshal to master Quatre Bras and move eastwards to assist at Ligny. Immediately afterwards, hearing that Ney had 20,000 men in front of him, he sent the "pencil-note" by General La Bédoyère which directed Ney to detach D'Erlon's corps to Ligny. This, as we know, the A.D.C. in a fit of mistaken zeal took upon himself to do. Hence the corps appeared too soon, and in the wrong direction. But neither order made it sufficiently clear to Ney that co-operation at Ligny was the essential, provided that Wellington was held fast at Quatre Bras. In other words, Ney had merely to hold Wellington with part of the French left wing all day, and detach the remainder of his force to co-operate in the deathblow at Ligny. This is clear when the first letter to Ney is studied with the orders, as it was meant to be; but Ney in the heat of action misread the later instructions. Meanwhile the emperor ordered Lobau to bring up his corps at once to Fleurus where he could hardly be of great service, whereas had he been directed to move on Wagnelée he might have co-operated in the last struggle far more efficiently. The fight for the villages continued to rage fiercely and incessantly, each side behaving as if its mortal foe was in front. The villages were captured and recaptured, but generally the French had the better of the fighting, for they compelled Blücher to use up more and more of his reserves, and prevented the Prussians from breaking through to the southward of S. Amand. Eventually the fighting became so furious that the troops engaged literally melted away, particularly at Ligny, and the emperor was finally compelled to call on his reserve to replenish the troops first engaged. But hardly had the Young and Middle Guard marched off to reinforce Vandamme and Gérard, when Vandamme sent word that a hostile column, over 30,000 strong, was threatening the French left (in reality this was D'Erlon's corps). Vandamme's exhausted troops were unnerved at the sight of this fresh foe, and an incipient panic was only quelled by turning guns on the fugitives. It was now between 5.30 and 6. The emperor concluded that this could not be D'Erlon, because he had arrived too soon and was marching in an evidently wrong direction. He at once sent an officer to reconnoitre. Meanwhile the reinforcements which he had despatched were most opportune. The Prussians had seized the opportunity offered by the slackening of the French attacks to rally and deliver a counterstroke, which was parried, after achieving a small measure of success, by the bayonets of the Young Guard. It was about 6.30 before Napoleon learned that the unknown force was actually D'Erlon's, and somewhat later he heard that it had counter-marched and withdrawn westwards. Repeated orders sent to the commander of the division left by D'Erlon failed to induce him to engage his command decisively, and thus Napoleon obtained no direct co-operation from his left wing on this, the first decisive day of the campaign. Thus relieved about his left, but realizing that D'Erlon had returned to Ney, the emperor had perforce to finish the battle single-handed. Blücher now delivered a general counterstroke against Vandamme. Massing every available man he led the attack in person; but he vainly attempted to make ground to the south of S. Amand; the exhausted Prussians were overpowered by the chasseurs of the Guard and forced to retire in disorder. Napoleon's opportunity to finish the battle had come at last. He could at least beat Blücher and render the Prussians unfit for any serious operation except retreat on June 17, although he could no longer expect to destroy the Prussian army. Lobau's corps, too, was now arriving and forming up on the heights east of Fleurus. The artillery of the Guard, therefore, came into action above Ligny to prepare Blücher's centre for assault. Some delay was occasioned by a thunderstorm; but, as this passed over, the guns opened and the Old Guard and Milhaud's cuirassiers proceeded to form up opposite to Ligny. About 7.45 P.M. a crashing salvo of 60 guns gave the signal for a combined assault to be delivered by Gérard and the Guard, with Milhaud moving on their right flank. Blücher's worn-out soldiers could not withstand the tremendous impact of Napoleon's choicest troops, and the Prussian centre was pierced and broken. But the gallant old marshal still had some fresh squadrons in hand, and he promptly launched them to stem the French advance. While leading one of the charges in person his horse was shot and fell under him, but he was rescued and borne in a semi-conscious condition from the field. Without doubt, the personal risk to which Blücher exposed himself at this crisis was far too great; for it was essential that the command of the Prussian army should remain vested in a chief who would loyally keep in touch and act entirely in concert with his colleague. In this way only could the allies hope to obtain a decisive success against Napoleon. By 9 P.M. the main battle was over, and everywhere the French pushed resistlessly forward. Napoleon was master of Blücher's battlefield, and the beaten Prussians had retired to the north of the Namur-Nivelles road. Under the circumstances, the late hour, the failing light and the lack of information as to events on the left wing, immediate pursuit was out of the question.

The execution had again fallen short of the conception; Blücher though beaten was not destroyed, nor was his line with Wellington cut. If the Prussians now retired northwards, parallel to the direction which Wellington would follow perforce on the morrow, the chance of co-operating in a decisive battle would still remain to the allies; and Gneisenau's order issued by moonlight, directing the retreat on Tilly and Wavre, went far to ensuring the possibility of such combined action. However, Gneisenau was very remiss in not immediately reporting this vital move and the necessity for it to the duke, as it left the Anglo-Dutch inner flank quite exposed. Gneisenau apparently selected Wavre, not with the intention of assisting his ally, but rather to re-establish his own line of communication, and the presence of the Prussians on the field of battle of Waterloo must be put down to the immortal credit of Blücher and Grolmann, his quartermaster-general. Gneisenau at this crisis in the affairs of the allies does not appear to have subordinated everything to co-operation at all cost with Wellington, and he allowed supply considerations and the re-establishment of his communications to overweigh the paramount necessity of arranging concerted action with his ally. Probably Wellington's failure to co-operate at Ligny had heightened the Prussian chief-of-staff's unworthy suspicions of the good faith and soldierly qualifications of the British marshal; and it was well for the allies that Blücher was able to resume command before Napoleon had time to profit from the dissensions that would probably have arisen had Gneisenau remained in control. The casualties in the hard-fought battle of Ligny were very heavy. The Prussians lost about 12,000 men and 21 guns, and the French 8500; in Ligny more than 4000 dead lay on an area of about 400 sq. yds., and in one of the hamlets of S. Amand there lay, almost to a man, the gallant 82nd of the line (Girard's division). So close was the fighting that most of the 20,000 casualties lay on about 2 sq. m. of ground. It was a really Napoleonic battle.

Despite D'Erlon's misadventure the emperor had the game still in his hands, for Ney's failure had actually placed the Anglo-Dutch army in a precarious position. So true is it that a tactical failure encountered in carrying out a sound strategical plan matters but little. Again Napoleon's plan of campaign had succeeded. The emperor having beaten Blücher, the latter must fall back to rally and re-form, and call in Bülow, who had only reached the neighbourhood of Gembloux on June 16; whilst on the other flank Ney, reinforced by D'Erlon's fresh corps, lay in front of Wellington, and the marshal could fasten upon the Anglo-Dutch army and hold it fast during the early morning of June 17, sufficiently long to allow the emperor to close round his foe's open left flank and deal him a deathblow. But it was clearly essential to deal with Wellington on the morrow, ere Blücher could again appear on the scene. Wellington was by no means so well acquainted with the details of the Prussian defeat at Ligny as he ought to have been. It is true that, before leading the final charge, Blücher despatched an aide-de-camp to his colleague, to tell him that he was forced to retire; but this officer was shot and the message remained undelivered. To send a message of such vital importance by a single orderly was a piece of bad staff work. It should have been sent in triplicate at least, and it was Gneisenau's duty to repeat the message directly he assumed temporary command. Opposed as they were to Napoleon, Gneisenau's neglect involved them in an unnecessary and very grave risk.

June 17.

Napoleon was unwell, and consequently was not in the saddle on the 17th as early as he would otherwise have been. In his absence neither Ney nor Soult appears to have made any serious arrangements for an advance, although every minute was now golden. During the night more reinforcements arrived for Wellington, and on the morning of June 17 the duke had most of his army about Quatre Bras. But it was 24 hours too late, for Blücher's defeat had rendered the Anglo-Dutch position untenable. Early in the morning Wellington (still ignorant of the exact position of his ally) sent out an officer, with an adequate escort, to establish touch with the Prussians. This staff officer discovered and reported that the Prussians were drawing off northwards to rally at Wavre; and about 9 A.M. a Prussian orderly officer arrived from Gneisenau to explain the situation and learn Wellington's plans. The duke replied that he should fall back on Mt S. Jean, and would accept battle there, in a selected position to the south of the Forest of Soignes, provided he was assured of the support of one of Blücher's corps. Like the good soldier and loyal ally that he was, he now subordinated everything to the one essential of manœuvring so as to remain in communication with Blücher. It was 2 A.M. on June 18 before he received the answer to his suggestion.

Early on the 17th the Prussians drew off northwards on three roads, Thielemann covering the withdrawal and moving via Gembloux to join hands with Bülow. The French cavalry on the right, hearing troops in motion on the Namur road, dashed in pursuit down the turnpike road shortly after dawn, caught up the fugitives and captured them. They turned out to be stragglers; but their capture for a time helped to confirm the idea, prevalent in the French army, that Blücher was drawing off towards his base. Some delay too was necessary before Napoleon could finally settle on his plan for this day. The situation was still obscure, details as to what had happened on the French left were wanting, and the direction of Blücher's retreat was by no means certain. Orders, however, were sent to Ney, about 8 A.M., to take up his position at Quatre Bras, and if that was impossible he was to report at once and the emperor would co-operate. Napoleon clearly meant that Ney should attack whatever happened to be in his front. If confronted by a rear-guard he would drive it off and occupy Quatre Bras; and if Wellington was still there the marshal would promptly engage and hold fast the Anglo-Dutch army, and report to the emperor. Napoleon would in this case hasten up with the reserve and crush Wellington. Wellington in fact was there; but Ney did nothing whatever to retain him, and the duke began his withdrawal to Mt. S. Jean about 10 A.M. The last chance of bringing about a decisive French success was thus allowed to slip away.

Grouchy's operations.

Meanwhile Napoleon paid a personal visit about 10 A.M. to the Ligny battlefield, and about 11 A.M. he came to a decision. He determined to send the two cavalry corps of Pajol and Exelmans, and the corps of Vandamme and Gérard, with Teste's division (VI. Corps), a force of 33,000 men and 110 guns, to follow the Prussians, penetrate their intentions and discover if they meditated uniting with Wellington in front of Brussels. As Exelmans' dragoons had already gained touch of the III. Prussian corps at Gembloux, the emperor directed Marshal Grouchy, to whom he handed over the command of this force, to "proceed to Gembloux." This order the marshal only too literally obeyed. After an inconceivably slow and wearisome march, in one badly arranged column moving on one road, he only reached Gembloux on June 17, and halted there for the night. His cavalry gained contact before noon with Thielemann's corps, which was resting at Gembloux, but the enemy was allowed to slip away and contact was lost for want of a serious effort to keep it. Grouchy did not proceed to the front, and entirely failed to appreciate the situation at this critical juncture. Pressing danger could only exist if Blücher had gone northwards, and northwards, therefore, in the Dyle valley, he should have diligently sought for traces of the Prussian retreat.[1] Had Blücher gone eastwards, Grouchy, holding the Dyle, could easily have held back any future Prussian advance towards Wellington. Grouchy, however, went to Gembloux as ordered. By nightfall the situation was all in favour of the allies; for Grouchy was now actually outside the four Prussian corps, who were by this time concentrated astride the Dyle at Wavre. Their retreat having been unmolested, the Prussians were ready once more to take the field, quite twenty-four hours before Napoleon deemed it possible for the foe defeated at Ligny.

On the other flank, too, things had gone all in favour of Wellington. Although the emperor wrote to Ney again at noon, from Ligny, that troops had now been placed in position at Marbais to second the marshal's attack on Quatre Bras, yet Ney remained quiescent, and Wellington effected so rapid and skilful a retreat that, on Napoleon's arrival at the head of his supporting corps,

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[1] There appears to be no reason to believe that Grouchy pushed any reconnaissances to the northward and westward of Gentinnes on June 17; had he done so, touch with Blücher's retiring columns must have been established, and the direction of the Prussian retreat made clear. The right of Milhaud's cuirassier corps, whilst marching from Marbais to Quatre Bras, saw a column of Prussian infantry retiring towards Wavre, and Milhaud reported this fact about 9 P.M. to the emperor, who, however, attached little weight to it.

Napoleon's pursuit of Wellington.

he found only the duke's cavalry screen and some horse artillery still in position. Can we wonder that he gave vent to his anger and declared that Ney had ruined France? This was the fatal mistake of the campaign, and Fortune turned now against her former favourite. Although the smouldering fires of his old energy flamed out once more and Napoleon began a rapid pursuit of the cavalry screen, which crumpled up and decamped as he advanced, yet all his efforts were powerless to entangle the Anglo-Dutch rearguard to such an extent that Wellington must turn back to its assistance. The pursuit, too, was carried out in the midst of a tropical thunderstorm which broke at the roar of the opening cannonade, and very considerably retarded the French pursuit. It was not until the light was failing that Napoleon reached the heights of Rossomme opposite to Wellington's position and, by a masterly reconnaissance in force, compelled the duke to disclose the presence of practically the whole Anglo-Dutch army. The French halted, somewhat loosened by pursuit, between Rossomme and Genappe and spent a wretched night in the sodden fields.

June 18.

During the night Wellington received the reassuring news that Blücher would bring two corps certainly, and possibly four, to Waterloo, and determined to accept battle. Napoleon's plan being to penetrate between the allies and then defeat them successively, the left was really the threatened flank of the Anglo-Dutch army. Yet so far was Wellington from divining Napoleon's object that he stationed 17,000 men (including Colville's British division) at Hal and Tubize, 8 m. away to his right, to repel the turning movement that he groundlessly anticipated and to form a rallying point for his right in case his centre was broken. By deliberately depriving himself of this detachment, on June 18, the duke ran a very grave risk. With the 67,600 men whom he had in hand, however, he took up a truly admirable "Wellingtonian" position astride the Nivelles-Brussels and Charleroi-Brussels roads which meet at Mt S. Jean. He used a low ridge to screen his main defensive position, exposing comparatively few troops in front of the crest. Of his 156 guns, 78 belonged to the British artillery; but of his 67,600 men only 29,800 were British or King's German Legion troops, whereas all Napoleon's were Frenchmen and veterans. Wellington occupied Hougoumont in strength, chiefly with detachments of the British Guards; and he also placed a garrison of the K.G.L. in La Haye Sainte, the tactical key of the allied position. Both these farms were strengthened; but, still nervous about his right flank, the duke occupied Hougoumont in much greater force than La Haye Sainte, and massed the bulk of his troops on his right. The main position was very skilfully taken up, and care was taken to distribute the troops so that the indifferent and immature were closely supported by those who were "better disciplined and more accustomed to war." Owing to a misconception, one Dutch-Belgian brigade formed up in front of the ridge. Full arrangements were made for Blücher's co-operation through General Müffling, the Prussian attaché on the duke's staff. The duke was to stand fast to receive the attack, whilst the Prussians should close round Napoleon's exposed right and support Wellington's left. The Prussians were thus the real general reserve, and it was Wellington's task to receive Napoleon's attack and prepare him for the decisive counter-stroke.

Blücher loyally kept his promise to his ally; but the execution left much to be desired. He did not start his corps on their westward march until a considerable time after dawn, and then, owing to bad staff work, the rear corps of all (Bülow) was selected to lead the march. This unnecessary delay was aggravated further by a fire that broke out in Wavre and delayed the march. In spite of his hurts the old marshal was in the saddle.

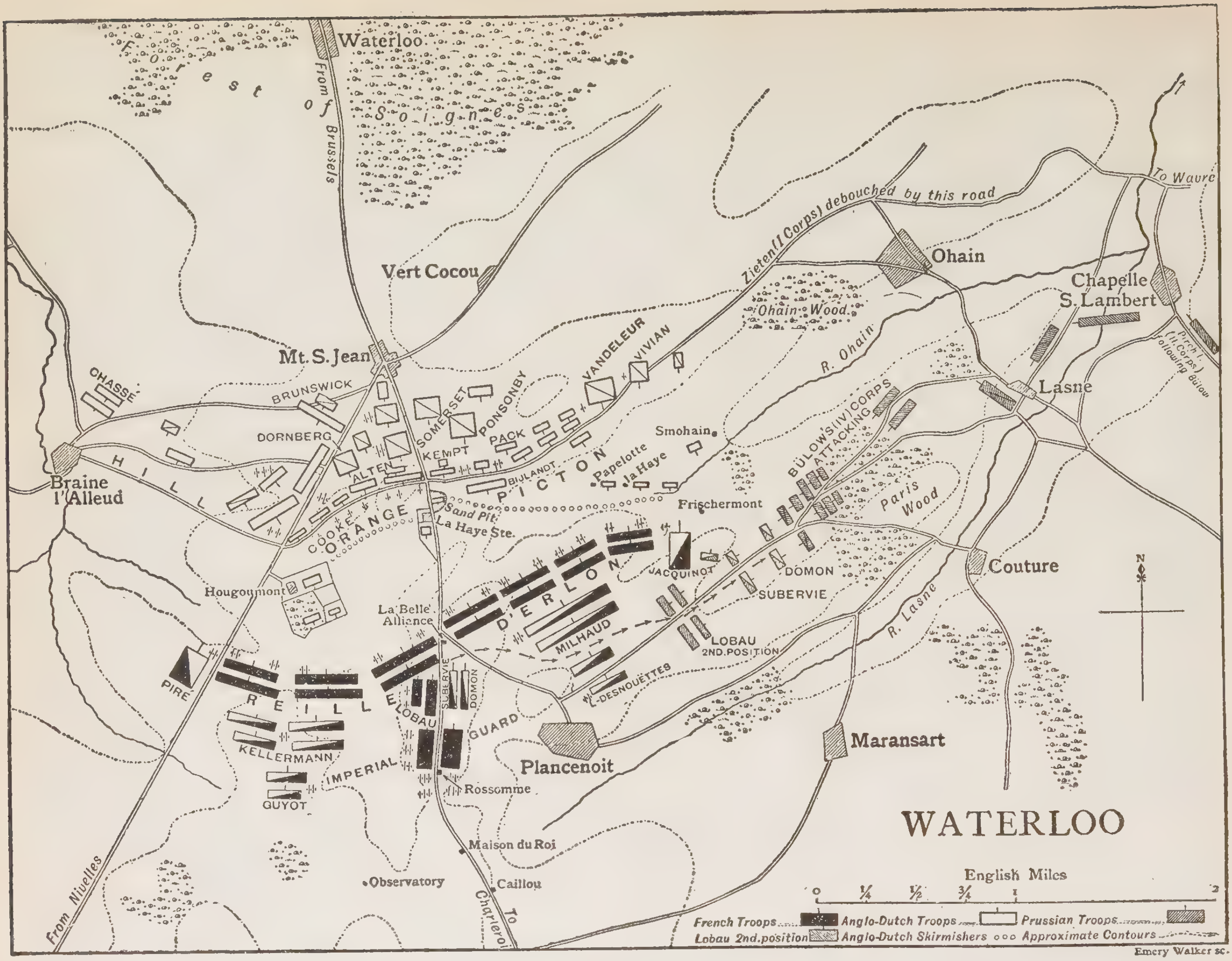
Meanwhile Napoleon formed his army for the attack on Wellington's position. The wet state of the ground (largely composed of corn-fields) and the scattered bivouacs of the French army prevented the attack from being made at 6 A.M. as Napoleon had desired. It was therefore put off first of all until 9 A.M., and later until 11.30, to permit the sodden ground to dry sufficiently for the mounted arms to manœuvre freely and give time to the French army to close up. During the night the emperor had received a report from Marshal Grouchy, dated Gembloux, 10 P.M., 17th, which stated that the Prussians were retiring in two columns towards Wavre and Perwez. Grouchy added that if he found that the bulk of the Prussians were moving on Wavre he would follow them and separate them from Wellington. But a glance at the map shows that this was impossible. By following the Prussians Grouchy, who had taken up a position outside the Prussian left flank, would inevitably drive the allies together. It was 10 A.M. when the emperor answered this letter, and he directed the marshal to march for Wavre, thus approaching the French army and entering the zone of the main operations. The underlying idea of manœuvring in two wings and a reserve should be kept in mind when considering this letter. Its meaning will then clearly be, that Grouchy was to endeavour to place his force on the inner Prussian flank and hold them back from Waterloo. But this is just what the despatch does not state verbally and precisely, and accordingly Grouchy, like Ney on the 16th and 17th, misread it.

The French army proceeded to form up in an imposing array some 1300 yards from Wellington's position, and if some misgivings as to the result filled the minds of men like Soult, Reille and Foy, who had had previous experience of Wellington in the field, none at any rate dwelt in Napoleon's mind. The lateness of the hour at which the attack was delivered, and the emperor's determination to break Wellington's centre instead of outflanking the Anglo-Dutch left and further separating the allies, deprived him of whatever chance he still possessed of beating Wellington before Blücher could intervene. Napoleon drew up his army of 74,000 men and 246 guns in three lines, fully in view of the allies. In the first line were the corps of Reille and D'Erlon, who were destined to attack the allied line and prepare it for the final assault. In the second line were Kellermann's cuirassiers, the incomplete corps of Lobau, the squadrons of Domon and Subervie, and Milhaud's cuirassiers. In the third line was the Guard. It was an imposing array of veteran troops, and when their emperor rode along the lines they received him with extraordinary enthusiasm.

Waterloo: first phase.

The battle of Waterloo may be divided into five phases. About 11.30 the first phase opened with an attack by one of Reille's divisions on Hougoumont. This was a mere side-issue, destined to draw Wellington's attention to his right, and in this it failed. About noon, however, a battery of 80 French guns unlimbered on the long spur to the S.E. of La Haye Sainte, to prepare the duke's centre for the main attack. Here the form of the ground so skilfully chosen sheltered the defence in some degree from the tempest of iron that now beat against the position. After 1 P.M., and just before he gave orders for Ney to lead the main attack, the emperor scanned the battlefield, and on his right front he saw a dense dark cloud emerging from the woods at Chapelle Saint Lambert. It was soon discovered that this was Bülow's corps marching to Wellington's assistance. A letter was now awaiting despatch to Grouchy, and to it was added a postscript that the battle was raging with Wellington, that Bülow's corps had been sighted by the emperor, and that the marshal was to hasten to the field and crush Bülow. This order at least was precise and clear, but it was sent 12 hours too late, and when Grouchy received it he was unable to carry it out. To neutralize Bülow when necessity arose, the emperor now detached Lobau together with the squadrons of Domon and Subervie. The French general, however, hardly drew out far enough from the French right; otherwise the magnificent resolution he displayed and the admirable obstinacy with which his troops fought against ever-increasing odds are worthy of all praise. Thus as early as 1.30 P.M. the Prussian intervention deranged the symmetry of Napoleon's battle-array.

It did not occur to the emperor that it would be wise to break off the fight now and seek a more favourable opportunity of beating the allies in detail. He was still determined to play the game out to the bitter end, and involve Wellington and Bülow's corps in a common ruin.


Waterloo
Forest of Soignes
From Brussels
Vert Cocou
Mt. S. Jean
Zieten (I Corps) debouched by this road
To Wavre
Ohain
Ohain Wood
Chapelle S. Lambert
Pirch I (II Corps) following Bülow
Lasne
R. Ohain
CHASSE
BRUNSWICK
DORNBERG
SOMERSET
PONSONBY
VANDELEUR
VIVIAN
PACK
KEMPT
ALTEN
BIJLANDT
PICTON
Smohain
Papelotte
La Haye
Frischermont
BÜLOW'S (IV) CORPS ATTACKING
Paris Wood
Braine l'Alleud
HILL
COOKE
ORANGE
Sand Pit
La Haye Ste.
Hougoumont
La Belle Alliance
D'ERLON
JACQUINOT
DOMON
SUBERVIE
MILHAUD
LOBAU 2ND. POSITION
Couture
R. Lasne
N
DESNOUËTTES
PIRE
REILLE
LOBAU
SUBERVIE
DOMON
IMPERIAL GUARD
KELLERMANN
GUYOT
Plancenoit
Rossomme
Maransart
WATERLOO
Maison du Roi
Observatory
Caillou
To Charleroi
From Nivelles
English Miles
0 1/4 1/2 3/4 1 2
French Troops
Anglo-Dutch Troops
Prussian Troops
Lobau 2nd. position
Anglo-Dutch Skirmishers ○○○
Approximate Contours

Emery Walker sc.

Map III.

Second phase.

Ney was therefore ordered to attack Wellington's centre with D'Erlon's corps. Owing to a misconception the columns used for advance were over-heavy and unwieldy, and the corps failed to achieve anything of importance. As D'Erlon's troops advanced the Dutch-Belgian brigade in front of the ridge, which had been subjected to an overwhelming fire from the 80 French guns at close range, turned about and retired in disorder through the main position. This, however, was the solitary success secured by the I. corps; for the left division failed to storm La Haye Sainte, which was most gallantly defended, and Picton's division met the remainder of D'Erlon's corps face to face, engaging them in a murderous infantry duel in which Picton fell. It was during this struggle that Lord Uxbridge launched two of his cavalry brigades on the enemy; and the "Union brigade" catching the French infantry unawares rode over them, broke them up, and drove them to the bottom of the slope with the loss of two eagles. The charge, however, over-reached itself, and the British cavalry, crushed by fresh French horsemen hurled on them by the emperor, were driven back with great loss. So far no success against Wellington had been achieved, and Bülow was still an onlooker.

Third phase.

Ney was now ordered to attack La Haye Sainte again, but the attack failed. A furious cannonade raged, and the Anglo-Dutch line withdrew slightly to gain more cover from the ridge. Ney misinterpreted this manœuvre and led out, about 4 P.M., Milhaud's and Lefebvre-Desnouëttes' horsemen (43 squadrons) to charge the allied centre between the two farms. For several reasons, the cavalry could only advance at a trot. As the horsemen closed they were received with volleys of case from the guns, and the infantry formed into squares. Against the squares the horsemen were powerless, and failing to break a single square, they were finally swept off the plateau by fresh allied horsemen. Kellermann's cuirassiers and the heavy horse of the Guard (37 fresh squadrons) now advanced to support the baffled cavalry, the latter falling in as supports. The whole 80 squadrons resumed the attack, but with no better result. The cavalry gradually became hopelessly entangled among the squares they were unable to break, and at last they were driven down the face of the ridge and the most dramatic part of the battle came to an end. Had these great cavalry attacks been closely supported by infantry, there can be little doubt that they must have achieved their object. But they were not. In his handling of the three arms together, Napoleon on this day failed to do justice to his reputation.

About 4.30 P.M. Bülow at last engaged. Lobau's men were gradually overpowered and forced back into Plancenoit, the village was stormed, and the Prussian round shot reached the main road. To set his right flank free the emperor called further on his reserve, and sent Duhesme with the Young Guard to Lobau's support. Together, these troops drove Bülow out of Plancenoit, and forced him back towards the Paris wood. But the Prussians had not yet changed the fate of the day.

Fourth phase.

Napoleon now ordered Ney to carry La Haye Sainte at whatever cost, and this the marshal accomplished with the wrecks of D'Erlon's corps soon after 6 P.M. The garrison (King's German Legion) had run out of rifle ammunition and the French bursting in seized the post. This was the first decided advantage that Napoleon had gained during the day. The key of the duke's position was now in Napoleon's hands, Wellington's centre was dangerously shaken, the troops were exhausted, and the reserves inadequate. But the Iron Duke faced the situation unmoved. Calmly he readjusted his line and strengthened the torn centre. Happily for him, Pirch I.'s and Zieten's corps were now at hand. Pirch I. moved to support Bülow; together they regained possession of Plancenoit, and once more the Charleroi road was swept by Prussian round shot. Napoleon, therefore, had to free his right flank before he could make use of Ney's capture. To this end he sent two battalions of the Old Guard to storm Plancenoit. The veterans did the work magnificently with the bayonet, ousted the Prussians from the place, and drove them back 600 yards beyond it. But Napoleon could not turn now on Wellington. Zieten was fast coming up on the duke's left, and the crisis was past. Zieten's advent permitted the two fresh cavalry brigades of Vivian and Vandeleur on the duke's extreme left to be moved and posted behind the depleted centre. The value of this reinforcement at this particular moment can hardly be overestimated.

Fifth phase.

The French army now fiercely attacked Wellington all along the line; and the culminating point of this phase was reached when Napoleon sent forward the Guard, less 5 battalions, to attack Wellington's centre. Delivered in three échelons, these final attacks were repulsed, the first échelon by Colin Halkett's British Brigade, a Dutch-Belgian battery, and a brigade of Chassé's Dutch-Belgian division; the second and third échelons by the Guards, the 52nd, and the Royal Artillery. Thus ended the fifth phase.

Rout of the French.

As the Guard recoiled (about 8 P.M.) Zieten pierced the north-east corner of the French front, and their whole line gave way as the allies rushed forward on their now defenceless prey. Three battalions of the Guard indeed stood their ground for some time, but they were finally overwhelmed. Afterwards, amidst the ruins of their army, two battalions of the 1st Grenadiers of the Guard defied all efforts to break them But, with the exception of these two battalions, the French army was quickly transformed into a flying rabble. Bülow and Pirch I. now finally overpowered Lobau, once more recaptured Plancenoit, and sealed the doom of the French army. But Lobau's heroic efforts had not been in vain; they had given his master time to make his last effort against Wellington; and when the Guard was beaten back the French troops holding Plancenoit kept free the Charleroi road, and prevented the Prussians from seizing Napoleon's line of retreat.

When Wellington and Blücher met about 9.15 P.M. at "La Belle Alliance," the victorious chiefs arranged that the Prussians should take up the pursuit, and they faithfully carried out the agreement. Pushing on through the night, they drove the French out of seven successive bivouacs and at length drove them over the Sambre. The campaign was virtually at an end, and the price paid was great. The French had lost over 40,000 men and almost all their artillery on June 18; the Prussians lost 7000, and Wellington over 15,000 men. So desperate was the fighting that some 45,000 killed and wounded lay on an area of roughly 3 sq. m. At one point on the plateau "the 27th (Inniskillings) were lying literally dead in square"; and the position that the British infantry held was plainly marked by the red line of dead and wounded they left behind them.

Grouchy's operations June 18-19.

A few words may now be bestowed on Marshal Grouchy, commanding the right wing. The marshal wrongly determined on the 18th to continue his march to Wavre in a single column, and he determined, still more wrongly, to move by the right bank of the Dyle. Breaking up from bivouac long after dawn, he marched forward, via Walhain. Here he stopped to report to the emperor some intelligence which turned out to be false, and he remained for breakfast. Hardly had he finished when the opening roar of the cannonade at Waterloo was heard. Grouchy was now urged by his generals, especially by Gérard, to march to the sound of the firing, but he refused to take their advice, and pushed on to Wavre, where he found the Prussians (Thielemann's corps of 16,000 men) holding the passages across the Dyle. A fierce fight (called the Action of Wavre) began about 4 P.M., in which the Prussians were for long victorious. Instead of concentrating his force upon one bridge over the swampy and unfordable Dyle, Grouchy scattered it in attacks upon several; and when the emperor's despatch arrived, saying Bülow was in sight, the marshal was powerless to move westward. Towards the end of the day Colonel Vallin's Hussars stormed the Limale bridge, and a large part of Grouchy's force then promptly gained the left bank. The action continued till about 11 P.M., when it died out, to recommence shortly after dawn. Thielemann was at length overborne by sheer weight of numbers, and towards 11 A.M. he was forced to retire towards Louvain. The losses were considerable, about 2400 men on each side.

Grouchy's victory was barren. In the far higher duty of co-operation he had failed miserably. His tactical achievement could avail the emperor nothing, and it exposed his own force to considerable danger. Whilst pondering on the course he should follow, the marshal received the news of the awful disaster that had overtaken the emperor at Waterloo. In a flash he realized his danger and made prompt arrangements to begin his retreat on Namur, the only line to France that was then available. This retreat he carried out resolutely, skilfully and rapidly, slipping past Blücher and finally bringing his force to Paris. But the rapid advance of the allies gave France no time to rally. Napoleon was forced to abdicate, and finding escape was impossible, he surrendered (on July 14) to the British—"the most powerful, the most unwavering and the most generous of his foes."

The causes of Napoleon's failure in the Waterloo campaign were as follows:—The French army was numerically too weak for the gigantic task it undertook. Napoleon himself was no longer the Napoleon of Marengo or Austerlitz, and though he was not broken down, his physical strength was certainly impaired. Ney failed to grasp and hold Wellington on the critical 17th June; and on the 17th and 18th Grouchy's feeble and false manœuvres enabled Blücher to march and join Wellington at Waterloo. Napoleon's chance of success was dangerously diminished, if not utterly destroyed, by the incompetence of the two marshals whom in an evil hour he selected for high commands. Another dominant influence in shaping the course of events was the loyalty of Blücher to his ally, and the consequent appearance of the Prussian army at Waterloo. Nor must we overlook Wellington's unswerving determination to co-operate with Blücher at all costs, and his firmness on June 18; or the invincible steadiness shown by the British troops and those of the King's German Legion.

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In this article the writer has been greatly assisted by the advice and suggestions of Lieut.-Col. H. W. L. Hime, R.A. (A. F. B.*)

WATERLOO-WITH-SEAFORTH, an urban district in the Bootle and Ormskirk parliamentary divisions of Lancashire, England, at the mouth of the Mersey, 4 m. N. by W. of Liverpool. Pop. (1891) 17,225; (1901) 23,102. On account of its facilities for bathing, firm sands, pleasant scenery and nearness to Liverpool, of which it is a suburb, it is much frequented both by visitors and by residents.

WATERLOW, SIR ERNEST ALBERT (1850–), English painter, was born in London, and received the main part of his art education in the Royal Academy schools, where, in 1873, he gained the Turner medal for landscape-painting. He was elected associate of the Royal Society of Painters in Water-Colours in 1880, member in 1894, and president in 1897; associate of the Royal Academy in 1890, and academician in 1903; and he was knighted in 1902. He began to exhibit in 1872 and has produced a considerable number of admirable landscapes, in oil and water-colour, handled with grace and distinction. One of his pictures, "Galway Gossips," is in the National Gallery of British Art.

See *Sir E. A. Waterlow, R.A., P.R.W.S.*, by C. Collins Baker (*Art Journal* Office, 1906).

WATER MOTORS. The subject of hydraulic transmission of power is treated generally under POWER TRANSMISSION (*Hydraulic*), and the present article is confined to water motors.

Hydraulic Lifts.—The direct-acting lift is perhaps the simplest of all machines using pressure-water, but as the height of the lift increases, certain problems in construction become exceedingly difficult to cope with, notably those due to the great increase in the weight and displacement of the ram. In fact, with a simple ram it is not possible to lift beyond a certain height with a given pressure and load. It becomes, therefore, necessary to balance in some way the varying displacement of the ram if economy is to be secured in the working: this is often done by the use of counter-weights attached to chains travelling over head sheaves, but this largely destroys the simplicity and safety of the direct-acting lift, and hence some form of hydraulic balancing is more satisfactory and more certain.

In one form, shown in fig. 1, the lift cylinder is in hydraulic connexion with a pair of short cylinders placed one above the other, the pistons working in them being connected together by a common rod. Below the piston of the upper cylinder is an annular space E (surrounding the common piston rod) with a capacity equal to the maximum displacement of the lift-ram, while the corresponding annular area C of the piston of the lower cylinder is just large enough when subjected to the working water pressure to enable the work of lifting the net load to be done and any friction to be overcome. The area B of the top side of the upper piston is proportioned in such a way that when under the full water pressure the dead weight of the ram and cage is just balanced when the former is at the bottom of its stroke. With this arrangement the lift-ram and the two balance pistons are always in equilibrium, or, in other words, the ever-changing displacement of the lift-ram is automatically in balance. To work the lift, pressure-water is admitted to the annular space C above the lower of the two balance pistons (the space B above the upper one is always in communication with the pressure-water), and the combined pressure on the two pistons is sufficient to lift the cage, ram and load. As the ram ascends it apparently increases in weight, but this is balanced by the greater pressure on the two balance pistons as they descend, owing to the increase of the head of water acting on them. To allow the lift-ram to descend, the pressure-water in C above the lower balance piston is discharged through the exhaust into the drain, while that above the upper piston is simply pushed back into the pressure main. As an illustration of the economy of this system, it may be mentioned that in one lift having a 6-in. ram with a lift of 90 ft., the working load being 1 ton and the maximum working speed 180 ft. a minute, the quantity of pressure-water used per journey of 90 ft. was reduced from 109 to 24½ gallons by the use of this method of balancing.

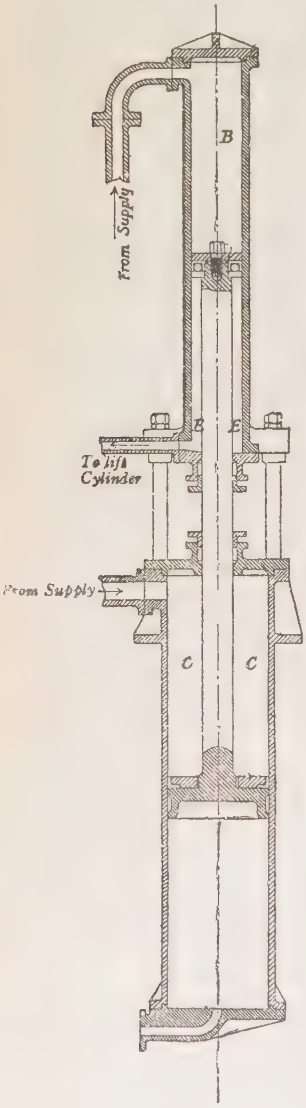

FIG. 1.—Hydraulic Balancing.

In another system of hydraulic balance (fig. 2) the ram A has an annular area so proportioned that when it is connected with the water in an elevated tank (usually placed somewhere in the roof of the building), the hydraulic pressure upon it just balances the weight of the ram and cage. Here again, since the intensity of the pressure on A becomes greater as it descends owing to the increased head, the apparent increase of weight of the lift-ram as it rises is automatically balanced; water from the high-pressure system is admitted down the hollow ram B and does the work of lifting the live load.

Since the introduction of deep-level electric railways in London and elsewhere, hydraulic passenger lifts on a large scale have been brought into use for conveying passengers up and down from the street level to the underground stations.

Direct-acting Water Motors.—Owing to the difficulty of securing a durable motor with a simple and trustworthy means of automatically regulating the quantity of water used to the power needed at various times from the motor, not much advance has been recently made in the use of water motors with reciprocating rams or pistons. Probably the most successful one has been a rotary engine invented by Mr Arthur Rigg.[1]

In this engine the stroke, and therefore the amount of water used, can be varied either by hand or by a governor while it is running; the speed can also be varied, very high rates, as much as 600 revolutions a minute, being attainable without the question of shock or vibration becoming troublesome. The cylinders are cast in one piece with a circular valve, and rotate about a main stud S (fig. 3), while their plungers are connected to a disk crank which rotates above the point O, which is the centre of the main crank; O S being the crank length or half stroke of the engine, any variation in its length will vary the power of the engine and at the same time the quantity of water used. The movement of S is obtained by means of a relay engine, in which there are two rams of different diameters; a constant pressure is always acting on the smaller of these when the motor is at work, while the governor (or hand-power if desired) admits or exhausts pressure-water from the face of the other, and the movements to and fro thus given to the two rams alter the position of the stud S, and thus change the stroke of the plungers of the main engine. Fig. 4 gives an outside view of a 30-H.P. engine capable of using water at a pressure of 700 lb per sq. in.; the governor is carried within the driving pulley shown at the right-hand end, while the working revolving cylinders are carried inside the boxed-in flywheel at the left-hand end, the relay cylinder and its attachments being fixed to the bed-plate in front of the flywheel. On a test one of these engines gave an efficiency or duty of 80%.

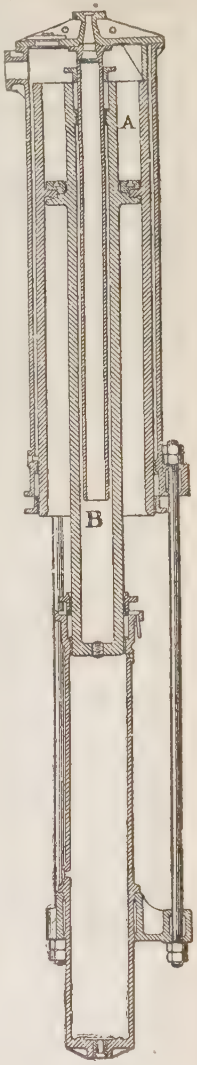

FIG. 2.—Hydraulic Balancing.

Water Wheels.—The Pelton water wheel (fig. 5) has proved a most successful motor when very high heads are available, heads of 2000 feet having been used occasionally. Such machines have been extensively employed in America, and have also lately been used in Great Britain, worked by the high-pressure water supplied in large towns.

The wheel carries a series of cups placed at equal distances around the circumference. A jet or jets of water impinge on the cups, the interiors of which are shaped in such a way that the jet is discharged parallel to its original direction. If the linear velocity of the cups in feet a second is V_1, and the linear velocity of the jet is V_2, then the velocity of the jet relative to the cup is V_2-V_1 feet a second, and if the whole energy of the water is to be given up to the cups, the water must leave the cup with zero absolute velocity. But its velocity relative to the cup, as it passes backwards, is $-(V_2-V_1)$, and since the forward velocity of the cup is V_1, the absolute velocity of the water is $-(V_2-V_1)+V_1$ or $2V_1-V_2$. This will become zero if V_1 is $\frac{1}{2}V_2$, that is, if the linear velocity of the cup-centres is one-half that of the jet of water impinging upon them. The theoretical efficiency of the wheel would then be 100%. The actual efficiency of these wheels when used with high falls is from 80 to 86%; when used in connexion with high-pressure water in London an efficiency

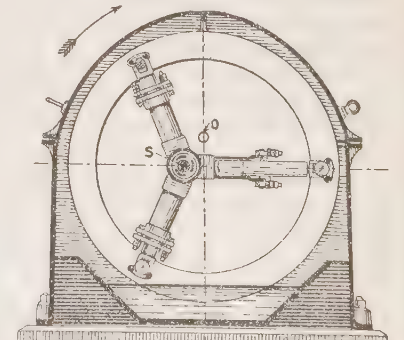

FIG. 3.—Section of Rigg's Water-Engine.

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[1] This engine was fully described in *Engineering*, vol. xlv. p. 61.

of 70% has been obtained, and when a dynamo is driven directly by them about 66% of the hydraulic energy has been converted into electric energy.

Pelton wheels are very sensitive to variation of load, and considerable trouble was experienced at first in securing adequate governing when they were used to generate electric energy; but this difficulty has been overcome, and they have been rendered most efficient machines for use with high falls, where ordinary turbines would be difficult to manage owing to the excessive speed at which they would run. In a small installation in the United States water is brought in a 36-in. pipe a distance of 1800 ft., and supplies six Pelton wheels each 28 in. in diameter, running at 135 revolutions a minute under a head of 130 ft. The total power developed is 600 H.P., and though the load factor varies very greatly in this case, the differential type of governor used secures perfect control of the running of the wheels.

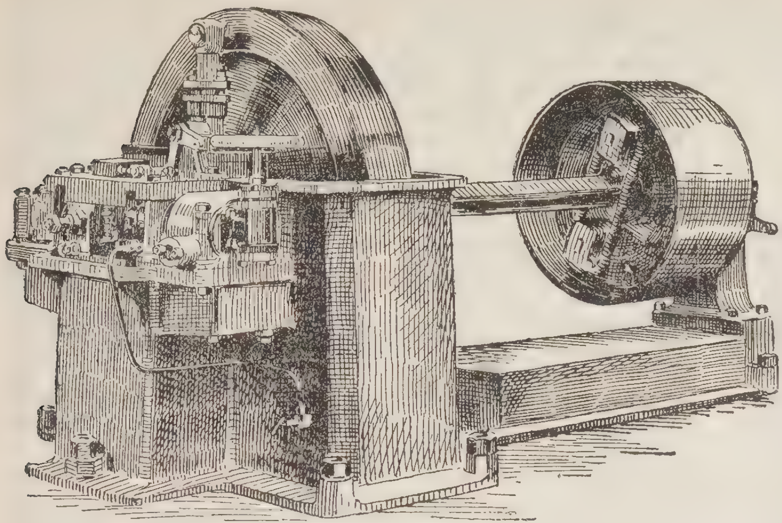
FIG. 4.—External View of Rigg's Water-Engine.[1]

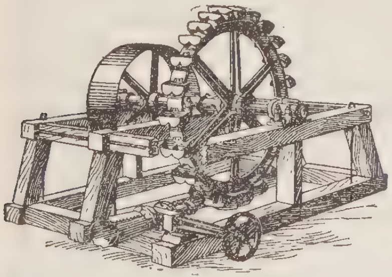
FIG. 5.—Pelton Wheel.

Turbines.—The turbine has now become one of the most efficient of the prime movers employed by man, and in the United States of America and on the continent of Europe[2] its use has enormously increased of recent years. Though no radical changes have been made in the design of turbines for some years, an immense amount of skill and ingenuity has been shown in perfecting and improving details, and such machines of great size and power are now constantly being made, and give every satisfaction when in use.

In the "Hercules" turbine, shown in fig. 6, the flow is what is called mixed, that is, it is partly a radial inward and partly an axial flow machine. On entering, the water flows at first in a radial direction, and then gradually, as it passes through the wheel, it receives a downward component which becomes more and more important. Professor Thurston has published the results of a test of one of these, which gave an efficiency of 87% at full load and 70% at about three-fifths full load.

Another turbine of the mixed flow type is the "Victor," which consists of three parts—the outer guide case, and, inside this, the register gate, and the wheel. The gate regulates the speed of the wheel by varying the quantity of water; when fully open it merely forms a continuation of the guide passages, and thus offers no obstruction to the flow of the water, but by giving it a movement through a part of a revolution the passages are partly blocked and the flow of the water is checked. This form of regulation is fairly efficient down to three-quarter opening. Turbines of this type may also be used on horizontal shafts, and are very useful in the case of low falls where there is a large amount of water and the head is fairly constant. At Massena, in New York State, 75,000 H.P. is to be developed from fifteen sets of these turbines working under a head of 40 ft. Each generator can develop 5000 H.P. at a potential of 2200 volts, and is driven by three horizontal double turbines on the same shaft; when working under a minimum head of 32 ft. at 150 revolutions, each turbine will have a nominal horsepower of 1000.

Probably the most important application of turbines to the generation of power on a great scale is that at Niagara Falls. The water is tapped off from the river Niagara about 1 m. above the falls and brought by a canal to the powerhouse. The wheel-pit is 180 ft. in depth, and is connected with the river below the falls by a tail-race, consisting of a tunnel 21 ft. high and 18 ft. 10 in. wide at its largest section. The original turbines were of the "Fourneyron" type, and a pair were mounted on each vertical shaft, the two being capable of giving out 5000 H.P. with a fall of 136 ft. Each pair of wheels is built in three storeys, and the outflow of the water is controlled by a cylindrical gate or sluice, which is moved up and down by the action of the governor. As the pair of wheels and the big vertical shaft (which is of hollow steel 38 in. in diameter) with the revolving part of the dynamo mounted on the upper end of the shaft weigh about 152,000 ℔, a special device, since adopted in other similar power plants, was designed to balance in part this dead weight. The water passes from the penstock through the guide blades of the upper wheel, and in doing so acts in an upward direction on a cover of the upper wheel, which thus becomes, as it were, a balance-piston. The total upward pressure on this piston is calculated to be equal to 150,000 ℔; hence the shaft-bearings are practically relieved from pressure when the wheels are running. Another turbine which has come into extensive use is the "Francis," an exceedingly efficient turbine on a low fall with large quantities of water. At Schaffhausen two of them with a fall of 12½ ft. developed 430 H.P., when the older turbines only gave 260 H.P., the

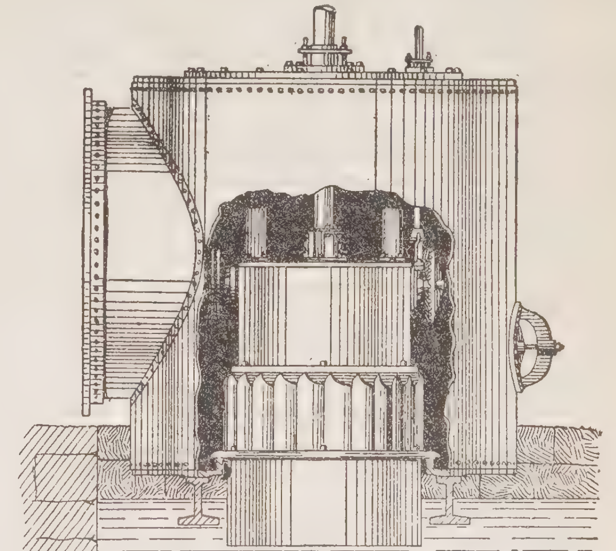
FIG. 6.—"Hercules" Turbine.

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[1] This and some of the other drawings have been taken from Blaine's *Hydraulic Machinery*.

[2] The following statistics of turbine construction in Switzerland are taken from *Schweizerische Bauzeitung* (1901), p. 128, which, in the same volume at p. 53, contains a valuable article on the most important improvements in turbines and their regulation shown in the Paris Exhibition of 1901:—

Period.	Number of Turbines.	Total H.P.	Average H.P.
1844–1869	767	36,894	48
1869–1879	1006	66,688	66½
1879–1889	1840	133,579	72½
1889–1899	2231	400,474	179½
Totals .	5844	637,635	. .

efficiency of the Francis turbine being in this case 86% at full load and 77% at half load.

A recent form of the Jonval turbine is shown in fig. 7. This turbine was designed to give 1250 H.P. with a fall of 25 ft. and an efficiency of 77%. It is fitted with a suction pipe and a circular balanced sluice for admitting and cutting off the water-supply. The wheel is 12 ft. 3½ in. in diameter, and has a speed of fifty revolutions per minute, and the power generated is transmitted through bevel-gearing to a horizontal shaft from which the power is taken off for various purposes. When complete the turbine weighed about 140 tons. There is a regulating arrangement, by which one-half of the guide-passages can be shut off in pairs from the water, and at the same time air is freely admitted into these unused passages by pipes which pass through the hinges of the controlling shutter. Tests of a turbine of this slow-moving type showed an efficiency of 82% at full gate, and one of 75% when half of the passages in the guide-blades were closed by the shutters, as described above.

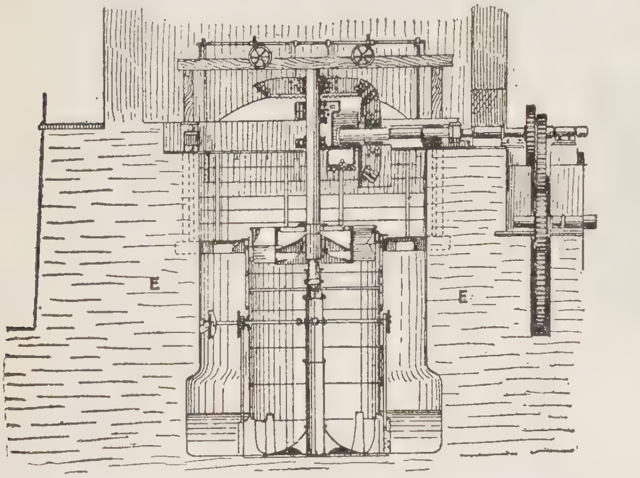

FIG. 7.—Jonval Turbine.

As an illustration of the use of water-power, even at a considerable distance from a town, the case of Lausanne may be described. The town has secured the right of using a waterfall of 113 to 118 ft. high, by impounding the Rhône near Saint Maurice. In dry seasons this will supply 6000 H.P., and for quite ten months in an ordinary year 14,000 H.P. The plant in 1902 consisted of five turbines, having horizontal axles, and each developing 1000 H.P. when running at 300 revolutions a minute. They drive electric generators, and the current so produced is taken at a pressure of 22,000 volts on overhead wires a distance of 35 m. to Lausanne, the loss being estimated not to exceed 10% in the long transmission. Near the town is a station for reducing the voltage, and current is distributed at 125 volts for lighting purposes and at 500 volts for use on the tramways and for other power purposes.

AUTHORITIES.—For further information concerning the construction and employment of water motors, the reader is referred to the following papers and textbooks:—*Proc. Inst. Mech. Eng.* (1882), p.119 (1889), p. 350; (1895), p. 353. (These papers contain full accounts of recent forms of lifts.)—*Engineering*, vol. lxvii. pp. 91, 128, 160, "Power Station at Niagara"; vol. lxxii. pp. 391-767, "Governing of Water Wheels."—*Proc. Inst. Civil Eng.*, vol. lxxxvi. p. 60, "Mersey Railway Lifts"; vol. xciii. p. 596, "Experiments on Jonval and Girard Turbines at Alching"; vol. xcvi. p. 182, "Hydraulic Canal Lifts"; vol. cii. p. 154, "Keswick Water-Power Electric Station"; vol. cxii. p. 410, "Hydraulic Works at Niagara"; vol. cxviii. p. 537, "A 12-Mile Transmission of Power Generated by Pelton Wheels"; vol. cxxiii. p. 530, "The Pelton Water Wheel"; vol. cxxiv. p. 223, "The Niagara Power Works"; vol. cxxvi. p. 494, "The Rheinfelden Power Transmission Plant"; vol. cxli. p. 269, "Electric Transmission Plants in Transvaal," p. 307, "Turbines"; vol. cxlii. p. 451, "Electrical Installations at Lausanne"; vol. cxlv. p. 423, "Water Power at Massena"; vol. cxlvii. p. 467, "Some Large Turbine Installations."—Wood, *Theory of Turbines*; Bovey, *Hydraulics*; Björling, *Hydraulic Motors*; Blaine, *Hydraulic Machinery*; Bodmer, *Hydraulic Motors*; Unwin, "Water Motors" (Lectures on Hydro-Mechanics, *Inst. Civil Eng.*, 1885). (T. H. B.)

WATER-OPOSSUM, or YAPOCK (*Chironectes minimus*), the single representative of the genus. This animal is distinguished from other opossums by its webbed hind-feet, non-tuberculated soles, and peculiar coloration. Its ground colour is light grey, with four or five sharply contrasted brown bands passing across its head and back, giving it a very peculiar mottled appearance; the head and body together are about 14 in. long, and the tail measures a little more. It is almost wholly aquatic in its habits, living on small fish, crustaceans and other water animals; its range extends from Guatemala to southern Brazil.

WATER POLO, a game which has done much to advance swimming in popular favour and to improve the stamina of swimmers. It is played either in a bath or open water, the teams consisting of seven a side. The field of play must not exceed 30 yds. or be less than 19 yds. in length, and the width must not be more than 20 yds. The ball used must be round and fully inflated, and must not measure less than 26½, nor more than 28 in. in circumference. It must be waterproof, with no strapped seams outside, and no grease or other objectionable substance placed on it. The goals must be 10 ft. in width, with a cross-bar 3 ft. above the surface when the water is 5 ft. or over in depth, and 8 ft. from the bottom when the water is less than 5 ft. in depth; in no case must the water in which a game is played be less than 3 ft. Goal nets are used in all important matches. The duration of a match is supposed to be 14 minutes, seven minutes each way. The officials consist of a referee, a time-keeper and two goal scorers, the first-named official starting the game by throwing the ball into the centre of the bath. A goal is scored by the entire ball passing between the goal posts and under the cross-bar.

The players have to place themselves in a line with their respective goals, and are not allowed to start swimming to the centre of the bath until the word "Go" is given. They are usually divided into 3 forwards, 1 half-back, 2 backs and a goalkeeper. To the fastest swimmer is usually assigned the place of centre-forward, and it is his duty to make all headway possible so as to reach the ball before the opposing forward of the other side, then pass rapidly back to the half or one of the backs and swim on to within close proximity of the opponent's goal and wait for a pass. The other forwards should rapidly follow him up and each man carefully shadow one of the opposing side. In handling the ball only one hand may be used, for to touch the ball with both hands at the same time constitutes a foul, as also does the holding of the rail or the side, during any part of the game, the standing on or touching of the bottom of the bath except for the purpose of resting, interfering or impeding an opponent in any way, unless he be holding the ball, holding the ball under water when tackled, jumping from the bottom or pushing off from the side (except at starting or restarting) in order to play the ball or duck an opponent, holding, pulling back or pushing off from an opponent, turning on the back to kick at an opponent, assisting a player at the start or restart to get a good push off, throwing the ball at the goalkeeper from a free throw or refusing to play the ball at the command of the referee after a foul or the ball has been out of the field of play. Dribbling or striking the ball is held to be not holding, but lifting, carrying, pressing under water or placing the hand under or over the ball when actually touching, is holding; dribbling up the bath and through the posts is permissible. There is a penalty area, 4 yds. from each goal-post, and the imaginary line across the bath is not allowed to be passed by the respective goal-keepers, otherwise they commit a foul. They may stand to defend their goal, touch the ball with both hands or jump from the bottom to play the ball, but in all other respects the same rules as to fouls apply to them as to other players. In any case they are not allowed to throw the ball beyond half-distance. If they do so the opposing side is awarded a free throw. For fouls which the referee considers to have been committed wilfully there are very severe penalties, and those guilty of them are ordered out of the water until a goal has been scored, thus for the time being crippling the side. Deliberately wasting time, starting before the word "Go," taking up a position within 2 yds. of the opponent's goal, changing position after the whistle has blown for a free throw or other similar stoppage of play, or deliberately splashing an opponent in the face, are all held to be wilful fouls. Whenever the whistle blows for fouls the players have to remain in their respective places until the ball has left the hand of the player to whom the free throw was awarded. A player who has been wilfully fouled within 4 yds. of his opponent's goal line is given a penalty throw, and the consequence is that a close match is often won by reason of a player deliberately breaking the rules when his goal is hotly assailed. In ordinary fouls the ball must touch another player before a goal can be scored, but in penalty throws it need not. Any player throwing the ball over his own goal line concedes a corner throw to the other side, but if an opposing player sends it over it is a free throw for the goalkeeper. After each goal is scored the players return to their respective ends, waiting for the word "Go," and at half-time they are allowed a rest of three minutes, during which they leave the water. Fouls, half-time and time are declared by whistle, and goals by bell.

The game requires careful practice of smart and scientific passing, side and back-handed throws, and accurate shooting. For this purpose "throwing the water-polo ball" contests are commonly held by the leading clubs, who also engineer competitions on points for shooting at goal.

It was not until the formation of the London Water Polo League in 1889 that the game was specially catered for, but a form of it had previously been known and played in several parts of England and Scotland. In 1870 the old London Swimming Association, the forerunner of the present Amateur Swimming Association, appointed a committee to draw up rules for a game of "Football in the water," but no report of that committee appears to have been presented. In 1876 aquatic handball matches were played in the sea off Bournemouth by members of the Bournemouth Premier Rowing Club, and in 1877 there were similar matches at the annual competition for the Bon Accord Club in the river Dee, and a year prior to that some rules had been drawn up for the Aberdeen Club. The game at length found its way to the Midlands, and led to the foundation of the Midland Aquatic Football Association, whose rules were somewhat similar to those in vogue in America, where goals are scored by placing the ball in a marked-out space called "goal." In 1883 Birmingham Leander played All England at Portsmouth; in 1885 the Amateur Swimming Association took official recognition of the game, and in 1888 started the English championship, this being won the first year by Burton-on-Trent. Then came the foundation of the London Water Polo League, through whose agency county associations came into being, inter-county matches were played, and international games arranged. The first county matches were played in 1890, and the first international the same year, the game being between England and Scotland at Kensington Baths on 28th July. England was beaten by four goals to none, but the outcome of the match was the cementing of friendly relations between the English and Scottish associations, and the gradual spread of the game, until the English, Irish, Scottish and Welsh associations joined together and formed an international board, without whose sanction none of the rules of the game can now be altered. Oxford and Cambridge met for the first time in 1891, and since then the Blues' committee of each university have given swimming and water polo a "half blue." The game has become popular in many European countries, and friendly matches between English and continental clubs are frequently played. It has also extended to Egypt, India and Australia, in which countries the British rules have been adopted.

See the Amateur Swimming Association's *Handbook* for rules of the game and instructions to referees. (W. Hy.)

WATER RIGHTS. By the law of England the property in the bed and water of a tidal river, as high as the tide ebbs and flows at a medium spring tide, is presumed to be in the crown or as a franchise in a grantee of the crown, such as the lord of a manor, or a district council, and to be extra-parochial. The bed and water of a non-tidal river are presumed to belong to the person through whose land it flows, or, if it divide two properties, to the riparian proprietors, the rights of each extending to midstream (*ad medium filum aquae*). In order to give riparian rights, the river must flow in a defined channel, or at least above ground. The diminution of underground water collected by percolation, even though malicious, does not give a cause of action to the owner of the land in which it collects, it being merely *damnum sine injuria*, though he is entitled to have it unpolluted unless a right of pollution be gained against him by prescription. The right to draw water from another's well is an easement, not a *profit à prendre*, and is therefore claimable by custom. As a general rule a riparian proprietor, whether on a tidal or a non-tidal river, has full rights of user of his property. Most of the statute law will be found in the Sea Fisheries Acts 1843 to 1891, and the Salmon and Freshwater Fisheries Acts 1861 to 1886. In certain cases the rights of the riparian proprietors are subject to the intervening rights of other persons. These rights vary according as the river is navigable or not, or tidal or not. For instance, all the riparian proprietors might combine to divert a non-navigable river, though one alone could not do so as against the others, but no combination of riparian proprietors could defeat the right of the public to have a navigable river maintained undiverted. We shall here consider shortly the rights enjoyed by, and the limitations imposed upon, riparian proprietors, in addition to those falling under the head of fishery or navigation. In these matters English law is in substantial accordance with the law of other countries, most of the rules being deduced from Roman law. Perhaps the main difference is that running water is in Roman law a *res communis*, like the air and the sea. In England, owing to the greater value of river water for manufacturing and other purposes, it cannot be said to be common property, even though it may be used for navigation. The effect of this difference is that certain rights, public in Roman law, such as mooring and unloading cargo, bathing, drying nets, fishing for oysters, digging for sand, towing, &c., are only acquirable by prescription or custom in England. By Roman law, a hut might lawfully be built on the shore of the sea or of a tidal river; in England such a building would be a mere trespass. Preaching on the foreshore is not legal unless by custom or prescription (*Llandudno Urban Council* v. *Woods*, 1899, 2 Ch. 705). Nor may a fisherman who dredges for oysters appropriate a part of the foreshore for storing them (*Truro Corporation* v. *Rowe*, 1902, 2 K.B. 709).

The right of use of the water of a natural stream cannot be better described than in the words of Lord Kingsdown in 1858: "By the general law applicable to running streams, every riparian proprietor has a right to what may be called the ordinary use of water flowing past his land—for instance, to the reasonable use of the water for domestic purposes and for his cattle, and this without regard to the effect which such use may have in case of a deficiency upon proprietors lower down the stream. But, further, he has a right to the use of it for any purpose, or what may be deemed the extraordinary use of it, provided he does not thereby interfere with the rights of other proprietors, either above or below him. Subject to this condition, he may dam up a stream for the purposes of a mill, or divert the water for the purpose of irrigation. But he has no right to intercept the regular flow of the stream, if he thereby interferes with the lawful use of the water by other proprietors, and inflicts upon them a sensible injury" (*Miner* v. *Gilmour*, 12 Moore's P.C. Cases, 156). The rights of riparian proprietors where the flow of water is artificial rest on a different principle. As the artificial stream is made by a person for his own benefit, any right of another person as a riparian proprietor does not arise at common law, as in the case of a natural stream, but must be established by grant or prescription. If its origin be unknown the inference appears to be that riparian proprietors have the same rights as if the stream had been a natural one (*Baily* v. *Clark*, 1902, 1 Ch. 649). The rights of a person not a riparian proprietor who uses land abutting on a river or stream by the licence or grant of the riparian proprietor are not as full as though he were a riparian proprietor, for he cannot be imposed as a riparian proprietor upon the other proprietors without their consent. The effect of this appears to be that he is not entitled to sensibly affect their rights, even by the ordinary as distinguished from the extraordinary use of the water. Even a riparian proprietor cannot divert the stream to a place outside his tenement and there use it for purposes unconnected with the tenement (*McCartney* v. *Londonderry & Lough Swilly Rly. Co.*, 1904, A.C. 301).

The limitations to which the right of the riparian proprietor is subject may be divided into those existing by common right, those imposed for public purposes, and those established against him by crown grant or by custom or prescription. Under the first head comes the public right of navigation, of anchorage and fishery from boats (in tidal waters), and of taking shell-fish (and probably other fish except royal fish) on the shore of tidal waters as far as any right of several fishery does not intervene. Under the second head would fall the right of eminent domain by which the state takes riparian rights for public purposes, compensating the proprietor, the restrictions upon the sporting rights of the proprietor, as by acts forbidding the taking of fish in close time, and the Wild Birds Protection Acts, and the restrictions on the ground of public health, as by the Rivers Pollution Act 1876 and the regulations of port sanitary authorities. The jurisdiction of the state over rivers in England may be exercised by officers of the crown, as by commissioners of sewers or by the Board of Trade, under the Crown Lands Act 1866. A bridge is erected and maintained by the county authorities, and the riparian proprietor must bear any inconvenience resulting from it. An example of an adverse right by crown grant is a ferry or a port. The crown, moreover, as the guardian of the realm, has jurisdiction to restrain the removal of the foreshore, the natural barrier of the sea, by its owner in case of apprehended danger to the coast. The rights established against a riparian proprietor by private persons must as a rule be based on prescription or custom, only on prescription where they are in the nature of profits *à prendre*. The public cannot claim such rights by prescription, still less by custom. Among such rights are the right to land, to discharge cargo, to tow, to dry nets, to beach boats, to take sand, shingle or water, to have a sea-wall maintained, to pollute the water (subject to the Rivers

Pollution Act), to water cattle, &c. In some cases the validity of local riparian customs has been recognized by the legislature. The right to enter on lands adjoining tidal waters for the purpose of watching for and landing herrings, pilchards and other sea-fish was confirmed to the fishermen of Somerset, Devon and Cornwall by 1 Jac. I. c. 23. Digging sand on the shore of tidal waters for use as manure on the land was granted to the inhabitants of Devon and Cornwall by 7 Jac. I. c. 18. The public right of taking or killing rabbits in the daytime on any sea bank or river bank in the county of Lincoln, so far as the tide extends, or within one furlong of such bank, was preserved by the Larceny Act 1881. It should be noticed that rights of the public may be subject to private rights. Where the river is navigable, although the right of navigation is common to the subjects of the realm, it may be connected with a right to exclusive access to riparian land, the invasion of which may form the ground for legal proceedings by the riparian proprietor (see *Lyon* v. *The Fishmongers' Company*, 1876, 1 A.C. 662). There is no common-law right of support by subterranean water. A grant of land passes all watercourses, unless reserved to the grantor.

A freshwater lake appears to be governed by the same law as a non-tidal river, surface water being *pars soli*. The preponderance of authority is in favour of the right of the riparian proprietors as against the crown. Most of the law will be found in *Bristow* v. *Cormican*, 1878, 3 A.C. 648.

Unlawful and malicious injury to sea and river banks, towing paths, sluices, flood-gates, mill-dams, &c., or poisoning fish, is a crime under the Malicious Damage Act 1861.

Ferry is a franchise created by grant or prescription. When created it is a highway of a special description, a monopoly to be used only for the public advantage, so that the toll levied must be reasonable. The grantee may have an action or an injunction for infringement of his rights by competition unless the infringement be by act of parliament. In *Hopkins* v. *G.N. Ry. Co.*, 1877, 2 Q.B.D. 224 (followed in *Dibden* v. *Skirrow*, 1907, 1 Ch. 437), it was held that the owner of a ferry cannot maintain an action for loss of traffic caused by a new bridge or ferry made to provide for new traffic. Many ferries are now regulated by local acts.

Weir, the *gurges* of Domesday, the *kidellus* of Magna Carta, as appurtenant to a fishery, is a nuisance at common law unless granted by the crown before 1272. From the etymology of *kidellus* the weir was probably at first of wicker, later of timber or stone. The owner of a several fishery in tidal waters cannot maintain his claim to a weir unless he can show a title going back to Magna Carta. In private waters he must claim by grant or prescription. Numerous fishery acts from 25 Edw. III. st. 4, c. 4 deal with weirs, especially with regard to salmon fishery. An interesting case is *Hanbury* v. *Jenkins*, 1901, 2 Ch. 401, where it was held that a grant of "wears" in the Usk by Henry VIII. in 1516 passed the bed of the river as well as the right of fishing.

Mill may be erected by any one, subject to local regulations and to his detaining the water no longer than is reasonably necessary for the working of the wheel. But if a dam be put across running water, the erection of it can only be justified by grant or prescription, or (in a manor) by manorial custom. On navigable rivers it must have existed before 1272. The owner of it cannot pen up the water permanently so as to make a pond of it.

Bathing.—The reported cases affect only sea-bathing, but Hall (p. 160) is of opinion that a right to bathe in private waters may exist by prescription or custom. There is no common-law right to bathe in the sea or to place bathing-machines on the shore. Prescription or custom is necessary to support a claim, whether the foreshore is the property of the crown or of a private owner (*Brinckman* v. *Matley*, 1904, 2 Ch. 313). Bathing in the sea or in rivers is now often regulated by the by-laws of a local authority.

Scotland.—The law of Scotland is in general accordance with that of England. One of the principal differences is that in Scotland, if a charter state that the sea is the boundary of a grant, the foreshore is included in the grant, subject to the burden of crown rights for public purposes. Persons engaged in the herring fishery off the coast of Scotland have, by 11 Geo. III. c. 31, the right to use the shore for 100 yds. from high-water mark for landing and drying nets, erecting huts and curing fish. By the Army Act 1881, s. 143, soldiers on the march in Scotland pay only half toll at ferries. The right of ferry is one of the *regalia minora* acquirable by prescriptive possession on a charter of barony. Sea-greens are private property. The right to take seaweed from another's foreshore may be prescribed as a servitude. Interference with the free passage of salmon by abstraction of water to artificial channels is restrainable by interdict (*Pirie* v. *Earl of Kintore*, 1906, A.C. 478). See the Salmon Fisheries (Scotland) Acts 1828 to 1868.

In *Ireland* the law is in general accordance with that of England. In *R.* v. *Clinton*, I.R. 4 C.L. 6, the Irish court went perhaps beyond any English precedent in holding that to carry away drift seaweed from the foreshore is not larceny. The Rivers Pollution Act 1876 was re-enacted for Ireland by the similar act of 1893.

In the *United States* the common law of England was originally the law, the state succeeding to the right of the crown. This was no doubt sufficient in the thirteen original states, which are not traversed by rivers of the largest size, but was not generally followed when it became obvious that new conditions, unknown in England, had arisen. Accordingly the soil of navigable rivers, fresh or salt, and of lakes, is vested in the state, which has power to regulate navigation and impose tolls. The admiralty jurisdiction of the United States extends to all public navigable rivers and lakes where commerce is carried on between different states or with foreign nations (*Genesee Chief* v. *Fitzhugh*, 12 Howard's Rep. 443). And in a case decided in 1893 it was held that the open waters of the great lakes are "high seas" within the meaning of § 5346 of the Revised Statutes (*U.S.* v. *Rodgers*, 150 U.S. Rep. 249). A state may establish ferries and authorize dams. But if water from a dam overflow a public highway, an indictable nuisance is caused. The right of eminent domain is exercised to a greater extent than in England in the compulsory acquisition of sites for mills and the construction of levees or embankments, especially on the Mississippi. In the drier country of the west and in the mining districts, the common law as to irrigation has had to be altered, and what was called the "Arid Region Doctrine" was gradually established. By it the first user of water has a right by priority of occupation if he give notice to the public of an intention to appropriate, provided that he be competent to hold land.

AUTHORITIES.—Hall's *Essay on the Rights of the Crown on the Sea-Shore* (1830) has been re-edited in 1875 and 1888. See also S. A. and H. S. Moore, *History and Law of Fisheries* (1903). Among American authorities are the works of Angell, Gould and Pomeroy, on *Waters and Watercourses*, Washburn on *Easements*, Angell on the *Right of Property in Tide Waters*, Kirney on *Irrigation* and the *Report to the Senate on Irrigation* (1900). (J. W.)

WATER-SCORPION, an aquatic hemipterous insect of the family Nepidae, so called from its superficial resemblance to a scorpion, which is due to the modification of the legs of the anterior pair for prehension, and to the presence of a long slender process, simulating a tail, at the posterior end of the abdomen. The common British species (*Nepa cinerea*) lives in ponds and stagnant water, and feeds upon aquatic animal organisms principally of the insect kind. Respiration in the adult is effected by means of the caudal process, which consists of a pair of half-tubes capable of being locked together to form a siphon by means of which air is conducted to the tracheae at the apex of the abdomen when the tip of the tube is thrust above the surface of the water. In immature forms the siphon is undeveloped and breathing takes place through six pairs of abdominal spiracles. The eggs, laid in the stems of plants, are supplied with seven filamentous processes which float freely in the water.

In *Nepa* the body is broad and flat; but in an allied water-bug, *Ranatra*, which contains a single British species (*R. linearis*), it is long and narrow, while the legs are very slender and elongate. Certain exotic members of this group, sometimes erroneously referred to the Nepidae, but really forming a special family, Belostomidae, are of large size, a South American species, *Belostoma grande*, reaching a length of between 4 and 5 in.

WATERSHED, in physical geography, the line separating the headstreams tributary to two different river-systems or basins. Alternative terms are "water-parting" and "divide." The crest of a mountain ridge forms the most clearly marked watershed; in a plain country of gentle slope (*e.g.* the central plain of Ireland) the watershed is often difficult to trace, as the headwaters of two different river systems may merge in marshes or lakes at the highest levels. In a mountainous country, where two streams, flowing in opposite directions but having their sources adjacent, are both gradually eroding or cutting back the land at their heads, a pass is formed. In such cases, where one stream erodes faster than the other, the stronger may ultimately "behead" the weaker, and "capture" some of its waters, whose flow is diverted from one basin to another.

WATERSPOUT, a local vorticular storm occurring over a water-surface, and in origin and form similar to a tornado (*q.v.*) over the land. A whirling, funnel-shaped cloud, first observed as a pendant from the mass of storm-cloud above, seems to grow downwards, tapering, towards the water-surface, which is violently agitated, and finally (when the spout is fully developed) appears to be drawn up to meet the cloud from above. This appearance is deceptive, as the bulk of the water carried along by the whirling spout is condensed from the atmosphere, and, even when the spout is formed over a salt-water surface, is found to be fresh. Waterspouts occur most frequently over the warm seas of the tropics, but they are not confined to the warmer tropical seasons, or even to low latitudes.

WATER SUPPLY. This article is confined to the collection and storage of water for domestic and industrial uses and irrigation, and its purification on a large scale. The conveyance of water is dealt with in the article AQUEDUCT.

COLLECTING AREAS

Surface Waters.—Any area, large or small, of the earth's surface from any part of which, if the ground were impermeable, water would flow by gravitation past any point in a natural watercourse is commonly known in Europe as the "hydrographic basin" above that point. In English it has been called indifferently the "catchment basin," the "gathering ground," the "drainage area" and the "watershed." The latter term, though originally equivalent to the German *Wasserscheide*—"water-parting"—is perhaps least open to objection. The water-parting is the line bounding such an area and separating it from other watersheds. The banks of a watercourse or sides of a valley are distinguished as the right and left bank respectively, the spectator being understood to be looking down the valley.

The surface of the earth is rarely impermeable, and the structure of the rocks largely determines the direction of flow of so much of the rainfall as sinks into the ground and is not evaporated. Thus the figure and area of a surface watershed may not be coincident with that of the corresponding underground watershed; and the flow in any watercourse, especially from a small watershed, may, by reason of underground flow from or into other watersheds, be disproportionate to the area apparently drained by that watercourse.

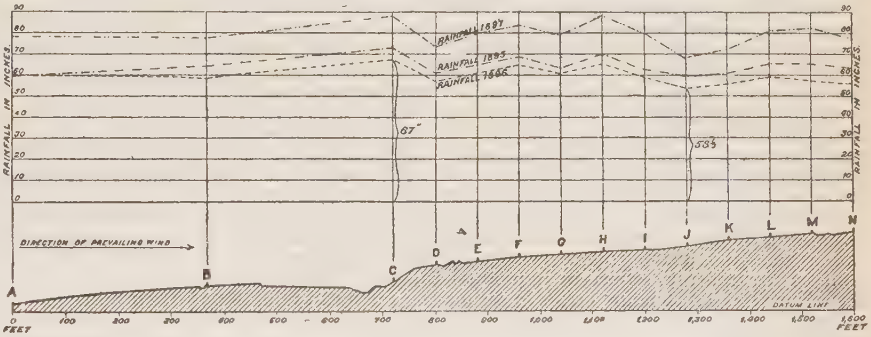

FIG. 1.

Dry weather flow of stream.

When no reservoir exists, the volume of continuous supply from any watershed area is evidently limited to the minimum, or, so-called, *extreme dry weather flow of the stream* draining it. This cannot be determined from the rainfall; it entirely depends upon the power of the soil and rock to store water in the particular area under consideration, and to yield it continuously to the stream by means of concentrated springs or diffused seepage. Mountain areas of 10,000 acres and upwards, largely covered with moorland, upon nearly impermeable rocks with few water-bearing fissures, yield in temperate climates, towards the end of the driest seasons, and therefore solely from underground, between a fifth and a quarter of a cubic foot per second per 1000 acres. Throughout the course of the river Severn, the head-waters of which are chiefly supplied from such formations, this rate does not materially change, even down to the city of Worcester, past which the discharge flows from 1,256,000 acres. But in smaller areas, which on the average are necessarily nearer to the water-parting, the limits are much wider, and the rate of minimum discharge is generally smaller.

Thus, for example, on 1000 acres or less, it commonly falls to one-tenth of a cubic foot, and upon an upland Silurian area of 940 acres, giving no visible sign of any peculiarity, the discharge fell, on the 21st of September 1893, to one-thirty-fifth of a cubic foot per second per 1000 acres. In this case, however, some of the water probably passed through the beds and joints of rocks to an adjoining valley lying at a lower level, and had both streams been gauged the average would probably have been considerably greater. The Thames at Teddington, fed largely from cretaceous areas, fell during ten days in September 1898 (the artificial abstractions for the supply of London being added) to about one-sixth of a cubic foot, and since 1880 the discharge has occasionally fallen, in each of six other cases, to about one-fifth of a cubic foot per second per 1000 acres. Owing, however, to the very variable permeability of the strata, the tributaries of the Thames, when separately gauged in dry seasons, yield the most divergent results. It may be taken as an axiom that the variation of minimum discharges from their mean values increases as the separate areas diminish. In the eastern and south-eastern counties of England even greater variety of dry weather flow prevails than in the west, and upon the chalk formations there are generally no surface streams, except such as burst out after wet weather and form the so-called "bournes." On the other hand, some rocks in mountain districts, notably the granites, owing to the great quantity of water stored in their numerous fissures or joints, commonly yield a much higher proportion of so-called dry weather flow.

Rainfall.

When, however, a reservoir is employed to equalize the flow during and before the period of dry weather, the minimum flow continuously available may be increased to a much higher figure, depending upon the capacity of that reservoir in relation to the mean flow of the stream supplying it. In such a case the first essential in determining the yield is to ascertain the rainfall. For this purpose, if there are no rain-gauges on the drainage area in question, an estimate may be formed from numerous gaugings throughout the country, most of which are published in *British Rainfall*, initiated by the late Mr G. J. Symons, F.R.S., and now carried on by Dr H. R. Mill.[1] But except in the hands of those who have spent years in such investigations, this method may lead to most incorrect conclusions. If any observations exist upon the drainage area itself they are commonly only from a single gauge, and this gauge, unless the area is very level, may give results widely different from the mean fall on the whole area. Unqualified reliance upon single gauges in the past has been the cause of serious errors in the estimated relation between rainfall and flow off the ground.

The uncertainties are illustrated by the following actual example: A battery of fourteen rain-gauges, in the same vertical plane, on ground having the natural profile shown by the section (fig. 1), gave during three consecutive years the respective falls shown by the height of the dotted lines above the datum line. Thus on the average, gauge C recorded 20% more than gauge D only 70 ft. distant; while at C, in 1897, the rainfall was actually 30% greater than at J only 560 ft. away. The greatly varying distribution of rainfall over that length of 1600 ft. is shown by the dotted lines measured upwards from the datum to have been remarkably consistent in the three years; and its cause—the path necessarily taken in a vertical plane by the prevailing winds blowing from A towards N—after passing the steep bank at C D—may be readily understood. Such examples show the importance of placing any rain-gauge, so far as possible, upon a plane surface of the earth—horizontal, or so inclined that, if produced, especially in the direction of prevailing winds, it will cut the mean levels of the area whose mean rainfall is intended to be represented by that gauge. It has been commonly stated that rainfall increases with the altitude. This is broadly true. A rain-cloud raised vertically upwards expands, cools and tends to precipitate; but in the actual passage of rain-clouds over the surface of the earth other influences are at work. In fig. 2 the thick line represents the profile of a vertical section crossing two ranges of hills and one valley. The arrows indicate the directions of the prevailing winds. At the extreme left the rain-clouds are thrown up, and if this were all, they would precipitate a larger proportion of the moisture

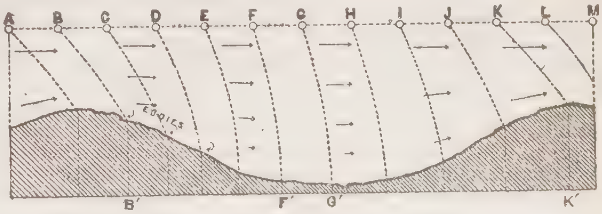

FIG. 2.

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[1] Since the above was written, this work has been taken over by the "British Rainfall Organization."

they contained as the altitude increased. But until the clouds rise above the hill there is an obvious countervailing tendency to compression, and in steep slopes this may reduce or entirely prevent precipitation until the summit is reached, when a fall of pressure with commotion must occur. Very high mountain ranges usually consist of many ridges, among which rain-clouds are entangled in their ascent, and in such cases precipitation towards the windward side of the main range, though on the leeward sides of the minor ridges of which it is formed, may occur to so large an extent that before the summit is reached the clouds are exhausted or nearly so, and in this case the total precipitation is less on the leeward than on the windward side of the main range; but in the moderate heights of the United Kingdom it more commonly happens from the causes explained that precipitation is prevented or greatly retarded until the summit of the ridge is reached. The following cause also contributes to the latter effect. Imagine eleven raindrops A to K to fall simultaneously and equi-distantly from the horizontal plane A M. A strong wind is urging the drops from left to right. The drops A and K may be readily conceived to be equally diverted by the wind, and to fall near the tops of the two hills respectively. Not so drop C, for directly the summit is passed the wind necessarily widens out vertically and, having a greater space to fill, loses forward velocity. It may even eddy backwards, as indicated by the curved arrows, and it is no uncommon thing, in walking up a steep hill in the contrary direction to the flight of the clouds, to find that the rain is coming from behind. Much the same tendency exists with respect to all drops between B and E, but at F the wind has begun to accommodate itself to the new regime and to assume more regular forward motion, and as J is approached, where vertical contraction of the passage through which the wind must pass takes place, there is an increasing tendency to lift the raindrops beyond their proper limits. The general effect is that the rain falling from between G and K is spread over a greater area of the earth G′K′ than that falling from the equal space between B and F, which reaches the ground within the smaller area B′F′. From this cause also, therefore, the leeward side of the valley receives more rain than the windward side. In the United Kingdom the prevailing winds are from the south-west, and some misapprehension has been caused by the bare, but perfectly correct, statement that the general slope towards the western coast is wetter than that towards the eastern. Over the whole width of the country from coast to coast, or of the Welsh mountain ranges only, this is so; but it is nevertheless true that the leeward side of an individual valley or range of hills generally receives more rain than the windward side. Successive abstraction of raindrops as the rain-clouds pass over ridge after ridge causes a gradually diminishing precipitation, but this is generally insufficient to reverse the local conditions, which tend to the contrary effect in individual ranges. The neglect of these facts has led to many errors in estimating the mean rainfall on watershed areas from the fall observed at gauges in particular parts of those areas.

In the simplest case of a single mountain valley to be used for the supply of an impounding reservoir, the rainfall should be known at five points, three being in the axis of the valley, of which one is near the point of intersection of that axis with the boundary of the watershed. Then, in order to connect with these the effect of the right- and left-hand slopes, there should be at least one gauge on each side about the middle height, and approximately in a line perpendicular to the axis of the valley passing through the central gauge. The relative depths recorded in the several gauges depend mainly upon the direction of the valley and steepness of the bounding hills. The gauge in the bottom of the valley farthest from the source will in a wide valley generally record the least rainfall, and one of those on the south-west side, the highest. Much will depend upon the judicious placing of the gauges. Each gauge should have for 10 or 15 yds. around it an uninterrupted plane fairly representing the general level or inclination, as the case may be, of the ground for a much larger distance around it. The earliest records of such gauges should be carefully examined, and if any apparently anomalous result is obtained, the cause should be traced, and when not found in the gauge itself, or in its treatment, other gauges should be used to check it. The central gauge is useful for correcting and checking the others, but in such a perfectly simple case as the straight valley above assumed it may be omitted in calculating the results, and if the other four gauges are properly placed, the arithmetical mean of their results will probably not differ widely from the true mean for the valley. But such records carried on for a year or many years would afford no knowledge of the worst conditions that could arise in longer periods, were it not for the existence of much older gauges not far distant and subject to somewhat similar conditions. The nearer such long-period gauges are to the local gauges the more likely are their records to rise and fall in the same proportion. The work of the late Mr James Glaisher, F.R.S., of the late Mr G. J. Symons, F.R.S., of the Meteorological Office and of the Royal Meteorological Society, has resulted in the establishment of a vast number of rain-gauges in different parts of the United Kingdom, and it is generally, though not always, found that the mean rainfall over a long period can be determined, for an area upon which the actual fall is known only for a short period, by assigning to the missing years of the short-period gauges, rainfalls bearing the same proportion to those of corresponding years in the long-period gauges that the rainfalls of the known years in the short-period gauges bear to those of corresponding years in the long-period gauges. In making such comparisons, it is always desirable, if possible, to select as standards long-period gauges which are so situated that the short-period district lies between them. Where suitably placed long-period gauges exist, and where care has been exercised in ascertaining the authenticity of their records and in making the comparisons, the short records of the local gauges may be thus carried back into the long periods with nearly correct results.

Rainfall is proverbially uncertain; but it would appear from the most trustworthy records that at any given place the total rainfall during any period of 50 years will be within 1 or 2 % of the total rainfall at the same place during any other period of 50 years, while the records of any period of 25 years will generally be found to fall within 3½ % of the mean of 50 years. It is equally satisfactory to know that there is a nearly constant ratio on any given area (exceeding perhaps 1000 acres) between the true mean annual rainfall, the rainfall of the driest year, the two driest consecutive years and any other groups of driest consecutive years. Thus in any period of 50 years the driest year (not at an individual gauge but upon such an area) will be about 63 % of the mean for the 50 years.

That in the two driest consecutive years will be about 75 % of the mean for the 50 years.

That in the three driest consecutive years will be about 80 % of the mean for the 50 years.

That in the four driest consecutive years will be about 83 % of the mean for the 50 years.

That in the five driest consecutive years will be about 85 % of the mean for the 50 years.

That in the six driest consecutive years will be about 86½ % of the mean for the 50 years.

Apart altogether from the variations of actual rainfall produced by irregular surface levels, the very small area of a single rain-gauge is subject to much greater variations in short periods than can possibly occur over larger areas. If, therefore, instead of regarding only the mean rainfall of several gauges over a series of years, we compare the relative falls in short intervals of time among gauges yielding the same general averages, the discrepancies prove to be very great, and it follows that the maximum possible intensity of discharge from different areas rapidly increases as the size of the watershed decreases. Extreme cases of local discharge are due to the phenomena known in America as "cloud-bursts," which occasionally occur in Great Britain and result in discharges, the intensities of which have rarely been recorded by rain-gauges. The periods of such discharges are so short, their positions so isolated and the areas affected so small, that we have little or no exact knowledge concerning them, though their disastrous results are well known. They do not directly affect the question of supply, but may very seriously affect the works from which that supply is given.

Evaporation and absorption.

Where in this article the term "evaporation" is used alone, it is to be understood to include absorption by vegetation. Of the total quantity of rainfall a very variable proportion is rapidly absorbed or re-evaporated. Thus in the western mountain districts of Great Britain, largely composed of nearly impermeable rocks more or less covered with pasture and moorland, the water evaporated and absorbed by vegetation is from 13 to 15 in. out of a rainfall of 80 in., or from 16 to 19 %, and is nearly constant down to about 60 in., where the proportion of loss is therefore from 22 to 25 %. The Severn down to Worcester, draining 1,256,000 acres of generally flatter land largely of the same lithological character, gave in the dry season from the 1st of July 1887 to the 30th of June 1888 a loss of 17·93 in. upon a rainfall of 27·34 in. or about 66 %; while in the wet season, 1st of July 1882 to the 30th of June 1883, the loss was 21·09 in. upon a rainfall of 43·26 in., or only 49 %. Upon the Thames basin down to Teddington, having an area of 2,353,000 acres, the loss in the dry season from the 1st of July 1890 to the 30th of June 1891 was 17·22 in. out of a rainfall of 21·62 in., or 79 %; while in the wet season, 1st of July 1888 to the 30th of June 1889, it was 18·96 out of 29·22 in., or only 65 %. In the eastern counties the rainfall is lower and the evaporation approximately the same as upon the Thames area, so that the percentage of loss is greater. But these are merely broad examples and averages of many still greater variations over smaller areas. They show generally that, as the rainfall increases on any given area evaporation increases, but not in the same proportion. Again, the loss from a given rainfall depends greatly upon the previous season. An inch falling in a single day on a saturated mountain area will nearly all reach the rivers, but if it falls during a drought seven-eighths may be lost so far as the period of the drought is concerned. In such a case most of the water is absorbed by the few upper inches of soil, only to be re-evaporated during the next few days, and the small proportion which sinks into the ground probably issues in springs many months later. Thus the actual yield of rainfall to the streams depends largely upon the mode of its time-distribution, and without a knowledge of this it is impossible to anticipate the yield of a particular rainfall. In estimating the evaporation to be deducted from the rainfall for the purpose of determining the flow into a reservoir, it is important to bear in mind that the loss from a constant water surface is nearly one and a half times as great as from the intermittently saturated land surface. Even neglecting the isolated and local discharges due to excessive and generally unrecorded rainfall, the variation in the discharge of all streams, and especially of mountain streams, is very great. We have seen that the average flow from mountain areas in Great Britain towards the end of a dry season does not exceed one-fifth of a cubic foot per second per 1000 acres. Adopting this general minimum as the unit, we find that the flow from such areas up to about 5000 acres, whose mean annual rainfall exceeds 50 in., may be expected occasionally to reach 300 cub. ft., or 1500 such units; while from similar areas of 20,000 or 30,000 acres with the same mean rainfall the discharge sometimes reaches 1200 or 1300 such units. It is well to compare these results with those obtained from much larger areas but with lower mean rainfall. The Thames at Teddington has been continuously gauged by the Thames Conservators since 1883, and the Severn at Worcester by the writer, on behalf of the corporation of Liverpool, during the 10 years 1881 to 1890 inclusive. The highest flood, common to the two periods, was that which occurred in the middle of February 1883. On that occasion the Thames records gave a discharge of 7·6 cub. ft. per second per 1000 acres, and the Severn records a discharge of 8·6 cub. ft. per second per 1000 acres, or 38 and 43 respectively of the above units; while in February 1881, before the Thames gaugings were commenced, the Severn had risen to 47 of such units, and subsequently in May 1886 rose to 50 such units, though the Thames about the same time only rose to 13. But in November 1894 the Thames rose to about 80 such units, and old records on the Severn bridges show that that river must on many occasions have risen to considerably over 100 units. In both these cases the natural maximum discharge is somewhat diminished by the storage produced by artificial canalization of the rivers.

Compensation water.

These illustrations of the enormous variability of discharge serve to explain what is popularly so little understood, namely, the advantage which riparian owners, or other persons interested in a given stream, may derive from works constructed primarily for the purpose of diverting the water of that stream—it may be to a totally different watershed—for the purposes of a town supply. Under modern legislation no such abstraction of water is usually allowed, even if limited to times of flood, except on condition of an augmentation of the natural dry-weather flow, and this condition at once involves the construction of a reservoir. The water supplied to the stream from such a reservoir is known as "compensation water," and is generally a first charge upon the works. This water is usually given as a continuous and uniform flow, but in special cases, for the convenience of mill-owners, as an intermittent one.[1] In the manufacturing districts of Lancashire and Yorkshire it generally amounts to one-third of the whole so-called "available supply." In Wales it is usually about one-fourth, and elsewhere still less; but in any case it amounts to many times the above unit of one-fifth of a cubic foot per second per 1000 acres. Thus the benefit to the fisheries and to the riparian owners generally is beyond all question; but the cost to the water authority of conferring that benefit is also very great—commonly (according to the proportion of the natural flow intended to be rendered uniform) 20 to 35% of the whole expenditure upon the reservoir works.

Yield of stream with reservoir.

Down to the middle of the 19th century, the proportioning of the size of a reservoir to its work was a very rough operation. There were few rainfall statistics, little was known of the total loss by evaporation, and still less of its distribution over the different periods of dry and wet weather. Certain general principles have since been laid down, and within the proper limits of their application have proved excellent guides. In conformity with the above-mentioned convention (by which compensation water is determined as a certain fraction of the average flow during the three driest consecutive years) the available supply or flow from a given area is still understood to be the average annual rainfall during those years, less the corresponding evaporation and absorption by vegetation. But this is evidently only the case when the reservoir impounding the water from such an area is of just sufficient capacity to equalize that flow without possible exhaustion in any one of the three summers. If the reservoir were larger it might equalize the flow of the four or more driest consecutive years, which would be somewhat greater than that of the three; if smaller, we might only be able to count upon the average of the flow of the two driest consecutive years, and there are many reservoirs which will not yield continuously the average flow of the stream even in the single driest year. With further experience it has become obvious that very few reservoirs are capable of equalizing the full flow of the three consecutive driest years, and each engineer, in estimating the yield of such reservoirs, has deducted from the quantity ascertained on the assumption that they do so, a certain quantity representing, according to his judgment, the overflow which in one or more of such years might be lost from the reservoir. The actual size of the reservoir which would certainly yield the assumed supply throughout the driest periods has therefore been largely a matter of judgment. Empirical rules have grown up assigning to each district, according to its average rainfall, a particular number of days' supply, independently of any inflow, as the contents of the reservoir necessary to secure a given yield throughout the driest seasons. But any such generalizations are dangerous and have frequently led to disappointment and sometimes to needless expenditure. The exercise of sound judgment in such matters will always be necessary, but it is nevertheless important to formulate, so far as possible, the conditions upon which that judgment should be based. Thus in order to determine truly the continuously available discharge of any stream, it is necessary to know not only the mean flow of the stream, as represented by the rainfall less the evaporation, but also the least favourable distribution of that flow throughout any year.

The most trying time-distribution of which the author has had experience in the United Kingdom, or which he has been able to discover from a comparison of rainfalls upon nearly impermeable areas exceeding 1000 acres, is graphically represented by the thick irregular line in the left-hand half of fig. 3, where the total flow for the driest year measures 100 on the vertical percentage scale; the horizontal time scale being divided into calendar months.

The diagram applies to ordinary areas suitable for reservoir construction and in which the minimum flow of the stream reaches about one-fifth of a cubic foot per second per 1000 acres. Correspondingly, the straight line *a a* represents uniformly distributed supply, also cumulatively recorded, of the same quantity of water over the same period. But, apart from the diurnal fluctuations of consumption which may be equalized by local "service reservoirs," uniform distribution of supply throughout twelve months is rarely what we require; and to represent the demand in most towns correctly, we should increase the angle of this line to the horizontal during the summer and diminish it during the winter months, as indicated by the dotted lines *b b*. The most notable features of this particular diagram are as follows: Up to the end of 59 days (to the 28th February) the rate of flow is shown, by the greater steepness of the thick line, to be greater than the mean for the year, and the surplus water—about 11% of the flow during the year—must be stored; but during the 184 days between this and the end of the 243rd day (31st August) the rate of flow is generally below the mean, while from that day to the end of the year it is again for the most part above the mean. Now, in order that a reservoir may enable the varying flow, represented cumulatively by the irregular line, to be discharged in a continuous and uniform flow to satisfy a demand represented cumulatively by the straight line *a a*, its capacity must be such that it will hold not only the 11 % surplus of the same year, but that, on June 10th, when this surplus has been used to satisfy the demand, it will still contain the water *c d*—19 %—stored from a previous year; otherwise between June 10th and August 31st the reservoir will be empty and only the dry weather flow of the stream will be available for supply. In short, if the reservoir is to equalize the whole flow of this year, it must have a capacity equal to the greatest deficiency *c d* of the cumulative flow below the cumulative demand, plus the greatest excess *e f* of the cumulative flow over the cumulative demand. This capacity is represented by the height of the line *a′a′* (drawn parallel to *a a* from the point of maximum surplus *f*) vertically above the point of greatest deficiency *c*, and equal, on the vertical scale, to the difference between the height *c*=48 % and *g*=78 % or 30 % of the stream-flow during the driest year. A reservoir so proportioned to the stream-flow with a proper addition to avoid drawing off the bottom water, would probably be safe in Great Britain in any year for a uniform demand equal to the cumulative stream-flow; or, if it failed, that failure would be of very short duration, and would probably only occur once in 50 years.

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[1] The volume of compensation water is usually fixed as a given fraction of the so-called "available supply" (which by a convention that has served its purpose well, is understood to be the average flow of the stream during the three consecutive driest years).

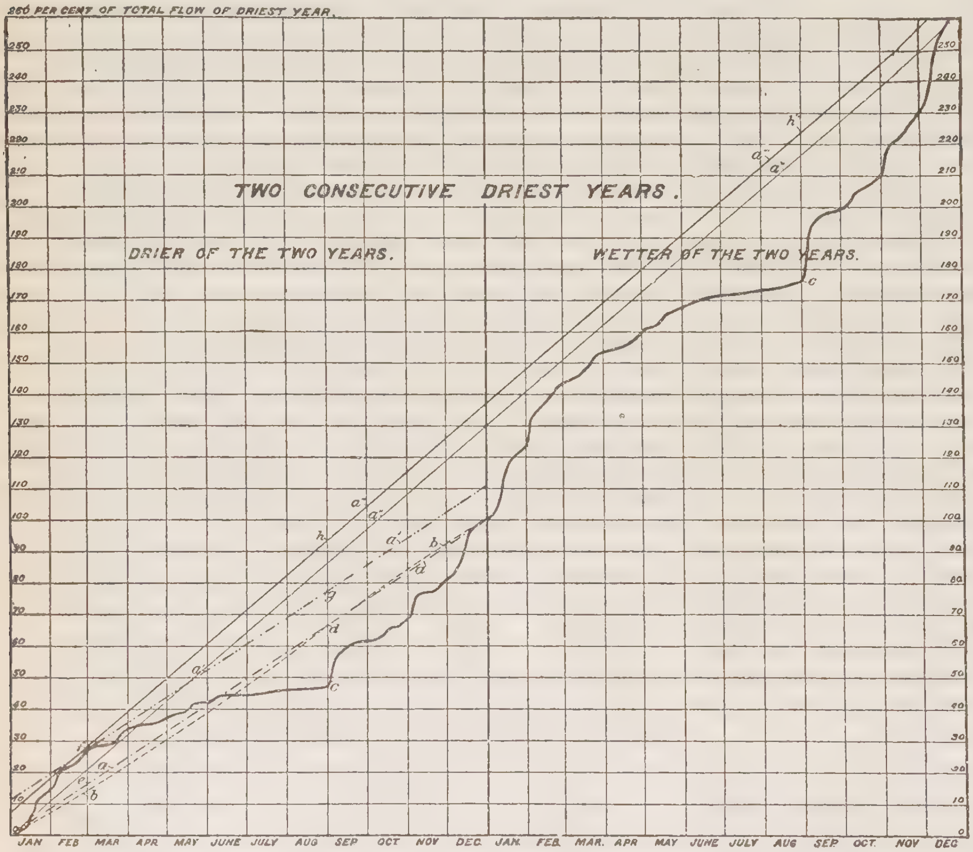

FIG. 3.

It may be at first sight objected that a case is assumed in which there is no overflow before the reservoir begins to fall, and therefore no such loss as generally occurs from that cause. This is true, but it is only so because we have made our reservoir large enough to contain in addition to its stock of 19 %, at the beginning of the year, all the surplus water that passes during the earlier months in this driest year with its least favourable time-distribution of flow. Experience shows, in fact, that if a different distribution of the assumed rainfall occurs, that distribution will not try the reservoir more severely while the hitherto assumed uniform rate of demand is maintained. But, as above stated, the time-distribution of demand is never quite uniform. The particular drought shown on the diagram is the result of an exceptionally early deficiency of rainfall which, in conjunction with the variation of demand shown by the dotted line *b b*, is the most trying condition. The reservoir begins to fall at the end of February, and continues to do so with few and short exceptions until the end of August, and it so happens that about the end of August this dotted line, *b b* representing actual cumulative demand, crosses the straight line *a a* of uniform demand, so that the excess of demand, represented by the slope from June to September, is balanced by the deficiency of demand, represented by the flatter slope in the first five months, except as regards the small quantity *b e* near the end of February, which, not having been drawn off during January and February, must overflow before the end of February. To avoid this loss the 11 % is in this case to be increased by the small quantity *b e* determined by examination of the variation of the actual from a constant demand. After the reservoir begins to fall—in this case at the end of February—no ordinary change in the variation of demand can affect the question, subject of course to the cumulative demand not exceeding the reservoir yield for the assumed year of minimum rainfall. In assuming a demand at the beginning of the year below the mean, resulting in an overflow equal in this case to *b e* at the end of February and increasing our reservoir to meet it, we assume also that some additional supply to that reservoir beyond the 11 % of the stream-flow from the driest year can be obtained from the previous year. In relation to this supply from the previous year the most trying assumption is that the rainfall of that year, together with that of the driest year, will be the rainfall of the two driest consecutive years. We have already seen that while the rainfall of the driest of 50 years is about 63 % of the mean, that of the driest two consecutive years is about 75 % of the mean. It follows, therefore, that the year immediately preceding the driest cannot have a rainfall less than about 87 % of the mean. As the loss by evaporation is a deduction lying between a constant figure and a direct proportional to the rainfall, we should err on the safe side in assuming the flow in the second driest year to be increased proportionally to the rainfall, or by the difference between 63 and 87 equal to 24 % of the mean of 50 years. This 24 % of the 50 years' mean flow is 38 % of the driest year's flow in fig. 3, and is therefore much more than sufficient to ensure the reservoir beginning the driest year with a stock equal to the greatest deficiency—19 %—of the cumulative flow of that year beyond the cumulative demand.

But in determining the capacity of reservoirs intended to yield a supply of water equal to the mean flow of two, three or more years, the error, though on the safe side, caused by assuming the evaporation to be proportional to the rainfall, is too great to be neglected. The evaporation slightly increases as the rainfall increases, but at nothing like so high a rate. Having determined this evaporation for the second driest consecutive year and deducted it from the rainfall—which, as above stated, cannot be less than 87 % of the mean of 50 years—we may, as shown on fig. 3, extend our cumulative diagram of demand and flow into the reservoir from one to two years.

The whole diagram shows, by the greater gradient of the unbroken straight lines, the greater demand which can be satisfied by the enlargement of the reservoir to the extent necessary to equalize the flow of the two driest consecutive years. The new capacity is either *c h* or *c′ h′*, whichever, in the particular case under investigation, is the greater. In the illustration the *c′ h′* is a little greater, measuring 47½ % of the flow of the driest year. In the same way we may group in a single diagram any number of consecutive driest years, and either ascertain the reservoir capacity necessary for a given uniform yield (represented cumulatively by a straight line corresponding with *a′a′*, but drawn over all the years instead of one), or conversely, having set up a vertical from the most trying point in the line of cumulative flow (*c* or *c′* in fig. 3—representing, in percentage of the total annual flow of the driest year, the capacity of reservoir which it may be convenient to provide) we may draw a straight line *a‴ a‴* of uniform yield from the head of that vertical to the previous point of maximum excess of cumulative flow. The line *a″ a″* drawn from zero parallel to the first line, produced to the boundaries of the diagram, will cut the vertical at the end of the first year at the percentage of the driest year's flow which may be safely drawn continuously from the reservoir throughout the two years. It is to be observed that any irregularity in the rate of supply from the reservoir may occur between the critical periods of maximum excess of cumulative flow and maximum deficiency

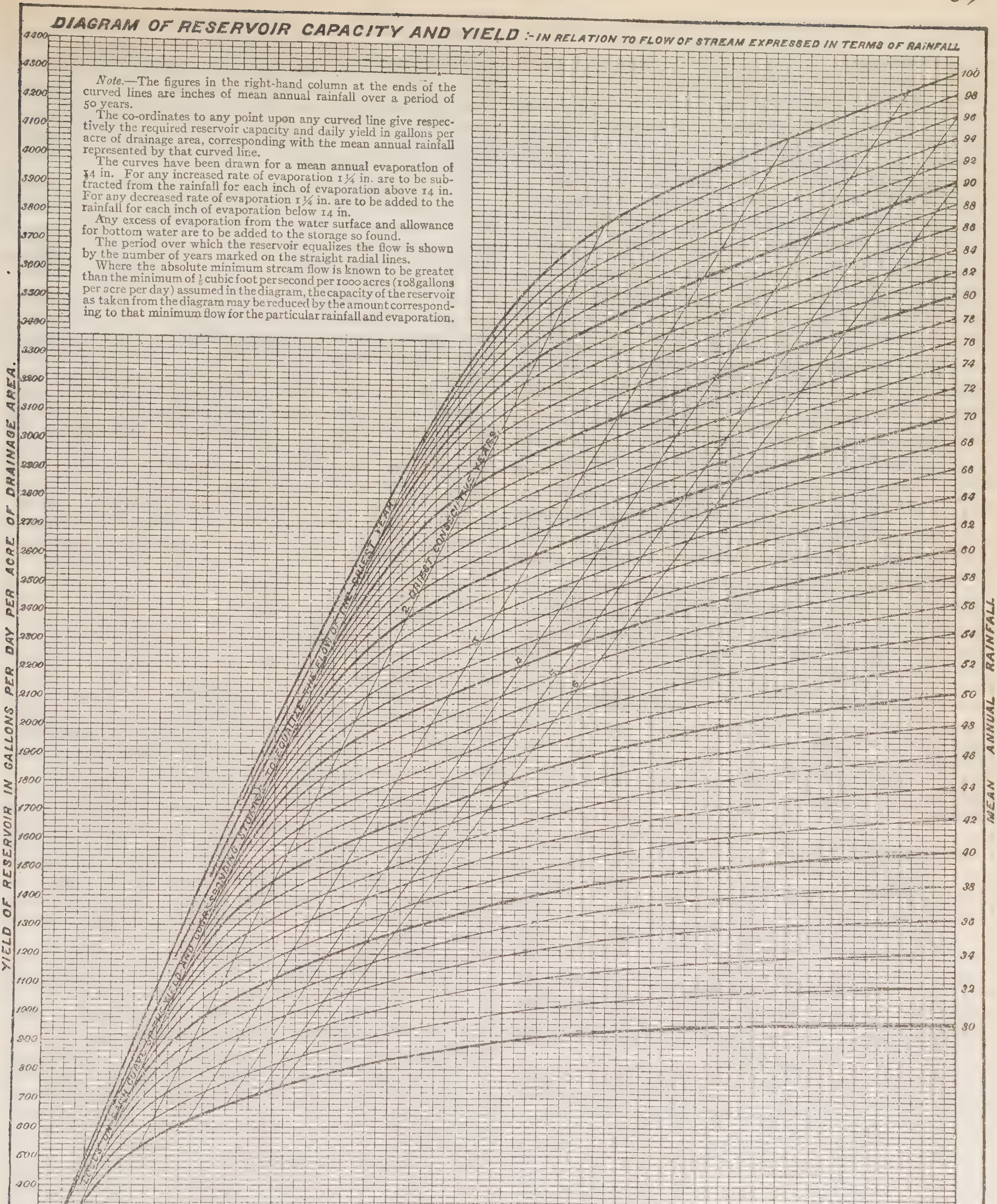

DIAGRAM OF RESERVOIR CAPACITY AND YIELD :- IN RELATION TO FLOW OF STREAM EXPRESSED IN TERMS OF RAINFALL

Note.—The figures in the right-hand column at the ends of the curved lines are inches of mean annual rainfall over a period of 50 years.

The co-ordinates to any point upon any curved line give respectively the required reservoir capacity and daily yield in gallons per acre of drainage area, corresponding with the mean annual rainfall represented by that curved line.

The curves have been drawn for a mean annual evaporation of 14 in. For any increased rate of evaporation 1¼ in. are to be subtracted from the rainfall for each inch of evaporation above 14 in. For any decreased rate of evaporation 1¼ in. are to be added to the rainfall for each inch of evaporation below 14 in.

Any excess of evaporation from the water surface and allowance for bottom water are to be added to the storage so found.

The period over which the reservoir equalizes the flow is shown by the number of years marked on the straight radial lines.

Where the absolute minimum stream flow is known to be greater than the minimum of ⅛ cubic foot per second per 1000 acres (108 gallons per acre per day) assumed in the diagram, the capacity of the reservoir as taken from the diagram may be reduced by the amount corresponding to that minimum flow for the particular rainfall and evaporation.

YIELD OF RESERVOIR IN GALLONS PER DAY PER ACRE OF DRAINAGE AREA.
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
3000
3100
3200
3300
3400
3500
3600
3700
3800
3900
4000
4100
4200
4300
4400
CAPACITY OF RESERVOIR IN GALLONS PER ACRE OF DRAINAGE AREA
0
100,000
200,000
300,000
400,000
500,000
600,000
700,000
800,000
MEAN ANNUAL RAINFALL
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100
ENDS OF EACH CURVE SHOW THE YIELD AND CORRESPONDING STORAGE TO EQUALIZE THE FLOW OF THE DRIEST YEAR
2 DRIEST CONSECUTIVE YEARS.
3
4
5
6

FIG. 4.

of cumulative flow (*f* and *c* respectively, in the one year diagram) which does not increase the aggregate cumulative supply between those points, or cause the line of cumulative supply from the reservoir to cut the line of cumulative flow into it.

From diagrams constructed upon these principles, the general diagram (fig. 4) has been produced. To illustrate its use, assume the case of a mean rainfall of 50 in., figured in the right-hand column at the end of a curved line, and of 14 in. of evaporation and absorption by vegetation as stated in the note on the diagram. The ordinate to any point upon this curved line then represents on the left-hand scale the maximum continuous yield per day for each acre of drainage area, from a reservoir whose capacity is equal to the corresponding abscissa. As an example, assume that we can conveniently construct a reservoir to contain, in addition to bottom water not to be used, 200,000 gallons for each acre of the watershed above the point of interception by the proposed dam. We find on the left-hand scale of yield that the height of the ordinate drawn to the 50-inch mean rainfall curve from 200,000 on the capacity scale, is 1457 gallons per day per acre; and the straight radial line, which cuts the point of intersection of the curved line and the co-ordinates, tells us that this reservoir will equalize the flow of the two driest consecutive years. Similarly, if we wish to equalize the flow of the three driest consecutive years we change the co-ordinates to the radial line figured 3, and thus find that the available capacity of the reservoir must be 276,000 gallons per acre, and that in consideration of the additional expense of such a reservoir we shall increase the daily yield to 1612 gallons per acre. In the same manner it will be found that by means of a reservoir having an available capacity of only 118,000 gallons per acre of the watershed, we may with the same rainfall and evaporation secure a daily supply of 1085 gallons per acre. In this case the left-hand radial line passes through the point at which the co-ordinates meet, showing that the reservoir will just equalize the flow of the driest year. Similarly, the yield from any given reservoir, or the capacity required for any yield, corresponding with any mean rainfall from 30 to 100 in., and with the flow over any period, from the driest year to the six or more consecutive driest years, may be determined from the diagram.

It is instructive to note the ratio of increase of reservoir capacity and yield respectively for any given rainfall. Thus, assuming a mean rainfall of 60 in. during 50 years, subject to evaporation and absorption equal to 14 in. throughout the dry period under consideration, we find from the diagram the following quantities (in gallons per acre of drainage area) and corresponding ratios:—

	Net Capacity of Reservoir.			Yield of Reservoir.		
Number of driest consecutive years, the flow of which is equalized.	In gallons per acre of drainage area.	In terms of Reservoir equalizing one year's flow = 100.	Increase per cent on each step.	Gallons per day.	In terms of yield of driest year = 100.	Increase per cent on each step.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	162,000	100	0	1475	100	0
2	256,000	158·0	58·0	1922	130·3	30·3
3	352,000	217·3	37·5	2108	142·9	9·7
4	416,000	256·8	18·2	2220	150·5	5·3
5	466,000	287·7	12·0	2294	155·5	3·3
6	504,000	311·1	8·1	2350	159·3	2·4

On comparing columns 3 and 6 or 4 and 7 it appears that so great is the increase required in the size of a reservoir in relation to its increased yield, that only in the most favourable places for reservoir construction, or under the most pressing need, can it be worth while to go beyond the capacity necessary to render uniform the flow of the two or three driest consecutive years.

It must be clearly understood that the diagram fig. 4 does not relieve the reader from any exercise of judgment, except as regards the net capacity of reservoirs when the necessary data have been obtained. It is merely a geometrical determination of the conditions necessarily consequent in England, Scotland and Wales, upon a given mean rainfall over many years, upon evaporation and absorption in particular years (both of which he must judge or determine for himself), and upon certain limiting variations of the rainfall, already stated to be the result of numerous records maintained in Great Britain for more than 50 years. It must also be remembered that the total capacity of a reservoir must be greater than its net available capacity, in order that in the driest seasons fish life may be maintained and no foul water may be drawn off.

Applied to most parts of Ireland and some parts of Great Britain, the diagram will give results rather unduly on the safe side, as the extreme annual variations of rainfall are less than in most parts of Great Britain. Throughout Europe the annual variations follow nearly the same law as in Great Britain, but in some parts the distribution of rainfall in a single year is often more trying. The droughts are longer, and the rain, when it falls, especially along the Mediterranean coast, is often concentrated into shorter periods. Moreover, it often falls upon sun-heated rocks, thus increasing the evaporation for the time; but gaugings made by the writer in the northern Apennines indicate that this loss is more than compensated by the greater rapidity of the fall and of the consequent flow. In such regions, therefore, for reservoirs equalizing the flow of 2 or more years, the capacity necessary does not materially differ from that required in Great Britain. As the tropics are approached, even in mountain districts, the irregularities become greater, and occasionally the rainy season is entirely absent for a single year, though the mean rainfall is considerable.

Springs and shallow wells.

We have hitherto dealt only with the collection and storage of that portion of the rainfall which flows over the surface of nearly impermeable areas. Upon such areas the loss by percolation into the ground, not retrieved in the form of springs above the point of interception may be neglected, and the only loss to the stream is that already considered of re-evaporation into the air and of absorption by vegetation. But the crust of the earth varies from almost complete impermeability to almost complete permeability. Among the sedimentary rocks we have, for example, in the clay slates of the Silurian formations, rocks no less cracked and fissured than others, but generally quite impermeable by reason of the joints being packed with the very fine clay resulting from the rubbing of slate upon slate in the earth movements to which the cracks are due. In the New Red Sandstone, the Greensand and the upper Chalk, we find the opposite extremes; while the igneous rocks are for the most part only permeable in virtue of the open fissures they contain. Wherever, below the surface, there are pores or open fissures, water derived from rainfall is (except in the rare cases of displacement by gas) found at levels above the sea determined by the resistance of solids to its passage towards some neighbouring sea, lake or watercourse. Any such level is commonly known as the level of saturation. The positions of springs are determined by permeable depressions in the surface of the ground below the general level of saturation, and frequently also by the holding up of that level locally by comparatively impermeable strata, sometimes combined with a fault or a synclinal fold of the strata, forming the more permeable portion into an underground basin or channel lying within comparatively impermeable boundaries. At the lower lips or at the most permeable parts of these basins or channels such rainfall as does not flow over the surface, or is not evaporated or absorbed by vegetation, and does not, while still below ground reach the level of the sea, issues as springs, and is the cause of the continued flow of rivers and streams during prolonged droughts. The average volume in dry weather, of such flow, generally reduced to terms of the fraction of a cubic foot per second, per thousand acres of the contributing area, is commonly known in water engineering as the "dry weather flow" and its volume at the end of the dry season as the "extreme dry weather flow."

Deep Wells.

Perennial springs of large volume rarely occur in Great Britain at a sufficient height to afford supplies by gravitation; but from the limestones of Italy and many other parts of the world very considerable volumes issue far above the sea-level, and are thus available, without pumping, for the supply of distant towns. On a small scale, however, springs are fairly distributed over the United Kingdom, for there are no formations, except perhaps blown sand, which do not vary greatly in their resistance to the percolation of water, and therefore tend to produce overflow from underground at some points above the valley levels. But even the rural populations have generally found surface springs insufficiently constant for their use and have adopted the obvious remedy of sinking wells. Hence, throughout the world we find the shallow well still very common in rural districts. The shallow well, however, rarely supplies enough water for more than a few houses, and being commonly situated near to those houses the water is often seriously polluted. Deep wells owe their comparative immunity from pollution to the circumstances that the larger quantity of water yielded renders it worth while to pump that water and convey it by pipes from comparatively unpolluted areas; and that any impurities in the water must have passed through a considerable depth, and by far the larger part of them through a great length of filtering material, and must have taken so long a time to reach the well that their organic character has disappeared. The principal water-bearing formations, utilized in Great Britain by means of deep wells, are the Chalk and the New Red Sandstone. The Upper and Middle Chalk are permeable almost through their mass. They hold water like a sponge, but part with it under pressure to fissures by which they are intersected, and, in the case of the Upper Chalk, to ducts following beds of flints. A well sunk in these formations without striking any fissure or water-bearing flint bed, receives water only at a very slow rate; but if, on the other hand, it strikes one or more of the natural water-ways, the quantity of water capable of being drawn from it will be greatly increased.

It is a notable peculiarity of the Upper and Middle Chalk formations that below their present valleys the underground water passes more freely than elsewhere. This is explained by the fact that the Chalk fissures are almost invariably rounded and enlarged by the erosion of carbonic acid carried from the surface by the water passing through them. These fissures take the place of the streams in an impermeable area, and those beneath the valleys must obviously be called upon to discharge more water from the surface, and thus be brought in contact with more carbonic acid, than similar fissures elsewhere. Hence the best position for a well in the Chalk is generally that over which, if the strata were impermeable, the largest quantity of surface water would flow. The Lower Chalk formation is for the most part impermeable, though it contains many ruptures and dislocations or smashes, in the interstices of which large bodies of water, received from the Upper and Middle Chalk, may be naturally stored, or which may merely form passages for water derived from the Upper Chalk. Thus despite the impermeability of its mass large springs are occasionally found to issue from the Lower Chalk. A striking example is that known as Lydden Spout, under Abbot's Cliff, near Dover. In practice it is usual in chalk formations to imitate artificially the action of such underground watercourses, by driving from the well small tunnels, or "adits" as they are called, below the water-level, to intercept fissures and water-bearing beds, and thus to extend the collecting area.

Next in importance to the Chalk formations as a source of underground water supply comes the Trias or New Red Sandstone, consisting in Great Britain of two main divisions, the Keuper above and the Bunter below. With the exception of the Red Marls forming the upper part of the Keuper, most of the New Red Sandstone is permeable, and some parts contain, when saturated, even more water than solid chalk; but, just as in the case of the chalk, a well or borehole in the sandstone yields very little water unless it strikes a fissure; hence, in New Red Sandstone, also, it is a common thing to form underground chambers or adits in search of additional fissures, and sometimes to sink many vertical boreholes with the same object in view.

Wells in sand.

Artificial increase of yield.

As the formation approaches the condition of pure sand, the water-bearing property of any given mass increases, but the difficulty of drawing water from it without admixture of sand also increases. In sand below water there are, of course, no open fissures, and even if adits could be usefully employed, the cost of constructing and lining them through the loose sand would be prohibitive. The well itself must be lined; and its yield is therefore confined to such water as can be drawn through the sides or the bottom of the lining without setting up a sufficient velocity to cause any sand to flow with the water. Hence it arises that, in sand formations, only shallow wells or small boreholes are commonly found. Imagine for a moment that the sand grains were by any means rendered immobile without change in the permeability of their interspaces; we could then dispense with the iron or brickwork lining of the well; but as there would still be no cracks or fissures to extend the area of percolating water exposed to the open well, the yield would be very small. Obviously, it must be very much smaller when the lining necessary to hold up loose sand is used. Uncemented brickwork, or perforated ironwork, are the usual materials employed for lining the well and holding up the sand, and the quantity of water drawn is kept below the comparatively small quantity necessary to produce a velocity, through the joints or orifices, capable of disturbing the sand. The rate of increase of velocity towards any isolated aperture through which water passes into the side of a well sunk in a deep bed of sand is, in the neighbourhood of that aperture, inversely proportional to the square of the distance therefrom. Thus, the velocity across a little hemisphere of sand only ½ in. radius covering a 1-in. orifice in the lining is more than 1000 times the mean velocity of the same water approaching the orifice radially when 16 in. therefrom. This illustration gives some idea of the enormous increase of yield of such a well, if, by any means, we can get rid of the frictional sand, even from within the 16 in. radius. We cannot do this, but happily the grains in a sand formation differ very widely in diameter, and if, from the interstices between the larger grains in the neighbourhood of an orifice, we can remove the finer grains, the resistance to flow of water is at once enormously reduced. This was for the first time successfully done in a well, constructed by the Biggleswade Water Board in 1902, and now supplying water over a large area of North Bedfordshire. This well, 10 ft. diameter, was sunk through about 110 ft. of surface soil, glacial drift and impermeable gault clay and thence passed for a further depth of 70 ft. into the Lower Greensand formation, the outcrop of which, emerging on the south-eastern shore of the Wash, passes south-westwards, and in Bedfordshire attains a thickness exceeding 250 ft. The formation is probably more or less permeable throughout; it consists largely of loose sand and takes the general south-easterly dip of British strata. The Biggleswade well was sunk by processes better known in connexion with the sinking of mine shafts and foundations of bridges across the deep sands or gravels of bays, estuaries and great rivers. Its full capacity has not been ascertained; it much exceeds the present pumping power, and is probably greater than that of any other single well unassisted by adits or boreholes. This result is mainly due to the reduction of frictional resistance to the passage of water through the sand in the immediate neighbourhood of the well, by washing out the finer particles of sand and leaving only the coarser particles. For this purpose the lower 45 ft. of the cast-iron cylinders forming the well was provided with about 660 small orifices lined with gun-metal tubes or rings, each armed with numerous thicknesses of copper wire gauze, and temporarily closed with screwed plugs. On the removal of any plug, this wire gauze prevented the sand from flowing with the water into the well; but while the finer particles of sand remained in the neighbourhood of the orifice, the flow of water through the contracted area was very small. To remove this obstruction the water was pumped out while the plugs kept the orifices closed. A flexible pipe, brought down from a steam boiler above, was then connected with any opened orifice. This pipe was provided, close to the orifice, with a three-way cock, by means of which the steam might be first discharged into the sand, and the current between the cock and the well then suddenly reversed and diverted into the well. The effect of thus alternately forcing high-pressure steam among the sand, and of discharging high-pressure water contained in the sand into the well, is to break up any cohesion of the sand, and to allow all the finer particles in the neighbourhood of the orifice to rush out with the water through the wire gauze into the well. This process, in effect, leaves each orifice surrounded by a hemisphere of coarse sand across which the water flows with comparative freedom from a larger hemisphere where the corresponding velocity is very slow, and where the presence of finer and more obstructive particles is therefore unimportant. Many orifices through which water at first only dribbled were thus caused to discharge water with great force, and entirely free from sand, against the opposite side of the well, while the general result was to increase the inflow of water many times, and to entirely prevent the intrusion of sand. Where, however, a firm rock of any kind is encountered, the yield of a well (under a given head of water) can only be increased by enlargement

Pumps in boreholes.

Air-lift.

of the main well in depth or diameter, or by boreholes or adits. No rule as to the adoption of any one of these courses can be laid down, nor is it possible, without examination of each particular case, to decide whether it is better to attempt to increase the yield of the well or to construct an additional well some distance away. By lowering the head of water in any well which draws its supply from porous rock, the yield is always temporarily increased. Every well has its own particular level of water while steady pumping at a given rate is going on, and if that level is lowered by harder pumping, it may take months, or even years, for the water in the interstices of the rock to accommodate itself to the new conditions; but the permanent yield after such lowering will always be less than the quantity capable of being pumped shortly after the change. We have hitherto supposed the pumps for drawing the water to have been placed in the well at such a level as to be accessible, while the suction pipe only is below water. Pumps, however, may be (and have been) placed deep down in boreholes, so that water may be pumped from much greater depths. By this means the head of pressure in the boreholes tending to hold the water back in the rock is reduced, and the supply consequently increased; but when the cost of maintenance is included, the increased supply from the adoption of this method rarely justifies expectations. When the water has been drawn down by pumping to a lower level its passage through the sandstone or chalk in the neighbourhood of the borehole is further resisted by the smaller length of borehole below the water; and there are many instances in which repeated lowering and increased pumping, both from wells and boreholes, have had the result of reducing the water available, after a few years, nearly to the original quantity. One other method—the use of the so-called "air-lift"—should be mentioned. This ingenious device originated in America. The object attained by the air-lift is precisely the same as that attained by putting a pump some distance down a borehole; but instead of the head being reduced by means of the pump, it is reduced by mixing the water with air. A pipe is passed down the borehole to the desired depth, and connected with air-compressors at the surface. The compressors being set to work, the air is caused to issue from the lower end of the pipe and to mix in fine bubbles with the rising column of water, sometimes several hundred feet in height. The weight of the column of water, or rather of water and air mixed, is thus greatly reduced. The method will therefore always increase the yield for the time, and it may do so permanently, though to a very much smaller extent than at first; but its economy must always be less than that of direct pumping.

In considering the principles of well supplies it is important to bear the following facts in mind. The crust of the earth, so far as it is permeable and above the sea-level, receives from rainfall its supply of fresh water. That supply, so far as it is not evaporated or absorbed by vegetation, passes away by the streams or rivers, or sinks into the ground. If the strata were uniformly porous the water would lie in the rock at different depths below the surface according to the previous quantity and distribution of the rainfall. It would slowly, but constantly, percolate downwards and towards the sea, and would ooze out at or below the sea-level, rarely regaining the earth's surface earlier except in deep valleys. Precisely the same thing happens in the actual crust of the earth, except that, in the formations usually met with, the strata are so irregularly permeable that no such uniform percolation occurs, and most of the water, instead of oozing out near the sea-level, meets with obstructions which cause it to issue, sometimes below the sea-level and sometimes above it, in the form of concentrated springs. After prolonged and heavy rainfall the upper boundary of the sub-soil water is, except in high ground, nearly coincident with the surface. After prolonged droughts it still retains more or less the same figure as the surface, but at lower depths and always with less pronounced differences of level.

Saline water below ground.

Sedimentary rocks, formed below the sea or salt lagoons, must originally have contained salt water in their interstices. On the upheaval of such rocks above the sea-level, fresh water from rainfall began to flow over their exposed surfaces, and, so far as the strata were permeable, to lie in their interstices upon the salt water. The weight of the original salt water above the sea-level, and of the fresh water so superimposed upon it, caused an overflow towards the sea. A hill, as it were, of fresh water rested in the interstices of the rock upon the salt water, and continuing to press downwards, forced out the salt water even below the level of the sea. Subject to the rock being porous this process would be continued until the greater column of the lighter fresh water balanced the smaller head of sea water. It would conceivably take but a small fraction of the period that has in most cases elapsed since such upheavals occurred for the salt water to be thus displaced by fresh water, and for the condition to be attained as regards saturation with fresh water, in which with few exceptions we now find the porous portions of the earth's crust wherever the rainfall exceeds the evaporation. There are cases, however, as in the valley of the Jordan, where the ground is actually below the sea-level, and where, as the total evaporation is equal to or exceeds the rainfall, the lake surfaces also are below the sea-level. Thus, if there is any percolation between the Mediterranean and the Dead Sea, it must be towards the latter. There are cases also where sedimentary rocks, formed below the sea or salt lagoons, are almost impermeable: thus the salt deposited in parts of the Upper Keuper of the New Red Sandstone, is protected by the red marls of the formation, and has never been washed out. It is now worked as an important industry in Cheshire.

Wells in sand.

Perhaps the most instructive cases of nearly uniform percolation in nature are those which occur in some islands or peninsulas formed wholly of sea sand. Here water is maintained above the sea-level by the annual rainfall, and may be drawn off by wells or borings. On such an island, in the centre of which a borehole is put down, brackish water may be reached far below the sea-level; the salt water forming a saucer, as it were, in which the fresh water lies. Such a salt-water saucer of fresh water is maintained full to overflowing by the rainfall, and owing to the frictional resistance of the sand and to capillary action and the fact that a given column of fresh water is balanced by a shorter column of sea water, the fresh water never sinks to the mean sea-level unless artificially abstracted.

Although such uniformly permeable sand is rarely met with in great masses, it is useful to consider in greater detail so simple a case. Let the irregular thick line in fig. 5 be the section of a circular island a mile and a quarter in diameter, of uniformly permeable sand.

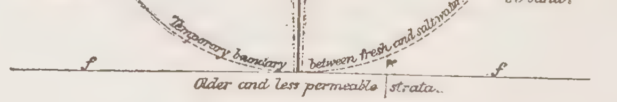
Vertical scale 13 times longitudinal scale
Diameter of island 1¼ Miles
Surface of Ground.
Sea level.
a
b
b
a
a
a
d
d
e
e
Well
Fresh Water in sand.
C
C
Salt Water in sand.
Salt Water in sand.
Temporary boundary between fresh and salt water.
f
f
Older and less permeable strata.

FIG. 5.

The mean sea-level is shown by the horizontal line *aa*, dotted where it passes through the land, and the natural mean level of saturation *bb*, above the sea-level, by a curved dot and dash line. The water, contained in the interstices of the sand above the mean sea-level, would (except in so far as a film, coating the sand particles, is held up by capillary attraction) gradually sink to the sea-level if there were no rainfall. The resistance to its passage through the sand is, however, sufficiently great to prevent this from occurring while percolation of annual rainfall takes place.

Hence we may suppose that a condition has been attained in which the denser salt water below and around the saucer *CC* (greatly exaggerated in vertical scale) balances the less dense, but deeper fresh water within it. Next suppose a well to be sunk in the middle of the island, and a certain quantity of water to be drawn therefrom daily. For small supplies such a well may be perfectly successful; but however small the quantity drawn, it must obviously have the effect of diminishing the volume of fresh water, which contributes to the maintenance of the level of saturation above the sea-level; and with further pumping the fresh water would be so far drawn upon that the mean level of saturation would sink, first to a curved figure—a cone of depression—such as that represented by the new level of saturation *dd*, and later to the figure represented by the lines *ee*, in which the level of saturation has everywhere been drawn below the mean sea-level. Before this stage the converse process begins, the reduced column of fresh water is no longer capable of balancing the sea water in the sand, inflow occurs at *c* and *e*, resulting finally in the well water becoming saline. The figure, in this case of uniform percolation, assumed by the water in the neighbourhood of a deep well is a surface of revolution, and, however irregular the percolation and the consequent shape of the figure, it is commonly, but somewhat incorrectly, called the "cone of depression." It cannot have straight, or approximately straight, sides in any vertical plane, but in nature is an exceedingly irregular figure drawn about curves—not unlike those in fig. 5. In this case, as in that of a level plane of uniformly porous sand, the vertical section of the figure is tangential to the vertical well and to the natural level of the subsoil water.

The importance of this illustration is to be found elsewhere than in islands, or peninsulas, or in uniformly porous sand. Where the strata are not uniformly porous, they may resist the passage of water from the direction of the sea or they may assist it; and round the whole coast of England, in the Magnesian limestone to the north-east, in the Chalk and Greensand to the east and south, and in the New Red Sandstone to the west, the number of wells which have been abandoned as sources of potable supply, owing to the percolation of sea water, is very great. Perhaps the first important cases occurred in the earlier part of the 19th century on the Lancashire shore of the Mersey estuary, where, one after another, deep wells in the New Red Sandstone had to be abandoned for most purposes. On the opposite side, in the Cheshire peninsula, the total quantity of water drawn has been much less, but even here serious warnings have been received. In 1895 the single well then supplying Eastbourne was almost suddenly rendered unfit for use, and few years pass without some similar occurrence of a more or less serious kind. The remarkable suddenness with which such changes are brought about is not to be wondered at when the true cause is considered. The action of sandstone in filtering salt waters was investigated in 1878 by Dr Isaac Roberts, F.R.S., who showed that when salt water was allowed to percolate blocks of sandstone, the effluent was at first nearly fresh, the salt being filtered out and crystallized for the most part near the surface of ingress to the sandstone. As the process continued the salt-saturated layer, incapable of further effective filtration, grew in thickness downwards, until in the process of time it filled the whole mass of sandstone. But before this was accomplished the filtration of the effluent became defective, and brackish water was received, which rapidly increased nearly to the saltness of the inflow. Into such blocks, charged with salt crystals and thoroughly dried, fresh water was then passed, and precisely the converse process took place. A thickness of only 12 in. of Bunter sandstone proved at first to be capable of removing more than 80% of the chlorides from sea water; but, after the slow passage of only 0·6 gallon through 1 cub. ft. of stone, the proportion removed fell to 8·51%. The general lesson to be learned from these facts is, that if the purity of the water of any well not far removed from the sea is to be maintained, that water must not be pumped down much below the sea-level. In short, the quantity of water drawn must in no case be allowed to exceed the quantity capable of being supplied to the well through the medium of the surrounding soil and rock, by rain falling upon the surface of the land. If it exceeds this, the stock of fresh water held in the interstices of the rock, and capable of flowing towards the well, must disappear; and the deficit between the supply and demand can only be made up by water filtering from the sea and reaching the well at first quite free from salt, but sooner or later in a condition unfit for use.

DAMS

Earthen dams.

Any well-made earthen embankment of moderate height, and of such thickness and uniformity of construction as to ensure freedom from excessive percolation at any point, will in the course of time become almost impermeable to surface water standing against it; and when permeable rocks are covered with many feet of soil, the leakage through such soil from standing water newly placed above it generally diminishes rapidly, and in process of time often ceases entirely. Even the beds of sluggish rivers flowing over porous strata generally become so impermeable that excavations made in their neighbourhood, though freely collecting the subsoil water, receive no river water whatever. Thus natural or artificial surfaces which are completely permeable to rainfall may become almost impermeable when protected by surface water from drought and frost, and from earth-worms, vegetation and artificial disturbance. The cause of this choking of the pores is precisely the same as that described below in the case of sand filters. But in order that the action may be complete the initial resistance to percolation of water at every part of the soil must be such that the motion of the water through it shall be insufficient to disturb the water-borne mineral and organic particles lodged on the surface or in the interstices of the soil. If, therefore, a reservoir so formed survives the first few years without serious leakage, it is not likely, in the absence of artificial disturbance, to succumb owing to leakage at a later period. Hence, as the survival of the fittest, there are many artificial waters, with low dams consisting exclusively of earth—and sometimes very sandy earth—satisfactorily performing their functions with no visible leakage. But it is never advisable to rely upon this action, where, as in the case of a reservoir for water supply, large portions of naturally permeable bottom are liable to be uncovered and exposed to the weather.

Construction.

The most important dams are those which close the outlets of existing valleys, but a dam may be wholly below ground, and according to the commoner method of construction in Great Britain, wherever sufficiently impermeable rising ground is not met with at the intended boundary of a reservoir, a trench is cut along such portion, and carried down to rock or such other formation as, in the engineer's opinion, forms a sufficiently impermeable sheet beneath the whole surface to be covered with water. Into this trench so-called "puddled clay," that is, clay rendered plastic by kneading with water, is filled and thoroughly worked with special tools, and trodden in layers. In this manner an underground compartment is formed, the bottom of which is natural, and the sides partly natural and partly artificial, both offering high resistance to the passage of water. Above ground, if the water level is to be higher than the natural boundary, the same puddle walls or cores are carried up to the required level, and are supported as they rise by embankments of earth on either side.

Fig. 6 is a typical section of a low dam of this class, impounding water upon gravel overlying impermeable clay. In such a structure the whole attention as regards water-tightness should be concentrated upon the puddle wall or core. When, as may happen in dry seasons, the puddle wall remains long above the water level, it parts with moisture and contracts. It is essential that this contraction shall not proceed to such an extent as may possibly produce cracking. Drying is retarded, and the contraction due to a given degree of drying is greatly reduced, by the presence of sand and small stones among the clay. Nearly all clays, notably those from the Glacial deposits, naturally contain sand and stones, 40 to 50% by weight of which is not too much if uniformly distributed and if the clay is otherwise good. But in the lower parts of the trench, where the clay can never become dry, plasticity and ductility are, for reasons to be explained below, the first consideration, and there the proportion of grit should be lower. The resistance of clay to percolation by water depends chiefly upon the density of the clay, while that density is rapidly reduced if the clay is permitted to absorb water. Thus, if dry clay is prevented from expanding, and one side be subjected to water pressure while the other side is held up by a completely porous medium, the percolation will be exceedingly small; but if the pressure preventing the expansion is reduced the clay will swell, and the percolation will increase. On the restoration of the pressure, the density will be again increased by the reduction of the

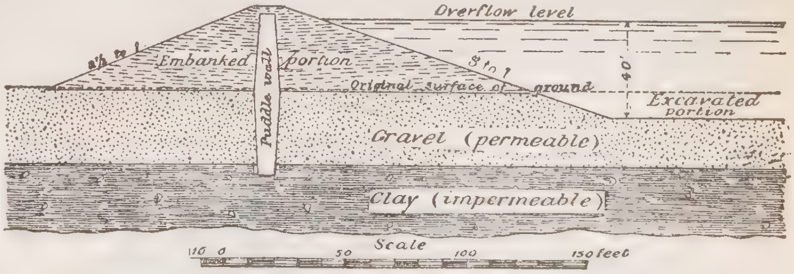

FIG. 6.—Section of Typical Low Earth Embankment in Flat Plain.

water-filled interstices, and the percolation will be correspondingly checked. Hence the extreme importance in high dams with clay cores of loading the clay well for some time before water pressure is brought against it. If this is done, the largest possible quantity of clay will be slowly but surely forced into any space, and, being prevented from expanding, it will be unable subsequently to absorb more water. The percolation will then be very small, and the risk of disintegration will be reduced to a minimum. The embankments on either side of the puddle wall are merely to support the puddle and to keep it moist above the ground level when the reservoir is low. They may be quite permeable, but to prevent undue settlement and distortion they must, like the puddle, be well consolidated. In order to prevent a tendency to slip, due to sudden and partial changes of saturation, the outer embankment should always be permeable, and well drained at the base except close to the puddle. The less permeable materials should be confined to the inner parts of the embankments; this is especially important in the case of the inner embankment in order that, when the water level falls, they may remain moist without becoming liable to slip. The inner slope should be protected from the action of waves by so-called "hand-pitching," consisting of roughly-squared stonework, bedded upon a layer of broken stone to prevent local disturbance of the embankment by action of the water between the joints of the larger stones.

In mountain valleys, rock or shale, commonly the most impermeable materials met with in such positions, are sometimes not reached till considerable depths are attained. There are several cases in Great Britain where it has been necessary to carry down the puddle trench to about 200 ft. below the surface of the ground vertically above those parts. The highest dams of this class in the British islands impound water to a level of about 110 ft. above the bottom of the valley. Such great works have generally been well constructed, and there are many which after fifty years of use are perfectly sound and water-tight, and afford no evidence of deterioration. On the other hand, the partial or total failure of smaller dams of this description, to retain the reservoir water, has been much more common in the past than is generally supposed. Throughout Great Britain there are still many reservoirs, with earthen dams, which cannot safely be filled; and others which, after remaining for years in this condition, have been repaired. From such cases and their successful repair valuable experience of the causes of failure may be derived.

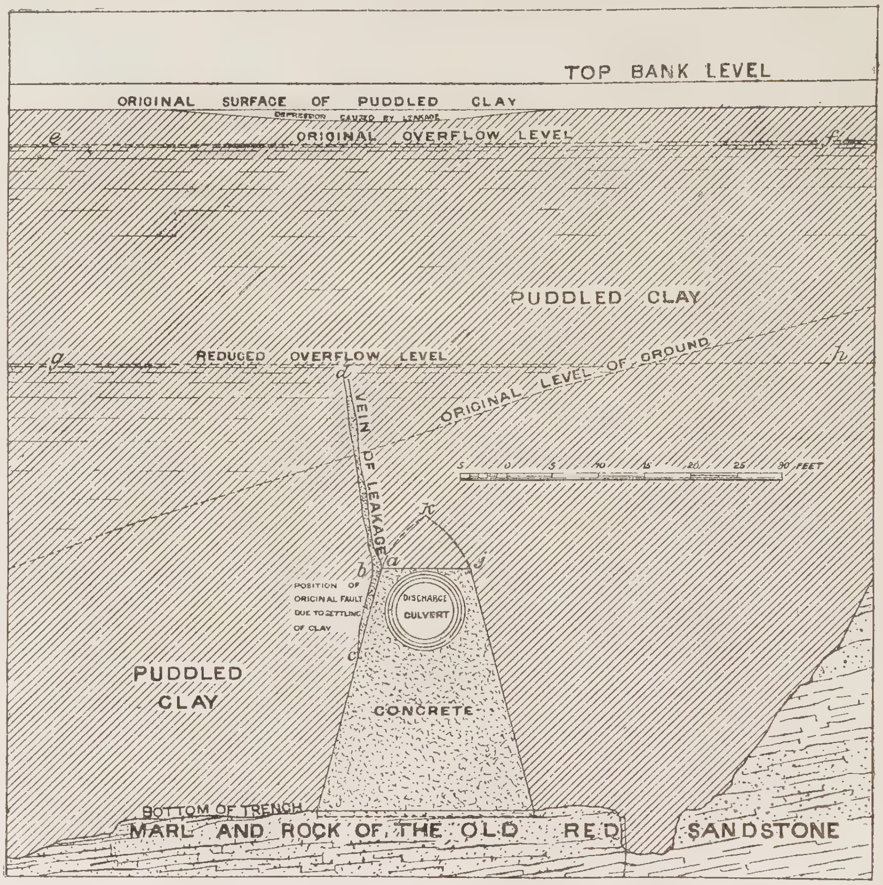
TOP BANK LEVEL
ORIGINAL SURFACE OF PUDDLED CLAY
DEPRESSION CAUSED BY LEAKAGE
ORIGINAL OVERFLOW LEVEL
e
f
PUDDLED CLAY
REDUCED OVERFLOW LEVEL
g
h
d
ORIGINAL LEVEL OF GROUND
VEIN OF LEAKAGE
5 0 5 10 15 20 25 30 FEET
x
a
b
j
POSITION OF ORIGINAL FAULT DUE TO SETTLING OF CLAY
DISCHARGE CULVERT
c
PUDDLED CLAY
CONCRETE
BOTTOM OF TRENCH
MARL AND ROCK OF THE OLD RED SANDSTONE

FIG. 8.—Leakage due to improperly formed discharge culvert through puddle wall of reservoir.

Most of these causes are perfectly well understood by experienced engineers, but instances of malconstruction of recent date are still met with. A few such cases will now be mentioned. ***Erosion by leakage.*** The base of a puddle trench is often found to have been placed upon rock, perfectly sound in itself, but having joints which are not impermeable. The loss of water by leakage through such joints or fissures below the puddle wall may or may not be a serious matter in itself; but if at any point there is sufficient movement of water across the base of the trench to produce the slightest erosion of the clay above it, that movement almost invariably increases. The finer particles of clay in the line of the joint are washed away, while the sandy particles, which nearly all natural clays contain, remain behind and form a constantly deepening porous vein of sand crossing the base of the puddle. Percolation through this sand is thus added to the original leakage. Having passed through the puddle core the leaking water sometimes rises to the surface of the ground, producing a visibly turbid spring. As erosion proceeds, the contraction of the space from which the clay is washed continues, chiefly by the sinking down of the clay above the sand. Thus the permeable vein grows vertically rather than horizontally, and ultimately assumes the form of a thin vertical sheet traversing the puddle wall, often diagonally in plan, and having a thickness which has varied in different cases from a few inches to a couple of feet or more, of almost clean sand rising to an observed height of 30 or 40 ft., and only arrested in its upward growth by the necessary lowering of the reservoir water to avoid serious danger. The settlement of the plastic clay above the eroded portion soon produces a surface depression at the top of the embankment over or nearly over the leakage, and thus sometimes gives the first warning of impending danger. It is not always possible to prevent any leakage whatever through the strata below the bottom or beyond the ends of the trench, but it is always possible to render such leakage entirely harmless to the work above it, and to carry the water by relief-pipes to visible points at the lower toe of the dam. Wherever the base of a puddle wall cannot be worked into a continuous bed of clay or shale, or tied into a groove cut in sound rock free from water-bearing fissures, the safest course is to base it on an artificial material at once impermeable and incapable of erosion, interposed between the rock and the puddled clay. Water-tight concrete is a suitable material for the purpose; it need not be made so thick as the puddle core, and is therefore sometimes used with considerable advantage in lieu of the puddle for the whole depth below ground. In fig. 7 a case is shown to be so treated. Obviously, the junction between the puddle and the concrete might have been made at any lower level.

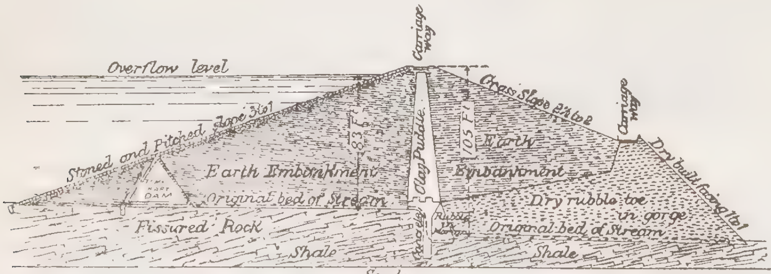

FIG. 7.—Earth Embankment, with stone toe and concrete trench.

However well the work may be done, the lower part of a mass of puddled clay invariably settles into a denser mass when weighted with the clay above. ***Unequal settlement.*** If, therefore, one part is held up, by unyielding rock for example, while an adjoining part has no support but the clay beneath it, a fracture—not unlike a geological fault—must result. Fig. 8 is a part longitudinal section through the puddle wall of an earthen embankment. The puddle wall is crossed by a pedestal of concrete carrying the brick discharge culvert. The puddle at *a* was originally held up by the flat head of this pedestal; not so the puddle at *b*, which under the superincumbent weight settled down and produced the fault *bc*, accompanied with a shearing or tangential strain or, less probably, with actual fracture in the direction *bd*. Serious leakage at once began between *c* and *b* and washed out the clay, particle by particle, but did not wash out the sand associated with it, which remained behind in the crevice. The clay roof, rather than the walls of this crevice of sand, gave way and pressed down to fill the vacancy, and the leakage worked up along the weakened plane of tangential strain *bd*. On the appearance of serious leakage the overflow level of the water originally at *ef* was lowered for safety to *gh*; and for many years the reservoir was worked with its general level much below *gh*. The sand-filled vein, several inches in width, was found, on taking out the puddle, to have terminated near the highest level to which the water was allowed to rise, but not to have worked downwards. There can be little doubt that the puddle at the right-hand angle *j* was also strained, but not to the point of rupture, as owing to the rise of the sandstone base there was comparatively little room for settlement on that side. In repairing this work the perfectly safe form shown by the dotted lines *ka*, *kj* was substituted for the flat surface *aj*, and this alone, if originally adopted, would have prevented dangerous shearing strains. As an additional precaution, however, deep tongues of concrete like those in fig. 7 were built in the rock throughout the length of the trench, and carried up the sides and over the top of the pedestal. The puddle was then replaced, and remains sensibly watertight. The lesson taught by fig. 8 applies also to the ends of puddle walls where they abut against steep faces of rock. Unless such faces are so far below the surface of the puddle, and so related to the lower parts of the trench, that no tension, and consequent tendency to separation of the puddle from the rock, can possibly take place, and unless abundant time is given, before the reservoir is charged, for the settlement and compression of the puddle to be completed, leakage with disastrous results may occur.

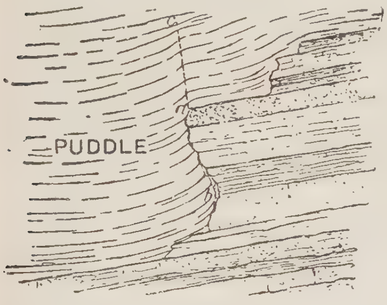

FIG. 9.—Overhanging Rock Leakage.

In other cases leakage and failure have arisen from allowing a part of the rock bottom or end of a puddle trench to overhang, as in fig. 9. Here the straining of the original horizontal puddle in settling down is indicated in a purposely exaggerated way by the curved lines. There is considerable distortion of the clay, resulting from combined shearing and tensile stress, above each of the steps of rock, and reaching its maximum at and above the highest rise *ab*, where it has proved sufficient to produce a dangerous line of weakness *ac*, the tension at *a* either causing actual rupture, or such increased porosity as to permit of percolation capable of keeping open the wound. In such cases as are shown in figs. 8 and 9 the growth of the sand vein is not vertical, but inclined towards the plane of maximum shearing strain. Fig. 9 also illustrates a weak place at *b* where the clay either never pressed hard against the overhanging rock or has actually drawn away therefrom in the process of settling towards the lower part to the left. When it is considered that a parting of the clay, sufficient to allow the thinnest film of water to pass, may start the formation of a vein of porous sand in the manner above explained, it will be readily seen how great must be the attention to details, in unpleasant places below ground, and below the water level of the surrounding area, if safety is to be secured. In cases like fig. 9 the rock should always be cut away to a slope, such as that shown in fig. 10.

If no considerable difference of water-pressure had been allowed between the two sides of the puddle trench in figs. 8 or 9 until the clay had ceased to settle down, it is probable that the interstices, at first formed between the puddle and the concrete or rock, would have been sufficiently filled to prevent injurious percolation at any future time. Hence it is always a safe precaution to afford plenty of time for such settlement before a reservoir is charged with water. But to all such precautions should be added the use of concrete or brickwork tongues running longitudinally at the bottom of the trench, such as those shown at a higher level in fig. 7.

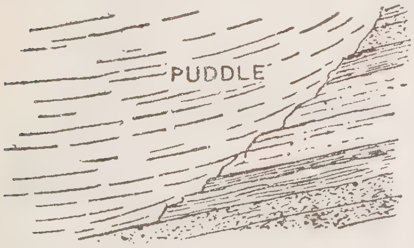

FIG. 10.—Proper Figure for Rock Slope.

Defects in puddle wall.

In addition to defects arising out of the condition or figure of the rock or of artificial work upon which the puddle clay rests, the puddle wall itself is often defective. The original material may have been perfectly satisfactory, but if, for example, in the progress of the work a stream of water is allowed to flow across it, fine clay is sometimes washed away, and the gravel or sand associated with it left to a sufficient extent to permit of future percolation. Unless such places are carefully dug out or re-puddled before the work of filling is resumed, the percolation may increase along the vertical plane where it is greatest, by the erosion and falling in of the clay roof, as in the other cases cited. Two instances probably originating in some such cause are shown in fig. 11 in the relative positions in which they were found, and carefully measured, as the puddle was removed from a crippled reservoir dam. These fissures are in vertical planes stretching entirely across the puddle trench, and reaching in one case, *aa*, nearly to the highest level at which the reservoir had been worked for seventeen years after the leakage had been discovered. The larger and older of these veins was $44\frac{1}{2}$ ft. high, of which 14 ft. was above the original ground level, and it is interesting to note that this portion, owing probably to easier access for the water from the reservoir and reduced compression of the puddle, was much wider than below. The little vein to the left marked *bb*, about $3\frac{1}{2}$ ft. deep, is curious. It looks like the beginning of success of an effort made by a slight percolation during the whole life of the reservoir to increase itself materially by erosion.

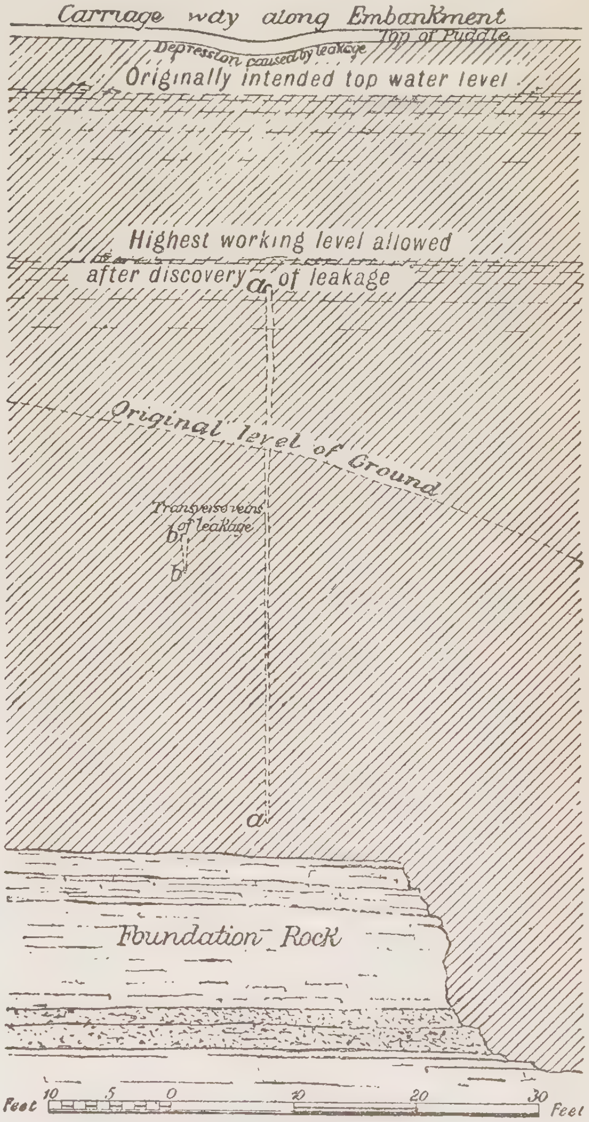
Carriage way along Embankment
Top of Puddle
Depression caused by leakage
Originally intended top water level
Highest working level allowed after discovery of leakage
a
Original level of Ground
Transverse veins of leakage
b
b
a
Foundation Rock
Feet 10 5 0 10 20 30 Feet

FIG. 11.—Vertical Vein of Leakage.

There is no reason to believe that the initial cause of such a leakage could be developed except during construction, and it is certain that once begun it must increase. Only a knowledge of the great loss of capital that has resulted from abortive reservoir construction justifies this notice of defects which can always be avoided, and are too often the direct result, not of design, but of parsimony in providing during the execution of such works, and especially below ground, a sufficiency of intelligent, experienced and conscientious supervision.

In some cases, as, for example, when a high earthen embankment crosses a gorge, and there is plenty of stone to be had, it is desirable to place the outer bank upon a toe or platform of rubble stonework, as in fig. 7, by which means the height of the earthen portion is reduced and complete drainage secured. But here again great care must be exercised in the packing and consolidation of the stones, which will otherwise crack and settle.

As with many other engineering works, the tendency to slipping either of the sides of the valley or of the reservoir embankment itself has often given trouble, and has sometimes led to serious disaster.

This, however, is a kind of failure not always attributable to want of proper supervision during construction, but rather to improper choice of the site, or treatment of the case, by those primarily responsible.

Dams with diaphragms of wood, steel, concrete, &c.

In countries where good clay or retentive earth cannot be obtained, numerous alternative expedients have been adopted with more or less success. In the mining districts of America, for example, where timber is cheap, rough stone embankments have been lined on the water face with timber to form the water-tight septum. In such a position, even if the timber can be made sufficiently water-tight to begin with, the alternate immersion and exposure to air and sunshine promotes expansion and contraction, and induces rapid disintegration, leakage and decay. Such an expedient may be justified by the doubtful future of mining centres, but would be out of the question for permanent water supply. Riveted sheets of steel have been occasionally used, and, where bedded in a sufficient thickness of concrete, with success. At the East Cañon Creek dam, Utah, the height of which is about 61 ft. above the stream, the trench below ground was filled with concrete much in the usual way, while above ground the water-tight diaphragm consists of a riveted steel plate varying in thickness from $\frac{5}{16}$ in. to $\frac{3}{16}$ in. This steel septum was protected on either side by a thin wall of asphaltic concrete supported by rubble stone embankments, and owing to irregular settling of the embankments became greatly distorted, apparently, however, without causing leakage. Asphalt, whether a natural product or artificially obtained, as, for example, in some chemical manufactures, is a most useful material if properly employed in connexion with reservoir dams. Under sudden impact it is brittle, and has a conchoidal fracture like glass; but under continued pressure it has the properties of a viscous fluid. The rate of flow is largely dependent upon the proportion of bitumen it contains, and is of course retarded by mixing it with sand and stone to form what is commonly called asphalt concrete. But given time, all such compounds, if they contain enough bitumen to render them water-tight, appear to settle down even at ordinary temperatures as heavy viscous fluids, retaining their fluidity permanently if not exposed to the air. Thus they not only penetrate all cavities in an exceedingly intrusive manner, but exert pressures in all directions, which, owing to the density of the asphalt, are more than 40 % greater than would be produced by a corresponding depth of water. From the neglect of these considerations numerous failures have occurred.

Elsewhere, a simple concrete or masonry wall or core has been used above as well as below ground, being carried up between embankments either of earth or rubble stone. This construction has received its highest development in America. On the Titicus, a tributary of the Croton river, an earthen dam was completed in 1895, with a concrete core wall 100 ft. high—almost wholly above the original ground level, which is said to be impermeable; but other dams of the same system, with core walls of less than 100 ft. in height, are apparently in their present condition not impermeable. Reservoir No. 4 of the Boston waterworks, completed in 1885, has a concrete core wall. The embankment is 1800 ft. long and 60 ft. high. The core wall is about 8 ft. thick at the bottom and 4 ft. thick at the top, and in the middle of the valley nearly 100 ft. in height. At irregular intervals of 150 ft. or more buttresses 3 ft. wide and 1 ft. thick break the continuity on the water side. That this work has been regarded as successful is shown by the fact that Reservoir No. 6 of the same waterworks was subsequently constructed and completed in 1894 with a similar core wall. There is no serious difficulty in so constructing walls of this kind as to be practically water-tight while they remain unbroken; but owing to the settlement of the earthen embankments and the changing level of saturation they are undoubtedly subject to irregular stresses which cannot be calculated, and under which, speaking generally, plastic materials are much safer. In Great Britain masonry or concrete core walls have been generally confined to positions below ground. Thus placed, no serious strains are caused either by changes of temperature or of moisture or by movements of the lateral supports, and with proper ingredients and care a very thin wall wholly below ground may be made water-tight.

Masonry dams.

The next class of dam to be considered is that in which the structure as a whole is so bound together that, with certain reservations, it may be considered as a monolith subject chiefly to the overturning tendency of water-pressure resisted by the weight of the structure itself and the supporting pressure of the foundation. Masonry dams are, for the most part, merely retaining walls of exceptional size, in which the overturning pressure is water. If such a dam is sufficiently strong, and is built upon sound and moderately rough rock, it will always be incapable of sliding. Assuming also that it is incapable of crushing under its own weight and the pressure of the water, it must, in order to fail entirely, turn over on its outer toe, or upon the outer face at some higher level. It may do this in virtue of horizontal water-pressure alone, or of such pressure combined with upward pressure from intrusive water at its base or in any higher horizontal plane. Assume first, however, that there is no uplift from intrusive water. As the pressure of water is *nil* at the surface and increases in direct proportion to the depth, the overturning moment is as the cube of the depth; and the only figure which has a moment of resistance due to gravity, varying also as the cube of its depth, is a triangle. The form of stability having the least sectional area is therefore a triangle. It is obvious that the angles at the base of such a hypothetical dam must depend upon the relation between its density and that of the water. It can be shown, for example, that for masonry having a density of 3, water being 1, the figure of minimum section is a right-angled triangle, with the water against its vertical face; while for a greater density the water face must lean towards the water, and for a less density away from the water, so that the water may lie upon it. For the sections of masonry dams actually used in practice, if designed on the condition that the centre of all vertical pressures when the reservoir is full shall be, as hereafter provided, at two-thirds the width of the base from the inner toe, the least sectional area for a density of 2 also has a vertical water face. As the density of the heaviest rocks is only 3, that of a masonry dam must be below 3, and in practice such works if well constructed vary from 2·2 to 2·6. For these densities, the deviation of the water face from the vertical in the figure of least sectional area is, however, so trifling that, so far as this consideration is concerned, it may be neglected.

If the right-angled triangle *abc*, fig. 12, be a profile 1 ft. thick of a monolithic dam, subject to the pressure of water against its vertical side to the full depth $ab = d$ in feet, the horizontal pressure of water against the section of the dam, increasing uniformly with the depth, is properly represented by the isosceles right-angled triangle *abe*, in which *be* is the maximum water-pressure due to the full depth *d*, while the area $abe = \frac{d^2}{2}$ is the total horizontal pressure against the dam, generally stated in cubic feet of water, acting at one-third its depth above the base. Then $\frac{d^2}{2}$ is the resultant horizontal pressure with an overturning moment of

$$\frac{d^3}{6} \quad \ldots \ldots \quad (1)$$

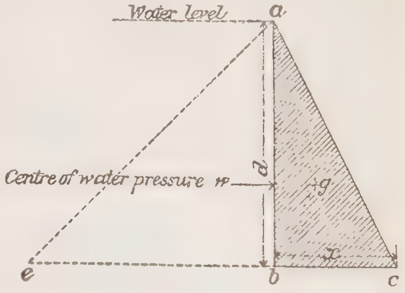

FIG. 12.—Diagram of Right-Angled Triangle Dam.

If x be the width of the base, and ρ the density of the masonry, the weight of the masonry in terms of a cubic foot of water will be $\frac{\rho x d}{2}$ acting at its centre of gravity g, situated at $\frac{2}{3}x$ from the outer toe, and the moment of resistance to overturning on the outer toe,

$$\frac{\rho x^2 d}{3} \quad \ldots \ldots \quad (2)$$

Equating the moment of resistance (2) to the overturning moment (1), we have

$$\frac{\rho x^2 d}{3} = \frac{d^3}{6}$$

and

$$x = \frac{d}{\sqrt{2\rho}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

That is to say, for such a monolith to be on the point of overturning under the horizontal pressure due to the full depth of water, its base must be equal to that depth divided by the square root of twice the density of the monolith. For a density of 2·5 the base would therefore be 44·7 % of the height.

Factors of safety.

We have now to consider what are the necessary factors of safety, and the modes of their application. In the first place, it is out of the question to allow the water to rise to the vertex *a* of such a masonry triangle. A minimum thickness must be adopted to give substance to the upper part; and where the dam is not used as a weir it must necessarily rise several feet above the water, and may in either event have to carry a roadway. Moreover, considerable mass is required to reduce the internal strains caused by changes of temperature. In the next place, it is necessary to confine the pressure, at every point of the masonry, to an intensity which will give a sufficient factor of safety against crushing. The upper part of the dam having been designed in the light of these conditions, the whole process of completing the design is simple enough when certain hypotheses have been adopted, though somewhat laborious in its more obvious form. It is clear that the greatest crushing pressure must occur, either, with the reservoir empty, near the lower part of the water face *ab*, or with the reservoir full, near the lower part of the outer face *ac*. The principles hitherto adopted in designing masonry dams, in which the moment of resistance depends upon the figure and weight of the masonry, involve certain assumptions, which, although not quite true, have proved useful and harmless, and are so convenient that they may be continued with due regard to the modifications which recent investigations have suggested. One such assumption is that, if the dam is well built, the intensity of vertical pressure will (neglecting local irregularities) vary nearly uniformly from face to face along any horizontal plane. Thus, to take the simplest case, if *abce* (fig. 13) represents a rectangular mass already designed for the superstructure of the dam, and *g* its centre of gravity, the centre of pressure upon the base will be vertically under *g*, that is, at the centre of the base, and the load will be properly represented by the rectangle *bfgc*, of which the area represents the total load and the uniform depth of its uniform intensity. At this high part of the structure the intensity of pressure will of course be much less than its permissible intensity. If now we assume the water to have a depth *d* above the base, the total water pressure represented by the triangle *kbh* will have its centre at *d*/3 from the base, and by the parallelogram of forces, assuming the density of the masonry to be 2·5, we find that the centre of pressure upon the base *bc* is shifted from the centre of the base to a point *i* nearer to the outer toe *c*, and adopting our assumption of uniformly varying intensity of stress, the rectangular diagram of pressures will thus be distorted from the figure *bfgc* to the figure of equal area *bjlc*, having its centre *o* vertically under the point at which the resultant of all the forces cuts the base *bc*. For any lower level the same treatment may, step by step, be adopted, until the maximum intensity of pressure *cl* exceeds the assumed permissible maximum, or the centre of pressure reaches an assigned distance from the outer toe *c*, when the base must be widened until the maximum intensity of pressure or the centre of pressure, as the case may be, is brought within the prescribed limit. The resultant profile is of the kind shown in fig. 14.

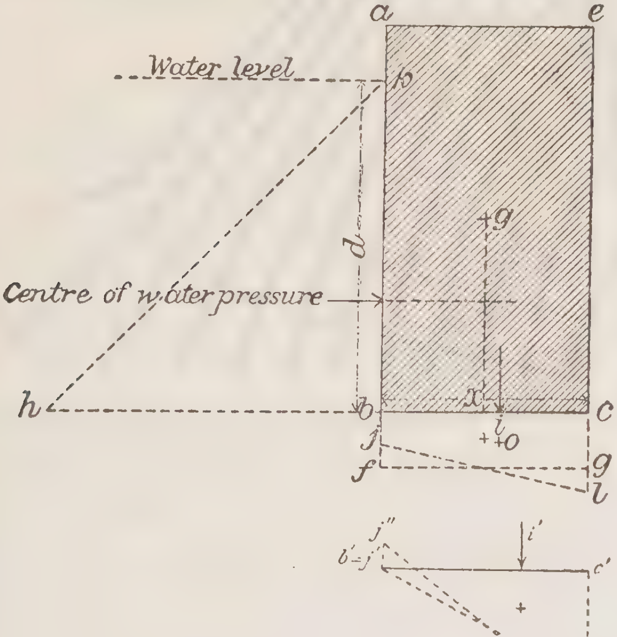

FIG. 13.—Factor of Safety Diagram.

Having thus determined the outer profile under the conditions hitherto assumed, it must be similarly ascertained that the water face is everywhere capable of resisting the vertical pressure of the masonry when the reservoir is empty, and the base of each compartment must be widened if necessary in that direction also. Hence in dams above 100 ft. in height, further adjustment of the outer profile may be required by reason of the deviation of the inner profile from the vertical. The effect of this process is to give a series of points in the horizontal planes at which the resultants of all forces above those planes respectively cut the planes. Curved lines, as dotted in fig. 14, drawn through these points give the centre of pressure, for the reservoir full and empty respectively, at any horizontal plane. These general principles were recognized by Messrs Graeff and Delocre of the Ponts et Chaussées, and about the year 1866 were put into practice in the Furens dam near St Etienne. In 1871 the late Professor Rankine, F.R.S., whose remarkable perception of the practical fitness or unfitness of purely theoretical deductions gives his writings exceptional value, received from Major Tulloch, R.E., on behalf of the municipality of Bombay, a request to consider the subject generally, and with special reference to very high dams, such as have since been constructed in India. Rankine pointed out that before the vertical pressure reached the maximum pressure permissible, the pressure tangential to the slope might do so. Thus conditions of stress are conceivable in which the maximum would be tangential to the slope or nearly so, and would therefore increase the vertical stress in proportion to the cosecant squared of the slope. It is very doubtful whether this pressure is ever reached, but such a limit rather than that of the vertical stress must be considered when the height of a dam demands it. Next, Rankine pointed out that, in a structure exposed to the overturning action of forces which fluctuate in amount and direction, there should be no appreciable tension at any point of the masonry. But there is a still more important reason why this condition should be strictly adhered to as regards the inner face. We have hitherto considered only the *horizontal* overturning pressure of the water; but if from originally defective construction, or from the absence of vertical pressure due to weight of masonry towards the water edge of any horizontal bed, as at *ab* in fig. 14, water intrudes beneath that part of the masonry more readily than it can obtain egress along *bc*, or in any other direction towards the outer face, we shall have the uplifting and overturning pressure due to the full depth of water in the reservoir over the width *ab* added to the horizontal pressure, in which case all our previous calculations would be futile. The condition, therefore, that there shall be no tension is important as an element of design; but when we come to construction, we must be careful also that no part of the wall shall be less permeable than the water face. In fig. 13 we have seen that the varying depth of the area *bjlc* approximately represents the varying distribution of the vertical stress. If, therefore, the centre of that became so far removed to the right as to make *j* coincident with *b*, the diagram of stresses would become the triangle *j'l'c'*, and the vertical pressure at the inner face would be nil. This will evidently happen when the centre of pressure *i'* is two-thirds from the inner toe *b'* and one-third from the outer toe *c'*; and if we displace the centre of pressure still further to the right, the condition that the centre of figure of the diagram shall be vertically under that centre of pressure can only be fulfilled by allowing the point *j'* to cross the base to *j''* thus giving a negative pressure or tension at the inner toe. Hence it follows that on the assumption of uniformly varying stress the line of pressures, when the reservoir is full, should not at any horizontal plane fall outside the middle third of the width of that plane.

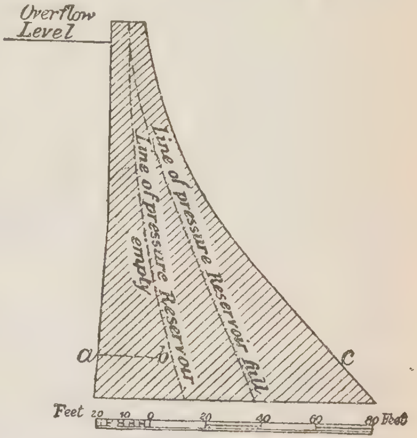
Overflow Level
Line of pressure Reservoir full
Line of pressure Reservoir empty
a
b
c
Feet 20 10 0 20 40 60 80 Feet

FIG. 14.—Diagram showing lines of pressure in Masonry Dam.

Rankine in his report adopted the prudent course of taking as the safe limits certain pressures to which, at that time, such structures were known to be subject. Thus for the inner face he took, as the limiting vertical pressure, 320 ft. of water, or nearly 9 tons per sq. ft., and for the outer face 250 ft. of water, or about 7 tons per sq. ft.

For simplicity of calculation Rankine chose logarithmic curves for both the inner and outer faces, and they fit very well with the conditions. With one exception, however—the Beetaloo dam in Australia 110 ft. high—there are no practical examples of dams with logarithmically curved faces.

After Rankine, a French engineer, Bouvier, gave the ratio of the maximum stress in a dam to the maximum vertical stress as 1 to the cosine squared of the angle between the vertical and the resultant which, in dams of the usual form, is about as 13 is to 9.

During the last few years attention has been directed to the stresses—including shearing stresses—on planes other than horizontal. M. Levy contributed various papers on the subject which will be found in the *Comptes rendus de l'Académie des Sciences* (1895 and 1898) and in the *Annales des Ponts et Chaussées* (1897). He investigated the problem by means of the general differential equations of static equilibrium for dams of triangular and rectangular form considered as isotropic elastic solids. In one of these papers Levy formulated the requirement now generally adopted in France that the vertical pressure at the upstream end of any joint, calculated by the law of uniformly varying stress, should not be less than that of the water pressure at the level of that joint in order to prevent intrusive water getting into the structure.

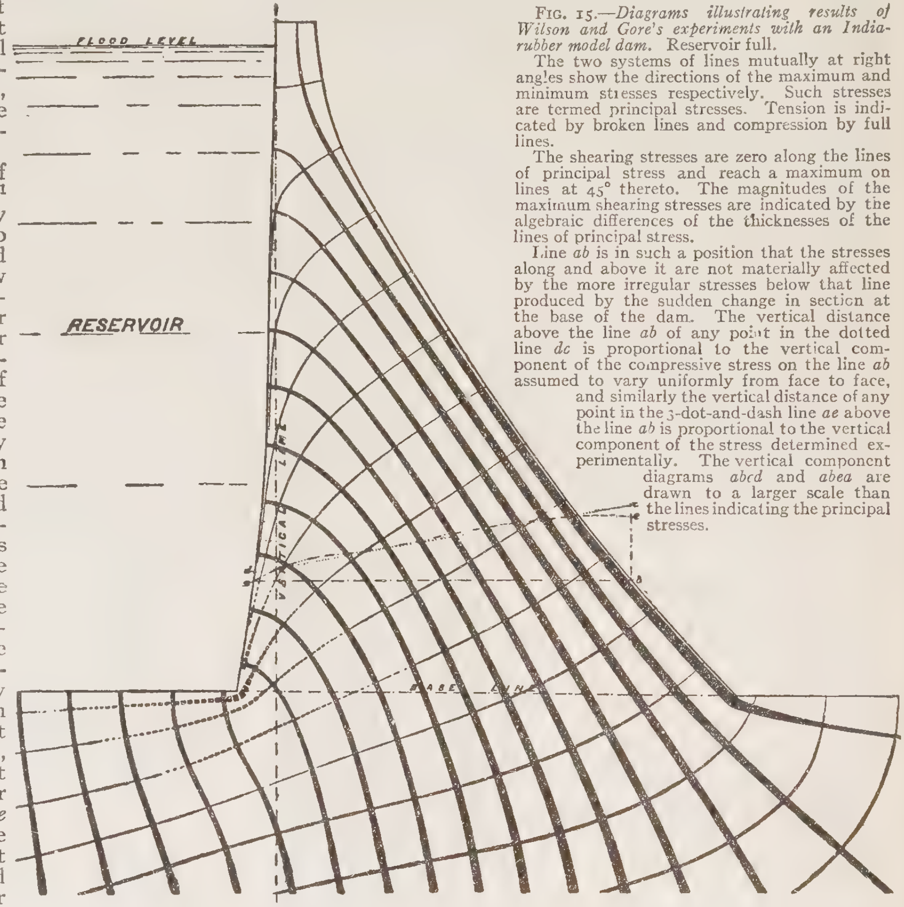

Fig. 15.—*Diagrams illustrating results of Wilson and Gore's experiments with an India-rubber model dam.* Reservoir full.

The two systems of lines mutually at right angles show the directions of the maximum and minimum stresses respectively. Such stresses are termed principal stresses. Tension is indicated by broken lines and compression by full lines.

The shearing stresses are zero along the lines of principal stress and reach a maximum on lines at 45° thereto. The magnitudes of the maximum shearing stresses are indicated by the algebraic differences of the thicknesses of the lines of principal stress.

Line *ab* is in such a position that the stresses along and above it are not materially affected by the more irregular stresses below that line produced by the sudden change in section at the base of the dam. The vertical distance above the line *ab* of any point in the dotted line *dc* is proportional to the vertical component of the compressive stress on the line *ab* assumed to vary uniformly from face to face, and similarly the vertical distance of any point in the 3-dot-and-dash line *ae* above the line *ab* is proportional to the vertical component of the stress determined experimentally. The vertical component diagrams *abcd* and *abea* are drawn to a larger scale than the lines indicating the principal stresses.

These researches were followed by those of Messrs L. W. Atcherley and Karl Pearson, F.R.S.,[1] and by an approximate graphical treatment by Dr W. C. Unwin, F.R.S.[2] Dr Unwin took two horizontal planes, one close above the other, and calculated the vertical stresses on each by the law of uniformly varying stresses. Then the difference between the normal pressure on a rectangular element in the lower plane and that on the upper plane is the weight of the element and the difference between the shears on the vertical faces of that element. The weights being known, the principal stresses may be determined. These researches led to a wide discussion of the sufficiency of the law of uniformly varying stress when applied to horizontal joints as a test of the stability of dams. Professor Karl Pearson showed that the results are dependent upon the assumption that the distribution of the vertical stresses on the base of the structure also followed the law of uniformly varying stress. In view of the irregular forms and the uncertainties of the nature of the materials at the foundation, the law of uniformly varying stress was not applicable to the base of the dam. He stated that it was practically impossible to determine the stresses by purely mathematical means. The late Sir Benjamin Baker, F.R.S., suggested that the stresses might be measured by experiments with elastic models, and among others, experiments were carried out by Messrs Wilson and Gore[3] with indiarubber models of plane sections of dams (*including the foundations*) who applied forces to represent the gravity and water pressures in such a manner that the virtual density of the rubber was increased many times without interfering with the proper ratio between gravity and water pressure, and by this means the strains produced were of sufficient magnitude to be easily measured.

The more important of their results are shown graphically in figs. 15 and 16, and prove that the law of uniformly varying stress is generally applicable to the upper two-thirds of a dam, but that at parts in or near the foundations that law is departed from in a way which will be best understood from the diagrams.

Fig. 15 shows a section of the model dam. The maximum principal stresses are represented by the directions and thicknesses of the two systems of intersecting lines mutually at right angles.

Tensile stresses (indicated by broken lines on the diagram) are shown at the upstream toe notwithstanding that the line of resistance is well within the middle third of the section. It is important to notice that the maximum value of the tension at the toe lies in a direction approximately at 45° to the vertical, but at points lower down in the foundation this tension, while less in magnitude, becomes much more horizontal. This feature indicates that in the event of a crack occurring at the upstream toe, its extension would tend to turn downwards and follow a direction nearly parallel with the maximum pressure lines, in which direction it would not materially affect the stability of the structure.

As a matter of fact, the foundations of most dams are carried down in vertical trenches, the lower part only being in sound materials so that actual separation almost corresponding with the hypothetical crack is allowed in the first instance with no harmful effects. Similar experiments upon models with rounded toes but otherwise of the same form showed a considerable reduction in the magnitude of the tensile stresses.

On examining the diagram it will be observed that the maximum compressive stresses are parallel to and near to the down stream face of the section, which values are approximately equal to the maximum value of the vertical stress determined by the law of uniformly varying stress divided by the cosine squared of the angle between the vertical and the resultant.

The distributions of stress on the base line of the model for "reservoir empty" and "reservoir full" are shown in fig. 16 by ellipses of stress and by diagrams of stress on vertical and horizontal sections.

Arrow heads at the ends of an axis of an ellipse indicate tension as distinct from compression, and the semi-axes in magnitude and direction represent the principal stresses.

It is obvious that experiments of the kind referred to cannot take into account all the conditions of the problem met with in actual practice, such as the effect of the rock at the sides of the valley and variations of temperature, &c., but deviations in practice from the conditions which mathematical analyses or experiments assume are nearly always present. Such analyses and experiments are not on that account the less important and useful.

So far we have only considered water-pressure against the reservoir side of the dam; but it sometimes happens that the water and earth pressure against the outer face is considerable enough to modify the lower part of the section. In dams of moderate height above ground and considerable depth below ground there is, moreover, no reason why advantage should not be taken of the earth resistance due either to the downstream face of the trench against which the foundations are built, or to the materials excavated and properly embanked against that face above the ground level or to both. We do not always know the least resistance which it is safe to give to a retaining wall subject to the pressure of earth, or conversely, the maximum resistance to side-thrust which natural or embanked earth will afford, because we wisely neglect the important but very variable element of adhesion between the particles. It is notorious among engineers that retaining walls designed in accordance with the well-known theory of conjugate pressures in earth are unnecessarily strong, and this arises mainly from the assumption that the earth is merely a loose granular mass without any such adhesion. As a result of this theory, in the case of a retaining wall supporting a vertical face of earth beneath an extended horizontal plane level with the top of the wall, we get

$$P=\frac{wx^2}{2}\cdot\frac{1-\sin\phi}{1+\sin\phi},$$

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[1] *On Some Disregarded Points in the Stability of Masonry Dams*, Drapers' Company Research Memoir (London, 1904).

[2] *Engineering* (May 12th, 1905).

[3] *Proceedings of the Institution of Civil Engineers*, vol. 172, p. 107.

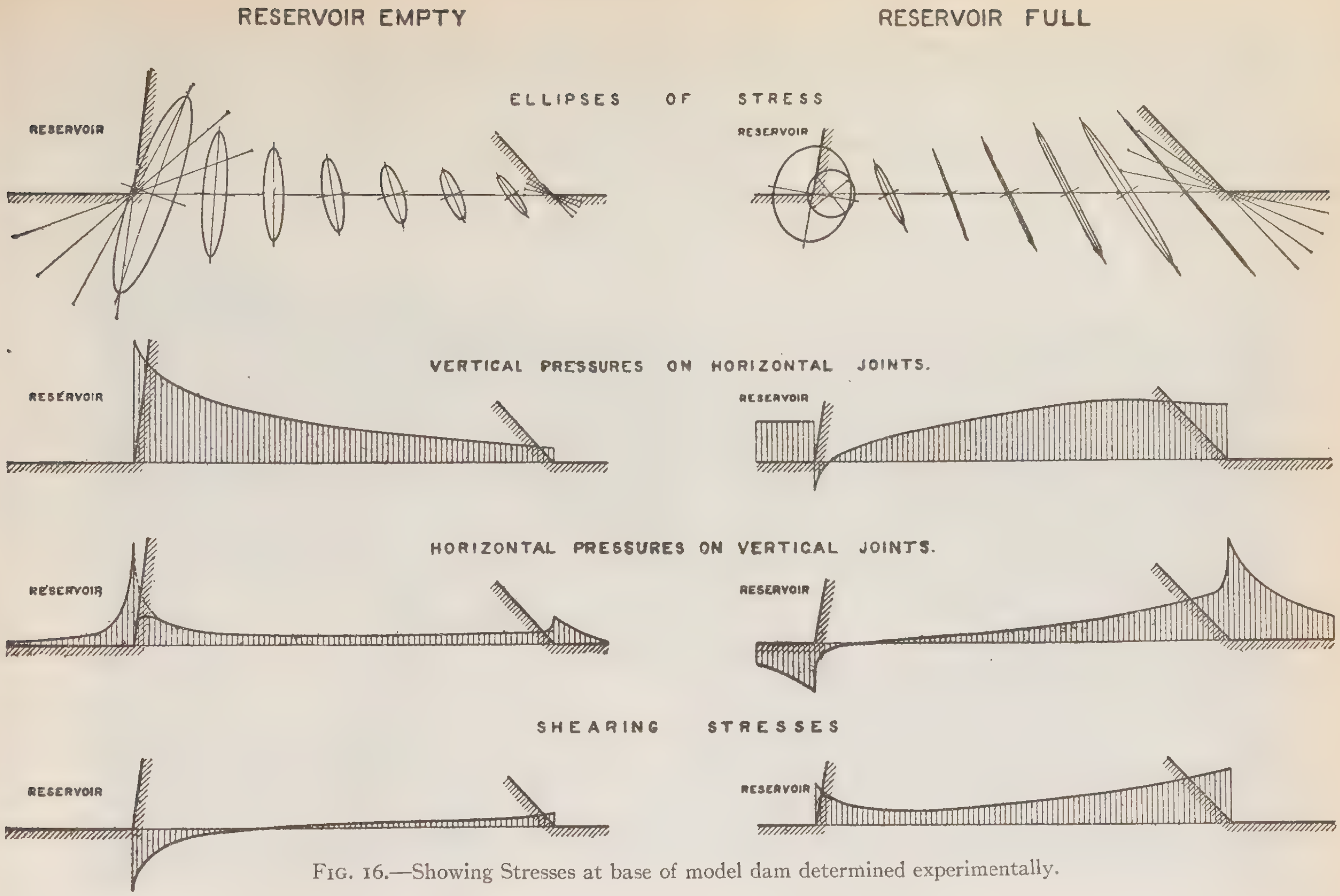


FIG. 16.—Showing Stresses at base of model dam determined experimentally.

where P is the horizontal pressure of the earth against the wall exerted at one-third its height, w the weight of unit volume of the material, x the height of the wall, and ϕ the angle of repose of the material. That the pressure so given exceeds the maximum possible pressure we do not doubt; and, conversely, if we put

$$P' = \frac{wx^2}{2} \cdot \frac{1 + \sin\phi}{1 - \sin\phi},$$

we may have equal confidence that P' will be less than the maximum pressure which, if exerted by the wall against the earth, will be borne without disturbance. But like every pure theory the principles of conjugate pressures in earth may lead to danger if not applied with due consideration for the angle of repose of the material, the modifications brought about by the limited width of artificial embankments, the possible contraction away from the masonry, of clayey materials during dry weather for some feet in depth and the tendency of surface waters to produce scour between the wall and the embankment. Both the Neuadd and the Fisher Tarn dams are largely dependent upon the support of earthen embankments with much economy and with perfectly satisfactory results.

In the construction of the Vyrnwy masonry dam Portland cement concrete was used in the joints. When more than six months old, 9 in. cubes of this material never failed under compression below 111 tons per sq. ft. with an average of 167 tons; and the mean resistance of all the blocks tested between two and three years after moulding exceeded 215 tons per sq. ft., while blocks cut from the concrete of the dam gave from 181 to 329 tons per sq. ft. It has been shown that the best hydraulic lime, or volcanic puzzuolana and lime, if properly ground while slaking, and otherwise treated in the best-known manner, as well as some of the so-called natural (calcareous) cements, will yield results certainly not inferior to those obtained from Portland cement. The only objection that can in any case be urged against most of the natural products is that a longer time is required for induration; but in the case of masonry dams sufficient time necessarily passes before any load, beyond that of the very gradually increasing masonry, is brought upon the structure. The result of using properly treated natural limes is not to be judged from the careless manner in which such limes have often been used in the past. Any stone of which it is desirable to build a masonry dam would certainly possess an average strength at least as great as the above figures for concrete; the clay slate of the Lower Silurian formation, used in the case of the Vyrnwy dam, had an ultimate crushing strength of from 700 to 1000 tons per sq. ft. If, therefore, with such materials the work is well done, and is not subsequently liable to be wasted or disintegrated by expansion or contraction or other actions which in the process of time affect all exposed surfaces, it is clear that 15 to 20 tons per sq. ft. must be a perfectly safe load. There are many structures at present in existence bearing considerably greater loads than this, and the granite ashlar masonry of at least one, the Bear Valley dam in California, is subject to compressive stresses, reaching, when the reservoir is full, at least 40 to 50 tons per sq. ft., while certain brickwork linings in mining shafts are subject to very high circumferential stresses, due to known water-pressures. In one case which has been investigated this circumferential pressure exceeds 26 tons per sq. ft., and the brickwork, which is 18 in. thick and 20 ft. internal diameter, is perfectly sound and water-tight. In portions of the structure liable to important changes of pressure from the rise and fall of the water and subject to the additional stresses which expansion and contraction by changes of temperature and of moisture induce, and in view of the great difficulty of securing that the average modulus of elasticity in all parts of the structure shall be approximately the same, it is probably desirable to limit the calculated load upon any external work, even of the best kind, to 15 or 20 tons per sq. ft. It is clear that the material upon which any high masonry dam is founded must also have a large factor of safety against crushing under the greatest load that the dam can impose upon it, and this consideration unfits any site for the construction of a masonry dam where sound rock, or at least a material equal in strength to the strongest shale, cannot be had; even in the case of such a material as shale the foundation must be well below the ground.

Materials.

The actual construction of successful masonry dams has varied from the roughest rubble masonry to ashlar work. It is probable, however, that, all things considered, random rubble in which the flattest side of each block of stone is dressed to a fairly uniform surface, so that it may be bedded as it were in a tray of mortar, secures the nearest approach to uniform elasticity. Such stones may be of any size subject to each of them covering only a small proportion of the width of the structure (in the Vyrnwy dam they reached 8 or 10 tons each), and the spaces between them, where large enough, must be similarly built in with smaller, but always the largest possible, stones; spaces too small for this treatment must be filled and rammed with concrete. All stones must be beaten down into their beds until the mortar squeezes up into the joints around them. The faces of the work may be of squared masonry, thoroughly tied into the hearting; but, in view of the expansion and contraction mentioned below, it is better that the face masonry should not be coursed. Generally speaking, in the excavations for the foundations springs are met with; these may be only sufficient to indicate a continuous dampness at certain beds or joints of the rock, but all such places should be connected by relief drains carried to visible points at the back of the dam. It should be impossible, in short, for any part of the rock beneath the dam to become charged with water under pressure, either directly from the water in the reservoir or from higher places in the mountain sides. For similar reasons care must be taken to ensure that the structure of the water face of the dam shall be the least permeable of any part. In the best examples this has been secured by bedding the stones near to the water face in somewhat finer mortar than the rest, and sometimes also by placing pads to fill the joints for several inches from the water face, so that the mortar was kept away from the face and was well held up to its work. On the removal of the pads, or the cutting out of the face of the mortar where pads were not used, the vacant joint was gradually filled with almost dry mortar, a hammer and caulking tool being used to consolidate it. By these means practical impermeability was obtained. If the pores of the water face are thus rendered extremely fine, the surface water, carrying more or less fine detritus and organic matter, will soon close them entirely and assist in making that face the least permeable portion of the structure.

But no care in construction can prevent the compression of the mass as the superincumbent weight comes upon it. Any given yard of height measured during construction, or at any time after construction, will be less than a yard when additional weight has been placed upon it; hence the ends of such dams placed against rock surfaces must move with respect to those surfaces when the superincumbent load comes upon them. This action is obviously much reduced where the rock sides of the valley rise slowly; but in cases where the rock is very steep, the safest course is to face the facts, and not to depend for water-tightness upon the cementing of the masonry to the rock, but rather to provide a vertical key, or dowel joint, of some material like asphalt, which will always remain water-tight. So far as the writer has been able to observe or ascertain, there are very few masonry dams in Europe or America which have not been cracked transversely in their higher parts. They generally leak a little near the junction with the rock, and at some other joints in intermediate positions. In the case of the Neuadd dam this difficulty was met by deliberately omitting the mortar in transverse joints at regular intervals near the top of the dam, except just at their faces, where it of course cracks harmlessly, and by filling the rest with asphalt. Serious movement from expansion and contraction does not usually extend to levels which are kept moderately damp, or to the greater mass of the dam, many feet below high-water level.

The first masonry dam of importance constructed in Great Britain was that upon the river Vyrnwy, a tributary of the Severn, in connexion with the Liverpool water-supply (Plate I.). Its height, subject to water-pressure, is about 134 ft., and a carriage-way is carried on arches at an elevation of about 18 ft. higher. As this dam is about 1180 ft. in length from rock to rock, it receives practically no support from the sides of the valley. Its construction drew much attention to the subject of masonry dams in England—where the earthwork dam, with a wall of puddled clay, had hitherto been almost universal—and since its completion nine more masonry dams of smaller size have been completed. In connexion with the Elan and Claerwen works, in Mid-Wales, for the supply of Birmingham, six masonry dams were projected, three of which are completed, including the Caban Goch dam, 590 ft. long at the water level, and subject to a water-pressure of 152 ft. above the rock foundations and of 122 ft. above the river bed, and the Craig-yr-allt Goch dam, subject to a head of 133 ft. The latter dam is curved in plan, the radius being 740 ft. and the chord of the arc 515 ft. In the Derwent Valley scheme, in connexion with the water supplies of Derby, Leicester, Nottingham and Sheffield, six more masonry dams have received parliamentary sanction. Of these the highest is the Hagglee, on the Ashop, a tributary of the Derwent, which will impound water to about 136 ft. above the river bed, the length from rock to rock being 980 ft. Two of these dams are now in course of construction, one of which, the Howden, will be 1080 ft. in length and will impound water to a depth of 114 ft. above the river bed. In 1892 the excavation was begun for the foundations of a masonry dam across the Croton river, in connexion with the supply of New York. The length of this dam from rock to rock at the overflow level is about 1500 ft. The water face, over the maximum depth at which that face cuts the rock foundations, is subject to a water-pressure of about 260 ft., while the height of the dam above the river bed is 163 ft. The section, shown in fig. 17, has been well considered. The hearting is of rubble masonry, and the faces are coursed ashlar.

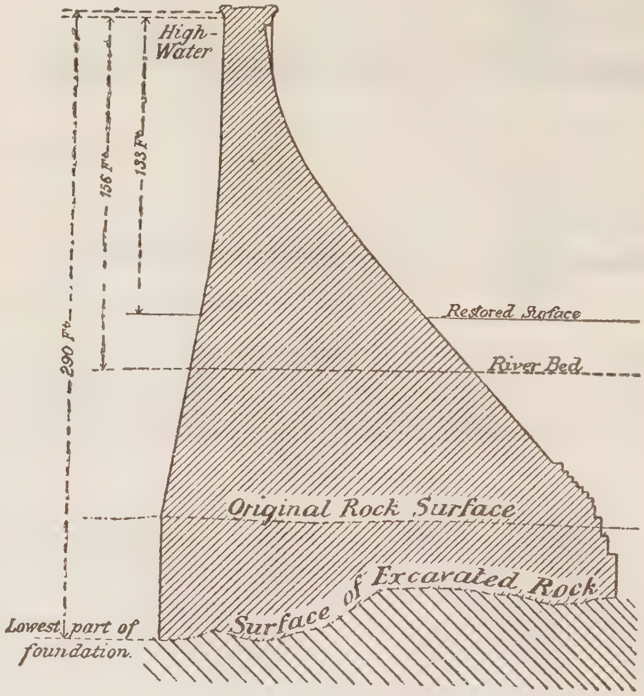
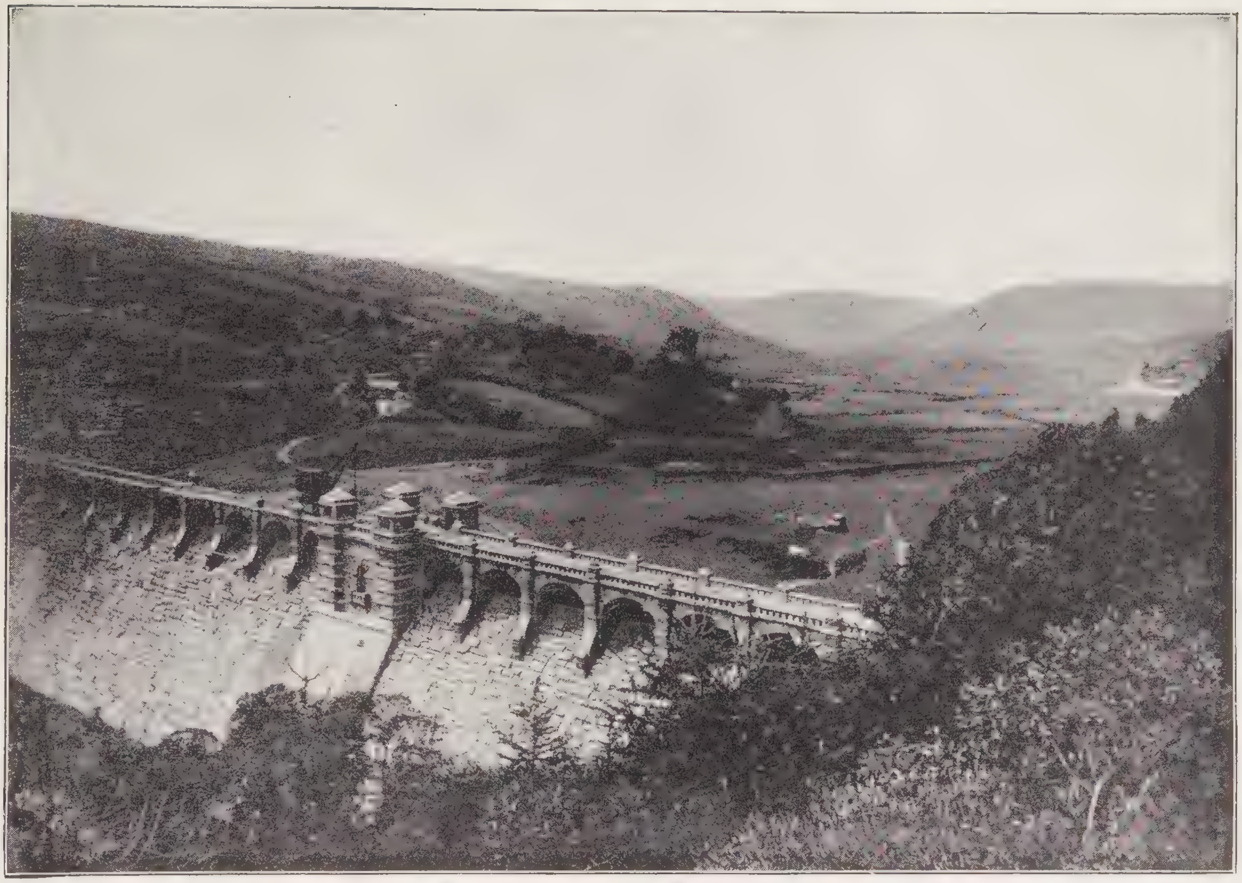


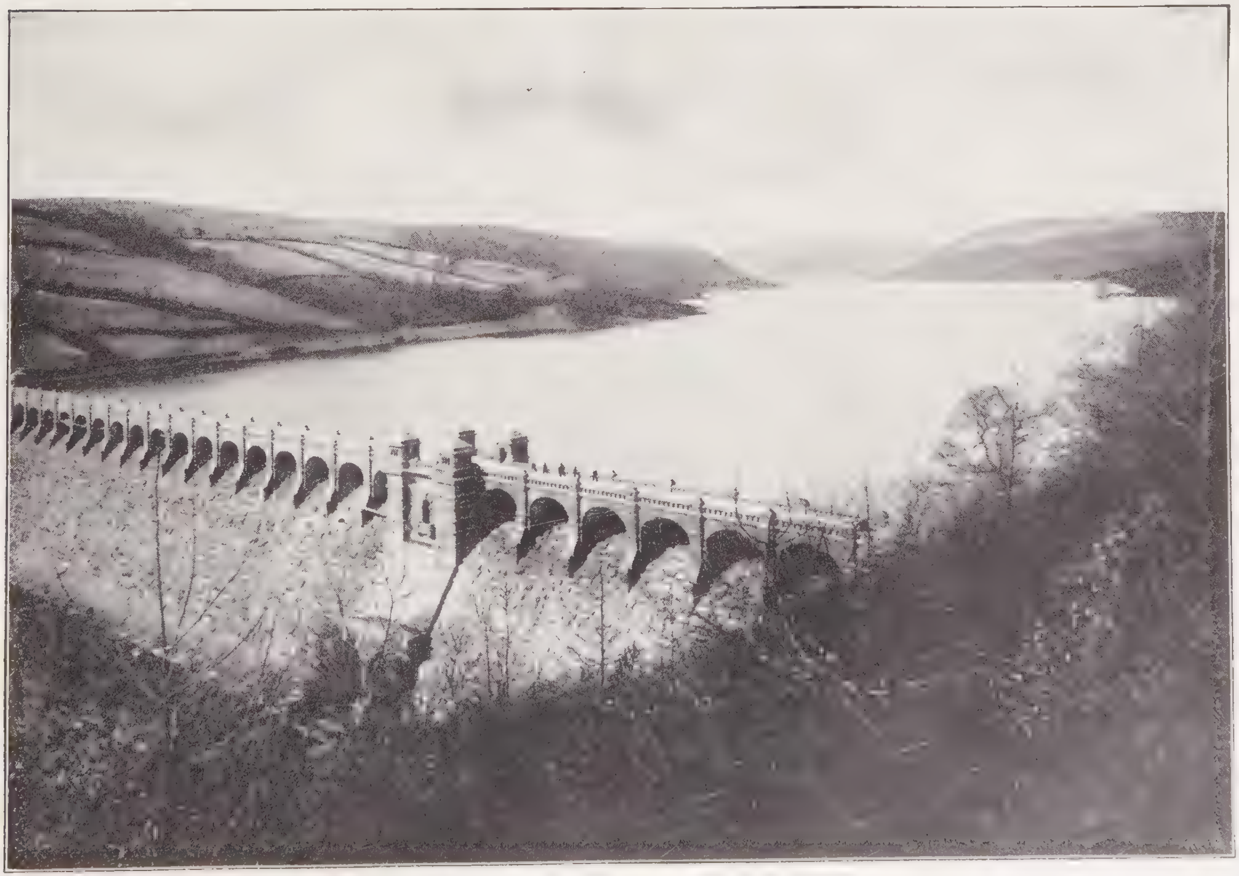
FIG. 17.—Section of Croton Dam.

So-called "natural cement" has been used, except during frosty weather, when Portland cement was substituted on account of its more rapid setting. An important feature in connexion with this dam is the nature of the foundation upon which it stands. Part of the rock is schist, but the greater portion limestone, similar in physical qualities to the Carboniferous limestone of Great Britain. The lowest part of the surface of this rock was reached after excavating through alluvial deposits to a depth of about 70 ft., but owing to its fissured and cavernous nature it became necessary to excavate to much greater depths, reaching in places more than 120 ft. below the original bottom of the valley. Great pains appear to have been taken to ascertain that the cavernous portions of the rock had been cut out and built up before the building was begun.

The Furens dam, already referred to as the earliest type of a scientifically designed structure of the kind, is subject to a pressure of about 166 ft. of water; the valley it crosses is only about 300 ft. wide at the water level, and the dam is curved in plan to a radius of 828 ft. Much discussion has taken place as to the utility of such curvature. The recent investigations already referred to indicate the desirability of curving dams in plan in order to reduce the possibility of tension and infiltration of water at the upstream face. In narrow rock gorges extremely interesting and complex problems relating to the combined action of horizontal and vertical stresses arise, and in some such cases it is evident that much may be done by means of horizontal curvature to reduce the quantity of masonry without reduction of strength. The Bear Valley dam, California, is the most



THE VYRNWY VALLEY, MONTGOMERYSHIRE, June 1888.



From Photographs by J. Maclardy.

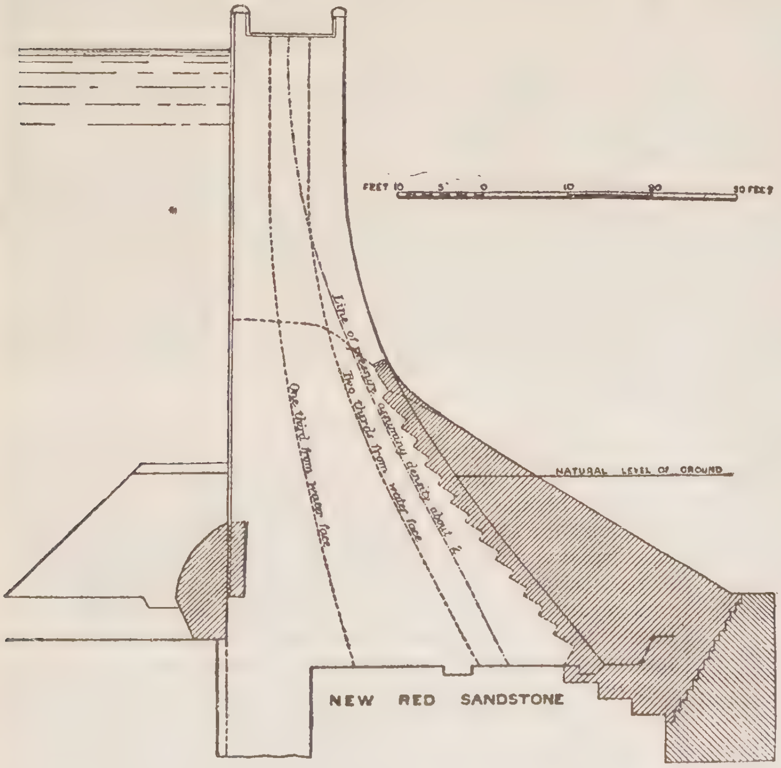
LAKE VYRNWY, December 1889.

daring example in existence of the employment of the arch principle. Its height from the rock bed is 64 ft., and it is subject during floods to a head of water not much less. The length of the chord of the arc across the valley is about 250 ft. and the radius 335 ft. The dam was begun in 1883, with a base 20 ft. thick, narrowing to 13 ft. at a height of 16 ft. The cost of this thickness being regarded as too great, it was abruptly reduced to 8 ft. 6 in., and for the remaining 48 ft. it was tapered up to a final width of about 3 ft. The masonry is described by Mr Schuyler as "a rough uncut granite ashlar, with a hearting of rough rubble all laid in cement mortar and gravel." This dam has been in satisfactory use since 1885, and the slight filtration through the masonry which occurred at first is said to have almost entirely ceased.

In New South Wales thirteen thin concrete dams, dependent upon horizontal curvature for their resistance to water pressure, have been constructed in narrow gorges at comparatively small cost to impound water for the use of villages. The depth of water varies from 18 ft. to 76 ft. and five of them have cracked vertically, owing apparently to the impossibility of the base of the dam partaking of the changes of curvature induced by changes of temperature and of moisture in the upper parts. It is stated, however, that these cracks close up and become practically water-tight as the water rises.

Failures.

Something has been said of the failures of earthen dams. Many masonry dams have also failed, but, speaking generally, we know less of the causes which have led to such failures. The examination of one case, however, namely, the bursting in 1895 of the Bouzey dam, near Épinal, in France, by which many lives were lost, has brought out several points of great interest. It is probably the only instance in which a masonry dam has slipped upon its foundations, and also the only case in which a masonry dam has actually overturned, while curiously enough there is every probability that the two circumstances had no connexion with each other. A short time after the occurrence of the catastrophe the dam was visited by Dr W. C. Unwin, F.R.S., and the writer, and a very careful examination of the work was made by them. Some of the blocks of rubble masonry carried down the stream weighed several hundred tons. The original section of the dam is shown by the continuous thick line in fig. 18, from which it appears that the work was subject to a pressure of only about 65 ft. of water. In the year 1884 a length of 450 ft. of the dam, out of a total length of 1706 ft., slipped upon its foundation of soft sandstone, and became slightly curved in plan as shown at *a*, *b*, fig. 19, the maximum movement from the original straight line being about 1 ft. Further sliding on the base was prevented by the construction of the cross-lined portions in the section (fig. 18). These precautions were perfectly effective in securing the safety of the dam up to the height to which the counterfort was carried. As a consequence of this horizontal bending of the dam the vertical cracks shown in fig. 19 appeared and were repaired. Eleven years after this, and about fifteen years after the dam was first brought into use, it overturned on its outer edge, at about the level indicated by the dotted line just above the counterfort; and there is no good reason to attribute to the movement of 1884, or to the vertical cracks it caused, any influence in the overturning of 1895. Some of the worst cracks were, indeed, entirely beyond the portion overturned, which consisted of the mass 570 ft. long by 37 ft. in depth, and weighing about 20,000 tons, shown in elevation in fig. 19. The line of pressures as generally given for this dam with the reservoir full, on the hypothesis that the density of the masonry was a little over 2, is shown by long and short dots in fig. 18. Materials actually collected from the dam indicate that the mean density did not exceed 1·85 when dry and 2·07 when saturated, which would bring the line of pressures even closer to the outer face at the top of the counterfort. In any event it must have approached well within 3½ ft. of the outer face, and was more nearly five-sixths than two-thirds of the width of the dam distant from the water face; there must, therefore, have been considerable vertical tension at the water face, variously computed according to the density assumed at from 1¼ to 1¾ ton per square foot. This, if the dam had been thoroughly well constructed, either with hydraulic lime or Portland cement mortar, would have been easily borne. The materials, however, were poor, and it is probable that rupture by tension in a roughly horizontal plane took place. Directly this occurred, the front part of the wall was subject to an additional overturning pressure of about 35 ft. of water acting upwards, equivalent to about a ton per square foot, which would certainly, if it occurred throughout any considerable length of the dam, have immediately overturned it. But, as a matter of fact, the dam actually stood for about fifteen years. Of this circumstance there are two possible explanations. It is known that more or less leakage took place through the dam, and to moderate this the water face was from time to time coated and repaired with cement. Any cracks were thus, no doubt, temporarily closed; and as the structure of the rest of the dam was porous, no opportunity was given for the percolating water to accumulate in the horizontal fissures to anything like the head in the reservoir. But in reservoir work such coatings are not to be trusted, and a single horizontal crack might admit sufficient water to cause an uplift. Then, again, it must be remembered that although the full consequences of the facts described might arise in a section of the dam 1 ft. thick (if that section were entirely isolated), they could not arise throughout the length unless the adjoining sections were subject to like conditions. Any horizontal fissure in a weak place would, in the nature of things, strike somewhere a stronger place, and the final failure would be deferred. Time would then become an element. By reason of the constantly changing temperatures and the frequent filling and emptying of the reservoir, expansion and contraction, which are always at work tending to produce relative movements wherever one portion of a structure is weaker than another, must have assisted the water-pressure in the extension of the horizontal cracks, which, growing slowly during the fifteen years, provided at last the area required to enable the intrusive water to overbalance the little remaining stability of the dam.



FEET 10 5 0 10 20 30 FEET
NATURAL LEVEL OF GROUND
Line of pressures, assuming density about 2
Two thirds from water face
One third from water face
NEW RED SANDSTONE

FIG. 18.—Section of Bouzey Dam.

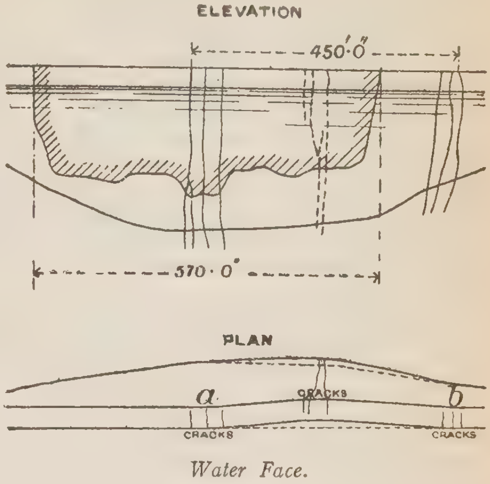


FIG. 19.—Elevation and Plan of Bouzey Dam.

RESERVOIRS

From very ancient times in India, Ceylon and elsewhere, reservoirs of great area, but generally of small depth, have been built and used for the purposes of irrigation; and in modern times, especially in India and America, comparatively shallow reservoirs have been constructed of much greater area, and in some cases of greater capacity, than any in the United Kingdom

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[1] See *Proc. Inst. C.E.* vol. cxxvi. pp. 91-95.

Yet the hilly parts of the last-named country are rich in magnificent sites at sufficient altitudes for the supply of any parts by gravitation, and capable, if properly laid out, of affording a volume of water, throughout the driest seasons, far in excess of the probable demand for a long future. Many of the great towns had already secured such sites within moderate distances, and had constructed reservoirs of considerable size, when, in 1879, 1880 and 1892 respectively, Manchester, Liverpool and Birmingham obtained statutory powers to draw water from relatively great distances, viz. from Thirlmere in Cumberland, in the case of Manchester; from the river Vyrnwy, Montgomeryshire, a tributary of the Severn, in the case of Liverpool; and from the rivers Elan and Claerwen in Radnorshire, tributaries of the Wye, in the case of Birmingham. Lake Vyrnwy, completed in 1889, includes a reservoir which is still by far the largest in Europe.

Lake Vyrnwy.

This reservoir is situated in a true Glacial lake-basin, and having therefore all the appearance of a natural lake, is commonly known as Lake Vyrnwy. It is 825 ft. above the sea, has an area of 1121 acres, an available capacity exceeding 12,000 million gallons, and a length of nearly 5 m. Its position in North Wales is shown in black in fig. 20, and the two views on Plate I. show respectively the portion of the valley visible from the dam before impounding began, and the same portion as a lake on the completion of the work. Before the valves in the dam were closed, the village of Llanwddyn, the parish church, and many farmsteads were demolished. The church was rebuilt outside the watershed, and the remains from the old churchyard were removed to a new cemetery adjoining it. The fact that this valley is a post-Glacial lake-basin was attested by the borings and excavations made for the foundations of the dam. The trench in which the masonry was founded covered an area 120 ft. wide at the bottom, and extending for 1172 ft. across the valley. Its site had been determined by about 190 borings, probings and shafts, which, following upon the indications afforded by the rocks above ground, proved that the rock bed crossing the valley was higher at this point than elsewhere. Here then, buried in alluvium at a depth of 50 to 60 ft. from the surface, was found the rock bar of the post-Glacial lake; at points farther up the valley, borings nearly 100 ft. deep had failed to reach the rock. The Glacial striae, and the dislocated rocks—moved a few inches or feet from their places, and others, at greater distances, turned over, and beginning to assume the sub-angular form of Glacial boulders—were found precisely as the glacier, receding from the bar, and giving place to the ancient lake, had left them, covered and preserved by sand and gravel washed from the terminal morain. Later came the alluvial silting-up. Slowly, but surely, the deltas of the tributary streams advanced into the lake, floods deposited their burdens of detritus in the deeper places, the lake shallowed and shrank and in its turn yielded to the winding river of an alluvial strath, covered with peat, reeds and alders, and still liable to floods. It is interesting to record that during the construction of the works the implements of Neolithic man were found, near the margin of the modern lake, below the peat, and above the alluvial clay on which it rested. Several of the reservoir sites in Wales, shown by shaded lines in fig. 20, are in all probability similar post-Glacial lake-basins, and in the course of time some of them may contain still greater reservoirs. They are provided with well-proportioned watersheds and rainfall, and being nearly all more than 500 ft. above the sea, may be made available for the supply of pure water by gravitation to any part of England. In 1892 the Corporation of Birmingham obtained powers for the construction of six reservoirs on the rivers Elan and Claerwen, also shown in fig. 20, but the sites of these reservoirs are long narrow valleys, not lake-basins. The three reservoirs on the Elan were completed in 1904. Their joint capacity is 11,320 million gallons, and this will be increased to about 18,000 millions when the remaining three are built.

Of natural lakes in Great Britain raised above their ordinary levels that the upper portions may be utilized as reservoirs, Loch Katrine supplying Glasgow is well known. Whitehaven is similarly supplied from Ennerdale, and in the year 1894 Thirlmere in Cumberland was brought into use, as already mentioned, for the supply of Manchester. The corporation have statutory power to raise the lake 50 ft., at which level it will have an available capacity of about 8000 million gallons; to secure this a masonry dam has been constructed, though the lake is at present worked at a lower level.

Overflow.

It is obvious that the water of a reservoir must never be allowed to rise above a certain prescribed height at which the works will be perfectly safe. In all reservoirs impounding the natural flow of a stream, this involves the use of an overflow. Where the dam is of masonry it may be used as a weir; but where earthwork is employed, the overflow, commonly known in such a case as the "bye-wash," should be an entirely independent work, consisting of a low weir of sufficient length to prevent an unsafe rise of the water level, and of a narrow channel capable of easily carrying away any water that passes over the weir. The absence of one or both of these conditions has led to the failure of many dams.

Reservoirs unsafe from this cause still exist in the United Kingdom. Where the contributory drainage area exceeds 5000 acres, the discharge, even allowing for so-called "cloud-bursts," rarely or never exceeds the rate of about 300 cub. ft. per second per 1000 acres, or 1500 times the minimum dry weather flow, taken as one-fifth of a cubic foot; and if we provide against such an occasional discharge, with a possible maximum of 400 cub. ft. at much more distant intervals, a proper factor of safety will be allowed. But when a reservoir is placed upon a smaller area the conditions are materially changed. The rainfall which produces, as the average of all the tributaries in the larger area, 300 cub. ft. per second per 1000 acres, is made up of groups of rainfall of very varying intensity, falling upon different portions of that area, so that upon any section of it the intensity of discharge may be much greater.

The height to which the water is permitted to rise above the sill of the overflow depends upon the height of the embankment above that level (in the United Kingdom commonly 6 or 7 ft.), and this again should be governed by the height of possible waves. In open places that height is seldom more than about one and a half times the square root of the "fetch" or greatest distance in nautical miles from which the wave has travelled to the point in question; but in narrow reaches or lakes it is relatively higher. In lengths not exceeding about 2 m., twice this height may be reached, giving for a 2-mile "fetch" about 3½ ft., or 1¾ ft. above the mean level. Above this again, the height of the wave should be allowed for "wash," making the embankment in such a case not less than 5¼ ft. above the highest water-level. If, then, we determine that the depth of overflow shall not exceed 1½ ft., we arrive at 6¾ ft. as sufficient for the height of the embankment above the sill of the overflow. Obviously we may shorten the sill at the cost of extra height of embankment, but it is rarely wise to do so.

The overflow sill or weir should be a masonry structure of rounded vertical section raised a foot or more above the waste-water course, in which case for a depth of 1½ ft. it will discharge, over every foot of length, about 6 cub. ft. per second. Thus, if the drainage area exceeds 5000 acres, and we provide for the passage of 300 cub. ft. per second per 1000 acres, such a weir will be 50 ft. long for every 1000 acres. But, as smaller areas are approached, the excessive local rainfalls of short duration must be provided for, and beyond these there are extraordinarily heavy discharges generally over and gone before any exact records can be made; hence we know very little of them beyond the bare fact that from 1000 acres the discharge may rise to two or three times 300 cub. ft. per second per 1000 acres. In the writer's experience at least one case has occurred where, from a mountain area of 1300 acres, the rate per 1000 was for a short time certainly not less than 1000 cub. ft. per second. Nothing but long observation and experience can help the hydraulic engineer to judge of the configuration of the ground favourable to such phenomena. It is only necessary, however, to provide for these exceptional discharges during very short periods, so that the rise in the water-level of the reservoir may be taken into consideration; but subject to this, provision must be made at the bye-wash for preventing such a flood, however rare, from filling the reservoir to a dangerous height.

From the overflow sill the bye-wash channel may be gradually narrowed as the crest of the embankment is passed, the water being prevented from attaining undue velocity by steps of heavy masonry, or, where the gradient is not very steep, by irregularly set masonry.

PURIFICATION

Sand filtration.

When surface waters began to be used for potable purposes, some mode of arresting suspended matter, whether living or dead, became necessary. In many cases gauze strainers were at first employed, and, as an improvement upon or addition to these, the water was caused to pass through a bed of gravel or sand, which, like the gauze, was regarded merely as a strainer. As such strainers were further improved, by sorting the sand and gravel, and using the fine sand only at the surface, better clarification of the water was obtained; but chemical analysis indicated, or was at the time thought to indicate, that that improvement was practically confined to clarification, as the dissolved impurities in the water were certainly very little changed. Hence such filter beds, as they were even then called, were regarded as a luxury rather than as a necessity, and it was never suspected that, notwithstanding the absence of chemical improvement in the water, changes did take place of a most important kind. Following upon Dr Koch's discovery of a method of isolating bacteria, and of making approximate determinations of their number in any volume of water, a most remarkable diminution in the number of microbes contained in sand-filtered water was observed; and it is now well known that when a properly constructed sand-filter bed is in its best condition, and is worked in the best-known manner, nearly the whole of the microbes existing in the crude water will be arrested. The sand, which is nominally the filter, has interstices about thirty times as wide as the largest dimensions of the larger microbes; and the reason why these, and, still more, why organisms which were individually invisible under any magnifying power, and could only be detected as colonies, were arrested, was not understood. In process of time it became clear, however, that the worse the condition of a filter bed, in the then general acceptation of the term, the better it was as a microbe filter; that is to say, it was not until a fine film of mud and microbes had formed upon the surface of the sand that the best results were obtained.

Even yet medical science has not determined the effect upon the human system of water highly charged with bacteria which are not known to be individually pathogenic. In the case of the bacilli of typhoid and cholera, we know the direct effect; but apart altogether from the presence of such specific poisons, polluted water is undoubtedly injurious. Where, therefore, there is animal pollution of any kind, more especially where there is human pollution, generally indicated by the presence of *bacillus coli communis*, purification is of supreme importance, and no process has yet been devised which, except at extravagant cost, supersedes for public supplies that of properly-conducted sand filtration. Yet it cannot be too constantly urged that such filtration depends for its comparative perfection upon the surface film; that this surface film is not present when the filter is new, or when its materials have been recently washed; that it may be, and very often is, punctured by the actual working of the filters, or for the purpose of increasing their discharge; and that at the best it must be regarded as an exceedingly thin line of defence, not to be depended upon as a safeguard against highly polluted waters, if a purer source of supply can possibly be found. Such filters are not, and in the nature of things cannot be, worked with the precision and continuity of a laboratory experiment.

In fig. 21 a section is shown of an efficient sand-filter bed. The thickness of sand is 3 ft. 6 in. In the older filters it was usual to support this sand upon small gravel resting upon larger gravel, and so on until the material was sufficiently open to pass the water laterally to under-drains. But a much shallower and certainly not less efficient filter can be constructed by making the under-drains cover the whole bottom. In fig. 21 the sand rests on small gravel of such degree of coarseness that the whole of the grains would be retained on a sieve of $\frac{1}{8}$-in. mesh and rejected by a sieve of $\frac{1}{2}$-in. mesh in the clear, supported upon a 3-in. thickness of bricks laid close together, and constituting the roof of the under-drains, which are formed by other bricks laid on thin asphalt, upon a concrete floor. In this arrangement the whole of the materials may be readily removed for cleansing. In the best filters an automatic arrangement for the measurement of the supply to each separate filter, and for the regulation of the quantity within certain limits, is adopted, and the resistance at outflow is so arranged that not more than a certain head of pressure, about $2\frac{1}{2}$ ft., can under any circumstances come upon the surface film, while a depth of several feet of water is maintained over the sand. It is essential that during the working of the filter the water should be so supplied that it will not disturb the surface of the sand. When a filter has been emptied, and is being re-charged, the water should be introduced from a neighbouring filter, and should pass upwards in the filter to be charged, until the surface of the sand has been covered. The unfiltered water may then be allowed to flow quietly and to fill the space above the sand to a depth of 2 or 3 ft. It would appear to be impossible with any water that requires filtration to secure that the first filtrate shall be satisfactory if filtration begins immediately after a filter is charged; and if the highest results are to be obtained, either the unfiltered water must be permitted to pass extremely slowly over the surface of the sand without passing through it, or to stand upon the sand until the surface film has formed. With waters giving little or no sediment, which are often the most dangerous, some change, as by the first method, is necessary. It has been proposed, on the other hand, to allow the filter to act slowly until the surface film is formed, and to discard the first effluent. This course can scarcely fail to introduce into the sand many bacteria, which may be washed through when the full working of the filters is begun; and it should not, therefore, be adopted when the source of the supply is known to be subject to human pollution. The time for the formation of an efficient surface films varies, according to the quality of the raw water, from a few hours to a few days. Judging from the best observations that have been made on a large scale, the highest rate of efficient filtration when the surface film is in good condition is about 4 in. downwards per hour of the water contained above the sand, equivalent to about 50 gallons per day from each square foot of sand. When the surface film has once been formed, and the filter has begun its work, it should continue without interruption until the resistance of that film becomes too great to permit of the necessary quantity of water being passed. That period will vary, according to the condition of the water, from eight or ten days to four weeks. The surface film, together with half an inch to an inch of sand, is then carefully scraped off and stored for subsequent washing and use. This process may be repeated many times until the thickness of the fine sand is reduced to about 18 in., when the filter bed should be restored to its full thickness.

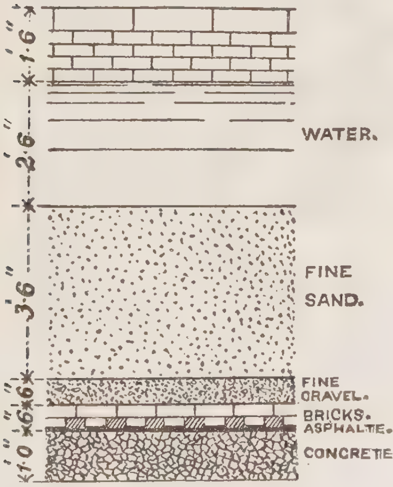


FIG. 21.—Section of Sand-Filter Bed.

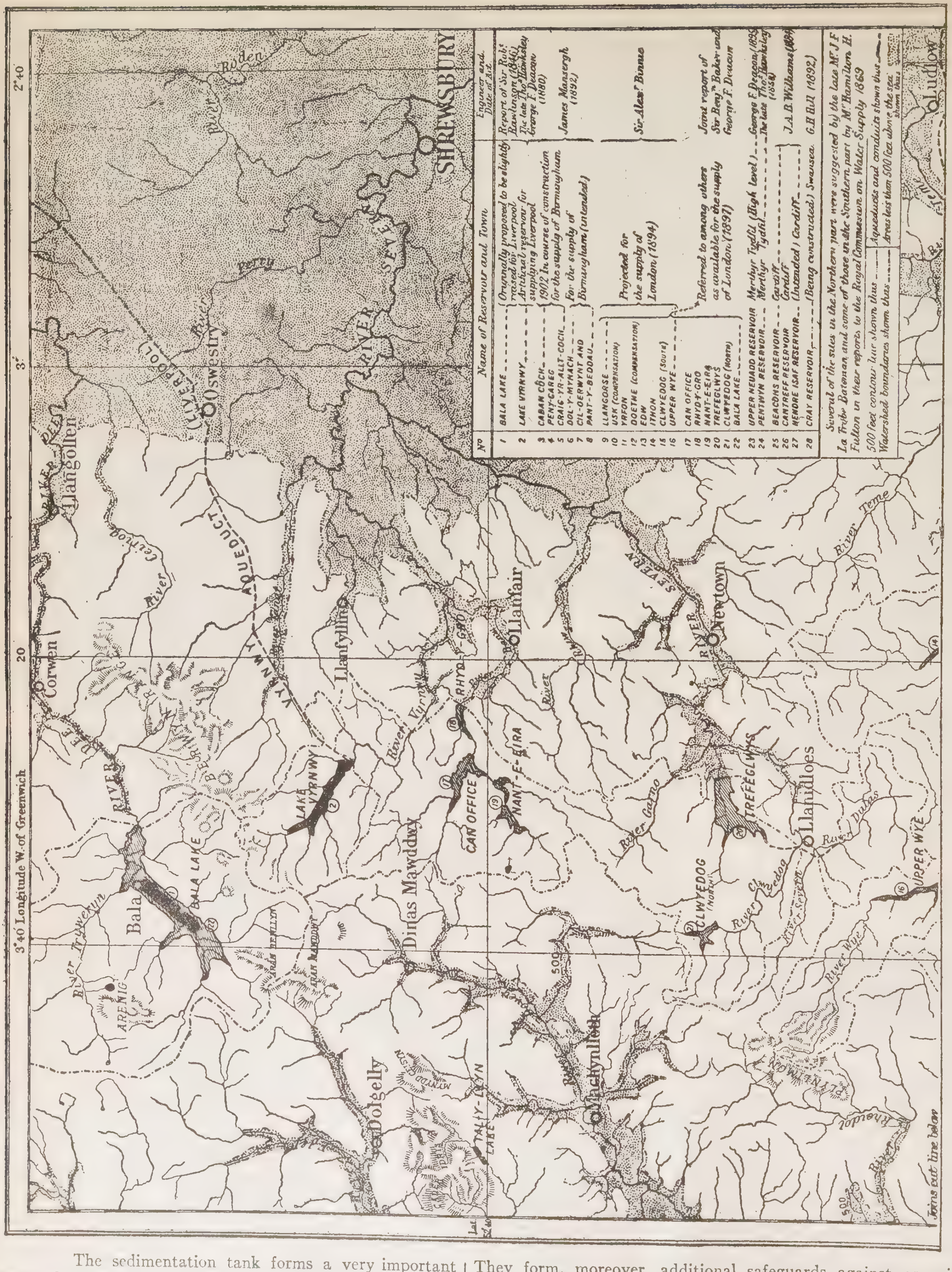
A lately discovered effect of sand filtration is a matter of great importance in connexion with the subject of aqueducts. A brown slimy sediment, having the appearance of coffee grounds when placed in clear water, has been long observed in pipes conveying surface waters from mountain moorlands. The deposit grows on the sides of the pipes and accumulates at the bottom, and causes most serious obstruction to the flow of water. The chemists and bacteriologists do not appear to have finally determined the true nature and origin of this growth, but it is found in the impounded waters, and passes into the pipes, where it rapidly increases. It is checked even by fine copper wire-gauze strainers, and where the water passes through sand-filter beds in the course of an aqueduct, the growth, though very great between the reservoir and the filter beds, is almost absent between the filter beds and the town. Even the growth of the well-known nodular incrustations in iron pipes is much reduced by sand filtration. From these facts it is clear that, other things being the same, the best position for the strainers and filter beds is as close as possible to the reservoir.

Some surface waters dissolve lead when bright, but cease to do so when the lead becomes tarnished. More rarely the action is continuous, and the water after being passed through lead cisterns and pipes produces lead poisoning—so called "plumbism." The liability to this appears to be entirely removed by efficient sand filtration.

Sand filtration, even when working in the best possible manner, falls short of the perfection necessary to prevent the passage of bacteria which may multiply after the filter is passed. Small, however, as the micro-organisms are, they are larger than the capillary passages in some materials through which water under pressure may be caused to percolate. It is therefore natural that attempts should have been made to construct filters which, while permitting the slow percolation of water, should preclude the passage of bacteria or their spores. In the laboratory of Pasteur probably the first filter which successfully accomplished this object was produced. In this apparatus, known as the Pasteur-Chamberland filter, the filtering medium is biscuit porcelain. It was followed by the Berkefield filter, constructed of baked infusorial earth. Both these filters arrest the organisms by purely mechanical action, and if the joints are water-tight and they receive proper attention and frequent sterilization, they both give satisfactory results on a small scale for domestic purposes. The cost, however—to say nothing of the uncertainty—where large volumes of water are concerned, much exceeds the cost of obtaining initially safe water. Moreover, if a natural water is so liable to pathogenic pollution as to demand filtration of this kind, it ought at once to be discarded for an initially pure supply; not necessarily pure in an apparent or even in a chemical sense, for water may be visibly coloured, or may contain considerable proportions both of organic and inorganic impurity, and yet be tasteless and free from pathogenic pollution.

There are several materials now in use possessing remarkable power to decolourize clarify, chemically purify and oxidize water; but they are too costly for use in connexion with public water supplies unless a rate of filtration is adopted quite inconsistent with the formation of a surface film capable of arresting micro-organisms. This fact does not render them less useful when applied to the arts in which they are successfully employed.

Attempts have been made, by adding certain coagulants to the water to be filtered, to increase the power of sand and other granular materials to arrest bacteria when passing through them at much higher velocities than are possible for successful filtration by means of the surface film upon sand. The effect is to produce between the sand or other grains a glutinous substance which does the work performed by the mud and microbes upon the surface of the sand filter. Elsewhere centrifugal force, acting somewhat after its manner in the cream separator, has been called in aid.


SHREWSBURY
Oswestry
Llangollen
Corwen
Bala
Llanfyllin
Llanfair
Newtown
Llanidloes
Dinas Mawddwy
Machynlleth
Dolgelly
Ludlow
River Roden
River Perry
River Severn
River Vyrnwy
River Teme
River Dee
River Ceiriog
River Tryweryn
River Garno
River Clywedog
River Dulas
River Wye
River Rheidol
LIVERPOOL
VYRNWY AQUEDUCT
LAKE VYRNWY
BALA LAKE
CAN OFFICE
NANT-F-EIRA
RHYD-Y-GRO
TREFEGLWYS
CLWYEDOG (NORTH)
UPPER WYE
TALLY-LLYN LAKE
ARENIG
ARAN BENLLYN
ARAN MAWDDWY
PLYNLIMMON
500
3°40 Longitude W. of Greenwich
3°
2°40
20
Joins out line below

Nº	Name of Reservoir and Town		Engineer and Date of Act.
1	BALA LAKE	Originally proposed to be slightly raised for Liverpool	Report of Sir Robt Rawlinson (1846)
2	LAKE VYRNWY	Artificial reservoir for supplying Liverpool	The late Thos Hawksley George F. Deacon (1880)
3	CABAN COCH	1902 In course of construction for the supply of Birmingham	James Mansergh (1892)
4	PEN-Y-GAREG		
5	CRAIG-YR-ALLT-COCH		
6	DOL-Y-MYNACH	For the supply of Birmingham (intended)	
7	CIL-OERWYNT AND		
8	PANT-Y-BEDDAU		
9	LLANGORSE	Projected for the supply of London (1894)	Sir Alexr Binnie
10	USK (COMPENSATION)		
11	YRFON		
12	DOETHIE (COMPENSATION)		
13	EDW		
14	ITHON		
15	CLWYEDOG (SOUTH)		
16	UPPER WYE		
17	CAN OFFICE	Referred to among others as available for the supply of London (1897)	Joint report of Sir Benjn Baker and George F. Deacon
18	RHYD-Y-GRO		
19	NANT-E-EIRA		
20	TREFEGLWYS		
21	CLWYEDOG (NORTH)		
22	BALA LAKE		
23	UPPER NEUADD RESERVOIR	Merthyr Tydfil (High level)	George F. Deacon (1895)
24	PENTWYN RESERVOIR	Merthyr Tydfil	The late Thos Hawksley (1858)
25	BEACONS RESERVOIR	Cardiff	J.A.B. Williams (1884)
26	CANTREFF RESERVOIR	Cardiff	
27	NENORE ISAF RESERVOIR	(Intended) Cardiff	
28	CRAY RESERVOIR	(Being constructed) Swansea	G.H. Hill (1892)

Several of the sites in the Northern part were suggested by the late Mr J F La Trobe Bateman and some of those in the Southern part by Mr Hamilton H. Fulton in their reports to the Royal Commission on Water Supply 1869

500 feet contour line shown thus

Watershed boundaries shown thus

Aqueducts and conduits shown thus

Areas less than 500 feet above the sea shown thus

Sedimentation tanks. The sedimentation tank forms a very important help to filtration. In the case of river waters liable to turbidity the water should always be passed through such tanks before being placed in the filters. They form, moreover, additional safeguards against organic impurity. Sedimentation tanks on a sufficient scale may effect the purification of the water to almost any desired extent. This is shown to be the case by the purity of some lake

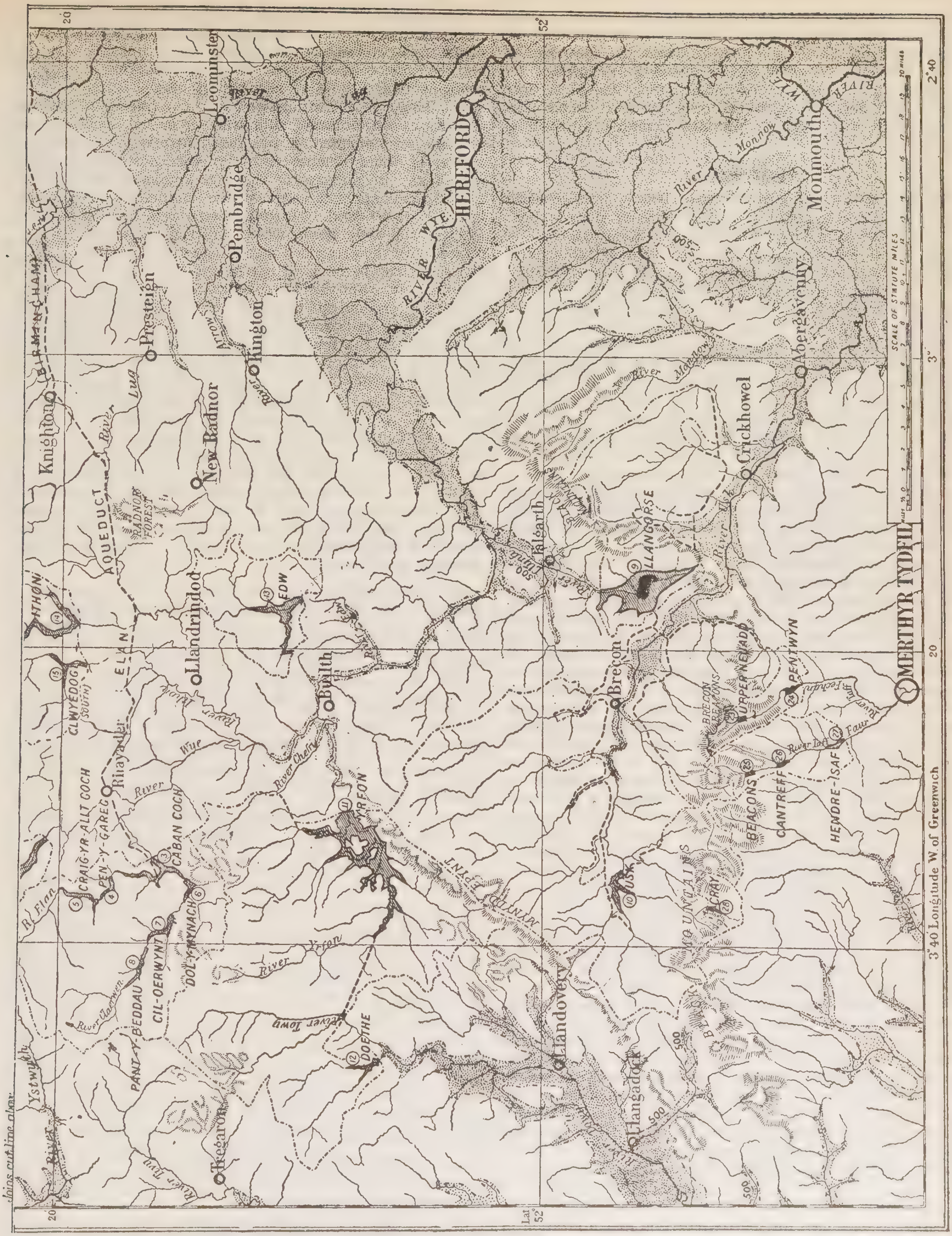

Leominster
HEREFORD
Pembridge
Kington
Presteign
Knighton
New Radnor
Monmouth
Abergavenny
Crickhowel
Talgarth
Brecon
Builth
Llandrindod
Rhayader
MERTHYR TYDFIL
Llandovery
Llangadock
Tregaron
River Wye
River Lug
River Monnow
River Usk
River Irfon
River Towy
River Elan
River Claerwen
River Taff
AQUEDUCT
BIRMINGHAM
RADNOR FOREST
MYNYDD EPYNT
BRECON BEACONS
BLACK MOUNTAINS
CRAIG-YR-ALLT GOCH
PEN-Y-GAREG
CABAN COCH
DOL-Y-MYNACH
CIL-OERWYNT
PANT-Y-BEDDAU
CLWYEDOG (SOUTH)
ITHON
EDW
IRFON
LLANGORSE
USK
DOETHE
UPPER NEUADD
PENTWYN
BEACONS
CANTREFF
HENDRE-ISAF
CRAI
SCALE OF STATUTE MILES
3°40 Longitude W. of Greenwich
Lat 52°

FIG. 20.—WELSH RESERVOIR SITES.

waters; but the first cost of the works and the subsequent removal of the sediment are in some cases a serious matter, and any approach to the comparatively perfect action of lakes is out of the question. By the use of such tanks, however, when the condition of the water demands it, and by passing the effluent water through sand filters when in good condition, the number of microbes is found to be reduced by as much as 97 or even 99%. This, when attained, is undoubtedly a most important reduction in the chance of pathogenic bacteria passing into the filtered water; but much more must be done than has hitherto in most places been done to ensure the constancy of such a condition before it can be assumed to represent the degree of safety attained. No public supply should be open to any such doubt as ought to, or may, deter people from drinking the water without previous domestic filtration or boiling.

Distribution

Intermittent supply.

The earliest water supplies in Great Britain were generally distributed at low pressure by wooden pipes or stone or brick conduits. For special purposes the Romans introduced cast-lead pipes, but they were regarded as luxuries, not as necessaries, and gave way to cheaper conduits made, as pump barrels had long been made, by boring out tree trunks, which are occasionally dug up in a good state of preservation. This use of tree-trunks as pipes is still common in the wooded mountain districts of Europe. Within the 19th century, however, cast iron became general in the case of large towns; but following the precedent inseparable from the use of weaker conduits, the water was still delivered under very low pressure, rarely more than sufficient to supply taps or tanks near the level of the ground, and generally for only a short period out of each twenty-four hours. On the introduction of the Waterworks Clauses Act 1847, an impetus was given to high-pressure supplies, and the same systems of distributing mains were frequently employed for the purpose; but with few exceptions the water continued to be supplied intermittently, and cisterns or tanks were necessary to store it for use during the periods of intermission. Thus it happened that pipes and joints intended for a low-pressure supply were subjected, not only to high pressure, but to the trying ordeal of suddenly varying pressures. As a rule such pipes were not renewed: the leakage was enormous, and the difficulty was met by the very inefficient method of reducing the period of supply still farther. But even in entirely new distributing systems the network is so extensive, and the number of joints so great, that the aggregate leakage is always considerable; the greatest loss being at the so-called "ferrules" connecting the mains with the house "communication" or "service" pipes, in the lead pipes, and in the household fittings. But a far greater evil than mere loss of water and inconvenience soon proved to be inseparable from intermittent supply. Imagine a hilly town with a high-pressure water supply, the water issuing at numerous points, sometimes only in exceedingly small veins, from the pipes into the sub-soil. In the ordinary course of intermittent supply or for the purpose of repairs, the water is cut off at some point in the main above the leakages; but this does not prevent the continuance of the discharge in the lower part of the town. In the upper part there is consequently a tendency to the formation of a vacuum, and some of the impure sub-soil water near the higher leakages is sucked into the mains, to be mixed with the supply when next turned on. We are indebted to the Local Government Board for having traced to such causes certain epidemics of typhoid, and there can be no manner of doubt that the evil has been very general. It is therefore of supreme importance that the pressure should be constantly maintained, and to that end, in the best-managed waterworks the supply is not now cut off even for the purpose of connecting house-service pipes, an apparatus being employed by which this is done under pressure. Constant pressure being granted, constant leakage is inevitable, and being constant it is not surprising that its total amount often exceeds the aggregate of the much greater, but shorter, draughts of water taken for various household purposes. There is therefore, even in the best cases, a wide field for the conservation and utilization of water hitherto entirely wasted.

Constant supply.

Detection of waste.

Following upon the passing of the Waterworks Clauses Act 1847, a constant supply was attempted in many towns, with the result in some cases that, owing to the enormous loss arising from the prolongation of the period of leakage from a fraction of an hour to twenty-four hours, it was impossible to maintain the supply. Accordingly, in some places large sections of the mains and service pipes were entirely renewed, and the water consumers were put to great expense in changing their fittings to new and no doubt better types, though the old fittings were only in a fraction of the cases actually causing leakage. But whether or not such stringent methods were adopted, it was found necessary to organize a system of house-to-house visitation and constantly recurring inspection. In Manchester this was combined with a most careful examination, at a depôt of the Corporation, of all fittings intended to be used. Searching tests were applied to these fittings, and only those which complied in every respect with the prescribed regulations were stamped and permitted to be fixed within the limits of the water supply. But this did not obviate the necessity for house-to-house inspection, and although the number of different points at which leakage occurred was still great, it was always small in relation to the number of houses which were necessarily entered by the inspector; moreover, when the best had been done that possibly could be done to suppress leakage due to domestic fittings, the leakage below ground in the mains, ferrules and service pipes still remained, and was often very great. It was clear, therefore, that in its very nature, house-to-house visitation was both wasteful and insufficient, and it remained for Liverpool to correct the difficulty by the application, in 1873, of the "Differentiating waste water meter," which has since been extensively used for the same purpose in various countries. One such instrument was placed below the roadway upon each main supplying a population of generally between 1000 and 2000 persons.

Its action is based upon the following considerations: When water is passing through a main and supplying nothing but leakage the flow of that water is necessarily uniform, and any instrument which graphically represents that flow as a horizontal line conveys to the mind a full conception of the nature of the flow, and if by the position of that line between the bottom and the top of a diagram the quantity of water (in gallons per hour, for example) is recorded, we have a full statement, not only of the rate of flow, but of its nature. We know, in short, that the water is not being usefully employed. In the actual instrument, the paper diagram is mounted upon a drum caused by clockwork to revolve uniformly, and is ruled with vertical hour lines, and horizontal quantity lines representing gallons per hour. Thus, while nothing but leakage occurs the uniform horizontal line is continued. If now a tap is opened in any house connected with the main, the change of flow in the main will be represented by a vertical change of position of the horizontal line, and when the tap is turned off the pencil will resume its original vertical position, but the paper will have moved like the hands of a clock over the interval during which the tap was left open. If, on the other hand, water is suddenly drawn off from a cistern supplied through a ball-cock, the flow through the ball-cock will be recorded, and will be represented by a sudden rise to a maximum, followed by a gradual decrease as the ball rises and the cistern fills; the result being a curve having its asymptote in the original horizontal line. Now, all the uses of water, of whatever kind they may be, produce some such irregular diagrams as these, which can never be confused with the uniform horizontal line of leakage, but are always superimposed upon it. It is this leakage line that the waterworks engineer uses to ascertain the truth as to the leakage and to assist him in its suppression. In well-equipped waterworks each house service pipe is controlled by a stop-cock accessible from the footpath to the officials of the water authority, and the process of waste detection by this method depends upon the manipulation of such stop-cocks in conjunction with the differentiating meter. As an example of one mode of applying the system, suppose that a night inspector begins work at 11.30 p.m. in a certain district of 2000 persons, the meter of which records at the time a uniform flow of 2000 gallons an hour, showing the not uncommon rate of leakage of 24 gallons per head per day. The inspector proceeds along the footpath from house to house, and outside each house he closes the stop-cock, recording opposite the number of each house the exact time of each such operation. Having arrived at the end of the district he retraces his steps, reopens the whole of the stop-cocks, removes the meter diagram, takes it to the night complaint office, and enters in the "night inspection book" the records he has made. The next morning the diagram and the "night inspection book" are in the hands of the day inspector, who compares them. He finds, for example, from the diagram that the initial leakage of 2000 gallons an hour has in the course of a 4½ hours' night inspection fallen to 400 gallons an hour, and that the 1600 gallons an hour is accounted for by fifteen distinct drops of different amounts and at different times. Each of these drops is located by the time and place records in the book and the time records on the diagram as belonging to a particular service pipe; so that out of possibly 300 premises the bulk of the leakage has been localized in or just outside fifteen. To each of these premises he goes with the knowledge that a portion of the total leakage of 2000 gallons an hour is almost certainly there, and that it must be found, which is a very different thing from visiting three or four hundred houses, in not one of which he has any particular reason to expect to find leakage. Even when he enters a house with previous knowledge that there is leakage, its discovery may be difficult. It is often hidden, sometimes underground, and may only be brought to light by excavation. In these cases, without some such system of localization, the leakage might go on for years or for ever. There are many and obvious variations of the system. That described requires a diagram revolving once in a few hours, otherwise the time scale will be too close; but the ordinary diagram revolving once in 24 hours is often used quite effectively in night inspections by only closing those stop-cocks which are actually passing water. This method was also first introduced in Liverpool. The night inspector carries with him a stethoscope, often consisting merely of his steel turning-rod, with which he sounds the whole of the outside stop-cocks, but only closes those through which the sound of water is heard. An experienced man, or even a boy, if selected as possessing the necessary faculty (which is sometimes very strongly marked), can detect the smallest dribble when the stop-cock is so far closed as to restrict the orifice. Similar examinations by means of the stop-valves on the mains are also made, and it often happens that the residual leakage (400 gallons an hour in the last case) recorded on the diagram, but not shut off by the house stop-cocks, is mentioned by the inspector as an "outside waste," and localized as having been heard at a stop-cock and traced by sounding the pavement to a particular position under a particular street. All leakages found on private property are duly notified to the water tenant in the usual way, and subsequent examinations are made to ascertain if such notices have been attended to. If this work is properly organized, nearly the whole of the leakage so detected is suppressed within a month. A record of the constantly fluctuating so-called "night readings" in a large town is most interesting and instructive. If, for example, in the case of a hundred such districts we watch the result of leaving them alone, a gradual growth of leakage common to most of the districts, but not to all, is observed, while here and there a sudden increase occurs, often doubling or trebling the total supply to the district. Upon the original installation of the system in any town, the rate of leakage and consequent total supply to the different districts is found to vary greatly, and in some districts it is usually many times as great per head as in others. An obvious and fruitful extension of the method is to employ the inspectors only in those districts which, for the time being, promise the most useful results.

Supply by meter.

In many European cities the supply of water, even for domestic purposes, is given through ordinary water meters, and paid for, according to the meter record, much in the same manner as a supply of gas or electricity. By the adoption of this method great reductions in the quantity of water used and wasted are in some cases effected, and the water tenant pays for the leakage or waste he permits to take place, as well as for the water he uses. The system, however, does not assist in the detection of the leakage which inevitably occurs between the reservoir and the consumer's meter; thus the whole of the mains, joints and ferrules connecting the service pipes with the mains, and the greater parts of the service pipes, are still exposed to leakage without any compensating return to the water authority. But the worst evil of the system, and one which must always prevent its introduction into the United Kingdom, is the circumstance that it treats water as an article of commerce, to be paid for according to the quantity taken. In the organization of the best municipal water undertakings in the United Kingdom the free use of water is encouraged, and it is only the leakage or occasional improper employment of the water that the water authority seeks, and that successfully, to suppress. The objection to the insanitary effect of the meter-payment system has, in some places, been sought to be removed by providing a fixed quantity of water, assumed to be sufficient, as the supply for a fixed minimum payment, and by using the meter records simply for the purpose of determining what additional payment, if any, becomes due from the water tenant. Clearly, if the excesses are frequent, the limit must be too low; if infrequent, all the physical and administrative complication involved in the system is employed to very little purpose.

The question of the distribution of water, rightly considered, resolves itself into a question of delivering water to the water tenant, without leakage on the way, and of securing that the fittings employed by the water tenant shall be such as to afford an ample and ready supply at all times of the day and night without leakage and without any unnecessary facilities for waste. If these conditions are complied with, it is probable that the total rate of supply will not exceed, even if it reaches, the rate necessary in any system, not being an oppressive and insanitary system, by which the water is paid for according to the quantity used. (G. F. D.)

WATERS, TERRITORIAL. In international law "territorial waters" are the belt of sea adjacent to their shores which states respect as being under their immediate territorial jurisdiction, subject only to a right of "inoffensive" passage through them by vessels of all nations. As to the breadth of the belt and the exact nature of this inoffensive right of passage, however, there is still much controversy. The 3-miles' limit recognized and practised by Great Britain, France and the United States seems to have been derived from the cannon range of the period, when it was adopted as between Great Britain and the United States, *i.e.* towards the close of the 18th century. Bynkershoek, a famous Dutch jurist, whose authority at one time was almost as great in England as in his own country, in a dissertation on the Dominion of the Sea (1702), had devised a plausible juridical theory to support a homogeneous jurisdiction over environing waters in the place of the quite arbitrary claims made at that time, to any distance seawards, from whole seas to range of vision. Starting from the fact that fortresses can give effective protection within range of their cannon, and that in practice this effective protection was respected, he argued that the respect was not due to the reality of the presence of cannon, but to the fact that the state was in a position to enforce respect. This it could do from any point along its shore. Hence his well-known doctrine: *terrae dominium finitur, ubi finitur armorum vis.* The doctrine satisfied a requirement of the age and became a maxim of international law throughout northern Europe, both for the protection of shore fisheries and for the assertion of the immunity of adjacent waters of neutral states from acts of war between belligerent states. Germany still holds in principle to this varying limit of cannon range. Norway has never agreed to the 3 m., maintaining that the special configuration of her coast necessitates the exercise of jurisdiction over a belt of 4 m. Spain lays claim to jurisdiction over 6 m. from her shores. The writers and specialists on the subject are quite as much divided. A British Fishery Commission in 1893 reported that "the present territorial limit of 3 m. is insufficient, and that, for fishery purposes alone, this limit should be extended, provided such extension can be effected upon an international basis and with due regard to the rights and interests of all nations." The committee recommended that "a proposition on these lines should be submitted to an international conference of the powers who border on the North Sea." There is already an international convention, dated 6th May 1882, between Great Britain, France, Belgium, Holland, Germany and Denmark, relating to the regulation of the fisheries in the North Sea, which has fixed the limit of territorial waters as between the contracting parties at 3 m. measured from low-water mark and from a straight line drawn from headland to headland at the points where they are 10 m. across. In the British Act of 29th June 1893, giving effect to a subsequent convention (16th November 1887) between the same parties for the regulation of the liquor traffic in the North Sea, "territorial waters" are declared to be as defined in the Territorial Waters Jurisdiction Act 1878. In this Act the definition is as follows:—

> The territorial waters of Her Majesty's dominions in reference to the sea means such part of the sea adjacent to the coast of the United Kingdom, or the coast of some other part of Her Majesty's dominions, as is deemed by international law to be within the territorial sovereignty of Her Majesty; and for the purpose of any offence declared by this act to be within the jurisdiction of the admiral, any part of the open sea within one marine league of the coast measured from low-water mark shall be deemed to be open sea within the territorial waters of Her Majesty's dominions.

This definition only restricts the operation of the 3 m. limit to offences dealt with in the act, and does not deal with bays. The act of 1893 declares that the articles of the convention "shall be of the same force as if they were enacted in the body of the act," but this convention gives no definition of territorial waters.

The jurisdiction exercised in British territorial waters under the Territorial Waters Jurisdiction Act of 1878[1] is asserted without distinction between them and inland waters. "All offences" committed by any person, whether a British subject or not, and whether or not committed "on board or by means of a foreign ship," "within the territorial waters of Her Majesty's dominions," are made punishable under it. No exception is made for offences committed on merely passing foreign vessels, except that there is this attenuation in their case, that no prosecution can take place without a special authorization given by certain high officers of state.[2] It is doubtful whether any Continental state would recognize so complete a jurisdiction. The subject has been exhaustively dealt with by both the Institute of International Law and the International Law Association, which, at the suggestion of the *rapporteur* of the two committees, decided that the subjects of fisheries and neutrality should be dealt with separately. The following considerations and rules were adopted in 1894 by the institute and afterwards by the association:—

Whereas there is no reason to confound in a single zone the distance necessary for the exercise of sovereignty and protection of coast fisheries and the distance necessary to guarantee the neutrality of non-belligerents in time of war; And whereas the distance most commonly adopted of 3 m. from low-water mark has been recognized as insufficient for the protection of coast fisheries; And whereas, moreover, this distance does not correspond to the real range of cannon placed on the coast; The following dispositions are adopted:—

Art. I. The state has the right of sovereignty over a belt of sea along its coast subject to the right of inoffensive passage reserved in article 5. This belt is called territorial waters (*mer territoriale*).

Art. II. Territorial waters extend for 6 sea m. (60 to 1 degree of latitude) from low-water mark along the whole extent of its coasts.

Art. III. For bays, territorial waters follow the trend of the coast except that it is measured from a straight line drawn across the bay from the two points nearest the sea where the opening of the bay is of 12 marine m. in width, unless a greater width shall have become recognized by an immemorial usage.

Art. IV. In case of war the adjacent neutral state shall have the right to extend by its declaration of neutrality or by special notification its neutral zone from 6 m. to cannon range from the coast.

Art. V. All ships, without distinction, have the right of inoffensive passage through territorial waters, subject to the belligerent right to regulate, and for purposes of defence to bar, the passage through the said waters for every ship, and subject to the right of neutrals to regulate the passage through the said waters for ships of war of all nationalities.

Art. VI. Crimes and offences committed on board foreign ships passing through territorial waters by persons on board such ships, upon persons or things on board the same ships, are, as such, beyond the jurisdiction of the adjacent state, unless they involve a violation of the rights or interests of the adjacent state, or of its subjects or citizens not forming part of its crew or its passengers.

Art. VII. Ships passing through territorial waters must conform to the special rules laid down by the adjacent state, in the interest and for the security of navigation and for the police of the sea.

Art. VIII. Ships of all nationalities, by the simple fact of being in territorial waters, unless merely passing through them, are subject to the jurisdiction of the adjacent state.

The adjacent state has the right to continue upon the high seas the pursuit of a ship commenced within territorial waters, and to arrest and try it for an offence committed within the limits of its waters. In case of capture on the high seas the fact shall, however, be notified without delay to the state to which the ship belongs. The pursuit is interrupted from the moment the ship enters the territorial waters of its own state or of a third power. The right of pursuit ceases from the moment the ship enters a port either of its own country or of a third power.

Art. IX. The special position of ships of war and of ships assimilated to them is reserved.

Art. X. The provisions of the preceding articles are applicable to straits not exceeding 12 m. in width, with the following modifications and exceptions:—

(1) Straits, the coast of which belong to different powers, form part of the territorial waters of the adjacent states, their jurisdiction respectively extending to the middle line of the straits;

(2) Straits whose coasts belong to the same state, and which are indispensable for maritime communication between two or more states other than the state in question, form part of the territorial waters of the said state whatever the proximity of the two coasts may be;

(3) Straits serving as a passage between one open sea and another can never be closed.

Art. XI. The position of straits already regulated by conventions or special usage is reserved.

The Dutch government in 1896 brought these rules to the notice of the leading European governments, and suggested the desirability of concluding an international convention on the subject. The only government which was unfavourable to the proposal was that of Great Britain. (See as to the Moray Firth Fisheries controversy, NORTH SEA FISHERIES CONVENTION.)

In the Hague Convention of 1907 respecting the rights and duties of neutral powers in naval war, the existing practice in regard to territorial waters is confirmed (see arts. 2, 3, 9, 10, 12, 13 and 18), but no definition of what constitutes the distance of these waters seawards is given. This question is among those which the next Hague Conference may deal with, inasmuch as for purposes of neutrality the difficulties connected with fishery questions do not arise.[3]

AUTHORITIES.—Sir Thomas Barclay, *Question de la mer territoriale* (published by the Association Internationale de la Marine, Paris, 1902); *Idem*, as *rapporteur* on the subject in the *Annuaires de l'institut de droit international* for 1893 and 1894; *Idem*, Special Report of the International Law Association (replies to Questionnaire, 1893), and Report and Discussion (1895); Idem, *Problems of International Practice and Diplomacy* (London, 1907), pp. 109 et seq. See also Coulson and Forbes, *Law relating to Waters* (London, 1910), 3rd ed., pp. 5 et seq. (T. BA.)

WATER-THYME, known botanically as *Elodea canadensis*, a small submerged water-weed, native of North America. It was introduced into Co. Down, Ireland, about 1836, and appeared in England in 1841, spreading through the country in ponds, ditches and streams, which were often choked with its rank growth. *Elodea* is a member of the monocotyledonous natural order Hydrocharideae (*q.v.*).

WATERTON, CHARLES (1782–1865), English naturalist and traveller, was born at Walton Hall, near Pontefract, Yorkshire, on the 3rd of June 1782. After being educated at the Roman Catholic college of Stonyhurst, and travelling a short time in Spain, he went to Demerara to manage some estates belonging to his family. He continued in this occupation for about eight years, when he began those wanderings upon the results of which his fame as a naturalist principally rests. In his first journey, which began in 1812, and the principal object of which was to collect the poison known as curare, he travelled through British Guiana by the Demerara and Essequibo rivers to the frontiers of Brazil, making many natural history collections and observations by the way. After spending some time in England he returned to South America in 1816, going by Pernambuco and Cayenne to British Guiana, where again he devoted his time to the most varied observations in natural history. For the third time, in 1820, he sailed from England for Demerara, and again he spent his time in similar pursuits. Another sojourn in England of about three years was followed by a visit to the United States in 1824; and, having touched at several of the West India islands, he again went on to Demerara, returning to England at the end of the year. In 1828 he published the results of his four journeys, under the title of *Wanderings in South America* —consisting largely of a collection of observations on the appearance, character and habits of many of the animals to be found in British Guiana. Waterton was a keen and accurate observer, and his descriptions are of a graphic and humorous character, rarely to be found in works on natural history. He married in 1829, and from that time lived mostly at Walton Hall, devoting himself to the improvement of his estate, to country pursuits, and to natural history observations. He also published three series of *Essays in Natural History* (1838, 1844, 1857). He died at Walton Hall on the 27th of May 1865, from the result of an accident. His only son, Edmund Waterton (1830–1887), was an antiquary, who paid special attention to rings; some of those he collected are in the Victoria and Albert Museum.

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[1] This act was passed to meet what was thought to be a defect in British law, the decision in the well-known "Franconia" case having been that territorial waters were "out of the realm," and that criminal jurisdiction within them over a foreign ship could be exercised only in virtue of an act of parliament.

[2] Proceedings, says § 3 of the act, for the trial and punishment of a person who is not a British subject, and who is charged with any offence as is declared by this act to be within the jurisdiction of the admiral, shall not be instituted in any Court of the United Kingdom, except with the consent of one of the principal Secretaries of State, and on his certificate that the institution of such proceedings is in his opinion expedient, and shall not be instituted in any British dominions outside of the United Kingdom except with the leave of the governor of the part of the dominions in which such proceedings are proposed to be instituted, and on his certificate that it is expedient that such proceedings should be instituted.

[3] The question of revising the limits fixed for Territorial Waters in the Convention of 1882 (see above) was the subject of an animated discussion at the conference at Hull of the National Sea Fisheries Protection Association in 1906, when a resolution was adopted in favour of maintaining the present 3-miles limit on grounds of expediency, which deserve serious consideration.

WATERTOWN, a township of Middlesex county, Massachusetts, U.S.A., on the Charles river, about 6 m. W. of Boston. Pop. (1890) 7073; (1900) 9706, of whom 2885 were foreign-born and 53 were negroes; (1910 census) 12,875. Area, 4·1 sq. m. Watertown is served by the Fitchburg division of the Boston & Maine railway, and is connected with Boston, Cambridge, Newton (immediately adjacent and served by the New York, New Haven & Hartford railway) and neighbouring towns by electric railways. It is a residential and manufacturing suburb of Boston. The township is at the head of navigation on the Charles, and occupies the fertile undulating plains along the river running back to a range of hills, the highest of which are Whitney Hill (200 ft.) and Meeting House Hill (250 ft.). Within the township are several noteworthy examples of colonial architecture. There are several small parks and squares, including Central Square, Beacon Square, about which the business portion of the township is centred, and Saltonstall Park, in which is a monument to the memory of Watertown's soldiers who died in the Civil War, and near which are the Town House and the Free Public Library, containing a valuable collection of 60,000 books and pamphlets and historical memorials. There are two interesting old burying-grounds: one on Grove Street, near the Cambridge line, first used in 1642, contains a monument to John Coolidge, killed during the British retreat from Concord and Lexington on the 19th of April 1775; the other is near the centre of the village about the former site of the First Parish Church. In Coolidge's Tavern (still standing) Washington was entertained on his New England tour in 1789; and in a house recently moved from Mt Auburn Street to Marshall Street the Committee of Safety met in 1775. Within the township are mounds and earthworks which Professor E. N. Horsford thought were the remains of a Norse settlement in the 11th century, and which include a semicircular amphitheatre of six tiers or terraces which he thought was an assembly place, and a portion of a stone wall or dam. The Federal government maintains at Watertown one of its principal arsenals, occupying grounds of about 100 acres along the river. Several of the original low brick buildings, built between 1816 and 1820, still stand. In 1905 the value of Watertown's factory products was $15,524,675.

Watertown was one of the earliest of the Massachusetts Bay settlements, having been begun early in 1630 by a group of settlers led by Sir Richard Saltonstall and the Rev. George Phillips. The first buildings were upon land now included within the limits of Cambridge. For the first quarter century Watertown ranked next to Boston in population and area. Since then its limits have been greatly reduced. Thrice portions have been added to Cambridge, and it has contributed territory to form the new townships of Weston (1712), Waltham (1738), and Belmont (1859). In 1632 the residents of Watertown protested against being compelled to pay a tax for the erection of a stockade fort at Cambridge; this was the first protest in America against taxation without representation and led to the establishment of representative government in the colony. As early as the close of the 17th century Watertown was the chief horse and cattle market in New England and was known for its fertile gardens and fine estates. Here about 1632 was erected the first grist mill in the colony, and in 1662 one of the first woollen mills in America was built here. In the First Parish Church, the site of which is marked by a monument, the Provincial Congress, after adjournment from Concord, met from April to July 1775; the Massachusetts General Court held its sessions here from 1775 to 1778, and the Boston town meetings were held here during the siege of Boston, when many of the well-known Boston families made their homes in the neighbourhood. For several months early in the War of Independence the Committees of Safety and Correspondence made Watertown their headquarters and it was from here that General Joseph Warren set out for Bunker Hill. In 1832–1834 Theodore Parker conducted a private school here and his name is still preserved in the Parker School.

See S. A. Drake, *History of Middlesex County* (2 vols., Boston, 1880); Convers Francis, *A Historical Sketch of Watertown to the close of its Second Century* (Cambridge, 1830); S. F. Whitney, *Historical Sketch of Watertown* (Boston, 1906); and "Watertown," by S. F. Whitney, in vol. iii. of D. Hamilton Hurd's *History of Middlesex County* (Philadelphia, 1890). The *Watertown Records* (4 vols., Watertown and Boston, 1894–1906) have been published by the Historical Society of Watertown (organized in 1888 and incorporated in 1891).

WATERTOWN, a city and the county-seat of Jefferson county, New York, U.S.A., 73 m. (by rail) N. of Syracuse, on the Black river. Pop. (1890) 14,725; (1900) 21,696, of whom 5119 were foreign-born and 75 were negroes; (1910 census) 26,730. Watertown is served by the New York Central & Hudson River railway. The city has several squares and public parks, one of them, City Park, having an area of about 300 acres. Among the public buildings and institutions are the city hall, the Federal building, the county court house, a state armoury, the Flower Memorial Library (erected as a memorial to Roswell P. Flower, governor of New York in 1892–1895, by his daughter, Mrs J. B. Taylor) with 25,514 vols. in 1910, the Immaculate Heart Academy (Roman Catholic), the Jefferson County Orphan Asylum (1859), the St Patrick's Orphanage (1897; under the Sisters of St Joseph), the Henry Keep Home (1879), for aged men and women, St Joachim's Hospital (1896; under the Sisters of Mercy), and the House of the Good Samaritan (1882). Watertown is situated in a fertile agricultural and dairying region, of which it is a distributing centre, and it ships large quantities of farm produce and dairy products (especially cheese). The Black river furnishes water-power which is utilized by manufacturing establishments of diversified character. In 1905 the city's factory product was valued at $8,371,618. Watertown was settled during the late years of the 18th century. It became the county-seat in 1805, was incorporated as a village in 1816 and was first chartered as a city in 1869.

WATERTOWN, a city of Dodge and Jefferson counties, Wisconsin, U.S.A., on both banks of the Rock river, about 45 m. W.N.W. of Milwaukee. Pop. (1890) 8755; (1900) 8437, including 2447 foreign-born; (1905, state census) 8623; (1910) 8829. Watertown is served by the Chicago & North-Western and the Chicago, Milwaukee & St Paul railways, and by an interurban electric line, connecting with Milwaukee. It is the seat of North-western University (1865; Lutheran), which includes collegiate, preparatory and academic departments, and had in 1908–1909 11 instructors and 283 students, and of the Sacred Heart College (Roman Catholic, opened in 1872 and chartered in 1874), under the Congregation of the Holy Cross. There are also a Carnegie library, a Lutheran Home for the Feeble-Minded, and a City Hospital. The Rock river furnishes water-power which is utilized for manufacturing. The value of the factory product in 1905 was $2,065,487. The city is situated in a dairying and farming region. The municipality owns and operates its water-works. Watertown was founded about 1836 by settlers who gave it the name of their former home, Watertown, New York. Afterwards there was a great influx of Germans, particularly after the Revolution of 1848, among them being Carl Schurz, who began the practice of law here. Germans by birth or descent still constitute a majority of the population. Watertown was incorporated as a village in 1849, and was chartered as a city in 1853.

WATERVILLE, a city of Kennebec county, Maine, U.S.A., on the Kennebec river, 19 m. above Augusta. Pop. (1900)

9477, of whom 2087 were foreign-born; (1910 census) 11,458. It is served by the Wiscasset, Waterville & Farmington railway, and two lines of the Maine Central railroad. The Ticonic Falls in the river afford excellent water-power, which is used in the manufacture of cotton and woollen goods, &c. In Winslow (pop. in 1910, 2709), on the opposite side of the river and connected by bridges with Waterville, are large paper and pulp mills. Waterville has a Carnegie library and is the seat of Colby College (Baptist), which was incorporated as the Maine Literary and Theological Institution in 1813, was renamed Waterville College in 1821, was named Colby University in 1867, in honour of Gardner Colby (1810–1879), a liberal benefactor, and received its present name in 1899. Since 1871 women have been admitted on the same terms as men. In 1910 the college library contained 51,000 volumes. Waterville was settled about the middle of the 18th century. It was a part of the township of Winslow from 1771 to 1802, when it was incorporated as a separate township. It was first chartered as a city in 1883.

WATERVLIET, a city of Albany county, New York, U.S.A., on the W. bank of the Hudson river opposite Troy and about 5 m. N. of Albany. Pop. (1890) 12,967; (1900) 14,321, of whom 2754 were foreign-born and 59 were negroes; (1910 census) 15,074. Watervliet is served by the Delaware & Hudson railway and by steamboat lines on the Hudson river, and is connected with Troy by bridges and ferries, and with Albany, Troy, Cohoes and Schenectady by electric lines. The Erie and Champlain canals have their terminals a short distance above the city. The city has a city hall and a public library. Watervliet is situated in a good farming country, but is chiefly a manufacturing place; in 1905 its factory products were valued at $1,884,802 (25% more than in 1900), not including the product of the United States Arsenal (1807), on the river, an important manufactory of heavy ordnance. The place was originally called West Troy and was incorporated as a village in 1836; in 1897 it was chartered as a city under its present name; at the same time the township of Watervliet in which it was situated was divided into the townships of Colonie and Green Island. In 1776 the first settlement of Shakers (*q.v.*) in America was made in the township by " Mother Ann " Lee and her followers, who named it Niskayuna. Here " Mother Ann " died and is buried.

WATFORD, a market town in the Watford parliamentary division of Hertfordshire, England, 17½ m. N.W. of London by the London & North-Western railway. Pop. of urban district (1891) 17,063; (1901) 29,327. It lies on the small river Colne in a pleasant undulating and well wooded district. The church of St Mary, with embattled tower and spire, is of various dates, and contains good examples of monumental work of the early 17th century; and in the churchyard is buried Robert Clutterbuck (d. 1831), author of the *History and Antiquities of the County of Hertford*. There are several modern churches and chapels. The chief building within the town is the Watford Public Library and School of Art. There are large breweries, also corn-mills, malt-kilns and an iron foundry. Bushey, on the south side of the Colne, lying for the most part high above it, is a suburb, chiefly residential, with a station on the North-Western line. The church of St James, extensively restored by Sir Gilbert Scott, is Early English in its oldest part, the chancel. Here a school of art was founded by Sir Hubert von Herkomer, R.A., but it was closed in 1904, and subsequently revived in other hands. Other institutions are the Royal Caledonian Asylum and the London Orphan Asylum. At Aldenham, 2 m. N.E., the grammar school founded in 1599 now ranks as one of the minor English public schools.

WATKIN, SIR EDWARD WILLIAM, 1st Bart. (1819–1901), English railway manager, was born in Manchester on the 26th of September 1819. He was the son of Absalom Watkin, a merchant in Manchester, and was employed in his father's counting-house, ultimately becoming a partner; but in 1845 he was appointed secretary of the Trent Valley railway, which was soon afterwards absorbed by the London & North-Western Company. He next joined the Manchester & Sheffield Company, of which he became general manager and then chairman, subsequently combining with the duties thus entailed the chairmanship of the South-Eastern (1867) and of the Metropolitan (1872). His connexion with these three railways was maintained to within a short time of his death, and they formed the material of one of his most ambitious schemes—the establishment of a through route under one management from Dover to Manchester and the north. This was the end he had in view in his successful fight for the extension of the Manchester, Sheffield & Lincolnshire railway (now the Great Central) to London; and his persistent advocacy of the Channel tunnel (*q.v.*) between Dover and Calais was really a further development of the same idea, for its construction would have enabled through trains to be run from Paris to Lancashire and Scotland, via the East London (of which also he was for a time chairman) and the Metropolitan. The latter scheme, however, failed to obtain the necessary public and political support. Other projects had even less success. His plans for a tunnel between Scotland and Ireland under the North Channel, and for a ship canal across Ireland from Galway to Dublin, did not come to anything; while the great tower at Wembley Park (near Harrow), intended to surpass the Eiffel Tower at Paris, stopped at an early stage. It was in the realms of railway politics that Watkin showed to best advantage; for the routine work of administration pure and simple he had no aptitude. He entered parliament as a Liberal, and after representing Stockport from 1864 to 1868, sat as member for Hythe for twenty-one years from 1874, becoming a Liberal-Unionist at the time of the Home Rule split, and subsequently acting as a " free lance." In 1868 he received a knighthood, and in 1880 he was created a baronet. His death occurred at Northenden, Cheshire, on the 13th of April 1901.

WATKINS, a village and the county-seat of Schuyler county, New York, U.S.A., at the head (south end) of Seneca Lake, about 22 m. N.N.W. of Elmira. Pop. (1890) 2604; (1900) 2943; (1905) 2957; (1910) 2817. Watkins is served by the New York Central & Hudson River, the Northern Central (Pennsylvania) and the Lehigh Valley railways, by an electric line to Elmira and by a steamer line on the lake. There are mineral springs, whose waters, notably those of an iodo-bromated brine spring, are used in bath treatment for rheumatism, gout, heart, kidney and liver diseases, &c. Partly within the village limits is Watkins Glen, a narrow winding gorge about 2 m. long, with walls and precipices from 100 to 300 ft. high, through which flows a small stream, forming many falls, cascades and pools. The Glen property, about 103 acres, was opened as an excursion resort in 1863, and in 1906 was made a free state reservation or park and was placed in the custody of the American Scenic and Historic Preservation Society. About 3 m. S.E. is Havana Glen, about 1¼ m. long. The first settlement here was made in 1788, and Watkins was incorporated as a village in 1842.

WATLING STREET, the Early English name for the great road made by the Romans from London past St Albans (Roman *Verulamium*) to Wroxeter (Roman *Viroconium*) near Shrewsbury and used by the Anglo-Saxons, just as a great part of it is used to-day. According to early documents the name was at first Wæclinga (or Wætlinga) stræt; its derivation is unknown, but an English personal name may lie behind it. After the Conquest the road was included in the list of four Royal Roads which the Norman lawyers recorded or invented (see ERMINE STREET). Later still, in the Elizabethan period and after it, the name Watling Street seems to have been applied by antiquaries to many Roman or reputed Roman roads in various parts of Britain, and English map-makers and inferior writers on Roman roads still perpetuate the fictions. In particular, the Roman " North Road " which ran from York through Corbridge and over Cheviot to Newstead near Melrose, and thence to the Wall of Pius, and which has largely been in use ever since Roman times, is now not unfrequently called Watling Street, though there is no old authority for it and throughout the middle ages the section of the road between the Tyne and the Forth was called Dere Street. (F. J. H.)

WATSON, RICHARD (1737–1816), English divine, was born in August 1737 at Heversham in Westmorland. His father, a schoolmaster, sent him to Trinity College, Cambridge, where he was elected a fellow in 1760. About the same time he had the offer of the post of chaplain to the factory at Bencoolen, in the Straits Settlements. "You are too good," said the master of Trinity, "to die of drinking punch in the torrid zone"; and Watson, instead of becoming, as he had flattered himself, a great orientalist, remained at home to be elected professor of chemistry, a science of which he did not at the time possess the simplest rudiments. "I buried myself," he says, "in my laboratory, and in fourteen months read a course of chemical lectures to a very full audience." One of his discoveries led to the black-bulb thermometer. Not the least of his services was to procure an endowment for the chair, which served as a precedent in similar instances. In 1771 he was appointed regius professor of divinity, but did not entirely renounce the study of chemistry. In 1768 he had published *Institutiones metallurgicae*, intended to give a scientific form to chemistry by digesting facts established by experiment into a connected series of propositions. In 1781 he followed this up with an introductory manual of *Chemical Essays*. In 1776 he answered Gibbon's chapters on Christianity, and had the honour of being one of the only two opponents whom Gibbon treated with respect. The same year he offended the court by a Whig sermon, but in 1779 became archdeacon of Ely. He had always opposed the American War, and on the accession of Lord Shelburne to power in 1782 was made bishop of Llandaff, being permitted to retain his other preferments on account of the poverty of the see. Shelburne expected great service from him as a pamphleteer, but Watson proved from the ministerial point of view a most impracticable prelate. He immediately brought forward a scheme for improving the condition of the poorer clergy by equalizing the incomes of the bishops, the reception of which at the time may be imagined, though it was substantially the same as that carried into effect by Lord Melbourne's government fifty years later. Watson now found that he possessed no influence with the minister, and that he had destroyed his chance of the great object of his ambition, promotion to a better diocese. Neglecting both his see and his professorship, to which latter he appointed a deputy described as highly incompetent, he withdrew to Calgarth Park, in his native county, where he occupied himself in forming plantations and in the improvement of agriculture. He also frequently came forward as a preacher and as a speaker in the House of Lords. His advice to the government in 1787 is said to have saved the country £100,000 a year in gunpowder. In 1796 he published, in answer to Thomas Paine, an *Apology for the Bible*, perhaps the best known of his numerous writings. Watson continued to exert his pen with vigour, and in general to good purpose, denouncing the slave trade, advocating the union with Ireland, and offering financial suggestions to Pitt, who seems to have frequently consulted him. In 1798 his *Address to the People of Great Britain*, enforcing resistance to French arms and French principles, ran through fourteen editions, but estranged him from many old friends, who accused him, probably with injustice, of aiming to make his peace with the government. Though querulous because of his non-preferment, De Quincey tells us that "his lordship was a joyous, jovial, and cordial host." He died on the 2nd of July 1816, having occupied his latter years in the composition and revision of an autobiography (published in 1817), which, with all its egotism and partiality, is a valuable work, and the chief authority for his life.

WATSON, THOMAS (*c.* 1557–1592), English lyrical poet, was born in London, probably in 1557. He proceeded to Oxford, and while quite a young man enjoyed a certain reputation, even abroad, as a Latin poet. His *De remedio amoris*, which was perhaps his earliest important composition, is lost, and so is his "piece of work written in the commendation of women-kind," which was also in Latin verse. He came back to London and became a law-student. The earliest publication by Watson which has survived is a Latin version of the *Antigone* of Sophocles, issued in 1581. It is dedicated to Philip Howard, earl of Arundel, who was perhaps the patron of the poet, who seems to have spent some part of this year in Paris. Next year Watson appears for the first time as an English poet in some verses prefixed to Whetstone's *Heptameron*, and also in a far more important guise, as the author of the Ἑκατομπαθία or *Passionate Centurie of Love*. This is a collection or cycle of 100 pieces, in the manner of Petrarch, celebrating the sufferings of a lover and his long farewell to love. The technical peculiarity of these interesting poems is that, although they appear and profess to be sonnets, they are really written in triple sets of common six-line stanza, and therefore have eighteen lines each. It seems likely that Watson, who courted comparison with Petrarch, seriously desired to recommend this form to future sonneteers; but in this he had no imitators.[1] Among those who were at this time the friends of Watson we note Matthew Royden and George Peele. In 1585 he published a Latin translation of Tasso's pastoral play of *Aminta*, and his version was afterwards translated into English by Abraham Fraunce (1587). Watson was now, as the testimony of Nashe and others prove, regarded as the best Latin poet of England. In 1590 he published, in English and Latin verse, his *Meliboeus*, an elegy on the death of Sir Francis Walsingham, and a collection of *Italian Madrigals*, put into English by Watson and set to music by Byrd. Of the remainder of Watson's career nothing is known, save that on the 26th of September 1592 he was buried in the church of St Bartholomew the Less, and that in the following year his latest and best book, *The Tears of Fancie*, or *Love Disdained* (1593), was posthumously published. This is a collection of sixty sonnets, regular in form, so far at least as to have fourteen lines each. Spenser is supposed to have alluded to the untimely death of Watson in *Colin Clout's Come Home Again*, when he says:—

> "Amyntas quite is gone and lies full low,
> Having his Amaryllis left to moan."

He is mentioned by Meres in company with Shakespeare, Peele and Marlowe among "the best for tragedie," but no dramatic work of his except the translations above mentioned has come down to us. It is certain that this poet enjoyed a great reputation in his lifetime, and that he was not without a direct influence upon the youth of Shakespeare. He was the first, after the original experiment made by Wyat and Surrey, to introduce the pure imitation of Petrarch into English poetry. He was well read in Italian, French and Greek literature. Watson died young, and he had not escaped from a certain languor and insipidity which prevent his graceful verses from producing their full effect. This demerit is less obvious in his later than in his earlier pieces, and with the development of the age, Watson, whose contemporaries regarded him as a poet of true excellence, would probably have gained power and music. As it is, he has the honour of being one of the direct forerunners of Shakespeare (in *Venus and Adonis* and in the *Sonnets*), and of being the leader in the long procession of Elizabethan sonnet-cycle writers. (E. G.)

The English works of Watson, excepting the madrigals, were first collected by Edward Arber in 1870. *Thomas Watson's "Italian Madrigals Englished"* (1590) were reprinted (ed. F. J. Carpenter) from the *Journal of Germanic Philology* (vol. ii., No. 3, p. 337) with the original Italian, in 1899. See also Mr Sidney Lee's Introduction (pp. xxxii.-xli.) to *Elizabethan Sonnets* in the new edition (1904) of *An English Garner*.

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[1] Speaking of the *Hecatompathia*, Mr Sidney Lee says: "Watson deprecates all claim to originality. To each poem he prefixes a prose introduction in which he frankly indicates, usually with ample quotations, the French, Italian or classical poem which was the source of his inspiration" (*Elizabethan Sonnets*, p. xxviii.). In a footnote (p. xxxix.) he adds: "Eight of Watson's sonnets are, according to his own account, renderings from Petrarch; twelve are from Serafino dell' Aquila (1466–1500); four each come from Strozza, the Ferrarese poet, and from Ronsard; three from the Italian poet, Agnolo Firenzuola (1493–1548); two each from the French poet, Étienne Forcadel, known as Forcatulus (1514?–1573), the Italian Girolamo Parabosco (fl. 1548), and Aeneas Sylvius; while many are based on passages from such authors as (among the Greeks) Sophocles, Theocritus, Apollonius of Rhodes (author of the epic *Argonautica*); or (among the Latins), Virgil, Tibullus, Ovid, Horace, Propertius, Seneca, Pliny, Lucan, Martial and Valerius Flaccus; or (among the modern Italians) Angelo Poliziano (1454–1494) and Baptista Mantuanus (1448–1516); or (among other modern Frenchmen) Gervasius Sepinus of Saumur, writer of eclogues after the manner of Virgil and Mantuanus."

WATSON, WILLIAM (*c.* 1559–1603), English conspirator, was a native of the north of England, and was born probably on the 23rd of April 1559. In 1586 he became a Roman Catholic priest in France, and during the concluding years of Elizabeth's reign he paid several visits to England; he was imprisoned and tortured more than once. He became prominent as a champion of the secular priests in their dispute with the Jesuits, and in 1601 some writings by him on this question appeared which were answered by Robert Parsons. When Elizabeth died, Watson hastened to Scotland to assure James I. of the loyalty of his party, and to forestall the Jesuits, who were suspected of intriguing with Spain. The new king did not, however, as was hoped, cease to exact the necessary fines; and the general dissatisfaction felt by the Roman Catholics gave rise to the "Bye plot," or "Watson's plot," in which connexion this priest's name is best known, and to its sequel the Main or Cobham's, plot. Watson discussed the grievances of his co-religionists with another priest, William Clark, with Sir Griffin Markham and Anthony Copley, and with a disappointed Protestant courtier, George Brooke; they took another Protestant, Thomas, 15th Lord Grey de Wilton, into their confidence, and following many Scottish precedents it was arranged that James should be surprised and seized, while they talked loudly about capturing the Tower of London, converting the king to Romanism, and making Watson lord keeper. One or two of the conspirators drew back; but Watson and his remaining colleagues arranged to assemble at Greenwich on the 24th of June 1603, and under the pretence of presenting a petition to carry out their object. The plot was a complete failure; Henry Garnet and other Jesuits betrayed it to the authorities, and its principal authors were seized, Watson being captured in August at Hay on the Welsh border. They were tried at Winchester and found guilty; Watson and Clark were executed on the 9th of December 1603, and Brooke suffered the same fate a week later. Grey and Markham were reprieved. Before the executions took place, however, the failure of the Bye plot had led to the discovery of the Main plot. Brooke's share in the earlier scheme caused suspicion to fall upon his brother Henry Brooke, Lord Cobham, the ally and brother-in-law of Sir Robert Cecil, afterwards earl of Salisbury. Cobham appears to have been in communication with Spain about the possibility of killing "the king and his cubs" and of placing Lady Arabella Stuart on the throne. He was seized, tried and condemned to death, but although led out to the scaffold he was not executed. It was on suspicion of being associated with Cobham in this matter that Sir Walter Raleigh was arrested and tried.

See the documents printed by T. G. Law in *The Archpriest controversy* (1896–1898); the same writer's *Jesuits and Seculars* (1889), and S. R. Gardiner, *History of England*, vol. i. (1905).

WATSON, WILLIAM (1858–   ), English poet, was born on the 2nd of August 1858 at Burley-in-Wharfedale, Yorkshire, and was brought up at Liverpool, whither his father moved for business. In 1880 he published his first book *The Prince's Quest*, a poem showing the influence of Keats and Tennyson, but giving little indication of the author's mature style. It attracted no attention until it was republished in 1893 after Mr Watson had made a name by other work. In 1884 appeared *Epigrams of Art, Life and Nature*, a remarkable little volume, which already showed the change to Mr Watson's characteristic restraint and concision of manner. But it passed unnoted. Recognition came with the publication of *Wordsworth's Grave* in 1890; and fame with the publication of the second edition in 1891, and the appearance in the *Fortnightly Review*, August 1891, of an article by Grant Allen entitled "A New Poet." *Wordsworth's Grave*, which marked a reversion from the current Tennysonian and Swinburnian fashion to the meditative note of Matthew Arnold, exhibited in full maturity Mr Watson's poetical qualities; his stately diction, his fastidious taste, his epigrammatic turn, his restrained yet eloquent utterance, his remarkable gift of literary criticism in poetic form. Besides *Wordsworth's Grave* the volume contained *Ver tenebrosum* (originally published in the *National Review* for June 1885), a series of political sonnets indicating a fervour of political conviction which was later to find still more impassioned expression; also a selection with additions from the *Epigrams* of 1884, and among other miscellaneous pieces his tribute to Arnold, "In Laleham Churchyard." During the years 1890–1892 he contributed articles to the *National Review*, *Spectator*, *Illustrated London News*, *Academy*, *Bookman* and *Atalanta*, which were collected and republished in 1893 as *Excursions in Criticism*. In 1893 he also published *Lacrymae Musaram*, the poem which gave the title to the volume being a fine elegy on the death of Tennyson; and it included the poem on "Shelley's Centenary" (both of these printed privately in 1892), and "The Dream of Man," the earliest of his philosophical poems. The same year, too, saw the publication of *The Eloping Angels*, a serio-comic trifle of small merit, dedicated to Grant Allen. During this year Mr Gladstone bestowed on him the Civil List pension of £200 available on the death of Tennyson. In 1894 followed *Odes and Other Poems*, and in 1895 *The Father of the Forest*, which contained also the fine "Hymn to the Sea" in English elegiacs (originally contributed to the *Yellow Book*), "The Tomb of Burns," and "Apologia," a piece of candid and just self-criticism. The volume contained also a sonnet "To the Turk in Armenia," a prelude to the series of sonnets about Armenia contributed to the *Westminster Gazette* and republished in a brochure called *The Purple East* in 1896. These sonnets were republished with revision and considerable additions, and a preface by the bishop of Hereford, in *The Year of Shame* in 1897. Whatever view was taken of the poet's incursion into politics, no one doubted his passionate sincerity, or the excellence of the poetical rhetoric it inspired. In 1898 were published his *Collected Poems* and a volume of new poetry *The Hope of the World*, which opened with his three chief philosophical poems, the title piece, "The Unknown God," and "Ode in May." In 1902 he printed privately 50 copies of *New Poems*, and published his "Ode on the Coronation of King Edward VII.," a favourable specimen of its class; and in 1903 besides a volume of *Selected Poems* a collection of poems contributed to various periodicals and called *For England: Poems Written During Estrangement*, a poetical defence of his impugned patriotism during the Boer War. In 1909 appeared an important volume of *New Poems*.

Mr Watson's poetry falls chiefly into the classes above indicated—critical, philosophical and political—to which may be added a further class of Horatian epistles to his friends. This classification indicates the high character and also the limitations of his poetry. It is contemplative, not dramatic, and only occasionally lyrical in impulse. In spite of the poet's plea in his "Apologia" that there is an ardour and a fire other than that of Eros or Aphrodite, ardour and fire are not conspicuous qualities of his verse. Except in his political verse there is more thought than passion. Bearing trace enough of the influence of the romantic epoch, his poetry recalls the earlier classical period in its epigrammatic phrasing and Latinized diction. By the distinction and clarity of his style and the dignity of his movement William Watson stands in the true classical tradition of great English verse, in a generation rather given over to lawlessness and experiment.

See also section on William Watson in *Poets of the Younger Generation*, by William Archer (1902); and for bibliography up to Aug. 1903, *English Illustrated Magazine*, vol. xxix. (N.S.), pp. 542 and 548. (W. P. J.)

WATT, JAMES (1736–1819), Scottish engineer, the inventor of the modern condensing steam-engine, was born at Greenock on the 19th of January 1736. His father was a small merchant there, who lost his trade and fortune by unsuccessful speculation, and James was early thrown on his own resources. Having a taste for mechanics he made his way to London, at the age of nineteen, to learn the business of a philosophical-instrument maker, and became apprenticed to one John Morgan, in whose service he remained for twelve months. From a child he had been extremely delicate, and the hard work and frugal living of his London pupilage taxed his strength so severely that he was forced at the end of a year to seek rest at home, not, however, until he had gained a fair knowledge of the trade and become handy in the use of tools. Before going to London he had made the acquaintance of some of the professors in Glasgow college, and on his return to Scotland in 1756 he sought them out and obtained work in repairing astronomical instruments. He next tried to establish himself as an instrument maker in Glasgow, but the city gilds would not recognize a craftsman who had not served the full term of common apprenticeship, and Watt was forbidden to open shop in the burgh. The college, however, took him under its protection, and in 1757 he was established in its precincts with the title of mathematical-instrument maker to the university.

Before many months Joseph Black, the discoverer of latent heat, then lecturer on chemistry, and John Robison, then a student, afterwards professor of natural philosophy at Edinburgh, became his intimate friends, and with them he often discussed the possibility of improving the steam-engine, of which at that time Thomas Newcomen's was the most advanced type. The engine was then applied only to pumping water—chiefly in the drainage of mines; and it was so clumsy and wasteful of fuel as to be but little used. Some early experiments of Watt in 1761 or 1762 led to no positive result, but in 1764 his attention was seriously drawn to the matter by having a model of Newcomen's engine, which formed part of the college collection of scientific apparatus, given him to repair. Having put the model in order, he was at once struck with its enormous consumption of steam, and set himself to examine the cause of this and to find a remedy.

In Newcomen's engine the cylinder stood vertically under one end of the main lever or "beam" and was open at the top. Steam, at a pressure scarcely greater than that of the atmosphere, was admitted to the under side; this allowed the piston to be pulled up by a counterpoise at the other end of the beam. Communication with the boiler was then shut off, and the steam in the cylinder was condensed by injecting a jet of cold water from a cistern above. The pressure of the air on the top of the piston then drove it down, raising the counterpoise and doing work. The injection water and condensed steam which had gathered in the cylinder were drained out by a pipe leading down into a well.

Watt at once noticed that the alternate heating and cooling of the cylinder in Newcomen's engine made it work with tedious slowness and excessive consumption of steam. When steam was admitted at the beginning of each stroke, it found the metal of the cylinder and piston chilled by contact with the condensed steam and cold injection water of the previous stroke, and it was not until much steam had been condensed in heating the chilled surfaces that the cylinder was able to fill and the piston to rise. His first attempt at a remedy was to use for the material of the cylinder a substance that would take in and give out heat slowly. Wood was tried, but it made matters only a little better, and did not promise to be durable. Watt observed that the evil was intensified whenever, for the sake of making a good vacuum under the piston, a specially large quantity of injection water was supplied.

He then entered on a scientific examination of the properties of steam, studying by experiment the relation of its density and pressure to the temperature, and concluded that two conditions were essential to the economic use of steam in a condensing steam-engine. One was that the temperature of the condensed steam should be as low as possible, 100° F. or lower, otherwise the vacuum would not be good; the other was, to quote his own words, "that the cylinder should be always as hot as the steam which entered it." In Newcomen's engine these two conditions were incompatible, and it was not for some months that Watt saw a means of reconciling them. Early in 1765, while walking on a Sunday afternoon in Glasgow Green, the idea flashed upon him that, if the steam were condensed in a vessel distinct from the cylinder, it would be practicable to make the temperature of condensation low, and still keep the cylinder hot. Let this separate vessel be kept cold, either by injecting cold water or by letting it stream over the outside, and let a vacuum be maintained in the vessel. Then, whenever communication was made between it and the cylinder, steam would pass over from the cylinder and be condensed; the pressure in the cylinder would be as low as the pressure in the condenser, but the temperature of the metal of the cylinder would remain high, since no injection water need touch it. Without delay Watt put this idea to the test, and found that the separate condenser did act as he had anticipated. To maintain the vacuum in it he added another new organ, namely, the air-pump, the function of which is to remove the condensed steam and water of injection along with any air that gathers in the condenser.

To further his object of keeping the cylinder as hot as the steam that entered it, Watt supplemented his great invention of the separate condenser by several less notable but still important improvements. In Newcomen's engine a layer of water over the piston had been used to keep it steam-tight; Watt substituted a tighter packing lubricated by oil. In Newcomen's engine the upper end of the cylinder was open to the air; Watt covered it in, leading the piston-rod through a steam-tight stuffing box in the cover, and allowed steam instead of air to press on the top of the piston. In Newcomen's engine the cylinder had no clothing to reduce loss of heat by radiation and conduction from its outer surface; Watt not only cased it in non-conducting material, such as wood, but introduced a steam-jacket, or layer of steam, between the cylinder proper and an outer shell.

All these features were specified in his first patent (see STEAM-ENGINE), which, however, was not obtained till January 1769, nearly four years after the inventions it covers had been made. In the interval Watt had been striving to demonstrate the merits of his engine by trial on a large scale. His earliest experiments left him in debt, and, finding that his own means were quite insufficient to allow him to continue them, he agreed that Dr John Roebuck, founder of the Carron ironworks, should take two-thirds of the profits of the invention in consideration of his bearing the cost. An engine was then erected at Kinneil, near Linlithgow, where Roebuck lived, and this gave Watt the opportunity of facing many difficulties in details of construction. But the experiments made slow progress, for Roebuck's affairs became embarrassed, and Watt's attention was engaged by other work. He had taken to surveying, and was fast gaining reputation as a civil engineer. In 1767 he was employed to make a survey for a Forth and Clyde canal—a scheme which failed to secure parliamentary sanction. This was followed during the next six years by surveys for a canal at Monkland, for another through the valley of Strathmore from Perth to Forfar, and for others along the lines afterwards followed by the Crinan and Caledonian canals. He prepared plans for the harbours of Ayr, Port-Glasgow and Greenock, for deepening the Clyde, and for building a bridge over it at Hamilton. In the course of this work he invented a simple micrometer for measuring distances, consisting of a pair of horizontal hairs placed in the focus of a telescope, through which sights were taken to a fixed and movable target on a rod held upright at the place whose distance from the observer was to be determined. The micrometer was varied in a number of ways; and another fruit of his ingenuity about the same time was a machine to facilitate drawing in perspective.

Meanwhile the engine had not been wholly neglected. Watt had secured his patent; the Kinneil trials had given him a store of valuable experience; Roebuck had failed, but another partner was ready to take his place. In 1768 Watt had made the acquaintance of Matthew Boulton, a man of energy and capital, who owned the Soho engineering works at Birmingham. Boulton agreed to take Roebuck's share in the invention, and to join Watt in applying to parliament for an act to prolong the term of the patent. The application was successful. In 1775 an act was passed continuing the patent for twenty-five years. By this time the inventor had abandoned his civil engineering work and had settled in Birmingham, where the manufacture of steam-engines was begun by the firm of Boulton & Watt. The partnership was a singularly happy one. Boulton had the good sense to leave the work of inventing to Watt, in whose genius he had the fullest faith; on the other hand, his substantial means, his enterprise, resolution and business capacity supplied what was wanting to bring the invention to commercial success.

During the next ten years we find Watt assiduously engaged in developing and introducing the engine. Its first and for a time its only application was in pumping; it was at once put to this use in the mines of Cornwall, where Watt was now frequently engaged in superintending the erection of engines. Further inventions were required to fit it for other uses, and these followed in quick succession. Watt's second steam-engine patent is dated 1781. It describes five different methods of converting the reciprocating motion of the piston into motion of rotation, so as to adapt the engine for driving ordinary machinery. The simplest way of doing this, and the means now universally followed, is by a crank and fly-wheel; this had occurred to Watt, but had meanwhile been patented by another, and hence he devised the "sun and planet wheels" and other equivalent contrivances. A third patent, in 1782, contained two new inventions of the first importance. Up to this time the engine had been single-acting; Watt now made it double-acting; that is to say, both ends of the cylinder, instead of only one, were alternately put in communication with the boiler and the condenser. Up to this time also the steam had been admitted from the boiler throughout the whole stroke of the piston; Watt now introduced the system of expansive working, in which the admission valve is closed after a portion only of the stroke is performed, and the steam enclosed in the cylinder is then allowed to expand during the remainder of the stroke, doing additional work upon the piston without making any further demand upon the boiler until the next stroke requires a fresh admission of steam. He calculated that, as the piston advanced after admission had ceased, the pressure of the steam in the cylinder would fall in the same proportion as its volume increased—a law which, although not strictly true, does accord very closely with the actual behaviour of steam expanding in the cylinder of an engine. Recognizing that this would cause a gradual reduction of the force with which the piston pulled or pushed against the beam, Watt devised a number of contrivances for equalizing the effort throughout the stroke. He found, however, that the inertia of the pump-rods in his mine engines, and the fly-wheel in his rotative engines, served to compensate for the inequality of thrust sufficiently to make these contrivances unnecessary. His fourth patent, taken out in 1784, describes the well-known "parallel motion," an arrangement of links by which the top of the piston-rod is connected to the beam so that it may either pull or push, and is at the same time guided to move in a sensibly straight line. "I have started a new hare," he writes to Boulton in June of that year; "I have got a glimpse of a method of causing a piston-rod to move up and down perpendicularly by only fixing it to a piece of iron upon the beam, without chains or perpendicular guides or untowardly frictions, arch-heads, or other pieces of clumsiness. I think it a very probable thing to succeed, and one of the most ingenious simple pieces of mechanism I have contrived."

A still later invention was the throttle-valve and centrifugal governor, by which the speed of rotative engines was automatically controlled. One more item in the list of Watt's contributions to the development of the steam-engine is too important to be passed without mention: the indicator, which draws a diagram of the relation of the steam's pressure to its volume as the stroke proceeds, was first used by Boulton & Watt to measure the work done by their engines, and so to give a basis on which the charges levied from their customers were adjusted. It would be difficult to exaggerate the part which this simple little instrument has played in the evolution of the steam-engine. The eminently philosophic notion of an indicator diagram is fundamental in the theory of thermodynamics; the instrument itself is to the steam engineer what the stethoscope is to the physician, and more, for with it he not only diagnoses the ailments of a faulty machine, whether in one or another of its organs, but gauges its power in health.

The commercial success of the engine was not long in being established. By 1783 all but one of the Newcomen pumping-engines in Cornwall had been displaced by Watt's. The mines were then far from thriving; many were even on the point of being abandoned through the difficulty of dealing with large volumes of water; and Watt's invention, which allowed this to be done at a moderate cost, meant for many of them a new lease of life. His engine used no more than a fourth of the fuel that had formerly been needed to do the same work, and the Soho firm usually claimed by way of royalty a sum equivalent to one-third of the saving—a sum which must have been nearly equal to the cost of the fuel actually consumed. Rival manufacturers came forward, amongst whom Edward Bull and Jonathan Carter Hornblower are the most conspicuous names. They varied the form of the engine, but they could not avoid infringing Watt's patent by the use of a separate condenser. When action was taken against them on that ground, they retaliated by disputing the validity of the fundamental patent of 1769. In the case of *Boulton & Watt* v. *Bull* the court was divided on this point, but in an action against Hornblower the patent was definitely affirmed to be valid by a unanimous finding of the Court of King's Bench. This was in 1799, only a year before the monopoly expired, but the decision enabled the firm to claim a large sum as arrears of patent dues. In connexion with these trials Watt himself, as well as his early friends Black and Robison, drew up narratives of the invention of the steam-engine, which are of much interest to the student of its history.[1]

Before Watt's time the steam-engine was exclusively a steam-pump, slow-working, cumbrous and excessively wasteful of fuel. His first patent made it quick in working, powerful and efficient, but still only as a steam-pump. His later inventions adapted it to drive machinery of all kinds, and left it virtually what it is to-day, save in three respects. In respect of mechanical arrangement the modern engine differs from Watt's chiefly in this, that the beam, an indispensable feature in the early pumping-engines, and one which held its place long after the need for it had vanished, has gradually given way to more direct modes of connecting the piston with the crank. Another difference is in the modern use of high-pressure steam. It is remarkable that Watt, notwithstanding the fact that his own invention of expansive working must have opened his eyes to the advantage of high-pressure steam, declined to admit it into his practice. He persisted in the use of pressures that were little if at all above that of the atmosphere. His rivals in Cornwall were not so squeamish. Richard Trevithick ventured as far as 120 ℔ on the square inch, and a curious episode in the history of the steam-engine is an attempt which Boulton & Watt made to have an act of parliament passed forbidding the use of high pressure on the ground that the lives of the public were endangered. The third and only other respect in which a great improvement has been effected is in the introduction of compound expansion. Here, too, one cannot but regret to find the Soho firm hostile, though the necessity of defending their monopoly makes their action natural enough. Hornblower had in fact stumbled on the invention of the compound engine, but as his machine employed Watt's condenser it was suppressed, to be revived after some years by Arthur Woolf (1766–1837). In one of his patents (1784) Watt describes a steam locomotive, but he never prosecuted this, and when William Murdoch, his chief assistant (famous as the inventor of gas-lighting), made experiments on the same lines, Watt gave him little encouragement. The notion then was to use a steam carriage on ordinary roads; its use on railways had not yet been thought of. When that idea took form later in the last years of Watt's life, the old man refused to smile upon his offspring; it is even said that he put a clause in the lease of his house that no steam carriage should on any pretext be allowed to approach it.

On the expiry in 1800 of the act by which the patent of 1769 had been extended, Watt gave up his share in the business of engine-building to his sons, James, who carried it on along with a son of Boulton for many years, and Gregory, who died in 1804. The remainder of his life was quietly spent at Heathfield Hall, his house near Birmingham, where he devoted his time, with scarcely an interruption, to mechanical pursuits. His last work was the invention of machines for copying sculpture

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[1] Another narrative of the utmost interest was written by Watt in 1814 in the form of a footnote to Robison's article "Steam-Engine," from the fourth edition of the *Encyclopaedia Britannica*, which Watt revised before it was reprinted in the collected edition of Robison's works. See Robison's *Mechanical Philosophy*, vol. ii.

—one for making reduced copies, another for taking facsimiles by means of a light stiff frame, which carried a pointer over the surface of the work while a revolving tool fixed to the frame alongside of the pointer cut a corresponding surface on a suitable block. We find him in correspondence with Sir Francis Chantrey about this machine not many months before his death, and presenting copies of busts to his friends as the work "of a young artist just entering on his eighty-third year." His life drew to a tranquil close, and the end came at Heathfield on the 19th of August 1819. His remains were interred in the neighbouring parish church of Handsworth.

Watt was twice married—first in 1763 to his cousin Margaret Miller, who died ten years later. Of four children born of the marriage, two died in infancy; another was James (1769–1848), who succeeded his father in business; the fourth was a daughter who lived to maturity, but died early, leaving two children. His second wife, Anne Macgregor, whom he married before settling in Birmingham in 1775, survived him; but her two children, Gregory and a daughter, died young.

Some of Watt's minor inventions have been already noticed. Another, which has proved of great practical value, was the letter-copying press, for copying manuscript by using a glutinous ink and pressing the written page against a moistened sheet of thin paper. He patented this in 1780, describing both a roller press, the use of which he seems to have preferred in copying his own correspondence, and also the form of screw press now found in every merchant's office.

In the domain of pure science Watt claims recognition not only as having had ideas greatly in advance of his age regarding what is now called energy, but as a discoverer of the composition of water. Writing to Joseph Priestley in April 1783, with reference to some of Priestley's experiments, he suggests the theory that "water is composed of dephlogisticated air and phlogiston deprived of part of their latent or elementary heat." It is difficult to determine the exact meaning attached to these antiquated terms, and to say how far Watt's suggestion anticipated the fuller discovery of Cavendish. Watt's views were communicated to the Royal Society in 1783, Cavendish's experiments in 1784, and both are printed in the same volume of the *Philosophical Transactions*.

The early and middle part of Watt's life was a long struggle with poor health: severe headache prostrated him for days at a time; but as he grew old his constitution seems to have become more robust. His disposition was despondent and shrinking; he speaks of himself, but evidently with unfair severity, as "indolent to excess." "I am not enterprising," he writes; "I would rather face a loaded cannon than settle an account or make a bargain; in short, I find myself out of my sphere when I have anything to do with mankind." He was a man of warm friendships, and has left a personal memorial of the greatest interest in his numerous letters. They are full of sagacity and insight: his own achievements are told with a shrewd but extremely modest estimate of their value, and in a style of remarkable terseness and lucidity, lightened here and there by a touch of dry humour. In his old age Watt is described by his contemporaries as a man richly stored with the most various knowledge, full of anecdote, familiar with most modern languages and their literature, a great talker. Scott speaks of "the alert, kind, benevolent old man, his talents and fancy overflowing on every subject, with his attention alive to every one's question, his information at every one's command."

See J. P. Muirhead, *Origin and Progress of the Mechanical Inventions of James Watt* (3 vols., 1854; vols. i. and ii. contain a memoir and Watt's letters; vol. iii. gives a reprint of his patent specifications and other papers); Muirhead, *Life of Watt* (1858); Smiles, *Lives of Boulton and Watt*; Williamson, *Memorials of the Lineage, &c., of James Watt*, published by the Watt Club (Greenock, 1856); *Correspondence of the late James Watt on his Discovery of the Theory of the Composition of Water*, edited by Muirhead (1846); Cowper, "On the Inventions of James Watt and his Models preserved at Handsworth and South Kensington," *Proc. Inst. Mech. Eng.* (1883); article "Watt" in the *Encyclopaedia Britannica* (6th edition, 1823), by James Watt, junior; Robison, *Mechanical Philosophy*, vol. ii. (1822) (letters and notes by Watt on the History of the Steam-Engine). (J. A. E.)

WATTEAU, ANTOINE (1684–1721), French painter, was born in Valenciennes, of humble Flemish origin. Comte de Caylus, his staunch friend of later years, and his first biographer, refers to Watteau's father as a hard man, strongly disinclined to accede to his son's wish to become a painter; but other accounts show him in a kinder light—as a poor, struggling man, a tiler by trade, who secured for his son the best possible education. Certain it is that at the age of fourteen Watteau was placed with Gérin, a mediocre Valenciennes painter, with whom he remained until 1702. It is to be assumed that he learnt far more from the study of Ostade's and Teniers's paintings in his native town than from his first master's teaching. Not only in subject-matter, but in their general tonality, his earliest works, like "La Vraie Gaieté," which was in the collection of Sir Charles Tennant, suggest this influence. Gérin died in 1702, and Watteau, almost penniless, went to Paris, where he found employment with the scene-painter Métayer. Things, however, went badly with his new master, and Watteau, broken down in health and on the verge of starvation, was forced to work in a kind of factory where devotional pictures were turned out in wholesale fashion. Three francs a week and meagre food were his reward; but his talent soon enabled him to paint the St Nicolas, the copying of which was allotted to him, without having to refer to the original. Meanwhile he spent his rare leisure hours and the evenings in serious study, sketching and drawing his impressions of types and scenes. His drawings attracted the attention of Claude Gillot, an artist imbued with the spirit of the Renaissance, who after having successfully tried himself in the mythological and historical genre, was just at that time devoting himself to the characters and incidents of the Italian comedy. Gillot took Watteau as pupil and assistant, but the young man made such rapid progress that he soon equalled and excelled his master, whose jealousy led to a quarrel, as a result of which Watteau, and with him his fellow-student and later pupil, Lancret, severed his connexion with Gillot and entered about 1708 the studio of Claude Audran, a famous decorative painter who was at that time keeper of the collections at the Luxembourg Palace. From him Watteau acquired his knowledge of decorative art and ornamental design, the garland-like composition which he applied to the designing of screens, fans and wall panels. At the same time he became deeply imbued with the spirit of Rubens and Paolo Veronese, whose works he had daily before him at the palace; and he continued to work from nature and to collect material for his formal garden backgrounds among the fountains and statues and stately avenues of the Luxembourg gardens. His *chinoiseries* and *singeries* date probably from the years during which he worked with Audran.

Perhaps as a recreation from the routine of ornamental design, Watteau painted at this time "The Departing Regiment," the first picture in his second and more personal manner, in which the touch reveals the influence of Rubens's technique, and the first of a long series of camp pictures. He showed the painting to Audran, who, probably afraid of losing so talented and useful an assistant, made light of it, and advised him not to waste his time and gifts on such subjects. Watteau, suspicious of his master's motives, determined to leave him, advancing as excuse his desire to return to Valenciennes. He found a purchaser, at the modest price of 60 livres, in Sirois, the father-in-law of his later friend and patron Gersaint, and was thus enabled to return to the home of his childhood. In Valenciennes he painted a number of the small camp-pieces, notably the "Camp-Fire," which was again bought by Sirois, the price this time being raised to 200 livres; this is now in the collection of Mr W. A. Coats in Glasgow. Two small pictures of the same type are at the Hermitage in St Petersburg.

Returning to Paris after a comparatively short sojourn at Valenciennes, he took up his abode with Sirois, and competed in 1709 for the Prix de Rome. He only obtained the second prize, and, determined to go to Rome, he applied for a crown pension and exhibited the two military pictures which he had sold to Sirois, in a place where they were bound to be seen by the academicians. There they attracted the attention of de la Fosse, who, struck by the rare gifts displayed in these works, sent for Watteau and dissuaded him from going to Italy, where he had nothing to learn. It was to a great extent due to de la Fosse and to Rigaud that Watteau was made an associate of the Academy in 1712, and a full member in 1717, on the completion of his diploma picture, "The Embarkment for Cythera," now at the Louvre. A later, and even more perfect, version of the same subject is in the possession of the German emperor. It is quite possible that the superb portrait of Rigaud by Watteau belonging to Mr Hodgkins, was painted in acknowledgment of Rigaud's friendly action.

Watteau now went to live with Crozat, the greatest private art collector of his time, for whom he painted a set of four decorative panels of "The Seasons," one of which, "Summer," is now in the collection of Mr Lionel Phillips. Crozat left at his death some 400 paintings and 19,000 drawings by the masters. It is easy to imagine how Watteau roamed among these treasures, and became more and more familiar with Rubens and the great Venetians. In 1719 or 1720 the state of his health had become so alarming that he went to London to consult the famous doctor Richard Mead. But far from benefiting by the journey, he became worse, the London fog and smoke proving particularly pernicious to a sufferer from consumption. On his return to Paris he lived for six months with his friend Gersaint, for whom he painted in eight mornings the wonderful signboard depicting the interior of an art dealer's shop, which is now—cut into two parts—in the collection of the German emperor. His health made it imperative for him to live in the country, and in 1721 he took up his abode with M. le Fèvre at Nogent. During all this time, as though he knew the near approach of the end and wished to make the best of his time, he worked with feverish haste. Among his last paintings were a "Crucifixion" for the curé of Nogent, and a portrait of the famous Venetian pastellist Rosalba Carriera, who at the same time painted her portrait of Watteau. His restlessness increased with the progress of his disease; he wished to return to Valenciennes, but the long journey was too dangerous; he sent for his pupil Pater, whom he had dismissed in a fit of ill-temper, and whom he now kept by his side for a month to give him the benefit of his experience; and on the 18th of July 1721 he died in Gersaint's arms.

Watteau's position in French art is one of unique importance, for, though Flemish by descent, he was more French in his art than any of his French contemporaries. He became the founder —and at the same time the culmination—of a new school which marked a revolt against the pompous decaying classicism of the Louis XIV. period. The vitality of his art was due to the rare combination of a poet's imagination with a power of seizing reality. In his treatment of the landscape background and of the atmospheric surroundings of the figures can be found the germs of impressionism. All the later theories of light and its effect upon the objects in nature are foreshadowed by Watteau's *fêtes champêtres*, which give at the same time a characteristic, though highly idealized, picture of the artificiality of the life of his time. He is the initiator of the Louis XV. period, but, except in a few rare cases, his paintings are entirely free from the licentiousness of his followers Lancret and Pater, and even more of Boucher and Fragonard. During the last years of his life Watteau's art was highly esteemed by such fine judges as Sirois, Gersaint, the comte de Caylus, and M. de Julienne, the last of whom had a whole collection of the master's paintings and sketches, and published in 1735 the *Abrégé de la vie de Watteau*, an introduction to the four volumes of engravings after Watteau by Cochin, Thomassin, Le Bas, Liotard and others. From the middle of the 18th century to about 1875, when Edmond de Goncourt published his *Catalogue raisonné* of Watteau's works and Caylus's discourse on Watteau delivered at the Academy in 1748, the discovery of which is also due to the brothers de Goncourt, Watteau was held in such slight esteem that the prices realized by his paintings at public auction rarely exceeded £100. Then the reaction set in, and in 1891 the "Occupation according to Age" realized 5200 guineas at Christie's, and "Perfect Harmony" 3500 guineas. At the Bourgeois sale at Cologne in 1904 "The Village Bride" fetched £5000.

The finest collection of Watteau's works is in the possession of the German emperor, who owns as many as thirteen, all of the best period, and mostly from M. de Julienne's collection. At the Kaiser Friedrich museum in Berlin are two scenes from the Italian and French comedy and a *fête champêtre*. In the Wallace Collection are nine of his paintings, among them "Rustic Amusements," "The Return from the Chase," "Gilles and his Family," "The Music Party," "A Lady at her Toilet" and "Harlequin and Columbine." The Louvre owns, besides the diploma picture, the "Antiope," "The Assemblage in the Park," "Autumn," "Indifference," "La Finette," "Gilles," "A Reunion" and "The False Step," as well as thirty-one original drawings. Other paintings of importance are at the Dresden, Glasgow, Edinburgh, St Petersburg and Vienna galleries; and a number of drawings are to be found at the British Museum and the Albertina in Vienna. Of the few portraits known to have been painted by Watteau, one is in the collection of the late M. Groult in Paris.

Authorities.—Since the resuscitation of Watteau's fame by the de Goncourts, an extensive literature has grown around his life and work. The basis for all later research is furnished by Caylus's somewhat academic *Life*, Gersaint's *Catalogue raisonné* (Paris, 1744), and Julienne's *Abrégé*. For Watteau's childhood, the most trustworthy information will be found in Cellier's *Watteau, son enfance, ses comtemporains* (Valenciennes, 1867). Of the greatest importance is the *Catalogue raisonné de l'œuvre de Watteau*, by E. de Goncourt (1875), and the essay on Watteau by the brothers de Goncourt in *L'Art du XVIII^e siècle*. See also *Watteau* by Paul Mantz (Paris, 1892); "Antoine Watteau," by G. Dargenty (*Les Artistes célèbres*, Paris, 1891); *Watteau*, by Gabriel Séailles (Paris, 1892); *Antoine Watteau* by Claude Phillips (London, 1895; reprinted without alterations or corrections by the author, 1905); and Camille Mauclair's brilliant monograph *Antoine Watteau* (London, 1905), which is of exceptional interest as a physiological study, since the author establishes the connexion between Watteau's art and character and the illness to which he succumbed in the prime of his life. (P.G.K.)

WATTENBACH, WILHELM (1819–1897), German historian, was born at Ranzau in Holstein on the 22nd of September 1819. He studied philology at the universities of Bonn, Göttingen and Berlin, and in 1843 he began to work upon the *Monumenta Germaniae historica*. In 1855 he was appointed archivist at Breslau; in 1862 he became professor of history at Heidelberg, and ten years later professor at Berlin, where he was a member of the directing body of the *Monumenta* and a member of the Academy. He died at Frankfort on the 21st of September 1897. Wattenbach was distinguished by his thorough knowledge of the chronicles and other original documents of the middle ages, and his most valuable work was done in this field.

His principal book, *Deutschlands Geschichtsquellen im Mittelalter bis zur Mitte des 13. Jahrhunderts*, is unrivalled as a guide to the sources of the history of Germany in the middle ages; this was first published in 1858, and has passed through several editions. Cognate works are his *Anleitung zur lateinischen Paläographie* (Leipzig, 1869, and again 1886); and *Das Schriftwesen im Mittelalter* (Leipzig, 1871, and again 1896). Wattenbach also wrote *Beiträge zur Geschichte der christlichen Kirche in Böhmen und Mähren* (Vienna, 1849); *Geschichte des römischen Papsttums* (Berlin, 1876); and *Anleitung zur griechischen Paläographie* (Leipzig, 1867, and again 1895).

WATTERSON, HENRY (1840–), American journalist, was born in Washington, D.C., on the 16th of February 1840. His father, Harvey McGee Watterson (1811–1891), was a journalist and lawyer, and was a Democratic representative in Congress in 1839–1843. The son was educated by private tutors, and between 1858 and 1861 was editor of the Washington *States* and of the Democratic *Review*. During the Civil War he served in the Confederate army as aide-de-camp to General Nathan B. Forrest and to General Leonidas Polk in 1861–1862; he was editor of the Chattanooga *Rebel* in 1862–1863, and was chief of scouts in General Joseph E. Johnston's army in 1864. In 1865–1867 he was an editor of the *Republican Banner*, at Nashville, Tennessee, and in 1867–1868 was editor of the *Journal* at Louisville, Kentucky. In 1868, with W. N. Haldeman, he founded and became editor of the Louisville *Courier-Journal*, a consolidation of the *Courier* (1843), the *Democrat* (1844), and the *Journal* (1830); and it soon became one of the most influential of Southern newspapers. He was a Democratic representative in Congress from August 1876 to March 1877, and was delegate at large to the National Democratic Conventions of 1876, 1880, 1884, 1888 and 1892, serving as temporary chairman in 1876, and as chairman of the platform committee in 1880 and 1888. He became widely known as a lecturer and orator. His publications include *History of the Spanish-American War* (1899) and *The Compromises of Life* (1902).

WATTIGNIES, a village of France $5\frac{1}{2}$ m. S.S.E. of Maubeuge, the scene of a battle in the French Revolutionary Wars (*q.v.*), fought on the 15th-16th October 1793. The Allied army, chiefly Austrians, under Coburg, was besieging Maubeuge, and the Revolutionary army, preparing to relieve it, gathered behind Avesnes. Coburg disposed a covering force of 21,000 astride the Avesnes-Maubeuge road, 5000 on the right with their flank on the Sambre, 9000 in the centre, on a ridge in an amphitheatre of woods, and 6000 on the left, chiefly on the plateau of Wattignies. A long line of woods enabled the Republican commander, Jourdan, to deploy unseen; 14,000 men were to attack the right, 16,000 were sent towards Wattignies, and 13,000 were to demonstrate in the centre till the others had succeeded and then to attack. Meantime (though this part of the programme miscarried) the Maubeuge garrison, which was almost as strong as its besiegers, was to sally out. Even without the Maubeuge garrison Jourdan had a two-to-one superiority. But the French were still the undisciplined enthusiasts of Hondschoote. Their left attack progressed so long as it could use "dead ground" in the valleys, but when the Republicans reached the gentler slopes above, the volleys of the Austrian regulars crushed their swarms, and the Austrian cavalry, striking them in flank, rode over them. The centre attack, ordered by Carnot on the assumption that all was well on the flanks, was premature; like the left, it progressed while the slopes were sharp, but when the Republicans arrived on the crest they found a gentle reverse slope before them, at the foot of which were Coburg's best troops. Again the disciplined volleys and a well-timed cavalry charge swept back the assailants. The French right reached, but could not hold, Wattignies. But these reverses were, in the eyes of Carnot and Jourdan, mere mishaps. Jourdan wished to renew the left attack, but Carnot, the engineer, considered the Wattignies plateau the key of the position and his opinion prevailed. In the night the nearly equal partition of force, which was largely responsible for the failure, was modified, and the strength of the attack massed opposite Wattignies. Coburg meanwhile strengthened his wings. He heard that Jourdan had been reinforced up to 100,000. But he called up few fresh battalions, and put into line only 23,000 men. In reality Jourdan had not received reinforcements, and the effects of the first failure almost neutralized the superiority of numbers and enthusiasm over discipline and confidence. But at last, after a long fight had eliminated the faint-hearted, enough brave men remained in the excited crowds held together by Carnot and Jourdan to win the plateau. Coburg then drew off. His losses were 2500 out of 23,000, Jourdan's 3000 out of 43,000.

WATTLE AND DAB, a term in architecture (Lat. *cratitius*) applied to a wall made with upright stakes with withes twisted between them and then plastered over. It is probably one of the oldest systems of construction; the Egyptians employed the stems of maize for the upright stakes; these were secured together with withes and covered over with mud, the upper portions of the maize stems being left uncut at the top, to increase the height of the enclosure; and these are thought by Professor Petrie to have given the origin for the cavetto cornice of the temples, the torus moulding representing the heavier coil of withes at the top of the fence wall. Vitruvius (ii. 8) refers to it as being employed in Rome. In the middle ages in England it was employed as a framework for clay chimneys.

WATTMETER, an instrument for the measurement of electric power, or the rate of supply of electric energy to any circuit. The term is generally applied to describe a particular form of electrodynamometer, consisting of a fixed coil of wire and an embracing or neighbouring coil of wire suspended so as to be movable. In general construction the instrument resembles a Siemens electrodynamometer (see AMPEREMETER). The fixed coil is called the current coil, and the movable coil is called the potential coil, and each of these coils has its ends brought to separate terminals on the base of the instrument. The principle on which the instrument works is as follows: Suppose any circuit, such as an electric motor, lamp or transformer, is receiving electric current; then the power given to that circuit reckoned in watts is measured by the product of the current flowing through the circuit in amperes and the potential difference of the ends of that circuit in volts, multiplied by a certain factor called the power factor in those cases in which the circuit is inductive and the current alternating.

Take first the simplest case of a non-inductive power-absorbing circuit. If an electro-dynamometer, made as above described, has its fixed circuit connected in series with the power-absorbing circuit and its movable coil (wound with fine wire) connected across the terminals of the power-absorbing circuit, then a current will flow through the fixed coil which is the same or nearly the same as that through the power-absorbing circuit, and a current will flow through the high resistance coil of the wattmeter proportional to the potential difference at the terminals of the power-absorbing circuit. The movable coil of the wattmeter is normally suspended so that its axis is at right angles to that of the fixed coil and is constrained by the torsion of a spiral spring. When the currents flow through the two coils, forces are brought into action compelling the coils to set their axes in the same direction, and these forces can be opposed by another torque due to the control of a spiral spring regulated by moving a torsion head on the instrument. The torque required to hold the coils in their normal position is proportional to the mean value of the product of the currents flowing through two coils respectively, or to the mean value of the product of the current in the power-absorbing circuit and the potential difference at its ends, that is, to the power taken up by the circuit. Hence this power can be measured by the torsion which must be applied to the movable coil of the wattmeter to hold it in the normal position against the action of the forces tending to displace it. The wattmeter can therefore be calibrated so as to give direct readings of the power reckoned in watts, taken up in the circuit; hence its name, wattmeter. In those cases in which the power-absorbing circuit is inductive, the coil of the wattmeter connected across the terminals of the power-absorbing circuit must have an exceedingly small inductance, else a considerable correction may become necessary. This correcting factor has the following value: If T_S stands for the time-constant of the movable circuit of the wattmeter, commonly called the potential coil, the time constant being defined as the ratio of the inductance to the resistance of that circuit, and if T_R is the time-constant similarly defined of the power-absorbing circuit, and if F is the correcting factor, and $p=2\pi$ times the frequency n, then,[1]

$$F=\frac{1+p^2T_S{}^2}{1+p^2T_ST_R}.$$

Hence an electrodynamic wattmeter, applied to measure the electrical power taken up in a circuit when employing alternating currents, gives absolutely correct readings only in two cases—(i.) when the potential circuit of the wattmeter and the power-absorbing circuit have negligible inductances, and (ii.) when the same two circuits have equal time-constants. If these conditions are not fulfilled, the wattmeter readings, assuming the wattmeter to have been calibrated with continuous currents, may be either too high or too low when alternating currents are being used.

In order that a wattmeter shall be suitable for the measurement of power taken up in an inductive circuit certain conditions of construction must be fulfilled. The framework and case of the instrument must be completely non-metallic, else eddy currents induced in the supports will cause disturbing forces to act upon the movable coil. Again the shunt circuit must have practically zero inductance and the series or current coil must be wound or constructed with stranded copper wire, each strand being silk covered, to prevent the production of eddy currents in the mass of the conductor. Wattmeters of this kind have been devised by J. A. Fleming, Lord Kelvin and W. Duddell and Mather. W. E. Sumpner, however, has devised forms of wattmeter of the dynamometer type in which iron cores are employed, and has defined the conditions under which these instruments are available for accurate measurements. See "New Alternate Current Instruments," *Jour. Inst. Elec. Eng.*, 41, 227 (1908).

There are methods of measuring electrical power by means of electrostatic voltmeters, or of quadrant electrometers adapted for the purpose, which when so employed may be called electrostatic wattmeters. If the quadrants of an electrometer (*q.v.*) are connected to the ends of a non-inductive circuit in series with the power-absorbing circuit, and if the needle is connected to the end of this last circuit opposite to that at which the inductionless resistance is connected, then the deflexion of the electrometer will be proportional to the power taken up in the circuit, since it is proportional to the mean value of $(A-B)\{C-\frac{1}{2}(A+B)\}$, where A and B are the potentials of the quadrants and C is that of the needle. This expression, however, measures the power taken up in the power-absorbing circuit. In the case of the voltmeter method of measuring power devised by W. E. Ayrton and W. E. Sumpner in 1891, an electrostatic voltmeter is employed to measure the fall of potential V_1 down any inductive circuit in which it is desired to measure the power absorption, and also the volt-drop V_2 down an inductionless resistance R in series with it, and also the volt-drop V_3 down the two together. The power absorption is then given by the expression $(V_3^2-V_1^2-V_2^2)/2R$. For methods of employing the heating power of a current to construct a wattmeter see a paper by J. T. Irwin on "Hot-wire Wattmeters," *Jour. Inst. Elec. Eng.* (1907), 39, 617.

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[1] For the proof of this formula see J. A. Fleming, *The Alternate Current Transformer in Theory and Practice*, i. 168.

For the details of these and many other methods of employing wattmeters to measure the power absorption in single and polyphase circuits the reader is referred to the following works: J. A. Fleming, *Handbook for the Electrical Laboratory and Testing Room* (1903); Id., *The Alternate Current Transformer in Theory and Practice* (1905); G. Aspinall Parr, *Electrical Engineering Measuring Instruments* (1903); A. Gray, *Absolute Measurements in Electricity and Magnetism* (1900); E. Wilson, "The Kelvin Quadrant Electrometer as a Wattmeter," *Proc. Roy. Soc.* (1898), 62, 356; J. Swinburne, "The Electrometer as a Wattmeter," *Phil. Mag.* (June 1891); W. E. Ayrton and W. E. Sumpner, "The Measurement of the Power given by an Electric Current to any Circuit," *Proc. Roy. Soc.* (1891), 49, 424; Id., "Alternate Current and Potential Difference Analogies in the Method of Measuring Power," *Phil. Mag.* (August 1891); W. E. Ayrton, "Electrometer Methods of Measuring Alternating Current Power," *Journ. Inst. Elec. Eng.* (1888), 17, 164; T. H. Blakesley, "Further Contributions to Dynamometry or the Measurement of Power," *Phil. Mag.* (April 1891); G. L. Addenbrooke, "The Electrostatic Wattmeter and its Calibration and Adaptation for Polyphase Measurements," *Electrician* (1903), 51, 811; W. E. Sumpner, "New Iron-cored Instruments for Alternate Current Working," *Jour. Inst. Elec. Eng.* 36, 421 (1906). (J. A. F.)

WATTS, ALARIC ALEXANDER (1797–1864), English journalist and poet, was the son of John Mosley Watts and grandson of William Watts, a Leicester physician of repute. After leaving school he made his living for a short time by teaching, and in 1818 joined the staff of the *New Monthly Magazine* in London, becoming about the same time a contributor to the *Literary Gazette*. In 1822 he was made editor of the *Leeds Intelligencer*, in the columns of which he was one of the first to advocate measures for protecting workers in factories against accidents from machinery. In 1823 he published his first volume of verse, *Poetical Sketches*, and in 1824 he became the editor of the *Literary Souvenir*, of which he also became the proprietor two years later, and in the conduct of which he secured the co-operation of some of the most famous men of letters of the period. In 1825 he went to Manchester as editor of the *Manchester Courier*, a position which he resigned a year later; in 1827 he assisted in founding the *Standard*, of which the first editor was Stanley Lees Giffard; and in 1833 he started the *United Service Gazette*, which he edited for several years. Watts was also interested in a number of provincial Conservative newspapers which were not financially successful, and he became bankrupt in 1850, but was awarded a civil service pension by Lord Aberdeen in 1854. In 1856 he edited the first edition of *Men of the Time*. Watts died in London on the 5th of April 1864. In 1867 a collection of his poems was published in a volume entitled *The Laurel and the Lyre*.

See A. A. Watts, *Alaric Watts* (2 vols., London, 1884).

WATTS, GEORGE FREDERICK (1817–1904), English painter and sculptor, was born in London on the 23rd of February 1817. While hardly more than a boy he was permitted to enter the schools of the Royal Academy; but his attendance was short-lived, and his further art education was confined to personal experiment and endeavour, guided and corrected by a constant appeal to the standard of ancient Greek sculpture. There are portraits of himself, painted in 1834; of Mr James Weale, about 1835; of his father, "Little Miss Hopkins," and Mr Richard Jarvis, painted in 1836; and in 1837 he was already far enough advanced to be an exhibitor at the Academy with a picture of "The Wounded Heron" and two portraits. His first exhibited figure-subject, "Cavaliers," appeared on the Academy walls in 1839, and was followed in 1840 by "Isabella e Lorenzo," in 1841 by "How should I your true love know?" and in 1842 by a scene from *Cymbeline* and a portrait of Mrs Ionides. The Royal Commission appointed for the decoration of the new Houses of Parliament offered prizes in 1842 to those artists whose cartoons for frescoes should be adjudged best adapted to its object, and at the exhibition in Westminster Hall next year Watts secured a prize of £300 for a design of "Caractacus led in triumph through the streets of Rome." This enabled him to visit Italy in 1844, and he remained there during the greater portion of the three following years, for the most part in Florence, where he enjoyed the patronage and personal friendship of Lord Holland, the British ambassador. For him he painted a portrait of Lady Holland, exhibited in 1848, and in his Villa Careggi, near the city, a fresco, after making some experimental studies in that medium, fragments of which are now in the Victoria and Albert Museum. To Lord Holland's encouragement, also, it was chiefly due that in 1846 the artist took part in another competition, the third organized by the Royal Commissioners, who on this occasion announced a further list of prizes for works in oil. Watts sent in a cartoon depicting "Alfred inciting his subjects to prevent the landing of the Danes, or the first naval victory of the English," which, after obtaining a first-class prize of £500 at the exhibition in Westminster Hall, was purchased by the government, and hangs in one of the committee rooms of the House of Commons. It led, moreover, to a commission for the fresco of "St George overcomes the Dragon," which, begun in 1848 and finished in 1853, forms part of the decorations of the Hall of the Poets in the Houses of Parliament. He next proposed to adorn gratuitously the interior of the Great Hall of Euston railway station with a series of frescoes illustrating "The Progress of the Cosmos," but the offer was refused. A similar proposition made shortly afterwards to the Benchers of Lincoln's Inn was received in a less commercial spirit, and was followed by the execution of the fresco, "Justice: a Hemicycle of Lawgivers," on the north side of their hall.

While this large undertaking was still in progress, Watts was working steadily at pictures and portraits. In 1849 the first two of the great allegorical compositions which form the most characteristic of the artist's productions were exhibited—"Life's Illusions," an elaborate presentment of the vanity of human desires, and "The people that sat in darkness," turning eagerly towards the growing dawn. In 1850 he first gave public expression to his intense longing to improve the condition of humanity in the picture of "The Good Samaritan" bending over the wounded traveller; this, as recorded in the catalogue of the Royal Academy, was "painted as an expression of the artist's admiration and respect for the noble philanthropy of Thomas Wright, of Manchester," and to that city he presented the work. In 1856 Watts paid a visit to Lord Holland at Paris, where he was then ambassador, and through him made the acquaintance and painted the portraits of Thiers, Prince Jerome Bonaparte and other famous Frenchmen; while other celebrities who sat to him during these years were Guizot (1848), Colonel Rawlinson, C.B., Sir Henry Taylor and Thomas Wright (1851), Lord John Russell (1852), Tennyson (1856, and again in 1859), John Lothrop Motley the historian (1859), the duke of Argyll (1860), Lord Lawrence and Lord Lyndhurst (1862), Lord Wensleydale (1864), Mr Gladstone (1858 and 1865), Sir William Bowman and Swinburne (1865), Panizzi (1866) and Dean Stanley and Dr Joachim in 1867. Notable pictures of the same period are "Sir Galahad" (1862), "Ariadne in Naxos" (1863), "Time and Oblivion" (1864), originally designed for sculpture to be carried out "in divers materials after the manner of Pheidias," and "Thetis" (1866).

In spite of these and many other evidences of his importance, it was not until 1867 that Watts was elected an Associate of the Royal Academy, but the council then conferred upon him the rare distinction of promoting him, in the course of the same year, to full Academicianship. Thenceforward he continued to exhibit each year, with a few exceptions, at the Academy, even after his retirement in 1896, and he was also a frequent contributor to the Grosvenor Gallery, and subsequently to the New Gallery, at which last a special exhibition of his works was held in the winter of 1896–1897. Though he travelled abroad to some extent, going to Asia Minor in 1857 with the expedition sent to investigate the ruins of Halicarnassus, and visiting in later years Italy, Greece and Egypt, the greater part of his life was passed in the laborious seclusion of his studio either at Little Holland House, Melbury Road, Kensington, where he settled in 1859, or in the country at Limnerslease, Compton, Surrey. Apart from his art, his life was happily uneventful, the sole facts necessary to record being his marriage in 1886 with Miss Mary Fraser-Tytler, an early union with Miss Ellen Terry having been dissolved many years before; his twice receiving (1885 and 1894), but respectfully declining, the offer of a baronetcy; and his inclusion in June 1902 in the newly founded Order of Merit. He died on the 1st of July 1904.

The world is exceptionally well provided with opportunities of judging of the qualities of G. F. Watts's art, for with a noble generosity he presented to his country a representative selection of the best work of his long life. A prominent element in it, and one which must prove of the greatest value to posterity, is the inestimable series of portraits of his distinguished contemporaries, a series no less remarkable for its artistic than for its historical interest. A glance through the list of his subjects shows the breadth of his sympathies and his superiority to creed or party. Among politicians are the duke of Devonshire (1883), Lords Salisbury (1884), Sherbrooke (1882), Campbell (1882), Cowper (1877), Ripon (1896), Dufferin (1897) and Shaftesbury (1882), Mr Gerald Balfour (1899) and Mr John Burns (1897); poets—Tennyson, Swinburne (1884), Browning (1875), Matthew Arnold (1881), Rossetti (1865, and subsequent replica) and William Morris (1870); artists—himself (1864, 1880, and eleven others), Lord Leighton (1871 and 1881), Calderon (1872), Prinsep (1872), Burne-Jones (1870), Millais (1871), Walter Crane (1891), and Alfred Gilbert (1896); literature is represented by John Stuart Mill (exhibited 1874), Carlyle (1869), George Meredith (1893), Max Müller (1895) and Mr Lecky (1878); music, by Sir Charles Hallé; while among others who have won fame in diverse paths are Lords Napier (1886) and Roberts (1899), General Baden-Powell (1902), Garibaldi, Sir Richard Burton (1882), Cardinal Manning (1882), Dr Martineau (1874), Sir Andrew Clark (1894), George Peabody, Mr Passmore Edwards, Claude Montefiore (1894). Even more significant from an artistic point of view is the great collection of symbolical pictures in the Tate Gallery which forms the artist's message to mankind. Believing devoutly in the high mission of didactic art, he strove ever to carry out his part of it faithfully. To quote his own words: "My intention has not been so much to paint pictures that charm the eye, as to suggest great thoughts that will appeal to the imagination and the heart, and kindle all that is best and noblest in humanity"; and his tenet is that the main object of the painter should be "demanding noble aspirations, condemning in the most trenchant manner prevalent vices, and warning in deep tones against lapses from morals and duties."

There are not wanting critics who radically dissent from this view of the proper functions of art. It must be admitted that there is force in their objection when the inner meaning of a picture is found to be exceedingly obscure, if not incomprehensible, without a verbal explanation In the female figure, for instance, bending blindfolded on the globe suspended in space and sounding the sole remaining string upon her lyre, while a single star shines in the blue heavens, it is not obvious to every one that the idea of "Hope" (1885) is suggested. There can be few, nevertheless, who will maintain that his aim is not a lofty one; and the strongest evidence of the artist's greatness, to those who accept his doctrine, is the fact that he has not only striven untiringly for his own ideals, but has very often gloriously attained them. Moreover, in so doing he has not failed on occasion to impart to his work much of that very charm which is to him a secondary consideration, or to exhibit an assured and accomplished mastery of the technical achievement which is to some the primary object and essential triumph of painting. It was, in short, the rare combination of supreme handicraft with a great imaginative intellect which secured to Watts his undisputed place in the public estimation of his day. The grandeur and dignity of his style, the ease and purposefulness of his brushwork, the richness and harmoniousness of his colouring—qualities partly his own, partly derived from his study of Italian masters at an early and impressionable age—are acknowledged even by those to whom his elevated educational intentions are a matter of indifference, if not of absolute disapprobation; while many, to whom his exceptional artistic attainment is a sealed book, have gathered courage or consolation from the grave moral purpose and deep human sympathy of his teaching. He expresses his ideas for the most part in terms of beauty, an idealized, classical beauty of form, a glowing, Venetian beauty of colour, though his conviction of the deadly danger of heaped-up riches, which he vindicated in his life as well as in his work, has, in such cases as "The Minotaur" (exhibited in 1896), "Mammon" (1885) and "Jonah" (1895), where the unveiled vileness of Cruelty and Greed is fearlessly depicted, driven him to the presentment of sheer ugliness or brutality. Far oftener a vast, all-embracing tenderness inspires his work; it is the sorrow, not the sin, that stirs him. When he would rebuke the thoughtless inhumanity which sacrifices its annual hecatombs of innocent birds to fashionable vanity and grasping commerce, it is not upon the blood and cruelty that he dwells, but the pity of it that he typifies in "Dedication" or "The Shuddering Angel" (1892) weeping over the altar spread with Woman's spoils.

Yet it is as a teacher that the artist is seen at his highest: he would sooner point out the true way to those who seek it than admonish those who have wandered. He never wearies of emphasizing the reality of the power of Love, the fallacy underlying the fear of Death. To the early masters Death was a bare and ghastly skeleton, above all things to be shunned; to Watts it is a grand, impressive figure, awful indeed but not horrible, irresistible but not ruthless, a bringer of rest and peace, not to be rashly sought but to be welcomed when the inevitable hour shall strike. "*Sic transit*" (1892) conveys most completely, perhaps, Watts's lesson on the theme of death. Stretched on a bier and reverently sheeted lies a corpse; strewn neglected on the ground lie the ermine robe of worldly rank, the weapons of the warrior, the lute of the musician, the book of human learning, the palmer's robe of late repentance and the roses of fleeting pleasures; the laurel crown remains as the one thing worth the winning; and the inscription "What I spent I had; what I saved I lost; what I gave I have," points the moral. Such is the significance of the still more masterly "Court of Death" (finally completed 1902 and now in the Tate Gallery). To the same early masters Love was usually a mere distributor of sensual pleasures, a tricksy spirit instinct with malice and bringing more harm than happiness to humanity, though neither was of much moment. Watts has not altogether ignored this view, and in "Mischief" (1878) has portrayed Man, love-led, entangled among the thorns of the world; but, in the main, Love to him is the chief guide and helper of mankind along the barren, rock-strewn path of life, through whom alone he can attain the higher levels, and who triumphs in the end over Death itself. To these views on the all-importance of love a trilogy of pictures in the Tate Gallery gives full expression. In the first, "Love and Life," exhibited in 1885, a replica of an earlier picture in the Metropolitan Museum, New York, and of another version presented by him to the Luxembourg, Paris, Love, a figure in the prime of manhood, leads and supports the slender, clinging girl who symbolizes Life up to the craggy mountain-top, while he partly shields her from the blast under a broad wing. Of this he himself said, "Probably 'Love and Life' best portrays my message to the age. Life, represented by the female figure, never could have reached such heights unless protected and guided by Love";[1] and in the prefatory note to the exhibition of his works in 1896 he wrote, "The slight female figure is an emblem of the fragile quality in humanity, at once its weakness and its strength; *sensibility*, aided by Love, sympathy, tenderness, self-sacrifice, and all that the range of the term implies, humanity ascends the rugged path from brutality to spirituality." The limitations of earthly love are shown in the second "Love and Death," one version of which was exhibited in 1877 and others in 1896, &c. In this, Love, a beautiful boy, striving vainly to bar the door to the mighty figure of Death, is thrust back with crushed wings powerless to stay the advance; but that the defeat is merely apparent and temporary is suggested rather than asserted by the third "Love Triumphant" (1898), where Time, with broken scythe, and Death lie prostrate, while the same youth, with widespread wings and face and arms upraised to heaven, stands between them on tiptoe as if preparing to soar aloft. Though the purely symbolical is the most distinctive side of Watts's art, it is by no means the only one. He has drawn inspiration largely from both the Old and New Testaments, more rarely from the poets and classical myths; still more rarely he has treated subjects of modern life, though even in these he has not abandoned his moral purpose, but has sought out such incidents, whether fictitious or historical, as will serve him in conveying some lesson or monition. The three pictures of the story of Eve in the Tate Gallery, "She shall be called woman" (1892), "Eve Tempted" and "Eve Repentant" (both exhibited in 1896), and "The Curse of Cain" (1872) in the Diploma Gallery, may be cited as examples of the first; "For he had great possessions" (1894) of the second; "Sir Galahad" (1862), "Orpheus and Eurydice" and "Psyche" (1880), of the third; and "The Irish Famine" (about 1847) and "A Patient Life of Unrewarded Toil" (1890), of the last of these. Never has he treated religion from a sectarian point of view.

Watts is before all things a painter with a grave and earnest purpose, painting because that form of expression was easier to him than writing, though he has published some few articles and pamphlets, chiefly on art matters; but he, too, has his lighter side, and has daintily treated the humorously fanciful in "Good luck to your fishing" (1889); "The habit does not make the monk" (1889), in which Cupid, half-hidden under the frock, taps maliciously at a closed door; and "Trifles Light as Air" (exhibited 1901), a swarm of little amorini drifting in the summer air like a cloud of gnats; while in "*Experientia docet B.C.*" (1890), a primeval woman watching with admiration, not unmixed with anxiety, the man who has first swallowed an oyster, he condescends, not very successfully, to the frankly comic. These must be regarded, however, as merely the relaxations of the serious mind that has left its impress even on the relatively few, but very admirable, landscapes he produced, in which, as for instance "The Carrara Mountains from Pisa" (1881), a sober dignity of treatment is conspicuous.

Watts's technique is as individual as his point of view. It is chiefly remarkable for its straightforwardness and simplicity, and its lack of any straining after purely technical effects. The idea to be expressed is of far higher importance to him than the manner of expressing it. The statement of it should be a matter of good, sound workmanship, not of artistic agility or manual dexterity. To say what he has to say as clearly and briefly as may be is his aim, and when he has achieved the effect he desires, the method of his doing so is of no further moment. In the use of paint as paint, in the intrinsic beauties of surface and handling, he would seem in his later years to take no delight. Thus in parts of the picture the rough, coarse canvas he prefers may be so thinly covered that every fibre of the material can be seen, while in others a richly modelled impasto loads the surface. He employs, as far as possible, pure colours laid on in direct juxtaposition or broken into and across each other, not blended and commingled on the palette. He eschews all elaboration of detail and, except in portraiture, works rarely from the living model, neglecting minor delicacies of form or passages of local colour, conventionalizing to a standard of his own rather than idealizing—a process not always unproductive of faults of drawing and proportion, as in the figure of "Faith" (1896), or of singularities of tint, as in the curious leaden face and prismatic background in "The Dweller in the Innermost" (1886). He avoids, as a rule, the use of definite outline, leaving the limits of his forms to melt imperceptibly into the background; nor does texture interest him greatly, and a uniform fresco-like surface is apt to represent flesh and foliage, distance and foreground alike. He intends deliberately that the things he depicts, be they what they may, shall be symbols, useful for their meaning alone, and he makes no attempt at conferring on them an accurate actuality, which might distract the attention from the paramount idea. That this reticence is intentional may be learned from an examination of his earliest works, in which the accessories are rendered with a precise, if sometimes a dry, truthfulness of observation; that it is not due to carelessness or indifference is shown by the inexhaustible patience with which each picture has been executed. His earlier pictures are unsurpassed in the art of England for fine technical qualities of colour and delicacy of handling. Though working unceasingly, Watts never hurried the completion of any canvas. Of two slightly differing versions of "Fata Morgana," both begun in 1847, the first was not finished before 1870, the second not until ten years later. Even after finishing a picture sufficiently for exhibition, he often subsequently worked further upon it. The portrait of Lord Leighton, exhibited in 1881, was repainted in 1888; the version of "Love and Death," exhibited in 1877, and 1883, and all the pictures presented to the Tate Gallery in 1897, were more or less retouched when hung there. Furthermore, he painted more than one version of several of his favourite subjects, a circumstance which, combined with the fact that he rarely added the year to his signature and kept no record of his annual production, makes the task of precisely dating his pictures for the most part impossible, while it renders any attempt to dispose his works in periods untrustworthy and artificial, since even the growth and inevitable decay of artistic power are to a considerable extent obscured.

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[1] *G. F. Watts, R.A.*, by Charles T. Bateman.

Founded admittedly on the Grecian monuments, there is a sculpturesque rather than pictorial quality in most of his compositions, a regulated disposition which, though imparting often a certain air of unreality and detachment, inspires them nevertheless with that noble impressiveness which forms their most conspicuous characteristic. It is natural, therefore, that in sculpture itself he should also take a high place. A taste for this he acquired as a boy; he was a constant visitor to the studio of Behnes, where he not infrequently made drawings from the casts, though he was never in any sense his pupil. Among his works in this branch of art are a bust of "Clytie" (1868), monuments to the marquis of Lothian, Bishop Lonsdale and Lord Tennyson, a large bronze equestrian statue of "Hugo Lupus" at Eaton Hall (1884), and a colossal one of a man on horseback, emblematical of "Physical Energy," originally intended for a place on the Embankment, but destined to stand among the Matoppo Hills as an enduring evidence of the artist's admiration for Cecil Rhodes; a replica has been placed in Kensington Gardens. It was the practical idealism of Rhodes that appealed to him, and in this quality Watts himself was by no means lacking. Much of his time and attention was given to the promotion of the Home Arts and Industries Association; he assisted Mrs Watts with both money and advice in the founding of an art pottery at Compton, and in the building at the same place of a highly decorated mortuary chapel, carried out almost entirely by local labour; and it was entirely due to his initiative that the erection in Postmen's Park, Aldersgate Street, London, of memorial tablets to the unsung heroes of everyday life was begun.

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(M. BE.)

WATTS, ISAAC (1674–1748), English theologian and hymn writer, son of a clothier, was born at Southampton on the 17th of July 1674. The father, who afterwards had a boarding-school at Southampton, also wrote poetry, and a number of his pieces were included by mistake in vol. i. of the son's *Posthumous Works*. Isaac Watts is stated to have begun to learn Latin when only in his fifth year, and at the age of seven or eight to have composed some devotional pieces to please his mother. His nonconformity precluded him from entering either of the universities, but in his sixteenth year he went to study at the nonconformist academy at Stoke Newington, of which the Rev. Thomas Rowe, minister of the Independent meeting at Girdlers' Hall, was then president. On leaving the academy he spent more than two years at home, and began to write his hymns, but in the autumn of 1696 he became tutor in the family of Sir John Hartopp at Stoke Newington, where he probably prepared the materials of his two educational works—*Logick, or the Right Use of Reason in the Enquiry after Truth* (1725), and *The Knowledge of the Heavens and the Earth made easy, or the First Principles of Geography and Astronomy Explained* (1726). In his twenty-fourth year Watts was chosen assistant to Dr Isaac Chauncy (1632–1712), pastor of the Independent congregation in Mark Lane, London, and two years later he succeeded as sole pastor. The state of his health, which he had injured by overwork, led to the appointment of an assistant in 1703. In 1704 the congregation removed to Pinner's Hall, and in 1708 they built a new meeting-house in Bury Street. In 1712 Watts was attacked by fever, which incapacitated him for four years from the performance of his duties. In 1712 he went to live with Sir Thomas Abney of Abney Park, where he spent the remainder of his life, the arrangement being continued by Lady Abney after her husband's death. Watts preached only occasionally, devoting his leisure chiefly to the writing of hymns (see HYMNS), the preparation of his sermons for publication, and the composition of theological work. In 1706 appeared his *Horae Lyricae*, of which an edition with memoir by Robert Southey forms vol. ix. of *Sacred Classics* (1834); in 1707 a volume of *Hymns*; in 1719 *The Psalms of David*; and in 1720 *Divine and Moral Songs for Children*. His Psalms are free paraphrases, rather than metrical versions, and some of them ("O God, our help in ages past," for instance) are amongst the most famous hymns in the language. His religious opinions were more liberal in tone than was at that time common in the community to which he belonged; his views regarding Sunday recreation and labour were scarcely of puritanical strictness; and his Calvinism was modified by his rejection of the doctrine of reprobation. He did not hold the doctrine of the Trinity as necessary to salvation, and he wrote several works on the subject in which he developed views not far removed from Arianism. He died on the 25th of November 1748, and was buried at Bunhill Fields, where a tombstone was erected to his memory by Sir John Hartopp and Lady Abney. A memorial was also erected to him in Westminster Abbey, and a memorial hall, erected in his honour at Southampton, was opened in 1875.

Among the theological treatises of Watts, in addition to volumes of sermons, are *Doctrine of the Trinity* (1722); *Discourses on the Love of God and its Influence on all the Passions* (1729); *Catechisms for Children and Youth* (1730); *Essays towards a Proof of a Separate State for Souls* (1732); *Essay on the Freedom of the Will* (1732); *Essay on the Strength and Weakness of Human Reason* (1737); *Essay on the Ruin and Recovery of Mankind* (1740); *Glory of Christ as God-Man Unveiled* (1746); and *Useful and Important Questions concerning Jesus, the Son of God* (1746). He was also the author of a variety of miscellaneous treatises. His *Posthumous Works* appeared in 1773, and a further instalment of them in 1779. *The Works of... Issac Watts* (6 vols.), edited by Dr Jennings and Dr Doddridge, with a memoir compiled by G. Burder, appeared in 1810–1811. His poetical works were included in Johnson's *English Poets*, where they were accompanied by a *Life*, and they appear in subsequent similar collections. See also *The Life, Times and Correspondence of Isaac Watts* (1834) by Thomas Milner.

WATTS-DUNTON, WALTER THEODORE (1832–   ), English man of letters, was born at St Ives, Huntingdon, on the 12th of October 1832, his family surname being Watts, to which he added in 1897 his mother's name of Dunton. He was originally educated as a naturalist, and saw much of the East Anglian gypsies, of whose superstitions and folk-lore he made careful study. Abandoning natural history for the law, he qualified as a solicitor and went to London, where he practised for some years, giving his spare time to his chosen pursuit of literature. He contributed regularly to the *Examiner* from 1874 and to the *Athenaeum* from 1875 until 1898, being for more than twenty years the principal critic of poetry in the latter journal. His article on "Poetry" in the ninth edition of the *Ency. Brit.* (vol. xix., 1885) was the principal expression of his views on the first principles of the subject, and did much to increase his reputation, which was maintained by other articles he wrote for the *Encyclopaedia Britannica* and for the chief periodicals and reviews. Mr Watts-Dunton had considerable influence as the friend of many of the leading men of letters of his time; he enjoyed the confidence of Tennyson, and contributed an appreciation of him to the authorized biography. He was in later years Rossetti's most intimate friend. He was the bosom friend of Swinburne (*q.v.*), who shared his home for nearly thirty years before he died in 1909. The obituary notices and appreciations of the poets of the time, which he contributed to the *Athenaeum* and other periodicals, bore testimony to his sympathy, insight and critical acumen. It was not, however, until 1897 that he published a volume under his own name, this being his collection of poems called *The Coming of Love*, portions of which he had printed in periodicals from time to time. In the following year his prose romance *Aylwin* attained immediate success, and ran through many editions in the course of a few months. Both *The Coming of Love* and *Aylwin* set forth, the one in poetry, the other in prose, the romantic and passionate associations of Romany life, and maintain the traditions of Borrow, whom Mr Watts-Dunton had known well in his own early days. Imaginative glamour and mysticism are their prominent characteristics, and the novel in particular has had its share in restoring the charms of pure romance to the favour of the general public. He edited George Borrow's *Lavengro* (1893) and *Romany Rye* (1900); in 1903 he published *The Renascence of Wonder*, a treatise on the romantic movement; and his *Studies of Shakespeare* appeared in 1910. But it was not only in his published work that Mr Watts-Dunton's influence on the literary life of his time was potent. His long and intimate association with Rossetti and Swinburne made him, no doubt, a unique figure in the world of letters; but his own grasp of metrical principle and of the historic perspective of the glories of English poetry made him, among the younger generation, the embodiment of a great tradition of literary criticism which could never cease to command respect. In 1905 he married. His life has been essentially one of devotion to letters, faithfully and disinterestedly followed.

WAUGH, BENJAMIN (1839–1908), English social reformer, was born at Settle, Yorkshire, on the 20th of February 1839. He passed the early years of his life in business, but in 1865 entered the congregational ministry. Settling at Greenwich he threw himself with ardour into the work of social reform, devoting himself especially to the cause of the children. He served on the London School Board from 1870 to 1876. In 1884 he was responsible for the establishment of the London society for the prevention of cruelty to children, which four years later was established on a national basis. He was elected its honorary secretary, and it was largely owing to information obtained by him that the Criminal Law Amendment Act of 1885 was passed, while by his personal effort he secured the insertion of a clause giving magistrates power to take the evidence of children too young to understand the nature of an oath. In 1889 he saw the work accomplished by his society (of which he had been made director the same year) recognized by the passing of an act for the prevention of cruelty to children, the first stepping-stone to the act of 1908 (see CHILDREN, LAW RELATING TO). In 1895 a charter of incorporation was conferred on the society, but in 1897 it was the object of a serious attack on its administration. An inquiry was demanded by Waugh, and the commission of inquiry, which included Lord Herschell and others, completely vindicated the society and its director. Waugh had given up pastoral work in 1887 to devote his whole time to the society, and he retained his post as director until 1905, when the state of his health compelled his retirement. He remained consulting director until his death at Westcliff, near Southend, Essex, on the 11th of March 1908. Waugh edited the *Sunday Magazine* from 1874 to 1896, but he had otherwise little leisure for literary work. His *The Gaol Cradle, who rocks it?* (1873) was a plea for the abolition of juvenile imprisonment.

WAUGH, EDWIN (1817–1890), known as "The Lancashire Poet," was born at Rochdale, on the 29th of January 1817, the son of a shoemaker. For several years he earned his living as a journeyman printer in various parts of the country. In 1855 he published his first book, *Sketches of Lancashire Life and Localities*, following this up with reprinted *Poems and Songs* (1859). His rendering of the Lancashire dialect was most happy, and his rude lyrics, full of humour and pathos, were great favourites with his countrymen. He died on the 30th of April 1890.

See Milner's *Memoir* in an edition of Waugh's selected works (1892–1893).

WAUKEGAN, a city and the county-seat of Lake county, Illinois, U.S.A., on the W. shore of Lake Michigan, about 36 m. N. of Chicago. Pop. (1890) 4915; (1900) 9426, of whom 2506 were foreign-born; (1910 census) 16,069. It is served by the Elgin, Joliet & Eastern (of which it is a terminus) and the Chicago & North Western railways, by an interurban electric line, and by lake steamers. In 1880 the United States government undertook the formation of an artificial harbour with a channel 13 ft. deep, and in 1902–1904 the depth was increased to 20 ft. The main portion of the city is situated about 100 ft. above the level of the lake. There are a number of parks and mineral springs, and along the lake front a fine driveway, Sheridan Road. The city is a residential suburb of Chicago. The principal buildings are the Federal building, the Court House, a Carnegie library, the Masonic Temple and McAlister Hospital. At the village of North Chicago (pop. in 1910, 3306), about 3 m. S. of Waukegan, there is a United States Naval Training Station. Waukegan is the commercial centre of an agricultural and dairying region, and has various manufactures. The total value of the factory product in 1905 was $3,961,513. Waukegan was settled about 1835, and until 1849 was known as Little Fort, which is supposed to be the English equivalent of the Indian name Waukegan. It became the county-seat of Lake county in 1841, was incorporated as a town in 1849, and first chartered as a city in 1859.

WAUKESHA, a city and the county-seat of Waukesha county, Wisconsin, U.S.A., about 19 m. W. of Milwaukee on the Little Fox river. Pop. (1890) 6321; (1900) 7419, including 1408 foreign-born; (1905 state census) 6949; (1910) 8740. Waukesha is served by the Minneapolis, St Paul & Sault Ste Marie, the Chicago & North-Western and the Chicago, Milwaukee & St Paul railways, and by interurban electric railways connecting it with Milwaukee, Oconomowoc and Madison. The medicinal mineral springs (Bethesda, White Rock, &c.) are widely known. Among the public buildings are the county court house and the public library. Waukesha is the seat of the State Industrial School for Boys (established as a house of refuge in 1860) and of Carroll College (Presbyterian, co-educational, 1846). Waukesha was first settled in 1834, was named Prairieville in 1839, was incorporated as a village under its present name (said to be a Pottawatomi word meaning "fox") in 1852, and chartered as a city in 1896. In 1851 the first railway in the state was completed between Milwaukee and Waukesha, but the village remained only a farming community until the exploitation of the mineral springs was begun about 1868. About 15 m. S. of Waukesha, near Mukwonago (pop. in 1910, 615), in 1844–1845, there was an unsuccessful communistic agricultural settlement, the Utilitarian Association, composed largely of London mechanics led by Campbell Smith, a London bookbinder.

WAURIN (or WAVRIN), **JEHAN** (or JEAN DE) (d. *c.* 1474), French chronicler, belonged to a noble family of Artois, and was present at the battle of Agincourt. Afterwards he fought for the Burgundians at Verneuil and elsewhere, and then occupying a high position at the court of Philip the Good, duke of Burgundy, was sent as ambassador to Rome in 1463. Jehan wrote, or rather compiled, the *Recueil des croniques et anchiennes istories de la Grant Bretaigne*, a collection of the sources of English history from the earliest times to 1471. For this work he borrowed from Froissart, Monstrelet and others; but for the period between 1444 and 1471 the *Recueil* is original and valuable, although somewhat untrustworthy with regard to affairs in England itself.

From the beginning to 688 and again from 1399 to 1471 the text has been edited for the Rolls Series (5 vols., London, 1864–1891), by W. and E. L. C. P. Hardy, who have also translated the greater part of it into English. The section from 1325 to 1471 has been edited by L. M. E. Dupont (Paris, 1858–1863).

WAUSAU, a city and the county-seat of Marathon county, Wisconsin, U.S.A., on both banks of the Wisconsin river, about 185 m. N.W. of Milwaukee. Pop. (1890) 9253; (1900) 12,354, of whom 3747 were foreign-born; (1910 census) 16,560. There is a large German element in the population, and two German semi-weekly newspapers are published here. Wausau is served by the Chicago, Milwaukee & St Paul and the Chicago & North-Western railways. The city is built for the most part on a level plateau above the river and extends to the top of high bluffs on either side. It has a fine city hall, a Carnegie library, the Marathon County Court House, a hospital, built by the Sisters of the Divine Saviour, and a Federal Building. In Wausau are a U.S. land office, the Marathon County Training School for Teachers, the Marathon County School of Agriculture and Domestic Science, and a County Asylum for the Chronic Insane. Valuable water-power furnished by the Big Bull Falls of the Wisconsin (in the city) is utilized for manufacturing, and in 1910 water-power sites were being developed on the Wisconsin river immediately above and below the city. In 1905 the factory products were valued at $4,644,457. Wausau had its origin in a logging-camp, established about 1838. In 1840 a saw-mill was built here, and in 1858 the village was incorporated under its present name. After 1880, when Wausau was chartered as a city, its growth was rapid.

WAUTERS, EMILE (1848–), Belgian painter, was born in Brussels, 1848. Successively the pupil of Portaels and Gérôme, he produced in 1868 "The Battle of Hastings: the Finding of the body of Harold by Edith," a work of striking, precocious talent. A journey was made to Italy, but that the study of the old masters in no wise affected his individuality was proved by "The Great Nave of St Mark's" (purchased by the king of the Belgians). As his youth disqualified him for the medal of the Brussels Salon, which otherwise would have been his, he was sent, by way of compensation, by the minister of fine arts, as artist-delegate to Suez for the opening of the canal—a visit that was fruitful later on. In 1870, when he was yet only twenty-two years of age, Wauters exhibited his great historical picture of "Mary of Burgundy entreating the Sheriffs of Ghent to pardon the Councillors Hugonet and Humbercourt" (Liége Museum) which created a veritable furore, an impression which was confirmed the following year at the London International Exhibition. It was eclipsed by the celebrated "Madness of Hugo van der Goes" (1872, Brussels Museum), a picture which led to the commission for the two large works decorating the Lions' staircase of the Hôtel de Ville—"Mary of Burgundy swearing to respect the Communal Rights of Brussels, 1477" and "The Armed Citizens of Brussels demanding the Charta from Duke John IV. of Brabant." His other large compositions comprise "Sobieski and his Staff before Besieged Vienna" (Brussels Museum) and the harvest of a journey to Spain and Tangiers, "The Great Mosque," and "Serpent Charmers of Sokko," and a souvenir of his Egyptian travel, "Cairo, from the Bridge of Kasr-el-Nil" (Antwerp Museum). His vast panorama—probably the noblest and most artistic work of this class ever produced—"Cairo and the Banks of the Nile" (1881), 380 ft. by 49 ft., executed in six months, was exhibited with extraordinary success in Brussels, Munich, and the Hague. Wauters is equally eminent as a portraitist, in his earliest period exhibiting, as in his pictures, sober qualities and subtle grip, but later on developing into the whole range of a brilliant, forceful palette, and then into brighter and more delicate colours, encouraged thereto, in his more recent work, by his adoption of pastel as a medium even for life-size portraits, mainly of ladies. His portraits, numbering over two hundred, include many of the greatest names in Belgium, France, and America (Wauters having for some years made Paris his chief home). Among these may be named the Baron Goffinet, the Baroness Goffinet, Madame Somzée (standing at a piano), Master Somzée (on horseback by the sea-shore), the Princess Clementine of Belgium (Brussels Museum), Lady Edward Sassoon, Baron de Bleichroder, Princess de Ligne, Miss Lorillard, a likeness of the artist in the Dresden Museum, and M. Schollaert (president of the Chamber of Deputies)—the last named an amazing example of portraiture, instinct with character and vitality. The vigour of his male, and the grace and elegance of his female, portraits are unsurpassable, the resemblance perfect and the technical execution such as to place the artist in the front rank. Between 1889 and 1900 the painter contributed to the Royal Academy of London. Few artists have received such a succession of noteworthy distinctions and recognitions. His "Hugo van der Goes," the work of a youth of twenty-four, secured the grand medal of the Salon. He has been awarded no fewer than six "medals of honour"—at Paris in 1878 and 1889; Munich, 1879; Antwerp, 1885; Vienna, 1888; and Berlin, 1883. He is a member of the academy of Belgium, and honorary member of the Vienna, Berlin, and Munich academies, and corresponding member of the Institut de France and of that of Madrid. He has received the order of merit of Prussia, and is Commander of the order of Leopold, and of that of St Michael of Bavaria, officer of the Legion of Honour, &c.

See M. H. Spielmann, *Magazine of Art* (1887); A. J. Wauters, *Magazine of Art* (1894); Joseph Anderson, *Pall Mall Magazine* (1896); G. Seraé ("Wauters as a Painter of Architecture") *Architectural Record* (1901). (M. H. S.)

WAVE.[1] It is not altogether easy to frame a definition which shall be precise and at the same time cover the various physical phenomena to which the term "wave" is commonly applied. Speaking generally, we may say that it denotes a process in which a particular *state* is continually handed on without change, or with only gradual change, from one part of a medium to another. The most familiar instance is that of the waves which are observed to travel over the surface of water in consequence of a local disturbance; but, although this has suggested the name[1] since applied to all analogous phenomena, it so happens that water-waves are far from affording the simplest instance of the process in question. In the present article the principal types of wave-motion which present themselves in physics are reviewed in the order of their complexity. Only the leading features are as a rule touched upon, the reader being referred to other articles for such developments as are of interest mainly from the point of view of special subjects. The theory of water-waves, on the other hand, will be treated in some detail.

§ 1. *Wave-Propagation in One Dimension.*

The simplest and most easily apprehended case of wave-motion is that of the transverse vibrations of a uniform tense string. The axis of x being taken along the length of the string in its undisturbed position, we denote by y the transverse displacement at any point. This is assumed to be infinitely small; the resultant lateral force on any portion of the string is then equal to the tension (P, say) multiplied by the total curvature of that portion, and therefore in the case of an element δx to $Py''\delta x$, where the accents denote differentiations with respect to x. Equating this to $\rho\delta x.\ddot{y}$, where ρ is the line-density. we have

$$\ddot{y}=c^2y'', \qquad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where

$$c=\sqrt{(P/\rho)}. \qquad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

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[1] The word "wave," as a substantive, is late in English, not occurring till the Bible of 1551 (Skeat, *Etym. Dict.*, 1910). The proper O. Eng. word was *wǣg*, which became *wawe* in M. Eng.; it is cognate with Ger. *Woge*, and is allied to "wag," to move from side to side, and is to be referred to the root *wegh*, to carry, Lat. *vehere*, Eng. "weigh," &c. The O. Eng. *wafian*, M.Eng. *waven*, to fluctuate, to waver in mind, cf. *waefre*, restless, is cognate with M.H.G. *wabelen*, to move to and fro, cf. Eng. "wabble" of which the ultimate root is seen in "whip," and in "quaver."

The general solution of (1) was given by J. le R. d'Alembert in 1747; it is

$$y=f(ct-x)+F(ct+x), \quad . \quad . \quad . \quad . \quad (3)$$

where the functions f, F are arbitrary. The first term is unaltered in value when x and ct are increased by equal amounts; hence this term, taken by itself, represents a wave-form which is propagated without change in the direction of x-positive with the constant velocity c. The second term represents in like manner a wave-form travelling with the same velocity in the direction of x-negative; and the most general free motion of the string consists of two such wave-forms superposed. In the case of an initial disturbance confined to a finite portion of an unlimited string, the motion finally resolves itself into two waves travelling unchanged in opposite directions. In these separate waves we have

$$\dot{y}=\mp cy', \quad . \quad . \quad . \quad . \quad . \quad (4)$$

as appears from (3), or from simple geometrical considerations. It is to be noticed, in this as in all analogous cases, that the wave-velocity appears as the square root of the ratio of two quantities, one of which represents (in a generalized sense) the elasticity of the medium, and the other its inertia.

The expressions for the kinetic and potential energies of any portion of the string are

$$T=\tfrac{1}{2}\rho\int\dot{y}^2dx, \quad V=\tfrac{1}{2}P\int y'^2dx, \quad . \quad . \quad . \quad (5)$$

where the integrations extend over the portion considered. The relation (4) shows that in a single progressive wave the total energy is half kinetic and half potential.

When a point of the string (say the origin O) is fixed, the solution takes the form

$$y=f(ct-x)-f(ct+x). \quad . \quad . \quad . \quad . \quad (6)$$

As applied (for instance) to the portion of the string to the left of O, this indicates the superposition of a reflected wave represented by the second term on the direct wave represented by the first. The reflected wave has the same amplitudes at corresponding points as the incident wave, as is indeed required by the principle of energy, but its sign is reversed.

The reflection of a wave at the junction of two strings of unequal densities ρ, ρ' is of interest on account of the optical analogy. If A, B be the ratios of the amplitudes in the reflected and transmitted waves, respectively, to the corresponding amplitudes in the incident wave, it is found that

$$A=-(\mu-1)/(\mu+1), \quad B=2\mu/(\mu+1), \quad . \quad . \quad . \quad (7)$$

where μ, $=\sqrt{(\rho'/\rho)}$, is the ratio of the wave-velocities. This is on the hypothesis of an abrupt change of density; if the transition be gradual there may be little or no reflection.

The theory of waves of longitudinal vibration in a uniform straight rod follows exactly the same lines. If ξ denote the displacement of a particle whose undisturbed position is x, the length of an element of the central line is altered from δx to $\delta x+\delta\xi$, and the elongation is therefore measured by ξ'. The tension across any section is accordingly $E\omega\xi'$, where ω is the sectional area, and E denotes Young's modulus for the material of the rod (see ELASTICITY). The rate of change of momentum of the portion included between two consecutive cross-sections is $\rho\omega\delta x.\xi$, where ρ now stands for the volume-density. Equating this to the difference of the tensions on these sections we obtain

$$\xi=c^2\xi'', \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

where

$$c=\sqrt{(E/\rho)}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

The solution and the interpretation are the same as in the case of (1). It may be noted that in an iron or steel rod the wave-velocity given by (9) amounts roughly to about five kilometres per second.

The theory of plane elastic waves in an unlimited medium, whether fluid or solid, leads to differential equations of exactly the same type. Thus in the case of a fluid medium, if the displacement ξ normal to the wave-fronts be a function of t and x, only, the equation of motion of a thin stratum initially bounded by the planes x and $x+\delta x$ is

$$\rho_0\frac{\partial^2\xi}{\partial t^2}=-\frac{\partial p}{\partial x}, \quad . \quad . \quad . \quad . \quad . \quad (10)$$

where p is the pressure, and ρ_0 the undisturbed density. If p depends only on the density, we may write, for small disturbances,

$$p=p_0+ks, \quad . \quad . \quad . \quad . \quad . \quad (11)$$

where s, $=(\rho-\rho_0)\rho_0$, is the "condensation," and k is the coefficient of cubic elasticity. Since $s=-\partial\xi/\partial x$, this leads to

$$\frac{\partial^2\xi}{\partial t^2}=c^2\frac{\partial^2\xi}{\partial x^2}, \quad . \quad . \quad . \quad . \quad . \quad (12)$$

with

$$c=\sqrt{(k/\rho)}. \quad . \quad . \quad . \quad . \quad . \quad (13)$$

The latter formula gives for the velocity of sound in water a value (about 1490 metres per second at 15° C.) which is in good agreement with direct observation. In the case of a gas, if we neglect variations of temperature, we have $k=p_0$ by Boyle's Law, and therefore $c=\sqrt{(p_0/\rho_0)}$. This result, which is due substantially to Sir I. Newton, gives, however, a value considerably below the true velocity of sound. The discrepancy was explained by P. S. Laplace (about 1806?). The temperature is not really constant, but rises and falls as the gas is alternately compressed and rarefied. When this is allowed for we have $k=\gamma p_0$, where γ is the ratio of the two specific heats of the gas, and therefore $c=\sqrt{(\gamma p_0/\rho_0)}$. For air, $\gamma=1{\cdot}41$, and the consequent value of c agrees well with the best direct determinations (332 metres per second at 0° C.).

The potential energy of a system of sound waves is $\frac{1}{2}ks^2$ per unit volume. As in all cases of propagation in one dimension, the energy of a single progressive system is half kinetic and half potential.

In the case of an unlimited isotropic elastic solid medium two types of plane waves are possible, viz. the displacement may be normal or tangential to the wave-fronts. The axis of x being taken in the direction of propagation, then in the case of a normal displacement ξ the traction normal to the wave-front is $(\lambda+2\mu)\partial\xi/\partial x$, where λ, μ are the elastic constants of the medium, viz. μ is the "rigidity," and $\lambda=k-\frac{2}{3}\mu$, where k is the cubic elasticity. This leads to the equation

$$\xi=a^2\xi'', \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

where

$$a=\sqrt{\{(\lambda+2\mu)/\rho\}}=\sqrt{\{(k+\tfrac{4}{3}\mu)/\rho\}}. \quad . \quad . \quad (15)$$

The wave-velocity is greater than in the case of the longitudinal vibrations of a rod, owing to the lateral yielding which takes place in the latter case. In the case of a displacement η parallel to the axis of y, and therefore tangential to the wave-fronts, we have a shearing strain $\partial\eta/\partial x$, and a corresponding shearing stress $\mu\partial\eta/\partial x$. This leads to

$$\ddot{\eta}=b^2\eta'' \quad . \quad . \quad . \quad . \quad . \quad (16)$$

with

$$b=\sqrt{(\mu/\rho)}. \quad . \quad . \quad . \quad . \quad . \quad (17)$$

In the case of steel ($k=1{\cdot}841 \,.\, 10^{12}$, $\mu=8{\cdot}19 \,.\, 10^{11}$, $\rho=7{\cdot}849$ C.G.S.) the wave-velocities a, b come out to be 6·1 and 3·2 kilometres per second, respectively.

If the medium be crystalline the velocity of propagation of plane waves will depend also on the aspect of the wave-front. For any given direction of the wave-normal there are in the most general case three distinct velocities of wave-propagation, each with its own direction of particle-vibration. These latter directions are perpendicular to each other, but in general oblique to the wave-front. For certain types of crystalline structure the results simplify, but it is unnecessary to enter into further details, as the matter is chiefly of interest in relation to the now abandoned elastic-solid theories of double-refraction. For the modern electric theory of light see LIGHT, and ELECTRIC WAVES.

Finally, it may be noticed that the conditions of wave-propagation without change of type may be investigated in another manner. If we impress on the whole medium a velocity equal and opposite to that of the wave we obtain a "steady" or "stationary" state in which the circumstances at any particular point of space are constant. Thus in the case of the vibrations of an inextensible string we may, in the first instance, imagine the string to run through a fixed smooth tube having the form of the wave. The velocity c being constant there is no tangential acceleration, and the tension P is accordingly uniform. The resultant of the tensions on the two ends of an element δs is $P\delta s/R$, in the direction of the normal, where R denotes the radius of curvature. This will be exactly sufficient to produce the normal acceleration c^2/R in the mass $\rho\delta s$, provided $c^2=P/\rho$. Under this condition the tube, which now exerts no pressure on the string, may be abolished, and we have a free stationary wave on a moving string. This argument is due to P. G. Tait.

The method was applied to the case of air-waves by W. J. M. Rankine in 1870. When a gas flows steadily through a straight tube of unit section, the mass m which crosses any section in unit time must be the same; hence if u be the velocity we have

$$\rho u=m. \quad . \quad . \quad . \quad . \quad . \quad . \quad (18)$$

Again, the mass which at time t occupies the space between two fixed sections (which we will distinguish by suffixes) has its momentum increased in the time δt by $(mu_2-mu_2)\,\delta t$, whence

$$p_1-p_2=m(u_2-u_1). \quad . \quad . \quad . \quad . \quad (19)$$

Combined with (18) this gives

$$p_1+m^2/\rho_1=p_2+m^2/\rho_2. \quad . \quad . \quad . \quad . \quad (20)$$

Hence for absolutely steady motion it is essential that the expression $p+m^2/\rho$ should have the same value throughout the wave. This condition is not accurately fulfilled by any known substance, whether subject to the "isothermal" or "adiabatic" condition; but in the case of *small* variations of pressure and density the relation is equivalent to

$$m^2=\rho^2dp/d\rho, \quad . \quad . \quad . \quad . \quad . \quad (21)$$

and therefore by (18), if c denote the general velocity of the current,

$$c^2=dp/d\rho=k/\rho, \quad . \quad . \quad . \quad . \quad (22)$$

in agreement with (13). The fact that the condition (20) can only be satisfied approximately shows that some progressive change of type must inevitably take place in sound-waves of finite amplitude. This question has been examined by S. D. Poisson (1807), Sir G. G. Stokes (1848), B. Riemann (1858), S. Earnshaw (1858), W. J. M. Rankine (1870), Lord Rayleigh (1878) and others. It appears that the more condensed portions of the wave gain continually on the less condensed, the tendency being apparently towards the production of a discontinuity, somewhat analogous to a "bore" in water-waves. Before this stage can be reached, however, dissipative forces (so far ignored), such as viscosity and thermal conduction, come into play. In practical acoustics the results are also modified by the diminution of amplitude due to spherical divergence.

§ 2. *Wave-Propagation in General.*

We have next to consider the processes of wave-propagation in two or three dimensions. The simplest case is that of air-waves. When terms of the second order in the velocities are neglected, the dynamical equations are

$$\rho_0\frac{\partial u}{\partial t}=-\frac{\partial p}{\partial x},\ \rho_0\frac{\partial v}{\partial t}=-\frac{\partial p}{\partial y},\ \rho_0\frac{\partial w}{\partial t}=-\frac{\partial p}{\partial z};\quad . \quad . \quad (1)$$

and the "equation of continuity" (see HYDROMECHANICS) is

$$\frac{\partial\rho}{\partial t}+\rho_0\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}\right)=0.\quad . \quad . \quad . \quad (2)$$

If we write $\rho=\rho_0(1+s)$, $p=p_0+ks$, these may be written

$$\frac{\partial u}{\partial t}=-c^2\frac{\partial s}{\partial x},\ \frac{\partial v}{\partial t}=-c^2\frac{\partial s}{\partial y},\ \frac{\partial w}{\partial t}=-c^2\frac{\partial s}{\partial z},\quad . \quad . \quad (3)$$

where c is given by § 1 (13), and

$$\frac{\partial s}{\partial t}=-\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}\right),\quad . \quad . \quad . \quad (4)$$

the latter equation expressing that the condensation s is diminishing at a rate equal to the "divergence" of the vector (u, v, w) (see VECTOR ANALYSIS). Eliminating u, v, w, we obtain

$$\frac{\partial^2 s}{\partial t^2}=c^2\nabla^2 s\quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

where ∇^2 stands for Laplace's operator $\partial^2/\partial x^2+\partial^2/\partial y^2+\partial^2/\partial z^2$. This, the general equation of sound-waves, appears to be due to L. Euler (1759). In the particular case where the disturbance is symmetrical with respect to a centre O, it takes the simpler form

$$\frac{\partial^2(rs)}{\partial t^2}=c^2\frac{\partial^2(rs)}{\partial r^2},\quad . \quad . \quad . \quad . \quad . \quad (6)$$

where r denotes distance from O. It is easily deduced from (1) that in the case of a medium initially at rest the velocity (u, v, w) is now wholly radial. The solution of (6) is

$$s=\frac{f(ct-r)}{r}+\frac{F(ct+r)}{r},\quad . \quad . \quad . \quad . \quad (7)$$

This represents two spherical waves travelling outwards and inwards, respectively, with the velocity c, but there is now a progressive change of amplitude. Thus in the case of the diverging wave represented by the first term, the condensation in any particular part of the wave continually diminishes as $1/r$ as the wave spreads. The potential energy per unit volume [§ 1 (5)] varies as s^2, and so diminishes in inverse proportion to the square of the distance from O. It may be shown that as in the case of plane waves the total energy of a diverging (or a converging) wave is half potential and half kinetic.

The solution of the general equation (5), first given by S. D. Poisson in 1819, expresses the value of s at any given point P at time t, in terms of the mean values of s and $\dot{s}$ at the instant $t=0$ over a spherical surface of radius ct described with P as centre, viz.

$$s_P=\frac{t}{4\pi}\iint F(ct)\,d\omega+\frac{d}{dt}\left[\frac{t}{4\pi}\iint f(ct)\,d\omega\right],\quad . \quad . \quad (8)$$

where the integrations extend over the surface of the aforesaid sphere, $d\omega$ is the solid angle subtended at P by an element of its surface, and $f(ct)$, $F(ct)$ respectively denote the original values of s and $\dot{s}$ at the position of the element. Hence, if the disturbance be originally confined to a limited region, the agitation at any point P external to this region will begin after a time r_1/c and will cease after a time r_2/c, where r_1, r_2 are the least and greatest distances of P from the boundary of the region in question. The region occupied by the disturbance at any instant t is therefore delimited by the envelope of a family of spheres of radius ct described with the points of the original boundary as centres.

One remarkable point about waves diverging in three dimensions remains to be noticed. It easily appears from (3) that the value of the integral $\int s\,dt$ at any point P, taken over the whole time of transit of a wave, is independent of the position of P, and therefore equal to zero, as is seen by taking P at an infinite distance from the original seat of disturbance. This shows that a diverging wave necessarily contains both condensed and rarefied portions. If initially we have zero velocity everywhere, but a uniform condensation s_0 throughout a spherical space of radius a, it is found that we have ultimately a diverging wave in the form of a spherical shell of thickness $2a$, and that the value of s within this shell varies from $\frac{1}{2}s_0 a/r$ at the anterior face to $-\frac{1}{2}s_0 a/r$ at the interior face, r denoting the mean radius of the shell.

The process of wave-propagation in *two* dimensions offers some peculiarities which are exemplified in cylindrical waves of sound, in waves on a uniform tense plane membrane, and in annular waves on a horizontal sheet of water of (relatively) small depth. The equation of motion is in all these cases of the form

$$\frac{\partial^2 s}{\partial t^2}=c^2\nabla_1{}^2 s,\quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

where $\nabla_1{}^2=\partial^2/\partial x^2+\partial^2/\partial y^2$. In the case of the membrane s denotes the displacement normal to its plane; in the application to water-waves it represents the elevation of the surface above the undisturbed level. The solution of (9), even in the case of symmetry about the origin, is analytically much less simple than that of (6). It appears that the wave due to a transient local disturbance, even of the simplest type, is now not sharply defined in the rear, as it is in the front, but has an indefinitely prolonged "tail." This is illustrated by the annexed figures which represent graphically the time-variations in the condensation s at a particular point, as a wave originating in a local condensation passes over this point. The curve A represents (in a typical case) the effect of a plane wave, B that of a cylindrical wave, and C that of a spherical wave. The changes of type from A to B and from B to C are accounted for by the increasing degree of mobility of the medium.

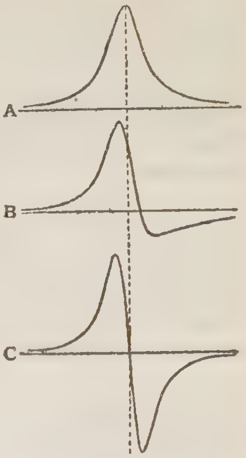

FIG. 1.[1]

The equations governing the displacements u, v, w of a uniform isotropic elastic solid medium are

$$\left.\begin{aligned}\rho\frac{\partial^2 u}{\partial t^2}&=(\lambda+\mu)\frac{\partial\Delta}{\partial x}+\mu\nabla^2 u,\\ \rho\frac{\partial^2 v}{\partial t^2}&=(\lambda+\mu)\frac{\partial\Delta}{\partial y}+\mu\nabla^2 v,\\ \rho\frac{\partial^2 w}{\partial t^2}&=(\lambda+\mu)\frac{\partial\Delta}{\partial z}+\mu\nabla^2 w,\end{aligned}\right\}\quad . \quad . \quad . \quad . \quad (10)$$

where

$$\Delta=\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}\quad . \quad . \quad . \quad . \quad . \quad (11)$$

From these we derive by differentiation

$$\frac{\partial^2\Delta}{\partial t^2}=a^2\nabla^2\Delta,\quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

$$\frac{\partial^2\xi}{\partial t^2}=b^2\nabla^2\xi,\ \frac{\partial^2\eta}{\partial t^2}=b^2\nabla^2\eta,\ \frac{\partial^2\zeta}{\partial t^2}=b^2\nabla^2\zeta,\quad . \quad . \quad (13)$$

where

$$\xi,\ \eta,\ \zeta=\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z},\ \frac{\partial u}{\partial z}-\frac{\partial w}{\partial x},\ \frac{\partial v}{\partial x}-\frac{\partial u}{\partial y},\quad . \quad . \quad (14)$$

and

$$a^2=(\lambda+2\mu)/\rho,\ b^2=\mu/\rho,\quad . \quad . \quad . \quad (15)$$

as in § 1. It appears then that the "dilatation" Δ and the "rotations" ξ, η, ζ are propagated with the velocities a, b, respectively. By formulae analogous to (8) we can calculate the values of Δ, ξ, η, ζ at any instant in terms of the initial conditions. The subsequent determination of u, v, w is a merely analytical problem into which we do not enter; it is clear, however, that if the original disturbance be confined to a limited region we have ultimately two concentric spherical diverging waves. In the outer one of these, which travels with the velocity a, the rotations ξ, η, ζ vanish, and the wave is accordingly described as "irrotational," or "condensational." In the inner wave, which travels with the smaller velocity b, the dilatation Δ vanishes, and the wave is therefore characterized as "equivoluminal" or "distortional." In the former wave the directions of vibration of the particles tend to become normal, and in the latter tangential, to the wave-front, as in the case of plane elastic waves (§ 1).

The problems of reflection and transmission which arise when a wave encounters the boundary of an elastic-solid medium, or the interface of two such media, are of interest chiefly in relation to the older theories of optics. It may, however, be worth while to remark that an irrotational or an equivoluminal wave does not in general give rise to a reflected (or transmitted) wave of single character; thus an equivoluminal wave gives rise to an irrotational as well as an equivoluminal reflected wave, and so on.

Finally, in a limited elastic solid we may also have systems of waves of a different type. These travel *over the surface* with a definite velocity somewhat less than that of the equivoluminal waves above referred to; thus in an incompressible solid the velocity is $\cdot 9554b$; in a solid such that $\lambda=\mu$ it is $\cdot 9194b$. The agitation due to these waves is confined to the immediate neighbourhood of the surface, diminishing exponentially with increasing depth. The theory of these surface waves was given by Lord Rayleigh in 1885. In the modern theory of earthquakes three phases of the disturbance at a station distant from the origin are recognized; the first corresponds to the arrival of condensational waves, the second to that of distortional waves, and the third to that of the Rayleigh waves (see ELASTICITY).

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[1] Figures 1, 2, 4, 6, 7 and 8 are from Professor Horace Lamb's *Hydrodynamics*, by permission of the Cambridge University Press.

The theory of waves diverging from a centre in an unlimited *crystalline* medium has been investigated with a view to optical theory by G. Green (1839), A. L. Cauchy (1830), E. B. Christoffel (1877) and others. The surface which represents the wave-front consists of three sheets, each of which is propagated with its own special velocity. It is hardly worth while to attempt an account here of the singularities of this surface, or of the simplifications which occur for various types of crystalline symmetry, as the subject has lost much of its physical interest now that the elastic-solid theory of light is practically abandoned.

§ 3. *Water-Waves. Theory of "Long" Waves.*

The simplest type of water-waves is that in which the motion of the particles is mainly horizontal, and therefore (as will appear) sensibly the same for all particles in a vertical line. The most conspicuous example is that of the forced oscillations produced by the action of the sun and moon on the waters of the ocean, and it has therefore been proposed to designate by the term "tidal" all cases of wave-motion, whatever their scale, which have the above characteristic property.

Beginning with motion in two dimensions, let us suppose that the axis of x is drawn horizontally, and that of y vertically upwards. If we neglect the vertical acceleration, the pressure at any point will have the statical value due to the depth below the instantaneous position of the free surface, and the horizontal pressure-gradient $\partial p/\partial x$ will therefore be independent of y. It follows that all particles which at any instant lie in a plane perpendicular to Ox will retain this relative configuration throughout the motion. The equation of horizontal motion, on the hypothesis that the velocity (u) is infinitely small, will be

$$\rho\frac{\partial u}{\partial t}=-\frac{\partial p}{\partial x}=-g\rho\frac{\partial \eta}{\partial x}, \quad \text{(1)}$$

where η denotes the surface-elevation at the point x. Again, the equation of continuity, viz.,

$$\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}=0, \quad \text{(2)}$$

gives

$$v=-\int_0^y\frac{\partial u}{\partial x}dy=-y\frac{\partial u}{\partial x}, \quad \text{(3)}$$

if the origin be taken at the bottom, the depth being assumed to be uniform. At the surface we have $y=h+\eta$, and $v=\partial n/\partial t$, subject to an error of the second order in the disturbance. To this degree of approximation we have then

$$\frac{\partial \eta}{\partial t}=-h\frac{\partial \eta}{\partial x}. \quad \text{(4)}$$

If we eliminate u between (1) and (4) we obtain

$$\frac{\partial^2 \eta}{\partial t^2}=c^2\frac{\partial^2 \eta}{\partial x^2}, \quad \text{(5)}$$

with

$$c^2=gh. \quad \text{(6)}$$

The solution is as in § 1, and represents two wave-systems travelling with the constant velocity $\sqrt{(gh)}$, which is that which would be acquired by a particle falling freely through a space equal to half the depth.

Two distinct assumptions have been made in the foregoing investigation. The meaning of these is most easily understood if we consider the case of a simple-harmonic train of waves in which

$$\eta=\beta\cos k(ct-x),\ u=\frac{g\beta}{c}\cos k(ct-x), \quad \text{(7)}$$

where k is a constant such that $2\pi/k$ is the wave-length λ. The first assumption, viz. that the vertical acceleration may be neglected in comparison with the horizontal, is fulfilled if kh be small, *i.e.* if the wave-length be large compared with the depth. It is in this sense that the theory is regarded as applicable only to "long" waves. The second assumption, which neglects terms of the second order in forming the equation (1), implies that the ratio η/h of the surface-elevation to the depth of the fluid must be small. The formulae (7) indicate also that in a progressive wave a particle moves forwards or backwards according as the water-surface above it is elevated or depressed relatively to the mean level. It may also be proved that the expressions

$$\mathrm{T}=\tfrac{1}{2}\rho h\int u^2dx,\ \mathrm{V}=\tfrac{1}{2}g\rho\int\eta^2dx, \quad \text{(8)}$$

for the kinetic and potential energies per unit breadth are equal in the case of a progressive wave.

It will be noticed that there is a very close correspondence between the theory of "long" water-waves and that of plane waves of sound, *e.g.* the ratio η/h corresponds exactly to the "condensation" in the case of air-waves. The theory can be adapted, with very slight adjustment, to the case of waves propagated along a canal of *any* uniform section, provided the breadth, as well as the depth, be small compared with the wave-length. The principal change is that in (6) h must be understood to denote the *mean* depth. The theory was further extended by G. Green (1837) and by Lord Rayleigh to the case where the dimensions of the cross-section are variable. If the variation be sufficiently gradual there is no sensible reflection, a progressive wave travelling always with the velocity appropriate to the local mean depth. There is, however, a variation of amplitude; the constancy of the energy, combined with the equation of continuity, require that the elevation η in any particular part of the wave should vary as $b^{-\frac{1}{2}}h^{-\frac{1}{4}}$, where b is the breadth of the water surface and h is the mean depth.

Owing to its mathematical simplicity the theory of long waves in canals has been largely used to illustrate the dynamical theory of the tides. In the case of forced waves in a uniform canal, the equation (1) is replaced by

$$\frac{\partial u}{\partial t}=-g\frac{\partial \eta}{\partial x}+\mathrm{X}, \quad \text{(9)}$$

where X represents the extraneous force. In the case of an equatorial canal surrounding the earth, the disturbing action of the moon, supposed (for simplicity) to revolve in a circular orbit in the plane of the equator, is represented by

$$\mathrm{X}=-\frac{g\mathrm{H}}{a}\sin 2\left(\sigma t+\frac{x}{a}+\epsilon\right), \quad \text{(10)}$$

where a is the earth's radius, H is the total range of the tide on the "equilibrium theory," and σ is the angular velocity of the moon relative to the rotating earth. The corresponding solution of the equations (4) and (9) is

$$\left.\begin{aligned}\frac{\eta}{\mathrm{H}}&=\tfrac{1}{2}\frac{c^2}{c^2-\sigma^2a^2}\cos 2\left(\sigma t+\frac{x}{a}+\epsilon\right);\\ u&=-\tfrac{1}{2}\frac{g\mathrm{H}\sigma a}{c^2-\sigma^2a^2}\cos 2\left(\sigma t+\frac{x}{a}+\epsilon\right).\end{aligned}\right\} \quad \text{(11)}$$

The coefficient in the former of these equations is negative unless the ratio h/a exceed σ^2a/g, which is about 1/311. Hence unless the depth of our imagined canal be much greater than such depths as are actually met with in the sea the tides in it would be *inverted*, *i.e.* there would be *low* water beneath the moon and at the antipodal point, and high water on the meridian distant 90° from the moon. This is an instance of a familiar result in the theory of vibrations, viz. that in a forced oscillation of a body under a periodic force the phase is opposite to that of the force if the imposed frequency exceed that of the corresponding free vibration (see MECHANICS). In the present case the period of the free oscillation in an equatorial canal 11,250 ft. deep would be about 30 hours.

When the ratio η/h of the elevation to the depth is no longer treated as infinitely small, it is found that a progressive wave-system must undergo a continual change of type as it proceeds, even in a uniform canal. It was shown by Sir G. B. Airy (1845) that the more elevated portions of the wave travel with the greater velocities, the expression for the velocity of propagation being

$$c(1+\tfrac{3}{2}\eta/h)$$

approximately. Hence the slopes will become continually steeper in front and more gradual behind, until a stage is reached at which the vertical acceleration is no longer negligible, and the theory ceases to apply. The process is exemplified by sea-waves running inwards in shallow water near the shore. The theory of forced periodic waves of finite (as distinguished from infinitely small) amplitude was also discussed by Airy. It has an application in tidal theory, in the explanation of "overtides" and "compound tides" (see TIDE).

§ 4. *Surface-Waves.*

This is the most familiar type of water-waves, but the theory is not altogether elementary. We will suppose in the first instance that the motion is in two dimensions x, y, horizontal and vertical respectively. The velocity-potential (see HYDROMECHANICS) must satisfy the equation

$$\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}=0, \quad \text{(1)}$$

and must make $\partial\phi/\partial y=0$ at the bottom, which is supposed to be plane and horizontal. The pressure-equation is, if we neglect the square of the velocity,

$$\frac{p}{\rho}=\frac{\partial\phi}{\partial t}-gy+\text{const.} \quad \text{(2)}$$

Hence, if the origin be taken in the undisturbed surface, we may write, for the surface-elevation,

$$\eta=\frac{1}{g}\left[\frac{\partial\phi}{\partial t}\right]_{y=0} \quad \text{(3)}$$

with the same approximation. We have also the geometrical condition

$$\frac{\partial\eta}{\partial t}=-\left[\frac{\partial\phi}{\partial y}\right]_{y=0}. \quad \text{(4)}$$

The general solution of these equations is somewhat complicated, and it is therefore usual to fix attention in the first place on the case of an infinitely extended wave-system of simple-harmonic profile, say

$$\eta=\beta \sin k(x-ct). \quad . \quad . \quad . \quad . \quad . \quad (5)$$

The corresponding value of ϕ is

$$\phi=\frac{g\beta}{kc}\frac{\cos h\, k(y+h)}{\cos h\, kh}\cos k(x-ct), \quad . \quad . \quad . \quad (6)$$

where h denotes the depth; it is in fact easily verified that this satisfies (1), and makes $\partial\phi/\partial y=0$, for $y=-h$, and that it fulfils the pressure-condition (3) at the free surface. The kinematic condition (4) will also be satisfied, provided

$$c^2=\frac{g}{k}\tan h\, kh=\frac{g\lambda}{2\pi}\tan h\frac{2\pi h}{\lambda}, \quad . \quad . \quad . \quad . \quad (7)$$

λ denoting the wave-length $2\pi/k$. It appears, on calculating the component velocities from (6), that the motion of each particle is elliptic-harmonic, the semi-axes of the orbit, horizontal and vertical, being

$$\beta\frac{\cos h\, k(y+h)}{\sin h\, kh},\ \beta\frac{\sin h\, k(y+h)}{\sin h\, kh}, \quad . \quad . \quad . \quad . \quad (8)$$

where y refers to the mean level of the particle. The dimensions of the orbits diminish from the surface downwards. The direction of motion of a surface-particle is forwards when it coincides with a crest, and backwards when it coincides with a trough, of the waves.

When the wave-length is anything less than double the depth we have $\tan h\, kh=1$, practically, and the formula (6) reduces to

$$\phi=\frac{g\beta}{kc}e^{ky}\cos k(x-ct) \quad . \quad . \quad . \quad . \quad . \quad (9)$$

with

$$c^2=\frac{g}{k}=\frac{g\lambda}{2\pi}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

the same as if the depth were infinite. The orbits of the particles are now circles of radii βe^{ky}. When, on the other hand, λ is moderately large compared with h, we have $\tan h\, kh=kh$, and $c=\sqrt{(gh)}$, in agreement with the preceding theory of "long" waves. These results date from G. Green (1839) and Sir G. B. Airy (1845).

The energy of our simple-harmonic wave-train is, as usual, half kinetic and half potential, the total amount per unit area of the free surface being $\frac{1}{2}g\rho\beta^2$. This is equal to the work which would be required to raise a stratum of fluid, of thickness equal to the surface-amplitude β, through a height $\frac{1}{2}\beta$.

It has been assumed so far that the upper surface is free, the pressure there being uniform. We might also consider the case of waves on the common surface of two liquids of different densities. For wave-lengths which are less than double the depth of either liquid the formula (10) is replaced by

$$c^2=\frac{g\lambda}{2\pi}\cdot\frac{\rho-\rho'}{\rho+\rho'}, \quad . \quad . \quad . \quad . \quad . \quad (11)$$

where ρ, ρ' are the densities of the lower and upper fluids respectively. The diminution in the wave-velocity c has, as the formula indicates, a twofold cause; the potential energy of a given deformation of the common surface is diminished by the presence of the upper fluid in the ratio $(\rho-\rho')/\rho$, whilst the inertia is increased in the ratio $(\rho+\rho')/\rho$. When the two densities are very nearly equal the waves have little energy, and the oscillations of the common surface are very slow. This is easily observed in the case of paraffin oil over water.

To examine the progress, over the surface of deep water, of a disturbance whose initial character is given quite arbitrarily it would be necessary to resolve it by Fourier's theorem into systems of simple-harmonic trains. Since each of these is propagated with the velocity proper to its own wave-length, as given by (10), the resulting wave-profile will continually alter its shape. The case of an initial local impulse has been studied in detail by S. D. Poisson (1816), A. Cauchy (1815) and others. At any subsequent instant the surface is occupied on either side by a train of waves of varying height and length, the wave-length increasing, and the height diminishing, with increasing distance (x) from the origin of the disturbance. The longer waves travel faster than the shorter, so that each wave is continually being drawn out in length, and its velocity of propagation therefore continually increases as it advances. If we fix our attention on a particular point of the surface, the level there will rise and fall with increasing rapidity and increasing amplitude. These statements are all involved in Poisson's approximate formula

$$\eta\propto\frac{t^2}{x^{\frac{5}{2}}}\left(\cos\frac{gt^2}{4x}-\sin\frac{gt^2}{4x}\right), \quad . \quad . \quad . \quad . \quad (12)$$

which, however, is only valid under the condition that x is large compared with $\frac{1}{2}gt^2$. This shows moreover that the occurrence of a particular wave-length λ is conditioned by the relation

$$\frac{x}{t}=\frac{1}{2}\sqrt{\frac{g\lambda}{2\pi}}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

The foregoing description applies in the first instance only to the case of an initial impulse concentrated upon an infinitely narrow band of the surface. The corresponding results for the more practical case of a band of finite breadth are to be inferred by superposition. The initial stages of the disturbance at a distance x, which is large compared with the breadth b of the band, will have the same character as before, but when, owing to the continual diminution of the length of the waves emitted, λ becomes comparable with or smaller than b, the parts of the disturbance which are due to the various parts of the band will no longer be approximately in the same phase, and we have a case of "interference" in the optical sense. The result is in general that in the final stages the surface will be marked by a series of groups of waves of diminishing amplitude separated by bands of comparatively smooth water.

The fact that the wave-velocity of a simple-harmonic train varies with the wave-length has an analogy in optics, in the propagation of light in a dispersive medium. In both cases we have a contrast with the simpler phenomena of waves on a tense string or of light-waves *in vacuo*, and the notion of "group-velocity," as distinguished from wave-velocity, comes to be important. If in the above analysis of the disturbance due to a local impulse we denote by U the velocity with which the locus of any particular wave-lengths λ travels, we see from (13) that $U=\frac{1}{2}c$. The actual fact that when a limited group of waves of approximately equal wave-length travels over relatively deep water the velocity of advance of the group as a whole is less than that of the individual waves composing it seems to have been first explicitly remarked by J. Scott Russell (1844). If attention is concentrated on a particular wave, this is seen to progress through the group, gradually dying out as it approaches the front, whilst its former place in the group is occupied in succession by other waves which have come forward from the rear. General explanations, not restricted to the case of water-waves, have been given by Stokes, Rayleigh, and others. If the wave-length λ be regarded as a function of x and t, we have

$$\frac{\partial\lambda}{\partial t}+U\frac{\partial\lambda}{\partial x}=0, \quad . \quad . \quad . \quad . \quad . \quad . \quad (14)$$

since λ does not vary in the neighbourhood of a geometrical point travelling with velocity U, this being in fact the definition of U. Again, if we imagine a second geometrical point to move with the *waves*, we have

$$\frac{\partial\lambda}{\partial t}+c\frac{\partial\lambda}{\partial x}=\frac{\partial c}{\partial x}\lambda=\lambda\frac{dc}{d\lambda}\cdot\frac{\partial\lambda}{\partial x}, \quad . \quad . \quad . \quad . \quad (15)$$

the second member expressing the rate at which two consecutive wave-crests are separating from one another. Comparing (14) and (15), we have

$$U=c-\lambda\frac{dc}{d\lambda}. \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

If a curve be constructed with λ as abscissa and c as ordinate, the group-velocity U will be represented by the intercept made by the tangent on the axis of c. This is illustrated by the annexed figure, which refers to the case of deep-water waves; the curve is a parabola, and the intercept is half the ordinate, in accordance with the relation $U=\frac{1}{2}c$, already remarked. The physical importance of the motion of group-velocity was pointed out by O. Reynolds (1877), who showed that the rate at which energy is propagated is only half that which would be required for the transport of the group as a whole with the velocity c.

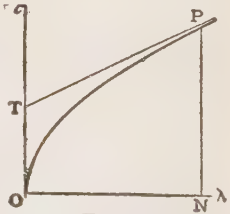


FIG. 2.

The preceding investigations enable us to infer the effect of a pressure-disturbance travelling over the surface of still water with, say, a constant velocity c in the direction of x-negative. The abnormal pressure being supposed concentrated on an infinitely narrow band of the surface, the elevation η at any point P may be regarded as due to a succession of infinitely small impulses delivered over bands of the surface at equal infinitely short intervals of time on equidistant lines parallel to the (horizontal) axis of z. Of the wave-systems thus successively generated, those only will combine to produce a sensible effect at P which had their origin in the neighbourhood of a line Q whose position is determined by the consideration that the phase at P is "stationary" for variations in the position of Q. Now if t be the time which the source of disturbance has taken to travel from Q to its actual position O, it appears from (12) that the phase of the waves at P, originated at Q, is $gt^2/4x+\frac{1}{4}\pi$, where $x=$QP. The condition for stationary phase is therefore

$$\dot{x}=2x/t. \quad . \quad . \quad (17)$$

In this differentiation, O and P are to be regarded as fixed; hence $\dot{x}=c$, and therefore $OQ=ct=2PQ$. We have already seen that the wave-length at P is such that $PQ=Ut$, where U is the corresponding group-velocity. Hence the

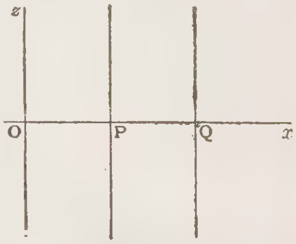


FIG. 3.

wave-length λ at points to the right of O is uniform, being that proper to a wave-velocity c, viz. $\lambda = 2\pi c^2/g$. The disturbance is therefore followed by a train of waves of approximately simple-harmonic profile, of the length indicated. An approximate calculation shows that, except in the immediate neighbourhood of the source of disturbance, the surface-elevation is given by

$$\eta = \frac{2P_0}{pc^2}\sin\frac{gx}{c^2}, \quad . \quad . \quad . \quad . \qquad (18)$$

where x is now measured from O, and $P_0 (= \int p\,dx)$ represents the integral of the disturbing surface pressure over the (infinitely small) breadth of the band on which it acts. The case of a diffused pressure can be inferred by integration. The annexed figure gives a representation of a particular case, obtained by a more exact process. The pressure is here supposed uniformly distributed over a band of breadth AB.

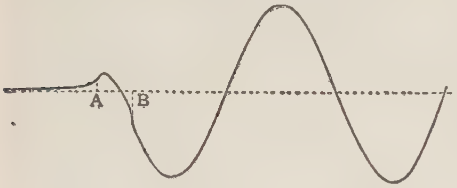


FIG. 4.

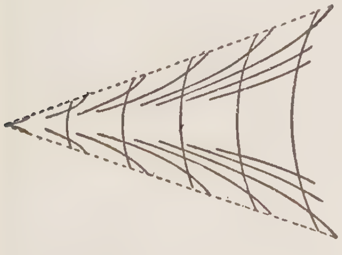
A similar argument can be applied to the case of finite depth (h), but since the wave-velocity cannot exceed $\sqrt{(2gh)}$ the results are modified if the velocity c of the travelling pressure exceeds this limit. There is then no train of waves generated, the disturbance of level being purely local. It hardly needs stating that the investigation applies also to the case of a stationary surface disturbance on a running stream, and that similar results follow when the disturbance consists in an equality of the bottom. In both cases we have a train of standing waves on the down-stream side, of length corresponding to a wave-velocity equal to that of the stream.

The effect of a disturbance confined to the neighbourhood of a *point* of the surface (of deep water) was also included in the investigations of Cauchy and Poisson already referred to. The formula analogous to (12), in the case of a local impulse, is

$$\zeta \propto \frac{t^3}{r^4}\sin\frac{gt^2}{4r}, \quad . \quad . \quad . \quad . \qquad (19)$$

where r denotes distance from the source. The interpretation is similar to that of the two-dimensional case, except that the amplitude of the annular waves diminishes outwards, as was to be expected, in a higher ratio.

The effect of a pressure-point travelling in a straight line over the surface of deep water is interesting, as helping us to account in some degree for the peculiar system of waves which is seen to accompany a ship. The configuration of the wave-system is shown by means of the lines of equal phase in the annexed diagram, due to V. W. Ekman (1906), which differs from the drawing originally given by Lord Kelvin (1887) in that it indicates the difference of phase between the transverse and diverging waves at the common boundary of the two series. The two systems of waves are due to the fact that at any given instant there are *two* previous positions of the moving pressure-point which have transmitted vibrations of stationary phase to any given point P within the range of the figure. When the depth is finite the configuration is modified, and if it be less than c^2/g, where c is the velocity of the disturbance, the transversal waves disappear.



After V. Walfrid Ekman, *On Stationary Waves in Running Water.*

FIG. 5.

The investigations referred to have a bearing on the wave-resistance of ships. This is accounted for by the energy of the new wave-groups which are continually being started and left behind. Some experiments on torpedo boats moving in shallow water have indicated a falling off in resistance due to the absence of transversal waves just referred to. For the effect of surface-tension and the theory of "ripples" see CAPILLARY ACTION.

§ 5. *Surface-Waves of Finite Height.*

The foregoing results are based on the assumption that the amplitude may be treated as infinitely small. Various interesting investigations have been made in which this restriction is, more or less, abandoned, but we are far from possessing a complete theory.

A system of exact equations giving a possible type of wave-motion on deep water was obtained by F. J. v. Gerstner in 1802, and rediscovered by W. J. M. Rankine in 1863. The orbits of the particles, in this type, are accurately circular, being defined by the equations

$$x = a + k^{-1}e^{kb}\sin k(a-ct),\ y = b - k^{-1}e^{kb}\cos k(a-ct), \quad . \qquad (1)$$

where (a, b) is the mean position of the particle, $k = 2\pi/\lambda$; and the wave-velocity is

$$c = \sqrt{(g/k)} = \sqrt{(g\lambda/2\pi)}. \quad . \quad . \quad . \quad . \qquad (2)$$

The lines of equal pressure, among which is included of course the surface-profile, are trochoidal curves. The extreme form of wave-profile is the cycloid, with the cusps turned upwards. The mathematical elegance and simplicity of the formulae (1) are unfortunately counterbalanced by the fact that the consequent motion of the fluid elements proves to be "rotational" (see HYDROMECHANICS), and therefore not such as could be generated in a previously quiescent liquid by any system of forces applied to the surface.

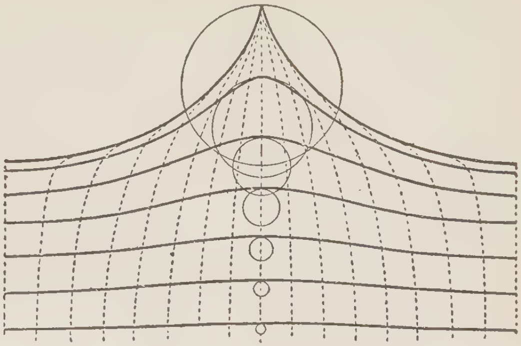


FIG. 6.

Sir G. Stokes, in a series of papers, applied himself to the determination of the possible "irrotational" wave-forms of finite height which satisfy the conditions of uniform propagation without change of type. The equation of the profile, in the case of infinite depth, is obtained in the form of a Fourier series, thus

$$y = a\cos kx + \tfrac{1}{2}ka^2\cos 2kx + \tfrac{3}{8}k^2a^3\cos 3kx + \ldots, \quad . \qquad (3)$$

the corresponding wave-velocity being approximately

$$c = \sqrt{\left\{\frac{g\lambda}{2\pi}\left(1 + \frac{4\pi^2a^2}{\lambda^2}\right)\right\}}, \quad . \quad . \quad . \quad . \quad . \qquad (4)$$

where $\lambda = 2\pi/k$. The equation (3), so far as we have given the development, agrees with that of a trochoid (fig. 7). As in the case of Gerstner's waves the outline is sharper near the crests and flatter in the troughs than in the case of the simple-harmonic curve, and these features become accentuated as the ratio of the amplitude to the wave-length increases. It has been shown by Stokes that the extreme form of irrotational waves differs from that of the rotational Gerstner waves in that the crests form a blunt angle of 120°. According to the calculations of J. H. Michell (1893), the height is then about one-seventh of the wave-length, and the wave-velocity exceeds that of very low waves of the same length in the ratio 6:5. It is to be noticed further that in these waves of permanent type the motion of the water-particles is not purely oscillatory, there being on the whole a gradual drift at the surface in the direction of propagation. These various conclusions appear to agree in a general way with what is observed in the case of sea-waves.

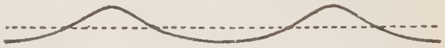


FIG. 7.

In the case of finite depth the calculations are more difficult, and we can only here notice the limiting type which is obtained when the wave-length is supposed very great compared with the depth (h). We have then practically the "solitary wave" to which attention was first directed by J. Scott Russell (1844) from observation. The theory has been worked out by J. Boussinesq (1871) and Lord Rayleigh. The surface-elevation is given by

$$\eta = a\,\mathrm{sech}^2\,\tfrac{1}{2}(x/b), \quad . \quad . \quad . \quad . \quad . \quad . \qquad (5)$$

provided

$$b^2 = h^2(h+a)/3a, \quad . \quad . \quad . \quad . \quad . \quad . \qquad (6)$$

and the velocity of propagation is

$$c = \sqrt{\{g(h+a)\}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (7)$$

In the extreme form $a = h$ and the crest forms an angle of 120°. It appears that a solitary wave of depression, of permanent type, is impossible.

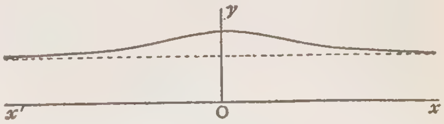


FIG. 8.

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in the following collections: G. Green, *Math. Papers* (Cambridge, 1871); H. v. Helmholtz, *Gesammelte Abhandlungen* (Leipzig, 1882–1895); Lord Rayleigh, *Scientific Papers* (Cambridge, 1899–1903); W. J. M. Rankine, *Misc. Scientific Papers* (London, 1881); Sir G. G. Stokes, *Math. and Phys. Papers* (Cambridge, 1880–1905). Numerous references to other writers will be found in the articles by P. Forchheimer ("Hydraulik"), H. Lamb ("Schwingungen elastischer Körper, insb. Akustik"), and A. E. H. Love ("Hydrodynamik") in various divisions of the fourth volume of the *Encykl. d. math. Wiss.*; and in H. Lamb's *Hydrodynamics* (3rd ed., Cambridge, 1906). (H. Lb.)

WAVELLITE, a mineral consisting of hydrated aluminium phosphate, $Al_3(OH)_3(PO_4)_2 + 4\frac{1}{2}H_2O$, crystallizing in the orthorhombic system. Distinct crystals are of rare occurrence, the mineral usually taking the form of hemispherical or globular aggregates with an internal radiated structure. It is translucent and varies in colour from grey or white to greenish, yellowish, &c. The hardness is $3\frac{1}{2}$, and the specific gravity 2·32. It was first found, at the end of the 18th century, by Dr W. Wavell near Barnstaple in Devonshire, where it lines crevices in a black slaty rock. It has also been found in Ireland (Tipperary and Cork), Arkansas, &c. (L. J. S.)

WAVERLY, a village of Tioga county, New York, U.S.A., about 18 m. S.E. of Elmira, on the Cayuta Creek, near the Chemung and the Susquehanna rivers, which unite several miles S. of the village. Pop. (1890) 4123; (1900) 4465, of whom 295 were foreign-born; (1905) 4915; (1910) 4855. It is served by the Delaware, Lackawanna & Western, the Erie and the Lehigh Valley railways. With South Waverly (pop. in 1910 1084)—separated from Waverly only by the state line and really a part of the village—Sayre, and Athens, Pennsylvania, it is connected by electric railway and the three form practically an industrial unit. Waverly is also connected by electric line with Elmira. The village is a railway centre of some importance, distributes coal from the Wyoming Valley mines, and ships the dairy products of a large farming district and small fruits and garden products. Waverly was settled about 1804 by settlers from Connecticut and the Hudson River Valley, and was incorporated as a village in 1854.

WAVRE, a town of Belgium, in the province of Brabant, 14 m. S.E. of Brussels. Pop. (1904) 8517. It was on this place that Grouchy advanced on the day of Waterloo, gaining a useless success here over a Prussian corps while the fate of the campaign was being decided elsewhere. The Prussians erected here a fine monument by Van Oemberg in 1859.

WAX, a solid fatty substance of animal and vegetable origin, allied to the fixed oils and fats. From these it is distinguished by the fact that while oils and fats are glycerides, a true wax contains no glycerin, but is a combination of fatty acids with certain solid monatomic alcohols (see Oils).

WAX FIGURES. Beeswax is possessed of properties which render it a most convenient medium for preparing figures and models, either by modelling or by casting in moulds. At ordinary temperatures it can be cut and shaped with facility; it melts to a limpid fluid at a low heat; it mixes with any colouring matter, and takes surface tints well; and its texture and consistency may be modified by the addition of earthy matters and oils or fats. When molten, it takes the minutest impressions of a mould, and it sets and hardens at such a temperature that no ordinary climatic influences affect the form it assumes, even when it is cast in thin laminae. The facilities which wax offers for modelling have been taken advantage of from the remotest times. Figures in wax of their deities were used in the funeral rites of the ancient Egyptians, and deposited among other offerings in their graves; many of these are now preserved in museums. That the Egyptians also modelled fruits can be learned from numerous allusions in early literature. Among the Greeks during their best art period, wax figures were largely used as dolls for children; statuettes of deities were modelled for votive offerings and for religious ceremonies, and wax images to which magical properties were attributed were treasured by the people. Wax figures and models held a still more important place among the ancient Romans. The masks (*effigies* or *imagines*) of ancestors, modelled in wax, were preserved by patrician families, this *jus imaginum* being one of the privileges of the nobles, and these masks were exposed to view on ceremonial occasions, and carried in their funeral processions. The closing days of the Saturnalia were known as *Sigillaria*, on account of the custom of making, towards the end of the festival, presents of wax models of fruits and waxen statuettes which were fashioned by the *Sigillarii* or manufacturers of small figures in wax and other media. The practice of wax modelling can be traced through the middle ages, when votive offerings of wax figures were made to churches, and the memory and lineaments of monarchs and great personages were preserved by means of wax masks as in the days of Roman patricians. In these ages malice and superstition found expression in the formation of wax images of hated persons, into the bodies of which long pins were thrust, in the confident expectation that thereby deadly injury would be induced to the person represented; and this belief and practice continued till the 17th century. Indeed the superstition still survives in the Highlands of Scotland, where as recently as 1885 a clay model of an enemy was found in a stream, having been placed there in the belief that, as the clay was washed away, so would the health of the hated one decline. With the renaissance of art in Italy, modelling in wax took a position of high importance, and it was practised by some of the greatest of the early masters. The bronze medallions of Pisano and the other famous medallists owe their value to the art qualities of wax models from which they were cast by the *cire perdue* process; and indeed all early bronzes and metal work were cast from wax models. The *tête de cire* in the Wicar collection at Lille is one of the most lovely examples of artistic work in this medium in existence. Wicar, one of Napoleon's commissaries, brought this figure from Italy. It represents the head and shoulders of a young girl. It has been claimed as a work of Greek or Roman art, and has been assigned to Leonardo da Vinci and to Raphael, but all that can be said is that it probably dates from the Italian Renaissance. In 1909 Dr Bode, the director of the Kaiser Friedrich Museum at Berlin, purchased in England, for (it was stated) £8000, a life-sized half-length female figure in wax, which he attributed to Leonardo da Vinci or his school. The figure was shown to have once been in the possession of Richard Cockle Lucas (1800–1883), a sculptor and worker in ivory, wax, &c. It was claimed that the figure was really Lucas's work and was a reproduction in wax of a picture of "Flora" attributed to Leonardo da Vinci, now in the possession of the Morrison family at Basildon Park, near Pangbourne; this view was repudiated by Dr Bode, but was generally accepted in England (see *The Times*, Oct.–Dec. 1909; and particularly the *Burlington Magazine*, May, June, August, 1910). Till towards the close of the 18th century modelling of medallion portraits and of relief groups, the latter frequently polychromatic, was in considerable vogue throughout Europe. About the end of the 18th century Flaxman executed in wax many portraits and other relief figures which Josiah Wedgwood translated into pottery for his jasper ware. The modelling of the soft parts of dissections, &c., for teaching illustrations of anatomy was first practised at Florence, and is now very common. Such preparations formed part of a show at Hamburg in 1721, and from that time wax-works, on a plane lower than art, have been popular attractions. These exhibitions consist principally of images of historical or notorious personages, made up of waxen masks on lay figures in which sometimes mechanism is fitted to give motion to the figure. Such an exhibition of *wax-works* with mechanical motions was shown in Germany early in the 18th century, and is described by Steele in the *Tatler*. The most famous modern wax-work exhibition is that of Madame Tussaud (*q.v.*) in London.

WAX-TREE, Wax Myrtle, Candleberry, popular names of species of *Myrica*, especially *M. cerifera*, a North American plant, the fruits of which have a waxy covering and are used as a source of vegetable wax. *M. Gale* is the native British gale (*q.v.*) or sweet-gale.

WAXWING, a bird first so called apparently by P. J. Selby in 1825 (*Illustr. Brit. Ornithology*, p. 87), having been before known as the "silk-tail" (*Philos. Transactions*, 1685, p. 1161)—a literal rendering of the German *Seidenschwanz*—or "chatterer"—the prefix "German," "Bohemian" or "waxen" being often also applied. Selby's convenient name has now been generally adopted, since the bird is readily distinguished from almost all others by the curious expansion of the shaft of some of its wing-feathers at the tip into a flake that looks like scarlet sealing-wax, while its exceedingly silent habit makes the name "chatterer" wholly inappropriate, and indeed this last arose from a misinterpretation of the specific term *garrulus*, meaning a jay (from the general resemblance in colour of the two birds), and not referring to any garrulous quality. It is the *Ampelis garrulus* of Linnaeus and of more recent ornithologists, and is the type of the Passerine family *Ampelidae*.

The waxwing is a bird that for many years excited vast interest. An irregular winter-visitant, sometimes in countless hordes, to the whole of the central and some parts of southern Europe, it was of old time looked upon as the harbinger of war, plague or death, and, while its harmonious coloration and the grace of its form were attractive, the curiosity with which its irregular appearances were regarded was enhanced by the mystery which enshrouded its birthplace, and until the summer of 1856 defied the searching of any explorer. In that year, however, all doubt was dispelled through the successful search in Lapland, organized by John Wolley, as briefly described by him to the Zoological Society (*Proceedings*, 1857, pp. 55, 56, pl. cxxii.).[1] In 1858 H. E. Dresser found a small settlement of the species on an island in the Baltic near Uleåborg, and with his own hands took a nest. It is now pretty evident that the waxwing, though doubtless breeding yearly in some parts of northern Europe, is as irregular in the choice of its summer-quarters as in that of its winter-retreats. Moreover, the species exhibits the same irregular habits in America. It has been found in Nebraska in "millions," as well as breeding on the Yukon and on the Anderson river.

Beautiful as is the bird with its full erectile crest, its cinnamon-brown plumage passing in parts into grey or chestnut, and relieved by black, white and yellow—all of the purest tint—the external feature which has invited most attention is the "sealing-wax" (already mentioned) which tips some of the secondary or radial quills, and occasionally those of the tail. This is nearly as much exhibited by the kindred species, *A. cedrorum*—the well-known cedar-bird of the English in North America—which is easily distinguished by its smaller size, less black chin-spot, the yellower tinge of the lower parts and the want of white on the wings. In the *A. phoenicopterus* of southern-eastern Siberia and Japan, the remiges and rectrices are tipped with red in the ordinary way without dilatation of the shaft of the feathers.

Both the waxwing and cedar-bird seem to live chiefly on insects in summer, but are marvellously addicted to berries during the rest of the year, and will gorge themselves if opportunity allow. They are pleasant cage-birds, quickly becoming tame. The erratic habits of the waxwing are probably due chiefly to the supplies of food it may require, prompted also by the number of mouths to be fed, for there is some reason to think that this varies greatly from one year to another, according to season. The flocks which visit Britain and other countries outside the breeding range of the species naturally contain a very large proportion of young birds. (A. N.)

WAYCROSS, a city and the county-seat of Ware county, Georgia, U.S.A., about 96 m. S.W. of Savannah and about 60 m. W. of Brunswick. Pop. (1880) 628; (1890) 3364; (1900) 5919 (2899 negroes); (1910) 14,485. Waycross is served by the Atlanta, Birmingham & Atlantic, and the Atlantic Coast Line railways, several branches of the latter intersecting here. In the city is the Bunn-Bell Institute (Baptist, opened in 1909). There are large railway car construction and repair shops here, and Waycross is a commercial centre for the forest products (naval stores and lumber) and the cotton, sugar cane, sweet potatoes, melons and pears of the surrounding country. The municipality owns the water-works, the water-supply being obtained from artesian wells. Before the passage of the state prohibition law Waycross secured virtual prohibition of the sale of intoxicating liquors by requiring a large liquor license fee ($20,000 in 1883, increased to $30,000 in 1892). Waycross was settled in 1870, was first incorporated in 1874 and became a city in 1909.

WAYLAND, FRANCIS (1796–1865), American educationist, was born in New York City on the 11th of March 1796. His father was an Englishman of the same name, who was a Baptist pastor. The son graduated at Union College in 1813 and studied medicine in Troy and in New York City, but in 1816 entered Andover Theological Seminary, where he was greatly influenced by Moses Stuart. He was too poor to conclude his course in theology, and in 1817–1821 was a tutor at Union College, to which after five years as pastor of the First Baptist Church of Boston he returned in 1826 as professor of natural philosophy. In 1827 he became president of Brown University. In the twenty-eight years of his administration he gradually built up the college, improving academic discipline, formed a library and gave scientific studies a more prominent place. He also worked for higher educational ideals outside the college, writing text-books on ethics and economics, and promoting the free school system of Rhode Island and especially (1828) of Providence. His *Thoughts on the Present Collegiate System in the United States* (1842) and his *Report to the Corporation of Brown University* of 1850 pointed the way to educational reforms, particularly the introduction of industrial courses, which were only partially adopted in his lifetime. He resigned the presidency of Brown in 1855, and in 1857–1858 was pastor of the First Baptist Church of Providence. He died on the 30th of September 1865. He was an early advocate of the temperance and anti-slavery causes, for many years was "inspector of the state prison and Providence county jail," president of the Prison Discipline Society, and active in prison reform and local charities. He was one of the "law and order" leaders during the "Dorr Rebellion" of 1842, and was called "the first citizen of Rhode Island." His son Francis (1826–1904) graduated at Brown in 1846, and studied law at Harvard; he became probate judge in Connecticut in 1864, was lieutenant-governor in 1869–1870, and in 1872 became a professor in the Yale Law School, of which he was dean from 1873 to 1903.

Besides several volumes of sermons and addresses and the volumes already mentioned, he published *Elements of Moral Science* (1835, repeatedly revised and translated into foreign languages); *Elements of Political Economy* (1837), in which he advocated free-trade; *The Limitations of Human Responsibility* (1838); *Domestic Slavery Considered as a Scriptural Institution* (1845); *Memoirs of Harriet Ware* (1850); *Memoirs of Adoniram Judson* (1853); *Elements of Intellectual Philosophy* (1854); *Notes on the Principles and Practices of Baptist Churches* (1857); *Letters on the Ministry of the Gospel* (1863); and a brief *Memoir of Thomas Chalmers* (1864).

See *The Life and Labors of Francis Wayland* (2 vols., New York, 1867) by his sons Francis and Heman Lincoln; the shorter sketch (Boston, 1891) by James O. Murray in the "American Religious Leaders" series; and an article by G. C. Verplanck in vol. xiv. of the *American Journal of Education*.

WAYLAND THE SMITH (Scand. *Völundr*, Ger. *Wieland*), hero of romance. The legend of Wayland probably had its home in the north, where he and his brother Egill[2] were the types of the skilled workman, but there are abundant local traditions of the wonderful smith in Westphalia and in southern England. His story is told in one of the oldest songs of the Edda, the *Völundarkiða*, and, with considerable variations, in the prose *Þiðrekssaga* (Thidrek's sage), while the Anglo-Saxon *Beowulf* and *Deor's Lament* contain allusions to it. The tale of Wayland falls naturally into two parts, the former of which contains obviously mythical features. He was the son of the giant sailor Wate and of a mermaiden. His grandfather was that Vilkinus, king of Norway, who lent his name to the *Vilkina-* or *Þiðrekssaga*. Three brothers Völundr, Egill and Slagfiþr seized the swan-maidens Hlaþguþr, Ōlrún and Hervor, who, divested of their feather dresses, stayed with them seven or eight years as their wives. The second part of the story concerns Völundr, lord of the elves, the cunning smith, who, after learning his art from Mime, then from the dwarfs, came to the court of King Niþoþr, and there defeated in fight the smith Amilias. Völundr's sword, Mimung, with which he won this victory, was one of the famous weapons in German epic poetry. In the Dietrich cycle it descended to

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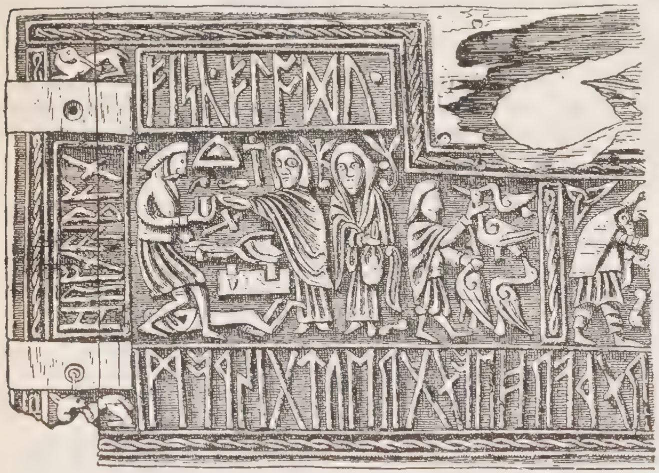
[1] A fuller account of his discovery, illustrated by Hewitson, is given in *The Ibis* (1861, pp. 92-106, pl. iv).

[2] Egill was compelled to prove his skill as an archer by shooting an apple off the head of his three-year-old son; he is thus the prototype of William Tell.

Wayland's son Wittich, and was cunningly exchanged by Hildebrand for a commoner blade before Wittich's fight with Dietrich. Níþoþr, in order to secure Völundr's services, lamed him by cutting the sinews of his knees, and then established him in a smithy on a neighbouring island. The smith avenged himself by the slaughter of Níþoþr's two sons and the rape of his daughter Bodvildr. He then soared away on wings he had prepared. The story in its main outlines bears a striking resemblance to the myth of Daedalus. For the vengeance of Völundr there is a very close counterpart in the medieval versions of the vengeance of the Moorish slave on his master. The dénouement of this tale, which made its first appearance in European literature in the *De obedientia* (*Opera*, Venice, 3 vols., 1518–1519) of Jovianus Pontanus (d. 1503), is different, for the Moorish slave casts himself down from a high tower. The Aaron of the Shakespearian play of *Titus Andronicus* was eventually derived from this source.

Swords fashioned by Wayland are regular properties of medieval romance. King Rhydderich gave one to Merlin, and Rimenhild made a similar gift to Child Horn. English local tradition placed Wayland Smith's forge in a cave close to the White Horse in Berkshire. If a horse to be shod, or any broken tool were left with a sixpenny piece at the entrance of the cave the repairs would presently be executed.

The earliest extant record of the Wayland legend is the representation in carved ivory on a casket of Northumbrian workmanship of a date not later than the beginning of the 8th century. The fragments of this casket, known as the Franks casket, came into the possession of a professor at Clermont in Auvergne about the middle of the last century, and was presented to the British Museum by Sir A. W. Franks, who had bought it in Paris for a dealer. One fragment is in Florence. The left-hand compartment of the front of the casket shows Völundr holding with a pair of tongs the skull of one of Níþoþr's children, which he is fashioning into a goblet. The boy's body lies at his feet. Bodvildr and her attendant also appear, and Egill, who in one version made Völundr's wings, is depicted in the act of catching birds.



The Franks Casket.

See also Vigfússon and Powell, *Corpus poet. bor.* (i. pp. 168-174, Oxford, 1883); A. S. Napier, *The Franks Casket* (Oxford, 1901); G. Sarrazin, *Germanische Heldensage in Shakespere's Titus Andronicus* (Herrig's *Archiv*, xcvii., Brunswick, 1896); P. Maurus, *Die Wielandsage in der Literatur* (Erlangen and Leipzig, 1902); C. B. Depping and F. Michel, *Véland le Forgeron* (Paris, 1833). Sir Walter Scott handled the Wayland legend in *Kenilworth*; there are dramas on the subject by Borsch (Bonn, 1895), English version by A. Comyn (London, 1898), August Demmin (Leipzig, 1880), H. Drachmann (Copenhagen, 1898), and one founded on K. Simrock's heroic poem on Wieland is printed in Richard Wagner's *Gesammelte Schriften* (vol. iii. 2nd ed., Leipzig, 1887).

WAYNE, ANTHONY (1745–1796), American soldier, was born in the township of Easttown, Chester county, Pennsylvania, on the 1st of January 1745, of a Yorkshire family. As a boy he exhibited a marked bent toward a military life. He was educated in Philadelphia, and was a surveyor in Pennsylvania and (1765) in Nova Scotia, where he was agent for a proposed colony. He married in 1766 and passed the next few years on the Chester county farm inherited from his father, holding some minor offices and after 1774 taking an active part upon various patriotic committees. Having recruited and organized the Fourth Pennsylvania battalion of Continental troops, he first saw active service at its head in Canada during the retreat of Benedict Arnold after the Quebec campaign. His excellent behaviour at the skirmish of Three Rivers led Philip Schuyler to place him for some months in command of Ticonderoga. While at this post, on the 21st of February 1777, he was commissioned brigadier-general. In April Washington ordered him to take command of the "Pennsylvania Line" at Morristown, and he rendered distinguished service at Brandywine and Germantown, and by his coolness and courage at Monmouth, after the retreat of General Charles Lee, did much to save the day for the Americans. Later in 1778 political necessity led to his being superseded by St Clair, his ranking officer, in the command of the regular Pennsylvania troops, but upon Washington's recommendation he organized a new Light Infantry corps, with which he performed the most daring exploit of the War of Independence—the recapture of Stony Point by a midnight attack (15-16 July 1779) at the point of the bayonet. This well-planned enterprise aroused the greatest enthusiasm throughout the country and won for Wayne the popular soubriquet "Mad Anthony." Upon the disbanding of the Light Infantry corps, Wayne, again in command of the Pennsylvania line, rendered effective service in counteracting the effect of Benedict Arnold's treason and of the mutiny of the Pennsylvania troops. In 1781 he was sent south to join General Nathanael Greene, but in Virginia was deflected to aid Lafayette against Lord Cornwallis. After the American success at Yorktown, Wayne served with such marked success in Georgia, that the state rewarded him with a large rice plantation (which proved a financial failure) and Congress breveted him major-general. In 1792 Washington offered him the command of the regular army with the rank of major-general to fight the hostile Indians north-west of the Ohio, who had been rendered insolent by their successes over General Josiah Harmar in 1790 and General Arthur St Clair in 1791, and indirectly to compel the British to yield the posts they held on the American side of the lakes. Wayne spent the winter of 1792–1793 in recruiting his troops near Pittsburg and in drilling them for effective service in the reorganized army. The government continued its efforts to induce the Indians to allow white settlements beyond the Ohio, but a mission in 1793 ended in a failure. Meanwhile Wayne had transferred his troops to Fort Washington (Cincinnati), and upon learning of the failure of the negotiations, advanced the greater part of his forces to Greenville, a post on a branch of the Great Miami, about 80 m. north of Cincinnati. During the winter he also established an outpost at the scene of St Clair's defeat. The Indians attacked this post, Fort Recovery, in June 1794, but were repulsed with considerable slaughter. Late in July Wayne's legion of regulars, numbering about 2000, was reinforced by about 1600 Kentucky militia under General Charles Scott, and the combined forces advanced to the junction of the Auglaize and Maumee rivers, where Fort Defiance was constructed. Here Wayne made a final effort to treat with the Indians, and upon being rebuffed, moved forward and encountered them on the 20th of August in the battle of Fallen Timbers, fought near the falls of the Maumee, and almost under the walls of the British post Fort Miami. This decisive defeat, supplemented by the Treaty of Greenville, which he negotiated with the Indians on the 3rd of August 1795, resulted in opening the North-west to civilization. Wayne retained his position as commander of the army after its reorganization, and he rendered service in quelling the proposed filibustering expeditions from Kentucky against the Spanish dominions, and also took the lead in occupying the lake posts delivered up by the British. While engaged in this service he died at Erie, Pennsylvania, on the 15th of December 1796, and was interred there. In 1809 his remains were removed to St David's Churchyard, Radnor, Pennsylvania.

See Charles J. Stillé, *Major-General Anthony Wayne and the Pennsylvania Line* (Philadelphia, 1893); J. Munsell, (ed.), *Wayne's Orderly Book of the Northern Army at Fort Ticonderoga and Mount Independence* (Albany, 1 59); Boyer, *A Journal of Wayne's Campaign* (Cincinnati, 1866); William Clark, *A Journal of Major-General Anthony Wayne's Campaign against the Shawnee Indians* (MSS. owned by R. C. Ballard Thruston); H. P. Johnston, *The Storming of Stony Point* (New York, 1900); J. R. Spears, *Anthony Wayne* (New York, 1903).

WAYNESBORO, a borough of Franklin county, Pennsylvania, U.S.A., near Antietam Creek, about 14 m. S.E. of Chambersburg, and about 65 m. S.W. of Harrisburg. Pop. (1890) 3811; (1900) 5396; (1910) 7199. Waynesboro is served by the Cumberland Valley and the Western Maryland railways. It lies at the foot of the South Mountain, and under the borough are many caves and caverns. A settlement was made here about 1734; it was called Mount Vernon for twenty years, and then Wallacetown (in honour of an early settler) until the close of the War of Independence, when it was named Waynesborough in honour of General Anthony Wayne; a village was platted in 1797; its charter as a borough, granted in 1818, was repealed in 1824 but was revived in 1830, the spelling being changed to "Waynesboro."

See Benjamin M. Nead, *Waynesboro* (Harrisburg, Pa., 1900).

WAYNFLETE, WILLIAM (1395–1486), English lord chancellor and bishop of Winchester, was the son of Richard Pattene or Patyn, alias Barbour, of Wainfleet, Lincolnshire (Magd. Coll. Oxon. Reg. f. 84b), whose monumental effigy, formerly in the church of Wainfleet, now in Magdalen College Chapel at Oxford, seems to be in the dress of a merchant. His mother was Margery, daughter of Sir William Brereton of that ilk in Cheshire (Ormerod's *Cheshire*, iii. 81). Of Waynflete's education it is only possible to assert that he was at Oxford University. It has been alleged that he was a Wykehamist, a scholar at Winchester College and New College, Oxford. But unless he was, as is improbable, the "Willelmus Pattney, de eadem, Sar. Dioc.," admitted in 1403, he was not a scholar of Winchester, and in any case was not a scholar of New College. Nor was he a commoner in college at Winchester or at New College, as his name does not appear in the Hall books, or lists of those dining in hall, at either college. That he was a day-boy commoner at Winchester is possible, but seems unlikely. He was never claimed in his lifetime by either college as one of its alumni. That he was at Oxford, and probably a scholar at one of the grammar schools there, before passing on to the higher faculties, is shown by a letter of the chancellor addressed to him when provost of Eton (Ep. Acad. Oxf. Hist. Soc. i. 158) which speaks of the university as his "mother who brought him forth into the light of knowledge and nourished him with the alimony of all the sciences." He is probably the William Barbour who was ordained acolyte by Bishop Fleming of Lincoln on the 21st of April 1420 and subdeacon on the 21st of January 1421; and as "William Barbour," otherwise Waynflete of Spalding, was ordained deacon on the 18th of March 1421, and priest on the 21st of January 1426, with title from Spalding Priory. He may have been the William Waynflete who was admitted a scholar of the King's Hall, Cambridge, on the 6th of March 1428 (Exch. Q. R. Bdle. 346, no. 31), and was described as LL.B. when receiving letters of protection on the 15th of July 1429 (*Proc. P.C.* iii. 347) to enable him to accompany Robert FitzHugh, D.D., warden of the hall, on an embassy to Rome. For the scholars of the King's Hall were what we should call fellows, as may be seen by the appointment to the hall on the 3rd of April 1360 of Nicholas of Drayton, B.C.L., and John Kent, B.A., instead of two scholars who had gone off to the French wars without the warden's leave (Cal. Close Rolls). William Waynflete, presented to the vicarage of Skendleby, Lincs, by the Priory of Bardney (Lincoln, Ep. Reg. f. 34, Chandler, 16), on the 14th of June 1430, may also have been our Waynflete. There was, however, another William Waynflete, who was instituted rector of Wroxhall, Somerset, on the 17th of May 1433 (Wells, Ep. Reg. Stafford), and was dead when his successor was appointed on the 18th of November 1436 (Wells, Ep. Reg. Stillington). A successor to the William Waynflete at the King's Hall was admitted on the 3rd of April 1434. Meanwhile, our Waynflete had become headmaster of Winchester; Mr William Wanneflete being paid 50s. as Informator scolarium, teacher of the scholars of the college, for the quarter beginning on the 24th of June 1430 (Win. Coll. Bursars' Roll 8-9 Hen. VI.) and so continuously, under many variants of spelling, at the rate of £10 a year until Michaelmas 1441 (*V.C.H.*, Bucks, ii. 154). He was collated by Bishop Beaufort at some date unascertainable (through the loss of the 2nd volume of Beaufort's Episcopal Register) to the mastership of St Mary Magdalen's Hospital, a leper hospital on St Giles' Hill, just outside the city of Winchester (Vet. Mon. iii. 5). The first recorded headmaster after the foundation of the college, John Melton, had been presented by Wykeham to the mastership of this hospital in 1393 shortly before his retirement. Its emoluments, amounting to £9, 12s. a year, nearly doubled the headmaster's income.

Under the influence of Archbishop Chicheley, who had himself founded two colleges in imitation of Wykeham, and Thomas Bekynton, king's secretary and privy seal, and other Wykehamists, Henry VI., on the 11th of October 1440, founded, in imitation of Winchester College, "a college in the parish church of Eton by Windsor not far from our birthplace," called the King's College of the Blessed Mary of Eton by Windsor, as "a sort of first-fruits of his taking the government on himself." The college was to consist of a provost, 10 priests, 6 choristers, 25 poor and needy scholars, 25 almsmen and a magister informator "to teach gratis the scholars and all others coming from any part of England to learn grammar." Only two fellows, 4 choristers, 2 scholars and 2 almsmen were named in the charter and probably were only colourably members. Waynflete was not, as alleged (*Dict. Nat. Biog.*), named a fellow. On the 5th of March 1440–1441, the king endowed the college out of alien priories with some £500 a year, almost exactly the amount of the original endowment of Winchester. On the 31st of July 1441 Henry VI. went for a week-end visit to Winchester College to see the school for himself. Here he seems to have been so much impressed with Waynflete, that at Michaelmas, 1441, Waynflete ceased to be headmaster of Winchester. In October he appears dining in the hall there as a guest, and at Christmas 1442 he received a royal livery, five yards of violet cloth, as provost of Eton. Though reckoned first headmaster of Eton, there is no definite evidence that he was. The school building was not begun till May 1442 (*V.C.H.*, Bucks, ii. 154). William Westbury, who left New College, "transferring himself to the king's service," in May 1442, and appears in the first extant Eton Audit Roll 1444–1445 as headmaster, was probably such from May 1442. If Waynflete was headmaster from October 1441 to May 1442, his duties must have been little more than nominal. As provost, Waynflete procured the exemption of the college from archidiaconal authority on the 2nd of May, and made the contract for completion of the carpenter's work of the eastern side of the quadrangle on the 30th of November 1443. On the 21st of December 1443 he was sworn to the statutes by Bishop Bekynton and the earl of Suffolk, the king's commissioners, and himself administered the oath to the other members of the foundation, then only five fellows and eleven scholars over fifteen years of age. He is credited with having taken half the scholars and fellows of Winchester to Eton to start the school there. In fact, five scholars and perhaps one commoner left Winchester for Eton in 1443, probably in July, just before the election. For three of them were admitted scholars of King's College, Cambridge, on the 19th of July, that college, by its second charter of the 10th of July 1443 having been placed in the same relation to Eton that New College bore to Winchester; *i.e.* it was to be recruited entirely from Eton. The chief part of Waynflete's duties as provost was the financing and completion of the buildings and establishment. The number of scholars was largely increased by an election of 25 new ones on the 26th of September 1444, the income being then £946, of which the king contributed £120 and Waynflete £18, or more than half his stipend of £30 a year. The full number of 70 scholars was not filled up till Waynflete's last year as provost, 1446–1447 (Eton Audit Roll). So greatly did Waynflete ingratiate himself with Henry that when Beaufort, bishop of Winchester, Henry's uncle, died on the 11th of April 1447, the same day Henry wrote to the chapter of Winchester, the prior and monks of St Swithin's cathedral, to elect Waynflete as his successor. On the 12th of April he was given the custody of the temporalities, on the 15th of April he was elected, and on the 10th of May provided to the see by a papal bull. On the 13th of July 1447 he was consecrated in Eton church, when the warden and fellows and others of his old college gave him a horse at a cost of £6, 13s. 4d., and 13s. 4d. to the boys. Subsequent visits to Winchester inspired Henry with the idea of rebuilding Eton church on cathedral dimensions. Waynflete was assigned as the principal executor of his "will" for that purpose, and if there was any variance between the executors, he was to determine it. From 1448 to 1450 £3336 or some £100,000 of our money was spent on the church, of which Waynflete with the marquis of Suffolk and the bishop of Salisbury contributed £700 or £21,000. The troubles which began in 1450 put a stop to the work.

Waynflete, as bishop, lost no time in following the example of Wykeham and his royal patron in becoming a college founder. On the 6th of May 1448 he obtained licence in mortmain and on the 20th of August founded at Oxford "for the extirpation of heresies and errors, the increase of the clerical order and the adornment of holy mother church, a perpetual hall, called Seint Marie Maudeleyn Halle, for study in the sciences of sacred theology and philosophy," to consist of a president and 50 scholars. Its site was not that of the present college, but of two earlier halls called Boston and Hare, where the new schools now are. Thirteen M.A.'s and seven bachelors, besides the president, John Hornley, B.D., were named in the charter. The dedication to Mary Magdalen was no doubt derived from the hospital at Winchester of which the founder had been master. On St Wolstan's Day, the 19th of January 1448–1449, Waynflete was enthroned in Winchester cathedral in the presence of the king; and, probably partly for his sake, parliament was held there in June and July 1449, when the king frequently attended the college chapel, Waynflete officiating (Win. Coll. Reg. Vet.). When Jack Cade's rebellion occurred in 1450 Waynflete was employed with Archbishop Stafford, the chancellor, to negotiate with the rebels at St Margaret's church, Southwark, close to Winchester House. A full pardon was promised, but on the 1st of August Waynflete was one of the special commissioners to try the rebels. On the 7th of May 1451 Waynflete, from "le peynted chambre" in his manor house at Southwark, asserting that his bishopric was canonically obtained and that he laboured under no disqualification, but feared some grievous attempt against himself and his see, appealed to the protection of the pope. It is suggested (*Dict. Nat. Biog.*) that this was due to some disturbances at Winchester (*Proc. P.C.* vi. 108), where one of Cade's quarters was sent after his execution. But it is more likely, as suggested by Richard Chandler (*Life of Waynflete*, 1811), that it was some Yorkist attack on him in progress in the papal court, to meet which he appointed next day 19 proctors to act for him. In the result nothing disturbed his peaceable possession of the see. With the archbishop of Canterbury he received Henry VI. on a pilgrimage to St Thomas à Becket on the 2nd of August 1451. When in November the duke of York encamped near Dartford, Waynflete with three others was sent from the king's camp at Blackheath to propose terms, which were accepted. Edward, prince of Wales, was born on the 13th of October 1453 and baptized by Waynflete the next day. This year Waynflete acquired the reversion of the manor of Stanswick, Berks, from Lady Danvers (Chandler, p. 87) for Magdalen Hall. The king became insane in 1454. On the death of the chancellor, John Kemp, archbishop of Canterbury, during the sitting of parliament, presided over by the duke of York, commissioners, headed by Waynflete, were sent to Henry, to ask him to name a new chancellor, apparently intending that Waynflete should be named. But no answer could be extracted from the king, and after some delay Lord Salisbury took the seals. During York's regency, both before and after the battle of St Albans, Waynflete took an active part in the proceedings of the privy council. With a view to an ampler site for his college, Waynflete obtained on the 5th of July 1456 a grant of the Hospital of St John the Baptist outside the east gate at Oxford and on the 15th of July licence to found a college there. Having obtained a papal bull, he founded it by deed of the 12th of June 1458, converting the hospital into a college with a president and six fellows, to which college two days later Magdalen Hall surrendered itself and its possessions, its members being incorporated into "the New College of St Mary Magdalen."

Meanwhile Waynflete himself had been advanced to the highest office in the state, the chancellorship, the seals being delivered to him by the king in the priory of Coventry in the presence of the duke of York, apparently as a person acceptable to both parties. On the 27th of October 1457 he took part in the trial and condemnation for heresy of Reginald Pecock, bishop of Chichester, who had been ordained subdeacon and deacon on the same day and by the same bishop as Waynflete himself. Only Pecock's books and not the heretic were burnt. As the heresy consisted chiefly in defending the clergy on grounds of reason instead of authority, the proceeding does not show any great enlightenment on Waynflete's part. It must have been at this time that an addition was made by Waynflete to the Eton college statutes, compelling the fellows to forswear the heresies of John Wycliffe and Pecock. Waynflete presided as chancellor at the parliament at Coventry in November 1459, which, after the Yorkist catastrophe at Ludlow, attainted the Yorkist leaders. It was no doubt because of this that, three days before the Yorkist attack at Northampton, he delivered the great seal to the king in his tent near Delapre abbey, a nunnery by Northampton, on the 7th of July 1460 (Rot. Claus. 38 Hen. VI. m. 5 d). It was taken with Henry and handed to the Yorkist, George Neville, bishop of Exeter, brother of the kingmaker, earl of Warwick, in London on 25th July following. Whether, as alleged by some, Waynflete fled and hid himself during the period covered by the battle of Wakefield and Edward's first parliament in 1461, is very doubtful. A testimonial to his fidelity written by Henry to the pope on the 8th of November 1460 (Chandler, 346) was written while Henry was in Yorkist hands. The fact too that complaints laid before Edward IV. himself in August 1461 of wrongful exaction of manorial rights from the tenants of the episcopal manor of East Meon, Hants, were decided in the bishop's favour in parliament in the December following (Rot. Parl. v. 475) also suggests that he was not regarded as an enemy to the Yorkists, though a personal favourite of Henry's. A general charter of confirmation to him and his successors of the property and rights of the bishopric of Winchester on the 1st of July 1462 (Pat. 2 Ed. IV.) points in the same direction. It is certain that he took an active part in the restoration of Eton College, which Edward annexed to St George's, Windsor, in 1463, depriving it of a large part of its possessions. In the earliest Audit Rolls after the restoration of the college in 1467 there are many entries of visits of Provost Westbury to "the lord of Winchester," which in January 1468–1469 were for "beginning the work of the church" "and providing money for them." Why a pardon was granted to Waynflete on the 1st of February 1469 (Pat. 8 Ed. IV. pt. iii. m. 16) does not appear. On the restoration of Henry VI. on the 28th of September 1470 Waynflete welcomed him on his release from the Tower, which necessitated a new pardon, granted a month after Edward's reinstatement on the 30th of May 1471 (Pat. 11. Ed. IV. pat. i. m. 24), and a loan to the king of 2000 marks (£1333, 6s. 8d.), or some £40,000 of our money. In the years 1471–1472 to 1474 Waynflete was largely engaged in completing the church, now called chapel, at Eton, his glazier supplying the windows, and he contracted on the 15th of August 1475 for the rood-loft to be made on one side "like to the rode lofte in Bishop Wykeham's college at Winchester," and on the other like that "of the college of St Thomas of Acres in London." In 1479 he built the ante-chapel at the west-end, as it now stands, of stone from Headington, Oxford.

In 1474 Waynflete, being the principal executor of Sir John Fastolf, who died in 1459, leaving a much-contested will, procured the conversion of his bequest for a collegiate church of seven priests and seven almsmen at Caistor, Norfolk, into one for seven fellows and seven poor scholars at Magdalen. In the same year that college took possession of the alien priory of Sele, Sussex, the proceedings for the suppression of which had been going on since 1469. The new, now the old, buildings at Magdalen were begun the same year, the foundation-stone being laid in the middle of the high altar on the 5th of May 1474 (Wood, 207). Licences on the 1st of July, the 22nd of July 1477 and the 12th of February 1479, authorized additions to the endowment. On the 23rd of August 1480, the college being completed, the great west window being contracted to be made after the fashion of that at All Souls' College, a new president, Richard Mayhew, fellow of New College, was installed on the 23rd of August 1480, and statutes were promulgated. The foundation is commonly dated from this year and not from 1448, when Magdalen Hall was founded, though if not dated from 1448 it surely dates from 1458, when that hall and St John's Hospital were converted into Magdalen College. The statutes were for the most part a replica of those of New College, members of which were, equally with members of Magdalen, declared to be eligible for the presidency. They provided for a head and 70 scholars, but the latter were divided into 40 fellows and 30 scholars called demies, because their commons were half those of the fellows. Magdalen College School was established at the gates and as a part of the college, to be, like Eton, a free grammar school, free of tuition fees for all comers, under a master and usher, the first master being John Ankywyll, a married man, with a salary of £10 a year, the same as at Winchester and Eton. The renewal of interest in classical literature was shown in the prohibition of the study of sophistry by any scholar under the age of eighteen, unless he had been pronounced proficient in grammaticals. On the 22nd of September 1481 Waynflete received Edward IV. in state at the college, where he passed the night, and in July 1483 he received Richard III. there in even greater state, when Master William Grocyn, "the Grecian," a fellow of New College, "responded," in divinity. In 1484 Waynflete gave the college the endowment for a free grammar school at his name-place, Wainfleet, sufficient to produce for the chantry-priest-schoolmaster £10 a year, the same salary as the headmaster of Magdalen School, and built the school which still exists almost untouched, a fine brick building with two towers, 76 ft. long by 26 ft. broad. The next year saw the appropriation to the college of the Augustinian Priory of Selborne, Hants.

On the 27th of April 1486, Waynflete, like Wykeham, made his will at their favourite manor, South or Bishop's Waltham. It is remarkable that he gives the same pecuniary bequests to Winchester and New Colleges as to his own college of Magdalen, but the latter he made residuary devisee of all his lands. He died on the 11th of May 1486, and was buried in the chantry chapel of St Mary Magdalen behind the high altar in Winchester cathedral, which he had erected in his lifetime. The effigy on it may be taken to be an authentic portrait. (A. F. L.)

WAYZGOOSE, a term for the annual dinner and outing of printers and their employés. The derivation of the term is doubtful. It may be a misspelling for "wasegoose," from *wase*, Mid. Eng. for "sheaf," thus meaning sheaf or harvest goose, the bird that was fit to eat at harvest-time, the "stubble-goose" mentioned by Chaucer in "The Cook's Prologue." It is more probable that the merry-making which has become particularly associated with the printers' trade was once general, and an imitation of the grand goose-feast annually held at Waes, in Brabant, at Martinmas. The relations of England and Holland were formerly very close, and it is not difficult to believe that any outing or yearly banquet might have grown to be called colloquially a "Waes-Goose." It is difficult to explain why the term should have only survived in the printing trade, though the English printers owed much to their Dutch fellow-workers. Certainly the goose has long ago parted company with the printers' wayzgoose, which is usually held in July, though it has no fixed season. An unlikely suggestion is that the original wayzgoose was a feast given by an apprentice to his comrades at which the bird formed the staple eatable.

WAZIR, or VIZIER (Arabic *wazir*), a minister, usually the principal minister under a Mahommedan ruler. In India the nawab of Oudh was long known as the nawab wazir, the title of minister to the Mogul emperor having become hereditary in the family.

WAZIRABAD, a town of British India, in Gujranwala district of the Punjab, near the right bank of the river Chenab, 62 m. N. of Lahore. Pop. (1901) 18,069. It is an important railway junction. The main line of the North-Western railway here crosses the Chenab by the Alexandra bridge, opened by the prince of Wales in 1876. The branch to Sialkot has been extended to Jammu (51 m.); another branch follows the line of the Chenab canal towards Multan. Boat-building and manufactures of steel and iron are carried on.

WAZIRISTAN, a section of the mountain tract in the North-West Frontier Province of India, lying between the Tochi river on the north and the Gomal river on the south. The whole of Waziristan lies within the British sphere of influence, the boundary with Afghanistan having been demarcated in 1894. It forms two political agencies, but only a portion, consisting of the Tochi valley, with an area of about 700 sq. m. and a population (1903) of 24,670, is directly administered. Northern Waziristan has an area of about 2310 sq. m., and southern Waziristan an area of about 2734 sq. m.

The Tochi and the Gomal rivers enclose Waziristan, their affluents rising to the west of that country in the upland valleys of Shawal and Birmal, and flowing north and south to a junction with the main streams. Between the two rivers stretches the central dominating range of Waziristan from north-east to south-west, geologically connected with the great limestone ranges of the Suliman hills to the south, and dominated by the great peaks of Shuidar (Sheikh Haidar) and Pirghal, both of them between 11,000 and 12,000 ft. above the sea, and hardly inferior to the Khaisargarh peak of the Takht-i-Suliman. From these peaks westwards a view is obtained across the grass slopes and cedar woods of Birmal and Shawal (lying thousands of feet below) to the long, serrated ridges of the central watershed which shuts off the plains of Ghazni. To the eastward several lines of drainage strike away for the Indus, breaking through parallel folds and flexures of the mountains, of which the conformation is here distinctly observable, although not so marked as it is south of the Gomal. These lines of drainage are, as usual, the main avenues of approach to the interior of the country. They are the Khaisora and the Shakdu on the north, which, uniting, join the Tochi south of Bannu, and the Tank Zam (which is also called Khaisor near its head) on the south. The two former lead from the frontier to Rasmak and Makin, villages of some local importance, situated on the slopes of Shuidar; and the latter leads to Kaniguram, the Waziri capital, and the centre of a considerable iron trade. Kaniguram lies at the foot of the Pirghal mountain.

Amongst the mountains of Waziristan there is much fine scenery and a delightful climate. Thick forests of ilex clothe many of the spurs, which reach down to the grassy deodar-covered uplands of Birmal on the west; and the spreading poplar attains magnificent dimensions amongst the flats and plateaus of the eastern slopes. The indigenous trade of the country is inconsiderable, although Waziri iron is much esteemed. The agricultural products are poor, and the general appearance of the priest-ridden people is significant of the endurance of many hardships, even of chronic starvation. The most notable product of the country is the Waziri breed of horses and donkeys. The latter especially deserve to rank as the best of their kind on the Indian frontier, if not in all India.

The geological formation of Waziristan is the same as that of the contiguous frontier. Recent subaqueous deposits have been disturbed by a central upheaval of limestone; the lower hills are soft in composition and easily weather-worn, the slopes are rounded, and large masses of detritus have collected in the nullah beds and raised their level. Through these deposits heavy rain-floods have forced their way with many bends and curves to the plains, enclosing within each curve a "wam" or "raghza," which slopes gradually to the hills and affords the only available space for irrigation and agriculture. A "wam" is a gently sloping open space, generally raised but slightly above the river level. A "raghza" differs from a "wam" in being on a higher level and often beyond the reach of irrigation. Pasture is found abundantly in the hills, but cultivation only on the borders of the main streams. Passing up and down these main water-courses, there is an appearance of great fertility and wealth, which is entirely due to these thriving strips of verdure, their restricted and narrow limits being hardly visible from the river beds. From above, when viewed from the flanking ridges, the vast extent of hill country, neither high, nor imposing, nor difficult of access, but invariably stony and rough, compares strongly with the narrow bands of enclosed cultivation winding about like green ribbons, and marking the course of the main streams from the snow-covered peaks to the plains. The physiography of Waziristan is that of the Kurram to the north rather than that of the Suliman hills to the south.

The Waziris are the largest tribe on the frontier, but their state of civilization is very low. They are a race of robbers and murderers, and the Waziri name is execrated even by the neighbouring Mahommedan tribes. Mahommedans from a settled district often regard Waziris as utter barbarians, and seem inclined to deny their title to belong to the faith. They have been described as being "free-born and murderous, hot-headed and light-hearted, self-respecting but vain." The poverty of their country and the effort required to gain a subsistence in it have made the Waziris a hardy and enduring race. Their physique is uncommonly good, and though on the average short of stature, some extremely tall and large men are to be found amongst them. They are generally deep-chested and compact of build, with a powerful muscular development common to the whole body, and not confined to the lower limbs as is the case with some hill tribes of the Himalayas. As mountaineers the Waziris would probably hold their own with any other Pathan tribe of the frontier.

Except in a few of the highest hills, which are well-wooded, the Waziri country is a mass of rock and stones, bearing a poor growth of grass and thinly sprinkled with dark evergreen bushes; progress in every direction except on devious paths known to the natives is obstructed by precipices or by toilsome stony ascents; and knowledge of the topography, a mere labyrinth of intricate ranges and valleys, comes only as the result of long acquaintance. Broken ground and tortuous ravines, by making crime easy and precaution against attack difficult, have fostered violence among the people and developed in them an extraordinary faculty of prudence and alertness. In consequence of his isolation the Waziri has become independent, self-reliant and democratic in sentiment. Through the inaccessibility of his own country to lowlanders, combined with the proximity of open and fertile tracts inhabited by races of inferior stamina, he has developed into a confirmed raider; and the passage through his country of mountain footpaths, connecting India with Afghanistan, has made him by frequent opportunity a hereditary highwayman as well. The women enjoy more freedom than amongst most Pathan tribes, and are frequently unfaithful. The ordinary punishment of adultery is to put the woman to death, and to cut off half the right foot of the man. Amongst Waziris also, as amongst other Pathans, the blood-feud is a national institution.

The Waziris, who number some 40,000 fighting men altogether, are divided into two main sections, the Darwesh Khel (30,000) and the Mahsuds (8000), with two smaller sections. The Darwesh Khel, the more settled and civilized of the two, inhabit the lower hills bordering on Kohat and Bannu districts, and the ground lying on both sides of the Kurram river, between Thal on the north and the Tochi Valley on the south. The Mahsuds, who inhabit the tract of country lying between the Tochi Valley on the north and the Gomal river on the south, have earned for themselves an evil name as the most confirmed raiders on the border; but they are a plucky race, as active over the hills as the Afridis, and next to them the best-armed large tribe on the frontier. The Mahsud country, especially that part within reach of British posts, is more difficult even than Tirah. To the south and east it is girt by an intricate belt of uninhabited, generally waterless hills and ravines. To the north a zone of Darwesh Khel territory, not less than 20 m. in width, hilly and difficult, separates the Mahsuds from the Tochi. The Tochi Valley is inhabited by a degraded Pathan tribe, known as Dauris, who have voluntarily placed themselves under British protection since 1895. In dealing with the Mahsuds it must be remembered that from Wana to Tank, from Tank to Bannu, and from Bannu to Datta Khel, or for a distance of over 200 m., British territory is open to Mahsud depredations. This length of frontier is equal to the whole Thal-Kohat-Peshawar-Malakand line, covering the eight or ten tribes that took part in the frontier risings of 1897. So that the Mahsuds should really be compared with the whole of those ten tribes, and not with any single one.

British expeditions were needed against various sections of the Waziris in 1852, 1859, 1860, 1880, 1881, 1894, 1897 and 1902.

The success of Sir Robert Sandeman in subduing the wild tribes of Baluchistan had led to a similar attempt to open up Waziristan to British civilization; but the Pathan is much more democratic and much less subject to the influence of his maliks than is the Baluchi to the authority of his chiefs; and the policy finally broke down in 1894, when the Waziris made a night attack upon the camp of the British Delimitation Commission at Wana. The Commission had been appointed to settle the boundary with the Afghans, and the Waziris regarded it as the final threat to their independence. The attack was delivered with such determination that the tribesmen penetrated into the centre of the camp, and it was only with the greatest difficulty that friend could be distinguished from foe. A large force of 11,000 British troops subsequently traversed the tribal country, destroyed their towers and dictated terms, one of which was that the Tochi Valley should be occupied by British garrisons. But still there was trouble, which led to the Tochi expedition of 1897; and, in spite of the further lessons taught the Waziris in two expeditions in 1902, the attempt to "Sandemanise" Waziristan was given up by Lord Curzon. The British garrisons in the Tochi and Gomal valleys were withdrawn, and two corps of tribal militia, from 1300 to 1500 strong, were gradually formed to replace the British troops.

See *Grammar and Vocabulary of Waziri Pashto*, by J. G. Lorimer (Calcutta, 1902); Paget and Mason's *Frontier Expeditions* (1884); *Mahsud Waziri Operations* (1902), Blue-book.

WAZZĀN, a small hillside town, 60 m. N.W. by N. of Fez, Morocco. It has a considerable trade with the country round, and manufactures a coarse white woollen cloth with rough surface from which the hooded cloaks (called *jellâbs*) are made. Its proudest name is Dár D'manah—House of Safety—as it is sanctuary for any who gain its limits, on account of the tomb of a sainted Idrisi Sharif, who lived there in 1727. It is the headquarters of his descendants.

WEALD, THE, a district in the south-east of England. It includes the portions of Sussex, Kent and Surrey which are enclosed between the North and South Downs—a district of Lower Cretaceous rocks encircled by Upper Cretaceous hills. It extends from Frensham and Petersfield on the Hampshire borders to the English Channel between Folkestone and Eastbourne. With the exception of the easternmost part, it drains by rivers running northward and southward through gaps in the Downs, the origin of which is considered under that heading. The Weald was formerly covered by the forest of Andredesleah or Andredsweald ("the wood or forest without habitations"), which was 120 m. in length and about 30 in greatest breadth. About 1660 the total area under forest was estimated at over 200,000 acres. The chief remains of the ancient forests are Ashdown, St Leonards and Tilgate, and the nomenclature often indicates the former extent of woodland, as in the case of Hurstpierpoint (*hurst* meaning wood), Midhurst, Fernhurst, Billingshurst, Ashurst and many others. The forests were interspersed with lagoons; and the rainfall being very great caused marshes, but it abated in consequence of the cutting down of the Wealden forests for fuel in the extensive ironworks that formerly existed in the district. The locality best preserving the ancient character of the Weald is the hilly district in the centre, forming a picturesque broken range running east and west under the name of the Forest Ridges. This forms the main water-parting of the Weald, dividing the Vale of Sussex from the Vale of Kent; and was also the seat of the iron industry which was prosecuted by the Romans and probably earlier, reached its highest importance in the 16th and 17th centuries, and was maintained even till the early years of the 19th century. The Andredesleah had an early historical interest as forming a physical barrier which kept the South Saxons isolated from other Saxon kingdoms. Descending from over sea upon the coastal district of Sussex, to which they gave name, towards the close of the 5th century, they populated it thickly, and maintained independence, in face of the accretions of the West Saxon kingdom, for upwards of a hundred years.

WEALDEN, in geology, a thick series of estuarine and freshwater deposits of Lower Cretaceous age, which derives its name from its development in the Weald of Kent and Sussex. In the type area it is exposed by the denudation of a broad anticlinal fold from which the higher Cretaceous beds have been removed. The Wealden rocks lie in the central part of this anticline between the escarpments of the North and South Downs; they extend eastwards from the neighbourhood of Haslemere and Elland Chapel to the west between Pevensey and Hythe. This formation is divisible into two portions, the Weald Clay above and the Hastings Sands below. The Weald Clay which occupies the central, upland part of the area from Horsham to the sea coast consists of dark brown and blue clays and shales, occasionally mottled in the neighbourhood of sandy lenticles, which together with calcareous sandstones, shelly limestones and nodular ironstones take a subordinate place in the series. About Horsham the Weald Clay is 1000 ft. thick, but it decreases in an eastward direction; at Tunbridge it is only 600 ft. Certain subordinate beds within the Weald Clay have received distinctive names. "Horsham stone" is a calcareous flaggy sandstone, often ripple marked, usually less than 5 ft. thick, which occurs at about 120 ft. above the base of the Clay. "Sussex marble" is the name given to more than one of the high limestone beds which are mainly composed of a large form of *Paludina* (*P. fluviorum*); some of the lower limestone layers contain a small species (*P. sussexiensis*). The Sussex marble (proper) occurs about 100 ft. below the top of the clays; it is the most important of the limestone bands, and its thickness varies from 6 ft. to 2 in.; it is known also as Bethersden marble, Petworth marble, Laughton stone, &c. It has been widely used in the Weald district in church architecture and for polished mantelpieces. The ironstones were formerly smelted in the western part of the area.

The Hastings Sands are divisible into three main subdivisions: the Tunbridge Wells Sand, the Wadhurst Clay and the Ashdown Sand. Like the overlying Weald Clay this series thickens as a whole towards the west. In the west, the Tunbridge Wells Sand is separated into an upper and lower division by the thickening of a bed of clay—the Grinstead Clay—which in the east, about Rye, &c., is quite thin; at Cuckfield a second clay bed 15 ft. thick divides the upper division. The upper beds of the lower Tunbridge Wells Sand cause good landscapes around West Hoathly and near East Grinstead. The Wadhurst Clay is very constant in character; near the base it frequently contains clay-ironstone, which in former times was the main source of supply for the Wealden iron industry. Much of the higher portion of the Hastings Sand country is made of the Ashdown Sands, consisting of sand, soft sandstones and subordinate clay bends; in the east, however, clay is strongly developed at the base of this group, and at Fairlight is more than 360 ft. thick, while the sandy portion is only 150 ft. These clays with sandy layers are known as the Fairlight Clays. Beds of lignite are found in these beds, and a calcareous sandstone, called Tilgate stone, occurs near the top of the Ashdown Sands and in the Wadhurst Clay. The old town of Hastings is built on Ashdown Sand, but St Leonards is mainly on Tunbridge Wells Sand.

Wealden beds occur on the southern side of the Isle of Wight and in the Isle of Purbeck in Dorsetshire. The Wealden anticline can be traced across the Channel into the Bas Boulonnais. A separate Wealden area exists in north Germany between Brunswick and Bentheim, in the Ostervald and Teutoberger Wald, where the Deister Sandstone (150 ft.) corresponds to the Hastings Sands and the Wälderthon (70–100 ft.) to the Weald Clay. The former contains valuable coal beds, worked in the neighbourhood of Obernkirchen, &c., and a good building stone.

The fossils of the Wealden beds comprise freshwater shellfish, *Unio*, *Paludina*, *Melanopsis*, *Cyrena*; and estuarine and marine forms such as *Ostrea*, *Exogyra* and *Mytilus*. An interesting series of dinosaurs and pterodactyles has been obtained from the Wealden of England and the continent of Europe, of which *Iguanodon* is the best known—a large number of almost entire skeletons of this genus were discovered in some buried Cretaceous valleys at Bernissart in Belgium; other forms are *Heterosuchus*, *Ornithocheirus*, *Ornithopsis*, *Cimoliosaurus* and *Titanosaurus*. Among the plant remains are *Chara*, *Bennettites*, *Equisitites*, *Fittonia*, *Sagenopteris* and *Thujites*. The fishes, plants and reptiles of these formations possess a decidedly Jurassic aspect, and for this reason several authorities are in favour of retaining the Wealden rocks in that system, and the close relationship between this formation and the underlying Purbeckian, both in England and in Germany, tends to support this view.

See Cretaceous, Neocomian, Purbeckian; also W. Topley, "Geology of the Weald," *Mem. Geol. Survey* (London, 1875). (J. A. H.)

WEALTH, etymologically the condition of well-being, prosperity in its widest sense. The word does not appear in Old English, but is a Middle English formation, *welthe*, on the O. Eng. *wela*, well-being, from *wel*, well, cognate with Dan. *vel*, Ger. *wohl*. The original meaning survives in the *Prayer for the King's Majesty* of the English Book of Common Prayer, "Grant him in health and wealth long to live," and in "commonwealth," *i.e.* good of the body politic, hence applied to the body politic itself.

In economics, wealth is most commonly defined as consisting of all useful and agreeable things which possess exchange value, and this again is generally regarded as coextensive with all desirable things except those which do not involve labour or sacrifice for their acquisition in the quantity desired. On analysis it will be evident that this definition implies, directly, preliminary conceptions of utility and value, and, indirectly, of sacrifice and labour, and these terms, familiar though they may appear, are by no means simple and obvious in their meaning. Utility, for the purposes of economic reasoning, is usually held to mean the capacity to satisfy a desire or serve a purpose (J. S. Mill), and in this sense is clearly a much wider term than wealth. Sunshine and fresh air, good temper and pleasant manners, and all the infinite variety of means of gratification, material and immaterial, are covered by utility as thus defined. Wealth is thus a species of utility, and in order to separate it from other species some *differentia* must be found. This, according to the general definition, is exchange value, but a little reflection will show that in some cases it is necessary rather to contrast value with wealth. "Value," says Ricardo, expanding a thought of Adam Smith, "essentially differs from riches, for value depends not on abundance but on the difficulty or facility of production." According to the well-known tables ascribed to Gregory King (1648–1712), a deficiency of a small amount in the annual supply of corn will raise its value far more than in proportion; but it would be paradoxical to argue that this rise in value indicated an increase in an important item of national wealth. Again, as the mines of a country are exhausted and its natural resources otherwise impaired, a rise in the value of the remainder may take place, and as the free gifts of nature are appropriated they become valuable for exchange; but the country can hardly be said to be so much the wealthier in consequence. And these difficulties are rather increased than diminished if we substitute for value the more familiar concrete term "money-price"—for the contrast between the quantity of wealth and its nominal value becomes more sharply marked. Suppose, for example, that in the total money value of the national inventory a decline were observed to be in progress, whilst at the same time, as is quite possible, an increase was noticed in the quantity of all the important items and an improvement in their quality, it would be in accordance with common sense to say that the wealth of the country was increasing and not decreasing.

So great are these difficulties that some economists (*e.g.* Ricardo) have proposed to take utility as the direct measure of wealth, and, as H. Sidgwick has pointed out, if double the quantity meant double the utility this would be an easy and natural procedure. But even to the same individual the increase in utility is by no means simply proportioned to the increase in quantity, and the utility of different commodities to different individuals, and a fortiori of different amounts, is proverbial. The very same things may to the same individual be productive of more utility simply owing to a change in his tastes or habits, and a different distribution of the very same things, which make up the wealth of a nation, might indefinitely change the quantity of utility; but it would be paradoxical to say that the wealth had increased because it was put to better uses.

We thus seem thrown back on value as the essential characteristic, allowance being made for any change in the standard of value; but there are still difficulties to be overcome. Some things that undoubtedly possess value or that can command a price are immaterial, *e.g.* the advice of a lawyer or physician or the song of a *prima donna*, and, although perhaps the skill of a workman (in any grade of the social scale) might be considered as attached to the man, as a coal mine is attached to a place, it is more in accordance with popular usage to consider skill as immaterial, whilst at the same time it seems equally natural prima facie to confine the term wealth to material things in the common sense. Again, the credit system of a country is a product of great labour and sacrifice, it is most closely connected with the production of its material wealth in the narrowest sense, and it certainly commands a pecuniary value, and yet credit is more generally held to be a representative rather than a part of wealth, owing apparently to its insubstantial character. Apart from the question of materiality some writers have insisted on relative permanence and possibility of accumulation as essential attributes of wealth, and have thus still further narrowed the scope of the definition.

There can be no doubt that it is on many grounds desirable in economics to use terms as far as possible in their popular acceptations; but this rule must always be subordinate to the primary object in view. In nearly every department of knowledge in which popular terms have been retained it has been found necessary either constantly to use qualifying adjectives where the context is not a sufficient guide, and in some cases, when analysis discloses very different elements, to make a selection. Sometimes it has been found convenient to use a term with some variation in the definition according to the branch of the subject in hand.[1] Applying these rules to the definition of wealth, perhaps the best solution is that which is generally connected with German economists (*e.g.* Adolf von Held). Wealth consists of utilities, and in the first great department of economics—the *consumption* of wealth— it is utility with which we are principally concerned—the idea of value, for example, being overshadowed. The most general law of the consumption of wealth is that successive portions of any stock give a diminishing amount of utility when consumed. Then in the department of the *production* of wealth the most important characteristics are the labour and sacrifice necessary to put the utilities desired into the things and to place the things where they are wanted. The idea of value is again secondary and subordinate. We can readily see the part played by nature, labour and capital respectively in the production of any commodity without considering the *effects* on its value of the various factors; we can understand the principles of division of labour and of the relative productiveness of large and small industries without entering into questions of value except in the most general manner. In the department of the *distribution* of wealth the fundamental conception is the right of appropriation; and accordingly J. S. Mill very properly commences this part of his subject by an account of the relative advantages of the socialistic and individual systems of property. It is quite possible under the former to conceive of all the distribution being made without any exchange and with reference simply to the wants or the deserts of the members of the society. Thus it is not until we arrive at the department of the *exchange* of wealth that the characteristic of value becomes predominant, although of course value is closely connected with utility and labour and sacrifice.

Usually, however, it will be found that in most cases anything which can fairly be classed as wealth in one department is also wealth in the others, and thus the definition is reached that wealth in general consists of all "consumable utilities which require labour for their production and can be appropriated and exchanged." It only remains to add that "utilities" may be divided into "inner" and "outer" (to translate the German literally)—the "inner" being such as are simply sources of personal gratification to their possessor, *e.g.* a good ear for music; the "outer" utilities again may be divided into "free" and "economic," the former, as a rule, *e.g.* sunlight, not being the result of labour and not capable of appropriation or exchange, and the latter as a rule possessing each of these marks. It is these "economic utilities" which constitute wealth in the specific sense of the term, although its use may be extended by analogy to include almost all utilities.

See A. Marshall, *Principles of Economics* (1907); J. B. Clark, *Philosophy of Wealth* (1886) and *Distribution of Wealth* (1899); W. E. Hearn, *Plutology* (1864); F. A. Walker, *Political Economy* (1888); and J. S. Nicholson, *Principles of Political Economy* (1903). (J. S. N.)

WEAPON (O. Eng. *wǣpen*, cf. Du. *wapen*, Ger. *Wappe*, also *Wappen*, a coat of arms, heraldic shield), any instrument of offence or defence, more usually a term confined to offensive or attacking instruments. The general sketch of the history and development of weapons of offence and defence is given under ARMS AND ARMOUR; particular weapons are treated under such heads as HALBERD, LANCE, SPEAR, SWORD, GUN, PISTOL, RIFLE, ORDNANCE AND MACHINE-GUNS.

WEAR, a river of Durham, England, rising in the Pennine chain near the Cumberland border, and traversing a valley about 60 m. in length to the North Sea, with a drainage area of 458 sq. m. A series of streams draining from the hills between Killhope Law and Burnhope Seat (2452 ft.) are collected at Wearhead, up to which point the valley is traversed by a branch of the North-Eastern railway. Hence eastward, past the small towns of St John's Chapel and Stanhope, and as far as that of Wolsingham, Weardale is narrow and picturesque, sharply aligned by high-lying moorland. Below, it takes a south-easterly bend as far as Bishop Auckland, then turns northward and north-eastward, the course of the river becoming extremely sinuous. The scenery is particularly fine where the river sweeps round the bold peninsula which bears the cathedral and castle of the city of Durham. The valley line continues northerly until Chester-le-Street is passed, then it turns north-east; and soon the river becomes navigable, carrying a great traffic in coal, and having its banks lined with factories. At the mouth is the large seaport of Sunderland.

WEASEL (*Putorius nivalis*), the smallest European species of the group of mammals of which the polecat and stoat are well-known members (see CARNIVORA). The weasel is an elegant little animal, with elongated slender body, back much arched, head small and flattened, ears short and rounded, neck long and flexible, limbs short, five toes on each foot, all with sharp, compressed, curved claws, tail rather short, slender, cylindrical, and pointed at the tip, and fur short and close. The upper-parts, outside of limbs and tail, are uniform reddish brown, the under-parts white. In cold regions the weasel turns white in winter, but less regularly and only at a lower temperature than the stoat or ermine, from which it is distinguished by its smaller size and the absence of the black tail-tip. The length of the head and body of the male is usually about 8 in., that of the tail 2½ in.; the female is smaller. The weasel is generally distributed throughout Europe and Northern and Central Asia; and is represented by a closely allied animal in North America. It possesses all the active, courageous and bloodthirsty disposition of the rest of the genus, but its diminutive size prevents it attacking and destroying any but the smaller mammals and birds. Mice, rats, water-rats and moles, as well as frogs, constitute its principal food. It is generally found on or near the surface of the ground, but it can not only pursue its prey through holes and crevices of rocks and under dense tangled herbage, but follow it up the stems and branches of trees, or even into the water, swimming with perfect ease. It constructs a nest of dried leaves and herbage, placed in a hole in the ground or a bank or hollow tree, in which it brings up its litter of four to six (usually five) young ones. The mother will defend her young with the utmost desperation against any assailant, and has been known to sacrifice her own life rather than desert them. (R. L.*)

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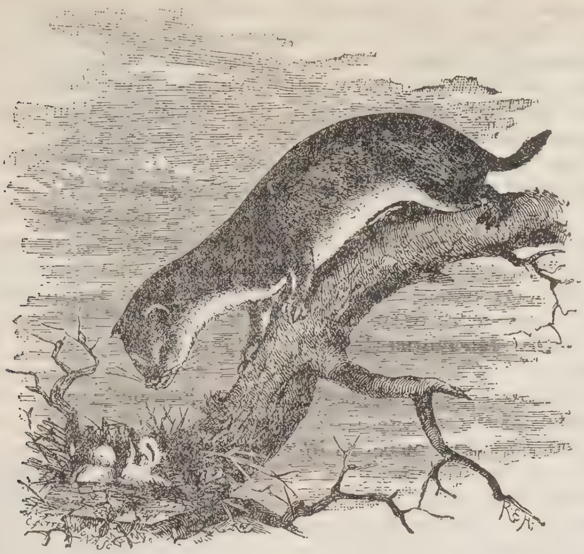
[1] On the uses and difficulties of definitions in political economy compare H. Sidgwick's *Principles of Political Economy*, bk. i. ch. ii., and J. N. Keynes's *Scope and Method of Political Economy*.



The Weasel (*Putorius nivalis*).

WEATHER (O. Eng. *weder*; the word is common to Teutonic languages; cf. Du. *weder*, Dan. *veir*, Icel. *veðr*, and Ger. *Wetter* and *Gewitter*, storm; the root is *wa-* to blow, from which is derived "wind"), the condition of the atmosphere in regard to its temperature, presence or absence of wind or cloud, its dryness or humidity, and all the various meteorological phenomena (see METEOROLOGY). The term "weathering" is used in geology of the gradual action of the weather upon rocks, and is also applied, in architecture, to the inclination or slope outwards given to cornices, string courses and window sills, to throw off the rain.

WEAVER, JAMES BAIRD (1833–), American lawyer and political leader, was born at Dayton, Ohio, on the 12th of June 1833. He studied law at Cincinnati, Ohio, and served on the Federal side in the Civil War, becoming colonel in November 1862; he was mustered out in May 1864, and in March 1865 was breveted brigadier-general of volunteers. He was district-attorney for the second Judicial District of Iowa in 1866–1870 and an assessor of internal revenue in Iowa in 1863–1873; and was a representative in Congress in 1879–1881 and in 1885–1889, being elected by a Greenback-Democratic fusion. In 1880 he was the candidate of the Greenback party for president and received a popular vote of 308,578; and in 1892 he was the candidate of the People's party, and received 22 electoral votes and a popular vote of 1,041,021.

WEAVER-BIRD, the name[1] by which a group of between 200 and 300 species are now usually called, from the elaborately interwoven nests that many of them build, some of the structures being of the most marvellous kind. By the older systematists such of these birds as were then known were distributed among the genera *Oriolus*, *Loxia*, *Emberiza* and *Fringilla*; and it was G. L. Cuvier who in 1817 first brought together these dissevered forms, comprising them in a genus *Ploceus*. Since his time others have been referred to its neighbourhood, and especially the genus *Vidua* with its allies, so as to make of them a subfamily *Ploceinae*, which in 1847 was raised by J. Cabanis to the rank of a family *Ploceidae*—a step the propriety of which has since been generally admitted, though the grounds for taking it are such as could not be held valid in any other order than that of *Passeres*. The *Ploceidae* are closely related to the *Fringillidae* (see FINCH), and are now divided into two subfamilies, the *Ploceinae* and *Viduinae*, the former chiefly found in Africa and its islands, the latter in the Ethiopian, Australian and Indian regions.

Perhaps the most typical Ploceine weaver-bird is *Hyphantornis cucullata*, an African species, and it is to the Ethiopian Region that by far the greatest number of these birds belong, and in it they seem to attain their maximum of development. They are all small, with, generally speaking, a sparrow-like build; but in richness of colouring the males of some are very conspicuous—glowing in crimson, scarlet or golden-yellow, set off by jet-black, while the females are usually dull in hue. Some species build nests that are not very remarkable, except in being almost invariably domed—others (such as the most typical Indian weaver-bird, *Ploceus baya*) fabricate singular structures[2] of closely and uniformly interwoven tendrils or fine roots, that often hang from the bough of a tree over water, and, starting with a solidly wrought rope, open out into a globular chamber, and then contract into a tube several inches in length, through which the birds effect their exit and entrance. But the most wonderful nests of all, and indeed the most wonderful built by birds, are those of the so-called sociable grosbeak, *Philhetaerus socius*, of Africa. These are composed wholly of grass, and are joined together to the number of 100 or 200—indeed 320 are said to have been found in one of these aggregated masses, which usually take the form of a gigantic mushroom,[3] affording a home and nursery to many pairs of the birds which have been at the trouble of building it. These nests, however, have been so often described and figured by South African travellers that there is no need here to dilate longer on their marvels. It may be added that this species of weaver-bird, known to French writers as the *Rêpublicain*, is of exceptionally dull plumage.

The group of widow-birds,[4] *Viduinae*, is remarkable for the extraordinary growth of the tail-feathers in the males at the breeding-season. In the largest species, *Vidua* (sometimes called *Chera*) *progne*, the cock-bird, which, with the exception of a scarlet and buff bar on the upper wing-coverts, is wholly black, there is simply a great elongation of the rectrices; but in *V. paradisea* the form of the tail is quite unique. The middle pair of feathers have the webs greatly widened, and through the twisting of the shafts their inferior surfaces are vertically opposed. These feathers are comparatively short, and end in a hair-like filament. The next pair are produced to the length of about a foot—the bird not being so big as a sparrow—and droop gracefully in the form of a sickle. But this is not all: each has attached to its base a hair-like filament of the same length as the feather, and this filament originally adhered to and ran along the margin of the outer web, only becoming detached when the feather is full grown.[5] In another species, *V. principalis*, the middle two pairs of rectrices are equally elongated, but their webs are convex, and the outer pair contains the inner, so that when the margins of the two pairs are applied a sort of cylinder is formed.[1] The females of all the widow-birds differ greatly in appearance from the males, and are generally clothed in a plumage of mottled brown.

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[1] First bestowed in this form apparently by J. F. Stephens in 1826 (G. Shaw's *Gen. Zoology*, xiv. pt. i. p. 34); but in 1782 J. Latham (*Synopsis*, i, p, 435) had called the "*Troupiale du Sénégal*" of Buffon the "weever oriole," from its habit of entwining the wires of the cage in which it was kept with such vegetable fibres as it could get, and hence in 1788 Gmelin named it *Oriolus textor*. In 1800 F. M. Daudin used the term "*Tisserin*" for several species of the Linnaean genus *Loxia*, and this was adopted some years later by Cuvier as the equivalent of his *Ploceus*, as mentioned in the text.

[2] These differ from those built by some of the ORIOLES (*q.v.*) and other birds, whose nests may be compared to pensile pockets, while those of these weaver-birds can best be likened to a stocking hung up by the "toe," with the "heel" enlarged to receive the eggs, while access and exit are obtained through the "leg."

[3] But at a distance they may often be mistaken for a native hut, with its grass-roof.

[4] It has been ingeniously suggested that this name should be more correctly written Whydah bird—from the place on the West Coast of Africa so named; but Edwards, who in 1745 figured one of the species, states that he was informed that "the Portuguese call this bird the widow, from its colour and long train" (*Nat. Hist. Birds*, i. p. 86).

[5] This curious structure was long ago described by Brisson (*Ornithologie*, iii. p. 123), and more recently by Strickland (*Contr. Ornithology* (1850), pp. 88 and 149, pl. 59).

Usually classed with the weaver-birds is a vast group of small seed-eating forms, often called *Spermestinae*, but for which *Estreldinae* would seem to be a more fitting name. These comprehend the numerous species so commonly seen in cages, and known as amadavats, *Estrelda amandava*, nutmeg-birds, *Munia punctularia*, waxbills, *Pytelia melba* and *phoenicoptera*, cutthroats, *Amadina fasciata*, the Java sparrow, *Munia oryzivora* and many others. Many of these genera are common to Africa and India, and some also to Australia. (A. N.)

WEAVING. The process of weaving consists in interlacing, at right angles, two or more series of flexible materials, of which the longitudinal are called warp and the transverse weft. Weaving, therefore, only embraces one section of the textile industry, for felted, plaited, netted, hosiery and lace fabrics lie outside this definition. Felting consists in bringing masses of loose fibres, such as wool and hair, under the combined influences of heat, moisture and friction, when they become firmly interlocked in every direction. Plaited fabrics have only one series of threads interlaced, and those at other than right angles. In nets all threads are held in their appointed places by knots, which are tied wherever one thread intersects another. Hosiery fabrics, whether made from one or many threads, are held together by intersecting a series of loops; while lace fabrics are formed by passing one set of threads between and round small groups of a second set of threads, instead of moving them from side to side. Notwithstanding the foregoing limitations, woven fabrics are varied in texture and have an enormous range of application. The demands made by prehistoric man for fabrics designed for clothing and shelter were few and simple, and these were fashioned by interlacing strips of fibrous material and grasses, which in their natural condition were long enough for the purpose in hand. But, as he passed from a state of savagery into a civilized being, his needs developed with his culture, and those needs are still extending. It no longer suffices to minister to individual necessities; luxury, commerce and numerous industries must also be considered.

The invention of spinning (*q.v.*) gave a great impetus to the introduction of varied effects; previously the use of multicoloured threads provided ornament for simple structures, but the demand for variety extended far beyond the limits of colour, and different materials were employed either separately or conjointly, together with different schemes of interlacing. Eventually the weaver was called upon to furnish articles possessing lustre, softness and delicacy; or those that combine strength and durability with diverse colourings, with a snowy whiteness, or with elaborate ornamentation. In cold countries a demand arose for warm clothing, and in hot ones for cooler materials; while commerce and industry have requisitioned fabrics that vary from normal characteristics to those that exceed an inch in thickness. In order to meet these and other requirements the world has been searched for suitable raw materials. From the animal kingdom, wool, hair, fur, feathers, silk and the pinna fibre have long been procured. From the vegetable kingdom, cotton, flax, hemp, jute, ramie and a host of other less known but almost equally valuable materials are derived. Amongst minerals there are gold, silver, copper, brass, iron, glass and asbestos. In addition, strips of paper, or skin, in the plain, gilt, silvered and painted conditions are available as well as artificial fibres. All of the foregoing may be used alone or in combination.

From such varied raw materials it is not surprising that woven fabrics should present an almost endless variety of effects; yet these differences are only in part due to the method of weaving. The processes of bleaching (*q.v.*), mercerizing (*q.v.*), dyeing (*q.v.*), printing (see TEXTILE PRINTING) and finishing (*q.v.*) contribute almost as much to the character and effect of the resultant product as do the incorporation in one fabric of threads spun in different ways and from fibres of different origin, with paper, metal, beads or even precious stones.

INDUSTRIAL TECHNICOLOGY

All weaving schemes are reducible to a few elementary principles, but no attempted classification has been quite successful, for fabrics are constantly met with that possess characteristics supposed to be peculiar to one class, but lack others which are deemed equally typical. Nevertheless, since some classification is essential, the following will be adopted, namely: Group 1, to include all fabrics made from one warp and one weft, provided both sets of threads remain parallel in the finished article and are intersected to give the requisite feel and appearance. Group 2, to include (*a*) fabrics constructed from two warps and one weft, or two wefts and one warp, as in those that are backed, reversible and figured with extra material; (*b*) two or more distinct fabrics built simultaneously from two or more warps and wefts, as in two, three and other ply cloths; (*c*) fabrics built by so intersecting two or more warps and wefts that only one texture results, as in loom-made tapestries and figured repps. Group 3, to include fabrics in which a portion of the weft or warp rises vertically from the groundwork of a finished piece, as in velveteens, velvets, plushes and piled carpets. Groups 4, to embrace all fabrics in which one portion of the warp is twisted partially, or wholly, round another portion, as in gauzes and lappet cloths. Although some fabrics do not appear to fall into any of the above divisions, and in others the essential features of two or more groups are combined, yet the grouping enumerated above is sufficiently inclusive for most purposes.

The fabrics included in Group 1 are affected by the nature and closeness of the yarns employed in their construction, by colour, or by the scheme of intersecting the threads. The most important section of this group is *Plain Cloth*, in which the warp and weft threads are approximately equal in thickness and closeness, and pass over and under each other alternately, as in fig. 1, which shows a design, plan and two sections of plain cloth. Such a fabric would, therefore, appear to admit of but slight ornamentation, yet this is by no means the case, for if thick and thin threads of warp and weft alternate, the resultant fabric may be made to assume a corrugated appearance on the face, while beneath it remains flat, as in poplins, repps and cords. A plan and a longitudinal section of a repp cloth is shown at fig. 2. Colour may also be employed to ornament plain fabrics, and its simplest application produces stripes and checks. But colour may convert these fabrics into the most artistic and costly productions of the loom, as is the case with tapestries, which are at once the oldest and most widely diffused of ornamented textiles. Tapestries only differ from simple plain cloth in having each horizontal line of weft made up of numerous short lengths of parti-coloured thread. Many fine specimens of this art have been recovered from ancient Egyptian and Peruvian tombs, and many are still produced in the Gobelins and other celebrated manufactories of Europe.

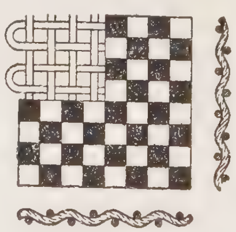
FIG. 1.—Plain Cloth.

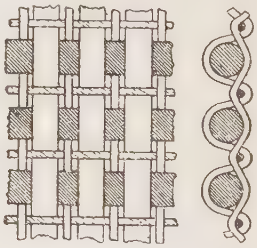
FIG. 2.—Repp Cloth.

Twills are next in importance to plain cloth on account of their wide range of application and great variety of effects; in elaborately figured goods their use is as extensive as where they provide the only ornament. Twills invariably form diagonal ribs in fabrics, and these are due to the intervals at which the warp and weft are intersected; thus two or more warp threads are passed over or under one or more than one weft thread in regular succession. Twills are said to be equal when similar quantities of warp and weft are upon the face of a fabric, unequal when one set of threads greatly preponderates over the other set, as in figs. 3, 4, which require four warp and weft threads to complete the scheme of intersections. If the ribs form angles of 45 degrees, the warp and weft threads per inch are about equal in number, but for an unequal twill the material most in evidence should be closest and finest. The angle formed may be greater or less than 45 degrees, as in figs. 5, 6; if greater, the warp preponderates, if less, the weft preponderates. Twills are *simple* and *fancy*; both terms refer to the schemes of intersecting. In the former the same number of warp threads are placed successively above or below each weft thread, and the ribs are of uniform width, as in figs. 3, 4. In the latter more warp threads may be above one pick than another, the ribs may vary in width and small ornament may be introduced between the ribs, as in figs. 5, 6 and 7, where the dark squares represent warp upon the surface. Twills may be broken up into zigzags, lozenges, squares and other geometrical designs; all of which may be produced by reversings in the diagonal lines, or by reversing the weave of an unequal twill. Fig. 8 is a zigzag, namely, a twill reversed in one direction. Fig. 9 is a diamond, or a twill reversed in two directions, and fig. 10 is a diaper, or an unequal twill which gives a warp face in one place and a weft face in another. *Satins* and *satteens* form another important section of Group 1. In a satin the bulk of the warp, and in a satteen the bulk of the weft, is on the face of a fabric. If perfect in construction both present a smooth, patternless appearance, which is due in part to the scheme of intersections, in part to using fine material for the surface threads and placing it close enough together to render the points of intersection invisible; the threads of the other set being coarser and fewer in number. Satins differ from twills in having each warp thread lifted, or depressed, separately, but not successively. From five to upwards of thirty threads of warp and weft are required to complete the various schemes of intersecting. If the intervals between the intersections are equal the weave is said to be perfect, as in fig. 11, but if the intervals are irregular it is said to be imperfect, as in fig. 12. In *Damasks* a satin is combined with a satteen weave, and since any desired size and shape of either weave may be produced, great facilities are offered for the development of all kinds of ornamentation. But in combination neither the satin nor the satteen can be perfect in construction, for one requires a preponderance of warp, the other a preponderance of weft; as a sequence every point of intersection is distinctly visible on both surfaces. *Brocades* are fabrics in which both sets of threads may be floated irregularly upon the surface to produce ornamental effects, and they may be taken as typical of all one warp and one weft fabrics that are figured by irregularly floated materials, whether the threads are uniformly or irregularly distributed, and whether one weave or several weaves be employed.

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[1] Both these species seem to have been first described and figured in 1600 by Aldrovandus (lib. xv. cap. 22, 23) from pictures sent to him by Ferdinando de' Medici, duke of Tuscany.

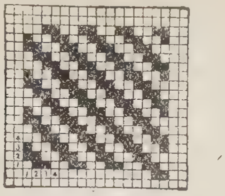


FIG. 3.—Four-thread $\frac{2}{2}$ Twill.

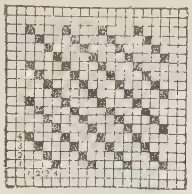


FIG. 4.—Four-thread $\frac{1}{3}$ Twill.

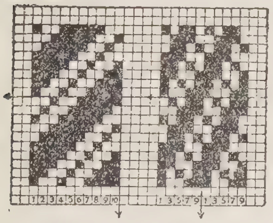


FIG. 5.—Upright Twill.

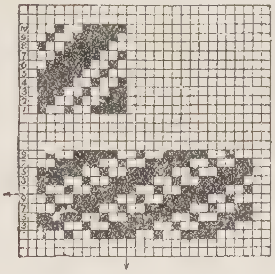


FIG. 6.—Reclining Twill.

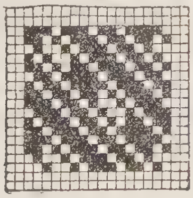


FIG. 7.—Fancy Twill.

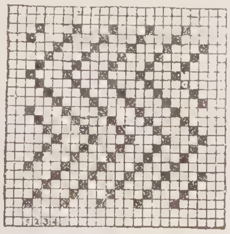


FIG. 8.—Zigzag.

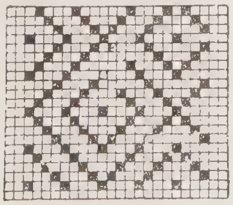


FIG. 9.—Diamond.

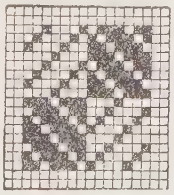


FIG. 10.—Diaper.

Group 2 includes all backed and reversible fabrics, as well as those ornamented with extra material and compounded. Cloths intended for men's wear are often *backed*, the object of which is to give weight and bulk to a thin texture without interfering with the face effects. Either warp or weft may be used as backing; if the former there are two series of warp to one series of weft threads, while in the latter there are two series of weft to one series of warp threads. The face material is superposed upon that of the back, but the ratio of face threads may be one or two to one of back. In order to avoid disturbing the face weave, only those threads are used to bind the backing that are hidden on the face, as in fig. 13, which gives the design and a transverse section of a backed fabric; A is face weft; B back weft, and the circles are warp threads; of the latter C, D, are beneath both B and A. This diagram will serve equally as a longitudinal section of a warp-backed fabric, if A represents a thread of face warp, B a thread of back warp and the circles are weft threads. Weft backing is capable of giving a more spongy feel to a fabric than warp, because softer materials may be used, but in these fabrics the length output of loom is reduced by reason of the wefts being superposed. Warp-backed fabrics, whether uniformly coloured or striped, do not materially reduce the output of a loom, for every weft thread adds to the cloth length. *Reversible* fabrics may have either two series of differently coloured wefts or warps to one of the other series, in which event they may be similarly figured on both sides by causing the threads of the double series to change places, as in the design and transverse section, fig. 14; or, by allowing one series to remain constantly above the other, as in backed cloths, both sides may be similar or dissimilar in colour and pattern. *Fabrics figured with extra material* may have two series of warp or weft threads to one series of the other set, and they may yield reversible or one-sided cloths. A ground texture may have extra material placed above or below it, as in fig. 15, where a design and transverse section of the cloth are given; the waved lines and circles represent a cross-section of plain cloth and A is a thread of extra material; or ordinary and extra material may be used conjointly for figuring. *Compound cloths* must have at least two textures, and be as distinct in character as if woven in separate looms; they have many advantages over backed cloths, thus: the same design and colouring may be produced on both sides; where bulk and weight are required a fine surface texture may be formed over a ground of inferior material, and soft weft be passed between the upper and lower textures. The fabric is more perfect and admits of either simple or elaborate patterns being wrought upon the surface, with simple ones beneath, as in piqués and matelassés. One texture may be constantly above the other and connected at the selvages only, as in hose pipes and pillow slips; or at intervals a thread may pass from one texture into the other, in which event both are united, as in many styles of bed-covers and vestings. If differently coloured the textures may change places at pleasure, as in Kidderminster carpets; or, from three to twelve textures may be woven simultaneously, and united, as in belting cloth. There may be from one to three threads of face warp to one of back, and the wefting may or may not correspond with the warping. Fig. 16 shows the face and

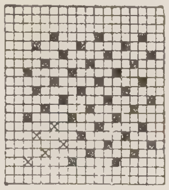


FIG. 11.—Five-thread Satteen.

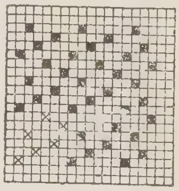


FIG. 12.—Six-thread Satteen.

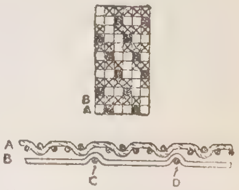


FIG. 13.—Weft-backed Fabric.

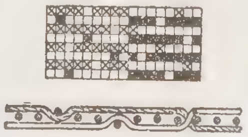


FIG. 14.—Weft Reversible Fabric.

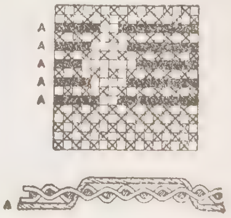


FIG. 15.—Figuring with Extra Weft.

back weaves, the design, and a transverse section of a compound cloth with two threads of face warp and weft to one of back, and both are stitched together. The circles in the upper and lower lines represent face and back warps respectively, and A, B, C are weft threads placed in the upper and lower textures. *Loom-made tapestries and figured repps* form another section of Group 2. As compared with true tapestries, the loom-made articles have more limited colour schemes, and their figured effects may be obtained from warp as well as weft, whether interlaced to form a plain face, or left floating more or less loosely. Every weft thread, in passing from selvage to selvage, is taken to the surface where required, the other portions being bound at the back. Some specimens are reversible, others are one-sided, but, however numerous the warps and wefts, only one texture is produced. When an extra warp of fine material is used to bind the wefts firmly together a plain or twill weave shows on both sides. If a single warp is employed, two or more wefts form the figure, and the warp seldom floats upon the surface. Where warps do assist to form figure it rarely happens that more than three can be used without overcrowding the reed. Fig. 17 gives the design, and a transverse section of a reversible tapestry in four colours, two of which are warps and two wefts. If either warp or weft is on the surface, corresponding threads are beneath. The bent lines represent weft and the circles warp. *Figured repps* differ from plain ones in having threads of one, or more than one, thick warp floated over thick and thin weft alike; or, in having several differently coloured warps from which a fixed number of threads are lifted over each thick weft thread; the face of the texture is then uniform, and the figure is due to colour.

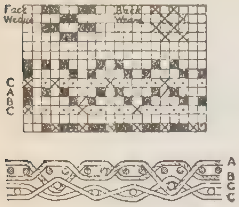


FIG. 16.—Compound Fabric.

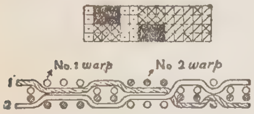


FIG. 17.—Tapestry with Two Warps and Two Wefts.

Group 3. *Piled Fabrics.*—In all methods of weaving hitherto dealt with the warp and weft threads have been laid in longitudinal and transverse parallel lines. In piled fabrics, however, portions of the weft or warp assume a vertical position. If the former there are two series of weft threads, one being intersected with the warp to form a firm ground texture, the other being bound into the ground at regular intervals, as in the design and transverse section of a velveteen, fig. 18; the circles and waved lines form plain cloth, and the loose thread A is a pile pick. After leaving the loom all threads A are cut by pushing a knife lengthwise between the plain cloth and the pile. As each pick is severed both pieces rise vertically and the fibres open out as at B. Since the pile threads are from two to six times as numerous as those of the ground, and rise from an immense number of places, a uniform brush-like surface is formed. Raised figures are produced by carrying the threads A beneath the ground cloth, where no figure is required, so that the knife shall only cut those portions of the pile weft that remain on the surface. The effect upon the face varies with the distribution of the binding points, and the length of pile is determined by the distance separating one point from another.

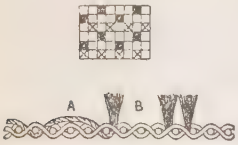


FIG. 18.—Velveteen.

Chenille.—When chenille is used in the construction of figured weft-pile fabrics, it is necessary to employ two weaving operations, namely, one to furnish the chenille, the other to place it in the final fabric. Chenille is made from groups of warp threads that are separated from each other by considerable intervals; then, multi-coloured wefts are passed from side to side in accordance with a predetermined scheme. This fabric is next cut midway between the groups of warp into longitudinal strips, and, if reversible fabrics such as table-covers and curtains are required, each strip is twisted axially until the protruding ends of weft radiate from the core of warp, and form a cylinder of pile. In the second weaving this chenille is folded backward and forward in a second warp to lay the colours in their appointed places and pile projects on both sides of the fabric. If chenille is intended for carpets, the ends of pile weft are bent in one direction, and then woven into the upper surface of a strong ground texture.

Warp-piled Fabrics have at least two series of warp threads to one of weft, and are more varied in structure than weft-piled fabrics, because they may be either plain or figured, and have their surfaces cut, looped or both.

Velvets and Plushes are woven single and double. In the former case both ground and pile warps are intersected with the weft, but at intervals of two or three picks the pile threads are lifted over a wire, which is subsequently withdrawn; if the wire is furnished with a knife at its outer extremity, in withdrawing it the pile threads are cut, but if the wire is pointed a line of loops remains, as in terry velvet. Fig. 19 is the design, and two longitudinal sections of a Utrecht velvet. The circles at A are weft threads, and the bent line is a pile thread, part of which is shown cut, another part being looped over a wire. At B the circles are repeated to show how the ground warp intersects the weft.

Double Plushes consist of two distinct ground textures which are kept far enough apart to ensure the requisite length of pile. As weaving proceeds the pile threads are interlaced with each series of weft threads, and passed from one to the other. The uniting pile material is next severed midway between the upper and lower textures, and two equal fabrics result. Fig. 20 gives three longitudinal sections of a double pile fabric. The circles A, B are weft threads in the upper and lower fabrics respectively; the lines that interlace with these wefts are pile warp threads which pass vertically from one fabric to the other. At C, D the circles are repeated to show how the ground warps intersect the wefts, and at E the arrows indicate the cutting point.

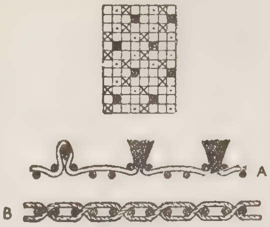


FIG. 19.—Utrecht Velvet.

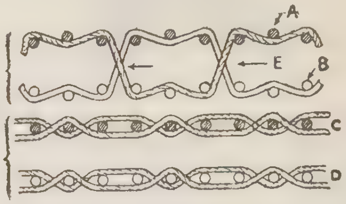


FIG. 20.—Double Plush.

Figured Warp-pile Fabrics are made with regular and irregular cut and looped surfaces. If regular, the effect is due to colour, and this again may be accomplished in various ways, such as (*a*) by knotting tufts of coloured threads upon a warp, as in Eastern carpets; (*b*) by printing a fabric after it leaves the loom; (*c*) by printing each pile thread before placing it in a loom, so that a pattern shall be formed simultaneously with a pile surface, as in tapestry carpets; (*d*) by providing several sets of pile threads, no two of which are similar in colour; then, if five sets are available, one-fifth of all the pile warp must be lifted over each wire, but any one of five colours may be selected at any place, as in Brussels and Wilton carpets. Fig. 21 is the design, and a longitudinal section of a Brussels carpet. The circles represent two tiers of weft, and the lines of pile threads, when not lifted over a wire to form loops, are laid between the wefts; the ground warp interlaces with the weft to bind the whole together. When the surface of a piled fabric is irregular, also when cut and looped pile are used in combination, design is no longer dependent upon colour, for in the former case pile threads are only lifted over wires where required, at other places a flat texture is formed. In the latter case the entire surface of a fabric is covered with pile, but if the figure is cut and the ground looped the pattern will be distinct.

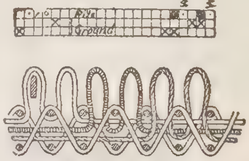


FIG. 21.—Brussels Carpet.

Group 4. *Crossed Weaving.*—This group includes all fabrics in which the warp threads intertwist amongst themselves to give intermediate effects between ordinary weaving and lace, as in gauzes. Also those in which some warp threads are laid transversely in a piece to imitate embroidery, as in lappets.

Plain Gauze embodies the principles that underlie the construction of all crossed woven textiles. In these fabrics the twisting of two warp threads together leaves large interstices between both warp and weft. But although light and open in texture, gauze fabrics are the firmest that can be made from a given quantity and quality of material. One warp thread from each pair is made to cross the other at every pick, to the right and to the left alternately, therefore the same threads are above every pick, but since in crossing from side to side they pass below the remaining threads, all are bound securely together, as in fig. 22, where A is a longitudinal section and B a plan of gauze.

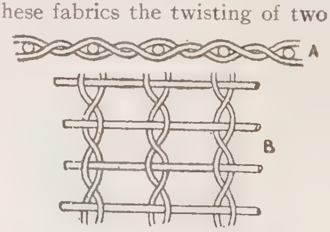


FIG. 22.—Plain Gauze.

Leno is a muslin composed of an odd number of picks of a plain weave followed by one pick of gauze. In texture it is heavier than gauze, and the cracks are farther apart transversely.

Fancy Gauze may be made in many ways, such as (*a*) by using crossing threads that differ in colour or count from the remaining threads, provided they are subjected to slight tensile strain; (*b*) by causing some to twist to the right, others to the left simultaneously; (*c*) by combining gauze with another weave, as plain, twill, satin, brocade or pile; (*d*) by varying the number of threads that cross, and by causing those threads to entwine several ordinary threads; (*e*) by passing two or more weft threads into each crossing, and operating any assortment of crossing threads at pleasure.

Lappet weaving consists in diapering the surface of a plain or gauze fabric with simple figures. This is done by drawing certain warp threads into a transverse position and then lifting them over a thread of weft to fix them in the texture; after which they are moved in the opposite direction and lifted over the following pick. The material between one binding point and another must float loosely, and this limits the usefulness of lappet figuring. In fig. 23, the thick lines show a lappet spot upon a plain texture. Notwithstanding diverse structure, intricate mechanisms are not essential to the production of either simple or complex textures; the most elaborate and beautiful specimens of the weaver's art have been manufactured upon simple machinery.

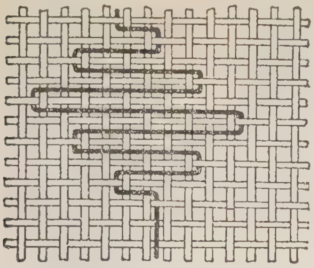


FIG. 23.—Lappet Fabric.

Weaving Machinery.

The longitudinal threads of a fabric are called warp, caine, twist and organzine, and the transverse threads are weft, shoot, woof, filling and tram. A loom for intersecting these several threads must provide for: (1) Shedding; namely, raising and lowering the warp threads in a predetermined sequence so as to form two lines between which the weft may be passed. (2) Picking, or placing lines of weft between the divided warp. (3) Beating-up, or striking each weft thread into its appointed position in the fabric. (4) Letting-off, or holding the warp tense and delivering it as weaving proceeds. (5) Taking-up, or drawing away the cloth as manufactured. (6) Temples, for stretching the fabric widthwise in order to prevent the edge threads of a warp from injuring the reed, and from breaking. Power looms require the above-named contrivances to act automatically, and in addition: (7) A weft-fork, to stop a loom when the weft becomes exhausted or breaks. (8) Mechanism for stopping a loom when the shuttle fails to reach its appointed box. (9) For weaving cross stripes, multiple shuttle boxes are needed to bring different colours, or counts of weft, into use at the proper time. (10) In some looms a device for automatically ejecting a spent cop, pirn or shuttle, and inserting a full one, is requisite. (11) If a weaver has to attend to a greater number of looms than usual, a device for stopping a loom when a warp thread fails is essential.

The Hand-Loom.—During the 17th and the first half of the 18th centuries it was observed that wherever any branch of the textile industry had been carried to a high state of excellence the looms used to manufacture a given fabric were similar in essentials, although in structural details they differed greatly. Prior to the invention of the fly shuttle by John Kay, in 1733, no far-reaching invention had for generations been applied to the hand-loom, and subsequently the Jacquard machine and multiple shuttle boxes represent the chief changes. A hand-loom as used in Europe at the present time (see fig. 24) has the warp coiled evenly upon a beam whose gudgeons are laid in open steps formed in the loom framing. Two ropes are coiled round this beam, and weighted to prevent the warp from being given off too freely. From the beam the threads pass alternately over and under two lease rods, then separately through the eyes of the shedding harness, in pairs between the dents of a reed, and finally they are attached to a cloth roller. For small patterns healds are used to form sheds, but for large ones a Jacquard machine is required. Healds may be made of twine, of wire or of twine loops into which metal eyes, called mails, are threaded. But they usually consist of a number of strings which are secured above and below upon wooden laths called shafts, and each string is knotted near the middle to form a small eye. From two to twenty-four pairs of shafts may be employed, but the healds they carry must collectively equal the number of threads in the warp. These healds will be equally or unequally distributed upon the shafts according to the nature of the pattern to be woven, and the threads will be drawn through the eyes in a predetermined order. The upper shafts are suspended from pulleys or levers, and the lower ones are attached directly or indirectly to treadles placed near the floor. The weaver depresses these treadles with his feet in a sequence suited to the pattern, and the scheme of drawing the warp through the healds. When a treadle is pressed down, at least one pair of shafts will be lifted above the others, and the warp threads will ascend or descend with the healds to form a shed for a shuttle, containing weft, to be passed through (see SHUTTLE). The reed (fig. 25) is the instrument by which weft is beaten into position in the cloth; it also determines the closeness of the warp threads, and guides a moving shuttle from side to side. It is made by placing strips of flattened wire between two half round ribs of wood, and binding the whole together by passing tarred twine between the wires and round the ribs. Such a reed is placed in the lower portion of a batten, which is suspended from the upper framework of the loom. In front of the reed, and immediately below the warp, the projecting batten forms a race for the shuttle to travel upon from side to side. Before Kay's invention a shuttle was thrown between the divided warp and caught at the opposite selvage, but Kay continued the projecting batten on both sides of the warp space, and constructed boxes at each end. Over each box he mounted a spindle, and upon it a driver, or picker. Bands connected both pickers to a stick which the weaver held in his right hand, while with the left hand he controlled the batten. Thus: a treadle is pressed down by one foot to form a shed; the batten is pushed back till a sufficient portion of the shed is brought in front of the reed, and the depressed threads lie upon the shuttle race; a clear way is thus provided for the shuttle. A quick movement of the stick tightens the cord attached to a picker and projects the shuttle from one box to the other. The batten is now drawn forward, and the reed beats up the weft left by the shuttle. As the next treadle is depressed to form another division of the warp for the return movement of the shuttle, the last length of weft is enwrapped between intersecting warp threads, and the remaining movements follow in regular succession (see fig. 26).

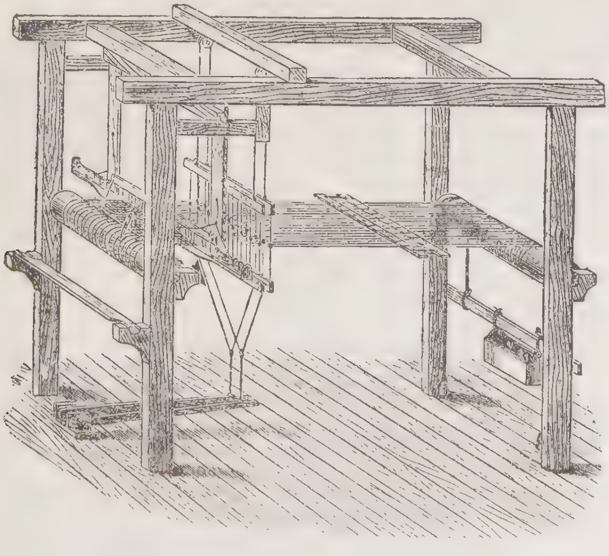


FIG. 24.—Diagram of Hand-Loom.

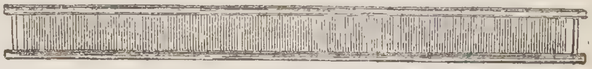


FIG. 25.—Weaver's Reed.

In cases where the weft forms parti-coloured stripes across a fabric, also where different counts of weft are used, shuttles, equal in number to the colours, counts or materials, must be provided. By Robert Kay's invention of multiple shuttle boxes, in 1760, much of the time lost through changing shuttles by hand was prevented. His drop boxes consist of trays formed in tiers and fitted into the ordinary shuttle boxes. Each tray is capable of holding a shuttle, and by operating a lever and plug with the forefinger and thumb of the left hand, the trays may be raised and lowered at pleasure to bring that shuttle containing the colour next needed into line with the picker.

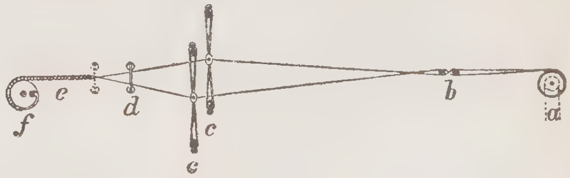


FIG. 26.—Section of Plain Web in Process of Weaving on the Loom.

a, The warp beam.
b, The lease rods by which the warp is divided and crossed.
c, *c*, Two pairs of shafts containing healds.
d, The reed in position for picking, and also for beating-up.
e, Woven cloth.
f, The cloth beam.

The Draw Loom.—Large figured effects were formerly produced in draw looms, where the warp threads were so controlled by separate strings that any assortment could be lifted when required. Thus: to the lower end of each string a dead weight, called a lingoe, was attached, and a few inches above the lingoe a mail was fixed for the control of a warp thread. The strings passed through a drilled board which held the mails and warp threads facing the proper reed dents. Still higher up, groups of strings were connected to neck cords; each group consisted of all strings required to rise and fall together constantly. If, for example, in the breadth of a fabric there were twelve repeats of a design, twelve strings would be tied to the same neck cord, but taken to their respective places in the comber board. The foregoing parts of a draw loom harness are clearly shown in fig. 27: A are lingoes, and the dots represent mails. B is the comber board; between B and C are mounting strings and neck cords, two strings being attached to each cord; and C is the bottom board. Each neck cord, after being led through a perforated bottom board C, and over a grooved pulley, was threaded through a ring on the top of a vertical cord called the simple, and passed horizontally to, and tied upon a bar rigidly fixed near the ceiling of the weaving room. The simple cords were similarly attached to a bar placed near the floor. From one hundred to several thousands of neck and simple cords could be used in one harness. The design to be reproduced in cloth was read into the parallel lines of the simple by looping a piece of string round each cord that governed warp threads to be lifted for a given shed; after which all the loops were bunched together. By pulling at a bunch of loops the simple cords were deflected and they caused all warp threads controlled by them to be lifted above the level of those undisturbed. Similar bunches of loops were formed for every shed required for one repeat of a design, and they were pulled in succession by the draw-boy, while the weaver attended to the batten and picking.

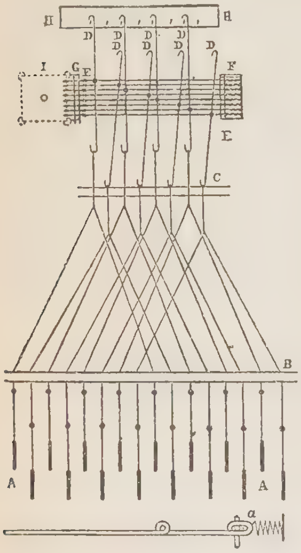


FIG. 27.—Diagram of Jacquard Machine and Harness.

The *Jacquard machine* is the most important invention ever applied to the hand-loom, but it is not the work of one man; it represents the efforts of several inventors whose labours extended over three-quarters of a century. This apparatus has taken the places of the simple, the loops, the pulleys and the draw-boy of the older shedding motion, but other parts of the harness remain unchanged. In 1725 Basile Bouchon substituted for the bunches of looped string an endless band of perforated paper by which the simples for any shed could be selected. In 1728 M. Falcon constructed the machine since known as the Jacquard and operated it through the medium of perforated cards, but it was attached to the simple cords and required a draw-boy to manipulate it. In 1745 Jacques de Vaucanson united in one machine Bouchon's band of paper and the mechanism of Falcon. He placed this machine where the pulley box previously stood, and invented mechanism for operating it from one centre.

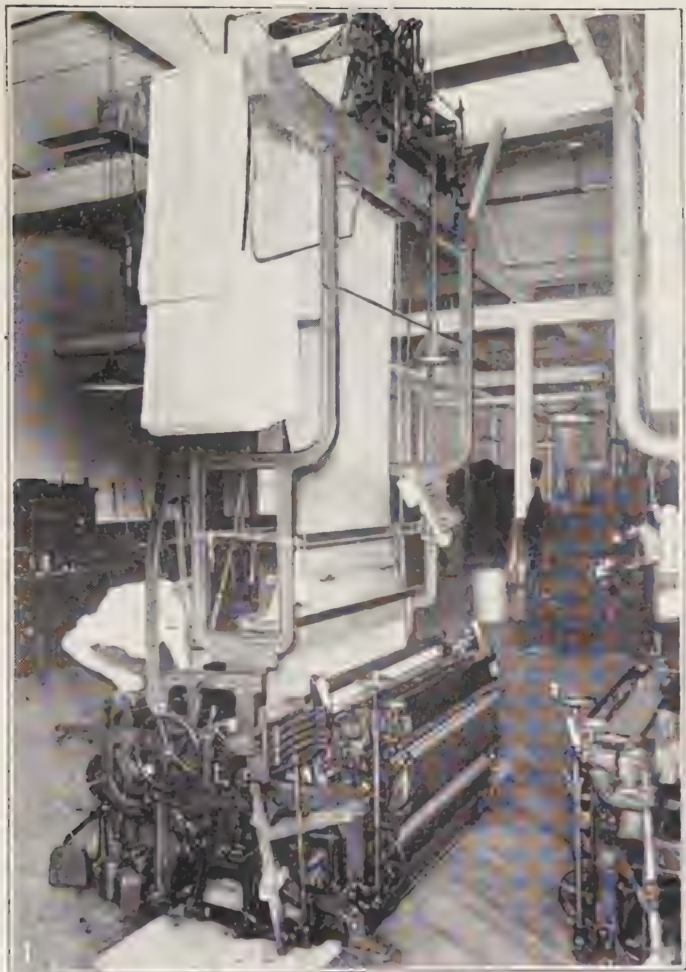
It is said that about the year 1801 J. M. Jacquard was called upon to correct the defects of a certain loom belonging to the state, in doing which he asserted that he could produce the desired effects by simpler means, and this he undoubtedly accomplished. In or about 1804 he discarded the simple and all but a few inches of the vertical neck cords; he placed Falcon's apparatus immediately over the centre of the loom and severally attached the upper portions of the neck cords to the hooks; all of which Vaucanson had previously done. He then perforated each face of a quadrangular frame—used by Falcon to guide the cards to the draw-boy, and since known as the cylinder—and invented means whereby the cylinder could be made to slide horizontally to and fro, and at each outward journey make one-quarter of a revolution. Cards were so held upon this cylinder by pegs that at each rotatory movement one was brought into action and another moved away. By means of two treadles placed beneath the warp one weaver could operate the entire loom. The cylinder was controlled with one foot, the selecting parts with the other, and both hands were free to attend to picking and beating-up.

In a Jacquard machine the warp threads are raised by rows of upright wires called hooks. See D, fig. 27. These are bent at both extremities and are normally supported upon a bottom board C, which is perforated to permit the neck cords from the harness beneath to be attached to the hooks. Each of a series of horizontal needles E—one of which is shown enlarged and detached at the foot of the drawing—is provided with a loop and a coiled eye; the former to permit of a to-and-fro movement, the latter to receive a hook. The straight ends of the needles protrude about one-quarter of an inch through a perforated needle board G, but the looped ends rest upon bars placed in tiers. A wire passed through all the loops of the needles which form one vertical line limits the extent of their lateral movement, and small helical springs, *a*, enclosed in a box F, impinge upon the loops of the needles with sufficient force to press them and their hooks forward. A frame H, called a griffe, is made to rise and fall vertically by a treadle which the weaver actuates with one foot. This frame contains a blade for each line of hooks, and when the blades are in their lowest position the hooks are free and vertical with their heads immediately over the blades, hence, an upward movement given to the griffe would lift all the hooks and thereby all the warp threads. Only certain hooks, however, must be lifted with the griffe, and the selection is made by a quadrangular block of wood, I, called a cylinder, and cards which are placed upon it. Thus, each face of the cylinder has a perforation opposite each needle, so that if the cylinder be pressed close to the needle board the needle points will enter the holes in the cylinder and remain undisturbed. But if a card, which is not perforated in every possible place, is interposed between the cylinder and the needles, the unpunctured parts of the card close up some of the holes in the cylinder, and prevent corresponding needles from entering them. Each needle so arrested is thrust back by the advancing card; its spiral spring *a* is contracted and its hook D is tilted as shown in the figure. If at this instant the griffe H ascends, its blades will engage the heads of all vertical hooks and lift them, but those dislocated by being tilted will remain unlifted So soon as the pressing force of a card is removed from the needles the elasticity of the springs restores both needles and hooks to their normal positions. Cards are perforated by special machinery from a painted design, after which they are laced into a chain and passed over conical pegs upon the cylinder; the number required to weave any pattern equals the number of weft threads in that pattern. The cylinder is generally drawn out and turned by each upward movement of the griffe, and restored to the needles by each downward movement, so that each face in succession is presented to the needles, and each rotatory movement brings forward a fresh card. As the griffe rises with vertical hooks a shed is formed, and a thread of weft is passed across the warp. The griffe then descends and the operation is repeated but with a new combination of lifted threads for each card. A Jacquard may contain from 100 to 1200 hooks and needles, and two or more machines may be mounted upon the same loom.

Since Jacquard's time attempts have been made to dispense with hooks, needles, springs, cards, the cylinder and several other parts; machines have also been specially designed for effecting economies in the manufacture of certain fabrics; but although some of these devices are used in different sections of the industry, the single lift Jacquard remains unchanged, except in its details, which have been modified to give greater certainty of action to the moving parts. The most far-reaching changes are directly due to efforts made to adapt the Jacquard to fast running power looms. Alfred Barlow, John and William Crossley, and others, devised means whereby two hooks could control the same warp thread, and they provided the machine with two griffes, each capable of actuating alternate rows of hooks. One griffe was caused to ascend as the other descended, therefore, if one of the two hooks that operate a warp thread is lifted for the first shed, the other hook can begin to rise for a second shed immediately the first begins to fall. About half the time originally needed for shedding is thus saved, and as a result Jacquards can now be run at 210 to 220 picks per minute.

Preparing Warp and Weft for Weaving.—The power loom is only one of a series of machines which revolutionized weaving. Although early inventors of the power loom did much to perfect its various movements, the commercial results were disappointing, chiefly because means had not been devised for preparing warp and weft in a suitable manner for such a machine. William Radcliffe, of Stockport, perceived these shortcomings, and concluded that, by division of labour, weaving could be brought into line with, the then recently invented, spinning machinery. He, therefore, set himself the task of solving the problems involved, and by inventing the beam warper, the dressing sizing machine, the shuttle tongue, and the pin cop, he enabled the power loom to become a factor in the textile industry. The term preparation embraces winding, warping, sizing, Yorkshire dressing, drawing-in, twisting and occasionally other operations.

Weft Winding.—Weft yarns invariably receive simpler treatment than warp yarns; in many cases none at all. Cops and ring spools pass direct to the loom unless their dimensions are unsuited to the shuttles, in which case they, together with wefts bleached or dyed in hanks or used in a saturated condition, require winding upon pirns, or into cops of suitable sizes. Pirn winders differ greatly in construction, but the majority are furnished with conical shapers, consisting either of slip cups, or of cone rollers mounted upon studs. A pirn, whose head is coned to fit inside a shaper, is slipped over a spindle, and both are passed, either vertically or horizontally, through a shaper; the basal end of the spindle being flattened to enter a rectangular hole in a wharve which is driven from a central tin drum. A thread is attached to a rotating pirn, and a vibrating guider leads it to and fro inside the shaper. Both spindle and pirn recede from the shaper until the pirn is full, when they become stationary. Hanks are carried by ryces, and cops and ring spools by skewers. Cop winders are chiefly used for coarse yarns, which they coil upon bare spindles. By this means a greater length of weft can be placed in a shuttle than when pirns are used.



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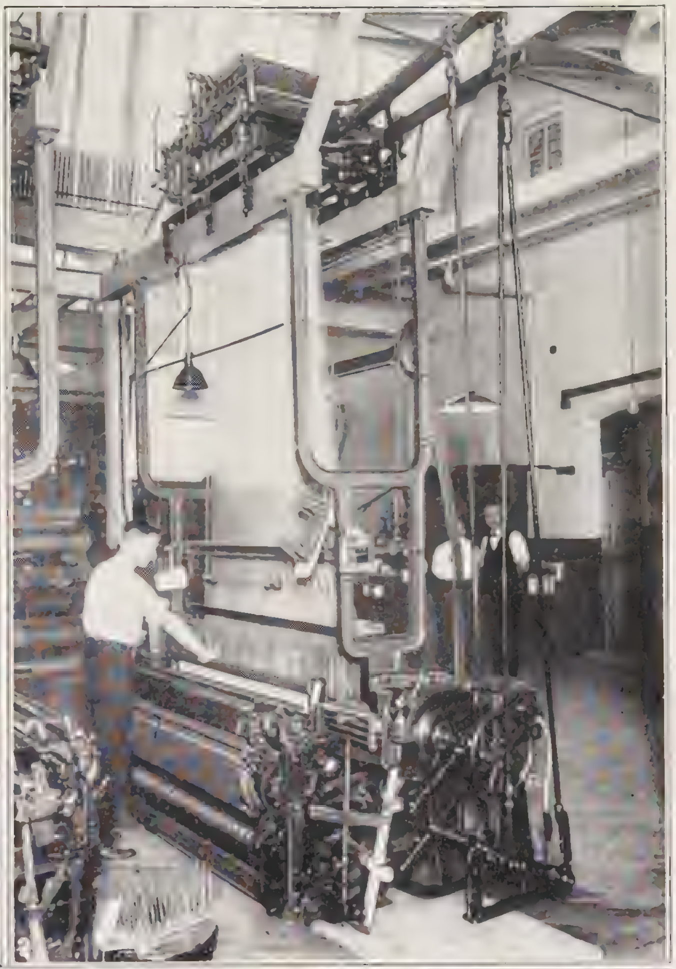

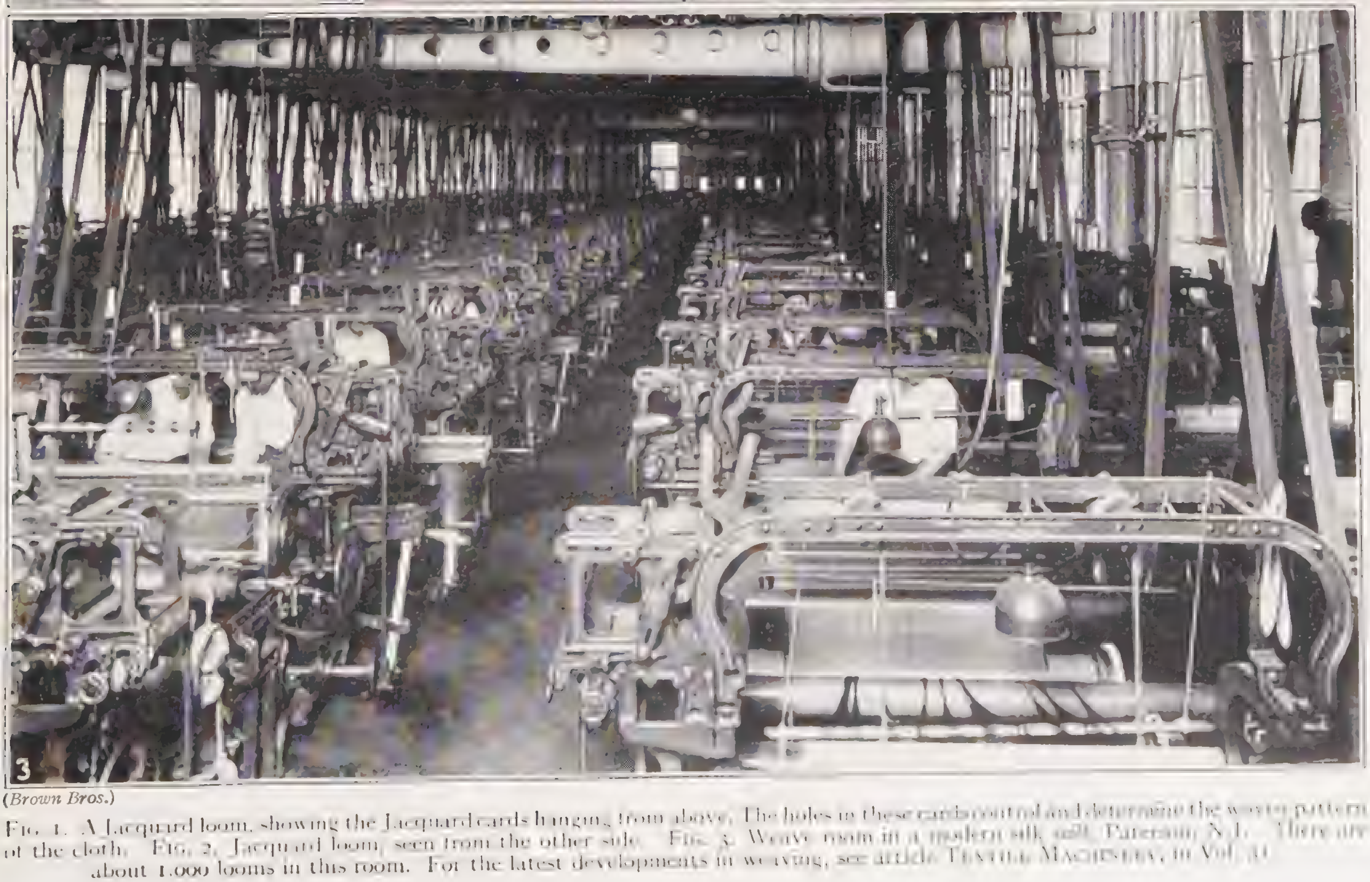

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(Brown Bros.)

Fig. 1. A Jacquard loom, showing the Jacquard cards hanging from above. The holes in these cards control and determine the woven pattern of the cloth. Fig. 2. Jacquard loom, seen from the other side. Fig. 3. Weave room in a modern silk mill, Paterson, N.J. There are about 1,000 looms in this room. For the latest developments in weaving, see article Textile Machinery, in Vol. 31.

Warp winding consists in transferring yarn from cops, ring spools or hanks, either to warpers, bobbins or cheeses (see COTTON-SPINNING MACHINERY). Machines for this purpose are of two kinds, which are known respectively as spindle and drum. In the former each bobbin is placed upon a vertical spindle and rotated by frictional contact; a yarn guider meanwhile rises and falls far enough to lay the threads in even coils between the bobbin flanges. In the latter each bobbin, or tube, is laid upon a rotating drum and a thread guide moves laterally to and fro; slowly for a bobbin, but quickly for a tube.

Warping.—The number of longitudinal threads in a web vary according to their closeness and its breadth. It is the function of a warper to provide a sufficient number of parallel threads for a web, all of equal length, and to retain their parallelism. Warpers are of three types, viz. mill, beam and sectional.

Mill warping is the oldest type now in extensive use. A mill warper has a creel in which from 50 to upwards of 300 bobbins or cheeses, are supported horizontally upon pegs, and the mill has a vertical axis which carries three wheels, upon whose rims vertical staves are fixed about 1 ft. apart to form a reel, from 5 to upwards of 20 yds. in circumference. The threads from the creel are threaded in succession through leasing needles, then passed in groups of four to twenty threads between runners, and, finally, fastened by a peg to the mill staves. The needles are mounted alternately in two frames which may be moved up inclined planes; one to elevate odd threads, the other even ones, and both separations thus formed are retained upon separate pegs; this is the lease which enables a weaver to readily fix the position of a broken thread. As the mill rotates the threads form a tape about 1 in. wide, and the leasing apparatus slides down a post to coil the threads spirally upon the reel. When the full length of warp has been made the mill is stopped, a half beer lease is picked by hand from the divisions formed by the runners, and also retained upon pegs. The mill next reverses its direction of rotation, and as the leasing apparatus ascends the threads are folded back upon themselves. Hence, if a reel is 20 yds. in circumference, and 200 threads are in use to make a warp 600 yds. long, and containing 2000 threads, the reel will make 30 revolutions ($600 \div 20 = 30$) also 10 reversals, for at each reversal 200 additional threads will be added ($2000 \div 200 = 10$). When a warp is complete, strings are passed through the leases, and it is coiled into a ball, loosely linked into a chain, or dropped into a sheet. If a mill has its axis horizontal the leasing apparatus must slide horizontally.

Winding on Frame.—After a ball warp has been bleached, dyed or sized, the half beers are laid amongst the teeth of a coarse comb to open out the threads to the necessary breadth, in which condition they are coiled upon a loom beam.

Beam warping is the system most extensively used in the cotton trade. The creels for these machines have an average capacity of about 600 bobbins, and are often V-shaped in plan. In each leg of the V the bobbins are arranged in tiers of 16 to 20, and row behind row. The threads are drawn separately between the dents of an adjustable reed, then under and over a series of rollers; from here they are dropped amongst the teeth of an adjustable comb and led down to a warpers beam, which rests upon the surface of a drum. As the drum rotates the threads are drawn from the bobbins and wrapped in even coils upon the beam. On most of these machines mechanism is attached for arresting motion on the fracture of a thread, and also for accurately measuring and recording the lengths of warp made. When full, a warpers beam holds threads of much greater length than are needed for any warp, but they are insufficient in number. Thus: If 500 threads are in use, and warps of the above-named particulars are required, four similar beams must be filled ($2000 \div 500 = 4$) and the threads from all are subsequently united. The chief parts of a beam warper may be used as a substitute for a mill warper, provided that mechanism be employed to contract the threads to the form of a loose rope and coil them into a cylindrical ball, which will be subsequently treated as a mill warp. Or, one of these warpers may be furnished with parts which, when the threads are roped, links them loosely into a chain.

Sectional warping is chiefly employed for coloured threads and its outstanding features consist in contracting the threads to form a ribbon of from 3 in. to 12 in. wide. This ribbon is coiled upon a block placed between flanges, and when completed is set aside until a sufficient number of similar sections have been made; after which they are slipped upon a shaft and by endlong pressure converted into a compact mass. All the threads are then collected and transferred in the form of a sheet to a loom beam; each section contributing its own width to that of the warp. Sectional warps are also made upon horizontal mills by superposing the coils of a ribbon of yarn upon a portion of the staves. When the first section is formed a second is wound against it, and the operation continued until all the sections have been made; after which the yarn is run upon a loom beam.

Yorkshire dressing is used to make striped warps from balled warps which have been dyed in different colours. The operation is as follows: The requisite number of threads of any colour is split from a uniformly dyed ball and set aside until warps of the remaining colours have been similarly treated. The split sections from the several balls collectively contain as many threads as are needed for a warp, but those threads have still to be placed in their proper sequence. This is done by drawing them in groups of two or four between the dents of a reed to a predetermined colour scheme, then all are attached to a loom beam which is supported in a frame. The beam is rotated by stepped cones and gearing, and winds the threads upon itself. But in order to hold the threads taut they are passed between weighted rollers and deflected by bars arranged ladder-wise; in passing from one part of the machine to another they are gradually opened out to the width of the beam.

Sizing.—In cases where single yarns are made from short fibrous materials, smooth surfaces are obtained by laying the outstanding ends of fibres upon the thread, and fastening the fibres together to impart sufficient strength to resist the strains of weaving. This is accomplished either by coating a thread or by saturating it with an adhesive paste. In hand-loom days the paste was applied by brushes to successive stretches of warp while in a loom. But with the advent of mechanical weaving it was found necessary to size a warp before placing it in a loom. Two systems were evolved, the one invented by William Radcliffe sizes, dries and beams a warp in one operation, the yarn is made to pass in the form of a sheet between a pair of rollers, the lower one being partly immersed in warm size. In rotating this roller carries upon its surface a film of size which it deposits upon the threads, while, by pressure, the upper roller distributes the size evenly. Brushes acting automatically smooth down the loose fibres and complete the distribution of size. As the yarn advances it is separated by reeds and lease rods, so that in passing over steam chests and fans the moisture contained in the threads may be quickly evaporated. This machine is a duplex one, for the warpers beams are divided into two sets and placed at opposite ends of the machine. Both halves receive similar treatment as they move to the centre, where the loom beam is placed.

The Ball Warp Sizer.—While efforts were being made to perfect Radcliffe's dressing machine a system of sizing ball warps was being gradually evolved and this system is still largely employed. The machine consists of a long trough, inside which a series of rollers are fitted, either in one horizontal plane or alternately in two horizontal planes; but over the front end of the trough a pair of squeezing rollers are mounted. The trough contains size, which is maintained at a boiling temperature and in sufficient quantity to submerge the rollers. Two warps, in the form of loose tapes, may be simultaneously led over, under and between the rollers. As the warps advance the threads become saturated with size, and the squeezing rollers press out all but a predetermined percentage, the latter being regulated by varying the pressure of the upper roller upon the lower one. If more size be required than can be put into the threads during one passage through the machine, they may be similarly treated a second time. This process does not lay all the loose fibres, but the threads remain elastic. After sizing, the warps are passed backward and forward, and over and under, a set of steam-heated cylinders by which the moisture contained in the threads is evaporated; they are next either reballed, or wound upon a loom beam.

Slasher Sizing.—For sizing cotton yarns Radcliffe's dressing machine has to a large extent been displaced by the slasher, but in some branches of the textile industry it is still retained under various modifications. In a slasher the threads from a number of warping beams are first combined into one sheet, then plunged into a trough filled with size which is kept at a boiling temperature by perforated steam pipes; and next squeezed between two pairs of rollers mounted in the trough. The under surfaces of the sizing rollers are in the size, but the upper squeezing rollers are covered with flannel, and rest by gravitation upon the lower ones. On leaving the size trough the sheet of yarn almost encircles two steam-heated cylinders whose diameters are respectively about 6 ft. and 4 ft.; these quickly expel moisture from the yarn, but so much heat is generated that fans have to be employed to throw cool air amongst the threads. The yarn is next measured, passed above and below rods which separate threads that have been fastened together by size, smeared with piece marks, and coiled upon a loom beam by means of a slipping friction gear. The last-named is employed so that the surface speed of winding shall not be affected by the increasing diameter of the loom beam. By means of mechanism which greatly reduces the velocities of the moving parts, much necessary labour may be performed without actually stopping the machine; this relieves the yarn of strain, and gives better sizing, yet slashed warps are less elastic than dressed, or balled sized ones, and they lack the smoothness of dressed warps.

Hank sizing is chiefly, but not exclusively, employed for bleached and coloured yarns. Machines for doing this work consist of a tank which contains size, flanged revolving rollers and two hooks. One hook is made to rotate a definite number of times in one direction, then an equal number the reverse way; the other has a weight suspended from its outer end and can be made to slide in and out. Size in the tank is kept at the required temperature by steam pipes, and "doles" of hanks are suspended from the rollers with about one-third their length immersed in size. As the hanks rotate all parts of the yarn enter the size, and when sufficiently treated they are removed from the rollers to the hooks where they are twisted to wring out excess, and force in required size. If sufficient size has not been added by one treatment, when untwisted, the wrung-out hanks are passed to a similar machine containing paste of greater density than the first there to be again treated; if necessary this may be followed by a third passage. On the completion of sizing the hanks are removed either to a drying stove or a drying machine. If to the former, they are suspended from fixed, horizontal poles in a specially heated and ventilated chamber. If to the latter, loose poles containing hanks are dropped into recesses in endless chains, and slowly carried through a large, heated and ventilated box, being partially rotated the while. On reaching the front of the box they are removed, brushed and made up into bundles. After which the yarn is wound, warped and transferred to a loom beam.

Drawing-in, or entering, is the operation of passing warp threads through the eyes of a shedding harness, in a sequence determined by the nature of the pattern to be produced, and the order of lifting the several parts. It is effected by passing a hook through each harness eye in succession, and each time a thread is placed in the hook by an attendant, it is drawn into an eye by the withdrawal of the hook.

Twisting or looming consists in twisting, between the finger and thumb, the ends of a new warp separately upon those of an old one, the remains of which are still in the eyes of the shedding harness. The twisted portions adhere sufficiently to permit of all being drawn through the eyes simultaneously.

The Power Loom.—Little is known of the attempts made before the beginning of the 17th century to control all parts of a loom from one centre, but it is certain the practical outcome was inconsiderable. In the year 1661, a loom was set up in Danzig, for which a claim was made that it could weave four or six webs at a time without human aid, and be worked night and day; this was probably a ribbon loom. In order to prevent such a machine from injuring the poor people, the authorities in Poland suppressed it, and privately strangled or drowned the inventor. M. de Gennes, a French naval officer, in 1678 invented a machine whose chief features consisted in controlling the healds by cams, the batten by cams and springs and the shuttle by a carrier. From 1678 to 1745 little of importance appears to have been done for the mechanical weaving of broadcloth. But in the last-named year M. Vaucanson constructed a very ingenious, self-acting loom, on which the forerunner of the Jacquard machine was mounted; he also adopted de Gennes's shuttle carrier. All early attempts to employ mechanical motive power for weaving failed, largely because inventors did not realize that success could only be reached through revolution. Mechanical preparing and spinning machinery had first to be invented, steam was needed for motive power, and the industry required reorganization, which included the abolition of home labour and the introduction of the factory system.

During the last quarter of the 18th century it was generally believed that, on the expiry of Arkwright's patents, so many spinning mills would be erected as to render it impossible to consume at home the yarns thus produced, and to export them would destroy the weaving industry. Many manufacturers also maintained it to be impossible to devise machinery which would bring the production of cloth up to that of yarn. It was as a protest against the last-named assertions that Dr Edmund Cartwright, a clergyman of the church of England, turned his attention to mechanical weaving. More fortunate than his predecessors, he attacked the problem after much initial work had been done, especially that relating to mechanical spinning and the factory system, for without these no power loom could succeed. In 1785 Dr Cartwright patented his first power loom, but it proved to be valueless. In the following year, however, he patented another loom which has served as the model for later inventors to work upon. He was conscious that for a mechanically driven loom to become a commercial success, either one person would have to attend several machines, or each machine must have a greater productive capacity than one manually controlled. The thought and ingenuity bestowed by Dr Cartwright upon the realization of his ideal were remarkable. He added parts which no loom, whether worked manually or mechanically, had previously been provided with, namely, a positive let-off motion, warp and weft stop motions, and sizing the warp while the loom was in action. With this machine he commenced, at Doncaster, to manufacture fabrics, and by so doing discovered many of its shortcomings, and these he attempted to remedy: by introducing a crank and eccentrical wheels to actuate the batten differentially; by improving the picking mechanism; by a device for stopping the loom when a shuttle failed to enter a shuttle box; by preventing a shuttle from rebounding when in a box; and by stretching the cloth with temples that acted automatically. In 1792 Dr Cartwright obtained his last patent for weaving machinery; this provided the loom with multiple shuttle boxes for weaving checks and cross stripes. But all his efforts were unavailing; it became apparent that no mechanism, however perfect, could succeed so long as warps continued to be sized while a loom was stationary. His plans for sizing them while a loom was in operation, and also before being placed in a loom, both failed. Still, provided continuity of action could be attained, the position of the power loom was assured, and means for the attainment of this end were supplied in 1803, by William Radcliffe, and his assistant Thomas Johnson, by their inventions of the beam warper, and the dressing sizing machine.

For upwards of thirty years the power loom was worked under numerous difficulties; the mechanism was imperfect, as were also organization, and the preparatory processes. Textile workers were unused to automatic machinery, and many who had been accustomed to labour in their own homes refused employment in mills, owing to dislike of the factory system and the long hours of toil which it entailed, that spinners and manufacturers were compelled to procure assistants from workhouses; this rendered mill life more distasteful than it otherwise would have been to hand spinners and weavers. Their resentment led them to destroy machinery, to burn down mills, to ill-use mill workers and to blame the power loom for the distress occasioned by war and political disturbances. Yet improvements in every branch of the textile industry followed each other in quick successions, and the loom slowly assumed its present shape. By using iron instead of wood in its construction, and centring the batten, or slay, below instead of above the warp line, the power loom became more compact than the hand-loom.

Motion is communicated to all the working parts from a main shaft A (fig. 28), upon which two cranks are bent to cause the slay B to oscillate; by toothed wheels this shaft, drives a second shaft, C, at half its own speed. For plain weaving four tappets are fixed upon the second shaft, two, D, for moving the shuttle to and fro, and two others, E, for moving the healds, L, up and down through the medium of treadles M, M. For other schemes of weaving shedding tappets are more numerous, and are either loosely mounted upon the second shaft, or fixed upon a separate one. In either event they are driven by additional gearing, for the revolutions of the tappets to those of the crank shaft must be as one is to the number of picks in the repeat of the pattern to be woven. Also, when two or more shuttles are driven successively from the same side of a loom, if the picking tappets rotate with the second shaft, those tappets must be free to slide axially in order to keep one out of action so long as the other is required to act. The warp beam F is often put under the control of chains instead of ropes, as used in hand looms, and the chains are attached to adjustably weighted levers, G, whereby the effectiveness of the weights may be varied at pleasure. In the manufacture of heavy fabrics, however, it may be necessary to deliver the warp by positive gearing, which is either connected, or otherwise, to the taking-up motion. The cloth is drawn forward regularly as it is manufactured by passing it over the rough surface of a roller, I, and imparting to the roller an intermittent motion each time a pick of weft is beaten home. This motion is derived from the oscillating slay, and is communicated through a train of wheels. The loom is stopped when the weft fails by a fork-and-grid stop motion, which depends for its action on the lightly balanced prongs of a fork, N. These prongs come in contact with the weft, between the selvage of the web and the shuttle box each time the shuttle is shot to the side at which the apparatus is fixed. If the prongs meet no thread they are not depressed, and being unmoved a connexion is formed with a vibrating lever, J; the latter draws the fork forward, and with it a second lever O, by which the loom is stopped. On the other hand, if the prongs are tilted, the loom continues in action. If more than one shuttle is used it may be necessary to feel for each, instead of alternate threads of weft. In such cases a fork is placed beneath the centre of the cloth and lifted above a moving shuttle; if in falling it meets with weft it is arrested, and the loom continues in motion, but if the weft is absent the prongs fall far enough beneath the

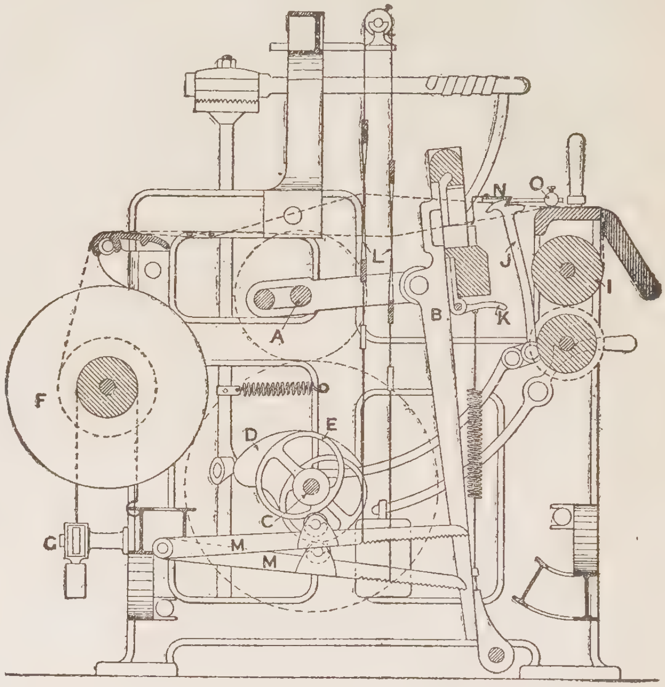


Fig. 28.—Vertical Section of a Power Loom.

shuttle race for a stop to act upon a lever and bring the loom to a stand. To prevent a complete wreck of the warp it is essential to arrest the loom when a shuttle fails to reach its appointed box. For this purpose there are two devices, which are known respectively as fast and loose reed stop motions. The first was invented in 1796 by Robert Miller, and its action depends upon the shuttle, as it enters a box, raising two blades, K, which if left down would strike against stops, and so disengage the driving gear. The second was invented in 1834 by W. H. Hornby and William Kenworthy; it is an appliance for liberating the lower part of a reed when a shuttle remains in the warp, thus relieving it, for the time being, of its function of beating up the weft. On the release of a reed from the motion of the slay, a dagger stops the loom. Temples must keep a fabric distended to the breadth of the warp in the reed, and be self-adjusting. This is usually accomplished by small rollers whose surfaces are covered with fine, closely set points. The rollers are placed near the selvages of a web which is prevented from contracting widthwise by being drawn tightly over the points.

Looms are varied in details to suit different kinds of work, but as a rule fabrics figured with small patterns are provided with healds for shedding as at L, while those with large patterns are provided with the Jacquard and its harness. Healds may be operated either by tappets or dobbies, but the range of usefulness in tappets is generally reached with twelve shafts of healds and with patterns having sixteen picks to a repeat; where they are unsuitable for heald shedding a dobby is used. A dobby may resemble, in construction and action, a small Jacquard; if so the selection of healds that rise and fall for any pick is made by cards. In other types of dobbies the selection is frequently made by lags, into which pegs are inserted to pattern in the same manner that cards are perforated. By acting upon levers the pegs bring corresponding hooks into contact with oscillating griffe bars, and these lift the required heald shafts. Such machines are made single and double acting, and some have rollers in place of pegs to form a pattern. When multiple shuttles are required for power looms one of two types is selected, namely, drop or rotating boxes; the former are applicable to either light or heavy looms, but the latter are chiefly confined to light looms. As previously stated, Robert Kay invented drop boxes in 1760, but they were not successfully applied to the power loom until 1845, when Squire Diggle patented a simple device for operating them automatically. Since his time many other methods have been introduced, the most successful of these being operated indirectly from the shedding motion. Revolving boxes were patented in 1843 by Luke Smith. They consist in mounting a series of shuttles in chambers formed in the periphery of a cylinder, and in moving the cylinder far enough, in each direction, to bring the required shuttle in line with the picker.

Automatic Weft Supply.—Many devices have been added to power looms with a view to reduce stoppages, amongst which those for the automatic supply of weft are probably the most important. These efforts originated with Charles Parker, who, in 1840, obtained the first patent, but no marked success was achieved until 1894, when J. H. Northrop patented a cop changer. By his plan a cylindrical hopper, placed over one shuttle box, is charged with cops or pirns. At the instant fresh weft becomes necessary the lowest cop in the hopper is pressed into a shuttle from above, the spent one is pressed out from beneath, and the new weft is led into the shuttle eye, while the loom is moving at its normal speed. The mechanism is controlled by the weft fork, or by a feeler which acts when only a predetermined quantity of weft remains inside a shuttle. Many inventions are designed to eject an empty shuttle and introduce a full one; others change a cop, but differ in construction and action from the Northrop, yet, at the time of writing, they have not been so successful as the last-named. By relieving a weaver of the labour of withdrawing, filling, threading and inserting shuttles it was seen that a large increase might be made in the number of looms allotted to one weaver, provided suitable mechanism could be devised for stopping a loom on the failure of a warp thread.

Warp Stopping Motions date from 1786, when Dr Cartwright suspended an independent detector from each warp thread until a fracture occurred, at which time a detector fell into the path of a vibrator and the loom was arrested. The demand for warp stop motions was, however, small until automatic weft supply mechanisms were adopted. The majority of those devices now in use are constructed upon Dr Cartwright's lines, but some are so attached to wire healds that, at one position in every shed, an unbroken thread supports both heald and detector until a thread fails, when a detector is engaged by a vibrator, and the driving mechanism is dislocated. In other warp stop motions pairs of threads are crossed between the lease rods, and a wire passed between them is held forward by the crossed threads until one breaks; the wire then springs back, makes contact with a metal bar, and electro-mechanical connexions stop the loom.

Smallware Looms.—A loom, which was for a long period operated manually, but to which mechanical power could be applied, was brought into use more than a century before Dr Cartwright's invention. It was known as the Dutch engine loom, and was designed to weave from eight to upwards of forty tapes or ribbons simultaneously. This machine may be regarded as a series of looms mounted in one frame, each having a complete set of parts, and as the first practical effort to connect and control all the motions of weaving from one centre. The place and date of its invention are uncertain; but it is known that in some districts its use was entirely prohibited, in others it was strictly limited, and that it was worked in Holland about 1620. In England the first patent was obtained by John Kay and John Snell, in 1745, for additions which enabled it to be worked by hand, by water, or other force, and in 1760 John Snell appears to have added the draw harness for weaving flowered ribbons. In 1765 a factory in Manchester was filled with ribbon looms which were either invented by M. Vaucanson, or Kay and Snell, but one weaver could only attend to one machine. When worked by hand it was known as the bar loom, because the weaver oscillated by hand a horizontal bar that set in motion all parts of the machine. The shuttles and reeds are actuated from the batten, the former originally by pegs, but later by a rack and pinion arrangement, which in action shoot the shuttles simultaneously across a web, to the right and left alternately, each into the place vacated by its next neighbour. One small warp beam is required for each web, but tappets, dobbies, or Jacquards are available for dividing the threads. Where differently coloured wefts are needed in one web the shuttles are mounted in tiers and all raised or lowered at once to bring the proper colour in line with the shed.

In *Swivel Weaving* similar shuttles are added to the battens of broad looms in order to diaper small figure effects, in different colours or materials, over the surface of broad webs.

Pile Weaving.—Looms for weaving piled fabrics differ in certain important respects from those employed for ordinary weaving; they are also made to differ from each other to suit the type of fabric to be manufactured, as, for example, double and single, plain and figured, textures.

In *Double Pile Looms* the special features are those that control the pile threads, and those that sever the vertical lines of pile. Two ground warps are requisite, and unless they are kept a uniform distance apart the piled effects will be irregular. For plain goods the pile threads are wound upon two or more beams, and, as they move from web to web, cloth-covered rollers deliver them in fixed lengths. Meanwhile, a shuttle passes twice in succession through each ground warp, and the pile threads in moving above or beneath the wefts are bound securely. Both fabrics are furnished with taking-up rollers which draw the pieces apart and so stretch the uniting pile in front of a knife, which severs it, thus forming two pieces at once. A knife may consist of a short blade that merely moves to and fro across the webs, or of a disk mounted upon a spindle, which, in moving from side to side, revolves; in either case it is automatically sharpened. But if a knife is longer than the breadth of a fabric it receives only a slight lateral movement, and must be periodically removed for sharpening. In plain and printed goods healds control all the warps; but in figured goods, other than those made from printed warps, a Jacquard is needed to lift, and a creel to hold, the pile threads.

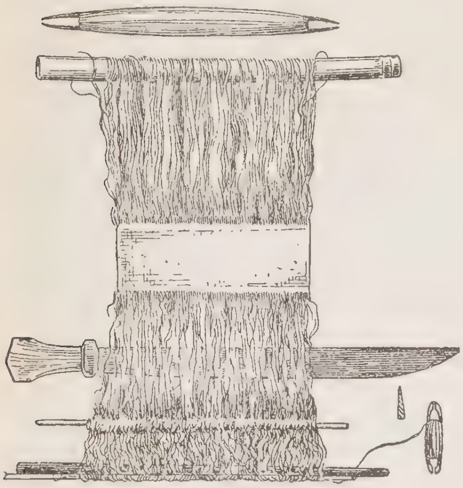
Single Pile Looms.—The chief feature which renders most single pile looms dissimilar from others is the mechanism by which wires are woven upon, and withdrawn automatically from, a ground texture. Wires are of two kinds, namely, without and with knives; the former, being flattened and somewhat pointed, are woven above the weft of a ground texture, but beneath the pile, hence, by withdrawing them, looped pile is formed. A wire terminating in a knife with a sloping blade, on being withdrawn, cuts the pile and produces a brush-like surface. The mechanism for operating the wires is placed at one end of a loom and consists of an arm which moves in and out; at each inward movement a wire is inserted, and at each outward movement one is withdrawn. In weaving tapestry carpets, and certain other fabrics, a wire and a shuttle move simultaneously, but a shuttle passes through the ground warp, while a wire passes beneath the pile. After several wires have been woven upon the ground texture the one first inserted is withdrawn by the vibrating arm, and at the next inward movement the same wire enters the warp near the reed, where it is beaten up with the weft, and, from this point, the operation is continuous. Tapestry carpets require three warps, one for the ground texture, a second, or stuffing warp, to give bulk and elasticity to the tread, and a third to form the pile. The last named is printed upon a large drum, thread by thread to the colour scheme of the design, then, when the colours have been fixed, and the threads accurately placed, they are wound upon a beam, and all the warps are operated by healds. For figured velvets, and Brussels and Wilton carpets, the pile warp beam is replaced by a creel, in order that each thread of pile may be wound upon a bobbin and separately tensioned. This is essential, because, in the weaving of a design, it is probable that no two threads of pile will be required in equal lengths. Creels are made in sections called frames, each of which usually carries as many bobbins as there are loops of pile across a web, and the number of sections equal the number of colours. In weaving these fabrics healds are used to govern the ground warp, but a Jacquard is needed for the pile. It must form two sheds, the lower one to receive a shuttle, the upper one to make a selection of threads beneath which the wire is to pass.

Terry Looms.—Looms for weaving piled textures, of the Turkish towel type, have the reed placed under the control of parts that prevent it from advancing its full distance for two picks out of every series that separate one line of loops from another. At such times the weft is not beaten home, but a broad crack is formed. So soon as the reed again moves through its normal space three picks of weft are simultaneously driven home, thus closing the gap, and causing part of the pile to loop upward, the remainder downward. The system is available for plain and figured effects.

Gauze Textures are woven in looms having a modified shedding harness, which, at predetermined intervals, draws certain warp threads crosswise beneath others, and lifts them while crossed. Also, a tensioning device to slacken the crossed threads and thus prevent breakages due to excessive strain. At other times the shedding is normal.

Lappet Looms have a series of needles fixed upright in laths, and placed in a groove cut in the slay, in front of the reed. Each needle carries a thread which does not pass through the reed, hence, by giving the laths an endlong movement of varying extent, and lifting the needles for each pick, their threads are laid crosswise in the web to pattern. (T. W. F.)

Archaeology and Art



From Roth's *Natives of Sarawak*, by permission of Truslove and Hanson.

FIG. 29.—Loom from Sarawak.

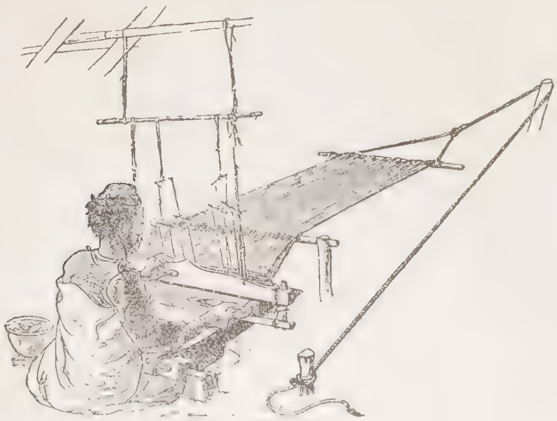


FIG. 30.—Indian Hill Tribesman's Loom.

The archaeology of shuttle-weaving shows that for ages the use of a loom for weaving plain, as distinct from ornamental or figured textiles, whether of fibres or of spun threads, has been practically universal, whilst the essential points of its construction have been almost uniform in character. An early stage in its development, anterior probably to that when the spinning of threads had been invented, is represented by the loom or frame (see fig. 29) used by a native of Sarawak to make a textile with shreds of grass. As will be seen, the shreds of grass for the warp are divided into groups by a flat sword-shaped implement which serves as the batten (Latin *spatha*). The shuttle is passed above it, leaving a weft of grass in between the warp; the batten is then moved upwards and compresses the weft into the warp; this method of pressing the weft upwards was usually employed by Egyptian and Greek weavers for their linen textiles of beautiful quality. Fig. 30 gives us an Indian Hill tribesman weaving with spun threads; but here we find the loom fitted with rudely constructed headles, by which the weaver lifts and lowers alternate ranks of warp threads so that he may throw his shuttle-carried weft across and between them. Besides the headles there is a hanging reed or comb, and between the reeds of it the warp threads are passed and fastened to a roller or cylinder. After throwing his shuttle once or twice backwards and forwards, the weaver pulls the comb towards himself, thereby pressing his weft and warp together, thus making the textile which he gradually winds from time to time on to the roller. This advance in the construction of the loom is also virtually of undateable age; and except for more substantial construction, there is little difference in main principles between it and the medieval loom of fig. 31. With such looms, and by arranging coloured warp threads in a given order and then weaving into them coloured shuttle or weft threads, simple textiles with stripes and chequer patterns could be, and were, produced; but textiles of complex patterns and textures necessitated the more complicated apparatus that belongs to a later stage in the evolution of the loom. Fig. 32 is from a Chinese drawing, illustrating the description given in a Chinese book published in 1210 on the art of weaving intricate designs. The traditions and records of such figured weavings are far older than the date of this book. As spun silken threads were brought into use, so the development of looms with increasing numbers of headles and other mechanical facilities for this sort of weaving seems to have started. But as far back as 2690 B.C. the Chinese were the only cultivators of silk,[1] the delicacy and fineness of which must have postulated possibilities in weaving far beyond those of looms in which grasses, wools and flax were used. It therefore is probably correct to credit the Chinese with being the earlier inventors of looms for weaving figured silks, which in course of time other nations (acquainted only with wool and flax textiles) saw with wonder. At the comparatively modern period of 300 B.C. Chinese dexterity in fine-figured weaving had become matured and was apparently in advance of any other elsewhere. Designs were being woven by the Chinese of the earlier Han Dynasty 206 B.C. as elaborate almost

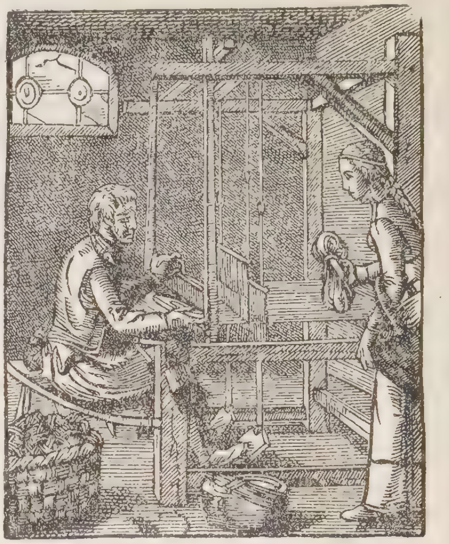


FIG. 31.—Medieval Loom, from a Cut by Jost Amman; middle of the 16th century.

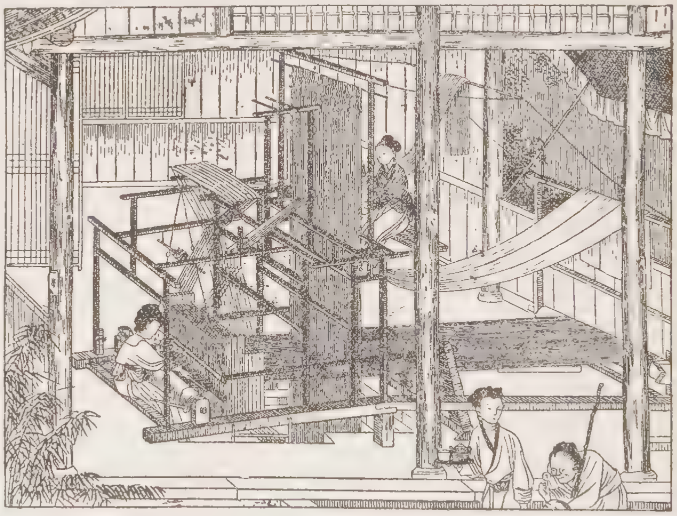


FIG. 32.—Chinese Loom for Figured Weaving (Photo).

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[1] E. Pariset, *Histoire de la soie* (Paris, 1862).

as those of the present day, with dragons, phoenixes, mystical bird forms, flowers and fruits.[1] At that time even Egypt, Assyria or Babylonia, Greece and Rome, seem to have been only learning of the fact that there was such a material as silk.[2] Their shuttle-weaving had been and was then concerned with spun wool and flax and possibly some cotton, whilst the ornamentation of their textiles, although sparkling on occasion with golden threads, was done apparently not by shuttle-weaving but by either embroidery or a sort of compromise between darning and weaving from which tapestry weaving descended (see TAPESTRY). The range of their colours was limited, reds, purples and yellows being the chief; and their shuttle-weaving was principally concerned with plain stuffs, and in a much smaller degree with striped, spotted and chequered fabrics. Remains of these, whether made by Egyptians thousands of years B.C., by Scandinavians of the early Bronze Age, by lake dwellers, by Aztecs or Peruvians long before the Spanish Conquest, display little if any technical difference when compared with those woven by nomads in Asia, hill tribes in India and natives in Central Africa and islands of the Pacific. Such ornamental effect as is seen in them depends upon the repetition of stripes or very simple crossing forms, still this principle of repetition is a prominent factor in more intricate designs which are shuttle-woven in broad looms and lengths of stuff.

The world's apparent indebtedness to the Chinese for knowledge of figured shuttle-weaving leads to some consideration of their early overland commerce westwards. About 200 B.C. during the Han Dynasty Chinese trade had extended beyond inner Asia to the confines of the Graeco-Parthian empire, then at its zenith, and the protection of the route by which the Seres (Chinese) sent their merchandise was fully recognized as a matter of importance. Seventy years later the emperor of China sent a certain Chang Kien on a mission to the Indo-Scythians; and according to his records the people as far west as Bactria (adjacent to the Graeco-Parthian territory) were knowing traders, and amongst other things understood the preparation of silk. Chinese weavings had for some time been coming into Persia, and doubtless instigated the more skilled weavers there to adapt their shuttle looms in course of time to the weaving of stuffs with greater variety of effects than had been hitherto obtained by them; and into Persian designs were introduced details taken not only from Chinese textiles, but also from sculptured, embroidered and other ornament of Graeco-Parthian and earlier Babylonian styles. In A.D. 97 Chinese enterprise in still furthering their trade relations with the Far West is at least suggested by the fact that envoys from the emperor of China to Rome actually reached the eastern shores of the Mediterranean, but turned back frightened by the Parthian accounts of the terrors of the sea voyage.

Early in the 3rd century A.D. Heliogabalus is reputed to have been amongst the first of the Roman emperors to wear garments entirely of silk (holosericum), which, if figured (as is not unlikely), were probably of Syrian or Persian manufacture. Sidonius Apollinaris (5th century) writes of Persian patterned stuffs,—"Bring forth brilliant cushions and stuffs on which, produced by a miracle of art, we behold the fierce Parthian with his head turned back on a prancing steed; now escaping, now returning to hurl his spear, by turns fleeing from and putting to flight wild animals whom he pursues"—a description quite appropriate to such silk weaving as that in fig. 33. A number of kindred pieces have been recovered of late years from Egyptian burial-places of the Roman period. The Persians of the Sassanian dynasty (3rd to 7th century) traded in silks with Romans and Byzantines; King Chosroes (about 570) encouraged the trade, and ornamental weaving seems to have been an industry of some standing at Bagdad and other towns north, east and south, *e.g.* Hamadan, Kazvin Kashan, Yezd Persepolis, &c. To the north-west of Persia and north of Syria lay the Byzantine region of Anatolia (now Asia Minor), some towns in which became noted for their fine weavings: the mass of the population there was well off in the 6th century, the country highly cultivated and prosperous, and justice fairly administered,[3] thus affording favourable conditions for an industry like ornamental weaving, which had been and was prospering in neighbouring Syrian districts.

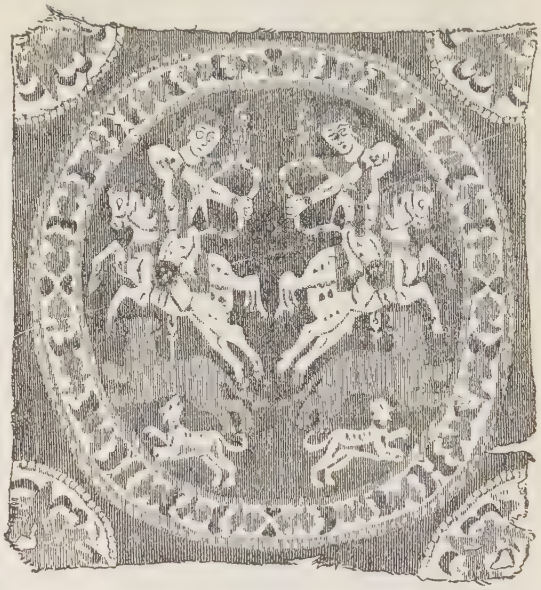

FIG. 33.—Syrian or Persian Silk Weaving of the 5th Century.

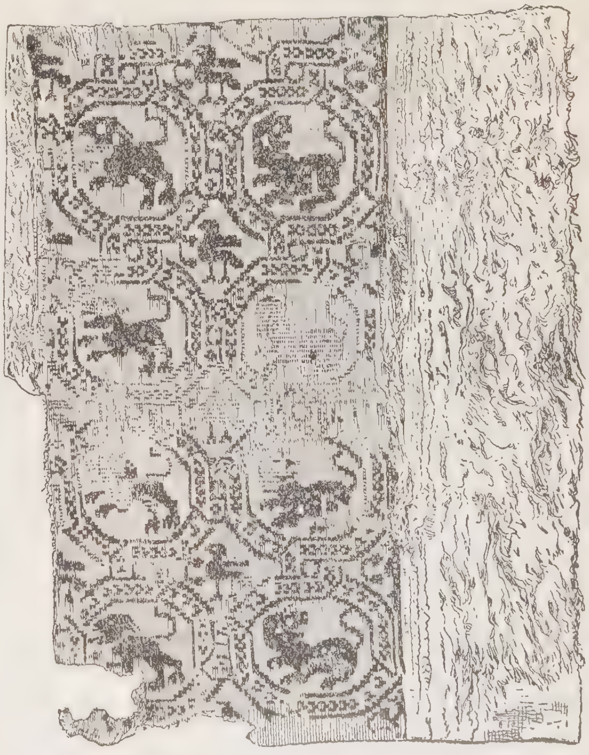

FIG. 34.—Syrian and Coptic Flax Weaving of the 5th or 6th Century.

Between the 1st and 6th centuries A.D., then, knowledge of silk and its value in fine weaving was spreading itself, not only in the further western regions of Southern Asia, but also in Egypt, where Greek and Roman taste influenced the works of Copts or those natives who maintained old Egyptian traditions in technical handicrafts. Of peculiar interest in this connexion are fragments of flax (yellow and brown) woven with a comparatively elaborate texture, as well as in patterns (see fig. 34) which suggest an ordinary type of Roman pavement designs (3rd century and earlier), the basis of which is roundels linked together. Stuffs in which the style of patterns, though comparatively simple, is rather more Oriental, are of flax and wool, and the official robes of Roman consuls seem to have been of this character, and amongst other goods may have been made with small technical difference at Rome[4] or at Fostat (Cairo) or Alexandria or other towns in Lower Egypt as well as in Syria. Contemporaneously the development of similar weaving appears to have been proceeding in Byzantine provinces, though perhaps not in so marked a way as when Justinian systematized sericulture[1] and still further stimulated shuttle-weaving in the town of Byzantium (Constantinople) itself in A.D. 552.

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[1] See *Chinese Art*, by Stephen W. Bushell, C.M.G., B.Sc., M.D. (London, 1906), vol. ii. p. 95.

[2] Aristotle describes the silk-worm and its cocoon. Virgil-Martial and late Roman writers (including Pliny) throw scarcely more light upon the use of silken stuffs than that they were of rarity and greatly prized by opulent Romans. Propertius (19 B.C.) writes of "silken garments of varied tissue," and of Cynthia that "perchance she glistens in Arabian Silk."

[3] W. M. Ramsay, *Studies in the History and Art of the Roman Empire* (University of Aberdeen, 1906).

[4] In 369 by order of the emperors Valens and Valentinian the making of textiles in which gold and silken threads were introduced was limited to women's workrooms or gynecia (see Codex of Theodosius, lib. x. tit. 21, lex 1). In the 5th century the weaving of silken tunics and mantles was prohibited (Codex Theodosius, lib x. tit. 21, lex 3).

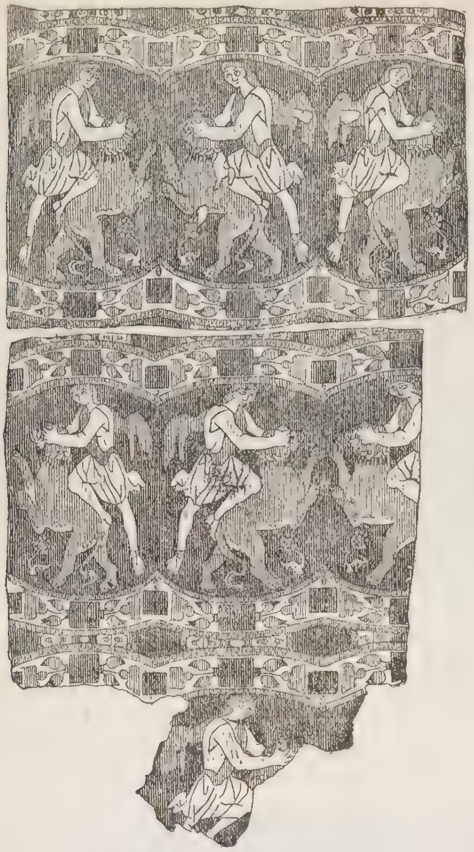

FIG. 35.—Syrian or Anatolian Silk Weaving of the 5th Century. with Samson and the Lion (repeated).

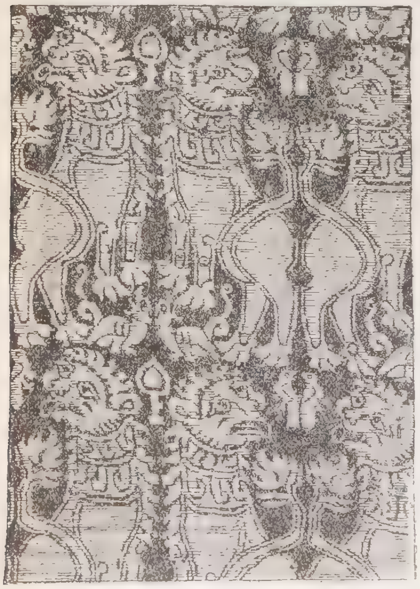

FIG. 36.—Byzantine Red Silk and Gold Thread Weaving of the 11th Century. Pairs of lions and pairs of small birds.

For examples of the elaborate figure weavings at that time we have to rely upon such as have been rescued in the service of archaeology from the oblivion of tombs and burial-places. The dates of some specimens can be fixed with almost certainty by means of nearly contemporary records, *e.g.* those of Sidonius Apollinaris and later Anastasius the Librarian; comparison and classification lead to almost conclusive inferences as to the dates of other examples. Broadly speaking, the earlier of these remains (*i.e.* from about the 4th to the 7th century) seem to be either of Persian (Sassanian) manufacture and design, or of Syrian and possibly Alexandrian make. Christian subjects were occasionally introduced into the designs. Between the 7th and the 13th centuries Byzantine manufactures come to the fore, and it is difficult if not impossible now to draw a clear line between those of Roman-Byzantine, Perso-Byzantine and Moslem-Byzantine styles, though one may do so in respect of certain Moslem (Moorish and Saracenic) weavings, which have distinctive features of design, and were produced in the south of Spain and in Sicily about a period from the 10th century to the 13th.

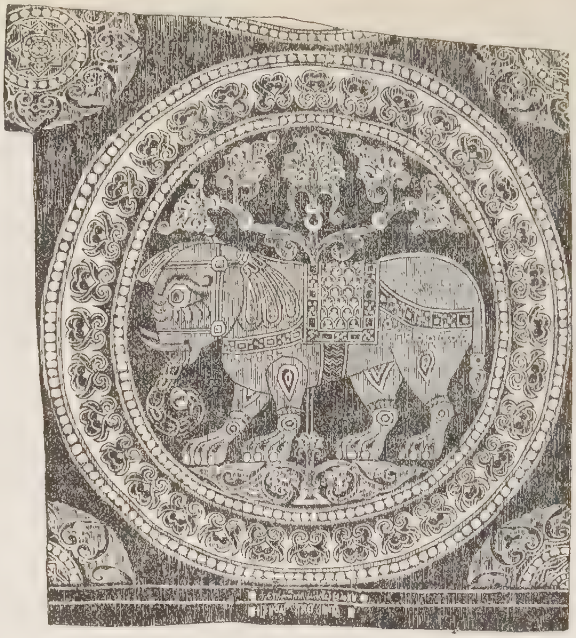

FIG. 37.—Part of Silk Wrapping of the Emperor Charlemagne, possibly of Bagdad manufacture, 9th Century, with Fanciful Elephant and Sacred Tree device in a Roundel.

Fig. 35, from a piece of sarcenet with repeated parallel series of Samsons and lions (or gladiators?), is probably 5th-century Syrian or Anatolian; of the same date are pieces with scenes of the Annunciation repeated in roundels, and with artistic birds and lions, in the treasury of the Sancta Sanctorum of the Chapel of St Lawrence in

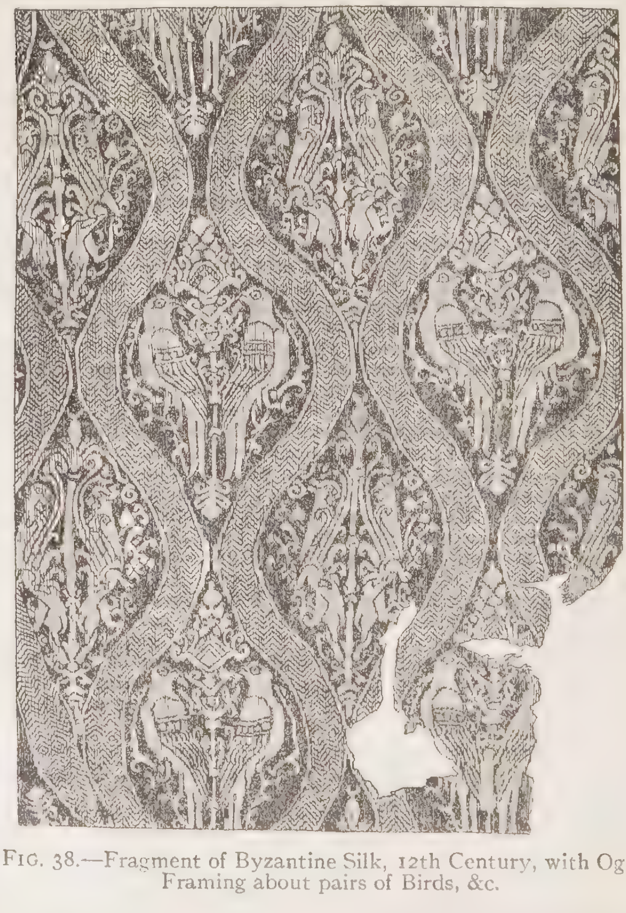

FIG. 38.—Fragment of Byzantine Silk, 12th Century, with Ogival Framing about pairs of Birds, &c.

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[1] This virtually was the starting of sericulture in Europe.

the old Lateran Palace, Rome. Scriptural subjects[1] seem to be typical of those which were condemned by Anatolian and Syrian fathers of the Christian church as early as in the late 4th century, and Asterius, bishop of Amasus, in denouncing the luxury of the rich in flaunting themselves in such inappropriately decorated silks, has left a most useful description of the subjects decorating them. A scheme long maintained in Syrian and Byzantine patterns was that of repeated roundels, within which other than scriptural subjects were wrought, *e.g.* hunters on horseback (as in fig. 33), fantastic animals and birds, singly or in pairs, confronting one another or back to back, frequently with a sacred tree device[2] between them. A piece of Sassanian silk, probably of the 6th century, shows a gryphon practically identical with that sculptured on the patterned saddle-cloth of a king (Chosroes II.?) in the archway to the garden of the king's palace at Kermchah.

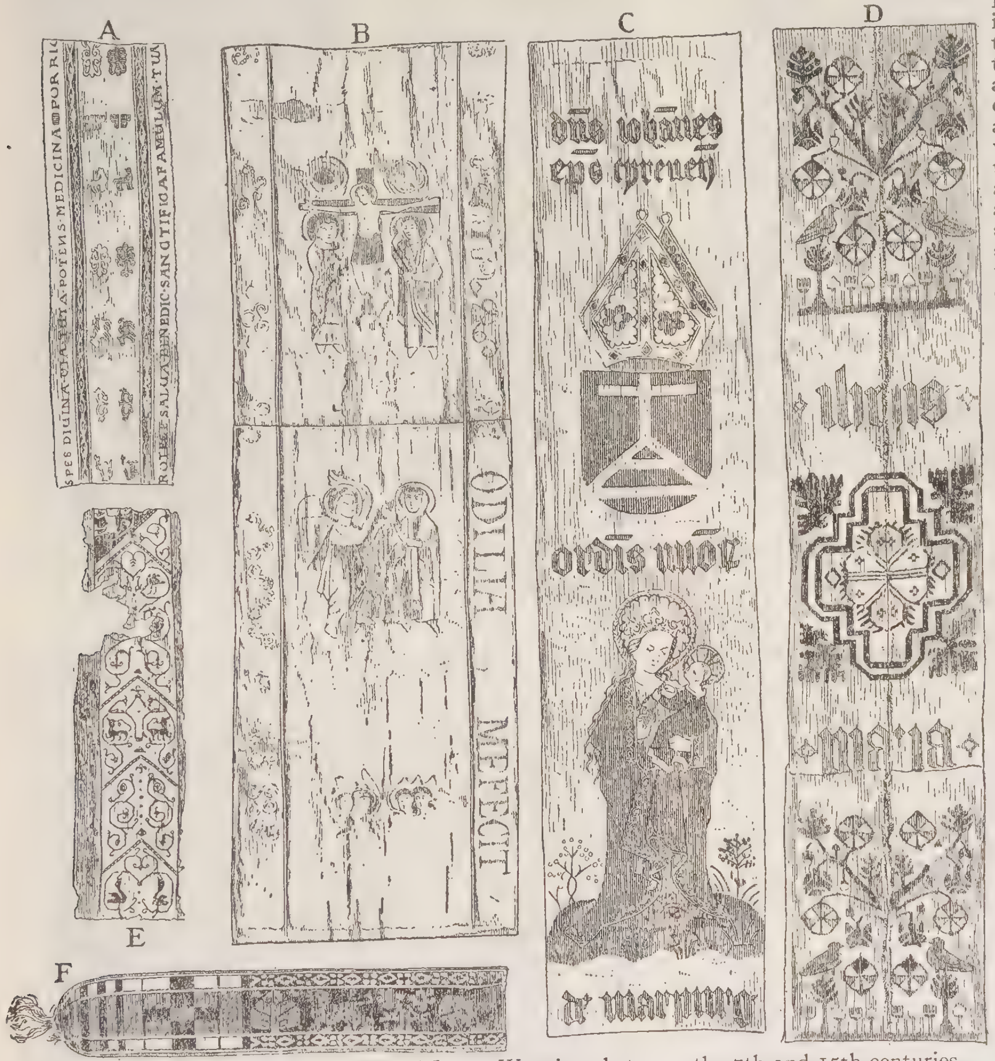

FIG. 39.—Specimens of various Small Loom Weavings between the 7th and 15th centuries.

A. Part of a narrow band or orphrey woven in gold and silk threads with a Latin inscription along the edges. German work of the 13th century.

B. Part of a broad band or orphrey woven in gold and silk threads with figures of the Crucifixion and the Annunciation (?). It bears an inscription, Odilia me fecit. It is probably German work of the 13th century.

C and D. Specimens of Cologne orphreys woven in silk and gold threads; C bears a Latin inscription, and the faces of the Virgin and Child are embroidered.

E. Part of a narrow band woven in gold and silk threads with chevron spaces filled with delicate scroll ornament, among which are occasional animal and bird devices. Possibly English or French work of the 13th century.

F. Part of a narrow band or clavus from a Coptic tunic of the 9th or 10th century.

Less common perhaps are patterns, without roundel or other framing, composed of animals, birds and the like, formally treated and repeated vertically and horizontally, as in fig. 36, which is from a silk and gold thread shuttle-weaving classified as Byzantine of the 11th century manufacture. But this style of composition also occurs in a Sassanian or Syrian silk of the 5th century at Le Mans,[3] and again in the Cope of St Maxim at Chinon, which is powdered with panthers. Conventional eagles (reminiscent perhaps of the Roman Eagle), with scale patterns on their breasts and wings, are woven in the wrappings reputed to have been given by the Empress Placidia for the corpse of St Germain (448) preserved at the church of St Eusebius at Auxerre. Some likeness in style may be detected between these latter and a fragment of one of the wrappings of St Cuthbert (d. 688) at Durham, though in this case the elaborate ornamentation is set within a roundel. Prior to the discovery of woven silks in the Akhmin cemeteries, the periods to which tradition and association had ascribed the Auxerre and Durham specimens were considered too early; but there now seems to be far less reason to question that ascription. Fig. 37 is from part of a silken wrapping of Charlemagne (early 9th century) now at Aix-la-Chapelle. It bears a Greek inscription of the names of Peter, governor of Negropont, and Michael, chamberlain of the Imperial Chambers, and this is taken by some authorities as evidence that the weaving was made at Byzantium. On the other hand, Eginhard, Charlemagne's secretary, has written of gifts, including rich textiles presented in his day by Haroun al Raschid to the emperor,[4] and a fabric like that in question might have been made quite possibly even at Baghdad in the 9th century or earlier. In the 11th century amongst the handicraftsmen in the city of Byzantium were many skilled native and foreign weavers; and their designs generally appear to reflect the style of earlier Persianesque and Syrian taste.

About the 12th century the well-used pattern scheme of roundels became more or less superseded by one of continuous ovals, of ogival framings (see fig. 38), contemporary with which are Saracenic patterns based on hexagonal and star-shape frames. Within these new varieties of pattern framings recur the Byzantine and Persianesque pairs of birds, animals, &c. But distinct from these is the more restricted style which has been mentioned. It had arisen under the influence for the most part of the Fatimy Khalifs, not only in Syria and Alexandria but also in Sicily and southern Spain. Patterns of this Moslem or Saracenic type are usually composed of a succession of parallel bands—narrow and wide—containing Kufic inscriptions, groups of small intricate geometrical devices, and occasionally conventional animals and birds. A 12th-century example of this class of pattern has been given elsewhere (see BROCADE, fig. 1).

Almeria, Malaga, Grenada and Seville were notable Moorish weaving places in Spain for such patterned silks and stuffs as these; and even after the Christian conquest of Grenada at the end of the 15th century this city retained its celebrity for silks woven "à la Moresque."

In Sicily no similar survival of Saracenic influence seems to have been as strongly maintained, notwithstanding the numerous Saracen weavers at work in the island for years before the Royal factory for silk weaving came to be organized at Palermo under Norman supremacy. According to the usual story, Roger of Sicily, or Roger Guiscard, who in 1147 made a successful raid on the shores of Attica, and took Athens, Thebes and Corinth, carried off as prisoners a number of Greek (Byzantine) weavers and settled them at Palermo in the factory known as the Hôtel des Tiraz. A mixture of Byzantine and Saracenic styles of textile patterns ensued; and this peculiarity is demonstrated in many of the rich fabrics attributed to south and north Italian weavers from the 12th century onwards. From Palermo the art of ornamental weaving in this style soon extended into the mainland, and from Apulia a bishop of St Evroul in Normandy is mentioned as having obtained a number of silken goods in the 12th century. From the 13th century onwards Lucca, Florence, Milan, Genoa and Venice became important centres, using not only imported silk, but also such as was being then cultivated in Italy, for sericulture had become an Italian industry early in the 13th century. Wandering Saracenic and Byzantine weavers even before that time had strayed or been taken to work at places in Germany, France and Britain, but the output of their productions in northern countries was almost infinitesimal as compared with that of the far greater Italian output, nevertheless they were sowing the seeds of a harvest to be reaped centuries later by these more northerly European countries.

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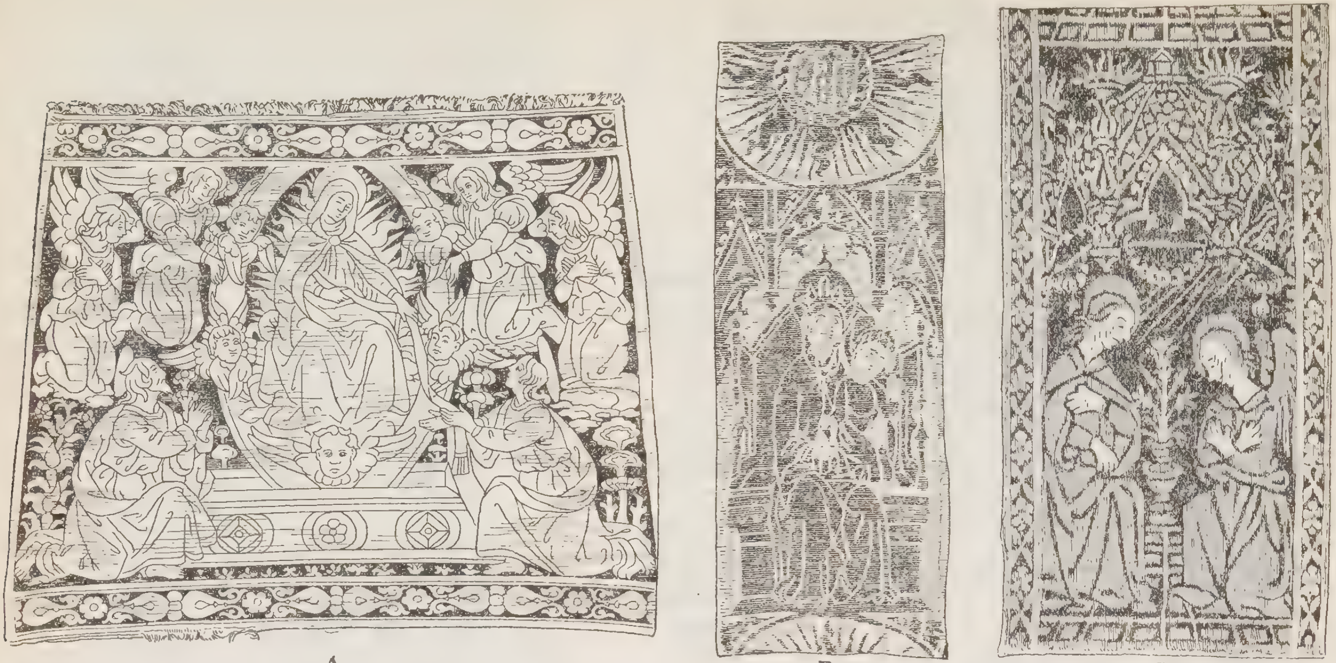
[1] The silken wrappings of St Wilibald (700–786), a founder of the church at Eichstätt, where they are still preserved, are woven with repeated roundels, each enclosing a Daniel between two lions, and are perhaps Byzantine of the 8th century.

[2] See Sir George Birdwood's chapter on Knop and Flower pattern in his *Industrial Arts of India*, in which this device of ancient Assyrian art is discussed as well as its relation and that of the hom, a fanlike symbol, to cognate ornament in Greek, Roman and even Renaissance art.

[3] See *Abécédaire d'archéologie* (June 1854).

[4] *Recherches*, &c., by Francisque Michel, i. 40.



A
Apparel of a Dalmatic woven in Venice late in the 15th century, with the Virgin in glory.

B
Part of Orphrey with the Virgin and Child (Siena weaving, 1425–1450).

C
Part of Orphrey, with the Annunciation (Florentine weaving, late 15th century)

Fig. 40.

To the influence of these early sporadic weavings we seem to trace a distinctive class of work, which was done by inmates of monasteries and convents as well as by devout ladies, in little looms, for use as stoles, maniples, orphreys and similar narrow bands. A rhyming chronicler of the 13th century paraphrases the older record by Eginhard of the skill of Charlemagne's daughters in silk weaving, "ouvrer en soie en taulieles" or small looms.[1] The illustrations in fig. 39 give varieties of this class of work between the 7th and 15th centuries, for which Cologne especially seems to have become famous in the 15th century. Venice also made work of corresponding character: and the designs were evidently furnished by or directly adapted from the compositions of such artists as those who produced the notable German and Venetian woodcuts of the 15th century (fig. 40).

Whilst the bulk of the Italian patterned stuffs issuing in great lengths from large looms were of silk, a good many also were woven in wools, or wools intermixed with silks. The earlier of the silk textiles—Persian, Syrian and Byzantine—were of the nature of sarcenet and taffetas; later in development are satins, damask satins, brocades, and still later (*i.e.* about the end of the 14th century) come Italian velvets and cloths of gold, which quite transcended the ancient and less substantial attalic cloths of the early Roman period. Medieval inventories and records contain many names of textiles, but the exact technical meaning of several of them is uncertain. *Cendal, Sandal, Syndonus* seem to relate to such materials as sarcenet or taffeta: *zetani*, from low Latin, is held by some writers to be of the same class as *samit* or *examite*, so called because the weft threads were only caught at every sixth thread of the warp; *damask*, now regarded as a special class of textile, the ornamentation of which depends upon contrasting sheens in the surface of the stuff, whether of silk or linen, got its name from Damascus, much in the same way as *Baudekin* comes from Baldak, or Baghdad. *Baudekin*, and an apparently somewhat earlier word *ciclatoun*, seem to have been general terms for rich-looking textiles, in which gold thread played an important part, and possibly was applicable to early brocades. *Carmoca* or *Carmuk* (Arab *Kamkla*, from the Chinese *Kimka*—also brocade) was another handsome stuff corresponding in a way with Indian *Kincobs*. Velvet (Italian *velluto*—shaggy) is *veluiau* in French documents of the 14th century, and is a finely piled material of silk, and on that account may have been called *Samit*, as the German word *Sammet* implies velvet, as does the Russian *Axamitt*. Diaper (Italian *diaspro*, meaning patterned) was used not only to denote a regular and geometric patterning but in some cases a special sort of linen or silk. Muslin from Mosul, and gauze from Gaza, are two

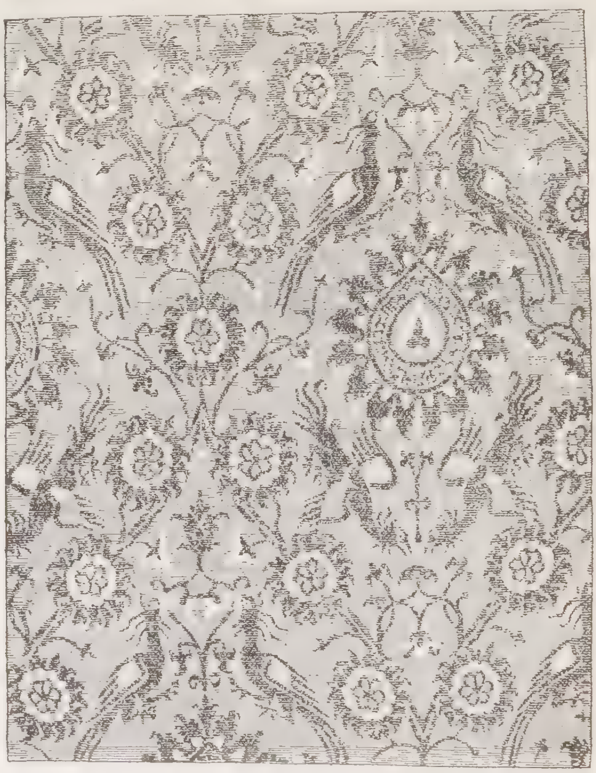


Fig. 41.—Piece of North Italian Silk Weaving of the 14th century, with pattern planned on an ogival basis with fantastic birds, some of which are of a Chinese type, and Persianesque cone forms containing sham Arabic inscriptions.

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[1] See *Recherches*, &c., by Francisque Michel, i. 93-94.

well-known and kindred textiles. Frequently one meets with odd phrases such as "silk of Brydges" (Bruges), "silk dornex" (from Dorneck), "sheets of raynes" (Rheims), and "fuschan in Appules" (Naples fustian).

Many of the foregoing stuffs are identifiable by textures peculiar to them; this is, however, not so as regards their ornamental patterns, for these are frequently interchanged, the same class of patterns appearing in satin damasks, velvets and brocades. This is particularly the case with 13th- and 14th-century Italian stuffs. In the patterns of these, as previously suggested, are strong traces of Saracenic and Byzantine motives, intermingled with badges, heraldic devices, human figures, eagles, falcons, hounds, lions, harts, boards, leopards, rays of light, Persianesque pine cone and cloud forms, and even Chinese mystical birds, symmetrically distributed, without framings, as a rule, though elaborations of the ogival frame or scheme are also met with, but less frequently (see fig. 41). Such fabrics, made in the main by Lucchese weavers, appear to have been traded in with other European countries. But besides trade records, there are others relating to Lucchese weavers who left their own town under stress of circumstances, civil wars and the like, to settle and work elsewhere, as in France and Flanders, during the 15th century. Nevertheless the northern parts of Italy were the fertile places for producing fine types of patterned textiles used by Italian and other European courts and nobles: and if the art seriously dwindled in the town of Lucca, it flourished conspicuously, from the end of the 14th century and up to the beginning of the 16th century, in Venice, Bologna, Genoa, Florence and Milan. There was nothing similar to compete with it in France, Germany or England. The identification of its splendid varieties is made possible upon referring to contemporary paintings by Orcagna, Crivelli, Spinello Aretino and later Italian masters, as well as to those of the Flemish School, Gheraet David, Mabuse, &c.

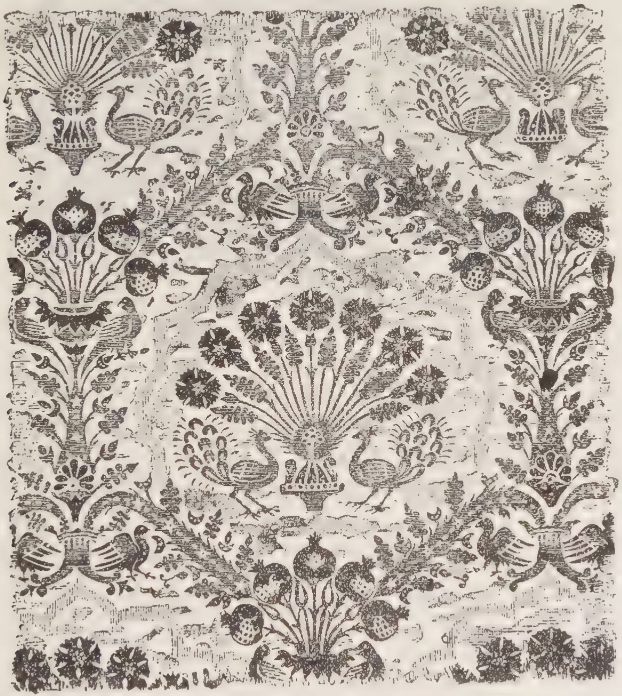

FIG. 42.—Damask and Brocade Silk Fabric. Italian manufacture of the 15th century.

Of a specially distinct class, very dignified in effect, are patterns of the 15th century based upon the repetition of conventional pentagonally constructed leaf panels, clearly defined in outline, each encircling a pomegranate or cone form around which radiate small leaves or blossoms; though they were more richly developed in superb velvets and cloths of gold, for which Florence, Venice and Genoa were famed, this type of design is also woven in less costly materials. A composite unusual and beautiful design of another kind is given in fig. 42. Repeated large leaf shapes can just be detected in it, but more remarkable are the bunches of radiating stalks of wheat-ears and cornflowers within them; whilst about them, arranged in hexagonal trellising, are leafy bars, small birds, crowns, pomegranates and other daintily depicted plant forms. This piece of damask combined with brocade weaving is of late 15th century manufacture: and after the opening of the next century the freedom towards realistic treatment, which we find here, enters into many of the Italian patterns. In some of them, however, an Ottoman or Anatolian feeling is apparent, as in fig. 43 from a figured silk which is considered to have been made in Venice. The chained dogs and birds in this design recall the rather more formal ones in Lucchese patterns of a hundred and fifty years earlier, whereas the lengthy serrated leaves and elongated flower devices charged with carnations and hyacinths depicted on a smaller scale are unmistakably Ottoman. Persian fabrics of rather thin silk material or taffetas like that of the original of this were also being woven with varieties of floral designs, as well as others portraying Persian stories. At this period there was considerable activity in weaving sumptuous stuffs at Broussa and Constantinople (fig. 44). Arabic and Turkish weavers often came over to be employed in Venice, blending Italian and Oriental characteristics into their designs.

In Spain during the early 16th century we have traces of Hispano-Moresque influence in the overlapping and interlocking nondescript forms; but Spanish weavings are hardly comparable in quality with the Italian of the same time. In the middle of this century cloths of gold or of silver, with the pattern details raised in velvet and brocatelles of similar formal design were made in greater quantities in Italy for costumes of men and women. The frequent basis of most of the designs is the ogival framework already referred to, but it is much elaborated with detail and combined with the cone device of a previous century. The ornamentation of this style is purely conventional throughout, the various devices having little of the appearance of actual objects like fruit, leaves, &c.

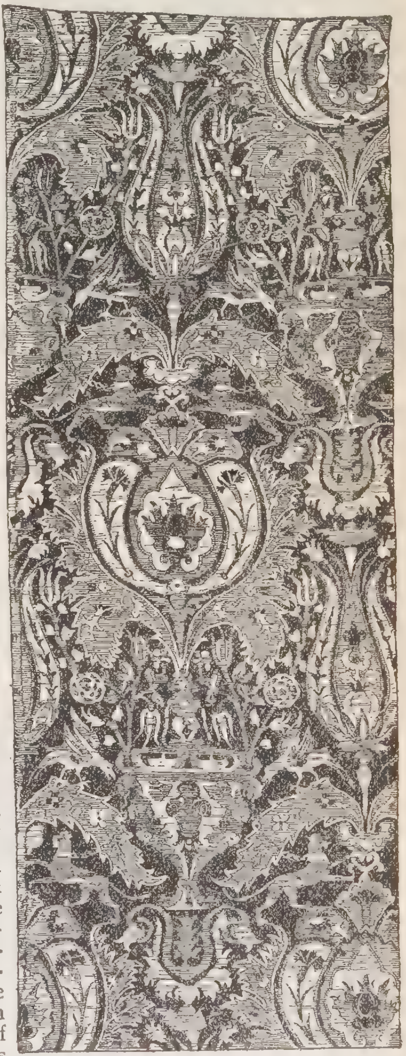

FIG. 43.—Piece of Venetian Silk Weaving showing Ottoman influence in the design (16th century).

The time, however, was close at hand when a more general reaction was to set in, in the direction of designs representing forms very nearly as they actually look, an example of which occurs in fig. 45, with its leaf forms and crowns. This from a class of silk damask or lampas, which is kindred to brocatelle; a feature in lampas is that its ground is different in colour from that of the ornament on it, and as in the case of portions of brocatelles its texture is of taffeta or sarcenet quality.[1] At the end of the 16th century a peculiar type of pattern consists of repetitions in different positions of the same detail treated realistically or purely ornamentally, little if anything of quite the same character having been previously designed. Of such fig. 46, with its repeated realistic leafy logs variously placed, is an example. The principle in the composition of these patterns, but with a greater variety of conventional detail, is followed in French 17th century examples. However, as soon as figured weaving became well organized in France at this time, a school of designers arose in that country who adopted a realism that predominated in French patterns during the succeeding 150 years, that is, from Louis XIV. to the end of the 18th century. Throughout this period French figured stuffs seem to surpass those of other countries. "If," writes Monsieur Pariset, "any account is to be taken of the weavers during the 14th and 15th centuries who made cloths and velvets of silk at Paris, Rouen, Lyons, Nimes and Avignon, it must be remembered that they were almost solely Italian emigrants from Lucca and Florence, who had fled their towns during troublous times." By a charter granted by Francis I. to Lyons, foreign and native workmen were encouraged to promote the city's interests in trade and manufacture; still, it is not until the 17th century that Lyons really asserts herself in producing fabrics possessing French taste and ornamentation. The more important designs were supplied by trained artists of whom Reval, a pupil of Le Brun, the first principal of the Academie des Beaux Arts founded by Colbert in Paris (1648), Pillement and Philippe de la Salle in the 18th century, may be named. Their influence in the domain of fanciful, and at times extravagant realistic, floral patterns was widespread. Soon after the revocation of the Edict of Nantes, in consequence of which thousands of Protestant weavers left France, factories for weaving silks and mixed materials with patterns imitating the successive French phases became organized at Spitalfields, in Cheshire, Yorkshire, Norfolk and elsewhere in England, as well as in Germany at Crefeld, Elberfeld, Barmen and Weissen.

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[1] See *Ornament in European Silks* (London, 1899), p. 15

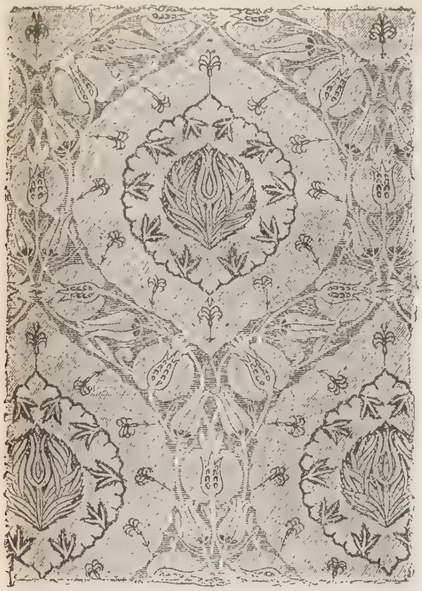
FIG. 44.—Ottoman (Anatolian) Silk and Gold Thread Weaving of the 16th century, with ogival framed ornament. The original is stated to have come from a sultana's tomb at Broussa or Constantinople.

Entirely distinct from what has already been discussed is a branch of artistic weaving concerned with the decoration of linens, that flourished notably in Italy towards the end of the 15th century and in the 16th century. From early times long and narrow Italian table-cloths were enriched with ornament of linen or cotton threads of a single colour, and Signora Isabella Erera has written at some length about them,[1] illustrating the result of her investigations with several examples culled from paintings by Pietro Lorenzetto of Siena (1340), by Ghirlandaja (1447–1490), &c. In Leonardo da Vinci's painting of the Last Supper, now in the Louvre, the border of the tablecloth is very like many examples of this sort of textile in the Victoria and Albert Museum, South Kensington. Their characteristic ornament, in rather heavy blue thread, consists of quaint animals and birds in pairs, which are evident derivations of those so often seen in Italo-Byzantine and Lucchese silks and brocades. Besides animals and birds, reversed names and words were sometimes introduced, *e.g.* " Amor " for " Roma," " Asoizarg " for " Graziosa " and " Eroma " for " Amore," &c. The simpler of these table-cloth patterns probably date from before the 14th century, whilst the fuller ones were certainly made in considerable quantities in the 15th century. An inventory dated 1342 has an entry of two napkins or cloths woven in cotton with bands of dragons and lions *à la Pérugina*, which is suggestive that this type of weaving was associated particularly with Perugia. In the 16th century, work of similar style was produced, but it was lighter and flatter in texture and often done with red or yellow silk, and embroidery was sometimes added to the weaving.

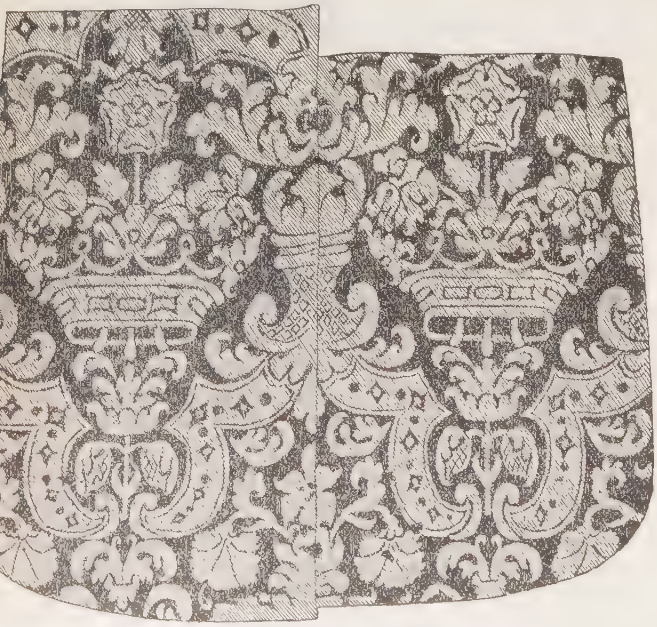
FIG. 45.—Italian Silk Damask or Lampas, with purple ground and pattern of late 16th century.

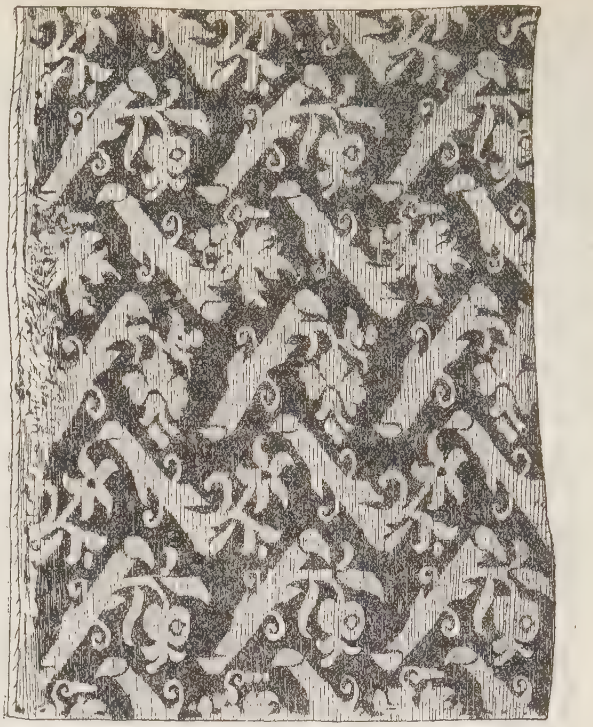
FIG. 46.—Italian Silk Damask or Lampas of late 16th century, with pattern of repeated leafy logs.

The most important and probably the best known class of later ornamental linen weaving is that of damask household napery, which, as a reflection of satin damask, was developed in the flax-growing regions of Saxony, Flanders and North France, during the late 15th or early 16th century; it was then rare and acquired for use by wealthy persons only.[2] The style of design in the better of the old linen damasks has some kinship with that of bold 15th- and 16th-century woodcuts of the Flemish or German schools. To some extent these damask figure subjects recall those of the coloured Cologne and Venetian orphreys for copes and apparels for dalmatics. The early history of linen damask is obscure, but a great many of its results are preserved in England. A napkin with the royal shield of Henry VII., the supporters within the garter surmounted by the crown, is in the Victoria and Albert Museum where it is called Flemish. On the other hand it is possibly the work of Flemings in England, since from the time of Edward I. and for a hundred years " a constant stream of emigrants passed from Flanders to England."[3] The Victoria and Albert Museum contains an early 16th-century tablecloth in damask linen of German or Flemish manufacture with various subjects, chiefly religious and moral: Gideon being shown as a kneeling knight, the fleece of wool on the ground being near him, while from above the dew falls on it; below Gideon is the Virgin Mary and the unicorn, and lower down an angel with seven dogs' heads typifying different virtues as shown in the lettering—*fides, spes, charitas*, &c. In another which was probably made in England (at Norwich?) by Flemings during the second half of the 16th century, we find St George and the Dragon, the royal arms of Queen Anne Boleyn, the badges of Queen Anne Boleyn and Queen Elizabeth, the crowned Tudor Rose, and repeated portraits of Queen Elizabeth, with the legend below, " God save the Queene." This specimen is also in the Victoria and Albert Museum. A hundred years later in date is a tablecloth on which is a view of old St Paul's (burnt in 1666), while above and below occurs the wreathed shield of the City of London. A different class of linen, with the design done in blue, was evidently, from the inscriptions on it, the work of a German or Fleming, and probably woven in Germany about 1730. Here we find the wreathed arms of the City of London, a view of " London," and " George der II. König in Engelland " mounted on horseback. In this specimen the design is repeated, and not reversed, as is the case with the earlier pieces. A large collection of this German damask weaving with coloured thread was formed under the auspices of the Royal Kunstgewerbe Museum at Dresden.[1] The north-eastern Irish industry of damask weaving owes much to French Protestant refugees, who settled there towards the close of the 17th century, though linen manufacture had been established in the district by a colony of Scots in 1634. Dunfermline in Scotland is said to produce as much damask as the rest of Europe, but there are important manufactories of it at Courtrai and Liége in Belgium, in Silesia, Austria and elsewhere.

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[1] See the Italian monthly art review, *Emporium*, vol. xxiii. (1906).

[2] The earl of Northumberland (1512) is said to have had but eight linen cloths for his personal use, while his large retinue of servants had but one, which was washed once a month. (See notes by Rev. C. H. Evelyn White on damask linen. *Proceedings of Society of Antiquaries*, second series, vol. xx. p. 132.)

[3] See Rev. C. H. Evelyn White's paper on damask linen, *Proceedings of Society of Antiquaries*, second series, vol. xx. pp. 130-140.

LITERATURE.—The following are titles of a few works on weaving, from which much important information on the subject may be derived:—J. Bezon, *Dictionnaire des tissus* (8 vols., Paris, 1859–1863), more or less technical only, *Dictionnaire des sciences* (Paris, 1751–1780), technical; Michel Francisque, *Recherches sur le commerce, la fabrication et l'usage des étoffes de soie, d'or et d'argent* (2 vols., Paris, 1852–1854), a well-known work full of erudition in respect of the archaeology of woven fabrics, their technical characteristics, &c.; James Yates, *Textrinum antiquorum: an Account of the Art of Weaving among the Ancients* (London, 1843), a very valuable and learned work of reference; Very Rev. Daniel Rock, D.D., *Textile Fabrics* (London, 1870), with some few good illustrations; Pariset, *Histoire de la soie* (Paris, 1862); Raymond Cax, *L'Art de décorer les tissus*, &c. (Paris, 1900); Alan Cole, *Ornament in European Silks* (London, 1899), well illustrated; J. Lessing, *Berlin königliche Museen, Die Gewebe-Sammlung des k. Kunstgewerbe-Museums* (Berlin, 1900), a very fine series of phototype facsimiles of all kinds of textiles; A. Riegl, *Die ägyptischen Textil-Funde* (Wien, 1889); R. Forrer, *Römische und byzantinische Seiden-Textilien* (Strassburg, 1891); A. Dupont Auberville, *L'Ornament des tissus* (Paris, 1877), admirable illustrations; F. Fischbach, *Die wichtigsten Webe-Ornamente* (3 vols., Wiesbaden, 1901), admirable illustrations; Raymond Cax, *Le Musée historique des tissus . . . de Lyon* (Lyon, 1902); Nuremberg: Germanisches Museum, *Katalog der Gewebesammlung des germanischen National-Museums* (Nuremberg, 1896).

(A. S. C.)

WEB (a word common to Teutonic languages, cf. Du. *webbe*, Dan. *vaev*, Ger. *Gewebe*, all from the Teutonic *wabh*—to weave), that which is woven (see WEAVING). The word is thus applied to anything resembling a web of cloth, to the *vexillum* of the feather of a bird, to the membrane which connects the toes of many aquatic birds and some aquatic mammals; it is particularly used of the "cobweb," the net spun by the spider, the Old English name for which was *átor-coppe*, *i.e.* poison-head (*átor*, poison, and *coppe*, tuft or head). In architecture the term "web" is sometimes given, in preference to "panel," to the stone shell of a vault resting on the ribs and taking its winding surface from the same; see VAULT.

WEBB, MATTHEW (1848–1883), English swimmer, generally known as "Captain Webb," was born at Dawley in Shropshire on the 18th of January 1848, the son of a doctor. While still a boy he saved one of his brothers from drowning in the Severn, and, while serving on board the training ship in the Mersey, he again distinguished himself by saving a drowning comrade. He served his apprenticeship in the East India and China trade, shipped as second mate for several owners, and in 1874, was awarded the first Stanhope gold medal by the Royal Humane Society for an attempt to save a seaman who had fallen overboard from the Cunard steamship "Russia." In 1875 Captain Webb abandoned a sea-faring life and became a professional swimmer. On the 3rd of July he swam from Blackwall Pier to Gravesend, a distance of 20 m., in 4¾ hours, a record which remained unbeaten until 1899. In the same year, after one unsuccessful attempt, he swam the English Channel, on the 24th of August, from Dover to Calais in 21¾ hours. For the next few years Webb gave performances of diving and swimming at the Royal Aquarium in London and elsewhere. Crossing to America, he attempted, on the 24th of July 1883, to swim the rapids and whirlpool below Niagara Falls. In this attempt he lost his life.

WEBB, SIDNEY (1859–), English socialist and author, was born in London on the 13th of July 1859. He was educated at private schools in London and Switzerland, at the Birkbeck Institute and the City of London College. From 1875 to 1878 he was employed in a city office, but he entered the civil service by open competition as a clerk in the War Office in 1878, became surveyor of taxes in 1879, and in 1881 entered the colonial office, where he remained until 1891. In 1885 he was called to the bar at Gray's Inn. Mr Webb was one of the early members of the Fabian Society, contributing to *Fabian Essays* (1889); and he became well-known as a socialist, both by his speeches and his writings. He entered the London County Council in 1892 as member for Deptford, and was returned at the head of the poll in the successive elections of 1895, 1898, 1901 and 1904. He resigned from the civil service in 1891 to give his whole time to the work of the Council (where he was chairman of the Technical Education Board) and to the study of economics. He served from 1903 to 1906 on the Royal Commission on Trade Union Law and on other important commissions. He married in 1892 Miss Beatrice Potter, herself a writer on economics and sociology, the author of *The Co-operative Movement in Great Britain* (1891) and a contributor to Charles Booth's *Life and Labour of the People* (1891–1903). His most important works are: a number of Fabian tracts; *London Education* (1904); *The Eight Hours Day* (1891), in conjunction with Harold Cox; and, with Mrs Sidney Webb, *The History of Trade Unionism* (1894, new ed. 1902), *Industrial Democracy* (1897, new ed. 1902), *Problems of Modern Industry* (1898), *History of Liquor Licensing* (1903), *English Local Government* (1906), &c. Mrs Webb was a member of the Royal Commission on the Poor Law, and she and her husband were responsible for the Minority Report (see POOR LAW) and for starting the widespread movement in its favour.

WEBB CITY, a city of Jasper county, Missouri, U.S.A., in the S.W. part of the state, about 160 m. S. of Kansas City. Pop. (1890) 5043; (1900) 9201, of whom 248 were foreign-born; (1910 U.S. census) 11,817. It is served by the Missouri Pacific and the St Louis & San Francisco railway systems, and is the headquarters of the electric interurban railway connecting with Carthage and Joplin, Missouri, Galena, Kansas and other cities. With Carterville (pop. 1910, 4539), which adjoins it on the E., it forms practically one city; they are among the most famous and productive "camps" in the rich lead and zinc region of south-western Missouri, and Webb City owes its industrial importance primarily to the mining and shipping of those metals. The value of the factory product increased from $353,566 in 1900 to $637,965 in 1905. Webb City was laid out and incorporated as a town in 1875, and first chartered as a city in 1876. White lead was discovered here in 1873, on the farm of John C. Webb, in whose honour the city is named; and systematic mining began in 1877.

WEBBE, WILLIAM (fl. 1586), English literary critic, was educated at St John's College, Cambridge, where he took his degree in 1572–1573. He was tutor to the two sons of Edward Sulyard of Flemyngs, Essex, and later to the children of Henry Grey of Pirgo in the same county. A letter from him is prefixed to the 1592 edition of *Tancred and Gismunda*,[2] written by his friend, Robert Wilmot. In 1586 he published *A Discourse of English Poetrie*, dedicated to his patron, Edward Sulyard. Webbe argued that the dearth of good English poetry since Chaucer's day was not due to lack of poetic ability, or to the poverty of the language, but to the want of a proper system of prosody. He abuses "this tinkerly verse which we call ryme," as of barbarous origin, and comments on the works of his contemporaries, displaying enthusiasm for Spenser's *Shepheardes Calendar*, and admiration for Phaer's translation of Virgil. He urged the adoption of hexameters and sapphics for English verse, and gives some lamentable examples of his own composition.

The *Discourse* was reprinted in J. Haslewood's *Ancient Critical Essays* (1811–1815), by E. Arber in 1869, and in Gregory Smith's *Elizabethan Critical Essays* (1904).

WEBER, CARL MARIA FRIEDRICH ERNEST VON (1786–1826), German composer, was born at Eutin, near Lübeck, on the 18th of December 1786, of a family that had long been devoted to art. His father, Baron Franz Anton von Weber, a military officer in the service of the palgrave Karl Theodor, was an excellent violinist, and his mother once sang on the stage. His cousins, Josepha, Aloysia, Constanze and Sophie, daughters of Franz Anton's brother Fridolin, attained a high reputation as vocalists. The great composer, Mozart, after having been rejected by Aloysia, married Constanze, and thus became Franz Anton's nephew by marriage. Fridolin played the violin nearly as well as his brother; and the whole family displayed exceptional talent for music. Franz Anton von Weber was a man of thriftless habits and culpable eccentricity. Having been wounded at Rosbach, he quitted the army, and in 1758 he was appointed financial councillor to Clement August, elector of Cologne, who for nine years overlooked his incorrigible neglect of duty. But the elector's successor dismissed him in 1768; and for many years after this he lived in idleness at Hildesheim, squandering the property of his wife, Anna de' Fumetti, and doing nothing for the support of his children until 1778, when he was appointed director of the opera at Lübeck. In 1779 the prince bishop of Eutin made him his kapellmeister, and not long afterwards his wife died of a broken heart. Five years later he went to Vienna, placed two of his sons under Michael Haydn, and in 1785 married the young Viennese singer Genovefa von Brenner. In the following year Carl Maria von Weber was born—a delicate child, afflicted with congenital disease of the hip-joint.

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[1] See *Leinendamastmuster des XVII. und XVIII. Jahrhunderts*, Emil Kumsch (Dresden, 1891).

[2] The original play, *Gismonde of Salerne*, was by five authors, and was produced in the Queen's presence at the Inner Temple in 1568

On his return from Vienna, Franz Anton, finding that a new kapellmeister had been chosen in his place, accepted the humbler position of "Stadt Musikant." This, however, he soon relinquished; and for some years he wandered from town to town, giving dramatic performances, in conjunction with the children of his first wife, wherever he could collect an audience. The effect of this restless life upon the little Carl Maria's health and education was deplorable; but, as he accompanied his father everywhere, he became familiarized with the stage from his earliest infancy, and thus gained an amount of dramatic experience that laid the foundation of his future greatness. Franz Anton hoped to see him develop into an infant prodigy, like his cousin Mozart, whose marvellous career was then rapidly approaching its close. In furtherance of this scheme, the child was taught to sing and place his fingers upon the pianoforte almost as soon as he could speak, though he was unable to walk until he was four years old. Happily his power of observation and aptitude for general learning were so precocious that he seems, in spite of all these disadvantages, to have instinctively educated himself as became a gentleman. In 1798 Michael Haydn taught him gratuitously at Salzburg. In the March of that year his mother died. In April the family visited Vienna, removing in the autumn to Munich. Here the child's first composition—a set of "Six Fughettas"—was published, with a pompous dedication to his half-brother Edmund; and here also he took lessons in singing and in composition. Soon afterwards he began to play successfully in public, and his father compelled him to write incessantly. Among the compositions of this period were a mass and an opera—*Die Macht der Liebe und des Weins*—now destroyed. A set of "Variations for the Pianoforte," composed a little later, was lithographed by Carl Maria himself, under the guidance of Alois Senefelder, the inventor of the process, in which both the father and the child took great interest.

In 1800 the family removed to Freiberg, where the Ritter von Steinsberg gave Carl Maria the libretto of an opera called *Das Waldmädchen*, which the boy, though not yet fourteen years old, at once set to music, and produced in November at the Freiburg theatre. The performance was by no means successful, and the composer himself was accustomed to speak of the work as "a very immature production"; yet it was afterwards reproduced at Chemnitz, and even at Vienna.

Carl Maria returned with his father to Salzburg in 1801, resuming his studies under Michael Haydn. Here he composed his second opera, *Peter Schmoll und seine Nachbarn*, which was unsuccessfully produced at Nuremberg in 1803. In that year he again visited Vienna, where, though Joseph Haydn and Albrechtsberger were both receiving pupils, his father preferred placing him under Abt Vogler. Through Vogler's instrumentality Carl Maria was appointed conductor of the opera at Breslau, before he had completed his eighteenth year. In this capacity he greatly enlarged his experience of the stage, so that he ranks among the greatest masters of stage-craft in musical history; but he lived a sadly irregular life, contracted debts, and lost his beautiful voice through accidentally drinking an acid used in lithography—a mishap which nearly cost him his life. These hindrances, however, did not prevent him from beginning a new opera called *Rübezahl*, the libretto of which was "romantic" to the last degree, and Weber worked at it enthusiastically, but it was never completed, and little of it has been preserved beyond a quintet and the masterly overture, which, re-written in 1811 under the title of *Der Beherrscher der Geister*, now ranks among its author's finest instrumental compositions.

Quitting Breslau in 1806, Weber removed in the following year to Stuttgart, where he had been offered the post of private secretary to Duke Ludwig, brother of Frederick, king of Würtemberg. The appointment was a disastrous one. The stipend attached to it was insufficient to meet the twofold demands of the young man's new social position and the thriftlessness of his father, who was entirely dependent upon him for support. Court life at Stuttgart was uncongenial to him, though he yielded to its temptations. The king hated him and his practical jokes. He fell hopelessly into debt, and, worse than all, became involved in a fatal intimacy with Margarethe Lang, a singer at the opera. Notwithstanding these distractions he worked hard, and in 1809 re-modelled *Das Waldmädchen*, under the title of *Sylvana*,[1] and prepared to produce it at the court theatre. But a dreadful calamity prevented its performance. Franz Anton had misappropriated a large sum of money placed in the young secretary's hands for the purpose of clearing a mortgage upon one of the duke's estates.[2] Both father and son were charged with embezzlement, and, on the 9th of February 1810, they were arrested at the theatre, during a rehearsal of *Sylvana*, and thrown by the king's order into prison. No one doubted Weber's innocence, but after a summary trial he and his father were ordered to quit the country, and on the 27th of February they began a new life at Mannheim.

Having provided a comfortable home for his father, and begun a new comic opera, in one act, called *Abu Hassan*, Weber removed to Darmstadt in order to be near his old master Abt Vogler, and his fellow-pupils Meyerbeer and Gänsbacher. On the 16th of September 1810, he reproduced *Sylvana* at Frankfort, but with very doubtful success. *Abu Hassan* was completed at Darmstadt in January 1811, after many interruptions, one of which (his attraction to the story of *Der Freischütz*—see below) exercised a memorable influence upon his later career.

Weber started in February 1811 on an extended artistic tour, during which he made many influential friends, and on the 4th of June brought out *Abu Hassan* with marked success at Munich. His father died at Mannheim in 1812, and after this he had no settled home, until in 1813 his wanderings were brought to an end by the unexpected offer of an appointment as kapellmeister at Prague, coupled with the duty of entirely remodelling the performances at the opera-house. The terms were so liberal that he accepted at once, engaged a new company of performers, and directed them with uninterrupted success until the autumn of 1816. During this period he composed no new operas, but he had already written much of his best pianoforte music, and played it with never-failing success, while the disturbed state of Europe inspired him with some of the finest patriotic melodies in existence. First among these stand ten songs from Körner's *Leyer und Schwerdt*, including "Vater, ich rufe dich," and "Lützow's wilde Jagd"; and in no respect inferior to these are the splendid choruses in his cantata *Kampf und Sieg*, which was first performed at Prague, on the 22nd of December 1815.

Weber resigned his office at Prague on the 30th of September

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[1] As the MS. of *Das Waldmädchen* has been lost, it is impossible now to determine its exact relation to the later work.

[2] Spitta gives a different account of the occurrence, and attributes the robbery to a servant.

1816, and on the 21st of December, Frederick Augustus, king of Saxony, appointed him kapellmeister at the German opera at Dresden. The Italian operas performed at the court theatre were superintended by Morlacchi, whose jealous and intriguing disposition gave endless trouble. The king, however, placed the two kapellmeisters on an exact equality both of title and salary, and Weber found ample opportunity for the exercise of his remarkable power of organization and control. He now gave his close attention to the story of *Der Freischütz*, which he had previously meditated turning into an opera, and, with the assistance of Friedrich Kind, he produced an admirable libretto, under the title of *Des Jägers Braut*. No subject could have been better fitted than this to serve as a vehicle for the new art-form which, under Weber's skilful management, developed into the type of "romantic opera." He had dealt with the supernatural in *Rübezahl*, and in *Sylvana* with the pomp and circumstance of chivalry; but the shadowy impersonations in *Rübezahl* are scarcely less human than the heroine who invokes them; and the music of *Sylvana* might easily have been adapted to a story of the 19th century. But Weber now knew better than to let the fiend in *Der Freischütz* sing; with three soft strokes of a drum below an unchanging dismal chord he brings him straight to us from the nether world. Every note in *Euryanthe* breathes the spirit of medieval romance; and the fairies in *Oberon* have an actuality quite distinct from the tinsel of the stage. This uncompromising reality, even in face of the unreal, forms the strongest characteristic of the pure "romantic school," as Weber understood and created it. It treats its wildest subjects in earnest, and without a doubt as to the reality of the scenes it ventures to depict, or the truthfulness of their dramatic interpretation.

Weber wrote the first note of the music of *Der Freischütz* on the 2nd of July—beginning with the duet which opens the second act. But so numerous were the interruptions caused by Morlacchi's intrigues, the insolence of unfriendly courtiers, and the attacks of jealous critics that nearly three years elapsed before the piece was completed. In the meantime the performances at the opera-house were no less successfully remodelled at Dresden than they had already been at Prague, though the work of reformation was far more difficult; for the new kapellmeister was surrounded by enemies who openly subjected him to every possible annoyance, and even the king himself was at one time strongly prejudiced against him. Happily, he no longer stood alone in the world. Having, after much difficulty, broken off his *liaison* with Margarethe Land, he married the singer Carolina Brandt, a noble-minded woman and consummate artist, who was well able to repay him for the part he had long played in her mental development. The new opera was completed on the 13th of May 1820, on which day Weber wrote the last note of the overture—which it was his custom to postpone until the rest of the music was finished. There is abundant evidence to prove that he was well satisfied with the result of his labours; but he gave himself no rest. He had engaged to compose the music to Wolff's Gipsy drama, *Preciosa*. Two months later this also was finished, and both pieces ready for the stage.

In consequence of the unsatisfactory state of affairs at Dresden, it had been arranged that both *Preciosa* and *Der Freischütz*—no longer known by its original title, *Des Jägers Braut*—should be produced at Berlin. In February 1821 Sir Julius Benedict was accepted by Weber as a pupil; and to his pen we owe a delightful account of the rehearsals and first performance of his master's *chef-d'œuvre*. *Preciosa* was produced with great success at the old Berlin opera-house on the 14th of June 1821. On the 18th of June, the anniversary of the battle of Waterloo, the opening of the new "Schauspielhaus" was celebrated by the production of *Der Freischütz*. Much anxiety was caused by unforeseen difficulties at the rehearsals; yet, so calm was Weber's mind that he devoted his leisure time to the composition of his *Concertstück* in F minor—one of his finest pianoforte pieces. Until the last moment his friends were anxious; the author was not; and the result justified his confidence in his own powers. The success of the piece was triumphant. The work was received with equal enthusiasm at Vienna on the 3rd of October, and at Dresden on the 26th of January 1822. Yet Weber's position as kapellmeister was not much improved by his success, though, in order to remain faithful to his engagements, he had refused tempting offers at Berlin and Cassel, and, at the last-named place, had installed Ludwig Spohr in a position much more advantageous than his own.

For his next opera Weber accepted a libretto based, by Frau Wilhelmine von Chezy, on the story of *Euryanthe*, as originally told in the 13th century, in Gilbert de Montreuil's *Roman de la Violette*, and repeated with alterations in the *Decamerone*, in Shakespeare's *Cymbeline*, and in several later forms. In place of the ghostly horrors of *Der Freischütz*, the romantic element was here supplied by the chivalric pomp of the middle ages. The libretto is in one respect superior to that of *Der Freischütz*, inasmuch as it substitutes elaborate recitative for the spoken dialogue peculiar to the German "Schauspiel" and French "opéra comique." It is, in fact, a "grand opera" in every sense of the words,—the prototype of the "music drama" perfected fifty years later by Wagner. The overture—as usual, written last—presents a feature that has never been imitated. During its performance the curtain temporarily rises, to exhibit, in a *tableau vivant*, the scene in the sepulchral vault upon which the whole story turns. This direction is now rarely carried out; but Weber himself well knew how much the interest of the piece depended on it. The work was produced at the Kärntnerthor theatre in Vienna, on the 25th of October 1823, and received with enthusiasm.

Weber's third and last dramatic masterpiece was an English opera, written for Covent Garden theatre, upon a libretto adapted by Planché from Wieland's *Oberon*. It was disfigured by the spoken dialogue abandoned in *Euryanthe*; but in musical beauty it is quite equal to it, while its fairies and mermaids are as vividly real as the spectres in *Der Freischütz*. Though already far gone in consumption, Weber began to compose the music on the 23rd of January 1825. Charles Kemble had offered him £1000 for the work, and he could not afford to rest. He finished the overture in London, at the house of Sir George Smart, soon after his arrival, in March 1826; and on the 12th of April the work was produced with triumphant success. But it cost the composer his life. Wearied out with rehearsals and performances of the opera, and concerts at which he was received with rapturous applause, he grew daily perceptibly weaker; and, notwithstanding the care of his kind host, Sir George Smart, and his family, he was found dead in his bed on the morning of the 5th of June 1826. For eighteen years his remains rested in a temporary grave in Moorfields chapel; but in 1844 they were removed and placed in the family vault at Dresden, Wagner making an eloquent speech.

Besides his three great dramatic masterpieces and the other works already mentioned, Weber wrote two masses, two symphonies, eight cantatas, and a large number of songs, orchestral and pianoforte pieces, and music of other kinds, amounting altogether to more than 250 compositions. (W. S. R.)

Weber's style rises, in his three greatest works, to heights which show his kinship with the great classics and the great moderns. His intellect was quick and clear; but yet finer was the force of character with which he overcame the disadvantages of his feeble health, desultory education and the mistakes of his youth. With such gifts of intellect and character, every moment of his short life was precious to the world; and it is impossible not to regret the placing of his training in the hands of Abt Vogler. Weber's master was an amiable charlatan, whose weakness as a teacher was thoroughly exposed, in perfect innocence, by his two illustrious pupils. Meyerbeer wished to be famous as the maker of a new epoch in opera. Weber could not help being so in reality. But he was sadly hampered by his master's inability to teach realities instead of appearances; and to this impediment alone must we assign the fact that his masterpieces do not begin earlier in his career. With extraordinary rapidity and thoroughness he learnt English a year before his death in order to compose *Oberon*, with the result that there is only one obvious mistake in the whole work, and the general correctness of declamation is higher than in most of his German works. This is typical of Weber's general culture, mental energy and determination; points in which, as in many traits in his music, he strikingly resembles Wagner. But all his determination could not quite repair the defects of his purely musical training, and though his weaknesses are not of glaring effect in opera, still there are moments when even the stage cannot explain them away. Thus the finale of *Der Freischütz* breaks down so obviously that no one thinks of it as anything but a perfunctory winding-up of the story, though it really might have made quite a fine subject for musical treatment. In *Euryanthe* Weber attained his full power, and his inspiration did not leave him in the lurch where this work needed large musical designs. But the libretto was full of absurdities; especially in the last act, which not even nine remodellings under Weber's direction could redeem. Yet it is easy to see why it fascinated him, for, whatever may be said against it from the standpoints of probability and literary merit, its emotional contrasts are highly musical. Indeed it is through them that the defects invite criticism.

Oberon is spoilt by the old local tradition of English opera according to which its libretto admitted of no music during the action of the drama. Thus Weber had in it no opportunity for his musical stage-craft; apart from the fact that the action itself is entirely without dramatic motive and passion, since the characters are simply shifted from Bordeaux to Bagdad whenever Oberon waves his wand.

Many attempts have been made to improve the libretti of *Euryanthe* and *Oberon*, but none are quite successful, for Weber has taken a great artist's pains in making the best of bad material. All that can be said against Weber's achievements only reveals the more emphatically how noble and how complete in essentials was his success and his claim to immortality. His pianoforte works, while showing his helplessness in purely musical form, more than bear out his contemporary reputation as a very great pianoforte player. They have a pronounced theatrical tendency which, in the case of such pieces of gay romanticism as the *Invitation à la danse* and the *Concertstück*, is amusing and by no means inartistic. In orchestration Weber is one of the greatest masters. His treatment of the voice is bold and interesting, but very rash; and his declamation of words is often incorrect. His influence on the music of his own day is comparable to his influence on posterity; for he was not only a most efficient director but a very persuasive journalist; and (in spite of the inexperience that made him disapprove of Beethoven) for all good music other than his own he showed a growing enthusiasm that was infectious. (D. F. T.)

WEBER, WILHELM EDUARD (1804–1891), German physicist, was born at Wittenberg on the 24th of October 1804, and was a younger brother of Ernst Heinrich Weber, the author of Weber's Law (see below). He studied at the university of Halle, where he took his doctor's degree in 1826 and became extraordinary professor of physics in 1828. Three years later he removed to Göttingen as professor of physics, and remained there till 1837, when he was one of the seven professors who were expelled from their chairs for protesting against the action of the king of Hanover (duke of Cumberland) in suspending the constitution. A period of retirement followed this episode, but in 1843 he accepted the chair of physics at Leipzig, and six years later returned to Göttingen, where he died on the 23rd of June 1891. Weber's name is especially known for his work on electrical measurement. Until his time there was no established system either of stating or measuring electrical quantities; but he showed, as his colleague K. F. Gauss did for magnetic quantities, that it is both theoretically and practically possible to define them, not merely by reference to other arbitrary quantities of the same kind, but absolutely in terms in which the units of length, time, and mass are alone involved. He also carried on extensive researches in the theory of magnetism; and it is interesting that in connexion with his observations in terrestrial magnetism he not only employed an early form of mirror galvanometer, but also, about 1833, devised a system of electromagnetic telegraphy, by which a distance of some 9000 ft. was worked over. In conjunction with his elder brother he published in 1825 a well-known treatise on waves, *Die Wellenlehre auf Experimente gegründet*; and in 1833 he collaborated with his younger brother, the physiologist Eduard Friedrich Weber (1806–1871), in an investigation into the mechanism of walking.

WEBER'S LAW, in psychology, the name given to a principle first enunciated by the German scientist, Ernst Heinrich Weber (1795–1878), who became professor at Leipzig (of anatomy, 1818, of physiology, 1840). He was specially famous for his researches into aural and cutaneous sensations. His law, the purport of which is that the increase of stimulus necessary to produce an increase of sensation in any sense is not a fixed quantity but depends on the proportion which the increase bears to the immediately preceding stimulus, is the principal generalization of that branch of scientific investigation which has come to be known as psycho-physics (*q.v.*).

According to Gustav Fechner (*q.v.*), who has done most to prosecute these inquiries and to consolidate them under a separate name, "psycho-physics is an exact doctrine of the relation of function or dependence between body and soul." In other words, it is throughout an attempt to submit to definite measurement the relation of physical stimuli to the resulting psychical or mental facts, and forms an important department of experimental psychology. It deals with the quantitative aspects of mental facts—their intensity or quantity proper and their duration. Physical science enables us, at least in the case of some of the senses, to measure with accuracy the objective amount of the stimulus, and introspection enables us to state the nature of the subjective result. Thus we are able to say whether a stimulus produces *any* psychical result, and can fix in that way the *minimum sensibile* or "threshold of consciousness" for each of the senses. In like manner (though with less accuracy, owing to the disturbing nature of the conditions) we can fix the sensational maximum, or upper limit of sensibility, in the different senses, that is to say, the point beyond which no increase of stimulus produces any appreciable increase of sensation. We thus determine, as Wundt puts it, the limit-values between which changes of intensity in the stimulus are accompanied by changes in sensation. But the central inquiry of psycho-physics remains behind. Between the quantitative minimum and the quantitative maximum thus fixed can we discover any definite relation between changes in the objective intensity of the stimuli and changes in the intensity of the sensations as estimated by consciousness. The answer of psycho-physics to this inquiry is given in the generalization variously known as "Weber's law," "Fechner's law," or the "psycho-physical law," which professes to formulate with exactitude the relations which exist between change of stimulus and change of sensation.

As we have no means of subjectively measuring the absolute intensity of our sensations, it is necessary to depend upon the mental estimate or comparison of two or more sensations. Comparison enables us to say whether they are equal in intensity, or if unequal which is the greater and which is the less. But as they approach equality in this respect it becomes more and more difficult to detect the difference. By a series of experiments, therefore, it will be possible, in the case of any particular individual, to determine the least observable difference in intensity between two sensations of any particular sense. This least observable difference is called by Fechner the *Unterschiedsschwelle* or "difference-threshold," that is to say, the limit of the discriminative sensibility of the sense in question. That such a "threshold," or least observable difference, exists is plain from very simple examples. Very small increases may be made in the objective amount of light, sound or pressure—that is, in the physical stimuli applied to these senses—without the subject on whom the experiment is made detecting any change. It is further evident that, by means of this *Unterschiedsschwelle*, it is possible to compare the discriminative sensibility of different individuals, or of different senses, or (as in the case of the skin) of different parts of the same sense organ: the smaller the difference observable the finer the discriminative sensibility. Thus the discrimination of the muscular sense is much more delicate than that of the sense of touch or pressure, and the discriminative sensibility of the skin and the retina varies very much according to the parts of the surface affected. Various methods have been adopted with a view to determine these *minima* of discriminative sensibility with an approach to scientific precision. The first is that employed by Weber himself, and has been named the method of just observable differences. It consists either in gradually adding to a given stimulus small amounts which at first cause no perceptible difference in sensation but at a certain point do cause a difference to emerge in consciousness, or, vice versa, in gradually decreasing the amount of additional stimulus, till the difference originally perceived becomes imperceptible. By taking the average of a number of such results, the minimum may be determined with tolerable accuracy. The second method is called by Fechner the method of correct and incorrect instances. When two stimuli are very nearly equal the subject will often fail to recognize which is the greater, saying sometimes that A is greater, sometimes that B is greater. When in a large number of trials the right and wrong guesses exactly balance one another we may conclude that the difference between the two stimuli is not appreciable by the sense. On the other hand, as soon as the number of correct guesses definitely exceeds half of the total number of cases, it may be inferred that there is a certain subjective appreciation of difference. This method was first employed by Vierordt. The third method, that of average errors, is very similar to the one just explained. Here a certain weight (to take a concrete example) is laid upon the hand of the person experimented upon, and he is asked, by the aid of subjective impression alone, to fix upon a second weight exactly equal to the first. It is found that the second weight sometimes slightly exceeds the first, sometimes slightly falls below it. Whether above or below is of no consequence to the method, which depends solely on the amount of the error. After a number of experiments, the different errors are added together, and the result being divided by the number of experiments gives us the average error which the subject may be calculated upon to make. This marks the amount of stimulus which is just below the difference-threshold for him. This method was first employed by Fechner and Volkmann. The different methods were first named, and the theory of their application developed by Fechner in his *Elemente der Psychophysik* (1860).

A number of experimental variations have since been devised by Wundt and others, but they are all reducible to the two types of the "gradation" and "error" methods. These methods have been chiefly applied to determine the relation of the difference-threshold to the absolute magnitude of the stimuli employed. For a very little reflection tells us that the smallest perceivable difference is not an amount whose absolute intensity is constant even within the same sense. It varies with the intensity of the stimuli employed. We are unable, for example, to recognize slight differences in weight when the weights compared are heavy, though we should be perfectly able to make the distinction if the weights compared were both light. Ordinary observation would lead us, therefore, to the conclusion that the greater the intensity of the original stimulus at work the greater must be the increase of stimulus in order that there may be a perceptible difference in the resulting sensation. Weber was the first (after a prolonged series of experiments) to clothe this generality with scientific precision by formulating the law which has since gone by his name. He showed that the smallest perceptible difference is not absolutely the same, but remains relatively the same, that is, it remains the same fraction of the preceding stimulus. For example, if we can distinguish 16 oz. and 17 oz., we shall be able to distinguish 32 oz. and 34 oz., but not 32 oz. and 33 oz., the addition being in each case $\frac{1}{16}$ of the preceding stimulus. This fraction (supposing it to be the difference-threshold of the muscular sense) remains a constant, however light or however heavy the weights compared. The law may be formulated thus:—The difference between any two stimuli is experienced as of equal magnitude, in case the mathematical relation of these stimuli remains unaltered. Or, otherwise expressed, in order that the intensity of a sensation may increase in arithmetical progression the stimulus must increase in geometrical progression. It is also expressed by Fechner in the form—The sensation increases as the logarithm of the stimulus.

The law has been variously interpreted. Fechner himself designated it the psycho-physical law, and treated it as the fundamental formula of the relation between body and mind, thus assigning to it an ontological dignity and significance. But in this "psycho-physical" interpretation of his results he has not had a numerous following. Wundt interprets the law in a purely "psychological" sense, making it a special instance of the general law of relativity which governs our mental states. Introspection can give us no information as to the absolute intensity of the stimulus; for a stimulus is known in consciousness only through its sensational resultant. Hence, he argues, we can only compare one psychical state with another, and our standard of measurement is therefore necessarily a relative one; it depends directly upon the preceding state with which we compare the present. Others (*e.g.* G. E. Müller) have attempted to give the law a purely physical or "physiological" explanation. Instead of holding with Fechner that the law expresses a recondite relation between the material and the spiritual world, they prefer to regard the quantitative relation between the last physical antecedent in the brain and the resultant mental change as prima facie one of simple proportion, and to treat Weber's law as holding between the initial physical stimulus and the final action of the nerve-centres. According to this interpretation, the law would be altogether due to the nature of nervous action. As a nerve, says Sully, after a temporary degree of stimulation temporarily loses its sensibility, so the greater the previous stimulation of a nerve the greater is the additional stimulus required to produce an appreciable amount of sensation.

Weber's law, it must be added, holds only within certain limits. In the "chemical" senses of taste and smell experiments are almost impossible. It is not practicable to limit the amount of the stimulus with the necessary exactitude, and the results are further vitiated by the long continuance of the physiological effects. The same considerations apply with still more force to the organic sensations, and the results in the case of temperature sensations are completely uncertain. The law is approximately true in the case of sight, hearing pressure, and the muscular sense—most exactly in the case of sound. As this is the sense which affords the greatest facilities for measuring the precise amount of the stimulus, it may perhaps be inferred that, if we could attain the same exactitude in the other senses, with the elimination of the numerous disturbing extraneous influences at work, the law would vindicate itself with the same exactitude and certainty. It is further to be noted, however, that even in those senses in which it has been approximately verified, the law holds with stringency only within certain limits. The results are most exact in the middle regions of the sensory scale; when we approach the upper or lower limit of sensibility they become quite uncertain.

Literature.—Weber's investigations were published as "Der Tastsinn und das Gemeingefühl," in Wagner's *Handwörterbuch der Physiologie*, iii. (1846). Fechner's *Elemente der Psychophysik* (1860) contains an elaborate exposition of the whole subject. He replied to his critics in two later works, *In Sachen der Psychophysik* (1877) and *Revision der Hauptpunkte der Psychophysik* (1882). Delbœuf's *Étude psychophysique* (1873), *Examen critique de la loi psychophysique* (1883), and *Éléments de psychophysique générale et spéciale* (1883), and G. E. Müller's *Zur Grundlegung der Psychophysik* (1878) are also important documents; and the subject is fully treated in Wundt's *Grundzüge der physiologischen Psychologie* (ed. 1902–1903), and "Über die Methode d. Minimaländerungen," in *Philos. Stud.* (Leipzig, 1883), or, more popularly, in his *Human and Animal Psychology* (2nd ed., 1892), Lectures 2, 3, 4. See also Ladd's *Physiological Psychology* (1887), which is based upon Wundt; Meinong. in *Zeitschr. für Psychologie*, xi. (1896); Ziehen, *Leitfaden der physiologischen Psychologie* (7th ed., Jena, 1906); E. B. Titchener, *Experimental Psychology* (ii., 1905); Professor James Ward's "Attempt to Interpret Fechner's Law," in *Mind*, i. 452 sqq.; and generally textbooks of psychology, *e.g.* G. F. Stout's *Manual of Psychology*, bk. ii. ch. 7 (following Meinong); James's *Principles of Psychology*, ch. 13; Külpe's *Outlines of Psychology*, part i. chap. 1 and 3. (A. S. P.-P.)

WEBSTER, ALEXANDER (1707–1784), Scottish writer and minister, son of James Webster, a covenanting minister, was born in Edinburgh in 1707. Having become a minister in the church of Scotland, he propounded a scheme in 1742 for providing pensions for the widows of ministers. The tables which he drew up from information obtained from all the presbyteries of Scotland were based on a system of actuarial calculation that supplied a precedent followed by insurance companies in modern times for reckoning averages of longevity. In 1755 the government commissioned Webster to obtain data for the first census of Scotland, which he carried out in the same year. In 1753 he was elected moderator of the General Assembly; in 1771 he was appointed a dean of the Chapel Royal and chaplain to George III. in Scotland; and he died on the 25th of January 1784.

Webster published in 1748 his *Calculations*, setting forth the principles on which his scheme for widows' pensions was based; he also wrote a defence of the Methodist movement in 1742, and *Zeal for the Civil and Religious Interests of Mankind Commended* (1754).

WEBSTER, BENJAMIN NOTTINGHAM (1797–1882), English actor, manager and dramatic writer, was born in Bath on the 3rd of September 1797, the son of a dancing master. First appearing as Harlequin, and then in small parts at Drury Lane, he went to the Haymarket in 1829, and was given leading comedy character business. He was the lessee of the Haymarket from 1837; he built the new Adelphi theatre (1859); later the Olympic, Princess's and St James's came under his control; and he was the patron of all the contemporary playwrights and many of the best actors, who owed their opportunity of success to him. As a character actor he was unequalled in his day, especially in such parts as Triplet in *Masks and Faces*, Joey Ladle in *No Thoroughfare*, and John Peerybingle in his own dramatization of *The Cricket on the Hearth*. He wrote, translated or adapted nearly a hundred plays. Webster took his formal farewell of the stage in 1874, and he died on the 3rd of July 1882. His daughter, Harriette Georgiana (d. 1897), was the first wife of Edward Levy-Lawson, 1st baron Burnham; and his son, W. S. Webster, had three children—Benjamin Webster (b. 1864; married to Miss May Whitby), Annie (Mrs A. E. George) and Lizzie (Mrs Sydney Brough)—all well known on the London stage, and further connected with it in each case by marriage.

WEBSTER, DANIEL (1782–1852), American statesman, was born in Salisbury (now Franklin), New Hampshire, on the

18th of January 1782. He was a descendant of Thomas Webster, of Scottish ancestry, who settled in New Hampshire about 1636. His father, Ebenezer Webster (1739–1806), was a sturdy frontiersman; when, in 1763, he built his log cabin in the town of Salisbury there was no habitation between him and Canada. He was a member of Rogers' Rangers in the Seven Years' War, served in the War of Independence, was for several years a member of the New Hampshire legislature, was a delegate to the New Hampshire convention which ratified the Federal constitution, and was a justice of the court of common pleas for his county. Daniel was a frail but clever child, and his family made great sacrifices to give him and his elder brother Ezekiel a good education. He attended Phillips Exeter Academy about nine months in 1794, was further prepared for college by Dr Samuel Wood, the minister at Boscawen, and graduated at Dartmouth College in 1801. He was chosen Fourth of July orator in Hanover, the college town, in 1800, and in his speech appears the substance of the political principles for the development of which he is chiefly famous. After graduation he began the study of law in his native town. When in the following winter money had to be earned to enable Ezekiel to remain in college, Daniel accepted the principalship of the academy at Fryeburg, Maine; but he resumed his law studies in the following year, and in 1804, with Ezekiel's assistance, he was enabled to go to Boston and conclude his studies under Christopher Gore (1758–1827), later governor of Massachusetts (1809–1810) and a U.S. senator (1813–1816). Admitted to the bar in Boston in 1805, Webster began the practice of law at Boscawen, but his father died a year later, and Webster removed in the autumn of 1807 to Portsmouth, then one of the leading commercial cities of New England. Here he rose rapidly to eminence both at the bar and in politics.

His political career began in earnest at the opening of the War of 1812. He led the opposition in his state to the policy of Madison's administration, was elected by the Federalists a member of the National House of Representatives, and took his seat in May 1813. Henry Clay, the speaker, appointed him a member of the Committee on Foreign Relations, of which John C. Calhoun was chairman, and for some forty years these three constituted a great triumvirate in American politics. Webster had been in the House less than three weeks when he greatly embarrassed the administration by introducing a set of resolutions asking for information relating to the immediate cause of the war. In January 1814, when a bill to encourage enlistments was before the House, he attacked the conduct of the war in his first great speech. An even more forcible speech, delivered later in the same session, in support of a bill for repealing the embargo and non-importation acts, marked him as one of the foremost men in Congress. He successfully opposed a bill providing for what would have been practically an irredeemable currency, and he voted against the bill for chartering the second United States bank, although it provided for the redemption of bank notes in specie, because he objected to permitting the government to have so large a share in its management. Webster removed to Boston in June 1816. This cost him his seat in Congress after the 4th of March 1817, and for the next six years he was engaged chiefly in the practice of law in the courts of Massachusetts and before the U.S. Supreme Court.

His first leading case before the Supreme Court was the Dartmouth College Case. In 1815, when the Dartmouth board of trustees was rent by factions, the majority, who were Federalists and Congregationalists, removed the president, John Wheelock, who was a Presbyterian, and appointed Francis Brown in his place. Wheelock appealed to the legislature in the following year, when it was strongly Republican, and that body responded by passing acts which virtually repealed the charter received from George III., created a state university, placed Wheelock at its head, and transferred to it the property of the college. The case came before the Supreme Court of New Hampshire in May 1817. Jeremiah Mason (1768–1848), a lawyer of the first rank, Jeremiah Smith and Webster appeared for the college, and argued that these acts were invalid because they were not within the general scope of the legislature's power, because they violated provisions of the state constitution and because they violated the clause of the Federal Constitution which prohibits a state from impairing the obligation of contracts but the court decided against them. On the last point, however, the case was carried to the Supreme Court of the United States, and there Webster, presenting principally arguments of his colleagues at the state trial and making a powerful appeal to the emotions of the court, won the case for the college and for himself the front rank at the American bar. The result, too, vindicating as it did the supremacy of the Constitution of the United States, was a substantial gain for that nationalism which Webster advocated in his first Fourth of July oration at Hanover, and the promotion of which was for the remainder of his career his principal service to his country. His next great case was that of *M'Culloch* v. *Maryland* Maryland had imposed a tax upon the Baltimore branch of the Bank of the United States. The Maryland Court of Appeals sustained the validity of this act. Webster, supported by William Pinkney and William Wirt, argued in February 1819, (1) that the power to establish a bank was to be implied from the general power given to Congress to administer the financial affairs of the nation, and was a means of administering the finances which was appropriate and within the discretion of Congress; (2) that "the power to tax is the power to destroy," and that a state had not the constitutional power to impose a tax upon any instrumentality of the government of the United States. The Supreme Court sustained these arguments and the act of Maryland was held to be void. Four years later (1823) Webster argued the case of *Gibbons* v. *Ogden*. The state of New York, in order to reward the enterprise of Robert R. Livingston and the inventive genius of Robert Fulton in the application of the steam engine to traffic on the water, had given to them a monopoly of all transportation by steam within the waters of New York. The highest court of that state sustained the validity of the monopoly. Gibbons, who had begun to run a steamboat from New Jersey, appealed to the Supreme Court. Webster argued that the Federal Constitution gave to Congress control over interstate commerce, and that any interference by the legislature of a state with this commerce was unconstitutional and void. The Supreme Court so held; its opinion, written by Chief Justice Marshall, being little else than a recital of Webster's argument. In the case of *Ogden* v. *Saunders*, heard in 1824 and reheard in 1827, in which the question was the validity or invalidity of the insolvent laws of the several states, Webster argued that the clause prohibiting a state from impairing the obligation of contracts applied to future as well as to past contracts, but the court decided against him.

Meanwhile Webster had come to be recognized as the first American orator. His oration at Plymouth, on the 22nd of December 1820, on the second centennial anniversary of the landing of the Pilgrims, placed him in this rank. No man mastered more thoroughly the fundamental principles of government and the currents of feeling which influence the destiny of nations. His oration in 1825 at the laying of the corner stone of the Bunker Hill monument contained perhaps the clearest statement to be found anywhere of the principles underlying the American War of Independence. In the following year Webster delivered his oration in commemoration of the second and third presidents of the United States—John Adams and Thomas Jefferson—who died on the 4th of July 1826; it is particularly remarkable for Adams's imaginary reply in the Continental Congress to the arguments against a Declaration of Independence, beginning with the familiar quotation: "Sink or swim, live or die, survive or perish, I gave my hand and my heart to this vote." Webster's physical endowments as an orator were extraordinary. Thomas Carlyle thus describes him as he appeared in London in 1839.

"Not many days ago I saw at breakfast the notablest of your notabilities, Daniel Webster. He is a magnificent specimen. You might say to all the world, 'This is our Yankee Englishman; such limbs we make in Yankee land!' As a logic fencer, or parliamentary Hercules, one would be inclined to back him at first sight against all the extant world. The tanned complexion, that amorphous crag-like face; the dull black eyes under the precipice of brows, like dull anthracite furnaces, needing only to be *blown*; the mastiff mouth accurately closed; I have not traced so much of *silent Berserkir rage* that I remember in any man."

In 1820 Webster took an important part in the convention called to revise the constitution of Massachusetts, his arguments in favour of removing the religious test, in favour of retaining property representation in the Senate, and in favour of increasing the independence of the judiciary, being especially notable. He was a member of the National House of Representatives from 1823 to 1827 and of the Senate from 1827 to 1841. Soon after returning to the House he supported in a notable speech a resolution to send a commissioner to Greece, then in insurrection.

The tariff was to him a distasteful subject, and he was governed in his attitude toward it largely by the wishes of the majority of his constituents. He opposed the tariff bill of 1816 and in 1824, and he repudiated the name of "American system," claimed by Clay for his system of protection. When, however, the tariff bill of 1828, which was still more protective, came up for discussion, Webster had ceased to oppose protection; but he did not attempt to argue in favour of it. He stated that his people, after giving warning in 1824 that they would consider protection the policy of the Government, had gone into protected manufactures, and he now asked that that policy be not reversed to the injury of his constituents. In later speeches, too, he defended protection rather as a policy under which industries had been called into being than as advisable if the stage had been clear for the adoption of a new policy.

The tariff of 1828 aroused bitter opposition in South Carolina, and called from Vice-President Calhoun the statement of the doctrine of nullification which was adopted by the South Carolina legislature at the close of the year and is known as the South Carolina Exposition. Senator Robert Y. Hayne, from the same state, voiced this doctrine in the Senate, and Webster's reply was his most powerful exposition of the national conception of the Union. The occasion of this famous Webster-Hayne debate was the introduction by Senator Samuel A. Foote (1780–1846) of Connecticut of a resolution of inquiry into the expediency of restricting the sales of the Western lands. This was on the 29th of December 1829, and after Senator Benton of Missouri had denounced the resolution as one inspired by hatred of the East for the West, Hayne, on the 19th of January 1830, made a vigorous attack on New England, and declared his opposition to a permanent revenue from the public lands or any other source on the ground that it would promote corruption and the consolidation of the government and "be fatal to the sovereignty and independence of the states." Webster's brief reply drew from Hayne a second speech, in which he entered into a full exposition of the doctrine of nullification, and the important part of Webster's second reply to Hayne on the 26th and 27th of January is a masterly exposition of the Constitution as in his opinion it had come to be after a development of more than forty years. He showed the revolutionary and unpractical character of any doctrine such as nullification (*q.v.*) based on the assumption that the general government was the agent of the state legislatures. It placed the general government, he said, in the absurd position of a "servant of four-and-twenty masters, of different wills and different purposes, and yet bound to obey all." He then argued at length that the correct assumption was that both the general government and the state government were "all agents of the same supreme power, the people," that the people had established the Constitution of the United States and that in the Supreme Court, established under that Constitution, was vested the final decision on all constitutional questions. Whatever may be said of the original creation of the Constitution, whether by the states or by the people, its development under the influences of a growing nationalism was a strong support to Webster's argument, and no other speech so strengthened Union sentiment throughout the North; its keynote was "Liberty and Union, now and forever, one and inseparable." South Carolina, however, insisted that its doctrine was sound, and in November 1832 passed an ordinance declaring the revenue laws of the United States null and void. President Jackson responded with a proclamation denying the right of nullification, and asked Congress for authority to collect the revenue in South Carolina by force if necessary. A bill, known as the Force Bill, was introduced in the Senate, and in the debate upon it Webster had an encounter with Calhoun. His reply to Calhoun, printed as "The Constitution not a compact between sovereign States," is one of his closest legal arguments, but somewhat overmatched by the keen logic of his adversary.

Webster's support of President Jackson in the South Carolina trouble helped to drive Calhoun into an alliance with Clay; and Clay, whose plan of preserving the Union was by compromise, came forward with a bill for greatly reducing the tariff. Webster, strongly opposed to yielding in this way, made a vigorous speech against the bill, but it passed and South Carolina claimed a victory. In the same year (1833) the Whig party began to take definite form under the leadership of Clay, in opposition, chiefly, to President Jackson's bank policy, and Webster joined the ranks behind Clay with an aspiration for the presidency. He was formally nominated for that office by the Massachusetts legislature in 1835, and received the electoral vote of that state, but of that state only. Four years later his party passed him by for William Henry Harrison, the hero of Tippecanoe, and Webster refused the proffered nomination for vice-president.

President Harrison appointed Webster secretary of state but died one month after taking office. John Tyler, who succeeded to the presidency, was soon "read out of his party," and all his cabinet except Webster resigned. Webster hesitated, but after consultation with a delegation of Massachusetts Whigs decided to remain. Although he was severely criticized there were good reasons for his decision. When he entered office the relations between the United States and Great Britain were critical. The M'Leod case[1] in which the state of New York insisted on trying a British subject, with whose trial the Federal government had no power to interfere, while the British government had declared that it would consider conviction and execution a *casus belli*; the exercise of the hateful right of search by British vessels on the coast of Africa; the Maine boundary, as to which the action of a state might at any time bring the Federal government into armed collision with Great Britain—all these at once met the new secretary, and he felt that he had no right to abandon his work for party reasons. With the special commissioner from Great Britain, Lord Ashburton, he concluded the treaty of 1842 known as the Webster-Ashburton Treaty. Differences arising out of the M'Leod case were adjusted by extending the principle of extradition. The question of the suppression of the African slave trade, with which was connected the right of search, was settled by an agreement that each nation should keep in service off the coast of Africa a squadron carrying not fewer than eighty guns, and that the two squadrons should act in concert when necessary. The North-east boundary dispute was settled by a compromise which allowed Maine about 5500 sq. m. less than she had claimed, and allowed Great Britain about as much less on her claim, and by an agreement on the part of the government of the United States to pay to Maine and Massachusetts "in equal moieties" the sum of $300,000 for their assent (see MAINE).

Immediately after the treaty had been concluded the Whigs insisted that Webster should leave the cabinet. He refused, for a time, to be driven, but because of their continued attacks, together with his ambition to become president, and because Tyler favoured the annexation of Texas while he was opposed to it, he resigned in May 1843. He was forgiven by his party in the following year, but not until the opposition, provoked by the retention of his position under Tyler, had ruined whatever chance he might have had in that year of receiving the presidential nomination. In June 1843, on the occasion of the completion of the Bunker Hill monument, Webster delivered another classic oration. In February 1844 he argued the Girard Will Case before the United States Supreme Court. Stephen Girard (*q.v.*) had devised and bequeathed the residue of his estate for the establishment and maintenance of Girard College, in which no minister of the Gospel of any sect or denomination whatever should be admitted. The suit was brought to break the will, and Webster, for the plaintiffs, after stating that the devise could stand only on condition that it was a charity, argued that it was not a charity because no teaching was such except Christian teaching. He made an eloquent plea for Christianity, but his case was weak in law, and the court sustained the will.

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[1] This case grew out of the Canadian rebellion of 1837. Alexander M'Leod boasted in November 1840 that he was one of a Canadian party who, on the 29th of December 1837, had captured and burned a small American steamboat, the "Caroline," and in the course of the attack had shot Amos Durfee. The Canadian commander had regarded the "Caroline" as being in the service of the insurgents and had asked for volunteers to destroy her (see SEWARD, W. H.).

Webster was returned to the Senate in 1845. He opposed the annexation of Texas and the Mexican War, and was, as before, the recognized spokesman of his party. At the beginning of the quarrel of the North and the South over the organization of the territory acquired from Mexico, Calhoun contended that the Constitution of the United States extended over this territory and carried slavery with it, but Webster denied this on the ground that the territory was the property of, not part of, the United States, and Webster's view prevailed. The whole matter had, therefore, to be adjusted by Congress, and as the growing intensity of the quarrel revealed the depth of the chasm between the sections, Clay came forward with the famous compromise of 1850, and Webster's last great speech—" The Constitution and the Union," or as it is more commonly known " The Seventh of March Speech "—was in support of this Compromise. It was a noble effort to secure a lasting settlement of the slavery question, but he was bitterly denounced throughout the north as a renegade. In July 1850 Webster again became secretary of state, in the cabinet of President Fillmore. Perhaps the most important act of his second term was obtaining the release of Kossuth and other Hungarian refugees who had fled to Turkey, and whose surrender had been demanded by the Austrian government. He died at his home in Marshfield, Massachusetts, on the 24th of October 1852. Webster was twice married—first in 1808 to Grace, daughter of Rev. Elijah Fletcher, a New Hampshire clergyman. She died in 1828, leaving two sons, Daniel Fletcher, killed in the second battle of Bull Run, and Edward, a major in the United States army, who died while serving in the Mexican War, and a daughter Julia, who married Samuel Appleton. Webster's second wife was Caroline Le Roy, daughter of Jacob Le Roy, a New York merchant. He was married to her in 1829 and she survived him.

The universal expression of respect and admiration at the time of Webster's death showed that he had retained the confidence of his people. Never, since the death of Washington, had there been in the United States such a universal expression of public sorrow and bereavement. It is not too much to say that the conviction of the justice of their cause that carried the northern states successfully through the Civil War was largely due to the arguments of Webster. He had convinced the majority of the people that the government created by the Constitution was not a league or confederacy, but a Union, and had all the powers necessary to its maintenance and preservation. He had convinced the Supreme Court, and established the principle in American jurisprudence, that whenever a power is granted by a Constitution, everything that is fairly and reasonably involved in the exercise of that power is granted also. He established the freedom of the instrumentalities of the national government from adverse legislation by the states; freedom of commerce between the different states; the right of Congress to regulate the entire passenger traffic through and from the United States, and the sacredness of public franchises from legislative assault. The establishment of these principles was essential to the integrity and permanence of the American Union.

Bibliography.—*The Works of Daniel Webster* (6 vols., Boston, 1851) contain a biographical memoir by Edward Everett; G. T. Curtis, *Life of Daniel Webster* (2 vols., New York, 1870) is the most complete biography, but it is written wholly from an admirer's point of view. See also J. W. McIntyre (ed.), *Writings and Speeches of Daniel Webster* (18 vols., Boston, 1903); Fletcher Webster (ed.), *Daniel Webster's Private Correspondence* (2 vols., Boston, 1857); H. C. Lodge, *Daniel Webster* (Boston, 1899); J. B. McMaster, *Daniel Webster* (New York, 1902); E. P. Wheeler, *Daniel Webster, the Expounder of the Constitution* (New York, 1905); S. W. McCall, *Daniel Webster* (Boston, 1902); and Norman Hapgood, *Daniel Webster* (Boston, 1899). (E. P. W.; X.)

WEBSTER, JOHN (fl. 1602–1624), English dramatist, was a writer for the stage in the year 1602, when he had a share in three plays noted by Philip Henslow, and he published in 1624 the city pageant for that year, " invented and written by John Webster, merchant-tailor." In the same year a tragedy by Ford and Webster, *A late Murther of the Sonn upon the Mother*, was licensed for the stage; it is one of the numberless treasures now lost to us through the carelessness of genius or the malignity of chance. Beyond the period included between these two dates there are no traces to be found of his existence; nor is anything known of it with any certainty during that period, except that seven plays appeared with his name on the title page, three of them only the work of his unassisted hand. He was the author of certain additions to Marston's tragi-comedy of *The Malcontent* (1604); these probably do not extend beyond the induction, a curious and vivacious prelude to a powerful and irregular work of somewhat morbid and sardonic genius. Three years later, in 1607, two comedies and a tragedy, " written by Thomas Dekker and John Webster," were given to the press. The comedies are lively and humorous, full of movement and incident; but the beautiful interlude of poetry which distinguishes the second scene of the fourth act of *Westward Ho!* is unmistakably and unquestionably the work of Dekker; while the companion comedy of *Northward Ho!* is composed throughout of homespun and coarse-grained prose. *The Famous History of Sir Thomas Wyatt* is apparently a most awkward and injurious abridgment of an historical play in two parts on a pathetic but undramatic subject, the fate of Lady Jane Grey. In this lost play of *Lady Jane* (noted by Henslow in 1602) Heywood, Dekker, Chettle and Smith had also taken part; so that even in its original form it can hardly have been other than a rough piece of patchwork. There are some touches of simple eloquence and rude dramatic ability in the mangled and corrupt residue which is all that survives of it; but on the whole this " history " is crude, meagre, and unimpressive. In 1612 John Webster stood revealed to the then somewhat narrow world of readers as a tragic poet and dramatist of the very foremost rank in the very highest class. *The White Devil*, also known as *Vittoria Corombona*,[1] is a tragedy based on events then comparatively recent—on a chronicle of crime and retribution in which the leading circumstances were altered and adapted with the most delicate art and the most consummate judgment from the incompleteness of incomposite reality to the requisites of the stage of Shakespeare. By him alone among English poets have the finest scenes and passages of this tragedy been ever surpassed or equalled in the crowning qualities of tragic or dramatic poetry—in pathos and passion, in subtlety and strength, in harmonious variety of art and infallible fidelity to nature. Eleven years had elapsed when the twin masterpiece of its author—if not indeed a still greater or more absolute masterpiece—was published by the poet who had given it to the stage seven years before. *The Duchess of Malfy*[2] (an Anglicized version of Amalfi, corresponding to such designations as Florence, Venice and Naples) was probably brought on the stage about the time of the death of Shakespeare; it was first printed in the memorable year which witnessed the first publication of his collected plays. This tragedy stands out among its compeers as one of the imperishable and ineradicable landmarks of literature. All the great qualities apparent in *The White Devil* reappear in *The Duchess of Malfy*, combined with a yet more perfect execution, and utilized with a yet more consummate skill. No poet has ever so long and so successfully sustained at their utmost height and intensity the expressed emotions and the united effects of terror and pity. The transcendent imagination and the impassioned sympathy which inspire this most tragic of all tragedies save *King Lear* are fused together in the fourth act into a creation which has hardly been excelled for unflagging energy of impression and of pathos in all the dramatic or poetic literature of the world. Its wild and fearful sublimity of invention is not more exceptional than the exquisite justice and tenderness and subtlety of its expression. Some of these executive merits may be found in an ill-constructed and ill-conditioned tragi-comedy which was printed in the same year; but few readers will care to remember much more of *The Devil's Law Case* than the admirable scenes and passages which found favour in the unerring and untiring sight of Webster's first and final interpreter or commentator, Charles Lamb. Thirty-one years later (1654) the noble tragedy of *Appius and Virginia* was given to the world—a work which would alone have sufficed to perpetuate the memory of its author among all competent lovers of English poetry at its best. Seven years afterwards an unprincipled and ignorant bookseller published, under the title of *Two New Playes: viz. A Cure for a Cuckold: a Comedy. The Thracian Wonder, A Comical History. As it hath been several times acted with great Applause*, two plays of which he assigned the authorship to John Webster and William Rowley. This attribution may or may not be accurate; the former play is a mixture of coarsely realistic farce and gracefully romantic comedy. An elegy on Henry, prince of Wales, and a few slight occasional verses, compose the rest of Webster's remaining extant works.

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[1] *The White Divel; or, The Tragedy of Paulo Giordano Ursini, Duke of Brachiano, with the Life and Death of Vittoria Corombona, the famous Venetian Curtizan* (1612). Other editions, with varying title-pages, 1631, 1665, 1672.

[2] *The Dutchess of Malfey, A Tragedy. As it was approvedly well acted at Blackfriers* . . . (1623). The plot is taken from a novel by Bandello, and is also the subject of a tragedy by Lope de Vega, *El Mayor Domo de la duquessa d'Amalfi.*

[Edward Phillips, in his *Theatrum poëtarum*, wrongly attributed to him a share in *The Weakest goes to the Wall*. The play of *Guise*, mentioned by Webster himself in the introduction to *The Devil's Law Case*, is lost.]

Webster's claims to a place among the chief writers of his country were ignored for upwards of two centuries. In 1830 the Rev. Alexander Dyce first collected and edited the works of a poet who had found his first adequate recognition twenty-two years earlier at the pious and fortunate hands of Lamb. But we cannot imagine that a presentiment or even a foreknowledge of this long delay in the payment of a debt so long due from his countrymen to the memory of so great a poet would seriously have disturbed or distressed the mind of the man who has given us the clue to his nature in a single and an imperishable sentence—"I rest silent in my own work." (A. C. S.)

See *The Works of John Webster; with some Account of the Author and Notes*, by Alexander Dyce (new ed., 1857); *The Dramatic Works of John Webster*, edited by William Hazlitt the younger (1857); *The Best Plays of Webster and Tourneur*, edited by J. A. Symonds for the "Mermaid" series (1888–1903); *Love's Graduate* . . . (Oxford, 1885), in which Webster's supposed share in *A Cure for a Cuckold* is presented separately by S. Spring-Rice, with an introduction by Edmund Gosse. See also E. Gosse, *Seventeenth-Century Studies* (1883); and especially an exhaustive treatise by E. E. Stoll, *John Webster, The Periods of his Work as determined by his Relations to the Drama of his Day* (Boston, Massachusetts, 1905). Mr Stoll's account (see p. 42) shows that the additional biographical suggestions made by Mr Sidney Lee in his article in the *Dict. Nat. Biog.* are not supported.

WEBSTER, NOAH (1758–1843), American lexicographer and journalist, was born at West Hartford, Connecticut, on the 16th of October 1758. He was descended from John Webster of Hartford, governor of Connecticut in 1656–1657, and on his mother's side from Governor William Bradford of Plymouth. He entered Yale in 1774, graduating in 1778. He studied law, and was admitted to the bar at Hartford in 1781. In 1782–1783 he taught in a classical school at Goshen, New York, and became convinced of the need of better textbooks of English. In 1783–1785 he published at Hartford *A Grammatical Institute of the English Language*, in three parts, a spelling-book, a grammar and a reader. This was the pioneer American work in its field, and it soon found a place in most of the schools of the United States. During the twenty years in which Webster was preparing his dictionary, his income from the spelling-book, though the royalty was less than a cent a copy, was enough to support his family; and before 1861 the sale reached more than a million copies a year. The wide use of this book contributed greatly to uniformity of pronunciation in the United States, and, with his dictionary, secured the general adoption in the United States of a simpler system of spelling than that current in England. In 1785 he published *Sketches of American Policy*, in which he argued for a constitutional government whose authority should be vested in Congress. This he regarded as the first distinct proposal for a United States Constitution, and when in 1787 the work of the commissioners was completed at Philadelphia, where Webster was then living as superintendent of an academy, he wrote in behalf of the constitution an *Examination of the Leading Principles of the Federal Constitution*. In 1788 he started in New York the *American Magazine*, but it failed at the end of a year, and he resumed the practice of law at Hartford. In 1793, in order to support Washington's administration, he removed to New York and established a daily paper, the *Minerva* (afterwards the *Commercial Advertiser*), and later a semi-weekly paper, the *Herald* (afterwards the *New York Spectator*). In 1798 he removed to New Haven. He served in the Connecticut House of Representatives in 1800 and 1802-07, and as a county judge in 1807-11. In 1807 he published *A Philosophical and Practical Grammar of the English Language*. In 1806 he had brought out *A Compendious Dictionary of the English Language*, and in 1807 he began work on his dictionary. While engaged on it he removed in 1812 to Amherst, Massachusetts, where he was president of the Board of Trustees of the Academy and assisted in founding Amherst College. He was also a member of the General Court of Massachusetts. In 1822 he returned to New Haven, and the next year he received the degree of LL.D. from Yale. He spent a year (1824-1825) abroad, working on his dictionary, in Paris and at the university of Cambridge, where he finished his manuscript. The work came out in 1828 in two volumes. It contained 12,000 words and from 30,000 to 40,000 definitions that had not appeared in any earlier dictionary. An English edition soon followed. In 1840 the second edition, corrected and enlarged, came out, in two volumes. He completed the revision of an appendix a few days before his death, which occurred in New Haven on the 28th of May 1843.

The dictionary was revised in 1847 under the editorship of Professor Chauncey A. Goodrich and published in one volume. In 1859 a pictorial edition was issued. In 1864 it was revised mainly under the direction of Professor Noah Porter, and again in 1890 under the same direction, the latter revision appearing with the title of the *International Dictionary of the English Language*. The latter was again issued in 1900, with a supplement of 25,000 words and phrases, under the supervision of William Torrey Harris, who edited another revision, in 1909, under the title of the *New International Dictionary of the English Language*. It has frequently been abridged.

Among Webster's other works are *Dissertations on the English Language* (1789), a course of lectures that he had given three years before in some of the chief American cities; *Essays* (1790); *The Revolution in France* (1794); *A Brief History of Epidemics and Pestilential Diseases* (1799), in two vols.; *The Rights of Neutral Nations in Time of War* (1802); *Historical Notices of the Origin and State of Banking Institutions and Insurance Offices* (1802); and *A Collection of Papers on Political, Literary, and Moral Subjects* (1843), which included "On the Supposed Change in the Temperature of Winter," a treatise showing long and careful research. He also published Governor John Winthrop's *Journal* in 1790, and wrote a *History of the United States*, of which a revised edition appeared in 1839.

See *Memoir of Noah Webster* by his son-in-law, Professor Chauncey A. Goodrich, in the quarto editions of the *Dictionary*, also *Noah Webster* (1882), by Horace E. Scudder, in "American Men of Letters."

WEBSTER, THOMAS (1773–1844), British geologist, was born in the Orkney Isles in 1773, and was educated at Aberdeen. He subsequently went to London and studied architecture, the Royal Institution in Albemarle Street being built from his design. In 1826 he was appointed house-secretary and curator to the Geological Society of London, and for many years he rendered important services in editing and illustrating the Transactions of the Society. In 1841–1842 he was professor of geology in University College, London. He was distinguished for his researches on the Tertiary formations of the Isle of Wight, where he recognized the occurrence of both fresh-water and marine strata; he continued his observations on the mainland of Hampshire, and subsequently in Dorsetshire, where he described the Purbeck and Portland rocks. To him Sir Henry C. Englefield (1752–1822) was indebted for the geological descriptions and the effective geological views and sections of the Isle of Wight and Dorset that enriched his *Description of the Principal Picturesque Beauties, Antiquities and Geological Phenomena of the Isle of Wight* (1816). The mineral Websterite was named after him. He died in London on the 26th of December 1844.

WEBSTER, THOMAS (1800–1886), English figure painter, was born at Ranelagh Street, Pimlico, London, on the 20th of March 1800. His father was a member of the household of George III.; and the son, having shown an aptitude for music, became a chorister in the Chapel Royal, St James's. He, however, developed a still stronger love for painting, and in 1821 he was admitted student of the Royal Academy, to whose exhibition he contributed, in 1824, portraits of "Mrs Robinson and Family." In the following year he gained the first medal in the school of painting. Till 1879 he continued to exhibit in the Royal Academy work of a genial and gently humorous character, dealing commonly with subjects of familiar incident, and especially of child life. Many of these were exceedingly popular, particularly his "Punch" (1840), which procured in 1841 his election as A.R.A., followed five years later by full membership. He became an honorary retired academician in 1877, and died at Cranbrook, Kent, on the 23rd of September 1886. His "Going into School, or the Truant" (1836), and his "Dame's School" (1845) are in the National Gallery, and five of his works are in the South Kensington Museum.

WEBSTER, a township of Worcester county, Massachusetts, U.S.A., on the French river, about 16 m. S.S.W. of Worcester. Pop. (1890) 7031; (1900) 8804, of whom 3562 were foreign-born; (1910 census), 11,509. Land area (1906), 12·19 sq. m. Webster is served by the New York, New Haven & Hartford, and the Boston & Albany railways, and by interurban electric lines. In the township is Lake Chaubunagungamaug, a beautiful sheet of water about 2 sq. m. in area. The manufacture of textiles and of boots and shoes is the principal industry; the total value of the factory product in 1905 was $5,867,769. Webster was founded by Samuel Slater (1768–1835), who in 1812 built cotton-mills and in 1815–1816 began the manufacture of woollen cloth. The township, named in honour of Daniel Webster, was erected in 1832 from common lands and from parts of Dudley and Oxford townships, which before the cotton-mills were built here were almost uninhabited.

See Holmes Ammidown, *Historical Collections* (New York, 1874), vol. i. pp. 461-524.

WECKHERLIN, GEORG RUDOLF (1584–1653), German poet, was born at Stuttgart on the 15th of September 1584. After studying law he settled at Stuttgart, and, as secretary to the Duke Johann Friedrich of Württemberg, was employed on diplomatic missions to France and England. Between 1620 and 1624 he lived in England in the service of the Palatinate, and seems also to have been employed by the English government. In 1644 he was appointed "Secretary for Foreign Tongues" in England, a position in which, on the establishment of the Commonwealth, he was followed by Milton. He died in London on the 13th of February 1653. Weckherlin was the most distinguished of the circle of South German poets who prepared the way for the Renaissance movement associated in Germany with Martin Opitz. Two volumes of his *Oden und Gesänge* appeared in 1618 and 1619; his collected *Geistliche und weltliche Gedichte* in 1641. His models were the poets of the French *Pléiade*, and with his psalms, odes and sonnets he broke new ground for the German lyric. An epic poem on the death of Gustavus Adolphus, in alexandrines, seems to have won most favour with his contemporaries.

Weckherlin's *Gedichte* have been edited by H. Fischer for the *Stuttgarter Literarischer Verein* (vols. cxcix.-cc., 1894–1895). Selections were published by W. Müller (1823) and K. Goedeke (1873). See also C. P. Conz, *Nachrichten von dem Leben und den Schriften Weckherlins* (1803); E. Höpfner, *G. R. Weckherlins Oden und Gesänge* (1865); H. Fischer, *Beiträge zur Literaturgeschichte Schwabens* (1891), and the same author's article in the *Allgemeine deutsche Biographie* (1896).

WEDDERBURN, JAMES (1495?–1533), **JOHN** (1500–1556) and **ROBERT** (1510?–?1556), Scottish poets and religious reformers, were natives of Dundee, where their father James Wedderburn was a prosperous merchant. All three brothers studied at St Andrews University. James Wedderburn, who had gone to St Andrews in 1514, was for a time in France preparing for a mercantile career. On his return to Dundee in 1514 he received instruction in the Reformed faith from Friar Hewat, a Dominican monk. He composed a play on the beheading of St John the Baptist, and another, a morality satirizing church abuses, in the setting of episodes from the story of Dionysius the Tyrant, both of which were performed in 1540 in the playfield of Dundee. Neither of these nor a third ascribed to him by Calderwood, the historian, are extant. A charge of heresy was brought against him, but he escaped to France, and established himself as a merchant at Rouen or Dieppe, where he lived unmolested until his death in 1553, although attempts were made by the Scottish community there to bring further charges against him.

John Wedderburn graduated M.A. at St Andrews in 1528. He took priests' orders and appears to have held the chaplaincy of St Matthews, Dundee, but in March 1539 he was accused of heresy, apparently for having, in conjunction with his brothers, written some anti-Catholic ballads. He escaped to Wittenberg, where with other of his compatriots he received the teaching of the German reformers. There he gained an acquaintance with the Lutheran hymns, which he turned to account on his return to Scotland. The death of James V. and the known leanings of the regent, the earl of Arran, to reform, encouraged many exiles, Wedderburn among them, to revisit Scotland. It is probable that he was the author of the greater portion of the *Compendious Book of Psalms and Spiritual Songs* which contains a large number of hymns from the German. The enormous influence of the collection, with its added *Gude and Godlie Ballatis*, on Scottish reform, is attested by the penalties enacted against the authors and printers of these books. John Wedderburn was in Dundee as late as 1546, when he was obliged to flee to England. John Johnston in his *Coronis martyrum* says he died in exile in 1556.

Robert Wedderburn, who graduated M.A. in 1530, was ordained priest, and succeeded his uncle John Barry as vicar of Dundee; but before he came into actual possession he also was suspected of heresy, and was compelled to flee to France and Germany. He returned to Scotland in 1546. He appears to have been actual vicar of Dundee in 1552. His sons were legitimized in January 1553.

The earliest known edition of the *Compendious Book of Psalms and Spiritual Songs* (of which an unique copy is extant) dates back to 1567, though the contents were probably published in broad sheets during John Wedderburn's lifetime. It consists of a calendar and almanac, a catechism, hymns, many of them translations from the German, metrical versions of the Psalms, and a collection of ballads and satirical poems against the Catholic church and clergy. The separate shares of the brothers in this compilation cannot be settled, but Robert is said to have edited the whole and added the section of "gude and godlie ballatis." Many of these ballads are adapted from secular songs. Editions of the book appeared in 1578 (printed by John Ros), in 1600 (by Robert Smith), in 1621 (by Andro Hart); selections were published by Lord Hailes (1765) and by Sibbald (1802); a reprint of the 1621 volume was edited by Sir J. G. Dalyell in *Scotish Poems of the Sixteenth Century* (1801); and of the 1578 volume by David Laing in 1868. In 1897 Professor A. F. Mitchell reprinted the 1567 volume (expurgated) for the Scottish Text Society.

"Vedderburn's" *Complainte of Scotlande* (1549) has been variously assigned to Robert Wedderburn, to Sir David Lyndsay and to Sir James Inglis, who was chaplain of the Abbey of Cambuskenneth from about 1508 to 1550. It is a prose treatise pleading for the maintenance of the Scottish alliance with France, written by a determined enemy of England and of the English party in Scotland. It is dedicated to Mary of Guise, and consists of the "Dreme" of Dame Scotia and her complaint against her three sons. These two sections are connected by a "Monologue Recreatif," in which the author displays his general knowledge of popular songs, dances and tales, of astronomy, natural history and naval matters. Four copies of this work are extant, but in none is the title-page preserved. In the Harleian catalogue the book is entered as *Vedderburn's Complainte of Scotlande, wyth ane Exortatione to the thre Estaits to be vigilante in the Deffens of their Public Veil* (1549) (*Catalogus Bibliothecae*

Harleianae, vol. i. no. 8371). This title, which is repeated with variations in spelling in vol. iv. no. 12070, bears every mark of authenticity. The book appears to have been printed in France, and the idea of Dame Scotia's exhortations to her sons, the Three Estates, is borrowed from Alain Chartier's *Quadrilogue invectif*, some passages of which are appropriated outright. Other passages are borrowings from Octavien de Saint Gelais and Sir David Lyndsay. There are strong arguments against Robert Wedderburn's authorship, as maintained by Laing and others. It is not likely that he would write in support of Cardinal Beaton's policy, and the dialect is an exaggerated form of Latinized Middle Scots, differing materially from the language of the *Compendious Book*. Some of the orthographical and typographical peculiarities are due to the fact that the book was set up by Parisian printers. Sir J. A. H. Murray inclines to assign it to Sir James Inglis, or an unknown priest of the name of Wedderburn.

The text of the *Complaynt* was first edited by Leyden in 1801. Murray's edition for the E.E.T.S. appeared in 1872. The introduction to the latter requires revision in the light of later discoveries as to the plagiarisms in the text. See the paper by W. A. Neilson in *The Journal of Germanic Philology* (iv.), the note by W. A. Craigie in *The Modern Quarterly of Language and Literature* (i. 267), Gregory Smith's *Specimens of Middle Scots* (1902), p. 135 et seq., and the article by J. T. T. Brown in the *Scottish Historical Review* (January 1904).

WEDDING, the common term for the marriage ceremony. The verb "to wed" is properly to engage by a pledge (O. Eng. *wed*, a pledge, wager; cf. Lat. *vas*, *vadis*; M. Dutch *wedde*, pledge, pawn; Swed. *vad*, bet, &c.). The term "wedlock" (O. Eng. *wedlác*; from *lác*, a gift), used of the state of marriage, or the vows and sacrament of marriage, properly means a gift given as a pledge; cf. Ger. *Morgengabe*, the gift to the bride on the morning after the marriage.

See Marriage and Family.

WEDGE (O. Eng. *wecg*, a mass of metal, cognate with Dutch *wig*, *wigge*, Dan. *vaegge*, &c.; in Lith. the cognate form outside Teut. is found in *wagis*, a peg, spigot; there is no connexion with "weigh," "weight," which must be referred to the root *wegh*, to lift, carry, draw, cf. Lat. *vehere*, whence "vehicle," &c.), a piece of wood or metal, broad and thick at one end, and inclined to a thin edge or point at the other, used as a means for splitting wood, rocks, &c., of keeping two closely pressing surfaces apart, or generally for exerting pressure in a confined space. The "wedge" has sometimes been classed as one of the simple mechanical powers, but it is properly only an application of the inclined plane.

In meteorology, the term "wedge" is used of a narrow area of high pressure between two adjacent cyclonic systems, which takes the form of a wedge or tongue, as do the isobars representing it on a weather-chart. A wedge moves along between the rear of a retreating cyclone and the front of one advancing, and may be regarded as a projection from an anticyclonic system lying to one side of the course of the cyclones. As the crest of the wedge (*i.e.* the line of highest pressure) passes over any point the wind there changes suddenly from one direction almost to the opposite, while the clearing weather of the retreating cyclone and the temporary fine weather after its passing are quickly succeeded by a break indicating the approach of the following cyclone. Conditions exactly opposite to those accompanying a wedge are provided by a "V-shaped depression."

WEDGWOOD, JOSIAH (1730–1795), the most distinguished of English manufacturers of pottery, came of a family many members of which had been established as potters in Staffordshire throughout the 17th century and had played a notable part in the development of the infant industry. Dr Thomas Wedgwood of Burslem was one of the best of the early saltglaze potters. Josiah, born in 1730, was the youngest child of another Thomas Wedgwood, who owned a small but thriving pottery in Burslem. At a very early age he distinguished himself by keen powers of observation and interest in all that was curious and beautiful. Soon after the death of his father in 1739, Josiah, then scarcely ten years of age, was taken away from school and set to learn the art of "throwing" clay, *i.e.* shaping pottery vessels on the thrower's wheel, at which he soon became extraordinarily skilful.

In 1744 he was apprenticed to his eldest brother, who had succeeded to the management of his father's pottery; and in 1752, shortly after the term of his apprenticeship had expired, he became manager of a small pottery at Stoke-upon-Trent, known as Alder's pottery, at a very moderate salary. Within a year or two he became junior partner with Thomas Whieldon of Fenton, then the cleverest master-potter in Staffordshire. Many of Whieldon's apprentices afterwards became noted potters, and there can be little doubt that Wedgwood gained greatly at this period of his life by his association with Whieldon. But he was too original to remain long content with a subordinate position, and the pottery business was developing so rapidly that he had every inducement to commence work on his own account.

In 1759 he leased the Ivy House pottery in Burslem from some relatives, and like a sensible man he continued to make only such pottery as was being made at the period by his fellow-manufacturers. Salt-glaze and green and yellow glaze seem to have been his first staples. In 1762 he also leased the Brick-House, alias "Bell" works, at Burslem. The fine white English earthenware was just reaching perfection, and Wedgwood was soon one of its best-known makers. He was most active and energetic in his efforts, not only for the improvement of Staffordshire pottery, but almost equally so for the improvement of turnpike roads, the construction of a canal (the Trent & Mersey) and the founding of schools and chapels. Almost the first step in his public career outside his native district was the presentation of a service of his improved cream-coloured earthenware to Queen Charlotte in 1762. The new ware was greatly appreciated, and Wedgwood was appointed potter to the queen and afterwards to the king. He gave the name of Queen's Ware to his productions of this class, and this judicious royal patronage awarded to a most deserving manufacturer undoubtedly helped Wedgwood greatly. Having laid the foundations of a successful business in his admirable domestic pottery—the best the world had ever seen up to that time—he turned his attention to artistic pottery, and the European renaissance of classic art—fostered by the discovery of Pompeii and the recovery of Greek painted vases from the ancient graves in Campania and other parts of Italy—being at its height it was natural that Wedgwood should turn to such a source of inspiration. Although every European country was affected by this neo-classical revival it may be claimed that England absorbed it more completely than any other country, for the brothers Adam (the architects) and Josiah Wedgwood brought it into absolute correspondence with modern tastes and ideas. Wedgwood was particularly successful in this direction, for his "dry" bodies—some of which, like the black and cane bodies, had long been known in the district, others, such as the famous Jasper bodies, which he invented after years of laborious effort—lent themselves particularly well to the reproduction of designs based on the later phases of Greek art. If our increased appreciation and knowledge of Greek and Roman art makes us at times impatient with the mechanical perfection of the works of Wedgwood and his contemporaries, the fault is even more the fault of a nation and a period than that of any individual, however commanding. It will always remain to Wedgwood's credit that he was the most successful and original potter the world has ever seen—the only one, through all the centuries, of whom it can be truthfully said that the whole subsequent course of pottery manufacture has been influenced by his skill.

Of the externals of his life a few facts will suffice. He married his cousin, Sarah Wedgwood, in 1764, and they had a numerous family of sons and daughters. One of these daughters was the mother of the famous naturalist Charles Darwin. Some time after his marriage (viz. 1768) he entered into a partnership with Thomas Bentley of Liverpool, a man of considerable taste and culture. Bentley, who was a handsome, courtly man, attended largely to the London sales. In 1769 they opened splendid new works, near Hanley, that with their classic leanings they christened "Etruria." They continued a practice of Wedgwood's in employing able artists to produce designs, and the most famous of these was John Flaxman, whose name will for ever be associated with the firm's productions. Bentley died in 1780 and Wedgwood remained sole owner of the Etruria works until 1790, when he took some of his sons and a nephew, named Byerley, into partnership. He died on the 3rd of January 1795, rich in honours and in friends, for besides being a great potter he was a man of high moral worth, and was associated with many noted men of his time, amongst whom should be mentioned Sir Joseph Banks, Joseph Priestley and Erasmus Darwin. His descendants have carried on the business at Etruria to this day, and have lately established at the works a Wedgwood museum of great interest.

See CERAMICS. For detailed accounts of his life see Eliza Meteyard, *Life of Wedgwood* (1865–1866); Jewitt, *Life of Wedgwood* (1865); Rathbone, *Old Wedgwood* (1893); Church, *Josiah Wedgwood: Master-Potter* (1894; new ed., 1903); Burton, *History and Description of English Earthenware and Stoneware* (1904); J. C. Wedgwood, *A History of the Wedgwood Family* (1909). (W. B.*)

WEDMORE, FREDERICK (1844–), English art critic and man of letters, was born at Richmond Hill, Clifton, on the 9th of July 1844, the eldest son of Thomas Wedmore of Druids Stoke, Stoke Bishop. His family were Quakers, and he was educated at a Quaker private school and then in Lausanne and Paris. After a short experience of journalism in Bristol he came to London in 1868, and began to write for the *Spectator*. His early works included two novels, but the best examples of his careful and artistic prose are perhaps to be found in his volumes of short stories, *Pastorals of France* (1877), *Renunciations* (1893), *Orgeas and Miradou* (1896), reprinted in 1905 as *A Dream of Provence*. In 1900 he published another novel, *The Collapse of the Penitent*. As early as 1878 he had begun a long connexion with the London *Standard* as art critic. He began his studies on etching with a noteworthy paper in the *Nineteenth Century* (1877–1878) on the etchings of Charles Méryon. This was followed by *The Four Masters of Etching* (1883), with original etchings by Sir F. S. Haden, Jules Ferdinand Jacquemart, J. M. Whistler, and Alphonse Legros; *Etching in England* (1895); an English edition (1894) of E. Michel's *Rembrandt*; and a study and a catalogue of *Whistler's Etchings* (1899). His other works include *Studies in English Art* (2 vols., 1876–1880), *The Masters of Genre Painting* (1880), *English Water Colour* (1902), *Turner and Ruskin* (2 vols., 1900).

WEDNESBURY, a market town and municipal and parliamentary borough of Staffordshire, England, in the Black Country, 121 m. N.W. from London by the London & North-Western railway, and on the northern line of the Great Western. Pop. (1901) 26,554. An overhead electric tramway connects with Walsall, 3½ m. N. The town is ancient, but of modern growth and appearance as an industrial centre. The church of St Bartholomew, however, is a fine Perpendicular building standing high. It is traditionally supposed to occupy the site of a place of the worship of Woden or Odin, and the name of the town to be derived from this god through the form Wodensborough. A church was built, probably in the 11th century, and from 1301 to 1535 the advowson, tithes, &c., belonged to the abbot of Halesowen. The present church was several times restored in the 18th and 19th centuries. The chief public buildings are the town hall (1872), art gallery (1891), and free library (1878). Coal, limestone and ironstone are mined. A special kind of coal, giving an intense heat, is largely used in forges. There are great iron and steel works, producing every kind of heavy goods used by railway and engineering works, such as boiler plates, rails, axles, tubes, bolts and nuts. Stoneware potteries are also important. Similar industries, with brick-making, are practised at DARLASTON, an urban district (pop. 15,395), within the parliamentary borough. Wednesbury returns one member to parliament. The town is governed by a mayor, 4 aldermen, and 12 councillors. Area, 2287 acres.

Here Ethelfleda, widow of Æthelred of Mercia, in 916 constructed a castle. The place is not mentioned in Domesday, but appears to have belonged to the barony of Dudley. After the Conquest it became a demesne of the crown, and it was bestowed by Henry II. on the Heronvilles. It received parliamentary representation in 1867, and became a municipal borough in 1886.

WEED, THURLOW (1797–1882), American journalist and politician, was born in Cairo, Greene county, New York, on the 15th of November 1797. He began to earn his own living at the age of eight. From 1811 to 1818 he worked as an apprentice and journeyman printer in Onondaga Hollow, Utica, Auburn, Cooperstown, Albany and New York City. His first independent enterprises, the *Republican Agriculturist*, established at Norwich, N.Y., in 1818, and the *Onondaga County Republican*, established at Manlius, N.Y., in 1821, proving unsuccessful, he became editor of the *Rochester Telegraph* in 1822. Entering politics as an opponent of the Democratic machine, which he termed the Albany Regency, Weed was in 1824 elected to the Assembly on the John Quincy Adams ticket, serving for a single session (1825). Two years later, during the excitement over the disappearance of William Morgan (see ANTI-MASONIC PARTY), he retired from the *Telegraph* and threw himself with enthusiasm into the attack on the Masonic order, editing for a time the *Anti-Masonic Enquirer*. In 1830 he established and became editor of the *Albany Evening Journal*, which he controlled for thirty-five years. Supporting the Whigs and later the Republicans, it was one of the most influential anti-slavery papers in the north-east; and Thurlow Weed himself became a considerable force in politics. In 1863 he retired from the *Journal* and settled in New York City. In 1867 he assumed editorial control of the *Commercial Advertiser*, but was soon compelled to resign on account of ill-health. He died in New York City on the 22nd of November 1882.

See *The Life of Thurlow Weed* (vol. i., Autobiography, edited by his daughter, Harriet A. Weed; vol. ii., Memoir, by his grandson, Thurlow Weed Barnes, Boston and New York, 1884). The Memoir is especially full for the period 1850–1867.

WEEHAWKEN, a township of Hudson county, New Jersey, U.S.A., in the N.E. part of the state, on the Hudson river, adjoining Hoboken and opposite the city of New York. Pop. (1890) 1943; (1900) 5325; (1910 census), 11,228. It is served by the New York, Ontario & Western, and the West Shore railways (being a terminus of the latter), and by suburban electric lines, and is connected with New York City by steam ferries. The township consists of a narrow strip of land along the western bank of the Hudson, and at the southern extremity of the Palisades. The extensive water-front is lined with wharves, some of which can accommodate the largest ocean steamers. On a ledge below the crest of the Palisades is the famous duelling ground, where New York citizens and others once settled their quarrels. Originally a part of Hoboken and North Bergen, the township of Weehawken was separately incorporated in 1859. Its name is an Indian word said to mean "maize land."

WEEK (from A.S. *wicu*, Germanic **wikôn*, probably = change, turn), the name given to periods of time, varying in length in different parts of the world, but shorter than a "month." The month may be divided in two ways: a fractional part may be taken (decad or pentad), as in East Africa or Ancient Egypt (moon-week), or the week may be settled without regard to the length of the month (market-week, &c.). The seven-day week (see CALENDAR) originated in West Asia, spread to Europe and later to North Africa (Mahommedan). In other parts of Africa three, four (especially in the Congo), five, six and eight (double four) day weeks are found, and always in association with the market; the same applies to the three-day week of the Muyscas (S. America), the four-day week of the Chibchas, the five-day week of Persia, Malaysia, Java, Celebes, New Guinea and Mexico; in ancient Scandinavia a five-day period was in use, but markets were probably unknown. That the recurrence of the market determined the length of the week seems clear from the Wajagga custom of naming the days after the markets they visit, as well as from the fact that on the Congo the word for week is the same as the word for market. Among agricultural tribes in Africa one day of the week, which varies from place to place, is often a rest-day, visiting the market being the only work allowed.

Lasch in *Zts. für Socialwissenschaft*, ix. 619 seq., and N.W. Thomas in *Journ. Comparative Legislation*, xix. 90 seq., refer to the week in connexion with the market. (N. W. T.)

WEEKS, EDWIN LORD (1849–1903), American artist, was born at Boston, Massachusetts, in 1849. He was a pupil of Léon Bonnat and of J. L. Gérôme, at Paris. He made many voyages to the East, and was distinguished as a painter of oriental scenes. In 1895 he wrote and illustrated a book of travels, *From the Black Sea through Persia and India*, and two years later he published *Episodes of Mountaineering*. He died on the 17th of November 1903. He was a member of the Legion of Honour, France, an officer of the Order of St Michael, Germany, and a member of the Secession, Munich.

WEENIX, JAN BAPTIST (1621–1660), Dutch painter, the son of an architect, was born in Amsterdam, and studied first under Jan Micker, then at Utrecht under A. Bloemaert, and at Amsterdam under Moijaert, and finally, between 1643 and 1647, in Rome. In that city he acquired a great name and worked for Pope Innocent and Cardinal Pamphili. He returned to his native country in 1649, in which year he became master of the gild of St Luke at Utrecht, where he died in 1660. He was a very productive and versatile painter, his favourite subjects being landscapes with ruins and large figures, seaports, and, later in life, large still-life pictures of dead game. Now and then he attempted religious genre, one of the rare pieces of this kind being the "Jacob and Esau" at the Dresden Gallery. At the National Gallery, London, is a "Hunting Scene" by the master, and the Glasgow Gallery has a characteristic painting of ruins. Weenix is represented at most of the important continental galleries, notably at Munich, Vienna, Berlin, Amsterdam, and St Petersburg. His chief pupils were his son Jan, Berchem, and Hondecoeter.

His son, JAN WEENIX (1640–1719), was born at Amsterdam and was a member of the Utrecht gild of painters in 1664 and 1668. Like his father he devoted himself to a variety of subjects, but his fame is chiefly due to his paintings of dead game and of hunting scenes. Indeed, many of the pictures of this genre, which were formerly ascribed to the elder Weenix, are now generally considered to be the works of his son, who even at the early age of twenty rivalled, and subsequently surpassed, his father in breadth of handling and richness of colour. At Amsterdam he was frequently employed to decorate private houses with wall-paintings on canvas; and between 1702 and 1712 he was occupied with an important series of large hunting pictures for the Prince Palatine Johann Wilhelm's castle of Bensberg, near Cologne. Some of these pictures are now at Munich Gallery. He died at Amsterdam in 1719. Many of his best works are to be found in English private collections, though the National Gallery has but a single example, a painting of dead game and a dog. Jan Weenix is well represented at the galleries of Amsterdam, The Hague, Haarlem, Rotterdam, Berlin, and Paris.

WEEVER, JOHN (1576–1632), English poet and antiquary, a native of Lancashire, was born in 1576. He was educated at Queens' College, Cambridge, where he resided for about four years from 1594, but he took no degree. In 1599 he published *Epigrammes in the Oldest Cut and Newest Fashion*, containing a sonnet on Shakespeare, and epigrams on Samuel Daniel, Michael Drayton, Ben Jonson, William Warner and Christopher Middleton, all of which are valuable to the literary historian. In 1601 he published *The Mirror of Martyrs or The Life and Death of . . . Sir John Oldcastle*, which he calls in his preface the "first trew Oldcastle," perhaps on account of the fact that Shakespeare's Falstaff first appeared as Sir John Oldcastle. In the fourth stanza of this long poem, in which Sir John is his own panegyrist, occurs a reminiscence of Shakespeare's *Julius Caesar* which serves to fix the date of the play. After travelling in France, the Low Countries and Italy, Weever settled in Clerkenwell, and made friends among the chief antiquaries of his time. The result of extensive travels in his own country appeared in *Ancient Funerall Monuments* (1631), now valuable on account of the later obliteration of the inscriptions.

The Huth Library contains a unique copy of a thumb-book *Agnus Dei* (1606), containing a history of Christ. The *Mirror of Martyrs* has been reprinted for the Roxburghe Club (1872).

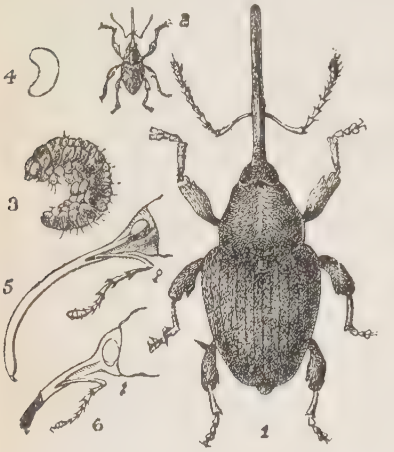
WEEVER. The weevers (*Trachinus*) are small marine fishes which are common on the coasts of Europe, and which have attained notoriety from the painful and sometimes dangerous wounds they are able to inflict upon those who incautiously handle them. They belong to a family of spiny-rayed fishes (*Trachinidae*), and are distinguished by a long low body with two dorsal fins, the anterior of which is composed of six or seven spines only, the posterior being long and many-rayed; their anal resembles in form and composition the second dorsal fin. The ventral fins are placed in advance of the pectorals, and consist of a spine and five rays. The caudal fin has the hind margin not excised. The body is covered with very small scales, sunk in and firmly adherent to the skin, but the upper surface of the head is bony, without integument. The head, like the body, is compressed, with the eyes of moderate size and placed on the side of the head; the mouth is wide, oblique, and armed with bands of very small teeth.

Several species of weevers are known, but two only occur on the British coasts, viz., the Greater Weever (*Trachinus draco*) and the Lesser Weever (*T. vipera*); the former is frequently found of a length of 12 in., and possesses some thirty rays in the second dorsal fin, whilst the latter grows only to about half that length, and has about ten rays less in the dorsal. The coloration of both is plain, but the short first dorsal fin is always of a deep black colour. The weevers are bottom fish, burying and hiding themselves in the sand or between shingle—the lesser species living close inshore and the greater preferring deeper water, and being found sometimes floating on the surface at a distance of several miles from the shore. Although weevers, especially the lesser, are in the habit of burying themselves in the sand, and are abundant in some localities much resorted to by bathers, accidents from stepping upon them are much more rare than from incautiously handling them after capture. They probably make their escape on perceiving the approach of a person. The wounds are inflicted by the dorsal and opercular spines, are very painful, and sometimes cause violent local inflammation. The spines are deeply grooved, and the poisonous fluid which is lodged in the grooves is secreted by small glands at their base. The flesh is not bad eating, and great numbers of the larger species (*T. draco*) are brought to the Paris market. On the poisonous properties, cf. G. J. Allman, *Ann. and Mag. N.H.*, vi. (1841), p. 161; L. Gressin, *Contribution à l'étude de l'appareil à venin chez les poissons du genre Vive* (Paris, 1884); W. N. Parker, *Proc. Zool. Soc.* (1888), p. 359; C. Phisalix, *Bull. Mus. Paris* (1899), p. 256; A. Briot, *C. R. Soc. Biol.*, liv. (1902), pp. 1169 and 1197, and lv. (1903), p. 623.

WEEVIL, Anglo-Saxon *wifel*, a term now commonly applied to the members of a group of Coleoptera termed the Rhyncophora. This group is characterized by the prolongation of the head into a rostrum or proboscis, at the end of which the mouth, with its appendages, is placed. The antennae are usually elbowed, and often end in a club-shaped swelling. The basal portion of the antennae frequently lies in a depression at the side of the rostrum, and this gives the antennae the appearance of emerging half-way along the rostrum. The mouth appendages are small; the mandibles, however, are stout. The palps are very short and conical as a rule. The body is usually small; in shape it varies very much. The elytra are very hard, and in some cases fused with one another, rendering flight impossible. The larvae are white, fleshy, apodal grubs, with a series of tubercles along each side of the body; the head is round, and bears strong jaws, and sometimes rudimentary ocelli. They are exclusively phytophagous. The Rhyncophora embrace four families,—(1) the Curculionidae, or true weevils, (2) the Scolytidae, or bark-beetles, (3) the Brenthidae, (4) the Anthribidae.

The Curculionidae form one of the largest families amongst the Coleoptera, the number of species described exceeding 20,000, arranged in 1150 genera. The antennae are elbowed, and clavate, with the basal portion inserted in a groove. The third tarsal joint is generally bilobed. Over 400 species exist in Great Britain, few of which exceed half an inch in length. The genera *Phyllobius* and *Polydrosus* include some of the most beautiful insects found in Britain—their brilliancy, like that of the Lepidoptera, being due to the presence of microscopic scales. The diamond beetle of South America, *Entimus imperialis*, is another singularly beautiful weevil; its colour is black, studded with spangles of golden green. The immense family of the Curculionidae includes members which differ greatly from one another in size, colour, and appearance; even the rostrum, the most striking common characteristic, varies greatly. The form of the body is very various: some are rounded or oval, others elongated, almost linear; some are covered with warty protuberances, whilst others are smooth and shining, often with a metallic lustre.

One of the commonest members of this family in Great Britain is the nut weevil, *Balaninus nucum*. It is of a brownish colour, varied with yellow, the legs reddish. Its rostrum is unusually long, being five-sixths of the body length in the female, and slightly shorter in the male. The antennae are 7-jointed. The first three joints are much longer than thick; the four following are shorter, and the seventh not longer than thick. The larva is very common in hazel nuts and filberts. When the nuts are about half-grown, the female bores, with its rostrum, a minute hole in the still comparatively soft nut-shell, and deposits an egg within the nut. The egg is said to be pushed in by means of the long rostrum. As the nut grows the slight puncture becomes almost obliterated, so that it is unnoticed by all but the most observant eye. The larva is a thick white grub with a brownish head, bearing fleshy tubercles along its side. It feeds upon the substance of the nut. The nuts which are infested by this insect are usually the first to fall to the ground; the larva then bores a round hole through the nut shell, by means of its jaws, and creeps out. It hides itself in the ground during the winter, and in the spring it passes into the pupa stage, from which it emerges about August as the full-grown insect. A nearly allied form, *Balaninus glandium*, attacks both hazel nuts and acorns.



1. *Balaninus glandium*, magnified.
2. The same, natural size.
3. The larva, magnified.
4. The same, natural size.
5. Head and snout of the female, magnified.
6. The same parts of the male, magnified, to show arrangement of antennae.

In an unobtrusive way weevils do immense harm to vegetation. This is effected not so much by their numbers and their powers of consumption, as amongst caterpillars, but by their habits of attacking the essential parts of a plant, and causing by their injuries the death of the plant affected. They destroy the young buds, shoots and fruits, and attack the young plants in their most delicate organs. Many of them devour seed, as the corn weevils, *Calandra granaria* and *C. oryzae*, and in this way vegetation is severely injured, and its spread seriously checked. Others cause much damage in forests, by boring under the bark and through the wood of trees, whilst some even burrow in the tissue of the leaves.

The Brenthidae, Anthribidae and Scolytidae are described in the article COLEOPTERA.

The Bruchidae are often called "weevils," but they have no close affinity with the Rhynchophora, being nearly allied to the Chrysomelidae or leaf beetles. The antennae are straight, and inserted upon the head just in front of the eyes; they are 11-jointed, and serrated or toothed in the inside. *Bruchus pisi* causes considerable damage to pease; during the spring the beetle lays its eggs in the young pea, which is devoured by the larva which hatches out in it.

(A. E. S.; G. H. C.)

WEGSCHEIDER, JULIUS AUGUST LUDWIG (1771–1849), German theologian, was born at Kübelingen, Brunswick, on the 17th of September 1771, studied theology at Helmstädt, was tutor in a Hamburg family 1795–1805, *Repetent* at Göttingen, professor of theology at Rinteln in Hesse (1806–1815), and at Halle from 1815. In 1830 he (with his colleague Wilhelm Gesenius) was threatened with deposition for teaching rationalism, and though he retained his office he lost his influence, which passed to F. A. Tholuck and Julius Müller. He died on the 27th of January 1849.

His chief works were *Über die von der neuesten Philosophie geforderte Trennung der Moral von der Religion* (1804); *Einleitung in das Evangelium Johannis* (1806); and *Institutiones theologicae dogmaticae* (1815), to which W. Steiger's *Kritik des Rationalismus in Wegscheider's Dogmatik* (1830) was a reply.

WEIGHING MACHINES. Mechanical devices for determining weights or comparing the masses of bodies may be classified as (*a*) equal-armed balances, (*b*) unequal-armed balances, (*c*) spring balances and (*d*) automatic machines. Equal-armed balances may be divided into (1) scale-beams or balances in which the scale-pans are below the beam; (2) counter machines and balances on the same principle, in which the scale-pans are above the beam. Unequal-armed balances may be divided into (1) balances consisting of a single steelyard; (2) balances formed by combinations of unequal-armed levers and steelyards, such as platform machines, weighbridges, &c.

Equal-armed Balances.

Scale-beams are the most accurate balances, and the most generally used. When constructed for purposes of extreme accuracy they will turn with the one-millionth part of the load weighed, though to ensure such a result the knife-edges and their bearings must be extremely hard (either hardened steel or agate) and worked up with great care. The beam must be provided with a small ball of metal which can be screwed up and down a stem on the top of the beam for the purpose of accurately adjusting the position of the centre of gravity, and there should be a small adjustable weight on a fine screw projecting horizontally from one end of the beam for the purpose of accurately balancing the arms.

The theory of the scale-beam is stated by Weisbach in his *Mechanics of Machinery and Engineering*, as follows:—In fig. 1 D is the fulcrum of the balance, S the centre of gravity of the beam alone without the scales, chains or weights; A and B the points of suspension of the chains. If the length of the arms AC = BC = l, CD = a, SD = s, the angle of deviation of the balance from the horizontal = ϕ, the weight of the beam alone = G, the weight on one side = P, that on the other = P + Z, and lastly the weight of each scale with its appurtenances = Q then

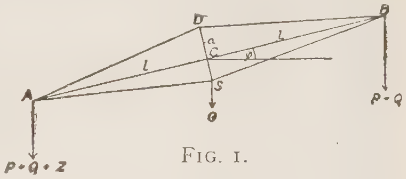


FIG. 1.

$$\tan\phi = \frac{Zl}{\{2(P+Q)+Z\}a+Gs}.$$

From this it is inferred that the deviation, and therefore the sensitiveness, of the balance increases with the length of the beam, and decreases as the distances, a and s, increase; also, that a heavy balance is, *ceteris paribus*, less sensitive than a light one, and that the sensitiveness decreases continually the greater the weight put upon the scales. In order to increase the sensitiveness of a balance, the line AB joining the points of suspension and the centre of gravity of the balance must be brought nearer to each other. Finally, if a is made extremely small, so that practically $\tan\phi = Zl/Gs$, the sensitiveness is independent of the amount weighed by the balance. Weisbach also shows that if Gy^2 is the moment of inertia of the beam, the time, t, of a vibration of the balance is

$$t = \pi\sqrt{\frac{2(P+Q)(l^2+a^2)+Gy^2}{g\{2(P+Q)a+Gs\}}}.$$

This shows that the time of a vibration increases as P, Q and l increase, and as a and s diminish. Therefore with equal weights a balance vibrates more slowly the more sensitive it is, and therefore weighing by a sensitive balance is a slower process than with a less sensitive one.

The conditions which must be fulfilled by a scale-beam in proper adjustment are:—(1) The beam must take up a horizontal position when the weights in the two scale-pans are equal, from nothing to the full weighing capacity of the machine. (2) The beam must take up a definite position of equilibrium for a given small difference of weight in the scale-pans. The sensitiveness, *i.e.* the angle of deviation of the beam from the horizontal after it has come to rest, due to a given small difference of weight in the scale-pans, should be such as is suited to the purposes for which the balance is intended. Bearing in mind that with ordinary trade balances there is always a possibility of the scale-pans and chains getting interchanged, these conditions require; (*a*) That the beam without the scale-pans and chains must be equally balanced and horizontal; (*b*) that the two scale-pans with their chains must be of equal weight; (*c*) that the arms of the beam must be exactly equal in length; *i.e.* the line joining the end knife edges must be exactly bisected by a line drawn perpendicular to it from the fulcrum knife-edge. By testing the beam with the scale-pans attached and equal weights in the pans, and noting carefully the position which it takes up; and then interchanging the scale-pans, &c., and again noting the position which the beam takes up, a correct inference can be drawn as to the causes of error; and if after slightly altering or adjusting the knife-edges and scale-pans in the direction indicated by the experiment, the operation is repeated, any required degree of accuracy may be obtained by successive approximations. The chief reason for testing balances with weights in the scale-pans rather than with the scale-pans empty, is that the balance might be unstable with the weights though stable without them. This is not an infrequent occurrence, and arises from the tendency on the part of manufacturers to make balances so extremely sensitive that they are on the verge of instability. In fig. 2 let ABCD be the beam of a scale-beam, Z the fulcrum knife-edge, and X, Y the knife-edges on which the scales are hung In order to ensure a high degree of sensitiveness, balances are sometimes constructed so that Z is slightly below the line joining X and Y, and is only slightly above H, the centre of gravity of the beam with the scale-pans and chains attached. The addition of weights in the scales will have the effect of raising the point H till it gets above Z, and the balance, becoming unstable, will turn till it is brought up by a stop of some kind.

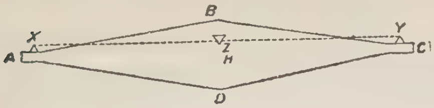
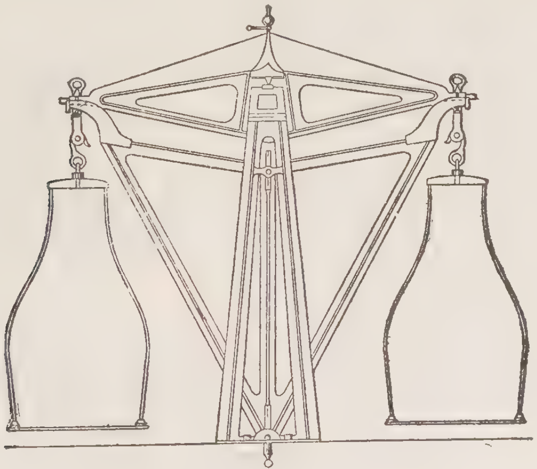


FIG. 2.

Fig. 3 represents a precision balance constructed to weigh with great accuracy. The beam is of bronze in a single deep casting, cored out in the middle so as to allow the saddle at the top of the stand to pass through the beam and afford a continuous bearing for the fulcrum knife-edge. The knife-edge and its bearing are both of steel or agate, and the bearing surface is flat. The end knife-edges also are of steel or agate, and have continuous bearing on flat steel or agate surfaces at the upper part of the suspension links. To relieve the knife-edges from wear when the balance is not being used a triangular frame is provided, which is lifted and lowered by a cam action at the bottom, and moves vertically in guides fixed on the stand. By its upward movement the tops of the screw studs near its ends are first received by the projecting studs on each side of the suspension links, and the suspension links are lifted off the end knife-edges; and next, as the sliding frame continues its upward motion, the horizontal studs at the two ends of the beam are received in the forks at the ends of the sliding frame, and by them the fulcrum of the beam is lifted off its bearing. To keep the beam truly in its place, which is very necessary, as all the bearings are flat, the recesses for the ends of the studs are formed so as to draw the beam without strain into its true position every time that it is thrown out of gear by the sliding frame. The end knife-edges are adjusted and tightly jammed into exact position by means of wedge pieces and set screws, and the beam is furnished with delicate adjusting weights at its top. The position of the beam with respect to the horizontal is shown by a horizontal pointer (not shown) projecting from one end of it, which plays past a scale, each division of which corresponds to the $\frac{1}{10}$th or $\frac{1}{100}$th of a grain according to the size and delicacy of the machine. A first-class chemical balance would be made in this manner, but in all places where there are acids and gases the knife-edges and bearings must be made of agate, as the fumes attack and corrode steel.



From Airy, "On Weighing Machines," Institution of Civil Engineers, 1892.

FIG. 3.—Precision Balance.

For the weighing of very small quantities with balances of great delicacy, the following method is adopted:—If the balance be in perfect adjustment, and l be the length of each arm, and w a very minute difference of the weights in the two scale-pans, by which the beam is deflected from the horizontal by a very small angle ϕ, it can easily be shown that tan ϕ, or ϕ, varies as $w \times l$. Therefore the angle of deflection which would be produced by grain weight hung at the distance $l/10$ (for example) from the centre is the same as would be produced by $\frac{1}{10}$th of a grain in the scale-pan at the distance l. Therefore by graduating the top of the beam and shifting a rider grain weight till the beam is horizontal, it is easy to ascertain the small difference of weight in the scale-pans which caused the deflection to the $\frac{1}{100}$th or $\frac{1}{1000}$th part of a grain without using a weight smaller than a grain.

The fitting of the knife-edges is of great importance. In ordinary trade balances a triangular piece of hard steel, with a finely-ground edge, is driven through a triangular hole in the beam and jammed tight. This forms the knife-edge, and the scale-pans are hung from the two projecting ends of the piece of steel. Similarly the two projecting ends of the central piece of steel which forms the fulcrum take bearing on two cheeks of the stand, between which the beam sways. It is clear that errors will arise if the pieces of steel are not truly perpendicular to the plane of the beam, and the adjustment of great accuracy would be very tedious. Therefore for balances of precision the end knife-edges are fixed on the top of the beam so as to present a continuous unbroken knife-edge, and the fulcrum knife-edge is also made continuous, the beam being cored out or cut away to admit of the introduction of the stand bearing. With this arrangement the knife-edges can be easily adjusted and examined, and the system is now rapidly extending to the better class of trade balances.

The knife-edges of weighing machines are the parts that wear out soonest, but very little is known about them experimentally, and the knife-edges made by different makers vary extremely in their angles. Those made by some of the best makers for the most delicate machines are formed to an angle of about 80° between the sides, with the finished edge ground to an angle varying from 110° to 120°. The following may be taken as the maximum loads per in. of acting or efficient knife-edge allowed by the best makers:—

1. For scale-beams of the highest accuracy—From ½ lb per in for a machine of ½ lb capacity, to 25 lb per in. for a machine of 80 lb capacity.

2. For ordinary trade scale-beams, counter machines, and dead-weight machines—From 20 lb per in. for a machine of 7 lb capacity to 600 lb per in. for a machine of ½ ton capacity.

3. For platform machines and weighbridges—From 120 lb per in. for a machine of 4 cwt. capacity, to 1 ton per in. for a machine of 25 tons capacity.

The sensitiveness of scale-beams depends entirely upon the skill and care used in their construction. With balances of the highest precision it may be as high as $\frac{1}{1000000}$th of the load weighed while with trade balances when new it would be about $\frac{1}{2000}$th of the load.

In Emery's testing machine there are no knife-edges, but their function is performed by thin steel plates, which are forced under a very heavy pressure into slots formed in the parts that are to be connected, so that the parts are united by the plate. In this case there is no friction and no sensible wear, so that very great permanency of condition and constancy of action might be expected But the resistance to bending of the steel plates would render this arrangement unsuitable for scale-beams, in which the movement is large. In some respects it would appear to be very suitable for weighbridges, in which the movement of the lever is very small, but for general convenience of adjustment the knife-edges appear preferable.

In the comparison of standard weights, or in any weighing operations where great accuracy is required, it is necessary to use many precautions. The comparison of standard weights has to be conducted at the standard temperature, and the room must be brought to that temperature and maintained at it. The balance must be enclosed in a glass case to protect it from draughts of air or from the heat of the body of the operator. And the operations of placing and shifting the weights must be effected by mechanism which will enable this to be done without opening the case or exposing the machine.

When the weights which are to be compared are of different metals further complications arise, for the volumes of equal weights of different metals will be different, and therefore the quantity of air displaced by them will be different, and the difference of the weights of air displaced by the two weights must be allowed for. And the weight of air displaced depends upon the density of the air at the time of weighing, and therefore the barometer reading must be taken. For this correction an exact knowledge of the specific gravities of the metals under comparison is required. In this way an exact comparison of the weights *in vacuo* can be computed, but of course the simplest way of arriving at the result would be by the construction of a strong air-tight case which can be completely exhausted of air by an air-pump, and in which the weighing can then be effected *in vacuo*. The difficulty about weighing *in vacuo* is that it is found almost impossible to exhaust the case entirely, or even to maintain a constant degree of exhaustion, by reason of the leakage connected with the weighing operations, and in consequence weighing *in vacuo* is not much in favour. Whatever method is adopted, very exact weighing is a difficult and troublesome work.

Counter machines have an advantage over scale-beams in not being encumbered with suspension chains and the beam above. They are usually made with two beams, each with its three knife-edges, rigidly tied together or cast in one piece and some distance apart, so that the scale-pans being carried on two knife-edges, each is prevented from tipping over sideways. To prevent them from tipping over in the direction of the beams a vertical leg is rigidly fastened to the under side of each pan, the lower end of which is loosely secured by a horizontal stay to a pin in the middle of the frame. In using these machines there is seldom any question of determining the weight to any great nicety, and rapid action is generally of high importance. Hence they are very commonly made unstable, or "accelerating," *i.e.* they are constructed with the fulcrum knife-edges lower than the line joining the end knife-edges, and they are arranged so that the beam is horizontal when the stop of the weights-pan is hard down on its bearings. This arrangement is well adapted for weighing out parcels of goods of a definite weight, though not for ascertaining the correct weight of a given article. For the latter purpose machines are used of which the beams are made stable, or "vibrating," by constructing them with the fulcrum knife-edges above the line joining the end knife-edges.

"Accelerating" machines can be used to the advantage of the vendor in two ways. Firstly, in using them to determine the weight of a given article. For with unstable balances, although the smallest excess of weight in the goods-pan will cause it to descend till it is brought up by its stop, yet being in this position, a very much greater weight than the difference which brought it there will be required in the weights-pan to enable it to mount again. If W be the weight in each pan when the goods-pan commenced to sink, l the length of each arm, m the distance of the fulcrum below the line joining the end knife-edges, and β the angle at the fulcrum which defines the range of sway of the beam, it can easily be shown that w, the additional weight required in the weights-pan to enable the goods-pan to rise from its stop, is given by the equation $w = \mathrm{W}\,2m\tan\beta/\mathrm{L} - m\tan\beta$. So that if, for example, a fishmonger uses such a machine to ascertain the weight of a piece of fish which he places in the goods-pan, and thereby depresses it down upon its stop, and then places weights in the weights-pan till the goods-pan rises, the customer is charged for more than the real weight of the fish. Secondly, in using them out of level, with the goods end of the machine lower than the weights end. If θ be the angle of tilt of the machine, and the other symbols be as before, it may be shown that the additional weight, w which is needed in the weights-pan to enable the goods-pan to rise off its stop, is given by the equation $w = \mathrm{W}\,2m\tan(\beta-\theta)/\mathrm{L} - m\tan(\beta-\theta)$. When θ is negative, as it is when the goods end of the machine is lower than the weights end, the value of w may be very appreciable. With "vibrating" machines the value of m is in general so extremely small that w is of no practical importance in either of the above cases.

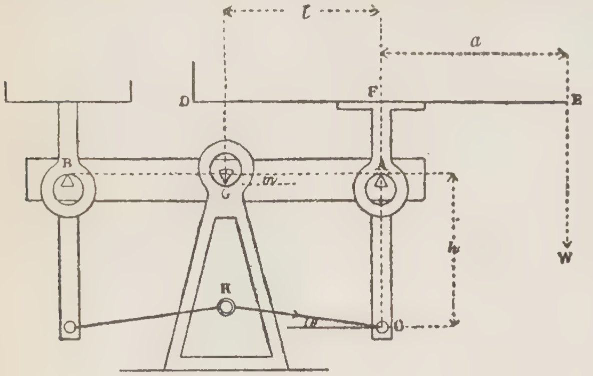


FIG. 4.

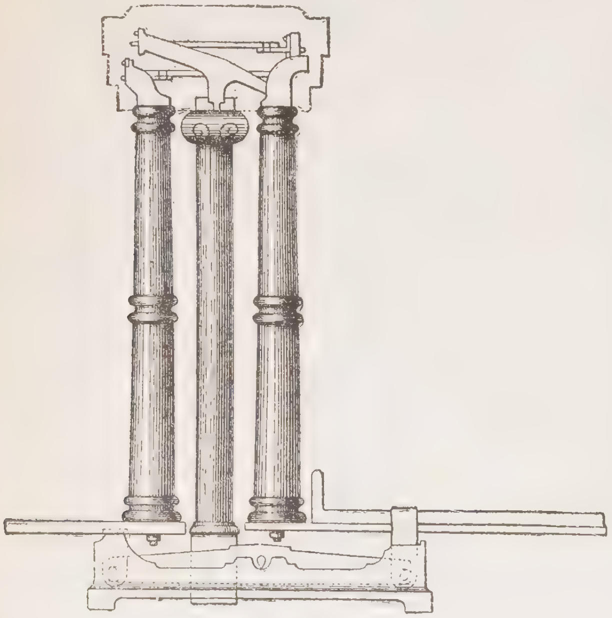


FIG. 5.

If a counter machine be made with a large flat goods-pan, as in fig. 4, an error may be caused by placing the goods eccentrically on the pan, as at D or E. Using the symbols of the diagram, it can be shown that the effect of placing the weight W at E instead of F is to cause the end of the beam to descend, as if under the action of an additional weight, w, at F such that

$$w = \mathrm{W}a(ml^{-1} + \tan\theta)/h.$$

The condition that must exist in order that the balance may weigh correctly for all positions of the weight W is $w = 0$, or $\tan\theta = -ml^{-1}$; that is, the stay KG must be adjusted parallel to the line joining the points A and C. From the equation for w, it is seen that the larger h is the smaller w will be. Therefore for the larger counter machines, where it is not convenient to have the scale-pans raised high above the counter, and for "dead-weight" machines on the same principle, where it is not convenient to have the scale-pans raised high above the floor, there is an advantage in adopting the "inverted counter machine" arrangement (fig. 5), because the vertical leg can be produced upwards as high as is required. This arrangement is very common. As will be readily understood from the construction of the machines, there is more friction in counter machines than in scale-beams. The "sensitiveness" error allowed by the Board of Trade for counter machines is five times as great as that allowed for scale-beams.

The torsion balance made by the United States Torsion Balance and Scale Company of New York is a counter machine made without knife-edges, and is very sensitive. It is constructed with two similar beams, one above the other, which are coupled together at the ends to form a parallel motion for carrying the pans upright. The coupling is effected by firmly clamping the ends of the beams upon the top and bottom respectively of a loop of watch-spring, which is tightly stretched round the casting carrying the pan, as is shown in the end view in fig. 6. At their middles the beams are similarly clamped upon the top and bottom of a loop of watch-spring which is tightly stretched round a casting which is bolted upon the bed-plate. When the case which holds the machine is adjusted horizontally by means of its foot-screws, and the weights in the pans are equal, the beams remain perfectly horizontal; but with the slightest difference of weight in the pans the beams are tilted, and the elastic resistance of the springs to torsion allows the beams to take up a definite position of equilibrium. The lower beam carries on a saddle a scale which is raised nearly to the top of the glass case in which the machine is enclosed, and as the beams sway this scale plays past a scratch on the glass, which is so placed that when the zero point on the scale coincides with the scratch the beams are horizontal. With proper care this machine should be very permanent in its action.

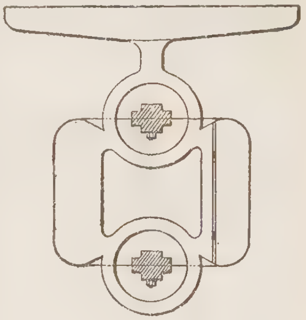


FIG. 6.

Unequal-armed Balances.

Steelyards are simple, trustworthy and durable, but unless special contrivances are introduced for ascertaining the position of the travelling poise with very great accuracy, there will be a little uncertainty as to the reading, and therefore steelyards are not in general so accurate as scale-beams. When carefully nicked they are well-adapted for weighing out definite quantities of goods, such as 1 ℔, 2 ℔, &c., as in such cases there is no question of estimation. The ordinary way of using a steelyard is to bring it into a horizontal position by means of movable weights, and to infer the amount of the load from the positions of these. But it is sometimes convenient to use a fixed weight on the long arm, and to infer the amount of the load from the position of the steelyard. The rule for graduation is very simple. The simplest form is that which has a single travelling poise. The more elaborate ones are made either with a heavy travelling poise to measure the bulk of the load with a light travelling poise for the remainder, or else with a knife-edge at the end of the steelyard, on which loose weights are hung to measure the bulk of the load, the remainder being measured with a light travelling poise. The advantage of the first arrangement is that the weights on the steelyard are always the same, and inconsistencies of indication are avoided, while in the second arrangement the loose weights are lighter and handier, though they must be very accurate and consistent among themselves, or the error will be considerable, by reason of the great leverage they exert.

Steelyards, like other weighing machines, will be "accelerating," or "vibrating" according to the arrangement of the knife-edges.

In fig. 7 let Z be the fulcrum knife-edge, X the knife-edge on which the load R is hung, and H the centre of gravity of the weights to the right of Z, viz. the weight, W, of the steelyard acting at its centre of gravity; G, the travelling poise; P, acting at M; and the weights, Q, hung on the knife-edge at Y. Then if Z be below the line joining X and H, the steelyard will be "accelerating"; *i.e.* with the smallest excess of moment on the left-hand side of the fulcrum, the end C of the steelyard will rise with accelerating velocity till it is brought up by a stop of some sort; and with the smallest excess of moment on the right-hand side of the fulcrum, the end C of the steelyard will drop, and will descend with accelerating velocity till it is brought up by a similar stop. If Z be above the line XH, the steelyard is "vibrating"; *i.e.* it will sway or vibrate up and down, ultimately coming to rest in its position of equilibrium. Steelyards, again, are frequently arranged as counter machines, having a scoop or pan resting on a pair of knife-edges at the short end, which is prevented from tipping over by a stay arrangement similar to that of other counter machines.

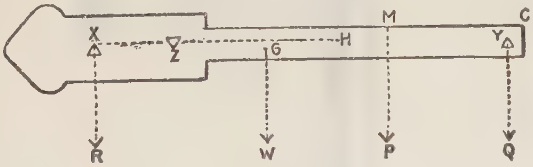


FIG. 7.

Steelyards are largely used in machines for the automatic weighing out of granular substances. The principle is as follows: The weighing is effected by a steelyard with a sliding poise which is set to weigh a definite weight of the material, say 1 lb. A pan is carried on the knife-edges at the short end, and is kept from tipping over by stays. A packet is placed on the pan to receive the material from the shoot of a hopper. A rod, connected at its lower end with the steelyard, carries at its upper end a horizontal dividing knife, which cuts off the flow from the shoot when the steelyard kicks. When the filled packet is removed, the steelyard resumes its original position, and the filling goes on automatically.

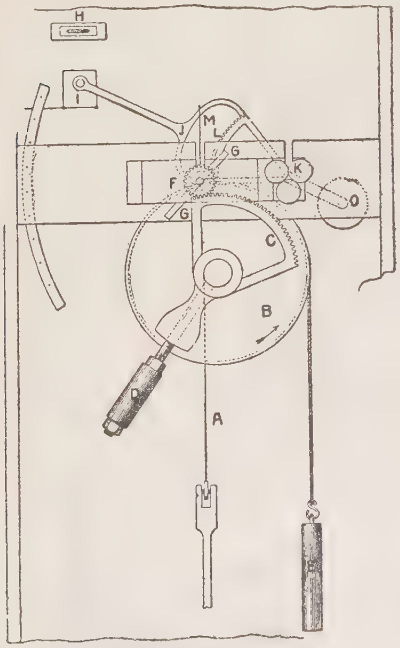


FIG. 8.

The automatic personal weighing machine found at most railway stations operates by means of a steelyard carrying a fixed weight on its long arm, the load on the platform being inferred from the position of the steelyard. In fig. 8 the weight on the platform is transferred by levers to the vertical steel band, A, which is wrapped round an arbor on the axle of the disk-wheel, B, to which is rigidly attached the toothed segment, C. The weight, D, is rigidly attached to the axle of the wheel, B, and the counterbalance, E, is hung from the wheel, B, by means of a cord wrapped round it. When the pull of the band, A, comes upon the wheel, B, it revolves through a certain angle in the direction of the arrow until the three forces, viz. the pull of A, the weight, D, and the counterbalance, E, are in equilibrium. The toothed segment, C, actuates the pinion, F, which carries the finger, G, and this finger remains fixed in position so long as the person is standing on the platform. If now a small weight, as a penny, be passed through the slot, H, it falls into the small box, I, and causes the lever, J, to turn; the lever, J, which turns in friction wheels at K, and is counterbalanced at O, carries a toothed segment, L, which actuates a small pinion on the same axle as F, and is free to turn on that axle by a sleeve. This small pinion carries a finger, M, which is arranged to catch against the finger, G, when moved up to it. Consequently as the lever, J, turns, the finger, M, revolves, and is stopped when it reaches G. The sleeve of the pinion which carries M also carries the dial finger, and if the dial is properly graduated its finger will indicate the weight. The box, I, has a hinged bottom with a projecting click finger which, as the box descends, plays idly over the staves of a ladder arc. When the weight is removed from the platform, the counterbalance, E, causes the finger, G, to run back to its zero position, carrying with it the finger M, and causing the click finger of the box, I, to trip open the bottom of the box and let the penny fall out. The lever, J, regains its zero position, and all is ready for another weighing. Since so small a weight as a penny has to move the lever, J, together with the dial finger, &c., it is evident that the workmanship must be good and the friction kept very low by means of friction wheels.

Some of the largest and most accurate steelyards are those made for testing machines for tearing and crushing samples of metals and other materials. They are sometimes made with a sliding poise weighing 1 ton, which has a run of 200 in., and the steelyard can exert a pull of 100 tons.

Balances are frequently used as counting machines, when the articles to be counted are all of the same weight or nearly so, and this method is both quick and accurate. They are also used as trade computing machines, as in the case of the machine made by the Computing Scale Company, Dayton, Ohio, U.S.A. In this machine the goods to be priced are placed on the platform of a small platform machine whose steelyard is adjusted to balance exactly the weight of the platform, levers and connexions. The rod which transmits the pull of the long body lever of the platform machine to the knife-edge at the end of the short arm of the steelyard is continued upwards, and by a simple mechanical arrangement transmits to an upper steelyard any additional pull of the long body lever due to the weight of goods placed on the platform. This upper steelyard is arranged as in fig 9, where A is the point where the pull of the long body lever due to the weight of the goods on the platform comes upon the steelyard; C is the fulcrum of the steelyard, which with the steelyard can be slid to and fro on the frame of the machine; and Q is a poise which can be slid along the upper bar of the steelyard. The steelyard is exactly in balance when there is no weight on the platform and Q is at the zero end of its run, at O. Suppose that the weight of the goods on the platform is (p) lb, and that $\frac{1}{n}$th of this weight is transmitted by the long body lever to the point A, so that $\frac{p}{n}$ lb is the pull at A. Let the lower bar of the steelyard be graduated in equal divisions of length, d, each of which represents one penny, so that the distance $CA = q \times d$ represents q pence. Then the number $\overline{p \times q}$ represents the total value of the goods on the platform. If Q lb be the weight of the poise Q, the position of Q when the steelyard is exactly in balance is given by the equation $\frac{p}{n} \times q.d = Q \times OQ$, or $OQ = \overline{p \times q} \times \frac{d}{nQ}$. If therefore the upper bar be graduated in divisions, each of which is $\frac{d}{nQ}$, the indication of the poise Q, viz. $\overline{p \times q}$ graduations, gives correctly the value of the goods. Thus to ascertain the value of goods on the platform of unknown weight at a given price per lb, it is only necessary to slide the steelyard till the weight acts at the division which represents the price per lb, and then to move the poise Q till the steelyard is in balance; the number of the division which defines the position of the poise Q will indicate the sum to be paid for the goods. When the load on the platform is large, so that the value of the goods may be considerable, it is convenient to measure the larger part of the value by loose weights which, when hung at the end of the steelyard, represent each a certain money value, and the balance of the value is determined by the sliding poise Q.

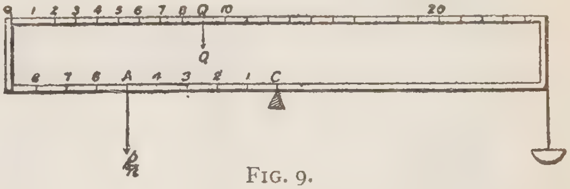


FIG. 9.

In the machines commonly used to weigh loads exceeding 2 cwt. the power is applied at the end of the long arm of the steelyard and multiplied by levers from 100 to 500 times, so that the weights used are small and handy. The load is received upon four knife-edges, so that on the average each knife-edge receives only one-fourth of the load, and, as will be seen, it is immaterial whether the load is received equally by the four knife-edges or not, which is essential to the useful application of these machines.

In fig. 10 AB is the steelyard. The platform and the load upon it are carried on four knife-edges, two of which, x_1 and x_2, are shown, and the load is transferred to the steelyard by the two levers shown, the upper one CD being known as the "long body," and the lower one EF as the "short body." If $z_1x_1 = z_2x_2$, and $z_1t = z_2y_2$, then the leverage of any portion of the load applied at x_2 will be the same as the leverage of any part of the load applied at x_1, and the pressure produced at y_1 will be the same for equal portions of the load, whether they were originally applied at x_1 or x_2. Platform machines, like steelyards, may be arranged either on the "accelerating" principle or on the "vibrating" principle. If in fig. 10 g_1 be the centre of gravity of the long body CD, and h_1 be the centre of gravity of the three vertical forces acting downwards at the points x_1, t and g_1, considered as weights collected at those points; then if h_1 be above the line z_1y_1 it can be shown that this arrangement of the knife-edges of CD favours the "acceleration" principle, and is suited to act with and assist an "accelerating" steelyard, and similarly if the point h_2 be above the line z_2y_2 in the case of the short body EF. If the knife-edges be placed so that h_1 and h_2 are below the lines x_1y_1 and x_2y_2 respectively, the arrangement will favour the "vibration" principle, and is suited to act with and assist a "vibrating" steelyard.

It is very important that platform machines should be truly level. With accelerating machines a small amount of tilt in any direction considerably affects the accuracy of the weighing, and when the amount of tilt is considerable the action may be changed, so that a machine which was intended to act as an accelerating machine acts like a vibrating one. Vibrating machines are only slightly affected by being out of level in comparison with accelerating machines, and in this matter they have a distinct advantage. When a platform machine is in true adjustment, and the loose weights which are intended to be hung at the end of the steelyard are correct and consistent among themselves, a good and new machine, whose capacity is 4 cwt., should not show a greater error than 4 oz. when fully loaded. Platform machines are slightly affected by changes of temperature. In some cases they are made "self-recording" by the following arrangement: The steelyard is provided with a large and a small travelling poise. Each of these poises carries a horizontal strip of metal, which is graduated and marked with raised figures corresponding to those on the steelyard itself. These strips pass under a strong punching lever arranged on the frame of the machine. A card prepared for the purpose is introduced through a slit in the frame between the punch and the strips. When the poises have been adjusted to weigh a load on the platform the punch is operated by a strong pull, and the impression of the raised figures is left on the card. Thus the weight is recorded without reading the positions of the poises. In another arrangement the self-recording parts are entirely enclosed in the travelling poise itself.

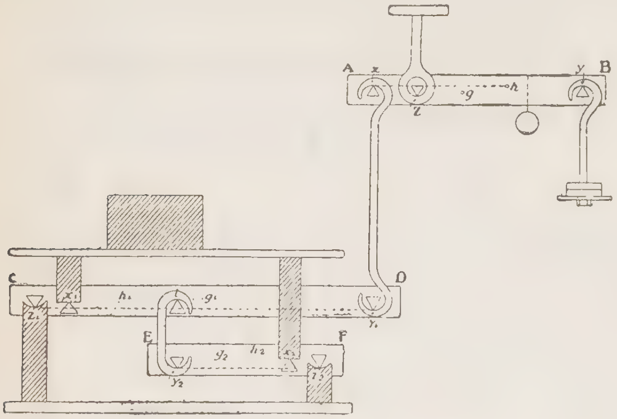


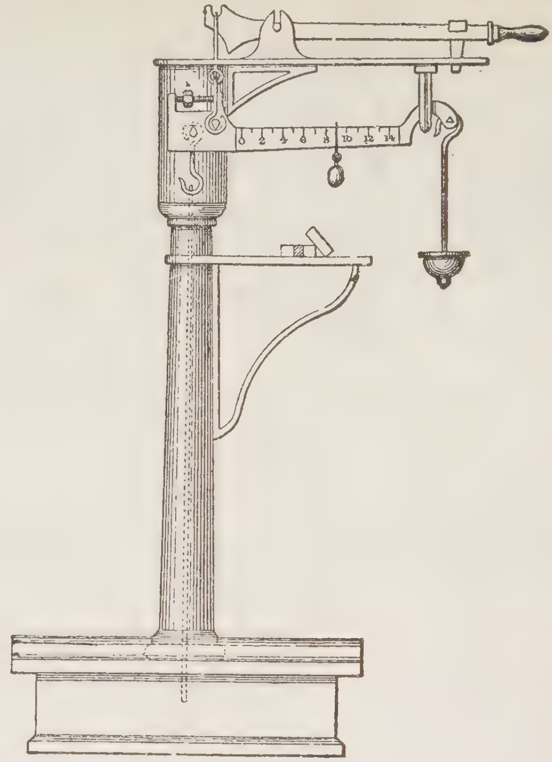
FIG. 10.

Fig. 11 shows the ordinary arrangement of the parts of a platform machine, but there are many types which differ greatly in detail though not in principle.

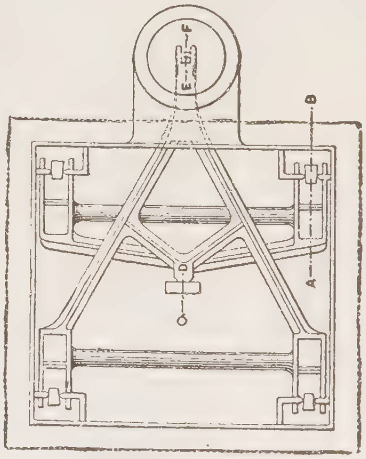
When the goods to be weighed are very heavy, portable weighbridges or platform machines are inapplicable and it is necessary to erect the weighbridge on a solid foundation. Some weighbridges are arranged in a manner similar to that of the platform machines already described, but having the long body lever turned askew, so that the end of it projects considerably beyond the side of the weighbridge casing, and the pillar and steelyard which receive its pull are clear of the wagon on the platform. In another arrangement two similar triangular levers take bearing on opposite sides of an intermediate lever which communicates their pressures to the steelyard; this is a very sound and simple arrangement for ordinary long weighbridges. Lastly, when the weighbridge is very long—and they are sometimes made 40 ft. long, and are arranged to weigh up to 100 tons or more—it is practically composed of two platform machines end to end, each having its four knife-edges to receive the load, and the two long bodies take bearing on the opposite sides of an intermediate horizontal lever, the end of which is connected with the steelyard. When skilfully made they are very accurate and durable.

A useful application of weighbridges is to ascertain the exact weights on the separate wheels of locomotive engines, so that they may be properly adjusted. For this purpose a number of separate weighbridges of simple construction are erected, one for each wheel of the engine, with their running surfaces in exactly the same horizontal plane. The engine is moved on to them, and the pressures of all the wheels are taken simultaneously, each by its own weighbridge.

There are many kinds of weighing machines depending for their action on combinations of levers, and arranged to meet special requirements. Such are coal platform machines for weighing out coal in sacks, the levers of which are arranged as in the ordinary platform machines, but for the sake of compactness the steelyard is returned back over the long body, and when loaded with the proper weight indicates the correct weight of the coal in the sack by its end kicking up. Crane machines are used to weigh goods as they are hoisted by a crane; the lever arrangement is shown in fig. 12.



Elevation.



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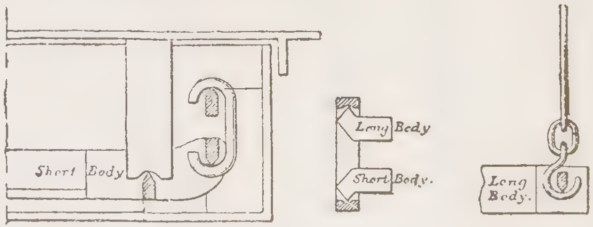

Section on AB. Section on CD. Section on EF.

FIG. 11.

A crane machine of peculiar construction, well adapted for weighing heavy loads, and extremely simple and compact, which does not properly come under any of the heads under which the machines have been classified, is the hydrostatic weighing machine. This machine is constructed with an open top cylinder, a stirrup strap being provided by which it may be suspended from a crane. The cylinder, which is filled with oil or other liquid, is fitted with a piston having a piston-rod passing downwards and terminating in an attachment for the goods to be weighed. As the goods are lifted by the crane the whole of their weight is taken by the liquid in the cylinder, and the pressure on the liquid, as indicated by a pressure gauge, gives the weight. The gauge has a plain dial, marked off to indications given by the application of standard tons and cwts.; it could probably be read to about ½% of the load weighed.

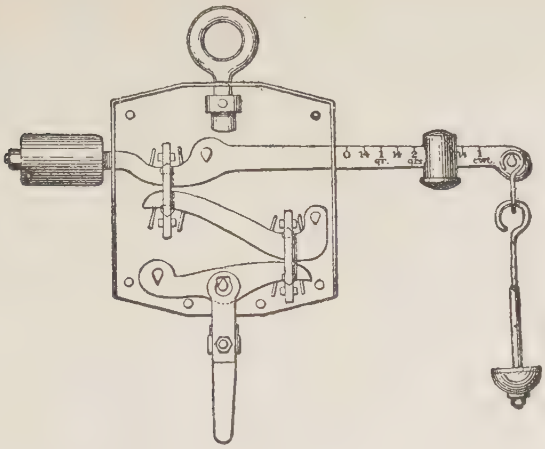

Fig. 12.

Spring Balances.

For many purposes spring balances are the most convenient of all weighing machines. They are rapid in action, the indication is in general clear, and there is no need of loose weights except for testing the machine occasionally. Their action depends upon the extension of one or more spiral springs, and as the extension is proportionate to the weight which causes it the graduation is very simple. The accuracy of spring machines depends upon the accuracy of the springs and the workmanship of the machines. The springs in general are very accurate and uniform in their extension, and are very permanent when fairly well used; but their indications are apt to vary from fatigue of the springs if they are kept extended by a weight for a long time. Their indications also vary with the temperature, so that for good work it is advisable that spring balances should be frequently checked with standard weights. For the sake of compactness and convenience of reading the extension of the springs, and consequently the load, is frequently indicated on a dial, by means of a small rack and pinion, which give motion to a finger on the dial-plate, but the regularity and correctness of the indications of the finger will depend upon the condition of the rackwork and upon the friction, and these will vary with the wear of the machine. For the above reasons spring balances are not in general so accurate as knife-edge machines. It is found that when a spiral spring is extended by a weight it has a tendency to turn a little round its axis. Therefore an index pointer attached to the bottom of the spring, and moving past a scale would rub slightly against the case. To correct this tendency the spring is usually made half with right-hand spiral and half with left-hand spiral.

The extension of a spiral spring is given by the formula:—
Extension $= W4nR^3/Er^4$, in which W = weight causing extension, in ℔s; n = number of coils; R = radius of spring, from centre of coil to centre of wire, in inches; r = radius of wire of which the spring is made, in inches; E = coefficient of elasticity of wire, in ℔s per square inch. The value of E depends upon the tempering of the wire and will vary accordingly: for the springs of trade balances E will usually be about 10,500,000. For the application of the above formula it is necessary to measure (R) and (r) very accurately, by reason of the high powers involved, but when this has been carefully done the formula may be relied upon. Thus in the case of a spring for which the values of the quantities were $W = 7$ ℔, $n = 51$, $R = \cdot 30$ in., $r = \cdot 038$ in., $E = 10{,}500{,}000$, the formula gives extension $= 1 \cdot 764$ in., while direct experiment gave extension $= 1 \cdot 75$ in. And with a very long and weak spring for which the values of the quantities were $W = \frac{1}{2}$ oz., $n = 233$, $R = \cdot 35$ in., $r = \cdot 0085$ in., $E = 10{,}500{,}000$, the formula gives extension $= 22 \cdot 78$ in., while direct experiment with the spring gave $23 \cdot 5$ in.

Automatic Weighing Machines.

During the last few years great efforts have been made to expedite the operation of weighing machines by the introduction of machinery, more or less complicated, which renders the machines to a great extent self-acting. The object aimed at varies very much with different machines. Sometimes the object is to weigh out parcels of goods in great numbers of the same definite weight. Sometimes the object is to weigh out parcels of goods, of unknown weight, as in ordinary retail dealing, and to give the exact value of each parcel at different rates per ℔. Sometimes the object is to weigh many loads in succession, the loads being of varying weight, and to present the total weight at the end of a day's work; this is the case with machines for weighing coal and other minerals. Of course the introduction of automatic mechanism introduces friction and other complications, and it is difficult to construct automatic machines that shall be as accurate in their weighing as the simpler weighing machines, but in many weighing operations a moderate degree of accuracy will suffice, and speed is of great importance. It is to meet such cases that the greater number of automatic weighing machines have been invented. Some examples of these machines will now be given.

Automatic Computing Spring Weighing Machine for Retail Purposes (fig. 13).—A light and carefully balanced drum with its axis horizontal is enclosed within a cylindrical casing, and rotates freely in bearings formed in the ends of the casing. The casing is fixed in supports on the top of a strong frame, which also carries a small platform machine of ordinary construction on which the goods to be weighed are placed. The pull of the load is transmitted to a hook which hangs freely from the middle of a horizontal bar below the drum casing. At each end of the drum casing is attached a vertical spiral spring, and by the extension of these springs the weighing of the goods is effected. There are also two vertical racks, one at each end of the casing, in connexion with the two springs, and these actuate pinions on the axle of the drum and cause it to revolve as the springs extend. The horizontal bar which receives the pull of the load is connected at its ends with the two spiral springs and pulls vertically upon them. Above the horizontal bar, and parallel with it, is a rod which is connected at its ends with the lower ends of the vertical racks, and at its middle with the horizontal bar. The connexion with the horizontal bar is through the medium of an adjustable cam. This cam can be turned by hand in a vertical plane by means of a worm and wheel movement, and by turning the worm the vertical distance between the bar which is attached to the springs and the rod which is attached to the racks can be increased or diminished, and thus the racks can be moved relatively to the springs. By this means the zero of the scale on the drum can be adjusted to the fixed index on the casing when there are no goods on the platform. There is also a compensation arrangement for effecting automatically the same adjustment for changes of temperature. To deaden the vibration of the springs after a load has been placed on the platform, and thus to enable the weights and values of the goods to be read rapidly, the piston of a glycerin cylinder is attached to the end of the lever which pulls upon the hook of the horizontal bar and is worked by it in the glycerin.

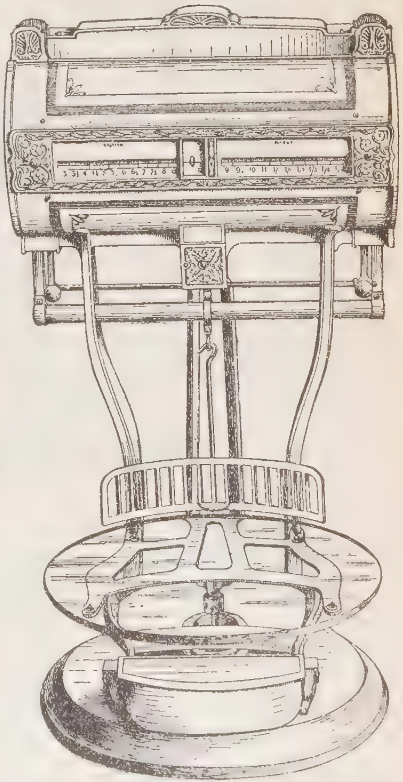

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Fig. 13.—Price-computing Spring Weighing Machine.

On the outer surface of the drum are printed the weight of the goods in lb and oz., and the money value of the goods corresponding to the different rates per lb. The side of the casing which is next to the seller is pierced centrally by two slots, one a vertical slot through which the weight is read on the drum, and the other a horizontal slot, half of it on each side of the vertical slot, through which the money values of the goods, corresponding to the different rates per lb, are read. The weight of the goods is recorded by means of an index pointer fixed to the casing on one side of the vertical slot, and the money values are opposite the figures defining the rates per lb, which are marked on the edge of the casing below the horizontal slot. On the side of the casing which is next to the buyer there is a vertical slot through which the weight of the goods can be read on the drum.

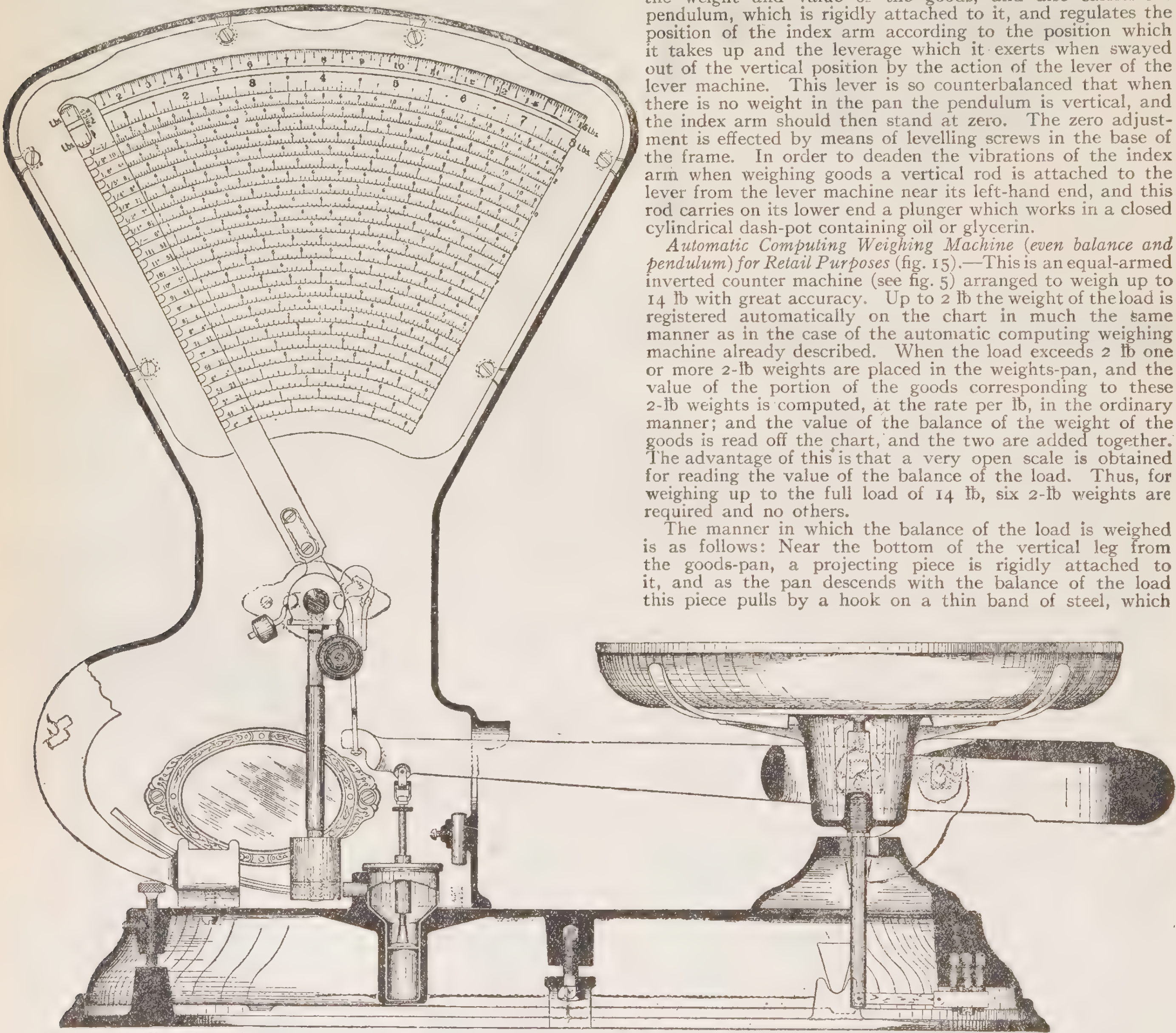

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FIG. 14.—Price-computing Weighing Machine.

Automatic Computing Weighing Machine for Retail Purposes (fig. 14).—The action of the machine shown in fig. 14 depends upon the displacement of a loaded pendulum. And the machine is arranged to weigh goods up to 8 lb with the fixed weight only on the pendulum, and up to 16 lb with an additional weight which can be readily slipped on to the pendulum rod. The weights and money values are arranged on a vertical chart, the sides of which converge towards the pivoting centre of an index arm which is actuated by the weighing mechanism. The two outer arcs of the chart are occupied by the scales for the weight of the goods in lb and oz., and the rest of the chart is occupied by a series of 25 concentric arcs which show the money values of the goods for 25 rates per lb. The rates per lb are inscribed on the index arm at points corresponding to the values on the concentric arcs of the chart, and the values are indicated on the chart by the toothed edge of the index arm. On the customer's side of the machine the weight of the goods is indicated on a pair of arcs by a separate index arm precisely in the same manner as on the seller's side.

In weighing, the goods are placed in the pan of an ordinary lever machine (see fig. 14), and the end of the lever rests on the stirrup end of a short vertical rod. The upper end of this rod is formed into a loop, and this loop pulls upon a knife-edge which is fixed to a short lateral arm rigidly attached to a vertical disk, and this disk turns in bearings formed in the frame of the machine. The same disk carries the index arm, which is rigidly fixed to it and indicates the weight and value of the goods, and also carries the pendulum, which is rigidly attached to it, and regulates the position of the index arm according to the position which it takes up and the leverage which it exerts when swayed out of the vertical position by the action of the lever of the lever machine. This lever is so counterbalanced that when there is no weight in the pan the pendulum is vertical, and the index arm should then stand at zero. The zero adjustment is effected by means of levelling screws in the base of the frame. In order to deaden the vibrations of the index arm when weighing goods a vertical rod is attached to the lever from the lever machine near its left-hand end, and this rod carries on its lower end a plunger which works in a closed cylindrical dash-pot containing oil or glycerin.

Automatic Computing Weighing Machine (even balance and pendulum) for Retail Purposes (fig. 15).—This is an equal-armed inverted counter machine (see fig. 5) arranged to weigh up to 14 lb with great accuracy. Up to 2 lb the weight of the load is registered automatically on the chart in much the same manner as in the case of the automatic computing weighing machine already described. When the load exceeds 2 lb one or more 2-lb weights are placed in the weights-pan, and the value of the portion of the goods corresponding to these 2-lb weights is computed, at the rate per lb, in the ordinary manner; and the value of the balance of the weight of the goods is read off the chart, and the two are added together. The advantage of this is that a very open scale is obtained for reading the value of the balance of the load. Thus, for weighing up to the full load of 14 lb, six 2-lb weights are required and no others.

The manner in which the balance of the load is weighed is as follows: Near the bottom of the vertical leg from the goods-pan, a projecting piece is rigidly attached to it, and as the pan descends with the balance of the load this piece pulls by a hook on a thin band of steel, which is led upwards and wraps round the surface of a disk to which it is firmly secured. This disk rotates by rocking on a pair of knife-edges whose bearings are rigidly attached to the frame. The disk carries a weighted brass cylinder rigidly attached to it, which is pulled into an oblique position by the steel band until equilibrium is established. And the disk also carries the index arm which plays past the vertical face of the chart, and indicates the weight and price up to 2-lb weight. The disk also carries a second and corresponding index arm which indicates the weight on the purchaser's side of the machine. At the bottom of the vertical leg from the goods-pan there is also a projecting piece which is attached to the top of a vertical piston rod, the piston of which plays in a dash-pot of glycerin as the beam sways, and deadens the vibrations of the index arm.

Automatic Tea Weighing Machine (fig. 16).—This machine is designed to weigh out tea in quantities of ¼ lb each, which are done up in separate packets by hand. A large number of movements have to be provided for, and the machinery is complicated, so that a general description of the action of the machine is all that will be here given.

The tea is fed into a hopper, which has a large opening at the bottom, and this opening is entirely closed by two cylindrical brushes, which are mounted end to end on a horizontal shaft. As they revolve these brushes engage the tea in the hopper, draw it out by degrees, and drop it into a compartment of a circular drum which hangs on one end of a scale-beam. The brushes have the same diameter, but one is much longer than the other, and they move independently of one another. For the bulk of the filling both brushes are in operation, but when the load is nearly complete the longer brush is stopped and the filling is completed by the shorter brush only. When the load is complete the shorter brush also is stopped while the compartment of the drum is emptied. And the action is then renewed. All these operations are effected automatically.

The circular drum is divided into four equal compartments by radial diaphragms. And in a pan at the other end of the beam (which is counterbalanced for the weight of the drum) is a ½-℔ weight to weigh the tea. As the uppermost compartment fills, the weights end of the beam rises, and by means of a vertical rod successively operates on detents connected with the rotation of the two brushes, and stops them in turn. And when the short brush is stopped a rod from the shaft frees a spring detent which keeps the drum in position and tips it over. The tea is shot out and falls into a receptacle below, and the drum makes a quarter of a revolution, and is again held in position by the detent with an empty compartment at top ready for the next filling.

The power is applied by a belt round a pulley, which is mounted on the end of the horizontal shaft which carries the brushes. The brushes are carried by sleeves which run loosely on the shaft, and to each sleeve is rigidly fixed a ratchet wheel. Next the ratchet wheel is a disk which is keyed on to the shaft. The ratchet wheel and the disk are automatically connected by clutch mechanism in order to effect the rotation of the brushes. The clutch mechanism is freed at the proper time by the action of the vertical rod at the end of the beam, and the brushes then stand still while the load is discharged. The beam then recovers its original position and the action of the machine is renewed.

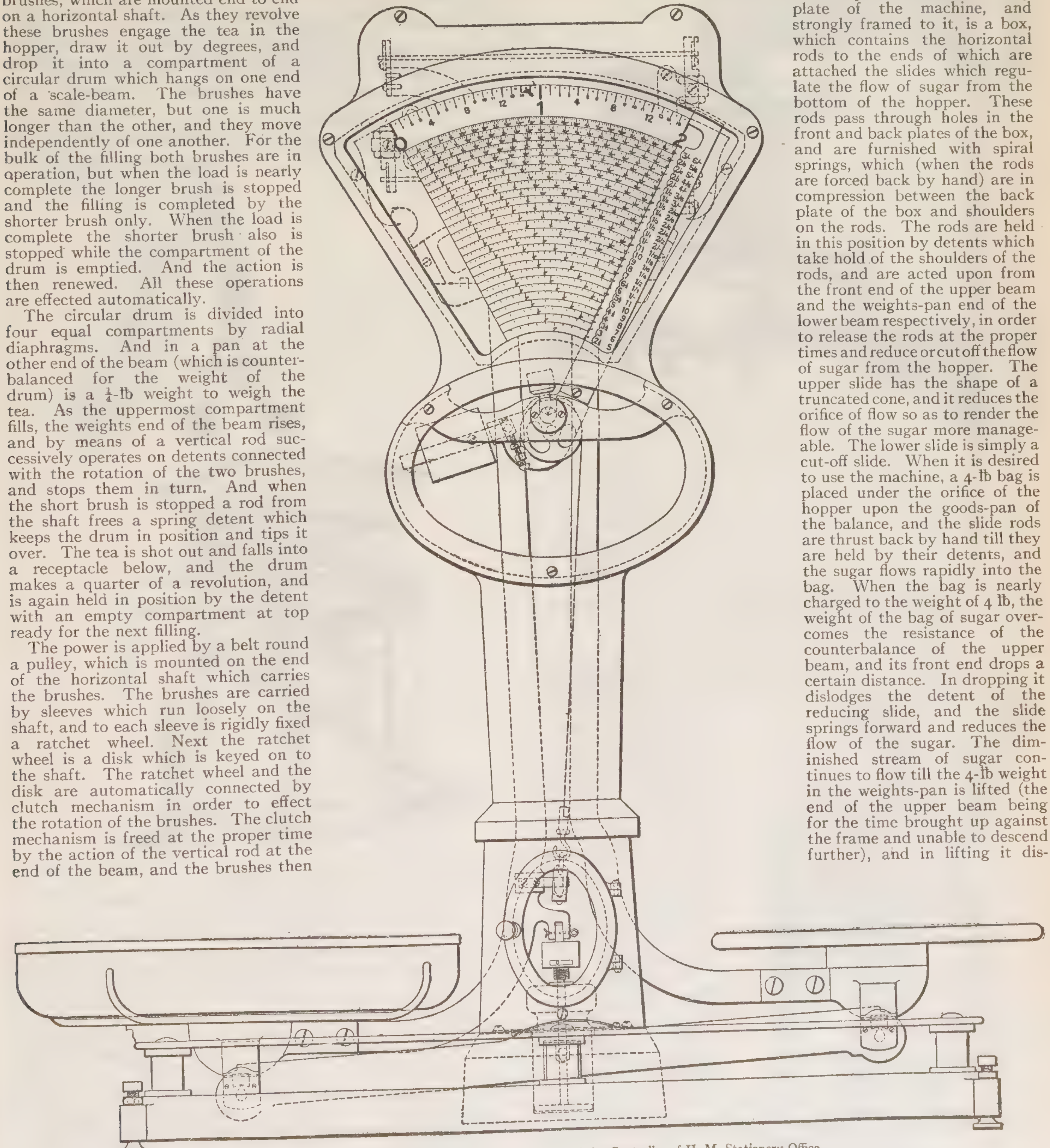

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FIG. 15.—Price-computing Weighing Machine—even Balance and Pendulum.

Automatic Sugar Weighing Machine (fig. 17).—This machine is adapted for weighing out granulated white sugar in parcels of 1-℔, 2-℔ and 4-℔ weight. The sugar is run into a conical hopper and is delivered into the open mouth of a bag which is placed on the goods-pan of a balance. The balance consists of a pair of equal-armed beams rigidly connected together and acting as a single beam. A 4-℔ weight is placed in the weights-pan of the balance, and is the only loose weight used with the machine. The pair of beams are hung centrally by rods and hooks from knife-edges in the forked end of a strong beam, which is carried at its fulcrum by the top plate of the frame of the machine. This beam is heavily counterbalanced at its further extremity. Underneath the top plate of the machine, and strongly framed to it, is a box, which contains the horizontal rods to the ends of which are attached the slides which regulate the flow of sugar from the bottom of the hopper. These rods pass through holes in the front and back plates of the box, and are furnished with spiral springs, which (when the rods are forced back by hand) are in compression between the back plate of the box and shoulders on the rods. The rods are held in this position by detents which take hold of the shoulders of the rods, and are acted upon from the front end of the upper beam and the weights-pan end of the lower beam respectively, in order to release the rods at the proper times and reduce or cut off the flow of sugar from the hopper. The upper slide has the shape of a truncated cone, and it reduces the orifice of flow so as to render the flow of the sugar more manageable. The lower slide is simply a cut-off slide. When it is desired to use the machine, a 4-℔ bag is placed under the orifice of the hopper upon the goods-pan of the balance, and the slide rods are thrust back by hand till they are held by their detents, and the sugar flows rapidly into the bag. When the bag is nearly charged to the weight of 4 ℔, the weight of the bag of sugar overcomes the resistance of the counterbalance of the upper beam, and its front end drops a certain distance. In dropping it dislodges the detent of the reducing slide, and the slide springs forward and reduces the flow of the sugar. The diminished stream of sugar continues to flow till the 4-℔ weight in the weights-pan is lifted (the end of the upper beam being for the time brought up against the frame and unable to descend further), and in lifting it dislodges the detent of the cut-off slide. The slide springs forward and cuts off the flow. The filled bag is then removed and replaced by an empty bag and the action is renewed.

In order to ensure the correct weight of the bag it is necessary to consider that when the cut-off slide acts, a certain quantity of sugar is *in transitu* and has not at that moment taken its place in the bag. This is allowed for by means of a rider weight, which is arranged so as automatically to add its weight to that of the sugar in the bag while the 4-lb weight is being lifted. But at the same instant that the cut-off takes place the rider weight is lifted off the end of the balance by a self-acting arrangement, and the sugar *in transitu* takes its place in the bag. And, if the rider weight has been correctly adjusted, the bag of sugar will be shown to weigh exactly 4 lb by the beam vibrating in equipoise.

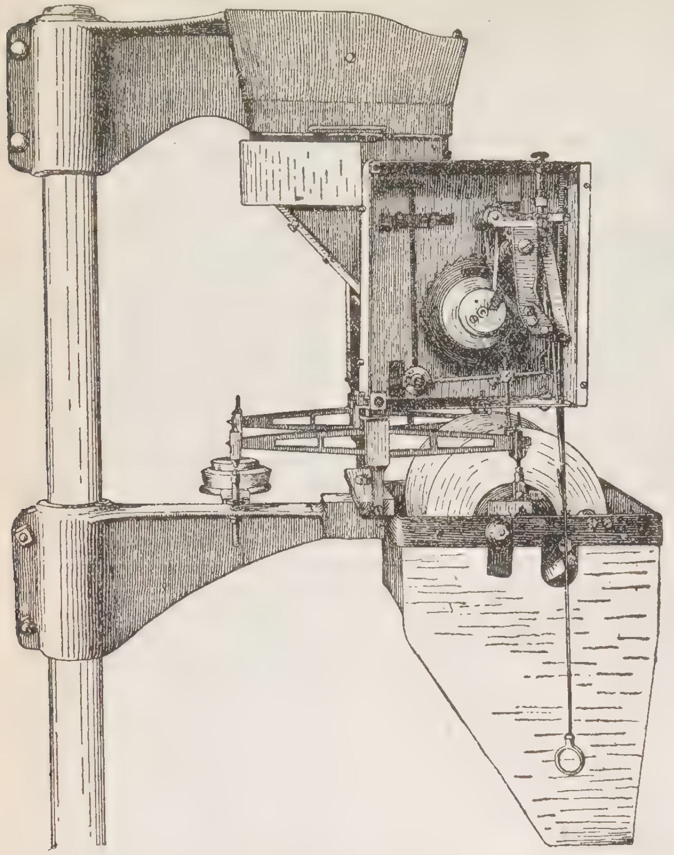

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FIG. 16.—Automatic Tea Weighing Machine.

Automatic Coal Weighing Machine (fig. 18).—This machine weighs the coal delivered into factories, &c., by charges up to 20 cwt. at a time, and records and sums up the weights of the charges so as to exhibit the total weight delivered. The whole of this work is effected automatically.

The coal is dropped into a hopper by a grab. The hopper is carried on two knife-edges, one on each side, and is prevented from tipping over fore and aft by a pair of parallel motion bars on each side. The knife-edges on which the hopper rests are on two horizontal levers, one on each side of the hopper. These levers are carried by knife-edge fulcra in bearings on the frame of the machine, and transmit the weight of the hopper by means of an intermediate lever and a vertical rod to the indicator lever. And the long arm of the indicator lever pulls vertically upon the spring of an ordinary spring balance, which registers the load, and with the addition of suitable counting mechanism sums up the weights of any number of successive loads.

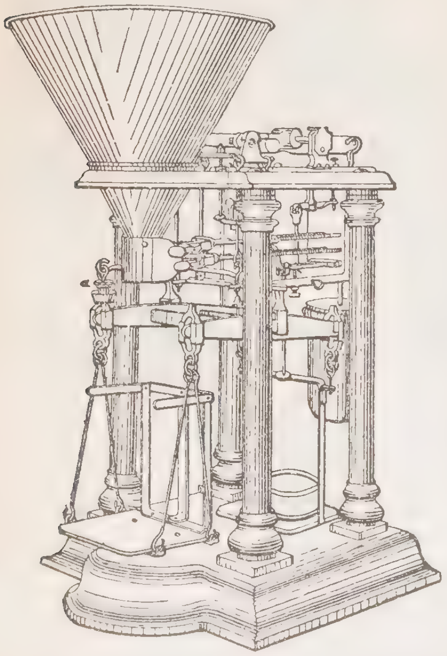

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FIG. 17.—Automatic Sugar Weighing Machine.

The charges of coal fall into the hopper with a heavy shock, and in order to save the knife-edges there is a strong pin in each side of the hopper below the knife-edge, which, before the charge of coal is dropped into the hopper, is acted on by a strong horizontal flitch-plate, which heaves the hopper off the knife-edges and relieves them from the shock. The heaving-up of the flitch-plate and hopper is effected by a cam on the end of a horizontal shaft which runs along the back of the machine behind the hopper. The flitch-plate rests at one end on the top of this cam, and at the other end is shackled to the horizontal arm of a bell-crank lever which is pivoted on the frame. When a charge of coal is dropped into the hopper, the bell-crank lever receives a violent jerk from the shackle of the flitch-plate, and this jerk by means of suitable mechanical arrangements throws a pinion on the cam shaft into gear with a wheel on a counter shaft which is kept constantly running by means of a belt and pulley driven by an engine. The cam shaft and the cam then begin to revolve, and the flitch-plate is gradually lowered till the knife-edge bearings of the hopper are received on the knife-edges of the main measuring levers, and the load is then weighed by the levers and the spring-balance. Shortly after this is done the mechanism at the back of the hopper automatically opens the doors at the bottom of the hopper, and the coal drops out. The rotation of the cam shaft continues till the cam has again heaved up the flitch-plate, when the pinion on the cam shaft is thrown out of gear with the wheel on the counter shaft, and the cam remains steady till another charge of coal is dropped into the hopper and the action is renewed. The coal when dropped out of the hopper runs down a shoot into a receptacle, from whence it is lifted by a Jacob's Ladder and distributed to the boilers, &c., of the factory.

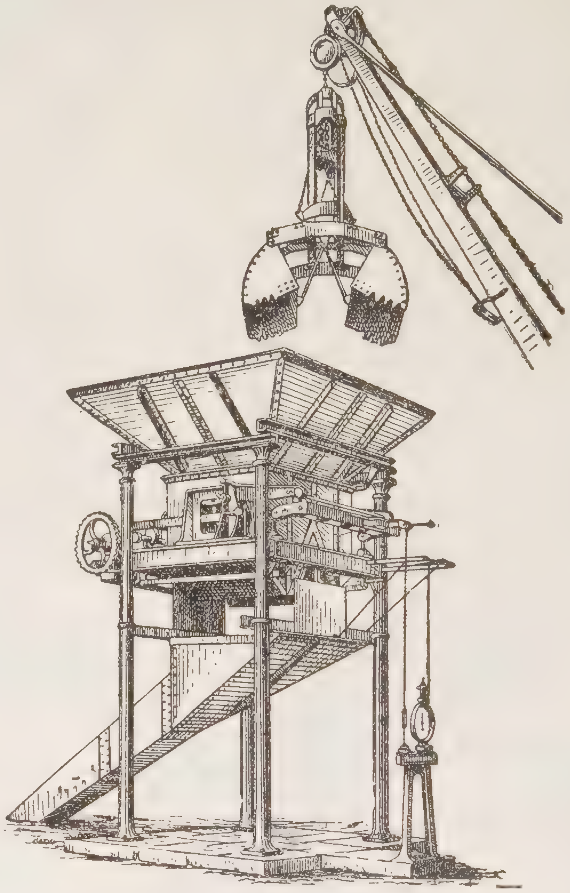

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FIG. 18.—Automatic Coal Weighing Machine.

Automatic Coal Weighing Machine (fig. 19).—This machine is designed to weigh and total up the weight of materials passed over it during a considerable course of operations. The trucks or other receptacles containing the coal, &c., are drawn upon the platform of the machine, and the pull of the load is transferred by a vertical rod at the left-hand end of the machine to the knife-edge on the short arm of the steelyard, whose fulcrum is carried on bearings in the frame. Behind the pulley at the top of the machine and on the same shaft is a spur wheel, which drives both of the spur wheels shown in the diagram. The small spur wheel is mounted on the steelyard, and this wheel and the one that drives it are so arranged that their line of pressure shall exactly coincide with the line of the fulcrum knife-edge; the object of this is that the pressure may not influence the sway of the steelyard, which must depend entirely upon the poise. By means of a pair of mitre wheels the small spur wheel causes a screwed shaft, which runs along the middle of the steelyard, to revolve, and as it revolves it carries the large poise along the steelyard. Thus, if the poise be at the zero end of the steelyard at the left-hand side of the machine, when the load comes upon the platform the screwed shaft carries the poise along the steelyard till equilibrium is established, and the end of the steelyard drops. By the first part of this drop the movement of the poise is suddenly stopped, as will be explained below, and the travel of the poise along the steelyard, which measures the load on the platform, is recorded by the amount of rotation of the large spur wheel, and this is suitably shown on a dial in connexion with the wheel. By the second part of the drop the motion of the poise is reversed and the poise is run back to the zero end in readiness for the next load. All of this is effected automatically as follows:—

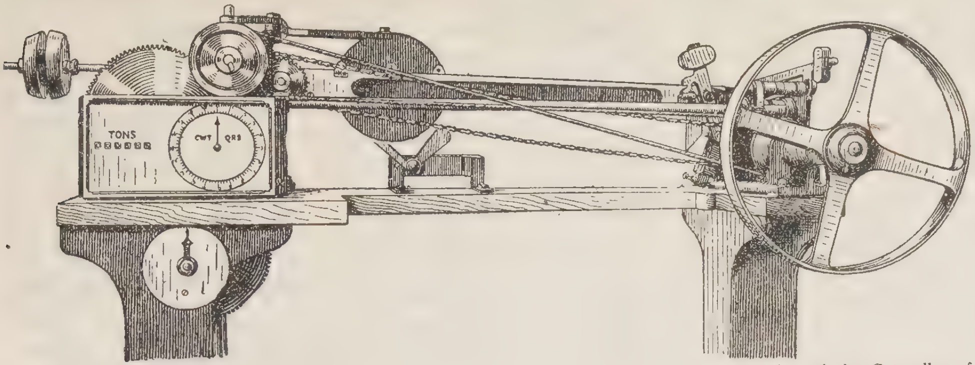

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FIG. 19.—Automatic Coal Weighing Machine.

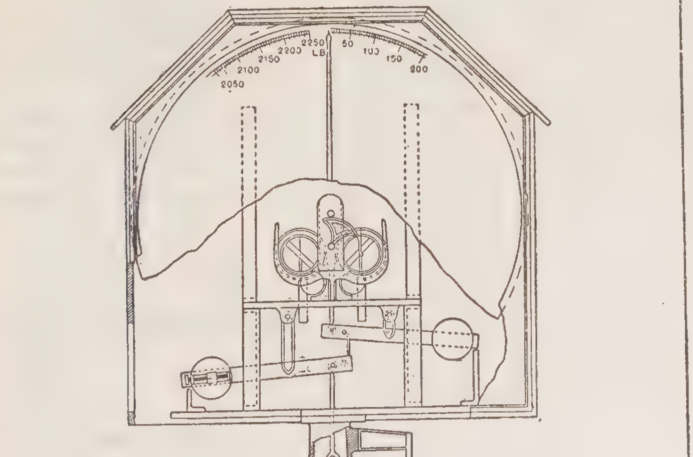

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FIG. 20.—Automatic Luggage Weighing Machine.

The machine is driven continuously by a belt from a motor which wraps round the large drum at the right-hand side of the machine. On the same axle as the drum and behind it is a small pulley which is keyed upon the axle and is connected with the small pulley (which runs idle on its shaft) at the left-hand side of the machine by a crossed belt. Thus these two small pulleys are always running, but in opposite directions. The drum-shaft is connected by a friction clutch with a shaft in the same line, on which are keyed a sprocket wheel and a ratchet wheel. The sprocket wheel is connected by a chain with a similar sprocket wheel which is keyed on the same shaft as that of the left-hand pulley. The ratchet wheel is acted upon by a pawl which is shown on the diagram. When the poise is at the zero end, and there is no load on the platform, the end of the steelyard is down, and has locked the ratchet wheel by means of the pawl; the shaft being thus locked, the sprocket wheels are stopped, the drum-shaft runs free by the friction clutch, and the two pulleys which are connected by the crossed band are running idle. When the load to be weighed comes upon the platform, the end of the steelyard rises and unlocks the ratchet wheel through the pawl; the sprocket gearing is driven by the friction clutch, and drives the axle of the left-hand small pulley. The mitre wheels come into operation and the poise is carried along till the end of the steelyard drops, and locks the ratchet wheel. By means of a horizontal rod the same drop of the steelyard also locks together by clutch gearing the left-hand pulley and the adjacent sprocket wheel, and the pulley drives the sprocket wheel in the opposite direction to that which it had before. Consequently the motion of the mitre wheels is reversed and the poise is run back to zero. When the poise arrives at zero it frees the clutch which connects the pulley and the sprocket wheel, and the machine is then ready for the next load. The poise having arrived at the end of its run and unable to go further, the mitre wheels and the sprocket gearing are stopped, and the two pulleys and the cross belt run idle till the next load comes upon the platform.

Automatic Luggage Weighing Machine (fig 20).—This machine is intended for the weighing of personal luggage at railway stations. It consists of a platform which is carried by levers arranged in the manner of an ordinary platform machine, which are connected with the registration mechanism by a vertical rod. This rod is continued upwards by a pair of thin nickel bands which are led right and left over two horizontal cylinders, round which they partly wrap, and to which they are firmly attached. The diameter of the middle part of the cylinders is greater than that of the ends, and the bands from the vertical rod are led over the middle part. To each cylinder a pair of similar nickel bands are led downwards from the top of a casting which is bolted to the frame. The lower ends of these bands pass round the under side of the end portions of the cylinders, wrapping close round them, and are firmly attached to them. To the bottom of each cylinder is rigidly attached a heavy solid cylinder of lead, and these are the regulators of the position of equilibrium of the cylinders when they rotate under the action of the load. When the load comes upon the platform the pull of the vertical rod is transmitted by the nickel bands to the cylinders around which they are wrapped, and causes them to revolve. As they rotate they roll themselves up the pairs of bands which are attached to the top of the casting, and at the same time cause the leaden weights attached to the bottoms of the cylinders to take up a lateral position, where they exercise a leverage opposing the motion of the cylinders, and bringing them up in a definite position corresponding to the pull of the vertical rod. By the rolling of the cylinders up the vertical bands from the casting the cylinders are raised vertically through a space defined by the position of the leaden regulators. By means of suitable and simple mechanism this vertical movement of the cylinders works plunger pistons in a pair of cylinders which contain glycerin, and these deaden the vibrations of the machinery while weighing is going on. The same vertical movement also actuates the index finger of a large dial, on which the weight of their luggage can be easily read by passengers standing near while their luggage is being weighed.

AUTHORITIES.—Julius Weisbach, *Mechanics of Machinery and Engineering* (London, 1848); Ernest Brauer, *Die Konstruktion der Waage* (Weimar, 1887); H. J. Chaney, *Our Weights and Measures* (London, 1897); Airy on "Weighing Machines," *Proc. Inst. C.E.* vol. cviii.; W. H. Brothers on "Weighing Machinery," *Trans. Soc. Engineers*, vol. for 1890. (W. AY.)

WEIGHTS AND MEASURES. This subject may be most conveniently considered under three aspects—I. Scientific; II. Historical; and III. Commercial.

I. SCIENTIFIC

1. *Units.*—In the United Kingdom two systems of weights and measures are now recognized—the imperial and the metric. The fundamental units of these systems are—of length, the yard and metre; and of mass, the pound and kilogram.

The legal theory of the British system of weights and measures is—(*a*) the standard yard, with all lineal measures and their squares and cubes based upon that; (*b*) the standard pound of 7000 grains, with all weights based upon that, with the troy pound of 5760 grains for trade purposes; (*c*) the standard gallon (and multiples and fractions of it), declared to contain 10 ℔ of water at 62° F., being in volume 277·274 cub. in., which contain each 252·724 grains of water in a vacuum at 62°, or 252·458 grains of water weighed with brass weights in air of 62° with the barometer at 30 in. Of the metric units international definitions have been stated as follows:—

(*a*) The unit of volume for determinations of a high degree of accuracy is the volume occupied by the mass of 1 kilogram of pure water at its maximum density and under the normal atmospheric pressure; this volume is called litre.

(*b*) In determinations of volume which do not admit of a high degree of accuracy the cubic decimetre can be taken as equivalent to the litre; and in these determinations expressions of volumes based on the cube of the unit of linear measure can be substituted for expressions based on the litre as defined above.

(*c*) The kilogram is the unit of mass; it is equal to the mass of the international prototype of the kilogram.[1]

(*d*) The term "weight" denotes a magnitude of the same nature as a force; the weight of a body is the product of the mass of the body by the acceleration of gravity; in particular, the normal weight of a body is the product of the mass of the body by the normal acceleration of gravity. The number adopted for the value of the normal acceleration of gravity is 980·665 cm/sec^2.

2. *Standards.*—The metre (*mètre-à-traits*) is represented by the distance marked by two fine lines on an iridio-platinum bar (t=0° C.) deposited with the Standards Department. This metre (m.) is the only unit of metric extension by which all other metric measures of extension—whether linear, superficial or solid—are ascertained.

The kilogram (kg.) is represented by an iridio-platinum standard weight, of cylindrical form, by which all other metric weights, and all measures having reference to metric weight, are ascertained in the United Kingdom.

From the above four units are derived all other weights and measures (W. and M.) of the two systems.

The gallon is the standard measure of capacity in the imperial system as well for liquids as for dry goods.

In the United Kingdom the metric standard of capacity is the litre, represented (Order in Council, 19th May 1890) by the capacity of a hollow cylindrical brass measure whose internal diameter is equal to one-half its height, and which at 0° C., when filled to the brim, contains one kg. of distilled water of the temperature of 4° C., under an atmospheric pressure equal to 760 millimetres at 0° C. at sea-level and latitude 45°; the weighing being made in air, but reduced by calculation to a vacuum. In such definition an attempt has been made to avoid former confusion of expression as to capacity, cubic measure, and volume; the litre being recognized as a measure of capacity holding a given weight of water.

For the equivalent of the litre in terms of the gallon, see below III. *Commercial.*

In the measurement of the cubic inch it has been found that[2] the specific mass of the cubic inch of distilled water freed from air, and weighed in air against brass weights ($\Delta=8{\cdot}13$), at the temperature of 62° F., and under an atmospheric pressure equal to 30 in. (at 32° F.), is equal to 252·297 grains weight of water at its maximum density (4° C.). Hence a cubic foot of water would weigh 62·281 ℔ avoir., and not 62·321 ℔ as at present legally taken.

For the specific mass of the cubic decimetre of water at 4° C., under an atmospheric pressure equal to 760 mm., Guillaume and Chappuis of the Comité International des Poids et Mesures at Paris (C.I.P.M.) have obtained 0·9999707 kg.,[3] which has been accepted by the committee.

The two standards, the cubic inch and the cubic decimetre, may not be strictly comparable owing to a difference in the normal temperature (Centigrade and Fahrenheit scales) of the two units of extension, the metre and the yard.

For the weight of the cubic decimetre of water, as deduced from the experiments made in London in 1896 as to the weight of the cubic inch of water, D. Mendeléeff (*Proc. Roy. Soc.*, 1895) has obtained the following results, which have been adopted in legislative enactments in the United Kingdom:—

Temperature on the Hydrogen Thermometer Scale.		Weight of Water *in vacuo.*		
C.	F.	Of a Cubic Decimetre in Grammes.	Of a Cubic Inch in Grains.	Of a Cubic Inch in Russian Dolis.
0°	32°·0	999·716	252·821	368·686
4	39·2	999·847	252·854	368·734
15	59·0	998·979	252·635	368·414
16⅔	62·0	998·715	252·568	368·316
20	68·0	998·082	252·407	368·083

In this no account is taken of the compressibility of water—that is to say, it is supposed that the water is under a pressure of one atmosphere. The weight of a cubic decimetre of water reaches 1000 grammes under a pressure of four atmospheres; but *in vacuo*, at all temperatures, the weight of water is less than a kilogram.

3. *National Standards.*—National standards of length are not legally now referred to natural standards or to physical constants,[4] but it has been shown by A. A. Michelson that a standard of length might be restored, if necessary, by reference to the measurement of wave-lengths of light. Preliminary experiments have given results correct to ±0·5 micron, and it appears probable that by further experiments, results correct to ±1·0μ may be obtained. That is to say, the metre might be redetermined or restored as to its length within one ten-millionth part, by reference to, *e.g.*, 1553163·5 wave-lengths of the red ray of the spectrum of cadmium, in air at 15° C. and 760 mm.

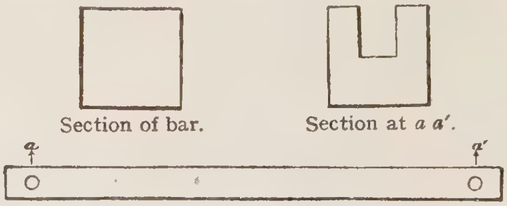
Section of bar.
Section at *a a′*.

FIG. 1.—Present Imperial Standard Yard, 1844.

Total length of bronze bar, 38 in.; distance *a a′*, 36 in., or the imperial yard; *a a′*, wells sunk to the mid-depth of the bar, at the bottom of each of which is inserted a gold stud, having the defining line of the yard engraved on it.

In all countries the national standards of weights and measures are in the custody of the state, or of some authority administering the government of the country. The standards of the British Empire, so far as they relate to the imperial and metric systems, are in the custody of the Board of Trade. Scientific research is not, of course, bound by official standards.

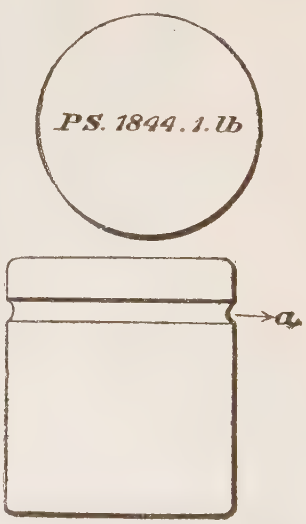

FIG. 2.—Imperial Standard Pound, 1844.

Platinum pound avoirdupois, of cylindrical form, with groove at *a* for lifting the weight.

For the care of these national standards the Standards Department was developed, under the direction of a Royal Commission[5] (of which the late Henry Williams Chisholm was a leading member), to conduct all comparisons and other operations with reference to weights and measures in aid of scientific research or otherwise, which it may be the duty of the state to undertake. Similar standardizing offices are established in other countries (see STANDARDS). Verified "Parliamentary Copies" of the imperial standard are placed at the Royal Mint, with the Royal Society, at the Royal Observatory, and in the Westminster Palace.

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[1] *Troisième Conférence Générale des Poids et Mesures* (Paris, 1901). *Metric Units Com. Roy. Soc.* (1898).

[2] *Phil. Trans.* (1892); and *Proc. Roy. Soc.* (1895), p. 143.

[3] *Proc. Verb. Com. Intern. des Poids et Mesures* (1900), p. 84. Congrès International de Physique réuni à Paris en 1900.

[4] *Valeur du Mètre*, A. A. Michelson (Paris, 1894); *Units*, Everett, Illustrations of C.G.S. System; *Unites et Étalons*, Guillaume (Paris, 1890); Lupton's Numerical Tables, 1892; Metric Equivalent Cards, 1901; *Dictionary of Metric Measures*, L. Clark (1891); Glazebrook and Shaw's *Physics* (1901).

[5] Report Standards Commission, 1870.

The forms of the four primary standards representing the four units of extension and mass are shown in figs. 1 to 4.

A secondary standard measure for dry goods is the bushel of 1824, containing 8 imperial gallons, represented by a hollow bronze cylinder having a plane base, its internal diameter being double its depth.

The imperial standard measure of capacity is a hollow cylinder (fig. 5) made of brass, with a plane base, of equal height and diameter; which when filled to the brim, as determined by a plane glass disk, contains 10 ℔ weight of water at $t=62°$ F.B. $=30$ in., weighed in air against brass weights.

4. *Atmospheric Pressure, and Materials.*—In the verification of a precise standard of length there may be taken into account the influence of the variation of atmospheric pressure. Taking the range of the barometer in Great Britain from 28 to 31 in., giving a difference of 3 in. (76 millimetres), which denotes a variation of 103 grammes per square centimetre in the pressure of the atmosphere, the change caused thereby in the length of a standard of linear measurement would appear to be as follows:—

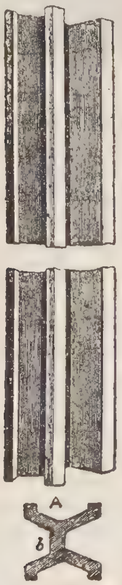

FIG. 3.—National Standard Metre, 1897.

Iridio-platinum bar of Tresca section as shown at A. The two microscopic lines are engraved on the measuring axis of the bar at *b*, one near to each end of the bar. The standard metre (*mètre-à-traits*) was supplemented by the delivery to Great Britain, in 1898, of an end standard metre (*mètre-à-bouts*) also made of iridio-platinum, and also verified by the C.I.P.M. A comparison of the yard with the metre was made by the C.I.P.M. in 1896, and of the pound and kilogram in 1883–1885 (see III. *Commercial*).

For the yard measure of the form shown in fig. 1 a difference of length equal to 0·000002 in. is caused by the variation of atmospheric pressure from 28 to 31 in. For the metre of the form shown in fig. 3 the difference in length for a variation of 76 mm. in the barometer would be 0·000048 mm. on the metre.

With reference to the materials of which standards of length are made, it appears that the Matthey alloy iridio-platinum (90% platinum, 10% iridium) is probably of all substances the least affected by time or circumstance, and of this costly alloy, therefore, a new copy of the imperial yard has been made. There appears, however, to be some objection to the use of iridio-platinum for weights, as, owing to its great density ($\Delta=21\cdot57$), the slightest abrasion will make an appreciable difference in a weight; sometimes, therefore, quartz or rock-crystal is used; but to this also there is some objection, as owing to its low density ($\Delta=2\cdot65$) there is a large exposed surface of the mass. For small standard weights platinum ($\Delta=21\cdot45$) and aluminium ($\Delta=2\cdot67$) are used, and also an alloy of palladium (60%) and silver (40%) ($\Delta=11\cdot00$).

For ordinary standards of length Guillaume's alloy (*invar*) of nickel (35·7%) and steel (64·3%) is used, as it is a metal that can be highly polished, and is capable of receiving fine graduations. Its coefficient of linear expansion is only 0·0000008 for 1° C.[1]

5. *Electrical Standards.*—Authoritative standards and instruments for the measurement of electricity, based on the fundamental units of the metric system, have been placed in the Electrical Laboratory of the Board of Trade.[2] These include

Current measuring instruments.	The standard ampere, and sub-standards from 1 to 2500 amperes.
Potential measuring instruments.	The standard volt, and sub-standards for the measurement of pressure from 25 to 3000 volts.
Resistance measuring instruments.	The standard ohm, sub-standards up to 100,000 ohms, and below 1 ohm to $\frac{1}{1000}$ ohm.

6. *Temperature.*—In the measurement of temperature the Fahrenheit scale is still followed for imperial standards, and the Centigrade scale for metric standards. At the time of the construction of the imperial standards in 1844, Sheepshanks's Fahrenheit thermometers were used; but it is difficult to say now what the true temperature then, of 62° F., may have been as compared with 62° F., or 16·667° C., of the present normal hydrogen scale. For metrological purposes the C.I.P.M. have adopted as a normal thermometric scale the Centigrade scale of the hydrogen thermometer, having for fixed points the temperature of pure melting ice (0°) and that of the vapour of boiling distilled water (100°), under a normal atmospheric pressure; hydrogen being taken under an initial manometric pressure of 1 metre, that is to say, at $\frac{1000}{760}=1\cdot3158$ times the normal atmospheric pressure. This latter is represented by the weight of a column of mercury 760 mm. in height; the specific gravity of mercury being now taken as 13·5950, after Volkmann and Marek, and at the normal intensity followed under this pressure. The value of this intensity is equal to that of the force of gravity at the Bureau International, Paris (at the level of the Bureau), divided by 1·000332; a co-efficient which allows for theoretical reduction to the latitude 45° and to the level of the sea. The length of the metre is independent of the thermometer so far that it has its length at a definite physical point, the temperature of melting ice (0° C.), but there is the practical difficulty that for ordinary purposes measurements cannot be always carried out at 0° C.

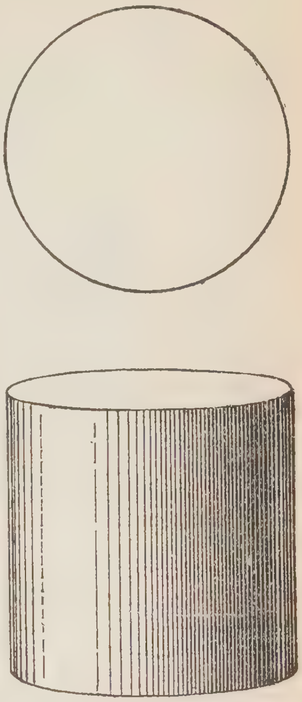

FIG. 4.—National Standard Kilogram, 1897.

The International Geodetic Committee have adopted the metre as their unit of measurement. In geodetic measurements the dimensions of the triangles vary with the temperature of the earth, but these variations in the same region of the earth are smaller than the variations of the temperature of the air, less than 10° C. Adopting as a co-efficient of dilatation of the earth's crust 0·000002, the variations of the distances are smaller than the errors of measurement (see GEODESY).

7. *Standardizing Institutions.*—Besides the State departments dealing with weights and measures, there are other standardizing institutions of recent date. In Germany, *e.g.* there is at Charlottenburg (Berlin) a technical institute (Physikalisch - technische-Reichsanstalt) established under Dr W. Förster in 1887, which undertakes researches with reference to physics and mechanics, particularly as applied to technical industries.[3] In England a National Physical Laboratory (N.P.L.) has been established, based on the German institute, and has its principal laboratory at Bushey House, near Hampton, Middlesex. Here is carried out the work of standardizing measuring instruments of various sorts in use

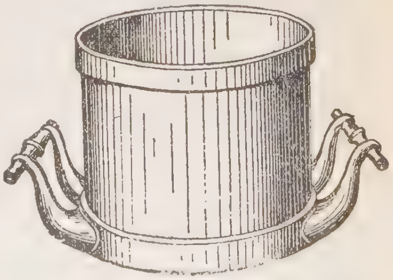

FIG. 5—Present Imperial Standard Gallon, 1824

Rapport du Yard, Dr Benoit (1896).

[2] Orders in Council (1894).

[3] *Wissenschaftliche Abhandlungen der physikalischen Reichsanstalt*, Band ii. (Berlin, 1900); *Denkschrift betreffend die Tätigkeit der K. Norm.-Aichungs Kommn.* (1869–1900).

by manufacturers, the determination of physical constants and the testing of materials. The work of the Kew Observatory, at the Old Deer Park, Richmond, has also been placed under the direction of the N.P.L. (see III. *Commercial*).[1] The C.I.P.M. at Paris, the first metrological institution, also undertakes verifications for purely scientific purposes. A descriptive list of the verifying instruments of the Standards Department, London, has been published.[2] In the measurement of woollen and other textile fabrics, as to quality, strength, number of threads, &c., there exists at Bradford a voluntary standardizing institution known as the Conditioning House (Bradford Corporation Act 1887), the work of which has been extended to a chemical analysis of fabrics.

8. *Ancient Standards of England and Scotland.*—A "troy pound" and a new standard yard, as well as secondary standards, were constructed by direction of parliament in 1758–1760, and were deposited with the Clerk of the House of Commons. When the Houses of Parliament were burned down in 1834, the pound was lost and the yard was injured. It may here be mentioned that the expression "imperial" first occurs in the Weights and Measures Act of 1824. The injured standard was then lost sight of, but it was in 1891 brought to light by the Clerk of the Journals, and has now been placed in the lobby of the residence of the Clerk of the House, together with a standard "stone" of 14 ℔.[3]

In the measurement of liquids the old "wine gallon" (231 cub. in.) was in use in England until 1824, when the present imperial gallon (fig. 5) was legalized; and the wine gallon of 1707 is still referred to as a standard in the United States. Together with the more ancient standard of Henry VII. and of Queen Elizabeth, this standard is deposited in the Jewel Tower at Westminster. They are probably of the Norman period, and were kept in the Pyx Chapel at Westminster, now in the custody of the Commissioners of Works. A sketch of these measures is given in fig. 6.[4]

Besides these ancient standards of England (1495, 1588, 1601) there are at the council chambers of Edinburgh and Linlithgow some of the interesting standards of Scotland, as the Stirling jug or Scots pint, 1618; the choppin or half-pint, 1555 (fig. 7); the Lanark troy and tron weights of the same periods (fig. 8).[5]

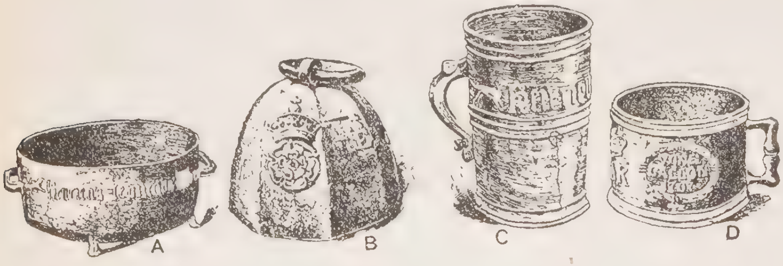

Fig. 6.—A, Winchester Bushel of Henry VII.; B, Standard Hundredweight (112 ℔) of Elizabeth; C, Ale Gallon of Henry VII.; D, the old Wine Gallon.

English Weights and Measures Abolished.—The yard and handful, or 40 in. ell, abolished in 1439. The yard and inch, or 37 in. ell (cloth measure), abolished after 1553; known later as the Scotch ell = 37·06. Cloth ell of 45 in., used till 1600. The yard of Henry VII. = 35·963 in. Saxon moneyers pound, or Tower pound, 5400 grains, abolished in 1527. Mark, $\frac{2}{3}$ pound = 3600 grains. Troy pound in use in 1415, established as monetary pound 1527. Troy weight was abolished, from the 1st of January 1879, by the Weights and Measures Act 1878, with the exception only of the Troy ounce, its decimal parts and multiples, legalized in 1853, 16 Vict. c. 29, to be used for the sale of gold and silver articles, platinum and precious stones. Merchant's pound, in 1270 established for all except gold, silver and medicines = 6750 grains, generally superseded by avoirdupois in 1303. Merchant's pound of 7200 grains, from France and Germany, also superseded. ("Avoirdepois" occurs in 1336, and has been thence continued: the Elizabethan standard was probably 7002 grains.) Ale gallon of 1601 = 282 cub. in., and wine gallon of 1707 = 231 cub. in., both abolished in 1824. Winchester corn bushel of 8×268.8 cub. in. and gallon of 274¼ are the oldest examples known (Henry VII.), gradually modified until fixed in 1826 at 277.274, or 10 pounds of water.

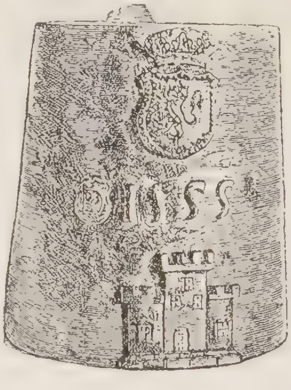

Fig. 7.—The Scots Choppin or Half-Pint, 1555.

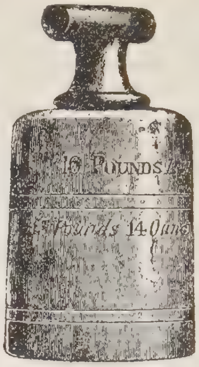

Fig. 8.—Lanark Stone Troy Weight, 1618.

French Weights and Measures Abolished.—Often needed in reading older works.

ligne, ·08883 in.	12 = pouce, 1·0658	12 = pied, 12·7892	6 = toise, 76·735	2000 = lieue de poste. 2·42219 miles.
grain, ·8197 gr.	72 = gros, 59·021	8 = once, 472·17	8 = marc, 3777·33	2 = poids de marc. 1·0792 ℔.

Rhineland foot, much used in Germany, = 12·357 in. = the foot of the Scotch or English cloth ell of 37·06 in., or 3×12·353. (H. J. C.)

II. Ancient Historical

Though no line can be drawn between ancient and modern metrology, yet, owing to neglect, and partly to the scarcity of materials, there is a gap of more than a thousand years over which the connexion of units[6] of measure is mostly guess-work. Hence, except in a few cases, we shall not here consider any units of the middle ages. A constant difficulty in studying works on metrology is the need of distinguishing the absolute facts of the case from the web of theory into which each writer has woven them—often the names used, and sometimes the very existence of the units in question, being entirely an assumption of the writer. Again, each writer has his own leaning: A. Böckh, to the study of water-volumes, and weights, even deriving linear measures therefrom; V. Queipo, to the connexion with Arabic and Spanish measures; J. Brandis, to the basis of Assyrian standards; Mommsen, to coin weights; and P. Bortolotti to Egyptian units; but F. Hultsch is more general, and appears to give a more equal representation of all sides than do other authors. In this article the tendency will be to trust far more to actual measures and weights than to the statements of ancient writers; and this position seems to be justified by the great increase in materials, and their more accurate means of study. The usual arrangement by countries has been mainly abandoned in favour of following out each unit as a whole, without recurring to it separately for every locality.

The materials for study are of three kinds. (1) *Literary*, both in direct statements in works on measures (*e.g.* Elias of Nisibis), medicine (Galen) and cosmetics (Cleopatra), in ready-reckoners (Didymus), clerk's (kātīb's) guides, and like handbooks, and in indirect explanations of the equivalents of measures mentioned by authors (*e.g.* Josephus). But all such sources are liable to the most confounding errors, and some passages relied on have in any case to submit to conjectural emendation. These authors are of great value for connecting the monumental information, but must yield more and more to the increasing evidence of actual weights and measures. Besides this, all their evidence is but approximate, often only stating quantities to a half or quarter of the amount, and seldom nearer than 5 or 10%; hence they are entirely worthless for all the closer questions of the approximation or original identity of standards in different countries; and it is just in this line that the imagination of writers has led them into the greatest speculations, unchecked by accurate evidence of the original standards. (2) *Weights and measures actually remaining.* These are the prime sources, and as they increase and are more fully studied, so the subject will be cleared and obtain a fixed basis. A difficulty has been in the paucity of examples, more due to the neglect of collectors than the rarity of specimens. The number of published weights did not exceed 600 of all standards in 1880; but the collections from Naucratis (**28**),[1] Defenneh (**29**) and Memphis (**44**) have supplied over six times this quantity, and of an earlier age than most other examples, while existing collections have been more thoroughly examined. It is above all desirable to make allowances for the changes which weights have undergone; and, as this has only been done for the above Egyptian collections and that of the British Museum, conclusions as to the accurate values of different standards will here be drawn from these rather than continental sources. (3) *Objects which have been made by measure or weight,* and from which the unit of construction can be deduced. Buildings will generally yield up their builder's foot or cubit when examined (*Inductive Metrology,* p. 9). Vases may also be found bearing such relations to one another as to show their unit of volume. And coins have long been recognized as one of the great sources of metrology—valuable for their wide and detailed range of information, though most unsatisfactory on account of the constant temptation to diminish their weight, a weakness which seldom allows us to reckon them as of the full standard. Another defect in the evidence of coins is that, when one variety of the unit of weight was once fixed on for the coinage, there was (barring the depreciation) no departure from it, because of the need of a fixed value, and hence coins do not show the range and character of the real variations of units as do buildings, or vases, or the actual commercial weights.

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[1] Treasury Committee on National Physical Laboratory, Parliamentary Paper, 1898.

[2] Descriptive List of Standards and Instruments, Parliamentary Paper, 1892.

[3] Report on Standards deposited in House of Commons, 1st November 1891.

[4] S. Fisher, *The Art Journal*, August 1900.

[5] Buchanan, *Ancient Scotch Standard*

[6] In the absence of the actual standards of ancient times the units of measure and of weight have to be inferred from the other remains; hence unit in this division is used for any more or less closely defined amount of length or weight in terms of which matter was measured.

PRINCIPLE OF STUDY.—1. *Limits of Variation in Different Copies, Places and Times.*—Unfortunately, so very little is known of the ages of weights and measures that this datum—most essential in considering their history—has been scarcely considered. In measure, Egyptians of Dynasty IV. at Gizeh on an average varied 1 in 350 between different buildings (**27**). Buildings at Persepolis, all of nearly the same age, vary in unit 1 in 450 (**25**). Including a greater range of time and place, the Roman foot in Italy varied during two or three centuries on an average $\frac{1}{400}$ from the mean. Covering a longer time, we find an average variation of $\frac{1}{200}$ in the Attic foot (**25**), $\frac{1}{150}$ in the English foot (**25**), $\frac{1}{170}$ in the English itinerary foot (**25**). Se we may say that an average variation of $\frac{1}{400}$ by toleration, extending to double that by change of place and time, is usual in ancient measures. In weights of the same place and age there is a far wider range; at Defenneh (**29**), within a century probably, the average variation of different units is $\frac{1}{36}$, $\frac{1}{60}$, and $\frac{1}{67}$, the range being just the same as in all times and places taken together. Even in a set of weights all found together, the average variation is only reduced to $\frac{1}{60}$, in place of $\frac{1}{36}$ (**29**). Taking a wider range of place and time, the Roman libra has an average variation of $\frac{1}{50}$ in the examples of better period (**43**), and in those of Byzantine age $\frac{1}{35}$ (**44**). Altogether, we see that weights have descended from original varieties with so little intercomparison that no rectification of their values has been made, and hence there is as much variety in any one place and time as in all together. Average variation may be said to range from $\frac{1}{40}$ to $\frac{1}{70}$ in different units, doubtless greatly due to defective balances.

2. *Rate of Variation.*—Though large differences may exist, the rate of general variation is but slow—excluding, of course, all monetary standards. In Egypt the cubit lengthened $\frac{1}{170}$ in some thousands of years (**25, 44**). The Italian mile has lengthened $\frac{1}{100}$ since Roman times (**2**); the English mile lengthened about $\frac{1}{300}$ in four centuries (**31**). The English foot has not appreciably varied in several centuries (**25**). Of weights there are scarce any dated, excepting coins, which nearly all decrease; the Attic tetradrachm, however, increased $\frac{1}{50}$ in three centuries (**28**), owing probably to its being below the average trade weight to begin with. Roughly dividing the Roman weights, there appears a decrease of $\frac{1}{40}$ from imperial to Byzantine times (**43**).

3. *Tendency of Variation.*—This is, in the above cases of lengths, to an increase in course of time. The Roman foot is also probably $\frac{1}{300}$ larger than the earlier form of it, and the later form in Britain and Africa perhaps another $\frac{1}{300}$ larger (**25**). Probably measures tend to increase and weights to decrease in transmission from time to time or place to place.

4. *Details of Variation.*—Having noticed variation in the gross, we must next observe its details. The only way of examining these is by drawing curves (**28, 29**), representing the frequency of occurrence of all the variations of a unit; for instance, in the Egyptian unit—the kat—counting in a large number how many occur between 140 and 141 grains, 141 and 142, and so on; such numbers represented by curves show at once where any particular varieties of the unit lie (see *Naukratis*, i. 83). This method is only applicable where there is a large number of examples; but there is no other way of studying the details. The results from such a study—of the Egyptian kat, for example—show that there are several distinct families or types of a unit, which originated in early times, have been perpetuated by copying, and reappear alike in each locality (see *Tanis*, ii. pl. l.). Hence we see that if one unit is derived from another it may be possible, by the similarity or difference of the forms of the curves, to discern whether it was derived by general consent and recognition from a standard in the same condition of distribution as that in which we know it, or whether it was derived from it in earlier times before it became so varied, or by some one action forming it from an individual example of the other standard without any variation being transmitted. As our knowledge of the age and locality of weights increases these criteria in curves will prove of greater value; but even now no consideration of the connexion of different units should be made without a graphic representation to compare their relative extent and nature of variation.

5. *Transfer of Units.*—The transfer of units from one people to another takes place almost always by trade. Hence the value of such evidence in pointing out the ancient course of trade and commercial connexions (**17**). The great spread of the Phoenician weight on the Mediterranean, of the Persian in Asia Minor and of the Assyrian in Egypt are evident cases; and that the decimal weights of the laws of Manu (**43**) are decidedly not Assyrian or Persian, but on exactly the Phoenician standard, is a curious evidence of trade by water and not overland. If, as seems probable, units of length may be traced in prehistoric remains, they are of great value; at Stonehenge, for instance, the earlier parts are laid out by the Phoenician foot, and the later by the Pelasgo-Roman foot (**26**). The earlier foot is continually to be traced in other megalithic remains, whereas the later very seldom occurs (**25**). This bears strongly on the Phoenician origin of our prehistoric civilization. Again, the Belgic foot of the Tungri is the basis of the present English land measures, which we thus see are neither Roman nor British in origin, but Belgic. Generally a unit is transferred from a higher to a less civilized people; but the near resemblance of measures in different countries should always be corroborated by historical considerations of a probable connexion by commerce or origin (Head, *Historia Numorum*, xxxvii.). It should be borne in mind that in early times the larger values, such as minae, would be transmitted by commerce, while after the introduction of coinage the lesser values of shekels and drachmae would be the units; and this needs notice, because usually a borrowed unit was multiplied or divided according to the ideas of the borrowers, and strange modifications thus arose.

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[1] These figures refer to the authorities at the end of this section.

6. *Connexions of Lengths, Volumes and Weights.*—This is the most difficult branch of metrology, owing to the variety of connexions which can be suggested, to the vague information we have, especially on volumes, and to the liability of writers to rationalize connexions which were never intended. To illustrate how easy it is to go astray in this line, observe the continual reference in modern handbooks to the cubic foot as 1000 oz. of water; also the cubic inch is very nearly 250 grains, while the gallon has actually been fixed at 10 lb of water; the first two are certainly mere coincidences, as may very probably be the last also, and yet they offer quite as tempting a base for theorizing as any connexions in ancient metrology. No such theories can be counted as more than coincidences which have been adopted, unless we find a very exact connexion, or some positive statement of origination. The idea of connecting volume and weight has received an immense impetus through the metric system, but it is not very prominent in ancient times. The Egyptians report the weight of a measure of various articles, amongst others water (**6**), but lay no special stress on it; and the fact that there is no measure of water equal to a direct decimal multiple of the weight-unit, except very high in the scale, does not seem as if the volume was directly based upon weight. Again, there are many theories of the equivalence of different cubic cubits of water with various multiples of talents (**2**, **3**, **18**, **24**, **33**); but connexion by lesser units would be far more probable, as the primary use of weights is not to weigh large cubical vessels of liquid, but rather small portions of precious metals. The Roman amphora being equal to the cubic foot, and containing 80 librae of water, is one of the strongest cases of such relations, being often mentioned by ancient writers. Yet it appears to be only an approximate relation, and therefore probably accidental, as the volume by the examples is too large to agree to the cube of the length or to the weight, differing $\frac{1}{20}$, or sometimes even $\frac{1}{12}$.[1]

Another idea which has haunted the older metrologists, but is still less likely, is the connexion of various measures with degrees on the earth's surface. The lameness of the Greeks in angular measurement would alone show that they could not derive itinerary measures from long and accurately determined distances on the earth.

7. *Connexions with Coinage.*—From the 7th century B.C. onward, the relations of units of weight have been complicated by the need of the interrelations of gold, silver and copper coinage; and various standards have been derived theoretically from others through the weight of one metal equal in value to a unit of another. That this mode of originating standards was greatly promoted, if not started, by the use of coinage we may see by the rarity of the Persian silver weight (derived from the Assyrian standard), soon after the introduction of coinage, as shown in the weights of Defenneh (**29**). The relative value of gold and silver (**17**, **21**) in Asia is agreed generally to have been $13\frac{1}{3}$ to 1 in the early ages of coinage; at Athens in 434 B.C. it was 14:1; in Macedon, 350 B.C., $12\frac{1}{2}$:1; in Sicily, 400 B.C., 15:1, and 300 B.C., 12:1; in Italy in 1st century, it was 12:1, in the later empire 13·9:1, and under Justinian 14·4:1. Silver stood to copper in Egypt as 80:1 (Brugsch), or 120:1 (Revillout); in early Italy and Sicily as 250:1 (Mommsen), or 120:1 (Soutzo), under the empire 120:1, and under Justinian 100:1. The distinction of the use of standards for trade in general, or for silver or gold in particular, should be noted. The early observance of the relative values may be inferred from Num. vii. 13, 14, where silver offerings are 13 and 7 times the weight of the gold, or of equal value and one-half value.

8. *Legal Regulations of Measures.*—Most states have preserved official standards, usually in temples under priestly custody. The Hebrew "shekel of the sanctuary" is familiar; the standard volume of the apet was secured in the dromus of Anubis at Memphis (**35**); in Athens, besides the standard weight, twelve copies for public comparison were kept in the city; also standard volume measures in several places (**2**); at Pompeii the block with standard volumes cut in it was found in the portico of the forum (**33**); other such standards are known in Greek cities (Gythium, Panidum and Trajanopolis) (**11**, **33**); at Rome the standards were kept in the Capitol, and weights also in the temple of Hercules (**2**); the standard cubit of the Nilometer was before Constantine in the Serapaeum, but was removed by him to the church (**2**). In England the Saxon standards were kept at Winchester before A.D. 950 and copies were legally compared and stamped; the Normans removed them to Westminster to the custody of the king's chamberlains at the exchequer; and they were preserved in the crypt of Edward the Confessor, while remaining royal property (**9**). The oldest English standards remaining are those of Henry VII. Many weights have been found in the temenos of Demeter at Cnidus, the temple of Artemis at Ephesus, and in a temple of Aphrodite at Byblus (**44**); and the making or sale of weights may have been a business of the custodians of the temple standards.

9. *Names of Units.*—It is needful to observe that most names of measures are generic and not specific, and cover a great variety of units. Thus foot, digit, palm, cubit, stadium, mile, talent, mina, stater, drachm, obol, pound, ounce, grain, metretes, medimnus, modius, hin and many others mean nothing exact unless qualified by the name of their country or city. Also, it should be noted that some ethnic qualifications have been applied to different systems, and such names as Babylonian and Euboic are ambiguous; the normal value of a standard will therefore be used here rather than its name, in order to avoid confusion, unless specific names exist, such as *kat* and *uten*.

All quantities stated in this article without distinguishing names are in British units of inch, cubic inch or grain.

Standards of Length.—Most ancient measures have been derived from one of two great systems, that of the cubit of 20·63 in., or the digit of ·729 in.; and both these systems are found in the earliest remains.

20·63 in.—First known in Dynasty IV. in Egypt, most accurately 20·620 in the Great Pyramid, varying 20·51 to 20·71 in Dyn. IV. to VI. (**27**). Divided decimally in 10cths; but usually marked in Egypt into 7 palms of 28 digits, approximately; a mere juxtaposition (for convenience) of two incommensurate systems (**25**, **27**). The average of several cubit rods remaining is 20·65, age in general about 1000 B.C. (**33**). At Philae, &c., in Roman times 20·76 on the Nilometers (**44**). This unit is also recorded by cubit lengths scratched on a tomb at Beni Hasan (**44**), and by dimensions of the tomb of Ramessu IV. and of Edfu temple (**5**) in papyri. From this cubit, *mahi*, was formed the *xylon* of 3 cubits, the usual length of a walking-staff; fathom, *nent*, of 4 cubits, and the *khet* of 40 cubits (**18**); also the *schoenus* of 12,000 cubits, actually found marked on the Memphis-Faium road (**44**).

Babylonia had this unit nearly as early as Egypt. The divided plotting scales lying on the drawing boards of the statues of Gudea (*Nature*, xxviii. 341) are of $\frac{1}{2}$ 20·89, or a span of 10·44, which is divided in 16 digits of ·653, a fraction of the cubit also found in Egypt.

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[1] Relative to the uncertain connexion of length, capacity and weight in the ancient metrological systems of the East, Sir Charles Warren, R.E., has obtained by deductive analysis a new equivalent of the original cubit (*Palestine Exploration Fund Quarterly*, April, July, October 1899). He shows that the length of the cubit arose through the weights; that is to say, the original cubit of Egypt was based on the cubic double—cubit of water—and from this the several nations branched off with their measures and weights. For the length of the building cubit Sir C. Warren has deduced a length equivalent to 20·6109 English inches, which compares with a mean Pyramid cubit of 20·6015 in. as hitherto found. By taking all the ancient cubits, there appears to be a remarkable coincidence throughout with 20·6109 in.

Sir C. Warren has derived a primitive unit from a proportion of the human body, by ascertaining the probable mean height of the ancient people in Egypt, and so thereby has derived a standard from the stature of man. The human body has furnished the earliest measure for many races (H. O. Arnold-Forster, *The Coming of the Kilogram*, 1898), as the foot, palm, hand, digit, nail, pace, ell (*ulna*), &c. It seems probable, therefore, that a royal cubit may have been derived from some kingly stature, and its length perpetuated in the ancient buildings of Egypt, as the Great Pyramid, &c.

So far this later research appears to confirm the opinion of Bockh (**2**) that fundamental units of measure were at one time derived from weights and capacities. It is curious, however, to find that an ancient nation of the East, so wise in geometrical proportions, should have followed what by modern experience may be regarded as an inverse method, that of obtaining a unit of length by deducing it through weights and cubic measure, rather than by deriving cubic measure through the unit of length.

Buildings in Assyria and Babylonia show 20·5 to 20·6. The Babylonian system was sexagesimal, thus (**18**)—

uban,	5=qat,	6=ammat,	6=qanu,	60=sos,	30=parasang,	2=kaspu.
·69 inch	3·44	20·6	124	7430	223,000	446,000

Asia Minor had this unit in early times—in the temples of Ephesus 20·55, Samos 20·62; Hultsch also claims Priene 20·90, and the stadia of Aphrodisias 20·67 and Laodicea 20·94. Ten buildings in all give 20·63 mean (**18**, **25**); but in Armenia it arose to 20·76 in late Roman times, like the late rise in Egypt (**25**). It was specially divided into ⅕th, the foot of ⅗ths being as important as the cubit.

12·45 in. ⅗×20·75. This was especially the Greek derivative of the 20·63 cubit. It originated in Babylonia as the foot of that system (**24**), in accordance with the sexary system applied to the early decimal division of the cubit. In Greece it is the most usual unit, occurring in the Propylaea at Athens 12·44, temple at Aegina 12·40, Miletus 12·51, the Olympic course 12·62, &c. (**18**); thirteen buildings giving an average of 12·45, mean variation ·06 (**25**), =⅗ of 20·75, m. var. ·10. The digit=¼ palaeste, =$\frac{1}{16}$ foot of 12·4; then the system is—

foot,	{ 1½=cubit, { 10	4=orguia	=acaena,	10=plethron,	100= 6= } stadion.
12·4 in.	18·7	74·7	124·5	1245	7470

In Etruria it probably appears in tombs as 12·45 (**25**); perhaps in Roman Britain; and in medieval England as 12·47 (**25**).

13·8 in. ⅔×20·7. This foot is scarcely known monumentally. On three Egyptian cubits there is a prominent mark at the 19th digit or 14 in., which shows the existence of such a measure (**33**). It became prominent when adopted by Philetaerus about 280 B.C. as the standard of Pergamum (**42**), and probably it had been shortly before adopted by the Ptolemies for Egypt. From that time it is one of the principal units in the literature (Didymus, &c.), and is said to occur in the temple of Augustus at Pergamum as 13·8 (**18**). Fixed by the Romans at 16 digits (13⅓=Roman foot), or its cubit at 1⅞ Roman feet, it was legally =13·94 at 123 B.C. (**42**); and 7½ Philetaerean stadia were=Roman mile (**18**). The multiples of the 20·63 cubit are in late times generally reckoned in these feet of ⅔ cubit. The name "Babylonian foot" used by Böckh (**2**) is only a theory of his, from which to derive volumes and weights; and no evidence for this name, or connexion with Babylon, is to be found. Much has been written (**2**, **3**, **33**) on supposed cubits of about 17-18 in. derived from 20·63—mainly in endeavouring to get a basis for the Greek and Roman feet; but these are really connected with the digit system, and the monumental or literary evidence for such a division of 20·63 will not bear examination.

17·30 ⅚×20·76. There is, however, fair evidence for units of 17·30 and 1·730 or $\frac{1}{12}$ of 20·76 in Persian buildings (**25**); and the same is found in Asia Minor as 17·25 or ⅚ of 20·70. On the Egyptian cubits a small cubit is marked as about 17 in., which may well be this unit, as ⅚ of 20·6 is 17·2; and, as these marks are placed *before* the 23rd digit or 17·0, they cannot refer to 6 palms, or 17·7, which is the 24th digit, though they are usually attributed to that (**33**).

We now turn to the second great family based on the digit. This has been so usually confounded with the 20·63 family, owing to the juxtaposition of 28 digits with that cubit in Egypt, that it should be observed how the difficulty of their incommensurability has been felt. For instance, Lepsius (**3**) supposed two primitive cubits of 13·2 and 20·63, to account for 28 digits being only 20·4 when free from the cubit of 20·63—the first 24 digits being in some cases made shorter on the cubits to agree with the true digit standard, while the remaining 4 are lengthened to fill up to 20·6. In the

·727 in. Dynasties IV. and V. in Egypt the digit is found in tomb sculptures as ·727 (**27**); while from a dozen examples in the later remains we find the mean ·728 (**25**). A length of 10 digits is marked on all the inscribed Egyptian cubits as the "lesser span" (**33**). In Assyria the same digit appears as ·730, particularly at Nimrud (**25**); and in Persia buildings show the 10-digit length of 7·34 (**25**). In Syria it was about ·728, but variable; in eastern Asia Minor more like the Persian, being ·732 (**25**). In these cases the digit itself, or decimal multiples, seem to have been used.

18·23 25×·729. The pre-Greek examples of this cubit in Egypt, mentioned by Böckh (**2**), give 18·23 as a mean, which is 25 digits of ·729, and has no relation to the 20·63 cubit. This cubit, or one nearly equal, was used in Judaea in the times of the kings, as the Siloam inscription names a distance of 1758 ft. as roundly 1200 cubits, showing a cubit of about 17·6 in. This is also evidently the Olympic cubit; and, in pursuance of the decimal multiple of the digit found in Egypt and Persia, the cubit of 25 digits was ¼ of the orguia of 100 digits, the series being—

old digit,	{ 25=cubit, { 100	4= = } orguia,	10=amma,	10=stadion.
·729 inch	18·2	72·9	729	7296.

Then, taking ⅔ of the cubit, or ⅙ of the orguia as a foot, the Greeks arrived at their foot of 12·14; this, though very well known in literature, is but rarely found, and then generally in the form of the cubit, in monumental measures. The Parthenon step, celebrated as 100 ft. wide, and apparently 225 ft. long, gives by Stuart 12·137, by Penrose 12·165, by Paccard 12·148, differences due to scale and not to slips in measuring. Probably 12·16 is the nearest value. There are but few buildings wrought on this foot in Asia Minor, Greece or Roman remains. The Greek system, however, adopted this foot as a basis for decimal multiplication, forming

foot,	10=acaena,	10=plethron,
12·16 inches	121·6	1216

which stand as ⅙th of the other decimal series based on the digit. This is the agrarian system, in contrast to the orguia system, which was the itinerary series (**33**).

Then a further modification took place, to avoid the inconvenience of dividing the foot in 16⅔ digits, and a new digit was formed —longer than any value of the old digit—of $\frac{1}{16}$ of the foot, or ·760, so that the series ran

digit,	{ 10=lichas { 96	=orguia,	10=amma,	10=stadion.
·76 inch	7·6	72·9	729	7296.

This formation of the Greek system (**25**) is only an inference from the facts yet known, for we have not sufficient information to prove it, though it seems much the simplest and most likely history.

11·62 16×·726. Seeing the good reasons for this digit having been exported to the West from Egypt—from the presence of the 18·23 cubit in Egypt, and from the ·729 digit being the decimal base of the Greek long measures—it is not surprising to find it in use in Italy as a digit, and multiplied by 16 as a foot. The more so as the half of this foot, or 8 digits, is marked off as a measure on the Egyptian cubit rods (**33**). Though Queipo has opposed this connexion (not noticing the Greek link of the digit), he agrees that it is supported by the Egyptian square measure of the plethron, being equal to the Roman actus (**33**). The foot of 11·6 appears probably first in the prehistoric and early Greek remains, and is certainly found in Etrurian tomb dimensions as 11·59 (**25**). Dörpfeld considers this as the Attic foot, and states the foot of the Greek metrological relief at Oxford as 11·65 (or 11·61, Hultsch). Hence we see that it probably passed from the East through Greece to Etruria, and thence became the standard foot of Rome; there, though divided by the Italian duodecimal system into 12 unciae, it always maintained its original 16 digits, which are found marked on some of the foot-measures. The well-known ratio of 25:24 between the 12·16 foot and this we see to have arisen through one being ⅙ of 100 and the other 16 digits—16⅔ : 16 being as 25 : 24, the legal ratio. The mean of a dozen foot-measures (**1**) gives 11·616±·008, and of long lengths and buildings 11·607±·01. In Britain and Africa, however, the Romans used a rather longer form (**25**) of about 11·68, or a digit of ·730. Their series of measures was—

digitus,	4=palmus,	4=pes,	5=passus,	125=stadium,	8=milliare;
·726 inch	2·90	11·62	58·1	7262	58,100

also

uncia ·968=$\frac{1}{12}$ pes, palmipes 14·52=5 palmi, cubitus 17·43=6 palmi.

Either from its Pelasgic or Etrurian use or from Romans, this foot appears to have come into prehistoric remains, as the circle of Stonehenge (**26**) is 100 ft. of 11·68 across, and the same is found in one or two other cases. 11·60 also appears as the foot of some medieval English buildings (**25**).

We now pass to units between which we cannot state any connexion.

25·1.—The earliest sign of this cubit is in a chamber at Abydos (**44**) about 1400 B.C.; there, below the sculptures, the plain wall is marked out by red designing lines in spaces of 25·13±·03 in., which have no relation to the size of the chamber or to the sculpture. They must therefore have been marked by a workman using a cubit of 25·13. Apart from medieval and other very uncertain data, such as the Sabbath day's journey being 2000 middling paces for 2000 cubits, it appears that Josephus, using the Greek or Roman cubit, gives half as many more to each dimension of the temple than does the Talmud; this shows the cubit used in the Talmud for temple measures to be certainly not under 25 in. Evidence of the early period is given, moreover, by the statement in 1 Kings (vii. 26) that the brazen sea held 2000 baths; the bath being about 2300 cub. in., this would show a cubic of 25 in. The corrupt text in Chronicles of 3000 baths would need a still longer cubit; and, if a lesser cubit of 21·6 or 18 in be taken, the result for the size of the bath would be impossibly small. For other Jewish cubits see 18·2 and 21·6. Oppert (**24**) concludes from inscriptions that there was in Assyria a royal cubit of $\frac{7}{6}$ the U cubit, or 25·20; and four monuments show (**25**) a cubit averaging 25·28. For Persia Queipo (**33**) relies on, and develops, an Arab statement that the Arab *hashama* cubit was the royal Persian, thus fixing it at about 25 in.; and the Persian guerze at present is 25, the royal guerze being 1½ times this, or 37½ in. As a unit of 1·013, decimally multiplied, is most commonly to be deduced from the ancient Persian buildings, we may take 25·34 as the nearest approach to the ancient Persian unit.

21·6.—The circuit of the city wall of Khorsabad (**24**) is minutely stated on a tablet as 24,740 ft. (U), and from the actual size the U is therefore 10·806 in. Hence the recorded series of measures on the Senkereh tablet are valued (Oppert) as—

susi,	{ 20=(palm), { 60	3=U, =U, 60	6=qanu,	2=sa,	5=(*n*), =(*n*),	12=us,	30=kasbu.
·18 inch	3·6	10·80	64·8	129·6	648	7776	223,280

Other units are the suklum or ½U=5·4, and cubit of 2U=21·9 which are not named in this tablet. In Persia (**24**) the series on the same base was—

vitasti,	2=arasni,	360=asparasa,	30=parathañha,	2=gāv;
10·7 inches	21·4	7704	231,120	462,240

probably

yava,	6=angusta	10=vitasti;	and gama=$\frac{3}{5}$	arasni;	also bāzu=2	arasni.
·18 inch	1·07	10·7	12·8	21·4	42·8	21·4

The values here given are from some Persian buildings (**25**), which indicate 21·4, or slightly less; Oppert's value, on less certain data, is 21·52. The Egyptian cubits have an arm at 15 digits or about 10·9 marked on them, which seems like this same unit (**33**).

This cubit was also much used by the Jews (**33**), and is so often referred to that it has eclipsed the 25·1 cubit in most writers. The Gemara names 3 Jewish cubits (**2**) of 5, 6 and 7 palms; and, as Oppert (**24**) shows that 25·2 was reckoned 7 palms, 21·6 being 6 palms, we may reasonably apply this scale to the Gemara list, and read it as 18, 21·6 and 25·2 in. There is also a great amount of medieval and other data showing this cubit of 21·6 to have been familiar to the Jews after their captivity; but there is no evidence for its earlier date, as there is for the 25-in. cubit (from the brazen sea) and for the 18-in. cubit from the Siloam inscription.

From Assyria also it passed into Asia Minor, being found on the city standard of Ushak in Phrygia (**33**), engraved as 21·8, divided into the Assyrian foot of 10·8, and half and quarter, 5·4 and 2·7. Apparently the same unit is found (**18**) at Heraclea in Lucania, 21·86; and, as the general foot of the South Italians, or Oscan foot (**18**), best defined by the 100 feet square being $\frac{3}{10}$ of the jugerum, and therefore = 10·80 or half of 21·60. A cubit of 21·5 seems certainly to be indicated in prehistoric remains in Britain, and also in early Christian buildings in Ireland (**25**).

22·2.—Another unit not far different, but yet distinct, is found apparently in Punic remains at Carthage (**25**), about 11·16 (22·32), and probably also in Sardinia as 11·07 (22·14), where it would naturally be of Punic origin. In the Hauran 22·16 is shown by a basalt door (British Museum), and perhaps elsewhere in Syria (**25**). It is of some value to trace this measure, since it is indicated by some prehistoric English remains as 22·4.

20·0.—This unit may be that of the pre-Semitic Mesopotamians, as it is found at the early temple of Muḳayyir (Ur); and, with a few other cases (**25**), it averages 19·97. It is described by Oppert (**24**), from literary sources, as the great U of 222 susi or 39·96, double of 19·98; from which was formed a reed of 4 great U or 159·8. The same measure decimally divided is also indicated by buildings in Asia Minor and Syria (**25**).

19·2.—In Persia some buildings at Persepolis and other places (**25**) are constructed on a foot of 9·6, or cubit of 19·2; while the modern Persian arish is 38·27 or 2×19·13. The same is found very clearly in Asia Minor (**25**), averaging 19·3; and it is known in literature as the Pythic foot (**18**, **33**) of 9·75, or $\frac{1}{2}$ of 19·5, if Censorinus is rightly understood. It may be shown by a mark (**33**) on the 26th digit of Sharpe's Egyptian cubit = 19·2 in.

13·3.—This measure does not seem to belong to very early times, and it may probably have originated in Asia Minor. It is found there as 13·35 in buildings. Hultsch gives it rather less, at 13·1, as the "small Asiatic foot." Thence it passed to Greece, where it is found (**25**) as 13·36. In Romano-African remains it is often found, rather higher, or 13·45 average (**25**). It lasted in Asia apparently till the building of the palace at Mashita (A.D. 620), where it is 13·22, according to the rough measures we have (**25**). And it may well be the origin of the dirā‘ Stambuli of 26·6, twice 13·3. Found in Asia Minor and northern Greece, it does not appear unreasonable to connect it, as Hultsch does, with the Belgic foot of the Tungri, which was legalized (or perhaps introduced) by Drusus when governor, as $\frac{1}{8}$ longer than the Roman foot, or 13·07; this statement was evidently an approximation by an increase of 2 digits, so that the small difference from 13·3 is not worth notice. Further, the pertica was 12 ft. of 18 digits, *i.e.* Drusian feet.

Turning now to England, we find (**25**) the commonest building foot up to the 15th century averaged 13·22. Here we see the Belgic foot passed over to England, and we can fill the gap to a considerable extent from the itinerary measures. It has been shown (**31**) that the old English mile, at least as far back as the 13th century, was of 10 and not 8 furlongs. It was therefore equal to 79,200 in., and divided decimally into 10 furlongs 100 chains, or 1000 fathoms. For the existence of this fathom (half the Belgic pertica) we have the proof of its half, or yard, needing to be suppressed by statute (**9**) in 1439, as "the yard and full hand," or about 40 in.,—evidently the yard of the most usual old English foot of 13·22, which would be 39·66. We can restore then the old English system of long measure from the buildings, the statute-prohibition, the surviving chain and furlong, and the old English mile shown by maps and itineraries, thus:—

foot,	3=yard,	2=fathom,	10=chain,	10=furlong,	10=mile.
13·22	39·66	79·32	793	7932	79,320

Such a regular and extensive system could not have been put into use throughout the whole country suddenly in 1250, especially as it must have had to resist the legal foot now in use, which was enforced (**9**) as early as 950. We cannot suppose that such a system would be invented and become general in face of the laws enforcing the 12-in. foot. Therefore it must be dated some time before the 10th century, and this brings it as near as we can now hope to the Belgic foot, which lasted certainly to the 3rd or 4th century, and is exactly in the line of migration of the Belgic tribes into Britain. It is remarkable how near this early decimal system of Germany and Britain is the double of the modern decimal metric system. Had it not been unhappily driven out by the 12-in. foot, and repressed by statutes both against its yard and mile, we should need but a small change to place our measures in accord with the metre.

The Gallic leuga, or league, is a different unit, being 1·59 British miles by the very concordant itinerary of the Bordeaux pilgrim. This appears to be the great Celtic measure, as opposed to the old English, or Germanic, mile. In the north-west of England and in Wales this mile lasted as 1·56 British miles till 1500; and the perch of those parts was correspondingly longer till this century (**31**). The "old London mile" was 5000 ft., and probably this was the mile which was modified to 5280 ft., or 8 furlongs, and so became the British statute mile.

STANDARDS OF AREA.—We cannot here describe these in detail. Usually they were formed in each country on the squares of the long measures. The Greek system was—

foot,	36=hexapodes			
	100=..........acaena,		25=aroura,	4=plethron.
1.027 sq. ft.	36·96	102.68	2567	10,268

The Roman system was—

pes,	100=decempeda,	36=clima,	4=actus,	2=jugerum.
·94 sq. ft.	94	3384	13,536	27,072

jugerum,	2=heredium,	100=centuria,	4=saltus.
·6205 acre	1·241	124·1	496·4

STANDARDS OF VOLUME.—There is great uncertainty as to the exact values of all ancient standards of volume—the only precise data being those resulting from the theories of volumes derived from the cubes of feet and cubits. Such theories, as we have noticed, are extremely likely to be only approximations in ancient times, even if recognized then; and our data are quite inadequate for clearing the subject. If certain equivalences between volumes in different countries are stated here, it must be plainly understood that they are only known to be approximate results, and not to give a certain basis for any theories of derivation. All the actual monumental data that we have are alluded to here, with their amounts. The impossibility of safe correlation of units necessitates a division by countries.

Egypt.—The hon was the usual small standard; by 8 vases which have contents stated in hons (**8**, **12**, **20**, **22**, **33**, **40**) the mean is 29·2 cub. in. ± ·6; by 9 unmarked pottery measures (**30**) 29·1 ± ·16, and divided by 20; by 18 vases, supposed multiples of hon (**1**), 32·1 ± ·2. These last are probably only rough, and we may take 29·2 cub. in. ± ·5. This was reckoned (**6**) to hold 5 utens of water (uten.·. 1470 grains), which agrees well to the weight; but this was probably an approximation, and not derivative, as there is (**14**) a weight called shet of 4·70 or 4·95 uten, and this was perhaps the actual weight of a hon. The variations of hon and uten, however, cover one another completely. From ratios stated before Greek times (**35**) the series of multiples was—

ro,	8=hon,	4=honnu,	10=apet or besha	4=tama	10=(Theban),	10=sa.
3·65 cub. in.	29·2	116·8	1168	4672	11,680	116,800

(Theban) is the "great Theban measure."

In Ptolemaic times the artaba (2336·), modified from the Persian, was general in Egypt, a working equivalent to the Attic metretes—value 2 apet or $\frac{1}{2}$ tama; medimnus = tama or 2 artabas, and fractions down to $\frac{1}{400}$ artaba (**35**). In Roman times the artaba remained (Didymus), but $\frac{1}{6}$ was the usual unit (name unknown), and this was divided down to $\frac{1}{24}$ or $\frac{1}{144}$ artaba (**35**)—thus producing by $\frac{1}{72}$ artaba a working equivalent to the xestes and sextarius (**35**). Also a new Roman artaba (Didymus) of 1540· was brought in. Beside the equivalence of the hon to 5 utens weight of water, the mathematical papyrus (**35**) gives 5 besha = $\frac{2}{3}$ cubic cubit (Revillout's interpretation of this as 1 cubit^3 is impossible geometrically; see *Rev. Eg.*, 1881, for data); this is very concordant, but it is very unlikely for 3 to be introduced in an Egyptian derivation, and probably therefore only a working equivalent. The other ratio of Revillout and Hultsch, 320 hons = cubit^3, is certainly approximate.

Syria, Palestine and Babylonia.—Here there are no monumental data known; and the literary information does not distinguish the closely connected, perhaps identical, units of these lands. Moreover, none of the writers are before the Roman period, and many relied on are medieval rabbis. A large number of their statements are rough (**2**, **18**, **33**), being based on the working equivalence of the bath or epha with the Attic metretes, from which are sometimes drawn fractional statements which seem more accurate than they are. This, however, shows the bath to be about 2500 cub. in. There are two better data (**2**) of Epiphanius and Theodoret—Attic medimnus = 1$\frac{1}{2}$ baths, and saton ($\frac{1}{3}$ bath) = 1$\frac{3}{8}$ modii; these give about 2240 and 2260 cub. in. The best datum is in Josephus (*Ant.* iii. 15, 3), where 10 baths = 41 Attic or 31 Sicilian medimni, for which it is agreed we must read modii (**33**); hence the bath = 2300 cub. in. Thus these three different reckonings agree closely, but all equally depend on the Greek and Roman standards, which are not well fixed. The Sicilian modius here is $\frac{10}{81}$, or slightly under $\frac{1}{3}$, of the bath, and so probably a

Punic variant of the $\frac{1}{3}$ bath or saton of Phoenicia. One close datum, if trustworthy, would be log of water = Assyrian mina ∴ bath about 2200 cub. in. The rabbinical statement of cub. cubit of 21·5 holding 320 logs puts the bath at about 2250 cub. in.; their log-measure, holding six hen's eggs, shows it to be over rather than under this amount; but their reckoning of bath = $\frac{1}{2}$ cubit cubed is but approximate; by 21·5 it is 1240, by 25·1 it is 1990 cubic in. The earliest Hebrew system was—

(log,	4=kab)…………	‘issarón……………16	3=hin, 6	} = { bath, or epha },	10= { homer—wet. or kor—dry.
32 cub. in.	128	230	283	2300	23,000

‘Issarón (“ tenth-deal ”) is also called gomer. The log and kab are not found till the later writings; but the ratio of hin to ‘issarón is practically fixed in early times by the proportions in Num. xv. 4-9. Epiphanius stating great hin = 18 xestes, and holy hin = 9, must refer to Syrian xestes, equal to 24 and 12 Roman; this makes holy hin as above, and great hin a double hin, *i.e.* seah or saton. His other statements of saton = 56 or 50 sextaria remain unexplained, unless this be an error for bath = 56 or 50 Syr. sext. and ∴ = 2290 or 2560 cub. in. The wholesale theory of Revillout (35) that all Hebrew and Syrian measures were doubled by the Ptolemaic revision, while retaining the same names, rests entirely on the resemblance of the names apet and epha, and of log to the Coptic and late measure lok. But there are other reasons against accepting this, besides the improbability of such a change.

The Phoenician and old Carthaginian system was (**18**)—

log,	4=kab,	6=saton,	30=corus,
31 cub. in.	123	740	22,200

valuing them by 31 Sicilian = 41 Attic modii (Josephus, above).

The old Syrian system was (**18**)—

cotyle,	2=Syr. xestes,	18=sabitha or saton,	$1\frac{1}{2}$=collathon,	2=bath-artaba;
21 cub. in.	41	740	1110	2220

also

Syr. xestes,	45=maris,	2=metretes or artaba.
41	1850	3700

The later or Seleucidan system was (**18**)—

cotyle,	2=Syr. xestes,	90=Syr. metretes,
22	44	4000

the Syrian being $1\frac{1}{3}$ Roman sextarii.

The Babylonian system was very similar (**18**)—

($\frac{1}{4}$),	4=capitha,	{ 15=maris	18=…..epha,	10=homer,	6 =achane.
33 cub. in.	132	1980	2380	23,800	142,800

The approximate value from capitha = 2 Attic choenices (Xenophon) warrants us in taking the achane as fixed in the following system, which places it closely in accord with the preceding.

In Persia Hultsch states—

capetis…………	maris……………	48 =artaba,	40 72 } =achane,
74·4 cub. in.	1983	3570	142,800

the absolute values being fixed by artaba = 51 Attic choenices (Herod. i. 192). The maris of the Pontic system is $\frac{1}{2}$ of the above, and the Macedonian and Naxian maris $\frac{1}{10}$ of the Pontic (**18**). By the theory of maris = $\frac{1}{5}$ of $20·6^3$ it is 1755·; by maris = Assyrian talent, 1850, in place of 1850 or 1980 stated above; hence the more likely theory of weight, rather than cubit, connexion is nearer to the facts.

Aeginetan System.—This is so called from according with the Aeginetan weight. The absolute data are all dependent on the Attic and Roman systems, as there are no monumental data. The series of names is the same as in the Attic system (**18**). The values are $1\frac{1}{2}$ × the Attic (Athenaeus, Theophrastus, &c.) (**2, 18**), or more closely 11 to 12 times $\frac{1}{8}$ of Attic. Hence, the Attic cotyle being 17·5 cub. in., the Aeginetan is about 25·7. The Boeotian system (**18**) included the achane; if this = Persian, then cotyle = 24·7. Or, separately through the Roman system, the mnasis of Cyprus (**18**) = 170 sextarii; then the cotyle = 24·8. By the theory of the metretes being $1\frac{1}{2}$ talents Aeginetan, the cotyle would be 23·3 to 24·7 cub. in. by the actual weights, which have tended to decrease. Probably then 25·0 is the best approximation. By the theory (**18**) of 2 metretes = cube of the 18·67 cubit from the 12·45 foot, the cotyle would be about 25·4. within ·4; but then such a cubit is unknown among measures, and not likely to be formed, as 12·4 is $\frac{3}{5}$ of 20·6. The Aeginetan system then was—

cotyle,	4=choenix,	{ 3=chous……………16	8=………hecteus,	4=metretes, $1\frac{1}{2}$	} =medimnus.
25 cub. in.	100	300	800	3200	4800

This was the system of Sparta, of Boeotia (where the aporryma = 4 choenices, the cophinus = 6 choenices, and saites or saton or hecteus = 2 aporrymae, while 30 medimni = achane, evidently Asiatic connexions throughout), and of Cyprus (where 2 choes = Cyprian medimnus, of which 5 = medimnus of Salamis, of which 2 = mnasis (**18**)

Attic or Usual Greek System.—The absolute value of this system is far from certain. The best data are three stone slabs, each with several standard volumes cut in them (**11, 18**), and two named vases. The value of the cotyle from the Naxian slab is 15·4 (best, others 14·6–19·6); from a vase about 16·6; from the Panidum slab 17·1 (var. 16·2–18·2); from a Capuan vase 17·8; from the Ganus slab 17·8 (var. 17·–18·). From these we may take 17·5 as a fair approximation. It is supposed that the Panathenaic vases were intended as metretes; this would show a cotyle of 14·4–17·1. The theories of connexion give, for the value of the cotyle, metretes = Aeginetan talent, ∴ 15·4–16·6; metres $\frac{4}{3}$ of 12·16 cubed, ∴ 16·6; metretes = $\frac{27}{20}$ of 12·16 cubed, ∴ 16·8; medimnus = 2 Attic talents, hecteus = 20 minae, choenix = $2\frac{1}{2}$ minae, ∴ 16·75; metretes = 3 cub. spithami ($\frac{1}{2}$ cubit = 9·12), ∴ 17·5; 6 metretes = 2 ft. of 12·45 cubed, ∴ 17·8 cub. in. for cotyle. But probably as good theories could be found for any other amount; and certainly the facts should not be set aside, as almost every author has done, in favour of some one of half a dozen theories. The system of multiples was for liquids—

cyathus,	$1\frac{1}{2}$=oxybaphon,	4=cotyle,	12=chous,	12=metretes,
2·9 cub. in.	4·4	17·5	210	2520

with the tetarton (8·8), 2 = cotyle, 2 = xestes (35·), introduced from the Roman system. For dry measure—

cyathus,	6=cotyle,	4=choenix,	8=hecteus,	6=medimnus,
2·9 cub. in.	17·5	70	560	3360

with the xestes, and amphoreus (1680) = $\frac{1}{2}$ medimnus, from the Roman system. The various late provincial systems of division are beyond our present scope (**18**).

System of Gythium.—A system differing widely both in units and names from the preceding is found on the standard slab of Gythium in the southern Peloponnesus (*Rev. Arch.*, 1872). Writers have unified it with the Attic, but it is decidedly larger in its unit, giving 19·4 (var. 19·1–19·8) for the supposed cotyle. Its system is—

cotyle,	4=hemihecton,	4=chous,	3=(*n*).
58 cub. in.	232	932	2796

And with this agrees a pottery cylindrical vessel, with official stamp on it (ΔΗΜΟΣΙΟΝ, &c.), and having a fine black line traced round the inside, near the top, to show its limit; this seems to be probably very accurate, and contains 58·5 cub. in., closely agreeing with the cotyle of Gythium. It has been described (*Rev. Arch.*, 1872) as an Attic choenix. Gythium being the southern port of Greece, it seems not too far to connect this 58 cub. in. with the double of the Egyptian hon = 58·4, as it is different from every other Greek system.

Roman System.—The celebrated Farnesian standard congius of bronze of Vespasian, “ mensurae exactae in Capitolio P. X., ” contains 206·7 cub. in. (**2**), and hence the amphora 1654. By the sextarius of Dresden (**2**) the amphora is 1695; by the congius of Ste Geneviève (**2**) 1700 cub. in.; and by the ponderarium measures at Pompeii (**33**) 1540 to 1840, or about 1620 for a mean. So the Farnesian congius, or about 1650, may best be adopted. The system for liquid was—

quartarius,	4=sextarius,	6=congius,	4=urna,	2=amphora,
8·6 cub. in.	34·4	206	825	1650

for dry measure 16 sextarii = modius, 550 cub. in.; and to both systems were added from the Attic the cyathus (2·87), acetabulum (4·3) and hemina (17·2 cub. in.). The Roman theory of the amphora being the cubic foot makes it 1569 cub. in., or decidedly less than the actual measures; the other theory of its containing 80 librae of water would make it 1575 by the commercial or 1605 by the monetary libra—again too low for the measures. Both of these theories therefore are rather working equivalents than original derivations; or at least the interrelation was allowed to become far from exact.

Indian and Chinese Systems.—On the ancient Indian system see *Numismata Orientalia*, new ed., i. 24; on the ancient Chinese, *Nature*, xxx. 565, and xxxv. 318.

STANDARDS OF WEIGHT.— For these we have far more complete data than for volumes or even lengths, and can ascertain in many cases the nature of the variations, and their type in each place. The main series on which we shall rely here are those—(1) from Assyria (**38**) about 800 B.C.; (2) from the eastern Delta of Egypt (**29**) (Defenneh); (3) from western Delta (**28**) (Naucratis); (4) from Memphis (**44**)—all these about the 6th century B.C., and therefore before much interference from the decreasing coin standards; (5) from Cnidus; (6) from Athens; (7) from Corfu; and (8) from Italy (British Museum) (**44**). As other collections are but a fraction of the whole of these, and are much less completely examined, little if any good would be done by including them in the combined results, though for special types or inscriptions they will be mentioned.

146 grains.—The Egyptian unit was the kat, which varied between 138 and 155 grains (**28,29**). There were several families or varieties within this range, at least in the Delta, probably five or six in all (**29**). The original places and dates of these cannot yet be fixed, except for the lowest type of 138–140 grains; this belonged to Heliopolis (**7**), as two weights (**35**) inscribed of “ the treasury of An ” show 139·9 and 140·4, while a plain one from there gives 138·8; the variety 147–149 may belong to Hermopolis (**35**), according to an inscribed weight. The names of the kat and tema are fixed by being found on weights, the uten by inscriptions; the series was—

(*n*),	10=kat,	10=uten,	10=tema.
14·6 grs.	146	1460	14,600.

The tema is the same name as the large wheat measure (**35**), which was worth 30,000 to 19,000 grains of copper, according to Ptolemaic receipts and accounts (*Rev. Eg.*, 1881, 150), and therefore very likely worth 10 utens of copper in earlier times when metals were scarcer. The kat was regularly divided into 10; but another division, for the sake of interrelation with another system, was in $\frac{1}{3}$ and scarcely found except in the eastern Delta, where it is common (**29**); and it is known from a papyrus (**38**) to be a Syrian weight. The uten is found ÷6=245, in Upper Egypt (rare) (**44**). Another division (in a papyrus) (**38**) is a silver weight of $\frac{6}{10}$ kat = about 88—perhaps the Babylonian siglus of 86. The uten was also binarily divided into 128 peks of gold in Ethiopia; this may refer to another standard (see **129**) (**33**). The Ptolemaic copper coinage is on two bases—the uten, binarily divided, and the Ptolemaic five shekels (1050), also binarily divided. (This result is from a larger number than other students have used, and study by diagrams.) The theory (**3**) of the derivation of the uten from $\frac{1}{1500}$ cubic cubit of water would fix it at 1472, which is accordant; but there seems no authority either in volumes or weights for taking 1500 utens. Another theory (**3**) derives the uten from $\frac{1}{1000}$ of the cubic cubit of 24 digits, or better $\frac{6}{7}$ of 20·63; that, however, will only fit the very lowest variety of the uten, while there is no evidence of the existence of such a cubit. The kat is not unusual in Syria (**44**), and among the haematite weights of Troy (**44**) are nine examples, average 144, but not of extreme varieties.

129 grs.; **258** grs.
7750; 15,500;
465,000.

The great standard of Babylonia became the parent of several other systems; and itself and its derivatives became more widely spread than any other standard. It was known in two forms—one system (**24**) of—

um,	60=sikhir,	6=shekel,	10=stone,	6=maneh,	60=talent;
·36 grs.	21·5	129	1290	7750	465,000

and the other system double of this in each stage except the talent. These two systems are distinctly named on the weights, and are known now as the light and heavy Assyrian systems (**19**, **24**). (It is better to avoid the name Babylonian, as it has other meanings also.) There are no weights dated before the Assyrian bronze lion weights (**9**, **17**, **19**, **38**) of the 11th to 8th centuries B.C. Thirteen of this class average 127·2 for the shekel; 9 haematite barrel-shaped weights (**38**) give 128·2; 16 stone duck-weights (**38**), 126·5. A heavier value is shown by the precious metals—the gold plates from Khorsabad (**18**) giving 129, and the gold daric coinage (**21**, **35**) of Persia 129·2. Nine weights from Syria (**44**) average 128·8. This is the system of the "Babylonian" talent, by Herodotus = 70 minae Euboic, by Pollux = 70 minae Attic, by Aelian = 72 minae Attic, and, therefore, about 470,000 grains. In Egypt this is found largely at Naucratis (**28**, **29**), and less commonly at Defenneh (**29**). In both places the distribution, a high type of 129 and a lower of 127, is like the monetary and trade varieties above noticed; while a smaller number of examples are found, fewer and fewer, down to 118 grains. At Memphis (**44**) the shekel is scarcely known, and a $\frac{1}{2}$ mina weight was there converted into another standard (of 200). A few barrel weights are found at Karnak, and several egg-shaped shekel weights at Gebelen (**44**); also two cuboid weights from there (**44**) of 1 and 10 utens are marked as 6 and 60, which can hardly refer to any unit but the heavy shekel, giving 245. Hultsch refers to Egyptian gold rings of Dynasty XVIII. of 125 grains. That this unit penetrated far to the south in early times is shown by the tribute of Kush (**34**) in Dynasty XVIII.; this is of 801, 1443 and 23,741 kats, or 15 and 27 manehs and 7½ talents when reduced to this system. And the later Ethiopic gold unit of the pek (**7**), or $\frac{1}{128}$ of the uten, was 10·8 or more, and may therefore be the $\frac{1}{2}$ sikhir or obolos of 21·5. But the fraction $\frac{1}{128}$, or a continued binary division repeated seven times, is such a likely mode of rude subdivision that little stress can be laid on this. In later times in Egypt a class of large glass scarabs for funerary purposes seem to be adjusted to the shekel (**30**). Whether this system or the Phoenician of 224 grains was that of the Hebrews is uncertain. There is no doubt but that in the Maccabean times and onward 218 was the shekel; but the use of the word darkemôn by Ezra and Nehemiah, and the probabilities of their case, point to the daragmaneh, $\frac{1}{60}$ maneh or shekel of Assyria; and the mention of $\frac{1}{3}$ shekel by Nehemiah as poll tax nearly proves that the 129 and not 218 grains is intended, as 218 is not divisible by 3. But the Maccabean use of 218 may have been a reversion to the older shekel; and this is strongly shown by the fraction $\frac{1}{4}$ shekel (1 Sam. ix. 8), the continual mention of large decimal numbers of shekels in the earlier books, and the certain fact of 100 shekels being = mina. This would all be against the 129 or 258 shekel, and for the 218 or 224. There is, however, one good datum if it can be trusted: 300 talents of silver (2 Kings xviii. 14) are 800 talents on Sennacherib's cylinder (**34**), while the 30 talents of gold is the same in both accounts. Eight hundred talents on the Assyrian silver standard would be 267—or roundly 300—talents on the heavy trade or gold system, which is therefore probably the Hebrew. Probably the 129 and 224 systems coexisted in the country; but on the whole it seems more likely that 129 or rather 258 grains was the Hebrew shekel before the Ptolemaic times—especially as the 100 shekels to the mina is paralleled by the following Persian system (Hultsch)—

shekel, { 50 = mina.....	60 = talent of gold		
{ 60 = ...mina.................			60 = talent of trade,
129 grs.	6450 7750	387,000	465,000

the Hebrew system being

gerah,	20 = shekel,	100 = maneh,	30 = talent,
12·9 grs.	258 ?	25,800	774,000

and, considering that the two Hebrew cubits are the Babylonian and Persian units, and the volumes are also Babylonian, it is the more likely that the weights should have come with these. From the east this unit passed to Asia Minor; and six multiples of 2 to 20 shekels (av. 127) are found among the haematite weights of Troy (**44**), including the oldest of them. On the Aegean coast it often occurs in early coinage (**17**)—at Lampsacus 131–129, Phocaea 256–254, Cyzicus 252–247, Methymna 124·6, &c. In later times it was a main unit of North Syria, and also on the Euxine, leaden weights of Antioch (3), Callatia and Tomis being known (**38**). The mean of these eastern weights is 7700 for the mina, or 128. But the leaden weights of the west (**44**) from Corfu, &c., average 7580, or 126·3; this standard was kept up at Cyzicus in trade long after it was lost in coinage. At Corinth the unit was evidently the Assyrian and not the Attic, being 129·6 at the earliest (**17**) (though modified to double Attic, or 133, later) and being ÷3, and not into 2 drachms. And this agrees with the mina being repeatedly found at Corcyra, and with the same standard passing to the Italian coinage (**17**) similar in weight, and in division into $\frac{1}{3}$—the heaviest coinages (**17**) down to 400 B.C. (Terina, Velia, Sybaris, Posidonia, Metapontum, Tarentum, &c.) being none over 126, while later on many were adjusted to the Attic, and rose to 134. Six disk weights from Carthage (**44**) show 126. It is usually the case that a unit lasts later in trade than in coinage; and the prominence of this standard in Italy may show how it is that this mina (18 unciae = 7400) was known as the "Italic" in the days of Galen and Dioscorides (2).

126 grs.
6300.

A variation on the main system was made by forming a mina of 50 shekels. This is one of the Persian series (gold), and the $\frac{1}{4}$ of the Hebrew series noted above. But it is most striking when it is found in the mina form which distinguishes it. Eleven weights from Syria and Cnidus (**44**) (of the curious type with two breasts on a rectangular block) show a mina of 6250 (125·0); and it is singular that this class is exactly like weights of the 224 system found with it, but yet quite distinct in standard. The same passed into Italy and Corfu (**44**), averaging 6000—divided in Italy into unciae ($\frac{1}{12}$), and scripulae ($\frac{1}{288}$), and called litra (in Corfu?). It is known in the coinage of Hatria (**18**) as 6320. And a strange division of the shekel in 10 (probably therefore connected with this decimal mina) is shown by a series of bronze weights (**44**) with four curved sides and marked with circles (British Museum, place unknown), which may be Romano-Gallic, averaging 125 ÷ 10. This whole class seems to cling to sites of Phoenician trade, and to keep clear of Greece and the north—perhaps a Phoenician form of the 129 system, avoiding the sexagesimal multiples.

If this unit have any connexion with the kat, it is that a kat of gold is worth 15 shekels or $\frac{1}{4}$ mina of silver; this agrees well with the range of both units, only it must be remembered that 129 was used as gold unit, and another silver unit deduced from it. More likely then the 147 and 129 units originated independently in Egypt and Babylonia.

86 grs.
8600;
516,000.

From 129 grains of gold was adopted an equal value of silver = 1720, on the proportion of $1:13\frac{1}{3}$, and this was divided in 10 = 172—which was used either in this form, or its half, 86, best known as the siglus (**17**). Such a proportion is indicated in Num. vii., where the gold spoon of 10 shekels is equal in value to the bowl of 130 shekels, or double that of 70, *i.e.* the silver vessels were 200 and 100 sigli. The silver plates at Khorsabad (**18**) we find to be 80 sigli of 84·6. The Persian silver coinage shows about 86·0; the danak was $\frac{1}{3}$ of this or 28·7, Xenophon and others state it at about 84. As a monetary weight it seems to have spread, perhaps entirely, in consequence of the Persian dominion; it varies from 174· downwards, usually 167, in Aradus, Cilicia and on to the Aegean coast, in Lydia and in Macedonia (**17**). The silver bars found at Troy averaging 2744, or $\frac{1}{3}$ mina of 8232, have been attributed to this unit (**17**); but no division of the mina in $\frac{1}{3}$ is to be expected, and the average is rather low. Two haematite weights from Troy (**44**) show 86 and 87·2. The mean from leaden weights of Chios, Tenedos (**44**), &c., is 8430. A duck-weight of Camirus, probably early, gives 8480; the same passed on to Greece and Italy (**17**), averaging 8610; but in Italy it was divided, like all other units, into unciae and scripulae (**44**). It is perhaps found in Etrurian coinage as 175–172 (**17**). By the Romans it was used on the Danube (**18**), two weights of the first legion there showing 8610; and this is the mina of 20 unciae (8400) named by Roman writers. The system was—

obol,	6 = siglus,	100 = mina.	60 = talent.
14·3 grs.	86	8600	516,000

A derivation from this was the $\frac{1}{3}$ of 172, or 57·3, the so-called Phocaean drachma, equal in silver value to the $\frac{1}{60}$ of the gold 258 grains. It was used at Phocaea as 58·5, and passed to the colonies of Posidonia and Velia as 59 or 118. The colony of Massilia brought it into Gaul as 58·2–54·9.

224 grs.
11,200;
672,000.

That this unit (commonly called Phoenician) is derived from the 129 system can hardly be doubted, both being so intimately associated in Syria and Asia Minor. The relation is 258 : 229 :: 9 : 8; but the exact form in which the descent took place is not settled: $\frac{1}{80}$ or 129 of gold is worth 57 of silver or a drachm, $\frac{1}{4}$ of 230 (or by trade weights 127 and 226); otherwise, deriving it from the silver weight of 86 already formed, the drachm is $\frac{1}{3}$ of the stater, 172, or double of the Persian danak of 28·7, and the sacred unit of Didyma in Ionia was this half-drachm, 27; or thirdly, what is indicated by the Lydian coinage (**17**), 86 of gold was equal to 1150 of silver, 5 shekels or $\frac{1}{10}$ mina. Other proposed derivations from the kat or pek are not satisfactory. In actual use this unit varied greatly: at Naucratis (**29**) there are groups of it at 231, 223 and others down to 208; this is the earliest form in which we can study it, and the corresponding values to these are 130 and 126, or the gold and trade varieties of the Babylonian, while the lower tail down to 208 corresponds to the shekel down to 118, which is just what is found. Hence the 224 unit seems to have been formed from the 129, after the main families or types of that had arisen. It is scarcer at Defenneh (**29**) and rare at Memphis (**44**). Under the Ptolemies, however, it became the great unit of Egypt, and is very prominent in the later literature in consequence (**18, 35**). The average of coins (**21**) of Ptolemy I. gives 219·6, and thence they gradually diminish to 210, the average (**33**) of the whole series of Ptolemies being 218. The "argenteus" (as Revillout transcribes a sign in the papyri) (**35**) was of 5 shekels, or 1090; it arose about 440 B.C., and became after 160 B.C. a weight unit for copper. In Syria, as early as the 15th century B.C., the tribute of the Rutennu, of Naharaina, Megiddo, Anaukasa, &c. (**34**), is on a basis of 454–484 kats, or 300 shekels ($\frac{1}{10}$ talent) of 226 grains. The commonest weight at Troy (**44**) is the shekel, averaging 224. In coinage it is one of the commonest units in early times; from Phoenicia, round the coast to Macedonia, it is predominant (**17**); at a maximum of 230 (Ialysus), it is in Macedonia 224, but seldom exceeds 220 elsewhere, the earliest Lydian of the 7th century being 219, and the general average of coins 218. The system was—

($\frac{1}{8}$),	8 = drachm,	4 = shekel,	25 = mina,	120 = talent.
7 grs.	56	224	5600	672,000

From the Phoenician coinage it was adopted for the Maccabean. It is needless to give the continual evidences of this being the later Jewish shekel, both from coins (max. 223) and writers (**2, 18, 33**); the question of the early shekel we have noticed already under 129. In Phoenicia and Asia Minor the mina was specially made in the form with two breasts (**44**), 19 such weights averaging 5600 (= 224); and thence it passed into Greece, more in a double value of 11,200 (= 224). From Phoenicia this naturally became the main Punic unit; a bronze weight from Iol (**18**), marked 100, gives a drachma of 56 or 57 (224–228); and a Punic inscription (**18**) names 28 drachmae = 25 Attic, and ∴ 57 to 59 grains (228–236); while a probably later series of 8 marble disks from Carthage (**44**) show 208, but vary from 197 to 234. In Spain it was 236 to 216 in different series (**17**), and it is a question whether the Massiliote drachmae of 58-55 are not Phoenician rather than Phocaic. In Italy this mina became naturalized, and formed the "Italic mina" of Hero, Priscian, &c.; also its double, the mina of 26 unciae or 10,800, = 50 shekels of 216; the average of 42 weights gives 5390 (= 215·6), and it was divided both into 100 drachmae, and also in the Italic mode of 12 unciae and 288 scripulae (**44**). The talent was of 120 minae of 5400, or 3000 shekels, shown by the talent from Herculaneum, TA, 660,000 and by the weight inscribed PONDO CXXV. (*i.e.* 125 librae) TALENTUM SICLORVM. iii., *i.e.* talent of 3000 shekels (**2**) (the M being omitted; just as Epiphanius describes this talent as 125 librae, or *θ* (= 9) nomismata, for 9000). This gives the same approximate ratio 96:100 to the libra as the usual drachma reckoning. The Alexandrian talent of Festus, 12,000 denarii, is the same talent again. It is believed that this mina ÷ 12 unciae by the Romans is the origin of the Arabic raṭl of 12 ūkīyas, or 5500 grains (**33**), which is said to have been sent by Harun al-Rashid to Charlemagne, and so to have originated the French monetary pound of 5666 grains. But, as this is probably the same as the English monetary pound, or tower pound of 5400, which was in use earlier (see Saxon coins), it seems more likely that this pound (which is common in Roman weights) was directly inherited from the Roman civilization.

80 grs.
4000;
400,000.

Another unit, which has scarcely been recognized in metrology hitherto, is prominent in the weights from Egypt—some 50 weights from Naucratis and 15 from Defenneh plainly agreeing on this and on no other basis. Its value varies between 76·5 and 81·5—mean 79 at Naucratis (**29**) or 81 at Defenneh (**29**). It has been connected theoretically with a binary division of the 10 shekels or "stone" of the Assyrian systems (**28**), 1290 ÷ 16 being 80·6; this is suggested by the most usual multiples being 40 and 80 = 25 and 50 shekels of 129; it is thus akin to the mina of 50 shekels previously noticed. The tribute of the Asi, Rutennu, Khita, Assaru, &c., to Thothmes III. (**34**), though in uneven numbers of kats, comes out in round thousands of units when reduced to this standard. That this unit is quite distinct from the Persian 86 grains is clear in the Egyptian weights, which maintain a wide gap between the two systems. Next, in Syria three inscribed weights of Antioch and Berytus (**18**) show a mina of about 16,400, or 200 × 82. Then at Abydus, or more probably from Babylonia, there is the large bronze lion-weight, stated to have been originally 400,500 grains; this has been continually ÷ 60 by different writers, regardless of the fact (*Rev. arch.*, 1862, 30) that it bears the numeral 100; this therefore is certainly a talent of 100 minae of 4005; and as the mina is generally 50 shekels in Greek systems it points to a weight of 80·1. Farther west the same unit occurs in several Greek weights (**44**) which show a mina of 7800 to 8310, mean 8050 ÷ 100 = 80·5. Turning to coinage, we find this often, but usually overlooked as a degraded form of the Persian 86 grains siglos. But the earliest coinage in Cilicia, before the general Persian coinage (**17**) about 380 B.C., is Tarsus, 164 grains; Soli, 169, 163, 158; Nagidus, 158, 161-153 later; Issus, 166; Mallus, 163-154—all of which can only by straining be classed as Persian; but they agree to this standard, which, as we have seen, was used in Syria in earlier times by the Khita, &c. The Milesian or "native" system of Asia Minor (**18**) is fixed by Hultsch at 163 and 81·6 grains—the coins of Miletus (**17**) showing 160, 80 and 39. Coming down to literary evidence, this is abundant. Böckh decides that the "Alexandrian drachma" was $\frac{6}{5}$ of the Solonic 67, or = 80·5, and shows that it was not Ptolemaic, or Rhodian, or Aeginetan, being distinguished from these in inscriptions (**2**). Then the "Alexandrian mina" of Dioscorides and Galen (**2**) is 20 unciae = 8250; in the "Analecta" (**2**) it is 150 or 158 drachmae = 8100. Then Attic: Euboic or Aeginetan :: 18:25 in the metrologists (**2**), and the Euboic talent = 7000 "Alexandrian" drachmae; the drachma therefore is 80·0. The "Alexandrian" wood talent: Attic talent :: 6:5 (Hero, Didymus), and ∴ 480,000, which is 60 minae of 8000. Pliny states the Egyptian talent at 80 librae = 396,000; evidently = the Abydus lion talent, which is ÷ 100, and the mina is ∴ 3960, or 50 × 79·2. The largest weight is the "wood" talent of Syria (**18**) = 6 Roman talents, or 1,860,000, evidently 120 Antioch minae of 15,500 or 2 × 7750. This evidence is too distinct to be set aside; and, exactly confirming as it does the Egyptian weights and coin weights, and agreeing with the early Asiatic tribute, it cannot be overlooked in future. The system was

drachm,	2 = stater,	50 = mina,	{ 50 = talent.	60 = Greek talent.
80 grs.	160	8000	400,000	480,000

207 grs. to **190**
9650;
579,000.

This system, the Aeginetan, one of the most important to the Greek world, has been thought to be a degradation of the Phoenician (**17, 21**), supposing 220 grains to have been reduced in primitive Greek usage to 194. But we are now able to prove that it was an independent system—(1) by its not ranging usually over 200 grains in Egypt before it passed to Greece; (2) by its earliest example, perhaps before the 224 unit existed, not being over 208; and (3) by there being no intermediate linking on of this to the Phoenician unit in the large number of Egyptian weights, nor in the Ptolemaic coinage, in which both standards are used. The first example (**30**) is one with the name of Amenhotep I. (17th century B.C.) marked as "gold 5," which is 5 × 207·6. Two other marked weights are from Memphis (**44**), showing 201·8 and 196·4, and another Egyptian 191·4. The range of the (**34**) Naucratis weights is 186 to 199, divided in two groups averaging 190 and 196, equal to the Greek monetary and trade varieties. Ptolemy I. and II. also struck a series of coins (**32**) averaging 199. In Syria haematite weights are found (**30**) averaging 198·5, divided into 99·2, 49·6 and 24·8; and the same division is shown by gold rings from Egypt (**38**) of 24·9. In the medical papyrus (**38**) a weight of $\frac{2}{3}$ kat is used, which is thought to be Syrian; now $\frac{2}{3}$ kat = 92 to 101 grains, or just this weight which we have found in Syria; and the weights of $\frac{2}{3}$ and $\frac{1}{3}$ kat are very rare in Egypt except at Defenneh (**29**), on the Syrian road, where they abound. So we have thus a weight of 207-191 in Egypt on marked weights, joining therefore completely with the Aeginetan unit in Egypt of 199 to 186, and coinage of 199, and strongly connected with Syria, where a double mina of Sidon (**18**) is 10,460 or 50 × 209·2. Probably before any Greek coinage we find this among the haematite weights of Troy (**44**), ranging from 208 to 193·2 (or 104-96·6), *i.e.* just covering the range from the earliest Egyptian down to the early Aeginetan coinage. Turning now to the early coinage, we see the fuller weight kept up (17) at Samos (202), Miletus (201), Calymna (100, 50), Methymna and Scepsis (99, 49),[1] Ionia (197); while the coinage of Aegina, (**17, 12**), which by its wide diffusion made this unit best known, though a few of its earliest staters go up even to 207, yet is characteristically on the lower of the two groups which we recognize in Egypt, and thus started what has been considered the standard value of 194, or usually 190, decreasing afterwards to 184. In later times, in Asia, however, the fuller weight, or higher Egyptian group, which we have just noticed in the coinage, was kept up (**17**) into the series of cistophori (196-191), as in the Ptolemaic series of 199. At Athens the old mina was fixed by Solon at 150 of his drachmae (**18**) or 9800 grains, according to the earliest drachmae, showing a stater of 196; and this continued to be the trade mina in Athens, at least until 160 B.C., but in a reduced form, in which it equalled only 138 Attic drachmae, or 9200. The Greek mina weights show (**44**), on an average of 37,9650 (= stater of 193), varying from 186 to 199. In the Hellenic coinage it varies (**18**) from a maximum of 200 at Pharae to 192, usual full weight; this unit occupied (**17**) all central Greece, Peloponnesus and most of the islands. The system was—

obol,	6 = drachm,	2 = stater,	50 = mina,	60 = talent.
16 grs.	96	192	9600	576,000

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[1] That this unit was used for gold in Egypt, one thousand years before becoming a silver coin weight in Asia Minor, need not be dwelt on, when we see in the coinage of Lydia (**17**) gold pieces and silver on the same standard, which was expressly formed for silver alone, *i.e.* 84 grains. The Attic and Assyrian standards were used indifferently for either gold or silver.

It also passed into Italy, but in a smaller multiple of 35 drachmae, or $\frac{1}{4}$ of the Greek mina; 12 Italian weights (**44**) bearing value marks (which cannot therefore be differently attributed) show a libra of 2400 or $\frac{1}{4}$ of 9600, which was divided in unciae and sextulae, and the full-sized mina is known as the 24 uncia mina, or talent of 120 librae of Vitruvius and Isidore (**18**) = 9900. Hultsch states this to be the old Etruscan pound.

412 4950 grs. With the trade mina of 9650 in Greece, and recognized in Italy, we can hardly doubt that the Roman libra is the half of this mina. At Athens it was 2×4900, and on the average of all the Greek weights it is 2×4825, so that 4950—the libra—is as close as we need expect. The division by 12 does not affect the question, as every standard that came into Italy was similarly divided. In the libra, as in most other standards, the value which happened to be first at hand for the coinage was not the mean of the whole of the weights in the country; the Phoenician coin weight is below the trade average, the Assyrian is above, the Aeginetan is below, but the Roman coinage is above the average of trade weights, or the mean standard. Rejecting all weights of the lower empire, the average (**44**) of about 100 is 4956; while 42 later Greek weights (nomisma, &c.) average 4857, and 16 later Latin ones (solidus, &c.) show 4819. The coinage standard, however, was always higher (**18**); the oldest gold shows 5056, the Campanian Roman 5054, the consular gold 5037, the aurei 5037, the Constantine solidi 5053 and the Justinian gold 4996. Thus, though it fell in the later empire, like the trade weight, yet it was always above that. Though it has no exact relation to the congius or amphora, yet it is closely = 4977 grains, the $\frac{1}{80}$ of the cubic foot of water. If, however, the weight in a degraded form, and the foot in an undegraded form, come from the East, it is needless to look for an exact relation between them, but rather for a mere working equivalent, like the 1000 ounces to the cubit foot in England. Böckh has remarked the great diversity between weights of the same age—those marked "Ad Augusti Temp" ranging 4971 to 5535, those tested by the fussy praefect Q. Junius Rusticus vary 4362 to 5625, and a set in the British Museum (**44**) belonging together vary 4700 to 5168. The series was—

siliqua,	6 = scripulum,	4 = sextula,	6 = uncia,	12 = libra,
2·87 grs.	17·2	68·7	412	4950

the greater weight being the centumpondium of 495,000. Other weights were added to these from the Greek system—

obolus,	6 = drachma,	2 = sicilicus,	4 = uncia;
8·6 grs.	51·5	103	412

and the sextula after Constantine had the name of solidus as a coin weight, or nomisma in Greek, marked N on the weights. A beautiful set of multiples of the scripulum was found near Lyons (**38**), from 1 to 10×17·28 grains, showing a libra of 4976. In Bryzantine times in Egypt glass was used for coin-weights (**30**), averaging 68·0 for the solidus = 4896 for the libra. The Saxon and Norman ounce is said to average 416·5 (*Num. Chron.*, 1871, 42), apparently the Roman uncia inherited.

67 grs. 6700; 402,000. The system which is perhaps the best known, through its adoption by Solon in Athens, and is thence called Attic or Solonic, is nevertheless far older than its introduction into Greece, being found in full vigour in Egypt in the 6th century B.C. It has been usually reckoned as a rather heavier form of the 129 shekel, increased to 134 on its adoption by Solon. But the Egyptian weights render this view impossible. Among them (**29**) the two contiguous groups can be discriminated by the 129 being mulliplied by 30 and 60, while the 67 or 134 is differently ×25, 40, 50 and 100. Hence, although the two groups overlap owing to their nearness, it is impossible to regard them as all one unit. The 129 range is up to 131·8, while the Attic range is 130 to 138 (65-69). Hultsch reckons on a ratio of 24:25 between them, and this is very near the true values; the full Attic being 67·3, the Assyrian should be 129·2, and this is just the full gold coinage weight. We may perhaps see the sense of this ratio through another system. The 80-grain system, as we have seen, was probably formed by binarily dividing the 10 shekels, or "stone"; and it had a talent (Abydus lion) of 5000 drachmae; this is practically identical with the talent of 6000 Attic drachmae. So the talent of the 80-grain system was sexagesimally divided for the mina which was afterwards adopted by Solon. Such seems the most likely history of it, and this is in exact accord with the full original weight of each system. In Egypt the mean value at Naucratis (**29**) was 66·7, while at Defenneh (**29**) and Memphis (**44**)—probably rather earlier—it was 67·0. The type of the grouping is not alike in different places, showing that no distinct families had arisen before the diffusion of this unit in Egypt; but the usual range is 65·5 to 69·0. Next it is found at Troy (**44**) in three cases, all high examples of 68·2 to 68·7; and these are very important, since they cannot be dissociated from the Greek Attic unit, and yet they are of a variety as far removed as may be from the half of the Assyrian, which ranges there from 123·5 to 131; thus the difference of unit between Assyrian and Attic in these earliest of all Greek weights is very strongly marked. At Athens a low variety of the unit was adopted for the coinage, true to the object of Solon in depreciating debts; and the first coinage is of only 65·2, or scarcely within the range of the trade weights (**28**); this seems to have been felt, as, contrary to all other states, Athens slowly increased its coin weight up to 66·6, or but little under the trade average. It gradually supplanted the Aeginetan standard in Greece and Italy as the power of Athens rose; and it was adopted by Philip and Alexander (**17**) for their great gold coinage of 133 and 66·5. This system is often known as the "Euboic," owing to its early use in Euboea, and its diffusion by trade from thence. The series was—

chalcous,	8 = obolus,	6 = drachma,	100 = mina,	60 = talanton.
1·4 grs.	11·17	67	6700	402,000

Turning now to its usual trade values in Greece (**44**), the mean of 113 gives 67·15; but they vary more than the Egyptian examples, having a sub-variety both above and below the main body, which itself exactly coincides with the Egyptian weights. The greater part of those weights which bear names indicate a mina of double the usual reckoning, so that there was a light and a heavy system, a mina of the drachma and a mina of the stater, as in the Phoenician and Assyrian weights. In trade both the minae were divided in $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{3}$, and $\frac{1}{6}$, regardless of the drachmae. This unit passed also into Italy, the libra of Picenum and the double of the Etrurian and Sicilian libra (**17**); it was there divided in unciae and scripulae (**44**), the mean of 6 from Italy and Sicily being 6600; one weight (bought in Smyrna) has the name "Leitra" on it. In literature it is constantly referred to; but we may notice the "general mina" (Cleopatra), in Egypt, 16 unciae = 6600; the Ptolemaic talent, equal to the Attic in weight and divisions (Hero, Didymus); the Antiochian talent, equal to the Attic (Hero); the treaty of the Romans with Antiochus, naming talents of 80 librae, *i.e.* mina of 16 unciae; the Roman mina in Egypt, of 15 unciae, probably the same diminished; and the Italic mina of 16 unciae. It seems even to have lasted in Egypt till the middle ages, as Jabarti and the "kātīb's guide" both name the raṭl misri (of Cairo) as 144 dirhems = 6760.

Authorities.—(**1**) A. Aurès, *Métrologie égyptienne* (1880); (**2**) A. Böckh, *Metrologische Untersuchungen* (1838) (general); (**3**) P. Bortolotti, *Del primitivo cubito egizio* (1883); (**4**) J. Brandis, *Münz-, Mass-, und Gewicht-Wesen* (1866) (specially Assyrian); (**5**) H. Brugsch, in *Zeits. äg. Sp.* (1870) (Edfu); (**6**) M. F. Chabas, *Détermination métrique* (1867) (Egyptian volumes); (**7**) Id., *Recherches sur les poids, mesures, et monnaies des anciens Égyptiens*; (**8**) Id., *Ztschr. f. ägypt. Sprache* (1867, p. 57; 1870, p. 122) (Egyptian volumes); (**9**) H. W. Chisholm, *Weighing and Measuring* (1877) (history of English measures); (**10**) Id., *Ninth Rep. of Warden of Standards* (1875) (Assyrian); (**11**) A. Dumont, *Mission en Thrace* (Greek volumes); (**12**) Eisenlohr, *Ztschr. äg. Sp.* (1875) (Egyptian hon); (**13**) W. Golénischeff, in *Rev. égypt.* (1881), 177 (Egyptian weights); (**14**) C. W. Goodwin, in *Ztschr. äg. Sp.* (1873), p. 16 (shet); (**15**) B. V. Head, in *Num. Chron.* (1875); (**16**) Id., *Jour. Inst. of Bankers* (1879) (systems of weight); (**17**) Id., *Historia numorum* (1887) (essential for coin weights and history of systems); (**18**) F. Hultsch, *Griechische und römische Metrologie* (1882) (essential for literary and monumental facts); (**19**) Ledrain, in *Rev. égypt.* (1881), p. 173 (Assyrian); (**20**) Leemans, *Monumens égyptiens* (1838) (Egyptian hon); (**21**) T. Mommsen, *Histoire de la monnaie romaine*; (**22**) Id., *Monuments divers* (Egyptian weights); (**23**) Sir Isaac Newton, *Dissertation upon the Sacred Cubit* (1737); (**24**) J. Oppert, *Étalon des mesures assyriennes* (1875); (**25**) W. M. F. Petrie, *Inductive Metrology* (1877) (principles and tentative results); (**26**) Id., *Stonehenge* (1880); (**27**) Id., *Pyramids and Temples of Gizeh* (1883); (**28**) Id., *Naukratis*, i. (1886) (principles, lists, and curves of weights); (**29**) Id., *Tanis*, ii. (1887) (lists and curves); (**30**) Id., *Arch. Jour.* (1883), 419 (weights, Egyptian, &c.); (**31**) Id., *Proc. Roy. Soc. Edin.* (1883–1884), 254 (mile); (**32**) R. S. Poole, *Brit. Mus. Cat. of Coins, Egypt*; (**33**) Vazquez Queipo, *Essai sur les systèmes métriques* (1859) (general, and specially Arab and coins); (**34**) *Records of the Past*, vols. i., ii., vi. (Egyptian tributes, &c.); (**35**) E. Revillout, in *Rev. ég.* (1881) (many papers on Egyptian weights, measures, and coins); (**36**) E. T. Rogers, *Num. Chron.* (1873) (Arab glass weights); (**37**) M. H. Sauvaire, in *Jour. As. Soc.* (1877), translation of Elias of Nisibis, with notes (remarkable for history of balance); Schillbach (lists of weights, all in next); (**38**) M. C. Soutzo, *Étalons pondéraux primitifs* (1884) (lists of all weights published to date); (**39**) Id., *Systèmes monétaires primitifs* (1884) (derivation of units); (**40**) G. Smith, in *Zeits. äg. Sp.* (1875); (**41**) L. Stern, in *Rev. ég.* (1881), 171 (Egyptian weights); (**42**) P. Tannery, *Rev. arch.* xli. 152; (**43**) E. Thomas, *Numismata orientalia*, pt. i. (Indian weights); (**44**) a great amount of material of weighings of weights of Troy (supplied through Dr Schliemann's kindness), Memphis, at the British Museum, Turin, &c.

(W. M. F. P.)

III. Commercial

1. *Denominations.*—The denominations of trade weights and measures at present used in the United Kingdom are represented by "Board of Trade standards," by which are regulated the accuracy of the common weights and measures handled in shops, &c.:[1]

Imperial Measures of Length.—100 feet, 66 feet or a chain of 100 links, rod, pole, or perch, measures from 10 feet to 1 foot;

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[1] Board of Trade Model Regulations, 1892; Weights and Measures Acts, 1878 1889, 1892, 1893.

18 inches; yard of 36 inches, ½, ¼, ⅛, 1/16 yard, nail, inch, and duodecimal, decimal and binary parts of the inch.

Imperial Measures of Capacity.—Liquid measures from 32 gallons to 1 gallon, quart, pint, ½ pint, gill, ½ gill, ¼ gill. Dry measures of bushel, ½ bushel, peck, gallon, quart, pint, ½ pint.

Apothecaries' Measures.—40 fluid ounces to ½ fl. oz., 16 fluid drachms to ½ fl. dr., 60 minims to 1 minim.

Avoirdupois Weights.—Cental (100 ℔), 56 ℔ (½ cwt.), 28 ℔, 14 ℔ (stone), 7, 4, 2, 1 ℔; 8, 4, 2, 1, ½ ounce (8 drams); 4, 2, 1, ½ drams.

Troy Weights.—The ounce (480 gr.) and multiples and decimal parts of the ounce troy from 500 ounces to 0·001 oz.

Apothecaries' Weights.—10 oz. to 1 oz. (480 gr.); 4 drachms to ½ oz.; 2, 1 drachms; 2 scruples to ½ scruple; and 6 grains to ½ grain.

Pennyweights.—20 dwt. (480 grains), 10, 5, 3, 2, 1 dwts.

Grain Weights.—4000, 2000, 1000 gr. (making 7000 gr. or 1 ℔), 500 to 0·01 gr.

2. The international trade metric weights and measures (1897) handled in shops, &c., of which there are also Board of Trade standards, are set out as follows:—

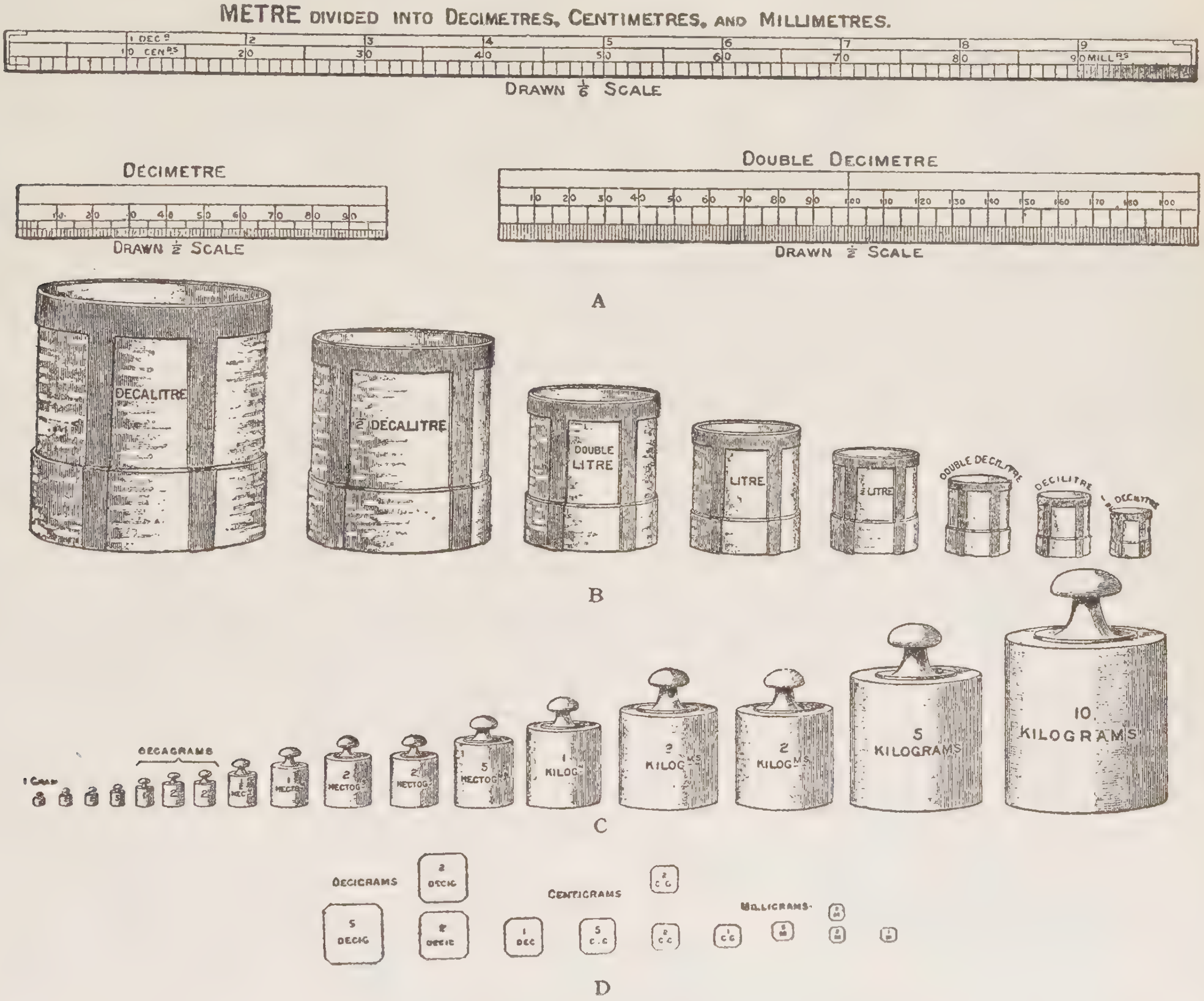
METRE DIVIDED INTO DECIMETRES, CENTIMETRES, AND MILLIMETRES.
1 DECᴹ
10 CENᴿˢ
2
20
3
30
4
40
5
50
6
60
7
70
8
80
9
90 MILLᴿˢ
DRAWN 1/6 SCALE
DECIMETRE
DRAWN ½ SCALE
DOUBLE DECIMETRE
DRAWN ½ SCALE
A
DECALITRE
½ DECALITRE
DOUBLE LITRE
LITRE
½ LITRE
DOUBLE DECILITRE
DECILITRE
½ DECILITRE
B
1 GRAM
DECAGRAMS
HECTOG
2 HECTOG
5 HECTOG
1 KILOG
2 KILOGMS
5 KILOGRAMS
10 KILOGRAMS
C
DECIGRAMS
5 DECIG
2 DECIG
1 DEC
CENTIGRAMS
5 C.G
2 C.G
MILLIGRAMS
D

FIG. 9.—International Metric Trade Weights and Measures, 1897. A, linear; B, capacity; C, and D, weights.

Length.—Decametre or 10 metres; double metre; metre or 1000 millimetres; decimetre or 0·1 metre; centimetre or 0·01 metre; millimetre.

Capacity.—20 litres; 10 litres or decalitre; 5, 2, 1, 0·5, 0·2, 0·1 (decilitre); 0·05, 0·02, 0·01 (centilitre); 0·005, 0·002, 0·001 (millilitre) litres.

Cubic Measures.—1000 (litre), 500, 200, 100, 50, 20, 10, 5, 2 cubic centimetres, 1 c.c. or 1000 cubic millimetres.

Weights.—20, 10, 5, 2, 1 kilograms; 500 to 1 gramme; 5 to 1 decigram; 5 to 1 centigram; 5 to 1 milligram. (Series 5, 2, 2,^{1} 1, *i.e.* with a duplicate weight of "2.")

3. *Equivalents.*—The metric equivalents of the units of the metric system in terms of the imperial system, as recalculated in 1897, are as follows:—[1]

IMPERIAL TO METRIC

1 yard	=	0·914399 m.
1 square yard	=	0·836126 m².
1 cubic inch	=	16·387 c.c.
1 gallon[2]	=	4·5459631 l.
1 pound (7000 grains)	=	0·45359243 kg.
1 ounce troy (480 gr.)	=	31·1035 grammes.
1 fluid drachm	=	3·552 millilitres (ml.).
1 fluid ounce	=	2·84123 centilitres (cl.).

METRIC TO IMPERIAL

1 metre (m.) at 0° C.	=	39·370113 inches at 62° F.
1 square metre (m².)	=	10·7639 square feet.
1 cubic decimetre (c.d.) or 1000 cubic centimetres (c.c.)	=	61·024 cubic inches.
1 litre (l.)	=	1·7598 pints.
1 kilogram (kg.)	=	2·2046223 ℔ avoir.
1 gramme (g.)	=	15·4323564 grains or 0·7716 scruple.

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[1] *Metric Equivalents*, King's Printers (1898).

[2] The equivalent of the litre in gallons may also be derived as follows:—

Let $P(1-p/d)=P^1(1-p/d')$, where P is the weight of the water contained in the gallon when weighed in London—g. London = g. Paris (45°) × 1·000577.

The correction for temperature, 62° F., is −0·0906 in.; hence 29·9094 inches. One inch = 25·4 mm.; also 29·9094 × 25·4 = 759·69876; and 759·698761 × 1·000577 = 760·137 mm. P^1 is the weight of the brass weights (10 ℔) $\Delta = 8·143$.

p, the density (0·001218738) of dry air, containing 4 vols. of carbonic acid in 10,000 vols.; $t = 16·667°$ C.; $B = 760·137$ mm. of mercury at 0°, lat. 45°, and at sea-level. Coefficient of expansion of air = 0·00367; Δ mercury at 0° C. = 13·595. d is the density of water at 62° F. (16·667° C.) = 0·9988611. d^1, the density of the brass as above. 10 ℔ = 4·5359243 kg.

From the above it follows that P = 4·5407857 kg. Therefore—1 gallon = P/0·9988611 = 4·5459631 litres.

The equivalents of the Russian weights and measures, in terms also of the imperial and metric weights and measures, were recalculated in 1897.[1] The following are the leading equivalents:

1 Russian pound = { 0·025 pood.
96 zolotniks.
9216 dolis.
= 0·40951240 kg.
= 0·90282018 ℔ avoir.

1 archinne = { 0·00066 verst.
0·33̇ sagène.
16 verchoks.
280 liniias.
= 0·711200 metre.
= 0·777778 yard.

1 vedro = { 10 schtoffs
= 100 tcharkas
= 12·299 litres
= 2·7056 gallons.

1 tchetverte = 8 tchetveriks
= 2·0991 hectolitres
= 5·7719 bushels.

4. *Local Control.*—The necessary local inspection and verification of weights and measures in use for trade (as distinct from the verbal and written use of weights and measures) is in the United Kingdom undertaken by inspectors of weights and measures, who are appointed by the local authorities, as the county and borough councils. An inspector is required to hold a certificate of qualification, and for his guidance general regulations are made by his local authority as to modes of testing weights, measures and weighing instruments.[2] In Europe the local inspection is generally carried out through the State, and a uniform system of local verification is thereby maintained.

5. *Errors.*—In the verification of weights and measures a margin of error is permitted to manufacturers and scale-makers, as it is found to be impossible to make two weights, or two measures, so identical that between them some difference may not be found either by the balance or the microscope. For common weights and measures this margin (tolerance, remedy or allowance, as it is also called) has been set out by the Board of Trade for all the various kinds of weights and measures in use for commercial purposes in the United Kingdom, and similar margins of error are recognized in other countries. For instance, on 1 ℔ avoir. weight made of brass, 2 grains in excess are allowed; on 1 oz. troy or apothecaries' weight, +0·2 grain is allowed; on 1 pint pot, 4 fluid drachms is permitted; on 1 brass yard, 0·05 inch in excess or 0·02 inch in deficiency in length is allowed for ordinary trade purposes.

6. *Foreign Weights and Measures.*—Throughout the British Empire the imperial system of weights and measures is legal.

In Russia, as in the United Kingdom and the United States, the national weights and measures are followed (§ 3 above), although the use of metric weights and measures is permissive.

In India the native weights, &c., ancient and arbitrary, are still followed. In 1889 the British yard was adopted for the whole of India (Measures of Length Act) at a normal temperature of 85° F. as standardized to the imperial yard at 62° F. The metric system was also introduced, mainly for railway purposes, in 1870 and 1871 (Indian Acts). Certified measures of the yard, foot and inch are kept by the Commissioners of Police at Calcutta, Madras and Bombay.

In standardizing a weight for use in India, correction has to be made for the weight of air displaced by the material standard, and for such purpose the normal temperature of 85°, atmospheric pressure 29·8 inches, latitude 22° 35′ 6·5″ (Calcutta), $g = \left\{ g_{45^\circ}\ 0{\cdot}9982515 \right\}$ are taken. The "tola" (180 grains) is properly the Government unit of weight for currency; and 80 tolas make the "Government seer."

7. *Customary Weights and Measures.*—In some districts of the United Kingdom, as well as in provincial districts of other countries, old local and customary denominations of weights and measures are still found to be in use, although their use may have been prohibited by law. So powerful is custom with the people.[3]

8. *Legislation.*—In everyday transactions with reference to weights and measures, the British legislature also exercises control in industrial pursuits. For instance, in weighing *live* cattle, owners of markets are now required to provide adequate accommodation.[4] Useful statutes have also been passed to protect the working class, as in checking the weighing instruments used in mines in Great Britain, over which instruments wages are paid, and in the inspection of similar instruments used in factories and workshops. The Merchandise Marks Act 1887 makes it an offence also to apply in trade a false description, as to the number, quantity, measure, gauge or weight of goods sold; and this Act appears to reach offences that the Weights and Measures Acts may perhaps not reach.

9. *Pharmaceutical Weights and Measures.*—By the Medical Act of 1858, and the Act of 1862, the General Council of Medical Education and Registration of the United Kingdom are authorized to issue a "Pharmacopoeia" with reference to the weights and measures used in the preparation and dispensing of drugs, &c. The British Pharmacopoeia issued by the Council in 1898 makes no alteration in the imperial weights and measures required to be used by the Pharmacopoeia of 1864. For all pharmaceutical purposes, however, the use of the metric system alone is employed in all paragraphs relating to analysis, whether gravimetric or volumetric. For measures of capacity the Pharmacopoeia continues to use imperial measuring vessels graduated at the legal temperature of 62° F. The official names of the metric capacity units are defined at 4° C., as generally on the Continent. The new Pharmacopoeia also follows foreign practice, and employs metric measures of capacity and volumetric vessels graduated at 15·5 C., or 60° F. Specific gravity bottles are also adjusted at 60° F., the figures indicating specific gravities being quotients obtained by dividing in each instance the weight of the solid or liquid by the weight of an equal bulk of water, both taken at 60° F.[5]

10. *Gauges.*—"Gauges," as understood at one time, included only those used in the measurement of barrels, casks, &c., and hence the term "gauger." For engineering and manufacturing purposes the more important linear gauges are, however, now used, adjusted to some fundamental unit of measure as the inch; although in certain trades, as for wires and flat metals, gauges continue to be used of arbitrary scales and of merely numerical sizes, having no reference to a legal unit of measure; and such are rarely accurate. A standard gauge, however, exists (Order in Council, August 1883), based on the inch, but having numbered sizes from 7/0 (0·5 inch) to No. 50 (0·001 inch) to meet the convenience of certain trades.[6]

11. *Screws.*—The screw is an important productive measuring instrument, whether used as a micrometer-screw of less than an inch in length, or as a master-screw of 20 feet in length. The probable errors and eccentricities of small micrometer-screws have been carefully investigated to ±0·00001 inch; but the accuracy of leading screws used in workshops has not been sufficiently verified. For some engineering purposes it would appear to be desirable to produce master-screws to an accuracy of $\frac{1}{2000}$ of an inch to the foot of screw, so as to serve indirectly for the verification of "guiding screws" for general use in workshops.[7] Attempts in this direction were originally made by Whitworth, Clement, Donkin, Rogers, Bond and others, but we still need a higher accuracy in screw-threads.

12. *Educational.*—Ordinary arithmetic books often contain references to local and customary weights and measures and to obsolete terms of no practical use to children. It appears to be desirable, as the Committee of Council on Education have done, to recognize only the legal systems of weights and measures—the imperial and metric. The Education Code of Regulations for 1900 prescribes that the tables of weights and measures to be learned include those only which are in ordinary use, viz. in all classes or forms above the third the tables of

{ Weight—ton, cwt, stone, ℔, oz. and dr.,
Length—mile, furlong, rod or pole, chain, yd., ft. and inch,
Capacity—quarter, bushel, pk., gall., qt. and pt.

In Code standards above the fifth, in addition to the foregoing, the tables of

{ Area—sq. mile, acre, rood, pole, yd., ft. and inch,
Volume—cubic yard, foot and inch.

Instruction in the principles of the metric system, and in the advantages to be gained from uniformity in the method of forming multiples and sub-multiples of the unit, are, under this Code, to be given to the scholars in Standards IV., V., VI. and VII. As a preparation for this it is stated in the Code that it will be useful to give in Standard III. (arithmetic) elementary lessons on the notation of decimal fractions. (See ARITHMETIC.)

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[1] *C.I.P.M. Procès-verbaux* (1897), p. 155.

[2] Regulations, Birmingham, Glasgow, London, Manchester, &c.

[3] Report Select Committee (1892); *Merchant's Handbook*, W. A. Browne (1892); Reports H.M. Representatives Abroad, Foreign Office, 1900–1901

[4] Markets and Fairs (Cattle) Acts 1887, 1891; Coal Mines Regulation Act 1887; Factory and Workshop Act 1878.

[5] *Pharmacopoeia* (1901); Calendar Pharmaceutical Society, 1902.

[6] Order in Council, 26th August 1881.

[7] *Systématique des vis horlogères*, Thury (Geneva, 1878). Bulletin Soc. d'Encouragement pour l'Industrie Nationale, Paris, 1894. Report of British Association on Screw-threads, 1900.

Table of the Principal Foreign Weights and Measures now in use, and of their Equivalents in Imperial or in Metric Weights and Measures.

Almude	Portugal	16·8 litres.
Anoman (Ammomam, Amomam)	Ceylon	0·699 quarter (dry measure), 5·60 bushels.
Ara	Italy	1 metric are, 119.6 sq. yds.
Archin, or Arshin	Turkey	1 new archin (Law 1881) = 1 metre (39·37 inches) = 10 parmaks (decimetres) = 100 khats (centimetres), 1 mill = 1000 archins (kilometre). Pharoagh = 10 mills. Another pharoagh = 2 hours' journey.
Archin	Bulgaria	0·758 metre (masons). 0·680 metre (tailors).
Archine, or Archinne	Russia	28 inches, or 0·7112 metre.
Ardeb	Egypt	5·447 bushels (Customs). 5 bushels (old measure).
Are		= 100 sq. metres = 119·6 sq. yds.
Area	Spain	1 metric are.
Arpent	France	Legal arpent was equal to 100 sq. perches = 51·07 metric ares. in Quebec = 180 French feet.
	Canada	
Arroba	Portugal	14·68 to 15 kilogrammes.
	Spain	Mayor = 3·55 gallons, or 1 cantara.
Artaba	Persia	1·809 bushel.
		Menor = 2·76 gallons (liquids).
Aune	Belgium	1 metre. Formerly 1·312 yard.
	France	1·885 metre (1812).
	Jersey	4 feet.
Barilo	Rome	12·834 gallons.
Bat, or Tical	Siam	234 grains.
Batman	Persia	$6\frac{1}{2}$ ℔ av.; varies locally.
	Turkey	= 10 ocks.
Behär	Arabia	439·45 ℔ av., nearly.
Berri	Turkey	1·084 mile (old measure).
Boisseau	Belgium	15 litres.
Boutylka	Russia	1·353 pint (wine bottle).
Braça	Portugal	2·22 metres.
Braccio	Spain	0·670 metre (commercial).
	Rome	Braccio-d'ara = 29·528 inches.
Brasse	France	5·328 feet.
Braza	Argentina	5·682 feet.
Bu, or tsubo	Japan	3·0306 square metres.
Bushel	U. States	2150·42 cubic inches, about 0·96944 imperial bushel. 1 bushel = 8 gallons = 32 quarts = 64 pints.
	Canada	
Bunder	Netherlands	2·471 acres (old hectare).
Cabot	Jersey	10 pots, or 4 gallons, 1 quart 3 gills imperial measure.
Candy	Bombay	560 ℔ av.
	Madras	493·7 ℔ av.
Cantar	Turkey	124·7 ℔ av. (old weight).
Cantara piccolo	Italy	74·771 ℔ av.
Capicha	Persia	0·58 gallon.
Catty	China	$1\frac{1}{3}$ ℔ av. See *Tael*.
	N. Borneo	$1\frac{1}{3}$ ℔ av.
	Siam	2·675 ℔ av., or $\frac{1}{50}$ hap.
Cawnie	Madras	1·322 acre.
Cental	U. States	100 ℔ av. (As in Great Britain.)
	Canada	
Centigramme		$=\frac{1}{100}$ grm. = 0·154 grain.
Centilitre		$=\frac{1}{100}$ litre = 0·07 gill.
Centimetre		= 0·394 inch $=\frac{1}{100}$ m.
Centimetre, cubic (c.c.)		= 0·061 cubic inch, or 1 c.c.
Centimetre, square		= 0·155 square inch.
Centner	Austria	50 kilogrammes = 110·231 ℔. av.
	Denmark	50 kilogrammes = 110·231 ℔. av.
	Switzerland	50 kilogrammes = 110·231 ℔.
Chain	Canada	66 feet.
	Cyprus	0·33 pic.
Chang	China	10 ch'ih = 11 ft. 9 inches (Treaty).
	Siam	2·675 ℔.
Chapah	N. Borneo	$1\frac{4}{5}$ ℔ av.
Chee. See *Tahil*.		
Chek	Hong Kong	$14\frac{5}{8}$ inches.
Chenica	Persia	0·289 gallon.
Ch'ien	China	$58\frac{1}{3}$ grains (silver weight).
Ch'ih	China	Varies throughout China from 11 to 15·8 inches. For Customs purposes the Treaty ch'ih = 14·1 inches, and 5 ch'ih = 1 pu.
Ch'ih	Peking	= 12·3 = 12·5 public works.
		= 12·4 statistics.
		= 12·6 architects.
		= 12·7 common.
		= 13·1 tribunal of mathematics.
	Shanghai	= 13·2 Board of Revenue.
		= 14·1 Customs.
Chilogramme	Italy	1 kilogramme.
Chin or Catty	China	$1\frac{1}{3}$ ℔ av. (Treaty).
Ching	China	121 sq. feet (Treaty).
Ch'ing	China	72,600 sq. feet (Treaty).
Chittack	Bengal	5 tolas, or 900 grains.
Ch'ok	Corea	$7\frac{3}{4}$ in. (linear); $12\frac{1}{8}$ in. (building).
Chüo	China	1815 sq. feet (Treaty).
Chupah	Singapore	1·66 ℔ av. of water at 62° F., as a measure of capacity.
	Malacca	144 oz. av. of water.
Chupak	Straits Settlements	1 quart.
Collothun	Persia	1·809 gallon.
Coss	Bengal	1·136 metre.
Covado	Portugal	0·66 metre.
Covid, or Cubit	Madras	18 to 21 inches.
	Bombay	18 inches.
	Siam	18 inches.
Covido	Arabia	18 inches approximately.
Covido (Great)		27 inches.
Cuartillo	Spain	1·16 litre (dry); 0·504 litre liquid.
Daktylon (Royal)	Greece	1 centimetre.
Daribah	Egypt	43·58 bushels (Customs).
Decagramme		= 10 grms. = 5·64 drams av.
Decalitre		= 10 litres = 2·2 gallons.
Decametre		= 10·936 yards.
Déçïatina	Russia	= 2400 square sagènes = 2·7 acres.
Decigramme		$=\frac{1}{10}$ grm. = 1·54 grain.
Decilitre		$=\frac{1}{10}$ litre = 0·176 pint.
Decimetre		= 3·937 inches = 0·1 metre.
Decimetre, cubic		= 1000 c.c. = 61·024 cub. in.
Decimetre, square		= 100 sq. centm. = 15·5 sq. in.
Denaro	Rome	18·17 grains (old weight).
Deunam	Turkey	1 metric are.
Diraa, or Drâa, or Pic	Egypt	27 inches usually. 21·3 inches Nile measure.
	Turkey	27 inches (old measure of pike).
Dirhem	Egypt	1·761 dram av. (Customs).
		3·0884 grammes (Cairo).
Djerib	Turkey	1 hectare.
Dolïa, or Dola	Russia	0·686 grain. 96 doli = 1 zolotnick.
Drachma	Netherlands	3·906 grammes.
	Turkey	154·324 grains.
Drachmé (Royal)	Greece	1 gramme (gold weight).
	Constantinople	= 57·871 grains. See *Ock*.
Dram. See *Oke*.		
Ducat	Vienna	53·873 grains.
Duim	Netherlands	1 centimetre.
Eimer	Austria	12·448 gallons.
El	Netherlands	1 metre. (Old ell = 27·08 inches).
Ell	Jersey	4 feet.
Ella	N. Borneo	1 yard.
Elle	Switzerland	0·6561 yard.
Endaseh, or Hindâzì	Egypt	Usually 25 inches.
Faltche	Moldavia	1 hectare, 43 ares, 22 centiares.
Fanega	Argentina	3·773 bushels.
	Portugal	55·364 litres.
	Spain	1·526 bushel.
	Peru	$1\frac{1}{2}$ bushel.
		1·615 acre, but varies locally.
Fass	Germany	1 hectolitre.
Feddan	Egypt	1·038 acre (Masri). Also 1·127 acre locally.
		1.266 acre (old).
Fen	China	5·83 grains (silver weight).
Fjerdingkar	Denmark	0·9564 bushel.
Fod	Denmark	1·0297 foot.
	Norway	0·3137 metre.
Foglietto	Rome	0·8 pint.
Foot	U. States	12 inches.
	Canada	French foot = 12·8 inches.
	Amsterdam	11·147 in. old measure.
	South Africa	
	Old Rhenish	12·356 in. old measure.

Fot	Sweden	11·689 in. 10 fot = 1 stöng. 1 ref = 10 stänger. 1 mil = 360 ref.
Founte, or Funt or Livre	Russia	0·90282 ℔ av.
Foute, or Pied	Russia	1 English foot.
Frasco	Argentina	$2\frac{3}{8}$ litres.
Fuss	Vienna	12 zolls = 1·037 foot.
	Switzerland	$3\frac{1}{3}$ fuss = 1 metre. See *Stab.*
Gallon	U. States Canada	231 cubic inches = 8·3389 ℔ av. of water at t. 39·8° Fahr. At 62° Fahr. = 0·8325 imp. gallon.
Gantang	Straits Settlements	32 gallons.
	N. Borneo	144 oz. av. weight of water as measure of capacity.
Garnetz	Russia	0·3607 peck.
Gin. See *Kati.*		
Gisla	Zanzibar	Measure of 360 ℔ av. of rice.
Go	Japan	180·39 cubic centimetres.
Grain	Russia	0·960 grain (apothecaries).
Gramme (gr.)	. . . . .	= 15·4323564 grains av. troy. = 0·2572 drachm, or 0·7716 scruple. = 0·03215 oz. troy.
Grammé (Royal)	Greece	1 millimetre.
Gramo	Spain	1 gramme.
Grano	Rome	0·757 grain.
Grao	Portugal	0·768 grain; also measure 0·18 in.
Grein	Netherlands	= 0·065 gramme.
Guz, or Gudge	India: Bengal	36 inches.
	,, Bombay	27 inches.
	,, Madras	33 inches, Government Survey.
	Persia	The guz, gueza or zer varies from 24 to 44 inches. A guz of 40·95 inches (Guz, Azerbáiján) is common. Government standard guz = $36\frac{1}{2}$ inches. There is a guz for retail trade of 25 inches.
	Arabia	25 inches to 37 inches (Bassorah).
Hat'h, or Moolum, or Cubit	Bengal	18 inches.
	Bombay	18 inches, or cubit.
Hectare	. . . . .	= 100 ares, or 2·471 acres.
Hectogramme	. . . . .	100 grm. = 3·53 oz. av.
Hectolitre	. . . . .	100 litres = 2·7 bushels.
Hectometre	. . . . .	= 109·36 yards.
Hiyaka-me	Japan	5797·198 grains.
Hiyak-kin	Japan	$132\frac{1}{2}$ ℔ av.
Hoon. See *Tahil.*		
Hu	China	$12\frac{1}{2}$ gallons, nearly.
Immi	Switzerland	1·5 litre.
Joch	Austria-Hungary	1·422 acre.
Kaima	Sweden	0·576 gallon.
Kan	Netherlands	1 litre.
	Hong Kong	$1\frac{1}{3}$ ℔ av.
Kanne or Kanna	Germany	1 litre, or formerly 1·762 pint.
	Sweden	0·576 pint.
Kantar, or Cantaro	Egypt	99·0492 ℔ av. = 100 rotls (Customs). 45 kilogrammes of cotton. 44·5 kilogrammes other produce.
Karwar	Persia	100 batman.
Kassabah	Egypt	3·8824 yards (Customs).
Kati, Catty or Gin	China, Straits Settlements	$1\frac{1}{3}$ ℔ av.
Keila, or Pishi	Zanzibar	Measure of 6 ℔ av. of rice.
Ken	Japan	5·965 ft., 1·81 metre.
Kerât	Turkey	$1\frac{1}{8}$ inch measure (old). 3·09 grains weight (old)
Kette, or Chain	Germany	14·994 ellen, or 10·936 yards.
Keu	Siam	40 inches.
Khat (New)	Turkey	1 centimetre.
Kile	Cyprus	8 gallons.
Killow	Turkey	0·97 bushel.
Kilogramme	. . . . .	= 1000 grm. = 2·2046223 ℔ av.
Kilometre	. . . . .	= 0·6214 mile.
Kin	Japan, China	0·601 kilogramme = 1·325 ℔.
Klafter	Austria	= 2·0740 yards.
	Switzerland	1·9685 yard.
Köddi	Arabia	1·67 gallon.
Koilon (Royal)	Greece	1 hectolitre. Old koilon = 33·16 litra.
Koku	Japan	= 39·7033 galls. = 4·9629 bushels.
Kon	Corea	$1\frac{1}{3}$ ℔ av.
Korn-tonde	Norway	138·97 litres.
Korn-tonde	Sweden	3·821 bushels.
Korn-top Maal	Norway	160 litres.
Korrel	Netherlands	1 decigramme.
Kotyle (Royal)	Greece	1 decilitre.
Kouza	Cyprus	9 quarts.
Koyan	Straits Setts	$5333\frac{1}{3}$ ℔ av.
Krina	Bulgaria	12·8 litres.
Kung	China	78·96 inches (Treaty).
Kup	Siam	10 inches.
Kwan or Kuwan	Japan	8·281 ℔ = 3·75652 kilogrammes.
Kyàt	Burma	100 kyats = 3·652 ℔ av.
Lak't	Bulgaria	0·650 metre.
Last	Netherlands	30 hectolitres.
Léang	China	$583\frac{1}{3}$ grains (silver weight).
Lèkhà	Bulgaria	229·83 sq. metres.
Li	China	about $\frac{1}{3}$ mile = 360 pu. Varies with length of ch'ih. A small weight 0·583 grain.
Liang	China	$1\frac{1}{3}$ oz. 16 liang = 1 chin = $1\frac{1}{3}$ ℔ av.
Libbra	Italy	0·7477 ℔ av.
Libra	Argentina	1·0127 ℔ av.
Libra (Castilian)	Spain, Mexico	1·014 ℔.
Libra, or Arratel	Portugal	1·012 ℔ av.
Line or Ligne	Paris	$\frac{1}{12}$ point, or 0·089 inch.
Liniia	Russia	0·1 inch. 1 archine = 280 liniias.
Litra (Royal)	Greece	1 litre = 100 mystra.
Litre	Cyprus	$2\frac{4}{5}$ quarts.
Litre (metric)	. . . . .	= 1·7598 pint
Litro	Spain Italy	1 litre.
Livre (℔)	Russia	0·90282 ℔ av. Apoth. livre = 11·5204 oz. troy.
	Belgium	Kilogramme.
Livre-poids	France	0·4895 kilogramme.
Loth	Germany	New loth = 1 decagramme. Old loth, nearly $\frac{1}{2}$ oz. av.
	Switzerland	15·625 grammes.
	Vienna	270·1 grains. Postal loth, 257·2 grains.
Maass	Austria	1·245 quart.
	Switzerland	2·64 gallons.
Maatze	Netherlands	1 decilitre.
Mace	China	$58\frac{1}{3}$ grains.
	N. Borneo	$93\frac{1}{3}$ ℔ av.
Mahud	Arabia	2·04 ℔ av.
Maik	Burmah	3 maik = cubit = $19\frac{1}{2}$ inches.
Marc, or Mark	France	0·2448 kilogramme (old weight).
	Sweden	0·4645 ℔ av.
	Vienna	4331·37 grains = 24 karato.
Marco	Portugal	= 8 oncas = 229·5 grammes.
	Spain	3550·54 grains.
Maund	India	82·286 ℔ av., Government. $72\frac{1}{3}$ ℔ (old bazaar). 74·67 ℔ av., factory. 28 ℔ nearly, Bombay. 25 ℔ nearly, Madras. 37 to 44 ℔, Juggerat. Local maunds vary on either side of 80 ℔.
Megametre (astronomy)	. . . . .	1,000,000 metres.
Metre (m.)	U. States	39·37 inches.
	Great Britain	39·370113 inches = 1 m.
Metre. cubic	. . . . .	= 1000 c.d. = 35·315 cubic feet.
Metre, square	. . . . .	= 100 square decimetres = 10·764 square feet.
Metro	Spain Italy	1 metre.
Metz.	Austria	1·691 bushel.
Micron (μ)	. . . . .	= $\frac{1}{1000}$ millimetre.
Miglio	Rome	0·925 mile.
Mijle	Netherlands	1 kilometre.
Mil, or Mill	Turkey	1000 archins (new mil).
	Denmark	4·680 miles.
Mile	France Germany	Nautical mile = 1852 metres.
Mile (postal)	Austria	4·714 miles.
Milha	Portugal	1·296 mile.
Mille	France	1·949 kilometre.
Milligramme	. . . . .	= $\frac{1}{1000}$ gramme = 0·015 grain.
Millilitre.	. . . . .	= $\frac{1}{1000}$ litre.
Millimetre	. . . . .	= 0·03937 inch = $\frac{1}{1000}$ m.
Miscal	Persia	71 grains.
Mkono	East Africa	45·72 centimetres.
Mna	Greece	$1\frac{1}{2}$ kilogramme = 1·172 oka.
Momme	Japan	$\frac{1}{1000}$ kwan.
Morgen	Denmark Norway Prussia	0·631 acre.

Mou	China	Commonly 806·65 sq. yds. Varies locally. Shanghai = 6600 sq. ft. (Municipal Council). By Customs Treaty = 920·417 sq. yds., based on ch'ih of 14·1 inches.
Mud	Netherlands	1 hectolitre.
Myriagramme		= 10 kilogrammes = 22·046 ℔ av.
Ngoma	East Africa	7½ keilas.
Nin	Siam	$\frac{10}{12}$ inch.
Obolos	Greece	1 decigramme.
Ock	Turkey	Legal ock (1881) = 100 drachmas. New batman = 10 ocks, and kantar = 10 batmans ock = 1 kilogramme.
Octavillo	Spain	0·29 litre.
Oitavo	Portugal	1·730 litre.
Oke	Bulgaria	1·28 litre (for liquids). 1·282 kilogramme (old).
	Cyprus	2⅘ ℔. av. = 400 drams (Cyprus).
	Egypt	2·751 ℔ av. (Customs). 2·805 ℔ (Alexandria).
	Greece	2·80 ℔ = 1·282 kilogramme. 1·33 litre.
	Turkey	1·1518 pint. 2·834 ℔ av. (old weight).
Onça	Portugal	28·688 grammes.
Once	France	30·59 grammes (old).
Oncia	Rome	436·165 grains.
Onze	Netherlands	1 hectogramme. 10 onzen = pond.
Ounce	U. States	Av. ounce = 437·5 grains.
Packen	Russia	1083·382 ℔ av.
Palamé (Royal)	Greece	1 decimetre.
Palm	Holland	1 decimetre.
Palmo	Portugal	0·22 metre.
	Spain	8·346 inches.
Para	N. Borneo	90 ℔ av.
Parah	Ceylon	5·59 pints.
Parasang. See *Persakh.*		
Parmak. See *Archin.*		
Passeree	Bengal	5 seers.
Pé	Portugal	⅓ metre (old).
Pecheus (Royal)	Greece	1 metre = 1·543 old pecheuse.
Pecul	China	133⅓ ℔ av.
Perche	France Canada	22 square pieds de roi. In Quebec 18 French feet.
Persakh, or Parasang	Persia	Probably 3·88 miles = 6000 guz.
Pfund	Germany	= 16 unzen = 32 loth } 1·01 to 1·23 ℔ av. } old weight. Zoll. pfund (1872) = 500 grammes.
	Prussia	Old zoll. ℔ = 1·1023 ℔ av.
	Switzerland	500 grammes = 16 unze. Apoth. pf. = 375 grammes.
	Vienna	Pfund = 560·06 grammes. Zoll. pfund (1871) = 500 grammes.
Pharoagh. See *Archin.*		
Pic	Cyprus	2 feet.
Picul	Japan Straits Settlements, Hong Kong	133⅓ ℔ av.
	North Borneo	A measure of 180 ℔ weight of water.
Picki	Greece	0·648 metre.
	China	25 gallons (dry measure).
Pie	Rome	11·73 inches.
Pie de Burgos	Spain	11·13 inches.
Pied	Belgium	11·81 inches = 10 pounces.
	Canada	12·79 inches.
Pied de Roi	Paris	0·3248 metre.
Pike	Turkey	See *Dir'aa.*
Pint	U. States	0·8325 imperial pint.
Pinte	France	0·931 litre.
Pipa	Portugal	534 litres (Oporto). 420 litres (Lisbon). 500 litres (officially).
Pipe	Gibraltar	105 to 126 gallons.
Pishi. See *Keila.*		
Poide de Marc	France	0·2448 kilo = 8 onces.
Polegada	Portugal	27·77 millimetres.
Pond	Netherlands	1 kilogramme. Apothecaries pond = 375 grammes.
Pot	Denmark	1·7 pint = 4 paegle.
	Switzerland	2·64 pints or 1·5 litre.
	Belgium	1½ litre (dry). ½ litre (liquid).
	Norway	0·965 litre.
Pouce	France	1·066 inch (old measure).
	Russia	1 inch.
Poud, or Pood	Russia	0·016122 ton = 36 ℔.
Pound	U. States	Standard troy ℔ = 5760 grains. Avoir. ℔ = 7000 grains.
	Russia	0·90282 ℔ av. (0·4095 kilogramme).
	Jersey	7561 grains = 16 oz. Jersey = 1 livre.
Pu	China	70·5 inches = 5 ch'ih.
Puddee	Madras	2·89 pints. 100 cubic inches = Government puddee.
Pulgada	Spain	0·927 inch.
Pund	Denmark	1·1023 ℔ av., or 500 grammes.
	Norway	0·4981 kilogramme.
	Sweden	6560 grains. Varies locally. 5500·5 grains (apoth.).
Quart	U. States	See *Bushel.*
Quarto	Rome	2·024 bushels.
	Portugal	3·46 litres.
Quintal	Spain	100 libras (Castilian) = 101·4 ℔.
	Portugal	58·752 kilogrammes, or 129½ ℔ av.
	Argentina	100 libras, or 101·27 ℔ av.
Quintal (metric)	France	= 100 kilogrammes = 1·968 cwt.
Quintale	Italy	1 metric quintal.
Ratel	Persia	1·014 ℔ av.
Rattel, or Rottle	Arabia	1·02 ℔ av., nearly (dry measure). 17·219 ℔ av. weight.
Ri	Japan	2·440 miles (itinerary). 2·118 miles (natural).
Rode	Denmark	3·762 metres.
Roede	Netherlands	1 dekametre.
Rotl, or Rottolo	Egypt	0·9905 ℔ av. (Customs). 0·9805 ℔ av. (Govt.).
	Cairo	2·206 ℔ great rottolo. 0·715 ℔ less rottolo.
	Alexandria	2·124 ℔ great rottolo. Rottolo mina = ⅝ oka.
Rottol	Turkey	2·513 pints (old measure).
Rubbio	Spain	1·012 quarter (dry measure).
Sagène	Russia	7 feet.
Scheffel	Germany	50 litres, formerly 14·56 metzen (Prussia).
Schepel	Netherlands	1 decalitre.
Schoppen	Germany	½ litre, formerly 0·11 gallon.
	Switzerland	0·375 litre.
Se	Japan	118·615 square yards (·9918 are).
Seer	India	Government seer = $2\frac{2}{35}$ ℔ av. Bengal, 80 tolas weight of rice (heaped measure), about 60 cubic inches (struck measure). Southern India = weight of **24** current rupees. Madras, 25 ℔ nearly. Juggerat, weight of 40 **local** rupees. Bombay, old seer, about 28 ℔.
	Ceylon	Measure of 1·86 pint.
	Persia	16 miscals, or 1136 grains weight (Sihr).
		Note.—In India the seer, like the maund, varies considerably; usually 40 seers go to a maund.
Seidel	Austria	0·6224 pint.
Sen	Siam	44·4 miles, nearly.
Ser	India	1 litre (Indian Law, 1871).
Shaku	Japan	0·30 metre, also 9·18273 square decimetres; also 18·039 cubic centimetres.
Sheng	China	1·813 pint.
Shih	China	160 ℔.
Shóó	Japan	1·804 litre.
Skaal-pund	Sweden	435·076 grammes, or 0·959 ℔ av.
	Norway	0·4981 kilogramme, or officially ½ kilogramme.
Skeppe	Denmark	17·39 litres.
Skjeppe	Norway	17·37 litres.
Stab	Germany	1 metre, or 3·⅓ old fuss, but varied.
Stadron (Royal)	Greece	1 kilometre.
Stere (metric)		1 cubic metre.
Stero	Italy	1 metric stere.
Streepe	Holland	1 millimetre.
Stremma	Greece	1 metric are. 238·1 square pecheus (Constantinople).
Strich	Germany	1 millimetre.
Striche	Switzerland	3⅓ strich = 1 millimetre.
Stunde	Germany	Old itinerary measure, 2·3 to 3·4 miles.

Stunde	Switzerland	4·8 kilometres. Stunder = 5 stunden, or 24 kilometres.
Sultchek	Turkey	Cubic measure (1881) whose sides equal a parmak (decimetre).
Sung	Corea	4 ℔ av., nearly.
Tael	Siam	$936\frac{1}{4}$ grains.
	Hong Kong	$1\frac{1}{3}$ oz. av.
	China	Silver weight, $1\frac{1}{3}$ oz. av.
	Japan	10 momme.
	(No current *coin* of the tael.)	
Tahil	Straits Settlements	$1\frac{1}{3}$ oz. av. = 10 chee = 100 hoon.
Tam	Hong Kong	$133\frac{1}{3}$ ℔ av.
Tan	China	= 25 gallons. Also $133\frac{1}{2}$ ℔ weight.
Tang	Burma	2 miles, nearly.
Tang-sun	China	About $3\frac{1}{2}$ miles = 10 li.
Tank	Bombay	$17\frac{1}{72}$ grains, or 72 tanks = 30 pice.
Tcharka	Russia	0·866 gill = 0·218 pint.
Tchetverte	Russia	5·772 bushels = 8 tchetveriks, or 2·099 hectolitres.
Teng	Burma	Burmese measures of capacity depend on the teng or basket. Officially a basket is 2218·2 cubic inches, but the teng varies locally:— Akyab = 23 ℔ of rice. Bassein = 51 ℔ of rice. Moulmein = 48 ℔ of rice. Rangoon = 48 to 50 ℔ of rice.
Thanan	Siam	1·5 pint.
Thangsat	Siam	4·688 gallons.
To	Japan	18·0391 litres = 3·9703 galls. = 1·98 pecks.
Toise	France	2·1315 yards.
Tola	India	180 grains. Legal weight of rupee.
Tomand	Arabia	187·17 ℔ av. of rice.
Ton	U. States	2240 ℔ av., also a net ton of 2000 ℔.
Tönde	Denmark	131·392 litres (liquid measure). 139·121 litres (dry measure).
Tonne, or Millier	France Germany	1000 kilogrammes.
Tonne (metric)		1000 kilogrammes = 0·9842 ton.
Tonnelada	Portugal	793·15 kilogrammes.
Tonos	Greece	29·526 cwt.
Tou	China	18 pints approximately.
Tovar	Bulgaria	128·2 kilogrammes.
T'sun	China	1·41 inch (Treaty measure).
Tu	China	100·142 miles = 25 li, based on the ch'ih of 14·1 inches.
Vara	Peru	33 inches.
	Spain	2·782 feet.
	Argentina	2·841 feet.
	Portugal	1·11 metre.
Vat	Holland	1 hectolitre.
Vedro	Russia	2·7056 gallons = 10 schtoffs, or 12·3 litres.
	Bulgaria	12·8 litres.
Verchok	Russia	1·75 inch.
Versta, or Verst	Russia	0·66288 mile.
Vierkanteroede	Holland	1 metric are.
Viertel	Denmark	1·7 gallon.
	Switzerland	15 litres.
Viss	Rangoon	$3\frac{91}{140}$ ℔ av.
Wa	Siam	80 inches.
Wigtje	Netherlands	1 gramme.
Wisse	Netherlands	1 metric stere.
Yard	U. States	36 inches.
	Mexico	838 centimetres.
Zac	Netherlands	1 hectolitre.
Zer (Persia). See *Guz.*		
Zoll	Switzerland	$3\frac{1}{3}$ zoll = 1 decimetre. Old zoll nearly one inch. (See also *Pfund.*)
Zolotnik	Russia	65·8306 grains, or 96 doli.

(H. J. C.)

WEIGHT-THROWING, the athletic sport of hurling heavy weights either for distance or height. Lifting and throwing weights of different kinds have always been popular in Great Britain, especially Scotland and Ireland, and on the continent of Europe, particularly in Germany, Switzerland and Austria-Hungary. No form of throwing weights is included in the British athletic championship programme, although "putting the shot" (*q.v.*) and "hammer-throwing" (*q.v.*) are recognized championship events. In America throwing the 56-℔ weight for distance belongs to the championship programme. It was once a common event in Great Britain at all important athletic meetings, the ordinary slightly conical half-hundredweight being used and thrown by the ring attached to the top; the ring, however, was awkward to grip, and a triangular handle was afterwards substituted. In America the 56-℔ weight is a ball of iron or lead with a triangular or pear-shaped handle. The weight used to be thrown standing, but since 1888 it has been thrown from a 7-ft. circle with a raised edge, like that used for the hammer and shot in America.

In throwing the athlete stands slightly stooping, with his feet about 18 in. apart and grasping the handle with both hands opposite his thighs. The weight is swung round and back past the right leg as far as possible, then up, over and round the head, as in the hammer-throw. One complete swing round the head is usually enough, as too much momentum is apt to throw the athlete off his balance. The weight is then swung round together with the whole body as rapidly as possible, as in hammer-throwing. The athlete works himself to the front of the circle just before the moment of delivery and begins the final heave with his back towards the direction in which he wishes to throw the weight. This heave is accomplished by completing the final spin of the body, giving the legs, back and arms a vigorous upward movement at the same time, and following the weight through with the uplifted arms as it leaves the hands, but taking care not to overstep the circle. With one hand a smoother swing can be made but much less power applied. In throwing for height the athlete stands beside the high-jump uprights and casts the weight over the cross-piece, making the swing and spin in a more vertical direction with a heave upward at the moment of delivery. Throwing for height and with one hand were formerly events in the American championship programme, but have been discontinued. The record for throwing the 56-℔ weight for height is 15 ft. $6\frac{3}{8}$ in., made by the American-Irishman J. S. Mitchell. The record for distance, 38 ft. 8 in., was made in 1907 by the American-Irishman John Flanagan. In throwing weights large and heavy men have an advantage over small, brute strength being the chief requisite, while a heavy body makes a better fulcrum while revolving than a light one.

WEI-HAI-WEI, a British naval and coaling station, on the N.E. coast of the Shan-tung peninsula, China, about 40 m. E. of the treaty port of Chi-fu and 115 m. from Port Arthur. It was formerly a Chinese naval station strongly fortified, but was captured by the Japanese in February 1895, and occupied by their troops until May 1898, pending the payment of the indemnity. Port Arthur having in the spring of that year been acquired by the Russian government under a lease from China, a similar lease was granted of Wei-hai-wei to the British government, and on the withdrawal of the Japanese troops the British fleet took possession, the flag being hoisted on the 24th of May 1898. No period was fixed for the termination of the lease, but it was stipulated that it should continue so long as Russia continued to hold Port Arthur. The lease of Port Arthur having been ceded to Japan in September 1905, the British lease of Wei-hai-wei was made to run for as long as Japan held Port Arthur.

The harbour is formed by an island named Liu-kung-tao running east and west across the mouth of a small bay, leaving an entrance at each end. Towards the mainland the water shoals, and the best anchorage is under the lee of the island. The native city is walled, and has a population of about 2000. The chief port is named Port Edward; it has good anchorage with a depth of 45 ft. of water. The leased area comprises, besides the harbour and island, a belt of the mainland, 10 English miles wide, skirting the whole length of the bay. The coast line of the bay is some 10 m., and the area thus leased extends to 285 sq. m. Within this area Great Britain has exclusive jurisdiction, and is represented by a commissioner under the colonial office; and has, besides, the right to erect fortifications, station troops and take any other measures necessary for defensive purposes at any points on or near the coast in that part of the peninsula east of 121° 40′ E. Within that zone, which covers 1505 sq. m., Chinese administration is not interfered with, but no troops other than Chinese and British are allowed there. The territory consists of rugged hills rising to 1600 ft. and well-cultivated valleys. The hills also, as far as possible, are terraced for cultivation and in some instances are planted with dwarf pine and scrub oak. It contains some 310 villages and a population of about 150,000. Chinese war-vessels are at liberty to use the anchorage, notwithstanding the lease; and Chinese jurisdiction may continue to be exercised within the walled city of Wei-hai-wei, so far as not inconsistent with military requirements. Wei-hai-wei was made the headquarters of a native Chinese regiment in the pay of Great Britain, and organized and led by British officers; but this regiment was disbanded in 1902. Wei-hai-wei is used by the China squadron as a sanatorium and exercising ground. Its excellent climate attracts many visitors. Wei-hai-wei being a free port no duties of any kind are collected there. The import trade consists of timber, maize, paper, crockery, sugar, tobacco, kerosene oil, &c. Gold has been found in the territory, and silver, tin, lead and iron are said to exist. In each of the years 1903–1909 the expenditure exceeded the revenue (about $70,000 in 1909–1910), deficits being made good by grants from the British parliament.

WEILBURG, a town of Germany, in the Prussian province of Hesse-Nassau, picturesquely situated on the Lahn, just above the confluence of the Weil, 50 m. N.E. from Coblenz by the railway to Giessen. Pop. (1905) 3828. The old town, built on and around a rocky hill almost encircled by the river, contains a castle of the 16th century, formerly the residence of the dukes of Nassau-Weilburg, and later of the grand-dukes of Luxemburg. It has an Evangelical and a Roman Catholic church, the former, the Stadtkirche, containing the burial vaults of the princes of Nassau, a gymnasium and an agricultural college. Its industries include wool-spinning, mining, tanning and dyeing. In the neighbourhood are the ruins of the castles of Merenberg and Freienfels. Weilburg was in the 11th century the property of the bishops of Worms, from whom it passed to the house of Nassau. From 1355 to 1816 it was the residence of the princes of Nassau-Weilburg, a branch of this house.

See C. C. Spielmann, *Führer durch Weilburg und Umgebung* (Weilburg, 1894); and *Geschichte der Stadt und Herrschaft Weilburg* (Weilburg, 1896).

WEIMAR, a city of Germany, the capital of the grand-duchy of Saxe-Weimar-Eisenach. It is situated in a fertile valley on the Ilm, a small tributary of the Saale, 50 m. S.W. of Leipzig and 141 m. S.W. of Berlin, on the main line of railway to Bebra and Frankfort-on-Main, and at the junction of three lines to Jena, Gera and Berka and Rastenberg. Pop. (1885) 21,565, (1905) 31,121. Weimar owes its importance not to any industrial development, which the grand-dukes discourage within the limits of their *Residenz*, but to its intimate association with the classical period of German literature, which earned for it the title of the "poets' city" and "the German Athens." The golden age of Weimar, covered by the reign of Charles Augustus (*q.v.*) from 1775 to 1828, has left an indelible impress on the character of the town.

In spite of its classical associations and of modern improvements, Weimar still retains much of its medieval character. The walls survive, indeed, only in isolated fragments, but the narrow winding streets of the older part of the town, and the market-place surrounded by houses with high-pitched gables and roofs are very picturesque. Of the churches the *Stadtkirche* (parish church), of which Herder became pastor in 1776, is a Gothic building dating from about 1400, but much altered in detail under "classical" influences. It contains the tombs of the princes of the house of Saxe-Weimar, including those of the elector John Frederick the Magnanimous and his wife, and of Duke Bernhard of Weimar, a hero of the Thirty Years' War. The altar-piece is a triptych, the centre-piece representing the Crucifixion; beside the cross Luther is represented, with the open Bible in his hand, while the blood from the pierced side of the Saviour pours on to his head. The picture is regarded as the masterpiece of Lucas Cranach (*q.v.*), who lived for a time at Weimar, in the *Brück'sches Haus* on the market-place. In front of the church is a statue of Herder, whose house still serves as the parsonage. The other church, the *Jakobs-* or *Hofkirche* (court church) is also ancient; its disused churchyard contains the graves of Lucas Cranach and Musaeus. The most important building in Weimar is the palace, a huge structure forming three sides of a quadrangle, erected (1789–1803) under the superintendence of Goethe, on the site of one burned down in 1774. A remnant of the old palace, with a tower, survives. The interior is very fine, and in one of the wings is a series of rooms dedicated to the poets Goethe, Schiller, Herder and Wieland, with appropriate mural paintings. Of more interest, however, is the house in which Goethe himself lived from 1782 to 1832. It was built by the duke as a surprise present for the poet on his return from his Italian tour, and was regarded at the time as a palace of art and luxury. It has therefore a double interest, as the home of the poet, and as a complete example of a German nobleman's house at the beginning of the 19th century, the furniture and fittings (in Goethe's study and bedroom down to the smallest details) remaining as they were when the poet died.[1] The house is built round a quadrangle, in which is the coach-house with Goethe's coach, and has a beautiful, old-fashioned garden. The interior, apart from the scientific and art collections made by Goethe, is mainly remarkable for the extreme simplicity of its furnishing. The Goethe-Schiller Museum, as it is now called, stands isolated, the adjoining houses having been pulled down to avoid risk of fire.

Of more pathetic interest is the *Schillerhaus*, in the *Schillerstrasse*, containing the humble rooms in which Schiller lived and died. The atmosphere of the whole town is, indeed, dominated by the memory of Goethe and Schiller, whose bronze statues, by Rietschel, grouped on one pedestal (unveiled in 1857) stand in front of the theatre. The theatre, built under Goethe's superintendence in 1825, memorable in the history of art not only for its associations with the golden age of German drama, but as having witnessed the first performances of many of Wagner's operas and other notable stage pieces, was pulled down and replaced by a new building in 1907. The most beautiful monument of Goethe's genius in the town is, however, the park, laid out in the informal "English" style, without enclosure of any kind. Of Goethe's classic "conceits" which it contains, the stone altar round which a serpent climbs to eat the votive bread upon it, inscribed to the "genius hujus loci," is the most famous. Just outside the borders of the park, beyond the Ilm, is the "garden house," a simple wooden cottage with a high-pitched roof, in which Goethe used to pass the greater part of the summer. Finally, in the cemetery is the grand ducal family vault, in which Goethe and Schiller also lie, side by side.

Wieland, who came to Weimar in 1772 as the duke's tutor, is also commemorated by a statue (1857), and his house is indicated by a tablet. The town has been embellished by several other statues, including those of Charles Augustus (1875); Lucas Cranach (1886); Marie Seibach (1889); the composer Hummel (1895) and Franz Liszt (1904). Among the other prominent buildings in Weimar are the *Grünes Schloss* (18th century), containing a library of 200,000 volumes and a valuable collection of portraits, busts and literary and other curiosities; the old ducal dower-house (*Wittumspalais*); the museum, built in 1863–1868 in the Renaissance style with some old masters and Preller's famous mural paintings illustrating the *Odyssey*. In 1896 the Goethe-Schiller Archiv, an imposing building on the wooded height above the Ilm, containing MSS. by Goethe, Schiller, Herder, Wieland, Immermann, Fritz Reuter, Mörike, Otto Ludwig and others, was opened. Weimar possesses also archaeological, ethnographical and natural science collections and the Liszt Museum (in the gardener's house in the park, for many years the musician's home). Among the educational establishments are a gymnasium, and *Realschule*, the *Sophienstift* (a large school for girls of the better class, founded by the grand-duchess Sophia), the grand-ducal school of art, geographical institutes, a technical school, commercial school, music school, teachers' seminaries, and deaf and dumb and blind asylums. An English church was opened in 1899. There are a few industries, printing, tanning and cloth-weaving.

Various points in the environs of Weimar are also interesting from their associations. A broad avenue of chestnuts, about 2 m. in length, leads southwards from the town to the grand-ducal château of Belvedere, in the gardens of which the open-air theatre, used in Goethe's day, still exists. To the north-east, at about the same distance from the town, are the tiny château and park of Tiefurt, on the banks of the Ilm, the scene of many pastoral court revels in the past. To the north-west is the Ettersberg, with the Ettersburg, a château which was another favourite resort of Charles Augustus and his friends.

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[1] To be strictly accurate, they thus remained until the death of Goethe's last descendant in 1884. The house, which had been left to the grand-duke for the nation, was then found to be so structurally rotten that the interior had to be largely reconstructed. Everything was, however, replaced in the exact position it had previously occupied.

The history of Weimar, apart from its association with Charles Augustus and his court, is of little general interest. The town is said to have existed so early as the 9th century. Till 1140 it belonged to the counts of Orlamünde; it then fell to Albert the Bear and the descendants of his second son. In 1247 Otto III. founded a separate Weimar line of counts. In 1345 it became a fief of the landgraves of Thuringia, to whom it escheated in 1385 with the extinction of the line of Otto III. At the partition of Saxony in 1485 Weimar, with Thuringia, fell to the elder, Ernestine, branch of the Saxon house of Wettin, and has been the continuous residence of the senior branch of the dukes of this line since 1572. Under Charles Augustus Weimar became a centre of Liberalism as well as of art. It had previously narrowly escaped absorption by Napoleon, who passed through the town during the pursuit of the Prussians after the battle of Jena in 1806, and was only dissuaded from abolishing the duchy by the tact and courage of the duchess Louisa.

The traditions of Charles Augustus were well maintained by his grandson, the grand-duke Charles Alexander (1818–1901), whose statue now stands in the Karlsplatz. The grand-duke's connexion with the courts of Russia and Holland—his mother was a Russian grand-duchess and his wife, Sophia Louisa (1824–1897), a princess of the Netherlands—tended to give the Weimar society a cosmopolitan character, and the grand-duke devoted himself largely to encouraging men of intellect, whether Germans or foreigners, who came to visit or to settle in the town. The art school, founded by him in 1848, has had a notable series of eminent painters among its professors, including Preller, Böcklin, Kalckreuth, Max Schmidt, Pauwels, Heumann, Verlat and Thédy. Under the patronage of Charles Alexander, also, Weimar became a famous musical centre, principally owing to the presence of Franz Liszt, who from 1848 to 1886 made Weimar his principal place of residence. Other notable conductors of the Weimar theatre orchestra were Eduard Lassen and Richard Strauss.

See Schöll, *Weimar's Merkwürdigkeiten einst und jetzt* (Weimar, 1857); Springer, *Weimar's klassische Stätten* (Berlin, 1868); Ruland, *Die Schätze des Goethe National-Museums in Weimar* (Weimar and Leipzig, 1887); Francke, *Weimar und Umgebungen* (3rd ed., Weimar, 1900); Kuhn, *Weimar in Wort und Bild* (4th ed., Jena, 1905).

WEINHEIM, a town of Germany, in the grand-duchy of Baden, pleasantly situated on the Bergstrasse at the foot of the Odenwald, 11 m. N. of Heidelberg by the railway to Frankfort-on-Main. Pop. (1905) 12,560. It is still in part surrounded by the ruins of its ancient walls. The Gothic town hall; the ruins of the castle of Windeck and the modern castle of the counts of Berckheim; the house of the Teutonic Order; and three churches are the principal buildings. The town has various manufactures, notably leather, machinery and soap, and cultivates fruit and wine. It is a favourite climatic health resort and a great tourist centre for excursions in the Odenwald range. Weinheim is mentioned in chronicles as early as the 8th century, when it was a fief of the abbey of Lorsch, and it was fortified in the 14th century. In the Thirty Years' War it was several times taken and plundered, and its fortifications dismantled.

See Hegewald, *Der Luftkurort Weinheim an der Bergstrasse* (Weinheim, 1895); Ackermann, *Führer durch Weinheim und Umgebung* (Weinheim, 1895); and Zinkgräf, *Bilder aus der Geschichte der Stadt Weinheim* (Weinheim, 1904).

WEINSBERG, a small town of Germany, in the kingdom of Württemberg, pleasantly situated on the Sulm, 5 m. E. from Heilbronn by the railway to Crailsheim. Pop. (1905) 3097. It has an ancient Romanesque church, a monument to the reformer Oecolampadius (*q.v.*), and a school of viticulture, which is the chief occupation of the inhabitants. On the Schlossberg above the town lie the ruins of the castle of Weibertreu, and at its foot is the house once inhabited by Justinus Kerner (*q.v.*), with a public garden and a monument to the poet.

The German king Conrad III. defeated Count Welf VI. of Bavaria near Weinsberg in December 1140, and took the town, which later became a free imperial city. In 1331 it joined the league of the Swabian cities, but was taken by the nobles in 1440 and sold to the elector palatine, thus losing its liberties. It was burnt in 1525 as a punishment for the atrocities committed by the revolted peasants. The famous legend of Weibertreu ("women's faithfulness"), immortalized in a ballad by Chamisso, is connected with the siege of 1140, although the story is told of other places. It is said that Conrad III. allowed the women to leave the town with whatever they could carry, whereupon they came out with their husbands on their backs.

See Bernheim, "Die Sage von den treuen Weibern zu Weinsberg" (in the *Forschungen zur deutschen Geschichte*, vol. xv., Göttingen, 1875); Merk, *Geschichte der Stadt Weinsberg und ihrer Burg Weibertreu* (Heilbronn, 1880).

WEIR, ROBERT WALTER (1803–1889), American portrait and historical painter, was born at New Rochelle, New York, on the 18th of June 1803. He was a pupil of Jarvis, was elected to the National Academy of Design in 1829, and was teacher of drawing at the United States Military Academy at West Point in 1834–1846, and professor of drawing there in 1846–1876. He died in New York City on the 1st of May 1889. Among his better-known works are: "The Embarkation of the Pilgrims" (in the rotunda of the United States Capitol at Washington, D.C.); "Landing of Hendrik Hudson"; "Evening of the Crucifixion"; "Columbus before the Council of Salamanca"; "Our Lord on the Mount of Olives"; "Virgil and Dante crossing the Styx," and several portraits, now at West Point, and "Peace and War" in the Chapel there.

His son, JOHN FERGUSON WEIR (b. 1841), painter and sculptor, became a Member of the National Academy of Design in 1866, and was made director of the Yale University Art School in 1868. Another son, JULIAN ALDEN WEIR (b. 1852), studied under his father, and under J. L. Gérôme, and became a distinguished portrait, figure and landscape painter. He was one of the founders of the Society of American Artists in 1877, and became a member of the National Academy of Design (1886) and of the Ten American Painters, New York.

WEIR (from O. Eng. *wer*, a dam; cognate with *werian*, to defend, guard; cf. Ger. *Wehr*, defence), a barrier placed across rivers to raise the water-level for catching fish, for mills, for navigation or for irrigation, the discharge of the river taking place over the crest or through openings made for the purpose. Rough weirs, formed of stakes and twigs, were erected across English rivers in Saxon times for holding up the water and catching fish, and fish-traps, with iron-wire meshes and eel baskets, are still used sometimes at weirs. Weirs are essential for raising the head of water for water-wheels at mills, and for diverting some of the flow of a river into irrigation canals; but they have received their greatest and most varied extension in the canalization of rivers for navigation. There are three distinct classes of weirs, namely, solid weirs, draw-door weirs, including regulating sluices for irrigation, and movable weirs, which retain the water above them for navigation during the low stage of the river, and can be lowered or removed so as to leave the channel quite open in flood-time.

Solid Weirs.—The simplest form of weir is a solid, watertight dam of firm earthwork or rubble stone, faced with stone pitching, with cribs filled with rubble, with fascine mattresses weighted with stone, or with masonry, and protected from undermining by sheet piling or one or more rows of well foundations. These weirs, if solidly constructed, possess the advantages of simplicity, strength and durability, and require no superintendence. They, however, block up the river channel to the extent of their height, and consequently raise the flood-level above them. This serious defect of solid weirs, where the riparian lands are liable to be injured by inundations, can be slightly mitigated by keeping down the crest of the weir somewhat below the required level, and then raising the water-level at the low stage of the river by placing a row of planks along the top of the weir.

Waste weirs resemble ordinary solid weirs in providing for the surplus discharge from a reservoir of an impounded river or mountain stream over their crest; but in reality they form part of a masonry reservoir dam for storing up water for water-supply or irrigation, kept purposely lower than the rest of the dam to allow the excess of water to escape down the valley (see WATER-SUPPLY).

Draw-door Weirs.—The discharge of a river at a weir can be regulated as required and considerably increased in flood-time by introducing a series of openings in the centre of a solid weir, with sluice-gates or panels which slide in grooves at the sides of upright frames or masonry piers erected at convenient intervals apart, and which can be raised or lowered as desired from a foot-bridge. This arrangement has been provided at several weirs on the Thames, to afford control of the flood discharge, and reduce the extent of the inundations; the largest of these composite weirs on that river is at the tidal limit at Teddington, where the two central bays, with a total length of 242¼ ft., are closed by thirty-five draw-doors sliding between iron frames supporting a foot-bridge, from which the doors are raised by a winch.[1] Ordinary draw-doors, sliding in grooves of moderate size and raised against a small head of water, can be readily worked in spite of the friction of the sides of the doors against their supports; but with large draw-doors and a considerable head, the friction of the surfaces in contact offers a serious impediment in raising them. This friction has been greatly reduced by making the draw-doors, or sluice-gates, slide on each side against a vertical row of free-rollers suspended by an encircling chain; and the working is much facilitated by counterpoising the doors. By these arrangements the large draw-door weir across the Thames at Richmond, with three spans of 66 ft. closed by lifting doors, each 12 ft. high and weighing 32 tons, can be fully opened in seven minutes by two men raising each door from the arched double foot-bridge (figs. 1, 2 and 3). This weir retains the river above it at half-tide level, in order to cover the mud-banks which had been bared at low tide between Richmond and Teddington by the lowering of the low-water level, owing to the removal of various obstructions in the river below. The weir is raised out of the river as soon as the flood-tide on its lower side has risen to half-tide level, so as not to impede the flow and ebb of the tide up to Teddington above that level, and is not lowered till the tide has fallen again to the same level. In order that the doors when raised may not impede the view under the arches, the doors are rotated automatically at the top by grooves at the sides of the piers, so as to assume a horizontal position and pass out of sight in the central space between the two foot-ways (fig. 2). The barrage at the head of the Nile delta, and the regulating sluices across the Nile at Assiut and Esna in Upper Egypt below Assuan, are examples of draw-door weirs, with their numerous openings closed by sluice-gates sliding on free rollers, which control the discharge of water from the river for irrigation.

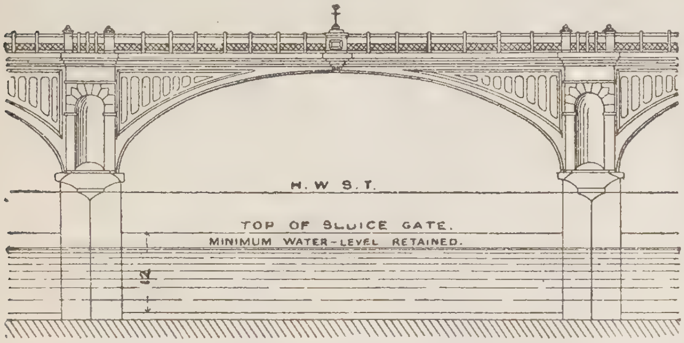

FIG. 1.—Lifting-gate Weir and Foot-bridge at Richmond, Surrey.

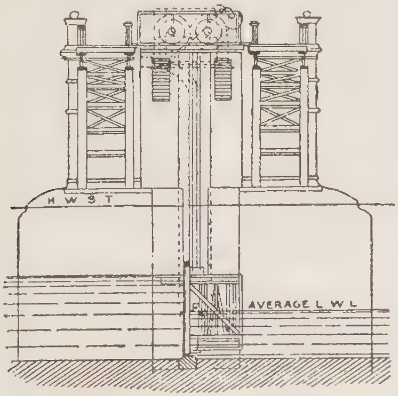

FIG. 2.—Mechanism of Lifting-gate, Richmond.

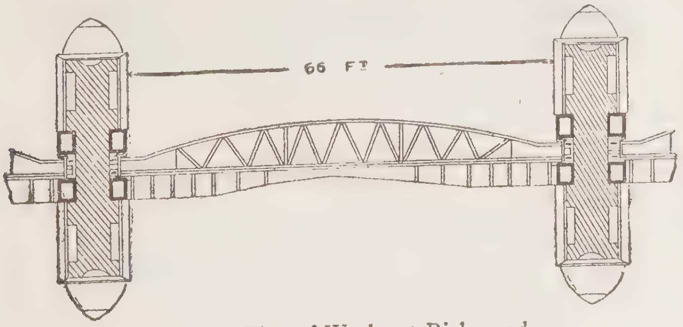

FIG. 3.—Plan of Works at Richmond.

Movable Weirs.—There are three main types of movable weirs, namely frame weirs, shutter weirs and drum weirs, which, however, present several variations in their arrangements.

Frame weir.

The ordinary form of frame weir consists of a series of iron frames placed across a river end on to the current, between 3 and 4 ft. apart, hinged to a masonry apron on the bed of the river and carrying a foot-bridge along the top, from which the actual barrier, resting against the frames and cross-bars at the top and a sill at the bottom, is put into place or removed for closing or opening the weir. The barrier was originally formed of a number of long square wooden spars which could be readily handled by one man, being inclined slightly from the vertical and placed close together for shutting the weir; but panels of wood or sheet-iron closing the space between adjacent frames and sliding in grooves at the sides, and rolling-up curtains composed of a series of horizontal wooden laths connected by leathern hinges, have also been employed. The needle weir, so called from the long, slender spars being termed *aiguilles* in France, had the merit of simplicity in its earliest form; and by means of some ingenious contrivances, comprising a hook, winch, lever and rotating bar, for assisting the weir-keepers in placing and releasing the needles, the system has been applied successfully to the weirs of greater height required on the Meuse, the Main and the Moldau (fig. 4). The needle weir has, however, attained its greatest development in the United States across the Big Sandy river at Louisa, where, instead of needles 3 to 4 in. square, beams 12 in. square and 18½ ft. long have been resorted to, provided with a steel eye at the top and a ring near the centre of gravity to enable them to be worked (fig. 5). The needles are put in place one by one against the raised frames, or trestles, by a derrick on a barge lifting them by their ring, whilst a man on the foot-bridge, taking hold of the eye at the top, arranges them in position close together. The weir is opened by joining the needles of each bay by a chain passed through the eyes at the top and a line of wire through the central rings, so that when released at the top by the tilting of the escape bar by the derrick, they float down as a raft, and are caught by a man in a boat, or when the current is strong, they are drawn to the bank by a rope attached to them previously to their release. The trestles of this weir are, as usual, hinged to the apron, so that in flood-time they can be completely lowered into a recess across the apron by means of chains actuated by a winch, leaving the channel perfectly open for the discharge of floods and for the passage of vessels when the lock is submerged. Whereas, however, ordinary frames placed nearer together than their height overlap one another when lowered on to the apron, the trestles of the Louisa weir lie clear of each other quite flat on the apron.

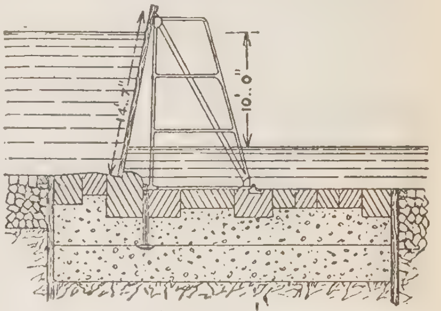

FIG. 4.—Needle Weir, River Moldau.

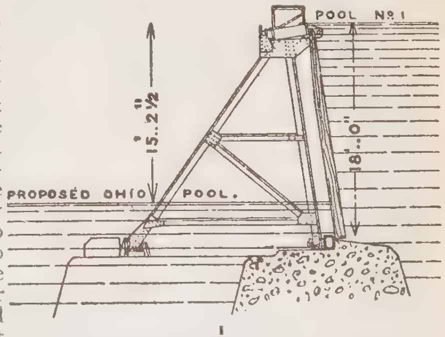

FIG. 5.—Spar Weir, Louisa, Big Sandy River, U.S.A.

The frame weir closed by sliding panels or rolling-up curtains (fig. 6) possesses the advantage that the panels or laths can be diminished in thickness towards the top in proportion to the reduced water-pressure; whereas the needles, being of uniform cross-section, have to be made stout enough to sustain the maximum bottom pressure.

An objection has occasionally been urged against frames lowered on to the bed of a river that they are liable to be covered over by detritus or drift brought down by floods, and consequently are subject to injury or impediments in being raised. In order to

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[1] L. F. Vernon-Harcourt, *Rivers and Canals*, 2nd edition, p. 114, and plate iii. figs. 15 and 16.

Suspended frame weir.

obviate this, the frames have, in a few instances, been suspended from an overhead foot-bridge. The system was first proposed in view of the canalization of the Rhone, which brings down large quantities of shingle and gravel; but it was first adopted for two weirs on the lower Seine under quite different conditions (fig. 7). The frames hang vertically from the bottom of the overhead bridge, and rest against a sill at the bottom when the weir is in operation, the openings between the frames being closed below the water-level by rolling-up curtains or sliding panels, which are lowered or raised by a travelling winch carried by a small foot-bridge formed by hinged brackets at the back of the frames, and situated a little above the highest flood-level. The weir is opened by removing the sliding panels or rolling up the curtains, and then lifting the hinged frames to a horizontal position under the overhead bridge by means of chains worked by a winch on the bridge. This system, which has been employed for the lowest weir on the Moldau, and for a weir at the upper end of the Danube canal near Vienna to shut out floods and floating ice, as well as on the Seine, possesses the merits of raising all the movable parts of the weir out of water in flood-time, and rendering the working of the weir very safe and easy. On the other hand, it involves the expense of a wide foot-bridge for raising the frames, and wide and high river piers, especially for the navigable passes where the bridge has to be raised high enough to afford the regulation headway for vessels at the highest navigable flood-level (fig. 7), so that its adoption should be restricted to positions where the conditions are quite exceptional.

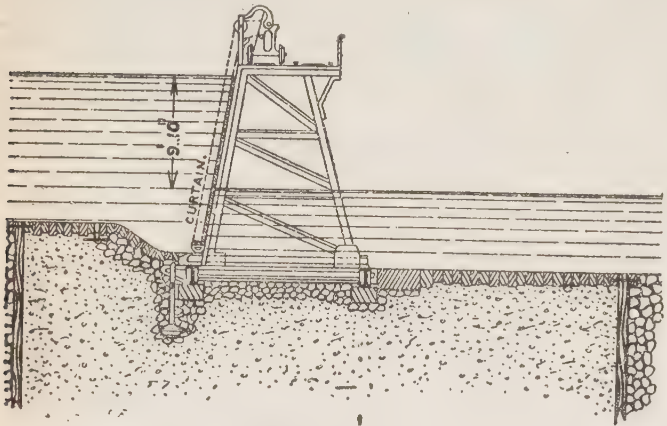

Fig. 6.—Frame Weir with Rolling-up Curtain, Port Villez, Lower Seine.

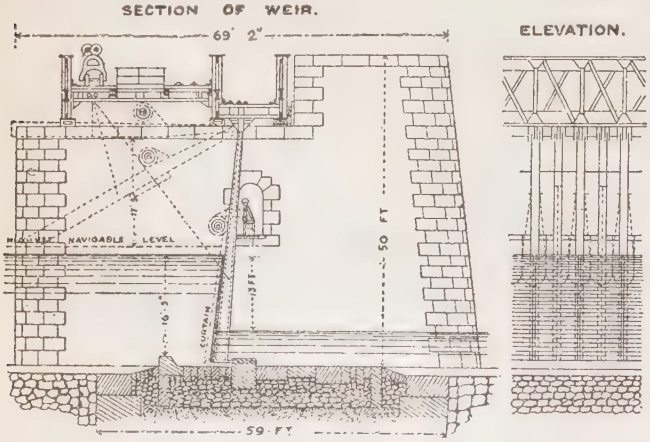

Fig. 7.—Suspended Frame Weir, Poses, River Seine.

Shutter weir.

The earliest form of shutter weir, known as a bear-trap, introduced in the United States in 1818, and subsequently erected across the Marne in France, consists of two wooden gates, each turning on a horizontal axis laid across the apron, inclined towards one another and abutting together at an angle in the centre when the weir is closed; the up-stream one serves as the weir, and the down-stream one forms its support, and both fall flat upon the apron for opening the weir.[1] This weir is raised by admitting water under pressure beneath the gates through culverts in connexion with the upper pool; and is lowered by unfastening the raised gates and letting the water under them escape into the lower pool. This old form of bear-trap has been used for closing an opening 52 ft. wide to provide for the escape of drift at the Davis Island weir across the Ohio. Improvements, however, in the bear-trap have been introduced in the United States, one of the best novel forms being shown in fig. 8, whereby the pass of a weir 80 ft. in width can be readily closed, opened or partially opened under a maximum head of 16 ft. by means of chains worked by a winch.[2] The shutter weir, introduced on the upper Seine about the middle of the 19th century and subsequently adopted for weirs across several rivers in France, Belgium and the United States, consists of a row of wooden or iron shutters turning on a horizontal axis a little above their centre of pressure, borne by an iron trestle at the back of each shutter, which is hinged to the apron of the weir, and supported when raised by an iron prop resting against an iron shoe fastened on the apron (fig. 9). The weir is opened by releasing the iron props from their shoes, either by a sideways pull of a tripping bar with projecting teeth laid on the apron and worked from the bank, or by pulling the props clear of their shoes by chains fastened to the bottom of the shutters; the unsupported trestles and shutters fall flat on the apron on the top of the props, as shown by dotted lines in fig. 9. The weir is raised again by pulling up the shutters to a horizontal position by their bottom chains from a special boat, or from a foot-bridge on movable frames, together with their trestles and the props which are replaced in their shoes. The discharge at the weir whilst it is raised is effected either by partially tipping some of the shutters by chains from a foot-bridge, or by opening butterfly valves resembling small shutters in the upper panels of the shutters. The addition of a foot-bridge greatly facilitates the raising and lowering of these shutter weirs, and also aids the regulation of the discharge; but it renders this form of weir much more costly than the ordinary frame weir, and where large quantities of drift come down with sudden floods, the frames of the bridge are liable to be carried away, and therefore boats must be relied on for working the weir.

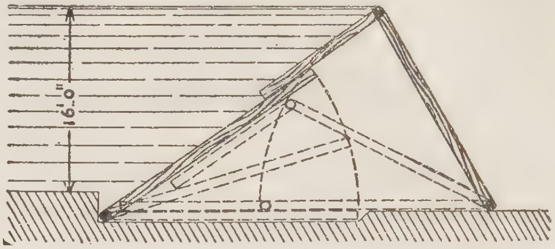

Fig. 8.—Bear-trap Weir, U.S.A.

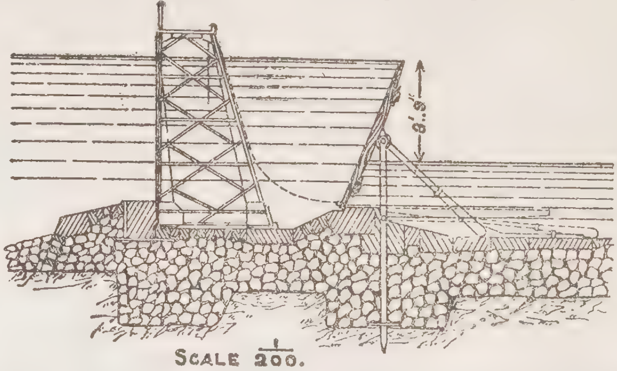

Fig. 9.—Shutter Weir with Foot-bridge, Port à l'Anglais, Upper Seine.

Drum weir.

The drum weirs erected across shallow, regulating passes on the river Marne in 1857–1867 comprise a series of upper and under wrought-iron paddles, which can make a quarter of a revolution round a central axis laid along the sill of the weir. The straight, upper paddles form the weir, and can be raised against the stream by making the water from the upper pool press upon the upper faces of the slightly larger lower paddles, crooked for the purpose, causing them to revolve in a quadrant of a cylinder under the sill, known as the drum; and they can be readily lowered by cutting off the flow from the upper pool and putting the drum in communication with the lower pool, which connexions can be adjusted by see-saw sluice-gates, so as to put the upper paddles in any intermediate position between vertical and horizontal (fig. 10). The merits of this weir in being easily raised against a strong current and in allowing of the perfect regulation of the discharge, are unfortunately, under ordinary conditions, more than counterbalanced by the necessity of carrying the drum and its foundations to a greater depth below the sill of the weir than the height of the weir above it. Accordingly, for several years its use was restricted to the Marne; but in 1883–1886 drum weirs were adopted for closing the timber passes alongside the needle weirs placed across the Main, with a single upper paddle $39\frac{1}{3}$ ft. long and 5 ft. 7 in. high in each case; and a still larger drum weir was erected about the same time for closing the navigable pass of a weir across the Spree at Charlottenburg, with an upper paddle $32\frac{3}{4}$ ft. long and $9\frac{1}{6}$ ft. high (fig. 10).

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[1] *Rivers and Canals*, p. 132 and plate iv. fig. 15.

[2] *Proc. Inst. C.E.*, vol. cxxix., p. 258 and plate vi., fig. 2.

A peculiar and cheaper form of drum weir has been constructed across ten bays each 75 ft. wide on the Osage river near its confluence with the Missouri, where a hollow, wooden, cylindrical sector, stiffened inside by iron framing and revolving on an axis laid along the crest of the solid part of the weir, fits into a drum at the back lined with planking, having a radius of 9 ft. The weir is raised by admitting water from the upper pool into a wedge-shaped space left below the sector when it is lowered in the drum, which by its pressure lifts the sector out of the drum, forming a barrier, 7 ft. high, closing each bay of the weir. Provision has also been made for rendering the sector buoyant by forcing air into it, so that it can be raised when the head of water is insufficient to lift it by the pressure of the water from the upper pool. In spite of its high cost, the drum weir furnishes a valuable hydraulic contrivance for situations where it is very important to be able to close a weir of moderate height against a strong current and to regulate with ease and precision the discharge past a weir. (L. F. V.-H.)

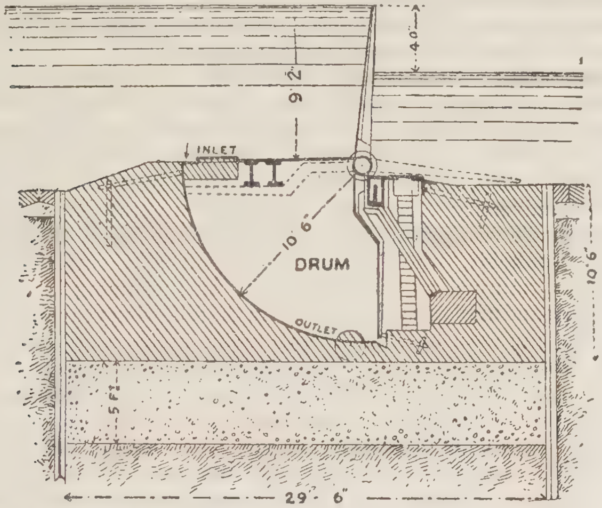

FIG. 10.—Drum Weir, Charlottenburg, River Spree.

WEISMANN, AUGUST (1834–), German biologist, was born at Frankfort-on-Main, on the 17th of January 1834, and studied medicine in Göttingen. After spending three years in Rostock, he visited successively Vienna (1858), Italy (1859) and Paris (1860), and from 1861 to 1862 he acted as private physician to the archduke Stephen of Austria at Schaumburg Palace. In 1863 he went to Giessen to devote himself to biological study under Leuckart, and in 1866 he was appointed extraordinary professor of zoology at Freiburg, becoming ordinary professor a few years later. His earlier work was largely concerned with purely zoological investigations, one of his earliest works dealing with the development of the Diptera. Microscopical work, however, became impossible to him owing to impaired eyesight, and he turned his attention to wider problems of biological inquiry. Between 1868 and 1876 he published a series of papers in which he attacked the question of the variability of organisms; these were published in an English translation by R. Meldola in 1882, under the title *Studies in the Theories of Descent*, Darwin himself contributing a preface in which the importance of the nature and cause of variability in individuals was emphasized. Weismann's name, however, is best known as the author of the germ-plasm theory of heredity, with its accompanying denial of the transmission of acquired characters—a theory which on its publication met with considerable opposition, especially in England, from orthodox Darwinism. A series of essays in which this theory is expressed was collected and published in an English translation (*Essays upon Heredity and Kindred Biological Problems*, vol. i. 1889, vol. ii. 1892). Weismann published many other works devoted to the exposition of his biological views, among them being *Die Dauer des Lebens*; *Vererbung*; *Ewigkeit des Lebens*; *Die Kontinuität des Keimplasmas als Grundlage einer Theorie der Vererbung*; *Das Keimplasma*; *Die Allmacht der Naturzüchtung*; *Äussere Einflüsse als Entwicklungsreize*; *Neue Gedanken zur Vererbungsfrage*, and *Germinal-Selektion*.

For an account of his doctrines the reader is referred to the articles on HEREDITY, REGENERATION and REPRODUCTION.

WEISS, BERNHARD (1827–), German Protestant New Testament scholar, was born at Königsberg on the 20th of June 1827. After studying theology at Königsberg, Halle and Berlin, he became professor extraordinarius at Königsberg in 1852, and afterwards professor ordinarius at Berlin. In 1880 he was made superior consistorial councillor. An opponent of the Tübingen School, he published a number of important works, which are well known to students in Great Britain and America.

He edited and revised *Matthew* (the 9th ed., 1897), *Mark and Luke* (the 9th ed., 1901), *John* (the 9th ed., 1902), *Romans* (the 9th ed., 1899), the *Epistles to Timothy and Titus* (the 7th ed., 1902), *Hebrews* (the 6th ed., 1897), the *Epistles of John* (the 6th ed., 1900). His other works include: *Lehrbuch der biblischen Theologie des Neuen Testaments* (1868, 9th ed., 1903; Eng. trans., 1883), *Das Leben Jesu* (1882, 4th ed., 1902; Eng. trans., 1883), *Lehrbuch der Einleitung in das Neue Testament* (1886; 3rd ed., 1897; Eng. trans. 1888), *Das Neue Testament: Berichtigter Text* (3 vols., 1902), and *Die Quellen des Lukasevangeliums* (1907). He was also the reviser of commentaries on the New Testament in the series of H. A. W. Meyer.

WEISSE, CHRISTIAN HERMANN (1801–1866), German Protestant religious philosopher, was born at Leipzig on the 10th of August 1801. He studied at Leipzig, and at first belonged to the Hegelian school of philosophy. In course of time, however, his ideas approximating to those of Schelling in his later years, he elaborated with I. H. v. Fichte a new speculative theism, and became an opponent of Hegel's pantheistic idealism. In his addresses on the future of the Protestant Church (*Reden über die Zukunft der evangelischen Kirche*, 1849), he finds the essence of Christianity in Jesus's conceptions of the heavenly Father, the Son of Man and the kingdom of Heaven. In his work on philosophical dogmatics (*Philosophische Dogmatik oder Philosophie des Christentums*, 3 vols. 1855–1862) he seeks, by idealizing all the Christian dogmas, to reduce them to natural postulates of reason or conscience. He died on the 19th of September 1866.

His other works include: *Die Idee der Gottheit* (1833), *Die philosophische Geheimlehre von der Unsterblichkeit des menschlichen Individuums* (1834), *Büchlein von der Auferstehung* (1836), *Die evangelische Geschichte, kritisch und philosophisch bearbeitet* (2 vols., 1838), and *Psychologie und Unsterblichkeitslehre* (edited by R. Seydel, 1869). See O. Pfleiderer, *Development of Theology* (1890); and cf. R. Seydel, *Christ. Herm. Weisse* (1866), and *Religion und Wissenschaft* (1887).

WEISSENBURG, a town of Germany, in the imperial province of Alsace-Lorraine, district of Lower Alsace, on the Lauter, at the foot of the eastern slope of the Vosges Mountains, 42 m. N.E. of Strassburg by the railway Basel-Strassburg-Mannheim. Pop. (1900) 6946. The beautiful Roman Catholic abbey church of SS. Peter and Paul, dating from the 13th century, contains some fine early stained glass. The industries include the manufacture of paper, matches, stockings and beer, and hops and wine are also extensively cultivated. Weissenburg grew up round a Benedictine abbey which was founded in the 7th century by Dagobert II. and became the seat of a famous school. Here Otfrid, who was a native of the district, completed (*c.* 868) his Old High German Gospel book (see GERMAN LITERATURE). The town became a free imperial city in 1305. It has been the scene of two memorable battles. The famous "Weissenburg lines," consisting of entrenched works erected by Villars in 1706 along the Lauter, and having a length of 12 m., were stormed in October 1793 by the Prussians and Saxons under the Austrian general Wurmser. The Allies were in their turn dispossessed by Pichegru in December and forced to retreat behind the Rhine. These lines, as well as the fortifications of Weissenburg, are now dismantled. On the 4th of August 1870 the Germans under the crown prince of Prussia, afterwards the emperor Frederick, gained the first victory of the war over a French corps (part of the army commanded by MacMahon) under General Douay, who was killed early in the engagement.

The name Weissenburg occurs in three other places; the town of Weissenburg-am-Sand in Bavaria (*q.v.*); a Swiss invalid resort in the Niedersimmental, above Lake Thun, with sulphate of lime springs, beneficial for bronchial affections; also a Hungarian comitat (Magyar Fejérvár), with Stuhlweissenburg as capital.

WEISSENBURG-AM-SAND, a town of Germany, in the Bavarian district of Middle Franconia, situated in a pleasant and fertile country at the western foot of the Franconian Jura, 1300 ft. above the sea, and 33 m. by rail S.W. of Nuremberg by the railway to Munich. Pop. (1905) 6709. It is still surrounded by old walls and towers, and has two Gothic churches and a Gothic town-hall. The town has a mineral spring, connected with which is a bathing establishment. A Roman castle has recently been discovered, and there is a collection of antiquities in the modern school. The old fortalice of Wülzburg (2060 ft.) overlooks the town. Gold and silver fringe, bricks, cement wares, beer and cloth are manufactured. Weissenburg dates from the 8th century, and in the 14th was made a free imperial town. It passed to Bavaria in 1806.

See C. Meyer, *Chronik der Stadt Weissenburg in Bayern* (Munich, 1904); and Fabricius, *Das Kastell Weissenburg* (Heidelberg, 1906).

WEISSENFELS, a town of Germany, in the Prussian province of Saxony, situated on the Saale 20 m. S.W. of Leipzig and 19 m. S. of Halle by the main line to Bebra and Frankfort-on-Main. Pop. (1905) 30,894. It contains three churches, a spacious market-place and various educational and benevolent institutions. The former palace, called the Augustusburg, built in 1664–1690, lies on an eminence near the town; this spacious edifice is now used as a military school. Weissenfels manufactures machinery, ironware, paper and other goods, and has an electrical power-house. In the neighbourhood are large deposits of sandstone and lignite. Weissenfels is a place of considerable antiquity, and from 1656 till 1746 it was the capital of the small duchy of Saxe-Weissenfels, a branch of the electoral house of Saxony, founded by Augustus, second son of the elector John George I. The body of Gustavus Adolphus was embalmed at Weissenfels after the battle of Lützen.

See Sturm, *Chronik der Stadt Weissenfels* (Weissenfels, 1846); and Gerhardt, *Geschichte der Stadt Weissenfels* (Weissenfels, 1907).

WEIZSÄCKER, KARL (1822–1899), German Protestant theologian, was born at Oehringen near Heilbronn in Württemberg, on the 11th of December 1822. After studying at Tübingen and Berlin, he became *Privatdozent* at Tübingen in 1847 and eventually (1861) professor of ecclesiastical and dogmatic history. From 1856 to 1878 he helped to edit the *Jahrbücher für deutsche Theologie*; and his elaborate studies *Untersuchungen über die evangelische Geschichte, ihre Quellen und den Gang ihrer Entwicklung* (1864) and *Das apostolische Zeitalter der christl. Kirche* (1886, 2nd ed. 1893; Engl. trans. 1894–1895) made him widely known and respected. He died on the 13th of August 1899. His son, Karl von Weizsäcker (b. 1853), was appointed in 1900 *Kultusminister* for Württemberg.

Weizsäcker's other works include *Zur Kritik des Barnabasbriefs* (1863) and *Ferdinand Christian Baur* (1892). Cf. Hegler, *Zur Erinnerung an Karl Weizsäcker* (1900).

WEKERLE, SANTOR [Alexander] (1848–), Hungarian statesman, was born on the 14th of November 1848 at Móór, in the comitat of Stuhlweissenburg. After studying law at the university of Budapest he graduated *doctor juris*. He then entered the government service, and after a period of probation was appointed to a post in the ministry of finance. He still, however, continued an academic career by lecturing on political economy at the university. In 1886 Wekerle was elected to the House of Deputies, became in the same year financial secretary of state, and in 1889 succeeded Tisza as minister of finance. He immediately addressed himself to the task of improving the financial position of the country, carried out the conversion of the State loans, and succeeded, for the first time in the history of the Hungarian budget, in avoiding a deficit. In November 1892 Wekerle succeeded Count Szapáry as premier, though still retaining the portfolio of finance. At the head of a strong government he was enabled, in spite of a powerful opposition of Catholics and Magnates, to carry in 1894 the Civil Marriage Bill. The continued opposition of the clerical party, however, brought about his resignation on the 22nd of December 1894, when he was succeeded by Banffy. On the 1st of January 1897 he was appointed president of the newly created judicial commission at Budapest, and for the next few years held aloof from politics, even under the *ex-lex* government of Fejérváry. On the reconciliation of the king-emperor with the coalition he was therefore selected as the most suitable man to lead the new government, and on the 8th of April 1906 was appointed prime minister, taking at the same time the portfolio of finance. He resigned the premiership on the 27th of April 1909, but was not finally relieved of his office until the formation of the Khuen-Hedérváry cabinet on the 17th of January 1910.

WELCKER, FRIEDRICH GOTTLIEB (1784–1868), German philologist and archaeologist, was born at Grünberg in the grand duchy of Hesse. Having studied classical philology at the university of Giessen, he was appointed (1803) master in the high school, an office which he combined with that of lecturer at the university. In 1806 he journeyed to Italy, and was for more than a year private tutor at Rome in the family of Wilhelm von Humboldt, who became his friend and correspondent. Welcker returned to Giessen in 1808, and resuming his school-teaching and university lectures was in the following year appointed the first professor of Greek literature and archaeology at that or any German university. After serving as a volunteer in the campaign of 1814 he went to Copenhagen to edit the posthumous papers of the Danish archaeologist Georg Zoëga (1755–1809), and published his biography, *Zoëgas Leben* (Stutt. 1819). His liberalism in politics having brought him into conflict with the university authorities of Giessen, he exchanged that university for Göttingen in 1816, and three years later received a chair at the new university of Bonn, where he established the art museum and the library, of which he became the first librarian. In 1841–1843 he travelled in Greece and Italy (cf. his *Tagebuch*, Berlin, 1865), retired from the librarianship in 1854, and in 1861 from his professorship, but continued to reside at Bonn until his death. Welcker was a pioneer in the field of archaeology, and was one of the first to insist, in opposition to the narrow methods of the older Hellenists, on the necessity of co-ordinating the study of Greek art and religion with philology.

Besides early work on Aristophanes, Pindar, and Sappho, whose character he vindicated, he edited Alcman (1815), Hipponax (1817), Theognis (1826) and the Theogony of Hesiod (1865), and published a *Sylloge epigrammatum Graecorum* (Bonn, 1828). His *Griechische Götterlehre* (3 vols., Göttingen, 1857–1862) may be regarded as the first scientific treatise on Greek religion. Among his works on Greek literature the chief are *Die Äschyleische Trilogie* (1824, 6), *Der epische Zyklus oder die Homerischen Gedichte* (2 vols. 1835, 49), *Die griechischen Tragödien mit Rücksicht auf den epischen Zyklus geordnet* (3 vols., 1839–1841). His editions and biography of Zoëga, his *Zeitschrift für Geschichte und Auslegung der alten Kunst* (Göttingen, 1817, 8) and his *Alte Denkmäler* (5 vols., 1849–1864) contain his views on ancient art.

See Kekulé, *Das Leben F. G. Welckers* (Leipzig, 1880); *W. von Humboldts Briefe an Welcker* (ed. R. Haym, Berlin, 1859); J. E. Sandys, *History of Classical Scholarship* (vol. iii., pp. 216, 7, Cambridge, 1908).

WELDING (*i.e.* the action of the verb "to weld," the same word as "to well," to boil or spring up, the history of the word being to boil, to heat to a high degree, to beat heated iron; according to Skeat, who points out that in Swedish the compound verb *uppvälla* means to boil, the simple *välla* is only used in the sense of welding), the process of uniting metallic surfaces by pressure exercised when they are in a semi-fused condition. It differs therefore from brazing and soldering, in which cold surfaces are united by the interposition of a fused metallic cementing material. The conditions in which welding is a suitable process to adopt are stated in the article Forging. The technique of the work will be considered here.

The conditions for successful welding may be summed up as clean metallic surfaces in contact, a suitable temperature and rapid closing of the joint. All the variations in the forms of welds are either due to differences in shapes of material, or to the practice of different craftsmen. The typical weld is the scarf. If, for instance, a bar has to be united to another bar or to an eye, the joint is made diagonally (scarfed) because that gives a longer surface in contact than a weld at right angles (a butt weld), and because the hammer can be brought into play better. Abutting faces for a scarfed joint are made slightly convex; the object is to force out any scale or dirt which might otherwise become entangled in the joint at the moment of closing and which would impair its union. The ends are upset (enlarged) previous to welding, in order to give an excess of metal that will permit of slight corrections being effected around the joint ("swaging") without reducing the diameter below that of the remainder of the bar. These principles are seen in other joints of diverse types, in the butt, the vee and their modifications. Joint faces must be clean, both chemically, *i.e.* free from oxides, and mechanically, *i.e.* free from dust and dirt, else they will not unite. The first condition is fulfilled by the use of a fluxing agent, the second by ordinary precautions. The flux produces with the oxide a fluid slag which is squeezed out at the instant of making the weld. The commonest fluxes are sand, used chiefly with wrought iron, and borax, used with steel; they are dusted over the joint faces both while in the fire and on the anvil. Mechanical cleanliness is ensured by heating the ends in a clean hollow fire previously prepared, and in brushing off any adherent particles of fuel before closing the weld. The scarf, the butt and the vee occur in various modifications in all kinds of forgings, but the principles and precautions to be observed are identical in all. But in work involving the use of rolled sections, as angles, tees, channels and joists, important differences occur, because the awkwardness of the shapes to be welded involves cutting and bending and the insertion of separate welding pieces ("gluts"). Welds are seldom made lengthwise in rolled sections, nor at right angles, because union is effected in such cases by means of riveted joints. But welding is essential in all bending of sections done at sharp angles or to curves of small radius. It is necessary, because a broad flange cannot be bent sharply; if the attempt be made when it is on an outer curve it is either ruptured or much attenuated, while on an inner curve it is crumpled up. The plater's smith therefore cuts the flanges in both cases, and then bends and welds them. If it is on an inner curve, the joint is a lap weld; if it is on an outer one, a fresh piece or glut is welded in. Gluts of rectangular section are used for cylindrical objects and rings of various sections. The edges to be united may or may not be scarfed, and the gluts, which are plain bars, are welded against the edges, all being brought to a welding heat in separate furnaces. The furnace tubes of boilers and the cross tubes are welded in this way, sometimes by hand, but often with a power hammer, as also are all rings of angle and other sections on the vertical web.

The temperature for welding is very important. It must be high enough to render the surfaces in contact pasty, but must not be in excess, else the metal will become badly oxidized (burnt) and will not adhere. Iron can be raised to a temperature at which minute globules melt and fall off, but steel must not be heated nearly so much, and a moderate white heat must not be exceeded. Welds in steel are not so trustworthy nor so readily made as those in iron.

Thermit Welding.—The affinity of finely powdered aluminium for metallic oxides, sulphides, chlorides, &c., may be utilized to effect a reduction of metals with which oxygen, sulphur or chlorine combine. C. Vautin in 1894 found that when aluminium in a finely divided state was mixed with such compounds and ignited, an exceedingly high temperature, about 3000° C., was developed by the rapid oxidation of the aluminium. He found that metals which are ordinarily regarded as infusible were readily reduced, and in a very high degree of purity. These facts were turned to practical account by Dr H. Goldschmidt, who first welded two iron bars by means of molten iron produced by the process, to which the name of "thermit" is now commonly applied. The method has also been applied to the production of pure metals for alloying purposes, as of chromium free from carbon, used in the manufacture of chrome steel, of pure manganese for manganese steel, of molybdenum, ferro-vanadium, ferro-titanium and others used in the manufacture of high speed steels.

Thermit as a welding agent is produced by mixing iron oxides with finely granulated aluminium, in a special crucible lined with magnesia. On ignition, the chemical reactions proceed so rapidly that the contents would be lost over the edges unless the crucible were closed with a cover. The result of the reaction is that two layers are produced, the bottom one of pure iron, the top one of oxide of alumina or corundum. If the contents are poured over the edge, the slag follows first, and is followed by the metal. But in welding the metal is poured first through the bottom upon the joint. It is practically pure wrought iron in a molten state, at 3000° C., or 5400° F. The heat is so intense that it is possible thus to burn a clean hole through a 1 in. wrought iron plate. The joints are prepared by abutting them, and provision is made with clamps to grip and retain them in correct positions. Often, but not always, the part to be welded is enclosed in a mould, into which the thermit is tapped from the crucible. The applications of thermit welding are numerous. A wide field is that of tramway rails, of which large numbers have been successfully welded. Steel girders have been welded, as also have broken and faulty steel and iron castings, broken shafts, broken sternposts (for which crucibles 6 ft. in height with a capacity of 7 cwt. have been constructed), and wrought iron pipes. Another application is to render steel ingots sound, by introducing thermit in a block on an iron rod into the mould, which prevents or greatly lessens the amount of piping in the head, due to shrinkage and occlusion of gases. (J. G. H.)

Arc welding.

Electric Welding.—In electric welding and metal working the heat may be communicated to the metal by an electric arc, or by means of the electric resistance of the metal, as in the Thomson process. Arc welding is the older procedure, and it appears to have been first made use of by de Meritens in 1881 for uniting the parts of storage-battery plates. The work-piece was placed upon a support or table, and connected with the positive pole of a source of current capable of maintaining an electric arc. The other pole was a carbon rod directed by the hand of the operator so as first to make contact with the work-piece, and then to effect the proper separation to maintain the arc. The heat of the arc was partly communicated to the work and partly dissipated in the hot gases escaping into the surrounding air. The result was a fusion of the metallic lead of the storage-battery plate which united various parts of the plate. The process was somewhat similar to the operation of lead-burning by the hydrogen and air blowpipe, as used in the formation of joints in chemical tanks made of sheet-lead. The method of de Meritens has been modified by Bernardos and Olszewski, Slavienoff, Coffin and others.

In the Bernardos and Olszewski process the work is made the negative pole of a direct current circuit, and an arc is drawn between this and a carbon rod, to which a handle is attached for manipulating. As this rod is the positive terminal, particles of carbon may be introduced as a constituent of the metal taking part in the operation, making it hard and brittle, and causing cracks in the joint or filling; the metal may, in fact, become very hard and unworkable. The Slavienoff modification of the arc-welding process consists in the employment of a metal electrode in place of the carbon rod. The metal electrode gradually melts, and furnishes fused drops of metal for the filling of vacant spaces in castings, or for forming a joint between two parts or pieces.

In arc welding, with a current source at practically constant potential, a choking resistance in series with the heating arc is needed to secure stability in the arc current, as in electric arc lighting from constant potential lines. Little effective work can be done by the Bernardos and Olszewski method with currents much below 150 amperes in the arc, and the value in some cases ranges above 500 amperes. The potential must be such that an arc of 2 to 3 in. in length is steadily maintained. This may demand a total of about 150 volts for the arc and the choking resistance together. In the Slavienoff arc the potential required will be naturally somewhat lower than when a carbon electrode is used, and the current strength will be, on the other hand, considerably greater, reaching, it appears, in certain cases, more than 4000 amperes. In some recent applications of the arc process the polarity of the work-piece and the arc-controlling electrode has, it is understood, been reversed, the work being made the positive pole and the movable electrode the negative. More heat energy is thus delivered to the work for a given total of electric energy expended.

The arc method is essentially a fusing process, though with due care it is used for heating to plasticity the edges of iron sheets to be welded by pressure and hammering. It has been found applicable in special cases to the filling of defective spots in iron castings, by fusing into blow-holes or other spaces small masses of similar metal, added gradually, and melted into union with the body of the piece by the heat of the arc. Similarly, a more or less complete union between separate pieces of iron plate $\frac{1}{4}$ to $\frac{1}{2}$ in. in thickness has been effected by fusing additional metal between them. The range of operations to which the arc process is applicable is naturally somewhat limited, and depends to a large extent upon the skill acquired by the operator, who necessarily works with his eyes well screened from the glare of the large arc. Unless the space in which the work is carried on is large, the irritating vapours which rise from the arc stream add to the difficulty. Strong draughts of air which would disturb the arc must also be avoided. These factors, added to the relative slowness of the work and the uncertainty as to its result, have tended to restrict the application of arc welding in practice. Moreover, much heat-energy is dissipated in the arc flame and passes into the air, while, owing to the time required for the work, the metal undergoing treatment loses much heat by radiation. Yet the method requires little special machinery. The current may be taken from existing electric lighting and power circuits of moderate potential without transformation, and may be utilized with simple appliances, consisting chiefly of heavy wire leads, a carbon or metal electrode with a suitable handle for its manipulation, a choking or steadying resistance, and screen of dark glass for the operator's eyes.

In 1874 Werdermann proposed to use, as a sort of electric blowpipe, the flame gases of an electric arc blown or deflected by an air jet or the like—a suggestion subsequently revived by Zerener for arc welding. The arc in this instance is deflected from the space between the usual carbon electrodes by a magnetic field. The metal to be heated takes no part in the conduction of current, the heat is communicated by the gases of the arc, and, to a small extent, by the radiation from the hot carbon electrodes between which the arc is formed. The process is scarcely to be called electric in any true sense. Another curious operation, resembling in some respects the arc methods, has been proposed for the heating of metal pieces before they are brought under the hammer for forging or welding. The end of a metal bar is plunged into an electrolytic bath while connected with the negative pole of a lighting or other electric circuit having a potential of 100 to 150 volts. The positive pole is connected with a metal plate as an anode immersed in the electrolyte, or forming the side of the containing vat or tank. A solution of sodium or potassium carbonate is a suitable electrolyte. That part of the bar which is immersed acts as a cathode of limited surface, and is at once seen to be surrounded by a luminous glow, with gas bubbles arising from it. The immersed end of the bar rapidly heats, and may even melt under the liquid of the bath. It is probable that an arc forms between the surface of the metal and the adjacent liquid layer, the intense heat of which is in part communicated to the metal and in part lost in the solution, causing thereby a rapid heating of the bath. This singular action appears to have been first made known by Hoho and Lagrange. It is distinctly a form of electric heating, having no necessary relation to such subsequent operations as welding, and is, moreover, wasteful of energy, as the heat is largely carried off in the liquid bath.

Thomson process.

The process of Elihu Thomson first brought to public notice in 1886, has since that time been applied commercially on a large scale to various metal-welding operations. The metal pieces to be united are held in massive clamps and pressed together in firm contact; and a current is made to traverse the proposed joint, bringing it to the welding temperature. The union is effected by forcing the pieces together mechanically. The characteristic feature of the process is the fact that the heat is given out in the body of the metal.

The voltage does not usually exceed two or three, though it may reach four or five volts; but as the resistance of the metal pieces to be joined is low, the currents are of very large values, sometimes reaching between 50,000 and 100,000 amperes. Even for the joining of small wires the current is rarely less than 100 amperes. Such currents cannot, of course, be carried more than a few feet without excessive loss, unless the conductors are given very large section. With alternating currents, also, the effectiveness of the work speedily diminishes, on account of the inductive drop in the leads, if they are of any considerable length. The carrying of the welding currents over a distance of several feet may, in fact, lead to serious losses. These difficulties are overcome in the Thomson welding transformer, which resembles the step-down transformers used in electric lighting distribution by alternating currents, with the exception that the secondary coil or conductor, which forms part of the welding circuit, usually consists of only one turn of great section, S S (fig. 1). This is often made in the form of a copper casing, which surrounds or encloses the primary coil P P in whole or in part. The primary coil is of copper wire of many turns. The secondary casing, with the primary enclosed, is provided with the usual laminated iron-transformer core, I, constituting a closed iron magnetic circuit threading both primary and secondary electric circuits. The terminals of the single-turn secondary serve as connexions and supports for the welding clamps C D, which hold the work. The clamps are variously modified to suit the size, shape and character of the metal pieces, M N, to be welded, and the proportions of the transformer itself are made proper for the conditions existing in each case. The potential of the primary circuit may be selected at any convenient value, provided the winding of the coil P P is adapted thereto, but usually 300 volts is employed, and the periodicity is about 60 cycles. Inasmuch as only the proposed joint and a small amount of metal on each side of it are concerned in the operation, the delivery of energy is closely localized. The chief electrical resistance in the welding circuit is in the projections between the clamps, where the electric energy is delivered and appears as heat. A portion of the energy is, as usual, lost in the transformation and in the resistance of the circuits elsewhere, but, by proper proportioning, the loss may be kept down to a moderate percentage of the total, as in other electric work.

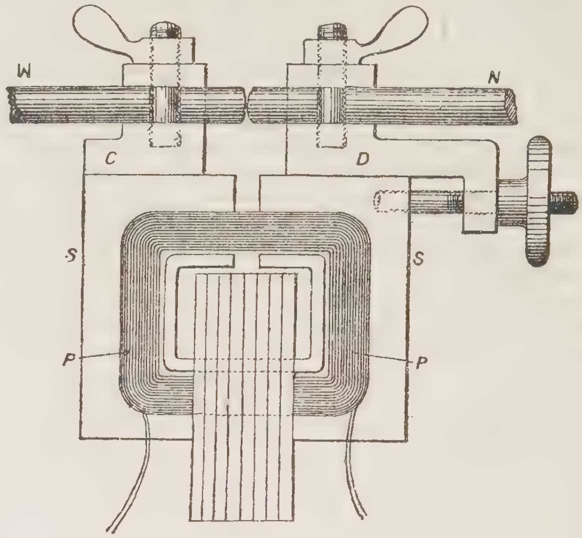

FIG. 1.—Thomson Welding Transformer.

The pieces are set firmly in the welding clamps, with the ends to be joined in abutment and in electric contact. The projection of each piece from the clamp varies with the section of the pieces, their form and the nature of the metal, and the time in which a joint is to be made; but it rarely exceeds the thickness or diameter of the pieces, except with metals of high heat conductivity such as copper. When the pieces are in place the current is turned into the primary coil of the transformer, sometimes suddenly and in full force, but more often gradually. Switches and regulating devices in the primary circuit permit complete and delicate control. At least one of the clamps, D (fig. 1), is movable through a limited range towards and from the other, and is thus the means of exerting pressure for forcing the softened metal into complete union. In large work the motion is given by a hydraulic cylinder and piston, under suitable control by valves. At about the time the current is cut off, it is usual to apply increased pressure. The softened metal is upset or pressed outwards at the joint and forms a characteristic burr, which may be removed by filing or grinding, or be hammered down while the metal is still hot. Sometimes the burr is not objectionable, and is allowed to remain. Lap welds may be made, but butt welds are found to be satisfactory for most purposes. The appearance of round bars in abutment before welding is shown in fig. 2 at A; and at B they are represented as having been joined by an electric butt weld, with the slight upset or burr at the joint. Before the introduction of the Thomson process a few only of the metals, such as platinum, gold and iron, were regarded as weldable; now nearly all metals and alloys may be readily joined. Such combinations as tin and lead, copper and brass, brass and iron, iron and nickel, brass and German silver, silver and copper, copper and platinum, iron and German silver, tin and zinc, zinc and cadmium, &c., are easily made; even brittle crystalline metals like bismuth and antimony may be welded, as well as different metals and alloys whose fusing or softening temperatures do not differ too widely.

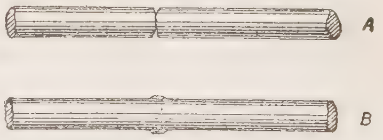

FIG. 2.

If the meeting ends conduct sufficiently to start the heating, it is not necessary that they should fit closely together, nor is it necessary that they should be quite clean, the effect of the incipient heating being to confer conductivity upon the scale and oxide at the joint.

In some cases the application of a flux, such as borax, enables the welding to be accomplished at a lower temperature, thus avoiding risk of injury by excessive heating. While the pieces are heating, the increase of temperature may raise the specific resistance of the metal so that the current required will be lessened per unit of area, while on the other hand the growing perfection of contact during welding, by increasing the conducting area at the joint, compensates for this in that it tends to the increase of current. With some alloys like brass and German silver, which have a low temperature coefficient, this compensating effect is nearly absent. The increase of specific resistance of the metals with increase of temperature has another valuable effect in properly distributing the heating over the whole section of the joint. Any portion which may be for the moment at a lower temperature than other portions will necessarily have a lower relative resistance, and more current will be diverted to it. This action rapidly brings any cooler portion into equality of temperature with the rest. It also prevents the overheating of the interior portions which are not losing heat by radiation and convection. The success of the electric process in welding metals which were not formerly regarded as weldable is probably due in a measure to this cause, and also to the ease of control of the operation, for the operator may work within far narrower limits of plasticity and fusibility than with the forge fire or blowpipe. The mechanical pressure may be automatically applied and the current automatically cut off after the completion of the weld. In some more recent types of welders the clamping and releasing of the pieces are also accomplished automatically, and nothing is left for the operator to do but to feed the pieces into the clamps. Repetition-work is thus rapidly and accurately done. The automatic welder represented in fig. 3 has a capacity of nearly 1000 welds per day. The pressure required is subject to considerable variation: the more rigid the material at the welding temperature, the greater is the necessary pressure. With copper the force may be about 600 pounds per square inch of section; with wrought iron, 1200 pounds; and with steel, 1800 pounds. It is customary to begin the operation with a much lighter pressure than that used when all parts of the pieces at the joint have come into contact. The pressure exerted in completing the weld has the effect of extruding from the joint all dross and slag, together with most of the metal which is rendered plastic by the heat. The strongest electric welds are those effected by this extrusion from the joint, in consequence of heavy pressure quickly applied at the time of completion of the weld. The unhammered weld, as ordinarily made by the electric process, has substantially the same strength as the annealed metal of the bar, the break under tensile strain, when the burr at the weld is left on, usually occurring a little to one side of the joint proper, where the metal has been annealed by heating. Hammering or forging the joint while the metal cools, in the case of malleable metals such as iron or copper, will usually greatly toughen the metal, and it should be resorted to where a maximum of strength is desired. The same object is partially effected by placing the weld, while still hot, between dies pressed forcibly together so as to give to the weld some desired form, as in drop-forging.

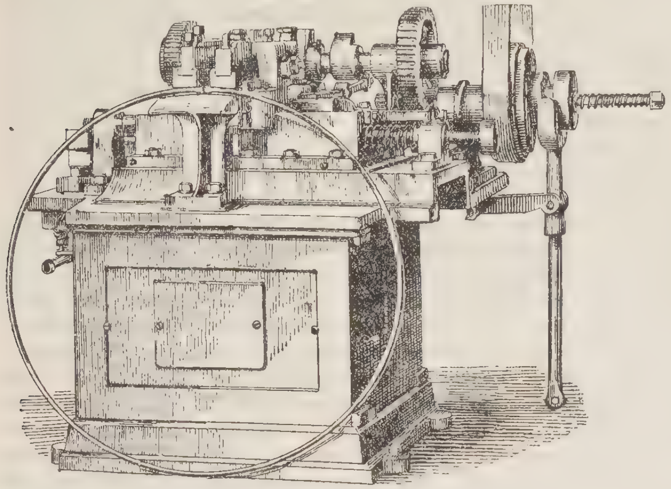

FIG. 3.—Automatic Welder.

The amount of electric energy necessary for welding by the Thomson process varies with the different metals, their electric conductivity, their heat conductivity, fusibility, the shape of the pieces, section at the joint, &c. In the following table are given some results obtained in the working of iron, brass and copper. The figures are of course only approximate, and refer to one condition alone of time-consumption in the making of each weld. The more rapidly the work is done, the less, as a rule, is the total energy required; but the rate of output of the plant must be increased with increase of speed, and this involves a larger plant, the consequent expense of which is often disadvantageous. If in the following table the watts for a given section be multiplied by the time, the relation between the total energy required for different sections of the same metal, or for the same section of the different metals, is obtained. These products are given under the head of watt-seconds. It will be seen that the energy increases more rapidly than the sections of the pieces—doubtless because the larger pieces take a longer time in welding, with the result of an increased loss by conduction of heat along the bars back from the joint. If the time of welding could be made the same for various sections, it is probable that the energy required would be more nearly in direct proportion to the area of section for any given metal. This relation would however, only hold approximately, as there is a greater relative loss of heat by radiation and convection into the air from the pieces of smaller section. The total energy in watt-seconds for any given section of copper will be found to be about half as much again as that for the same section of iron, while the amounts of energy required for equal sections of brass and iron do not greatly differ.

ENERGY USED IN ELECTRIC WELDING

Section, Sq. In.	Watts in Primary of Welder.	Time in Secs.	Watt-seconds.
Iron and Steel.			
0·5	8,500	33	280,500
1·0	16,700	45	751,500
1·5	23,500	55	1,292,500
2·0	29,000	65	1,885,000
2·5	34,000	70	2,380,000
3·0	39,000	78	3,042,000
3·5	44,000	85	3,740,000
4·0	50,000	90	4,500,000
Brass.			
·25	7,500	17	127,500
·5	13,500	22	297,000
·75	19,000	29	551,000
1·0	25,000	33	825,000
1·25	31,000	38	1,178,000
1·5	36,000	42	1,512,000
1·75	40,000	45	1,800,000
2·0	44,000	48	2,112,000
Copper.			
·125	6,000	8	48,000
·25	14,000	11	154,000
·375	19,000	13	247,000
·5	25,000	16	400,000
·625	31,000	18	558,000
·75	36,500	21	766,500
·875	43,000	22	946,000
1·0	49,000	23	1,127,000

In practice, joints in solid bars or in wires are the most common, but the process is applicable to pieces of quite varied form. Joints in iron, brass, or lead pipe are readily made; strips of sheet metal are joined, as in band saws; bars or tubes are joined at various angles; sheet metal is joined to bars, &c. One of the more interesting of the recent applications of electric welding is the longitudinal seaming of thin steel pipe. The metal or skelp is in long strips, bent to form a hollow cylinder or pipe, and the longitudinal seam moves through a special welder, which passes a current across it. The work is completed by drawing the pipe through dies. The welding of a ring formed by bending a short bar into a circle affords an excellent illustration of the character of the currents employed in the Thomson process. Notwithstanding the comparatively free path around the ring through the full section of the bent bar, the current heats the abutted ends to the welding temperature. In this way waggon and carriage wheel tyres, harness rings, pail and barrel hoops, and similar objects are extensively produced. The process is also largely applied to the welding of iron and copper wires used for electric lines and conductors, of steel axles, tyres and metal frames used in carriage work, and of such parts of bicycles as pedals, crank hangers, seat posts, forks, and steel tubing for the frames. The heat, whether it be utilized in welding or brazing, is so sharply localized that no damage is done to the finish of surfaces a short distance from the weld or joint. Parts can be accurately formed and finished before being joined, as in the welding of taper shanks to drills, the lengthening of drills, screw taps, or augers, and the like. Electric welding is applicable to forms of pieces or to conditions of work which would be impracticable with the ordinary forge fire or gas blowpipe. A characteristic instance is the wire bands which hold in place the solid rubber tyres of vehicles. The proximity of the rubber forbids the application of the heat of a fire or blowpipe, but by springing the rubber back from the proposed joint and seizing the ends of wire by the electric welding clamps, the union is rapidly and easily made. When the rubber of the tyre is released, it covers the joint, regaining its complete form. Special manufactures have in some cases arisen based upon the use of electric welding.

The welding clamps, and the mechanical devices connected with them, vary widely in accordance with the work they have to do. A machine for forming metal wheels is so constructed that the hubs are made in two sections, which when brought together in the welder are caused to embrace the radiating iron or steel spokes of the wheel. The two sections are then welded, and hold the spokes in solid union with themselves. Another machine, designed for the manufacture of wire fences, makes several welds automatically and simultaneously. Galvanized iron wires are fed into the machine from reels in several parallel lines about a foot apart, and at intervals are crossed at right angles by wire sections cut automatically from another reel of wire. As the wire passes, electric welds are formed between the transverse and the parallel lines. The machine delivers a continuous web of wire fencing, which is wound upon a drum and removed from time to time in large rolls. In the United States, street railway rails are welded into a continuous metal structure. A huge welding transformer is suspended upon a crane, which is borne upon a car arranged to run upon the track as it is laid. The joint between the ends of two contiguous rails is made by welding lateral strap pieces, covering the joint at each side and taking the place of the ordinary fish-plates and bolts. The exertion of a greatly increased pressure at the finish of the welding seems to be decidedly favourable to the permanence and strength of the joints. When properly made, the joint is strong enough to resist the strains of extension and compression during temperature changes. For electric railways the welded joint obviates all necessity for "bonding" the rails together with copper wires to convert them into continuous lines of return conductors for the railway current. In railway welding the source of energy is usually a current delivered from the trolley line itself to a rotary converter mounted on the welding car, whereby an alternating current is obtained for feeding the primary circuit of the welding transformer. Power from a distant station is thus made to produce the heat required for track welding, and at exactly the place where it is to be utilized. In this instance the work is stationary while the welding apparatus is moved from one joint to the next. Welding transformers are sometimes used to heat metal for annealing, for forging, bending, or shaping, for tempering, or for hard soldering. Under special conditions they are well adapted to these purposes, on account of the perfect control of the heating or energy delivery, and the rapidity and cleanliness of the operation.

Armour-plate annealing.

Divested of its welding clamps, the welding transformer has found a unique application in the armour-annealing process of Lemp, by means of which spots or lines are locally annealed in hard-faced ship's armour, so that it can be drilled or cut as desired. Before the introduction of this process, it was practically impossible to render any portion of the hardened face of such armour workable by cutting tools without detriment to the hardness of the rest. A very heavy electric current is passed through the spot or area which it is desired to soften, so that, notwithstanding the rapid conduction of heat into the body of the plate, the metal is brought to a low red heat. In order that the spot shall not reharden, it is requisite that the rate of cooling shall be slower than when the heating current is cut off suddenly, the current therefore undergoes gradual diminution, under control of the operator. The welding transformer has for its secondary terminals simply two copper blocks fixed in position, and mounted at a distance of an inch or more apart. These are placed firmly against the face of the armour plate, with the spot to be annealed bridging the contacts, or situated between them. As in track welding, the transformer is made movable, so that it can be brought into any position desired. When the annealing is to be done along a line, the secondary terminals, with the transformer, are slowly and steadily slid over the face of the plate, new portions of the plate being thus continually brought between the terminals, while those which had reached the proper heat are slowly removed from the terminals and cool gradually. (E. T.)

WELDON, WALTER (1832–1885), English technical chemist, was born at Loughborough on the 31st of October 1832. In 1854 he began to work as a journalist in London in connexion with the *Dial*, which was afterwards incorporated in the *Morning Star*, and in 1860 he started a monthly magazine, *Weldon's Register of Facts and Occurrences relating to Literature, the Sciences and the Arts*, which was discontinued after about three years' existence. Though he was without practical knowledge of the science, Weldon turned to industrial chemistry, and in the course of a few years took out the patents which led to his "manganese-regeneration" process (see CHLORINE). This was put into operation about 1869, and by 1875 it was being used by almost every chlorine manufacturer of importance throughout Europe. He continued to work at the production of chlorine in connexion with the processes of alkali-manufacture (*q.v.*), and became a leading authority on the subject, but none of his later proposals—not even the Weldon-Pechiney magnesia process, which was established on a commercial scale only a year or two before his death—met with equal success. He died at Burstow, Surrey, on the 20th of September 1885. He professed Swedenborgian principles and was a believer in spiritualism.

His son, WALTER FRANK RAPHAEL WELDON (1860–1906), was appointed in 1899 Linacre professor of comparative anatomy at Oxford.

WELF or **GUELPH,** a princely family of Germany, descended from Count Warin of Altorf (8th century), whose son Isenbrand is said to have named his family *Welfen, i.e.* whelps. From his son Welf I. (d. 824) were descended the kings of Upper Burgundy and the elder German line of Welf. Welf III. (d. 1055) obtained the duchy of Carinthia and the March of Verona. With him the elder line became extinct, but his grandson in the female line, Welf IV. (as duke, Welf I.), founded the younger line, and became duke of Bavaria in 1070. Henry the Black (d. 1126), by his marriage with a daughter of Magnus, duke of Saxony, obtained half of the latter's hereditary possessions, including Lüneburg, and his son Henry the Proud (*q.v.*) inherited by marriage the emperor Lothair's lands in Brunswick, &c., and received the duchy of Saxony. The power which the family thus acquired, and the consequent rivalry with the house of Hohenstaufen, occasioned the strife of Guelphs and Ghibellines (*q.v.*) in Italy. Henry the Lion lost the duchies of Bavaria and Saxony by his rebellion in 1180, and Welf VI. (d. 1191) left his hereditary lands in Swabia and his Italian possessions to the emperor Henry VI. Thus, although one of the Welfs reigned as the emperor Otto IV., there remained to the family nothing but the lands inherited from the emperor Lothair, which were made into the duchy of Brunswick in 1235. Of the many branches of the house of Brunswick that of Wolfenbüttel became extinct in 1884, and that of Lüneburg received the electoral dignity of Hanover in 1692, and founded the Hanoverian dynasty of Great Britain and Ireland in 1714. For its further history see HANOVER. The Hanoverian legitimists in the German Reichstag are known as Welfen.

See Sir A. Halliday, *History of the House of Guelph* (1821); R. D. Lloyd, *Origin of the Guelphs*; F. Schmidt, *Die Anfänge des welfischen Geschlechts* (Hanover, 1900).

WELHAVEN, JOHANN SEBASTIAN CAMMERMEYER (1807–1873), Norwegian poet and critic, was born at Bergen, the son of a pastor, in 1807. He first studied theology, but from 1828 onwards devoted himself to literature. In 1840 he became reader and subsequently professor of philosophy at Christiania, and delivered a series of impressive lectures on literary subjects. In 1836 he visited France and Germany; and in 1858 he went to Italy to study archaeology. His influence was extended by his appointment as director of the Society of Arts. He died at Christiania on the 21st of October 1873. Welhaven made his name as the representative of conservatism in Norwegian literature. In a violent attack on Wergeland's poetry he opposed the theories of the extreme nationalists. He desired to see Norwegian culture brought into line with that of other European countries, and he himself followed the romantic tradition, being most closely influenced by J. L. Heiberg. He represented clearness and moderation against the extravagances of Wergeland. He gave an admirable practical exposition of his aesthetic creed in the sonnet cycle *Norges Daemring* (1834). He published a volume of *Digte* in 1839; and in 1845 *Nyere Digte*. The collections of old Norse poetry made by Asbjörnsen and Moe influenced his talent, and he first showed his full powers as a poet in *Nyere Digte*. His descriptive poetry is admirable, but his best work was inspired by his poems on old Norse subjects, in which he gives himself unreservedly to patriotic enthusiasm. Other poems followed in 1848, 1851 and 1859.

His critical work includes *Ewald og de norske Digtere* (1863), *On Ludwig Holberg* (1854). Welhaven's *Samlede Skrifter* were published in 8 vols. at Copenhagen (1867–1869).

WELL, the name given to an artificial boring in the earth through which water can be obtained. Two classes may be distinguished: shallow or ordinary wells, sunk through a permeable stratum until an impermeable stratum is reached; and deep and Artesian wells (*q.v.*), the latter named from Artois in France, which are sunk through an impermeable stratum down into a water-bearing stratum which overlies an impermeable stratum. Obviously ordinary wells can supply water very cheaply, but, since impurities readily reach them, there is great risk of contamination. The same does not apply to deep wells, such water being usually free from organic impurities. In ordinary wells, and in deep wells, the water requires pumping to the surface; in artesian wells, on the other hand, the water usually spouts up to a greater or less height above it.

The Secondary and Tertiary geological formations, such as those underneath London and Paris, often present the appearance of immense basins, the boundary or rim of the basin having been formed by an upheaval of the subjacent strata. In these formations it often happens that a porous stratum is included between two impermeable layers of clay, so as to form a flat porous U tube, continuous from side to side of the valley, the outcrop on the surrounding hills forming the mouth of the tube. The rain filtering down through the porous layer to the bottom of the basin forms there a subterranean pool, which with the liquid or semi-liquid column pressing upon it constitutes a sort of huge natural hydrostatic bellows. It is obvious then, that when a hole is bored down through the upper impermeable layer to the surface of the lake, the water will be forced up by this pressure to a height above the surface of the valley greater or less according to the elevation of the level in the feeding column, thus forming a natural fountain.

In the Tertiary formations, the porous layers are not so thick as in the Secondary, and consequently the occurrence of underground lakes is not on so grand a scale; but there being a more frequent alternation of these sandy beds, we find a greater number of them, and often a series of natural fountains may be obtained in the same valley, proceeding from water-bearing strata at different depths, and rising to different heights.

It does not follow that all the essentials for an artesian well are present, though two impermeable strata with a porous one between may crop out round a basin. There must also be *continuity* of the permeable bed for the uninterrupted passage of the water, and no breach in either of the confining layers by which the water might escape. It has occasionally happened that on deepening the bore, with the hope of increasing the flow of water, it has ceased altogether, doubtless from the lower confining layer being pierced, and the water allowed to escape by another outlet. The subterranean pool is frequently of small extent, and of the nature of a channel rather than of a broad sheet of water; and the existence of one spring is no guarantee that another will be found by merely boring to the same depth in its neighbourhood. Faults also have an effect on the supply, which in many cases has been found to increase by cutting headings or adits. The most suitable strata in England are the Chalk, Oolite, New Red Sandstone and Lower Greensand; London is in part supplied by the Chalk, whilst Liverpool utilizes the New Red. The theoretical determination of the existence of artesian conditions can be arrived at only by a thorough acquaintance with the geology of the district. Although water from deep wells is free from organic matter, it usually contains salts such as calcium bicarbonate, &c., which make the water unsuitable for washing and certain manufacturing purposes although it is fit for drinking.

The mechanical appliances employed in boring for water are practically the same as in boring for petroleum (*q.v.*). The upper part of a deep well may be of brick, the continuation being lined with steel pipes, or, better, it may be lined with metal for its entire length.

One of the most remarkable artesian wells is at Grenelle, near Paris. The operation of boring extended from 1834 to 1841; after a depth of 1254 ft. had been reached (May 1837), a length of 270 ft. of the boring rods broke and fell to the bottom of the hole, and nearly fifteen months' constant labour was required to pick it up again. Discouraged by the delay, the French government was to have abandoned the project after a depth of 1500 ft. had been reached without any satisfactory result; but Arago prevailed on them to prosecute the work, and an additional depth of about 300 ft. proved the correctness of Arago's theory. On the 26th February 1841, at a depth of 1798 ft., the boring rods suddenly sank a few yards, and within a few hours a vast column of water spouted up at the rate of 600 gallons per minute, and at a temperature of nearly 82° F. Prior to this no artesian boring had reached even 1000 ft.; and that of Grenelle was the deepest executed till the completion (12th August 1850) of the salt-spring at Kissingen, in Bavaria, which throws up a column of water to the height of 58 ft. from a depth of $1878\frac{1}{2}$ ft. The most remarkable feature of this spring is that the projecting force is due, not to hydrostatic pressure, but to that of carbonic acid gas generated at the junction of the gypsum with the magnesian limestone, about 1680 ft down. Modern mechanical improvements have enabled engineers to exceed these Artesian dimensions considerably, and at a greatly diminished cost. The well at Passy, near Paris, which is supplied from the same water-bearing stratum as that of Grenelle, was bored by Kind in a very short time, having been begun on 15th September 1855, and carried to a depth of 1732 ft. by March 1857. Its total depth is now about 1923 ft. with the diameter of 2 ft. 4 in. at the bottom; and it throws up a continuous stream of water at the rate of five and a half million gallons per day to a height of 54 ft. above the ground.

Among other deep wells sunk in the Paris basin subsequently to those of Grenelle and Passy, the following may be mentioned. A gigantic bore, 5 ft. 7 in. in diameter, was begun in January 1866 at La Chapelle, and by November 1869 had reached a depth of 1811 ft., the intention being to extend it to a depth of 2950 ft. A bore of 19 in. diameter was carried down to a depth of 1570 ft. in about two and a half years (1864–1867), for the purpose of obtaining a water-supply for the sugar refinery of Say in Paris; and the same engineer who executed this work (Dru) began in 1866 an artesian boring of the huge diameter of $6\frac{1}{2}$ ft. at the part of Paris named *Butte aux Cailles*, to be carried down to a depth of 2600 to 2900 ft. In the Paris basin there are a great many other wells, varying from 300 to 400 ft. in depth, and from 2 to 8 in. in the diameter of the bore-hole.

The Tertiary chalk strata over which London stands have been riddled with artesian borings for the sake of pure water supply. Many of the large London factories, railways, institutions are supplied by artesian wells over 300 ft. deep. At Merton in Surrey, at Brighton, at Southampton, all along the east coast of Lincolnshire, and in the low district between the chalk wolds near Louth and the Wash, artesian borings have long been known, and go by the name of *blow-wells* among the people of the district. The general level to which the water rises in the London district has been very sensibly lowered by the immense number of perforations that have been made; and in several wells where the water formerly rose to the surface, it now requires to be pumped up.

None of the artesian borings in England approach the depths frequent on the Continent and in America. The average depth of the water-bearing stratum around Paris is six times that of the London chalk beds; and in some parts of Germany and of America, wells have been sunk to even double the depth of the Parisian wells of Grenelle and Passy. In Chicago there are several wells more than 2000 ft. deep; and at West Chicago in Dupage county, Illinois, there is one 3081 ft. deep. In the city of St Louis, Missouri, there is an artesian well $3843\frac{1}{3}$ ft. deep, yielding a few gallons of salty water (temperature, 105° F.) a minute; boring was stopped in September 1868. Among the deepest borings in the world are: a well in Putnam Heights, Windham county, Connecticut, 6004 ft. deep and 6 in. in diameter, yielding 2 gallons per minute with water rising to 4 ft. from the surface; one at Schladenbach (5735 ft.), near Leipzig; one 12 m. south-east of Pittsburg, which is 5575 ft. deep and $6\frac{1}{4}$ in. in diameter; one in Lawrence county, Alabama, 5120 ft. deep and 6 in. in diameter, yielding gas, oil and salt water; and one (about 4200 ft.) at Sperenberg 20 m. from Berlin, sunk for the purpose of obtaining a supply of rock salt,—the salt deposit here is 3907 ft. thick.

The following are some of the other most important artesian sinkings that have been made. At Louisville, Kentucky, a bore of 3 in. was carried to a depth of 2086 ft. between April 1857 and the summer of 1858; it yields 264 gallons a minute and its fountain rises 170 ft. high. At Charleston, South Carolina, there are: one well 2050 ft. deep and 4 in. in diameter, yielding 450 gallons a minute; another 1945 ft. deep and 5 in. in diameter, yielding 695 gallons a minute; and three more each exceeding 1900 ft. in depth. In 1858 a well at Neusalwerk, near Minden, had reached the depth of 2288 ft. At Bourne, Lincolnshire, there is a well 95 ft. deep, which yields over half a million gallons of water per day, the pressure being sufficient to supply the town and force the water to the tops of the highest houses. There is one in Philadelphia (Mount Vernon and 13th sts.), 3031 ft. deep and 8 in. in diameter, yielding 2600 gallons a minute. There are several deep wells in South Dakota: in Aberdeen City there are two 1300 ft. deep with flows of 1350 and 1000 gallons, respectively, per minute. Two artesian wells at Croydon supply a million gallons of water per day; and Brighton draws over a million gallons from artesian sinkings. There is a well at Bages, near Perpignan, which gives 330 gallons per minute; and one at Tours, which jets about 6 ft. above ground, and gives 237 gallons per minute.

The boring of wells in the great desert of Sahara is a very ancient industry; and some oases are supplied with water wholly from artesian wells. The average depth of these is from 160 to 200 ft., and the upper strata have only to be pierced to give a constant stream. With their primitive methods of boring, the Arabs often labour for years before they reach the wished-for pool; and with only palm wood as a casing, they have great difficulty in keeping the bore-hole from closing up by the drifting of the sand, and they require to scour them out periodically. Since 1858 an immense number of perforations have been made by French engineers, and the fertilising effect upon the sandy desert plains has already made itself apparent. The importance of deep wells in such cases cannot be over-estimated.

Artesian wells have been made to supply warm water, for keeping hospitals, &c., at a constant temperature. Invariably the temperature of water from great depths is higher than that at the surface. The temperature of the water in the well at Grenelle is 82° F., and that of Passy the same, showing that they have a common source. Kissingen well has a temperature of 66° F., that of St Louis one of 73°·4 F. that of Louisville 76½° F., and that of Charleston 87° F. The average rate of increase of temperature is 1° for a descent of from 40 to 55 ft. In Württemberg the water of artesian wells is employed to maintain in large manufactories a constant temperature of 47° when it is freezing outside. Artesian waters have also been employed to reduce the extreme variations of temperature in fish-ponds.

WELLES, GIDEON (1802–1878), American political leader, was born at Glastonbury, Connecticut, on the 1st of July 1802. He studied for a time at Norwich University, Vermont, but did not graduate. From 1826 to 1837 he edited the *Hartford Times*, making it the official organ of the Jacksonian Democracy in southern New England. He served in the state House of Representatives in 1827, 1829–30, 1832 and 1834–35, was state comptroller in 1835 and 1842–43, was postmaster at Hartford in 1835–42, and was chief of the bureau of provisions and clothing in the Navy Department at Washington in 1846–1849. Leaving the Democratic party on the Kansas-Nebraska issue, he assisted in the formation of the Republican party in Connecticut, and was its candidate for governor in 1856; he was a delegate to the Republican national conventions of 1856 and 1860. On the inauguration of President Lincoln in 1861 he was appointed secretary of the navy, a position which he held until the close of President Andrew Johnson's administration in 1869. Although deficient in technical training, he handled with great skill the difficult problems which were presented by the Civil War. The number of naval ships was increased between 1861 and 1865 from 90 to 670, the officers from 1300 to 6700, the seamen from 7500 to 51,500, and the annual expenditure from $12,000,000 to $123,000,000; important changes were made in the art of naval construction, and the blockade of the Confederate ports was effectively maintained. Welles supported President Johnson in his quarrel with Congress, took part in the Liberal Republican movement of 1872, and returning to the Democratic party, warmly advocated the election of Samuel J. Tilden in 1876. He died at Hartford, Connecticut, on the 11th of February 1878.

In 1874 Welles published *Lincoln and Seward*, in which he refutes the charge that Seward dominated the Administration during the Civil War. His *Diary*, which appeared in the *Atlantic Monthly* (1909–1911), is extremely valuable for the study of the Civil War and Reconstruction. See also Albert Welles, *History of the Welles Family* (New York, 1876).

WELLESLEY, RICHARD COLLEY WESLEY (or WELLESLEY), MARQUESS (1760–1842), eldest son of the 1st earl of Mornington, an Irish peer, and brother of the famous duke of Wellington, was born on the 20th of June 1760. He was sent to Eton, where he was distinguished as a classical scholar, and to Christ Church, Oxford. By his father's death in 1781 he became earl of Mornington, taking his seat in the Irish House of Peers. In 1784 he entered the English House of Commons as member for Beeralston. Soon afterwards he was appointed a lord of the treasury by Pitt. In 1793 he became a member of the board of control over Indian affairs; and, although he was best known by his speeches in defence of Pitt's foreign policy, he was gaining the acquaintance with Oriental affairs which made his rule over India so effective from the moment when, in 1797, he accepted the office of governor-general. Wellesley seems to have caught Pitt's large political spirit during his intercourse with him from 1793 to 1797. That both had consciously formed the design of acquiring a great empire in India to compensate for the loss of the American colonies is not proved; but the rivalry with France, which in Europe placed England at the head of coalition after coalition against the French republic and empire, made Wellesley's rule in India an epoch of enormous and rapid extension of English power. Clive won and Warren Hastings consolidated the British ascendancy in India, but Wellesley extended it into an empire. On the voyage outwards he formed the design of annihilating French influence in the Deccan. Soon after his landing, in April 1798, he learnt that an alliance was being negotiated between Tippoo Sultan and the French republic. Wellesley resolved to anticipate the action of the enemy, and ordered preparations for war. The first step was to effect the disbandment of the French troops entertained by the Nizam of Hyderabad. The invasion of Mysore followed in February 1799, and the campaign was brought to a rapid close by the capture of Seringapatam. In 1803 the restoration of the peshwa proved the prelude to the Mahratta war against Sindhia and the raja of Berar. The result of these wars and of the treaties which followed them was that French influence in India was extinguished, that forty millions of population and ten millions of revenue were added to the British dominions, and that the powers of the Mahratta and all other princes were so reduced that England became the really dominant authority over all India. He found the East India Company a trading body, he left it an imperial power. He was an excellent administrator, and sought to provide, by the foundation of the college of Fort William, for the training of a class of men adequate to the great work of governing India. In connexion with this college he established the governor-general's office, to which civilians who had shown talent at the college were transferred, in order that they might learn something of the highest statesmanship in the immediate service of their chief. A free-trader, like Pitt, he endeavoured to remove some of the restrictions on the trade between England and India. Both the commercial policy of Wellesley and his educational projects brought him into hostility with the court of directors, and he more than once tendered his resignation, which, however, public necessities led him to postpone till the autumn of 1805. He reached England just in time to see Pitt before his death. He had been created an English peer in 1797, and in 1799 an Irish marquess.

On the fall of the coalition ministry in 1807 Wellesley was invited by George III. to join the duke of Portland's cabinet, but he declined, pending the discussion in parliament of certain charges brought against him in respect of his Indian administration. Resolutions condemning him for the abuse of power were moved in both the Lords and Commons, but defeated by large majorities. In 1809 Wellesley was appointed ambassador to Spain. He landed at Cadiz just after the battle of Talavera, and endeavoured, but without success, to bring the Spanish government into effective co-operation with his brother, who, through the failure of his allies, had been compelled to retreat into Portugal. A few months later, after the duel between Canning and Castlereagh and the resignation of both, Wellesley accepted the post of foreign secretary in Perceval's cabinet. He held this office until February 1812, when he retired, partly from dissatisfaction at the inadequate support given to Wellington by the ministry, but also because he had become convinced that the question of Catholic emancipation could no longer be kept in the background. From early life Wellesley had, unlike his brother, been an advocate of Catholic emancipation, and with the claim of the Irish Catholics to justice he henceforward identified himself. On Perceval's assassination he refused to join Lord Liverpool's administration, and he remained out of office till 1821, criticizing with severity the proceedings of the congress of Vienna and the European settlement of 1814, which, while it reduced France to its ancient limits, left to the other great powers the territory that they had acquired by the partition of Poland and the destruction of Venice. He was one of the peers who signed the protest against the enactment of the Corn Laws in 1815. In 1821 he was appointed lord-lieutenant of Ireland. Catholic emancipation had now become an open question in the cabinet, and Wellesley's acceptance of the viceroyalty was believed in Ireland to herald the immediate settlement of the Catholic claims. The Orange faction was incensed by the firmness with which their excesses were now repressed, and Wellesley was on one occasion mobbed and insulted. But the hope of the Catholics still remained unfulfilled. Lord Liverpool died without having grappled with the problem. Canning in turn passed away; and on the assumption of office by Wellington, who was opposed to Catholic emancipation, his brother resigned the lord-lieutenancy. He had, however, the satisfaction of seeing the Catholic claims settled in the next year by the very statesmen who had declared against them. In 1833 he resumed the office of lord-lieutenant under Earl Grey, but the ministry soon fell, and, with one short exception, Wellesley did not further take part in official life. He died on the

26th of September 1842. He had no successor in the marquisate, but the earldom of Mornington and minor honours devolved on his brother William, Lord Maryborough, on the failure of whose issue in 1863 they fell to the 2nd duke of Wellington.

See Montgomery Martin, *Despatches of the Marquess Wellesley* (1840); W. M. Torrens, *The Marquess Wellesley* (1880); W. H. Hutton, *Lord Wellesley* ("Rulers of India" series, 1893); and G. B. Malleson, *Wellesley* ("Statesmen" series, 1895).

WELLESLEY, a township of Norfolk county, Massachusetts, U.S.A., 14 m. S.W. of Boston. Pop. (1890) 3600, (1900) 5072, of whom 1306 were foreign-born and 17 were negroes, (1910 census) 5413. Area, 10·4 sq. m. Wellesley is served by the Boston & Albany railway, and is connected with Natick (3 m. W.), Newton, Needham, Boston and Worcester by electric lines. The north-eastern boundary of the township is the Charles river, which divides it from the city of Newton. The surface of the township is hilly and abundantly wooded, with many small streams and lakes; the two principal villages are Wellesley Hills and Wellesley, and smaller villages are Wellesley Falls, Wellesley Farms and Wellesley Fells. The highest point is Maugus Hill (416 ft.), near Wellesley Hills village. In the northern part of Wellesley and extending into Weston is a large forest tract known as "The Hundreds." Within the township are parts of two of the reservations of the Metropolitan Park system, 66·07 acres of the Charles river reservation, and 4·58 acres of Hemlock Gorge. Hunnewell Park is the former home of Dr W. T. G. Morton, who discovered the anaesthetic properties of sulphuric ether. West of Wellesley village, among the hills, lie Morses Pond and Lake Waban, on which are beautiful Italian gardens and (on the north side) the buildings and extensive grounds (350 acres) of Wellesley College (undenominational, 1875) for women, which was established by Henry Towle Durant (1822–1881), a prominent Boston lawyer. In 1910 the college had 130 instructors and 1319 students. The library (65,200 volumes in 1910) was endowed by Eben N. Horsford, the chemist and ethnologist; it contains a library of American linguistics collected by Major J. W. Powell and Mr Horsford, and the Frances Pearson Plimpton library of early Italian literature. There are about 30 buildings, of which twelve are residential halls or cottages. Instruction is in classical, literary and scientific branches, and the degrees of A.B. and A.M. are awarded.

Wellesley was settled about 1640, being then within the limits of Dedham. When the township of Needham was set off from Dedham in 1711, Wellesley was included within the new territory, and in 1774 was organized as the west parish of Needham or West Needham. In 1881 it was incorporated under its present name.

See J. E. Fiske in D. H. Hurd's *History of Norfolk County* (Boston, 1884).

WELLHAUSEN, JULIUS (1844–), German biblical scholar and Orientalist, was born at Hameln on the Weser, Westphalia, on the 17th of May 1844. Having studied theology at the university of Göttingen under Heinrich Ewald, he established himself there in 1870 as privat-docent for Old Testament history. In 1872 he was appointed professor ordinarius of theology in Greifswald. Resigning in 1882 owing to conscientious scruples, he became professor extraordinarius of oriental languages in the faculty of philology at Halle, was elected professor ordinarius at Marburg in 1885, and was transferred to Göttingen in 1892. Wellhausen made his name famous by his critical investigations into Old Testament history and the composition of the Hexateuch, the uncompromising scientific attitude he adopted in testing its problems bringing him into antagonism with the older school of biblical interpreters. The best known of his works are *De gentibus et familiis Judaeis* (Göttingen, 1870); *Der Text der Bücher Samuelis untersucht* (Göttingen, 1871); *Die Pharisäer und Sadducäer* (Greifswald, 1874); *Prolegomena zur Geschichte Israels* (Berlin, 1882; Eng. trans., 1885; 5th German edition, 1899; first published in 1878 as *Geschichte Israels*); *Muhammed in Medina* (Berlin, 1882); *Die Komposition des Hexateuchs und der historischen Bücher des Alten Testaments* (1889, 3rd ed. 1899); *Israelitische und jüdische Geschichte* (1894, 4th ed. 1901); *Reste arabischen Heidentums* (1897); *Das arabische Reich und sein Sturz* (1902); *Skizzen und Vorarbeiten* (1884–1899); and new and revised editions of F. Bleek's *Einleitung in das Alte Testament* (4-6, 1878–1893). In 1906 appeared *Die christliche Religion, mit Einschluss der israelitisch-jüdischen Religion*, in collaboration with A. Jülicher, A. Harnack and others. He also did useful and interesting work as a New Testament commentator. He published *Das Evangelium Marci, übersetzt und erklärt* in 1903, *Das Evangelium Matthäi* and *Das Evangelium Lucae* in 1904, and *Einleitung in die drei ersten Evangelien* in 1905.

WELLINGBOROUGH, a market town in the eastern parliamentary division of Northamptonshire, England, 63½ m. N.N.W. from London by the Midland railway; served also by the London & North-Western railway. Pop. of urban district (1901), 18,412. It lies on the declivity of a hill near the junction of the Ise with the Nene, in a pleasant well-wooded district. The church of St Luke is a beautiful building with Norman and Early English portions, but is mainly Decorated, with a western tower and spire. The grammar-schools, founded in 1594 and endowed with the revenues of a suppressed gild, include a school of the second and a school of the third grade, the former a building of red brick in the Renaissance style erected in 1880, and the latter an old Elizabethan structure. Another educational endowment is Freeman's school, founded by John Freeman in 1711. There are also several charities. The principal public building is the corn exchange. The town is of some importance as a centre of agricultural trade; but the staple industry is in leather. A great impulse to the prosperity of the town was given by the introduction of the boot and shoe trade, especially the manufacture of uppers. Smelting, brewing and iron-founding are also carried on, as well as the manufacture of portable steam-engines, and iron ore is raised in the vicinity.

In 948 Edred gave the church at Wellingborough to Crowland Abbey, and the grant was confirmed by King Edgar in 966. In the reign of Edward II. the abbot was lord in full. The town received the grant of a market in 1201. It was formerly famed for the chalybeate springs to which it owes its name, and in 1621 was visited by Charles I. and his queen, who resided in tents during a whole season while taking the waters. It was after its almost total destruction by fire in 1738 that the town was built on its present site on the hill.

WELLINGTON, ARTHUR WELLESLEY, 1ST DUKE OF (1769–1852), was the fourth son of Garrett (1735–1781) Wellesley or Wesley, 2nd baron and 1st earl of Mornington, now remembered only as a musician. He was descended from the family of Colley or Cowley, which had been settled in Ireland for two centuries. The duke's grandfather, Richard Colley, 1st Baron Mornington (d. 1758), assumed the name of Wesley on succeeding to the estates of Garrett Wesley, a distant relative of the famous divine. In Wellington's early letters the family name is spelt Wesley; the change to Wellesley seems to have been made about 1790. Arthur (born in Ireland in 1769[1]) was sent to Eton, and subsequently to a military college at Angers. He entered the army as ensign in the 73rd Highlanders in 1787, passed rapidly through the lower ranks (in five different regiments), became major of the 33rd (now duke of Wellington's West Riding), and purchased the lieutenant-colonelcy of that regiment in 1793 with money advanced to him by his eldest brother. But in all these changes he did little regimental duty, for he was aide-de-camp to the lord-lieutenant of Ireland for practically the whole of these years. Before reaching full age he was returned to the Irish parliament by the family borough of Trim. Little is known of his history during these years; but neither in boyhood nor in youth does he appear to have made any mark among his contemporaries.

His first experience of active service was in the campaign of 1794–1795, when the British force under the duke of York was driven out of Holland by Pichegru. In 1796 he was sent with his regiment to India, being promoted colonel by brevet about the same time. It was thus as a commanding officer that he learnt for the first time the details of regimental duty. He mastered them thoroughly, gained a minute acquaintance with every detail of the soldier's life, learned the precise amount of food required for every mouth, the exact weight that could be carried, the distances that could be traversed without exhaustion, the whole body of conditions in short which govern the military activity of man and beast. It was to the completeness of his practical knowledge that Wellington ascribed in great part his later success. It is probable, moreover, that he at this time made a serious study of the science and history of war. His formal training at Angers was altogether too slight to account for his great technical knowledge; no record, however, exists of the stages by which this was acquired except that as soon as he landed in India he began to devote fixed hours to study, giving up cards and the violin. This study was directed chiefly to the political situation of India, and when on his advice his eldest brother, Lord Mornington, afterwards Marquess Wellesley, accepted the governor-generalship of India, he became his trusted though unofficial adviser. In the war with Tippoo Saib the 33rd was attached to the Nizam's contingent, and Colonel Wellesley commanded this division in the army of General (Lord) Harris. Though his military services in this short campaign were not of a striking character, he was appointed by his brother to the supreme military and political command in Mysore, in spite of the claims of his senior, Sir David Baird.

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[1] At 24 Upper Merrion Street, Dublin, or at Dungan Castle, Meath, on the 29th of April or on 1st May; but both place and date are uncertain.

His great faculties now for the first time found opportunity for their exercise. In the settlement and administration of the conquered territory he rapidly acquired the habits and experience of a statesman, while his military operations against Doondiah, a robber chief, were conducted with extraordinary energy and success, Doondiah being killed and his army scattered. More important, however, than the military side of these operations was their political character. When pressed in Mysore, Doondiah moved into Mahratta territory, whither Wellesley followed him. Here, negotiating and bargaining with the Mahratta chiefs, Wellesley acquired a knowledge of their affairs and an influence over them such as no other Englishman possessed. Simple and honourable himself, he was shrewd and penetrating in his judgment of Orientals; and, unlike his great predecessor Clive, he rigidly adhered to the rule of good faith in his own actions, however depraved and however exasperating the conduct of those with whom he had to deal. The result of Wellesley's singular personal ascendancy among the Mahrattas came into full view when the Mahratta War broke out. In the meantime, however, his Indian career seemed likely to be sacrificed to the calls of warfare in another quarter. Wellesley was ordered in December 1800 to take command of a body of troops collected for foreign service at Trincomalee, in Ceylon. It was at first intended that these troops should act against Java or Mauritius; their destination was, however, altered to Egypt, with a view to co-operation with Sir Ralph Abercromby's expedition, and Baird was placed in command. Though deeply mortified at the loss of the command, Wellesley in his devotion to duty moved the troops on his own responsibility from Trincomalee to Bombay, from the conviction that, if they were to be of any use in Egypt, it was absolutely necessary that they should provision at Bombay without delay. But at Bombay Wellesley was attacked by fever, and prevented from going on. The troop-ship in which he was to have sailed went down with all on board.

He returned in May 1801 to Mysore, where he remained until the Mahratta War broke out. The power of the Peshwa, nominally supreme in the Mahratta territory, had been overthrown by his rivals Holkar and others, and he had himself fled. The Indian government undertook to restore his authority. Wellesley, now a major-general, was placed in command of a division of the army charged with this task. Starting from Seringapatam, he crossed the frontier on March 12, 1803, and moved through the southern Mahratta territory on Poona. The march was one unbroken success, thanks to Wellesley's forethought and sagacity in dealing with the physical conditions and his personal and diplomatic ascendancy among the chieftains of the district. No hand was raised against him, and a march of 600 m. was conducted without even a skirmish. Wellesley had intended to reach Poona on the 23rd of April. On the night of the 18th he heard that a rival of the Peshwa intended to burn the city. At once Wellesley pressed on with the cavalry and an infantry battalion in light order, and after a forced march of 32 hours entered Poona on the afternoon of the 20th, in time to save the city. The Peshwa was now restored, and entered into various military obligations with Wellesley, which he very imperfectly fulfilled.

In the meantime Sindhia and Holkar, with the raja of Berar, maintained a doubtful but threatening aspect farther north. It was uncertain whether or not a confederacy of the northern Mahrattas had been formed against the British government. In these critical circumstances Wellesley was charged with "the general direction and control of military and political affairs in the territories of the Nizam, the Peshwa and the Mahratta states and chiefs." Armed with these powers, he required Sindhia, as a proof of good faith, to withdraw to the north of the Nerbudda. Sindhia not doing so, war was declared on the 6th of August 1803. Wellesley marched northwards, captured Ahmadnagar on the 11th, crossed the Godavery ten days later, and moved against the combined forces of Sindhia and the raja of Berar. Colonel Stevenson was meanwhile approaching with a second division from the east, and it was intended that the two should unite. On the 23rd of September Wellesley supposed himself to be still some miles from the enemy; he suddenly found that the entire forces of Sindhia and the raja of Berar were close in front of him at Assaye. Weighing the dangers of delay, of retreat, and of an attack with his single division of 4500 men, supported only by 5000 native levies of doubtful quality, Wellesley convinced himself that an immediate attack, though against greatly superior forces (30,000 horse, 10,000 European-drilled infantry and 100 well-served guns) in a strong position, was the wisest course. He threw himself upon the Mahratta host, and, carrying out a bold manœuvre under an intense fire, ultimately gained a complete victory, though with the loss of 2500 men out of a total probably not much exceeding 7000. In comparison with the battle of Assaye, all fighting that had hitherto taken place in India was child's play. Wellesley himself had two horses killed under him. Uniting with Stevenson's division, the conqueror followed up the pursuit, and brought the war to a close by a second victory at Argaum on the 29th of November, and the storming of Gawilghur on the 15th of December. The treaties with Sindhia and the raja of Berar, which marked the downfall of the Mahratta power, were negotiated and signed by Wellesley (who was made K.B. in Sept. 1804) in the course of the following month. Not yet thirty-five years old, he had proved himself a master in the sphere of Indian statesmanship and diplomacy as on the field of battle. Had his career ended at this time, his Indian despatches alone would have proved him to have been one of the wisest and strongest heads that have ever served England in the East.

His ambitions now led him back to Europe, and in the spring of 1805 he quitted India. On his return home he was immediately sent on the abortive expedition to Hanover. In 1806 he was elected M.P. for Rye, in order to defend his brother, the governor-general, in the House, and in the following year he was Irish secretary for a few months. He was then employed in the expedition against Copenhagen, in which he defeated the Danes in the action of Kjoge (29th Oct.). In 1808, however, began the war (see Peninsular War) in which his military renown was fully established. In April he was promoted lieutenant-general and placed in command of a division of the troops destined to operate against the French in Spain or Portugal. The conduct of events is narrated in a separate article, and need only be summarized here. Finding that the junta of Corunna wished for no foreign soldiery, he followed his alternative instructions to act against Junot at Lisbon. He landed at Mondego Bay in the first week of August, and moved southwards, driving in the enemy at Roliça on the 17th of August. On the 21st the battle of Vimeiro was fought and won. In the midst of this engagement, however, Sir Harry Burrard landed, and took over the command. Burrard was in turn superseded by Sir Hew Dalrymple, and the campaign ended with the convention of Cintra, which provided for the evacuation of Portugal by the French, but gave Junot's troops a free return to France. So great was the public displeasure in England at the escape of the enemy that a court of inquiry was held. After the battle of Corunna, Wellesley, who had in the meantime resumed his duties as Irish secretary, returned to the Peninsula as chief in command. He drove the French out of Oporto by a singularly bold and fortunate attack, and then prepared to march against Madrid by the valley of the Tagus. He had the support of a Spanish army under General Cuesta; but his movements were delayed by the neglect of the Spanish government, and Soult was able to collect a large force for the purpose of falling upon the English line of communication. Wellesley, unconscious of Soult's presence in force on his flank, advanced against Madrid, and defeated his immediate opponent, King Joseph, at Talavera de la Reina (*q.v.*) on the 27th-28th of July. The victory of Talavera, however, brought prestige but nothing else. Within the next few days Soult's approach on the line of communication was discovered, and Wellesley, disgusted with his Spanish allies, had no choice but to withdraw into Portugal and there stand upon the defensive.

A peerage, with the title of Viscount Wellington and Baron Douro, was conferred upon him for Talavera. He was also made marshal-general of the Portuguese army and a Spanish captain-general. But his conduct after the battle was sharply criticized in England, and its negative results were used as a weapon against the ministry. Even on the defensive, Wellington's task was exceedingly difficult. Austria having made peace, Napoleon was at liberty to throw heavy forces into the Peninsula. Wellington, foreseeing that Portugal would now be invaded by a very powerful army, began the fortification of the celebrated lines of Torres Vedras (see FORTIFICATION). The English army wintered about Almeida. As summer approached Wellington's anticipations were realized. Masséna moved against Portugal with an army of 70,000 men. Wellington, unable to save Ciudad Rodrigo, retreated down the valley of the Mondego, devastating the country, and at length halted at Busaco and gave battle. The French attack was repelled, but other roads were open to the invader, and Wellington continued his retreat. Masséna followed, but was checked completely in front of the lines. He sought in vain for an unprotected point. It was with the utmost difficulty that he could keep his army from starving. At length, when the country was exhausted, he fell back to Santarem, where, Wellington being still too weak to attack, he maintained himself during the winter. But in the spring of 1811 Wellington received reinforcements and moved forward. Masséna retreated, devastating the country to check the pursuit, but on several occasions his rearguard was deeply engaged, and such were the sufferings of his army, both in the invasion and in the retreat, that the French, when they re-entered Spain, had lost 30,000 men. Public opinion in England, lately so hostile, now became confident, and Wellington, whose rewards for Talavera had been opposed in both Houses, began to gain extraordinary popularity.

In the meantime Soult, who was besieging Cadiz, had moved to support Masséna. But after capturing Badajoz, Soult learnt that Masséna was in retreat, and also that his own forces at Cadiz had been beaten. He in consequence returned to the south. Wellington, freed from pressure on this side, and believing Masséna to be thoroughly disabled, considered that the time had come for an advance into Spain. The fortresses of Almeida, Ciudad Rodrigo and Badajoz barred the roads. Almeida was besieged, and Wellington was preparing to attack Badajoz when Masséna again took the field, and marched to the relief of Almeida. The battle of Fuentes d'Onoro followed, in which Wellington was only able to extricate the army from a dangerous predicament which "if Boney had been there" would have been a disaster. The garrison of Almeida too escaped, after blowing up part of the fortress. In the south, in spite of the hard-won victory of Albuera, the English attack on Badajoz had to be given up. The same misfortune attended a fresh stroke against Ciudad Rodrigo, and at the end of a campaign in which he had used all his skill and care to compensate for inferior numbers, he withdrew behind the Coa. He had meanwhile been given the local rank of general and had also received the Portuguese title of Conde de Vimeiro.

Wellington had from the first seen that, whatever number of men Napoleon might send against him, it was impossible, owing to the poverty of the country, that any great mass of troops could long be held together, and that the French, used to "making war support war," would fare worse in such conditions than his own troops with their organized supply service. It was so at the end of 1811. Soult had to move southwards to live, and the English were again more than a match for the enemy in front of them. Wellington resumed the offensive, and on the 19th of January 1812 Ciudad Rodrigo was taken by storm. Again, suddenly altering the centre of gravity, Wellington invested Badajoz in the middle of March. It was necessary at whatever cost to anticipate the arrival of Soult with a relieving army, and on the 6th of April Wellington ordered the assault. The fearful slaughter which took place before the British were masters of the defences caused Wellington to be charged with indifference to loss, but a postponement of the attack would merely have resulted in more battles against Soult. Of all generals Wellington was the last to waste a single trained man, and the sight of the breaches of Badajoz after the storm for a moment unnerved even his iron sternness.

The advance from Ciudad Rodrigo into Spain was now begun. Marmont, who had succeeded Masséna, fell back to the Douro, but there turned upon his assailant, and, by superior swiftness, threatened to cut the English off from Portugal. Wellington retreated as far as Salamanca (*q.v.*), and there extricated himself from his peril by a most brilliant victory (July 22). The French fell back on Burgos. Instead of immediately following them, Wellington thought it wise to advance upon the Spanish capital. King Joseph retired, and the English entered Madrid in triumph. The political effect was great, but the delay gave the French northern army time to rally. "The vigorous following of a beaten enemy was not a prominent characteristic of Lord Wellington's warfare," as Napier says. Burgos offered an obstinate defence. Moreover, Soult, raising the siege of Cadiz, and gathering other forces to his own, pressed on towards Madrid. Wellington was compelled once more to retire into Portugal. The effect of the campaign was, however, that the southern provinces were finally cleared of the invader. During this retreat he announced in general orders that the demoralization and misconduct of the British army surpassed anything that he had ever witnessed. Such wholesale criticism was bitterly resented, but indeed throughout his career Wellington, cold and punctilious, never secured to himself the affections of officers and men as Marlborough or Napoleon did. He subjugated his army and gave it brilliant victories, but he inspired few disciples except the members of his own staff. To the end of his life his relations with the principal generals who served under him were by no means intimate.

Wellington had been made an earl after the fall of Ciudad Rodrigo, and the Spanish government created him duke of Ciudad Rodrigo about the same time. For Salamanca his reward was a marquessate, and a grant of £100,000 for the purchase of an estate. He was also made Duque da Victoria by the Portuguese regency, and before the opening of the campaign of 1813, which was to crown his work, he was given both the Garter and the Golden Fleece.

He was now invested with the supreme command of the Spanish armies. He visited Cadiz in December 1812, and offered counsels of moderation to the democratic assembly, which were not followed. During the succeeding months he was occupied with plans and preparations, and at length, in May 1813, the hour for his final and victorious advance arrived. The Russian disasters had compelled Napoleon to withdraw some of his best troops from the Peninsula. Against a weakened and discouraged adversary Wellington took the field with greatly increased numbers and with the utmost confidence. The advance of the allied army was irresistible. Position after position was evacuated by the French, until Wellington, driving everything before him, came up with the retreating enemy at Vittoria (*q.v.*), and won an overwhelming victory (June 21st). Soult's combats in the Pyrenees, and the desperate resistance of St Sebastian, prolonged the struggle through the autumn, and cost the English thousands of men. But at length the frontier was passed, and Soult forced back into his entrenched camp at Bayonne. Both armies now rested for some weeks, during which interval Wellington gained the confidence of the inhabitants by his unsparing repression of marauding, his business-like payment for supplies, and the excellent discipline which he maintained. In February 1814 the advance was renewed. The Adour was crossed, and Soult was defeated at Orthes. At Toulouse, after the allies had entered Paris, but before the abdication of Napoleon had become known, the last battle of the war was fought. Peace being proclaimed, Wellington took leave of his army at Bordeaux, and returned to England, where he was received with extraordinary honours, created duke of Wellington, and awarded a fresh grant of £400,000.

After the treaty of Paris (May 30) Wellington was appointed British ambassador at the French capital. During the autumn and winter of 1814 he witnessed and reported the mistakes of the restored Bourbon dynasty, and warned his government of the growing danger from conspiracies and from the army, which was visibly hostile to the Bourbons. His insight, however, did not extend beyond the circumstances immediately before and around him, and he failed to realize that the great mass of the French nation was still with Napoleon at heart. He remained in France until February 1815, when he took Lord Castlereagh's place at the congress of Vienna. All the great questions of the congress had already been settled, and Wellington's diplomatic work here was not of importance. His imperfect acquaintance with French feeling was strikingly proved in the despatch which he sent home on learning of Napoleon's escape from Elba. "He has acted," he wrote, "upon false or no information, and the king (Louis XVIII.) will destroy him without difficulty and in a short time." Almost before Wellington's unfortunate prediction could reach London, Louis had fled, and France was at Napoleon's feet. The ban of the congress, however, went out against the common enemy, and the presence of Wellington at Vienna enabled the allies at once to decide upon their plans for the campaign. To Wellington and Blücher were committed the invasion of France from the north, while the Russians and Austrians entered it from the east. Wellington, with the English troops and their Dutch, German and Belgian allies, took his post in the Netherlands, guarding the country west of the Charleroi road. Blücher, with the Prussians, lay between Charleroi, Namur and Liége. In the meantime Napoleon had outstripped the preparations of his adversaries. By the 13th of June he had concentrated his main army on the northern frontier, and on the 14th crossed the Sambre. The four days' campaign that followed, and the crowning victory of the 18th of June, are described in the article WATERLOO CAMPAIGN. Wellington's reward was a fresh grant of £200,000 from parliament, the title of prince of Waterloo and great estates from the king of Holland, and the order of the Saint-Esprit from Louis XVIII.

Not only the prestige of his victories, but the chance circumstances of the moment, now made Wellington the most influential personality in Europe. The emperors of Russia and Austria were still far away at the time of Napoleon's second abdication, and it was with Wellington that the commissioners of the provisional government opened negotiations preliminary to the surrender of Paris. The duke well knew the peril of delaying the decision as to the government of France. The emperor Alexander was hostile to Louis XVIII. and the Bourbons generally; the emperor Francis might have been tempted to support the cause of Napoleon's son and his own grandson, who had been proclaimed in Paris as Napoleon II.; and if the restoration of Louis—which Wellington believed would alone restore permanent peace to France and to Europe—was to be effected, the allies must be confronted on their arrival in Paris with the accomplished fact. He settled the affair in his usual downright manner, telling the commissioners bluntly that they must take back their legitimate king, and refusing—perhaps with more questionable wisdom—to allow the retention of the tricolour flag, which to him was a "symbol of rebellion." At the same time the opposition of the most influential member of the commission and the most powerful man in France, Fouché, was overcome by his appointment, on Wellington's suggestion, as minister of police. The result was that when the emperor Alexander arrived in Paris he found Louis XVIII. already in possession, and the problem before the allies was merely how to keep him there.

In the solution of this problem the common sense of Wellington and of Castlereagh, with whom the duke worked throughout in complete harmony, played a determining part; it was mainly owing to their influence that France escaped the dismemberment for which the German powers clamoured, and which was advocated for a while by Lord Liverpool and the majority of the British cabinet. Wellington realized the supreme necessity, in the interests not only of France but of Europe, of confirming and maintaining the prestige of the restored monarchy, which such a dismemberment would have irretrievably damaged. It was this conviction that inspired his whole attitude towards French affairs. If he unwillingly refused to intervene in favour of Marshal Ney, it was because he believed that so conspicuous an example of treason could not safely be allowed to go unpunished. If he bore in silence the odium that fell upon him owing to the break-up of the collection of the Louvre, it was because he knew that it would be fatal to allow it to be known that the first initiative in the matter had come from the king. In the same spirit he carried out the immense and unique trust imposed upon him by the allies when they placed him in command of the international army by which France was to be occupied, under the terms of the second peace of Paris, for five years. By the terms of his commission he was empowered to act, in case of emergency, without waiting for orders; he was, moreover, to be kept informed by the French cabinet of the whole course of business. His power was immense, and it was well and wisely used. If he had no sympathy with revolutionary disturbers of the peace, he had even less with the fatuous extravagances of the comte d'Artois and his reactionary *entourage*, and his influence was thrown into the scale of the moderate constitutional policy of which Richelieu and Decazes were the most conspicuous exponents. The administrative duties connected with the army of occupation would alone have taxed to the uttermost the powers of an ordinary man.[1] Besides this, his work included the reconstruction of the military frontier of the Netherlands, and the conduct of the financial negotiations with Messrs Baring, by which the French government was able to pay off the indemnities due from it, and thus render it possible for the powers to reduce the period of armed occupation from five years to three. He was consulted, moreover, in all matters of international importance, notably the affairs of the Spanish colonies, in which he associated himself with Castlereagh in pressing those views which were afterwards carried into effect by George Canning.

The length of time during which France was to be occupied by the allies practically depended upon Wellington's judgment. On the 10th of December 1816 Pozzo di Borgo wrote to the duke enclosing a memorandum in which the emperor Alexander of Russia suggested a reduction in the army of occupation: "no mere question of finance, but one of general policy, based on reason, equity and a severe morality"; at the same time he left the question of its postponement entirely to Wellington. To

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[1] Isolated fortresses were still holding out for Napoleon in September 1815, *e.g.* Longwy, which surrendered on the 20th. Much trouble was caused by the behaviour of some of the allied troops, notably the Prussians. Detailed reports of the condition of the country for the first months of the occupation are contained in the *Bulletins de la correspondance de l'Intérieur*, copies of which are preserved in the Foreign Office records (F.O. *Congress. Paris. Castlereagh*, August, &c., 1815).

Wellington the proposal seemed premature; he would prefer to wait till "the assembly had published its conduct by its acts"; for if the new chambers were to prove as intractable as the dissolved *Chambre introuvable*, the monarchy would not be able to dispense with its foreign tutors. To Castlereagh he wrote (December 11, 1816) that although he believed that the common people of the departments occupied, "particularly those occupied by us," were delighted to have the troops and the money spent among them, among the official and middle classes the feeling was very different. In view of the weakness of the king's government, to reduce the army would be to expose the excitable elements of the population to the temptation of attacking it. "Suppose I or my officers were forced to take military action. Suppose this were to happen in the *Prussian* cantonments. The whole Prussian army would be put in motion, and all Europe would resound with the alarm of the danger to be apprehended from the Jacobins in France."[1]

The events of the next few months considerably modified his opinions in this matter. The new chambers proved their trustworthy quality by passing the budget, and the army of occupation was reduced by 30,000 men. Wellington now pressed for the total evacuation of France, pointing out that popular irritation had grown to such a pitch that, if the occupation were to be prolonged, he must concentrate the army between the Scheldt and the Meuse, as the forces, stretched in a thin line across France, were no longer safe in the event of a popular rising. But such a concentration would in itself be attended with great risk, as the detachments might be destroyed piecemeal before they could combine. These representations determined the allies to make the immediate evacuation of France the principal subject of discussion at the congress which it was arranged to hold at Aix-la-Chapelle in the autumn of 1818. Here Wellington supported the proposal for the immediate evacuation of France, and it was owing to his common-sense criticism that the proposal of Prussia, supported by the emperor Alexander and Metternich, to establish an "army of observation" at Brussels, was nipped in the bud. The conduct of the final arrangements with Messrs Baring and Hope, which made a definitive financial settlement between France and the allies possible, was left entirely to him.

On Wellington's first entry into Paris he had been received with popular enthusiasm,[2] but he had soon become intensely unpopular. He was held responsible not only for the occupation itself, but for every untoward incident to which it gave rise; even Blücher's attempt to blow up the Pont de Jéna, which he had prevented, was laid to his charge. His characteristically British temperament was wholly unsympathetic to the French, whose sensibility was irritated by his cold and slightly contemptuous justice. Two attempts were made to assassinate him.[3] After the second the prince regent commanded him to leave Paris and proceed to the headquarters at Cambrai.[4] For the first time the duke disobeyed orders; the case, he wrote, was one in which he was "principally and personally concerned," and he alone was in a position to judge what line of action he ought to pursue.[5] His work in Paris, however, was now finished, and on the 30th of October, in a final "order of the day," he took leave of the international troops under his command. On the 23rd of October, while still at Aix, he had received an offer from Lord Liverpool of the office of master-general of the ordnance, with a seat in the cabinet. He accepted, though with some reluctance, and only on condition that he should be at liberty, in the event of the Tories going into opposition, to take any line he might think proper.

For the next three years "the Duke" was little before the world. He supported the repressive policy of Liverpool's cabinet, and organized the military forces held ready in case of a Radical rising. It was his influence with George IV. that led to the readmittance of Canning to the cabinet after the affair of the royal divorce had been settled. It was only in 1822, however, that the tragic death of his friend Londonderry (Castlereagh) brought him once more into international prominence. Londonderry had been on the eve of starting for the conference at Vienna, and the instructions which he had drawn up for his own guidance were handed over by Canning, the new foreign secretary, to Wellington, who proceeded in September to Vienna, and thence in October to Verona, whither the conference had been adjourned. Wellington's official part at the congress is outlined elsewhere (see VERONA, CONGRESS OF). Unofficially, he pointed out to the French plenipotentiaries, arguing from Napoleon's experience, the extreme danger of an invasion of Spain, but at the same time explained, for the benefit of the duke of Angoulême, the best way to conduct a campaign in the Peninsula.

Wellington's intimate association for several years with the sovereigns and statesmen of the Grand Alliance, and his experience of the evils which the Alliance existed to hold in check, naturally led him to dislike Canning's aggressive attitude towards the autocratic powers, and to view with some apprehension his determination to break with the European concert. He realized, however, that in the matter of Spain and the Spanish colonies the British government had no choice, and in this question he was in complete harmony with Canning. This was also at first the case in respect to the policy to be pursued in the Eastern Question raised by the war of Greek independence. Both Canning and Wellington were anxious to preserve the integrity of Turkey, and therefore to prevent any isolated intervention of Russia; and Wellington seemed to Canning the most suitable instrument for the purpose of securing an arrangement between Great Britain and Russia on the Greek question, through which it was hoped to assure peace in the East. In February 1826, accordingly, the duke was sent to St Petersburg, ostensibly to congratulate the emperor Nicholas I. on his accession, but more especially—to use Wellington's own words—"to induce the emperor of Russia to put himself in our hands."[6] In this object he signally failed. He was, indeed, received in St Petersburg with all honour; but as a diplomatist the "Iron Duke"—whom Nicholas, writing to his brother Constantine, described as "old and broken (*cassé*)"—was no match for the "Iron Tsar." As for the Greeks, the emperor said bluntly that he took no interest in "*ces messieurs*," whom he regarded as "rebels"; his own particular quarrel with Turkey, arising out of the non-fulfilment of the treaty of Bucharest, was the concern of Russia alone; the ultimatum to Turkey had, indeed, been prepared before Wellington's arrival, and was despatched during his visit. Under stress of the imminence of the peril, which Nicholas was at no pains to conceal, the duke was driven from concession to concession, until at last the tsar, having gained all he wanted, condescended to come to an arrangement with Great Britain in the Greek question. On the 4th of April was signed the Protocol of St Petersburg, an instrument which—as events were to prove—fettered the free initiative not of Russia, but of Great Britain (see TURKEY: *History*; GREECE: *History*).[7]

After the death of the duke of York on the 5th of December 1826 the post of commander-in-chief was conferred upon Wellington. His relations with Canning had, however, become increasingly strained, and when, in consequence of Lord Liverpool's illness, Canning in April 1827 was called to the head of the administration, the duke refused to serve under him. On the day after the resignation of his seat in the cabinet he also resigned his offices of master of the ordnance and commander-in-chief, giving as his reason "the tone and temper of Mr Canning's letters," though it is difficult to see in these letters any adequate reason for such a course (see Maxwell's *Life*, ii. 199). The effect of his withdrawal was momentous in its bearing upon Eastern affairs. Canning, freed from Wellington's restraint, carried his intervention on behalf of Greece a step further, and concluded, on the 27th of July, the treaty of London, whereby France, England and Russia bound themselves to put an end to the conflict in the East and to enforce the conditions of the St Petersburg protocol upon the belligerents. Against this treaty Wellington protested, on the ground that it "specified means of compulsion which were neither more nor less than measures of war." His apprehensions were fulfilled by the battle of Navarino.

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[1] F. O. *Continent; Paris; Wellington* (No. 32).

[2] See the interesting letter of Lord Castlereagh to Lord Liverpool preserved in the Foreign Office Records (*Congress; Paris; Viscount Castlereagh*, July 7–20, 1815), dated July 8, 1815.

[3] Maxwell, *Life*, ii. 114 ff.

[4] Suppl. Despatches, xii. 326.

[5] Suppl. Despatches, ii. 335.

[6] Memorandum to Canning of January 26, 1826 (*Well. Desp.* iii.)

[7] An interesting account of Wellington's negotiations in St Petersburg, based on unpublished documents in the Russian archives, is given in T. Schiemann's *Geschichte Russlands unter Nikolaus I.* (Berlin, 1908), ii. 126–138.

Canning died on the 8th of August 1827, and was succeeded as premier by Lord Goderich. The duke was at once again offered the post of commander-in-chief, which he accepted on the 17th of August. On the fall of Lord Goderich's cabinet five months later Wellington became prime minister. He had declared some time before that it would be an act of madness for him to take this post; but the sense of public duty led him to accept it when it was pressed upon him by the king. His cabinet included at the first Huskisson, Palmerston and other followers of Canning. The repeal of the Test and Corporation Acts having been carried in the House of Commons in the session of 1828, Wellington, to the great disappointment of Tories like Lord Eldon, recommended the House of Lords not to offer further resistance, and the measure was accordingly carried through. Soon afterwards a quarrel between the duke and Huskisson led to the retirement from the ministry of all its more liberal members. It was now hoped by the so-called Protestant party that Wellington, at the head of a more united cabinet, would offer a steady resistance to Catholic emancipation. Never were men more bitterly disappointed. The Clare election and the progress of the Catholic Association convinced both Wellington and Peel that the time had come when Catholic emancipation must be granted; and, submitting when further resistance would have led to civil war, the ministry itself brought in at the beginning of the session of 1829 a bill for the relief of the Catholics. Wellington, who had hitherto always opposed Catholic emancipation, explained and justified his change of front in simple and impressive language. His undoubted seriousness and his immense personal reputation did not, however, save him from the excesses of calumny and misinterpretation; and in order to impose some moderation upon his aspersers the duke thought it necessary to send a challenge to one of the most violent of these, the earl of Winchelsea. No mischief resulted from the encounter.

Catholic emancipation was the great act of Wellington's ministry; in other respects his tenure of office was not marked by much success. The imagination and the breadth of view necessary to a statesman of the highest order were not part of his endowment, nor had he the power of working harmoniously with his subordinates. His Eastern policy was singularly short-sighted. There might have been good reason, from Wellington's point of view, for condemning Canning's treaty of London; but when, in consequence of this treaty, the battle of Navarino had been fought, the Turkish fleet sunk, and the independence of Greece practically established, it was the weakest of all possible courses to withdraw England from its active intervention, and to leave to Russia the gains of a private and isolated war. This, however, was Wellington's policy; and, having permitted Russia to go to war alone in 1828, nothing remained for him but to treat Greece as a pawn in Russia's hands, and to cut down the territory of the Greek kingdom to the narrowest possible limits, as if the restoration to the sultan of an inaccessible mountain-tract, inhabited by the bitterest of his enemies, could permanently add to the strength of the Ottoman empire. The result was the renunciation of the Greek crown by Prince Leopold; and, although, after the fall of Wellington's ministry, a somewhat better frontier was given to Greece, it was then too late to establish this kingdom in adequate strength, and to make it, as it might have been made, a counterpoise to Russia's influence in the Levant. Nor was the indulgence shown by the cabinet towards Dom Miguel and the absolutists of Portugal quite worthy of England. That Wellington actively assisted despotic governments against the constitutional movements of the time is not true. He had indeed none of the sympathy with national causes which began to influence British policy under Canning, and which became so powerful under Palmerston; but the rule which he followed in foreign affairs, so far as he considered it possible, was that of non-intervention.

As soon as Catholic emancipation was carried, the demand for parliamentary reform and extension of the franchise agitated Great Britain from end to end. The duke was ill informed as to the real spirit of the nation. He conceived the agitation for reform to be a purely fictitious one, worked up by partisans and men of disorder in their own interest, and expressing no real want on the part of the public at large. Met with a firm resistance, it would, he believed, vanish away, with no worse result than the possible plunder of a few houses by the city mobs. Wholly unaware of the strength of the forces which he was provoking, the duke, at the opening of the parliament which met after the death of George IV., declared against any parliamentary reform whatever. This declaration led to the immediate fall of his government. Lord Grey, the chief of the new ministry, brought in the Reform Bill, which was resisted by Wellington as long as anything was to be gained by resistance. When the creation of new peers was known to be imminent, however, Wellington was among those who counselled the abandonment of a hopeless struggle. His opposition to reform made him for a while unpopular. He was hooted by the mob on the anniversary of Waterloo, and considered it necessary to protect the windows of Apsley House with iron shutters.

For the next two years the duke was in opposition. On the removal of Lord Althorp to the House of Lords in 1834, William IV. unexpectedly dismissed the Whig ministry and requested Wellington to form a cabinet. The duke, however, recommended that Peel should be at the head of the government, and served under him, during the few months that his ministry lasted, as foreign secretary. On Peel's later return to power in 1841 Wellington was again in the cabinet, but without departmental office beyond that of commander-in-chief. He supported Peel in his Corn-Law legislation, and throughout all this later period of his life, whether in office or in opposition, gained the admiration of discerning men, and excited the wonder of zealots, by his habitual subordination of party spirit and party connexion to whatever appeared to him the real interest of the nation. On Peel's defeat in 1846 the duke retired from active public life. He was now nearly eighty. His organization of the military force in London against the Chartists in April 1848, and his letter to Sir John Burgoyne on the defences of the country, proved that the old man had still something of his youth about him. But the general character of Wellington's last years was rather that of the old age of a great man idealized. To the unbroken splendours of his military career, to his honourable and conscientious labours as a parliamentary statesman, life unusually prolonged added an evening of impressive beauty and calm. The passions excited during the stormy epoch of the Reform Bill had long passed away. Venerated and beloved by the greatest and the lowliest, the old hero entered, as it were, into the immortality of his fame while still among his countrymen. Death came to him at last in its gentlest form. He passed away on the 14th of September 1852, and was buried under the dome of St Paul's, in a manner worthy both of the nation and of the man. His monument, by Alfred Stevens (*q.v.*), stands in the nave of the cathedral.

AUTHORITIES.—The *Wellington Despatches*, edited by Gurwood; *Supplementary Despatches*; and *Wellington Despatches, New Series*, edited by the second duke of Wellington. Unlike Napoleon's despatches and correspondence, everything from Wellington's pen is absolutely trustworthy: not a word is written for effect, and no fact is misrepresented. Almost all the political memoirs of the period 1830–1850 contain more or less about Wellington in his later life. Those of Greville and Croker have perhaps most of interest. A good deal of information, from the unpublished Russian archives, is given in F. F. de Martens' *Recueil des traités conclus par la Russie*. See also Sir Herbert Maxwell, *Life of Wellington* (2 vols., London, 1900), and the literature of the Peninsular War (*q.v.*), Waterloo Campaign (*q.v.*).

WELLINGTON, a town of Wellington county, New South Wales, Australia, 248 m. by rail N.W. of Sydney. Pop. (1901) 2988. The river Macquarie is here spanned by a fine railway bridge. There are rich gold-bearing reefs in the vicinity of the town and gold dredging is a growing industry; wheat growing is the most considerable agricultural pursuit, but fruit trees and vines are cultivated with success. Stock-rearing also is extensively followed on account of the fine pasturage in the district. In the vicinity are the beautiful Wellington caves.

WELLINGTON, a market town in the Wellington (Mid) parliamentary division of Shropshire, England, 10½ m. by rail E. of Shrewsbury. Pop. of urban district (1901), 6283. It is an important junction on the London & North-Western and Great Western railways, being 152 m. N.W. from London by the former line. The Shropshire Union canal connects it with the Severn. The neighbourhood is picturesque, the Wrekin, about 1½ m. from the town, rising to a height of 1335 ft. The church of All Saints dates from 1790. The manufacture of agricultural implements and nails, iron and brass founding and malting are carried on. The Roman Watling Street, running near the town, gives its name to a suburb of Wellington.

Before the Conquest Wellington (*Weliton*, *Welintun*) belonged to Earl Edwin of Mercia, and after his forfeiture in 1071 was granted to Roger, earl of Shrewsbury. It came into the king's hands in 1102 through the attainder of Robert de Belêsme. King John in 1212 granted Wellington to Thomas de Erdington "as a reward for services rendered in Rome at the time of the Interdict." Among the numerous subsequent lords of the manor were the families of Burnell and Lovell, the present owner being Colonel Sir Thomas Mayrick, Bart. Like many other towns in Shropshire, Wellington appears to have grown into importance as a border town, and possibly had some manner of corporate community in 1177, when it paid three marks to an aid, but its privileges seem to have disappeared after the annexation of Wales, and it was never incorporated. Markets are held on Thursday and Saturday under a charter of 1691–1692 to William Forester, but the Thursday market was first granted in 1244 to Giles de Erdington. Wellington has never been represented in parliament.

WELLINGTON, a market town in the Wellington parliamentary division of Somersetshire, England, at the foot of the Blackdown hills, and near the river Tone, 170½ m. W. by S. of London by the Great Western railway. Pop. of urban district (1901), 7283. The 15th-century church of St John has a fine Perpendicular tower and chancel; while the clerestoried nave is Early English. There is a magnificent altar-tomb to Sir J. Popham, Lord Chief Justice under Elizabeth and James I. The chief buildings include the West Somerset County School and a 17th-century hospital for the aged poor, founded by Sir J. Popham. A tower, which stands on the highest peak of the Blackdowns, 2½ m. S., was erected in honour of the duke of Wellington. The town has woollen manufactures, iron foundries and brick and tile works.

WELLINGTON, the capital of New Zealand, the seat of government and of a bishop. Pop. (1901) 43,638; (1906) 58,563, and including suburbs, 63,807. It lies on the south-western shore of North Island, on the inner shore of Port Nicholson, an inlet of Cook's Strait, the site affording a splendid harbour, walled in by abrupt hills. The original flat shore is occupied by massive walls constructed for the reclaiming of land, as the hills prevent an inland extension of the city. Wood was originally in favour as a building material, owing to the prevalence of earthquakes, but brick and stone subsequently took its place in the construction of the principal buildings. The main street is a winding thoroughfare named in different parts Thorndon Quay, Lambton Quay, Willis Street and Manners Street. It runs parallel to the shore, but the quays properly so called are separated from it by blocks of buildings. It is traversed by an electric tramway. There are two railway stations in the town and one in the southern suburb of Te Aro. Two main lines leave the town, one following the west coast, the other an inland route to Napier. The principal buildings are governmental; the houses of parliament, formerly a wooden erection, are rebuilt in brick and stone; there are also the residence of the governor and court house. The fine town hall was founded by the prince of Wales in 1901. There are several fine churches, and among educational institutions the chief is the Victoria University. An excellent school of art and several public libraries are provided, the latter including that in the house of parliament. The museum contains a beautiful Maori house of carved woodwork, and biological collections. There are several public parks and gardens on well-chosen elevated sites, the principal being the Botanical Garden, from which the city and port are well seen. Shipping is controlled by a harbour board (1880). The extensive wharves are amply served by hydraulic machinery and railways. Wellington was founded in 1840, being the first settlement of New Zealand colonists, and the seat of government was transferred here from Auckland in 1865. The town is under municipal government.

WELLS, CHARLES JEREMIAH (1798?–1879), English poet, was born in London, probably in the year 1798. He was educated at Cowden Clarke's school at Edmonton, with Tom Keats, the younger brother of the poet, and with R. H. Horne. He became acquainted with John Keats, and was the friend "who sent me some roses," to whom Keats wrote a sonnet on the 29th of June 1816:—

> "When, O Wells! thy roses came to me,
> My sense with their deliciousness was spelled;
> Soft voices had they, that, with tender plea,
> Whisper'd of peace and truth and friendliness unquelled."

Unfortunately, Wells soon afterwards played a cruel practical joke on the dying Tom Keats, and reappears in the elder poet's correspondence as "that degraded Wells." Both with Keats and Reynolds, Wells was in direct literary emulation, and his early writings were the result of this. In 1822 he published *Stories after Nature*—or rather, in the manner of Boccaccio, tempered by that of Leigh Hunt—a curious little volume of brocaded prose. At the close of 1823, under the pseudonym of H. L. Howard, appeared the Biblical drama of *Joseph and his Brethren* (dated 1824). For the next three years Wells saw Hazlitt, as he said, "every night," but in 1827 the two men were estranged. When Hazlitt died, in September 1830, Wells took Horne to see his dead friend, and afterwards raised a monument to the memory of Hazlitt in the church of St Anne's, Soho. His two books passed almost unnoticed, and although Hazlitt said that *Joseph and his Brethren* was "more than original, aboriginal, and a mere experiment in comparison with the vast things" Wells could do, he forbore to review it, and even dissuaded the young poet from writing any more. Wells was now practising as a solicitor in London, but he fancied that his health was failing and proceeded to South Wales, where he occupied himself with shooting, fishing and writing poetry until 1835, when he removed to Broxbourne, in Hertfordshire. In 1840 he left England, never to set foot in it again. He settled at Quimper, in Brittany, where he lived for some years. A story called *Claribel* appeared in 1845, and one or two slight sketches later, but several important tragedies and a great deal of miscellaneous verse belonging to these years are lost. Wells stated in a letter to Horne (November 1877) that he had composed eight or ten volumes of poetry during his life, but that, having in vain attempted to find a publisher for any of them, he burned the whole mass of MSS. at his wife's death. The only work he had retained was a revised form of *Joseph and his Brethren*, which was praised in 1838 by Wade, and again, with great warmth, by Horne, in his *New Spirit of the Age*, in 1844. The drama was then once more forgotten, until in 1863 it was read and vehemently praised by D. G. Rossetti. The tide turned at last; *Joseph and his Brethren* became a kind of shibboleth—a rite of initiation into the true poetic culture—but still the world at large remained indifferent. Finally, however, Swinburne wrote an eloquent study of it in the *Fortnightly Review* in 1875, and the drama itself was reprinted in 1876. The old man found it impossible at first to take his revival seriously, but he woke up at length to take a great interest in the matter, and between 1876 and 1878 he added various scenes, which are in the possession of Mr Buxton Forman, who published one of them in 1895. After leaving Quimper, Wells went to reside at Marseilles, where he held a professorial chair. He died on the 17th of February 1879.

From R. H. Horne, the author of *Orion*, the present writer received the following account of the personal appearance of Wells in youth. He was short and sturdy, with dark red hair, a sanguine complexion, and bright blue eyes; he used to call himself "the cub," in reference to the habitual roughness of his manners, which he was able to resolve at will into the most taking sweetness and good-humour. Wells's wife who had been a Miss Emily Jane Hill, died in 1874. Their son, after his father's death, achieved a notoriety which was unpoetical, although recorded in popular song, for he was the once-famous "man who broke the bank at Monte Carlo."

The famous *Joseph and his Brethren*, concerning which criticism has recovered its self-possession, is an overgrown specimen of the pseudo-Jacobean drama in verse which was popular in ultra-poetical circles between 1820 and 1830. Its merits are those of rich versification, a rather florid and voluble eloquence and a subtle trick of reserve, akin to that displayed by Webster and Cyril Tourneur in moments of impassioned dialogue. Swinburne has said that there are lines in Wells "which might more naturally be mistaken, even by an expert, for the work of the young Shakespeare, than any to be gathered elsewhere in the fields of English poetry." This may be the case, but even the youngest Shakespeare would have avoided the dulness of subject-matter and the slowness of evolution which impede the reader's progress through this wholly undramatic play. *Joseph and his Brethren*, in fact, although it has been covered with eulogy by the most illustrious enthusiasts, is less a poem than an odd poetical curiosity.

In 1909 a reprint was published of *Joseph and his Brethren*, with Swinburne's essay, and reminiscences by T. Watts-Dunton. (E. G.)

WELLS, DAVID AMES (1828–1898), American economist, was born in Springfield, Massachusetts, on the 17th of June 1828. He graduated at Williams College in 1847, was on the editorial staff of the *Springfield Republican* in 1848, and at that time invented a machine for folding newspapers and book-sheets. He then removed to Cambridge, graduated at the Lawrence Scientific School in 1851, and published in 1850–1865 with George Bliss (1793–1873) an *Annual of Scientific Discovery*. In 1866 he patented a process for preparing textile fabrics. His essay on the national debt, *Our Burden and Our Strength* (1864), secured him the appointment in 1865 as chairman of the national revenue commission, which laid the basis of scientific taxation in the United States. In 1866–1870 he was special commissioner of revenue and published important annual reports; during these years he became an advocate of free trade, and he argued that the natural resources of the United States must lead to industrial supremacy without the artificial assistance of a protective tariff which must produce an uneven development industrially. The creation of a Federal Bureau of Statistics in the Department of the Treasury was largely due to Wells's influence. In 1871 he was chairman of the New York State Commission on local taxation which urged the abolition of personal taxes, except of moneyed corporations, and the levy of a tax on the rental value of dwellings to be paid by the occupant; and in 1878 he reported on New York canal tolls. In 1877 he was president of the American Social Science Association. He died in Norwich, Connecticut, on the 5th of November 1898.

He edited many scientific text-books, and wrote *The Creed of the Free Trader* (1875), *Robinson Crusoe's Money* (1878), *Our Merchant Marine* (1882), *The Primer of Tariff Reform* (1884), *Practical Economics* (1885), *Principles of Taxation* (1886), *Recent Economic Changes* (1889).

WELLS, HERBERT GEORGE (1866–), English novelist was born at Bromley, Kent, on the 21st of September 1866, the son of Joseph Wells, a professional cricketer. He was educated at Midhurst grammar school and at the Royal College of Science, where he was trained in physics, chemistry, astronomy, geology and biology. He graduated B.Sc. of London University in 1888 with first-class honours, taught science in a private school, and subsequently did private coaching. In 1893 he began to write for the *Pall Mall Gazette*, of which he was dramatic critic in 1895. He also wrote for *Nature* and the *Saturday Review*. After the success of his fantastic story *The Time Machine* (1895) he gave his time chiefly to the writing of romances, in which the newest scientific and technical discoveries were used to advance his views on politics and sociology. But he did not confine himself to fiction. His *Anticipations* (1902) showed his real gift for sociological speculation. Beginning with a chapter on the means of locomotion in the 20th century, it went on to discuss war, the conflict of languages, faith, morals, the elimination of the unfit, and other general topics, with remarkable acuteness and constructive ability. In *The Discovery of the Future* (1902), *Mankind in the Making* (1903), *A Modern Utopia* (1905) and *New Worlds for Old* (1908) his socialistic theories were further developed. As a novelist, meanwhile, he had taken a very high place. Some earlier stories, such as *The Wheels of Chance* (1896) and *Love and Mr Lewisham* (1900), had proved his talent for drawing character, and pure phantasies like *The War of the Worlds* (1898) his abundant invention; but *Kipps* (1905) and *Tono-Bungay* (1909) showed a great advance in artistic power. The list of his works of fiction includes *The Stolen Bacillus and other Stories* (1895), *The Wonderful Visit* (1895), *The Island of Doctor Moreau* (1896), *The Plattner Story and Others* (1897), *When the Sleeper Wakes* (1899), *The First Men in the Moon* (1901), *The Food of the Gods* (1904), *In the Days of the Comet* (1906), *The War in the Air* (1908), *Anne Veronica* (1909), *The History of Mr Polly* (1910).

WELLS, SIR THOMAS SPENCER, 1st Bart. (1818–1897), English surgeon, was born at St Albans on the 3rd of February 1818, and received his medical education in Leeds, Dublin and St Thomas's Hospital, London (M.R.C.S. 1841). From 1841 to 1848 he served as a surgeon in the navy, and in 1848 he went to Paris to study pathology. In 1853 he settled in London, and took up ophthalmic surgery, interrupting his work to go out to the East in the Crimean War. In 1854 he became surgeon to the Samaritan Free Hospital for Women and Children, London. His reputation in surgery had obtained for him in 1844 the fellowship of the Royal College of Surgeons, and he subsequently became a member of council, Hunterian professor of surgery and pathology (1878), President (1882) and Hunterian Orator (1883). In 1883 he was made a baronet. His name is best known in connexion with his successful revival of the operation of ovariotomy, which had fallen into disrepute owing to the excessive mortality attending it; and in his skilful hands, assisted by modern surgical methods, the operation lost almost all its danger. His book on *Diseases of the Ovaries* was published in 1865. Sir Spencer Wells married in 1853 Miss Elizabeth Wright, and had a son and daughters. He died on the 31st of January 1897. His estate at Golder's Hill, Hampstead, was sold after his death to the London County Council and converted into a public park.

WELLS, a city, municipal borough and market town in the Wells parliamentary division of Somerset, England, 20 m. S. of Bristol, on the Great Western and Somerset & Dorset railways. Pop. (1901) 4849. It is a quiet, old-fashioned place, lying in a hollow under the Mendip Hills, whose spurs rise on all sides like islands. The city is said to have derived its name from some springs called St Andrew's Wells, which during the middle ages were thought to have valuable curative properties. During Saxon times Wells was one of the most important towns of Wessex, and in 905 it was made the seat of a bishopric by King Edward the Elder. About the year 1091–1092 Bishop John de Villula removed the see to Bath; and for some years Wells ceased to be an episcopal city. After many struggles between the secular clergy of Wells and the regulars of Bath, it was finally arranged in 1139 that the bishop should take the title of "bishop of Bath and Wells," and should for the future be elected by delegates appointed partly by the monks of Bath and partly by the canons of Wells. The foundation attached to the cathedral church of Wells consisted of a college of secular canons of St Augustine, governed by a dean, sub-dean, chancellor and other officials. The diocese covers the greater part of Somerset. The importance of the city is almost wholly ecclesiastical; and the theological college is one of the most important in England.

Wells is governed by a mayor, 4 aldermen and 12 councillors. Area 720 acres.

The cathedral, one of the most magnificent of all the secular churches of England, was executed principally by Bishops Reginald Fitz-Jocelyn (1171–1191), Savaricus (1192–1205) and Jocelyn (1206–1242). According to the usual medieval practice, the eastern part of the church was begun first, and the choir was consecrated for use long before the completion of the nave, the western part of which, with the magnificent series of statues on the façade, is commonly attributed to Bishop Jocelyn. With him was associated a famous architect in Elias de Derham, who was his steward in 1236, and died in 1245. The upper half of the two western towers has never been built. The noble central tower, 160 ft. high, was built early in the 14th century; the beautiful octagonal chapter-house on the north side, and the lady chapel at the extreme east, were the next important additions in the same century. The whole church is covered with stone groining of various dates, from the Early English of the choir to the fan vaulting of the central tower. Its plan consists of a nave (161 ft. in length and 82 in breadth) and aisles, with two short transepts, each with a western aisle and two eastern chapels. The choir and its aisles are of unusual length (103 ft.), and behind the high altar are two smaller transepts, beyond which is the very rich Decorated lady chapel, with an eastern semi-octagonal apse. On the north of the choir is the octagonal chapter-house, the vaulting of which springs from a slender central shaft; as the church belonged to secular clergy, it was not necessary to place it in its usual position by the cloister. The cloister, 160 by 150 ft., extends along the whole southern wall of the nave. The extreme length of the church from east to west is 383 ft. The oak stalls and bishop's throne in the choir are magnificent examples of 15th-century woodwork, still well preserved.

The glory of the church, and that which makes it unique among the many splendid buildings of medieval England, is the wonderful series of sculptured figures which decorate the exterior of the west front. The whole of the façade, 150 ft. wide, including the two western towers, is completely covered with this magnificent series; there are nine tiers of single figures under canopies, over 600 in number, mostly large life size, with some as much as 8 ft. in height, and other smaller statues; these represent angels, saints, prophets, kings and queens of the Saxon, Norman and Plantagenet dynasties, and bishops and others who had been benefactors to the see. There are also forty-eight reliefs with subjects from Bible history, and immense representations of the Last Judgment and the Resurrection, the latter alone containing about 150 figures. The whole composition is devised so as to present a comprehensive scheme of theology and history, evidently thought out with much care and ingenuity. As works of art, these statues and reliefs are of high merit; the faces are noble in type, the folds of the drapery very gracefully treated with true sculpturesque simplicity, and the pose of the figures remarkable for dignity. A great variety of hands and much diversity of workmanship can be traced in this mass of sculpture, but in very few cases does the work fall conspicuously below the general level of excellence.

The interior of the central tower presents an interesting example of the skilful way in which the medieval builders could turn an unexpected constructional necessity into a beautiful architectural feature. While it was being built the four piers of the great tower arches showed signs of failure, and, therefore, in order to strengthen them, a second lower arch was built below each main arch of the tower; and on this a third inverted arch was added. Thus the piers received a steady support along their whole height from top to bottom, and yet the opening of each archway was blocked up in the smallest possible degree. The contrasting lines of these three adjacent arches on each side of the tower have a very striking and graceful effect; nothing similar exists elsewhere.

On the south side of the cathedral stands the bishop's palace, a moated building, originally built in the form of a quadrangle by Bishop Jocelyn, and surrounded by a lofty circuit wall. The hall and chapel are beautiful structures, mostly of the 14th century.

The vicars' college was a secular foundation for two principals and twelve vicars; fine remains of this, dating from the 15th century, and other residences of the clergy stand within and near the cathedral close; some of these are among the most beautiful examples of medieval domestic architecture in England.

The church of St Cuthbert is one of the finest of the many fine parochial churches in Somersetshire, with a noble tower and spire at the west end. It was originally an Early English cruciform building, but the central tower fell in during the 16th century, and the whole building was much altered during the Perpendicular period. Though much damaged, a very interesting reredos exists behind the high altar; it consists of a "Jesse tree" sculptured in relief, erected in 1470. Another beautiful reredos was discovered in 1848, hidden in the plaster on the east wall of the lady chapel, which is on the north side.

There was a Roman settlement at Wells (*Theorodunum, Fonticuli, Tidington, Welliae, Welle*), this site being chosen on account of the springs from which the town takes its name, and the Roman road to Cheddar passed through Wells. King Ine founded a religious house there in 704, and it became an episcopal see in 910. To this latter event the subsequent growth of Wells is due. There is evidence that Wells had become a borough owned by the bishops of Wells before 1160, and in that year Bishop Robert granted the first charter, which exempted his burgesses from certain tolls. Other charters granted by Bishop Reginald before 1180 and by Bishop Savaric about 1201 gave the burgesses of Wells the right to jurisdiction in their own disputes. These charters were confirmed by John in 1201, by Edward I. in 1290, by Edward III. with the grant of new privileges in 1334, 1341, 1343 and 1345, by Richard II. in 1377, by Henry IV. in 1399 and by Henry VI. in 1424. Wells obtained charters of incorporation in 1589, 1683, 1688 and 1835. It was represented in parliament from 1295 to 1868. Fairs on March 3, October 14 and November 30 were granted before 1160, and in 1201 fairs on May 9, November 25 and June 25 were added. They were important in the middle ages for the sale of cloth made in the town, but the fairs which are now held on the first Tuesdays in January, May, July, November and December are noted for the sale of cheese. The market days for the sale of cattle and provisions are Wednesdays and Saturdays. Silk-making, stocking-making and gloving replaced the cloth trade in Wells, but have now given place to brush-making, corn and paper milling, which began early in the 19th century.

See *Victoria County History, Somerset*; Thomas Serel, *Lectures on Wells* (1880).

WELLSTON, a city of Jackson county, Ohio, U.S.A., about 30 m. S.E. of Chillicothe. Pop. (1880) 952; (1890) 4377; (1900) 8045, of whom 311 were foreign-born; (1910 census) 6875. Land area (1906), 6·62 sq. m. Wellston is served by the Baltimore & Ohio South-western, the Hocking Valley, the Cincinnati, Hamilton & Dayton, and the Detroit, Toledo & Ironton railways, and is connected by an electric line with Jackson (pop. in 1910, 5468), the county-seat, about 10 m. S.W. Immediately N. of the city is Lake Alma Park. Wellston is situated in a coal and iron mining country; among the city's manufactures are iron and cement, and in 1905 the value of the factory product was $1,384,295, 41·4% more than in 1900. The municipality owns and operates its water-works and its electric lighting plant. Wellston (named in honour of Harvey Wells, its founder) was settled in 1871, and was chartered as a city in 1876.

WELLSVILLE, a city of Columbiana county, Ohio, U.S.A., about 35 m. S. of Youngstown, on the Ohio river. Pop. (1890) 5247; (1900) 6146 (475 being foreign-born and 113 negroes); (1910) 7769. Wellsville is served by the Pennsylvania railway, and by an interurban electric line connecting with Rochester, Pa., and Steubenville, Ohio. It is in a region which has rich deposits of coal, natural gas, oil and clay; and there are various manufactures. The neighbourhood was first settled in 1795 by one James Clark of Washington county, Pennsylvania, who bought a tract of 304 acres here and who transferred it a year afterwards to his son-in-law, William Wells, in whose honour the settlement was named in 1820 when it was platted. From 1832 to 1852 Wellsville was an important shipping point on the Ohio, with daily steamboats to Pittsburg; it was incorporated as a village in 1848, and was chartered as a city in 1890.

WELS, a town of Austria, in Upper Austria, 17 m. S.S.W. of Linz by rail. Pop. (1900) 12,187. It is situated on the river Traun and possesses an interesting parish church, in Gothic style, rebuilt in the 15th century, but the oldest part supposed to date from the 9th century. The town draws a supply of natural gas, used for lighting, heat and motive power, from deep artesian borings first made in 1891. It has an important trade in corn, timber, horned cattle, pigs and horses, fowls, dairy produce and lard; and considerable manufactures, including machinery, cast-iron, copper and brass goods, calico, gunpowder, oil, paper, articles in felt, flour, leather and biscuits. Wels stands on the site of the Roman *Ovilaba*, and was in the 8th century the residence of the dukes of Lambach-Wels. The actual town dates from the 11th century.

WELSER, the name of a famous family of German merchants, members of which held official positions in the city of Augsburg during the 13th century. The family first became important during the 15th century, when the brothers Bartholomew and Lucas Welser carried on an extensive trade with the Levant and elsewhere, and had branches in the principal trading centres of south Germany and Italy, and also in Antwerp, London and Lisbon. The business was continued by Antony (d. 1518), a son of Lucas Welser, who was one of the first among the Germans to use the sea route to the East, which had been discovered by Vasco da Gama. The Welsers were also interested in mining ventures; and, having amassed great wealth, Antony's son Bartholomew (1488–1561) lent large sums of money to Charles V., receiving in return several marks of the imperial favour. Bartholomew and his brother Antony, however, are chiefly known as the promoters of an expedition under Ambrose Dalfinger (d. 1532), which in 1528 seized the province of Caracas in Venezuela. With the consent of Charles V., this district was governed and exploited by the Welsers; but trouble soon arose with the Spanish government, and the undertaking was abandoned in 1555. After Bartholomew's death the business was carried on by three of his sons and two of his nephews; but the firm became bankrupt in 1614. Bartholomew's niece Philippine (1527–1580), the daughter of his brother Francis (1497–1572), married the Archduke Ferdinand, son of the emperor Ferdinand I.

Perhaps the most famous member of the Welser family was Antony's grandson, Marcus (1558–1614). Educated in Italy, Marcus became burgomaster of Augsburg, but was more distinguished for his scholarship and his writings. The most important of his many works is his *Rerum Boicarum libri quinque*, dealing with the early history of the Bavarians, which was translated into German by the author's brother Paul (d. 1620). His works, *Marci Velseri opera historica et philologica*, were collected and published with a biography of Marcus by C. Arnold (Nuremberg, 1682). The Augsburg branch of Welsers became extinct in 1797, and a branch which settled at Nuremberg in 1878; but the Ulm branch of the family is still flourishing.

See K. Häbler, *Die überseeischen Unternehmungen der Welser* (Leipzig, 1903); W. Böheim, *Philippine Welser* (Berlin, 1894); and A. Kleinschmidt, *Augsburg, Nürnberg und ihre Handelsfürsten* (Cassel, 1881).

WELSH LAWS, or LEGES WALLIAE. There is, comparatively speaking, no great distance of time between the *leges barbarorum* and the Laws of Wales, while the contents of the latter show a similar, nay almost the same, idea of law as the former; and, apart from the fact that Wales became permanently connected at the end of the 13th century with a Teutonic people, the English, it has been noticed that in Wales Roman and Germanic, but no traces of a specific Welsh, law are found. King Howel Dda (*i.e.* the Good), who died in 950, is the originator of the Welsh code.[1] In the preface it is stated that Howel, "seeing the laws and customs of the country violated with impunity, summoned the archbishop of Menevia, other bishops and the chief of the clergy, the nobles of Wales, and six persons (four laymen and two clerks) from each comot, to meet at a place called Y Ty Gwyn ar Dav, or the white house on the river Tav, repaired thither in person, selected from the whole assembly twelve of the most experienced persons, added to their number a clerk or doctor of laws, named Bllgywryd, and to these thirteen confided the task of examining, retaining, expounding and abrogating. Their compilation was, when completed, read to the assembly, and, after having been confirmed, proclaimed. Howel caused three copies to be written, one of which was to accompany the court for daily use, another was deposited in the court at Aberfraw, and a third at Dinevwr. The bishops denounced sentence of excommunication against all transgressors, and soon after Howel himself went to Rome attended by the archbishop of St David's, the bishops of Bangor and St Asaph and thirteen other personages. The laws were recited before the pope and confirmed by his authority, upon which Howel and his companions returned home." All this could not have been effected before Howel had subjected Wales to his own rule, therefore not before 943. We have three different recensions of the code, one for Venedotia or North Wales, another for Dimetia or South Wales, a third for Gwent or North-east Wales. We do not know how far these recensions were uniform in the beginning; but a variance must have occurred shortly after, for the manuscripts in which the codes are preserved differ greatly from each other. The code was originally compiled in Welsh, but we have no older MSS. than the 12th century, and even the earliest ones (especially those of the Venedotia recension) contain many interpolations. The Latin translations of the code would seem to be very old, though even here we have no earlier MSS. (belonging to the Dimetia recension) than the 13th century. The Latin text is much shorter than the Welsh, but we do not know whether this abridgment was made on purpose, or whether the translation is an imitation of an earlier text. The texts present only a few traces of Roman law, which, however, are evidently additions of a later period.

The whole body of Welsh laws was published in one volume by Aneurin Owen under the direction of the commissioners on the public records as *Ancient Laws and Institutes of Wales* (London, 1841). The text of Howel's laws has been edited by A. W. Wade-Evans as *Welsh Medieval Law* (London, 1909).

WELSHPOOL (or Welchpool, so called because *Pool*, its old name, led to confusion with Poole, in Dorsetshire; Welsh *Trallwm*), a market town and municipal and contributary parliamentary borough of Montgomeryshire, N. Wales, in the upper Severn valley, on the Montgomeryshire canal and the Cambrian railway, 8 m. N. of Montgomery, and 182 m. from London. Pop. (1901) 6121. Its buildings and institutions include the old Gothic church of St Mary, the Powysland Museum, with local fossils and antiquities, and a library, vested (with its science and art school) in the corporation in 1887. Powis Castle (about a mile S.W. of the town) is the seat of Earl Powis, and has been in the possession of the Herberts for many generations. The flannel manufacture has been transferred to Newtown, but Welshpool has tweeds and woollen shawls, besides a fair trade in agricultural produce, malting and tanning. The town returned a member to parliament from 1536 to 1728, was again enfranchised in 1832, and now (with Llanfyllin, Llanidloes, Montgomery, Machynlleth and Newtown) forms the Montgomery district of parliamentary boroughs. A charter was granted to the town by the lords of Powis, confirmed by James I. (1615), and enlarged by Charles II. The castle was begun, in or about 1109, by Cadwgan ab Bleddyn ab Cynfyn (*Cynvyn*), and finished by Gwenwynwyn; in 1196 it was besieged, undermined and taken by Hubert, archbishop of Canterbury. Retaken by Gwenwynwyn in 1197, it was dismantled by Llewelyn, prince of N. Wales, in 1233. It then remained for several years in the hands of the lords of Powis. During the Civil War, the then lord Powis, a royalist, was imprisoned, and the castle was later demolished. Powis Castle, being of red sandstone, is usually called in Welsh Castell Coch (red castle). In the park is Llyn du (black pool), whence Welshpool is said to be named.

WEM, a market town in the northern parliamentary division of Shropshire, England, 11 m. N. of Shrewsbury on the London & North Western railway. Pop. (1901), 3796. It is a pleasantly situated town with a considerable agricultural trade. The church of St Peter and St Paul retains a Norman tower. Flour-milling and tanning are the chief industries. In the neighbourhood is the splendid domain of Hawkstone.

In the reign of Edward the Confessor Wem was held as four manors, but at the time of the Domesday Survey William

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[1] There is no historical foundation for the legendary laws of a prince Dymal (or Dyvnwal) Moel Mud, nor for the Laws of Marsia, which are said to belong to a period before the Roman invasion, even so early as 400 years before Christ. An English translation by the side of the Welsh text of the so-called triads of Dyvnwal Moel Mud is given by Owen, in *The Ancient Laws of Wales*.

Pantulf was holding the whole as one manor of Roger, earl of Shrewsbury, from whom it passed to the Botelers, barons of Wem. The famous Judge Jeffreys was among the subsequent lords of the manor and was created Baron Jeffreys of Wem in 1685, but upon the death of his only son and heir in 1720 the title became extinct. The town was a borough by prescription, but there appears to be no mention of burgesses before the 15th century. In 1459 Ralph, Lord Greystock, is said to have granted a charter, no longer extant, to his tenants in the manor, and in 1674 the freeholders, "borough-holders" and copyholders, of Wem brought an action against Daniel Wicherley, then lord of the manor, for the establishment of customs and privileges chiefly connected with the tenure of their lands and tenements, which was decided in their favour. The borough was governed by two bailiffs, both elected at the court leet of the lord of the manor, one by his steward, the other by a borough jury, but in the beginning of the 19th century there were only seventy-two burgesses and their rights seem to have gradually disappeared. An urban district council was formed in 1900. Wem has never been represented in parliament. The market was originally held on Sunday under grant from John to Warin Fitz Gerald in 1205, but in 1351, in consequence of a protest from the archbishop of Canterbury, it was changed to Thursday, on which day it is still held. The grant of 1205 also included a fair at the feast of SS. Peter and Paul, which was maintained until within recent years, when fairs were also held at the feast of St Mark, chiefly for linen cloth, under grant from Charles I. to Thomas Howard in 1636, and at the feast of St Martin, bishop of Tours, for the sale of hops. A great fire which broke out at Wem on the 3rd of March 1677 caused damage to the extent of £23,677.

See *Victoria County History*, *Shropshire*; Samuel Garbet, *The History of Wem* (1818).

WEMBLEY, an urban district in the Harrow parliamentary division of Middlesex, England, 10 m. W.N.W. of St Paul's Cathedral, on the Metropolitan and London & North Western railways. Pop. (1901) 4519. Wembley adjoins Sudbury on the east; the district is residential, but lacks natural attractions except in the case of Wembley Park, a pleasant wooded recreation ground, owned by a company. Here a tower was begun on the lines of the Eiffel Tower in Paris, and projected to exceed it in height, reaching 1200 ft., but only a short stage was completed. The manor of Wembley belonged to the priory of Kilburn until that foundation was dissolved by Henry VIII.

WEMYSS, EARLS OF, the title held by a Scottish family who had possessed the lands of Wemyss in Fifeshire since the 12th century, and of which various members had attained distinction. In 1628 Sir John Wemyss, who had been created a baronet in 1625, was raised to the peerage as Baron Wemyss of Elcho; and in 1633 he became earl of Wemyss, and Baron Elcho and Methel, in the peerage of Scotland. He took part with the Scottish parliament against Charles I., and died in 1649. On the death of David, 2nd earl of Wemyss (1610–1679), the estates and titles passed to his daughter Margaret, countess of Wemyss, whose son David, 3rd earl of Wemyss, succeeded on her death in 1705. His son James, 4th earl (1699–1756), married a great heiress, Janet, daughter of Colonel Francis Charteris, who had made a large fortune by gambling. His son David, Lord Elcho (1721–1787), was implicated in the Jacobite rising of 1745, and was consequently attainted, the estates passing to his younger brother James, while the title remained dormant after his father's death, though it was assumed by Elcho's brother Francis, who took the name of Charteris on inheriting his maternal grandfather's estate. A reversal of the attainder was granted in 1826 to his descendant Francis Charteris Wemyss Douglas (1772–1853), who had been created Baron Wemyss of Wemyss in the peerage of the United Kingdom in 1821, and had assumed the name of Charteris Wemyss Douglas on inheriting some of the Douglas estates through a female ancestor. Thenceforward the title descended in the direct line.

WEMYSS, a parish of Fifeshire, Scotland, embracing the villages of East and West Wemyss and the police burgh of Buckhaven, a fishing port lying on the northern shore of the Firth of Forth, 2½ m. S.W. of Leven, on the North British Railway Company's branch line from Thornton Junction to Methil. Coal mining is the principal industry of the district, the coal being exported from the port of Methil, of which the harbour was constructed by David, 2nd earl of Wemyss (d. 1679), the town being made a burgh of barony in 1662. Population of Buckhaven, including Methil and Innerleven (1901), 8828; of East Wemyss, 2522; of West Wemyss, 1253; of Wemyss parish, 15,031. The district is of much archaeological and historic interest. On the shore to the north-east are two square towers which are supposed to have formed part of Macduff's castle; and near them are the remarkable caves (weems, from the Gaelic, *uamha*) from which the district derives its name. Several of them contain archaic sculptures, held by some to be the work of the Christian missionaries who found shelter here; by others ascribed to the same prehistoric agency as the inscribed stones of northern Scotland. Near East Wemyss is Wemyss Castle, the ancient seat of the family of the same name which has played a conspicuous part in Scottish history. It was at Wemyss castle that Mary, queen of Scots, first met the earl of Darnley, in 1565, and her room is still known as "the Presence Chamber."

WENCESLAUS (1361–1419), German king, and, as Wenceslaus IV., king of Bohemia, was the son of the emperor Charles IV. and Anna, daughter of Henry II., duke of Schweidnitz. Born at Nuremberg on the 26th of February 1361, he was crowned king of Bohemia in June 1363, and invested with the margraviate of Brandenburg in 1373. In September 1370 he married Joanna (d. 1386) daughter of Albert I., duke of Bavaria, and was elected king of the Romans or German king at Frankfort on the 10th of June 1376, and crowned at Aix-la-Chapelle on the 6th of July following. He took some part in the government of the empire during his father's lifetime, and when Charles died in November 1378 became sole ruler of Germany and Bohemia, but handed over Brandenburg to his half-brother Sigismund. His reign was a period of confusion both in church and state, and although he appears to have begun to rule with excellent intentions, he was totally unfit to cope with the forces of disorder. Germany was torn with feuds, the various orders for the establishment of peace were disregarded, and after 1389 the king paid very little attention to German affairs. In 1383 he inherited the duchy of Luxemburg from his uncle Wenceslaus and in 1387 assisted his half-brother Sigismund to obtain the Hungarian throne.

For some time Wenceslaus ruled Bohemia successfully, but he fell under the influence of favourites and aroused the irritation of the nobles. A quarrel with John II., archbishop of Prague, which led to the murder of John's vicar-general, John of Pomuk, at the instigation of the king, provoked a rising led by Jobst, margrave of Moravia, a cousin of Wenceslaus; and in 1394 the king was taken prisoner and only released under pressure of threats from the German princes. Having consented to limitations on his power in Bohemia, he made a further but spasmodic effort to restore peace in Germany. He then met Charles VI., king of France at Reims, where the monarchs decided to persuade the rival popes Benedict XIII. and Boniface IX. to resign, and to end the papal schisms by the election of a new pontiff. Many of the princes were angry at this abandonment of Boniface by Wenceslaus, who had also aroused much indignation by his long absence from Germany and by selling the title of duke of Milan to Gian Galleazzo Visconti. The consequence was that in August 1400 the four Rhenish electors met at Oberlahnstein and declared Wenceslaus deposed. He was charged with attempting to dismember the empire to his own advantage, with neglecting to end the schism in the church, with allowing favourites to enrich themselves, and was further accused of murder. Though he remained in Bohemia he took no steps against Rupert III. count palatine of the Rhine, who had been elected as his successor. He soon quarrelled with Sigismund, who took him prisoner in 1402 and sent him to Vienna, where he remained in captivity for nineteen months after abdicating in Bohemia. In 1404, when Sigismund was recalled to Hungary, Wenceslaus regained his freedom and with it his authority in Bohemia; and after the death of the German king Rupert in 1410 appears to have entertained hopes of recovering his former throne. Abandoning this idea, however, he voted for the election of Sigismund in 1411, but stipulated that he should retain the title of king of the Romans. His concluding years were disturbed by the troubles which arose in Bohemia over the death of John Huss, and which the vacillating king did nothing to check until compelled by Sigismund. In the midst of these disturbances he died at Prague on the 16th of August 1419. His second wife was Sophia, daughter of John, duke of Bavaria-Munich, but he left no children. Wenceslaus was a capable and educated man, but was lacking in perseverance and industry. He neglected business for pleasure and was much addicted to drunkenness. He favoured the teaching of Huss, probably on political grounds, but exercised very little influence during the Hussite struggle.

See Th. Lindner, *Geschichte des deutschen Reiches vom Ende des 14ten Jahrhunderts bis zur Reformation*, part i. (Brunswick, 1875–1880), and "Die Wahl Wenzels," in the *Forschungen zur deutschen Geschichte*, Band xiv. (Göttingen, 1862–1886); F. M. Pelzel, *Lebensgeschichte des römischen und böhmischen Königs Wenceslaus* (Prague, 1788–1790); F. Palacky, *Geschichte von Böhmen*, Bände iii. and iv. (Prague, 1864–1874); H. Mau, *König Wenzel und die rheinischen Kurfürsten* (Rostock, 1887). The article by Th. Lindner in the *Allgemeine deutsche Biographie*, Band xli., should also be consulted for a bibliography, and also the same writer's work, *Das Urkundenwesen Karls IV. und seiner Nachfolger* (Stuttgart, 1882).

WÊN-CHOW-FU, a prefectural city in the province of Chehkiang, China, and one of the five ports opened by the Chifu convention to foreign trade, situated (28° 1′ N., 120° 31′ E.) on the south bank of the river Gow, about 20 m. from the sea. The population is estimated at 80,000. The site is said to have been chosen by Kwo P'oh (A.D. 276–324), a celebrated antiquary who recognized in the adjacent mountain peaks a correspondence with the stars in the constellation of the Great Bear, from which circumstance the town was first known as the Tow or Great Bear city. Subsequently the appearance in its vicinity of a white deer carrying a flower in its mouth was deemed so favourable an omen as to more than justify the change of its name to Luh or Deer city. Its present name, which signifies the "mild district," and is correctly descriptive of the climate, though not of the inhabitants, was given to it during the Ming dynasty (1368–1644). The walls, which were built in the 10th century, are about 4 m. in circumference, 35 ft. in height, and 12 ft. broad at the top. The streets are paved with brick and are wide, straight and clean. The gates, seven in number, were erected in 1598. Wên-chow is about 1560 m. S.S.E. by road from Peking and 600 m. E.S.E. of Hankow. The British consul and the customs outdoor staff occupy foreign-built houses on Conquest Island, which lies abreast of the city. The neighbourhood is hilly and pretty, while opposite the north-west gate Conquest Island forms a picturesque object. The island is, however, more beautiful than healthy. The port, which was opened to foreign trade in 1876, has not justified the expectations which were formed of it as a commercial centre, and in 1908 the direct foreign trade was valued at £19,000 only.

There is no foreign settlement at Wên-chow, and the foreign residents are mainly officials and missionaries. The tea trade of Wên-chow-Fu, formerly important, has declined owing to careless cultivation. A considerable native export trade in wood, charcoal, bamboo, medicines, paper umbrellas, oranges, otter skins and tobacco leaf is carried on. The imports are chiefly cotton yarn and piece goods, kerosene oil, palm-leaf fans, aniline dyes, sugar and matches.

WENDEN (Lettish *Tscziz*), a town of western Russia, in the government of Livonia, 60 m. by rail N.E. of Riga. Pop. (1897) 6327. Here are the well preserved ruins of a former castle of the Brethren of the Sword, afterwards (from 1237) of the grandmaster of the Teutonic Knights. In 1577 the garrison blew it up to prevent it from falling into the hands of Ivan the Terrible of Russia. It was rebuilt, but has been in ruins since a fire in 1748.

WENDOVER, a market town in the Aylesbury parliamentary division of Buckinghamshire, England, 33 m. N.W. of London by the Metropolitan and the Great Central joint railway. Pop. (1901) 2036. It is picturesquely situated in a shallow defile of the Chiltern Hills, towards their western face. Wendover is a quiet town of no great activity. Its church of St Mary is mainly Decorated, and a few old houses remain.

Wendover (*Wendovre, Wandovre, Wendoura*) is on the Upper Icknield Way, which was probably an ancient British road, and various traces of a British settlement have been found in the town and neighbourhood. In 1087 the king held the manor of Wendover, and therefore it belonged to the ancient demesne of the crown. There is no trace of any incorporation of the town. Two burgesses were summoned to the parliaments of 1300, 1307 and 1309, but no further returns were made until 1625. In 1832 Wendover lost its right of separate representation. It is noteworthy that John Hampden and Edmund Burke both represented the borough. In 1464 Edward IV. confirmed to his tenants and the residents within the borough the market that they had always held every Thursday. For a short period the day was changed to Tuesday, but the market was given up before 1888. Hugh de Gurnay held a fair in Wendover on the eve, feast and morrow of St John the Baptist, granted him in 1214. Another fair was granted to John de Molyns in 1347–1348 on the eve, feast and morrow of St Barnabas, but in 1464 Edward IV. granted two fairs to his tenants and residents in the borough, to be held on the vigils, feasts and morrows of St Matthew and of SS. Philip and James. These fairs have been held without interruption till the present day, their dates being October 2 and May 13.

WENDS, the name applied by the Germans to the Slavs (*q.v.*) wherever they came in contact with them. It is now used for the Slovenes (*q.v.*), for the Germanized Polabs (*q.v.*) in eastern Hanover, and especially for the Lusatian Wends or Sorbs (*q.v.*). It is first found in Pliny (*Venedae*) and in English is used by Alfred.

WENDT, HANS HINRICH (1853–   ), German Protestant theologian, was born in Hamburg on the 18th of June 1853. After studying theology at Leipzig, Göttingen and Tübingen, he became in 1885 professor ordinarius of systematic theology at Heidelberg, and in 1893 was called to Jena. His work on the teaching of Jesus (*Die Lehre Jesu*, 1886–1890; Eng. trans. of second part, 1892) made him widely known. He also edited several editions (5th to 8th, 1880–1898) of the *Commentary on the Acts of the Apostles* in H. A. W. Meyer's series. In May 1904 he delivered two addresses in London on "The Idea and Reality of Revelation, and Typical Forms of Christianity," as the *Essex Hall Lectures* (published, 1904).

His works include: *Die christliche Lehre von der menschlichen Vollkommenheit* (1882), *Der Erfahrungsbeweis für die Wahrheit des Christentums* (1897), and *Das Johannesevangelium* (1900; Eng. trans., 1902).

WENLOCK, a municipal borough in the Ludlow and Wellington parliamentary divisions of Shropshire, England, extending on both sides of the river Severn. Pop. (1901) 15,866. It includes the market towns of Broseley, Madeley and Much Wenlock (*q.v.*). The parish of Madeley includes the small towns of Ironbridge and Coalport, with part of Coalbrookedale (*q.v.*). The district is in part agricultural, but contains limestone quarries, some coal-mines and iron-works. The borough is under a mayor, 8 aldermen and 24 councillors. Area, 22,657 acres.

Wenlock (*Weneloche*) is said to be of pre-Roman origin, but owed its early importance to the nunnery founded *c.* 680 by St Milburg, daughter of Merewald, king of Mercia. This was destroyed by the Danes but refounded as a priory by Earl Leofric in 1017. It was again deserted after the Conquest until Roger de Montgomery founded a house of the Cluniac order on its site. The town was a borough by prescription, and its privileges began with the grants made to the priory and its tenants. It was incorporated under the name of "Bailiff, Burgesses and Commonalty" by Edward IV. in 1468 at the request of Sir John Wenlock, Kt., and "in consideration of the laudable services which the men of the town performed in assisting the king to gain possession of the crown," and the charter was confirmed in

1547 by Henry VIII, and in 1631 by Charles I. The bailiff was to be chosen annually by the burgesses, but his election seems to have depended entirely upon the lord of the manor, and, after a contest in 1821 between Lord Forester and Sir W. W. Wynne, the lord of the manor at that date, was nominated by each of them alternately. In the report of 1835 the borough is said to consist of seventeen parishes and to be unfit for corporate government. By the charter of Edward IV. the town obtained the right of sending two members to parliament, but was disfranchised in 1885. The first grant of a market and fair is dated 1227, when the prior of Wenlock obtained licence to hold a fair on the vigil, day and morrow of the Nativity of St John the Baptist, and a market every Monday. The incorporation charter of 1468 granted these to the burgesses, who continue to hold them.

See *Victoria County History: Shropshire*; John Randall, *Randall's Tourists' Guide to Wenlock* (1875); "Borough of Wenlock," *The Salopian and West Midland Monthly Illustrated Journal*, March, April, November, December, 1877, April and October, 1878, March, 1879 (1877–1879).

WENLOCK GROUP (Wenlockian), in geology, the middle series of strata in the Silurian (Upper Silurian) of Great Britain. This group in the typical area in the Welsh border counties contains the following formations: Wenlock or Dudley limestone, 90-300 ft.; Wenlock shale, up to 1900 ft.; Woolhope or Barr limestone and shale, 150 ft.

The *Woolhope* beds consist mainly of shales which are generally calcareous and pass frequently into irregular nodular and lenticular limestone. In the Malvern Hills there is much shale at the base, and in places the limestone may be absent. These beds are best developed in Herefordshire; they appear also at May Hill in Gloucestershire and in Radnorshire. Common fossils are *Phacops caudatus*, *Encrinurus punctatus*, *Orthis calligramma*, *Atrypa reticularis*, *Orthoceras annulatum*.

The *Wenlock Shales* are pale or dark-grey shales which extend through Coalbrookdale in Shropshire, through Radnorshire into Carmarthenshire. They appear again southward in the Silurian patches in Gloucestershire, Herefordshire and Monmouthshire. They thicken from the south northward. The fossils are on the whole closely similar to those in the limestones above with the natural difference that corals are comparatively rare in the shales, while graptolites are abundant. Six graptolite zones have been recognized by Miss G. L. Elles in this formation.

The *Wenlock limestone* occurs either as a series of thin limestones with thin shales or as thick massive beds; it is sometimes hard and crystalline and sometimes soft, earthy or concretionary. It is typically developed in Wenlock Edge, where it forms a striking feature for some 20 m. It appears very well exposed in a sharp anticline at Dudley, whence it is sometimes called the "Dudley limestone"; it occurs also at Aymestry, Ludlow, Woolhope, May Hill, Usk and Malvern. The fossils include corals in great variety (*Halysites catenularis*, *Favosites aspera*, *Heliolites interstinctus*), crinoids (*Crotalocrinus*, *Marsupiocrinus*, *Periechocrinus*), often very beautiful specimens, and trilobites (*Calymene Blumenbachii*, the "Dudley locust," *Phacops caudatus*, *Illaenus* (*Bumbastes*) *barriensis*, *Homolonotus delphinocephalus*). Merostomatous crustaceans make their first appearance here (*Eurypterus punctatus*, *Hemiaspis horridus*). Brachiopods are abundant (*Atrypa reticularis*, *Spirifer plicatilis*, *Rhynchonella cuneata*, *Orthis*, *Leptaena*, *Pentamerus*); lamellibranchs include the genera *Avicula*, *Cardiola*, *Grammysia*; *Murchisonia*, *Bellerophon*, *Omphalotrochus* are common gasteropod genera. *Conularia Sowerbyi* is by no means rare, and there are several common cephalopod genera (*Orthoceras*, *Phragmoceras*, *Trochoceras*).

The greater part of the known Silurian fauna of Britain comes from Wenlock rocks; J. Davidson and G. Maw obtained no fewer than 25,000 specimens of brachiopods from 7 tons of the shale. Not only are there many different genera and species but individually certain forms are very numerous. The three principal zonal graptolites are, from above downwards: *Monograptus testis*, *Cyrtograptus Linnarssoni*, *Cyrtograptus Murchisoni*.

When traced northward into Denbighshire and Merionethshire the rocks change their character and become more slaty or arenaceous; they are represented in this area by the "Moel Ferna Slates," the "Pen-y-glog Grit," and "Pen-y-glog Slates," all of which belong to the lower part of a great series (3000 ft.) of slates and grits known as the "Denbighshire Grits." Similar deposits occur on this horizon still farther north, in the Lake district, where the Wenlock rocks are represented by the "Brathay Flags" (lower part of the Coniston Flags series), and in southern Scotland, where their place is taken by the variable "Riccarton beds" of Kirkcudbright Shore, Dumfriesshire, Riccarton and the Cheviots; by greywackes and shales in Lanarkshire; by mudstones, shales and grits in the Pentland Hills, and in the Girvan area by the "Blair" and "Straiton beds." In Ireland the "Ferriters Cove beds," a thick series of shales, slates and sandstones with lavas and tuffs in the Dingle promontory; the "Mweelrea beds" and others in Tipperary and Mayo are of Wenlock age. Lime and flagstones are the most important economic products of the British Wenlock rocks.

See the article Silurian, and for recent papers, *Geological Literature*, Geol. Soc., London, annual, and the *Q.J. Geol. Soc.*, London. (J. A. H.)

WENNERBERG, GUNNAR (1817–1901), Swedish poet, musician and politician, was born at Lidköping, of which place his father was parish priest, on the 2nd of October 1817. He passed through the public school of Skara, and in his twentieth year became a student at Upsala. He was remarkable from the first, handsome in face and tall in figure, with a finely trained singing voice, and brilliant in wit and conversation. From the outset of his career he was accepted in the inner circle of men of light and leading for which the university was at that time famous. In 1843 he became a member of the musical club who called themselves "The Juvenals," and for their meetings were written the trios and duets, music and words, which Wennerberg began to publish in 1846. In the following year appeared the earliest numbers of *Gluntarne* (or "The Boys"), thirty duets for baritone and bass, which continued to be issued from 1847 to 1850. The success of these remarkable productions, masterpieces in two arts, was overwhelming: they presented an epitome of all that was most unique and most attractive in the curious university life of Sweden. In the second volume of his collected works Wennerberg gave, long afterwards, a very interesting account of the inception and history of these celebrated duets. His great personal popularity, as the representative Swedish student, did not prevent him, however, from pursuing his studies, and he became an authority on Spinoza. In 1850 he first travelled through Sweden, singing and reciting in public, and his tour was a long popular triumph. In 1860 he published his collected trios, as *The Three*. In 1865, at the particular wish of the king, Charles XV., Wennerberg entered official life in the department of elementary education. He succeeded Fahlcrantz in 1866 as one of the eighteen of the Swedish Academy, and in 1870 became minister for education (*Ekklesiastikminister*) in the Adlercreutz government, upon the fall of which in 1875 he retired for a time into private life. He was, however, made lord-lieutenant in the province of Kronoberg, and shortly afterwards was elected to represent it in the Diet. His active parliamentary life continued until he was nearly eighty years of age. In 1881 and 1885 he issued his collected works, mainly in verse. In 1893 he was elected to the upper house. He preserved his superb appearance in advanced old age, and he died, after a very short illness, on the 24th of August 1901, at the royal castle of Leckö, where he was visiting his brother-in-law, Count Axel Rudenschöld. His wife, the Countess Hedvig Cronstedt, whom he married in 1852, died in 1900. Wennerberg was a most remarkable type of the lyrical, ardent Swedish aristocrat, full of the joy of life and the beauty of it. In the long roll of his eighty-four years there was scarcely a crumpled rose-leaf. His poems, to which their musical accompaniment is almost essential, have not ceased, in half a century, to be universally pleasing to Swedish ears; outside Sweden it would be difficult to make their peculiarly local charm intelligible. (E. G.)

WENSLEYDALE, JAMES PARKE, Baron (1782–1868), English judge, was born near Liverpool on the 22nd of March 1782. He was educated at Macclesfield grammar school and Trinity College, Cambridge. He had a brilliant career at the university, winning the Craven scholarship, Sir William Browne's gold medal, and being fifth wrangler and senior chancellor's medallist in classics. Called to the bar at the Inner Temple he rapidly acquired an excellent common law practice and in 1828 was raised to the king's bench, while still of the junior bar. In 1834 he was transferred from the king's bench to the court of exchequer, where for some twenty years he exercised considerable influence. The changes introduced by the Common Law Procedure Acts of 1854, 1855 proved too much for his legal conservatism and he resigned in December of the latter year. The government, anxious to have his services as a law lord in the House of Lords, proposed to confer on him a life peerage, but this was opposed by the House of Lords (see Peerage), and he was eventually created a peer with the usual remainder (1856). He died at his residence, Ampthill Park, Bedfordshire, on the 25th of February 1868, and having outlived his three sons, the title became extinct.

WENSLEYDALE, the name given to the upper part of the valley of the river Ure in the North Riding, Yorkshire, England. It is celebrated equally for its picturesque scenery and for the numerous points of historical and other interest within it. The Ure rises near the border of Yorkshire and Westmorland, in the uplands of the Pennine Chain. Its course is generally easterly as long as it is confined by these uplands, but on debouching upon the central plain of Yorkshire it takes a south-easterly turn and flows past Ripon and Boroughbridge to form, by its union with the Swale, the river Ouse, which drains to the Humber. The name Wensleydale is derived from the village of Wensley, some 25 m. from the source of the river, and is primarily applied to a section of the valley extending 10 m. upstream from that point, but is generally taken to embrace the whole valley from its source to a point near Jervaulx abbey, a distance of nearly 40 m., below which the valley widens out upon the plain. The dale is traversed by a branch of the North-Eastern railway from Northallerton.

As far up as Hawes, the dale presents a series of landscapes in which the broken limestone crags of the valley-walls and the high-lying moors beyond them contrast finely with the rich land at the foot of the hills. Beyond Hawes, towards the source, the valley soon becomes wide, bare and shallow, less rich in contrast, but wilder. On both sides throughout the dale numerous narrow tributary vales open out. Small waterfalls are numerous. The chief are Aysgarth Force, on the main stream, Mill Gill Force on a tributary near Askrigg, and Hardraw Scaur beyond Hawes, the finest of all, which shoots forth over a projecting ledge of limestone so as to leave a clear passage behind it. The surrounding cliffs complete a fine picture. The small river Bain, joining the Ure near Askrigg, forms a pretty lake called Semerer or Semmer Water, ¾ m. in length.

Following the valley upward, the points of chief interest apart from the scenery are these. Jervaulx Abbey was founded in 1156 by Cistercians from Byland, who had previously settled near Askrigg. The remains are mainly transitional Norman and Early English, and are not extensive. Of the great church hardly any fragments rise above ground-level, but the chapter-house, refectory and cloisters remain in part, and the ivy-clad ruins stand in a beautiful setting of woodland. Above the small town of Middleham, where there are large training stables, rises the Norman keep of Robert Fitz-Ranulph, which passed to the Nevills, being held by the "King-maker," Warwick. The subsidiary buildings date down to the 14th century. In Cover Dale near Middleham is the ruined Premonstratensian abbey of Coverham, founded here in the 13th century and retaining a gatehouse and other portions of Decorated date. Farther up Wensleydale Bolton Castle stands high on the north side. This was the stronghold of the Scropes, founded by Richard I.'s chancellor of that name. Its walls, four corner-towers and fine position still give it an appearance of great strength.

WENTWORTH, the name of an English family distinguished in the parliamentary history of the 16th and 17th centuries. The Wentworths traced descent from William Wentworth (d. 1308) of Wentworth Woodhouse, in Yorkshire, who was the ancestor of no fewer than eight distinct lines of the family, two main branches of which were settled in the 14th century at Wentworth Woodhouse and North Elmshall respectively. From the elder, or Wentworth Woodhouse branch, were descended Thomas Wentworth the celebrated earl of Strafford (*q.v.*), and through him the Watson-Wentworths, marquesses of Rockingham in the 18th century, and the earls FitzWilliam of the present day. To the younger branch belonged Roger Wentworth (d. 1452), great-great-grandson of the above-mentioned William. Roger, who was a son of John Wentworth (fl. 1413) of North Elmshall, Yorkshire, acquired the manor of Nettlestead in Suffolk in right of his wife, a grand-daughter of Robert, Baron Tibetot, in whose lands this manor had been included, and who died leaving an only daughter in 1372. Roger's son Henry (d. 1482) was twice married; by his first wife he was the ancestor of the Wentworths of Gosfield, Essex; by his second of the Wentworths of Lillingstone Lovell, Buckinghamshire.[1] Another of Roger Wentworth's sons, Sir Philip Wentworth, was the grandfather of Margery, wife of Sir John Seymour, mother of the Protector Somerset and of Henry VIII.'s wife Jane Seymour, and grandmother of King Edward VI. Margery's brother Sir Robert Wentworth (d. 1528) married a daughter of Sir James Tyrrell, the reputed murderer of Edward V. and his brother in the Tower; and Sir Robert's son by this marriage, Thomas Wentworth (1501–1551), was summoned to parliament by writ in 1529 as Baron Wentworth of Nettlestead. He was one of the peers who signed the letter to the pope in favour of Henry VIII.'s divorce from Catherine of Aragon, and was one of the judges of Anne Boleyn. He was lord chamberlain to Edward VI., and died in 1551 leaving sixteen children.

Thomas Wentworth, 2nd Baron Wentworth of Nettlestead (1525–1584), was the eldest son of the above-mentioned 1st baron. He served with distinction under his relative the Protector Somerset at the battle of Pinkie in 1547; but in 1551 he was one of the peers who condemned Somerset to death on a charge of felony. He was a trusted counsellor of Queen Mary, who appointed him deputy of Calais. Wentworth was the last Englishman to hold this post, for on the 7th of January 1558 he was compelled to surrender Calais to the French, his representations as to the defenceless condition of the fortress having been disregarded by the English Council some years earlier. Wentworth himself remained in France as a prisoner of war for more than a year, and on his return to England in 1559 he was sent to the Tower for having surrendered Calais; but he was acquitted of treason. He died on the 13th of January 1584. His eldest son William married a daughter of Lord Burghley, but predeceased his father, whose peerage consequently passed to his second son Henry (1558–1593), who was one of the judges of Mary, queen of Scots, at Fotheringay in 1586.

Thomas Wentworth, 1st earl of Cleveland (1591–1667), was the eldest son of Henry, whom he succeeded as 4th Baron Wentworth of Nettlestead in 1593. In 1614 he inherited from an aunt the estate of Toddington in Bedfordshire, till then the property of the Cheyney family, and here he made his principal residence. In 1626 he was created earl of Cleveland, and in the following year he served under Buckingham in the expedition to La Rochelle. Adhering to the king's cause in the parliamentary troubles, he attended his kinsman Strafford at his execution, and afterwards was a general on the royalist side in the Civil War until he was taken prisoner at the second battle of Newbury. Cleveland commanded a cavalry regiment at Worcester in 1651, when he was again taken prisoner, and he remained in the Tower till 1656. He died on the 25th of March 1667. His early extravagance and the fortunes of war had greatly reduced his estates, and Nettlestead was sold in 1643. Cleveland was described by Clarendon as "a man of signal courage and an excellent officer"; his cavalry charge at Cropredy Bridge was one of the most brilliant incidents in the Civil War, and it was by his bravery and presence of mind that Charles II. was enabled to escape from Worcester. At his death the earldom of Cleveland became extinct. He outlived his son Thomas (1613–1645), who was called up to the House of Lords in his father's lifetime as Baron Wentworth, and whose daughter Henrietta Maria became Baroness Wentworth in her own right on her grandfather's death. This lady, who was the duke of Monmouth's mistress, died unmarried in 1686. The barony of Wentworth then reverted to Cleveland's daughter Anne, who married the 2nd Lord Lovelace, from whom it passed to her grand-daughter Martha (d. 1745), wife of Sir Henry Johnson, and afterwards to a descendant of Anne's daughter Margaret, Edward Noel, who was created Viscount Wentworth of Wellesborough in 1762. The viscountcy became extinct at his death, and the barony again passed through the female line in the person of Noel's daughter Judith to the latter's daughter Anne Isabella, who married Lord Byron the poet; and from her to Byron's daughter Augusta Ada, whose husband was in 1838 created earl of Lovelace. The barony of Wentworth was thereafter held by the descendants of this nobleman in conjunction with the earldom of Lovelace.

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[1] In the 16th century Lillingstone Lovell was in Oxfordshire, that portion of the county being surrounded by Buckinghamshire, with which it was afterwards incorporated.

PAUL WENTWORTH (1533–1593), a prominent member of parliament in the reign of Elizabeth, was a member of the Lillingstone Lovell branch of the family (see above). His father Sir Nicholas Wentworth (d. 1557) was chief porter of Calais. Paul Wentworth was of puritan sympathies, and he first came into notice by the freedom with which in 1566 he criticized Elizabeth's prohibition of discussion in parliament on the question of her successor. Paul, who was probably the author of the famous puritan devotional book *The Miscellanie, or Regestrie and Methodicall Directorie of Orizons* (London, 1615), died in 1593. He became possessed of Burnham Abbey through his wife, to whose first husband, William Tyldesley, it had been granted at the dissolution of the monasteries by Henry VIII.

PETER WENTWORTH (1530–1596) was the elder brother of the above-mentioned Paul, and like his brother was a prominent puritan leader in parliament, which he first entered as member for Barnstaple in 1571. He took a firm attitude in support of the liberties of parliament against encroachments of the royal prerogative, on which subject he delivered a memorable speech on the 8th of February 1576, for which after examination by the Star Chamber he was committed to the Tower. In February 1587 Sir Anthony Cope (1548–1614) presented to the Speaker a bill abrogating the existing ecclesiastical law, together with a puritan revision of the Prayer Book, and Wentworth supported him by bringing forward certain articles touching the liberties of the House of Commons; Cope and Wentworth were both committed to the Tower for interference with the queen's ecclesiastical prerogative. In 1593 Wentworth again suffered imprisonment for presenting a petition on the subject of the succession to the Crown; and it is probable that he did not regain his freedom, for he died in the Tower on the 10th of November 1596. While in the Tower he wrote *A Pithie Exhortation to her Majesty for establishing her Successor to the Crown*, a famous treatise preserved in the British Museum. Peter Wentworth was twice married; his first wife, by whom he had no children, was a cousin of Catherine Parr, and his second a sister of Sir Francis Walsingham, Elizabeth's secretary of state. His third son, Thomas Wentworth (*c.* 1568–1623), was an ardent and sometimes a violent opponent of royal prerogative in parliament, of which he became a member in 1604, continuing to represent the city of Oxford from that year until his death. He was called to the bar in 1594 and became recorder of Oxford in 1607. Another son, Walter Wentworth, was also a member of parliament.

SIR PETER WENTWORTH (1592–1675) was a grandson of Peter Wentworth, being the son of Peter's eldest son Nicholas, from whom he inherited the manor of Lillingstone Lovell. As sheriff of Oxfordshire in 1634 he was charged with the duty of collecting the levy of ship-money, in which he encountered popular opposition. He was member for Tamworth in the Long Parliament, but refused to act as a commissioner for the trial of Charles I. He was a member of the council of state during the Commonwealth; but was denounced for immorality by Cromwell in April 1653, and his speech in reply was interrupted by Cromwell's forcible expulsion of the Commons. Sir Peter, who was a friend of Milton, died on the 1st of December 1675, having never been married. By his will he left a legacy to Milton, and considerable estates to his grand-nephew Fisher Dilke, who took the name of Wentworth; and this name was borne by his descendants until dropped in the 18th century by Wentworth Dilke Wentworth, great-grandfather of Sir Charles Wentworth Dilke (*q.v.*).

See W. L. Rutton, *Three Branches of the Family of Wentworth of Nettlestead* (London, 1891); Joseph Foster, *Pedigrees of the County Families of Yorkshire* (2 vols., London, 1874); Charles Wriothesley, *Chronicle of England during the Reigns of the Tudors*, edited by W. D. Hamilton (2 vols., London, 1875–1877); Bulstrode Whitelocke, *Memorials of the English Affairs: Charles I. to the Restoration* (London, 1732); John Strype, *Annals of the Reformation* (7 vols., Oxford, 1824); Mark Noble, *Lives of the English Regicides* (2 vols., London, 1798) containing a memoir of Sir Peter Wentworth; Lord Clarendon, *History of the Rebellion* (7 vols., Oxford, 1839), and *Calendar of the Clarendon State Papers*; S. R. Gardiner, *History of England from the Accession of James I. to the Outbreak of the Civil War* (10 vols., London, 1883–1884), and *History of the Great Civil War, 1642–1649* (3 vols., London, 1886–1891); J. A. Froude, *History of England* (12 vols., London, 1856–1870); G. E. C., *Complete Peerage*, vol. viii. (London, 1898). See also articles "Wentworth" by A. F. Pollard, C. H. Firth and Sir C. W. Dilke, in *Dict. Nat. Biog.* (London, 1899). (R. J. M.)

WENTWORTH, WILLIAM CHARLES (1793–1872), the "Australian patriot," who claimed descent from the great Strafford, but apparently without sufficient reason, was born in 1793 in Norfolk Island, the penal settlement of New South Wales, where his father D'Arcy Wentworth, an Irish gentleman of Roscommon family, who had emigrated in 1790 and later became a prominent official, was then government surgeon. The son was educated in England, but he spent the interval between his schooling at Greenwich and his matriculation (1816) at Peterhouse, Cambridge, in Australia, and early attracted the attention of Governor Macquarie by some adventurous exploration in the Blue Mountains. In 1819 he published in London a work on Australasia in two volumes, and in 1823 he only just missed the chancellor's medal at Cambridge (won by W. M. Praed) with a stirring poem on the same subject. Having been called to the bar, he returned to Sydney, and soon obtained a fine practice. With a fellow barrister, Wardell, he started a newspaper, the *Australian*, in 1824, to advocate the cause of self-government and to champion the "emancipists"—the incoming class of ex-convicts, now freed and prospering—against the "exclusivists"—the officials and the more aristocratic settlers. With Wardell, Dr William Bland and others, he formed the "Patriotic Association," and carried on a determined agitation both in Australia and in England, where they found able supporters. The earlier object of their attack was the governor, Sir Ralph Darling, who was recalled in 1831 in consequence, though he was acquitted by a select committee of the House of Commons of the charges brought against him by Wentworth in connexion with his severe punishment of two soldiers, Sudds and Thompson, who had perpetrated a robbery in order to obtain their discharge (a favourite dodge at the time), and one of whom, Sudds, had died. Wentworth continued, under the succeeding governor, Sir Richard Bourke, who was guided by him, and Sir George Gipps, with whom he had constant differences, to exercise a powerful influence; and in 1842, when the Constitution Act was passed, it was generally recognized as mainly his work. He became a member of the first legislative council and led the "squatter party." He was the founder of the university of Sydney (1852), where his son afterwards founded bursaries in his honour; and he led the movement resulting in the new constitution for the colony (1854), subsequently (1861) becoming president of the new legislative council. But things had meanwhile moved fast in the colony, and Wentworth's old supremacy had waned, since Robert Lowe (afterwards Lord Sherbrooke) and others had come into prominence in the political arena. He had done his work for colonial autonomy, and was becoming an old man, somewhat out of touch with the new generation. For some years before 1861 he stayed chiefly in England, where in 1857 he founded the "General Association for the Australian Colonies," with the object of obtaining from the government a federal assembly for the whole of Australia; and in 1862 he definitely settled in England, dying on the 20th of March 1872. His body was taken to Sydney and accorded a public funeral by the unanimous vote of the New South Wales legislature.

WENZEL, KARL FRIEDRICH (1740–1793), German metallurgist, was born at Dresden in 1740. Disliking his father's trade of bookbinding, for which he was intended, he left home in 1755, and after taking lessons in surgery and chemistry at Amsterdam, became a ship's surgeon in the Dutch service. In 1766, tired of sea-life, he went to study chemistry at Leipzig, and afterwards devoted himself to metallurgy and assaying at his native place with such success that in 1780 he was appointed chemist to the Freiberg foundries by the elector of Saxony. In 1785 he became assessor to the superintending board of the foundries, and in 1786 chemist to the porcelain works at Meissen. He died at Freiberg on the 26th of February 1793.

In consequence of the quantitative analyses he performed of a large number of salts, he has been credited with the discovery of the law of neutralization (*Vorlesungen über die chemische Verwandtschaft der Körper*, 1777). But this attribution rests on a mistake first made by J. J. Berzelius and copied by subsequent writers, and Wenzel's published work (as pointed out by G. H. Hess in 1840) does not warrant the conclusion that he realized the existence of any law of invariable and reciprocal proportions in the combinations of acids and bases.

WEPENER, a town of the Orange Free State, 82 m. by rail S.E. of Bloemfontein, and 2 m. W. of the Basuto border. Pop. (1904) 1366, of whom 822 were whites. It lies in a rich grain district, and 3 m. north by the Caledon river are large flour mills. The town, named after the leader of the Boers in their war with the Basuto chief Moshesh in 1865, was founded in 1888. In April 1900 it was successfully defended against the Boers under Christiaan de Wet by a Cape force of Irregulars commanded by Colonel E. H. Dalgety.

WERDAU, a town of Germany, in the kingdom of Saxony, on the Pleisse, in the industrial district of Zwickau, and 40 m. S. of Leipzig. Pop. (1905) 19,473. Its chief industries are cotton and wool-spinning and the weaving of cloth, but machinery of various kinds, paper and a few other articles are also manufactured. In addition to the usual schools, Werdau contains a weaving-school. The town is mentioned as early as 1304 and in 1398 it was purchased by the margrave of Meissen, who afterwards became elector of Saxony.

See Stichard, *Chronik der Fabrikstadt Werdau* (2nd ed., Werdau, 1865).

WERDEN, a town of Germany, in the Prussian Rhine province, on the river Ruhr, 6 m. by rail S. of Essen. Pop. (1905) 11,029. It has an interesting Roman Catholic church which belonged to the Benedictine abbey founded about 800 by St Ludger, whose stone coffin is preserved in the crypt. The abbey buildings are used as a prison. The manufacture of cloth, woollens, shoes and paper, dyeing, tanning, brewing and distilling are the principal industries. In the neighbourhood are stone quarries and coal mines. Werden grew up around the Benedictine abbey, which was dissolved in 1802. The *Codex Argenteus* of Ulfilas, now in the university library at Upsala, was discovered here in the 16th century.

See Flügge, *Chronik der Stadt Werden* (Düsseldorf, 1887); and *Führer durch Werden* (Werden, 1887).

WERDER, KARL WILHELM FRIEDRICH AUGUST LEOPOLD, Count von (1808–1887), Prussian general, entered the Prussian Gardes du Corps in 1825, transferring the following year into the Guard Infantry, with which he served for many years as a subaltern. In 1839 he was appointed an instructor in the Cadet Corps, and later he was employed in the topographical bureau of the Great General Staff. In 1842–1843 he took part in the Russian operations in the Caucasus, and on his return to Germany in 1846, was placed, as a captain, on the staff. In 1848 he married. Regimental and staff duty alternately occupied him until 1863, when he was made major-general, and given the command of a brigade of Guard Infantry. In the Austrian War of 1866 von Werder greatly distinguished himself at Gitschin (Jičin) and Königgrätz at the head of the 3rd division. He returned home with the rank of lieutenant-general and the order *pour le mérite*. In 1870, at first employed with the 3rd Army Headquarters and in command of the Württemberg and Baden forces, he was after the battle of Wörth entrusted with the operations against Strassburg, which he captured after a long and famous siege. Promoted general of infantry, and assigned to command the new XIVth Army Corps, he defeated the French at Dijon and at Nuits, and, when Bourbaki's army moved forward to relieve Belfort, turned upon him and fought the desperate action of Villersexel, which enabled him to cover the Germans besieging Belfort. On the 15th, 16th and 17th of January 1871, von Werder with greatly inferior forces succeeded in holding his own on the Lisaine against all Bourbaki's efforts to reach Belfort, a victory which aroused great enthusiasm in southern Germany. After the war von Werder commanded the Baden forces, now called the XIVth Army Corps, until he retired in 1879. On his retirement he was raised to the dignity of count. He died in 1887 at Grüssow in Pomerania. The 30th (4th Rhenish) Infantry regiment bears his name, and there is a statue of von Werder at Freiburg in the Breisgau.

See von Conrady, *Leben des Grafen A. von Werder* (Berlin, 1889).

WERGELAND, HENRIK ARNOLD (1808–1845), Norwegian poet and prose writer, was born at Christiansand on the 17th of June 1808. He was the eldest son of Professor Nikolai Wergeland (1780–1848), who had been a member of the constitutional assembly which proclaimed the independence of Norway in 1814 at Eidsvold. Nikolai was himself pastor of Eidsvold, and the poet was thus brought up in the very holy of holies of Norwegian patriotism. He entered the university of Christiania in 1825 to study for the church, and was soon the leader of a band of enthusiastic young men who desired to revive in Norway the spirit and independence of the old vikings. His earliest efforts in literature were wild and formless. He was full of imagination, but without taste or knowledge. He published poetical farces under the pseudonym of "Siful Sifadda"; these were followed in 1828 by an unsuccessful tragedy; and in 1829 by a volume of lyrical and patriotic poems, *Digte, förste Ring*, which attracted the liveliest attention to his name. At the age of twenty-one he became a power in literature, and his enthusiastic preaching of the doctrines of the revolution of July made him a force in politics also. Meanwhile he was tireless in his efforts to advance the national cause. He established popular libraries, and tried to alleviate the widespread poverty of the Norwegian peasantry. He preached the simple life, denounced foreign luxuries, and set an example by wearing Norwegian homespun. But his numerous and varied writings were coldly received by the critics, and a monster epic, *Skabelsen, Mennesket og Messias* (Creation, Man and Messiah), 1830, showed no improvement in style. It was remodelled in 1845 as *Mennesket*. From 1831 to 1835 Wergeland was submitted to severe satirical attacks from J. S. le Welhaven and others, and his style improved in every respect. His nationalist political propaganda lacked knowledge and system. His partisans were alienated by his inconsistent admiration for King Carl Johan, by his unpopular advocacy of the Jewish cause, and by the extravagance of his methods generally. His popularity waned as his poetry improved, and in 1840 he found himself a really great lyric poet, but an exile from political influence. In that year he became keeper of the royal archives. He died on the 12th of July 1845. In 1908 a statue was erected to his memory by his compatriots at Fargo, North Dakota. His *Jan van Huysums Blomsterstykke* (1840), *Svalen* (1841), *Jöden* (1842), *Jödinden* (1844) and *Den Engelske Lods* (1844), form a series of narrative poems in short lyrical metres which remain the most interesting and important of their kind in Norwegian literature. He was less successful in other branches of letters; in the drama neither his *Campbellerne* (1837), *Venetianerne* (1843), nor *Sökadetterne* (1848), achieved any lasting success; while his elaborate contribution to political history, *Norges Konstitutions Historie* (1841–1843), is forgotten. The poems of his later years include many lyrics of great beauty, which are among the permanent treasures of Norwegian poetry.

Wergeland's *Samlede Skrifter* (9 vols., Christiania, 1852–1857) were edited by H. Lassen, the author of *Henrik Wergeland og hans Samtid* (1866), and the editor of his *Breve* (1867). See also H. Schwanenflügel, *Henrik Wergeland* (Copenhagen, 1877); and J. G. Kraft, *Norsk Forfatter-Lexikon* (Christiania, 1857), for a detailed bibliography.

WERGILD, Wergeld or Wer, the Anglo-Saxon terms for the fine paid by, *e.g.* a murderer to the relatives of the deceased in proportion to the rank of the latter. The *wer* was part of the early Teutonic and Celtic customary law, and represented the substitution of compensation for personal retaliation, resulting from the rise in authority of the power of the community as such. (See Criminal Law; Homicide; and Teutonic Peoples.)

WERMELSKIRCHEN, a town of Germany, in the Prussian Rhine province, situated 4 m. S.W. from Lennep by rail and at the junction of a line to Remscheid. Pop. (1900) 15,469. It contains an Evangelical and a Roman Catholic church and a Latin school. Wermelskirchen is the centre of many thriving industries, chief among which are the manufacture of silks, cotton and silk ribbons, plush, tobacco and steel goods.

WERMUND, an ancestor of the Mercian royal family, a son of Wihtlæg and father of Offa. He appears to have reigned in Angel, and his story is preserved by certain Danish historians, especially Saxo Grammaticus. According to these traditions, his reign was long and happy, though its prosperity was eventually marred by the raids of a warlike king named Athislus, who slew Frowinus, the governor of Schleswig, in battle. Frowinus's death was avenged by his two sons, Keto and Wigo, but their conduct in fighting together against a single man was thought to form a national disgrace, which was only obliterated by the subsequent single combat of Offa. It has been suggested that Athislus, though called king of the Swedes by Saxo, was really identical with the Eadgils, lord of the Myrgingas, mentioned in Widsith. As Eadgils was a contemporary of Ermanaric (Eormenric), who died about 370, his date would agree with the indication given by the genealogies which place Wermund nine generations above Penda. Frowinus and Wigo are doubtless to be identified with the Freawine and Wig who figure among the ancestors of the kings of Wessex.

For the story of the aggression against Wermund in his later years, told by the Danish historians and also by the *Vitae duorum Offarum*, see OFFA; also Saxo Grammaticus, *Gesta Danorum*, edited by A. Holder, pp. 105 ff. (Strassburg, 1886); *Vitae duorum Offarum* (in Wats's edition of Matthew Paris, London, 1640). See also H. M. Chadwick, *Origin of the English Nation* (Cambridge, 1907).

WERNER, ANTON ALEXANDER VON (1843–), German painter, was born at Frankfort-on-the-Oder, on the 9th of May 1843. He first studied painting at the Berlin Academy, pursued his studies at Carlsruhe, and, having won a travelling scholarship upon the exhibition of his early works, he visited Paris in 1867, and afterwards Italy, where he remained for some time. On his return he received several state commissions, and on the outbreak of the Franco-Prussian War in 1870 he was sent with the staff of the third corps d'armée, and stayed in France till the close of the campaign. In 1873 he was appointed professor at the Berlin Academy, of which he afterwards became director. Among his more important works must be named "The Capitulation of Sedan," "Proclamation of the German Empire at Versailles," "Moltke before Paris," "Moltke at Versailles," "The Meeting of Bismarck and Napoleon III.," "Christ and the Tribute Money," "William I. visiting the Tombs," "The Congress of Berlin," and some decorations executed in mosaic for the Triumphal Arch at Berlin. Von Werner's work is chiefly interesting for the historic value of his pictures of the events of the Franco-German War.

See *Kunst für Alle*, vol. i.; Knackfuss, *Künstler-Monographieen*, No. 9.

WERNER, ABRAHAM GOTTLOB (1750–1817), father of German geology, was born in Upper Lusatia, Saxony, on the 25th of September 1750. The family to which he belonged had been engaged for several hundred years in mining pursuits. His father was inspector of Count Solm's iron-works at Wehrau and Lorzendorf, and from young Werner's infancy cultivated in him a taste for minerals and rocks. The boy showed early promise of distinction. He began to collect specimens of stones, and one of his favourite employments was to pore over the pages of a dictionary of mining. At the age of nine he was sent to school at Bunzlau in Silesia, where he remained until 1764, when he joined his father at Wehrau with the idea of ultimately succeeding him in the post of inspector. When nineteen years of age (1769) he journeyed to Freiberg, where he attracted the notice of the officials, who invited him to attend the mining school established two years previously. This was the turning point in Werner's career. He soon distinguished himself by his industry and by the large amount of practical knowledge of mineralogy which he acquired. In 1771 he repaired to the university of Leipzig and went through the usual curriculum of study, paying attention at first chiefly to the subject of law, but continuing to devote himself with great ardour to mineralogical pursuits. While still a student he wrote his first work on the external characters of minerals, *Von den äusserlichen Kennzeichen der Fossilien* (1774), which at once gave him a name among the mineralogists of the day. In 1775 he was appointed inspector in the mining school and teacher of mineralogy at Freiberg. To the development of that school and to the cultivation of mineralogy and geognosy he thenceforth, for about forty years, devoted the whole of his active and indefatigable industry. From a mere provincial institution the Freiberg academy under his care rose to be one of the great centres of scientific light in Europe, to which students from all parts of the world flocked to listen to his eloquent teaching. He wrote but little, and though he elaborated a complete system of geognosy and mineralogy he never could be induced to publish it. From the notes of his pupils, however, the general purport of his teaching was well known, and it widely influenced the science of his time. He died at Freiberg on the 30th of June 1817.

One of the distinguishing features of Werner's teaching was the care with which he taught lithology and the succession of geological formation; a subject to which he applied the name geognosy. His views on a definite geological succession were inspired by the works of J. G. Lehmann and G. C. Fuchsel (1722–1773). He showed that the rocks of the earth are not disposed at random, but follow each other in a certain definite order. Unfortunately he had never enlarged his experience by travel, and the sequence of rock-masses which he had recognized in Saxony was believed by him to be of universal application (see his *Kurze Klassifikation und Beschreibung der verschiedenen Gebirgsarten*, 1787). He taught that the rocks were the precipitates of a primeval ocean, and followed each other in successive deposits of world-wide extent. Volcanoes were regarded by him as abnormal phenomena, probably due to the combustion of subterranean beds of coal. Basalt and similar rocks, which even then were recognized by other observers as of igneous origin, were believed by him to be water-formed accumulations of the same ancient ocean. Hence arose one of the great historical controversies of geology. Werner's followers preached the doctrine of the aqueous origin of rocks, and were known as Neptunists; their opponents, who recognized the important part taken in the construction of the earth's crust by subterranean heat, were styled Vulcanists. R. Jameson, the most distinguished of his British pupils, was for many years an ardent teacher of the Wernerian doctrines. Though much of Werner's theoretical work was erroneous, science is indebted to him for so clearly demonstrating the chronological succession of rocks, for the enthusiastic zeal which he infused into his pupils, and for the impulse which he thereby gave to the study of geology.

See S. G. Frisch, *Lebensbeschreibung A. G. Werners* (Leipzig, 1825); Cuvier, *Éloge de Werner*; Lyell, *Principles of Geology*; and Sir A. Geikie, *Founders of Geology* (1897; 2nd ed., 1906).

WERNER, FRIEDRICH LUDWIG ZACHARIAS (1768–1823), German poet, dramatist and preacher, was born on the 18th of November 1768 at Königsberg in Prussia. From his mother, who died a religious maniac, Werner inherited a weak and unbalanced nature, which his education did nothing to correct. At the university of his native place he studied law; but Rousseau and Rousseau's German disciples were the influences that shaped his view of life. For years he oscillated violently between aspirations towards the state of nature, which betrayed him into a series of rash and unhappy marriages, and a sentimental admiration—in common with so many of the Romanticists—for the Roman Catholic Church, which ended in 1811 in his conversion. Werner's talent was early recognized and obtained for him, in spite of his character, a small government post at Warsaw, which he exchanged afterwards for one at Berlin. In the course of his travels, and by correspondence, he got into touch with many of the men most eminent in literature at the time; and succeeded in having his plays put on the stage, where they met with much success. In 1814 he was ordained priest, and, exchanging the pen for the pulpit, became a popular preacher at Vienna, where, during the famous congress of 1814, his eloquent but fanatical sermons were listened to by crowded congregations. He died at Vienna on the 17th of January 1823.

Werner was the only dramatist of the Romantic movement who—thanks to the influence of Schiller—was able to subordinate his exuberant imagination to the practical needs of the stage. His first tragedy, *Die Söhne des Tals* (1803–1804), is in two parts, and it was followed by *Das Kreuz an der Ostsee* (1806). More important is the Reformation drama *Martin Luther, oder die Weihe der Kraft* (1807), which, after his conversion to Catholicism, Werner recanted in a poem *Weihe der Unkraft* (1813). His powerful one-act tragedy, *Der vierundzwanzigste Februar* (1815, but performed 1810), was the first of the so-called "fate tragedies." *Attila* (1808), *Wanda* (1810) and *Die Mutter der Makkabäer* (1820) show a falling-off in Werner's powers.

Z. Werner's *Theater* was first collected (without the author's consent) in 6 vols. (1816–1818); *Ausgewählte Schriften* (15 vols., 1840–1841), with a biography by K. J. Schütz. See also J. E. Hitzig, *Lebensabriss F. L. Z. Werners* (1823); H. Düntzer, *Zwei Bekehrte* (1873); J. Minor, *Die Schicksalstragödie in ihren Hauptvertretern* (1883) and the same author's volume, *Das Schicksalsdrama* (in Kürschner's *Deutsche Nationalliteratur*, vol. 151, 1884); F. Poppenberg, *Zacharias Werner* (1893).

WERNIGERODE, a town of Germany, in the province of Prussian Saxony, 13 m. by rail S.W. of Halberstadt, picturesquely situated on the Holzemme, on the north slopes of the Harz Mountains. Pop. (1905) 13,137. It contains several interesting Gothic buildings, including a fine town hall with a timber façade of 1498. Some of the quaint old houses which have escaped the numerous fires that have visited the town are elaborately adorned with wood-carving. The gymnasium, occupying a modern Gothic building, is the successor of an ancient grammar-school, which existed until 1825. Brandy, cigars and dye-stuffs are among the manufactures of the place. Above the town rises the château of the prince of Stolberg-Wernigerode. A pavilion in the park contains the library of 117,000 volumes, the chief feature in which is the collection of over 3000 Bibles and over 5000 volumes of hymnology. Wernigerode is the chief town of the county (*Grafschaft*) of Stolberg-Wernigerode, which has an extent of 107 sq. m., and includes the Brocken within its limits.

The counts of Wernigerode, who can be traced back to the early 12th century, were successively vassals of the margraves of Brandenburg (1268), and the archbishops of Magdeburg (1381). On the extinction of the family in 1429 the county fell to the counts of Stolberg, who founded the Stolberg-Wernigerode branch in 1645. The latter surrendered its military and fiscal independence to Prussia in 1714, but retained some of its sovereign rights till 1876. The counts were raised to princely rank in 1890.

See Förstemann, *Die Gräflich-Stolbergische Bibliothek in Wernigerode* (Nordhausen, 1866), and G. Sommer, *Die Grafschaft Wernigerode* (Halle, 1883).

WERTH [Weert], **JOHANN,** Count von (*c.* 1595–1652), German general of cavalry in the Thirty Years' War, was born between 1590 and 1600 at Büttgen in the duchy of Jülich. His parents belonged to the numerous class of the lesser nobility, and at an early age he left home to follow the career of a soldier of fortune in the Walloon cavalry of the Spanish service. In 1622, at the taking of Jülich, he won promotion to the rank of lieutenant. He served as a colonel of cavalry in the Bavarian army in 1630. He obtained the command of a regiment, both titular and effective, in 1632, and in 1633 and 1634 laid the foundations of his reputation as a swift and terrible leader of cavalry forays. His services were even more conspicuous in the great pitched battle of Nördlingen (1634), after which the emperor made him a *Freiherr* of the Empire, and the elector of Bavaria gave him the rank of lieutenant field-marshal. About this time he armed his regiment with the musket as well as the sword. In 1635 and 1636 his forays extended into Lorraine and Luxemburg, after which he projected an expedition into the heart of France. Starting in July 1636, from the country of the lower Meuse, he raided far and wide, and even urged the cardinal infante, who commanded in chief, to "plant the double eagle on the Louvre." Though this was not attempted, Werth's horsemen appeared at St Denis before the uprising of the French national spirit in the shape of an army of fifty thousand men at Compiègne forced the invaders to retire whence they had come. The memory of this raid lasted long, and the name of "Jean de Wert" figures in folk-songs and serves as a bogey to quiet unruly children. In 1637 Werth was once more in the Rhine valley, destroying convoys, relieving besieged towns and surprising the enemy's camps. In February 1638 he defeated the Weimar troops in an engagement at Rheinfelden, but shortly afterwards was made prisoner by Bernhard of Saxe-Weimar. His hopes of being exchanged for the Swedish marshal Horn were disappointed, for Bernhard had to deliver up his captive to the French. The terrible Jean de Wert was brought to Paris, amidst great rejoicings from the country people. He was lionized by the society of the capital, visited in prison by high ladies, who marvelled at his powers of drinking and his devotion to tobacco. So light was his captivity that he said that nothing bound him but his word of honour. However, he looked forward with anxiety for his release, which was delayed until March 1642 because the imperial government feared to see Horn at the head of the Swedish army and would not allow an exchange.

When at last he reappeared in the field it was as general of cavalry in the imperial and Bavarian and Cologne services. His first campaign against the French marshal Guébriant was uneventful, but his second (1643) in which Count Mercy was his commander-in-chief, ended with the victory of Tüttlingen, a surprise on a large scale, in which Werth naturally played the leading part. In 1644 he was in the lower Rhine country, but he returned to Mercy's headquarters in time to take a brilliant share in the battle of Freiburg. In the following year his resolution and bravery, and also his uncontrolled rashness, played the most conspicuous part in deciding the day at the second battle of Nördlingen. Mercy was killed in this action, and Werth succeeded to the command of the defeated army, but he was soon superseded by Field-marshal Geleen. Johann von Werth was disappointed, but remained thoroughly loyal to his soldierly code of honour, and found an outlet for his anger in renewed military activity. In 1647 differences arose between the elector and the emperor as to the allegiance due from the Bavarian troops, in which, after long hesitation, Werth, fearing that the cause of the Empire and of the Catholic religion would be ruined if the elector resumed control of the troops, attempted to take his men over the Austrian border. But they refused to follow, and escaping with great difficulty from the elector's vengeance Werth found a refuge in Austria. The emperor was grateful for his conduct in this affair, ordered the elector to rescind his ban, and made Werth a count. The last campaign of the war (1648) was uneventful, and shortly after its close he retired to live on the estates which he had bought in the course of his career, and on one of these, Benatek near Königgrätz, he died on the 16th of January 1652.

See *Lives* by F. W. Barthold (Berlin, 1826), W. von Janko (Vienna, 1874), F. Teicher (Augsburg, 1877).

WERWOLF (from A.S. *wer*; cf. Lat. *vir*, man; and wolf; or, according to a later suggestion, from O.H.G. *weri*, wear, *i.e.* wearer of the wolf-skin), a man transformed temporarily or permanently into a wolf. The belief in the possibility of such a change is a special phase of the general doctrine of lycanthropy (*q.v.*). In the European history of this singular belief, wolf transformations appear as by far the most prominent and most frequently recurring instances of alleged metamorphosis, and consequently in most European languages the terms expressive of the belief have a special reference to the wolf. Examples of this are found in the Gr. *λυκάνθρωπος*, Russian *volkodlák*, Eng. "werwolf," Ger. *währwolf*, Fr. *loup-garou*. More general terms (*e.g.* Lat., *versipellis*; Russ., *óboroten*; O. Norse, *hamrammr*; Eng. "turnskin," "turncoat") are sufficiently numerous to furnish some evidence that the class of animals into which metamorphosis was possible was not viewed as a restricted one. But throughout the greater part of Europe the werwolf is preferred; there are old traditions of his existence in England, in Wales and in Ireland; in southern France, Germany, Lithuania, Bulgaria, Servia, Bohemia, Poland and Russia he can hardly be pronounced extinct now; in Denmark, Sweden, Norway and Iceland the bear competes with the wolf for preeminence.

In Greek mythology the story of Lycaon supplies the most familiar instance of the werwolf. According to one form of it Lycaon was transformed into a wolf as a result of eating human flesh; one of those who were present at periodical sacrifice on Mount Lycaon was said to suffer a similar fate. Pliny, quoting Euanthes, tells us (*Hist. Nat.* viii. 22) that a man of the family of Antaeus was selected by lot and brought to a lake in Arcadia, where he hung his clothing on an ash and swam across. This resulted in his being transformed into a wolf, and he wandered in this shape nine years. Then, if he had attacked no human being, he was at liberty to swim back and resume his former shape. Probably the two stories are identical, though we hear nothing of participation in the Lycaean sacrifice by the descendant of Antaeus. Herodotus (iv. 105) tells us that the Neuri, a tribe of eastern Europe, were annually transformed for a few days, and Virgil (*Ecl.* viii. 98) is familiar with transformation of human beings into wolves.

There are women, so the Armenian belief runs, who in consequence of deadly sins are condemned to pass seven years in the form of a wolf. A spirit comes to such a woman and brings her a wolf's skin. He orders her to put it on, and no sooner has she done this than the most frightful wolfish cravings make their appearance and soon get the upper hand. Her better nature conquered, she makes a meal of her own children, one by one, then of her relatives' children according to the degree of relationship, and finally the children of strangers begin to fall a prey to her. She wanders forth only at night, and doors and locks spring open at her approach. When morning draws near she returns to human form and removes her wolf skin. In these cases the transformation was involuntary or virtually so. But side by side with this belief in involuntary metamorphosis, we find the belief that human beings can change themselves into animals at will and then resume their own form.

The expedients supposed to be adopted for effecting change of shape may here be noticed. One of the simplest apparently was the removal of clothing, and in particular of a girdle of human skin, or the putting on of such a girdle—more commonly the putting on of a girdle of the skin of the animal whose form was to be assumed. This last device is doubtless a substitute for the assumption of an entire animal skin, which also is frequently found. In other cases the body is rubbed with a magic salve. To drink water out of the footprint of the animal in question, to partake of its brains, to drink of certain enchanted streams, were also considered effectual modes of accomplishing metamorphosis. Olaus Magnus says that the Livonian werwolves were initiated by draining a cup of beer specially prepared, and repeating a set formula. Ralston in his *Songs of the Russian People* gives the form of incantation still familiar in Russia. Various expedients also existed for removing the beast-shape. The simplest was the act of the enchanter (operating either on himself or on a victim); another was the removal of the animal girdle. To kneel in one spot for a hundred years, to be reproached with being a werwolf, to be saluted with the sign of the cross, or addressed thrice by baptismal name, to be struck three blows on the forehead with a knife, or to have at least three drops of blood drawn were also effectual cures. In other cases the transformation was supposed to be accomplished by Satanic agency voluntarily submitted to, and that for the most loathsome ends, in particular for the gratification of a craving for human flesh. "The werwolves," writes Richard Verstegan (*Restitution of Decayed Intelligence*, 1628), "are certayne sorcerers, who having annoynted their bodies with an oyntment which they make by the instinct of the devill, and putting on a certayne inchaunted girdle, doe not onely unto the view of others seeme as wolves, but to their owne thinking have both the shape and nature of wolves, so long as they weare the said girdle. And they do dispose themselves as very wolves, in wourrying and killing, and most of humane creatures." Such were the views about lycanthropy current throughout the continent of Europe when Verstegan wrote. France in particular seems to have been infested with werwolves during the 16th century, and the consequent trials were very numerous. In some of the cases—*e.g.* those of the Gandillon family in the Jura, the tailor of Châlons and Roulet in Angers, all occurring in the year 1598,—there was clear evidence against the accused of murder and cannibalism, but none of association with wolves; in other cases, as that of Gilles Garnier in Dôle in 1573, there was clear evidence against some wolf, but none against the accused; in all the cases, with hardly an exception, there was that extraordinary readiness in the accused to confess and even to give circumstantial details of the metamorphosis, which is one of the most inexplicable concomitants of medieval witchcraft. Yet, while this lycanthropy fever, both of suspectors and of suspected, was at its height, it was decided in the case of Jean Grenier at Bordeaux, in 1603, that lycanthropy was nothing more than an insane delusion. From this time the *loup-garou* gradually ceased to be regarded as a dangerous heretic, and fell back into his pre-Christianic position of being simply a "man-wolf-fiend," as which he still survives among the French peasantry. In Prussia, Livonia and Lithuania, according to the bishops Olaus Magnus and Majolus, the werwolves were in the 16th century far more destructive than "true and natural wolves," and their heterodoxy appears from the assertion that they formed "an accursed college" of those "desirous of innovations contrary to the divine law." In England, however, where at the beginning of the 17th century the punishment of witchcraft was still zealously prosecuted by James I., the wolf had been so long extinct that that pious monarch was himself able (*Demonologie*, lib. iii.) to regard "warwoolfes" as victims of delusion induced by "a naturall superabundance of melancholie." Only small creatures, such as the cat, the hare and the weasel, remained for the malignant sorcerer to transform himself into; but he was firmly believed to avail himself of these agencies. Belief in witch-animals still survives among the uneducated classes in parts of the United Kingdom.

The werwolves of the Christian dispensation were not, however, all heretics, all viciously disposed towards mankind. "According to Baronius, in the year 617, a number of wolves presented themselves at a monastery, and tore in pieces several friars who entertained heretical opinions. The wolves sent by God tore the sacrilegious thieves of the army of Francesco Maria, duke of Urbino, who had come to sack the treasure of the holy house of Loreto. A wolf guarded and defended from the wild beasts the head of St Edmund the martyr, king of England. St Oddo, abbot of Cluny, assailed in a pilgrimage by foxes, was delivered and escorted by a wolf" (A. de Gubernatis, *Zoological Mythology*, 1872, vol. ii. p. 145). Many of the werwolves were most innocent and God-fearing persons, who suffered through the witchcraft of others, or simply from an unhappy fate, and who as wolves behaved in a truly touching fashion, fawning upon and protecting their benefactors. Of this sort were the "Bisclaveret" in Marie de France's poem (*c.* 1200), the hero of "William and the Were-wolf" (translated from French into English about 1350), and the numerous princes and princesses, knights and ladies, who appear temporarily in beast form in the *Märchen* of the Aryan nations generally. Nay, the power of transforming others into wild beasts was attributed not only to malignant sorcerers, but also to Christian saints. "Omnes angeli, boni et mali, ex virtute naturali habent potestatem transmutandi corpora nostra," was the dictum of St Thomas Aquinas. St Patrick transformed Vereticus, king of Wales, into a wolf; and St Natalis cursed an illustrious Irish family, with the result that each member of it was doomed to be a wolf for seven years. In other tales the divine agency is still more direct, while in Russia, again, men are supposed to become werwolves through incurring the wrath of the devil.

LITERATURE.—In the numerous medieval works directed to the study of sorcery and witchcraft, the contemporaneous phases of lycanthropy occupy a prominent place. In addition to the authors who have been already mentioned, the following may be named as giving special attention to this subject: Wier, *De praestigiis daemonum* (Amsterdam, 1563); Bodin, *Démonomanie des sorciers* (Paris, 1580); Boguet, *Discours des sorciers* (Lyons, 2nd ed. 1608);

Lancre, *Tableau de l'inconstance de mauvais anges* (Paris, 1613); Psellus, *De operatione daemonum* (Paris, 1615); see also Glanvil, *Sadducismus triumphatus*, for the English equivalents of lycanthropy. Treatises solely confined to lycanthropy are rare both in medieval and in modern times; but a few are well known, as, for instance, those of Bourquelot and Nynauld, *De la lycanthropie* (Paris, 1615). See also Leubuscher, *Über die Wehrwölfe* (1850); Grimm, *Deutsche Mythologie*, 4, ii. and iii.; Hertz, *Der Werwolf* (Stuttgart, 1862); Baring Gould, *The Book of Were-wolves* (London, 1865). Also the bibliography to LYCANTHROPY, and Andree, *Ethnographische Parallelen*. 1st series, 62–80; Tylor, *Primitive Culture*, i.; P. Sebillot, *Traditions de la Haute-Bretagne*, i. 289.

(N. W. T.; J. F. M'L.)

WESEL, JOHANN RUCHRAT VON (d. 1481), German theologian, was born at Oberwesel early in the 15th century. He appears to have been one of the leaders of the humanist movement in Germany, and to have had some intercourse and sympathy with the leaders of the Hussites in Bohemia. Erfurt was in his day the headquarters of a humanism which was both devout and opposed to the realist metaphysic and the Thomist theology which prevailed in the universities of Cologne and Heidelberg. Wesel was one of the professors at Erfurt between 1445 and 1456, and was vice-rector in 1458. In 1460 he was appointed preacher at Mainz, in 1462 at Worms, and in 1479, when an old and worn-out man, he was brought before the Dominican inquisitor Gerhard Elten of Cologne. The charges brought against him took a theological turn, though they were probably prompted by dislike of his philosophical views. They were chiefly based on a treatise, *De indulgentiis*, which he had composed while at Erfurt twenty-five years before. He had also written *De potestate ecclesiastica*. He died under sentence of imprisonment for life in the Augustinian convent in Mainz in 1481.

It is somewhat difficult to determine the exact theological position of Wesel. Ullmann claims him as a "reformer before the Reformation," but, while he mastered the formal principle of Protestantism, that scripture is the sole rule of faith, it is more than doubtful that he had that experimental view of the doctrines of grace which lay at the basis of Reformation theology. He held that Christ is men's righteousness in so far as they are guided by the Holy Ghost, and the love towards God is shed abroad in their hearts, which clearly shows that he held the medieval idea that justification is an habitual grace implanted in men by the gracious act of God. He seems, however, to have protested against certain medieval ecclesiastical ideas which he held to be excrescences erroneously grafted on Christian faith and practice. He objected to the whole system of indulgences; he denied the infallibility of the church, on the ground that the church contains within it sinners as well as saints; he insisted that papal authority could be upheld only when the pope remained true to the evangel; and he held that a sharp distinction ought to be drawn between ecclesiastical sentences and punishments, and the judgments of God.

The best account of Wesel is to be found in K. Ullmann's *Reformers before the Reformation*. His tract on *Indulgences* is published in Walch's *Monumenta Medii Aevi*, vol. i., while a report of his trial is given in Ortuin Gratius's *Fasciculus rerum expetendarum et fugiendarum* (ed. by Browne, London, 1690), and d'Argentré's *Collectio judiciorum de novis erroribus* (Paris, 1728). See also Otto Clemen's art. in Herzog-Hauck's *Realencyklopädie für prot. Theologie und Kirche* (3rd ed., Leipzig, 1908), xxi. 127.

WESEL, a fortress town of Germany, in the Prussian province of Westphalia at the confluence of the Rhine and the Lippe, 46 m. S.W. of Münster and 35 m. N.W. of Duisburg. Pop. (1905) 23,237 (43% Protestants), including a considerable garrison. There is a junction of five railway lines, and the Rhine is crossed by a large railway bridge and by a bridge of boats. The inner line of fortifications was razed in 1890, and the defensive works now consist only of the citadel and three detached forts, one of which, Fort Blücher, serves as a *tête-de-pont* on the left bank of the Rhine. Wesel contains some quaint old houses, and a town hall, dating from 1396, with an elaborate façade, and containing a valuable collection of old silver plate. The large Protestant church of St Willibrord has a choir, built 1424–1526, which is one of the noblest Gothic structures on the Lower Rhine, and a modern nave (1882–96). The Mathena church dates from 1429–1477. The two Roman Catholic churches, the castle, now the commandant's house (built in 1417), the Berliner Tor—Berlin gate—(built in 1722 and recently restored), the Lower-Rhenish museum of antiquities and the modern gymnasium and military hospital, are among the other chief buildings. Wesel carries on a considerable trade in grain, timber, colonial goods, tobacco, &c., facilitated by new harbour accommodation and wharves at the mouth of the Lippe. It has manufactures of wire, leaden pipes and other metal goods, cement, sugar, &c.

Wesel, formerly known as Lippemünde, was one of the points from which Charlemagne directed his operations against the heathen Saxons. Incorporated in 1241, it became a flourishing commercial town, and though repeatedly subject to the counts of Cleves, was a member of the Hanseatic League, and as late as 1521 a free imperial city. It was occupied by the Spaniards in 1614, by the Dutch in 1629, by the French in 1672, also during the Seven Years' War, and in 1805, and was ceded to Prussia in 1814. A monument outside the town commemorates eleven of Ferdinand von Schill's officers who were shot here on the 16th of September 1809 after their unsuccessful attempt at Stralsund. Wesel is occasionally spoken of as Unterwesel, to distinguish it from Oberwesel, a small town on the Rhine, above St Goar.

See Gantesweiler, *Chronik der Stadt Wesel* (Wesel, 1881), and Reinhold, *Verfassungsgeschichte Wesels* (Breslau, 1888).

WESER (O. Ger. *Visuracha*, *Wisura*, Lat. *Visurgis*), one of the chief rivers of Germany, formed by the union of the Werra and the Fulda at Münden, in the Prussian province of Hanover, flowing generally north and entering the North Sea below Bremerhaven, between Jade Bay and the estuary of the Elbe. The mouth is 170 m. from Münden, but the winding course of the river is 270 m. long; if the measurement be made from the source of the Werra, in the Thüringer Wald, the total length of the stream is 440 m. At Münden the river surface is 380 ft. above sea-level; the most rapid fall in its course is between Karlshafen and Minden in Westphalia. Nearly the entire course of the Weser lies in Prussia, but it also touches part of Brunswick and Lippe, and after flowing through Bremen expands into an estuary separating the duchy of Oldenburg from the Prussian province of Hanover. Between Münden and Minden its course lies through a picturesque valley flanked by irregular and disjointed ranges of hills (Reinhardswald, Sollinger Wald, Weser Hills, &c.); but after it emerges from these mountains by the narrow pass called the "Porta Westfalica," near Minden, its banks become flat and uninteresting. The breadth of the river varies from 110 yds. at Münden to 220 yds. at Minden, 250 yds. at Bremen, 1¼ m. at Elsfleth and 7½ m. at its entrance into the sea.

The Weser on the whole is shallow, and navigation above Bremen is sometimes interrupted by drought. Until 1894 the fairway up to Bremen had a minimum depth of little over 8 ft.; thereafter important works were undertaken, the minimum depth was made 18 ft., and the importance of Bremen as a port was greatly enhanced. Boats of 350 tons can ascend generally as far as Münden. A system of waterways (the Geeste and Hadelner canals, meeting one another at Bederkesa) connects the estuary of the Weser with that of the Elbe; a canal between the Hunte and the Leda gives connexion with the Ems. On the upper Weser (above Bremen) the navigation, which is interrupted by occasional rapids, is assisted by locks and weirs. The principal tributaries on the right are the Aller, Wümme, Drepte, Lune and Geeste, and on the left the Diemel, Nethe, Emmer, Werra, Aue and Hunte. The Werra and Fulda are both navigable when they unite to form the Weser, the Fulda being canalized between Cassel and the town of Fulda for a distance of 17¼ m.; the Aller, Wümme, Geeste and Hunte are also navigable. Below the junction of the Hunte the Weser, hitherto a single stream, is divided into several channels by islands. The Weser drains a basin estimated at 18,530 sq. m.

The navigation of the Weser was long hampered by the various and vexatious claims and rights of the different states through whose territories it ran. Before 1866 the joint stream, including the Werra and the Fulda, changed its ruler no less than thirty-five times on its way to the sea. In 1823, however, a treaty was made establishing a fixed toll and a uniform system of management; this was further improved in 1856 and 1865; and when Prussia took possession of Hanover and Hesse-Nassau in 1866 the chief difficulties in the way of organizing the river-trade disappeared. The principal town on the Weser is Bremen. Other towns past which it flows between Münden and the sea are Karlshafen, Höxter, Holzminden, Bodenwerder, Hameln, Rinteln, Vlotho, Minden, Stolzenau, Nienburg, Vegesack, Elsfleth, Brake, Geestemünde and Bremerhaven. The Weser gave name to a department in the short-lived kingdom of Westphalia: the chief town was Osnabrück.

WESLEY (FAMILY). The Wesley family sprang from Welswe, near Wells in Somerset. Their pedigree has been traced back to Guy, whom Athelstan made a thane about 938. One branch of the family settled in Ireland. Sir Herbert Westley of Westleigh, Devon, married Elizabeth Wellesley of Dangan in Ireland. Their third son, Bartholomew, studied both medicine and theology at Oxford, and, in 1619, married the daughter of Sir Henry Colley of Kildare. In 1660 he held the rectories of Catherston and Charmouth in Dorset valued at £35, 10s. per annum. He was ejected in 1662 and gained his living as a doctor. He was buried at Lyme Regis on February 15th, 1670.

His son, John Westley, grandfather of the founder of Methodism, was born in 1636 and studied at New Inn Hall, Oxford, where he became proficient in Oriental languages and won the special regard of John Owen, then vice-chancellor. Cromwell's Triers approved him as minister of Winterborn-Whitchurch, Dorset, in 1658. The following year he married the daughter of John White, the patriarch of Dorchester. In 1661 he was committed to prison for refusing to use the Book of Common Prayer. His candour and zeal made a deep impression on Gilbert Ironside the elder, Bishop of Bristol, with whom he had an interview. He was ejected in 1662 and became a Nonconformist pastor at Poole. He died in 1678; his widow survived him for 32 years. One of his sons, Matthew, became a surgeon in London, where he died in 1737.

Another son, Samuel, was trained in London for the Nonconformist ministry, but changed his views, and, in August 1683, entered Exeter College, Oxford, as a sizar. He dropped the "t" in his name and returned to what he said was the original spelling, Wesley. In 1689 he was ordained and married Susanna, youngest daughter of Dr Samuel Annesley, vicar of St Giles, Cripplegate, and nephew of the 1st earl of Anglesea. Annesley gave up his living in 1662 and formed a congregation in Little St Helen's, Bishopsgate, where he was honoured as the St Paul of the Nonconformists. Samuel Wesley was appointed rector of South Ormsby in 1691, and moved to Epworth in 1697. He had nineteen children, of whom eight died in infancy. His lawless parishioners could not endure his faithful preaching, and in 1705 he was confined in Lincoln Castle for a small debt. Two-thirds of his parsonage was destroyed by fire in 1702 and in 1709 it was burnt to the ground. He managed to rebuild the rectory, but his resources were so heavily strained that thirteen years later it was only half furnished. Samuel Wesley was a busy author. At Oxford in 1685 he wrote a volume of poems bearing the strange title *Maggots*. He wrote a *Life of Christ* in verse (1693), *The History of the Old and New Testament in Verse* (1701?), a noble *Letter to a Curate*, full of strong sense and ripe experience, and *Dissertations on the Book of Job* (1735). He died at Epworth in 1735. Susanna Wesley died at the Foundery, London, in 1742 and was buried in Bunhill Fields.

Their eldest son, Samuel Wesley (1690–1739), was born in London, entered Westminster School in 1704, became a Queen's scholar in 1707 and in 1711 went up to Christ Church, Oxford. He returned to Westminster as head usher, took orders and enjoyed the intimate friendship of Bishop Atterbury, Harley earl of Oxford, Addison, Swift and Prior. He became headmaster of Blundell's School at Tiverton in 1732 and died there on the 6th of November 1739. He was a finished, classical scholar, a poet and a devout man, but he was never reconciled to the Methodism of his brothers. His poems, published in 1736, reached a second edition in 1743, and were reprinted with new poems, notes and a *Life* by W. Nichols, in 1862.

Charles Wesley (1707–1788) was the eighteenth child of the Rector of Epworth, and was saved from the fire of 1709 by his nurse. He entered Westminster School in 1716, became a King's Scholar and was captain of the school in 1725. He was a plucky boy, and won the life-long friendship of the future earl of Mansfield by fighting battles on his behalf. Garret Wesley of Ireland wished to adopt his young kinsman, but this offer was declined and the estates were left to Richard Colley on condition that he assumed the name Wesley. The duke of Wellington was Colley's grandson, and appears in the Army List for 1800 as the Hon. Arthur Wesley. Charles Wesley was elected to Christ Church in 1726. John had become fellow of Lincoln the previous March. Charles lost his first twelve months at Oxford in "diversions," but whilst John was acting as their father's curate, his brother "awoke out of his lethargy." He persuaded two or three other students to go with him to the weekly sacrament. This led a young gentleman of Christ Church to exclaim: "Here is a new set of Methodists sprung up." The name quickly spread through the university and Oxford Methodism began its course. In 1735 Charles Wesley was ordained and went with his brother to Georgia as secretary to Colonel, afterwards General, Oglethorpe, the Governor. The work proved uncongenial, and after enduring many hardships his health failed and he left Frederica for England on July the 26th, 1736. He hoped to return, but in February 1738 John Wesley came home, and Charles found that his state of health made it necessary to resign his secretaryship. After his evangelical conversion on Whit Sunday (May 21st, 1738), he became the poet of the Evangelical Revival. He wrote about 6500 hymns. They vary greatly in merit, but Canon Overton held him, taking quantity and quality into consideration, to be "the great hymn-writer of all ages." Their early volumes of poetry bear the names of both brothers, but it is generally assumed that the original hymns were by Charles and the translations by John Wesley. Poetry was like another sense to Charles, and he was busy writing verse from his conversion up to his death-bed when he dictated to his wife his last lines, "In age and feebleness extreme." For some years he took a full share in the hardships and perils of the Methodist itinerancy, and was often a remarkably powerful preacher. After his marriage in 1749 his work was chiefly confined to Bristol, where he then lived, and London. He moved to London in 1771 and died in Marylebone on March the 29th, 1788. He was strongly opposed to his brother's ordinations, and refused to be buried at City Road, because the ground there was unconsecrated. He was buried in the graveyard of Marylebone Old Church, but this appears to have been unconsecrated also.

Charles Wesley married Sarah Gwynne, daughter of a Welsh magistrate living at Garth, on April 8th, 1749. She died in 1822 at the age of ninety-six. Five of their children died as infants and are buried in St James's Churchyard, Bristol. Their surviving daughter Sarah, who was engaged in literary work, died unmarried in 1828. Charles Wesley, Junr. (1759–1834) was organist of St George's, Hanover Square. He published *Six Concertos for the Organ and Harp* in 1778. He also died unmarried. Samuel, the younger brother (1766–1837), was even more gifted than Charles as an organist and composer; he was also a lecturer on musical subjects. Two of his sons were Dr Wesley, sub-dean of the Chapel Royal, and Dr Samuel Sebastian Wesley (1810–1876), the famous composer and organist of Gloucester Cathedral.

Bibliography.—A volume of Charles Wesley's sermons with memoir appeared in 1816. Lives by Thomas Jackson (1841) and John Telford (1886). Journal and Letters with Notes by Thomas Jackson (1849); *The Early Journal* (1736–1739) with additional matter (1910); *Poetical works of John and Charles Wesley* (13 vols., 1868); *Methodist Hymn Book Illustrated* by J. Telford (1906); Adam Clarke's *Memoirs of the Wesley Family* (1822); Dove's *Biographical History of the Wesley Family* (1832); G. J. Stevenson, *Memorials of the Wesley Family* (1876); Tyerman's *Life and Times of Samuel Wesley, M.A.* (1866). (J. T*.)

WESLEY, JOHN (1703–1791), English divine, was born at Epworth Rectory on the 17th of June (O.S.) 1703. He was the fifteenth child of Samuel and Susanna Wesley (see Wesley Family). His mother's training laid the foundation of his character, and under her instruction the children made remarkable progress. On February 9, 1709, the rectory was burnt down, and the children had a narrow escape. On the duke of Buckingham's nomination, Wesley was for six years a pupil at Charterhouse. In June 1720 he went up to Christ Church, Oxford, with an annual allowance of £40 as a Charterhouse scholar. His health was poor and he found it hard to keep out of debt, but he made good use of his opportunities. A scheme of study which he drew up for 1722 with a time-table for each day of the week is still to be seen in his earliest diary, which became the property of Mr George Stampe of Great Grimsby. The diary runs from April 5, 1725, to February 19, 1727. A friend describes Wesley at this time as "a young fellow of the finest classical taste, and the most liberal and manly sentiments." He was "gay and sprightly, with a turn for wit and humour."

The standard edition of *Wesley's Journal* (1909) has furnished much new material for this period of Wesley's life, the Rev. N. Curnock having unravelled the difficult cipher and shorthand in which Wesley's early diaries were kept. He reached the conclusion that the religious friend who directed Wesley's attention to the writings of Thomas à Kempis and Jeremy Taylor, in 1725, was Miss Betty Kirkham, whose father was rector of Stanton in Gloucestershire. Up to this time Wesley says he had no notion of inward holiness, but went on "habitually and for the most part very contentedly in some or other known sin, indeed with some intermission and short struggles especially before and after Holy Communion," which he was obliged to attend three times a year. On the 25th of September 1725 he was ordained deacon, and on the 17th of March 1726 was elected fellow of Lincoln. His private diaries, seven of which are in the hands of Mr Russell J. Colman of Norwich, contain monthly reviews of Wesley's reading. It covered a wide range, and he made careful notes and abstracts of it. He generally took breakfast or tea with some congenial friend and delighted to discuss the deepest subjects. At the coffee house he saw the *Spectator* and other periodicals. He loved riding and walking, was an expert swimmer and enjoyed a game at tennis.

He preached frequently in the churches near Oxford in the months succeeding his ordination, and in April 1726 he obtained leave from his college to act as his father's curate. The new material in the *Journal* describes the simple matter of his life. He read plays, attended the village fairs, shot plovers in the fenland, and enjoyed a dance with his sisters. In October he returned to Oxford, where he was appointed Greek lecturer and moderator of the classes. He gained considerable reputation in the disputation for his master's degree in February 1727. He was now free to follow his own course of studies and began to lose his love for company, unless it were with those who were drawn like himself to religion. In August he returned to Lincolnshire, where he assisted his father till November 1729. During those two years he paid three visits to the university. In the summer of 1729 he was up for two months. Almost every evening found him with the little society which had gathered round Charles.

When he came into residence in November he was recognized as the father of the Holy Club. It met at first on Sunday evenings, then every evening was passed in Wesley's room or that of some other member. They read the Greek Testament and the classics; fasted on Wednesday and Friday; received the Lord's Supper every week; and brought all their life under review. In 1730 William Morgan, an Irish student, visited the gaol and reported that there was a great opening for work among the prisoners. The friends agreed to visit the Castle twice a week and to look after the sick in any parish where the clergyman was willing to accept their help. Wesley's spirit at this time is seen from his sermon on "The Circumcision of the Heart," preached before the university on the 1st of January 1733. In 1765 he said it "contains all that I now teach concerning salvation from all sin, and loving God with an undivided heart." Wesley rose at four, lived on £28 a year and gave away the remainder of his income. He already displayed those gifts for leadership which were to find so conspicuous a field in the evangelical revival. John Gambold, a member of the Holy Club, who afterwards became a Moravian bishop, says "he was blest with such activity as to be always gaining ground, and such steadiness that he lost none. What proposals he made to any were sure to charm them, because they saw him always the same." He wore an air of authority yet never lacked address, or "assumed anything to himself above his contemporaries." William Law's books produced a great impression on Wesley, and on his advice the young tutor began to read mystic authors, but he saw that their tendency was to make good works appear mean and insipid, and he soon laid them aside.

Wesley had not yet found the key to the heart and conscience of his hearers. He says, "From the year 1725 to 1729, I preached much, but saw no fruit to my labour. Indeed it could not be that I should; for I neither laid the foundation of repentance nor of preaching the Gospel, taking it for granted that all to whom I preached were believers, and that many of them needed no repentance. From the year 1729 to 1734, laying a deeper foundation of repentance, I saw a little fruit. But it was only a little; and no wonder: for I did not preach faith in the blood of the covenant. From 1734 to 1738, speaking more of faith in Christ, I saw more fruit of my preaching." Looking back on these days in 1777, Wesley felt "the Methodists at Oxford were all one body, and, as it were, one soul; zealous for the religion of the Bible, of the Primitive Church, and, in consequence, of the Church of England; as they believed it to come nearer the scriptural and primitive plan than any other national church upon earth." The number of Oxford Methodists was small and probably never exceeding twenty-five. John Clayton, afterwards chaplain of the Collegiate Church of Manchester, who remained a strong High Churchman; James Hervey, author of *Meditations among the Tombs*, and *Theron and Aspasio*; Benjamin Ingham, who became the Yorkshire evangelist; and Thomas Broughton, afterwards secretary of the S.P.C.K., were members of the Holy Club, and George Whitefield joined it on the eve of the Wesleys' departure for Georgia.

Wesley's father died on April 25, 1735, and in the following October John and Charles took ship for Georgia, with Benjamin Ingham and Charles Delamotte. John was sent out by the Society for the Propagation of the Gospel, and hoped to labour as a missionary among the Indians, but though he had many interesting conversations with them the mission was found to be impracticable. The cabin of the "Simmonds" became a study for the four Methodists. The calm confidence of their Moravian fellow-passengers amid the Atlantic storms convinced Wesley that he did not possess the faith which casts out fear. Closer acquaintance with these German friends in Savannah deepened the impression. Wesley needed help, for he was beset by difficulties. Mrs Hawkins and Mrs Welch poisoned the mind of Colonel Oglethorpe against the brothers for a time. Wesley's attachment to Miss Hopkey also led to much pain and disappointment. All this is now seen more clearly in the standard edition of the *Journal*. Wesley was a stiff High Churchman, who scrupulously followed every detail of the rubrics. He insisted on baptizing children by trine immersion, and refused the Communion to a pious German because he had not been baptized by a minister who had been episcopally ordained. At the same time he was accused of "introducing into the church and service at the altar compositions of psalms and hymns not inspected or authorized by any proper judicature." The list of grievances presented by Wesley's enemies to the Grand Jury at Savannah gives abundant evidence of his unwearying labours for his flock. The foundation of his future work as the father of Methodist hymnody was laid in Georgia. His first *Collection of Psalms and Hymns* (Charlestown, 1737) contains five of his incomparable translations from the German, and on his return to England he published another *Collection* in 1738, with five more translations from the German and one from the Spanish. In April 1736 Wesley formed a little society of thirty or forty of the serious members of his congregation. He calls this the second rise of Methodism, the first being at Oxford in November 1729. The company in Savannah met every Wednesday evening "in order to a free conversation, begun and ended with singing and prayer." A select company of these met at the parsonage on Sunday afternoons. In 1781 he writes, "I cannot but observe that these were the first rudiments of the Methodist societies."

In the presence of such facts we can understand the significance of the mission to Georgia. Wesley put down many severe things against himself on the return voyage, and he saw afterwards that even then he had the faith of a servant though not that of a son. In London he met Peter Böhler who had been ordained by Zinzendorf for work in Carolina. By Böhler Wesley was convinced that he lacked "that faith whereby alone we are saved." On Wednesday, May 24, 1738, he went to a society meeting in Aldersgate Street where Luther's *Preface to the Epistle to the Romans* was being read. "About a quarter before nine, while he was describing the change which God works in the heart through faith in Christ, I felt my heart strangely warmed. I felt I did trust in Christ, Christ alone, for salvation; and an assurance was given me that he had taken away *my* sins, even *mine*, and saved *me* from the law of sin and death." Mr Lecky points out the significance of that event. "It is scarcely an exaggeration to say that the scene which took place at that humble meeting in Aldersgate Street forms an epoch in English history. The conviction which then flashed upon one of the most powerful and most active intellects in England is the true source of English Methodism" (*History of England in Eighteenth Century*, ii. 558).

Wesley spent some time during the summer of 1738 in visiting the Moravian settlement at Herrnhuth and returned to London on September 16, 1738, with his faith greatly strengthened. He preached in all the churches that were open to him, spoke in many religious societies, visited Newgate and the Oxford prisons. On New Year's Day, 1739, the Wesleys, Whitefield and other friends had a Love Feast at Fetter Lane. In February Whitefield went to Bristol, where his popularity was unbounded. When the churches were closed against him he spoke to the Kingswood colliers in the open air, and after six memorable weeks wrote urging Wesley to come and take up the work. Wesley was in his friend's congregation on April 1, but says, "I could scarcely reconcile myself to this strange way of preaching in the fields . . . having been all my life (till very lately) so tenacious of every point relating to decency and order, that I should have thought the saving of souls almost a sin, if it had not been done in a church." Next day Wesley followed Whitefield's example. His fears and prejudices melted away as he discerned that this was the very method needed for reaching the multitudes living in almost heathen darkness. He already had the means of shepherding those who were impressed by the preaching. On the 1st of May 1738 he wrote in his journal: "This evening our little society began, which afterwards met in Fetter Lane." Among its "fundamental rules" we find a provision for dividing the society into bands of five or ten persons who spoke freely and plainly to each other as to the "real state" of their hearts. The bands united in a conference every Wednesday evening. The society first met at James Hutton's shop, "The Bible and Sun," Wild Street, west of Temple Bar. About the 25th of September it moved to Fetter Lane. Wesley describes this as the third beginning of Methodism. After the field preaching began converts multiplied. They found all the world against them, and Wesley advised them to strengthen one another and talk together as often as they could. When he tried to visit them at their homes he found the task beyond him, and therefore invited them to meet him on Thursday evenings. This meeting was held in the end of 1739 at the Foundery in Moorfields which Wesley had just secured as a preaching place. Grave disorders had arisen in the society at Fetter Lane, and on the 25th of July 1740 Wesley withdrew from it. About 25 men and 48 women also left and cast in their lot with the society at the Foundery. The centenary of Methodism was kept in 1839, a hundred years after the society first met at the Foundery.

Wesley's headquarters at Bristol were in the Horse Fair, where a room was built in May 1739 for two religious societies which had been accustomed to meet in Nicholas Street and Baldwin Street. To meet the cost of this Captain Fox suggested that each member should give a penny per week. When it was urged that some were too poor to do this, he replied, "Then put eleven of the poorest with me; and if they can give anything, well: I will call on them weekly, and if they can give nothing I will give for them as well as for myself." Others followed his example and were called leaders, a name given as early as the 5th of November 1738 to those who had charge of the bands in London. Wesley saw that here was the very means he needed to watch over his flock. The leaders thus became a body of lay pastors. Those under their care formed a class. It proved more convenient to meet together and this gave opportunity for religious conversation and prayer. As the society increased Wesley found it needed "still greater care to separate the precious from the vile." He therefore arranged to meet the classes himself every quarter and gave a ticket "under his own hand" to every one "whose seriousness and good conversation" he found no reason to doubt. The ticket furnished an easy means for guarding the meetings of the society against intrusion. "Bands" were formed for those who wished for closer communion. Love-feasts for fellowship and testimony were also introduced, according to the custom of the primitive church. Watchnights were due to the suggestion of a Kingswood collier in 1740. Wesley issued the rules of the united societies in February 1743. Those who wished to enter the society must have "a desire to flee from the wrath to come, to be saved from their sins." When admitted they were to give evidence of their desire for salvation "by doing no harm; by doing good of every possible sort; by attending upon all the means of grace." It was expected that all who could do so would contribute the penny a week suggested in Bristol, and give a shilling at the renewal of their quarterly ticket. Wesley had at first to take charge of the contributions, but as they grew larger he appointed stewards to receive the money, to pay debts, and to relieve the needy. The memorable arrangement in Bristol was made a few weeks before Wesley's field of labour was extended to the north of England in May 1742. He found Newcastle ripe for his message. English Christianity seemed to have no power to uplift the people. Dram-drinking was spreading like an epidemic. Freethinkers' clubs flourished. "The old religion," Lecky says, "seemed everywhere loosening round the minds of men, and indeed it had often no great influence even on its defenders." Some of the clergy in country parishes were devoted workers, but special zeal was resented or discouraged.

The doctrine of election had led to a separation between Whitefield and the Wesleys in 1741. Wesley believed that the grace of God could transform every life that received it. He preached the doctrine of conscious acceptance with God and daily growth in holiness. Victory over sin was the goal which he set before all his people. He made his appeal to the conscience in the clearest language, with the most cogent argument, and with all the weight of personal conviction. Hearers like John Nelson felt as though every word was aimed at themselves. No preacher of the century had this mastery over his audience. His teaching may be described as Evangelical Arminianism and its standards are his own four volumes of sermons and his *Notes on the New Testament*.

Up till 1742 Wesley's work was chiefly confined to London and Bristol, with the adjacent towns and villages or the places which lay between them. On his way to Newcastle that year Wesley visited Birstal, where John Nelson, the stone-mason, had already been working. On his return he held memorable services in the churchyard at Epworth. Methodism this year spread out from Birstal into the West Riding. Societies were also formed in Somerset, Wilts, Gloucestershire, Leicester, Warwickshire, Nottinghamshire and the south of Yorkshire. In the summer Charles Wesley visited Wednesbury, Leeds and Newcastle. Next year he took Cornwall by storm. The work in London was prospering. In 1743 Wesley secured a west-end centre at West Street, Seven Dials, which for fifty years had a wonderful history. In August 1747 Wesley paid his first visit to Ireland, where he had such success that he gave more than six years of his life to the country and crossed the Irish Channel forty-two times. Ireland has its own conference presided over by a delegate from the British conference. Wesley's first visit to Scotland was in 1751. He paid twenty-two visits, which stirred up all the Scottish churches.

Such extension of his field would have been impossible had not Wesley been helped by a heroic band of preachers. Wesley says: "Joseph Humphreys was the first lay preacher that assisted me in England, in the year 1738." That was probably help in the Fetter Lane Society, for Wesley then had no preaching place of his own. John Cennick, the hymn-writer and schoolmaster at Kingswood, began to preach there in 1739. Thomas Maxwell, who was left to meet and pray with the members at the Foundery during the absence of the Wesleys, began to preach. Wesley hurried to London to check this irregularity, but his mother urged him to hear Maxwell for himself, and he soon saw that such assistance was of the highest value. The autobiographies of these early Methodist preachers are among the classics of the Evangelical Revival. As the work advanced Wesley held a conference at the Foundery in 1744. Besides himself and his brother, four other clergymen were present and four "lay brethren." It was agreed that "lay assistants" were allowable, but only in cases of necessity. This necessity grew more urgent every year as Methodism extended. One of the preachers in each circuit was the "assistant," who had general oversight of the work, the others were "helpers." The conference became an annual gathering of Wesley's preachers. In the early conversations doctrine took a prominent place, but as Methodism spread the oversight of its growing organization occupied more time and more attention. In February 1784 Wesley's deed of declaration gave the conference a legal constitution. He named one hundred preachers who after his death were to meet once a year, fill up vacancies in their number, appoint a president and secretary, station the preachers, admit proper persons into the ministry, and take general oversight of the societies. In October 1768, a Methodist chapel was opened in New York. At the conference of 1769 two preachers, Richard Boardman and Joseph Pilmoor, volunteered to go out to take charge of the work. In 1771, Francis Asbury, the Wesley of America, crossed the Atlantic. Methodism grew rapidly, and it became essential to provide its people with the sacraments. In September 1784 Wesley ordained his clerical helper, Dr Coke, superintendent (or bishop), and instructed him to ordain Asbury as his colleague. Richard Whatcoat and Thomas Vasey were ordained by Wesley, Coke and Creighton to administer the sacraments in America. Wesley had reached the conclusion in 1746 that bishops and presbyters were essentially of one order (see METHODISM, sect. "United States").

He told his brother in 1785: "I firmly believe that I am a scriptural ἐπίσκοπος as much as any man in England or in Europe; for the uninterrupted succession I know to be a fable, which no man ever did or can prove." Other ordinations for the administration of the sacraments in Scotland, the colonies and England followed. The interests of his work stood first with Wesley. He did everything that strong words against separation could do to bind his societies to the Church of England; he also did everything that legal documents and ordinations could do to secure the permanence of that great work for which God had raised him up. In the words of Canon Overton and Rev. F. H. Relton (*Hist. of Eng. Ch.* 1714–1800): "It is purely a modern notion that the Wesleyan movement ever was, or ever was intended to be, except by Wesley, a church movement." Despite his strong sayings, it was Wesley who broke the links to the church, for, as Lord Mansfield put it, "ordination is separation."

Wesley's account of his itinerancy is given in his famous *Journal*, of which the first part appeared about 1739. Mr Birrell has called it "the most amazing record of human exertion ever penned by man." It is certainly Wesley's most picturesque biography and the most vivid account of the evangelical revival that we possess. The rapid development of his work made a tremendous strain upon Wesley's powers. He generally travelled about 5000 m. a year and preached fifteen sermons a week. He had constant encounters with the mob, but his tact and courage never failed. His rule was always to look a mob in the face. Many delicious stories are told of his presence of mind and the skilful appeals which he made to the better feeling of the crowd.

Wesley's writings did much to open the eyes of candid men to his motives and his methods. Besides the incomparable *Journal*, his *Appeals to Men of Reason and Religion* also produced an extraordinary effect in allaying prejudice and winning respect. He constantly sought to educate his own people. No man in the 18th century did so much to create a taste for good reading and to supply it with books at the lowest prices. Sir Leslie Stephen pays high praise to Wesley's writings, which went "straight to the mark without one superfluous flourish." As a social reformer Wesley was far in advance of his time. He provided work for the deserving poor, supplied them with clothes and food in seasons of special distress. The profits on his cheap books enabled him to give away as much as £1400 a year. He established a lending stock to help struggling business men and did much to relieve debtors who had been thrown into prison. He opened dispensaries in London and Bristol and was keenly interested in medicine.

Wesley's supreme gift was his genius for organization. He was by no means ignorant of this. "I know this is the peculiar talent which God has given me." Wesley's special power lay in his quickness to avail himself of circumstances and of the suggestions made by those about him. The class-meeting, the love-feast, the watch-night, the covenant service, leaders, stewards, lay preachers, all were the fruit of this readiness to avail himself of suggestions made by men or events. Wesley skilfully wove these into his system, and kept the whole machinery moving harmoniously. He inspired his preachers and his people with his own spirit and made everything subordinate to his overmastering purpose, the spread of scriptural holiness throughout the land.

In 1751 Wesley married Mary Vazeille, a widow, but the union was unfortunate and she finally left him. John Fletcher, the vicar of Madeley, to whom Wesley had turned as a possible successor, died in 1785. He had gone to Wesley's help at West Street after his ordination at Whitehall in 1757 and had been one of his chief allies ever since. He was beloved by all the preachers, and his *Checks to Antinomianism* show that he was a courteous controversialist. Charles Wesley died three years after Fletcher. During the last three years of his life John Wesley reaped the harvest he had sown. Honours were lavished upon him. His people hailed every appearance among them with delight, and his visits to various parts of the country were public holidays. His interest in everything about him continued unabated. He had a wealth of happy stories which made him the most delightful of companions in the homes of his people. Robert Southey never forgot how Wesley kissed his little sister and put his hand on his head and blessed him. Alexander Knox says, "So fine an old man I never saw! The happiness of his mind beamed forth in his countenance. Every look showed how fully he enjoyed 'The gay remembrance of a life well spent.' Wherever Wesley went, he diffused a portion of his own felicity." He preached his last sermon in Mr Belson's house at Leatherhead on Wednesday, the 23rd of February 1791; wrote next day his last letter to Wilberforce, urging him to carry on his crusade against the slave trade; and died in his house at City Road on the 2nd of March 1791, in his eighty-eighth year. He was buried on the 9th of March in the graveyard behind City Road chapel. His long life enabled him to perfect the organization of Methodism and to inspire his preachers and people with his own ideals, while he had conquered opposition by unwearying patience and by close adherence to the principles which he sought to teach.

See also METHODISM, and the articles on the separate Methodist bodies; see also WESLEY FAMILY. (J. T.*)

WESLEY, SAMUEL (1766–1837), English musical composer, son of Charles Wesley (see above), was born at Bristol on the 24th of February 1766, and developed so precocious a talent for music that at three years old he played the organ and at eight composed an oratorio entitled *Ruth*—a fact which is duly chronicled on a curious portrait, painted in 1774, and afterwards engraved, wherein he is represented in the childish costume of the period. Though suffering for many years from an accidental injury to the brain, Wesley was long regarded as the most brilliant organist and the most accomplished extempore fugue-player in England. He may indeed be regarded as the father of modern organ-playing, for he it was who, aided by his friends Benjamin Jacob and C. F. Horn, first introduced the works of Sebastian Bach to English organists, not only by his superb playing, but by editing with Horn, in 1810, the first copy of *Das wohltemperirte Clavier* ever printed in England. Wesley's last performance took place on the 12th of September 1837 at Christ Church, Newgate Street, London, where, after hearing the wonderful performances of Mendelssohn, he was himself induced to play an extempore fugue. He died on the 11th of October 1837, leaving a vast number of MS. and printed compositions.

His brother Charles (1757–1815) was also an accomplished organist, and still more famous was his son, Samuel Sebastian (*q.v.*).

WESLEY, SAMUEL SEBASTIAN (1810–1876), English composer and organist, natural son of Samuel Wesley, the eminent composer, was born in London on the 14th of August 1810. He was one of the Children of the Chapel Royal from 1819, held various unimportant posts as organist from the age of fifteen, and in 1832 was appointed to Hereford Cathedral. His career as a composer began with his splendid anthem, "The Wilderness," which was probably written for the opening of the Hereford organ in that year. In 1834 it fell to him to conduct the Festival of the Three Choirs, and in the following year he resigned Hereford for Exeter Cathedral; and during the next six years his name became gradually more and more widely known. In 1842 Dr Hook, afterwards dean of Chichester, offered him a large salary to become organist of Leeds parish church, and at Leeds much of his finest work as a composer was done. In 1849 he quitted this post for Winchester, in order to secure educational advantages for his sons. He was at Winchester until 1865, when he offered himself as a candidate for Gloucester Cathedral, the last of his many posts. He again conducted the Three Choirs Festivals of 1865, 1868, 1871 and 1874. A civil list pension of £100 a year was conferred on him in 1873; he died at Gloucester on the 19th of April 1876, and was buried at Exeter.

Like his father he was a very eccentric man, but his compositions show powers that are found in very few Englishmen of his date. If the list of his compositions is smaller than that of his father's, it must be remembered that his anthems, in which is contained his best work, are far more important and more extensive than most compositions so called: in many of them the whole anthem is no longer sung, but even the selections from them make up anthems of ordinary length. They are masterly in design, fine in inspiration and expression, and noble in character. His "Blessed be the God and Father," "The Wilderness," already mentioned, "Ascribe unto the Lord," "O Lord, Thou art my God," and many others, are masterpieces in their way, and in all of these, as in the service in E, published with a rather trenchant preface in 1845, there is a happy combination of the modern resources of harmony with the dignified cathedral style, a combination which naturally alarmed the orthodox party of his time.

WESLEYAN METHODIST CHURCH, one of the chief branches of Methodism (*q.v.*). On the day of John Wesley's death the preachers in London sent a brief note to those stationed in the country: "Dear Brother, The melancholy period we have so long dreaded is now arrived. Our aged and honoured Father, Mr Wesley, is no more! He was taken to Paradise this morning, in a glorious manner, after a sickness of five days. We have not time to say more at present relative to his Demise. Only what respects out future Oeconomy. This injunction he laid upon us, and all our Brethren on his death-bed, That we each continue in our respective Station till the time appointed for the next Conference at Manchester. We have, therefore, no doubt but you will, with us, readily comply with his Dying Request. The more so, as this is consonant with the determination of the Conference held at Bristol when he was supposed to be near death there, and confirmed in succeeding Conferences."

In 1790 there were 294 preachers and 71,668 members in Great Britain, 19 missionaries and 5300 members on the mission stations; 198 preachers and 43,265 members in the United States. The 6th of April was kept as a day of fasting and prayer, and the 1st of July was thus set apart in order to seek divine guidance for the approaching conference. The crisis was serious. The large proportion of Wesley's members had been gathered by the labours of himself and his helpers. They had been taught to observe the sacraments and naturally desired that provision should be made for their administration in their own chapels. Some felt that they could not go to the Lord's Table where the clergyman was a worldly man; others went, but with much fear and doubt. The Church party was influential and resolute to maintain close relations with the Church of England. Their object was to prevent Methodism becoming independent. There was also a small but determined party that leaned to dissent. The struggle between these conflicting tendencies soon began. On the 30th of March 1791 nine preachers sent out the famous Halifax circular making suggestions as to the choice of president and other matters that must come before the conference. The first signature to this circular was that of William Thompson who was afterwards elected as the first president. On the 4th of May eighteen laymen met at Hull and expressed their conviction that the usefulness of Methodism would be promoted by its continued connexion with the Church of England. They would not consent to the administration of the sacraments by the preachers in Hull, nor to Methodist preaching at the time when services were held in church. A trenchant reply to this circular was prepared by Alexander Kilham (*q.v.*), one of the younger Methodist preachers.

The conference met in Manchester on the 26th of July 1791. A letter from Wesley (dated Chester, April 7, 1785) was read, beseeching the members of the Legal Conference not to use their powers for selfish ends but to be absolutely impartial in stationing the preachers, selecting boys for education at Kingswood School, and disposing of connexional funds. The conference at once resolved that all privileges conferred by Wesley's Poll Deed should be accorded to every preacher in full connexion. To supply the lack of Wesley's supervision the circuits were now grouped together in districts. At first the preachers of the district elected their own chairman, but they were afterwards appointed by the conference. Regulations as to its business were issued in 1812. As to the sacraments and the relations of Methodism to the Church of England the decision was: "We engage to follow strictly the plan which Mr Wesley left us." This was ambiguous and was interpreted variously. Some held that it forbade the administration of the sacraments except where they were already permitted; others maintained that it left Methodism free to follow the leadings of Providence as Wesley had always done. During the year the difficulties of the situation became more apparent. Wesley had given the sacrament to the societies when he visited them and this privilege was greatly missed. The conference of 1792 was so much perplexed that it resorted to the casting of lots. The decision was thus reached that the sacraments should not be administered that year. This was really shelving the question, but it gave time for opinion to ripen, and in 1793 it was resolved by a large majority that "the societies should have the privilege of the Lord's Supper where they unanimously desired it." In 1794, this privilege was definitely granted to ninety-three societies. The feeling in Bristol was very strong. The trustees of Broadmead, who were opposed to the administration of the sacrament by the preachers, forbade Henry Moore to occupy that pulpit. Nearly the whole society thereupon withdrew to Portland Chapel. The conference of 1795 had to deal with this controversy. It prepared a "Plan of Pacification" which was approved by the conference and by an assembly of trustees, and was welcomed by the societies. The Lord's Supper, baptism, the burial of the dead and service in church hours were not to be conducted by the preachers unless a majority of the trustees, stewards and leaders of any chapel approved, and assured the conference that no separation was likely to ensue. The consent of conference had to be given before any change was made.

In 1796, Alexander Kilham, who refused to abstain from agitation for further reform, and accused his brethren of priestcraft, was expelled from their ranks and the New Connexion was formed with 5000 members (see METHODIST NEW CONNEXION). The conference of 1797 set itself to remove any ground for distrust among the societies and to enlist their hearty support in all branches of the work. Annual accounts were to be published of various funds. The Circuit Quarterly Meeting had to approve the arrangements for the support of the preachers. The preachers had long been accustomed to consult the leader's meetings of their societies, but it was now clearly decided that stewards and leaders should be appointed in connexion with the leaders' meeting, and certain rights were granted to that meeting as to the admission and expulsion of members. Local preachers had to be accepted by the local preachers' meeting, and the powers of trustees of chapels were considerably extended. The constitution of Methodism thus practically took the shape which it retained till the admission of lay representatives to conference in 1878. No period in the history of Methodism was more critical than this, and in none was the prudence and good sense of its leaders more conspicuous. Advance was quietly made along the lines now laid down. The preachers had agreed in 1793 that all distinction between those whom Wesley had ordained and their brethren should cease. In the minutes of conference for 1818 "Rev." appears before the names of preachers who were members of the Missionary Committee. Jabez Bunting (*q.v.*), who had become the acknowledged leader of the conference, wished to have its young ministers set apart by the imposition of hands, but this scriptural custom was not introduced till 1836.

Meanwhile, Methodism was growing into a great missionary church. Its work in the West Indies was firmly established in Wesley's lifetime. In 1786 eleven hundred negroes were members of the society in Antigua. The burden of superintending these missions and providing funds for their support rested on Dr Coke, who took his place as the missionary bishop of Methodism. In 1813 he prevailed on the conference to sanction a mission to Ceylon. He sailed with six missionaries on the 30th of December, but died in the following May in the Indian Ocean. To meet these new responsibilities a branch Missionary Society had been formed in Leeds in October 1813, and others soon sprang up in various parts of the country. The Centenary of the Missionary Society falls in 1913, but Methodist Missions really date from 1786 when Dr Coke landed at Antigua. The area of operations gradually extended. Missions were begun in Madras, at the Cape of Good Hope, in Australia, and on the west coast of Africa. Two missionaries were sent to the Friendly Islands in 1826, and in 1835 a mission was undertaken among the cannibals of Fiji, which spread and deepened till the whole group of islands was transformed. The work in China began in 1851; the Burma mission was established in 1887. The rapid progress of the Transvaal and Swaziland missions has been almost embarrassing. The Missionary Jubilee in 1863–1868 yielded £179,000 for the work abroad. As the growth of the missions permitted conferences have been formed in various countries. Upper Canada had its conference in 1834, France in 1852, Australia in 1855, South Africa in 1882. The missionary revival which marked the Nottingham Conference of 1906 quickened the interest at home and abroad and the *Foreign Field* (monthly) is prominent among missionary periodicals. The Women's Auxiliary, founded in 1858, kept its jubilee in 1908. It supports schools and medical missions, homes and orphanages. In 1828 the erection of an organ in Brunswick Chapel, Leeds, led to a violent agitation and a small body of "Protestant Methodists" was formed. A more formidable division was led by Dr Warren, a preacher of ability and influence, who was disappointed because no place was found for him in the newly-formed Theological Institution. He tried to awaken general opposition to the Institution scheme, and being suspended from his office as superintendent by a special district meeting, appealed to the law courts, which sustained the action of the district meeting. He was expelled from the conference and joined the Wesleyan Methodist Association in 1836, but shortly afterwards became a clergyman in Manchester. In his first conference in 1744 Wesley asked, "Can we have a seminary for labourers?" The answer was: "If God spare us to another Conference." Next year the subject was broached with the reply: "Not till God give us a proper tutor." The idea was not realized in his lifetime, but Wesley did everything in his power to train his preachers. He gathered them together and read with them as he had done with his pupils at Oxford; he urged them to spend at least five hours a day in reading the best books. He made this challenge, "I will give each of you, as fast as you will read them, books to the value of £5." In 1834 Hoxton Academy was taken as a training place for ministers; and in 1839 the students moved to Abney House, Stoke Newington. Didsbury College was opened in 1842, Richmond in 1843. Headingley was added in 1868, Handsworth in 1881.

The Centenary of Methodism was celebrated in 1839 and £221,939 was raised as a thank-offering: £71,609 was devoted to the colleges at Didsbury and Richmond; £70,000 was given to the missionary society, which spent £30,000 on the site and building of a mission-house in Bishopsgate Within; £38,000 was set apart for the removal of chapel debts, &c.

Methodism was now recognized as one of the great moral and spiritual forces of the world. Its progress was rapid, but in 1849 there came a disastrous check. There was much jealousy of Dr Bunting, the master mind of Methodism, to whose foresight and wisdom large part of its success was due. *Fly-sheets* were issued attacking him and other eminent ministers. James Everett, Samuel Dunn and William Griffith were expelled from the ministry, and an agitation began which robbed Wesleyan Methodism of 100,000 members. Those who now left the Connexion joined the reformers of 1828 and 1836 and formed the Methodist Free Churches. In 1852 the constitution of the Quarterly Meeting was clearly defined, and the June Quarterly Meeting obtained the right to approach conference with memorials. Various other provisions were made which increased confidence. It was not till 1856 that the Connexion began to recover from the loss caused by this agitation.

Methodism began its work for popular education in a very modest way. In 1837 it had nine infant schools and twenty-two schools for elder children. A grant of £5000 was made from the Centenary Fund for the provision of Wesleyan day-schools. The conference of 1843 directed that greater attention must be given to this department, and a committee met in the following October which resolved that 700 schools should be established if possible within the next seven years, and an Education Fund raised of £5000 a year. In 1849 the Normal Training College for the education of day-school teachers was opened in Westminster, and in 1872 a second college was opened in Battersea for school-mistresses. Westminster provides for 120 and Southlands for 110 students. They supply teachers not only for Wesleyan, but for council schools all over the country, and no colleges have a higher reputation. Besides its day-schools, Methodism possesses the Leys School at Cambridge, Rydal Mount at Colwyn Bay and prosperous boarding-schools for boys and girls in many parts of the country.

Methodism has from the beginning done much work in the army. Dr William Harris Rule (1802–1890), who was appointed chaplain at Gibraltar in 1832, won for it fuller recognition from the authorities. Charles H. Kelly, his colleague at Aldershot, and R. W. Allen had a large share in the struggle by which Methodist work both in the army and the navy was developed. Capitation grants have made it possible to organize the work at every station at home and abroad. No homes for soldiers and sailors are more efficient or better liked by the men. The service done by Methodist chaplains in war time, and especially in the Boer War, won the warmest recognition from the authorities.

In 1878, laymen were introduced into the Wesleyan conference. They had been members of the committee appointed in 1803 to "guard our privileges in these perilous times," and had gradually taken their place on the missionary and other committees. Circuit stewards had attended the district meetings before 1817 but in that year their right to attend was established. The Financial District Meeting of which they were members was created in 1819 and the financial business of each district soon came under its control. Out of the Annual Home Missionary gathering sprang a system of committees of review which, in 1852, James H. Rigg suggested might be enlarged and combined into a kind of diet composed of ministers and laymen who should consider reports from the various departments. The time was not ripe for such a scheme, but in 1861 the principle of direct representation was introduced into the committees of review. The Representative Session which met in 1878 consisted of 240 ministers and 240 laymen. The Pastoral Session of ministers met first to deal with pastoral affairs. In 1891 the Representative Session was sandwiched between the two parts of the Pastoral Session. In 1898 it met first and its numbers were enlarged to 300 ministers and 300 laymen. In 1892 the district meeting became known as the District Synod, and in 1893 the circuits began to choose representatives to the Synod in addition to the circuit stewards. The great advance in organization made with such peace and goodwill was commemorated in 1878 by the Thanksgiving Fund which reached £297,500. Dr Rigg, the president of that year, put all his strength into the movement, and every department of Methodist work at home and abroad shared in the benefits of the fund.

The Forward Movement in Methodism dates from that period. A bolder policy won favour. Methodism realized its strength and its obligations. In 1885 the Rev. S. F. Collier was appointed to Manchester and the Rev. Peter Thompson was sent to work in the East End. Next year the Revs. Hugh Price Hughes and Mark Guy Pearse began the West London Mission. Every succeeding year has witnessed development and growth. Large mission-halls have been built in the principal towns of England, Scotland and Ireland. Great congregations have been gathered, and the work done for uplifting the fallen and outcast has earned the gratitude of all good men. The Manchester mission is regarded as one of the glories of that city. The Forward Movement will always be associated with the name of Hugh Price Hughes (*q.v.*). Village Methodism shared in the quickening which the Forward Movement brought to the large towns. Chapels which had been closed were reopened; an entrance was found into many new villages. Weak circuits were grouped together and gained fresh energy and hope by the union.

No work has been dearer to Methodists than that of the National Children's Home and Orphanage founded by Dr Bowman Stephenson in 1869. Its headquarters are in Bethnal Green, but it has branches in various parts of the country and an emigration depôt in Canada. It cares not only for waifs and strays, but for cripples and delicate children. Orphans of respectable parents have a home at Birmingham, and the reformatory school has done splendid service for lads who have committed a first offence. Dr A. E. Gregory, who in 1900 succeeded Dr Stephenson, has seen remarkable progress in all departments of the great institution under his care. "Sisters of the People" and deaconesses, for whom there is a training home at Ilkley, founded by Dr Stephenson in 1902, have also done much to help in these modern developments of Methodism.

The Chapel Committee, which has its headquarters in Manchester, has general oversight of 9070 trusts with property valued at about twenty-five millions. The number of Methodist chapels in 1818 was 2000; in 1839, 3500; in 1910, 8606. The sitting increased from a million in 1851 to about 2,375,000 in 1910. The outlay on trust property in that period was more than fifteen millions. Debts amounting to £3,266,013 have been paid off since 1854. More than half a million has been advanced in loans and of this nothing has been lost. In 1907 and 1908 £1,292,282 was spent on trust property, and of this £892,114 was contributed. London Methodism owes more than can be told to the Metropolitan Chapel Building Fund which was founded in 1861. The names of the Rev. William Arthur, Sir Francis Lycett, Sir W. McArthur, will always be associated with this fund which has promoted the erection of some hundred new chapels. The Extension Fund, established in 1874, largely by the help of Sir Francis Lycett and Mr Mewburn, has done similar work for country towns and villages. About two thousand chapels have been assisted with grants and loans. Similar work has been done in Scotland by a fund established in 1878. North and South Wales also have their Chapel Funds. A secretary and committee were appointed in 1910 to carry out various developments of work in London. The work of the Metropolitan Chapel Building Fund and the London Mission is taken over by this new committee.

John Wesley felt a lively interest in the Sunday schools which began to spring up all over England in the last years of his life. The first rules for the management of Methodist Sunday schools were issued by the Conference in 1827. In 1837 there were 3339 Methodist Sunday schools with 59,297 teachers and 341,443 scholars. A quarter of the preaching places, however, had no schools. The Education Committee was formed in 1838 to take oversight of the work in day and Sunday schools. The Methodist Sunday School Union, founded in 1873, was formed into a department in 1907 and is doing much to guide and develop the work. The Temperance Committee was formed in 1875; a temperance secretary was set apart in 1890. The department has its monthly organ and has its offices in Westminster. The Wesley Guild Movement, established in 1901, has its headquarters in Leeds and is doing a great work for the young people of Methodism.

The centenary of Wesley's death was kept in 1891. Memorable services were held in City Road Chapel, which was restored and rendered more worthy of its historic position. Wesley's statue was placed in the forecourt. In 1898 the rooms in Wesley's house, where he studied and where he died, were set apart as a Methodist Museum. The first Methodist Oecumenical Conference was held in London in 1881, the second in Washington in 1891, the third in London in 1901, the fourth being fixed for Toronto in 1911. The Methodist Assembly which met in Wesley's Chapel, London, in 1909 brought the branches of British Methodism together with good results. A considerable extension of the three years' term has been secured in certain cases by a legal device for escaping the provisions of the eleventh clause of Wesley's Deed Poll, but some more satisfactory method of dealing with the subject is under consideration.

The great event of recent Methodist history was the Twentieth Century Fund inaugurated by Sir Robert W. Perks in 1898. To his unwearying zeal and business ability the triumph secured was chiefly due. The Rev. Albert Clayton, the secretary of the fund, lavished his strength on his vast task and the total income exceeded £1,073,782. The grants were: General Chapel Committee, £290,617; Missionary Society, £102,656; Education Committee, £193,705; Home Missions, £96,872; Children's Home, £48,436. The Royal Aquarium at Westminster was purchased and a central hall and church house as the headquarters of Methodism erected. For this object £242,206 was set apart.

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WESSEL, JOHAN[1] (*c.* 1420–1489), Dutch theologian, was born at Groningen. He was educated at the famous school at Deventer, which was under the supervision of the Brothers of Common Life, and in close connexion with the convent of Mount St Agnes at Zwolle, where Thomas à Kempis was then living. At Deventer, where the best traditions of the 14th-century mysticism were still cultivated, Wessel imbibed that earnest devotional mysticism which was the basis of his theology and which drew him irresistibly, after a busy life, to spend his last days among the Friends of God in the Low Countries. From Deventer he went to the Dominican school at Cologne to be taught the Thomist theology, and came in contact with humanism. He learnt Greek from monks who had been driven out of Greece, and Hebrew from some Jews. The Thomist theology sent him to study Augustine, and his Greek reading led him to Plato, sources which largely enriched his own theological system. Interest in the disputes between the realists and the nominalists in Paris induced him to go to that city, where he remained for sixteen years as scholar and teacher. There he eventually took the nominalist side, prompted as much by his mystical anti-ecclesiastical tendencies as by any metaphysical insight; for the nominalists were then the anti-papal party. A desire to know more about humanism sent him to Rome, where in 1470 he was the intimate friend of Italian scholars and under the protection of Cardinals Bessarion and Francis Della Rovere (general of the Franciscan order and afterwards Pope Sixtus IV.). It is said that Sixtus would have gladly made Wessel a bishop, but that he had no desire for any ecclesiastical preferment. From Rome he returned to Paris, and speedily became a famous teacher, gathering round him a band of enthusiastic young students, among whom was Reuchlin. In 1475 he was at Basel and in 1476 at Heidelberg teaching philosophy in the university. As old age approached he came to have a growing dislike to the wordy theological strife which surrounded him, and turned away from that university discipline, "non studia sacrarum literarum sed studiorum commixtae corruptiones." After thirty years of academic life he went back to his native Groningen, and spent the rest of his life partly as director in a nuns' cloister there and partly in the convent of St Agnes at Zwolle. He was welcomed as the most renowned scholar of his time, and it was fabled that he had travelled through all lands, Egypt as well as Greece, gathering everywhere the fruits of all sciences—"a man of rare erudition," says the title-page of the first edition of his collected works, "who in the shadow of papal darkness was called the light of the world." His remaining years were spent amid a circle of warm admirers, friends and disciples, to whom he imparted the mystical theology, the zeal for higher learning and the deep devotional spirit which characterized his own life. He died on the 4th of October 1489, with the confession on his lips, "I know only Jesus the crucified." He is buried in the middle of the choir of the church of the "Geestlichen Maegden," whose director he had been.

Wessel has been called one of the "reformers before the Reformation," and the title is justifiable if by it is meant a man of deeply spiritual life, who protested against the growing paganizing of the papacy, the superstitious and magical uses of the sacraments, the authority of ecclesiastical tradition, and that tendency in later scholastic theology to lay greater stress, in a doctrine of justification, upon the instrumentality of the human will than on the objective work of Christ for man's salvation. His own theology was, however, essentially medieval in type, and he never grasped that experimental thought of justification on which Reformation theology rests.

Martin Luther in 1521 published a collection of Wessel's writings[2] which had been preserved as relics by his friends, and said that if he (Luther) had written nothing before he read them, people might well have thought that he had stolen all his ideas from them. The books are of an aphoristical character, the ideas being rather mechanically arranged, so that it is not possible to single out any one as the centre of the whole system. The authority of the Bible Wessel would support when necessary, not by the priest but by the divinity professor. His views on the sacraments anticipated those of Zwingli rather than of Luther.

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[1] His correct name was Wessel Harmens Gansfort (or Ganzevort), the Christian name Wessel being a corruption of Basilius, and the surname Gansfort being that of a Westphalian village from which his family came.

[2] The collection included *De providentia*, [illegible] *incarnationis et passionis*, *De dig*[illegible] *sacramente*, *poenitentiae*, *Quae sit* [illegible] *purgatorio* and a number of letters.

See *Vita Wesseli Groningensis*, by Albert Hardenberg, published in an incomplete form in the preface to Wessel's collected works (Amsterdam, 1614; this preface also contains extracts from the works of several writers who have given facts about the life of Wessel); W. Muurling, *Com. Hist. Theol. de Wesseli Gansfortii vita*, &c. (1831); K. Ullmann, *Reformers before the Reformation* (the second volume of the German edition is a second and enlarged edition of a previous work entitled *Johann Wessel, ein Vorgänger Luthers* (1834); J. Friedrich, *Johann Wessel, ein Bild aus der Kirchengeschichte des 15ten Jahrhunderts* (1862); A. Ritschl, *History of the Christian Doctrine of Justification and Reconciliation* (Edinburgh, 1872); J. J. Doedes, "Hist.-litterarisches zur Biographie J. Wessels" in *Theol. Studien und Kritiken* (1870).

WESSELÉNYI, MIKLÓS, Baron (1796–1850), Hungarian statesman, son of Baron Miklós Wesselényi and Ilona Cserei, was born at Zsibó, and was educated at his father's castle by Mózes Pataky in the most liberal and patriotic direction. In 1823 he permanently entered public life and made the acquaintance of Count Stephen Széchenyi whose companion he was on a long educative foreign tour, on his return from which he became one of the leaders of the liberal movement in the Upper House. In 1833 appeared his *Balítéletek* (Prejudices), which was for long a prohibited book. He was the foremost leader of the Opposition at the diet of 1834, and his freely expressed opinions on land-redemption, together with his efforts to give greater publicity to the debates of the diet by printing them, involved him in two expensive crown prosecutions. He was imprisoned at Gräfenberg, whither he had gone to be cured of an eye trouble, and two years later became quite blind. Subsequently he did much for agriculture, children's homes and the introduction and extension of the silk industry in Hungary. The events of 1848 brought him home from a long residence abroad, but he was no longer the man he had been, and soon withdrew again to Gräfenberg. He died on the 21st of April 1850, on his way back to Hungary.

See Ferencz Szilágyi, *Life and Career of Baron Nicholas Wesselényi the Younger* (Hung. Budapest, 1876). (R. N. B.)

WESSEX, one of the kingdoms of Anglo-Saxon Britain. The story of its origin is given in the Saxon Chronicle. According to this the kingdom was founded by two princes, Cerdic, and Cynric his son, who landed in 494 or 495 and were followed by other settlers in 501 and 514. After several successful battles against the Welsh they became kings in 519. Very few of the localities connected with the story of these princes have been identified with certainty, but such identifications as there are point to the southern part of Hampshire. In 530 Cerdic and Cynric are said to have conquered the Isle of Wight, which they gave to two of their relatives, Stuf and Wihtgar. Cerdic died in 534. Cynric defeated the Britons at Salisbury in 552 and again in conjunction with his son Ceawlin at Beranburh, probably Barbury Hill, in 556. At his death in 560 he was succeeded by Ceawlin, who is mentioned by Bede as the second of the English kings to hold an *imperium* in Britain. With him we enter upon a period not perhaps of history, but at least of more or less reliable tradition. How far the earlier part of the story deserves credence has been and still is much debated. At all events no value can be attached to the dates given in the Chronicle. The preface to this work places Cerdic's assumption of the sovereignty six years after his landing, that is, in the year 500, and assigns him a reign of sixteen years, which makes his death fall eighteen years before 534, the date recorded in the annals. Again, while the annals record Ceawlin's accession in 560 and his expulsion in 592, the preface with other early authorities assigns him a reign of only seventeen years. Further a number of genealogies, both in the Chronicle and elsewhere, represent Cynric as grandson of Cerdic and son of a certain Creoda. Suspicion likewise attaches to the name Cerdic, which seems to be Welsh, while we learn from Bede that the Isle of Wight, together with part at least of the Hampshire coast, was colonized by Jutes, who apparently had a kingdom distinct from that of Wessex. For these reasons the story of the foundation of Wessex, though it appears to possess considerable antiquity, must be regarded as open to grave suspicion. It is worthy of note that the dynasty claimed to be of the same origin as the royal house of Bernicia and that two of Cerdic's ancestors, Freawine and Wig, figure in the story of Wermund, king of Angel.

Whatever may be the truth about the origin of the kingdom, and it is by no means impossible that the invasion really proceeded from a different quarter, we need not doubt that its dimensions were largely increased under Ceawlin. In his reign the Chronicle mentions two great victories over the Welsh, one at a place called Bedcanford in 571, by which Aylesbury and the upper part of the Thames valley fell into the hands of the West Saxons, and another at Deorham in 577, which led to the capture of Cirencester, Bath and Gloucester. Ceawlin is also said to have defeated Æthelberht at a place called Wibbandun (possibly Wimbledon) in 568. In 592 he was expelled and died in the following year. Of his successors Ceol and Ceolwulf we know little though the latter is said to have been engaged in constant warfare. Ceolwulf was succeeded in 611 by Cynegils, whose son Cwichelm provoked a Northumbrian invasion by the attempted murder of Edwin in 626. These kings are also said to have come into collision with the Mercian king Penda, and it is possible that the province of the Hwicce (*q.v.*) was lost in their time. After the accession of Oswald, who married Cynegils's daughter, to the throne of Northumbria, both Cynegils and Cwichelm were baptized. Cynegils was succeeded in 642 by his son Cenwalh, who married and subsequently divorced Penda's sister and was on that account expelled by that king. After his return he gained a victory over the Welsh near Pen-Selwood, by which a large part of Somerset came into his hands. In 661 he was again attacked by the Mercians under Wulfhere. At his death, probably in 673, the throne is said to have been held for a year by his widow Sexburh, who was succeeded by Aescwine, 674–676, and Centwine, 676–685. According to Bede, however, the kingdom was in a state of disunion from the death of Cenwalh to the accession of Ceadwalla in 685, who greatly increased its prestige and conquered the Isle of Wight, the inhabitants of which he treated with great barbarity. After a brief reign Ceadwalla went to Rome, where he was baptized, and died shortly afterwards, leaving the kingdom to Ine. By the end of the 7th century a considerable part at least of Devonshire as well as the whole of Somerset and Dorset seems to have come into the hands of the West Saxons. On the resignation of Ine, in 726, the throne was obtained by Æthelheard, apparently his brother-in-law, who had to submit to the Mercian king Æthelbald, by whom he seems to have been attacked in 733. Cuthred, who succeeded in 740, at first acted in concert with Æthelbald, but revolted in 752. At his death in 756 Sigeberht succeeded. The latter, however, on account of his misgovernment was deserted by most of the leading nobles, and with the exception of Hampshire the whole kingdom came into the hands of Cynewulf. Sigeberht, after putting to death the last of the princes who remained faithful to him, was driven into exile and subsequently murdered; but vengeance was afterwards taken on Cynewulf by his brother Cyneheard. Cynewulf was succeeded in 786 by Berhtric, who married Eadburg, daughter of the Mercian king Offa. Her violent and murderous conduct led to the king's death in 802; and, it is said, caused the title of queen to be denied to the wives of later kings. Berhtric was succeeded by Ecgberht (*q.v.*), the chief event of whose reign was the overthrow of the Mercian king Beornwulf in 825, which led to the establishment of West Saxon supremacy and to the annexation by Wessex of Sussex, Surrey, Kent and Essex.

Æthelwulf (*q.v.*), son of Ecgberht, succeeded to the throne of Wessex at his father's death in 839, while the eastern provinces went to his son or brother Æthelstan. A similar division took place on Æthelwulf's death between his two sons Æthelbald and Æthelberht, but on the death of the former in 858 Æthelberht united the whole in his own hands, his younger brothers Æthelred and Alfred renouncing their claims. Æthelberht was succeeded in 865 by Æthelred, and the latter by Alfred in 871. This was the period of the great Danish invasion which culminated in the submission of Guthrum in 878. Shortly afterwards the kingdom of the Mercians came to an end and their leading earl Æthelred accepted Alfred's overlordship. By 886 Alfred's authority was admitted in all the provinces of England which were not under Danish rule. From this time onwards the history of Wessex is the history of England.

Kings of Wessex.

Cerdic	519	Æthelheard	728 (726)
Cynric	534	Cuthred	741 (740)
Ceawlin	560 (*c.* 571)	Sigeberht	754 (756)
Ceol	592 (*c.* 588)	Cynewulf	755 (757)
Ceolwulf	597 (*c.* 594)	Berhtric	784 (786)
Cynegils	611	Ecgbert	800 (802)
Cenwalh	643 (*c.* 642)	Æthelwulf	836 (839)
Sexburh	672 (*c.* 673)	Æthelbald	855 (858)
Æscwine	674	Æthelberht	860
Centwine	676	Æthelred	866
Ceadwalla	685	Alfred	871
Ine	688		

The dates are those of the annals in the *Chronicle*, with approximate corrections in brackets.

See *Anglo-Saxon Chronicle*, edited by Earle and Plummer (Oxford, 1892–1899); Bede, *Hist. Eccl.* and *Continuatio*, edited by C. Plummer (Oxford, 1896); "Annales Lindisfarnenses," in the *Monumenta Germ. hist.* xix. 502-508 (Hanover, 1866); Asser, *Life of King Alfred*, edited by W. H. Stevenson (Oxford, 1904); W. de G. Birch, *Cartularium Saxonicum* (London, 1885–1893). (F. G. M. B.)

WEST, BENJAMIN (1738–1820), English historical and portrait-painter, was born on the 10th of October 1738, at Springfield, Pennsylvania, of an old Quaker family from Buckinghamshire. When a boy of seven he began to show his inclinations to art. According to a well-known story, he was sitting by the cradle of his sister's child, watching its sleep, when the infant happened to smile in its dreams, and, struck with its beauty, young Benjamin got some paper, and drew its portrait. The career thus begun was prosecuted amid many difficulties; but his perseverance overcame every obstacle, and at the age of eighteen he settled in Philadelphia as a portrait-painter. After two years he removed to New York, where he practised his profession with considerable success. In 1760, through the assistance of some friends, he was enabled to complete his artistic education by a visit to Italy, where he remained nearly three years. Here he acquired reputation, and was elected a member of the principal academies of Italy. On the expiry of his Italian visit he settled in London as an historical painter. His success was not long doubtful. George III. took him under his special patronage; and commissions flowed in upon him from all quarters. In 1768 he was one of the four artists who submitted to the king the plan for a royal academy, of which he was one of the earliest members; and in 1772 he was appointed historical painter to the king. He devoted his attention mainly to the painting of large pictures on historical and religious subjects, conceived, as he believed, in the style of the old masters, and executed with great care and much taste. So high did he stand in public favour that on the death of Sir Joshua Reynolds, in 1792, he was elected his successor as president of the Royal Academy, an office which he held for twenty-eight years. In 1802 he took advantage of the opportunity afforded by the peace of Amiens to visit Paris, and inspect the magnificent collection of the masterpieces of art, pillaged from the gallery of almost every capital in Europe, which then adorned the Louvre. On his return to London he devoted himself anew to the labours of his profession, which were, however, somewhat broken in upon by quarrels with some of the members of the Royal Academy. In 1804 he resigned his office, but an all but unanimous request that he should return to the chair induced him to recall his resignation. Time did not at all weaken the energy with which he laboured at his easel. When sixty-five he painted one of his largest works, "Christ healing the Sick." This was originally designed to be presented to the Quakers in Philadelphia, to assist in erecting a hospital. On its completion it was exhibited in London to immense crowds, and was purchased by the British Institution for 3000 guineas, West sending a replica to Philadelphia. His subsequent works were nearly all on the same grand scale as the picture which had been so successful, but they did not meet with very ready sale. He died in London on the 11th of March 1820, and was buried in St Paul's.

West's works, which fond criticism ranked during his life with the great productions of the old masters, are now considered as in general formal, tame, wanting that freedom of nature and that life which genius alone can breathe into the canvas. His "Death of Wolfe" is interesting as introducing modern costume instead of the classical draperies which had been previously universal in similar subjects by English artists; and his "Battle of La Hogue" is entitled to an honourable place among British historical paintings.

An account of West's life was published by Galt (*The Progress of Genius*, 1816). See also H. T. Tuckerman, *Book of the Artists* (N.Y., 1868).

WEST, NICHOLAS (1461–1533), English bishop and diplomatist, was born at Putney, and educated at Eton and at King's College, Cambridge, of which he became a fellow in 1483. He was soon ordained and appointed rector of Egglescliffe, Durham, receiving a little later two other livings and becoming chaplain to King Henry VII. In 1509 Henry VIII. appointed him dean of St George's chapel, Windsor, and in 1515 he was elected bishop of Ely. West's long and successful career as a diplomatist began in 1502 through his friendship with Richard Fox, bishop of Durham. In the interests of Henry VII. he visited the German king Maximilian I. and George, duke of Saxony; in 1506 he negotiated an important commercial treaty with Flanders, and he attempted to arrange marriages between the king's daughter Mary and the future emperor Charles V., and between the king himself and Charles's sister Margaret. By Henry VIII. West was sent many times to Scotland and to France. Occupied mainly during the years 1513 and 1514 with journeys to and from Scotland, he visited Louis XII. of France in the autumn of 1514 and his successor Francis I. in 1515. In 1515 also he arranged a defensive treaty between England and France, and he was principally responsible for treaties concluded between the two countries in 1518 and 1525, and at other times. He was trusted and employed on personal matters by Cardinal Wolsey. He died on the 28th of April 1533. The bishop built two beautiful chapels, one in Putney church and the other in Ely cathedral, where he is buried.

WESTALL, RICHARD (1765–1836), English subject painter, was born in Hertford in 1765, of a Norwich family. In 1779 he went to London, and was apprenticed to an engraver on silver, and in 1785 he began to study in the schools of the Royal Academy. He painted "Esau seeking Jacob's Blessing," "Mary Queen of Scots going to Execution" and other historical subjects in water-colour, and some good portraits in the same medium, but he is mainly known as a book-illustrator. He produced five subjects for the Shakespeare Gallery, illustrated an edition of Milton, executed a very popular series of illustrations to the Bible and the prayer-book, and designed plates for numerous other works. In 1808 he published a poem, *A Day in Spring*, illustrated by his own pencil. His designs are rather tame, mannered and effeminate. He became an associate of the Royal Academy in 1792, and a full member in 1794; and during his later years he was a pensioner of the Academy. He died on the 4th of December 1836. His brother, William Westall, A.R.A. (1781–1850), landscape painter, is mainly known by his illustrations to works of travel.

WESTBORO, a township of Worcester county, Massachusetts, U.S.A., about 12 m. E. of Worcester. Pop. (1890) 5195; (1900) 5400 (1127 being foreign-born); (1905, state census) 5378; (1910) 5446. Westboro is served by the Boston & Albany railway and by interurban electric lines. Area, about 22 sq. m. It has a public library, which has belonged to the township since 1857; and here are the Lyman School for Boys, a state industrial institution (opened in 1886 and succeeding a state reform school opened in 1846), and the Westboro Insane Hospital (homoeopathic, 1884), which is under the general supervision of the State Board of Insanity. There are manufactures of boots and shoes, straw and leather goods, carpets, &c. Westboro was the birthplace of Eli Whitney, inventor of the cotton gin. The first settlement here was made about 1659 in a part of Marlboro called Chauncy (because of a grant of 500 acres here to Charles Chauncy, president of Harvard College, made in 1659 and revoked in 1660 by the General Court of Massachusetts). In 1717 this part of Marlboro, with other lands, was erected into the township of Westboro, to which parts of Sutton (1728), Shrewsbury (1762 and 1793) and Upton (1763) were subsequently annexed, and from which Northboro was separated in 1766.

WEST BROMWICH, a market town and municipal, county and parliamentary borough of Staffordshire, England, 6 m. N.W. of Birmingham, on the northern line of the Great Western railway. Pop. (1891) 59,538, (1901) 65,175. The appearance of the town, like its growth as an industrial centre of the Black Country, is modern. It is, however, of ancient origin; thus the church of All Saints, formerly St Clement, was given by Henry I. to the convent of Worcester, from which it passed to the priors of Sandwell, who rebuilt it in the Decorated period, the present structure (1872) following their plan. The chief public buildings are the town hall (1875), the Institute (1886), providing instruction in science and art, under the corporation since 1894, the free library (1874) and law-courts (1891). The picturesque Oak House, of the 16th century, was opened as a museum and art gallery in 1898. Among schools is one for pauper children in which engineering, baking, spade-husbandry, &c., are taught. Sandwell Hall, formerly a seat of the earls of Dartmouth, contains a school for daughters of clergymen, &c. The house, standing in pleasant wooded grounds, is on the site of the Benedictine priory of Sandwell, founded in the time of Henry II. There are charities founded by the families of Stanley and Whorwood (1613 and 1614). Dartmouth Park is a recreation ground of about 60 acres; others are Farley, Kenwick and Hill Top Park. Numerous mines work the extensive coalfields, which include a thirty-foot seam. There are large iron and brass foundries and smelting furnaces, and malting and brickmaking are carried on. The parliamentary borough returns one member. The town is governed by a mayor 6 aldermen and 18 councillors. Area, 5860 acres.

WESTBROOK, a city of Cumberland county, Maine, U.S.A., on the Presumpscot river, 5 m. N.W. of Portland. Pop. (1890) 6632, (1900) 7283 (1673 foreign-born), (1910) 8281. It is served by the Maine Central and the Boston & Maine railways. In Westbrook are the Walker Memorial Library (1894) and the Warren Library (1879). The river provides water-power, and among the manufactures are paper, silks, cotton goods, &c. In 1814 Westbrook was separated from Falmouth and incorporated as a township under the name of Stroudwater, and in 1815 the present name was adopted in honour of Colonel Thomas Westbrook, who had distinguished himself in wars with the Indians. In 1871 Deering, now a part of Portland, was taken from the township. A city charter was granted to Westbrook in 1889 and adopted in 1891.

WESTBURY, RICHARD BETHELL, 1st Baron (1800–1873), lord chancellor of Great Britain, was the son of Dr Richard Bethell, and was born at Bradford, Wilts. Taking a high degree at Oxford in 1818, he was elected a fellow of Wadham College. In 1823 he was called to the bar at the Middle Temple. On attaining the dignity of queen's counsel in 1840 he rapidly took the foremost place at the Chancery bar and was appointed vice-chancellor of the county palatine of Lancaster in 1851. His most important public service was the reform of the then existing mode of legal education, a reform which ensured that students before call to the bar should have at least some acquaintance with the elements of the subject which they were to profess. In 1851 he obtained a seat in the House of Commons, where he continued to sit, first as member for Aylesbury, then as member for Wolverhampton, until he was raised to the peerage. Attaching himself to the liberals, he became solicitor-general in 1852 and attorney-general in 1856 and again in 1859. On June 26, 1861, on the death of Lord Campbell, he was created lord high chancellor of Great Britain, with the title of Baron Westbury of Westbury, county Wilts. The ambition of his life was to set on foot the compilation of a digest of the whole law, but for various reasons this became impracticable. The conclusion of his tenure of the chancellorship was unfortunately marked by events which, although they did not render personal corruption imputable to him, made it evident that he had acted with some laxity and want of caution. Owing to the reception by parliament of reports of committees nominated to consider the circumstances of certain appointments in the Leeds Bankruptcy Court, as well as the granting a pension to a Mr Leonard Edmunds, a clerk in the patent office, and a clerk of the parliaments, the lord chancellor felt it incumbent upon him to resign his office, which he accordingly did on the 5th of July 1865, and was succeeded by Lord Cranworth. After his resignation he continued to take part in the judicial sittings of the House of Lords and the privy council until his death. In 1872 he was appointed arbitrator under the European Assurance Society Act 1872, and his judgments in that capacity have been collected and published by Mr F. S. Reilly. As a writer on law he made no mark, and few of his decisions take the highest judicial rank. Perhaps the best known is the judgment delivering the opinion of the judicial committee of the privy council in 1863 against the heretical character of certain extracts from the well-known publication *Essays and Reviews*. His principal legislative achievements were the passing of the Divorce Act 1857, and of the Land Registry Act 1862 (generally known as Lord Westbury's Act), the latter of which in practice proved a failure. What chiefly distinguished Lord Westbury was the possession of a certain sarcastic humour; and numerous are the stories, authentic and apocryphal, of its exercise. In fact, he and Mr Justice Maule fill a position analogous to that of Sydney Smith, convenient names to whom "good things" may be attributed. Lord Westbury died on the 20th of July 1873, within a day of the death of Bishop Wilberforce, his special antagonist in debate.

See *Life* of Lord Westbury by T. A. Nash.

WESTBURY, an urban district in the Westbury parliamentary division of Wiltshire, England, on the river Biss, a small tributary of the Lower Avon. Pop. (1901) 3305. It is $95\frac{1}{2}$ m. W. by S. of London by the Great Western railway, and lies within 3 m. of the Somerset border, sheltered on the east by the high tableland of Salisbury Plain. All Saints' church is Norman and later, with a magnificent nave. In the south transept stands a monument to Sir James Ley, earl of Marlborough and president of the council in 1629; the "good earl" addressed in a sonnet by Milton. A chained black-letter copy of Erasmus' "Paraphrase of the New Testament" is preserved in the south chapel. In the suburb of Westbury Leigh is the "Palace Garden," a moated site said to have been a royal residence in Saxon times.

Westbury (*Westberie, Westburi*) figures in Domesday as a manor held by the king. The manor was granted by Henry II. to Reginald de Pavely in 1172–1173, and from then onwards passed through various families until in 1810 it was purchased by Sir M. M. Lopez from the earl of Abingdon. A post mote was held for Westbury in 1361–1362, but the earliest mention of the town as a borough occurs in 1442–1443. The charter of incorporation is lost (tradition says it was burnt), and the town possesses no other charter. The title of the corporation was "Mayor and Burgesses of Westbury," and it consisted of a mayor, recorder and 13 capital burgesses. The borough returned two members to parliament from 1448. In 1832 the number was reduced to one, and in 1885 the representation was merged in that of the county. In 1252 Henry III. granted to Walter de Pavely a yearly fair for three days from October 31, and a weekly market on Friday. Henry VI. in 1460 granted three fairs yearly for three days from April 22, Whit Monday and September 13 respectively, and a market on Thursdays. In 1835 the mayor's fair was held at Whitsuntide, and the lord of the manor's at Easter. In 1875 a yearly sheep fair took place on the first Tuesday in September and a pleasure fair on Easter and Whit Monday; in 1888 on the first Tuesday in September and on the 24th of that month; the former still exists. In 1673 there was a market on Friday, in 1835 a nominal one on Tuesday and after 1875 it ceased. During the 18th and 19th centuries there was a considerable trade in malt, bricks, tiles and cloth. The last, once the most extensive, has now sunk into insignificance, while the others exist also only on a small scale.

WEST CHESTER, a borough and the county-seat of Chester county, Pennsylvania, U.S.A., about 20 m. W. of Philadelphia. Pop. (1890) 8028; (1900) 9524, of whom 566 were foreign-born and 1777 were negroes; (1910 census) 11,767. West Chester is served directly by the Pennsylvania and the Philadelphia, Baltimore & Washington railways and by an interurban electric line to Philadelphia; electric lines connect with the Philadelphia & Reading at Lenape, 4 m. to the south-west, and at Coatesville, 10 m. to the west. The borough lies about 450 ft. above sea-level in an undulating country. At West Chester are the West Chester State Normal School (1871), the Darlington Seminary (non-sectarian; for girls), founded in 1851 by Smedley Darlington (1827–1899; principal of the school in 1851–1861 and a representative in Congress in 1887–1891), the Friends' Graded School and the Friends' (Orthodox) Select School. There are fine botanical gardens in Marshall Square. Among the public buildings are a county court house (1847–1848), a county jail and a county hospital (1892–1893), the public library and a large Y.M.C.A. building. The colonial Turk's Head Hotel here has been so called since 1768 and was probably first opened in 1762. West Chester is in a farming country with important market-gardens and dairy farms; among its manufactures are dairy implements, foundry and machine-shop products and carriage and wagon materials. The factory product in 1905 was valued at $2,121,185. There are several large nursery farms here. West Chester was first settled in 1713, succeeded Chester as the county-seat in 1784–1786, and was incorporated as a town in 1788 and as a borough in 1799. During the War of Independence the battle of Brandywine was fought about 7 m. S. of West Chester on the 11th of September 1777, and on the 20th General Anthony Wayne, with a small force, was surprised and routed by the British at Paoli, about 8 m. N.E.

WESTCOTT, BROOKE FOSS (1825–1901), English divine and bishop of Durham, was born on the 12th of January 1825 in the neighbourhood of Birmingham. His father, Frederick Brooke Westcott, was a botanist of some distinction. Westcott was educated at King Edward VI. school, Birmingham, under James Prince Lee, where he formed his friendship with Joseph Barber Lightfoot (*q.v.*). In 1844 Westcott obtained a scholarship at Trinity College, Cambridge. He took Sir William Browne's medal for a Greek ode in 1846 and 1847, the Members' Prize for a Latin essay in 1847 as an undergraduate and in 1849 as a bachelor. He took his degree in January 1848, obtaining double-first honours. In mathematics he was twenty-fourth wrangler, Isaac Todhunter being senior. In classics he was senior, being bracketed with C. B. Scott, afterwards headmaster of Westminster. After obtaining his degree, Westcott remained for four years in residence at Trinity. In 1849 he obtained his fellowship; and in the same year he was ordained deacon and priest by his old headmaster, Prince Lee, now bishop of Manchester. The time spent at Cambridge was devoted to most strenuous study. He took pupils; and among his pupils there were reading with him, almost at the same time, his school friend Lightfoot and two other men who became his attached and lifelong friends, E. W. Benson and F. J. A. Hort (*qq.v.*). The inspiring influence of Westcott's intense enthusiasm left its mark upon these three distinguished men; they regarded him not only as their friend and counsellor, but as in an especial degree their teacher and oracle. He devoted much attention to philosophical, patristic and historical studies, but it soon became evident that he would throw his strength into New Testament work. In 1851 he published his Norrisian prize essay with the title *Elements of the Gospel Harmony*.

In 1852 he became an assistant master at Harrow, and soon afterwards he married Miss Whithard. He prosecuted his school work with characteristic vigour, and succeeded in combining with his school duties an enormous amount both of theological research and of literary activity. He worked at Harrow for nearly twenty years under Dr C. J. Vaughan and Dr Montagu Butler, but while he was always conspicuously successful in inspiring a few senior boys with something of his own intellectual and moral enthusiasm, he was never in the same measure capable of maintaining discipline among large numbers. The writings which he produced at this period created a new epoch in the history of modern English theological scholarship. In 1855 he published the first edition of his *History of the New Testament Canon*, which, frequently revised and expanded, became the standard English work upon the subject. In 1859 there appeared his *Characteristics of the Gospel Miracles*. In 1860 he expanded his Norrisian essay into an *Introduction to the Study of the Gospels*, a work remarkable for insight and minuteness of study, as well as for reverential treatment combined with considerable freedom from traditional lines. Westcott's work for Smith's *Dictionary of the Bible*, notably his articles on "Canon," "Maccabees," "Vulgate," entailed most careful and thorough preparation, and led to the composition of his subsequent valuable popular books, *The Bible in the Church* (1864) and a *History of the English Bible* (1869). To the same period belongs *The Gospel of the Resurrection* (1866). As a piece of consecutive reasoning upon a fundamental Christian doctrine it deservedly attracted great attention. Its width of view and its recognition of the claims of historical science and pure reason were thoroughly characteristic of Westcott's mode of discussing a theological question. At the time when the book appeared his method of apologetic showed both courage and originality, but the excellence of the work is impaired by the difficulty of the style.

In 1865 he took his B.D., and in 1870 his D.D. He received in later years the honorary degrees of D.C.L. from Oxford (1881) and of D.D. from Edinburgh (1883). In 1868 Westcott was appointed examining chaplain by Bishop Connor Magee (of Peterborough); and in the following year he accepted a canonry at Peterborough, which necessitated his leaving Harrow. For a time he contemplated with eagerness the idea of a renovated cathedral life, devoted to the pursuit of learning and to the development of opportunities for the religious and intellectual benefit of the diocese. But the regius professorship of divinity at Cambridge fell vacant, and Lightfoot, who was then Hulsean professor, declining to become a candidate himself, insisted upon Westcott's standing for the post. It was due to Lightfoot's support almost as much as to his own great merits that Westcott was elected to the chair on the 1st of November 1870. This was the turning-point of his life. He now occupied a great position for which he was supremely fitted, and at a juncture in the reform of university studies when a theologian of liberal views, but universally respected for his massive learning and his devout and single-minded character, would enjoy a unique opportunity for usefulness. Supported by his friends Lightfoot and Hort, he threw himself into the new work with extraordinary energy. He deliberately sacrificed many of the social privileges of a university career in order that his studies might be more continuous and that he might see more of the younger men. His lectures were generally on Biblical subjects. His *Commentaries* on St John's Gospel (1881), on the Epistle to the Hebrews (1889) and the Epistles of St John (1883) resulted from his public lectures. One of his most valuable works, *The Gospel of Life* (1892), a study of Christian doctrine, incorporated the materials upon which he was engaged in a series of more private and esoteric lectures delivered on week-day evenings. The work of lecturing was an intense strain to him, but its influence was immense: to attend one of Westcott's lectures—even to watch him lecturing—was an experience which lifted and solemnized many a man to whom the references to Origen or Rupert of Deutz were almost ludicrously unintelligible. Between the years 1870 and 1881 Westcott was also continually engaged in work for the revision of the New Testament, and, simultaneously, in the preparation of a new text in conjunction with Hort. The years in which Westcott, Lightfoot and Hort could thus meet frequently and naturally for the discussion of the work in which they were all three so deeply engrossed formed a happy and privileged period in their lives. In the year 1881 there appeared the famous Westcott and Hort text of the New Testament, upon which had been expended nearly thirty years of incessant labour. The reforms in the regulations for degrees in divinity, the formation and first revision of the new theological tripos, the inauguration of the Cambridge mission to Delhi, the institution of the Church Society (for the discussion of theological and ecclesiastical questions by the younger men), the meetings for the divinity faculty, the organization of the new Divinity School and Library and, later, the institution of the Cambridge Clergy Training School, were all, in a very real degree, the result of Westcott's energy and influence as regius professor. To this list should also be added the Oxford and Cambridge preliminary examination for candidates for holy orders, with which he was from the first most closely identified. The success of this very useful scheme was due chiefly to his sedulous interest and help.

The departure of Lightfoot to the see of Durham in 1879 was a great blow to Westcott. Nevertheless it resulted in bringing him into still greater prominence. He was compelled to take the lead in matters where Lightfoot's more practical nature had previously been predominant. In 1883 Westcott was elected to a professorial fellowship at King's. Shortly afterwards, having previously resigned his canonry at Peterborough, he was appointed by the crown to a canonry at Westminster, and accepted the position of examining chaplain to Archbishop Benson. His little edition of the *Paragraph Psalter* (1879), arranged for the use of choirs, and his admirable lectures on the Apostles' Creed, entitled *Historic Faith* (1883), are reminiscences of his vacations spent at Peterborough. He held his canonry at Westminster in conjunction with the regius professorship. The strain of the joint work was very heavy, and the intensity of the interest and study which he brought to bear upon his share in the labours of the Ecclesiastical Courts Commission, of which he had been appointed a member, added to his burden.

Preaching at the Abbey gave him a valued opportunity of dealing with social questions. His sermons were generally portions of a series; and to this period belong the volumes *Christus Consummator* (1886) and *Social Aspects of Christianity* (1887).

In March 1890 he was nominated to the see of Durham, there to follow in the steps of his beloved friend Lightfoot, who had died in December 1889. He was consecrated on the 1st of May at Westminster Abbey by Archbishop Thompson (of York), Hort being the preacher, and enthroned at Durham cathedral on the 15th of May. The change of work and surroundings could hardly have been greater. But the sudden immersion in the practical administration of a northern diocese gave him new strength. He surprised the world, which had supposed him to be a recluse and a mystic, by the practical interest he took in the mining population of Durham and in the great shipping and artisan industries of Sunderland and Gateshead. Upon one famous occasion in 1892 he succeeded in bringing to a peaceful solution a long and bitter strike which had divided the masters and men in the Durham collieries; and his success was due to the confidence which he inspired by the extraordinary moral energy of his strangely "prophetic" personality, at once thoughtful, vehement and affectionate. His constant endeavour to call the attention of the Church to the religious aspect of social questions was a special note in his public utterances. He was a staunch supporter of the co-operative movement. He was practically the founder of the Christian Social Union. He continually insisted upon the necessity of promoting the cause of foreign missions, and he gladly gave four of his sons for the work of the Church in India. His energy was remarkable to the very end. But during the last two or three years of his life he aged considerably. His wife, who had been for some years an invalid, died rather suddenly on the 28th of May 1901, and he dedicated to her memory his last book, *Lessons from Work* (1901). He preached a farewell sermon to the miners in Durham cathedral at their annual festival on the 20th of July. Then came a short, sudden illness, and he passed away on the 27th of July.

Westcott was no narrow specialist. He had the keenest love of poetry, music and art. He was himself no mean draughtsman, and used often to say that if he had not taken orders he would have become an architect. His literary sympathies were wide. He would never tire of praising Euripides, while few men had given such minute study to the writings of Robert Browning. He followed with delight the development of natural science studies at Cambridge. He spared no pains to be accurate, or to widen the basis of his thought. Thus he devoted one summer vacation to the careful analysis of Comte's *Politique positive.* He studied assiduously *The Sacred Books of the East*, and earnestly contended that no systematic view of Christianity could afford to ignore the philosophy of other religions. The outside world was wont to regard him as a mystic; and the mystical, or sacramental, view of life enters, it is true, very largely into his teaching. He had in this respect many points of similarity with the Cambridge Platonists of the 17th century, and with F. D. Maurice, for whom he had profound regard. But in other respects he was very practical; and his strength of will, his learning and his force of character made him really masterful in influence wherever the subject under discussion was of serious moment. He was a strong supporter of Church reform, especially in the direction of obtaining larger powers for the laity.

He kept himself aloof from all party strife. He describes himself when he says, "The student of Christian doctrine, because he strives after exactness of phrase, because he is conscious of the inadequacy of any one human formula to exhaust the truth, will be filled with sympathy for every genuine endeavour towards the embodiment of right opinion. Partial views attract and exist in virtue of the fragment of truth—be it great or small—which they include; and it is the work of the theologian to seize this no less than to detect the first spring of error. It is easier and, in one sense, it is more impressive to make a peremptory and exclusive statement, and to refuse to allow any place beside it to divergent expositions; but this show of clearness and power is dearly purchased at the cost of the ennobling conviction that the whole truth is far greater than our individual minds. He who believes that every judgment on the highest matters different from his own is simply a heresy must have a mean idea of the faith; and while the qualifications, the reserve, the lingering sympathies of the real student make him in many cases a poor controversialist, it may be said that a mere controversialist cannot be a real theologian" (*Lessons from Work*, pp. 84-85). His theological work was always distinguished by the place which he assigned to Divine Revelation in Holy Scripture and in the teaching of history. His own studies have largely contributed in England to the better understanding of the doctrines of the Resurrection and the Incarnation. His work in conjunction with Hort upon the Greek text of the New Testament will endure as one of the greatest achievements of English Biblical criticism. The principles which are explained in Hort's introduction to the text had been arrived at after years of elaborate investigation and continual correspondence and discussion between the two friends. The place which it almost at once took among scientific scholars in Great Britain and throughout Europe was a recognition of the great advance which it represented in the use and classification of ancient authorities. His commentaries rank with Lightfoot's as the best type of Biblical exegesis produced by the English Church in the 19th century.

The following is a bibliography of Westcott's more important writings, giving the date of the first editions:—*Elements of the Gospel Harmony* (1851); *History of the Canon of First Four Centuries* (1853); *Characteristics of Gospel Miracles* (1859); *Introduction to the Study of the Gospels* (1860); *The Bible in the Church* (1864); *The Gospel of the Resurrection* (1866); *Christian Life Manifold and One* (1869); *Some Points in the Religious Life of the Universities* (1873); *Paragraph Psalter for the Use of Choirs* (1879); *Commentary on the Gospel of St John* (1881); *Commentary on the Epistles of St John* (1883); *Revelation of the Risen Lord* (1882); *Revelation of the Father* (1884); *Some Thoughts from the Ordinal* (1884); *Christus Consummator* (1886); *Social Aspects of Christianity* (1887); *The Victory of the Cross: Sermons in Holy Week* (1888); *Commentary on the Epistle to the Hebrews* (1889); *From Strength to Strength* (1890); *Gospel of Life* (1892); *The Incarnation and Common Life* (1893); *Some Lessons of the Revised Version of the New Testament* (1897); *Christian Aspects of Life* (1897); *Lessons from Work* (1901).

Lives by his son B. F. Westcott (1903), and by J. Clayton (1906). (H. E. R.*)

WESTERLY, a township of Washington county, Rhode Island, U.S.A., in the extreme S.W. part of the state, about 44 m. S.S.W. of Providence, separated from Connecticut on the W. by the Pawcatuck river, which forms the northern boundary of the township also. Pop. (1890) 6813, (1900) 7541, (1788 being foreign-born and 185 negroes), (1905, state census) 8381, (1910) 8696. Area, about 31 sq. m. Westerly is served by the New York, New Haven & Hartford railway, and by interurban electric lines connecting with Norwich and New London, Conn. The township includes several small villages, connected by electric railways, the best known being Watch Hill, which has fine sea-bathing. Larger villages are Westerly, in the western part of the township and at the head of navigation (for small vessels) on the Pawcatuck river, and Niantic, in the north-eastern part of the township. In Westerly there is a public library (1894), with 23,323 volumes in 1909. Beyond Watch Hill Point on the S.W. point of an L-shaped peninsula, running first W. and then N., is Napatree Point, on which is Fort Mansfield, commanding the N.E. entrance to Long Island Sound. The township is the centre of the granite industry of the state; the quarries are near the villages of Westerly and Niantic. The granite is of three kinds: white statuary granite, a quartz monzonite, with a fine even-grained texture, used extensively for monuments; blue granite, also a quartz monzonite and also much used for monuments; and red granite, a biotite granite, reddish grey in colour and rather coarse in texture, used for buildings.[1] Among the manufactures are cotton and woollen goods, thread and printing presses. The water supply is from artesian wells. The first settlement here was made in 1661, and the township was organized in 1669, when the present name was adopted instead of the Indian Misquamicut (meaning "salmon") by which it had been called. In 1686 the name was changed to Haversham, but in 1689 the present name was restored.

See Frederic Denison, *Westerly and its Witnesses, for Two Hundred and Fifty Years, 1626–1876* (Providence, R.I., 1878).

WESTERMANN, FRANÇOIS JOSEPH (d. 1794), French general, was born at Molsheim in Alsace. At an early age he entered a cavalry regiment, but soon left the service and went to Paris. He embraced enthusiastically the ideas of the Revolution, and in 1790 became *greffier* of the municipality of Haguenau. After a short imprisonment on a charge of inciting *émeutes* at Haguenau, he returned to Paris, where he joined Danton and played an important part in the attack on the Tuileries on the 10th of August 1792. He accompanied Dumouriez on his campaigns and assisted him in his negotiations with the Austrians, being arrested as an accomplice after the general's defection. He succeeded, however, in proving his innocence, and was sent with the rank of general of brigade into La Vendée, where he distinguished himself by his extraordinary courage, by the audacity of his manœuvres, and by his severe treatment of the insurgents. After suffering a defeat at Châtillon, he vanquished the Vendéans at Beaupréau, Laval, Granville and Baugé, and in December 1793 annihilated their army at Le Mans and Savenay. He was then summoned to Paris, where he was proscribed with the Dantonist party and executed on the 5th of April 1794.

See P. Holl, *Nos généraux alsaciens . . . Westermann* (Strassburg, 1900).

WESTERN AUSTRALIA, a British colonial state, forming part of the Commonwealth of Australia. (For Map, see AUSTRALIA.) This portion of Australia lies to the west of 129° E. long., forming considerably more than one-third of the whole; it has an area of 1,060,000 sq. m., is 1400 m. in length and 850 in breadth, and has a coast-line of 3500 m. It is divided into five districts—Central, Central Eastern, South-Eastern, North and Kimberley. The Central or settled district, in the south-west, is divided into twenty-six counties. Apart from the coast lands, the map presents almost a blank, as the major portion is practically a dry waste of stone and sand, relieved by a few shallow salt lakes. The rivers of the south are small—the Blackwood being the most considerable. To the north of this are the Murray, the well-known Swan, the Moore, the Greenough and the Murchison. The last is 400 m. long. Shark's Bay receives the Gascoyne (200 m. long), with its tributary the Lyons. Still farther north, where the coast trends eastward, the principal rivers are the Ashburton, the Fortescue and the De Grey. Kimberley district to the north-east has some fine streams—the Fitzroy and Ord and their tributaries, on some of which (the Mary, Elvira, &c.) are the goldfields, 250 m. south of Cambridge Gulf. The Darling mountain range is in the south-west, Mount William reaching 3000 ft.; in the same quarter are Toolbrunup (3341 ft.), Ellen's Peak (3420), and the Stirling and Victoria ranges. Gardner and Moresby are flat-topped ranges. Mount Elizabeth rises behind Perth. Hampton tableland overlooks the Bight. In the north-west are Mount Bruce (4000 ft.), Augustus (3580), Dalgaranger (2100), Barlee, Pyrton and the Capricorn range. Kimberley has the King Leopold, M'Clintock, Albert Edward, Hardman, Geikie, Napier, Lubbock, Oscar, Mueller and St George ranges. The lake district of the interior is in the Gibson and Victoria deserts from 24° to 32° S. The lakes receive the trifling drainage of that low region. Almost all of them are salt from the presence of saline marl.

Geology.—The main mass of Westralia consists of a vast block of Archean rocks, which forms the whole of the western half of the Australian continent. The rocks form a plateau, which faces the coast, in a series of scarps, usually a short distance inland. The edge of this plateau is separated from the Southern Ocean by the Nullarbor limestones, at the head of the Great Australian Bight; but they gradually become narrower to the west; and the Archean rocks reach the coast at Port Dempster and to the east of Esperance Bay. Thence the southern boundary of the Archean rocks extends due west, while the coast trends southward, and is separated by a belt of Lower Palaeozoic and Mesozoic deposits; but the reappearance of the granitic rocks at King George Sound and Albany may be due to an outlier of the Archean tableland. Along the western coast, the scarp of the Archean plateau forms the Darling Range behind Perth. Further north, behind Shark's Bay, the plateau recedes from the coast, and trends north-westward through the Hammersley Mountains and the highlands of Pilbarra. The Archean rocks underlie the Kimberley Goldfield; but they are separated from the main Archean plateau to the south by the Lower Palaeozoic rocks, which extend up the basin of the Fitzroy river and form the King Leopold and Oscar Ranges.

The Archean rocks are of most interest from the auriferous lodes which occur in them. The Archean rocks of the area between the Darling Range and the goldfield of Coolgardie were classified by H. P. Woodward into six parallel belts, running northward and southward. but with a slight trend to the west. The westernmost belt consists of clay slates, quartzites and schists, and is traversed by dykes of diorite and felstone; the belt forms the western foot of the Archean plateau, along the edge of the coastal plain. The second belt consists of gneisses and schists, and forms the western part of the Archean plateau. Its chief mineral deposit is tin, in the Green-bushes tin-field, and various other minerals, such as graphite and asbestos. Then follows a wide belt of granitic rocks; it has no permanent surface water and is bare of minerals, and, therefore, formed for a long time an effective barrier to the settlement or prospecting of the country to the east. This granitic band ends to the east in the first auriferous belt, which extends from the Phillips river, on the southern coast, to Southern Cross, on the Perth to Kalgoorlie railway; thence it goes through Mount Magnet, Lake Austin and the Murchison Goldfield at Nannine, and through the Peak Goldfield to the heads of the Gascoyne and Ashburton rivers. To the east of this belt is a barren band of granites and gneisses, succeeded again eastward by the second auriferous belt, including the chief goldfields of Westralia. They begin on the south with the Dundas Goldfield, and the mining centre of Norseman; then to the north follow the goldfields of Kalgoorlie, with its Golden Mile at Boulder, and the now less important field of Coolgardie. This line continues thence through the goldfields of Leonora and Mount Margaret, and reappears behind the western coast in the Pilbarra Goldfield. The rocks of the goldfields consist of amphobolite-schists and other basic schists, traversed by dykes of granite, diorite and porphyrite, with some peridotites. Some of the amphibolites have been crushed and then silicified into jasperoids, so that they much resemble altered sedimentary slates.

The Palaeozoic group is represented by the Cambrian rocks of the Kimberley Goldfield, which have yielded *Olenellus forresti.* There appear to be no certain representatives of the Ordovician system; while the Silurian is represented in the King Leopold Range of Kimberley, and, according to H. P. Woodward, in the contorted, unfossilliferous quartzites and shales of the Stirling Range, north of Albany. The Upper Palaeozoic is well represented by an area of some 2000 sq. m. of Devonian sedimentary and volcanic rocks in the Kimberley district, and by the Carboniferous system, including both a lower, marine type, and an upper, terrestrial type. The Lower Carboniferous limestones occur in the Napier, Oscar and Geikie Ranges of Kimberley, and in the basin of the Gascoyne river, where they contain the glacial deposits discovered by Gibb-Maitland.

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[1] See T. N. Dale, *The Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island* (Washington, 1908), Bulletin 354 of the United States Geological Survey.

between the Wooramel and Minilya rivers. The upper and terrestrial type of the Carboniferous include sandstones with *Stigmaria* and *Lepidodendron* in the Kimberley district, and the coals of the Irwin coalfield, the age of which is proved by the interstratification of the coal seams with beds containing *Productus subquadratus*, *Cyrtina carbonaria* and *Aviculopecten subquinquelineatus*. The Mesozoic rocks were discovered in 1861, and their chief outcrop is along the western coast plains of Westralia between Geraldton and Perth. They have been pierced by many bores put down for artesian wells. The fossils indicate a Lower Jurassic age; and, according to Etheridge, some of the fossils are Lower Cretaceous. The Collie coalfield, to the east of Bunbury, is generally regarded as Mesozoic. Its coal is inferior in quality to that of Eastern Australia, and contains on an average of 34 analyses 11·77 % of moisture, and 8·62 % of ash. According to Etheridge its age is Permo-Carboniferous. The Kainozoic rocks include the marine limestones in the Nullarbor Plains at the head of the Great Australian Bight, whence they extend inland for 150 m. They have no surface water, but the rainfall in this district nourishes artesian wells. The occurrence of marine Kainozoic beds under the western coastal plain is proved by the bores, as at Carnarvon, where they appear to be over 1000 ft. in thickness. The coastal region also includes sheets of clay and sandstone, with deposits of brown coal as on the Fitzgerald river on the southern coast, and in the basin of the Gascoyne. The Archean plateau of the interior is covered by wide sheets of subaerial and lacustrine deposits, which have accumulated in the basins and river valleys. They include mottled clays, lateritic ironstones and conglomerates. In places the materials have been roughly assorted by river action, as in the deep lead of Kanowna. The clays contain the bones of the *Diprotodon*, so that they are probably of Upper Pliocene or Pleistocene age. The Kainozoic volcanic period of Australia is represented by the basalts of Bunbury and Black Point, east of Flinders Bay.

A bibliography of Westralian geology has been issued by Maitland, Bulletin Geol. Survey, No. 1, 1898. An excellent summary of the mineral wealth of the state has been given by Maitland, Bulletin 8, No. 4, 1900, pp. 7-23, also issued in the Year-book of Western Australia. The main literature of the geology of Westralia is in the Bulletins of the Geol. Survey, and in the reports of the Mines Department. A general account of the gold-mining has been given by A. G. Charleton, 1902; and also by Donald Clark, *Australian Mining and Metallurgy* (1904). (J. W. G.)

Flora.—Judged by its vegetable forms, Western Australia would seem to be older than eastern Australia, South Australia being of intermediate age. Indian relations appear on the northern side, and South African on the western. There are fewer Antarctic and Polynesian representatives than in the eastern colonies. European forms are extremely scarce. Compared with the other side of Australia, a third of the genera on the south-west is almost wanting in the south-east. In the latter, 55, having more than ten species each, have 1260 species; but the former has as many in 55 of its 80 genera. Of those 55, 36 are wanting in the south-east, and 17 are absolutely peculiar. There are fewer natural orders and genera westward, but more species. Baron von Müller declared that "nearly half of the whole vegetation of the Australian continent has been traced to within the boundaries of the Western Australian territory." He includes 9 Malvaceae, 6 Euphorbiaceae, 2 Rubiaceae, 9 Proteaceae, 47 Leguminosae, 10 Myrtaceae, 12 Compositae, 5 Labiatae, 6 Cyperaceae, 13 Convolvulaceae, 16 Gramineae, 3 Filices, 10 Amaranthaceae. Yet over 500 of its tropical species are identified with those of India or Indian islands. While seventenths of the orders reach their maximum south-west, three-tenths do so south-east. Cypress pines abound in the north, and ordinary pines in Rottnest Island. Sandalwood (*Santalum cygnorum*) is exported. The gouty stem baobab (*Adansonia*) is in the tropics. *Xanthorrhoea*, the grass tree, abounds in sandy districts. Mangrove bark yields a purple tan. Palms and zamias begin in the northwest. The *Melaleuca Leucadendron* is the paperbark tree of settlers. The rigid-leafed *Banksia* is known as the honeysuckle. *Casuarinae* are the he and she oaks of colonists, and the *Exocarpus* is their cherry tree. Beautiful flowering shrubs distinguish the south-west; and the deserts are all ablaze with flowers after a fall of rain. Poison plants are generally showy Leguminosae, *Sida* and the *Gastrolobium*.

The timber trees of the south-west are almost unequalled. Of the Eucalypts, the jarrah or mahogany, *E. marginata*, is first for value. It runs over five degrees of latitude, and its wood resists the teredo and the ant. Sir Malcolm Fraser assigns 14,000 sq. m. to the jarrah, 10,000 to *E. viminalis*, 2300 to the karri (*E. colossea* or *E. diversicolor*), 2400 to York gum (*E. loxophleba*), 800 to the red gum (*E. calophylla*) and 500 to tuart or native pear (*E. gomphocephala*). Not much good wood is got within 20 m. of the coast. The coachbuilder's coorup rises over 300 ft. Morrel furnishes good timber and rich oil. An ever-increasing trade is done in the timber of the south-western forests.

Fauna.—Among the mammals are the *Macropus giganteus*, *M. irma*, *M. dama*, *M. brachyurus*, *Lagorchestes fasciatus*, *Bettongia penicillata*, *Phalangista vulpecula*, *Pseudochirus cooki*, *Dasyurus geoffroyi*, *Tarsipes rostratus*, *Antechinus apicalis*, *Perameles obesula*, *Perameles myosurus*, *Myrmecobius fasciatus*. Fossil forms partake of the existing marsupial character, *Diprotodon* being allied to the wombat and kangaroo. Nail-bearing kangaroos are in the northwest; the banded one, size of a rabbit, is on Shark's Bay. Nocturnal phalangers live in holes of trees or in the ground. Carnivorous *Phascogalae* are found in south-west. There are three kinds of wombat. The rock-loving marsupial *Osphranter* is only in the north-east, and *Perameles bougainvillei* at Shark's Bay. The dalgyte or *Petrogale lagotis* is at Swan river and *Hypsiprymnus* in the south. The colony has only two species of wallabies to five in New South Wales. The *Halmaturus* of the Abrolhos is a sort of wallaby; a very elegant species is 18 in. long. The pretty *Dromicia*, 6 in. long, lives on stamens and nectar, like the *Tarsipes*, having a brush at the tip of its tongue; its tail is prehensile. The hare-like *Lagorchestes fasciatus* is a great leaper. The *Hapalotis* of the interior has nests in trees. Beaver rats and other small rodents are troublesome, and bats are numerous. The dingo is the wild dog. The platypus (*Ornithorhynchus*) and the *Echidna* are the only forms of the *Monotremata*. The seal, whale and dugong occur in the adjacent seas.

The west is not so rich as the east of Australia in birds. Many forms are absent and others but poorly represented, though some are peculiar to the west. The timbered south-west has the greatest variety of birds, which are scarce enough in the dry and treeless interior. Of lizards the west has 12 genera not found in eastern Australia. Of snakes there are but 15 species to 3 in Tasmania and 31 in New South Wales. While the poisonous sorts are 2 to 1 in the east, they are 3 to 1 in the west. The turtle is obtained as an article of food. The freshwater fishes are not all like those of the east. They include the mullet, snapper, ring fish, guard fish, bonita, rock cod, shark, saw fish, parrot fish and cobbler. Under the head of fisheries may be mentioned the pearl oyster, which is dived for by natives at Shark's Bay; the trepang or bêche-de-mer is also met with in the north. Insects are well represented, especially Coleoptera, Lepidoptera, Hymenoptera, Hemiptera and Diptera.

Climate.—With little or no cold anywhere, the heat of summer over the whole area is considerable. Western Australia differs from the country to the east in having no extensive ranges to collect vapour, while the trade winds blow off the dry land instead of from the ocean; for these two reasons the climate is very dry. Thunderstorms often supply almost the only rainfall in the interior. The south-western corner, the seat of settlements, is the only portion where rains can be depended on for cultivation; but even there few places have a rainfall of 40 in. As one goes northward the moisture lessens. The north-west and all the coast along to Kimberley, with most of that district, suffer much from dryness. The north-east comes in summer within the sphere of the north-west monsoons, though just over the low coast-range few showers are known. The south coast, exposed to polar breezes, with uninterrupted sea, has to endure lengthened droughts. In the Swan river quarter the rainfall is in winter, being brought by north-west winds, and summer days have little moisture. While the south wind cools the settled region, it comes over the parched interior to the northern lands. The hot wind of Swan river is from the east and north-east; but it is from the south in summer to Kimberley and the north-west. In one season the land breeze is hot, in another cool, but always dry.

The climate of Perth is typical of the south-western districts. There are two distinct seasons, the winter and the summer. The winter commences somewhat abruptly, being ushered in by heavy rains; it begins usually not earlier than the middle of April or later than the middle of May, and continues until towards the end of October. The winters are, as a rule, very mild, but there is some cold weather in July and August, and though there is little at the coast, frost is not uncommon inland. The summer is heralded by an occasional hot day in October, in November the weather becomes settled and continues warm until the end of March. In the four months, December to March, the maximum temperature in the shade exceeds 90° on an average on 37 days, but as a rule the heat does not last long, the evenings and nights being tempered by a cool breeze.

In the interior the climate resembles that of the south-west in regard to the occurrence of two seasons only. The winter, however, has much less rain than on the coast, and is cold, clear and bracing. The summer is, as a rule, hot, but is tempered in the south by occasional cool changes, though unrelieved as the tropic is approached. Within the tropics there are two seasons, the wet and the dry. The wet season is most unpleasant, the temperature rarely falling below 100°; the dry season, which lasts from April to November, is usually fine, clear and calm. The average rainfall at Perth is 33 in. falling on 110 days; the mean maximum temperature is 74·9° and the minimum 54·8°; at Coolgardie the mean maximum is 77·8° and the mean minimum 52·4°; at Wyndham, on the north-west coast, the mean maximum is 93·9° and the minimum 75·4°.

Population.—Population made very slow increase under the old conditions of settlement, and even when gold was discovered in 1882 at Kimberley, and five years later at Yilgarn, no great impetus was given to the colony, and at the census of 1891 the population was still under 50,000. The sensational gold finds at Coolgardie in 1892, however, had a most important influence in drawing population, and in three and a half years the population was doubled: during a portion of this time the rush of miners to the gold-fields was so great as to be reminiscent of the experience of the eastern colonies during the 'fifties. At the end of 1905 the population was 254,779, comprising 150,495 males and 104,284 females. The slowness of the early growth and the more rapid strides of later years will be gathered from the following figures: pop. (1860) 15,227, (1870) 25,084, (1880) 29,019, (1890) 46,290, (1895) 101,238, (1901) 194,889. The chief towns of Western Australia are: Perth—the capital—56,000, Fremantle 23,008, Kalgoorlie 6780, Boulder 5658. The number of people in all gold-field towns fluctuates very greatly. Coolgardie, for example, was returned in July 1894 as having within its municipal boundaries 12,000 people; in 1905 it had only 3830.

The births during 1905 numbered 7582 and the deaths 2709, the rates per thousand of population being respectively 30·30 and 10·83, showing a net increment of 19·47 per 1000. In the period 1861–1865 the birth-rate was 39·07 per 1000. Between 1886 and 1890 it stood at 36·88; then came a rapid decline, and in 1896 was reached the low level of 22·67 per 1000. In 1904 the rate was 30·34 per 1000. The decline in the birth-rates has been a common experience of all the Australian states; in Western Australia it was due in a large degree to the decline in the proportion of females to males. In 1870 the females numbered 62% of the males, and in 1880 75%, while in 1895 the proportion was only 45%. The illegitimate births during 1905 were 4·19% of the total births. The death-rate, which in 1897 was 16·99 per 1000, has steadily declined in recent years. The large influx of young unmarried men in the years 1894–1898 was followed by the arrival of a large number of single women, and the marriage-rates increased from 7 per 1000 in the five years 1891–1895 to 10·7 per 1000 in 1897. In 1905 the rate stood at the more normal level of 8·48. Except for a slight influx of population in the three years 1885–1887, due to the gold discoveries at Kimberley, there was very little immigration to Western Australia prior to 1891; in that year, however, there was a considerable inpouring of population from the eastern colonies, notably from Victoria and South Australia, and in the seven years which closed with 1897 the population of the colony gained nearly 110,000 by immigration alone. In 1898 there was still a large inflow of population, but the outflow was also great, and in 1898 and the following year the two streams balanced one another; but 1900 showed an excess of 6000, and 1905 of 7617 gained by immigration.

Western Australia is the most sparsely populated of all the states; only the coastal fringe and the gold-fields show any evidences of settlement, and if the area were divided amongst the population there would be but ten persons to 52 sq. m. The population is almost exclusively of British origin, and only differs from that of the other states in that there is a larger body of Australian-born, who are not natives of the colony itself. About 45% of the population are members of the Church of England; one-fourth belong to other Protestant denominations, and one-fourth are Roman Catholics.

Administration.—In 1890 Western Australia, up to that time a crown colony administered by a governor, was granted responsible government. The legislative authority is vested in a parliament composed of two Houses—a Legislative Council, whose thirty members are elected for six years, and a Legislative Assembly of fifty members, elected by adult suffrage (men and women). As a portion of the Commonwealth, Western Australia sends six senators and five representatives to the federal parliament. In a country so sparsely settled municipal government has little scope for operation.

So far forty-four municipalities have been gazetted. Besides the municipalities there are district roads boards, elected by the ratepayers of their respective districts to take charge of the formation, construction and maintenance of the public roads throughout their districts. There were in 1905 ninety-four such boards in existence. Some of the districts are of enormous size: Pilbarra, for example, has an area of 14,356 sq. m.; Coolgardie North has 75,968 sq. m.; Nullagine has 90,438 sq. m., and the Upper Gascoyne has 136,000 sq. m. Over areas so vast little effective work can be accomplished, but where the districts are small the administration is much the same as in the municipalities. The receipts from rates of all local districts in 1905 was £104,760, and the grants by the government £80,938, making a total of £185,698.

Education.—Attendance at school is compulsory upon all children over six years and under fourteen years of age. Instruction is imparted only in secular subjects, but the law allows special religious teaching to be given during half an hour each day by clergymen to children of their own denomination. Children can claim free education on account of inability to pay fees, of living more than a mile from school, or of having attended school for more than 400 half-days during the preceding year. The state expended in 1905 £131,585 on public instruction, the great bulk of which was devoted to primary schools. The number of schools supported by the state in that year was 335, the teachers numbered 888, the net enrolment of scholars was 27,978, and the average attendance 23,703. There were in 1905 99 private schools with 350 teachers and 7353 scholars, the average attendance being 6128.

Judged by the number of persons arrested, crime is more prevalent than in any other part of Australia. The gold-fields have attracted some of the best and most enterprising of the Australian population; at the same time many undesirable persons flocked to the state expecting to reap a harvest in the movement and confusion of the gold diggings. These latter form a large part of the criminal population of the state. The arrests in 1905 numbered 14,646, of which 2104 were for serious offences; so that for every thousand of the population 49 were arrested for trivial and 8 for serious crimes.

Finance.—The discovery of gold and the settlement on the gold-fields of a large population, for the most part consumers of dutiable goods, has entirely revolutionized the public finances of the state. In 1891 the revenue was £497,670, that is, £10, 15s. per inhabitant; in 1895 it rose to £1,125,941, or £12, 10s. per inhabitant; and in 1897 to £2,842,751, or £20, 12s. 2d. per inhabitant. For 1905 the figures were £3,615,340, or £14, 18s. 5d. per inhabitant. The chief sources of revenue in 1905 were: customs and excise, £1,027,898; other taxation, £221,738; railways, £1,629,956; public lands (including mining), £207,905; all other sources, £527,843. The expenditure has risen with the revenue, the figures for 1905 being £3,745,224, equal to £15, 9s. 2d. per head of population. The chief items of expenditure in 1905 were: railway working expenses, £1,297,499; public works, £337,927; interest and charges upon debt, £578,704; mines, £248,496; education, £149,552. The public debt is of comparatively recent creation. In August 1872 an act was passed authorizing the raising of certain sums for the construction of public works; in 1881 the amount owing was not more than £511,000, and in 1891 only £1,613,000 or £30, 5s. 8d. per inhabitant; from the year last named the indebtedness has increased by leaps and bounds, and in 1905 had mounted up to £16,642,773, a sum equal to £66, 10s. 4d. per inhabitant, involving an interest charge of £574,406 or £2, 5s. 1d. per inhabitant. The proceeds of the loans were used largely for the purpose of railway extension—the expenditure on this service at the middle of 1906 was £9,618,970; on water supply and sewerage works, £2,892,390; on telegraphs and telephones, £269,308; on harbour and river improvements, £2,182,529; on development of gold-fields, £973,082; on development of agriculture, £597,189.

Defence.—The local defence force of Western Australia in 1905 comprised 57 permanent artillerymen, 772 militia, 580 volunteers, and 2534 riflemen—a total of 3943. The defence of the state is undertaken by the federal government.

Minerals.—Gold-mining is the main industry, and in 1905 16,832 miners were directly engaged in it; as large a number is indirectly engaged in the industry. Gold, silver, coal, tin and copper are the chief minerals mined; the mineral production of the state in 1905 was valued at £8,555,841. The value of the gold produced was £8,305,654, a falling off of £118,572 as compared with 1904. The dividends paid by the gold-mining companies for that year amounted to £2,167,639 as against £2,050,547 in 1904. Up to 1905 the total recorded mineral production of Western Australia amounted in value to £65,012,499—gold representing £63,170,911 of that sum; while £13,739,842 had been paid in dividends.

Western Australia ranks as the largest gold producer of the Australian group. Coal is worked at Collie, 25 m. E. of Bunbury; boring operations which had been going on between Greenough and Mullewa on the Geraldton-Cue railway line were discontinued in 1905, the bore hole, carried to a depth of 1418 ft. having failed to disclose any coal seams. The export of copper in 1905 was valued at £16,266; of tin, £86,840; of silver, £44,278. The value of the coal produced in that year was £55,312.

Industries.—The agricultural possibilities of the state are more restricted than those of the eastern states, as the rainfall in the southern and temperate portion does not extend far from the coast, and the land where the fall is satisfactory is only good over small areas. The area cultivated in 1871 was 52,000 acres; in 1881 it was 53,000 acres; in 1891, 64,000 acres; and in 1905, 467,122 acres. The principal crops grown in the year last named were: wheat, 195,071 acres; oats, 15,713 acres; hay, 124,906 acres. The wheat yield was 11·83 bushels per acre, and the hay crop 1·12 tons per acre. In 1905 the number of sheep depastured was 3,120,703; cattle, 631,825; horses, 97,397. These figures show an increase for all classes of stock. There are in the state about 2000 camels. The number of sheep has increased considerably in late years. In 1871, 2,000,000 ℔ of wool were exported; in 1881, 4,100,000 ℔; in

1891, 8,800,000 ℔; in 1900, 9,514,000 ℔; and in 1905, 17,489,402 ℔; the value of the latter being £594,872.

Western Australia has very extensive forests of timber, and it has been estimated that the forest surfaces cover more than 20 million acres, of which 8 million acres are jarrah; 1,200,000 acres, karri; 200,000 acres, tuart; 7 million acres, wandoo; and 4 million acres, York gum, yate, sandalwood and jam. The principal timber exported is jarrah, karri, and sandalwood, the value of the exports being about £656,000 annually. There are 30 saw-mills in operation, employing altogether 2750 hands.

Fisheries are taking an important position; they comprise pearl shell fishing bêche-de-mer, and preserved or tinned fish. The pearl shell fisheries in the north-west and in Shark's Bay have been a considerable source of wealth, the export of pearls and pearl shell being valued at £110,667 in 1899, £106,607 in 1900 and £171,237 in 1903. In 1892 the export was valued at £119,519.

Mandurah, at the mouth of the Murray, and Fremantle have preserving sheds for mullet and snapper. Guano beds are worked to much advantage at the Lacepede Isles. Salt is produced largely at Rottnest Island. Raisins are dried, and the oil of castor trees is expressed. The mulberry tree succeeds well, and sericulture is making progress. Dugong oil is got from Shark's Bay. Honey and wax are becoming valuable exports; from the abundance of flowers the hives can be emptied twice a year. Manna and gums of various kinds are among the resources of the country. Among the wines made are the Riesling, Burgundy, Sweetwater, Hock and Fontainebleau.

Commerce.—All the great lines of steamers trading between Australia and Europe make one of the ports a place of call both on the inward and outward voyage; this makes the shipping tonnage very large compared with the population. In 1891 the tonnage entered and cleared equalled 21 tons per head, and in 1905 14·3 tons. The increase of tonnage is shown by the following figures: 1881, tonnage entered, 145,048; 1891, 533,433; 1905, 1,839,227. In 1905 the tonnage entering Fremantle was 1,176,982, and the imports were valued at £6,030,415. The shipping entering Albany had a tonnage of 519,377, and the imports were valued at £160,305. The trade of Bunbury was: shipping 92,281 tons, imports £59,197; Broome, shipping 32,191 tons, imports £48,653; other ports, shipping 18,396 tons, imports £182,739.

The trade has increased very rapidly under the influence of the gold discoveries, as the following figures show:—

Year.	Imports.				Exports.			
	Total.	Per Head.			Total.	Per Head.		
		£	s.	d.		£	s.	d.
1861	147,913	9	9	8	95,789	6	2	10
1871	226,000	9	0	10	209,196	8	6	11
1881	404,831	13	14	3	502,770	17	0	8
1891	1,280,093	25	2	5	799,466	15	13	9
1901	6,454,171	34	4	5	8,515,623	45	3	0
1905	6,481,309	25	18	1	9,871,219	39	9	1

About 54% of the trade is with Great Britain and 21% with the other Commonwealth states.

Railways.—Western Australia is the only state of Australia in which there is any considerable length of railway lines not owned by the state. The total railway mileage in 1905 was 2260, of which 655 m. were privately owned. The divergence of the policy of Western Australia from that pursued by other states was caused by the inability of the government to construct lines at a time when the extension of the railway was most urgently required in the interests of settlement. Private enterprise was therefore encouraged by liberal grants of land to undertake the work of construction. Changed conditions have modified the state policy in respect of land grants, and in 1897 the government acquired the Great Southern railway, 243 m. in length, one of the two trunk lines in private hands. The cost of constructing and equipping the state lines open for traffic in 1905 was £9,808,458; the earnings for that year amounted to £1,610,129, the working expenses were £1,256,003, and the net receipts £354,126; this represents a return of 3·61% upon the capital cost.

Posts and Telegraphs.—The postal business has grown enormously since the gold discoveries. In 1905 there were 295 post offices as compared with 86 in 1891. In the latter year the letters despatched and received numbered 3,200,000, and the newspapers 1,665,000; in 1905 the letters and postcards totalled 22,107,000, and the newspapers and packets 14,800,000, being respectively 88 and 59 per head of population. There were in the same year 188 telegraph stations, 6389 m. of line, and 9637 m. of telegraph wire in use, while the number of telegrams sent and received was 1,634,597. There were sixteen public telephone exchanges and 4857 telephones in use at the end of that year.

Banking.—There are six banks of issue, with 109 branches in various parts of the country. The liabilities of these banks in 1904 averaged £5,206,170, and the assets £6,399,305; the note circulation was £354,810; the deposits bearing interest £1,475,616; deposits not bearing interest £3,258,294, making the total deposits £4,733,910. The gold and silver held by the banks, including bullion, was £2,129,304. The savings banks are directly controlled by the government and are attached to the post offices; in 1904 there were 54,873 depositors in these banks with £2,079,764 to their credit—an average of £37. 18s. per depositor. In 1891 there were only 3564 depositors and £46,181 at credit.

Authorities.—James Bonwick, *Western Australia, its Past and Future*, 8vo (London, 1885); Very Rev. J. Brady, *Descriptive Vocabulary of the Native Language of Western Australia* (Rome, 1845); Hon. D. W. Carnegie, *Spinifex and Sand* (London, 1898); Ernest Favenc, *The Great Australian Plain*, 8vo (Sydney, 1881), *Western Australia, its Past History, Present Trade and Resources, &c.* (Sydney, 1887); Sir John Forrest, *Explorations in Australia*, 8vo (London, 1875); M. A. C. Frazer, *Western Australia Year-Book*, annually (Perth). (T. A. C.)

History.—Both the western and northern coasts of the colony are pretty accurately laid down on maps said to date from 1540 to 1550, where the western side of the continent terminates at Cape Leeuwen. The discovery of the coast may be attributed to Portuguese and Spanish navigators, who were in the seas northward of Australia as early as 1520. The next visitors, nearly a century later, were the Dutch. John Edel explored northward in 1619, and De Witt in 1628. The "Gulde Zeepaard" in 1627 sailed along the south coast for 1000 m., the territory being named Nuyt's Land. Tasman made a survey of the north shore in 1644, but did not advance far on the western border. Dampier was off the north-west in 1688 and 1696, naming Shark's Bay. Vancouver entered King George Sound in 1791. The French, under D'Entrecasteaux, were off Western Australia in 1792; and their commodore Baudin, of the "Géographe" and "Naturaliste," in 1801 and 1802 made important discoveries along the western and north-western shores. Captain Flinders about the same time paid a visit to the Sound, and traced Nuyt's Land to beyond the South Australian boundary. Freycinet went thither in 1818. Captain King surveyed the northern waters between 1818 and 1822.

The earliest settlement was made from Port Jackson, at the end of 1825. Owing to a fear that the French might occupy King George Sound, Major Lockyer carried thither a party of convicts and soldiers, seventy-five in all, and took formal British possession, though Vancouver had previously done so. Yet the Dutch had long before declared New Holland, which then meant only the western portion of Australia, to be Dutch property. This convict establishment returned to Sydney in 1829. In 1827 Captain Stirling was sent to report upon the Swan river, and his narrative excited such interest in England as to lead to an actual free settlement at the Swan river. Captain Fremantle, R.N., in 1827 took official possession of the whole country. Stirling's account stimulated the emigration ardour of Sir F. Vincent, and Messrs Peel, Macqueen, &c., who formed an association, securing from the British government permission to occupy land in Western Australia proportionate to the capital invested, and the number of emigrants they despatched thither. In this way Mr Peel had a grant of 250,000 acres, and Colonel Latour of 103,000. Captain (afterwards Sir James) Stirling was appointed lieutenant-governor, arriving June 1, 1829. The people were scattered on large grants. The land was poor, and the forests heavy; provisions were at famine prices; and many left for Sydney or Hobart Town. The others struggled on, finding a healthful climate, and a soil favouring fruits and vegetables, whilst their stock grazed in the more open but distant quarters. The overland journey of Eyre from Adelaide to King George Sound in 1839–1840, through a waterless waste, discouraged settlers; but Grey's overland walk in 1838 from Shark's Bay to Perth revealed fine rivers and good land in Victoria district, subsequently occupied by farmers, graziers and miners. The difficulties of the settlers had compelled them to seek help from the British treasury, in the offer to accept convicts. These came in 1850; but transportation ceased in 1868, in consequence of loud protests from the other colonies.

The progressive history of Western Australia may be said to commence in 1870, when its energetic and capable governor, Sir Frederick Weld, began to inaugurate public works on a large scale. It was still the day of small things, for the colony, though of the enormous extent of 1,000,000 sq. m., was practically unknown, its resources were restricted, and its population scanty. However, a beginning was then made, and the first Loan Bill to raise money for pushing on telegraphs, for surveying lines of projected railways, and above all for starting exploring expeditions, passed the Legislative Council. The colony was fortunate in possessing two brothers of the best practical type of explorer, John and Alexander Forrest. The object of their earliest expeditions was to find more land available for pastoral or agricultural settlement. Vast distances in various directions were covered, and severe hardships, chiefly from want of water, undergone by these intrepid pioneers. Perhaps the most famous of these journeys was that accomplished by Mr (afterwards Sir) John Forrest between Eucla and Adelaide in 1870. Other dauntless explorers—notably Mr Ernest Giles, the Gregorys and Mr Austin—had also contributed to the growing knowledge of the resources of the vast territory, and the state owes and gratefully acknowledges its debt to these stalwart and splendid pioneers. Although, in consequence of the vast amount of gold which had been found in the eastern colonies, principally in Victoria, all these explorers had carefully examined any likely country for traces of gold, it was not until 1882 that the government geologist reported indications of auriferous country in the Kimberley district, and the first payable gold-field was shortly afterwards "proclaimed" there. Exploring expeditions in every direction were then started both privately and publicly, and prosecuted with great vigour. Within five years gold-fields were proclaimed at Yilgarn, about 200 m. to the east of Perth, and the discovery of patches of rich alluvial gold in the Pilbarra district quickly followed, but the rush for the Coolgardie and Kalgoorlie gold-fields did not begin until 1893.

The year 1889 found the colony on the eve of responsible government. Two years before, a practically unanimous vote of the Legislature had affirmed the principle of autonomy, and the general election in the following year showed still more plainly the desire of the people of Western Australia for the self-government which had enabled the eastern colonies to control their own affairs successfully for thirty years. The new Legislative Council of 1889 therefore drafted a Constitution Bill, which after some discussion was forwarded to Lord Knutsford, the Secretary of State for the Colonies. This Bill was duly laid before the Imperial Parliament; but the measure was then rejected by that assembly, chiefly owing to the misunderstanding of vital questions, such as the control of crown lands, the scantiness of the scattered population, and other less important details. However, the governor of that day, Sir Frederick Napier Broome, K.C.M.G., having satisfied himself that the constitutional change was necessary not only for the immediate needs of the rapidly growing colony, but in view of the larger question of Imperial Federation, supported the demands of the Legislature in every possible way. A clear and able statement of the colonists' case, which appeared above his signature in *The Times* in the summer of that year, helped to bring about a better understanding of the subject; and a slightly modified Constitution Bill having been passed by the new Legislative Council, the governor and two members of the Legislature (Sir T. C. Campbell and Mr S. H. Parker, Q.C.) were selected to proceed to England as delegates to explain and urge the wishes of the colonists upon the Imperial Parliament. A select committee, with Baron de Worms as chairman, was appointed, and the matter was carefully considered; with the satisfactory result that the Bill enabling the Queen to grant a constitution to Western Australia passed its third reading in the House of Commons on 4th July, and received the royal assent on 15th August 1890.

Since then the colony has made great progress. Sir John Forrest, who was for ten years its Premier, brought to his arduous task not only administrative ability of a very high order, but a thorough and intimate knowledge of the needs and resources of the vast colony over so much of which he had travelled.

For a long time the advantages of Federation were not so apparent to the people of Western Australia as to those of the eastern colonies, and although Sir John Forrest consistently and patiently laboured at every opportunity to explain the principles of the Bill framed by the Federal Convention which had held its sittings since 1886 in Adelaide, Sydney and Melbourne, the desire to federate was of slow growth. Among the objections was the feeling that so far as Western Australia was concerned the step was premature, and that the colony had more to lose than gain by Federation. This applied chiefly to the questions of tariff and free trade, and to the loss of the individual control of such sources of revenue as customs, postal and telegraph services. On the subject of defence there could be but one opinion, in favour of Federation, but that was hardly enough to counterbalance the fears of the local producer, who had become accustomed to a protective tariff. Then the gold-fields expressed a desire to be made into a separate colony, and although a numerously signed petition to that effect was forwarded to the Queen, it was regarded in the light of a party move, and did not prove successful. Still there was great hesitation on the part of many of the colonists of Western Australia to join the Commonwealth without receiving a pledge for the retention of their own customs dues for five years, and early in 1900 Sir John Forrest made a personal attempt to obtain this concession from the sister governments. He was, however, unsuccessful, as was Mr S. H. Parker, Q.C., who in the same year accompanied the delegates from the eastern colonies to London, and endeavoured to obtain the insertion in the Enabling Bill of certain recommendations of the select committee in Perth. Yet as a whole the people of Western Australia were loyal to the Federal cause, and therefore it was considered best to submit the Bill to a referendum of the electors, when a majority of over 25,000 votes decided in favour of Federation, as the Constitution Act provided that this state should have the right to enact her own tariff as against the sister states for the desired five years, decreasing annually at the rate of one-fifth of the amount of the original duty until the whole disappeared. (M. A. B.)

WESTFIELD, a township of Hampden county, Massachusetts, U.S.A., on the Westfield river, about 10 m. W. of Springfield. Pop. (1890) 9805; (1900) 12,310 (2441 being foreign-born); (1905, state census) 13,611; (1910) 16,044. It is served by the New York, New Haven & Hartford and the Boston & Albany railways, and is connected with Springfield, Holyoke and Huntington by electric lines. The township lies in and on either side of a deep alluvial valley, 6-7 m. long from east to west and 2-3 m. wide, and includes the large village of Westfield and the small villages of East Farms, Mundale, Middle Farms, Little River, West Farms and Wyben. In the township are the Westfield State Normal School (1844), the Westfield Atheneum (incorporated in 1864), which in 1910 had a library of 25,000 volumes, and the Noble hospital (1893). Westfield Academy, a famous secondary school, chartered in 1793 and opened in 1800, was closed in 1866 and its building and grounds were sold in 1877 to the township for a public high school. Woronoco Park (200 acres), in the western part of the township, is a tract of great natural beauty. Westfield manufactures more whips than any other place in the United States, the factory of the United States Whip Company being one of the largest in the world; this industry was begun here early in the 19th century. Other important manufactures are foundry and machine-shop products, paper, thread and bicycles. In 1905 the value of the factory product was $5,818,130, an increase of 31% since 1900. A trading post, known by the Indian name Woronoco (or Woronoko), was established here about 1640. In 1669 the township, which had previously been part of Springfield, was erected under its present name—it was then the westernmost township in Massachusetts. Land was added to it in 1713, and parts were taken from it to add to Southwick (1770 and 1779), to Montgomery (1780), to Russell (1792), and to West Springfield (1802).

See James C. Greenough, "The Town of Westfield," in vol. ii. (pp. 317-456) of *A History of Hampden County, Massachusetts* (3 vols., 1902), edited by Alfred M. Copeland; and John Alden, *History of Westfield* (Springfield, 1851).

WESTGATE-ON-SEA, a watering-place in the Isle of Thanet parliamentary division of Kent, England, 2 m. W. by S. of Margate on the South-Eastern & Chatham railway. Pop. (1901) 2738. It is of modern growth and noted for its healthy climate. Facing the sea there are gardens and promenades over 1 m. in length, and there is a marine drive along the top of the cliffs. There are also golf links and other appointments of a popular resort. BIRCHINGTON, immediately to the west (pop 2128), is also a growing resort. The church of All Saints is

Perpendicular, with an Early English tower, and contains some interesting monuments.

WEST HAM, a municipal, county, and parliamentary borough of Essex, England, forming an eastward suburb of London. Pop. (1891) 204,903, (1901) 267,358. The parish stretches north and south from Wanstead and Leyton to the Thames, and east and west from East Ham to the river Lea. It is divided into four wards—Church Street, Stratford-Langthorne, Plaistow and Upton. The church of All Saints has a good Perpendicular tower, but the remainder is extensively restored. There are a number of old monuments. In the restoration of 1866 some early mural painting was discovered, and a transition Norman clerestory was discovered, remaining above the later nave. There are several modern churches, and a Franciscan monastery and school (St Bonaventure's). West Ham Park (80 acres) occupies the site of Ham House and park, for many years the residence of Samuel Gurney, the banker and philanthropist. The place was purchased for £25,000, and vested in the corporation of London for the use of the public. Of this amount the Gurney family contributed £10,000 and the corporation the same sum, the remaining £5000 being collected from the inhabitants of West Ham. The house was taken down, and the park was opened in 1874. Mrs Elizabeth Fry lived in a house in Upton Lane, on the confines of her brother's park. In 1762 the number of houses in West Ham parish was stated to be 700, of which "455 are mansions and 245 cottages." Now few large houses remain, but the smaller houses have greatly increased. There are numerous chemical and other manufactures which have been removed from London itself; and the large population can also be traced in part to the foundation of the Victoria and Albert docks at Plaistow. Included within the borough are the extensive railway works of the Great Eastern railway at Stratford. This industrial centre is continued eastward in the urban district of East Ham (pop. 96,018), where the old village church of St Mary Magdalene retains Norman portions. West Ham is governed by a mayor, 12 aldermen and 36 councillors. Area 4683 acres.

At the time of the Conquest West Ham belonged to Alestan and Leured, two freemen, and at Domesday to Ralph Gernon and Ralph Peverel. West Ham village was included in the part which descended to the Gernons, who took the name of Montfichet. The manor of West Ham was settled upon Stratford-Langthorne Abbey, founded by William de Montfichet in 1135 for monks of the Cistercian order. The abbey stood in the marshes, on a branch of the Lea known as the Abbey Creek, about ½ m. south of Stratford Broadway. West Ham received the grant of a market and annual fair in 1253. The lordship was given to the abbey of Stratford, and, passing to the crown at the dissolution, formed part of the dowry of Catherine of Portugal, and was therefore called the Queen's Manor. In 1885 the urban sanitary district was erected into a parliamentary borough, returning two members for the northern and southern divisions respectively. It was incorporated in 1886.

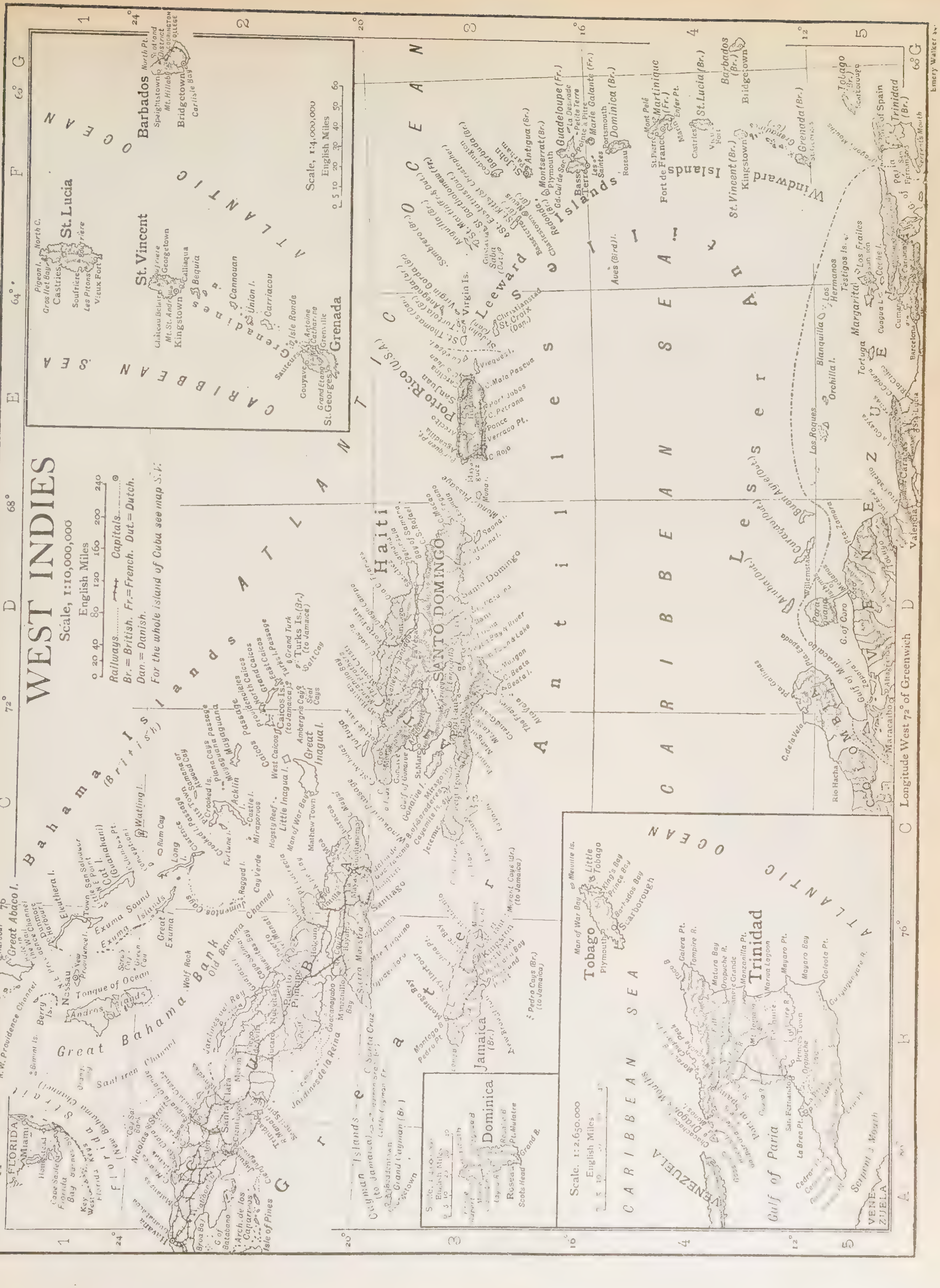
WEST HAVEN, a borough of Orange township, New Haven county, Connecticut, U.S.A., on New Haven Harbor and separated from New Haven by the West river. Pop. (1900) 5247 (893 foreign-born); (1910) 8543. West Haven is served by the New York, New Haven, & Hartford railway. It is mainly a residential suburb of New Haven. There is a public park, and Savin Rock, rising from Long Island Sound, is a summer resort. West Haven was set apart from New Haven in 1822 and was united with North Milford to form the township of Orange; it was incorporated as a borough in 1873.

WEST HOBOKEN, a town of Hudson county, New Jersey, U.S.A., in the N.E. part of the state, adjoining Hoboken and Jersey City. Pop. (1890) 11,665; (1900) 23,094, of whom 9119 were foreign-born; (1910, census) 35,403. For transportation facilities the town depends upon the railways serving Hoboken and Jersey City. West Hoboken lies about ¼ m. W. of the Hudson river, occupies a pleasant site somewhat higher than that of its neighbouring municipalities, and commands a fine view of the surrounding country. Among the prominent buildings are a Carnegie library, St Michael's Monastery (containing a theological school), a Dominican Convent, and several fine churches; and there are two Roman Catholic orphanages. The town is an important centre for the manufacture of silk and silk goods; in 1905 the value of these products was $4,211,018. West Hoboken was created a separate township in 1861, from a part of the township of North Bergen, and in 1884 was incorporated as a town.

WESTHOUGHTON, an urban district in the Westhoughton parliamentary division of Lancashire, England, 5 m. W.S.W. of Bolton on the Lancashire and Yorkshire railway. Pop. (1901) 14,377. There are coal mines in the neighbourhood, and the town possesses silk factories, print-works and cotton mills. Westhoughton before the time of Richard II. was a manor belonging to the abbey of Cockersand. It was confiscated at the Reformation, and since then has been vested in the crown. The army of Prince Rupert assembled on Westhoughton moor before the attack on Bolton.

WEST INDIES, THE, sometimes called the Antilles (*q.v.*), an archipelago stretching in the shape of a rude arc or parabola from Florida in North America and Yucatan in Central America to Venezuela in South America, and enclosing the Caribbean Sea (615,000 sq. m.) and the Gulf of Mexico (750,000 sq. m. in area). The land area of all the islands is nearly 100,000 sq. m., with an estimated population of about 6½ millions; that of the British islands about 12,000 sq. m. The islands differ widely one from another in area, population, geographical position, and physical characteristics. They are divided into the Bahamas, the Greater Antilles (Cuba, Jamaica, Haiti and Porto Rico), and the Lesser Antilles (comprising the remainder). The Lesser Antilles are again divided into the Windward Islands and Leeward Islands. Geographically, the Leeward Islands are those to the north of St Lucia, and the Windward, St Lucia and those to the south of it; but for administrative purposes the British islands in the Lesser Antilles are grouped as is shown in the table given later.

Geology.—The West Indies are the summits of a submerged mountain chain, the continuation of which towards the west must be sought in the mountains of Honduras. In Haiti the chain divides, one branch passing through Jamaica and the other through Cuba, the Cayman Islands and the Misteriosa Bank. In *Das Antlitz der Erde*, E. Suess divides the Antilles into three zones: (1) The first or interior zone, which is confined to the Lesser Antilles, is entirely of volcanic origin and contains many recent volcanic cones. It forms the inner string of islands which extends from Saba and St Kitts to Grenada and the Grenadines. The western part of the deep-cleft island Guadeloupe belongs to this zone. (2) The second zone consists chiefly of Cretaceous and early Tertiary rocks. In the west it is broad, including the whole of the Greater Antilles, but in the east it is restricted to a narrow belt which comprises the Virgin Islands (except Anegada), Anguilla, St Bartholomew, Antigua, the eastern part of Guadeloupe and part of Barbados. (3) The third and outermost zone is formed of Miocene and later beds, and the islands which compose it are flat and low. Like the second zone it is broad in the west and narrow in the east. It includes the Bahamas, Anegada, Sombrero, Barbuda and part of Barbados. Geologically, Florida and the plain of Yucatan may be looked upon as belonging to this zone. Neither Trinidad nor the islands off the Venezuelan coast can be said to belong to any of these three zones. Geologically they are a part of the mainland itself. They consist of gneisses and schists, supposed to be Archaean, eruptive rocks, Cretaceous, Tertiary and Quaternary deposits; and the strike of the older rocks varies from about W.S.W. to S.W. Geologically, in fact, these islands are much more nearly allied to the Greater Antilles and to Central America than they are to the Lesser Antilles; and there is accordingly some reason to believe that the arc formed by the West Indian Islands is really composite in origin. Although the three zones recognized by Suess are fairly clearly defined, the geological history of the Greater Antilles, with which must be included the Virgin Islands, differs considerably from that of the Lesser. In Cuba and Haiti there are schists which are probably of pre-Cretaceous age, and have, indeed, been referred to the Archaean; but the oldest rocks which have yet been certainly identified in the West Indies belong to the Cretaceous period. Throughout the Greater Antilles the geological succession begins as a rule with volcanic tuffs and conglomerates of hornblende-andesite, &c., in the midst of which are intercalated occasional beds of limestone with *Rudistes* and other Cretaceous fossils. These are overlaid by sediments of terrigenous origin, and the whole series was folded before the deposition of the next succeeding strata. The nature of these Cretaceous deposits clearly indicates the neighbourhood of an extensive area of land;



WEST INDIES

Scale, 1:10,000,000

English Miles 0 20 40 80 120 160 200 240

Railways……… Capitals………

Br. = British. Fr. = French. Dut. = Dutch. Dan. = Danish.

For the whole island of Cuba see map S.V.

Longitude West 72° of Greenwich

Emery Walker sc.

Bahama Islands (British)
Great Bahama Bank
Old Bahama Channel
Florida
Straits of Florida
Cayman Islands (to Jamaica)
Jamaica (Br.)
Haiti
SANTO DOMINGO
Porto Rico (U.S.A.)
Virgin Is.
Leeward Islands
Windward Islands
Lesser Antilles
Greater Antilles
ATLANTIC OCEAN
CARIBBEAN SEA
VENEZUELA
COLOMBIA
St. Lucia
St. Vincent
Grenada
Barbados
Grenadines
Dominica
Tobago
Trinidad
Gulf of Paria
Scale, 1:4,000,000
Scale, 1:2,650,000
English Miles
Isle of Pines
Turks Is. (Br.)
Caicos Is.
Martinique (Fr.)
Guadeloupe (Fr.)
Antigua (Br.)
St. Croix (Dan.)
Curaçao (Dut.)
Aruba (Dut.)
Buen Ayre (Dut.)
Margarita

but during the succeeding Eocene period and the early part of the Oligocene, a profound subsidence led to the deposition of the Globigerina chalks and white Radiolarian earths of Jamaica, Cuba and Haiti. The Greater Antilles must at this time have been almost completely submerged, and the similar deposits of Barbados and Trinidad point to a similar submergence beyond the Windward Islands. In the middle of the Oligocene period a mighty upheaval, accompanied by mountain folding and the intrusion of plutonic rocks, raised the Greater Antilles far above their present level, and united the islands with one another, and perhaps with Florida. A subsequent depression and a series of minor oscillations finally resulted in the production of the present topography.

The geology of the Lesser Antilles is somewhat different. In some of the islands there are old volcanic tuffs which may possibly be the equivalents of the Cretaceous beds of Jamaica, but volcanic activity here continued throughout the Tertiary period and even down to the present day. Another important difference is that except in Trinidad and Barbados, which do not properly belong to the Caribbean chain, no deep-sea deposits have yet been found in the Lesser Antilles and there is no evidence that the area ever sank to abysmal depths.

In the foregoing account the chronology of R. T. Hill has been followed; but there is still considerable difference of opinion as to the ages and correlation of the various Tertiary deposits and consequently as to the dates of the great depression and elevation. J. W. Spencer, for example, places the greatest elevation of the Antilles in the Pliocene and Pleistocene periods. Moreover, chiefly on the evidence of submerged valleys, he concludes that practically the whole of the Caribbean Sea was land and that a complete connexion existed, by way of the West Indian bridge, between North and South America.[1]

The mineral wealth of the islands is not remarkable. Gold, silver, iron, copper, tin, platinum, lead, coal of a poor quality, cobalt, mercury, arsenic, antimony, manganese, and rock salt either have been or are worked. Asphalt is worked to considerable advantage among the pitch lakes of Trinidad. Opal and chalcedony are the principal precious stones.

Climate.—As in most tropical countries where considerable heights are met with—and here over 15,500 sq. m. lie at an elevation of more than 1500 ft. above sea-level—the climate of the West Indies (in so far at least as heat and cold are concerned) varies at different altitudes, and on the higher parts of many of the islands a marked degree of coolness may generally be found. With the exception of part of the Bahamas, all the islands lie between the isotherms of 77° and 82° F. The extreme heat, however, is greatly tempered by the sea breezes, and by long, cool, refreshing nights. Frost is occasionally formed in the cold season when hail falls, but snow is unknown. The seasons may be divided as follows. The short wet season, or spring, begins in April and lasts from two to six weeks, and is succeeded by the short dry season, when the thermometer remains almost stationary at about 80° F. In July the heat increases to an extent well nigh unbearable. No change occurs till after a period varying from the end of July to the beginning of October, when the great rainfall of the year begins, accompanied by tremendous and destructive hurricanes. This season is locally known as the "hurricane months." The annual rainfall averages 63 in. These storms arise in the Atlantic and towards the east. For a day or two they follow a westerly course, inclining, at the same time, one or two points towards the north, the polar tendency becoming gradually more marked as the distance from the equator increases. When the hurricanes reach latitude 25° N., they curve to the north-east, and almost invariably wheel round on arriving at the northern portion of the Gulf of Mexico, after which they follow the coast line of North America. Their rate of speed varies considerably, but may be said to average 300 m. per day among the islands. The usual signs of the approach of the cyclones are an ugly and threatening appearance of the weather, sharp and frequent puffs of wind, increasing in force with each blast, accompanied with a long heavy swell and confused choppy sea, coming from the direction of the approaching storm. December marks the beginning of the long dry season, which, accompanied by fresh winds and occasional hail showers, lasts till April. The average temperature of the air at Barbados, which may be taken as a favourable average, is, throughout the year, 80° F. in the forenoon, and about 82° in the afternoon. The maximum is 87°, and the minimum 75°.

Flora.—The flora of the islands is of great variety and richness, as plants have been introduced from most parts of the globe, and flourish either in a wild state or under cultivation; grain, vegetables, and fruits, generally common in cool climates, may be seen growing in luxuriance within a short distance of like plants which only attain perfection under the influence of extreme heat, nothing being here required for the successful propagation of both but a difference in the height of the lands upon which they grow. The forests, which are numerous and wide-spreading, produce the most valuable woods and delicious fruits. Palms are in great variety, and there are several species of gum-producing trees. Some locust trees have been estimated to have attained an age of 4000 years, and are of immense height and bulk. *Piptadenia*, on account of its almost imperishable character when in the ground, is used as a material for house-building. *Xanthoxylon*, the admired and valuable satin-wood of commerce, is common; *Sapindus* finds a ready market on account of its toughness; crab-wood yields a useful oil and affords reliable timber; and tree ferns of various species are common. Pimento is peculiar to Jamaica. But it is to the agricultural resources of the islands that the greatest importance attaches. For centuries almost the whole care of the planters was bestowed upon the cultivation of the sugar-cane and tobacco plant, but in modern times, as will be seen later, attention has been turned to the production of other and more varying crops. Crops of tobacco, beans, peas, maize, and Guinea corn are popular, and a species of rice, which requires no flooding for its successful propagation, is largely produced. *Hymenachne striatum* covers many of the plains, and affords food for cattle.

Fauna.—The fauna of the region is Neotropical, belonging to that region which includes South and part of Central America, although great numbers of birds from the North-American portion of the Holarctic realm migrate to the islands. The resident birds, however, eighteen genera of which are certainly Neotropical, show beyond doubt to which faunal region the islands properly belong. Mammals are, as in most island groups, rare. The agouti abounds, and wild pigs and dogs are sufficiently numerous to afford good sport to the hunter, as well as smaller game, in the shape of armadillos, opossums, musk-rats and raccoons. The non-migrating birds include trogons, sugar-birds, chatterers, and many parrots and humming birds. Waterfowl and various kinds of pigeons are in abundance. Reptiles are numerous: snakes—both the boa and adder—are innumerable, while lizards, scorpions, tarantulas and centipedes are everywhere. Insects are in great numbers, and are often annoying. Among domestic animals mules are largely reared, and where the country affords suitable pasture and forage cattle-breeding is practised. Goats abound, and large flocks of sheep are kept for the sake of their flesh alone, as the climate is not adapted for wool-growing.

Area and Population.—The following list of the West Indian islands gives their area and population. Notwithstanding the

Name.	Area, sq. m.	Population.	
		1881.	1901 (unless stated).
British—			
Bahamas	5,450	43,521	53,735
Jamaica	4,207	584,170	806,690 [1]
Turks Island	169	4,732	5,287
Leeward Islands:			
Virgin Islands	58	5,287	4,908
St Kitts	63	41,001	29,782
Nevis	50		12,774
Antigua	108	34,964	34,178
Montserrat	32½	10,083	12,215
Dominica	291	28,211	28,894
Barbados	166	171,860	195,588
Windward Islands:			
St Lucia	233	38,551	49,833
St Vincent	140	40,548	44,000 [2]
Grenada	133	42,430	63,438
Trinidad	1,754	171,179	233,397
Tobago	114		18,751
French—			
Guadeloupe	688	..	182,110
Martinique	380	..	182,024 [3]
St Martin (part)	17	..	3,000 [6]
Dutch—			
St Martin (part)	21	..	3,187 [4]
Curaçao	212	..	30,883
Buen Ayre	95	..	6,233
Aruba	69	..	8,555
St Eustatius	8	..	1,283
Saba	5	..	2,294
Danish—			
St Thomas	33	..	11,012
St John	21	..	925
St Croix	84	..	18,590
U.S.A.—			
Porto Rico	3,606	..	1,118,012 [5]
Republics—			
Santo Domingo	18,045	..	500,000 [6]
Haiti	10,240	..	800,000 [6]
Cuba (and adjacent islands)	45,000	..	2,048,980 [7]

[1] Estimate, 1905. [2] Estimate, 1906. [3] 1905.
[4] Populations of all Dutch islands are for 1908.
[5] 1910. [6] Estimate. [7] 1907.

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[1] See E. Suess, *Das Antlitz der Erde* (Wien, 1885; Eng. trans., Oxford, 1904); J. W. Spencer, "Reconstruction of the Antillean Continent," *Bull. Geol. Soc. Amer.*, vol. vi. (1895), p. 103 (Abstract in Geol. Mag., 1894, pp. 448-451): see also a series of papers by J. W. Spencer in *Quart. Journ. Geol. Soc.*, vols. lxvii., lxviii. (1901, 1902); R. T. Hill, "The Geology and Physical Geography of Jamaica," *Bull. Mus. Comp. Zool. Harvard*, vol. xxxiv. (1899).

operations of educational institutions and of large numbers of missionaries of various religious denominations, the percentage of illegitimate births among the population of the British West Indian islands remains very high—in Barbados about 54; in Jamaica, 63; in Trinidad, 59% of the general births; and 79% of the East Indian.

The population of the West Indies represents many original stocks, the descendants of which have developed variations of habits and customs in their New World environment. They may be divided into six main classes: (1) Europeans—immigrants (British, French, Spanish and in a lesser degree Dutch, Danish and German) and West Indian born; (2) African negroes—immigrants (a fast vanishing quantity) and West Indian born; (3) a mixture of Europeans and Africans; (4) coolies from India—imported and West Indian born; (5) Chinese; (6) aboriginal Indians of more or less pure descent. Of these, the people of pure African blood are in a large majority, the "coloured" race of mixed European and African blood being next in numerical importance. Under British influence the negroes of the West Indies have become British in thought and habit; and it would seem that the stimulating influence of European direction and encouragement is absolutely necessary for the future development and progress of these islands. In the republics of Santo Domingo and Haiti the negroes are left to drift along, while the French and Danish islands show no great sign of progress.

British Colonies, Government, &c.—The British West India colonies[1] are either crown colonies—that is to say, their government is absolutely under the control of the British Colonial Office, the official members of their councils predominating, and the unofficial members being nominated by the crown, as in the Windward and Leeward Islands—or they have a measure of representative government, as in the Bahamas, Barbados and Jamaica, in which all or part of the legislatures are elected and are more or less independent of crown control. The laws of the various colonies are English, with local statutes to meet local needs. The governors and high officials are appointed by the crown; other officials are appointed by the governor. Each governor acts under the advice of a privy council. In matters of detail the colonies present a variety of forms of government (for which see the separate articles). Federation has been widely discussed and is held desirable by many, but in view of the insular character of the colonies, the considerable distances separating some of them, and in many instances the lack of common interests (apart from certain broad issues), the project appears to be far from realization.

The only fortified places in the British West Indies are Jamaica, Barbados and St Lucia—all of importance as coaling stations. In many of the islands there are local volunteer forces. The police forces of the colonies are in the main modelled on the Irish constabulary, supplemented by rural constabulary. The force is usually officered by Europeans.

Economic Conditions.—The West Indian colonies have suffered from periods of severe economic depression, though from the early years of the 20th century there has been good evidence of recovery and development. An obvious reason for temporary depression is the liability of the islands to earthquakes and hurricanes, in addition to eruptions in the volcanic islands, such as those in St Vincent and Martinique in 1902. For example, the great earthquake of January 1907 in Jamaica may be recalled, and hurricanes caused serious damage in Jamaica in August 1903 and November 1909, and in the Bahamas in September and October 1908. A treasury fund has been established in Jamaica as a provision against the effects of such disasters. It has been stated that the excessive rainfall which accompanies these storms is of great ultimate benefit to the soil.

The British West Indian colonies do not offer opportunities for ordinary labouring immigrants. Barbados is the only island where the land is entirely settled. But the settlement, planting and development of lands elsewhere involve a considerable amount of capital, and manual labour is provided by the natives or East Indian coolies. Attempts to settle European labourers have been unsuccessful. The West Indian negro, as a labouring class, has frequently been condemned as averse from regular work, apathetic in regard to both his own and his colony's affairs, immoral and dishonest. In so far as these shortcomings exist, they are due to the tendencies inherited from the period of slavery, to the ease with which a bare livelihood may be obtained, and to other such causes. But for the most part the negroes appreciate their advantages under British government and are quick to assimilate British customs and ideas. Advances in the system of peasant proprietorship have brought beneficial results. The drafting of large numbers of labourers from the West Indies to the Panama canal works early in the 20th century, though causing a shortage of labour and involving legislation in some of the islands, exercised a moral effect on the natives by enlarging their horizon.

The growth of general prosperity in the British West Indies is assigned[2] "to the revival of the sugar industry, to the development of the fruit trade; to the increase in the cultivation of cocoa and cotton; to the volume of tourist travel, which swells year by year; and to such local developments as the 'boom' in Trinidad oil." It was pointed out in the *Report* of the Royal Commission on Trade Relations between Canada and the West Indies (Cd. 5369, London, 1910) that "the geographical position of the West Indian Colonies must always tend to throw them under the influence of the fiscal system either of the United States or of the Dominion of Canada. Attempts have been made from time to time to obtain for these Colonies special advantages in the markets of the United States. . . . The Colonial policy of the United States has now finally stopped advance in that direction," and the connexion with the Dominion has therefore become of paramount importance. The Dominion government admitted the West Indies to the British preferential tariff (25% under existing duties) in 1898. The percentage was raised to 33⅓ in 1900. In 1903 the duties imposed on bounty-fed beet sugar in the United States, which had opened the market there to West Indian sugar, were abolished, and a surtax (since removed) was placed on German imports into Canada. Both acts enhanced the value of the Canadian market to the West Indies, while that of the American sugar market was further reduced when in 1901 sugar from Porto Rico began to be admitted thereto free of duty, and when special terms were extended to sugar from the Philippine Islands and Cuba in 1902 and 1903 respectively. The Canadian connexion was thus largely instrumental in saving the sugar industry in the West Indies from severe depression, if not from the actual extinction foreseen by a Royal Commission in 1897. This commission pointed out, in particular, the danger which threatened those colonies where sugar provided practically the sole industrial and commercial interest. On a recommendation of this commission the Imperial Department of Agriculture was established in 1898, its cost being met from imperial funds. It is under a commissioner with headquarters at Barbados. Its functions are to maintain and supervise botanical and experimental stations, to establish agricultural schools, arrange agricultural teaching in other schools, create scholarships, and issue publications. The department has been largely instrumental in establishing new industries and thus relieving many islands from dependence on the sugar industry alone.

The negotiations for commercial relations between the West Indies and Canada began in 1866; in 1872 proposals for steamship subsidies were accepted. The Commission of 1909 recommended that the governments should continue to subsidize a service, for which they suggested various improvements. In 1901 a line of subsidized steamers had been started between Jamaica and England, but this contract expired, and the mail contract was determined in 1910, and recommendations were put forward for a steamship service between Canadian and West Indian ports with improvements additional to those recommended by the Commission. It may be added that the

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[1] It is a common practice to include British Guiana with these, but the present article is confined to the insular colonies.

[2] In *The Times* of May 24, 1910, where, in an imperial supplement, a number of articles on the West Indian colonies appear.

Commission also made recommendations for the reduction of the high cable rates between the West Indies and the United Kingdom.

Besides sugar, the principal products of the islands are cocoa, fruits and cotton. Cotton-growing reached importance in a very short time owing largely to the efforts of the Imperial Department of Agriculture, Sea Island seed having been planted in St Vincent only in 1903, and in that island and elsewhere (Antigua, St Kitts, Montserrat) good crops are now obtained. Grenada is almost entirely, and Trinidad, Dominica and St Lucia are largely, dependent upon cocoa. The fruit and spice trade is of growing importance, and there is a demand for bottled fruit in Canada and elsewhere. The variety of fruits grown is great; the bananas and oranges of Jamaica, the limes of Montserrat, Dominica and St Lucia, and the pine-apples of the Bahamas may be mentioned as characteristic. It must be borne in mind, however, that the islands as a whole cannot be said to possess a community of commercial interests. Even the industries already indicated are by no means equally distributed throughout the islands; moreover there are certain local industries of high importance, such as the manufacture of rum in Jamaica, the production of asphalte and the working of the oilfields (the development of which was first seriously undertaken about 1905) in Trinidad, and the production of arrowroot in St Vincent. Sponges are an important product of the Bahamas, and salt of the Turks Islands. Rubber plantation has been successfully exploited in several islands, such as Trinidad, Dominica and St Lucia. (See further articles on the various islands.)

Religion.—In all the British colonies there is full religious toleration. The Church of England Province of the West Indies is divided into the following bishoprics: Jamaica, Nassau (*i.e.* Bahamas), Trinidad, (British) Honduras, Antigua (*i.e.* Leeward Islands), Barbados, Windward Islands, (British) Guiana. With the exception of Barbados and British Guiana, the Church of England is disestablished, disendowment taking place gradually, the churches thus becoming self-supporting. In Barbados the Church is both established and endowed. In the Bahamas and Jamaica disendowment is gradually taking place; in Trinidad and British Guiana the Church of England receives endowment concurrently with other religious bodies. The Windward Islands, Leeward Islands and British Honduras are totally disendowed. In all the islands, except Trinidad, St Lucia, Grenada and Dominica, the Church of England, though in all cases in a minority when compared with the aggregate of other bodies, is the most numerous of any denomination. There are Roman Catholic bishops at Port-of-Spain (Trinidad), Roseau (Dominica—for the Leeward Islands), Jamaica, British Guiana and Barbados (resident at Georgetown), British Honduras, Guadeloupe, Martinique, Haiti (archbishop and four bishops), Santo Domingo (archbishop), Cuba (archbishop and bishop), Porto Rico and Curaçao. Other religious denominations working actively in the West Indies are the Baptists, Wesleyans, Presbyterians, Congregationalists and Moravians.

History.—The archipelago received the name of the West Indies from Columbus, who hoped that, through the islands, he had found a new route to India. The name of Antilles was derived from the fact that Columbus, on his arrival here, was supposed to have reached the fabled land of Antilia. Columbus first landed on San Salvador, generally identified with Watling Island of the Bahamas, and several voyages to this new land were made in rapid succession by the great discoverer, resulting in the finding of most of the larger islands, and a more intimate knowledge of those already known. The importance of its latest possession was at once recognized by the court of Spain, and, as a first move towards turning the West Indies to profitable account, numbers of the natives, for the most part a harmless and gentle people, were shipped overseas and sold into slavery, others being employed in forced labour in the mines which the Spaniards had opened throughout the archipelago, and from which large returns were expected. Thus early in its history began that traffic in humanity with which the West India plantations are so widely associated, and which endured for so long a time. Goaded to madness by the wrongs inflicted upon them, the aborigines at last took arms against their masters, but with the result which might have been expected—their almost utter extirpation. Many of the survivors sought release from their sufferings in suicide, and numbers of others perished in the mines, so that the native race soon almost ceased to exist. Spain was not long allowed to retain an undisputed hold upon the islands: British and Dutch seamen soon sought the new region, accounts concerning the fabulous wealth and treasure of which stirred all Europe, and a desultory warfare began to be waged amongst the various voyagers who flocked to this El Dorado, in consequence of which the Spaniards found themselves gradually but surely forced from many of their vantage grounds, and compelled very materially to reduce the area over which they had held unchecked sway. The first care of the English settlers was to find out the real agricultural capabilities of the islands, and they diligently set about planting tobacco, cotton and indigo. A French West India Company was incorporated in 1625, and a settlement established on the island of St Christopher, where a small English colony was already engaged in clearing and cultivating the ground; these were driven out by the Spaniards in 1630, but only to return and again assume possession. About this time, also, the celebrated buccaneers, Dutch smugglers, and British and French pirates began to infest the neighbouring seas, doing much damage to legitimate traders, and causing commerce to be carried on only under force of arms, and with much difficulty and danger. Indeed, it was not till the beginning of the 18th century—some time after Spain had, in 1670, given up her claim to the exclusive possession of the archipelago—that these rovers were rendered comparatively harmless; and piracy yet lingered off the coasts down to the early years of the 19th century. In 1640 sugar-cane began to be systematically planted, and the marvellous prosperity of the West Indies began; it was not from the gold and precious stones, to which the Spaniards had looked for wealth and power, but from the cane that the fortunes of the West Indies were to spring. The successful propagation of this plant drew to the islands crowds of adventurers, many of them men of considerable wealth. The West Indies were for many years used by the English government as penal settlements, the prisoners working on the plantations as slaves. In 1655 a British force made an unsuccessful attack on Haiti, but a sudden descent on Jamaica was more fortunate in its result, and that rich and beautiful island has since remained in the possession of Great Britain. The Portuguese were the first to import negroes as slaves, and their example was followed by other nations having West-Indian colonies, the traffic existing for about 300 years. In 1660 a division of the islands was arranged between England and France, the remaining aborigines being driven to specified localities, but this treaty did not produce the benefits expected from it, and as wars raged in Europe the islands (see separate articles) frequently changed hands.

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WESTMACOTT, SIR RICHARD (1775–1856), British sculptor, was born in London, and while yet a boy learned the rudiments of the plastic art in the studio of his father, who was then a sculptor of some reputation. In 1793, at the age of eighteen, he went to Rome and became a pupil of Canova, then at the height of his fame. Under the prevailing influences of Italy at that time, Westmacott devoted all his energies to the study of classical sculpture, and throughout his life his real sympathies were with pagan rather than with Christian art. Within a year of his arrival in Rome he won the first prize for sculpture offered by the Florentine academy of arts, and in the following year (1795) he gained the papal gold medal awarded by the Roman Academy of St Luke with his bas-relief of Joseph and his brethren. In 1798, on the 20th of February, he married Dorothy Margaret, daughter of Dr Wilkinson of Jamaica. On his return to London Westmacott began to exhibit his works yearly at the Royal Academy, the first work so exhibited being his bust of Sir William Chambers. In 1805 he was elected an associate, and in 1811 a full member of the Royal Academy, his diploma work being a "Ganymede" in high relief; in 1827 he was appointed to succeed Flaxman as Royal Academy professor of sculpture, and in 1837 he was knighted. A very large number of important public monuments were executed by him, including many portrait statues; but little can be said in praise of such works as the statue on the duke of York's column (1833), the portrait of Fox in Bloomsbury Square, or that of the duke of Bedford in Russell Square. Much admiration was expressed at the time for Westmacott's monuments to Collingwood and Sir Ralph Abercromby in St Paul's Cathedral, and that of Mrs Warren in Westminster Abbey; but subjects like these were far less congenial to him than sculpture of a more classical type, such as the pedimental figures representing the progress of civilization over the portico of the British Museum, completed in 1847, and his colossal nude statue of Achilles in bronze, copied from the original on Monte Cavallo in Rome, and reared in 1822 by the ladies of England in Hyde Park as a compliment to the duke of Wellington. He died on the 1st of September 1856.

WESTMEATH, EARL OF, a title held in the Irish family of Nugent since 1621. During the reign of Henry II. Sir Gilbert Nugent received the lordship or barony of Delvin in Meath, which soon passed by marriage from the Nugents to the family of Fitzjohn. About two hundred years later the barony returned to the Nugent family, Sir William Nugent (d. *c.* 1415) marrying Catherine, daughter of John Fitzjohn. The barony, however, is considered to date from the time of Sir William Nugent and not from that of Sir Gilbert, 1389 being generally regarded as the date of its creation.

Sir William Nugent, who is generally called the 1st, but sometimes the 9th, baron Delvin, was succeeded by his son Sir Richard (d. *c.* 1460) as 2nd baron. In 1444 and 1449 Sir Richard was lord deputy of Ireland. His grandson, Richard, the 4th baron (d. *c.* 1538), was summoned to the Irish parliament in 1486. During his whole life he was loyal to the English king, and both before and after the years 1527 and 1528 when he was lord deputy, he took a vigorous part in the warfare against the Irish rebels. Among his descendants was Robert Nugent, Earl Nugent (*q.v.*). Richard's grandson, Christopher, the 6th baron (*c.* 1544–1602), also served England well, but about 1576 he fell under the displeasure of Queen Elizabeth and he was several times imprisoned, being in the intervals employed in Ireland. He was a prisoner in Dublin Castle when he died. Delvin wrote *A Primer of the Irish Language, compiled at the request and for the use of Queen Elizabeth.*

His son, Richard, the 7th baron (1583–1642), took part in 1606 in a plot against the English government and was imprisoned, but he soon escaped from captivity and secured a pardon from James I. In 1621 he was created earl of Westmeath. Having refused in 1641 to join the Irish rebellion, he was attacked by a party of rebels and was so seriously injured that he died shortly afterwards. His grandson, Richard, the 2nd earl (d. 1684), served Charles II. against Cromwell in Ireland and afterwards raised some troops for service in Spain. His grandson Thomas, the 4th earl (1656–1752), served James II. in Ireland. Thomas's brother, John, the 5th earl (1672–1754), left Ireland after the final defeat of James II. and took service in France. He fought against England at the battles of Ramillies, Oudenarde and Malplaquet and remained on active service until 1748. He died in Brabant on the 3rd of July 1754. His son Thomas, the 6th earl (d. 1792), also served in the French army; later he conformed to the established religion, being the first Protestant of his house, and took his seat in the Irish House of Lords in 1755. His son George Frederick, the 7th earl (1760–1814), a member of the Irish House of Commons before 1792, was succeeded by his son George Thomas John (1785–1871), who was created marquess of Westmeath in 1822 and who was an Irish representative peer from 1831 to 1871. He died without legitimate sons on the 5th of May 1871, when the marquessate became extinct.

The earldom of Westmeath now passed to a distant cousin, Anthony Francis Nugent (1805–1879), a descendant of Thomas Nugent (d. 1715) of Pallas, Galway, who was a son of the 2nd earl. Thomas was chief justice of Ireland from 1687 until he was outlawed by the government of William III. In 1689 he was created by James II. baron of Riverston, but the validity of this title has never been admitted. In 1883 his descendant, Anthony Francis (b. 1870), became the 11th earl.

Cadets of the Nugent family were Nicholas Nugent (d. 1582), chief justice of the common bench in Ireland, who was hanged for treason on the 6th of April 1582; William Nugent (d. 1625) an Irish rebel during the reign of Elizabeth; Sir George Nugent, Bart. (1757–1849), who, after seeing service in America and in the Netherlands, was commander-in-chief in India from 1811 to 1813 and became a field-marshal in 1846; and Sir Charles Edmund Nugent (*c.* 1759–1844), an admiral of the fleet. More famous perhaps was Lavall, Count Nugent (1777–1862), who rose to the rank of field-marshal in the Austrian army and was made a prince of the empire. His long and honourable military career began in 1793 and sixty-six years later he was present at the battle of Solferino. His most distinguished services to Austria were during the war with France in 1813 and 1814, and he was also useful during the revolution in Hungary in 1849.

See D'Alton, *Pedigree of the Nugent Family;* and *Historical Sketch of the Nugent Family*, printed by J. C. Lyons (1853).

WESTMEATH, a county of Ireland in the province of Leinster, bounded N.W. by Longford, N. by Cavan, N.E. and E. by Meath, S. by King's county, and W. by Roscommon. The area is 454,104 acres, or about 709 sq. m. The Shannon forms the western boundary. The average height of the surface of the county is over 250 ft. above sea-level. The highest summits are Knocklayde (795 ft.), Hill of Ben (710 ft.) and Knockayon (707 ft.). A large surface is occupied by bog. A special feature of Westmeath is the number of large loughs, which have a combined area of nearly 17,000 acres. In the north, on the borders of Cavan, is Lough Sheelin, with a length of 5 m., and an average breadth of between 2 and 3 m., and adjoining it is the smaller Lough Kinale. In the centre of the county there is a group of large loughs, of which Lough Dereveragh is 6 m. long by 3 broad at its widest part. To the north of it are Loughs Lene, Glore, Bawn and others, and to the south Loughs Iron and Owel. Farther south is Lough Ennell or Belvidere, and in the south-west Lough Ree, a great expansion of the river Shannon, forming part of the boundary with Roscommon. The river Inny, which rises in Co. Cavan, enters Westmeath from Lough Sheelin, and, forming for parts of its course the boundary with Longford, falls into Lough Ree. The Inny has as one of its tributaries the Glore, flowing from Lough Lene through Lough Glore, a considerable part of its course being underground. From Lough Lene the Dale also flows southwards to the Boyne and so to the Irish Sea, and thus this lake sends its waters to the opposite shores of the island. The Brosna flows from Lough Ennell southwards by King's county into the Shannon. The Westmeath loughs have a peculiar fame among anglers for the excellence of their trout-fishing.

Westmeath is essentially a county of the great Carboniferous Limestone plain, with numerous lakes occupying the hollows. Two or three little inliers of Old Red Sandstone, as at Killucan and Moate, form distinctive hills, about 500 ft. in height. At Sron Hill near Killucan, a core of Silurian strata appears within the sandstone dome. A considerable system of eskers, notably north of Tullamore, diversifies the surface of the limestone plain.

The soil is generally a rich loam of great depth resting on limestone, and is well adapted both for tillage and pasturage. The occupations are almost wholly agricultural, dairy farming predominating. Flour and meal are largely produced. The only textile manufactures are those of friezes, flannels, and coarse linens for home use. The only mineral of any value is limestone.

The main line of the Midland Great Western railway enters the county from E. and passes W. by Mullingar and Athlone. From Mullingar a branch runs N.W. to Inny Junction, where lines diverge N. to Cavan (county Cavan), and W.N.W. to Longford (county Longford) and Sligo. A branch of the Great Southern & Western railway runs from Portarlington (Queen's county) to Athlone, and this and the Midland Great Western main line are connected by a short line between Clare and Streamstown, worked by the latter company. Water communication with Dublin is furnished by the Royal Canal, traversing the centre of the county. A branch of the Grand Canal reaches Kilbeggan in the south.

The population (68,611 in 1891; 61,629 in 1901) decreases in excess of the average shown by the Irish counties, and emigration is considerable. About 92% of the total are Roman Catholics, and about 86% constitute the rural population. The principal towns are Athlone (pop. 6617), of which the part formerly in Roscommon was added to Westmeath by the Local Government (Ireland) Act of 1898, and Mullingar (4500), the county town. Castlepollard and Moate are lesser market towns. By the Redistribution Act of 1885 Westmeath was formed into two parliamentary divisions, North and South, each returning one member, Athlone being included in the county representation. The county is divided into twelve baronies. Assizes are held at Mullingar and quarter sessions at Mullingar and Moate. The county is in the Protestant dioceses of Dublin, Killaloe and Ossory, and in the Roman Catholic dioceses of Kildare and Leighlin, Killaloe and Ossory.

Westmeath was severed from Meath (*q.v.*) in 1543. The plan for the insurrection of 1641 was concerted in the abbey of Multifarnham, and both in the wars of this period and those of 1688 the gentry of the county were so deeply implicated that the majority of the estates were confiscated. There are a considerable number of raths or encampments: one at Rathconrath is of great extent; another at Ballymore was fortified during the wars of the Cromwellian period and those of 1688, and was afterwards the headquarters of General Ginkell, when preparing to besiege Athlone; and there is a third of considerable size near Lough Lene. The ruins of the Franciscan abbey of Multifarnham, founded in 1236 by William Delaware, picturesquely situated near Lough Dereveragh, include a tower 93 ft. in height.

WESTMINSTER, MARQUESSES AND DUKES OF. The title of marquess of Westminster was bestowed in 1831 upon Robert Grosvenor, 2nd Earl Grosvenor (1767–1845), whose grandson, Hugh Lupus Grosvenor (1825–1899), was created duke of Westminster in 1874. The family of Grosvenor is of great antiquity in Cheshire, the existence of a knightly house of this name (Le Grosvenur) in the palatine county being proved by deeds as early as the 12th century (see *The Ancestor*, vi. 19). The legend of its descent from a nephew of Hugh Lupus, earl of Chester, perpetuated in the name of the first duke, and the still more extravagant story, repeated by the old genealogists and modern "peerages," of its ancestors, the "grand huntsmen" (*gros veneurs*) of the dukes of Normandy, have been exploded by the researches of Mr W. H. B. Bird (see "The Grosvenor Myth" in *The Ancestor*, vol. i. April 1902). The ancestors of the dukes of Westminster, the Grosvenors of Eaton, near Chester, were cadets of the knightly house mentioned above, and rose to wealth and eminence through a series of fortunate marriages. Their baronetcy dates from 1622.

Sir Thomas Grosvenor, the 3rd baronet (1656–1700), in 1676 married Mary (d. 1730), heiress of Alexander Davies (d. 1665), a scrivener. This union brought to the Grosvenor family certain lands, then on the outskirts of London, but now covered by some of the most fashionable quarters of the West End. Sir Thomas's sons, Richard (1689–1732), Thomas (1693–1733) and Robert (d. 1755), succeeded in turn to the baronetcy, Robert being the father of Sir Richard Grosvenor (1731–1802), created Baron Grosvenor in 1761 and Viscount Belgrave and Earl Grosvenor in 1784. The 1st earl, a great breeder of racehorses, was succeeded by his only surviving son Robert (1767–1845), who rebuilt Eaton Hall and developed his London property, which was rapidly increasing in value. In the House of Commons, where he sat from 1788 to 1802, he was a follower of Pitt, who made him a lord of the admiralty and later a commissioner of the board of control, but after 1806 he left the Tories and joined the Whigs. He was created a marquess at the coronation of William IV. in 1831. His son, Richard, the 2nd marquess, (1795–1869), was a member of parliament from 1818 to 1835 and lord steward of the royal household from 1850 to 1852. The latter's son, Hugh Lupus (1825–1899), created a duke in 1874, was from 1847 to 1869 member of parliament for Chester and from 1880 to 1885 master of the horse under Gladstone, but he left the Liberal party when the split came over Home Rule for Ireland. His great wealth made him specially conspicuous; but he was a patron of many progressive movements. His eldest son, Victor Alexander, Earl Grosvenor (1853–1884), predeceased him, and he was succeeded as 2nd duke by his grandson, Hugh Richard Arthur Grosvenor (b. 1879), who in 1901 married Miss Cornwallis-West. Earl Grosvenor's widow, Countess Grosvenor, a daughter of the 9th earl of Scarborough, had in 1887 married Mr George Wyndham (b. 1863), a grandson of the 1st baron Leconfield, who subsequently became well-known both as a *littérateur* and as a Unionist cabinet minister.

Two other peerages are held by the Grosvenor family. In 1857 Lord Robert Grosvenor (1801–1893), a younger son of the 1st marquess, after having sat in the House of Commons since 1822, was created Baron Ebury. He was an energetic opponent of ritualism in the Church of England; and he was associated in philanthropic work with the earl of Shaftesbury. On his death his son, Robert Wellesley Grosvenor (b. 1834), became the 2nd baron. In 1886, Lord Richard Grosvenor (b. 1837), a son of the 2nd marquess, was created Baron Stalbridge; from 1880 to 1885 he had been "chief whip" of the Liberal party. In 1891 he became chairman of the London & North Western railway.

WESTMINSTER, a part of London, England; strictly a city in the administrative county of London, bounded E. by "the City," S. by the river Thames, W by the boroughs of Chelsea and Kensington, and N. by Paddington, St Marylebone and Holborn. Westminster was formed into a borough by the London Government Act of 1899, and by a royal charter of the 29th of October 1900 it was created a city. The council consists of a mayor, 10 aldermen and 60 councillors. The city comprises the parliamentary boroughs of the Strand, Westminster and St George's, Hanover Square, each returning one member. Area, 2502·7 acres. The City of Westminster, as thus depicted, extends from the western end of Fleet Street to Kensington Gardens, and from Oxford Street to the Thames, which it borders over a distance of 3 m., between Victoria (Chelsea) Bridge and a point below Waterloo Bridge. It thus includes a large number of the finest buildings in London, from the Law Courts in the east to the Imperial Institute in the west, Buckingham and St James's palaces, the National Gallery, and most of the greatest residences of the wealthy classes. But the name of Westminster is more generally associated with a more confined area, namely, the quarter which includes the Abbey, the Houses of Parliament, the government and other buildings in Whitehall, the Roman Catholic Cathedral, and the parts immediately adjacent to these.

Tradition and history.

Westminster Abbey.—The Abbey of St Peter is the most widely celebrated church in the British empire. The Thames, bordered in early times by a great expanse of fen on either hand from Chelsea and Battersea downward, washed, at the point where the Abbey stands, one shore of a low island perhaps three-quarters of a mile in circumference, known as Thorney or Bramble islet. Tributary streams from the north formed channels through the marsh, flanking the island north and south, and were once connected by a dyke on the west. These channels belonged to the Tyburn, which flowed from the high ground of Hampstead. Relics of the Roman occupation have been excavated in the former island, and it is supposed that traffic on the Watling Street, from Dover to Chester, crossed the Thames and the marshes by way of Thorney before the construction of London Bridge; the road continuing north-west in the line of the modern Park Lane (partly) and Edgware Road. Tradition places on the island a temple of Apollo, which was destroyed by an earthquake in the reign of the emperor Antoninus Pius. On the site King Lucius is said to have founded a church (*c.* A.D. 170). The irruption of the Saxons left Thorney desolate. Traditional still, but supported by greater probability, a story states that Sebert, king of the East Saxons, having taken part in the foundation of St Paul's Cathedral, restored or refounded the church at Thorney "to the honour of God and St Peter, on the west side of the City of London" (Stow). A splendid legend relates the coming of St Peter in person to hallow his new church. The sons of Sebert relapsed into idolatry and left the church to the mercy of the Danes. A charter of Offa, king of Mercia (785), deals with the conveyance of certain land to the monastery of St Peter; and King Edgar restored the church, clearly defining by a charter dated 951 (not certainly genuine) the boundary of Westminster, which may be indicated in modern terms as extending from the Marble Arch south to the Thames and east to the City boundary, the former river Fleet. Westminster was a Benedictine foundation. In 1050 Edward the Confessor took up the erection of a magnificent new church, cruciform, with a central and two western towers. Its building continued after his death, but it was consecrated on Childermas Day, 28th December 1065; and on the following "twelfth mass eve" the king died, being buried next day in the church. In 1245 Henry III. set about the rebuilding of the church east of the nave, and at this point it becomes necessary to describe the building as it now appears.

The church.

Westminster Abbey is a cruciform structure consisting of nave with aisles, transepts with aisles (but in the south transept the place of the western aisle is occupied by the eastern cloister walk), and choir of polygonal apsidal form, with six chapels (four polygonal) opening north and south of it, and an eastern Lady Chapel, known as Henry VII.'s chapel. There are two western towers, but in the centre a low square tower hardly rises above the pitch of the roof. The main entrance in common use is that in the north transept. The chapter-house, cloisters and other conventual buildings and remains lie to the south. The total length of the church (exterior) is 531 ft. and of the transepts 203 ft. in all. The breadth of the nave without the aisles is 38 ft. 7 in. and its height close upon 102 ft. These dimensions are very slightly lessened in the choir. Without, viewed from the open Parliament Square to the north, the beautiful proportions of the building are readily realized, but it is somewhat dwarfed by the absence of a central tower and by the vast adjacent pile of the Houses of Parliament. From this point (considered as a building merely) it appears only as a secondary unit in a magnificent group. Seen from the west, however, it is the dominant unit, but here it is impossible to overlook the imperfect conception of the "Gothic humour" (as he himself termed it) manifested by Wren, from whose designs the western towers were completed in 1740. The north front, called Solomon's Porch from a former porch over the main entrance, is from the designs of Sir G. G. Scott, considerably altered by J. L. Pearson.

Within, the Abbey is a superb example of the pointed style. The body of the church has a remarkable appearance of uniformity, because, although the building of the new nave was continued with intermissions from the 14th century until Tudor times, the broad design of the Early English work in the eastern part of the church was carried on throughout. The choir, with its unusual form and radiating chapels, plainly follows French models, but the name of the architect is lost. Exquisite ornament is seen in the triforium arcade, and between some of the arches in the transept are figures, especially finely carved, though much mutilated, known as the censing angels. Henry VII.'s Chapel replaces an earlier Lady Chapel, and is the most remarkable building of its period. It comprises a nave with aisles, and an apsidal eastward end formed of five small radiating chapels. Both within and without it is ornamented with an extraordinary wealth and minuteness of detail. A splendid series of carved oak stalls lines each side of the nave, and above them hang the banners of the Knights of the Bath, of whom this was the place of installation when the Order was reconstituted in 1725. The fan-traceried roof, with its carved stone pendants, is the most exquisite architectural feature of the chapel.

The choir stalls in the body of the church are modern, as is the organ, a fine instrument with an "echo" attachment, electrically connected, in the triforium of the south transept. The reredos is by Sir G. G. Scott, with mosaic by Salviati. In Abbot Islip's chapel there is a series of effigies in wax, representing monarchs and others. The earliest, which is well preserved, is of Charles II., but remnants of older figures survive. Some of the effigies were carried in funeral processions according to custom, but this was not done later than 1735. There are, however, figures of Lord Chatham and Nelson, set up by the officials who received the fees formerly paid by visitors to the exhibition.

Ceremonies and monuments.

But the peculiar fame of the Abbey lies not in its architecture, nor in its connexion with the metropolis alone, but in the fact that it has long been the place of the coronation of sovereigns and the burial-place of many of them and of their greatest subjects. The original reason for this was the reverence attaching to the memory of the Confessor, whose shrine stands in the central chapel behind the high altar. The Norman kings were ready to do honour to his name. From William the Conqueror onward every sovereign has been crowned here excepting Edward V. The coronation chairs stand in the Confessor's chapel. That used by the sovereign dates from the time of Edward I., and contains beneath its seat the stone of Scone, or stone of destiny, on which the Celtic kings were crowned. It is of Scottish origin, but tradition identifies it with Jacob's pillow at Bethel. Here also are kept the sword and shield of Edward III., still used in the coronation ceremony. The second chair was made for Mary, consort of William III. Subsequent to the Conquest many kings and queens were buried here, from Henry III. to George II. Not all the graves are marked, but of those which are the tomb of Henry VII. and his queen, Elizabeth of York, the central object in his own chapel, is the finest. The splendid recumbent effigies in bronze, of Italian workmanship, rest upon a tomb of black marble, and the whole is enclosed in a magnificent shrine of wrought brass. Monuments, tombs, busts and memorials crowd the choir, its chapels and the transepts, nor is the nave wholly free of them. All but the minority of the Gothic period (among which the canopied tombs of Edmund Crouchback and Aymer de Valence, in the sanctuary, are notable) appear incongruous in a Gothic setting. Many of the memorials are not worthy of their position as works of art, nor are the subjects they commemorate always worthy to lie here, for the high honour of burial in the Abbey was not always so conscientiously guarded as now. Eliminating these considerations, however, a wonderful range of sculptural art is found. A part of the south transept is famed under the name of the Poet's Corner. The north transept contains many monuments to statesmen.

Conventual and other buildings.

The monastery was dissolved in 1539, and Westminster was then erected into a bishopric, but only one prelate, Thomas Thurleby, held the office of bishop. In 1553 Mary again appointed an abbot, but Elizabeth reinstated the dean, with twelve prebendaries. Of the conventual buildings, the cloisters are of the 13th and 14th centuries. On the south side of the southern walk remains of a wall of the refectory are seen from without. From the eastern walk a porch gives entry to the chapter house and the chapel of the Pyx. The first is of the time of Henry III., a fine octagonal building, its vaulted roof supported by a slender clustered column of marble. It was largely restored by Sir Gilbert Scott. There are mural paintings of the 14th and 15th centuries. The chapel or chamber of the Pyx is part of the undercroft of the original dormitory, and is early Norman work of the Confessor's time. It was used as a treasury for the regalia and other articles of value in early times, and here were kept the standard coins of the realm used in the trial of the pyx now carried out at the Mint. The undercroft is divided into compartments by walls, and part of it appears in the gymnasium of Westminster School. Above it is now the chapter library. To the south-east lies the picturesque Little Cloister, with its court and fountain, surrounded by residences of canons and officials. Near it are slight ruins of the monastic infirmary chapel of St Catherine. West of the main cloisters are the Deanery, Jerusalem chamber and College Hall, the building surrounding a small court and dating in fabric mainly from the 14th century. This was the Abbot's house. Its most famous portion is the Jerusalem chamber, believed to be named from the former tapestries on its walls, representing the holy city. Here died Henry IV. in 1413, as set forth in Shakespeare's *Henry IV.* (Pt. ii., Act iv. Sc. 4). It is a beautiful room, with open timber roof, windows partly of stained glass, and walls tapestried and panelled. The College Hall, adjoining it, is of similar construction, but plainly fitted in the common manner of a refectory, with a dais for the high table at the north and a gallery at the south. It is now the dining-hall of Westminster School.

Westminster School.—St Peter's College, commonly called Westminster School, is one of the most ancient and eminent public schools in England, and the only school of such standing still occupying its original site in London. A school was maintained by the monks from very early times. Henry VIII. took steps to raise it in importance, but the school owes its present eminence to Queen Elizabeth, who is commemorated as the foundress at a Latin commemoration service held periodically in the Abbey, where, moreover, the daily school service is held. The school buildings lie east of the conventual buildings, surrounding Little Dean's Yard, which, like the cloisters, communicates with Dean's Yard, in which are the picturesque houses of the headmaster, canons of the Abbey, and others. The buildings are modern or large modernized. The Great Schoolroom is a fine panelled hall, bearing on its walls the arms and names of many eminent *alumni*; it is entered by a gateway attributed to Inigo Jones, also covered with names. Ashburnham House, now containing one of the school houses, the library and class-rooms, is named from the family for whom it was built, traditionally but not certainly, by Inigo Jones. The finest part remaining is the grand staircase. The number of scholars, called King's Scholars, on the foundation is 60, of which 40, who are boarders, represent the original number. The great proportion of the boys are home boarders (Town Boys). In the College dormitory a Latin play is annually presented, in accordance with ancient custom. It is preceded by a prologue, and followed by a humorous epilogue, in Latin adapted to subjects of the moment. Other customs for which the school is noted are the acclamation of the sovereign at coronation in the Abbey, in accordance with a privilege jealously held by the boys; and the "Pancake Greaze," a struggle in the Great Schoolroom on Shrove Tuesday to obtain possession of a pancake carrying with it a reward from the Dean. The number of boys is about 250. Valuable close scholarships and exhibitions at Christ Church, Oxford, and Trinity College, Cambridge, are awarded annually.

St Margaret's.—On the north side of the Abbey, close beside it, is the parish church of St Margaret. It was founded in or soon after the time of the Confessor, but the present building is Perpendicular, of greater beauty within than without. St Margaret's is officially the church of the House of Commons. It is frequently the scene of fashionable weddings, which are rarely held in the Abbey. On the south side of Dean's Yard is the Church House, a memorial of Queen Victoria's Jubilee (1887), consisting of a spacious hall of brick and stone, with offices for numerous Church societies.

Westminster Palace: Houses of Parliament.—A royal palace existed at Westminster at least as early as the reign of Canute, but the building spoken of by Fitzstephen as an "incomparable structure furnished with a breastwork and a bastion" is supposed to have been founded by Edward the Confessor and enlarged by William the Conqueror. The Hall, called Westminster Hall, was built by William Rufus and altered by Richard II. In 1512 the palace suffered greatly from fire, and thereafter ceased to be used as a royal residence. St Stephen's chapel, originally built by King Stephen, was used from 1547 for the meetings of the House of Commons, which had been held previously in the chapter house of the Abbey. The Lords used another apartment of the palace, but on the 16th of October 1834 the whole of the buildings, except the hall, was burnt down. In 1840 the building of the New Palace, or Houses of Parliament, began, and it was completed in 1867, at a cost of about three millions sterling. (For plan, &c., see ARCHITECTURE: *Modern.*) It covers an area of about 8 acres, and has a frontage of about 300 yds. to the Thames. The architect was Sir Charles Barry, and the style is late Perpendicular.

Towards the river it presents a rich *façade* with a terrace rising directly from the water. At the south-west corner rises the vast Victoria tower, above the royal entrance, 340 ft. high, and 75 ft. square. At the north is the clock tower, 320 ft. high, bearing the great clock which chimes the quarters on four bells, and strikes the hours on a bell weighing over 13 tons, named Big Ben after Sir Benjamin Hall, First Commissioner of Works at the time when the clock was erected. The building incorporates Westminster Hall, which measures 290 ft. in length, 68 in width, and 90 in height. It has a magnificent open roof of carved oak, and is used as the vestibule of the Houses of Parliament. Of the modern rooms, the House of Peers is a splendidly ornate chamber, 97 ft. in length; that of the Commons is 70 ft. long, and less lavishly adorned. The sitting of parliament is signified by a flag on Victoria Tower in daytime and by a light at the summit of the clock tower at night.

Whitehall.—Northward from Parliament Square a broad, slightly curving thoroughfare leads to Trafalgar Square. This is Whitehall, which replaced the narrow King Street. Here, between the Thames and St James's Park, formerly stood York House, a residence of the archbishops of York from 1248. Wolsey beautified the mansion and kept high state there, but on his disgrace Henry VIII. acquired and reconstructed it, employed Holbein in its decoration, and made it his principal residence. Inigo Jones designed a magnificent new palace for James I., but only the banqueting hall was completed (1622), and this survived several fires, by one of which (1697) nearly the whole of the rest of the palace was destroyed. The hall, converted into a royal chapel by George I., and now housing the museum of the Royal United Service Institution, the buildings of which adjoin it, is a fine specimen of Palladian architecture, and its ceiling is adorned with allegorical paintings by Rubens, restored and rehung in 1907. The museum contains military and naval relics, models and other exhibits. Through this hall Charles I. passed on his way to execution beneath its windows; and the palace was the scene of the death of Henry VIII., Cromwell and Charles II.

The principal government offices are situated in Whitehall. On the left, following the northerly direction, are buildings completed in 1908, from the designs of J. M. Brydon, for the Boards of Education, Trade, Local Government, &c. The Home, Foreign, Colonial and India Offices occupy the next block, a heavy building, adorned with allegorical figures, by Sir G. G. Scott (1873). Downing Street, separating these from the Treasury, contains the official residences of the First Lord of the Treasury and the Chancellor of the Exchequer. The Treasury itself dates from 1737, but the façade is by Sir Charles Barry. The Horse Guards, containing the offices of various military departments, is a low but not unpicturesque building surrounding a court-yard, built in 1753 on the site of a guard-house for the security of Whitehall palace, dating from 1631. On the parade ground between it and St James's Park the ceremony of trooping the colour is held at the celebration of the sovereign's birthday. The portion of the Admiralty facing Whitehall dates from 1726 and is plain and sombre; but there are handsome new buildings on the Park side. On the right of Whitehall, besides the banquet hall, are the fine War Office, completed in 1906, from the designs of W. Young, and Montagu House, the residence of the duke of Buccleuch. In front of the War Office an equestrian statue of the duke of Cambridge (d. 1904) was unveiled in 1907.

Trafalgar Square is an open space sloping sharply to the north. On the south side, facing the entry of Whitehall, is the Nelson column (1843) by W. Railton, 145 ft. in height, a copy in granite from the temple of Mars Ultor in Rome, crowned with a statue of Nelson by E. H. Baily, and having at its base four colossal lions in bronze modelled by Sir Edwin Landseer. The centre of the square is levelled and paved with asphalte, and contains two fountains. There are statues of George IV., Napier, Havelock and Gordon. Behind the terrace on the north rises the National Gallery (1838), a Grecian building by William Wilkins, subsequently much enlarged, with its splendid collection of paintings. The National Portrait Gallery is contained in a building (1895) on the north-east side of the National Gallery.

Westminster Cathedral.—A short distance from Victoria Street, towards its western end, stands Westminster Cathedral (Roman Catholic). Its foundation was laid in 1896, and its consecration took place at the close of 1903. Its site is somewhat circumscribed, and this and its great bulk renders impossible any general appreciation of its complex outline; but its stately domed campanile, 283 ft. in height, forms a landmark from far over London. The style was described by the architect, J. F. Bentley, as early Christian Byzantine, and the material is mainly red brick. The extreme length is 360 ft., the breadth 156 ft., the breadth of the nave 60 ft., and its height (domes within) 112 ft.

WESTMINSTER, STATUTES OF, two English statutes passed during the reign of Edward I. Parliament having met at Westminster on the 22nd of April 1275, its main work was the consideration of the statute of Westminster I. This was drawn up, not in Latin, but in Norman French, and was passed "par le assentement des erceveskes, eveskes, abbes, priurs, contes, barons, et la communaute de la tere ileokes somons." Its provisions can be best summarized in the words of Stubbs (*Const. Hist.* cap. xiv.):—

> "This act is almost a code by itself; it contains fifty-one clauses, and covers the whole ground of legislation. Its language now recalls that of Canute or Alfred, now anticipates that of our own day; on the one hand common right is to be done to all, as well poor as rich, without respect of persons; on the other, elections are to be free, and no man is by force, malice or menace, to disturb them. The spirit of the Great Charter is not less discernible: excessive amercements, abuses of wardship, irregular demands for feudal aids, are forbidden in the same words or by amending enactments. The inquest system of Henry II., the law of wreck, and

the institution of coroners, measures of Richard and his ministers, come under review as well as the Provisions of Oxford and the Statute of Marlborough."

The second statute of Westminster was passed in the parliament of 1285. Like the first statute it is a code in itself, and contains the famous clause *De donis conditionalibus* (*q.v.*), "one of the fundamental institutes of the medieval land law of England." Stubbs says of it: "The law of dower, of advowson, of appeal for felonies, is largely amended; the institution of justices of assize is remodelled, and the abuses of manorial jurisdiction repressed; the statute *De religiosis*, the statutes of Merton and Gloucester, are amended and re-enacted. Every clause has a bearing on the growth of the later law."

The statute *Quia Emptores* of 1290 is sometimes called the statute of Westminster III.

WESTMINSTER, SYNODS OF. Under this heading are included certain of the more important ecclesiastical councils held within the present bounds of London. Though the precise locality is occasionally uncertain, the majority of the medieval synods assembled in the chapter-house of old St Paul's, or the former chapel of St Catherine within the precincts of Westminster Abbey or at Lambeth. The councils were of various types, each with a constitutional history of its own. Before the reign of Edward I., when convocation assumed substantially its present form (see Convocation), there were convened in London various diocesan, provincial, national and legatine synods; during the past six centuries, however, the chief ecclesiastical assemblies held there have been convocations of the province of Canterbury.

The first really notable council at St Paul's was that of 1075 under the presidency of Lanfranc; it renewed ancient regulations, forbade simony and permitted three bishops to remove from country places to Salisbury, Chichester and Chester respectively. In 1102 a national synod at Westminster under Anselm adopted canons against simony, clerical marriages and slavery. The councils of 1126, 1127 and 1138 were legatine, that of 1175 provincial; their canons, chiefly re-enactments, throw light on the condition of the clergy at that time. The canons of 1200 are based in large measure on recommendations of the Lateran Council of 1179. At St Paul's the legatine constitutions of Otto were published in a synod of 1237, those of Ottobon in 1268: these were the most important national councils held after the independence of York had been established. A synod at Lambeth in 1281 put forth canons none too welcome to Edward I.; they included a detailed scheme for the religious instruction of the faithful. During the next two centuries the councils devoted much attention to heresy: eight propositions concerning the body of Christ after his death were rejected at St Mary-le-Bow in 1286; the expulsion of the Jews from England was sanctioned by a legatine synod of Westminster in 1291; ten theses of Wiclif's were condemned at the Dominican friary in 1382, and eighteen articles drawn from his *Trialogus* met the same fate at St Paul's in 1396; and the doom of Sir John Oldcastle was sealed at the latter place in 1413. The 14th-century synods at St Paul's concerned themselves largely with the financial and moral status of the clergy, and made many quaint regulations regarding their dress and behaviour (1328, 1342, 1343; cf. 1463). From the time of Edward VI. on, many of the most vital changes in ecclesiastical discipline were adopted in convocations at St Paul's and in the Abbey. To enumerate them would be to give a running commentary on the development of the Church of England; among the most important were those of 1547, 1552, 1554, 1562, 1571, 1604, 1605, 1640 and 1661. In 1852 there was held the first of a series of synods of the newly organized Roman Catholic archdiocese of Westminster. For the "Pan-Anglican Synods" see Lambeth Conferences.

Bibliography.—For acts of synods prior to the Reformation see Spelman, Hardouin, W. Lynwood, *Provinciale* (Oxford, 1679), and best of all Wilkins; for the canons and proceedings of convocations from 1547 to 1717 consult E. Cardwell, *Synodalia* (2 vols., Oxford, 1842); for translations and summaries, Guérin, Landon and Hefele, *Conciliengeschichte*, vol. iv. ff.; see also T. Lathbury, *A History of the Convocation of the Church of England* (2nd enlarged edition, London, 1853); A. P. Stanley, *Historical Memorials of Westminster Abbey* (4th and revised ed., London, 1876), 411-413, 495-504; H. H. Milman, *Annals of S. Paul's Cathedral* (2nd ed., London, 1869). Full titles under Councils. (W. W. R.*)

WESTMORLAND, EARLS OF. Ralph Neville, 4th Baron Neville of Raby, and 1st earl of Westmorland (1364–1425), eldest son of John, 3rd Baron Neville, and his wife Maud Percy (see Neville, *Family*), was knighted by Thomas of Woodstock, afterwards duke of Gloucester, during the French expedition of 1380, and succeeded to his father's barony in 1388. He had been joint warden of the west march in 1386, and was reappointed for a new term in 1390. In 1391 he was put on the commission which undertook the duties of constable in place of the duke of Gloucester, and he was repeatedly engaged in negotiations with the Scots. His support of the court party against the lords appellant was rewarded in 1397 by the earldom of Westmorland. He married as his second wife Joan Beaufort, half-sister of Henry of Lancaster, afterwards Henry IV., whom he joined on his landing in Yorkshire in 1399. He already held the castles of Brancepeth, Raby, Middleham and Sheriff Hutton when he received from Henry IV. the honour and lordship of Richmond for life. The only rivals of the Nevilles in the north were the Percies, whose power was broken at Shrewsbury in 1403. Both marches had been in their hands, but the wardenship of the west marches was now assigned to Westmorland, whose influence was also paramount in the east, which was under the nominal wardenship of the young Prince John, afterwards duke of Bedford. Westmorland had prevented Northumberland from marching to reinforce Hotspur in 1403, and before embarking on a new revolt he sought to secure his enemy, surrounding, but too late, one of Sir Ralph Eure's castles where the earl had been staying. In May the Percies were in revolt, with Thomas Mowbray, earl marshal, and Archbishop Scrope. Westmorland met them on Shipton Moor, near York, on the 29th of May 1405, and suggested a parley between the leaders. By pretending accord with the archbishop, the earl induced him to allow his followers to disperse. Scrope and Mowbray were then seized and handed over to Henry at Pontefract on the 3rd of January. The improbabilities of this narrative have led some writers to think, in face of contemporary authorities, that Scrope and Mowbray must have surrendered voluntarily. If Westmorland betrayed them he at least had no share in their execution. Thenceforward he was busily engaged in negotiating with the Scots and keeping the peace on the borders. He did not play the part assigned to him by Shakespeare in *Henry V.*, for during Henry's absence he remained in charge of the north, and was a member of Bedford's council. He consolidated the strength of his family by marriage alliances. His daughter Catherine married in 1412 John Mowbray, second duke of Norfolk, brother and heir of the earl marshal, who had been executed after Shipton Moor; Anne married Humphrey, first duke of Buckingham; Eleanor married, after the death of her first husband Richard le Despenser, Henry Percy, 2nd earl of Northumberland; Cicely married Richard, duke of York, and was the mother of Edward IV. and Richard III. The sons by his second marriage were Richard Neville, earl of Salisbury, William, Baron Fauconberg, George, Baron Latimer, Robert, bishop of Salisbury and then of Durham, and Edward, Baron Abergavenny. The earl died on the 21st of October 1425, and a fine alabaster tomb was erected to his memory in Staindrop church close by Raby Castle.

See J. H. Wylie, *History of England under Henry IV.* (4 vols., 1884–1898).

Ralph, 2nd earl of Westmorland (*c.* 1404–1484), the son of John, Lord Neville (d. 1423), succeeded his grandfather in 1425, and married as his first wife Elizabeth Clifford, daughter of Sir Henry Percy (Hotspur), thus forming further bonds with the Percies. The 3rd earl, Ralph Neville (1456–1499), was his nephew, and the son of John Neville, Lord Neville, who was slain at Towton. His grandson Ralph, 4th earl of Westmorland (1499–1550), was an energetic border warrior, who remained faithful to the royal cause when the other great northern lords joined the Pilgrimage of Grace. He was succeeded by his son Henry, 5th earl (*c.* 1525–1563).

Charles, 6th earl (1543–1601), eldest son of the 5th earl by his first wife Jane, daughter of Thomas Manners, 1st earl of Rutland, was brought up a Roman Catholic, and was further attached to the Catholic party by his marriage with Jane, daughter of Henry Howard, earl of Surrey. He was a member of the council of the north in 1569 when he joined Thomas Percy, 7th earl of Northumberland, and his uncle Christopher Neville, in the Catholic rising of the north, which had as its object the liberation of Mary, queen of Scots. On the collapse of the ill-organized insurrection Westmorland fled with his brother earl over the borders, and eventually to the Spanish Netherlands, where he lived in receipt of a pension from Philip II. of Spain, until his death on the 16th of November 1601. He left no sons, and his honours were forfeited by his formal attainder in 1571. Raby Castle remained in the hands of the crown until 1645.

The title was revived in 1624 in favour of Sir Francis Fane (*c.* 1574–1629), whose mother, Mary Neville, was a descendant of a younger son of the first earl. He was created baron of Burghersh and earl of Westmorland in 1624, and became Lord le Despenser on his mother's death in 1626. His son Mildmay Fane, 2nd or 8th earl of Westmorland (*c.* 1602–1666), at first sided with the king's party, but was afterwards reconciled with the parliament. John Fane, 7th or 13th earl of Westmorland (1682?–1762), served under Marlborough, and was made in 1739 lieutenant-general of the British armies.

John Fane, 11th or 17th earl (1784–1859), only son of John, 10th earl, was known as Lord Burghersh until he succeeded to the earldom in 1841. He entered the army in 1803, and in 1805 took part in the Hanoverian campaign as aide-de-camp to General Sir George Don. He was assistant adjutant-general in Sicily and Egypt (1806–1807), served in the Peninsular War from 1808 to 1813, was British military commissioner to the allied armies under Schwarzenberg, and marched with the allies to Paris in 1814. He was subsequently promoted major-general (1825), lieutenant-general (1838) and general (1854), although the latter half of his life was given to the diplomatic service. He was British resident at Florence from 1814 to 1830, and British ambassador at Berlin from 1841 to 1851, when he was transferred to Vienna. In Berlin he had mediated in the Schleswig-Holstein question, and in Vienna he was one of the British plenipotentiaries at the congress of 1855. He retired in 1855, and died at Apthorpe House, Northamptonshire, on the 16th of October 1859. Himself a musician of considerable reputation and the composer of several operas, he took a keen interest in the cause of music in England, and in 1822 made proposals which led to the foundation in the next year of the Royal Academy of Music. His wife Priscilla Anne (1793–1879), daughter of William Wellesley-Pole, 3rd earl of Mornington, was a distinguished artist.

His published works include *Memoirs of the Early Campaigns of the Duke of Wellington in Portugal and Spain* (1820), and *Memoir of the Operations of the Allied Armies under Prince Schwarzenberg and Marshal Blücher* (1822).

Francis William Henry, 12th or 18th earl (1825–1891), fourth son of the preceding, was also a distinguished soldier. He entered the army in 1843 and served through the Punjab campaign of 1846; was made aide-de-camp to the governor-general in 1848, and distinguished himself at Gujrat on the 21st of February 1849. He went to the Crimea as aide-de-camp to Lord Raglan, and was promoted lieutenant-colonel in 1855. On his return to England he became aide-de-camp to the duke of Cambridge, and received the Crimean medal. The death of his elder brother in 1851 gave him the style of Lord Burghersh, and after his accession to the earldom in 1859 he retired from the service with the rank of colonel. He died in August 1891 and was succeeded by his son, Anthony Mildmay Julian Fane (b. 1859), as 13th earl.

WESTMORLAND, a north-western county of England, bounded N.W. by Cumberland, N.E. for a short distance by Durham, E. by Yorkshire, S. and S.W. by Lancashire. It reaches the sea in the Kent estuary in Morecambe Bay. The area is 786·2 sq. m. Physically the county may be roughly divided into four areas. (1) The great upland tract in the north-eastern part, bordering on the western margin of Yorkshire and part of Durham, consists mainly of a wild moorland area, rising to elevations of 2780 ft. in Milburn Forest, 2403 in Dufton Fell, 2446 in Hilton Fell, 2024 in Bastifell, 2328 in High Seat, 2323 in Wild Boar Fell and 2235 in Swarth Fell. (2) The second area comprises about a third of the Lake District (*q.v.*), westward from Shap Fells. This area includes High Street (2663 ft.), Helvellyn (3118) and Fairfield (2863), Langdale Pikes (2401) and on the boundary Bow Fell (2960), Crinkle Crags (2816) and Pike o' Blisco (2304). It must also be taken to cover the elevated area on the Yorkshire border which includes the Ravenstonedale and Langdale Fells to the N. and the Middleton and Barbon Fells to the S., of an intrusive angle of Yorkshire. This area, however, which reaches in some points over 2200 ft. of altitude, is marked off from the Lake District mountains by the Lune valley. All but the lower parts of the valleys within these two areas lie at or above 1000 ft. above Ordnance datum; and more than half the remainder lies between that elevation and 1750 ft., the main mass of high land lying in the area first mentioned. (3) The third area includes the comparatively low country between the northern slopes of that just described and the edge of the uplands to the north-east thereof. This covers the Vale of Eden. About three-fifths of this area lies between the 500 and the 1000 ft. contour. (4) The Kendal area consists mainly of undulating lowlands, varied by hills ranging in only a few cases up to 1000 ft. More than half this area lies below the 500 ft. contour. Westmorland may thus be said to be divided in the middle by uplands ranging in a general south-easterly direction, and to be bordered all along its eastern side by the elevated moorlands of the Pennine chain. The principal rivers are—in the northern area the higher part of the Tees, the Eden with its main tributaries, the Lowther and the Eamont, and in the southern area the Lune and the Kent, with their numerous tributary becks and gills. The lakes include Windermere, part of Ullswater, Grasmere, Hawes Water and numerous smaller lakes and tarns, which are chiefly confined to the north-western parts of the county. Amongst the other physical features of more or less interest are numerous crags and scars, chiefly in the neighbourhood of the lakes; others are Mallerstang Edge, Helbeck, above Brough; Haikable or High Cup Gill, near Appleby; Orton Scars; and the limestone crags west of Kirkby Lonsdale. Among the waterfalls are Caldron Snout, on the northern confines of the county, flowing over the Whin Sill, and Stock Gill Force, Rydal Falls, Skelwith Force, and Dungeon Gill Force, all situated amongst the volcanic rocks in the west. Hell Gill, near the head of the Eden, and Stenkrith, near Kirkby Stephen, are conspicuous examples of natural arches eroded by the streams flowing through them.

Geology.—The diversity of scenery and physical features in this county are directly traceable to the influence of geological structure. In the mountainous north-western portion, which includes the heights of Helvellyn, Langdale Pikes, and Bow Fell, and the lakes Ullswater, Hawes Water, Grasmere and Elterwater, we find the great mass of igneous rocks known as the Borrowdale volcanic series—andesites, basalts and tuffs—of Ordovician age. On the northern and north-western sides these volcanic rocks pass into the neighbouring county of Cumberland; their southern boundary runs north-easterly from the upper end of Windermere by Kentmere and past the granitic mass of Shap Fell; thence the boundary turns north-westward through Rasgill to the east end of Ullswater. Narrow strips of Ordovician Skiddaw slate occur on the south banks of Ullswater and fringe the Borrowdale rocks for some distance east of Windermere. A large area of Silurian rocks occupies most of the south-western part of the county from Windermere to near Ravenstonedale and southward to Sedbergh, Kendal and Kirkby Lonsdale. The Ordovician and Silurian rocks are bordered on the east and south by Carboniferous limestone from the river Eamont southward through Clifton, Shap, Crosby Garrett and Ravenstonedale; and again south of Kendal, down the Kent valley and eastward to Kirkby Lonsdale. Outlying patches of limestone rest on the Silurian at Grayrigg, Mealbank and elsewhere. The Carboniferous limestone is found again on the east side of the Eden valley in Milburn Forest, Dufton Fell, Stainmore and Winster Fell. Here and there in the south-east corner Millstone Grit and Shales cap the limestone and some little distance east of Brough under Stainmore a small patch of Coal Measures remains. At the base of the Carboniferous rocks in this county is a red conglomeratic deposit, the lower part of which may be regarded as of Old Red Sandstone age; it may be traced from Ullswater through Butterwick, Rasgill and Tebay, and it appears again at Sedbergh, Barton and around Kendal. In the limestones on the east side of the Eden the Great Whin Sill, a diabase dike, may be followed for a considerable distance. In the Eden valley two sets of red sandstones occur, that on the western side is of Permian age and includes the conglomerate beds known as "brockram." The Permian extends as a belt from 4 to 2 m. wide between Penrith, Appleby and Kirkby Stephen. The sandstone on the eastern side of the valley is of Bunter age. The eastern side of the valley is strongly faulted so that small patches of Ordovician and Silurian rocks appear all along the margin of the Carboniferous limestone. Evidences of glaciation are abundant in the form of morainic accumulations and transported or striated blocks.

Climate and Agriculture.—The rainfall is very heavy, especially in the western part (see LAKE DISTRICT), whence it diminishes eastward. Thus at Kendal, on the eastern flank of the Lake District, the mean annual rainfall is still as high as 48·71 in., whereas at Appleby in the Eden valley it is only 32·45 in. The greater part of the county may, however, be considered to lie within an area having 40 to 60 in. mean annual fall. The average temperature in January at Appleby is 35·8° F., but at Windermere it is 37·4°. The summer temperature is mild; thus at the same two points 58·4° and 58·7° are recorded. The principal characteristic of the climate is the preponderance of cloudy, wet and cold days, especially in the spring and autumn,—combining to retard the growth of vegetation. The late stay of cold winds in the spring has much to do with the same, especially in the lowlands extending along the foot of the Cross Fell escarpment from Brough north-westwards. The helm-wind (*q.v.*) is characteristic of this district. Scarcely one-half of the total area of the county is under cultivation, and of this acreage about five-sixths is in permanent pasture, both cattle and sheep being largely kept. Large portions of the valleys are well wooded. Nearly the whole of the acreage under corn crops is occupied by oats; a little barley is grown, but the wheat crop is insignificant. About three-fourths of the acreage under green crops is occupied by turnips. The meadow-land yields excellent grass. Grass of inferior value characterizes the pasture-lands; while on the fell (or unenclosed) land, except in limestone areas, the herbage consists chiefly of the coarser kinds of grass, bents and heather. These, however, furnish nourishment for the hardier breeds of sheep, which are pastured there in large numbers. It is from the sale of these, of their stock cattle, horses and pigs, and of their dairy produce that the staple of the farmers' income is derived. A large part of Westmorland was formerly in the hands of "statesmen" (see CUMBERLAND) whose holdings were usually of small extent, but were sufficient, with careful management, for the respectable maintenance of themselves and their families. The proportion of landowners of this class has greatly decreased.

Manufactures.—The manufacturing industries, owing to the absence of any large supplies of native fuel, are not numerous. The principal is woollen manufacture in one form or another, and this is chiefly confined to the low country in and near Kendal. Bobbin-making, the manufacture of explosives, fulling, snuff-grinding and several small industries are carried on, and use the water-power available at so many points. Paper-making is also carried on. The quarries occupy a considerable number of hands at various points, as in the case of the green slate quarries which are detrimental to the scenery in the lower part of Langdale.

Communications.—The main line of the London and North-Western railway from the south serves Oxenholme (branch to Kendal and Windermere), Low Gill (branch to Ingleton in Yorkshire), and Tebay, leaving the county after surmounting the heavy gradient at Shap. The Midland main line, with a parallel course, serves Appleby. A branch of the North Eastern system from Darlington serves Kirkby Stephen and Tebay, and another branch connects Kirkby Stephen with Appleby and Penrith.

Population and Administration.—The area of the ancient county is 503,160 acres, with a population in 1891 of 66,098 and in 1901 of 64,303. The natives are prevalently tall, wiry, long-armed, big-handed, dark-grey-eyed and fresh-coloured. In disposition they are cautious, reserved and unemotional and thrifty beyond measure. The general character of the dialects of Westmorland is that of a basis of Anglian speech, influenced to a certain extent by the speech current amongst the non-Anglian peoples of Strathclyde. This is overlaid to a much greater though variable extent by the more decidedly Scandinavian forms of speech introduced at various periods between the 10th and the 12th centuries. Three well-marked dialects can be made out.

The area of the administrative county is 505,330 acres. The county contains four wards (corresponding to hundreds). The municipal boroughs are Appleby, the county town (pop. 1764) and Kendal (14,183). The urban districts are Ambleside (2536), Bowness and Windermere (5061), Grasmere (781), Kirkby Lonsdale (1638) and Shap (1226). The county is in the northern circuit, and assizes are held at Appleby. It has one court of quarter sessions, and is divided into five petty sessional divisions. The borough of Kendal has a separate commission of the peace. There are 115 civil parishes. Westmorland is in the diocese of Carlisle, and contains 86 ecclesiastical parishes or districts, wholly or in part. There are two parliamentary divisions, Northern or Appleby and Southern or Kendal, each returning one member.

History.—The earliest English settlements in the district which is now Westmorland were effected by the Anglian tribes who entered Yorkshire by the Humber in the 6th century and laid the foundations of the kingdom of Deira, which included within its bounds that portion of Westmorland afterwards known as the barony of Kendal. The northern district, corresponding to the later barony of Appleby, meanwhile remained unconquered, and it was not until the close of the 7th century that Ecgfrith drove out the native Britons and established the Northumbrian supremacy over the whole district. With the Danish invasions of the 9th century the Kendal district was included in the Danelaw, while the barony of Appleby formed a portion of the land of Carlisle. The first mention of Westmorland in the Saxon Chronicle occurs under 966, when it was harried by Thored son of Gunnar, the term here applying only to the barony of Appleby, which at this period was being extensively colonized by Norwegian settlers, traces of whose occupation are especially noticeable in the place-names of the Lake District.

The Domesday Survey describes only the barony of Kendal which appears as part of Amounderness in Yorkshire. Before the Conquest it had formed part of the earldom of Tostig of Northumbria, and had been bestowed by William I. on Roger of Poitou, but, owing to the forfeiture of his estates by the latter, at the time of the survey it was in the hands of the crown. The annexation of the northern portion of Westmorland to the crown of England was accomplished by William Rufus, who in 1092 drove out Dolfin from the land of Carlisle, and fortified Brough-under-Stainmore, Brougham, Appleby and Pendragon. In the reign of Henry I. the barony of Appleby was included in the grant to Ranulph Meschin of the earldom of Carlisle, but on the accession of Ranulph to the earldom of Chester in 1120 it was surrendered to the crown, and its inclusion in the pipe roll of 1131 shows that Westmorland was now definitely established on the administrative basis of an English county.

The barony of Kendal was held in the 12th century by the Mowbrays, and from them passed to the family of Lancaster, who held it as of the honour of Westmorland. In the 13th century it was separated into two moieties; the Lindsay moiety which passed from the Lindsays to the Copelands and Coucys and in the reign of Henry VI. to the Beauforts and Richmonds, whence was derived its later name of Richmond Fee; the Brus moiety, which became subdivided into the Marquis Fee held by the Parr family, ancestors of Katherine Parr, and the Lumley Fee which passed from the Thwengs to the Lumleys and Hothams. The barony of Appleby, with the hereditary shrievalty, was bestowed by King John on the family of Veteripont, from whom it passed by female descent to the Cliffords in the 13th century, and in the 16th century to the Tuftons, afterwards earls of Thanet, who retained the dignity until their descendant, Mr Barham of Trecwn, yielded his rights to the crown.

The division of Westmorland into wards originated with the system of defence against the inroads of the Scots, each barony being divided into two wards, and each ward placed under a high constable, who presided over the wards to be maintained at certain fords and other appointed places. The barony of Kendal was divided into Kendal and Lonsdale wards, and the barony of Appleby, called the Bottom, into east and west wards, there being anciently a middle ward between these last two. The shire court and assizes for the county were held at Appleby.

The barony of Appleby was included in the diocese of York from the 7th century, and in 1291 formed the deaneries of

Lonsdale and Kendal within the archdeaconry of Richmond. The barony of Appleby, which had been bestowed by Henry I. in the see of Carlisle, formed in 1291 the deanery of Westmorland within the archdeaconry and diocese of Carlisle. The barony of Kendal was placed by Henry VIII. in his new diocese of Chester, of which it remained a part until in 1856 it was constituted the archdeaconry of Westmorland within the diocese of Carlisle. In 1859 the Westmorland portion of the archdeaconry of Carlisle was subdivided into the deaneries of Appleby, Kirkby Stephen and Lowther; and the additional deanery of Ambleside was formed within the archdeaconry of Westmorland. The only religious foundation of any importance in Westmorland was the Premonstratensian house at Shap founded by Thomas, son of Gospatric, in the 12th century.

The early political history of Westmorland after the Conquest is a record of continuous inroads and devastations from the Scots. In the Scottish invasion of the northern counties which followed the battle of Bannockburn Brough and Appleby were burnt, and the county was twice harried by Robert Bruce in the ensuing years. In 1385 a battle was fought at Hoff near Appleby against the Scots under Earl Douglas, and in 1388, after Otterburn, the Scots sacked Appleby with such effect that nine-tenths of it lay in ruins and was never rebuilt. In the Wars of the Roses, Westmorland, under the Clifford influence, inclined to favour the Lancastrian cause, but was not actively concerned in the struggle. In the Civil War of the 17th century the chief families of the county were royalist, and in 1641 Anne, countess of Pembroke, hereditary high sheriff of the county, garrisoned Appleby Castle for the king, placing it in charge of Sir Philip Musgrave, the colonel of the train-bands of Westmorland and Cumberland. In 1642 a memorial was presented to Charles signed by nearly 5000 of the inhabitants of Westmorland and Cumberland protesting their loyalty and readiness to sacrifice their lives and fortunes in his service. Appleby Castle surrendered in 1648, but the strength of the royalist feeling was shown in the joy which greeted the news of the Restoration, the mayor of Appleby publicly destroying the charter which the town had received from Cromwell. The Jacobite rising of 1745 found many adherents in Westmorland, and a skirmish took place on Clifton Moor between the forces of Lord George Murray and the duke of Cumberland.

The economic development of Westmorland, both on account of natural disadvantages and of the ravages of border strife, has been slow and unimportant; the rugged and barren nature of the ground being unfavourable to agricultural prosperity, while the lack of fuel hindered the growth of manufactures. Sheep-farming was carried on in the moorland districts, however, and the Premonstratensian house at Shap supplied wool to the Florentine and Flemish markets in the 13th and 14th centuries. The clothing industry, which spread from Kendal to the surrounding districts, is said to have been introduced by one John Kempe of Flanders, who settled there in the reign of Edward III., and a statute of 1465 alludes to cloths of a distinct make being manufactured at Kendal. In 1589 the county suffered severely from the ravages of the plague, 2500 deaths being recorded in the deanery of Kendal alone. Speed, writing in the 17th century, says of Westmorland that "it is not commended either for plenty of corn or cattle, being neither stored with arable grounds to bring forth the one, nor pasturage to lead up the other; the principal profit that the people of this province raise unto themselves is by clothing." The comb manufacture was established at Kendal in 1700, and about the same time the development of the boot and shoe trade to some extent supplemented the loss consequent on the decline of the clothing industry. There were two paper-mills at Milnthorpe in 1777, one of which existed eighty years before.

Westmorland returned two knights for the county to the parliament of 1290, and in 1295 two burgesses for the borough of Appleby. Under the Reform Act of 1832 Appleby was disfranchised and Kendal returned one member.

Antiquities.—Notable ecclesiastical buildings are almost entirely wanting in Westmorland, though mention may be made of the ruins of Shap Abbey, which lies near the small market town of that name in the bleak upper valley of the Lowther. The Perpendicular western tower and other fragments remain. Late Norman work is preserved in some of the churches, as at Kirkby Lonsdale, and in a few castles. Among the castles, those at Appleby, Brough, Brougham and Kendal are notable, but examples are numerous. Among old houses, Levens Hall dates from the 16th century, and Sizergh Hall embodies part of an ancient castle; both are in the Kendal district. The formal gardens at Levens Hall are remarkable. Lowther Castle, near Penrith, the seat of the earl of Lonsdale, is a fine modern mansion, in a Gothic style more satisfactory in broad effect than in detail.

See Joseph Nicholson and Richard Burn, *The History and Antiquities of the Counties of Westmorland and Cumberland* (2 vols., London, 1777); William Whellan, *The History and Topography of the Counties of Cumberland and Westmorland* (Pontefract, 1860); *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society* (Kendal, 1870, &c.); R. S. Ferguson, *History of Westmorland* (Popular County Histories, 1894); Sir D. Fleming, *Description of Westmorland* (1671); T. Gibson, *Legends and Notes on Places of North Westmorland* (London, 1887); M. W. Taylor, *Manorial Halls of Westmorland* (Kendal, 1892); T. Ellwood, *Landnama Book of Iceland as it illustrates the Dialect and Antiquities of Westmorland* (Kendal, 1894); *Victoria County History, Westmorland.*

WESTON, THOMAS (1737–1776), English actor, was the son of a cook. His first London appearance was about 1759, and from 1763 until his death he was admitted to be the most amusing comedian on the English stage. Foote wrote for him the part of Jerry Sneak in the *Mayor of Garratt.* Abel Drugger in the *Alchemist* was one of his famous performances; and Garrick, who also played this part, praised him highly for it.

WESTON-SUPER-MARE, a seaside resort in the Wells parliamentary division of Somersetshire, England, on the Bristol Channel, 137½ m. W. by S. of London by the Great Western railway. Pop. of urban district (1901), 19,048. It is built partly on level ground near the shore, and partly on the slopes of Worlebury Hill, which aids in giving shelter from the north and east. Among the fir-clad slopes of the neighbourhood, which command a fine view of the Welsh hills across the Channel, there are many beautiful walks and drives. An esplanade extends for about 3 m., and public gardens have been laid out on Worlebury Hill, from the far end of which a long pier projects, linking the rocky islet of Birnbeck to the town. Grove Park, once the manor-house, is owned by the council, and is used as a free library, its grounds being open. Other institutions include a museum opened in honour of Queen Victoria's Diamond Jubilee, and the West of England Sanatorium, to which two large conservatories are attached, as a winter-garden for invalids. The town has long been famous for its potteries, and there are mineral water-works and fisheries. Large quantities of sprats are caught. Intermittent springs exist in Weston, which are affected by the ebb and flow of the tide.

WEST ORANGE, a town of Essex county, New Jersey, U.S.A., in the N.E. part of the state, about 13 m. W. of New York City. Pop. (1890) 4358, (1900) 6889 (1772 foreign-born); (1905, state census) 7872; (1910) 10,980. It is served by the Orange branch of the Erie railroad, and is connected with neighbouring towns and cities by electric lines. The town has an area of about 7 sq. m. It is crossed in a N.E. and S.W. direction by two ridges —the First (also called the Orange or Watchung) Mountain and the Second Mountain. Eagle Rock (about 650 ft.), on the summit of First Mountain, commands a splendid view. On the eastern slope of First Mountain are Hutton Park, containing the grounds of the Essex County Country Club, and Llewellyn Park, a beautiful residential tract of 750 acres, named in honour of its originator, Llewellyn S. Haskell (1815–1872). West Orange has various manufactures, including phonographs, lawn mowers and felt hats. In 1862 parts of the townships of Orange, Caldwell and Livingston were united into a new township named Fairmount. In 1863 another part of Orange was added and the name of the new township was changed to West Orange. In 1900 West Orange was chartered as a town.

See H. Whittemore, *The Founders and Builders of the Oranges* (Newark, 1896).

WESTPHAL, RUDOLF (1826–1892), German classical scholar, was born at Obernkirchen in Schaumburg on the 3rd of July 1826. He studied at Marburg and Tübingen, and was professor at Breslau (1858–1862) and Moscow (1875–1879). He subsequently lived at Bückeburg, and died at Stadthagen in Schaumburg-Lippe on the 10th of July 1892. Westphal was a man of varied attainments, but his chief claim to remembrance rests upon his contributions on Greek music and metre. His chief works are: *Griechische Metrik* (3rd ed., 1885–1889); *System der antiken Rhythmik* (1865); Hephaestion's *De metris enchiridion* (1866); *Aristoxenus of Tarentum* (translation and commentary, 1883–1893, vol. ii. being edited after his death by F. Saran); *Die Musik des griechischen Altertums* (1883); *Allgemeine Metrik der indogermanischen und semitischen Völker* (1892). He made translations of Catullus (1870) and of Aristophanes' *Acharnians* (1889), in which he successfully reproduced the Dorisms in Plattdeutsch.

WESTPHALIA (Ger. *Westfalen*), a province of the kingdom of Prussia. The ancient duchy and the Napoleonic kingdom of the same name, neither of which was conterminous with the modern province, are dealt with in the historical part of this article. The area of the province is 7801 sq. m., its length both from N. to S. and from E. to W. is about 130 m., and it is bounded N. by Hanover, E. by Schaumburg-Lippe, Hanover, Lippe-Detmold, Brunswick, Hesse-Nassau and Waldeck, S. and S.W. by Hesse-Nassau and the Rhine Province, and N.W. by the kingdom of the Netherlands.

Nearly half of Westphalia is an extension of the great North-German plain, which here stretches S.E. into an acute angle enclosed on the N.E. by the long low range of the Teutoburger Wald and its southern prolongation the Eggegebirge, and on the S. by the line of hills called the Haar or Haarstrang, which divides the basins of the Lippe and Ruhr. The Westphalian plain is broken by extensive outcrops of the underlying cretaceous beds, and is not very fertile, except in the Hellweg, a zone between the Haarstrang and the Lippe. There are extensive fens in the N. and W., and N. of Paderborn is a sandy waste called the Senne. The plain is drained in the N. by the Ems and in the S. by the Lippe, which rise close together in the Teutoburger Wald. Between their basins are the Vechte and other small rivers flowing into the Zuider Zee. The triangular southern portion of Westphalia, most of which is included in Sauerland ("south land"), is a rugged region of slate hills and wooded valleys drained chiefly by the Ruhr with its affluents the Lenne, Möhne, &c., and in the S. by the Sieg and Eder. The hills rise in the S.E. to the Rotlager or Rothaargebirge, culminating in the Winterberg plateau with the Kahler Asten (2713 ft.), the highest summit in the province. The Rotlagergebirge, Eggegebirge and Teutoburger Wald form with some intermediate ranges the watershed between the basin of the Weser and those of the Rhine and Ems. In the N.E. corner of the province the Weser divides the Wiehengebirge from the Wesergebirge by the narrow pass called *Porta Westfalica*.

The climate is temperate except in the south, which is cold in winter and has a heavy rainfall. Of the total area 43% is occupied by arable land and gardens, 18% by meadows and pastures and 28% by forests. The best agricultural land is in the Hellweg and the Weser basin. The number of peasant proprietors is proportionately greater than in any other part of Prussia, and as a class they are well-to-do. The crops include grain of all kinds (not sufficient, however, for the needs of the province), peas and beans, buckwheat, potatoes, fruit and hemp. The cultivation of flax is very extensive, especially in the N.E. Swine, which are reared in great numbers in the plains, yield the famous Westphalian hams; and the rearing of cattle and goats is important. The breeding of horses is fostered by the government.

The mineral wealth is very great, especially in coal and iron. The production of coal is greater than that of any other province of Prussia, and amounted in 1906 to 53,000,000 tons. The great Ruhr coal-field extends from the Rhineland into the province as far as Unna, the centre being Dortmund, and there is a smaller coal-field in the N. at Ibbenbüren. The production of iron ore, chiefly S. of the Ruhr (1,360,000 tons in 1905) is exceeded in Prussia only by that of the Rhine province. After coal and iron the most valuable minerals are zinc, lead, pyrites and copper. Antimony, quicksilver, stone, marble, slate and potter's clay are also worked, and there are brine springs in the Hellweg and mineral springs at Lippspringe, Öynhausen, &c.

The manufacturing industry of the province, which chiefly depends upon its mineral wealth, is very extensive. Iron and steel goods are produced in the so-called "Enneper Strasse," the valley of the Ennepe, a small tributary of the Ruhr with the town of Hagen, and in the neighbouring towns of Bochum, Dortmund, Iserlohn and Altena, and also in the Siegen district. The brass and bronze industries are carried on at Iserlohn and Altena, those of tin and Britannia metal at Lüdenscheid; needles are made at Iserlohn and wire at Altena. The very important linen industry of Bielefeld. Herford, Minden and Warendorf has flourished in this region since the 14th century. Jute is manufactured at Bielefeld and cotton goods in the W. Paper is extensively made on the lower Lenne, and leather around Siegen. Other manufactures are glass, chemicals, sugar, sausages and cigars. An active trade is promoted by several trunk lines of railway which cross the province (total mileage in 1906, 1889 m., exclusive of light railways) and by the navigation of the Weser (on which Minden has a port), Ems, Ruhr and Lippe. Beverungen is the chief market for corn and Paderborn for wool.

The population in 1905 was 3,618,090, or 464 per sq. m. It is very unevenly distributed, and in the industrial districts is increasing very rapidly. In recent years there has been a great influx of Poles into these parts, attracted by the higher wages. In 1900 they already numbered more than 100,000. Between 1895 and 1900 the mean annual increase of the population was 3·3%, the highest recorded in the German empire, but between 1900 and 1905 it fell to 2·5%. The percentage of illegitimate births (2·6) is the lowest in Germany. 51·0% of the inhabitants are Roman Catholics, 47·9% Protestants. The distribution of the two communions still closely follows the lines of the settlement at the peace of Westphalia. Thus the former duchy of Westphalia and the bishoprics of Münster and Paderborn which remained in ecclesiastical hands are almost entirely Roman Catholic, while the secularized bishopric of Minden and the former counties of Ravensberg and Mark, which fell or had fallen to Brandenburg, and the Siegen district, which belonged to Nassau, are predominantly Protestant.

The province is divided into the three governmental departments (*Regierungsbezirke*) of Minden, Münster and Arnsberg. Münster is the seat of government and of the provincial university. Westphalia returns thirty-one members to the Prussian Lower House and seventeen to the Reichstag.

The inhabitants are mainly of the Saxon stock and speak Low German dialects, except in the Upper Frankish district around Siegen, where the Hessian dialect is spoken.

Westphalia, "the western plain" (in early records *Westfalahi*), was originally the name of the western province of the early duchy of Saxony, including the western portion of the modern province and extending north to the borders of Friesland. When Duke Henry the Lion of Saxony fell under the ban of the empire in 1180, and his duchy was divided, the bishops of Münster and Paderborn became princes of the empire, and the archbishop of Cologne, Philip of Heinsberg, received from the emperor Frederick I. the Sauerland and some other districts which became the duchy of Westphalia. Within the duchy were some independent secular territories, notably the county of Mark, while other districts were held as fiefs from the archbishops, afterwards electors. From 1368 the electors themselves held the county of Arnsberg as an imperial fief. The duchy received a constitution of its own, and was governed for the elector by a marshal (*Landmarschall*, after 1480 *Landdrost*) who was also stadtholder, and presided over the Westphalian chancellery. This system lasted till 1803. By Maximilian's administrative organization of the empire in 1500 the duchy of Westphalia was included as an appanage of Cologne in the scattered circle of the Lower Rhine. The Westphalian circle which was formed at the same time comprised nearly all the rest of the modern province (including Mark) and the lands north of it between the Weser and the frontier of the Netherlands, also Verden, Schaumburg, Nassau, Wied, Lippe, Berg, Cleves, Jülich, Liége, Bouillon and Cambrai.

Brandenburg laid the foundations of her dominion in Westphalia by obtaining the counties of Mark and Ravensberg in 1614 (confirmed 1666), to which the bishopric of Minden was added by the peace of Westphalia in 1648 and Tecklenburg in 1707. By the settlement of 1803 the church lands were secularized, and Prussia received the bishopric of Paderborn and the eastern part of Münster, while the electoral duchy of Westphalia was given to Hesse-Darmstadt.

After the peace of Tilsit the kingdom of Westphalia was created by Napoleon I. on the 18th of August 1807, and given to his brother Jerome (see BONAPARTE). It included the present governmental department of Minden, but by far the larger part of the kingdom lay outside and chiefly to the east of the modern province, and comprised the Hanoverian department of Hildesheim and in part that of Arensberg, Brunswick, the northern part of the province of Saxony as far as the Elbe, Halle, and most of Hesse-Cassel. The area was 14,627 sq. m., and the population nearly two millions. Cassel was the capital. A constitution on the French imperial pattern granted by the king remained practically inoperative, an arbitrary bureaucratic régime was instituted, the finances were from the beginning in a hopeless condition, and the country was drained of men and money for Napoleon's wars. In January 1810 most of Hanover was added, but at the end of the same year half the latter, together with the city of Minden, was annexed to the French empire. There had already been serious revolts and raids, and after the battle of Leipzig the Russians drove the king from Cassel (October 1813), the kingdom of Westphalia was dissolved and the old order was for a time re-established. At the congress of Vienna (1815) Hesse-Darmstadt surrendered her share of Westphalia to Prussia, and the present province was constituted.

See Weddigen, *Westfalen, Land und Leute* (Paderborn, 1896); G. Schulze, *Heimatskunde der Provinz Westfalen* (Minden, 1900); Lemberg, *Die Hütten- und Metallindustrie Rheinlands und Westfalens* (4th ed., Dortmund, 1905); J. S. Seibertz, *Landes- und Rechtsgeschichte des Herzogtums Westfalen* (4 vols., Arnsberg, 1839–1875); R. Wilmans, *Die Kaiserurkunden der Provinz Westfalen* (2 vols., Münster, 1867–1881); M. Jansen, *Die Herzogsgewalt der Erzbischöfe von Köln in Westfalen* (Munich, 1895); Holzapfel, *Das Königreich Westfalen* (Magdeburg, 1895); G. Servières, *L'Allemagne française sous Napoléon I*^{er} (Paris, 1904); Haselhoff, *Die Entwickelung der Landeskultur in der Provinz Westfalen im 19ten Jahrhundert* (Münster, 1900).

WESTPHALIA, TREATY OF, a collective name given to the two treaties concluded on the 24th of October 1648 by the empire with France at Münster and with Sweden and the Protestant estates of the empire at Osnabrück, by which the Thirty Years' War (*q.v.*) was brought to an end.

As early as 1636 negotiations had been opened at Cologne at the instance of Pope Urban VIII., supported by the seigniory of Venice, but failed owing to the disinclination of Richelieu to stop the progress of the French arms, and to the refusal of Sweden to treat with the papal legate. In 1637 the agents of the emperor began to negotiate at Hamburg with Sweden, though the mediation of Christian IV., king of Denmark, was rejected by Sweden, and the discussions dragged on for years without result. In the meantime the new emperor Ferdinand III. proposed at the diet of Regensburg in 1640 to extend the peace of Prague to the whole empire, on the basis of an amnesty, from which, however, those Protestant estates who were still leagued with foreign powers were to be excluded. His aim was by settling the internal affairs of the empire to exclude the German princes from participation in negotiations with foreign powers; but these efforts had no result.

A more practical suggestion was made by the Comte d'Avaux, the French envoy at Hamburg, who proposed in 1641 that the negotiations at Cologne and Hamburg should be transferred to Münster and Osnabrück, two cities in the Westphalian circle not more than 30 m. apart. A preliminary treaty embodying this proposal was concluded between the representatives of the emperor, France and Sweden at Hamburg on the 25th of December 1641. A dispute as to precedence between France and Sweden, and the refusal of the latter power to meet the papal nuncio, made the choice of a single meeting-place impossible. It was arranged, however, that the two assemblies should be regarded as a single congress, and that neither should conclude peace without the other.

The date fixed for the meeting of the two conventions was the 11th of July 1643, but many months elapsed before all the representatives arrived, and the settlement of many questions of precedence and etiquette caused further delays. England, Poland, Muscovy and Turkey were the only European powers unrepresented. The war continued during the deliberations, which were influenced by its fortunes.

The chief representative of the emperor was Count Maximilian von Trautmansdorff, to whose sagacity the conclusion of peace was largely due. The French envoys were nominally under Henry of Orleans, duke of Longueville, but the marquis de Sablé and the comte d'Avaux were the real agents of France. Sweden was represented by John Oxenstierna, son of the chancellor, and by John Adler Salvius, who had previously acted for Sweden at Hamburg. The papal nuncio was Fabio Chigi, afterwards Pope Alexander VII. Brandenburg, represented by Count Johann von Sayn-Wittgenstein, played the foremost part among the Protestant states of the empire. On the 1st of June 1645 France and Sweden brought forward propositions of peace, which were discussed by the estates of the empire from October 1645 to April 1646. The settlement of religious matters was effected between February 1646 and March 1648. The treaty was signed at Münster by the members of both conventions on the 24th of October 1648, and ratifications were exchanged on the 8th of February 1649. The papal protest of January 3, 1651, was disregarded.

The results were determined in the first place by the support given to each other by France and Sweden in their demands for indemnification, the concession of which necessitated compensation to the German states affected, and secondly by the determination of France to weaken the power of the emperor while strengthening the Roman Catholic states, especially Bavaria.

Sweden received western Pomerania with Rügen and the mouths of the Oder, Wismar and Poel, in Mecklenburg, and the lands of the archbishopric of Bremen and the bishopric of Verden, together with an indemnity of 5,000,000 thalers. The privileges of the Free Towns were preserved. Sweden thus obtained control of the Baltic and a footing on the North Sea, and became an estate of the empire with three deliberative voices in the diet.

The elector of Brandenburg received the greater part of eastern Pomerania, and, as he had a claim on the whole duchy since the death of the last duke in 1635, he was indemnified by the bishoprics of Halberstadt, Minden and Kammin, and the reversion of the archbishopric of Magdeburg, which came to him on the death of the administrator, Prince Augustus of Saxony, in 1680. The elector of Saxony was allowed to retain Lusatia. As compensation for Wismar, Mecklenburg-Schwerin obtained the bishoprics of Schwerin and Ratzeburg and some lands of the Knights of St John. Brunswick-Lüneburg restored Hildesheim to the elector of Cologne, and gave Minden to Brandenburg, but obtained the alternate succession to the bishopric of Osnabrück and the church lands of Walkenried and Gröningen. Hesse-Cassel received the prince-abbacy of Hersfeld, the county of Schaumburg, &c. The elector of Bavaria was confirmed in his possession of the Upper Palatinate, and in his position as an elector which he had obtained in 1623. Charles Louis, the son and heir of Frederick V., the count palatine of the Rhine, who had been placed under the ban of the empire, received back the Lower Palatinate, and a new electorate, the eighth, was created for him.

France obtained the recognition of the sovereignty (which she had enjoyed *de facto* since 1552) over the bishoprics and cities of Metz, Toul and Verdun, Pinerolo in Piedmont, the town of Breisach, the landgraviate of Upper and Lower Alsace, the Sundgau, the advocacy (*Landvogtei*) of the ten imperial cities in Alsace, and the right to garrison Philippsburg. During the Thirty Years' War France had professed to be fighting against the house of Austria, and not against the empire. It was stipulated that the immediate possessions of the empire in Alsace should remain in enjoyment of their liberties (*in ea libertate et possessione immedietatis erga imperium Romanum, qua hactenus gavisae sunt*), but it was added as a condition that the sovereignty of France in the territories ceded to her should not be impaired (*ita tamen, ut praesenti hac declaratione nihil detractatum intelligatur de eo omni supremi dominii iure, quod supra concessum est*). The intention of France was to acquire the full rights of Austria in Alsace, but as Austria had never owned the landgraviate of Lower Alsace, and the *Landvogtei* of the ten free cities did not in itself imply possession, the door was left open for disputes. Louis XIV. afterwards availed himself of this ambiguous clause in support of his aggressive policy on the Rhine. The independence of Switzerland was at last formally recognized, as was that of the United Netherlands in a separate treaty signed by Spain at Münster.

Apart from these territorial changes, a universal and unconditional amnesty to all those who had been deprived of their possessions was declared, and it was decreed that all secular lands should be restored to those who had held them in 1618. Some exceptions were made in the case of the hereditary dominions of the emperor.

Even more important than the territorial redistribution was the ecclesiastical settlement. By the confirmation of the treaty of Passau of 1552 and the religious peace of Augsburg of 1555, and the extension of their provisions to the Reformed (Calvinist) Church, toleration was secured for the three great religious communities of the empire. Within these limits the governments were bound to allow at least private worship, liberty of conscience and the right of emigration, but these measures of toleration were not extended to the hereditary lands of the house of Habsburg. The Protestant minority in the imperial diet was not to be coerced by the majority, but religious questions were to be decided by amicable agreement. Protestant administrators of church lands obtained seats in the diet. Religious parity was established in the imperial chamber (*Reichskammergericht*), and in the imperial deputations and commissions.

The difficult question of the ownership of spiritual lands was decided by a compromise. The edict of restitution of 1629 was annulled. In Württemberg, Baden and the Palatinate these lands were restored to the persons who had held them in 1618 or their successors, but for the rest of the empire possession was determined by the fact of occupation on the 1st of January 1624 (*annus decretorius* or normal year). By the provision that a prince should forfeit his lands if he changed his religion an obstacle was placed in the way of a further spread of the Reformation. The declaration that all protests or vetoes by whomsoever pronounced should be null and void dealt a blow at the intervention of the Roman curia in German affairs.

The constitutional changes made by the treaty had far-reaching effects. The territorial sovereignty of the states of the empire was recognized. They were empowered to contract treaties with one another and with foreign powers, provided that the emperor and the empire suffered no prejudice. By this and other changes the princes of the empire became absolute sovereigns in their own dominions. The emperor and the diet were left with a mere shadow of their former power. The emperor could not pronounce the ban of the empire without the consent of the diet. The diet, in which the 61 imperial cities gained the right of voting on all imperial business, and thus were put on an equality with the princes, retained its legislative and fiscal powers in name, but practically lost them by the requirement of unanimity among the three colleges, which, moreover, were not to give their several decisions by majorities of their members, but by agreement between them.

Not only was the central authority replaced almost entirely by the sovereignty of about 300 princes, but the power of the empire was materially weakened in other ways. It lost about 40,000 sq. m. of territory, and obtained a frontier against France which was incapable of defence. Sweden and France as guarantors of the peace acquired the right of interference in the affairs of the empire, and the former gained a voice in its councils. For many years Germany thus became the principal theatre of European diplomacy and war. But if the treaty of Westphalia pronounced the dissolution of the old order in the empire, it facilitated the growth of new powers in its component parts, especially Austria, Bavaria and Brandenburg.

The treaty was recognized as a fundamental law of the German constitution, and formed the basis of all subsequent treaties until the dissolution of the empire.

See the text in Dumont, *Corps universel diplomatique* (The Hague, 1726–1731), vi. 429 ff.; J. G. von Meiern, *Acta pacis Westphalicae publica* (6 vols., Hanover and Göttingen, 1734–1736), *Instrumenta pacis Caesareo-Suecicae et Caesareo-Gallicae* (Göttingen, 1738); "A. A." [Bishop Adam Adami], *Arcana pacis Westphalicae* (Frankfort, 1698), edited by J. G. von Meiern (Leipzig, 1737); K. T. Heigel, "Das Westfälische Friedenswerk von 1643–1648" in the *Zeitschrift für Geschichte und Politik* (1888); F. Philippi and others, *Der Westfälische Frieden, ein Gedenkbuch* (Münster, 1898); *Journal du Congrès de Munster par F. Ogier, aumônier du comte d'Avaux*, edited by A. Boppe (Paris, 1893); *Cambridge Modern History*, iv. p. 395 ff. and bibliography, p. 866 ff.; J. Bryce, *The Holy Roman Empire*, ch. xix. (A. B. Go.)

WEST POINT, a village and military post, in Orange county, New York, U.S.A., on the west bank of the Hudson river, 50 m. above New York City. It is served by the West Shore railway, and is connected by ferry with the New York Central railway at Garrison. The United States Military Academy occupies a plateau 180 ft. above the river, reached by a roadway cut into the cliff and commanding a view up and down the river for many miles. Between 1902 and 1908 Congress appropriated about $7,500,000 for the reconstruction of the academy, but most of the old buildings of historic interest have been incorporated. The Headquarters Building and Grant Hall (the mess hall) contain portraits of famous American soldiers. The military library is one of the finest in existence (80,000 volumes in 1910), and its building contains interesting memorials, by Saint Gaudens, to J. McNeill Whistler and Edgar Allan Poe, both former cadets in the academy. Cullum Memorial Hall (1899) was the gift of Major-General George Washington Cullum (1809–1892), superintendent of the academy in 1864–1866. Opposite it is a monument (1845) to Major F. L. Dade's command of 110 men who were ambushed and killed by the Seminole Indians in Florida in December 1835. In the S.E. corner of the parade ground (60 acres) is a granite statue to Colonel Sylvanus Thayer (1785–1872), who was superintendent of the academy from 1817 to 1833. In the N.W. angle is the bronze statue (1868) of Major-General John Sedgwick, U.S. Volunteers, who was killed by a sharpshooter, on the 9th of May 1864, while making a personal reconnaissance at Spottsylvania. Between Trophy Point and the hotel is the Battle Monument (1874, 78 ft. high, surmounted by a statue of Victory by MacMonnies), a memorial to the soldiers of the regular army who died in the Civil War. Above the cliff towards the N. and E. of the plain is Fort Clinton; in its E. front stands a monument erected in 1828 by the Corps of Cadets to Kosciuszko, who planned the original fortifications here in 1778. About 1 m. N. of the academy is "West Point Cemetery" (about 14 acres) on the E. angle of an elevated plain overlooking the river, formerly known as "German Flats," in which rest the remains of Thayer, Winfield Scott, Robert Anderson and other distinguished soldiers. The Cadet Monument (1817) stands on the E. angle overlooking the river. High above the academy on Mount Independence (490 ft.) still stands old Fort Putnam, commanding a fine view for miles up and down the Hudson. In 1908, as the gift of Mrs Russell Sage and Miss Anna B. Warner, there was added to the military reservation Constitution Island (about 280 acres), lying directly opposite West Point, with the remains of two forts built during the War of Independence.

West Point, "the Gibraltar of the Hudson," was first occupied as a military post in January 1778, when a chain of redoubts was erected at various strategic points along the Hudson. At West Point were built a half-dozen earthwork fortifications, of which Fort Putnam on Mt. Independence, Fort Clinton on the extremity of the point (not to be confused with the Fort Clinton captured by the British in 1777 farther down the river) and Battery Knox, just above the river landing, were the largest. These were the fortifications that Benedict Arnold, their commander, in 1780 agreed to deliver into British hands. After the discovery of his treason, Washington made his headquarters for some time at West Point before removing to Newburgh. Later Washington recommended West Point as a site for a military school. Such an establishment had been suggested by Henry Knox in May 1776; and in October of that year the Continental Congress passed a resolution appointing a committee to draw plans for "a military academy of the army." A Corps of Invalids was established in June 1777, was organized in Philadelphia in July 1777, and was transferred to West Point in 1781; this corps was "to serve as a military school for young gentlemen previously to their being appointed to marching regiments." Three buildings had been erected here to house a library, an engineers' school and a laboratory, and practical experiments in gunnery had been begun here in February 1780. In 1783, at Newburgh, Washington laid before his officers the matter of a military academy such as Knox had suggested. A school for artillerists, engineers and cadets of the corps was established here on the president's recommendation in 1794, and continued until the buildings were destroyed by fire in 1796. In July 1801, Henry Dearborn, Jefferson's secretary of war, directed that all cadets of the corps of artillerists, a subordinate rank which had been established in 1794, should report at West Point for instruction, and in September of that year a school was opened with five instructors, four of them army officers. On the 16th of March 1802, President Jefferson approved an act establishing a military academy at West Point, and on the 4th of July it was formally opened with ten cadets present. Acts of 1802 and 1808 authorized 40 cadets from the artillery, 100 from the infantry, 16 from the dragoons and 20 from the riflemen. But few of these were actually appointed, and for several years instruction was disorganized and desultory. In 1811–1812 instruction was practically abandoned, and in March 1812 the "academy" was without a single instructor. Up to this time 88 cadets had been graduated, but they had been admitted without any sort of examination, and at any age between 12 and 34. An act of Congress of the 29th of April 1812 reorganized the academy, and laid down the general principles and plan on which it has since been conducted. A maximum of 250 cadets was then authorized. Under the able superintendency of Major Sylvanus Thayer this plan was perfected and put into successful operation. Up to 1843 no territorial requirement was necessary for appointment, but in that year a custom that had grown up of providing for one cadet from each Congressional district, each Territory and the District of Columbia, was embodied in the law.

By acts of 1900, 1902, 1903 and 1908 the Corps of Cadets as now constituted consists of one cadet from each congressional district (appointed on recommendation by members of Congress), one from each Territory, one from the District of Columbia, one from Porto Rico, two from each state at large (on recommendation of the senators), and 40 from the United States at large, all to be appointed by the president. Four Filipinos may also receive instruction and become eligible on graduation for commissions in the Philippine scouts. The maximum number of cadets under the apportionment of the twelfth census was 533. Candidates for admission must be between 17 and 22 years, unmarried, and at least 5 ft. 4 in. high. For entrance there are physical examinations, and examinations in algebra, plane geometry, English grammar, composition and literature, geography and general history. In 1902 the entrance requirements were raised and the actual amount of work done in the academy was thus decreased. The principal courses are: tactics for all classes; civil and military engineering (first class); practical military engineering (fourth, third, second and first classes); mechanics and astronomy (third and second classes); mathematics (new cadets, fourth and third classes); chemistry, mineralogy and geology (third and second classes); drawing (third and second classes); modern languages, *i.e.* French and Spanish (fourth, third, second and first classes); law (first class); ordnance and gunnery (first class); military hygiene (second class); and English and history (new cadets and fourth class). The course is four years, and academic instruction continues from the 1st of September to the 5th of June. The summer months are devoted to field work and encampments. Each cadet while in attendance receives pay at the rate of $600 a year and one ration per day, or commutation thereof at thirty cents per day, amounting to $709·50. The number of graduates from 1802 to 1909 inclusive was 4852. The superintendents of the academy have been: in 1802–1803 and in 1805–1812, Jonathan Williams; in 1812–1814, Joseph Gardner Swift (1783–1865); in 1815–1817, Alden Partridge (1785–1854); in 1817–1833, Sylvanus Thayer; in 1833–1838 René E. De Russy (1796–1864); in 1838–1845 and in 1856–1861, Richard Delafield (1798–1873); in 1845–1852, Henry Brewerton (1801–1879); in 1852–1855, Robert E. Lee; in 1855–1856, John Gross Barnard (1815–1882); in January 1861, P. G. T. Beauregard; in 1861–1864, Alexander Hamilton Bowman (1803–1865); in 1864, Zealous Bates Tower (1819–1900); in 1864–1866, G. W. Cullum; in 1866–1871, Thomas Gamble Pitcher (1824–1895); in 1871–1876, Thomas Howard Ruger (1833–1907); in 1876–1881, J. M. Schofield; in 1881–1882, O. O. Howard; in 1882–1887, Wesley Merritt; in 1887–1889, John Grubb Park (1827–1900); in 1889–1893, John Moulden Wilson (b. 1837); in 1893–1898, Oswald Herbert Ernst (b. 1842); in 1898–1906, Albert Leopold Mills (b. 1854); in 1906–1910, H. L. Scott (b. 1853); and, 1910, T. H. Barry (b. 1855).

See G. W. Cullum, *Biographical Register of the Officers and Graduates of the United States Military Academy* (4 vols., New York, 1891–1904); E. C. Boynton, *History of West Point* (ibid. 1863); J. P. Farley, *West Point in the Early Sixties* (Troy, 1902); Morris Schaff, *The Spirit of Old West Point* (Boston, 1907); and the annual reports of the superintendent.

WESTPORT, a market-town, seaport and seaside resort of County Mayo, Ireland, near the mouth of a small river in Clew Bay. Pop. (1901) 3892. The town is 160 m. W. from Dublin by the Midland Great Western railway, Westport Quay at the river mouth being served by a branch line. There is a small export trade in grain. The beautiful demesne of the marquess of Sligo enriches the neighbourhood. Clew Bay, thickly studded with islands and surrounded with mountains, is one of the most magnificent of the great inlets on the W. coast. Near the S. shore is Croagh Patrick (2510 ft.), an isolated conical hill of singularly perfect form, in wide repute as a place of pilgrimage.

WEST PRUSSIA (Ger. *Westpreussen*), a province of Prussia, bounded on the N. by the Baltic, on the E. by East Prussia, on the S. by Russian Poland and the province of Posen, and on the W. by Brandenburg and Pomerania. The area is 9862 sq. m. The greater part is occupied by the low Baltic plateau, intersected by a network of streams and lakes, and rising to the Turmberg (1086 ft.) near Danzig. East of Konitz is an extensive moorland, 70 m. long, called the Tucheler Heide. The lakes, though very numerous, are not large. The Vistula, here of great width, and subject to destructive floods, enters the province near Thorn, and flowing north in a valley which divides the plateau, enters Danzig Bay by a large delta, the Werder. The other rivers are chiefly tributaries of the Vistula, as the Drewenz on its right bank and the Brahe on its left.

In general physical characteristics the province resembles East Prussia, but the climate is less harsh and the fertility of the soil greater. Arable land and gardens occupy 55·6% of the area, meadows and pastures 12·9%, forests 21·7%, and the rest is mostly waste. The valley and delta of the Vistula are very fertile, and produce good crops of wheat and pasturage for horses, cattle and sheep. Besides cereals, the chief crops are potatoes, hay, tobacco, garden produce, fruit and sugar-beet. Poultry, fish and timber are important sources of wealth. Cavalry horses (especially at the government stud farm of Marienwerder) and merino sheep are reared. The minerals are unimportant, except amber, peat and clay. Shipbuilding is carried on at Danzig and Elbing, and in various places there are iron and glass works, saw-mills, sugar factories and distilleries. Much of the trade passes through the ports of Danzig and Elbing.

The population in 1905 was 1,641,746, showing a mean density of 166 to the sq. m. Of these 567,318 or 34·5 % were Poles, a larger proportion than in any other Prussian province except Posen. They are increasing somewhat faster than the Germans, and the efforts of the colonization commission have done little to promote the immigration of German farmers. The Kashubes (*q.v.*), nearly all of whom (less than 200,000) live in W. Prussia, chiefly in the west, from Putzig to Konitz, are here reckoned with the Poles. The Poles proper chiefly inhabit the centre of the province, and the borders of Russian Poland. Among the Germans, who are most numerous in the north-east, Low German dialects are spoken, except in a Swabian colony round Kulmsee. Roman Catholics number 51·4% and Protestants 46·6% of the population, and there are 16,000 Jews. The Poles are almost all Roman Catholics.

The province is divided into the governmental departments of Danzig and Marienwerder. It returns twenty-two members to the Prussian Lower House and thirteen to the Reichstag. Danzig is the capital, and the only large town.

West Prussia, with the exception of southern Pomerania (around Marienwerder) which belonged to Prussia, was a possession of Poland from 1466 till the first partition of Poland in 1772, when it was given to Prussia with the exception of Danzig and Thorn, which Poland retained till 1793. The present province was formed in 1808, but from 1824 to 1878 was united with East Prussia. For its history see also PRUSSIA and POLAND.

See K. Lohmeyer, *Geschichte von Ost- und Westpreussen* (part i., 3rd ed., Gotha, 1908); Vallentin, *Westpreussen seit den ersten Jahrzehnten dieses Jahrhunderts* (Tübingen, 1893); Ambrassat, *Westpreussen, ein Handbuch der Heimatkunde* (Danzig, 1906).

WEST SPRINGFIELD, a township of Hampden county, Massachusetts, U.S.A., on the Connecticut river, opposite Springfield. Pop. (1890) 5077; (1900) 7105 (1501 foreign born); (1910) 9224. Area, about 18 sq. m. The township is served by the Boston & Albany railway, and by interurban electric railways to Holyoke and Hartford. The principal villages are Merrick and West Springfield on the Connecticut river and Mittineague on the Westfield river. West Springfield was originally a part of Springfield. The first settlement was not made, however, until about 1653, and there were few settlers until after King Philip's War (1676). In 1696 West Springfield was organized as a separate parish, and in 1774 was made a separate township. Holyoke was set off from it in 1860, and Agawam in 1855.

WEST VIRGINIA, the north-westernmost of the so-called Southern states of the United States of America, lying between latitudes 37° 10′ and 40° 40′ N., and longitudes 77° 40′ and 82° 40′ W. It is bounded on the north-west by Ohio, from which it is separated by the Ohio river, on the north by Pennsylvania and Maryland, the Potomac river dividing it from the latter state; on the east and south-east by Pennsylvania, Maryland and Virginia, the boundary lines in the first two cases being meridians, in the last case a very irregular line following the crest of mountain ridges in places; and on the south-west by Virginia and Kentucky, the Big Sandy river separating it from the latter state. The extreme length of the state from north to south is about 240 m., the extreme breadth from east to west about 265 m. Area, 24,170 sq. m., of which 148 sq. m. is water surface.

Physical Features.—The state is divided into two distinct physiographic provinces; the Alleghany Plateau on the west, comprising perhaps two-thirds of the area of the state, and forming a part of the great Appalachian Plateau Province which extends from New York to Alabama; and the Newer Appalachians or Great Valley Region on the east, being a part of the large province of the same name which extends from Canada to Central Alabama. The Alleghany Plateau consists of nearly horizontal beds of limestone, sandstone and shales, including important seams of coal; inclines slightly toward the north-west, and is intricately dissected by extensively branching streams into a maze of narrow canyons and steep-sided hills. Along the Ohio river, these hills rise to an elevation of 800 to 1000 ft. above sea-level, while toward the south-east the elevation increases until 3500 and 4000 ft. are reached along the south-east margin of the plateau, which is known as the Alleghany Front. The entire plateau area is drained by the Ohio river and its tributaries. Along the flood-plains of the larger rivers are fertile "bottomlands," but the ruggedness of the plateau country as a whole has retarded the development of the state, much of which is still sparsely populated. The coal beds are of enormous extent, and constitute an important element in the wealth of the state. Petroleum and natural gas also occur in the plateau rocks in great quantities.

In the Newer Appalachian region, the beds which still lie horizontal in the plateau province were long ago thrown into folds and planed off by erosion, alternate belts of hard and soft rock being left exposed. Uplift permitted renewed erosion to wear away the soft belts, leaving mountain ridges of hard rock separated by parallel valleys. Hence the region is variously known as the Ridge and Valley Belt, the Great Valley Region, or the Folded Appalachians. The mountain ridges vary in height up to 4000 ft. and more, the highest point in the state being Spruce Knob (4860 ft.). The parallel valleys are drained by north-east and south-west flowing streams, those in the north-east being tributary to the Potomac, those farther south tributary to the Great Kanawha. Although the valleys between the ridges are not always easy of access, they give broad areas of nearly level agricultural land.

Flora.—The plateau portion of West Virginia is largely covered by hardwood forests, but along the Ohio river and its principal tributaries the valuable timber has been removed and considerable areas have been wholly cleared for farming and pasture lands. Among the most important trees of this area are the white and chestnut oaks, the black walnut, the yellow poplar, and the cherry, the southern portion of the state containing the largest reserve supply. In the area of the Newer Appalachian Mountains, the eastern Panhandle region has a forest similar to that of the plateau district; but between these two areas of hardwood there is a long belt where spruce and white pine cover the mountain ridges. Other trees common in the state are the persimmon, sassafras, and, in the Ohio Valley region, the sycamore. Hickory, chestnut, locust, maple, beech, dogwood, and pawpaw are widely distributed. Among the shrubs and vines are the blackberry, black and red raspberry, gooseberry, huckleberry, hazel and grape. Ginseng is an important medicinal plant. Wild ginger, elder and sumach are common, and in the mountain areas, rhododendrons, mountain laurel and azaleas.

Climate.—Inasmuch as the state has a range of over 4000 ft. in altitude, the climate varies greatly in different districts. The mean annual temperatures for typical sections are as follows: Ohio Valley north of the thirty-ninth parallel, 53° F.; south-western part of state, 56°; central plateau district, 52°; mountainous belt along south-eastern boundary of state, 48° to 50°. Wellsburg, in the northern Panhandle, has a mean winter temperature of 27°, a summer mean of 70°. Parkersburg, farther down the Ohio Valley, has a winter mean of 34° and a summer mean of 74°. Martinsburg, in the eastern Panhandle, has nearly the same means, 32° and 74°. Terra Alta, in the north-eastern mountains, has a winter mean of 26°, a summer mean of only 67°. The first killing frosts generally occur about the middle of October in the Ohio Valley region, and about the first of October in the higher plateau and mountain region; the average dates for the last killing frosts in the same localities are the middle and last of April respectively. In the Ohio Valley and eastern Panhandle the summer mean temperature is 74°, the winter mean 31° to 34°. The highest recorded temperature for the state is 107°, the lowest–35°. Temperatures above 100° and below–15° are rare. Precipitation is greatest in the mountains, over 50 in.; and least over the Ohio Valley, the eastern Panhandle and the extreme south-east, 35 to 40 in. Snows are frequent during the winter, and sometimes deep in the higher plateau and mountain districts. The prevailing winds are from south to west.

AGRICULTURE.—The state is primarily agricultural. In general the richer western part is devoted to crops, and the eastern part to raising live-stock. The crop of Indian corn in 1909 was 27,632,000 bushels, and the acreage 880,000. The wheat crop was 4,810,000 bushels, and the acreage 370,000. The crop of buckwheat was 499,000 bushels (grown on 22,000 acres). The rye crop was 148,000 bushels, and the acreage 11,000. The production of oats was 2,156,000 bushels (grown on 98,000 acres). In 1909 the acreage of hay alone was 675,000 acres, and the crop was 844,000 tons, valued at $11,225,000. Tobacco is grown throughout the state; in 1909 on 12,000 acres was grown a crop of 12,000,000 ℔, valued at $1,663,200.

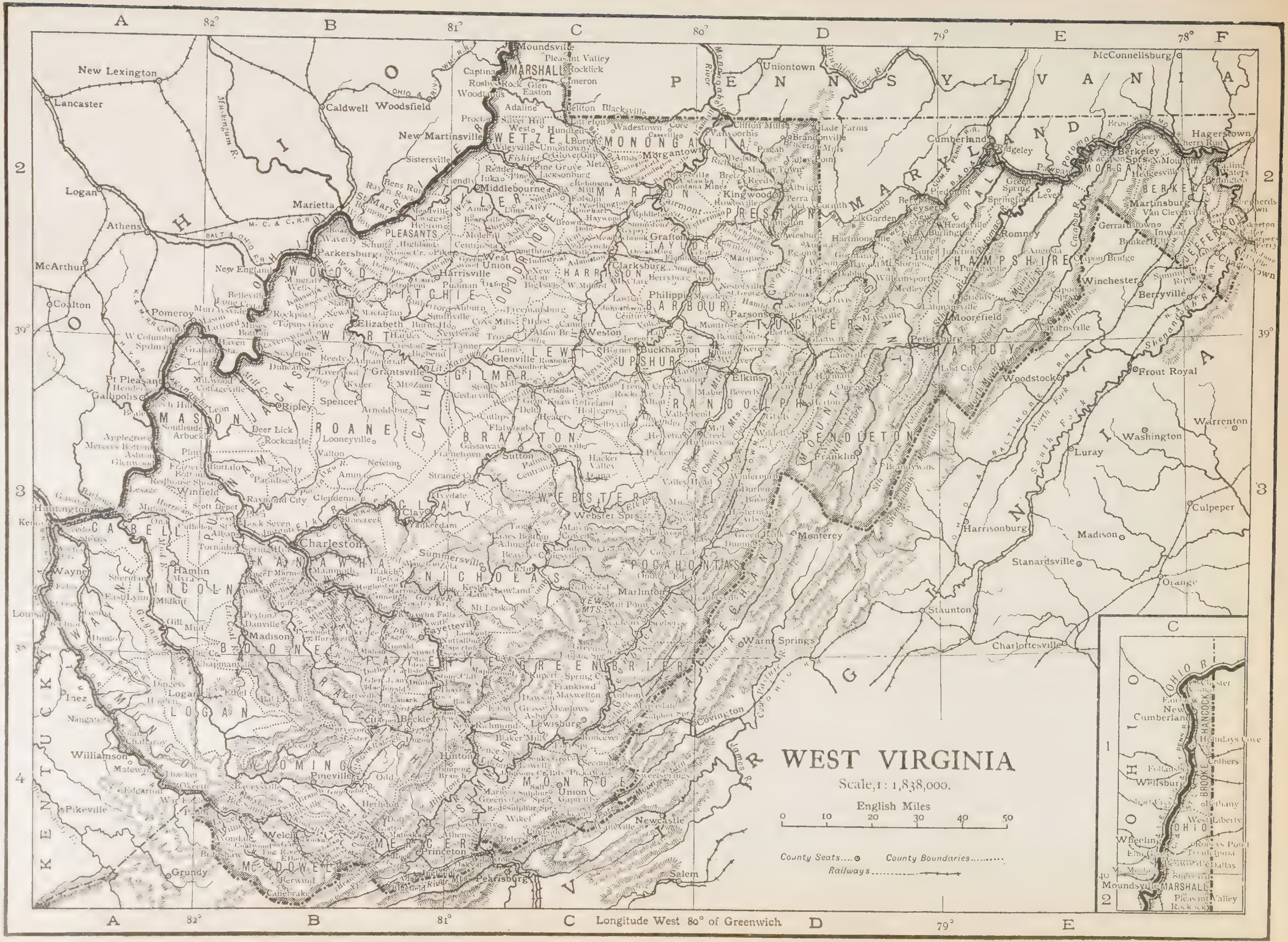
Stock-raising is an important industry, especially in the eastern part of the state.

Mines and Quarries.—The state's great mineral wealth is in coals of various kinds, petroleum, and natural gas.

The coal deposits underlie about 17,000 sq. m. (more than 70 % of the total) of the state's area, and bituminous coal has been found in 51 of the 55 counties; this is one of the largest continuous coal fields in the world. The principal districts are the Fairmont (or Upper Monongahela) and the Elk Garden (or Upper Potomac) in the northern, and the Pocahontas (or Flat Top) and the New and Kanawha rivers districts in the southern part of the state. The total output of the state was 44,648 tons in 1863, when the first shipments outside the state were made; and 41,897,843 tons (valued at $40,009,054) in 1908, when the output of West Virginia was third in quantity and in value among the states of the Union, being exceeded only by that of Pennsylvania and of Illinois. The seams are principally above water levels and in many cases have been laid bare by erosion; and the supply is varied—besides a "fat coking, gassy bituminous," there are an excellent grade of splint coal (first mined in 1864 at Coalburg, Kanawha county) and (except that in Kentucky) the only important supply of cannel coal in the United States. Most of the mines are operated under "non-union" rules. The bituminous coal of West Virginia is a particularly good coking coal, and in 1905, 1906, 1907 and 1908 West Virginia ranked second (to Pennsylvania) among the states of the Union in the amount of coke manufactured; the Flat Top district is the principal coke-making region.

Petroleum ranks second to coal among the state's mineral resources. In 1771 Thomas Jefferson described a "burning spring" in the Kanawha Valley, and when wells were drilled for salt brine near Charleston petroleum and natural gas were found here before there was any drilling for oil in Pennsylvania. Immediately before the Civil War, petroleum was discovered in shallow wells near Parkersburg, and there was a great rush of prospectors and speculators to the Little Kanawha Valley. But the Civil War interrupted development. After the war, wells were drilled at Burning Springs, Oil Rock, California House, Volcano, Sandhill and Horseneck, and in the years 1865–1876 3,000,000 bbls. of oil, valued at $20,000,000, were taken out of these districts. A successful well in Marion county, near Mannington, far from the region of the earlier wells, was drilled in 1889, and the output of the state increased from 119,448 bbls. in 1888 to 544,113 in 1889, and to 2,406,218 in 1891; in 1893 it was first more than 8,000,000 bbls.; and in 1900 it was 16,195,675. After 1900 it gradually decreased—although new pools in Wetzel county were found in 1902—and in 1908 it was 9,523,176 bbls. (valued at $16,911,865).

Natural gas, like petroleum, was first heard of in West Virginia in connexion with a burning spring on the Kanawha, and there were gas springs on the Big Sandy and the Little Kanawha. In 1841 natural gas was found with salt brine in a well on the Kanawha, and was used as a fuel to evaporate the salt water. The production was not large until after 1895; it was valued at $1,334,023 in 1898, at $3,954,472 in 1901, at $10,075,804 in 1905, at $16,670,962 in 1907, and at $14,837,130 in 1908, when (as since 1904, when it first was greater than that of Indiana) it was second only in value to that of Pennsylvania. The principal field is in Wetzel county, but there are important supplies in Lewis, Harrison, Marion, Monongahela,


WEST VIRGINIA
Scale, 1 : 1,838,000.
English Miles
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County Seats....◎
County Boundaries.........
Railways
Longitude West 80° of Greenwich
A B C D E F
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Lincoln and Wayne counties. Much of the natural gas is piped out of the state into Ohio (even into the northern parts), Kentucky, Pennsylvania and Maryland; within the state gas has been utilized as a fuel in carbon black and glass factories.

Brine wells have been mentioned above; the salt industry is still carried on in Mason county, and in 1908 145,157 bbls. were produced with a value of $10,481; and there is a small output of bromine. Iron ore is found in the state in the coal hills (especially Laurel Hills and Beaver Lick Mountain), but the deposits have not been worked on a large scale. Pig iron is manufactured cheaply because of the low price of fuel; in 1907 the value of pig iron manufactured in the state was $6,454,000. There are deposits of excellent clay, especially for pottery, and in 1907 ($2,159,132) and 1908 ($2,083,821) the state ranked after Ohio and New Jersey in the value of pottery. The total value of all clay products in West Virginia was $3,261,736 in 1908. An excellent glass sand is procured from crushed sandstone near Berkeley Springs, Morgan county. Grindstones have been quarried in Wood and Jackson counties. There are black slate deposits near Martinsburg. There are mineral springs, mostly medicinal waters, in Greenbrier, Summers, Webster, Ohio and Preston counties. Among the more noted medicinal springs are: classed as calcareous and earthy, Sweet Springs, 74° F., in Monroe county, diuretic and diaphoretic; and Berkeley Springs, 74° F., in Morgan county, reputed restorative in neuralgic cases, and as containing sulphur; Salt Sulphur Springs, in Monroe county, of value in scrofula and skin diseases.

Manufactures.—Manufacturing is largely localized in the north-western part of the state along the Ohio river. The value of the factory product in 1905 was $99,040,676. The principal manufacture is iron and steel: in 1905 the product of steel works and rolling mills was $13,454,802. The iron mills are almost all in the vicinity of Wheeling. The first rolling mill west of the Alleghanies was probably one near Morgantown. Next in importance among the state's manufactures are lumber and timber, and flour and grist mills. The tanning, currying and finishing of leather, an industry largely dependent on the plentiful supply of oak and hemlock bark for tanning, is centralized in the northern and eastern parts of the state, near the forests. The glass industry began in Wheeling in 1821, and there a process was discovered by which in 1864 for soda ash bicarbonate of lime was substituted, and a lime glass was made which was as fine as lead glass; other factors contributing to the localization of the manufacture of glass here are the fine glass sand obtained in the state and the plentiful supply of natural gas for fuel.

Transportation and Commerce.—Railway development in West Virginia has been due largely to the exploitation of the coal and lumber resources of the state. The Baltimore & Ohio railway leads in trackage: it enters the state with several lines at its northern end; its main line crosses this portion of the state from east to west, striking the Ohio at Parkersburg, and one of its lines (Ohio River railway) extends nearly the length of the state from Wheeling in the north through Parkersburg to Kenova in the south. This road serves as a carrier for the northern coal producing districts. The Chesapeake & Ohio traverses the southern part of the state, from White Sulphur Springs in the east, through Charleston to the Ohio, serving the New and Kanawha rivers coal district as a freight carrier; the Norfolk & Western runs just within the south-western boundary along the valley of the Big Sandy, carrying coal both east and west from the Pocahontas coal-field; and the new Virginian railway entering at the south-east taps the coal-producing region (the Kanawha and Pocahontas districts) at Deepwater, serving in addition to the Norfolk & Western as a carrier of coal to Norfolk on the Virginia coast. The railway mileage of the state grew with great rapidity in the decade 1880–1890; it was 691 m. in 1880, 1,433·30 in 1890, 2,473·34 in 1900 and 3,215·32 in January 1909. Natural facilities for transportation, afforded by the Ohio river and its branches, the Monongahela, at the northern end of the state, and the Little Kanawha and the Great Kanawha, are of special value for the shipment of lumber and coal. The Monongahela has been improved by locks and dams to Fairmont. It is the carrier of a heavy tonnage of coal to Pittsburg, Pennsylvania. The Little Kanawha, which has also been improved, serves chiefly for the transportation of logs which are floated down to the Ohio.

Population.—The population of West Virginia at the various censuses since its organization as a state has been as follows: 1870, 442,014; 1880, 618,457; 1890, 762,794; 1900, 958,800; 1910, 1,221,119. In 1890–1900 and 1900–1910 the increase in population was more than one fourth. Of the total population in 1900, 97·7% was native-born, 892,854 were native whites, 43,499 were negroes, 56 were Chinese and 12 were Indians. Of the inhabitants born in the United States 61,508 were natives of Virginia, 40,301 of Ohio, 28,927 of Pennsylvania and 10,867 of Kentucky; and of the foreign-born there were 6537 Germans, 3342 Irish, 2921 Italians and 2622 English. Of the total population 71,388 were of foreign parentage—*i.e.* either one or both parents were foreign-born, and 18,232 were of German and 10,534 of Irish parentage, on both the father's and the mother's side.

In 1906 there were in the state 301,565 members of religious denominations, of whom 86·2% were Protestants. The Methodist bodies with 115,825 communicants (38·4% of the total communicants or members) were the strongest. There were 67,044 Baptists (2226 United Baptists, 2019 Primitive Baptists and 1513 Free Baptists); 40,011 Roman Catholics; 19,993 United Brethren, all of the "New Constitution"; 19,668 Presbyterians; 13,323 Disciples of Christ; 6506 Lutherans, and 5230 Protestant Episcopalians. The principal cities of the state are Wheeling, Huntington, Parkersburg, Charleston (the capital), Martinsburg, Fairmont and Grafton.

Administration.—The first constitution of 1863 was superseded by the present instrument which was adopted August 1872 and was amended in 1880, 1883 and 1902. The constitution may be amended by either of two methods. A majority of the members elected to each house may submit the question of calling a convention to the people; and if a majority of the votes cast approve, an election for members of a convention shall be held, and all acts of the convention must be submitted to the people for ratification or rejection. On the other hand, a two-thirds majority of each house of the legislature may submit an amendment or amendments to popular vote at the next general election, when the approval of a majority of the qualified voters is necessary for ratification. All male citizens above twenty-one years of age have the right of suffrage, subject to a residence of one year in the state and sixty days in the county in which they offer to vote. Paupers, insane, and those convicted of treason, felony or bribery in an election are barred, "while the disability continues," and no person in the military, naval or marine service of the United States is deemed a resident of the state by reason of being stationed therein. An official blanket ballot containing the names of the candidates arranged in columns according to party is provided at public expense.

Executive.—The executive department consists of the governor, secretary of state, superintendent of free schools, auditor, treasurer and attorney-general, all elected by the people at the time of the presidential election and serving for four years from the fourth of March following. The governor must have been a citizen for five years preceding this election, must have attained the age of thirty and is ineligible for re-election during the four years succeeding the expiration of his term. In case of the death, resignation or other disability of the governor, the president of the Senate acts as governor, and in case of his incapability the Speaker of the House of Delegates; and these two failing, the legislature on joint ballot elects an acting governor. A new election must be called to fill the vacancy unless the unexpired term is less than one year. The governor appoints, subject to the consent of a majority of the members elected to the Senate, all officers whose appointment or election is not otherwise provided for. In case of a vacancy in the court of appeals or in the circuit court the governor appoints until the next general election, or if the unexpired term is less than two years, until the end of the term. The governor sends a message at the beginning of each session of the legislature, and may convene the houses in extraordinary session when he deems it necessary. He may veto a bill, or in case of an appropriation bill, the separate items, but this veto may be overridden by a simple majority of the total membership of each house. Any bill not returned with objections within five days after presentation becomes a law. An appropriation bill cannot be vetoed after the legislature adjourns.

Legislative.—The legislature, consisting of the Senate and the House of Delegates, meets at the capital on the first Wednesday in January of the odd years. The Senate is composed (1910) of thirty members, chosen from fifteen districts for a term of four years, but one half the membership retires biennially. A senator must be twenty-five years of age, and must have been a citizen of the state for five years and a resident of the district for one year preceding his election. The Senate elects a president, confirms or rejects the nominations of the governor, and acts as a court of impeachment for the trial of public officers, besides sharing in legislative functions. The House of Delegates is composed (1910) of eighty-six members, of whom each county chooses at least one. A delegate must be a citizen and have resided one year in the county from which he is chosen. No person holding a lucrative office under the state or the United States, no salaried officer of a railroad company, and no officer of any court of record is eligible for membership in either house. Besides its legislative functions the House prepares articles of impeachment and prosecutes the proceedings before the Senate. The length of the legislative session is forty-five days, but it may be extended by a vote of two-thirds of the members elected to each house. No act takes effect until ninety days after its passage unless two-thirds of the members of each house specifically order otherwise.

Judiciary.—The judicial power is vested in the Supreme Court of Appeals, the Circuit courts, such inferior courts as may be established, county courts, the powers and duties of which are, however, chiefly police and fiscal, and in justices of the peace. The Supreme Court of Appeals, consisting of five judges, elected for terms of twelve years, holds three terms annually, one at Wheeling, one at Charleston and one at Charles Town. It has original jurisdiction in cases of *habeas corpus*, *mandamus* and prohibition, and appellate jurisdiction in cases involving a greater amount than one hundred dollars; concerning title or boundary of lands, probate of wills; the appointment or qualification of personal representatives, guardians, curators, committees, &c.; concerning a mill, roadway, ferry or landing; the right of a corporation or county to levy tolls or taxes; in cases of *quo warranto*, *habeas corpus*, *mandamus*, *certiorari* and prohibition, and all others involving freedom or the constitutionality of a law; in criminal cases where there has been a conviction for felony or misdemeanour in a circuit, criminal or intermediate court; and in cases relating to the public revenues. The court designates one of its members as president. Nineteen judges elected for terms of eight years in eighteen circuits compose the circuit court, the judges of which have original jurisdiction of matters involving more than $50; of all cases of *habeas corpus*, *mandamus*, *quo warranto* and prohibition; of all cases in equity; and of all crimes and misdemeanours. The judges have appellate jurisdiction of cases civil and criminal coming up from the lower courts. In order to relieve the circuit judges the legislature has established by special acts inferior courts, generally with criminal jurisdiction only, in nine counties of the state. The judicial powers of the county court are confined to probate, the appointment of executors, administrators and other personal representatives, and the settlement of their accounts, matters relating to apprentices and to contested elections for county and district officers. (See below under *Local Government.*) One or two justices of the peace (depending on population) are elected from each magisterial district; there must be not less than three, nor more than ten, districts in each county.

Local Government.—As in Virginia, the county is the unit of government, though an unsuccessful attempt to introduce the township system was made in the first constitution. The county court, consisting of three commissioners elected for six years but with terms so arranged that one retires every two years, is the police and fiscal authority. Other officers are the clerk of the county court, elected for six years, the sheriff, who also acts as tax-collector and treasurer, the prosecuting attorney, one or two assessors, the surveyor of lands and the superintendent of free schools, all elected for the term of four years; the sheriff may not serve two consecutive full terms. In addition there are boards appointed or elected by various authorities and charged with specific duties. They include the local board of health and the board of jury commissioners. Each of the magisterial districts (of which, as has been said, there must be at least three and not more than ten in each county) elects one or two magistrates and constables, and a board of education of three members. The constitution provides that the legislature, on the request of any county, may establish a special form of county government, and several of the larger and more populous counties have special acts.

Miscellaneous Laws.—A woman's right to hold, manage and acquire property is not affected by marriage, except that unless she lives apart from her husband, she may not mortgage or convey real estate without his consent. A woman becomes of age at twenty-one. Rights of dower and courtesy both exist. When a husband dies intestate leaving a widow and issue, the widow is entitled to the life use of one-third of the real estate and to one-third of the personal estate absolutely. If there is no issue she takes the whole of the personal estate, while the real estate, subject to her dower, goes first to her husband's father and then to his mother, brothers and sisters. If the wife dies intestate the husband has a right to the use of her real estate for life, and to one-third of the personal estate if there is issue; otherwise to the whole. Neither can by will deprive the other of the right of dower or courtesy in the real estate and of the right to one-third of the personal estate. Children may be disinherited with or without cause. Any parent or infant children of deceased parents may set apart personal estate not exceeding $200 in value which shall be exempt from execution. A homestead not exceeding $1000 in value may be set apart, provided that it is recorded before the debt against which it was claimed was contracted. Marriages between whites and negroes, or where either party had a wife or husband living, or within the prohibited degrees of consanguinity, or where either was insane or physically incapable of marriage, or where the male was under eighteen or the female under sixteen may be annulled. No female or male under twelve may be employed in mines, and no child under twelve may be employed in a factory, and when school is in session none under fourteen.

Charities, &c.—The state charitable and penal institutions consist of the West Virginia Hospital for the Insane at Weston, the Second Hospital for the Insane at Spencer, three miners' hospitals—one at Welch, one at McKendree and one at Fairmont; the West Virginia Asylum for Incurables at Huntington, Schools for the Deaf and Blind at Romney, the West Virginia Penitentiary at Moundsville, the West Virginia Reform School at Grafton and the West Virginia Industrial Home for Girls near Salem. These are all under the supervision of a state board of control of three members, appointed by the governor, which was created in 1909, and also has control of the finances of the state educational system. There is also a state humane society, which was organized in 1899 for the protection of children and of the helpless aged, and for the prevention of cruelty to animals. The West Virginia Colored Orphans' Home near Huntington is not under state control, but has received appropriations from the legislature. In 1908 a law was enacted for establishing the West Virginia Children's Home to be under the control of the Humane Society.

Education.—Each magisterial district constitutes a school district and there are also a few independent school districts. For each school district there is a board of education consisting of a president and two commissioners, each elected for a term of four years, one commissioner every two years. This board is authorized to establish and alter sub-districts. A law enacted in 1908 requires that children between eight and fifteen years of age shall attend school twenty-four weeks each year, provided the public school in their district is in session that length of time. The county supervision of public schools is vested in a county superintendent, who is elected for a term of four years. The state supervision is vested in a state superintendent, who is elected for a term of four years. A state board of education, consisting of the state superintendent and five other persons appointed by him, constitutes a state board of examiners (for special primary, high school and professional certificates) and prescribes the course of study. There is also a state school book commission, consisting of the state superintendent and eight other members appointed by the governor. The state maintains six normal schools for whites (at Huntington, Fairmont, West Liberty, Glenville, Shepherdstown, Athens) and two for negroes (at Institute and at Bluefield). They are governed by a board of regents consisting of the state superintendent and six other members appointed by the governor. At the head of the educational system is the West Virginia University (1867) at Morgantown (*q.v.*). The principal institutions of higher learning not under state control are Bethany College (Christian, 1841), at Bethany; Morris Harvey College (Methodist Episcopal, Southern, 1888), at Barboursville; West Virginia Wesleyan College (Methodist Episcopal, 1890), at Buckhannon; and Davis and Elkins College (Presbyterian, 1904), at Elkins.

Finance.—The state revenue is derived mainly from a general property tax, licence taxes levied on various businesses and occupations, a collateral inheritance tax and a capitation tax. For the year ending on the 30th of September 1908 the receipts were $3,382,131·66 and the disbursements $3,482,317·03. West Virginia's share of the Virginia debt which existed when West Virginia was set off from Virginia has not yet been determined (see below, § HISTORY), but other than this the state has no debt, and the contraction of a state debt other than "to meet casual deficits in the revenue, to redeem a previous liability of the state, to suppress insurrection, repel invasion or defend the state in time of war" is forbidden by the constitution. The indebtedness of a county, municipality or school district is limited to 5% of the value of its taxable property.

History.—That part of Virginia beyond the Alleghany mountains was a favourite haunt of the Indians before the first coming of the whites, and there are many Indian mounds, indicative of an early and high cultural development, within the present limits of the state, and especially in the neighbourhood of Moundsville (*q.v.*). The western part of Virginia was not explored until long after considerable settlements had been made in the east. In 1671 General Abram Wood, at the direction of Governor William Berkeley (*c.* 1610–1677), sent a party which discovered Kanawha Falls, and in 1716, Governor Alexander Spottswood with about thirty horsemen made an excursion into what is now Pendleton county. John Van Metre, an Indian trader, penetrated into the northern portion in 1725, and Morgan ap Morgan, a Welshman, built a cabin in the present Berkeley county in 1727. The same year German settlers from Pennsylvania founded New Mecklenburg, the present Shepherdstown, on the Potomac, and others soon followed. Charles II. of England, in 1661, granted to a company of gentlemen the land between the Potomac and Rappahannock rivers, commonly known as the "Northern Neck." The grant finally came into the possession of Thomas, Lord Fairfax, and in 1746 a stone was erected at the source of the north branch of the Potomac to mark the western limit of the grant. A considerable part of this land was surveyed by George Washington between 1748 and 1751. The diary kept by the young surveyor indicates that there were already many squatters, largely of German origin, along the South Branch of the Potomac. Christopher Gist, a surveyor in the employ of the first Ohio Company (see OHIO COMPANY), which was composed chiefly of Virginians, in 1751–1752 explored the country along the Ohio river north of the mouth of the Kanawha, and the company sought to have a fourteenth colony established with the name "Vandalia." Many settlers crossed the mountains after 1750, though they were somewhat hindered by Indian depredations. Probably no Indians lived within the present limits of the state, but the region was a common hunting ground, crossed also by many war trails, and during the French and Indian war (1754–63) the scattered settlements were almost destroyed. In 1774 the governor of Virginia, Lord Dunmore, himself led a force over the mountains, and a body of militia under General Andrew Lewis dealt the Shawnee Indians under Cornstalk a crushing blow at Point Pleasant (*q.v.*) at the junction of the Kanawha and the Ohio rivers, but Indian attacks continued until after the War of Independence. During the war the settlers in Western Virginia were generally active Whigs and many served in the Continental army.

Social conditions in western Virginia were entirely unlike those existing in the eastern portion of the state. The population was not homogeneous, as a considerable part of the immigration came by way of Pennsylvania and included Germans, the Protestant Scotch-Irish and settlers from the states farther north. During the War of Independence the movement to create another state beyond the Alleghanies was revived, and a petition (1776) for the establishment of "Westsylvania" was presented to Congress, on the ground that the mountains made an almost impassable barrier on the east. The rugged nature of the country made slavery unprofitable, and time only increased the social, political and economic differences between the two sections of the state. The convention which met in 1829 to form a new constitution for Virginia, against the protest of the counties beyond the mountains, required a property qualification for suffrage, and gave the slave-holding counties the benefit of three-fifths of their slave population in apportioning the state's representation in the lower Federal house. As a result every county beyond the Alleghanies except one voted to reject the constitution, which was nevertheless carried by eastern votes. Though the Virginia constitution of 1850 provided for white manhood suffrage, yet the distribution of representation among the counties was such as to give control to the section east of the Blue Ridge Mountains. Another grievance of the West was the large expenditure for internal improvements at state expense in the East compared with the scanty proportion allotted to the West. For an account of the Virginia convention of 1861, which adopted the Ordinance of Secession, see VIRGINIA. Here it is sufficient to say that only nine of the forty-six delegates from the present state of West Virginia voted to secede. Almost immediately after the adoption of the ordinance a mass meeting at Clarksburg recommended that each county in north-western Virginia send delegates to a convention to meet in Wheeling on the 13th of May 1861. When this "First Wheeling Convention" met, four hundred and twenty-five delegates from twenty-five counties were present, but soon there was a division of sentiment. Some delegates favoured the immediate formation of a new state, but the more far-sighted members argued that as the ordinance had not yet been voted upon by the people, and Virginia was still in the Union, such action would be revolutionary, since the United States Constitution provides that no state may be divided without its consent. Therefore it was voted that in case the ordinance should be adopted (of which there was little doubt) another convention including the members-elect of the legislature should meet at Wheeling on the 11th of June. At the election (23rd May 1861) the ordinance was ratified by a large majority in the state as a whole, but in the western counties 40,000 votes out of 44,000 were cast against it. The "Second Wheeling Convention" met according to agreement (11th June), and declared that, since the Secession Convention had been called without the consent of the people, all its acts were void, and that all who adhered to it had vacated their offices. An act for the "reorganization" of the government was passed on the 19th of June. The next day Francis H. Pierpont was chosen governor of Virginia, other officers were elected and the convention adjourned. The legislature, composed of the members from the western counties who had been elected on the 23rd of May and some of the hold-over senators who had been elected in 1859, met at Wheeling on the 1st of July, filled the remainder of the state offices, organized a state government and elected two United States senators who were recognized at Washington. There were, therefore, two state governments in Virginia, one owning allegiance to the United States and one to the Confederacy. The Convention, which had taken a recess until the 6th of August, then re-assembled and (August 20) adopted an ordinance providing for a popular vote on the formation of a new state, and for a convention to frame a constitution if the vote should be favourable. At the election (October 24, 1861) 18,489 votes were cast for the new state and only 781 against. The convention met on the 26th of November 1861, and finished its work on the 18th of February 1862, and the instrument was ratified by the people (18,162 for and 514 against) on the 11th of April 1862. Next the legislature of the "Reorganized" government on the 13th of May gave its consent to the formation of the new state. Application for admission to the Union was now made to Congress, and on the 31st of December 1862 an enabling act was approved by President Lincoln admitting the state on the condition that a provision for the gradual abolition of slavery be inserted in the Constitution. The Convention was reconvened on the 12th of February 1863, and the demand of Congress was met. The revised instrument was adopted by the people on the 26th of March 1863, and on the 20th of April 1863 President Lincoln issued a proclamation admitting the state at the end of sixty days (June 20, 1863). Meanwhile officers for the new state were chosen, and Governor Pierpont removed his capital to Alexandria where he asserted jurisdiction over the counties of Virginia within the Federal lines. The question of the constitutionality of the formation of the new state was brought before the Supreme Court of the United States in the following manner. Berkeley and Jefferson counties lying on the Potomac east of the mountains, in 1863, with the consent of the "Reorganized" government of Virginia voted in favour of annexation to West Virginia. Many voters absent in the Confederate army when the vote was taken refused to acknowledge the transfer on their return. The Virginia legislature repealed the act of cession and in 1866 brought suit against West Virginia asking the court to declare the counties a part of Virginia. Meanwhile Congress on the 10th of March 1866 passed a joint resolution recognizing the transfer. The Supreme Court in 1871 decided in favour of West Virginia, and there has been no further question. During the Civil War West Virginia suffered comparatively little. McClellan's forces gained possession of the greater part of the territory in the summer of 1861, and Union control was never seriously threatened, in spite of Lee's attempt in the same year. In 1863 General John D. Imboden, with 5000 Confederates, overran a considerable portion of the state. Bands of guerrillas burned and plundered in some sections, and were not entirely suppressed until after the war was ended. The state furnished about 36,000 soldiers to the Federal armies and somewhat less than 10,000 to the Confederate. The absence in the army of the Confederate sympathizers helps to explain the small vote against the formation of the new state. During the war and for years afterwards partisan feeling ran high. The property of Confederates might be confiscated, and in 1866 a constitutional amendment disfranchising all who had given aid and comfort to the Confederacy was adopted. The addition of the Fourteenth and Fifteenth Amendments to the U.S. Constitution caused a reaction, the Democratic party secured control in 1870, and in 1871 the constitutional amendment of 1866 was abrogated. The first steps toward this change had been taken, however, by the Republicans in 1870. In 1872 an entirely new constitution was adopted (August 22).

Though the first constitution provided for the assumption of a part of the Virginia debt, negotiations opened by Virginia in 1870 were fruitless, and in 1871 that state funded two-thirds of the debt and arbitrarily assigned the remainder to West Virginia.

The legislature of the latter state in 1873 adopted a report declaring that between 1822 and 1861, during which period the debt had been incurred, the western counties had paid an excess of taxes, more than equal to the amount which had been expended in the west for the purposes for which the debt had been incurred, and concluded with the statement: "West Virginia owes no debt, has no bonds for sale and asks no credit." In 1906 Virginia entered suit in the U.S. Supreme Court to compel West Virginia to assume a portion of the debt. West Virginia demurred, but was overruled, and on the 4th of May 1908 a master was appointed to take testimony. The state rejected decisively the overtures made by Virginia in 1866, looking towards a reunion of the commonwealths.

Governors of West Virginia.

Arthur I. Boreman	Republican	1863–1869
D. D. T. Farnsworth (acting)	,,	1869
Wm. E. Stevenson	,,	1869–1871
John J. Jacobs	Democrat	1871–1877
Henry M. Mathews	,,	1877–1881
Jacob B. Jackson	,,	1881–1885
E. Willis Wilson	,,	1885–1890
A. Brooks Fleming [1]	,,	1890–1893
Wm. A. MacCorkle	,,	1893–1897
George W. Atkinson	Republican	1897–1901
Albert B. White	,,	1901–1905
Wm. M. O. Dawson	,,	1905–1909
Wm. E. Glasscock	,,	1909–

BIBLIOGRAPHY.—For general description see Henry Gannett, *Gazetteer of West Virginia* (Washington, 1904), being Bulletin 233 of the U.S. Geological Survey; the *Reports* and the *Bulletins of the Geological Survey of West Virginia* (Morgantown, 1901 sqq.). Bulletin 1 is a *Bibliography of Works upon the Geology and Natural Resources of West Virginia*, by S. S. Brown; folios 26, 28, 32, 34, 44, 69, 72, 77 and 160 of the *Geologic Atlas* of the United States; M. F. Maury and W. M. Fontaine, *Resources of West Virginia* (Charleston, 1876); and George W. Summers, *The Mountain State* (ibid. 1893). For administration and history see the *Manual of West Virginia* (Charleston, 1907), issued by the Secretary of State; *West Virginia Public Documents* (ibid. 1902 sqq.); *The Code of West Virginia* (St Paul, 1906); A. R. Whitehill, *History of Education in West Virginia* (Washington, 1902), a Circular of Information of the U.S. Bureau of Education; a *History of Education in West Virginia* (Charleston, 1904), by the State Superintendent of Free Schools; V. A. Lewis, *History of West Virginia* (new ed., New York, 1904), and *History and Government of West Virginia* (Chicago, 1896); R. E. Fast and Hu Maxwell, *History and Government of West Virginia* (Morgantown, 1901; new edition, 1908); A. S. Withers, *Chronicles of Border Warfare* (1831, reprinted Cincinnati, 1905); J. P. Hale, *Trans-Alleghany Pioneers* (Cincinnati, 1887); W. P. Willey, *Formation of West Virginia* (Wheeling, 1901); and M. F. Callahan, *Evolution of the Constitution of West Virginia* (Morgantown, 1909).

WESTWARD HO, a small seaside village in the Barnstaple parliamentary division of Devonshire, England, on the east of Barnstaple Bay, 2½ m. N.W. of Bideford, on the Bideford, Appledore & Westward Ho railway. Of modern growth, it takes its name from a famous novel by Charles Kingsley. Many visitors are attracted in summer by its pure and bracing air, its quiet, and, above all, by its golf club, with links laid out on the sandhills known as Braunton Burrows. Westward Ho forms part of the urban district of NORTHAM, which had a population in 1901 of 5355.

WETHERSFIELD, a township of Hartford county, Connecticut, U.S.A., on the Connecticut river, adjoining on the N. the city of Hartford, of which it is a residential suburb. Pop. (1890) 2271; (1900) 2637 (489 foreign-born); (1910) 3148. Area, about 12 sq. m. It is served by the New York, New Haven & Hartford railway and by electric lines to Hartford. Among its old buildings are the house in which in 1781 George Washington and Count Rochambeau met to plan the Yorktown campaign; the First Church of Christ (Congregational), erected in 1761 and remodelled in 1838 and 1882; and the old academy building, which was built in 1802, is now used as a town hall, and houses a public library. There is a giant elm here, 26½ ft. in girth. The Connecticut state prison is in Wethersfield. In the township tobacco, vegetables and garden seeds are raised and dairy interests are of considerable importance; the principal manufactures are small tools and mattresses. Wethersfield is the oldest permanently inhabited township in the state; it was first settled in the winter of 1634–1635 by colonists from Watertown, Massachusetts, and received its present name in 1637. With Hartford and Windsor in 1639 it framed the Fundamental Orders of the Colony of Connecticut. Before 1660 its inhabitants aided in the founding of Stamford and Milford, Connecticut, and of Hadley, Massachusetts.

See H. R. Stiles, *History of Ancient Wethersfield* (New York, 1900).

WETSTEIN (also WETTSTEIN), **JOHANN JAKOB** (1693–1754), New Testament critic, was born at Basel on the 5th of March 1693. Among his tutors in theology was Samuel Werenfels (1657–1740), an influential anticipator of modern scientific exegesis. While still a student he began to direct his attention to the special pursuit of his life—the text of the Greek New Testament. A relative, Johann Wetstein, who was the university librarian, gave him permission to examine and collate the principal MSS. of the New Testament in the library, and he copied the various readings which they contained into his copy of Gerard of Maestricht's edition of the Greek text. In 1713 in his public examination he defended a dissertation entitled *De variis Novi Testamenti lectionibus*, and sought to show that variety of readings did not detract from the authority of the Bible. Wetstein paid great attention also to Aramaic and Talmudic Hebrew. In the spring of 1714 he undertook a learned tour, which led him to Paris and England, the great object of his inquiry everywhere being manuscripts of the New Testament. In 1716 he made the acquaintance of Richard Bentley at Cambridge, who took great interest in his work. The great scholar induced him to return to Paris to collate carefully the *Codex Ephraemi*, Bentley having then in view a critical edition of the New Testament. In July 1717 Wetstein returned to take the office of a curate at large (*diaconus communis*) at Basel, a post which he held for three years, at the expiration of which he exchanged it to become his father's colleague and successor in the parish of St Leonard's. At the same time he pursued his favourite study, and gave private lectures on New Testament exegesis. It was then that he decided to prepare a critical edition of the Greek New Testament. He had in the meantime broken with Bentley, whose famous *Proposals* appeared in 1720. His earlier teachers, however, J. C. Iselin and J. L. Frey, who were engaged upon work similar to his own, became so unfriendly towards him that after a time he was forbidden any further use of the manuscripts in the library. Then a rumour got abroad that his projected text would take the Socinian side in the case of such passages as 1 Timothy iii. 16; and in other ways (*e.g.* by regarding Jesus's temptation as a subjective experience, by explaining some of the miracles in a natural way) he gave occasion for the suspicion of heresy. At length in 1729 the charge of projecting an edition of the Greek Testament savouring of Arian and Socinian views was formally laid against him. The end of the long and unedifying trial was his dismissal, on the 13th of May 1730, from his office of curate of St Leonard's. He then removed from Basel to Amsterdam, where a relative, Johann Heinrich Wetstein, had an important printing and publishing business, from whose office excellent editions of the classics were issued, and also Gerard of Maestricht's edition of the Greek Testament. Wetstein had begun to print in this office an edition of the Greek Testament, which was suddenly stopped for some unknown reason. As soon as he reached Amsterdam he published anonymously the *Prolegomena ad Novi Testamenti Graeci editionem*, which he had proposed should accompany his Greek Testament, and which was republished by him, with additions, as part of his great work, 1751. The next year (1731) the Remonstrants offered him the chair of philosophy in their college at Amsterdam, vacated by the illness of Jean le Clerc, on condition that he should clear himself of the suspicion of heresy. He thereupon returned to Basel, and procured a reversal (March 22, 1732) of the previous decision, and readmission to all his clerical offices. But, on his becoming a candidate for the Hebrew chair at Basel, his orthodox opponents procured his defeat and his retirement to Amsterdam. At length, after much painful contention, he was allowed to instruct the Remonstrant students in philosophy and Hebrew on certain somewhat humiliating conditions. For the rest of his life he continued professor in the Remonstrant college, declining in 1745 the Greek chair at Basel. In 1746 he once more visited England, and collated Syriac MSS. for his great work. At last this appeared in 1751–1752, in two folio volumes, under the title *Novum Testamentum Graecum editionis receptae cum lectionibus variantibus codicum MSS.*, &c. He did not venture to put new readings in the body of his page, but consigned those of them which he recommended to a place between the *textus receptus* and the full list of various readings. Beneath the latter he gave a commentary, consisting principally of a mass of valuable illustrations and parallels drawn from classical and rabbinical literature, which has formed a storehouse for all later commentators. In his *Prolegomena* he gave an admirable methodical account of the MSS., the versions and the readings of the fathers, as well as the troubled story of the difficulties with which he had had to contend in the prosecution of the work of his life. He was the first to designate uncial manuscripts by Roman capitals, and cursive manuscripts by Arabic figures. He did not long survive the completion of this work. He died at Amsterdam on the 23rd of March 1754.

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[1] Title contested by Nathan Goff. Contest settled by legislature Feb. 4, 1890, until which time Governor Wilson held over.

Wetstein's New Testament has never been republished entire. The London printer, William Bowyer, published, in 1763, a text in which he introduced the readings recommended by Wetstein; J. G. Semler republished the *Prolegomena* and appendix (1764); A. Lotze commenced a new edition of the work, but the *Prolegomena* only appeared (Rotterdam, 1831), and this "castigated." It is generally allowed that Wetstein rendered invaluable service to textual criticism by his collection of various readings and his methodical account of the MSS. and other sources, and that his work was rendered less valuable through his prejudice against the Latin version and the principle of grouping MSS. in families which had been recommended by Richard Bentley and J. A. Bengel.

See Wetstein's account of his labours and trials in his *Nov. Test.* i.; articles in C. F. Illgen's *Ztschr. für histor. Theol.* by C. R. Hagenbach (1839), by L. J. Van Rhyn in 1843 and again by Heinrich Böttger in 1870; S. P. Tregelles, *Account of the Printed Text of the New Testament*; F. H. A. Scrivener's *Introduction to the Criticism of the New Testament*; W. Gass, *Protestantische Dogmatik*, vol. iii.; the art. in Herzog's *Realencyklopädie* and in the *Allgemeine deutsche Biographie*.

WETTIN, the name of a family from which several of the royal houses of Europe have sprung, derived from a castle which stood near the small town of that name on the Saale. Attempts to trace the descent to the Saxon chief Widukind or Wittekind, who died about 807, or to Burchard, margrave of Thuringia (d. 908), have failed, and the earliest known ancestor is one Dietrich, who was count of Hassegau or Hosgau, a district on the left bank of the Saale. Dietrich was killed in 982 fighting the Hungarians, and his sons Dedo I. (d. 1009) and Frederick (d. 1017) received lands taken from the Wends, including the county or *Gau* of Wettin on the right bank of the Saale. Dedo's son Dietrich II. inherited these lands, distinguished himself in warfare against the Poles, and married Matilda, daughter of Ekkard I., margrave of Meissen. Their son Dedo II. obtained the Saxon east mark and lower Lusatia on the death of his uncle Ekkard II., margrave of Meissen, in 1046, but in 1069 he quarrelled with the emperor Henry IV. and was compelled to surrender his possessions. He died in 1075, and his lands were granted to his son Henry I., who in 1089 was invested with the mark of Meissen. In 1103 Henry was succeeded by his cousin Thimo (d. 1104), who built a castle at Wettin, and was called by this name. Henry II., son of Henry I., followed, but died childless in 1123; his cousin, Conrad I., son of Thimo, claimed Meissen, of which he secured possession in 1130, and in 1135 the emperor Lothair II. added lower Lusatia to his possessions. Abdicating in 1156, Conrad's lands were divided between his five sons, when the county of Wettin fell to his fourth son Henry, whose family died out in 1217. Wettin then passed to the descendants of Conrad's youngest son Frederick, and in 1288 the county, town and castle of Wettin were sold to the archbishop of Magdeburg. They were retained by the archbishop until the peace of Westphalia in 1648, when they passed to the elector of Brandenburg, and afterwards became incorporated in the kingdom of Prussia.

Conrad I. and his successors had added largely to their possessions, until under Henry I., the Illustrious, margrave of Meissen, the lands of the Wettins stretched from the Oder to the Werra, and from the Erzgebirge to the Harz mountains. The subsequent history of the family is merged in that of Meissen, Saxony and the four Saxon dukedoms. In June 1889 the 800th anniversary of the rule of the Wettins in Meissen and Saxony was celebrated with great splendour at Dresden.

See G. E. Hofmeister, *Das Haus Wettin* (Leipzig, 1889); C. W. Böttiger, *Geschichte des Kurstaates und Königreichs Sachsen* (Gotha, 1867–1873); O. Posse, *Die Markgrafen von Meissen und das Haus Wettin* (Leipzig, 1881); K. Wenck, *Die Wettiner im 14ten Jahrhundert* (Leipzig, 1877); Kämmel, *Festschrift zur 800 jährigen Jubelfeier des Hauses Wettin* (Leipzig, 1889); and H. B. Meyer, *Hof- und Zentralverwaltung der Wettiner* (Leipzig, 1902).

WETZLAR, a town of Germany, in the Prussian Rhine province, pleasantly situated at the confluence of the Dill and Lahn, 64 m. N.E. of Coblenz by the railway to Giessen. Pop. (1905) 12,276. The most conspicuous building is the cathedral, dating in part from the 11th, in part from the 14th–16th centuries. The municipal archives contain interesting documents of the whilom imperial chamber (see *infra*). The town preserves associations of Goethe, who wrote *Die Leiden des jungen Werthers* after living here in 1772 as a legal official, and of Charlotte Buff, the Lotte of *Werther*. Overlooking the town are the ruins of the medieval castle of Kalsmunt. There are iron mines and foundries and optical instrument factories. Wetzlar was originally a royal demesne, and in the 12th century became a free imperial town. It had grown in importance when, in 1693, the imperial chamber (*Reichskammergericht*) was removed hither from Spires. The town lost its independence in 1803, and passed to the prince-primate Dalberg. Three years later (1806), on the dissolution of the empire, the imperial chamber ceased to exist. The French were defeated here by the Austrians and Saxons under the archduke Charles, 15th June 1796.

WEXFORD, a county of Ireland in the province of Leinster, bounded N. by Wicklow, E. and S. by St George's Channel, and W. by Waterford, Kilkenny and Carlow. The area is 576,757 acres or about 902 sq. m. The coast-line does not present any striking features, and owing to the number of sandbanks navigation is dangerous near the shore. The only inlet of importance on the east coast and the only safe harbour is Wexford Harbour, which, owing to a bar, is not accessible to large vessels at ebb-tide. The artificial harbour of Rosslare, outside Wexford Harbour to the south, was therefore opened in 1906. On the south coast the great inlet of Waterford Harbour separates the county from Waterford and Kilkenny, and among several inlets Bannow Bay is the largest. Several islets adjoin the coast. South from Crossfarnogue Point are the Saltee Islands, and Coningmore and Coningbeg, beyond the latter of which is the Saltee lightship. South-east from Greenore Point is the Tuskar Rock.

The surface of the county is chiefly a series of verdant low hills, except towards the northern and western boundaries. An elevated ridge on the north-western boundary forms the termination of the granitic range in Wicklow, and in Croghan Kinshela, on the borders of Wicklow, rises to a height of 1985 ft. On the western border, another range, situated chiefly in Carlow, extends from the valley of the Slaney at Newtownbarry to the confluence of the Barrow with the Nore at New Ross, and reaches 2409 ft. in Blackstairs Mountain, and 2610 ft. in Mount Leinster on the border of Co. Carlow. In the southern district, a hilly region, reaching in Forth Mountain a height of 725 ft., forms with Wexford Harbour the northern boundaries of the baronies of Forth and Bargy, a peninsula of flat and fertile land. The river Slaney enters the county at its north-western extremity, and flows south-east to Wexford Harbour. Its chief tributary is the Bann, which flows south-westwards from the borders of Wicklow. The Barrow forms the western boundary of the county from the Blackstairs range of mountains till its confluence with the Suir at Waterford Harbour.

Geology.—The Leinster Chain, with its granite core and margin of mica-schist, bounds the county on the west. From this, Silurian ground stretches to the sea, like a platform with a hummocky surface, numerous intrusive and contemporaneous felsitic lavas, and some diorites occurring along the strike in continuation of the Waterford series. A granite outlier rises south-east of Enniscorthy; and granite, in part gneissic, forms Carnsore Pt. From near Courtown to Bannow Bay, greenish slates like the Oldhamian series of Wicklow form a broad band, with Old Red Sandstone and Carboniferous Limestone above them near Wexford. Silurian beds appear again towards Carnsore. The surface of the county is much modified by glacial drift, and by the presence of sands and gravels of pre-Glacial and possibly late Pliocene age. These interesting beds are used for liming the fields, under the name of "manure gravels," on account of the fossil shells that they contain.

Industries.—The soil for the most part is a cold stiff clay resting on clay-slate. The interior and western districts are much inferior to those round the coasts. In the south-eastern peninsula of Forth and Bargy the soil is a rich alluvial mould mixed with coralline sandstone and limestone. The peninsula of Hookhead, owing to the limestone formation, is specially fruitful. In the western districts of the county there are large tracts of turf and peat-moss. The acreage under pasture is a little over twice that of tillage, and figures show a fair maintenance of the principal crops, barley, of which the county produces more than any other Irish county, oats, potatoes and turnips. The numbers also of cattle, sheep, pigs and poultry are large and increasing, or well maintained. Except in the town of Wexford the manufactures and trade are of small importance. The town of Wexford is the headquarters of sea and salmon fishing districts, and there are a few fishing villages on the inlets of the south coast.

The main line of the Dublin & South-Eastern railway enters the county from N.E., and runs to Wexford by way of Enniscorthy, with a branch W. to New Ross, from Macmine Junction. Connecting with this line at Palace East, a branch of the Great Southern & Western joins the Kilkenny & Kildare line at Bagenalstown, county Carlow. This company also owns the lines from Rosslare harbour to Wexford and across the southern part of the county to Waterford. There is water communication for barges by the Slaney to Enniscorthy; by the Barrow for larger vessels to New Ross, and by this river and the Grand Canal for barges to Dublin.

Population and Administration.—The population decreases (112,063 in 1891; 104,104 in 1901), but this decrease and the emigration returns are less serious than the average of Irish counties. Of the total about 91% are Roman Catholics, and about 83% form the rural population. The principal towns are Wexford (pop. 11,168), New Ross (5847), Enniscorthy (5458) and Gorey (2178). Newtownbarry, finely situated on the Slaney below the outliers of Mount Leinster, is a lesser market town. To the Irish parliament, until the Union of 1800, the county returned two members, and the boroughs of Bannow, Clonmines, Enniscorthy, Fethard, Gorey, New Ross, Taghmon and Wexford two each. By the Redistribution Act of 1885 Wexford, which had returned two members since 1800, was divided into two parliamentary divisions, North and South, each returning one member, the borough of Wexford, which formerly returned one member, and the portion of the borough of New Ross within the county, being merged in the South Division. The county is divided into ten baronies. It is in the Protestant diocese of Dublin, and the Roman Catholic dioceses of Dublin, Ferns, and Kildare and Leighlin. Assizes are held at Wexford, and quarter sessions at Enniscorthy, Gorey, New Ross and Wexford.

History and Antiquities.—The northern portion of Wexford was included in *Hy Kinselagh*, the peculiar territory of the Macmorroughs, overlords of Leinster, who had their chief residence at Ferns. Dermod Macmorrough, having been deposed from the kingdom of Leinster, asked help of Henry II., king of England, who authorized him to raise forces in England for the assertion of his claim. He secured the aid of Strongbow by promising him the hand of Eva, and in addition obtained assistance from Robert Fitzstephen and Maurice Fitzgerald of Wales. On the 1st of May 1169 Fitzstephen landed at Bagenbon on the south side of Fethard, and after four days' siege captured the town of Wexford from its Danish inhabitants. After this Dermod granted the territory of Wexford to Fitzstephen and Fitzgerald and their heirs for ever. Macmorrough having died in 1172, Strongbow became lord of Leinster. At first Henry II. retained Wexford in his own possession, but in 1174 he committed it to Strongbow. The barony of Forth is almost entirely peopled by the descendants of those who accompanied these English expeditions. Wexford was one of the twelve counties into which the conquered territory in Ireland is generally stated to have been divided by King John, and formed part of the possessions of William Marshal, earl of Pembroke, who had married Strongbow's daughter. Through the female line it ultimately passed to John Talbot, earl of Shrewsbury, who in 1446 was made earl of Waterford and baron of Dungarvan. In 1474 George Talbot was seneschal of the liberty of Wexford. The district was actively concerned in the rebellion of 1641; and during the Cromwellian campaign the town of Wexford was carried by storm on the 9th of October 1649, and a week later the garrison at New Ross surrendered—a "seasonable mercy," according to Cromwell, as giving him an "opportunity towards Munster." Wexford was the chief seat of the rebellion of 1798, the leaders there being the priests.

Evidences of the Danish occupation are seen in the numerous raths, or encampments, especially at Dunbrody, Enniscorthy and New Ross. Among the monastic ruins special mention may be made of Dunbrody abbey, of great extent, founded about 1178 for Cistercian monks by Hervey de Montmorency, marshal of Henry II.; Tintern abbey, founded in 1200 by William Marshal, earl of Pembroke, and peopled by monks from Tintern abbey in Monmouthshire; the abbey of St Sepulchre, Wexford, founded shortly after the invasion by the Roches, lords of Fermoy; Ferns abbey, founded by Dermod Macmorrough (with other remains including the modernized cathedral of a former see, and ruins of a church); and the abbey of New Ross, founded by St Alban in the 6th century. There are a considerable number of old castles, including Ferns, dismantled by the parliamentary forces under Sir Charles Coote in 1641, and occupying the site of the old palace of the Macmorroughs; the massive pile of Enniscorthy, founded by Raymond le Gros; Carrick Castle, near Wexford, the first built by the English; and the fort of Duncannon.

WEXFORD, a seaport, market town and municipal borough, and the county town of Co. Wexford, Ireland, finely situated on the south side of the Slaney, where it discharges into Wexford Harbour, on the Dublin & South-Eastern railway, 92¾ m. S. of Dublin. Pop. (1901) 11,168. Wexford Harbour, formed by the estuary of the Slaney, is about 5 m. from N. to S. and about 4 from E. to W. There are quays extending nearly 900 yds., and the harbour affords good accommodation for shipping, but its advantages are in great part lost by a bar at its mouth preventing the entrance of vessels drawing more than 12 ft. An artificial harbour was therefore opened at Rosslare in 1906, outside the southern part of the promontory closing in the harbour, and this is connected with Wexford by a railway (8¾ m.) owned by the Great Southern & Western Company, and is served by the passenger steamers of the Great Western railway of England from Fishguard. The town of Wexford consists, for the most part, of extremely narrow streets, of picturesque appearance, but inconvenient to traffic. Some remains exist of the old walls and flanking towers. The Protestant church, near the ruins of the ancient abbey of St Sepulchre or Selsker, is said to occupy the spot where the treaty was signed between the Irish and the English invaders in 1169. The principal modern buildings are the town-hall, court-house, barracks, occupying the site of the ancient castle, St Peter's College for the education of Catholic clergy, with a striking chapel by A. W. Pugin, and a number of convents. At Carrick, 2 m. W., the Anglo-Normans erected their first castle, and opposite this, across the river, is a modern round tower commemorating the men of Wexford who died in the Crimean War. The principal exports are agricultural produce, live stock and whisky. Shipbuilding is carried on, and also tanning, malting, brewing, iron-founding, distilling and the manufacture of artificial manure, flour, agricultural implements, and rope and twine. Wexford is the headquarters of salmon and sea fishery districts. Under the Local Government (Ireland) Act 1898 it retains its mayor and corporation.

Wexford was one of the earliest colonies of the English, having been taken by Fitzstephen. It was the second town that Cromwell besieged in 1649. It was garrisoned for William III. in 1690. In 1798 it was made the headquarters of the rebels, who, however, surrendered it on the 21st of June. In 1318 the town received a charter from Aymer de Valence, which was extended by Henry IV. in 1411, and confirmed by Elizabeth in 1558.

By James I. it was in 1608 made a free borough corporate, by the title of "the town and free borough corporate of Wexford." It returned two members to parliament from 1374 till the Union, when they were reduced to one. In 1885 it was included in the south division of the county.

WEYBRIDGE, an urban district in the Chertsey parliamentary division of Surrey, England; 19 m. W.S.W. from London by the London & South-Western railway. Pop. (1901) 5329. It lies in the flat valley of the river Wey, 1 m. above its junction with the Thames. The river is locked up to Godalming, and navigation is assisted by cuts. Weybridge has grown in modern times out of a village into a residential town. The church of St James is modern but contains numerous ancient memorials, and one by Sir F. Chantrey for the duchess of York (d. 1820), daughter of Frederick William II. of Prussia, to whose memory there is also a column on Weybridge Green. The summit of this column is that which formerly stood at Seven Dials, London. The Roman Catholic chapel of St Charles Borromeo was the burial-place of Louis Philippe, ex-king of the French (d. 1850), who resided at Claremont in the neighbouring parish of Esher, his queen and other members of his family; but their bodies were subsequently removed to Dreux in Normandy. To the east of Weybridge lies Henry VIII.'s park of Oatlands (see Walton-on-Thames). In 1907 the Brooklands racing track for motor-cars was opened near Weybridge. It has a circuit of $2\frac{11}{16}$ m. round the inner edge, and including the straight finishing track is $3\frac{1}{4}$ m. in total length; its maximum width is 100 ft., and at the curves it is banked up to a maximum height of 28 ft. 8 in.

WEYDEN, ROGIER VAN DER [originally Roger de la Pasture][1] (*c.* 1400–1464), Flemish painter, was born in Tournai, and there apprenticed in 1427 to Robert Campin. He became a gild master in 1432 and in 1435 removed to Brussels, where he was shortly after appointed town painter. His four historical works in the Hôtel de Ville have perished, but three tapestries in the Bern museum are traditionally based on their designs. In 1449 Rogier went to Italy, visiting Rome, Ferrara (where he painted two pictures for Lionel d'Este), Milan and probably Florence. On returning (1450) he executed for Pierre Bladelin the "Magi" triptych, now in the Berlin Gallery, and (1435) an altarpiece for the abbot of Cambrai, which has been identified with a triptych in the Prado Gallery representing the "Crucifixion," "Expulsion from Paradise" and "Last Judgment." Van der Weyden's style, which was in no way modified by his Italian journey, is somewhat dry and severe as compared with the painting of the Van Eycks, whose pupil Vasari erroneously supposed him to be; his colour is less rich than theirs, his brush-work more laboured, and he entirely lacks their sense of atmosphere. On the other hand, he cared more for dramatic expression, particularly of a tragic kind, and his pictures have a deeply religious intention. Comparatively few works are attributed with certainty to this painter; chief among such are two altarpieces at Berlin, besides that mentioned above, "The Joys and Sorrows of Mary," and "Life of St John the Baptist," a "Deposition" and "Crucifixion" in the Escorial, the Prado triptych, another ("Annunciation," "Adoration" and "Presentation") at Munich; a "Madonna" and a "St John the Baptist" at Frankfort. The "Seven Sacraments" altarpiece at Antwerp is almost certainly his, likewise the "Deposition" in the Uffizi, the triptych of the Beaune hospital, and the "Seven Sorrows" at Brussels. Two pictures of St Luke painting the Virgin, at Brussels and St Petersburg respectively, are attributed to him. None of these is signed or dated. Van der Weyden attracted many foreigners, notably Martin Schongauer, to his studio, and he became one of the main influences in the northern art of the 15th century. He died at Brussels in 1464. His descendant, Rogier van der Weyden the younger, is known to have entered the Antwerp gild in 1528, but no work of his has yet been satisfactorily authenticated.

See Hasse, *Roger van der Weyden und Roger van Brügge* (Strassburg, 1905).

WEYLER Y NICOLAU, VALERIANO, Marquess of Tenerife (1839–), Spanish soldier, was born at Palma de Majorca. His family were originally Prussians, and served in the Spanish army for several generations. He entered at sixteen the military college of infantry at Toledo, and, when he attained the rank of lieutenant, passed into the staff college, from which he came out as the head of his class. Two years afterwards he became captain, and was sent to Cuba at his own request. He distinguished himself in the expedition to Santo Domingo in many fights, and especially in a daring reconnaissance with few men into the heart of the enemy's lines, for which he got the cross with laurels of San Fernando. From 1868 to 1872 he served also brilliantly against the Cuban rebels, and commanded a corps of volunteers specially raised for him in Havana. He returned to Spain in 1873 as brigadier-general, and took an active part against the Carlists in the eastern provinces of the Peninsula in 1875 and 1876, for which he was raised to the rank of general of division. Then he was elected senator and given the title of marquess of Tenerife. He held the post of captain-general in the Canary Isles from 1878 to 1883, and in the Balearic Isles afterwards. In 1888 he was sent out as captain-general to the Philippines, where he dealt very sternly with the native rebels of the Carolines, of Mindanao and other provinces. On his return to Spain in 1892 he was appointed to the command first of the 6th Army Corps in the Basque Provinces and Navarre, where he soon quelled agitations, and then as captain-general at Barcelona, where he remained until January 1896. In Catalonia, with a state of siege, he made himself the terror of the anarchists and socialists. After Marshal Campos had failed to pacify Cuba, the Conservative government of Canovas del Castillo sent out Weyler, and this selection met the approval of most Spaniards, who thought him the proper man to crush the rebellion. Weyler attempted to do this by a policy of inexorable repression, which raised a storm of indignation, and led to a demand from America for his recall. This recall was granted by the Liberal government of Sagasta, but Weyler afterwards asserted that, had he been left alone, he would have stamped out the rebellion in six months. After his return to Spain his reputation as a strong and ambitious soldier made him one of those who in case of any constitutional disturbance might be expected to play an important rôle, and his political position was nationally affected by this consideration; his appointment in 1900 as captain-general of Madrid resulted indeed in more than one ministerial crisis. He was minister of war for a short time at the end of 1901, and again in 1905. At the end of October 1909 he was appointed captain-general at Barcelona, where the disturbances connected with the execution of Francisco Ferrer were quelled by him without bloodshed.

WEYMAN, STANLEY JOHN (1855–), English novelist, was born at Ludlow, Shropshire, on the 7th of August 1855, the son of a solicitor. He was educated at Shrewsbury School, and at Christ Church, Oxford. He took his degree in modern history in 1877, and was called to the bar at the Inner Temple in 1881, joining the Oxford circuit. He had been practising as a barrister for eight years when he made his reputation as a novelist by a series of romances dealing with French history: *The House of the Wolf* (1889), *A Gentleman of France* (1893), *Under the Red Robe* (1894), *Memoirs of a Minister of France* (1895), &c. Among his later novels were: *Shrewsbury* (1897), *The Castle Inn* (1898), *Sophia* (1900), *Count Hannibal* (1901), *In King's Byways* (1902), *The Long Night* (1903), *The Abbess of Vlaye* (1904), *Starvecrow Farm* (1905), *Chippinge* (1906).

WEYMOUTH, a township of Norfolk county, Massachusetts, U.S.A., on Weymouth harbour, a part of Boston Bay, 9 m. S.E. of Boston, between Quincy and Braintree (to the W.) and Hingham to the E. Pop. (1890) 10,866; (1900) 11,324 (1845 foreign-born); (1905, state census) 11,585; (1910) 12,895. Area, 19 sq. m. Weymouth is served by the New York, New Haven & Hartford railway, and is connected with Boston, Quincy, Braintree, Hingham, Nantasket and Rockland by electric lines. In the township there are several villages, including Weymouth, North Weymouth, East Weymouth and South

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[1] He has sometimes been wrongly identified with a painter called Roger of Bruges or Ruggiero da Bruggia.

Weymouth, and the smaller villages of Weymouth Centre, Weymouth Heights, Lovell's Corner, Nash's Corner and Old Spain, and there are also four islands, Round, Grape, Slate and Sheep. The mainland itself is largely a peninsula lying between the Weymouth Fore river and the Weymouth Back river, to the west and east respectively. The surface of the country is rough: Great Hill (at one of the narrowest parts of the peninsula) is about 140 ft. above the rivers. In the township are the Fogg Library (1898, in South Weymouth) founded by a bequest of John S. Fogg; and the Tufts Library (1879, in Weymouth village), endowed by Quincy Tufts and his sister Susan Tufts. In 1905 the township's factory products were valued at $4,921,955, of which $2,588,213, or 52·6% of the total, was the value of boots and shoes. The township owns and operates its water works; the water supply is obtained from Weymouth Great Pond in the village of South Weymouth. Weymouth was first settled in 1623 by Robert Gorges. It was known first as the Plantation of Wessaguscus or Wessagusset; was incorporated as a township in 1635, and its boundaries have been practically unchanged since 1637, when Round and Grape islands were granted to Weymouth.

See C. F Adams, Jr., "Wessagusset and Weymouth" in No. 3 (1905) of the *Publications* of the Weymouth Historical Society (organized in 1879 and incorporated in 1886), and D. H. Hurd, *History of Norfolk County* (Boston, 1884).

WEYMOUTH and **MELCOMBE REGIS,** a seaport, watering-place, market town and municipal borough in the Southern parliamentary division of Dorsetshire, England, 142 m. S.W. by W. from London, on the London & South-Western and Great Western railways. Pop. (1891) 16,100; (1901) 19,843. It is formed of Weymouth, a fishing town and seaport on the south-west of the Wey, and Melcombe Regis on the north-east of the river, the two towns being contiguous. The situation on Weymouth Bay, which is enclosed to the south by the Isle of Portland, and north by the eastward trend of the coast, is picturesque. An esplanade about 1 m. in length fronts the sea. To the south of the esplanade is a pier of stone on wooden piles, and the Alexandra and other public gardens are attractive. The harbour lies between the pier on the north and the spur of land called the Nothe on the south, and is protected by a concrete wall extending 500 ft. northward from the Nothe. The principal buildings are the old town-hall, the market house, the guildhall, the Royal Dorset Yacht Clubhouse, the theatre, the Royal Victoria Jubilee Hall, the Weymouth and Dorset eye infirmary, the Weymouth royal hospital and dispensary and the barracks. Of the numerous churches none dates from before the 19th century. Opposite the Royal Terrace is an equestrian statue of George III., erected in 1809 in commemoration of his jubilee. A mile S.W. of Weymouth is Sandsfoot Castle, a fort erected by Henry VIII. for the protection of the shipping. The principal exports are Portland stone, bricks and tiles and provisions, and the imports are coal, timber, garden and dairy produce and wine. Ship and boat building, rope and sail making, and brewing are carried on. The Great Western railway company maintains a regular service of passenger steamers to Guernsey and Jersey. The municipal borough is under a mayor, 8 aldermen and 24 councillors. Area, 1299 acres.

Although its convenient harbour was probably used before Saxon times, and bronze weapons and Roman interments have been found, there is no evidence that Weymouth (*Waimue, Waymuth*) was a place of early settlement. The first mention of "that place called Weymouth" occurs in a charter of King Æthelred (866–871), while it is again spoken of in a charter of King Æthelstan (895–940). Edward the Confessor gave the manor to the church of Winchester in 1042, and it remained with the prior and convent of St Swithin until the 13th century, when it passed by exchange to Gilbert de Clare, earl of Gloucester, though the vassals of the prior and convent remained exempt from dues and tronage in the port. Coming by marriage into the hands of the earls of March and Plantagenets, the manor was finally vested in the crown. The first charter was that granted by the prior and convent in 1252, by which Weymouth was made a free borough and port for all merchants, the burgesses holding their burgages by the same customs as those of Portsmouth and Southampton. The demand of six ships from the town by the king in 1324 shows its importance in the 14th century, but there is no mention of a mayor until 1467. It is probable that the town suffered considerably at the hands of the French at the beginning of the 15th century, though in 1404 the men of Weymouth were victorious over a party which landed in the Isle of Portland. Early in the 16th century the commercial rivalry between Weymouth and the neighbouring borough of Melcombe came to a height. Melcombe had received a charter from Edward I. in 1280 granting to its burgesses half the port and privileges similar to those enjoyed by the citizens of London; Edward II. in 1307–1308 granted that its men might elect for themselves two bailiffs. The date of the grant of the town at an annual fee-farm of 8 marks is uncertain, but in the reign of Henry VI. a commission was appointed to inspect the destruction wrought by the king's enemies on the town, with the result that the fee-farm was reduced to 20s. The continual disputes between the two boroughs led to the passing of an act of union in 1571, the new borough being incorporated under the title of the "Mayor, Bailiffs and Burgesses" by James I. in 1616; further charters were granted by Charles II. and George II. Melcombe Regis first returned two members to parliament in 1307, and Weymouth in 1319, four members being returned by the united boroughs until 1832, when the representation was reduced to two and ceased in 1885. The medieval fairs are no longer held. As early as 1293 trade was carried on with Bayonne, and six years later a receiver of customs on wool and wool-fells is mentioned at Weymouth, while wine was imported from Aquitaine. In 1586 sugar is mentioned as an import, and in 1646 deal boards were brought here from Hamburg. The town suffered severely during the Civil War, being garrisoned by the parliamentary troops in 1642, taken by the earl of Carnarvon in 1643, and surrendered in the following year. The town is described as "but little" in 1733, but a few years afterwards it gained a reputation as a watering-place, and the duke of Gloucester built a house here; George III. and the royal family in 1789 paid Weymouth the first of a series of visits which further ensured its popularity.

See H. J. Moule, *Descriptive Catalogue of the Charters, Minute Books, and other Documents of the Borough of Weymouth and Melcome Regis, A.D. 1250 to 1860* (Weymouth, 1883); John Hutchins, *History and Antiquities of the County of Dorset* (3rd ed., Westminster, 1860).

WHALE, the English name applied to all the larger and some of the smaller representatives of the order CETACEA (*q.v.*). Although by their mode of life far removed from close observation, whales are in many respects the most interesting and wonderful of all creatures; and there is much in their structure and habits worthy of study. One of the first lessons a study of these animals affords is that, in the endeavour to discover what a creature really is, from what others it is descended, and to which it is related, the outward appearance affords little clue, and we must go deep below the surface to find the essential characteristics of its nature. There was once, and may be still, an idea that a whale is a fish. To realize the fallacy of this notion we have only to consider what a fish really is, what under all the diversities of form, size and colour there is common to all fishes, and we see that in everything which characterizes a true fish and separates it from other classes, as reptiles, birds and mammals, the whale resembles the last and differs from the fish. It is as essentially a mammal as a cow or a horse, and simply resembles a fish externally because it is adapted to inhabit the same element; but it is no more on that account a fish than is a bat (because adapted to pass a great part of its existence on the wing) nearly related to a bird. In every part of the structure of a whale we see the result of two principles acting and reacting upon each other—on the one hand, adherence to type, or rather to fundamental inherited structural conditions, and, on the other, adaptation to the peculiar circumstances under which it lives, and to which it has become gradually fitted. The external fish-like form is perfectly suited for swimming through the water; the tail, however, is not placed vertically as in fishes, but horizontally, a position which accords better with the constant necessity for rising to the surface for the purpose of breathing. The hairy covering characteristic of all mammals, which if present might interfere with rapidity of movement through the water, is reduced to the merest rudiments—a few short bristles about the chin or upper lip—which are often only present in young animals. The function of keeping the body warm is performed by a thick layer of non-conducting material, the "blubber," a dense kind of fat placed immediately beneath the skin. The fore-limbs, though functionally reduced to mere paddles, with no power of motion except at the shoulder-joint, have beneath their smooth and continuous external covering all the bones, joints and even most of the muscles, nerves and arteries of the human arm and hand; and rudiments even of hind-legs are found buried deep in the interior of the animal, serving no useful purpose, but pointing a lesson to those able to read it.

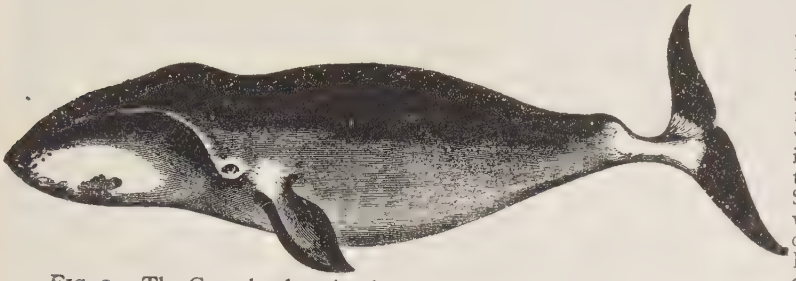

FIG. 1.—The Greenland or Arctic Right Whale (*Balaena mysticetus*).

In the present article attention is directed only to what may be regarded as the typical whales. Of these the Greenland or Arctic right whale (*Balaena mysticetus*) attains, when full grown, a length of from 45 to 50 ft. In this species (fig. 1) all the peculiarities which distinguish the head and mouth of the whales from those of other mammals have attained their greatest development. The head is of enormous size, exceeding one-third the whole length of the creature. The cavity of the mouth is actually larger than that of the body, thorax and abdomen together. The upper jaw is very narrow, but greatly arched from before backwards, to increase the height of the cavity and allow for the great length of the whalebone-blades; the enormous lateral halves of the lower jaw are widely separated posteriorly, and have a further outward sweep before they meet at the symphysis in front, giving the floor of the mouth the shape of an immense spoon. The whalebone-blades attain the number of 380 or more on each side, and those in the middle of the series have a length of 10 or sometimes 12 ft. They are black in colour, fine and highly elastic in texture, and fray out at the inner edge and ends into long, delicate, soft, almost silky, but tough hairs. The remarkable development of the mouth and of the structures in connexion with it, which distinguishes the right whale from all its allies, is entirely in relation to the nature of its food. By this apparatus the creature is enabled to avail itself of the minute but highly nutritious crustaceans and pteropods which swarm in immense shoals in the seas it frequents. The large mouth enables it to take in at one time a sufficient quantity of water filled with these small organisms, and the length and delicate structure of the whalebone provide an efficient strainer or hair-sieve by which the water can be drained off. If the whalebone were rigid, and only as long as is the aperture between the upper and lower jaws when the mouth is shut, a space would be left beneath it when the jaws were separated, through which the water and the minute particles of food would escape. But instead of this the long, slender, brush-like, elastic ends of the whalebone blades fold back when the mouth is closed, the front ones passing below the hinder ones in a channel lying between the tongue and the lower jaw. When the mouth is opened, their elasticity causes them to straighten out like a bow unbent, so that at whatever distance the jaws are separated the strainer remains in perfect action, filling the whole of the interval. The mechanical perfection of the arrangement is completed by the great development of the lower lip, which rises stiffly above the jaw-bone and prevents the long, slender, flexible ends of the whalebone from being carried outwards by the rush of water from the mouth, when its cavity is being diminished by the closure of the jaws and raising of the tongue.

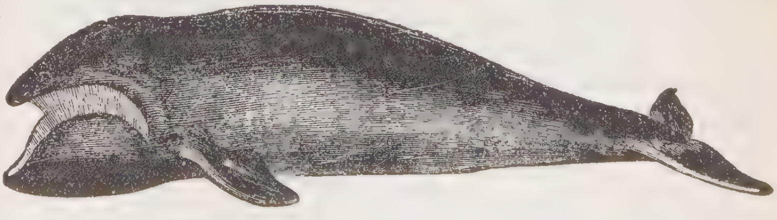

FIG. 2.—The Black Whale or Southern Right Whale (*B. australis*).

If, as appears highly probable, the "bowhead" of the Okhotsk Sea and Bering Strait belongs to this species, its range is circumpolar. Though found in the seas on both sides of Greenland, and passing freely from one to the other, it is never seen so far south as Cape Farewell; but on the Labrador coast, where a cold stream sets down from the north, its range is somewhat farther. In the Bering Sea, according to Scammon, "it is seldom seen south of the fifty-fifth parallel, which is about the farthest southern extent of the winter ice, while in the Sea of Okhotsk its southern limit is about the latitude of 54°." "Everything tends to prove," Scammon says, "that *Balaena mysticetus* is truly an 'ice whale,' for among the scattered floes, or about the borders of the ice-fields or barriers, is its home and feeding-ground. It is true that these animals are pursued in the open water during the summer months, but in no instance have we learned of their being captured south of where winter ice-fields are occasionally met with." The occurrence of this species, therefore, on the British or any European coast is unlikely, as when alive and in health the southern limit of its range in the North Sea is from the east coast of Greenland at 64° N. lat. along the north of Iceland towards Spitzbergen, and a glance at a physical chart will show that there are no currents setting southwards which could bear a disabled animal or a floating carcase to the British shores. To this improbability may be added the fact that no authentic instance has been recorded of the capture or stranding of this species upon any European coast. Still, as two other Arctic cetaceans, the narwhal and the beluga, have in a few instances found their way to British shores, it would be rash to deny the possibility of the Greenland right whale doing the same.

The black whale or southern right whale (*B. australis*) resembles the preceding in the absence of a dorsal fin and of longitudinal furrows in the skin of the throat and chest, but differs in that it possesses a smaller head in proportion to its body, shorter whalebone, a different-shaped contour of the upper margin of the lower lip, and a greater number of vertebrae. This type inhabits the temperate seas of both southern and northern hemispheres and is divided into several species according to their geographical distribution: *B. biscayensis* of the North Atlantic, *B. japonica* of the North Pacific, *B. australis* of the South Atlantic, and *B. antipodarum* and *B. novae-zelandiae* of the South Pacific. But the differential characters by which they are separated are slight, and the number of specimens available for comparison is not sufficient to afford the necessary data to determine whether these characters can be regarded as specific or not.

The Biscay right whale was formerly abundant in the North Atlantic, but is now verging on extinction. This was the whale the pursuit of which gave occupation to a numerous population on the shores of the Basque provinces of France and Spain in the middle ages. From the 10th to the 16th centuries Bayonne, Biarritz, St Jean de Luz and San Sebastian, as well as numerous other towns on the north coast of Spain, were the centres of an active whale "fishery," which supplied Europe with oil and whalebone. In later times the whales were pursued as far as the coast of Newfoundland. They were, however, already getting scarce when the voyages undertaken towards the close of the 16th century for the discovery of the north-eastern route to China and India opened the seas round Spitzbergen; then for the first time the existence of the Greenland whale became known, and henceforth the energies of the European whale-fishers became concentrated upon that animal. Among instances of the occurrence of this whale in Europe in modern times may be mentioned three, namely, in the harbour of San Sebastian in January 1854, in the Gulf of Taranto, in the Mediterranean, in February 1877, and on the Spanish coast between Guetaria and Zarauz (Guipuzcoa) in February 1878. The skeletons of these three whales are preserved in the museums of Copenhagen, Naples and San Sebastian respectively. On the coast of the United States several specimens have been taken; and a cargo of whalebone belonging to this species was received at New Bedford in 1906. During the latter year six examples were killed by whalers from Buneveneader, in the island of Harris (see R. C. Haldane, *Ann. Scot. Nat. Hist.*, 1907, p. 13). In the North Pacific a similar if not identical whale is regularly hunted by the Japanese, who tow the carcases ashore for the purpose of flensing and extracting the whalebone. In the tropical seas, however, right whales are never or rarely seen; but the southern temperate ocean, especially in the neighbourhood of the Cape of Good Hope, Kerguelen's Island, Australia and New Zealand, is inhabited by "black whales," once abundant, but now nearly exterminated through the wanton destruction of the females as they visit the bays and inlets round the coast, their constant habit in the breeding time. The range of these whales southward has not been accurately determined; but no species corresponding with the Arctic right whale has been met with in the Antarctic seas.

See also Hump-back Whale, Rorqual, Sperm-Whale, Beluga, &c. (W. H. F.; R. L.*)

WHALEBONE, the inaccurate name under which the baleen plates of the right whale are popularly known; the trade-name of whale-fin, which the substance receives in commerce, is equally misleading. Whalebone is formed in the palate on the roof of the mouth and is an exaggeration of the ridges, often horny in character, which are found on the roof of the mouth of all mammals. Three kinds are recognized by traders—the Greenland, yielded by the Greenland whale, *Balaena mysticetus*; the South Sea, the produce of the Antarctic black whale, *B. australis*; and the Pacific or American, which is obtained from *B. japonica*. Very many different names have been given to whales of the *B. australis* group, and it is possible that local races exist, whilst some writers are inclined to regard *B. japonica* as not specifically distinct from *B. australis*. Of these the Greenland whalebone is the most valuable. It formed the only staple known in earlier times, when the northern whale fishery was a great and productive industry. This whalebone usually comes into the market trimmed and clean, with the hairy fringe which edges the plates removed. To prepare whalebone for its economic applications, the blades or plates are boiled for about twelve hours, till the substance is quite soft, in which state it is cut either into narrow strips or into small bristle-like filaments, according to the use to which it is to be devoted.

Whalebone possesses a unique combination of properties which render it peculiarly and almost exclusively suitable for several purposes. It is light, flexible, tough and fibrous, and its fibres run parallel to each other without intertwisting. One of its earliest uses, referred to by William le Breton in the 13th century, was to form the plumes on helmets. It has been found practicable to employ flexible steel for several purposes to which whalebone was formerly applied, especially in the umbrella and corset industries, in which steel is now almost exclusively used. Whalebone, is, however, still in large demand among dressmakers and milliners; but it is principally used in the brush trade. In cases where bristles are too soft and weak, and where the available vegetable fibres possess insufficient elasticity and durability, whalebone offers the great advantage of being procurable in strips or filaments, long or short, thick or thin, according to requirement. Hence it is principally used for making brushes for mechanical purposes. The use of whalebone in brush-making was originally patented by Samuel Crackles in 1808, and various special machines have been adapted for cutting the material into filaments. When whalebone came into the English market in the 17th century it cost at first about £700 per ton. In the 18th century its price ranged from £350 to £500 per ton, but early in the 19th century it fell as low as £25. Later it varied from £200 to £250; but with the decrease in whaling the article has become very scarce, and upwards of £2000 per ton is now paid for Greenland whalebone.

WHALE-FISHERY, or Whaling, the pursuit and capture of the larger species of cetaceans (see Cetacea and Whale). Man, in all probability, first became acquainted with the value of the products yielded by whales from stranded individuals; but at what time he first ventured to hunt and kill these monsters in the open ocean it is now impossible to ascertain. We know, however, from King Alfred's account of Ohthere's voyage to the White Sea that the Norwegians were expert whalers at least a thousand years ago; and we also know that from the 10th to the 16th centuries the Basques of Bayonne, Biarritz, St Jean-de-Luz, San Sebastian and certain other French and Spanish ports were carrying on a lucrative trade in the products of a whale-fishery conducted by themselves, which supplied Europe with whalebone and oil. In the latter, and not improbably also in the former case, the species hunted was the Atlantic right-whale, or black whale (*Balaena biscayensis*), which the Basques seem to have well-nigh exterminated in their own waters; and it was not till a later epoch that the pursuit of its larger-headed cousin, the Greenland right-whale (*B. mysticetus*), was initiated. Hunting the sperm-whale, or cachalot, in the South Sea was a still later development, while rorqual-hunting is quite a modern industry.

Of whaling vessels of the old type, a brief notice will suffice. Those engaged in the British South Sea fishery, which was in its prime about the year 1790, were from 300 to 400 tons burden, and equipped for at least a three-years' voyage. They carried from 28 to 33 officers and men, and six whale-boats. Built sharp at both ends, these boats were about 27 ft. long, and were furnished, in addition to masts and sails, with a couple of 200-fathom whale-lines. When a whale was sighted from the "crow's-nest" at the masthead of the vessel, four boats, each carrying a crew of six men, were lowered and despatched in pursuit. The crew consisted of a boat-steerer in the bow, four rowers and a headsman in the stern. The boat-steerer carried the harpoons with which the whale was first attacked, and when the boat was once "fast" to a whale by means of the harpoon and line, the attack was carried on by the headsman, who was armed with long slender lances. When several whales were seen, two or more of the boats might make separate attacks; but in other instances they kept together, so that their united lines were available when the whale descended or "sounded." After the first blow of the harpoon, or at all events after the first effective lancing, the "sounding" was deep and prolonged; but loss of blood eventually caused the victim to keep near the surface, when, if all went well, it was finally despatched by lance-thrusts behind one of the flippers into the vital parts.

When a sperm-whale was killed, the carcase was made fast to the side of the vessel, and the process of flensing, or "cutting-in," commenced. On being made fast to the vessel, the whale was enveloped in a framework, and a strip of the blubber cut in a spiral direction. By raising this strip with the aid of proper apparatus, the whale could be turned round and round on its axis, and nearly the whole of the blubber removed in a continuous piece, to be cut, as required, into convenient lengths. Meanwhile the liquid spermaceti, or "head-matter," was ladled out in buckets from the great cavity in the skull and put in casks, where it solidified, to be carried to port and there refined. The blubber was, however, reduced to oil by "try-works" with which the vessel was provided, and stored in barrels. A large male sperm-whale will yield as much as eighty barrels, or about 3 tons of oil; while the yield of a small female does not exceed 1 or 2 tons. In the old days the cargo of a successful vessel might include the products of a hundred whales, yielding from 150 to 200 tons of boiled sperm-oil in addition to the spermaceti.

In the old days of the Greenland whale-fishery vessels of about 350 tons burden were deemed the most eligible, these being constructed in such a manner as to resist so far as possible the pressure of the ice. The crew was about fifty in number, and the vessel carried six or seven whale-boats of the same length as those used in the South Sea fishery. The vessels left Peterhead and Dundee (the ports for the Greenland fishery, as was London for the South Sea fishery) about the beginning of April, and, after touching at the Shetlands, reached the whaling-grounds before the end of that month. In approaching a whale, which was effected from behind, silence was essential, and the harpoon had to be delivered within a distance of a few yards. The moment the wounded whale disappeared a flag was hoisted in the boat to give notice that assistance was required from the ship. Attention to the line was a matter of the utmost importance, as if it became entangled the boat would be drawn under water by the whale. Sometimes its motion was retarded by one or more turns round the "bollard," a post fixed for this purpose in the boat; when this was done the friction was so great as to produce quantities of smoke, fire being prevented by sluicing the bollard with water. Even with the assistance offered by the bollard, the whale-line might be run out within ten minutes, when the lines of a second or even a third boat would be attached. In this manner some 600 or 700 fathoms of line would be taken out; the whale commonly remaining under water when first wounded for about 40 minutes, although a period of an hour is said to be not unfrequent. On rising after its second descent the whale was attacked with lances thrust deep into the body and aimed at the vital parts. The old-fashioned lance was a 6-ft. rod and $\frac{1}{2}$-in. iron, flattened at one end into the form of a lance-head with cutting edges, and at the other expanding into a socket for the reception of a short wooden handle. Torrents of blood spouted from the blow-hole of the whale denoted the approaching end of the struggle. So soon as the whale was dead, no time was lost in piercing the tail or "flukes," and thus making the carcase fast to the boats by means of a cable, and then towing it in the direction of the ship. From fifteen minutes to as much as fifty hours might be occupied in a whale-hunt.

The following account of the operation of "flensing," or securing the blubber and whalebone of the Greenland whale, is taken from Sir William Jardine's *Naturalists' Library*:—

> "The huge carcase is somewhat extended by strong tackles placed at the snout and tail. A band of blubber, two or three feet in width, encircling the whale's body at what is the neck in other animals, is called the *kent*, because by means of it the whale is turned over or *kented*. To this band is fixed the lower extremity of a combination of powerful blocks, called the *kent-purchase*, by means of which the whole circumference of the animal is, section by section, brought to the surface. The harpooners, having spikes on their feet to prevent their falling from the carcase, then begin with a kind of spade, and with huge knives, to make long parallel cuts from end to end, which are divided by cross-cuts into pieces of about half a ton. These are conveyed on deck, and, after being reduced to smaller portions, are stowed in the hold. Finally, being by other operations still further divided, the blubber is put into casks, which is called 'making-off,' and packed down completely by a suitable instrument.
>
> "While this flensing is proceeding, and when it reaches the lips, which contain much oil, the baleen (whalebone) is exposed. This is detached by means of bone hand-spikes, bone knives and bone spades. The whole whalebone is hoisted on deck in one mass, when it is split by bone wedges into junks, containing five or ten blades each, and stowed away. When the whole whalebone and blubber are thus secured, the two jaw-bones, from the quantity of oil which they contain, are usually hoisted on deck, and then only the *kreng* remains—the huge carcase of flesh and bone, which is abandoned either to sink or to be devoured by the birds, sharks and bears, which duly attend on such occasions for their share of the prey."

The largest cargo ever secured by a Scotch whaler was that of the "Revolution" of Peterhead in 1814, which comprised the products of no less than forty-four whales. The oil, which amounted to 299 tons, realized £9568, while the price obtained for the whalebone, added to the government bounty then given to Greenland whalers, brought up the total sum to £11,000. Allowing a ton to each whale, the whalebone alone at present prices would have yielded about £110,000!

At a later period, say about 1880, the Greenland whaler had grown to a vessel of from 400 to 500 tons gross register, rigged either as a ship or a bark, and provided with auxiliary engines of about 75 horse-power. She would be manned by from fifty to sixty hands, and would carry eight boats of the type mentioned above. Below the hold-beams were fitted about fifty iron tanks capable of containing from 200 to 250 tons of oil. Such a vessel would cost about £17,500 to build, and her working expenses, exclusive of interest and insurance, would be about £500 a month. At the period mentioned each whale-boat was armed with a harpoon-gun measuring 4 ft. 6 in. in length and weighing 75 lb; the barrel being 3 ft. long, with $1\frac{1}{2}$-in. bore, and mounted in a wooden stock, tapering behind into a pistol-handle. The gun-harpoon is used solely for first getting on to the whales; hand-harpoons being employed for getting a hold with other lines.

Without referring to further improvements in the weapons and vessels employed, it will suffice to state that in the Greenland whale-fishery the whales are still killed from whale-boats. In the rorqual-fishery, as at Newfoundland, on the other hand, the actual attack is made from a steam-vessel of considerable size, as is described in the following quotation from a paper by Mr G. M. Allen in the *American Naturalist* for 1904, referring to the fishery at Rose-au-Rue, Placentia Bay, Newfoundland:—

> "The fishery itself," observes the author, "is carried on by means of small and staunchly built iron steamers of something over one hundred tons. A cannon-like gun is mounted on a pivot at the bow, and discharges a 5-ft. harpoon of over 100 lb weight, which at short range is nearly buried in the body of the whale. A hollow iron cap filled with blasting powder is screwed to the tip of the harpoon, forming its point. A timed fuse discharges the bomb inside the body of the whale. The harpoon carries a stout cable which is handled by a powerful 5-sheet winch on the steamer's deck."

Explosive harpoons of the type referred to were invented by Svend Foyn, a Norwegian, and used by him about the year 1865 or 1866 in the manner described above, as they still are in various Norwegian rorqual-fisheries.

In fisheries of this type the carcases of the whales are towed into harbour for flensing; and in place of the "kreng" being wasted, the flesh is worked up to form an excellent manure, while the bones are ground up and also used as fertilisers.

A somewhat similar mode of proceeding characterizes the sperm-whale fishery now carried on in the Azores, so far at least as the towing of the carcases to shore for the purpose of flensing is concerned. According to an account given by Professor E. L. Bouvier in the *Bulletin de l'Institut Océanographique* for 1907, American whalers have observation stations on most of the islands of the Azores group; Horta, in Fayal, being the favourite station. The carcases of the cachalots are towed for flensing into a small creek adjacent to the port, where, after the removal of the spermaceti and blubber, they are left to rot. Even the teeth have a commercial value, being either sold as curiosities in Horta, or utilized for ivory. Whenever practicable, the whales caught by the vessels belonging to the great sperm-whaling station at New Bedford are towed into the harbour for flensing.

Passing on to a review of some of the more important whale-fisheries of the world, the Atlantic fishery by the Basques in the 10th and six succeeding centuries claims first mention. Readers desirous of obtaining further insight into the little that is known about it are referred to an interesting paper by Sir Clements Markham published in the *Proceedings* of the Zoological Society of London for 1881. Although, as already mentioned, the black whale (*Balaena biscayensis*) was well-nigh exterminated in the north Atlantic by the Basques, and for many years afterwards was excessively rare, yet quite recently several examples have been taken by Scottish whalers off the Hebrides, while the whalebone of others has been received at New Bedford.

The discovery in 1596 by the Dutch navigator Barents of Spitzbergen, followed by the voyage of Hudson in the "Hopewell" in 1607, may be said to have inaugurated the second phase in the whaling industry; these adventurous voyages bringing to light for the first time the existence of the Greenland whale (*B. mysticetus*); a species of much greater value than any that had been previously hunted.

Here it may be well to refer to two common misconceptions regarding this whale. In the first place, it does not appear to be, as commonly supposed, a circumpolar species. There is, for instance, no evidence of its occurrence eastward of Spitzbergen along the Siberian coast between 10° and 170° E.; and it is not till the latter parallel is reached, at Cape Schelagskoi, that the domain of the so-called bowhead of the American whales is entered.

> "On the other side of Bering Strait," writes Mr T. Southwell in the *Annals of Scottish Natural History* for April 1904, "these whales do not appear to penetrate much farther east than Cape Bathurst, and it seems highly improbable that there is any intercommunication between those at that point and the whales in Baffin Bay. On the other hand, the whales on the east side of

Davis Strait do not descend so far south as Cape Farewell, nor are those in the Greenland Sea known to pass westward round that cape. It seems therefore that, although their range as a species is undoubtedly extensive longitudinally, the localities they inhabit are greatly restricted, each being inhabited by a local race differing from the other in some slight degree."

The second misconception is that the Greenland whale has gradually been driven northward by the whalers. A sufficient proof of the falsity of this idea is afforded by the fact that the minute organisms constituting the food of the species are restricted to the icy seas of the far north. The Greenland whale is, in fact, essentially an ice-whale.

To revert to the history of the fishery, no sooner was the accessibility of the Spitzbergen seas made known than vessels were fitted out for whaling there, at first by the British, and soon after by the Dutch. The seas absolutely swarmed with whales, which showed little fear of vessels and could thus be captured with ease. The first whaling expedition was despatched by the Muscovy Company, under the command of Jonas Poole; and the success of four voyages (1609–1612) soon attracted the attention of other nations. Some indication of the abundance of the whales may be gathered from the fact that in the year 1697 no less than 1959 of these monsters were killed off Spitzbergen by 188 vessels.

The fishery in Davis Strait was begun in 1719 by the Dutch, who at first killed large numbers of whales and were subsequently followed by the British. Although many whales have been seen in recent years, few are taken; and it is the opinion of many that in Greenland waters, at any rate, steam has been fatal to the industry.

The following summary of the rise and fall of the British Greenland whale-fishery is given by Mr Southwell in the article already cited:—

> "For the first quarter of the 19th century scarcely a seaport of any importance on the east coast of England was unrepresented in the Arctic seas: from Scotland, Berwick, Leith, Kirkcaldy, Dundee, Montrose, Aberdeen, Peterhead, Kirkwall, Greenock and for a time Banff and Bo'ness, all took part in the whale-fishery. Gradually, one by one, they fell off, till only Peterhead, which sent out her first whaler in 1788, and Dundee (which started in 1790) were left. In 1893 Peterhead, which in 1857 sent out 34 vessels, ceased to be represented in the industry, leaving Dundee in possession of the field. Dundee sent out its largest fleet in 1885,—16 vessels; in 1903 she was represented by 5 vessels only, one of which was wrecked."

According to Mr Southwell's account of the Arctic fishery (*Zoologist*, 1906), a Dundee vessel, the "Scotia," visited the east Greenland seas in the summer of 1906, where she took four small right-whales; this visit being the first made to those seas by a British vessel since 1899.

As already mentioned, the British whalers were accustomed to sail for the Arctic Ocean early in April; and if their destination was the east Greenland sea, off the west coast of Spitzbergen, they generally arrived on the grounds about a month later. The whales make their appearance amongst the ice near the sea edge about the 15th of May, but only remain until the opening of the barrier-ice permits them to resume their northward journey; for about the middle of June they suddenly disappear from these grounds, and are last seen going north-west, when the north Greenland whale-fishing is over for the season. If unsuccessful in obtaining a cargo at the northern grounds, the whale-ships were accustomed to proceed southwards as far as lat. 75°; where, if the sea were sufficiently open, they penetrated westwards until the coast of Greenland became visible. There they cruised amongst the ice until August, when the darkness of the nights put an end to the season's fishing. If the south-west fishery, in Davis Strait, were the first object of the voyage, the vessels arrived at the edge of the ice near Resolution Island in April. If unsuccessful here they proceeded direct to Disco Island, where they usually arrived early in May. The whales appear about the middle of May at South East Bay, where a great fishing was once carried on. The dangerous passage of Melville Bay was next performed; the whales entering the north water in June, and pushing on towards the sounds. If there were a "land-floe across," *i.e.* if the land-ice of the west side were continuous across the entrance of Ponds Bay and Lancaster Sound, whales would be seen in considerable numbers and good cargoes might be obtained; but immediately the land-floe broke up they departed to the westward. When there was no land-floe across, the whales proceeded at once to the secluded waters of Eclipse Sound and Prince Regent Inlet for the summer months. At this season most of the vessels cruised in the sounds, but a few searched the middle ice, until the darkness of the August nights compelled them to seek anchorage in some of the harbours of the west side, to await the return of the whales south. This migration takes place on the formation of young ice in the sounds, usually in the latter part of September. Only the larger whales, most of which are males, come, however, close down along the land of the west side. These the ships sent their boats to intercept; this forming the inshore-fishing, or "rock-nosing," which continued till the formation of young ice drove the vessels out of harbour, usually early in October.

A few vessels, American as well as British, occasionally entered Hudson Bay and prosecuted the fishing in the neighbourhood of Southampton Island, even entering Fox Channel. There were whaling-stations in Cumberland Inlet, and a few vessels usually remained throughout the winter, ready to take advantage of the opening of the ice in the following spring. Here both young and old whales make their appearance in May; and the fishing continued till the whales migrated northwards in June.

Of the other nationalities which took part in the Spitzbergen-Greenland fisheries, it may be mentioned that the Dutch had fisheries both at Jan Mayen till 1640 and at Spitzbergen. In the Spitzbergen fishery 10,019 whales were taken by them in the ten years from 1679 to 1688. About 1680, when the fishing was probably most prosperous, they had 260 vessels and 14,000 seamen employed. The fishery continued to flourish on an extensive scale till 1770, when it began to decline, and it finally came to a close before the end of the century. At the same time the Germans prosecuted the fishing to a very considerable extent; 79 vessels from Hamburg and Bremen being employed in 1721, while during the fifty years from 1670 to 1719 an average of 45 vessels sailed yearly from Hamburg alone. German vessels continued to engage in the fishery until 1873. The Spaniards, although they at first supplied the harpooners to the crews of the English and Dutch vessels, never seem to have engaged largely in the northern fishery. The Danes, although likewise early appearing on the Spitzbergen fishing-grounds, never pursued the industry on a large scale until after the commencement of the Davis Strait fishing in 1721, in which year they had 90 vessels engaged; but by 1803 the number had fallen to 35.

The continually increasing rarity of the Greenland whale has caused an enormous appreciation in the value of whalebone of recent years, as compared to the prices obtaining the first half of the last century. For about twenty years preceding the year 1840 the average price of this commodity was about £163 per ton; while in the year 1835 whalebone of the Greenland whale sold at £250 per ton, and that of the south Atlantic black whale (*Balaena australis*) at £145 per ton. At the present date the price is about £2500 per ton, but a few years ago it touched £2800, although soon after it fell for a short time to £1400. The reason of the fall from £2800 to £2500 (at about which figure the price has stood for some time) is believed to be owing to the use of strips of horn for many purposes where whalebone was formerly employed. Owing to its much greater length, the whalebone of the Greenland whale is, as indicated above, far more valuable than that yielded by the northern and southern Atlantic black whales, of which comparatively little generally comes into the market. The best quality of whalebone is known in the trade as "size-bone," and consists of plates not less than 6 ft. in length.

In the twenty years preceding 1840 the average price of whale-oil from the northern fisheries was £30 per ton; the actual price in 1835 being £40 per ton. At the present day the price is only £23 per ton. It may be added that in 1835 South Sea oil sold at £43 and sperm-oil at £75 per ton.

A few words will suffice for the American fishery of the so-called bowhead, the western race of the Greenland whale, in Bering Strait. Here the whales are mostly sought for and killed in open water, and the vessels are consequently less adapted for ice-work. For the most part the vessels sail from San Francisco in March, and arrive at the ice-edge off Cape Navarin, where the fishing is begun, in May. The whales disappear during summer, but return in the autumn, when the "fall-fishing" is carried on in the neighbourhood of Point Barrow; and between the seasons it was customary for the vessels to go south for sperm-whaling. The Bering Strait fishery was begun in 1848, and in the three following years 250 ships obtained cargoes. In 1871 no less than 34 vessels were abandoned in the ice off Cape Belcher, the crews making good their escape to other vessels; while again in 1876 a dozen vessels experienced a similar fate.

The sperm-whale fishery, of which the products are spermaceti, sperm-oil, ambergris (mostly found floating in masses in the sea) and teeth, appears to have been initiated by the Americans in 1690, who for a considerable period found sufficient occupation in the neighbourhood of their own coasts. The British are, however, stated to have opened up the great whaling-grounds of the Pacific and Indian Oceans, although they did not embark on sperm-whaling till 1775. Within less than twenty years from that date their trade had, however, attained its maximum; no less than 75 British vessels, all from the port of London, being engaged in this industry in the year 1791. After this there was a steady decline till 1830, when only 31 vessels were thus employed; and since 1853 sperm-whaling has ceased to be a British industry.

As regards the American fishery, the island of Nantucket embarked in this trade about the year 1712, and by 1774 there were 360 American ships engaged in sperm-whaling, while in 1846, when the fishery was about at its zenith, the number was 735, mostly from New Bedford. Between 1877 and 1886 the average number of vessels had sunk to 159. New Bedford, on the Atlantic, and San Francisco, on the Pacific side, are the two great whaling centres; and during the period last mentioned the average imports of whaling products into the United States totalled 5304 tons of sperm-oil, together with 4863 tons of whale-oil and 145 tons of whalebone.

During the first half of the last century the colony of New South Wales was busily engaged in this trade, and in 1835 exported 2989 tons of sperm-oil.

Since the year 1882, when no less than 203 head were taken by the Peterhead whaler "Eclipse," the Norwegians have carried on a fishery for the bottle-nosed whale (*Hyperoödon rostratus*), a species which although greatly inferior in point of size, yields an oil closely akin to sperm-oil, but possessed of even greater lubricating power. An average male bottle-nose will yield about 22 cwts. of oil, containing 5% of pure spermaceti. Bottle-nose fishing is chiefly carried on in the neighbourhood of Jan Mayen and Iceland during the months of May, June and July, the whales usually disappearing quite suddenly about the middle of the last-mentioned month. In 1903 about 1600 tons of this oil came on the market, which would imply the destruction of nearly 2000 whales.

The invention by Svend Foyn of the explosive harpoon, already referred to, inaugurated about the year 1866 the Norwegian fin-whale fishery, an industry which has since been taken up by other nationalities. The rorquals or fin-whales (*Balaenoptera*), which include the largest of all cetaceans, are built for speed, and are much fiercer animals than either the Greenland or the Atlantic right whale; their rush when wounded being of enormous velocity, while their vitality is such that attacking them in the old-fashioned way with the hand-harpoon is practically useless, and at the same time fraught with great danger to the pursuers. To a considerable extent the same may be affirmed of the humpbacked whale (*Megaptera*). Under these circumstances, previous to the invention of the bomb-harpoon, these whales were left entirely alone by the whalers.

By the year 1885 the Norwegians had a fleet of over 30 vessels engaged in this fishery off the coast of Finmark, the amount of whose catch comprised 1398 whales in 1885, and 954 in the following year. Gradually the Norwegians have developed and extended the rorqual-fishery, and they now possess stations in Iceland, the Faroes and Shetlands, and also at Buneveneader in Harris in the Hebrides. In the Shetlands there are two stations at the head of Ronas Voe on the north-west side of the mainland where operations are carried on from May and June till September, when the whales leave the shore. During the first season (1903) the Norröna Whaling Company's vessels killed 64 whales, while 62 were accounted for by the Shetland Whaling Company.

In 1898 a successful rorqual-fishery was established by the Newfoundland Steam Whaling Company at Rose-au-Rue, Placentia Bay, Newfoundland. Four species of rorquals as well as humpbacks are hunted; and during a portion of the season in 1903 the catch included 174 of the former and 14 of the latter.

In addition to the above-mentioned fisheries for the larger whales, there are considerable local captures of the smaller kinds, commonly known as grampuses or killers, porpoises, and dolphins. Of these, however, very brief mention must suffice. The most important captures are generally made in northern seas. The black pilot-whale, or grindhval (*Globicephalus melas*), is, for instance, not infrequently taken in large shoals by the Faroe islanders; these whales being driven by boats into the shallows, where they are sometimes slaughtered by hundreds. Much the same may be stated with regard to the grampus or killer (*Orca gladiator*), of which no less than 47 head were killed at once in January 1904 at Bildoströmmen, Norway. Of even more importance is the white-whale or *beluga* (*Delphinapterus leucas*), which is hunted for its blubber, hide and flesh; the average yield per head being about 100 gallons of oil. In 1871 the Tromsoe whalers captured no less than 2167 individuals; while in 1898 300 out of a school of some 900 were captured on a single occasion at Point Barrow, Alaska. These whales, which are worth about £3 a head, yield the leather known commercially as "porpoise-hide." The narwhal (*Monodon monoceros*), yielding both blubber and the valuable ivory tusks, is usually captured singly by the Greenlanders in their "kayaks." Local porpoise and dolphin fisheries are carried on by the fishermen in many parts of the world, the natives of the Travancore coast being noted for their success in this respect; while even the fresh-water susu or Ganges dolphin (*Platanista gangetica*) and the Rio de la Plata dolphin (*Pontoporia blainvillei*) are also caught in considerable numbers for the sake of their blubber.

LITERATURE.—The following books and papers may be consulted: T. Beale, *The Natural History of the Sperm-Whale* (London, 1837); W. S. Tower, *A History of the American Whale Fishery* (Philadelphia, 1907); J. R. Spears, *Story of New England Whaling* (New York, 1908); C. R. Markham, "On the Whale-Fishery of the Basque Provinces of Spain," *Proc. Zool. Soc. London* (1881), p. 969; T. Southwell, "Notes on the Seal and Whale Fishery," *Zoologist* (London, 1884–1907), and "On the Whale-Fishery from Scotland, with some account of the changes in that industry and of the species hunted," *Ann. Scot. Nat. Hist.* (1904), p. 77; G. M. Allen, "Some Observations on Rorquals off Southern Newfoundland," *American Naturalist*, xxxviii. 613 (1904); R. C. Haldane, "Whaling in Shetland, 1904," *Ann. Scott. Nat. Hist.* (1905), p. 65, and "Whaling in Scotland," *t.c.* (1907), p. 10; E. L. Bouvier, "Quelques impressions d'un naturaliste au cours d'une campagne scientifique de S.A.S. le Prince de Monaco, 1905," *Bulletin de l'Institut Océanographique* (Monaco, 1907), No. 93. (R. L.*)

WHALE-OIL, the oil obtained from the blubber of various species of the genus *Balaena*, as *B. mysticetus*, Greenland or "right" whale (northern whale-oil), *B. australis* (southern whale-oil), *Balaenoptera longimana*, *Balaenoptera borealis* (Finback oil, Finner whale-oil, Humpback oil). The "orca" or "killer" whale, and the "beluga" or white whale, also yield "whale-oils." "Train-oil" proper is the northern whale-oil, but this term has been applied to all blubber oils, and in Germany, to all marine animal oils—fish-oils, liver oils, and blubber oils. The most important whale-oil is sperm or spermaceti oil, yielded by the sperm-whales.

Whale-oil varies in colour from a bright honey yellow to a dark brown, according to the condition of the blubber from which it has been extracted. At best it has a rank fishy odour, and the darker the colour the more disagreeable the smell. With lowering of the temperature stearin, accompanied with a small proportion of spermaceti, separates from the oil, and a little under the freezing-point nearly the whole of these constituents may be crystallized out. When separated and pressed, this deposit is known as whale tallow, and the oil from which it is removed is distinguished as pressed whale-oil; this, owing to its limpidity, is sometimes passed as sperm-oil. Whale-oil is principally used in oiling wools for combing, in batching flax and other vegetable fibres, in currying and chamois leather-making, and as a lubricant for machinery. Sperm-oil is obtained from the cavity in the head of the sperm-whale, and from several smaller receptacles throughout the body of the animal. During the life of the whale the contents of these cavities are in a fluid condition, but no sooner is the "head matter" removed than the solid wax spermaceti separates in white crystalline flakes, leaving the oil a clear yellow fluid having a fishy odour. Refined sperm-oil is a most valuable lubricant for small and delicate machinery (see OILS).

WHALLEY, EDWARD (*c.* 1615–*c.* 1675), English regicide, the exact dates of whose birth and death are unknown, was the second son of Richard Whalley, who had been sheriff of Nottinghamshire in 1595, by his second wife Frances Cromwell, aunt of Oliver Cromwell. His great-grandfather was Richard Whalley (1499–1583), a prominent adherent of the protector Somerset and member of parliament. He is said to have started in the trade of a woollen-draper, but on the outbreak of the great rebellion he took up arms for the parliament, became major of Cromwell's regiment of horse, and greatly distinguished himself in the field. His conduct at Gainsborough fight in 1643 was especially praised by Cromwell; he fought at Marston Moor, commanded one of Cromwell's two regiments of cavalry at Naseby and at the capture of Bristol, was then sent into Oxfordshire, took Banbury, and was besieging Worcester when he was superseded, according to Richard Baxter, the chaplain of his regiment, on account of his religious orthodoxy. He, however, supported his regiment in their grievances against the parliament in 1647. When the king was seized by the army, he was entrusted to the keeping of Whalley and his regiment at Hampton Court. Whalley refused to remove Charles's chaplains at the bidding of the parliamentary commissioners, and treated his captive with due courtesy, receiving from Charles after his flight a friendly letter of thanks. In the second Civil War, Whalley again distinguished himself as a soldier, and when the king was brought to trial he was chosen to be one of the tribunal and signed his death-warrant. He took part in Cromwell's Scottish expedition, was wounded at Dunbar, and in the autumn of 1650 was active in dealing with the situation in north Britain. Next year he took part in Cromwell's pursuit of Charles II. and was in the fight at Worcester. He followed and supported his great kinsman in his political career, presented the army petition to parliament (August 1652), approved of the protectorate, and represented Nottinghamshire in the parliaments of 1654 and 1656, taking an active part in the prosecution of the Quaker James Naylor. He was one of the administrative major-generals, and was responsible for Lincoln, Nottingham, Derby, Warwick and Leicester. He supported the "Petition and Advice," except as regards the proposed assumption of the royal title by Cromwell, and became a member of the newly constituted House of Lords in December 1657. On the protector's death, at which he was present, he in vain gave his support to Richard; his regiment refused to obey his orders, and the Long Parliament dismissed him from his command as a representative of the army. In November 1659 he undertook an unsuccessful mission to Scotland to arrange terms with Monk. At the Restoration, Whalley, with his son-in-law, General William Goffe, escaped to America, and landed at Boston on the 27th of July 1660, living successively at New Haven and at Hadley, Massachusetts, every attempt on the part of the government at home to procure his arrest meeting with failure. He was alive, but failing in health, in 1674, and probably did not long survive. Whalley was twice married; first to Judith Duffell, by whom, besides other children, he had a son John and a daughter Frances (who married Major-General William Goffe, the regicide); and secondly to Mary Middleton, sister of Sir George Middleton, by whom he had two sons, Henry and Edward.

AUTHORITIES.—An account of Whalley's life is in Noble's *Lives of the Regicides*, and of his family in Noble's *Memoirs of the Protectoral House of Cromwell*, vol. ii.; see also Gardiner's and Clarendon's histories of the period, Peck's *Desiderata curiosa* (1779; Whalley's account of the king's flight); Ezra Stiles's *History of three of the Judges of Charles I.* (1794, &c.). The article by C. H. Firth in the *Dict. Nat. Biog.* is an admirable summary. Whalley's sojourn in America is dealt with in numerous papers published by the Massachusetts Historical Society, and in the Hutchinson Papers published (1865) by the Prince Society; see also *Atlantic Monthly*, vi. 89-93; *Pennsylvania Mag.*, i. 55-66, 230, 359; F. B. Dexter's Memoranda concerning Whalley and Goffe, *New Haven Col. Hist. Soc. Papers*, ii. (1877); *Poem commemorative of Goffe, Whalley and Dixwell*, with abstract of their history, by Philagathos (Boston, 1793); Palfrey's *Hist. of New England*, ii. (1866); *Notes and Queries*, 5th series, viii. 359 (bibliography of American works on the regicides).

WHARF, a place for loading or unloading ships or vessels, particularly a platform of timber, stone or other material along the shore of a harbour or along the bank of a navigable river against which vessels may lie and discharge their cargo or be loaded. The O. Eng. word *hwerf* meant literally a turning or turning-place (*hweorfan*, to turn, cf. Goth. *hwairban*, Gr. καρπός, wrist), and was thus used particularly of a bank of earth, a dam which turns the flow of a stream; the cognate word in Dutch, *werf*, meant a wharf or a shipbuilder's yard, cf. Dan. *vaerft*, dockyard, and the current meaning of the word is probably borrowed from Dutch or Scandinavian languages.

In English law all water-borne goods must be landed at specified places, in particular hours and under supervision; wharves, which by the Merchant Shipping Act 1895, § 492, include quays, docks and other premises on which goods may be lawfully landed, are either "sufferance wharves," authorized by the commissioners of customs under bond, or "legal wharves" specially appointed by treasury warrant and exempt from bond. There are also wharves authorized by statute or by prescriptive right. The owner or occupier of a wharf is styled a "wharfinger," properly "wharfager," with an intrusive *n*, as in "messenger" and "passenger."

WHARNCLIFFE, JAMES ARCHIBALD STUART-WORTLEY-MACKENZIE, 1ST BARON (1776–1845), English statesman, was the son of Colonel Stuart, son of the 3rd earl of Bute and of his wife Mary Wortley-Montagu (Baroness Mountstuart in her own right), as whose heir Colonel Stuart added the name of Wortley, taking later also that of Mackenzie (which his son in later life discarded) as heir to his uncle J. S. Mackenzie of Rosehaugh. He entered the army, becoming colonel in 1797, but retired in 1801 and devoted himself to politics, sitting in parliament as a Tory for Bossiney in Cornwall till 1818, when he was returned for Yorkshire. His attitude on various questions became gradually more Liberal, and his support of Catholic emancipation lost him his seat in 1826. He was then raised to the peerage as Baron Wharncliffe of Wortley, a recognition both of his previous parliamentary activity and of his high position among the country gentlemen. At first opposing the Reform Bill, he gradually came to see the undesirability of a popular conflict, and he separated himself from the Tories and took an important part in modifying the attitude of the peers and helping to pass the bill, though his attempts at amendment only resulted in his pleasing neither party. He became lord privy seal in Peel's short ministry at the end of 1834, and again joined him in 1841 as lord president of the council. In 1837 he brought out an edition of the writings of his ancestress, Lady Mary Wortley-Montagu (new ed. 1893). On his death in 1845 he was succeeded as 2nd baron by his eldest son, John Stuart-Wortley (1801–1855), whose son Edward, 3rd baron (1827–1899), best known as chairman of the Manchester, Lincoln & Sheffield railway, converted under him into the Great Central, was created 1st earl of Wharncliffe and Viscount Carlton in 1876; his name was prominently identified with railway enterprise, and became attached to certain features of its nomenclature. He was succeeded as 2nd earl by his nephew Francis (b. 1856).

Among other members of the family, several of whom distinguished themselves in law, politics, art and the army, may be mentioned the 1st baron's third son, James Archibald Stuart-Wortley (1805–1881), recorder of London and solicitor-general; his son, C. B. Stuart-Wortley, K.C. (b. 1851), became well known in parliament as under-secretary for the home office (1885, and 1886–1892) and deputy-chairman of committees.

WHARTON (FAMILY). The Whartons of Wharton were an old north of England family, and in 1543 THOMAS WHARTON (1495–1568) was created a baron for his services in border warfare. From him descended the 2nd, 3rd and 4th barons; and the latter, PHILIP WHARTON (1613–1696), was the father of THOMAS WHARTON (1648–1715), who in 1706 was created earl and in

1714 marquess of Wharton. The 1st marquess was one of the chief Whig politicians after the Revolution. He is famous in literary history as the author of the famous political ballad, *Lilliburlero*, which "sang James II. out of three kingdoms." Wharton was lord-lieutenant of Ireland in Anne's reign, and incurred the wrath of Swift, who attacked him as Verres in the *Examiner* (No. 14), and drew a separate "character" of him, which is one of Swift's masterpieces. He was a man of great wit and versatile cleverness, and cynically ostentatious in his immorality, having the reputation of being the greatest rake and the truest Whig of his time. Addison dedicated to him the fifth volume of the *Spectator*, giving him a very different "character" from Swift's. His first wife, ANNA WHARTON (1632–1685), was an authoress, whose poems, including an *Elegy on Lord Rochester*, were celebrated by Walter and Dryden. His son, PHILIP WHARTON (1698–1731), duke of Wharton, succeeded to his father's marquessate and fortune, and in 1718 was created a duke. But he quickly earned for himself, by his wild and profligate frolics and reckless playing at politics, Pope's satire of him as "the scorn and wonder of our days" (*Moral Essays*, i. 179). He spent his large estates in a few years, then went abroad and gave eccentric support to the Old Pretender. There is a lively picture of his appearance at Madrid in 1726 in a letter from the British consul, quoted in Stanhope's *History of England* (ii. 140). He was outlawed in 1729, and at his death the titles became extinct. In 1843 a claim was made before the House of Lords for a revival of the barony in favour of Mr Kemys-Tynte, a descendant of the 1st baron in the female line.

For the history of the family see E. R. Wharton's *Whartons of Wharton Hall* (1898).

WHARTON, FRANCIS (1820–1889), American legal writer and educationalist, was born in Philadelphia, Pennsylvania, on the 7th of March 1820. He graduated at Yale in 1839, was admitted to the bar in 1843, became prominent in Pennsylvania politics as a Democrat, and in Philadelphia edited the *North American and United States Gazette*. He was professor of English history and literature at Kenyon College, Gambier, Ohio, in 1856–1863. He took orders in the Protestant Episcopal church in 1862 and in 1863–1869 was rector of St Paul's Church, Brookline, Massachusetts. In 1871–1881 he taught ecclesiastical polity and canon law in the Protestant Episcopal Theological School at Cambridge, Massachusetts, and at this time he lectured on the conflict of laws at Boston University. For two years he travelled in Europe, and after two years in Philadelphia he went to Washington, D.C., where he was lecturer on criminal law (1885–1886) and then professor of criminal law (1886–1888) at Columbian (now George Washington) University; in 1885–1888 he was solicitor (or examiner of claims) of the Department of State, and from 1888 to his death on the 21st of February 1889 was employed on an edition (authorized by Congress) of the *Revolutionary Diplomatic Correspondence of the United States* (6 vols., 1889, ed. by J. B. Moore), which superseded Sparks's compilation. Wharton was a "broad churchman" and was deeply interested in the hymnology of his church. He received the degree of LL.D. from the university of Edinburgh in 1883, and was the foremost American authority on international law.

He published: *A Treatise on the Criminal Law of the United States* (1846; many times reprinted); *State Trials of the United States during the Administrations of Washington and Adams* (1849); *A Treatise on the Law of Homicide in the United States* (1855); with Moreton Stillé, *A Treatise on Medical Jurisprudence* (1855); *Modern Theism* (1859), in which he applied rules of legal evidence to modern sceptical theories; *A Treatise on the Conflict of Laws* (1872; 3rd ed. 1905); *A Treatise on the Law of Negligence* (1874); *A Commentary on the Law of Agency and Agents* (1876), *A Commentary on the Law of Evidence in Civil Issues* (1877; 3rd ed. 1888); a companion work on *Criminal Evidence*; *Commentary on the Law of Contracts* (1882); *Commentaries on Law* (1884); and a *Digest of the International Law of the United States* (3 vols. 1886).

See the *Memoir* (Philadelphia, 1891) by his daughter, Mrs Viele, and several friends; and J. B. Moore's "Brief Sketch of the Life of Francis Wharton," prefaced to the first volume of the *Revolutionary Diplomatic Correspondence*.

WHARTON, HENRY (1664–1695), English writer, was descended from Thomas, 2nd Baron Wharton (1520–1572), being a son of the Rev. Edmund Wharton, vicar of Worstead, Norfolk. Born at Worstead on the 9th of November 1664, Wharton was educated by his father, and then at Gonville and Caius College, Cambridge. Both his industry and his talents were exceptional, and his university career was brilliant. In 1686 he entered the service of the ecclesiastical historian, the Rev. William Cave (1637–1713), whom he helped in his literary work; but considering that his assistance was not sufficiently appreciated he soon forsook this employment. In 1687 he was ordained deacon, and in 1688 he made the acquaintance of the archbishop of Canterbury, William Sancroft, under whose generous patronage some of his literary work was done. The archbishop, who had a very high opinion of Wharton's character and talents, made him one of his chaplains, and presented him to the Kentish living of Sundridge, and afterwards to that of Chartham in the same county. In 1689 he took the oath of allegiance to William and Mary, but he wrote a severe criticism of Bishop Burnet's *History of the Reformation*, and it was partly owing to the bishop's hostility that he did not obtain further preferment in the English church. He died on the 5th of March 1695, and was buried in Westminster Abbey.

Wharton's most valuable work is his *Anglia sacra*, a collection of the lives of English archbishops and bishops, which was published in two volumes in 1691. Some of these were written by Wharton himself; others were borrowed from early writers. His other writings include, in addition to his criticism of the *History of the Reformation*, *A treatise of the celibacy of the clergy* (1688); *The enthusiasm of the Church of Rome demonstrated in some observations upon the life of Ignatius Loyola* (1688); and *A defence of pluralities* (1692, new ed. 1703). In the Lambeth Library there are sixteen volumes of Wharton's manuscripts. Describing him as "this wonderful man," Stubbs says that Wharton did for the elucidation of English Church history "more than any one before or since." A life of Wharton is included in George D'Oyly's *Life of W. Sancroft* (1821).

WHATELY, RICHARD (1787–1863), English logician and theological writer, archbishop of Dublin, was born in London on the 1st of February 1787. He was educated at a private school near Bristol, and at Oriel College, Oxford. He obtained double second-class honours and the prize for the English essay; in 1811 he was elected fellow of Oriel, and in 1814 took orders. During his residence at Oxford he wrote his celebrated tract, *Historic Doubts relative to Napoleon Bonaparte*, a very clever *jeu d'esprit* directed against excessive scepticism as applied to the Gospel history. After his marriage in 1821 he settled in Oxford, and in 1822 was appointed Bampton lecturer. The lectures, *On the Use and Abuse of Party Spirit in Matters of Religion*, were published in the same year. In August 1823 he removed to Halesworth in Suffolk, but in 1825, having been appointed principal of St Alban Hall, he returned to Oxford. At St Alban Hall Whately found much to reform, and he left it a different place. In 1825 he published a series of *Essays on Some of the Peculiarities of the Christian Religion*, followed in 1828 by a second series *On some of the Difficulties in the Writings of St Paul*, and in 1830 by a third *On the Errors of Romanism traced to their Origin in Human Nature*. While he was at St Alban Hall (1826) the work appeared which is perhaps most closely associated with his name—his treatise on *Logic*, originally contributed to the *Encyclopaedia Metropolitana*, in which he raised the study of the subject to a new level. It gave a great impetus to the study of logic throughout Great Britain. A similar treatise on *Rhetoric*, also contributed to the *Encyclopaedia*, appeared in 1828. In 1829 Whately was elected to the professorship of political economy at Oxford in succession to Nassau William Senior. This was a subject admirably suited to his lucid, practical intellect; but his tenure of office was cut short by his appointment to the archbishopric of Dublin in 1831. He published only one course of *Introductory Lectures* (1831), but one of his first acts on going to Dublin was to endow a chair of political economy in Trinity College out of his private purse.

Whately's appointment by Lord Grey to the see of Dublin came as a great surprise to everybody, for though a decided Liberal Whately had from the beginning stood aloof from all political parties, and ecclesiastically his position was that of an Ishmaelite fighting for his own hand. The Evangelicals regarded him as a dangerous latitudinarian on the ground of his views on Catholic emancipation, the Sabbath question, the doctrine of election, and certain quasi-Sabellian opinions he was supposed to hold about the character and attributes of Christ, while his view of the church was diametrically opposed to that of the High Church party, and from the beginning he was the determined opponent of what was afterwards called the Tractarian movement. The appointment was challenged in the House of Lords, but without success. In Ireland it was immensely unpopular among the Protestants, both for the reasons just mentioned and as being the appointment of an Englishman and a Whig. Whately's blunt outspokenness and his "want of conciliating manners," which even his friends admit, prevented him from ever completely eradicating these prejudices, while at the same time he met with determined opposition from his own clergy. He ran counter to their most cherished prejudices from the first by connecting himself prominently with the attempt to establish a national and unsectarian system of education. He enforced strict discipline in his diocese, where it had been long unknown; and he published an unanswerable statement of his views on the Sabbath (*Thoughts on the Sabbath*, 1832). He took a small country place at Redesdale, 4 m. out of Dublin, where he could enjoy his favourite relaxation of gardening. Here his life was one of indefatigable industry. Questions of tithes, reform of the Irish church and of the Irish Poor Laws, and, in particular, the organization of national education occupied much of his time. But he found leisure for the discussion of other public questions, for example, the subject of transportation and the general question of secondary punishments. In 1837 he wrote his well-known handbook of *Christian Evidences*, which was translated during his lifetime into more than a dozen languages. At a later period he also wrote, in a similar form, *Easy Lessons on Reasoning*, on *Morals*, on *Mind* and on the *British Constitution*. Among his other works may be mentioned *Charges and Tracts* (1836), *Essays on Some of the Dangers to Christian Faith* (1839), *The Kingdom of Christ* (1841). He also edited Bacon's *Essays*, Paley's *Evidences* and Paley's *Moral Philosophy*. His cherished scheme of unsectarian religious instruction for Protestants and Catholics alike was carried out for a number of years with a measure of success, but in 1852 the scheme broke down owing to the opposition of the new Catholic archbishop of Dublin, and Whately felt himself constrained to withdraw from the Education Board. From the beginning Whately was a keen-sighted observer of the condition of Ireland question, and gave much offence by openly supporting the state endowment of the Catholic clergy as a measure of justice. During the terrible years of 1846 and 1847 the archbishop and his family were unwearied in their efforts to alleviate the miseries of the people. From 1856 onwards symptoms of decline began to manifest themselves in a paralytic affection of the left side. Still he continued the active discharge of his public duties till the summer of 1863, when he was prostrated by an ulcer in the leg, and after several months of acute suffering he died on the 8th of October 1863.

Whately was a great talker, much addicted in early life to argument, in which he used others as instruments on which to hammer out his own views, and as he advanced in life much given to didactic monologue. He had a keen wit, whose sharp edge often inflicted wounds never deliberately intended by the speaker, and a wholly uncontrollable love of punning. Whately often offended people by the extreme unconventionality of his manners. When at Oxford his white hat, rough white coat, and huge white dog earned for him the sobriquet of the White Bear, and he outraged the conventions of the place by exhibiting the exploits of his climbing dog in Christchurch Meadow. With a remarkably fair and lucid mind, his sympathies were narrow, and by his blunt outspokenness on points of difference he alienated many. With no mystical fibre in his own constitution, the Tractarian movement was incomprehensible to him, and was the object of his bitter dislike and contempt. The doctrines of the Low Church party seemed to him to be almost equally tinged with superstition. He took a practical, almost business-like view of Christianity, which seemed to High Churchmen and Evangelicals alike little better than Rationalism. In this they did Whately less than justice, for his religion was very real and genuine. But he may be said to have continued the typical Christianity of the 18th century—that of the theologians who went out to fight the Rationalists with their own weapons. It was to Whately essentially a belief in certain matters of fact, to be accepted or rejected after an examination of "evidences." Hence his endeavour always is to convince the logical faculty, and his Christianity inevitably appears as a thing of the intellect rather than of the heart. Whately's qualities are exhibited at their best in his *Logic*, which is, as it were, the quintessence of the views which he afterwards applied to different subjects. He wrote nothing better than the luminous Appendix to this work on *Ambiguous Terms*.

In 1864 his daughter published *Miscellaneous Remains* from his commonplace book and in 1866 his *Life and Correspondence* in two volumes. The *Anecdotal Memoirs of Archbishop Whately*, by W. J Fitzpatrick (1864), enliven the picture.

WHAT-NOT, a piece of furniture, derived from the French *étagère*, which was exceedingly popular in England in the first three-quarters of the 19th century. It usually consists of slender uprights or pillars, supporting a series of shelves for holding china, ornaments or trifles of any kind—hence the allusive name. In its English form, although a convenient drawing-room receptacle, it was rarely beautiful. The early mahogany examples are, however, sometimes graceful in their simplicity.

WHEAT (*Triticum*), the most important and the most generally diffused of cereal grasses. It is an annual plant, with hollow, erect, knotted stems, and produces, in addition to the direct developments from the seedling plant, secondary roots and secondary shoots (tillers) from the base. Its leaves have each a long sheath encircling the stem, and at the junction of the blade or "flag" with the sheath a small whitish outgrowth or "ligula." The inflorescence or ear consists of a central stalk bent zigzag, forming a series of notches (see fig. 1), and bearing a number of flattened spikelets, one of which grows out of each notch and has its inner or upper face pressed up against it. At the base of each spikelet are two empty boat-shaped glumes or "chaff-scales," one to the right, the other to the left, and then a series of flowers, 2 to 8 in number, closely crowded together; the uppermost are abortive or sterile,—indeed, in some varieties only one or two of the flowers are fertile. Each flower consists of an outer or lower glume, called the flowering glume, of the same shape as the empty glume and terminating in a long, or it may be in a short, awn or "beard." On the other side of the flower and at a slightly higher level is the "palea," of thinner texture than the other glumes, with infolded margins and with two ribs or veins. These several glumes are closely applied one to the other so as to conceal and protect the ovary,

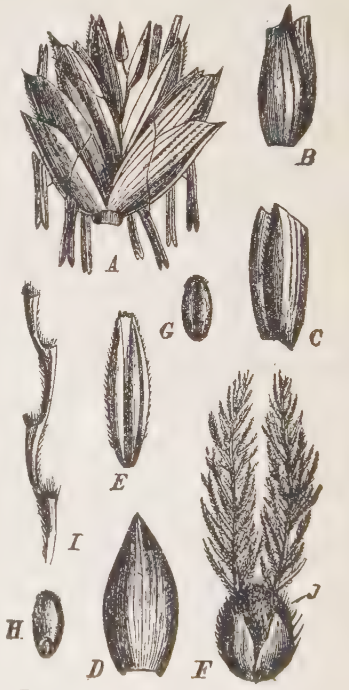

FIG. 1.—Spikelet and Flowers of Wheat.

A, Spikelet magnified.
B, Glumes, from side.
C, Glumes, from back.
D, Flowering glume or lower palea.
E, Palea.
F, Lodicules at base of *j*, the ovary, surmounted by styles.
G and *H*, Seed from front and back respectively.
I, Rachis, or central stalk of ear, spikelets removed.

and they only separate for a short time when flowering takes place; after fertilization they close again. Within the pale are two minute, ovate, pointed, white membranous scales called "lodicules." These contain three stamens with thread-like filaments and oblong, two-lobed anthers. The stamens are placed round the base of the ovary, which is rounded or oblong, much smaller than the glumes, covered with down, and surmounted by two short styles, extending into feathery brush-like stigmas. The ripe fruit or grain, sometimes called the "berry," the matured state of the ovary and its contents, is oblong or ovoid, with a longitudinal furrow on one side. The ovary adheres firmly to the seed in the interior, so that on examining a longitudinal section of the grain by the microscope the outer layer is seen to consist of epidermal cells, of which the uppermost are prolonged into short hairs to cover the apex of the grain. Two or three layers of cells inside the epidermis constitute the tissue of the ovary, and overlie somewhat similar layers which form the coats of the seed. Within these is the albumen or endosperm, constituting the flowery part of the seed. The outermost layer of the endosperm consists of square cells larger and more regular in form than those on each side; these contain aleuron grains—small particles of gluten or nitrogenous matter. The remaining central mass of the seed is composed of numerous cells of irregular form and size containing many starch grains as well as gluten granules. The several layers of cells above referred to become more or less dry and inseparable one from another, forming the substance known as "bran." At the lower end of the albumen, and placed obliquely, is the minute embryo-plant, which derives its nourishment in the first instance from the albumen; this is destined to form the future plant.

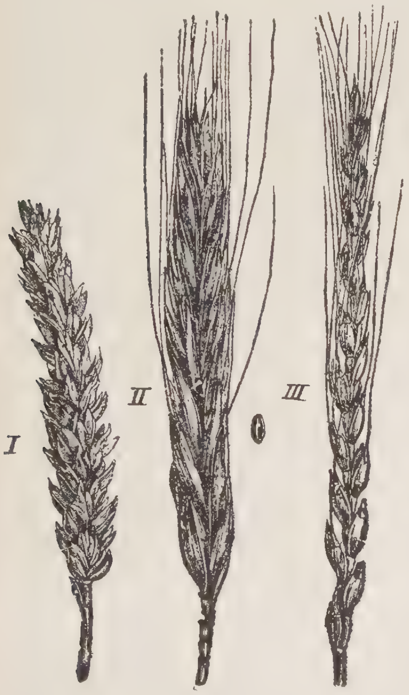

FIG. 2.—*I.* Beardless wheat. *II.* Polish wheat, with seed. *III.* Spelt wheat. All much reduced.

Origin and species.

The wheat plant is nowhere found in a wild condition. Some of the species of the genus *Aegilops* (now generally referred to *Triticum* by Bentham and Hooker and by Haeckel) may possibly have been the sources of our cultivated forms, as they cross freely with wheats. Haeckel considers that there are three species. (1) *Triticum monococcum*, which undoubtedly grows wild in Greece and Mesopotamia, is cultivated in Spain and elsewhere, and was also cultivated by the aboriginal Swiss lake-dwellers, as well as at Hissarlik, as is shown by the grain[1] found in those localities. (2) *T. sativum* is the ordinary cultivated wheat, of which Haeckel recognizes three principal races, *spelta*, *dicoccum* and *tenax*. Spelt wheats (see fig. 2) were cultivated by the aboriginal Swiss, by the ancient Egyptians, and throughout the Roman empire. The variety *dicoccum* was also cultivated in prehistoric times, and is still grown in Southern Europe as a summer wheat and one suitable for starch-making. The variety *tenax* includes four sub-races, *vulgare* (common wheat), *compactum*, *turgidum* and *durum* (see below). (3) The third species, *T. polonicum*, or Polish wheat, is a very distinct-looking form, with long leafy glumes; ts origin is not known. As these varieties intercross with each other, the presumption is that they, like the species of *Aegilops*, which also intercross with wheat, may have all originated from one common stock.

Home and distribution.

Basing his conclusions upon philological data, such as the names of wheat in the oldest known languages, the writings of the most ancient historians, and the observations of botanical travellers, De Candolle infers that the original home of the wheat plant was in Mesopotamia, and that from there its cultivation extended in very early times to the Canaries on the west and to China on the east. In the western hemisphere wheat was not known till the 16th century. Humboldt mentions that it was accidentally introduced into Mexico with rice brought from Spain by a negro slave belonging to Cortes, and the same writer saw at Quito the earthen vase in which a Flemish monk had introduced from Ghent the first wheat grown in South America.

Principal variations.

As might be anticipated from the cultivation of the plant from time immemorial and from its wide diffusion throughout the eastern hemisphere, the varieties of wheat—that is, of *T. sativum*—are very numerous and of every grade of intensity. Those cases in which the variation is most extreme some botanists would prefer to consider as forming distinct species; but others, as De Vilmorin, having regard to the general facts of the case and to the numerous intermediate gradations, look upon all the forms as derivatives from one. In illustration of this latter point it may be mentioned that not only do the several varieties run one into the other, but their chemical composition varies likewise according to climate and season. According to Professor Church,[2] even in the produce of a single ear there may be 3 to 4% more of albuminoid matters in some grains than in others; but on the average the proportion of gluten to starch is as 9·11 to 100. From the point of view of agriculture it is generally of no great moment what rank be assigned to the various forms. It is only important to take cognizance of them for purposes of cultivation under varying circumstances. Hence we only allude to some of the principal variations and to those characteristics which are found to be unstable. (1) Setting aside differences of constitution, such as hardihood, size, and the like, there is relatively little variation in the form of the organs of vegetation. This indicates that less attention has been paid to the straw than to the grain, for it is certain that, were it desirable, a great range of variation might be induced in the foliage and straw. As it is, some varieties are hardier and taller than others, and the straw more solid, varying in colour and having less liability to be "laid"; but in the matter of "tillering," or the production of side-shoots from the base of the stem, there is much difference. Spring wheats procured from northern latitudes mature more rapidly than those from temperate or hot climates, whilst the reverse is the case with autumn wheats from the same source. The difference is accounted for by the greater amount of light which the plants obtain in northern regions, and, especially, by its comparatively uninterrupted continuance during the growing period, when there are more working hours for the plants in the day than in more southern climes. Autumn wheats, on the other hand, are subjected to an enforced rest for a period of several months, and even when grown in milder climates remain quiescent for a longer period, and start into growth later in spring—much later than varieties of southern origin. These latter, accustomed to the mild winters of those latitudes, begin to grow early in spring, and are in consequence liable to injury from spring frosts. Wheats of dry countries and of those exposed to severe winds have, says De Vilmorin, narrow leaves, pliant straw, bearded ears, and velvety chaff—characteristics which enable them to resist wind and drought. Wheats of moist climates, on the other hand, have broader leaves, to admit of more rapid transpiration. No doubt careful microscopic scrutiny of the minute anatomy of the leaves of plants grown under various conditions would reveal further adaptations of structure to external conditions of climate. At any rate, it is certain that, as a general rule, the hard wheats are almost exclusively cultivated in hot, dry countries, the spelt wheats in mountainous districts and on poor soil, turgid (*durum* forms) and common wheats in plains or in valleys—the best races of wheat being found on rich alluvial plains and in fertile valleys. The wheat used in the neighbourhood of Florence for straw-plaiting is a variety with very slender stalks. The seed is sown very thickly at the beginning of winter and pulled, not cut, about the end of May, before the ear is ripe. In the United Kingdom ordinary wheat, such as old red Lammas and Chiddam white, is used for straw-plaiting, the straw being cut some time before the berry ripens. The propensity to "tiller" is of the greatest importance, as it multiplies the resources of the farmer. An instance of this is given in the *Philosophical Transactions* (1768), where it is stated that one seedling plant in the Cambridge botanic garden was divided into eighteen parts, each of which was replanted and subsequently again divided, till it produced sixty-seven plants in one season In March and April of the following year these were again divided and produced 500 plants, which in due time yielded 21,109 ears. (2) The variations in root-development have not been much attended to, although it would be well to study them in order to ascertain the degree of adaptability to various depths and conditions of soil. (3) A most important difference is observable in the liability to attacks of rust (*Puccinia*), some varieties being almost invariably free from it, while others are in particular localities so subject to it as to be not worth cultivating. (4) The ears vary, not only in size, but also in form, this latter characteristic being dependent on the degree of closeness with which the spikelets are set on. In such varieties as Talavera the spikelets are loose, while in the club and square-headed varieties they are closely packed. The form of the ear depends on the relative width of the anterior and posterior surfaces as compared with that of the lateral surfaces. In the square-headed varieties the lateral surfaces are nearly as wide as the median ones, owing to the form and arrangement of the spikelets. The number of abortive or sterile spikelets at the top of the ear also varies: in some cases nearly all the spikelets are fertile, while in others several of the uppermost ones are barren.

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[1] See drawings made to scale by Mr. Worthington Smith in the *Gardener's Chronicle* (25th December 1886).

[2] *Food Grains of India*, p. 94.

Classification of cultivated wheats.

The classification of the different varieties of cultivated wheat has occupied the attention of many botanists and agriculturists. The classification adopted by Henry de Vilmorin in his *Les Blés meilleurs* (Paris, 1881) is based, in the first instance, on the nature of the ear: when mature its axis or stem remains unbroken, as in the true wheats, or it breaks into a number of joints, as in the spelt wheats. In the first class the ripe grain readily detaches itself from the chaff-scales, while in the spelts it is more or less adherent to them, or not readily separable from them. The true wheats are further subdivided into common wheats (*T. vulgare*), turgid wheats (*T. turgidum*), hard wheats (*T. durum*) and Polish wheats (*T. polonicum*). In the common wheats the chaff-scales are boat-shaped, ovoid, of the consistence of parchment, and shorter than the spikelet; the seed is usually floury, opaque, white, and easily broken. In the turgid wheats the glumes have long awns, and the seed is turgid and floury, as in the common wheats. In the hard wheats the outer glumes are keeled, sharply pointed, awned, and the seed is elongated and of hard glassy texture, somewhat translucent, and difficult to break owing to its toughness. These seeds are richer in nitrogen than the common and turgid wheats, so that an approximate notion of the richness in albuminoids may be gained by simply inspecting the cut surface of the seed. The Polish wheat, rarely if ever cultivated in the United Kingdom, has very large lanceolate glumes, longer than the spikelet, and elongated glassy seeds. Further subdivisions are made, according to the presence or absence of awns (bearded and beardless wheats), the colour of the ears (white, fawn-coloured or red), the texture of the ears (glabrous—*i.e.* smooth—or downy) and the colour of the seed or "berry." In the jointed or spelt wheats the distinctions lie in the presence of awns, the direction of the points of the glumes (straight, bent outwards, or turned inwards), the form of the ear as revealed on a cross-section, and the entire or cleft palea. As illustrating the fact of the occasional instability of these variations, Professor Church mentions that a single grain will be sometimes horny and partly opaque and floury, in which case its composition will correspond with its aspect. The division into spring wheat and winter wheat is an agricultural one solely. Any variety may be a spring or a winter wheat according to the time at which it is sown. In the summer wheats it may often be observed that the median florets do not fill out so fully as in the autumn wheats. Among the turgid wheats there is a frequent tendency in the spike to branch or become compound—a tendency which is manifested to a less degree in other forms. The Egyptian, or so-called "mummy" wheat is of this character, the lower part of the spike branching out into several subdivisions. This multiplication of the seed-bearing branches might at first sight be considered advantageous; but in practice the quality of the grain is found to be inferior, as if the force that should have been devoted to the maturation of the grain were, in a measure, diverted and expended in the production of additional branches to the spike.

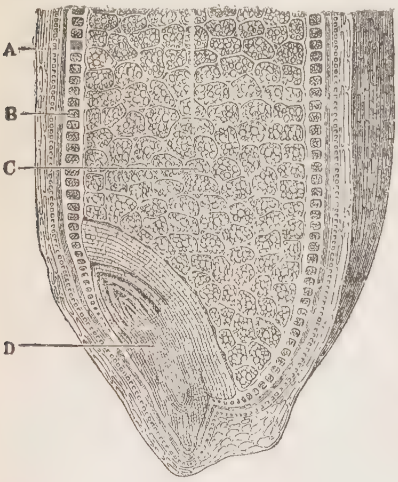

Fig. 3.—Longitudinal Section of a Grain of Wheat; highly magnified.
A, Epidermal cells.
B, Cells containing aleuron or gluten grains.
C, Cells of endosperm or albumen, filled with starch.
D, Embryo cut through the middle, root-end pointing downwards.

With regard to the chemical composition of the ripe grain, the Rothamsted experiments reveal a singular uniformity, even under very varied conditions of manuring, and even where much diversity was apparent in the constitution of the straw. A high or low percentage of nitrogen in the grain was also shown to depend more directly on the degree of ripening, as influenced by the character of the season, than on difference in manure; but it depends more upon the variety than upon soil or nutrition.

Adaptability to soil and locality.

Apart from the botanical interest of these diversities, as indications of the faculty of variation in plants, and possibly as clues to the genealogy and origin of the cultivated plant, their practical importance is very great. Some varieties are suited to hot, others to cold countries; some will flourish on one description of soil, others on another. Hence the paramount importance of ascertaining by experiment, not only what are the best varieties, but which are the best adapted for particular localities and particular climatic conditions. Porion and Dehérain have shown[1] the "infinite superiority" in yield over the ordinary wheats of a particular square-headed variety grown on rich soil in the north of France. A good selection of seed, according to the nature of the soil, demands, says De Vilmorin, intelligence and accurate knowledge on the part of the farmer. If a good variety be grown in poor soil, the result will be unprofitable, while, if bad wheat be grown on good soil, the result may be nil. In botanical collections there exist, it is stated, herbarium specimens or other evidences of plants grown in Norway as far north as lat. 65° (Schubeler), in Switzerland at an elevation of 1200 ft. above the valley of Zermatt (or 6500 ft. above the sea), near the straits of Magellan, as well as in Teneriffe, the Cape of Good Hope, Abyssinia, Rodriguez, the Philippine Islands and the Malay Archipelago. These widely separated localities show the great area over which the culture is possible, and illustrate the powers of adaptation of the plant. The requirements of the consumer have also to be considered: for some purposes the soft floury wheats, with their large relative proportion of starch, are the best, for others the harder wheats, with their larger quantity of gluten. With the modern processes of milling, the harder wheats are preferred, for they make the best flour for bakers' use; and in North America the spring wheats are, as a rule, harder than the winter wheats. The bearded varieties are supposed to be hardier; at any rate they defy the ravages of predatory birds more completely than the unarmed varieties, and they are preferable in countries liable to storms of wind, as less likely to have their seeds detached. The *durum* wheats are specially employed in Italy for the fabrication of macaroni. Polish wheat is used for similar purposes. Spelt wheats are grown in the colder mountainous districts of Europe; their flour is very fine, and is used especially for pastry-making; but, owing to the construction of the grain, it requires special machinery for grinding (see Flour).

Wheat begins to grow at a temperature of 5° C. (41° F.); and, when the aggregate temperature, as represented by the sum of the daily means, has mounted up to 185° F., the germ begins to escape from the husk, if the seed be not deeply buried; but if it is deeply buried, an amount of heat is required greater in proportion to the depth. If the seed lies at a depth lower than a foot from the surface, it rarely germinates. The seedling plant ceases to grow if the mean temperature of the day remains below 42° F. When the young plants have been influenced by an aggregate temperature amounting to 1896° F. from the period when sown, or 1715° from the period of germination, branching or "tillering" goes on freely, and the young ears are formed. Under the influence of a mean temperature of 55°, or a little above, the flowers are produced. A still higher daily mean is required for the full development and ripening of the grain. The figures here cited are given by Risler and are calculated for the climate of Paris; but, of course, the same principles apply in the case of other countries. The amount of light and of moisture has also to be taken into account. The fact that the wheat plant requires less water than other cereals, and therefore does not suffer so much from drought, is one of great importance to the cultivator, and furnishes one reason for the greater proportionate culture of wheat in the eastern than in the western counties of England.

The following figures, cited by De Vilmorin from Joulie, will give an idea of the nature and amount of the demands made upon the soil by a wheat crop: in order to yield a crop of 44½ bushels of wheat to the acre, the soil must supply to the crop during its growth in round numbers—202 ℔ of nitrogen, 81 ℔ of phosphoric acid, 55 ℔ of lime, 26 ℔ of magnesia, and 255 ℔ of potash.

Production of varieties.

The numerous varieties of wheat now in cultivation have been obtained either by selection or by cross-breeding. In any wheat-field there may be observed on close inspection plants differing in character from the majority. If seeds of these "sporting" plants be taken and grown in another season, they may (or may not) reproduce the particular variation. If they do, and the same process of selection be continued, the variation becomes in time "fixed," though it is always more or less liable to revert to its original condition. By continuously and systematically selecting the best grains from the best ears, Major Hallett succeeded in introducing "pedigree wheats" of fine quality. But even greater results may be expected from cross-breeding, or the fertilization of the flowers of one description of wheat by the pollen of another. This has been attempted by Shireff, Le Couteur, Maund and others in the past, and more recently by H. de Vilmorin and Messrs Carter. Under natural circumstances wheat is self-fertilized: that is to say, the pollen of any given flower impregnates the stigma and ovule of the same flower; the glumes and coverings of the flower being tightly pressed round the stamens and stigmas in such a way as to prevent the access of insects and to ensure the deposit of the pollen upon the stigmas of the same flower. This process of self-fertilization is the usual method, and no doubt keeps the variety true or unmixed; but the occasional presence of varieties in a wheat-field shows that cross-fertilization is sometimes secured. The stamens of the wheat plant may frequently be seen protruding beyond the glumes, and their position might lead to the inference that cross-fertilization was the rule; but on closer examination it will be found that the anthers are empty or nearly so, and that they are not protruded till after they have deposited the pollen upon the stigma. The separation of the glumes, which occurs at the time of fertilization, and which permits the egress of the useless stamens after that operation, occurs only under certain conditions of temperature, when the heat, in fact, is sufficient to cause the lodicules of the flower to become turgid and thus to press apart the glumes. A temperature of about 75° F. is found by Messrs Carter to be the most favourable. From what has been said it will be evident that the artificial fertilization of wheat is a very delicate operation. The glumes have to be separated and the anthers cut away before the pollen is fully formed, care being taken at the same time not to injure the stigma, and specially not to introduce, on the scissors or otherwise, any pollen except that of the variety desired. De Vilmorin's experiments have shown that all the varieties will intercross, and that even such a distinct form as the Polish is no exception. From this he concludes that all the forms have originated from one stock and are to be comprised within one species. In the progeny of these crossed wheats, especially in the second generation, much variation and difference of character is observable—a phenomenon commonly noticed in the descendants from crosses and hybrids, and styled by Naudin "irregular variation." Sometimes characteristics appear in the crossed wheats which are not found in the parent varieties, although they occur in other wheats. Thus, De Vilmorin records the presence of turgid wheats among seedlings raised from a common wheat fertilized with the pollen of a hard variety, and spelt wheats among the descendants of a common crossed with a turgid wheat.

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[1] *Ann. agronom.* (January 1888), p. 33.

The production of wheat, with the use of wheat bread, has increased enormously since the extension of railways has made possible the transportation of grain for great distances (see GRAIN TRADE). Of late years the increase of production has been most notable in southern Russia, Argentina, Australia, India and North America.

American Wheat-Farming.[1]—That wonderful agricultural region, extending from the international line on the north to the 37th parallel, and from the Atlantic Ocean to the 100th meridian, and comprising 26 states, produces 76% of the American wheat crop. This region, which contains only 30% of the land surface of the country, but embraces 60% of its total farm area and 70% of its improved farm acreage, is the greatest cereal-producing region of the world. Besides wheat, it produces 82% of the total corn crop, 91% of the total oat crop and 83% of the total hay crop of the United States. The methods pursued in the eastern portion of this region are similar to those used in other parts of the world; but in the north-western portion wheat-growing is carried on on a gigantic scale, and by methods almost unknown anywhere else. The best illustration of the great or "bonanza" wheat farms, as they are called, are found along the Red river (of the North), where it flows between the states of North Dakota and Minnesota.

The wheat grown in the United States is of two distinct kinds. One is the large-kernel winter wheat of the Eastern states; the other is the hard spring wheat. The "blue stem" or the "Scotch-Fife" are native varieties of the latter kind grown in Minnesota and the two Dakotas. For flour-making this wheat is considered the best in the world. During the season of 1899 the product of hard spring wheat amounted to nearly 250,000,000 bushels, or two-fifths of the entire wheat product of the United States. Of this, Minnesota and the two Dakotas alone produced 200,000,000 bushels. Minnesota is the greatest wheat-producing state in the Union. Her fields in 1899 covered 5,000,000 acres, and she produced nearly 80,000,000 bushels, which is twice the entire production of all Australia, and more than that of Great Britain and Ireland put together. In Minnesota and the Dakotas the farms are devoted almost exclusively to wheat-growing. Many of them contain from 3000 to 10,000 acres. The country is a very level one, making it possible to use all kinds of machinery with great success. As there are no mountains or swamps, there is here very little waste land, and every square foot of the vast wheat fields can be made productive.

Bonanza farms.

The first characteristic of a "bonanza" wheat farm is the machinery. The smallest agricultural implement used upon them is a plough, and the largest is the elevator. A hoe or a spade is almost unknown. Between these two there are machines of all sizes adapted to the needs of the particular work. Let us assume the conditions prevailing upon a bonanza farm of 5000 acres, and briefly describe the process of wheat production from the ploughing of the land to the delivery of the grain in the final market. These great wheat farms were established upon new lands sold directly to capitalists by the railroads. The lands became the property of the railroads largely through government grants, and they attracted capitalists, who bought them in large bodies and at low prices. The improvements made upon them consist of the cheap wooden dwellings for the managers, dormitories and dining-halls for the men, stables for the horses, and sheds and workshops for repairing machinery. Very little of the land is under fence. Since the desirable lands of the country have been occupied, the prices of these lands have advanced slowly, with the result that the big farms are being divided up into small holdings. After a generation or two, if land continues to rise in the market as it has recently, the bonanza farms will become a thing of the past. At present the best of these lands in the valley of the Red river (of the North) are worth from $25 to $30 an acre. The improvements upon them add about $5 an acre more. A farm is not considered a big one unless it contains from 2000 to 10,000 acres at least. There are, of course, many small farmers owning from two to five sections (640 acres in each section), but their methods are more like those of the small farmers in the eastern United States or on the continent of Europe. It is necessary to own a large body of land in order to be able to use the machinery and methods here described. It is hard to convey a just notion of the size of these farms. They stretch away as far as the eye can reach in every direction, making it difficult even for the visitor to conceive their size. The distances across wheat fields are so great that even horseback communication is too slow. The farms are separated into divisions, and lodging-houses and dining-halls and barns are scattered over them, so as to keep the workmen and teams near the scene of their labour. The men living at one end of the farm may not see those at the other for months at a time. Even then it is necessary to take the meals to the men in the fields rather than allow them to walk or ride to the dining-halls. It is not an unusual thing for a working crew to find themselves at the dinner hour 2 m. from their hall.

Ploughing.

First, after burning the old straw of the previous year—which is real labour in itself, so enormous is its bulk—comes the ploughing. This begins in October. The plough used has a 16-in. share, turns two furrows, and is drawn by five horses. Each plough covers about 250 acres in a season, travelling an average of 20 m. a day. The ploughing begins in October, and continues a month or six weeks, according to the season. The ploughs are driven in "gangs" under the eye of a superintendent, who rides with them. From eight to ten of these ploughs follow each other around the vast section. If one stands a few rods ahead of them they seem to be following one another in a line; but, if one stands to the right of the "gang," one sees that the line is broken, and that the second plough is a width farther in the field than the leader, and so on for the entire number. Experience shows that it costs about 70 cents an acre to plough the land in this way. About forty men are employed upon a farm of 5000 acres during the ploughing season. The men are paid by the month, and receive about $25, including their board. They breakfast at five o'clock, take an hour for their dinner at noon—usually in the field—and have their supper at seven. At the end of the ploughing season these particular men are usually discharged. Only eight or ten are kept on a farm of this size throughout the year. The other men go back to their homes or to the factories in the cities, where they await the harvesting and threshing season. The eight or ten who remain upon the farm are employed in doing odd jobs, such as overhauling machinery, or helping the carpenter and blacksmith, or looking after the horses. The wheat region is a country of heavy snows, and of severe, dry cold; but when March comes the snows begin to melt away, and by April the ploughed land is dry enough for the harrow. The harrowing is done with 25-ft. harrows, drawn by four horses, and operated by a single man. One man can harrow 60 to 73 acres a day.

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[1] For Canadian Wheat see CANADA § *Agriculture*.

Seeding.

The seeding follows immediately with four-horse press drills that cover 12 ft. The harrows and drills are worked in "gangs" as the ploughs were. Each drill will go from 20 to 25 m. a day. When the weather is good the seeding upon a 5000-acre farm will be done in twenty or twenty-five days. It is usual to seed a bushel and a peck of wheat to the acre. The wheat used for this purpose is carefully selected after the harvest of the previous year, and is thoroughly cleaned of foreign seeds. Through years of cultivation, varieties of wheat have been produced which are particularly well adapted to the soil and climate of this region. It has been found more profitable to use the native "blue stem" or "Scotch-Fife" wheat than the seed from any other country, or even from the neighbouring states. Counting the seed, wheat and the labour, it costs about $1 an acre to harrow the ground and plant the wheat.

Labour.

When the planting is done the extra labourers are discharged again, and the regular ones are put to work on the corn, oats and millet, which are grown to feed the horses. The men who do the most important work are all temporary labourers. They come from the cities of the east or the farms of the south. They begin with the early harvest in Oklahoma, and work northwards up the Missouri and the Red river until the season closes in Manitoba. They are not tramps, but steady, industrious men, with few bad habits and few ambitions. On well-managed farms drinking and gambling are strictly forbidden. The work is hard, and, as there are few amusements on the farm, the men spend their resting periods in sleep. Their dormitories are usually comfortably furnished, their dining-halls clean. The bonanza farmers find it good policy to feed their men well. Many a strike has occurred in the midst of the harvest because the quality or quantity of the food served was not what it ought to have been. The largest part of this food is brought from the eastern states. Some potatoes, turnips and beans are grown upon the farms; but the corned beef, bacon and groceries come from the cities. It is estimated that it costs 35 cents a day to feed each labourer. Farmers say that a good name in these respects enables them to get the choice of workmen, and that no money brings such sure returns as that expended in the bedrooms and upon the food.

The harvest.

The harvest labourers begin to arrive from the south about the middle of July, and by the end of this month the harvest is at its height. A farm of 5000 acres will use 75 or 100 extra men. With the men comes the new machinery in train loads. It is estimated that at least $5,000,000 worth of agricultural machines is annually sold in this region. The wheat farmers say that it does not pay to take undue care of old machinery, that more money is lost in repairing and tinkering an old machine than would pay for a new one. The result is that new machinery is bought in very large quantities, used until it is worn out or cannot be repaired without considerable work, and then left in the fields to rust. Heaps of cast-iron can be seen already upon many of the large farms. Of course a great many extra parts are bought to take the place of those which break most frequently, and some men are always kept at work repairing machines in the field. One of the big 10,000-acre farms will use up two car-loads of twine in a single harvest, enough to lay a line around the whole coast of England, Ireland and Scotland. The harvesters vary in size according to the character of the land. Upon the rougher ground and small farms the ordinary binders are used; upon the great plains, like those of California, a great harvester is used, which has a cutting line 52 ft. wide. These machines cut, thresh and stack the grain at the rate of 1600 sacks a day, and cover an area in that time of 100 acres. These machines can only be used where the wheat ripens thoroughly standing in the field. The harvest labourer earns $10 a week everywhere in America. The bonanza farmer expects one machine to cut at least 250 acres, and three men are required for each of them. The harvest lasts from ten days to three weeks, according to the weather. Including the labour and the wear and tear, it costs about 60 cents an acre to harvest wheat.

Threshing.

The wheat is not stacked as in the Eastern states and in England, but stands upright in shocks in the field. The grain cures very rapidly in the dry climate, so that by the time the wheat is all cut and shocked on one end of the division, it is ready for the thresher at the other. The shocks of wheat are hauled directly to the thresher and fed into the self-feeder. It usually takes a day and a quarter to thresh the wheat which it took a day to cut. The farmer estimates that a threshing-machine can thresh all the wheat ordinarily grown upon 2500 acres, so that a 5000-acre farmer would have at least two machines running at the same time. Time is a very important thing in threshing, since a rainfall might spoil enough grain in one night to buy several machines. The threshing season is thus a time of great pressure and of extensively active work. The wheat straw is worse than a waste product—it is a great nuisance upon the bonanza farm. A little of it is used for fuel for the engines and for bedding the stock; but the bulk of it is dragged away from the threshing machine by machinery, and left lying in great heaps until an opportunity is afforded for burning it up. This is usually done immediately before the ploughing in the autumn. The grain falls from the spout of the thresher into the box-wagon, which carries it to the elevator. The elevator is placed at the railway station, and is usually owned by the bonanza farmer.

The returns.

From the time the sheaves of wheat are tumbled into the wagon until the flour reaches the hands of the cook, no hand touches the wheat that passes through the great Minneapolis mills. When the box-wagons reach the elevator the loosing of a bolt dumps the grain into the bin, where it remains until the pulling of a lever lets it into the cars. Every pound of it is weighed and accounted for, and entered upon the books, so as to show the exact product of each division of the farm. After the rush of the threshing is over the farmer studies these books carefully to see what his land is doing, and makes his plans for the next year, so as to rest or strengthen those divisions which are failing. It costs about $1.50 an acre to thresh the grain and put it into the elevator. This sum, added to the estimated cost of the other processes mentioned above, makes the total cost of growing an acre of grain about $3.80. This includes the cost of labour, seed and wear and tear of machinery, but does not include the interest on land or plant. The taxes on land will average 25 cents an acre. The farmers estimate that the other improvements, the waterworks, elevators, insurance, horse feed, &c., will make this up to $6 an acre. The best of these farms will yield 20 bushels to the acre. This makes the wheat cost 30 cents a bushel. During the last five years the average farm-selling price of wheat in the North-West has been 58 cents. An acre thus produces $11.60, making a gross profit of $5.60. Still to be provided for is the interest on the operating expenses for eighteen months, which will, at 8%, be 48 cents per acre. Interest on the capital in land, improvements and machinery, at $30 per acre, make $1.80 more, or a total interest charge of $2.28. When this is deducted from the gross profits of $5.60 prices found above, we have a net profit of $3.32 an acre, not an exorbitant one by any means. This is about 8% on the capital invested in the land, plant and operating expenses. But we have described the conditions on one of the best bonanza farms. The average yield per acre in this region is not over 18 bushels, and the average expenses would be higher than those given.

Marketing.

Every bonanza farmer's office is connected by wire with the markets at Minneapolis, Chicago and Buffalo. Quotations arrive hourly in the selling season, and the superintendent keeps in close touch with his agents in the wheat-pits of these and other cities. When the instrument tells him of a good price, his agent is instructed to sell immediately. The farmer on the upper waters of the Red river (of the North) is kept fully informed as to the drought in India, the hot winds in the Argentine and the floods of the Danube. Any occurrences in these distant parts of the world are known to him in a surprisingly short time. The world's great wheat fields almost lie within his sight, so well does he know the conditions that prevail in them. Ten days are allowed for delivery, so that he can usually ship the wheat after it is sold. In the early days of wheat-farming the bonanza farmer often speculated, but experience has taught him that he had better leave this to the men in the cities, and content himself with the profit from the business under his eye. The great elevator centres are in Duluth, St Paul, Minneapolis, Chicago and Buffalo. These elevators have a storage capacity of from 100,000 to 2,500,000 bushels. The new ones are built of steel, operated by steam or electricity, protected from fire by pneumatic water-pipes, and have complete machinery for drying and scouring the wheat whenever it is necessary. The elevators are provided with long spouts containing movable buckets, which can be lowered into the hold of a grain-laden vessel. The wheat is shovelled into the pathway of the huge steam shovels, which draw it up to the ends of these spouts, where the buckets seize it, and carry it upwards into the elevator, and distribute it among the various bins according to grade. A cargo of 200,000 bushels can thus be unloaded in two hours, while spouts on the other side of the elevator reload it into cars, five to ten at a time, filling a car in from five to ten minutes, or the largest canal boat in an hour. The entire work of unloading, storing and reloading adds only one cent to the price of a bushel of wheat.

Inspecting and grading.

The great wheat-growing states like Minnesota have established systems of inspecting and grading wheat under state supervision. In Minnesota the system is carried out by the Railroad and Warehouse Commission (1885), which fixes and defines the different grades of wheat and directs the work. At present there are 18 grades recognized in this state. The first is described as "No. 1, hard spring wheat, sound, bright and well cleaned, composed mainly of hard 'Scotch-Fife,' weighing not less than 58℔ to the measured bushel." The second grade is known as "No. 1, northern spring wheat, sound, and well cleaned, composed of the hard and soft varieties of spring wheat." So the varieties run—"No. 2, northern"; "No. 3, northern," &c.—down to the 18th, which is "no grade." The official inspectors examine, grade and sample the wheat in the cars in which it is received at the great markets or elevators. The cars are sealed at the point of original shipment. The first thing, therefore, is to examine the seals to see that they are unbroken. The inspector then samples and examines the wheat, and enters the grade upon a blank opposite the number and letters of the car. His tag and sample go to the wheat exchange or chamber of commerce, where they are exposed in small tin pans, and form the basis of the trading. A few years ago the wheat received from the north-west was very clean indeed, but since the new land has all been cultivated the fields are growing more weedy, with the result that the wheat brought in is becoming mixed with oats and seeds of weeds, requiring more careful separating and inspection. After the inspector has finished his work the cars are resealed with the state seal, and await orders of the purchaser. The delay will not ordinarily be more than one day. The commission keeps complete records and samples of each car until the wheat has passed entirely out of the market. When disputes occur as to the grade they can thus be instantly settled. If the grade is changed after a second examination the state pays the expense of the inspection; if not, it is paid by the agent who raises the objection. Only about 5% of the samples are ever reinspected, and in less than 2% of these is the grade changed. The commission collects the small fee of 20 cents a car for its services as inspector, and later weighs all the wheat as it is distributed into the elevators. This small charge pays all the expenses.

Transportation.

The transportation of the wheat from the fields of the north-west to the seaport is a business of tremendous magnitude. Most of this wheat goes by way of the lakes through the Sault Sainte Marie canal to Buffalo, where it is shipped by rail or inland canal to New York, Philadelphia or Baltimore. Duluth, on Lake Superior, is, surprising to say, the second port in the United States in point of tonnage. The Sault Sainte Marie canal passes two and a half times as much tonnage during the eight months it is open as the Suez canal passes in the entire year. The cheapest transportation in the world is found upon these lakes, the rate being only three-fourths of a mill per ton of wheat per mile. The greater lake vessels, called "Whalebacks," carry cargoes up to 250,000 bushels, a bulk difficult to conceive. 700 bushels is a car-load. At that rate the cargo of 250,000 bushels will fill 360 American cars, or 9 trains of 40 cars each. At 20 bushels to the acre, this single cargo would represent the yield of two and a half farms of 5000 acres each, like that described above, with every acre in cultivation. The railways of the north-west have a monopoly of the business of hauling wheat, with the result that it costs 20 cents to ship a bushel of wheat from the Dakota field to Duluth, which is as much as it costs to forward it from Duluth to Liverpool. The bushel of wheat, or an equivalent amount of flour, can be shipped from Minneapolis or Duluth to almost any point in western Europe for from 20 to 25 cents.

Prospect of wheat production.

What are the prospects of wheat production in the United States? In his presidential address before the British Association for the Advancement of Science (1900), Sir William Crookes painted a rather dark picture of the future of the world's wheat production. Among other things he said, "It is almost certain that within a generation the ever-increasing population of the United States will consume all the wheat grown within its borders, and will be driven to import like ourselves." Americans think that this statement is altogether too pessimistic. Not sufficient account had been taken of the uncultivated land in farms, and of the possibilities of improving the yield, and still further cheapening the product. It is probable that the United States will by 1933 have a population of 133,000,000. This population would require a wheat crop of 700,000,000 bushels for its own use alone. Limiting attention to the great cereal-producing region described above, let us see what the prospects are for increasing the acreage and the yield. The fact that these States contain, according to the last census, over 100,000,000 acres of unimproved land, already enclosed in farms, suggests at once the great possibilities in wheat. But all this land is not immediately available for cultivation. The availableness of the unimproved land in these states is chiefly a question of population and physical features. In states like New York and Pennsylvania, which are much broken up by hills and mountains, and have already a large population, it is probable that the land available for wheat cultivation is now nearly all taken up, although they still have 30% of unimproved land in farms. In the great states of Michigan, Missouri, Wisconsin, Minnesota and the Dakotas there is still 40 to 50% of unimproved land in farms. There are few mountains and hills in these States, and there is still room in them for a large population. It is evident that in states like these wheat culture is destined to increase greatly. Twelve states, in this vast cereal-growing region—Ohio, Indiana, Illinois, Missouri, Kansas, Nebraska, Michigan, Iowa, Wisconsin, Minnesota, North and South Dakota—still have from 20 to 40% of unimproved land in farms. The total area of these states is nearly four times that of France. Their soil is primarily as fertile as hers. If we put the population of France at 40,000,000, the states in question could, at the same ratio, support a population of 140,000,000. France produced during the five years ending 1897 eight bushels of wheat per caput. At eight bushels per caput, the people in these twelve states alone could produce 1,120,000,000 bushels, or 420,000,000 bushels more than will be required by the population of 133,000,000 expected by 1933. This is a great manufacturing as well as a great agricultural region, and it is here, therefore, that a large part of this increase in population will be found.

It is evident that there is great room for improvement also in the matter of yield per acre. The average yield of wheat per acre has increased slowly in recent years. So long as there was so much virgin land to be brought under cultivation, it is surprising that it has increased at all, since the tendency everywhere is to "skin" the rich, new lands first. Mr B. W. Snow, formerly one of the statisticians of the United States Department of Agriculture, has shown (*The Forum*, vol. xxviii. p. 94) that the producing capacity of the wheat lands, under favourable weather, increased steadily during the period 1880–1899. He distinguishes between the actual yield and the producing capacity, and bases his comparison upon the latter. He takes the average for each year of five years between 1880 and 1899, and shows that the producing capacity per acre increased 0.5 bushel between the first and the second period, 1.3 bushels between the second and the third, and 1.4 bushels between the third and the fourth. In the period 1880–1884, inclusive, the maximum capacity was a little less than 14 bushels, while in the period 1895–1899 the maximum capacity exceeded slightly 17 bushels—an increase of 3.2 bushels per acre, or 23%, in less than twenty years. He says, "To account for this increase in the potential yield in our wheat-fields many factors must be taken into consideration. Among these may be mentioned improved methods of ploughing, tile drainage, use of the press drill, which results in greater immunity against winter killing, crop rotation, and, to a very small extent, fertilization. An important factor to be mentioned in this connexion is the change in the distribution of the acreage under wheat, consequent upon falling prices. A decline in the price of wheat rendered its production unprofitable where the rate of yield was small. Gradually these lands were passed over to crops better suited to them; while at the same time the wheat acreage was increased in districts having a better rate of yield." He predicts that "the increase in the acre yields in this country has only begun. All that has been accomplished during the period under review may be attributed to improvements in implements for preparing the soil and planting the seed. Wheat is grown year after year without rotation—except in a few cases—on a third or more of our wheat acreage; not one acre in fifty is directly fertilized for the crop, and only a minimum amount of attention is given to the betterment of seed stock. If, in the face of what cannot be considered less than careless and inefficient agricultural practice, we have increased the wheat capacity of our land by 3.2 bushels per acre in so short a time, what may we not expect in the way of large acre yields before we experience the hardships of a true wheat famine?"

Diseases.—Wheat, like other cereals, is liable to epidemic diseases caused by parasitic organisms which prey on the plant tissues. Of these the rust, smut and bunt fungi are by far the most common and the most destructive. Rust alone is said to cause an annual loss of wheat in India amounting to from 4,000,000 to 20,000,000 rupees. We have no similar calculation of loss for Great Britain, where wheat is not so much grown, but it is well known that there is a continual, serious depreciation of value in the crops due to parasitic fungi.

The rust fungus, *Puccinia graminis*, is a Uredine belonging to the heteroecious group, that is, one that passes from one host to another at different stages of its life-history. In spring, while the wheat plants are still green and immature, the rust makes its appearance as orange-red spots or streaks on the stalks and leaves. These coloured spots are due to the presence of a sorus or layer of countless numbers of minute brown spores, the *uredospores* of the summer fruiting form. The fine thread-like filaments composing the mycelium of the fungus are embedded in the tissue underneath and around the uredo-sorus, and draw from the host the nourishment required. The spores, when mature, are easily detached, and are carried by insects or by the wind to other wheat-plants. If infection takes place, other sori are formed in ten days or a fortnight under favourable conditions of moisture and warmth.

Towards the end of the summer the uredospores are replaced by the winter resting-spores, called *teleutospores*, which are larger, thicker-walled and darker in colour. These teleutospores remain inactive on the straw until spring, when they germinate in manure heaps or on moist ground and produce minute sporidia, which are conveyed by air currents to the alternate host, in this case a barberry. In due time the fungus, known as *Aecidium Berberidis*, appears on the barberry leaves in the form of small cluster-cups on *aecidia*, each of which is filled with chains of orange-coloured *aecidiospores*. Infection of the leaves of the young wheat plants follows on the scattering of the aecidiospores: a sorus of the rusty uredospores is produced, and the life-cycle is complete.

Though this is the normal and complete development of *Puccinia graminis*, it is not invariably followed. In Australia, for instance, the berberry is an imported plant and of rare occurrence, yet rust is very abundant. Teleutospores of heteroecious rusts never reinfect the host on which they are produced, so that in many cases the uredospores probably survive the winter in Europe as well as in Australia and give rise to the rust of the following year. Wind dispersal of the spores would account for mysterious appearances of the disease, in some years almost every straw in a wheat-field being affected, while in other years scarcely one is attacked. Rust disease does not directly affect the grains, but both quantity and quality are impaired by the exhausted condition of the wheat plants. No cure is possible, but as winter wheat suffers less than spring wheat, early sowing is recommended. Fungus spores will not germinate without moisture, and attention to drainage helps to keep down this and other fungus pests. It has also been observed that too heavy nitrogenous manuring stimulates and prolongs the growing period of the wheat; flowering is retarded, and thus there is a greater opportunity for infection to take place. Wheat growing on an old manure heap is nearly always badly diseased. Much attention has been paid recently to the cultivation of varieties of wheat that are immune to rust attacks, and care should be taken to select strains that have been proved able to resist the disease.

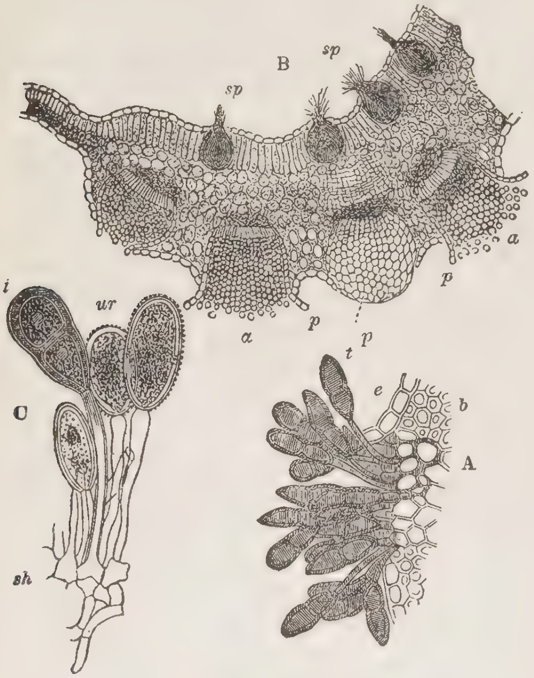


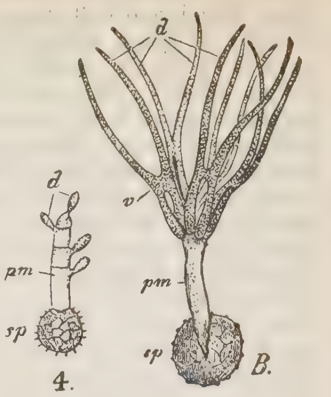
FIG. 4.—*Puccinia graminis.*

A, Mass of teleutospores (*t*) on a leaf of couch-grass.
e, Epidermis ruptured.
b, Sub-epidermal fibres. (After De Bary.)
B, Part of vertical section through leaf of *Berberis vulgaris*, with *a*, aecidium fruits, *p*, peridium, and *sp*, spermogonia. (After Sachs.)
C, Mass of uredospores (*ur*) with one teleutospore (*t*).
sh, Sub-hymenial hyphae. (After De Bary.)

The other two parasites, smut and bunt, affect principally the grain. Smut of wheat, *Ustilago Tritici*, infects the host at the time of flowering. The fungus-spores, from some diseased plant, alight on the stigma of the flower, and germinate there along with the pollen-grains. The developing seed thus encloses fungal hyphae, which remain dormant within the seed and in spring develop symbiotically with the growth of the wheat plant, doing no apparent injury until the time of fruiting is reached, when the fungus takes complete possession and fills the new seed with a mass of dark-coloured spores. These are scattered over the field and alight on other flowering wheat plants. It is impossible to detect the first infection or to cleanse the seed; the only remedy is to procure seed from a smut-free source, and to prevent further spread of the disease by gathering all smutted heads before the spores have matured or dispersed.

Tilletia Tritici, bunt or stinking smut of wheat, is so-called because the bunted grain has a disagreeable odour of stale herrings. Bread made from bunted flour is dark in colour, and both unpalatable and unwholesome. The spores of the fungus remain in the soil or in manure-heaps until spring, when they germinate and attack the first green leaves of the host plant. The after development is similar to that of smut, and the seed grain becomes a mere mass of fungus spores. Much can be done in this case to clean the seed before sowing by immersing it in hot water or in some solution that will kill the spores without injuring the grain.

Other parasitic fungi of less economic importance occasionally do considerable damage. *Erysiple graminis*, a mildew of grasses, has caused great loss in various countries; *Dilophia graminis* sometimes causes deformities of the leaves and inflorescence; another somewhat similar fungus, *Ophiobolus graminis*, attacks the leaves and stalks near the ground, completely destroying the plants.



From Vine's *Students' Text-Book of Botany*, by permission of Swan, Sonnenschein & Co.

FIG. 5.—Germinating Resting-Gonidia: A of *Ustilago receptaculorum*; B of *Tilletia Caries*.
sp, The gonidium.
pm, The promycelium.
d, The sporidia: in B the sporidia have coalesced in pairs at *v*.

Helminthosporium gramineum, a disease of barley, has also been recorded as growing on wheat; it forms long narrow dark-brown streaks on the leaves, which wither and die. The lower leaves are usually the only ones attacked, and the yield of grain has not been seriously affected.

WHEATEAR, a bird's name, perhaps of doubtful meaning,[1] though J. Taylor, the "water poet" (d. 1654), in whose writings it seems first to occur, and F. Willughby, explain it (in the words of J. Ray, the latter's translator) as given "because [in] the time of wheat harvest they wax very fat." The wheatear, *Saxicola œnanthe*, is one of the earliest migrants of its kind to return to its home, often reaching England at the end of February and almost always by the middle of March. The cock bird, with his bluish grey back and light buff breast, set off by black ear-coverts, wings, and part of the tail, is rendered still more conspicuous by his white rump as he takes short flights in front of those who disturb him, while his sprightly actions and gay song harmonize so well with his delicately-tinted plumage as to render him a welcome object to all who delight in free and open country. When alarmed both sexes have a sharp monosyllabic note that sounds like *chat*; and this has not only entered into some of the local names of this species and of its allies, but has caused all to be frequently spoken of as "chats." The nest is constantly placed under ground; the bird takes advantage of the hole of some other animal, or the shelter of a clod in a fallow-field or a recess beneath a rock. A large amount of soft material is therein collected, and on them from 5 to 8 pale blue eggs are laid.

The wheatear has a very wide range throughout the Old World, extending in summer far within the Arctic Circle, from Norway to the Lena and Yana valleys, while it winters in Africa beyond the Equator and in India. But it also breeds regularly in Greenland and some parts of North America. Its reaching the former and the eastern coast of the latter, as well as the Bermudas, may possibly be explained by the drifting of individuals from Iceland; but far more interesting is the fact of its continued seasonal appearance in Alaska without ever showing itself in British Columbia or California, and without ever having been observed in Kamchatka, Japan or China, though it is a summer resident in the Tchuktchi peninsula. Hence it would seem as though its annual flights across Bering's Strait must be in connexion with a migratory movement that passes to the north and west of the Stanovoi range of mountains.

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[1] The vulgar supposition of its being an euphemism of an Anglo-Saxon name (cf. Bennett's ed. of White's *Nat. Hist. Selborne*, p. 69, note) must be rejected until evidence that such a name ever existed be adduced. It is true that "whittaile" (cf. Dutch *Witstaart* and French *Culblanc*) is given by Cotgrave in 1611; but the older names, according to Turner, in 1544, of "clotburd" (=clod-bird) and smatch (=chat) do not favour the usual derivation. "Fallow-chat" is another old name still locally in use, as is "coney-chuck."

Many species more or less allied to the wheatear have been described. Some eight are included in the European fauna; but the majority are inhabitants of Africa. Several of them are birds of the desert; and here it may be remarked that, while most of these exhibit the sand-coloured tints so commonly found in animals of like habitat, a few assume a black plumage, which, as explained by H. B. Tristram, is equally protective, since it assimilates them to the deep shadows cast by projecting stones and other inequalities of the surface.

Amongst genera closely allied to *Saxicola* are *Pratincola*, which comprises among others two well-known British birds, the stonechat and whinchat, *P. rubicola* and *P. rubetra*, the latter a summer-migrant, while the former is resident as a species, and the black head, ruddy breast, and white collar and wing-spot of the cock render him a conspicuous object on almost every furze-grown common or heath in the British Islands, as he sits on a projecting twig or flits from bush to bush. This bird has a wide range in Europe, and several other species, more or less resembling it, inhabit South Africa, Madagascar, Réunion and Asia, from some of the islands of the Indian Archipelago to Japan. The whinchat, on the other hand, much more affects enclosed lands, and with a wide range has no very near ally. The wheatear and its allies belong to the sub-family *Turdinae* of the thrushes (*q.v.*). (A. N.)

WHEATLEY, FRANCIS (1747–1801), English portrait and landscape painter, was born in 1747 at Wild Court, Covent Garden, London. He studied at Shipley's drawing-school and the Royal Academy, and won several prizes from the Society of Arts. He assisted in the decoration of Vauxhall, and aided Mortimer in painting a ceiling for Lord Melbourne at Brocket Hall (Hertfordshire). In youth his life was irregular and dissipated. He eloped to Ireland with the wife of Gresse, a brother artist, and established himself in Dublin as a portrait-painter, executing, among other works, an interior of the Irish House of Commons. His scene from the London Riots of 1780 was admirably engraved by Heath. He painted several subjects for Boydell's *Shakespeare Gallery*, designed illustrations to Bell's edition of the poets, and practised to some small extent as an etcher and mezzotint-engraver. It is, however, as a painter, in both oil and water-colour, of landscapes and rustic subjects that Wheatley is best remembered. He was elected an associate of the Royal Academy in 1790, and an academician in the following year. He died on the 28th of June 1801. His wife, afterwards Mrs Pope, was known as a painter of flowers and portraits.

WHEATON, HENRY (1785–1848), American lawyer and diplomatist, was born at Providence, Rhode Island, on the 27th of November 1785. He graduated at Brown University in 1802, was admitted to the bar in 1805, and, after two years' study abroad, practised law at Providence (1807–1812) and at New York City (1812–1827). He was a justice of the Marine Court of the city of New York from 1815 to 1819, and reporter of the United States Supreme Court from 1816 to 1827, aiding in 1825 in the revision of the laws of New York. His diplomatic career began in 1827, with an appointment to Denmark as chargé d'affaires, followed by that of minister to Prussia, 1837 to 1846. During this period he had published a *Digest of the Law of Maritime Captures* (1815); twelve volumes of *Supreme Court Reports*, and a *Digest*; a great number of historical articles, and some collected works; *Elements of International Law* (1836), his most important work, of which a 6th edition with memoir was prepared by W. B. Lawrence and an eighth by R. H. Dana (*q.v.*); *Histoire du Progrès du Droit des Gens en Europe*, written in 1838 for a prize offered by the French Academy of Moral and Political Science, and translated in 1845 by William B. Lawrence as *A History of the Law of Nations in Europe and America*; and the *Right of Visitation and Search* (1842). The *History* took rank at once as one of the leading works on the subject of which it treats. Wheaton's general theory is that international law consists of "those rules of conduct which reason deduces, as consonant to justice, from the nature of the society existing among independent nations, with such definitions and modifications as may be established by general consent." In 1846 Wheaton was requested to resign by the new president, Polk, who needed his place for another appointment. The request provoked general condemnation; but Wheaton resigned and returned to the United States. He was called at once to the Harvard Law School as lecturer on international law; but he died at Dorchester, Massachusetts, on the 11th of March 1848.

WHEATSTONE, SIR CHARLES (1802–1875), English physicist and the practical founder of modern telegraphy, was born at Gloucester in February 1802, his father being a music-seller in that city. In 1806 the family removed to London. Wheatstone's education was carried on in several private schools, at which he appears to have displayed no remarkable attainments, being mainly characterized by a morbid shyness and sensitiveness that prevented him from making friends. About 1816 he was sent to his uncle, a musical instrument maker in the Strand, to learn the trade; but with his father's countenance he spent more time in reading books of all kinds than at work. For some years he continued making experiments in acoustics, following out his own ideas and devising many beautiful and ingenious arrangements. Of these the "acoucryptophone" was one of the most elegant—a light box, shaped like an ancient lyre and suspended by a metallic wire from a piano in the room above. When the instrument was played, the vibrations were transmitted silently, and became audible in the lyre, which thus appeared to play of itself. On the death of his uncle in 1823 Wheatstone and his brother succeeded to the business; but he never seems to have taken a very active part in it, and he virtually retired after six years, devoting himself to experimental research, at first chiefly with regard to sound. Although he occasionally read a paper to scientific societies when a young man, he never could become a lecturer on account of his shyness. Hence many of his investigations were first described by Faraday in his Friday evening discourses at the Royal Institution. By 1834 his originality and resource in experiment were fully recognized, and he was appointed professor of experimental philosophy at King's College, London, in that year. This appointment was inaugurated by two events,—a course of eight lectures on sound, which proved no success and was not repeated, and the determination by means of a revolving mirror of the speed of electric discharge in conductors, a piece of work leading to enormously important results. The great velocity of electrical transmission suggested the possibility of utilizing it for sending messages; and, after many experiments and the practical advice and business-like co-operation of William Fothergill Cooke (1806–1879), a patent for an electric telegraph was taken out in their joint names in 1837. Wheatstone's early training in making musical instruments now bore rich fruit in the continuous designing of new instruments and pieces of mechanism. His life was uneventful except in so far as the variety of his work lent it colour. He became a fellow of the Royal Society in 1837; in 1847 he married; and in 1868, after the completion of his masterpiece, the automatic telegraph, he was knighted. While in Paris perfecting a receiving instrument for submarine cables, Sir Charles Wheatstone caught cold, and died on the 19th of October 1875.

Wheatstone's physical investigations are described in more than thirty-six papers in various scientific journals, the more important being in the *Philosophical Transactions*, the *Proceedings of the Royal Society*, the *Comptes rendus* and the British Association *Reports*. They naturally divide themselves into researches on sound, light and electricity, but extend into other branches of physics as well. But his best work by far was in the invention of complicated and delicate mechanism for various purposes, in the construction of which he employed a staff of workmen trained to the highest degree of excellence. For his insight into mechanism and his power over it he was unequalled, except perhaps by Charles Babbage. A cryptographic machine, which changed the cipher automatically and printed a message, entirely unintelligible until translated by a duplicate instrument, was one of the most perfect examples of this. Cryptography had a great fascination for Wheatstone; he studied it deeply at one time, and deciphered many of the MSS. in the British Museum which had defied all other interpreters. In acoustics his principal work was a research on the transmission of sound through solids, the explanation of Chladni's figures of vibrating solids, various investigations of the principles of acoustics and the mechanism of hearing, and the invention of new musical instruments, *e.g.* the concertina (*q.v.*).

The kaleidophone, intended to present visibly the movements of a sonorous body, consisted of a vibrating wire or rod carrying a silvered bead reflecting a point of light, the motions of which, by persistence of the successive images on the retina, were thus represented in curves of light. In light there are a series of papers on the eye, on the physiology of vision, on binocular vision, including the invention of one of the popular scientific instruments, the stereoscope (*q.v.*), and on colour. The polar clock, devised for use in place of a sun-dial, applies the fact that the plane of polarization of sky light is always 90° from the position of the sun; hence by measuring the azimuthal angle of the plane, even when the sun is below the horizon, correct apparent solar time may be obtained. In 1835, in a paper on "The Prismatic Decomposition of Electrical Light," he proved that sparks from different metals give distinctive spectra, which afforded a ready means of discriminating between them. But it is by his electrical work that Wheatstone is best remembered. He not only guided the growth of scientific telegraphy on land wires, but made the earliest experiments with submarine cables, foreseeing the practicability of this means of communication as early as 1840. He devised the "A, B, C" telegraph instrument, the automatic transmitter, by which messages may be sent at the rate of 500 words a minute, printing telegraph receivers of various forms, electrical chronoscopes, and many forms of electrical recording apparatus,—amongst others two sets of registering meteorological instruments, of which the earlier, described in 1842, was afterwards developed by Father A. Secchi and F. van Rysselberghe, but the later, put forward in 1867, included metallic thermometers and was less successful.

Wheatstone's *Scientific Papers* were collected and published by the Physical Society of London in 1879. Biographical notices of him will be found in his *Proc. Inst. C.E.*, xlvii. 283, and *Proc. Roy. Soc.*, xxiv. xvi. For his connexion with the growth of telegraphy, see *Nature*, xi. 510, and xii. 30 sq.

WHEATSTONE'S BRIDGE, an electrical instrument which consists of six conductors, joining four points, of such a character that when an electromotive force is applied in one branch the absence of a current in another branch (called the conjugate branch) establishes a relation between the resistance of the four others by which we can determine the value of the resistance in one of these, that of the others being assumed to be known. This arrangement was not invented by Sir Charles Wheatstone—although it bears his name and is commonly attributed to him, and was employed by him in some of his electrical researches—but by S. H. Christie, in 1833.[1]

The arrangement of the six conductors is diagrammatically represented in fig. 1. In one of these branches is placed a battery B and in another a galvanometer G; the four other resistances are denoted by the letters P, Q, R, S. The circuits in which the battery and galvanometer are placed are called conjugate circuits, and the circuits P, Q, R, and S are called the *arms* of the bridge, the branches P and Q being called the *ratio arms* and S the *measuring arm.* The circuit in which the galvanometer is placed is the *bridge circuit.* Keys are inserted in the battery and galvanometer circuits to open or close them at pleasure. The resistance forming the four arms of the bridge can be so adjusted that if these resistances have values denoted by P, Q, R, and S, then when P : Q :: R : S, the current in the galvanometer circuit will be zero when an electromotive force is applied in the battery circuit.

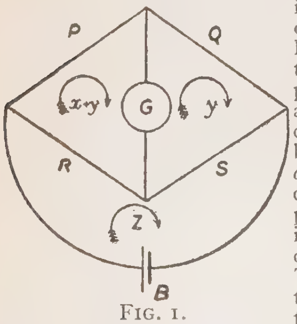

FIG. 1.

To prove this statement, let the conductors P, Q, R, S., be arranged in a lozenge shape, as in fig. 1. Let E be the electromotive force in the battery circuit, and let $(x+y)$ be the current through the resistance P, y the current through the resistance Q and z that through B. Then by G. R. Kirchhoff's laws (see ELECTROKINETICS) we have the current equations,

$$\begin{aligned}(P+G+R)\ (x+y)-Gy-Rz&=0\\(Q+G+S)\,y-G\,(x+y)-Sz&=0\\(R+S+B)\,z-R\,(x+y)-Sy&=E\end{aligned}$$

Rearranging the terms and solving for x (the current through the galvanometer), we obtain

$$x=(PS-RQ)E/\Delta,$$

where Δ is a complex expression, involving the resistances P, Q, R, S, G, and B, which does not concern us. Hence when $x=0$, P : Q = R : S and the value of R can be determined in terms of P, Q and S.

In the practical instrument the three arms of the bridge P, Q, and S are generally composed of coils of wire contained in a box, whilst R is the resistance the value of which is to be determined. This last resistance is connected to the other three with the addition of a galvanometer and a battery connected up as shown in the diagram. The operation of determining the value of the resistance R therefore consists in altering the ratio of the three resistances P, Q, and S, until the galvanometer indicates no current through it when the battery circuit is completed or closed by the key. In one form of Wheatstone's Bridge, known as the series pattern plug-resistance bridge, or Post Office pattern, the two ratio arms, P and Q, each consist of a series of coils of wire, viz. two 1-ohm coils, two 10-ohm coils, two 100-ohm coils and two 1000-ohm coils, which are joined up in series in the order, 1000, 100, 10, 1; 1, 10, 100, 1000, the junctions between each pair being connected to brass blocks, a series of which are mounted upon an ebonite slab that forms the lid of the box. The blocks are bored out with a hole partly in one block and partly in the other (see fig. 2) so that they can be connected by accurately fitting conical plugs. When the blocks are interconnected by the plugs all the coils are short-circuited; but if the plug or plugs are taken out, then a current flowing from one end of the series to the other is compelled to pass through the corresponding coils. In series with this set of coils is another set, S, which forms a measuring arm, the resistances of which are generally 1, 2, 3, 4, 10, 20, 30, 40, 100, 200, 300, 400, 1000, 2000, 3000, 4000 ohms. The junction between each pair of coils is connected as above described to a block, the blocks being interconnected by plugs all of which are made interchangeable.

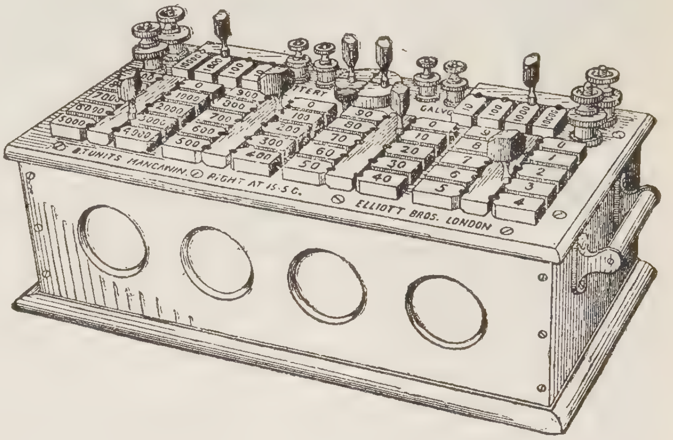
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FIG. 2.—Standard Wheatstone's Bridge.

Another form of Wheatstone's Bridge, shown in fig. 2, is known as the *dial* pattern. Ten brass blocks are arranged parallel to or around another brass block, and by means of a plug which fits into holes bored partly out of the common block and partly out of the surrounding blocks, any one of the latter can be connected with the common one. A series of nine equal resistances, say 1-ohm coils, or nine 100-ohm coils, are joined in between these circumferential blocks (fig. 3). It will be seen that if a plug is placed so as to connect any outside block with the central block, the current can only pass from the zero outer block to the central block by passing through a certain number of the resistance coils. Hence according to the magnitude of each coil the total resistance may be made anything from 1 to 9, 10 to 90, or 100 to 900 ohms, &c. Three or four of the "dials" thus composed are arranged side by side, the brass blocks being mounted on a slab of ebonite and the coils contained in the box underneath, and they are so joined up that the central block of one dial is connected to the outside block of the next marked O. This arrangement forms the measuring arm of the bridge, the ratio arms being constructed on the series plug pattern just described. A bridge of this pattern has the advantage that the insertion or removal of a

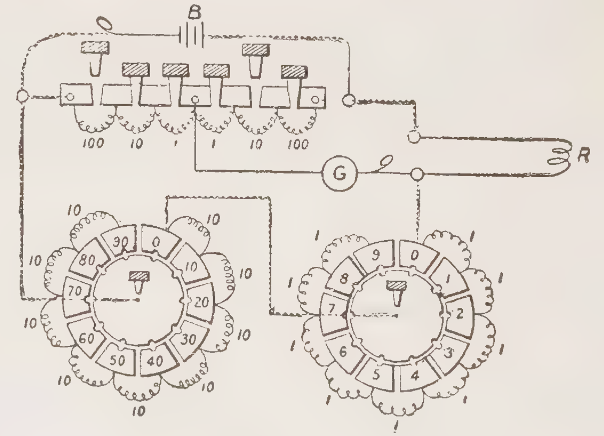

FIG. 3.—Diagram showing Connexions of a Dial and Plug pattern, Wheatstone's Bridge.

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[1] See Wheatstone's *Scientific Papers*, p. 129.

plug in the measuring arm does not tend to tighten or loosen all the rest of the plugs; moreover, there are fewer plugs to manipulate, and each plug is occupied. The resistance coils themselves are generally wound on brass or copper bobbins, with silk-covered manganin wire, which should first be aged by heating for about ten hours to a temperature of 140° C., to remove the slight tendency to change in resistivity which would otherwise present itself.

For the accurate comparison of resistance coils it is usual to make use of the Matthiessen and Hockin bridge, and to employ the method of differential comparison due to G. Carey Foster.[1] On a board is stretched a uniform metallic wire *a b*, generally of platinum silver. The ends of this wire are connected to copper blocks, which themselves are connected to a series of four resistance coils, A, B, and P, Q (fig. 4). A and B are the coils to be compared, P and Q are two other coils of convenient value. Over the stretched wire moves a contact maker S, which makes contact with it at any desired point, the position of which can be ascertained by means of an underlying scale. A battery C of two or three cells is connected to the extremities of the slide wire, and the sensitive galvanometer G is connected in between the contact-maker and the junction between the coils P and Q. The observer begins by moving the slider until the galvanometer shows no current. The position of the coils A and B is then interchanged, and a fresh balance in position on the bridge is obtained. It is then easily shown that the difference between the resistance of the coils A and B is equal to the resistance of the length of the slide wire intercepted between the two places at which the balance was found in the two observations.

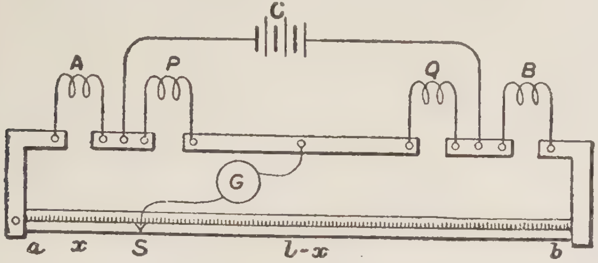

FIG. 4.

Let the balance be supposed to be attained, and let x be the position of the slider on the wire, so that x and $l-x$ are the two sections of the slide wire, then the relation between the resistance is

$$(A+x) \,/\, (B+l-x) = P/Q.$$

Next, let the position of A and B be interchanged, and the slide-wire reading be x'; then

$$(B+x') \,/\, (A+l-x') = P/Q.$$

Hence it follows that $A-B=x'-x$, or the difference of the resistances of the coils A and B is equal to the resistance of that length of the slide wire between the two points where balance is obtained.

Various plans have been suggested for effecting the rapid interchange of the two coils A and B; one of the most convenient was designed by J. A. Fleming in 1880, and has been since used by the British Association Committee on Electrical Units for making comparison between standard coils with great accuracy (see *Phil. Mag.*, 1880, and *Proc. Phys. Soc.*, 1879). In all very exact resistance measurements the chief difficulty, however, is not to determine the resistance of a coil, but to determine the temperature of the coil at the time when the resistance measurement is made. The difficulty is caused by the fact that the coil is heated by the current used to measure its resistance, which thus alters in value. In accurate comparisons, therefore, it is necessary that the coils to be compared should be immersed in melting ice, and that sufficient time should be allowed to elapse between the measurements for the heat generated in the coil to be removed.

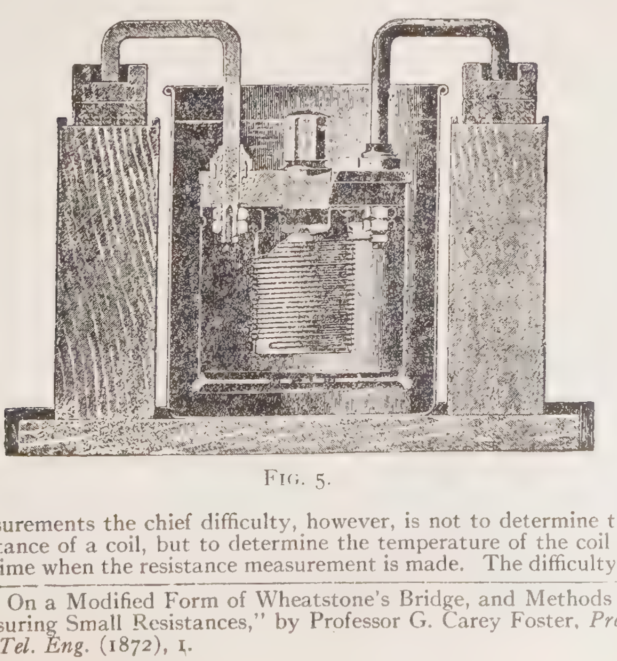

FIG. 5.

The standard resistance coil employed as a means of comparison by which to regulate and check other coils consists of a wire, generally of manganin or platinum silver, insulated with silk and wound on a brass cylinder (fig. 5). This is soldered to two thick terminal rods of copper, and the coil is enclosed in a water-tight brass cylinder so that it can be placed in water, or preferably in paraffin oil, and brought to any required temperature. In the form of standard coil recommended by the Berlin Reichsanstalt the coil is immersed in an insulating oil which is kept stirred by means of a small electric motor during the time of making the measurement. The temperature of the oil can best be ascertained by means of a platinum resistance thermometer.

For the measurement of low resistances a modification of the Wheatstone's bridge devised by Lord Kelvin is employed. The Kelvin bridge consists of nine conductors joining six points, and in one practical form is known as a Kelvin and Varley slide. Modifications of the ordinary Wheatstone's bridge for very accurate measurements have been devised by H. L. Callendar and by Callendar and E. H. Griffiths (see G. M. Clark, the *Electrician*, 38, p. 747). A useful bridge method for measurement of low resistances has been given by R. T. Housman (the *Electrician*, 40, p. 300, 1897). These and numerous modifications of the Wheatstone's bridge will be found described in J. A. Fleming's *Handbook for the Electrical Laboratory and Testing-Room*, vol. i. (1903).

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(J. A. F.)

WHEEL (O. Eng. *hwēol*, *hwēohl*, &c., cognate with Icel. *hjōl*, Dan. *hiul*, *&c.*; the Indo-European root is seen in Sanskrit *chakrā*, Gr. κύκλος, circle, whence "cycle"), a circular frame or solid disk revolving on an axis, of which the function is to transmit or to modify motion. For the mechanical attributes and power of the wheel and for the modification of the lever, known as the "wheel and axis," and of the mechanical powers, see MECHANICS. The most familiar type of the wheel is of course that used in every type of vehicle, but it forms an essential part of nearly every kind of mechanism or machinery. Vehicular wheels in the earliest times were circular disks either cut out of solid pieces of wood, or formed of separate planks of wood fastened together and then cut into a circular shape. Such may be still seen in use among primitive peoples to-day, especially where the tracks, if any exist, are of the roughest description, and travelling is heavy. The ordinary wheel consists of the nave (O. Eng. *nafu*, cf. Ger. *Nabe*, allied with "navel"), the central portion or hub, through which the axle passes, the spokes, the radial bars inserted in the nave and reaching to the peripheral rim, the felloe or felly (O. Eng. *felge*, Ger. *Felge*, properly that which fitted together, Teut. *felhan*, to fit together). From the monuments we see that the ancient Egyptian and Assyrian chariots had usually six spokes; the Greek and Roman wheels from four to eight. (See further CARRIAGE and CHARIOT; also TIRE; and articles on BICYCLE; TRICYCLE; and MOTOR VEHICLES.)

WHEEL, BREAKING ON THE, a form of torture and execution formerly in use, especially in France and Germany. It is said to have been first used in the latter country, where the victim was placed on a cart-wheel and his limbs stretched out along the spokes. The wheel was made to slowly revolve, and the man's bones broken with blows of an iron bar. Sometimes it was mercifully ordered that the executioner should strike the criminal on chest and stomach, blows known as *coups de grâce*, which at once ended the torture, and in France he was usually strangled after the second or third blow. A wheel was not always used

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[1] "On a Modified Form of Wheatstone's Bridge, and Methods of Measuring Small Resistances," by Professor G. Carey Foster, *Proc. Soc. Tel. Eng.* (1872), 1.

In some countries it was upon a frame shaped like St Andrew's Cross that the sufferer was stretched. The punishment was abolished in France at the Revolution. It was employed in Germany as late as 1827. A murderer was broken on the *row* or wheel at Edinburgh in 1604, and two of the assassins of the regent Lennox thus suffered death.

WHEELER, JOSEPH (1836–1906), American soldier, was born at Augusta, Georgia, in 1836, and entered the United States cavalry from West Point in 1859. Within two years the Civil War broke out, and Wheeler, as a Southerner, resigned to enter the Confederate service. In a short time he became colonel of the 19th Alabama Infantry, with which he took part in the desultory operations of 1861 in Kentucky and Tennessee. He commanded a brigade at the battle of Shiloh, but soon afterwards he returned to the cavalry arm in which he won a reputation second only to Stuart's. After the action of Perryville he was promoted brigadier-general, and in January 1863 major-general. Thenceforward throughout the campaigns of Chickamauga, Chattanooga and Atlanta he commanded the cavalry of the Confederate army in the West, and when Hood embarked upon the Tennessee expedition, he left Wheeler's cavalry to harass Sherman's army during the "March to the Sea." In the closing operations of the war, having now the rank of lieutenant-general, he commanded the cavalry of Joseph Johnston's weak army in North Carolina, and was included in its surrender. After this he became a lawyer and a cotton planter and in 1882–83 and 1885–1900 was a representative in Congress. At the outbreak of the Spanish-American War in 1898, President M'Kinley, in pursuance of the policy of welding the North and the South, commissioned two ex-Confederate generals—Wheeler and Fitzhugh Lee—as major-generals of United States volunteers, and in this capacity Wheeler was placed in command of the cavalry division of Shafter's army in Cuba. He commanded in the actions of Guasimas and San Juan, was afterwards sent to the Philippines in command of a brigade, and in 1900 was commissioned a brigadier-general in the regular army. Shortly afterwards he retired. General Wheeler died on the 25th of January 1906.

WHEELER, WILLIAM ALMON (1819–1887), vice-president of the United States from 1877 to 1881, was born at Malone, New York, on the 30th of June 1819. He studied at the university of Vermont for two years (1833–1835), and in 1845 was admitted to the bar. First as a Whig, and then, after 1856, as a Republican, he was prominent for many years in state and national politics. He was a member of the state Assembly in 1849–1850, a member and president *pro tempore* of the state Senate in 1858–1859, and a member of the national House of Representatives in 1861–1863, and again from 1869 until 1877. He was the author of the so-called "Wheeler Compromise," by which the difficulties between contending political factions in Louisiana were adjusted in 1875. Nominated for vice-president by the Republicans in 1876 on the ticket with President Hayes, he was installed in office through the decision of the Electoral Commission, and at the end of his term he retired from public life. He died at Malone on the 4th of June 1887.

WHEELING, a city and the county-seat of Ohio county, West Virginia, U.S.A., on the east bank of the Ohio river, at the mouth of Wheeling Creek, 66 m. (by rail) S.W. of Pittsburg. Pop. (1890) 34,522; (1900) 38,878, of whom 1066 were negroes, and 5461 were foreign-born, including 3106 Germans and 876 Irish; (1910, census) 41,641. Area, 3·2 sq. m. Wheeling is served by the Baltimore & Ohio, the Pennsylvania and the Wheeling & Lake Erie railways, by the belt line of the Wheeling Terminal Company and by interurban electric lines. Wheeling is the largest city in West Virginia, and commercially the most important place on the Ohio river between Pittsburg and Cincinnati. It is built on a narrow strip of bottom land, between the river and steep hills, at an elevation of about 640 ft. above tidewater. Between the mainland and Wheeling (formerly Zane's) Island, which forms a part of the city, there are a suspension-bridge, which has a span of 1010 ft., and a steel bridge, and from the island across the back river channel there are two bridges to the Ohio shore, one from the middle of the island to Bridgeport on which the Old National Road crosses the river, and the other from the northern end of the island to Martin's Ferry, Ohio. A fifth bridge connects Wheeling with Bellaire, Ohio. Wheeling has a public library, containing 23,261 volumes in 1909. Near the city is the Mount de Chantal Academy (Roman Catholic) for girls, and in Wheeling is Linsly Institute, a secondary school for boys. The principal public buildings are the Custom-House and Post-Office, the City Hall, a High School, a Y.M.C.A. building and a Scottish Rite Cathedral. In the city are a City Hospital (private, 1890) and the Wheeling Hospital (under the Sisters of St Joseph, 1853). On the National Road there is a monument to Henry Clay; and in the City Hall Square is a Soldiers' Monument. By reason of its situation on the Ohio river Wheeling is an important shipping and distributing centre, and it has various important manufacturing interests. Its factory products were valued in 1905 at $23,297,475. The chief industry is the manufacture of iron and steel, which in 1905 gave employment to more than 34% of the city's wage-earners, and yielded more than 46% of the total value of its products. The manufacture of nails, begun here in 1849, was for many years of great importance. Other products in 1905 were slaughtering and meat products, $1,812,348; malt liquors, $1,541,185; tobacco and cigars (especially stogies), $1,161,594; foundry and machine-shop products, $709,376; lumber and planing mill products, $685,861; pickles, preserves and sauces, $676,437; glass, $508,145; and pottery. Glass was first manufactured here in 1821. Coal is found in abundance in the surrounding region, and also natural gas, which is much used as fuel in the manufacture of iron, steel and glass.

The first settlement here was made in 1770 by Colonel Ebenezer Zane (1747–1811), and his brothers, Jonathan (one of the founders of Zanesville, Ohio) and Silas, who in the autumn of that year made their way to this point from their home in Virginia, and took possession of claims at the mouth of Wheeling Creek. Other settlers came soon afterward, and in 1774 a strong stockade fort was erected within the present limits of Wheeling —at the top of Main Street hill. Until 1776 this fort was called Fort Fincastle in honour of Lord Dunmore, Viscount Fincastle, governor of Virginia from 1771 to 1776. After 1776 it was called Fort Henry, in honour of Patrick Henry. During this period the Indians were hostile, and the settlers were frequently forced to take refuge in the stockade. On the 1st of September 1777 the fort was attacked by a large force of Indians and 15 of the whites were killed; during this attack, when the ammunition of the defenders had failed, Elizabeth Zane (*c.* 1759–1847), a sister of Ebenezer, brought under fire a keg of powder from a house sixty yards from the fort. In September 1782 the fort was unsuccessfully besieged for two days by a force of about 40 British regular soldiers and about 250 Indians. The town was laid out by Colonel Zane in 1793, was incorporated in 1806, and was chartered as a city in 1836. It was designated as the capital of the "restored government of Virginia" in 1861, after the secession of Virginia at the beginning of the Civil War, and was the capital of West Virginia from 1863 to 1869, and again from 1875 until May 1885. The name "Wheeling" is a corruption of an Indian word, of uncertain meaning, sometimes translated as "the place of the head."

WHETHAMSTEDE, JOHN (d. 1465), English abbot, was a son of Hugh Bostock, and was born at Wheathampstead in Hertfordshire, owing his name, the Latin form of which is *Frumentarius*, to this circumstance. In early life he entered St Albans Abbey and in 1420 he was chosen abbot of this house. In 1423 he attended a council at Pavia, but in England his time was mainly occupied with lawsuits, several of which he carried on to defend the property and enforce the rights of the abbey. In 1440 he resigned his post, but in 1451, on the death of his successor, John Stoke, he became abbot for the second time. He died on the 20th of January 1465, and his tomb may still be seen in the abbey church. Whethamstede was an energetic and successful abbot. He greatly improved the buildings at St Albans, which suffered somewhat during his later years owing to the wars of the roses; he also did some building at Gloucester

College, Oxford, with which he was connected. He was a friend of Duke Humphrey of Gloucester, whom he helped to gather together his famous collection of books, and was himself a writer, his works including *Granarium de viris illustribus*; *Palearium poëtarum*; and *Super Valerium in Augustinum de Anchona*.

Whethamstede's *Chronicle*, or the *Registrum abbatiae Johannis Whethamstede*, is a register compiled soon after the abbot's death, which tells the events of his second abbacy. It has been edited by H. T. Riley, and is in vol. i. of the *Registra quorundam abbatum monasterii S. Albani* (London, 1872). The events of his first abbacy are narrated in the *Annales monasterii S. Albani* of John Amundesham, also edited by H. T. Riley (London, 1870–1871).

WHETSTONE, GEORGE (1544?–1587?), English dramatist and author, was the third son of Robert Whetstone (d. 1557). A member of a wealthy family that owned the manor of Walcot at Bernack, near Stamford, he appears to have inherited a small patrimony which he speedily dissipated, and he complains bitterly of the failure of a lawsuit to recover an inheritance of which he had been unjustly deprived. In 1572 he joined an English regiment on active service in the Low Countries, where he met George Gascoigne and Thomas Churchyard. Gascoigne was his guest near Stamford when he died in 1577, and Whetstone commemorated his friend in a long elegy. His first volume, the *Rocke of Regarde* (1576), consisted of tales in prose and verse adapted from the Italian, and in 1578 he published *The right excellent and famous Historye of Promos and Cassandra*, a play in two parts, drawn from the eighty-fifth novel of Giraldi Cinthio's *Hecatomithi*. To this he wrote an interesting preface addressed to William Fleetwood, recorder of London, with whom he claimed kinship, in which he criticizes the contemporary drama. In 1582 he published his *Heptameron of Civill Discourses*, a collection of tales which includes *The Rare Historie of Promos and Cassandra*. From this prose version apparently Shakespeare drew the plot of *Measure for Measure*, though he was doubtless familiar with the story in its earlier dramatic form. Whetstone accompanied Sir Humphrey Gilbert on his expedition in 1578–1579, and the next year found him in Italy. The Puritan spirit was now abroad in England, and Whetstone followed its dictates in his prose tract *A Mirour for Magestrates* (1584), which in a second edition was called *A Touchstone for the Time*. Whetstone did not abuse the stage as some Puritan writers did, but he objected to the performance of plays on Sundays. In 1585 he returned to the army in Holland, and he was present at the battle of Zutphen. His other works are a collection of military anecdotes entitled *The Honourable Reputation of a Souldier* (1585); a political tract, the *English Myrror* (1586), numerous elegies on distinguished persons, and *The Censure of a Loyall Subject* (1587). No information about Whetstone is available after the publication of this last book, and it is conjectured that he died shortly afterwards.

WHEWELL, WILLIAM (1794–1866), British philosopher and historian of science, was born on the 24th of May 1794 at Lancaster. His father, a carpenter, wished him to follow his trade, but his success in mathematics at Lancaster and Heversham grammar-schools enabled him to proceed with an exhibition to Trinity, Cambridge (1812). He was second wrangler in 1816, became fellow and tutor of his college, and, in 1841, succeeded Dr Wordsworth as master. He was professor of mineralogy from 1828 to 1832, and of moral philosophy (then called "moral theology and casuistical divinity") from 1838 to 1855. He died on the 6th of March 1866 from the effects of a fall from his horse.

Whewell was prominent not only in scientific research and philosophy, but also in university and college administration. His first work, *An Elementary Treatise on Mechanics* (1819), co-operated with those of Peacock and Herschel in reforming the Cambridge method of mathematical teaching; to him in large measure was due the recognition of the moral and natural sciences as an integral part of the Cambridge curriculum (1850). In general, however, especially in later years, he opposed reform: he defended the tutorial system, and in a controversy with Thirlwall (1834) opposed the admission of Dissenters; he upheld the clerical fellowship system, the privileged class of "fellow-commoners," and the authority of heads of colleges in university affairs. He opposed the appointment of the University Commission (1850), and wrote two pamphlets (*Remarks*) against the reform of the university (1855). He advocated as the true reform, against the scheme of entrusting elections to the members of the senate, the use of college funds and the subvention of scientific and professorial work.

In 1826 and 1828, Whewell was engaged with Airy in conducting experiments in Dolcoath mine, Cornwall, in order to determine the density of the earth. Their united labours were unsuccessful, and Whewell did little more in the way of experimental science. He was the author, however, of an *Essay on Mineralogical Classification*, published in 1828, and contributed various memoirs on the tides to the *Philosophical Transactions* of the Royal Society between 1833 and 1850. But it is on his *History* and *Philosophy of the Sciences* that his claim to an enduring reputation mainly rests. The *History of the Inductive Sciences, from the Earliest to the Present Time* appeared originally in 1837. Whewell's wide, if superficial, acquaintance with various branches of science enabled him to write a comprehensive account of their development, which is still of the greatest value. In his own opinion, the *History* was to be regarded as an introduction to the *Philosophy of the Inductive Sciences* (1840). The latter treatise[1] analyses the method exemplified in the formation of ideas, in the new inductions of science, and in the applications and systematization of these inductions all exhibited by the *History* in the process of development

In the *Philosophy*, Whewell endeavours to follow Bacon's plan for discovery of an effectual art of discovery. He examines ideas ("explication of conceptions") and by the "colligation of facts endeavours to unite these ideas to the facts and so construct science. But no art of discovery, such as Bacon anticipated, follows, for "invention, sagacity, genius" are needed at each step. He analyses induction into three steps:—(1) the selection of the (fundamental) idea, such as space, number, cause or likeness; (2) the formation of the conception, or more special modification of those ideas, as a circle, a uniform force, &c.; and (3) the determination of magnitudes. Upon these follow special methods of induction applicable to quantity, viz., the method of curves, the method of means, the method of least squares and the method of residues, and special methods depending on resemblance (to which the transition is made through the law of continuity), viz. the method of gradation and the method of natural classification.

Here, as in his ethical doctrine (see ETHICS), Whewell was moved by opposition to contemporary English empiricism. Following Kant, he asserted against J. S. Mill the a priori nature of necessary truth, and by his rules for the construction of conceptions he dispensed with the inductive methods of Mill.

Between 1835 and 1861 Whewell was the author of various works on the philosophy of morals and politics, the chief of which, *Elements of Morality, including Polity*, was published in 1845. The peculiarity of this work—written, of course, from what is known as the intuitional point of view—is its fivefold division of the springs of action and of their objects, of the primary and universal rights of man (personal security, property, contract, family rights and government), and of the cardinal virtues (benevolence, justice, truth, purity and order). Among Whewell's other works—too numerous to mention—reference must be made to writings popular in their day, such as the Bridgewater Treatise on *Astronomy* (1833), and the essay, *Of the Plurality of Worlds* (1854), in which he argued against the probability of planetary life, and also to the *Platonic Dialogues for English Readers* (1859–1861), to the *Lectures on the History of Moral Philosophy in England* (1852), to the essay, *Of a Liberal Education in General, with particular reference to the Leading Studies of the University of Cambridge* (1845), to the important edition and abridged translation of Grotius, *De jure belli et pacis* (1853), and to the edition of the *Mathematical Works* of Isaac Barrow (1860).

Full bibliographical details are given by Isaac Todhunter, *W. Whewell: an Account of his Writings* (2 vols., 1876). See also *Life of W. Whewell*, by Mrs Stair Douglas (1881).

WHICHCOTE (or WHITCHCOTE), **BENJAMIN** (1609–1683), English divine and philosopher, was born at Whichcote Hall, Stoke, Shropshire, and educated at Emmanuel College, Cambridge, where he became fellow in 1633. He was ordained in 1636, and appointed shortly afterwards to be Sunday afternoon lecturer at Trinity Church, Cambridge. In 1643 he received the rectory of North Cadbury, Somerset, and in the following year he was appointed provost of King's College, Cambridge, in place of Samuel Collins who was ejected. On resigning North Cadbury in 1649 he became rector of Milton, Cambridgeshire. In 1650 he was vice-chancellor of Cambridge University. Cromwell in 1655 consulted him upon the question of extending tolerance to the Jews. His Puritan views lost him the provostship of King's College at the Restoration of 1660, but on complying with the Act of Uniformity he was appointed to the living of St Anne's, Blackfriars, London. In 1668 he became vicar of St Lawrence Jewry, London. He is regarded as the founder of the important school of Cambridge Platonists. His works, chiefly theological treatises and sermons, were all published posthumously. He died in May 1683.

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[1] Afterwards broken up into three parts published separately: (1) the *History of Scientific Ideas* (1858), substantially a reproduction of the first part of the *Philosophy*; (2) the *Novum organum renovatum* (1858), containing the second part of the same work, but without the historical review of opinions, which was issued with large additions as (3) the *Philosophy of Discovery* (1860).

See John Tulloch, *Rational Theology*, ii. 59-84 (1874); and *Masters in English Theology*, edited by A. Barry (1877).

WHICKHAM, an urban district in the Chester-le-Street parliamentary division of Durham, England, 4 m. S.W. of Newcastle-upon-Tyne, near the river Derwent. Pop. (1901) 12,852. There is a station (Swalwell) on a branch of the North-Eastern railway. The church of St Mary has Norman and Transitional portions, and in the neighbourhood is the mansion of Gibside, of the 17th century. The demesne borders the Derwent, and is of great beauty, part being laid out in formal gardens and straight avenues. It contains a lofty Doric column and a detached chapel and banqueting hall, and in the vicinity are picturesque fragments of the monastic chapel of Friarside, and of the manor house of Hollinside. Whickham is one of the centres of a coal-mining district, the mines employing the majority of the industrial population; but there are also iron, steel, and chemical works.

WHIG AND TORY, the names associated with two opposing political parties in England. The origin of "Whig" has been much controverted; it has been associated with the Scots for "whey," as implying a taunt against the "sour-milk" faces of the western Lowlanders; another theory is that it represented the initials of the Scots Covenanters' motto, "We hope in God"; another derives it from the Scots word "whiggam," used by peasants in driving their horses. It was, however, a form of the Scots Gaelic term used to describe cattle and horse thieves, and transferred to the adherents of the Presbyterian cause in Scotland. "Tory" is derived from the Irish *Tar a Ri*, "Come, oh king!" associated with the creed of the Irish native levies enlisted in the civil wars on behalf of the loyalist cause; the outlaws who fought for James in Ireland after the revolution were similarly nicknamed Rapparees or Tories.

Parliamentary parties, as such, came into existence in England as soon as parliament achieved or aimed at predominance in the state. In 1641, shortly after the meeting of the Long Parliament, they were divided on the question of church reform, passing, as soon as political questions were involved, into Cavaliers and Roundheads. After the expulsion of the Cavaliers in 1642 and 1643 the Houses were divided into a peace party and a war party, and these in 1643 took the shape of Presbyterians and Independents. After the Restoration there was a country party and a court party, and to these the names of Whig and Tory were applied in 1679, in the heat of the struggle which preceded the meeting of the first short parliament of Charles II. The words were nicknames given by the opponents of each party. To call a man a Whig was to compare him with the Presbyterian rebels of the west of Scotland. To call a man a Tory was to compare him with the Papist outlaws of Ireland. In fact, at this time the Whigs were maintainers of parliamentary power over the crown and of toleration for Dissenters, the Tories maintainers of the hereditary indefeasible rights of the wearer of the crown and of the refusal of toleration to Dissenters. The relation between the parties was further qualified by the fact that the heir to the crown was a Roman Catholic, whose claim to succeed was defended by the Tories and assailed by the Whigs.

The persistency of the names of the two parties is mainly owing to their essential unmeaningness. As new questions arose, the names of the old parties were retained, though the objects of contention were no longer the same. The Revolution of 1688–89 made it impossible for the Tories to retain their old attitude of attachment to the hereditary right of the occupant of the throne, with the exception of the extreme wing of the party, which remained Jacobite. They still, however, continued, though accepting the Toleration Act, to oppose the offering of further favours to Dissenters. In Anne's reign, after the war with France had gone on for some time, they supported a peace policy, whilst the Whigs advocated a continuance of the war. On the whole, during the last years of the 17th and the first years of the 18th century the Whigs may be regarded as the party of the great landowners, and of the merchants and tradesmen, the Tories as the party of the smaller landowners and the country clergy. The Whigs established, through their hold upon the boroughs under the influence of the great landowners, a firm government, which could keep in check, and at last practically set aside, the power of the crown. The Tories, distrusting the authority of the ministerial government, and fearing a new despotism based on parliamentary corruption, became, especially after Bolingbroke's return from exile, almost democratic in their views and in their demands for the purification of the existing system.

With the accession of George III. Toryism took a new form. The struggle about the Dissenters was now a thing of the past, and the king was accepted as a leader in carrying on the attack against the power of the great Whig families. The attack was the easier because the Whig families had split into factions. For some time the dividing line between Whigs and Tories was this: the Tories asserted that the king had a right to choose his ministers and control their policy, subject to the necessity of securing a majority of the House of Commons, whilst the Whigs thought that the choice should lie with leading members of parliament, and that the king should have no controlling power. The Whig view appears to resemble that subsequently adopted; but in the middle of the 18th century the corruption which prevailed rendered the analogy worthless, and the real conflict was between the corrupt influence of the crown and the influence of a clique of great landowners resting on their possession of electoral power through the rotten boroughs. In 1770 the king had his way and established Lord North at the treasury as his nominee. The Whigs, deprived of power, improved their position by the loss of one great instrument of corruption; but they were weakened by the establishment of two distinct currents of opinion in their own ranks. The main body under Rockingham was influenced by Burke to demand practical reforms, but set its face against any popular changes in the constitution. The Whigs who followed Chatham wished to place parliament on a more popular basis by the reform of the House of Commons. When in 1783 Chatham's son Pitt became prime minister, the Tory party took a new start. It retained the Tory principle of reliance on the crown, and joined to it Chatham's principle of reliance on the people as opposed to the great Whig families. It also supported Pitt in practical reforms.

All this was changed by the French Revolution. In opposition to the new democracy, the Tories coalesced with a section of the Whig families, the representatives of which entered the ministry in 1794. From this time till 1822, in spite of men like Pitt, and the personal influence of Tory leaders who supported moderate reform, Toryism came to be popularly identified with a desire to retain the existing state of things, however full of abuses it might be. When Canning and Peel entered the ministry in 1822, a gradual change took place, and a tendency to practical reform manifested itself. The refusal of Wellington to listen to any proposal for altering the constitution of the House of Commons threw power once more into the hands of the Whigs in 1830. Shortly afterwards the name Tory gave place to that of Conservative (*q.v.*), though it was cherished by those Conservatives who wished to assert their power of originating a definite policy, and who disliked to be branded with a purely negative appellation, and it was also retained as a term of opprobrium by the Liberals for those whom they regarded as old-fashioned opponents of reform. The name of Whig was replaced by that of Liberal, being frequently, however, assigned to the less progressive portion of the party, the "moderate Liberals," or even to half-and-half Conservatives, as a term more or less of reproach. It ceased to be a name accepted by any definite English political section.

WHIG PARTY, in America, a political party prominent from about 1824 to 1854.[1] The first national party system of the United States came to an end during the second war with Great Britain. The destruction of the Federalist party (*q.v.*) through a series of suicidal acts which began with the Alien and Sedition laws of 1798, and closed with the Hartford Convention of 1814–1815, left the Jeffersonian Republican (Democratic) party in undisputed control. When, after Waterloo, Napoleon ceased to disturb the relations of the new world with the old, the American people, freed for the first time from all trace of political dependence on Europe, were at liberty to shape their public policy in their own way. During the period of rapid internal development which followed after 1815, the all-inclusive Republican party began gradually to disintegrate and a new party system was evolved, each member of which was the representative of such groups of ideas and interests, class and local, as required the support of a separate party. This work of disintegration and rebuilding proceeded so slowly that for more than a decade after the Peace of Ghent each new party, disguised during the early stages of organization as the personal following of a particular leader or group of leaders, kept on calling itself Republican. Even during the sharply contested election of 1824 the rival partisans were known as Jackson, Crawford and Calhoun, or as Clay and Adams Republicans. (See DEMOCRATIC PARTY.) It was not until late in the administration of John Quincy Adams, 1825 to 1829, that the supporters of the president and Henry Clay, the secretary of state, were first recognized as a distinct party and began to be called by the accurately descriptive term National Republicans. But after the party had become consolidated, in the passionate campaign of 1828, and later in opposing the measures of President Jackson, it adopted in 1834 the name Whig, which, through memorable associations both British and American, served as a protest against executive encroachments, and thus facilitated union with other parties and factions, such as the Anti-Masonic party (*q.v.*), that had been alienated by the high-handed measures of President Jackson. The new name announced not the birth but the maturity of the party, and the definite establishment of its principles and general lines of policy. The ends for which the Whigs laboured were: first, to maintain the integrity of the Union; second, to make the Union thoroughly national; third, to maintain the republican character of the Union; fourth, while utilizing to the full the inheritance from and through Europe, to develop a distinctly American type of civilization; fifth, to propagate abroad by peaceful means American ideas and institutions. Among the policies or means which the Whigs used in order to realize their principles were the broad construction of those provisions of the Federal Constitution which confer powers on the national government; protective tariffs; comprehensive schemes of internal improvements under the direction and at the cost of the national government; support of the Bank of the United States; resistance to many acts of President Jackson as encroachments by the executive on the legislative branch of the government and therefore hostile to republicanism; coalition with other parties in order to promote national as opposed to partisan ends; resort to compromise in order to allay sectional irritation and compose sectional differences; and cordial and yet prudent expression of sympathy with the liberal movement in other lands.

The activity of the Whig party, reckoned from the election of 1824, when its organization began, to the repeal of the Missouri Compromise in 1854, covers thirty years. In two respects, namely, the rise of the new radical democracy under Andrew Jackson, and the growth of sectionalism over the slavery issue, this period was highly critical. In view of these events the most difficult task of the Whigs, clearly discerned and heartily accepted by them, under the patriotic and conservative leadership of Henry Clay and Daniel Webster, was to moderate and enlighten, rather than antagonize, the new democracy; and—what proved to be beyond their powers—to overcome the disrupting influence of the slavery issue.

The inaugural address and the messages to Congress of President J. Q. Adams set forth clearly the nationalizing, broad-construction programme of the new party. But his supporters in Congress, imperfectly organized and facing a powerful opposition, accomplished very little in the way of legislation. The election of 1828 gave to Andrew Jackson the presidency, and to the people, in a higher degree than ever before, the control of the government. The president's attack upon the Bank, the introduction of the modern "spoils system" into the Federal civil service, the unprecedented use of the veto power, Jackson's assumption of powers which his opponents deemed unconstitutional, and his personal hostility towards Clay, who had succeeded Adams in the leadership of the party, brought about, under Whig leadership, a coalition of opposition parties which influenced deeply and permanently the character, policy and fortunes of the Whig party. It became the champion of the Bank, of the right of Congress, and of the older and purer form of the civil service. Moreover, as a means of strengthening the bond with their new allies, the Whigs learned to practise a tolerance towards the opinions and even the principles of their associates which is exceptional in the history of American political parties. In strict accord with their own principles, however, the Whigs supported the president during the Nullification Controversy (see NULLIFICATION). The renown of Webster as the foremost expositor of the national theory of the Union rests largely on his speeches during this controversy, in particular on his celebrated reply to Senator R. Y. Hayne of South Carolina. Nevertheless, after vindicating the rights of the Union, most of the Whigs supported Clay in arranging the compromise tariff of 1832 which enabled the Nullifiers to retreat without acknowledging discomfiture. The majority of the Northern Whigs, with the entire Southern membership of the party, disapproved the propaganda of the Abolitionists on the ground of its tendency to endanger the Union, and many from a like motive voted for the "Gag Rules" of 1835–1844 (see ADAMS, J. Q.), which in spirit, if not in letter, violated the constitutional right of petition. In the election of 1832 Clay was the nominee of the party for the presidency, but in 1836 and 1840, purely on grounds of expediency, the Whig conventions nominated General W. H. Harrison. During the administration of Martin Van Buren the Whigs tried with success to make party capital out of the panic of 1837, which they ascribed to Jackson, and out of the long depression that followed, for which they held Van Buren responsible. The election of General Harrison in the "log cabin and hard cider" campaign of 1840 proved a fruitless victory: the early death of the president and the anti-Whig politics of his successor, John Tyler (*q.v.*), whom the Whigs had imprudently chosen as vice-president, shattered their legislative programme.

In 1844 Clay was again the Whig candidate, and the annexation of Texas, involving the risk of a war with Mexico, was the leading issue. The Whigs opposed annexation; and the prospect of success seemed bright, until Clay, in the effort to remove Southern misapprehensions, wrote that he "would be glad" at some future time to see Texas annexed if it could be done "without dishonour, without war, with the common consent of the Union, and upon just and fair terms." It is widely held that this letter turned against Clay the anti-slavery element and lost him the presidency. The triumph of Polk in 1844 was followed by the annexation of Texas and by war with Mexico. The Whigs opposed the war, but on patriotic grounds voted supplies for its prosecution. The acquisition of Texas, and the assured prospect of a great territorial enlargement, at the cost of Mexico, brought to the front the question of slavery in the new domain. The agitation that followed continued through the presidential election of 1848 (in which the Whigs elected General Zachary Taylor), and did not subside until the passage of the

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[1] Immediately before the War of Independence and during the war those who favoured the colonial cause and independence were called "Whigs."

"Compromise Measures of 1850" (*q.v.*). To its authors this compromise seemed essential to the preservation of the Union; but it led directly to the destruction of the Whig party. In the North, where the inhumane Fugitive Slave Law grew daily more odious, the adherence to the Compromise on which Clay and Webster insisted weakened the party fatally. The alternative, namely, a committal of the party to the repeal of the obnoxious law, would have driven the Southern Whigs into the camp of the Democrats, leaving the Northern Whigs a sectional party powerless to resist the disruption of the Union. The only weapons that the Whigs knew how to use in defence of the Fugitive Slave Law were appeals to patriotism and sectional bargaining, and these could be employed only so long as the party remained intact.

The National Whig Convention of 1852, the last that represented the party in its entirety, gave to the Northern Whigs the naming of the candidate—General Winfield Scott—who was defeated in the ensuing election, and to the Southern the framing of the platform with its "finality" plank, which, as revised by Webster, read as follows: "That the series of acts of the Thirty-second Congress, the act known as the Fugitive Slave Law included, are received and acquiesced in by the Whig party of the United States as a settlement in principle and substance of the dangerous and exciting questions which they embrace . . . and we will maintain this system as essential to the nationality of the Whig party and the integrity of the Union."

Two years later the Repeal of the Missouri Compromise by the Kansas-Nebraska Act demonstrated that "this system" could not be maintained, and that in committing the Whig party to the policy of its maintenance the Convention of 1852 had signed the death-warrant of the party.

Among the services of the Whigs the first in importance are these: During the thirty critical years in which under the leadership of Clay and Webster they maintained the national view of the nature of the Union, the Whigs contributed more than all their rivals to impress this view upon the hearts and minds of the people. During this same extended period as peacemakers between the sections they kept North and South together until the North had become strong enough to uphold by force the integrity of the Union. And lastly they bequeathed to the Republican party the principles on which, and the leader, Abraham Lincoln, through whom the endangered Union was finally saved.

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(A. D. Mo.)

WHIP, in general, an instrument for striking, usually consisting of a handle of a flexible nature with a lash attached (see Whipping, below). In English parliamentary usage, a "whip" is a member (or members) chosen by the leader or leaders of a political party for the special duty of securing the attendance of the other members of that party on all necessary occasions, the term being abbreviated from the whipper-in of a hunt. The name is also given to the summons urging members of the party to attend. Whips are, of course, always members of parliament, and for the party in power (*i.e.* the government) their services are very essential, seeing that the fate of an important measure, or even the existence of the government itself, may depend upon the result of a division in the House. Where the majority of the party in power is not large it is very necessary that there should always be at hand a sufficient number of its supporters to make up a majority, and without the assistance of the whips it would be impossible to secure this. The chief whip of the government holds the office of patronage secretary to the treasury, so called because when offices were freely distributed to secure the support of members, it was his chief duty to dispose of the patronage to the best advantage of his party. He is still the channel through which such patronage as is left to the prime minister is dispensed. He is assisted by three junior whips, who are officially appointed as junior lords of the treasury; their salaries are £1000 a year each, while the patronage secretary has a salary of £2000. The parties not in office have whips who are unpaid. Attendance of members is primarily secured by lithographed notices sent by the whips to their following, the urgency or importance of the notice being indicated by the number of lines underscoring the notice, a four-line whip usually signifying the extremest urgency. The whips also arrange for the "pairing" of such of the members of their party who desire to be absent with those members of the opposition party who also desire to be absent. The chief whips of either party arrange in consultation with each other the leading speakers in an important debate, and also its length, and give the list of speakers to the speaker or chairman, who usually falls in with the arrangement. They take no part in debate themselves, but are constantly present in the House during its sittings, keeping a finger, as it were, upon the pulse of the House, and constantly informing their leader as to the state of the House. When any division is regarded as a strictly party one, the whips act as tellers in the division.

An interesting account of the office of whip is given in A. L. Lowell's *Government of England* (1908), vol. i. c. xxv.

WHIPPING, or Flogging, a method of corporal punishment which in one form or another has been used in all ages and all lands (see Bastinado, Knout, Cat-o'-Nine-Tails). In ancient Rome a citizen could not be scourged, it being considered an infamous punishment. Slaves were beaten with rods. Similarly in early medieval England the whip could not be used on the freeman, but was reserved for the villein. The Anglo-Saxons whipped prisoners with a three-corded knotted lash. It was not uncommon for mistresses to whip or have their servants whipped to death. William of Malmesbury relates that as a child King Æthelred was flogged with candles by his mother, who had no handier weapon, until he was insensible with pain. During the Saxon period whipping was the ordinary punishment for offences, great or small. Payments for whipping figure largely in municipal and parish accounts from an early date. The abolition of the monasteries, where the poor had been sure of free meals, led during the 16th century to an increase of vagrancy, at which the Statute of Labourers (1350) and its provisions as to whipping had been early aimed. In the reign of Henry VIII. was passed (1530) the famous Whipping Act, directing vagrants to be carried to some market town or other place "and there tied to the end of a cart naked and beaten with whips throughout such market town till the body shall be bloody." In the 39th year of Elizabeth a new act was passed by which the offender was to be stripped to the waist, not quite naked. It was under this statute that whipping-posts were substituted for the cart. Many of these posts were combined with stocks, as that at Waltham Abbey, which bears date "1598." It is of oak, 5 ft. 9 in. high, with iron clasps for the hands when used for whipping, and for the feet when used as stocks. Fourpence was the old charge for whipping male and female rogues. At quarter-sessions in Devonshire at Easter 1598 it was ordered that the mothers of bastard children should be whipped; the reputed fathers suffering a like punishment. In the west of England in 1684, "certain Scotch pedlars and petty chapmen being in the habit of selling their goods to the greate damage and hindrance of shoppe-keepers," the court ordered them to be stripped naked and whipped. The flogging of women was common. Judge Jeffreys, in so sentencing a female prisoner, is reported to have exclaimed, "Hangman, I charge you to pay particular attention to this lady. Scourge her soundly, man: scourge her till her blood runs down! It is Christmas: a cold time for madam to strip. See that you warm her shoulders." Lunatics, too, were whipped, for in the Constable's Accounts of Great Staughton, Hunts, occurs the entry, "1690–1, Paid in charges taking up a distracted woman, watching her and whipping her next day—8/6d." A still more remarkable entry is "1710–1, Pd. Thomas Hawkins for whipping two people yt had smallpox—8d." In 1764 the *Public Ledger* states that a woman who is described as "an old offender" was taken from the Clerkenwell Bridewell to Enfield and there publicly whipped at the cart's tail by the common hangman for cutting wood in Enfield Chase. A statute of 1791 abolished the whipping of females.

WHISKER, a word chiefly used in the plural in the sense of the hair worn by a man on the cheeks as opposed to the beard on the chin and the moustache on the upper lip (see Beard). It is also applied to the bristly feelers growing round the mouth of a cat or other animal. The word by derivation means that which "whisks" or "brushes."

WHISKY, or Whiskey, a potable spirit distilled from cereal grains. The name is probably derived from the Celtic *uisgebeatha* (water of life), which was subsequently contracted to *usquebaugh*, and still later to whisky (cf. Skeat, *Etym. Dict. s.v.*). The liquor known as "usquebaugh" in the 17th and 18th centuries was not, however, of the same character as the whisky of modern times, but was a compound of plain spirit with saffron, nutmegs, sugar and other spices and flavouring matters. Whether the term whisky to denote a plain type of spirit was used concurrently with usquebaugh, or whether the latter name covered both varieties, is not clear. It is certain, however, that an alcoholic liquor, derived mainly from grain, has been prepared for very many centuries in both Ireland and Scotland (see Spirits). There are three main types of whisky, namely, Scotch, Irish and American.

Scotch whiskies may be broadly divided into two main groups, namely (*a*) pot-still or malt whiskies, and (*b*) patent-still or grain whiskies; the former are made practically without exception from malted barley only, the latter from a mixture of malted barley and other unmalted cereals, chiefly rye, oats and maize (see Spirits). (*a*) There are four main varieties of Scotch malt whiskies, namely, Highland Malts, Lowland Malts, Campbeltowns and Islays. The Highland Malts are produced (if we except a few distilleries on the islands in the west and north) in the district on the mainland lying north of an imaginary line drawn through Dundee on the east and Greenock on the west. The largest group of distilleries is in the famous Speyside or Glenlivet district. The Lowland Malts are made south of the imaginary line alluded to. The Campbeltowns are distilled in or near the town of that name at the southern end of the Kintyre peninsula. The Islays are produced in the island of that name. These different varieties of whisky, although made in much the same way, yet possess distinctive characteristics of flavour. The type of barley employed, the quantity of peat employed in curing the malt, the quality of the water, the manner of carrying out the various distillery processes—particularly that of distillation—the shape and size of the stills, &c., all these are factors which affect the flavour of the final product. The Islays, which, as a rule, are considered to be among the most valuable of Scotch whiskies, possess a very full and peaty flavour together with a strong ethereal bouquet. For this reason they are much used for blending with whiskies of a lighter type. The Highland Malts proper (Speyside type) are less peaty than the Islays, yet possess a full flavour, although many of them are inclined to be "elegant" rather than "big." The Lowland Malts, again, are, as a class, less peated than the Highland Malts, and indeed, nowadays, in view of the growing taste for a more neutral class of beverage, there are some Lowland Malt distilleries which dispense with the use of peat altogether. Many of the Lowland Malts possess considerable body and flavour, but, on the whole, they are lighter and not so fine as those of the Highland variety. Lowland distillers are now running their spirit at much the same strength as their Highland colleagues, whereas formerly it was the custom to work at a far higher strength. The result is that the difference between the two classes of spirit is not so marked as it was. The Campbeltowns, although in some respects similar to the Islays on the one hand, and the Highland Malts on the other, are somewhat rougher and less elegant than these. They usually possess a full peaty flavour. (*b*) Patent-still or grain whiskies are, as a class, lighter in flavour and "body" than the pot-still types. This is due to the fact that the rectification of these whiskies is carried a good deal further than is the case with the "malts." They are made from a mixture of malted and unmalted cereals, and, as no peat is employed in the curing of the malt, they lack the "smoky" flavour of the other varieties. Some controversy has arisen as to whether these patent-still spirits have a right to the name of "whisky" or "Scotch whisky," but although, no doubt, this controversy is largely due to conflicting trade interests, it has also, in the author's opinion, been caused by a very general popular misconception as to the true character of these whiskies. The idea that they are true "silent" or "neutral" spirits—*i.e.* alcohol and water pure and simple—is quite incorrect. They possess a distinct flavour, which varies at different distilleries, and analysis discloses the fact that they contain very appreciable quantities of the "secondary" products which distinguish potable spirits from plain alcohol. Indeed, as a result of an extensive investigation of the question

Composition of Scotch Whiskies.

Note.—The figures below are based on a large number of analyses of typical samples. Cf. Schidrowitz and Kaye, *Journal Soc. Chem. Ind.* (June 1905). Where two figures are given in the same column, they do not indicate extremes, but merely normal variation.

Description.	(Results expressed in grams per 100 litres of absolute alcohol.)						
	Alcohol.	Total Acid.	Non-volatile Acid.	Esters.	Higher Alcohols.	Aldehydes.	Furfurol.
Highland Malts—	Practically all Scotch whiskies are distilled at about 25 O.P. (about 72% of alcohol by volume). Prior to storage they are reduced to 11 O.P. with water. Mature whiskies contain 45 to 60% of alcohol according to age, humidity of store, &c. For retail sale, whiskies are reduced to a strength of roughly 17 to 24 U.P.						
New light type		15	Nil	50	140	10	2·5–3
New heavy type		20	Nil	75	200	20–40	3–5
Mature light type		20–80	5–35	50–100	150	15–50	2–3
Mature heavy type					220		2·5–4·5
Lowland Malts—							
New		15	Nil	25–50	110–180	15–50	2·5–4·5
Mature		20–60	5–20	50–75	120–200		2–3·5
Campbeltown—							
New		20–30	Nil	50–70	180–220	20–40	3–8
Mature		30–80	5–25	60–120	230–250	30–70	2·5–7
Islay[1]		..	..	..	..	..	..
Grain Whiskies—							
New		Trace to 5	Nil	20–40	50–60	2–10	Trace to 0·75
Mature		25–50	5–25	25–50	60–70	5–15	

[1] The Islays give similar figures to the Highland Malts except that the Higher Alcohols and Furfurol are slightly higher

by the author, it has been shown that the relative proportion of "secondary" products in Highland Malt, Lowland Malt and "grain" whiskies respectively, is roughly as 3 : 2 : 1. The figures in the foregoing table illustrate, as far as we are at present able to determine them, the general composition of the various types of Scotch whiskies referred to.

The character of Scotch whisky is much influenced by the manner in which it is matured. Chief among the factors in this connexion is the nature of the cask employed. The main varieties are plain wood, sherry and refill casks. Technically the term "plain" wood is applied to a cask made from seasoned oak which has contained no other liquor than whisky. Similarly the term "sherry" wood is as a rule only applied to a cask the wood of which has become impregnated with sherry by contact with that wine, and which has not been used in any other manner. A sherry cask which has been filled with whisky, then emptied and "refilled" with whisky, is known as a "refill." Brandy and Madeira "wood" are also occasionally employed. The nature of the atmospheric conditions of the cellar is also of importance in determining character and quality (see SPIRITS).

Blending.—Scotch whiskies are, as a general rule, "blended" prior to sale to the public. By "blending" is understood the art of putting together different types and varieties of whisky to form a harmonious combination. The general run of "self" whiskies—*i.e.* whiskies from a single distillery—do not appear to be to the public taste, but by combining different kinds of whisky blenders have succeeded in producing an article the demand for which has increased enormously during the past quarter of a century, and which may now be regarded as a staple beverage in all English-speaking countries. The great expansion of the Scotch whisky trade of late years is undoubtedly due in the main to the introduction of blending on scientific lines. There are different types of blends. In some a Highland Malt, in others an Islay, in others again a "grain" flavour may predominate, but, generally speaking, the aim of the blender is to produce an article in which no single constituent "comes through"—*i.e.* is markedly apparent. The best blends are produced by blending a number of "vatted" whiskies. A "vat" is produced by blending a number of whiskies of the same style or type, for instance, ten or fifteen Highland Malts from different distilleries. The "vat" is allowed to mature before being blended with other types to form the final blend. The better-class blends contain, as a general rule, 50 to 60% of Highland and Lowland Malts, 10 to 20% of Islays, and about 20 to 40% of "grain" whisky.

A typical high-class blend would, on analysis, show figures much as follows: *Alcohol*, 45 to 48% by vol.; *total acid*, 30 to 50; *non-volatile acid*, 20 to 30; *esters*, 30 to 60; *higher alcohols*, 120 to 170; *aldehydes*, 15 to 25; *furfurol*, 2·5 to 3·5.

Irish Whisky.—Irish pot-still whisky is sharply differentiated from the Scotch variety in that (*a*) the raw materials employed are generally composed largely of unmalted grain, (*b*) the malt is not peat-cured, (*c*) the process of distillation is entirely different both as regards method and apparatus (see SPIRITS). The result is that whereas Scotch whisky possesses a characteristic dry, clean flavour, Irish whisky is round and sweet, with a full ethereal bouquet. The general run of Irish pot-still whiskies are made with 30 to 50% of malted barley, the balance being rye, oats, unmalted barley and wheat. A few distilleries employ malted barley only, but the product so obtained—owing to the different methods employed and the absence of peat curing—is quite different from Scotch malt whisky. The Irish "grain" or "patent still" whiskies are made in a manner practically identical with that employed for Scotch "grain," but as a class they are somewhat lighter as regards flavour and body than the latter. Irish whiskies are not classified territorially, although occasionally the distinction of "Dublin" or "Country makes" is recognized in the trade. Broadly speaking, however, the differences between Irish whiskies are not due to class, but to individual variation.

American Whisky.—There are two main varieties of American whisky, namely, Rye whisky, the predominant raw material in the manufacture of which is rye, and Bourbon or corn whisky, made mainly from Indian corn (maize). Both varieties possess a much higher flavour and greater body than do the Scotch or Irish whiskies, due partly to the class of raw material employed, and partly to the method of distillation. Broadly speaking, the American self (so-called "straight") whiskies contain double the quantity of secondary or "by" products present in Scotch or Irish whiskies.

American whiskies are almost invariably stored in very heavily charred barrels, which, while it very appreciably affects the flavour, is necessary, inasmuch as it is doubtful whether it would be possible to mature these exceedingly heavy whiskies within a commercially reasonable time without the cleansing and purifying effect of the charcoal formed by the burning of the cask. Even with the aid of the charred cask, the average maturation time of the American pot-still whiskies is certainly two or three years longer than that of Scotch and Irish whiskies. (P. S.)

Composition of Irish Whiskies (Analyses by Schidrowitz and Kaye).

Description.	(Results expressed in grams per 100 litres of absolute alcohol.)						
	Alcohol per cent by vol. [1]	Total Acid.	Non-volatile Acid.	Esters.	Higher Alcohols.	Aldehydes.	Furfurol.
Dublin Whiskies—							
1.[2] Pot-still (new) . .	71·72	7	Trace	34	145	12	5·5
1a. Pot-still. From same distillery, 14 years old (plain wood) .	57·08	29	8	38	185	68	3·3
2. Pot-still (new) . .	74·11	6	Nil	28	233	8	4·1
2a. Pot-still. From same distillery, 14 years old	60·47	32	8	47	264	21	4·4
3. Pot-still, 14 years old	63·42	87	45	87	226	32	4·5
4. Patent-still (new) .	70·76	17	Trace	25	38	. .	. .

[1] Irish whisky is generally distilled at about 50 O.P. and reduced with water to 25 O.P. prior to storage.

[2] Nos. 1, 2, 3 and 4 represent different distilleries.

WHISKY INSURRECTION, THE, an uprising in Western Pennsylvania in 1794 against the Federal Government, occasioned by the attempted enforcement of the excise law (enacted by Congress March 1791) on domestic spirits. The common prejudice in America against excise in any form was felt with especial strength in Western Pennsylvania, Virginia and North Carolina, where many small whisky stills existed; and protests were made almost immediately by the Pennsylvanians. Albert Gallatin (*q.v.*) took a leading part in expressing their resentment in a constitutional manner, but under the agitator David Bradford the movement soon developed into excesses. The attempt to enforce the law led to stormy scenes and riotous violence, the Federal revenue officers in some cases being tarred and feathered; but in September 1794 President Washington, using the new powers bestowed by Congress in May 1792, despatched a considerable force of militia against the rebellious Pennsylvanians, who thereupon submitted without bloodshed, the influence of Gallatin being used to that end. Bradford fled to New Orleans; some of his more prominent supporters were tried for treason and convicted, but promptly pardoned. In American history this so-called "rebellion" is important chiefly on account of the emphasis it gave to the employment by the Federal Executive of the new powers bestowed by Congress for interfering to enforce Federal laws within the states. It is indeed inferred from one of Hamilton's own letters that his object in proposing this excise law was less to obtain revenue than to provoke just such a local resistance as would enable the central government to demonstrate its strength.

WHIST, a game at cards. The etymology of the name is disputed. Possibly it is of imitative origin, from "whist" (Hist! Hush! Silence!). "It is called Whist from the silence that must be observed in the play" (Cotton, *Compleat Gamester*). In the 16th century a card game called *triumph* or *trump* was commonly played in England. A game called *trionfi* is mentioned as early as 1526, and *triumphus Hispanicus* in 1541. *La triomphe* occurs in the list of games played by Gargantua (Rabelais, first half of 16th century). In Giovanni Florio's *Worlde of Wordes* (1598) *trionfo* is defined as "the play called trump or ruff." It is probable that the game referred to by the writers quoted is *la triomphe* of the early editions of the *Académie des jeux*. It is important to note that this game, called by Charles Cotton "French ruff," is similar to écarté. "English ruff-and-honours," also described by Cotton, is similar to whist. If we admit that ruff and trump are convertible terms, of which there is scarcely a doubt, the game of trump was the precursor of whist. A purely English origin may, therefore, be claimed for trump (not *la triomphe*). No record is known to exist of the invention of this game, nor of the mode of its growth into ruff-and-honours, and finally into whist. The earliest reference to trump in English is believed to occur in a sermon by Latimer, "On the Card," preached at Cambridge, in Advent, about the year 1529. He says, "The game that we play at shall be the triumph. . . . Now turn up your trump, . . . and cast your trump, your heart, on this card." In *Gammer Gurton's Needle* (1575) Dame Chat says, "We be fast set at trumpe." Eliot (*Fruits for the French*, 1593) calls trump "a verie common ale-house game." Richard Price or Rice (*Invective against Vices*, 1579) observes that "renouncing the trompe and comming in againe" (*i.e.* revoking intentionally) is a common sharper's trick. Cotton in his *Compleat Gamester* says, "He that can by craft overlook his adversary's game hath a great advantage." Thomas Dekker (*Belman of London*, 1608) speaks of the deceits practised at "tromp and such like games." Trump also occurs in *Antony and Cleopatra* (written about 1607), with other punning allusions to card-playing—

> "She, Eros, has
> Packed cards with Caesar, and false-played my glory
> Unto an enemy's triumph."—Act iv.

Ruff-and-honours, if not the same game as trump, was probably the same with the addition of a score for the four highest cards of the trump suit. A description of the game is first met with in *The Compleat Gamester* (1674) by Cotton. He states that ruff-and-honours (*alias* slamm) and whist are games very commonly known in England. It was played by four players, paired as partners, and it was compulsory to follow suit when able. The cards ranked as at whist, and honours were scored as now. Twelve cards were dealt to each player, four being left in the stock. The top card of the stock was turned up for trumps. The holder of the ace of trumps was allowed to *ruff*, *i.e.* to take in the stock and to put out four cards from his hand. The game was played nine up; and at the point of eight honours could be called, as at long whist. Cotton adds that at whist there was no stock. The deuces were put out and the bottom card was turned up for trumps.

It is believed that the earliest mention of whist is by Taylor, the Water Poet (*Motto*, 1621). He spells the word "whisk." The earliest known use of the present spelling is in *Hudibras, the Second Part* (spurious), 1663. The word is afterwards spelt indifferently whisk or whist for about half a century. Cotton (1674) spells it both ways. Richard Seymour (*Court Gamester*, 1734) has "whist, vulgarly called whisk." While whist was undergoing this change of name, there was associated with it the additional title of *swabbers* (probably allied to sweep, or sweep-stakes). Fielding (*History of Mr Jonathan Wild*) says that whisk-and-swabbers was "the game then [1682] in chief vogue." Francis Grose (*Classical Dictionary of the Vulgar Tongue*, 1785) states that swabbers are "the ace of hearts, knave of clubs, ace and duce of trumps at whist." The true function of the swabbers is not positively known; it is probable that the holders of these cards were entitled to receive a certain stake from the other players. Swabbers dropped out of general use during the 18th century. The points of the game rose from nine to ten ("nine in all," Cotton, 1725; "ten in all," Seymour, 1734, "rectified according to the present standard of play"). Simultaneously with this alteration, or closely following it, the entire pack of fifty-two cards was used, the deuces being no longer discarded. This improvement introduces the odd trick, an element of great importance in modern whist. Early in the 18th century whist was not a fashionable game. The Hon. Daines Barrington (*Archaeologia*, vol. viii.) says it was the game of the servants' hall. Contemporary writers refer to it in a disparaging way, as being only fit for hunting men and country squires, and not for fine ladies or people of quality. According to Barrington, whist was first played on scientific principles by a party of gentlemen who frequented the Crown Coffee House in Bedford Row, London, about 1728. They laid down the following rules: "Lead from the strong suit; study your partner's hand; and attend to the score." Shortly afterwards the celebrated Edmond Hoyle (*q.v.*) published his *Short Treatise* (1742). It has been surmised by some that Hoyle belonged to the Crown Coffee House party. This, however, is only a conjecture. There is abundant evidence to show that, in the middle of the 18th century, whist was regularly played at the coffee houses of London and in fashionable society. From the time of Hoyle the game continued to increase in public estimation, until the introduction of bridge, which has to a large extent replaced it, but which has much in common with it.

It will be of interest to mark the successive stages through which whist passed from the time of Cotton. The only suggestions as to play in Cotton are that, "though you have but mean cards in your own hand, yet you may play them so suitable to those in your partner's hand that he may either trump them or play the best of that suit"; also that "you ought to have a special eye to what cards are play'd out, that you may know by that means either what to play if you lead or how to trump securely and advantagiously." It appears from this that the main ideas were to make trumps by ruffing, to make winning cards, and to watch the fall of the cards with these objects. In the rules laid down by the Crown Coffee House school a distinct advance is to be noticed. Their first rule, "Lead from the strong suit," shows a sound knowledge of the game. Their second rule, "Study your partner's hand," though sound, is rather vague. Their third rule, "Attend to the score," if amended into "Play to the score," is most valuable. From the Crown Coffee House school to Hoyle is rather a wide jump; but there is no intervening record. Hoyle in his *Short Treatise* endorses and illustrates the "Crown" rules. He also brought the doctrine of probabilities to bear on the game, and gave a number of cases which show a remarkable insight into the play.

About 1770 was published William Payne's *Maxims for Playing the Game of Whist*. The advance in this book is decided, as it inculcates the rules of leading invariably from five trumps and the return of the highest card from three held originally. Matthews's *Advice to the Young Whist-Player* (anon., 1804) repeats the "maxims of the old school," with "observations on those he thinks erroneous" and "with several new ones," but some of the maxims which he thinks erroneous are now generally allowed to be correct.

Soon after Matthews wrote the points of the game were cut down from ten (long whist) to five (short whist). Clay's account of this change is that, about the beginning of the 19th century, Lord Peterborough having lost a large sum of money, the players proposed to make the game five up, in order to give the loser a chance of recovering his loss. The new game, short whist, was found to be so lively that it soon became general, and eventually superseded the long game. "Coelebs" (*Laws and Practice of Whist*, 1851), who mainly repeats former writers, only calls for mention because he first printed in his second edition (1856) an explanation of the call for trumps. Calling for trumps was first recognized as part of the game by the players at Graham's Club about 1840. Long whist may be said to have died about 1835. The new game necessarily caused a change in the style of play, as recorded by James Clay in *The Laws of Short Whist, and a Treatise on the Game* (1864).

Whist then travelled, and about 1830 some of the best French whist-players, with Deschapelles at their head, modified and improved the old-fashioned system. They were but little influenced by the traditions of long whist, and were not content merely to imitate the English. The French game was the scorn and horror of the old school, who vehemently condemned its rash trump leads; those who adopted the practice of the new school were found to be winning players.

Dr William Pole (*Philosophy of Whist*, 1883) remarks that the long experience of adepts had led to the introduction of many improvements in detail since the time of Hoyle, but that nothing had been done to reduce the various rules of the game to a systematic form until between 1850 and 1860, when a knot of young men proceeded to a thorough investigation of whist, and in 1862 Henry Jones, one of the members of this "little whist school," brought out a work, under the pseudonym of "Cavendish," which "gave for the first time the rules which constitute the art of whist-playing according to the most modern form of the game." The little school was first brought prominently into notice by an article on whist in the *Quarterly Review* of January. Whist had previously been treated as though the "art" of the game depended on the practice of a number of arbitrary conventions. But it was now shown that all rules of whist-play depend upon and are referable to general principles. Hence, as soon as these general principles were stated, and the reasons for their adoption were argued, players began to discuss and to propose innovations on the previously established rules of play.

A further development was the introduction of the system of discarding from the best protected suit instead of from the weakest, when the adversaries have the command in trumps. Soon after this (1872) followed the "echo" of the call for trumps, and contemporaneously with the echo the lead of the penultimate card from suits of five cards or more, not including the ace, a lead that was so vigorously opposed by some players that "the grand battle of the penultimate" ensued. The old players indeed regarded the new system with the same horror as they had formerly displayed with respect to the French school, stigmatizing it not only as an innovation, but as a private understanding, and even as cheating! Even Clay, the greatest player of his day, was at first an opponent of the penultimate lead, but after consideration adopted it. General Drayson (*Art of Practical Whist*, 1879) was the first to propose an analogous system, namely, that six cards in a suit, not including the ace, could be shown by leading the *antepenultimate* card, but his proposal, logical though it was, did not at first find favour. Before this (1874–1875) leads from high cards, having regard to the number held in the suit, had not escaped attention, several innovations being introduced, but it yet remained for some one to propound a constant method of treating *all* leads, and to classify isolated rules so as to render it possible to lay down general principles. This was done in 1883–1884 by Nicholas Browse Trist of New Orleans, who introduced the system of "American Leads." American leads propose a systematic course of play when opening and continuing the lead from the strong suit. First, with regard to a low card led. When you open a strong suit with a low card, lead your fourth best. When opening a four-card suit with a low card, the lowest, which is the fourth best, is the card selected. When opening a five-card suit with a low card, the penultimate card is selected. Instead of calling it the penultimate, call it the fourth best. So with a six-card suit; but, instead of antepenultimate, say fourth best. And so on with suits of more than six cards: disregard all the small cards and lead the fourth best. Secondly, with regard to a high card led, followed by a low card. When you open a strong suit with a high card and next lead a low card, lead your original fourth best. The former rule was to proceed with the lowest. Thus, from ace, knave, nine, eight, seven, two, the leader was expected to open with the ace, and then to lead the two. An American leader would lead ace, then eight. Thirdly, with regard to a high card led, followed by a high card. When you remain with two high indifferent cards, lead the higher if you opened a suit of four, the lower if you opened a suit of five or more. A player who adopts this system notifies by it to his partner that, when he originally leads a low card, he holds exactly three cards higher than the one led; when he originally leads a high card, and next a low one, he still holds exactly two cards higher than the second card led; and when he originally leads a high card, and follows it with a high card, he indicates in many cases, to those who know the analysis of leads (as laid down in whist books), whether the strong suit consisted originally of four or of more than four cards. (See *Whist Developments*, by "Cavendish," 1885.)

These leads led to an overhauling of the play of the second and third hands, whist becoming apparently so complicated as to deter players of moderate ability from plunging into its intricacies. This fact, combined with the introduction of the fascinating and simpler game of bridge, caused a distinct decadence in the popularity of whist during the last decade of the 19th century.

Whist (*i.e.* modern "short" whist) is played with a full pack of 52 cards. The ace is the highest, except in cutting, when it is the lowest. After the ace rank king, queen, &c., in order, down to the two. Four persons play, but with only three or two players the game can still be played with certain modifications (see *Dummy* below). The players each draw a card, the one who gets the lowest deals, and has choice of cards and seats. The player who draws the next lowest is his partner; if two or more players draw cards of equal value, they cut again, the lowest playing with the original lowest. The cards are then cut and dealt one by one from left to right. The last card is turned up to show the trump suit. In America the trump suit is sometimes cut for, the card then being replaced in the pack before shuffling (blind trump). A misdeal passes the deal, and at the end of each hand it passes in any case to the player on the left. At the end of the first trick the dealer takes the turned trump card into his hand. If he fails to do so, the card may be called to any subsequent trick. The player on the dealer's left leads, and it is compulsory for the others to follow suit if possible, under penalty for "revoke" (by which the adversaries may either add three to their score, deduct three from the defaulting side, or take three tricks of theirs and add them to their own). A player who cannot follow suit may play any card he chooses to the trick unless he has exposed a card and the adversaries call it. The highest card, or trump (if one is played), wins the trick, the winner leading to the next trick. When all the cards have been played the tricks gained by each side are counted, each trick over six counting one. Six tricks are called "a book." Trump honours—ace, king, queen, knave—also count to the score, but a side which has a score of four at the beginning of a hand cannot score for honours. Tricks count before honours; thus if one side has a score of one and holds four honours, while the other has a score of four and makes the odd trick, the latter wins a double, the honours not counting, as the game has already been won by tricks. The scores for honours are as follows, but some players halve these scores, or, particularly in America, do not count honours at all. This is a matter of arrangement. If one side holds all four honours, four points; if three, two points; if both sides hold two there is no score, honours being "divided," or "easy." A rubber consists of the best of three games, unless one side wins the first two games. A game consists of five points. Thus if one side makes nine tricks and holds three honours it scores a game—three points by tricks (or "by cards") and two by honours—but if a revoke has been made, *i.e.* if a player, holding a card of the suit led, has played a card of another suit, the revoking side cannot score more than four, whatever its score in points may be. The side that wins the rubber scores two points in addition to the game points, which are reckoned thus: three points for a "treble," a game in which the adversaries have no score; two points for a "double," *i.e.* when the adversaries have made one or two; one point for a "single," *i.e.* when they have made three or four. Thus two trebles and the rubber (or "rub") count eight points; treble, single and the rub count six points. If the losers have won a game, its value is deducted. Sometimes, by arrangement, the rubber points are raised to four. At the end of a rubber, or, by arrangement, of two rubbers, the players cut again for partners. If others wish to join the table the original players cut, the highest going out. It is not customary for more than two to join—technically, to "cut in"; hence, if two players vacate at the end of the next rubber, they now take the place of the other original pair, who leave without cutting. When only one player "cuts in," the other three retire by rotation, decided by cutting, and come back in their turn. If more than four players wish to form a table, they cut first to see who shall stand out, the highest retiring; they then cut afresh for partners.

Dummy Whist is played by three players, two being partners and the other playing with dummy, whose cards, which must be dealt face downwards, are exposed on the table before the play begins. Dummy has the first deal in every rubber. His cards being exposed he is not considered able to revoke; if he does, there is no penalty, nor is his partner liable for any mistake of his own whereby he cannot profit, *e.g.* by exposing a card; but if he leads from the wrong hand, a suit can be called. At *Double Dummy* each player has a dummy partner, and there is no misdeal, as the deal is a disadvantage.

The leads and the play of the different hands have been so minutely systematized that some of the various text-books should be studied carefully by any one who wishes to become proficient, but some broad general rules may be useful to the beginner. *The original leader* should lead from his strongest, which is almost always his *longest* suit, but if his longest suit contains only four cards and is also the trump suit, opinions differ, though most players would observe the general rule. The same rule applies to subsequent first leads of a suit, unless they have to be modified owing to information derived from cards already played. Thus a player who has to lead after, say, the third or fourth trick may have to sacrifice his lead of his strongest suit in response to a "call for trumps" by his partner. Such a lead is called a "forced" lead, and from three cards the highest should invariably be led, and, if the opportunity occurs, the second best at the second lead, but from four the lowest should be led. This lead of the highest from three applies to all forced leads, whether they are due to a "call," or to the fall of the cards already played. As a broad rule an ace is led always when five or more are held in the suit, but if you have the king also, lead it first; from a five suit without the ace lead the worst but one. With ace and two or three small ones, lead a small one; with ace and one small one, the ace. *The second hand* generally plays his worst card, but if an honour is led and he holds the ace, he should play the ace; also holding queen and king he should play the queen, or with knave, queen and king, the knave. If queen is led it is usually unwise to put on the king, but it is generally sound play to put the knave on the ten. With king and one other, or queen and one other, most players advocate the play of the small card; some would play the king under these conditions, but not the queen; many play the queen and not the king; but the state of the score may affect the play. If it is important to get the lead, so as to lead trumps, the honour should be played, but as a rule the second hand reserves his strength. *The third hand* should win the trick if he can, unless he knows that his partner's card is a winning one; consequently he generally plays his highest card. *The fourth hand* should win the trick if he can, as a player is justified in passing a trick only if by so doing he is absolutely sure of winning two.

Returned Leads.—A partner's lead should be returned at once, unless one has a strong suit of one's own, in which event it is advisable to lead a card of it, to guide one's partner as to his future lead, but a lead of trumps must be returned as soon as possible. If a player holds three cards originally in his partner's suit he should invariably return the higher of the two left in his hand after the first round. Thus holding ace, three, two only, he should win with the ace and return the three; when the two falls afterwards, his partner will know that he holds no more. So, with ace, knave, ten only, win with the ace and return the knave, though from a scoring point of view the knave and ten are of equal value. With four originally, return the lowest, but a winning card should always be led or played in the second round, unless there is any special reason for retaining it. If your partner has called for trumps and you get the lead, with four trumps lead the smallest, with three lead the highest, and, if it wins, go in with the next highest. This law is universal in trumps (and also applies to forced leads from three-card suits) even if ace, king and another be held, from which the ordinary lead would be the king. If, however, one adversary has obviously played his last trump, a third round is not always advisable, as two trumps will fall from the leader and his partner, and only one from the adversaries. On the other hand it is generally good play to draw two opposing trumps for one, so that they may not make separately.

In the play of a hand never play an unnecessarily high card—unless you are "calling." Thus, holding ten and knave, play the ten; your partner will infer that you do *not* hold the nine, but *may* hold the knave, and even the queen as well, though all the cards are of equal value for making tricks. Similar inferences should be drawn from all cards played, and should be drawn at the moment. Never play false cards unless you see your partner is so weak that it can do no harm to deceive him; in such a case, with knave and ten, the knave may be played. It is a maxim that information given by play is more valuable to the partner than it is to the two adversaries.

Trumping or "Ruffing" and Discarding. The second player should not trump a doubtful card (*i.e.* a card that his partner might be able to beat), if he is strong in trumps; if weak, he should trump. A winning card from an adversary should be trumped in any case. With weak trumps, it is bad play to "force" one's partner, *i.e.* invite him to trump; but with strong trumps force him. If your partner refuse to trump an adverse winning card, lead a trump at the first opportunity. If you have a "cross-ruff" (*i.e.* if you and your partner can trump different suits), those suits should be led alternately, and not trumps. Force an adversary who is known to be strong in trumps. A weak suit in trumps (three only) should be led if the adversaries have a cross-ruff, or if the game is hopeless unless partner is strong, or if winning cards are held in all plain suits, which might be trumped.

It is usual to discard originally from the weakest suit, but if the adversaries are shown to have strength in trumps, from the strongest, *i.e.* the longest, so as to guard the weak suits. With absolute command of a suit, if you are compelled to discard from it, discard the winning card to inform your partner that you have command; *e.g.* with king, knave, ten—ace and queen being out—discard the king. *The "call" for trumps*, an artifice, which is also known as to "ask," to "signal," to "hang out blue-Peter" or to "peter," for trumps, consists in playing an unnecessarily high card, followed later by a lower one, *e.g.* by playing the three before the two, or the ten before the nine. As the "call" is an imperious command, equivalent to "sacrifice everything, partner, for the sake of leading trumps," it is only justified by great strength in the trump suit. *The echo:* To your partner's call you should "echo," if you hold four or more, by calling yourself, however low your trumps are. Similarly four trumps may be shown in partner's lead of trumps by playing a high card followed by a lower one.

General Maxims. Play to the score. If winning the odd trick saves or wins the game, do not try risky combinations for the sake of getting two or three tricks. Count your cards before playing. If your partner "renounces," *i.e.* discards or trumps, always ask him if he has a card of the suit led, to save the revoke. Announce the score when you mark it. Watch the fall of every card. Study the rules, especially those about penalties and consultation with partner. If the winning of one more trick wins or saves the game, and you hold the winning card, play it, unless it be the winning trump, which is good at any time. Retain the trump-card if you can play others of equal trick-making value; your partner then knows the position of one trump; *e.g.* with nine and ten in addition to the eight, the turn-up, play them before parting with the eight. Keep command of adversaries' suits as long as is judicious; get rid of the command of partner's strong suit. Do not finesse (*i.e.* play a lower card than your highest in the third hand) in partner's suit, unless he leads a high card in an obviously forced lead. Lead through a known strong suit on your left, and (especially) up to a known weak suit on your right. If you have to lead from a suit of two lead the highest. Leading from a "singleton" (your only card in one suit), in order to be able to trump— sometimes disparagingly called "Whitechapelling"—is not generally good play, and results badly unless the side is strong in trumps, but in some circumstances it is useful. Do not lead from a "tenace" (*i.e.* best and third best of a suit) if you have another equally good suit. Remember that whist is a game of combination, and that tricks made by your partner are just as valuable to you as tricks made by yourself. Sort your hand so as to keep the suits separate, red and black alternately, keeping the cards each in order of their value.

For Long Whist the play of the hands and the laws of the game are practically the same as at ordinary or "short" whist, but a more venturesome style of play may be adopted in view of the number of points required, *i.e.* a certain amount of risk may be taken when the odd trick is a certainty in the hope of getting two or three tricks instead. With the score at nine, honours cannot be secured, but at eight a player who holds *two* honours may ask his partner before playing if he too holds an honour, the formula being "Can you *one*, partner?" If the answer is "Yes," the honours are scored and the game ends. There is no "treble" at long whist. A double is scored when the losers are less than five, a single if they have made five or more. The game, however, is almost obsolete.

Progressive Whist.—This form of the game is social rather than scientific, but is a pleasant variety on the ordinary round game. The host provides prizes, as a rule—first, second and "booby" prizes for both ladies and gentlemen, the "booby" prizes going to the players who make the fewest points. Any number of tables may be formed. Partners are selected by lot, two ladies and two gentlemen never being partners. This can be done by means of two sets of tickets of different colours, numbered identically, No. 1 pairing with No. 1 and so on. After the first round there is no drawing for partners, as will be seen. The holders of all tickets numbered 1 and 2 form the first table, of 3 and 4 the second table. Only one pack of cards is needed at each table, but every player should be provided with a scoring card and pencil. The players at all the tables cut for deal, but no dealing is begun before a signal given by the master of the ceremonies. At each table one hand only is played. Honours are not counted. The score is marked by the number of tricks made, or the winner may mark all tricks above six. The winners remain at their original tables. The losers move on, from No. 1 table to No. 2, from No. 2 to No. 3 and from the last table to No. 1. Partners are formed afresh, the gentleman who has just won playing with the lady who has just lost, and *vice versa.* Play may last for one or more complete rounds, or for a given time, indicated by a signal, after which no fresh hand is begun. The scores are then added up and the prizes awarded. In playing the ordinary rules of whist are observed.

A printed existence was first given to the laws of whist by Hoyle in 1743. The fourteen laws then issued were subsequently increased to twenty-four. These laws were the authority until 1760, when the members of White's and Saunders's Chocolate Houses revised them. The revised laws (nearly all Hoyle) were accepted by whist players for over a century, notwithstanding that they were very incomplete. The laws of short whist, a more comprehensive code approved by the Portland and Arlington clubs, were brought out in 1864, and became the accepted standard, small modifications only having been introduced since. The latest edition of the rules should be consulted for what is not indicated in the text.

See *Principles of Whist, Stated and Explained*, by "Cavendish" (London, 1902), the most authoritative work.

WHISTLE, the shrill warbling sound made by forcing the breath through the lips, contracted to form a small orifice, or produced by means of an instrument of the whistle type; also, generally, any similar shrill, hissing or warbling sound, as of a bird's note, of wind through trees, ropes, &c. The O. Eng. *hwistlian*, to whistle, and *hwistlere*, whistler, piper, are closely allied to *hwisprian* or *hwǽstrian*, to whisper, to speak softly or under one's breath; and both are imitative words, representing a shrill hissing sound, cf. Ger. *wispeln*, to whisper, Dan. *hvisle*, to whistle. The instrument known as a "whistle" takes many forms, from the straight flute and flageolet type made of wood or metal and pierced with holes, to the metal signalling pipe used for signalling on board ship or by policemen. Similarly the term is used of the instruments sounded by the escape of steam on a locomotive or other engine and on steamships, &c., as a means of giving signals.

WHISTLER, JAMES ABBOTT McNEILL (1834–1903), American artist, was born at Lowell, Massachusetts, on the 10th of July 1834. His father was Major G. W. Whistler, and his mother one of the Baltimore family of Winans. He was first heard of in Europe in 1857, when he had already been an art student, in Paris, in the studio of Gleyre. His first etchings, those known as "The French Set," were the means of bringing him under the notice of certain people interested in art, but the circulation of these first, like that of his later etchings, has always, of necessity, been more limited than their fame. The impressions from each plate are generally few. It was still in etching that Whistler continued his labours, and, coming to London in 1859, it appears, he almost at once addressed himself to the chronicle of the quaint riverside buildings and the craft of the great stream—the Thames "below Bridge." The "French Set" had included De Hooch-like or Nicholas Maes-like genre pieces, such as "La Vieille aux loques," the "Marchande de moutarde," and "The Kitchen," this last incomparably improved and perfected by the retouching that was accomplished a quarter of a century after the first performance. The Thames series of sixteen etchings, wrought chiefly in 1859, disclosed a new vision of the river, in which there was expressed, with perfect draughtsmanship, with a hitherto unparalleled command of vivacious line, the form of barge and clipper, of warehouse, wharf and waterside tavern. "The Pool," "Thames Police" and "Black Lion Wharf" are perhaps the finest of this series. Before it was begun, Whistler, ere he left Paris, had proceeded far with a plate, existing only in the state of trial proof, and, in that, of extreme rarity. It is called "Paris, Île de la Cité," and has distinct and curious manifestations of a style to be more generally adopted at a later period. For several years after the completion of the "Sixteen Etchings," Whistler etched comparatively little; but about 1870 we find him entering what has been described as his "Leyland period," on account of his connexion with the wealthy shipowner and art patron, Mr Frederick R. Leyland, of Prince's Gate, whose house became famous for Whistler's Peacock Room,[1] painted in 1877. In that period he worked greatly in dry-point. The "Model Resting," one of the most graceful of his figure pieces, and "Fanny Leyland"—an exquisite instance of girl portraiture—are notable performances of this time. To it also belong the largely conceived dry-points, so economical of means and endowed with so singular a unity of effect, the "London Bridge" and "Price's Candle-works." A little later came the splendid visions of the then disappearing wooden bridges of Battersea and Putney, and the plate "The Adam and Eve," which records the river-front of old Chelsea. This, however, is only seen in perfection in the most rare proofs taken before the publication by the firm of Hogarth. From these plates we pass almost imperceptibly to the period of the Venetian etchings, for in 1879, at the instance of the Fine Art Society, Whistler made a sojourn in Venice, and here he wrought, or, to speak accurately, commenced, not only the set of prints known as the "Venice Set," but also the "Twenty-six Etchings"—likewise chiefly, though not wholly, of Venice—issued later by the firm of Dowdeswell. One or two of the minor English subjects of the "Twenty-six Etchings"—those done after the artist's return from Venice—give indications of the phase reached more clearly in certain little prints executed a few years later, and, with perhaps one exception, never formally published. "Fruit Shop," "Old Clothes Shop," and "Fish Shop, busy Chelsea," belong to this time. Later, and bent upon doing justice to quite different themes, which demand different methods, the ever flexible artist again changes his way, and—not to speak of the dainty little records of the places about the Loire, which in method have affinity with the pieces last named—we have "Steps, Amsterdam," "Nocturne, Dance House," with its magical suggestion of movement and light, and the admirable landscape "Zaandam." With the mention of these things may fitly close a sketch of Whistler's periods in etching; but before proceeding to other branches of his work, the main characteristics of the whole series of etchings (of which, in Wedmore's *Whistler's Etchings*, nearly 300 examples are described) should be briefly indicated. These main characteristics are precision and vivacity; freedom, flexibility, infinite technical resource, at the service always of the most alert and comprehensive observation; an eye that no picturesqueness of light and shade, no interesting grouping of line, can ever escape—an eye, that is, that is emancipated from conventionality, and sees these things therefore with equal willingness in a cathedral and a mass of scaffolding, in a Chelsea shop and in a suave nude figure, in the façade of a Flemish palace and in a "great wheel" at West Kensington. Mr Whistler's pictures have as a chief source of their attractiveness those mental qualities of alertness and emancipation. Charm of colour and of handling enhance the hold which they obtain upon such people of taste as may be ready to receive them. There are but very few of them, however, at least very few oil pictures, when one considers the number of years since the artist began to labour; and one notable fact must be at once understood—the admitted masterpieces in painting belong almost entirely to the earlier time. "Sarasate" is an exception, and "Lady Archibald Campbell," and in its smaller, but still charming, way "The Little Rose of Lyme Regis"; but even these—save the "Little Rose"—are of 1885 or thereabouts. A few years earlier than they are the "Connie Gilchrist," the "Miss Alexander," and the "Rosa Corder," and the Thames "Nocturnes"; but we go farther back to reach the "Portrait of the Painter's Mother," which is now in the Luxembourg; the "Portrait of Carlyle," now at Glasgow; the "Cremorne Gardens," the "Nocturne, Valparaiso Harbour," the "Music Room," with little Miss Annie Haden standing by the piano while her mother plays, and the "White Girl," or "Little White Girl," in which Whistler shows the influence, but never the domination, of the Japanese. Of the slight but always exquisitely harmonious studies in water colour, undertaken by Whistler in his middle period, none call for special notice. To the middle time, too, belong, not perhaps all of his slight but delicately modelled pastels of the figure, but at least his more universally accepted pastels of Venetian scenes, in which he caught the sleepy beauty of the Venetian by-way. In pastel, as in painting, in water colour and in etching, Whistler has never been unmindful of the particular qualities of the medium in which he has worked, nor of the applicability of a given medium to a given subject. The result, accordingly, is not now a victory and now a failure, now a "hit" and now a "miss," but rather a succession of triumphs great and small. One other medium taken up by Whistler must now be mentioned. His lithographs—his drawings on the stone in many instances, and in others his drawings on that "lithographic paper" which with some people is the easy substitute for the stone to-day—are perhaps half as numerous as his etchings. Mr T. R. Way has catalogued about a hundred. Some of the lithographs are of figures slightly draped; two or three of the very finest are of Thames subjects—including a "nocturne" at Limehouse, of unimaginable and poetic mystery; others are bright and dainty indications of quaint prettiness in the old Faubourg St Germain, and of the sober lines of certain Georgian churches in Soho and Bloomsbury. An initiator in his own generation, and ever tastefully experimental, Whistler no doubt has found enjoyment in the variety of the mediums he has worked in, and in the variety of subjects he has brilliantly tackled. The absence of concentration in the Whistlerian temperament, the lack of great continuity of effort, may probably prove a drawback to his taking exactly the place as a painter of oil pictures, which, in other circumstances, his genius and his taste would most certainly have secured for him. In the future Whistler must be accounted, in oil painting, a master exquisite but rare. But the number and the range of his etched subjects and the extraordinary variety of perception and of skill which he has brought to bear upon the execution of his nearly three hundred coppers, ensure, and have indeed already compassed, the acceptance of him as a master among masters in that art of etching. Rembrandt's, Van Dyck's, Méryon's, Claude's, are, in fact, the only names which there is full warranty for pronouncing beside his own.

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[1] Whistler quarrelled with Leyland, and eventually painted his life-size portrait as a devil with horns and hoofs.

No account of Whistler's career would be complete without a reference to his supremely controversial personality. In 1878 he brought a libel action against Ruskin for his criticisms in *Fors Clavigera* (1877). Ruskin had denounced one of his nocturnes at the Grosvenor Gallery as "a pot of paint flung in the public face." After a long trial, Whistler was awarded a farthing damages. His examination caused much interest, especially in artistic circles, on account of his attitude in vindication of the purely artistic side of art; and it was in the course of it that he answered the question as to how long a certain "impression" had taken him to execute by saying, "All my life." His eccentricity of pose and dress, combined with his artistic arrogance, sharp tongue, and bitter humour, made him one of the most talked-about men in London, and his *mots* were quoted everywhere. He followed up his quarrel with Ruskin by publishing a satirical pamphlet, *Whistler* v. *Ruskin: Art* v. *Art Critics*. In 1885 he gave his *Ten o'Clock Lecture* in London, afterwards embodied in *The Gentle Art of Making Enemies* (1890). The substance of this flippantly written and amusing outburst was an insistence on the liberty of the artist to do what was right in his artistic eyes, and the inability of the public or the critics to have any ideas about art worth considering at all. In 1895 another quarrel, with Sir William Eden, whose wife's portrait Whistler had painted, but refused to hand over, came into the courts in Paris; and Whistler, though allowed to keep his picture, was condemned in damages. In later years he lived mainly in Paris, but he returned to live in London in 1902; and he died on the 17th of July 1903 at 74 Cheyne Walk, Chelsea. In 1888 he had married Mrs Goodwin, widow of E. W. Goodwin, the architect, and daughter of J. B. Philip, the sculptor; she died in 1896, leaving no children. In 1886 he became president of the Royal Society of British Artists (a title at which afterwards he scoffed); and he took a leading part later in founding the International Art Society, of which he was the first president. His "Nocturne in blue and silver" was presented to the National Gallery after his death by the National Art Collection Fund.

See also T. R. Way and G. R. Dennis, *The Art of J. McN. Whistler* (1901); F. Wedmore, *Mr Whistler's Etchings*; Théodore Duret, *Histoire de J. McN. Whistler et de son œuvre* (1904); Mortimer Menpes, *Whistler as I knew him*; W. G. Bowdoin, *Whistler, the Man and his Work* (1902); Catalogue of Memorial Exhibition (International Society, 1905); and E. R. and J. Pennell, *The Life of James McNeill Whistler* (1908). (F. We.)

WHISTON, WILLIAM (1667–1752), English divine and mathematician, was born on the 9th of December 1667 at Norton in Leicestershire, of which village his father was rector. He was educated privately, partly on account of the delicacy of his health, and partly that he might act as amanuensis to his father, who had lost his sight. He afterwards entered at Clare College, Cambridge, where he applied himself to mathematical study, and obtained a fellowship in 1693. He next became chaplain to John Moore (1646–1714), the learned bishop of Norwich, from whom he received the living of Lowestoft in 1698. He had already given several proofs of his noble but overscrupulous conscientiousness, and at the same time of a propensity to paradox. His *New Theory of the Earth* (1696), although destitute of sound scientific foundation, obtained the praise of both Newton and Locke, the latter of whom justly classed the author among those who, if not adding much to our knowledge, "at least bring some new things to our thoughts." In 1701 he resigned his living to become deputy at Cambridge to Sir Isaac Newton, whom two years later he succeeded as Lucasian professor of mathematics. In 1707 he was Boyle lecturer. For several years Whiston continued to write and preach both on mathematical and theological subjects with considerable success; but his study of the *Apostolical Constitutions* had convinced him that Arianism was the creed of the primitive church; and with him to form an opinion and to publish it were things almost simultaneous. His heterodoxy soon became notorious, and in 1710 he was deprived of his professorship and expelled from the university. The rest of his life was spent in incessant controversy—theological, mathematical, chronological and miscellaneous. He vindicated his estimate of the *Apostolical Constitutions* and the Arian views he had derived from them in his *Primitive Christianity Revived* (5 vols., 1711–1712). In 1713 he produced a reformed liturgy, and soon afterwards founded a society for promoting primitive Christianity, lecturing in support of his theories at London, Bath and Tunbridge Wells. One of the most valuable of his books, the *Life of Samuel Clarke*, appeared in 1730. While heretical on so many points, he was a firm believer in supernatural Christianity, and frequently took the field in defence of prophecy and miracle, including anointing the sick and touching for the king's evil. His dislike to rationalism in religion also made him one of the numerous opponents of Benjamin Hoadly's *Plain Account of the Nature and End of the Sacrament*. He proved to his own satisfaction that Canticles was apocryphal and that Baruch was not. He was ever pressing his views of ecclesiastical government and discipline, derived from the *Apostolical Constitutions*, on the ecclesiastical authorities, and marvelled that they could not see the matter in the same light as himself. He assailed the memory of Athanasius with a virulence at least equal to that with which orthodox divines had treated Arius. He attacked Sir Isaac Newton's chronological system with success; but he himself lost not only time but money in an endeavour to discover the longitude. Of all his singular opinions the best known is his advocacy of clerical monogamy, immortalized in the *Vicar of Wakefield*. Of all his labours the most useful is his translation of Josephus (1737), with valuable notes and dissertations, often reprinted. His last "famous discovery, or rather revival of Dr Giles Fletcher's," which he mentions in his autobiography with infinite complacency, was the identification of the Tatars with the lost tribes of Israel. In 1745 he published his *Primitive New Testament*. About the same time (1747) he finally left the Anglican communion for the Baptist, leaving the church literally as well as figuratively by quitting it as the clergyman began to read the Athanasian creed. He died in London, at the house of his son-in-law, on the 22nd of August 1752, leaving a memoir (3 vols., 1749–1750) which deserves more attention than it has received, both for its characteristic individuality and as a storehouse of curious anecdotes and illustrations of the religious and moral tendencies of the age. It does not, however, contain any account of the proceedings taken against him at Cambridge, these having been published separately at the time.

Whiston is a striking example of the association of an entirely paradoxical bent of mind with proficiency in the exact sciences. He also illustrates the possibility of arriving at rationalistic conclusions in theology without the slightest tincture of the rationalistic temper. He was not only paradoxical to the verge of craziness, but intolerant to the verge of bigotry. "I had a mind," he says, "to hear Dr (John) Gill preach. But, being informed that he had written a folio book on the Canticles, I declined to go to hear him." When not engaged in controversy he was not devoid of good sense. He often saw men and things very clearly, and some of his *bon mots* are admirable.

WHITAKER, JOSEPH (1820–1895), English publisher, was born in London on the 4th of May 1820, and apprenticed to a bookseller at the age of fourteen. After a long experience with various bookselling firms, he began business on his own account as a theological publisher. In January 1858 he started the *Bookseller*, and for 1869 published the first issue of *Whitaker's Almanack*, the annual work of reference, which also met with immediate success. In 1874 he published the first edition of the *Reference Catalogue of Current Literature*, of which several editions have since appeared. Whitaker died at Enfield on the 15th of May 1895. He had been the father of fifteen children.

WHITBREAD, SAMUEL (1758–1815), English politician, came of a Bedfordshire Nonconformist family; his father had made a considerable fortune as owner of the well-known brewery associated with his name. Educated at Eton and St John's College, Cambridge (after originally going to Christ Church, Oxford), he began by entering the brewing business; but after his marriage with the daughter of the 1st Earl Grey in 1789 he took to politics, and in 1790 was elected for Bedfordshire as a Whig, attaching himself to Fox. He became known as a social and financial reformer and a constant assailant in parliament of all sorts of abuses. It was on his motion in 1805 that Lord Melville was impeached for financial maladministration of the navy, and he conducted the case for the prosecution. His Poor Law bill in 1807, an elaborate Radical scheme, came to nothing. Whitbread continued to be a constant speaker in parliament, and the principal representative of Liberal criticism, a monument of opposition tactics. He opposed the regency, championed the princess of Wales, and led the peace party; and the caricaturists were busy with his personality. In 1809 he became chairman of the committee for rebuilding Drury Lane theatre, and for some time he was immersed in controversies connected with it, which eventually seem to have unstrung his mind, for he committed suicide on the 6th of July 1815. The Whitbread influence in Liberal politics continued to be very strong in Bedfordshire in later generations, his son William Henry (from 1818 to 1837) and grandson Samuel (from 1852 to 1895) representing Bedford for many years.

WHITBY, a seaport, watering-place and market town in the Whitby parliamentary division of the North Riding of Yorkshire, England, 245 m. N. from London, on the North-Eastern railway. Pop. of urban district (1901) 11,755. There are a terminal station in the town and a station at West Cliff on the Saltburn branch. Whitby is beautifully situated at the mouth and on both banks of the River Esk; the old town of narrow streets and picturesque houses standing on the steep slopes above the river, while the modern residential quarter is mainly on the summit of West Cliff. A long flight of steps leads up the eastern height to the abbey, the ruins of which gain a wonderful dignity from their commanding position. This was a foundation of Oswy, king of Northumbria, in 658, in fulfilment of a vow for a victory over Penda, king of Mercia. It embraced an establishment for monks and (until the Conquest) for nuns of the Benedictine order, and under Hilda, a grand-niece of Edwin, a former king of Northumbria, acquired high celebrity. The existing ruins comprise parts of the Early English choir, the north transept, also Early English but of later date, and the rich Decorated nave. The west side of the nave fell in 1763 and the tower in 1830. On the south side are foundations of cloisters and domestic buildings. Adjoining the abbey is Whitby Hall, built by Sir Francis Cholmley about 1580 from the materials of the monastic buildings, and enlarged and fortified by Sir Hugh Cholmley about 1635. A little below the abbey is the parish church of St Mary, originally Norman, and retaining traces of the first building; owing to a variety of alterations at different periods, and the erection of high wooden pews and galleries, its appearance is more remarkable than beautiful. A modern cross in the churchyard commemorates St Caedmon, the Northumbrian poet (*c.* 670), who was a monk at the abbey and there died. Other features of the town are the pleasant promenades and gardens on West Cliff, the antiquarian and geological museum, and an excellent golf course. The coast is cliff-bound and very beautiful both to the north and to the south, while inland the Esk traverses a lovely wooded vale, surrounded by open, high-lying moors. Whitby is a quiet resort, possessing none of the brilliance of Scarborough on the same coast. A large fishing industry is carried on from the harbour, which is formed by the mouth of the river and protected by two piers. The manufacture of ornaments from the jet found in the vicinity forms a considerable industry. The jet is a species of petrified wood found towards the bottom of the Upper Lias, and its use for the purpose of ornament dates from very early times. A former activity in shipbuilding is of interest through the recollection that here were constructed the ships for Captain Cook's voyages. Wooden ships and boats are still built, and rope-making and sail-making are carried on.

Whitby (*Streanaeshalch c.* 657–857; *Prestebi c.* 857–1080; *Witeby*, &c. *c.* 857 onwards) is first mentioned by Bede, who states that a religious house was established here about A.D. 657. In the 9th century it was destroyed by the Danes, but being refounded became the centre of a Danish colony, and until laid waste by the Conqueror was the most prosperous town in the district. Henry I. made a grant to the abbot and convent of Whitby of a burgage in the vill of Whitby, and Richard de Waterville, abbot 1175–1190, granted the town in free burgage to the burgesses. In 1200 King John, bribed by the burgesses, confirmed this charter, but in 1201, bribed by the successor of Richard de Waterville, quashed it as injurious to the dignity of the church of Whitby. A bitter struggle went on, however, till the 14th century, when a trial resulted in a judgment against the burgesses. In 1629 Whitby petitioned for incorporation on the ground that the town was in decay through want of good government and received letters patent giving them self-government. However, in 1674–1675 the crown, probably in gratitude for the part played by the Cholmleys in the Civil War, restored to the lords of the manor all the liberties ever enjoyed by the abbots of Whitby in Whitby and Whitby Strand. Whitby became a parliamentary borough under the Reform Act of 1832, returning one member until it was disfranchised under the Redistribution of Seats Act 1885. At the beginning of the 14th century Sir Alexander Percy claimed the hereditary right of buying and selling in Whitby without payment of toll. The market was held time out of mind on Sunday until the reign of Henry VI., who changed the day to Saturday, still the market day. A fortnightly cattle market was granted by Charles I. Henry I. granted to the abbot of Whitby a fair at the feast of St Hilda and the king's firm peace to all coming to the fair. A second fair was used later, but neither of them is any longer held. There was a port at Whitby in the 12th century and probably before, and though never important there have always since been traces of Whitby shipping and merchandise. In medieval times the salting and sale of herrings and the sale of cod, fish and other products of the North Sea fishery were the only industries. Whale-fishing began in 1753.

See J. C. Atkinson, *Memorials of Old Whitby* (London, 1894); Lionel Charlton, *History of Whitby* (York, 1779); George Young, *History of Whitby* (Whitby, 1817); *Victoria County History, Yorkshire, North Riding.*

WHITCHURCH, a market town in the Newport parliamentary division of Shropshire, England, 171 m. N.W. from London on a joint line of the London & North-Western and Great Western railways, and the terminus of the Cambrian railway. Pop. of urban district (1901) 5221. Malting and cheese-making are the principal industries. The church of St Alkmund, rebuilt in the 18th century, retains the fine tomb of John Talbot, first earl of Shrewsbury, who fell at the battle of Bordeaux (1453). The town hall and other public buildings are modern. The grammar school was founded in 1550, and here (*c.* 1791) Reginald Heber, Bishop of Calcutta, was educated. The parish of Whitchurch extends into Cheshire.

Whitchurch was at first known as *Westun* and belonged before the Conquest to King Harold, but was afterwards granted to Earl Roger, of whom William de Warenne was holding it at the time of the Domesday Survey. The name is said to have been altered to Whitchurch or Album Monasterium on account of a stone church built there soon after 1086. The manor appears to have been held by a younger branch of the Warenne family, from whom it passed by marriage to the families of Lestrange and Talbot. It was sold by the Talbots to Thomas Egerton, from whom it passed to the earls of Bridgwater and eventually to the present owner, Earl Brownlow. Whitchurch is mentioned as a borough in the 14th century, and was governed by a bailiff, but its privileges, which sprang up with the castle, appear to have disappeared after its decay. The town has never been represented in parliament nor noted for any trade except agriculture. In 1228 John Fitz-Alan received the right of changing the day of the market he held at Whitchurch from Thursday to Monday, and in 1362 a fair lasting three days from the feast of SS. Simon and Jude was granted to John Lestrange. Lord Brownlow granted the market rights to the local authority.

WHITE, ANDREW DICKSON (1832–), American educationist, was born in Homer, New York, on the 7th of November 1832. He graduated at Yale (A.B.) in 1853, studied at the Sorbonne in 1854, and at the University of Berlin in 1855–1856, meanwhile serving as attaché at the United States Legation at St Petersburg in 1854–1855. He was professor of history and English literature in 1857–1863, and lecturer on history in 1863–1867 at the University of Michigan. In 1864–1867 he was a member of the New York state Senate, and as chairman of the Committee on Education took an active part in formulating the educational features of the bill under which Cornell University (*q.v.*) was incorporated (1865). At Mr Cornell's suggestion Mr White drew up a plan of organization for the institution, and in 1867 became its first president, which post he held continuously until 1885, serving thereafter as a member of the board of trustees and of its executive committee. During his administration he greatly strengthened the curriculum of the university, to which he gave his architectural library, and, upon his retirement, his historical and general library of about 20,000 volumes (including bound collections of pamphlets) and about 3000 unbound pamphlets, which was installed in a special room in the main library building of the university. In recognition of this gift the departments of history and political science of the university have been named the President White School of History and Political Science. In 1870 President Grant appointed Benjamin F. Wade, Mr White and Samuel G. Howe a commission to visit Santo Domingo and report on the advisability of the president's project for annexing it to the United States, and in 1895 he was appointed by President Cleveland a member of the commission established to determine the boundary between Venezuela and British Guiana. Dr White was United States minister to Germany in 1879–1881, and to Russia in 1892–1894, and was United States ambassador to Germany in 1897–1903. In 1899 he was president of the American delegation at the Hague Peace Conference. He received the degree of LL.D. from the University of Michigan (1867), from Cornell (1886), from Yale (1887), from St Andrews, Scotland (1902), from Johns Hopkins, (1902), and from Dartmouth (1906); L.H.D. from Columbia (1887) and D.C.L. from Oxford (1902). He was also made an officer of the Legion of Honour, was awarded the royal gold medal of Prussia for arts and sciences in 1902, was president of the American Historical Association, of which he was a founder, in 1884, and was actively identified with various other learned bodies.

His publications include *The Greater States of Continental Europe* (1874); *A History of the Warfare of Science with Theology in Christendom* (2 vols., 1896), his most important work, his *Autobiography* (2 vols., New York, 1905) and *Seven Great Statesmen* (1910).

WHITE, SIR GEORGE STUART (1835–), British field marshal, the son of an Irish country gentleman, was born in County Antrim on the 6th of July 1835. He was educated at Sandhurst, and in 1853 joined the Inniskillings, with which regiment he served in India during the Mutiny in 1857. In the second Afghan War (1878–80) he was second in command of the Gordon Highlanders, whom he led in their charge at the battle of Charasiah. For conspicuous gallantry in this action, and again shortly afterwards at Kandahar, he received the Victoria Cross. In 1881 he assumed command of the Gordon Highlanders, and took part in the Nile Expedition of 1884–85. As brigadier in the Burmese War (1885–87) he rendered distinguished service, for which he was promoted major-general; and when Sir Frederick (afterwards Lord) Roberts returned to India from Burma in 1887, White was left in command of the force charged with the duty of suppressing the dacoits and pacifying the country. This he accomplished with a thoroughness which earned the thanks of the government of India. He was in command of the Zhob expedition in 1890, and in 1893 he succeeded Lord Roberts as commander-in-chief in India; and during his tenure of this office directed the conduct of the Chitral expedition in 1895 and the Tirah campaign in 1897. In the latter year he was made G.C.B. and in 1898 G.C.S.I. Returning to England in 1898 he became quartermaster-general to the forces; and on the outbreak of the Boer War in 1899 he was given command of the forces in Natal. He defeated the Boers at Elandslaagte on the 21st of October 1899 and at Reitfontein on the 24th; but the superior numbers of the Boers enabled them to invest Ladysmith, which Sir George White defended in a siege lasting 119 days, from the 2nd of November 1899 to the 1st of March 1900, in the course of which he refused to entertain Sir Redvers Buller's suggestion that he should arrange terms of capitulation with the enemy (see LADYSMITH, SIEGE and RELIEF OF). After the relief of Ladysmith, White, whose health had been impaired by the siege, returned to England, and was appointed governor of Gibraltar (1900–1904). King Edward VII., who visited the fortress in 1903, personally gave him the baton of a field marshal. In 1905 Sir George White was appointed governor of Chelsea Hospital, and in the same year was decorated with the Order of Merit.

See T. F. G. Coates, *Sir George White* (1900).

WHITE, GILBERT (1720–1793), English writer on natural history, was born on the 18th of July 1720 in the little Hampshire village of Selborne, which his writings have rendered so familiar to all lovers of either books or nature. He was educated at Basingstoke under Thomas Warton, father of the poet, and subsequently at Oriel College, Oxford, where in 1744 he was elected to a fellowship. Ordained in 1747, he became curate at Swarraton the same year and at Selborne in 1751. In 1752 he was nominated junior proctor at Oxford and became dean of his college. In 1753 he accepted the curacy of Durley, and in 1757 he was a candidate for the provostship of Oriel, but failed to secure election. Soon afterwards he received the college living of Moreton Pinkney, though he did not reside there, and in 1761 he became curate at Faringdon, near Selborne, a position which he held until in 1784 he again became curate in his native parish. He died in his home, The Wakes, Selborne, on the 26th of June 1793.

Gilbert White's daily life was practically unbroken by any great changes or incidents; for nearly half a century his pastoral duties, his watchful country walks, the assiduous care of his garden, and the scrupulous posting of his calendar of observations made up the essentials of a full and delightful life, but hardly of a biography. At most we can only fill up the portrait by reference to the tinge of simple old-fashioned scholarship, which on its historic side made him an eager searcher for antiquities and among old records, and on its poetic occasionally stirred him to an excursion as far as that gentlest slope of Parnassus inhabited by the descriptive muse. Hence we are thrown back upon that correspondence with brother naturalists which has raised his life and its influence so far beyond the commonplace. His strong naturalist tendencies are not, however, properly to be realized without a glance at the history of his younger brothers. The eldest, Thomas, retired from trade to devote himself to natural and physical science, and contributed many papers to the Royal Society, of which he was a fellow. The next, Benjamin, became the publisher of most of the leading works of natural history which appeared during his lifetime, including that of his brother. The third, John, became chaplain at Gibraltar, where he accumulated much material for a work on the natural history of the rock and its neighbourhood, and carried on a scientific correspondence, not only with his eldest brother, but with Linnaeus. The youngest, Henry, was vicar of Fyfield, near Andover. The sister's son, Samuel Barker, also became in time one of White's most valued correspondents. With other naturalists, too, he had intimate relations: with Thomas Pennant and Daines Barrington he was in constant correspondence, often too with the botanist John Lightfoot, and sometimes with Sir Joseph Banks and others, while Richard Chandler and other antiquaries kept alive his historic zeal. At first he was content to furnish information from which the works of Pennant and Barrington largely profited; but gradually the ambition of separate authorship developed from a suggestion thrown out by the latter of these writers in 1770. The next year White sketched to Pennant the project of "a natural history of my native parish, an *annus historico-naturalis*, comprising a journal for a whole year, and illustrated with large notes and observations. Such a beginning might induce more able naturalists to write the history of various districts and might in time occasion the production of a work so much to be wished for—a full and complete natural history of these kingdoms." Yet the famous *Natural History and Antiquities of Selborne* did not appear until 1789. It was well received from the beginning, and has been reprinted time after time.

To be a typical parish natural history so far as completeness or order is concerned, it has of course no pretensions; batches of letters, an essay on antiquities, a naturalist's calendar and miscellaneous jottings of all kinds are but the unsystematized material of the work proper, which was never written. Yet it is largely to this very piecemeal character that its popularity has been due. The style has the simple, yet fresh and graphic, directness of all good letter-writing, and there is no lack of passages of keen observation, and even shrewd interpretation. White not only notes the homes and ways, the times and seasons, of plants and animals— comparing, for instance, the different ways in which the squirrel, the field-mouse and the nuthatch eat their hazel-nuts—or watches the migrations of birds, which were then only beginning to be properly recorded or understood, but he knows more than any other observer until Charles Darwin about the habits and the usefulness of the earthworms, and is certain that plants distil dew and do not merely condense it. The book is also interesting as having appeared on the borderland between the medieval and the modern school of natural history, avoiding the uncritical blundering of the old Encyclopaedists, without entering on the technical and analytic character of the opening age of separate monographs. Moreover, as the first book which raised natural history into the region of literature, much as the *Compleat Angler* did for that gentle art, we must affiliate to it the more finished products of later writers like Thoreau or Richard Jefferies. Yet, while these are essential merits of the book, its endearing charm lies deeper, in the sweet and kindly personality of the author, who on his rambles gathers no spoil, but watches the birds and field-mice without disturbing them from their nests, and quietly plants an acorn where he thinks an oak is wanted, or sows beech-nuts in what is now a stately row. He overflows with anecdotes, seldom indeed gets beyond the anecdotal stage, yet from this all study of nature must begin; and he sees everywhere intelligence and beauty, love and sociality, where a later view of nature insists primarily on mere adaptation of interests or purely competitive struggles. The encyclopaedic interest in nature, although in White's day culminating in the monumental synthesis of Buffon, was also disappearing before the analytic specialism inaugurated by Linnaeus; yet the catholic interests of the simple naturalist of Selborne fully reappear a century later in the greater naturalist of Down, Charles Darwin.

The *Life and Letters of Gilbert White of Selborne*, by his great grand-nephew, Rashleigh Holt-White, appeared in 1901.

WHITE, HENRY KIRKE (1785–1806), English poet, was born at Nottingham, the son of a butcher, on the 21st of March 1785. He was destined at first for his father's trade, but after a short apprenticeship to a stocking-weaver, was eventually articled to a lawyer. Meanwhile he studied hard, and his master offered to release him from his contract if he had sufficient means to go to college. He received encouragement from Capel Lofft, the friend of Robert Bloomfield, and published in 1803 *Clifton Grove, a Sketch in Verse, with other Poems*, dedicated to Georgiana, duchess of Devonshire. The book was violently attacked in the *Monthly Review* (February 1804), but White was in some degree compensated by a kind letter from Robert Southey. Through the efforts of his friends, he was entered as a sizar at St John's College, Cambridge, spending a year beforehand with a private tutor. Close application to study induced a serious illness, and fears were entertained for his sanity, but he went into residence at Cambridge, with a view to taking holy orders, in the autumn of 1805. The strain of continuous study proved fatal, and he died on the 19th of October 1806. He was buried in the church of All Saints, Cambridge. The genuine piety of his religious verses secured a place in popular hymnology for some of his hymns. Much of his fame was due to sympathy inspired by his early death, but it is noteworthy that Byron agreed with Southey in forming a high estimate of the young man's promise.

His *Remains*, with his letters and an account of his life, were edited (3 vols., 1807–1822) by Robert Southey. See prefatory notices by Sir Harris Nicolas to his *Poetical Works* (new ed., 1866) in the "Aldine Edition" of the British poets; by H. K. Swann in the volume of selections (1897) in the *Canterbury Poets*; and by John Drinkwater to the edition in the "Muses' Library." See also J. T. Godfrey and J. Ward, *The Homes and Haunts of Henry Kirke White* (1908).

WHITE, HUGH LAWSON (1773–1840), American statesman, was born in Iredell county, North Carolina, on the 30th of October 1773. In 1787 he crossed the mountains into East Tennessee (then a part of North Carolina) with his father James White (1737–1815), who was subsequently prominent in the early history of Tennessee. Hugh became in 1790 secretary to Governor William Blount, and in 1792–1793 served under John Sevier against the Creek and Cherokee Indians, and in the battle of Etowah (December 1793), according to the accepted tradition, killed with his own hand the Cherokee chief Kingfisher. He studied in Philadelphia and in 1796 he was admitted to the bar at Knoxville. He was a judge of the Superior Court of Tennessee in 1801–1807, a state senator in 1807–1809, and in 1809–1815 was judge of the newly organized Supreme Court of Errors and Appeals of the state. From 1812 to 1827 he was president of the State Bank of Tennessee at Knoxville, and managed it so well that for several years during this period it was the only western bank that in the trying period during and after the War of 1812 did not suspend specie payments. In 1821–1824 he was a member of the Spanish Claims Commission, and in 1825 succeeded Andrew Jackson in the United States Senate, serving until 1840 and being president *pro tem.* in 1832–1834. In the Senate he opposed internal improvements by the Federal government and the recharter of the United States Bank, favoured a protective tariff and Jackson's coercive policy in regard to nullification, and in general supported the measures of President Jackson, though his opposition to the latter's indiscriminate appointments caused a coolness between himself and Jackson, which was increased by White's refusal to vote to expunge the resolutions of a former Senate censuring the president. In 1830, as chairman of the Committee on Indian Affairs, he secured the passage of a bill looking to the removal of the Indians to lands west of the Mississippi. He was opposed to Van Buren, Jackson's candidate for the presidency in 1836, was himself nominated in several states as an independent candidate, and received the twenty-six electoral votes of Tennessee and Georgia, though President Jackson made strong efforts to defeat him in the former state. About 1838 he became a Whig in politics, and when the Democratic legislature of Tennessee instructed him to vote for Van Buren's sub-treasury scheme he objected and resigned (Jan. 1840). His strict principles and his conservatism won for him the sobriquet of "The Cato of the United States Senate." He died at Knoxville on the 10th of April 1840.

See Nancy N. Scott (ed.), *A Memoir of Hugh Lawson White* (Philadelphia, 1856).

WHITE, JOSEPH BLANCO (1775–1841), British theologian and poet, was born at Seville on the 11th of July 1775. He was educated for the Roman Catholic priesthood; but after his ordination (1800) religious doubts led him to escape from Spain to England (1810), where he ultimately entered the Anglican Church, having studied theology at Oxford and made the friendship of Arnold, Newman and Whately. He became tutor in the family of the last-named when he was made archbishop of Dublin (1831). While in this position he embraced Unitarian views; and he found an asylum amongst the Unitarians of Liverpool, where he died on the 20th of May 1841.

White edited *El Español*, a monthly Spanish magazine in London, from 1810 to 1814, and afterwards received a civil list pension of £250. His principal writings are *Doblado's Letters from Spain* (1822); *Evidence against Catholicism* (1825); *Second Travels of an Irish Gentleman in Search of a Religion* (2 vols., 1834); *Observations on Heresy and Orthodoxy* (1835). They all show literary ability, and were extensively read in their day. He also translated Paley's *Evidences* and the *Book of Common Prayer* into Spanish. He is best remembered, however, by his sonnet "Night and Death" ("Mysterious Night! when our first parent knew"), which was dedicated to S. T. Coleridge on its appearance in the *Bijou* for 1828 and has since found its way into several anthologies. Three versions are given in the *Academy* of the 12th of September 1891.

See *Life of the Rev. Joseph Blanco White, written by himself, with portions of his Correspondence*, edited by John Hamilton Thom (London, 3 vols., 1845).

WHITE, RICHARD GRANT (1822–1885), American Shakespearean scholar, philologist and essayist, was born in New York city, on the 23rd of May 1822. He graduated at the university of the City of New York in 1839, studied medicine and then law, and was admitted to the bar in 1845, but made no serious attempts to practise. He contributed (anonymously) musical criticisms to the New York *Courier and Enquirer*, of which he was co-editor in 1851–1858, and became a member of the staff of the New York *World*, when that paper was established in 1860. In 1861–1878 he was chief of the United States Revenue Marine Bureau, for the district of New York. When he was 21 years old he wrote his sonnet, "Washington: Pater Patriae," which, published anonymously, was frequently ascribed to Wordsworth, and by William Cullen Bryant was ascribed to Landor; White did not admit his authorship until 1852. In 1853 he contributed anonymously to *Putnam's Magazine* (October and November), an acute and destructive criticism of Collier's folio manuscript emendations of Shakespeare;[1] and in the following year this criticism was republished (with other matter) in his *Shakespeare's Scholar: being Historical and Critical Studies of his Text, Characters, and Commentators; with an Examination of Mr Collier's Folio of 1623.* During the Civil War he contributed to the *Spectator*, under the pseudonym, "A Yankee," a series of articles which greatly influenced English public opinion in favour of the North, while his clever and pungent satire, *The New Gospel of Peace; according to St Benjamin*, in four books (1863–1866)—also published anonymously—was an effective attack upon "copper-headism" and the advocates of "peace at any price." He died in New York on the 8th of April 1885.

In addition to those mentioned above, his Shakespearean publications include, *Essay on the Authorship of the Three Parts of King Henry VI.* (1859), *Memoirs of the Life of William Shakespeare; with an Essay towards the Expression of his Genius, and an account of the Rise and Progress of the English Drama to the Time of Shakespeare* (1865); an annotated edition of Shakespeare's works in 3 vols. (1883), and *Studies in Shakespeare* (1885), pleading for a rational treatment of the plays without over-annotation, textual or aesthetic. On linguistic subjects he wrote *Words and their Uses, Past and Present* (1870), and a sequel, *Every Day English* (1880), which without linguistic thoroughness, stimulated interest in the general subject of good use in language. His other publications include *National Hymns: How they are Written and How they are not Written* (1861), containing some of the best and worst of 1200 hymns submitted to a committee (of which White was a member) in a competition for a prize offered for a national hymn; *Poetry, Lyrical, Narrative and Satirical, of the Civil War* (1866); *The Fall of Man; or, The Loves of the Gorillas, By a Learned Gorilla* (1871); *Chronicles of Gotham. By U. Donough Outis* (1871); *The American View of the Copyright Question* (1880), *England Without and Within* (1881), and *The Fate of Mansfield Humphreys* (1884), a novel. For estimates of White's critical writing see the review of *Shakespeare's Scholar* in the *Eclectic Magazine*, vol. xxxiv. (1855); and the articles in the *Atlantic Monthly*, vol. xlix. (1882) by E. P. Whipple, and vol. lvii. (1886).

His son, Stanford White (1853–1906), the famous architect, studied under Henry H. Richardson, whom he assisted in the designing of Trinity Church, Boston, and became a member of the New York firm of McKim, Mead & White in 1881. He designed the Madison Square Garden, the Century and Metropolitan Clubs in New York City, the buildings of the New York University and the University of Virginia, and the pedestals for several of the statues by Augustus St Gaudens. He was murdered by Harry Thaw in 1906.

WHITE, ROBERT (1645–1704), English engraver and draughtsman, was born in London in 1645. He studied engraving under David Loggan, for whom he executed many architectural subjects; his early works also include landscapes and engraved title-pages for books. He acquired great skill in portraiture, his works of this class being commonly drawn with black-lead pencil upon vellum, and afterwards excellently engraved in line. Portraits executed in this manner he marked *ad vivum*, and they are prized by collectors for their artistic merit and their authenticity. Virtue catalogued 275 portrait engravings by White, including the likenesses of many of the most celebrated personages of his day; and nine portraits engraved in mezzotint are assigned to him by J. Chaloner Smith. White died at Bloomsbury, London, in 1704. His son, George White, who was born about 1671 and died about 1734, is also known as an engraver and portrait-painter.

WHITE, SIR THOMAS (1492–1567), founder of St John's College, Oxford, was a son of William White, a clothier, and was born at Reading. At an early age he became a merchant in London and was soon a member, and then master of the Merchant Taylors Company; growing wealthier he became an alderman and sheriff of the city of London. One of the promoters of the Muscovy Company, he was knighted in 1553, and in October of the same year he was chosen lord mayor. His term of office fell in a strenuous time. He had to defend the city against Sir Thomas Wyat and his followers, and he took part in the trial of the rebels, as just previously he had done in the case of Lady Jane Grey. In 1555 White received a licence to found a college at Oxford, which he endowed with lands in the neighbourhood of the city and which, dedicated to the Virgin Mary and St John Baptist, was opened in 1560. Soon after this event Sir Thomas began to lose money, and he was comparatively poor when he died at Oxford on the 12th of February 1567. His later years were mainly spent in Oxford, and he was buried in the chapel of St John's College. White had some share in founding the Merchant Taylors' School in London. He was twice married, but left no children. A portrait of him hangs in the hall of St John's College and one on glass, painted in the 16th century, is in the old library. Several early lives of him are among the college manuscripts. Sir Thomas must be distinguished from another Sir Thomas White of South Warnborough, Hampshire, some of whose property, by a curious coincidence, passed also into the possession of St John's College.

WHITE, THOMAS (*c.* 1550–1624), English divine, was born at Bristol about 1550, the son of a clothier. He graduated from Magdalen Hall (now Hertford College), Oxford, in 1570; took holy orders, and, coming to London, became rector of St Gregory by St Paul's and shortly after vicar of St Dunstan's in the West. Several of his sermons, attacking play-going and the vices of the metropolis, were printed. He was made a prebendary of St Paul's, treasurer of Salisbury, canon of Christ Church, Oxford, and canon of Windsor. In 1613 he built and endowed an almshouse, called the Temple Hospital, in Bristol. In 1621 he founded what is now known as White's chair of moral philosophy at Oxford, with a salary of £100 per annum for the reader, and several small exhibitions for scholars of Magdalen Hall. He died on the 1st of March 1624, bequeathing £3000 for the establishment of a college of "all the ministers, parsons, vicars, lecturers and curates in London and its suburbs" (afterwards Sion College (*q.v.*)), and an almshouse, now abolished, and leaving bequests for lectureships at St Paul's, St Dunstan's and at Newgate.

WHITE, THOMAS (1628–1698), bishop of Peterborough, was born at Aldington in Kent, and educated at St John's College, Cambridge. Having taken holy orders, he became vicar of Newark-on-Trent in 1660, vicar of Allhallows the Great, London, in 1666, and vicar of Bottesford, Leicestershire, in 1679. In 1683 he was appointed chaplain to the princess Anne, and in 1685 he was chosen bishop of Peterborough. In 1688 he joined the archbishop of Canterbury, William Sancroft, and five of his suffragan bishops in petitioning against the declaration of indulgence issued by James II., sharing the trial and the triumphant acquittal of his colleagues. In 1689 he refused to take the oath of allegiance to William and Mary and was deprived of his see, but he did not become very active among the nonjurors. White died on the 30th of May 1698.

The bishop must be distinguished not only from the founder of Sion College, but also from Thomas White (1593–1676), philosopher and controversialist. Educated at St Omer, Valladolid and Douai, the latter was ordained priest in 1617, and taught for some years in the college at Douai. Later he was president of the English college at Lisbon. He died in London on the 6th of July 1676. White was a voluminous writer; not only did he engage in controversy with Protestants, but he attacked the personal infallibility of the pope.

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[1] J. Paine Collier, *Notes and Emendations to the Text of Shakespeare's Plays from Early MS. Corrections in a Copy of the Folio, 1632* (London, 1853).

WHITE, SIR WILLIAM ARTHUR (1824–1891), British diplomatist, was born at Pulawy, in Poland, on the 13th of February 1824. He was descended on his father's side from an Irish Roman Catholic family. His mother's family, though not of Polish extraction, owned considerable estates in Poland, where White, though educated at King William's College, Isle of Man, and Trinity College, Cambridge, spent a great part of his early days, and thus gained an intimate knowledge of the Slavonic tongues. From 1843 to 1857 he lived in Poland as a country gentleman, but in the latter year he accepted a post in the British consulate at Warsaw, and had almost at once to perform the duties of acting consul-general. The insurrection of 1863 gave him an opportunity of showing his immense knowledge of Eastern politics and his combination of diplomatic tact with resolute determination. He was promoted in 1864 to the post of consul at Danzig. The Eastern Question was, however, the great passion of his life, and in 1875 he succeeded in getting transferred to Belgrade as consul-general for Servia. In 1879 he was made British Agent at Bucharest. In 1884 he was offered by Lord Granville the choice of the legation at Rio or Buenos Aires, and in 1885 Lord Salisbury, who was then at the Foreign Office, urged him to go to Peking, pointing out the increasing importance of that post. White's devoted friend, Sir Robert Morier, wrote in the same sense. But White, who was already acting as ambassador *ad interim* at Constantinople, decided to wait; and during this year he rendered one of his most conspicuous services. It was largely owing to his efforts that the war between Servia and Bulgaria was prevented from spreading into a universal conflagration, and that the union of Bulgaria and eastern Rumelia was accepted by the powers. In the following year he was rewarded with the embassy at Constantinople. He was the first Roman Catholic appointed to a British embassy since the Reformation. He pursued consistently the policy of counteracting Russian influence in the Balkans by erecting a barrier of independent states animated with a healthy spirit of national life, and by supporting Austrian interests in the East. To the furtherance of this policy he brought an unrivalled knowledge of all the under-currents of Oriental intrigue, which his mastery of languages enabled him to derive not only from the newspapers, of which he was an assiduous reader, but from the obscurest sources. His bluff and straightforward manner, and the knowledge that with him the deed was ready to follow the word, enabled him at once to inspire confidence and to overawe less masterful rivals. The official honours bestowed on him culminated in 1888 with the G.C.B. and a seat on the Privy Council. He was still ambassador at Constantinople when he was attacked by influenza during a visit to Berlin, where he died on the 28th of December 1891.

WHITE, SIR WILLIAM HENRY (1845–), English naval architect, was born at Devonport on the 2nd of February 1845, and at the age of fourteen became an apprentice in the dockyard there. In 1864 he took the first place in the scholarship competition at the Royal School of Naval Architecture, which had then just been established by the Admiralty at South Kensington, and in 1867 he gained his diploma as fellow of the school with first-class honours. At once joining the constructive staff of the Admiralty, he acted as confidential assistant to the chief constructor, Sir Edward Reed, until the latter's retirement in 1870. The loss of the "Captain" in that year was followed by an inquiry into designs for ships of war, and in connexion with this White, together with his old fellow-student, William John, worked out a long series of calculations as to the stability and strength of vessels, the results of which were published in an important paper read in 1871 before the Institution of Naval Architects. In 1872 White was appointed secretary to the Council of Construction at the Admiralty, in 1875 assistant constructor, and in 1881 chief constructor. In April 1883 he left the service of the Admiralty, at the invitation of Lord (then Sir W. G.) Armstrong, in order to undertake the difficult task of organizing a department for the construction of warships of the largest size at the Elswick works; but he only remained there for two and a half years, for in October 1885 he returned to the Admiralty in succession to Sir Nathaniel Barnaby as director of naval construction, retaining that post until the beginning of 1902, when ill-health obliged him to relinquish the arduous labours it entailed. During that period, which in Great Britain was one of unprecedented activity in naval shipbuilding as a result of the awakening of public opinion to the vital importance of sea-power, more than 200 vessels of various types were added to the British navy, at a total cost of something like 100 millions sterling, and for the design of all of these, as well as for the work of their construction, Sir William White was ultimately responsible. In addition, he did much to further the knowledge of scientific shipbuilding. He was professor of naval architecture at the Royal School from 1870 to 1873, and when in the latter year it was moved to Greenwich to be merged in the Royal Naval College, he reorganized the course of instruction and acted as professor for eight years more. The lectures he gave in that capacity were the foundation of his *Manual of Naval Architecture*, which has been translated into several foreign languages and is recognized as a standard text-book all over the world. Sir William White, who was chosen a fellow of the Royal Society in 1888, also read many professional papers before various learned and engineering societies. He was created K.C.B. in 1895.

WHITEAVES, JOSEPH FREDERICK (1835–), British palaeontologist, was born at Oxford, on the 26th of December 1835. He was educated at private schools, and afterwards worked under John Phillips at Oxford (1858–1861); he was led to study the Oolitic rocks, and added largely to our knowledge of the fossils of the Great Oolite series, Cornbrash and Corallian (*Rep. Brit. Assoc.* 1860, and *Ann., Nat. Hist.* 1861). In 1861 he visited Canada and made acquaintance with the geology of Quebec and Montreal, and in 1863 he was appointed curator of the museum and secretary of the Natural History Society of Montreal, posts which he occupied until 1875. He studied the land and freshwater mollusca of Lower Canada, and the marine invertebrata of the coasts; and also carried on researches among the older Silurian (or Ordovician) fossils of the neighbourhood of Montreal. In 1875 he joined the palaeontological branch of the Geological Survey of Canada at Montreal; in the following year he became palaeontologist, and in 1877 he was further appointed zoologist and assistant director of the survey. In 1881 the offices of the survey were removed to Ottawa. His publications on Canadian zoology and palaeontology are numerous and important. Dr Whiteaves was one of the original fellows of the Royal Society of Canada, and contributed to its Transactions, as well as to the *Canadian Naturalist* and other journals. He received the hon. degree of LL. D. in 1900 from McGill University, Montreal.

WHITEBAIT, the vernacular name of the small fish which appears in large shoals in the estuary of the Thames during the summer months, and is held in great esteem as a delicacy for the table. Formerly whitebait was supposed to be a distinct species of fish. T. Pennant and G. Shaw believed it to be some kind of Cyprinoid fish, similar to the bleak, whilst E. Donovan, in his *Natural History of British Fishes* (1802–1808), misled by specimens sent to him as whitebait, declared it to be the young of the shad. In 1820 W. Yarrell proved conclusively that Donovan's opinion was founded upon an error; unfortunately he contented himself with comparing whitebait with the shad only, and in the end adopted the opinion of the Thames fishermen, whose interest it was to represent it as a distinct adult form; thus the whitebait is introduced into Yarrell's *History of British Fishes* (1836) as *Clupea alba*. The French ichthyologist Valenciennes went a step farther, declaring it to be not only specifically but also generically distinct from all other Clupeoids. It is now known to consist of the young fry of herrings and sprats in varying proportions mixed with a few shrimps, gobies, sticklebacks, pope-fishes and young flounders: but these impurities are as far as possible picked out from the whitebait before it is marketed. The fishing is carried on from February to August, and samples taken in the successive months were found to contain the following percentages of herrings, the remainder being young sprats: 7, 5, 14, 30, 87, 75, 52. Hence it will be seen that sprats predominated in February, March, April and May, herrings in June and July. There is reason to believe that these young herrings are derived from a local "winter" race spawning about February and March, and having nothing to do with the great shoals of the more open sea spawning in the North Sea in November. The Thames being unequal to the supply of the large demand for this delicacy, large quantities of whitebait are now brought to London and other markets from many parts of the coast. In times past whitebait were considered to be peculiar to the estuary of the Thames; and, even after the specific identification of Thames whitebait with the young of the herring and sprat, it was still thought that there was a distinctive superiority in its condition and flavour. It is possible that the young fish find in the estuary of the Thames a larger amount of suitable food than on other parts of the coast, where the water may be of greater purity, but possesses less abundance of the minute animal life on which whitebait thrive. Indeed, Thames whitebait which have been compared with that from the mouth of the Exe, the Cornish coast, Menai Strait, and the Firth of Forth seemed to be better fed; but, of course, the specific characteristics of the herring and sprat—into which we need not enter here—were nowise modified.

The fry of fishes is used as an article of diet in almost every country: in Germany the young of various species of Cyprinoids, in Italy and Japan the young of nearly every fish capable of being readily captured in sufficient numbers, in the South Sea Islands the fry of *Teuthis*, in New Zealand young *Galaxias* are consumed at certain seasons in large quantities; and, like whitebait, these fry bear distinct names, different from those of the adult fish.

Whitebait are caught on the flood-tide from boats moored in from 3 to 5 fathoms of water. The net used is a bag some 20 ft. long, narrow and small-meshed towards the tail end, the mouth being kept open in the direction of the advancing tide by a framework 3 or 4 ft. square. It is placed alongside the boat and sunk to a depth of 4 ft. below the surface; from time to time the end of the bag is lifted into the boat, to empty it of its contents. The "schools" of whitebait advancing and retiring with the tide for days, and probably for weeks, have to run the gauntlet of a dozen of these nets, and therefore get very much thinned in number by the end of the season. When the view commenced to gain ground that whitebait were largely young herring, the question arose whether or not the immense destruction of the young brood caused by this mode of fishing injuriously affected the fishery of the mature herring. This perhaps it does; but, since it has been ascertained that the herring is much more restricted in its migrations than was formerly believed, and that the shoals are to a great extent local, the injury, such as it is, must be local and limited to the particular district in which the fishing for whitebait is methodically practised. Similar reasoning applies to sprats. (J. T. C.)

WHITEFIELD, GEORGE (1714–1770), English religious leader, was born on the 16th of December 1714 at the Bell Inn, Gloucester, of which his father was landlord. At about twelve years of age he was sent to the school of St Mary de Crypt, Gloucester, where he developed some skill in elocution and a taste for reading plays, a circumstance which probably had considerable influence on his subsequent career. At the age of fifteen he was taken from school to assist his mother in the public-house, and for a year and a half was a common drawer. He then again returned to school to prepare for the university, and in 1733 entered as a servitor at Pembroke College, Oxford, graduating in 1736. There he came under the influence of the Methodists (see WESLEY), and entered so enthusiastically into their practices and habits that he was attacked by a severe illness, which compelled him to return to his native town. His enthusiastic piety attracted the notice of Martin Benson, bishop of Gloucester, who ordained him deacon on the 20th of June 1736. He then began an evangelizing tour in Bath, Bristol and other towns, his eloquence at once attracting immense multitudes.

In 1736 he was invited by Wesley to go out as missionary to Georgia, and went to London to wait on the trustees. Before setting sail he preached in some of the principal London churches, and in order to hear him, crowds assembled at the church doors long before daybreak. On the 28th of December 1737 he embarked for Georgia, which he reached on the 7th of May 1738. After three months' residence there he returned to England to receive priest's orders, and to raise contributions for the establishment of an orphanage. As the clergy did not welcome him to their pulpits, he began to preach in the open air. At Kingswood Hill, Bristol, his addresses to the colliers soon attracted crowds, and his voice was so clear and powerful that it could reach 20,000 folk. His fervour and dramatic action held them spell-bound, and his homely pathos soon broke down all barriers of resistance. "The first discovery of their being affected," he says, "was by seeing the white gutters made by their tears, which plentifully fell down their black cheeks." In 1738 an account of Whitefield's voyage from London to Georgia was published without his knowledge. In 1739 he published his *Journal* from his arrival in Savannah to his return to London, and also his *Journal* from his arrival in London to his departure thence on his way to Georgia. As his embarkation was further delayed for ten weeks he published *A Continuation of the Rev. Mr Whitefield's Journal during the Time he was delayed in England by the Embargo*. His unfavourable reception in England by the clergy led him to make reprisals. To Joseph Trapp's attack on the Methodists he published in 1739 *A Preservative against Unsettled Notions*, in which the clergy of the Church of England were denounced with some bitterness; he also published shortly afterwards *The Spirit and Doctrine and Lives of our Modern Clergy*, and a reply to a pastoral letter of the bishop of London in which he had been attacked. In the same year appeared *Sermons on Various Subjects* (2 vols.), the *Church Companion, or Sermons on Several Subjects*, and a recommendatory epistle to the *Life of Thomas Halyburton*. He again embarked for America in August 1739, and remained there two years, preaching in all the principal towns. He left his incumbency of Savannah to a lay delegate and the commissary's court at Charleston suspended him for ceremonial irregularities. While there he published *Three Letters from Mr Whitefield*, in which he referred to the "mystery of iniquity" in Tillotson, and asserted that that divine knew no more of Christ than Mahomet did.

During his absence from England Whitefield found that a divergence of doctrine from Calvinism had been introduced by Wesley; and notwithstanding Wesley's exhortations to brotherly kindness and forbearance he withdrew from the Wesleyan connexion. Thereupon his friends built for him near Wesley's church a wooden structure, which was named the Moorfields Tabernacle. A reconciliation between the two great evangelists was soon effected, but each thenceforth went his own way. In 1741, on the invitation of Ralph and Ebenezer Erskine, he paid a visit to Scotland, commencing his labours in the Secession meeting-house, Dunfermline. But, as he refused to limit his ministrations to one sect, the Seceders and he parted company, and without their countenance he made a tour through the principal towns of Scotland, the authorities of which in most instances presented him with the freedom of the burgh, in token of their estimate of the benefits to the community resulting from his preaching. From Scotland he went to Wales, where on the 14th of November he married a widow named James. The marriage was not a happy one. On his return to London in 1742 he preached to the crowds in Moorfields during the Whitsun holidays with such effect as to attract nearly all the people from the shows. After a second visit to Scotland, June–October 1742 (where at Cambuslang in particular he wielded a great spiritual influence), and a tour through England and Wales, 1742–1744, he embarked in August 1744 for America, where he remained till June 1748. On returning to London he found his congregation at the Tabernacle dispersed; and his circumstances were so depressed that he was obliged to sell his household furniture to pay his orphan-house debts. Relief soon came through his acquaintance with Selina, countess of Huntingdon (*q.v.*), who appointed him one of her chaplains.

The remainder of Whitefield's life was spent chiefly in evangelizing tours in Great Britain, Ireland and America. It has been stated that "in the compass of a single week, and that for years, he spoke in general forty hours, and in very many sixty, and that to thousands." In 1748 the synods of Glasgow, Perth and Lothian passed vain resolutions intended to exclude him from churches; in 1753 he compiled his hymn-book, and in 1756 opened the chapel which still bears his name in Tottenham Court Road. On his return from America to England for the last time the change in his appearance forcibly impressed Wesley, who wrote in his *Journal*: "He seemed to be an old man, being fairly worn out in his Master's service, though he had hardly seen fifty years." When health was failing him he placed himself on what he called "short allowance," preaching only once every week-day and thrice on Sunday. In 1769 he returned to America for the seventh and last time, and arranged for the conversion of his orphanage into Bethesda College, which was burned down in 1773. He was now affected by a severe asthmatic complaint; but to those who advised him to take some rest, he answered, "I had rather *wear* out than *rust* out." He died on the 30th of September 1770 at Newburyport, Massachusetts, where he had arrived on the previous evening with the intention of preaching next day. In accordance with his own desire he was buried before the pulpit in the Presbyterian church of the town where he died.

Whitefield's printed works convey a totally inadequate idea of his oratorical powers, and are all in fact below mediocrity. They appeared in a collected form in 1771–1772 in seven volumes, the last containing *Memoirs of his Life*, by Dr John Gillies. His *Letters* (1734–1770) were comprised in vols. i., ii. and iii. of his *Works* and were also published separately. His *Select Works*, with a memoir by J. Smith, appeared in 1850. See *Lives* by Robert Philip (1837), L. Tyerman (2 vols., 1876–1877), J. P. Gledstone (1871, new ed. 1900), and W. H. Lecky's *History of England*, vol. ii.

WHITEFISH, a collective name applied in different countries to very different kinds of freshwater fishes. The numerous European species of the Cyprinoid genus *Leuciscus* are frequently comprised under the name of "Whitefish," but the term is employed here for the various species of the Salmonoid genus *Coregonus*. The *Coregonus* group are somewhat herring-shaped, silvery salmonids with small, toothless or feebly toothed mouth, and rather large scales. They are distributed over Europe, Asia and North America, some species living in the sea, but most inhabiting clear lakes. The highly esteemed "lavaret" of Savoy, the "felchen," "kilch," "gangfisch," "palée," "gravenche," "féra" or Switzerland and southern Germany, the "sik" of Sweden, belong to this genus, which is represented in British and Irish waters by the houting (*C. oxyrhynchus*), occasionally found in the North Sea; the gwyniad or pawan (*C. clupeoides*) of Loch Lomond, Haweswater, Ullswater and Bala, the vendace (*C. vandesius*) of Lochmaben, and its newly described ally (*C. gracilior*) from Derwentwater and Bassenthwaite lakes in Cumberland. About eight species are distinguished from the northern parts of North America. The *Coregonus* are mostly of small size, few of them attaining a length of 18 in. Secondary nuptial sexual characters are by no means so well marked as in *Salmo*, but pearl-like excrescences may appear on the scales during the breeding season, and are more prominent in males than in females.

WHITEHALL, a village of Washington county, New York, U.S.A., in a township of the same name on the Poultney river and the Champlain Canal, at the head of Lake Champlain, and 78 m. by rail N. by E. of Albany. Pop. (1890) 4434; (1900) 4377, of whom 547 were foreign-born; (1905) 4148; (1910) 4917. Whitehall is served by the Delaware & Hudson railway, and is the N. terminus of the new barge-canal system of New York state. It is situated in a narrow valley between two hills called West Mountain and Skene's Mountain, and Wood Creek flows through the village and empties into the lake with a fall, from which valuable water-power is derived; there are various manufactures, and the village owns and operates the water works. In 1759, to strengthen the British hold on Canada, a large tract of land at the S. end of Lake Champlain was granted to Colonel Philip Skene (1725–1810), who fought at Ticonderoga in 1758 and in 1759, and who established here in 1761 a settlement of about thirty families which he called Skenesborough and which was patented in 1765. Skene was a Loyalist, and in May 1775 Skenesborough was seized by a party of American volunteers. In Burgoyne's expedition (1777) Skene and his son, Andrew Philip Skene (1753–1826), served as guides, and Skenesborough was recovered by the British after most of it had been burned by the Americans. At the close of the war Skene's estate was confiscated and in 1786 the place was named Whitehall. In the War of 1812 Whitehall was fortified and was a base of supplies for American operations against Canada. It was incorporated as a village in 1806.

WHITEHAVEN, a municipal and parliamentary borough, seaport and market town of Cumberland, England, 41 m. S.W. of Carlisle. Pop. (1901) 19,324. It lies mainly in a valley opening upon the Irish Sea, with high ground to north and south, and is served by the London & North-Western, the Cockermouth, Keswick & Penrith and the Furness railways. The harbour is protected by two main piers, of which the western is a fine structure by Sir John Rennie, and divided into four parts by others; it has a wet dock and extensive quayage. Regular passenger communications are maintained with the Isle of Man. The exports are principally coal, pig iron and ore, steel and stone. The port was made subordinate to that of Maryport in 1892. There are collieries near the town, the workings extending beneath the sea; there are also iron mines and works, engineering works, shipbuilding yards, breweries, tanneries, stone quarries, brick and earthenware works, and other industrial establishments in and near the town. The parliamentary borough returns one member. The municipal borough is under a mayor, 6 aldermen and 18 councillors. Area 1810 acres.

Whitehaven (*Witofthaven*) was an insignificant possession of the priory of St Bee which became crown property at the dissolution of the religious houses. It was acquired before 1644 by relatives of the earl of Lonsdale, who secured the prosperity of the town by working the coal-mines. From 1708 the harbour was governed by twenty-one trustees, whose power was extended and municipalized by frequent legislation, until, in 1885, they were incorporated. In 1894 this government by incorporated trustees gave place to that of a municipal corporation created by charter in that year. The harbour was entrusted to fifteen commissioners. Since the Reform Act of 1832 Whitehaven has returned one representative to parliament. A weekly market and yearly fairs were granted to Sir John Lowther in 1660; two fairs were held in 1888; and the market days are now Tuesday, Thursday and Saturday. Whitehaven coal was sent chiefly to Ireland in the 18th century. In the first half of the 19th century other exports were lime, freestone, and grain; West Indian, American and Baltic produce, Irish flax and Welsh pig iron were imported, and shipbuilding was a growing industry. Paul Jones, the notorious buccaneer, served his apprenticeship at the port, which in 1778 he successfully raided, burning three vessels.

WHITEHEAD, WILLIAM (1715–1785), English poet-laureate, son of a baker, was born at Cambridge, and baptized on the 12th of February 1715. His father had extravagant tastes, and spent large sums in ornamenting a piece of land near Grantchester, afterwards known as "Whitehead's Folly." William was his second son, and through the patronage of Henry Bromley, afterwards Lord Montfort, was admitted to Winchester College. In 1735 he entered Clare Hall, Cambridge, as a sizar, and became a fellow in 1742. At Cambridge Whitehead published an epistle "On the Danger of writing Verse"[1] and some other poems, notably an heroic epistle, *Ann Boleyn to Henry the Eighth* (1743), and a didactic *Essay an Ridicule* (1743). In 1745 he became tutor to Viscount Villiers, son of the earl of Jersey, and took up his residence in London. He produced two tragedies: *The Roman Father* (Drury Lane, 24th of February 1750), and *Creusa, Queen of Athens* (Drury Lane, 20th of April 1754). The plots are based respectively on the *Horace* of Corneille, and the *Ion* of Euripides. In June 1754 he went abroad with Lord Villiers, and his companion Viscount Nuneham, son of Earl Harcourt, only returning to England in the autumn of 1756. In 1757 he was appointed poet-laureate in succession to Cibber, and proceeded to write annual effusions in the royal honour. That he was not altogether happy in his position, which was discredited by the fierce attacks made on his predecessor, Colley Cibber, appears from "A Pathetic Apology for all Laureates, past, present and to come." Charles Churchill attacked him in 1762, in the third book of *The Ghost*, as the heir of Dullness and Method. In the same year Whitehead produced his most successful work in the comedy of the *School for Lovers*, produced at Drury Lane on the 10th of February. This success encouraged David Garrick to make him his reader of plays. Whitehead's farce, *The Trip to Scotland*, was performed on the 6th of January 1770. He collected his *Plays and Poems* in 1774. He had for some time, after his return from the Continent, resided in the houses of his patrons, but from 1769 he lived in London, where he died on the 14th of April 1785. Beside the works already mentioned, Whitehead wrote a burlesque poem, *The Sweepers*, a number of verse *contes*, of which "Variety" and "The Goat's Beard" are good examples, and much occasional and official verse.

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[1] Printed in *A Collection of Poems by several Hands* (vol. ii., 1748).

See memoirs by his friend William Mason, prefixed to a complete edition of his poems (York, 1788). His plays are printed in Bell's *British Theatre* (vols. 3, 7, 20) and other collections, and his poems appear in Chalmers's *Works of the English Poets* (vol. 17) and similar compilations.

WHITE HORSE, VALE OF, the name of the valley of the Ock, a stream which joins the Thames from the west at Abingdon in Berkshire, England. The vale is flat and well wooded, its green meadows and foliage contrasting richly with the bald summits of the White Horse Hills, which flank it on the south. On the north a lower ridge separates it from the upper Thames valley; but local usage sometimes extends the vale to cover all the ground between the Cotteswolds (on the north) and the White Horse Hills. According to the geographical definition, however, the vale is from 2 to 5 m. wide, and the distance by road from Abingdon to Shrivenham at its head is 18 m. Wantage is the only town in the heart of the vale, lying in a sheltered hollow at the foot of the hills, along which, moreover, villages are more numerous than elsewhere in the vale. Towards the west, above Uffington, the hills reach a culminating point of 856 ft. in White Horse Hill. In its northern flank, just below the summit, a gigantic figure of a horse is cut, the turf being removed to show the white chalky soil beneath. This figure gives name to the hill, the range and the vale. It is 374 ft. long and of the rudest outline, the neck, body and tail varying little in width. Its origin is unknown. Tradition asserted it to be the monument of a victory over the Danes by King Alfred, who was born at Wantage; but the site of the battle, that of Ashdown (871), has been variously located. Moreover, the figure, with others of a similar character elsewhere in England, is considered to be of a far higher antiquity, dating even from before the Roman occupation. Many ancient remains occur in the vicinity of the Horse. On the summit of the hill there is an extensive and well-preserved circular camp, apparently used by the Romans, but of earlier origin. It is named Uffington Castle from the village in the vale below. Within a short distance are Hardwell Castle, a square work, and, on the southern slope of the hills near Ashdown Park, a small camp traditionally called Alfred's. A smooth, steep gully on the north flank of White Horse Hill is called the Manger, and to the west of it rises a bald mound named Dragon's Hill, the traditional scene of St George's victory over the dragon, the blood of which made the ground bare of grass for ever. But the name, properly Pendragon, is a Celtic form signifying "chief of kings," and may point to an early place of burial. To the west of White Horse Hill lies a cromlech called Wayland Smith's Cave, said to be the home of a smith who was never seen, but shod the horses of travellers if they were left at the place with payment. The legend is elaborated, and the smith appears as a character, in Sir Walter Scott's novel *Kenilworth*. The White Horse itself has been carefully cleared of vegetation from time to time, and the process, known as the "Scouring of the White Horse," was formerly made the occasion of a festival. Sports of all kinds were held, and keen rivalry was maintained, not only between the inhabitants of the local villages, but between local champions and those from distant parts of England. The first of such festivals known took place in 1755, and they died out only subsequently to 1857. A grassy track represents the ancient road or Ridge Way along the crest of the hills continuing Icknield Street, from the Chiltern Hills to the north-east, across the Thames; and other earthworks in addition to those near the White Horse overlook the vale, such as Letcombe Castle above Wantage. At the foot of the hills not far east of the Horse is preserved the so-called Blowing Stone, a mass of sandstone pierced with holes in such a way that when blown like a trumpet a loud note is produced. It is believed that in the earliest times the stone served the purpose of a bugle. Several of the village churches in the vale are of interest, notably the fine Early English cruciform building at Uffington. The length of the vale is traversed by the main line of the Great Western railway, between Didcot and Swindon.

See Thomas Hughes, *The Scouring of the White Horse* (1859).

WHITEING, RICHARD (1840–), English author and journalist, was born in London on the 27th of July 1840, the son of a civil servant. He was a pupil of Benjamin Wyon, medallist and seal-engraver, and made his journalistic début by a series of papers in the *Evening Star* in 1866, printed separately in the next year as *Mr Sprouts, His Opinions*. He became leader-writer and correspondent on the *Morning Star*, and was subsequently on the staff of the *Manchester Guardian*, the New York *World*, and for many years the *Daily News*, resigning from the last-named paper in 1899. His novel *The Democracy* (3 vols., 1876) was published under the pseudonym of Whyte Thorne. His remarkable story *The Island* (1888) attracted little attention until, years afterwards, its successor, *No. 5 John Street* (1899), made him famous; the earlier novel was then republished. Later works were *The Yellow Van* (1903), *Ring in the New* (1906), *All Moonshine* (1907).

WHITELEY, WILLIAM (1831–1907), English "Universal Provider," was born at Agbrigg, near Wakefield, Yorkshire, on the 29th of September 1831, the son of a corn-factor. At the age of sixteen he was apprenticed to a firm of drapers at Wakefield. In 1851 he made his first visit to London to see the Great Exhibition, and was so impressed with the size and activity of the metropolis that he determined to settle there as soon as his apprenticeship was over. A year later he obtained a subordinate position in a draper's establishment in the city, and after studying the drapery trade in this and other London establishments for ten years, in 1863 himself opened a small shop for the sale of fancy drapery in Westbourne Grove, Bayswater. His capital amounted to about £700, which he had saved from his salaries and commissions, and he at first employed two young girls and an errand boy. Friends in the trade had assured him that Westbourne Grove was one of the two worst streets in London for his business, but Whiteley had noted the number and quality of the people who passed the premises every afternoon, and relied on his own judgment. Events justified his confidence, and within a year he was employing fifteen hands. He made a consistent practice of marking all goods in plain figures and of "dressing" his shop-window attractively, both unusual features in the retail trading of the time, and to this, coupled with the fact that he was satisfied with small profits, he largely attributed a success in which his own genius for organization and energy played a conspicuous part. In 1866 Whiteley added general drapery to his other business, opening by degrees shop after shop and department after department, till he was finally enabled to call himself the "Universal Provider," and boast that there was nothing which his stores could not supply. "Whiteley's was, in fact, the first great instance of a large general goods store in London, held under one man's control. In 1899 the business, of which the profits then averaged over £100,000 per annum, was turned into a limited liability company, Whiteley retaining the bulk of the shares. On the 23rd of January 1907 he was shot dead, after an interview in his private office, by Horace George Rayner, who claimed (but, as was proved, wrongly) to be his illegitimate son and who had been refused pecuniary assistance. Rayner was found guilty of murder, and sentenced to be hanged; but the home secretary (Mr Herbert Gladstone), in response to an agitation for his reprieve, commuted the sentence to penal servitude for life.

WHITELOCKE, SIR JAMES (1570–1632), English judge, son of Richard Whitelocke, a London merchant, was born on the 28th of November 1570. Educated at Merchant Taylors' School, London, and at St John's College, Oxford, he became a fellow of his college and a barrister. He was then engaged in managing the estates belonging to St John's College, Eton College and Westminster College, before he became recorder of Woodstock and member of parliament for the borough in 1610. In 1620 Whitelocke was made chief justice of the court of session of the county palatine of Chester, and was knighted; in 1624 he was appointed justice of the court of king's bench. He died at Fawley Court, near Reading, an estate which he had bought in 1616, on the 22nd of June 1632. His wife, Elizabeth, was a daughter of Edward Bulstrode of Hedgerley Bulstrode, Buckinghamshire, and his son was Bulstrode Whitelocke.

Sir James was greatly interested in antiquarian studies, and was the author of several papers which are printed in T. Hearne's *Collection of Discourses* (1771); his journal, or *Liber famelicus*, was edited by John Bruce and published by the Camden Society in 1858.

Whitelocke's elder brother, Edmund Whitelocke (1565–1608), was a soldier in France and later a courtier in England. He was imprisoned because he was suspected of being concerned in the Gunpowder Plot, and although he was most probably innocent, he remained for some time in the Tower of London.

The soldier John Whitelocke (1757–1833) was doubtless a descendant of Sir James Whitelocke. He entered the army in 1778 and served in Jamaica and in San Domingo. In 1805 he was made a lieutenant-general and inspector-general of recruiting, and in 1807 he was appointed to command an expedition sent to recover Buenos Aires from the Spaniards. An attack on the city was stubbornly resisted, and then Whitelocke concluded an arrangement with the opposing general by which he abandoned the undertaking. This proceeding was regarded with great disfavour both by the soldiers and others in South America and in England, and its author was brought before a court-martial in 1808. On all the charges except one he was found guilty and he was dismissed from the service. He lived in retirement until his death on the 23rd of October 1833.

WHITELOCKE, BULSTRODE (1605–1675), English lawyer and parliamentarian, eldest son of Sir James Whitelocke, was baptized on the 19th of August 1605, and educated at Merchant Taylors' School and at St John's College, Oxford, where he matriculated on the 8th of December 1620. He left Oxford, without a degree, for the Middle Temple, and was called to the bar in 1626 and chosen treasurer in 1628. He was fond of field sports and of music, and in 1633 he had charge of the music in the great masque performed by the inns of court before the king and queen. Meanwhile he had been elected for Stafford in the parliament of 1626 and had been appointed recorder of Abingdon and Henley. In 1640 he was chosen member for Great Marlow in the Long Parliament. He took a prominent part in the proceedings against Strafford, was chairman of the committee of management, and had charge of articles XIX.-XXIV. of the impeachment. He drew up the bill for making parliaments indissoluble except by their own consent, and supported the Grand Remonstrance and the action taken in the Commons against the illegal canons; on the militia question, however, he advocated a joint control by king and parliament. On the outbreak of the Great Rebellion he took the side of the parliament, using his influence in the country as deputy-lieutenant to prevent the king's raising troops in Buckinghamshire and Oxfordshire. He was sent to the king at Oxford both in 1643 and 1644 to negotiate terms, and the secret communications with Charles on the latter occasion were the foundation of a charge of treason brought against Whitelocke and Denzil Holles (*q.v.*) later. He was again one of the commissioners at Uxbridge in 1645. Nevertheless he opposed the policy of Holles and the peace party and the proposed disbanding of the army in 1647, and though one of the lay members of the assembly of divines, repudiated the claims of divine authority put forward by the Presbyterians for their church, and approved of religious tolerance. He thus gravitated more towards Cromwell and the army party, but he took no part either in the disputes between the army and the parliament or in the trial of the king. On the establishment of the Commonwealth, though out of sympathy with the government, he was nominated to the council of state and a commissioner of the new Great Seal. He urged Cromwell after the battle of Worcester and again in 1652 to recall the royal family, while in 1653 he disapproved of the expulsion of the Long Parliament and was especially marked out for attack by Cromwell in his speech on that occasion. Later in the autumn, and perhaps in consequence, Whitelocke was despatched on a mission to Christina, queen of Sweden, to conclude a treaty of alliance and assure the freedom of the Sound. On his return he resumed his office as commissioner of the Great Seal, was appointed a commissioner of the treasury with a salary of £1000, and was returned to the parliament of 1654 for each of the four constituencies of Bedford, Exeter, Oxford and Buckinghamshire, electing to sit for the latter constituency.

Whitelocke was a learned and a sound lawyer. He had hitherto shown himself not unfavourable to reform, having supported the bill introducing the use of English into legal proceedings, having drafted a new treason law, and set on foot some alterations in chancery procedure. A tract advocating the registering of title-deeds is attributed to him. But he opposed the revolutionary innovations dictated by ignorant and popular prejudices. He defeated the strange bill which sought to exclude lawyers from parliament; and to the sweeping and ill-considered changes in the court of chancery proposed by Cromwell and the council he offered an unbending and honourable resistance, being dismissed in consequence, together with his colleague Widdrington, on the 6th of June 1655 from his commissionership of the Great Seal (see Lenthall, William). He still, however, remained on good terms with Cromwell, by whom he was respected; he took part in public business, acted as Cromwell's adviser on foreign affairs, negotiated the treaty with Sweden of 1656, and, elected again to the parliament of the same year as member for Buckinghamshire, was chairman of the committee which conferred with Cromwell on the subject of the Petition and Advice and urged the protector to assume the title of king. In December 1657 he became a member of the new House of Lords. On Richard Cromwell's accession he was reappointed a commissioner of the Great Seal, and had considerable influence during the former's short tenure of power. He returned to his place in the Long Parliament on its recall, was appointed a member of the council of state on the 14th of May 1659, and became president in August; and subsequently, on the fresh expulsion of the Long Parliament, he was included in the committee of safety which superseded the council. He again received the Great Seal into his keeping on the 1st of November. During the period which immediately preceded the Restoration he endeavoured to oppose Monk's schemes, and desired Fleetwood to forestall him and make terms with Charles, but in vain.

On the failure of his plans he retired to the country and awaited events. Whitelocke's career, however, had been marked by moderation and good sense throughout. The necessity of carrying on the government of the country somehow or other had been the chief motive of his adherence to Cromwell rather than any sympathy for a republic or a military dictatorship, and his advice to Cromwell to accept the title of king was doubtless tendered with the object of giving the administration greater stability and of protecting its adherents under the Statute of Henry VII. Nor had he shown himself unduly ambitious or self-seeking in the pursuit of office, and he had proved himself ready to sacrifice high place to the claims of professional honour and duty. These considerations were not without weight with his contemporaries at the Restoration. Accordingly Whitelocke was not excepted from the Act of Indemnity, and after the payment of various sums to the king and others he was allowed to retain the bulk of his property. He lived henceforth in seclusion at Chilton in Wiltshire, dying on the 28th of July 1675.

Whitelocke married (1) Rebecca, daughter of Thomas Bennet, (2) Frances, daughter of Lord Willoughby of Parham, and (3) Mary Carleton, widow of Rowland Wilson, and left children by each of his wives. He was the author of *Memorials of the English affairs from the beginning of the reign of Charles I. . . .*, published 1682 and reprinted, a work which has obtained greater authority than it deserves, being largely a compilation from various sources, composed after the events and abounding in errors. His work of greatest value, his *Annals*, still remains in MS. in Lord Bute's and Lord de la Warr's collections (*Hist. Brit. Comm. III. Rep.* pp. 202, 217; also Egerton MSS. Brit. Mus. 997, add. MSS. 4992, 4994); his *Journal of the Swedish Embassy* . . . was published 1772 and re-edited by Henry Reeve in 1885 (add. MSS. 4902, 4991 and 4995 and *Hist. MSS. Comm. III. Rep.* 190, 217); *Notes on the King's Writ for choosing Members of Parliament* . . . were published 1766 (see also add. MSS. 4993); *Memorials of English Affairs from the supposed expedition of Bruce to this Island to the end of the Reign of James I.*, were published 1709; *Essays Ecclesiastical and Civil* (1706); *Quench not the Spirit* . . . (1711); some theological treatises remain in MS., and several others are attributed to him.

See the article by C. H. Firth in the *Dict. Nat. Biog.* with authorities there quoted; *Memoirs of B. Whitelocke* by R. H. Whitelocke (1860); H. Reeve's edition of the *Swedish Embassy*; Foss's *Judges of England*; *Eng. Hist. Rev.* xvi. 737; Wood's *Ath. Oxon.* iii. 1042.

WHITE MOUNTAINS, the portion of the Appalachian Mountain system which traverses New Hampshire, U.S.A., between the Androscoggin and Upper Ammonoosuc rivers on the north and the lake country on the south. They cover an area of about 1300 sq. m., are composed of somewhat homogeneous granite rocks, and represent the remnants of long-continued erosion of a region formerly greatly elevated. From a plateau which has been cut deep by rivers and streams they rise to rounded summits often noble in outline and of greater elevation than elsewhere in the Appalachian system, except in North Carolina, and culminate in Mount Washington, 6293 ft. above the sea. Thirteen other summits have an elevation exceeding 5000 ft. The scenery is so beautiful and varied that the region has long been popular as a summer resort. It is traversed by railways, one of which ascends Mount Washington, and contains numerous villages and fine hotels.

See the article NEW HAMPSHIRE; the *Guidebook* (Part i., Boston, 1907) published by the Appalachian Mountain Club; and *Appalachia* (ibid., 1876 seq.), a periodical published by the same club.

WHITE PLAINS, a village and the county-seat of Westchester county, New York, U.S.A., about 12 m. N. of New York City on the Bronx river, about midway between the Hudson river and Long Island Sound. Pop. (1890) 4508; (1900) 7899, of whom 1679 were foreign-born and 269 were negroes; (1910 census) 26,425. The village is served by the New York Central & Hudson River railway, and is connected by electric lines with New York City, and with Yonkers, Mount Vernon, New Rochelle, Tarrytown and Mamaroneck. White Plains is a beautiful residential suburb stretching over a considerable area of rolling tree-clad hills and picturesque stretches of meadow lands in the valley of the Bronx and Mamaroneck rivers. Near the village are Silver, Kensico and Rye lakes. Among the public buildings and the institutions here are a fine Public Library building, a town hall, an armoury, the Westchester county court house and county jail, several private schools, the White Plains Hospital, St Agnes Hospital, the Presbyterian Convalescents' Sanitarium, the New York Orthopaedic Hospital, Muldoon's Hygienic Institute and Bloomingdale Hospital for the Insane (1821). In White Plains are the grounds of the Century Country Club, the Knollwood Golf and Country Club and the Westchester County Fair Association. There are some prosperous farms and market gardens.

When the Dutch first settled Manhattan, the central portion of what is now Westchester county was the granary for part of the Mahican tribe; it was called Quarropas by the Indians. To the early traders here the region was known as "the White Plains" from the groves of white balsam which covered it. The first organized settlement (November 1683) was by a party of Connecticut Puritans, who had settled at Rye in what was then disputed territory between New York and Connecticut; they moved westward in a body and took up lands the title to which they bought from the Indians. The heirs of John Richbell claimed that White Plains was comprised in a tract extending N. from the Mamaroneck river granted to him by the Dutch and confirmed by the English, and the controversy between these heirs and the settlers from Rye was only settled in 1722 by the grant to Joseph Budd and sixteen other settlers of a royal patent under which the freeholders chose their local officers and managed their own affairs. In 1759 White Plains succeeded Westchester as the county-seat of Westchester county. In the early summer of 1776 the Third Provincial Congress, having adjourned from New York City, met here in the old court house on South Broadway—the site is now occupied by an armoury and is marked by a monument (1910). From the steps of this building the Declaration of Independence, brought from Philadelphia, was officially read for the first time in New York on the 11th of July 1776. Here Congress adopted formally the name "Convention of Representatives of the State of New York," and from this dates the existence of New York as a state. After the British under Lord Howe had effected a landing at Throg's Neck on Long Island Sound, Washington withdrew (October) all his forces from the North end of Manhattan Island except the garrison of Fort Washington, and (21st October) concentrated his army near White Plains. His right rested on the Bronx river here, and there was a small force in rude earthworks on Chatterton's Hill on the W. bank. This point Howe attacked (October 28th), his troops advancing in two columns 4000 strong, the British under General Alexander Leslie, the Hessians under Colonel Johann Gottlieb Rall. General Alexander McDougall, in command of the American right wing, reinforced the troops on the hill, making the number of the defenders about 1600. The attack was stubbornly resisted for some time, after which the Americans retreated in good order across the river. The British had sustained such a severe loss (about 250) that no attempt was made to follow the Americans, who carried their dead and wounded, some 125 in number, away with them. Washington's forces retired three days later to North Castle township, where they occupied a stronger position. The old Miller House, which still stands in North White Plains, was occupied at intervals by Washington as his headquarters before the battle and again in the summer of 1778. In 1779 a Continental force under Aaron Burr was stationed here for some months, and in 1781 (July) White Plains was occupied by parts of Lauzun's and Rochambeau's French force. In 1866 White Plains received a village charter, which it still retains in spite of its large population.

See F. Shonnard and W. W. Spooner, *History of Westchester County* (N.Y., 1900), and J. T. Scharf, *History of Westchester County* (2 vols., ibid., 1886).

WHITESIDE, JAMES (1804–1876), Irish judge, son of William Whiteside, a clergyman of the Church of Ireland, was born on the 12th of August 1804, and was educated at Trinity College, Dublin, being called to the Irish bar in 1830. He very rapidly acquired a large practice, and after taking silk in 1842 he gained a reputation for forensic oratory surpassing that of all his contemporaries, and rivalling that of his most famous predecessors of the 18th century. He defended Daniel O'Connell in the state trial of 1843, and William Smith O'Brien in 1848; and his greatest triumph was in the Yelverton case in 1861. He was elected member for Enniskillen in 1851, and in 1859 became member for Dublin University. In parliament he was no less successful as a speaker than at the bar, and in 1852 was appointed solicitor-general for Ireland in the first administration of the earl of Derby, becoming attorney-general in 1858, and again in 1866. In the same year he was appointed chief justice of the Queen's Bench; and he died on the 25th of November 1876. Whiteside was a man of handsome presence, attractive personality and cultivated tastes. In 1848, after a visit to Italy, he published *Italy in the Nineteenth Century*; and in 1870 he collected and republished some papers contributed many years before to periodicals, under the title *Early Sketches of Eminent Persons*. In 1833 Whiteside married Rosetta, daughter of

William Napier, and sister of Sir Joseph Napier (1804–1882), lord chancellor of Ireland.

See J. R. O'Flanagan, *The Irish Bar* (London, 1879).

WHITETHROAT, a name commonly given to two species of little birds, one of which, the *Motacilla sylvia* of Linnaeus and *Sylvia rufa* or *S. cinerea* of recent authors, is regarded as the type, not only of the genus *Sylvia*, but of the sub-family of thrushes known as *Sylviinae* (cf. WARBLER). Very widely spread over Great Britain, in some places tolerably common, and by its gesticulations and song rather conspicuous, it is one of those birds which have gained a familiar nickname, and "peggy whitethroat" is the anthropomorphic appellation of schoolboys and milkmaids, though it shares "nettle-creeper" and other homely names with perhaps more than one congener, while to the writers and readers of books it is by way of distinction the greater whitethroat. The lesser whitethroat, *Sylvia curruca*, is both in habits and plumage a much less sightly bird: the predominant reddish brown of the upper surface, and especially the rufous edging of the wing-feathers, that are so distinctive of its larger congener, are wanting, and the whole plumage above is of a smoky-grey, while the bird in its movements is never obtrusive, and it rather shuns than courts observation. The nests of each of these species are very pretty works of art, firmly built of bents or other plant-stalks, and usually lined with horsehair; but the sides and bottom are often so finely woven as to be like open basket-work, and the eggs, splashed, spotted or streaked with olive-brown, are frequently visible from beneath through the interstices of the fabric. This style of nest-building seems to be common to all the species of the genus *Sylvia*, as now restricted, and in many districts has obtained for the builders the name of "hay-jack," quite without reference to the kind of bird which puts the nests together, and thus is also applied to the blackcap, *S. atricapilla*, and the garden-warbler—this last being merely a book-name—*S. salicaria* (*S. hortensis* of some writers). The former of these deserves mention as one of the sweetest songsters of Great Britain. The name blackcap is applicable only to the cock bird, who further differs from his brown-capped mate by the purity of his ashy-grey upper plumage; but, notwithstanding the marked sexual difference in appearance, he takes on himself a considerable share of the duties of incubation. All these four birds, as a rule, leave Great Britain at the end of summer to winter in the south. Two other species, one certainly belonging to the same genus, *S. orphea*, and the other, *S. nisoria*, a somewhat aberrant form, have occurred two or three times in Great Britain. The curious Dartford warbler of English writers, *Sylvia undata*, is on many accounts a very interesting bird, for it is one of the few of its family that winter in England—a fact the more remarkable when it is known to be migratory in most parts of the continent of Europe. Its distribution in England is very local, and chiefly confined to the southern counties. It is a pretty little dark-coloured bird, which here and there may be seen on furze-grown heaths from Kent to Cornwall. For a species with wings so feebly formed it has a wide range, inhabiting nearly all the countries of the Mediterranean seaboard, from Palestine to the Strait of Gibraltar, and thence along the west coast of Europe to the English Channel; but everywhere else it seems to be very local.

This may be the most convenient place for noticing the small group of warblers belonging to the well-marked genus *Hypolais*, which, though in general appearance and certain habits resembling the *Phylloscopi* (cf. [willow] WREN), would seem usually to have little to do with those birds, and to be rather allied to the *Sylviinae*. They have a remarkably loud song, and in consequence are highly valued on the continent of Europe, where two species at least spend the summer. One of them, *H. icterina*, has occurred more than once in the British Islands, and their absence as regular visitors is to be regretted. Among the minor characteristics of this little group is one afforded by their eggs, which are of a deeper or paler brownish pink, spotted with purplish black. Their nests are beautiful structures, combining warmth with lightness in a way that cannot be fully appreciated by any description. (A. N.)

WHITFIELD, JOHN CLARKE (1770–1836), English organist and composer, was born at Gloucester on the 13th of December 1770, and educated at Oxford under Dr Philip Hayes. In 1789 he was appointed organist of the parish church at Ludlow. Four years later he took the degree of Mus. Bac. at Cambridge, and in 1795 he was chosen organist of Armagh cathedral, whence he removed in the same year to Dublin, with the appointments of organist and master of the children at St Patrick's cathedral and Christchurch. Driven from Ireland by the rebellion of 1798, he accepted the post of organist at Trinity and St John's Colleges, Cambridge, and about the same time assumed the surname of Whitfield, in addition to that of Clarke, by which he had been previously known. He took the degree of Mus. Doc. at Cambridge in 1799, and in 1810 proceeded to the same grade at Oxford. In 1820 he was elected organist and master of the choristers at Hereford cathedral; and on the death of Dr Haig he was appointed professor of music at Cambridge. Three years afterwards he resigned these appointments in consequence of an attack of paralysis. He died at Hereford, on the 22nd of February 1836.

Whitfield's compositions were very numerous. Among the best of them are four volumes of anthems, published in 1805. He also composed a great number of songs, one of which—"Bird of the Wilderness," written to some well-known verses by James Hogg, the "Ettrick Shepherd"—attained a high degree of popularity. But the great work of his life was the publication, in a popular and eminently useful form, of the oratorios of Handel, which he was the first to present to the public with a complete pianoforte accompaniment.

WHITGIFT, JOHN (*c.* 1530–1604), English archbishop, was the eldest son of Henry Whitgift, merchant of Great Grimsby, Lincolnshire, where he was born, according to one account in 1533, but according to a calculation founded on a statement of his own in 1530. At an early age his education was entrusted to his uncle, Robert Whitgift, abbot of the neighbouring monastery of Wellow, by whose advice he was afterwards sent to St Anthony's school, London. In 1549 he matriculated at Queens' College, Cambridge, and in May 1550 he migrated to Pembroke Hall, where he had the martyr John Bradford for a tutor. In May 1555 he became a fellow of Peterhouse. Having taken orders in 1560, he became in the same year chaplain to Richard Cox, bishop of Ely, who collated him to the rectory of Teversham, Cambridgeshire. In 1563 he was appointed Lady Margaret professor of divinity at Cambridge, and his lectures gave such satisfaction to the authorities that on the 5th of July 1566 they considerably augmented his stipend. The following year he was appointed regius professor of divinity, and also became master first of Pembroke Hall and then of Trinity. He had a principal share in compiling the statutes of the university, which passed the great seal on the 25th of September 1570, and in November following he was chosen vice-chancellor. Macaulay's description of Whitgift as "a narrow, mean, tyrannical priest, who gained power by servility and adulation," is tinged with rhetorical exaggeration; but undoubtedly Whitgift's extreme High Church notions led him to treat the Puritans with exceptional intolerance. In a pulpit controversy with Thomas Cartwright, regarding the constitutions and customs of the Church of England, he showed himself Cartwright's inferior in oratorical effectiveness, but the balance was redressed by the exercise of arbitrary authority. Whitgift, with other heads of the university, deprived Cartwright in 1570 of his professorship, and in September 1571 exercised his prerogative as master of Trinity to deprive him of his fellowship. In June of the same year Whitgift was nominated dean of Lincoln. In the following year he published *An Answere to a Certain Libel intituled an Admonition to the Parliament*, which led to further controversy between the two divines. On the 24th of March 1577, Whitgift was appointed bishop of Worcester, and during the absence of Sir Henry Sidney in Ireland (1577) he acted as vice-president of Wales. In August 1583 he was appointed archbishop of Canterbury, and thus was largely instrumental in giving its special complexion to the church of the Reformation. Although he wrote a letter to Queen Elizabeth remonstrating against the alienation of church property, Whitgift always retained her special confidence. In his policy against the Puritans, and in his vigorous enforcement of the subscription test, he thoroughly carried out the queen's policy of religious uniformity. He drew up articles aimed at nonconforming ministers, and obtained increased powers for the Court of High Commission. In 1586 he became a privy councillor. His action gave rise to the Marprelate tracts, in which the bishops and clergy were bitterly attacked. Through Whitgift's vigilance the printers of the tracts were, however, discovered and punished; and in order more effectually to check the publication of such opinions he got a law passed in 1593 making Puritanism an offence against the statute law. In the controversy between Walter Travers and Richard Hooker he interposed by prohibiting the preaching of the former; and he moreover presented Hooker with the rectory of Boscombe in Wiltshire, in order to afford him more leisure to complete his *Ecclesiastical Polity*, a work which, however, cannot be said to represent either Whitgift's theological or his ecclesiastical standpoint. In 1595 he, in conjunction with the bishop of London and other prelates, drew up the Calvinistic instrument known as the Lambeth Articles, which were not accepted by the church. Whitgift attended Elizabeth on her deathbed, and crowned James I. He was present at the Hampton Court Conference in January 1604, and died at Lambeth on the 29th of the following February. He was buried in the church of Croydon, and his monument there with his recumbent effigy was in great part destroyed in the fire by which the church was burnt down in 1867.

Whitgift is described by his biographer, Sir G. Paule, as of "middle stature, strong and well shaped, of a grave countenance and brown complexion, black hair and eyes, his beard neither long nor thick." He was noted for his hospitality, and was somewhat ostentatious in his habits, sometimes visiting Canterbury and other towns attended by a retinue of 800 horsemen. He left several unpublished works, which are included among the MSS. *Angliae*. Many of his letters, articles, injunctions, &c. are calendared in the published volumes of the "State Paper" series of the reign of Elizabeth. His *Collected Works*, edited for the Parker Society by John Ayre (3 vols., Cambridge, 1851–1853), include, besides the controversial tracts already alluded to, two sermons published during his lifetime, a selection from his letters to Cecil and others, and some portions of his unpublished MSS.

A *Life* of Whitgift by Sir G. Paule appeared in 1612, 2nd ed. 1649. It was embodied by John Strype in his *Life and Acts of Whitgift* (1718). There is also a life in C. Wordsworth's *Ecclesiastical Biography* (1810), W. F. Hook's *Archbishops of Canterbury* (1875), and vol. i. of Whitgift's *Collected Works*. See also C.H. Cooper's *Athenae Cantabrigienses*.

WHITHORN, a royal burgh of Wigtownshire, Scotland. Pop. (1901) 1118. It is situated near the southern extremity of the peninsula of Machers, 12¼ m. S. of Wigtown by railway. The town consists of one long street running north and south, in which the town-hall is situated. It is famous for its associations with St Ninian or Ringan, the first Christian missionary to Scotland. He landed at the Isle of Whithorn, a small promontory about 3½ m. to the S.E. where he built (397) a church of stone and lime, which, out of contrast with the dark mud and wattle huts of the natives, was called Candida Casa, the White House (Anglo-Saxon, *Hwit ærn*, Whitherne or Whithorn). This he dedicated to his master St Martin of Tours. Ninian died probably in 432 and was buried in the church. A hundred years later the Magnum Monasterium, or monastery of Rosnat, was founded at Whithorn, and became a noted home of learning and, in the 8th century, the seat of the bishopric of Galloway. It was succeeded in the 12th century by St Ninian's Priory, built for Premonstratensian monks by Fergus "King" of Galloway, of which only the chancel (used as the parish church till 1822) with a richly decorated late Norman doorway, and fragments of the lady chapel, vaults, cellars, buttresses and tombs remain. The priory church was the cathedral church of the see till the Reformation, when it fell into gradual decay. In Roman times Whithorn belonged to the Novantae, and William Camden, the antiquary, identified it with the Leukopibia of Ptolemy. It was made a royal burgh by Robert Bruce.

WHITING, a city of Lake county, Indiana, U.S.A., on the S.W. shore of Lake Michigan, about 10 m. S.E. of Chicago. Pop. (1890) 1408; (1900) 3983 (1597 foreign-born); (1910) 6587. It is served by the Baltimore & Ohio, the Lake Shore & Michigan Southern, the Pennsylvania, the Chicago, Indiana & Southern and (for freight only) the Elgin, Joliet & Eastern, the Chicago Terminal Transfer, and the Indiana Harbour Belt railways; and is connected with Chicago and with the surrounding towns by an electric line. The city has a Carnegie library and a public park. Manual training, from the fourth to the twelfth grades, is a feature of the public school system. Whiting adjoins the cities of Hammond and East Chicago, and is practically a part of industrial Chicago, from which it is separated only by a state line. It is a shipping point; the Standard Oil Company has a large refinery here, and among its manufactures are asphaltum for street paving, linoleum and men's garments. Whiting was first settled about 1870, was incorporated as a town in 1895, and chartered as a city in 1903.

WHITING (*Gadus merlangus*), a fish of the family *Gadidae*, which is abundant on the shores of the German Ocean and all round the coasts of the British Islands; it is distinguished from the other species of the genus by having from 33 to 35 rays in the first anal fin, and by lacking the barbel on the chin. The snout is long, and the upper jaw longer than the lower. A black spot at the root of the pectoral fin is also very characteristic of this species, and but rarely absent. The whiting is one of the most valuable food fishes of northern Europe, and is caught throughout the year by hook and line and by the trawl. It is in better condition at the beginning of winter than after the spawning season, which falls in the months of February and March. Its usual size is from 1 to 1½ ℔, but it may attain to twice that weight.

WHITLOW, a name applied loosely to any inflammation involving the pulp of the finger, attended by swelling and throbbing pain. In the simplest form, which is apt to occur in sickly children, the inflammation results in a whitish vesicle of the skin, containing watery or bloody fluid. In all such cases, where the deeper structures are not implicated, no radical local treatment is needed, although the illness is an indication for constitutional treatment. The inflammation is not usually spoken of as whitlow unless it involves the deeper structures of the last joint of the finger, in which case it is associated with intense pain. As the result of a scratch or prick of the finger septic germs enter the skin and give rise to an acute inflammation, with throbbing and bursting pain. If the germs do not spread from that spot, they set up an acute localized attack of erysipelas which may end in a superficial abscess. More often, however, they make their way to the periosteum of the last bone of the finger, and involve it in a devastating inflammation which may end in death (necrosis) of that bone. Sometimes the germs find their way into the tendon-sheath, and, spreading into the palm of the hand, cause a deep abscess with, perhaps, sloughing of the tendon, and leaving a permanently stiffened finger. In some cases amputation of the finger is eventually called for. Whitlow is especially apt to occur in people who are out of health, as in them the micro-organisms of the disease meet with less resistance. So soon, therefore, as the acute stage of the disease is over, tonic treatment, with quinine and iron, is needed. The local treatment of whitlow demands a free incision into the area in which the germs are undergoing cultivation, and the sooner that this is done the better. It is wrong to wait for an abscess to be formed. A prompt incision may actually prevent the formation of abscess, and the easing of the tension of the inflamed tissue by the incision gives immediate relief. Perhaps, even in the early stage of the disease, a bead or two of pus may find exit, but whether there is abscess or not, the depths of the wound should be swabbed out with some strong carbolic or mercuric lotion in order to destroy the germs. The hand should then be placed upon a splint with antiseptic fomentations around the finger. It should, moreover, be kept well raised, or worn in a sling. (E. O.*)

WHITMAN, MARCUS (1802–1847), American missionary and pioneer, was born at Rushville, New York, on the 4th of September 1802. He studied medicine at Pittsfield, Massachusetts, and practised in Canada and in Wheeler, Steuben county, New York. In 1834 he was accepted by the American Board of Commissioners for Foreign Missions for missionary work among the American Indians, and was assigned to the Oregon territory, then under the joint occupation of Great Britain and the United States. He set out early in 1835, but returned almost immediately to secure other workers. In February 1836 he married and in March again crossed the continent, accompanied by his wife, Rev. and Mrs H. H. Spalding and W. H. Gray, and settled at Waiilatpu, near the present Walla Walla, Washington. Dissensions which arose among the missionaries and their apparent lack of success led to a resolution (February 1842) of the Prudential Committee of the Board to abandon the southern station. With the consent of his associates, Dr Whitman started from the station (3rd October 1842) on the perilous winter journey over the Rocky Mountains and across the plains for the missionary headquarters at Boston, to urge the revocation of the order. He visited New York and Washington also to enlist help and sympathy. On his return journey he joined a considerable body of emigrants on their way to Oregon and piloted them across the mountains. The mission, however, gained the ill-will of the Indians, and, on the 29th of October 1847 Dr and Mrs Whitman and twelve others were killed, and the station was broken up.

On the 16th of November 1864 the statement was published, on the authority of Mr Spalding, that the purpose of Dr Whitman's ride, twenty-two years before, was to prevent the cession of the territory to Great Britain. The story was amplified by Spalding and Gray in 1865, 1866 and 1870, and in its final form declared that Whitman learned at the British fort Walla Walla in September 1842 that a large number of British settlers were expected, and that it was hoped that the treaty then supposed to be in process of negotiation between Lord Ashburton and Daniel Webster, Secretary of State, would give the territory to the British. Thereupon Whitman made his way to Washington, and with much difficulty convinced Webster and President Tyler of the value of the country and prevented its exchange for fishing privileges off Newfoundland. This story has been widely disseminated, but Professor E. G. Bourne and Mr W. I. Marshall independently investigated the whole question, and showed that there is no evidence that Dr Whitman influenced or attempted to influence the State Department. For the pro-Whitman side, see W. H. Gray, *Oregon* (Portland, 1870); William Barrows, *Oregon* (Boston, 1883); O. W. Nixon, *How Marcus Whitman saved Oregon* (Chicago, 1895); W. A. Mowry, *Marcus Whitman* (New York, 1901); Myron Eells, *Marcus Whitman* (Seattle, 1909). On the other side see H. H. Bancroft, *Oregon* (San Francisco, 1886–1888); E. G. Bourne, *Essays in Historical Criticism* (New York, 1901); W. I. Marshall, *History* v. *The Whitman-saved-Oregon Story* (Chicago, 1904).

WHITMAN, WALT (1819–1892), American poet, was born at West Hills, on Long Island, New York, on the 31st of May 1819. His ancestry was mingled English and Holland Dutch, and had flourished upon Long Island more than 150 years—long enough to have taken deep root in the soil and to have developed, in its farmers and seafaring men, many strong family traits. His father, Walter Whitman, was a farmer and carpenter; his mother, Louisa Van Velsor, was the granddaughter of a sea captain. There do not appear to be any men in his line of descent given to scholarly or intellectual pursuits till we get back to the 17th century, when we come to Abijah Whitman, a clergyman, settled in Connecticut. Later this Abijah moved to Long Island, and from him all the Whitmans on the island descended. Walt was the second of a family of nine children. The parents early moved to Brooklyn, where Whitman spent his youth. His career was a chequered one, like that of so many other self-made American men. First he was an errand boy in a lawyer's office; then he was employed in a printing office; next he became a country school teacher; he founded (1836) and till 1839 edited the *Long Islander* at Huntington, and later edited a daily paper in Brooklyn (the *Eagle*, 1846–1847); then he was found in New Orleans, on the editorial staff of the *Crescent* (1848–1849); afterwards he passed his time carpentering, building and selling small houses in Brooklyn (1851–1854), in the meanwhile writing for the magazines and reviews and turning out several novels, and finally revolving in his mind the scheme of his *Leaves of Grass.* This scheme was probably gestating in his mind during the years 1853, 1854 and 1855. He frequently stopped his carpentering to work at his poems. He left voluminous manuscript notes, showing the preparatory studies and reflections that preceded the *Leaves*; many of them, under the title of *Notes and Fragments*, were privately printed by his literary executor, Dr Richard Maurice Bucke, in 1899. Finally, in the summer of 1855 the first edition of *Leaves of Grass* appeared—a small quarto of ninety-four pages. The book did not attract the attention of the critics and the reading public till a letter from Emerson to the poet, in which the volume was characterized as "the most extraordinary piece of wit and wisdom that America has yet contributed," was published in the New York *Tribune.* This created a demand for the book, and started it upon a career that has probably had more vicissitudes and called forth more adverse as well as more eulogistic criticism than any other contemporary literary work. In 1856 a second and much enlarged edition of *Leaves of Grass* appeared. In 1860 a third edition, with much new matter, was published in Boston. In 1862 Whitman went to Washington to look after his brother, Lieutenant-Colonel George W. Whitman, who was wounded at the battle of Fredericksburg. Henceforth, for more than ten years he remained in and about Washington, acting as a volunteer nurse in the army hospitals as long as the war lasted, and longer, and then finding employment as a clerk in the government departments, in the meantime adding to and revising his *Leaves* and publishing two or three editions of them, himself his own publisher and bookseller. Out of his war experiences came in 1866 his *Drum Taps*, subsequently incorporated into the main volume. Early in 1873 he suffered a paralytic stroke which partially disabled him. He then went to Camden, New Jersey, to live and continued to reside in that city till his death on the 27th of March 1892. In 1871 appeared his prose volume called *Democratic Vistas.* In 1876 he published a thin volume, called *Two Rivulets*, made up of prose and verse. *Specimen Days and Collect*, also prose, appeared in 1882. New editions of his *Leaves* continued to appear at intervals as long as he lived. A final and complete edition of his works, including both prose and verse, was published in Philadelphia in 1889.

Whitman never married, never left America, never laid up, or aimed to lay up, riches: he gave his time and his substance freely to others, belonged to no club nor coterie, associated habitually with the common people—mechanics, coach-drivers, working men of all kinds—was always cheerful and optimistic. He was large and picturesque of figure, slow of movement, tolerant, receptive, democratic and full of charity and goodwill towards all. His life was a poet's life from first to last—free, unworldly, unhurried, unconventional, unselfish, and was contentedly and joyously lived. He left many notes that throw light upon his aims and methods in composing *Leaves of Grass.* "Make no quotations," he charged himself, "and no reference to any other writers. Lumber the writing with nothing—let it go as lightly as the bird flies in the air or a fish swims in the sea. Avoid all poetical similes; be faithful to the perfect likelihoods of nature—healthy, exact, simple, disdaining ornaments. Do not go into criticisms or arguments at all; make full-blooded, rich, flush, natural works. Insert natural things, indestructibles, idioms, characteristics, rivers, states, persons, &c. Be full of *strong sensual germs.* . . . Poet! beware lest your poems are made in the spirit that comes from the study of pictures of things—and not from the spirit that comes from the contact with real things themselves." The mother-idea of his poems, he says, is democracy, and democracy "carried far beyond politics into the region of taste, the standards of manners and beauty, and even into philosophy and theology." His *Leaves* certainly radiates democracy as no other modern literary work does, and brings the reader into intimate and enlarged relations with fundamental human qualities—with sex, manly love, charity, faith, self-esteem, candour, purity of body, sanity of mind. He was democratic because he was not in any way separated nor detached from the common people by his quality, his culture, or his aspirations. He was bone of their bone and flesh of their flesh. Tried by current standards his poems lack form and structure, but they undoubtedly have in full measure the qualities and merits that the poet sought to give them. (J. Bu.)

See his *Complete Writings* (10 vols., New York, 1902), with bibliographical and critical matter by O. L. Triggs. His *Poems* (1902) has a biographical introduction by John Burroughs, whose *Whitman: A Study* (Boston, 1896) forms the tenth volume of the "New Riverside" edition of the poet's works. See also *Walt Whitman's Diary in Canada, with Extracts from other of his Diaries and Literary Notebooks*

(Boston, 1904) edited by W. S. Kennedy; *In re Walt Whitman* (Philadelphia, 1893) edited by his literary executors, H. L. Traubel, R. M. Bucke, T. B. Harned; Horace Traubel, *With Walt Whitman in Camden* (Boston, 1907), a record of talks in 1888, full of material; Bliss Perry, *Walt Whitman: His Life and Work* (Boston, 1907), with new material and unpublished letters; *Calamus*, a series of letters (1868–1880) written by Whitman to a "young friend" (Peter Doyle), edited by R. M. Bucke (1897), who also wrote an authorized biography—*Walt Whitman* (Philadelphia, 1883)—which contains contemporary criticisms of Whitman and W. D. O'Connor's "Good Gray Poet" (1866); *Walt Whitman* (London, 1893), a study by J. Addington Symonds; *Reminiscences of Walt Whitman with Extracts from his Letters* (London, 1896) by W. S. Kennedy; H. B. Binns, *Life of Walt Whitman* (New York, 1906); and critical estimates in R. L. Stevenson's *Familiar Studies of Men and Books* (1882); E. Dowden's *Studies in Literature* (1892), and in E. C. Stedman's *Poets of America*, &c. A bibliography of writings on Whitman is appended to *Selections* (Boston, 1898), edited by O. L. Triggs.

WHITNEY, ELI (1765–1825), American inventor, was born on a farm in Westboro, Massachusetts, on the 8th of December 1765. He exhibited unusual mechanical ability at an early age and earned a considerable part of his expenses at Yale College, where he graduated in 1792. He soon went to Savannah, Georgia, expecting to secure a position as a teacher, but was disappointed, and accepted the invitation of Mrs Nathanael Greene, the widow of the Revolutionary general, to spend some time on her plantation on the Savannah river, while deciding upon his future course. The construction by Whitney of several ingenious household contrivances led Mrs Greene to introduce him to some gentlemen who were discussing the desirability of a machine to separate the short staple upland cotton from its seeds, work which was then done by hand at the rate of a pound of lint a day. In a few weeks Whitney produced a model, consisting of a wooden cylinder encircled by rows of slender spikes set half an inch apart, which extended between the bars of a grid set so closely together that the seeds could not pass, but the lint was pulled through by the revolving spikes; a revolving brush cleaned the spikes, and the seed fell into another compartment. The machine was worked by hand and could clean 50 ℔ of lint a day. The model seems to have been stolen, but another was constructed and a patent was granted on the 14th of March 1794. Meanwhile Whitney had formed a partnership with Phineas Miller (who afterward married Mrs Greene), and they built at New Haven, Connecticut, a factory (burned in March 1795) for the manufacture of the gins. The partners intended to establish an absolute monopoly and to charge a toll of one-third of the cotton or to buy the whole crop. They were unable to supply the demand for gins, and country blacksmiths constructed many machines. A patent, later annulled, was granted (May 12, 1796) to Hogden Holmes for a gin which substituted circular saws for the spikes. Whitney spent much time and money prosecuting infringements of his patent, and in 1807 its validity was finally settled. The financial returns in Georgia cannot be ascertained. The legislature of South Carolina voted $50,000 for the rights for that state, while North Carolina levied a license tax for five years, from which about $30,000 was realized. Tennessee paid, perhaps, $10,000.[1] Meanwhile Whitney, disgusted with the struggle, began the manufacture of fire-arms near New Haven (1798) and secured profitable government contracts; he introduced in this factory division of labour and standardized parts. Although the modern gin has been much enlarged and improved, the essential features are the same as in Whitney's first model, and the invention profoundly influenced American industrial, economic and social history.

See Denison Olmsted, *Memoir* (New Haven, 1846); D. A. Tompkins, *Cotton and Cotton Oil* (Charlotte, N.C., 1901); and W. P. Blake, "Sketch of Eli Whitney" in New Haven Colony Historical Society, *Papers*, vol. v. (New Haven, 1894).

WHITNEY, JOSIAH DWIGHT (1819–1896), American geologist, was born at Northampton, Massachusetts, on the 23rd of November 1819. He graduated at Yale in 1839, and after two years' work as assistant in the geological survey of New Hampshire, spent some time in Europe in the study of chemistry, mineralogy and geology. Returning to the United States in 1847, he laboured successfully for a time in the copper and iron lands of the Lake Superior region; in 1855 he became State chemist and professor in the Iowa University and took part in the geological survey of the state; he subsequently worked in the lead region of the upper Missouri river, in Wisconsin, and in Illinois, publishing many reports, singly or in collaboration with others. From 1860 to 1874 he was state geologist of California, and issued a comprehensive series of reports on its topography, geology and botany. In 1869, with William H. Brewer, he determined the heights of the principal Rocky Mountain summits; and in recognition of his labours Mount Whitney (14,502, in Inyo county, California, the highest peak in the United States) received its name from him. From 1865 until his death he was professor of geology and director of the school of mining and practical geology at Harvard University, residing in Cambridge save when absent on expeditions of research. The records of his investigations are somewhat dispersed; the most homogeneous of his writings are *The Metallic Wealth of the United States, described and compared with that of other Countries* (1854), a work of importance at the time of its issue, and *Contributions to American Geology* (vol. i. only, 1880). He died at Lake Sunapee, New Hampshire, on the 18th of August 1896.

WHITNEY, WILLIAM COLLINS (1841–1904), American political leader and financier, was born at Conway, Massachusetts, on the 15th of July 1841, of Puritan stock. He graduated at Yale in 1863, studied law at Harvard, and practised with success in New York City. He was an aggressive opponent of the "Tweed Ring," and was actively allied with the anti-Tammany organizations, the "Irving Hall Democracy" of 1875–1890, and the "County Democracy" of 1880–1890, but upon the dissolution of the latter he became identified with Tammany. In 1875–1882 he was corporation counsel of New York, and as such brought about a codification of the laws relating to the city, and successfully contested a large part of certain claims, largely fraudulent, against the city, amounting to about $20,000,000, and a heritage from the Tweed regime. During President Cleveland's first administration (1885–1889), Whitney was secretary of the navy department and did much to develop the navy, especially by encouraging the domestic manufacture of armour plate. In 1892 he was instrumental in bringing about the third nomination of Mr Cleveland, and took an influential part in the ensuing presidential campaign; but in 1896, disapproving of the "free-silver" agitation, he refused to support his party's candidate, Mr W. J. Bryan. Whitney took an active interest in the development of urban transit in New York, and was one of the organizers of the Metropolitan Street Railway Company. He was also interested in horse-racing, and in 1901 won the English Derby with Volodyovski, leased by him from Lady Meux. He died in New York City on the 2nd of February 1904.

WHITNEY, WILLIAM DWIGHT (1827–1894), American philologist, was born at Northampton, Massachusetts, on the 9th of February 1827. He was the fourth child and the second surviving son of Josiah Dwight Whitney, a banker, and Sarah Williston, daughter of the Rev. Payson Williston (1763–1856) of Easthampton, Mass., and a sister of Samuel Williston (1795–1874), founder of Williston Seminary at Easthampton. Through both parents he was descended from New England stock remarkable alike for physical and mental vigour; and he inherited all the social and intellectual advantages that were afforded by a community noted, in the history of New England, for the large number of distinguished men whom it produced. At the age of fifteen (1842) he entered the sophomore class of Williams College (at Williamstown, Mass.), where he graduated three years later with the highest honours. His attention was at first directed to natural science, and his interest in it always remained keen, and his knowledge of its principles and methods exerted a noticeable influence upon his philological work. In the summer of 1849 he had charge of the botany, the barometrical observations and the accounts of the United States survey of the Lake Superior region conducted by his brother, Josiah D. Whitney, and in the summer of 1873 assisted in the geographical work of the Hayden expedition in Colorado. His interest in the study of Sanskrit was first awakened in 1848, and he at once devoted himself with enthusiasm to this at that time little-explored field of philological labour. After a brief course at Yale with Professor Edward Elbridge Salisbury (1814–1901), then the only trained Orientalist in the United States, Whitney went to Germany (1850) and studied for three years at Berlin, under Weber, Bopp and Lepsius, and at Tübingen (two summer semesters) under Roth, returning to the United States in 1853. In the following year he was appointed professor of Sanskrit in Yale, and in 1869 also of comparative philology. He also gave instruction in French and German in the college until 1867, and in the Sheffield scientific school until 1886. An urgent call to a professorship at Harvard was declined in 1869. The importance of his contributions to science was early and widely recognized. He was elected to membership in numerous learned societies in all parts of the world, and received many honorary degrees, the most notable testimonial to his fame being his election on the 31st of May 1881, as foreign knight of the Prussian order *pour le mérite* for science and arts to fill the vacancy caused by the death of Carlyle. In 1870 he received from the Berlin Academy of Sciences the first Bopp prize for the most important contribution to Sanskrit philology during the preceding three years—his edition of the *Tāittirīya-Prātiçākhya* (*Journal of the American Oriental Society*, vol. ix.). He died at New Haven, Connecticut, on the 7th of June 1894.

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[1] D. A. Tompkins, *Cotton* (1901), p. 28.

As a philologist Whitney is noted especially for his work in Sanskrit, which placed him among the first scholars of his time. He edited (1855–1856), with Professor Roth, the *Atharva-Veda-Sanhitā*; published (1862) with a translation and notes the *Atharva-Veda-Prātiçākhya*; made important contributions to the great Petersburg lexicon; issued an index verborum to the published text of the *Atharva-Veda* (*Journal of the American Oriental Society*, 1881); made a translation of the *Atharva-Veda*, books i.-xix., with a critical commentary, which he did not live to publish (edited by Lanman, 1905); and published a large number of special articles upon various points of Sanskrit philology. His most notable achievement in this field, however, is his *Sanskrit Grammar* (1879), a work which, as Professor Delbrück has said, not only is "the best text-book of Sanskrit which we possess," but also places its author, as a scientific grammarian, on the same level with such writers as Madvig and Krüger. To the general public Whitney is best known through his popular works on the science of language and his labours as a lexicographer. The former are, perhaps, the most widely read of all English books on the subject, and have merited their popularity through the soundness of the views which they present and the lucidity of their style.[1] His most important service to lexicography was his guidance, as editor-in-chief, of the work on *The Century Dictionary* (1889–1891). Apart from the permanent value of his contributions to philology, Whitney is notable for the great and stimulating influence which he exerted throughout his life upon the development of American scholarship.

The chronological bibliography of Whitney's writings appended to vol. xix. (first half) of the *Journal of the American Oriental Society*, issued in May 1897, contains 360 numbers. Of these the most important, in addition to those mentioned above, are: *Translation of the Sūryasiddhānta, a Text-book of Hindu Astronomy* (*Jour. Am. Oriental Soc.*, vol. vi., 1860); *Language and the Study of Language* (1867); *A Compendious German Grammar* (1869); *Oriental and Linguistic Studies* (1873; second series, 1874); *The Life and Growth of Language* (1875); *Essentials of English Grammar* (1877); *A Compendious German and English Dictionary* (1877); *A Practical French Grammar* (1886); *Max Müller and the Science of Language* (1892). (B. E. S.)

WHITSTABLE, a watering-place in the St Augustine's parliamentary division of Kent, England, on the north coast at the east end of the Swale, 6 m. N.N.W. of Canterbury, on the South Eastern & Chatham railway. Pop. of urban district (1901), 7086. The branch railway connecting Whitstable with Canterbury was one of the earliest in England, opened in 1830. The church of All Saints (Decorated and Perpendicular) possesses some old brasses; it was restored in 1875. Whitstable has been famous for its oyster beds from time immemorial. The fisheries were held by the Incorporated Company of Dredgers (incorporated by Act of Parliament in 1793), the affairs being administered by a foreman, deputy foreman and jury of twelve; but in 1896 an Act of Parliament transferred the management of the fishery to a company. The less extensive Seasalter and Ham oyster fishery adjoins. There is also a considerable coasting trade in coal in conjunction with the South-Eastern & Chatham railway company, who are the owners of the harbour, which accommodates vessels of about 400 tons alongside the quay. The urban district consists of parts of the old parishes of Whitstable and Seasalter. In modern times the manor was held by Wynne Ellis (1790–1875), who left a valuable collection of paintings to the nation.

Tankerton, adjoining Whitstable to the N.E., is a newly established seaside resort.

WHITSUNDAY, or PENTECOST (Lat. *Pentecoste*, Gr. *πεντηκοστή* sc. *ἡμέρα*, Fr. *Pentecôte*, Ger. *Pfingsten*, fr. O. H. Ger. *fimfchustin*), one of the principal feasts of the Christian Church, celebrated on the fiftieth (*πεντηκοστή*) day after Easter to commemorate the descent of the Holy Spirit on the disciples. The day became one of the three baptismal seasons, and the name Whitsunday is now generally attributed to the white garments formerly worn by the candidates for baptism on this feast, as in the case of the *Dominica in albis*. The festival is the third in importance of the great feasts of the Church and the last of the annual cycle commemorating the Lord. It is connected with the Jewish Pentecost (*q.v.*), not only in the historical date of its origin (see Acts vii.), but in idea; the Jewish festival is one of thanks for the first-fruits of the earth, the Christian for the first-fruits of the Spirit. In the early Church the name of Pentecost was given to the whole fifty days between Easter and Whitsunday, which were celebrated as a period of rejoicing (Tertullian, *De idolatr.* c. 12, *De bapt.* 19, *De cor. milit.* 3, *Apost. Canons*, c. 37, *Canons of Antioch*, 30). In the narrower sense, as the designation of the fiftieth day of this period, the word Pentecost occurs for the first time in a canon of the council of Elvira (305), which denounces as an heretical abuse the tendency to celebrate the 40th day (Ascension) instead of the 50th, and adds: "juxta auctoritatem scripturarum cuncti diem Pentecostis celebremus." There is plentiful evidence that the festival was regarded very early as one of the great feasts; Gregory Nazianzen (*Orat.* xliv. *De Pentec.*) calls it the "day of the Spirit" (*ἡμέρα τοῦ Πνεύματος*), and in 385 the *Peregrinatio Silviae* (see Duchesne, *Origines*, App.) describes its elaborate celebration at Jerusalem. The code of Theodosius (xv. 5, *De spectaculis*) forbade theatrical performances and the games of the circus during the feast. The custom of hallowing the days immediately surrounding the festival is comparatively late. Thus, among others, the synod of Mainz in 813 ordered the celebration of an octave similar to that at Easter. The custom of celebrating the vigil by fasting had already been introduced. The duration of the festival was, however, ultimately fixed at three days. In the Church of England this is still the rule (there are special collects, gospels and epistles for Monday and Tuesday in Whitsun week); in the Lutheran churches two days only are observed.

In the middle ages the Whitsun services were marked by many curious customs. Among these described by Durandus (*Rationale div. off.* vi. 107) are the letting down of a dove from the roof into the church, the dropping of balls of fire, rose-leaves and the like. Whitsun is one of the Scottish quarter-days, and though the Church festival is movable, the legal date was fixed for the 15th of May by an act of 1693. Whitmonday, which, with the Sunday itself, was the occasion for the greatest of all the medieval church ales, was made an English Bank Holiday by an act passed on the 25th of May 1871.

See Duchesne, *Origines du culte Chrétien* (1889); W. Smith and Cheetham, *Dic. of Christian Antiquities* (1874–1880); Herzog-Hauck,

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[1] They are particularly important in that they counteracted the popular and interestingly written books of Max Müller: for instance, Müller, like Renan and Wilhelm von Humboldt, regarded language as an innate faculty and Whitney considered it the product of experience and outward circumstance. See Whitney's article *Philology* in the present edition of the *Encyclopaedia Britannica*.

Realencyklopädie (1904), xv. 254, s.v. "Pfingsten." For the many superstitions and observances of the day see P. H. Ditchfield, *Old English Customs* (1897); Brand, *Antiquities of Great Britain* (Hazlitt's edit., 1905); B. Picart, *Cérémonies et coutumes religieuses de tous les peuples* (1723).

WHITTIER, JOHN GREENLEAF (1807–1892), America's "Quaker poet" of freedom, faith and the sentiment of the common people, was born in a Merrimack Valley farmhouse, Haverhill, Massachusetts, on the 17th of December 1807. The dwelling was built in the 17th century by his ancestor, the sturdy immigrant, Thomas Whittier, notable through his efforts to secure toleration for the disciples of George Fox in New England. Thomas's son Joseph joined the Society of Friends and bore his share of obloquy. Successive generations obeyed the monitions of the Inner Light. The poet was born in the faith, and adhered to its liberalized tenets, its garb and speech, throughout his lifetime. His father, John, was a farmer of limited means but independent spirit. His mother, Abigail Hussey, whom the poet strongly resembled, was of good stock. The Rev. Stephen Bachiler, an Oxford man and a Churchman, who became a Nonconformist and emigrated to Boston in 1632, was one of her forebears and also an ancestor of Daniel Webster. The poet and the statesman showed their kinship by the "dark, deep-set and lustrous eyes" that impressed one who met either of these uncommon men. The former's name of Greenleaf is thought to be derived from the French Feuillevert, and to be of Huguenot origin; and there was Huguenot blood as well in Thomas Whittier, the settler. The poet thus fairly inherited his conscience, religious exaltation and spirit of protest. All the Whittiers were men of stature and bodily strength, John Greenleaf being almost the first exception, a lad of delicate mould, scarcely adapted for the labour required of a Yankee farmer and his household. He bore a fair proportion of it, but throughout his life was frequently brought to a halt by pain and physical debility. In youth he was described as "a handsome young man, tall, slight, and very erect, bashful, but never awkward." His shyness was extreme, though covered by a grave and quiet exterior, which could not hide his love of fun and sense of the ludicrous. In age he retained most of these characteristics, refined by a serene expression of peace after contest. His eyes never lost their glow, and were said by a woman to be those of one "who had kept innocency all his days."

Whittier's early education was restricted to what he could gain from the primitive "district school" of the neighbourhood. His call as a poet came when a teacher lent to him the poems of Burns. He was then about fifteen, and his taste for writing, bred thus far upon the quaint *Journals of Friends*, the Bible and *The Pilgrim's Progress*, was at once stimulated. There was little art or inspiration in his boyish verse, but in his nineteenth year an older sister thought a specimen of it good enough for submission to the *Free Press*, a weekly paper which William Lloyd Garrison, the future emancipationist, had started in the town of Newburyport. This initiated Whittier's literary career. The poem was printed with a eulogy, and the editor sought out his young contributor: their alliance began, and continued until the triumph of the anti-slavery cause thirty-seven years later. Garrison overcame the elder Whittier's desire for the full services of his son, and gained permission for the latter to attend the Haverhill academy. To meet expenses the youth worked in various ways, even making slippers by hand in after-hours; but when he came of age his text-book days were ended. Meanwhile he had written creditable student verse, and contributed both prose and rhyme to newspapers, thus gaining friends and obtaining a decided if provincial reputation. He soon essayed journalism, first spending a year and a half in the service of a publisher of two Boston newspapers, the *Manufacturer*, an organ of the Clay protectionists, and the *Philanthropist*, devoted to humane reform. Whittier edited the former, having a bent for politics, but wrote for the latter also. His father's last illness recalled him to the homestead, where both farm and family became his pious charge. Money had to be earned, and he now secured an editorial post at Hartford, Connecticut, which he sustained until forced by ill-health, early in his twenty-fifth year, to re-seek the Haverhill farm. There he remained from 1832 to 1836, when the property was sold, and the Whittiers removed to Amesbury in order to be near their meeting-house and to enable the poet to be in touch with affairs. The new home became, as it proved, that of his whole after-life; a dwelling then bought and in time remodelled was the poet's residence for fifty-six years, and from it, after his death on the 7th of September 1892, his remains were borne to the Amesbury graveyard.

While in Hartford Whittier issued in prose and verse his first book, *Legends of New England* (1831), and edited the writings of the poet John Gardiner C. Brainard. Thenceforward he was constantly printing verse, but of the hundred or more pieces composed before his settlement at Amesbury less than fifty are retained in his final collection. Of these none has more significance than the poem to Garrison, which appeared in 1831, and was read (December 1833) at the Philadelphia Convention that formed the Anti-Slavery Society. To that convention, with one-third of its membership composed of Friends, Whittier was a delegate, and was appointed one of the committee that drafted the famous Declaration of Sentiments. Although a Quaker, he had a polemical spirit; men seeing Whittier only in his saintly age knew little of the fire wherewith, setting aside ambition and even love, he maintained his warfare against the "national crime," employing action, argument and lyric scorn. A future was open for him among the Protectionists, who formed the Whig party, and doubtless soon would have carried him to the United States Congress. As it was, he got no farther than the legislature of his own state (1835–1836), elected by his neighbours in an anti-slavery town. But if Garrison, Phillips and Sumner and Mrs Stowe were to be the rhapsodists of the long emancipation struggle, Whittier was its foreordained poet-seer. In 1833 he had issued at his own cost a pamphlet, "Justice and Expediency," that provoked vehement discussion North and South. Later he shared with the agitators their experience of lawlessness, mob-violence and political odium. His sister Elizabeth, who became his life companion, and whose verse is preserved with his own, was president of the Woman's Anti-Slavery Society in Amesbury. It is to be noted that the first collection of Whittier's lyrics was the *Poems written during the Progress of the Abolition Question in the United States*, issued by a friend in 1837. But *Mogg Megone* (1836) was his first book, a crude attempt to apply the manner of Scott's romantic cantos to a native theme. Among his other lyrical volumes, of dates earlier than the Civil War, were *Lays of my Home* (1843), *Voices of Freedom* (1846), *Songs of Labor* (1850), *The Chapel of the Hermits* (1853), *The Panorama* (1856), *Home Ballads* (1860). The titles of *In War Time* (1863) and *National Lyrics* (1865) rightly designate the patriotic rather than Tyrtaean contents of these books. The poet was closely affiliated with the *Atlantic Monthly* from the foundation of that classic magazine in 1857. His repute became national with the welcome awarded to *Snow-Bound* in 1866, and brought a corresponding material reward. Of his later books of verse may be mentioned *The Tent on the Beach* (1867), *The Pennsylvania Pilgrim* (1872), *The Vision of Echard* (1878), *The King's Missive* (1881), *At Sundown*, his last poems (1890). As early as 1849 an illustrated collection of his poems appeared, and his *Poetical Works* was issued in London in 1850. During the ensuing forty years no less than ten successive collections of his poems appeared. Meanwhile he did much editing and compiling, and produced, among other works in prose, *The Stranger in Lowell* (1845), *Supernaturalism in New England* (1847), *Leaves from Margaret Smith's Journal* (1849), a pleasing treatment in old-style English of an early Colonial theme. When he died, in 1892, in New Hampshire, among the hills he loved and sang so well, he had been an active writer for over sixty years, leaving more than that number of publications that bore his name as author or editor. His body was brought to Amesbury for interment; the funeral services were held in the open air, and conducted after the simple rites of the Friends, in the presence of a large concourse, certain of whom "spake as they were moved" in tribute to the bard. The Amesbury house has been acquired by the "Whittier Home Association," so that the building and grounds are guarded as he left them, and form a shrine to which there is a constant pilgrimage. The Haverhill homestead, memorized in *Snow-Bound*, is also held by trustees "to preserve the natural features of the landscape," and to keep the buildings and furniture somewhat as they were in their minstrel's boyhood.

It would be unjust to consider Whittier's genius from an academic point of view. British lovers of poetry—except John Bright and others of like faith or spirit—have been slow to comprehend his distinctive rank. As a poet he was essentially a balladist, with the faults of his qualities; and his ballads, in their freedom, naïveté, even in their undue length, are among the few modern examples of unsophisticated verse. He returned again and again to their production, seldom labouring on sonnets and lyrics of the Victorian mould. His ear for melody was inferior to his sense of time, but that his over-facility and structural defects were due less to lack of taste than to early habit, Georgian models, disassociation from the schools, is indicated by his work as a writer of prose. In *Margaret Smith's Journal* an artistic, though suppositive, Colonial style is well maintained. Whittier became very sensible of his shortcomings; and when at leisure to devote himself to his art he greatly bettered it, giving much of his later verse all the polish that it required. In extended composition, as when he followed Longfellow's *Tales of a Wayside Inn* with his own *Tent on the Beach*, he often failed to rival his graceful brother poet. In American balladry he was pre-eminent; such pieces as "The Swan Song of Parson Avery," "Marguerite," "Barclay of Ury," "Skipper Ireson's Ride," "In the 'Old South,'" hold their place in literature. It is necessary above all to consider the relation of a people's years of growth and ferment to the song which represents them; for in the strains of Whittier, more than in those of any other 19th-century lyrist, the saying of Fletcher of Saltoun as to the ballads and laws of a nation finds a historic illustration. He was the national bard of justice, humanity and reform, whose voice went up as a trumpet until the victory was won. Its lapses resembled those of Mrs Browning, who was of his own breed in her fervour and exaltation. To the last it was uncertain whether a poem by Whittier would "turn out a sang," or "perhaps turn out a sermon"; if the latter, it had deep sincerity and was as close to his soul as the other. He began as a liberator, but various causes employed his pen; his heart was with the people, and he was understanded of them; he loved a worker, and the *Songs of Labor* convey the zest of the artisan and pioneer. From 1832 to 1863 no occasion escaped him for inspiring the assailants of slavery, or chanting paeans of their martyrdom or triumph. No crusade ever had a truer laureate than the author of "The Virginia Slave Mother," "The Pastoral Letter"—one of his stinging ballads against a time-serving Church—"A Sabbath Scene," and "The Slaves of Martinique." "Randolph of Roanoke" is one of the most pathetic and most elevated of memorial tributes. "Ichabod" and "The Lost Occasion," both evoked by the attitude of Webster, are Roman in their condemnation and "wild with all regret."

The green rusticity of Whittier's farm and village life imparted a bucolic charm to such lyrics as "In School Days," "The Barefoot Boy," "Telling the Bees," "Maud Muller," and "My Schoolmate." His idyllic masterpiece is the sustained transcript of winter scenery and home-life, *Snow-Bound*, which has had no equal except Longfellow's "Evangeline" in American favour, but, in fact, nothing of its class since "The Cottar's Saturday Night" can justly be compared with it. Along with the Quaker poet's homing sense and passion for liberty of body and soul, religion and patriotism are the dominant notes of his song. His conception of a citizen's prerogative and duty, as set forth in "The Eve of Election," certainly is not that of one whose legend is "our country, right or wrong." Faith, hope and boundless charity pervade the "Questions of Life," "Invocation," and "The Two Angels," and are exquisitely blended in "The Eternal Goodness," perhaps the most enduring of his lyrical poems. "We can do without a Church," he wrote in a letter; "we cannot do without God, and of Him we are sure." The inward voice was his inspiration, and of all American poets he was the one whose song was most like a prayer. A knightly celibate, his stainless life, his ardour, caused him to be termed a Yankee Galahad; a pure and simple heart was laid bare to those who loved him in "My Psalm," "My Triumph" and "An Autograph." The spiritual habit abated no whit of his inborn sagacity, and it is said that in his later years political leaders found no shrewder sage with whom to take counsel. When the question of primacy among American poets was canvassed by a group of the public men of Lincoln's time, the vote was for Whittier; he was at least one whom they understood, and who expressed their feeling and convictions. Parkman called him "the poet of New England," but as the North and West then were charged with the spirit of the New England states, the two verdicts were much the same. The fact remains that no other poet has sounded more native notes, or covered so much of the American legendary, and that Whittier's name, among the patriotic, clean and true was one with which to conjure. He was revered by the people cleaving to their altars and their fires, and his birthdays were calendared as festivals, on which greetings were sent to him by young and old.

In his age the poet revised his works, classifying them for a definitive edition, in seven volumes, published at Boston, 1888. Their metrical portion, annotated by Horace E. Scudder, can be found in the one-volume "Cambridge Edition," (Boston, 1894). Whittier's *Life and Letters*, prepared by his kinsman and literary executor, Samuel T. Pickard, also appeared in 1894.

See also G. R. Carpenter, *John Greenleaf Whittier* (Boston, 1903) in the "American Men of Letters" series; a life (1907) by Bliss Perry; and B. Wendell, *Stelligeri* (New York, 1893, pp. 149-201). (E.C.S.)

WHITTINGHAM, CHARLES (1767–1840), English printer, was born on the 16th of June 1767, at Caludon or Calledon, Warwickshire, the son of a farmer, and was apprenticed to a Coventry printer and bookseller. In 1789 he set up a small printing press in a garret off Fleet Street, London, with a loan obtained from the typefounding firm of William Caslon, and by 1797 his business had so increased that he was enabled to move into larger premises. An edition of Gray's *Poems*, printed by him in 1799, secured him the patronage of all the leading publishers. Whittingham inaugurated the idea of printing cheap, handy editions of standard authors, and, on the bookselling trade threatening not to sell his productions, took a room at a coffee house and sold them by auction himself. In 1809 he started a paper-pulp factory at Chiswick, near London, and in 1811 founded the Chiswick Press. From 1810 to 1815 he devoted his chief attention to illustrated books, and is credited with having been the first to use proper overlays in printing woodcuts, as he was the first to print a fine, or "Indian Paper" edition. He was one of the first to use a steam-engine in a pulp mill, but his presses he preferred to have worked by hand. He died at Chiswick on the 5th of January 1840.

His nephew, CHARLES WHITTINGHAM (1795–1876), who from 1824 to 1828 had been in partnership with his uncle, in 1838 assumed control of the business. He already had printing works at Took's Court, Chancery Lane, London, and had printed various notable books, specially devoting himself to the introduction of ornamental initial letters, and the artistic arrangement of the printed page. The imprint of the Chiswick press was now placed on the productions of the Took's Court as well as of the Chiswick works, and in 1852 the whole business was removed to London. Under the management of the younger Whittingham the Chiswick Press achieved a considerable reputation. He died on the 21st of April 1876.

WHITTINGHAM, WILLIAM (*c.* 1524–1579), English scholar, who belonged to a Lancashire family, was born at Chester. Educated at Brasenose College, Oxford, he became a fellow of All Souls' College and a senior student of Christ Church, and later he visited several universities in France and Germany. A strong Protestant, he returned to England in 1553, but soon found it expedient to travel again to France. In 1554 he was a leading member of the band of English Protestant exiles who were assembled at Frankfort-on-the-Main, and in the controversies which took place between them concerning the form of service to be adopted, Whittingham strongly supported the Calvinistic views propounded by John Knox. These opinions, however, did not prevail, and soon the Scottish reformer and his follower were found at Geneva; in 1559 Whittingham succeeded Knox as minister of the English congregation in that city, and here he did his most noteworthy work, that of making an English translation of the Bible. He was probably responsible for the English translation of the New Testament which appeared in 1557, and he had certainly a large share in the translation of both the Old and the New Testaments which is called the *Genevan* or *Breeches* Bible. This was printed at Geneva in 1560 and enjoyed a remarkable popularity (see BIBLE, ENGLISH). He also made a metrical translation of some of the Psalms. Having returned to England in 1560, Whittingham went to France in the train of Francis Russell, 2nd earl of Bedford, and a little later he acted as minister of the English garrison at Havre, being in this place during its siege by the French in 1562. In the following year he was made dean of Durham. He attended well to the duties of his office, but his liking for puritan customs made certain prelates and others look upon him with suspicion, and in 1576 or 1577 a commission was appointed to inquire into his conduct. This had no result, and another commission was appointed in 1578, one charge against Whittingham being that he had not been duly ordained. The case was still under consideration when the dean died on the 10th of June 1579.

WHITTINGTON, RICHARD (d. 1423), mayor of London, described himself as son of William and Joan (Dugdale, *Monasticon Anglicanum*, vi. 740). This enables him to be identified as the third son of Sir William Whittington of Pauntley in Gloucestershire, a knight of good family, who married after 1355 Joan, daughter of William Mansel, and widow of Thomas Berkeley of Cubberley. Consequently Richard was a very young man when he is mentioned in 1379 as subscribing five marks to a city loan. He was a mercer by trade, and clearly entered on his commercial career under favourable circumstances. He married Alice, daughter of Sir Ivo Fitzwaryn, a Dorset knight of considerable property. Whittington sat in the common council as a representative of Coleman Street Ward, was elected alderman of Broad Street in March 1393, and served as sheriff in 1393–1394. When Adam Bamme, the mayor, died in June 1397, Whittington was appointed by the king to succeed him, and in October was elected mayor for the ensuing year. He had acquired great wealth and much commercial importance, and was mayor of the staple at London and Calais. He made frequent large loans both to Henry IV. and Henry V., and according to the legend, when he gave a banquet to the latter king and his queen in 1421, completed the entertainment by burning bonds for £60,000, which he had taken up and discharged. Henry V. employed him to superintend the expenditure of money on completing Westminster Abbey. But except as a London commercial magnate Whittington took no great part in public affairs. He was mayor for a third term in 1406–1407, and for a fourth in 1419–1420. He died in March 1423. His wife had predeceased him leaving no children, and Whittington bequeathed the whole of his vast fortune to charitable and public purposes. In his lifetime he had joined in procuring Leadenhall for the city, and had borne nearly all the cost of building the Greyfriars Library. In his last year as mayor he had been shocked by the foul state of Newgate prison, and one of the first works undertaken by his executors was its rebuilding. His executors, chief of whom was John Carpenter, the famous town clerk, also contributed to the cost of glazing and paving the new Guildhall, and paid half the expense of building the library there; they repaired St Bartholomew's hospital, and provided bosses for water at Billingsgate and Cripplegate. But the chief of Whittington's foundations was his college at St Michael, Paternoster church, and the adjoining hospital. The college was dissolved at the Reformation, but the hospital or almshouses are still maintained by the Mercers' Company at Highgate. Whittington was buried at St Michael's church. Stow relates that his tomb was spoiled during the reign of Edward VI., but that under Mary the parishioners were compelled to restore it (*Survey*, i. 243). Whittington had a house near St Michael's church; it is doubtful whether he had any connexion with the so-called Whittington Palace in Hart Street, Mark Lane. There is no proof that he was ever knighted; Stow does not call him Sir Richard. Much of Whittington's fame was probably due to the magnificence of his charities. But a writer of the next generation bears witness to his commercial success in *A Libell of English Policy* by styling him "the sunne of marchaundy, that lodestarre and chief-chosen flower."

> "Pen and paper may not me suffice
> Him to describe, so high he was of price."

The Richard Whittington of history is thus very different from the Dick Whittington of popular legend, which makes him a poor orphan employed as a scullion by the rich merchant, Sir Hugh Fitzwarren, who ventures the cat, his only possession, on one of his master's ships. Distressed by ill-treatment he runs away, but turns back when he hears from Holloway the prophetic peal of Bow bells. He returns to find that his venture has brought him a fortune, marries his master's daughter, and succeeds to his business. The legend is not referred to by Stow, whose love for exposing fables would assuredly have prompted him to notice it if it had been well established when he wrote. The first reference to the story comes with the licensing in 1605 of a play, now lost, *The History of Richard Whittington, of his lowe byrth, his great fortune.* Thomas Heywood in 1606 makes one of the characters in *If you know not me you know nobody*, allude to the legend, to be rebuked by another because "they did more wrong to the gentleman." "The legend of Whittington," probably meaning the play of 1605, is also mentioned by Beaumont and Fletcher in 1611 in *The Knight of the Burning Pestle.* The story was then no doubt popular. When a little later Robert Elstracke, the engraver, published a supposed portrait of Whittington with his hand resting on a skull, he had in deference to the public fancy to substitute a cat; copies in the first state are very rare. Attempts have been made to explain the story as possibly referring to vessels called "cats," which were employed in the North Sea trade, or to the French *achat* (purchase). But Thomas Keightley traced the cat story in Persian, Danish and Italian folk-lore at least as far back as the 13th century. The assertion that a carved figure of a cat existed on Newgate gaol before the great fire is an unsupported assumption.

BIBLIOGRAPHY.—The most important early references to Whittington are contained in Dr R. R. Sharpe's *Calendar of Letter-book H*; H. T. Riley's *Memorials of London*; and *Political Songs*, ii. 178 (Rolls series). For his charities see Stow's *Survey of London* (ed. C. L. Kingsford, 1908). For documents relating to Whittington College see Dugdale, *Monasticon Anglicanum*, vi. 740, and the *Calendar of Patent Rolls, Henry VI.*, ii. 214-217. Samuel Lysons collected the facts, but accepted the legend in *The Model Merchant of the Middle Ages* (1860). The *Life* by W. Besant and J. Rice does not improve on Lysons. Some useful references will be found in J. H. Wylie's *History of England under Henry IV.* For an examination of the legend see T. Keightley's *Tales and Popular Fictions*, pp. 241-286 (1834), and H. B. Wheatley's preface to his edition of *The History of Sir Richard Whittington* (first published in 1656). (C. L. K.)

WHITTINGTON, an urban district in the north-eastern parliamentary division of Derbyshire, England, 10 m. S. by E. of Sheffield and 2 m. N. of Chesterfield, on the Midland railway. Pop. (1901) 9416. The parish church of St Bartholomew was restored after its destruction by fire, excepting the tower and spire, in 1895. Samuel Pegge, the antiquary (1704–1796), was vicar of Whittington and Heath for many years, and was buried here. Stone bottles and coarse earthenware are manufactured in the town, where there are also large ironworks, collieries and brickworks. A small stone cottage, known as Revolution House, was the meeting-place of John Darcy, the 1st earl of Danby, and the 4th earl of Devonshire, who there concerted the plans by which, in 1688, the Whig party brought about the fall of James II. and the succession of William III. It was then a hostelry, known as the "Cock and Pynot"; pynot being the local name for a magpie.

WHITTLESEA (or WHITTLESEY), **WILLIAM** (d. 1374), archbishop of Canterbury, was probably born in the Cambridgeshire village of Whittlesey. He was educated at Oxford, and owing principally to the fact that he was a nephew of Simon Islip, archbishop of Canterbury, he received numerous ecclesiastical preferments; he held prebends at Lichfield, Chichester and Lincoln, and livings at Ivychurch, Croydon and Cliffe. Later he was appointed vicar-general, and then dean of the court of arches by Islip. In 1360 he became bishop of Rochester, and two years later bishop of Worcester. In 1368 Whittlesea was elected archbishop of Canterbury in succession to Simon Langham, but his term of office was very uneventful, a circumstance due partly, but not wholly, to his feeble health. He died at Lambeth on the 5th or 6th of June 1374.

WHITTLESEY, a market town in the Wisbech parliamentary division of Cambridgeshire, England, $5\frac{1}{4}$ m. E. of Peterborough, between that city and March, on the Great Eastern railway. Pop. of urban district (1901) 3909. It lies on a gentle eminence in the flat fen country, and the fine Perpendicular tower and spire of the church of St Mary are a landmark from far. A little to the north is the great artificial cut carrying the waters of the river Nene; and the neighbourhood is intersected with many other navigable "drains." To the south-west is the tract known as Whittlesey Mere, 6 m. distant from the town, in Huntingdonshire. It was a lake until modern times, when it was included in a scheme of drainage. The so-called Whittlesey Wash, in the neighbourhood of the town, is among several tracts in the fens which are perennially flooded. St Mary's church is principally Perpendicular, but has Norman and Decorated portions; the church of St Andrew is also Decorated and Perpendicular. The town has manufactures of bricks and tiles, and a considerable agricultural trade.

WHITWORTH, SIR JOSEPH, Bart. (1803–1887), English engineer, was born at Stockport, near Manchester, on the 21st of December 1803. On leaving school at the age of fourteen, he was placed with an uncle who was a cotton-spinner, with the view of becoming a partner in the business; but his mechanical tastes were not satisfied with this occupation, and in about four years he gave it up. He then spent some time with various machine manufacturers in the neighbourhood of Manchester, and in 1825 moved to London, where he gained more experience in machine shops, including those of Henry Maudslay. In 1833 he returned to Manchester and started in business as a toolmaker. In 1840 he attended the meeting of the British Association at Glasgow, and read a paper on the preparation and value of true planes, describing the method which he had successfully used for making them when at Maudslay's, and which depended on the principle that if any two of three surfaces exactly fit each other, all three must be true planes. The accuracy of workmanship thus indicated was far ahead of what was contemplated at the time as possible in mechanical engineering, but Whitworth not only proved that it could be attained in practice, but also showed how it could be measured. He found that if two true planes were arranged parallel to each other, an exceedingly small motion towards or from each other was sufficient to determine whether an object placed between them was held firmly or allowed to drop, and by mounting one of the planes on a screwed shaft provided with a comparatively large wheel bearing a scale on its periphery, he was able to obtain a very exact measurement of the amount, however minute, by which the distance between the planes was altered, by observing through what angular distance the wheel had been turned. In 1841, in a paper read before the Institution of Civil Engineers, he urged the necessity for the adoption of a uniform system of screw threads in place of the various heterogeneous pitches then employed. His system of standard gauges was also widely adopted. The principles of exact measurement and workmanship which he advocated were strictly observed in his own manufactory, with the result that in the Exhibition of 1851 he had a show of machine tools which were far ahead of those of any competitor. It was doubtless this superiority in machine construction that caused the government three years later to request him to design, and estimate for making, the machinery for producing rifled muskets at the new factory at Enfield. He did not see his way to agree to the proposition in this form, but it was ultimately settled that he should undertake the machinery for the barrels only. Finding that there was no established practice to guide him, he began a series of experiments to determine the best principles for the manufacture of rifle barrels and projectiles. He ultimately arrived at a weapon in which the necessary rotation of the projectile was obtained, not by means of grooving, but by making the barrel polygonal in form, with gently rounded angles, the bullets also being polygonal and thus travelling on broad bearing-surfaces along the rotating polygon. The projectile he favoured was 3 to 3½ calibres in length, and the bore he fixed on was 0·45 in., which was at first looked upon as too small. It is reported that at the trial in 1857 weapons made according to these principles excelled the Enfield weapons in accuracy of fire, penetration and range to a degree "which hardly leaves room for comparison." He also constructed heavy guns on the same lines; these were tried in competition with Armstrong's ordnance in 1864 and 1865, and in their inventor's opinion gave the better results, but they were not adopted by the government. In constructing them Whitworth experienced difficulty in getting large steel castings of suitable soundness and ductility, and thus was led about 1870 to devise his compressed steel process, in which the metal is subjected to high pressure while still in the fluid state, and is afterwards forged in hydraulic presses, not by hammers. In 1868 he founded the Whitworth scholarships, setting aside an annual sum of £3000 to be given for "intelligence and proficiency in the theory and practice of mechanics and its cognate sciences," and in the following year he was created a baronet. He died at Monte Carlo, whither he had gone for the sake of his health, on the 22nd of January 1887. In addition to handing over £100,000 to the Science and Art Department for the permanent endowment of the thirty Whitworth scholarships, his residuary legatees, in pursuance of what they knew to be his intentions, expended over half a million on charitable and educational objects, mainly in Manchester and the neighbourhood.

WHOOPING-COUGH, or HOOPING-COUGH (syn. *Pertussis*, Chin-cough), a specific infective disease of the respiratory mucous membrane, of microbic origin (see PARASITIC DISEASES), manifesting itself by frequently recurring paroxysms of convulsive coughing accompanied with peculiar sonorous inspirations (or whoops). Although specially a disease of childhood, whooping-cough is by no means limited to that period but may occur at any time of life. It is one of the most dangerous diseases of infancy, the yearly death-rate in England and Wales for each of the five years 1904–1908 being greater than that from scarlet fever and typhoid added together. The majority of these deaths were in infants under one year, 97% in children under 5 years (Tatham). It is more common in female than in male children. There is a distinct period of incubation variously estimated at from two to ten days. Three stages of the disease are recognized, viz. (1) the catarrhal stage, (2) the spasmodic or paroxysmal stage, (3) the stage of decline.

The *first stage* is characterized by the ordinary phenomena of a catarrh, with sneezing, watering of the eyes, irritation of the throat, feverishness and cough, but in general there is nothing in the symptoms to indicate that they are to develop into whooping-cough, but the presence of an ulcer on the fraenum linguae is said to be diagnostic. The catarrhal stage usually lasts from ten to fourteen days. The *second stage* is marked by the abatement of the catarrhal symptoms, but at the same time by increase in the cough, which now occurs in irregular paroxysms both by day and by night. Each paroxysm consists in a series of violent and rapid expiratory coughs, succeeded by a loud sonorous or crowing inspiration—the "whoop." During the coughing efforts the air is driven with great force out of the lungs, and as none can enter the chest the symptoms of impending asphyxia appear. The patient grows deep-red or livid in the face, the eyes appear as if they would burst from their sockets, and suffocation seems imminent till relief is brought by the "whoop"—the louder and more vigorous the better. Occasionally blood bursts from the nose, mouth and ears, or is extravasated into the conjunctiva of the eyes. A single fit rarely lasts beyond from half to three-quarters of a minute, but after the "whoop" another recurs, and of these a number may come and go for several minutes. The paroxysm ends by the coughing or vomiting up of a viscid tenacious secretion, and usually after this the patient seems comparatively well, or, it may be, somewhat wearied and fretful. The frequency of the paroxysms varies according to the severity of the case, being in some instances only to the extent of one or two in the whole day, while in others there may be several in the course of a single hour. Slight causes serve to bring on the fits of coughing, such as the acts of swallowing, talking, laughing, crying, &c., or they may occur without any apparent exciting cause. In general children come to recognize an impending attack by a feeling of tickling in the throat, and they cling with dread to their mothers or nurses, or take hold of some object near them for support during the paroxysm; but although exhausted by the severe fit of coughing they soon resume their play, apparently little the worse. The attacks are on the whole most severe at night. This stage of the disease usually continues for thirty to fifty days, but it may be shorter or longer. It is during this time that complications are apt to arise which may become a source of danger greater even than the malady itself. The chief of these are inflammatory affections of the bronchi and lungs and convulsions, any of which may prove fatal. When, however, the disease progresses favourably, the *third* or *terminal stage* is announced by the less frequent paroxysms of the cough, which generally loses in great measure its "whooping" character. The patient's condition altogether undergoes amendment, and the symptoms disappear in from one to three weeks. It is to be observed, however, that for a long period afterwards in any simple catarrh from which the patient suffers the cough often assumes a spasmodic character, which may suggest the erroneous notion that a relapse of the whooping-cough has occurred.

In severe cases it occasionally happens that the disease leaves behind it such structural changes in the lungs (emphysema, &c.), as entail permanent shortness of breathing or a liability to attacks of asthma. Further, whooping-cough is well known to be one of those diseases of early life which are apt to give rise to a weakened and vulnerable state of the general health, or to call into activity any inherited morbid tendency, such as that towards consumption.

As regards the treatment in mild cases, little is necessary beyond keeping the patient warm and carefully attending to the general health. The remedies applicable in the case of catarrh or the milder forms of bronchitis are of service here, while gentle counter-irritation to the chest by stimulating liniments may be employed all through the attack. In mild weather the patient may be in the open air. An abdominal binder should be worn night and day in order to prevent the occurrence of hernia. Systematic disinfection of the sputum by means of a solution of corrosive sublimate or by burning should be practised in order to check the spread of infection. In the more severe forms efforts have to be employed to modify the severity of the paroxysms. Numerous remedies are recommended, the chief of which are the bromides of ammonium or potassium, chloral, codeine, &c. These can only be safely administered under medical advice, and with due regard to the symptoms in individual cases. During convalescence, where the cough still continues to be troublesome, a change of air will often effect its removal.

WHYMPER, EDWARD (1840–), British artist, explorer and mountaineer, was born in London on the 27th of April 1840. The son of an artist, he was at an early age trained to the profession of a wood-engraver. In 1860 he was commissioned to make a series of sketches of Alpine scenery, and undertook an extensive journey in the Central and Western Alps. Among the objects of this tour was the illustration of an attempt, which proved unsuccessful, made by Professor Bonney's party, to ascend Mont Pelvoux, at that time believed to be the highest peak of the Dauphiné Alps. He successfully accomplished the ascent in 1861—the first of a series of expeditions that threw much light on the topography of a district at that time very imperfectly mapped. From the summit of Mont Pelvoux he discovered that it was overtopped by a neighbouring peak, subsequently named the Pointe des Écrins, which, before the annexation of Savoy added Mont Blanc to the possessions of France, was the highest point in the French Alps. Its ascent by Mr Whymper's party in 1864 was perhaps the most remarkable feat of mountaineering up to that date. The years 1861 to 1865 are filled with a number of new expeditions in the Mont Blanc group and the Pennine Alps, among them the ascent of the Aiguille Verte and the crossing of the Moming Pass. Professor Tyndall and Mr Whymper emulated each other in fruitless attempts to reach the summit of the Matterhorn by the south-western or Italian ridge. Mr Whymper, six times repulsed, determined to try the eastern face, convinced that its precipitous appearance when viewed from Zermatt was an optical illusion, and that the dip of the strata, which on the Italian side formed a continuous series of overhangs, should make the opposite side a natural staircase. His attempt by what is now the usual route was crowned with success (14th of July 1865); but on the descent four of the party slipped and were killed, and only the breaking of the rope saved Mr Whymper and the two remaining guides from the same fate. The account of his attempts on the Matterhorn occupies the greater part of his *Scrambles among the Alps* (1871), in which the illustrations are engraved by the author himself, and are very beautiful. His campaign of 1865 had been planned to exercise his judgment in the choice of routes as a preparation for an expedition to Greenland (1867). This resulted in an important collection of fossil plants, which were described by Professor Heer and deposited in the British Museum. Mr Whymper's report was published in the *Report* of the British Association for the year 1869. Though hampered by want of means and by the prevalence of an epidemic among the natives, he proved that the interior could be explored by the use of suitably constructed sledges, and thus contributed an important advance to Arctic exploration. Another expedition followed in 1872, and was devoted to a survey of the coast-line. He next organized an expedition to Ecuador, designed primarily to collect data for the study of mountain-sickness and of the effect of diminished pressure on the human frame. He took as his chief guide Jean-Antoine Carrel, whose subsequent death from exhaustion on the Matterhorn after bringing his employers into safety through a snowstorm forms one of the noblest pages in the history of mountaineering. During 1880 Mr Whymper on two occasions ascended Chimborazo, whose summit, 20,500 ft. above sea-level, had never before been reached; spent a night on the summit of Cotopaxi, and made first ascents of half-a-dozen other great peaks. In 1892 he published the results of his journey in a volume, entitled *Travels amongst the Great Andes of the Equator*. His observations on mountain-sickness led him to conclude that it was caused by "diminution in atmospheric pressure, which operates in at least two ways—namely, (*a*) by lessening the value of the air that can be inspired in any given time, and (*b*) by causing the air or gas within the body to expand, and to press upon the internal organs"; and that "the effects produced by (*b*) may be temporary and pass away when equilibrium has been restored between the internal and external pressure." The publication of his work was recognized on the part of the Royal Geographical Society by the award of the Patron's medal. His experiences in South America having convinced him of certain serious errors in the readings of aneroid barometers at high altitudes, he published a work, entitled *How to Use the Aneroid Barometer*, and succeeded in introducing important improvements in their construction. He afterwards published two guide-books to Zermatt and Chamonix. In 1901–1905 he undertook an expedition in the region of the Great Divide of the Canadian Rockies.

WHYTE, ALEXANDER (1837–), Scottish divine, was born at Kirriemuir in Forfarshire on the 13th of January 1837, and was educated at the university of Aberdeen and at New College, Edinburgh. He entered the ministry of the Free Church of Scotland and after serving as colleague in Free St John's, Glasgow (1866–1870), removed to Edinburgh as colleague and successor to Dr R. S. Candlish at Free St George's. In 1909 he succeeded Dr Marcus Dods as principal, and professor of New Testament literature, at New College, Edinburgh.

Among his publications are *Characters and Characteristics of William Law* (1893); *Bunyan Characters* (3 vols., 1894); *Samuel Rutherford* (1894); *An Appreciation of Jacob Behmen* (1895); *Lancelot Andrewes and his Private Devotions* (1895); *Bible Characters* (7 vols., 1897); *Santa Teresa* (1897); *Father John of Cronstadt* (1898); *An Appreciation of Browne's Religio Medici* (1898); *Cardinal Newman, An Appreciation* (1901).

WHYTE-MELVILLE, GEORGE JOHN (1821–1878), English novelist, son of John Whyte-Melville of Strathkinness, Fifeshire, and grandson on his mother's side of the 5th duke of Leeds, was born on the 19th of June 1821. Whyte-Melville received his education at Eton, entered the army in 1839, became captain in the Coldstream Guards in 1846 and retired in 1849. After translating Horace (1850) in fluent and graceful verse, he published his first novel, *Digby Grand*, in 1853. The unflagging verve and intimate technical knowledge with which he described sporting scenes and sporting characters at once drew attention to him as a novelist with a new vein. He was the laureate of fox-hunting all his most popular and distinctive heroes and heroines, Digby Grand, Tilbury Nogo, the Honourable Crasher, Mr Sawyer, Kate Coventry, Mrs Lascelles, are or would be mighty hunters. *Tilbury Nogo* was contributed to the *Sporting Magazine* in 1853 and published separately in 1854. He showed in the adventures of Mr Nogo—and it became more apparent in his later works—that he had a surer hand in humorous narrative than in pathetic description; his pathos is the pathos of the preacher. His next novel, *General Bounce*, appeared in *Fraser's Magazine* (1854). When the Crimean War broke out Whyte-Melville went out as a volunteer major of Turkish irregular cavalry; but this was the only break in his literary career from the time that he began to write novels till his death. By a strange accident, he lost his life in the hunting-field on the 5th of December 1878, the hero of many a stiff ride meeting his fate in galloping quietly over an ordinary ploughed field in the Vale of the White Horse.

Twenty-one novels appeared from his pen after his return from the Crimea:—*Kate Coventry* (1856); *The Interpreter* (1858); *Holmby House* (1860); *Good for Nothing* (1861); *Market Harborough* (1861); *The Queen's Maries* (1862); *The Gladiators* (1863); *Brookes of Bridlemere* (1864); *Cerise* (1866); *Bones and I* (1868); *The White Rose* (1868); *M or N* (1869); *Contraband* (1870); *Sarchedon* (1871); *Satanella* (1873); *Uncle John* (1874); *Sister Louise* (1875); *Katerfelto* (1875); *Rosine* (1875); *Roy's Wife* (1878); *Black but Comely* (1878). Several of these novels are historical, *The Gladiators* being perhaps the most famous of them. As an historical novelist Whyte-Melville is not equal to Harrison Ainsworth in painstaking accuracy and minuteness of detail; but he makes his characters live and move with great vividness. It is on his portraiture of contemporary sporting society that his reputation as a novelist must rest; and, though now and then a character reappears, such as the supercilious stud-groom, the dark and wary steeple-chaser, or the fascinating sporting widow, his variety in the invention of incidents is amazing. Whyte-Melville was not merely the annalist of sporting society for his generation, but may also be fairly described as the principal moralist of that society; he exerted a considerable and a wholesome influence on the manners and morals of the gilded youth of his time. His *Songs and Verses* (1869) and his metrical *Legend of the True Cross* (1873), though respectable in point of versification, are of no particular merit.

WICHITA, a tribe of North American Indians of Caddoan stock. They call themselves Kitikitish or Tawéhash. Their former range was between the Red and Washita rivers, Oklahoma, and they are now on a reservation there. They were kinsmen of the Pawnee, and the French called them *Pani Piqué* ("Tattooed Pawnee"). They were known to other Indians as the "Tattooed People" in allusion to the extensive tattooing customary among them. They numbered 3000 in or about 1800, but only about 300 now survive.

WICHITA, a city and the county-seat of Sedgwick county, Kansas, U.S.A., on the Arkansas river, at the mouth of the Little Arkansas, 208 m. (by rail) S.W. of Kansas City. Pop. (1880) 4911; (1890) 23,853; (1900) 24,671, of whom 1447 were foreign-born and 1389 were negroes; (1910 census), 52,450. Area, 18·75 sq. m. Wichita is served by the Atchison, Topeka & Santa Fé, the Chicago, Rock Island & Pacific, the Missouri Pacific, the St Louis & San Francisco, and the Kansas City, Mexico & Orient railways. The site of the city is level, about 1300 ft. above the sea. The principal public buildings are the Federal building, the city hall, the county court house, a Y.M.C.A. building, an auditorium and exposition hall and a Masonic Temple. In Wichita are Fairmount College (Congregational; co-educational; organized as a preparatory school in 1892 and as a college in 1895); Friends' University (Society of Friends; co-educational; 1898); and Mount Carmel Academy and the Pro-Cathedral School (both Roman Catholic). Among the city's parks (area in 1909, 325 acres) is one (Riverside) of 146 acres. The city is supplied with natural gas. Wichita is a transportation centre for the rich agricultural region surrounding it, and is an important market for broom-corn. In 1905 it ranked third among the cities of the state in value of its factory product ($7,389,844). The principal industry is slaughtering and meat-packing. The Kansas City, Mexico & Orient railway has car-shops here. Wichita, named from an Indian tribe, was settled in 1870, and was chartered as a city in 1871. In 1909 the city adopted by popular vote government by commission under a state law of 1907 providing for a mayor and four commissioners, heads of the executive, finance, streets and public improvements, parks, public buildings and health, and water and lights departments, all elected for two years and nominated by primary election or by petition signed by at least 25 voters.

WICK, a royal, municipal and police burgh, seaport and county town of Caithness, Scotland. Pop. (1901) 7911. It is situated at the head of Wick Bay, on the North Sea, 327 m. N. of Edinburgh, by the North British and Highland railways. It consists of the old burgh and Louisburgh, its continuation, on the north bank of the river Wick, and of Pulteneytown, the chief seat of commerce and trade, on the south side. Pulteneytown, laid out in 1805 by the British Fishery Society, is built on a regular plan; and Wick proper consists chiefly of the narrow and irregular High Street, with Bridge Street, more regularly built, which contains the town hall and the county buildings. In Pulteneytown there are an academy, a chamber of commerce, a naval reserve station and a fish exchange. Among other buildings are the free libraries, the Rhind Charitable Institution and the combination hospital. The port consists of two harbours of fair size, but the entrance is dangerous in stormy weather. The chief exports are fish, cattle and agricultural produce, and the imports include coal, wood and provisions. Steamers from Leith and Aberdeen run twice a week and there is also weekly communication with Stromness, Kirkwall and Lerwick. It is to its fisheries that the town owes its prosperity. For many years it was the chief seat of the herring fishing on the east coast, but its insufficient harbour accommodation has hampered its progress, and both Peterhead and Fraserburgh surpass it as fishing ports. Women undertake the cleaning and curing, and the work attracts them from all parts. So expert are they that on the occasion of a heavy catch they are sent as far even as Yarmouth to direct and assist the local hands. Shipbuilding has now been discontinued, but boat-building and net-making are extensively carried on. There are also cooperage, the manufacture of fish-guano and fish products, flour mills, steam saw mills, a ropery and a woollen manufactory, a brewery and a distillery. The town, with Cromarty, Dingwall, Dornoch, Kirkwall and Tain, forms the Wick group of parliamentary burghs. Wick (Vik or "bay") is mentioned as early as 1140. It was constituted a royal burgh by James VI. in 1589, its superior being then George Sinclair, 5th earl of Caithness. By a parliamentary bounty in 1768 some impetus was given to the herring-fishery, but its real importance dates from the construction of a harbour in 1808.

WICKLOW, a county of Ireland in the province of Leinster, bounded E. by St George's Channel, N. by the county of Dublin, S. by Wexford and W. by Carlow and detached portions of Kildare. The area is 500,216 acres or about 782 sq. m. Wicklow is among the most famous counties of Ireland for beauty of scenery, both coastal and more especially inland. The coast is precipitous and picturesque, but very dangerous of approach owing to sandbanks. There are no inlets that can be properly termed bays. The harbour at Wicklow has a considerable trade; but that of Arklow is suitable only for small vessels. To the north of the town of Wicklow there is a remarkable shingle beach, partly piled up by the waves and currents. The central portion of the county is occupied by a mountain range, forming one of the four principal mountain groups of Ireland. The direction of the range is from N.E. to S.W., and the highest elevations are generally attained along the central line. The range consists of long sweeping moorlands, rising occasionally by precipitous escarpments into culminating points, the highest summits being Kippure (2473 ft.), Duff Hill (2364), Table Mountain (2416) and Lugnaquilla (3039), the last acquired by the War Office as a manœuvring ground. The range rises from the north by a succession of ridges intersected by deep glens, and subsides towards the borders of Wexford and Carlow. To the north its foothills enter county Dublin, and add attraction to the southern residential outskirts of the capital.

In the valleys there are many instances of old river terraces, the more remarkable being those at the lower end of Glenmalure and the lower end of Glendalough. It is in its deep glens that much of the peculiar charm of Wicklow scenery is to be found, the frequently rugged natural features contrasting finely with the rich and luxuriant foliage of the extensive woods which line their banks. Among the more famous of these glens are Glendalough, Dargle, Glencree, Glen of the Downs, Devil's Glen, Glenmalure and the beautiful vale of Avoca or Ovoca. The principal rivers are the Liffey, on the north-western border; the Vartry, which passes through Devil's Glen to the sea north of Wicklow Head; the Avonmore and the Avonbeg, which unite at the "meeting of the waters" to form the Avoca, which is afterwards joined by the Aughrim and falls into the sea at Arklow; and the Slaney, in the west of the county, passing southwards into Carlow. There are a number of small but finely situated lakes in the valleys, the principal being Loughs Dan, Bray and Tay or Luggelaw, and the loughs of Glendalough. The trout-fishing is generally fair. Owing to its proximity to Dublin and its accessibility from England, the portions of the county possessing scenic interest have been opened up to great advantage. Bray in the north is one of the most popular seaside resorts in the country, and Greystones, 5 m. S., is a smaller one. Of the small towns and villages inland which are much frequented for the beauty of the country in which they lie, are Enniskerry, west of Bray, and near the pass of the Scalp; Laragh, near Glendalough, from which a great military road runs S.W. across the hills below Lugnaquilla; and, on the railway south of Wicklow, Rathdrum, a beautifully situated village, Woodenbridge in the Vale of Avoca and Aughrim. Near the village of Shillelagh lies the wood which is said to have given the name of *shillelagh* to the oaken or blackthorn staves used by Irishmen. Ashford and Roundwood on the Vastry river, Delgany near the Glen of the Downs, and Rathnew, a centre of coach routes, especially for the Devil's Glen, must also be mentioned. The beauty of the central district of the Wicklow mountains lies in its wild solitude in contradistinction to the more gentle scenery of the populated glens. In the extreme north-west of the county Blessington is a favourite resort from Dublin, served by a steam tramway, which continues up the valley of the Liffey to the waterfalls of Pollaphuca. The climate near the sea is remarkably mild, and permits the myrtle and arbutus to grow.

Geology.—Wicklow, as regards its geology, is mainly an extension of county Wexford, the Leinster chain bounding it on the west, and Silurian foothills sloping thence down to the sea. The highland of muscovite-granite, with a marginal zone of mica-schist, produced by contact-action on the Silurian shales, runs from Shillelagh to the sea north of Bray, its highest point being Lugnaquilla. The rounded heather-clad moors give way to more broken country on either side, where the streams cut deeply into the Silurian region. The water-supply of Dublin is obtained from an artificial lake on the first plateau of the foothills at Roundwood. From Wicklow town to near Bray, red and greenish slates and yellow-brown quartzites, probably Cambrian, form a hilly country, in which rise Carrick Mt., the Great Sugarloaf and Bray Head. *Oldhamia* occurs in this series. Volcanic and intrusive felsites and diorites abound in the Silurian beds of the south, running along the strike of the strata. A considerable amount of gold has been extracted from the valley-gravels north of Croghan Kinshela on the Wexford border. Tinstone has also been found in small quantities. Lead-ore is raised west of Laragh, and the mines in the Avoca valley have been worked for copper, lead and sulphur, the last-named being obtained from pyrite. Paving-setts are made from the diorite at Arklow, and granite is extensively quarried at Ballyknockan on the west side of the mountain-chain.

Industries.—The land in the lower grounds is fertile; and although the greater part of the higher districts is covered with heath and turf, it affords good pasturage for sheep. There is a considerable extent of natural timber as well as artificial plantations. The acreage under pasture is nearly three times that of tillage, and, whereas the principal crops of oats and potatoes decrease considerably, the numbers of sheep, cattle, pigs and poultry are well maintained. Except in the Avoca district, where the mining industry is of some importance, the occupations are chiefly agricultural. The port of Wicklow is the headquarters of a sea-fishery district.

The Dublin and South-Eastern railway skirts the coast by way of Bray and the town of Wicklow, touching it again at Arklow, with a branch line from Woodenbridge junction to Shillelagh. A branch of the Great Southern & Western line from Sallins skirts the west of the county by Baltinglass.

Population and Administration.—The population (64,492 in 1891, 60,824 in 1901) decreases to a less extent than the average of the Irish counties, and emigration is considerable. Of the total about 80% are Roman Catholics, and 18% Protestant Episcopalians; about 80% forms the rural population. Bray (pop. 7424), Wicklow (the county town, 3288) and Arklow (4944) are the principal towns, all on the coast; Wicklow is the only considerable port. Wicklow returned to the Irish parliament, until the Union in 1800, two county members and two each for the boroughs of Baltinglass, Bray, Tinahely and Arklow; it is now formed into two parliamentary divisions, an eastern and a western, each returning one member. The county is divided into eight baronies. It is mainly in the Protestant diocese of Dublin and in the Roman Catholic dioceses of Dublin, Kildare and Leighlin and Ferns. Assizes are held at Wicklow, and quarter-sessions at Bray, Baltinglass, Tinahely, Arklow and Wicklow.

History and Antiquities.—Wicklow was not made a county until 1606. It was the last Irish ground shired, for in this mountainous district the Irish were long able to preserve independence. Wicklow sided with the royal cause during the Cromwellian wars, but on Cromwell's advance submitted to him without striking a blow. During the rebellion of 1798 some of the insurgents took refuge within its mountain fastnesses, and an engagement took place near Aughrim between a band of them under Joseph Holt (1756–1826) and the British troops. A second skirmish was fought at Arklow between the rebels and General Needham, the former being defeated.

Of the ancient cromlechs there are three of some interest, one near Enniskerry, another on the summit of Lugnaquilla and a third, with a druidical circle, at Donaghmore. There are comparatively unimportant monastic remains at Rathdrum, Baltinglass and Wicklow. The ruins in the vale of Glendalough, known as the "seven churches," including a perfect round tower, are, perhaps excepting Clonmacnoise, the most remarkable ecclesiastical remains in Ireland. They owe their origin to St Kevin, who lived in the vale as a hermit, and is reputed to have died on the 3rd of June 618. Of the old fortalices or strongholds associated with the early wars, those of special interest are Black Castle, near Wicklow, originally founded by the Norman invaders, but taken by the Irish in 1301, and afterwards rebuilt by William Fitzwilliam; the scattered remains of Castle Kevin, the ancient stronghold of the O'Tooles, by whom it was probably originally built in the 12th century; and the ruins of the old castle of the Ormondes at Arklow, founded by Theobald FitzWalter (d. 1285), the scene of frequent conflicts up to the time of Cromwell, by whom it was demolished in 1649, and now containing within the interior of its ruined walls a constabulary barrack. The fine mansion of Powerscourt occupies the site of an old fortalice founded by De la Poer, one of the knights who landed with Strongbow; in the reign of Henry VIII. it was taken by the O'Tooles and O'Brynes.

WICKLOW, a seaport, market town, and the county town of county Wicklow, Ireland, picturesquely situated at the mouth of a lagoon which receives the river Vartry and other streams, 28¼ m. S. of Dublin by the Dublin & South-Eastern railway. Pop. (1901) 3288. The harbour, which is governed by commissioners and can accommodate vessels of 1500 tons, has two piers, with quayage. There is a considerable import trade in coal, timber, iron and slate; and some exports of grain and metallic ore, but the latter suffers by competition with the imports to Britain of sulphur ore from Spain. The town has county buildings, a parish church embodying a good Norman door from a previous structure, some ruins of a Franciscan abbey of the 13th century, and remains of Black Castle, on a commanding situation above the sea, founded in Norman times and rebuilt by William Fitzwilliam after capture by the Irish in 1301. The name shows the town to have been a settlement of the Norsemen. The cliff scenery to the S. towards Wicklow Head is fine, and the town has some claims as a seaside resort. It is governed by an urban district council.

WICKRAM, JÖRG, or GEORG (d. *c.* 1560), German poet and novelist, was a native of Colmar in Alsace; the date of his birth is unknown. He passed the latter part of his life as town clerk of Burgheim on the Rhine, and died before 1562. Wickram was a many-sided writer. He founded a Meistersinger school in Colmar in 1549, and has left a number of *Meistersingerlieder*. He edited Albrecht von Halberstadt's Middle High German version of Ovid's *Metamorphoses* (1545), and in 1555 he published *Das Rollwagenbüchlein*, one of the best of the many German collections of tales and anecdotes which appeared in the 16th century. The title of the book implies its object, namely, to supply reading for the traveller in the "Rollwagen" or diligences. As a dramatist, Wickram wrote *Fastnachtsspiele* (*Das Narrengiessen*, 1537; *Der treue Eckart*, 1538) and two dramas on biblical subjects, *Der verlorene Sohn* (1540) and *Tobias* (1551). A moralizing poem, *Der irrereitende Pilger* (1556), is half-satiric, half-didactic. It is, however, as a novelist that Wickram has left the deepest mark on his time, his chief romances being *Ritter Galmy aus Schottland* (1539), *Gabriotto und Reinhard* (1554), *Der Knabenspiegel* (1554), *Von guten und bösen Nachbarn* (1556) and *Der Goldfaden* (1557). These may be regarded as the earliest attempts in German literature to create that modern type of middle-class fiction which ultimately took the place of the decadent medieval romance of chivalry.

Wickram's works have been edited by J. Bolte and W. Scheel for the Stuttgart *Literarischer Verein* (vols., 222, 223, 229, 230, 1900–1903); *Der Ritter Galmy* was republished by F. de la Motte Fouqué in 1806; *Der Goldfaden* by K. Brentano in 1809; the *Rollwagenbüchlein* was edited by H. Kurz in 1865, and there is also a reprint of it in Reclam's *Universalbibliothek*. See A. Stöber, *J. Wickram* (1866); W. Scherer, *Die Anfänge des deutschen Prosaromans* (1877).

WIDDRINGTON, BARONS. In November 1643 Sir William Widdrington (1610–1651), of Widdrington, Northumberland, son and heir of Sir Henry Widdrington (d. 1623), was created Baron Widdrington, as a reward for his loyalty to Charles I. He had been member for Northumberland in both the Short and the Long Parliaments in 1640, but in August 1642 he was expelled because he had joined the royal standard. He fought for the king chiefly in Yorkshire and Lincolnshire during 1642 and 1643; he was governor of Lincoln in 1643, but in 1644, after helping to defend York, he left England. Although in 1648 he had been condemned to death by the House of Commons, he accompanied Charles II. to Scotland in 1650, and he was mortally wounded whilst fighting for him at Wigan, dying on the 3rd of September 1651. His great-grandson, William, the 4th baron (1678–1743), took part in the Jacobite rising of 1715, and with two of his brothers was taken prisoner after the fight at Preston. He was convicted of high treason, and his title and estates were forfeited, but he was not put to death, and he survived until the 19th of April 1743. When his son, Henry Francis Widdrington, who claimed the barony, died in September 1774, the family appears to have become extinct.

Other eminent members of this family were Sir Thomas Widdrington and his brother Ralph. Having married a daughter of Ferdinando Fairfax, afterwards 2nd Lord Fairfax, Thomas Widdrington was knighted at York in 1639, and in 1640 he became member of parliament for Berwick. He was already a barrister, and his legal knowledge was very useful during the Civil War. In 1651 he was chosen a member of the council of state, although he had declined to have any share in the trial of the king. Widdrington was elected Speaker in September 1656, and in June 1658 he was appointed chief baron of the exchequer. In 1659 and again in 1660 he was a member of the council of state, and on three occasions he was one of the commissioners of the great seal, but he lost some of his offices when Charles II. was restored. However, he remained in parliament until his death on the 13th of May 1664. He left four daughters, but no sons. Widdrington, who founded a school at Stamfordham, Northumberland, wrote *Analecta Eboracensia; some Remaynes of the city of York*. This was not published until 1877, when it was edited with introduction and notes by the Rev. Caesar Caine. His younger brother, Ralph Widdrington (d. 1688), was educated at Christ's College, Cambridge, where he made the acquaintance of Milton. In 1654 he was appointed regius professor of Greek at Cambridge, and in 1673 Lady Margaret professor of divinity.

The name of Roger Widdrington was taken by Thomas Preston (1563–1640), a Benedictine monk, who wrote several books of a controversial nature, and passed much of his time in prison, being still a captive when he died on the 3rd of April 1640. (See Rev. E. Taunton, *The English Black Monks of St Benedict*, 1897.)

In 1840 the writer, Samuel Edward Cook, took the name of Widdrington, his mother being the heiress of some of the estates of this family. Having served in the British navy he lived for some years in Spain, writing *Sketches in Spain* during the years 1829–1832 (London, 1834); and *Spain and the Spaniards in 1843* (London, 1844). He died at his residence, Newton Hall, Northumberland, on the 11th of January 1856 and was succeeded in the ownership of his estates by his nephew, Shalcross Fitzherbert Jacson, who took the name Widdrington. See Rev. John Hodgson, *History of Northumberland* (1820–1840).

WIDNES, a municipal borough in the Widnes parliamentary division of Lancashire, England, on the Mersey, 12 m. E.S.E. from Liverpool, served by the London & North-Western and Lancashire & Yorkshire railways and the Cheshire lines. Pop. (1901) 28,580. It is wholly of modern growth, for in 1851 the population was under 2000. There are capacious docks on the river, which is crossed by a wrought-iron bridge, 1000 ft. long, and 95 in height, completed in 1868, and having two lines of railway and a footpath. Widnes is one of the principal seats of the alkali and soap manufacture, and has also grease-works for locomotives and waggons, copper works, iron-foundries, oil and paint works and sail-cloth manufactories. The barony of Widnes in 1554–1555 was declared to be part of the duchy of Lancaster. The town was incorporated in 1892, and the corporation consists of a mayor, 6 aldermen and 18 councillors. Area, 3110 acres.

WIDOR, CHARLES MARIE (1845–), French composer and organist, was born at Lyons on the 22nd of February 1845. He studied first at Lyons, then at Brussels under Lemmens for the organ and Fétis for composition. In 1870 he became organist of the church of Saint Sulpice in Paris. He succeeded César Franck as professor of the organ at the Paris Conservatoire, where he was also appointed professor of composition, counterpoint and fugue in 1896. A very prolific composer, he displayed his creative ability in a variety of different styles. His works include an opera, *Maître Ambros* (Opéra Comique, 1896), *La Korrigane* (ballet, given at the Opéra, 1880), incidental music to *Conte d'avril* (1885), *Les Jacobites* (1885) and *Jeanne d'Arc* (a pantomime play, 1890), three symphonies, *The Walpurgis Night* and other works for orchestra, a quintet for strings and piano, trio for piano and strings, a mass, psalms and other sacred compositions, symphonies for organ, a large number of piano pieces and many songs.

WIDUKIND, Saxon historian, was the author of *Res gestae Saxonicae*. Nothing is known of his life except that he was a monk at the Benedictine abbey of Corvey, and that he died about 1004, although various other conjectures have been formed by students of his work. He is also supposed to have written lives of St Paul and St Thecla, but no traces of these now remain. It is uncertain whether he was a resident at the court of the emperor Otto the Great or not, and also whether he was on intimate terms with Otto's illegitimate son William, archbishop of Mainz. His *Res gestae Saxonicae*, dedicated to Matilda, abbess of Quedlinburg, who was a daughter of Otto the Great, is divided into three books, and the greater part of it was undoubtedly written during the lifetime of the emperor, probably about 968. Starting with certain surmises upon the origin of the Saxons, he deals with the war between Theuderich I., king of Austrasia, and the Thuringians, in which the Saxons played an important part. An allusion to the conversion of the race to Christianity under Charlemagne brings him to the early Saxon dukes and the reign of Henry the Fowler, whose campaigns are referred to in some detail. The second book opens with the election of Otto the Great as German king, treats of the risings against his authority, and concludes with the death of his wife Edith in 946. In the third book the historian deals with Otto's expedition into France, his troubles with his son Ludolf and his son-in-law, Conrad the Red, duke of Lorraine, and the various wars in Germany; but makes only casual reference to Otto's visits to Italy in 951 and 962. He gives a vivid account of the defeat of the Hungarians on the Lechfeld in August 955, and ends with the death of Otto in 973 and a eulogy on his life.

Widukind formed his style upon that of Sallust; he was familiar with the *De vitis Caesarum* of Suetonius, the *Vita Karoli magni* of Einhard, and probably with Livy and Bede. Many quotations from the Vulgate are found in his writings, and there are traces of a knowledge of Virgil, Ovid and other Roman poets. His sentences are occasionally abrupt and lacking in clearness, his Latin words are sometimes germanized (as when he writes *michi* for *mihi*) and grammatical errors are not always absent. The earlier part of his work is taken from tradition, but he wrote the contemporary part as one familiar with court life and the events of the day. He says very little about affairs outside Germany, and although laudatory of monastic life gives due prominence to secular affairs. He writes as a Saxon, proud of the history of his race and an admirer of Henry the Fowler and Otto the Great.

Three manuscripts exist of the *Res gestae*, one of which is in the British Museum, and the book was first published at Basel in 1532. The best edition is that edited by G. Waitz in the *Monumenta Germaniae historica. Scriptores*, Band iii. (Hanover and Berlin, 1826). A good edition published at Hanover and Leipzig in 1904 contains an introduction by K. A. Kehr.

See R. Köpke, *Widukind von Corvey* (Berlin, 1867); J. Raase, *Widukind von Korvei* (Rostock, 1880); and B. Simson, "Zur Kritik des Widukind" in the *Neues Archiv der Gesellschaft für ältere deutsche Geschichte*, Band xii. (Hanover, 1876). (A. W. H.*)

WIDUKIND, or WITTEKIND (d. *c.* 807), leader of the Saxons during the earlier part of their resistance to Charlemagne, belonged to a noble Westphalian family, and is first mentioned in 777 when his absence from an assembly of the Saxons held by the Frankish king of Paderborn was a matter for remark. It is inferred with considerable probability that he had taken a leading part in the attacks on two Frankish garrisons in 776, and possibly had shared in earlier fights against the Franks, and so feared to meet the king. In 778 he returned from exile in Denmark to lead a fresh rising, and in 782 the Saxons at his instigation drove out the Frankish priests, and plundered the border territories. It is uncertain whether Widukind shared in the Saxon victory at the Süntel mountains, or what part he took in the risings of 783 and 784. In 785 Charlemagne, leading an expedition towards the mouth of the Elbe, learned that Widukind was in the land of the Nordalbingians, on the right bank of the river. Negotiations were begun, and the Saxon chief, assured of his personal safety, appeared at the Frankish court at Attigny. There he was baptized, the king acting as his sponsor and loading him with gifts. The details of his later life are unknown. He probably returned to Saxony and occupied there an influential position, as in 922 the inheritance of the "old count or duke Widukind" is referred to. Many legends have gathered around his memory, and he was long regarded as a national hero by the Saxons. He is reported to have been duke of Engria, to have been a devoted Christian and a builder of churches, and to have fallen in battle in 807. Kingly and princely houses have sought to establish their descent from him, but except in the case of Matilda, wife of the German king, Henry I. the Fowler, without any success.

See W. Diekamp, *Widukind der Sachsenführer nach Geschichte und Sage* (Münster, 1877); J. Dettmer, *Der Sachsenführer Widukind nach Geschichte und Sage* (Würzburg, 1879).

WIEDEMANN, GUSTAV HEINRICH (1826–1899), German physicist, was born at Berlin on the 2nd of October 1826. After attending the Cologne gymnasium, he entered the university of Berlin in 1844, and took his doctor's degree there three years later. His thesis on that occasion was devoted to a question in organic chemistry, for he held the opinion that the study of chemistry is an indispensable preliminary to the pursuit of physics, which was his ultimate aim. In Berlin he made the acquaintance of H. von Helmholtz at the house of H. G. Magnus, and was one of the founders of the Berlin Physical Society. In 1854 he left Berlin to become professor of physics in Basel University, removing nine years afterwards to Brunswick Polytechnic, and in 1866 to Karlsruhe Polytechnic. In 1871 he accepted the chair of physical chemistry at Leipzig. The attention he had paid to chemistry in the earlier part of his career enabled him to hold his own in this position, but he found his work more congenial when in 1887 he was transferred to the professorship of physics. He died at Leipzig on the 24th of March 1899. His name is probably most widely known for his literary work. In 1877 he undertook the editorship of the *Annalen der Physik und Chemie* in succession to J. C. Poggendorff, thus starting the series of that scientific periodical which is familiarly cited as *Wied. Ann.* Another monumental work for which he was responsible was *Die Lehre von der Elektricität*, or, as it was called in the first instance, *Lehre von Galvanismus und Elektromagnetismus*, a book that is unsurpassed for accuracy and comprehensiveness. He produced the first edition in 1861, and a fourth, revised and enlarged, was only completed a short time before his death. But his original work was also important. His data for the thermal conductivity of various metals were for long the most trustworthy at the disposal of physicists, and his determination of the ohm in terms of the specific resistance of mercury showed remarkable skill in quantitative research. He carried out a number of magnetic investigations which resulted in the discovery of many interesting phenomena, some of which have been rediscovered by others; they related among other things to the effect of mechanical strain on the magnetic properties of the magnetic metals, to the relation between the chemical composition of compound bodies and their magnetic properties, and to a curious parallelism between the laws of torsion and of magnetism. He also investigated electrical endosmosis and the electrical resistance of electrolytes. His eldest son, Eilhard Ernst Gustav, born at Berlin on the 1st of August 1852, became professor of physics at Erlangen in 1886, and his younger son, Alfred, born at Berlin on the 18th of July 1856, was appointed to the extraordinary professorship of Egyptology at Bonn in 1892.

WIELAND, CHRISTOPH MARTIN (1733–1813), German poet and man of letters, was born at Oberholzheim, a village near Biberach in Württemberg, on the 5th of September 1733. His father, who was pastor in Oberholzheim, and subsequently in Biberach, took great pains with the child's education, and from the town school of Biberach he passed on, before he had reached his fourteenth year, to the gymnasium at Klosterberge, near Magdeburg. He was a precocious child, and when he left school in 1749 was widely read in the Latin classics and the leading contemporary French writers; amongst German poets his favourites were Brockes and Klopstock. While at home in the summer of 1750, he fell in love with a kinswoman, Sophie Gutermann, and this love affair seems to have acted as an incentive to poetic composition; under this inspiration he planned his first ambitious work, *Die Natur der Dinge* (1752), a didactic poem in six books. In 1750 he went to the university of Tübingen as a student of law, but his time was mainly taken up with literary studies. The poems he wrote at the university—*Hermann*, an epic (published by F. Muncker, 1886), *Zwölf moralische Briefe in Versen* (1752), *Anti-Ovid* (1752)—are pietistic in tone and dominated by the influence of Klopstock. They attracted the attention of the Swiss literary reformer, J. J. Bodmer, who invited Wieland to visit him in Zürich in the summer of 1752. After a few months, however, Bodmer felt himself as little in sympathy with Wieland as, two years earlier, he had felt himself with Klopstock, and the friends parted; but Wieland remained in Switzerland until 1760, residing, in the last year, at Bern where he obtained a position as private tutor. Here he stood in intimate relations with Rousseau's friend Julie de Bondeli. Meanwhile a change had come over Wieland's tastes; the writings of his early Swiss years—*Der geprüfte Abraham* (1753), *Sympathien* (1756), *Empfindungen eines Christen* (1757)—were still in the manner of his earlier writings, but with the tragedies, *Lady Johanna Gray* (1758), and *Clementina von Porretta* (1760)—the latter based on Richardson's *Sir Charles Grandison*—the epic fragment *Cyrus* (1759), and the "moral story in dialogues," *Araspes und Panthea* (1760), Wieland, as Lessing said, "forsook the ethereal spheres to wander again among the sons of men."

Wieland's conversion was completed at Biberach, whither he had returned in 1760, as director of the chancery. The dullness and monotony of his life here was relieved by the friendship of a Count Stadion, whose library in the castle of Warthausen, not far from Biberach, was well stocked with French and English literature. Here, too, Wieland met again his early love Sophie Gutermann, who had meanwhile become the wife of Hofrat La Roche, then manager of Count Stadion's estates. The former poet of an austere pietism now became the advocate of a light-hearted philosophy, from which frivolity and sensuality were not excluded. In *Don Sylvio von Rosalva* (1764), a romance in imitation of *Don Quixote*, he held up to ridicule his earlier faith and in the *Komische Erzählungen* (1765) he gave his extravagant imagination only too free a rein. More important is the novel *Geschichte des Agathon* (1766–1767), in which, under the guise of a Greek fiction, Wieland described his own spiritual and intellectual growth. This work, which Lessing recommended as "a novel of classic taste," marks an epoch in the development of the modern psychological novel. Of equal importance was Wieland's translation of twenty-two of Shakespeare's plays into prose (8 vols., 1762–1766); it was the first attempt to present the English poet to the German people in something approaching entirety. With the poems *Musarion oder die Philosophie der Grazien* (1768), *Idris* (1768), *Combabus* (1770), *Der neue Amadis* (1771), Wieland opened the series of light and graceful romances in verse which appealed so irresistibly to his contemporaries and acted as an antidote to the sentimental excesses of the subsequent *Sturm und Drang* movement. Wieland married in 1765, and between 1769 and 1772 was professor of philosophy at Erfurt. In the last-mentioned year he published *Der goldene Spiegel oder die Könige von Scheschian,* a pedagogic work in the form of oriental stories; this attracted the attention of duchess Anna Amalie of Saxe-Weimar and resulted in his appointment as tutor to her two sons, Karl August and Konstantin, at Weimar. With the exception of some years spent at Ossmannstedt, where in later life he bought an estate, Weimar remained Wieland's home until his death on the 20th of January 1813. Here, in 1773, he founded *Der teutsche Merkur*, which under his editorship (1773–1789) became the most influential literary review in Germany. Of the writings of his later years the most important are the admirable satire on German provinciality—the most attractive of all his prose writings—*Die Abderiten, eine sehr wahrscheinliche Geschichte* (1774), and the charming poetic romances, *Das Wintermärchen* (1776), *Das Sommermärchen* (1777), *Geron der Adelige* (1777), *Die Wünsche oder Pervonte* (1778), a series culminating with Wieland's poetic masterpiece, the romantic epic of *Oberon* (1780). Although belonging to a class of poetry in which modern readers take but little interest, *Oberon* has still, owing to the facile beauty of its stanzas, the power to charm. In Wieland's later novels, such as the *Geheime Geschichte des Philosophen Peregrinus Proteus* (1791) and *Aristipp und einige seiner Zeitgenossen* (1800–1802), a didactic and philosophic tendency obscures the small literary interest they possess. He also translated Horace's *Satires* (1786), Lucian's Works (1788–1789), Cicero's Letters (1808 ff.), and from 1796 to 1803 he edited the *Attisches Museum* which did valuable service in popularizing Greek studies.

Without creating a school in the strict sense of the term, Wieland influenced very considerably the German literature of his time. The verse-romance and the novel—more especially in Austria—benefited by his example, and even the Romanticists of a later date borrowed many a hint from him in their excursions into the literatures of the south of Europe. The qualities which distinguish his work, his fluent style and light touch, his careless frivolity rather than poetic depth, show him to have been in literary temperament more akin to Ariosto and Voltaire than to the more spiritual and serious leaders of German poetry; but these very qualities in Wieland's poetry introduced a balancing element into German classical literature and added materially to its fullness and completeness.

Editions of Wieland's *Sämtliche Werke* appeared in (1794–1802, 45 vols.), (1818–1828, 53 vols.), (1839–1840, 36 vols.), and (1853–1858, 36 vols.). The latest edition (40 vols.) was edited by H. Düntzer (1879–1882); a new critical edition is at present in preparation by the Prussian Academy. There are numerous editions of selected works, notably by H. Pröhle in Kürschner's *Deutsche Nationalliteratur* (vols. 51-56, 1883–1887); by F. Muncker (6 vols., 1889); by W. Bölsche (4 vols., 1902). Collections of Wieland's letters were edited by his son Ludwig (1815) and by H. Gessner (1815–1816); his Letters to Sophie Laroche by F. Horn (1820). See J. G. Gruber, *C. M. Wielands Leben* (4 vols., 1827–1828); H. Döring, *C. M. Wieland* (1853); J. W. Loebell, *C. M. Wieland* (1858); H. Pröhle, *Lessing, Wieland, Heinse* (1876); L. F. Ofterdinger, *Wielands Leben und Wirken in Schwaben und in der Schweiz* (1877); R. Keil, *Wieland und Reinhold* (1885); F. Thalmeyr, *Über Wielands Klassizität, Sprache und Stil* (1894); M. Döll, *Wieland und die Antike* (1896); C. A. Behmer, *Sterne und Wieland* (1899); W. Lenz, *Wielands Verhältnis zu Spenser, Pope und Swift* (1903); L. Hirzel, *Wielands Beziehungen zu den deutschen Romantikern* (1904). See also M. Koch's article in the *Allgemeine deutsche Biographie* (1897). (J. G. R.)

WIELICZKA, a mining town in Galicia, Austria, 220 m. by rail W. of Lemberg and 9 m. S.E. of Cracow. Pop. (1900) 6012. It is built on the slopes of a hill which half encircles the place, and over the celebrated salt-mines of the same name. These mines are the richest in Austria, and among the most remarkable in the world. They consist of seven different levels, one above the other, and have eleven shafts, two of which are in the town. The levels are connected by flights of steps, and are composed of a labyrinth of chambers and passages, whose length aggregates over 65 m. The length of the mines from E. to W. is 2⅓ m., the breadth from N. to S. is 1050 yds. and the depth reaches 980 ft. Many of the old chambers, some of which are of enormous size, are embellished with portals, candelabra, statues, &c., all hewn in rock-salt. There are also two large chapels, containing altars, ornaments, &c., in rock-salt, a room called the dancing saloon (*Tanzsaal*), where the objects of interest found in the mines are kept; the Kronleuchtersaal, and the chamber Michatovice are also worth mention. In the interior of the mines are sixteen ponds, of which the large lake of Przykos is 195 ft. long, 110 ft. broad, and 10-26 ft. deep. The mines employ over 1000 workers, and yield about 60,000 tons annually. The salt of Wieliczka is well known for its purity and solidity, but has generally a grey or blackish colour. The date of the discovery of the mines is unknown, but they were already worked in the 11th century. Since 1814 they have belonged entirely to the Austrian government. The mines suffered greatly from inundations in 1868 and 1879, and the soil on which the town is built shows signs of subsidence.

See E. Windakiewicz, *Das Steinsalzbergwerk in Wieliczka* (Freiberg, 1896).

WIELOPOLSKI, ALEKSANDER, Marquis of Gonzaga-Myszkowski (1803–1877), Polish statesman, was educated in Vienna, Warsaw, Paris and Göttingen. In 1830 he was elected a member of the Polish diet on the Conservative side. At the beginning of the Insurrection of 1831 he was sent to London to obtain the assistance, or at least the mediation, of England; but the only result of his mission was the publication of the pamphlet *Mémoire présenté à Lord Palmerston* (Warsaw, 1831). On the collapse of the insurrection he emigrated, and on his return to Poland devoted himself exclusively to literature and the cultivation of his estates. On the occasion of the Galician outbreak of 1845, when the Ruthenian peasantry massacred some hundreds of Polish landowners, an outbreak generally attributed to the machinations of the Austrian government, Wielopolski wrote his famous *Lettre d'un gentilhomme polonais au prince de Metternich* (Brussels, 1846), which caused a great sensation at the time, and in which he attempted to prove that the Austrian court was acting in collusion with the Russian in the affair. In 1861, when Alexander II. was benevolently disposed towards the Poles and made certain political and national concessions to them, Wielopolski was appointed president of the commissions of public worship and justice and subsequently president of the council of state. A visit to the Russian capital in November still further established his influence, and in 1862 he was appointed adjutant to the grand-duke Constantine. This office he held till the 12th of September 1863, when finding it impossible to resist the rising current of radicalism and revolution he resigned all his offices, and obtained at his own request unlimited leave of absence. He retired to Dresden, where he died on the 30th of December 1877.

See Henryk Lisicki, *Le Marquis Wielopolski, sa vie et son temps* (Vienna, 1880); Włodzimieriz Spasowicz, *The Life and Policy of the Marquis Wielopolski* (Rus.) (St Petersburg, 1882). (R. N. B.)

WIENER-NEUSTADT, a town of Austria, in Lower Austria, 31 m. S. of Vienna by rail. Pop. (1900) 28,438. It is situated between the Fischa and the Leitha and is close to the Hungarian frontier. It was almost entirely rebuilt after a destructive fire in 1834, and ranks among the handsomest provincial towns in Austria. Its ancient gates, walls and towers have disappeared, but it still possesses a few medieval edifices, the most important of which is the old castle of the dukes of Babenberg, founded in the 12th century, and converted by Maria Theresa in 1752 into a military academy. The Gothic chapel contains the remains of the emperor Maximilian I., who was born here in 1459. The parish church, with its two lofty towers, is substantially a Romanesque building of the 13th century, but the choir and transepts are Gothic additions of a later date. The late Gothic church of the old Cistercian abbey contains a handsome monument in memory of Leonora of Portugal (d. 1467), consort of the emperor Frederick III., and possesses a rich library and an interesting museum. The town-house is also a noteworthy building and contains large and important archives. The chief industrial establishments are a large ammunition factory and an engine factory; but manufactures of cotton, silk, velvet, pottery and paper, sugar-refining and tanning are also extensively carried on. Trade is also brisk, and is facilitated by a canal connecting the town with Vienna, and used chiefly for the transport of coal and timber.

Neustadt was founded in 1192, and was a favourite residence of numerous Austrian sovereigns, acquiring the title of the "ever-faithful town" (*die allezeit getreue Stadt*) from its unfailing loyalty. In 1246 it was the scene of a victory of the Hungarians over the Austrians; and in 1486 it was taken by Matthias Corvinus, king of Hungary, who, however, restored it to Maximilian I. four years later. In 1529 and 1683 it was besieged by the Turks. It was at Neustadt that the emperor Rudolf II. granted to the Bohemian Protestants, in 1609, the "Majestätsbrief," or patent of equal rights, the revocation of which helped to precipitate the Thirty Years' War.

See Hinner, *Wandelbilder aus der Geschichte Wiener-Neustadts* (Wiener-Neustadt, 1892).

WIENIAWSKI, HENRI (1835–1880), Polish violinist and composer, was born at Lublin, in Poland, on the 10th of July 1835. He was a pupil of the Paris Conservatoire from 1843 to 1846, and again in 1849–1850. Meanwhile he had given concerts in his native country and in Russia, and in 1850 entered upon the career of a travelling virtuoso, together with his brother Joseph, a distinguished pianist. He was appointed solo violinist to the tsar in 1860, and taught in the Conservatoire of St Petersburg from 1862 to 1867. He went on tour again in 1872 with Rubinstein in America, and on his return in 1874 was appointed to succeed Vieuxtemps as professor in the Brussels Conservatoire; but, like his predecessor, he was compelled through ill-health to give up the post after three years, returning to a public career in spite of his illness, until his death, which occurred in a hospital in Moscow, on the 31st of March 1880. He was a wonderfully sympathetic solo player, and a good if not a great quartet player. His *Légende*, the fantasias on *Faust* and on Russian airs, his two concertos and some other pieces, have retained their high place in the violin repertory.

WIEPRECHT, WILHELM FRIEDRICH (1802–1872), German musical conductor, composer and inventor, was born on the 10th of August 1802, at Aschersleben, where his father was town musician. According to his autobiography, Wieprecht early learned from his father to play on nearly all wind instruments. It was in violin-playing, however, that his father particularly wished him to excel; and in 1819 he went to Dresden, where he studied composition and the violin to such good purpose that a year later he was given a position in the city orchestra of Leipzig, playing also in those of the opera and the famous Gewandhaus. At this time, besides playing the violin and clarinet in the orchestra, he also gave solo performances on the trombone. In 1824 he went to Berlin, where he became a member of the royal orchestra, and was in the same year appointed chamber musician to the king. His residence at Berlin gave Wieprecht ample opportunity for the exercise of his genius for military music, on which his fame mainly rests. Several of his marches were early adopted by the regimental bands, and a more ambitious military composition attracted the attention of Gasparo Spontini, at whose house he became an intimate guest. It was now that he began to study acoustics, in order to correct the deficiencies in military musical instruments. As the result, he improved the valves of the brass instruments, and succeeded, by constructing them on sounder acoustic principles, in greatly increasing the volume and purity of their tone. He also invented the bass tuba or bombardon in order to give greater richness and power to the bass parts. In recognition of these inventions he was, in 1835, honoured by the Royal Academy of Berlin. In 1838 he was appointed by the Prussian government director-general of all the guards' bands, and in recognition of the magnificent performance by massed bands on the occasion of the emperor Nicholas I.'s visit the same year, was awarded a special uniform. In 1843 he became director-general of the bands of the 10th Confederate army corps, and from this time exercised a profound influence on the development of military music throughout Germany, and beyond. He was the first to arrange the symphonies and overtures of the classical masters for military instruments, and to organize those outdoor performances of concert pieces by military bands which have done so much to popularize good music in Germany and elsewhere. The performance arranged by him of Beethoven's "Battle of Vittoria," in which the bugle calls were given by trumpeters stationed in various parts of the garden and the cannon shots were those of real guns, created immense sensation. Besides the great work he accomplished in Germany, Wieprecht, in 1847, reorganized the military music in Turkey and, in 1852, in Guatemala. He composed military songs as well as numerous marches, and contributed frequently on his favourite subject to the Berlin musical papers. He died on the 4th of August 1872. Wieprecht was a man of genial, kindly and generous nature, and was associated with many charitable foundations established for the benefit of poor musicians.

WIESBADEN, a town and watering-place of Germany, in the Prussian province of Hesse-Nassau. Pop. (1905) 100,953. It is delightfully situated in a basin under the well-wooded southwestern spurs of the Taunus range, 5 m. N. of Mainz, 3 m. from the right bank of the Rhine (at Biebrich), and 25 m. W. of Frankfort-on-Main by rail. The town is on the whole sumptuously built, with broad and regular streets. Villas and gardens engirdle it on the north and east sides and extend up the hills behind. Its prosperity is mainly due to its hot springs and mild climate, which have rendered it a favourite winter as well as summer resort. The general character of the place, with its numerous hotels, pensions, bathing establishments, villas and places of entertainment, is largely determined by the requirements of visitors, who in 1907 numbered 180,000. The principal buildings are the royal palace, built in 1837–1840 as a residence for the dukes of Nassau, and now a residence of the king of Prussia; the Court Theatre (erected 1892–1894); the new Kurhaus, a large and handsome establishment, with colonnades, adjoining a beautiful and shady park; the town-hall, in the German Renaissance style (1884–1888); the government offices and the museum, with a picture gallery, a collection of antiquities, and a library of 150,000 vols. Among the churches, which are all modern, are the Protestant *Marktkirche*, in the Gothic style with five towers, built 1853–1862; the *Bergkirche*; the Roman Catholic church of St Boniface; the Anglican church and the Russian church on the Neroberg. There are two synagogues. Wiesbaden contains numerous scientific and educational institutions, including a chemical laboratory, an agricultural college and two musical conservatoria.

The alkaline thermal springs contain $\frac{2}{3}$% of common salt, and smaller quantities of other chlorides; and a great deal of their efficacy is due to their high temperature, which varies from 156° to 104° Fahr. The water is generally cooled to 93° F. for bathing. The principal spring is the *Kochbrunnen* (156° F.), the water of which is drunk by sufferers from chronic dyspepsia and obesity. There are twenty-eight other springs of nearly identical composition, many of which are used for bathing, and are efficacious in cases of rheumatism, gout, nervous and female disorders and skin diseases. The season lasts from April to October, but the springs are open the whole year through and are also largely attended in winter.

Two miles north-west of the town lies the Neroberg (800 ft.), whence a fine view of the surrounding country is obtained, and which is reached by a funicular railway from Beausite, and 6 m. to the west lies the Hohe Wurzel (2025 ft.) with an outlook tower.

Wiesbaden is one of the oldest watering-places in Germany, and may be regarded as the capital of the Taunus spas. The springs mentioned by Pliny (*Hist. nat.* xxi. 2) as *Fontes Matthiaci* were known to the Romans, who fortified the place *c.* 11 B.C. The massive wall in the centre of the town known as the *Heidenmauer* was probably part of the fortifications built under Diocletian. The name *Wisibada* (" meadow bath ") appears in 830. Under the Carolingian monarchs it was the site of a palace, and Otto I. gave it civic rights. In the 11th century the town and district passed to the counts of Nassau, fell to the Walram line in 1255, and in 1355 Wiesbaden became with Idstein capital of the county Nassau-Idstein. It suffered much from the ravages of the Thirty Years' War and was destroyed in 1644. In 1744 it became the seat of government of the principality Nassau-Usingen, and was from 1815 to 1866 the capital of the duchy of Nassau, when it passed with that duchy to Prussia. Though the springs were never quite forgotten, they did not attain their greatest repute until the close of the 18th century. From 1771 to 1873 Wiesbaden was a notorious gambling resort; but in the latter year public gambling was suppressed by the Prussian government.

See Roth, *Geschichte und historische Topographie der Stadt Wiesbaden* (Wiesbaden, 1883); Pagenstecher, *Wiesbaden in medizinisch-topographischer Beziehung* (Wiesbaden, 1870); Kranz, *Wiesbaden und seine Thermen* (Leipzig, 1884); Pfeiffer, *Wiesbaden als Kurort* (5th ed., Wiesbaden, 1899); and Heyl, *Wiesbaden und seine Umgebungen* (27th ed., Wiesbaden, 1908).

WIG (short for " periwig," an alternative form of " peruke," Fr. *perruque*; cf. Span. *peluca*; conjecturally derived from Lat. *pilus*), an artificial head of hair, worn as a personal adornment, disguise or symbol of office. The custom of wearing wigs is of great antiquity. If, as seems probable, the curious head-covering of a prehistoric ivory carving of a female head found by M. Piette in the cave of Brassempouy in the Landes represents a wig (see Ray Lankester, *Science from an Easy Chair*, fig. 7) the fashion is certainly some 100,000 years old. In historic times, wigs were worn among the Egyptians as a royal and official head-dress, and specimens of these have been recovered from mummies. In Greece they were used by both men and women, the most common name being *πηνίκη* or *φενάκη*, sometimes *προκόμιον* or *κόμαι πρόσθετοι*. A reference in Xenophon (*Cyr.* i. 3. 2) to the false hair worn by Cyrus's grandfather " as is customary among the Medes," and also a story in Aristotle (*Oecon.* 4. 14), would suggest that wigs were introduced from Persia, and were in use in Asia Minor. Another origin is suggested by Athenaeus (xii. 523), who says that the Iapygian immigrants into Italy from Crete were the first to wear *προκόμια περιθετά*, and the elaborately frizzled hair worn by some of the figures in the frescoes found at Cnossus makes it probable that the wearing of artificial hair was known to the Cretans. Lucian, in the 2nd century, mentions wigs of both men and women as a matter of course (*Alex.* 59, *Dial. mer.* 11). The theatrical wig was also in use in Greece, the various comic and tragic masks having hair suited to the character represented. A. E. Haigh (*Attic Theatre*, pp. 221, 239) refers to the black hair and beard of the tyrant, the fair curls of the youthful hero, and the red hair characteristic of the dishonest slave of comedy. These conventions appear to have been handed on to the Roman theatre.

At Rome wigs came into use certainly in the early days of the empire. They were also known to the Carthaginians; Polybius (iii. 78) says that Hannibal used wigs as a means of disguise. The fashionable ladies of Rome were much addicted to false hair, and we learn from Ovid, *Amores*, i. 14. 45) and Martial (v. 68) that the golden hair imported from Germany was most favoured. Juvenal (vi. 120) shows us Messalina assuming a yellow wig for her visits to places of ill-fame, and the scholiast on the passage says that the yellow wig was characteristic of courtesans. The chief names for wigs were *galerus*, *galericulum*, *corymbium*, *capillamentum*, *caliendrum*, or even *comae emptae*, &c. *Galerus* meant in the first place a skull-cap, or coif, fastening under the chin, and made of hide or fur, worn by peasants, athletes and *flamines*. The first men's wigs then would have been tight fur caps simulating hair, which would naturally suggest wigs or false hair. Otho wore a wig (Suetonius, *Otho* § 12), which could not be distinguished from real hair, while Nero (Dio Cass. lxi. 9) wore a wig as a disguise, and Heliogabalus also wore one at times (*ibid.* lxxix. 13). Women continued to have wigs of different colours as part of their ordinary wardrobe, and Faustina, wife of Marcus Aurelius, is said to have had several hundred. An amusing development of this is occasionally found in portrait busts, *e.g.* that of Plautilla in the Louvre, in which the hair is made movable, so that by changing the wig of the statue from time to time it should never be out of fashion.

The Fathers of the Church violently attacked the custom of wearing wigs, Tertullian (*De cultu fem. C.* 7) being particularly eloquent against them, but that they did not succeed in stamping out the custom was proved by the finding of an auburn wig in the grave of a Christian woman in the cemetery of St Cyriacus. In 672 a synod of Constantinople forbade the wearing of artificial hair.

Artificial hair has presumably always been worn by women when the fashion required abundant locks. Thus, with the development of elaborate coiffures in the 16th century, the wearing of false hair became prevalent among ladies in Europe; Queen Elizabeth had eighty attires of false hair, and Mary queen of Scots was also in the habit of varying the attires of hair she wore. The periwig of the 16th century, however, merely simulated real hair, either as an adornment or to supply the defects of nature. It was not till the 17th century that the peruke was worn as a distinctive feature of costume. The fashion started in France. In 1620 the abbé La Rivière appeared at the court of Louis XIII. in a periwig made to simulate long fair hair, and four years later the king himself, prematurely bald, also adopted one and thus set the fashion. Louis XIV., who was proud of his abundant hair, did not wear a wig till after 1670. Meanwhile, his courtiers had continued to wear wigs in imitation of the royal hair, and from Versailles the fashion spread through Europe. In England it came in with the Restoration; for though the prince of Wales (Charles I.), while in Paris on his way to Spain, had " shadowed himself the most he could under a burly perruque, which none in former days but bald-headed people used," he had dropped the fashion on returning to England, and he and his Cavaliers were distinguished from the " Roundheads " only by wearing their own flowing locks. Under Charles II. the wearing of the peruke became general. Pepys records that he parted with his own hair and " paid £3 for a periwigg ";[1] and on going to church in one he says " it did not prove so strange as I was afraid it would." It was under Queen Anne, however, that the wig attained its maximum development, covering the back and shoulders and floating down over the chest. So far, indeed, whatever the exaggeration of its proportions, the wig had been a " counterfeit hair " intended to produce the illusion of abundant natural locks. But, to quote the inimitable author of *Plocacosmos*, " as the perukes became more common, their shape and forms altered. Hence we hear of the clerical, the physical, and the huge tie peruke for the man of law, the brigadier or major for the army and navy; as also the tremendous fox ear, or cluster of temple curls, with a pig-tail behind. The merchant, the man of business and of letters, were distinguished by the grave full bottom, or more moderate tie, neatly curled; the tradesman by the long bob, or natty scratch; the country gentleman by the natural fly and hunting peruke. All conditions of men were distinguished by the cut of the wig, and none more so than the coachman, who wore his, as there does some to this day, in imitation of the curled hair of a water-dog."[2]

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[1] This was cheap. The author of *Plocacosmos* says that " when they first were wore, the price was usually one hundred guineas "; and the article in Diderot's *Encyclopédie* says that it sometimes cost as much as 1000 *écus*.

[2] *Plocacosmos*, p. 203. The writer goes on to describe the fashions on the stage. " So late as King William's reign, in one of Rowe's pieces, *Lady Jane Grey*, the Lord Guildford Dudley is dressed in all the modern fashion of laced coat, cravat, high peruke, &c., while the heroine is simply drest, her hair parted in the middle, hanging carelessly on her shoulders. . . . Nearer our time, in the tragedy of *Cato*, Mr Booth is dressed *a-la-mode*, with the huge peruke. . . . Mr Quin

This differentiation of wigs according to class and profession explains why, when early in the reign of George III. the general fashion of wearing wigs began to wane and die out, the practice held its own among professional men. It was by slow degrees that doctors, soldiers and clergymen gave up the custom. In the Church it survived longest among the bishops, the wig ultimately becoming a sort of ensign of the episcopal dignity. Wigs were first discarded by the bishops, by permission of the king, at the coronation banquet of William IV., the weather being hot; and Greville comments on the odd appearance of the prelates with their cropped polls. At the coronation of Queen Victoria the archbishop of Canterbury, alone of the prelates, still wore a wig. Wigs are now worn as part of official costume only in the United Kingdom and its dependencies, their use being confined, except in the case of the speaker of the house of commons and the clerks of parliament, to the lord chancellor, the judges and members of the bar (see ROBES). Wigs of course continue to be worn by many to make up for natural deficiencies; and on the stage the wig is, as in all times, an indispensable adjunct. Many of the modern stage wigs are made of jute, a fibre which lends itself to marvellously perfect imitations of human hair.

See F. W. Fairholt, *Costume in England*, 2 vols., ed. Dillon (1885); C. F. Nicolai, *Über den Gebrauch der falschen Haare und Perrücken* (1801); the articles "Coma" and "Galerus" in Daremberg and Saglio's *Dictionnaire des antiquités*. There is an admirable article on wigs and wig-making in Diderot's *Encyclopédie* (1765), t. xii., *s.v.* "Perruque." James Stewart's *Plocacosmos, or the Whole Art of Hairdressing* (London, 1782) also contains rich material.

WIGAN, a market town, and municipal, county and parliamentary borough of Lancashire, England, 194 m. N.W. by N. from London by the London & North-Western railway, served also by the Lancashire & Yorkshire and the Great Central railways. Pop. (1891) 55,013, (1901) 60,764. It lies on the small river Douglas, which flows into the estuary of the Ribble. There is connexion by canal with Liverpool, Manchester, &c. The older portions of the town occupy the north bank of the river, the modern additions being chiefly on the south bank. The church of All Saints, late Perpendicular, consisting of chancel with aisles and two chapels, was restored in 1630 and in modern times. There are numerous modern churches and chapels. The principal public buildings are the Royal Albert Edward Infirmary and Dispensary, the public hall, the borough courts and offices, the arcade, the market hall, the free public library and the county courts and offices (1888). The educational institutions include the free grammar school (founded by James Leigh in 1619 and rebuilt in 1876), the Wigan and District Mining and Technical College (built by public subscription and opened in 1903) and the mechanics' institution, also the convent of Notre Dame (1854), with a college for pupil teachers and a high school for girls, and several Roman Catholic schools. A public park of 27 acres was opened in 1878. The town owes much of its prosperity to its coal mines, which employ a large proportion of the inhabitants and supply the factory furnaces. The chief manufacture is that of cotton fabrics; the town also possesses iron forges, iron and brass foundries, oil and grease works, railway waggon factories, and bolt, screw and nail works. The parliamentary borough, returning one member since 1885, is coextensive with the municipal borough, and falls mainly within the Ince division of the county. The county borough was created in 1888. The corporation consists of a mayor, 10 aldermen and 30 councillors. Area 5082 acres, including the former urban district of Pemberton (pop. 21,664 in 1901), which was included with Wigan in 1904.

Roman remains have been found, and it is probable that the town covers the site of a Roman post or fort, Coccium. Wigan, otherwise Wygan and Wigham, is not mentioned in Domesday Book, but three of the townships, Upholland, Dalton and Orrel are named. After the Conquest Wigan was part of the barony of Newton, and the church was endowed with a carucate of land, the origin of the manor. Some time before Henry III.'s reign the baron of Newton granted to the rector of Wigan the manorial privileges. In 1246 Henry III. granted a charter to the famous John Mansel, parson of the church, by which Wigan was constituted a free borough and the burgesses permitted to have a Gild Merchant. In 1249 John Mansel granted by charter to the burgesses that each should have five roods of land to his burgage as freehold on payment of 12d. each. Confirmations and extensions of Henry III.'s charter were granted by Edward II. (1314), Edward III. (1349), Richard II. (1378), Henry IV. (1400), Henry V. (1413), Charles II. (1663), James II. (1685) and William IV. (1832 and 1836). In 1258 Henry III. granted by charter to John Mansel a weekly market on Monday and two fairs, each of three days, beginning on the eve of Ascension Day and on the eve of All Saints' Day, October 28th. Edward II. granted a three days' fair from the eve of St Wilfrid instead of the All Saints' fair, but in 1329 Edward III. by charter altered the fair again to its original date. Charles II.'s charter granted, and James II.'s confirmed, a three days' fair beginning on the 16th of July. Pottery and bell-founding were formerly important trades here, and the manufacture of woollens, especially of blankets, was carried on in the 18th century. The cotton trade developed rapidly after the introduction of the cylindrical carding machine, which was set up here two years before Peel used it at Bolton. During the Civil War the town, from its vicinity to Lathom House and the influence of Lord Derby, adhered staunchly to the king. On the 1st of April 1643 the Parliamentarians under Sir John Seaton captured Wigan after severe fighting. In the following month Lord Derby regained it for the Royalists, but Colonel Ashton soon retook it and demolished the works. In 1651 Lord Derby landed from the Isle of Man and marched through Preston to Wigan on the way to join Charles II. At Wigan Lane on the 25th of August a fierce battle took place between the Royalist forces under Lord Derby and Sir Thomas Tyldesley and the Parliamentarians under Colonel Lilburne, in which the Royalists were defeated, Tyldesley was killed and Lord Derby wounded. During the rebellion of 1745 Prince Charles Edward spent one night (December 10th) here on his return march. In 1295 Wigan returned two members to parliament and again in 1307; the right then remained in abeyance till 1547, but from that time till 1885, except during the Commonwealth, the borough returned two members, and since 1885 one member. The church of All Saints is of Saxon origin, and was existing in Edward the Confessor's time. The list of rectors is complete from 1199.

WIGEON, or WIDGEON (Fr. *Vigeon,* from the Lat. *Vipio*),[1] also called locally "Whewer" and "Whew" (names imitative of the whistling call-note of the male), the *Anas penelope* of Linnaeus and *Mareca penelope* of modern ornithologists, one of the most abundant species of ducks throughout the greater part of Europe and northern Asia, reaching northern Africa and India in winter. A good many pairs breed in the north of Scotland; but the nurseries of the vast numbers which resort in autumn to the waters of temperate Europe are in Lapland or farther to the eastward. Comparatively few breed in Iceland.

Intermediate in size between the teal and the mallard, and less showy in plumage than either, the drake wigeon is a beautiful bird, with the greater part of his bill blue, his forehead cream-colour, his head and neck chestnut,[2] replaced by greyish-pink below and above by lavender-grey, which last, produced by the transverse undulations of fine black and white lines, extends over the back and upper surface of the wings, except some of the coverts, which are

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acted almost all his young characters, as Hamlet, Horatio, Pierre, &c. in a full-dress suit and large peruke. But Mr Garrick's genius . . . first attacked the mode of dress, and no part more than that of the head of hair. The consequence of this was, that a capital player's wardrobe" [came to include] "what they call natural heads of hair; there is the comedy head of hair, and the tragedy ditto; the silver locks, and the common gray; the carotty poll, and the yellow caxon; the savage black, and the Italian brown, and Shylock's and Falstaff's very different heads of hair; . . . with the Spanish fly, the foxes tail, &c. &c." He adds that the tendency is to replace those by "the hair, without powder, simply curled."

[1] So PIGEON (*q.v.*) from *Pipio*. Other French names, more or less local, are, according to Rolland, *Vignon*, *Vingeon*, *Wagne*, *Woinge*, *Wignet*, *Wuiot*, *Vioux* and *Digeon*. In some parts of England the small teasing flies, generally called midges, are known as "wigeons."

[2] Hence come the additional local names "bald-pate" and "red-head."

conspicuously white, and shows itself again on the flanks. The wings are further ornamented by a glossy green speculum between two black bars; the tail is pointed and dark; the rest of the lower parts is white. The female has the inconspicuous coloration characteristic of her sex among most of the duck tribe. In habits the wigeon differs not a little from most of the *Anatinae*. It greatly affects tidal waters during the season of its southern stay, and becomes the object of slaughter to hundreds of gunners on the coasts of Britain and Holland; but, when it resorts to inland localities, as it also does to some extent, it passes much of its time in grazing, especially by day, on the pastures which surround the lakes or moors that it selects.

The wigeon occurs occasionally on the eastern coast of North America, and not uncommonly, it would seem, on the Pribyloff Islands in the Pacific. But the New World has two allied species of its own. One of them, *M. americana* (a freshly killed example of which was once found in a London market), inhabiting the northern part of that continent, and in winter reaching Central America and the West Indian islands as far as Trinidad, wholly resembles its Old-World congener in habits and much in appearance. But in it the chestnut of the head is replaced by a close speckling of black and buff, the white wing-coverts are wanting, and nearly all the plumage is subdued in tone. The other species, *M. sibilatrix*, inhabits the southern portion of South America and its islands, from Chile on the west to the Falklands on the east, and is easily recognized by its nearly white head, nape glossy with purple and green, and other differences; while the plumage hardly differs sexually at all. (A. N.)

WIGGIN, KATE DOUGLAS (1857–), American novelist, daughter of Robert N. Smith, a lawyer, was born in Philadelphia, Pennsylvania, on the 28th of September 1857. She was educated at Abbott Academy, Andover, Massachusetts, and removed in 1876 to Los Angeles, California. She taught in Santa Barbara College (1877–1878), established in San Francisco the first free kindergartens for poor children on the western coast (1878), and, with the help of her sister, Miss Nora Archibald Smith, and of Mrs Sarah B. Cooper, organized the California Kindergarten Training School (1880). She married, in 1880, Samuel Bradley Wiggin of San Francisco, who died in 1889. In 1895 she married George Christopher Riggs, but continued to write under the name of Wiggin. Her interest in children's education was shown in numerous books, some written in collaboration with her sister, in both prose and verse. But her literary reputation rests rather on her works of prose fiction, which show a real gift for depicting character and an original vein of humour. The best known of these are: *The Birds' Christmas Carol* (1888); *Penelope's English Experiences* (1893); *Marm Lisa* (1896); *Penelope's Progress* (1898), being Penelope's experiences in Scotland; *Penelope's Irish Experiences* (1901); *The Diary of a Goose-Girl* (1902); and *Rebecca of Sunnybrook Farm* (1903).

WIGGLESWORTH, MICHAEL (1631–1705), American clergyman and poet, was born in England, probably in Yorkshire, on the 18th of October 1631. His father, Edward (d. 1653), persecuted for his Puritan faith, emigrated with his family to New England in 1638 and settled in New Haven. Michael studied for a time at a school kept by Ezekiel Cheever, and in 1651 graduated at Harvard, where he was a tutor (and a Fellow) in 1652–1654. Having fitted himself for the ministry, he preached at Charlestown in 1653–1654, and was pastor at Malden from 1656 until his death, though for twenty years or more bodily infirmities prevented his regular attendance upon his duties—Cotton Mather described him as "a little feeble shadow of a man." During this interval he studied medicine and began a successful practice. He was again a Fellow of Harvard in 1697–1705. He died at Malden on the 10th of June 1705. Wigglesworth is best known as the author of *The Day of Doom; or a Poetical Description of the Great and Last Judgment* (1662). At least two English and eight American editions have appeared, notable among them being that of 1867 (New York), edited by W. H. Burr and including other poems of Wigglesworth, a memoir and an autobiography. For a century this realistic and terrible expression of the prevailing Calvinistic theology was by far the most popular work written in America. His other poems include *God's Controversy with New England* (written in 1662, "in the time of the great drought," and first printed in the *Proceedings of the Massachusetts Historical Society* for 1781), and *Meat out of the Eater; or Meditations concerning the Necessity, End and Usefulness of Afflictions unto God's Children* (1669; revised in 1703).

His son, SAMUEL (1689–1768), also a clergyman, was the author of several prose works and of one poem of merit, "A Funeral Song" (1709). Another son, Edward (1693–1765), was the first Hollis professor of Divinity at Harvard (1722–1765), and the author of various theological works; and a grandson, Edward (1732–1794), was the second Hollis professor of Divinity (1765–1791), in which position he was succeeded by Michael Wigglesworth's great-grandson, Rev. David Tappan (1752–1803).

See J. W. Deane, *Memoir of Rev. Michael Wigglesworth* (Boston, 1871).

WIGHT, ISLE OF, an island off the south coast of England, forming part of Hampshire, separated from the mainland by the Solent and Spithead. It is of diamond shape, measuring 22½ m. from E. to W. and 13½ from N. to S. (extremes). The area is 147 sq. m. The south coast is for the most part cliff-bound and grand, and there is much quietly beautiful scenery both inland and along the northern shores. Although east winds are at times prevalent in winter and spring, and summer heats may be excessive, the climate, especially in certain favoured spots, is mild and healthy. As a result numerous watering-places have grown up on the coasts.

A range of high chalk downs crosses the island from east to west, terminating seaward in the Culver cliffs and the cliffs near Freshwater respectively. It is breached eastward by the Yar stream flowing N.E., in the centre by the Medina, the principal stream in the island, flowing N., and by another Yar, flowing N., in the extreme west. These downs reach a height over 700 ft. west of the Medina, but east of it do not greatly exceed 400 ft. The slope northward is gradual. The north-west and north-east coasts, overlooking the Solent and Spithead respectively, rise sharply, but hardly ever assume the cliff form; they are beautifully wooded, and broken by many picturesque estuaries, such as those of the western Yar and Newtown on the north-west, the Medina opening northward opposite Southampton Water, and Wootton Creek and the mouth of the eastern Yar on the north-east. The streams mentioned rise very near the south coast; the western Yar, indeed, so close to it that the high land west of the stream is nearly insulated. A second range of downs in the extreme south, between St Catherine's Point and Dunnose, reaches the greatest elevation in the island, exceeding 800 ft. in St Catherine's Hill. Below these heights on the seaward side occurs the remarkable tract known as the Undercliff, a kind of terrace formed by the collapse of rocks overlying soft strata (sand and clay) which have been undermined. The upper cliffs shelter this terrace from the north winds; the climate is remarkably mild, and many delicate plants flourish luxuriantly. This part of the island especially affords a winter resort for sufferers from pulmonary complaints. Along the south coast the action of small streams on the soft rocks has hollowed out steep gullies or ravines, known as chines. Many of these, though small, are of great beauty; the most famous are Shanklin and Blackgang chines. The western peninsula shows perhaps the finest development of sea-cliffs. Off the westernmost promontory rise three detached masses of chalk, about 100 ft. in height, known as the Needles, exposed to the full strength of the south-westerly gales driving up the Channel. During a storm in 1764 a fourth spire was undermined and fell.

Geology.—The geology of the island possesses many features of interest. Its form has been determined by the simple monoclinal fold which has thrown up the Chalk with a high northward dip, so that it now exists as a narrow ridge running from the Needles eastward to Culver Cliffs. Owing to a kink in the fold the ridge expands somewhat south of Carisbrooke. On the north side of the ridge the Chalk dips beneath the Tertiaries of the Hampshire Basin. Immediately north of the Chalk the Lower Eocene, Reading beds and London Clay form a narrow parallel strip, followed by a similar strip of Upper Eocene, Bracklesham and Bagshot beds. The remaining northern portion of the island is occupied by fluvio-marine Oligocene strata, including the Headon, Osborne, Bembridge and Hamstead beds. The various Tertiary formations are exhibited along the north coast, and may also be studied to great advantage in White Cliff and Alum Bays. In Alum Bay the vertical disposition of the strata is well shown, and the highly-coloured Bagshot sands and clays form a conspicuous feature. From the excellent coast sections many fossils may be obtained. South of the Chalk ridge that rock has been completely removed by denudation so as to expose the underlying Upper Greensand, which has slipped in many places over the underlying Gault (locally called "blue slipper"), forming picturesque landslips. The Lower Greensand formation may best be studied in the cliff section from Atherfield Point to Rocken End, and in the chines of Shanklin and Blackgang. Beneath the Greensand the Wealden is exposed in the section from Brook to Atherfield, and also, to a much less extent, in Sandown Bay. The Wealden strata have yielded abundant fossil remains of extinct reptiles (*Iguanodon*), especially in the neighbourhood of Brook and Cowleaze Chines; and at Brook Point an extensive fossil forest exists, being the remains of a great raft of timber floated down and deposited in estuarine mud at the mouth of a great river. At Brook also the characteristic Wealden mollusk, *Unio valdensis*, occurs abundantly.

Towns, &c.—Newport at the head of the Medina estuary is the chief town; Cowes at the mouth the chief port. The principal resorts of visitors are Cowes (the headquarters of the Royal Yacht Squadron); Ryde on the north-east coast; Sandown, Shanklin and Ventnor on the south-east; Freshwater Gate on the south-west, and Yarmouth on the Solent. Others are Totland Bay near the mouth of the Solent, Gurnard near Cowes, and Seaview and Bembridge south of Ryde. The principal lines of communication with the mainland are between Cowes and Southampton, Ryde and Portsmouth, and Yarmouth and Lymington. Newport is the chief railway centre, lines running N. to Cowes, W. to Yarmouth and Freshwater, S. to Ventnor, with a branch to Sandown, and E. to Ryde. A direct line connects Ryde, Sandown, Shanklin and Ventnor, and has a branch to St Helen's and Bembridge. There are few industries in the island. The land is chiefly agricultural, a large proportion being devoted to sheep-grazing. Fishing is carried on to a considerable extent on the south coast—lobsters, crabs and prawns being plentiful. Oyster cultivation has been attempted in the Medina, in Brading Harbour and in the Newtown river. At Cowes shipbuilding is carried on, and timber is grown for the British navy in a part of the ancient forest of Parkhurst, between the Medina and the Solent. The general trade of the island centres at Newport, but in the coast towns the chief occupation of the inhabitants consists in providing for visitors. The island shares in the defences of the Solent, Spithead and Portsmouth; there are batteries at Puckpool near Ryde, and on the eastern foreland, and along the west coast between the Needles and Yarmouth. Strong associations connect the Isle of Wight with the British royal family. Osborne House, near Cowes, was a residence and the scene of the death of Queen Victoria, and was presented to the nation by King Edward in 1902 (see COWES). Princess Beatrice succeeded her husband Prince Henry of Battenberg as honorary governor of the island in 1896. The island is divided into two liberties, East and West Medina, excluding the boroughs of Newport and Ryde; and it forms one petty and special sessional division of the county. The urban districts are Cowes, East Cowes, St Helen's, Sandown, Shanklin and Ventnor. Until 1885 there was one member of parliament for the island and one for the borough of Newport; now, however, there is only one member for the whole island. Episcopally the island has for many centuries belonged to the see of Winchester. Pop. (1891) 78,672; (1901) 82,418.

History.—Among the most interesting relics of the Roman occupation of the Isle of Wight following its conquest by Vespasian in A.D. 43 are the villas at Brading and Carisbrooke, the cemetery at Newport, and remains of foundations at Combly Farm, Gurnet, and between Brixton and Calbourne. Of the settlement of the island by the Jutes no authentic details are preserved, but in 661 it was annexed by Wulfhere to Wessex and subsequently bestowed on his vassal, the king of Sussex. In 998 it was the headquarters of the Danes, who levied their supplies from the opposite coasts of Hampshire and Sussex.

From the 14th to the 16th century the island was continuously under fear of invasion by the French, who in 1377 burnt Yarmouth and Francheville (the latter being subsequently rebuilt and known as Newtown), and so devastated Newport that it lay uninhabited for two years. In 1419, on a French force landing in the island and demanding tribute in the name of King Richard and Queen Isabella, the islanders replied that the king was dead and the queen sent home to her parents without any such condition of tribute, "but if the Frenchmen's minde were to fight, they willed them to come up, and no man should let them for the space of five hours, to refresh themselves, but when that time was expired they should have battayle given to them"; a proposition prudently declined by the Frenchmen, who returned to their ships and sailed home again. A more formidable raid was attempted in 1545 when a French fleet of 150 large ships, 25 galleys, and 50 smaller vessels drew up off Brading Harbour, and in spite of the brave defence of the islanders wrought much serious destruction. Wolverton near Brading having lain a ruined site ever since. As a result of this, the last French invasion, an organized system of defence was planned for the island, and forts were constructed at Cowes, Sandown, Freshwater and Yarmouth. During the Civil War of the 17th century the island was almost unanimous in support of the parliament, and Carisbrooke Castle was the prison of Charles I. from 1647 to 1648, and in 1650 of his two children, the princess Elizabeth and the duke of Gloucester, the former dying there from the effects of a chill after only a few weeks of captivity.

The lordship of the island was granted by William the Conqueror to William Fitz-Osbern, but escheated to the crown by the treason of Roger, son of William, and was bestowed by Henry I. on Baldwin de Redvers, whose descendant Isabella de Fortibus sold it to Edward I. in 1293 for 6000 marks. Henceforth the island was governed by wardens appointed by the crown, who in the reign of Henry VII. were styled captains, a title revived in 1889 in the person of Prince Henry of Battenberg. The ancient place of assembly for the freemen of the island was at Shide Bridge near Newport, and at Newport also was held the Knighten Court, in which cases of small debt and trespasses were judged by those who held a knight's fee or part of a knight's fee of Carisbrooke Castle. The feudal tenants held their lands for the service of escorting their lords into and out of the island, and of serving forty days at their own cost in defence of Carisbrooke Castle. In the Domesday Survey twenty-nine mills are mentioned, and salt-works at Boarhunt, Bowcombe, Watchingwell and Whitfield. The island quarries have been worked from remote times, that of Quarr supplying material for Winchester cathedral. Alum was collected at Parkhurst Forest in 1579. Alum and sand for glass-making were formerly obtained at Alum Bay. In 1295 the united boroughs of Yarmouth and Newport made an isolated return of two members to parliament. From 1584 the boroughs of Lymington, Newport, Newtown and Yarmouth returned two members each, until under the act of 1832 the two last were disfranchised. By the act of 1868 Lymington and Newport lost one member each, and by the act of 1885 were disfranchised.

Antiquities.—Early antiquities include British pit villages near Rowborough, Celtic tumuli on several of the chalk downs, and the so-called Long Stone at Mottiston, a lofty sandstone monolith. The Roman villa near Brading contains some beautiful and well-preserved examples of tesselated pavements. Carisbrooke Castle is a beautiful ruin built upon the site of an ancient British stronghold. There are slight remains of Quarr Abbey near Ryde, founded for Benedictines (afterwards Cistercians) by Baldwin de Redvers in the first half of the 12th century. The most noteworthy ancient churches are those of Bonchurch (Norman), Brading (transitional Norman and Early English), Shalfleet (Norman and Decorated), and Carisbrooke, of various styles.

See *Victoria County History, Hampshire*; Sir R. Worsley, *The History of the Isle of Wight* (London, 1781); Richard Warner, *The History of the Isle of Wight* (Southampton, 1795); B. B. Woodward, *History of Hampshire, including the Isle of Wight* (3 vols., London, 1861–1869); Percy Stone, *Architectural History of the Isle of Wight* (London, 1891).

WIGTOWN, a royal burgh and the county town of Wigtownshire, Scotland. Pop. (1901) 1329. It is situated on the western shore of Wigtown Bay—whence the name, from the Scandinavian *vik*, "bay"—7 m. S. by E. of Newton Stewart by railway. It is built on an eminence around a spacious central area laid out in walks. The town hall stands at a corner of this square, and at the opposite side are two crosses, one of 1738 and the other commemorating Waterloo. Some fishing is carried on. In the old churchyard were buried Margaret MacLachlan, a widow aged 63, and Margaret Wilson, a girl of 18, two covenanting martyrs who were tied to stakes in the sands of Wigtown Bay and drowned by the rising waters (1685), to whose memory, as well as that of three men who were hanged at the same time without trial, an obelisk surmounted by an urn was erected in 1858 on the top of Windy Hill, outside the town. Wigtown was made a royal burgh in 1469.

WIGTOWNSHIRE (sometimes called West Galloway), a south-western county of Scotland, bounded N. by Ayrshire, E. by Kirkcudbrightshire and Wigtown Bay, S. by the Irish Sea and W. and N. by the North Channel. Including the small island of St Helena, at the head of Luce Bay, it covers an area of 311,609 acres, or 487 sq. m. On the eastern boundary the estuary of the Cree expands into Wigtown Bay, between which and Luce Bay, farther west, extends the promontory of the Machers, terminating in Burrow Head. By the indentation of Luce Bay on the south and Loch Ryan on the north the hammer-headed peninsula of the Rinns is formed, of which the Mull of Galloway, the most southerly point of Scotland, is the southern, and Milleur Point the northern extremity. The more or less rugged coast has many small inlets, few of which, owing to hidden rocks, afford secure landing-places. Excepting Loch Ryan, a fine natural harbour of which Stranraer is the port, the harbours are not available for vessels of heavy burden, on account either of the great distance to which the sea retires, or of their exposure to frequent fierce gales. Much of the county has a wild, bleak appearance, the higher land being covered with heath and whins, while in the lower districts there are long stretches of bog and moss, and in the north centre, a few miles west of Newton Stewart, is a tract known as the Moors. Only towards the Ayrshire border do the hills reach a considerable altitude, Benbrake and Craigairie Fell being each 1000 ft. in height. The chief rivers are the Cree, forming the boundary with Kirkcudbrightshire and flowing past Newton Stewart and Carty into Wigtown Bay; the Bladenoch, issuing from Loch Maberry and falling into Wigtown Bay at Wigtown after a course of 22 m., its principal affluents, all on the right, being Black Burn, the Tarff and the Malzie; and the Luce, formed by the junction at New Luce of Main Water and Cross Water of Luce, and emptying itself into Luce Bay. Most of the numerous lochs are small, several being situated in private parks, as at the earl of Stair's estate of Castle Kennedy. Among the larger lakes are Loch Maberry and Loch Dornal, both partly in Ayrshire, and Loch Ochiltree in the north of the shire, Loch Connell in the west, Loch Ronald in the centre and the group of Castle Loch and four others in the parish of Mochrum, towards the south, and Loch Dowalton, at the junction of Kirkinner, Sorbie and Glasserton parishes.

Geology.—A line drawn in a north-easterly direction from the coast about 3 m. below Portpatrick, passing slightly north of the head of Luce Bay by Newton Stewart to the Cairnsmore of Fleet, divides the county so that practically all the rocks on the northern side are of Ordovician age, while those on the south are Silurian. This line coincides with the general direction of the strike of the beds throughout the county. Most of the Ordovician rocks are black shales, in which graptolites may be found, along with greywackes and grits; they include the Glenkill and Hartfell groups of the Moffat district. These rocks may be seen exposed on the coast south of Portpatrick and in the valley of the Cree. The slate quarries of Cairn Ryan are of Llandeilo age. Nearly the whole of the Silurian region is occupied by dark grits, greywackes and shales of Llandovery age, though here and there a small exposure of the underlying black Moffat shales appears on the denuded crest of one of the innumerable folds into which all these rocks have been thrown. A series of shales, flags and greywackes of Wenlock age is found on the shore between Burrow Head and Whithorn. On the west side of Loch Ryan is a narrow belt of Permian breccia and thin sandstones about 9 m. long and 1 m. wide: this rests unconformably upon a similar belt of Carboniferous sandstones, about 8 m. long and ¼ m. in width, which lies on the west side of the Permian. A small patch of granite stands out on the coast at Laggantulloch Head, north of the Mull of Galloway. There are also a few patches and dikes of diorite and quartz-felsite. Glacial moraines and drumlins are found over much of the older formations, and are well seen between Glenluce and Newton Stewart and south of Wigtown. The boulder-clay is used for brick-making near Stranraer. On the coasts of Luce Bay and Loch Ryan raised beaches are found at levels of 25 ft. and 50 ft. above the sea, and tracts of blown sand lie above the shore. There are several peat-covered areas in the county.

Climate and Agriculture.—The mean annual rainfall amounts to 36·3 in., varying from 49·19 in. at Kirkcowan, a few miles west of Newton Stewart, to 26·81 in. at the Mull of Galloway. The average temperature for the year is 48·3° F., for January 40° F. and for July 58·5° F. In spite of its humidity the climate is not unfavourable for the ripening of crops, and frosts as a rule are not of long duration. Much of the shire consists of stony moors, rendering the work of reclamation difficult and in some parts impossible. The gravelly soil along the coasts requires heavy manuring to make it fruitful, and in the higher arable quarters a rocky soil prevails, better adapted for grass and green crops than for grain. A large extent of the surface is black top reclaimed from the moors, and in some districts loam and clay are found. By dint of energy, however, and constant resort to scientific agriculture, the farmers have placed half of the shire under cultivation, and the standard of farming is as high as that of any county in Scotland. Oats is the leading crop, barley and wheat occupying only a small area. Turnips and swedes constitute the great bulk of the green crops, potatoes coming next. Large tracts are under clover and rotation grasses and in permanent pasture, in consequence of the increasing attention paid to dairy-farming, which is carried on in combination and on scientific principles. Several creameries have been established in the dairy country, cheese being a leading product. Though the size of the herds is surpassed in several other Scottish counties, the number of milch cattle is only exceeded in three (Ayr, Aberdeen and Lanark). Ayrshire is the favourite breed for dairy purposes, and black polled Galloways are found in the eastern districts. A cross of the two breeds is also maintained. The sheep are principally black-faced on the hill farms, and in other parts Leicester and other long-woolled breeds. The flocks are usually heavy, and great numbers of pigs are kept. The shire has acquired some reputation for its horses, chiefly Clydesdale. The holdings are fairly large, the average being considerably over 100 acres, one-third of them running from 100 acres to 300. Most of the park land is finely wooded, and there are a few nurseries, market gardens and orchards.

Other Industries.—There are small manufactures in several of the towns, as woollens at Kirkcowan; tweeds, leather and agricultural implements at Newton Stewart; dairy appliances, beer, flour and bricks at Stranraer; and whisky at Bladenoch. Sandstone and slates are quarried, and peat is cut in various places. Fisheries, on a minor scale, are conducted chiefly from Stranraer, certain villages on Loch Ryan and Luce Bay, and Wigtown, and the Cree, Bladenoch and Luce yield salmon. Shipping is mainly carried on from Stranraer, but also from Port William, Portpatrick, Wigtown and Garliestown.

The Glasgow & South-Western railway runs to Stranraer via Girvan, and the Portpatrick and Wigtownshire joint railway from Newton Stewart to Portpatrick via Stranraer, with a branch line at Newton Stewart to Wigtown and Whithorn. There are coach services from Stranraer to Ballantrae on the Ayrshire coast and to Drumore, 4 m. N. of the Mull, and regular communication by mail steamer between Stranraer and Larne in Co. Antrim, Ireland.

Population and Administration.—In 1891 the population amounted to 36,062; in 1901 to 32,685 or 67 persons to the sq. m., the decrease for the decade being the third highest in Scotland. In 1901 there were 88 persons speaking Gaelic and English. The principal towns are Stranraer (pop. 6036); Newton Stewart (2598), which, however, standing on both banks of the Cree, extends into Kirkcudbrightshire; Wigtown (1329); and Whithorn (1188). Formerly Wigtown, Stranraer and Whithorn formed with New Galloway, in Kirkcudbrightshire, a group of burghs returning one member, but in 1885 the first three were merged in the county, which returns one member to parliament. Wigtown, the county town, Stranraer and Whithorn are royal burghs. The shire forms part of the sheriffdom of Dumfries and Galloway, and a sheriff-substitute sits at Wigtown and Stranraer. The administrative county is divided into the Lower district, comprising the shire east of the parishes of New Luce and Old Luce, and the Upper district, comprising the shire west of and including these parishes. The county is under school-board jurisdiction, and there are high schools in Newton Stewart and Stranraer. The board-schools in Whithorn and Wigtown have secondary departments, and several of the schools in the shire earn grants for higher education. The county council expends the "residue" grant in providing bursaries for science pupils, and in subsidizing agricultural classes at Kilmarnock and Edinburgh University, and the cookery classes and science department of the high schools.

History and Antiquities.—Galloway, or the country west of the Nith, belonged to a people whom Ptolemy called Novantae and Agricola subdued in A.D. 79. They were Atecott Picts, and are conjectured to have replaced a small, dark-haired aboriginal race, akin probably to the Basques of the Iberian peninsula. They held this south-western corner of Scotland for centuries, protecting themselves from the northern and southern Picts by a rampart, called the Deil's Dyke, which has been traced in a north-easterly direction from Beoch on the eastern side of Loch Ryan to a spot on the Nith near the present Thornhill, a distance of 50 m. Evidences of the Pictish occupation are prevalent in the form of hill forts, cairns, standing stones, hut circles and crannogs or lake dwellings (several of which were exposed when Dowalton Loch near Sorbie and Barhapple Loch near Glenluce were drained), besides canoes and flint, stone and bronze implements. The Romans possessed a small camp at Rispain near Whithorn and a station at Rerigonium, which has been identified with Innermessan on the eastern shore of Loch Ryan; but so few remains exist that it has been concluded they effected no permanent settlement in West Galloway. Ninian, the first Christian missionary to Scotland, landed at Isle of Whithorn in 396 to convert the natives. His efforts were temporarily successful, but soon after his death (432) the people relapsed into paganism, excepting a faithful remnant who continued to carry on Christian work. A monastery was built at Whithorn, and, though the bishopric founded in the 8th century was shortly afterwards removed, it was established again in the 12th, when the priory erected by Fergus, "king" of Galloway, became the cathedral church of the see of Galloway and so remained till the Reformation. In the 6th century the people accepted the suzerainty of the Northumbrian kings who allowed them in return autonomy under their own Pictish chiefs. On the decay of the Saxon power more than two hundred years later this overlordship was abandoned, and the Atecotts formed an alliance with the Northmen then ravaging the Scottish coasts. Because of this relationship the other Picts styled the Atecotts, by way of reproach, Gallgaidhel, or stranger Gaels, whence is derived Galloway, the name of their territory. With the aid of the Norsemen and the men of Galloway Kenneth Macalpine defeated the northern Picts at Forteviot and was crowned king of Scotland at Scone in 844. Henceforward the general history of Wigtownshire is scarcely distinguishable from that of Kirkcudbrightshire. A few particular points, however, must be noted. Malcolm MacHeth, who had married a sister of Somerled, lord of the Isles, headed about 1150 a Celtic revolt against the intrusion of Anglo-Norman lords, but was routed at Causewayend near the estuary of the Cree. In 1190 Roland, lord of Galloway, built for Cistercians from Melrose the fine abbey of Glenluce, of which the only remains are the foundations of the nave, the gable of the south transept, the cloisters, quadrangle and the vaulted chapter-house. In the disordered state of the realm during David II.'s reign east Galloway had been surrendered to Edward III. (1333), but Wigtownshire, which had been constituted a shire in the previous century and afterwards called the Shire to distinguish it from the Stewartry of Kirkcudbright, remained Scottish territory. In 1342 Sir Malcolm Fleming, earl of Wigtown, was appointed sheriff with power to hold the county separate from the other half of Galloway, but falling into straitened circumstances he sold his earldom and estates in 1372 to Archibald the Grim, 3rd earl of Douglas, thus once more placing all Galloway under one lord. Under Douglas's lordship the laws of Galloway, which had obtained from Pictish times and included, among other features, trial by battle (unless an accused person chose expressly to forgo the native custom and ask for a jury), were modified, and in 1426 abolished, the province then coming under the general law. Soon after the fall of the Douglases (1455) the Kennedy family, long established in the Ayrshire district of Carrick, obtained a preponderating influence in Wigtownshire, and in 1509 David Kennedy was created earl of Cassillis. Gilbert, the 4th earl, so powerful that he was called the "king of Carrick," held the shire for Mary, queen of Scots, when she broke with the Lords of the Congregation, but could do little for her cause. He profited by the Reformation himself, however, to acquire by fraud and murder the estate of Glenluce Abbey (about 1570). In 1603 James VI. instituted a bishop in the see of Galloway—which had not been filled for twenty years—and otherwise strove to impose episcopacy upon the people, but the inhabitants stood firm for the Covenant. The acts against Nonconformity were stringently enforced and almost every incumbent in Galloway was deprived of his living. Field-preaching was a capital crime and attendance at conventicles treason. A reign of terror supervened, and numbers of persons emigrated to Ulster in order to escape persecution. John Graham of Claverhouse, Viscount Dundee, having replaced Sir Andrew Agnew, who had refused the Test, as sheriff (1682), goaded the people into rebellion, the drowning of Margaret MacLachlan and Margaret Wilson within flood-mark in Wigtown Bay (1685) being an instance of his ruthless methods. With the Revolution of 1688 Presbyterianism was restored, and John Gordon, recently consecrated bishop of Galloway, retired to France. The Jacobite risings of 1715 and 1745 excited only languid interest, but in 1747 heritable jurisdictions were abolished and Sir Andrew Agnew ceased to be hereditary sheriff, though he was the only official able to prove continuous tenure of the post since it was granted to his family in 1451. The first sheriff appointed under the new system was Alexander Boswell, Lord Auchinleck, father of James Boswell, the biographer of Dr Johnson. In 1760 an engagement took place in Luce Bay, when the young French seaman, François Thurot, with three warships, attempting a diversion in Jacobite interests, was defeated and killed with the loss of three hundred men and his vessels.

Among ancient castles in Wigtownshire may be mentioned the cliff towers, possibly of Norse origin, of Carghidown and Castle Feather near Burrow Head; the ruins of Baldoon, south of Wigtown, associated with events which suggested to Sir Walter Scott the romance of *The Bride of Lammermoor*; Corsewall near the northern extremity of the Rinns; the Norse stronghold of Cruggleton, south of Garliestown, which belonged in the 13th century to de Quincy, earl of Winchester, who had married a daughter of Alan, "king" of Galloway, and to Alexander Comyn, 2nd earl of Buchan (d. 1289), his son-in-law; Dunskey, south of Portpatrick, built in the 16th century, occupying the site of an older fortress; the fragments of Long Castle at Dowalton Loch, the ancient seat of the MacDonells; Myrton, the seat of the MacCullochs, in Mochrum parish; and the ruined tower of Sorbie, the ancient keep of the Hannays.

See Sir Herbert Maxwell, *History of Dumfries and Galloway* (Edinburgh, 1896); Sir Andrew Agnew, *The Agnews of Lochnaw* (Edinburgh, 1893); *The Galloway Herd-Book* (Dumfries, 1880); *Proceedings of the Soc. of Ant. of Scotland, passim*; Gordon Fraser, *Wigtown and Whithorn* (Wigtown, 1877).

WIGWAM, a term loosely adopted as a general name for the houses of North American Indians. It is, however, strictly applied to a particular dome-shaped or conical hut made of poles lashed together at the tops and covered with bark. The skin tents of many of the Plains Indians are called *tipis*. The word "wigwam" represents the Europeanized or Anglicized form of the Algonkian *wēkou-om-ut, i.e.* "in his (their) house."

WIHTRED, king of Kent (d. 725), son of Ecgberht, nephew of Hlothhere and brother of Eadric, came to the Kentish throne in 690 after the period of anarchy which followed the death of the latter king. Bede states that Wihtred and Swefheard were both kings in Kent in 692, and this statement would appear to imply a period of East Saxon influence (see KENT), while there is also evidence of an attack by Wessex. Wihtred, however, seems to have become sole king in 694. At his death, which did not take place until 725, he left the kingdom to his sons Aethelberht, Eadberht and Alric. After the annal 694 in the Chronicle there is inserted a grant of privileges to the church, which purports to have been issued by Wihtred at a place called Baccancelde. This grant, however, cannot be accepted as genuine and has merely an illustrative value, but there is still extant a code of laws issued by him in a council held at a place called Berghamstyde (Barham?) during the fifth year of his reign (probably 695).

See Bede, *Hist. Eccl.*, ed. C. Plummer (Oxford, 1896); *Anglo-Saxon Chronicle*, ed. Earle and Plummer (Oxford, 1899).

WILBERFORCE, ROBERT ISAAC (1802–1857), English clergyman and writer, second son of William Wilberforce, was born on the 19th of December 1802. He was educated at Oriel College, Oxford, taking a double first in 1823. In 1826 he was chosen fellow of Oriel and was ordained, among his friends and colleagues being Newman, Pusey and Keble. For a few years he was one of the tutors at Oriel, but the provost, Edward Hawkins, disliked his religious views, and in 1831 he resigned and left Oxford. In 1832 he obtained the living of East Farleigh, Kent, which in 1840 he exchanged for that of Burton Agnes, near Hull. In 1841 he was appointed archdeacon of the East Riding. About this time Wilberforce became very intimate with Manning, and many letters on theological and ecclesiastical questions passed between them. In 1851 Manning joined the Church of Rome, and three years later Wilberforce took the same step. He was preparing for his ordination when he died at Albano on the 3rd of February 1857. He left two sons, the younger of whom, Edward Wilberforce (b. 1834), became one of the masters of the Supreme Court of Judicature. Edward's son, Lionel Robert Wilberforce (b. 1861), was in 1900 appointed professor of physics in the university of Liverpool.

R. I. Wilberforce assisted his brother Samuel to write the *Life* and to edit the *Correspondence* of his father. His other writings include: *Church Courts and Church Discipline* (1843); *Doctrine of the Holy Eucharist* (1853); *Doctrine of the Incarnation in Relation to Mankind and the Church* (1848 and later editions); *The Five Empires, a Sketch of Ancient History* (1840); *A Sketch of the History of Erastianism* (1851); *An Enquiry into the Principles of Church Authority* (1854); and a romance, *Rutilius and Lucius* (1842).

WILBERFORCE, SAMUEL (1805–1873), English bishop, third son of William Wilberforce, was born at Clapham Common, London, on the 7th of September 1805. In 1823 he entered Oriel College, Oxford. In the "United Debating Society," which afterwards developed into the "Union," he distinguished himself as a zealous advocate of liberalism. The set of friends with whom he chiefly associated at Oxford were sometimes named, on account of their exceptionally decorous conduct, the "Bethel Union"; but he was by no means averse to amusements, and specially delighted in hurdle jumping and hunting. He graduated in 1826, taking a first class in mathematics and a second in classics. After his marriage on the 11th of June 1828 to Emily Sargent, he was in December ordained and appointed curate-in-charge at Checkenden near Henley-on-Thames. In 1830 he was presented by Bishop Sumner of Winchester to the rectory of Brightstone in the Isle of Wight. In this comparatively retired sphere he soon found scope for that manifold activity which so prominently characterized his subsequent career. In 1831 he published a tract on tithes, "to correct the prejudices of the lower order of farmers," and in the following year a collection of hymns for use in his parish, which had a large general circulation; a small volume of stories entitled the *Note Book of a Country Clergyman*; and a sermon, *The Apostolical Ministry*. At the close of 1837 he published the *Letters and Journals* of Henry Martyn. Although a High Churchman Wilberforce held aloof from the Oxford movement, and in 1838 his divergence from the "Tract" writers became so marked that J. H. Newman declined further contributions from him to the *British Critic*, not deeming it advisable that they should longer "co-operate very closely." In 1838 Wilberforce published, with his elder brother Robert, the *Life* of his father, and two years later his father's *Correspondence*. In 1839 he also published *Eucharistica* (from the old English divines), to which he wrote an introduction, *Agathos and other Sunday Stories*, and a volume of *University Sermons*, and in the following year *Rocky Island and other Parables*. In November 1839 he was installed archdeacon of Surrey, in August 1840 was collated canon of Winchester and in October he accepted the rectory of Alverstoke. In 1841 he was chosen Bampton lecturer, and shortly afterwards made chaplain to Prince Albert, an appointment he owed to the impression produced by a speech at an anti-slavery meeting some months previously. In October 1843 he was appointed by the archbishop of York to be sub-almoner to the queen. In 1844 appeared his *History of the American Church*. In March of the following year he accepted the deanery of Westminster, and in October the bishopric of Oxford.

The bishop in 1847 became involved in the Hampden controversy, and signed the remonstrance of the thirteen bishops to Lord John Russell against Hampden's appointment to the bishopric of Hereford. He also endeavoured to obtain satisfactory assurances from Hampden; but, though unsuccessful in this, he withdrew from the suit against him. The publication of a papal bull in 1850 establishing a Roman hierarchy in England brought the High Church party, of whom Wilberforce was the most prominent member, into temporary disrepute. The secession to the Church of Rome of his brother-in-law, Archdeacon (afterwards Cardinal) Manning, and then of his brothers, as well as his only daughter and his son-in-law, Mr and Mrs J. H. Pye, brought him under further suspicion, and his revival of the powers of convocation lessened his influence at court; but his unfailing tact and wide sympathies, his marvellous energy in church organization, the magnetism of his personality, and his eloquence both on the platform and in the pulpit, gradually won for him recognition as without a rival on the episcopal bench. His diary reveals a tender and devout private life which has been overlooked by those who have only considered the versatile facility and persuasive expediency that marked the successful public career of the bishop, and earned him the sobriquet of "Soapy Sam." In the House of Lords he took a prominent part in the discussion of social and ecclesiastical questions. He has been styled the "bishop of society"; but society occupied only a fraction of his time. The great bent of his energies was ceaselessly directed to the better organization of his diocese and to the furtherance of schemes for increasing the influence and efficiency of the church. In 1854 he opened a theological college at Cuddesdon, which was afterwards the subject of some controversy on account of its alleged Romanist tendencies. His attitude towards *Essays and Reviews* in 1861, against which he wrote an article in the *Quarterly*, won him the special gratitude of the Low Church party, and latterly he enjoyed the full confidence and esteem of all except the extreme men of either side and party. On the publication of J. W. Colenso's *Commentary on the Romans* in 1861, Wilberforce endeavoured to induce the author to hold a private conference with him; but after the publication of the first two parts of the *Pentateuch Critically Examined* he drew up the address of the bishops which called on Colenso to resign his bishopric. In 1867 he framed the first *Report* of the Ritualistic Commission, in which coercive measures against ritualism were discountenanced by the use of the word "restrain" instead of "abolish" or "prohibit." He also endeavoured to take the sting out of some resolutions of the second Ritualistic Commission in 1868, and was one of the four who signed the *Report* with qualifications. Though strongly opposed to the disestablishment of the Irish Church, yet, when the constituencies decided for it, he advised that no opposition should be made to it by the House of Lords. After twenty-four years' labour in the diocese of Oxford, he was translated by Gladstone to the bishopric of Winchester. He was killed on the 19th of July 1873, by the shock of a fall from his horse near Dorking, Surrey.

Wilberforce left three sons. The eldest, Reginald Garton Wilberforce, being the author of *An Unrecorded Chapter of the Indian Mutiny* (1894). His two younger sons both attained distinction in the English church. Ernest Roland Wilberforce (1840–1908) was bishop of Newcastle-on-Tyne from 1882 to 1895, and bishop of Chichester from 1895 till his death. Albert Basil Orme Wilberforce (b. 1841) was appointed canon residentiary of Westminster in 1894, chaplain of the House of Commons in 1896 and archdeacon of Westminster in 1900; he has published several volumes of sermons.

Besides the works already mentioned, Wilberforce wrote *Heroes of Hebrew History* (1870), originally contributed to *Good Words*, and several volumes of sermons. See *Life of Samuel Wilberforce, with Selections from his Diary and Correspondence* (1879–1882), vol. i., ed. by Canon A. R. Ashwell, and vols. ii. and iii., ed. by his son R. G. Wilberforce, who also wrote a one-volume Life (1888). One of the volumes of the "English Leaders of Religion" is devoted to him, and he is included in Dean Burgon's *Lives of Twelve Good Men* (1888).

WILBERFORCE, WILLIAM (1759–1833), English philanthropist whose name is chiefly associated with the abolition of the slave trade, was descended from a Yorkshire family which possessed the manor of Wilberfoss in the East Riding from the time of Henry II. till the middle of the 18th century. He was the only son of Robert Wilberforce, member of a commercial house at Hull, by his wife Elizabeth, daughter of Thomas Bird of Barton, Oxon, and was born at Hull on the 24th of August 1759. It was from his mother that he inherited both his feeble frame and his many rich mental endowments. He was not a diligent scholar, but at the grammar school of Hull his skill in elocution attracted the attention of the master. Before he had completed his tenth year he lost his father and was transferred to the care of a paternal uncle at Wimbledon; but in his twelfth year he returned to Hull, and soon afterwards was placed under the care of the master of the endowed school of Pocklington. Here his love of social pleasures made him neglectful of his studies, but he entered St John's College, Cambridge, in October 1766. Left by the death of his grandfather and uncle the possessor of an independent fortune under his mother's sole guardianship, he was somewhat idle at the university, though he acquitted himself in the examinations with credit; but in his serious years he "could not look back without unfeigned remorse" on the opportunities he had then neglected. In 1780 he was elected to the House of Commons for his native town, his success being due to his personal popularity and his lavish expenditure. He soon found his way into the fast political society of London, and at the club at Goosetrees renewed an acquaintance begun at Cambridge with Pitt, which ripened into a friendship of the closest kind. In the autumn of 1783 he set out with Pitt on a tour in France; and after his return his eloquence proved of great assistance to Pitt in his struggle against the majority of the House of Commons. In 1784 Wilberforce was elected for both Hull and Yorkshire, and took his seat for the latter constituency.

A journey to Nice in the autumn of the same year with his friend Dr Isaac Milner (1750–1820), who had been a master at Hull grammar school when Wilberforce was there as a boy, and had since made a reputation as a mathematician, and afterwards became president of Queens' College, Cambridge, and dean of Carlisle, led to his conversion to Evangelical Christianity and the adoption of more serious views of life. The change had a marked effect on his public conduct. In the beginning of 1787 he busied himself with the establishment of a society for the reformation of manners. About the same time he made the acquaintance of Thomas Clarkson, and began the agitation against the slave trade. Pitt entered heartily into their plans, and recommended Wilberforce to undertake the guidance of the project as a subject suited to his character and talents. While Clarkson conducted the agitation throughout the country, Wilberforce took every opportunity in the House of Commons of exposing the evils and horrors of the trade. In 1788, however, a serious illness compelled him to retire for some months from public life, and the introduction of the subject in parliament therefore devolved on Pitt, whose representations were so far successful that an act was passed providing that the number of slaves carried in ships should be in proportion to the tonnage. On the 12th of May of the following year Wilberforce, in co-operation with Pitt, brought the subject of abolition again before the House of Commons; but the friends of the planters succeeded in getting the matter deferred. On the 27th of January following Wilberforce carried a motion for referring to a special committee the further examination of witnesses, but after full inquiry the motion for abolition in April 1791 was lost by 163 votes to 88. In the following April he carried a motion for gradual abolition by 238 to 85 votes; but in the House of Lords the discussion was finally postponed till the following session. Notwithstanding his unremitting labours in educating public opinion and annual motions in the House of Commons, it was not till 1807, the year following Pitt's death, that the first great step towards the abolition of slavery was accomplished. When the anti-slavery society was formed in 1823, Wilberforce and Clarkson became vice-presidents; but before their aim was accomplished Wilberforce had retired from public life, and the Emancipation Bill was not passed till August 1833, a month after his death.

In 1797 Wilberforce published *A Pratical View of the Prevailing Religious System of Professed Christians in the Higher and Middle Classes of this Country Contrasted with Real Christianity*, which within half a year went through five editions and was afterwards translated into French, Italian, Dutch and German. In the same year (May 1797) he married Barbara Ann Spooner and took a house at Clapham, where he became one of the leaders of what was known as the "Clapham Sect" of Evangelicals, including Henry Thornton, Charles Grant, E. J. Eliot, Zacchary Macaulay and James Stephen. It was in connexion with this group that he then occupied himself with a plan for a religious periodical which should admit "a moderate degree of political and common intelligence," the result being the appearance in January 1801 of the *Christian Observer*. He also interested himself in a variety of schemes for the advancement of the social and religious welfare of the community, including the establishment of the Association for the Better Observance of Sunday, the foundation, with Hannah More (*q.v.*), of schools at Cheddar, Somersetshire, a project for opening a school in every parish for the religious instruction of children, a plan for the education of the children of the lower classes, a bill for securing better salaries to curates, and a method for disseminating, by government help, Christianity in India. In parliament he was a supporter of parliamentary reform and of Roman Catholic emancipation. In 1812, on account of failing health, he exchanged the representation of Yorkshire for that of a constituency which would make less demands on his time, and was returned for Bramber, Sussex. In 1825 he retired from the House of Commons, and the following year settled at Highwood Hill, near Mill Hill, "just beyond the disk of the metropolis." He died at London on the 29th of July 1833, and was buried in Westminster Abbey close to Pitt, Fox and Canning. In Westminster Abbey a statue was erected to his memory, and in Yorkshire a county asylum for the blind was founded in his honour. A column was also erected to him by his townsmen of Hull. Wilberforce left four sons, two of whom, Samuel and Robert Isaac, are noticed separately. The youngest, Henry William Wilberforce (1807–1873), was educated at Oriel College, Oxford, and was president of the Oxford Union. He took orders in the English Church, but in 1850 became a Roman Catholic. He was an active journalist and edited the *Catholic Standard*.

The chief authorities of the career of William Wilberforce are his *Life* (5 vols., 1838) by his sons, Robert Isaac and Samuel, and his *Correspondence* (1840) also published by his sons. A smaller edition of the *Life* was published by Samuel Wilberforce in 1868. See also *The private papers of William Wilberforce*, edited by A. M. Wilberforce (1897); Sir James Stephen, *Essays in Ecclesiastical Biography* (1849); J. C. Colquhoun, *Wilberforce, His Friends and Times* (1866); John Stoughton, *William Wilberforce* (1880); J. J. Gurney, *Familiar Sketch of Wilberforce* (1838); and J. S. Hartford, *Recollections of W. Wilberforce* (1864).

WILBRANDT, ADOLF (1837–), German novelist and dramatist, was born at Rostock on the 24th of August 1837, the son of a professor at that university. Having received his early education at the gymnasium of his native town, he entered the university and engaged in the study of law. This, however, he soon abandoned in favour of philology and history, and continued these studies in Berlin and Munich. After taking the degree of doctor of philosophy, he joined the staff of the *Süddeutsche Zeitung* in Munich. He travelled abroad for a time and in 1871 settled in Vienna, where, two years later, he married the actress, Auguste Baudius. In 1881 Wilbrandt was appointed director of the Hofburg theatre in succession to Franz Dingelstedt, an office he held until 1887. In this year he returned to his native town of Rostock, and remained actively engaged in literary production. Wilbrandt is distinguished both as a dramatist and novelist. His merits were acknowledged by the award of the Grillparzer prize on two occasions—in 1875 for the tragedy *Gracchus der Volkstribun*, and in 1890 for his dramatic poem *Der Meister von Palmyra*, while in 1878 he received the Schiller prize for his dramatic productions.

Among his plays may be mentioned the tragedies, *Arria und Messalina* (1874), *Nero* (1876); *Kriemhild* (1877); the comedies *Unerreichbar* (1870), *Die Maler* (1872), *Jugendliebe* (1873) and *Der Kampf ums Dasein* (1874); and the drama *Die Tochter des Herrn Fabricius* (1883). Among his novels the following deserve notice:—*Meister Amor* (1880); *Hermann Ifinger* (1892); *Der Dornenweg* (1894); *Die Osterinsel* (1895); *Die Rothenburger* (1895); and *Hildegard Mahlmann* (1897). He also published translations of Sophocles and Euripides (1866), *Gedichte* (1874, 1889 and 1907), and a volume of *Erinnerungen* (1905).

See V. Klemperer, *Adolf Wilbrandt. Eine Studie über seine Werke* (1907), and A. Stern, *Studien zur Literatur der Gegenwart* (3rd ed., 1905).

WILBYE, JOHN, English 16th-century madrigal composer, was born probably at Bury St Edmunds, but the details of his life are obscure. A set of madrigals by him appeared in 1598 and a second in 1608, the two sets containing sixty-four pieces; and from a few contributions known to have been made by him to other contemporary sets, we can infer that he was alive in 1614. He is the most famous of all the English madrigalists; his pieces have long been favourites and are included in modern collections.

WILD, JONATHAN (*c.* 1682–1725), English criminal, was born about 1682 at Wolverhampton, where his father was a wig-maker. After being apprenticed to a local buckle-maker, he went to London to learn his trade, and, getting into debt, was imprisoned for several years. The acquaintance of many criminals which he made in prison he turned to account after his release by setting up as a receiver of stolen goods. Wild shrewdly realized that it was safer, and in most cases more profitable, to dispose of such property by returning it to its legitimate owners than to sell it, with the attendant risks, in the open market, and he thus built up an immense business, posing as a recoverer of stolen goods, the thieves receiving a commission on the price paid for recovery. A special act of parliament was passed by which receivers of stolen property were made accessories to the theft, but Wild's professed "lost property office" had little difficulty in evading the new law, and became so prosperous that two branch offices were opened. From profiting by robberies in which he had no share, Wild naturally came to arrange robberies himself, and he devised and controlled a huge organization, which plundered London and its approaches wholesale. Such thieves as refused to work with him received short shrift. The notorious Jack Sheppard, wearied of Wild's exactions, at last refused to deal with him, whereupon Wild secured his arrest, and himself arrested Sheppard's confederate, "Blueskin." In return for Wild's services in tracking down such thieves as he did not himself control, the authorities for some time tolerated the offences of his numerous agents, each a specialist in a particular kind of robbery, and so themselves strengthened his position. If an arrest were made, Wild had a plentiful supply of false evidence at hand to establish his agents' *alibi*, and he did not hesitate to obtain the conviction, by similar means, of such thieves as refused to recognize his authority. Such stolen property as could not be returned to the owners with profit was taken abroad in a sloop purchased for this work. At last either the authorities became more strict or Wild less cautious. He was arrested, tried at the Old Bailey, and after being acquitted on a charge of stealing lace, found guilty of taking a reward for restoring it to the owner without informing the police. He was hanged at Tyburn on the 24th of May 1725.

WILDBAD, a watering-place of Germany, in the kingdom of Württemberg, picturesquely situated 1475 ft. above the sea, in the romantic pine-clad gorge of the Enz in the Black Forest, 28 m. W. of Stuttgart and 14 E. of Baden-Baden by rail. Pop. (1905) 3734. It contains an Evangelical, a Roman Catholic and an English church, and has some small manufactures (cigars, paper and toys). Its thermal alkaline springs have a temperature of 90°-100° Fahr. and are used for bathing in cases of paralysis, rheumatism, gout, neuralgia and similar ailments. The fact that the springs rise within the baths, and are thus used at the fountain-head, is considered to contribute materially to their curative value. The water is used internally for affections of the stomach and digestive organs, and of the kidneys, bladder, &c. Wildbad possesses all the usual arrangements for the comfort and amusement of the visitors (over 15,000 annually), including large and well-appointed hotels, a Kurhaus, a Trink-Halle and promenades. The neighbourhood is picturesque, the most attractive spot being the Wildsee, of which legends are told.

See W. T. v. Renz, *Die Kur zu Wildbad* (with Guide, Wildbad, 1888), and Weizsäcker, *Wildbad* (2nd ed., 1905).

WILDE, OSCAR O'FLAHERTIE WILLS (1856–1900), English author, son of Sir William Wilde, a famous Irish surgeon, was born in Dublin on the 15th of October 1856; his mother, Jane Francisca Elgee, was well known in Dublin as a graceful writer of verse and prose, under the pen-name of "Speranza." Having distinguished himself in classics at Trinity College, Dublin, Oscar Wilde went to Magdalen College, Oxford, in 1874, and won the Newdigate prize in 1878 with his poem "Ravenna," besides taking a first-class in classical Moderations and in Literae Humaniores. But his career at Oxford, brilliant intellectually as he showed himself to be, was chiefly signalized by the part he played in what came to be known as the aesthetic movement. He adopted what to undergraduates appeared the effeminate pose of casting scorn on manly sports, wearing his hair long, decorating his rooms with peacock's feathers, lilies, sunflowers, blue china and other *objets d'art*, which he declared his desire to "live up to," affecting a lackadaisical manner, and professing intense emotions on the subject of "art for art's sake"—then a new-fangled doctrine which J. M. Whistler was bringing into prominence. Wilde made himself the apostle of this new cult. At Oxford his behaviour procured him a ducking in the Cherwell, and a wrecking of his rooms, but the cult spread among certain sections of society to such an extent that languishing attitudes, "too-too" costumes and "aestheticism" generally became a recognized pose. Its affectations were burlesqued in Gilbert and Sullivan's travesty *Patience* (1881), which practically killed by ridicule the absurdities to which it had grown. At the same time it cannot be denied that the "aesthetic" movement, in the aspect fundamentally represented by the school of William Morris and Rossetti, had a permanent influence on English decorative art. As the leading "aesthete," Oscar Wilde became one of the most prominent personalities of the day; apart from the ridicule he encountered, his affected paradoxes and his witty sayings were quoted on all sides, and in 1882 he went on a lecturing tour in the United States. In 1884 he married Constance Lloyd. He had already published in 1881 a selection of his poems, which, however, only attracted admiration in a limited circle. In 1888 appeared *The Happy Prince and Other Tales*, illustrated by Walter Crane and Jacomb Hood. This charming volume of fairy tales was followed up later by a second collection, *The House of Pomegranates* (1892), acknowledged by the author to be "intended neither for the British child nor the British public." In much of his writings, and in his general attitude, there was to most people an undertone of rather nasty suggestion which created prejudice against him, and his novel, *The Picture of Dorian Gray* (1891), with all its sparkle and cleverness, impressed them more from this point of view than from its purely literary brilliance. Wilde contributed some characteristic articles to the reviews, all coloured by his peculiar attitude towards art and life, and in 1891 republished three of them as a book called *Intentions*. His first real success with the larger public was as a dramatist with *Lady Windermere's Fan* at the St James's Theatre in 1892, followed by *A Woman of No Importance* (1893), *An Ideal Husband* (1895) and *The Importance of Being Earnest* (1895). The dramatic and literary ability shown in these plays, all of which were published later in book form, was as undoubted as their diction and ideas were characteristically paradoxical. In 1893 the licenser of plays refused a licence to Wilde's *Salome*, but it was produced in French in Paris by Sarah Bernhardt in 1894. His success as a dramatist had by this time gone some way to disabuse hostile critics of the suspicions as regards his personal character which had been excited by the apparent looseness of morals which since his Oxford days it had always pleased him to affect; but to the consternation of his friends, who had ceased to credit the existence of any real moral obliquity, in 1895 came fatal revelations as the result of his bringing a libel action against the marquis of Queensberry; and at the Old Bailey, in May, Wilde was sentenced to two years' imprisonment with hard labour for offences under the Criminal Law Amendment Act. It was a melancholy end to what might have been a singularly brilliant career. Even after leaving prison he was necessarily an outcast from decent circles, and he lived mainly on the Continent, under the name of "Sebastian Melmoth." He died in Paris on the 30th of November 1900. In 1898 he published his powerful *Ballad of Reading Gaol*. His *Collected Poems*, containing some beautiful verse, had been issued in 1892. While in prison he wrote an apology for his life which was placed in the hands of his executor and published in 1905. The manuscripts of *A Florentine Tragedy* and an essay on Shakespeare's sonnets were stolen from his house in 1895. In 1904 a five-act tragedy, *The Duchess of Padua*, written by Wilde about 1883 for Mary Anderson, but not acted by her, was published in a German translation (*Die Herzogin von Padua*, translated by Max Meyerfeld) in Berlin. It is still impossible to take a purely objective view of Oscar Wilde's work. The Old Bailey revelations removed all doubt as to the essential unhealthiness of his personal influence; but his literary genius was none the less remarkable, and his plays were perhaps the most original contributions to English dramatic writing during the period. (H. CH.)

WILDENBRUCH, ERNST VON (1845–1909), German poet and dramatist, was born on the 3rd of February 1845 at Beyrout in Syria, the son of the Prussian consul-general. Having passed his early years at Athens and Constantinople, where his father was attached to the Prussian legation, he came in 1857 to Germany, received his early schooling at the Pädagogium at Halle and the Französische Gymnasium in Berlin, and, after passing through the Cadet school, became, in 1863, an officer in the Prussian army. He abandoned the military career two years later, but was recalled to the colours in 1866 for the war with Austria. He next studied law at the university of Berlin, and again served in the army during the Franco-Prussian War, 1870–71. In 1876 Wildenbruch was attached to the foreign office, which he finally quitted in 1900 with the title of counsellor of legation. He achieved his first literary successes with the epics *Vionville* (1874) and *Sedan* (1875). After publishing a volume of poems, *Lieder und Balladen* (Berl., 1877; 7th ed., 1900), he produced, in 1882, the tragedy, *Die Karolinger*. Among his chief dramas may be mentioned the tragedy *Harold* (1882); *Die Quitzows* (1888); *Der Generalfeldoberst* (1889); *Die Haubenlerche* (1891); *Heinrich und Heinrichs Geschlecht* (1895); *Die Tochter des Erasmus* (1900); and *König Laurin* (1902). Wildenbruch was twice (in 1884 and 1896) awarded the Schiller prize, and was, in 1892, created a doctor of philosophy *honoris causa* by the university of Jena. He also wrote several volumes of short stories (*Novellen*, 1883; *Neue Novellen*, 1885; *Tiefe Wasser*, 1897, &c.). He died on the 15th of January 1909.

Cf. B. Litzmann, *Das deutsche Drama in den Bewegungen der Gegenwart* (1894; 4th ed., 1897); H. Bulthaupt, *Dramaturgie des Schauspiels*, vol. iv. (1901).

WILDERNESS, a large forest in Spottsylvania county, Virginia, U.S.A., on the S. bank of the Rapidan, extending from Mine Run on the E. to Chancellorsville on the W. It is famous in military history for the battles of Chancellorsville (1863) and Wilderness (1864) during the American Civil War.

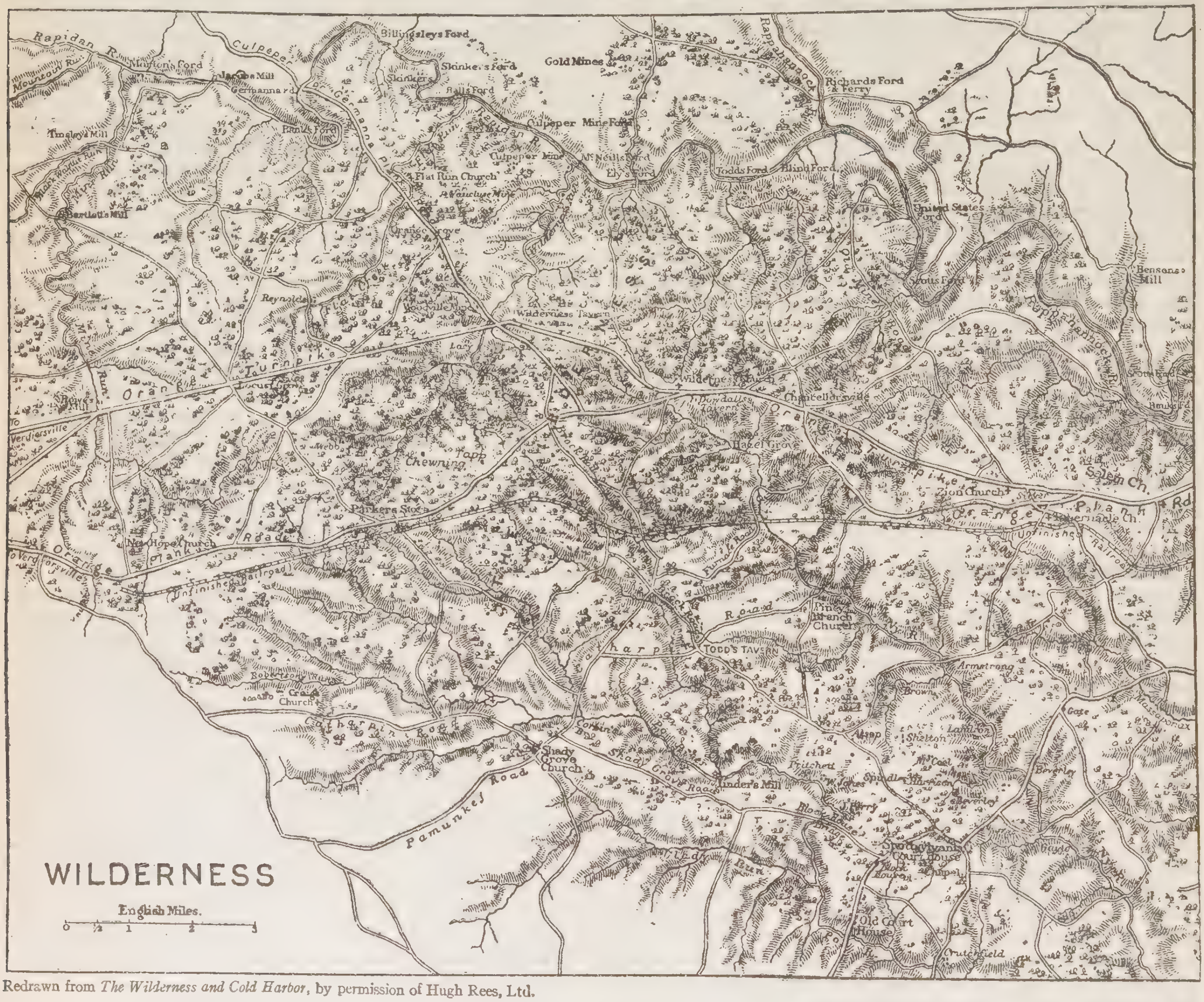
Chancellorsville.—In May 1863 a three days' battle was fought at Chancellorsville between the Army of the Potomac, under General J. Hooker, and General Lee's Army of Northern Virginia, which had stemmed the tide of invasion in the East by taking up a defensive position along the right or south bank of the Rappahannock. General Burnside had suffered a severe repulse in front of the Confederate position at Fredericksburg in December 1862, and his successor resolved to adopt the alternative plan of turning Lee's flank and so gaining the road to Richmond. General Lee had meanwhile weakened his forces by detaching Longstreet's two divisions and the cavalry brigades of Hampton, Robertson and Jones. Hooker had now at his disposal 12,000 cavalry, 400 guns and 120,000 infantry and artillery, organized in seven corps (I. Reynolds, II. Couch, III. Sickles, V. Meade, VI. Sedgwick, XI. Howard, XII. Slocum). General Lee counted only 45,000 men of all arms effective. Hooker detached 10,000 cavalry under Stoneman and Sedgwick's corps (30,000) to demonstrate on his flanks along the Rapidan and at Fredericksburg, while with the remainder he moved up the Rappahannock and crossed that river and afterwards the Rapidan and on the 30th of April fixed his headquarters at Chancellorsville, a farmhouse in the Wilderness. Lee's cavalry under Stuart had duly reported the Federal movements and Lee called up "Stonewall" Jackson's four divisions from below the Massaponax as soon as Sedgwick's corps crossed the river at Fredericksburg. At Chancellorsville Anderson's division was in position, and McLaws was sent to support him, while Jackson took three divisions to the same point, leaving Early's division to observe Sedgwick. Hooker had cleared and entrenched a position in the forest, inviting attack from the E. or S. General Lee, however, discovered a route by which the Federals might be attacked from the N. and W., and Jackson was instructed to execute the turning movement and fall upon them. As soon as a brigade of cavalry was placed at his disposal Jackson marched westward with his corps of 22,000 men and by a détour of 15 m. gained the Federal right flank, while Anderson and McLaws with 20 guns and 12,000 men demonstrated in front of Hooker's army and so kept 90,000 men idle behind their earthworks. One of Stuart's cavalry brigades neutralized Stoneman's 10,000 horsemen. Sedgwick was being contained by Early. Jackson's attack surprised the Federals, who fled in panic at nightfall, but Jackson was mortally wounded. Next day the attack was resumed under the direction of Stuart, who was reinforced by Anderson, while McLaws now threatened the left flank of the Federals and Fitz Lee's cavalry brigade operated against their line of retreat. Hooker finally gained the shelter of an inner line of works covering the ford by which he must retreat. Meanwhile, Early had checked Sedgwick, but when at last the Federal corps was about to overwhelm the Confederate division Lee came to succour it. Then Sedgwick was assailed by Early, McLaws and Anderson, and driven over the Rappahannock to join the remainder of Hooker's beaten army, which had recrossed the Rapidan on the 5th of May and marched back to Falmouth. Phisterer's *Record* states that the Federal loss was 16,000 and that of the Confederates 12,000 men.

See A. C. Hamlin, *Chancellorsville*; G. F. R. Henderson, *Stonewall Jackson*; A. Doubleday, *Chancellorsville and Gettysburg, Battles and Leaders of the Civil War* and *Official Records of the War of Secession.* (G. W. R.)

Grant's Campaign of the Wilderness and Cold Harbor.—On the evening of the 3rd of May 1864, after dark, the Army of the Potomac, commanded by Major-General G. G. Meade and consisting of the II., V. and VI., and Cavalry corps, left its winter quarters about Culpeper to manœuvre across the Rapidan with a view to fighting a battle at or near New Hope Church and Craig's Church. The army, and the IX. corps (Burnside), which was an independent command, were directed by Lieutenant-General Grant, the newly appointed commander of the armies of the United States, who accompanied Meade's headquarters. The opposing Army of Northern Virginia under General R. E. Lee lay in quarters around Orange Court House (A. P. Hill's corps), Verdiersville (Ewell's corps) and Gordonsville

(Longstreet's corps). The respective numbers were: Army of the Potomac, 98,000; IX. corps, 22,000; Army of Northern Virginia rather less than 70,000.

The crossing of the Rapidan was made at Germanna and Ely's Fords, out of reach of Lee's interference, and in a few hours the two leading corps had reached their halting-places—V., Wilderness Tavern; and II., Chancellorsville. The VI. followed the V. and halted south of Germanna Ford. Two of the three divisions of cavalry preceded the march, and scouted to the front and flanks. Controversy has arisen as to whether the early halt of the Union army in the midst of the Wilderness was not a serious error of judgment. The reason assigned was the necessity of protecting an enormous wagon train, carrying 15 days' supplies for the whole army, that was crossing after the II. corps at Ely's Ford. Burnside's corps was far to the rear when the advance began, but by making forced marches it was able to reach Germanna Ford during the 5th of May. On that day the manœuvre towards Craig's Church was resumed at 5 A.M., Wilson's cavalry division moving from Parker's Store southward, the V. corps (Warren) moving from Wilderness Tavern towards Parker's Store, followed by the VI. under Sedgwick, the II. from Chancellorsville by way of Todd's Tavern towards Shady Grove Church. Of the other cavalry divisions, Gregg's went towards Fredericksburg (near where the Confederate cavalry corps had been reported) and Torbert's (which had acted as rearguard and watched the upper Rapidan during the first day's march) was not yet across the river.


WILDERNESS
English Miles.
0 ½ 1 2 3
Rapidan R.
Culpeper
Mountain Run
Mortons Ford
Jacobs Mill
Germanna Ford
Billingsleys Ford
Skinkers Ford
Rolls Ford
Gold Mines
Richards Ford & Ferry
Culpeper Mine Ford
Tinsleys Mill
Flat Run Church
Ely's Ford
Todds Ford
Blind Ford
United States Ford
Scotts Ford
Bensons Mill
Bartletts Mill
Reynolds
Wilderness Tavern
Turnpike
Orange
Verdiersville
Wilderness Church
Chancellorsville
Dowdalls Tavern
Hazel Grove
Chewning
Tapp
Parkers Store
Zion Church
Salem Ch.
Tabernacle Ch.
New Hope Church
Plank Road
Unfinished Railroad
Brock Road
Piney Branch Church
Todd's Tavern
Craigs Church
Catharpin Road
Corbins Bridge
Shady Grove Church
Pamunkey Road
Armstrong
Brown
Shelton
Alsop
Fritchett
Beverley
Gayle
Massaponax
Anders Mill
Block House
Spottsylvania Court House
Old Court House
Crutchfield
Ny R.

Redrawn from *The Wilderness and Cold Harbor*, by permission of Hugh Rees, Ltd.

Grant's intention of avoiding a battle until he was clear of the Wilderness was not achieved, for Confederate infantry appeared on the Orange Turnpike east of Mine Run, where on his own initiative Warren had posted a division of the V. corps overnight as flank-guard, and some cavalry, judiciously left behind by Wilson at Parker's Store, became engaged a little later with hostile forces on the Orange Plank Road. This led to the suspension of the whole manœuvre towards Lee's right rear. The first idea of the Union headquarters was that Lee was falling back to the North Anna, covered by a bold rearguard, which Grant and Meade arranged to cut off and destroy by a convergent attack of Warren and Sedgwick. But the appearance of infantry on the Plank Road as well as the Pike had shown that Lee intended to fight in the Wilderness, and Hancock (II. corps) was called in from Todd's Tavern, while one division (Getty's) of the VI. was hurried to the intersection of the Brock and Plank roads to hold that point until Hancock's arrival. Getty arrived just in time, for Confederate skirmishers were found dead and wounded only 30 yds. from the cross roads. The division then formed up to await Hancock's arrival up the Brock Road, practically unmolested, for Lee had only two of his corps on the ground (Hill on the Plank Road, Ewell on the Pike), and did not desire to force a decision until Longstreet's distant corps should arrive.

Meanwhile Warren had been slowly forming up his attacking line with great difficulty in the woods. Grant appears to have used bitter words to Meade on the subject of Warren's delays, and Meade passed these on to Warren, who in turn forced his subordinates into premature action. In the end, about noon, Griffin's division of Warren's corps attacked directly along the Pike and crushed the enemy's first line, but, unsupported by the VI. corps on the right and Wadsworth's division (V. corps) on the left, both of which units were still groping their way forward in the woods, was forced back with heavy losses. Wadsworth took a wrong direction in the woods and presented himself as an easy victim to Ewell's right, soon after Griffin's repulse. The VI. corps advanced later in the day on Warren's right, but was only partially engaged. The result of the attack on Ewell was thus completely unsatisfactory, and for the rest of the battle the V. and VI. corps were used principally as reservoirs to find supports for the offensive wing under Hancock, who arrived on the Plank Road about 2 P.M.

Hancock's divisions, as they came up, entrenched themselves along the Brock Road. In the afternoon he was ordered to attack whatever force of the enemy was on the Plank Road in front of him, but was unwilling to do so until he had his forces well in hand. Finally Getty was ordered to attack "whether Hancock was ready or not." This may have been an attempt to force Hancock's hand by an appeal to his soldierly honour, and as a fact he did not leave Getty unsupported. But the disjointed attacks of the II. corps on Hill's entrenchments, while forcing the Confederates to the verge of ruin, were not as successful as the preponderance of force on the Union side ought to have ensured. For four hours the two lines of battle were fighting 50 yds. apart, until at nightfall the contest was given up through mutual exhaustion.

The battle of the 6th was timed to begin at 5 A.M. and Grant's attack was wholly directed on Parker's Store, with the object of crushing Hill before Longstreet could assist him. If Longstreet, instead of helping Hill, were to attack the extreme Union left, so much the better; but the far more probable course for him to take was to support Hill on or north of the Plank Road, and Grant not only ordered Hancock with six of the eleven divisions of Meade's army to attack towards Parker's Store, but sent his own "mass of manœuvre" (the IX. corps) thither in such a way as to strike Hill's left. The cavalry was drawn back for the protection of the trains,[1] for "every musket" was required in the ranks of the infantry. Warren and Sedgwick were to hold Ewell occupied on the Pike by vigorous attacks. At 5 o'clock Hancock advanced, drove back and broke up Hill's divisions, and on his right Wadsworth attacked their left rear. But after an hour's wood fighting the Union attack came to a standstill, and at this moment, the critical moment for the action of the IX. corps, Burnside was still more than a mile away, having scarcely passed through Warren's lines into the woods. Then Longstreet's corps, pushing its way in two columns of fours through Hill's retreating groups, attacked Hancock with the greatest fury, and forced him back some hundreds of yards. But the woods broke the force of this attack too, and by 7.30 the battle had become a stationary fire-fight. After an interval in which both sides rallied their confused masses, Longstreet attacked again and gained more ground. Persistent rumours came into the Union headquarters of a Confederate advance against the Union left rear, and when Grant realized the situation he broke off one of Burnside's divisions from the IX. corps column and sent it to the cross roads as direct reserve to Hancock. At this moment the battle took a very unfavourable turn on the Plank Road. Longstreet had sent four brigades of infantry by a détour through the woods south of the Plank Road to attack Hancock's left. This was very effective, and the Union troops were hustled back to the cross-roads. But Longstreet, like Jackson a year before in these woods, was wounded by his own men at the critical moment and the battle again came to a standstill (2-2.30 P.M.).

Burnside's corps, arriving shortly before 10 A.M. near Chewning's house, the position whence it was to have attacked Hill's left in the early morning, was about to attack, in ignorance of Hancock's repulse, when fortunately an order reached it to suspend the advance and to make its way through the woods towards Hancock's right. This dangerous flank march, screened by the woods, was completed by 2 P.M., and General Burnside began an attack upon the left of Longstreet's command (R. H. Anderson's fresh division of Hill's corps). But Hancock being in no condition to support the IX. corps, the whole attack was, at 3 P.M., postponed by Grant's order until 6 P.M. Thus there was a long respite for both sides, varied only by a little skirmishing. But Lee was determined, as always, to have the last word, and about 4.15–4.30 a fierce assault was delivered amidst the burning woods upon Hancock's entrenchments along the Brock Road. For a moment, aided by the dense smoke, the Confederates seized and held the first line of works, but a counterstroke dislodged them. Burnside, though not expecting to have to attack before 6, put into the fight such of his troops as were ready, and at 5.30 or thereabouts the assaulting line receded into the woods. Grant cancelled his order to attack at 6, and at the decisive point the battle was at an end. But on the extreme right of the Union army a sudden attack was delivered at sunset upon the hitherto unmolested VI. corps, by Gordon, one of Ewell's brigadiers. This carried off two generals and several hundred prisoners, and a panic ensued which affected all the Union forces on the Pike, and was not quieted until after nightfall.

Lee, therefore, had the last word on both flanks, but in spite of this and of the very heavy losses,[2] Grant had already resolved to go on, instead of going back like his various predecessors. To him, indeed, the battle of the Wilderness was a victory, an indecisive victory indeed, but one that had given him a moral superiority which he did not intend to forfeit. His scheme, drafted early on the morning of the 7th, was for the army to march to Spottsylvania on the night of the 7th–8th, to assemble there on the 8th, and thence to undertake a fresh manœuvre against Lee's right rear on the 9th. This movement required the trains with the fighting line to be cleared away from the roads needed for the troops at once, and Lee promptly discovered that a movement was in progress. He mistook its object, however, and assuming that Grant was falling back on Fredericksburg, he prepared to shift his own forces to the south of that place so as to bar the Richmond road. This led to a race for Spottsylvania, which was decided more by accidents to either side than by the measures of the two commanding generals. On the Union side Warren was to move to the line Spottsylvania Court House–Todd's Tavern, followed by Hancock; Sedgwick was to take a roundabout route and to come in between the V. and II. corps; Burnside to follow Sedgwick. The cavalry was ordered to watch the approaches towards the right of the army. The movement began promptly after nightfall on the 7th. But ere long the head of Warren's column, passing in rear of Hancock's line of battle, was blocked by the headquarters escort of Grant and Meade. Next, the head of the V. corps was again checked at Todd's Tavern by two cavalry divisions which had been sent by Sheridan to regain the ground at Todd's Tavern,[3] given up on the 6th, and after fighting the action of Todd's Tavern had received no further orders from him. Meade, greatly irritated, ordered Gregg's division out towards Corbin's Bridge and Merritt's (Torbert's) to Spottsylvania. On the latter road the Union cavalry found themselves opposed by Fitz Lee's cavalry, and after some hours of disheartening work in the woods, Merritt asked Warren to send forward infantry to drive the enemy. This Warren did, although he was just preparing to rest and to feed his men after their exhausting night-march. Robinson's division at the head of the corps deployed and swiftly drove in Fitz Lee. A little beyond Alsop's, however, Robinson found his path barred by entrenched infantry. This was part of Anderson's (Longstreet's) corps. That officer had been ordered to draw out of his (Wilderness) works, and to bivouac, preparatory to marching at 3 A.M. to the Court House, but, finding no good resting-place, he had moved on at once. His route took him to the Catharpin Road (Hampton's cavalry protecting him towards Todd's Tavern), and thence over Corbin's Bridge to Block House Bridge. At or near Block House Bridge the corps halted to rest, but Stuart (who was with Fitz Lee) called upon Anderson for assistance and the march was resumed at full speed. Sheridan's new orders to Gregg and Merritt did not arrive until Meade had given these officers other instructions, but Wilson's cavalry division, which was out of the line of march of the infantry, acted in accordance with Sheridan's plan of occupying the bridges in front of the army's intended position at Spottsylvania Court House, and seized that place, inflicting a smart blow upon a brigade of Stuart's force that was met there.

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[1] Wilson's division, in its movement on Shady Grove Church on the 5th, had been cut off by the enemy's advance on the Plank Road and attacked by some Confederate cavalry. But it extricated itself and joined Gregg, who had been sent to assist him, at Todd's Tavern.

[2] The Union losses in the battle were 18,000, the Confederates at least 11,500.

[3] In consequence of a mistaken order that the trains which he was protecting were to move forward to Piney Branch Church.

The situation about 9 A.M. on the 8th was therefore curious. Warren, facing E., and opposed by part of Anderson's corps, was seeking to fight his way to Spottsylvania Court House by the Brock Road. Wilson, facing S., was holding the Court House and driving Fitz Lee's cavalry partly westward on to the backs of the infantry opposing Warren, partly towards Block House Bridge, whence the rest of Anderson's infantry was approaching. All the troops were weary and hungry, and Sheridan ordered Wilson to evacuate the Court House and to fall back over the Ny. Warren fruitlessly attacked the Confederate infantry at Spindler's, General Robinson being severely wounded, and his division disorganized. The other divisions came up by degrees, and another attack was made about 11. It was pressed close up to, and in some places over, the Confederate log-works, but it ended in failure like the first. A third attempt in the evening dwindled down to a reconnaissance in force. Anderson was no longer isolated. Early's division observed Hancock's corps at Todd's Tavern, but the rest of Ewell's and all Hill's corps went to Spottsylvania and prolonged Anderson's line northward towards the Ny. Thus the re-grouping of the Union army for manœuvre, and even the running fight or strategic pursuit imagined by Grant when he found Anderson at Spottsylvania, were given up, and on the 9th both armies rested. On this day General Sedgwick was killed by a long-range shot from a Confederate rifle. His place was taken by General H. G. Wright. On this day also a violent quarrel between Meade and Sheridan led to the departure of the cavalry corps on an independent mission. This was the so-called Richmond raid, in which Sheridan defeated Stuart at Yellow Tavern (where Stuart was killed) and captured the outworks of Richmond, but, having started with empty forage wagons,[1] had then to make his way down the Chickahominy to the nearest supply depots of the Army of the James, leaving the Confederate cavalry free to rally and to rejoin Lee.

Finding the enemy thus gathered in his front, Grant decided to fight again on the 10th. While Hancock opposed Early, and Warren and Wright Hill and Anderson, Burnside was ordered by Grant to work his way to the Fredericksburg-Spottsylvania road, thence to attack the enemy's right rear. The first stage of this movement of the IX. corps was to be made on the 9th, but not the attack itself, and Burnside was consequently ordered not to go beyond a place called "Gate" on the maps used by the Union staff. This, it turned out, was not the farm of a person called Gate, as headquarters supposed, but a mere gate into a field. Consequently it was missed, and the IX. corps went on to Gale's or Gayle's house, where the enemy's skirmishers were driven in.[2] The news of an enemy opposing Burnside at "Gate," which Grant still supposed to be the position of the IX. corps, at once radically altered the plan of battle. Lee was presumed to be moving north towards Fredericksburg, and Grant saw an opportunity of a great and decisive success. The IX. corps was ordered to hold its position at all costs, and the others were to follow up the enemy as he concentrated upon Burnside. Hancock was called in from Todd's Tavern, sent down to force the fords of the Po at and below Tinder's Mill, and directed upon Block House Bridge by an officer of Grant's own staff, while Warren and Wright were held ready. But once more a handful of cavalry in the woods delayed the effective deployment of the moving wing, and by the time that the II. corps was collected opposite Block House Bridge it was already night. Still there was, apparently, no diminution of force opposite Burnside, and Hancock was ordered to resume his advance at early dawn on the 10th.

Meade, however, had little or no cognizance of Grant's orders to the independent IX. corps, and his orders, conflicting with those emanating from the Lieutenant-General's staff, puzzled Hancock and crippled his advance. At 10 the whole scheme was given up, and the now widely deployed Union army closed on its centre as best it could for a direct attack on the Spottsylvania position. At 4, before the new concentration was complete, and while Hancock was still engaged in the difficult operation of drawing back over the Po in the face of the enemy, Warren attacked unsupported and was repulsed. In the woods on the left Wright was more successful, and at 6 P. M. a rush of twelve selected regiments under Colonel Emory Upton carried the right of Lee's log-works. But for want of support this attack too was fruitless, though Upton held the captured works for an hour and brought off 1000 prisoners. Burnside, receiving Grant's new orders to attack from Gayle's towards Spottsylvania, sent for further orders as to the method of attack, and his advance was thus made too late in the day to be of use. Lee had again averted disaster, this time by his magnificent handling of his only reserve, Hill's (now Early's) corps, which he used first against Hancock and then against Burnside with the greatest effect.

This was the fourth battle since the evening of the 4th of May. On the morning of the 11th Grant sent his famous message to Washington, "I purpose to fight it out on this line if it takes all summer." The 12th was to be the fifth and, Grant hoped, the decisive battle. A maze of useful and useless entrenchments had been constructed on both sides, especially on the Union side, from mere force of habit. Grant, seeing from the experience of the 10th that his corps commanders were manning these entrenchments so strongly that they had only feeble forces disposable for the attack, ordered all superfluous defences to be given up. Three corps were formed in a connected line (from right to left, V., VI., IX.) during the 11th, and that night the II. corps moved silently to a position between Wright and Burnside and formed up in the open field at Brown's in an attacking mass of Napoleonic density—three lines of divisions, in line and in battalion and brigade columns. Burnside was to attack from Gayle's (Beverly's on the map) towards McCool's. Warren and Wright were to have at least one division each clear of their entrenchments and ready to move.

Up to the 11th Lee's line had extended from the woods in front of Block House Bridge, through Perry's and Spindler's fields to McCool's house, and its right was refused and formed a loop round McCool's. All these works faced N.W. In addition, Burnside's advance had caused Early's corps to entrench Spottsylvania and the church to the south of it, facing E. Between these two sections were woods. The connexion made between them gave the loop around McCool's the appearance from which it derives its historic name of The Salient. Upon the northern face of this Salient Hancock's attack was delivered.

On the 11th the abandonment of Burnside's threatening advance on his rear and other indices had disquieted Lee as to his left or Block House flank, and he had drawn off practically all Ewell's artillery from the McCool works to aid in that quarter. The infantry that manned the Salient was what remained of Stonewall Jackson's "foot cavalry," veterans of Antietam Fredericksburg and Chancellorsville. But at 4.35, in the mist, Hancock's mass swept over their works at the first rush and swarmed in the interior of the Salient, gathering thousands of prisoners and seizing the field batteries that Lee had sent back just too late.

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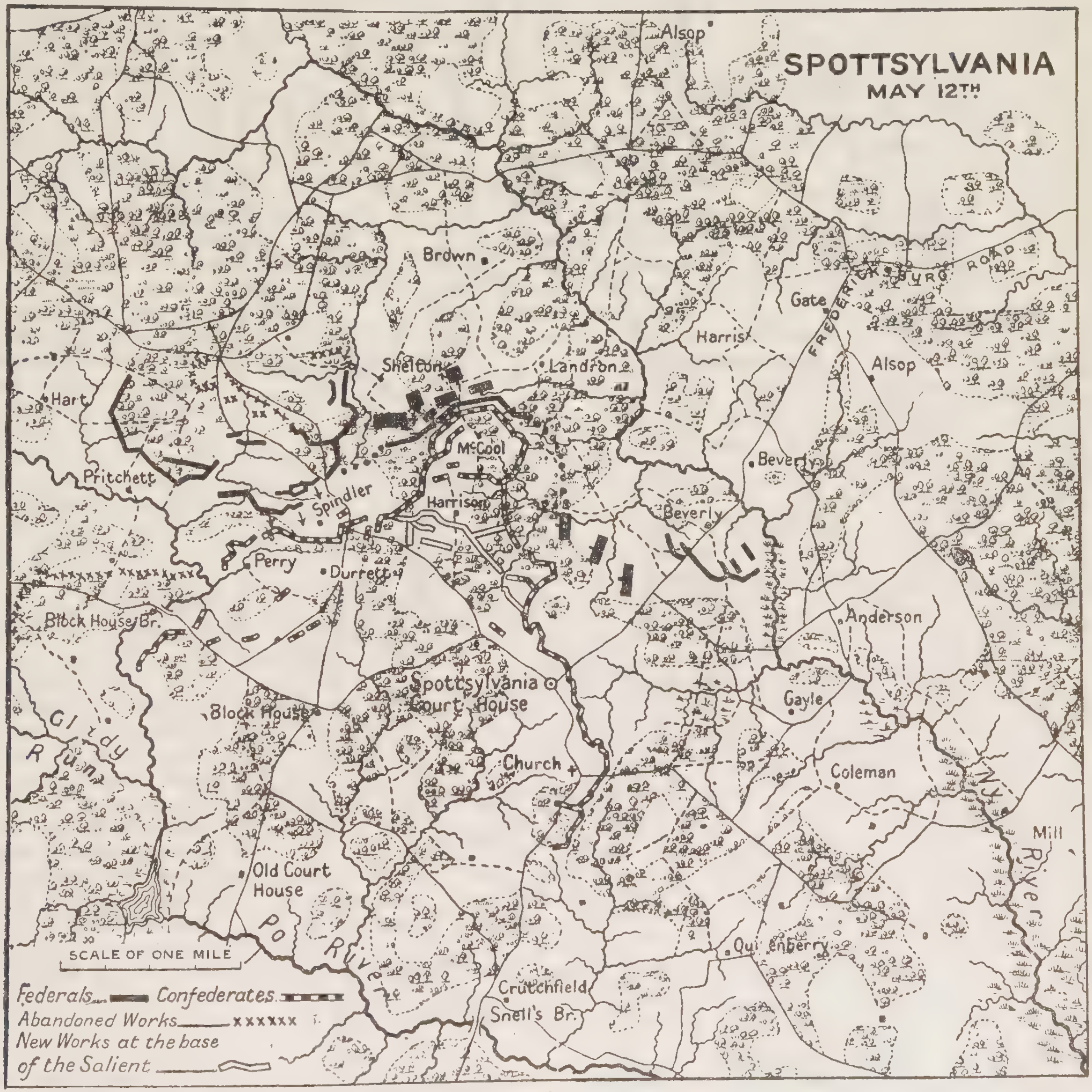
[1] Owing to the circumstances of his departure, the angry army staff told him to move out at once with the forage that he had, and Sheridan, though the army reserve supplies were at hand, made no attempt to fill up from them.

[2] A further source of confusion, for the historian at least, is that on the survey maps made in 1867 this "Gayle" is called "Beverly" (see map II.).

The thronging and excited Federals were completely disordered by success, and the counter-attack of one or two Confederate brigades in good order drove them back to the line of the captured works. Then, about 6, there began one of the most remarkable struggles in history. While Early, swiftly drawing back from Block House, checked Burnside's attack from the east, and Anderson, attacked again and again by parts of the V. corps,[1] was fully occupied in preserving his own front, Lee, with Ewell's corps and the few thousand men whom the other generals could spare, delivered all day a series of fierce counter-strokes against Hancock. Nearly all Wright's corps and even part of Warren's (in the end 45,000 men) were drawn into the fight at the Salient, for Grant and Meade well knew that Lee was struggling to gain time for the construction of a retrenchment across the base of it. If the counter-attacks failed to gain this respite, the Confederates would have to retreat as best they could, pressed in front and flank. But the initial superiority of the Federals was neutralized by their disorder, and, keeping the fight alive by successive brigade attacks, while the troops not actually employed were held out of danger till their time came, Lee succeeded so well that after twenty hours' bitter fighting the new line was ready and the Confederates gave up the barren prize to Hancock. Lee had lost 4000 prisoners as well as 4500 killed and wounded, as against 7000 in the Army of the Potomac and the IX. corps.


SPOTTSYLVANIA
MAY 12TH
Alsop
Brown
Gate
FREDERICKSBURG ROAD
Harris
Alsop
Shelton
Landron
Hart
McCool
Pritchett
Spindler
Harrison
Beverly
Beverly
Perry
Durrett
Block House Br.
Anderson
Spottsylvania Court House
Gayle
Block House
Glady Run
Church
Coleman
Mill
Ny River
Old Court House
Po River
Quisenberry
SCALE OF ONE MILE
Crutchfield
Snell's Br.
Federals
Confederates
Abandoned Works
xxxxxx
New Works at the base of the Salient

From *The Wilderness and Cold Harbor*, by permission of Hugh Rees, Limited.

There were other battles in front of Spottsylvania, but that of the 12th was the climax. From the 13th to the 20th the Federals gradually worked round from west to east, delivering a few partial attacks in the vain hope of discovering a weak point. Lee's position, now semicircular, enabled him to concentrate on interior lines on each occasion. In the end the Federals were entrenched facing E. between Beverly's house (Burnside's old "Gayle") and Quisenberry's, Lee facing W. from the new works south of Harrison's through the Court House to Snell's Bridge on the Po. In the fork of the Po and the Ny, with woods and marshes to obstruct every movement, Grant knew that nothing could be done, and he prepared to execute a new manœuvre. But here, as in the Wilderness, Lee managed to have the last word. While the Union army was resting in camp for the first time since leaving Culpeper, Ewell's corps suddenly attacked its baggage-train near Harris's house. The Confederates were driven off, but Grant had to defer his intended manœuvre for two days. When the armies left Spottsylvania, little more than a fortnight after breaking up from winter quarters, the casualties had reached the totals of 35,000 out of an original total of 120,000 for the Union army, 26,000 out of 70,000 for the Confederates.

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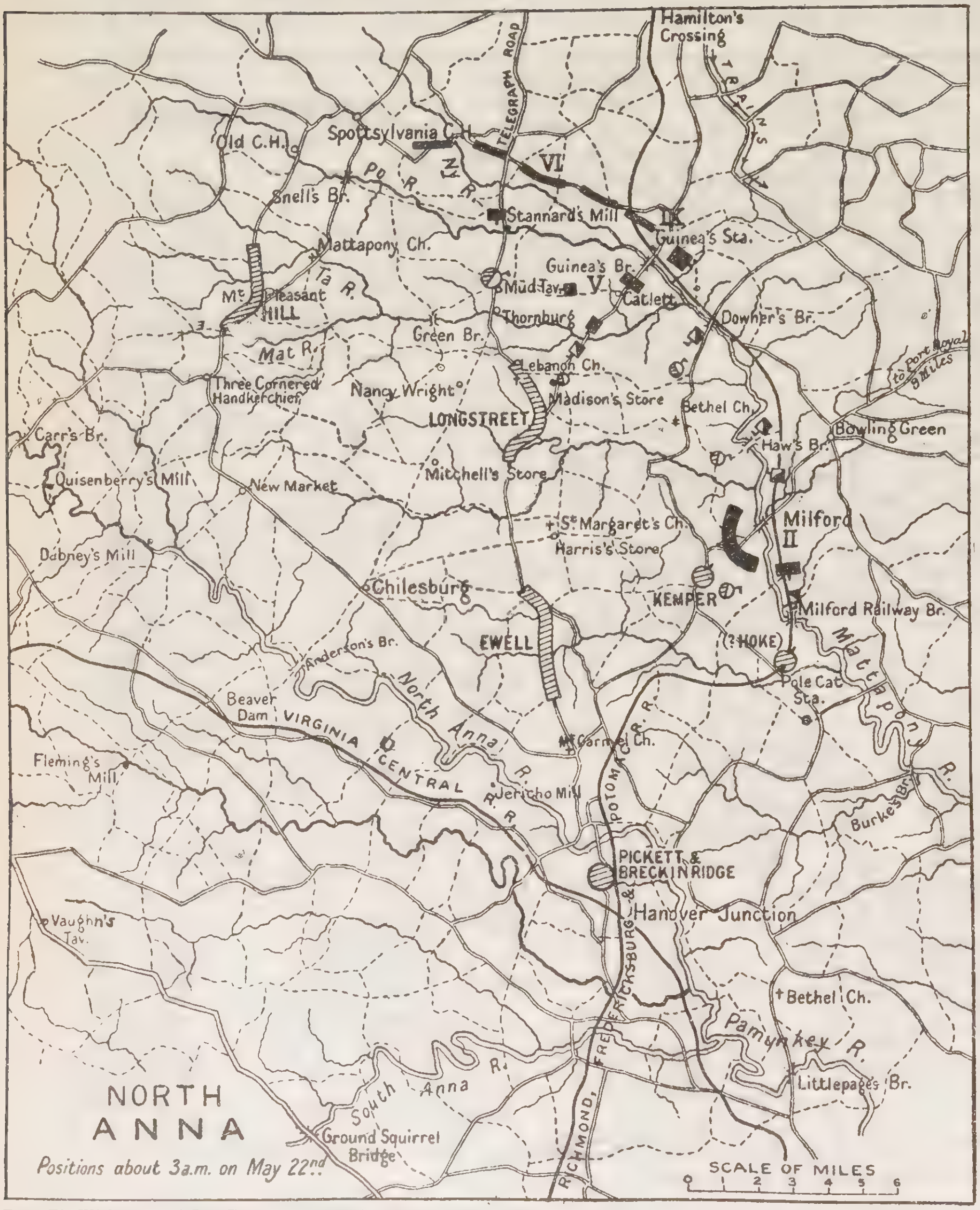
[1] The tension was so great that, after threatening to deprive Warren of his command, Meade sent General Humphreys, his chief of staff, to direct the V. corps' attack.

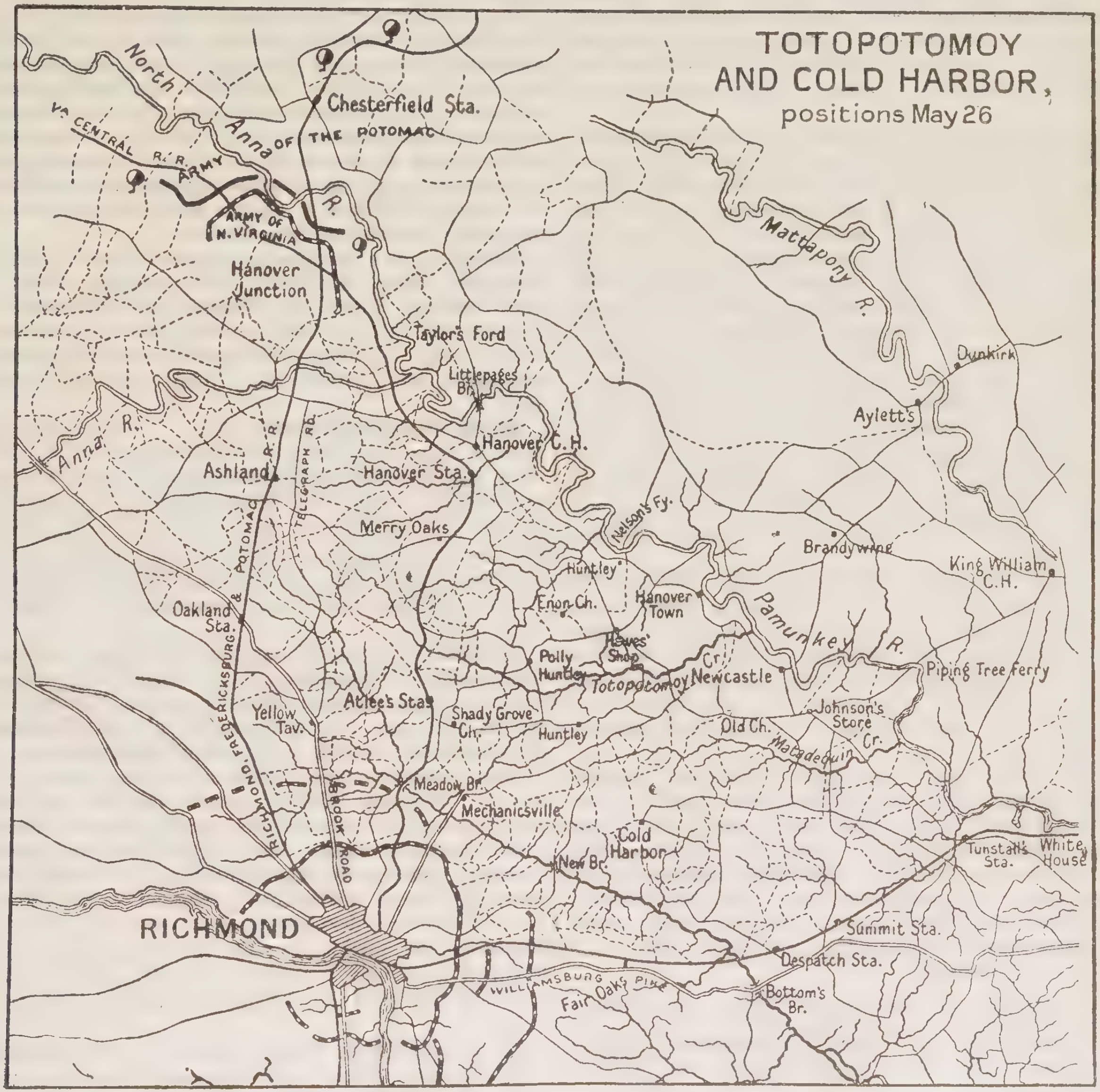
The next manœuvre attempted by Grant to bring Lee's army to action “ outside works ” was of an unusual character, though it had been foreshadowed in the improvised plan of crushing Lee against Burnside's corps on the 9th. Hancock was now (20th) ordered to move off under cover of night to Milford; thence he was to march south-west as far as possible along the Richmond and Fredericksburg railroad, and to attack whatever force of the enemy he met. It was hoped that this bold stroke by an isolated corps would draw Lee's army upon it, and the rest of the Army of the Potomac would, if this hope were realized, drive down upon Lee's rear while Hancock held him up in front. Supposing, however, that Lee did not take the bait, the manœuvre would resolve itself into a turning movement with the object of compelling Lee to come out of his Spottsylvania lines on pain of being surrounded.


Hamilton's Crossing
TELEGRAPH ROAD
TRAINS
Old C.H.
Spottsylvania C.H.
VI
Po R.
Ny R.
Snell's Br.
Stannard's Mill
IX
Guinea's Sta.
Mattapony Ch.
Guinea's Br.
Mt Pleasant
HILL
Ta R.
Mud Tav.
V
Catlett
Thornburg
Downer's Br.
Green Br.
Mat R.
to Port Royal 9 Miles
Lebanon Ch.
Three Cornered Handkerchief
Nancy Wright
Madison's Store
Bethel Ch.
LONGSTREET
Bowling Green
Carr's Br.
Haw's Br.
Quisenberry's Mill
New Market
Mitchell's Store
Milford
II
St Margaret's Ch.
Harris's Store
Dabney's Mill
Chilesburg
KEMPER
Milford Railway Br.
Anderson's Br.
EWELL
(?HOKE)
Mattapony R.
Beaver Dam
VIRGINIA CENTRAL R.R.
North Anna R.
Pole Cat Sta.
Mt Carmel Ch.
Fleming's Mill
Jericho Mill
POTOMAC R.R.
Burke's Br.
PICKETT & BRECKINRIDGE
Hanover Junction
Vaughn's Tav.
RICHMOND, FREDERICKSBURG &
Bethel Ch.
Pamunkey R.
South Anna R.
Littlepage's Br.
NORTH ANNA
Ground Squirrel Bridge
Positions about 3a.m. on May 22nd
SCALE OF MILES
0 1 2 3 4 5 6

From *The Wilderness and Cold Harbor*, by permission of Hugh Rees, Limited.

The II. corps started on the night of the 20th-21st. The alarm was soon given. At Milford, where he forced the passage of the Mattapony, Hancock found himself in the presence of hostile infantry from Richmond and heard that more had arrived at Hanover Junction, both from Richmond and from the Shenandoah Valley. He therefore suspended his advance and entrenched. The main army began to move off, after giving Lee time to turn against Hancock, at 10 a.m. on the 21st, and marched to Catlett's, a place a few miles S.W. of Guinea's bridge, Warren leading, Burnside and Wright following. But no news came in from Hancock until late in the evening, and the development of the manœuvre was consequently delayed, so that on the night of the 21st-22nd Lee's army slipped across Warren's front *en route* for Hanover Junction. The other Confederate forces that had opposed Hancock likewise fell back. Grant's manœuvre had failed. Its principal aim was to induce Lee to attack the II. corps at Milford, its secondary and alternative purpose was, by dislodging Lee from Spottsylvania, to force on an encounter battle in open ground. But he was only offered the bait—not compelled to take it, as he would have been if Hancock with two corps had been placed directly athwart the road between Spottsylvania and Hanover Junction—and, having unimpaired freedom of action, he chose to retreat to the Junction. The four Union corps, therefore, could only pursue him to the North Anna, at which river they arrived on the morning of the 23rd, Warren on the right, Hancock on the left, Wright and Burnside being well to the rear in second line. The same afternoon Warren seized Jericho Ford, brought over the V. corps to the south side, and repulsed a very sharp counterstroke made by one of Lee's corps. Hancock at the same time stormed a Confederate redoubt which covered the Telegraph Road bridge over the river. Wright and Burnside closed up. It seemed as if a battle was at hand, but in the night reports came in that Lee had fallen back to the South Anna, and as these were more or less confirmed by the fact that Warren met with no further opposition, and by the enemy's retirement from the river bank on Hancock's front, the Union generals gave orders, about midday on the 24th, for what was practically a general pursuit. This led incidentally to an attempt to drive Lee's rearguard away from the point of passage, between Warren's and Hancock's, required for Burnside, and in the course of this it became apparent that Lee's army had not fallen back, but was posted in a semicircle to which the North Anna formed a tangent. On the morning of the 25th this position was reconnoitred, and found to be more formidable than that of Spottsylvania. Moreover, it divided the two halves of the Union army that had crossed above and below.

Grant gave up the game as drawn and planned a new move. This had as its objects, first, the seizure of a point of passage on the Pamunkey; secondly, the deployment of the Army of the Potomac and of a contingent expected from the Army of the James, and thirdly, the prevention of Lee's further retirement, which was not desired by the Union commanders, owing to the proximity of the Richmond defences and the consequent want of room to manœuvre. On the 27th Sheridan's cavalry and a light division of infantry passed the Pamunkey at Hanover Town, and the two divided wings of the Army of the Potomac were withdrawn over the North Anna without mishap—thanks to exactitude in arrangement and punctuality in execution. On the 28th the Army of the Potomac had arrived near Hanover Town, while at Hawes's Shop, on the road to Richmond, Sheridan had a severe engagement with the enemy's cavalry. Lee was now approaching from Hanover Junction via Ashland, and the Army of the Potomac swung round somewhat to the right so as to face in the presumed direction of the impending attack. The Confederate general, however, instead of attacking, swerved south, and planted himself behind the Totopotomoy. Here he was discovered, entrenched as always, on the 29th, and skirmishing all along the line, varied at times by more severe fighting, occupied that day and the 30th. On the morning of the 31st the Union army was arranged from right to left in the order VI., II., IX. and V. corps, Sheridan having meantime drawn off to the left rear of the infantry.


TOTOPOTOMOY AND COLD HARBOR, positions May 26
North Anna R.
VA. CENTRAL R.R.
ARMY OF THE POTOMAC
ARMY OF N. VIRGINIA
Chesterfield Sta.
Hanover Junction
Mattapony R.
Taylor's Ford
Littlepages Br.
Dunkirk
Aylett's
Anna R.
Ashland
Hanover Sta.
Hanover C.H.
RICHMOND FREDERICKSBURG & POTOMAC R.R.
TELEGRAPH RD.
Merry Oaks
Nelson's Fy.
Brandywine
King William C.H.
Huntley
Enon Ch.
Hanover Town
Oakland Sta.
Pamunkey R.
Hawes' Shop
Polly Huntley
Totopotomoy Cr.
Newcastle
Piping Tree Ferry
Yellow Tav.
Atlee's Sta.
Shady Grove Ch.
Huntley
Johnson's Store
Old Ch.
Matadequin Cr.
Meadow Br.
BROOK ROAD
Mechanicsville
Cold Harbor
New Br.
Tunstall's Sta.
White House
RICHMOND
Summit Sta.
Despatch Sta.
WILLIAMSBURG PIKE
Fair Oaks
Bottom's Br.

From *The Wilderness and Cold Harbor*, by permission of Hugh Rees, Limited.

Now, for the last time in the campaign, the idea of a hammer and anvil battle was again taken up, the "anvil" being Smith's XVIII. corps, which had come up from the James river to White House on the 30th; but once more the lure failed because it was not made sufficiently tempting.

The last episode of the campaign centred on Cold Harbor, a village close to the Chickahominy, which Sheridan's cavalry seized, on its own initiative, on the 31st. Here, contrary to the expectation of the Union staff, a considerable force of Confederate infantry—new arrivals from the James—was met, and in the hope of bringing on a battle before either side had time to entrench, Grant and Meade ordered Sheridan to hold the village at all costs, and directed Wright's (VI.) corps from the extreme right wing, and Smith's (XVIII.) from Old Church, to march thither with all possible speed, Wright in the night of the 31st of May and Smith on the morning of the 1st of June. Lee had actually ordered his corps commanders to attack, but was too ill to enforce his wishes, and in the evening Wright and Smith themselves assaulted the Confederate front opposite Cold Harbor. The assault, though delivered by tired men, was successful. The enemy's first or skirmish line was everywhere stormed, and parts of the VI. corps even penetrated the main line. Nearly 800 prisoners were taken, and Grant at once prepared to renew the attack, as at Spottsylvania, with larger forces, bringing Hancock over from the right of the line on the night of the 1st, and ordering Hancock, Wright and Smith to assault on the next morning. But Lee had by now moved more forces down, and his line extended from the Totopotomoy to the Chickahominy. Hancock's corps, very greatly fatigued by its night march, did not form up until after midday, and meanwhile Smith, whose corps, originally but 10,000 strong, had been severely tried by its hard marching and fighting on the 1st, refused to consider the idea of renewing the attack. The passive resistance thus encountered dominated Grant's fighting instinct for a moment. But after reconsidering the problem he again ordered the attack to be made by Wright, Smith and Hancock at 5 p.m. A last modification was made when, during the afternoon, Lee's far distant left wing attacked Burnside and Warren. This, showing that Lee had still a considerable force to the northward, and being, not very inaccurately, read to mean that the 6 m. of Confederate entrenchments were equally —*i.e.* equally thinly—guarded at all points, led to the order being given to all five Union corps to attack at 4·30 a.m. on the 3rd of June.

The resolution to make this plain, unvarnished frontal assault on entrenchments has been as severely criticized as any action of any commander in the Civil War, and Grant himself subsequently expressed his regret at having formed it. But such criticisms derive all their force from the event, not from the conditions in which, beforehand, the resolution was made. The risks of failure were deliberately accepted, and the battle—if it can be called a battle—was fought as ordered. The assault was made at the time arranged and was repulsed at all points, with a loss to the assailants of about 8000 men. Thereafter the two armies lay for ten days less than a hundred yards apart. There was more or less severe fighting at times, and an almost ceaseless bickering of skirmishers. Owing to Grant's refusal to sue for permission to remove his dead and wounded in the terms demanded, Lee turned back the Federal ambulance parties, and many wounded were left to die between the lines. It was only on the 7th that Grant pocketed his feelings and the dead were buried.

This is one of the many incidents of Cold Harbor that must always rouse painful memories—though to blame Lee or Grant supposes that these great generals were infinitely more inhuman here than at any other occasion in their lives, and takes no account of the consequences of admitting a defeat at this critical moment, when the causes for which the Union army and people contended were about to be put to the hazard of a presidential election.

The Federal army lost, in this month of almost incessant campaigning, about 50,000 men, the Confederates about 32,000. Though the aggregate of the Union losses awed both contemporaries and historians of a later generation, proportionately the losses of the South were heavier (46% of the original strength as compared with 41% on the Union side), and whereas within a few weeks Grant was able to replace nearly every man he had lost by a new recruit, the Confederate government was almost at the end of its resources.

See A. A. Humphreys, *The Campaign of Virginia, 1864–65* (New York, 1882); Military History Society of Massachusetts, *The Wilderness Campaign*; *Official Records of the Rebellion*, serial numbers 67, 68 and 69; and C. F. Atkinson, *The Wilderness and Cold Harbor* (London, 1908). (C. F. A.)

WILDMAN, SIR JOHN (*c.* 1621–1693), English agitator, was educated at the university of Cambridge, and during the Civil War served for a short time under Sir Thomas Fairfax. He became prominent, however, not as a soldier but as an agitator, being in 1647 one of the leaders of that section of the army which objected to all compromise with the king. In a pamphlet, *Putney Projects*, he attacked Cromwell; he was responsible for *The Case of the Army stated*, and he put the views of his associates before the council of the army at a meeting in Putney church in October 1647. The authorities looked upon him with suspicion, and in January 1648 he and John Lilburne were imprisoned, preparations, says Clarendon, being made "for his trial and towards his execution." However, he was released in the following August, and for a time he was associated with the party known as the levellers, but he quickly severed his connexion with them and became an officer in the army. He was a large buyer of the land forfeited by the royalists, and in 1654 he was sent to the House of Commons as member for Scarborough. In the following year he was arrested for conspiring against Cromwell, and after his release four months later he resumed the career of plotting, intriguing alike with royalists and republicans for the overthrow of the existing régime. In 1659 he helped to seize Windsor castle for the Long Parliament, and then in November 1661 he was again a prisoner on some suspicion of participating in republican plots. For six years he was a captive, only regaining his freedom after the fall of Clarendon in October 1667.

In or before 1681 Wildman became prominent among those who were discontented with the rule of Charles II., being especially intimate with Algernon Sydney. He was undoubtedly concerned in the Rye House Plot, and under James II. he was active in the interests of the duke of Monmouth, but owing to some disagreements, or perhaps to his cowardice, he took no part in the rising of 1685. He found it advisable, however, to escape to Holland, and returned to England with the army of William of Orange in 1688. In 1689 he was a member of the convention parliament.

Wildman was postmaster-general from April 1689 to February 1691, when some ugly rumours about his conduct brought about his dismissal. Nevertheless, he was knighted by William III. in 1692, and he died on the 2nd of June 1693. Sir John, who was the author of many political pamphlets, left an only son, John, who died childless in 1710.

WILES, IRVING RAMSAY (1861–), American artist, was born at Utica, New York, on the 8th of April 1861. He studied under his father, the landscape painter, Lemuel Maynard Wiles (1826–1905), in the Art Students' League, New York, and under Carolus Duran, at Paris. His earlier work was as an illustrator for American magazines, and later he devoted himself with great success to portraiture. He became a full member of the National Academy of Design (1897) and a member of the American Water Color Society.

WILFRID (*c.* 634–709), English archbishop, was born of good parentage in Northumbria, *c.* 634. When serving in King Oswio's court, he attracted the notice of the queen, Eanfled, who, fostering his inclination for a religious life, placed him under the care of an old noble, Cudda, now a monk at Lindisfarne. Later on Eanfled enabled him to visit Rome in the company of Benedict Biscop. At Lyons Wilfrid's pleasing features and quick intelligence made Annemund, the archbishop, desire to adopt him and marry him to his niece. Resisting his offers, the youth went on to Rome, received the papal benediction, and then, in accordance with his promise, returned to Lyons, where he stayed for three years, till the murder of his patron, whose fate the executioners would not let him share. On his return home, Oswio's son Alchfrid gave him a monastery at Ripon, and, before long, Agilbert, bishop of the Gewissae, or West Saxons, ordained him priest.

He was probably already regarded as the leading exponent of the Roman discipline in England when his speech at the council of Whitby determined the overthrow of the Celtic party (664). About a year later he was consecrated to the see of York, not, however, in England, where perhaps he could not find the fitting number of orthodox prelates, but at Compiègne, Agilbert being now bishop of Paris. On his return journey he narrowly escaped the pagan wreckers of Sussex, and only reached his own country to find Ceadda (St Chad) installed in his see.

The rest of his life is largely a record of wandering and misfortune. For three years (665–668) he ruled his monastery at Ripon in peace, though acting as bishop in Mercia and Kent during vacancies in sees there. On Archbishop Theodore's arrival (668) he was restored to his see, and spent in it nine years of ceaseless activity, especially in building churches, only to be driven out through the anger of King Ecgfrith's queen (677).

Theodore now divided Wilfrid's large diocese into three; and the aggrieved prelate went to lay his case before the bishop of Rome. On his way a west wind drove him to Friesland, where he evangelized the natives and prepared the way for Willibrord (*q.v.*). Late in life he ordained Suidbert bishop of the Frisians. A synod held at Rome under Agatho (680) ordained his restitution; but even this decision could not prevent his being cast into prison on his return home. When released he wandered first to Mercia, then to Wessex and finally to Sussex. Here he rescued the pagan folk from an impending famine, sent preachers to the Isle of Wight and founded a monastery at Selsey. After Ecgfrith's death (20th May 685) Wilfrid was restored to York (much circumscribed), and Ripon (686–687). He was once more driven out in 691–692, and spent seven years in Mercia. A great council of the English Church held in Northumbria excommunicated him in 702. He again appealed to Rome in person, and obtained another decision in his favour (703–704). Despite the intercession of Brihwald, archbishop of Canterbury, Aldfrith king of Northumbria refused to admit the aged prelate into his kingdom till his last illness (705). This year or the next a council was held near the River Nidd, the papal letters were read, and, despite the opposition of the bishops, Wilfrid once more received the abbeys of Ripon and Hexham. Not long after he died at Oundle in Northamptonshire as he was going on a visit to Ceolred, king of Mercia (709). He was buried at Ripon, whence, according to Eadmer, his bones were afterwards removed to Canterbury.

Wilfrid's is a memorable name in English history, not only because of the large part he played in supplanting the Celtic discipline and in establishing a precedent of appeal to papal authority, but also by reason of his services to architecture and learning. At York he renewed Paulinus's old church, roofing it with lead and furnishing it with glass windows; at Ripon he built an entirely new basilica with columns and porches; at Hexham in honour of St Andrew he reared a still nobler church, over which Eddius grows eloquent. In the early days of his bishopric he used to travel about his diocese attended by a little troop of skilled masons. He seems to have also reformed the method of conducting the divine services by the aid of his skilled chanters, Ædde and Æona, and to have established or renewed the rule of St Benedict in the monasteries. On each visit to Rome it was his delight to collect relics for his native land; and to his favourite basilica at Ripon he gave a bookcase wrought in gold and precious stones, besides a splendid copy of the Gospels.

Wilfrid's life was written shortly after his death by Eddius at the request of Acca, his successor at Hexham, and Tatbert, abbot of Ripon—both intimate friends of the great bishop. Other lives were written by Frithegode in the 10th, by Folcard in the 11th, and by Eadmer early in the 12th century. See also Bede's *Hist. Eccl.* v. 19, iii. 25, iv. 13, &c. All the lives are printed in J. Raine's *Historians of the Church of York*, vol. i. "Rolls" series.

WILHELMINA [WILHELMINA HELENA PAULINE MARIA OF ORANGE-NASSAU] (1880–   ), queen of the Netherlands, was born at the Hague on the 31st of August 1880. Her father, William III. (Willem Paul Alexander Frederik Lodewijk), had by his first wife, Sophia Frederika Mathilde of Württemberg, three sons, all of whom predeceased him. Having been left a widower on the 3rd of June 1877, he married on the 7th of January 1879 Adelheid Emma Wilhelmina Theresia, second daughter of Prince George Victor of Waldeck-Pyrmont, born on the 2nd of August 1858, and Wilhelmina was the only issue of that union. She succeeded to the throne on her father's death, which took place on the 23rd of November 1890, but until her eighteenth year, when she was "inaugurated" at Amsterdam on the 6th of September 1898, the business of the state was carried on under the regency of the queen-mother, in accordance with a law made on the 2nd of August 1884. On the 7th of February 1901 Queen Wilhelmina married Henry Wladimir Albert Ernst, duke of Mecklenburg-Schwerin (born on the 19th of April 1876). To the great joy of the Dutch people, Queen Wilhelmina, on the 30th of April 1909, gave birth to an heir to the throne, the Princess Juliana (Juliana Louise Emma Maria Wilhelmina). (See HOLLAND: *History*.)

WILHELMINA (SOPHIA FRIDERIKA WILHELMINA) (1709–1758), margravine of Baireuth, was born in Berlin on the 3rd of July 1709, the daughter of Frederick William I., crown prince, afterwards king of Prussia, and of Sophia Dorothea, daughter of the elector of Hanover (George I. of England). Wilhelmina shared the unhappy childhood of her brother, Frederick the Great, whose friend and confidante she remained, with the exception of one short interval, all her life. Sophia Dorothea wished to marry her daughter to Frederick, prince of Wales, but on the English side there was no disposition to make the offer except in exchange for substantial concessions, to which the king of Prussia was not prepared to assent. The fruitless intrigues carried on by Sophia Dorothea to bring about this match played a large part in Wilhelmina's early life. After much talk of other matches, which came to nothing, she was eventually married in 1731 to Frederick, hereditary prince of Baireuth. The marriage, only accepted by Wilhelmina under threats from her father and with a view to lightening her brother's disgrace, proved at the outset a happy one, though it was clouded at first by narrow means, and afterwards by the infidelities of the future margrave with Dorothea von Marwitz, whose ascendancy at the court of Baireuth was bitterly resented by Frederick the Great, and caused an estrangement of some three years between Wilhelmina and the brother she so devotedly loved. When Wilhelmina's husband came into his inheritance in 1735 the pair set about making Baireuth a miniature Versailles. Their building operations included the rebuilding of their summer residence, the Ermitage, the great Baireuth opera-house, the building of a theatre and the reconstruction of the Baireuth palace and of the new opera house. They also founded the university of Erlangen, the undertakings bringing the court to the verge of bankruptcy.

The margravine made Baireuth one of the intellectual centres of Germany, surrounding herself with a little court of wits and artists which gained added prestige from the occasional visits of Voltaire and Frederick the Great. With the outbreak of the Seven Years' War, Wilhelmina's interests shifted from dilettantism to diplomacy. She acted as eyes and ears for her brother in southern Germany until her death on the 14th of October 1758, the day of Frederick's defeat by the Austrians at Hochkirch. Her only daughter Frederica had contracted in 1748 an unhappy marriage with Charles Eugene, duke of Württemberg.

The margravine's memoirs, *Mémoires de ma vie*, written or revised between 1748 and her death, are preserved in the Royal Library of Berlin. They were first printed in two forms in 1810—a German translation down to the year 1733 from the firm of Cotta of Tübingen: and in French published by Vieweg of Brunswick, and coming down to 1742. There have been several subsequent editions, including a German one published at Leipzig in 1908. An English translation was published in Berlin in 1904. For the discussion on the authenticity of these entertaining, though not very trustworthy, memoirs, see G. H. Pertz, *Über die Merkwürdigkeiten der Markgräfin* (1851). See also Arvède Barine, *Princesses et grandes dames* (Paris, 1890); E. E. Cuttell, *Wilhelmine, Margravine of Baireuth* (London, 2 vols., 1905); and R. Fester, *Die Bayreuther Schwester Friedrichs des Grossen* (Berlin, 1902).

WILHELMSHAVEN, or WILHELMSHAFEN, a town of Germany, and the chief naval station and war harbour of the empire on the North Sea, situated on the north-west shore of the Jade Busen, a large shallow basin formed by inundations and united with the sea by the Jade, a channel 3 m. long. Pop. (1885), 19,422; (1905), 26,012, of whom 8227 belonged to the navy or army. The ground on which it stands (4 sq. m.) was purchased by Prussia from the grand-duke of Oldenburg in 1853, when the Prussian navy was being formed. The construction of the harbour and town was begun in 1855, and the former was opened in 1869. Though reckoned a part of the Prussian province of Hanover it is completely surrounded on the landward side by Oldenburg territory. The town is laid out on a regular plan and ample scale, and the streets are wide and shaded with trees. The main thoroughfare is the Roonstrasse, which, running E. and W., passes the market-square, upon which stand the town hall and the post office. There are two Evangelical and two Roman Catholic churches, a gymnasium, schools for warrant officers and engineers and other naval educational institutions. The original harbour, constructed in 1855–1869, consists of an inner and outer basin. To the south-east of the inner harbour a large new harbour has been more recently constructed for war vessels in commission. This so-called new harbour (170 acres in area and 26¼ ft. deep) is connected by means of a lock (571 ft. long) with the new harbour entrance, which was completed in 1886. On the north it is connected with the fitting-out basin (3832 ft. long, 446 ft. wide), which again is connected by a lock (158 ft. long) with the outer basin (617 ft. long, 410 ft. wide), and so with the old harbour entrance. North of this the "third entrance" has been recently constructed, with two enormous locks, one of which in an emergency could be used as an additional dock. On the west side of the fitting-out basin lies the shipbuilding basin (1237 ft. long by 742 ft. wide), with three dry-docks (of which two are each 453 ft. long, 85 ft. wide and more than 30 ft. deep, whilst the third is 394 ft. long), and also with two slips of the largest size. Further new docks (each about 617 ft. by 97 ft.), capable of containing large battle-ships, were completed in 1906. A torpedo harbour lies to the south-east of the new harbour. The three entrances to the old and new harbours are sheltered by long and massive moles; and the whole complex of docks, building slips, machine shops, &c., forms the government dockyard, which is enclosed by a lofty wall with fourteen iron gates. The establishment is defended by strong fortifications. The commercial harbour lies on the south side of the town at the east end of the Ems-Jade canal. The industries of the place are almost exclusively connected with the requirements of the dockyard, and embrace machine shops, iron foundries and boiler works. Wilhelmshaven is visited for its sea-bathing. It possesses depots for artillery and mines, a meteorological observatory and a signalling station. A battalion of marines is stationed here. Since 1900 the development of the naval establishment and of the town has been exceptionally rapid, coincident with the growth of the German navy, and with the shifting of political and naval activity from the Baltic to the North Sea.

See Eberhard, *Führer durch Wilhelmshaven und seine Umgebung* (Wilhelmshaven, 1906); L. v. Krohn, *Vierzig Jahre in einem deutschen Kriegshafen* (Wilhelmshaven, 1905).

WILKES, CHARLES (1798–1877), American naval officer and explorer, was born in New York City on the 3rd of April 1798. He entered the United States Navy as a midshipman in 1818, and became a lieutenant in 1826. In 1830 he was placed in charge of the division of instruments and charts, and in 1838 was appointed to command an exploring and surveying expedition in the Southern Seas, authorized by Congress in 1836. The expedition, including naturalists, botanists, a mineralogist, taxidermists, a philologist, &c., was carried by the sloops-of-war "Vincennes" and "Peacock," the brig "Porpoise," the storeship "Relief" and two tenders. Leaving Hampton Roads on the 18th of August 1838, it stopped at Madeira and Rio de Janeiro; visited Tierra del Fuego, Chile, Peru, the Paumotu group of the Low Archipelago, the Samoan islands and New South Wales; from Sydney sailed into the Antarctic Ocean in December 1839 and reported the discovery of an Antarctic continent west of the Balleny islands;[1] visited the Fiji and the Hawaiian islands in 1840, explored the west coast of the United States, including the Columbia river, San Francisco Bay and the Sacramento river, in 1841, and returned by way of the Philippine islands, the Sulu archipelago, Borneo, Singapore, Polynesia and the Cape of Good Hope, reaching New York on the 10th of June 1842. He was court-martialled on his return, but was acquitted on all charges except that of illegally punishing men in his squadron. For a short time he was attached to the Coast Survey, but from 1844 to 1861 he was chiefly engaged in preparing the report of the expedition. Twenty-eight volumes were planned but only nineteen were published. Of these Wilkes wrote the *Narrative* (6 vols., 1845; 5 vols., 1850) and the volumes *Hydrography* and *Meteorology* (1851). The *Narrative* contains much interesting material concerning the manners and customs and political and economic conditions in many places then little known. Other valuable contributions were the three reports of James D. Dana on *Zoophytes* (1846), *Geology* (1849) and *Crustacea* (2 vols., 1852–1854). At the outbreak of the Civil War, Wilkes (who had reached the rank of commander in 1843 and that of captain in 1855) was assigned to the command of the "San Jacinto" to search for the Confederate commerce destroyer, "Sumter." On the 8th of November 1861 he stopped the British mail packet "Trent," and took off the Confederate commissioners to Europe, James M. Mason and John Slidell. Though he was officially thanked by Congress, his action was later disavowed by President Lincoln. His next service was in the James river flotilla, but after reaching the rank of commodore, on the 16th of July 1862, he was assigned to duty against blockade runners in the West Indies. He was disrated (becoming a captain on the retired list) in November 1862 on the ground that he had been too old to receive the rank of commodore under the act then governing promotions; and engaged in a long controversy with Gideon Welles, secretary of the navy. This controversy ended in his being court-martialled in 1864 and being found guilty on several counts and sentenced to public reprimand and suspension for three years. But on the 25th of July 1866 he was promoted to the rank of rear-admiral on the retired list. He died at Washington on the 8th of February 1877.

In addition to many shorter articles, reports, &c., he published *Western America, including California and Oregon* (1849) and *Theory of the Winds* (1856).

WILKES, JOHN (1727–1797), English politician, descended from a family long connected with Leighton-Buzzard in Bedfordshire, was born at Clerkenwell, London, on the 17th of October 1727, being the second son of Israel Wilkes, a rich distiller, and the owner, through his wife Sarah, daughter of John Heaton of Hoxton, of considerable house property in its north-eastern suburbs. After some training under private tuition John Wilkes was sent to the university of Leyden, matriculating there on the 8th of September 1744. Several young men of talent from Scotland and England were studying in this Dutch university at that period, and a lively picture of their life, in which Wilkes displays the gaiety of temper which remained faithful to him all his days, is presented to us by Alexander Carlyle (*Autobiog.*, 1860, ed. J. H. Burton). With this training he acquired an intimate knowledge of classical literature, and he enlarged his mind by travelling through Holland, Flanders and part of Germany. At the close of 1748 he returned to his native land, and in a few months (October 1749) was drawn by his relations into marrying Mary, sole daughter and heiress of John Mead, citizen and grocer of London, who was ten years his senior. The ill-assorted pair—for she was grave and staid, while he rioted in exuberant spirits and love of society—lived together at Aylesbury for some months, when, to make matters worse, they returned to town to dwell with the wife's mother. One child, a daughter, was born to them (5th of August 1750), and then Wilkes left his wife and removed to Westminster, where he kept open house for many young men about town possessing more wit than morals. In 1754 he contested the constituency of Berwick-upon-Tweed, but failed to gain the seat.

Wilkes was now a well-known figure in the life of the west end, and among his associates were Thomas Potter, the son of the archbishop of Canterbury, Sir Francis Dashwood, afterwards Lord le Despencer, and Lord Sandwich, the last of whom in after years showed great animosity towards his old companion in revelry. In July 1757, by a triangular arrangement in which Potter and the first William Pitt played the other parts, Wilkes was elected for Aylesbury, and for this constituency he was again returned at the general election in March 1761. Pitt was his leader in politics; but to Pitt he applied in vain for a seat at the Board of Trade, nor was he successful in his application for the post of ambassador at Constantinople, or for that of governor of Quebec. As he attributed these failures to the opposition of Lord Bute, he established a paper called the *North Briton* (June 1762), in which he from the first attacked the Scotch prime minister with exceeding bitterness, and grew bolder as it proceeded in its course. One of its articles ridiculed Lord Talbot, the steward of the royal household, and a duel was the result. When Bute resigned, the issue of the journal was suspended; but, when the royal speech framed by George Grenville's ministry showed that the change was one of men only, not of measures, a supplementary number, No. 45, was published, 23rd of April 1763, containing a caustic criticism of the king's message to his parliament. Lord Halifax, the leading secretary of state, issued a general warrant "to search for authors, printers and publishers," and to bring them before him for examination. Charles Churchill, the poet and a coadjutor in this newspaper enterprise, escaped through the good offices of Wilkes; but the chief offender was arrested and thrown into the Tower (30th of April 1763). A week later, however, he was released by order of the Court of Common Pleas on the ground that his privilege as a member of parliament afforded him immunity from arrest. General warrants were afterwards declared illegal, and Halifax himself, after a series of discreditable shifts, was cast in heavy sums, on actions brought against him by the persons whom he had injured—the total expenses incurred by the ministry in these lawless proceedings amounting to at least £100,000. So far Wilkes had triumphed over his enemies, but he gave them cause for rejoicing by an indiscreet reprint of the obnoxious No. 45, and by striking off at his private press thirteen copies of an obscene *Essay on Woman*, written by his friend Potter, in parody of Pope's *Essay on Man*, one of which got into the hands of Lord Sandwich. Immediately on the meeting of the House of Commons (15th of November 1763) proceedings were taken against him. Lord North moved that No. 45 was "a false, scandalous and seditious libel," and the paper was publicly burnt in Cheapside on the 4th of December. The *Essay on Woman* was on the same day brought before the Upper House by Lord Sandwich, and, on account of the improper use which had been made of Bishop Warburton's name as the author of some coarse notes, the work was voted a breach of privilege, and Wilkes was ordered to be prosecuted in the Court of King's Bench for printing and publishing an impious libel. He was expelled from the House of Commons on the 19th of January 1764; and on the 21st of February he was found guilty in the King's Bench of reprinting No. 45 and of printing and publishing the *Essay on Woman*. Wilkes was on these dates absent from England. Some strong expressions applied to him by Samuel Martin, an ex-secretary of the treasury, had provoked a duel (16th of November 1763), in which Wilkes was severely wounded in the stomach. He withdrew to Paris, and as he did not return to England to receive his sentence in the law courts was pronounced an outlaw.

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[1] This discovery was made on the 19th of January 1840, one day before Dumont d'Urville sighted Adélie Land about 400 m. farther W. That Wilkes discovered an Antarctic continent was long doubted, and one of the charges against him when he was court-martialled was that he had fabricated this discovery, but the expedition of Sir Ernest Shackleton in 1908–1909 corroborated Wilkes. That part of the Antarctic continent known as Wilkes Land was named in his honour.

For several years Wilkes remained abroad, receiving £1000 a year from the leading Whigs, and in the course of his travels he visited many parts of Italy. In February 1768 he returned to London and sued the king for pardon, but in vain. His next step was to offer himself as a candidate for the representation of the city of London, when he was the lowest at the poll. Undaunted by this defeat, he solicited the freeholders of Middlesex to return him as their champion, and they placed him at the head of all competitors (28th of March). He appeared before the King's Bench, and on a technical point procured a reversal of his outlawry; but the original verdict was maintained, and he was sentenced to imprisonment for twenty-two months as well as to a fine of £1000, and he was further ordered to produce securities for good behaviour for seven years after his liberation. His conduct was brought before the House of Commons, with the result that he was expelled from the House on the 3rd of February 1769, and with this proceeding there began a series of contests between the ministry and the electors of Middlesex without parallel in English history. They promptly re-elected him (16th of February), only to find him pronounced incapable of sitting and his election void. Again they returned him (16th of March) and again he was rejected. A fourth election then followed (13th of April), when Colonel Henry Lawes Luttrell, with all the influence of the court and the Fox family in his favour, obtained 296 votes, while 1143 were given for Wilkes, but two days later the House declared that Luttrell had been duly elected. Through these audacious proceedings a storm of fury broke out throughout the country. In the cause of "Wilkes and liberty" high and low enlisted themselves. His prison cell was thronged daily by the chief of the Whigs, and large sums of money were subscribed for his support. So great was the popular sympathy in his favour, that a keen judge of contemporary politics declared that, had George III. possessed a bad and Wilkes a good character, the king would have been an outcast from his dominions. At the height of the combat in January 1769 Wilkes was elected an alderman for the city of London; in 1771 he served as sheriff for London and Middlesex, and as alderman he took an active part in the struggle between the corporation and the House of Commons by which freedom of publication of the parliamentary debates was obtained. His admirers endeavoured in 1772 to procure his election as lord mayor of London, but he was set aside by the aldermen, some of whom were allied with the ministry of Lord North, while others, as Oliver and Townshend, leant to the Liberalism of Lord Shelburne. In 1774, however, he obtained that dignity, and he retained his seat for Middlesex from the dissolution in 1774 until 1790. He moved in 1776 for leave to bring in a bill "for a just and equal representation of the people of England in parliament"; but attempts at parliamentary reform were premature by at least half a century. After several failures better fortune attended his efforts in another direction, for on the 3rd of May 1782 all the declarations and orders against him for his elections in Middlesex were ordered to be expunged from the journals of the House. In 1779 Wilkes was elected chamberlain of the city by a large majority, and the office became his freehold for life. He died at his house in Grosvenor Square, London, on the 26th of December 1797. His daughter Mary, to whom he was tenderly attached, died on the 12th of March 1802.

Wilkes printed editions of Catullus (1788) and Theophrastus (1790), and at the time of his death had made considerable progress with a translation of Anacreon. His conversation was often sullied by obscenity and profanity; but he knew how to suit his conversation to his company, and his well-known assertion that, in spite of his squint and ugly as he was, with the start of a quarter of an hour he could get the better of any man, however good-looking, in the graces of any lady, shows his confidence in his powers of fascination. The king was obliged to own that he had never met so well-bred a lord mayor, and Dr Johnson, who made his acquaintance at the house of Dilly, the bookseller in the Poultry, confessed that "Jack has great variety of talk, Jack is a scholar, and Jack has the manners of a gentleman." It is doubtful how far he himself believed in the justice of the principles which he espoused. To George III. he remarked of his devoted friend and legal adviser, Serjeant Glynn, "Ah, sir! he was a Wilkite, which I never was." His writings were marked by great power of sarcasm. Two collections of his letters were published, one of *Letters to his Daughter*, in four volumes in 1804, the other *Correspondence with his Friends, in which are introduced Memoirs of his Life, by John Almon*, in five volumes, in 1805. A *Life* by Percy Fitzgerald was published in 1888. Essays on him are in *Historical Gleanings*, by J. E. Thorold Rogers, 2nd ser. (1870); *Wilkes and Cobbett*, by J. S. Watson (1870); and *Wilkes, Sheridan and Fox*, by W. F. Rae (1874). His connexion with Bath is set out in *John Wilkes*, by W. Gregory (1888), and that with the city of London in *Modern History of the City*, by Charles Welch (1896). A fragment of his autobiography (Br. Museum Addit. MSS. 30865), chiefly descriptive of his exile in France and Italy, was printed for W. F. Taylor of Harrow in 1888. (W. P. C.)

WILKES-BARRÉ, a city and the county-seat of Luzerne county, Pennsylvania, U.S.A., on the north branch of the Susquehanna river, about 100 m. N.N.W. of Philadelphia. Pop. (1890), 37,718; (1900), 51,721, of whom 12,188 were foreign-born, including 2792 Germans, 2083 Welsh, 2034 Irish, 1578 English and 1000 Russian Poles; (1910 census), 67,105. Area, 4·8 sq. m. Wilkes-Barré is served by the Central Railroad of New Jersey, the Lehigh Valley, the Delaware, Lackawanna & Western, the Delaware & Hudson, the New York, Susquehanna & Western and the Pennsylvania railways, and by three interurban electric lines—the Wilkes-Barré & Hazleton, connecting with Hazleton, about 20 m. S., the Wilkes-Barré & Wyoming Valley, and the Lackawanna & Wyoming Valley, connecting with Scranton about 17 m. N.E. On the opposite bank of the river (which is here spanned by two iron bridges) lies Kingston.

The city is attractively situated in the historic Wyoming Valley. The principal public buildings include the county court-house, the post office, the city hall, the county gaol and the 9th Regiment Armory. Among the city parks are Hollenback (102 acres) and Riverside (19 acres) parks, the River Common (35 acres) and the Frances Slocum Playground. In the city are the Harry Hillman Academy (non-sectarian), a secondary school for boys; the Malinckrodt Convent, the Wilkes-Barré Institute (Presbyterian), a school for girls; St Mary's Academy (Roman Catholic), for girls; the Osterhout Free Library (44,000 vols.), the Library of the Law and Library Association (10,000 vols.) and that of the Wyoming Historical and Geological Society (18,000 vols.), which was founded in 1858. Wilkes-Barré is situated in the centre of the richest anthracite coal region in the United States, Luzerne county ranking first in 1908 in the production of anthracite in Pennsylvania; and the value of the factory products increased from $8,616,765 in 1900 to $11,240,893 in 1905, or 30·5 %. Among important manufactures are foundry and machine-shop products, valued at $1,273,491 in 1905; silk and silk goods ($1,054,863); lace curtains, cotton goods, wirework, &c. The city is governed by a mayor elected for three years, and by a legislative body composed of a select council (one member from each of the 16 wards elected for four years) and of a common council (one member from each ward, elected for two years).

The township of Wilkes-Barré was one of five townships the free grant of which, in December 1768, by the Susquehanna Land Company of Connecticut was intended to encourage settlement and make good the company's claim to the Wyoming Valley (*q.v.*). In May 1769 more than 100 settlers from New England, in command of Major John Durkee (1728–1782), arrived at this place. With others who came a few days later they erected the necessary log cabins on the river bank, near the present Ross Street, and in June began to enclose these within a stockade, known as Fort Durkee. During the same summer Major Durkee gave the town its present name in honour of John Wilkes (1727–1797) and Colonel Isaac Barré (1726–1802), both stout defenders in parliament of the American colonists' cause before and during the War of Independence, and in the following year the town plat was made. In September 1769 the "First Pennamite-Yankee War," as the conflict between Connecticut and Pennsylvania for the possession of the valley is called, broke out. The Yankees lost Fort Durkee in November, but recovered it in the following February. The Pennamites erected Fort Wyoming on the river bank near the present Northampton Street in January 1771, but the Yankees took it from them in the following August. In the War of Independence, immediately after the battle of Wyoming (July 3, 1778), Wilkes-Barré was burned by the Indians and British Rangers; and again in July 1784, during the "Second Pennamite-Yankee War," twenty-three of the twenty-six buildings were burned. In 1786 the Pennsylvania legislature sent here Colonel Timothy Pickering (*q.v.*) to organize Luzerne county, and to effect a reconciliation between the Connecticut settlers and the government of Pennsylvania. Colonel John Franklin (1749–1831) led a counter movement, and was imprisoned on a charge of treason in October 1787, but Franklin's followers retaliated by kidnapping Pickering in June 1788, and kept him in the woods for nearly three weeks in a vain effort to make him promise to intercede for Franklin's pardon. Wilkes-Barré was gradually rebuilt after its destruction in 1784, and in 1806 the borough was erected, though it was not separated politically from the township until 1818 (or 1819). A new charter was granted to the borough in 1855, and Wilkes-Barré was chartered as a city in 1871.

See O. J. Harvey, *A History of Wilkes-Barré* (3 vols., Wilkes-Barré, 1909–1910).

WILKIE, SIR DAVID (1785–1841), Scottish painter, was born on the 18th of November 1785, the son of the parish minister of Cults in Fifeshire. He very early developed an extraordinary love for art. In 1799, after he had attended school at Pitlessie, Kettle and Cupar, his father reluctantly yielded to his desire to become a painter; and through the influence of the earl of Leven Wilkie was admitted to the Trustees' Academy in Edinburgh, and began the study of art under John Graham, the teacher of the school. From William Allan (afterwards Sir William Allan and president of the Royal Scottish Academy) and John Burnet, the engraver of Wilkie's works, we have an interesting account of his early studies, of his indomitable perseverance and power of close application, of his habit of haunting fairs and market-places, and transferring to his sketch-book all that struck him as characteristic and telling in figure or incident, and of his admiration for the works of Carse and David Allan, two Scottish painters of scenes from humble life. Among his pictures of this period are mentioned a subject from Macbeth, "Ceres in Search of Proserpine," and "Diana and Calisto," which in 1803 gained a premium of ten guineas at the Trustees' Academy, while his pencil portraits of himself and his mother, dated that year, and now in the possession of the duke of Buccleuch, prove that he had already attained considerable certainty of touch and power of rendering character. A scene from Allan Ramsay, and a sketch from Macneill's ballad of *Scotland's Skaith*, afterwards developed into the well-known "Village Politicians," were the first subjects in which his true artistic individuality began to assert itself.

In 1804 Wilkie returned to Cults, established himself in the manse, and began his first important subject-picture, "Pitlessie Fair," which includes about 140 figures, and in which he introduced portraits of his neighbours and of several members of his family circle. In addition to this elaborate figure-piece, Wilkie was much employed at the time upon portraits, both at home and in Kinghorn, St Andrews and Aberdeen. In the spring of 1805 he left Scotland for London, carrying with him his "Bounty-Money, or the Village Recruit," which he soon disposed of for £6, and began to study in the schools of the Royal Academy. One of his first patrons in London was Stodart, a pianoforte maker, a distant connexion of the Wilkie family, who commissioned his portrait and other works and introduced the young artist to the dowager-countess of Mansfield. This lady's son was the purchaser of the "Village Politicians," which attracted great attention when it was exhibited in the Royal Academy of 1806, where it was followed in the succeeding year by the "Blind Fiddler," a commission from the painter's lifelong friend Sir George Beaumont. Wilkie now turned aside into the paths of historical art, and painted his "Alfred in the Neatherd's Cottage," for the gallery illustrative of English history which was being formed by Alexander Davison. After its completion he returned to genre-painting, producing the "Card-Players" and the admirable picture of the "Rent Day," which was composed during recovery from a fever contracted in 1807 while on a visit to his native village. His next great work was the "Ale-House Door," afterwards entitled the "Village Festival" (now in the National Gallery), which was purchased by J. J. Angerstein for 800 guineas. It was followed in 1813 by the well-known "Blind Man's Buff," a commission from the prince regent, to which a companion picture, the "Penny Wedding," was added in 1818.

Meanwhile Wilkie's eminent success in art had been rewarded by professional honours. In November 1809 he was elected an associate of the Royal Academy, when he had hardly attained the age prescribed by its laws, and in February 1811 he became a full academician. In 1812 he opened an exhibition of his collected works in Pall Mall, but the experiment was unsuccessful, entailing pecuniary loss upon the artist. In 1814 he executed the "Letter of Introduction," one of the most delicately finished and perfect of his cabinet pictures. In the same year he made his first visit to the continent, and at Paris entered upon a profitable and delighted study of the works of art collected in the Louvre. Interesting particulars of the time are preserved in his own matter-of-fact diary, and in the more sprightly and flowing pages of the journal of Haydon, his fellow-traveller. On his return he began "Distraining for Rent," one of the most popular and dramatic of his works. In 1816 he made a tour through Holland and Belgium in company with Raimbach, the engraver of many of his paintings. The "Sir

Walter Scott and his Family," a cabinet-sized picture with small full-length figures in the dress of Scottish peasants, was the result of a visit to Abbotsford in 1818. "Reading a Will," a commission from the king of Bavaria, now in the New Pinakothek at Munich, was completed in 1820; and two years later the great picture of "Chelsea Pensioners Reading the Gazette of the Battle of Waterloo," commissioned by the duke of Wellington in 1816, at a cost of 1200 guineas, was exhibited at the Royal Academy.

In 1822 Wilkie visited Edinburgh, in order to select from the royal progress of George IV. a fitting subject for a picture. The "Reception of the King at the Entrance of Holyrood Palace" was the incident ultimately chosen; and in the following year, when the artist, upon the death of Raeburn, had been appointed royal limner for Scotland, he received sittings from the monarch, and began to work diligently upon the subject. But several years elapsed before its completion; for, like all such ceremonial works, it proved a harassing commission, uncongenial to the painter while in progress and unsatisfactory when finished. His health suffered from the strain to which he was subjected, and his condition was aggravated by heavy domestic trials and responsibilities. In 1825 he sought relief in foreign travel: after visiting Paris, he passed into Italy, where, at Rome, he received the news of fresh disasters through the failure of his publishers. A residence at Töplitz and Carlsbad was tried in 1826, with little good result, and then Wilkie returned to Italy, to Venice and Florence. The summer of 1827 was spent in Geneva, where he had sufficiently recovered to paint his "Princess Doria Washing the Pilgrims' Feet," a work which, like several small pictures executed at Rome, was strongly influenced by the Italian art by which the painter had been surrounded. In October he passed into Spain, whence he returned to England in June 1828.

It is impossible to over-estimate the influence upon Wilkie's art of these three years of foreign travel. It amounts to nothing short of a complete change of style. Up to the period of his leaving England he had been mainly influenced by the Dutch genre-painters, whose technique he had carefully studied, whose works he frequently kept beside him in his studio for reference as he painted, and whose method he applied to the rendering of those scenes of English and Scottish life of which he was so close and faithful an observer. Teniers, in particular, appears to have been his chief master; and in his earlier productions we find the sharp, precise, spirited touch, the rather subdued colouring, and the clear, silvery grey tone which distinguish this master; while in his subjects of a slightly later period—those, such as the "Chelsea Pensioners," the "Highland Whisky Still" and the "Rabbit on the Wall," executed in what Burnet styles his second manner, which, however, may be regarded as only the development and maturity of his first—he begins to unite to the qualities of Teniers that greater richness and fulness of effect which are characteristic of Ostade. But now he experienced the spell of the Italian masters, and of Velazquez and the great Spaniards.

In the works which Wilkie produced in his final period he exchanged the detailed handling, the delicate finish and the reticent hues of his earlier works for a style distinguished by breadth of touch, largeness of effect, richness of tone and full force of melting and powerful colour. His subjects, too, were no longer the homely things of the genre-painter: with his broader method he attempted the portrayal of scenes from history, suggested for the most part by the associations of his foreign travel. His change of style and change of subject were severely criticized at the time; to some extent he lost his hold upon the public, who regretted the familiar subjects and the interest and pathos of his earlier productions, and were less ready to follow him into the historic scenes towards which this final phase of his art sought to lead them. The popular verdict had in it a basis of truth: Wilkie was indeed greatest as a genre-painter. But on technical grounds his change of style was criticized with undue severity. While his later works are admittedly more frequently faulty in form and draughtsmanship than those of his earlier period, some of them at least (the "Bride's Toilet," 1837, for instance) show a true gain and development in power of handling, and in mastery over complex and forcible colour harmonies. Most of Wilkie's foreign subjects—the "Pifferari," "Princess Doria," the "Maid of Saragossa," the "Spanish Podado," a "Guerilla Council of War," the "Guerilla Taking Leave of his Family" and the "Guerilla's Return to his Family"—passed into the English royal collection; but the dramatic "Two Spanish Monks of Toledo," also entitled the "Confessor Confessing," became the property of the marquis of Lansdowne. On his return to England Wilkie completed the "Reception of the King at the Entrance of Holyrood Palace,"—a curious example of a union of his earlier and later styles, a "mixture" which was very justly pronounced by Haydon to be "like oil and water." His "Preaching of John Knox before the Lords of the Congregation" had also been begun before he left for abroad; but it was painted throughout in the later style, and consequently presents a more satisfactory unity and harmony of treatment and handling. It was one of the most successful pictures of the artist's later period.

In the beginning of 1830 Wilkie was appointed to succeed Sir T. Lawrence as painter in ordinary to the king, and in 1836 he received the honour of knighthood. The main figure-pictures which occupied him until the end were "Columbus in the Convent at La Rabida" (1835); "Napoleon and Pius VII. at Fontainebleau" (1836); "Sir David Baird Discovering the Body of Tippoo Sahib" (1838); the "Empress Josephine and the Fortune-Teller" (1838); and "Queen Victoria Presiding at her First Council" (1838). His time was also much occupied with portraiture, many of his works of this class being royal commissions. His portraits are pictorial and excellent in general distribution, but the faces are frequently wanting in drawing and character. He seldom succeeded in showing his sitters at their best, and his female portraits, in particular, rarely gave satisfaction. A favourable example of his cabinet-sized portraits is that of Sir Robert Liston; his likeness of W. Esdaile is an admirable three-quarter length; and one of his finest full-lengths is the gallery portrait of Lord Kellie, in the town hall of Cupar.

In the autumn of 1840 Wilkie resolved on a voyage to the East. Passing through Holland and Germany, he reached Constantinople, where, while detained by the war in Syria, he painted a portrait of the young sultan. He then sailed for Smyrna and travelled to Jerusalem, where he remained for some five busy weeks. The last work of all upon which he was engaged was a portrait of Mehemet Ali, done at Alexandria. On his return voyage he suffered from an attack of illness at Malta, and died at sea off Gibraltar on the morning of the 1st of June 1841. His body was consigned to the deep in the Bay of Gibraltar.

An elaborate *Life of Sir David Wilkie*, by Allan Cunningham, containing the painter's journals and his observant and well-considered "Critical Remarks on Works of Art," was published in 1843. Redgrave's *Century of Painters of the English School* and John Burnet's *Practical Essays on the Fine Arts* may also be referred to for a critical estimate of his works. A list of the exceptionally numerous and excellent engravings from his pictures will be found in the *Art Union Journal* for January 1840. Apart from his skill as a painter Wilkie was an admirable etcher. The best of his plates, such as the "Gentleman at his Desk" (Laing, VII.), the "Pope examining a Censer" (Laing, VIII.), and the "Seat of Hands" (Laing, IV.), are worthy to rank with the work of the greatest figure-etchers. During his lifetime he issued a portfolio of seven plates, and in 1875 Dr David Laing catalogued and published the complete series of his etchings and dry-points, supplying the place of a few copper-plates that had been lost by reproductions, in his *Etchings of David Wilkie and Andrew Geddes*. (J. M. G.)

WILKINS, SIR CHARLES (1749?–1836), English Orientalist, was born at Frome, Somersetshire, probably in 1749, and in 1770 he went to India as a writer in the East India Company's service. He was soon attracted to the study of Oriental languages, particularly Sanskrit, and did an important work towards facilitating such study by founding a printing press for these languages, taking a large personal share in the practical work of preparing the type. He returned to England in 1786, but continued his study of Sanskrit, and he afterwards became librarian to the East India Company, and examiner at Haileybury on the establishment of the college there in 1805. Wilkins was knighted in 1833 in recognition of his services to Oriental scholarship, and he died in London in 1836. He was a pioneer in the department of learning with which his name was associated, being the first Englishman to acquire mastery of Sanskrit, and to make a thorough study of Indian inscriptions in that script. He compiled a Sanskrit grammar and published several translations from the sacred books of the East, besides preparing a new edition of Richardson's Persian and Arabic dictionary, and a catalogue of the manuscripts collected by Sir William Jones, who acknowledged his indebtedness to Wilkins, and whom the latter assisted in founding the Asiatic Society of Bengal.

WILKINS, GEORGE (fl. 1607), English playwright and pamphleteer, is first mentioned as the author of a pamphlet on the *Three Miseries of Barbary*, which probably dates from 1604. He was associated with the King's Men, and was thus a colleague of Shakespeare. He was chiefly employed in remodelling old plays. He collaborated in 1607 with William Rowley and John Day in *The Travailes of the Three English Brothers*. In the same year a play was produced which was apparently entirely Wilkins's work. It is *The Miseries of Inforst Mariage*, and treats the story of Walter Calverley, whose identity is thinly veiled under the name of "Scarborough." This man had killed his two children and had attempted to murder his wife. The play had originally a tragic ending, but as played in 1607 ended in comedy, and the story stopped short before the catastrophe, perhaps because of objections raised by Mrs Calverley's family, the Cobhams. The crime itself is dealt with in *A Yorkshire Tragedy*, which was originally performed with three other plays under the title of *All's One*. It was entered on the Stationers' Register in 1608 as "written by William Shakespeare," published with the same ascription in that year, and reprinted in 1619 without contradiction of the statement. Mr Sidney Lee assigns to George Wilkins a share in Shakespeare's *Pericles* and possibly in *Timon of Athens*. Delius conjectured that Wilkins was the original author of *Pericles* and that Shakespeare remodelled it. However that may be, Wilkins published in 1608 a novel entitled *The Painfull Adventures of Pericles, Prynce of Tyre, being the true history of Pericles as it was lately presented by . . . John Gower*, which sometimes follows the play very closely.

Mr Fleay (*Biog. Chron. of the Drama*) says that the external evidence for the Shakespearian authorship of the *Yorkshire Tragedy* cannot be impugned, and in the absence of other authorship cannot be lightly set aside, but he does not abandon the hope of establishing a contrary opinion. Both Mr Fleay and Professor A. W. Ward (*Eng. Dram. Lit.* ii. p. 182) seem to think that the story of Marina in *Pericles* was a complete original play by Shakespeare, and that the remodelling story should be reversed, *i.e.* that *Pericles* is a Shakespearian play remodelled by a playwright, possibly Wilkins. Mr Lee (*Dict. Nat. Biog.*, Art. "Wilkins") says the *Yorkshire Tragedy* was "fraudulently" assigned to Shakespeare by Thomas Pavier, the publisher.

WILKINS, JOHN (1614–1672), bishop of Chester, was born at Fawsley, Northamptonshire, and educated at Magdalen Hall, Oxford. He was ordained and became vicar of Fawsley in 1637, but soon resigned and became chaplain successively to Lord Saye and Sele, Lord Berkeley, and Prince Charles Louis, nephew of Charles I. and afterwards elector palatine of the Rhine. In 1648 he became warden of Wadham College, Oxford. Under him the college was extraordinarily prosperous, for, although a supporter of Cromwell, he was in touch with the most cultured royalists, who placed their sons in his charge. In 1659 Richard Cromwell appointed him master of Trinity College, Cambridge. At the Restoration in 1660 he was deprived, but appointed prebendary of York and rector of Cranford, Middlesex. In 1661 he was preacher at Gray's Inn, and in 1662 vicar of St Lawrence Jewry, London. He became vicar of Polebrook, Northamptonshire, in 1666, prebendary of Exeter in 1667, and in the following year prebendary of St Paul's and bishop of Chester. Possessing strong scientific tastes, he was the chief founder of the Royal Society and its first secretary. He died in London on the 19th of November 1672.

The chief of his numerous works is an *Essay towards a Real Character and a Philosophical Language* (London, 1668), in which he expounds a new universal language for the use of philosophers. He is remembered also for a curious work entitled *The Discovery of a World in the Moon* (1638, 3rd ed., with an appendix "The possibility of a passage thither," 1640). Other works are *A Discourse concerning a New Planet* (1640); *Mercury, or the Secret and Swift Messenger* (1641), a work of some ingenuity on the means of rapid correspondence; and *Mathematical Magick* (1648).

See P. A. Wright Henderson, *The Life and Times of John Wilkins* (1910), and also the article AERONAUTICS.

WILKINS, MARY ELEANOR (1862–), American novelist, was born in Randolph, Massachusetts, on the 7th of January 1862, of Puritan ancestry. Her early education, chiefly from reading and observation, was supplemented by a course at Mount Holyoke Seminary, South Hadley, Mass. Her home was in her native village and in Brattleboro, Vermont, until her marriage in 1902 to Dr Charles M. Freeman of Metuchen, New Jersey. She contributed poems and stories to children's magazines, and published several books for children, including *Young Lucretia and other Stories* (1892), *The Pot of Gold and other Stories* (1892), and *Once upon a Time and other Child Verses* (1897). For older readers she wrote the following volumes of short stories: *A Humble Romance and other Stories* (1887), *A New England Nun and other Stories* (1891), *Silence and other Stories* (1898), three books which gave her a prominent place among American short-story writers; *The People of Our Neighborhood* (1898), *The Love of Parson Lord and other Stories* (1900), *Understudies* (1901) and *The Givers* (1904); the novels *Jane Field* (1892), *Pembroke* (1894), *Madelon* (1896), *Jerome, a Poor Man* (1897), *The Jamesons* (1899), *The Portion of Labor* (1901) and *The Debtor* (1905); and *Giles Corey, Yeoman* (1893), a prose tragedy founded on incidents from New England history. Her longer novels, though successful in the portrayal of character, lack something of the unity, suggestiveness and charm of her short stories, which are notable contributions to modern American literature. She deals usually with a few traits peculiar to the village and country life of New England, and she gave literary permanence to certain characteristics of New England life which are fast disappearing.

WILKINSBURG, a borough of Allegheny county, Pennsylvania, U.S.A., immediately E. of Pittsburg, of which it is a residential suburb. Pop. (1890) 4662; (1900) 11,886, of whom 1336 were foreign-born and 275 were negroes; (1910 census) 18,924. Wilkinsburg is served by the Pennsylvania railway and by interurban electric lines. It is a post-station of Pittsburg. In the borough are a Home for Aged Protestants (1882), the United Presbyterian Home for the Aged (1879), and Columbia hospital (1908). Settled in 1798 and known first as McNairville and then as Rippeyville, the place was renamed about 1840 in honour of William Wilkins (1779–1865), a member of the United States Senate in 1831–1834, minister to Russia in 1834–1835, a representative in Congress in 1843–1844, and secretary of war in President John Tyler's cabinet in 1844–1845. In 1887 Wilkinsburg was incorporated as a borough.

WILKINSON, JAMES (1757–1825), American soldier and adventurer, was born in Calvert county, Maryland, in 1757. At the outbreak of the War of Independence he abandoned the study of medicine to enter the American army, and he served with General Benedict Arnold in the Quebec campaign and was later under General Horatio Gates, acting from May 1777 to March 1778 as adjutant-general of the Northern Department. He was sent to Congress to report Gates's success against Burgoyne, but his tardiness secured for him a sarcastic reception. Gates recommended him for a brigadier-general's commission for services which another actually performed, and succeeded in gaining it, but their friendship was broken by the collapse of the Conway Cabal against Washington in which both were implicated and about which Wilkinson had indiscreetly blabbed. Wilkinson then resigned (March 1778) his newly-acquired commission, but later re-entered the service in the quartermaster-general's department, and was clothier-general from July 1779 to March 1781.

In common with many other army officers Wilkinson now turned toward the West, and in 1784 settled near the Falls of the Ohio (Louisville), where he speedily became a prominent merchant and farmer and a man of considerable influence. He began to take an active part in the movement for separate statehood for Kentucky, and in 1787 he entered into an irregular commercial agreement with the Spanish officials of Louisiana. At this time, as his own papers in the Spanish archives show, he took an oath of allegiance to Spain and began to intrigue with his fellow-Kentuckians to detach the western settlements from the Union and bring them under the influence of the Louisiana authorities. His commercial connections at New Orleans enabled him to hold out the lure of a ready market at that port for Kentucky products, and this added greatly to the strength of the separatist movement. He neutralized the intrigues of certain British agents who were then working in Kentucky. For these various services he received until 1800 a substantial pension from the Spanish authorities, being officially known in their correspondence as "Number Thirteen." At the same time he worked actively against the Spanish authorities, especially through Philip Nolan. Wilkinson's ventures were not as lucrative as he hoped for, and in October 1791 he was given a lieut.-colonel's commission in the regular army, possibly, as a contemporary suggested, to keep him out of mischief. During this year he took an active part in the minor campaigns which preceded General Arthur St Clair's disastrous defeat by the Indians. As brigadier-general (from March 1792) and second in command, he served under General Anthony Wayne in the latter's successful campaign of 1794 against the Indians, and in this campaign he seems to have tried to arouse discontent against his superior among the Kentucky troops, and to have intrigued to supplant him upon the reduction of the army. Upon Wayne's death in 1796, Wilkinson became general in command of the regular army, retaining his rank as brigadier and likewise his Spanish pension. He seems to have tried to stir up both the Indians and the Spaniards to prevent the survey of the southern boundary of the United States in 1797 and 1798, and succeeded in delaying Commissioner Andrew Ellicott for several months in this important task. At the same time his protégé, the filibusterer, Philip Nolan, was engaged in a reconnaissance for him west of the Mississippi. In 1803 Wilkinson was one of the commissioners to receive Louisiana from France, and in 1805 became governor of that portion of the Purchase above the 33rd parallel, with headquarters at St Louis. In his double capacity as governor of the Territory and commanding officer of the army, reasonably certain of his hold on Jefferson, and favourably situated upon the frontier remote from the centre of government, he attempted to realize his ambition to conquer the Mexican provinces of Spain. For this purpose in 1805 he entered into some sort of agreement with Aaron Burr, and in 1806 sent Z. M. Pike to explore the most favourable route for the conquest of the south-west. Before his agent returned, however, he had betrayed his colleague's plans to Jefferson, formed the Neutral Ground Agreement with the Spanish commander of the Texas frontier, placed New Orleans under martial law, and apprehended Burr and some of his alleged accomplices. In the ensuing trial at Richmond the prisoners were released for lack of sufficient evidence to convict, and Wilkinson himself emerged with a much damaged reputation. He was then subjected to a series of courts-martial and congressional investigations, but succeeded so well in hiding traces of his duplicity that in 1812 he resumed his military command at New Orleans, and in 1813 was promoted major-general and took possession of Mobile. Later in this year he made a most miserable fiasco of the campaign against Montreal, and this finally brought his military career to a dishonourable end. For a time he lived upon his plantation near New Orleans, but later appeared in Mexico City as an applicant for a land grant, incidentally acting as agent for the American Bible Society. Here on the 28th of December 1825 he succumbed to the combined effects of climate and of opium.

See Wilkinson's *Memoirs of My Own Time* (Philadelphia, 1816); untrustworthy and to be used with caution; W. R. Shepherd, "Wilkinson and the Beginning of the Spanish Conspiracy" in *American Historical Review*, vol. ix. (New York, 1904). (I. J. C.)

WILKINSON, JAMES JOHN GARTH (1812–1899), Swedenborgian writer, the son of James John Wilkinson (died 1845), a writer on mercantile law and judge of the County Palatine of Durham, was born in London on the 3rd of June 1812. He studied medicine, and set up as a homoeopathic doctor in Wimpole Street in 1834. He was early attracted by the works of William Blake, whose *Songs of Experience* he endeavoured to interpret, and of Swedenborg, to the elucidation of whose writings he devoted the best energies of his life. Between 1840 and 1850 he edited Swedenborg's treatises on *The Doctrine of Charity*, *The Animal Kingdom*, *Outlines of a Philosophic Argument on the Infinite*, and *Hieroglyphic Key to Natural and Spiritual Mysteries*. Wilkinson's preliminary discourses to these translations and his criticisms of Coleridge's comments upon Swedenborg displayed a striking aptitude not only for mystical research, but also for original philosophic debate. The vigour of his thought won admiration from Henry James (father of the novelist) and from Emerson, through whom he became known to Carlyle and Froude; and his speculation further attracted Tennyson, the Oliphants and Edward Maitland. He wrote an able sketch of Swedenborg for the *Penny Cyclopaedia*, and a standard biography, *Emanuel Swedenborg* (published in 1849); but interest in this subject far from exhausted his intellectual energy, which was, indeed, multiform. He was a traveller, a linguist, well versed in Scandinavian literature and philology, the author of mystical poems entitled *Improvisations from the Spirit* (1857), a social and medical reformer, and a convinced opponent of vivisection and also of vaccination. He died at Finchley Road, South Hampstead, where he had resided for nearly fifty years, on 18th October 1899. He is commemorated by a bust and portrait in the rooms of the Swedenborgian Society in Bloomsbury Street, London.

WILKINSON, JOHN (1728–1808), "the great Staffordshire iron-master," was born in 1728 at Clifton, Cumberland, where his father had risen from day labourer to be overlooker in an iron furnace. A box-iron, patented by his father, but said to have been invented by the son, helping laundresses to gratify the frilled taste of the dandies of the day, was the beginning of their fortunes. This they made at Blackbarrow, near Furness. When he was about twenty, John moved to Staffordshire, and built, at Bilston, the first furnace there, and, after many experiments, succeeded in utilizing coal instead of wood-charcoal in puddling and smelting. The father, who now had works at Bersham, near Chester, was again joined by his son, who constructed a new boring machine, of an accuracy heretofore unequalled. James Watt found that the work of this machine exactly filled his requirements for his "fire-engine" for cylinders bored with greater precision. Wilkinson, who now owned the Bersham works, resolved to start the manufacture of wrought iron at Broseley on a larger scale, and the first engine made by Boulton and Watt was for him to blow the bellows there. Heretofore bellows were worked by a water wheel or, when power failed, by horses. His neighbours in the business, who were contemplating installing Newcomen engines, waited to see how his would turn out. Great care was taken in all its parts, and Watt himself set it up early in 1776. Its success made the reputation of Boulton and Watt in the Midland counties. Wilkinson now found he had the power alike for the nicest and the most stupendous operations. The steam cylinder suggested to him the plan of producing blast now in use. He was near coal; he surrounded himself with capable men, whom he fully trusted; he made a good article, and soon obtained large orders and prospered. In 1786 he was making 32-pounders, howitzers, swivels, mortars and shells for government. The difficulty of getting barges to carry his war material down the Severn led him, in 1787, to construct the first iron barge—creating a wonderful sensation among owners and builders. Wilkinson taught the French the art of boring cannon from the solid, and cast all the tubes, cylinders and iron work required for the Paris water-works, the most formidable undertaking of the day. He also erected the first steam engine in France, in connexion with these works.

Wilkinson is said to have anticipated by many years the introduction of the hot blast for furnaces, but the leathern pipes, then used, scorched, and it was not a success. His were the first coal-cutting machines. He proposed and cast the first iron bridge. It connected Broseley and Madeley, across the Severn, and its span of 100 ft. 6 in. was considered a triumphal wonder. Wilkinson was now a man of great means and greater influence. He issued tokens of copper, bearing his likeness and on the reverse a forge and tools of the trade, silver coins for 3s. 6d., and also pound notes, as other tradesmen of that day did. He never wrote a letter without using the word iron, indeed he was iron-mad, and provided by will that he should be buried in an iron coffin, preferably in his garden at Castle Head, near Lindal. He died on the 14th of July 1808.

Wilkinson was twice married without issue. His very large property was frittered away during a lawsuit brought by a nephew against the illegitimate children whom he had named as his heirs. It was carried from various courts in the kingdom to the House of Lords and then to the Court of Chancery. Here Lord Eldon decided for the defendants, thus reversing all previous decisions taken upon the law of the case.

WILKINSON, SIR JOHN GARDNER (1797–1875), English traveller and Egyptologist, was born on the 5th of October 1797, the son of the Rev. John Wilkinson, a well-known student of antiquarian subjects. Having inherited a sufficient income from his parents, who died when he was young, he was sent by his guardian to Harrow in 1813, and to Exeter College, Oxford, in 1816. He took no degree, and, suffering from ill-health, went to Italy, where he met Sir William Gell, and resolved to study Egyptology. Between 1821 and 1833 he travelled widely in the Nile Valley and began to publish the results. He returned to England in 1833 for the sake of his health, was elected fellow of the Royal Society in 1834, published *The Topography of Thebes and General Survey of Egypt* (1835) and *Manners and Customs of the Ancient Egyptians* (3 vols., 1837), and on the 26th of August 1839 was knighted by the Melbourne ministry. In 1842 he returned to Egypt and contributed to the *Journal* of the Geographical Society an article entitled "Survey of the Valley of the Natron Lakes." This appeared in 1843, in which year he also published an enlarged edition of his *Topography*, entitled *Moslem Egypt and Thebes*, a work afterwards reissued in Murray's series. During 1844 he travelled in Montenegro, Bosnia and Herzegovina, an account of his observations being published in 1848 (*Dalmatia and Montenegro*, 2 vols.). A third visit to Egypt in 1848–1849 resulted in a further article in the *Journal*, "On the Country between Wady Halfah and Jebel Berkel" (1851); in 1855 he again visited Thebes. Subsequently he investigated Cornish antiquities, and studied zoology. He died at Llandovery on the 29th of October 1875. To his old school, Harrow, he had already in 1864 presented his collections with an elaborate catalogue.

Besides the works mentioned he published *Materia Hieroglyphica* (Malta, 1828); *Extracts from several Hieroglyphical Subjects* (1830); *Topographical Survey of Thebes* (1830); facsimile of the Turin papyrus (1851), previously edited without the writing on the back of the papyrus by Lepsius; *Architecture of Ancient Egypt* (1850); *A Popular Account of the Ancient Egyptians* (1854); important notes in Rawlinson's *Herodotus*; *Colour and Taste* (1858); articles in archaeological and scientific periodicals.

WILKINSON, TATE (1739–1803), English actor and manager, was born on the 27th of October 1739, the son of a clergyman. His first attempts at acting were badly received, and it was to his wonderful gift of mimicry that he owed his success. His imitations, however, naturally gave offence to the important actors and managers whose peculiarities he hit off to the life. Garrick, Peg Woffington, Samuel Foote and Sheridan, after being delighted with the imitations of the others, were among the most angry, when it came to their turn, and threatened never to forgive him. Garrick never did. As an actor, Wilkinson was most successful in Foote's plays, but his list of parts was a long one. In Shakespearian characters he was very popular in the provinces. In 1766 he became a partner of Joseph Baker in the management of several Yorkshire theatres, and sole manager after his partner's death in 1770 of these and others. In this capacity he was both liberal and successful. He died on the 16th of November 1803.

See his *Memoirs* (4 vols., 1790) and *The Wandering Patentee* (4 vols., 1795).

WILL, in philosophy. The "Problem of Freedom" provides in reality a common title under which are grouped difficulties and questions of varying and divergent interest and character. These difficulties arise quite naturally from the obligation, which metaphysicians, theologians, moral philosophers, men of science, and psychologists alike recognize, to give an account, consistent with their theories, of the relation of man's power of deliberate and purposive activity to the rest of the universe. In the main, no doubt, the problem is a metaphysical problem, and has its origin in the effort to reconcile that belief in man's freedom which is regarded by the unsophisticated moral consciousness as indisputable, with a belief in a universe governed by rational and necessary laws. But the historical origin of the questions at issue is to be sought rather in theology than in metaphysics, while the discovery made from time to time by men of science of the inapplicability of natural laws or modes of operation (which they have been accustomed to regard as of universal range and necessity) to the facts or assumed facts of human activity, is a constant source of fresh discussions of the problem. Similarly the modern attempt upon the part of psychology to analyse (under whatever limitations and with whatever object of inquiry) all the forms and processes of human consciousness has inevitably led to an examination of the consciousness of human freedom: while the postulate of most modern psychologists that conscious processes are not to be considered as removed from the sphere of those necessary causal sequences with which science deals, produces, if the consciousness of freedom be admitted as a fact of mental history, the old metaphysical difficulty in a new and highly specialized form.

There is some ground nevertheless for maintaining, contrary to much modern opinion, that the controversy is fundamentally and in the main a moral controversy. It is true that the precise relation between the activities of human wills and other forms of activity in the natural world is a highly speculative problem and one with which the ordinary man is not immediately concerned. It is true also that the ordinary moral consciousness accepts without hesitation the postulate of freedom, and is unaware of, or imperfectly acquainted with, the speculative difficulties that surround its possibility. Moreover, much work of the highest importance in ethics in modern as well as ancient times has been completed with but scanty, if any, reference to the subject of the freedom of the will, or upon a metaphysical basis compatible with most of the doctrines of both the rival theories. The determinist equally with the libertarian moral philosopher can give an account of morality possessing internal coherence and a certain degree of verisimilitude. Yet it may be doubted (1) whether the problem would ever have arisen at all except for the necessity of reconciling the theological and metaphysical hypotheses of the omniscience and omnipotence of God with the needs of a moral universe: and (2) whether it would retain its perennial interest if the incursions of modern scientific and psychological inquiry into the domain of human consciousness did not appear to come into conflict from time to time with the presuppositions of morality. The arguments proceeding from either of the disputants by means of which the controversy is debated may be largely or almost wholly speculative and philosophical. But that which produces the rival arguments is primarily a moral need. And there are not wanting signs of a revival in recent years of the earlier tendency of philosophical speculation to subordinate the necessities of metaphysical, scientific and even psychological inquiries to the prima facie demands of the moral consciousness.

There is no trace of the emergence of the problem of freedom

Greek philosophers.

in any intelligible or distinct form in the minds of early Greek physicists or philosophers. Their doctrines were mainly based upon a belief in the government of the universe by some form of physical necessity, and though different opinions might prevail as to the mode of operation of the various forms of physical necessity the occasional recognition of non-material contributory causes never amounted to a recognition of the independence of human volition or intelligence. Nor can it be seriously maintained that the problem of freedom in the form in which it is presented to the modern mind ever became the subject of debate in the philosophy of Socrates, Plato or Aristotle. It is true that Socrates brought into prominence the moral importance of rational and intelligent conduct as opposed to action which is the result of unintelligent caprice. Moral conduct was, according to Socrates, the result of knowledge while it is strictly impossible to do wrong knowingly. Vice, therefore, is the result of ignorance and to this extent Socrates is a determinist. But the subsequent speculations of Aristotle upon the extent to which ignorance invalidates responsibility, though they seem to assume man's immediate consciousness of freedom, do not in reality amount to very much more than an analysis of the conditions ordinarily held sufficient to constitute voluntary or involuntary action. The further question whether the voluntary acts for which a man is ordinarily held responsible are really the outcome of his freedom of choice, is barely touched upon, and most of the problems which surround the attempt to distinguish human agency from natural and necessary causation and caprice or chance are left unsolved. For Aristotle remained content with a successful demonstration of the dependence of "voluntariness" as an attribute of conduct upon knowledge and human personality. And though ultimately the attribution of responsibility for conduct is further limited to actions which are the result of purposive choice (*προαίρεσις*), Aristotle appears to waver between a view which regards *προαίρεσις* as involving an ultimate choice between divergent ends of moral action and one which would make it consist in the choice of means to an end already determined. A similar absence of discussion of the main problem at issue is noticeable in Plato. It is true that in a famous passage in the tenth book of the *Republic* (x. 617 ff.) he seems to make human souls responsible through their power of choice for the destinies which they meet with during their respective lives. But, as with Socrates, their power of making a right choice is limited by their degree of knowledge or of ignorance, and the vexed question of the relation of this determining intelligence to the human will is left unsolved. With the Stoic and Epicurean philosophies the problem as it shapes itself for the consideration of the modern world begins to appear in clearer outlines. Stoic loyalty to a belief in responsibility based on freedom of choice appeared difficult to reconcile with a belief in an all-pervading *Anima Mundi*, a world power directing and controlling actions of every kind. And though the Stoic doctrine of determinism did not, when applied to moral problems, advance much beyond the reiteration of arguments derived from the universal validity of the principles of causality, nor the Epicurean counter-assertion of freedom avoid the error of regarding chance as a real cause and universal contingency as an explanation of the universe, it was nevertheless a real step forward to perceive the existence of the problem. Moreover, the argument by means of which Chrysippus endeavoured to prove the compatibility of determinism with ethical responsibility is in some respects an anticipation of modern views. For the distinction between main and contributory causes of conduct (*causae adjuvantes* and *causae principales*—the *αἴτιον* and *ξυναίτιον* of Platonic and Aristotelian philosophy) preserved the possibility of regarding character, the main cause, as the responsible and accountable element in morality. And there is much that is anticipatory of modern libertarian views in the psychological argument by which Carneades attempted at once to avoid the Epicurean identification of will with chance, and to prove the rationality of choice, undetermined by any external or antecedent necessity, as an explanation of human actions (cf. Janet and Séailles, *Hist. of Problems of Philosophy—Psychology*, p. 324).

Christianity.

It was not until the rise of Christianity as an historical religion that the difficulty of reconciling a belief in human freedom with a belief in the Divine government of the world became apparent to its fullest extent. The Christian doctrine of the Creation at once challenged the pantheistic presuppositions of Hellenic thought and reinforced the belief already existing in will as a real cause. At the same time the dualism involved in the simultaneous acceptance of an optimistic account of the origin and nature of the universe (such as is implied in Christian theology) and a belief in the reality of moral evil witnessed to by the Christian doctrine of Redemption, intensified the difficulties already felt concerning man's responsibility and God's omnipotence. Neoplatonic philosophy had been in the main content either to formulate the contradiction or to deny the reality of one of the opposing terms. And traces of Neoplatonic influence, more especially as regards their doctrine of the unreality of the material and sensible world, are to be found everywhere in the Christian philosophers of Alexandria, preventing or impeding their formulation of the problem of freedom in its full scope and urgency. St Augustine was, perhaps, the first thinker to face, though not to solve, the true theological and moral difficulty inherent in Christian thought. Two lines of thought are to be traced in the most implacable hostility and contradiction throughout his system. On the one hand no thinker reiterates or emphasizes more cogently the reality of individual responsibility and of will. He affirms the priority of will to knowledge and the dependence of consciousness upon physical attention. He asserts also the fact that our human power of receiving divine illumination (*i.e.* a capacity of spiritual insight in no sense dependent upon the creative activity of the intellect) is conditioned by our spontaneous acts of faith. And he finds in the existence of divine foreknowledge no argument for the impotence or determined character of human acts of will. The timeless foreknowledge of the Deity foresees human actions as contingent, not as causally determined. But when Augustine is concerned to reconcile the reality of individual freedom with humanity's universal need of redemption and with the absolute voluntariness of Divine Grace, he is constrained to contradict most of those postulates of which in his advocacy of libertarianism he was an eager champion. He limits the possession of freedom to Adam, the first man, who, by abusing his prerogative, has corrupted the human race. Man as he now is cannot do otherwise than evil. Inherited incapacity for the choice of good is the punishment for Adam's misuse of freedom. The possibility of redemption depends upon the bestowal of Divine Grace, which, because it is in no instance deserved, can be awarded or withdrawn without injustice. And because Adam's choice necessitates punishment it follows that in some instances Divine Grace can never be bestowed. Hence arises in Augustine's system the doctrine of Predestination (*q.v.*). From the theological standpoint every individual is predestined either by his natural birthright to evil or by Divine Grace to good, and the absolute foreknowledge and omnipotence of God excludes even the possibility of any initiative on the part of the individual by means of which he might influence God's timeless choice.

Scholasticism.

The medieval treatment of the problem follows in the main Augustinian or Aristotelian traditional lines of thought, though successive thinkers arrive at very diverse conclusions. Thomas Aquinas, for example, develops the Platonic argument which proves the dependence of the will upon the intellect and makes the identification of morality with knowledge. Freedom exists for Thomas, if it exists at all, only as the power of choosing what is necessarily determined by the intellect to be choiceworthy, the various possibilities of choice being themselves presented by the understanding to the will. And though in a certain sense Divine foreknowledge is compatible upon his view with human freedom, the freedom with which men act is itself the product of Divine determination. Man is predetermined to act freely, and Divine foreknowledge foresees human actions as contingent. Duns Scotus on the other hand is the great champion of indeterminism. Upon his view the intellect must always be subordinate to the will, and to the will belongs the power of complete self-determination. Morality in effect—to such an extreme position is he driven in his opposition to the Thomists—becomes the arbitrary creation of the Divine Will and in no sense depends for its authority upon rational principles or is a form of knowledge.

Hobbes and Descartes.

Spinoza and Leibnitz.

The modern treatment of the problem from Descartes, Hobbes, Spinoza and Leibnitz down to Kant is too much inwoven into the metaphysical systems of individual great philosophers to afford the possibility of detailed treatment in the present article. Reference should be made either to the individual philosophers themselves or to articles on metaphysics or on ethics. Hobbes is the great exponent of materialistic determinism. Ideals and volitions are upon his view ultimately movements of the brain. Will is identified with appetite or fear, the causes of which are to be found only in the external world. Descartes advocates a kind of freedom which is apparently consistent with forms both of determinism and indeterminism. He explains the possibility of error on the ground that the mind possesses the *liberum arbitrium indifferentiae* and can always refuse to affirm the truth of a conclusion drawn from premises which are not self-evident. And even when the presentations before the mind are so clear that assent to their truth cannot be refused, the possibility of assenting still rests with the will, which can refuse to attend to any presentation, or can refuse assent with the sole motive of proving its freedom. Spinoza is a convinced determinist regarding the will as necessarily determined by ideas. Extension, *i.e.* the spatial world, and the world of consciousness are alike attributes of the one substance which can only be called free in the sense of being determined by nothing but itself. Freedom in the moral sphere consists simply in the control of the passions by reason. Leibnitz retains this attenuated belief in moral freedom and combines with it a belief in the spontaneity of moral agents in the sense that they possess the power of acting and need no other principle of action save the laws of their own natures. But inasmuch as the agreement between the acts of Leibnitz's monads is due to a divine pre-established harmony, and the theoretical contingency which in the abstract, *i.e.* as logically possible, can be predicated of their acts, is in practice non-existent, Leibnitz is in effect a determinist.

Locke and Hume.

Locke's treatment of the problem is in some respects more interesting than the theories of other English philosophers of his school. Freedom, according to Locke, belongs to the man, not to the will. If we will at all we are to that extent free, *i.e.* our actions express our purposes. If, on the other hand, we press Leibnitz's objection, *i.e.* that such an argument is no answer to the question whether an act of will can be free in the sense that it is not determined by reasons presented by the understanding, Locke replies that the will is in effect determined by the uneasiness of desire, *i.e.* by the desire to avoid pain. Hume's doctrine follows logically from his theory as to the nature of causality. If our belief in necessary connexion in the physical world is in reality an illusion, it follows that the opposition between freedom and necessity will be illusory also. On the other hand if our belief in the necessity of causal connexion is the result of custom, to custom will be due also the belief in a necessity governing human actions observable everywhere in men's ordinary opinions and practice. Contrasted with this belief in necessity the supposition we have of freedom is illusory, and, if extended so as to involve a belief that men's actions do not proceed from character or habitual disposition, immoral.

Kant.

Kant's theory of freedom is, perhaps, the most characteristic doctrine of his system of ethics. Distinguishing between two worlds, the sensuous and the intelligible, the phenomenal and the noumenal, Kant allows no freedom to the natural will determined by the succession of motives, desires and appetites which form the empirical and sensuous self. But in contrast with the phenomenal world governed by empirical laws Kant sets the noumenal and intelligible world in which by a timeless act of will man is free to accept the moral command of an unconditional imperative for no reason other than its own rational necessity as the deliverance of his highest nature. The difficulties of the Kantian system are mainly to be looked for in his account of the relation between the phenomenal and noumenal world.

Modern materialism.

In more recent times the controversy has been concerned either with the attempted proof of determinism by the advocates of psychological Hedonism, an attempt which at the present time is generally admitted to have failed; or with the new biological knowledge concerning the influence of heredity and environment in its bearing upon the development of character and the possibility of freedom. The great advance of biological knowledge in recent times though it has in no sense created a new problem (men have always been aware of the importance of racial or hereditary physical qualities in their influence upon human conduct) has certainly rendered the existence of complete individual freedom (in the sense in which it was advocated by older libertarians) in the highest degree unlikely. The advocates of freedom are content in the present day to postulate a relative power of influencing conduct, *e.g.* a power of controlling inherited temperament or subduing natural passion. Such a relative freedom, indeed, taking into account the admitted inviolability of natural laws, was from the very beginning all that they could claim.

But it was inevitable that the enormous advances made by the physical and other sciences in modern times should bring with them a reasoned attempt to bring the phenomena of consciousness within the sphere controlled by physical laws and natural necessity. There will never perhaps in any period of the world's history be wanting advocates of materialism, who find in the sensible the only reality. But the materialism of modern times is more subtle than that of Hobbes. And the determinism of modern science no longer consists in a crude denial of the reality of conscious processes, or an attempt to explain them as only a sublimated form of matter and its movements; it is content to admit the relative independence of the world of consciousness, while it maintains that laws and hypotheses sufficient to explain material processes may be extended to and will be discovered to be valid of the changing sequences of conscious states of mind. Moreover, much of the apparent cogency of modern scientific determinist arguments has been derived from the unguarded admissions or timorous acquiescence of their opponents. It is not enough merely to repel the incursions of physiological science, armed with hypotheses and theories valid enough in their own sphere, upon the domain of consciousness. If the attack is to be finally repulsed it will be imperatively necessary for the libertarian to maintain that no full explanation of the physical universe can ever gain assent which does not take account of the reality and influence within the material world of human power of initiative and freedom. Of this necessity there is a growing consciousness in recent years, and no more notable exposition of it has been published than is contained in James Ward's *Naturalism and Agnosticism.* Nor is there any lack of evidence of a growing dissatisfaction on the part of many physiologists with the complacent assumption that the methods of physical science, and particularly the conception of causal activity common to the sciences which study inorganic nature, can be transferred without further criticism to the examination of life and mind. Meanwhile the scientific onslaught upon the libertarian position has been directed from two chief quarters It has been maintained, on the one hand, that any theory which presupposes a direct correspondence between the molecular movements of the brain, and the states of consciousness which accompany them must make the freedom of the will impossible. On the other hand it is asserted that quite apart from any particular view as to the relation between mind and body the existence of the freedom of the will is necessarily incompatible with the principle of the conservation of energy and is therefore in direct contradiction to many if not most of the assured conclusions of the physical sciences.

As regards the first of these two main contentions, it must suffice here to point out the main difficulties in which a determinist and especially materialist account of the relation between consciousness and the organic processes which accompany it appears to be involved.

Objections to materialism.

The arguments of thorough-going materialism can in most cases be met with a direct negative. No kind of evidence can be adduced sufficient to prove that consciousness is a secretion of the brain, an effect or even a consequent of material processes or modes of motion. No direct causal relationship between a molecular movement and a state of consciousness has ever been established. No physiologist has ever claimed the power to prophesy with any approach to accuracy the future mental states of any individual from an examination of his brain. And, though some kind of correspondence between the physical and conscious series of states has been observed and is commonly taken for granted in a number of instances, proof that entire correspondence exists is still wanting, and the precise kind of correspondence is left undetermined. Nevertheless, the belief that material processes must be held sufficient to account for material changes in the human organism as in all other regions of the material world, can be held quite independently of any particular theory as to the relation between mind and body, and in many of its forms is equally destructive of a belief in the freedom of the will. It is a belief, too, which is increasingly prevalent in modern science. The theory of psychophysical parallelism involves no doubt in the minds of the majority of its upholders the further assumption of some unity underlying both the physical and psychical series which may one day be discovered to be susceptible of scientific expression and interpretation. Certainly without some such assumption the hypothesis of an exact correspondence between the series described as parallel becomes, as Professor Ward has shown, unmeaning. And many scientific thinkers, while professing allegiance to a theory which insists upon the independence of each parallel series, in reality tacitly assume the superior importance if not the controlling force of the physical over the psychical terms. But a mere insistence upon the complete independence of the physical series coupled with the belief that its changes are wholly explicable as modes of motion, *i.e.* that the study of molecular physics is competent to explain all the phenomena of life and organic movements, is sufficient to eliminate the possibility of spontaneity and free origination from the universe. For if consciousness be looked upon as simply an epiphenomenon, an unaccountable appearance accompanying the succession of material changes, the possibility either of active interference by human volition at any point within the physical series or of any controlling or directing efficacy of consciousness over the whole set of material changes which accompany its activity becomes unthinkable. There are, nevertheless, serious difficulties involved in the supposition that the changes in the brain with which physiology and the biological sciences deal can be satisfactorily explained by the mechanical and mathematical conceptions common to all these sciences, or, indeed, that any of these organic changes is susceptible in the last resort of explanation derived from purely material premises. The phenomena of life and growth and assimilation have not been satisfactorily explained as mechanical modes of motion, and the fact that identical cerebral movements have not been discovered to recur makes scientific and accurate prediction of future cerebral changes an impossibility. But more convincing than most of the philosophical arguments by which the theories of psychophysical parallelism have been assailed is the fact that it runs counter to the plain evidence of the ordinary consciousness. No matter to what extent the unphilosophical thinker may be under the influence of materialistic presuppositions, he always recoils from the conclusion that the facts of his mental life have no influence upon his physical movements. Meaning, design and purpose are to him terms far more explanatory of his movements in the outer world than the mechanical and mathematical equivalents to which his actions will ultimately be reduced if the sciences should achieve their avowed purpose. To regard himself as a conscious automaton he can never be persuaded. Further, he finds in the series of antecedents and consequents capable of mathematical and spatial determination, which certain men of science present to him as their final account of his physical and psychical history, no real explanation of the facts: he is far more inclined to look for an explanation of the efficacy of causal changes in the categories of will and purpose for which they are a substitution.

Nor, finally, is the last defensive position of scientific determinism—the theory, namely, that the freedom of the will is incompatible with the doctrine of the conservation of energy—to be accepted without question. That doctrine, if it is to possess cogency as a proof of the impossibility of the libertarian position, must assume that the amount of energy sufficient to account for physical and psychical changes is constant and invariable in quantity, an assumption which no scientific investigator is competent to prove. A regulative principle which may possess great value when applied and confined to the comparatively abstract material of the mathematical and quasi-mathematical sciences is highly dangerous if extended to the investigation of living bodies. "In its present form, and since the development of the mechanical theory of heat, the principle of the conservation of energy certainly seems to apply to the whole range of physico-chemical phenomena. But no one can tell whether the study of physiological phenomena in general, and of nervous phenomena in particular, will not reveal to us, besides the *vis viva* or kinetic energy of which Leibnitz spoke, and the potential energy which was a later and necessary adjunct, some new kind of energy which may differ from the other two by rebelling against calculation" (Bergson, *Time and Free Will*, Eng. trans. by F. L. Pogson, pp. 151, 152).

Modern psychology.

It is, however, from the development of the scientific study of psychology more than from any other region of thought that light has been thrown upon the problem of freedom. The determinist presuppositions of psychology (determinist because they involve the application of the causal conceptions of modern science to mental phenomena) have in many instances in no way retarded the utilization of new information concerning mental processes in order to prove the reality of freedom. Bergson is perhaps the most notable instance of a philosopher fully conversant with psychological studies and methods who remains a convinced libertarian. But the contribution made by psychology to the solution of the problem has taken the form not so much of a direct reinforcement of the arguments of either of the opponent systems, as of a searching criticism of the false assumptions concerning conative processes and the phenomena of choice common alike to determinists and libertarians. It has already been pointed out that the problem as it presented itself to utilitarian philosophers could lead only to a false solution, depending as it did upon a wholly fictitious theory as to the nature of desire. There are still many traces to be found in modern psychology of a similar unreal identification of desire with will. But, nevertheless, the new light thrown upon the unity of the self and the more careful and accurate scrutiny made by recent psychologists of the phenomena of decision have rendered it no longer possible either for determinists to deny the fact of choice (whatever be their theory as to its nature) or for libertarians to regard the self or the will as isolated from and unaffected by other mental constituents and antecedents, and hence, by an appeal to wholly fictitious entities, to prove the truth of freedom. The self or the will can no longer be looked upon as possessing a kind of *imperium in imperio*, "this way and that dividing the swift mind." And if freedom of choice be a possibility at all, it must in future be regarded as the prerogative of a man's whole personality, exhibited continuously throughout the development of his character, displayed to some extent in all conscious conative processes, though especially apparent in crises necessitating deliberate and serious purpose. The mistake of earlier advocates of determinism lay in the supposition that self-conscious moral action could be explained by the use of the same categories and upon the same hypotheses usually considered sufficient to explain the causal sequences observable in the physical world. Conduct was regarded as the result of interaction between character and environment; or it was asserted to be the resultant effect of a struggle between motives in which the strongest prevailed. And the libertarian critic had before him a comparatively easy task when he exhibited the complete interdependence of character and environment, or rather the impossibility of treating either as definite and fixed factors in a process explicable by the use of ordinary scientific categories.

It was not difficult to show that motives have meaning only with reference to a self, and that it is the self which alone has power to erect a desire into a motive, or that the attraction of an object of appetite derives much of its power from the character of the self to which it makes its appeal. What is possibly not so obvious is the extent to which libertarians have themselves been guilty of a similar fallacy. It is comparatively unimportant to the determinist whether the cause to which he attributes conduct be the self, or the will, or character, or the strongest motive, provided that each of these causes be regarded as definitely ascertainable and that its effects in sufficiently known circumstances be calculable. It is possible to treat will as a permanent cause manifesting itself through a series of sequent changes, and obedient to the laws which govern the development of the personality of the single individual.

Objections to libertarianism.

And the libertarian, by his arguments showing that appeal must be made to an act of will or of the self in the explanation of the phenomena of choice, does nothing directly to disprove the truth of such a contention. If, however, it be argued by libertarians that no explanation is possible of the manner in which the self or the will makes its decisions and inclines to this motive or to that, while they still assert the independent existence of the self or will, then they are undoubtedly open to the retort of their opponents that upon such a theory no rational explanation of conduct will be possible. For to regard a particular decision as the effect of the "fiat" of a self or will unmotived and uninfluenced by the idea of a future object of attainment seems to be equivalent to the simple statement that the choice was made or the decision taken. Such a theory can prove nothing either for or against the possibility of freedom.

Idealism.

Moreover, many of the arguments by which the position of rigid libertarians of the older school has been proved untenable have been advanced by moral philosophers, and by thinkers not always inclined to regard psychology with complete sympathy. The doctrine of self-determination, advocated by T. H. Green and idealist writers of his school, has little or nothing in common with the doctrine that the self manifests its freedom in unmotived acts of will. The advocates of self-determination maintain that conduct is never determined, in the sense in which, *e.g.* movements in the physical world are determined, because man in virtue of his self-consciousness has a power of distinguishing himself from, even while he identifies himself with, a purely natural object of desire; and this must always make it impossible to regard him as an object governed by purely natural forces. Consciousness and especially self-consciousness, can never be explained upon hypotheses adequate only to explain the blind working of the unconscious world. But the insistence of idealist writers upon the relation of the world of nature to conscious intelligence, and especially to a universal consciousness realizing itself throughout the history of individuals, rendered it alike impossible to deny altogether some influence of environment upon character, and to regard the history of individual willing selves as consisting in isolated and unconnected acts of choice. Self-consciousness, if it be conceived as distinguishing itself from its past history or from the natural world, must be conceived also as in some sense related to the empirical self which has a history in time and to the natural organism in which it finds a home. It is the precise mode of this relation which idealist philosophers leave obscure.

Nor is that obscurity to any appreciable degree illuminated by the tendency also noticeable in idealist writers to find the true possession of freedom only in a self emancipated from the influence of irrational passion, and liberated by knowledge from the dominion of chance or the despotism of unknown natural forces. Here also psychology, by its elucidation of the important part which instinctive appetites and animal impulses play in the development of intelligence, still more perhaps by arguments (based largely upon the examination of hypnotic subjects or the phenomena of fixed ideas) which show the permanent influence of irrational or semi-rational suggestions or habits upon human conduct, has done much to aid and abet idealists in their contentions. It cannot in fact be denied that from one point of view human freedom is strictly relative, a possession to be won only after painful effort, exhibiting itself in its entirety only in supreme moments when the self is unswayed by habit, and out of full knowledge makes an individual and personal choice. Ideal freedom will be the supreme achievement of a self completely moralized. But the process by which such freedom is eventually to be gained must, if the prize is to be worth the having, itself exhibit the gradual development of a self which, under whatever limitations, possesses the same liberty of choice in its early stages as in its latest. And no theory which limits the exercise of freedom to the choice only of what is strictly good or rational can avoid the imputation of destroying man's responsibility for the choice of evil.

The ethical problem.

But the most important point at issue between the opposing theories has remained throughout the history of the controversy, the morality or immorality of their respective solutions of the problem. The advocates of either theory must in the last resort appeal to the direct evidence of the moral consciousness. It remains to give a brief sketch of the arguments advanced on either side.

It has always been maintained by convinced libertarians that without a belief in the freedom of the will morality becomes unmeaning (see DETERMINISM). Moreover, without a belief in the freedom of the will the conception of moral obligation upon which the existence of morality depends and from which all other moral terms derive their meaning loses its chief significance. What is opposed to obligation, or at least always distinguished from it, is that very domain of necessity within which determinists would bring the will. For even when the felt obligation is absolute, where the will is completely moralized, where it is inconceivable in the case of a good man that the act which he performs should be other than it is, there the obligation which he recognizes is an obligation to choose autonomously, and as such is distinguished from desire or appetite or any of the other alleged determinants of action. If the question be asked "Where is the evidence for this alleged freedom to choose between alternatives?" the appeal is always made to the witness of the moral consciousness itself. No one, it is said, who ever feels remorse for the committal of a wrong act can honestly avoid the admission that at the moment when the act was committed he could have acted otherwise. No one at the moment of action is ever aware that his will is being necessitated. What he is clearly conscious of is the power to choose. Any proof, in the scientific sense, that a man's acts are due to his power of free initiative would be from the nature of the case impossible. For, inasmuch as scientific proof depends upon the evidence of causality, such efforts after scientific demonstration would end only by bringing either the man's whole personality or some element in it within the sequence of the chain of natural causes and effects, under the domination of that natural necessity from which as a conscious being he is free. The science of morality must be content in its search for causes to recognize the rationality of choice as a real determining agent in human affairs. And no account of the psychology of human action which regards conduct as due to self-determination, but leaves open the question whether the self is free to choose is, so it is argued, capable of providing an adequate theory of the admitted facts of moral consciousness.

We must now consider the arguments by which determinists

Determinist ethics.

attack the position of their opponents and the evidence which they adduce to show that the freedom of the will is no necessary postulate for moral action. For thorough-going determinism of the older type the dependence of morality upon freedom did not of necessity prove an obstacle. Hedonistic psychology denied the libertarian hypothesis, but it denied also the absoluteness and intuitive character of moral obligation, and attached no validity to the ordinary interpretation of terms like "ought" and duty. Modern determinists differ from the earlier advocates of their theory in their endeavour to exhibit at least the compatibility of morality with the absence of freedom, if not the enhancement of moral values which, according to some of its advocates, follows upon the acceptance of the deterministic account of conduct.

Punishment.

If a coherent theory capable of giving an explanation of the ordinary facts of morality and not involving too violent a breach with the meaning of moral terms in their accepted usage were all that need be required of determinists in order to reconcile the defenders of the moral consciousness to the loss of their belief in the will's freedom, it would follow without question that the determinists have proved their case. Neither the deterrent nor the reformatory theories of punishment (*q.v.*) necessarily depend upon or carry with them a belief in the freedom of the will. On the contrary, a belief that conduct necessarily results upon the presence of certain motives, and that upon the application of certain incentives, whether of pain or pleasure, upon the presence of certain stimuli whether in the shape of rewards or punishments, actions of a certain character will necessarily ensue, would seem to vindicate the rationality of ordinary penal legislation, if its aim be deterrent or reformatory, to a far greater extent than is possible upon the libertarian hypothesis. Humanitarian moralists, who hesitate to believe in the retributive theory of punishment because, as they think, its aim is not the criminal's future well-being but merely the vindication through pain of an outrage upon the moral law which the criminal need never have committed, might welcome a theory which urges that the sole aim of punishment should be the exercise of an influence determining the criminal's future conduct for his own or the social good.

Moreover, the belief that the justice of punishment depends upon the responsibility of the criminal for his past offences and the admission of the moral consciousness that his previous wrong-doing was freely chosen carries with it, so it is argued, consequences which the libertarian moralist might be willing to accept with reluctance. For whatever may have been the character of the individual in the past, it is possible upon the libertarian view that by the exercise of his freedom he has brought about in himself a complete change of character: he may be now the exact opposite in character of what he was then. Upon what grounds, therefore, shall we discriminate between the justice of punishing him for what he was at a previous period in his life and the injustice of forgiving him because of what he is in the present? While if the deterrent and reformatory theories alone provide a rational end for punishment to aim at then the libertarian hypothesis pushed to its extreme conclusion must make all punishments equally useless. For no punishments can prevent the individual from becoming a person of whatsoever character he chooses or from committing acts of whatsoever moral quality he determines to prefer. A similar line of argument would lead to the conclusion that the conception of the state as an educating, controlling and civilizing agency involves the belief that individual citizens can be influenced and directed by motives which have their origin in external suggestion, *i.e.* that the determinist theory alone provides a rational basis for state activity of whatever kind.

Remorse.

It might, however, be thought that whatever be the compatibility of theories of punishment or of the activity of the state as a moralizing agency with determinism, to reconcile the denial of freedom with a belief in the reality of remorse or penitence will be plainly impossible. Nevertheless there is no tendency on the part of modern determinists to evade the difficulty. They argue with considerable cogency that determinism is very far from affording any ground for believing in the impotence of will. The belief that our actions have been determined in the past carries with it no argument that they will be of a like character in the future. Though in the future as in the past they must be equally determined, yet the forces that will determine their character in the future may be as yet unanalysed and unapparent. No man can exhaust by introspective analysis the hidden elements in his personality. The existence of feelings of remorse and penitence testify to the presence in the individual of motives to good conduct which, if acted upon and allowed full scope and development, may produce a complete change of character. Determinism is not necessarily the logic of despair. Moreover, in a certain sense the very feelings of remorse and penitence which are the chief weapons in the libertarians' armoury testify to the truth of the determinists' contention. For they are the natural and logical consequence of the acts which the penitent deplores. Such feelings follow the committal of acts of a certain character in a consciousness sufficiently moralized as inevitably as pain in the natural world follows upon the violation of one of nature's laws. And they would lose a great part of their significance if they did not testify to the continued existence in a man's personality of motives and tendencies likely to influence his conduct in the future as they have already influenced it in the past. Nor is it possible to give any rational explanation of the idea of responsibility itself upon indeterminist assumptions. For to hold a person to be a responsible agent is to believe that he possesses a certain fixity and stability of character. Freedom in the sense of complete liberty of choice would seem to lead to the conclusion that free agents are irresponsible, unaccountable. The truth seems to be that throughout the history of the controversy the chief arguments for either side have been provided by the extreme and exaggerated statements to which their opponents have been driven in the presentation of their case. So long as libertarians contend that what alone possesses moral value is unmotived choice, acts of will of which no explanation can be given save the arbitrary fiat of individual selves at the moment of decision, it is not difficult for determinists to exhibit the absurdities to which their arguments lead. It can easily be shown that men do as a matter of fact attach moral adjectives to environment, temperamental tendencies, natural endowments, instinctive desires, in a word to all or most of those forces moulding character, from which, according to libertarians, the individual's freedom of choice should be clearly distinguished and separated, and to which it can be and is frequently opposed. While it is not easy to avoid the suspicion that a choice of which nothing can be predicated, which is guided by no motive, influenced by no desire, which is due neither to the natural display of character nor to the influence of environment, is either merely fortuitous or the product of a philosophical theory.

But, as has been already suggested, the libertarian argument by no means necessarily leads to such extreme conclusions. The libertarian is not pledged to the belief that acts which alone exhibit real freedom are isolated acts which depend upon a complete change of character, a change which is in no sense continuous with, and is in no kind of relation to, the series of successive changes which make up an individual's mental and moral history. It is true that a consistent advocate of indeterminism must deny that the will is determined by motives, and must admit that no reason can finally be given for the individual's choice beyond the act of choice itself. For to give a reason for choosing (where "reason" is not merely equivalent to the determinists' "cause" or "necessary antecedent") would simply be to find the explanation of the individual's choice in some previous decision. Moral conduct is conduct which follows upon the choice of ends, and to give a reason for the choice of an end in any particular instance is either to explain the nature of the end chosen and thus to describe the choice (a process which can in no sense show that the act of choice was itself necessitated), or it is to find the ground of the particular decision in its relation to an end already chosen. But whatever be the nature of the end chosen the libertarian is not concerned to deny that it must possess a fixed determinate character. If duty be chosen as opposed to pleasure the opposition between duty and pleasure is a necessary one. The recognition of such a necessary opposition is involved in the determinate act of choice. But the choice itself is neither necessary nor determined. The belief that libertarianism denies the binding force of habit or the gradual development of unchecked tendencies in character depends upon a similar misconception. The continuity of a man's life and purposes would be equally apparent whether he habitually performed the same acts and made the same decisions in virtue of his freedom of choice or as the product of necessary forces moulding his character in accordance with fixed laws. Just as the phenomena of sudden conversion, complete revolutions of character occurring to outward appearance in a momentary space of time, are no valid argument against determinism—they may be due to the sudden emergence of elements in life and character long concealed—so what looks like the orderly and necessary development of a character growing and exhibiting its activity in accordance with fixed laws may in reality be due to innumerable secret struggles and momentous decisions, acts of choice of which only the results are outwardly apparent. The ends which at any moment the individual is free to choose or reject possess a determinate character: their existence or non-existence as possibilities is also to a very large extent determined for him. No man can choose to become whatsoever he will, for the ends which he can accomplish are restricted in number as well as definite in quality. But the real strength of the libertarian position is to be found in the fact that consciousness is capable of distinguishing ends at all. Whenever, for example, there is an admission on the part of any individual that in any previous act he made the attainment of pleasure his end rather than the performance of duty, there is also a tacit admission that he might have acted otherwise. And the existence of penitence and remorse is not merely a sign of the emergence in consciousness of elements in character nobler than and opposed to those tendencies which once held sway. They are feelings which are incapable of coming into being at all save when coupled with the judgment, "I ought to have acted otherwise because I possessed the power." The same argument holds good concerning our feelings with regard to the justice or injustice of punishing a criminal if we believe that his will was determined. It may be politic or expedient to inflict pain upon a criminal in order either to effect an alteration in his character or to deter him or others from future performance of acts of a certain character. But even with regard to the expediency of such punishments we may have doubts. For the very argument from the undeveloped possibilities of each man's character by which the determinist proves the compatibility of his theory with the phenomenon of sudden conversion and the like is sufficient also to prove that the state can never be sure that the punishments which it inflicts upon the individual will have the effect upon his character and conduct which it desires. It may be replied that experience makes it reasonably certain that the infliction of certain penalties will produce acts of a certain character and that the influence of certain incentives upon conduct may be established as reasonably probable by induction. But when the data are admittedly so uncertain is a valid inductive argument of such a character possible? And even if it were what would be its bearing upon the justice or injustice of inflicting punishments at all? The unsophisticated moral consciousness will still consider it unjust to punish a man for deeds of which he could not avoid the performance, and regard the alleged desire to produce in his future life consequences favourable to himself or society as beside the mark and irrelevant to the question at issue.

The free-will position.

At the moment of action the individual invariably regards himself as free to choose between alternatives. This immediate consciousness of freedom persists upon another occasion even though subsequent reflection upon conduct should lead the individual to regard himself as determined at the very moment when he was aware of himself as free. It is this immediate consciousness of the power of choosing between alternatives which the determinist finds so difficult to explain. He may regard it as an illusion, and attempt to prove the incompatibility of our consciousness of freedom with the facts of existence and the nature of the world. But, in ordinary cases of illusion, once let the reason for the illusion be discovered, and there is no longer the possibility of our being longer deceived. The phenomena which deceived us may continue to persist, but they no longer persist as illusory: the appearance which deceived us is seen in its true nature, even though it should still retain those characteristic marks or signs of reality which hitherto we regarded as significant of a nature which we now no longer believe it to possess. But can it be maintained that the same truth holds good of our consciousness of freedom? Is it possible to hold that determinist arguments are of so convincing a character as to enable us to perceive at the moment of action the untrustworthy nature of our consciousness that we are free to choose between alternatives and to grasp beneath the appearance the underlying necessity which rules our wills? Our actual consciousness of freedom is not seriously disputed. And though reflection upon conduct may lead us to suppose that our past acts were determined, that desire of pleasure or the wish to avoid pain controlled our wills, the unphilosophical observer interprets, in offenders against morality, such arguments as a mere excuse. Moreover, remorse and penitence are witnesses in the wrongdoer to the truth of the interpretation. On the other hand we have no such immediate consciousness of the necessity which is said to control our wills. We sharply distinguish that freedom which is the prerogative of human action from the necessary causation discoverable in nature. Within the domain of consciousness introspective analysis is unable to discover those chains of necessary sequences which it is the province of science to investigate in the physical world. And until the determinist can successfully explain to us how in a world obeying throughout its history necessary laws and limited in its nature to the exhibition of causal sequences the consciousness of freedom could ever have arisen, we may be content to trust the immediate affirmation of our moral selves.

For modern discussions of the problem consult Lotze, *Microcosmus*, i. 256 seq., English trans. Martineau; *Study of Religion*, vol. ii. bk. iii. chap. 2; Ward, *Naturalism and Agnosticism*; Rashdall, *The Theory of Good and Evil*, vol. ii. bk. iii.; Taylor, *Elements of Metaphysics*, bk. iv. chap. 4; McTaggart, *Some Dogmas of Religion*, v.; Shadworth Hodgson, *The Philosophy of Experience*, iv. 118 seq.; Galloway, *Studies in the Philosophy of Religion*; Bergson, *Essai sur les données immédiates de la conscience*; James, *The Will to Believe*; Fonsegrive, *Essai sur le libre arbitre*; Renouvier, *Les Dilemmes de la métaphysique pure*; Boutroux, *La Contingence des lois de la nature*; Noël, *La Conscience du libre arbitre*; Boyce Gibson, Essay in *Personal Idealism* on "The Problem of Freedom."

(H. H. W.)

WILL, or TESTAMENT, the legal documentary instrument by which a person regulates the rights of others over his property or family after his death.[1] For the devolution of property not disposed of by will, see INHERITANCE, INTESTACY. In strictness "will" is a general term whilst "testament" applies only to dispositions of personalty; but this distinction is seldom observed. The conception of freedom of disposition by will, familiar as it is in modern England, is by no means universal. In fact, complete freedom is the exception rather than the rule. Legal systems which are based upon Roman law, such as those of Scotland and France, allow the whole property to be alienated only where the deceased leaves no widow or near relatives. In France this restriction has met with condemnation from eminent legal and economical authorities. R. T. Troplong, for instance, held that "un peuple n'est pas libre, s'il n'a pas le droit de tester, et la liberté du testament est la plus grande preuve de la liberté civile."[2]

Roman law.

History.—The will, if not purely Roman in origin, at least owes to Roman law its complete development—a development which in most European countries was greatly aided at a later period by ecclesiastics versed in Roman law. In India, according to the better opinion, it was unknown before the English conquest; in the Mosaic law and in ancient Athens the will, if it existed at all, was of a very rudimentary character. The same is the case with the *Leges barbarorum*, where they are unaffected by Roman law. The will is, on the other hand, recognized by Rabbinical and Mohammedan law. The early Roman will, as Sir H. Maine shows,[3] differed from the modern will in most important respects. It was at first effectual during the lifetime of the person who made it; it was made in public; and it was irrevocable. Its original object, like that of adoption, was to secure the perpetuation of the family. This was done by securing the due vesting of the *hereditas* in a person who could be relied upon to keep up the family rites. There is much probability in the conjecture that a will was only allowed to be made when the testator had no *gentiles* discoverable, or when the *gentiles* had waived their rights. It is certain from the text of Gaius[4] that the earliest forms of will were those made in the *comitia calata* and those made *in procinctu*, or on the eve of battle. The former were published before the *comitia*, as representative of the patrician *gentes*, and were originally a legislative act. These wills were the peculiar privilege of patricians. At a later time grew up a form of plebeian will (*testamentum per aes et libram*), and the law of succession under testament was further modified by the influence of the praetor, especially in the direction of recognition of *fideicommissa* or testamentary trusts. *Codicilli* or informal wills, also came into use, and were sufficient for almost every purpose but the appointment of an heir. In the time of Justinian a will founded partly on the *jus civile*, partly on the edict of the praetor, partly on imperial constitutions and so called *testamentum tripertitum*, was generally in use. The main points essential to its validity were that the testator should possess testamentary capacity, and that the will should be signed or acknowledged by the testator in the presence of seven witnesses, or published orally in open court. The witnesses must be *idonei*, or free from legal disability. For instance, women and slaves were not good witnesses. The whole property of the testator could not be alienated. The rights of heirs and descendants were protected by enactments which secured to them a legal minimum, the *querela inofficiosi testamenti* being the remedy of those passed over. The age at which testamentary capacity began was fourteen in the case of males, twelve in the case of females. Up to A.D. 439 a will must have been in Latin; after that date Greek was allowed. Certain persons, especially soldiers, were privileged from observing the ordinary forms. The liability of the heir to the debts of the testator varied at different periods. At first it was practically unlimited. Then the law was gradually modified in his favour, until in the time of Justinian the heir who duly made an inventory of the property of the deceased was liable only to the assets to which he had succeeded. This limitation of liability is generally termed by the civilians *beneficium inventarii*. Something like the English probate is to be found in the rules for breaking the seals of a will in presence of the praetor. Closely connected with the will was the *donatio mortis causa*, the rules of which have been as a whole adopted in England (see below). An immense space in the *Corpus juris* is occupied with testamentary law. The whole of part v. of the *Digest* (books xxviii.-xxxvi.) deals with the subject, and so do a large number of constitutions in the *Code* and *Novels*.

The effect of Christianity upon the will was very marked. For instance, the duty of bequeathing to the Church was inculcated as

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[1] This is practically in accordance with the definition of Modestinus in *Digest* xxviii. 1, 1, *voluntatis nostrae justa sententia de eo quod quis post mortem suam fieri velit.*

[2] *Traité des donations entre-vifs et des testaments* (1855), preface.

[3] *Ancient Law*, chap. vi.

[4] ii. 101.

Canon law.

early as Constantine, and heretics and monks were placed under a disability to make a will or take gifts left by will. A will was often deposited in a church. The canon law follows the Roman law with a still greater leaning to the advantage of the Church. No Church property could be bequeathed. Manifest usurers were added to the list of those under disability. For the validity of a will it was generally necessary that it should be made in the presence of a priest and two witnesses, unless where it was made *in pias causas*. The witnesses, as in Roman law, must be *idonei*. Gifts to the Church were not subject to the deductions in favour of the heir and the children necessary in ordinary cases.[1] In England the Church succeeded in holding in its own hands for centuries jurisdiction in testamentary matters.

English law.

The Roman law of wills has had considerable effect upon English law. In the words of Sir H. Maine, "The English law of testamentary succession to personalty has become a modified form of the dispensation under which the inheritances of Roman citizens were administered."[2] At the same time there are some broad and striking differences which should be borne in mind. The following among others may be noticed. (1) A Roman testator could not, unless a soldier, die partly testate and partly intestate. The will must stand or fall as a whole. This is not the case in England. (2) There is no one in English law to whom the *universitas juris* of the testator descends as it did to the Roman *heres*, whose appointment was essential to the validity of a formal will, and who partook of the nature of the English heir, executor, administrator, devisee and legatee. (3) The disabilities of testators differed in the two systems. The disability of a slave or a heretic is peculiar to Roman law, of a youth between fourteen and twenty-one to English law. (4) The whole property may be disposed of in England; but it was not so at Rome, where, except by the wills of soldiers, children could not be disinherited unless for specified acts of misconduct. During the greater part of the period of Roman law the heir must also have had his Falcidian fourth in order to induce him to accept the inheritance. (5) In English law all wills must conform to certain statutory requirements; the Romans recognized from the time of Augustus an informal will called *codicilli*. The English codicil has little in common with this but the name. It is not an informal will, but an addition to a will, read as a part of it, and needing the same formalities of execution. (6) The Roman *legatum* applied to both movables and immovables; in England a legacy or bequest is a gift of personalty only, a gift of real estate being called a devise.[3] (7) The Roman will spoke from the time of making; the English speaks from the time of death. This difference becomes very important in case of alteration in the position of the testator between the making of the will and his death. As a rule the Roman will could not, the English can, pass after-acquired property.

Liberty of alienation by will is found at an early period in England. To judge from the words of a law of Canute, intestacy appears to have been the exception at that time.[4] How far the liberty extended is uncertain; it is the opinion of some authorities that complete disposition of land and goods was allowed, of others that limited rights of wife and children were recognized. However this may be, after the Conquest a distinction, the result of feudalism, to use a convenient if inaccurate term, arose between real and personal property. It will be convenient to treat the history of the two kinds of will separately.

Real property.

It became the law after the Conquest, according to Sir E. Coke,[5] that no estate greater than for a term of years could be disposed of by will, unless in Kent, where the custom of gavelkind prevailed, and in some manors and boroughs (especially the City of London), where the pre-Conquest law was preserved by special indulgence. The reason why devise of land was not acknowledged by law was, no doubt, partly to discourage deathbed gifts in mortmain, a view supported by Glanvill, partly because the testator could not give the devisee that seisin which was the principal element in a feudal conveyance. By means of the doctrine of uses, however, the devise of land was secured by a circuitous method, generally by conveyance to feoffees to uses in the lifetime of the feoffor to such uses as he should appoint by his will (see TRUST).[6] Up to comparatively recent times a will of lands still bore traces of its origin in the conveyance to uses *inter vivos*. On the passing of the Statute of Uses lands again became non-devisable, with a saving in the statute for the validity of wills made before the 1st of May 1536. The inconvenience of this state of things soon began to be felt, and was probably aggravated by the large amount of land thrown into the market after the dissolution of the monasteries. As a remedy an act was passed in 1540, and a further explanatory act in 1542–1543. The effect of these acts was to make lands held in fee simple devisable by will in writing, to the extent of two-thirds where the tenure was by knight service, and the whole where it was in socage. Corporations were incapacitated to receive, and married women, infants, idiots and lunatics to devise. An act of 1660, by abolishing tenure by knight service, made all lands devisable. In the same reign the Statute of Frauds (1677) dealt with the formalities of execution. Up to this time simple notes, even in the handwriting of another person, constituted a sufficient will, if published by the testator as such. The Statute of Frauds required, *inter alia*, that all devises should be in writing, signed by the testator or by some person for him in his presence and by his direction, and should also be subscribed by three or four credible witnesses. The strict interpretation by the courts of the credibility of witnesses led to the passing of an act in 1751–1752, making interested witnesses sufficient for the due execution of the will, but declaring gifts to them void. The will of a man was revoked by marriage and the birth of a child, of a woman by marriage only. A will was also revoked by an alteration in circumstances, and even by a void conveyance *inter vivos* of land devised by the will made subsequently to the date of the will, which was presumed to be an attempt by the grantor to give legal effect to a change of intention. As in Roman law, a will spoke from the time of the making, so that it could not avail to pass after-acquired property without republication, which was equivalent to making a new will. Copyholds were not devisable before 1815, but were usually surrendered to the use of the will of the copyhold tenant; an act of 1815 made them devisable simply. Devises of lands have gradually been made liable to the claims of creditors by a series of statutes beginning with the year 1691.

Personal property.

The history of wills of personalty was considerably different, but to some extent followed parallel lines. In both cases partial preceded complete power of disposition. The general opinion of the best authorities is that by the common law of England a man could only dispose of his whole personal property if he left no wife or children; if he left either wife or children he could only dispose of one-half, and one-third if he left both wife and children. The shares of wife and children were called their *pars rationabilis*. This *pars rationabilis* is expressly recognized in Magna Carta and was sued for by the writ *de rationabili parte*. At what period the right of disposition of the whole personalty superseded the old law is uncertain. That it did so is certain, and the places where the old rule still existed—the province of York, Wales and the City of London—were regarded as exceptions. The right of bequest in these places was not assimilated to the general law until comparatively recent times by acts passed between 1693 and 1726. A will of personalty could be made by a male at fourteen, by a female at twelve. The formalities in the case of wills of personalty were not as numerous as in the case of wills of land. Up to 1838 a nuncupative or oral will was sufficient, subject, where the gift was of £30 or more, to the restrictions contained in the Statute of Frauds. The witnesses to a written will need not be "credible," and it was specially enacted by an act of 1705 that any one who could give evidence in a court of law was a good witness to a will of personalty. A will entirely in the testator's handwriting, called a holograph will, was valid without signature. At one time the executor was entitled to the residue in default of a residuary legatee. But the Executors Act 1830 made him in such an event trustee for the next of kin.

Jurisdiction over wills of personalty was till 1858 in the ecclesiastical courts, probate being granted by the diocesan court[7] if the goods of the deceased lay in the same diocese, in the provincial court of Canterbury (the prerogative court) or York (the chancery court) if the deceased had *bona notabilia*, that is, goods to the value of £5 in two dioceses. The ecclesiastical jurisdiction was of a very ancient origin. It was fully established under Henry II., as it is mentioned by Glanvill. In the city of London wills were enrolled in the Court of Hustings from 1258 to 1688 after having been proved before the ordinary. Contested cases before 1858 were tried in the provincial court with an appeal originally to the Court of Delegates, later to the judicial committee of the privy council. There were also a few special local jurisdictions, courts baron, the university courts, and others, probably for the most part survivals of the pre-Conquest period, when wills seem to have been published in the county court. The ecclesiastical courts had no jurisdiction over wills of land, and the common law courts were careful to keep the ecclesiastical courts within their limits by means of prohibition. No probate of a will of land was necessary, and title to real estate by will might be made by production of the will as a document of title. The liability of the executor and legatee for the debts of the testator has been gradually established by legislation. In general it is limited to the amount of the succession. Personal liability of the executor beyond this can by the Statute of Frauds only be established by contract in writing.

Modern English Law.—Such were the principal stages in the history of the law as it affected wills made before 1838 or proved before 1858. The principal acts now in force are the Wills Act 1837, the amending act of 1852, the Court of Probate Act 1857, the Judicature Acts 1873 and 1875 and the Land Transfer Act 1897. All but the acts of 1837 and 1852 deal mainly with what happens to the will after death, whether under the voluntary or contentious jurisdiction of the Probate Division (see PROBATE). Some of the earlier acts are still law, though of little importance since the more modern and comprehensive enactments.

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[1] Most of the law is contained in *Decretals*, iii. 26, "De Testamentis."

[2] *Ancient Law*, chap. vi.

[3] The distinction between bequest and devise did not always exist. For instance, the Assize of Northampton, c. 4, speaks of a devise (*divisa*) of chattels (see BEQUEST).

[4] *Secular Laws*, c. 68.

[5] 2 *Inst.* 7.

[6] Many instances of such conveyances occur in Sir Harris Nicolas' *Testamenta vetusta* and in *Fifty Earliest English Wills* (1387–1439), edited by Dr F. J. Furnivall in 1882.

[7] The testamentary jurisdiction of the archdeacon's court is alluded to by Chaucer in the "Friar's Tale," but it was afterwards completely superseded by the bishop's court.

The earliest on the statute roll is an act of Henry III. (1236), enabling a widow to bequeath the crops of her lands. Before the Wills Act uniformity in the law had been urgently recommended by the Real Property Commissioners in 1833. It appears from their report[1] that at the time of its appearance there were ten different ways in which a will might be made under different circumstances.

The act of 1837 affected both the making and the interpretation of wills.[2] Excluding the latter for the present, its main provisions were these. All property, real and personal, and of whatever tenure, may be disposed of by will. If customary freeholds or copyholds be devised, the will must be entered on the court rolls. No will made by any person under the age of twenty-one is valid. Every will is to be in writing, signed at the foot or end thereof by the testator or by some person in his presence and by his direction, and such signature is to be made or acknowledged by the testator in the presence of two or more witnesses present at the same time, who are to subscribe the will in the presence of the testator. It is usual for the testator and the witnesses to sign every sheet. Publication is not necessary. A will is not void on account of the incompetency of a witness. Gifts to a witness or the husband or wife of a witness are void. A creditor or executor may attest. A will is revoked (except where made in exercise of a power of appointment of a certain kind) by a later will, or by destruction with the intention of revoking, but not by presumption arising from an alteration in circumstances. Alterations in a will must be executed and attested as a will. A will speaks from the death of the testator, unless a contrary intention appear. An unattested document may be, if properly identified, incorporated in a will, but such a document, if executed subsequently to the will, is inoperative.

Rules of interpretation or construction depend chiefly on decisions of the courts, to a smaller extent on statutory enactment. The law was gradually brought into its present condition through precedents extending back for centuries, especially decisions of the court of chancery, the court *par excellence* of construction, as distinguished from the court of probate. The court of probate did not deal unless incidentally with the meaning of the will; its jurisdiction was confined to seeing that it was duly executed. The present state of the law of interpretation is highly technical. Some phrases have obtained a conventional meaning which the testators who used them probably did not dream of. Many of the judicial doctrines which had gradually become established were altered by the Wills Act. These provisions of the act have since that time themselves become the subject of judicial decision. Among other provisions are these, most of them to take effect only in the absence of a contrary intention. A residuary devise is to include estates comprised in lapsed and void devises. A general gift of the testator's lands is to include copyholds and leaseholds. A general gift of real or personal estate is to include real or personal estate over which the testator had a general power of appointment. A devise without words of limitation is to pass the fee simple. The words "die without issue," or similar words, are to mean die without issue living at the time of the death of the person whose issue was named, not as before the act, an indefinite failure of issue, an estate tail being thus created. Trustees under an unlimited devise are to take the fee simple. Devises of estates tail are not to lapse if the devisee, though he predeceased the testator, left issue inheritable under the entail. Gifts to children or other issue leaving issue living at the testator's death are not to lapse. Rules of interpretation founded on principles of equity independent of statute are very numerous, and for them the works devoted to the subject must be consulted. Some of the more important, stated in as general a form as possible, are these. The intention of the testator is to be observed. This rule is called by Sir E. Coke the pole star to guide the judges. There is a presumption against intestacy, against double portions, against constructing merely precatory words to import a trust, &c. One part of the will is to be expounded by another. Interlineations and alterations are presumed to have been made after, not as in deeds before, execution. Words are supposed to be used in their strict and primary sense. Many words and phrases, however, such as "money," "residue" and "issue" and other words of relationship, have become invested with a technical meaning, but there has been a recent tendency to include illegitimate children in a gift to "children." Evidence is admissible in certain cases to explain latent ambiguity, and parol evidence of the terms of a lost will may be given as in the famous case of *Sugden* v. *Lord St Leonards* (1876), 1 Prob. Div. 154.

A will may be void, in whole or in part, for many reasons, which may be divided into two great classes, those arising from external circumstances and those arising from the will itself. The main examples of the former class are revocation by burning, tearing, &c., by a later will, or by marriage of the testator (except as below), incapacity of the testator from insanity, infancy or legal disability (such as being a convict), undue influence and fraud, any one of which is ground for the court to refuse or revoke probate of a will. A will being ambulatory is always revocable, unless in one or two exceptional instances. Undue influence is a ground upon which frequent attempts are made to set aside wills. Its nature is well explained in a judgment of Lord Penzance's: "Pressure of whatever character, whether acting on the fears or the hopes, if so exerted as to overpower the volition without convincing the judgment, is a species of restraint under which no valid will can be made."[3] There is nothing corresponding to the *querela inofficiosi testamenti*, but unnatural provisions may be evidence of mental defect. The circumstances appearing on the face of the will which make it open to objection may either avoid it altogether or create a partial intestacy, the will remaining good as a whole. Where the will is not duly executed, *e.g.* if it is a forgery or if it is not signed by the testator or the proper number of witnesses, the will is not admitted to probate at all. Where it contains devises or bequests bad in law, as in general restraint of marriage, or tending to create perpetuities, or contrary to public policy, or to some particular enactment, only the illegal part is void. A remarkable instance is a well-known case in which a condition subsequent in a devise was held void as against public policy, being a gift over of the estate devised in case the first devisee, the eldest son of an earl, did not before his death obtain the lapsed title of duke of Bridgewater.[4]

There are some wills of an exceptional kind which demand special notice. The *King.*—It was resolved in parliament in Richard II.'s reign (1392) that the king, his heirs and successors, might lawfully make their testaments.[5] In some later cases parliamentary authority has been given to royal wills, in others not. The executors of Henry IV. were confirmed in their office by letters patent of Henry V., those of Henry V. by parliament. The largest testamentary powers ever conferred on an English king were given to Henry VIII. by an act of 1533–1534, empowering him to limit and appoint the succession to the crown by will, in default of children by Jane Seymour or any future wife. By 39 & 40 Geo. III. c. 88 the king and his successor may devise or bequeath their private property.[6] No court, however, has jurisdiction to grant probate of the will of a king. *Guardianship.*—As a general rule wills deal with property, but even at common law a will simply appointing a guardian was good. The common law was superseded by an act of 1660, under which a father may dispose of the custody of his unmarried infant children by will. The Guardianship of Infants Act 1886 extended such powers in certain cases to the mother. *Married Woman.*—At common law a married woman could not (with a few exceptions) make a will without her husband's licence and consent, and this disability was specially preserved by the Wills Acts of Henry VIII. and of 1837. A common mode of avoiding this difficulty was for the husband to contract before marriage to permit the wife to make an appointment disposing of personalty to a certain value. Courts of equity from an early time allowed her, under certain restrictions, to make a will of property held for her separate use. In some cases her husband could dispose of her property by will, in others not. The law as it existed previously to 1883 is now practically obsolete, the Married Women's Property Act 1882 enabling a married woman to dispose by will of any real or personal property as her separate property as a *feme sole* without the intervention of any trustee. The act also enables a married woman who is executrix of a will to act as if she were a *feme sole.* The Married Women's Property Act 1893 extended the act of 1882 by making it unnecessary for the will of a married woman to be re-executed or republished after the death of her husband. *Alien.*—Before 1870 an alien enemy resident in England could only dispose of property by will with the king's licence. The Naturalization Act 1870 enables him to do so as fully as a natural-born British subject. But if he be an alien domiciled abroad he cannot avail himself of Lord Kingsdown's Act (see below). *Soldier and Sailor.*—Wills of soldiers in actual military service, and of sailors, are subject to special legislation, and are excepted from the operation of the Wills Act. The privilege only applies to wills of personal estate. Such wills may usually be made when the testator has attained the age of fourteen, and are not revoked by marriage only but by marriage and the birth of a child. Wills of soldiers on an expedition may be made by unattested writing or by nuncupative testament before two witnesses. Wills of petty officers and seamen in the navy, and of marines, as far as relates to their pay or prize-money, must be attested by an officer, and wills made by a seaman in the merchant service must, if made at sea, be attested by the master or mate, if made on land by a superintendent of a mercantile marine office, a minister of religion, justice of the peace, or consular or customs officer. See the Merchant Shipping Act 1894, s. 177. The wills of prisoners of war are subject to special regulations, and the Admiralty may at its discretion waive the due execution of wills in other instances. The effects of seamen, marines and soldiers, killed or dying in the service, are exempt from duty. Pay, wages, prize money and pensions due to persons employed in the navy may be paid out without probate where the whole assets do not exceed £32. The Board of Trade may at its discretion dispense with probate of the will of a merchant seaman whose effects do not exceed £50 in value. By an act passed in 1868 the existing exemptions are extended to the sum of £100 in the case of civil service pay or annuities, of civil or military allowances chargeable to the army votes, and of army prize money. *Will made under power.*—A will made under a power of appointment is not revoked by marriage when the real or personal estate thereby appointed would not in default of appointment pass to the testator's executor or administrator or to the next of kin. Before the Wills Act a will exercising a power of appointment had to conform to any special requisitions in the power, but since the act the power is duly exercised if executed and attested like an ordinary will. *Registration.*—In the register counties memorials of wills affecting lands in those counties must be registered. *Member of friendly society*, &c.—Members of friendly, industrial and provident societies, depositors in savings banks, and servants in certain public offices, may under the provisions of numerous acts make a nomination to an amount not exceeding £100. Such nomination is practically equivalent to a will, and may be made at the age of sixteen.

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[1] *Fourth Report*, p. 12.

[2] By § 1 of the act the word "will" includes codicil.

[3] *Hall* v. *Hall*, L.R. 1 Prob. 481.

[4] *Egerton* v. *Earl Brownlow*, 4 House of Lords Cases, 210.

[5] 4 *Inst.* 335.

[6] See the *Collection of Royal Wills* printed for the Society of Antiquaries by J. Nichols (1780).

At common law there could be no larceny of a will of lands. But now by the Larceny Act of 1861 stealing, injuring or concealing a will, whether of real or personal estate, is punishable with penal servitude for life. Forgery of a will (at one time a capital crime) renders the offender liable to the same penalty. Fraudulent concealment of a will material to the title by a vendor or mortgagor of land or chattels is, by the Law of Property Amendment Act 1859, a misdemeanour punishable by fine or imprisonment or both. It should be noticed that a contract to make a will containing provisions in favour of a certain person or certain persons is valid if it fulfil the requirements of the law regulating contract. A good example is *Synge* v. *Synge* (1894) 1 K.B. 466.

For death duties see ESTATE DUTY, LEGACY, SUCCESSION DUTY.

The principal authorities for the English law are, for the formalities, Sir E. V. Williams, *Executors*; Holdsworth and Vickers, *Law of Succession*; J. Williams, *Wills and Succession*; for the construction, the works of Sir James Wigram and of Messrs Jarman, F. V. Hawkins and Theobald. Precedents will be found in Hayes and Jarman's *Concise forms of Wills*, and in ordinary collections of precedents in conveyancing. For comparative law see E. Lambert, *Le Régime successoral* (Paris, 1903).

Ireland.

The act of 1837 applies to Ireland. The main difference between the law of the two countries is that in Ireland a bequest for masses for the repose of the testator's soul is valid, provided that the masses be public, in England such a bequest is void as tending to superstitious uses.

Scotland.

Up to 1868 wills of immovables were not allowed in Scotland. The usual means of obtaining disposition of heritage after death was a trust disposition and settlement by deed *de praesenti*, under which the truster disponed the property to trustees according to the trusts of the settlement, reserving a life interest. Thus something very similar to a testamentary disposition was secured by means resembling those employed in England before the Wills Act of Henry VIII. The main disadvantage of the trust disposition was that it was liable to be overthrown by the heir, who could reduce *ex capite lecti* all voluntary deeds made to his prejudice within sixty days of the death of his ancestor. In 1868 the Titles to Land Consolidation Act made it competent to any owner of lands to settle the succession to the same in the event of death by testamentary or *mortis causa* deeds or writings. In 1871 reduction *ex capite lecti* was abolished. A will of immovables must be executed with the formalities of a deed and registered to give title. The disability of a woman as a witness was removed by the Titles to Land Consolidation Act. As to wills of movables, there are several important points in which they differ from corresponding wills in England, the influence of Roman law being more marked. Males may make a will at fourteen, females at twelve. A nuncupative legacy is good to the amount of £100 Scots (£8, 6s. 8d.), and a holograph testament is good without witnesses, but it must be signed by the testator, differing in this from the old English holograph. By the Conveyancing Act 1874 such a will is presumed to have been executed on the date which it bears. Not all movables can be left, as in England. The movable property of the deceased is subject to *jus relictae* and *legitim*. See McLaren, *Wills and Succession*, for the law, and *Judicial Styles* for styles.

United States.—By the constitutions of many states laws giving effect to informal or invalid wills are forbidden. The age of testamentary capacity varies very much. Eighteen is a common one. Full liberty of disposition is not universal. Homesteads generally, and dower estates frequently, are not devisable. In some states only a disposable portion of the property can be left, so that children cannot be disinherited without good cause, and in some children omitted in a will may still take their share. It is frequently provided that a certain amount must be left to the widow. Louisiana follows French law, by which the testator can under no circumstances alienate by will more than half his property if he leave issue or ascendants. In some states a married woman may not leave more than half her property away from her husband. Some require the husband's consent and subscription to make the will of a married woman valid. Nuncupative and holograph wills are in use. The former are confined to personalty and must generally be reduced to writing within a short time after the words are spoken. In Louisiana the mystic or sealed will still exists. The number of witnesses necessary for the validity of a will of any kind is usually two, sometimes three. Wills of soldiers and sailors are privileged, as in England. There are several decisions of state courts that belief in spiritualism does not of itself constitute testamentary incapacity.

See Jarman, American edition by Randolph and Talcott.

France.—The law is mainly contained in ss. 967-1074 of the *Code Civil.* Wills in France may be of three kinds: (1) *holograph*, which must be wholly written, dated and signed by the testator; (2) made as a *public instrument*, *i.e.* received by two notaries before two witnesses or by one notary before four witnesses; this form of will must be dictated by the testator and written by the notary, must be read over to the testator in the presence of the witnesses and must be signed by testator and witnesses; (3) *mystic*, which are signed by the testator, then closed and sealed and delivered by him to a notary before six witnesses; the notary then draws up an account of the proceedings on the instrument which is signed by the testator, notary and witnesses. Legatees and their blood relations to the fourth degree may not be witnesses. Nuncupative wills are not recognized. Soldiers' and sailors' wills are subject to special rules as in most other countries. Full liberty of disposition only exists where the testator has no ascendants or descendants, in other cases his *quantité disponible* is subject to *réserve*; if the testator has one child he may only dispose of half his estate, if two only one-third, if three or more only one-fourth; if he has no descendants but ascendants in both lines he may dispose of half, if ascendants in one line only he may dispose of three-fourths. The full age of testamentary capacity is twenty-one years, but minors over the age of sixteen may dispose by will of half of the estate of which they could dispose had they been of full age. There is no restriction against married women making wills. A contract to dispose of the succession is invalid, s. 791.

The codes of the Latin races in Europe are in general accordance with the French law.

Germany.—Most of the law will be found in the *Bürgerliches Gesetzbuch*, ss. 2064-2273. A holograph will, either single or joint, is allowed. Other wills must be declared before a judge or notary or (outside Germany) a consul. Two witnesses are required, unless the witness be a notary or the registrar of the court, who is sufficient alone. The formalities may be relaxed in certain cases, such as imminent death, a state of siege, a prevailing epidemic, &c. Descendants, ascendants and the husband and wife, are entitled to compulsory portions (*pflichtteilsberechtigt*). But those prima facie entitled may be deprived of their share for certain specified kinds of misconduct. A contract to make any specified testamentary disposition is inoperative. But a contract of inheritance (*Erbvertrag*) made *inter vivos* by direct disposition is valid in certain cases and will operate on the death of the contractor. The modes of revocation are much the same as in England (except marriage). But there is one peculiar to Germany, the inconsistency of a will with an *Erbvertrag*; in such an event the will is wholly or *pro tanto* revoked.

International Law.—There are three main directions which the opinion of jurists and the practice of courts have taken. (1) The whole property of the testator may be subjected to the law of his domicil. To this effect is the opinion of Savigny and the German practice. Certain modifications have been made by modern law, especially by the *Einführungsgesetz* of 1896. (2) The property may be subjected to the law of the place where it happens to be at the time of the testator's death. (3) The movable property may be subjected to the law of the domicil, the immovable (including leaseholds) to the law of the place where it is situate, the *lex loci rei sitae*. England and the United States follow this rule. Testamentary capacity is generally governed by the law of the testator's domicil at the time of his death, the form of the instrument in most countries either by the law of his domicil or the law of the place where the will was made, at his option. The old rule of English law was to allow the former alternative only. The law was altered for the United Kingdom in 1861 by the Wills Act 1861 (known as Lord Kingsdown's Act), by which a will made out of the United Kingdom by a British subject is, as far as regards personal estate, good if made according to the forms required by the law of the place where it was made, or by the law of the testator's domicil at the time of making it, or by the law of the place of his domicil of origin. Subsequent change of domicil does not avoid such a will. Another act passed on the same day, the Domicile Act 1861, enacted that by convention with any foreign government foreign domicil with regard to wills could not be acquired by a testator without a year's residence and a written declaration of intention to become domiciled. By the same act foreign consuls may by convention have certain authority over the wills and property of subjects of foreign states dying in England. In the United States some states have adopted the narrow policy of enacting by statute the old common law rule, and providing that no will is valid unless made in the form required by the law of the state of the testator's domicil. The capacity of the testator, revocation and construction of a will, are governed by the law of the domicil of the testator at the time of his death—except in cases affected by Lord Kingsdown's Act, as he must be supposed to have used language in consonance with that law, unless indeed he express himself in technical language of another country. A good instance is *Groos' Case* (1904), Prob. 269, where it was held that the will of a Dutch woman (at the time of her death domiciled in England) duly made in Holland was not revoked by her marriage, that being no ground of revocation by the law of Holland.[1] The persons who are to take under a will are decided by different rules according as the property is movable or immovable, the former being governed by the law of the domicil, the latter by the *lex loci rei sitae*. It was held, however, in 1881 by the court of appeal in England that, under the will of an Englishman domiciled in Holland, leaving personal property to children, children legitimated *per subsequens matrimonium* could take, as they were legitimate by the law of Holland, though not by the law of England (*re Goodman's Trusts*, 17 Ch. D. 266). This principle was carried further in *re Grey's Trusts* (1892), 3 Ch. 88, where it was held that a legitimated child was entitled to share in a devise of English realty. But it is to be noted that a person born out of lawful wedlock, though legitimated, cannot succeed as *heir* to real estate in England (*Birtwhistle v. Vardill*, 2 Cl. and F. 895). A will duly executed abroad is generally required to be clothed with the authority of a court of the country where any property affected by the will is situate. (J. W.)

WILLARD, FRANCES ELIZABETH (1839–1898), American reformer, was born at Churchville, Monroe county, New York, on the 28th of September 1839. She attended the Milwaukee Female College in 1857 and in 1859 graduated at the Northwestern Female College at Evanston, Illinois. She then became a teacher, and in 1871–1874 she was president and professor of aesthetics of the Woman's College at Evanston, which became part of the North-Western University in 1873. In 1874 she became corresponding secretary and from 1879 until her death was president of the National Woman's Christian Temperance Union, and from 1887 until her death was president of the World's Woman's Christian Temperance Union. She first spoke in favour of woman's suffrage in 1877; and in 1884 she was a member of the Executive Committee of the Prohibition party. In 1890 she was elected president of the Woman's National Council, which represented nearly all of the women's societies in America. She was one of the founders of *Our Union*, a New York publication in the interests of the National Woman's Christian Temperance Union, and of the *Signal* (after 1882 the *Union Signal*), which she edited in 1892–1898 and which was the Illinois organ of the union. She died in New York City on the 18th of February 1898.

With Mary A. Livermore she edited *A Woman of the Century* (Buffalo, N.Y., 1893), which includes a sketch of her life; and she published *Nineteen Beautiful Years* (1864), a life of her sister; *How to Win: A Book for Girls* (1886), *Glimpses of Fifty Years* (1889), and, in collaboration with H. M. Winslow, Mrs S. J. White and others, *Occupations for Women* (1897). See A. A. Gordon, *The Beautiful Life of Frances E. Willard* (Chicago, 1898), with an introduction by Lady Henry Somerset, and W. M. Thayer, *Women Who Win* (New York, 1896).

WILLEMITE, a mineral consisting of zinc orthosilicate, Zn_2SiO_4, crystallizing in the parallel-faced hemihedral class of the rhombohedral system. Crystals have the form of hexagonal prisms terminated by rhombohedral planes: there are distinct cleavages parallel to the prism-faces and to the base. Granular and cleavage masses are of more common occurrence. The colour varies considerably, being colourless, white, greenish-yellow, apple-green, flesh-red, &c. The hardness is $5\frac{1}{2}$, and the specific gravity 3·9-4·2. A variety containing much manganese replacing zinc is called "troostite." Willemite occurs at Sterling Hill, Sussex county, and Franklin Furnace in New Jersey, where it is associated with other zinc ores (franklinite and zincite) in crystalline limestone. It has been found at only a few other localities, one of which is near Liége, and for this reason the mineral was named after William I. of the Netherlands. Under the influence of radium radiations, willemite fluoresces with a brilliant green colour. (L. J. S.)

WILLEMS, FLORENT JOSEPH MARIE (1823–1905), Belgian painter, was born at Liége on the 8th of January 1823. He had no regular tuition in painting, but learnt by copying and restoring old pictures at Malines, where he lived from 1832. He made his debut at the Brussels Salon in 1842 with a "Music Party" and an "Interior of a 17th-century Guard-room" in the style of Terburg and Metsu. Soon afterwards he settled in Paris, where his pictures enjoyed considerable popularity under the second empire. Among his most famous works may be mentioned "The Wedding Dress" (Brussels Gallery), "La Fête des grands-parents" (Brussels Gallery), "Le Baise-main" (Mme. Cardon's collection, Brussels), "Farewell" (Willems coll., Brussels), "The Arches of the Peace" (Delahaye coll., Antwerp) and "The Widow" (engraved by Desvachez). He died at Neuilly-sur-Seine on the 23rd of October 1905.

WILLEMS, JEAN FRANÇOIS (1793–1846), Flemish writer, began life in the office of a notary at Anvers. He devoted his leisure to literature, and in 1810 he gained a prize for poetry with an ode in celebration of the peace of Tilsit. He hailed with enthusiasm the constitution of the kingdom of the Netherlands, and the revival of Flemish literature; and he published a number of spirited and eloquent writings in support of the claims of the native tongue of the Netherlands. His political sympathies were with the Orange party at the revolution of 1830, and these views led him into trouble with the provisional government. Willems, however, was soon recognized as the unquestioned leader of the Flemish popular movement, the chief plank in whose platform he made the complete equality of the languages in the government and the law courts. He died at Ghent in 1846.

Among his writings, which were very numerous, the most important were: *Les Sciences et les arts* (1816), *Aux Belges* (1818); *Étude sur les origines et l'histoire des temps primitifs de la ville d'Anvers* (1828); *Mélanges de littérature et d'histoire* (1829); besides several learned critical editions of old Flemish texts.

WILLESDEN, an urban district in the Harrow parliamentary division of Middlesex, England, suburban to London, lying immediately outside the boundary of the county of London (boroughs of Hammersmith and Kensington). Pop. (1881) 27,453; (1901) 114,811. It has increased greatly as a residential district, mainly of the working classes. There are, moreover, considerable railway works attached to Willesden Junction, where the suburban lines of the London & North Western, North London, and Great Western railways connect with the main line of the first-named company. Remains of Norman building have been discovered in the church of St Mary, which is of various dates, and has been much enlarged in modern times. Several ancient monuments and brasses are retained. There is a Jewish cemetery in Willesden Lane. The adjoining residential districts are Harlesden on the south, Kilburn and Brondesbury on the east, Cricklewood and Neasden (with the works of the Metropolitan railway) on the north.

At Domesday the manor of Willesden and Harlesden was held by the canons of St Paul's. In the 12th century it was formed into eight distinct manors, seven of which were held by the same number of prebendaries. A shrine or image of St Mary (Our

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[1] The law of Holland will be found set out in the case. It is in general accordance with that of France.

Lady of Willesden) was in the 15th century an object of pilgrimage, but by the middle of the century following the ceremonies had fallen into abuse, and the shrine was suppressed.

WILLETTE, LEON ADOLPHE (1857–), French painter, illustrator, caricaturist, and lithographer, was born in Chalons-sur-Marne. He studied for four years at the École des Beaux-Arts under Cabanel—a training which gave him a unique position among the graphic humorists of France. Whether comedy or tragedy, dainty triviality or political satire, his work is instinct with the profound sincerity of the artist. He set Pierrot upon a lofty pedestal among the imaginary heroes of France, and established Mimi Pinson, frail, lovable, and essentially good-hearted, in the affections of the nation. Willette is at once the modern Watteau of the pencil, and the exponent of sentiments that move the more emotional section of the public. Always a poet, and usually gay, fresh, and delicate, in his presentation of idylls exquisitely dainty and characteristically Gallic, illustrating the more "charming" side of love, often pure and sometimes unnecessarily materialistic, Willette frequently reveals himself bitter and fierce, even ferocious, in his hatreds, being a violent though at the same time a generous partizan of political ideas, furiously compassionate with love and pity for the people—whether they be ground down under the heel of political oppression, or are merely the victims of unrequited love, suffering all the pangs of graceful anguish that are born of scornful treatment. There is charm even in his thrilling apotheosis of the guillotine, and in the introduction into his caricatures of the figure of Death itself. The artist was a prolific contributor to the French illustrated press under the pseudonyms "Cémoi," "Pierrot," "Louison," "Bébé," and "Nox," but more often under his own name. He illustrated Mélandri's *Les Pierrots* and *Les Giboullés d'avril*, and has published his own *Pauvre Pierrot* and other works, in which he tells his stories in scenes in the manner of Busch. He decorated several "brasseries artistiques" with wall-paintings, stained glass, &c., notably Le Chat noir and La Palette d'or, and he painted the highly imaginative ceiling for La Cigale music hall. His characteristically fantastic "Parce Domine" was shown in the Franco-British Exhibition in 1908. A remarkable collection of his works was exhibited in 1888. His "Valmy" is in the Luxembourg, Paris.

WILLIAM (A.S. *Wilhelm*, O. Norse *Vilhiâlmr*; O. H. Ger. *Willahelm*, *Willahalm*, M. H. Ger. *Willehelm*, *Willehalm*, Mod. Ger. *Wilhelm*; Du. *Willem*; O. Fr. *Villalme*, Mod. Fr. *Guillaume*; from "will," Goth. *vilja*, and "helm," Goth. *hilms*, Old Norse *hiâlmr*, meaning possibly "one who wills to protect"), a masculine proper name borne by many European sovereigns and others, of whom the more important are treated below in the following order:—(1) kings of England and Scotland. (2) Other sovereigns in the alphabetical order of their states. (3) Other ruling princes. (4) Prelates, Chroniclers, &c.

WILLIAM I. (1027 or 1028–1087), king of England, surnamed the Conqueror, was born in 1027 or 1028. He was the bastard son of Robert the Devil, duke of Normandy, by Arletta, the daughter of a tanner at Falaise. In 1034 Robert resolved on a pilgrimage to Jerusalem. Having no legitimate son he induced the Norman barons to acknowledge William as his successor. They kept their engagement when Robert died on his journey (1035), though the young duke-elect was a mere boy. But the next twelve years was a period of the wildest anarchy. Three of William's guardians were murdered; and for some time he was kept in strict concealment by his relatives, who feared that he might experience the same fate. Trained in a hard school, he showed a precocious aptitude for war and government. He was but twenty years old when he stamped out, with the help of his overlord, Henry I. of France, a serious rising in the districts of the Bessin and Cotentin, the object of which was to put in his place his kinsman, Guy of Brionne. Accompanied by King Henry, he met and overthrew the rebels at Val-des-Dunes near Caen (1047). It was by no means his last encounter with Norman traitors, but for the moment the victory gave him an assured position. Next year he joined Henry in attacking their common enemy, Geoffrey Martel, count of Anjou. Geoffrey occupied the border fortress of Alençon with the good will of the inhabitants. But the duke recovered the place after a severe siege, and inflicted a terrible vengeance on the defenders, who had taunted him with his base birth; he also captured the castle of Domfront from the Angevins (1049).

In 1051 the duke visited England, and probably received from his kinsman, Edward the Confessor, a promise of the English succession. Two years later he strengthened the claims which he had thus established by marrying Matilda, a daughter of Baldwin V. of Flanders, who traced her descent in the female line from Alfred the Great. This union took place in defiance of a prohibition which had been promulgated, in 1049, by the papal council of Reims. But the affinity of William and Matilda was so remote that political rather than moral considerations may have determined the pope's action. The marriage was zealously opposed by Archbishop Malger of Rouen and Lanfranc, the prior of Bec; but Lanfranc was persuaded to intercede with the Curia, and Pope Nicholas II. at length granted the needful dispensation (1059). By way of penance William and his wife founded the abbeys of St Stephen and the Holy Trinity at Caen. The political difficulties caused by the marriage were more serious. Alarmed at the close connexion of Normandy with Flanders, Henry I. renounced the alliance which had long existed between the Capets and the house of Rollo. He joined forces with Geoffrey Martel in order to crush the duke, and Normandy was twice invaded by the allies. In each case William decided the campaign by a signal victory. The invasion of 1054 was checked by the battle of Mortemer; in 1058 the French rearguard was cut to pieces at Varaville on the Dive, in the act of crossing the stream. Between these two wars William aggrandized his power at the expense of Anjou by annexing Mayenne. Soon after the campaign of Varaville both Henry I. and Geoffrey Martel were removed from his path by death (1060). He at once recovered Maine from the Angevins, nominally in the interest of Herbert II., the lawful count, who became his vassal. In 1062, however, Herbert died and Maine was formally annexed to Normandy. This acquisition brought the Norman frontier almost to the Loire and isolated Brittany, long coveted by the Norman dukes, from the rest of France.

About 1064 the accidental visit of Harold to the Norman court added another link to the chain of events by which William's fortunes were connected with England. Whatever doubt hangs over the details of the story, it seems clear that the earl made a promise to support the claims of his host upon the English succession. This promise he was invited to fulfil in 1066, after the Confessor's death and his own coronation. Harold's perjury formed the chief excuse for the Norman Conquest of England, which in reality was a piratical venture resembling that of the sons of Tancred d'Hauteville in Lower Italy. William had some difficulty in securing the help of his barons. When consulted in a great council at Lillebonne they returned an unfavourable reply, and it was necessary to convince them individually by threats and persuasions. Otherwise the conditions were favourable. William secured the benevolent neutrality of the emperor Henry IV.; the influence of the archdeacon Hildebrand obtained for the expedition the solemn approval of Pope Alexander II. Philip I. of France was a minor under the guardianship of William's father-in-law, the count of Flanders. With Tostig, the banished brother of Harold, William formed an alliance which proved of the utmost service. The duke and his Normans were enabled, by Tostig's invasion of northern England, to land unmolested at Pevensey on the 28th of September 1066. On the 14th of October a crushing defeat was inflicted on Harold at the battle of Senlac or Hastings; and on Christmas Day William was crowned at Westminster.

Five years more were to elapse before he became master of the west and north. Early in 1067 he made a progress through parts of the south, receiving submissions, disposing of the lands of those who had fought against him, and ordering castles to be built; he then crossed the Channel to celebrate his triumph in Normandy. Disturbances at once occurred in Northumbria, on the Welsh marches and in Kent; and he was compelled to return in December. The year 1068 was spent in military expeditions against Exeter and York, in both of which the adherents of Harold had found a welcome. In 1069 Robert of Comines, a Norman to whom William had given the earldom of Northumberland, was murdered by the English at Durham; the north declared for Edgar Atheling, the last male representative of the West-Saxon dynasty; and Sweyn Estrithson of Denmark sent a fleet to aid the rebels. Joining forces, the Danes and English captured York, although it was defended by two Norman castles. The position seemed critical; but, fortunately for the king, the south and west gave no effective support to the rebellion. Marching rapidly on York he drove the Danes to their ships; and the city was then reduced by a blockade. The king ravaged the country as far north as Durham with such completeness that traces of devastation were still to be seen sixty years later. But the English leaders were treated with politic clemency, and the Danish leader, Jarl Osbiorn, was bribed to withdraw his fleet. Early in 1070 the reduction of the north was completed by a march over the moors to Chester, which had not hitherto submitted but was now placed under an earl of William's choice. From this point we hear no more of general rebellions against the foreign rule. In 1071 a local rising in the fens caused some trouble. An outlawed Englishman, Hereward by name, fortified the Isle of Ely and attracted a number of desperate spirits to his side; amongst others came Morcar, formerly earl of Northumbria, who had been disappointed in the hopes which he based on William's personal favour. The king in person undertook the siege of Ely, which proved unexpectedly difficult. But the failure of the insurgents was a foregone conclusion.

Of the measures which William took to consolidate his authority we have many details; but the chronological order of his proceedings is obscure. The redistribution of land appears to have proceeded pari passu with the reduction of the country; and at every stage of the conquest each important follower received a new reward. Thus were formed the vast but straggling fiefs which are recorded in Domesday. The great earldoms of the West-Saxon period were allowed to lapse; the new earls, for the most part closely connected with William by the ties of blood or friendship, were lords of single shires; and only on the marches of the kingdom was the whole of the royal jurisdiction delegated to such feudatories. William's writs show not only that he kept intact the old system of governing through the sheriffs and the courts of shire and hundred, but also that he found it highly serviceable. Those whom he enfeoffed with land held it according to the law of Norman feudalism, which was already becoming precise. They were thus brought into close personal relations with the king. But he forced the most powerful of them to acknowledge the jurisdiction of the ancient local courts; and the old fyrd-system was maintained in order that the crown might not be wholly dependent on feudal levies. Though his forest-laws and his heavy taxation caused bitter complaints, William soon won the respect of his English subjects. They appear to have accepted him as the lawful heir of the Confessor; and they regarded him as their natural protector against feudal oppression. This is to be explained by his regard for legal forms, by his confirmation of the "laws of Edward" and by the support which he received from the church. Domesday Book shows that in his confiscations he can have paid little attention to abstract justice. Almost every English landholder of importance was dispossessed, though only those who had actually borne arms against William should have been so treated. As far as possible Englishmen were excluded from all responsible positions both in church and state. After 1071 our accounts of William's doings become jejune and disconnected. Much of his attention must have been engrossed by the work of administration, carried on without the help of those elaborate institutions, judicial and financial, which were perfected by Henry I. and Henry II. William had few ministers of note. William Fitz Osbern, earl of Hereford, who had been his right-hand man in Normandy, fell in the civil wars of Flanders (1071). Odo, bishop of Bayeux, William's half-brother, lost favour and was finally thrown into prison on a charge of disloyalty (1082). Another half-brother, Robert of Mortain, earl of Cornwall, showed little capacity. Of the king's sons Robert, though titular count of Maine, was kept in leading strings; and even William Rufus, who was in constant attendance on his father, never held a public office. The Conqueror reposed much confidence in two prelates, Lanfranc of Canterbury and Geoffrey of Coutances. They took an active part in the civil no less than the ecclesiastical government. But the king himself worked hard in hearing lawsuits, in holding councils and ceremonious courts, in travelling between England and Normandy, and finally in conducting military operations.

In 1072 he undertook a campaign against Malcolm, king of Scots, who had married Margaret, the sister of Edgar Atheling, and was inclined to promote English rebellions. When William reached the Forth his adversary submitted, did homage as a vassal, and consented to expel Edgar Atheling, who was subsequently endowed with an English estate and admitted to William's favour. From Scotland the king turned to Maine, which had profited by the troubles of 1069 to expel the Norman garrisons. Since then the Manceaux had fallen out among themselves. The barons supported Azo of Liguria, the lawful successor of Herbert II.; the citizens of Le Mans set up a commune, expelled Azo's representatives and made war on the barons. William had therefore no difficulty in reducing the country, even though Le Mans was assisted by Fulk of Anjou (1073). In 1075 the king's attention was claimed by a conspiracy of the earls of Hereford and Norfolk, in which the Englishman Waltheof, earl of Northampton, was implicated to some degree. The rebels were defeated by Lanfranc in the king's absence; but William returned to settle the difficult question of their punishment, and to stamp out the last sparks of disaffection. The execution of Waltheof, though strictly in accordance with the English law of treason, was a measure which he sanctioned after long hesitation, and probably from considerations of expediency rather than justice. This severity to a man who was generally thought innocent, is one of the dark stains on his career. In 1076 he invaded Brittany to get possession of the fugitive earl of Norfolk; but Philip of France came to the aid of the Bretons, and William gave way before his suzerain. The next few years were troubled by a quarrel between the king and his eldest son. Robert fled from Normandy and after aimless wanderings obtained from King Philip the castle of Gerberoi, in the Beauvaisis, from which he harassed the Norman marches. William besieged Gerberoi in 1079, and was wounded in single combat by his son. A little later they were reconciled; but the reconciliation was short-lived; to the end of the reign Robert was a source of trouble. In the years 1083–1085 there was a second rising in Maine which was not laid to rest until William had granted liberal terms to the leader, Hubert of Beaumont. In 1085 news arrived that Cnut the Saint, king of Denmark, was preparing to assert the claims of his house in England. The project fell through, but gave occasion for the famous moot at Salisbury in which William took an oath of direct allegiance from "all the land-sitting men that were in England" (1086). While the danger was still impending he took in hand the compilation of Domesday Book. The necessary inquiries were ordered at the Christmas Council of 1085, and carried out in the following year. It is probable that William never saw the Domesday Book as we possess it, since he left England in the summer of 1086 and never returned. In 1087 he invaded the French Vexin to retaliate on the garrison of Mantes for raids committed on his territory. He sacked and burned the town. But as he rode out to view the ruins his horse plunged on the burning cinders and inflicted on him an internal injury. He was carried in great suffering to Rouen and there died on the 9th of September 1087. He was buried in St Stephen's at Caen. A plain slab still marks the place of his tomb, before the high altar; but his bones were scattered by the Huguenots in 1562.

In a profligate age William was distinguished by the purity of his married life, by temperate habits and by a sincere piety. His most severe measures were taken in cold blood, as part of his general policy; but his natural disposition was averse to unnecessary bloodshed or cruelty. His one act of wanton devastation, the clearing of the New Forest, has been grossly exaggerated. He was avaricious, but his church policy (see article English History) shows a disinterestedness as rare as it was honourable. In personal appearance he was tall and corpulent, of a dignified presence and extremely powerful physique, with a bald forehead, close-cropped hair and short moustaches.

By Matilda, who died in Normandy on the 3rd of November 1083, William had four sons, Robert, duke of Normandy, Richard, who was killed whilst hunting, and the future kings, William II. and Henry I., and five or six daughters, including Adela, who married Stephen, count of Blois.

Of the original authorities the most important are the *Gesta Willelmi*, by William of Poitiers (ed. A. Duchesne in *Historiae Normannorum scriptores*, Paris, 1619); the Winchester, Worcester and Peterborough texts of the *Anglo-Saxon Chronicle* (ed. B. Thorpe, "Rolls" series, 2 vols., 1861, and also C. Plummer, 2 vols., Oxford, 1892–1899); William of Malmesbury's *De gestis regum* (ed. W. Stubbs, "Rolls" series, 2 vols., 1887–1889); William of Jumièges' *Historia Normannorum* (ed. A. Duchesne, *op. cit.*); Ordericus Vitalis' *Historia ecclesiastica* (ed. A. le Prévost, *Soc. de l'historie de France*, 5 vols., Paris, 1838–1855). Of modern works the most elaborate is E. A. Freeman's *History of the Norman Conquest*, vols. iii.–v. (Oxford, 1870–1876). Domesday Book was edited in 1783–1816 by H. Farley and Sir H. Ellis in four volumes. Of commentaries the following are important: *Domesday Studies* (ed. P. E. Dove, 2 vols., London, 1888–1891); *Feudal England*, by J. H. Round (London, 1895); *Domesday Book and Beyond*, by F. W. Maitland (Cambridge, 1897); *English Society in the Eleventh Century*, by P. Vinogradoff (Oxford, 1908). See also F. M. Stenton, *William the Conqueror* (1908). (H. W. C. D.)

WILLIAM II. (*c.* 1056–1100), king of England, surnamed Rufus, was the third son of William I. by his queen Matilda of Flanders. Rufus was born some years before the conquest of England, but the exact date is uncertain. He seems to have been his father's favourite son, and constantly appears in the Conqueror's company, although like his brothers he was carefully excluded from any share in the government either of England or Normandy. A squabble with Rufus was the immediate cause of Robert's first rupture with the Conqueror; in the ensuing civil war we find Rufus bearing arms on the royal side (1077–1080). On this death-bed the Conqueror was inclined to disinherit his eldest son in favour of Rufus, who, by the early death of Prince Richard, was now left second in the order of succession. The king's advisers, however, used their influence to obtain a partition; Normandy was accordingly bequeathed to Robert, while Rufus was designated as the son on whom the Conqueror desired that the kingdom of England should devolve. With the help of Lanfranc the English were easily induced to accept this arrangement. Rufus was crowned at Westminster on the 26th of September 1087, fifteen days after the death of his father.

It may be in part the fault of our authorities that the reign of Rufus presents itself to us as a series of episodes between which the connexion is often of the slightest. In his domestic administration we can trace a certain continuity of purpose, and in his dealings with the Welsh and Scots he proceeded, though intermittently, along the broad lines of policy which his father had marked out. Beyond the Channel he busied himself with schemes, first for the reunion of England and Normandy, then for the aggrandisement of Normandy at the expense of France. But his attention was perpetually distracted by the exigencies of the moment. He threw himself into each particular design with unreflecting impetuosity, but never completed what had been well begun. The violence, the irregularity, the shamelessness of his private life are faithfully reflected in his public career. Even in cases where his general purpose could be justified, his methods of execution were crudely conceived, brutal and short-sighted. Rufus may well stand as the typical product of early feudalism. He was not without valour or glimmerings of chivalry, but perfidious to his equals, oppressive to his subjects, contemptuous of religion; with no sense of his responsibilities, and possessed by a fixed determination to exact the last farthing of his rights. The first year of his reign was troubled by a general conspiracy among the baronage, who took up arms for Robert in the name of the hereditary principle, but with the secret design of substituting a weak and indolent for a ruthless and energetic sovereign. Local risings in Norfolk, Somerset and the Welsh marches were easily repressed by the king's lieutenants. The castles of Kent and Sussex offered a more formidable resistance, since their lords were in direct communication with Robert of Normandy, and were led by the able Odo of Bayeux (*q.v.*), the king's uncle, who had been released from prison at the opening of the reign. Rufus, however, made an earnest appeal to the native English, promising good laws, the abolition of unjust taxes and redress for those who had suffered by the afforestments of the late king. These promises, which he never attempted to fulfil, served the purpose of the moment. Followed by large contingents of the national militia he successfully laid siege to the strongholds of the rebels. They were leniently treated, and the arch-conspirator, Odo of Bayeux, left England under a safe-conduct to sow fresh seeds of discord in Normandy. But Rufus resolved to take vengeance on his brother, and two years later invaded eastern Normandy. Encountering little resistance—for under Robert's rule the duchy had relapsed into a state of anarchy—he might have expelled the duke with no great trouble. But in 1091 a treaty was hastily patched up. Rufus retained the eastern marches of the duchy, and also received certain seaports. In return he undertook to aid Robert in reducing the rebellious county of Maine, and in recovering the Cotentin from their younger brother, Henry Beauclerk, to whom it had been pledged by the impecunious duke. The last part of the agreement was duly executed. But Rufus then recrossed the Channel to chastise the Scots who in his absence had raided the north country. By a march to the Firth of Forth he vindicated English honour; Malcolm III. of Scotland prudently purchased his withdrawal, by doing homage (Aug. 1091) on the same terms which William I. had imposed in 1072. Next year Rufus broke the treaty by seizing the stronghold of Carlisle and the other lands held or claimed by Malcolm in Cumberland and Westmorland. Malcolm in vain demanded satisfaction; while attempting reprisals on Northumberland he was slain in an obscure skirmish (1093). Rufus immediately put forward a candidate for the vacant throne; and this policy, though at first unsuccessful, finally resulted in the accession of Edgar (1097), a son of Malcolm, who had acknowledged the English overlordship. Carlisle remained an English possession; in the next reign Cumberland and Westmorland appear as shires in the accounts of the Exchequer. The Scottish policy of Rufus, though legally unjustifiable, was thus comparatively successful. In dealing with the Welsh he was less fortunate. Three campaigns which he conducted in North Wales, during 1095 and 1097, yielded no tangible result. The expansion of the Welsh marches in this reign was due to the enterprise of individual adventurers.

The affairs of Wales and Scotland did not prevent Rufus from resuming his designs on Normandy at the first opportunity. Robert was rash enough to reproach his brother with non-fulfilment of the terms arranged in 1091; and Rufus seized the excuse for a second invasion of the duchy (1094). Less prosperous than the first, and interrupted by a baronial conspiracy, which kept Rufus in England for the whole of 1095, this enterprise found an unexpected termination. Robert resolved to go upon Crusade and, to obtain the necessary funds, gave Normandy in pledge to his brother (1096). There can be no doubt that Rufus intended to remain in lasting possession of this rich security. The interests of Normandy at once became the first consideration of his policy. In 1098–1099 he recovered Maine at the cost of a vast expenditure on mercenaries, and commenced operations for the recovery of the Vexin. Early in 1100 he accepted a proposal, made by William IX. of Aquitaine, that he should take over that duchy on terms similar to those arranged in the case of Normandy. Contemporaries were startled at the rapid progress of the king's ambitions, and saw the direct interposition of heaven in the fate which cut them short. On the 2nd of August 1100 Rufus fell, in the New

Forest, the victim of an arrow from an unknown hand. The common story names Walter Tirel, who was certainly close at hand and fled the country without venturing to abide the issue of a trial. But a certain Ralph of Aix is also accused; and Tirel, from a safe distance, solemnly protested his innocence.

It remains to notice the main features of the domestic administration which made the names of William and his minister, Ralph Flambard, infamous. Respecting the grievances of the laity we have few specific details. But we are told that the "moots" all over England were "driven" in the interests of the king; which perhaps means that aids were extorted from the shire-courts. We also learn that the forest-laws were rigorously administered; that the king revived, for certain offences, the death-penalty which his father had abolished; that all men were vexed by unjust gelds and the feudal classes by unscrupulous misinterpretations of the customs relating to the incidents of wardship, marriage and relief. On one occasion the militia were summoned in considerable numbers for a Norman expedition, which was no part of their duty; but when they arrived at the sea-coast they were bidden to hand over their journey money and go home. The incident is not uninstructive as a side-light on the king's finance. As to the oppression of the church we are more fully informed; after allowing for exaggeration there still remains evidence enough to prove that the ecclesiastical policy of Rufus was unscrupulously venal. Vacant sees and abbacies were either kept for years in the hands of the king, who claimed the right of a feudal guardian to appropriate the revenues so long as the vacancy continued; or they were openly sold to the highest bidder. The history of Anselm's relations with the king is fully narrated by the biographer Eadmer. Anselm received the see of Canterbury in 1093, after it had been in the king's hands for upwards of four years. William made the appointment in a moment of repentance, when sick and at death's door. But he resented Anselm's demand for full restitution of the temporalities and his refusal to make any payment, in the nature of an aid or relief, which might be construed as simoniacal. Other grounds of quarrel were found in the reproofs which the primate aimed at the vices of the court, and in his requests for leave to hold a church-council and initiate reforms. Finally, in 1095, Anselm exasperated the king by insisting on his right to recognize Urban II. as the lawful pope. By the "customs" of the Conqueror it had been the rule that no pope should be recognized in England without the king's permission; and Rufus was unwilling that the English Church should be committed to either party in the papal schism which had already lasted fifteen years. Anselm, on the other hand, asserted that he had accepted the primacy on the distinct condition that he should be allowed to acknowledge Urban. The dispute came before a great council which was held at Rockingham (Feb. 25, 1095). The king demanded that the assembly should adjudge Anselm guilty of contumacy, and was supported by the bishops. The lay barons, however, showed their ill-will towards the king's general policy by taking Anselm's part. Rufus was forced to give way. He recognized Urban, but entered upon intrigues at Rome to procure the suspension of the archbishop. Finding that Urban would not betray a loyal supporter, the king fell back upon his authority as a feudal suzerain. He taxed Anselm with having failed to provide a satisfactory quota of knights for the Welsh war (1097). The archbishop, seeing that he was never to be left in peace, and despairing of an opportunity to effect the reforms on which his heart was set, demanded urgently that he should be allowed to leave England for the purpose of visiting Urban. Both the king and the barons suspected that this was the first step towards an appeal to the pope's jurisdiction against that of the royal court. Leave was at first refused; but ultimately, as Anselm continued to press his demand, he was suffered to depart, not without experiencing some petty insults on his way (Oct. 1097). The motive of the king's apparent clemency was soon revealed. He seized the estates of the archbishopric, and kept them in his own hands for the future. The friends of the archbishop were thus justified in their assertion that the zeal of Rufus for his father's "customs" was a mere cloak for avarice and tyranny.

In appearance William II. was unattractive; bull-necked, with sloping shoulders, extremely corpulent and awkward in his gait. His long locks and clean-shaven face marked his predilection for the new-fangled fashions which contemporary ecclesiastics were never weary of denouncing. His features were strongly marked and coarse, his eyes grey and deeply set; he owed his nickname to the fiery hue of his complexion. He stuttered violently and in moments of passion was almost inarticulate. His familiar conversation was witty and blasphemous. He was surrounded by a circle of vicious parasites, and no semblance of decorum was maintained in his household. His character was assailed by the darkest rumours which he never attempted to confute. He died unmarried and without issue.

The main authorities for the reign are the *Peterborough Chronicle* (ed. C. Plummer, 2 vols., Oxford, 1892–1899); Eadmer's *Vita Anselmi* and *Historia Novorum* (ed. M. Rule, "Rolls" series, 1884); William of Malmesbury's *De gestis regum* (ed. W. Stubbs, "Rolls" series, 2 vols., 1887–1889); Orderic Vitalis' *Historia ecclesiastica* (ed. A. le Prévost, 5 vols., Paris, 1838–1855). Of modern works the most exhaustive is E. A. Freeman's *Reign of William Rufus* (2 vols., Oxford, 1882). See also J. H. Round's *Feudal England* (London, 1895). (H. W. C. D.)

WILLIAM III. (1650–1702), king of England and prince of Orange, was the only son of William II., prince of Orange, stadtholder of the Dutch republic, and Mary, daughter of Charles I. of England, and was born at the Hague on the 4th of November 1650, eight days after his father's death. His father had attempted a *coup d'état*, which had failed, with the result that on his death the office of stadtholder was abolished. Power passed into the hands of John de Witt, who represented the oligarchic element and the special interests of one province, Holland, and was taken from the Orange party which represented the more democratic element and the more general interests of the Seven Provinces. William inherited the baleful lustre, without the substantial power, which his ancestors had given to the name of Orange. He grew up among enemies, and became artful, suspicious and self-controlled, concealing his feeling behind the mask of an immobile, almost repulsive, coldness. Like Charles XII. of Sweden and the younger Pitt, he was a wonderful example of premature mental development.

In 1672 Louis XIV. suddenly invaded Dutch territory. The startling successes of the French produced a revolution among the Dutch people, who naturally turned for help to the scion of the house of Orange. On the 8th of July 1672 the states general revived the stadtholderate, and declared William stadtholder, captain-general and admiral for life. This revolution was followed by a riot, in which John de Witt and his brother Cornelius were murdered by the mob at the Hague. Evidence may be sought in vain to connect William with the outrage, but since he lavishly rewarded its leaders and promoters this circumstance is not very much to his credit. The cold cynicism with which he acted towards de Witt is only matched by the heroic obstinacy with which he confronted Louis. Resolved as he said "to die in the last ditch," he rejected all thought of surrender and appealed to the last resource of Dutch patriotism by opening the sluices and laying vast tracts under water. The French army could not advance, while the French and English fleets were defeated by the Dutch admiral, De Ruyter. William summoned Brandenburg to his aid (1672) and made treaties with Austria and Spain (1673). In August 1674 he fought his first great battle at Seneffe, where, though the struggle was not unequal, the honours lay with Condé. The French evacuated Dutch territory early in 1674, but continued to hold places on the Rhine and in Flanders. In April 1677 William was badly beaten at St Omer, but balanced his military defeat by France by a diplomatic victory over England. In November 1677 he married Mary, eldest daughter of James, duke of York, afterwards King James II., and undertook negotiations with England in the following year which forced Louis to make terms and sign the treaty of Nijmwegen in August 1678, which gave

Franche Comté and other places in Spanish Flanders to France. For some reason never yet made clear, but perhaps in order to produce a modification of terms which threatened the balance of power, William attacked the French army at Mons four days after the signature of peace. Luxembourg defeated him after a sanguinary and resultless struggle, and William gained nothing by his inexplicable action.

After the war Louis continued a course of aggression, absorbing frontier-towns in imperial or Spanish territory. William started a new coalition against him in October 1681 by making a treaty with Sweden, and subsequently with the empire, Spain and several German princes. After absorbing Strassburg (1681), Louis invaded Spanish Flanders and took Luxemburg (1684). Even then the new league would not fight and allowed Louis to retain his conquests by the truce of Regensburg (1685), but none the less these humiliations gave rise to a more closely-knit and aggressive coalition, which was organized in 1686 and known as the League of Augsburg.

From 1677 onwards William had carefully watched the politics of England. On the accession of James II. in 1685 he forced the duke of Monmouth to leave Holland, and sought to dissuade him from his ill-starred expedition to England. He apparently tried to conciliate his father-in-law in the hope of bringing him into the League of Augsburg. At the same time he astutely avoided offending the party in England which was opposed to James. By November 1687 he had decided that it was hopeless to expect that James would join the league against Louis, and he therefore turned for support to the English opposition. He caused his chief minister Fagel to write a letter expressing his disapprobation of the religious policy of James, which was published in November 1687. This announcement of his views was received with wild enthusiasm by the English who saw in him the friend of their liberties and their Church. But he knew too much of the English to suppose they would tolerate an armed invasion, and he accordingly made it clear that he would not undertake active interference unless he received a definite invitation from leading Englishmen. On the 30th of June 1688 Admiral Herbert, disguised as a blue-jacket, set out from England with a letter from seven influential Englishmen, asking William to "bring over an army and secure the infringed liberties" of England.

William set out from Holland with an army on the 2nd of November and landed at Torbay (Nov. 5th 1688). After a few days of hesitation, many influential noblemen declared for him in different parts of the country. James, who had at first joined his army at Salisbury, fell back to London and tried to negotiate. While his commissioners were amusing William, James sent off his wife and son to France, and tried to follow them. He was stopped in his flight by some fishermen at Faversham, and was forced to return to London. William insisted that he should be sent to Rochester, and there allowed him to escape to France. After this final flight of James, William, on the advice of an assembly of notables, summoned a convention parliament on the 22nd of January 1689. After a great deal of discussion, William was at length proclaimed joint-sovereign of England in conjunction with his wife, Mary (Feb. 13th 1689).

A constitutional settlement was effected by the end of 1689, almost all the disputed points between king and parliament being settled in favour of the latter. Though William by no means appreciated this confinement of his prerogative, he was too wise to oppose it. His own initiative is more clearly traceable in the Toleration Act, extending liberty of private worship to Dissenters. He also succeeded in passing an Act of Grace and Indemnity in 1690, by which he calmed the violence of party passion. But in general his domestic policy was not very fortunate, and he can hardly claim any personal credit for the reassessment of the land-tax (1692), the creation of the national debt or the recoinage act (1693–1695). Further, he threatened the existence of the Bank of England, by lending his support to a counter-institution, the Land Bank, which ignominiously collapsed. Though he was not blind to the commercial interests of England, he was neglectful of the administration and affairs of her oversea colonies. But though he was unable to extract the best results from parliament he was always able to avert its worst excesses. In spite of strong personal opinions to the contrary, he accepted the Triennial Act (1694), the vote reducing the army to 10,000 men (1697), the vote disbanding his favourite Dutch Guards (1699) and even (November 1699) a bill rescinding the grants of forfeited Irish estates, which he had made to his favourites. The main cause of the humiliations William suffered from parliament lay in his incapacity to understand the party or cabinet system. In his view the best way to govern was to have both parties represented in the ministry, so that, as Whig and Tory fell out, the king came by his own. A study of his reign shows that this method was unsuccessful, and that his affairs went most smoothly when the parliamentary majority held the same views as the ministry. It is not often remembered that William possessed an experience of the workings of representative government in Holland, which was remarkably similar to that in England. Hence his mistakes though easy to understand are by no means so pardonable as were, for example, those of the Georges, who had been absolute monarchs in their own country. William's unpopularity with his new people was, on the whole, unjustified, but his memory is rightly darkened by the stain of the "Massacre of Glencoe." In 1692 he signed an order for the "extirpation" of the Macdonalds, a small clan in the vale of Glencoe. It is improbable that he meant his order to be literally executed, it is not certain that he knew they had taken the oath of allegiance to him. None the less, when the massacre was carried out with circumstances of revolting barbarity, William behaved as he had done after the murder of De Witt. Popular pressure forced him to bring the murderers to justice, to punish them and dismiss them his service. But shortly afterwards they were all received into favour; "one became a colonel, another a knight, a third a peer."

These and other actions indicate that William could show on occasion a cold and cynical ruthlessness. But while admitting that his means were sometimes unprincipled, it must be recollected that his real ends were high and noble. While he sometimes disregarded the wishes of others, no one was more ready to sacrifice his own feelings for the attainment of the master aim of his life, the restoration of the "Balance of Power," by the overthrow of the predominance of France. This was the real aim of William in going to England in 1688. He had set off to secure an ally against Louis, and he came back from his expedition with a crown on his head and a new nation at his back, united in its detestation of popery and of France.

As king of England he concluded treaties of alliance with the members of the League of Augsburg and sent a large army to oppose the French in Flanders. But his greatest immediate peril during 1689–1690 came from the circumstance that the French disputed the mastery of the seas with the Anglo-Dutch fleet, and that Ireland was strongly for King James. On the 1st of July 1690 the allies were badly beaten at sea off Beachy Head, but on the same day William himself won a decisive victory over James's army at the Boyne in Ireland. Dublin and Drogheda soon fell and James fled from Ireland. The chances of continued resistance in Ireland, which depended on communication with France, were finally destroyed by the great victory off Cape La Hogue (May 19th, 1692). Ireland was speedily conquered when once the supremacy of England on the sea became assured. Now the French fleet was definitely destroyed, and though a destructive privateering warfare continued, England was no longer in danger of invasion.

The decisive successes for the Alliance were gained by its naval victories, whose importance William somewhat underrated and for whose execution he had only an indirect responsibility. In 1692 he lost Namur and was badly defeated at Steinkirk (August 4th), and in 1693 he was disastrously beaten at Neerwinden or Landen (July 19th). In 1695 he was able to resume the offensive and to retake Namur in a brilliant and, what was more unusual, a successful campaign. William had assumed the duties of commander-in-chief too young to learn the full duties of a professional soldier himself, and his imperious will did not suffer others to direct him. Hence though often fertile in resource and ingenious in plan, he was always a brilliant amateur; and, though sometimes unlucky, he was never really the equal of such generals as Condé or Luxembourg.

In diplomacy William was as uniformly successful as in war he was the reverse. His unity of aim and constancy of purpose make him one of the greatest of modern diplomatists. He held together his ill-assorted coalition, and finally concluded peace at Ryswick in September 1697. Louis restored all his acquisitions since 1678, except Strassburg, and recognized William as king of England. During the subsequent years William tried to arrange a partition treaty with France, by which the domains of the childless Charles II. of Spain were to be divided at his death. But on the death of Charles in 1700 the whole heritage was left to France. William endeavoured to oppose this, and used Louis's recognition of James Edward the "Old Pretender" as king of England (September 1701) to set the English people in a flame. War was already declared in 1702, but William, who had long been ailing, died from the combined effects of a fall from his horse and a chill on the 8th of March 1702. It was truly tragic that his doom should have come at the moment when he had once more drawn together a great alliance in Europe, and when he possessed a popularity in England such as he had never before enjoyed.

In viewing William's character as a whole one is struck by its entire absence of ostentation, a circumstance which reveals his mind and policy more clearly than would otherwise be the case. No one can doubt his real belief in religion in spite of many moral failings or weaknesses. He was an unfaithful husband and often treated his wife with scant consideration; he was too fond of Dutch favourites like Keppel or worthless women like Lady Orkney. When it suited his interests he sanctioned the systematic corruption of members of parliament, and he condoned massacres like those at the Hague or in Glencoe. On the other hand he did not hesitate to inflict considerable injury on his own people, the Dutch, by the terms of the treaty with England (1689), when it became clear that only in this way could England's co-operation be secured. The Dutch criticism on him has been that he might have done more to reform the clumsiness of their constitutional procedure, and thus given them some return for the crippling expenses of the war. English criticism avers that he ought to have recognized more fully the system of party government, and to have done more to promote our colonial and commercial development. Military historians point out that he sometimes sacrificed great advantages to impetuosity; naval experts that he sometimes threw away great opportunities by indifference. Some of these criticisms are rather beside the mark, but were all true, they would not impair his essential greatness, which lay in another sphere. The best proof of his real powers of statesmanship is that the peace of Utrecht was subsequently made on the broad lines which he had laid down as the only security for European peace nearly a dozen years before its conclusion. While he lacked in diplomacy the arts of a Louis XIV. or the graces of a Marlborough, he grasped the central problems of his time with more clearness, or advanced solutions with more ultimate success, than any other statesman of his age. Often baffled, but never despairing, William fought on to the end, and the ideas and the spirit of his policy continued to triumph long after the death of their author.

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WILLIAM IV. (1765–1837), king of England, third son of George III., was born at Buckingham Palace on the 21st of August 1765. In 1779 he was sent to sea and became a midshipman under Admiral Digby. Next year he sailed under Rodney and took part in the action off Cape St Vincent (16th of January 1780). During the rest of the war the young prince saw plenty of service, for which he imbibed a strong liking, and so laid the foundation of his popularity. On the conclusion of the war he travelled in Germany, visiting Hanover and Berlin, where he was entertained by Frederick the Great. In 1785 he passed for lieutenant; next year he was made captain and stationed in the West Indies. Shortly after 1787, being tired of his station, he sailed home without orders, and was punished for his insubordination by being obliged to stay at Plymouth till his ship was refitted, when he again sailed for the West Indies.

In 1789 he was made duke of Clarence. When war was declared against the French republic in 1793, he strongly supported it and was anxious for active employment; but, though he was made rear-admiral of the red, he could obtain no command. Thus condemned to inactivity, he amused or revenged himself by joining the prince of Wales and the duke of York in their opposition to the king. He threw himself into the dissipations of society, and his hearty geniality and bluff, sailor-like manners gained him popularity, though they did not secure him respect. He took his seat in the House of Lords, where he defended the extravagancies of the prince of Wales, spoke on the Divorce Bill, vehemently opposed the emancipation of slaves and defended slavery on the ground of his experience in the West Indies. Meanwhile he formed a connexion with Mrs Jordan, the actress, with whom he lived on terms of mutual affection and fidelity for nearly twenty years, and the union was only broken off eventually for political reasons. During all this period the prince had lived in comparative obscurity. The death of Princess Charlotte in 1817 brought him forward as in the line of succession to the crown. In 1818 he married Adelaide of Saxe-Meiningen, a lady half his age, without special attractions, but of a strong, self-willed nature, which enabled her subsequently to obtain great influence over her husband. On the death of the duke of York in 1827 the duke of Clarence became heir to the throne, and in the same year he was appointed lord high admiral. In discharging the functions of that office he endeavoured to assume independent control of naval affairs, although his patent precluded him from acting without the advice of two members of his council. This involved him in a quarrel with Sir George Cockburn, in which he had to give way. As he still continued to act in defiance of rules, the king was at length obliged to call upon him to resign.

On the 28th of June 1830 the death of George IV. placed him on the throne. During the first two years of his reign England underwent an agitation more violent than any from which it had suffered since 1688. William IV. was well-meaning and conscientious; but his timidity and irresolution drove ministers to despair, while his anxiety to avoid extremes and his want of insight into affairs prolonged a dangerous crisis and brought the country to the verge of revolution. Immediately after his accession the revolution of July broke out in France and gave a great impulse to the reform movement in England. The king, though he called himself an "old Whig," did not dismiss the Tory ministry which had governed the country during the last two years of his brother's reign; but the elections for the new parliament placed them in a minority. Within a fortnight of the opening of parliament they were beaten on a motion for the reform of the civil list, and resigned. Lord Grey undertook to form a ministry, with the avowed intention of bringing in a large measure of reform. This was not in itself displeasing to the king, who had liberal tendencies, and a few years before had supported Catholic emancipation. But, when the struggle in parliament began, his disinclination to take up a decided attitude soon exposed the government to difficulties. The first Reform Bill was introduced on the 1st of March 1831; the second reading was carried on the 21st of March by a majority of one. Shortly afterwards the government were beaten in committee.

and offered to resign. The king declined to accept their resignation, but at the same time was unwilling to dissolve, although it was obvious that in the existing parliament a ministry pledged to reform could not retain office. From this dilemma William was rescued by the conduct of the opposition, which, anxious to bring on a change of ministry, moved an address against dissolution. Regarding this as an attack on his prerogative, William at once dissolved parliament (April 1831). The elections gave the ministry an overwhelming majority. The second Reform Bill was brought in in June, and passed its third reading (21st of September) by a majority of 109. A fortnight later (8th of October) the Lords threw out the bill by a majority of 41. But after a protracted political crisis (see the article on GREY, CHARLES GREY, 2nd earl) the king was compelled to consent to create a sufficient number of new peers to carry the bill, and the threat was successful in bringing about the passing of the act in 1832.

During the rest of his reign William IV. had not much opportunity of active political interference, but on one other occasion he made an unjustifiable use of his prerogative. Two years after the passing of the Reform Bill the ministry of Lord Grey had become unpopular. In July 1834 Lord Grey himself retired and Lord Melbourne took the lead. There were divergences of opinion in the cabinet, and the king strongly objected to the ministerial policy respecting the Irish Church. On the shallow pretext that Lord Althorp's removal to the Upper House would weaken the ministry in the House of Commons, where, however, they still had a majority, he suddenly dismissed them and summoned Sir Robert Peel (14th of November). Peel's ministry, containing many members who had been in the government on the king's accession, was called from its short duration "the ministry of the hundred days." Its formation clearly indicated that the Whig proclivities of the king, which had never been more than partial or lukewarm, had wholly disappeared. The step was regarded with general disapprobation. It was immediately followed by a dissolution, and the ministry soon found themselves in a minority. Beaten on Lord John Russell's motion respecting the Irish Church (3rd of April 1835), Peel resigned and Melbourne again came into power. Under him the Whigs retained the lead during the remainder of the reign. This *coup d'état* of November 1834 was the last occasion on which the English sovereign has attempted to impose an unpopular ministry on the majority in parliament.

In May 1837 the king began to show signs of debility, and died from an affection of the heart on the 20th of June, leaving behind him the memory of a genial, frank, warm-hearted man, but a blundering, though well-intentioned prince. He was succeeded by his niece Queen Victoria.

AUTHORITIES.—*Correspondence of Earl Grey with William IV. and Sir Herbert Taylor* (London, 1867); Fitzgerald's *Life and Times of William IV.*; Greville's *Memoirs*; *Memoirs* of Sir Robert Peel; the *Creevey Papers*; *Civil Correspondence of the Duke of Wellington*; Walpole's *History of England*; Martineau's *History of the Peace*. (G. W. P.)

WILLIAM (1143–1214), king of Scotland, surnamed "the Lion," was the second son of Henry, earl of Huntingdon (d. 1152), a son of King David I., and became king of Scotland on the death of his brother, Malcolm IV., in December 1165, being crowned at Scone during the same month. After his accession to the throne William spent some time at the court of the English king, Henry II.; then, quarrelling with Henry, he arranged in 1168 the first definite treaty of alliance between France and Scotland, and with Louis VII. of France assisted Henry's sons in their revolt against their father in 1173. In return for this aid the younger Henry granted to William the earldom of Northumberland, a possession which the latter had vainly sought from the English king, and which was possibly the cause of their first estrangement. However, when ravaging the country near Alnwick, William was taken prisoner in July 1174, and after a short captivity at Richmond was carried to Normandy, where he soon purchased his release by assenting in December 1174 to the treaty of Falaise. By this arrangement the king and his nobles, clerical and lay, undertook to do homage to Henry and his son; this and other provisions placing both the church and state of Scotland thoroughly under the suzerainty of England. William's next quarrel was with Pope Alexander III., and arose out of a double choice for the vacant bishopric of St Andrews. The king put forward his chaplain, Hugh; the pope supported the archdeacon, John the Scot, who had been canonically elected. The usual interchange of threats and defiances followed; then after the death of Alexander in 1181 his successor, Lucius III., consented to a compromise by which Hugh got the coveted bishopric and John became bishop of Dunkeld. In 1188 William secured a papal bull which declared that the Church of Scotland was directly subject only to the see of Rome, thus rejecting the claims to supremacy put forward by the English archbishop. This step was followed by the temporal independence of Scotland, which was one result of the continual poverty of Richard I. In December 1189, by the treaty of Canterbury, Richard gave up all claim to suzerainty over Scotland in return for 10,000 marks, the treaty of Falaise being thus definitely annulled.

In 1186 at Woodstock William married Ermengarde de Beaumont, a cousin of Henry II., and peace with England being assured three years later, he turned his arms against the turbulent chiefs in the outlying parts of his kingdom. His authority was recognized in Galloway which, hitherto, had been practically independent; he put an end to a formidable insurrection in Moray and Inverness; and a series of campaigns taught the far north, Caithness and Sutherland, to respect the power of the crown. The story of William's relations with King John is interesting, although the details are somewhat obscure. Soon after John's accession in 1199 the Scottish king asked for the earldom of Northumberland, which Richard I., like his father, had refused to restore to Scotland. John, too, refused this demand, but the threatened war did not take place, and in 1200 William did homage to the English king at Lincoln with the ambiguous phrase "saving his own rights." After a period of inaction war between the two countries again became imminent in 1209; but a peace was made at Norham, and about three years later another amicable arrangement was reached. Both these treaties seem to have been more favourable to England than to Scotland, and it is possible that William acknowledged John as overlord of his kingdom. William died at Stirling on the 4th of December 1214 and was buried at Arbroath. He left one son, his successor Alexander II., and two daughters, Margaret and Isabella, who were sent to England after the treaty of 1209, and who both married English nobles, Margaret becoming the wife of Hubert de Burgh. He also left some illegitimate children. William's reign is a very important period in the early history of Scotland, and may almost be said to mark an epoch in every department of public life. The relations of England and Scotland and of Scotland and France; the rise of towns, the development of trade and the establishment of order in Scotland itself; and the attitude of the Scottish Church, both to the papal see and to England, were all vitally affected by the events of this reign. William founded and richly endowed the abbey at Arbroath, and many of the Scottish towns owe their origin to his charters.

See E. W. Robertson, *Scotland under her Early Kings* (Edinburgh, 1862); Lord Hailes, *Annals of Scotland* (Edinburgh, 1819); A. Lang, *History of Scotland*, vol. i. (1900); also SCOTLAND: *History*.

WILLIAM I. (1797–1888), king of Prussia and German emperor, was the second son of Frederick William III. of Prussia and Louise, a princess of Mecklenburg-Strelitz. He was born at Berlin on the 22nd of March 1797, and received the names of Wilhelm Friedrich Ludwig. He was a delicate child and had to be carefully nurtured. His constitution, however, was sound, and he became one of the most vigorous men in Germany. After the battle of Jena he spent three years at Königsberg and Memel. Meanwhile he had given evidence of sterling honesty, a strict love of order, and an almost passionate interest in everything relating to war. On the 1st of January 1807 he received an officer's patent, and on the 30th of October 1813 was appointed a captain. William accompanied his father in the campaign of 1814, and early in the following year received the iron cross for personal bravery shown at Bar-sur-Aube. He took part in the entry into Paris on the 31st of March 1814, and afterwards visited London. He joined the Prussian army in the final campaign of the Napoleonic wars, and again entered Paris. The prince was made a colonel and a member of the permanent military commission immediately after his twentieth birthday, and at the age of twenty-one became a major-general. In 1820 he received the command of a division; and during the following nine years he had not only made himself master of the military system of his own country but studied closely those of the other European states. In 1825 he was promoted to the rank of lieutenant-general, and obtained the command of the corps of guards. On the 11th of June 1829 he married Augusta, daughter of Charles Frederick, grand duke of Saxe-Weimar. This lady, who had imbibed the Liberal tendencies of the court of Weimar and later developed a keen sympathy with Catholicism, exercised afterwards as queen and empress a considerable influence at court, in a sense generally hostile to Bismarck's views. She died on the 7th of January 1890.

On the death of his father in 1840—the new king, Frederick William IV., being childless—Prince William, as heir presumptive to the throne, received the title of prince of Prussia. He was also made lieutenant-governor of Pomerania and appointed a general of infantry. In politics he was decidedly conservative; but at the outbreak of the revolutionary movement of 1848 he saw that some concessions to the popular demand for liberal forms of government were necessary. He urged, however, that order should be restored before the establishment of a constitutional system. At this time he was the best-hated man in Germany, the mass of the Prussian people believing him to be a vehement supporter of an absolutist and reactionary policy. He was even held responsible for the blood shed in Berlin on the 18th of March, and was nicknamed the "Cartridge Prince," although he had been relieved nine days before of his command of the guards. So bitter was the feeling against him that the king entreated him to leave the country for some time, and accordingly he went to London, where he formed intimate personal relations with Prince Albert, Sir Robert Peel, Lord John Russell, Lord Palmerston and other English statesmen. On the 8th of June he was back at Berlin, and on the same day he took his seat as member for Wirsitz in the Prussian national assembly, and delivered a speech in which he expressed belief in constitutional principles. In 1849, when the revolutionary party in the grand-duchy of Baden became dangerous, he accepted the command of "the army of operation in Baden and the Palatinate," and his plans were so judiciously formed and so skilfully executed that in the course of a few days the rebellion was crushed. At the beginning of the campaign an unsuccessful attempt was made on his life. In October 1849 he was appointed military governor of the Rhineland and Westphalia, and took up his residence at Coblenz. In 1854 the prince was raised to the rank of a field-marshal and made governor of the federal fortress of Mainz. When the king was attacked with a disease of the brain, Prince William assumed the regency (7th October 1858), and on his brother's death, on the 2nd of January 1861, succeeded him as William I.

The political events of William's regency and reign are told elsewhere (see Germany: *History*; Prussia: *History*). His personal influence upon these events is, however, of great importance and deserves separate notice. William was not a ruler of the intellectual type of Frederick the Great; but he believed intensely in the "God of battles" and in his own divine right as the vicegerent of God so conceived. He believed also in the ultimate union of Germany and in the destiny of Prussia as its instrument; and he held that whoever aspired to rule Germany must seize it for himself (Letter to von Natzmer of the 20th of May 1849, in Natzmer's *Unter den Hohenzollern*). But an attitude so wholly alien to the Liberal temper of contemporary Germany was tempered by shrewd common sense, and, above all, by a capacity to choose his advisers well and listen to their advice. Thus it came about that the regent, whose reactionary views were feared, called the Liberals into office on Bismarck's advice, though later he did not hesitate to override the constitution when the refusal of the supplies for the new armaments made this course necessary. From September 1862, when Bismarck took office as minister president, William's personality tends to be obscured by that of his masterful servant, who remained beside him till his death. But Bismarck's *Reminiscences* contain plentiful proof that his master was by no means a cipher. His prejudices, indeed, were apt to run athwart the minister's plans; as in the Schleswig-Holstein question, when the king's conscience in the matter of the claims of the Augustenburg prince threatened to wreck Bismarck's combinations. But, as Bismarck put it, the annexation of the duchies gave him "a taste for conquest," and in the campaign of 1866 the difficulty was to restrain the king, who wished to enter Vienna in triumph. Whatever may have been the feelings of the Prussians before the war, its striking success fully justified the king's policy, and on his return to Berlin he was received with unbounded enthusiasm.

In the events immediately preceding the Franco-German War of 1870–71 again it was Bismarck and not the king that gave the determining impulse. In the matter of the Hohenzollern candidature King William's attitude was strictly "correct." He was justified in refusing to discuss further with Benedetti the question of "guarantees," a matter which touched his honour; and if the refusal, courteously framed, was read in Paris as an insult, this was due to Bismarck's "editing" of the Ems telegram (see Bismarck). The result of the outcry in France and of the French declaration of war was that all Germany rallied round the king of Prussia, and when, on the 31st of July, he quitted Berlin to join his army, he knew that he had the support of a united nation. He crossed the French frontier on the 11th of August, and personally commanded at the battles of Gravelotte and Sedan. It was during the siege of Paris, at his headquarters in Versailles, that he was proclaimed German emperor on the 18th of January 1871. On the 3rd of March 1871 he signed the preliminaries of peace which had been accepted by the French Assembly; and on the 21st of March he opened the first imperial parliament of Germany. On the 16th of June he triumphantly entered Berlin at the head of his troops.

After that period the emperor left the destinies of Germany almost entirely in the hands of Bismarck, who held the office of imperial chancellor. In his personal history the most notable events were two attempts upon his life in 1878—one by a working lad called Hödel, another by an educated man, Karl Nobiling. On the first occasion the emperor escaped without injury, but on the second he was seriously wounded. These attacks grew out of the Socialist agitation; and a new Reichstag, elected for the purpose, passed a severe anti-Socialist law, which was afterwards from time to time renewed. Until within a few days of his death the emperor's health was remarkably robust; he died at Berlin on the 9th of March 1888.

The reign of William I. marked an era of vast importance in the history of Germany. In his time Prussia became the first power in Germany and Germany the first power in Europe, though these momentous changes were due in a less degree to him than to Bismarck and Moltke; but to him belongs the credit of having recognized the genius of these men, and of having trusted them absolutely. Personally William maintained the best traditions of the Hohenzollerns, not only by the splendour of the achievements with which his name will always be intimately associated, but by the simplicity, manliness and uprightness of his daily life. By his marriage with Augusta of Saxe-Weimar William I. had two children: the crown prince Frederick William (b. 1831), who succeeded him as Frederick III. (*q.v.*), and the princess Louise (b. 1838), married in 1856 to the grand-duke of Baden.

William I.'s military writings were published in 2 vols. at Berlin in 1897. Of his letters and speeches several collections have appeared: *Politische Korrespondenz Kaiser Wilhelms I.* (1890); *Kaiser Wilhelms des Grossen Briefe, Reden und Schriften* (2 vols., 1905), and his correspondence with Bismarck (ed. Penzler, Leipzig, 1900). A large number of biographies have appeared in German, of which may be mentioned L. Schneider's *Aus dem Leben Kaiser Wilhelms* (3 vols., Berlin, 1888; Fr. translation, 1888); v. Bernhardi, *Die ersten Regierungsjahre K. Wilhelms, Tagebuchblätter* (Leipzig, 1895); Oncken, *Das Zeitalter Kaiser Wilhelms* (2 vols., Berlin, 1890–1892); F. Delbrück, *Die Jugend des Königs Friedrich Wilhelm IV. von Preussen und des Kaisers u. Königs Wilhelm I., Tagebuchblätter* (Berlin, 1907); Blume, *Kaiser Wilhelm und . . . Roon als Bildner des preussisch-deutschen Heeres* (Berlin, 1906); E. Marcks, *Kaiser*

Wilhelm I. (Leipzig, 1897; 5th ed. 1905). In English have appeared *William of Germany*, by Archibald Forbes (1888), a translation of Edouard Simon's *The Emperor William and his Reign* (2 vols., 1886). See also Sybel's *Founding of the German Empire* (Eng. trans., New York, 1890–1891).

WILLIAM II. [FRIEDRICH WILHELM VICTOR ALBERT] (1859–), king of Prussia and German emperor, was born on the 27th of January 1859 at Berlin, being the eldest child of Prince Frederick of Prussia, afterwards crown prince and second German emperor, and of Victoria, princess royal of Great Britain and Ireland. On his tenth birthday he was appointed second lieutenant in the First Regiment of the Guards. From September 1874 to January 1877 he attended the gymnasium at Cassel; he studied for two years at Bonn, and was then for some time chiefly occupied with his military duties. In 1885 he was appointed colonel of the Hussars of the Guard. He was much influenced by the military atmosphere in which his life was spent, and was more in sympathy with the strongly monarchical feelings of the emperor William and Bismarck than with the more liberal views of his own parents, but until the illness of his father in 1887 he took no part in political life. The death of his grandfather was quickly followed by that of his father, and on the 15th of June he became ninth king of Prussia and third German emperor. The chief events of his reign up to 1910 are narrated under GERMANY: *History*, but here it is necessary to dwell rather on the personality of the emperor himself. His first act was an address to the army and navy, while that to his people followed after three days. Throughout his reign, indeed, he repeatedly stated that the army was the true basis of his throne: "The soldier and the army, not parliamentary majorities, have welded together the German Empire. My confidence is placed on the army."

From the first he showed his intention to be his own chancellor, and it was this which brought about the quarrel with Bismarck, who could not endure to be less than all-powerful. The dismissal and disgrace of the great statesman first revealed the resolution of the new ruler; but, as regards foreign affairs, the apprehensions felt at his accession were not fulfilled. While he maintained and confirmed the alliance with Austria and Italy, in obedience to the last injunctions of his grandfather, he repeatedly attempted to establish more cordial relations with Russia. His overtures, indeed, were scarcely received with corresponding cordiality. The intimacy of Russia with France increased, and more than a year passed before the Russian emperor appeared on a short visit to Berlin. In 1890 the emperor again went to Russia, and the last meeting between him and Alexander III. took place at Kiel in the autumn of 1891, but was marked by considerable coolness. By his visit to Copenhagen, as in his treatment of the duke of Cumberland and in his frequent overtures to France, the emperor showed the strong desire, by the exercise of his own great personal charm and ability, to heal the wounds left by the events of a generation before. In the autumn of 1888 he visited not only the courts of the confederate princes, but those of Austria and Italy. While at Rome he went to the Vatican and had a private conversation with Pope Leo XIII., and this visit was repeated in 1895 and again in 1903. In 1889 the marriage of his sister, the Princess Sophie, to the duke of Sparta, took him to Athens; and thence he sailed to Constantinople. It was the first time that one of the great rulers of Christendom had been the guest of the sultan. A more active interest was now taken by Germany in the affairs of the Levant, and the emperor showed that he would not be content to follow the secure and ascertained roads along which Bismarck had so long guided the country. It was not enough that Berlin had become the centre of the European system. The emperor was the apostle of a new Germany, which claimed that her voice should be heard in all political affairs, in whatever quarter of the globe they might rise. Once again, in 1898, he went to Constantinople. It was the time when the Armenian massacres had made the name of Abd-ul Hamid notorious, and the very striking friendliness shown towards him scarcely seemed consistent with the frequent claims made by the emperor to be the leader of Christendom; but any scruples were doubtless outweighed by the great impulse he was able to give to German influence in the East. From Constantinople he passed on to Palestine. He was present at the consecration of the German Protestant church of the Redeemer. By the favour of the sultan he was able to present to the German Catholics a plot of ground, the Dormition de la Sainte Vierge, very near to the Holy Places.

The motive of his frequent travels, which gained for him the nickname of *Der Reise-Kaiser*, was not solely political, but a keen interest in men and things. His love of the sea was shown in an annual voyage to Norway, and in repeated visits to the Cowes regatta. He was a keen yachtsman and fond of all sorts of sport, and, though deprived of the use of his left arm through an accident when he was a child, he became an excellent shot and rider.

At the time of his accession there was a strong manifestation of anti-British feeling in Berlin, and there seemed reason to suppose that the party from which it proceeded had the patronage of the emperor. Any temporary misunderstanding was removed, however, by his visit to England in 1889. For the next six years he was every year the guest of Queen Victoria, and during the period that Caprivi held office the political relations between Germany and Great Britain were very close. While the emperor's visits were largely prompted by personal reasons, they had an important political effect; and in 1890, when he was entertained at the Mansion House in London and visited Lord Salisbury at Hatfield, the basis for an *entente cordiale* seemed to be under discussion. But after 1895 the growth of the colonial spirit in Germany and the strong commercial rivalry with Great Britain, which was creating in Germany a feeling that a navy must be built adequate to protect German interests, made the situation as regards England more difficult. And an unexpected incident occurred at the end of that year, which brought to a head all the latent feelings of suspicion and jealousy in both countries. On the occasion of the Jameson Raid he despatched to the president of the Transvaal a telegram, in which he congratulated him that "without appealing to the help of friendly powers," he had succeeded in restoring peace and preserving the independence of his country. It was very difficult to regard this merely as an impulsive act of generous sympathy with a weak state unjustly attacked, and though warmly approved in Germany, it caused a long alienation from Great Britain. The emperor did not again visit England till the beginning of 1901, when he attended the deathbed and funeral of Queen Victoria. On this occasion he placed himself in strong opposition to the feelings of the large majority of his countrymen by conferring on Lord Roberts the Order of the Black Eagle, the most highly prized of Prussian decorations. He had already refused to receive the ex-president of the Transvaal on his visit to Europe. Meanwhile, with the other great branch of the English-speaking people in the United States, it was the emperor's policy to cultivate more cordial relations. In 1902, on the occasion of the launching of a yacht built for him in America, he sent his brother Prince Henry to the United States as his representative. The occasion was rendered of international importance by his official attitude and by his gifts to the American people, which included a statue of Frederick the Great. The emperor also initiated in 1906 the exchange of professors between German and American universities.

As regards home policy, the most important work to which the emperor turned his attention was the increase of the German naval forces. From the moment of his accession he constantly showed the keenest interest in naval affairs, and the numerous changes made in the organization were due to his personal initiative. It was in January 1895, at an evening reception to members of the Reichstag, that he publicly put himself at the head of the movement for making Germany a sea power. In all the subsequent discussions on the naval bills his influence was decisively used to overcome the resistance of the Reichstag. "Our future," he declared, "is on the water," and in speeches in all parts of the country he combated the indifference of the inland Germans to the sea. "I will not rest," he telegraphed to his brother, "till I have brought my navy to the same height at which my army stands." The development of German armaments during the next few years (see NAVY) showed that this was no idle boast. But, while it was inevitable that the inference should be drawn that the increase of the German navy was directed towards eventual hostilities with Great Britain, the emperor himself insisted that the real object was the preservation of peace consistently with the maintenance of Germany's "place in the sun." In March 1905, in a speech at Bremen, he declared the aim of the Hohenzollerns to be "a world-wide dominion founded upon conquests not gained by the sword, but by the mutual confidence of nations that press towards the same goal." "Every German warship launched," he said, "is one guarantee more for peace on earth." In the same spirit he protested later, in an "interview" published in the *Daily Telegraph* of the 28th of October 1908, that he had always been actuated by the friendliest feelings towards England, but that "Germany must be prepared for any eventualities in the East," and that, in view of the growing naval power of Japan, England should welcome the existence of a German fleet "when they speak together on the same side in the great debates of the future" For to the emperor, who had published a cartoon, drawn by himself, representing the European powers in league against the Yellow Peril, the Anglo-Japanese alliance seemed a betrayal of the white race, an unnatural league which could not last. The justification of his naval policy so far as European affairs were concerned was revealed in the effective intervention of Germany in regard to France and Morocco in 1905, and in 1909 in the defiance of British policy when Austria, backed by Germany, tore up the treaty of Berlin in regard to Bosnia and Herzegovina.

In numerous rhetorical speeches the emperor had impressed the world with his personal conviction of autocratic sovereignty, and his monarchical activity was certain, sooner or later, to bring him into conflict with the constitutional limitations of his position as king of Prussia and German emperor. His imperial style, constitutionally but the honorary title of the *primus inter pares* in a free confederation of sovereign princes, was invested by him with something of the glamour of that of the Holy Roman emperors, with their shadowy claim to world-dominion. In speech after speech he proclaimed the world-mission of Germany, of which he himself was the divinely appointed instrument; Germans are "the salt of the earth[1];" they must not "weary in the work of civilization," and Germanism, like the spirit of imperial Rome, must expand and impose itself.[2] This new imperialism, too, had a religious basis, for "the whole of human life hinges simply and solely on our attitude towards our Lord and Saviour."[3] The emperor's progresses in the East were conceived in the spirit of the new crusade, at once Christian and German; and a solemn service, to which none but the emperor and his train were admitted, was held on the summit of the Mount of Olives. In the same spirit, too, the emperor dispensed the marks of his approval and disapproval beyond the borders of his own jurisdiction, sometimes with results which were open to criticism. The "Kruger telegram" has been mentioned; scarcely less characteristic was the message despatched by him on the 9th of April 1906, after the Algeciras conference, to Count Goluchowski, the Austro-Hungarian foreign minister, congratulating him on having proved "a brilliant second on the duelling-ground." Goluchowski's retirement was mainly due to this compliment. In 1905 he bestowed the order *Pour le Mérite* not only on the Japanese general Nogi, but also on the Russian general Stössel, the defender of Port Arthur, who was afterwards condemned by a Russian court-martial for dereliction of duty. In 1902 his telegram to the regent of Bavaria condemning the refusal of the clerical majority in the diet to vote £5000 for art purposes, and offering himself to supply the money, was regarded as an unwarrantable interference in the internal affairs of Bavaria and roused strong resentment among the clericals all over Germany.

Owing to the political conditions in Germany it was generally left for the Socialists to attack these excursions on the part of the emperor into fields which lay beyond his strict prerogative. But, apart from the traditional lines of political cleavage, such as the inherited hatred of the Liberal South for the Hohenzollern "corporal's cane," other centres of dissatisfaction were coming into being. The emperor was isolated in his efforts to impose the old, strenuous, Prussian ideals of "self-denial, discipline, religion, avoidance of foreign contagion." With the growth of wealth Germany was becoming materialized and to some extent Americanized, partly through the actual reflux of emigrants grown rich in the United States. In this new society, far removed from the days, denounced by the historian Gervinus, when the Germans were content to "fiddle and be slaves," the phrases which still woke responsive echoes in the squires of the Old Mark of Brandenburg were apt to create surprise, if not indignation; and in the great industrial classes the principles of Social Democracy spread apace. The emperor himself here and there even yielded a little to the new ideas, as when, in the famous "Babel and Bible" controversy of 1903, arising out of lectures in which Professor Delitzsch had derived Jewish monotheism from Babylonian polytheism, he publicly accepted the main conclusion of the "higher criticism" of the Old Testament, while maintaining that the kernel and contents, God and His works, remain always the same; or when on the 17th of November 1906, on the 25th anniversary of William I.'s edict announcing national insurance, he promised further social reforms. But he was impatient of what he considered factious opposition, and was apt to appeal from the nation in parliament to the nation in arms, as when in 1906, at the Silesian manœuvres, he condemned the critical spirit exercised towards the government, and invoked once more the protection of Germany's "Divine Ally." Clearly, this was an attitude which was inconsistent with the development of what prided itself on being a constitutional state; but there were obvious difficulties in the way of controlling the utterances of a ruler, vigorous, self-confident and conscious of the best intentions, who was also the master of many legions, whose military spirit he could evoke at will. In October 1906 the publication of Prince Hohenlohe's *Memoirs*, containing indiscreet revelations of the emperor's action in the dismissal of Bismarck, caused a profound sensation. A few months later, in February 1907, the prestige of the court was further damaged by various unsavoury revelations, made by Herr Harden in the *Zukunft*, as to the character of the "camarilla" by which the emperor was surrounded, and it was affirmed that a connexion could here be traced with the fall of Caprivi in 1894. The long-drawn-out trials and counter-trials left the character of the emperor entirely unstained, but they resulted in the disgrace of men who had been his confidants—Prince Philip Eulenburg, Count Kuno Moltke and others. The attitude of the emperor throughout was manly and sensible; and not the least satisfactory outcome of the whole sorry business was the issue, on the 28th of January 1907, of an edict, afterwards embodied in a bill, greatly modifying the law of *lèse-majesté*, which in the earlier part of the reign had been used to ridiculous excess in the imprisonment of the authors of the slightest reflection on the person of the sovereign.

Anglo-German relations were apparently improved by a visit of the emperor to England in November 1907. But early in 1908 they were again strained by the revelation, made in *The Times* of the 6th of March, of a correspondence between the emperor and Lord Tweedmouth, the first lord of the admiralty, in which, in answer to friendly assurances on the emperor's part, the British secretary of state had communicated to him an outline of the new naval programme before it had even been laid on the table of the House of Commons. The angry controversy to which this gave rise, and the emperor's attempts to allay it, led at the end of the year to a serious crisis in his relations with his subjects. On the 11th of August he had met Edward VII. at Cronberg; on the 30th, in a speech at Strassburg, he reiterated the intention of Germany to maintain the high level of her armaments; and on the 28th of October there appeared in the *Daily Telegraph* an extraordinary "interview," authorized by him, in which he expounded his attitude. The document was a résumé of his table-talk during his stay at Highcliffe Castle, on the Hampshire coast opposite the Isle of Wight, in the autumn of 1907. In it he reiterated that his heart was set on peace; he declared that, so far from being hostile to the English, he had offended large sections of his people by his friendship for England. He instanced his refusal to receive the Boer delegates and his rejection of the proposals of France and Russia for a joint intervention to stop the South African War; he also mentioned the curious fact that at an early stage of the war he had himself drawn up a plan of campaign for the British and sent it to Windsor. It was on this occasion, too, that he made the suggestion of an eventual co-operation of the British and German fleets in the Far East. This pronouncement created a profound sensation, not only in Germany, where the indignation was intense, but in Russia, France and Japan, where it was regarded as a Machiavellian attempt to loosen existing alliances. In the German press and parliament a storm of protest arose. Prince Bülow, as technically responsible, handed in his resignation, which was not accepted, and he was forced to make in the Reichstag the best defence that he could for the imperial indiscretion, declaring that henceforth the emperor would show more reserve. The emperor publicly endorsed the chancellor's explanations, and for nearly two years maintained in public an almost unbroken silence. But this came to an end in a speech delivered at Königsberg, on the 25th of August 1910. In this the emperor again laid special stress upon the divine right by which alone the kings of Prussia rule, adding: "considering myself as the instrument of the Lord, without heeding the views and opinions of the day, I go my way." This speech led to a debate, on a Socialist interpellation, in the Reichstag (November 26). In reply to the enquiry what the government intended to do in fulfilment of the pledge given in 1908, the chancellor denied that the emperor had exceeded his constitutional rights, a view supported by the majority of the House.

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[1] Speech at Bremen (March 1905).

[2] Speech at Gniezno, Poland (August 1905).

[3] Speech at confirmation of his son (October 1903).

The emperor married on the 27th of February 1881 Princess Auguste Victoria, daughter of Frederick, duke of Augustenburg, who in 1864 had come forward as claimant to the duchies of Schleswig-Holstein; the marriage had, therefore, some political importance, for it sealed the reconciliation of one of the dynasties that had suffered by the rise of Prussia. They had six sons and one daughter: (1) Wilhelm, born 6th May 1882, Crown Prince, whose coming of age was celebrated with much ceremony on his eighteenth birthday, and who married on the 6th of June 1905 the duchess Cecilia of Mecklenburg, their eldest son, Wilhelm, being born on the 4th of July 1906; (2) Eitel Friedrich, born on the 7th of July 1883; (3) Adalbert, born on the 14th of July 1884; (4) August Wilhelm, born on the 29th of January 1887; (5) Oskar, born on the 27th of July 1888; (6) Joachim, born on the 17th of December 1890; and (7) Viktoria Luise, born on the 13th of September 1892.

For the emperor's speeches, &c., see *Kaiserreden. Reden und Erlasse, Briefe und Telegramme Kaiser Wilhelms II.* (Leipzig, 1902); translated by L. Elkind, as *The German Emperor's Speeches* (London, 1904).

WILLIAM I. (1772–1844), king of the Netherlands, born at the Hague on the 24th of August 1772, was the son of William V., prince of Orange and hereditary stadtholder of the United Netherlands by Sophia Wilhelmina, princess of Prussia. In 1791 he married Frederica Wilhelmina, daughter of Frederick William II., king of Prussia, thus cementing very closely the relations between the houses of Orange-Nassau and Hohenzollern. After the outbreak of war with the French republic in 1793, he distinguished himself in the struggle against the revolutionary army under Dumouriez by the capture of Landrecies and the relief of Charleroi. By the victories of Pichegru the stadtholder and all his family were, however, compelled to leave Holland and seek refuge in England, where the palace of Hampton Court was set apart for their use. He afterwards made Berlin his residence, and took an active part in the unfortunate campaign under the duke of York for the reconquest of the Netherlands. After the peace of Amiens he had an interview with Napoleon at Paris, and received some territory adjoining the hereditary domains of the house of Nassau in Westphalia as a compensation for the abandonment of the stadtholderate and the domains of his house. William refused, however, in 1806, in which year by the death of his father he became prince of Orange, to separate his interests from those of his Prussian relatives, and fought bravely at Jena. He was therefore despoiled by Napoleon of all his possessions. In 1809 he accepted a command in the Austrian army under the archduke Charles and was wounded at the battle of Wagram. When Holland rose in revolt against French domination in 1813, after eighteen years of exile he landed at Scheveningen (on the 19th of November) and was on the 3rd of December, amid universal rejoicing, proclaimed prince sovereign of the Netherlands. His assumption in the following year of the title of king of the Netherlands was recognized by the powers, and by the treaty of Paris his sovereignty was extended over the southern as well as the northern Netherlands, Belgium being added to Holland "as an increase of territory." After the battle of Waterloo, in which Dutch and Belgian troops fought side by side under his command, the congress of Vienna further aggrandized him by making him sovereign of the territory of Luxemburg with the title of grand duke.

William had many excellent qualities, but his long life of exile and hardship had made him niggardly and narrow. He was unable to rise to the great opportunity which lay before him of creating out of the Dutch and Belgian provinces a strong and united state. Two hundred and fifty years of political separation and widely differing experiences had caused the two kindred populations on this and that side of the Scheldt to grow apart in sentiment and tradition. This difference was still further accentuated by strong divergence in religious creed. Further, one-third of the Belgian provinces was inhabited by a Walloon population divided from the Flemings by racial characteristics and their use of a Romance instead of a Teutonic dialect. All these things William was inclined to ignore. He drew up a constitution, which was accepted unanimously by the Dutch, but was rejected by the Belgians, because it contained provisions for liberty of worship. The king, however, by a subterfuge declared that the fundamental law had been approved. The new constitution, therefore, started badly, and it was soon evident that William intended to make his will prevail, and to carry out his projects for what he conceived the social, industrial and educational welfare of the kingdom regardless of the opposition of Belgian public opinion. The Belgians had many grievances. Their representation in the states general was exactly equal to that of the Dutch, though their population was in the proportion of seven to five. With the help of the official vote of ministers the Dutch were thus able to have a perpetual majority. The whole machinery of government was centralized at the Hague, and Dutchmen filled nearly all the principal posts. The attempt of the king to enforce the official use of the Dutch language, and the foundation of the so-called philosophical college at Louvain helped to exacerbate the growing discontent. The rapid advance of Belgium in industrial and manufacturing prosperity, due largely to the stimulus of William's personal initiative, did nothing to bring north and south together, but rather increased their rivalry and jealousy, for the Dutch provinces had neither manufactures nor iron- and coal-mines, but were dependent on agriculture and sea-borne commerce for their welfare. Such clashing of interests was sure to produce alienation, but the king remained apparently blind to the signs of the times, and the severe enforcement of a harsh law restricting freedom of the press led suddenly in 1830 to a revolt (see BELGIUM), which, beginning at Brussels at the end of August, rapidly spread over the whole country. The Dutch were almost without striking a blow expelled from the country, the strongly fortified seaport of Antwerp alone remaining in their hands. Had the king consented at once to the administrative autonomy of Belgium, and appointed the prince of Orange governor of the southern Netherlands, it is probable that the revolt might have been appeased. At the first there was undoubtedly a strong body of public opinion in favour of such a compromise, and the house of Orange had many adherents in the country. William, however, was too proud and too obstinate to lend himself to such a course. He appealed to the powers, who had, in 1815, created and guaranteed the independence of the kingdom of the Netherlands. By the treaty of the eighteen articles, however, concluded at London on the 29th of June 1831, the kingdom of Belgium was recognized, and Leopold of Saxe-Coburg was elected king. William refused his assent, and in August suddenly invaded Belgium. The Belgian forces were dispersed, and the Dutch would have entered Brussels in triumph but for the intervention of the French. Still, however, William declined to recognize the new throne, and he had behind him the unanimous support of Dutch public opinion. For nine years he maintained this attitude, and resolutely refused to append his signature to the treaty of 1831. His subjects at length grew weary of the heavy expense of maintaining a large military force on the Belgian frontier and in 1839 the king gave way. He did so, however, on favourable terms and was able to insist on the Belgians yielding up their possession of portions of Limburg and Luxemburg, which they had occupied since 1830.

A cry now arose in Holland for a revision of the fundamental law and for more liberal institutions; ministerial responsibility was introduced, and the royal control over finance diminished. William, however, disliked these changes, and finding further that his proposed marriage with the countess d'Oultremont, a Belgian and a Roman Catholic, was very unpopular, he suddenly abdicated on the 7th of October 1840. After his abdication he married the countess and spent the rest of his life in quiet retirement upon his private estate in Silesia. He died in 1844.

See L. Jottsand, *Guillaume d'Orange avant son avénement au trône des Pays-Bas*; E. C. de Gerlache, *Histoire du royaume des Pays-Bas depuis 1814 jusqu'en 1830* (3 vols., Brussels, 1842); W. H. de Beaufort, *De eerste regeeringsjaren van Koning Willem I.* (Amsterdam, 1886); H. C. Colenbrander, *De Belgische Omwenteling* (The Hague, 1905); T. Juste, *Le Soulèvement de la Hollande en 1813 et la fondation du royaume des Pays-Bas* (Brussels, 1870); and P. Blok, *Geschiedenis der Nederlandsche Volk*, vols. vii. and viii. (Leiden, 1907–1908).

WILLIAM II. (1792–1849), king of the Netherlands, son of William I., was born at the Hague on the 6th of December 1792. When he was three years old his family was driven out of Holland by the French republican armies, and lived in exile until 1813. He was educated at the military school at Berlin and afterwards at the university of Oxford. He entered the English army, and in 1811, as *aide-de-camp* to the duke of Wellington, took part in several campaigns of the Peninsula War. In 1815 he commanded the Dutch and Belgian contingents, and won high commendations for his courage and conduct at the battles of Quatre Bras and Waterloo, at the latter of which he was wounded. The prince of Orange married in 1816 the grand duchess Anna Paulowna, sister of the tzar Alexander I. He enjoyed considerable popularity in Belgium, as well as in Holland for his affability and moderation, and in 1830, on the outbreak of the Belgian revolution, he betook himself to Brussels, and did his utmost by personal conferences with the most influential men in the Belgian capital to bring about a peaceable settlement on the basis of the administrative autonomy of the southern provinces under the house of Orange. His father had given him powers to treat, but afterwards threw him over and rejected the terms of accommodation that he had proposed. He withdrew on this to England and resided there for several months. In April 1831 William took the command of a Dutch army for the invasion of Belgium, and in a ten-days' campaign defeated and dispersed the Belgian forces under Leopold I. after a sharp fight near Louvain. He would have entered Brussels in triumph, but his victorious advance was stayed by the intervention of the French. In 1840, on the abdication of his father, he ascended the throne as William II. The peace of 1839 had settled all differences between Holland and Belgium, and the new king found himself confronted with the task of the reorganization of the finances, and the necessity of meeting the popular demand for a revision of the fundamental law, and the establishment of the electoral franchise on a wider basis. He acted with good sense and moderation, and, although by no means a believer in democratic ideas, he saw the necessity of satisfying public opinion and frankly gave his support to larger measures of reform. The fundamental law was altered in 1848 and the Dutch monarchy, from being autocratic, became henceforth constitutional. The king's attitude secured for him the good will and affection of a people, loyal by tradition to the house of Orange, and the revolutionary disturbances of 1848 found no echo in Holland. William died suddenly on the 17th of March 1849.

See J. J. Abbink, *Leven van Koning Willem II.* (Amsterdam, 1849); J. Bosscha, *Het Leven van Willem den Tweede, Koning der Nederlanden, 1793–1849* (Amsterdam, 1852); P. Blok, *Geschiedenis der Nederlandsche Volk* (Leiden, 1908). (G. E.)

WILLIAM III. (1817–1890), king of the Netherlands, son of William II., was born at Brussels on the 19th of February 1817. He married in 1839 Sophia, daughter of William I., king of Württemberg. Sophia was an accomplished woman of high intelligence, but unfortunately the relations between the royal pair were far from cordial and finally ended in complete disagreement, and the breach between them continued until the death of the queen in 1877. The private life of the king in fact gave rise to much scandal; nevertheless he was an excellent constitutional monarch, and, though he never sought to win popular favour, succeeded in winning and retaining in a remarkable degree his people's affectionate loyalty. He had no sympathy with political liberalism, but throughout his long reign of forty-two years, with a constant interchange of ministries and many ministerial crises, he never had a serious conflict with the states-general, and his ministers could always count upon his fair-mindedness and an earnest desire to help them to further the national welfare. He was economical, and gave up a third of his civil list in order to help forward the task of establishing an equilibrium in the annual budget, and he was always ready from his large private fortune to help forward all schemes for the social or industrial progress of the country. It was largely due to his prudent diplomacy that Holland passed pacifically through the difficult period of the Luxemburg settlement in 1866 and the Franco-German War of 1870.

William III. had two sons by his marriage with Sophia of Württemberg, William (1841–1879), and Alexander (1843–1884). Both of them died unmarried. The decease of Prince Alexander left the house of Orange without a direct heir male, but the prospect of a disputed succession had fortunately been averted by the marriage of the king in 1879 with the princess Emma of Waldeck-Pyrmont. From this union a daughter, Wilhelmina, was born in 1880. On her father's death at the Loo, on the 23rd of November 1890, she succeeded as queen of the Netherlands under the regency of her mother.

William was grand duke of Luxemburg by a personal title, and his death severed the dynastic relation between the kingdom of the Netherlands and the grand duchy. The sovereignty of the Luxemburg duchy passed to the next heir male of the house of Nassau, Adolphus, ex-duke of Nassau.

See J. A. Bruijne, *Geschiedenis van Nederland in onzen tijd.* (5 vols. Schiedam, 1889–1906); P. Blok, *Geschiedenis der Nederlandsche Volk* (Leiden, 1908), vol. viii.; and G. L. Keppers, *De regeering van Koning Willem III.* (Groningen, 1887). (G. E.)

WILLIAM (1227–1256), king of the Romans and count of Holland, was the son of Count Floris IV. and his wife Matilda daughter of Henry, duke of Brabant. He was about six years of age when his father was killed in a tournament, and the fact that his long minority was peaceful and uneventful speaks well for the good government of his two paternal uncles, who were his guardians. William was, however, suddenly in 1247 to become a prominent figure in the great Guelph-Ghibelline struggle, which at that time was disturbing the peace of Europe The quarrel between the church and the emperor Frederick II had now reached an acute stage. Pope Innocent IV., who had failed in repeated efforts to induce various princes to accept the dignity of king of the Romans in place of the excommunicated Frederick, found the youthful William of Holland ready to accept the proffered crown. After a long siege William succeeded in taking the imperial city of Aix-la-Chapelle, where he was crowned on All Saints' Day 1248. As the recognized head of the Guelph party he spared no efforts to win for himself friend in Germany, but he never really succeeded in forming a party or gaining for himself a footing in the Empire during the lifetime of Frederick. With the extinction of the Hohenstaufen house in 1254 his chances were much improved, but shortly afterwards his death occurred on the 28th of January 1256 through his horse breaking through the ice during an obscure campaign among the Frisian marshes. William was more successful in his struggles with Margaret, countess of Flanders and Hainaut, known as "Black Meg." She wished her succession to pass to the sons of her second marriage with William of Dampierre in preference to those of his first marriage with Bouchard of Avennes. But John of Avennes, her eldest son, had married William's sister Aleidis. William took up arms in defence of his brother-in-law's rights and Margaret was decisively beaten at West Kappel in 1253, and was compelled to acknowledge John of Avennes as her successor to the county of Hainaut.

See A. Ulrich, *Geschichte des römischen Königs, Wilhelm von Holland* (Hanover, 1882).

WILLIAM I. (d. 1166), king of Sicily, son of King Roger II. by Elvira of Castile, succeeded in 1154. His title "the Bad" seems little merited and expresses the bias of the historian Falcandus and the baronial class against the king and the official class by whom he was guided. It is obvious, however, that William was far inferior in character and energy to his father, and was attached to the semi-Moslem life of his gorgeous palaces of Palermo. The real power in the kingdom was at first exercised by Maio of Bari, a man of low birth, whose title *ammiratus ammiratorum* was the highest in the realm. Maio continued Roger's policy of excluding the nobles from the administration, and sought also to curtail the liberties of the towns. The barons, always chafing against the royal power, were encouraged to revolt by Pope Adrian IV., whose recognition William had not yet sought, by the Basileus Manuel and the emperor Frederick II. At the end of 1155 Greek troops recovered Bari and began to besiege Brindisi. William, however, was not devoid of military energy; landing in Italy he destroyed the Greek fleet and army at Brindisi (28th May 1156) and recovered Bari. Adrian came to terms at Benevento (18th June 1156), abandoned the rebels and confirmed William as king, and in 1158 peace was made with the Greeks. These diplomatic successes were probably due to Maio; on the other hand, the African dominions were lost to the Almohads (1156–1160), and it is possible that he advised their abandonment in face of the dangers threatening the kingdom down from the north. The policy of the minister led to a general conspiracy, and in November 1160 he was murdered in Palermo by Matthew Bonello, leader of the Sicilian nobles. For a while the king was in the hands of the conspirators, who purposed murdering or deposing him, but the people and the army rallied round him; he recovered power, crushed the Sicilian rebels, had Bonello blinded, and in a short campaign reduced the rest of the Regno. Thus freed from feudal revolts, William confided the government to men trained in Maio's school, such as the grand notary, Matthew d'Agello. His latter years were peaceful; he was now the champion of the true pope against the emperor, and Alexander III. was installed in the Lateran in November 1165 by a guard of Normans. William died on the 7th of May 1166. (E. Cu.)

WILLIAM II. (d. 1189), king of Sicily, was only thirteen years old at the death of his father William I. when he was placed under the regency of his mother, Marguerite of Navarre. Until the king came of age in 1171 the government was controlled first by the chancellor Stephen of Perche, cousin of Marguerite (1166–1168), and then by Walter Ophamil, archbishop of Palermo, and Matthew d'Ajello, the vice-chancellor. William's character is very indistinct. Lacking in military enterprise, secluded and pleasure-loving, he seldom emerged from his palace life at Palermo. Yet his reign is marked by an ambitious foreign policy and a vigorous diplomacy. Champion of the papacy and in secret league with the Lombard cities he was able to defy the common enemy, Frederick II. In 1174 and 1175 he made treaties with Genoa and Venice and his marriage in February 1177 with Joan, daughter of Henry II. of England, marks his high position in European politics. To secure peace with the emperor he sanctioned the marriage of his aunt Constance, daughter of Roger II., with Frederick's son Henry, afterwards the emperor Henry VI., causing a general oath to be taken to her as his successor in case of his death without heirs. This step, fatal to the Norman kingdom, was possibly taken that William might devote himself to foreign conquests.[1]

Unable to revive the African dominion, William directed his attack on Egypt, from which Saladin threatened the Latin kingdom of Jerusalem. In July 1174, 50,000 men were landed before Alexandria, but Saladin's arrival forced the Sicilians to re-embark in disorder. A better prospect opened in the confusion in Byzantine affairs which followed the death of Manuel Comnenus (1180), and William took up the old design and feud against Constantinople. Durazzo was captured (11th June 1185) and in August Thessalonica surrendered to the joint attack of the Sicilian fleet and army. The troops then marched upon the capital, but the troop of the emperor Isaac Angelus overthrew the invaders on the banks of the Strymon (7th Sept. 1185). Thessalonica was at once abandoned and in 1189 William made peace with Isaac, abandoning all the conquests. He was now planning to induce the crusading armies of the West to pass through his territories, and seemed about to play a leading part in the third Crusade. His admiral Margarito, a naval genius equal to George of Antioch, with 600 vessels kept the eastern Mediterranean open for the Franks, and forced the all-victorious Saladin to retire from before Tripoli in the spring of 1188. In November 1189 William died, leaving no children. His title of "the Good" is due perhaps less to his character than to the cessation of internal troubles in his reign. The "Voyage" of Ibn-Giobair, a traveller in Sicily in 1183–1185, shows William surrounded by Moslem women and eunuchs, speaking and reading Arabic and living like "a Moslem king." (E. Cu.)

WILLIAM I. [FRIEDRICH KARL] (1781–1864), king of Württemberg, son of Frederick, afterwards King Frederick I. of Württemberg, was born at Lüben in Silesia on the 27th of September 1781. In his early days he was debarred from public life owing to a quarrel with his father, whose time-serving deference to Napoleon was distasteful to him. In 1814–1815 he suddenly rose into prominence through the Wars of Liberation against France, in which he commanded an army corps with no little credit to himself. On his accession to the throne of Württemberg in 1816 he realized the expectations formed of him as a liberal-minded ruler by promulgating a constitution (1819), under which serfdom and obsolete class privileges were swept away, and by issuing ordinances which greatly assisted the financial and industrial development and the educational progress of his country. In 1848 he sought to disarm the revolutionary movement by a series of further liberal reforms which removed the restrictions more recently imposed at Metternich's instance by the Germanic diet. But his relations with the legislature, which had from time to time become strained owing to the bureaucratic spirit which he kept alive in the administration, were definitely broken off in consequence of a prolonged conflict on questions of Germanic policy. He cut the knot by repudiating the enactments of 1848–1849 and by summoning a packed parliament (1851), which re-enforced the code of 1819.

The same difficulties which beset William as a constitutional reformer impeded him as a champion of Germanic union. Intent above all on preserving the rights of the Middle Germanic states against encroachments by Austria and Prussia he lapsed into a policy of mere obstruction. The protests which he made in 1820–1823 against Metternich's policy of making the minor German states subservient to Austria met with less success than they perhaps deserved. In 1849–1850 he made a firm stand against the proposals for a Germanic union propounded in the National Parliament at Frankfort, for fear lest the exaltation of Prussia should eclipse the lesser principalities. Though forced to accede to the proffering of the imperial crown to the king of Prussia, he joined heartily in Prince Schwarzenberg's schemes for undoing the work of the National Parliament, and by means of

[1] Chalandon, *La Domination normande*, ii. 3

the *coup d'état* described above forced his country into a policy of alliance with Austria against Prussia. Nevertheless his devotion to the cause of Germanic union is proved by the eagerness with which he helped the formation of the Zollverein (1828–1830), and in spite of his conflicts with his chambers he achieved unusual popularity among his subjects. He died on the 25th of June 1864, and was succeeded by his son Charles.

See Nick, *Wilhelm I., König von Württemberg, und seine Regierung* (Stuttgart, 1864); P. Stälin, "König Wilhelm I. von Württemberg," *Zeitschrift für allgemeine Geschichte*, 1885, pp. 353-367, 417-434.

WILLIAM IV., landgrave of Hesse (1532–1592), was the son and successor of the landgrave Philip the Magnanimous. He took a leading part in safeguarding the results of the Reformation and was indefatigable in his endeavours to unite the different sections of Protestantism for the sake of effective resistance against the Catholic reaction. His counsels were marred by his reluctance to appeal to arms at the critical moments of action, and by the slenderness of his own resources, but they deserve attention for their broad common sense and spirit of tolerance. As an administrator of his principality he displayed rare energy, issuing numerous ordinances, appointing expert officials, and in particular establishing the finances on a scientific basis. By a law of primogeniture he secured his land against such testamentary divisions as had diminished his own portion of his father's estate. He not only patronized art and science, but continued as ruler the intercourse with scholars which he had cultivated in his youth.

William was a pioneer in astronomical research and perhaps owes his most lasting fame to his discoveries in this branch of study. Most of the mechanical contrivances which made Tycho Brahe's instruments so superior to those of his contemporaries were adopted at Cassel about 1584, and from that time the observations made there seem to have been about as accurate as Tycho's; but the resulting longitudes were 6′ too great in consequence of the adopted solar parallax of 3′. The principal fruit of the observations was a catalogue of about a thousand stars, the places of which were determined by the methods usually employed in the 16th century, connecting a fundamental star by means of Venus with the sun, and thus finding its longitude and latitude, while other stars could at any time be referred to the fundamental star. It should be noticed that clocks, on which Tycho Brahe depended very little, were used at Cassel for finding the difference of right ascension between Venus and the sun before sunset; Tycho preferred observing the angular distance between the sun and Venus when the latter was visible in the daytime. The Hessian star catalogue was published in Lucius Barettus's *Historia coelestis* (Augsburg, 1668), and a number of other observations are to be found in *Coeli et siderum in eo errantium observationes Hassiacae* (Leiden, 1618), edited by Willebrord Snell. R. Wolf, in his "Astronomische Mittheilungen," No. 45 (*Vierteljahrsschrift der naturforschenden Gesellschaft in Zürich*, 1878), has given a résumé of the manuscripts still preserved at Cassel, which throw much light on the methods adopted in the observations and reductions.

WILLIAM (1533–1584), surnamed the SILENT, prince of Orange and count of Nassau, was born at the castle of Dillenburg in Nassau, on the 25th of April 1533. His grandfather, John, count of Nassau, had left his Netherland possessions to his elder son Henry, his German to his younger son William. This William of Nassau (d. 1559) had by his wife, Juliana of Stolberg, a family of five sons, of whom the subject of this notice was the eldest, and seven daughters. Henry became the trusted friend and counsellor of Charles V., and married (1515) Claude, sister of Philibert, prince of Orange. Philibert, having no issue, made Réné, the son of Henry and Claude, his heir. Réné, at the age of twenty-six, was killed at the siege of St Dizier in 1544, and left his titles and great possessions by will to his cousin William, who thus became prince of Orange. William's parents were Lutherans, but the emperor insisted that the boy-successor to Réné's heritage should be brought up in his court at Brussels, as a Catholic. The remembrance of his ancestors' services and his own high qualities endeared William to Charles, who secured for him, at the age of seventeen, the hand of Anne of Egmont, heiress of the count of Buren. Anne died in 1558, leaving issue a son Philip William, prince of Orange and count of Buren, and a daughter. It was on the shoulder of the young prince of Orange that Charles V. leant when, in 1555, in the presence of a great assembly at Brussels, he abdicated in favour of his son Philip, the sovereignty of the Netherlands. William was also selected to carry the insignia of the empire to Ferdinand, king of the Romans, when Charles resigned the imperial crown. He had, at the age of twenty-one, been placed by the emperor, before his abdication, at the head of an army of 20,000 men in the war with France, and he continued to fill that post under Philip in 1556, but without distinction. His services, as a diplomatist, were much more brilliant. He was one of the three plenipotentiaries who negotiated the treaty of Cateau-Cambrésis (1559), and was largely responsible for bringing about a settlement so favourable to Spanish interests. After the conclusion of the peace, the prince spent some time at the French court, in the capacity of a state hostage for the carrying out of the treaty. It was during his sojourn in France that William by his discreetness acquired the soubriquet of *le Taciturne* (the Silent), which has ever since clung to his name. The appellation is in no way expressive of the character of the man, who was fond of conversation, most eloquent in speech, and a master of persuasion. His two great adversaries of the decade, which followed the peace of Cateau-Cambrésis, were in 1559 closely associated with him; Granvelle as a plenipotentiary, Alva as a fellow-hostage.

Up to this time the life of Orange had been marked by lavish display and extravagance. As a *grand seigneur* in one of the most splendid of courts, he surrounded himself with a retinue of gay young noblemen and dependents, kept open house in his magnificent Nassau palace at Brussels, and indulged in every kind of pleasure and dissipation. The revenue of his vast estates was not sufficient to prevent him being crippled by debt. But after his return from France, a change began to come over Orange. Philip made him councillor of state, knight of the Golden Fleece, and stadtholder of Holland, Zeeland and Utrecht; but there was a latent antagonism between the natures of the two men which speedily developed into relations of coolness and then of distrust. The harshness with which the stern laws against heretics were carried out, the presence of Spanish troops, the filling up of ministerial offices by Spaniards and other foreigners had, even before the departure of Philip for Spain (August 1559), stirred the most influential Netherland noblemen—foremost among them the prince of Orange, and the counts of Egmont and Hoorn—to a policy of constitutional opposition. With the advent of Margaret of Parma the situation became more serious. All state business was carried out by the *Consulta*; all power virtually placed in the hands of Cardinal Granvelle; the edicts against heretics enforced with the utmost severity; the number of bishoprics increased from three to fourteen (see NETHERLANDS). As a protest, Orange, Egmont and Hoorn withdrew from the council of state, and wrote to the king setting forth their grievances. At this time Orange was still nominally a Catholic, but his marriage in August 1561 with Anne, daughter and heiress of the elector Maurice of Saxony, with Lutheran rites, at Dresden, was significant of what was to come. It marked the beginning of that gradual change in his religious opinions, which was to lead William through Lutheranism to that moderate Calvinism which he professed after 1573. Of the sincerity of the man during this period of transformation there can be little doubt. Policy possibly played its part in dictating the particular moments at which the changes of faith were acknowledged. No student of the prince's voluminous correspondence can fail, however, to see that he was a deeply religious man. The charges of insincerity brought against him by his enemies arise from the fact that in an age of bigotry and fanaticism the statesmanlike breadth and tolerance of William's treatment of religious questions, and his aversion to persecution for matters of opinion, were misunderstood. His point of view was in advance of that of his time.

In the spring of 1564 the constitutional opposition of the great nobles to the policy of the king appeared to be successful. Granvelle was withdrawn, the *Consulta* abolished, and Orange, Egmont and Hoorn took their seats once more on the Council. They speedily found, however, that things did not mend. Granvelle had gone, but the royal policy was unchanged. In

August 1564 Philip issued an order for carrying out the decrees of the Council of Trent, and for the strict execution of the placards against heretics. Protests, letters, personal missions were in vain, the king's will was not to be moved from its purpose. The spirit of resistance spread first to the lesser nobles, then to the people. In the memorable year 1566 came "the Compromise," "the Request," the banquet at the Hotel Culemburg with its cries of "*Vivent les Gueux*" followed by the wild iconoclastic riots and outrages by bodies of fanatical Protestant sectaries at Antwerp and elsewhere. The effect of this last outbreak was disastrous. Philip was filled with anger and vowed vengeance. The national leaders drew back, afraid to identify themselves with revolutionary movements, or the cause of extreme Protestantism. Egmont was a good Catholic, and took active steps to suppress disorder, and Orange himself at the request of the regent betook himself to Antwerp, where the citizens in arms were on the point of engaging in civil strife. At the risk of his life the prince succeeded in bringing about an accord, and as he proclaimed its terms to a sullen and half-hostile crowd he uttered for the last time the words, "Long live the King!" It was his final act of loyal service to a sovereign, who from secret emissaries that he kept at Madrid, he knew to be plotting the destruction of himself and his friends. In vain he endeavoured to rouse Egmont to a sense of his danger, and to induce him and other prominent leaders to take steps, if necessary by armed resistance, to avert their doom. Finding all his efforts fruitless William, after resigning all his posts, left the country (22nd of April 1567), and took up his residence with his family at the ancestral home of the Nassaus at Dillenburg.

At that very time Alva was quitting Madrid for his terrible mission of vengeance in the Netherlands (see ALVA). The story of the Council of Blood and of the executions of Egmont and Hoorn is told elsewhere. The prince of Orange was out of reach of the tyrant's arm, but by an act of imprudence he had left his eldest son, Philip William, count of Buren, studying at the university of Louvain. He was seized (February 1568) and carried off to Spain, to be brought up as an enemy to the political and religious principles of his father. He himself was outlawed, and his property confiscated. In March he published a lengthy defence of his conduct, entitled "Justification of the Prince of Orange against his Calumniators," and meanwhile strained every nerve to enlist an armed force for the invasion of the Netherlands. To raise money his brother, John of Nassau, pledged his estates, William himself sold his plate and jewels. An attack was made in three directions, but with disastrous results. The force under Louis of Nassau indeed gained a victory at Heiligerlee in Friesland (May 23rd), but met with a crushing defeat at the hands of Alva in person (July 21st) at Jemmingen. All seemed lost, but William's indomitable spirit did not despair. "With God's help," he wrote to his brother Louis, "I am determined to go on." In September he himself crossed the Meuse at the head of 18,000 infantry and 7000 cavalry. But Alva, while clinging to his steps, refused to fight, and William, through lack of funds, was compelled to disband his mercenaries, and withdraw over the French frontier (November 17th).

Then followed the most miserable period of Orange's life. In fear of assassination, in fear of creditors, he wandered about from place to place, and his misfortunes were aggravated by the bad conduct of his wife, Anne of Saxony, who left him. She was finally, on the ground of insanity, placed in close confinement by her own family, and remained incarcerated until her death six years later. During the years 1569–1572 the brothers William and Louis, the one in Germany, the other in France, were, however, actively preparing for a renewal of the struggle for the freedom of the Netherlands. The barbarities of Alva had caused Spanish rule to be universally hated, and the agents of the Nassaus were busy in the provinces rousing the spirit of resistance and trying to raise funds. In 1569 eighteen vessels provided with letters of marque from the prince of Orange were preying upon Spanish commerce in the narrow seas. Stimulated by the hope of plunder their number rapidly grew, until the wild and fierce corsairs—named "Beggars of the sea" (*Gueux de mer*)—became a terror to their enemies. The refusal of Queen Elizabeth in 1572 to allow the Beggars to refit in English harbours led to the first success of the patriot cause. On the 1st of April a force under the command of Lumbres and Tresling, being compelled to take refuge in the Maas, seized the town of Brill by surprise. Encouraged by their success they likewise took by assault the important sea-port of Flushing. Like wildfire the revolt spread through Holland, Zeeland, Utrecht and Friesland, and the principal towns, one after the other, submitted themselves to the authority of the prince of Orange as their lawful stadtholder. Louis of Nassau immediately afterwards dashed with a small force from France into Hainault, and captured Valenciennes and Mons. In Mons, however, Louis was blockaded by a superior Spanish force, and eventually forced to surrender. William crossed the Rhine with 20,000 men to relieve him, but he was out-generalled by Alva, nearly lost his life during a night attack on his camp at Harmignies (September 11th), and retired into Holland. Delft became henceforth his home, and he cast in his lot for good and all with the brave Hollanders and Zeelanders in their struggle for freedom, "being resolved," as he wrote to his brother John, "to maintain the affair there as long as possible and decided to find there my grave." It was his spirit that animated the desperate resistance that was offered to the Spanish arms at Haarlem and Alkmaar, and it was through his personal and unremitting exertions that, despite an attack of fever which kept him to his bed, the relief of Leiden, on the 3rd of October 1574, was effected just as the town had been reduced to the last extremity.

In order to identify himself more closely with the cause for which he was fighting, Orange had, on October 23rd, 1573, made a public profession of the Calvinist religion. But he was never a bigot in religious matters. The three conditions which he laid down as the irreducible minimum on which negotiations could be based, and from which he never departed, were: (1) freedom of worship and liberty to preach the Gospel according to the word of God; (2) the restoration and maintenance of all the ancient charters, privileges and liberties of the land; (3) the withdrawal of all Spaniards and other foreigners from all posts and employments, civil and military. On these points he was inflexible, but he was a thoroughly moderate man. He hated religious tyranny whether it were exercised by Papist or Calvinist, and his political aims were not self-seeking. His object was to prevent the liberties of the Netherlands from being trampled underfoot by a foreign despotism, and he did not counsel the provinces to abjure their allegiance to Philip, until he found the Spanish monarch was intractable. But when the abjuration became a necessity he sought to find in Elizabeth of England or the duke of Anjou, a sovereign possessing sufficient resources to protect the land from the Spaniard.

William (24th of June 1575) took as his third wife, Charlotte de Bourbon, daughter of the duke of Montpensier. This marriage gave great offence to the Catholic party, for Charlotte was a renegade nun, having been abbess of Jouarre, and Anne of Saxony was still alive. In April 1576, an act of Union between Holland and Zeeland was agreed upon and signed at Delft, by which supreme authority was conferred upon the prince, as *ad interim* ruler. In this year (1576) the outrages of the Spanish troops in the southern Netherlands, who had mutinied for want of pay, caused a revulsion of feeling. The horrors of the "Spanish Fury" at Antwerp (November 4th) led to a definite treaty being concluded, known as the Pacification of Ghent, by which under the leadership of the prince of Orange, the whole seventeen provinces bound themselves together to drive the foreigners out of the country. This was supplemented by the Union of Brussels (January 1577) by which the Southerners pledged themselves to expel the Spaniards, but to maintain the Catholic religion and the king's authority. To these conditions William willingly assented; he desired to force no man's conscience, and as yet he professed to be acting as stadtholder under the king's commission. On September 23rd he entered Brussels in triumph as the acknowledged leader of the whole people of the Netherlands, Catholic as well as Protestant, in their resistance to foreign oppression. At this moment he touched the zenith of his career. It was, however, but a short-lived position of eminence. After the entry into Brussels followed the period of tangled intrigue during which the archduke Matthias, the duke of Anjou, the palatine count John Casimir and Don John of Austria were all striving to secure for themselves a position of supremacy in the land. William had to steer a difficult course amidst shoals and quicksands, and never did his brilliant talents as diplomatist and statesman shine more brightly. But after the sudden death of Don John he found himself face to face with an opponent of abilities equal to his own in the person of Alexander Farnese, prince of Parma, appointed governor general by Philip. Farnese skilfully fomented the jealousy of the Catholic nobles of the south—the Malcontents—against the prince of Orange, and the Pacification of Ghent was henceforth doomed. The Walloon provinces bound themselves together in a defensive league, known as the league of Arras (5th of January 1579) and by the exertions of John of Nassau (at that time governor of Gelderland) Holland, Zeeland, Utrecht, Gelderland and Zutphen replied by signing (29th of January) the compact known as the Union of Utrecht. William still struggled to keep the larger federation together, but in vain. The die was now cast, and the Northern and Southern Netherlands from this time forward had separate histories.

On the 25th of March 1581 a ban was promulgated by King Philip against the prince of Orange, in which William was denounced as a traitor and enemy of the human race, and a reward of 25,000 crowns in gold or land with a patent of nobility was offered to any one who should deliver the world of this pest. William replied in a lengthy document, the *Apology*, in which he defended himself from the accusations brought against him, and on his part charged the Spanish king with a series of misdeeds and crimes. The *Apology* is valuable for the biographical details which it contains. William now felt that his struggle with Philip was a war *à outrance*, and knowing that the United Provinces were too weak to resist the Spanish armies unaided, he endeavoured to secure the powerful aid of France, by making the duke of Anjou sovereign of the Netherlands. Holland and Zeeland were averse to this project, and to conciliate their prejudices Orange, provisionally, and after some demur, accepted from those provinces the offer of the countship (24th of July 1581). Two days later the representatives of Brabant, Flanders, Utrecht, Gelderland, Holland and Zeeland assembled at The Hague, solemnly abjured the sovereignty of Philip, and agreed to accept the French duke as their sovereign in his place. Anjou was solemnly inaugurated by the prince in person at Antwerp, as duke of Brabant, on the 19th of February 1582. While at Antwerp an attempt was made upon William's life (March 18th) by a Biscayan youth, named Juan Jaureguy. Professing to offer a petition he fired a pistol at the prince's head, the ball passing in at the right ear and out by the left jaw. After hanging for some time between life and death, William ultimately recovered and was able to attend a thanksgiving service on the 2nd of May. The shock and anxiety proved, however, fatal to his wife, Charlotte de Bourbon. She expired on the 5th of May after a very short illness.

The French sovereign soon made himself impossible to his new subjects, and the hopes that William had based upon Anjou were sorely disappointed. The duke was dissatisfied with his position, aimed at being an absolute ruler, and tried to carry his ambitious ideas into effect by the treacherous attack on Antwerp, which bears the name of the "French Fury." Its failure rendered Anjou at once ridiculous and detested, and his shameless misconduct brought no small share of opprobrium on William himself. The trusty Hollanders and Zeelanders remained, however, staunchly loyal to him, and Orange now fixed his residence permanently in their midst. On the 7th of April 1583 he married in fourth wedlock Louise de Coligny, daughter of the famous Huguenot leader, and widow of the Seigneur de Téligny. With her, "Father William," as he was affectionately styled, settled at the Prinsenhof at Delft, and lived like a plain, homely Dutch burgher, quietly and unostentatiously, as became a man who had spent his all in his country's cause, and whose resources were now of the most modest description.

Ever since the promulgation of the ban and the offer of a reward upon his life, religion and political fanaticism had been continually compassing his assassination, and the free access which the prince gave to his person offered facilities for such a purpose, despite the careful watch and ward kept over him by the burghers of Delft and his own household. He was shot dead by a Burgundian, Balthazar Gérard, on the 9th of July 1584, as he was leaving his dining hall. Gérard was moved by devoted loyalty to his faith and king, and endured the torments of a barbarous death with supreme courage and resignation. William was buried with great pomp at the public charges in the Neuwe Kerk at Delft amidst the tears of a mourning people.

William the Silent was tall and well formed, of a dark complexion, with brown hair and eyes. He was the foremost statesman of his time, capable of forming wise and far-reaching plans and of modifying them to suit the changing circumstances in which it was necessary to put them in execution. In moments of difficulty he displayed splendid resource and courage, and he had a will of iron, which misfortunes were never able to bend or break. To rescue the Netherlands from the tyrannical power of Spain, he sacrificed a great position, vast wealth and eventually his life. He had the satisfaction, however, of knowing before he died that the cause for which he had endured so much and striven so hard had survived many dangers, and had acquired strength to offer successful resistance to the overwhelming power of King Philip. He was the real founder of the independence and greatness of the Dutch republic.

He left a large number of children. By Anne of Egmont he had a son Philip William, who was kidnapped from Louvain (1567) and educated at Madrid, and a daughter. By Anne of Saxony, a son Maurice (see MAURICE OF NASSAU, prince of Orange) and two daughters. By Charlotte de Bourbon, six daughters. By Louise de Coligny, one son, Frederick Henry (see FREDERICK HENRY, prince of Orange).

See Genhard, *Correspondance de Guillaume le Taciturne*; Groen von Prinsterer, *Archives ou correspondance inédite de la maison d'Orange-Nassau*; Commelin, *Wilhelm en Maurits van Nassau, prinsen van Orangien, haer leven en bedrijf*; Meursius, *Gulielmus Auriacus*; Putnam, *William the Silent, Prince of Orange, the Moderate Man of the Sixteenth Century*; Harrison, *William the Silent*; Vorsterman van Oyen, *Het Vorstenhuis Orange-Nassau*; Delaborde, *Charlotte de Bourbon, princesse d'Orange*; Delaborde, *Louise de Coligny, princesse d'Orange*; Blok, *Geschiedenis van het Nederlandsche Volk*, vol. ii.; R. Fruin, *Het voorspel van den tachtigjarigen oorlog*; Motley, *Rise of the Dutch Republic; Cambridge Modern History*, vol. iii. cc. vi., vii. (G. E.)

WILLIAM II. (1626–1650), prince of Orange, born at The Hague on the 27th of May 1626, was the son of Frederick Henry, prince of Orange, and his wife Amalia von Solms, and grandson of William the Silent. By the act of survivance passed in 1631 the offices and dignities held by Frederick Henry were made hereditary in his family. On the 12th of May 1641 William married, in the royal chapel at Whitehall, Mary, princess royal of England, eldest daughter of King Charles I. At the time of the wedding the bridegroom was not yet fifteen years old, the bride was five years younger. William from his early youth accompanied his father in his campaigns, and already in 1643 highly distinguished himself in a brilliant cavalry fight at Burgerhout (September 5). On the death of Frederick Henry William succeeded him, not only in the family honours and possessions, but in accordance with the terms of the act of survivance in all his official posts, as stadtholder of Holland, Zeeland, Utrecht, Gelderland, Overyssel and Groningen and captain-general and admiral-general of the Union. At the moment of his accession to power the negotiations for a separate treaty of peace with Spain were almost concluded, and peace was actually signed at Münster on the 30th of January 1648. By this treaty Spain recognized the independence of the United Netherlands and made large concessions to the Dutch. William, who had always been bitterly opposed to the policy of abandoning the French alliance in order to gain better terms from Spain, did his utmost to prevent the ratification, but matters were too far advanced for his interposition to prevail in the face of the determination of the states of Holland to conclude a peace so advantageous to their trade interests. William, however, speedily opened secret negotiations with France in the hope of securing the armed assistance of that power for the carrying out of his ambitious projects of a war of aggrandisement against the Spanish Netherlands and of a restoration of his brother-in-law, Charles II., to the throne of England. The states of Holland, on the other hand, were determined to thwart any attempts for a renewal of war, and insisted, in defiance of the authority of the captain-general supported by the states-general, in virtue of their claim to be a sovereign province, in disbanding a large part of the regiments in their pay. A prolonged controversy arose, which ended in the states-general in June 1650 commissioning the prince of Orange to visit the towns of Holland and secure a recognition of their authority. The mission was unsuccessful. Amsterdam refused any hearing at all. William resolved therefore to use force and crush resistance. On the 30th of July six leading members of the states of Holland were seized and imprisoned in the castle of Loevestein. On the same day an attempt was made to occupy Amsterdam with troops. The citizens were, however, warned in time, and the gates closed. William's triumph was nevertheless complete. Cowed by the bold seizure of their leaders, the states of Holland submitted. The prince had now obtained that position of supremacy in the republic at which he had been aiming, and could count on the support alike of the states-general and of the provincial states for his policy. He lost no time in entering into fresh negotiations with the French government, and a draft treaty was already early in October drawn up in Paris and the Count d'Estrades was commissioned to deliver it in person to the prince of Orange. It was, however, never to reach his hands. William had, on the 8th of October, after his victory was assured, gone to his hunting seat at Dieren. Here on the 27th he became ill and returned to The Hague. The complaint proved to be small-pox, and on the 6th of November he died. William was one of the ablest of a race rich in great men, and had he lived he would probably have left his mark upon history. A week after his death his widow gave birth to a son, who was one day to become William III., king of England. (G. E.)

WILLIAM THE BRETON (*c.* 1160–*c.* 1225), French chronicler and poet, was as his name indicates born in Brittany. He was educated at Mantes and at the university of Paris, afterwards becoming chaplain to the French king Philip Augustus, who employed him on diplomatic errands, and entrusted him with the education of his natural son, Pierre Charlot. William is supposed to have been present at the battle of Bouvines. His works are the *Philippide* and the *Gesta Philippi II. regis Francorum.* The former, a poem three versions of which were written by the author, gives some very interesting details about Philip Augustus and his time, including some information about military matters and shows that William was an excellent Latin scholar. In its final form the *Gesta* is an abbreviation of the work of Rigord (*q.v.*), who wrote a life of Philip Augustus from 1179 to 1206, and a continuation by William himself from 1207 to 1220. In both works William speaks in very laudatory terms of the king; but his writings are valuable because he had personal knowledge of many of the facts which he relates. He also wrote a poem *Karlotis*, dedicated to Pierre Charlot, which is lost.

William's works have been edited with introduction by H. F. Delaborde as *Œuvres de Rigord et de Guillaume le Breton* (Paris, 1882–1885), and have been translated into French by Guizot in *Collection des mémoires relatifs à l'histoire de France*, tomes xi. and xii. (Paris, 1823–1835). See Delaborde's introduction, and A. Molinier, *Les Sources de l'histoire de France*, tome iii. (Paris, 1903).

WILLIAM THE CLITO (1101–1128) was the son of Robert, duke of Normandy, by his marriage with Sibylla of Conversano. After his father's defeat and capture by Henry I. of England at the battle of Tinchebrai (1106) the young William fell into the hands of the conqueror. Henry magnanimously placed his nephew in the custody of Helias of Saint Saens, who had married a natural daughter of Duke Robert. Fearing for the safety of the boy, Helias carried him, in 1111, to the court of Louis VI. of France. That sovereign joined with the discontented Norman barons and others of Henry's enemies in recognizing William as the rightful claimant to the duchy; Robert, a prisoner whom there was no hope of releasing, they appear to have regarded as dead in the eye of the law. William's claims furnished the pretext for two Norman rebellions. The first which lasted from 1112 to 1120 was abetted by Louis, by Fulk V. of Anjou and by Baldwin VII. of Flanders. In the second, which broke out during 1123, Henry I. had merely to encounter the forces of his own Norman subjects; his diplomatic skill had been successfully employed to paralyse the ill-will of other enemies. In 1122 or 1123 William married Sibylle, daughter of Fulk of Anjou, and with her received the county of Maine; but Henry I. prevailed upon the Curia to annul this union, as being within the forbidden degrees. In 1127, however, the pretender obtained from Louis the hand of Johanna of Montferrat, half-sister of the French queen, and the vacant fief of Flanders. His own rigorous government or the intrigues of Henry I. raised up against William a host of rebels; a rival claimant to Flanders appeared in the person of Thierry or Dirk of Alsace. In besieging Alost, one of the strongholds of the rival party, William received a wound which mortified and proved fatal (July 28, 1128). He left no issue; although Duke Robert survived him and only died in 1134, the power of Henry I. was thenceforth undisputed by the Normans.

See Ordericus Vitalis, *Hist. ecclesiastica*, and Sir James Ramsay's *Foundations of England*, vol. ii. (1898).

WILLIAM OF MALMESBURY (*c.* 1080–*c.* 1143), English historian of the 12th century, was born about the year 1080, in the south country. He had French as well as English blood in his veins, but he appears to have spent his whole life in England, and the best years of it as a monk at Malmesbury. His tastes were literary, and the earliest fact which he records of his career is that he assisted Abbot Godfrey (1081–1105) in collecting a library for the use of the community. The education which he received at Malmesbury included a smattering of logic and physics; but moral philosophy and history, especially the latter, were the subjects to which he devoted most attention. Later he made for himself a collection of the histories of foreign countries, from reading which he conceived an ambition to produce a popular account of English history, modelled on the great work of Bede. In fulfilment of this idea, William produced about 1120 the first edition of his *Gesta regum*, which at once gave him a reputation. It was followed by the first edition of the *Gesta pontificum* (1125). Subsequently the author turned aside to write on theological subjects. A second edition of the *Gesta regum* (1127) was dedicated to Earl Robert of Gloucester, whose literary tastes made him an appreciative patron. William also formed an acquaintance with Bishop Roger of Salisbury, who had a castle at Malmesbury. It may have been due to these friends that he was offered the abbacy of Malmesbury in 1140. But he preferred to remain a simple *bibliothecarius.* His one public appearance was made at the council of Winchester (1141), in which the clergy declared for the empress Matilda. About this date he undertook to write the *Historia novella*, giving an account of events since 1125. This work breaks off abruptly at the end of 1142, with an unfulfilled promise that it will be continued. Presumably William died before he could redeem his pledge.

He is the best English historian of his time. The master of a good Latin style, he shows literary instincts which are, for his time, remarkably sound. But his contempt for the annalistic form makes him at times careless in his chronology and arbitrary in his method of arranging his material; he not infrequently flies off at a tangent to relate stories which have little or no connexion with the main narrative; his critical faculty is too often allowed to lie dormant. His researches were by no means profound; he gives us less of the history of his own time than we have a right to expect—far less, for example, than Orderic. He is, however, an authority of considerable value from 1066 onwards; many telling anecdotes, many shrewd judgments on persons and events, can be gleaned from his pages.

Printed Works.—The *Gesta regum* covers, in its final form, the years 449–1127. But the later recensions add little, beyond fulsome dedications to Earl Robert, to the edition of 1120. The sources used are not always easy to trace. But for the pre-Conquest period William had at his disposal the works of Bede, Ado of Vienne and William of Jumièges; one or more English chronicles similar to the extant "Worcester" and "Peterborough" texts; Asser's life of Alfred, and a metrical biography of Æthelstan; the chronicles of S. Riquier and Fontanelle; a collection of tales relating to the reign of the emperor Henry III.; and the lives of various saints. For the life of William I. he draws on William of Poitiers; for the first crusade he mainly follows Fulcher of Chartres; his knowledge of Anselm's primacy comes mainly from Eadmer; and at least up to 1100, he makes use of an English chronicle. The fifth and last book, dealing with the reign of Henry I., is chiefly remarkable for its desultoriness and an obvious desire to make the best case for that monarch, whose treatment of Anselm he prudently ascribes to Robert of Meulan (d. 1118). Both in this work and in the *Gesta pontificum* the later recensions are remarkable for the omission of certain passages which might give offence to those in high places. The deleted sentences usually relate to eminent persons; they sometimes repeat scandal, sometimes give the author's own opinion. The *Gesta pontificum* gives accounts of the several English sees and their bishops, from the beginning to about 1120; the later recensions continue the work, in part, to 1140. Many saints of the south and midlands are also noticed. This work, like the *Gesta regum*, contains five books; the fifth relates the life and miracles of St Aldhelm of Malmesbury, and is based upon the biography by Abbot Faricius; it is less useful than books i.-iv., which are of the greatest value to the ecclesiastical historian. The *Historia novella* is annalistic in form. It was projected soon after the battle of Lincoln, as an apology for the supporters of the empress. The author embarks on special pleading in favour of Earl Robert and Bishop Roger of Salisbury, but shows a certain liking for the personal character of Stephen, whose case he states with studious fairness.

The historical works of William of Malmesbury were edited by Savile in his *Scriptores post Bedam* (London, 1596); but the text of that edition is full of errors. Sir T. D. Hardy edited the *Gesta regum* and *Historia novella* for the English Historical Society in 1840, and put the criticism of the manuscripts on a sound basis. But the standard edition of these works is that of W. Stubbs in the "Rolls" series (1 vol., in 2, 1887–1889); the second part of this edition contains a valuable introduction on the sources and value of the chronicler. The *Gesta pontificum* has been edited for the "Rolls" series by N. G. S. A. Hamilton (London, 1870) from a manuscript which he was the first to identify as the archetype. Another work, *De antiquitate Glastoniensis ecclesiae* (A.D. 63–1126), is printed in Gale's *Scriptores XV.* (Oxford, 1691). Wharton in the second volume of his *Anglia sacra* (London, 1691) gives considerable portions of a life of Wulfstan which is an amplified translation of an Anglo-Saxon biography. Finally Stubbs in his *Memorials of St Dunstan* ("Rolls" series, London, 1874) prints a *Vita S. Dunstani* which was written about 1126.

Unprinted Extant Works.—Among these are *Miracles of the Virgin*; *Liber super explanationem lamentationum Yeremiae prophetae*; an abridgment of Amalarius' *De divinis officiis*; *De dictis et factis memorabilibus philosophorum*; an epitome of the *Historia* of Haymo of Fleury and some other works, historical and legal (autograph in the Bodleian); *Lives of the English Saints*. The MSS. of these works are to be found partly in the British Museum, partly in the Bodleian.

Lost Works.—A *Vita Sancti Patricii* and *Miracula Sancti Benigni* are mentioned in the prologue to the book on Glastonbury; a metrical life of St Ælfgyfu is quoted in the *Gesta pontificum*; *Chronica tribus libellis* are mentioned in the prologue to the *Historia novella*, and a fragment of them is apparently preserved in the Brit. Mus. Lansdowne MS. 436. Leland gives extracts from an *Itinerarium Johannis abbatis*, describing the journey of Abbot John to Rome in 1140 (Leland, *Collectanea*, iii. 272). (H. W. C. D.)

WILLIAM OF NANGIS (d. 1300), French chronicler, was a monk in the abbey of St Denis. About 1285 he was placed in charge of the abbey library as *custos cartarum*, and he died in June or July 1300. Having doubtless done some work on the Latin manuscripts on which the *Grandes Chroniques de France* are based, William wrote a long *Chronicon*, dealing with the history of the world from the creation until 1300. For the period before 1113 this work merely repeats that of Sigebert of Gembloux and others; but after this date it contains some new and valuable matter.

William's other writings are: *Gesta Ludovici IX.*; *Gesta Philippi III., sive Audacis*; *Chronicon abbreviatum regum Francorum*; and a French translation of the same work written for the laity. Making use of the large store of manuscripts at St Denis, William was a compiler rather than an author, and with the exception of the latter part of the *Chronicon* his writings do not add materially to our knowledge of the time. Both his chronicles, however, became very popular and found several continuators, Jean de Joinville being among those who made use of the *Chronicon*. This work from 1113 to 1300, with continuations to 1368, has been edited by H. Géraud for the *Société de l'histoire de France* (Paris, 1843), and practically all William's writings are found in tome xx. of Dom Bouquet's *Recueil des historiens des Gaules et de la France* (Paris, 1738–1876). A French translation of the *Chronicon* is in tome xiii. of Guizot's *Collection des mémoires relatifs à l'histoire de France* (Paris, 1823–1835).

See A. Potthast, *Bibliotheca historica* (Berlin, 1896); and A. Molinier, *Les Sources de l'histoire de France*, tome iii. (Paris, 1903).

WILLIAM OF NEWBURGH (d. *c.* 1198), or, as he is sometimes styled, Guillelmus Parvus, English ecclesiastic and chronicler, was a canon of the Augustinian priory of Newburgh in the North Riding of Yorkshire. He was born about 1136, and lived at Newburgh from his boyhood. Shortly before 1196 he began his *Historia rerum Anglicarum.* This work, divided into five books, covers the period 1066–1198. A great part of it is derived from known sources, especially from Henry of Huntingdon, Jordan Fantosme, the *Itinerarium regis Ricardi*, or its French original, and a lost account, by Anselm the chaplain, of the captivity of Richard I. The value of Newburgh's work lies in his estimates of men and situations. Except for the years 1154–1173 and the reign of Richard he records few facts which cannot be found elsewhere; and in matters of detail he is prone to inaccuracy. But his political insight and his impartiality entitle him to a high place among the historians of the 12th century.

See the editions of the *Historia* by H. C. Hamilton (2 vols., London, 1856) and by R. Howlett in *Chronicles of the Reigns of Stephen, &c.* ("Rolls" series, 1884–1885), vols. i. and ii. In the latter edition a continuation, the *Annales Furnesienses* (1190–1298), composed by a monk of Furness Abbey, Lancashire, is also given. See also Sir T. D. Hardy's *Descriptive Catalogue* ("Rolls" series, 1865), ii. p. 512; and H. E. Salter in the *English Historical Review*, vol. xxii. (1907).
(H. W. C. D.)

WILLIAM OF POITIERS (*c.* 1020–*c.* 1090), Norman chronicler, was born at Préaux, near Pont Audemer, and belonged to an influential Norman family. After serving as a soldier he studied at Poitiers, and then returning to Normandy became chaplain to Duke William (William the Conqueror) and archdeacon of Lisieux. He wrote an eulogistic life of the duke, the earlier and concluding parts of which are lost; and Ordericus Vitalis, who gives a short biography of him in his *Historia ecclesiastica*, says that he also wrote verses. William's *Gesta Guilelmi II. ducis Normannorum*, the extant part of which covers the period between 1047 and 1068, is valuable for details of the Conqueror's life, although untrustworthy with regard to affairs in England. According to Freeman, "the work is disfigured by his constant spirit of violent partisanship." It was written between 1071 and 1077, and was used by Ordericus Vitalis.

The *Gesta* was first published by A. Duchesne in the *Historiae Normannorum scriptores* (Paris, 1619); and it is also found in the *Scriptores rerum gestarum Willelmi Conquestoris* of J. A. Giles (London, 1845). There is a French translation in tome xxix. of Guizot's *Collection des mémoires relatifs à l'histoire de France* (Paris, 1826). See G. Körting, *Wilhelms von Poitiers Gesta Guilelmi ducis* (Dresden, 1875); and A. Molinier, *Les Sources de l'histoire de France*, tome iii. (Paris, 1903).

WILLIAM OF ST CALAIS (CARILEF) (d. 1096), bishop of Durham and chief counsellor of William Rufus, was a Norman monk and prior of St Calais in Maine, who received the see of Durham from the Conqueror (1081). In Durham annals he is honourably remembered as the prelate who designed the existing cathedral, and also for his reform of ecclesiastical discipline. His political career is less creditable. Honoured with the special confidence of William Rufus he deserted his patron's cause at the first sign of rebellion, and joined with Odo of Bayeux in urging Duke Robert of Normandy to claim the crown (1088). After the collapse of this plot William was put upon his trial before the Great Council. He claimed the right to be judged by his fellow-bishops alone; this claim being rejected he appealed to the see of Rome. This was the first case of an appeal to the pope from an English tribunal which had occurred since the 7th century. Rufus and Lanfranc did not venture to dispute the right of appeal, but contended that the bishop, as a royal vassal, could not appeal against the forfeiture of his temporalities. These were confiscated, and William left the kingdom, but no more was heard of his appeal, and in 1091 he regained the royal favour and his see. Thenceforward he showed the utmost subservience. He managed the king's case against Anselm, and at Rockingham (1095) actually claimed the right of appeal, when it was claimed by the archbishop. Notwithstanding his zeal for the royal interests, William was soon afterwards disgraced. He died in January 1096.

See E. A. Freeman, *William Rufus* (1882), and *Symeon of Durham*, vol. i. pp. 170-195 (Rolls ed.).

WILLIAM (*c.* 1130–*c.* 1190), archbishop of Tyre and chronicler, belonged to a noble French family and was probably born in Palestine about 1130. This, however, is only an inference from his works, borne out by the fact that he had seen Ralph, the patriarch of Antioch, who died about 1141; that he seems to call himself a contemporary historian from the accession of Baldwin III. to the throne of Jerusalem, an event which he places in November 1142; and that he remembered the fall of Edessa in 1144. Unfortunately the chapter (xix. 12) which relates to his early life has been excised or omitted from every extant manuscript of his *Historia*, and this remark holds good, not only for the original Latin, but also for the French translation of the 13th century. William was still pursuing his studies in Europe when Amalric I. became king of Jerusalem in 1162, but he returned to Palestine towards the close of 1166, or early in 1167, and was appointed archdeacon of Tyre at the request of Amalric in August 1167. In 1168 he was sent on an embassy, the forerunner of several others, to the emperor Manuel I. at Constantinople, and in 1169, at the time of the disastrous campaign against Damietta, he was obliged to take refuge in Rome from the "unmerited anger" of his archbishop. But he was soon in Palestine again, and about 1170 he was appointed tutor to Amalric's son, Baldwin, afterwards King Baldwin IV. Towards the end of 1174, soon after Baldwin's accession to the throne, he was made chancellor of the kingdom of Jerusalem, an office which he held until 1183, and less than a year later (May 1175) he was consecrated archbishop of Tyre. He was one of those who went to negotiate with Philip I., count of Flanders, in 1177, and in 1179 he was one of the bishops who represented the Latin Church of the East at the Lateran council in Rome. On his return to Palestine he stayed seven months at Constantinople with Manuel. This is William's last appearance in history, but he was writing his history in 1181, and this breaks off abruptly at the end of 1183 or early in 1184. He died probably between 1187 and 1190. About fifty years later one of his continuators accused Heraclius, the patriarch of Jerusalem, of procuring his death by poison at Rome, but this story appears to be legendary. Equally untrustworthy is the theory which identifies William with the archbishop of Tyre sent to Europe to preach a new crusade in 1188. It is true that Matthew Paris speaks of the English king, Henry II., as receiving the cross from the hands of *Willelmus episcopus Tyrensis*; but more contemporary writers omit the Christian name, while others write it Josce or Joscius.

If not the greatest, William of Tyre is at least among the greatest, of medieval historians. His *Historia rerum in partibus transmarinis gestarum*, or *Historia Hierosolymitana* or *Belli sacri historia* covers the period between 1095 and 1184, and is the main authority for the history of the Latin kingdom of Jerusalem between 1127, where Fulcher of Chartres leaves off, and 1183 or 1184, where Ernoul takes up the narrative. It was translated into French in the 13th century, or possibly before the end of the 12th, and this translation, known as the *Chronique d'outremer*, or *Livre d'Eracles* or *Livre du conquest*, is quoted by Jean de Joinville, and increased by various continuations, is the standard account of the exploits of the French warriors in the East. William's work consists of twenty-two books and a fragment of another book; it extends from the preaching of the first crusade by Peter the Hermit and Pope Urban II. to the end of 1183 or the beginning of 1184. It was undertaken at the request of Amalric, who was himself a lover of history and who supplied the author with Arabic manuscripts, and William says of it, "in this work we have had no guide, whether Greek or Arab, but have had recourse to traditions only, save as regards a few things that we ourselves have seen." The "traditions" here referred to must be taken to include the *Gesta Francorum* of Tudebode, the writings of Fulcher of Chartres, of Baudry of Bourgueil and, above all, of Albert of Aix. From the beginning to about 1144 the *Historia* is taken from these writers; from 1144 to the end it is contemporary and original.

William also wrote *Historia de orientalibus principibus*. This work, which is now unfortunately lost, was partly based upon the Arabic chronicle of a certain Said-ibn-Batrik (d. 940), patriarch of Alexandria.

No medieval writer, except perhaps Giraldus Cambrensis, possesses William's power of delineating the physical and mental features of his heroes. Very few, moreover, had his instinctive insight into what would be of real value to future ages; genealogy, topography, archaeology, social life, both political and ecclesiastical, and military and naval matters all find due exposition in his pages. It is hardly too much to say that from his work alone a fairly detailed map of the Levant, as it was in the 12th century, might be constructed; and it is impossible to praise too highly the scrupulous fidelity with which he defines nearly all the technical terms, whether relating to land or sea, which he uses. His chief fault is in his chronology, where, indeed, he is often at discord with himself. In the later books of the *Historia* his information, even regarding events taking place beyond the Nile or the Euphrates as well as in Europe, is singularly exact.

His powers of industry were exceptionally great, and although a man of much learning and almost certainly acquainted with Greek and Arabic, he is as ready to enliven his pages with a homely proverb as he is to embellish them with quotations from Cicero, Virgil, Ovid or Plato. A prelate of pious character, he was inclined to see the judgment of God on the iniquities of his fellow-countrymen in every disaster that overtook them and in every success which attended the arms of the Saracens.

As *Belli sacri historia* the *Historia rerum* was first published in 1549 at Basel. More recent editions are in J. P. Migne's *Patrologia Latina*, tome cci., and in the "Recueil des historiens des croisades," *Hist. occid.* i. (Paris, 1844). Manuscripts are in the British Museum, London, and in Corpus Christi College, Cambridge. It has been translated into German by E. and R. Kausler (Stuttgart, 1848); into French in Guizot's *Collection des mémoires*, tomes xvi., xviii. (Paris, 1824); into Italian and into Spanish. An English translation has been made for the Early English Text Society by M. N. Colvin (London, 1893). See the *Histoire littéraire de la France*, tome xiv. (1869); B. Kugler, *Studien zur Geschichte des zweiten Kreuzzuges* (Stuttgart, 1866); H. Prutz, *Studien über Wilhelm von Tyrus* (Hanover, 1883); and H. von Sybel, *Geschichte des ersten Kreuzzuges* (Leipzig, 1881).

WILLIAM OF VALENCE (d. 1296), brother of Henry III. of England, was a son of John's widow, Isabelle of Angoulême, by her second marriage. William came to England with his brothers in 1247, and at once became a court favourite. He married Joan de Munchensi, the heiress to the Pembroke estates, whence he is sometimes styled earl of Pembroke. In 1258 he was attacked by the baronial opposition and forced to leave England. He returned in 1261, after Henry III. had repudiated the Provisions of Oxford, and fought on the royal side at Lewes (1264). Escaping from the pursuit of the victorious Montfortians, he later appeared at the head of a small army in Pembrokeshire. This gave the signal for the outbreak of a new civil war which ended with the defeat of Montfort at Evesham (1265). Valence accompanied Prince Edward to the Holy Land and, in later years, became a trusted agent of the crown, especially in the Welsh wars. The position of his estates made him the natural leader of all expeditions undertaken against Llewelyn from South Wales. He was also employed in Aquitaine. He died at Bayonne in 1296. Despite his origin he had become, in course of time, a respected leader of the baronage; and as a military commander rose high above the average level.

See R. Pauli's *Geschichte von England*, vol. iii. (Hamburg, 1853); W. H. Blaauw, *Barons' War* (1871).

WILLIAM OF WYKEHAM (1323–1404), English lord chancellor and bishop of Winchester. William de Wykham, as he is called in earlier, William Wykeham in later life, has been variously guessed to be the son of a freedman carpenter, and an illegitimate son of Queen Isabella and Roger Mortimer (*Notes and Queries*, 10th s. i. 222). In sober truth (*Life* by Robert Heete in *Reg. Winch. Coll. c.* 1430) he was born at Wickham, Hants, in 1323 or 1324, son of John, whose name was probably Wykeham, but nicknamed Long, who was "endowed with the freedom of his ancestors," and "according to some" had a brother called Henry Aas. His mother Sibyl was "of gentle birth," a daughter of William Bowate and granddaughter of William Stratton of Stratton, Hants. His education at Winchester, no doubt in the Great Grammar school or High school in Minster Street, was paid for by some patron unnamed by the biographer, perhaps Sir Ralph Sutton, who is named first by Wykeham among his benefactors to be prayed for by his colleges. That he was, as stated by Archdeacon Thomas Martin, the author of a *Life of Wykeham*, published in 1597, taught classics, French and geometry by a learned Frenchman on the site of Winchester College, is a guess due to Wykeham's extant letters being in French and to the assumption that he was an architect. After some unspecified secular employment, Wykeham became "under-notary (*vice tabellio*) to a certain squire, constable of Winchester Castle," probably Robert of Popham, sheriff of Hampshire, appointed constable on the 25th of April 1340, not as commonly asserted Sir John Scures, the lord of Wykeham, who was not a squire but a knight, and had held the office from 1321, though, from Scures being named as second of his benefactors, Wykeham perhaps owed this appointment to his influence. "Two or three years afterwards, namely after he was twenty," Wykeham "was transferred to the king's court," *i.e. c.* 1343. Wykeham has been credited (*Gent. Mag.* lxxxv. 189) with the living of Irstead, Norfolk, of the king's gift on the 12th of July 1349. But apart from the fact that this Wykeham is described in the grant as "chaplain," the probate of his will on the 8th of March 1376–1377 (Norwich Reg. Heydon, f. 139) shows that he was a different person (H. Chitty in *Notes and Queries*, 10th ser. iv. 130). Our Wykeham first appears in the public records in 1350 as keeper of the manor of Rochford, Hants, during the minority of the heir, William Botreaux.

On the 12th of October 1352 Henry Sturmy of Elvetham, sheriff and escheator of Hants, and frequently a justice in eyre for the forests of Hants and Wilts, at Winchester, describes William of Wykeham as "my clerk" in a power of attorney dated at Winchester, to deliver seisin of lands in Meonstoke Ferrand, Hants, which he had sold to William of Edyndon, bishop of Winchester (Win. Coll. Lib. H. 249). On the 10th of November (not December as Lowth, *Life of Wykeham*, 14) Edyndon, by a letter dated at London, appointed William of Wykeham, clerk (not "my clerk" as Kirby, *Archaeol.* 57, ii. 292, where the deed is also misdated 1353), his attorney to take seisin of lands in Meonstoke Tour, Hants, which he had bought from Alice de Roche, daughter of William of Tour (*ibid.* f. 250). These lands were afterwards bought by Wykeham and given to Winchester College. On the 14th of April 1353 (Claus. 29 E. III. m. 29 d) Wykeham served as attorney of John of Foxle, of Bramshill, Hants, son of Thomas of Foxle, constable of Windsor Castle, in acknowledging payment of a debt due from John of Palton, sheriff of Somerset and of Hants. On the 15th of April 1356 schedules touching the New Forest and other forests in Hants and Wilts were delivered out of the Tower of London to William of Wykeham to take to the justices in eyre (Claus. 30 E. III. m. 19 d). In the same year on the 24th of August Peter-atte-Wode and William of Wykeham, clerk, were appointed keepers of the rolls and writs in the eyre for the forests of Hants and Wilts, of which Henry Sturmy was one of the justices. On the 10th of May 1356 Wykeham first appears in the direct employment of the king, being appointed clerk of the king's works in the manors of Henley and Yeshampsted (Easthampstead) to pay all outgoings and expenses, including wages of masons and carpenters and other workmen, the purchase of stone, timber and other materials, and their carriage, under the view of one controller in Henley and two in Easthampstead. On the 8th of June Walter Nuthirst and Wykeham were made commissioners to keep the statute of labourers and servants in the liberty of the Free Chapel (St George's), Windsor. On the 30th of October 1356 Wykeham was appointed during pleasure surveyor (supervisor) of the king's works in the castle of Windsor, for the same purposes as at Henley, with power to take workmen everywhere, except in the fee of the church or those employed in the king's works at Westminster, the Tower of Dartford, at the same wages as Robert of Bernham, probably Burnham, Bucks, who had been appointed in 1353, used to have, viz. 1s. a day and 3s. a week for his clerk. He was to do this under supervision of Richard of Teynton, John le Peyntour (the painter) and another. From this appointment it has been inferred that Wykeham was the architect of the "Round Table" at Windsor, which has been confused with the Round Tower, and a story which is first told by Archbishop Parker, writing thirty years afterwards (*Antiq. Brit. Eccles.* ed. 1729, p. 385), relates that Wykeham nearly got into trouble for inscribing on it, "This made Wickam," which he only escaped by explaining that it did not mean that Wykeham made the tower, but that the tower was the making of Wykeham. But Wykeham had nothing to do with building either the Round Tower or the Round Table. The Round Tower, called the High Tower in Wykeham's day, is the Norman Keep. It was being refitted for apartments for the king and queen a little before Wykeham's time, and his first accounts include the last items for its internal decoration, including 28 stained glass windows. The Round Table, a building 200 ft. in diameter for the knights of the Round Table, who preceded the knights of the Garter, had been built in 1344 (*Chron. Angl.* "Rolls" ser. No. 61, p. 17) when Wykeham had nothing to do with Windsor. The inscription, "This made Wykeham," did exist on a small square tower in the Middle Bailey formerly known as Wykeham Tower, now entirely rebuilt with the inscription recopied and known as Winchester Tower. But it could hardly be of sufficient importance to cause Wykeham to play the sphinx, and the story is apparently due to the Elizabethan love of quips. All that was built during the five years, 1356 to 1361, when Wykeham was clerk of the works, were the new royal apartments, two long halls and some chambers in the upper ward, quite unconnected with and east of the Round Tower, and a gateway or two leading to them, the order for building which was given on the 1st of August 1351 (Pipe Roll 30 Ed. III.). The accounts of Robert of Bernham, Wykeham's predecessor, who was a canon of St George's Chapel (Le Neve's *Fasti*, iii. 378), are extant, and from the payments of 1s. a day to Mr John Sponle, mason and orderer or setter-out (ordinator) of the king's works, and Geoffrey of Carlton "appareller" of the carpentry work, it is clear that they, and not Bernham, were the architects and builders. Canon Bernham was only the paymaster and overlooker to see that men and materials were provided and to pay for them. While in 1353–1354 £1440 and in 1355–1356 £747 was expended under the supervision of Robert of Bernham, in 1357–1358 £867 was spent by Wykeham, including Winchester Tower. In 1358–1359 the expenditure rose to £1254, while between the 6th of June 1360 and the 12th of April 1361 it amounted to £2817. The chief items were a new Great Gate with two flanking towers, a belfry for St George's Chapel and houses in the Lower Bailey, probably for the canons, and in the Upper Bailey, probably for the royal household. On the 1st of November 1361 Wykeham was succeeded as clerk of the works by William of Mulsho, another canon of Windsor, who afterwards succeeded him also as dean of St Martin-le-Grand. Under Wykeham, William of Wynford, who appears in 1360 as "appareller" under Sponle, in 1361 became chief mason and ordinator, and he was probably what we should call the architect of the Great Gate, the rest of which was built under Wykeham's supervision. For wherever we find Wykeham building afterwards, we find Wynford as chief mason. When Wykeham was provost of Wells, Wynford was retained as architect on the 1st of February 1364–1365 at a fee of 40s. a year and 6d. a day when in Wells (Wells, *Lib. Abb.* f. 253). He was architect to Abingdon Abbey (at a fee of £3, 6s. 8d. and a furred robe) in 1375–1376 when the existing Outer Gate of the abbey was built (*Abingdon Obed. Acc.* Camd. Soc., 1892). He was chief mason for Wykeham's works at Winchester Cathedral and for Winchester College, where his portrait may be seen in the east window of the chapel, and where his contract with the clerk of the works, an ex-scholar of the college, for the building of the outer gate, is still preserved.

The ascription to Wykeham of the invention of the Perpendicular style of medieval architecture is now an abandoned theory. In so far as he gave vogue to that style the credit must be given to William of Wynford, not to William of Wykeham. At all events he had very little to do with building Windsor Castle. How far he really was responsible for the other great castle attributed to him, that of Queenborough Castle in the Isle of Sheppey, cannot be tested, as the building accounts for it are only partially extant. The account from the 1st of

November 1361 to 1362 shows Simon of Bradstede, clerk of the works, then expending £1773, of which £100 was received by the hands of William of Wykeham at the exchequer, and that from 1369 shows Bernard Cokles, clerk of the works, expending £2306. The chief evidence cited in support of the theory that Wykeham owed his advancement to his skill as an architect is the remark in a tract *Why Poor Priests have no benefices* that "Lords will not present a clerk able of cunning of God's law and good life and holy ensample . . . but a kitchen clerk or a fancy clerk or wise in building castles or worldly doing, though he cannot well read his psalter." This tract has been attributed to Wycliffe, but without adequate authority, and it is thought to be of later date, and if Wykeham is meant by the castle-building clerk it only shows that popular repute is no guide to fact. That Wykeham, who was clearly an extremely good man of business, should, when clerk of the works, have played a considerable part in determining what works should be done and the general character of the buildings with which he was connected, we may believe; but to think that this attorney and notary, this keeper of the king's dogs (20th Aug. 1356, Devon's *Issues of the Exchequer*, 163) and of the king's forests, this carrier of rolls and paymaster at the exchequer, was also the architect of Windsor and Queenborough Castles, of Winchester Cathedral and College, is to credit Wykeham with a superhuman combination of knowledge, of training and of functions.

That he gave great satisfaction to the king when once he was appointed surveyor at Windsor in 1356 is unquestionable. He is first called king's clerk on the 14th of November 1357, when he was given 1s. a day, beyond the wages he was already receiving for his offices at Windsor and elsewhere, "until peacefully advanced to some benefice." Ecclesiastical benefices were the chief means by which, before the Reformation, the civil servants of the crown were paid for services which, being clerical, were also ecclesiastical, and for which the settled stipends were wholly inadequate. In his accumulation of benefices Wykeham seems to have distanced all his predecessors and successors, except perhaps John Maunsell, the chancellor of Henry III., and Thomas Wolsey, the chancellor of Henry VIII., the latter being a pluralist not in canonries and livings but in bishoprics.

Wykeham's first benefice was the rectory of Pulham, the richest in Norfolk, worth £53 a year, or some £1600 of our money, to which he was presented on the 30th of November 1357. But this was not a "peaceful" advancement, for it was only in the king's patronage by reason of the temporalities of the see of Ely having been seized into the king's hands the year before, on account of the bishop being implicated in certain murders and robberies, which he denied, contesting the king's action in the papal court. On the 16th of April 1359 the king gave Wykeham a pension of £20 a year from the exchequer until he could obtain peaceful possession of Pulham. On this, and what may have been a similarly contested presentation to the canonry and prebend of Flixton in Lichfield cathedral on the 1st of March 1359, repeated on the 22nd of August 1360, and supported by a mandate to the new bishop on the 29th of January 1361, Wykeham's latest biographer (George Herbert Moberly, *Life of Wykeham*, 1887, 2nd ed., 1893) has built an elaborate story of Wykeham's advancement being opposed by the pope because he was the leader of a national party against papal authority in England. The baselessness of this is clear when we find that Wykeham had obtained from Innocent VI., on the 27th of January 1357, an indulgence to choose his own confessor (*Cal. Pap. Reg.*), and on the 8th of July 1358 (*Cal. Pap. Pet.* i. 331) asked and obtained a papal provision to this very church of Pulham on the ground that it had passed to the pope's patronage by the promotion of its former possessor to the see of London. In spite of papal and royal authority, it is doubtful whether Wykeham obtained peaceful possession of Pulham till again presented to it by the king on the 10th of July 1361 after the bishop of Ely's death. The difficulty as to the prebend of Flixton was no doubt something of the same kind. Between bishop, pope and king the next vacant prebend in every great church was generally promised two or three deep before it was vacant, and the episcopal and chapter registers are full of the contests which ensued.

Wykeham's civil offices rapidly increased. On the Ides (15th) of March 1359 a French fleet sacked Winchelsea, carrying off the women and girls. On the 10th of July 1359 Wykeham was made chief keeper and surveyor, not only of Windsor, but of the castles of Dover, Hadley and Leeds (Kent), and of the manors of Foliejohn, Eton, Guildford, Kennington, Sheen (now Richmond), Eltham and Langly and their parks, with power to repair them and to pay for workmen and materials. On the 20th of February 1360, when another French invasion was feared, the bailiff of Sandwich was ordered to send all the lead he had to Wykeham for the works at Dover. In April the sheriffs of four batches of counties were each ordered to send forty masons to Wykeham at Windsor. This secular activity was rewarded by presentation to the deanery of St Martin-le-Grand, with an order for induction on the 21st of May, on which day he was commissioned to inquire by a jury of men of Kent into the defects of the walls and tower of Dover (Pat. 34 E. III. pt. i. m. 12). On the 15th of August he was directed to hand over £40 given him for the purpose, to a successor, the treaty of Brêtigny having been made meanwhile and confirmed at Calais with Wykeham as one of the witnesses on the 24th of October. In January 1361 building work at Windsor was vigorously resumed, and again the sheriffs were ordered to contribute their quotas of 40 freestone masons and 40 *cementarii* to Wykeham's charge. On the 13th of February, on the joint petition of the kings of England and of France, the pope "provided" Wykeham to a canonry and dignity at Lincoln, notwithstanding his deanery and a prebend at Llandaff. On the 2nd of April four commissioners were appointed to superintend the construction of the new castle ordered in the Isle of Sheppey, which when finished was called Queenborough, the purchases and payments, not the works, being under the beloved clerk, Wykeham. In this year came the second visitation of the Black Death, the Second Plague, as it was called, and carried off four bishops and several magnates, with many clerics, whose vacated preferments were poured on Wykeham. The bishop of Hereford being dead, on the 12th of July 1361, the king presented Wykeham to a prebend in Hereford cathedral, and on the 24th of July to one in Bromyard collegiate church; the bishop of St David's being dead, prebends in the collegiate churches of Abergwilly and Llandewybrewi were given him on the 16th of July. On the 11th of August the pope, on the king's request, provided him with a prebend in St Andrew's Auckland collegiate church. This Mr Moberly curiously misrepresents as action against Wykeham. He in fact never obtained possession of it, probably because the pope had already "provided" it to Robert of Stretton, a papal chaplain, who, however, asked in January 1362 for a canonry at Lincoln instead, because he was "in fear and terror of a certain William of Wykeham." On the 24th of September 1361 the king gave Wykeham a prebend in Beverley Minster, on the 1st of October the prebend of Oxgate in St Paul's (which he exchanged for Tattenhall on the 10th of December), on the 22nd of November a prebend in St David's cathedral, on the 20th of December a prebend in Wherwell Abbey, Hants. So far the Patent Rolls. The Salisbury records show him also admitted to a prebend there on the 16th of August, which he exchanged for other prebends on the 9th and 15th of October. All these clerical preferments Wykeham held when he was a simple clerk, who had no doubt undergone the "first tonsure," but was not even ordained an acolyte till the 5th of December of this golden year. He added to his civil offices during the year that of clerk (*officium cirograffie*) of the exchequer on the 24th of October. On the 9th of October he acted as attorney to the king in the purchase of the manor of Thunderley, Essex. Next year, 1362, he entered holy orders, being ordained subdeacon on the 12th of March and priest on the 12th of June; and adding to his canonries and prebends one in Shaftesbury Abbey on the 15th of July and another in Lincoln cathedral on the 20th of August. Wykeham meanwhile was acting as keeper of the forests south of Trent and as a trustee for Juliana, countess of Huntingdon. Next year, 1363, he was made a canon of the collegiate church in Hastings Castle on the 3rd of February, and of the royal chapel of St Stephen's, Westminster, then newly founded, or re-founded, on the 21st of April. He obtained the archdeaconry of Northampton on the 26th of April, and resigned it on the 12th of June, having been promoted to that of Lincoln, the richest of all his preferments, on the 23rd of May. On the 31st of October he was made a canon of York, and on the 15th of December provost of the fourteen prebends of Combe in Wells cathedral, while at some date unknown he obtained also prebends in Bridgenorth collegiate church and St Patrick's, Dublin, and the rectory of Menheniot in Cornwall. On the 5th of May 1364 he became privy seal, and in June is addressed by the new pope, Urban V., as king's secretary. On the 14th of March 1365 he was given 20s. a day from the exchequer "notwithstanding that he is living in the household." He was so much the king's factotum that Froissart (i. 249) says "a priest called Sir William de Wican reigned in England . . . by him everything was done and without him they did nothing." In fact, as privy seal he was practically prime minister, as Thomas Cromwell was afterwards to Henry VIII. On the 7th of October 1366, William Edingdon, the treasurer of England and bishop of Winchester, died; on the 13th of October Wykeham was recommended by the king to the chapter of monks of St Swithun's cathedral priory and elected bishop.

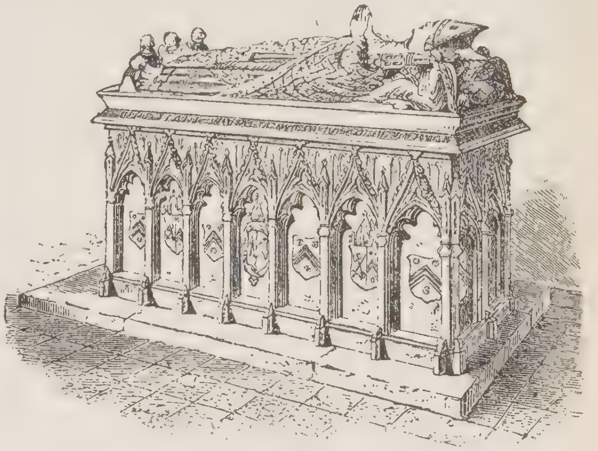
A long story has been made out of Pope Urban V.'s delay in the recognition of Wykeham, which has been conjectured to have been because of his nationalist proclivities. But little more than the ordinary delays took place. On the 1st of December the king, "for a large sum of money paid down," gave Wykeham, not only the custody of the temporalities of the see, but all the profits from the day of Edingdon's death. On the 11th the pope granted him the administration of the spiritualities. The papal court was then moving from Avignon to Rome, and on the 14th of July 1367 the bull of "provision" issued at Viterbo. Wykeham was in no hurry himself, as it was not till the 10th of October 1367 that he was consecrated, nor till the 9th of July 1368, after the war parliament which met on the 3rd of June had been dissolved on the 10th of June, that he was enthroned. Meanwhile he had been made chancellor on the 17th of September 1367—thus at the age of forty-three he held the richest ecclesiastical, and the best-paid civil, office in the kingdom at the same time. The war in France was disastrous, how far through Wykeham's fault we have no means of knowing. When parliament again met in 1371, the blame was laid on the clerical ministers, under the influence of Wycliffe. He had been born in the same year as Wykeham, and like him had profited by papal provisions to prebends in 1361, but had since led an attack on papal and clerical abuses. Parliament demanded that laymen only should be chancellor, treasurer, privy seal and chamberlain of the exchequer. On the 8th of March 1372 Wykeham resigned the chancellorship, and Bishop Brantingham of Exeter the treasurership, and laymen were appointed in their places, though Sir Robert Thorp, who became chancellor, was master of Pembroke Hall at Cambridge, and as much a cleric as Wykeham had been when he was dean of St Martin-le-Grand and surveyor of Windsor Castle.

As soon as he became bishop Wykeham had begun his career as founder. In 1367 (Pat. 41 E. III. pt. 2, m. 5) he purchased the estates of Sir John of Boarhunt, near Southwick, with which he endowed a chantry in Southwick Priory for his parents. Next year he began buying lands in Upsomborne, Hants, which he gave to Winchester College, and in Oxford, which he gave to New College. On the 1st of September 1373 he entered into an agreement (*Episc. Reg.* iii. 98) with Master Richard of Herton "gramaticus" for ten years faithfully to teach and instruct the poor scholars, whom the bishop maintained at his own cost, in the art of grammar, and to provide an usher to help him. Meanwhile the war with France was even more unsuccessful under the lay ministry and John of Gaunt. In the parliament of 1373 Wykeham was named by the Commons as one of the eight peers to treat with them on the state of the realm. In the parliament which met on the 12th of February 1376, Lord Latimer and Alice Perrers, the king's mistress, a lady of good birth, and not (as the mendacious St Albans chronicler alleged) the ugly but persuasive daughter of a tiler, were impeached, and Wykeham took a leading part against Latimer, even to the extent of opposing his being allowed counsel. At the dissolution of parliament a council of nine, of whom Wykeham was one, was appointed to assist the king. But on the 8th of June the Black Prince died. Alice Perrers returned. John of Gaunt called a council on the 16th of October to impeach Wykeham on articles which alleged misapplication of the revenues, oppressive fines on the leaders of the free companies, taking bribes for the release of the royal French prisoners, especially of the duke of Bourbon, who helped to make him bishop, failing to send relief to Ponthieu and making illegal profits by buying up crown debts cheap. He was condemned on one only, that of halving a fine of £80 paid by Sir John Grey of Rotherfield for licence to alienate lands, and tampering with the rolls of chancery to conceal the transaction. Wykeham's answer was that he had reduced the fine because it was too large, and that he had received nothing for doing so. Skipwith, a judge of the common pleas, cited a statute under which for any erasure in the rolls to the deceit of the king 100 marks fine was imposed for every penny, and so Wykeham owed 960,000 marks. Wykeham was convicted, and on the 17th of November his revenues were seized and bestowed on the 15th of March 1377 on the young prince Richard, and he was ordered not to come within 20 m. of the king. He "brake up household . . . sending also to Oxford, whear upon almose and for God's sake he found 70 scollers, that they should depart to their frendis for he could no longer help or finde them" (*Chron. Angliae*, lxxx.). But when convocation met in 1377 the bishops refused to proceed to business without Wykeham, and he was fetched back from Waverley Abbey. He was exempted, however, from the general pardon issued on the occasion of Edward III.'s jubilee. But on the 13th of June the prince restored his temporalities, on condition of his maintaining three galleys with 50 men-at-arms and 50 archers for three months, or providing the wages of 300 men. The St Albans monk says that this was obtained by a bribe to Alice Perrers. Meonstoke Perrers, part of the endowment of Winchester College, was certainly bought on the 12th of June 1380 from Sir William Windsor, her husband, whose name seems to be derived from Windsor, near Southampton water. As Hampshire people they may have helped Wykeham. But as Wykeham was of the party of the Black Prince and his widow Joan of Kent, no *dea ex machina* was needed.

On the 21st of June 1377 Edward III. died. Wykeham was present at the coronation of Richard II. on the 19th of July, and on the 31st of July full pardons were granted him under the privy seal, which at the request of Richard's first parliament were ratified under the great seal on the 4th of December 1377. Wykeham at once took an active part in the financial affairs of the new king, giving security for his debts and himself lending 500 marks, afterwards secured on the customs (Pat. 4 Rich. II. pt. i. m. 4). He then set to work to buy endowments for Winchester and New Colleges. On the 30th of June he obtained licence in mortmain and on the 26th of November issued his charter of foundation of "Seynt Marie College of Wynchestre in Oxenford" for a warden and 70 scholars to study theology, canon and civil law and arts, who were temporarily housed in various old halls. On the 5th of March 1380 the first stone was laid of the present buildings, which were entered on by the college on the 14th of April 1386. The foundation of Winchester was begun with a bull of Pope Urban VI. on the 1st of June 1378, enabling Wykeham to found "a certain college he proposed to establish for 70 poor scholars, clerks, who should live college-wise and study in grammaticals near the city of Winchester," and appropriate to it Downton rectory, one of the richest livings belonging to his bishopric. The bull says that the bishop "had, as he asserts, for several years administered the necessaries of life to scholars studying grammar in the same city." On the 6th of October 1382 the crown licence in mortmain was issued, on the 10th-13th of October the site was conveyed, and on the 20th of October 1382 "Sancte Marie collegium" or in vulgar tongue "Seinte Marie College of Wynchestre by Wynchestre" was founded for a warden and "70 pore and needy scholars studying and becoming proficient in grammaticals or the art and science of grammar." The first stone of the buildings was laid on the 26th of March 1388, and they were entered on by the scholars on the 28th of March 1394, not, as supposed at the quincentenary celebration in 1893, in 1393. While the new buildings were being erected, the college remained in the parish of "St John the Baptist on the Hill" of St Giles, supplying scholars to New College then as since. A reference to this in a letter of Wykeham's of the 8th of April 1388 has given rise to the creation of an imaginary college of St John the Baptist at Winchester by the Rev. W. Hunt (*Dic. Nat. Biog.* sub. "Chicheley"). The foundation was on the model of Merton and Queen's colleges at Oxford, to which grammar schools were attached by their founders, while fellows of Merton were the first wardens of both of Wykeham's colleges. Both were double the size of Merton, and the same size as the Navarre college of the queen of France and Navarre, founded at Paris in 1304, which also contained a school. But each of Wykeham's colleges contained as many members as the French queen's. The severance of the school which was to feed the college exclusively, placing it not at Oxford, but at Winchester, and constituting it a separate college, was a new departure of great importance in the history of education. Ten fellows and 16 choristers were added in 1394 to the 70 scholars, the choristers attending the school like the scholars, and being generally, during the first three centuries of the foundation, promoted to be scholars. The original statutes have not come down to us. Those which governed the colleges until 1857 were made in 1400. They state that the colleges were provided to repair the ravages caused by the Black Deaths in the ranks of the clergy, and for the benefit of those whose parents could not without help maintain them at the universities, and the names of the boys appointed by Wykeham and in his time show that "poor and indigent" meant the younger sons of the gentry, and the sons of yeomen, citizens of Winchester or London, and the middle classes generally, who needed the help of exhibitions.

The time which elapsed between the foundation and completion of the colleges may be attributed to Wykeham's preoccupation with politics in the disturbed state of affairs, due to the papal schism begun in 1379, in which England adhered to Urban VI. and France to Clement VII., to the rising of the Commons in 1381, and the wars with France, Scotland and Spain during John of Gaunt's ascendancy. Then followed the constitutional revolution of the lords appellant in 1388. When Richard II. took power on himself, on the 3rd of May 1389, he at once made Wykeham chancellor, with Brantingham of Exeter again as treasurer. Wykeham's business capacity is shown perhaps by the first record of the minutes of the privy council being kept during his term of office, and his promulgation in 1390 of general orders as to its business. At least one occasion is recorded in the minutes on which Wykeham, on behalf of the council, took a firm stand against Richard II. and that in spite of the king's leaving the council in a rage. Peace was made with France in August. On the meeting of parliament in January 1390 Wykeham resigned the great seal; and asked for an inquiry into the conduct of the privy council, and on being assured that all was well resumed it. He now showed that he had not by his charities wronged his relations by settling on his great-nephew and heir Thomas Wykeham, whom he had educated at Winchester and New College, Broughton Castle and estates, still held by his descendants in the female line, the family of Twisleton-Wykeham-Fiennes (peerage of Saye and Sele). In July 1391 he obtained a papal bull enabling him to appoint at pleasure coadjutors to do his episcopal business.

On the 27th of September 1391, Wykeham finally resigned the chancellorship. For three years after there are no minutes of the Council. On the 24th of November 1394 Wykeham lent the king the sum of £1000 (some £30,000 of our money), which same sum or another £1000 he promised on the 21st of February 1395 to repay by midsummer, and did so (Pat. 18, Rich. II. pt. ii. m. 23, 41). The murder of the duke of Gloucester, Richard's uncle, in 1397, was followed next year by the assumption of absolute power by Richard. Wykeham was clearly against these proceedings. He excused himself from convocation in 1397, and from the subservient parliament at Shrewsbury in 1398. The extraordinary comings and goings of strangers to Winchester College, just opposite the gates of the bishop's palace at Wolvesey in 1399, suggest that he took part in the revolution of Henry IV. He appeared in the privy council four times at the beginning of Henry's reign (*Proc. P.C.* i. 100). On the 23rd of July 1400 he lent Henry IV. £500 for his journey towards Scotland, and in 1402 another £500, while a general loan for the war with France and Scotland on the 1st of April 1403 was headed by Wykeham with £1000, the bishop of Durham lending 1000 marks (£666, 13s. 4d.), and no one else more than £500. Meanwhile on the 29th of September 1394 he had begun the recasting of the nave of the cathedral with William Wynford, the architect of the college, as chief mason, and Simon Membury, an old Wykehamist, as clerk of the works. On the 24th of July 1403, he made his will, giving large bequests amounting to some £10,000 (£300,000 of our money), to friends and relations and every kind of religious house. On the 16th of August 1404, he signed an agreement with the prior and convent for three monks to sing daily three masses in his beautiful chantry chapel in the nave of the cathedral, while the boys of the almonry, the cathedral choir-boys, were to say their evening prayers there for his soul. He died on the 27th of September 1404, aged eighty.



His effigy in the cathedral chantry and a bust on the groining of the muniment tower at Winchester college are no doubt authentic portraits. The pictures at Winchester and New College are late 16th-century productions. Three autograph letters of his, all in French, and of the years 1364–1366, are preserved, one at the British Museum, one at the Record Office, a third at New College, Oxford. A fourth letter imputed to Wykeham at the British Museum is shown alike by its contents and its handwriting not to be his.

See Thomas Martin, *Wilhelmi Wicami* (1597); R. Lowth, *Life of Wykeham* (1736); Mackenzie E. C. Walcott, *William of Wykeham and his Colleges* (1852); T. F. Kirby, *Annals of Winchester College* (1892); G. H. Moberly, *Life of Wykeham* (1887); A. F. Leach, *History of Winchester College* (1899); and the *Calendars of Patent and Close Rolls. Edward III. and Richard II.* (A. F. L.)

WILLIAMS, JOHN (1582–1650), English archbishop and lord keeper, son of Edmund Williams of Conway, a Welsh gentleman of property, was born in March 1582 and educated at St John's College, Cambridge. He was ordained about 1605, and in 1610 he preached before King James I., whose favour he quickly gained by his love of compromise. The result was the rapid promotion of Williams in the church; he obtained several livings besides prebends at Hereford, Lincoln and Peterborough. In 1617 he became chaplain to the king, in 1619 dean of Salisbury, and in the following year dean of Westminster. On the fall of Bacon in 1621 Williams, who had meantime ingratiated himself with the duke of Buckingham, was appointed lord keeper, and was at the same time made bishop of Lincoln, retaining also the deanery of Westminster. As a political adviser of the king

Williams consistently counselled moderation and compromise between the unqualified assertion of the royal prerogative and the puritan views of popular liberties which were now coming to the front. He warned Buckingham and Prince Charles of the perils of their project for the Spanish marriage, and after their return from Madrid he encountered their resentment by opposing war with Spain. The lord keeper's counsel of moderation was less pleasing to Charles I. than it had been to his father. The new king was offended by Williams's advice to proceed with caution in dealing with the parliament, with the result that within a few months of Charles's accession the Great Seal was taken from Williams. In the quarrel between the king and the Commons over the petition of right, Williams took the popular side in condemning arbitrary imprisonment by the sovereign. In the matter of ecclesiastical administration he similarly followed a middle course; but he had now to contend against the growing influence of Laud and the extreme high church party. A case was preferred against him in the Star Chamber of revealing state secrets, to which was added in 1635 a charge of subornation of perjury, of which he had undoubtedly been guilty and for which he was condemned in 1637 to pay a fine of £10,000, to be deprived of the temporalities of all his benefices, and to be imprisoned during the king's pleasure. He was sent to the Tower. In 1639 he was again condemned by the Star Chamber for libelling Laud, a further heavy fine being imposed for this offence. In 1641 he recovered his liberty on the demand of the House of Lords, who maintained that as a peer he was entitled to be summoned to parliament. When the Long Parliament met, Williams was made chairman of a committee of inquiry into innovations in the church; and he was one of the bishops consulted by Charles as to whether he should veto the bill for the attainder of Strafford. In December 1641 the king, anxious to conciliate public opinion, appointed Williams archbishop of York. In the same month he was one of the twelve bishops impeached by the Commons for high treason and committed to the Tower. Released on an undertaking not to go to Yorkshire, a promise which he did not observe, the archbishop was enthroned in York Minster in June 1642. On the outbreak of the Civil War, after visiting Conway in the Royalist interest, he joined the king at Oxford; he then returned to Wales, and finding that Sir John Owen, acting on Charles's orders, had seized certain property in Conway Castle that had been deposited with the archbishop for safe-keeping, he went over to the Parliamentary side and assisted in the recapture of Conway Castle in November 1646. Williams, who was a generous benefactor of St John's College, Cambridge, died on the 25th of March 1650.

WILLIAMS, JOHN (1796–1839), English Nonconformist missionary, was born at Tottenham near London on the 29th of June 1796. He was trained as an ironmonger, and acquired considerable experience in mechanical work. Having offered himself to the London Missionary Society, he was sent, after some training, in 1816 to Eimeo, in the Society Islands, where he rapidly acquired a knowledge of the native language. After staying there for a short time, he finally settled at Raiatea, which became his permanent headquarters. His success as a missionary here and elsewhere was remarkable. The people rapidly became Christianized and adopted many of the habits of civilization. Williams was fairly liberal for his age, and the results of his labours among the Pacific Islands were essentially beneficial. He travelled unceasingly among the various island groups, planting stations and settling native missionaries whom he himself had trained. From the Society Islands he visited the Hervey group, where he discovered, and stayed for a considerable time on, the island of Rarotonga. Most of the inhabitants of the group were converted in a remarkably short time, and Williams's influence over them, as over the people of other groups, was very great. Besides establishing Christianity and civilization among them, he also, at their own request, helped them to draw up a code of laws for civil administration upon the basis of the new religion. While at Rarotonga he, with the help of the natives, built himself a 60-ft. ship, "The Messenger of Peace," within about four months; with this he returned to Raiatea, and made voyages among other island groups, including Samoa and the neighbouring islands. Williams returned to England in 1834 (having previously visited New South Wales in 1821); and during his four years' stay at home he had the New Testament, which he had translated into Rarotongan, printed. Returning in 1838 to the Pacific, he visited the stations already established by him, as well as several fresh groups. He went as far west as the New Hebrides, and, while visiting Eromanga, one of the group, for the first time, was murdered by cannibal natives on the 20th of November 1839.

His *Narrative of Missionary Enterprises in the South Sea Islands* was published in 1837, and formed an important contribution to our knowledge of the islands with which the author was acquainted. See *Memoir of John Williams*, by Ebenezer Prout (London, 1843); C. S. Horne, *The Story of the L.M.S.*, pp. 41-54.

WILLIAMS, ROGER (*c.* 1604–1684), founder of the colony of Rhode Island in America and pioneer of religious liberty, son of a merchant tailor, was born (probably) about 1604 in London. It seems reasonably certain that he was educated, under the patronage of Sir Edward Coke, at the Charter House and at Pembroke College, Cambridge, where he received his degree in 1627. According to tradition (probably untrue), he studied law under Sir Edward Coke; he certainly devoted himself to the study of theology, and in 1629 was chaplain to Sir William Masham of Otes, in the parish of High Laver, Essex, but from conscientious scruples, in view of the condition of ecclesiastical affairs in England at the time, refused preferment. He soon decided to emigrate to New England, and, with his wife Mary, arrived at Boston early in February 1631. In April he became teacher of the church at Salem, Mass., as assistant to the Reverend Samuel Skelton. Owing to the opposition of the ecclesiastical authorities at Boston, with whose views his own were not in accord, he removed to Plymouth in the summer, and there remained for two years as assistant pastor. In August 1633 he again became assistant teacher at Salem, and in the following year succeeded Skelton as teacher. Here he incurred the hostility of the authorities of the Massachusetts Bay Colony by asserting, among other things, that the civil power of a state could properly have no jurisdiction over the consciences of men, that the King's patent conveyed no just title to the land of the colonists, which should be bought from its rightful owners, the Indians, and that a magistrate should not tender an oath to an unregenerate man, an oath being, in reality, a form of worship. For the expression of these opinions he was formally tried in July 1635 by the Massachusetts General Court, and at the next meeting of the General Court in October, he not having taken advantage of the opportunity given to him to recant, a sentence of banishment was passed upon him, and he was ordered to leave the jurisdiction of Massachusetts within six weeks. The time was subsequently extended, conditionally, but in January 1636 an attempt was made to seize him and transport him to England, and he, forewarned, escaped from his home at Salem and proceeded alone to Manton's Neck, on the east bank of the Seekonk river. At the instance of the authorities at Plymouth, within whose jurisdiction Manton's Neck was included, Williams, with four companions, who had joined him, founded in June 1636 the first settlement in Rhode Island, to which, in remembrance of "God's merciful providence to him in his distress," he gave the name *Providence*. He immediately established friendly relations with the Indians in the vicinity, whose language he had learned, and, in accordance with his principles, bought the land upon which he had settled from the sachems Canonicus (*c.* 1565–1647) and Miantonomo. His influence with the Indians, and their implicit confidence in him, enabled him in 1636, soon after arriving at Providence, to induce the Narragansets to ally themselves with the Massachusetts colonists at the time of the Pequot War, and thus to render a most effective service to those who had driven him from their community. Williams and his companions founded their new settlement upon the basis of complete religious toleration, with a view to its becoming "a shelter for persons distressed for conscience" (see RHODE ISLAND). Many settlers came from Massachusetts and elsewhere, among others some Anabaptists, by one of whom in 1639 Williams was baptized, he baptizing others in turn and thus establishing what has been considered the first Baptist church in America. Williams, however, maintained his connexion with this church for only three or four months, and then became what was known as a "Seeker," or Independent, though he continued to preach. In June 1643 he went to England, and there in the following year obtained a charter for Providence, Newport and Portsmouth, under the title "The Providence Plantations in the Narragansett Bay." He returned to Providence in the autumn of 1644, and soon afterwards was instrumental in averting an attack by the Narragansets upon the United Colonies of New England and the Mohegans. In 1646 he removed from Providence to a place now known as Wickford, R.I. He was at various times a member of the general assembly of the colony, acted as deputy president for a short time in 1649, was president, or governor, from September 1654 to May 1657, and was an assistant in 1664, 1667 and 1670. In 1651, with John Clarke (1609–1676), he went to England to secure the annulment of a commission which had been obtained by William Coddington for the government of Rhode Island (Newport and Portsmouth) and Connecticut, and the issue of a new and more explicit charter, and in the following year succeeded in having the Coddington commission vacated. He returned in the summer of 1654, having enjoyed the friendship of Cromwell, Milton and other prominent Puritans; but Clarke remained in England and in 1663 obtained from Charles II. a new charter for "Rhode Island and Providence Plantations." Williams died at Providence in March or April 1684; the exact date is unknown.

Though headstrong, opinionative and rigid in his theological views, he was uniformly tolerant, and he occupies a high place among those who have striven for complete liberty of conscience. He was the first and the foremost exponent in America of the theory of the absolute freedom of the individual in matters of religion; and Rhode Island, of which he was pre-eminently the founder, was the first colony consistently to apply this principle in practice.

Williams was a vigorous controversialist, and published, chiefly during his two visits to England, besides *A Key into the Language of the Indians of America* (written at sea on his first voyage to England (1643); reprinted in vol. i. of the *Collections of the Rhode Island Historical Society* (1827), and in series i. vol. iii. of the *Massachusetts Historical Society Collections*); *Mr Cotton's Letter Examined and Answered* (1644); *The Bloudy Tenent of Persecution for the Cause of Conscience* (1644); *Queries of Highest Consideration* (1644); *The Bloudy Tenent yet more Bloudy* (1652); *The Hireling Ministry none of Christ's* (1652); *Experiments of Spiritual Life and Health*(1652); and *George Fox Digged out of his Burrowes* (1676).

His writings have been republished in the *Publications of the Narragansett Club* (6 vols., Providence, 1866–1874), the last volume containing his extant letters, written between 1632 and 1682. The best biographies are those by Oscar Straus (New York, 1894) and E. J. Carpenter (*ibid.* 1910). Also see J. D. Knowles, *Memoir of Roger Williams* (Boston, 1834), and Elton, *Life of Roger Williams* (London, 1852; Providence, 1853); *New England Hist. and Gen. Register*, July and October 1889, and January 1899; and M.C.Tyler, *History of American Literature, 1607–1765* (New York, 1878). For the best apology for his expulsion from Massachusetts, see Henry M. Dexter's *As to Roger Williams and his "Banishment" from the Massachusetts Plantation* (Boston, 1876), an unsuccessful attempt to prevent Massachusetts from revoking the order of banishment.

WILLIAMS, ROWLAND (1817–1870), English divine and scholar, was born at Halkyn, Flint, the son of Rowland Williams (d. 1854), canon of St Asaph, and educated at Eton and Cambridge. He was elected fellow of King's College, Cambridge, in 1839, and took orders in 1842. During the next few years he actively opposed the amalgamation of the sees of St Asaph and Bangor. In 1850 he became vice-principal and Hebrew lecturer at St David's College, Lampeter, where he introduced much-needed educational and financial reforms. He was appointed elect preacher of Cambridge University in 1854, and preached a ermon on inspiration, afterwards published in his *Rational Godliness after the Mind of Christ and the Written Voices of the Church* (London, 1855). He was charged with heterodoxy, and Alfred Ollivant (1798–1882), bishop of Llandaff, required him o resign his chaplaincy, but he remained at the college in spite of these difficulties. His views were further defined in *Christianity and Hinduism* (Cambridge, 1856), an expansion of the Muir prize essay which he had won in 1848. He became vicar in 1858 of Broadchalke with Bowerchalke and Alvedistone, Wiltshire. As a result of his favourable review of Bunsen's "Biblical Researches" contributed to *Essays and Reviews* (1860) he was prosecuted for heterodoxy. An unfavourable judgment was given by the Canterbury Court of Arches in 1862, but reversed by the Privy Council in 1864. Williams died on the 18th of January 1870.

Besides the above works his most important production was a translation of the Hebrew Prophets with commentary (pt. i. 1866; pt. ii. edited by Mrs Williams 1871; pt. iii. though planned was never written). See *Life and Letters*, edited by Mrs Williams (2 vols., 1874); and T. K. Cheyne, *Founders of Old Testament Criticism* (1893).

WILLIAMS, SIR WILLIAM FENWICK, Bart. (1800–1883), British general, second son of Commissary-General Thomas Williams, barrack-master at Halifax, Nova Scotia, was born at Annapolis, Nova Scotia, on the 4th of December 1800. He entered the Royal Artillery as second lieutenant in 1825. His services were lent to Turkey in 1841, and he was employed as a captain in the arsenal at Constantinople. He was British commissioner in the conferences preceding the treaty of Erzerúm in 1847, and again in the settlement of the Turko-Persian boundary in 1848 (brevet majority and lieutenant-colonelcy and C.B.). Promoted colonel, he was British commissioner with the Turkish army in Anatolia in the Russian War of 1854–56, and, having been made a *ferik* (lieutenant-general) and a pasha, he practically commanded the Turks during the heroic defence of Kars, repulsing several Russian attacks and severely defeating the Russian general Muraviev in the battle of Kars on 29th September 1855. Cold, cholera, famine and hopelessness of succour from without, however, compelled Williams to make an honourable capitulation on the 28th of November following. A baronetcy with pension for life, the K.C.B., the grand cross of the Legion of Honour and of the Turkish Medjidie, the freedom of the City of London with a sword of honour, and the honorary degree of D.C.L. of Oxford University, were the distinctions conferred upon him for his valour. Promoted major-general in November 1855 on his return from captivity in Russia, he held the Woolwich command, and represented the borough of Calne in parliament from 1856 to 1859. He became lieutenant-general and colonel-commandant Royal Artillery in 1864, general in 1868, commanded the forces in Canada from 1859 to 1865, held the governorship of Nova Scotia until 1870, and the governorship of Gibraltar until 1876. He was made G.C.B. in 1871, and Constable of the Tower of London in 1881. He died in London on the 26th of July 1883.

WILLIAMSBURG, a city and the county-seat of James City county, Virginia, U.S.A., on a peninsula between the York and James rivers, 48 m. by rail E.S.E. of Richmond. Pop. (1900) 2044; (1910) 2714. Williamsburg is served by the Chesapeake & Ohio railway. It is the seat of the Williamsburg Female Institute (Presbyterian), and of the College of William and Mary, chartered by the Crown in 1693 and the second oldest college in the United States. Besides the main building and the president's house, the College of William and Mary has a science hall, a gymnasium, a library building, an infirmary and dormitories; in front of the main building is a statue by Richard Hayward of Norborne Berkeley, Lord Botetourt (1717–1770), the most popular royal governor of Virginia. The college offers a classical course and a scientific course, two-thirds of the work in each being prescribed, and in connexion with the normal department is the Matthew Whaley Model and Practice School. In 1909 there were 21 instructors and 228 students in the college, 6 instructors and 140 pupils in the model school, and 20,000 volumes, many of them rare, in the library. Since 1892 the college has published the *William and Mary College Quarterly*, an historical magazine.

Here in December 1776 was established the Phi Beta Kappa Society, the first American college "Greek Letter" Society, now an inter-collegiate honorary fraternity. The college suffered heavy losses during the War of Independence and in the Civil War. In June 1781 Lord Cornwallis made the president's house his headquarters, and the institution was closed for a few months of that year. It was closed in 1861 because of the Civil War, and the main building was occupied in turn by Confederate troops and by Federal troops until some of the latter burned it in 1862. Although reopened in 1869, the college was closed again from 1881 to 1888 because of the low state of its finances. In 1888 it was reorganized under an act of the state legislature which provided for the addition of a normal course and an annual appropriation towards its maintenance. In 1893 Congress passed an act indemnifying it in some measure for its loss during the Civil War; and in 1906 its endowment was increased to more than $150,000 and it was made a state institution governed by a board (appointed by the governor) and receiving $35,000 annually from the state. Peyton Randolph, Edmund Randolph, Thomas Jefferson, James Monroe, John Tyler, Chief Justice John Marshall and General Winfield Scott were graduates of the college.

Bruton Parish Church, completed in 1717 and enlarged in 1752, is the second church of a parish dating from 1674. It contains a Bible given by King Edward VII., a lectern given by President Roosevelt, and some old relics. The church itself has been restored (1905–1907) so far as practicable to its original form and appearance. The Association for the Preservation of Virginia Antiquities has preserved a powder magazine, erected in 1714, from which the last royal governor of Virginia, Lord Dunmore, removed the powder on the day after the encounter at Lexington, Massachusetts, and thus occasioned the first armed uprising of the Virginia patriots. The County and City Court-House was erected in 1769. The Eastern State Hospital for the Insane was opened here in 1773, but its original building was burned in 1885. Among several colonial residences are the George Wythe House, which was the headquarters of Washington during the siege of Yorktown in 1781, and the Peyton Randolph House. The principal industries are the manufacture of men's winter underwear, lumber and ice, and the shipment of lumber and farm and garden produce.

Williamsburg, originally named Middle Plantation from its position midway between the York and James rivers, was founded in 1632. It was immediately walled in and for several years it served as a refuge from Indian attacks. On the 3rd of August 1676 Nathaniel Bacon held here his "rebel" assembly of the leading men of the province, and in January 1677 two of the "rebels" were hanged here. In 1698 Middle Plantation was made the provincial capital; and in 1699 the present name was adopted in honour of William III. Williamsburg was chartered as a city in 1722. In 1736 the *Virginia Gazette*, the oldest newspaper in the South, was established here. In the capitol here Patrick Henry, on the 30th of May 1765, presented his historic resolutions and made his famous speech against the Stamp Act. On the 15th of May 1776, the Virginia Convention in session here passed resolutions urging the Continental Congress to declare for Independence. In 1779 Richmond became the seat of the state government, and in 1832 fire destroyed the last of the old capitol at Williamsburg with the exception of the foundations, which since 1897 have been cared for by the Association for the Preservation of Virginia Antiquities. In the Peninsula campaign of the Civil War the Battle of Williamsburg was fought on the 5th of May 1862 on the south-eastern outskirts of the city. The Confederate army under General J. E. Johnston was retreating from Yorktown toward Richmond and a part of it under General James Longstreet waited here to check the pursuit of the advance portion of the Union army under General E. V. Sumner. A Union division under General J. D. Hooker began a spirited attack at 7.30 A.M., other Union divisions dealt heavy blows, but they failed from lack of co-operation to rout the Confederates and at night the latter continued their retreat. The Union loss in killed, wounded and missing was 2228; the Confederate about 1560.

See L. G. Tyler, *Williamsburg, the Old Colonial Capital* (Richmond, 1907), and his "Williamsburg, the Ancient Capital," in L. P. Powell's *Historic Towns of the Southern States* (New York, 1900).

WILLIAMSON, ALEXANDER WILLIAM (1824–1904), English chemist, was born at Wandsworth, London, on the 1st of May 1824. After working under Leopold Gmelin at Heidelberg, and Liebig at Giessen, he spent three years in Paris studying the higher mathematics under Comte. In 1849 he was appointed professor of practical chemistry at University College, London, and from 1855 until his retirement in 1887 he also held the professorship of chemistry. He had the credit of being the first to explain the process of etherification and to elucidate the formation of ether by the interaction of sulphuric acid and alcohol. Ether and alcohol he regarded as substances analogous to and built up on the same type as water, and he further introduced the water-type as a widely applicable basis for the classification of chemical compounds. The method of stating the rational constitution of bodies by comparison with water he believed capable of wide extension, and that one type, he thought, would suffice for all inorganic compounds, as well as for the best-known organic ones, the formula of water being taken in certain cases as doubled or tripled. So far back as 1850 he also suggested a view which, in a modified form, is of fundamental importance in the modern theory of ionic dissociation, for, in a paper on the theory of the formation of ether, he urged that in an aggregate of molecules of any compound there is an exchange constantly going on between the elements which are contained in it; for instance, in hydrochloric acid each atom of hydrogen does not remain quietly in juxtaposition with the atom of chlorine with which it first united, but changes places with other atoms of hydrogen. A somewhat similar hypothesis was put forward by R. J. E. Clausius about the same time. For his work on etherification Williamson in 1862 received a Royal medal from the Royal Society, of which he became a fellow in 1855, and which he served as foreign secretary from 1873 to 1889. He was twice president of the London Chemical Society, in 1863–1865, and again in 1869–1871. His death occurred on the 6th of May 1904, at Hindhead, Surrey, England.

WILLIAMSON, SIR JOSEPH (1633–1701), English politician, was born at Bridekirk, near Cockermouth, his father, Joseph Williamson, being vicar of this place. He was educated at St Bees, at Westminster school and at Queen's College, Oxford, of which he became a fellow, and in 1660 he entered the service of the secretary of state, Sir Edward Nicholas, retaining his position under the succeeding secretary, Sir Henry Bennet, afterwards earl of Arlington. For his connexion with the foundation of the *London Gazette* in 1665 see NEWSPAPERS. He entered parliament in 1669, and in 1672 was made one of the clerks of the council and a knight. In 1673 and 1674 he represented his country at the congress of Cologne, and in the latter year he became secretary of state, having practically purchased this position from Arlington for £6000, a sum which he required from his successor when he left office in 1679. Just before his removal he had been arrested on a charge of sharing in the popish plots, but he had been at once released by order of Charles II. After a period of comparative inactivity Sir Joseph represented England at the congress of Nijmwegen in 1697, and in 1698 he signed the first treaty for the partition of the Spanish monarchy. He died at Cobham, Kent, on the 3rd of October 1701. Williamson was the second president of the Royal Society, but his main interests, after politics, were rather in antiquarian than in scientific matters. Taking advantage of the many opportunities of making money which his official position gave him, he became very rich. He left £6000 and his library to Queen's College, Oxford; £5000 to found a school at Rochester; and £2000 to Thetford.

A great number of Williamson's letters, despatches, memoranda, &c., are among the English state papers.

WILLIAMSON, WILLIAM CRAWFORD (1816–1895), English naturalist, was born at Scarborough on the 24th of November 1816. His father, John Williamson, after beginning life as a gardener, became a well-known local naturalist, who, in conjunction with William Bean, first explored the rich fossiliferous beds of the Yorkshire coast. He was for many years curator of the Scarborough natural history museum, and the younger Williamson was thus from the first brought up among scientific surroundings and in association with scientific people. William Smith, the "father of English geology," lived for two years in the Williamsons' house. Young Williamson's maternal grandfather was a lapidary, and from him he learnt the art of cutting stones, an accomplishment which he found of great use in later years, when he undertook his work on the structure of fossil plants. Williamson very early made a beginning as an original contributor to science. When little more than sixteen he published a paper on the rare birds of Yorkshire, and a little later (in 1834) presented to the Geological Society of London his first memoir on the Mesozoic fossils of his native district. In the meantime he had assisted Lindley and Hutton in the preparation of their well-known *Fossil Flora of Great Britain*. On entering the medical profession he still found time to carry on his scientific work during his student days, and for three years acted as curator of the Natural History Society's museum at Manchester. After completing his medical studies at University College, London, in 1841, he returned to Manchester to practise his profession, in which he met with much success. When Owens College at Manchester was founded in 1851 he became professor of natural history there, with the duty of teaching geology, zoology and botany. A very necessary division of labour took place as additional professors were appointed, but he retained the chair of botany down to 1892. Shortly afterwards he removed to Clapham, where he died on the 23rd of June 1895. Williamson's teaching work was not confined to his university classes, for he was also a successful popular lecturer, especially for the Gilchrist Trustees. His scientific work, pursued with remarkable energy throughout life, in the midst of official and professional duties, had a wide scope. In geology, his early work on the zones of distribution of Mesozoic fossils (begun in 1834), and on the part played by microscopic organisms in the formation of marine deposits (1845), was of fundamental importance. In zoology, his investigations of the development of the teeth and bones of fishes (1842–1851), and on recent Foraminifera, a group on which he wrote a monograph for the Ray Society in 1857, were no less valuable. In botany, in addition to a remarkable memoir on the minute structure of *Volvox* (1852), his work on the structure of fossil plants established British palaeobotany on a scientific basis; on the ground of these researches Williamson may rank with A. T. Brongniart as one of the founders of this branch of science. His contributions to fossil botany began in the earliest days of his career, and he returned to the subject from time to time during the period of his geological and zoological activity. His investigation of the Mesozoic cycadioid fossil *Zamia* (now *Williamsonia*) *gigas* was the chief palaeobotanical work of this intermediate period. His long course of researches on the structure of Carboniferous plants belongs mainly to the latter part of his life, and his results are chiefly, though not wholly, embodied in a series of nineteen memoirs, ranging in date from 1871 to 1893, in the *Philosophical Transactions*. In this series, and in some works (notably the monograph on *Stigmaria ficoides*, Palaeontographical Society, 1886), published elsewhere, Williamson elucidated the structure of every group of Palaeozoic vascular plants. Among the chief results of his researches may be mentioned the discovery of plants intermediate between ferns and cycads, the description of the true structure of the fructification in the extinct cryptogamic family Sphenophylleae, and the demonstration of the cryptogamic nature of the dominant Palaeozoic orders Calamarieae, Lepidodendreae and Sigillarieae, plants which on account of the growth of their stems in thickness, after the manner of gymnospermous trees, were regarded as phanerogams by Brongniart and his followers. After a long controversy the truth of Williamson's views has been fully established, and it is now known that the mode of growth, characteristic in present times, of dicotyledons and gymnosperms prevailed in Palaeozoic ages in every family of vascular cryptogams. Thus, as Count Solms-Laubach has pointed out, palaeobotany for the first time spoke the decisive word in an important question of general botany. Williamson's work in fossil botany was scarcely appreciated at the time as it deserved, for its great merits were somewhat obscured by the author's want of familiarity with the modern technicalities of the science. Since, however, the subject has been seriously taken up by botanists of a newer school, the soundness of the foundation he laid has become fully recognized. It may be added that he was a skilled draughtsman, illustrating all his works by his own drawings, and practising water-colour painting as his favourite recreation.

A full account of Williamson's career will be found in his autobiography, entitled *Reminiscences of a Yorkshire Naturalist*, edited by his wife (London, 1896). Among obituary notices may be mentioned that by Count Solms-Laubach, *Nature* (5th September 1895), and one by D. H. Scott in *Proc. R.S.* vol. lx. (1897).
(D. H. S.)

WILLIAMSPORT, a city and the county-seat of Lycoming county, Pennsylvania, U.S.A., on the north bank of the west branch of the Susquehanna river, about 70 m. N. by W. of Harrisburg. Pop. (1890) 27,132; (1900) 28,757, of whom 1144 were negroes and 2228 were foreign-born, including 1089 Germans; (1910 census), 31,860. Area, about 7 sq. m. Williamsport is served by the New York Central & Hudson River, the Pennsylvania, the Susquehanna & New York, and the Philadelphia & Reading railways, and by electric lines connecting with the neighbouring towns of Montoursville (pop. in 1900, 1665), South Williamsport (pop. in 1900, 3328), on the S. bank of the river, and Du Boistown (pop. in 1900, 650). The city has an attractive site, on a high plain, nearly surrounded by hills. It has five parks, Brandon (44 acres) within the city limits, and Vallamont, Starr Island, Sylvan Dell and Nippono in its suburbs. Williamsport is the seat of Williamsport Dickinson Seminary (Methodist Episcopal, co-educational, 1848), a secondary school. Among the principal buildings are the county court house, the city hall, the United States Government building, the Scottish Rite Cathedral, the Masonic Temple, a Y.M.C.A. building, and the James V. Brown Memorial Library (1907). In the city are a Boys' Industrial Home (1898), a Girls' Training School (1895), a Florence Crittenton Home (1895), a Home for Aged Coloured Women (1898), a Home for the Friendless (1872), and Williamsport Hospital (1873). There are practically no tenement houses. The value of factory products in 1905 was $11,738,473, 20·7% more than in 1900. Williamsport has the largest lumber market in Pennsylvania; lumber was for forty years the most important of its manufactures, and Williamsport was styled the "sawdust city." The decreasing importance of the industry is due to the virtual exhaustion of standing timber in the neighbourhood. Lumber and timber products were valued at $1,310,368 in 1905, and lumber and planing mill products at $579,667. Among other manufactures are silk and silk goods, valued at $1,191,273 in 1905; foundry and machine shop products, $1,164,737; rubber and leather boots and shoes, furniture, &c. The city has a large trade with the surrounding country. The water supply is derived from mountain streams S. of the city. Lycoming county was erected in 1795, in which year Williamsport was founded and became the county-seat, after a bitter contest with Jaysburg, which was then a village of only some half a dozen houses and which subsequently ceased to exist. Williamsport was incorporated as a borough in 1806, and was chartered as a city in 1866.

WILLIAMSTOWN, a town of Bourke county, Victoria, Australia, 9 m. by rail S.W. of Melbourne. Pop. (1901) 14,083. Shipping is the chief business of the place, there being commodious piers, breakwater, also provision for the repair of vessels, patent slips and shipbuilding yards. Several quarries of superior basalt are worked near the town, and brown coal of good quality has also been found. The flourishing industries include woollen-milling, bottle-making, fodder-compressing, meat-freezing and cycle-making.

WILLIAMSTOWN, a township of Berkshire county, Massachusetts, U.S.A., on the Hoosick and Green rivers, in the N.W. corner of the state, and about 20 m. N. of Pittsfield. Pop. (1890) 4221; (1900) 5013, of whom 929 were foreign-born and 138 were negroes; (1910 census), 3708. Williamstown is served by the Boston & Maine railway and by an interurban electric line to North Adams. It covers an area of about 49 sq. m. and contains five villages. Williamstown, the principal village, is a pleasant residential centre on the Green river; it is surrounded by beautiful scenery and its streets are shaded by some fine old trees. Mission Park (10 acres) here is adorned by native and foreign shrubs and by maples, elms, pines and arbor vitae, and "Haystack Monument" in this park marks the place where Samuel John Mills (1783–1818), in 1806, held the prayer meeting which was the forerunner of the American foreign missionary movement. Williamstown village is best known as the seat of Williams College, chartered in 1793 as a successor to a "free school" in Williamstown (chartered in 1785 and endowed by a bequest of Colonel Ephraim Williams). Besides recitation and residence halls, it has the Lawrence Hall Library (1846), containing (1910) 68,000 volumes, the Thompson Memorial Chapel (1904), the Lasell Gymnasium (1886), an infirmary (1895), the Hopkins Observatory (1837) and the Field Memorial Observatory (1882), the Thompson Chemical Laboratory (1892), the Thompson Biological Laboratory (1893) and the Thompson Physical Laboratory (1893). In 1910 the college had 59 instructors and 537 students. The fourth president of the college was Mark Hopkins (*q.v.*), and one of its most distinguished alumni was James A. Garfield, president of the United States, whose son, Harry Augustus Garfield (b. 1863), became president of the college in 1908.

The principal manufactures of the township are cotton and woollen goods (especially corduroy), and market gardening is an important industry. The limits of the township, originally called West Hoosac, were determined by a committee of the General Court of Massachusetts in 1749, and two or three years later the village was laid out. Two of the lots were immediately purchased by Captain Ephraim Williams (1715–1755), who was at the time commander of Fort Massachusetts in the vicinity; several other lots were bought by soldiers under him; and in 1753 the proprietors organized a township government. Williams was killed in the battle of Lake George on the 8th of September 1755, but while in camp in Albany, New York, a few days before the battle, he drew a will containing a small bequest for a free school at West Hoosac on condition that the township when incorporated should be called Williamstown. The township was incorporated with that name in 1765.

See A. L. Perry, *Origins in Williamstown* (New York, 1894; 3rd ed. 1900); and *Williamstown and Williams College* (Norwood, Mass., 1899).

WILLIAMS-WYNN, SIR WATKIN, Bart. (1692–1749), Welsh politician, was the eldest son and heir of Sir William Williams, Bart., of Llanforda near Oswestry; his mother, Jane Thelwall, was a descendant of the antiquary, Sir John Wynn of Gwydir, Carnarvonshire. Educated at Jesus College, Oxford, Williams succeeded to Wynnstay near Ruabon and the estates of the Wynns on the death of a later Sir John Wynn in 1719, and took the name of Williams-Wynn. He was member of parliament for Denbighshire from 1716 to 1741, and was prominent among the opponents of Sir Robert Walpole; as a leading and influential Jacobite he was in communication with the supporters of Prince Charles Edward before the rising of 1745, but his definite offer of help did not reach the prince until the retreat to Scotland had begun. He died on the 26th of September 1749. His first wife, Ann Vaughan (d. 1748), was the heiress of extensive estates in Montgomeryshire which still belong to the family. His son and heir, Sir Watkin Williams-Wynn, Bart. (1749–1789), was the father of another Sir Watkin (1772–1842), the 5th baronet. Two other sons attained some measure of distinction: Charles (1775–1850), a prominent Tory politician, and Sir Henry (1783–1856), a diplomatist. A daughter, Frances Williams-Wynn (d. 1857), was the authoress of *Diaries of a Lady of Quality, 1797–1844,* which were edited with notes by Abraham Hayward in 1864.

See Askew Roberts, *Wynnstay and the Wynns* (Oswestry, 1876).

WILLIBRORD (or Wilbrord), **ST** (d. 738), English missionary, "the apostle of the Frisians," was born about 657. His father, Wilgils, an Angle or, as Alcuin styles him, a Saxon, of Northumbria, withdrew from the world and constructed for himself a little oratory dedicated to St Andrew. The king and nobles of the district endowed him with estates till he was at last able to build a church, over which Alcuin afterwards ruled. Willibrord, almost as soon as he was weaned, was sent to be brought up at Ripon, where he must doubtless have come under the influence of Wilfrid. About the age of twenty the desire of increasing his stock of knowledge (*c.* 679) drew him to Ireland, which had so long been the headquarters of learning in western Europe. Here he stayed for twelve years, enjoying the society of Ecgberht and Wihtberht, from the former of whom he received his commission to missionary work among the North-German tribes. In his thirty-third year (*c.* 690) he started with twelve companions for the mouth of the Rhine. These districts were then occupied by the Frisians under their king, Rathbod, who gave allegiance to Pippin of Herstal. Pippin befriended him and sent him to Rome, where he was consecrated archbishop (with the name Clemens) by Pope Sergius on St Cecilia's Day 696.[1] Bede says that when he returned to Frisia his see was fixed in Ultrajectum (Utrecht). He spent several years in founding churches and evangelizing, till his success tempted him to pass into other districts. From Denmark he carried away thirty boys to be brought up among the Franks. On his return he was wrecked on the holy island of Fosite (Heligoland), where his disregard of the pagan superstition nearly cost him his life. When Pippin died, Willibrord found a supporter in his son Charles Martel. He was assisted for three years in his missionary work by St Boniface (719–722), who, however, was not willing to become his successor.

He was still living when Bede wrote in 731. A passage in one of Boniface's letters to Stephen III. speaks of his preaching to the Frisians for fifty years, apparently reckoning from the time of his consecration. This would fix the date of his death in 738; and, as Alcuin tells us he was eighty-one years old when he died, it may be inferred that he was born in 657—a theory on which all the dates given above are based, though it must be added that they are substantially confirmed by the incidental notices of Bede. The day of his death was the 6th of November, and his body was buried in the monastery of Echternach, near Trier, which he had himself founded. Even in Alcuin's time miracles were reported to be still wrought at his tomb.

The chief authorities for Willibrord's life are Alcuin's *Vita Willibrordi*, both in prose and in verse, and Bede's *Hist. Eccl.* v. cc. 9-11. See also Eddius's *Vita Wilfridii*, and J. Mabillon, *Annales ordinis sancti Benedicti*, lib. xviii.

WILLIMANTIC, a city of Windham county, Connecticut, U.S.A., in the township of Windham, at the junction of the Willimantic and Natchaug rivers to form the Shetucket, in the E. part of the state, about 16 m. N.W. of Norwich. Pop. (1890) 8648; (1900) 8937, of whom 2491 were foreign-born; (1910 census) 11,230. It is served by the New York, New Haven & Hartford and the Central Vermont railways, and by electric lines to Baltic, Norwich and New London, and to South Coventry. It is the seat of a State Normal Training School, and has a public library and Dunham Hall Library (1878). The Willimantic river provides good water-power, and there are various manufactures. The total value of the factory product in 1905 was $4,902,447. The township of Windham was incorporated in 1692. Willimantic was settled in 1822, incorporated as a borough in 1833, and chartered as a city in 1893. The name is from an Indian word meaning "good look-out" or "good cedar swamps."

WILLIS, NATHANIEL PARKER (1806–1867), American author, was descended from George Willis, described as a "Puritan of considerable distinction," who arrived in New England about 1630 and settled in Cambridge, Massachusetts. Nathaniel Parker was the eldest son and second child of Nathaniel Willis, a newspaper proprietor in Boston, and was born in Portland, Maine, on the 20th of January 1806. After attending Boston grammar school and the academy at Andover, he entered Yale College in October 1823. Although he did not specially distinguish himself as a student, university life had considerable influence in the development of his character, and furnished him with much of his literary material. Immediately after leaving Yale he published in 1827 a volume of poetical *Sketches*, which attracted some attention, although the critics found in his verses more to blame than to praise. It was followed by *Fugitive Poetry* (1829) and another volume of verse (1831). He also contributed frequently to magazines and periodicals. In 1829 he started the *American Monthly Magazine*, which was continued from April of that year to August 1831, but failed to achieve success. On its discontinuance he went to Europe as foreign editor and correspondent of the *New York Mirror*. To this journal he contributed a series of letters, which, under the title *Pencillings by the Way*, were published at London in 1835 (3 vols.; Philadelphia, 1836, 2 vols.; and first complete edition, New York, 1841). Their vivid and rapid sketches of scenes and modes of life in the old world at once gained them a wide popularity; but he was censured by some critics for indiscretion in reporting conversations in private gatherings. Notwithstanding, however, the small affectations and fopperies which were his besetting weaknesses as a man as well as an author, the grace, ease and artistic finish of his style won general recognition. His "Slingsby Papers," a series of magazine articles descriptive of American life and adventure, republished in 1836 under the title *Inklings of Adventure*, were as successful in England as were his *Pencillings by the Way* in America. He also published while in England *Melanie and other Poems* (London, 1835; New York, 1837), which was introduced by a preface by Barry Cornwall (Procter). After his marriage to Mary Stace, daughter of General William Stace of Woolwich, he returned to America, and settled at a small estate on Oswego Creek, just above its junction with the Susquehanna. Here he lived off and on from 1837 to 1842, and wrote *Letters from under a Bridge* (London, 1840; first complete edition, New York, 1844), the most charming of all his works. During a short visit to England in 1839–1840 he published *Two Ways of Dying for a Husband*. Returning to New York, he established, along with George P. Morris, a newspaper entitled the *Evening Mirror*. On the death of his wife in 1845 he again visited England. Returning to America in the spring of 1846, he married Cornelia Grinnell, and established the *National Press*, afterwards named the *Home Journal*. In 1845 he published *Dashes at Life with a Free Pencil*, in 1846 a collected edition of his *Prose and Poetical Works*, in 1849 *Rural Letters*, and in 1850 *Life Here and There*. In that year he settled at Idlewild on the Hudson river, and on account of failing health spent the remainder of his life chiefly in retirement. Among his later works were *Hurry-Graphs* (1851), *Outdoors at Idlewild* (1854), *Ragbag* (1855), *Paul Fane* (1856), and the *Convalescent* (1859), but he had survived his great reputation. He died on the 20th of January 1867, and was buried in Mount Auburn, Boston.

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[1] He had been consecrated bishop, also by Sergius, on a previous visit in 692.

The best edition of his verse writings is *The Poems, Sacred, Passionate and Humorous, of N. P. Willis* (New York, 1868); 13 volumes of his prose, *Complete Prose Works*, were published at New York (1849–1859), and a *Selection from his Prose Writings* was edited by Henry A. Beers (New York, 1885). His *Life*, by Henry A. Beers, appeared in the series of "American Men of Letters" the same year. See also E. P. Whipple, *Essays and Reviews* (vol. i., 1848); M. A. de Wolfe Howe, *American Bookmen* (New York, 1898).

WILLIS, THOMAS (1621–1675), English anatomist and physician, was born at Great Bedwin, Wiltshire, on the 27th of January 1621. He studied at Christ Church, Oxford; and when that city was garrisoned for the king he bore arms for the Royalists. He took the degree of bachelor of medicine in 1646, and applied himself to the practice of his profession. In 1660, shortly after the Restoration, he became Sedleian professor of natural philosophy in place of Dr Joshua Cross, who was ejected, and the same year he took the degree of doctor of physic. In 1664 he discovered the medicinal spring at Astrop, near Brackley in Northamptonshire. He was one of the first members of the Royal Society, and was elected an honorary fellow of the Royal College of Physicians in 1664. In 1666, after the fire of London, he took a house in St Martin's Lane, and there rapidly acquired an extensive practice, his reputation and skill marking him out as one of the first physicians of his time. He died in St Martin's Lane on the 11th of November 1675 and was buried in Westminster Abbey.

Willis was admired for his piety and charity, for his deep insight into natural and experimental philosophy, anatomy and chemistry, and for the elegance and purity of his Latin style. Among his writings were *Cerebri anatome nervorumque descriptio et usus* (1664), in which he described what is still known, in the anatomy of the brain, as the circle of Willis, and *Pharmaceutice rationalis* (1674), in which he characterized diabetes mellitus. He wrote in English *A Plain and Easy Method for Preserving those that are Well from the Infection of the Plague, and for Curing such as are Infected*. His Latin works were printed in two vols. 4to at Geneva in 1676, and at Amsterdam in 1682. Browne Willis (1682–1760), the antiquarian, author of three volumes of *Surveys* of the cathedrals of England, was his grandson.

See Munk, *Roll of the Royal College of Physicians, London* (2nd ed., vol. i., London, 1878).

WILLMORE, JAMES TIBBITTS (1800–1863), English line engraver, was born at Bristnall's End, Handsworth, near Birmingham, on the 15th of September 1800. At the age of fourteen he was apprenticed to William Radcliffe, a Birmingham engraver, and in 1823 he went to London and was employed for three years by Charles Heath. He was afterwards engaged upon the plates of Brockedon's *Passes of the Alps* and Turner's *England and Wales*. He engraved after Chalon, Leitch, Stanfield, Landseer, Eastlake, Creswick and Ansdell, and especially after Turner, from whose "Alnwick Castle by Moonlight," "The Old Téméraire," "Mercury and Argus," "Ancient Rome," and the subjects of the rivers of France, he executed many admirable plates. He was elected an associate engraver of the Royal Academy in 1843. He died on the 12th of March 1863.

WILLOBIE (or Willoughby), **HENRY** (1575?–1596?), the supposed author of a poem called *Willobie his Avisa*, which derives interest from its possible connexion with Shakespeare's personal history. Henry Willoughby was the second son of a Wiltshire gentleman of the same name, and matriculated from St John's College, Oxford, in December 1591, at the age of sixteen. He is probably identical with the Henry Willoughby who graduated B.A. from Exeter College early in 1595, and he died before the 30th of June 1596, when to a new edition of the poem Hadrian Dorrell added an "Apologie" in defence of his friend the author "now of late gone to God," and another poem in praise of chastity written by Henry's brother, Thomas Willoughby. *Willobie his Avisa* was licensed for the press on the 3rd of September 1594, four months after the entry of Shakespeare's *Rape of Lucrece*, and printed by John Windet. It is preceded by two commendatory poems, the second of which, signed "Contraria Contrariis; Vigilantius; Dormitanus," contains the earliest known printed allusion to Shakespeare by name:—

> "Yet Tarquyne pluckt his glistering grape,
> And Shake-speare paints poore Lucrece rape."

In the poem itself, Avisa, whose name is explained in Dorrell's "Epistle to the Reader" as *Amans Uxor Inviolata Semper Amanda*, takes up the parable alternately with her suitors, one of whom is introduced to the reader in a prose interlude signed by the author H. W., as Henrico Willobego Italo Hispalensis. This passage contains a reference which may fairly be applied to the sonnets of Shakespeare. It runs:

> "H. W. being sodenly infected with the contagion of a fantasticall fit, at the first sight of A, . . . bewrayeth the secresy of his disease unto his familiar frend W. S. who not long before had tryed the curtesy of the like passion, and was now newly recouered . . . he determined to see whether it would sort to a happier end for this new actor, then it did for the old player."

Then follows a dialogue between H. W. and W. S., in which W. S., "the old player," a phrase susceptible of a double sense, gives somewhat commonplace advice to the disconsolate wooer.

Dorrell alleges that he found the MS. of *Willobie his Avisa* among his friend's papers left in his charge when Willoughby departed from Oxford on her majesty's service. There is no trace of any Hadrian Dorrell, and the name is probably fictitious; there is, indeed, good reason to think that the pseudonym, if such it is, covers the personality of the real author of the work. *Willobie his Avisa* proved extremely popular, and passed through numerous editions, and Peter Colse produced in 1596 an imitation named *Penelope's Complaint*.

See *Shakspere Allusion-Books*, part i., ed. C. M. Ingleby (New Shakspere Society, 1874); A. B. Grosart's "Introduction" to his reprint of *Willobie his Avisa* (1880)

WILLOCK (or Willocks), **JOHN** (*c.* 1515–1585), Scottish reformer, was a native of Ayrshire and was educated at the university of Glasgow. After being a monk for a short time he embraced the reformed religion and went to London, where, about 1542, he became chaplain to Henry Grey, afterwards duke of Suffolk, the father of Lady Jane Grey. On the accession of Mary to the English throne in 1553 he went to Emden in Friesland, where he practised as a physician, varying this profession with visits to Scotland. He was associated with the leading Scottish reformers in their opposition to the queen regent, Mary of Lorraine, and the Roman Catholic religion, and in 1558 he returned definitely to his native land. Willock now began to preach and in 1559 was outlawed. Popular sympathy, however, rendered this sentence fruitless, and in the same year, being Knox's deputy as minister of St Giles' cathedral, Edinburgh, he frustrated the efforts of the regent to restore the Roman Catholic religion, and administered the communion for the first time in accordance with the ideas of the reformers. He was one of the four ministers chosen by the convention of October 1559 to seats on the council of government, and was one of those appointed to compile the first book of discipline. About 1562 he became rector of Loughborough in Leicestershire, but he retained his connexion with the Scottish church and was moderator of the general assembly in 1562, and again in 1564, in 1565 and in 1568. He died at Loughborough on the 4th of December 1585.

WILLOUGHBY, the name of an English family long settled in Nottinghamshire, and now represented by Baron Middleton. Having exchanged his name of Bugge for that of Willoughby, Richard de Willoughby became a judge during the reign of Edward II. and purchased the manors of Wollaton in Nottinghamshire and of Risley in Derbyshire. His son, Richard de Willoughby (d. 1362), was justice of the common pleas under Edward III. Richard's descendant, Dorothy, who became the heiress of the family estates, married Robert Willoughby of Bore Place, Kent, and their descendant, Sir Thomas Willoughby, Bart. (*c.* 1670–1729), of Wollaton, was created Baron Middleton in 1712. In 1877 his descendant, Digby Wentworth Bayard Willoughby (b. 1844), became the 9th baron. This title must be distinguished from that of Viscount Midleton, borne by the Brodrick family.

Sir Hugh Willoughby, the seaman, was a member of this family. He was a son of Sir Henry Willoughby (d. 1528), and a grandson of Sir Hugh Willoughby of Wollaton. His early services were as a soldier on the Scottish borders, but he soon turned his thoughts to the sea, and was appointed captain of a fleet of three ships which set out in 1553 with the object of discovering a north-eastern passage to Cathay and India. Two of the three ships reached the coast of Lapland, where it was proposed to winter, and here Willoughby and his companions died of cold and starvation soon after January 1554. A few years later their remains were found, and with them Willoughby's *Journal*, which is printed in vol. i. of R. Hakluyt's *Principal Navigations*.

Another famous member of this family was Sir Nesbit Josiah Willoughby (1777–1849), who entered the British navy in 1790 and was present at the battle of Copenhagen. In 1800, however, he was dismissed from the service by the sentence of a court-martial for his insolent conduct towards a superior officer, a previous offence of this kind having been punished less severely. In 1803, on the renewal of war, as a volunteer he joined an English squadron bound for the West Indies, and was soon admitted again to the navy; his courage and promptness at Cape Français were responsible for saving 900 lives, and he distinguished himself on other occasions, being soon restored to his former rank in the service. After further services in the West Indies, during which he displayed marked gallantry on several occasions, Willoughby was tried by court-martial at Cape Town in 1808 on charges of cruelty; he seems to have taken a great delight in inflicting punishment, but he was acquitted with the advice to be more moderate in future in his language Again in the West Indies, where he commanded the Néréide frigate, he was responsible for the heroic defence made by his ship against a much stronger French force at Port Louis, Mauritius, in August 1810, when 222 out of his crew of 281 men were disabled before he surrendered. Undeterred by the severe wounds which he had received, and seeing no prospect of active service with the British fleet, Willoughby offered his services in 1812 to the Russian government, and while serving with the Russian army he was captured by the French. He was taken to France, whence he escaped to England. Having seen a little more service in the navy, he was knighted in 1827, was made a rear-admiral in 1847, and died unmarried in London on the 19th of May 1849.

WILLOW (*Salix*), a very well-marked genus of plants constituting, with the poplar (*Populus*), the order Salicaceae. Willows are trees or shrubs, varying in stature from a few inches, like the small British *S. herbacea* and arctic species generally, to 100 ft., and occurring most abundantly in cold or temperate climates in both hemispheres, and generally in moist situations; a few species occur in the tropical and sub-tropical portions of the three great continents. Their leaves are deciduous, alternate, simple, and generally much longer than broad, whence the term willow-leaved has become proverbial. At their base they are provided with stipules, which are also modified to form the scales investing the winter buds. The flowers are borne in catkins (fig. 1), which are on one tree male (staminate) only, on another female (pistillate). Each male flower consists of a small scale or bract, in the axil of which are usually two, sometimes three, rarely five stamens, and still more rarely a larger number. In addition there is a small glandular disk, which assumes different shapes in different species. The female flowers are equally simple, consisting of a bract, from whose axil arises usually a very short stalk, surmounted by two carpels adherent one to the other for their whole length, except that the upper ends of the styles are separated into two stigmas. When ripe the two carpels separate in the form of two valves and liberate a large number of seeds, each provided at the base with a tuft of silky hairs, and containing a straight embryo without any investing albumen. The flowers appear generally before the leaves and are thus rendered more conspicuous, while passage of pollen by the wind is facilitated. Fertilization is effected by insects, especially by bees, which are directed in their search by the colour and fragrance of the

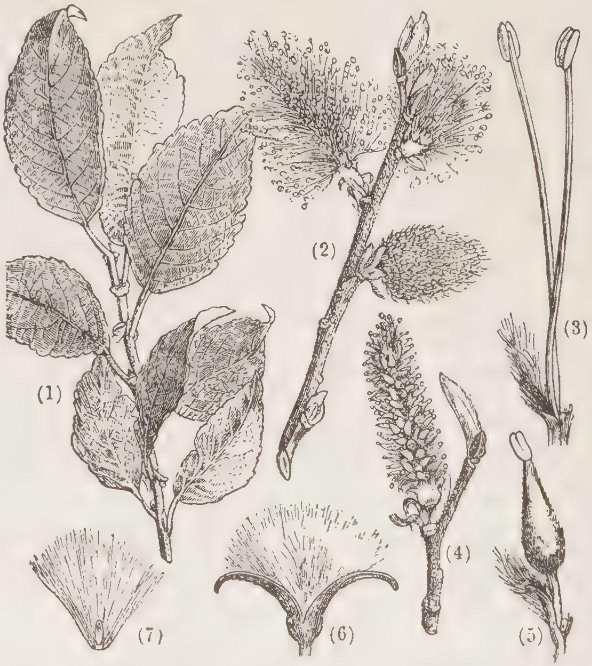

Fig. 1.—*Salix caprea*—Common Sallow or Goat Willow.

1, Leaf shoot.
2, Branchlet bearing male catkins.
3, Male flower.
4, Female catkin.
5, Female flower.
6, Capsule, opened.
7, Seed.

1, 2, 4 reduced; 3, 5-7 enlarged.

flowers; but some pollen must also be transported by the wind to the female flowers, especially in arctic species which, in spite of the poverty of insect life, set abundant fruit. The tuft of hairs at the base facilitates rapid dispersion of the seed, early germination of which is rendered desirable owing to its tenuity. Although the limitations of the genus are well marked, and its recognition in consequence easy, it is otherwise with regard to the species. The greatest difference of opinion exists among botanists as to their number and the bounds to be assigned to each; and the cross-fertilization that takes place between the species intensifies the difficulty. Andersson, a Swede, spent nearly a quarter of a century in their investigation, and ultimately published a monograph which is the standard authority on the subject. He admits about a hundred species. Professor C. S. Sargent (*Silva of North America*) suggests 160 to 170 as the number of distinguishable species. Some botanists have enumerated 80 species from Great Britain alone, while others count only 12 or 15. Dr Buchanan White, who made a special study of the British willows, grouped them under 17 species with numerous varieties and hybrids. To illustrate the great perplexity surrounding the subject, we may mention that to one species, *S. nigricans*, one hundred and twenty synonyms have been attached. Some of these are doubtless such as no botanist, with adequate material for forming an opinion, would accept; but, after making the necessary deductions for actual mistakes and misstatements, there still remains a large number upon which legitimate differences of opinion prevail. Andersson says that he has rarely seen two specimens of this species which were alike in the collective characters offered by the stature, foliage and catkins. No better example could be found of the almost limitless variation in so-called species.

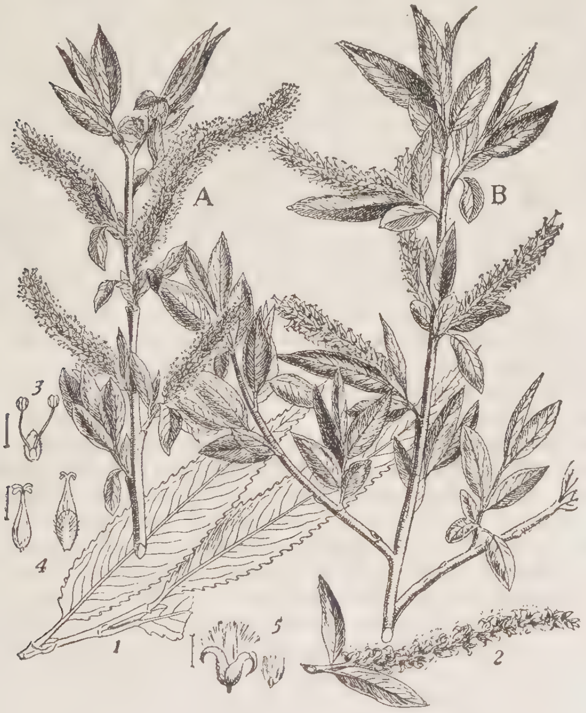

FIG. 2.—*Salix fragilis*—Crack Willow.

A, Flowering shoot from male plant.
B, Flowering shoot from female plant.
1, Foliage.
2, Catkin of fruits.
3, Male flower.
4, Female flower with and without bract.
5, Single fruit from which the hairy seeds are escaping; one seed shown separately.
A, B, 1, 2, about half nat. size, 3-5 enlarged.

Few genera have greater claims to notice from an economic point of view. As timber trees many of the species are valuable from their rapidity of growth and for the production of light durable wood, serviceable for many purposes. Among the best trees of this kind are *S. fragilis*, the crack willow (fig. 2), especially the variety known as *S. fragilis*, var. *Russelliana*, and *S. alba*, the white or Huntingdon willow. These trees are usually found growing by rivers' banks or in other moist situations, and are generally pollarded for the purpose of securing a crop of straight poles. This plan is, however, objectionable, as inducing decay in the centre of the trunk. Where poles are required, it is better to treat the trees as coppice and to cut the trunk level with the soil. The wood of *S. fragilis* is used for cricket-bats; there is a great difference in the value for this purpose of timber from different soils; and wood of the female tree is said to be preferable to that of the male. *S. caprea* (fig. 1), a hedgerow tree, generally grows in drier situations. It is a useful timber tree, and its wood, like that of *S. alba*, is prized in the manufacture of charcoal. Its catkins are collected in England in celebration of Palm Sunday, the bright-coloured flowers being available in early spring when other decorations of the kind are scarce. Certain sorts of willow are largely used for basket-making and wicker-work. The species employed for this purpose are mostly of shrubby habit, and are known under the collective name of osiers (see BASKET, and OSIER). The best for planting is the bitter osier, *S. purpurea*; planted on rich, well-drained soil, subject to occasional immersion, this willow may be grown profitably for basket-work. It is also well adapted for forming wind-breaks or screens, or for holding the banks of streams and preventing the removal of the soil by the current. *S. viminalis* is one of the best of the green osiers, suitable for hoops and valuable for retaining the soil on sloping embankments. *S. vitellina* yields the yellow osiers. *S. acuminata* and other species do well by the seaside, and are serviceable as wind-screens, nurse-trees and hedges. *S. daphnoides*, *S. repens* and other dwarf kinds are useful for binding heathy or sandy soil. In addition to their use for timber or basket-making, willows contain a large quantity of tannin in their bark. A valuable medicinal glucoside named salicin (*q.v.*) is also extracted from the bark. The wood, especially of *S. alba*, is used for paper pulp. As ornamental trees some willows also take a high rank. The white willow is a great favourite, while the drooping habit of the weeping willow renders it very attractive. Though named *S. babylonica*, it is really a native of China, from which it has been widely spread by man; the willow of the Euphrates (Ps. cxxxvii.) is in all probability *Populus euphratica*. *S. babylonica* is sometimes spoken of as Pope's willow, having been cultivated by that poet, or as Napoleon's willow, because his tomb at St Helena is overshadowed by a tree of this species, from which many offsets exist or are reputed to exist in modern gardens. *S. regalis* has very white, silvery leaves. *S. rosmarinifolia* is remarkable for its very narrow leaves—purplish above, silvery beneath.

The larvae of several nocturnal Lepidoptera feed upon the leaves of the willows, and the trunk of the sallow is often injured by the perforations of the lunar hornet sphinx (*Trochilium crabroniforme*).

WILLOW-HERB, in botany, the popular name for the species of *Epilobium*, a genus of often tall herbaceous plants, several of which are natives of Britain. The slender stems bear narrow leaves and pink or purple flowers, which in the rose-bay (*E. angustifolium*), found by moist river-sides and in copses, are 1 in. in diameter and form showy spikes. *E. hirsutum*, found by sides of ditches and rivers, a tall plant with many large rose-purple flowers, is known popularly as codlins-and-cream.

WILLS, WILLIAM GORMAN (1828–1891), Irish dramatist, was born at Kilmurry, Ireland, on the 28th of January 1828, the son of James Wills (1790–1868), author of *Lives of Illustrious and Distinguished Irishmen* (1839–1847). The son was educated at Waterford Grammar School and Trinity College, Dublin. After several years of journalistic and literary work in Dublin, he settled in London, where he wrote stories for the magazines. In 1868 he determined that he could make a better living at portrait-painting, for which, though his art education had been meagre, he had always had talent. He soon made a fair income, though in the long run his excessive Bohemianism, coupled with persistent absent-mindedness, lost him many sitters. Meanwhile he had begun to write for the stage. His first original work was the *Man o'Airlie*, produced at the Princess's theatre, London, in 1867. Early in 1872 he was engaged by Colonel Bateman as "dramatist to the Lyceum" at an annual salary. Under the terms of his agreement he wrote *Medea in Corinth*, *Charles I.* and *Eugene Aram*, all of which were produced at the Lyceum in 1872–1873. With *Charles I.*, in which Mr (afterwards Sir Henry) Irving confirmed the reputation he had earned by his performance in *The Bells*, Wills made a popular success, which he repeated in *Olivia* (adapted from Goldsmith's *Vicar of Wakefield*) in 1873. From this date onwards Wills wrote continuously, and till 1887 his name was practically never absent from the bill of some London theatre. His work never, however, quite came up to the expectations which were based on his genuine ability, and much of it is of an inferior quality. In *Claudian* (Princess's Theatre, 1883) and *Faust* (Lyceum Theatre, 1885) he merely supplied the text to a variety of dramatic situations. In 1887 his mother, whom he had supported for many years, died, and after her death he seemed to have less incentive for work. Wills was a painter by choice, and never put his whole heart into his dramatic work. He had some skill in ballad-writing, shown in the well-known "I'll sing thee songs of Araby." He died on the 13th of December 1891.

WILLUGHBY, FRANCIS (1635–1672), English ornithologist and ichthyologist, son of Sir Francis Willughby, was born at Middleton, Warwickshire, in 1635. He is memorable as the pupil, friend and patron as well as the active and original co-worker of John Ray (*q.v.*), and hence to be reckoned as one of the most important precursors of Linnaeus. His connexion with Ray dated from his studies at Trinity College, Cambridge (1653–1659); and, after concluding his academic life by a brief sojourn at Oxford, and acquiring considerable experience of travel in England, he made an extensive Continental tour in his company. The specimens, figures and notes thus accumulated were in great part elaborated on his return into his *Ornithologia*, which, however, he did not live to publish, having injured a naturally delicate constitution by alternate exposure and over-study. This work was published in 1676, and translated by Ray as the *Ornithology of Fr. Willughby* (London, 1678, fol.); the same friend published his *Historia Piscium* (1686, fol.). Willughby died at Middleton Hall on the 3rd of July 1672.

In Ray's preface to the former work he gives Willughby much of the credit usually assigned to himself, both as critic and systematist. Thus, while founding on Gesner and Aldrovandus, he omitted their irrelevancies, being careful to exclude "hieroglyphics, emblems, morals, fables, presages or ought else pertaining to divinity, ethics, grammar, or any sort of humane learning, and present him [the reader] with what properly belongs only to natural history." Again, he not only devised artificial keys to his species and genera, but, "that he might clear up all these obscurities [of former writers] and render the knowledge and distinction of species facile to all that should come after, he bent his endeavours mainly to find out certain characteristic notes of each kind," while finally, in apologizing for his engravings, he yet not unjustly claims that "they are best and truest of any hitherto graven in brass." (See also ORNITHOLOGY.)

WILMINGTON, a city, a port of entry and the county-seat of New Castle county, Delaware, U.S.A., in the N. part of the state, near the Delaware river, at the mouth of Brandywine and Christiana creeks. Pop. (1890) 61,431; (1900) 76,508, of whom 10,478 were foreign-born (3820 Irish, 1762 German, 998 English) and 9736 were negroes; (1910 census) 87,411. Area, 10·18 sq. m. It is served by the Baltimore & Ohio, the Philadelphia, Baltimore & Washington (Pennsylvania) and the Philadelphia & Reading railways, and by several steamship lines. Wilmington Harbor includes Christiana Creek for 4 m. above its mouth and the navigable part (2 m.) of the Brandywine, which enters the Christiana about 1¾ m. above its mouth. By 1881 the channel depth had been increased from 8½ to 15 ft., in 1896–1906 it was increased to 21 ft. in the lower part of the harbour, and in 1908 the upper part was dredged to 18 or 19 ft. for widths of 100, 200 and 250 ft. Between 1836 and 1909 $994,404 was expended on the improvement of the harbour. Most of the streets which run from E. to W. are numbered; those which run from N. to S. are named, often in honour of prominent American statesmen. The public parks and squares have a total area of 381 acres; the most important parks are Brandywine and Rockford, which lie along and near Brandywine creek, in the northern part of the city. Among the buildings of interest are the City Hall (1798); Holy Trinity (Old Swedes) Church (1698), probably the oldest church in the United States which has been in continuous use; the building occupied by the Historical Society of Delaware (organized in 1864), which was the old First Presbyterian Meeting House, built in 1740; the County Court House; and the Federal building. In Wilmington, besides other educational institutions, is the Wilmington Friends' School (1748), the oldest preparatory school in the state. The Wilmington Institute Free Library (69,000 volumes in 1910) was founded in 1788, but was not made free to the public until 1894. Wilmington is the see of a Roman Catholic bishop, and of a Protestant Episcopal bishop.

The favourable situation, railway facilities and proximity to the coal-fields of Pennsylvania, West Virginia and Virginia, to the sources of supply of raw materials, and the water-power furnished by the Brandywine, combined with the enterprise of its citizens, have made Wilmington the most important manufacturing centre of Delaware. In 1905 the value of the factory product of the city, $30,390,039, was 73·8% of the total product value of the state. The principal manufactures are tanned, curried and finished leather ($10,250,842), steam railway cars ($3,597,736), foundry and machine-shop products ($3,432,118), paper and wood pulp ($1,904,556), &c. Shipbuilding ($1,780,904 in 1905) was established as early as 1739, and in 1836 the first iron steamship and in 1854 the first iron sailing-boat built in the United States were built here. On the Brandywine, near the city, are the works of the Du Pont Powder Company, which extend over nearly 1000 acres, the largest powder plant in the world. The company was founded in 1802 by the French refugee, Eleuthère Irenée du Pont de Nemours (1771–1834), who had learned from Lavoisier the modern methods of powder-making, and here introduced them into the United States. Wilmington is the port of entry of the customs district of Delaware, with branch offices at New Castle and Lewes. In 1909 the imports of the district were valued at $463,092.

The city is governed under a charter of 1886, amended in 1893, by a mayor, who is chosen biennially and who appoints the board of water commissioners and the board of directors of the street and sewer departments, and by a unicameral legislature, the twelve members of which are elected by wards (except the president of the council, who is elected at large, and is acting mayor in the absence of the mayor). The council appoints the auditor, the clerk of council who acts as city clerk and various inspectors, &c. The police commission is appointed by the resident associate judge of New Castle county court. A board of education (two members from each ward), the city attorney and the city treasurer are elected by popular vote.

The site of Wilmington was settled in 1638 on behalf of the South Company of Sweden by Swedish and Dutch colonists, under the leadership of Peter Minuit. The fort which they built was called Christina, and the settlement that grew up around it, Christinaham, in honour of Queen Christina, daughter of Gustavus Adolphus. The fort was captured, without bloodshed, by Governor Peter Stuyvesant of New Netherland in 1655, but very few of the Swedes left Christinaham. The Swedish language and Swedish customs persisted, and the religion of the Swedes was tolerated. After the English conquest in 1664, especially after the annexation of the Delaware counties to Pennsylvania in 1682, Swedish influence declined. In 1731 a large part of the territory now included in the city was owned by Thomas Willing, who named it Willingtown. About eight years later, by a borough charter granted by William Penn, this named was changed to Wilmington, in honour of Spencer Compton, Earl of Wilmington (*c.* 1673–1743). During the War of Independence the battle of Brandywine was fought 13 m. N.W. of Wilmington. In the first half of the 19th century Wilmington was the centre of a strong anti-slavery sentiment and was a "station" of the "Underground Railroad." In 1809 the borough was enlarged by a new charter; in 1832 Wilmington was chartered as a city. In 1900 the city contained 41·4% of the total population of the state and, under the state constitution of 1897, it elects five of the thirty-five representatives and two of the seventeen senators in the state legislature.

See *Records of Holy Trinity (Old Swedes) Church* (Wilmington, 1890); Benjamin Ferris, *History of the Original Settlements on the Delaware*, part iii. (Wilmington, 1846); and Elizabeth Montgomery, *Reminiscences of Wilmington* (Philadelphia, 1851).

WILMINGTON, a city, a port of entry and the county-seat of New Hanover county, North Carolina, U.S.A., on the Cape Fear river, about 30 m. from its mouth, 10 m. in direct line from the ocean, and about 145 m. S.S.E. of Raleigh. Pop. (1890) 20,056; (1900) 20,976, of whom 10,407 were negroes and 467 were foreign-born; (1910 census) 25,748. It is the largest city and the chief seaport of the state. Wilmington is served by the Atlantic Coast Line and the Seaboard Air Line railways, and by steamboat lines to New York, Philadelphia and Baltimore, and to ports on the Cape Fear and Black rivers, and is connected by an electric line with Wrightsville Beach, a pleasure resort 12 m. distant on the Atlantic Ocean. Below Wilmington the channel of the Cape Fear river is 20 ft. deep throughout and in some parts 22 and 24 ft. deep; the width of the channel is to be made 270 ft. under Federal projects on which, up to the 30th of June 1909, there had been expended $4,344,029. Above Wilmington the Cape Fear river is navigable for boats drawing 2 ft. for 115 m. to Fayetteville. The city lies on an elevated sand ridge and extends along the river front for about 2½ m. Among its prominent buildings are the United States Government Building, the United States marine hospital, the city and county hospital, the county court house, the city hall (which houses the public library) and the masonic temple. The city is the seat of Cape Fear Academy (1872) for boys, of the Academy of the Incarnation (Roman Catholic) and of the Gregory Normal School (for negroes). The city is the see of a Protestant Episcopal bishop. Wilmington is chiefly a commercial city, and ships large quantities of cotton, lumber, naval stores, rice, market-garden produce and turpentine; in 1909 the value of its exports was $23,310,070 and the value of its imports $1,282,724. The total value of the factory product in 1905 was $3,155,458, of which $893,715 was the value of lumber and timber products.

A settlement was established here in 1730 and was named New Liverpool; about 1732 the name was changed to New Town; in 1739 the town was incorporated, was made the county-seat and was renamed, this time in honour of Spencer Compton, Earl of Wilmington (*c.* 1673-1743). In 1760 it was incorporated as a borough and in 1866 was chartered as a city. Some of Wilmington's citizens were among the first to offer armed resistance to the carrying out of the Stamp Act, compelling the stamp-master to take an oath that he would distribute no stamps. During most of 1781 the borough was occupied by the British, and Lord Cornwallis had his headquarters here. Although blockaded by the Union fleet, Wilmington was during the Civil War the centre of an important intercourse between the Confederacy and foreign countries by means of blockade runners, and was the last important port open to the Confederates. It was defended by Fort Fisher, a heavy earthwork on the peninsula between the ocean and Cape Fear river, manned by 1400 men under Colonel William Lamb. A federal expedition of 150 vessels under Admiral D. D. Porter and land forces (about 3000) under General B. F. Butler approached the fort on the 20th of December 1864; on the 24th the "Louisiana," loaded with 215 tons of powder, was exploded 400 yds. from the fort without doing any damage; on the 24th and 25th there was a terrific naval bombardment, which General Butler decided had not sufficiently injured the fort to make an assault by land possible; on the 13th and 14th of January there was another bombardment, and on the 15th a combined naval and land attack, in which General A. H. Terry, who had succeeded General Butler in command, stormed the fort with the help of the marines and sailors, and took 2000 prisoners and 169 guns. The Union losses were 266 killed, 57 missing and 1018 wounded. A magazine explosion on the morning of the 16th killed about 100 men in each army. The city was evacuated immediately afterwards.

WILMOT, DAVID (1814–1868), American political leader, was born at Bethany, Pennsylvania, on the 20th of January 1814. He was admitted to the bar in 1834 and practised law in Towanda. He entered politics as a Democrat, served in the National House of Representatives from 1845 to 1851, and although he favoured the Walker Tariff, the Mexican War and other party measures, opposed the extension of slavery. On the 8th of August 1846, when a bill was introduced appropriating $2,000,000 to be used by the president in negotiating a treaty of peace with Mexico, Wilmot immediately offered the following amendment: "Provided, That, as an express and fundamental condition to the acquisition of any territory from the Republic of Mexico by the United States, by virtue of any treaty which may be negotiated between them, and to the use by the Executive of the moneys herein appropriated, neither slavery nor involuntary servitude shall ever exist in any part of said territory, except for crime, whereof the party shall first be duly convicted." The amendment, famous in American history as the "Wilmot Proviso," was adopted by the House, but was defeated, with the original bill, by the Senate's adjournment. A similar measure was brought forward at the next session, the appropriation, however, being increased to $3,000,000, and the amendment being extended to include all territory which might be acquired by the United States; in this form it passed the House by a vote of 115 to 105; but the Senate refused to concur, passed a bill of its own without the amendment; and the House, owing largely to the influence of General Lewis Cass, in March 1847, receded from its position. The amendment was never actually adopted by Congress, and was in fact expressly repudiated in the Compromise of 1850, and its content declared unconstitutional by the Supreme Court in the Dred Scott case. Although known as the Wilmot Proviso it really originated with Jacob Brinkerhoff (1810–1880) of Ohio, Wilmot being selected to present it only because his party standing was more regular. The extension of the principle to territory other than that to be acquired from Mexico was probably due to Preston King (1806–1865) of New York. Wilmot supported Van Buren in 1848 and entered the Republican party at the time of its formation, and was a delegate to the national conventions of 1856 and 1860. He was president judge of the 13th Judicial District of Pennsylvania in 1853–1861, United States senator in 1861–1863 and Judge of the United States Court of Claims in 1863–1868. He died at Towanda, Pennsylvania, on the 16th of March 1868.

See G. P. Garrison, *Westward Extension* (New York and London, 1906).

WILSON, ALEXANDER (1766–1813), American ornithologist, was born in Paisley, Scotland, on the 6th of July 1766. His father, a handloom weaver, soon removed to the country, and there combined weaving with agriculture, distilling and smuggling —conditions which no doubt helped to develop in the boy that love of rural pursuits and adventure which was to determine his career. At first he was placed with a tutor and destined for the church, but afterwards he was apprenticed as a weaver. Then he became a peddler and spent a year or two in travelling through Scotland, recording in his journal every matter of natural history or antiquarian interest. Having incurred a short imprisonment for lampooning the master-weavers in a trade dispute, he emigrated to America in 1794. After a few years of weaving, peddling and desultory observation, he became a village schoolmaster, and in 1802 obtained an appointment near Philadelphia, where he formed the acquaintance of William Bartram the naturalist. Under his influence Wilson began to draw birds, having conceived the idea of illustrating the ornithology of the United States; and thenceforward he steadily accumulated materials and made many expeditions. In 1806 he obtained the assistant-editorship of the American edition of *Rees's Encyclopaedia*, and thus acquired more means and leisure for his great work, *American Ornithology*, the first volume of which appeared in the autumn of 1808, after which he spent the winter in a journey "in search of birds and subscribers." By the spring of 1813 seven volumes had appeared; but the arduous expedition of that summer, in search of the marine waterfowl to which the remaining volume was to be devoted, gave a shock to his already impaired health, and he succumbed to dysentery at Philadelphia on the 23rd of August 1813.

Of his poems, not excepting the *Foresters* (Philadelphia, 1805), nothing need now be said, save that they no doubt served to develop his descriptive powers. The eighth and ninth volumes of the *American Ornithology* were edited after his decease by his friend George Ord, and the work was continued by Lucien Bonaparte (4 vols., Philadelphia, 1825–1833). The complete work was republished several times, and his *Miscellaneous Prose Works and Poems* was edited with a memoir by the Rev. A. B. Grosart (Paisley, 1876). A statue was erected to him at Paisley in 1876.

WILSON, SIR DANIEL (1816–1892), archaeologist and Canadian educational reformer, was born in Edinburgh on the 5th of January 1816, the son of Archibald Wilson, a wine-merchant, and Janet Aitken. After studying at the High School and the University of Edinburgh, he spent the next ten years in journalism and in other forms of literary work (London 1837–1842, Edinburgh 1842–1847). In 1845 he became secretary to the Scottish Society of Antiquaries, and in 1848 published *Memorials of Edinburgh in the Olden Time*, of which the chief value lies in the numerous illustrations, done by himself. In 1851 appeared his most important work, *Prehistoric Annals of Scotland*, which placed him in the front rank of archaeologists. In 1853 he became professor of History and English Literature in the University of Toronto, where his practical ability and energy soon made him the most important member of the staff. While writing extensively on the archaeology and anthropology of Canada, and giving an impetus to the study, he produced nothing of lasting importance. His main work lay in asserting the claims of the University of Toronto, and of University College, the teaching body in connexion with it, against the sectarian universities of the province which denounced the provincial university as godless, and against the private medical schools in Toronto. Largely owing to Wilson's energy in fighting for what he called "the maintenance of a national system of university education in opposition to sectarian or denominational colleges," the provincial university gained the chief position in the intellectual life of Ontario. Two of the sectarian universities, the Methodist and the Anglican, have now become united to the provincial university, but the Baptist and the Presbyterian (see KINGSTON) still retain a vigorous existence. He was equally successful in his struggle against the rival medical schools in Toronto, the chief of which is now incorporated with Toronto university. In his efforts to escape the control of local politicians he was less successful, and in some cases appointments to the provincial university were made for political rather than for academic reasons. Though seeing that in a young and democratic country the Scotch-American model must be followed rather than the English, and though resisting attempts to follow the practice of Oxford or Cambridge, Wilson was a believer in the merits of a modified form of the residential system. He was one of the first in Canada to cast aside the classical tradition, and as early as 1860 had the courage to say: "It is just because . . . German and French are now the keys of so much modern philosophy and science that all wise University reformers are learning to give to modern languages the place they justly claim in a liberal education." In 1881 he was made president of Toronto university; and in 1885 president of the literature section of the Canadian Royal Society; in 1888 he was knighted; and in 1891 given the freedom of the city of Edinburgh. He died at Toronto on the 6th of August 1892.

Record of Historical Publications relating to Canada, edited by G. M. Wrong, vol. v. (Toronto and London, 1901), pp. 199-217, gives a good sketch of his career, and a bibliography of his numerous works. (W. L. G.)

WILSON, HENRY (1812–1875), vice-president of the United States from 1873 to 1875, was born at Farmington, New Hampshire, on the 16th of February 1812. His name originally was Jeremiah J. Colbaith. His father was a day-labourer and very poor. At ten years of age the son went to work as a farm-labourer. He was fond of reading, and before the end of his apprenticeship had read more than a thousand volumes. At the age of twenty-one, for some unstated reason, he had his name changed by Act of the Legislature to that of Henry Wilson. At Natick, Massachusetts, whither he travelled on foot, he learned the trade of shoemaker, and during his leisure hours studied much and read with avidity. For short periods, also, he studied in the academies of Strafford, N.H., Wolfeborough, N.H., and Concord, N.H. After successfully establishing himself as a shoe manufacturer, he attracted attention as a public speaker in support of William Henry Harrison during the presidential campaign of 1840. He was in the state House of Representatives in 1841-42, 1846 and 1850. and in the Senate in 1844-45 and 1851-52. In 1848 he left the Whig party and became one of the chief leaders of the Free Soil party, serving as presiding officer of that party's national convention in 1852, acting as chairman of the Free Soil national committee and editing from 1848 to 1851 the Boston *Republican*, which he made the chief Free Soil organ. The Free Soil party nominated him for governor of the state in 1853, but he was defeated. For a short time (1855) he identified himself with the American or Know Nothing party, and afterwards acted with the Republican party. In 1855 he was elected to the United States Senate and remained there by re-elections until 1873. His uncompromising opposition to the institution of slavery furnished the keynote of his earlier senatorial career, and he soon took rank as one of the ablest and most effective anti-slavery orators in the United States. He had been deeply interested from 1840 until 1850 in the militia of his state, and had risen through its grades of service to that of brigadier-general. Upon the outbreak of the Civil War he was made chairman of the military committee of the Senate, and in this position performed most laborious and important work for the four years of the war. The Republicans nominated Wilson for the vice-presidency in 1872, and he was elected; but he died on the 22nd of November 1875 before completing his term of office

He published, besides many orations, a *History of the Anti-Slavery Measures of the Thirty-Seventh and Thirty-Eighth United States Congresses* (1865); *Military Measures of the United States Congress* (1868); a *History of the Reconstruction Measures of the Thirty-Ninth and Fortieth Congresses* (1868) and a *History of the Rise and Fall of the Slave Power in America* (3 vols., 1872–1875), his most important work.

The best biography is that by Elias Nason and Thomas Russell, *The Life and Public Services of Henry Wilson* (Boston, 1876).

WILSON, HORACE HAYMAN (1786–1860), English orientalist, was born in London on the 26th of September 1786. He studied medicine at St Thomas's Hospital, and went out to India in 1808 as assistant-surgeon on the Bengal establishment of the East India Company. His knowledge of metallurgy caused him to be attached to the mint at Calcutta, where he was for a time associated with John Leyden. He became deeply interested in the ancient language and literature of India, and by the recommendation of Henry T. Colebrooke, he was in 1811 appointed secretary to the Asiatic Society of Bengal. In 1813 he published the Sanskrit text—with a graceful, if somewhat free, translation in English rhymed verse—of Kālidāsa's charming lyrical poem, the *Meghadūta*, or *Cloud-Messenger*. He prepared the first Sanskrit-English Dictionary (1819) from materials compiled by native scholars, supplemented by his own researches. This work was only superseded by the *Sanskritwörterbuch* (1853–1876) of R. von Roth and Otto Böhtlingk, who expressed their obligations to Wilson in the preface to their great work. Wilson published in 1827 *Select Specimens of the Theatre of the Hindus*, which contained a very full survey of the Indian drama, translations of six complete plays and short accounts of twenty-three others. His *Mackenzie Collection* (1828) is a descriptive catalogue of the extensive collection of Oriental, especially South Indian, MSS. and antiquities made by Colonel Colin Mackenzie, now deposited partly in the India Office, London, and partly at Madras. He also wrote a *Historical Sketch of the First Burmese War, with Documents, Political and Geographical* (1827), a *Review of the External Commerce of Bengal from 1813 to 1828* (1830) and a *History of British India from 1805 to 1835*, in continuation of Mill's *History* (1844–1848). He acted for many years as secretary to the committee of public instruction, and superintended the studies of the Sanskrit College in Calcutta. He was one of the staunchest opponents of the proposal that English should be made the sole medium of instruction in native schools, and became for a time the object of bitter attacks. In 1832 the university of Oxford selected Dr Wilson to be the first occupant of the newly founded Boden chair of Sanskrit, and in 1836 he was appointed librarian to the East India Company. He was an original member of the Royal Asiatic Society, of which he was director from 1837 up to the time of his death, which took place in London on the 8th of May 1860.

A full list of Wilson's works may be found in an Annual Report of the Royal Asiatic Society for 1860. A considerable number of Sanskrit MSS. (540 vols.) collected by Wilson in India are now in the Bodleian Library.

WILSON, JAMES (1742–1798), American statesman and jurist, was born in or near St Andrews, Scotland, on the 14th of September 1742. He matriculated at the University of St Andrews in 1757 and was subsequently a student at the universities of Glasgow and Edinburgh. In 1765 he emigrated to America. Landing at New York in June, he went to Philadelphia in the following year and in 1766–1767 was instructor of Latin in the college of Philadelphia, later the university of Pennsylvania. Meanwhile he studied law in the office of John Dickinson, was admitted to the bar in 1767, removed first to Reading and soon afterward to Carlisle, and rapidly rose to prominence. In August 1774 he published a pamphlet *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament*, in which he argued that parliament had no constitutional power to legislate for the colonies; this pamphlet strongly influenced members of the Continental Congress which met in September. Wilson was a delegate to the Pennsylvania provincial convention in January 1775, and he sustained there the right of Massachusetts to resist the change in its charter, declaring that as the force which the British Government was exercising to compel obedience was "force unwarranted by any act of parliament, unsupported by any principle of the common law, unauthorized by any commission from the crown," resistance was justified by "both the letter and the spirit of the British constitution"; he also, by his speech, led the colonies in shifting the burden of responsibility from parliament or the king's ministers to the king himself. In May 1775 Wilson became a member of the Continental Congress. When a declaration of independence was first proposed in that body he expressed the belief that a majority of the people of Pennsylvania were in favour of it, but as the instructions of the delegates from Pennsylvania and some of the other colonies opposed such a declaration, he urged postponement of action for the purpose of giving the constituents in those colonies an opportunity of removing such instructions. When independence was finally declared the unanimity of all the colonies except New York had been obtained. Receiving a commission as colonel in May 1775, Wilson raised a battalion of troops in his county of Cumberland, and for a short time in 1776 he took part in the New Jersey campaign, but his principal labours in 1776 and 1777 were in Congress. In January 1776 he was appointed a member of a committee to prepare an address to the colonies, and the address was written by him; he served on a similar committee in May 1777, and wrote the address *To the Inhabitants of the United States*, urging their firm support of the cause of Independence; he drafted the plan of treaty with France together with instructions for negotiating it; he was a member of the Board of War from its establishment in June 1776 until his retirement from Congress in September 1777; from January to September 1777 he was chairman of the Committee on Appeals, to hear and determine appeals from the courts of admiralty in the several states; and he was a member of many other important committees. In September 1777 the political faction in his state which had opposed Independence again came into power, and Wilson was kept out of Congress until the close of the war; he was back again, however, in 1783, and 1785–1786, and, advocating a sound currency, laboured in co-operation with Robert Morris to direct the financial policy of the Confederation.

Soon after leaving Congress in 1777 Wilson removed to Annapolis, Maryland, to practise law, but he returned to Philadelphia in the following year. In 1779 he was commissioned Advocate-General for France, and in this capacity he represented Louis XVI. in all claims arising out of the French alliance until the close of the war. In 1781–1782 he was the principal counsel for Pennsylvania in the Wyoming Valley dispute with Connecticut, which was decided in favour of Pennsylvania in December 1782 by an arbitration court appointed by Congress. Wilson was closely associated with Robert Morris in organizing the Bank of North America, and in the Act of Congress incorporating it (December 31, 1781) he was made one of the directors. In 1782 the legislature of Pennsylvania granted a charter to this bank, but three years later it passed an act to repeal it. Wilson responded with a famous constitutional argument in which he sustained the constitutionality of the bank on the basis of the *implied* powers of Congress.

As a constructive statesman Wilson had no superior in the Federal Convention of 1787. He favoured the independence of the executive, legislative and judicial departments, the supremacy of the Federal government over the state governments, and the election of senators as well as representatives by the people, and was opposed to the election of the President or the judges by Congress. His political philosophy was based upon implicit confidence in the people, and he strove for such provisions as he thought would best guarantee a government by the people. When the constitution had been framed Wilson pronounced it "the best form of government which has ever been offered to the world," and he, at least, among the framers regarded it not as a compact but as an ordinance to be established by the people. During the struggle for ratification he made a speech before a mass meeting in Philadelphia which has been characterized as "the ablest single presentation of the whole subject." In the Pennsylvania ratification convention (November 21 to December 15, 1787) he was the constitution's principal defender. Having been appointed professor of law in the university of Pennsylvania in 1790, he delivered at that institution in 1790–1791 a course of lectures on public and private law; some of these lectures, together with his speeches in the Federal convention, before the mass meeting in Philadelphia, and in the Pennsylvania ratification convention, are among the most valuable commentaries on the constitution.

Wilson was a delegate to the state constitutional convention of 1789–1790, and a member of the committee which drafted the new constitution. In 1789 Washington appointed him an associate justice of the United States Supreme Court, and in 1793 he wrote the important decision in the case of *Chisolm v. Georgia*, the purport of which was that the people of the United States constituted a sovereign nation and that the United States were not a mere confederacy of sovereign states. He continued to serve as associate justice until his death, near Edenton, North Carolina, on the 28th of August 1798.

Wilson's *Works*, consisting principally of his law lectures and a few speeches, were published under the direction of his son, Bird Wilson (3 vols., Philadelphia, 1803–1804). A revised edition in two volumes with notes by James D. Andrews was published in Chicago in 1896. See also *Documentary History of the Constitution of the United States of America*, vols. i. and iii. (Washington, 1894); J. B. McMaster and F. D. Stone, *Pennsylvania and the Federal Constitution*, 1787–1788 (Philadelphia, 1888); L. H. Alexander (ed.), *James Wilson* (Philadelphia, 1908); a biographical sketch entitled "James Wilson, Nation-Builder," by L. H. Alexander, in the *Green Bag*, vol. 19 (1907); "James Wilson, Patriot, and the Wilson Doctrine," by Alexander, in the *North American Review*, vol. 183 (1906); Justice J. M. Harlan, "James Wilson and the Formation of the Constitution," in the *American Law Review*, vol. 34; B. A. Konkle *et al.* "The James Wilson Memorial," in the *American Law Register*, vol. 55 (1907).

WILSON, JAMES (1835–), American administrator, was born in Ayrshire, Scotland, on the 16th of August 1835. In 1851 he was taken by his parents to America, where they originally settled in Connecticut, but in 1855 removed to Tama county Iowa. He studied at Iowa College, and in 1861 became a farmer. He was a Republican member of the state House of Representatives in 1868–1873, and was its speaker in 1872–1873, and he was a member of the National House of Representatives from 1873 to 1877 and again in 1883–1885. From 1870 to 1874 he was a regent of the State University of Iowa; in 1877–1883 was a member of the Iowa State Railway Commission, and from 1890 to 1897 was professor of agriculture at the Iowa Agricultural College, at Ames, and director of the State Agricultural Experiment Station. In March 1897 he became Secretary of Agriculture in President McKinley's Cabinet and served into President Taft's administration, holding office longer than any other cabinet officer since the organization of the government.

WILSON, JOHN (1627–1696), English playwright, son of Aaron Wilson, a royalist divine, was born in London in 1627. He matriculated from Exeter College, Oxford, in 1644, and entered Lincoln's Inn two years later, being called to the bar in 1649. His unswerving support of the royal pretensions recommended him to James, duke of York, through whose influence he became Recorder of Londonderry about 1681. *His Discourse of Monarchy* (1684), a tract in favour of the succession of the duke of York, was followed (1685) by a "Pindarique" on his coronation. In 1688 he wrote *Jus regium Coronae*, a learned defence of James's action in dispensing with the penal statutes. He died in obscurity, due perhaps to his political opinions, in 1696. Wilson was the author of four plays, showing a vigorous and learned wit, and a power of character-drawing that place him rather among the followers of Ben Jonson than with the Restoration dramatists.

The Cheats (written in 1662, printed 1664, 1671, &c.) was played with great success in 1663. John Lacy found one of his best parts in Scruple, a caricature of a Presbyterian minister of accommodating morality. *Andronicus Comnenius* (1664), a blank verse tragedy, is based on the story of Andronicus Comnenus as told by Peter Heylin in his *Cosmography*. It contains a scene between the usurper and the widow of his victim Alexius which follows very closely Shakespeare's treatment of a parallel situation in *Richard III*. *The Projectors* (1665), a prose comedy of London life, is, like Molière's *L'Avare*, founded on the Aulularia of Plautus, but there is no evidence that Wilson was acquainted with the French play. *Belphegor*, *or the Marriage of the Devil; a Tragi-comedy* (1690), treats of a theme familiar to Elizabethan drama, but Wilson took the subject from the *Belphegor* attributed to Machiavelli, and alludes also to Straparola's version in the *Notti*. He also translated into English Erasmus's *Encomium Moriae* (1668).

See *The Dramatic Works of John Wilson*, edited with introduction and notes by James Maidment and W. H. Logan in 1874 for the "Dramatists of the Restoration" series.

WILSON, JOHN (1785–1854), Scottish writer, the CHRISTOPHER NORTH of *Blackwood's Magazine*, was born at Paisley on the 18th of May 1785, the son of a wealthy gauze manufacturer who died when John was eleven years old. He was the fourth child, but the eldest son, and he had nine brothers and sisters.[1] He was only twelve when he was first entered at the university of Glasgow, and he continued to attend various classes in that university for six years, being for the most part under the tutorship of Professor George Jardine, with whose family he lived. In these six years Wilson "made himself" in all ways, acquiring not inconsiderable scholarship, perfecting himself in all sports and exercises, and falling in love with a certain "Margaret," who was the object of his affections for several years.

In 1803 Wilson was entered as a gentleman commoner at Magdalen College, Oxford. Few men have felt more than he the charm of Oxford, and in much of his later work, notably in the essay called "Old North and Young North," he has expressed his feeling. But it does not appear that his Magdalen days were altogether happy, though he perfected himself in "bruising," pedestrianism and other sports, and read so as to obtain a brilliant first class. His love affairs did not go happily, and he seems to have made no intimate friends at his own college and few in the university. He took his degree in 1807, and found himself at twenty-two his own master, with a good income, no father or guardian to control him, and apparently not under any of the influences which in similar circumstances generally make it necessary for a young man to adopt some profession, if only in name. His profession was an estate on Windermere called Elleray, ever since connected with his name. Here he built, boated, wrestled, shot, fished, walked and otherwise diverted himself for four years, besides composing or collecting from previous compositions a considerable volume of poems, published in 1812 as the *Isle of Palms*. Here he became intimate with Wordsworth, Coleridge, Southey and De Quincey. He married in 1811 Jane Penny, a Liverpool lady of good family, and four years of happy married life at Elleray succeeded; then came the event which made a working man of letters of Wilson, and without which he would probably have produced a few volumes of verse and nothing more. The major part of his fortune was lost by the dishonest speculation of an uncle, in whose hands Wilson had carelessly left it. But this hard fate was by no means unqualified. His mother had a house in Edinburgh, in which she was able and willing to receive her son and his family; nor had he even to give up Elleray, though henceforward he was not able constantly to reside in it. He read law and was called to the Scottish bar, in 1815, still taking many a sporting and pedestrian excursion, and publishing in 1816 a second volume of poems, *The City of the Plague*. In 1817, soon after the founding of *Blackwood's Magazine*, Wilson began his connexion with that great Tory monthly by joining with J. G. Lockhart in the October number, in a satire called the *Chaldee Manuscript*, in the form of biblical parody, on the rival *Edinburgh Review*, its publisher and his contributors. From this time he was the principal writer for *Blackwood's*, though never its nominal editor, the publisher retaining a certain supervision even over Lockhart's and "Christopher North's" contributions, which were the making of the magazine. In 1822 began the series of *Noctes Ambrosianae*, after 1825 mostly Wilson's work. These are discussions in the form of convivial table-talk, giving occasion to wonderfully various digressions of criticism, description and miscellaneous writing. From their origin it necessarily followed that there was much ephemeral, a certain amount purely local, and something wholly trivial in them. But their dramatic force, their incessant flashes of happy thought and happy expression, their almost incomparable fulness of life, and their magnificent humour give them all but the highest place among genial and recreative literature. "The Ettrick Shepherd," an idealized portrait of James Hogg, one of the talkers, is a most delightful creation. Before this, Wilson had contributed to *Blackwood's* prose tales and sketches, and novels, some of which were afterwards published separately in *Lights and Shadows of Scottish Life* (1822), *The Trials of Margaret Lyndsay* (1823) and *The Foresters* (1825); later appeared essays on Spenser, Homer and all sorts of modern subjects and authors.

The first result of his new occupation on Wilson's general mode of life was that he left his mother's house and established himself (1819) in Ann Street, Edinburgh, with his wife and family of five children. The second was much more unlooked for, his election to the chair of moral philosophy in the university of Edinburgh (1820). His qualifications for the post were by no means obvious, even if the fact that the best qualified man in Great Britain, Sir William Hamilton, was also a candidate, be left out of the question. But the matter was made a political one; the Tories still had a majority in the town council; Wilson was powerfully backed by friends, Sir Walter Scott at their head; and his adversaries played into his hands by attacking his moral character, which was not open to any fair reproach. Wilson made a very excellent professor, never perhaps attaining to any great scientific knowledge in his subject or power of expounding it, but acting on generation after generation of students with a stimulating force that is far more valuable than the most exhaustive knowledge of a particular topic. His duties left him plenty of time for magazine work, and for many years his contributions to *Blackwood* were extraordinarily voluminous, in one year (1834) amounting to over fifty separate articles. Most of the best and best known of them appeared between 1825 and 1835.

The domestic events of Wilson's life in the last thirty years of it may be briefly told. He oscillated between Edinburgh and Elleray, with excursions and summer residences elsewhere, a sea trip on board the Experimental Squadron in the Channel during the summer of 1832, and a few other unimportant diversions. The death of his wife in 1837 was an exceedingly severe blow to him, especially as it followed within three years that of his friend Blackwood. For many years after, his literary work was intermittent, and, with some exceptions, not up to the level of his earlier years. Late in 1850 his health showed definite signs of breaking up; and in the next year he resigned his professorship, and a Civil List pension of £300 a year was conferred on him. He died at Edinburgh on the 3rd of April 1854.

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[1] His youngest brother was James Wilson "of Woodville" (1795–1856), the zoologist. He purchased, on behalf of Edinburgh University, in Paris, the Dufresne collection of birds, and arranged them on his return to Scotland. He contributed to *Blackwood's Magazine* and to the *North British Quarterly Review*, and wrote many of the articles on natural history in the seventh edition of the *Encyclopaedia Britannica*.

Only a very small part of Wilson's extensive work was published in a collected and generally accessible form during his lifetime, the chief and almost sole exceptions being the two volumes of poems referred to, the *Lights and Shadows of Scottish Life*, and the *Recreations of Christopher North* (1842), a selection from his magazine articles. These volumes, with a selected edition of the *Noctes Ambrosianae* in four volumes, and of further essays, critical and imaginative, also in four volumes, were collected and reissued uniformly after his death by his son-in-law, Professor J. F. Ferrier. The collection is very far from exhaustive; and, though it undoubtedly contains most of his best work and comparatively little that is not good, it has been complained, with some justice, that the characteristic, if rather immature, productions of his first eight years on *Blackwood* are almost entirely omitted, that the *Noctes* are given but in part, if in their best part, and that at least three long, important and interesting series of papers, less desultory than is his wont, on "Spenser," on "British Critics" and the set called "Dies Boreales," have been left out altogether. Wilson's characteristics are, however, uniform enough, and the standard edition exhibits them sufficiently, if not exhaustively. His poems may be dismissed at once as little more than interesting. They would probably not have been written at all if he had not been a young man in the time of the full flood of the Lake school influence. His prose tales have in some estimates stood higher, but will hardly survive the tests of universal criticism. It is as an essayist and critic of the most abounding geniality, if not genius, of great acuteness, of extraordinary eloquence and of a fervid and manifold sympathy, in which he has hardly an equal, that Christopher North will live. His defects lay in the directions of measure and of taste properly so called, that is to say, of the modification of capricious likes and dislikes by reason and principle. He is constantly exaggerated, boisterous, wanting in refinement. But these are the almost necessary defects of his qualities of enthusiasm, eloquence and generous feeling. The well-known adaptation of phrase in which he did not recant but made up for numerous earlier attacks on Leigh Hunt, "the Animosities are mortal, but the Humanities live for ever," shows him as a writer at his very best, but not without a little characteristic touch of grandiosity and emphasis. As a literary critic, as a sportsman, as a lover of nature and as a convivial humorist, he is not to be shown at equal advantage in miniature; but almost any volume of his miscellaneous works will exhibit him at full length in one of these capacities, if not in all.

See *Christopher North*, by Mrs Mary Gordon, his daughter (1862); and Mrs Oliphant, *Annals of a Publishing House; William Blackwood and his Sons* (1897).

WILSON, JAMES HARRISON (1837–), American cavalry soldier, was born at Shawneetown, Illinois, in 1837 and entered West Point military academy in 1855, graduating in 1860. He was appointed to the engineer branch of the United States army, served in the Port Royal and Fort Pulaski operations, being breveted major for his gallant conduct at Pulaski, was on M'Clellan's staff at Antietam as a lieutenant-colonel in 1862, and as a topographical engineer on the headquarters staff of the Army of the Tennessee during the Vicksburg and Chattanooga campaigns. His services in the intricate operations before Vicksburg were rewarded by promotion to brigadier-general U.S.V. In 1864 he was appointed to command a division in Sheridan's cavalry corps, and played a distinguished part in the cavalry operations of the 4th to 6th of May during the battle of the Wilderness (for which he was breveted colonel U.S.A.), the so-called Richmond Raid, the operations on the Totopotomoy, &c. Later in 1864 he commanded the cavalry of Thomas's army in Tennessee. During the closing operations of the war he led a cavalry expedition on a grand scale through the South-Western states, occupying Selma, Montgomery and Macon, and capturing at different times nearly 7000 prisoners, including President Davis. He was promoted major-general of volunteers and breveted major-general U.S.A. shortly before the end of the war. Returning to duty in the regular army as a lieutenant-colonel of infantry for some years, he resigned in 1870 and engaged in engineering and railway construction. In 1898, during the Spanish-American War, he was appointed a major-general in the new volunteer army, and took part in the operations in Porto Rico. He served in the China expedition of 1900 as a brigadier-general and in 1901 was placed on the retired list as a brigadier-general U.S.A.

WILSON, RICHARD (1714–1782), English landscape painter, was born at Penegoes, Montgomeryshire, where his father was a clergyman, on the 1st of August 1714. His early taste for art was observed by a relative of his mother, Sir George Wynne, who in 1729 sent him to London to study under Thomas Wright, a little-known portrait painter of the time, by whom he was instructed for six years. He then started on his own account, and was soon in a good practice. Among his commissions was a full-length of the prince of Wales and the duke of York, painted for their tutor, the bishop of Norwich. Examples of his portraits may be studied in Greenwich Hospital, in the Garrick Club, and in various private collections. In 1749 Wilson visited Italy, where he spent six years. He had previously executed some landscapes, but it was now that the advice of Zuccarelli and Joseph Vernet decided him to adopt this department of art exclusively. He studied Claude and Poussin, but retained his own individuality, and produced some admirable views of Rome and the Campagna. In 1755 he returned to England, and became one of the first of English landscape painters. "Niobe," one of his most powerful works, was exhibited at the Society of Artists in 1760. On the establishment of the Royal Academy in 1768 he was appointed one of the original members, and he was a regular contributor to its exhibitions till 1780. He frequently executed replicas of his more important subjects, repeating some of them several times; in the figures which he introduced in his landscapes he was occasionally assisted by Mortimer and Hayman. During his lifetime his landscapes were never widely popular; his temper was consequently embittered by neglect, and so impoverished was he that he was obliged to seclude himself in an obscure, half-furnished room in Tottenham Court Road, London. In 1776, however, he obtained the post of librarian to the Academy; and by the death of a brother he acquired a small property near Llanferras, Denbighshire, to which he retired to spend his last days, and where he died suddenly in May 1782. After his death his fame increased, and in 1814 about seventy of his works were exhibited in the British Institution. The National Gallery, London, contains nine of his landscapes.

The works of Wilson are skilled and learned compositions rather than direct transcripts from nature. His landscapes are treated with great breadth, and with a power of generalization which occasionally led to a disregard of detail. They are full of classical feeling and poetic sentiment; they possess noble qualities of colour, and of delicate silvern tone; and their handling is vigorous and easy, the work of a painter who was thoroughly master of his materials.

See *Studies and Designs by Richard Wilson, done at Rome in the year 1752* (Oxford, 1811); T. Wright, *Some Account of the Life of Richard Wilson* (London, 1824); Thomas Hastings, *Etchings from the Works of Richard Wilson, with some Memoirs of his Life* (London, 1825). Many of Wilson's best works were reproduced by Woollett and other engravers of the time.

WILSON, ROBERT (d. 1600), English actor and playwright, was a comedian in the earl of Leicester's company, beginning with its establishment in 1574, and from 1583 to 1588 in the Queen's and afterwards in Lord Strange's company. He wrote several morality plays. In his *Three Ladies of London* (1584) he has the episode of the attempt of the Jew to recover his debt, afterwards adapted by Shakespeare in *The Merchant of Venice*. Another Robert Wilson (1579–1610), probably his son, was one of Henslowe's dramatic hack-writers.

WILSON, SIR ROBERT THOMAS (1777–1849), British general, was a son of the painter Benjamin Wilson (1721–1788), and obtained a commission in the 15th light dragoons in 1794, taking part in the famous charge at Villers-en-Cauchics. He was one of eight officers who received the emperor's commemoration medal (of which only nine were struck), the order of Maria Theresa and the dignity of Freiherr of the Empire. In the campaigns of Tourcoing and Tournay and in the retreat through Holland, Wilson repeatedly distinguished himself. In 1796 he became captain by purchase, in 1798 he served [illegible] brigade-major during the suppression of the Irish Rebellion, and in 1799 was with the 15th in the Helder expedition. Having in 1800 purchased a majority in a regiment serving in the Mediterranean he was sent on a military mission to Vienna in that year, but returned to take part in the battle of Alexandria. In 1802 he published an account of the expedition to Egypt, which was shortly afterwards translated into French, and created a considerable impression by its strictures upon French officers' barbarity. Wilson shortly afterwards produced a translation of General Regnier's work on the same campaign, with comments. Shortly afterwards Wilson published a work on the defects of the British army system which is remembered as the first protest against flogging. In 1804 he bought the colonelcy of the 19th light dragoons, in 1805 exchanged into the 20th, and in 1806 served with the 20th in the Cape of Good Hope expedition. In 1807 he was employed as military attaché of a mission to the king of Prussia, and so was present at Eylau, Heilsberg and Friedland, of which battles he published an account in 1810. Returning to England with despatches from St Petersburg he reached London before the Russian declaration of war and so gave the admiralty twenty-four hours' start in the operation at sea. In the early part of the Peninsular War Wilson raised and commanded the Lusitanian Legion, an irregular Portuguese corps which did good service in 1808 and 1809 and formed the starting-point of the new Portuguese army organized by Beresford in 1810. His services were rewarded by knighthood, a colonelcy in the British army and the Portuguese order of the Tower and Sword. In 1811, with the rank of brigadier-general, he went to Turkey, and in 1812 he travelled thence to Russia, where he was attached to Kutúzov's headquarters during the pursuit of the retreating French, being present at Malo-Jaroslavietz, Vyazma and Krasnoye. His account of the campaign, published in 1860, is one of the most valuable works on these events. He continued to serve with the Russian army during 1813 and distinguished himself at Lützen and Bautzen, the emperor Alexander decorating him with the knighthood of the St George order on the battlefield. He was promoted major-general in the British army about the same time. He was at Dresden, Kulm and Leipzig, and distinguished himself at the last great battle so much that Schwarzenberg writing to the British ambassador at Vienna attributed to Wilson's skill a large part in the successful issue of the battle. But his services in the counsels of the Allies were still more important on account of the confidence reposed in him personally by the allied sovereigns. But Castlereagh, treating Wilson as a political opponent, removed him to the minor theatre of Italy, in spite of the protests of the British ambassador. With the Austrian Army of Italy he served through the campaign of 1814. In 1816 after Waterloo he contrived the escape of one of Napoleon's supporters, condemned to death by the Restoration government, and was imprisoned for three months with his comrade in this adventure, Captain Hely-Hutchinson (3rd earl of Donoughmore), and censured by the commander-in-chief in a general order. In 1817 he published *The Military and Political Power of Russia*, in 1818 he became member of parliament for Southwark and in 1821 he interposed between the mob and the troops on the occasion of Queen Caroline's funeral, for which his political opponents secured his dismissal from the army, without compensation for the price of his commissions. He took an active part in politics on the opposition side, and also spent some time in Spain during the wars of 1822–23. On the accession of William IV., his political services in the formation of the Canning ministry of 1827 were rewarded by reinstatement in the army with the rank of lieutenant-general. But, disapproving of the Reform bill, he resigned his place in the Commons. He was promoted general in 1841 and appointed governor of Gibraltar in 1842. He died in London on the 9th of May 1849.

Besides the works mentioned above, Wilson left a diary of his travels and experiences in 1812–1814, published in 1861, and an incomplete autobiography, published two years later.

WILSON, THOMAS (*c.* 1525–1581), English statesman and critic, the son of Thomas Wilson of Strubby, in Lincolnshire, was born about 1525. He was educated at Eton and King's College, Cambridge, where he joined the school of Hellenists to which Cheke, Thomas Smith, Walter Haddon and others belonged. He graduated B.A. in 1546 and M.A. in 1549. In 1551 he produced, in conjunction with Walter Haddon, a Latin life of Henry and Charles Brandon, dukes of Suffolk. His earliest work of importance was *The Rule of Reason, conteinynge the Arte of Logique set forth in Englishe* (1551), which was frequently reprinted. It has been maintained that the book on which Wilson's fame mainly rests, *The Arte of Rhetorique*, was printed about the same time, but this is probably an error: the first edition extant is dated January 1553. It is the earliest systematic work of literary criticism existing in the English language. Wilson threw in his lot with the Dudley family, and when they fell, he fled to the Continent. He was with Sir John Cheke in Padua in 1555–1557, and afterwards at Rome, whither in 1558 Queen Mary wrote, ordering him to return to England to stand his trial as a heretic. He refused to come, but was arrested by the Roman Inquisition and tortured. He escaped, and fled to Ferrara, but in 1560 he was once more in London. Wilson became Master of St Katherine's Hospital in the Tower, and entered parliament in January 1563. In 1570 he published a translation, the first attempted in English, of the *Olynthiacs* and *Philippics* of Demosthenes, on which he had been engaged since 1556. His *Discourse upon Usury* appeared in 1572. From 1574 to 1577, Wilson, who had now become a prominent person in the diplomatic world, was principally engaged on embassies to the Low Countries, and on his return to England he was made a privy councillor and sworn secretary of state; Walsingham was his colleague. In 1580, although he was not in holy orders, Queen Elizabeth made Wilson dean of Durham. He died at St Katherine's Hospital on the 16th of June 1581, and was buried next day, "without charge or pomp," at his express wish. *The Arte of Rhetorique* gives Wilson a high place among the earliest artificers of English style; and it is interesting to see that he was opposed to pedantry of phrase, and above all to a revival of uncouth medieval forms of speech, and encouraged a simpler manner of prose writing than was generally appreciated in the middle of the 16th century.

WILSON, THOMAS (1663–1755), English bishop, was born at Burton, Cheshire, and educated at Trinity College, Dublin. He was ordained in 1686, and became curate at Newchurch Kenyon, Lancashire. In 1692 he was appointed chaplain to the 9th earl of Derby, who in 1697 offered him the bishopric of Sodor and Man. He was consecrated bishop in 1698. His episcopate was marked by a number of reforms in the Isle of Man. New churches were built, libraries founded and books were printed in Manx, his *Principles and Duties of Christianity* (London, 1707) being the first book published in that language. He also encouraged farming, and set the example of planting fruit and forest trees. In order to restore discipline in the island he drew up in 1704 his well-known *Ecclesiastical Constitutions.* The judgments of his courts often brought him into conflict with the governors of the island, and in 1722 he was even imprisoned for a time in Castle Rushen. In 1737, however, the jurisdiction of the civil and spiritual courts was better defined by new statutes, the lordship of the island having passed in 1736 to James Murray, 2nd duke of Atholl, with whom Wilson had no personal difficulties. In 1749 on Zinzendorf's invitation he accepted the title of Antistes—a synonym for bishop—in the Moravian Church.

A life of Wilson, by John Keble, was published with his *Works* (Oxford, 1847–1863). The Sodor and Man Theological School in the Isle of Man is called in his memory the Bishop Wilson School.

WILSON, SIR WILLIAM JAMES ERASMUS, generally known as Sir Erasmus Wilson (1809–1884), British surgeon and philanthropist, was born in London on the 25th of November 1809, studied at St Bartholomew's Hospital in London, and at Aberdeen, and early in life became known as a skilful operator and dissector. It was his sympathy with the poor of London and a suggestion from Thomas Wakley of the *Lancet*, of which Wilson acted for a time as sub-editor, which first led him to take up skin diseases as a special study. The horrible cases of scrofula, anaemia and blood-poisoning which he saw made him set to work to alleviate the sufferings of persons so afflicted, and he quickly established a reputation for treating this class of patient. It was said that he cured the rich by ordering them to give up luxuries; the poor, by prescribing for them proper nourishment, which was often provided out of his own pocket. In the opinion of one of his biographers, we owe to Wilson in great measure the habit of the daily bath, and he helped very much to bring the Turkish bath into use in Great Britain. He wrote much upon the diseases which specially occupied his attention, and his books, *A Healthy Skin* and *Student's Book of Diseases of the Skin*, though they were not received without criticism at the time of their appearance, long remained text-books of their subject. He visited the East in order to study leprosy, Switzerland that he might investigate the causes of goitre, and Italy with the purpose of adding to his knowledge of the skin diseases affecting an ill-nourished peasantry. He made a large fortune by his successful practice and by skilful investments, and, since he had no family, he devoted a great deal of his money to charitable and educational purposes. He founded in 1869 the chair and museum of dermatology in the Royal College of Surgeons, of which he was chosen president in 1881, and which just before his death awarded him its honorary gold medal, founded in 1800 and only six times previously awarded. He also founded a professorship of pathology at Aberdeen University. After the death of his wife the bulk of his property, some £200,000, went to the Royal College of Surgeons. In 1878 he earned the thanks of the nation, upon different grounds, by defraying the expense of bringing the Egyptian obelisk called Cleopatra's Needle from Alexandria to London, where it was erected on the Thames Embankment. The British government had not thought it worth the expense of transportation. He was knighted by Queen Victoria in 1881, and died at Westgate-on-Sea on the 7th of August 1884.

WILSON, WOODROW (1856–), American educationist, was born in Staunton, Virginia, on the 28th of December 1856. He graduated at Princeton in 1879, studied law at the University of Virginia in 1879–1880, practised law in Atlanta in 1882–1883, and received the degree of Ph.D. at Johns Hopkins University in 1886, his thesis being on *Congressional Government* (1885; and often reprinted). He was associate professor of history and political economy at Bryn Mawr in 1885–1888 and at Wesleyan University in 1888–1890; professor of jurisprudence and political economy at Princeton in 1890–1895, of jurisprudence in 1895–1897, and subsequently of jurisprudence and politics; and in 1902 he became president of Princeton University, being the first layman to hold that office. He retired in 1910, and was elected Democratic governor of New Jersey. His administration of the University was marked by the introduction of the "preceptorial" system, by the provision of dormitories and college eating-halls for members of the lower classes, and by the development of the graduate school.

He wrote: *The State: Elements of Historical and Practical Politics, Sketch of Institutional History and Administration* (1889); *The State and Federal Government of the United States* (1891); *Division and Reunion, 1829–1889* (1893) in the "Epochs of American History" series; *An Old Master and Other Political Essays* (1893); *Mere Literature and Other Essays* (1893); *George Washington* (1896), an excellent biography; the popular *History of the American People* (1902); *Constitutional Government in the United States* (1908), being Columbia University Lectures; and in the seventh volume of the *Cambridge Modern History* the chapter on "State Rights, 1850–1860."

WILTON, a market town and municipal borough in the Wilton parliamentary division of Wiltshire, England, 86 m. W. by S. of London, on the London & South-Western and Great Western railways. Pop. (1901) 2203. It lies among the pastures beside the rivers Nadder and Wylye. The church of St Mary and St Nicholas was built in 1844 by Lord Herbert of Lea, in a Romanesque style, richly adorned with marbles and mosaics. The central entrance is upheld by twisted columns based upon stone lions. The belfry is detached. Wilton House, a little to the south, was founded by William Herbert, first earl of Pembroke by the second creation, on the estates of the dissolved convent, which were granted him by Henry VIII.

Tradition says that Shakespeare and his company played here before James I. in 1603, and the house is rich in memories of Sir Philip Sidney the poet and soldier, of the artists Holbein and Vandyck, of the dramatists Jonson and Massinger, whose father was steward here, and of Inigo Jones the architect. The first folio edition of Shakespeare was dedicated, seven years after the poet's death, to the third earl and his brother. In style Wilton House is Italian of the 16th century, with a porch added by Holbein. The garden front was rebuilt and other changes made by the advice of Charles I., a frequent visitor; and many subsequent alterations were made. The art collections include the marbles gathered together by the eighth earl.

Carpet-making forms the main industry of Wilton; the most famous fabrics being those known as Wilton carpets; Saxony carpets made of short-staple wool; and the rich and durable Axminsters, long woven by hand at Axminster in Devonshire. It is also an important centre for the sale of sheep. The town is governed by a mayor, 4 aldermen and 12 councillors. Area, 1915 acres.

A chantry was founded here about A.D. 800, afterwards changed into a priory of Benedictine sisters, and refounded by Alfred. In 968 Wulftrude, a mistress of King Edgar, became abbess; and the same office was declined by her daughter Edith, who died at twenty-three. Miracles, it was said, were worked by Edith's remains, and she became patron saint of the convent, which afterwards gave shelter to many noble ladies and survived until the Dissolution. Its abbess was a baroness of England. Antiquaries have seen in Wilton the capital of a British kingdom. It was certainly the chief town of the Wilsaetas, or men of Wilts, whom Cynric the Saxon leader crushed in 556. It afterwards became a residence of the Wessex kings; and here, in 871, Alfred was severely defeated by the Danes. Wilton was burned in 1003 by Sweyn, the Danish king. After the Conquest it ranked among the richest of royal boroughs. In 1141 Queen Matilda celebrated Easter here with great pomp, and two years later Stephen, who came to found a castle, was driven off by her adherents. The prosperity of Wilton began to fail when Icknield Street, the great highway of commerce, was diverted to pass through Salisbury in 1224; and its decline was hastened by the plague, by which a third of the townsfolk were swept away in 1349.

Wilton (*Wylion*, *Wiltune*) was a seat of the West Saxon kings and a prosperous town until the removal thence in 1075 of the seat of the bishop of Sherborne to Sarum. The excessive number of markets held at the latter town in the 13th century caused its further decline into a poor and unimportant place. Sweyn burnt and sacked it in 1003, consequently under Edward the Confessor it rendered only £22. However, Domesday presents it as a valuable royal borough held in farm by the burgesses for £50. From 1204 onwards Wilton figures in various grants. Richard, earl of Cornwall, obtained it from Henry III., and William, earl of Pembroke, finally from Elizabeth. The first charter given by Henry I. (probably in 1101) granted franchises to the burgesses of the merchant gild and company of Wilton as enjoyed by London and Winchester, and was confirmed by succeeding monarchs from Henry II. to Henry VI. The corporation consisted in 1350 of a mayor, recorder, 5 aldermen, 3 capital burgesses, 11 common councilmen and other officers, the mayor being the returning officer. Two members were returned to parliament from 1293 to 1832 and one from 1832 to 1885, at which date Wilton lost its separate representation.

In 1414 Henry V. granted a fair on July 21 and 22. This was cancelled in 1416 and another substituted on July 22 and the three preceding days. Two yearly fairs were obtained by the burgesses from Henry VII. for four days from April 23 and September 1. In 1792 the fair days were November 13, September 12 and May 4; the two latter are still held, that in September being one of the largest sheep fairs in the west of England. Henry III. granted three markets weekly on Monday, Wednesday and Friday, and Henry VI., in 1433, one on Wednesday. The latter was still held in 1825, but had ceased in 1888.

WILTSHIRE [Wilts], a south-western county of England, bounded N.W. and N. by Gloucestershire, N.E. and E. by Berkshire, S.E. by Hampshire, S.W. and S. by Dorsetshire, and W. by Somersetshire. The area is 1374·9 sq. m. A great upland covers two-thirds of the county, comprising, in the north-east, Marlborough Downs, with Savernake Forest; in the centre, the broad undulating sweep of Salisbury Plain; and in the south, the more varied hills and dales of the Nadder watershed, the vale of Chalk and Cranborne Chase. Large tracts of the Chalk are over 600 ft. above the sea, rising in many parts into steep and picturesque escarpments. Several peaks attain an altitude of 900 ft., and Inkpen Beacon, on the borders of Berkshire, Wiltshire and Hampshire, reaches 1011 ft. Scattered in thousands over the downs lie huge blocks of silicious Tertiary grits, called sarsen stones or grey wethers, which were used by the primitive builders of Stonehenge and Avebury. The underlying Greensand is exposed in the deeper valleys of the Chalk, such as the vale of Pewsey, dividing Salisbury Plain from Marlborough Downs, and the vale of Chalk, dividing the Nadder westward from the heights of Cranborne Chase. One of the most charming features of the county is its fertile and well-wooded valleys. Three ancient forests remain: Cranborne Chase, which extends into Dorset, was a royal deer-park as early as the reign of John, and, like Savernake Forest, contains many noble old oaks and beeches. The main part of the New Forest belongs to Hampshire; but No Man's Land and Hampworth Common, its outlying heaths and coppices, encroach upon the south-eastern corner of Wilts. Bentley Wood, 5 m. E. of Salisbury, and the Great Ridge and Grovely Woods between the Nadder and Wylye, are fine uplands parks. There is no great sheet of water, but the reservoir near Swindon, and the lakes of Longleat, Stourton and Fonthill in the south-west of Earl Stoke near Westbury, and of Bowood, Corsham and Seagry near Chippenham, deserve mention for the beauty of their scenery. The upper reaches of the Thames skirt the north-eastern border, and three other considerable rivers drain the Wiltshire Downs. The Kennet, rising west of Marlborough, winds eastward into Berkshire and meets the Thames at Reading. The Lower or Bristol Avon flows from its source among the Cotteswolds in southern Gloucestershire, past Malmesbury, Chippenham, Melksham and Bradford, where it curves north-eastward into Somerset, finally falling into the Bristol Channel. Besides many lesser tributaries it receives from the south the Frome, which forms for about 5 m. the boundary between Wilts and Somerset. The East or Christchurch Avon, which rises near Bishops Cannings in the centre of the county, flows east and south into Hampshire, and enters the sea at Christchurch. Close to Salisbury it is joined by the united streams of the Nadder and the Wylye; by the Ebble, which drains the vale of Chalk; and by the Bourne, which flows south by west from its head near Ludgershall.

Geology.—As has been said, about two-thirds of the surface of Wilts is occupied by a great Chalk upland. Cropping out from beneath the Chalk is a fringe of the Selbornian—Upper Greensand and Gault—the former is well exposed in the vale of Pewsey, west of Devizes, and along the margins of the vale of Wardour; it forms a broad, hilly tract from Mere through Stourton to Warminster. The Gault Clay runs regularly at the foot of the Upper Greensand; it is excavated in several places for brick-making. The Lower Greensand, which oversteps the underlying formations, appears from beneath the Gault at Poulshot and follows the same line of outcrop northwards; a small outlier at Seend is worked for the iron it contains. About one-third of the county lying on the north-west side of the Chalk downs, including a portion of the vale of the White Horse, is occupied by Jurassic rocks. The Upper Lias—the oldest formation in the county—forms the floor of the valley near Box; it is followed by the overlying Inferior Oolite and Fuller's Earth. Then succeeds the Great Oolite Series, which includes the famous building-stones of Bath, quarried at Winsley Down, near Bradford, and at Box, Corsham Down and other places in the neighbourhood. Above the freestones near Bradford comes the Bradford clay, with the well-known fossil *Apiocrinus* or pear-encrinite, followed by the Forest Marble limestones and clays. The rubbly Cornbrash crops at Westwood, Trowbridge, and Malmesbury. Further east lies the outcrop of Oxfordian strata, comprising the sandy Kellaways beds and overlying Oxford Clay, together forming a broad low-lying tract in which stand Trowbridge, Melksham, Chippenham and Cricklade. Rising up from the eastern margin of the Oxfordian vale is the irregular scarp formed by the Corallian oolitic limestones and marls. The iron ores of Westbury are obtained in this formation. Another clay-bottomed vale lies on the eastern side of the Corallian ground, from near Calne to Swindon, where it is exploited for bricks. It appears also between Seend, Coulston and Westbury; also between Mere and Semley. About the former place it is brought into apposition with Cretaceous rocks through the agency of an east to west fault. At Tisbury and near Potterne are small outcrops of Portlandian rocks which yield the familiar building-stones of Tisbury and Chilmark. Limestones and clays of Purbeck age lie in the vale of Wardour about Teffont Evias. At Dinton in the same vale the Wealden formation just makes its appearance.

In the south-eastern corner of the county there are tracts of Tertiary Reading Beds and London Clay east of Downton and on the Clarendon Hills; these are covered by Bagshot Beds at Alderbury and Grinstead, also on Hampworth Common. Outliers of Reading Beds and London Clay occur about Great Bedwin; the sarsen stones previously referred to represent the last remnants of a mantle of Tertiary rocks which formerly covered the district. Here and there drift gravels and brick earths, besides low-level river gravels, rest upon the older rocks.

Agriculture.—Some five-sixths of the total area, a high proportion, is under cultivation, but a large amount of this is in permanent pasture. The soil, a heavy reddish loam, with a subsoil of broken stones, in the north-west, but lighter in the chalk region, is essentially that of a pastoral country, although there are wide tracts of richer land, suitable for wheat and beans. Oats, however, are the largest grain crop. There is a small acreage classified as hill pasture. The green crops consist mainly of turnips, mangolds and swedes. Bacon-curing is carried on. Large numbers of sheep are bred on the downs, and dairy-farming is practised in the north-west. There are manufactures of condensed milk. An agricultural college is established at Downton.

Manufactures.—A majority of the hands employed in factories and workshops are occupied in the locomotive works of the Great Western railway at Swindon. There are also large engineering works at Devizes. Cloth is still woven, though in greatly diminished quantities, at Trowbridge, Melksham, Chippenham and other places where water-power is available. Carpets are woven at Wilton, haircloth and coco-nut fibre at Melksham, silk at Malmesbury, Mere and Warminster. Portland and Bath stone are quarried for building purposes, while iron ore from mines near Westbury is smelted in that town.

Communications.—Three great railway lines traverse Wiltshire from E. to W., throwing out a number of branch lines to the larger towns. In the N. the Great Western main line passes through Swindon on its way from London to Bath. A second line of the same system runs also to Bath from Hungerford, by way of Devizes. South of Salisbury Plain the South-Western main line goes through Salisbury and the southern quarter of Wilts on its way into Somerset. The chief branch line is that between Salisbury and Westbury on the Great Western. The Midland & South-Western Junction railway runs north from Andover by Swindon, Cricklade and Cirencester. Swindon, Salisbury and Westbury are the three centres of railway traffic. The Avon is navigable as far as Salisbury, and goods are carried on the Thames & Severn Canal in the N.E., and on the Kennet & Avon Canal across Salisbury Plain. These waterways were formerly connected by a branch of the Berks & Wilts Canal, which runs S.W. from Berkshire, through Swindon and Melksham, but was closed in 1899.

The area of the ancient county is 879,943 acres, with a population in 1891 of 264,997 and in 1901 of 273,869. The area of the administrative county is 864,105 acres. The county contains 29 hundreds. The municipal boroughs are—Calne (pop. 3457), Chippenham (5074), Devizes (6532), Malmesbury (2854), Marlborough (3887), Salisbury, a city and the county town (17,117), Swindon (45,006), Wilton (2203). The urban districts are—Bradford-on-Avon (4514), Melksham (2450), Trowbridge (11,526), Warminster (5547), Westbury (3305). Other small towns are Cricklade (1517), Downton (1786), Highworth (2047), Mere (1977), Pewsey (1722), Wootton Bassett (2258). The county is in the western circuit, and assizes are held at Salisbury and Devizes. It has one court of quarter sessions, and is divided into 16 petty sessional divisions. The boroughs of Devizes and Salisbury have separate courts of quarter sessions and commissions of the peace, and the borough of Marlborough has a separate commission of the peace. There are 335 civil parishes. Wiltshire is mainly in the diocese of Salisbury, but a considerable part is in that of Bristol, and small parts in those of Gloucester, Oxford and Winchester. It contains 322 ecclesiastical parishes or districts, wholly or in part. The county is divided into five parliamentary divisions, each returning one member—Northern or Cricklade, North-western or Chippenham, Western or Westbury, Eastern or Devizes and Southern or Wilton. It also contains the parliamentary borough of Salisbury, returning one member.

History.—The English conquest of the district now known as Wiltshire began in 552 with the victory of Cynric at Old Sarum, by which the way was opened to Salisbury Plain. Four years later, pushing his way through the vale of Pewsey, Cynric extended the limits of the West Saxon kingdom to the Marlborough Downs by a victory at Barbury Hill At this period the district south of the Avon and the Nadder was occupied by dense woodland, the relics of which survive in Cranborne Chase, and the first wave of West Saxon colonization was chiefly confined to the valleys of the Avon and the Wylye, the little township of Wilton which arose in the latter giving the name of Wilsaetan to the new settlers. By the 9th century the district had acquired a definite administrative and territorial organization, Walstan, ealdorman of the Wilsaetan, being mentioned as early as 800 as repelling an attempted invasion of the Mercians. Moreover, "Wiltunscire" is mentioned by Asser in 878, in which year the Danes established their headquarters at Chippenham and remained there a year, plundering the surrounding country. In the time of Æthelstan mints existed at Old Sarum, Malmesbury, Wilton, Cricklade and Marlborough. Wilton and Salisbury were destroyed by the Danish invaders under Sweyn in 1003, and in 1015 the district was harried by Canute.

With the redistribution of estates after the Conquest more than two-fifths of the county fell into the hands of the church; the possessions of the crown covered one-fifth; while among the chief lay proprietors were Edward of Salisbury, William, count of Ewe, Ralph de Mortimer, Aubrey de Vere, Robert Fitzgerald, Miles Crispin, Robert d'Oily and Osbern Giffard. The first earl of Wiltshire after the Conquest was William le Scrope, who received the honour in 1397. The title subsequently passed to Sir James Butler in 1449, Sir John Strafford in 1470, Sir Thomas Boleyn in 1529, and in 1550 to the Paulett family. The Benedictine foundations at Wilton, Malmesbury and Amesbury existed before the Conquest; the Augustinian house at Bradenstoke was founded by Walter d'Evreux in 1142; that at Lacock by Ela, countess of Salisbury, in 1232; that at Longleat by Sir John Vernon before 1272. The Cluniac priory of Monkton Farleigh was founded by Humphrey de Bohun in 1125; the Cistercian house at Kingswood by William de Berkeley in 1139; and that of Stanley by the Empress Maud in 1154.

Of the forty Wiltshire hundreds mentioned in the Domesday Survey, Selkley, Ramsbury, Bradford, Melksham, Calne, Whorwellsdown, Westbury, Warminster, Heytesbury, Kinwardstone, Ambresbury, Underditch, Furstfield, Alderbury and Downton remain to the present day practically unaltered in name and extent; Thorngrave, Dunelawe and Cepeham hundreds form the modern hundred of Chippenham; Malmesbury hundred represents the Domesday hundreds of Cicemethorn and Sterchelee, which were held at farm by the abbot of Malmesbury; Highworth represents the Domesday hundreds of Crechelade, Scipe, Wurde and Staple; Kingbridge the hundreds of Chingbridge, Blachegrave and Thornhylle; Swanborough the hundreds of Rugeberge, Stodfæd and Swaneberg; Branch the hundreds of Branchesberge and Dolesfeld; Cawden the hundreds of Cawdon and Cadworth. A noticeable feature in the 14th century is the aggregation of church manors into distinct hundreds, at the court of which their ecclesiastical owners required their tenants to do suit and service. Thus the bishop of Winchester had a separate hundred called Kurwel Bishop, afterwards absorbed in Downton hundred; the abbot of Damerham had that of Damerham; and the prior of St Swithin's that of Elstub, under each of which were included manors situate in different parts of the county.

The meeting-place of Swanborough hundred was at Swanborough Tump, a hillock in the parish of Manningford Abbots identified as the moot-place mentioned in the will of King Alfred; that of Malmesbury was at Colepark; that of Bradford at Bradford Leigh; that of Warminster at Iley Oak, about 2 m. south of Warminster, near Southleigh Wood. The shire court for Wiltshire was held at Wilton, and until 1446 the shrievalty was enjoyed ex officio by the castellans of Old Sarum. Edward of Salisbury was sheriff at the time of the Domesday Survey, and the office remained hereditary in his family, descending to William Longespee by his marriage with Ela, great-granddaughter of Edward. In the 13th century the assizes were held at Wilton, Malmesbury and New Sarum.

On the division of the West Saxon see in 703 Wiltshire was included in the diocese of Sherborne, but in 905 a separate diocese of Wilton was founded, the see being fixed alternately at Ramsbury, Wilton and Sunning in Berkshire. Shortly before the Conquest Wilton was reunited to the Sherborne diocese, and by the synod of 1075–1076 the see was transferred to Salisbury. The archdeaconries of Wiltshire and Salisbury are mentioned in 1180; in 1291 the former included the deaneries of Avebury, Malmesbury, Marlborough and Cricklade within this county, and the latter the deaneries of Amesbury, Potterne, Wilton, Chalke and Wylye. In 1535 the archdeaconry of Salisbury included the additional deanery of Salisbury, while Potterne deanery had been transferred to the archdeaconry of Wiltshire. The deaneries of the archdeaconry of Salisbury have remained unaltered; Wiltshire archdeaconry now includes the deaneries of Avebury, Marlborough and Potterne; and the deaneries of Chippenham, Cricklade and Malmesbury form part of the archdeaconry and diocese of Bristol.

The inhabitants of Wiltshire have always been addicted to industrial rather than warlike pursuits, and the political history of the county is not remarkable. In 1086, after the completion of the Domesday Survey, Salisbury was the scene of a great council, in which all the landholders took oaths of allegiance to the king, and a council for the same purpose assembled at Salisbury in 1116. At Clarendon in 1166 was drawn up the assize which remodelled the provincial administration of justice. Parliaments were held at Marlborough in 1267 and at Salisbury in 1328 and 1384. During the wars of Stephen's reign Salisbury, Devizes and Malmesbury were garrisoned by Roger, bishop of Salisbury, for the empress, but in 1138 Stephen seized the bishop and captured Devizes Castle. In 1216 Marlborough Castle was surrendered to Louis by Hugh de Neville. Hubert de Burgh escaped in 1233 from Devizes Castle, where he had been imprisoned in the previous year. In the Civil War of the 17th century Wiltshire actively supported the parliamentary cause, displaying a spirit of violent anti-Catholicism, and the efforts of the marquess of Hertford and of Lord Seymour to raise a party for the king met with vigorous resistance from the inhabitants. The Royalists, however, made some progress in the early stage of the struggle, Marlborough being captured for the king in 1642, while in 1643 the forces of the earl of Essex were routed by Charles I. and Prince Rupert at Aldbourne, and in the same year Waller, after failing to capture Devizes, was defeated in a skirmish at Roundway Down. The year 1645 saw the rise of the "Clubmen" of Dorset and Wiltshire, whose sole object was peace; they systematically punished any member of either party discovered in acts of plunder. Devizes, the last stronghold of the Royalists, was captured by Cromwell in 1645. In 1655 a rising organized on behalf of the king at Salisbury was dispersed in the same year.

At the time of the Domesday Survey the industrial pursuits of Wiltshire were almost exclusively agricultural; 390 mills are mentioned, and vineyards at Tollard and Lacock. In the succeeding centuries sheep-farming was vigorously pursued, and the Cistercian monasteries of Kingswood and Stanlegh exported wool to the Florentine and Flemish markets in the 13th and 14th centuries. Wiltshire at this time was already reckoned among the chief of the clothing counties, the principal centres of the industry being Bradford, Malmesbury, Trowbridge, Devizes and Chippenham. In the 16th century Devizes was noted for its blankets, Warminster had a famous corn-market, and cheese was extensively made in north Wiltshire. Amesbury was famous for its tobacco pipes in the 16th century. The clothing trade went through a period of great depression in the

17th century, partly owing to the constant outbreaks of plague. Linen, cotton, gloves and cutlery were also manufactured in the county, silk at Malmesbury and carpets at Wilton.

In 1295 Wiltshire was represented by no less than twenty-eight members in parliament, the shire returning two knights, and the boroughs of Bedwin, Bradford, Calne, Chippenham, Cricklade, Devizes, Downton, Ludgershall, Malmesbury, Marlborough, Old Sarum, Salisbury and Wilton, two burgesses each, but the boroughs for the most part made very irregular returns. Hindon, Heytesbury and Wootton Bassett were enfranchised in the 15th century, and at the time of the Reform Act of 1832 the county with sixteen boroughs returned a total of thirty-four members. Under the latter act Great Bedwin, Downton, Heytesbury, Hindon, Ludgershall, Old Sarum and Wootton Bassett were disfranchised, and Calne, Malmesbury, Westbury and Wilton lost one member each. Under the act of 1868 the county returned two members in two divisions, and Chippenham, Devizes and Marlborough lost one member each. Under the act of 1885 the county returned five members in five divisions; Cricklade, Calne, Chippenham, Devizes, Malmesbury, Marlborough, Westbury and Wilton were disfranchised; and Salisbury lost one member.

Antiquities.—Wiltshire is extraordinarily rich in prehistoric antiquities. The stone age is represented by a number of flint and stone implements, preserved in the unsurpassed collection at Salisbury Museum. Stonehenge, with its circles of giant stones, and Avebury, with its avenues of monoliths leading to what was once a stone circle, surrounded by an earthwork, and enclosing two lesser circles, are the largest and most famous megalithic works in England. A valley near Avebury is filled with immense sarsen blocks, resembling a river of stone, and perhaps laid there by prehistoric architects. There are also menhirs, dolmens and cromlechs. Surrounded as they were by forests and marshy hollows, it is clear that the downs were densely peopled at a very early period. Circles, formed by a ditch within a bank, are common, as are grave-mounds or barrows. These have been classified according to their shape as bell-barrows, bowl-barrows and long barrows. Bones, ashes, tools, weapons and ornaments have been dug up from such mounds, many of which contain kistvaens or chambers of stone. The "lynchets" or terraces which score some of the hillsides are said to be the work of primitive agriculturists. Ancient strongholds are scattered over the county. Among the most remarkable are Vespasian's Camp, near Amesbury; Silbury Hill, the largest artificial mound in Europe, near Avebury; the mounds of Marlborough and Old Sarum; the camps of Battlesbury and Scratchbury, near Warminster; Yarnbury, to the N. of Wylye, in very perfect preservation; Casterley, on a ridgeway about 7 m. E.S.E. of Devizes; Whitesheet and Winkelbury, overlooking the vale of Chalk; Chisbury, near Savernake; Sidbury, near Ludgershall; and Figbury Ring, 3 m. N.E. of Salisbury. Ogbury, 6 m. N. of Salisbury, is an undoubted British enclosure. Durrington Walls, N. of Amesbury, are probably the remains of a British village, and there are vestiges of others on Salisbury Plain and Marlborough Downs.

There are many signs of the Roman rule. Wans Dyke or Woden's Dyke, one of the largest extant entrenchments, runs west for about 60 m. from a point east of Savernake, nearly as far as the Bristol Channel, and is almost unaltered for several miles along the Marlborough Downs. Its date is uncertain; but the work has been proved, wherever excavated, to be Roman or Romano-British. It consists of a bank, with a trench on the north side, and was clearly meant for defence, not as a boundary. Forts strengthened it at intervals. Bokerly Dyke, which forms a part of the boundary between Wilts and Dorset, is the largest among several similar entrenchments, and has also a ditch north of the rampart.

Chief among the few monastic buildings of which any vestiges remain are the ruined abbeys of Malmesbury and of Lacock near Melksham. There are some traces of the hospital for leprous women afterwards converted into an Austin priory at Maiden Bradley. Monkton Farleigh, farther north along the Somerset border, had its Cluniac priory, founded as a cell of Lewes in the 13th century, and represented by some outbuildings of the manor-house. A college for a dean and 12 prebendaries, afterwards a monastery of Bonhommes, was founded in 1347 at Edington. The church, Decorated and Perpendicular, resembles a cathedral in size and stately beauty. The 14th century buildings of Bradenstoke Priory or Cleck Abbey, founded near Chippenham for Austin canons, are incorporated in a farmhouse. The finest churches of Wiltshire, generally Perpendicular, were built in the districts where good stone could be obtained, while the architecture is more simple in the Chalk region, where flint was used perforce. Small wooden steeples and pyramidal bell-turrets are not uncommon; and the churches of Purton, 3½ m. N.W. of Swindon, and Wanborough, 3 m. S.E., have each two steeples, one in the centre, one at the west end. St Lawrence's church at Bradford-on-Avon is one of the most perfect Saxon ecclesiastical buildings in England; and elsewhere there are fragments of Saxon work imbedded in later masonry. Such are three arches in the nave of Britford church, within a mile of Salisbury; the east end of the chancel at Burcombe, near Wilton; and parts of the churches at Bremhill, and at Manningford Bruce or Braose in the vale of Pewsey. St John's at Devizes retains its original Norman tower and has Norman masonry in its chancel; while the chancel of St Mary's, in the same town, is also Norman, and the porch has characteristic Norman mouldings. The churches of Preshute, near Marlborough, Ditteridge or Ditcheridge, near Box, and Nether Avon, near Amesbury, preserve sundry Norman features. Early English is illustrated by Salisbury Cathedral, its purest and most beautiful example; and, on a smaller scale, at Amesbury, Bishops Cannings, Boyton in the vale of the Wylye, Collingbourne Kingston, east of Salisbury Plain, Downton and Potterne, near Devizes. Bishopstone, in the vale of Chalk, has the finest Decorated church in the county, with a curious external cloister, and unique south chancel doorway, recessed beneath a stone canopy. Mere, close to the borders of Dorset and Somerset, is interesting not only for its Perpendicular church, but for a medieval chantry, used as a schoolhouse by Barnes, the Dorsetshire poet, and for its 14th-century dwelling-houses.

The castles of Wiltshire have been almost entirely swept away. At Old Sarum, Marlborough and Devizes only a few vestiges are left in walls and vaults. Castle Combe and Trowbridge castle have long been demolished, and of Ludgershall castle only a small fragment survives. The ruins of Wardour castle, standing in a richly wooded park near Tisbury, date from the 14th century, and consist of a hexagonal outer wall of great height, enclosing an open court. Two towers overlook the entrance. The 18th-century castle, one mile distant, across the park, is noteworthy for its collection of paintings, and, among other curiosities, for the "Glastonbury Cup," said to be fashioned out of a branch of the celebrated thorn-tree at Glastonbury. The number of old country houses is a marked feature in Wilts. Few parishes, especially in the N.W., are without their old manor-house, usually converted into a farm, but preserving its flagged roof, stone-mullioned windows, gabled front, two-storeyed porch and oak-panelled interior. Place House, in Tisbury, and Barton Farm, at Bradford, date from the 14th century. Fifteenth-century work is best exemplified in the manor-houses of Norrington, in the vale of Chalk; Teffont Evias, in the vale of Nadder; Potterne; and Great Chaldfield, near Monkton Farleigh. At South Wraxall the hall of a very beautiful house of the same period is celebrated in local tradition as the spot where tobacco was first smoked in England by Sir Walter Raleigh and his host, Sir Walter Long. Later styles are represented by Longford Castle, near Salisbury, where the picture galleries are of great interest; by Heytesbury Park; by Wilton House at Wilton, Kingston House at Bradford, Bowood near Calne, Longleat near Warminster, Corsham Court, Littlecote near Ramsbury, Charlton House near Malmesbury, Compton Chamberlayne in the Nadder valley, Grittleton House and the modern Castle Combe, both near Chippenham and Stourhead, on the borders of Dorset and Somerset. Each of these is noteworthy for its architecture, its art treasures or the beauty of its surroundings.

See *Victoria County History, Wiltshire*; Sir R. C. Hoare, *The Ancient History of Wiltshire* (2 vols., London, 1812–1821), *The History of Modern Wiltshire* (14 pts., London, 1822–1844); Aubrey's *Collections for Wiltshire*, edited by Sir T. Phillipps, pts. 1, 2 (London, 1821); Leland's *Journey through Wiltshire, A.D. 1540–1542*, with notes by J. E. Jackson (Devizes, 1875); W. H. Jones, *Domesday for Wiltshire* (Bath, 1865); John Britton, *The Beauties of Wiltshire* (3 vols., London, 1801–1825); J. E. Jackson, *The Sheriff's Tourn, Co. Wilts, A.D. 1439* (Devizes, 1872); see also *Proceedings* of the Wiltshire Archaeological and Natural History Society.

WIMBLEDON, a municipal borough and western residential suburb of London, in the Wimbledon parliamentary division of Surrey, England, adjoining the metropolitan borough of Wandsworth, 8 m. S.W. of Charing Cross. Pop. (1891), 25,777; (1901) 41,652. Wimbledon Common, to the north-west of the district, forms a continuation of Putney Heath and a pleasant recreation ground. It was the meeting-place of the Rifle Association from its foundation in 1860 till 1888. The parish church of St Mary is supposed to date from Saxon times; but, after it had undergone various restorations and reconstructions, it was rebuilt in 1833 in the Perpendicular style. There are various other churches and chapels, all modern. A free library was established in 1887. Benevolent institutions are numerous. The corporation consists of a mayor, 6 aldermen, and 18 councillors. Area, 3221 acres.

Wimbledon (Wibbandune) is supposed to have been the scene of a battle in 568 between Ceawlin, king of Wessex, and Æthelberht, king of Kent, in which Æthelberht was defeated, and an earthwork which existed on the Common may have marked the site. At

Coombe's Hill and elsewhere British relics have been found. At Domesday Wimbledon formed part of the manor of Mortlake, held by the archbishops of Canterbury. Afterwards the name was sometimes used interchangeably with Mortlake, and in 1327 it is described as a grange or farm belonging to Mortlake. On the impeachment of Arundel, archbishop of Canterbury, in 1398, it was confiscated. In the reign of Henry VIII. Cromwell, earl of Essex, held the manor of Wimbledon, with Bristow Park as an appendage. On the confiscation of Cromwell's estates in 1540 it again fell to the crown, and by Henry VIII. it was settled on Catherine Parr for life. By Queen Mary it was granted to Cardinal Pole. In 1574 Elizabeth bestowed the manor-house, while retaining the manor, on Sir Christopher Hatton, who sold it the same year to Sir Thomas Cecil. In 1588 Elizabeth transferred the manor to his son Sir Edward Cecil, in exchange for an estate in Lincolnshire. At the time of the Civil War the manor was sold to Adam Baynes, a Yorkshireman, who shortly afterwards sold it to General Lambert; and at the Restoration it was granted to the queen dowager, Henrietta Maria, who sold it in 1661 to George Digby, earl of Bristol. On his death in 1676 it was sold by his widow to the lord-treasurer Danby. Some years after Danby's death it was purchased by Sarah, duchess of Marlborough, who bequeathed it to her grandson, John Spencer. It was sold by the fifth Earl Spencer in 1877. Wimbledon House, built by Sir Thomas Cecil in 1588, was replaced by another building in 1735 by the duchess of Marlborough; this was destroyed by fire in 1785, and a new house, called Wimbledon Park House, was erected about 1801. Wimbledon was incorporated in 1905.

WIMBORNE (Wimborne Minster), a market town, in the eastern parliamentary division of Dorsetshire, England, 111½ m. S.W. by W. from London by the London & South-Western railway; served also by the Somerset and Dorset railway. Pop. of urban district (1901) 3696. It is situated on a gentle slope above the river Allen near its confluence with the Stour. The church or minster of St Cuthberga is a fine cruciform structure of various styles from Early Norman to Perpendicular, and consists of a central lantern tower, nave and choir with aisles, transepts without aisles, western or bell tower, north and south porches, crypt and vestry or sacristy, with the library over it. It contains a large number of interesting monuments, including a brass with the date 873 (supposed to mark the resting-place of King Æthelred I.), a lunar orrery of the 14th century and an octagonal Norman font of Purbeck marble. There is a church dedicated to St John the Evangelist. The free grammar school occupies modern buildings in the Elizabethan style. Near Wimborne is Canford Manor, the seat of Lord Wimborne, a mansion in the Tudor style, built by Blore in 1826, and improved from designs of Sir Charles Barry. The town depends chiefly on agriculture; but the manufacture of hose is carried on to a small extent, and there are also coachbuilding works.

Although Wimborne (*Wimburn*) has been identified with the *Vindogladia* of the Antonine Itinerary, the first undoubted evidence of settlement is the entry of the Anglo-Saxon Chronicle, under the date 718, that Cuthburh, sister of King Ine, founded the abbey here and became the first abbess; the house is also mentioned in a somewhat doubtful epistle of St Aldhelm in 705. The importance of the foundation made it the burial-place of King Æthelred in 871, and of King Sifferth in 962. Æthelwald seized and fortified Wimborne in his revolt in 901 against Edward the Elder. The early abbey was probably destroyed by the Danes in the reign of Æthelred the Unready (978–1015), for in 1043 Edward the Confessor founded here a college of secular canons. The college remained unaltered until 1496, when Margaret, countess of Richmond, obtained letters patent from her son, Henry VII., to found a chantry, in connexion with which she established a school. The continuance of this was recommended by the commissioners of 1547, and in 1562 Elizabeth vested a great part of the property of the former college in a school corporation of twelve governors, who had charge of the church. New charters for the school were obtained from James I. in 1562 and from Charles I. At the conquest Wimborne was a royal borough, ancient demesne of the crown, and part of the manor of Kingston Lacy, which Henry I. gave to Robert Mellent, earl of Leicester. From him it descended by marriage to the earls of Lincoln, and, then passing by marriage to Earl Thomas of Lancaster, it became parcel of the county and later of the duchy of Lancaster; an inquisition of 1352 found that Henry, duke of Lancaster, had 77s. 3d. rent of assize in the borough of Wimborne. The borough is again mentioned in 1487–1488, when John Plecy held six messuages in free burgage of the king as of his borough of Wimborne, but it seems to have been entirely prescriptive, and was never a parliamentary borough. The town was governed until the 19th century by two bailiffs, chosen annually at a court leet of the royal manor of Wimborne borough, part of the manor of Kingston Lacy. The market held here on Friday of each week is not mentioned in Domesday Book, but seems to be of early origin. Wimborne carried on considerable manufactures of linen and woollen goods until the time of Charles II., when they declined, their place being taken by the stocking-knitting industry of the 18th century.

See John Hutchins, *The History and Antiquities of the County of Dorset* (3rd edition, Westminster, 1861); Anon., *History of Wimborne Minster* (London, 1860).

WIMPFFEN, EMMANUEL FELIX DE (1811–1884), French soldier. Entering the army from the military school of St Cyr, he saw considerable active service in Algeria, and in 1840 became captain, in 1847 *chef de bataillon*. He first earned marked distinction in the Crimean War as colonel of a Turco regiment, and his conduct at the storm of the Mamelon won him the grade of general of brigade. In the campaign of 1859 he was with General MacMahon at Magenta at the head of a brigade of Guard Infantry, and again won promotion on the field of battle. Between this campaign and that of 1870 he was mainly employed in Algeria, and was not at first given a command in the ill-fated "Army of the Rhine." But when the earlier battles revealed incapacity in the commander of the 5th corps, De Wimpffen was ordered to take it over, and was given a dormant commission appointing him to command the Army of Châlons in case of Marshal MacMahon's disablement. He only arrived at the front in time to rally the fugitives of the 5th corps, beaten at Beaumont, and to march them to Sedan. In the disastrous battle of the 1st of September, MacMahon was soon wounded, and the senior officer, General Ducrot, assumed the command. Ducrot was beginning to withdraw the troops when Wimpffen produced his commission and countermanded the orders. In consequence it fell to him to negotiate the surrender of the whole French army. After his release from captivity, he lived in retirement at Algiers, and died at Paris in 1884. His later years were occupied with polemical discussions on the surrender of Sedan, the responsibility for which was laid upon him.

He wrote, amongst other works, *Sedan* (1871), *La Situation de la France, et les réformes nécessaires* (1873) and *La Nation armée* (1875).

WINBURG, a town in the Orange Free State, 90 m. N.E. by rail of Bloemfontein. Pop. (1904) 2762, of whom 1003 were whites. It is built by the banks of a tributary of the Vet affluent of the Vaal, and is a trading centre for a large grain and pastoral district. It is joined to the trunk railway from Port Elizabeth to the Transvaal by a branch line from Smaldeel, 28 m. N.W. The town was founded in 1837 by Commandant H. Potgieter, one of the voortrekers, and was named by him in commemoration of a victory gained over the Matabele chief Mosilikatze. It became the capital of a quasi-independent Boer state, which included considerable areas north of the Vaal. In 1848 the town and district were annexed to Great Britain and thereafter followed the fortunes of the Orange river sovereignty (see Orange Free State). In the Boer War of 1899–1902 Winburg was one of the Boer centres in the guerrilla fighting which followed the fall of Pretoria.

WINCHCOMB, a market town in the northern parliamentary division of Gloucestershire, England, 7 m. N.E. of Cheltenham. Pop. (1901) 2864. It is picturesquely situated among the Cotteswold Hills, in the narrow valley of the Isbourne stream. The Perpendicular church of St Peter, cruciform, with a central tower, is a good example of its period. In the vicinity is Sudeley Castle, originally built by Thomas Boteler, Lord Sudeley (d. 1398). By gift of Edward VI. it came into the hands of Sir Thomas Seymour, fourth husband of Catherine Parr; this queen died here and was buried in the chapel. The castle suffered severely at the hands of the parliamentarians in 1644, and remained ruinous until 1837, when a careful restoration was begun. There are a tower of the 14th century, and considerable remains of the 15th, the inhabited portion being mainly of Tudor date. There are flour mills, paper-works and tanneries at Winchcomb.

Excavations prove that there were both British and Roman settlements at Winchcomb (*Wincelcumbe*, *Winchelcumbe*). It owed its growth to the foundation of religious houses by Offa and Coenwulf of Mercia in the 8th century. It became a borough in Saxon times, was the chief town of a shire to which it gave its name, and was the seat of government of the Mercian kings. Witenagemots were held there in 771 and 942. Harold, earl of Wessex, was the first overlord. It had become a royal borough by 1087, and was granted by a charter of 1224 to the abbots of St Mary's to be held of the king by a rent of £50. Winchcomb never received a charter and was not incorporated, but as a borough by prescription it was governed by 2 bailiffs and 10 chief burgesses until the corporate body was dissolved by act of parliament in 1883. It was never represented in parliament except by its mitred abbots before the dissolution of the monasteries. There is no trace of the original grant of a fair on July 17 (now held on July 28), but it is mentioned as already existing in a charter of 1221, which changed the market day from Sunday to Saturday. Elizabeth granted another fair on April 25 by charter in 1575. A Tuesday market was also granted under this charter, but the Saturday market only is now held. Both the modern fairs are horse and cattle fairs, but in the middle ages they were centres of the cloth manufacture. Tanning has been a local industry since the beginning of the 19th century, and paper and silk factories were introduced about 1830. Winchcomb took the side of the king in the Civil War and was twice plundered.

See *Victoria County History, Gloucestershire*; Emma Dent, *Annals of Winchecombe* (1877); David Royce, *Winchecombe Cartulary* (1892).

WINCHELSEA, ANNE FINCH, Countess of (1661–1720), English author, daughter of Sir William Kingsmill of Sidmonton, near Southampton, was born in April 1661. Five months later her father died, and her mother married in 1662 Sir Thomas Ogle. Lady Ogle died in 1664, and nothing is heard of her daughter Anne until 1683, when she is mentioned as one of the maids of honour of Mary of Modena, duchess of York. She married in May 1684 Colonel Heneage Finch, who was attached to the duke of York's household. To him she addressed poems and versified epistles, in which he figures as Daphnis and she as Ardelia. At the Revolution Heneage Finch refused the oath of allegiance to William and Mary, and he and his wife had no fixed home until they were invited in 1690 to Eastwell Park, Kent, by Finch's nephew Charles, 4th earl of Winchelsea, on whose death in 1712 Heneage Finch succeeded to the earldom. The countess of Winchelsea died in London on the 5th of August 1720, leaving no issue, her husband surviving until 1726.

Lady Winchelsea's poems contain many copies of verse addressed to her friends and contemporaries. She was to some extent a follower of the "matchless Orinda" in the fervour of her friendships. During her lifetime she published her poem "The Spleen" in *Gildon's Miscellany* (1701) and a volume of *Poems* in 1713 which included a tragedy called *Aristomenes*. With Alexander Pope she was on friendly terms, and one of the seven commendatory poems printed with the 1717 edition of his works was by her. But in the farce *Three Hours after Marriage* (1717) attributed to Gay, but really the work of Pope, Arbuthnot and Gay, she is ridiculed as the learned lady, Phoebe Clinket, a character assigned to Pope's hand. Lady Winchelsea's poems were almost forgotten when Wordsworth in the "Essay, supplementary to the Preface" of his *Poems* (1815), drew attention to her nature-poetry, asserting that with the exception of Pope's "Windsor Forest" and her "Nocturnal Reverie," English poetry between *Paradise Lost* and Thomson's *Seasons* did not present "a single new image of external nature." Wordsworth sent at Christmas 1819 a MS. of extracts from Lady Winchelsea and other writers to Lady Mary Lowther, and his correspondence with Alexander Dyce contains some minute criticism and appreciation of her poetry.

Mr Edmund Gosse wrote a notice of her poems for T. H. Ward's *English Poets* (vol. iii., 1880), and in 1884 came into possession of a MS. volume of her poems. A complete edition of her verse, *The Poems of Anne, Countess of Winchelsea*, was edited by Myra Reynolds (Chicago, 1903) with an exhaustive essay. See also E. Gosse, *Gossip in a Library* (1891), and E. Dowden, *Essays, Modern and Elizabethan*. Wordsworth's anthology for Lady Mary Lowther was first printed in 1905 (Oxford). Some of her work remains in MS. in the possession of Professor Dowden.

WINCHELSEA, ROBERT (d. 1313), archbishop of Canterbury, was probably born at Old Winchelsea. He studied and then taught at the universities of Paris and Oxford, where he attained celebrity as a scholar, and became rector of the former, and subsequently chancellor of the latter university. He held prebendal stalls in the cathedrals of Lincoln and St Paul's, and was made archdeacon of Essex about 1283. In December 1292 John Peckham, archbishop of Canterbury, died, and early in the following year Winchelsea was elected as his successor. His consecration, which took place at Aquila in September 1294, was delayed owing to the vacancy in the papacy, but he found no difficulty in obtaining the temporalities of the see from King Edward I. Winchelsea is chiefly renowned as a strenuous upholder of the privileges of the clergy and the authority of the pope, and as a fearless opponent of Edward I. Strengthened by the issue of the papal bull *Clericis laicos* in 1296, he stimulated the clergy to refuse pecuniary assistance to Edward in 1297; but after the king had pronounced sentence of outlawry against the delinquents he instructed each clerk to decide this question for himself. Personally the archbishop still declined to make any contribution towards the expenses of the French war, and his lands were seized and held by Edward until July 1297, when a somewhat ostentatious reconciliation between king and prelate took place at Westminster. He took some part in the movement which led to the confirmation of the charters by Edward later in the same year, but the struggle with the king did not exhaust his energies. He asserted his authority over his suffragans to the full; quarrelled with Pope Boniface VIII. over the presentation to a Sussex living, and was excommunicated by one of the pope's minions; and vigorously contested the claim of the archbishop of York to carry his cross erect in the province of Canterbury. Before these events, however, the quarrel with Edward had been renewed, although Winchelsea officiated in 1299 at the king's marriage with Margaret, daughter of Philip III., king of France. Joining the barons in demanding certain reforms from Edward at the parliament of Lincoln in 1301, he compelled the king to give way on the main issues; but the indignation which followed the claim of Pope Boniface to be the protector of Scotland, a claim which was supported by Winchelsea, led to the rupture of this alliance. It is probable that one of the reasons which led the archbishop to join in these proceedings was his hostility to Edward's adviser, Walter Langton, bishop of Lichfield, whom he sought to disgrace both in England and at Rome. The king cherished his indignation until his friend Clement V. became pope in 1305, when he made his final move against Winchelsea. Listening to Edward's envoys, Langton and Henry Lacy, earl of Lincoln, Clement suspended the archbishop, who, after vainly imploring the intercession of the king, left England and journeyed to the papal court at Bordeaux, remaining in exile until Edward's death in July 1307. The new king, Edward II., requested Clement to allow Winchelsea to return to his see. The pope assented, but soon after his return to England early in 1308 the archbishop joined the king's enemies; even demanded the release from prison of his old enemy, Langton, and was one of the "ordainers" appointed in 1310. He assisted the barons in their struggle with Edward II. by a frequent use of spiritual weapons, and took part in the proceedings against the Templars. He died at Otford on the 11th of May 1313. Miracles were said to have been worked at his tomb in Canterbury cathedral, but efforts to procure his canonization were unavailing. Although a secular priest Winchelsea was somewhat ascetic, and his private life was distinguished for sanctity and generosity. As an ecclesiastic, however, he was haughty and fond of power; and he has been not inappropriately described as "the greatest churchman of the time."

See *Chronicles of the Reigns of Edward I. and Edward II.*, edited with introduction by W. Stubbs (London, 1882–1883); S. Birchington, in the *Anglia sacra*, edited by H. Wharton (London, 1691); and W. Stubbs, *Constitutional History*, vol. ii. (Oxford, 1896).

WINCHELSEA, a village in the Rye parliamentary division of Sussex, England, 9 m. N.E. by E. from Hastings by the South Eastern and Chatham railways. Pop. (1901) 670. It stands on an abrupt hill-spur rising above flat lowlands which form a southward continuation of Romney marsh. This was within historic times a great inlet of the English Channel, and Winchelsea was a famous seaport until the 15th century. Two gates, the one of the time of Edward I., the other erected early in the 15th century, overlook the marshes; a third stands at a considerable distance west of the town, its position pointing the contrast between the extent of the ancient town and that of the shrunken village of to-day. The town was laid out by Edward I. with regular streets intersecting at right angles; the form is preserved, and in a picturesque open space in the centre stands the church of St Thomas à Becket. This comprises only the chancel and aisles of a building which, if entire, would rank as one of the finest parish churches in England. As it stands it is of the highest interest, showing remarkable Decorated work, with windows of beautiful and unusual design, and a magnificent series of canopied tombs. In the grounds of the residence called the Friars stands the shell of the apsidal choir of a Decorated chapel which belonged to a Franciscan house. Of a Dominican convent and other religious foundations and churches there are no remains.

The town of which the relics have been described was not the first of its name. On a site supposed to be about 3 m. S.E., and now therefore about 1½ m. out in the English Channel, a seaport had grown up on a low peninsula. In 1236 and at various subsequent dates in the same century this town suffered severely from encroachments of the sea, and in 1266 it paid the penalty for its adherence to the cause of Simon de Montfort. The waves finally obliterated the site in 1288, and Edward I. thereafter planted the new town in a safe position. In the 14th and 15th centuries Winchelsea was frequently attacked by the French, and in 1350 Edward III. defeated the Spaniards in a naval action close by.

In the time of the Confessor Winchelsea (*Winchenesel, Winchelese, Wynchelse*) was included in Rameslie which was granted by him to the abbey of Fécamp. The town remained under the lordship of the abbey until it was resumed by Henry III. Its early importance was due to its harbour, and by 1066 it was probably already a port of some consequence. By the reign of Henry II., if not before, Winchelsea was practically added to the Cinque Ports and shared their liberties. After the destruction of Old Winchelsea, New Winchelsea, a walled town, flourished for about a hundred years and provided a large proportion of the ships furnished by the Cinque Ports to the crown; but the ravages of the French destroyed it, its walls were broken down, and the decay of the harbour, owing to the recession of the sea, prevented any later return of its prosperity. The corporation, which in 1298 included a mayor, barons and bailiffs, was dissolved by an act of 1883.

Winchelsea as a Cinque Port was summoned to parliament in 1264–1265 and returned two members from 1366 till 1832, when it was disfranchised. The abbot of Fécamp seems to have originally held a market. In 1792 a market was held on Saturdays and a fair on the 14th of May, but no market or fair now exists. Shipbuilding and fishing were carried on in the 13th and 14th centuries. In later years Winchelsea became a great resort for smugglers, and the vaults originally constructed for the Gascon wine trade were used for storing contraband goods.

WINCHESTER, EARLS AND MARQUESSES OF. The title of earl of Winchester was first borne by Saier, or Seer, de Quincy, who was endowed by King John on the 13th of March 1207, with the earldom of Winchester, or the county of Southampton. Saier de Quincy was one of the twenty-five barons named to enforce the observance of the Great Charter. He served in the Crusades at the siege of Damietta in 1219, and died soon afterwards, probably on the 3rd of November of that year. His second son Roger de Quincy (*c.* 1195–1264), who is said to have usurped the earldom during the absence of his elder brother Robert in the Holy Land, took part in the struggle between Henry III. and the barons. He died without male issue in April 1264, and the earldom reverted to the crown. It was revived in 1322 in favour of Hugh le Despenser, favourite of King Edward II., and was forfeited when he was put to death by the barons as a traitor in 1326. In 1472 the title, together with a pension of £200 a year from the customs of Southampton, but not the right of sitting in parliament, was given by King Edward IV. to a Burgundian, Louis de Bruges, lord of Gruthuyse and prince of Steenhuyse, as a reward for services rendered to himself while an exile on the continent. Louis de Bruges surrendered his patent to Henry VII. in 1499.

The marquessate of Winchester was created in 1551 in favour of William Paulet, or Pawlet, K.G., a successful courtier during four reigns, who died on the 10th of March 1572. It has descended in the male line of his family to the sixteenth possessor. John Paulet, 2nd marquess (*c.* 1517–1576), was summoned to parliament as Baron St John during the life of his father, a distinction which was shared by his three immediate successors—William Paulet (*c.* 1535–1598), William Paulet (*c.* 1560–1628) and John Paulet (*c.* 1598–1674). Charles Paulet, son and heir of John Paulet, the eighth marquess, was created duke of Bolton, on the 9th of April 1689, and the marquessate of Winchester remained in connexion with the duchy of Bolton (*q.v.*) till the death of Harry Paulet, sixth duke and eleventh marquess, without male issue in December 1794. There being no male representative of the dukes of Bolton this title lapsed, but the marquessate of Winchester was inherited by George Paulet (1722–1800), great-grandson of Lord Henry Paulet (d. 1672), second son of William, the fourth marquess. On George's death on the 22nd of April 1800 he was succeeded by his son Charles Ingoldesby Burroughs-Paulet (1764–1843), who, in 1839, prefixed the name of Burroughs to his own by royal licence. Upon his death on the 29th of November 1843, the title passed to his son John Paulet (1801–1887), fourteenth marquess, who was succeeded, on the 4th of July 1887, by his son, Augustus John Henry Beaumont (1858–1899), officer in the Guards, who was killed at Magersfontein during the Boer War on the 11th of December 1899, and was followed in the peerage by his brother, Henry William Montague Paulet (b. 1862).

Three of the marquesses of Winchester were men of note. It is recorded of the founder of the family, William Paulet, that when asked how he had contrived to live through a long period of troubled times during four reigns, he replied that he came of the willow and not of the oak, *ortus sum e salice non ex quercu*. This saying, repeated by Sir Robert Naunton in his *Fragmenta regalia*, may possibly not have been due to the marquess himself, but if not it was well invented of a man who passed through many dangers and always contrived to keep, or to improve, his places. He was the son of Sir John Paulet of Basing, near Basingstoke in Hampshire, and his wife Alice or Elizabeth, daughter of Sir William Paulet of Hinton St George, Somerset. The year of his birth has been variously given as 1474 and 1485. Between 1512 and 1527 he was several times sheriff of Hampshire. He was knighted before 1525, and in that year became privy councillor. He was, henceforth, continually employed in the royal household and on the council, but his only military service was in the easy suppression of the Pilgrimage of Grace in 1536. In 1525 he was named master of the wards and keeper of the king's widows and idiots, that is to say he had the lucrative charge of persons of property who were wards in chivalry. He was a member of the House of Commons which co-operated with the king in carrying out the separation of the Church from Rome between 1529 and 1536. He served on the courts which tried Sir Thomas More and Anne Boleyn, and he was employed to tell Catharine of Aragon that she and her daughter were degraded from their rank. It is characteristic of the type of man that he did his work gently, and with a constant recollection of the changes of fortune. His personal kindness to Anne Boleyn, which she acknowledged, no doubt stood him in good stead on the accession of her daughter Queen Elizabeth. In 1538 he was created Lord St John, and he was enriched by a grant of the lands of Netley Abbey, near Southampton. He was appointed lord steward of the household, and lord chamberlain, and became a knight of the garter in 1543. Henry VIII. named him one of the council of regency for his son Edward VI. During the reign of Edward VI., St John kept the favour both of the Protector Somerset, who made him lord keeper of the great seal, and of Somerset's enemy, the duke of Northumberland, who kept him in office. He was created earl of Wiltshire in 1550, and marquess of Winchester in 1551. On the death of Edward VI., he trimmed cleverly between the parties of Lady Jane Grey, and Mary Tudor till he saw which was going to win, and then threw himself on the winning side. He opposed Queen Mary's marriage to Philip, prince of Spain (Philip II.), till he saw she was set on it, and then gave his approval, for it was his wise rule to show just as much independence as enhanced the merit of his obedience. He was lord treasurer under Mary, and kept his place under Elizabeth, to whose ecclesiastical policy he gave his usual discreet opposition and final obedience. Winchester died at his house of Basing on the 10th of March 1572. He had built it on so grand a scale that his descendants are said to have found it necessary to pull down a part. He married, first Elizabeth, daughter of Sir William Capel, Lord Mayor of London, by whom he had four sons and four daughters, and then Winifred, daughter of Sir John Bruges, alderman of London, and widow of Sir Richard Sackville, by whom he had no children. It is said that one hundred and three of his descendants were alive at the date of his death.

His grandson, William Paulet, third marquess (*c.* 1535–1598) was one of the judges of Mary, queen of Scots, and author of a book called *The Lord Marquesses Idleness* which contains a Latin acrostic of extreme ingenuity on the words *Regina nostra Angliae*.

The fifth marquess, John Paulet (1628–1674), was a Roman Catholic. He lived much in retirement in order to be able to pay off debts left by his father. He is remembered by the ardour and sincerity of his loyalty to King Charles I. It is said that he caused the words "Aimez Loyauté" to be engraved on every pane of glass in his house of Basing. During the first Civil War it was fortified for the king, and stood a succession of sieges by the parliamentary forces between 1643 and 1645. On the 14th of October 1645, it was stormed by Oliver Cromwell. The marquess, who fought valiantly, told Hugh Peters, chaplain of the New Model Army of the parliament, who had the vulgarity to crow over him, "That if the king had no more ground in England but Basing House, he would adventure as he did, and so maintain it to the utmost," for "that Basing House was called Loyalty." The house caught fire during the storm and was burnt down, the very ruins being carried away by order of the parliament. The marquess was imprisoned in the Tower of London, but was finally allowed to compound for his estate; after the restoration of King Charles II. he was promised compensation for his losses, but nothing was given to him. He died in Englefield Park on the 5th of March 1674. He was three times married, first to Jane, daughter of Viscount Savage, by whom he had one son; then to Honora de Burgh, daughter of Richard, earl of St Albans and Clanricarde, by whom he had four sons; and then to Isabella Howard, daughter of Viscount Stafford.

See Doyle, *Official Baronage* (London, 1886); and J. A. Froude, *History of England* (London, 1856–1870), for the first marquess; J. P. Collier, *Bibliographical Account of Early English Literature* (London, 1865), for the second marquess; and Clarendon, *History of the Rebellion* (Oxford, 1886), for the fifth marquess.

WINCHESTER, a city and municipal and parliamentary borough of Hampshire, England, 66½ m. S.W. by W. from London by the London & South-Western railway; served also by the Southampton branch of the Great Western railway, with a separate station. Pop. (1901) 20,929. It occupies a hilly and picturesque site in and above the valley of the Itchen, lying principally on the left bank. The surrounding hills are chalk downs, but the valley is well wooded.

Setting aside for the present the legends which place the foundation of a great Christian church at Winchester in the 2nd century, the erection of Winchester into an episcopal see may be placed early in the second half of the 7th century, though it cannot be dated exactly. The West Saxon see was removed hither from Dorchester on the Thame, and the first bishop of Winchester was Hedda (d. 705). The modern diocese includes nearly the whole of Hampshire, part of Surrey and very small portions of Wiltshire, Dorsetshire and Sussex. St Swithin (852–862), well known through the connexion of his feast day (15th July) with the superstition that weather-conditions thereon determine those of the next forty days, is considered to have enlarged the cathedral, as are Æthelwold (963–984) and Alphege (984–1005). The history of the Saxon building, however, is very slight, and as usual, its place was taken by a Norman one, erected by Bishop Walkelin (1070–1098). The cathedral church of St Swithin lies in the lower part of the city in a wide and beautiful walled close. It is not very conspicuous from a distance, a low central tower alone rising above the general level of the roof. It consists of a nave, transepts, choir and retrochoir, all with aisles, and a lady-chapel forms the eastward termination. The work of the exterior, of whatever date, is severely plain. The cathedral, however, is the longest in England, and indeed exceeds any other church of its character in length, which is close upon 556 ft. Within, the effect of this feature is very fine. The magnificent Perpendicular nave is the work of Bishop Edington (1346–1366) and the famous William of Wykeham (1367–1404), by whom only the skeleton of Walkelin's work was retained. The massive Norman work of the original building, however, remains comparatively intact in both transepts. The central tower is Norman, but later than Walkelin's structure, which fell in 1107, a mishap which was readily attributed to divine wrath because King William II., who fell to the arrow in the neighbouring New Forest, had been buried here seven years earlier, in spite of his unchristian life. The tomb believed to be his is in the choir, but its identity has been widely disputed, and even an examination of the remains has failed to establish the truth. The choir is largely Edington's work, though the clerestory is later, and the eastern part of the cathedral shows construction of several dates. Here appears the fine Early English construction of Bishop de Lucy (1189–1204), in the retrochoir and the lady-chapel, though this was considerably altered later. Beneath the cathedral east of the choir there are three crypts, connected together. The western and the central chambers are Norman, and have apsidal terminations, while the eastern is Early English. The cathedral contains many objects of interest. The square font of black marble is a fine example of Norman art, its sides sculptured with scenes from the life of St Nicholas of Myra. The magnificent reredos behind the high altar must have been erected late in the 15th century; it consists of a lofty wall, the full width of the choir, pierced by two processional doors, and covered with tiers of rich canopied niches, the statues in which are modern. A cross of plain ashlar stone in the centre shows where an immense silver crucifix was once attached; and a plain rectangular recess above the altar once contained a massive silver-gilt retable, covered with cast and repoussé statuettes and reliefs. A second stone screen, placed at the interval of one bay behind the great reredos, served to enclose the small chapel in which stood the gold shrine, studded with jewels, the gift of King Edgar, which contained the body of St Swithin. Under many of the arches of the nave and choir are a number of very elaborate chantry chapels, each containing the tomb of its founder. Some of these have fine recumbent effigies, noble examples of English medieval sculpture;

the most notable are the monuments of Bishops Edington, Wykeham, Waynflete, Cardinal Beaufort, Langton and Fox. The door of iron grills, of beautiful design, now in the north nave aisle, is considered to be the oldest work of its character in England; its date is placed in the 11th or 12th century. The mortuary chests in the presbytery contain the bones of Saxon kings who were buried here. The remains were collected in this manner by Bishop Henry de Blois (1129–1171), and again after they had been scattered by the soldiers of Cromwell. The choir stalls furnish a magnificent example of Decorated woodwork, and much stained glass of the Decorated and Perpendicular periods remains in fragmentary form. The library contains a Vulgate of the 12th century, a finely ornamented MS. on vellum.

In 1905 serious signs of weakness were manifested in the fabric of the cathedral, and it was found that a large part of the foundation was insecure, being laid on piles, or tree-trunks set flat, in soft and watery soil. Extensive works of restoration, including the underpinning of the foundations with cement concrete (which necessitated the employment of divers), were undertaken under the direction of Mr T. G. Jackson.

Relics of the monastic buildings are slight, and there are Early English arches and Perpendicular work in the deanery. Other old houses in the Close are very picturesque. Here formerly stood the house which Charles II. desired of Ken for Nell Gwyn. Ken refused it, but the king bore no malice, settling Nell Gwyn in another house near by, and afterwards raising Ken to the bishopric of Bath and Wells.

King Alfred founded a minster immediately north of the present site of the cathedral, and here he and other Saxon kings were buried. The house, known as Hyde Abbey, was removed (as was Alfred's body) to a point outside the walls considerably north of the cathedral, during the reign of Henry I. Here foundations may be traced, and a gateway remains. To the east of the cathedral are ruins of Wolvesey Castle, a foundation of Henry de Blois, where the bishops resided. On the southern outskirts of the city, in a pleasant meadow by the Itchen, is the Hospital of St Cross. This also was founded by Henry de Blois, in 1136, whose wish was to provide board and lodging for 13 poor men and a daily dinner for 100 others. It was reformed by William of Wykeham, and enlarged and mostly rebuilt by Cardinal Beaufort (1405–1447). The buildings form three sides of a quadrangle, with a lawn and sun-dial in its midst; while the fourth side is partly open, and partly formed by the magnificent cruciform church. The earliest parts of this building are late or transitional Norman, but other parts are Early English or Decorated. The work throughout is very rich and massive. St Cross is a unique example of a medieval almshouse, and its picturesqueness is enhanced by the curious costume of its inmates. It is still customary to provide a dole of bread and beer to all who desire it. The parish churches of Winchester are not of special interest, but the church of St Swithin is curious as occupying the upper part of the King's Gate. This gate and the West Gate alone remain of the gates in the walls which formerly surrounded the city. The West Gate is a fine structure of the 13th century. In the High Street stands the graceful Perpendicular city cross. The county hall embodies remains of the Norman castle, and in it is preserved the so-called King Arthur's round table. This is supposed to date actually from the time of King Stephen, but the painted designs upon it are of the Tudor period.

Winchester is famous as an educational centre, and in addition to Winchester College there are several modern preparatory schools here. The College of St Mary, lying to the south of the cathedral close, is one of the greatest of English public schools. While a monastic school was in existence here from very early times, the college was originated in 1387 by William of Wykeham, whose famous scheme of education embraced this foundation and that of New College, Oxford. The members on the foundation consisted of a warden, 10 fellows, 3 chaplains, 70 scholars and 16 choristers. The buildings were completed about 1395. The quadrangles, with the fine chapel, tower, hall and cloister are noteworthy, and there are extensive modern buildings.

The principal public buildings of the city are the gild-hall, public library and art school, museum, market house, mechanics' institution and barracks. The parliamentary borough returns one member and falls within the Andover division of the county. The corporation consists of a mayor, 6 aldermen and 18 councillors. Area, 1931 acres.

History.—The history of the earliest Winchester (*Winton*, *Wynton*) is lost in legend; tradition ascribes its foundation to Ludor Rous Hudibras and dates it ninety-nine years before the first building of Rome; earthworks and relics show that the Itchen valley was occupied by Celts, and it is certain from its position at the centre of six Roman roads and from the Roman relics found there that the Caer Gwent (White City) of the Celts was, under the name of *Venta Belgarum*, an important Romano-British country town. Hardly any traces of this survive, but mosaic pavements, coins, &c., have been discovered on the south side of High Street. The name of Winchester is indissolubly linked with that of King Arthur and his knights, but its historical greatness begins when, after the conquest of the present Hampshire by the Gewissas, it became the capital of Wessex. Its importance was increased by the introduction of Christianity, although it was not at first the seat of a bishop, because, according to the later Winchester chronicler, King Cynegils wished for time to build a worthy church in the royal city; his son Cenwalh is said to have built the old minster. When the kings of Wessex became kings of all England, Winchester became, in a sense, the capital of England, though it always had a formidable rival in London, which was more central in position and possessed greater commercial advantages. The parallel position of the two cities in Anglo-Saxon times is illustrated by the law of Edgar, ordaining that the standard of weights and measures for the whole kingdom should be "such as is observed at London and at Winchester." Under Alfred it became a centre of learning and education, to which distinguished strangers, such as St Grimbald and Asser the Welshman, resorted. It was the seat of Canute's government; many of the kings, including Ecgberht, Alfred, Edward the Elder and Canute, were buried there, and, in 1043, Edward the Confessor was crowned in the old minster. The city was sometimes granted as part of the dowry of a queen consort, and it was the home of Emma, the wife of Æthelred the Unready and of Canute, and later of Edith, the wife of the Confessor.

Winchester was very prosperous in the years succeeding the Conquest, and its omission, together with London, from Domesday Book is probably an indication of its peculiar position and importance; its proximity to the New Forest commended it to the Norman kings, and Southampton, only 12 m. distant, was one of the chief ports for the continent. The Conqueror wore his crown in state at Winchester every Easter, as he wore it at Westminster at Whitsuntide and at Gloucester at Christmas. The royal treasure continued to be stored there as it had been in Anglo-Saxon times, and was there seized by William Rufus, who, after his father's death, "rode to Winchester and opened the Treasure House." In the reign of Stephen and again in the reign of Henry II. the Court of Exchequer was held at Winchester, and the charter of John promises that the exchequer and the mint shall ever remain in the city; the mint was an important one, and when in 1125 all the coiners of England were tried for false coining those of Winchester alone were acquitted with honour.

Under the Norman kings Winchester was of great commercial importance; it was one of the earliest seats of the woollen trade, which in its different branches was the chief industry of the town, although the evidence furnished by the *Liber Winton* (*temp.* Henry I. and Stephen) indicates also a varied industrial life. As early as the reign of Henry I. the gild of weavers is mentioned, and the millers at the same date render their account to the exchequer.

The gild merchant of Winchester claims an Anglo-Saxon origin, but the first authentic reference to it is in one of the charters granted to the city by Henry II. The *Liber Winton* speaks of a "cnihts' gild," which certainly existed in the time of the Confessor. The prosperity of Winchester was increased by the St Giles's Fair, originally granted by Rufus to Bishop Walkelin. It was held on St Giles's Hill up to the 19th century, and in the middle ages was one of the chief commercial events of the year. While it lasted St Giles's Hill was covered by a busy town, and no trade was permitted to be done outside the fair within seven leagues, or at Southampton; the jurisdiction of the mayor and bailiffs of the city was in abeyance, that of the bishop's officials taking its place.

From the time of the Conqueror until their expulsion by Edward I., Winchester was the home of a large colony of Jews, whose quarter in the city is marked to the present day by Jewry Street; Winchester is called by Richard of Devizes "the Jerusalem of England" on account of its kind treatment of its Jews, and there alone no anti-Jewish riots broke out after the coronation of Richard I. The corporation of Winchester claims to be one of the oldest in England, but the earliest existing charters are two given by Henry II., one merely granting to "my citizens of Winchester, who are of the gild merchant with their goods, freedom from toll, passage and custom," the other confirming to them all liberties and customs which they enjoyed in the time of Henry I.; further charters, amplified and confirmed by succeeding sovereigns, were granted by Richard I. and John. The governing charter till 1835 was that of 1587, incorporating the city under the title of the "Mayor, Bailiffs and Commonalty of the City of Winchester"; this is the first charter which mentions a mayor, but it says that such an officer had existed "time out of mind," and as early as 897 the town was governed by a wicgerefa, by name Beornwulf, whose death is recorded in the Anglo-Saxon Chronicle. There is a doubtful reference to a mayor in 1194, and the office certainly existed early in the 13th century. Until 1832 the liberty of the soke encompassing the city on almost every side was outside the jurisdiction of the city magistrates, being under the seignioralty of the bishop of Winchester.

Winchester seems to have reached its zenith of prosperity at the beginning of the 12th century; the first check was given during the civil wars of Stephen's reign, when the city was burned. However, the last entry concerning it in the Anglo-Saxon Chronicle says that Henry Plantagenet, after the treaty of Wallingford, was received with "great worship" in Winchester and London, thus recognizing the equality of the two cities; but the latter was rising at Winchester's expense, and at the second coronation of Richard I. (1294) the citizens of Winchester had the significant mortification of seeing in their own city the citizens of London take their place as cupbearers to the king. The loss of Normandy further favoured the rise of London by depriving Winchester of the advantages it had enjoyed from its convenient position with regard to the continent. Moreover, it suffered severely at the hands of Simon de Montfort the Younger (1265), although it still continued to be an occasional royal residence, and the Statute of Winchester (1285) was passed in a council held there. Meanwhile the woollen trade had drifted in great measure to the east of England; and an attempt made to revive the prosperity of Winchester in the 14th century by making it one of the staple towns proved unsuccessful. The wine trade, which had been considerable, was ruined by the sack of Southampton (1338); a few years later the city was devastated by the black death, and the charter of Elizabeth speaks of "our city of Winchester now fallen into great ruin, decay and poverty." During the Civil War the city suffered much for its loyalty to Charles I. and lost its ancient castle founded by William I. After the Restoration a scheme was started to restore trade by making the Itchen navigable to Southampton, but neither then nor when revived in the 19th century was it successful. Charles II., intending to make Winchester again a royal residence, began a palace there, which being unfinished at his death was used eventually as barracks. It was burnt down in 1894 and rebuilt in 1901. Northgate and Southgate were pulled down in 1781, Eastgate ten years later. Westgate still stands at the top of the High Street. The guard-room was formerly used as a debtors' prison, now as a museum. The two weekly markets, still held in the Corn Exchange of Wednesday and Saturday, were confirmed by Elizabeth's charter; the latter dates from a grant of Henry VI. abolishing the Sunday market, which had existed from early times. The same grant established three fairs—one on October 13 (the day of the translation of St Edward, king and confessor), one on the Monday and Tuesday of the first week in Lent, and another on St Swithin's day; the former two are still held. Winchester sent two members to parliament from 1295 to 1885, when the representation was reduced to one.

WINCHESTER, a town and the county-seat of Clark county, Kentucky, U.S.A., in the E. part of the Blue Grass region of the state, about 18 m. E. by S. of Lexington. Pop. (1890) 4519; (1900) 5964, including 3128 negroes; (1910) 7156. It is served by the Louisville & Nashville, the Chesapeake & Ohio and the Lexington & Eastern railways, the last being a short road (from Lexington to Jackson) extending into the mineral and timber region of Eastern Kentucky. The town is the seat of the Kentucky Wesleyan College (co-educational; Methodist Episcopal, South), opened in 1866, and of the Winchester Trades and Industrial School (1900). Winchester is in an agricultural, lumbering and stock-raising region, and has various manufactures. It was first incorporated in 1792.

WINCHESTER, a township of Middlesex county, Massachusetts, U.S.A., about 8 m. W. of Boston at the head of Upper Mystic Pond, one of the sources of the Mystic river. Pop. (1900) 7248, of whom 1968 were foreign-born and 140 were negroes; (1910) 9309. Area, 6 sq. m. Winchester is served by the southern division of the Boston & Maine railway, and is connected with Boston, Arlington, Medford, Stoneham and Woburn by electric lines. It is chiefly a residential suburb of Boston. Through the centre of the township winds the Aberjona river, which empties into Mystic Pond, in Winchester township, both favourite resorts for canoeing, &c. Wedge Pond and Winter Pond, in the centre of the township, are clear and beautiful sheets of water. The streets of Winchester are heavily shaded, the view as presented from the neighbouring hills being that of a continuous forest stretching from the beautiful Mystic Valley parkway (of the Metropolitan park system), of which more than one-half (50·2 acres) is in the southern part of the township, to the Middlesex Fells Reservation (another Metropolitan park), of which 261·9 acres are in the eastern part; and there are a large public playground and a common. Horn Pond Mountain and Indian Hill are about 320 ft. above sea-level. One of the pleasantest residential districts is Rangely, a restricted private park. The town-hall and library building is a fine structure; the library contains about 20,000 volumes, and the museum and collections of the Winchester Historical and Genealogical Society. The principal manufactures are leather and felt goods.

Winchester was originally within the limits of Charlestown. In 1638 allotments of land between the Mystic Pond and the present Woburn were made to various Charlestown settlers, including John Harvard and Increase Nowell (1590–1655), secretary of the Massachusetts Bay Colony in 1644–1649, and the new settlement was called Waterfield. Most of this territory in 1642 was incorporated in Woburn and was called South Woburn. In 1850 Winchester was separately incorporated, parts of Arlington (then West Cambridge) and Medford going to make up its area, and was named in honour of Colonel W. P. Winchester of Watertown, who left to the township a legacy for municipal works.

WINCHESTER, an independent city and the county-seat of Frederick county, Virginia, U.S.A., 87 m. by rail W.N.W. of Washington. Pop. (1890) 5196; (1900) 5161, including 1105 negroes; (1910) 5864. Winchester is served by the Baltimore & Ohio and the Cumberland Valley railways. It is pleasantly situated in the fertile Shenandoah Valley about 720 ft. above sea-level. Fort Loudoun Seminary for girls occupies the site of old Fort Loudoun, and in the city is the Shenandoah Valley Academy, a military school for boys. The Handley library

(1910), a memorial to John Handley, a part of whose estate was bequeathed to establish industrial schools for the poor of Winchester, and an auditorium are owned by the municipality. The United States National Military Cemetery at Winchester contains the graves of 4480 Union soldiers, 2382 of them unknown, and adjoining it is the Confederate Stonewall Cemetery, with about 8000 graves. The manufacture of gloves is the leading industry; among the other manufactures are woollen and knit goods, flour, leather, lumber, paper and bricks. Electricity, generated at the Shenandoah river, is used for power in many of the factories.

A settlement was established in this vicinity as early as 1732. In 1752 the present name was adopted and the town was established by act of the colonial legislature. In 1756, during the Seven Years' War, George Washington, in command of the provincial troops of Virginia, established his headquarters here and built Fort Loudoun. The town was incorporated in 1779. The *Virginia Gazette and Winchester Advertiser*, the first newspaper published in the Shenandoah Valley, was established here in 1787. In the Civil War, Winchester, because of its position in the lower Shenandoah Valley, played a great part, and was several times the scene of engagements between the Union and Confederate forces—in 1862, Jackson's actions of Kernstown and Winchester; in the Gettysburg campaign, the capture of a Union garrison by Ewell (14-15 June 1863); and in Sheridan's campaign of 1864 the battle of Winchester or Opequon (Sept. 19, 1864), for all of which see SHENANDOAH VALLEY CAMPAIGNS. Winchester was chartered as a city in 1852 and in 1906 the corporate limits were enlarged.

See J. E. Norris (ed.), *History of the Lower Shenandoah Valley* (Chicago, 1890), and T. K. Cartmell, *Shenandoah Valley Pioneers* (Winchester, 1909).

WINCKELMANN, JOHANN JOACHIM (1717-1768), German archaeologist, was born at Stendal in Brandenburg on the 9th of December 1717, the son of a poor shoemaker. He attended a gymnasium at Berlin and the school at Salzwedel, and in 1738 was induced to go as a student of theology to Halle. But he was no theologian, and he soon devoted himself with enthusiasm to Greek art and literature. With the intention of becoming a physician he attended medical classes at Jena; but means were insufficient and he was obliged to accept a tutorship near Magdeburg. From 1743 to 1748 he was associate-rector of a school at Seehausen in the Altmark. He then went to Nöthenitz near Dresden as librarian to Count Henry von Bünau, for whose history of the Holy Roman empire he collected materials. The treasures in the Dresden gallery awakened an intense interest in art, which was deepened by association with various artists, and especially with A. F. Oeser, who afterwards exercised so powerful an influence over Goethe. Winckelmann's study of ancient literature had inspired him with a desire to visit Rome, and he became librarian to Cardinal Passionei in 1754. This compelled him reluctantly to join the Roman Catholic Church.

In 1755, before leaving for Rome, Winckelmann published his *Gedanken über die Nachahmung der griechischen Werke in Malerei und Bildhauerkunst* ("Thoughts on the Imitation of Greek Works in Painting and Sculpture"), followed by a pretended attack on the work, and a defence of its principles, nominally by an impartial critic. The *Gedanken* contains the first statement of the doctrines he afterwards developed, and was warmly admired not only for the ideas it contained but for its style. Augustus III., elector of Saxony and king of Poland, granted him a pension of 200 thalers, that he might prosecute his studies in Rome. He arrived in Rome in November 1755, became librarian to Cardinal Archinto, and received much kindness from Cardinal Passionei. After their deaths he was received as librarian and as a friend into the house of Cardinal Albani, who was forming his magnificent collection at Porta Salara. In 1763, while retaining this position, Winckelmann was made prefect of antiquities.

He devoted himself earnestly, at first with the aid of his friend A. R. Mengs, to the study of Roman antiquities, and gradually acquired an unrivalled knowledge of ancient art. In 1760 appeared his *Description des pierres gravées du feu Baron de Stosch*; in 1762 his *Anmerkungen über die Baukunst der Alten* ("Observations on the Architecture of the Ancients"), including an account of the temples at Paestum. In 1758 and 1762 he visited Naples, and from his *Sendschreiben von den herculanischen Entdeckungen* (1762) and his *Nachricht von den neuesten herculanischen Entdeckungen* (1764) scholars obtained their first real information about the treasures excavated at Pompeii and Herculaneum. Winckelmann again visited Naples in 1765 and 1767, and wrote for the use of the electoral prince and princess of Saxony his *Briefe an Bianconi*, which were published, eleven years after his death, in the *Antologia romana*. His masterpiece, the *Geschichte der Kunst des Alterthums* ("History of Ancient Art"), issued in 1764, was soon recognized as a permanent contribution to European literature. In this work Winckelmann sets forth both the history of Greek art and the principles on which it seemed to him to be based. He also presents a glowing picture of the conditions, political, social and intellectual, which tended to foster creative activity in ancient Greece. The fundamental idea of his theory is that the end of art is beauty, and that this end can be attained only when individual and characteristic features are strictly subordinated to the artist's general scheme. The true artist, selecting from nature the phenomena fitted for his purpose, and combining them through the imagination, creates an ideal type marked in action by "noble simplicity and calm greatness"—an ideal type in which normal proportions are maintained, particular parts, such as muscles and veins, not being permitted to break the harmony of the general outlines. In the historical portion he used not only the works of art he himself had studied but the scattered notices on the subject to be found in ancient writers; and his wide knowledge and active imagination enabled him to offer many fruitful suggestions as to periods about which he had little direct information. Many of his conclusions based on the inadequate evidence of Roman copies have been modified or reversed by subsequent research, but the fine enthusiasm of the work, its strong and yet graceful style, and its vivid descriptions of works of art give it enduring value and interest. It marked an epoch by indicating the spirit in which the study of Greek art should be approached, and the methods by which investigators might hope to attain to solid results. To Winckelmann's contemporaries it came as a revelation, and exercised a profound influence on the best minds of the age. It was read with intense interest by Lessing, who had found in the earliest of Winckelmann's works the starting-point for his *Laocoon*.

Winckelmann contributed various admirable essays to the *Bibliothek der schönen Wissenschaften*; and in 1766 he published his *Versuch einer Allegorie*, which, although containing the results of much thought and reading, is not conceived in a thoroughly critical spirit. Of far greater importance was the splendid work entitled *Monumenti antichi inediti* (1767–1768), prefaced by a *Trattato preliminare*, presenting a general sketch of the history of art. The plates in this work are representations of objects which had either been falsely explained or not explained at all. Winckelmann's explanations were of the highest service to archaeology, by showing that in the case of many works of art supposed to be connected with Roman history the ultimate sources of inspiration were to be found in Homer.

In 1768 Winckelmann went to Vienna, where he was received with honour by Maria Theresa. At Trieste on his way back he was murdered in an hotel by a man named Arcangeli to whom he had shown some coins presented by Maria Theresa (June 8th, 1768). He was buried in the churchyard of the cathedral of St Giusto at Trieste.

An edition of his works was begun by Fernow in 1808 and completed by Meyer and Schulze (1808–1820). There are admirable studies of his character and work in Goethe's *Winckelmann und sein Jahrhundert* (1805), to which contributions were made by Meyer and Wolf, and in Walter Pater's *Renaissance* (1902). The best biography of Winckelmann is by Justi, *Winckelmann und seine Zeitgenossen* (2nd ed., 3 vols., Leipzig, 1898). A collection of letters, *Briefe an seine Züricher Freunde*, was published by Blümner (Freiburg, 1882). (J. Si.; J. M. M.)

WIND (a common Teut. word, cognate with Skt. *vatas*, Lat. *ventus*, cf. "weather," to be of course distinguished from to "wind," to coil or twist, O.Eng. *windan*, cf. "wander," "wend," &c.), a natural motion of the air, a current of air coming from any particular direction or with any degree of velocity. For the general account of winds, their causes, &c., see METEOROLOGY. Winds may be classified according to the strength or velocity with which they blow, varying from a calm, a breeze to a gale, storm or hurricane; for the varying scale of velocity per hour of these see BEAUFORT SCALE, and for the measurement ANEMOMETER. Another classification divides them into "regular" or "constant" winds, such as the "trade winds" (*q.v.*), and "periodic" winds, such as the "monsoon" (*q.v.*). There are many special winds, such as the "Föhn," "chinook," "mistral," "harmattan," "sirocco," which are treated under their individual names. For the group of musical instruments known by the generic name of WIND INSTRUMENTS see that heading.

WINDAU (Russian *Vindava*, Lettish *Wentepils*), a seaport and sea-bathing resort of western Russia, in the government of Courland, at the mouth of the Windau, on the Baltic Sea, 110 m. by rail N.W. of Riga. Pop. (1897), 7132. It has a castle built in 1290. The harbour, 20 and 25 ft. deep, is free from ice all the year round. Timber, grain and other commodities are exported to the annual value of two to three millions sterling; the imports range between three-quarters and one million sterling.

WIND BRACES, in architecture, diagonal braces to tie the rafters of a roof together and prevent "racking." In the better sort of medieval roofs they are arched, and run from the principal rafters to catch the purlins.

WINDEBANK, SIR FRANCIS (1582–1646), English secretary of state, was the only son of Sir Thomas Windebank of Hougham, Lincs., who owed his advancement to the Cecil family. Francis entered St John's College, Oxford, in 1599, coming there under the influence of Laud. After a few years' continental travel (1605–1608), he was employed for many years in minor public offices, and became clerk of the council. In June 1632 he was appointed by Charles I. secretary of state in succession to Lord Dorchester, his senior colleague being Sir John Coke, and he was knighted. His appointment was mainly due to his Spanish and Roman Catholic sympathies. The first earl of Portland, Francis, Lord Cottington, and Windebank formed an inner group in the council, and with their aid the king carried on various secret negotiations, especially with Spain. In December 1634 Windebank was appointed to discuss with the papal agent Gregorio Panzani the possibility of a union between the Anglican and Roman Churches, and expressed the opinion that the Puritan opposition might be crippled by sending their leaders to the war in the Netherlands. Windebank's efforts as treasury commissioner in 1635 to shield some of those guilty of corruption led to a breach with Archbishop Laud, and the next year he was for a time disgraced for issuing an order for the conveyance of Spanish money to pay the Spanish troops in the Netherlands. In July 1638 he urged upon the king instant war with the Scots, and in 1640, when tumults were breaking out in England, he sent an appeal from the queen to the pope for money and men. He was elected in March 1640 member of the Short Parliament for Oxford University, and he entered the Long Parliament in October as member for Corfe. In December the House learnt that he had signed letters of grace to recusant priests and Jesuits, and summoned him to answer the charge, but with the king's connivance he fled to France. From Calais he wrote to the first Lord Hatton, defending his integrity, and affirming his belief that the church of England was the purest and nearest the primitive Church. He remained in Paris until his death on the 1st of September 1646, shortly after he had been received into the Roman communion.

WINDERMERE, the largest lake in England, in the south-eastern part of the Lake District (*q.v.*). It is in the county of Westmorland, the boundary with Lancashire running from the head southward along the western shore, round the foot and northward along about one-third of the eastern shore. It forms a narrow trough with a slightly curved axis of 10½ m. The width at right angles to the axis never reaches 1 m. The area is 5·69 sq. m. The shores are generally steep, beautifully wooded and fretted with numerous little sheltered bays. The hills immediately surrounding the lake rarely reach 1000 ft., but the distant views of the mountains to the north and west contrast finely with the sylvan beauty of the lake itself. The middle of the lake, immediately opposite Bowness, is especially beautiful, for here a group of islands (Belle Isle, Thompson's Holme, the Lilies and others) divide the lake into two basins, the water about them seldom exceeding 50 ft. in depth. On the other hand, the greatest depth sounded in the northern basin is 219 ft., and in the southern 134. The lake receives the Rothay and Brathay streams at the head; Trout Beck also flows into the north basin, and Cunsey Beck from Esthwaite into the south. The lake is drained by the Leven. Steamers belonging to the Furness Railway Company ply regularly on Windermere, the chief stations being Lakeside, the terminus of a branch railway, beautifully situated at the foot, Ferry on the west shore below the islands, Bowness on the east and Waterhead, at the head, for Ambleside. The lake contains perch, pike, trout and char; there are several large hotels at Bowness and elsewhere on its shores.

The town of WINDERMERE, above the eastern shore adjacent to Bowness (*q.v.*), is in the Appleby parliamentary division of Westmorland, and is the terminus of a branch of the London and North-Western railway from Oxenholme junction. Numerous mansions and villas have grown up in the vicinity. Here, from Orrest Head, in the grounds of Elleray, where lived Professor Wilson (Christopher North), superb views over the whole lake and its surroundings are obtained. In 1905 Bowness and Windermere were united as a single urban district.

WINDHAM, WILLIAM (1750–1810), English politician, came from an ancient family long resident at Felbrigg, near Cromer in Norfolk. His father, Colonel William Windham (1717–1761), was an adventurous soldier with a taste for languages, both ancient and modern; his son was born in Golden Square, London, on the 3rd of May 1750. He went to Eton, which he quitted in 1766 for the university of Glasgow, where he acquired the taste for mathematics which always distinguished him. In 1767 he matriculated as gentleman commoner at University College, Oxford, where he remained until 1771. He never took the degree of B.A., but qualified as M.A. on the 7th of October 1782, and received the degree of D.C.L. on the 3rd of July 1793. He made a tour in Norway in 1773 and visited Switzerland and Italy between 1778 and 1780. His maiden speech on the political platform was delivered at Norwich on the 28th of January 1778, when he vehemently opposed the prosecution of the American war. His entrance into public life took place in April 1783, when he went to Ireland as chief secretary to Lord Northington, the lord-lieutenant in the coalition ministry of Fox and Lord North. Windham was his own keenest critic, his distrust in his own powers and his disappointment at his own achievements being conspicuous on every page of his *Diary*. Sickness compelled his return to England early in July 1783, and he resigned his position in August; but change of scene and constant exercise restored him to health before the end of that year. In April 1784 he was returned to parliament as member for Norwich by a majority of 64 votes, thus scoring one of the few triumphs attained by the adherents of the coalition cabinet. This seat he retained until 1802, when he was beaten on account of his hostility to the peace of that year.

Though he strenuously opposed all proposals for parliamentary reform, to which most of the Whigs were deeply committed, Windham remained in alliance with that party until after the outbreak of the French Revolution, when he and several of his chief allies joined Pitt. The place of secretary-at-war was conferred upon him in July 1794, and he was at the same time created a privy councillor and admitted to a seat in the cabinet. Windham discharged the duties of his office with unflagging zeal, his efforts being particularly directed towards ameliorating the condition of the inferior grades of the army. In the autumn of

1794 he was despatched to the duke of York's camp in Flanders with the views of his ministerial colleagues, but their advice could not counteract the military incapacity of the royal duke. When Pitt was frustrated in his intention of freeing the Roman Catholics from their political disabilities, Windham, who in religious matters always inclined to liberal opinions, was one of the ministers who retired from office in February 1801. He was a constant opponent of all negotiations for peace with France, preferring to prosecute the campaign at whatever cost until some decisive victory had been gained, and the temporary peace of Amiens, which was carried through under Addington's administration, did not meet with his approval. When he was ousted from the representation of Norwich in June 1802, a seat for the pocket borough of St Mawes in Cornwall was found for him. He declined a place in Pitt's new cabinet (May 1804) on the ground that the exclusion of Fox prevented the formation of an administration sufficiently strong in parliament and the country to cope with the dangers which threatened the safety of the nation, and he offered a general opposition to the measures which the prime minister proposed. On Pitt's death in January 1806 the ministry of "All the Talents" was formed under the leadership of Lord Grenville, and Windham accepted the seals as secretary of state for war and the colonies. Fox's death necessitated several official changes; and a peerage was proposed for Windham, but he declined the proffered honour, and remained in office as long as the ministry existed. A general election took place in November 1806 and Windham was elected for the county of Norfolk; but the election was declared void on petition, and he was compelled to sit for the borough of New Romney, for which he had also been elected. In 1807, when parliament was dissolved under the influence of the "No Popery" cry of Spencer Perceval, a seat was found for Windham at Higham Ferrers. Liberty of religious opinion he uniformly supported at all periods of his life, and with equal consistency he opposed all outbreaks of religious fanaticism; hence with these convictions in his mind few of the domestic measures of the new ministers met with his approbation. Moreover, he disapproved of the expedition to the Scheldt, and thought the charges brought against the Duke of York, as commander-in-chief, required his retirement from office. At the same time he actively opposed the bill of Sir Samuel Romilly, his colleague on most political questions, for reducing the number of offences visited with the punishment of death. In July 1809 he received a blow on the hip whilst rendering assistance at a fire, which he thought little of at the time; but a tumour subsequently formed on the spot and an operation became necessary. This brought on a fever, and Windham rapidly sank. He died on the 4th of June 1810, and was buried in the family vault at Felbrigg.

His speeches were published in three volumes in 1806, with a memoir by Thomas Amyot, his private secretary while he was in office in 1806, and his *Diary* was edited by Mrs Henry Baring in 1866. The passages in the latter work relative to Dr Johnson's declining days have been of considerable use to the later editors of Boswell.

WIND INSTRUMENTS (Fr. *instruments à vent*, Ger. *Blasinstrumente*, Ital. *strumenti da fiato*), a numerous and powerful section of the orchestra, classified according to the acoustic properties of the instruments and to certain important structural features. The first great natural subdivision is that of (A) mouth blown, and (B) mechanically blown, instruments.

Section A falls into the classes of (1) wood wind, (2) brass wind, with their numerous subdivisions.

1. (*a*) *Wood Wind.*—Pipes without embouchure or mouthpiece, such as the ancient Egyptian *nay*, a long flute with narrow bore held obliquely, and the *syrinx* or pan-pipes, both of which are blown by directing the breath not *into* the pipe but *across* the open end, so that it impinges against the sharp edge of the rim. (*b*) Pipes with embouchure but no mouthpiece, such as the transverse flute, piccolo and fife; see Flute and Mouthpiece. (*c*) Pipes with whistle mouthpieces, an ancient contrivance, extensively used by primitive races of all ages, which finds application at the present day in the flageolet, the whistle, and in organ pipes known as the flue-work. A large class of medieval instruments, widely diffused but now obsolete, were known as recorders, beak or fipple-flutes, *flûtes à bec*, *flûtes douces*, *flûtes anglaises* (Fr.), *Plock* or *Blockflöten*, *Schnabelflöten* (Ger.). (*d*) Reed instruments, by which are to be understood not reed pipes but instruments with reed mouthpieces, which subdivide again into two families owing to the very different acoustic conditions produced by the combination of a reed mouthpiece with (1) a cylindrical pipe and (2) a conical pipe. These combinations influence not only the timbre, but principally the harmonics obtained by overblowing and used to supplement the fundamental scale given out as the lateral holes are uncovered one by one; the practical difference to the performer may be summed up as one of fingering. (*d*1) comprises pipes with cylindrical bore with either single or double reed mouthpiece, such as the clarinet family, the obsolete batyphone (*q.v.*) and the family of cromornes (*q.v.*). To these we may add the aulos and tibia of ancient Greece and Rome, which at different times had single and double reed mouthpieces. These pipes all overblow a twelfth. (*d*2) Pipes with conical bore and either single or double reed mouthpiece. This class comprises the important members of the oboe family (with double reed) derived from the Schalmey and Pommer of the middle ages, the *Schryari*, an instrument which had an ephemeral existence at the end of the 16th century and consisted of an inverted cone with a double reed placed within a *pirouette* or capsule, which had the result of restricting the compass of the instrument to the fundamental scale, for harmonics can only be produced when the reed is controlled by the lips (see Reed Instruments). The modern family of saxophones with single reed mouthpiece, intended to replace the clarinets in military bands, may be classed with the wood wind, although actually made of brass for durability. The same may be said of the sarrusophones, a family of brass oboes with double reed, invented by M. Sarrus to replace the oboe in military bands. To these we may add the *Cheng* (*q.v.*) or Chinese organ, consisting of a set of pipes arranged in a hollow gourd and sounded by means of free-reeds, the air being fed to the pipes in the reservoir by the mouth through a pipe shaped like the spout of a tea-pot. The Cheng is important, as embodying the principle of the harmonium. (*e*) Wooden tubes of conical bore having lateral holes and sometimes from one to three keys, played by means of a cup or funnel mouthpiece, such as the obsolete *cornet* (*q.v.*) or Zinke, which enjoyed such widespread popularity during the 16th and 17th centuries, and their bass the serpent. The bagpipe and its drones and chaunter are indirectly mouthblown, with the exception of the Union or Irish and of the Border bagpipes, and of the French bagpipe known as musette, in which the bag is fed with air by means of bellows, instead of through an insufflation pipe.

2. The *Brass Wind* consists of the following classes: (*a*) Tubes of fixed length, such as the natural trumpet and French horn, all medieval horns and trumpets, including the busine, the tuba, the oliphant, the hunting horn and the bugle, the classical buccina, cornu, lituus and tuba. The compass of all these was restricted to the few notes of the harmonic series obtained by overblowing. (*b*) Tubes of which the length is varied by a slide, such as the sackbut family, the slide trombone and slide trumpet. When the slide is drawn out the column of air is lengthened and the pitch proportionally lowered. Each position or shift of the slide enables the performer to overblow the harmonic series a semitone lower. (*c*) Tubes of which the length is varied by lateral holes and keys. To this class belong the keyed bugle and its bass the ophicleide, the obsolete keyed trumpet and the bass horns and Russian bassoon, which immediately preceded the invention of valves. The saxophones and sarrusophones might also be classed with these (see above, 1 *d*2). (*d*) Tubes of which the length is varied by valves or pistons. This class is the most modern of all, dating from the invention of valves in 1815, which revolutionized the technique and scoring for brass instruments. A rational subdivision of valve instruments is made in Germany into whole and half instruments (see Bombardon and Valves), according as to whether the whole length of tubing comes into practical use or only half, or from the performer's point of view whether the fundamental note of the harmonic series can be produced, or whether the series begins with the second member, an octave above the first, in which case it is obvious that half the tubing is of no practical value. The principal piston instruments are: the *whole* instruments—contrabass and bass tubas, bombardons or helicons; the euphonium or tenor tuba; the *half* instruments—saxhorns, Flügelhorns, tenor horns, cornets, the valve trombone, valve trumpet and valve horn (French horn), and the Wagner tubas, which are really the basses of the French horn and are played with funnel-shaped mouthpieces. The brass wind is further divided according to the shape of the mouthpiece used. (*a*) With funnel-shaped mouthpiece, such as the French horn, tenor horn and Wagner tubas; and (*b*) with cup-shaped mouthpiece, comprising all the other brass wind instruments except the bugle, of which the mouthpiece is a hybrid, neither true funnel nor true cup.

Section B: Mechanically Blown Instruments.—This section consists mainly of instruments having the air supply fed by means of bellows; it comprises the two classes: (1) with keyboard, (2) without keyboard.

1. This includes all kinds of organs: the ancient hydraulic organ or hydraulus, differing from the pneumatic only in that water pressure was used to compress the air supply instead of the bellows

being weighted by means of the foot and body of the performer at first and later by means of weights; the reed organ, consisting of pipes furnished with beating reeds, known also as the reed work when incorporated with the large church organ; the medieval portative and positive organs; the large modern church organ. To this class also belong the accordion and concertina and the numerous instruments of the harmonium type which have *free* instead of *beating* reeds, a difference which confers upon them the power of dynamic expression denied to all organs fitted with flue pipes or pipes having beating reeds. The complex instruments known as organized pianos also come within this category.

2. This comprises the bagpipes known as musette, and the Union or Irish and the Border bagpipes having a wind supply fed by bellows instead of by the insufflation pipe proper to the bagpipe; the barrel organ having instead of a keyboard a barrel studded with nails, which lift the valves admitting air to the flue pipes generally hidden within the case. (K. S.)

WINDISCHGRÄTZ, PRINCE ALFRED (1787–1862), Austrian field-marshal, entered the Austrian army in 1804, participated in all the wars against Napoleon and fought with distinction at Leipzig and in the campaign of 1814. In the following years of peace he held successive commands in Prague, being appointed head of the army in Bohemia in 1840. Having gained a reputation as a champion of energetic measures against revolution he was called upon to suppress the insurrection of March 1848 in Vienna, but finding himself ill-supported by the ministers he speedily threw up his post. Having returned to Prague he there showed firmness in quelling an armed outbreak of the Czech separatists (June 1848). Upon the recrudescence of revolt in Vienna he was summoned at the head of a large army and reduced the city by a formal siege (Oct. 20–29). Appointed to the chief command against the Hungarian rebels he gained some early successes and reoccupied Budapest (Jan. 1849), but by his slowness in pursuit he allowed the enemy to rally in superior numbers and to prevent an effective concentration of the Austrian forces. In April 1849 he was relieved of his command and henceforth rarely appeared again in public life.

See *Fürst Windischgrätz. Eine Lebens-Skizze. Aus den Papieren eines Zeitgenossen der Sturm-Jahre 1848 und 1849* (2nd ed., Leipzig, 1898).

WINDMILL, a term used, in the widest sense, for a machine by which the energy of the wind is applied to useful purposes. Windmills were certainly used as early as the 12th century and are still largely employed in Holland in draining the polders and grinding trass. They are somewhat extensively used in America for pumping and driving agricultural machinery. In spite of the competition of more powerful and tractable motors, they are serviceable, especially in new countries, where fuel is scarce and where work can be done intermittently. An inquiry was made in India in 1879 as to the possibility of using windmills for irrigation (*Professional Papers on Indian Engineering*, July 1879), with the result that it was concluded their usefulness would be very limited.

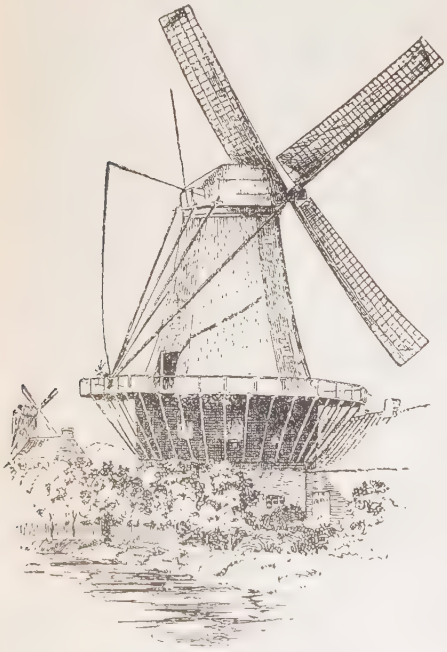

FIG. 1—Windmill near Delft.

A windmill is not in any case a very powerful or efficient motor, and its work is variable and intermittent. In favourable positions, it will run on an average for eight hours out of the twenty-four. For pumping on a small scale, the intermittent action is least an objection, because there is generally a tank or storage reservoir regulating the delivery of the water. For driving dynamos windmills are least suitable, on account of the variation of speed, though some attempts to generate electricity by wind power have been made, special arrangements being adopted for automatically regulating the speed.

European Windmills.—In all the older windmills a shaft, called the wind shaft, carried four to six arms or whips on which long rectangular narrow sails were spread. The wind shaft was placed at an inclination of 10° or 15° with the horizontal, to enable the sails to clear the lower part of the mill. The whip carrying the sail was often 30 to 40 ft. in length, so that the tips of the sails described a circle 60 to 80 ft. in diameter. The sails were rectangular, 5 to 6 ft. wide, and occupying five-sixths of the length of the whip. A triangular leading sail was sometimes added. Sometimes the sails consisted of a sail-cloth spread on a framework; at other times narrow boards were used. The oldest mill was no doubt the *post* mill, the whole structure being carried on a post; to bring the sails to face the wind, the structure was turned round by a long lever. The post mill was succeeded by the *tower*, *smock* or *frock* mill, in which the mill itself consisted of a stationary tower, and the wind shaft and sails were carried in a revolving cap rotating on the top of the tower. Andrew Meikle introduced in 1750 an auxiliary rotating fan at right angles to the principal sails, which came into action whenever the wind was oblique to the axis of the sails, automatically *veering* the sails or placing them normal to the wind. For safety, the sails must be *reefed* in high winds. In 1807, Sir W. Cubitt introduced automatic reefing arrangements. The sails were made of thin boards held up to the wind by weights. If the force of the wind exceeded a certain value the boards were pressed back and exposed little surface.

American Windmills.—These generally have the sails, 18 or more in number, arranged in an annulus or disk. The sails consist of narrow boards or slats arranged radially, each board having a constant or variable inclination to the wind's direction. An American mill presents a larger surface for a given length of sail than the older type, and consequently the construction is lighter. To turn the mill face to the wind a rudder is sometimes used projecting backward in a plane at right angles to the plane of rotation of the sails. Various arrangements are adopted for reefing the sails automatically. (*a*) In some an action equivalent to reefing is obtained by turning the sail disk oblique to the wind. The pressure on a side vane in the plane of rotation, controlled by a weight, turns the sail disk edgeways to the wind if the pressure exceeds a safe amount. (*b*) In centrifugal governor mills the slats forming the sails are connected in sets of six or eight, each set being fixed to a bar at the middle of its length. By rotating this bar the slats are brought end on to the wind, the action being analogous to shutting an umbrella. The slats are held up to the wind by a weight. A centrifugal governor lifts the weight if the speed becomes excessive and the sails are partially or completely furled. Many of the veering and reefing arrangements are very ingenious and too complicated to be described without detailed drawings. A description of some of these arrangements will be found in a paper by J. A. Griffiths (*Proc. Inst. Civ. Eng.*, 119, p. 321) and in a "Report on Trials of Wind Pumping Engines at Park Royal in 1903" (*Journ. Roy. Agric., Soc.*, 64, p. 174).

Warner's Annular Sail Windmill.—Messrs Warner of London make a windmill somewhat similar to American mills. The shutters or vanes consist of a frame covered with canvas, and these are pivoted between two angle-iron rings so as to form an annular sail. The vanes are connected with spiral springs, which keep them up to the best angle of weather for light winds. If the strength of the wind increases, the vanes give to the wind, forcing back the springs, and thus the area on which the wind acts diminishes. In addition, there are a striking lever and tackle for setting the vanes edgeways to the wind when the mill is stopped or a storm is expected. The wheel is kept face to the wind by a rudder in small mills; in large mills a subsidiary fan and gear are used. Fig. 2 shows a large mill of this kind, erected in a similar manner to a tower mill. The tower is a framework of iron, and carries a revolving cap, on which the wind shaft is fixed. Behind is the subsidiary fan with its gearing acting on a toothed wheel fixed to the cap.

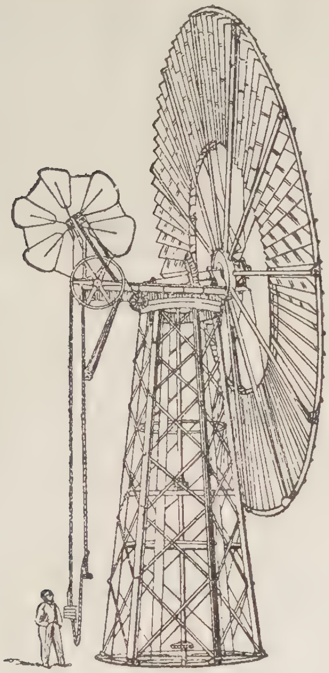

FIG. 2.—Warner's Annular Sail Windmill.

It is important that a wind-mill should control itself so that it works efficiently in moderately strong winds and at the same time runs in very light winds, which are much more prevalent. It should also, by reefing or otherwise, secure safety in storms.

Table I. gives the mean velocity of the wind in miles per hour for an inland station, Kew, and a very exposed station, Scilly, for each month during the period 1890–1899.

The pressure of the wind on a plane normal to its direction, composed partly of an excess front pressure and negative back pressure, is given by the relation

$$p=0{\cdot}003\,v^2,$$

where p is in pounds per square foot and v the velocity of the wind in miles per hour. It varies a little with the form and size of the surface, but for the present purpose this variation may be disregarded. (See experiments by Dr Stanton at the National Physical Laboratory, *Proc. Inst. Civ. Eng.* 156, p. 78.) For velocities of 5, 10 and 20 m. per hour the pressures on a plane normal to the wind would be about 0·075, 0·3 and 1·2 ℔ per sq. ft. respectively, and these may be taken to be ordinary working velocities for windmills. In storms the pressures are much greater, and must be reckoned with in considering the stability of the mill. A favourable wind velocity for windmills is 15 m. per hour.

TABLE I.

	Jan.	Feb.	March.	April.	May.	June.
Kew .	8·0	8·5	8·5	7·5	7·5	7·0
Scilly .	20·6	19·5	18·4	16·1	14·1	12·9
	July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
Kew .	7·0	7·0	6·0	6·5	7·0	8·0
Scilly .	12·4	13·9	14·6	17·2	19·3	22·0

Pressure on Surfaces oblique to the Wind.—Let fig. 3 represent a plane at rest on which a wind current impinges in the direction YY, making an angle θ with the normal Oa to the plane. Then the pressure n normal to the plane is given very approximately by Duchemin's rule

$$n=p\frac{2\cos\theta}{1+\cos^2\theta}\text{ ℔ per sq. ft.}$$

where p is the pressure in pounds per square foot on a plane struck normally by the same wind.

In fig. 3 let AB be part of a windmill sail or vane at rest, XX being the plane of rotation and YY the direction of the wind. The angle θ is termed the weather of the sail. This is generally a constant angle for the sail, but in some cases varies from a small angle at the outer end to a larger angle near the axis of rotation. In mills of the European type, $\theta=12°$ to $18°$, and the speed of the tips of the sails is $2\frac{1}{2}$ to 3 times the velocity of the wind. In mills of the American type, $\theta=28°$ to $40°$, and the speed of the tips of the vanes is $\frac{3}{4}$ to 1 time that of the wind. Then if O$a=n$ be the normal pressure on the sail or vane per square foot, $ba=t$ is the effective component of pressure in the direction of rotation and

$$t=n\sin\theta=p\frac{2\sin\theta\cos\theta}{1+\cos^2\theta}.$$

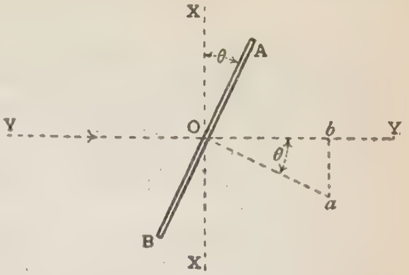

FIG. 3.

When the sail is rotating in a plane at right angles to the wind direction the conditions are more complicated. In fig. 4 let XX be the plane of rotation of the vane and YY the direction of the wind. Let Oa be the normal to the vane, θ being the weather of the vane. Let O$v=v$ be the velocity of the wind, O$u=u$ the velocity of the vane. Completing the parallelogram, O$v_r=v_r$ is the velocity and direction of the wind relatively to the vane.

$$v_r=\sqrt{(v^2+u^2)}=v\sec\phi,$$
$$\tan\phi=u/v,$$

and the angle between the relative direction of wind and normal to the vane is $\theta+\phi$. It is clear that $\theta+\phi$ cannot be greater than 90°, or the vane would press on the wind instead of the wind on the vane. Substituting these values in the equations already given, the normal pressure on the oblique moving vane is

$$n={\cdot}003\,v^2\sec^2\phi\frac{2\cos(\theta+\phi)}{1+\cos^2(\theta+\phi)}.$$

The component of this pressure in the direction of motion of the vane is

$$t={\cdot}003\,v^2\sec^2\phi\frac{2\sin(\theta+\phi)\cos(\theta+\phi)}{1+\cos^2(\theta+\phi)}$$

and the work done in driving the vane is

$$tu=tv\tan\phi$$
$$={\cdot}003\,v^3\sec^2\phi\tan\phi\frac{2\sin(\theta+\phi)\cos(\theta+\phi)}{1+\cos^2(\theta+\phi)}$$

foot ℔ per sq. ft. of vane per sec., where v is taken in miles per hour. For such angles and velocities as are usual in windmills this would give for a square foot of vane, near the tip about $0{\cdot}003\,v^3$ ft. ℔ per sec. But parts of the vane or sail nearer the axis of rotation are less effective, and there are mechanical friction and other causes of inefficiency. An old rule based on experiments by Coulomb on mills of the European type gave for the average effective work in foot ℔ per sec. per sq. ft. of sail

$$W=0{\cdot}0011\,v^3.$$

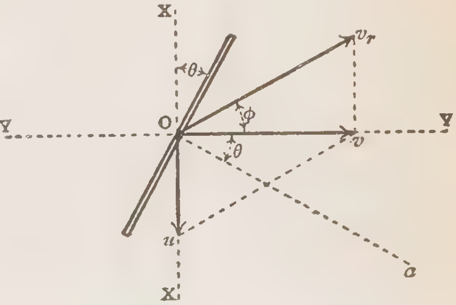

FIG. 4.

TABLE II.—*In 150 Working Hours.*

	I.	II.	III.	IV.	V.	VI.
Revolutions of wheel	208,000	308,000	264,000	322,000	222,000	202,000
Double strokes of pump . . .	40,000	122,000	264,000	160,000	78,000	202,000
Gallons lifted	78,000	40,000	46,000	40,000	36,000	48,000
Average effective horse-power .	0·53	0·27	0·31	0·27	0·24	0·32

I. Goold Shapley and Muir, Ontario; wheel 16 ft. diameter, 18 vanes, 131 sq. ft. area (first prize). II. Thomas & Son (second prize). III. J. W. Titt. IV. R. Warner. V. J. W. Titt. VI. H. Sykes.

Some data given by Wolff on mills of the American type gave for the same quantity

$$W = 0{\cdot}00045v^3.$$

From some of the data of experiments by Griffiths on mills of the American type used in pumping, the effective work in pumping when the mill was working in the best conditions amounted to from $0{\cdot}0005v^3$ to $0{\cdot}0003v^3$ ft. lb per sec. per sq. ft.

In 1903 trials of wind-pumping engines were carried out at Park Royal by the Royal Agricultural Society (*Journ. Roy. Agric. Soc.* lxiv. 174). The mills were run for two months altogether, pumping against a head of 200 ft. The final results on six of the best mills are given in Table II.

A valuable paper by J. A. Griffiths (*Proc. Inst. Civ. Eng.* cxix. 321) contains details of a number of windmills of American type used for pumping and the results of a series of trials. Table III. contains an abstract of the results of his observations on six types of windmills used for pumping:—

TABLE III.

	I.		II.		III.	IV.	V.	VI.
Diameter of wheel, feet	22·3		11·5		16·0	14·2	10·2	9·8
Sail area, square feet	392		104		201	157	81	80
Weather angle, outer ends	18° 47′		43°		36°	30°	28°	50°
,, ,, inner ends	38° 20′		43°		36°	30°	28°	14°
Pitch of vanes, outer ends, feet	23·8		33·7		36·5	25·7	17·0	22·4
,, ,, inner ends, feet	20·6		13·1		13·7	8·2	6·4	7·2
Height of lift, feet	25	100	29·2	61·2	39·0	66·3	38·7	30·7
Velocity of wind at maximum efficiency, miles per hour	4·3	7·0	5·8	6·5	6·0	7·0	8·5	6·0
Ratio of velocity of tips of vanes to velocity of wind	·93	·77	·92	·82	·65	·91	·87	·73
Revolutions of mill, per minute	5·0	6·8	13·0	13·3	7·5	12·6	20·5	12·5
Actual horse-power	0·018	0·098	0·011	0·025	0·024	0·065	0·028	0·012
In 100 average hours in a calm locality—								
Quantity of water lifted, gallons per hour	495	306	153	135	259	267	115	145
In 100 average hours in a windy locality—								
Quantity of water lifted, gallons per hour	816	629	287	271	525	540	237	270

I. Toowoomba; conical sail wheel with reefing vane. II. Stover; solid sail wheel with rudder; hand control. III. Perkins; solid wheel, automatic rudder. IV. and V. Althouse; folding sail wheel, rudderless. VI. Carlyle; special type, automatic rudder.

Table IV. gives the horse-power which may be expected, according to Wolff, for an average of 8 hours per day for wheels of the American type.

Diameter of Wheel in Feet.	Velocity of Wind in Miles per Hour.	Horse-power of Mill.	Revolutions of Wheel per Minute.
8½	16	0·04	70–75
10	16	0·12	60–65
12	16	0·21	55–60
14	16	0·28	50–55
16	16	0·41	45–50
18	16	0·61	40–45
20	16	0·78	35–40
25	16	1·34	30–35

Further information will be found in Rankine, *The Steam Engine and other Prime Movers*; Weisbach, *The Mechanics of Engineering*; and Wolff, *The Windmill as a Prime Mover*. (W. C. U.)

WINDOW (properly "wind eye"), the term applied in architecture (Ital. *fenestra*, Fr. *fenêtre*, Span. *ventana*, Ger. *Fenster*) to an aperture or opening in a wall for the admission of light and air to the interior of a hall or room.

The earliest windows are those which constituted the clerestory windows of the Great Hall of Columns at Karnak; they were filled with vertical slabs of masonry pierced with narrow slits. Other Egyptian temples were lighted in the same way. In one at Der el Medinet at Thebes the window was divided by miniature columns with lotus capitals. Some of the small ivory carvings found at Nimroud by Layard, now in the British Museum, are evidently of Egyptian workmanship, as they have lotus columns forming a balustrade in the lower part of the window; and such features are shown in the Assyrian bas-reliefs as windows in the towers. Dr Arthur Evans's discoveries at Cnossus have revealed, in the eastern portion of the palace, rectangular openings which were certainly windows, with raised sills and stone benches inside, and the representations of the ordinary houses at Cnossus on a series of plaques show that they were in two or three storeys with openings in the upper storeys filled with windows framed in timber with transoms and mullions. It was at one time thought that there were no windows in Greek temples, and those of the west front of the Erechtheum are known now to be later reconstructions of the Roman period, but the remains of two windows placed on either side of the eastern doorway of the Erechtheum, which formed part of the original building of 430 B.C., have lately been found; they were rectangular windows with moulded and enriched architrave, resting on a sill and crowned with the cymatium moulding. Of later date, at Ephesus, remains of similar windows have been discovered. Of Roman windows many examples have been found, those of the Tabularium being the oldest known. A coin of Tiberius representing the temple of Concord shows features in the side wings which might be windows, but as statues are shown in them they are possibly only niches. Over the door of the Pantheon is an open bronze grating, which is thought to be the prototype of the windows which lighted the large halls of the Thermae, as it was absolutely necessary that these should be closed so as to retain the heat, the openings in the gratings being filled with glass. In some cases window openings were closed with thin slabs of marble, of which there are examples still existing in the churches of S. Martino and the Quattro Santi Incoronati at Rome. Similar slabs exist in the upper storey of the amphitheatre at Pola; it still remains, however, an open question as to the lighting of some of the temples in Rome, in which were placed all the magnificent statues from Greece, so as to enable them to be seen properly. The Pantheon was lighted by a circular opening in the dome 30 ft. in diameter; the rain therefore fell in at times, and consequently the pavement had a convex contour, there being also holes under the hypaethral opening in connexion with drains beneath the pavement. There was a window at the south end of the tepidarium of the Forum baths at Pompeii, said to have been filled with a bronze frame with glass in it, half an inch thick. Although no window frames have been found in Pompeii, the openings in the walls show that some of the rooms were lighted by windows; one of them in the house of Diomede takes the form of a bow window with three lights in it.

In the later styles the windows assume much greater importance, and in Gothic cathedrals almost govern the whole design. Already, however, in the earliest Byzantine church, Sta Sophia at Constantinople, the windows constituted one of the chief features of the church; the forty windows round the base of the cupola giving an exceptional lightness to the structure; besides, there are windows in the larger and smaller apses and in the north and south walls. The windows in the latter, which are of great size, are subdivided by marble mullions with pierced lattices between of transparent marbles.

In the later Byzantine churches the windows were of smaller dimensions, but always filled with marble screens, sometimes pierced, and the grouping of two or three under a single arch is the prevailing design.

In the Romanesque styles the windows are universally round-headed, with infinite variety of design in the mouldings and their enrichment, greater importance being sometimes given by having two or more rings of arches, the outer ones carried by small columns; this is varied in Norman work by dividing them with a shaft into two or more lights placed in shallow recesses under an arched head. Circular windows occur occasionally, as in the eastern transept of Canterbury, at Iffley church, Oxford, Barfreston and Patricksbourne in Kent. In all these early windows, which are usually small, greater light is obtained by splaying the jambs inside with a scoinson arch over them. The coupling together of two or more windows under a single arch, and the piercing of the tympanum above, led to the development of plate and rib tracery (see TRACERY); also to that of the circular or rose windows, which throughout the Romanesque and Gothic periods constituted very important features in the church, being placed high up in the west front over the porch or in the transepts; sometimes, and more particularly in French churches, they occupied the whole of the upper portion of the windows, having vertical lights under them, but the junction was never quite satisfactory.

Although the employment of tracery continued long after the classic revival, the examples generally are poor in design, and even in those that are more elaborate (as those of the period of Henry II. in the church at Le Grand Andely) the introduction of classic details in the ordinary and rose windows was of too capricious a character to make them worthy of much attention. The early Renaissance architects in France in some cases, and notably in the apsidal chapels of St Pierre at Caen (1520), seemed to feel that the stained glass was too much cut up by the tracery and mullions, and omitted them altogether, trusting to the iron stanchions and cross-bars to carry their glass, so that a return was made to the simple semicircular-headed window of Roman times, retaining only the mouldings of the late Flamboyant period for the jambs and arch-moulds. Windows of this description, however, would be out of place in domestic architecture, so that the mullion window was there retained with two or three transoms, all moulded and with square heads; in the Tudor period cusping was introduced in the upper lights and occasionally in those below, and this custom lingered for a long time in the collegiate buildings of Oxford and Cambridge and in various houses throughout England. In France, square-headed windows were almost always employed, owing to the earlier introduction there of the Renaissance style, when the decoration of the mullions, generally consisting of classic pilasters, required some kind of architrave, frieze and cornice, to render the order complete; eventually the mullion and transom disappear, and in the earlier work of the Louvre the windows are simple rectangular openings, fitted with wooden framework, and, like those in Rome, Milan and Genoa, depend for their architectural effect on the moulded classic jambs, and the lintel, frieze and small cornice over; and in cases where more importance was required, with small semicircular columns or pilasters carrying the usual entablature, with small pediments sometimes angular and sometimes semicircular, repeating in fact an ancient Roman design, of which almost the only examples known are the blank windows and niches which decorated some of the enclosure walls of the Roman thermae. In Florence and Siena the early windows of the Renaissance often had semicircular heads and were coupled together, there being two lights to the window divided by shafts, thus continuing the tradition of those of the earlier Tuscan palaces; the same treatment was followed in Venice, Verona and other towns in the north-east, where the Gothic influence of the palaces in Venice created a transition; thus the mouldings of the windows of the Vendramini and Corner Spinelli palaces follow closely those of the Ducal Palace, but the arches are semicircular instead of being either pointed or ogee in form. Another type peculiar to Venice is a lofty window with semicircular head enclosed in a rectangular panel and crowned with a small entablature and pediment.

The only new combination of the 16th century in Italy, which was largely adopted in England by Inigo Jones and his followers in the 17th and 18th centuries, is the so-called Venetian or Palladian window, the finest example of which is that found in the Sala della Ragione or the basilica at Vicenza; it is true that it was here employed by Palladio to light an open gallery, but the composition was so generally approved that it led to its constant adoption for a window of more importance than the ordinary simple rectangular form. It consists of a central light with semicircular arch over, carried on an impost consisting of a small entablature, under which, and enclosing two other lights, one on each side, are pilasters. In the library at Venice, Sansovino varied the design by substituting columns for the two inner pilasters. The Palladian window was introduced by Inigo Jones in the centre of the garden front at Wilton, by Lord Burlington in the centres of the wings of the Royal Academy, and good examples exist in Holkham House, Norfolk, by Kent, and in Worcester College, Oxford. There do not seem to be any examples in either Germany, France or Spain. Circular and oval windows, lighting a mezzanine or the upper part of a hall, are found in Italy, France and England, sometimes over ordinary rectangular windows when the main front is decorated with semi-detached columns as in Hampton Court Palace. (R. P. S.)

WINDOW CORNICE, an ornamental framework of wood or composition to which window curtains are attached by rods with rings or hooks. Cornices are often gilded and of elaborate design, but they are less fashionable in the 20th century than before it had been discovered that elaborate draperies harbour dust and microbes. Like other pieces of furniture, they have reflected taste as it passed, and many of the carefully constructed examples of the latter part of the 18th century are still in use in the rooms for which they were made. Chippendale provided a famous series still *in situ* for the gallery at Harewood House, the valances of which are, like the cornices themselves, of carved and painted wood.

WINDOW SEAT, a miniature sofa without a back, intended to fill the recess of a window. In the latter part of the 18th century, when tall narrow sash windows were almost universal, the window seat was in high favour, and was no doubt in keeping with the formalism of Georgian interiors. It differed much in decorative detail, but little in form. It stood as high from the floor as a chair; the two ends were identical, with a roll-over curve, more or less pronounced. The seats and ends were usually upholstered in rich fabrics which in many cases have remained intact. The legs followed the fashion in chairs and were square and tapered, or, somewhat later, round and reeded. Hepplewhite and the brothers Adam designed many graceful window seats, but they were produced by all the cabinet-makers of the period.

WINDOW TAX, a tax first levied in England in the year 1697 for the purpose of defraying the expenses and making up the deficiency arising from clipped and defaced coin in the recoinage of silver during the reign of William III. It was an assessed tax on the rental value of the house, levied according to the number of windows and openings on houses having more than six windows and worth more than £5 per annum. Owing to the method of assessment the tax fell with peculiar hardship on the middle classes, and to this day traces of the endeavours to lighten its burden may be seen in numerous bricked-up windows.

The revenue derived from the tax in the first year of its levy amounted to £1,200,000. The tax was increased no fewer than six times between 1747 and 1808, but was reduced in 1823. There was a strong agitation in favour of the abolition of the tax during the winter of 1850–1851, and it was accordingly repealed on the 24th of July 1851, and a tax on inhabited houses substituted. The tax contributed £1,856,000 to the imperial revenue the year before its repeal. There were in England in that year about 6000 houses having fifty windows and upwards; about 275,000 having ten windows and upwards, and about 725,000 having seven windows or less.

In France there is still a tax on doors and windows, and this forms an appreciable amount of the revenue.

WINDPIPE, the trachea (Gr. *τραχεῖα*, *sc.* *ἀρτηρία*, literally, rough artery), the air tube which leads from the larynx to the bronchi and lungs (see RESPIRATORY SYSTEM).

WINDSOR, a city and port of entry of Essex county, Ontario, Canada, on the left bank of the Detroit river, opposite the city of Detroit. Pop. (1901) 12,153. It is on the Grand Trunk, Canadian Pacific, Pere Marquette and Michigan Central railways, which connect at this point with the railways of the United States by means of large and powerful car-ferries. It is the centre of an important agricultural and fruit-growing district, in which tobacco is also produced. Salt works, flour mills, canning factories, and the manufacture of type-setting machines are the principal industries. During the season of navigation it is the centre of a large coasting trade on the Great Lakes.

WINDSOR, a township of Hartford county, Connecticut, U.S.A., on the Connecticut and Farmington rivers, adjoining the city of Hartford on the N. Pop. (1890) 2954; (1900) 3614, 596 being foreign-born; (1910) 4178. Area about 27 sq. m. It is served by the New York, New Haven & Hartford railway and by electric lines to Hartford and to Springfield, Massachusetts. Among the buildings are the Congregational Church, built in 1794 (the church itself was organized in 1630 in England), the Protestant Episcopal Church (1864) and the Roger Ludlow School. In Windsor are the Campbell School (for girls) and a public library (1888). The Loomis Institute (incorporated 1874 and 1905) for the gratuitous education of persons between 12 and 20 years of age has been heavily endowed by gifts of the Loomis family. Tobacco and market vegetables are raised in Windsor, and among its manufactures are paper, canned goods, knit and woollen goods, cigars and electrical supplies.[1]

In 1633 Captain William Holmes, of the Plymouth Colony, established near the mouth of the Farmington river a trading post, the first settlement by Englishmen in Connecticut; a more important and a permanent settlement (until 1637 called New Dorchester) was made in 1635 by immigrants from Dorchester, Massachusetts, led by the Rev. John Wareham, Roger Ludlow and others. In 1639 representatives from Windsor, with those from Wethersfield and Hartford, organized the Connecticut Colony. Among the original land-holders were Matthew Grant and Thomas Dewey, ancestors respectively of General

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[1] In the township of Windsor Locks (pop. 1910, 3715), immediately north, cotton yarn and thread, silk, paper, steel and machinery are manufactured.

U. S. Grant and Admiral George Dewey; and Captain John Mason (1600–1672), the friend of Miles Standish, was one of its early citizens. It was the birthplace of Roger Wolcott, of the older Oliver Wolcott (1726–1797), of Oliver Ellsworth (whose home is now a historical museum), and of Edward Rowland Sill. Windsor has been called "The Mother of Towns"; it originally included the territory now constituting the present township, and the townships of East Windsor (1768), Ellington (1786), South Windsor (1845), Simsbury (1670), Granby (1786), East Granby (1858), Bloomfield (1835) and Windsor Locks (1854).

See H. R. Stiles, *Ancient Windsor* (2 vols., New York, 1891; revised edition).

WINDSOR (properly New Windsor), a municipal borough of Berkshire, England, and a parliamentary borough extending into Buckinghamshire. Pop. (1901) 14,130. The town, which is famous for its royal castle, lies on the west (right) bank of the Thames, 21¼ m. W. of London by the Great Western railway, which serves it with a branch line from Slough. It is also the terminus of a branch of the London & South-Western railway. Here the Thames, from an easterly course, sweeps first nearly northward and then south-eastward.

Windsor Castle.

The castle lies at the north-eastern edge of the town, on a slight but commanding eminence, while the massive round tower in the centre, on its artificial mound, is conspicuous from far over the flat land to the east, north and west. The site of the castle is an irregular parallelogram measuring about 630 yds. by 180. On the west the walls enclosing the "lower ward," with the Clewer, Garter, Salisbury and Henry III. towers, overlook Thames Street and High Street, from which the "hundred steps" give access to the ward on the north, and the Henry VIII. gateway, opening from Castle Hill, on the south. This ward contains St George's Chapel in the centre, with the Albert Memorial Chapel on the east and the Horseshoe Cloisters on the west. To the north are the deanery and the canon's residences, for the foundation attached to the royal chapel has the privileges of a "royal peculiar," the dean being exempt from episcopal jurisdiction. To the south are the guard-room and the houses of the military knights, or pensioners. The round tower occupies the "middle ward"; on its flag-turret the Union Jack or the Royal Standard is hoisted according as the sovereign is absent or present. The buildings in the "upper ward," east of this, form three sides of a square; the state apartments on the north, the private apartments on the east and the visitors' apartments on the south. Along the north side of the castle extends the north terrace, commanding, from its position above a steep slope, splendid views across the river to Eton on the Buckinghamshire side, and far over the valley. The east terrace, continuing the north, overlooks the gardens in front of the private apartments, and the south terrace continues farther, as far as the George IV. gateway. The Home Park lies adjacent to the castle on the south, east and north. The Great Park extends south of Windsor, where the land, rising gently, is magnificently timbered with the remnant of the old royal forest. The village of Old Windsor (in distinction from which the name of New Windsor is given to the borough) lies by the river, south of the Home Park. To the west of Windsor itself the village of Clewer has become a suburb of the town.

As early as the time of the Heptarchy a stronghold of some importance existed at Windsor, the great mound, which is moated, circular and about 125 ft. in diameter, being a remnant of this period. William the Conqueror was attracted by the forest as a hunting preserve, and obtained the land by exchange from Westminster Abbey, to which Edward the Confessor had given it. Thereafter the castle became what it remains, the chief residence of the English sovereigns. The Conqueror replaced the primitive wooden enclosure by a stone circuit-wall, and the first complete round tower was built by Henry III. about 1272, but Edward III. wholly reconstructed it on a more massive scale, about 1344, to form a meeting-place for his newly established order of Knights of the Garter. He selected this spot because, according to a legend quoted by the chronicler Froissart, it was on the summit of the mound that King Arthur used to sit surrounded by his Knights of the Round Table. The bulk of the existing round tower is of Edward's time, but its walls were heightened and the tall flag-turret added by the court architect, Sir Jeffrey Wyatville, in the reign of George IV. In addition to the Round Tower, Henry III. had constructed long lines of circuit-walls, crowned at intervals with smaller towers. He also built a great hall (the present chapter library) and other apartments, together with a chapel, which was afterwards pulled down to make room for the chapel of St George. The beautiful little dean's cloister preserves a portion of Henry's work in the south wall, a contemporary portrait of the king appearing in distemper on one of the arches. Another chapel was built by him and dedicated to his favourite saint, Edward the Confessor. This graceful building, with an eastern apse, is now called the Albert Memorial Chapel; some of Henry III.'s work still exists in the lower part of its walls, but the upper part was rebuilt in 1501–1503 by Henry VII., who intended it as a burial-place for himself and his line, before he began the chapel which bears his name and contains his tomb at Westminster Abbey. Some years later the unfinished chapel was given by Henry VIII. to Cardinal Wolsey, and for long after it was known as "Wolsey's tomb-house." Wolsey engaged a Florentine sculptor named Benedetto, probably a son or nephew of Benedetto da Maiano (d. 1497), also a Florentine artist, to make him a costly tomb of marble and gilt bronze, with a recumbent effigy at the top, no doubt similar in design to Torrigiano's tomb of Henry VII. at Westminster. The rich bronze work of Wolsey's tomb was torn off and melted by order of the Commonwealth in 1642, and the metal was sold for the then large sum of £600. In 1805 the black marble sarcophagus, stripped of its bronze ornaments, was moved from Windsor and used as a monument over Nelson's grave in the crypt of St Paul's. Though Wolsey's tomb-house was roofed in and used for mass by James II., the stone vaulting was not completed until the whole chapel was fitted by Sir Gilbert Scott as a memorial to Albert, Prince Consort. Its internal walls were then lined with rich marbles, and decorated with reliefs by Baron Triqueti. The cenotaph of the Prince Consort stands before the altar, with the tombs of Prince Leopold, duke of Albany, and the duke of Clarence; the last erected by King Edward VII., who was himself buried here in May 1910. In a vault beneath the chapel George III. and members of his family are buried.

The chapel of St George is one of the finest examples of Perpendicular architecture in England, comparable with two other royal chapels, that of King's College at Cambridge and that of Henry VII. at Westminster, which are a little later in date. The building was begun by Edward IV., who in 1473 pulled down almost the whole of the earlier chapel, which had been completed and filled with stained glass by Edward III. in 1363. The nave of St George's was vaulted about the year 1490, but the choir groining was not finished till 1507; the hanging pendants from the fan vaulting of the choir mark a later development of style, which contrasts strongly with the simpler lines of the earlier nave vault. In 1516 the lantern and the rood-screen were completed, but the stalls and other fittings were not finished till after 1519. The chapel ranks next to Westminster Abbey as a royal mausoleum, though no king was buried there before Edward IV., who left directions in his will that a splendid tomb was to be erected with an effigy of himself in silver. Nothing remains of this except part of the wrought iron grille which surrounded the tomb, one of the most elaborate and skilfully wrought pieces of ironwork in the world, said to be the work of Quintin Matsys. The next sovereign buried here was Henry VIII., who directed that his body should be laid beside that of Jane Seymour, in a magnificent bronze and marble tomb. The tomb was never completed, and what existed of its metal-work was probably melted down by the Commonwealth. No trace of it remains. Charles I. was buried here without service in 1649. Above the dark oak stalls hang the historic insignia of the Knights of the Garter, their swords, helmets and banners. On the stalls themselves appear a remarkable series of enamelled brass plates commemorating knights of the order. Many tombs and memorials are seen in the chantry chapels.

The deanery, adjoining the dean's cloister, is dated 1500, but the Winchester tower to the north-east of it is the work of the famous prelate and architect William of Wykeham, who was employed by Edward III. on the greater part of this extension and alteration of Henry III.'s work. The Horseshoe cloisters were restored in Tudor style by Sir Gilbert Scott. The Norman gate on the north side of the round tower was rebuilt by Wykeham.

The site of the upper ward was built upon by Henry II., and, to a greater extent, by Edward III., but only in the foundations and lowest storey are remains of so early a period to be found. The buildings were wanting in homogeneity until their reconstruction was undertaken by Sir Jeffrey Wyatville under the direction of George IV., for Charles II. was unable to carry out a similar intention, perhaps fortunately, as Sir Christopher Wren proposed drastic alterations. Charles, however, completed the so-called Star Building, named from the representation of the star of the Order of the Garter on the north front. Here the state apartments are situated. They include the throne room, St George's Hall, where meetings of the Order of the Garter are held, the audience and presence chambers, and the grand reception room, adorned with Gobelins tapestries, and the guard-room with armour. All these chambers contain also splendid pictures and other objects of art; but more notable in this connexion are the picture gallery, the Rubens room or king's drawing-room, and the magnificent Van Dyck room. The ceilings of several of the chambers were decorated by Antonio Verrio, under the direction of Charles II. In the royal library, which is included among the private apartments, is a fine collection of drawings by the old masters, including three volumes from the hand of Leonardo da Vinci. Here is also a magnificent series of eighty-seven portraits by Holbein, highly finished in sepia and chalk, representing the chief personages of the court of Henry VIII. There are, moreover, examples by Michelangelo and Raphael, though the series attributed to these masters are not accepted as genuine in their entirety.

The parks.

South of the castle, beside the Home Park, is the Royal Mews. Within the bounds of the park is Frogmore (*q.v.*), with the Royal Mausoleum and that of the duchess of Kent, and the royal gardens. An oak-tree marks the supposed site of Herne's Oak, said to be haunted by the ghost of "Herne the hunter," a forest-ranger who hanged himself here, having fallen under the displeasure of Queen Elizabeth (Shakespeare, *Merry Wives of Windsor*, Act iv. sc. 4). A splendid avenue, the Long Walk, laid out in the time of Charles II. and William III., leads from George IV.'s gate on the south side of the castle straight into the heart of the Great Park, a distance of 3 m. Another fine and still longer straight avenue is Queen Anne's Ride, planted in 1707. Among various buildings within the park is Cumberland Lodge, built by Charles II. and taking name from the duke of Cumberland, who commanded the victorious royal troops at the battle of Culloden in 1746, and resided here as chief ranger. At the southern boundary of the park is a beautiful artificial lake called Virginia Water, formed by the duke. Windsor Forest formerly extended far over the south of Berkshire, and into the adjacent county of Surrey, and even in 1790 still covered nearly 60,000 acres. It was disafforested by an act of 1813.

Windsor town.

A few old houses remain in the town of Windsor, but the greater part is modernized. The church of St John the Baptist was rebuilt in 1822, but contains some fine examples of Grinling Gibbons's wood-carving. There are statues of Queen Victoria, unveiled in the first Jubilee year, 1887, and of Prince Albert (1890). The town hall was built in 1686 by Sir Christopher Wren, who represented the borough in parliament. The town was formerly celebrated for the number of its inns, of which there were seventy in 1650. The most famous were the "Garter" and the "White Hart," the first of which was the favourite of Shakespeare's Sir John Falstaff, and is frequently mentioned in *The Merry Wives of Windsor*. The borough is under a mayor, 6 aldermen and 18 councillors. Area, 2717 acres.

History.—Windsor (*Wyndeshour*, *Wyndsore*, *Windlesore*) was probably the site of a Roman settlement, two Roman tombs having been discovered at Tyle-Place Farm in 1865, while a Roman camp and various antiquities were unearthed at St Leonard's Hill in 1705. The early history of Windsor centres round the now unimportant village of Old Windsor, which was a royal residence under Edward the Confessor; and Robert of Gloucester relates that it was at a fair feast which the king held there in 1053 that Earl Godwin met with his tragic end. By the Confessor it was granted to Westminster Abbey, but was recovered in exchange for two other manors by William I., who erected the castle about 2 m. north-west of the village and within the manor of Clewer, round which the later important town of New Windsor was to grow up. The earliest existing charter of New Windsor is that from Edward I. in 1277, which was confirmed by Edward II. in 1315–1316 and by Edward III. in 1328. This constituted it a free borough and granted to it a gild merchant and other privileges. The same king later leased it as fee farm to the burgesses on condition that they "did justice to merchants, denizen and alien and to the poor." The town does not seem to have been prosperous, and the fee-farm rent was reduced by several succeeding sovereigns. In 1439 extensive privileges were accorded to the burgesses by Henry VI., and Edward IV. in 1467 granted a charter of incorporation under the title of the "mayor, bailiffs and burgesses." Further confirmations of existing privileges were granted by Edward IV. in 1477, by Henry VII. in 1499, by Henry VIII. in 1515 and by Edward VI. in 1549. A fresh charter was granted by James I. in 1603, and the renewal of this by Charles II. in 1664 incorporating the town under the title of the "mayor, bailiffs and burgesses of the borough of New Windsor," remained the governing charter until 1835. By the charter of Edward I. the county gaol was fixed at Windsor, but on the petition of the men of Berkshire it was removed thence to a more central town in the reign of Edward II. New Windsor sent two members to parliament from 1302 to 1335 and again from 1446 to 1865, omitting the parliaments of 1654 and 1656; by the act of 1867 it lost one member. The market is of ancient date, and in 1273 the abbess of Burnham is said to hold markets at Burnham and Beaconsfield to the prejudice of the market at Windsor. Edward IV. in 1467 granted a fair on the feast of St Edward the Confessor, and the charter of 1603 mentions a Saturday market and three yearly fairs. No fairs are now held, but the Saturday market is still maintained. Windsor bridge is mentioned in the reign of Edward I.; the present structure dates from 1822. The town has never had an important industry, but has depended almost entirely upon the castle and court.

The political history of Windsor centres round the castle, at which the Norman kings held their courts and assembled their witan. Robert Mowbray was imprisoned in its dungeons in 1095, and at the Christmas court celebrated at Windsor in 1127 David of Scotland swore allegiance to the empress Maud. In 1175 it was the scene of the ratification of the treaty of Windsor. The castle was bestowed by Richard I. on Hugh, bishop of Durham, but in the next year was treacherously seized by Prince John and only surrendered after a siege. In 1217 Ingelram de Achie with a garrison of sixty men gallantly held the fortress against a French force under the count de Nevers. It was a centre of activity in the Barons' War, and the meeting-place of the parliament summoned by Henry in 1261 in rivalry to that of the barons at St Albans; two years later, however, it surrendered to Simon de Montfort. The appeal of high treason against Thomas Mowbray, duke of Norfolk, was heard by Richard II. in Windsor Castle in 1398. During the Civil War of the 17th century the castle was garrisoned for the parliament, and in 1648 became the prison of Charles, who spent his last Christmas within its walls.

See J. E. Tighe, *Annals of Windsor* (1858); *Victoria County History: Berkshire.*

WINDTHORST, LUDWIG (1812–1891), German politician, was born on the 17th of January 1812 at Kaldenhof, a country house near Osnabrück. He sprang from a Roman Catholic family which for some generations had held important posts in the Hanoverian civil service. He was educated at the Carolinum, an endowed school at Osnabrück, and studied at the universities of Göttingen and Heidelberg. In 1836 he settled down as an advocate in Osnabrück: his abilities soon procured him a considerable practice, and he was appointed president of the Catholic Consistorium. In 1848 he received an appointment at the supreme court of appeal for the kingdom of Hanover, which sat at Celle. In the next year the revolution opened for him, as for so many of his contemporaries, the way to public life, and he was elected as representative for his native district in the second chamber of the reformed Hanoverian parliament. He belonged to what was called the Great German party, and opposed the project of reconstituting Germany under the leadership of Prussia; he defended the government against the liberal and democratic opposition; at this time he began the struggle against the secularization of schools, which continued throughout his life. In 1851 he was elected president of the chamber, and in the same year minister of justice, being the first Catholic who had held so high an office in Hanover. As minister he carried through an important judicial reform which had been prepared by his predecessor, but had to retire from office because he was opposed to the reactionary measures for restoring the influence and privileges of the nobility. Though he was always an enemy to liberalism, his natural independence of character prevented him from acquiescing in the reactionary measures of the king. In 1862 he again was appointed minister, but with others of his colleagues he resigned when the king refused his assent to a measure for extending the franchise. Windthorst took no part in the critical events of 1866; contrary to the opinion of many of his friends, after the annexation of Hanover by Prussia he accepted the *fait accompli*, took the oath of allegiance, and was elected a member both of the Prussian parliament and of the North German diet. At Berlin he found a wider field for his abilities. He acted as representative of his exiled king in the negotiations with the Prussian government concerning his private property and opposed the sequestration, thus for the first time being placed in a position of hostility to Bismarck. He was recognized as the leader of the Hanoverians and of all those who opposed the "revolution from above." He took a leading part in the formation of the party of the Centre in 1870–1871, but he did not become a member of it, fearing that his reputation as a follower of the king of Hanover would injure the party, until he was formally requested to join them by the leaders.

After the death of Hermann von Mallinckrodt (1821–1874) in 1874, Windthorst became leader of the party, and maintained that position till his death. It was chiefly owing to his skill and courage as a parliamentary debater and his tact as a leader that the party held its own and constantly increased in numbers during the great struggle with the Prussian government. He was especially exposed to the attacks of Bismarck, who attempted personally to discredit him and to separate him from the rest of the party. And he was far the ablest and most dangerous critic of Bismarck's policy. The change of policy in 1879 led to a great alteration in his position: he was reconciled to Bismarck, and even sometimes attended receptions at his house. Never, however, was his position so difficult as during the negotiations which led to a repeal of the May laws. In 1887 Bismarck appealed to the pope to use his authority to order the Centre to support the military proposals of the government. Windthorst took the responsibility of keeping the papal instructions secret from the rest of his party and of disobeying them. In a great meeting at Cologne in March 1887 he defended and justified his action, and claimed for the Centre full independence of action in all purely political questions. In the social reform he supported Bismarck, and as the undisputed leader of the largest party in the Reichstag he was able to exercise influence over the action of the government after Bismarck's retirement. His relations with the emperor William II. became very cordial, and in 1891 he achieved a great parliamentary triumph by defeating the School bill and compelling Gossler to resign. A few days afterwards he died, on the 14th of March 1891, at Berlin. He was buried in the Marienkirche in Hanover, which had been erected from the money subscribed as a testimonial to himself. His funeral was a most remarkable display of public esteem, in which nearly all the ruling princes of Germany joined, and was a striking sign of the position to which, after twenty years of incessant struggle, he had raised his party. Windthorst was undoubtedly one of the greatest of German parliamentary leaders: no one equalled him in his readiness as a debater, his defective eyesight compelling him to depend entirely upon his memory. It was his misfortune that nearly all his life was spent in opposition, and he had no opportunity of showing his abilities as an administrator. He enjoyed unbounded popularity and confidence among the German Catholics, but he was in no way an ecclesiastic: he was at first opposed to the Vatican decrees of 1870, but quickly accepted them after they had been proclaimed. He was a very agreeable companion and a thorough man of the world, singularly free from arrogance and pomposity; owing to his small stature, he was often known as "die kleine Excellenz." He married in 1839. Of his three children, two died before him; his wife survived him only a few months.

Windthorst's *Ausgewählte Reden* were published in three volumes (Osnabrück, 1901–1902). See also J. N. Knopp, *Ludwig Windthorst: ein Lebensbild* (Dresden, 1898); and Hüsgen, *Ludwig Windthorst* (Cologne, 1907). (J. W. He.)

WINDWARD ISLANDS, a group and colony in the West Indies. They consist of the British island of St Lucia, St Vincent and Grenada, with a chain of small islands, the Grenadines, between the two latter islands. They are not a single colony, but a confederation of three separate colonies with a common governor-in-chief, who resides at St George's, Grenada. Each island retains its own institutions, and they have neither legislature, laws, revenue nor tariff in common. There is, however, a common court of appeal for the group as well as for Barbados, composed of the chief justices of the respective islands, and there is also a common audit system, while the islands unite in maintaining certain institutions of general utility. The Windward Islands, which, as a geographical division, properly include Barbados, derive their name from the fact that they are the most exposed of the Lesser Antilles to the N.E. Trade, the prevailing wind throughout the West Indies.

WINE (Lat. *vinum*, Gr. *οἶνος*), a term which when used in its modern sense without qualification designates the fermented product of grape juice. The fermented juices of other fruits or plants, such as the date, ginger, plum, &c., are also termed wine, but the material from which the wine is derived is in such cases also added in qualification. The present article deals solely with wine derived from the grape (see Vine).

Historical.—The art of viticulture or wine-making is a very ancient one. In the East it dates back almost as far as we have historical records of any kind. In Egypt and in Greece the introduction of wine was ascribed to gods; in Greece to Dionysus; in Egypt to Osiris. The Hebrews ascribed the art of wine-making to Noah. It is probable that the discovery that an intoxicating and pleasant beverage could be made from grape juice was purely accidental, and that it arose from observations made in connexion with crushed or bruised wild grapes, much as the manufacture of beer, or in its earliest form, mead, may be traced back to the accidental fermentation of wild honey. In ancient times the cultivation of the vine indicated a relatively settled and stable form of civilization, inasmuch as the vine requires a considerable maturation period. It is probable, therefore, that viticulture was introduced subsequent to the raising of cereal crops. The Nabataeans were forbidden to cultivate the vine, the object being to prevent any departure from their traditional nomadic habits. The earliest examples of specific wines of which we have any record are the Chalybon wine, produced near Damascus, in which the Phoenicians traded in the time of Ezekiel (xxvii. 18), and which at a later date was much appreciated by the Persian kings; and the wines from the Greek islands (Chios, Lesbos, Cos). With regard to the introduction of the vine into other parts of Europe, it appears that it was brought to Spain by the Phoenicians, and to Italy and southern Gaul from Greece. In the earliest Roman times the vine was very little cultivated in Italy, but gradually Rome and Italy generally became a great wine country. At a later date the republic sought to stimulate its home industry by prohibiting the importation of wine, and by restricting its cultivation in the colonies, thus preserving the latter as a useful market for Italian wines. According to Pliny, Spanish, Gallic and Greek wines were all consumed in Rome during the 1st century of the Christian era, but in Gaul the production of wine appears to have been limited to certain districts on the Rhone and Gironde. The cultivation of the vine in more northern parts (*i.e.* on the Seine and Moselle) was not commenced until after the death of Probus. Owing no doubt to the difficulties of transportation, wine was, in the middle ages, made in the south of England, and in parts of Germany, where it is now no longer produced (cf. Hehn, *Culturpflanzen*, &c., and Mommsen, *Römische Geschichte*, v. 98 et seq.). We know very little of the ancient methods of cultivating the vine, but the Romans—no doubt owing to the luxuriant ease with which the vine grows in Italy—appear to have trained it on trees, trellis work, palisades, &c. The dwarf form of cultivation now common in northern Europe does not appear to have obtained to any extent. It seems likely that the quality of the wine produced in ancient times was scarcely comparable to that of the modern product, inasmuch as the addition of resin, salts and spices to wine was a common practice. With regard to the actual making of the wine, this does not appear to have differed very much in principle from the methods obtaining at the present day. Plastering appears to have been known at an early date, and when the juice of the grapes was too thin for the production of a good wine, it was occasionally boiled down with a view to concentration. The first wine receptacles were made of skins or hides, treated with oil or resin to make them impervious. Later, earthenware vessels were employed, but the wooden cask—not to mention the glass bottle—was not generally known until a much later period.

Production.—The total wine production of the world, which, of course, fluctuates considerably from year to year, amounts to roughly 3000 million gallons. France and Italy are the chief wine-producing countries, the former generally producing rather more than the latter. During the phylloxera period Italy in some years had the greater output (*e.g.* 1886–1888 and 1890–1892). The average production of the chief wine-producing countries will be gathered from the following table:—

Wine Production. Average Annual Production in Millions of Gallons for Quinquennial Periods.

Country.	Period.		
	1891–1895.	1896–1900.	1901–1905.
France	770	988	1126
Italy	674	689	840
Spain	521	412	390
Portugal	74	123	105
Austria-Hungary	113	120	178
Germany	49	64	74

The United States produces roughly 50, Bulgaria and Rumania each 40 and Servia 10 million gallons. The United Kingdom produces no wine, but the Cape and the Australian Commonwealth each produce some 5 million gallons.

The variation from year to year in the quantity of wine produced in individual countries is, of course, far greater than that observed in the case of beer or spirits. Thus, owing to purely climatic vagaries, the quantity of wine produced in Germany in 1891 was only 16 million gallons, whereas in 1896 it amounted to 111 millions. Similarly the French production, which was 587 million gallons in 1895, amounted to no less than 1482 millions in 1900. In the same way the Italian production has varied between 583 million gallons (1895) and 793 millions (1901), and the Spanish between 331 million gallons in 1896 and 656 millions in 1892.

Consumption.—It is only natural that the consumption of wine should be greatest in the countries where it is produced on the largest scale, but the discrepancy between the consumption of different countries is little short of astonishing. Thus, at the present time, the consumption per head in France is practically a hundred times that of the United Kingdom and twenty times that of Germany—the latter, it must be remembered, being itself an important wine-producing area.

The following table will give some idea of the relative consumption of wine in different countries:—

Average Consumption of Wine per Head of Population.

Country.	Period.		
	1891–1895.	1896–1900.	1901–1905.
	Gallons.	Gallons.	Gallons.
France	23·0	28·8	30·8
Italy	20·6	20·0	25·1
Spain	21·1	16·4	18·5
Portugal	11·0	20·3	17·1
Austria-Hungary	2·9	3·2	3·9
Germany	1·19	1·38	1·45
United States	0·30	0·32	0·43
British Empire—			
United Kingdom	0·37	0·40	0·32
Australia	1·09	1·12	1·30
Cape[1]	..	..	..

[1] Has varied between 1·9 and 3·7.

The whole of the wine consumed in the United Kingdom is imported. On the average somewhat more than one-third of the wine imported is derived from France, and about a quarter from Spain and Portugal respectively.

Wines imported into the United Kingdom in 1906.

From	Nature of Wines.	Quantity.	Value.
		(Gallons).	£
France	Claret, burgundy, champagne, &c.	4,105,302	2,221,423
Portugal	Chiefly port	3,707,377[1]	1,099,727
Spain	Sherry, tarragona, &c.	2,808,751	397,840
Germany[2] Netherlands	Hock, Moselle	1,268,662	729,002
Italy	..	243,247	42,513
Total for foreign countries	..	12,356,425	4,094,672
Australia	..	622,836	100,161
Total British possessions	..	777,689	123,891

[1] The quantity of port received was exceptionally large. The average quantity is rather under 3 million gallons and the value about £850,000.

[2] A considerable proportion of the German wines come to the United Kingdom via the Netherlands.

Of the wines imported from France, about one-quarter was Champagne and Saumur, the remainder consisting almost entirely of still wines, such as claret and burgundy.

Viticulture and Wine-making

General Considerations.—Although the wine is cultivated in practically every part of the world possessing an appropriate climate and soil, from California in the West to Persia in the East, and from Germany in the North to the Cape of Good Hope and some of the South American republics in the South, yet, as is the case also with the cereal crops and many fruits and vegetables, the wines produced in countries possessing temperate climates are—when the vintage is successful—finer than those made in hot or semi-tropical regions. Although, for instance, the wines of Italy, Greece, the Cape, &c., possess great body and strength, they cannot compare as regards elegance of flavour and bouquet with the wines of France and Germany. On the other hand, of course, the vagaries of the temperate climate of northern Europe frequently lead to a partial or complete failure of the vintage, whereas the wines produced in relatively hot countries, although they undoubtedly vary in quality from year to year, are rarely, if ever, total failures. The character of a wine depends mainly (*a*) on the nature of the soil; (*b*) on the general type of the climate; (*c*) on the variety of vine cultivated. The quality, as distinct from general character, depends almost entirely on the vintage, *i.e.* on the weather conditions preceding and during the gathering of the grapes and the subsequent fermentation. Of all these factors, that of the nature of the soil on which the vine is grown is perhaps the most important. The same vine, exposed to practically identical conditions of climate, will produce markedly different wines if planted in different soils. On the other hand, different varieties of the vine, provided they are otherwise not unsuitable, may, if planted in the same soil, after a time produce wines which may not differ seriously in character. Thus the planting of French and German vines in other countries (*e.g.* Australia, the Cape) has not led to the production of directly comparable wines, although there may at first have been some general resemblance in character. On the other hand, the replanting of some of the French vineyards (after the ravages due to the phylloxera) with American vines, or, as was more generally the case, the grafting of the old French stock on the hardy American roots, resulted, after a time, in many cases, in the production of wines practically indistinguishable from those formerly made.

Wine-making.—The art of wine-making is, compared with the manufacture of beer or spirits, both in principle and in practice a relatively simple operation. When the grapes have attained to maturity they are collected by hand and then transferred in baskets or carts to the press house. After the stalks have been removed either by hand or by a simple apparatus the juice is expressed either—as is still the case in many quarters—by trampling under foot or by means of a simple lever or screw press or by rollers. In the case of red wines the skins are not removed, inasmuch as it is from the latter that the colour of the wine is derived. The must, as the expressed juice of the grape is termed, is now exposed to the process of fermentation, which consists essentially in the conversion of the sugar of the must into alcohol and various subsidiary products. The fermenting operations in wine-making differ radically from those obtaining in the case of beer or of spirits in that (if we except certain special cases) no yeast is added from without. Fermentation is induced spontaneously by the yeast cells which are always present in large numbers in the grape itself. The result is that—as compared with beer or spirits—the fermentation at first is relatively slow, but it rapidly increases in intensity and continues until practically the whole of the sugar is converted. In the case of the production of certain sweet wines (such as the sweet Sauternes, Port and Tokay) the fermentation only proceeds up to a certain extent. It then either stops naturally, owing to the fact that the yeast cells will not work rapidly in a liquid containing more than a certain percentage of alcohol, or it is stopped artificially either by the addition of spirit or by other means which will be referred to below. As the character of a wine depends to a considerable extent on the nature of the yeast (see FERMENTATION), many attempts have been made of late years to improve the character of inferior wines by adding to the unfermented must a pure culture of yeast derived from a superior wine. If pure yeast is added in this manner in relatively large quantities, it will tend to predominate, inasmuch as the number of yeast cells derived from the grapes is at the commencement of fermentation relatively small. In this way, by making pure cultures derived from some of the finest French and German wines it has been possible to lend something of their character to the inferior growths of, for instance, California and Australia. It is not possible, however, by this method to entirely reproduce the character of the wine from which the yeast is derived inasmuch as this depends on other factors as well, particularly the constitution of the grape juice, conditions of climate, &c. The other micro-organisms naturally present in the must which is pitched with the pure culture are not without their influence on the result. If it were possible to sterilize the must prior to pitching with pure yeast no doubt better results might be obtained, but this appears to be out of the question inasmuch as the heating of the must which sterilization involves is not a practicable operation. After the main fermentation is finished, the young wine is transferred to casks or vats. The general method followed is to fill the casks to the bung-hole and to keep them full by an occasional addition of wine. The secondary fermentation proceeds slowly and the carbonic acid formed is allowed to escape by way of the bung-hole, which in order to prevent undue access of air is kept lightly covered or is fitted with a water seal, which permits gas to pass out of the cask, but prevents any return flow of air. During this secondary fermentation the wine gradually throws down a deposit which forms a coherent crust, known as *argol* or *lees*. This consists chiefly of cream of tartar (bitartrate of potash), tartrate of lime, yeast cells and of albuminous and colouring matters. At the end of some four to five months this primary deposition is practically finished and the wine more or less bright. At this stage it receives its first *racking*. Racking consists merely in separating the bright wine from the deposit. The wine is racked into clean casks, and this operation is repeated at intervals of some months, in all three to four times. As a general rule, it is not possible by racking alone to obtain the wine in an absolutely bright condition. In order to bring this about, a further operation, namely that of *fining*, is necessary. This consists, in most cases, in adding to the wine proteid matter in a finely divided state. For this purpose isinglass, gelatin or, in the case of high-class red wines, white of egg is employed. The proteid matter combines with a part of the tannin in the wine, forming an insoluble tannate, and this gradually subsides to the bottom of the cask, dragging with it the mechanically suspended matters which are the main cause of the wine's turbidity. In some cases purely mechanical means such as the use of Spanish clay or filtration are employed for fining purposes. Some wines, particularly those which lack acid or tannin, are very difficult to fine. The greatest care is necessary to ensure the cleanliness and asepticity of the casks in which wine is stored or into which it is racked. The most common method of ensuring cask cleanliness is the operation known as "sulphuring." This consists in burning a portion of a sulphur "match" (*i.e.* a flat wick which has been steeped in melted sulphur, or simply a stick of melted sulphur) in the interior of the cask. The sulphurous acid evolved destroys such micro-organisms as may be in the cask, and in addition, as it reduces the supply of oxygen, renders the wine less prone to acidulous fermentation. Sweet wines, which are liable to fret, are more highly and frequently sulphured than dry wines. After the wine has been sufficiently racked and fined, and when it has reached a certain stage of maturation—varying according to the type of wine from, as a rule, two to four years—the wine is ready for bottling. Certain wines, however, such as some of the varieties of port, are not bottled, but are kept in the wood, at any rate for a considerable number of years. Wines so preserved, however, develop an entirely different character from those placed in bottle.

CHEMISTRY OF WINE

Maturation of the Grape.—The processes which take place in the grape during its growth and maturation are of considerable interest. E. Mach has made some interesting observations on this point. At first—*i.e.* at the beginning of July when the berries have attained to an appreciable size—the specific gravity of the juice is very low; it contains very little sugar, but a good deal of acid, chiefly free tartaric acid and malic acid. The juice at this period contains an appreciable amount of tannin. As the berry grows the amount of sugar gradually increases, and the same up to a certain point applies to the acidity. The character of the acidity, however, changes, the free tartaric acid gradually disappearing, forming bitartrate of potash and being otherwise broken up. On the other hand, the free malic acid increases and the tannin decreases. When the grape is ripe, the sugar has attained to a maximum and the acidity is very much reduced; the tannin has entirely disappeared.

The following figures obtained by Mach afford an interesting illustration of these processes:—

At first the sugar in the juice consists entirely of dextrose, but later fructose (laevulose) is formed. The sugar in ripe grape juice is practically invert sugar, *i.e.* consists of practically equal parts of dextrose and fructose. The proportion of sugar present in the juice of ripe grapes varies considerably according to the type of grape, the locality and the harvest. In temperate climates it varies as a rule between 15 and 20%, but in the case of hot climates or where the grapes are treated in a special manner, it may rise as high as 35% and more.

Fermentation.—The fermentation of grape juice, *i.e.* the must, is, as we have seen, a relatively simple operation, consisting as it does in exposing it to the spontaneous action of the micro-organisms contained in it. The main products formed are, as in all cases of

Constitution of Grape Juice at Various Periods of Maturation.
(E. Mach.)

	Date of Analysis of Juice.			
	6th July.	12th Aug.	9th Sept.	12th Oct.
Specific gravity .	1·010	1·029	1·083	1·093
	Per cent.	Per cent.	Per cent.	Per cent.
Sugar . . .	0·86	2·02	18·52	23·17
Total acid (as tartaric acid) .	2·66	3·46	0·87	0·71
Tartar . . .	0·67	0·55	0·54	0·55
Malic acid . .	1·16	2·47	0·55	0·42
Tannin . . .	0·106	0·012	. .	. .

alcoholic fermentation, ethylic alcohol, water and carbonic acid. At the same time various subsidiary products such as glycerin, succinic acid, small quantities of higher alcohols, volatile acids and compound esters are produced. In the case of red wines colouring matter is dissolved from the skins and a certain amount of mineral matter and tannin is extracted. It is to these subsidiary matters that the flavour and bouquet in wine are particularly due, at any rate in the first stages of maturation, although some of the substances originally present in the grape, such as ready-formed esters, essential oils, fat and so on, also play a rôle in this regard. In view of the fact that fresh grape juice contains innumerable bacteria and moulds, in addition to the yeast cells which bring about the alcoholic fermentation, and that the means which are adopted by the brewer and the distiller for checking the action of these undesirable organisms cannot be employed by the wine-maker, it is no doubt remarkable that the natural wine yeast so seldom fails to assert a preponderating action, particularly as the number of yeast cells at the beginning of fermentation is relatively small. The fact is that the constitution of average grape juice and the temperatures of fermentation which generally prevail are particularly well suited to the life action of wine yeast, and are inimical to the development of the other organisms. When these conditions fail, as is, for instance, the case when the must is lacking in acidity, or when the weather during the fermentation period is very hot and means are not at hand to cool the must, bacterial side fermentations may, and do, often take place. The most suitable temperature for fermentation varies according to the type of wine. In the case of Rhine wines it is between 20 and 25° C. If the temperatures rise above this, the fermentation is liable to be too rapid, too much alcohol is formed at a relatively early stage, and the result is that the fermentation ceases before the whole of the sugar has been transformed. Wines which have received a check of this description during the main fermentation are very liable to bacterial troubles and frets. In the case of wines made in more southerly latitudes temperatures between 25 and 30° are not excessive, but temperatures appreciably over 30° frequently lead to mischief. The young wine immediately after the cessation of the main fermentation is very differently constituted from the must from which it was derived. The sugar, as we have seen, has disappeared, and alcohol, glycerin and other substances have been formed. At the same time the acidity is markedly reduced. This reduction of acidity is partly due to the deposition of various salts of tartaric acid, which are less soluble in a dilute alcoholic medium than in water, and partly to the action of micro-organisms. Young wines differ very widely in their composition according to class and vintage. The alcohol in naturally fermented wines may vary between 7 and 16%, although these are not the outside limits. The acidity may vary between 0·3 and 1% according to circumstances. The normal proportion of glycerin varies between 7 and 14 parts for every 100 parts of alcohol in the wine, but even these limits are frequently not reached or exceeded. The total solid matter or "extract," as it is called, will vary between 1·5 and 3·5% for dry wines, and the mineral matter or ash generally amounts to about one-tenth of the "extract." The tannin in young red wines may amount to as much as 0·4 or 0·5%, but in white wines it is much less. The amount of volatile acid should be very small, and, except in special cases, a percentage of volatile acid exceeding 0·1 to 0·15%, according to the class of wine, will indicate that an abnormal or undesirable fermentation has taken place. As the wine matures the most noticeable feature in the first instance is the reduction in the acidity, which is mainly due to a deposition of tartar, and the disappearance of tannin and colouring matter, due to fining and the action of oxygen.

The taste and bouquet of wines in the earlier stages of their development, or within the first four or five years of the vintage, are almost entirely dependent upon constituents derived from the must, either directly or as a result of the main fermentation. In the case of dry wines, the quality which is known as "body" (palate-fulness) is mainly dependent on the solid, *i.e.* non-volatile, constituents. These comprise gummy and albuminous matters, acid, salts, glycerin and other matters of which we have so far little knowledge. The apparent "body" of the wine, however, is not merely dependent upon the absolute quantity of solid—non-volatile—matters it contains, but is influenced also by the relative proportions in which the various constituents exist. For instance, a wine which under favourable conditions would seem full and round may appear harsh or rough, merely owing to the fact that it contains a small quantity of suspended tartar, the latter causing temporary hyperacidity and apparent "greenness." It has been found by experience also that wines which are normally constituted as regards the relative proportions of their various constituents, provided that the quantities of these do not fall below certain limits, are likely to develop well, whereas wines which, although perfectly sound, show an abnormal constitution, will rarely turn out successful. The bouquet of young wines is due principally to the compound esters which exist in the juice or are formed by the primary fermentation. It was at one time thought that the quality of the bouquet was dependent upon the absolute quantity of these compound esters present, but the author and others have plainly shown that this is not the case. Among the characteristic esters present in wine is the well-known "oenanthic ether," which consists principally of ethylic pelargonate. It does not follow that a wine which shows a pretty bouquet in the primary stages will turn out well. On the contrary, it is frequently the case that the most successful wines in after years are those which at first show very little bouquet. The maturation of wine, whether it be in bottle or in cask, is an exceedingly interesting operation. The wines which remain for a long period in cask gradually lose alcohol and water by evaporation, and therefore become in time extremely concentrated as regards the solid and relatively non-volatile matters contained in them. As a rule, wines which are kept for many years in cask become very dry, and the loss of alcohol by evaporation—particularly in the case of light wines—has as a result the production of acidity by oxidation. Although these old wines may contain absolutely a very large quantity of acid, they may not appear acid to the palate inasmuch as the other constituents, particularly the glycerin and gummy matters, will have likewise increased in relative quantity to such an extent as to hide the acid flavour. In the case of maturation in bottle the most prominent features are the mellowing of the somewhat hard taste associated with new wine and the development of the secondary bouquet. The softening effect of age is due to the deposition of a part of the tartar together with a part of the tannin and some of the colouring matter. The mechanism of the development of the secondary bouquet appears to be dependent firstly on purely chemical processes, principally that of oxidation, and secondly on the life activity of certain micro-organisms. L. Pasteur filled glass tubes entirely with new wine and then sealed them up. It was found that wine so treated remained unchanged in taste and flavour for years. On the other hand, he filled some other tubes partly with wine, the remaining space being occupied by air. In this case the wine gradually matured and acquired the properties which were associated with age. Wortmann examined a number of old wines and found that in all cases in which the wine was still in good condition or of fine character a small number of living organisms (yeast cells, &c.) were still present. He also found that in the case of old wines which had frankly deteriorated, the presence of micro-organisms could not be detected. It is, however, not absolutely clear whether the improvement observed on maturation is actually due to the action of these micro-organisms. It may be that the conditions which are favourable to the improvement of the wine are also favourable to the continued existence of the micro-organisms, and that their disappearance is coincident with, and not the cause of, a wine's deterioration. It is frequently assumed that a wine is necessarily good because it is old, and that the quality of a wine increases indefinitely with age. This is, however, a very mistaken idea. There is a period in the life history of every wine at which it attains its maximum of quality. This period as a rule is short, and it then commences "to go back" or deteriorate. The age at which a wine is at its best is by no means so great as is popularly supposed. This age naturally depends upon the character of the wine and on the vintage. Highly alcoholic wines, such as port and sherry, will improve and remain good for a much longer period than relatively light wines, such as claret, champagne or Moselle. As regards the latter, indeed, it is nowadays held that it is at its best within a very short period of the vintage, and that when the characteristic slight "prickling" taste due to carbonic acid derived from the secondary fermentation has disappeared, the wine has lost its attraction for the modern palate. In the same way champagne rarely, if ever, improves after twelve to fourteen years. With regard to claret it may be said that as a general rule the wine will not improve after twenty-five to thirty years, and that after this time it will commence to deteriorate. At the same time there are exceptional cases in which claret may be found in very fine condition after a lapse of as much as forty years, but even in such cases it will be found that for every bottle that is good there may be one which is distinctly inferior.

DISEASES

Diseases of the Vine.—The vine is subject to a number of diseases some of which are due to micro-organisms (moulds, bacteria), others to insect life. The most destructive of all these diseases is that of the phylloxera. The *Phylloxera vastatrix* is an insect belonging to the green fly tribe, which destroys the roots and leaves of the growing plant by forming galls and nodosities. Practically every wine-growing country has been afflicted with this disease at one time or another. The great epidemic in the French vineyards in the years 1882 to 1885 led to a reduction of the yield of about 50%. Many remedies for this disease have been suggested, including total submersion of the vineyards, the use of carbon bisulphide for spraying, and of copper salts, but there appears to be little doubt that a really serious epidemic can only be dealt with by systematic destruction of the vines, followed by replanting with resistant varieties. This, of course, naturally leads to the production of a wine somewhat different in character to that produced before the epidemic, but this difficulty may be overcome to some extent, as it was in the Bordeaux vineyards, by grafting ancient stock on the roots of new and resistant vines. *Oidium* or *mildew* is only second in importance to the phylloxera. It is caused by a species of mould which lives on the green part of the plant. The leaves shrivel, the plant ceases to grow, and the grapes that are formed also shrivel and die. The most effective cure, short of destruction and replantation, appears to be spraying with finely divided sulphur. Another evil, which is caused by unseasonable weather during and shortly after the flowering, is known as *coulure*. This causes the flowers, or at a later period the young fruit, to fall off the growing plant in large numbers.

Diseases of Wine.—These are numerous, and may be derived either directly from the vine, from an abnormal constitution of the grape juice, or to subsequent infection. Thus the disease known as *tourne* or *casse* is generally caused by the wine having been made or partly made from grapes affected by mildew. The micro-organism giving rise to this disease generally appears in the form of small jointed rods and tangled masses under the microscope. Wine which is affected by this disease loses its colour and flavour. The colour in the case of red wines is first altered from red to brown, and in bad cases disappears altogether, leaving an almost colourless solution. This disease is also caused by the wine lacking alcohol, acid and tannin, and to the presence of an excess of albuminous matters. The most common disease to which wine is subject by infection is that caused by a micro-organism termed *mycoderma-vini* (French *fleurs de vin*). This micro-organism, which resembles ordinary yeast cells in appearance, forms a pellicle on the surface of wine, particularly when the latter is exposed to the air more than it should be, and its development is favoured by lack of alcohol. The micro-organism splits up the alcohol of the wine and some of the other constituents, forming carbonic acid and water. This process indicates a very intensive form of oxidation inasmuch as no intermediary acid is formed. One of the most common diseases, namely that producing acetous fermentation, differs from the disease caused by *M. vini* in that the alcohol is transformed into acetic acid. It is caused by a micro-organism termed *Mycoderma aceti*, which occurs in wine in small groups and chaplets of round cells. It is principally due to a lack of alcohol in the wine or to lack of acidity in the must. The micro-organism which causes the disease of *bitterness* (amer) forms longish branched filaments in the wine. Hand in hand with the development of a disagreeable bitter taste there is a precipitation of colouring matter and the formation of certain disagreeable secondary constituents. This disease is generally caused by infection and is favoured by a lack of alcohol, acid and tannin. Another disease which generally occurs only in white wines is that which converts the wine into a thick stringy liquid. It is the *viscous* or *graisse* disease. As a rule this disease is due to a lack of tannin (hence its more frequent occurrence in white wines). The *mannitic* disease, which is due to high temperatures during fermentation and lack of acid in the must, is rarely of serious consequence in temperate countries. The micro-organism splits up the laevulose in the must, forming mannitol and different acids, particularly volatile acid. The wine becomes turbid and acquires a peculiarly bitter sweet taste, and if the disease goes further becomes quite undrinkable. It would appear from the researches of the author and others that the mannitol ferment is more generally present in wines than is supposed to be the case. Thus the author found in some very old and fine wines very appreciable quantities of mannitol. In these cases the mannitic fermentation had obviously not developed to any extent, and small quantities of mannitol appear to exercise no prejudicial effect on flavour.

Treatment of Diseases.—It was found by Pasteur that by heating wine out of contact with air to about 66° C. the various germs causing wine maladies could be checked in their action or destroyed. The one disadvantage of this method is that unless very carefully applied the normal development of the wine may be seriously retarded. In the case of cheap wines or of wines which are already more or less mature, this is not a matter of any great importance, but in the case of the finer wines it may be a serious consideration. Pasteurizing alone, however, will only avail in cases where the disease has not gone beyond the initial stages, inasmuch as it cannot restore colour, taste or flavour where those have already been affected. In such cases, and also in others where pasteurizing is not applicable, some direct treatment with a view to eliminating or adding constituents which are in excess or lacking is indicated. In this regard it is somewhat difficult to draw the line between that which is a rational and scientific method for preventing waste of good material and sophistication pure and simple. It appears to the author, however, that where such methods are employed merely with a view to overcoming a specific malady and there is no intention of increasing the quantity of the wine for purposes of gain, or of giving it a fictitious appearance of quality, these operations are perfectly justifiable and may be compared to the modifications of procedure which are forced upon the brewer or distiller who has to deal with somewhat abnormal raw material. It has been found, for instance, that in the case of the mannitic disease the action of the micro-organism may be checked, or prevented altogether, by bringing the acidity of the must up to a certain level by the addition of a small quantity of tartaric acid. Again, it is well known that in the case of the viscous disease the difficulty may be overcome by the addition of a small quantity of tannin. In the same way the disease caused by the mildew organism may be counteracted by a slight addition of alcohol and tannin. One method of assisting nature in wine-making, which is, in the opinion of the author, not justifiable if the resulting product is sold as wine or in such a manner as to indicate that it is natural wine, is the process termed "gallisizing," so called from its inventor H. L. L. Gall, which has been largely practised, particularly on the Rhine. The process of Gall consists in adding sugar and water in sufficient quantity to establish the percentages of free acid and sugar which are characteristic of the best years in the must obtained in inferior years. Although there is no objection to this product from a purely hygienic point of view, it is not natural wine, and the products present in the must other than sugar and acid are by this process seriously affected. Another method of dealing with inferior must, due to J. A. C. Chaptal, consists in neutralizing excessive acid by means of powdered marble, and bringing up the sugar to normal proportions by adding appropriate amounts of this substance in a solid form. There is less objection to this process than to the former, inasmuch as it does not result in a dilution of the wine. It is scarcely necessary to say that the indiscriminate addition of alcohol and water, or of either to must or to wine, must be regarded as a reprehensible operation.

Plastering.—In some countries, particularly in Italy, Spain and Portugal, it has been and still is a common practice to add a small quantity of gypsum to the fermenting must or to dust it over the grapes prior to pressing. It is said that wines treated in this manner mature more quickly, and that they are more stable and of better colour. It certainly appears to be the case that musts which are plastered rarely suffer from abnormal fermentation, and that the wines which result very rarely turn acid. The main result of plastering is that the soluble tartrates in the wine are decomposed, forming insoluble tartrate of lime and soluble sulphate of potash. It is held that an excess of the latter is undesirable in wine, but unless the quantity appreciably exceeds two grams per litre, no reasonable objection can be raised.

Basis Wines.—Wines which are made not from fresh grape juice but from raisins or concentrated must, or similar material, are generally termed basis wines. They are prepared by adding water to the concentrated saccharine matter and subsequently pitching with wine yeast at an appropriate temperature. Frequently alcohol, tannin, glycerin, and similar wine constituents are also added. If carefully prepared there is no objection to these basis wines from a hygienic point of view, although they have not the delicate qualities and stimulating effects of natural wines; unfortunately, however, these wines have in the past been vended on a large scale in a manner calculated to deceive the consumer as to their real nature, but energetic measures, which have of late been taken in most countries affected by this trade, have done much to mitigate the evil.

WINES OF FRANCE

It may be safely said that there is no other country in which the general conditions are so favourable for the production of wine of high quality and on a large scale as is the case in France. The climate is essentially of a moderate character; the winters are rarely very cold, and the summers are seldom of the intensely hot and dry nature which is characteristic of most southerly wine countries. There are large tracts of gently undulating or relatively flat country which is, inasmuch as it ensures effective exposal of the vines to the sun, of a type particularly suited to viticulture. There is almost everywhere an efficient supply of water, and lastly the character of the soil is in many parts an ideal one for the production of wine high in quality and abundant in quantity. It may here be stated that a rich soil such as is suitable for the growth of cereal crops or vegetables is not, as a rule, an ideal one for the production of fine wines. The ideal soil for vine-growing is that which possesses a sufficiency, but not an excess, of nutriment for the plant, and which is so constituted that it will afford good drainage. The most important qualification, however, is that it should be so constituted as to preserve and store up during the relatively cold weather the heat which it has derived from the atmosphere during the summer. In this respect the famous Bordeaux or Gironde district is, perhaps, more fortunate than any other part of the world. The thrifty and methodical habits of the French peasantry, and also the system of small holdings which prevails in France, have, there is little doubt, done much to raise the French wine industry to the pre-eminent position which it holds. There is perhaps no branch of agriculture which requires more minute attention or for which a system of small holdings is more suitable than wine culture. At the present day, wine is produced in no less than 77 departments in France, the average total yield during the past ten years being roughly 1000 million gallons. This is considerably more than the average produced previous to the phylloxera period (1882–1887). The highest production on record was in the year 1875, when roughly 1840 million gallons were produced. Although France produces such enormous quantities of wine it is a remarkable fact that more wine is imported into France than is exported from that country. The average imports are in the neighbourhood of 120 million gallons, of which rather more than one-half comes from Algeria. The exports amount to roughly 40 million gallons. Of recent years (1896–1907) the only vintages which have been deficient as regards quantity are those of 1897, 1898, 1902 and 1903, but even in the most unfavourable of these years (1898) the quantity exceeded 700 million gallons. The greatest yield in this same period was in 1900, when over 1470 million gallons were produced. The number of different varieties of wines produced in France is remarkable. The red wines include the elegant and delicate (though not unstable) wines of the Gironde, and again the full, though not coarse, wines of the Burgundy district. Among the white wines we have the full sweet Sauternes, the relatively dry and elegant Graves and Chablis, and the light white wines which produce champagne and brandy.

Gironde (*Bordeaux*) *Wines.*—If France is the wine-growing country, *par excellence*, the Bordeaux district may be regarded as the heart and centre of the French wine industry. Although other parts of France produce excellent wines, the Gironde is easily first if high and stable character, elegance and delicacy, variety and quantity are considered together. The total area of the departments of the Gironde is about 2½ million acres, and roughly one-fifth of this is under the vine. It forms a tract of country some 90 m. long by 60 m. broad, in which the chief watersheds are those of the Garonne, Dordogne, and their confluent the Gironde. The soil varies very considerably in its character, and it is due to these variations that so many different types of wine are produced in this district. It generally consists of limestone, or of mixed limestone and clay, or of sand and clay, or of gravel, with here and there flint and rolled quartz. The subsoil is either of clay, of limestone, or mixed sand and clay, gravel, or of a peculiar kind of pudding stone which exists in a hard and a soft variety. It is formed of sand or fine gravel cemented by infiltrated oxide of iron. This stone is known locally under the name of *alios*. It is generally found at a depth of about 2 ft. under the better growths of the Médoc and Graves. The subsoils of some of the other districts (Côtes and St Emilion) contain much stone in the shape of flint and quartz. The finest wines of the Médoc and Graves are largely grown on a mixture of gravel, quartz and sand with a subsoil of *alios* or clay. The Gironde viticultural region is divided into six main districts, namely, Médoc, Sauternes, Graves, Côtes, Entre-deux-Mers and Palus. Although properly belonging to the Côtes, the St Emilion district is sometimes classified separately, as indeed, having regard to the excellence and variety of its wines, it has a right to be.

Médoc.—The most important subdivision of the Gironde district is that of the Médoc. It is here that the wine which is known to us as claret is produced in greatest excellence and variety. The Médoc consists of a tongue of land to the north of Bordeaux, bounded by the Garonne and Gironde on the east, and by the sea on the west and north. It is, roughly, 59 m. long by 6 to 10 m. broad. The soil varies considerably in nature, but consists mostly of gravel, quartz, limestone and sand on the surface, and of clay and *alios* beneath. The principal vines grown in the Médoc are the Cabernet-Sauvignon, which is the most important, the Gros Cabernet, the Merlot, the Carmenère, the Malbec, and the Verdot. All these produce red wines. Very little white wine is made in the Médoc proper. The method of vine cultivation is peculiar and characteristic. The vines are kept very low, and as a rule only two branches or arms, which are trained at right angles to the stem, are permitted to form. This dwarf system of culture gives the Médoc vineyards at a distance the appearance of a sea of small bushes, thereby producing an effect entirely different from, for instance, that seen on the Rhine with its high basket-shaped plants. The methods of making the wine in the Médoc are of the simplest description. The vintage generally takes place towards the end of September or the beginning of October. The grapes from which the stalks are partly or wholly (and occasionally not at all) removed are crushed by treading or some other simple method, but sometimes even this is omitted, the juice being expressed by the weight of the grapes themselves, or by the pressure caused by incipient fermentation. Presses are not used in the case of red wines until after fermentation, when they are employed in order to separate the wine from the murk. As a rule the fermentation occupies from 6 to 10 days; by this time the must has practically lost the whole of its sugar, and the young wine is drawn off and filled into hogsheads. The secondary fermentation proper is generally finished at the end of about six weeks to two months, and the first racking takes place, as a rule in February or March. Subsequent rackings are made about June and November of the same year, but in the following years, until bottling, two rackings a year suffice.

The Médoc is divided into a number of communes (such as St Julien, Margaux, Pauillac, &c.), and in these communes are situated the different vineyards from which the actual name of the wine is derived. Unlike the products of the different vineyards of most other districts, which are purchased by the merchants and vatted to supply a general wine for commerce, the yield of the principal estates of the Médoc are kept distinct and reach the consumer as the products of a particular growth and of a particular year. This practice is almost without exception resorted to with what are known as the "classed growths" and the superior "bourgeois" wines, whilst in seasons in which the wines are of good quality it is continued down to the lower grades. This classification of the Médoc growths became necessary owing to the great variety of qualities produced and the distinct characteristic excellence of the individual vintages. There are four main classes or *crus* (literally growths, but more correctly types or qualities), namely, the "grands crus classés" or "classed growths" and the bourgeois, artisan and peasant growths. The "classed growths," which include all the most famous wines of the Médoc, are themselves subdivided into five sections or growths. This general classification, which was made by a conference of brokers in 1855 as a result of many years of observation dating back to the 18th century, is still very fairly descriptive of the average merit of the wines classified. The following is a list of the classed red wines of the Médoc (*i.e.* claret) together with the names of the communes in which they are situated.

CLASSED GROWTHS OF THE MÉDOC (CLARET)

First Growths.

Château Lafite, Pauillac.
,, Margaux, Margaux.
,, Latour, Pauillac.

Second Growths.

Château Mouton-Rothschild, Pauillac.
,, Rauzan-Ségla, Margaux.
,, Rauzan-Gassies, Margaux.
,, Léoville-Lascases, St Julien.
,, Léoville-Poyferré, St Julien.
,, Léoville-Barton, St Julien.
,, Durfort-Vivens, Margaux.
,, Lascombes, Margaux.
,, Gruaud-Larose-Sarget, St Julien.
,, Gruaud Larose, St Julien.
,, Brane-Cantenac, Cantenac.
,, Pichon-Longueville, Pauillac.
,, Pichon-Longueville-Lalande, Pauillac.
,, Ducru-Beaucaillou, St Julien.
Cos d'Estournel, St Estèphe.
Château Montrose, St Estèphe.

Third Growths.

Château Kirwan, Cantenac.
,, D'Issan, Cantenac.
,, Lagrange, St Julien.
,, Langoa, St Julien.
,, Giscours, Labarde.
,, Malescot, Margaux.
,, Brown Cantenac, Cantenac.
,, Palmer, Cantenac.
,, La Lagune, Ludon.
,, Desmirail, Margaux.
,, Calon-Ségur, St Estèphe.
,, Ferrière, Margaux.
,, Becker, Margaux.

Fourth Growths.

Château Saint-Pierre, St Julien.
,, Branaire-Duluc, St Julien.
,, Talbot, St Julien.
,, Duhart-Milon, Pauillac.
,, Poujet, Cantenac.
,, La Tour Carnet, St Laurent.
,, Rochet, St Estèphe.
,, Beychevelle, St Julien.
Le Prieuré, Cantenac.
Marquis de Terme, Margaux.

Fifth Growths.

Château Pontet-Canet, Pauillac.
,, Batailley, Pauillac.
Grand-Puy-Lacoste, Pauillac.
Ducasse-Grand-Puy, Pauillac.
Château Lynch-Bages, Pauillac.
,, Lynch-Moussas, Pauillac.
,, Dauzac, Labarde.
,, Mouton-d'Armailhacq, Pauillac.
,, Le Tertre, Arsac.
,, Haut-Bages, Pauillac.
,, Pédesclaux, Pauillac.
,, Belgrave, St Laurent.
,, Camensac, St Laurent.
Cos-Labory, St Estèphe.
Château Clerc-Milon, Pauillac.
,, Croizet-Bages, Pauillac.
,, Cantemerle, Macau.

The quality of the Médoc red wines (and this applies also to some of the finer growths of the other Bordeaux districts) is radically different from that of wines similar in type grown in other parts of the world. The Gironde red wines have sufficient body and alcohol to ensure stability without being heavy or fiery. At the same time, their acidity is very low and their bouquet characteristically delicate and elegant. It is to this relatively large amount of body and absence of an excess of acid and of tannin that the peculiarly soft effect of the Bordeaux wines on the palate is due. It has been said that chemistry is of little avail in determining the value of a wine, and this is undoubtedly true as regards the bouquet and flavour, but there is no gainsaying the fact that many hundreds of analyses of the wines of the Gironde have shown that they are, as a class, distinctly different in the particulars referred to from wines of the claret type produced, for instance, in Spain, Australia or the Cape. The quality of the wines naturally varies considerably with the vintage; but it is almost invariably the case that the wines of successful vintages will contain practically the same relative proportions of their various constituents, although the absolute amounts present of these constituents may differ widely. It is the author's experience also that where a wine displays some abnormality as regards one or more constituents, that although it may be sound, it is rarely a wine of the highest class. The tables below will give a fair idea of the variations which occur in the same wine as a result of different vintages, and the variations due to differences of "growth" in the same vintage. These figures are selected from among a number published by the author in the *Journal of the Institute of Brewing*, April 1907.

Analyses of Château Lafite of Different Vintages.[1]

Vintage.	Description.	Alcohol Per Cent. by Vol.	Total Acidity.	Extract (Solid Matter).	Ash.	Total Tartaric Acid.	Glycerin.	Sugar.
1865	Château Lafite	11·26	4·17	26·83	2·18	2·28	7·99	1·10
1875	,,	10·31	3·67	..	..	..	7·25	..
1892	,,	11·00	4·38	25·92	2·42	2·11	4·60	1·25
1896	,,	11·05	3·51	26·08	2·68	1·71	8·64	1·69
1899	,,	11·47	3·49	27·91	3·01	1·78	7·11	1·74
1905	,,	10·75	3·02	25·34	2·42	2·42	7·52	2·12

Analyses of Different Clarets of the Same Vintage.[1]

Vintage.	Description.	Alcohol Per Cent. by Vol.	Total Acidity.	Extract (Solid Matter).	Ash.	Total Tartaric Acid.	Glycerin.	Sugar.
1900	Ch. Margaux	12·14	3·06	26·32	2·58	1·50	8·76	1·93
	Ch. Mouton-Rothschild	11·82	2·97	28·98	2·69	1·23	7·53	2·56
	Ch. Larose	12·06	3·23	29·01	2·29	1·50	8·02	3·97
	Ch. Batailley	12·14	3·15	26·54	2·39	1·48	8·45	2·27
	Ch. Palmer (Margaux)	11·73	3·19	28·64	2·72	1·52	8·23	2·27
	Ch. Smith-Haut-Lafite	13·76	3·10	27·48	2·10	1·56	7·48	2·32
	Second growth	10·91	3·32	29·44	2·84	1·75	6·99	1·72
	Bourgeois growth	12·71	3·32	29·57	2·16	1·56	9·01	2·49
	Peasant growth	11·47	3·58	20·97	1·71	2·50	7·18	1·20

The annual output of the Gironde during the last few years has been roughly 70 to 100 million gallons. In the decade 1876 to 1886 the average amount was barely 30 million gallons owing to the small yields of the years 1881 to 1885. In the years 1874 and 1875 the yield exceeded 100 million gallons. The output of the classed growths varies considerably according to the vintage, but is on the average, owing to the great care exercised in the vineyards, greater than that of the lower-grade areas. Thus within recent years the output of the Château Lafite was at a minimum in 1903 when only 229 hogsheads (the hogshead of claret = 46 gallons) were produced, and at a maximum in 1907, when close on 1000 hogsheads were obtained. Similarly, the Château Margaux, which yielded 1120 hogsheads in 1900, produced 280 hogsheads in 1903. The prices of the wines also are subject to great fluctuation, but in fair years will vary, according to class and quality, from £10 to £30 per hogshead for the better growths.

The principal claret vintages of modern times have been those of 1858, 1864, 1869, 1870, 1874, 1875, 1877, 1878, 1888, 1893, 1896, 1899 and 1900, while it was thought probable that many of the wines of 1904 to 1907 inclusive would turn out well. From 1882 to 1886 inclusive, the vintages were almost total failures owing to mildew. In 1887 to 1895 a number of fair wines were produced in each year, and the first really good vintage of the post-mildew-phylloxera period was that of 1888.

Graves.

Most of the wines grown on a purely gravelly soil are termed "Graves," but there is a specific district of Graves which lies south of Bordeaux and west of the river, and extends as far as Langon. The soil is almost a pure sandy gravel with a subsoil of varied nature, but principally *alios*, gravel, clay or sand. This district produces both red and white wines. The vines, the methods of viticulture and vinification as regards the red wines of the Graves district, are similar to those of the Médoc. The wines are, if anything, slightly fuller in body and more alcoholic than those of the latter region. They possess a characteristic flavour which differentiates them somewhat sharply from the Médoc wines. The Graves contains one vineyard, namely Château Haut-Brion, which ranks in quality together with the three first growths of the Médoc. The remainder of the red Graves are not classified, but among the more important wines may be mentioned the following: in the commune of Pessac, Château La Mission and Château Pape-Clément; in the commune of Villenave D'Ornon, Château La Ferrade; in Léognan, Château Haut-Bailly, Château Haut-Brion-Larrivet and Château Branon-Licterie; in Martillac, Château Smith-Haut-Lafite.

Sauternes.

The district of Sauternes produces the finest white wines of the Gironde, one might say of the whole of France. Whereas the white wines of the Graves are on the whole fairly dry and light in character, the white wines of Sauternes are full and sweet, with a very fine characteristic bouquet. The district of Sauternes covers the communes of Sauternes, Bommes and a part of Barsac, Preignac, Fargues and St Pierre-de-Mons. The general configuration of the country is markedly different from that of the Médoc, consisting of a series of low hills rising easily from the river. The soil consists chiefly of mixed clay and gravel, or clay and limestone, and the vines chiefly used are the Sauvignon, the Semillon and the Muscatelle. The wines are made entirely from white grapes, and the methods of collecting the latter, and of working them up into wine, are entirely different from those prevalent in the red wine districts. The grapes are allowed to remain on the vines some three to four weeks longer than is the case in the Médoc, and the result is that they shrivel up and become over-ripe, and so contain relatively little water and a very large quantity of sugar. This alone, however, does not account for the peculiar character of the Sauternes, for during the latter period of ripening a specific micro-organism termed *Botrytis cinerea* develops on the grape, causing a peculiar condition termed *pourriture noble* (German *Edelfäule*), which appears to be responsible for the remarkable bouquet observed in the wines. When the grapes have attained the proper degree of ripeness, or rather over-ripeness, they are gathered with the greatest care, the berries being frequently cut off from the branches singly, and sorted according to their appearance. The grapes are then not crushed, but are immediately pressed, and the juice alone is subjected to fermentation. As a rule, three wines are made in the principal vineyards in three successive periods. The first wine, which is termed the *vin de tête*, is generally the sweetest and finest, the next (called the *milieu*) being somewhat drier and the last (*vin de queue*) being the least valuable. For some markets these wines are shipped separately, for others they are blended according to the prevalent taste. The musts from which the Sauternes wines are made are so concentrated that only a part of the sugar is transformed into alcohol, an appreciable portion remaining unfermented. These wines, therefore, require very careful handling in order to prevent undesirable secondary fermentations taking place at a later period. They are subjected to frequent racking, the casks into which they are racked being more highly sulphured than is the case with red wines. This is necessary, not only to prevent fermentation recommencing, but also in order to preserve the light golden colour of the wine, which, if brought into contact with an excess of air, rapidly assumes an unsightly brown shade.

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[1] Results (excepting alcohol) are expressed in grams per litre, *i.e.* roughly *parts per thousand.*

The Sauternes generally are full-bodied wines, very luscious and yet delicate; they possess a special *sève*, or, in other words, that special taste which, while it remains in the mouth, leaves the palate perfectly fresh. The finer growths of the Sauternes are classified in much the same way as the red wines of the Médoc. There are two main growths, the wines being as follows:—

Classification of Sauternes

Grand First Growth.

Château Yquem, Sauternes.

First Growths.

Château La Tour Blanche, Bommes.
,, Peyraguey, Bommes.
,, Vigneau, Bommes.
,, Suduiraud, Preignac.
,, Coutet, Barsac.
,, Climens, Barsac.
,, Bayle (Guiraud), Sauternes.
,, Rieussec, Fargues.
,, Rabaud, Bommes.

Second Growths.

Château Mirat, Barsac.
,, Doisy, Barsac.
,, Peyxotto, Bommes.
,, d'Arche, Sauternes.
,, Filhot, Sauternes.
,, Broustet-Nérac, Barsac.
,, Caillou, Barsac.
,, Suau, Barsac.
,, Malle, Preignac.
,, Romer, Preignac.
,, Lamothe, Sauternes.

The production of the Sauternes vineyards is, as a rule, smaller than that of the chief red growths, and in consequence of this, and that the district is a relatively small one, the prices of the finer growths are often very high.

St Emilion.

The Côtes district consists of the slopes rising from the lower marshy regions to the east of the Garonne and the Dordogne respectively. The best of the Côtes wines are grown in the St Emilion region. This region consists of the commune of St Emilion, together with the four surrounding communes. It produces wines of a decidedly bigger type than those of the Médoc, and is frequently called the Burgundy of the Bordeaux district. The classification of the St Emilion wines is very complicated, but in principle is similar to that of the Médoc wines. Among the better known wines of the first growths are the following: Château Ausone, Château Belair, Château Clos Fourtet, Château Pavie, Château Coutet, Château Cheval-Blanc, Château Figeac. The Château Ausone is of peculiar interest, inasmuch as it is here that the poet Ausonius possessed a magnificent villa and cultivated a vineyard (A.D. 300).

Palus and Entre-deux-Mers.—The above wines are grown in the marshy regions in the immediate neighbourhood of the Garonne and Dordogne. They produce useful but rather rough wines. The Entre-deux-Mers district forms a peninsula between the Garonne and Dordogne, comprising the arrondissements of La Réole, the south of Libourne and the east of Bordeaux. This district produces both red and white wines, but their character is not comparable to that of the Médoc or of the Côtes. They are generally employed for local consumption and blending.

Champagne.

The sparkling wine known to us as champagne takes its name from the former province which is now replaced by the departments of Marne, Haute-Marne, Aube and Ardennes. The best wines, however, are grown almost exclusively in the Marne district. The cultivation of the vine in the Champagne is of very ancient date. It appears that both red and white wines were produced there in the reign of the Roman emperor, Probus (in the 3rd century A.D.), and according to Victor Rendu the *queue* of wine was already worth 19 livres in the time of Francis II., and had, in 1694, attained to the value of 1000 livres. It was at about the latter date that sparkling or effervescent wine was first made, for, according to M. Perrier, a publication of the year 1718 refers to the fact that wine of this description had then been known for some twenty years. The actual discovery of this type of wine is ascribed to Dom Pérignon, a monk who managed the cellars of the abbey of Haut Villers from 1670 to 1715. It appears also that it was this same Dom Pérignon who first used cork as a material for closing wine bottles. Up till then such primitive means as pads of hemp or cloth steeped in oil had been employed. It is very likely that the discovery of the utility of cork for stoppering led to the invention of effervescent wine, the most plausible explanation being that Dom Pérignon closed some bottles filled with partially fermented wine, with the new material, and on opening them later observed the effects produced by the confined carbonic acid gas. The art of making the wine was kept secret for some time, and many mysterious fables were circulated concerning it; *inter alia* it was believed that the Evil One had a hand in its manufacture. It does not appear, however, to have become popular or consumed on a large scale until the end of the 18th century.

The district producing the finest champagne is divided into two distinct regions, popularly known as the *river* and the *mountain* respectively. The former consists of the vineyards situated on or in the neighbourhood of the banks of the Marne. The principal vineyards in the valley, on the right bank of the river, are those at Ay, Dizy, Hautvillers and Mareuil; on the left bank, on the slopes of Epernay and parallel with the river, those at Pierry and Moussy; in the district towards the south-east, on the slopes of Avize, those of Avize, Cramant, Vertus and Mesnil. The chief vineyards in the "mountain" district are at Versy, Verzenay, Sillery, Rilly and Bouzy.

The soil in the champagne district consists on the slopes largely of chalk and in the plain of alluvial soil. It is interspersed with some clay and sand. The chief red vines of the champagne district are the Plant-doré, Franc-Pineau and the Plant vert doré. The Plant gris, or Meunier, yields grapes of a somewhat inferior quality. The chief white vine is the Pineau, also known as Chardonay. The best qualities of wine are made almost exclusively from the black grapes. For this reason it is necessary that the process of collection, separation and pressing should proceed as quickly as possible at vintage time in order that the juice may not, through incipient fermentation, dissolve any of the colouring matter from the skins. For the same reason the grapes are collected in baskets in order to avoid excessive pressure, and are transported in these to the press house. As there is no preliminary crushing, the presses used for extracting the juice have to be of a powerful character. As a rule, three qualities of wine are made from one batch of grapes, the first pressing yielding the best quality, whilst the second and third are relatively inferior. After the must has been allowed to rest for some hours in order to effect a partial clearing, it is drawn off into barrels and fermented in the latter. The first racking and fining takes place about December. The wine is allowed to rest for a further short period, and if not bright is again racked and fined. It is then ready for bottling, but previous to this operation it is necessary to ascertain whether the wine contains sufficient remanent sugar to develop the "gas" necessary for effervescence. If this is not the case, sugar is added, generally in the form of fine cane or candied sugar. The bottles employed have to be of very fine quality, as the pressure which they have to stand may be as much as 7 to 8 atmospheres or more. Formerly the loss through breakage was very great, but the art of making and selecting these bottles has greatly improved, and the loss now amounts to little more than 5%, whereas formerly 25% and even 30% was not an uncommon figure. In the spring-time, shortly after bottling, the rise in temperature produces a secondary fermentation, and this converts the sugar into alcohol and carbonic acid. This fermentation proceeds throughout the summer months, and in the meantime a sediment which adheres to the side of the bottle is gradually formed. The bottles, which up till now have been in a horizontal position, are then, in order to prepare them for the next process, namely, that known as disgorging, placed in a slanting position, neck downwards, and are daily shaken very slightly, so that by degrees the sediment works its way on to the cork. This process, which takes several weeks, is a very delicate one, and requires much skill on the part of the workman. When the whole of the sediment is on the cork, the iron clip, with which the latter is kept in position, is removed for a moment, and the force of the wine ejects the sediment and cork simultaneously. This operation also requires much skill in order to avoid an excessive escape of wine. An ingenious modification has of modern times been introduced, which consists in freezing part of the contents of the neck of the bottle. The cork may then be withdrawn and the sediment removed without any wine being lost.

After the sediment has been removed the wine is subjected to *dosage*, or liqueuring. It is by this process that the degree of sweetness required to suit the particular class of wine being made is attained. For wines exported to England very little liqueur is employed; in the case of some wines, known as *Brut* or *Nature*, none at all is added. Wines intended for consumption in France receive a moderate quantity of liqueur, but those for the Russian and South American markets, where very sweet wines are liked, receive more. This liqueur is made of fine wine, brandy and candied sugar. The liqueuring is nowadays generally carried out by means of a machine which regulates the quantity to a nicety. Champagne is not, as is the case, for instance, with the classified growths of the Gironde, the product of a single vineyard. The bulk of the wine is made in vineyards belonging to small peasant proprietors, who sell their produce to the great mercantile houses. The latter blend the wines received from the various proprietors, and the chief aim in this blending is to maintain the character of the wine which is sold under a particular trade mark or brand. Similarly, it has been said that, strictly speaking, there is no such thing as vintage champagne, for it is almost invariably the practice, in order to maintain the general character of a specific brand, to blend the new wines with some old wine or wines which have been vatted for this particular purpose. These vattings, and indeed all blendings of any particular batch of wines, are termed *cuvées*. The vintage date, therefore, which is borne by "vintage champagne," refers rather to the date of vintage prior to bottling than to the age of the wine, although the main bulk of the wine of a certain "vintage" will actually have been made in the year indicated. It is not unusual in the case of champagne to add some sugar to the must in the years in which the latter is deficient in this regard. No legitimate objection can be raised to this practice inasmuch as champagne in any case must be regarded in the light of a manufactured article rather than as a natural product. The principal centres of the champagne trade are at Reims, Epernay, Ay and Avize. The total output of the Marne district has for the past three years averaged about 9 million gallons, but it occasionally runs as high as 20 million gallons. A great part of this wine, however, is not suitable for making high-class champagne. As a rule, the supply considerably exceeds the demand, and the stock in hand at the present time amounts to roughly four years' consumption of finished wine, but to this must be added the stock existing in cask, which is considerable. For the period 1906–1907 the total number of bottles in stock amounted to over 121 millions, the bottles exported to over 23 millions, and the bottles required for internal commerce in France to something over 10 millions. There is, thus, at the present a total annual consumption of rather over 30 millions of bottles. The chief trade in champagne is with the United Kingdom, to which the finest varieties are exported. In the year 1906, 1,161,339 gallons of champagne, to the value of £1,679,611, were imported into the United Kingdom. The general composition of high-class champagnes, as supplied to the English market, will be gathered from the preceding table, which is taken from a large number of analyses published by the author and a collaborator in the *Analyst* for January 1900.

*Analyses of Champagne.**

No.	Description of Wine.	Vintage.	Alcohol per cent. by vol.	Total Acid.	Extract.	Ash.	Total Tartaric Acid.	Sugar (as invert Sugar).	Glycerin.	Carbonic Acid.
1	Champagne nature	1892	14·01	5·22	20·95	1·17	2·20	3·36	7·55	8·27
2	Brut	1892	12·57	3·23	19·78	2·53	2·76	1·32	7·64	7·79
3	Dry	1892	13·50	5·99	27·07	1·16	2·10	9·20	9·10	9·55
4	Extra sec	1893	13·53	5·01	22·95	1·10	2·18	7·84	6·50	8·12
5	Extra dry	1893	12·56	5·43	23·18	1·13	2·49	7·23	8·18	7·75
6	Dry	1893	14·44	4·80	30·33	1·05	2·04	13·86	9·05	..

* Results, excepting alcohol, are in grams per litre.

It will be seen that, compared with the dry, light red wines, the proportion of sugar, alcohol and acidity is comparatively high in champagne, and the extract (solid matter) rather low.

Saumur.

The fruitful departments watered by the Loire and its tributaries produce considerable quantities of wine. The white growths of the Loire have been known for many centuries, but up to 1834 were used only as still wines. At that date, however, it was found that the wines of Saumur (situated in the department of the Maine-et-Loire) could be successfully converted into sparkling wines, and since then a considerable trade in this class of wine has developed. At first it was chiefly used for blending with the wines of the Champagne when the vintage in this district was insufficient, but at the present time it is largely sold under its own name. The imports of sparkling Saumur into the United Kingdom in 1906 amounted to 114,234 gallons, valued at £73,984. Although the average wholesale value of Saumur is considerably less than that of champagne, it compares favourably with the lower grades of that article, and in flavour and character is similar to the latter. The successful evolution of the Saumur sparkling wine industry is largely due to the fact that the range of limestone hills, at the foot of which the town is situated, afford by excavation illimitable cellarage, easy of access and of remarkably even temperature, at a very small cost. The method of manufacture is similar to that followed in the Champagne.

Burgundy.

In the east of France, not far from the Jura, lies the oldest viticultural district of Europe, namely that of Burgundy. It is still so called, after the old French provinces, Upper and Lower Burgundy. It comprises the departments of the Yonne on the north-west, the Côte d'Or in the centre, and the Saône-et-Loire on the south. In the Yonne are made chiefly the white wines known to us as Chablis; in the Saône-et-Loire are made the red and white wines of Mâcon, and there is also, stretching into the department of the Rhône, the district producing the Beaujolais wines. The most important wines, however, the Burgundy wines proper, are made in the centre of this region on the range of low hills running north-east by south-west called the Côte d'Or, or the golden slope. The soil of the Côte d'Or is chiefly limestone, with a little clay and sand. The vineyards producing the best wines are situated about half-way up the slopes, those at the top producing somewhat inferior, and those at the foot and in the plain ordinary growths. Practically all the best vineyards (which are grown on flat terraces on the slopes, and not on the slopes themselves) face south-west and so get the full benefit of the sun's rays. The most important vine—in fact on the slopes of the Côte d'Or practically the only vine—is the Pineau or Noirien, but in the plain and in the districts of Mâcon and Beaujolais the Gamay is much cultivated. The influence of the soil on one and the same vine is interestingly illustrated by the different character of the vines grown in those districts, the Beaujolais wines having far greater distinction than those of Mâcon. The commune of Beaune must be regarded as the centre of the Burgundy district, and possesses numerous vineyards of the highest class. To the north of Beaune lie the famous vineyards of Chambertin, Clos Vougeot, Romanée, Richebourg, Nuits St Georges and Corton; to the south those of Pommard, Volnay, Monthélie and Meursault with its famous white wines.

The vinification of the Burgundy wines takes place in cuves of 500 to 2000 gallons capacity, and it has for very many years been the common practice in vintages in which the must is deficient in saccharine to ensure the stability of the wine by the addition of some sugar in the *cuve*. The first rackings generally take place in February or March, and the second in July. The practice of sugaring has ensured greater stability and keeping power to the wines, which formerly were frequently irregular in character and difficult to preserve.

There is no official classification of the Burgundy wines, but the following is a list comprising some of the finest growths in geographical order, from north to south, together with the localities in or near which they are situated.

1. *Red Wines.*

Locality.	Growth.
Fixey . .	. Les Arvelets.
Fixin . .	. Clos de la Perrière.
Chambertin	. Chambertin, Clos de Bize, Clos St Jacques.
Morey. .	. Clos de Tart, Les Bonnes Mares, Les Larrets.
Chambolle	. Les Musigny.
Vougeot .	. Clos de Vougeot.
Flagey .	. Les Grandes Eschezeaux.
Vosne. .	. Romanée-Conti, Les Richebourgs, La Tache, Romanée la Tache.
Nuits . .	. Les Saint-Georges, Les Vaucrains, Les Porrets, Les Pruliers, Les Boudots, Les Thorey.
Aloxe . .	. Le Corton, Le Clos-du-Roi-Corton.
Savigny .	. Les Vergelesses.
Beaune .	. Les Fèves, Les Grèves, Le Clos de la Mousse.
Pommard .	. Les Arvelets, Les Rugiens.
Volnay .	. Les Caillerets, Les Champans.
Santenay .	. Les Santenots, Le Clos-Tavannes.

2. *White Wines.*

Locality.	Growth.
Meursault .	. Les Perrières, Les Genevrières.
Puligny .	. Montrachet, Les Chevaliers-Montrachet, Le Batard Montrachet.

An interesting feature of the Côte d'Or is the Hospice de Beaune, a celebrated charitable institution and hospital, the revenues of which are principally derived from certain vineyards in Beaune, Corton, Volnay and Pommard. The wines of these vineyards are sold every year by auction early in November, and the prices they make serve as standards for the valuation of the other growths.

Hermitage.

To the south of Lyons, in the department of the Drôme, are made in the district of Valence the celebrated Hermitage red and white wines. The quality of some of these, particularly of the sweet white wines, is considered very fine. The quantity produced is very small. The red wines made at the present time are after the style of Burgundy and possess good keeping qualities.

Midi.

If we except the wines of Roussillon, produced in the old province of that name, in the extreme south of France, the above constitute the principal varieties of French wines known in the United Kingdom. They form, however, but a small fraction of the entire production of the country. The most prolific viticultural district of France is that known as the Midi, comprising the four departments of the Herault, Aude, Gard, and the Pyrenées-Orientales. Thus in 1901 the department of the Herault alone produced nearly 300 million gallons of wine, or approximately a quarter of the whole output of France. The average amount of wine made in the four departments for the past three years has been roughly 500 million gallons. These wines formerly were largely exported as *vin de cargaison* to South America, the United States, Australia, &c., and were also much employed for local consumption in other parts of France. Owing, however, to the fact that viticulture has made much progress in South America, in California, in Australia and particularly in Algeria, and also to the fact that the quality of these Midi wines has fallen off considerably since the phylloxera period, the outlet for them has become much reduced. These and other reasons, notably the manufacture of much fictitious wine with the aid of sugar (fortunately stopped by the rigid new wine laws), led to the grave wine crisis, which almost amounted to a revolution in the Midi in the spring and summer of 1907.

Algeria.

Viticulture has made great strides in Algeria during recent years. The first impetus to this department was given by the destruction or crippling of many of the French vineyards during the phylloxera period. The present output amounts to roughly 150 million gallons, and the acreage under the vine has increased from 107,048 hectares in 1890 to 167,657 hectares in 1905. The wines, moreover, of Algeria are on the whole of decidedly fair quality, possessing body and strength and also stability. In this regard they are superior to the wines of the Midi.

WINES OF SPAIN

The wines of Spain may be regarded as second in importance to those of France. Although the quantity produced is not so large as in Italy, the quality on the whole is decidedly superior to that of the latter country. There are three main types of wine with which consumers in the United Kingdom are familiar, namely Sherry, Tarragona (Spanish Port or Spanish Red) and wines of a claret type. The trade with the United Kingdom is of considerable proportions, the total quantity of Spanish wines imported in 1906 amounting to 1,689,049 gallons of red wine (to the value of £154,963), and white wines to the extent of 1,119,702 gallons (to the value of £242,877).

Sherry.

The most important wine produced in the province of Andalusia, which is the chief vine-growing district of Spain, is that known to us as sherry, so called from the town of Jerez de la Frontera, which is the centre of the industry. Sherry is produced in a small district bounded by San Lucar in the north-east, Jerez in the east and Port St Mary on the south. The total viticultural area amounts to about 20,000 acres. The soil is of very varying nature, and consists in some districts of the so-called *albariza* (mainly chalk with some sand and clay), in others of *barros*, which is mainly sand cemented together with chalk and clay, and of *arenas*, which consists of nearly pure sand. Most of the vineyards in the Jerez district are upon *albariza* soil, those to the north and north-east are mainly of *barros*, and those close to the seashore of *arenas*. The dominating vine is the *Palomino*, which produces *amontillados* and *finos*. Other important vines are the *Perruno* and the *Mantua Castellano*. There is also a variety of Pedro-Ximenes, which, however, is not used for making ordinary wine, but for the purpose of preparing the so-called dulce, a very sweet must or wine, made from over-ripe grapes, which, after fortification with spirit, is employed for sweetening other wines. The process of vinification is comparatively simple. The grapes are, after gathering, dusted over with plaster of Paris, and then crushed by treading in a shallow rectangular vessel termed the *lagar*. The juice, which is so obtained together with that which results from the pressing of the murk, is fermented in much the same manner as is customary in other countries. There are two main types of sherry known in the United Kingdom, namely, those of the *amontillado* and those of the *manzanilla* classes. The former are generally sweet and full-bodied, the latter light and dry. The *manzanillas* are mostly shipped in the natural state, except for the addition of a small quantity of spirit. The *amontillados* may be again divided into the *finos* and the *olorosos*, the former being the more delicate. These distinctions are not of a hard and fast character, for they frequently merely represent different developments of the same wine. Thus, according to Thudicum, the regular heavy sherry from *albariza* soil remains immature for a number of years and then becomes a *fino*. After five to eight years it may become an *amontillado*, and if it is left in cask and allowed to develop, it will, after it attains an age of nine to fourteen years, become an *oloroso*, and still later it may become a *secco*. In Jerez itself a different classification, namely that according to quality and not age, exists, which, however, is only employed locally. Thus the term *palma* is applied to fine dry wines when in their second or third years. These may be *amontillados*, but according to some they never become *olorosos*. Then there are varieties known as double and treble *palma*, and single, double and treble *palo*, the latter being the finest form of *oloroso*. Then there is the quality of wine termed *raya*. This is dry and sound, and forms a great part of the sherry exported to the United Kingdom. The sweetness of the sweet sherries is partly due to an inherent property of the wine (apart from any sugar they may contain) and partly to natural or added sugar. In some cases the fermentation of the must is stopped by the addition of spirit before the whole of the saccharine is converted, and the wines so prepared retain a proportion of the sugar naturally present in the must. In other cases dry wines are prepared and sugar is added to them in the form of *dulce* (see above). In order to prevent refermentation it is then necessary to fortify these wines with spirit. The standard of colour required for certain quantities is maintained by the addition of *color*. The latter is made by boiling wine down until it attains the consistency of a liqueur. The great bulk of sherry shipped to the United Kingdom is blended. The system of blending sherry in some respects recalls that of the blending of Scotch whiskies. Wines of the same type are stored in vats or *soleras*, and the contents of the *soleras* are kept as far as possible up to a particular style of colour, flavour and sweetness. Prior to shipment the contents of various *soleras* are blended according to the nature of the article required.

In addition to the wines described above, there are others of a similar nature grown in the vicinity, such as *montilla* (made in Cordova) and *moguer* (produced on the right bank of the Guadalquivir).

The bulk of the sherry imported into the United Kingdom still consists of the heavier, fortified wines, varying in strength from 17 to 21% of absolute alcohol, although the fiscal change introduced in 1886, whereby wines not exceeding 30° proof (*i.e.* about 17% of alcohol) were admitted at a duty of 1s. 3d., as against 3s. for heavier wines, naturally tended to promote the shipment of the lighter dry varieties. In this connexion it is interesting to note that the importation of sherry into the United Kingdom on a considerable scale commenced in the 15th century, and that the wine shipped at that time was of the dry variety. It seems possible that sherry was the first wine known as *sack* in this country, but it is at least doubtful whether this word is, as some contend, derived from *seck* or *sec*, *i.e.* dry. According to Morewood it is more likely to have come from the Japanese *Saké* or *Sacki* (see SAKÉ), derived in its turn from the name of the city of Osaka.

Chemically the sweet sherry differs from the natural dry light wines in that it contains relatively high proportions of alcohol, extractives, sugar and sulphates, and small quantities of acid and glycerin. This is well illustrated by the following analysis:—

Analysis of Sherry (*Fresenius*).

Alcohol per cent by vol.	Grams per Litre.					
	Extract.	Total Acid.	Ash.	Glycerin.	Sugar.	Sulphates.
19·94	48·9	3·3	4·2	4·3	30·2	3·75

Malaga.

Malaga is a sweet wine (produced in the province of that name) which is little known in England, but enjoys considerable favour on the Continent. It is generally, as exported, a blend made from *vino dulce* and *vino secco*, together with varying quantities of *vino maestro*, *vino tierno*, *arope* and *color*. The *vino dulce* and *vino secco* are both made as a rule from the Pedro Jimenez (white) grape, the former in much the same way as the *dulce* which is employed in the sherry industry, the latter by permitting fermentation to take its normal course. The *vino maestro* consists of must which has only fermented to a slight degree and which has been "killed" by the addition of about 17% of alcohol. The *vino tierno* is made by mashing raisins (6 parts) with water (2 parts) pressing, and then adding alcohol (1 part) to the must. *Arope* is obtained by concentrating *vino dulce* to one-third, and *color* by concentrating the *arope* over a naked fire. Malaga is therefore an interesting example of a composite wine. Besides the sweet variety, a coarse dry wine is also made, but this is little known abroad.

Another well-known wine district in the south of Spain is that of Rota, where a sweet red wine, known in England as *tent* (tinto), chiefly used for ecclesiastical purposes, is produced.

Wines of the Centre and North.—While the most important Spanish wines are those grown in the southern province of Andalusia, the central and northern districts also produce wine in considerable quantity, and much of this is of very fair quality. Thus in the central district of Val de Peñas and in the Rioja region (situated between Old Castile and Navarre) in the north-east are produced red wines which in regard to vinosity, body and in some other respects resemble the heavier clarets or burgundies of France—although not possessing the delicacy and elegance of the latter. They are shipped in some quantity to the United Kingdom as Spanish "claret" or Spanish "burgundy." The most important industry, outside the southern districts, is, however, that in Catalonia, where, in the neighbourhood of the town of that name, the wine known as Tarragona or Spanish "port" is produced. The finest Tarragona (which much resembles port) is made in the Priorato region, about 15 m. inland.

Wines of Portugal

In the north-east of Portugal, not far from the town of Oporto—from which it takes its name and whence it is exported—is produced the wine, unique in its full-bodied and generous character, known as port.

Port.

Port is grown in the Alto Douro district, a rugged tract of land some 30 to 40 m. long by 10 m. wide, which commences at a point on the river Douro some 60 m. above Oporto. The character of the Alto Douro is extremely mountainous and rugged. J. L. W. Thudichum, in his *Treatise on Wines*, gives a striking and almost poetical description of it as compared with Jerez. He says: "The vineyards of Jerez are so beautiful and productive that they might well be termed the vineyards of Venus. Undulating hills, easily accessible from all sides, are covered with a luxurious growth of vines. . . . Very different is the aspect of the Alto Douro. Here all is rock, gorge, almost inaccessible mountain, precipice and torrent, while over or along all these rude features of nature are drawn countless lines of stone walls by which man makes or supports the soil in which the vines find their subsistence. . . . I thought that if Jerez was the vineyard of Venus, this Alto Douro vineyard must be termed the vineyard of Hercules." The vineyards are, in fact, situated on artificially made terraces, supported by walls on the mountain sides. If this were not the case the heavy winter rains would wash away the soil. The climate of the Alto Douro is very variable. Intense heat in summer is followed by severe cold in winter. The soil is a peculiar clay-schist, on or alternating with granite, and it is to the peculiar conditions of climate and soil that port owes its remarkable qualities of colour, body and high flavour. There appears to be no predominant and distinct type of vine, such as is the case in other viticultural districts, but a number of varieties, mostly yielding grapes of a medium size are common to the Douro vineyards. The method of cultivation is generally that of a rational low culture, and in this respect differs from that employed in other parts of the country, where the vines are either trained on trees or over trellis-work at some height from the ground.

Vinification.—The process of converting the Alto Douro grapes into wine differs in some material particulars from those employed elsewhere. The grapes are cut and then conveyed in baskets by the Gallegos (as the labourers who come specially from Galicia in Spain for this purpose are termed) to the winery. Here the stalks are removed, generally by a machine similar to the French *égrappoir*, and the grapes then placed in the *lagar*. This is a square stone vessel of considerable size made to hold up to fifteen pipes (the pipe equals 115 gallons) of wine. It is roughly 2 ft. deep and from 3 to 10 yds. wide. The grapes are first trodden for a period varying from twenty-four hours upwards, and are then allowed to ferment in the *lagar* itself. When the fermentation has reached a certain point it is generally the custom to again tread the must in order to extract as much colour as possible from the skins. In order to preserve the sweet quality of the wine, fermentation is not permitted to continue beyond a certain point. When this is reached the wine is drawn from the *lagar* over a strainer or some similar arrangement into vats yielding from five to thirty pipes. The murk remaining in the *lagar* is then pressed by means of a lever or beam press with which this vessel is fitted. In order to prevent the wine from fermenting further and so becoming dry, from 4 to 5 volumes of brandy are added to every 100 volumes of wine in the vats. The alcohol employed for this purpose is as a rule of high quality and made solely from wine. When, after the approach of the cold weather, the lees have dropped, the wines are racked and a further addition of brandy is made. The second racking takes place in March or April, and the wine is now placed in casks and sent to Oporto, where it is stored in large over-ground buildings termed *lodges*. A further addition of brandy is generally added before shipment. The great bulk of the wine is stored for many years before shipping, but this does not apply to the commoner varieties, nor to the finest wines, which, being the produce of a specific year, are shipped unblended and as a vintage wine. The most famous vintages of recent times were those of 1847, 1851, 1863, 1868, 1870, 1873, 1878, 1881, 1884 and 1887. A white port is also made in the Alto Douro, and this, although little known in England, is exported in considerable quantities to Germany and Russia. The white port is grown in vineyards which are not quite so favoured as regards position as the red port growths. White port is made from white grapes, and a peculiarity of its manufacture is that the must is frequently fermented in the presence of the skins, which is most unusual in the case of white wines. This gives a certain stringency to white port, which is characteristic of the wine.

Diseases.—The Alto Douro has from time to time been sadly ravaged by the *oidium* and *phylloxera*. The former first made its appearance about the middle of the 19th century, and reached a climax in 1856, when only about 15,000 pipes, that is, about one-sixth of the usual quantity, was vintaged. In consequence of this, the exportation of port dropped from over 40,000 pipes in 1856 to about 16,000 pipes in 1858. Since then *oidium* has reappeared from time to time, but the remedy of spraying with finely divided sulphur, which was discovered at the time of the epidemic, has enabled the wine farmers to keep it under. The *phylloxera*, which appeared in Alto Douro in about 1868, also did enormous damage, and at one time reduced the yield to about one-half of the normal. At one time the position appeared to be desperate, particularly in view of the fact that the farmers refused to believe that the trouble was due to anything other than the continuous drought of successive dry seasons, but at the present time, after much expenditure of energy and capital, the condition of affairs is once more fairly satisfactory.

Port Wine Trade.—The port wine trade is of considerable importance to the United Kingdom not only because the chief trade in this wine is with that country, but also because a very large proportion of the capital invested in the industry is English. It is probable that the English capital locked up in the port industry amounts to some 2 millions sterling. In the period preceding the 'seventies of the last century practically the whole of the wine exported from Oporto came to Great Britain. Thus in the year 1864 there were exported to Great Britain 29,942 pipes and to the rest of the world 5677 pipes. The trade with the rest of the world, however, has gradually grown since then, the figures being as follows:—

Exports of Wine from Oporto.

Year.	To Great Britain.	To Rest of the World.
	Pipes.	Pipes.
1874	35,753	20,778
1884	30,281	31,741
1898	41,093	69,932
1903	32,832	65,058
1906	34,356	80,934

The growth of the export trade from Oporto with the rest of the world is principally due to the enormous increase in the quantity of wine sent to South America, chiefly Brazil, but only a small proportion of this (probably one-eighth) is port wine proper. The bulk of it consists of wine from the Minho and Beira districts. These facts also account for the apparent anomaly that the exports from Oporto are much higher than the total production of wine in the Alto Douro. At the present time the average production of the Alto Douro is about 50,000 pipes. During the last decade it was at a maximum in 1904, when 70,000 pipes were produced, and at a minimum in 1903, when only 18,000 pipes were obtained. The value of the port taken by the United Kingdom was in the year 1906 over one million sterling, that is, rather less than half of the total value of all the French wines imported, but more than double the value of the total of Spanish wines.

The chemical features of interest in port are the relatively high proportions of alcohol (the bulk of the wine imported into the United Kingdom containing some 18 to 22 % of alcohol), sugar and tannin. The sugar varies considerably according to the vintage, but as a rule amounts to from 7 % to 15 %.

Other Portuguese Wines.—The wines of the Alto Douro only form a small proportion of the total quantity of wine produced in Portugal. The main wine-growing district outside that of Oporto is in the neighbourhood of Lisbon. The chief varieties are those grown at Torres Vedras, which are of a coarse claret type; at Collares, where a wine of a somewhat higher quality is produced; at Carcavellos, at the mouth of the Tagus; and at Bucellas. In the latter district is produced a white wine from the Riessling grape, which is commonly known in the United Kingdom as Bucellas Hock.

Madeira.

As far as the United Kingdom is concerned, the Madeira wine industry is mainly of interest in that it was largely developed by and is still chiefly in the hands of British merchants. The shipments to the United Kingdom, however, which reached a maximum in 1820, when over half a million gallons were imported, has fallen off to one-tenth of that amount, and the consumption in these islands was barely 20,000 gallons in 1906. This falling away in the taste for Madeira is partly ascribable to fashion and partly to the temporary devastation of the vineyards by the phylloxera in the middle of last century. The re-establishment of the vineyards and the consequent development of the industry did not, however, lead to a renewal of the trade on the former scale with this country. The output in 1906 amounted to 10,000 pipes (Madeira pipe = 92 gallons) and the export to 6010 pipes, of which quantity 1951 pipes went to Germany, 1680 pipes to France, 796 pipes to Russia and 755 pipes to the United Kingdom. Madeira, like sherry and port, is a fortified wine. The method of vinification is similar to that employed in other parts of Portugal, but the method employed for hastening the maturation of the wine is peculiar and characteristic. This consists in subjecting the wine, in buildings specially designed for this purpose, to a high temperature for a period of some months. The temperature varies from 100° to 140° F. according to the quality of the wine, the lower temperature being used for the better wines. The buildings in which this process is carried out are built of stone and are divided into compartments heated by means of hot air derived from a system of stoves and flues. Much of the characteristic flavour of Madeira is due to this practice, which hastens the mellowing of the wine and also tends to check secondary fermentation inasmuch as it is, in effect, a mild kind of pasteurization.

Wines of Germany

Although the quantity of wine produced in Germany is comparatively small and subject to great variations, the quality of the finer wines is, in successful years, of a very high order. In fact Germany is the only country which produces natural (*i.e.* unfortified) wines of so high a class as to be comparable with—although of an entirely different character from—the wines of France. The finer wines possess great breed and distinction, coupled with a very fine and pronounced bouquet, and in addition they are endowed with the—in the case of lighter wines—rare quality of stability. The great inequalities observed in the different vintages and the exceptionally fine character of the wines in good years are, generally, due to the same cause, namely, to the geographical position of the vineyards. The wines of the Rhine are grown in the most northerly latitude at which viticulture is successful in Europe, and consequently, when the seasons are not too unpropitious, they display the hardiness and distinction characteristic of northern products. During the period 1891–1905 the total production of Germany has averaged roughly 62 million gallons, attaining a maximum of 111 million gallons in 1896 and a minimum of 16 million gallons in 1891. The trade with the United Kingdom is now a very considerable one, amounting in 1906 to roughly 1¼ million gallons to the value of three-quarters of a million sterling.

Rhine wines.

The wines grown in the Rheingau, Rheinhessen and in parts of the Palatinate are generally known by the name of Rhine wines, although many of these are actually produced on tributaries of that river. Thus the well-known Hochheimer, from which the curious generic term "hock" employed in England for Rhine wines is derived, is made in the vicinity of the little village of that name situated on the Main, a number of miles above the junction of the latter with the Rhine. The Rheingau district proper stretches along the north bank of the Rhine from Bingen on the west to Mainz on the east. The most important wines in this region are those of the Johannisberg and of the Steinberg. The vineyards of the former are said to have been planted originally in the 11th century, but were destroyed during the Thirty Years' War. They were replanted by the abbot of Fulda in the 18th century. During the French Revolution the property passed into the hands of the prince of Orange, but after the battle of Jena, Napoleon deprived him of it and presented it to Marshal Kellermann. On the fall of Napoleon, the emperor of Austria took possession of the vineyard and gave it to Prince Metternich. At the present time the property still belongs to the descendants of the latter. The vineyards of Steinberg belong to the state of Prussia. The vineyards of these two properties are tended with extraordinary care, and the wines, of which several qualities are made in each case, fetch exceedingly high prices. The finest wines are produced in a manner somewhat similar to that employed for making the Sauternes. The grapes are allowed to become over-ripe and are then selected by hand. This process produces the so-called *Auslese* wines, which frequently fetch as much as 30s. or 40s. a bottle. The other most important wines produced in the Rheingau and its extensions are those of Marcobrunn, Geisenheim, Rüdesheim and Hochheim. The most important wines produced in Rheinhessen (on the left bank of the Rhine and south of the Rheingau) are those of Liebfraumilch, Nierstein, Oppenheim, Bodenheim, Laubenheim and Scharlachberg. In the Palatinate the most important growths are those of Forst, Deidesheim and Dürkheim.

Moselle.

The wines of the Moselle are of a somewhat different character to those of the Rhine. Whereas the Rhine wines of the finer descriptions are as a rule fairly full bodied and of marked vinosity, the Moselle wines are mostly light and of a somewhat delicate nature. While the Rhine wines generally improve in bottle for a lengthy period, the Moselles are as a rule at their best when comparatively fresh. Indeed, many connoisseurs hold that when a Moselle ceases to show signs of the somewhat prolonged secondary fermentation, characterized by the slight prickling sensation produced on the palate (caused by the presence of bubbles of carbonic acid gas in the wine), that it has passed its best. The best-known growths of the Moselle are those of Brauneberg, Bernkastel, Piesport and Zeltingen. Some of the tributaries of the Moselle also produce wines which in quality approach those of the parent river. Among these may be cited the growths of Scharzhofberg, Geisberg and Bockstein.

Large quantities of wine are produced in Alsace-Lorraine, Baden and Württemberg, but the majority of these have little interest, inasmuch as they are used only for home consumption. Among the wines, however, which are well known may be mentioned the Franconian growths, amongst which the celebrated Stein wine, which is grown at the foot of the citadel of the town of Würzburg, and in the grand duchy of Baden the celebrated growths of Affenthal (red) and Markgräfler.

Practically all the important wines of Germany are white, although there are a few red growths of some quality, for instance that of Assmannshausen in the Rheingau. The latter is produced from the black Burgundy vine, the Pineau. In the Rheingau the predominant vine is the Riessling. This plant appears to be indigenous to the Rhine valley, and the finest wines are made exclusively from its grapes. In the hope of reproducing the characteristic of the Rhine wines, the Riessling has been planted in many young wine-producing countries, such as Australia, California and the Cape, and not entirely without success. It thrives best on rocky mountain slopes freely exposed to the sun, and requires a relatively high temperature to reach perfect maturity. In the lower lands, therefore, it is customary to plant, in addition to the Riessling, vines such as Österreicher and Kleinberger, which mature more readily than the former. Other vines, such as the Orléans and the Traminer, are also found in small quantities in the Rheingau. On the Moselle the Riessling and the Kleinberger are the chief growths. The vintage on the Rhine is, in order to permit the grapes to acquire the "over-ripeness" necessary to the peculiar character of the wines, generally very late, rarely taking place before the end of October. The process of vinification is peculiar in that fermentation takes place in relatively small casks, the result being that there are frequently marked differences in the produce of the same growth and vintage.

The very great variations which are shown by the same growths of different vintages makes it impracticable in the case of the German white wines to give representative analyses of them. Comparing the fine wines of the better vintages with, for instance, the red wines of the Gironde, the main features of interest are the relatively high proportions of acid and glycerin and the low proportion of tannin which they contain.

Wines of Italy

Italy ranks second to France as regards the quantity of wine produced, but in respect to quality a comparison is scarcely possible, inasmuch as the Italian wines are on the whole of a poor character. They display many of the features characteristic of southern wines, showing either an excessive vinosity coupled with a somewhat crude bouquet, or where the alcoholic strength is not high, a decided lack of stability. The reason for this is to be sought partly in the unscientific methods of cultivation, and partly, in many districts, in the haphazard methods of vinification employed. The vines are to a great extent still trained on trees or trellis-work, or allowed to grow among the rest of the vegetation in the most casual manner. It must be stated, nevertheless, that of recent years a decided improvement has set in in some quarters owing to the lively interest which the Italian government has taken in the subject, principally owing to the important export trade to America, Switzerland and other countries. The trade with the United States, which in 1887 amounted to little over 120,000 gallons, has risen to considerably over a million gallons. The exports to the Argentine Republic amount to roughly 4 million gallons, and to Switzerland from 4 to 8 million gallons. The trade with the United Kingdom is small, amounting to little over a quarter of a million gallons annually, and of a value rather less than £50,000. The total exports of Italy are on the average not far from 40 million gallons. The wines of northern Italy are on the whole of good colour, but somewhat harsh. Among the best-known wines in Piedmont are the Barolos and the wines of Asti, which are made from a species of muscatel grapes. They are of an agreeable flavour, and this especially applies to the white descriptions. A considerable quantity of sparkling wine is manufactured in this district. Among the best-known wines of Lombardy are the Passella wines of Valtelina. In central Italy the best growths are those of Chianti, Pomino, Montalcino, Carmignano and Montepulciano. Tuscany produces the greater part of these wines, which are of good but not excessive alcoholic strength, containing as a rule some 10½% to 11½% of alcohol. The Montepulciano wines have a brilliant colour and high bouquet, and are of a sweet, luscious flavour. The wines of Chianti, near Siena, are often described as being of the claret type, but actually they are somewhat similar to the growths of Beaujolais. The best Italian wines, however, are probably those grown in the Neapolitan district. The best of these is the celebrated Lacrima Christi, which is grown on the slopes of

Vesuvius from a vine bearing the same name. It has a fine red colour, and unites delicacy and a high bouquet with a sweet elegant taste. The white muscat wines of Vesuvius are also of good quality, and the island of Capri produces some excellent wine. Perhaps the best known of Italian wines in the United Kingdom is that produced in the neighbourhood of Marsala in the island of Sicily, which bears the name of the town from which it is exported. Marsala is a fortified white wine which is grown and made with considerable care. It is somewhat similar in character to the wines of Madeira, but its character also recalls some of the sherry types. It is vatted and blended in much the same way as sherry, and there is a considerable trade in this wine with the United Kingdom. In the neighbourhood of Palermo, Muscat and Malvoisie wines of very fair quality are made. The islands of Sardinia and Elba produce considerable quantities of wine, some of which is of fair quality.

Wines of Austria-Hungary

In point of quantity Austria-Hungary takes the fourth place among the wine-producing nations. The average production for the period 1901–1905 was 178 million gallons. Of this quantity Austria is responsible for roughly three-fifths and Hungary for the remaining two-fifths. The character of the Hungarian wine is, however, much higher than that of the Austrian growths. The quality of the bulk of the Austro-Hungarian wines has been improved of late years, principally owing to the endeavours of the respective governments to introduce scientific and modern methods among the wine-farmers. Since the recovery of the Hungarian vineyards from the phylloxera considerable efforts have been made to develop an export trade, but so far the wines of Hungary are not generally known in the United Kingdom. Nevertheless, Hungary produces at least one class of wine which may be considered of international importance, namely, the famous Tokay. This is produced in the mountainous Hegyalia region in a district which has the town of Tokay for its centre. The vine from which Tokay is made is the *Furmint.* The finest varieties of Tokay are made entirely or mainly from *Furmint* grapes which have been allowed to become over-ripe in a manner somewhat similar to that obtaining in the Sauternes districts. In the case of Tokay, however, the transformation of the grape into what is practically a raisin is not brought about by the intervention of any particular micro-organism. The sun is sufficiently powerful to cause the evaporation of the water in the grape through the skin without any preliminary loosening of the latter by the action of the *botrytis cinerea* or any other micro-organism. The most precious variety of Tokay is the so-called *essence.* This is produced by placing the finest grapes in casks and drawing off the juice which exudes naturally as a result of the weight of the material. The Tokay essence is, even after many years, still a partially fermented wine, rarely containing more than 7% to 9% of alcohol. Indeed, it may be said that the main fermentation rarely, if ever, reaches a climax. Another variety of Tokay is the so-called *szamorod.* This is produced by pressing a mixture of dried grapes and fully ripe grapes and fermenting the must so obtained. It contains up to about 14% of alcohol and relatively little sugar. The most common kind of Tokay is the so-called *Ausbruch* wine. This is obtained by extracting dried grapes with the must of ordinary grapes. According to the amount of dried grapes (*zibebs*) employed, the wine is termed 1 to 5 "buttig." The *Ausbruch* wines take from three to four years to ripen, and they may contain from 12% to 15% of alcohol and a little or a fair quantity of sugar, these factors varying according to the vintage and the number of "butts" of *zibebs* employed. Another variety of Tokay is the so-called *máslás.* The term is applied to different varieties of wines according to the district, but in the neighbourhood of Tokay it generally refers to wines obtained by treating *szamorod* or *Ausbruch* residues with dry wine. In the neighbourhood of Ménes sweet red wines produced by the *Ausbruch* system are also termed *máslás.* Hungary produces a variety of other wines both strong, such as those of central Hungary, and relatively light, such as those of Croatia and Transylvania. The wines produced at Carlowitz (on the Danube), some 40 m. north-west of Belgrade, are somewhat stronger. They have a flavour somewhat resembling port, but are coarser, and lack the fine bouquet of the latter. The other chief vine-growing countries of the empire are Dalmatia, Lower Austria and Styria. Some of the Dalmatian wines are of fair quality, and somewhat resemble Burgundy.

Wines of the United States

The cultivation of the vine has made very rapid strides in the United States during the past half-century. Whereas in 1850 the production amounted to little more than a million gallons, the output to-day is, in good years, not far short of 50 million gallons. The result has been that the domestic wines have now very largely displaced the foreign product for ordinary beverage purposes. At the same time, there is no reason to believe that the finer European wines will be entirely displaced, inasmuch as these are characterized by qualities of delicacy and breed which cannot be reproduced at will. At the same time, there is no doubt that much of the wine produced in the United States is of very fair quality, and this is largely due to the fact that the Americans have been at great pains to introduce the latest scientific methods in regard to the vine and wine-making. Thus in parts of California, where high temperatures are liable to prevail during the vintage, the system—first employed in Algeria—of cooling the must during fermentation to the proper temperature by means of a series of pipes in which iced water circulates is now largely employed. The use of pure culture yeast derived from many of the most famous European vineyards has also done much towards improving the quality. In California there are, in addition to the native growths, vines from almost every European wine-growing centre, and the produce of these goes by such names as Riesling, Hermitage, Sauternes, Chianti, &c., in accordance with the district of origin of the vine. California is the largest wine-growing state, as the Pacific slope seems particularly suitable to vine-growing. At the present time there are about 280,000 acres under the vine in California, and the number of vines is about 90 millions. The annual production is about 30 million gallons, of which rather more than one-half is dry wine. A good deal of sweet wine is also made, particularly in the Fresno district, where, however, a large proportion of the grapes is grown with a view to making raisins. Following California, New York and Ohio are the most important wine-producing states. The centre of the wine trade of Ohio is at Sandusky on the shores of Lake Erie. Here, as well as at Cleveland, "champagnes" and "clarets" and "sparkling Catawba" are the chief wines produced. The latter was first made by Nicolas Longworth of Cincinnati. The Catawba is the chief growth of the Lake Erie district; the other important vines being the Delaware and Concord. New York state, in which wine has been grown from a very early period, produces roughly three-quarters of all the domestic "champagnes." There are about 75,000 acres under the vine in this state, and roughly 5 million gallons are produced annually. The wines grown on the Pacific slope are generally of a mild and sweet character, resembling in general nature the wines of southern Europe (Italy, Spain, Portugal). In the eastern and middle states the wines produced are of a lighter type and of drier flavour, and are somewhat similar to the growths of Germany and France. At the present time America exports a considerable quantity of wine, and there is some trade in the United Kingdom in Californian "claret."

Wines of the British Empire

The production of the British empire is very small, amounting to roughly 10 million gallons, and this is produced almost entirely in the Cape of Good Hope and in the Australian Commonwealth. At present the average vintage of the Cape and of Australia is in each case roughly 5 to 6 million gallons. In 1905 New South Wales produced 831,000, Victoria 1,726,000, and South Australia 2,846,000 gallons respectively. The trade of Australia with the United Kingdom is now considerable, having increased from 168,188 gallons in 1887 to 622,836 gallons in 1906. It is possible that the trade would grow much more rapidly than it has done if it were practicable to ship the lighter varieties of wines. These, which would be suitable for ordinary beverage purposes, cannot as a rule stand the passage through the Red Sea, and it is therefore only possible to ship the heavier or fortified wines. It is doubtful, therefore, whether the products of the British Empire will ever displace European wines in the United Kingdom on a really large scale, for they cannot compete at present as regards quality with the finer wines of Europe, nor, for the reason stated, with the lighter beverage wines. The quality of the wine produced in the Cape and in Australia has improved very much of recent years, chiefly owing to the introduction of scientific methods of wine cultivation and of wine-making in much the same manner as has been the case in California. The red wines of Australia, particularly those of South Australia, somewhat resemble French wines, being intermediate between claret and burgundy as regards their principal characteristics. There are several types of white wines, some resembling French Sauternes and Chablis and others the wines of the Rhine. It has been recognized, however, that it is impossible to actually reproduce the character of the European wines, and it is now generally held to be desirable to recognize the fact that Australian and Cape wines represent distinct types, and to sell them as such without any reference to the European parent types from which they have been derived.

Other Countries

Considerable quantities of wine are produced in the Balkan states, but the bulk of this is of a coarse description and only fit for local consumption. The average yield of Bulgaria and Rumania is probably some 30 to 40 million gallons for each country, but in some years it is much larger. Thus in 1896 Rumania produced no less than 101 million gallons and Bulgaria 81 million gallons. The wine industry in Greece, which in ancient times and during the middle ages was of great importance, has now become, at any rate in point of quality, quite insignificant. At the present time a great part of the industry is devoted to the cultivation of the currant vine (*Vitis corinthiaca*). There is a considerable export of currants and raisins and concentrated wine must from this country. Many of the islands of the Mediterranean, from which the ancients drew their supplies of wine, such as Chios, Cos, Tenedos, Crete and Cyprus, still produce considerable quantities of wine, but the bulk of this is scarcely to the modern European taste. In Asia wine is produced, according to Thudichum, principally in Caucasia and Armenia. In Persia, also, wines are made, especially in the Shiraz district. Russia also produces a small quantity of wine, principally in the Crimea. (P.S.)

WINEBRENNER, JOHN (1797–1860), American clergyman, founder of the "Church of God," was born in Glade Valley, Frederick county, Maryland, on the 25th of March 1797. He studied at Dickinson College, Carlisle, Pennsylvania, was ordained in the German Reformed Church in 1820 and became a pastor at Harrisburg, Pennsylvania, where his revival preaching and his *Revival Hymn-Book* (1825) brought about a break between his followers and the Reformed Church. In 1830 he founded the Church of God (whose members are commonly called Winebrennerians); he was speaker of its conference and edited its organ, *The Church Advocate*, until his death in Harrisburg on the 12th of September 1860. He wrote *Brief Views of the Church of God* (1840); *A Treatise on Regeneration* (1844); *Doctrinal and Practical Sermons* (1860); and with I. B. Rupp, *The History of all the Religious Denominations in the United States* (1844).

The Church of God has three sacraments: baptism (by immersion), feet washing and the Lord's Supper (administered to Christians only, in a sitting posture, and in the evening); it is generally Arminian and pre-millenarian, and in government has local elders and deacons, an annual eldership composed of pastors and lay elders, and, chosen by (and from) the annual elderships, a general eldership which meets since 1905 once in four years. The denomination in 1906 numbered 518 organizations and 24,356 communicants, in the following states: Pennsylvania (11,157), Ohio (2980), Indiana (1999), Illinois (1555), Maryland (1204), Missouri (1053), Iowa, West Virginia, Arkansas, Kansas, Oklahoma, Nebraska, Michigan, Washington, Oregon and Minnesota. Under the general eldership are: Findlay College, Findlay, Ohio; Fort Scott Collegiate Institute, Fort Scott, Kansas; and an academy at Barkeyville, Pennsylvania. Some foreign missionary work is done in Bengal.

WINER, GEORG BENEDIKT (1789–1858), German Protestant theologian, was born at Leipzig on the 13th of April 1789. He studied theology at Leipzig, where eventually (1832) he became professor ordinarius. From 1824 to 1830 he edited with J. G. V. Engelhardt the *Neues kritisches Journal der theologischen Literatur*, and alone from 1826 to 1832 the *Zeitschrift für wissenschaftliche Theologie*. He is well known as the author of a *Grammatik des neutestamentlichen Sprachidioms* (1821, 8th ed. revised by P. W. Schmiedel, 1894 ff.), of which several translations have appeared, the latest being by W. F. Moulton (1870, 3rd ed. 1882). He died on the 12th of May 1858.

His other works include: *Komparative Darstellung des Lehrbegriffes der verschiedenen christlichen Kirchenparteien* (1824; 4th ed. by P. Ewald, 1882; Eng. trans. 1873), *Biblisches Realwörterbuch* (1820; 3rd ed. 1847–1848, 2 vols.), *Grammatik des biblischen und targumischen Chaldaismus* (1824; 3rd ed. by B. Fischer, *Chaldäische Grammatik für Bibel und Talmud*, 1882; Eng. trans. 1845) and a useful *Handbuch der theologischen Literatur* (1820; 3rd ed. 1838–1840, 2 vols.; supplement, 1842). Cf. W. Schmidt, "Zum Gedächtnis Dr G. B. Winers," in the *Beiträge zur sächsischen Kirchengeschichte*.

WINE-TABLE, a late 18th-century device for facilitating after-dinner drinking—the cabinetmakers called it a "Gentleman's Social Table." It was always narrow and of semicircular or horseshoe form, and the guests sat round the outer circumference. In the earlier and simpler shapes metal wells for bottles and ice were sunk in the surface of the table; they were fitted with brass lids. In later and more elaborate examples the tables were fitted with a revolving wine-carriage, bottle-holder or tray working upon a balanced arm which enabled the bottles to be passed to any guest without shaking. The side opposite the guests was often fitted with a network bag. It has been conjectured that this bag was intended to hold biscuits, but it is much more likely that its function was to prevent glasses and bottles which might be upset from falling to the floor. That the wine-table might be drawn up to the fire in cold weather without inconvenience from the heat it was fitted with curtains hung upon a brass frame and running upon rings. Sometimes the table was accompanied by a circular bottle-stand supported on a tripod into which the bottles were deeply sunk to preserve them from the heat of the fire. Yet another form was circular with a socket in the centre for the bottle. Wine-tables followed the fashion of other tables and were often inlaid with wood or brass. They are now exceedingly scarce.

WINFIELD, a city and the county-seat of Cowley county, Kansas, U.S.A., in the S. part of the state, on the Walnut river, about 40 m. S.S.E. of Wichita. Pop. (1890) 5184; (1900) 5554, of whom 203 were foreign born and 282 were negroes; (1905) 7845; (1910) 6700. It is served by the Atchison, Topeka & Santa Fé, the Missouri Pacific, and the St Louis & San Francisco railways, and is connected by electric line with Arkansas City, Arkansas. In the city are St John's Lutheran College (1893), the South-west Kansas College (Methodist Episcopal, opened in 1886), St Mary's Hospital and Training School (1898), Winfield Hospital (1900), a Lutheran orphans' home and a State School for Feeble-minded Youth. Island Park (50 acres) is the meeting-place of a summer Chautauqua. Winfield is a supply and distributing point for a rich farming country, in which large quantities of wheat and alfalfa are raised. Limestone is quarried near the city, and natural gas is found in the vicinity and piped in from eastern fields for general use in the city. The municipality owns and operates the waterworks and the electric-lighting plant. Winfield was settled in 1870 and incorporated in 1871.

WINGATE, SIR FRANCIS REGINALD (1861–), British general and administrator in the Sudan, was born at Broadfield, Renfrewshire, on the 25th of June 1861, being the seventh son of Andrew Wingate of Glasgow and Elizabeth, daughter of Richard Turner of Dublin. He was educated at the Royal Military Academy, Woolwich, and became a lieutenant in the Royal Artillery in 1880. He served in India and Aden, 1881–1883, and in the last-named year joined the Egyptian army on its reorganization by Sir Evelyn Wood, and in the Gordon Relief Expedition of 1884–1885 was A.D.C. and military secretary to Sir Evelyn. For his services he received the brevet rank of major. After holding an appointment in England for a brief period he rejoined the Egyptian army in 1886. He took part in the operations on the Sudan frontier in 1889, including the engagement at Toski and in the further operations in 1891, being present at the capture of Tokar. In 1894 he was governor of Suakin. His principal work was in the Intelligence branch of the service, of which he became director in 1892. A master of Arabic, his knowledge of the country, the examination of prisoners, refugees and others from the Sudan, and the study of documents captured from the Dervishes enabled him to publish in 1891 *Mahdiism and the Egyptian Sudan*, an authoritative account of the rise of the Mahdi and of subsequent events in the Sudan up to that date. Largely through his instrumentality Father Ohrwalder and two nuns escaped from Omdurman in 1891. Wingate also made the arrangements which led to the escape of Slatin Pasha in 1895. The English versions of Father Ohrwalder's narrative (*Ten Years in the Mahdi's Camp*, 1892) and of Slatin's book (*Fire and Sword in the Sudan*, 1896) were from Wingate's pen, being rewritten from a rough translation of the original German.

As director of military intelligence he served in the campaigns of 1896–1898 which resulted in the reconquest of the Sudan, including the engagement at Firket, the battles of the Atbara and Omdurman and the expedition to Fashoda. In an interval (March–June 1897) he went to Abyssinia as second in command of the Rennell Rodd mission. For his services he was made colonel, an extra A.D.C. to Queen Victoria, received the thanks of parliament and was created K.C.M.G. Wingate was in command of an expeditionary force which in November 1899 defeated the remnant of the Dervish host at Om Debreikat, Kordofan, the khalifa being among the slain. For this achievement he was made K.C.B. In December of the same year, on Lord Kitchener being summoned to South Africa, Sir Reginald Wingate succeeded him as governor-general of the Sudan and sirdar of the Egyptian army. His administration of the Anglo-Egyptian Sudan was conspicuously successful, the country, after the desolation of the Mahdia, rapidly regaining a measure of prosperity. In 1903 he was raised to the rank of major-general and in 1908 became lieutenant-general. He was also created a pasha and in 1905 received the honorary degree of D.C.L. from Oxford University. In 1909, at the request of the British government, Wingate undertook a special mission to Somaliland to report on the military situation in connexion with the proposed evacuation of the interior of the protectorate.

WINGFIELD, EDWARD MARIA (*c.* 1560–*c.* 1614), English colonist in America, was born at Stoneley, Huntingdonshire, about 1560. He served as a soldier both in Ireland and the Low Countries, was one of the patentees of Virginia in 1606, and in 1607 accompanied the first colonists to Jamestown. He was elected president of the Council (15th May 1607), but his arbitrary manners, the fact that he was a Roman Catholic, and the suspicion that he was friendly toward Spain led to his deposition in September. He returned to England in April 1608, and died after 1613.

His amplified diary, entitled "A Discourse of Virginia," was published in *Archaeologia Americana*, vol. iv. (Worcester, 1860), with introduction and notes by Charles Deane.

WINGFIELD, SIR RICHARD (*c.* 1469–1525), English diplomatist, was one of the twelve or thirteen sons of Sir John Wingfield (d. 1481) of Letheringham, Suffolk. He became a courtier during the reign of Henry VII. and was made marshal of Calais in 1511. With Sir Edward Poynings and others he was sent in 1512 to arrange a holy league between the pope, the English king and other sovereigns, and in 1514 he went to the Netherlands to try and arrange a marriage between the archduke Charles, afterwards the emperor Charles V., and Henry VIII.'s daughter Mary. In the intervals between these and similar errands Wingfield was occupied in discharging his duties at Calais, but in 1519 he resigned his post there and returned to England. In 1520 Sir Richard was appointed ambassador to the French court, and he helped to make the arrangements for the meeting between Henry VIII. and Francis I. at the Field of the Cloth of Gold. Twice during 1521 he visited Charles V., his object being to deter him from making war on France, and he was on an errand to Spain when he died at Toledo on the 22nd of July 1525. In 1524 he had been made chancellor of the duchy of Lancaster. For his services Wingfield received lands in various parts of England, including Kimbolton in Huntingdonshire, where he enlarged the castle.

Sir Richard had two brothers who attained some celebrity: Sir Robert (*c.* 1464–1539), a diplomatist, and Sir Humphrey (d. 1545), speaker of the House of Commons from 1533 to 1536. An elder brother, Sir John, sheriff of Norfolk and Suffolk in 1483, had a son Sir Anthony (*c.* 1458–1552), who was present at the Field of the Cloth of Gold, and became a member of the privy council and captain of the guard. One of his grandsons, Anthony Wingfield (*c.* 1550–*c.* 1615), was public orator in the university of Cambridge, and another was Sir John Wingfield (d. 1596), a soldier who was governor of Gertruydenberg from 1587 and 1589. Another of Sir Anthony's descendants, Sir Anthony Wingfield (d. 1638), was created a baronet in 1627. Another brother of Sir Richard, Ludovic, had a son, Sir Richard Wingfield, who was governor of Portsmouth under Queen Elizabeth. He was the father of another Sir Richard Wingfield (d. 1634), who served in Ireland and was created Viscount Powerscourt in 1618. He died without issue, and his Irish estates passed to a cousin, Sir Edward Wingfield (d. 1638), whose grandson, Folliott Wingfield (d. 1717), was created Viscount Powerscourt in 1665, but the title again became extinct when he died. In 1744 his cousin, Richard Wingfield (1697–1751), was created Viscount Powerscourt, and his descendants have held this title until the present day. Mervyn Wingfield (1836–1904), the 7th viscount, was created a peer of the United Kingdom as Baron Powerscourt in 1885.

See Lord Powerscourt, *Muniments of the Ancient Family of Wingfield* (1894).

WINKELMANN, EDUARD (1838–1896), German historian, was born at Danzig on the 25th of June 1838. He studied at the universities of Berlin and Göttingen, worked at the *Monumenta Germaniae historica*, and in 1869 became professor of history at the university of Bern, and four years later at Heidelberg. He also spent some time in Russia, teaching at Reval and at the university of Dorpat. He died at Heidelberg on the 10th of February 1896.

Winkelmann wrote a *Geschichte der Angelsachsen bis zum Tode König Ælfreds* (Berlin, 1883); and his residence in Russia induced him to compile a *Bibliotheca Livoniae historica* (St Petersburg, 1870, and Berlin, 1878); but his chief works deal with the history of the Empire during the later middle ages. The most important of these are: *Philipp von Schwaben und Otto IV. von Braunschweig* (Leipzig. 1873–1878). *Geschichte Kaiser Friedrichs II. und seiner Reiche 1212–1235* (Berlin, 1863) and *1235–1250* (Reval, 1865), *Kaiser Friedrich II.* (Leipzig, 1889–1898) and other writings on Frederick in the *Jahrbücher der deutschen Geschichte* (Leipzig, 1862 fol.). He edited the *Acta imperii inedita* (Innsbruck, 1880–1885), and with J. Ficker, *Die Regesten des Kaiserreichs unter Wilhelm, Alfons X. und Richard* (Innsbruck, 1882, 1901). Among Winkelmann's other works are *Allgemeine Verfassungsgeschichte* (Leipzig, 1901) and the *Urkundenbuch der Universität Heidelberg* (Heidelberg, 1886).

WINKELRIED, ARNOLD VON. The incident with which this name is connected is, after the feat of William Tell, the best known and most popular in the early history of the Swiss Confederation. We are told how, at a critical moment in the great battle of Sempach, when the Swiss had failed to break the serried ranks of the Austrian knights, a man of Unterwalden, Arnold von Winkelried by name, came to the rescue. Commending his wife and children to the care of his comrades, he rushed towards the Austrians, gathered a number of their spears together against his breast, and fell pierced through and through, having opened a way into the hostile ranks for his fellow-countrymen, though at the price of his own life. But the Tell and Winkelried stories stand in a very different position when looked at in the dry light of history, for, while in the former case imaginary and impossible men (bearing now and then a real historical name) do imaginary and impossible deeds at a very uncertain period, in the latter we have some solid ground to rest on, and Winkelried's act might very well have been performed, though, as yet, the amount of genuine and early evidence in support of it is very far from being sufficient.

The history of the Winkelrieds of Stans from 1248 to 1534 has been minutely worked out from the original documents by Hermann von Liebenau, in a paper published in 1854, and reprinted at Aarau in 1862, with much other matter, in his book, *Arnold von Winkelried, seine Zeit und seine That.* They were a knightly family when we first hear of them about 1250, though towards the end of the 14th century they seem to have been but simple men without the honours of knighthood, and not always using their prefix "von." Among its members we find an Erni Winkelried acting as a witness to a contract of sale on the 1st of May 1367, while the same man, or perhaps another member of the family, Erni von Winkelried, is plaintiff in a suit at Stans on the 29th of September 1389, and in 1417 is the landamman (or head man) of Unterwalden, being then called Arnold Winkelriet. We have, therefore, a real man named Arnold Winkelried living at Stans about the time of the battle of Sempach. The question is thus narrowed to the points, Was he present at the battle, and did he then perform the deed commonly attributed to him? This involves a minute investigation of the history of that battle, to ascertain if there are any authentic traces of this incident, or any opportunity for it to have taken place.

1. *Evidence of Chronicles.*—The earliest known mention of the incident is found in a Zürich chronicle (discovered in 1862 by G. von Wyss), which is a copy, made in 1476, of a chronicle written in or at any rate not earlier than 1438, though it is wanting in the 16th-century transcript of another chronicle written in 1466, which up to 1389 closely agrees with the former. It appears in the well-known form, but the hero is stated to be *ein getrüwer man under den Eidgenozen*, no name being given, and it seems clear that his death did not take place at that time. No other mention has been found in any of the numerous Swiss or Austrian chronicles till we come to the book *De Helvetiae origine*, written in 1538 by Rudolph Gwalther (Zwingli's son-in-law), when the hero is still nameless, being compared to Decius or Codrus, but is said to have been killed by his brave act. Finally, we read the full story in the original draft of Giles Tschudi's chronicle, where the hero is described as "a man of Unterwalden, of the Winkelried family," this being expanded in the final recension of the chronicle (1564) into "a man of Unterwalden, Arnold von Winckelried by name, a brave knight," while he is entered (in the same book, on the authority of the "Anniversary Book" of Stans, now lost) on the list of those who fell at Sempach at the head of the Nidwalden (or Stans) men as "Herr Arnold von Winckelriet, Ritter," this being in the first draft "Arnold Winckelriet."

2. *Ballads.*—There are several war songs on the battle of Sempach which have come down to us, but in one only is there mention of

Winkelried and his deed. This is a long ballad of 67 four-line stanzas, part of which (including the Winkelried section) is found in the additions made between 1531 and 1545 to Etterlin's chronicle by H. Berlinger of Basel, and the whole in Werner Steiner's chronicle (written 1532). It is agreed on all sides that the last stanza, attributing the authorship to Halbsuter of Lucerne, "as he came back from the battle," is a very late addition. Many authorities regard it as made up of three distinct songs (one of which refers to the battle and Winkelried), possibly put together by the younger Halbsuter (citizen of Lucerne in 1435, died between 1470 and 1480), though others contend that the Sempach-Winkelried section bears clear traces of having been composed after the Reformation began, that is, about 1520 or 1530. Some recent discoveries have proved that certain statements in the song usually regarded as anachronisms are quite accurate; but no nearer approach has been made towards fixing its exact date, or that of any of the three bits into which it has been cut up. In this song the story appears in its full-blown shape, the name of Winckelriet being given.

3. *Lists of those who fell at Sempach.*—We find in the "Anniversary Book" of Emmetten in Unterwalden (drawn up in 1560) the name of "der Winkelriedt" at the head of the Nidwalden men; and in a book by Horolanus, a pastor at Lucerne (about 1563), that of "Erni Winckelried" occurs some way down the list of Unterwalden men.

4. *Pictures and Drawings.*—In the MS. of the chronicle of Diebold Schilling of Bern (*c.* 1480) there is in the picture of the battle of Sempach a warrior pierced with spears falling to the ground, which may possibly be meant for Winkelried; while in that of Diebold Schilling of Lucerne (1511), though in the text no allusion is made to any such incident, there is a similar picture of a man who has accomplished Winkelried's feat, but he is dressed in the colours of Lucerne. Then there is an engraving in Stumpf's chronicle (1548), and, finally, the celebrated one by Hans Rudolf Manuel (1551), which follows the chronicle of 1476 rather than the ballad.

The story seems to have been first questioned about 1850 by Moritz von Stürler of Bern, but the public discussion of the subject originated with a lecture by O. Lorenz on *Leopold III. und die Schweizer Bünde*, which he delivered in Vienna on March 21, 1860. This began the lively paper war humorously called "the second war of Sempach," in which the Swiss (with but rare exceptions) maintained the historical character of the feat against various foreigners —Austrians and others.

Most of the arguments against the genuineness of the story have been already more or less directly indicated. (1) There is the total silence of all the old Swiss and Austrian chroniclers until 1538, with the solitary exception of the Zürich chronicle of 1476 (and this while they nearly all describe the battle in more or less detail). The tale, as told in the 1476 chronicle, is clearly an interpolation, for it comes immediately after a distinct statement that "God had helped the Confederates, and that with great labour they had defeated the knights and Duke Leopold," while the passage immediately following joins on to the former quite naturally if we strike out the episode of the "true man," who is not even called Winkelried. (2) The date of the ballad is extremely uncertain, but cannot be placed earlier than at least 60 or 70 years after the battle, possibly 130 or 140, so that its claims to be regarded as embodying an oral contemporary tradition are of the slightest. (3) Similar feats have been frequently recorded, but in each case they are supported by authentic evidence which is lacking in this case. Five cases at least are known: a follower of the count of Hapsburg, in a skirmish with the Bernese in 1271; Stülinger of Ratisbon (Regensburg) in 1332, in the war of the count of Kyburg against the men of Bern and Solothurn; Conrad Royt of Lucerne, at Nancy in 1477; Henri Wolleben, at Frastanz in 1499, in the course of the Swabian War; and a man at the battle of Kappel in 1531. (4) It is argued that the course of the battle was such that there was little or no chance of such an act being performed, or, if performed, of having turned the day. This argument rests on the careful critical narrative of the fight constructed by Herr Kleissner and Herr Hartmann from the contemporary accounts which have come down to us, in which the pride of the knights, their heavy armour, the heat of the July sun, the panic which befell a sudden part of the Austrian army, added to the valour of the Swiss, fully explain the complete rout. Herr Hartmann, too, points out that, even if the knights (on foot) had been ranged in serried ranks, there must have been sufficient space left between them to allow them to move their arms, and therefore that no man, however gigantic he might have been, could have seized hold of more than half a dozen spears at once.

Herr K. Bürkli (*Der wahre Winkelried,—die Taktik der alten Urschweizer*, Zürich, 1886) has put forth a theory of the battle which is, he allows, opposed to all modern accounts, but entirely agrees, he strongly maintains, with the contemporary authorities. According to this the fight was not a pitched battle but a surprise, the Austrians not having had time to form up into ranks. Assuming this, and rejecting the evidence of the 1476 chronicle as an interpolation and full of mistakes, and that of the song as not proved to have been in existence before 1531, Herr Bürkli comes to the startling conclusion that the phalanx formation of the Austrians, as well as the name and act of Winkelried, have been transferred to Sempach from the fight of Bicocca, near Milan (April 27, 1522), where a real leader of the Swiss mercenaries in the pay of France, Arnold Winkelried, really met his death in very much the way that his namesake perished according to the story. Herr Bürkli confines his criticism to the first struggle, in which alone mention is made of the driving back of the Swiss, pointing out also that the chronicle of 1476 and other later accounts attribute to the Austrians the manner of attack and the long spears which were the special characteristics of Swiss warriors, and that if Winkelried were a knight (as is asserted by Tschudi) he would have been clad in a coat of mail, or at least had a breastplate, neither of which could have been pierced by hostile lances.

Whatever may be thought of this daring theory, it seems clear that, while there is some doubt as to whether such an act as Winkelried's was possible at Sempach, taking into account the known details of the battle, there can be none as to the utter lack of any early and trustworthy evidence in support of his having performed that act in that battle. It is quite conceivable that such evidence may later come to light; for the present it is wanting.

Authorities.—See in particular Theodor von Liebenau's *Die Schlacht bei Sempach—Gedenkbuch zur fünften Säcularfeier* (1886), published at the expense of the government of Lucerne. This contains every mention or description of the battle or of anything relating to it, published or unpublished, in prose or in verse, composed within 300 years after the battle, and is a most marvellous and invaluable collection of original materials, in which all the evidence for Winkelried's deed has been brought together in a handy shape. Besides the works mentioned in the text, and the life of Winkelried by W. Oechsli in vol. liii. of the *Allgemeine deutsche Biographie*, the following are the most noteworthy publications relating to this controversy. In support of Winkelried's act: G. v. Wyss, *Über eine Zürcher-Chronik aus dem 15ten Jahrhundert* (Zürich, 1862); A. Daguet, "La Question de Winkelried," in the *Musée Neuchâtelois* for December 1883; G. H. Ochsenbein, "Die Winkelriedfrage," in the *Sonntagsblatt* of the *Bund* newspaper for January and February 1879; A. Bernoulli, *Winkelrieds That bei Sempach* (Basel, 1886); W. Oechsli, *Zur Sempacher Schlachtfeier* (Zürich, 1886); E. Secretan, *Sempach et Winkelried* (Lausanne, 1886); and the summary in K. Dändliker's larger *Geschichte der Schweiz*, i. 550-559 (3rd ed., Zürich, 1893). Against Winkelried's claims we have the remarkable study of O. Kleissner, *Die Quellen zur Sempacher Schlacht und die Winkelriedsage* (Göttingen, 1873); O. Hartmann, *Die Schlacht bei Sempach* (Frauenfeld, 1886); and the concise summary of the evidence given by M. v. Stürler (the first to suspect the story) in the *Anzeiger für Schweiz. Geschichte* (1881), 392-394.

(W. A. B. C.)

WINNIPEG, the capital of Manitoba, and chief city of Western Canada. It is situated at the junction of the Assiniboine and Red rivers in the middle of a wide plain. The river valley, being of exceptional richness, early attracted the traders, and so in the beginning of the 19th century gained the attention of Lord Selkirk, a benevolent Scottish nobleman who sent out in 1811–1815 several hundreds of Highland settlers. On the site at the junction of the two rivers where Verandreye, the first white explorer to visit the Red river, had three-quarters of a century before this time erected Fort Rouge, and where some ten years earlier in the century the Nor'-Westers of Montreal had erected Fort Gibraltar, the Hudson's Bay Company, which at the time Lord Selkirk and his friends controlled, erected Fort Douglas, bearing the family name of the colonizer. After bloodshed between the rival fur companies, and their union in 1821, Fort Garry was erected, as a trading post and settlers' depot, and with somewhat elaborate structure, with stone walls, bastions and portholes. Fort Garry (2) was erected at a considerable cost in 1835. A short distance north of this fort, about the year 1860, the first house on the plain was erected, and to the hamlet rising there was given the name of the lake 45 m. north, Winnipeg (Cree, *Win*, murky; *nipiy*, water). The name referred to the contrast between its water and that of the transparent lakes to the east. For ten years the hamlet grew—though very slowly, it being more than four hundred miles from St Paul, the nearest town in Minnesota, to the south. The fur-traders did not seek to increase its size. When the transfer of Rupert's Land took place to Canada in 1870, the governor of Assiniboia had his residence at Fort Garry, and here was the centre of government for the settlers over the area surrounding Fort Garry. Its acquisition by Canada and the influx of settlers from Eastern Canada led to the greater importance of Winnipeg, as the new town was now generally called. The establishment of Dominion government agencies, the formation of a local government, the machinery required for the government of the province, the influx of a small army of surveyors who mapped out and surveyed wide districts of the country, and the taking up of free lands in all directions by Canadian settlers, all tended to build up the hamlet of Winnipeg into a considerable town.

The following figures of population show the remarkable increase of Winnipeg: (1870) 215; (1874)[1] 1869; (1885) 19,574; (1898) 39,384; (1901) 42,340; (1905) 79,975; (1906) 90,153; (1907) 100,000 (estimated). The rapid growth of the city, the character of the soil, and the high prices of material for street construction have led to a large and expensive civic organization. The city is governed by a mayor, four controllers, and twelve aldermen. The city possesses the public utility of water, but the city street car system, gas, and private electric lighting are in the hands of a private company. The city has decided to introduce electric power from Winnipeg river, at a point some 50 m. distant. The streets are in some cases macadamized and in other cases block paved, and in still others asphalted. The Parks Board is a board appointed by the city council, and has the complete administration of a fixed percentage of the city taxes. The streets are boulevarded, trees planted on them, and both of these kept by the Parks Board. A number of well-kept small parks are found throughout the city, and a large park—the Assiniboine—is being prepared and beautified. The greatest business street is Main Street, on which (north) the Great Canadian Pacific railway station and Royal Alexandra Hotel are situated, and (south) the Union station of the Canadian Northern and Grand Trunk Pacific railways are found. On or near this street (132 ft. wide) are placed the great financial institutions of the city, including eighteen chartered banks, many of which are ornaments to the city, and many loan, insurance, and real estate buildings and offices. The departmental stores and offices of the Hudson's Bay Company and its Fort Garry court, which stand on Main Street South, are worthy of that ancient company. The city hall, with park and volunteers' monument, are on the same street, while the lofty Union Bank, McIntyre, and Bon Accord blocks are here wildernesses of offices of every description. The second great street, Portage Avenue, of the same width as Main Street, runs at right angles to Main Street, and is the mercantile street of the city. On this are the post office, *Free Press* office, Y.M.C.A. building, Aikins Block, T. Eaton & Co.'s enormous departmental shop, and the Ideal Building, which are worthy of note. The wholesale business street of the city is Princess, running parallel to Main Street; and the two most beautiful residential streets are Broadway and Assiniboine Avenues. All parts of the city are reached by the Winnipeg electric street railway, which runs north for 25 m. on the continuation of Main Street to the town of Selkirk, west along Portage Avenue for 12 m. to St James, Silver Heights, St Charles and Headingly, and south through Fort Rouge to River Park. At the north of the city are St John's episcopal buildings, including St John's College and boys' school. In the central part of the city are the parliament building, governor's residence, barracks, law courts, university, Manitoba College and Wesley College buildings. More than eighty churches, many of them of architectural value, are found scattered over the city, while the General Hospital, Women's Home, Children's Home, Children's Aid Shelter and Deaf and Dumb Institute speak of the benevolence of the citizens. One of the most striking features of Winnipeg is seen in the elaborate system of public schools. The buildings are not exceeded for beauty of design or for completeness of finish by any Canadian city and by few American cities.

The geographical position of Winnipeg is unique for the purposes of trade. Like Chicago it stands on the eastern border of the prairies. All western trade in Canada of the vast provinces of Manitoba, Saskatchewan, Alberta and British Columbia, must pass through the narrow belt of 100 m., lying between the international boundary line and Lake Winnipeg. Midway in this belt stands Winnipeg. The trade from the wide extent of three-quarters of a million of square miles of prairie and woodland, becoming more populous every year, must flow as through a narrow spout at Winnipeg; every railway must pass through Winnipeg. In consequence Winnipeg is already a considerable manufacturing centre. Its lumber and flour mills are its largest industries, but the following are found: aerated waters and breweries, tent makers, baking-powder manufactories, box manufacturers, brick makers, broom, brushes and carriage makers, cement blocks, manufacturing chemists, chocolate and cigar manufacturers, confectionery, copper plate, cornice makers, engine builders, gas fitters, ink manufacturers, jewelry makers, lime makers, milliners, opticians, paint makers, paper-box makers, photographers, pickle makers, planing mills, pork packers, publishers, pump makers, rubber-stamp makers, sash, door and blind factories, upholsterers, ventilating manufactory, vinegar factories, foundries, wire and fence manufactories. The area of the city is 12,700 acres.

WINNIPEG, a lake and river of Canada. The lake is in Saskatchewan, Manitoba and Keewatin, and is situated between 50° 20′ and 53° 50′ N. and 96° 20′ and 99° 15′ W. It covers an area of 8555 sq. m., is at an altitude of 710 ft. above the sea, is 260 m. long, 25 to 60 m. wide, and contains several large islands, including Reindeer (70 sq. m.) and Big Island (60 sq. m.). It is shallow, being nowhere more than 70 ft. in depth, and in consequence extremely stormy and dangerous. It abounds in fish, its white fish being especially celebrated. Its shores are low and on the south extremely marshy. The principal affluent rivers are: Red river, from the south; Winnipeg, Bloodvein, Berens and Poplar from the east; and the Dauphin and Saskatchewan from the west. It receives the surplus waters of lakes Manitoba and Winnipegosis, and discharges by the river Nelson into Hudson Bay. The river Winnipeg rises near Savanne station in 48° 47′ N. and 89° 57′ W., and flows in a westerly direction under the names of Savanne, Seine, and Rainy rivers to the Lake of the Woods; issuing thence as the Winnipeg, it flows N.W. with an exceedingly tortuous and turbulent course to the lake of the same name. It is navigable from the foot of the Lake of the Woods to the head of Rainy lake—with a short portage at Fort Frances falls—a distance of 208 m. Its principal tributary is English river.

WINNIPEGOSIS, a lake of Manitoba and Saskatchewan, Canada, between 51° 34′ and 53° 11′ N. and 99° 37′ and 101° 06′ W. Its greatest length is 122 m.; greatest width 17 m.; shoreline 570 m.; and area, exclusive of islands, 2000 sq. m. Its greatest ascertained depth is 38 ft., and mean altitude 828 ft. above the sea. Mossy river from the south, draining Lake Dauphin, Swan, and Red Deer rivers are the only considerable streams that fall into it. It drains by the Waterhen river through Waterhen lake into Lake Manitoba, and thence by the Little Saskatchewan into Lake Winnipeg. It was discovered by the chevalier de la Verendrye in 1739.

WINONA, a city and the county-seat of Winona county, Minnesota, U.S.A., about 95 m. S.E. of St Paul, on the W. bank of the Mississippi river, here crossed by three steel bridges. Pop. (1880) 10,208; (1890) 18,208; (1900) 19,714, of whom 5000 were foreign-born and 30 negroes; (1910 census) 18,583. There are large German and Polish elements in the population; and German and Polish journals, besides two dailies in English, are published here. Winona is served by the Chicago, Burlington & Quincy, the Chicago Great Western, the Chicago, Milwaukee & St Paul, the Green Bay & Western, and the Chicago & North-Western railways, and by river steamboat lines. It is picturesquely situated on a broad, level terrace, slightly elevated above the river, and surmounted by steep bluffs rising to 400-500 ft. At Winona are the Winona General Hospital (1894), to which is attached a Nurses' Training School; the first State Normal School (opened in 1860), and Winona Seminary (1894) for girls, conducted by the Sisters of Saint Francis. The city has a public library (about 30,000 vols.), with a mural decoration by Kenyon Cox; a Federal building; a Masonic Temple; and several parks; and it owns its own water supply (operated by the Holly system). In 1905 the total value of the factory product was $7,850,236 (30·5% more than in 1900). The site of the city was frequently used as a landing place in the old fur-trading days, but was not permanently settled until about 1853. Winona was first chartered as a city in 1857. A large part of it was destroyed by fire in 1860. The name Winona is said to be a Sioux word meaning "first-born daughter."

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[1] Incorporated in this year as a city.

WINSFORD, an urban district in the Northwich parliamentary division of Cheshire, England, on the river Weaver, 6 m. S. of Northwich, on the London & North-Western railway and the Cheshire lines. Pop. (1901) 10,382. In the town, which is only second to Northwich in this respect, large quantities of salt are raised and conveyed to Liverpool for exportation; being shipped in flats down the Weaver, which has been rendered navigable by an elaborate system of locks. Rock-salt is procured, as well as that obtained from the brine-pools. Boat-building is an important accompanying industry, and more than half a million tons of salt are shipped annually. Owing to the pumping of the brine, large tracts of land have been submerged, and there is thus a constant danger to houses. The iron bridge across the Weaver, which was built in 1856, had to be raised thrice in the following twenty-six years. The town has received much benefit from philanthropists, Sir Joseph Verdin providing a technical school, and Sir John Brunner a guildhall and other buildings.

WINSLOW, EDWARD (1595–1655), one of the founders of the Plymouth colony in America, was born in Droitwich, Worcestershire, England, on the 18th of October 1595. In 1617 he removed to Leiden, united with John Robinson's church there, and in 1620 was one of the "pilgrims" who emigrated to New England on the "Mayflower" and founded the Plymouth colony. His wife, Elizabeth (Barker) Winslow, whom he had married in May 1618 at Leiden, having died soon after their arrival, he married, in May 1621, Mrs Susannah White, the mother of Peregrine White (1620–1704), the first white child born in New England. This was the first marriage in the New England colonies. Winslow was delegated by his associates to treat with the Indians in the vicinity and succeeded in winning the friendship of their chief, Massasoit (*c.* 1580–1661). He was one of the assistants from 1624 to 1647, except in 1633–1634, 1636–1637 and 1644–1645, when he was governor of the colony. He was also, in 1643, one of the commissioners of the United Colonies of New England. On several occasions he was sent to England to look after the interests of Plymouth and Massachusetts Bay, and defend these colonies from the attacks of such men as John Lyford, Thomas Morton (*q.v.*) and Samuel Gorton (*q.v.*). He left on his last mission as the agent of Massachusetts Bay, in October 1646, and spent nine years in England, where he held a minor office under Cromwell, and in 1654 was made a member of the commission appointed to determine the value of certain English ships destroyed by Denmark. In 1655 he was the chief of the three English commissioners whom Cromwell sent on his expedition against the West Indies to advise with its leaders Admiral Venables and Admiral William Penn, but died near Jamaica on the 8th of May 1655, and was buried at sea. Winslow's portrait, the only authentic likeness of any of the "Mayflower" "pilgrims," is in the gallery of the Pilgrim Society at Plymouth, Mass.

His writings, though fragmentary, are of the greatest value to the historian of the Plymouth colony. They include: *Good Newes from New England, or a True Relation of Things very Remarkable at the Plantation of Plimouth in New England* (1624); *Hypocrisie Unmasked; by a True Relation of the Governor and Company of Massachusetts against Samuel Gorton, a Notorious Disturber of the Peace* (1646), to which was added a chapter entitled "A Brief Narration of the True Grounds or Cause of the First Plantation of New England"; *New England's Salamander* (1647); and *The Glorious Progress of the Gospel amongst the Indians in New England* (1649). With William Bradford he also is supposed to have prepared a *Journal of the Beginning and Proceeding of the English Plantation settled at Plymouth in New England* (1622), which is generally known as "Mourt's Relation," owing to its preface having been signed by "G. Mourt." Some of his writings may be found reprinted in Alexander Young's *Chronicles of the Pilgrims* (Boston, 1841).

See J. B. Moore's *Memoirs of American Governors* (New York, 1846); David P. and Frances K. Holton's *Winslow Memorial* (New York, 1877) and J. G. Palfrey's *History of New England* (3 vols., Boston, 1858–1864). Also see a paper by W. C. Winslow, "Governor Edward Winslow, his Place and Part in Plymouth Colony," in the *Annual Report of the American Historical Association* for 1895 (Washington, 1896).

His son, Josiah Winslow (1629–1680), was educated at Harvard College. He was elected a deputy to the General Court in 1653, was an "assistant" from 1657 to 1673, and governor from June 1673 until his death. From 1658 to 1672 he was one of the commissioners of the United Colonies of New England, and in 1675, during King Philip's War, he was commander-in-chief of the united forces of New England.

WINSOR, JUSTIN (1831–1897), American writer and librarian, was born in Boston, Massachusetts, on the 2nd of January 1831. At the age of nineteen he printed a *History of Duxbury*, Mass., the home of his ancestors. He left Harvard before graduation to study in Paris and Heidelberg, but not until he had planned an extended memoir of *Garrick and his Contemporaries*, the manuscript of which, in ten folio volumes with a mass of notes, is in the library of Harvard University. In 1866 Winsor was appointed a trustee of the Boston public library, and in 1868 its superintendent. In 1877 he became librarian of Harvard University, a position he retained until his death. He greatly popularized the use of both these great collections of books. While at the Boston public library he edited a most useful catalogue of books in history, biography and travel, and compiled the first of a series of separate lists of works of historical fiction. In 1876 he began a series of monumental publications. The first was a *Bibliography of the Original Quartos and Folios of Shakespeare with Particular Reference to Copies in America.* Unfortunately, all except about a hundred copies of this work were destroyed by fire. A small volume entitled *The Reader's Handbook of the American Revolution* (1879) is the model of a reasonable bibliography. In 1880 he began the editing of the *Memorial History of Boston* (4 vols., 4to), with the co-operation of seventy writers. He so manipulated the contributions and supplemented them with notes as to give an air of unity to the whole work, and completed it in twenty-three months. He then set to work on a still larger co-operative book, *The Narrative and Critical History of America*, which was completed (1889) in eight royal octavo volumes. These great tasks had compelled Winsor to make a careful and systematic study of historical problems with the aid of contemporaneous cartography. Among the early results of this study were the *Bibliography of Ptolemy's Geography* (1884), and the *Catalogue of the Kohl Collection of Maps relating to America* (1886), published in the *Harvard Library Bulletins.* His vast knowledge took the final form of four volumes entitled *Christopher Columbus* (1891), *Cartier to Frontenac* (1894), *The Mississippi Basin* (1895), and *The Westward Movement* (1897). Besides great stores of information hitherto accessible only to the specialist, these contain many strong expressions of dissent from currently received views. Winsor served for many years on the Massachusetts Archives Commission. His careful *Report on the Maps of the Orinoco-Essequibo Region* was prepared at the request of the Venezuela Boundary Commission. He was one of the founders of both the American Library Association and the American Historical Association, and was president of both—of the former for ten years, 1876–1885, and the latter in 1886–1887. He died in Cambridge on the 22nd of October 1897.

See Horace E. Scudder's "Memoir of Justin Winsor" in the *Proceedings of the Massachusetts Historical Society* (2nd series), vol. xii. Also the *Harvard Graduates' Magazine* (December 1897). A bibliography of his writings is in Harvard College Library, *Bibliographical Contributions*, No. 54.

WINSTED, a borough in the township of Winchester, Litchfield county, Connecticut, U.S.A., on the Mad and Still rivers, in the N.W. part of the state, about 26 m. N.W. of Hartford. Pop. of the township (1890) 6183; (1900) 7763: of the borough (1900) 6804, of whom 1213 were foreign-born; (1910) 7754. The borough is served by the New York, New Haven & Hartford and the Central New England railways, and by electric railway to Torrington. Among the public institutions are the William L. Gilbert Home for friendless children and the Gilbert free high school, each endowed with more than $600,000 by William L Gilbert, a prominent citizen; the Beardsley public library (1874), the Convent of Saint Margaret of Cortona, a Franciscan monastery, and the Litchfield County Hospital. In a park in the central part of the borough there is a tower (60 ft. high) to the memory of the soldiers of Winsted who fell in the Civil War, and another park contains a soldiers' monument and a memorial fountain. Water power is derived from the Mad river and Highland lake, which is west of the borough and is encircled by the Wakefield boulevard, a seven-mile drive, along which there are many summer cottages. The manufactures include cutlery and edge tools, clocks, silk twist, hosiery, leather, &c. Winsted was settled in 1756 and chartered as a borough in 1858. The name Winsted was coined from Winchester and Barkhamsted, the latter being the name of the township immediately east of Winchester. The township of Winchester was incorporated in 1771.

WINSTON-SALEM, two contiguous cities of Forsyth county, North Carolina, U.S.A., about 115 m. N.W. of Raleigh. Pop. of Winston (1880) 2854; (1890) 8018; (1900) 10,008 (5043 negroes); (1910) 17,167. Pop. of Salem (1890) 2711; (1900) 3642 (488 being negroes); (1910) 5533. Both cities are served by the Southern and the Norfolk & Western railways. Since July 1899, when the post office in Salem was made a sub-station of that of Winston, the cities (officially two independent municipalities) have been known by postal and railway authorities as Winston-Salem. Winston is the county-seat and a manufacturing centre. Salem is largely a residential and educational city, with many old-fashioned dwellings, but there are some important manufactories here also; it is the seat of the Salem Academy and College (Moravian) for women, opened as a boarding-school in 1802; and of the Slater Normal and Industrial School (non-sectarian) for negroes, founded from the Slater Fund in 1892. The surrounding country produces tobacco of a very superior quality, and to the tobacco industry, introduced in 1872, the growth of Winston is chiefly due; the manufacture of flat plug tobacco here is especially important. The total value of Winston's factory products increased from $4,887,649 in 1900 to $11,353,296 in 1905, or 132·3%.

Salem was founded in 1766 by Friedrich Wilhelm von Marschall (1721–1802), a friend of Zinzendorf, and the financial manager of the board controlling the Moravian purchase made in North Carolina in 1753, consisting of 100,000 acres, and called Wachovia. The town was to be the centre of this colony, where missionary work and religious liberty were to be promoted, and it remained the home of the governing board of the Moravian Church in the South. In 1849 exclusive Moravian control of Salem's industries and trades was abolished; in 1856 land was first sold to others than Moravians, and in the same year the town was incorporated. Winston was founded in 1851 as the county-seat and was named in honour of Major Joseph Winston (1746–1815), a famous Indian fighter, a soldier during the War of Independence and a representative in Congress in 1793–1795 and 1803–1807. The growth of the two cities has been rapid since 1900.

See J. H. Clewell, *History of Wachovia in North Carolina* (New York, 1902).

WINTER, JOHN STRANGE, the pen-name of Henrietta Eliza Vaughan Stannard (1856–), English novelist, who was born on the 13th of January 1856, the daughter of the Rev. H. V. Palmer, rector of St Margaret's, York. She early began to write fiction for different magazines, producing sentimental stories, chiefly of army life. Two of these, *Bootles' Baby* and *Houp-la*, which appeared originally in *The Graphic* in 1885, established her reputation, and she became a prolific novelist, producing some sixty other light and amusing books, the best of which deal with military life. An indefatigable journalist on matters affecting women, she was the first president of the Writers' Club (1892), and presided from 1901 to 1903 over the Society of Women Journalists. She married in 1884 Arthur Stannard, a civil engineer.

WINTER, PETER (*c.* 1755–1825), German dramatic composer, was born at Mannheim about 1755. He received some instruction from the Abt Vogler, but was practically self-taught. After playing in the Kapelle of the Elector Karl Theodor, at Munich, he became in 1776 director of the court theatre. When Mozart produced his *Idomeneo* at Munich in 1781, Winter, annoyed at his success, conceived a violent hatred for him; yet of more than thirty operas written by Winter between 1778 and 1820 very few were unsuccessful. His most popular work, *Das unterbrochene Opferfest*, was produced in 1796 at Vienna, where in 1797–1798 he composed *Die Pyramiden von Babylon* and *Das Labyrinth*, both written for him by Schickaneder in continuation of the story of Mozart's *Zauberflöte*. He returned to Munich in 1798. Five years later he visited London, where he produced *Calypso* in 1803, *Proserpina* in 1804, and *Zaïra* in 1805, with great success. His last opera, *Sänger und Schneider*, was produced in 1820 at Munich, where he died on the 17th of October 1825. Besides his dramatic works he composed some effective sacred music, including twenty-six masses.

WINTERFELDT, HANS KARL VON (1707–1757), Prussian general, was born on the 4th of April 1707 at Vanselow in Pomerania. His education was imperfect, and in later life he always regretted his want of familiarity with the French language. He entered the cuirassier regiment of his uncle, Major-General von Winterfeldt (now the 12th) in 1720, and was promoted cornet after two years' service. But he was fortunate enough, by his stature and soldierly bearing, to attract the notice of Frederick William I., who transferred him to the so-called giant regiment of grenadiers as a lieutenant. Before long he became a personal aide-de-camp to the king, and in 1732 he was sent with a party of selected non-commissioned officers to assist in the organization of the Russian army. While the guest of Marshal Münnich at St Petersburg, Winterfeldt fell in love with and married his cousin Julie von Maltzahn, who was the marshal's stepdaughter and a maid-of-honour to the grand-duchess Elizabeth. On returning to Prussia he became intimate with the crown prince, afterwards Frederick the Great, whom he accompanied in the Rhine campaign of 1734. This intimacy, in view of his personal relations with the king, made Winterfeldt's position very delicate and difficult, for Frederick William and his son were so far estranged that, as every one knows, the prince was sent before a court-martial by his father, on the charge of attempting to desert, and was condemned to death. Winterfeldt was the prince's constant friend through all these troubles, and on Frederick II.'s accession he was promoted major and appointed aide-de-camp to the new sovereign.

When the first Silesian War broke out Winterfeldt was sent on a mission to St Petersburg, which, however, failed. He then commanded a grenadier battalion with great distinction at Mollwitz, and won further glory in the celebrated minor combat of Rothschloss, where the Prussian hussars defeated the Austrians (May 17, 1741). One month from this day Winterfeldt was made a colonel, as also was Zieten (*q.v.*), the cavalry leader who had actually commanded at Rothschloss, though the latter, as the older in years and service, bitterly resented the rapid promotion of his junior. After this Frederick chiefly employed Winterfeldt as a confidential staff officer to represent his views to the generals, a position in which he needed extraordinary tact and knowledge of men and affairs, and as a matter of course made many enemies.

In the short peace before the outbreak of the second war he was constantly in attendance upon the king, who employed him again, when the war was resumed, in the same capacity as before, and, after he had been instrumental in winning a series of successful minor engagements, promoted him (1745) major-general, to date from January 1743.

For his great services at Hohenfriedberg Frederick gave him the captaincy of Tatiau, which carried with it a salary of 500 thalers a year. At Katholisch-Hennersdorf, where the sudden and unexpected invasion of the Austro-Saxons was checked by the vigour of Zieten, Winterfeldt arrived on the field in time to take a decisive share. Once again the rivals had to share their laurels, and Zieten actually wrote to the king in disparagement of Winterfeldt, receiving in reply a full and generous recognition of his own worth and services, coupled with the curt remark that the king intended to employ General von Winterfeldt in any way that he thought fit. During the ten years' peace that preceded the next great war, Winterfeldt was in constant attendance upon the king, except when employed on confidential missions in the provinces or abroad. In 1756 he was made a lieutenant-general and received the order of the Black Eagle.

In this year he was feverishly active in collecting information as to the coalition that was secretly preparing to crush Prussia, and in preparing for the war. He took a leading part in the discussions which eventuated in Frederick's decision to strike the first blow. He was at Pirna with the king, and advised him against absorbing the Saxon prisoners into his own army. He accompanied Schwerin in the advance on Prague in 1757 and took a conspicuous part in the battle there. After the defeat of Kolin, however, Winterfeldt, whom Frederick seems to have regarded as the only man of character whom he could trust to conduct the more delicate and difficult operations of the retreat, found himself obliged to work in close contact with the king's brother, Prince William, the duke of Brunswick-Bevern, Zieten and others of his enemies. The operations which followed may be summarized by the phrase "everything went wrong"; after an angry scene with his brother, the prince of Prussia retired from the army, and when Frederick gave Winterfeldt renewed marks of his confidence, the general animosity reached its height. As it chanced, however, Winterfeldt fell a victim to his own bravery in the skirmish of Moys near Görlitz on the 7th of September. His wound, the first serious wound he had ever received, proved fatal and he died on the 8th. The court enmities provoked by his twenty years' unbroken intimacy and influence with the king, and the denigration of less gifted or less fortunate soldiers, followed him beyond death. Prince William expressed the bitterness of his hatred in almost his last words, and Prince Henry's memoirs give a wholly incredible portrait of Winterfeldt's arrogance, dishonesty, immorality and incapacity. Frederick, however, was not apt to encourage incompetence in his most trusted officers, and as for the rest, Winterfeldt stood first amongst the very few to whom the king gave his friendship and his entire confidence. On hearing of Winterfeldt's death he said, "Einen Winterfeldt finde ich nie wieder," and a little later, "Er war ein guter Mensch, ein Seelenmensch, er war mein Freund." Winterfeldt was buried at his estate of Barschau, whence, a hundred years later, his body was transferred to the Invaliden Kirchhof at Berlin. A statue was erected to his memory, which stands in the Wilhelmsplatz there, and another forms part of the memorial to Frederick the Great in Unter den Linden.

See *Hans Karl v. Winterfeldt und der Tag von Moys* (Görlitz, 1857); and K. W. v. Schöning, *Winterfeldts Beisetzung; eine biographische Skizze* (Berlin, 1857).

WINTERGREEN, known botanically as *Gaultheria procumbens*, a member of the heath family (*Ericaceae*), is a small creeping, evergreen shrub with numerous short erect branches bearing in the upper part shortly-stalked oval, thick, smooth shining leaves with sharp-toothed edge. The flowers are borne singly in the leaf axels and are pendulous, with a pale pink waxy-looking urn-shaped corolla. The bright crimson-red subglobular, berry-like fruit consists of the much-enlarged fleshy calyx which surrounds the small thin-walled many-seeded capsule. The plant is a native of shady woods on sandy soil, especially in mountainous districts, in southern Canada and the northern United States; it is quite hardy in England. The leaves are sharply astringent and have a peculiar aromatic smell and taste due to a volatile oil known as oil of winter green, used in medicine in the treatment of muscular rheumatism (for the therapeutic action see SALICYLIC ACID). An infusion of the leaves is used, under the name mountain or Salvador tea, in some parts of North America as a substitute for tea; and the fruits are eaten under the name of partridge or deer berries. Other names for the plant are tea-berry, checker-berry, box-berry, jersey tea, spice-berry and ground holly.

See Bentley and Trimen, *Medicinal Plants*, t. 164.

WINTER'S BARK, the bark of *Drimys Winteri*, an evergreen tree belonging to the Magnolia family. It was formerly officinal in Europe, and is still held in esteem in Brazil and other parts of South America as a popular remedy for scurvy and other diseases. The plant is a native of the mountains and highlands from Mexico to the Straits of Magellan.

WINTERTHUR, a flourishing industrial town in the Töss valley, canton of Zürich, Switzerland, and by rail 17 m. N.E. of Zürich. It is 1450 ft. above sea-level, and has a rapidly increasing population (in 1870, 9317; in 1880, 13,502; in 1888, 15,805; and in 1900, 22,335), all German-speaking and nearly all Protestants. It is the point of junction of seven lines of railway, and is therefore of considerable commercial importance. Its main industries are cambric-weaving, cotton-printing, the manufacture of machinery, and wine-growing, Stadtberg being the best variety of wine grown in the neighbourhood of the town. It is a modern, well-built town, with a fine town-hall and well-arranged school buildings. It suffered severely from the disastrous financial enterprise of the National Railway of Switzerland which it promoted. In 1878 it had to sell its property in that line, and from 1881 to 1885 it was in great difficulties in the matter of a loan of nine million francs guaranteed in 1874 by the town, together with three others in Aargau, to that ill-fated railway. As the three co-guarantor towns were unable to pay their share, the whole burden fell on Winterthur, which struggled valiantly to meet its liabilities, and was helped by large loans from the cantonal and federal governments.

The Roman settlement of *Vitudurum* [Celtic *dur*, water] was a little north-east of the present town, at the place now known as Ober Winterthur. It was there that in 919 Burkhard II., duke of Alamannia, defeated Rudolf II., king of Transjuran Burgundy. It was refounded in the valley in 1180 by the counts of Kyburg (their castle rises on a hill, 4 m. to the south of the town), who granted it great liberties and privileges, making it the seat of their district court for the Thurgau. In 1264 the town passed with the rest of the Kyburg inheritance to the Habsburgs, who showed very great favour to it, and thus secured its unswerving loyalty. In 1292 the men of Zürich were beaten back in an attempt to take the town. For a short time after the outlawry of Duke Frederick of Austria, it became a free imperial city (1415–1442); but after the conquest of the Thurgau by the Swiss Confederates (1460–1461) Winterthur, which had gallantly stood a nine-weeks' siege, was isolated in the midst of non-Austrian territory. Hence it was sold by the duke to the town of Zürich in 1467, its rights and liberties being reserved, and its history since then has been that of the other lands ruled by Zürich. In 1717–1726 Zürich tried hard by means of heavy dues to crush the rival silk and cotton industries at Winterthur, which, however, on the whole very successfully maintained its ancient rights and liberties against the encroachments of Zürich.

See H. Glitsch, *Beiträge z. ältern Winterthurer Verfassungsgeschichte* (Winterthur, 1906); J. C. Troll, *Geschichte d. Stadt Winterthur* (8 vols., 1840–1850). (W. A. B. C.)

WINTHER, CHRISTIAN (1796–1876), Danish lyrical poet, was born on the 29th of July 1796 at Fensmark, in the province of Praestö, where his father was priest. He went to the university of Copenhagen in 1815, and studied theology, taking his degree in 1824. He began to publish verses in 1819, but no collected volume appeared until 1828. Meanwhile, from 1824 to 1830, Winther was supporting himself as a tutor, and with so much success that in the latter year he was able to go to Italy on his savings. In 1835 a second volume of lyrics appeared, and in 1838 a third. In 1841 King Christian VIII. appointed Winther to travel to Mecklenburg to instruct the princess Caroline, on the occasion of her betrothal to the Crown Prince of Denmark, in the Danish language. Further collections of lyrics appeared in 1842, 1848, 1850, 1853, 1865 and 1872. When he was past his fiftieth year Winther married. In 1851 he received a pension from the state as a poet, and for the next quarter of a century he resided mainly in Paris. Besides the nine or ten volumes of lyrical verse mentioned above, Winther published *The Stag's Flight*, an epical romance in verse (1855); *In the Year of Grace*, a novel (1874); and other works in prose. He died in Paris on the 30th of December 1876, but the body was brought to Denmark, and was buried in the heart of the woods. In the verse of

Christian Winther the scenery of Denmark, its beechwoods, lakes and meadows, its violet-scented dingles, its hollows perfumed by wild strawberries, found such a loving and masterly painter as they are never likely to find again. He is the most spontaneous of lyrists; his little poems are steeped in the dew and light and odour of a cool, sunshiny morning in May. His melodies are artless, but full of variety and delicate harmony. When he was forty-seven he fell in love, and at that mature age startled his admirers by publishing for the first time a cycle of love-songs. They were what were to be expected from a spirit so unfaded; they still stand alone for tender homage and simple sweetness of passion. The technical perfection of Winther's verse, in its extreme simplicity, makes him the first song-writer of Denmark. (E. G.)

WINTHROP, JOHN (1588–1649), a Puritan leader and governor of Massachusetts, was born in Edwardston, Suffolk, on the 12th of January (O.S.) 1588, the son of Adam Winthrop of Groton Manor, and Anne (Browne) Winthrop. In December 1602 he matriculated at Trinity College, Cambridge, but he did not graduate. The years after his brief course at the university were devoted to the practice of law, in which he achieved considerable success, being appointed, about 1623, an attorney in the Court of Wards and Liveries, and also being engaged in the drafting of parliamentary bills. Though his residence was at Groton Manor, much of his time was spent in London. Meanwhile he passed through the deep spiritual experiences characteristic of Puritanism, and made wide acquaintance among the leaders of the Puritan party. On the 26th of August 1629 he joined in the "Cambridge Agreement," by which he, and his associates, pledged themselves to remove to New England, provided the government and patent of the Massachusetts colony should be removed thither. On the 20th of October following he was chosen governor of the "Governor and Company of the Massachusetts Bay in New England," and sailed in the "Arbella" in March 1630, reaching Salem (Mass.) on the 12th of June (O.S.), accompanied by a large party of Puritan immigrants. After a brief sojourn in Charlestown, Winthrop and many of his immediate associates settled in Boston in the autumn of 1630. He shared in the formation of a church at Charlestown (afterwards the First Church in Boston) on the 30th of July 1630, of which he was thenceforth a member. At Boston he erected a large house, and there he lived till his death on the 26th of March (O.S.) 1649.

Winthrop's history in New England was very largely that of the Massachusetts colony, of which he was twelve times chosen governor by annual election, serving in 1629–1634, 1637–1640, in 1642–1644, and in 1646–1649, and dying in office. To the service of the colony he gave not merely unwearied devotion; but in its interests consumed strength and fortune. His own temper of mind was conservative and somewhat aristocratic, but he guided political development, often under circumstances of great difficulty, with singular fairness and conspicuous magnanimity. In 1634–1635 he was a leader in putting the colony in a state of defence against possible coercion by the English government. He opposed the majority of his fellow-townsmen in the so-called "Antinomian controversy" of 1636–1637, taking a strongly conservative attitude towards the questions in dispute. He was the first president of the Commissioners of the United Colonies of New England, organized in 1643. He defended Massachusetts against threatened parliamentary interference once more in 1645–1646. That the colony successfully weathered its early perils was due more to Winthrop's skill and wisdom than to the services of any other of its citizens.

Winthrop was four times married. His first wife, to whom he was united on the 16th of April 1605, was Mary Forth, daughter of John Forth, of Great Stambridge, Essex. She bore him six children, of whom the eldest was John Winthrop, Jr. (*q.v.*). She was buried in Groton on the 26th of June 1615. On the 6th of December 1615 he married Thomasine Clopton, daughter of William Clopton of Castleins, near Groton. She died in childbirth about a year later. He married, on the 20th of April 1618, Margaret Tyndal, daughter of Sir John Tyndal, of Great Maplested, Essex. She followed him to New England in 1631, bore him eight children, and died on the 14th of June 1647. Late in 1647 or early in 1648 he married Mrs Martha Coytmore, widow of Thomas Coytmore, who survived him, and by whom he had one son.

Winthrop's *Journal*, an invaluable record of early Massachusetts history, was printed in part in Hartford in 1790; the whole in Boston, edited by James Savage, as *The History of New England from 1630 to 1649*, in 1825–1826, and again in 1853; and in New York, edited by James K. Hosmer, in 1908. His biography has been written by Robert C. Winthrop, *Life and Letters of John Winthrop* (2 vols., Boston, 1864, 1867; new ed. 1869); and by Joseph H. Twichell, *John Winthrop* (New York, 1891). See also Mrs Alice M. Earle, *Margaret Winthrop* (New York, 1895). (W. Wr.)

WINTHROP, JOHN (1606–1676), generally known as John Winthrop the Younger, son of the preceding, born at Groton, England, on the 12th of February 1606. He was educated at the Bury St Edmunds grammar school and at Trinity College, Dublin, studied law for a short time after 1624 at the Inner Temple, London, accompanied the ill-fated expedition of the duke of Buckingham for the relief of the Protestants of La Rochelle, and then travelled in Italy and the Levant, returning to England in 1629. In 1631 he followed his father to Massachusetts, and was one of the "assistants" in 1635, 1640 and 1641, and from 1644 to 1649. He was the chief founder of Agawam (now Ipswich), Mass., in 1633, went to England in 1634, and in the following year returned as governor, for one year, of Connecticut, under the Saye and Sele patent, sending out the party which built the fort at Saybrook, at the mouth of the Connecticut river. He then lived for a time in Massachusetts, where he devoted himself to the study of science and attempted to interest the settlers in the development of the colony's mineral resources. He was again in England in 1641–1643, and on his return established iron-works at Lynn and Braintree, Mass. In 1645 he obtained a title to lands in south-eastern Connecticut, and founded there in 1646 what is now New London, whither he removed in 1650. He became one of the magistrates of Connecticut in 1651; in 1657–1658 was governor of the colony; and in 1659 again became governor, being annually re-elected until his death. In 1662 he obtained in England the charter by which the colonies of Connecticut and New Haven were united. Besides being governor of Connecticut, he was also in 1675 one of the commissioners of the United Colonies of New England. While in England he was elected to membership in the newly organized Royal Society, to whose *Philosophical Transactions* he contributed two papers, "Some Natural Curiosities from New England," and "Description, Culture and Use of Maize." He died on the 5th of April 1676 in Boston, whither he had gone to attend a meeting of the commissioners of the United Colonies of New England.

His correspondence with the Royal Society was published in series 1, vol. xvi. of the *Massachusetts Historical Society's Proceedings*. See T. F. Waters's *Sketch of the Life of John Winthrop the Younger* (Ipswich, Mass., 1899).

Winthrop's son, FITZ-JOHN WINTHROP (1638–1707), was educated at Harvard, though he did not take a degree; served in the parliamentary army in Scotland under Monck, whom he accompanied on his march to London, and returned to Connecticut in 1663. As major-general he commanded the unsuccessful expedition of the New York and Connecticut forces against Canada in 1690; from 1693 to 1697 he was the agent of Connecticut in London; and from 1698 until his death he was governor of Connecticut.

WINTHROP, ROBERT CHARLES (1809–1894), American orator and statesman, a descendant of Governor John Winthrop (1588–1649), was born in Boston, Massachusetts, on the 12th of May 1809. He graduated at Harvard in 1828, studied law with Daniel Webster and in 1831 was admitted to the bar. He was a member of the Massachusetts House of Representatives in 1834–1840—for the last three years as speaker,—and in 1840 was elected to the national House of Representatives as a Whig, serving from December 1840 to 1850 (with a short intermission, April-December 1842). He soon became prominent and was speaker of the Thirtieth Congress (1847–1849), though his conservatism on slavery and kindred questions displeased extremists, North and South, who prevented his re-election as speaker of the Thirty-first Congress. On the resignation of Daniel Webster to become secretary of state, Winthrop was appointed to the Senate (July 1850), but was defeated in the Massachusetts legislature for the short term (Jan. 30, 1851) and for the long term (April 24, 1851) by a coalition of Democrats and Free Soilers and served only until February 1851. In the same year he received a plurality of the votes cast for governor, but as the constitution required a majority vote, the election was thrown into the legislature, where he was defeated by the same coalition. Thereafter, he was never a candidate for political office. With the breaking up of the Whig party he became an independent and supported Millard Fillmore in 1856, John Bell in 1860, and General G. B. McClellan in 1864. He was president of the Massachusetts Historical Society from 1855 to 1885, and for the last twenty-seven years of his life was president of the Peabody Trust for the advancement of education in the Southern States. Among his noteworthy orations of a patriotic character were those delivered at Boston in 1876, at Yorktown in 1881, and in Washington on the completion of the Washington Monument in 1885. He died in Boston on the 16th of November 1894.

Among his publications were *Addresses and Speeches* (Boston, 1852–1886); *Life and Letters of John Winthrop* (2 vols., Boston, 1864–1867); and *Washington, Bowdoin and Franklin* (Boston, 1876). See R. C. Winthrop, Jr., *Memoir of R. C. Winthrop* (Boston, 1897).

WINTHROP, a township and a summer resort of Suffolk county, Massachusetts, U.S.A., occupying a peninsula jutting out into Massachusetts Bay about 5 m. N.E. of Boston and 3 m. S.E. of Chelsea, and forming part of the north-eastern boundary of Boston Harbour. Pop. (1900) 6058, of whom 1437 were foreign-born and 43 were negroes; (1910, U.S. census) 10,132. Between May and October the population is estimated to be between 14,000 and 16,000. Area, 1·6 sq. m. Winthrop is served by the Winthrop branch of the Boston, Revere Beach & Lynn railway, and by electric railway from Orient Heights to Revere, Chelsea, East Boston, Lynn and Boston. The township contains several villages connected by a railway loop; there are nine stations in its 5·3 m. of track. The peninsula has about 8 m. of water front on the ocean and the harbour. The northern part nearest the narrow neck connecting with the mainland is a high bluff, known as Winthrop Highlands, having its north-eastern terminus in Grover's Cliff, a bold headland which forms the north-easternmost point of the peninsula. On Grover's Cliff is Fort Heath, a battery of three powerful long-range guns. At the western end of the Highlands is Fort Banks (a part of Boston's harbour defence), consisting of a masked battery of sixteen 12 in. mortars, each able to drop a 600 ℔ shell on a ship 6 m. at sea. From Grover's Cliff a fine sandy beach facing the open ocean leads to Great Head, the highest elevation on the peninsula. Winthrop Shore Drive (16·73 acres), one of the reservations of the Metropolitan park system, is a public parkway along the shore. From Great Head, a long sandy spit curves away southward, ending in Point Shirley, a hillock and flat sandy plain, separated by Shirley Gut, a narrow channel of deep water, from Deer Island, on which are the Boston House of Correction and City Prison. At Point Shirley is the Point Shirley Club house; at the western foot of Great Head, on Crystal Bay, is the Winthrop Yacht Club house and anchorage; and at Winthrop Center on the west side are the Town Hall, the High School, the Public Library, the Masonic Hall, College Park Yacht Club and Ingleside Park. There are several large summer hotels.

Winthrop, first known as "Pullen Poynt" (Pulling Point) because the tide made hard pulling here for boatmen, was originally a part of Boston; it was part of Chelsea from 1739 until 1846, when with Rumney Marsh it was separately incorporated as North Chelsea, from which it was set off as a township in 1852 under its present name, in honour of Deane Winthrop (1623–1704), who was a son of Governor John Winthrop, the elder, and whose house is still standing. Point Shirley takes its name from Governor William Shirley who helped to establish a cod fishery there in 1753. Before and after the War of Independence Winthrop was a favourite seaside home for Bostonians, many prominent families, including the Gibbons, Hancocks, Bartletts, Emersons, Lorings and Lowells, having country-seats here. The community was a secluded rural retreat until the construction of the railway in 1876 converted it into a watering-place.

See C. W. Hall, *Historic Winthrop, 1630–1902* (Boston, 1902).

WINWOOD, SIR RALPH (*c.* 1563–1617), English politician, was born at Aynhoe in Northamptonshire and educated at St John's College, Oxford. In 1599 he became secretary to Sir Henry Neville (*c.* 1564–1615), the English ambassador in France, and he succeeded Neville in this position two years later, retaining it until 1603. In this year Winwood was sent to The Hague as agent to the States-General of the United Provinces, and according to custom he became a member of the Dutch council of state. His hearty dislike of Spain coloured all his actions in Holland; he was anxious to see a continuance of the war between Spain and the United Netherlands, and he expressed both his own views and those of the English government at the time when he wrote, "how convenient this war would be for the good of His Majesty's realms, if it might be maintained without his charge." In June 1608 Winwood signed the league between England and the United Provinces, and he was in Holland when the trouble over the succession to the duchies of Jülich and Cleves threatened to cause a European war. In this matter he negotiated with the Protestant princes of Germany on behalf of James I. Having returned to England Sir Ralph became secretary of state in March 1614 and a member of parliament. In the House of Commons he defended the king's right to levy impositions, and other events of his secretaryship were the inquiry into the murder of Sir Thomas Overbury and the release of Raleigh in 1616. Raleigh was urged by Winwood to attack the Spanish fleet and the Spanish settlements in South America, and the secretary's share in this undertaking was the subject of complaints on the part of the representatives of Spain. In the midst of this he died in London on the 27th of October 1617. "It can hardly be doubted," says Gardiner, "that, if he had lived till the following summer, he would have shared in Raleigh's ruin." One of Winwood's daughters, Anne (d. 1643), married Edward Montagu, 2nd Baron Montagu of Boughton, and their son was Ralph Montagu, 1st duke of Montagu.

Winwood's official correspondence and other papers passed to the duke of Montagu, and are now in the possession of the duke of Buccleuch. They are calendared in the Report of the Historical Manuscripts Commission on the manuscripts of the duke of Buccleuch. See the *Introduction* to this *Report* (1899); and also S. R. Gardiner, *History of England*, vols. ii. and iii. (1904–1907).

WINZET, NINIAN (1518–1592), Scottish polemical writer, was born in Renfrew, and was probably educated at the university of Glasgow. He was ordained priest in 1540, and in 1552 was appointed master of the grammar school of Linlithgow, from which town he was later "expellit and schott out" by the partisans of Dean Patrick Kinlochy, "preacher" there. He had also enjoyed the office of Provost of the Collegiate Church of St Michael in that town. He retired to Edinburgh, where the return of Queen Mary had given heart to the Catholics. There he took part in the pamphlet war which then raged, and entered into conflict with Knox and other leading reformers. He appears to have acted for a time as confessor to the queen. In July 1562, when engaged in the printing of his *Last Blast*, he narrowly escaped the vengeance of his opponents, who had by that time gained the upper hand in the capital, and he fled, on the 3rd of September, with the nuncio Gouda to Louvain. He reached Paris in 1565 and became a member of the "German Nation" of the university. At Queen Mary's request he joined Bishop Leslie on his embassy to Queen Elizabeth in 1571, and remained with the bishop after his removal by Elizabeth's orders to ward at Fenny Staunton, Huntingdonshire. When further suspicion fell on Leslie and he was committed to the Tower, Winzet was permitted to return to Paris. There he continued his studies, and in 1574 left for Douai, where in the following year he became a licentiate. He was in residence at Rome from 1575 to 1577, and was then appointed by Pope

Gregory XIII. abbot of the Benedictine monastery of St James, Regensburg. There he died on the 21st of September 1592.

Winzet's works are almost entirely controversial. He justified his literary activity on the side of Catholicism on the double plea of conscience and the inability of the bishops and theologians to supply the necessary arguments (*First Tractate*, ed. S.T.S., i. p. 10). "We may nawayis langer contene vs," he writes, "bot expresse on al sydis as we think, referring our iugement to the haly Catholik Kirk." In his first work, *Certaine Tractates* (three in number), printed in 1562, he rates his fellow clergy for negligence and sin, invites replies from Knox regarding his authority as minister and his share in the new ecclesiastical constitution, and protests against the interference with Catholic burgesses by the magistrates of Edinburgh. *The Last Blast*, which was interrupted in publication, is an onslaught on heretics and a falsely ordained clergy. In his *Buke of Four Scoir Thre Questions* (1563), addressed to the "Calviniane Precheouris," in which he treats of church doctrine, sacraments, priesthood, obedience to rulers, free-will and other matters, he is dogmatic rather than polemical. He translated the *Commonitorium* of Vincentius Lirinensis (1563), and wrote, in Latin, a *Flagellum sectariorum* and a *Velitatio in Georgium Buchananum* (1582).

Winzet's vernacular writings have been edited by J. Hewison for the S.T.S. (2 vols., 1888, 1890). The *Tractates* were printed, with a preface by David Laing, by the Maitland Club (1835). For Winzet's career see Zeigelbauer, *Historia rei literariae O.S.B.* iii., Mackenzie, *Lives*, iii., and the Introduction to S.T.S., edit. *u.s.*

WIRE (A.S. *wír*, a wire; cf. Swed. *vire*, to twist, M.H.G. *wiere*, a gold ornament, Lat. *viriae*, armlets, ultimately from the root *wi*, to twist, bind), a thin long rod of metal, generally round in section. The uses of wire are multifarious and diverse beyond all enumeration. It forms the raw material of important manufactures, such as the wire-net industry, wire-cloth making and wire-rope spinning, in which it occupies a place analogous to a textile fibre. Wire-cloth of all degrees of strength and fineness of mesh is used for sifting and screening machinery, for draining paper pulp, for window screens, and for many other purposes. Vast quantities of copper and iron wire are employed for telegraph and telephone wires and cables, and as conductors in electric lighting. It is in no less demand for fencing, and much is consumed in the construction of suspension bridges, and cages, &c. In the manufacture of stringed musical instruments and philosophical apparatus wire is again largely used. Among its other sources of consumption it is sufficient to mention pin and hair-pin making, the needle and fish-hook industries, nail, peg and rivet making, and carding machinery; indeed there are few industries into which it does not more or less enter.

The physical properties requisite to make useful wire are possessed by only a limited number of metals and metallic alloys. The metals must in the first place be ductile; and, further, the wire when drawn out must possess a certain amount of tenacity, the quality on which the utility of wire principally depends. The metals suitable for wire, possessing almost equal ductility, are platinum, silver, iron, copper, aluminium and gold; and it is only from these and certain of their alloys with other metals, principally brass and bronze, that wire is prepared. By careful treatment wire of excessive tenuity can be produced.

	Diameter.	Strain.
	In.	lb.
Gold	·0162	5·61- 5·42
Platinum . . .	·0161	6·70- 6·59
Silver	·0157	7·86- 7·78
Copper	·0177	10·11-10·20
Iron	·0169	11·12-10·89
Copper	·0605	233
Brass	·0640	203
Steel	·0600	342
Phosphor Bronze .	·0630	394

Dr W. H. Wollaston first succeeded in drawing a platinum wire $\frac{1}{30000}$ inch in diameter by encasing a fine platinum wire within silver to ten times its diameter. The cored wire he then reduced to $\frac{1}{3000}$ inch, and by dissolving away the silver coating the platinum wire $\frac{1}{30000}$ inch thick only remained. By continued treatment in this way wires of platinum for spider-lines of telescopes have been obtained of such extreme tenuity that a mile length of the wire weighs not more than a grain; and it is said that platinum wire has been made which measures not more than $\frac{1}{2000}$ mm., equal to less than the fifty-thousandth part of an inch. The accompanying table shows the comparative tenacity of the wire of metals and metallic alloys.

Wire was originally made by beating the metal out into plates, which were then cut into continuous strips, and afterwards rounded by beating. The art of wire-drawing does not appear to have been known till the 14th century, and it was not introduced into England before the second half of the 17th century. Wire is usually drawn of cylindrical form; but it may be made of any desired section by varying the outline of the holes in the draw-plate through which it is passed in the process of manufacture. The draw-plate or die is a piece of hard cast-iron or hard steel, or for fine work it may be a diamond or ruby. The object of utilizing precious stones is to enable the dies to be used for a considerable period without losing their size, and so producing wire of incorrect diameter. Diamond dies must be rebored when they have lost their original diameter of hole, but the metal dies are brought down to size again by *hammering-up* the hole and then drifting it out to correct diameter with a punch. The form of a die in section is shown by fig. 1; the bell-mouthed opening receives the wire, and when it is pulled through the hole at the end its diameter becomes reduced accordingly. The action of drawing has the effect of hardening the wire and rendering it brittle, so that annealing must be done at intervals to soften it again for further drawing; the annealing is done in cast-iron pots, holding coils of wire which are raised to a red heat and then allowed to cool. Although the wire is kept air-tight as much as possible, some amount of scaling occurs, and pickling must be done to remove this scale before redrawing.

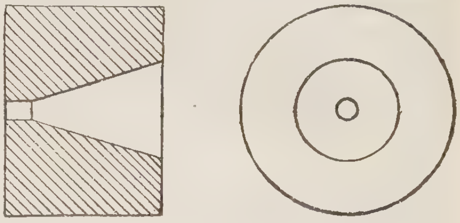

FIG. 1.

An important point in wire-drawing is that of lubrication to facilitate the operation and to lessen the wear on the dies. Various lubricants, such as oil, tallow, soapy water and stale beer, are employed. Another method is to immerse the wire in a sulphate of copper solution, so that a film of copper is deposited which forms a kind of lubricant, easing the drawing considerably; in some classes of wire the copper is left after the final drawing to serve as a preventive of rust.

The wire-drawing machines include means for holding the dies accurately in position and for drawing the wire steadily through the holes. The usual design consists of a cast-iron bench or table having a bracket standing up to hold the die, and a vertical drum which rotates and by coiling the wire around its surface pulls it through the die, the coil of wire being stored upon another drum or "swift" which lies behind the die and reels off the wire as fast as required. The wire drum or "block" is provided with means for rapidly coupling or uncoupling it to its vertical shaft, so that the motion of the wire may be stopped or started instantly. The block is also tapered, so that the coil of wire may be easily slipped off upwards when finished. Before the wire can be attached to the block, a sufficient length of it must be pulled through the die; this is effected by a pair of gripping pincers on the end of a chain which is wound around a revolving drum, so drawing the pincers along, and with them the wire, until enough is through the die to be coiled two or three times on the block, where the end is secured by a small screw clamp or vice ready for the drawing operation. Wire has to be pointed or made smaller in diameter at the end before it can be passed through the die; the pointing is done by hammering, filing, rolling or swaging in dies, which effect a reduction in diameter. When the wire is on the block the latter is set in motion and the wire is drawn steadily through the die; it is very important that the block shall rotate evenly and that it shall run true and pull the wire in an even manner, otherwise the "snatching" which occurs will break the wire, or at least weaken it in spots.

Continuous wire-drawing machines differ from the single-block machines in having a series of dies through which the wire passes in a continuous manner. The difficulty of feeding between each die is solved by introducing a block between each, so that as the wire issues it coils around the block and is so helped on to the next die. The speeds of the blocks are increased successively, so that the elongation due to drawing is taken up and slip compensated for. The operation of threading the wire first through all the dies and around the blocks is termed "stringing-up." The arrangements for lubrication include a pump which floods the dies, and in many cases also the bottom portions of the blocks run in lubricant. The speeds at which the wire travels vary greatly, according to the material and the amount of reduction effected; rates from 100 ft. up to 900 ft. are possible, the higher speeds being those of continuous machines.

Wires and cables for electrical purposes are covered with various insulating materials, such as cotton, silk, jute and paper, wrapped in spiral fashion and further protected with substances such as paraffin, some kind of preservative compound, bitumen or lead sheathing or steel taping. The stranding or covering machines employed in this work are designed to carry supplies of material and wind it on to the wire which is passing through at a rapid rate. Some of the smallest machines for cotton covering have a large drum, which grips the wire and moves it through toothed gears at a definite speed; the wire passes through the centre of disks mounted above a long bed, and the disks carry each a number of bobbins varying from six to twelve or more in different machines. A supply of covering material is wound on each bobbin, and the end is led on to the wire, which occupies a central position relatively to the bobbins; the latter being revolved at a suitable speed bodily with their disks, the cotton is consequently served on to the wire, winding in spiral fashion so as to overlap. If a large number of strands are required the disks are duplicated, so that as many as sixty spools may be carried, the second set of strands being laid over the first. For the heavier cables, used for electric light and power, and submarine cables, the machines are somewhat different in construction. The wire is still carried through a hollow shaft, but the bobbins or spools of covering material are set with their spindles at right angles to the axis of the wire, and they lie in a circular cage which rotates on rollers below. The various strands coming from the spools at various parts of the circumference of the cage all lead to a disk at the end of the hollow shaft. This disk has perforations through which each of the strands pass, thence being immediately wrapped on the cable, which slides through a bearing at this point. Toothed gears having certain definite ratios are used to cause the winding drum for the cable and the cage for the spools to rotate at suitable relative speeds which do not vary. The cages are multiplied for stranding with a large number of tapes or strands, so that a machine may have six bobbins on one cage and twelve on the other. In the case of submarine cables, coverings of jute-served gutta-percha are employed, upon which a protective covering of steel wires is laid, subsequently treated with jute yarns or tapes and protected with coatings of compound. Messrs Johnson & Phillips, Ltd., of Charlton, Kent, make combination machines which lay the steel wires, apply the tapes and cover with the preservative compound, in one continuous operation. The wire is carried on bobbins in two rotating cages, having twelve bobbins each, and the jute bobbins, seventy-two in number, are mounted on disks, while the compound is supplied from steam-heated tanks, through which the cable is passed by rollers. A machine of this class will turn out as much as 8 m. of finished cable in a day of twelve hours. When a supply of steel wire has been used up, the next portions are united by electric welding.

Tapes of paper, rubber or jute are served from bobbins on disks and also in some designs from independent bobbins, each mounted on its own pin, set at a suitable angle in a frame, to give the spiral lead. In some instances seventy-two layers of paper are applied to high-tension cables. These cables are subsequently put into steam-heated tanks, hermetically sealed and connected to a vacuum pump, by which the moisture is drawn off as quickly as possible. When the cable is thoroughly dry a quantity of compound is admitted to the tank and so permeates the insulation. Lead is put on the outside of the paper in a press, which has dies through which the cable passes, and is covered with a uniform coating or tube of lead, forced into the dies and around the cable by hydraulic pressure. Steel tapes are in some cases used to armour cables and protect them from external injury; the tape is wound in a similar manner to the other materials already described.

Rubber covering of wires and cables is done by passing them through grooved rollers simultaneously with rubber strips above and below, so that the rubber is crushed on to the wires, the latter emerging as a wide band. The separate wires are parted forcibly, each retaining its rubber sheathing. Vulcanizing is afterwards done in steam-heated drums.

Many auxiliary machines are necessary in connexion with wire- and cable-covering, as plant for preparing the rubber and paper, &c., cutting it into strips, winding it, measuring lengths, &c.

Wire Gauges.—In commerce, the sizes of wire are estimated by gauges which consist of plates of circular or oblong form having notches of different widths round their edges to receive wire and sheet metals of different thicknesses. Each notch is stamped with a number, and the wire or sheet, which just fits a given notch, is stated to be of, say, No. 10, 11, 12, &c., of the wire gauge. But it is always necessary to state what particular gauge is used, since, unfortunately, uniformity is wanting. Holtzapffel investigated the subject, and published a valuable collection of facts relating thereto in 1846. A more exhaustive report was published by a committee of the Society of Telegraph Engineers in 1879 (*Journ. Soc. Tel. Eng.* viii. p. 476), a result of which was the sanctioning by the Board of Trade, in 1884, of the New Imperial Standard Wire Gauge. That report stated: "The different gauges in use might be counted by hundreds. . . . Every wire-drawer has gauges adjusted to suit special objects. When competition is keen, wire is commonly drawn by one gauge and sold by another; half sizes and quarter sizes are in constant use among the dealers, the wire being sold as whole sizes. Sometimes four or five different gauge plates have been made by one maker—some by which the workmen are paid, and others by which the wire is sold. . . . The whole system is in confusion, and lends itself to those who desire to use fraudulent practices." Thomas Hughes (*The English Wire Gauge*, London, 1879) stated that, "In the same town some use Stubs, some the Warrington, some the Lancashire, some the Yorkshire, some the Birmingham, some the iron wire gauge and some their own made wire gauge, all maintaining the gauge in their own possession to be the correct one."

Gauges may be broadly divided into two groups, the empirical and the geometrical. The first include all the old ones, notably the Birmingham (B.W.G.) and the Lancashire or Stubs. The origin of the B.W.G. is lost in obscurity. The numbers of wire were in common use earlier than 1735. It is believed that they originally were based on the series of drawn wires, No. 1 being the original rod, and succeeding numbers corresponding with each draw, so that No. 10, for example, would have passed ten times through the draw plate. But the Birmingham and the Lancashire gauge, the latter being based on an averaging of the dimensions collated from a large number of the former in the possession of Peter Stubs of Warrington, have long held the leading position, and are still retained and used probably to a greater extent than the more recent geometrical gauges. There is no need, therefore, to give an account of the other and less known gauges which have been used by manufacturers. In no case is there any regular increment of dimensions from which a regular curve could be drawn.

The first attempt to adopt a geometrical system was made by Messrs Brown & Sharpe in 1855. They established a regular progression of thirty-nine steps between the English sizes, No. 0000 (460 mils) and No. 36 (5 mils). Each diameter was multiplied by 0·890522 to give the next lower size. This is now the American gauge, and is used to a considerable extent in the U.S.A.

The Imperial Standard Wire Gauge, which has been sanctioned by the British Board of Trade, is one that was formulated by J. Latimer Clark. Incidentally, one of its recommendations is that it differs from pre-existing gauges scarcely more than they differ among themselves, and it is based on a rational system, the basis being the mil. No. 7/0, the largest size, is 0·50 in. (500 mils) in diameter, and the smallest, No. 50, is 0·001 in. (1 mil) in diameter. Between these the diameter, or thickness, diminishes by 10·557 %, and the weight diminishes by 20 %.

But the fact remains that a large number of gauges are still in common use, and that gauges of the same name differ and are therefore not authoritative. Sheet iron wire gauge differs from Stubs' steel wire gauge. Gauges for wire and plate differ. Accuracy can only be secured by specifying precisely the name of the gauge intended, or, what is generally better, the dimensions in decimals, which can always be tested with a micrometer. A decimal gauge has been proposed. Tables of decimal equivalents of the wire gauges have been prepared, and are helpful.

The circular forms of gauge are the most popular, and are generally 3¼ in. in diameter, with thirty-six notches; many have the decimal equivalents of the sizes stamped on the back. Oblong plates are similarly notched. Rolling mill gauges are also oblong in form. Many gauges are made with a wedge-like slot into which the wire is thrust; one edge being graduated, the point at which the movement of the wire is arrested gives its size. The graduations are those of standard wire, or in thousandths of an inch. In some cases both edges are graduated differently to serve for comparison between two systems of measurement. A few gauges are made with holes into which the wire has to be thrust. All gauges are hardened and ground to dimensions.

WIREWORM, a popular name for the slender, hard-skinned grubs or larvae of the click-beetles or *Elateridae*, a family of the Coleoptera (*q.v.*). These larvae pass a long life (two or three years) in the soil, feeding on the roots of plants, and they often cause much damage to farm crops of all kinds, but especially to cereals. A wireworm may be known by its broad, quadrate head and cylindrical or somewhat flattened body, all of whose segments are protected by a firm, chitinous cuticle. The three pairs of legs on the thoracic segments are short and the last abdominal segment is, as is frequently the case in beetle grubs, directed downwards to serve as a terminal proleg. The hinder end of the body is acutely pointed in the larvae of the species of Agriotes (*A. obscurus* and *A. lineatus*) that are the best known of the wireworms, but in another common form (the grub of *Athous haemorrhoidalis*) the tail is bifid and beset with sharp processes. The subterranean habits of wireworms make it hard to exterminate them when they have once begun to attack a crop, and the most hopeful practice is, by rotation and by proper treatment of the land, to clear it of the insects before the seed be sown. Passing easily through the soil on account of their shape, wireworms travel from plant to plant and thus injure the roots of a large number in a short time. (See ECONOMIC ENTOMOLOGY.) Other subterranean creatures—such as the "leather-jacket" grub of crane-flies—which have no legs, and geophilid centipedes, which may have over two hundred, are often confounded with the six-legged wireworms.

WIRKSWORTH, a market town in the western parliamentary division of Derbyshire, England, 14 m. N.N.W. of Derby, on a branch of the Midland railway. Pop. of urban district (1901) 3807. It is picturesquely situated at the head of the valley of a small tributary of the Derwent, at an elevation exceeding 500 ft., and is almost encircled by sharply rising hills. The cruciform church of St Mary, with a central tower and short spire, is in great part Early English, with Perpendicular additions; but considerable traces of a Norman building were revealed during a modern restoration. There is a manufacture of tape in the town, and lead-mining and stone-quarrying are carried on in the neighbourhood; relics of the Roman working of the lead mines have been discovered. A large brass vessel used as a standard measure for the lead ore, and dating from the time of Henry VIII., is preserved.

WISBECH, a municipal borough, market town, and port in the Wisbech parliamentary division of Cambridgeshire, England, 38 m. N. by W. of Cambridge, on the Great Eastern and the Great Northern and Midland joint railways. It lies in the flat fen country, on the river Nene (mainly on the east bank), 11 m. from its outlet on the Wash. By the Wisbech canal it has communication with the Ouse. The church of St Peter and St Paul has a double nave, with aisles, the north arcade being Norman; but the rest of the building is mainly Decorated and Perpendicular. There are remains of a Norman west tower; the Perpendicular tower stands on the north side. The museum contains a valuable library and various collections, including antiquities and objects of art and natural history. Other institutions include a grammar school founded in the middle of the 16th century and provided for by a charter of Edward VI., the Cambridgeshire hospital, a custom-house, a cattle-market, and an important corn-exchange, for Wisbech has a large trade in grain. A Gothic monument commemorates Thomas Clarkson (1760–1846), a powerful opponent of the slave-trade, and a native of the town. The shipping trade is carried on both at the town itself and at Sutton Bridge, 8 m. lower down the river. The chief imports are coal, timber and iron, and the exports grain and other agricultural products and salt. Foreign trade is chiefly with the Russian Baltic ports. In the neighbourhood large quantities of fruit are grown, including apples, pears, plums, gooseberries, and strawberries. Potatoes, asparagus, and other vegetables are also grown for the London market. The town possesses agricultural implement works, coach-building works, breweries, ropeworks, planing and sawing mills, and corn and oil-cake mills. The borough is under a mayor, 6 aldermen, and 18 councillors. Area, 6476 acres.

Wisbech (*Wisebec, i.e. Ousebec*) is near a Roman embankment and tumuli. About 940 the manor is said to have been given to the abbey of Ely by Oswy and Leoflede; the abbot held it in 1086; and it became attached to the see of Ely with the other possessions of the monastery. The castle is alleged to have been built by William I., and was converted from a fortress in the fens into an episcopal palace between 1471 and 1473. The growth of Wisbech depended on its position and episcopal patronage. In 1190 tenants of Wisbech Barton acquired an exemption from tolls throughout England, confirmed by John, Henry IV. and Henry V. The Gild of the Holy Trinity is mentioned in 1379, and grew rich and powerful. After its dissolution the townsmen became, in 1549, a corporation holding of the king, by a charter which transferred to them the property and duties of the gild, and was renewed in 1610 and 1669. By the Municipal Corporations Act of 1835 a mayor, aldermen and a council replaced the capital burgesses, the older governing body. The borough returned a member only to the parliament of 1658; its elected member, Secretary Thurloe, chose then to represent another constituency. A fair of twenty days from the vigil of Holy Trinity was granted to the bishop of Ely in 1327. The mart still occupies by custom the interval between Lynn mart, of which it is probably an offshoot, and Stamford fair in mid-Lent. A pleasure fair, called the Statute Fair, takes place shortly before Michaelmas. Importance attaches to the horse fair, held in 1827 in the week before Whitsuntide and now on the second Thursday in May and on July 25, and to the cattle fair in the beginning of August. Saturday was market day in 1792; a corn market is now held on Saturday, a cattle market on Thursday and Saturday. In 1086 eels were prolific in Wisbech water. The port was noteworthy until a diversion of the Ouse, before 1292, rendered it hardly accessible. Drainage restored trade before 1634, and the act of 1773 for making Kinderley's Cut was the beginning of prosperity. From 1783 to 1825 agricultural produce was exported and coal imported. Hemp and flax had an importance, lost between 1827 and 1849, but responsible in 1792 for fairs on Saturday and Monday before Palm Sunday.

See W. Watson, *History of Wisbech* (Wisbech, 1827); N. Walker and C. Thomas, *History of Wisbech* (Wisbech, 1849); *History of Wisbech* (Wisbech and London, 1833).

WISCONSIN (known as "the Badger[1] state"), one of the North Central states of the United States of America. It is bounded on the E. by Lake Michigan, on the N. by the Upper Peninsula of Michigan and Lake Superior, on the W. by Minnesota and Iowa, and on the S. by Illinois. Its greatest length from N. to S. (42° 30′ N. Lat. to 47° 3′ N. Lat.) is 300 m., and its greatest breadth (86° 49′ W. Long. to 92° 54′ W. Long.) is 250 m. The greater part of the western boundary separating the state from Minnesota and Iowa consists of the Mississippi and St Croix rivers flowing S. and the Saint Louis river flowing into Lake Superior. The Menominee and Montreal rivers form a considerable part of the boundary line on the N. and E., separating it from the Upper Peninsula of Michigan. The state's lake shore boundary is more than 550 m. long. Included in Wisconsin are the Apostle Islands in Lake Superior, and Washington Island and a group of smaller islands at the entrance to Green Bay on the Lake Michigan side. The state occupies a total area of 56,066 sq. m.,[2] 810 of which are water surface. Roughly speaking, it divides the Great Lakes region from the upper valley of the Mississippi.

Physical Features.—Wisconsin forms part of the inner margin of an ancient coastal plain and the oldland of crystalline rocks about which the plain sediments were deposited. The plain and the oldland were well worn down by erosion and then were uplifted; were dissected by stream valleys, and were glaciated. The surface is generally rolling and undulating, comprising, with the Upper Peninsula of Michigan, a swelling elevation of land between the three depressions represented by Lakes Michigan and Superior and the Mississippi and the St Croix rivers. The lowest elevations are in the southern and central portions of the state, where the altitude averages between 580 and 600 ft. above sea-level. The highest points in the state are residual masses of relatively resistant rock rising above the erosion surface; such are: Rib Hill (1940 ft.) in Marathon county, in the north-central part, and some of the peaks of the Penokee Range in the N. part of the state, which are about 1800 ft. high. From the N. highland two heights of land (1200 to 1600 ft.) extend southward well into the central portions of the state, dividing the greater part of its area into two natural drainage basins. The westernmost of these elevations separates the valleys of the Mississippi, and the St Croix from that of the Wisconsin river. The eastern elevation is a ridge or cuesta formed by an outcropping hard layer of the ancient coastal plain; and it separates the Wisconsin river basin from the Fox River Valley and the streams flowing into Lake Michigan. Along the Mississippi and the Wisconsin runs a chain of bluffs varying in height from 200 to 300 ft., and in the E. a rocky limestone ridge or cuesta some 30 m. back from Lake Michigan extends from the Door county peninsula, E. of Lake Winnebago and as far south as the Illinois line. There are no large rivers flowing into Lake Superior and very little drainage in that direction, as from a point some 30 m. S. of the lake all the streams flow in a southerly direction. The Mississippi is the drainage basin for a greater part of the state. The St Croix river rises in the S.W. part of the Penokee Range and flows W. and S., forming the western boundary of the state for 135 m. before it joins the Mississippi 20 m. below St Paul. Before it is joined by the Wisconsin, the Mississippi receives several rivers of considerable length, the most important of which are the Chippewa and the Black. The Wisconsin river rises on the Upper Michigan border and flows S. and W. for 600 m., joining the Mississippi near Prairie du Chien. It is navigable as far as Portage, some 200 m. from its mouth. The Fox river (more than 260 m. long) rises in the south central portion of the state, flows N. and E. by a circuitous route through Lake Winnebago, and thence N. into Green Bay, and is the longest and most important stream draining into Lake Michigan. The Wolf river is its most important tributary, joining it from the N., in its upper course. Besides the Fox several smaller streams drain into the Lake Michigan basin. Among these are the Menominee and Oconto, which flow into Green Bay; an arm of Lake Michigan, and the Sheboygan and Milwaukee rivers emptying directly into the lake. The southern portion of the state is drained by several streams flowing across the Illinois boundary and finding their way eventually through other rivers into the Mississippi. The largest of these are the Rock, Des Plaines, Fox (of the Illinois), or Pishtaka, and the Pecatonica rivers. On account of glacial disturbance of the drainage, Wisconsin's many streams provide water-powers of great value that have contributed much to the industrial prosperity of the state. The most valuable of these are the Fox, the Rock and the upper Wisconsin and its tributaries. Wisconsin has more than 2500 lakes, mostly in the glaciated N. and E. parts of the state. Of these the largest is Lake Winnebago, between Calumet, Outagamie, Fond du Lac and Winnebago counties, with an extreme length of 30 m. and a breadth of 10 m., and one of the largest bodies of water lying wholly within any state in the Union. On its banks are the important manufacturing cities of Oshkosh, Fond du Lac, Neenah and Menasha, and through it flows the Fox river. In the S. and E. portions of the state the lakes are beautiful clear bodies of water with sandy or gravelled shores, and, as a rule, high banks heavily wooded. Many of them are famous as summer resorts, notably Lake Geneva, Green Lake, the lakes in Waukesha county and the famous "four lakes" near Madison.

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[1] The badger is not found in the state, and the name probably originated as a nickname for those lead miners N. of the Illinois line who came from the East, who lived in dug-outs like the hillside burrows of the badger, and who did not go home in winter like the miners from southern Illinois and farther south, who were called "suckers," a name borrowed from the migrating fish in the Rock, Illinois and other rivers flowing south. The name "suckers" was applied generally to all the people of Illinois, and the name "badgers" to the people of Wisconsin and "badger state" to the state.

[2] Besides the area as given here, the state has jurisdiction over approximately 7500 sq. m. of Lake Michigan and 2378 sq. m. of Lake Superior.

Flora and Fauna.—Wisconsin was originally the native home of most of the wild fowl and animals found in the other North Central states. Deer were found in large numbers in all sections of the state, bear were common in the central and northern parts, bison were found in the south-west, wolves, lynx ("wild cats"), and foxes and other smaller animals particularly of fur-bearing varieties. The streams abounded in fish. The abundance of game made the region between the lakes and the Mississippi a favourite hunting ground of the Indians, and later a productive field for the trapper and fur trader. Bear, deer and lynx are still to be found in the less settled forest regions of the N. parts, and the fisheries are still important.

The *avi-faunal* life of Wisconsin is exceedingly varied; C. B. Cory (see BIBLIOGRAPHY) enumerates 398 species for Wisconsin and Illinois, and of these probably not less than 350 occur in Wisconsin. The more characteristic and useful birds include many species of the sparrow, such as the song, swamp, Lincoln's chipping and field sparrow; the bank, barn, cliff, white-bellied and rough-winged swallow, as well as the purple martin and the chimney swift; ten or more species of fly-catchers, including the least, arcadian, phoebe, wood pewee, olive-sided and king bird; about ten species of woodpeckers, of which the more common are the downy, hairy, yellow-bellied and golden-winged (flicker); about thirty species of warblers, including the parula, cerulean, Blackburnian, prothonotary, yellow Nashville, red-start, worm-eating and chestnut-sided; and four or five species of vireos. The song-birds are well represented in the hermit thrush, wood thrush, Wilson's thrush (or veery), brown thrasher, robin, blue bird, bobolink, meadow lark, gold finch, &c. Among the game birds are the ruffed grouse (partridge), quail, prairie hen and wild turkey. The birds of prey include the red-shouldered, red-tailed, broad-winged, Cooper's, sharp-shinned and sparrow hawk and the bald eagle; the great horned, barred, barn, snowy, short-eared and screech owls. The ducks include the mallard, black duck, canvas-back and red-head; the Canadian goose, the snowy goose and the blue goose also appear during the migrating seasons.

Originally the greater portion of what is now Wisconsin was covered with forests, although in the S. and W. there were considerable tracts of rolling prairie lands. In the S. portion the predominating trees were hickory, elm, oak and poplar. Along the shore of Lake Michigan, and extending inland a quarter of the distance across the state and northward through the Fox River Valley, there was a heavy belt of oak, maple, birch, ash, hickory, elm and some pine. From the N. shores of Green Bay there stretched away to the N. and W. an enormous and unbroken forest of pines, hemlocks and spruce.

Climate.—The climate of the whole state is influenced by the storms which move eastward along the Canadian border and by those which move northward up the Mississippi Valley, and that of the eastern and northern sections is moderated by the Great Lakes. The winters, especially in the central and north-western sections, are long and severe, and the summers in the central and south-western sections are very warm; but the air is so dry that cold and heat are less felt here than they are in some humid climates with less extreme temperatures. The mean annual temperature for the state is 44° F. July, with an average temperature for the state of 70°, is the warmest month, and February, with an average of 15°, is the coldest. Within a period of thirty-eight years, from 1870 to 1908, extremes at Milwaukee ranged from 100° to − 25°, while at La Crosse, on the western border and less than 60 m. farther north, they ranged during the same period from 104° to − 43°. The greatest extremes recorded at regular observing stations range from 111° at Brodhead, in Green county and near the southern border, on the 21st of July 1901 to − 48° at Barron, in Barron county in the north-western part of the state, on the 10th of February 1889. The average annual precipitation for the state is 31·5 in. Two-thirds of this comes in the six growing months from April to September inclusive, and the rainfall is well distributed over all sections. There is an annual snowfall of 53 in. in the northern section, 40 in. in the southern section and 36 in. in the central section, which is quite evenly distributed through the months of December, January, February and March. In the northern section the heavy snowfall is caused by the cyclonic storms along the Canadian border, and in the southern section the snowfall is increased by the storms which ascend the Mississippi Valley. All sections of the state are subject to tornadoes. They occur more frequently in the western portion than in the eastern portion, but one of the most destructive in the history of the state occurred at Racine on the 18th of May 1883. This storm killed 25 persons, injured 100, and destroyed considerable property.

Agriculture.—Hay and grain are the most important crops. In 1909 the acreage of hay was 2,369,000 and the value of the crop $34,800,000. In the production of the hardy cereals, barley, rye and buckwheat, Wisconsin ranks high among the states of the Union; but oats and Indian corn are the largest cereal crops in the state. The crop of oats was 79,800,000 bushels (raised on 2,280,000 acres and valued at $31,122,000) in 1909; of Indian corn, 50,589,000 bushels (raised on 1,533,000 acres and valued at $30,353,000); of barley, 24,248,000 bushels (raised on 866,000 acres and valued at $13,579,000—a crop exceeded only by that of California and that of Minnesota); of wheat, 3,484,000 bushels (raised on 179,000 acres and valued at $3,345,000); of rye, 4,727,000 bushels (raised on 290,000 acres and valued at $3,214,000—a crop exceeded only by that of Pennsylvania and that of Michigan); and of buckwheat, 221,000 bushels (grown on 18,000 acres and valued at $172,000). The potato crop is large, 26,724,000 bushels being raised in 1909 on 262,000 acres, a crop exceeded only in New York, Michigan and Maine. Tobacco also is a valuable crop: in 1909 37,170,000 ℔, valued at $3,419,640, were grown on 31,500 acres. In 1909 14,000 acres of sugar beets were harvested and 34,340,000 ℔ of sugar were manufactured in the four beet sugar factories in the state. In the south-central part of the state there are valuable cranberry marshes. Orchard fruits, especially apples, are of increasing importance.

The raising of live-stock, particularly of dairy cows, is an important industry. In 1910, out of a total of 2,587,000 neat cattle, there were 1,506,000 milch cows. The total number of horses in the state was 669,000 in 1910, when they were valued at $80,949,000. There were 1,034,000 sheep, and 1,651,000 swine.

Manufactures.—The growth of manufacturing has been rapid: in 1850 the value of the manufactures was $9,293,068; in 1860, $27,849,467; in 1870, $77,214,326; in 1880, $128,255,480; in 1890, $248,546,164; and in 1900, $360,818,942. The product under the factory system, excluding hand trades and neighbourhood industries, was $326,752,878 in 1900 and $411,139,681 in 1905. The most important of the state's manufactures in 1900 and in 1905 were lumber and timber products, valued in the latter year at $44,395,766 (Wisconsin being second in rank to the state of Washington). About 60% (both in quantity and value) of the lumber sawed in 1905 was white pine; next in importance were hemlock (more than one-fourth in quantity), basswood (nearly 4%) and, in smaller quantities, birch, oak, elm, maple, ash, tamarack, Norway pine, cedar and spruce. The value of the product of planing mills was $11,210,205 in 1905; and other important manufactures based on raw materials from forests were paper and wood pulp ($17,844,174) and furniture (11,569,591). Second in value in 1905 were cheese, butter and condensed milk ($29,994,791), in the product of which Wisconsin ranked second to New York in 1900 and 1905. In 1905 Wisconsin ranked first of all the states in the value of butter, second in the value of cheese and fifth in the value of condensed milk; the dairy product of Wisconsin in this year was 17·8% (by value) of that of the entire country. Foundry and machine-shop products ranked third in value in 1905, when they were valued at $29,908,001, and when iron and steel manufactures were valued at $10,453,750.

Among the other important manufactures in 1905 were: malt liquors ($28,692,340) and malt ($8,740,103, being 113·7% more than in 1900); flour and grist-mill products ($28,352,237; about 60% was wheat flour); leather ($25,845,123); wholesale slaughtering and meat-packing ($16,060,423); agricultural implements ($10,076,760); carriages and wagons ($7,511,392); men's clothing ($6,525,276); boots and shoes ($6,513,563); steam railway cars, constructed and repaired ($6,511,731); hosiery and knit goods ($4,941,744); cigars ($4,372,139); mattresses and spring beds ($3,527,587); and electrical machinery, apparatus and supplies ($3,194,132).

In 1905, out of a total factory product of $411,139,681, $259,420,044 was the value of goods made in factories in the twenty-two municipalities of the state, with a population (1900) of at least 8000; but only 36·3% of the total number of factories were in urban districts. More than one-third of the value of factory products was that of the manufactures of Milwaukee ($138,881,545). Racine ranked second with a factory product valued at $16,458,965. The manufacture of furniture in Wisconsin is centralized especially in Sheboygan, where in 1905 was manufactured about one-third of the furniture made in the state.

Mines and Quarries.—The lead mines of south-western Wisconsin played an important part in the early development of the state (see § *History*). When the main deposits had been worked down to the water level, mining (up to that time principally of lead) stopped and did not start again until about 1900, when the high price of zinc stimulated renewed working of these deposits. The principal ores are galena, sphalerite or zinc blende and smithsonite or zinc carbonate, which is locally called "dry bone" and which was the first zinc ore mined in the state. In 1908 the lead product was valued at $347,592 and the zinc product at $1,711,364, Wisconsin ranking fourth among the zinc-mining states. The production of iron ore in the Gogebic and Menominee ranges on the upper Michigan border is important. Red haematite was mined in Dodge county before 1854; in 1877 the deposits in Florence county were first worked, and in 1882 276,017 tons were shipped from that county; and about 1884 began the development of the Gogebic deposits in Iron and Ashland counties. The maximum output was in 1890, being 948,965 long tons; in 1902 it was 783,996 long tons (79 % from Iron county); and in 1908, 733,993 tons. The output is almost entirely haematite. There are large deposits of stratified clay along the shores of Lake Michigan, from which is made a cream-coloured brick, so largely used in Milwaukee that that city has been called the "cream city"; the total value of clay products in 1907 was $1,127,819 and in 1908 $958,395. By far the most valuable mineral output is building stone, which was valued in 1908 at $2,850,920, including granite ($1,529,781), limestone ($1,102,009) and sandstone ($219,130). In 1907 and 1908 the state ranked fifth among the states of the country in the value of granite quarried; in 1902 it ranked fifteenth. The industry began in 1880, when the first quarry (at Granite Heights, Marathon county) was opened. The principal quarries are in Dodge, Green Lake (a blackish granite is quarried at Utley and a pinkish rhyolite at Berlin), Marathon, Marinette, Marquette, Sauk, Waupaca and Waushara counties. Wisconsin granite is especially suitable for monumental work. Limestone is found in a broad belt in the east, south and west; more than 40 % of the total output in 1908, which was valued at $1,102,009, was used for road-making and more than one-sixth in the manufacture of concrete. In 1907 and 1908 Wisconsin ranked seventh among the states in the value of limestone quarried. The first limestone quarries were opened at Genesee, Waukesha county, in 1848; at Wauwatosa, near Milwaukee, in 1855; and near Bridgeport in 1856. Freshwater pearls are found in many of the streams; and in 1907 and 1908 Wisconsin ranked first among the states in the value of mineral waters sold, with a value of $1,526,703 in 1907 and $1,413,107 in 1908, although in both years the quantity sold in Wisconsin was less than in Minnesota or in New York. The most famous of these springs are in Waukesha county, whence White Rock, Bethesda, Clysmic and other waters are shipped.

Forests.—In 1890 and in 1900 (when the wooded area was estimated at 31,750 sq. m., or 58 % of the total area of the state) Wisconsin was the foremost state in the Union in the production of lumber and timber. In 1905 the value of the lumber and timber product was exceeded by that of Washington; but as late as 1908 Wisconsin was the chief source of the white pine supply. Next to white pine (used largely in shipbuilding) in value in 1908 were red or Norway pine (used in house building), hemlock (used for lumber and wood pulp) and white spruce, a very valuable lumber tree. In 1908 the area of the state forest reserve lands under a state board of forestry (chiefly in Oneida, Forest, Iron, Price and Vilas counties) was 253,573 acres. Forest fires have been numerous and exceedingly destructive in Wisconsin; the loss of timber and other property from this cause in 1908 was about $9,000,000.

Fisheries.—The fisheries of Wisconsin are of considerable importance; the catch in 1908 was valued at $1,067,170, lake trout and herring being the most valuable. There is a state board of commissioners of fisheries (see below, § *Government*), which distributed in 1908 149,338,069 eggs, fry and fingerlings, including 112,075,000 wall-eyed pike and about 12,000,000 each of lake trout and whitefish. There are state hatcheries at Madison (for brook and rainbow trout), Bayfield (brook, rainbow and lake trout and whitefish), Oshkosh (lake trout, whitefish and wall-eyed pike), Minocqua (pike, bass and muskallonge), Delafield (black bass and wall-eyed pike) and Wild Rose (brook trout).

Transportation and Commerce.—Railway building in Wisconsin began in 1851, when a track was laid from Milwaukee to Waukesha (20 m.), which was extended westward in 1854 to Madison and in 1857 to the Mississippi at Prairie du Chien. This line was the forerunner of the great Chicago, Milwaukee & St Paul system, which now crosses the southern half of the state with two trunk lines and with one line parallels the shore of Lake Michigan. The Chicago & North-Western and the Chicago, St Paul, Minneapolis & Omaha, which it controls, are together known as "The North-Western Line." The tracks of the Chicago & North-Western (built to Janesville in 1855 and to Fond du Lac in 1858) form a network in the eastern part of the state, affording direct connexions with Chicago. The Chicago, St Paul, Minneapolis & Omaha extends into the western part of the state, where it connects with the trans-Mississippi lines of the Chicago & North-Western. The Chicago, Burlington & Quincy (owned by the Great Northern and the Northern Pacific railways) traverses the state along its western boundary and gives it access to a third great railway system with transcontinental service. The Minneapolis, St Paul & Sault Ste. Marie, in which has been absorbed the old Wisconsin Central, crosses the state and extends into the Canadian North-West, sharing in the heavy grain traffic of that section, and, like the Duluth, South Shore & Atlantic, which runs along the Lake Superior shore, is a link in the transcontinental system of the Canadian Pacific, which controls both these roads. The Northern Pacific enters Wisconsin in its north-western corner and extends to the Lake Superior country. The Green Bay & Western railway between Winona and Kewaunee has ferry connexion across Lake Michigan. In 1900 there were 6538 m. of track, and on the 1st of January 1909 7512 m. Characteristic of the commerce of the state is the shipment by the Great Lakes of bulky freight, chiefly iron ore, grain and flour and lumber. The return freight movement to the Wisconsin lake ports is made up chiefly of coal from the Lake Erie shipping points for the coalfields of Pennsylvania and West Virginia. Milwaukee is one of the leading lake ports, and is the only port of entry in the state; its imports were valued at $796,285 in 1899 and at $4,493,635 in 1909, and its exports at $2726 in 1899 and at $244,890 in 1909.

To connect the upper Mississippi river and the Great Lakes, between 1840 and 1850 a canal was begun between the Fox, flowing into Green Bay, an arm of Lake Michigan and the Wisconsin river, flowing into the Mississippi,[1] and improvement of navigation on these rivers was undertaken by the state with the assistance of the Federal government; in 1853 the work came into the hands of a private corporation which in 1856 opened the canal. In 1872 it was taken over by the United States. In 1887 the route through the Wisconsin river was abandoned, and thereafter only the Fox river was improved. Up to June 1909 $3,810,421 had been spent by the Federal government on this improvement. Green Bay has communication with Lake Michigan, not only by way of its natural entrance, but by a government ship canal (built 1872–1881 by a private company; taken over by the Federal government in 1893; maximum draft in 1909, 20 ft.; projected channel depth, 21 ft.) at Sturgeon Bay, an arm of Green Bay, which cuts across the Door county peninsula. In 1908 there passed through this canal 2307 vessels carrying cargoes of an estimated value of $18,261,455·15.

Population.—The population of Wisconsin in 1890 was 1,686,880 (exclusive of 6450 persons specially enumerated); in 1900 the total was 2,069,042—an increase of 22·2 % on the basis of the total at each enumeration; and in 1910 it reached a total of 2,333,860.[2] The density of the population in 1910 was 42.2 to the square mile. Of the total population in 1900, 1,553,071, or 75·1 %, were native-born, the increase in native-born since 1890 having been 32·3 %, while there was a decrease of foreign-born of 0·6 %. The falling off in foreign immigration in the decade 1890–1900 contrasts strongly with the increase of 28·1 % in the number of foreign-born in 1880–1890. Of the native-born population in 1900, 84 %, or 1,304,918, were born within the state. Of the foreign-born 242,777 were Germans, 61,575 were Norwegians, 26,196 were Swedes, 25,607 were natives of German Poland, 23,860 were English-Canadians and 23,544 were Irish. Of the total population 1,472,327 persons, or more than seven-tenths (71·2 %), were of foreign parentage—*i.e.* either one or both parents were foreign-born—and 576,746 were of German, 134,293 of Norwegian, 76,593 of Irish and 70,585 of Polish parentage, both on the father's and on the mother's side. At the census of 1840, with the exception of a few thousand French-Canadians, the population was made up of American-born pioneers from the Eastern states, and in the southern portion of the territory of a sprinkling of men from Kentucky, Virginia and farther south. Before the next census was taken the revolutionary movement of 1848 in Germany led to the emigration of thousands from that country to Wisconsin, and there was an increase of 886·9 % in the population from 1840 to 1850. Norwegians and other Scandinavians, Irish, Poles, Dutch, Belgians and Swiss followed. Germans and Irish are now scattered throughout the state; but the German element predominates markedly in Milwaukee. Norwegians, Danes and Swedes are more numerous in the western and northern counties. There are Finns in Douglas county and Icelanders on Washington Island, in Green Bay. Poles are chiefly in Milwaukee, Manitowoc and Portage counties, Belgians and Dutch in Brown and Door counties, German Swiss in Green, Fond du Lac, Winnebago, Buffalo and Pierce counties, and Bohemians in Kewaunee county, where they form almost 50 % of the population. Some Italians are massed in Vernon and Florence counties, and there are French Canadians in the north. There were 8372 Indians, of whom 1657 were not taxed, 2542 negroes, 212 Chinese and 5 Japanese in the state in 1900. The Indians include representatives of the Menominee (1487 in 1909), Stockbridge and Munsee (582) tribes under the Keshena School, Chippewa under the Lac du Flambeau School (705) and the La Pointe School (4453), Oneida (2259) under the Oneida

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[1] The Fox and Wisconsin rivers are separated at Portage by a distance of only 2 m.

[2] At each preceding census the population was as follows: (1840) 30,945, (1850) 305,391, (1860) 775,881, (1870) 1,054,670. By the state census of 1905 it was 2,228,949.

School, Winnebago (1094) under the Wittenberg School and Potawatomi (440) not under an agent. The civilized Brotherton and Stockbridge Indians live principally in Calumet county. Among religious denominations the Roman Catholics, with 505,264 members in 1906, had 50·5% of the total communicants or church members in the state. The Lutheran bodies ranked next with 284,286 members (including 153,690 of the Evangelical church, 49,535 of the United Norwegian church, 23,927 of the Synod for the Norwegian Evangelical church, 15,471 of the Evangelical Lutheran Joint Synod of Ohio, 15,220 of the Evangelical Lutheran Synod of Iowa and 8695 of the General Council). Only one other state (Pennsylvania) had a larger percentage of the total membership of this denomination. There were 57,473 Methodists (chiefly of the Methodist Episcopal Church), 26,163 Congregationalists and 21,716 Baptists.

Government.—The original constitution of the state, adopted in 1848, and amended in 1869, 1870, 1874, 1877, 1881, 1882, 1902 and 1908, is still in force. An amendment may be proposed by either house of the legislature, and if passed by two successive legislatures by a majority of the members elected to each house must be submitted to the people for ratification by a majority vote. A constitutional convention may be called on the recommendation of a majority of the Senate and Assembly if this proposal receives a majority vote at the next election for members of the legislature. Suffrage was originally granted to every male[1] twenty-one years of age or upwards resident in the state for one year preceding any election—if he were a white citizen of the United States, or a white of foreign birth who had declared his intention to be naturalized, or an Indian declared by Congress a citizen of the United States, or a civilized person of Indian descent not a member of any tribe; and the constitution provided that the legislature might by law give suffrage to others than those enumerated if such an act of legislature were approved by a majority of the popular vote at a general election. By an amendment of 1882 the word "white" was omitted and by an amendment of 1908 it was provided that those foreign-born and unnaturalized in order to become electors must have declared their intentions to become citizens before the 1st of December 1908, and that "the rights hereby granted to such persons shall cease on the first day of December A.D. 1912." The amendment of 1908 also permits the legislature to provide for the registration of electors in incorporated cities and villages.

The official ballot is of the blanket type, with names of candidates in party columns, but with no candidate's name repeated on the ballot and with no emblems to mark the party columns. In 1909 an act was passed permitting county boards to adopt a "coupon" ballot.[2] Since 1905 there has been a direct nomination system of primaries for all officers except delegates to national nominating conventions.

Executive power is vested in a governor and a lieutenant-governor, elected for two years. The governor's salary (since 1869) is $5000 a year and the lieutenant-governor's $1000. Candidates for either office must be citizens of the United States and qualified electors of the state. The lieutenant-governor is president of the Senate with a casting vote only. A bill vetoed by the governor becomes a law if it is approved by two-thirds of the members present in each house; and a bill not returned by the governor within six days (excepting Sunday; before 1908 the constitutional limit was three days) after its presentation to him becomes a law unless the return of the bill is prevented by the adjournment of the legislature. The governor has power to grant reprieves, commutations and pardons, except for treason—he may suspend execution of sentence for treason until action is taken by the legislature—and in cases of impeachment.

The administrative officers, a secretary of state, a treasurer and an attorney-general, are elected for two years and act as commissioners of public lands. The secretary of state is *ex-officio* auditor; and he acts as governor if the regularly elected governor and lieutenant-governor die, are removed from office or are absent from the state. A state superintendent of public instruction is chosen by popular vote for a four-year term. Other administrative officers are a commissioner of insurance (from 1867 to 1878 the secretary of the state was commissioner of insurance; the office became elective in 1881); a commissioner of labour and industrial statistics; three railroad commissioners,[3] who have jurisdiction over all public utilities, including telegraph and telephone; a commissioner of banking; a dairy and food commissioner; a state superintendent of public property; three tax commissioners who act (since 1901) as a state board of assessment; commissioners of fisheries (established 1874); a state board of agriculture (1897); and a state board of forestry (1905, succeeding a department created in 1903).

The legislature consists of a Senate and an Assembly and meets biennially, and when called in special session by the governor to transact special business definitely named in the governor's call. The number of assemblymen cannot be less than 54 or more than 100, and the number of senators must be not more than one-third or less than one-fourth the number of members of the Assembly. In 1910 there were 33 senators and 100 assemblymen. Elections to the Senate and Assembly are biennial[4] and the term of members of the Assembly is two years, but the senatorial term is four years and only one-half of the members are elected each two years. A candidate for either house must have resided in the state at least one year, must be a qualified elector in the district from which he is chosen, and may not be a member of Congress or hold any military or civil office under the United States. Since 1855 a state census has been taken every ten years, and on the basis of these censuses the legislature re-apportions the Senate and Assembly districts. Each member of the legislature receives $500 a year and 10 cents a mile for mileage. Any bill may originate in either house, and either house may amend a bill passed by the other. Special legislation of several specified kinds is forbidden, especially by amendments of 1871 and 1892; and the constitution as adopted in 1848 prohibited the legislature's authorizing any lottery or granting any divorce. The Assembly may impeach civil officers by a majority of all elected members, and the Senate to try impeachments; for conviction a two-thirds vote of all members present is required.

The judicial power of the state is vested: in a supreme court[5] of seven members (salary $6000 a year; elected for a term of ten years; the senior justice is chief justice) with appellate jurisdiction throughout the state, general superintendence over all inferior courts, power to issue, hear and determine writs of *habeas corpus*, *mandamus*, injunction, *quo warranto*, *certiorari* and other original and remedial writs; nineteen (only five under the constitution of 1848) circuit courts, of one judge each except in the second circuit (including Milwaukee) in which there are four judges, elected (at a spring election, and not at the general state election) by the voters of the circuit district; probate judges, one elected (for two years) in each county, except where the legislature confers probate powers on inferior courts; and in towns, cities and villages, justices of the peace, elected for two years.

Local Government.—Wisconsin has the mixed or township-county system of local government. Each township (or "town," as it is commonly called) elects at its annual town meeting on the first Tuesday in April three supervisors, a clerk, a treasurer, one or more assessors, two justices of the peace, from one to three constables, and, if the town has a library, a librarian. Justices of the peace hold office for two years, other town officers for one year only, except that in a county having a population of 100,000 or more (Milwaukee county), town meetings are biennial and all officers are elected for two years. For other than school purposes rates must not exceed 2% of the assessed valuation of the taxable property in the town. The chairmen of the several town boards of supervisors, with the supervisor of each ward of a city and the supervisor of each village in the county, constitute the county board of supervisors, and each county elects biennially, at the general election in November, a clerk, a treasurer, a sheriff, a coroner, a clerk of the circuit court, a district-attorney, a register of deeds and a surveyor. The county board represents the county, is entrusted with the care of the county property and the management of the county business, appoints a supervisor of assessments and levies the taxes necessary to defray the county expenses. The county board also elects a county highway commissioner for a term of three years, is required to designate a system of prospective county highways, and may levy a special tax and borrow money for the development of the system. Cities are chartered according to population,[1] with a mayor, a single legislative chamber known as the board of aldermen or city council and the usual administrative officers and boards. The mayor, aldermen, treasurer, comptroller, justices of the peace and supervisors must be elected by the people, but the other offices are filled as the council of each city directs. An act of 1909 provides for the adoption of government by commission in any city of the second, third or fourth class which votes for this form of government at an election called by a petition signed by 25 % of the voters at the preceding election for mayor.

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[1] Excepting persons under guardianship, those weak-minded or insane, those convicted (without restoration to civil rights) of treason or felony, and those who have engaged (directly or indirectly) in a duel.

[2] The coupon ballot was proposed for use throughout the state, but was defeated by popular vote in April 1906. The ticket is made up of as many coloured sheets as there are party organizations (plus one for independent nominations), and the name of each candidate is on a perforated slip, which must be detached if it is to be voted.

[3] The office of railroad commissioner was created in 1874, became elective in 1881 and was replaced under an act of 1905 by a commission of three members, which received jurisdiction over other public service corporations in 1907.

[4] Until 1881 elections to the legislature were held annually, and the term of assemblymen was one year and of senators two years.

[5] Not separately organized until 1853; the judges of the circuit court acted as justices of the supreme court.

Miscellaneous Laws.—A married woman may manage her separate property as if she were single. A widow is entitled to a dower in one-third of her husband's real estate, and a widower is life tenant by courtesy of all the real estate of which his wife died seized and not disposed of by her last will, unless she leaves issue by a former husband, to whom the estate might descend, in which case her estate passes immediately to such issue. If either husband or wife dies intestate and leaves no issue the surviving spouse is entitled to the entire estate of the deceased, both real and personal. The causes for an absolute divorce are adultery, impotency, sentence to imprisonment for a term of three years or more, wilful desertion for one year, cruel or inhuman treatment, habitual drunkenness and voluntary separation for five years. For any other cause than adultery an action for a divorce cannot be brought unless one of the parties has been a resident of the state for two years immediately preceding the suit. Neither party is permitted to marry a third party until one year after the divorce has been obtained. Adultery is punishable by imprisonment in the state prison for not more than three years nor less than one year, or by a fine not exceeding $1000 nor less than $200. A husband who wilfully abandons his wife, leaving her destitute, or who refuses to support her when he is able to do so, may be punished by imprisonment in the state prison not exceeding one year or in the county jail or workhouse not more than six months nor less than fifteen days, and for ten days, in the discretion of the judge, he may be kept on a bread and water diet. A homestead owned and occupied by any resident of the state and consisting of not more than 40 acres of agricultural land outside the limits of a city or village, or one-fourth of an acre within a city or village, together with the dwelling-house and other appurtenances, is exempt from liability for debts other than labourers', mechanics' and purchase-money liens, mortgages and taxes. If the homestead is sold the proceeds from the sale, to an amount not exceeding $5000, are likewise exempt for a period of two years, provided they are held for the purpose of procuring another homestead. If the owner is a married man his homestead cannot be sold or mortgaged without his wife's consent. The employment of children under fourteen years of age in any factory, workshop, mine, bowling alley or beer garden is forbidden, and their employment at any gainful occupation is permitted only during the vacation of the public school. A child between fourteen and sixteen years of age may be employed at a gainful occupation only upon the recommendation of the school principal or clerk of the board of education. No child under sixteen years of age may be employed longer than fifty-five hours in any one week, more than ten hours in any one day, more than six days in any one week, or between 6·0 p.m. and 7·0 a.m.

Other radical legislation, especially in regard to railways, has included: the Porter Law, regulating rates, which was enacted in 1874 during the "Granger Movement," was modified from time to time, and was displaced by a law of 1905 (in 1908 declared constitutional so long as stockholders receive a "reasonable compensation" on investments) creating a state railway commission, and providing for the physical valuation of railways on an *ad valorem* basis for taxation; a law (1907) making 2 cents a mile the maximum fare; an anti-tipping law (1905); a law forbidding the sale of cigarettes; an act (1907) forbidding insurance companies to do both participating and non-participating business; and an eight-hour labour law in effect on the 1st of January 1908.

Finance.—Revenue for state purposes is derived principally from taxes on corporations, from an inheritance tax and from departmental and institutional fees and charges; that for counties, towns, villages and cities from a general property tax. The general property tax has long been employed almost wholly for educational purposes only. The state tax on railways and other public service corporations is levied on an *ad valorem* basis; but telephone companies are taxed by collecting a percentage of the gross receipts. Insurance companies are taxed on premiums and income. In 1908 the constitution was amended to permit a graduated tax on incomes, privileges and occupations. A poll tax is levied for highway purposes in towns and villages, but the general charter law does not provide for the collection of poll taxes in cities. The proceeds from corporation taxes increased from $1,711,387 in 1899 to $3,969,771 in 1908. The state receipts from all sources increased from $4,070,316 for the year ending September 30, 1899, to $8,299,982 for the year ending June 30, 1908; the disbursements in the latter year were $7,762,771 or $537,211 less than the receipts.

As a result of the failure of "wildcat" banks during the Territorial period, a clause was inserted in the state constitution forbidding the legislature to charter a bank or pass a general banking law until the people had voted in favour of banks, and providing further that no bank charter or general banking law should be of any force until a majority of the voters at a general election had approved of it. The people gave their approval to a general banking law in 1852, and state banks were incorporated under it. Private banks and one savings bank were also chartered. In 1903 a state banking department was created under the management of a commissioner of banking appointed by the governor with the concurrence of the Senate for a term of five years. Under this law private banks became state banks, and all except national banks are examined by the commissioner, his deputy or some person appointed by the commissioner, at least once a year. When satisfied that a bank has become insolvent, the commissioner may take possession of it and wind up its affairs. In 1909 there were 470 state banks and 3 savings banks with total resources amounting to $140,155,455.

To prevent such extravagant expenditures for internal improvements as had brought disaster to Michigan and other states, the framers of the constitution of Wisconsin inserted a clause limiting its aggregate indebtedness to $100,000 for all purposes other than to repel an invasion, to suppress an insurrection or for defence in time of war, and the state is free from debt with the exception of that contracted on account of the Civil War. This war debt, although amounting to $2,251,000, is held by four state educational funds. A constitutional amendment, adopted in 1874, limits the indebtedness of each county, city, town, village and school district to 5 % of the value of its taxable property.

Education.—Wisconsin has an excellent free public school system, which was established in 1848 and which provides a graded system of instruction in country district and city schools, high schools and normal schools and the University of Wisconsin (incorporated 1848; see WISCONSIN, UNIVERSITY OF). By a law of 1907 school attendance (24 weeks per annum in the country—a law of 1903 had required only 20 weeks—32 weeks in cities) was made compulsory for children between seven and fourteen years of age who do not live more than 2 m. from school by the nearest travelled public highway. In 1907–1908 27·2 % of those between seven and fourteen years of age in the state attended no school. The total public school enrolment in 1909–1910 was 466,554. In 1901 a law was enacted providing for state graded schools of two classes, which must be opened for at least nine months each year; graded schools of the first class (of three or more departments) receive $300 a year each from the state, and graded schools of the second class (of two departments only) receive $200 a year each from the state. About 1906 rural graded schools, outside of villages, were first organized. There are twenty-two day schools for the deaf. There are a few township high schools (28 out of 285 in 1909), and these receive from the state one-half of the total annually paid for teachers' salaries; for free high schools the first state provision was made in 1875. There are special kindergarten training departments in the Milwaukee and Superior schools, departments for manual training at Oshkosh and Platteville, and a training department in domestic science at the Stevens Point school. The first kindergarten officially connected with any American state normal school was opened at Oshkosh in 1880. The state normal schools are supported largely from the interest ($89,137 in 1908) of a fund ($1,957,230 in 1908) created in 1865 from the sale of swamp and overflowed lands, and from an annual state tax ($230,000 in 1908). In addition to the state university the state maintains at Platteville a school of mines, opened in 1908. Under state control there is a system of teachers' and farmers' institutes. A Free Library Commission of five members created in 1895 maintains about 650 circulating free public libraries comprising more than 40,000 volumes. In 1907 there were about 960,000 volumes in public township libraries for which a law of 1887 had made provision; since 1895 the formation of such libraries has been mandatory, and books, chosen by the county superintendent, are bought from a fund of 10 cents for every person of school age in towns, villages and cities of the fourth class. An act of 1901 permits county boards to establish county systems of travelling libraries. In 1908 the total expenditure for public education in the state was $12,547,574; of this sum $10,604,294 was spent for common schools, high schools and graded schools, $1,091,135 for the university, and $547,661 for normal schools. The total income for schools in 1907–1908 was $1,773,659, of which $1,379,410 was from the seven-tenths-of-a-mill tax, $200,000 was from licence fees and taxes upon corporations (for salaries of rural school inspectors) and $194,249 the income from the common school fund which in that year amounted to $3,845,929.

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[1] The first class comprises cities having a population of 150,000 or more (Milwaukee); the second class those having a population between 40,000 and 150,000; the third class those having a population between 10,000 and 40,000; the fourth class those having a population less than 10,000.

Educational institutions of collegiate rank are Beloit College (1846; originally Congregational, now undenominational) at Beloit; Carroll College (1846, Presbyterian), at Waukesha; Lawrence College (1847; Methodist Episcopal), at Appleton; Concordia College (1881; Lutheran), Marquette University (1864, Roman Catholic), and Milwaukee-Downer College (1895; non-sectarian, for women; an outgrowth of Downer College, Congregational and Presbyterian, founded at Fox Lake in 1853), all at Milwaukee; Milton College (1867; Seventh Day Baptist), at Milton; North-western University (1865; Lutheran) at Watertown; Ripon College (1851; originally under Presbyterian and Congregational control, now non-sectarian), at Ripon; Wayland University (1855; co-educational; Baptist), at Beaver Dam; and the following Roman Catholic schools: St Clara Academy (1847; Dominican) at Sinsiniwa, St Francis Seminary (1853) at St Francis, and St Lawrence College (1861, Capuchin) at Mt Calvary. There are also many private academies and trade or technical schools, and six industrial schools for Indians.

Charitable and Penal Institutions.—In the number and equipment of its reformatory, charitable and penal institutions, Wisconsin stands high. These institutions are under the general direction of a state board of control (established in 1905) of five members (one a woman), appointed by the governor for a term of five years. This board has charge of the following institutions: a State Hospital for the Insane (1860) at Mendota; the Northern Hospital for the Insane (1873) at Winnebago, 4 m. N. of Oshkosh; a School for the Deaf (1852) at Delavan, Walworth county, in which the teaching is principally oral and which includes a high school; a School for the Blind (1849; taken over by the state in 1850) at Janesville; an Industrial School for Boys (opened in 1860, as a House of Refuge) at Waukesha, with a farm of 404 acres; the State Prison (1853) at Waupun; State Public School for Dependent and Neglected Children (1886) at Sparta, with a farm of 234 acres; Wisconsin Home for Feeble Minded (1896) at Chippewa Falls; Wisconsin State Reformatory (1898), near Green Bay; and Wisconsin State Tuberculosis Sanatorium (1907) at Wales, Waukesha county. In addition the board has partial control over the Wisconsin Workshop for the Blind (1903) at Milwaukee, where there is a willow ware factory, and the Wisconsin Industrial School for Girls (1875) also at Milwaukee. Its powers of inspection extend over 5 semi-state institutions, 33 county insane asylums, 69 gaols, 48 poor-houses, 50 private benevolent institutions and 206 police stations and lockups. The board has also power of visitation and inspection over the Wisconsin Veterans' Home at Waupaca, founded in 1887 by the state department of the Grand Army of the Republic. In the state's treatment of the insane, chronic cases are separated and sent to the county asylums. The labour of convicts in the state prison is leased; until 1878 the state itself supervised manufacturing in the prison; then for twenty-five years the convicts were employed in making shoes for a Chicago firm; and since 1903 the state has received 65 cents a day for the labour of each convict, and at least 300 convicts are employed in the manufacture of socks and stockings, from which in 1906–1908 (two years) the income to the state was $156,890. In 1910 a binding twine factory was established in the prison. In the state reformatory the labour of some inmates is leased to tailors, and the others make brooms or bricks, or work in a cabinet shop or on the farm. Since 1907 a parole law has been in force for prisoners with a good record at the state prison. By a law of 1909 certain offenders are placed under probation under the supervision of the State Board of Control.

History.—Politically Wisconsin has been under French domination (from 1634 to 1760); under British domination (from 1760, formally 1763, to 1783); and under that of the United States since 1783. But the British influence on the community was negligible, and British rule was never more than nominal and was confined to the military posts. When American troops occupied the posts at Green Bay and Prairie du Chien in 1816, thirty-three years after it had become a part of the territory of the United States, the region was still almost exclusively French in manners, customs and population; and so it remained for nearly two decades.

The region comprised in the present state of Wisconsin, when first explored by Europeans, was a favourite hunting-ground for the Indians who constantly crossed this region between the Great Lakes and the upper Mississippi. The Indian population of Wisconsin in the first half of the 17th century was probably larger than that of any region of similar size east of the Mississippi. Among the many different tribes were the Sioux, Chippewa, Kickapoo, Menominee, Mascoutin, Potawatomi, Winnebago, and Sauk and Foxes. In the eastern and southern portions of the region there are still numerous mounds, the relics of an earlier Indian civilization.[1] In the lead regions in the S.W., with the help of Pawnee slaves, the Indians worked the lead diggings in a rough way. The whole course of the early history of Wisconsin was profoundly influenced by these racial and geographic considerations. The French adventurers, bent on finding either a "North-west passage" or some land route to the Pacific (which they believed to be no farther west than the Mississippi), naturally went west by the water routes of Wisconsin; as a fine field for their bartering and trading with water-courses by which they could convey their pelts and skins back to Montreal, the region attracted the *coureurs de bois* and fur traders; and it seemed promising also to the zealous French Catholic missionaries. The impelling influences on the French settlement of the region were the love of exploration and adventure, the commercial instinct and religious zeal.

Jean Nicolet, an experienced explorer, was sent west by Samuel de Champlain, the governor-general of New France, in the summer of 1634 to investigate mysterious rumours of a people known as "the men of the sea" who were thought by some to be Tatars or Chinese.[2] After a long and difficult journey into a region which he seems to have been the first white man to enter, Nicolet landed on the soil of Wisconsin at a point on Green Bay about 10 m. below the present city of Green Bay. Near what is now known as Red Banks there was a populous village of Winnebago, which welcomed and entertained him. He made a treaty with the Indians, went up the Fox river to a point somewhere near the present city of Berlin (Green Lake county) where he found another large village, and returned to Green Bay and thence to his post on Lake Huron.

Twenty years later Pierre Esprit, Sieur de Radisson, and Medard Chouart, Sieur des Groseilliers, started (1654) from Quebec, crossed Lakes Huron and Michigan, wintered in Wisconsin, ascended the Fox, crossed to the Wisconsin and possibly reached the Mississippi river eighteen years before Jacques Marquette and Louis Joliet. In 1659–1660 they were again in the West, but the opposition of the French authorities prevented their further explorations.

The first of the missionary pioneers was the Jesuit, Father René Ménard, who in 1661 lost his life on the upper Wisconsin river. In 1665 Father Claude Allouez established the first permanent mission in Wisconsin on the shores of Chequamegon Bay, near the first trading post established by Radisson and Groseilliers. In 1669 he was succeeded by Father Jacques Marquette (*q.v.*) and went to the Fox River Valley; there he established the mission of St Francis Xavier at the first rapids[3] on the Fox river near a populous Indian village. About this mission, one of the most successful established by the Jesuits in the West, gathered a group of traders who formed a settlement that for many years existed as a transient post and store-house for trappers.

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[1] One of the most famous of these mounds is the so-called Elephant Mound, 4 m. S. of Wyalusing, in Grant county in the S.W. corner of the state, near the Mississippi river; it is an effigy mound, and a drifting of earth changed its original shape, that of a bear, so that it roughly resembled an elephant; see pp. 91-93 of the *Twelfth Annual Report* (1894), Bureau of American Ethnology.

[2] These "gens de mer" were the Winnebago Indians; the name "ouinipegou," meaning "men of the fetid water," was interpreted by the French to apply to salt water, whereas it probably referred to sulphur springs near Lake Winnipeg, from which the Winnebago came to Green Bay.

[3] It was from these "rapides des pères" (rapids of the fathers) that De Pere was named.

Father Marquette, forced in 1671 by Indian wars to abandon his post on Chequamegon Bay, settled with the Huron at the Straits of Mackinac, whence in May 1673 accompanied by Louis Joliet he set out for the Mississippi river. They halted at De Pere, set off down the Fox-Wisconsin route, followed the Wisconsin to its mouth and came out upon the Mississippi near the site of the present city of Prairie du Chien, on July 17th, exactly two months after they left St Ignace mission on Mackinac Island. After descending the Mississippi to the mouth of the Arkansas they returned by way of the Des Plaines portage, paddled along the western shore of Lake Michigan, and arrived at De Pere. In September 1679 Robert Cavelier, Sieur de la Salle, and Henri de Tonty entered the mouth of the Fox river in the "Griffon," the first ship to sail the Great Lakes. In the same year Daniel Greysolon Du Luth, a *coureur de bois*, explored the upper Mississippi and the Wisconsin and Black rivers. In 1680 Father Louis Hennepin, a Recollet Franciscan who had accompanied La Salle, followed the Mississippi northward from the mouth of the Illinois along the western border of Wisconsin to the site of the present city of St Paul. The same course was followed by the fur-trader, Pierre Charles Le Sueur, in 1683.

In 1671 Simon François Daumont Saint-Lusson at Sault Ste Marie had taken formal possession of the region in the name of the king of France; in 1685 Nicolas Perrot (1644–*c.* 1700), a trader who had first visited the wilds of Wisconsin probably as early as 1665, was appointed "commandant of the West," and this event closes the period of exploration and begins that of actual occupation. Traders had begun to swarm into the country in increasing numbers, and to protect them from the Indians and to control properly the licensed fur-trade a military force was necessary. Perrot built a chain of forts along the Mississippi and a post (the present Galena, Illinois) near the southern boundary of the state, where he discovered and worked a lead mine. In 1712 the slaughter of a band of Foxes near Detroit was the signal for hostilities which lasted almost continuously until 1740,[1] and in which every tribe in the Wisconsin country was sooner or later involved either in alliance with the Foxes or with the French; the Chippewa, always hostile to the Foxes, the Potawatomi and the Menominee sided with the French. This war seriously interfered with the French plans of trade development and exploitation, and by rendering difficult the maintenance of a chain of settlements which might have connected Canada and Louisiana was a contributing cause of the final overthrow of French dominion. In this period permanent military posts were established at Green Bay and Chequamegon (1718); in 1718 it was reported that traders had settled at Green Bay and De Pere; in 1727 a post was established on Lake Pepin.

Wisconsin was little disturbed by the Seven Years' War. Yet the French and Indians of Wisconsin contributed their quota to the French armies—a force of half-breeds and Indians under a half-breed, Charles Michel de Langlade (1729–1800). After the fall of Montreal (Sept. 1760) Robert Rogers, who had been sent to Detroit to occupy the French posts in the West, dispatched Captain Henry Balfour with a force of British and Colonial troops to garrison Mackinac and the Wisconsin posts which had been dismantled and were almost deserted. He arrived at La Baye (Green Bay) in October 1761, and left there a garrison under Lieut. James Gorrell of the 60th (Royal American Foot) Regiment. The traders who accompanied them were the nucleus of the first English-speaking colony on Wisconsin soil. The French fort was rechristened Fort Edward Augustus. The period of British occupation was brief. On the outbreak of the conspiracy of Pontiac Lieut. Gorrell was compelled (in July 1763) to evacuate the fort, and make his way to Montreal.[2] When the conspiracy was crushed in 1765, Wisconsin was reopened for traders, and not only French but American merchants and travellers flocked into the region. Among these were Alexander Henry (1739–1824), who as early as 1760 had visited the site of Milwaukee, and who now obtained a monopoly of the Lake Superior trade, and Jonathan Carver (*q.v.*), who in 1766 reached Green Bay on his way to the Mississippi.

In 1774 was passed the Quebec Act for the government of the Province of Quebec into which the Wisconsin region was incorporated by this act, but it had little effect on the French settlements west of Lake Michigan, which remained throughout the entire British period a group of detached and periodically self-governing communities. Little as they cared for their British rulers the Wisconsin *voyageurs* and *habitans*, influenced probably by their cupidity and by actual money payments, for the most part adhered to the British cause during the War of Independence. De Langlade led his French and Indian forces against the American frontier communities west of the Alleghanies. This pro-British spirit, however, did not dominate the whole Wisconsin region, and while De Langlade was harassing the Pennsylvania and Virginia frontier, Godefrey de Linctot, a trader of Prairie du Chien, acting as agent for George Rogers Clark, detached several western tribes from the British adherence, and personally led a band of French settlers to his aid. The close of the war, although it conveyed the region to the sovereignty of the United States, was not followed by American occupation. In this period, however, the fur-trade assumed proportions of greater importance, and trading posts were established by the North-west Company (Canadian). In 1786 a more systematic attempt was made to work the lead mines by Julien Dubuque, who obtained the privilege from the Indians. In 1787 Wisconsin became part of the North-west Territory, but it was not until after the ratification of Jay's treaty that in 1796 the western posts were evacuated by the British. Before the actual military occupation (1816) by the United States, American traders had begun to enter into a sharp rivalry for the Indian trade. In 1800 Wisconsin was included in the newly organized Indiana Territory; and in 1809 on the admission of Indiana as a state it was attached to Illinois. During the second war with Great Britain, the Wisconsin Indians and French settlers generally sided with the British, and in 1814 many of them participated in Major William McKay's expedition against Fort Shelby at Prairie du Chien. In 1816 Fort Howard was built at Green Bay, and Fort Crawford at Prairie du Chien. In the same year was confirmed the treaty negotiated in 1804 by William Henry Harrison, by the terms of which the Indian title to the lead region was extinguished. In 1810 the product of lead had been about 400,000 ℔, largely mined and smelted by Indians, but the output was now increased enormously by the American miners who introduced new machinery and new methods, and by 1820 there were several thousand miners in the region, including negro slaves who had been brought north by Southern prospectors from Kentucky and Missouri. In 1818 Illinois was admitted to the Union and Wisconsin was incorporated in Michigan Territory, and at that time American civil government in the Wisconsin region was first established on an orderly and permanent basis. Wisconsin then comprised two counties, Brown (east) and Crawford (west), with county seats at Green Bay and Prairie du Chien. Until 1830 the fur-trade, controlled largely by John Jacob Astor's American Fur Company, continued to be the predominating interest in the Wisconsin region, but then the growing lead mining industry began to overshadow the fur-trade, and in the mining region towns and smelting furnaces were rapidly built. Indian miners were soon driven out of business and were nearly crowded out of their homes. Friction between the settlers and the Indians could not long be avoided, and in 1827 Red Bird and his band of Winnebago attacked the whites, but after some bloodshed they were defeated by Major William Whistler (1780–1863) of Fort Howard. Five years later occurred a more serious revolt, the Black Hawk War (see BLACK HAWK), which also grew out of the dispute over the mineral lands.

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[1] In that year the Foxes were scattered or forced to surrender by Pierre Paul le Perrière, sieur Marin, who had been appointed commandant of the West in 1729.

[2] It was not until 1814 that a British force again occupied a Wisconsin post.

The Black Hawk War not merely settled the Indian question so far as Wisconsin was concerned, but made the region better known, and gave an appreciable impetus to its growth. A series of Indian treaties in 1829, 1831, 1832 and 1833 extinguished the Indian titles and opened up to settlement a vast area of new land. The first newspaper, the Green Bay *Intelligencer*, began publication in 1833. In 1834 two land offices were opened, and by 1836, 878,014 acres of land had been sold to settlers and speculators. A special census showed a population of more than 11,000 in 1836. The new growth started a movement for a separate Territorial organization for that part of Michigan lying west of Lake Michigan, but this was not finally accomplished until 1836, when Michigan entered the Union. The new Territory of Wisconsin comprised not only the area included in the present state, but the present Iowa and Minnesota and a considerable portion of North and South Dakota.[1] Henry Dodge (1782–1867) was appointed its first governor by President Jackson. The first Territorial Council met in 1836 at Old Belmont, now Leslie, Lafayette county, but in December of that year Madison was selected as the capital, after a contest in which Fond du Lac, Milwaukee, Racine, Green Bay, Portage and other places were considered, and in which James Duane Doty, later governor, owner of the Madison town plat, was charged with bribing legislators with town lots in Madison. In 1838 the Territory of Iowa was erected out of all that part of Wisconsin lying west of the Mississippi. The movement for the admission of Wisconsin to the Union was taken up in earnest soon after 1840, and after several years' agitation, in which Governor Doty took a leading part, on the 10th of August 1846 an Enabling Act introduced in Congress by Morgan L. Martin, the Territorial delegate, received the approval of President Polk. Meanwhile the Territorial legislature had passed favourably on the matter, and in April the act was ratified by a popular vote of 12,334 to 2487. The first constitution drafted was rejected (5th April 1847) owing to the articles relating to the rights of married women, exemptions, the elective judiciary, &c. A second convention, thought to be more conservative than the first, drafted another constitution, which on the 13th of March 1848 was adopted by 16,799 ayes and 6394 noes. The constitution was approved by Congress and signed by the president on the 29th of May 1848; the first state election had already been held on the 8th of May, and Governor Nelson Dewey and other state officers were sworn into office on the 7th of June. In the same year the free public school system was established, and the great stream of German immigration set in. Railway construction began in 1851. Wisconsin was a strong anti-slavery state. In 1854 one of the first steps in the organization of the Republican party (*q.v.*) was taken at Ripon. In the same year a fugitive slave named Glover was seized at Racine and was afterward rescued by an anti-slavery mob from Milwaukee; the State Supreme Court rendered a decision which declared the Fugitive Slave Law to be null and void in Wisconsin.

In 1856 a contested election for the governorship between Governor William A. Barstow (1813–1865), a candidate for re-election, and his Republican opponent, Coles Bashford (1816–1878), threatened to result in civil war. But the courts threw out "supplementary returns" (possibly forged by the canvassers) and decided in favour of Bashford, who was the first Republican to hold an office; with two exceptions Wisconsin has elected Republican governors ever since. The state gave its electoral vote for Lincoln in 1860 and supported the administration during the Civil War. The policy of the state to keep its regiments full rather than send new regiments to the front made the strength of a Wisconsin regiment, according to General W. T. Sherman, frequently equal to a brigade. The whole number of troops furnished by Wisconsin during the war was 91,379. In January 1874 a Democratic Liberal Reform administration came into power in the state with William R. Taylor as governor. At the legislative session which followed, the Potter law, one of the first attempts to regulate railway rates, was passed. The railways determined to evade the law, but Taylor promptly brought suit in the State Supreme Court and an injunction was issued restraining the companies from disobedience. In 1876, however, the Republicans regained control of the state government and the law was modified. In 1889 the passage of the Bennett law, providing for the enforcement of the teaching of English in all public and parochial schools, had a wide political effect. The Germans, usually Republicans, roused for the defence of their schools, voted the Democratic state ticket at the next state election (1890), with the result that George Wilbur Peck,[2] the Democratic nominee, was chosen governor by 30,000 plurality. The Bennett law was at once repealed, but not until 1895 did the Republicans regain control of the administration. It was accomplished then after a Democratic gerrymander had been twice overthrown in the courts. Since that time, however, the Republican party has grown more secure, and it has placed on the statute books a series of radical and progressive enactments in regard to railway rate legislation and taxation, publicity of campaign expenditures and a state-wide direct primary law (1905). In all these reforms a leading part was taken by Governor Robert M. LaFollette (b. 1855), who was elected to the United States Senate in 1905. Opposition to his political programme resulted in a serious split in the Republican ranks, the opposition taking the old name of "Stalwarts" and his followers came to be known as "Halfbreeds." Governor LaFollette, however, could draw enough support from the Democrats to maintain the control of the state by the Republicans. Wisconsin had several times been visited by disastrous forest fires. One in the north-eastern counties (Oconto, Brown, Door, Shawano, Manitowoc and Kewaunee) in 1871 resulted in the loss of more than a thousand lives. Another serious fire occurred in the north-west in July 1894.

Governors of Wisconsin

	Territorial.	
Henry Dodge	Democrat	1836–1841
James Duane Doty	Whig	1841–1844
Nathaniel P. Tallmadge	,,	1844–1845
Henry Dodge	Democrat	1845–1848
	State.	
Nelson Dewey	Democrat	1848–1852
Leonard J. Farwell	,,	1852–1854
William A. Barstow	,,	1854–1856
Arthur McArthur [3]	Republican	1856
Coles Bashford	,,	1856–1858
Alex. W. Randall	,,	1858–1862
Louis P. Harvey	,,	1862
Edward Salomon	,,	1862–1864
James T. Lewis	,,	1864–1866
Lucius Fairchild	,,	1866–1872
C. C. Washburn	,,	1872–1874
William R. Taylor	Democrat	1874–1876
Harrison Ludington	Republican	1876–1878
William E. Smith	,,	1878–1882
Jeremiah M. Rusk	,,	1882–1889
William D. Hoard	,,	1889–1891
George W. Peck	Democrat	1891–1895
William H. Upham	Republican	1895–1897
Edward Scofield	,,	1897–1901
Robert M. LaFollette [4]	,,	1901–1906
James O. Davidson [5]	,,	1906–1911
F. E. McGovern	,,	1911–

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[1] Wisconsin, as the last state to be created wholly out of the old North-West Territory, was the loser in boundary disputes with neighbouring states. As originally planned, Wisconsin would have included that part of Illinois west of a line running across the southern end of Lake Michigan; and the inhabitants of this tract actually voted to join Wisconsin, but Congress paid no attention to their demands, and this strip of land, including Chicago, became a part of Illinois. After the Toledo War (see TOLEDO, OHIO), to recompense Michigan for her losses to Ohio the northern peninsula, geographically a part of the Wisconsin region, was given to Michigan. Finally a larger tract of land E. of the Mississippi, which include St Paul, part of Minneapolis and Duluth, was cut off from Wisconsin on her admission to the Union to form with other land farther west the new Territory of Minnesota. See "The Boundaries of Wisconsin" in vol. xi. of *Wisconsin Historical Collections*.

[2] Peck (b. 1840) was a printer and then a journalist, founded in 1874 at La Crosse the *Sun*, which in 1878 he removed to Milwaukee, and was the author of many humorous sketches, notably a series of volumes of which the hero is "Peck's Bad Boy."

[3] Lieut.-Governor; succeeded Barstow, who resigned during a contest with Bashford.

[4] Resigned to become a member of the United States Senate.

[5] Lieut.-Governor; elected governor in 1906 and 1908.

Bibliography.—For physical description and natural resources see the *Reports* (biennial) and the *Bulletins* (Madison) of the Wisconsin Geological and Natural History Survey, especially important for economic geology, hydrography and agriculture, and the *Annual Reports* of the Wisconsin State Board of Agriculture; the *Reports* (biennial) of the State Forester, the Reports of the U.S. Census, and the *Mineral Resources of the United States*, published annually by the U.S. Geological Survey. A good school manual is E. C. Case's *Wisconsin, its Geology and Physical Geography* (Milwaukee, 1907). C. B. Cory, *The Birds of Illinois and Wisconsin*, Field Museum of Natural History, Publication No. 131 (Chicago, 1909), and L. Kumlien and N. Hollister, "The Birds of Wisconsin," in vol. iii., new series, of the *Bulletin* (Milwaukee) of the Wisconsin Natural History Society, are valuable. On state government see *The Blue Book of the State of Wisconsin* (Madison), published under the direction of the commissioner of labour and industrial statistics and D. E. Spencer, *Local Government in Wisconsin* (Madison, 1888). For a list of works on the history of the state see D. S. Durrie's "Bibliography of Wisconsin" in vol. vi., new series, *Historical Magazine*. The best short history is R. G. Thwaites, *Wisconsin* (Boston, 1908), in the "American Commonwealths" series. The same author's *Story of Wisconsin* (Ibid. 1890) in the "Story of the States" series, and H. E. Legler's *Leading Events in Wisconsin History* (Milwaukee, 1898), a good brief summary, are other single-volume works covering the entire period of the state's history. One of the best accounts of the state's early history is E. H. Neville and D. B. Martin's *Historic Green Bay* (Green Bay, 1893). S. S. Hebberd's *Wisconsin under the Dominion of France* (Madison, 1890) contains an account of the earlier period written, however, before much recent material was brought to light. Much material of value is contained in the *Historical Collections* (18 vols., Madison, 1855 sqq.) of the State Historical Society of Wisconsin (1846; reorganized, 1849), and in the *Bulletins of Information, Proceedings* and *Draper Series* of the same society are many valuable historical papers and monographs. See also W. R. Smith's *History of Wisconsin* (3 vols., Madison, 1854). The Parkman Society *Papers* (Milwaukee, 1895–1899) provide a collection of good articles on special topics of Wisconsin history, and the *Original Narratives* and *Reprints* published by the Wisconsin History Commission (created by an act of 1905) deal with Wisconsin in the Civil War. See also Auguste Gosselin, *Jean Nicolet 1618–1642* (1893); B. A. Hinsdale, *The Old North-West* (New York, 1888); Charles Moore, *The North-West under Three Flags* (New York, 1900); R. V. Phelan, *Financial History of Wisconsin* (Madison, 1908); F. J. Turner, *Character and Influence of the Indian Trade in Wisconsin*, vol. ix. of Johns Hopkins University Studies (Baltimore, 1899); F. Parkman, *The Jesuits in North America* (Boston, 1870); and the volumes of the *Jesuit Relations*, edited by R. G. Thwaites.

WISCONSIN, UNIVERSITY OF, a co-educational institution of higher learning at Madison, Wisconsin, the capital of the state, established in 1848 under state control, supported largely by the state, and a part of the state educational system. The university occupies a picturesque and beautiful site on an irregular tract (600 acres), including both wooded hills and undulating meadow lands stretching for 1 m. along the shores of Lake Mendota. The main building, University Hall (1859; enlarged 1897–1899 and 1905–1906), which crowns University Hill, is exactly 1 m. from the state capitol. The other buildings include North Hall (1850), South Hall (1854), Science Hall (1887), the Biology Building (1911), the Chemical Building (1904–1905), the Hydraulic Laboratory (1905), the Engineering Building (1900), the Law School (1894), Chadbourne Hall (1870; remodelled in 1896) for women, Lathrop Hall (1910) for women, Assembly Hall (1879), the Chemical Engineering Building (1885), Machine Shops (1885), the armoury and gymnasium (1894), a group of half a dozen buildings belonging to the College of Agriculture and the Washburn Observatory (1878; a gift of Governor C. C. Washburn). On the lower campus is the building of the Wisconsin State Historical Society.

The university includes a college of letters and science, with general courses in liberal arts and special courses in chemistry, commerce, journalism, music, pharmacy and training of teachers and library work; a college of engineering, with courses in civil, mechanical, electrical, chemical and mining engineering, and an applied electro-chemistry course; a college of agriculture, with a government experiment station, long, middle and short courses in agriculture, a department of home economics, a dairy course and farmers' institutes; a college of law (3 years' course); a college of medicine, giving the first two years of a medical course; a graduate school; and an extension division, including departments of instruction by lectures, of correspondence study, of general information and welfare, and of debating and public discussion. There is a summer session, in which, in addition to courses in all the colleges and schools, instruction is offered to artisans and apprentices and in library training. The college of agriculture, one of the largest and best equipped in the country, provides also briefer courses of practical training for farmers and farmers' wives. In connexion with the state department of health, instruction on the prevention and treatment of tuberculosis is provided, exhibits and instructors or demonstrators being sent to every part of the state. The state hygienic laboratory is conducted by the university. On the university campus is the forest products laboratory (1910) of the United States government. At Milwaukee there is a university settlement associated with the social work of the university.

Admission to the university is on examination or certificate from accredited high schools or academies. Tuition is free for residents of the state. Courses in the first two years are largely prescribed, in the last two years elective "under a definite system." In 1910 there were 395 instructors and 4947 students (3560 men and 1387 women). The university library proper, of 163,000 volumes and 40,000 pamphlets, is housed in the Historical Society's building, in which are also the collection of the Historical Society and that of the Wisconsin Academy of Arts and Sciences—a total in 1910 of 404,000 books and 202,000 pamphlets.

The grounds, buildings and equipments of the university are valued at $2,000,000. The income of the university, including income from the Federal land grants, from invested productive funds and from state tax levies, exceeds one million dollars annually. Since 1905 the state legislature has appropriated for the current expenses of the university a $\frac{2}{7}$ mill tax. More than $2,000,000 was left to the university in 1908 for a memorial theatre, research professorships and graduate fellowships by William Freeman Vilas (1840–1908), who graduated at the university in 1858 and was postmaster-general of the United States in 1885–1888, secretary of the interior in 1888–1889 and U.S. senator from Wisconsin in 1891–1897.

An act for the creation of a university to be supported by the Territory was passed by the first session of the Territorial legislature in 1836, but except for the naming of a board of trustees the plan was never put into operation. A similar act for the establishment of a university at Green Bay had no more result. In 1838 a university of the Territory of Wisconsin was created by act of the Territorial legislature and was endowed with two townships of land. This was the germ of the state university, provision for which was made in the state constitution adopted in 1848. The university was incorporated by act of the legislature in that year with a board of regents as the governing body, chosen by the legislature.[1] A preparatory department was opened in the autumn of that year, and John H. Lathrop (1799–1866), a graduate of Yale, then president of the university of Missouri, was chosen as the first chancellor of the new institution. He was inaugurated in 1850, and in that year North Hall, the first building, was erected. The first academic class graduated in 1854. In the same year the Federal Congress (which had granted to the state seventy-two sections of salt-spring lands, and as no such lands were found in the state, had been petitioned to change the nature of the grant) granted seventy-two sections to be "sold in such manner as the legislature may direct for the benefit and in aid of the university." The Federal land grants, however, which ought to have supported the university, were sacrificed to a desire to attract immigrants, and the institution for many years was compelled to get along on a small margin which rendered extension difficult; and the university permanent fund was soon impaired for the construction of buildings. Henry Barnard in 1859 succeeded Lathrop as chancellor, but resigned in 1861. After the Civil War, the office of chancellor was displaced by that of president. Paul Ansel Chadbourne (1823–1883), a graduate (and afterwards president) of Williams College, became president in 1867, and in his presidency (1867–1870) the university was reorganized, a college of law was founded, co-education was established and the agricultural college was consolidated with the university, a radical departure from the plan adopted in most of the Western states. In 1871–1874 John Hanson Twombly, a graduate of Wesleyan University and one of the founders of Boston University, was president, and the legislature first provided for an annual state tax of $10,000 for the university. With the coming to the presidency (1874) of John Bascom (b. 1827), another graduate of Williams, the university began a new period of development; the preparatory department was abolished in 1880, and the finances of the university were put on a firm basis by the grant of a state tax of one-tenth of a mill. Under the presidency (1887–1892) of Thomas Chrowder Chamberlin (b. 1843), a graduate of Beloit College and a member of the U.S. Geological Survey, the university attendance grew from 500 to 1000 students, and buildings were erected for the college of law, dairy school and science hall. Under President Charles Kendall Adams (1835–1902), who was a graduate of the university of Michigan, where as professor of history he had introduced in 1869–1870 the German method of "seminar" study and research, and who had just resigned the presidency (1885–1892) of Cornell University, the enrolment of the university increased from 1000 in 1892 to 2600 in 1901, and the growth of the graduate school was particularly notable. Under Charles Richard Van-Hise,[1] who was the first alumnus to become president and who succeeded President Adams in 1904, the growth of the university continued, and its activities were constantly enlarged and the scope of its work was widened.

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[1] The university is now governed by regents, of whom two—the president of the university and the state superintendent of public instruction—are *ex officio*, and the others are appointed by the governor for a term of three years, two from the state at large and one from each congressional district.

See S. H. Carpenter, *A Historical Sketch of the University of Wisconsin from 1849 to 1876* (Madison, 1876), and R. G. Thwaites, *The University of Wisconsin, its History and its Alumni* (Ibid., 1900).

WISDOM, BOOK OF, or WISDOM OF SOLOMON (Sept. Σοφία Σαλωμῶνος; Lat. Vulg. *Liber sapientiae*), an apocryphal book of the "Wisdom Literature" (*q.v.*), the most brilliant production of pre-Christian Hebrew philosophical thought, remarkable both for the elevation of its ideas and for the splendour of its diction. It divides itself naturally, by its contents, into two parts, in one of which the theme is righteousness and wisdom, in the other the early fortunes of the Israelite people considered as a righteous nation beloved by God.

The first part (ch. i.-ix.) falls also into two divisions, the first (i.-v.) dwelling on the contrast between the righteous and the wicked, the second (vi.-ix.) setting forth the glories of wisdom. After an exhortation to the judges of the earth to put away evil counsels and thus avoid death, the author declares that God has made no kingdom of death on the earth, but ungodly men have made a covenant with it: certain sceptics (probably both Gentile and Jewish) holding this life to be brief and without a future, give themselves up to sensuality and oppress the poor and the righteous; but God created man to be immortal (ii. 23), and there will be compensation and retribution in the future: the good will rule (on earth), the wicked will be hurled down to destruction, though they seem now to flourish with long life and abundance of children (ii.-v.). At this point Solomon is introduced, and from the following section (vi.-ix.) the book seems to have taken its title. Solomon reminds kings and rulers that they will be held to strict account by God, and, urging them to learn wisdom from his words, proceeds to give his own experience: devoting himself from his youth to the pursuit of wisdom he had found her to be a treasure that never failed, the source and embodiment of all that is most excellent and beautiful in the world—through her he looks to obtain influence over men and immortality, and he concludes with a prayer that God would send her out of his holy heavens to be his companion and guide.

The second part of the book (x.-xix.) connects itself formally with the first by a summary description of the rôle of wisdom in the early times: she directed and preserved the fathers from Adam to Moses (x. 1–xi. 1). From this point, however, nothing is said of wisdom—the rest of the book is a philosophical and imaginative narrative of Israelite affairs from the Egyptian oppression to the settlement in Canaan. A brief description of how the Egyptians were punished through the very things with which they sinned (though the punishment was not fatal, for God loves all things that exist), and how judgments on the Canaanites were executed gradually (so as to give them time to repent), is followed by a dissertation on the origin, various forms, absurdity and results of polytheism and idolatry (xiii.-xv.): the worship of natural objects is said to be less blameworthy than the worship of images—this latter, arising from the desire to honour dead children and living kings (the Euhemeristic theory), is inherently absurd, and led to all sorts of moral depravity. In the four last chapters the author, returning to the history, gives a detailed account of the provision made for the Israelites in the wilderness and of the pains and terrors with which the Egyptians were plagued.

It is not easy to determine whether the book is all from the same author. On the one hand, it may be said that one general theme—the salvation and final prosperity of the righteous—is visible throughout the work, that God is everywhere represented as the supreme moral governor of the world, and that the conception of immortality is found in both parts; the second part, though differing in form from the first, may be regarded as the historical illustration of the principles set forth in the latter. On the other hand, it must be admitted that the points of view in the two parts are very different: the philosophical conception of wisdom and the general Greek colouring, so prominent in the first part, are quite lacking in the second (x. 1–xi. 1 being regarded as a transition or connecting section inserted by an editor). While the first has the form of a treatise, the second is an address to God; the first, though it has the Jewish people in mind, does not refer to them by name except incidentally in Solomon's prayer; the second is wholly devoted to the Jewish national experiences (this is true even of the section on idolatry). It is in the second that we have the finer ethical conception of God as father and saviour of all men, lover of souls, merciful in his dealings with the wicked—in the first part it is his justice that is emphasized; the hope of immortality is prominent in the first, but is mentioned only once (in xv. 3) in the second. The two parts are distinguished by difference of style; the Hebrew principle of parallelism of clauses is employed far more in the first than in the second, which has a number of plain prose passages, and is also rich in uncommon compound terms. In view of these differences there is ground for holding that the second part is a separate production which has been united with the first by an editor, an historical haggadic sketch, a midrash, full of imaginative additions to the Biblical narrative, and enlivened by many striking ethical reflections. The question, however, may be left undecided.

Both parts of the book ignore the Jewish sacrificial cult. Sacrifices are not mentioned at all; a passing reference to the temple is put into Solomon's mouth (ix. 8). Moses is described (xi. 1) not as the great lawgiver, but as the holy prophet through whom the works of the people were prospered. (It may be noted, as an illustration of the allusive style of the book, that, though a number of men are spoken of, not one of them is mentioned by name; in iv. 10-14, which is an expansion of Gen. v. 24, the reader is left to recognize Enoch from his knowledge of the Biblical narrative.) In the second part of the book there is no expression of "messianic" hope; in the first part the picture of the national future agrees in general (if its expressions are to be taken literally) with that given in the book of Daniel: the Jews are to have dominion over the peoples (iii. 8), and to receive from the Lord's hand the diadem of beauty (v. 16), but there is no mention of particular nations. The historical review in the second part is coloured by a bitter hatred of the ancient Egyptians; whether this springs from resentment of the former sufferings of the Israelites or is meant as an allusion to the circumstances of the author's own time it is hardly possible to say.

The book appears to teach individual ethical immortality, though its treatment of the subject is somewhat vague. On the basis of Gen. i.-iii. it is said (ii. 23 f.) that God created man for immortality (that is, apparently, on earth) and made him an image of his own being, but through the envy of the devil death came into the world, yet (iii. 1-4) the souls of the righteous are in the hand of God, and, though they seem to die, their hope is full of immortality. The description, however, appears to glide into the conception of national immortality (iii. 8, v. 16), especially in the fine sorites in vi. 17-20: the beginning of wisdom is desire for instruction, and devoted regard to instruction is love, and love is observance of her laws, and obedience to her laws is assurance of incorruption, and incorruption brings us near to God, and therefore desire for wisdom leads to a kingdom (but the nature of the kingdom is not stated). The individualistic view is expressed in xv. 3: the knowledge of God's power (that is, a righteous life) is the root of immortality. This passage appears to exclude the wicked, who, however, are said (iv. 20) to be punished hereafter. The figurative nature of the language respecting the future makes it difficult to determine precisely the thought of the book on this point; but it seems to contemplate continued existence hereafter for both righteous and wicked, and rewards and punishments allotted on the basis of moral character. Angels are not mentioned; but the serpent of Gen. iii. is, for the first time in literature, identified with the devil ("Diabolos," ii. 24, the Greek translation of the Hebrew "Satan"); the rôle assigned him (envy) is similar to that expressed in "Secrets of Enoch," xxxi. 3-6; he is here introduced to account for the fact of death in the world. In iii. 4 the writer, in his polemic against the prosperous ungodly men of his time, denies that death, short life and lack of children are to be considered misfortunes for the righteous—over against these things the possession of wisdom is declared to be the supreme good. The ethical standard of the book is high except in the bitterness displayed towards the "wicked," that is, the enemies of the Jews. The only occurrence in old Jewish literature (except in Ecclus. xiv. 2) of a word for "conscience" is found in xvii. 11 (*συνείδησις*): wickedness is timorous under the condemnation of conscience (the same thought in Prov. xxviii. 1). The book is absolutely monotheistic, and the character ascribed to the deity is ethically pure with the exception mentioned above.

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[1] President VanHise (b. 1857) graduated at the university of Wisconsin in 1879, became instructor in geology there in 1883, in 1897 became consulting geologist of the Wisconsin Geological and Natural History Survey, and in 1900 became geologist in charge of the Division of Pre-Cambrian and Metamorphic Geology, U.S. Geological Survey. He wrote *Correlation Papers—Archaean and Algonkian* (1892), *Some Principles Controlling the Deposition of Ores* (1901). *A Treatise on Metamorphism* (1903) and several works with other authors on the different iron regions of Michigan.

The style shows that the book was written in Greek, though naturally it contains Hebraisms. The author of the first part was in all probability an Alexandrian Jew; nothing further is known of him; and this is true of the author of the second part, if that be a separate production. As to the date, the decided Greek colouring (the conception of wisdom, the list of Stoic virtues, viii. 7, the idea of pre-existence, viii. 20, and the ethical conception of the future life) points to a time not earlier than the 1st century B.C., while the fact that the history is not allegorized suggests priority to Philo; probably the work was composed late in the 1st century B.C. (this date would agree with the social situation described). Its exclusion from the Jewish Canon of Scripture resulted naturally from its Alexandrian thought and from the fact that it was written in Greek. It was used, however, by New Testament writers (vii. 22 f., Jas. iii. 17, vii. 26; Heb. i. 2 f., ix. 15; 2 Cor. v. 1-4, xi. 23; Acts xvii. 30, xiii. 1-5, xiv. 22-26; Rom. i. 18-32, xvi. 7; 1 Tim. iv. 10), and is quoted freely by Patristic and later authors, generally as inspired. It was recognized as canonical by the council of Trent, but is not so regarded by Protestants.

LITERATURE.—The Greek text is given in O. F. Fritzsche, *Lib. Apocr. Vet. Test.* (1871); W. J. Deane, *Bk. of Wisd.* (1881); H. B. Swete, *Old Test. in Grk.* (1st ed., 1891; 2nd ed., 1897; Eng. trans. in Deane, 1881); W. R. Churton, *Uncan. and Apocr. Script.* (1884); C. J. Ball, *Variorum Apocr.* (1892); Revised Vers. of Apocr. (1895). Introductions and Comms.: C. L. W. Grimm in *Kurzgef. Exeg. Hdbch. z. d. Apocr. d. A. T.* (1860); E. C. Bissell in Lange-Schaff (1860); W. J. Deane (1881); F. W. Farrar in Wace's *Apocr.* (1888); Ed. Reuss, French ed. (1878), Ger. ed. (1894); E. Schürer, *Jew. People* (Eng. trans., 1891); C. Siegfried in Kautzsch, *Apocr.* (1900); Tony André, *Les Apocr.* (1903). See also the articles in Herzog-Hauck's *Realencyclopädie*; Hastings, *Dict. Bible*; Cheyne and Black, *Encycl. Bibl.* (C. H. T.*)

WISDOM LITERATURE, the name applied to the body of Old Testament and Apocryphal writings that contain the philosophical thought of the later pre-Christian Judaism. Old Semitic philosophy was a science not of ontology in the modern sense of the term, but of practical life. For the Greeks "love of wisdom" involved inquiry into the basis and origin of things; the Hebrew "wisdom" was the capacity so to order life as to get out of it the greatest possible good. Though the early Hebrews (of the time before the 5th century B.C.) must have reflected on life, there is no trace of such reflection, of a systematic sort, in their extant literature. "Wise men" are distrusted and opposed by the prophets. The latter were concerned only with the maintenance of the sole worship of Yahweh and of social morality. This was the task of the early Hebrew thinkers, and to it a large part of the higher energy of the nation was devoted. The external law given, as was believed, by the God of Israel, was held to be the sufficient guide of life, and everything that looked like reliance on human wisdom was regarded as disloyalty to the Divine Lawgiver. While the priests developed the sacrificial ritual, it was the prophets that represented the theocratic element of the national life—they devoted themselves to their task with noteworthy persistence and ability, and their efforts were crowned with success; but their virtue of singlemindedness carried with it the defect of narrowness—they despised all peoples and all countries but their own, and were intolerant of opinions, held by their fellow-citizens, that were not wholly in accordance with their own principles.

The reports of the earlier wise men, men of practical sagacity in political and social affairs, have come to us from unfriendly sources; it is quite possible that among them were some who took interest in life for its own sake, and reflected on its human moral basis. But, if this was so, no record of their reflections has been preserved. The class of sages to whom we owe the Wisdom Books did not arise till a change had come over the national fortunes and life. The firm establishment of the doctrine of practical monotheism happened to coincide in time with the destruction of the national political life (in the 6th century B.C.). At the moment when this doctrine had come to be generally accepted by the thinking part of the nation, the Jews found themselves dispersed among foreign communities, and from that time were a subject people environed by aliens, Babylonian, Persian and Greek. The prophetic office ceased to exist when its work was done, and part of the intellectual energy of the people was thus set free for other tasks than the establishment of theistic dogma. The ritual law was substantially completed by the end of the 5th century B.C.; it became the object of study, and thus arose a class of scholars, among whom were some who, under the influence of the general culture of the time, native and foreign, pushed their investigations beyond the limits of the national law and became students and critics of life. These last came to form a separate class, though without formal organization. There was a tradition of learning (Job viii. 8, xv. 10)—the results of observation and experience were handed down orally. In the 2nd century B.C., about the time when the synagogue took shape, there were established schools presided over by eminent sages, in which along with instruction in the law much was said concerning the general conduct of life (see PIRKE ABOTH). The social unification produced by the conquests of Alexander brought the Jews into intimate relations with Greek thought. It may be inferred from Ben-Sira's statements (Ecclus. xxxix. 1-11) that it was the custom for scholars to travel abroad and, like the scholars of medieval Europe, to increase their knowledge by personal association with wise men throughout the world. Jews seem to have entered eagerly into the larger intellectual life of the last three centuries before the beginning of our era. For some the influence of this association was of a general nature, merely modifying their conception of the moral life; others adopted to a greater or less extent some of the peculiar ideas of the current systems of philosophy. Scholars were held in honour in those days by princes and people, and Ben-Sira frankly adduces this fact as one of the great advantages of the pursuit of wisdom. It was in cities that the study of life and philosophy was best carried on, and it is chiefly with city life that Jewish wisdom deals.

The extant writings of the Jewish sages are contained in the books of Job, Proverbs, Psalms, Ben-Sira, Tobit, Ecclesiastes, Wisdom of Solomon, 4th Maccabees, to which may be added the first chapter of Pirke Aboth (a Talmudic tract giving, probably, pre-Christian material). Of these Job, Pss. xlix., lxxiii., xcii. 6-8 (5-7), Eccles., Wisdom, are discussions of the moral government of the world; Prov., Pss. xxxvii., cxix., Ben-Sira, Tob. iv., xii. 7-11, Pirke, are manuals of conduct, and 4th Maccab. treats of the autonomy of reason in the moral life; Pss. viii., xix. 2-7 (1-6), xxix. 3-10, xc. 1-12, cvii. 17-32, cxxxix., cxliv. 3 f., cxlvii. 8 f. are reflections on man and physical nature (cf. the Yahweh addresses in Job, and Ecclus. xlii. 15–xliii. 33). Sceptical views are expressed in Job, Prov. xxx. 2-4 (Agur), Eccles.; the rest take the current orthodox position.

Though the intellectual world of the sages is different from that of the prophetic and legal Hebraism, they do not break with the fundamental Jewish theistic and ethical creeds. Their monotheism remains Semitic—even in their conception of the cosmogonic and illuminating function of Wisdom they regard God as standing outside the world of physical nature and man, and do not grasp or accept the idea of the identity of the human and the divine; there is thus a sharp distinction between their general theistic position and that of Greek philosophy. They retain the old high standard of morals, and in some instances go beyond it, as in the injunctions to be kind to enemies (Prov. xxv. 21 f.) and to do to no man what is hateful to one's self (Tob. iv. 15); in these finer maxims they doubtless represent the general ethical advance of the time.

They differ from the older writers in practically ignoring the physical supernatural—that is, though they regard the miracles of the ancient times (referred to particularly in Wisdom xvi.-xix.) as historical facts, they say nothing of a miraculous element in the life of their own time. Angels occur only in Job and Tobit, and there in noteworthy characters: in Job they are beings whom God charges with folly (iv. 18), or they are mediators between God and man

(v. 1, xxxiii. 23), that is, they are humanized, and the Elohim beings (including the Satan) in the prologue belong to a popular story, the figure of Satan being used by the author to account for Job's calamities; in Tobit the "affable" Raphael is a clever man of the world. Except in Wisdom ii. 24 (where the serpent of Gen. iii. is called "Diabolos"), there is mention of one demon only (Asmodeus, in Tob. iii. 8, 17), and that a Persian figure. Job alone introduces the mythical dragons (iii. 8, vii. 12, ix. 13, xxvi. 12) that occur in late prophetical writings (Amos ix. 3; Isa. xxvii. 1); as the earliest of the Wisdom books, it is the friendliest to supernatural machinery.

Like the prophetical writings before Ezekiel, the Wisdom books, while they recognize the sacrificial ritual as an existing custom, attach little importance to it as an element of religious life (the fullest mention of it is in Ecclus. xxxv. 4 ff., 1); the difference between prophets and sages is that the former do not regard the ritual as of divine appointment (Jer. vii. 22) and oppose it as nonmoral, while the latter, probably accepting the law as divine, by laying most stress on the universal side of religion, lose sight of its local and mechanical side (see Ecclus. xxxv. 1-3). Their broad culture (reinforced, perhaps, by the political conditions of the time) made them comparatively indifferent to Messianic hopes and to that conception of a final judgment of the nations that was closely connected with these hopes: a Messiah is not mentioned in their writings (not in Prov. xvi. 10-15), and a final judgment only in Wisdom of Solomon, where it is not of nations but of individuals. In this regard a comparison between them and Daniel, Enoch and Psalms of Solomon is instructive. Their interest is in the ethical training of the individual on earth.

There was nothing in their general position to make them inhospitable to ethical conceptions of the future life, as is shown by the fact that so soon as the Egyptian-Greek idea of immortality made itself felt in Jewish circles it was adopted by the author of the Wisdom of Solomon; but prior to the 1st century B.C. it does not appear in the Wisdom literature, and the nationalistic dogma of resurrection is not mentioned in it at all. Everywhere, except in the Wisdom of Solomon, the Underworld is the old Hebrew inane abode of all the dead, and therefore a negligible quantity for the moralist. Nor do the sages go beyond the old position in their ethical theory: they have no philosophical discussion of the basis of the moral life; their standard of good conduct is existing law and custom; their motive for right-doing is individual eudaemonistic, not the good of society, or loyalty to an ideal of righteousness for its own sake, but advantage for one's self. They do not attempt a psychological explanation of the origin of human sin; bad thought (*yēṣer ra'*, Ecclus. xxxvii. 3) is accepted as a fact, or its entrance into the mind of man is attributed (Wisd. ii. 24)to the devil (the serpent of Gen. iii.). In fine, they eschew theories and confine themselves to visible facts.

It is in keeping with their whole point of view that they claim no divine inspiration for themselves: they speak with authority, but their authority is that of reason and conscience. It is this definitely rational tone that constitutes the differentia of the teaching of the sages. For the old external law they substitute the internal law: conscience is recognized as the power that approves or condemns conduct (*ψυχή*, Ecclus. xiv. 2; *συνείδησις*, Wisd. Sol. xvii. 11). Wisdom is represented as the result of human reflection, and thus as the guide in all the affairs of life. It is also sometimes conceived of as divine (in Wisd. of Sol. and in parts of Prov. and Ecclus., but not in Eccles.), in accordance with the Hebrew view, which regards all human powers as bestowed directly by God; it is identified with the fear of God (Job xxviii. 28; Prov. i. 7; Ecclus. xv. 1 ff.) and even with the Jewish law (Ecclus. xxiv. 23). But in such passages it remains fundamentally human; no attempt is made to define the limits of the human and the divine in its composition—it is all human and all divine. The personification of wisdom reaches almost the verge of hypostasis: in Job xxviii. it is the most precious of things; in Prov. viii. it is the companion of God in His creative work, itself created before the world; in Ecclus. xxiv. the nationalistic conception is set forth: wisdom, created in the beginning, compasses heaven and earth seeking rest and finds at last its dwelling-place in Jerusalem (and so substantially 4th Maccabees); the height of sublimity is reached in Wisd. of Sol. vii., where wisdom, the brightness of the everlasting light, is the source of all that is noblest in human life.

Greek influence appears clearly in the sages' attitude toward the phenomena of life. God, they hold, is the sole creator and ruler of the world; yet man is free, autonomous—God is not responsible for men's faults (Ecclus. xv. 11-20); divine wisdom is visible in the works of nature and in beasts and man (Job xxxviii. f.; Pss. viii., cxxxix.). On the other hand, there is recognition of the inequalities and miseries of life (Job; Ecclus. xxxiii. 11 ff., xl. 1-11; Eccles.), and, as a result, scepticism as to a moral government of the world. In Job, which is probably the earliest of the philosophical books, the question whether God is just is not definitely answered: the prologue affirms that the sufferings of good men, suggested by the sneer of Satan, are intended to demonstrate the reality of human goodness; elsewhere (v. 17, xxxiii. 17 ff.) they are regarded as disciplinary; the Yahweh speeches declare man's inability to understand God's dealings; the prosperity of the wicked is nowhere explained. The ethical manuals, Prov. (except xxx. 2-4) and Ecclus., are not interested in the question and ignore it; Agur's agnosticism (Prov. xxx. 2-4) is substantially the position of the Yahweh speeches in Job directed against the "unco-wise" of his day. Koheleth's scepticism (in the original form of Ecclesiastes) is deep-seated and far-reaching: though he is a theist, he sees no justice in the world, and looks on human life as meaningless and resultless. For him death is the end-all, and it is against some such view as this that the argument in Wisd. of Sol. ii.-v. is directed. With the establishment of the belief in ethical immortality this phase of scepticism vanished from the Jewish world, not, however, without leaving behind it works of enduring value.

In all the Wisdom books virtue is conceived of as conterminous with knowledge. Salvation is attained not by believing but by the perception of what is right; wisdom is resident in the soul and identical with the thought of man. Yet, with this adoption of the Greek point of view, the tone and spirit of this literature remain Hebrew.

The writings of the sages are all anonymous. No single man appears as creator of the tendency of thought they represent; they are the product of a period extending over several centuries, but they form an intellectual unity, and presuppose a great body of thinkers. The sages may be regarded as the beginners of a universal religion: they felt the need of permanent principles of life, and were able to set aside to some extent the local features of the current creed. That they did not found a universal religion was due, in part at least, to the fact that the time was not ripe for such a faith; but they left material that was taken up into later systems.

LITERATURE.—K. Siegfried, *Philo von Alexandria* (1875); J. Drummond, *Philo Judaeus* (1888); H. Bois, *Origines d. l. phil. Judéo-Alex.* (1890); T. K. Cheyne, *Job and Sol.* (1887) and *Jew. Relig. Life*, &c. (1898). (C. H. T.*)

WISE, HENRY ALEXANDER (1806–1876), American politician and soldier, was born at Drummondtown (or Accomac), Accomack county, Virginia, on the 3rd of December 1806. He graduated from Washington (now Washington and Jefferson) College, Pennsylvania, in 1825, and began to practise law in Nashville, Tennessee, in 1828. He returned to Accomack county, Va., in 1830, and served in the National House of Representatives in 1833–1837 as an anti-nullification Democrat, but broke with the party on the withdrawal of the deposits from the United States Bank, and was re-elected to Congress in 1837, 1839 and 1841 as a Whig, and in 1843 as a Tyler Democrat. From 1844 to 1847 he was minister to Brazil. In 1850–1851 he was a member of the convention to revise the Virginia constitution, and advocated white manhood suffrage, internal improvements, and the abolition of imprisonment for debt. In 1855 he was elected governor of the state (1856–1860) as a Democrat. John Brown's raid occurred during his term, and Wise refused to reprieve Brown after sentence had been passed. He strongly opposed secession, but finally voted for the Virginia ordinance, was commissioned brigadier-general in the Confederate army and served throughout the war. He died at Richmond, Va., on the 12th of September 1876. He wrote *Seven Decades of the Union 1790–1860* (1872).

His son, JOHN SERGEANT WISE (b. 1846), United States attorney for the Eastern District of Virginia in 1881–1883, and a member of the National House of Representatives in 1883–1885, wrote *The End of an Era* (1899) and *Recollections of Thirteen Presidents* (1906).

See the *Life* of H. A. Wise, by his grandson, B. H. Wise (1899).

WISE, ISAAC MAYER (1819–1900), American Jewish theologian, was born in Bohemia, but his career is associated with the organization of the Jewish reform movement in the United States. From the moment of his arrival in America (1846) his influence made itself felt. In 1854 he was appointed rabbi at Cincinnati. Some of his actions roused considerable opposition. Thus he was instrumental in compiling a new prayer-book, which he designed as the "American Rite" (Minhag America). He was opposed to political Zionism, and the Montreal Conference (1897), at his instigation, passed resolutions disapproving of the attempt to establish a Jewish state, and affirming that the Jewish Messianic hope pointed to a great universal brotherhood. In keeping with this denial of a Jewish nationality, Wise believed in national varieties of Judaism, and strove to harmonize the synagogue with local circumstances and sympathies. In 1848 he conceived the idea of a union, and after a campaign lasting a quarter of a century the Union of American Hebrew Congregations was founded (1873) in Cincinnati. As a corollary of this he founded in 1875 the "Hebrew Union College" in the same city, and this institution has since trained a large number of the rabbis of America. Wise also organized various general assemblies of rabbis, and in 1889 established the Central Conference of American Rabbis. He was the first to introduce family pews in synagogues, and in many other ways "occidentalized" Jewish worship.

See D. Philipson, *The Reform Movement in Judaism* (1907). (I. A.)

WISEMAN, NICHOLAS PATRICK STEPHEN (1802–1865), English cardinal, was born at Seville on the 2nd of August 1802, the child of Anglo-Irish parents recently settled in Spain for business purposes. On his father's death in 1805 he was brought to Waterford, and in 1810 he was sent to Ushaw College, near Durham, where he was educated until the age of sixteen, when he proceeded to the English College in Rome, reopened in 1818 after having been closed by the Revolution for twenty years. He graduated doctor of theology with distinction in 1825, and was ordained priest in the following year. He was apppointed vice-rector of the English College in 1827, and rector in 1828 when not yet twenty-six years of age. This office he held until 1840. From the first a devoted student and antiquary, he devoted much time to the examination of oriental MSS. in the Vatican library, and a first volume, entitled *Horae Syriacae*, published in 1827, gave promise of a great scholar. Leo XII. apppointed him curator of the Arabic MSS. in the Vatican, and professor of oriental languages in the Roman university. At this date he had close relations, personal and by correspondence, with Mai, Bunsen, Burgess (bishop of Salisbury), Tholuck and Kluge. His student life was, however, broken by the pope's command to preach to the English in Rome; and a course of his lectures, *On the Connexion between Science and Revealed Religion*, deservedly attracted much attention, his general thesis being that whereas scientific teaching has repeatedly been thought to disprove Christian doctrine, further investigation has shown that a reconstruction is possible. He visited England in 1835–1836, and delivered lectures on the principles and main doctrines of Roman Catholicism in the Sardinian Chapel, Lincoln's Inn Fields, and in the church at Moorfields, now pulled down. Their effect was considerable; and at Pusey's request Newman reviewed them in the *British Critic* (December 1836), treating them for the most part with sympathy as a triumph over popular Protestantism. To another critic, who had taken occasion to point out the resemblance between Catholic and pagan ceremonies, Wiseman replied, boldly admitting the likeness, and maintaining that it could be shown equally well to exist between Christian and heathen doctrines. In 1836 he founded the *Dublin Review*, partly to infuse into the lethargic English Catholics higher ideals of their own religion and some enthusiasm for the papacy, and partly to enable him to deal with the progress of the Oxford Movement, in which he was keenly interested. At this date he was already distinguished as an accomplished scholar and critic, able to converse fluently in half-a-dozen languages, and well informed on most questions of scientific, artistic or antiquarian interest. In the winter of 1838 he was visited in Rome by Macaulay, Manning and Gladstone. An article by him on the Donatist schism appearing in the *Dublin Review* in July 1839 made a great impression in Oxford, Newman and others seeing the force of the analogy between Donatists and Anglicans. Some words he quoted from St Augustine influenced Newman profoundly: "Quapropter securus judicat orbis terrarum bonos non esse qui se dividunt ab orbe terrarum." And preaching at the opening of St Mary's church, Derby, in the same year, he anticipated Newman's argument on religious development, published six years later. In 1840 he was consecrated bishop, and sent to England as coadjutor to Bishop Walsh, vicar-apostolic of the Central district, and was also appointed president of Oscott College near Birmingham. Oscott, under his presidency, became a centre for English Catholics, where he was also visited by many distinguished men, including foreigners and non-Catholics. The Oxford converts (1845 and later) added considerably to Wiseman's responsibilities, as many of them found themselves wholly without means, while the old Catholic body looked on the newcomers with distrust. It was by his advice that Newman and his companions spent some time in Rome before undertaking clerical work in England. Shortly after the accession of Pius IX. Wiseman was appointed temporarily vicar-apostolic of the London district, the appointment becoming permanent in February 1849. On his arrival from Rome in 1847 he acted as informal diplomatic envoy from the pope, to ascertain from the government what support England was likely to give in carrying out the liberal policy with which Pius inaugurated his reign. In response Lord Minto was sent to Rome as "an authentic organ of the British Government," but the policy in question proved abortive. Residing in London in Golden Square, Wiseman threw himself into his new duties with many-sided activity, working especially for the reclamation of Catholic criminals and for the restoration of the lapsed poor to the practice of their religion. He was zealous for the establishment of religious communities, both of men and women, and for the holding of retreats and missions. He preached (4th July 1848) at the opening of St George's, Southwark, an occasion unique in England since the Reformation, 14 bishops and 240 priests being present, and six religious orders of men being represented. The progress of Catholicism was undeniable, but yet Wiseman found himself steadily opposed by a minority among his own clergy, who disliked his Ultramontane ideas, his "Romanizing and innovating zeal," especially in regard to the introduction of sacred images into the churches and the use of devotions to the Blessed Virgin and the Blessed Sacrament, hitherto unknown among English Catholics. In July 1850 he heard of the pope's intention to create him a cardinal, and he took this to mean that he was to be permanently recalled to Rome. But on his arrival there he ascertained that a part of the pope's plan for restoring a diocesan hierarchy in England was that he himself should return to England as cardinal and archbishop of Westminster. The papal brief establishing the hierarchy was dated 29th September 1850, and on 7th October Wiseman wrote a pastoral, dated "from out of the Flaminian Gate"—a form diplomatically correct, but of bombastic tone for Protestant ears—in which he spoke enthusiastically, if also a little pompously, of the "restoration of Catholic England to its orbit in the ecclesiastical firmament." Wiseman travelled slowly to England, round by Vienna; and when he reached London (11th November) the whole country was ablaze with indignation at the "papal aggression," which was misunderstood to imply a new and unjustifiable claim to territorial rule. Some indeed feared that his life was endangered by the violence of popular feeling. But Wiseman displayed calmness and courage, and immediately penned an admirable *Appeal to the English People* (a pamphlet of over 30 pages), in which he explained the nature of the pope's action, and argued that the admitted principle of toleration included leave to establish a diocesan hierarchy; and in his concluding paragraphs he effectively contrasted that dominion over Westminster, which he was taunted with claiming, with his duties towards the poor Catholics resident there, with which alone he was really concerned. A course of lectures at St George's, Southwark, further moderated the storm. In July 1852 he presided at Oscott over the first provincial synod of Westminster, at which Newman preached his sermon on the "Second Spring"; and at this date Wiseman's dream of the rapid conversion of England to the ancient faith seemed not incapable of realization. But many difficulties with his own people shortly beset his path, due largely to the suspicions aroused by his evident preference for the ardent Roman zeal of the converts, and especially of Manning, to the dull and cautious formalism of the old Catholics. The year 1854 was marked by his presence in Rome at the definition of the dogma of the immaculate conception of the Blessed Virgin (8th December), and by the publication of his historical romance, *Fabiola*, a tale of the Church of the Catacombs, which had a very wide circulation and was translated into ten languages. In 1855 Wiseman applied for a coadjutor, and

George Errington, bishop of Plymouth, his friend since boyhood, was appointed, with the title of archbishop of Trebizond. Two years later Manning was appointed provost of Westminster and he established in Bayswater his community of the "Oblates of St Charles." All Wiseman's later years were darkened by Errington's conscientious but implacable hostility to Manning, and to himself in so far as he was supposed to be acting under Manning's influence. The story of the estrangement, which was largely a matter of temperament, is fully told in Ward's biography. Ultimately, in July 1860, Errington was deprived by the pope of his coadjutorship with right of succession, and he retired to Prior Park, near Bath, where he died in 1886. In the summer of 1858 Wiseman paid a visit to Ireland, where, as a cardinal of Irish race, he was received with enthusiasm. His speeches, sermons and lectures, delivered during his tour, were printed in a volume of 400 pages, and show an extraordinary power of rising to the occasion and of speaking with sympathy and tact. Wiseman was able to use considerable influence with English politicians, partly because in his day English Catholics were wavering in their historical allegiance to the Liberal party. As the director of votes thus doubtful, he was in a position to secure concessions that bettered the position of Catholics in regard to poor schools, reformatories and workhouses, and in the status of their army chaplains. In 1863, addressing the Catholic Congress at Malines, he stated that since 1830 the number of priests in England had increased from 434 to 1242, and of convents of women from 16 to 162, while there were 55 religious houses of men in 1863 and none in 1830. The last two years of his life were troubled by illness and by controversies in which he found himself, under Manning's influence, compelled to adopt a policy less liberal than that which had been his in earlier years. Thus he had to condemn the Association for the Promotion of the Unity of Christendom, with which he had shown some sympathy in its inception in 1857; and to forbid Catholic parents to send their sons to Oxford or Cambridge, though at an earlier date he had hoped (with Newman) that at Oxford at least a college or hall might be assigned to them. But in other respects his last years were cheered by marks of general regard and admiration, in which non-Catholics joined; and after his death (16th February 1865) there was an extraordinary demonstration of popular respect as his body was taken from St Mary's, Moorfields, to the cemetery at Kensal Green, where it was intended that it should rest only until a more fitting place could be found in a Roman Catholic cathedral church of Westminster. On the 30th of January 1907 the body was removed with great ceremony from Kensal Green and reburied in the crypt of the new cathedral, where it lies beneath a Gothic altar tomb, with a recumbent effigy of the archbishop in full pontificals.

Wiseman was undoubtedly an eminent Englishman, and one of the most learned men of his time. He was the friend and correspondent of many foreigners of distinction, among whom may be named Döllinger, Lamennais, Montalembert and Napoleon III. As a writer he was apt to be turgid and prolix, and there was a somewhat un-English element of ostentation in his manner. But his accomplishments and ability were such as would have secured for him influence and prominence in any age of the Church; and besides being highly gifted intellectually and morally, he was marked by those specially human qualities which command the interest of all students of life and character. He combined with the principles known as Ultramontane no little liberality of view in matters ecclesiastical. He insisted on a poetical interpretation of the Church's liturgy; and while strenuously maintaining her Divine commission to teach faith and morals, he regarded the Church as in other respects a learner; and he advocated a policy of conciliation with the world, and an alliance with the best tendencies of contemporary thought. It was, in his judgment, quite in accordance with the genius of the Catholic Church that she should continuously assimilate all that is worthy in the civilization around.

See the biography by Wilfrid Ward, *The Life and Times of Cardinal Wiseman* (2 vols., 1897; fifth and cheaper edition, 1900). (A. W. Hu.)

WISHART, GEORGE (*c.* 1513–1546), Scottish reformer, born about 1513, belonged to a younger branch of the Wisharts of Pitarrow. His early life has been the subject of many conjectures; but apparently he graduated M.A., probably at King's College, Aberdeen, and taught as a schoolmaster at Montrose. Accused of heresy in 1538, he fled to England, where a similar charge was brought against him at Bristol in the following year. In 1539 or 1540 he started for Germany and Switzerland, and returning to England became a member of Corpus Christi College, Cambridge. In 1543 he went to Scotland in the train of a Scottish embassy which had come to London to consider the treaty of marriage between Prince Edward and the infant queen of Scots. There has been much controversy whether he was the Wishart who in April 1544 approached the English government with a proposal for getting rid of Cardinal Beaton. Roman Catholic historians such as Bellesheim, and Anglicans like Canon Dixon, have accepted the identification, while Froude does not dispute it and Dr Gairdner avoids committing himself (*Letters and Papers of Henry VIII*. vol. xix. pt. i., Introd. pp. xxvii-xxviii). There was another George Wishart, bailie of Dundee, who allied himself with Beaton's murderers; and Sir John Wishart (d. 1576), afterwards a Scottish judge, has also claims to the doubtful distinction. Sir John was certainly a friend of Creighton, laird of Branston, who was deeply implicated in the plot, but Creighton also befriended the reformer during his evangelical labours in Midlothian. The case against the reformer is not proven and is not probable.

His career as a preacher began in 1544, and the story has been told in glowing colours by his disciple John Knox. He went from place to place in peril of his life denouncing the errors of Rome and the abuses in the church at Montrose, Dundee, Ayr, in Kyle, at Perth, Edinburgh, Leith, Haddington and elsewhere. At Ormiston, in December 1545, he was seized by the earl of Bothwell, and transferred by order of the privy council to Edinburgh castle on January 19, 1546. Thence he was handed over to Cardinal Beaton, who had him burnt at St Andrews on March 1. Foxe and Knox attribute to him a prophecy of the death of the Cardinal, who was assassinated on May 29 following, partly at any rate in revenge for Wishart's death.

Knox's *Hist.*; Reg. P.C. Scotland; Foxe's *Acts and Monuments*; Hay Fleming's *Martyrs and Confessors of St Andrews*; Cramond's *Truth about Wishart* (1898); and *Dict. of Nat. Biogr.* vol. lxii. (248-251, 253-254). (A. F. P.)

WISHAW, a municipal and police burgh of Lanarkshire, Scotland. Pop. (1901) 20,873. It occupies the face of a hill a short distance south of the South Calder and about 2 m. N. of the Clyde, 15 m. E.S.E. of Glasgow by the Caledonian railway. It owes its importance to the development of the coal and iron industry, and was created a police burgh in 1855. It was extended to include the villages of Cambusnethan and Craigneuk in 1874. The chief public buildings are the town-hall, Victoria hall, the public library and the parish hall, and there is also a public park.

WISLICENUS, JOHANNES (1835–1902), German chemist, was born on the 24th of June 1835 at Klein-Eichstedt, in Thuringia. In 1853 he entered Halle University, but in a few months emigrated to America with his father. For a time he acted as assistant to Professor E. N. Horsford at Harvard, and in 1855 was appointed lecturer at the Mechanics' Institute in New York. Returning to Europe in 1856, he continued his studies at Zürich University, where nine years later he became professor of chemistry. This post he held till 1872. He then succeeded A. F. L. Strecker in the chair of chemistry at Würzburg, and in 1885, on the death of A. W. H. Kolbe, was appointed to the same professorship at Leipzig, where he died on the 6th of December 1902. As an original investigator he devoted himself almost exclusively to organic chemistry, and especially to stereochemistry. His work on the lactic acids cleared up many difficulties concerning the combination of acid and alcoholic properties in oxy-acids in general, and resulted in the discovery of two substances differing in physical properties though possessing a structure of proved chemical identity. To this phenomenon, then noticed for the first time, he gave the name of "geometrical isomerism." So far back as 1869, before the publication of the doctrine of J. H. van't Hoff and J. A. Le Bel, he expressed the opinion that the ordinary constitutional formulae did not afford an adequate explanation of certain carbon compounds, and suggested that account must be taken of the *verschiedene Lagerung ihrer Atome im Raume*. Later (see *Die räumliche Anordnung der Atome in organischen Molekülen*, 1887) he extended the application of the van't Hoff-Le Bel theory, believing that it, together with the supposition that there are "specially directed forces, the affinity-energies," which determine the relative position of atoms in the molecule, afforded a method by which the spatial arrangement of atoms in particular cases may be ascertained by experiment. Wislicenus is also known for his work on aceto-acetic ester and its application as a synthetical agent. He was awarded the Davy medal by the Royal Society in 1898.

WISMAR, a seaport town of Germany, in the grand-duchy of Mecklenburg-Schwerin, situated on the Bay of Wismar, one of the best harbours on the Baltic, 20 m. by rail N. of Schwerin. Pop. (1905) 21,902. The town is well and regularly built, with broad and straight streets, and contains numerous handsome and quaint buildings in the northern Gothic style. The church of St Mary, a Gothic edifice of the 13th and 14th centuries, with a tower 260 ft. high, and the church of St Nicholas (1381–1460), with very lofty vaulting, are regarded as good examples of the influence exercised in these northern provinces by the large church of St Mary in Lübeck. The elegant cruciform church of St George dates from the 14th and 15th centuries. The Fürstenhof, at one time a ducal residence, but now occupied by the municipal authorities, is a richly decorated specimen of the Italian early Renaissance style. Built in 1552–1565, it was restored in 1877–1879. The "Old School," dating from about 1300, has been restored, and is now occupied as a museum. The town hall (rebuilt in 1829) contains a collection of pictures. Among the manufactures of Wismar are iron, machinery, paper, roofing-felt and asphalt. There is a considerable trade, especially by sea, the exports including grain, oil-seeds and butter, and the imports coal, timber and iron. The harbour is deep enough to admit vessels of 17-ft. draught, and permits large steamers to unload along its quays. Two miles from Wismar lies the watering-place of Wendorf.

Wismar is said to have received civic rights in 1229, and came into the possession of Mecklenburg in 1301. In the 13th and 14th centuries it was a flourishing Hanse town, with important woollen factories. Though a plague carried off 10,000 of the inhabitants in 1376, the town seems to have remained tolerably prosperous until the 16th century. By the peace of Westphalia in 1648 it passed to Sweden, with a lordship to which it gives its name. In 1803 Sweden pledged both town and lordship to Mecklenburg for 1,258,000 thalers, reserving, however, the right of redemption after 100 years. In view of this contingent right of Sweden, Wismar was not represented in the diet of Mecklenburg until 1897. In 1903 Sweden finally renounced its claims. Wismar still retains a few relics of its old liberties, including the right to fly its own flag.

See Burmeister, *Beschreibung von Wismar* (Wismar, 1857); Willgeroth, *Geschichte der Stadt Wismar*, pt. i. (Wismar, 1898); and Bruno Schmidt, *Der Schwedisch-mecklenburgische Pfandvertrag über Stadt und Herrschaft Wismar* (Leipzig, 1901).

WITAN, or WITENAGEMOT (from O. Eng. *wita*, pl. *witan*, a wise man, and *gemôt*, a meeting, from O. Eng. *mêtan*, to meet), the national council in England in Anglo-Saxon times. Its origin is obscure. There is some resemblance between it and the two assemblies mentioned by Tacitus in the *Germania*, a larger and a smaller one, but this analogy must not be pressed too far. In Anglo-Saxon England in the 7th and 8th centuries it seems certain that each of the larger kingdoms, Kent, Wessex, Mercia and Northumbria, had its separate witan, or council, but there is a difference of opinion as to whether this was identical with, or distinct from, the folkmoot, in which, theoretically at least, all freemen had the right to appear. H. R. von Gneist (*History of the English Constitution*) agrees that the two assemblies were identical, and a somewhat similar view is put forward by J. M. Kemble (*Saxons in England*) and E. A. Freeman (*History of the Norman Conquest*). Freeman advances the theory that the right of all the freemen to attend the *gemôt* had for practical purposes fallen into disuse, and thus the assembly had come to be confined to the wise men. In other words, the folkmoot had become the witan. Evidence in support of this view is sought for in the accounts in the *Anglo-Saxon Chronicle* and elsewhere, where the decisions of the witan were received with loud expressions of approval or of disapproval by an assembled crowd, and it is argued that this is a survival from an earlier age, when all the freemen attended the witan. But the attendance of the crowd can be otherwise explained. The meetings referred to were probably those of exceptional interest, such as the election or the coronation of a king, and people from the neighbourhood were there merely as interested, and sometimes excited, spectators. The contrary opinion, that the two assemblies were distinct, is held, although with characteristic caution, by Stubbs (*Const. Hist.* vol. i.). He thinks that on the union of the kingdoms the witans were merged into one another, while the folkmoot became the shiremoot. As the number of kings decreased the number of witans decreased, until early in the 9th century there was one king and one witan in all England.

The power of the witan varied according to the personality of the reigning king, being considerable under a weak ruler, but inconsiderable under a strong one. Generally speaking, it diminished as the years went by, and from "necessary assenters" its members became "merely attesting witnesses." Its duties are shown by the preamble to the laws of Ine, king of Wessex, and 200 years later by the preamble to those of Alfred the Great, while several similar cases could be instanced. Ine legislates "with the counsel and with the teaching of Cenred my father and of Hedde my bishop, and of Eorcenwald my bishop, with all my ealdormen and the most distinguished witan of my people" (Stubbs, *Select Charters*), and Alfred issues his code of laws "with the counsel and consent of his witan." Thus the members of the witan were primarily counsellors. With their consent the king promulgated laws, made grants of land, appointed bishops and ealdormen, and discharged the other duties of government. The witan was also a court of justice, Earl Godwine and many other offenders receiving sentence of outlawry therein. Its members had the power of electing a new king, although the area of their choice was strictly limited by custom and also the right of deposing a king, although this seems to have been infrequently exercised.

Its members signed the charters by which the king conveyed grants of land to churches and to individuals, and it is from the extant charters that we mainly derive our knowledge about the composition of the witan. It consisted, in addition to the king, his sons and other relatives, of the bishops and later some abbots, of some under-kings and the ealdormen of the shires or provinces, and of a number of *ministri*, or king's thegns. These *ministri* were nominees of the king; they included the important members of his household, and their number gradually increased until it outstripped that of all the other members. The witan appears probably to have had no fixed place of meeting, and to have assembled around the person of the king, wherever he might be. In the later years of its existence, at least, it met three times a year, at Easter, Whitsuntide and Christmas. The number of counsellors attending the meetings of the witan varied considerably from time to time. "In a witenagemot held at Luton in November A.D. 931 were the two archbishops, two Welsh princes, seventeen bishops, fifteen ealdormen, five abbots and fifty-nine ministri. In another, that of Winchester of A.D. 934, were present the two archbishops, four Welsh kings, seventeen bishops, four abbots, twelve ealdormen and fifty-two ministri. These are perhaps the fullest extant lists. Of Edgar's witenagemots, the one of A.D. 966 contained the king's mother, two archbishops, seven bishops, five ealdormen and fifteen ministri; and this is a fair specimen of the usual proportion" (Stubbs, *Const. Hist.* ch. vi.). Almost immediately after the Norman Conquest the word fell into disuse.

See also D. J. Medley, *English Constitutional History* (1907); H. M. Chadwick, *Studies on Anglo-Saxon Institutions* (1905); and the article PARLIAMENT. (A. W. H.*)

WITCH and **WIZARD.** These two words are now generally used of an adept of the black art, a sorcerer, magician, female and male respectively (see Magic and Witchcraft). "Witch," formerly of common gender, represents O. Eng. *wicca* (masc.), *wicce* (fem.), agent-nouns to *wiccian*, to practise sorcery, probably a causative verb from O. Eng. *wican*, to give way (cf. "weak"), and therefore signifying to avert (evil), conjure away So Norweg. *vikja* means (1) to turn aside, (2) to exorcise. The participial "wicked" means witch-like. "Wizard" is formed from "wise," with the slightly contemptuous Anglo-French suffix *-ard*, as in drunkard, laggard, sluggard, &c.

WITCH BROOMS, or "Birds' Nests," in botany, peculiar broom-like growths often seen on the branches of many trees. They are a dense development of branching twigs formed at one place on a branch as the result of the irritation set up by the presence of a mite or a fungus.

WITCHCRAFT, a term often used of magical practices of all sorts, but here confined to the malevolent ("black") magic of women. It should, however, be noted that the male witch occasionally appears in folklore, while "white witchcraft" is common; the practices of the witch of Endor are akin rather to spiritualism than witchcraft. The German term *hexe* was not originally applied to human beings at all, but to child-devouring demons, corresponding to the Roman *lamia*; and it is used in this sense till the 14th century, it does not appear in literature in its present sense till some time in the 13th century.

The modern European conception of the witch is perhaps the result of the fusion of several originally discrete ideas. In some countries we find the distinction made between conjurers, witches and sorcerers; the former were supposed to raise the devil by means of spells and force him to do their will; the witch proceeded by way of friendly pact with an evil spirit; a third class produced strange effects, without the aid of spirits (see Magic), by means of images or forms of words. We also find a distinction drawn between diviners, *mathematici* (=astrologers), crystal-gazers, necromancers and others; but it must be remembered that our knowledge for the earlier period is rather of learned ideas than of the actual popular beliefs, and for the later period of the popular belief sophisticated by ecclesiastical subtleties. In present-day belief the witch is, like the savage magician, initiated by another or herself performs ceremonies believed to give her magical powers. She possesses a familiar (see Lycanthropy; Magic), whose form she can assume; she can ride through the air in some cases and is equally adept at all kinds of magic. Sir A. C. Lyall maintains that the witch is a person who works magic by her own powers, not by the aid and counsel of supernatural beings; but this view, though it may be true of poisoning and similar features formerly reckoned a part of witchcraft, does not apply to the European witch. Witchcraft and possession are found in close relation in the psychical epidemics of the middle ages, but are otherwise unrelated.

Witchcraft among Primitive Peoples.—Although magical powers are everywhere attributed to women, witchcraft as here defined is by no means universal; in Europe alone is the woman the almost exclusive repository of magical powers; in the Congo the *muntu ndongo* may be either a man or a woman, and in fact the sexes are said to be engaged in magical pursuits in approximately equal numbers; in Australia men are much more concerned with magic than women, but the latter have certain forms peculiar to themselves in the central area, and, as in medieval Europe, it is largely concerned with sexual matters. At the present day the European witch is almost invariably old, but this is not characteristic of the female magician of primitive peoples, or not to the same extent; it must be remembered that the modern idea of witchcraft is largely a learned product—the result of scholastic and inquisitorial ingenuity, mingled to a greater or less extent with genuine folk beliefs. In India, among the Agariyas of Bengal, the instruction in witchcraft is given by the old women; but the pupils are young girls. The Indian witch is believed to have a cat familiar; there, as in Europe, many tests are applied to witches; they may be thrown into water, or their identity discovered by various forms of divination; or they may be known by the fact that beating them with the castor oil plant makes them cry out. As a punishment the witch may be shaved, made to drink dirty water, or otherwise ill-used.

Witchcraft in Classical Times.—Our knowledge of witchcraft in pagan antiquity is slight, but Horace has left us an elaborate description of the proceedings of two witches in the Esquiline cemetery. At the new moon they steal into it to gather bones and noxious herbs, their feet bare, their hair loose and their robes tucked up. So far from aiming at secrecy, however, they alarm their neighbours with their cries. Making a hollow in the ground they rend a black lamb over it to summon the dead. Then taking two images, one of wool representing a witch, one of wax representing the man whose infidelity she wishes to punish, a witch performs magical ceremonies; the moon turns red, hell hounds and snakes glide over the spot. Then they bury the muzzle of a wolf and burn the waxen image; as it melts, so fades the life of its prototype. In Greece Thessalian women had the reputation of being specially powerful witches; their poisons were famous and they were said to be able to make the moon descend from the sky.

Medieval Witchcraft.—We know less of early and medieval witchcraft than of modern savage and popular beliefs; our knowledge of it is drawn partly from secular sources—the laws against, and in later times the trials for the offence—partly from ecclesiastical sources; but in each case the popular creed is filtered through the mind of a writer who did not necessarily understand or share the belief. For the earlier period we have penitentials, decisions of councils, discussions as to the possibility of the various kinds of witchcraft, as to their exact relation to the sin of heresy or as to the mechanism by which the supposed results were achieved; at a later period the trials of witches before the Inquisition are of great importance; but the beliefs of this period must be sharply distinguished from those of the earlier one. Finally we have a great mass of material in the secular trials of the 16th and two following centuries.

There are marked differences in the character of the witchcraft beliefs of different countries, due perhaps in part to the influence of the Inquisition, which reacted on the popular conceptions, in part to real differences in the original folk beliefs. In northern countries the witches' Sabbath never seems to assume any importance; in Germany, in the form of the Brocken assembly on May Eve, it is a prominent feature, and in England we may bring it into relation with the belief that at certain periods of the year demons and spirits are abroad and have special powers; in south Europe the idea of the Sabbath seems to owe much of its prominence to the association of witchcraft with heresy and the assemblies of the Waldenses and others. Again, the "evil eye" (*q.v.*) is especially associated with the south of Europe; and the "ligature" (production of impotence by magical means, often only with reference to a specified individual) has always played a far larger part in the conception of witchcraft than it has in the less amorous northern climes, and it is doubtless due to this in great part that woman in this part of Europe is so prominent in magic; in the north, on the other hand, we find the storm-raising woman, hardly yet extinct in the north of Scotland, already famous in pre-Christian times; we may perhaps connect the importance of woman in Germany in part with the conception of the Wild Hunt and the spirits who fly by night, though doubtless other factors played their part.

Development of Ideas.—In the history of European witchcraft we may distinguish three periods: (1) down to A.D. 1230, in which the real existence of some or even all kinds of magic is doubted, and the various species are clearly held asunder in secular and ecclesiastical writings; (2) from 1230 to 1430, during which, under the influence of scholasticism, the doubts as to the possibility and reality of witchcraft gradually vanish, while side by side with this theoretical development the practice of the Inquisition instils the new conception into the popular mind and produces the impression that a great recrudescence of witchcraft was in progress; (3) from 1430 onwards the previously disparate conceptions became fused, at any rate in literature, and we reach the period of witch persecution, which did not come to an end till the 17th or even the 18th century.

In the first of these three periods we find (1) the conception of the *malefica*, who, in common with her male counterpart, uses poison, spells and waxen images, produces tempests, works by means of the evil eye and is regarded as the cause of impotence, a feature which continually called the attention of theologians and jurists to the question of magic by the problems raised by suits for divorce or nullity of marriage. (2) Side by side with her, we find, this time without a male counterpart, the *striga*, frequently embodying also the ideas of the *lamia* and *larva*; originally she is a female demon, in bird form (and in many parts of the world female demons are specially malignant), who flies by night, kills children or even handsome young men, in order to eat them, assumes animal form, sometimes by means of an ointment, or has an animal familiar, rides on a besom, a piece of wood or an animal, and is sometimes brought into connexion with the souls of the dead. This latter feature arises from the gradual fusion of the belief in the *striga*, the *Unholde*, with the kindly suite of Frau Holde, the souls for whom the *tabulae fortunae* were spread. The flight through the air is so common a feature in the savage creed that the demon-idea of the *striga* in Europe can hardly be a genuine folk-belief; or, if it is, it must have existed side by side with a similar witch-belief, of which no traces seem to exist in the earlier literature. The same remark applies to belief in transformation. Although the development of the sexual element is mainly of later date and contemporaneous with the evolution of the Sabbath idea, the *concubitus daemonum* was certainly not unknown to the period before 800. This intrusion of the incubus in the domain of witchcraft was probably due to the attitude of the church towards magic.

Ecclesiastical and Civil Law.—For the attitude of the church to witchcraft there are three factors to be considered: (1) the Biblical recognition of its reality; (2) the universal belief in demons and magic; and (3) the identification of these demons with heathen deities. The orthodox view fluctuates between the theory that witchcraft is idolatry, a recognition of real powers, and that it is disobedience, a superstitious following of non-existent gods. The Biblical conception of a witch is a person who deals with familiar spirits (Lev. xx. 20), and the express provision that a witch should not be suffered to live (Ex. xxii. 18) could have left no doubt that the crime was a real one in the Mosaic law. Although the familiar plays but a small part in this early period, we find that the church early came to the conclusion that witchcraft depended on a compact with demons; in the synod of Elvira (A.D. 306) it was pronounced to be one of the three canonical sins—apostasy—and punished by the refusal of communion, even on the death-bed. Augustine lays down (*De doct. chr.* II. xx.) that witchcraft depends on a pact with the devil; at Worms in A.D. 829 the Frankish bishops declared that the devil aided both sexes to prepare love potions, to cause storms and to abstract milk, fruits of the field, &c.

It must not, however, be supposed that all kinds of witchcraft were equally recognized. The *inmissores tempestatum* and the poisoners by magical means were commonly recognized as real; but the *striga* was usually regarded as a pure superstition. An Irish synod (*c.* A.D. 800) pronounces a Christian to be anathema, who ventures to believe in the possibility of flight through the air and blood-sucking; Stephen of Hungary (997–1038) likewise distinguishes the *malefica* from the *striga*; Regino of Prüm (*c.* 906) concludes that the flight by night with the devil and the goddess Diana is a delusion, the work of the devil. Burchard of Worms (d. 1025) prescribes two years' penance for the belief that the *Unholde* kill Christians, cook them and eat their hearts, which they replace by a piece of wood, and then wake them. Agobard and others even express doubts as to the reality of weather-making. For those who took this view, and even for others who, like John of Damascus, accepted the *striga*, a mild attitude, in strong contrast to the later persecutions, was the accepted policy. The Synod of Reisbach (799) demands penance for witchcraft, but no punishment in this life. John of Damascus, Agobard, John of Salisbury and Burchard are equally mild.

For the church witchcraft was a canonical sin, or superstition; for the civil law it was a violation of the civil rights of others, so far as real results were produced. Consequently we find the legal distinction between the *malefica* and the *striga* is equally marked. The Frankish and Alemannish laws of A.D. 500–600 accept the former but regard the latter as mere superstition. The Lex Salica indeed punished the *striga* as a murderess, but only exacted wergeld. Rothar forbade judges to kill the *striga*, and Charlemagne even punished the belief in them. The Alemanni (A.D. 600) forbade private torture of women suspected of witchcraft or strigism. But although witchcraft was criminal, and we find occasional laws against *sortiariae* (Westfranks, A.D. 873), or expulsions (from Pomerania, 1124, &c.), in this period the crime is unimportant save where *maleficium* is combined with treason and the person of the king is aimed at.

Further Development.—In the second period (1230–1430) we have to deal with two factors of fundamental importance: (1) the elaboration of demonology and allied ideas by the scholastics, and (2) the institution of the Inquisition to deal with the rising flood of heresy. At the beginning of this era the prevalent view of the *striga* seems to have been that she really existed; Caesar of Heisterbach (*c.* 1225) recognizes the female monster who kills children; William of Paris (*c.* 1230) agrees that *lamiae* and *strigae* eat children, but they are allied to the *dominae nocturnae*; that they are real women is a foolish belief. Scholastic ingenuity, however, soon disposed of rationalistic objections to human flights through the air; the ride of disembodied spirits, led by the devil, Diana, Herodias (the Aradia of modern Italy), &c., became the assemblies of witches to do homage to the devil. But this fusion was not the work of the scholastics alone; for the church, witchcraft had long consisted in the recognition of demons. The new sects, especially the Cathars, who held that the influence of the devil had perverted the teachings of Christianity, were, like the early Christians, the object of unfounded charges, in this case of worship of the devil; this naturally led to the belief that they were given to witchcraft.

From the 7th century onwards women and priests figure largely in the accusations of witchcraft, the latter because their office made the canonical offence more serious, the former because love potions, and especially *impotentia ex maleficio*, are the weapons of the female sex. With the rise and development of the belief in the heretics' Sabbath, which first appears early in the 11th century, another sexual element—the *concubitus daemonum*—began to play its part, and soon the predominance of woman in magic was assured. In 1250 certain bishops gave to the Dominican Etienne de Bourbon (Stephanus de Borbone, d. *c.* 1261) a description of the Sabbath; and twenty-five years later the Inquisition took cognisance of the first case of this kind; from the 14th century onwards the idea was indissolubly connected with witchcraft.

In the first half of this second period, witchcraft was still superstition for the canon law, a civil wrong for the secular law; later, although these ideas still persisted, all magic was held to be heresy; its reality and heretical nature was expressly maintained by Thomas Aquinas. Already in 1258 the inquisitors took cognisance of magic as heresy, and from 1320 onwards there was a great increase in the number of cases. At first the witch was handed over to the secular arm for execution, either as an obstinate heretic or as the worker of evil magic; later it was found necessary to make provision for the numerous cases in which the offender abjured; it was decided that repentance due to fear did not release the witch from the consequences of her heresy.

Towards the end of the second period the jurisdiction passed in France from the spiritual to the secular courts by a decision of the parlement of Paris in 1391. The inquisitors did not, however, resign their work, but extended their sphere of operations; the great European persecution from 1434 to 1447 was ecclesiastical as well as secular. In the third period (1430 onwards) the opening of which is marked by this attempt to root out witchcraft, we find that the work of the scholastics and inquisitors has resulted in the complete fusion of originally distinct ideas and the crystallization of our modern idea of witch. To the methods of the inquisitors must be ascribed in great part the spread of these conceptions amongst the people; for the *Malleus Maleficarum* or Inquisitor's Manual (1489), following closely on the important bull *Summis desiderantes affectibus* (Innocent VIII., 1484), gave them a handbook from which they plied their tortured victims with questions and were able to extract such confessions as they desired; by a strange perversion these admissions, wrung from their victims by rack or thumb-screw, were described as voluntary.

The subsequent history of witchcraft may be treated in less detail. In England the trials were most numerous in the 17th century; but the absence of judicial torture made the cases proportionately less numerous than they were on the European continent. One of the most famous witch-finders was Matthew Hopkins, himself hanged for witchcraft after a career of some three years. Many of his methods were not far removed from actual torture; he pricked the body of the witch to find anaesthetic areas; other signs were the inability to shed tears, or repeat the Lord's Prayer, the practice of walking backwards or against the sun, throwing the hair loose, intertwining the fingers, &c. Witches were also weighed against the Bible, or thrown into water, the thumbs and toes tied crosswise, and those who did not sink were adjudged guilty; a very common practice was to shave the witch, perhaps to discover insensible spots, but more probably because originally the familiar spirit was supposed to cling to the hair. The last English trial for witchcraft was in 1712, when Jane Wenham was convicted, but not executed. Occasional cases of lynching continue to occur, even at the present day.

In Scotland trials, accompanied by torture, were very frequent in the 17th century. A famous witch-finder was Kincaid. The last trial and execution took place in 1722.

In New England there was a remarkable outburst of fanaticism—the famous Salem witchcraft delusion—in 1691–1692; but many of the prisoners were not convicted and some of the convicts received the governor's pardon (see SALEM, MASS.).

On the continent of Europe the beginning of the 16th century saw the trial of witchcraft cases taken out of the hands of the Inquisition in France and Germany, and the influence of the *Malleus* became predominant in these countries. Among famous continental trials may be mentioned that of a woman named Voisin in 1680, who was burnt alive for poisoning, in connexion with the Marquise de Brinvilliers. Trials and executions did not finally cease till the end of the 18th century. In Spain a woman was burnt in 1781 at Seville by the Inquisition; the secular courts condemned a girl to decapitation in 1782; in Germany an execution took place in Posen in 1793. In South America and Mexico witch-burning seems to have lasted till well on into the second half of the 19th century, the latest instance apparently being in 1888 in Peru.

The total number of victims of the witch persecutions is variously estimated at from 100,000 to several millions. If it is true that Benedict Carpzov (1595–1666) passed sentence on 20,000 victims, the former figure is undoubtedly too low.

Rise of the Critical Spirit.—It is commonly assumed and has been asserted by Lecky that the historical evidence for witchcraft is vast and varied. It is true that a vast amount of authority for the belief in witchcraft may be quoted; but the testimony for the occurrence of marvels is small in quantity, if we except the valueless declaration of the victims of torture; testimony as to the pathological side of witchcraft is abundant, but affords no proof of the erroneous inferences drawn from the genuine phenomena. If this uncritical attitude is found in our own day, it is not surprising that the rationalistic spirit was long in making its appearance and slow in gaining the victory over superstition. From the 15th century onwards the old view that transformation and transportation were not realities but delusions, caused directly by the devil, began to gather force. Among the important works may be mentioned Johann Weier's *De Praestigiis Daemonum* (1563), Reginald Scott's (*c.* 1538–1590) *Discovery of Witchcraft* (1584) which was ordered to be burnt by King James I., who had himself replied to it in his *Daemonologie* (1597), Balthasar Bekker's *Betooverde Wereld* (1691), which, though it went farther in the direction of scepticism, had less influence than Friedrich v. Spee's *Cautio criminalis* (1631). In France Jean Uvier defended the rationalistic view, and Jean Bodin demanded that he should be sent to the stake for his temerity.

Psychology of Witchcraft.—Although at the height of the witch persecution torture wrung from innocent victims valueless confessions which are at best evidence that long-continued agony of body may be instrumental in provoking hallucinations, there can be no doubt that witches commonly, like the magician in lower planes of culture, firmly believe in their own powers, and the causes of this seem to be not merely subjective. (1) Ignorance of the effects of suggestion leads both the witch and others to regard as supernormal effects which are really due to the victim's belief in the possibility of witchcraft. This applies especially to cases of "ligature." (2) Telepathy (*q.v.*) seems in some cases to play a part in establishing the witch's reputation; some evidence has been produced that hypnotism at a distance is possible, and an account of her powers given by a French witch to Dr Gibotteau suggests that this element cannot be neglected in appraising the evidence for witchcraft. (3) Whatever be the real explanation of the belief in poltergeists (*q.v.*) and "physical phenomena" (*q.v.*), the belief in them rests on a very different basis from that of the belief in lycanthropy; exaggeration and credulity alone will not explain how these phenomena come to be associated with witchcraft. On the other hand, subjective causes played their part in causing the witch to believe in herself. (4) Auto-suggestion may produce hallucinations and delusions in otherwise sane subjects; and for those who do not question the reality of witchcraft this must operate powerfully. (5) The descriptions of witches show that in many cases their sanity was more than questionable; trance and hysteria also played their part. (6) It is uncertain to what extent drugs and salves have helped to cause hallucination; but that they had some share seems certain, though modern experimenters have been led to throw doubt on the alleged effects of some of the drugs; here too, however, the effects of suggestion must be reckoned with; we do not associate the use of tobacco with hallucinations, but it was employed to produce them in Haiti in the same way as hemp among the Bantu of the present day. (7) Hallucinations occurring under torture must have tended to convince bystanders and victims alike, no less than the acceptance of suggestions, positive and negative.

As regards the nature of the ideas accepted as a result of suggestion or auto-suggestion, they were on the one hand derived, as we have seen, from ecclesiastical and especially scholastic sources; but beneath these elements is a stratum of popular belief, derived in the main perhaps from pagan sources, for to this day in Italy witchcraft is known as *la vecchia religione*, and has been handed down in an unbroken tradition for countless generations.

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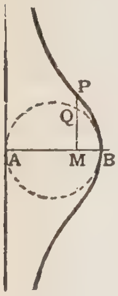
WITCH-HAZEL, in botany, the common name for a North American shrub, *Hamamelis virginica*, known in gardens. The clusters of rich yellow flowers begin to expand in the autumn before the leaves fall and continue throughout the winter. The bark and leaves are astringent, and the seeds contain a quantity of oil and are edible. The name is derived from the use of the twigs as divining rods, just as hazel twigs were used in England.

Britten and Holland (*Dictionary of English Plant Names*, p. 247) quote three British plants under this name: (1) Wych elm (*Ulmus montana*), which, according to Parkinson (*Theatr.* 1403), was called "Witch hasell," because the leaves are "like unto the leaves of the Hasell nut"; (2) Hornbeam (*Carpinus Betulus*), which, according to Gerard, was so called in some places from its likeness to the elm or "wich Hazell tree"; and (3) Mountain ash (*Pyras Aucuparia*).

WITCH OF AGNESI, in geometry, a cubic curve invented by Maria Gaetana Agnesi. It is constructed by the following method: Let AQB be a semicircle of diameter AB, produce MQ the ordinate of Q to P so that MQ : MP :: AM : AB. Then the locus of P is the witch. The cartesian equation, if A be taken as origin and AB($=2a$) for the axis of x, is $xy^2=4a^2(2a-x)$. The curve consists of one branch entirely to the left of the line $x=2a$ and having the axis of y as an asymptote.



WITHAM, an urban district in the Maldon parliamentary division of Essex, England, 39 m. N.E. by E. from London by the Great Eastern railway. Pop. (1901) 3454. It lies on the River Brain, an affluent of the Blackwater, also known as the Guith, a form connected with the name Witham. The church of St Nicholas is principally Decorated, but retains earlier portions. Roman bricks appear in its fabric, and premise a Roman station in the vicinity. Surrounding the church (which stands in a high-lying portion of the town known as Chipping Hill) there are earthworks, possibly the remains of a fortification recorded as made by order of Edward the Elder in 913, but perhaps of British origin.

WITHER, GEORGE (1588–1667), English poet and satirist, son of George Wither, of Hampshire, was born at Bentworth, near Alton, on the 11th of June 1588. He was sent to Magdalen College, Oxford, at the age of fifteen, and remained at the university for two years. His neighbours appear to have had no great opinion of him, for they advised his father to put him to "some mechanic trade." He was, however, sent to one of the Inns of Chancery, eventually obtaining an introduction at court. He wrote an elegy (1612) on the death of Prince Henry, and a volume of gratulatory poems (1613) on the marriage of the princess Elizabeth, but his uncompromising character soon prepared trouble for him. In 1611 he published *Abuses Stript and Whipt*, twenty satires of general application directed against Revenge, Ambition, Lust and other abstractions. The volume included a poem called "The Scourge," in which the lord chancellor was attacked, and a series of epigrams. No copy of this edition is known, and it was perhaps suppressed, but in 1613 five editions appeared, and the author was lodged in the Marshalsea prison. The influence of the Princess Elizabeth, supported by a loyal "Satyre" to the king, in which he hints that an enemy at court had fitted personal meanings to his general invective, secured his release at the end of a few months. He had figured as one of the interlocutors, "Roget," in his friend William Browne's *Shepherd's Pipe*, with which were bound up eclogues by other poets, among them one by Wither, and during his imprisonment he wrote what may be regarded as a continuation of Browne's work, *The Shepherd's Hunting* (printed 1615), eclogues in which the two poets appear as "Willie" and "Roget" (in later editions "Philarete"). The fourth of these eclogues contains a famous passage in praise of poetry. After his release he was admitted (1615) to Lincoln's Inn, and in the same year he printed privately *Fidelia*, a love elegy, of which there is a unique copy in the Bodleian. Other editions of this book, which contained the lyric "Shall I, wasting in despair," appeared in 1617 and 1619. In 1621 he returned to the satiric vein with *Wither's Motto. Nec habeo, nec careo, nec curo.* Over 30,000 copies of this poem were sold, according to his own account, within a few months. Like his earlier invective, it was said to be libellous, and Wither was again imprisoned, but shortly afterwards released without formal trial on the plea that the book had been duly licensed. In 1622 appeared his *Faire-Virtue, The Mistresse of Phil' Arete*, a long panegyric of a mistress, partly real, partly allegorical, written chiefly in the seven-syllabled verse of which he was a master.

Wither began as a moderate in politics and religion, but from this time his Puritan leanings became more and more pronounced, and his later work consists of religious poetry, and of controversial and political tracts. His *Hymnes and Songs of the Church* (1622–1623) were issued under a patent of King James I. ordaining that they should be bound up with every copy of the authorized metrical psalms offered for sale (see HYMNS). This patent was opposed, as inconsistent with their privilege to print the "singing-psalms," by the Stationers' Company, to Wither's great mortification and loss, and a second similar patent was finally disallowed by the House of Lords. Wither was in London during the plague of 1625, and in 1628 published *Britain's Remembrancer*, a voluminous poem on the subject, interspersed with denunciations of the wickedness of the times, and prophecies of the disasters about to fall upon England. He also incidentally avenged Ben Jonson's satire on him as the "Chronomastix" of *Time Vindicated*, by a reference to Ben's "drunken conclave." This book he was obliged to print with his own hand in consequence of his quarrel with the Stationers' Company. In 1635 he was employed by Henry Taunton, a London publisher, to write English verses illustrative of the allegorical plates of Crispin van Passe, originally designed for Gabriel Rollenhagen's *Nucleus emblematum selectissimorum* (1610–1613). The book was published as a *Collection of Emblemes, Ancient and Moderne*, of which the only perfect copy known is in the British Museum.

The best of Wither's religious poetry is contained in *Heleluiah: or Britain's Second Remembrancer*, which was printed in Holland in 1641. Many of the poems rise to a high point of excellence. Besides those properly entitled to the designation of hymns, the book contains songs of singular beauty, especially the Cradle-song ("Sleep, baby, sleep, what ails my dear"), the Anniversary Marriage Song ("Lord, living here are we"), the Perambulation Song ("Lord, it hath pleasèd Thee to say"), the Song for Lovers ("Come, sweet heart, come, let us prove"), the Song for the Happily Married ("Since they in singing take delight") and that for a Shepherd ("Renownèd men their herds to keep")—(Nos. 50 in the first part, 17 and 24 in the second, and 20, 21 and 41 in the third). There is also in the second part a fine song (No. 59), full of historical as well as poetical interest, upon the evil times in which the poet lived, beginning—

> "Now are the times, these are the days
> Which will those men approve
> Who take delight in honest ways
> And pious courses love;
> Now to the world it will appear
> That innocence of heart
> Will keep us far more free from fear
> Than helmet, shield or dart."

Wither wrote, generally, in a pure nervous English idiom, and preferred the reputation of "rusticity" (an epithet applied to him even by Baxter) to the tricks and artifices of poetical style which were then in favour. It may be partly on that account that he was better appreciated by posterity than by his contemporaries.

Wither had served as captain of horse in 1639 in the expedition of Charles I. against the Scottish Covenanters, and his religious rather than his political convictions must be accepted as the explanation of the fact that, three years after the Scottish expedition, at the outbreak of the Great Rebellion, he is found definitely siding with the parliament. He sold his estate to raise a troop of horse, and was placed by a parliamentary committee in command of Farnham Castle. After a few days' occupation he left the place undefended, and marched to London. His own house near Farnham was plundered, and he himself was captured by a troop of Royalist horse, owing his life to the intervention of Sir John Denham on the ground that so long as Wither lived he himself could not be accounted the worst poet in England. After this episode he was promoted to the rank of major. He was present at the siege of Gloucester (1643) and at Naseby (1645). He had been deprived in 1643 of his nominal command, and of his commission as justice of the peace, in consequence of an attack upon Sir Richard Onslow, who was, he maintained, responsible for the Farnham disaster. In the same year parliament made him a grant of £2000 for the loss of his property, but he apparently never received the full amount, and complained from time to time of his embarrassments and of the slight rewards he received for his services. An order was made to settle a yearly income of £150 on Wither, chargeable on Sir John Denham's sequestrated estate, but there is no evidence that he ever received it. A small place given him by the Protector was forfeited "by declaring unto him (Cromwell) those truths which he was not willing to hear of." At the Restoration he was arrested, and remained in prison for three years. He died in London on the 2nd of May 1667.

His extant writings, catalogued in Park's *British Bibliographer*, number over a hundred. Sir S. E. Brydges published *The Shepherd's Hunting* (1814), *Fidelia* (1815) and *Fair Virtue* (1818), and a selection appeared in Stanford's *Works of the British Poets*, vol. v. (1819). Most of Wither's works were edited in twenty volumes for the Spenser Society (1871–1882); a selection was included by Henry Morley in his *Companion Poets* (1891); *Fidelia* and *Fair Virtue* are included in Edward Arber's *English Garner* (vol. iv., 1882; vol. vi. 1883), and an excellent edition of *The Poetry of George Wither* was edited by F. Sidgwick in 1902. Among A. C. Swinburne's *Miscellanies* there is an amusing account of a copy of a selection from Wither's poems annotated by Lamb, then by Dr Nott, whose notes were the subject of further ruthless comment from Lamb.

WITHERITE, a mineral consisting of barium carbonate ($BaCO_3$), crystallizing in the orthorhombic system. The crystals are invariably twinned together in groups of three, giving rise to pseudo-hexagonal forms somewhat resembling bipyramidal crystals of quartz, the faces are usually rough and striated horizontally. The colour is dull white or sometimes greyish, the hardness is 3½ and the specific gravity 4·3. The mineral is named after W. Withering, who in 1784 recognized it to be chemically distinct from barytes. It occurs in veins of lead ore at Hexham in Northumberland, Alston in Cumberland, Anglezark, near Chorley in Lancashire, and a few other localities. Witherite is readily altered to barium sulphate by the action of water containing calcium sulphate in solution, and crystals are therefore frequently encrusted with barytes. It is the chief source of barium salts, and is mined in considerable amounts in Northumberland. It is used for the preparation of rat poison, in the manufacture of glass and porcelain, and formerly for refining sugar. (L. J. S.)

WITHERSPOON, JOHN (1723–1794), Scottish-American divine and educationalist, was born at Gifford, Yester parish, East Lothian, Scotland, on the 5th of February 1722/1723, the son of a minister of the Scotch Established Church, James Witherspoon (d. 1759), and a descendant on the distaff side from John Welch and John Knox. He studied at Haddington, and graduated in 1739 at the university of Edinburgh, where he completed a divinity course in 1743. He was licensed to preach by the Haddington presbytery in 1743, and after two years as a probationer was ordained (1745) minister of the parish of Beith. His *Ecclesiastical Characteristics* (1753), *Serious Apology* (1764), and *History of a Corporation of Servants discovered a few years ago in the Interior Parts of South America* (1765), attacked various abuses in the church and satirized the "moderate" party. In 1757 he had become pastor at Paisley; and in 1769 he received the degree of D.D. from Aberdeen. He was sued for libel for printing a rebuke to some of his parishioners who had travestied the sacrament of the Lord's Supper; and after several years in the courts he was ordered to pay damages of £150, which was raised by his parishioners. He refused calls to churches in Dublin and Rotterdam, and in 1766 declined an invitation brought him by Richard Stockton to go to America as president of the College of New Jersey (now Princeton University); but he accepted a second invitation and left Paisley in May 1768. His close relation with the Scotch Church secured important material assistance for the college of which he now became president, and he toured New England to collect contributions. He secured an excellent set of scientific apparatus and improved the instruction in the natural sciences; he introduced courses in Hebrew and French about 1772; and he did a large part of the actual teaching, having courses in languages, divinity, moral philosophy and eloquence. In the American Presbyterian church he was a prominent figure; he worked for union with the Congregationalists and with the Dutch Reformed body; and at the synod of 1786 he was one of the committee which reported in favour of the formation of a General Assembly and which drafted "a system of general rules for . . . government." In politics he did much to influence Irish and Scotch-Irish Presbyterians to support the Whig party. He was a member of the provincial congress which met at New Brunswick in July 1774; presided over the Somerset county committee of correspondence in 1774–1775; was a member of the New Jersey constitutional convention in the spring of 1776; and from June 1776 to the autumn of 1779 and in 1780–1783 he was a member of the Continental Congress, where he urged the adoption of the Declaration of Independence, being the only clergyman to sign it. He became a member of the secret committee of correspondence in October 1776, of the Board of War in October 1777, and of the committee on finance in 1778. He opposed the issue of paper money, supported Robert Morris's plan for a national bank, and was prominently connected with all Congressional action in regard to the peace with Great Britain. He had lost the sight of one eye in 1784, and in 1791 became quite blind. He died on his farm, Tusculum, near Princeton, on the 15th of November 1794.

There is a statue of Witherspoon in Fairmount Park, Philadelphia, and another on the University Library at Princeton. His *Essay on the Connexion between the Doctrine of Justification by the Imputed Righteousness of Christ and Holiness of Life* (1756) was his principal theological work. He also published several sermons, and *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament* (1774), sometimes attributed to Benjamin Franklin. His collected works, with a memoir by his son-in-law, Samuel Stanhope Smith (who succeeded him as president of the college), were edited by Dr Ashbel Green (New York, 1801–1802). See also David Walker Woods, *John Witherspoon* (New York, 1906); and M. C. Tyler, *Literary History of the American Revolution*, vol. ii. (1897).

WITNESS (from O. Eng. *witan*, to know), in law, a person who is able from his knowledge or experience to make statements relevant to matters of fact in dispute in a court of justice. The relevancy and probative effect of the statements which he makes belong to the law of evidence (*q.v.*). In the present article it is only proposed to deal with matters concerning the position of the witness himself. In England, in the earlier stages of the common law, the jurors seem to have been the witnesses, for they were originally chosen for their knowledge or presumed knowledge of the facts in dispute, and they could (and can) be challenged and excluded from the jury if related to the parties or otherwise likely to show bias (see JURY). The Scottish jurors' oath contains the words "and no truth conceal," an obvious survival from the time when a juror was a witness.

Competency.

Modern views as to the persons competent to give evidence are very different from those of Roman law and the systems derived from it. In Roman law the testimony of many persons was not admissible without the application of torture, and a large body of possible witnesses was excluded for reasons which have now ceased to be considered expedient, and witnesses were subject to rules which have long become obsolete. Witnesses must be *idonei*, or duly qualified. Minors, certain heretics, infamous persons (such as women convicted of adultery), and those interested in the result of the trial were inadmissible. Parents and children could not testify against one another, nor could slaves against their masters, nor those at enmity with the party against whom their evidence was offered. Women and slaves could not act as witnesses to a will. There were also some hard and fast rules as to number. Seven witnesses were necessary for a will, five for a *mancipatio* or manumission, or to determine the question whether a person were free or a slave. As under the Mosaic law, two witnesses were generally necessary as a minimum number to prove any fact. *Unius* *responsio testis omnino non audiatur* are the words of a constitution of Constantine. The evidence of a single witness was simply *semi-plena probatio*, to be supplemented, in default of a second witness, by torture or by reference to oath. The canon law followed the Roman law as to competence, but extended the disabilities to excommunicated persons and to a layman in a criminal charge against a clerk, unless he were actually the prosecutor. The evidence of a notary was generally equivalent to that of two ordinary witnesses. The evidence of the pope and that of a witness who simply proved baptism or heresy (according to some authorities) are perhaps the only other cases in which canon law dispensed with confirmatory evidence. It is probable that the incompetence of Jews as witnesses in Spain in the 14th and 15th centuries was based on what is termed "want of religion," *i.e.* heresy or unwillingness to take the Christian oath on the gospels. But in England until their expulsion they were in the status of slaves (*captivi*) of the king. A policy similar to that of Roman law was followed for centuries in England by excluding the testimony of parties or persons interested, of witnesses for a prisoner, and of infamous persons, such as those who had been attainted or had been vanquished in the trial by battle, or had stood in the pillory. All these were said *vocem non habere*. In the days of trial by battle a party could render a witness against him incompetent by challenging and defeating him in the judicial combat. Women were generally regarded as wholly or partially incompetent. English law had also certain rules as to the number of witnesses necessary. Thus under a statute of 1383 (6 Rich. II. st. 2, c. 5) the number of compurgators necessary to free an accused person from complicity in the peasant revolt was fixed at three or four. Five was the number necessary under the *Liber feudorum* for proving ingratitude to the lord. In one instance in old Scots law the number of witnesses had the curious effect of determining the punishment. By the assizes of King William, the ordeal of water was undergone by the accused on the oaths of three witnesses; if to them the oaths of three *seniores* were added, the penalty was immediate hanging.

In the course of the gradual development of the law of evidence, which is in a sense peculiar to the English system, the fetters of the Roman rules as to witnesses were gradually shaken off. In civil cases all disabilities by interest, relationship, sex or crime have been swept away. The witness need not be *idoneus* in the Roman sense, and objections which in Roman law went to his competence, in English law go to his credibility. The only general test of competency is now understanding. It excludes lunatics, idiots, dotards and children of tender years; a person convicted of perjury is said to be competent if convicted at common law, but incompetent if convicted under the act of Elizabeth. No trial ever takes place now under this act, and on this point the act seems to have been virtually repealed by Lord Denman's Act (1843; 6 & 7 Vict. c. 85). The disqualification is not absolute as to lunatics; as to children it is sometimes made to depend on whether they are able to understand the nature of the witness's oath. And in certain cases within the Criminal Law Amendment Act 1885 and the Prevention of Cruelty to Children Act 1904, the unsworn evidence of children of tender years is admissible but needs corroboration.

Non-judicial witnesses are those who attest an act of unusual importance, for the due execution of which evidence may afterwards be required. They are either made necessary by law, as the witnesses to marriages and wills, or used by general custom, as the witnesses to deeds. In some cases the attestation has become a mere form, such as the attestation of the lord chancellor to a writ of summons (see WRIT).

The rule of English law as to the number of witnesses necessary is expressed in the phrase *testes ponderantur non numerantur*. But there are certain exceptions, all statutory. Two witnesses are necessary to make a will valid; two are required to be present at a marriage and to attest the entry in the marriage register;[1] and in the case of blasphemy, perjury, personation and most forms of treason, two or more witnesses are necessary to justify conviction. Witnesses to bills of sale under the Bills of Sale Act 1882, and witnesses on a charge of personation at elections, are required to be "credible." And in the case of dishonour of a foreign bill of exchange the evidence of a notary public is required, probably a survival from the law merchant or a concession to continental practice. A warrant of attorney must be attested by a solicitor, and certain conveyances of property held on charitable uses must be attested by two solicitors. In certain civil cases the evidence of a single witness is not sufficient unless corroborated in some material particular—not necessarily by another witness—*e.g.* in actions of breach of promise of marriage, or affiliation proceedings and matrimonial causes, or where unsworn evidence of children is admissible. In practice, but not in strict law, the evidence of an accomplice is required to be corroborated.

The English common law in theory has never permitted examination by torture—unless certain forms of cross-examination can be so described. In trials in the court of admiralty the Roman system was used until 1536 (28 Henry VIII. c. 15). Torture in Scotland was abolished at the Union.

In criminal cases an accused person could not formerly be sworn as a witness or examined by the court, though he was free to make statements. The origin of this rule is by some traced to the maxim *nemo tenetur prodere seipsum*, by others to the theory that the petty jury were the prisoner's witnesses. Moreover, witnesses for the defence could not be examined on oath in cases of treason and felony until 1702 in England, 1711 in Ireland and 1735 in Scotland. The husband or wife of the accused could not be examined on oath as a witness either for the prosecution or the defence except in prosecutions for treason or for personal injuries done by one spouse to the other. This exclusion was in accord with the disqualification of parties to civil causes; but there was a lack of reciprocity, for the prosecutor was a competent witness because the crown is the nominal prosecutor. The rule had to a certain extent a beneficial effect for the defence, in saving the accused from cross-examination, which in certain periods and in political trials would have led to abuse. On the abolition of other disqualifications that of the accused was left. This inconsistency led to much legal discussion and to piecemeal, and ultimately complete, change in the law. In 1878 the Criminal Code Commission recommended that prisoners should be allowed to give evidence on their own behalf on oath. Since 1872 many statutes have been passed rendering accused persons and their husbands or wives competent witnesses on charges of particular offences. Most of these acts do not make them compellable witnesses.

By the Criminal Evidence Act 1898 (60 and 61 Vict. c. 36) the defendant, or the wife or husband of the defendant, is made a competent but not a compellable witness for the defence at every stage of criminal proceedings, subject to certain conditions, of which the principal are that a prisoner shall not be called except on his or her own application, and that the failure of the prisoner or his wife or her husband to give evidence is not to be the subject of comment by the prosecution, and that the prisoner may not be cross-examined as to any previous offence or conviction or as to character, unless the proof of a previous offence is admissible evidence in the case, or unless he or she has given evidence of his or her good character, or cross-examined with that view, or unless the nature and conduct of the defence is such as to involve imputations on the character of the prosecutor or the witnesses for the prosecution. The act applies to Great Britain but not to Ireland. It has been extended to proceedings before naval and military courts-martial. This statute abrogates the common law rule making an accused person incompetent, and in practice supersedes most of the prior particular statutes. But it is necessary to observe that as to certain offences named in the schedule of the act and in other earlier or later acts, the husband or wife is competent without the consent of the accused; and that proceedings by indictment for obstruction or non-repair of public ways, bridges and rivers are for purposes of evidence treated as civil proceedings.

Quite apart from statute a husband or wife has always and necessarily been a competent witness in criminal proceedings against the other spouse in respect of personal injuries.

Even where a witness is competent, his statements, whether of fact or of expert opinion, are not admissible in evidence unless he has taken the required oath,[2] or, where he conscientiously objects to taking an oath or by want of religion would not be bound by the oath, has made the substituted affirmation or declaration. This question was settled in 1888 after the entry of Mr Bradlaugh into parliament. Unless he is duly sworn, &c., there is no enforceable sanction for false evidence (see PERJURY). English law has gradually accepted as sufficient any form of oath which the witness is prepared to accept as binding on him in accordance with his religious beliefs, whether he be Christian or Jew, Mahommedan, Hindu, Sikh or Buddhist. At one time peers in certain proceedings testified on their honour unsworn, but now no distinction is made except as already stated in the case of young children.

The attestation of documents out of courts of justice is ordinarily not on oath; but where the documents have to be proved in court the attesting witnesses are sworn like others, and the only judicial exception is that of witnesses ordered to produce documents (called in Scotland "havers") who are not sworn unless they have to verify the documents produced. Questions as to competence (including questions of the right to affirm instead of swearing or as to the proper form of oath) are settled by examination by the court without oath, on what is termed the *voir dire*. The evidence of judicial witnesses is taken *viva voce* at the trial, except in interlocutory proceedings and in certain matters in the chancery division and in bankruptcy courts. Where the witness cannot attend the court or is abroad his evidence may be taken in writing by a commissioner delegated by the court, or by a foreign tribunal under letters of request issued by the court in which the cause is pending. The depositions are returned by the delegated authority to the court of trial. Under English law evidence must be taken *viva voce* in a criminal trial, with a few exceptions, *e.g.* where a witness who has made a deposition before a magistrate at an earlier stage in the case is dead or unable to travel, or in certain cases within the Merchant Shipping Acts, or of offences in India or by crown officials out of England. In Europe *commissions*

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[1] The provisions of the Marriage Act 1823 appear to be directory. Non-compliance does not invalidate the marriage, but creates difficulty as to its proof in other proceedings, *e.g.* for bigamy.

[2] The giving of evidence unsworn appears to have been at one time regarded as a privilege. The men of Ripon, for instance, were by a charter of Æthelstan to be believed on their yea and nay in all disputes.

vogatoires are freely used to obtain written depositions for the purpose of criminal trials, and are allowed to be executed in England. In England the *viva voce* examination of witnesses is not conducted by the presiding judge but by the advocates in the cause, and the witness is called not by the court but by the party. The court, however, has full power to call witnesses not called by either party, or to examine witnesses on questions not inquired into by the advocates of either party.

The examination of a witness by the advocate of the side for which he is called is termed "examination-in-chief"; when by the advocate of the other party it is called "cross-examination." The judge, and by his leave the jurors, are free to question the witness. But the main duty of the judge is not himself to interrogate the witness but to see that neither side asks irrelevant or vexatious questions (see R.S.C. 1883, order 36, rule 38).

Attendance.

As a general rule competent witnesses are also compellable, except the king; *i.e.* they can be required to attend the court and to take the oath and to answer all relevant questions. But by the statutes as to evidence in criminal cases the accused is not a compellable witness, nor in many specified cases is the husband or wife of the accused. The attendance of witnesses is secured in the following manner: In civil actions in the High Court of Justice by writ of subpoena personally served with tender of the necessary journey money (see WRIT); in civil actions in county courts by witness summons; in criminal proceedings before the High Court of Justice or a court of assize or quarter sessions by crown office subpoena or by recognizance entered into before justices when the accused was committed for trial. In proceedings before justices out of quarter sessions the attendance of a witness is secured by witness summons or if need be by arrest on warrant of a justice. In criminal cases tender of expenses is not essential. Where a witness refuses to attend or to be sworn or to answer, he is summarily punishable for contempt if the court is one of record,[1] and liable to imprisonment if the proceedings are before a court of summary jurisdiction. Various acts of parliament deal with compelling appearance before committees of parliament, courts martial and other tribunals of a special nature. The attendance of a witness who is in custody is obtained by writ of *habeas corpus ad testificandum* or by judge's order in certain cases, or by order of the home secretary under the Prison Act 1898. A witness's expenses in a civil case are payable by the party calling him and are included in the costs of the cause. Scales of allowances are scheduled to the Rules of the Supreme Court and the County Court Rules. Failure of a witness duly summoned to attend in a civil action exposes him to liability in respect of pecuniary damage done to the party by his absence. In criminal cases the witness's expenses fall on the party calling him, but in prosecutions for felony and many misdemeanours the expenses are paid out of the local rate in accordance with scales fixed by the home secretary (see COSTS).

A witness is privileged from arrest on civil process while he is in attendance on a court of justice or is on his way to or from the court (*eundo, morando et redeundo*). The privilege does not exempt from arrest on a criminal charge. All witnesses except the defendant in a criminal case are entitled to object to answer any question put to them in court on the ground that the answer might tend to criminate them or to expose them to a penalty or forfeiture, or where the question is as to the fact of adultery. The defendant in a criminal case if sworn as a witness is not entitled to refuse to answer questions tending to prove him guilty of the offence for which he is being tried, and a witness cannot refuse to answer a question on the ground that the answer might involve admission of a debt or subject him to a civil action (1806, c. 37).

Witnesses are also privileged from making disclosure of matters known to them in the following cases: (1) Public officers, as to matters coming within their official cognizance if they can swear that it is inconsistent with the public service to disclose them. This applies to state secrets, and extends to jurors as to what passed among them, and the public prosecutor; and the police on this ground refuse to disclose the sources of information leading to prosecutions for crime. (2) Lawyers, as to communications between themselves and their clients, unless the communications are in themselves part of a criminal or unlawful enterprise. English law declines to extend professional privilege to communications between doctor and patient or priest and penitent. In most European countries, and in many British colonies, medical privilege is recognized as to matters communicated to the doctor or even discovered by him in attending the patient. In Catholic countries confessions to a priest are sacred. In England it is not now the practice to insist on evidence by a minister of religion as to matters confessed to him as such. (3) Communications between husband and wife during the marriage have always been privileged from disclosure, and this privilege is preserved by modern legislation (1853, c. 83, s. 3; 1898, c. 36, s. 1. d.).

It is correlative to the obligation of a witness to testify that no action may be brought against him under English law for any statement however defamatory, however irrelevant, and however malicious, made by him in the course of his testimony in judicial proceedings (*Seaman* v. *Netherclift*, 1876, 1 C.P.D. 540; *Hodson* v. *Pare*, 1899, 1 Q.B. 455). The only remedy, if the statement is deliberately false, is to prosecute him for perjury.

On charges of treason lists of the witnesses to be called by the crown must be supplied to the accused. In ordinary indictable cases there is no such obligation, but the names of the witnesses for the crown are written on the back of the indictment; and where the witnesses have not been examined at the preliminary inquiry it is now established practice to require notice to the accused of their names, and a précis of what they will be called to prove. In Scotland in all indictable cases a list of witnesses must be served on the accused (the panel) (1887, c. 35), and the same rule is observed in France. In the United States the same course is adopted where a capital offence is charged.

Scotland.—The rules as to competence of witnesses have been made substantially the same as in England by modern legislation (1837, c. 37, s. 9; 1840, c. 59, s. 1; 1852, c. 27; 1874, c. 64). Their attendance is procured by citation. Witnesses to produce documents are called "havers."

The evidence of witnesses is taken on oath (in the Scots form) or affirmation. Their privileges are substantially the same as in England, but they may be sued for irrelevant defamatory statements volunteered during their evidence, the law of Scotland on this point being the same as under the Dutch Roman law (see Nathan, *Common Law of S. Africa*, § 1593).

British Possessions.—In India the law as to witnesses and evidence is consolidated in the Indian Evidence Act 1872, which contains in code form the substance of the English law on the subject. The test of competency is understanding: "all persons shall be competent to testify unless the court considers that they are prevented from understanding the questions put to them or from giving rational answers to these questions by tender years, extreme old age, disease whether of body or mind, or of any other cause of the same kind. A lunatic is not incompetent to testify unless he is prevented by his lunacy from understanding the questions put to him and giving rational answers to them" (s. 118). In criminal proceedings the defendant is not, but the husband or wife of the defendant is, competent (s. 120). Under the Indian Oaths Act (x. of 1873) Hindus or Mahommedans or persons objecting to make an oath may affirm (s. 6). The court may accept an oath or solemn affirmation in any form common amongst or held as binding by persons of the persuasion or religion to which the witness belongs, unless it is repugnant to justice or decency (s. 8). In the rest of the British empire the law as to witnesses does not differ materially from that of England, but has in most colonies been incorporated in statutes or codes (*e.g.* British Guiana, Ord. No. 20 of 1893). Colonial legislation has provided for the evidence of accused persons under conditions similar to but not identical with those prevailing in England. In colonies with a large native population there is from time to time a tendency to reject the evidence of coloured witnesses against Europeans.

United States.—The rules of the United States as to witnesses have a common origin with those of England and are on the same lines, but in most states depend on the particular provisions of state codes. The number of witnesses necessary for the attestation of a marriage or will is not uniform in all the states. While slavery was lawful, the evidence of slaves (and in some states that of free persons of colour) was not received for or against whites. These rules appear not to have been absolutely overridden by the 14th amendment to the Federal Constitution, and the laws of Delaware and Nebraska discriminate against free persons of colour. Incompetency by conviction of perjury or subornation is retained in federal laws (Rev. Stat. § 5392) and in those of a few states (see Wigmore, p. 654 *n*).

European Countries.—In the law of most European states the Roman law as to the competency and examination of witnesses is more closely followed than in countries whose law is based on that of England. In criminal cases the prisoner is not only competent but necessary, and the whole system of procedure is inquisitorial, beginning with interrogation of the accused, not by the state prosecutor, but by the president of the court. In view of this system it is not surprising that the English conception of the rules of proof and relevancy, known as the law of evidence, is not accepted; since under the continental system the person who puts the questions is the person who has to determine their relevancy. In France consanguinity and affinity to the parties disqualify a witness in civil cases, and he is also asked whether he is employé or servant of the parties (Code Civil, Proc. 262, 268). In criminal cases a like inquiry is made. Consanguinity and affinity in the case of lineals may be made ground of disqualification if the objection is taken, as may pecuniary interest in the penalty (*Code d'instr. Crim.* 75, 322). Husband and wife cannot testify for or against each other even after divorce (*ib.*). In France disability to be a witness may be inflicted as part of the punishment on conviction for certain crimes (Code Penal, art. 42). (W. F. C.)

WITNEY, a market town in the Woodstock parliamentary division of Oxfordshire, England, on the river Windrush, a tributary of the Thames, 75½ m. W.N.W. of London on the East Gloucestershire branch of the Great Western railway. Pop. of urban district (1901) 3574. The urban district was extended in 1898 to include portions of the scattered villages of Hailey and

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[1] In ecclesiastical courts the punishment was by excommunication.

Curbridge. Witney is the seat of an old-established industry in blanket-making, and gloves and other woollen goods are also made. The broad main street contains several picturesque houses of the 17th century and later, and in it stands the Butter Cross, supported on columns and dating from 1683. The grammar school was founded in 1683, and a Blue Coat School in 1723. The great church of St Mary is one of the finest in the county. It is cruciform with a lofty central tower and spire, the latter considered to be a direct development of the early spire of the cathedral at Oxford. The tower is Early English, but the church exhibits the other styles, including a remarkable Norman porch. At Coggs, in the water-meadows bordering the river immediately below Witney, a priory was attached to the Benedictine Priory of Fécamp, and of this there are Early English remains in the vicarage, while the church is mainly Decorated. The foundation, however, dates from the 11th century.

The manor of Witney (*Wyttineye*, *Wytnay*, *Wytney*) was held by the see of Winchester before the Conquest. It was sold in 1649, but was given back to the bishopric at the Restoration. In the middle of the 18th century it was leased by the bishop of Winchester to the duke of Marlborough. Witney was a borough by prescription at least as early as 1278, and sent representatives to parliament with more or less regularity from 1304 to 1330. The government was by the steward and bailiffs of the bishop of Winchester, assisted by constables, wardmen and other officers. A woollen industry was probably established at an early date, for there is reference to a fulling mill in a charter of King Edgar dated 909. In 1641 the blanket-makers petitioned the crown against vexatious trade regulations; in 1673 the town is described as "driving a good trade for blankets and rugs." In 1711 the blanket-makers obtained a charter making them into a company, consisting of a master, assistants, two wardens and a commonalty. In 1231 the bishop of Winchester received a grant of a five days' fair at Witney at the feast of St Leonard. In 1278 the bishop was declared to have at Witney a weekly market on Thursday and two fairs on the day of Ascension and on St Leonard's day. A further grant of two yearly fairs was made in 1414 to the bishop of Winchester at his manor of Witney, namely, on the vigil and day of St Clement the Pope, and at the feast of St Barnabas.

See J. A. Giles, *History of Witney* (London, 1852); *Victoria County History, Oxon*; W. J. Monk, *History of Witney* (1894).

WITOWT, or WITOLD (1350–1430), grand-duke of Lithuania, son of Kiejstut, prince of Samogitia, first appears prominently in 1382, when the Teutonic Order set him up as a candidate for the throne of Lithuania in opposition to his cousin Jagiello (see WLADISLAUS), who had treacherously murdered Witowt's father and seized his estates. Witowt, however, convinced himself that the German knights were far more dangerous than his Lithuanian rival; he accepted pacific overtures from Jagiello and became his ally. When Jagiello ascended the throne of Poland as Wladislaus II. in 1386, Witowt was at first content with the principality of Grodno; but jealousy of Skirgiello, one of Jagiello's brothers, to whom Jagiello committed the government of Lithuania, induced Witowt to ally himself once more with the Teutonic Order (treaty of Königsberg, 24th of May 1390). He strengthened his position by giving his daughter Sophia in marriage to Vasily, grand-duke of Muscovy; but he never felt secure beneath the wing of the Teutonic Order, and when Jagiello removed Skirgiello from the government of Lithuania and offered it to Witowt, the compact of Ostrow (5th of August 1392) settled all differences between them. Nevertheless, subsequent attempts on the part of Poland to subordinate Lithuania drove Witowt for the third time into the arms of the Order, and by the treaty of Salin in 1398, Witowt, who now styled himself *Supremus Dux Lithuaniae*, even went so far as to cede his ancestral province of Samogitia to the knights, and to form an alliance with them for the conquest and partition of Pskov and Great Novgorod. His ambition and self-confidence at this period knew no bounds. He nourished the grandiose idea of driving out the hordes of Tamerlane, freeing all Russia from the Tatar yoke, and proclaiming himself emperor of the North and East. This dream of empire was dissipated by his terrible defeat on the Lower Dnieper by the Tatars on the 12th of August 1399. He was now convinced that the true policy of Lithuania was the closest possible alliance with Poland. A union between the two countries was effected at Vilna on the 18th of January 1401, and was confirmed and extended by subsequent treaties. Witowt was to reign over Lithuania as an independent grand-duke, but the two states were to be indissolubly united by a common policy. The result was a whole series of wars with the Teutonic Order, which now acknowledged Swidrygiello, another brother of Jagiello, as grand-duke of Lithuania; and though Swidrygiello was defeated and driven out by Witowt, the Order retained possession of Samogitia, and their barbarous methods of "converting" the wretched inhabitants finally induced Witowt to rescue his fellow-countrymen at any cost from the tender mercies of the knights. In the beginning of 1409 he concluded a treaty with Jagiello at Novogrudok for the purpose, and on the 9th of July 1410 the combined Polish-Lithuanian forces, reinforced by Hussite auxiliaries, crossed the Prussian border. The rival forces encountered at Grünewald, or Tannenberg, and there on the 14th or 15th July 1410 was fought one of the decisive battles of the world, for the Teutonic Knights suffered a crushing blow from which they never recovered. After this battle Poland-Lithuania began to be regarded in the west as a great power, and Witowt stood in high favour with the Roman curia. In 1429, instigated by the emperor Sigismund, whom he magnificently entertained at his court at Lutsk, Witowt revived his claim to a kingly crown, and Jagiello reluctantly consented to his cousin's coronation; but before it could be accomplished Witowt died at Troki, on the 27th of October 1430. He was certainly the most imposing personality of his day in eastern Europe, and his martial valour was combined with statesmanlike foresight.

See Jozef Ignacz Kraszewski, *Lithuania under Witowt* (Pol.) (Wilna, 1850); Augustin Theiner, *Vetera Monumenta Poloniae* (Rome, 1860–1864); Karol Szajnocha, *Jadwiga and Jagiello* (Pol.) (Lemberg, 1850–1856); Teodor Narbutt, *History of the Lithuanian Nation* (Pol.) (Wilna, 1835–1836); *Codex epistolaris Witoldi Magni* (ed. Prochaska, Cracow, 1882). (R. N. B.)

WITSIUS, HERMANN (1636–1708), Dutch theologian, was born at Enkhuysen, North Holland, and studied at Gröningen, Leiden and Utrecht. He was ordained to the ministry, becoming pastor at Westwoud in 1656 and afterwards at Wormeren, Goesen and Leeuwaarden, and became professor of divinity successively at Franeker (1675) and at Utrecht (1680). In 1698 he went to Leiden as the successor of Friedrich Spanheim the younger (1632–1701). He died at Leiden on the 22nd of October 1708.

Witsius tried to mediate between the orthodox theology and the "federal" system of Johannes Cocceius, but did not succeed in pleasing either party. The more important of his works are: *Judaeus christianizans—circa principia fidei et SS. Trinitatem* (Utrecht, 1661); *De oeconomia foederum Dei cum hominibus* (1677, still regarded as one of the clearest and most suggestive expositions of the so-called "federal" theology); *Diatribe de septem epistolarum apocalypticarum sensu historico ac prophetico* (Franeker, 1678); *Exercitationes sacrae in symbolum quod apostolorum dicitur et in orationem Dominicam* (Franeker, 1681); *Miscellanea sacra* (Utrecht, 1692–1700, 2 vols.).

WITTE, SERGE JULIEVICH, COUNT (1849–), Russian statesman, was born at Tiflis, where his father (of Dutch extraction) was a member of the Viceregal Council of the Caucasus. His mother was a lady of the Fadeyev family, by whom he was brought up as a member of the Eastern Orthodox Church and thoroughly imbued with nationalist feeling in the Russian sense of the term. After completing his studies at Odessa University, in the faculty of mathematics and physical science, and devoting some time to journalism in close relations with the Slavophils and M. Katkov, he entered in 1877 the service of the Odessa State railway, and so distinguished himself in the transport operations necessitated by the Turkish campaign of 1877–1878, that he was soon afterwards appointed general traffic manager of the South-Western railway of Russia and member of an Imperial commission which had to study the whole question of railway construction and management throughout the empire. His speciality was an intimate acquaintance with the problem of railway rates in connexion with the general economic development of the country, and in 1884 he published a work on the subject which attracted some attention in the official world. Among those who had discovered his exceptional ability in matters of that kind was M. Vishnegradski, minister of finance, who appointed him head of the railway department in the finance ministry. In 1892 he was promoted to be minister of ways of communication, and in the following year, on the retirement of Vishnegradski, he succeeded him as minister of finance. In this important post he displayed extraordinary activity. He was an ardent disciple of Friedrich List and sought to develop home industries by means of moderate protection and the introduction of foreign capital for industrial purposes. At the same time he succeeded by drastic measures in putting a stop to the great fluctuations in the value of the paper currency and in resuming specie payments. The rapid extension of the railway system was also largely due to his energy and financial ingenuity, and he embarked on a crusade against the evils of drunkenness by organizing a government monopoly for the sale of alcohol. In the region of foreign policy he greatly contributed to the extension of Russian influence in northern China and Persia. Naturally of a combative temperament, and endowed with a persevering tenacity rare among his countrymen, he struggled for what he considered the liberation of his country from the economic bondage of foreign nations. Germany was, in his opinion, the neighbour whose aggressive tendencies had to be specially resisted. He was therefore not at all *persona grata* in Berlin, but the German imperial authorities learned by experience that he was an opponent to be respected, who understood thoroughly the interests of his country, and was quite capable of adopting if necessary a vigorous policy of reprisals. During his ten years' tenure of the finance ministry he nearly doubled the revenues of the empire, but at the same time he made for himself, by his policy and his personal characteristics, a host of enemies. He was transferred, therefore, in 1903 from the influential post of finance minister to the ornamental position of president of the committee of ministers. The object was to deprive him of any real political influence, but circumstances brought about a different result. The disasters of the war with Japan, and the rising tide of revolutionary agitation, compelled the government to think of appeasing popular discontent by granting administrative reforms, and the reform projects were revised and amended by the body over which M. Witte presided. Naturally the influence of a strong man made itself felt, and the president became virtually prime minister; but, before he had advanced far in this legislative work, he was suddenly transformed into a diplomatist and sent to Portsmouth, N. H., U.S.A., in August 1905, to negotiate terms of peace with the Japanese delegates. In these negotiations he showed great energy and decision, and contributed largely to bringing about the peace. On his return to St Petersburg he had to deal, as president of the first ministry under the new constitutional régime, with a very difficult political situation (see RUSSIA: *History*); he was no longer able to obtain support, and early in 1906 he retired into private life.

WITTELSBACH, the name of an important German family, taken from the castle of Wittelsbach, which formerly stood near Aichach on the Paar in Bavaria. In 1124, Otto V., count of Scheyern (d. 1155), removed the residence of his family to Wittelsbach, and called himself by this name. Otto was descended from Luitpold, duke of Bavaria and margrave of Carinthia, who was killed in 907 fighting the Hungarians. His son, Arnulf I., called the Bad, drove back the Hungarians, and was elected duke of Bavaria in 913. Arnulf, who was a candidate for the German crown in 919, claimed to be independent, and openly defied the German king, Conrad I. In 921, however, he recognized the authority of Henry I. the Fowler, in return for the right to dispense justice, to coin money and to appoint the bishops in Bavaria. He died at Regensburg in 937, and his elder son, Eberhard, fought in vain to retain the duchy. In 938 it was given by the German king, Otto I., the Great, to Arnulf's brother, Bertold I., with greatly reduced privileges. Arnulf's younger son, Arnulf II., continued the struggle against Otto I., and sometime before his death in 954 was made count palatine in Bavaria. This office did not become hereditary, however, and his descendants bore simply the title of counts of Scheyern until about 1116, when the emperor Henry V. recognized Count Otto V. as count palatine in Bavaria. His son, Count Otto VI., who succeeded his father in 1155, accompanied the German king, Frederick I., to Italy in 1154, where he distinguished himself by his courage, and later rendered valuable assistance to Frederick in Germany. When Henry the Lion, duke of Saxony and Bavaria, was placed under the imperial ban in 1180, Otto's services were rewarded by the investiture of the dukedom of Bavaria at Altenburg. Since the time of Otto I. Bavaria has been ruled by the Wittelsbachs.

Otto died at Pfullendorf in 1183, and was succeeded in the duchy by his son, Louis I. (1174–1231), but the dignity of count palatine in Bavaria passed to his brother Otto, whose son Otto, succeeding in 1189, murdered the German king Philip at Bamberg on the 21st of June 1208. He was placed under the ban by the emperor Otto IV., and was killed at Oberndorf, near Regensburg, by Henry of Kalden, marshal of the empire, in March 1209. His lands passed to his son Louis, then only nine years old, who began his rule in 1192. In 1208 he destroyed the ancestral castle of Wittelsbach, the site of which is now marked by a church and an obelisk.

At first Louis supported Otto IV. in his struggle with Frederick of Hohenstaufen (the emperor Frederick II.), but deserted his cause when Frederick invested his son, Otto, with the Palatinate of the Rhine in 1214. Louis appears to have been previously promised this succession, and to strengthen his claim married his son, Otto, to Agnes, the sister of Henry, the count palatine, who died without heirs in 1214. Louis accompanied the Crusaders to Damietta in 1221, and governed Germany as regent from 1225 until 1228, when he deserted Frederick II. at the instigation of Pope Gregory IX. He was murdered at the bridge of Kelheim on the 15th of September 1231, and the emperor was generally suspected of complicity in the deed. Louis' son, Otto the Illustrious (1206–1253), undertook the government of the Palatinate in 1228, and became duke of Bavaria in 1231. He was attached to the Hohenstaufen by the marriage of his daughter, Elizabeth, with Conrad, son of Frederick II. in 1246. He supported Frederick in his struggle with the anti-kings, Henry Raspe, landgrave of Thuringia, and William II., count of Holland, and was put under the papal ban by Pope Innocent IV., Bavaria being laid under an interdict. When King Conrad IV. went to Italy in 1251, Otto remained as his representative in Germany, until his death on the 29th of November 1253. He left two sons, Louis and Henry, who reigned jointly until 1255, when a division of the lands was made, by which Louis II. (1228–1294) received upper Bavaria and the Palatinate of the Rhine, and Henry I. (d. 1290) lower Bavaria. Louis, who soon became the most powerful prince in southern Germany, was called "the Stern," because in a fit of jealousy he caused his first wife, Maria of Brabant, to be executed in 1256. He was the uncle and guardian of Conradin of Hohenstaufen, whom he assisted to make his journey to Italy in 1267, and accompanied as far as Verona. When Conradin was executed in 1268 Louis inherited his lands in Germany, sharing them with his brother Henry. In 1273 he was a candidate for the German crown, but was induced to support Rudolph, count of Habsburg, whose eldest daughter, Matilda, he married in this year. He was a great source of strength to the Habsburgs until his death in 1294. Lower Bavaria was ruled by the descendants of Henry I. until the death of his great-grandson, John I., in 1340, when it was again united with upper Bavaria. The sons of Louis, Rudolph I. (d. 1319) and Louis, who became German king as Louis IV. in 1314, ruled their lands in common, but after some trouble between them Rudolph abdicated in 1317.

In 1329 the most important division of the Wittelsbach lands took place. By the treaty of Pavia in this year, Louis granted the Palatinate of the Rhine and the upper Palatinate of Bavaria to his brother's sons, Rudolph II. (d. 1353) and Rupert I. Rupert, who from 1353 to 1390 was sole ruler, gained the electoral dignity for the Palatinate of the Rhine in 1356 by a grant of some lands in upper Bavaria to the emperor Charles IV. It had been exercised from the division of 1329 by both branches in turn. The descendants of Louis IV. retained the rest of Bavaria, but made several divisions of their territory, the most important of which was in 1392, when the branches of Ingoldstadt, Munich and Landshut were founded. These were reunited under Albert IV., duke of Bavaria-Munich (1447–1508) and the upper Palatinate was added to them in 1628. Albert's descendants ruled over a united Bavaria, until the death of Duke Maximilian III. in 1777, when it passed to the Elector Palatine, Charles Theodore. The Palatinate of the Rhine, after the death of Rupert I. in 1390, passed to his nephew, Rupert II., and in 1398 to his son, Rupert III., who was German king from 1400 to 1410. On his death it was divided into four branches. Three of these had died out by 1559, and their possessions were inherited by the fourth or Simmern line, among whom the Palatinate was again divided (see PALATINATE).

In 1742, after the extinction of the two senior lines of this family, the Sulzbach branch became the senior line, and its head, the elector Charles Theodore, inherited Bavaria in 1777. He died in 1799, and Maximilian Joseph, the head of the Zweibrücken branch, inherited Bavaria and the Palatinate. He took the title of king as Maximilian I.

In 1623, when the elector Frederick V. (the "Winter King") was driven from his dominions, the electoral privilege was transferred to Bavaria, and in 1648, by the Peace of Westphalia, an eighth electorate was created for the Wittelsbachs of the Palatinate, and was exercised by the senior branch of the family.

The Wittelsbachs gave three kings to Germany, Louis IV., Rupert and Charles VII. Members of the family were also margraves of Brandenburg from 1323 to 1373, and kings of Sweden from 1654 to 1718.

See J. Döllinger, *Das Haus Wittelsbach und seine Bedeutung in der deutschen Geschichte* (Munich, 1880); J. F. Böhmer, *Wittelsbachische Regesten bis 1340* (Stuttgart, 1854); F. M. Wittmann, *Monumenta Wittelsbacensia* (Urkundenbuch, Munich, 1857–1861); K. T. Heigel, *Die Wittelsbacher* (Munich, 1880); F. Leitschuh, *Die Wittelsbacher in Bayern* (Bamberg, 1894).

WITTEN, a town of Germany, in the Prussian province of Westphalia, favourably situated among the coal-fields of the Ruhr, 14 m. E. of Essen and 15 m. N.E. of Elberfeld by rail. Pop. (1905) 35,841. It is an important seat of the steel industry. Other industries are the making of soap, chemicals and beer. Witten was made a town in 1825.

See Hassel, *Wittener Ortskunde und Ortsgesetze* (Witten, 1903).

WITTENBERG, a town of Germany, in the Prussian province of Saxony, situated on the Elbe, 59 m. by rail S.W. of Berlin, on the main line to Halle and at the junction of railways to Falkenberg, Torgau and Rosslau. Pop. (1905) 20,332. The three suburbs which adjoin the town are not older than 1817. Wittenberg is interesting chiefly on account of its close connexion with Luther and the dawn of the Reformation; and several of its buildings are associated with the events of that time. Part of the Augustinian monastery in which Luther dwelt, at first as a monk and in later life as owner with his wife and family, is still preserved, and has been fitted up as a Luther museum. It contains numerous relics of Luther and portraits and other paintings by the Cranachs. The Augusteum, built in 1564–1583 on the site of the monastery, is now a theological seminary. The Schlosskirche, to the doors of which Luther nailed his famous ninety-five theses in 1517, dates from 1439–1499; it was, however, seriously damaged by fire during the bombardment of 1760, was practically rebuilt, and has since (1885–1892) been restored. The old wooden doors, burnt in 1760, were replaced in 1858 by bronze doors, bearing the Latin text of the theses. In the interior of the church are the tombs of Luther and Melanchthon, and of the electors Frederick the Wise, by Peter Vischer the elder (1527), and John the Constant, by Hans Vischer; also portraits of the reformers by Lucas Cranach the younger. The parish church, in which Luther often preached, was built in the 14th century, but has been much altered since Luther's time. It contains a magnificent painting by Lucas Cranach the elder, representing the Lord's Supper, Baptism and Confession, also a font by Hermann Vischer (1457). The present infantry barracks were at one time occupied by the university of Wittenberg, founded in 1502, but merged in the university of Halle in 1815. Luther was appointed professor of philosophy here in 1508; and the new university rapidly acquired a considerable reputation from its connexion with the early Reformers. In opposition to the strict Lutheran orthodoxy of Jean it represented the more moderate doctrines of Melanchthon. In the Wittenberg Concord (1536) the reformers agreed to a settlement of the eucharistic controversy. Shakespeare makes Hamlet ~~and Horatio~~ study at Wittenberg. The ancient electoral palace is another of the buildings that suffered severely in 1760; it now contains archives. Melanchthon's house and the house of Lucas Cranach the elder (1472–1553), who was burgomaster of Wittenberg, are also pointed out. Statues of Luther (by Schadow), Melanchthon and Bugenhagen embellish the town. The spot, outside the Elster Gate, where Luther publicly burned the papal bull in 1520, is marked by an oak tree. Floriculture, iron-founding, distilling and brewing are carried on. The formerly considerable manufacture of the heavier kinds of cloth has died out.

Wittenberg is mentioned as early as 1180. It was the capital of the little duchy of Saxe-Wittenberg, the rulers of which afterwards became electors of Saxony; and it continued to be a Saxon residence under the Ernestine electors. The Capitulation of Wittenberg (1547) is the name given to the treaty by which John Frederick the Magnanimous was compelled to resign the electoral dignity and most of his territory to the Albertine branch of the Saxon family. In 1760 the town was bombarded by the Austrians. It was occupied by the French in 1806, and refortified in 1813 by command of Napoleon; but in 1814 it was stormed by the Prussians under Tauentzien, who received the title of "von Wittenberg" as a reward. Wittenberg continued to be a fortress of the third class until the reorganization of the German defences after the foundation of the new empire led to its being dismantled in 1873.

See Meynert, *Geschichte der Stadt Wittenberg* (Dessau, 1845); Stier, *Die Schlosskirche zu Wittenberg* (Wittenberg, 1860); Zitzlaff, *Die Begrabnissstätten Wittenbergs und ihre Denkmäler* (Wittenberg, 1897); and Gurlitt, "Die Lutherstadt Wittenberg," in Muther's *Die Kunst* (Berlin, 1902).

WITTENBERGE, a town of Germany, in the Prussian province of Brandenburg, on the Elbe, near the influx of the Stepenitz into that river, 77 m. N.W. from Berlin by the main line of railway to Hamburg, and at the junction of railways to Stendal, Lüneburg and Perleberg. Pop. (1905) 18,501. The magnificent bridge here spanning the Elbe, one mile in length, was built in 1851 at a cost of £237,500. The chief industries are the manufacture of railway plant, cloth, wool, soap, shoddy, furniture, bricks and cement.

WITTGENSTEIN, LUDWIG ADOLF PETER, COUNT, prince of Sayn-Wittgenstein-Ludwigsburg (1769–1843), Russian soldier, was descended from a family of formerly independent counts in Westphalia. His father had settled in Russia, and he entered the army, distinguishing himself in the Polish War of 1794–95, and then serving in the Caucasus. In 1805 he fought at Austerlitz, in 1806 against the Turks and in 1807 against Napoleon at Friedland and against the Swedes in Finland. In the war of 1812 he commanded the right wing army of the Russians. In the campaign of 1813 in January he took over the command of the Russian army after Kutúzov's death. But after the defeats of the Spring campaign he laid down this command and led an army corps during the Dresden and Leipzig campaigns, and at Bar-sur-Aube in the 1814 campaign he was severely wounded. In 1823 he was promoted field-marshal, and in 1828 he was appointed to command the Russian army in the war against Turkey. But ill health soon obliged him to retire. In 1834 the king of Prussia gave him the title of prince. He died on the 11th of June 1843.

WITTINGAU (Czech, *Třeboň*), a town of Bohemia, 95 m. S. of Prague by rail. Pop. (1900) 5467, mostly Czech. The parish church is a Gothic edifice of the 14th century, with fine cloisters; and the Lušnic château, once belonging to the family of Rosenberg, and now to Prince Schwarzenberg, dating from the 15th century, is reputed to contain the most extensive and valuable archives in Bohemia. The artificial cultivation of fish, now chiefly carp, in the numerous ponds that surround the town dates from the 14th century.

WITU, or VITU, a sultanate of East Africa included in the Tanaland province of the British East Africa protectorate. It extends along the coast from the town of Kipini at the mouth of the Ozi river (2° 30′ S.) to the northern limit of Manda Bay (2° S.); area 1200 sq. m. The chief town, Witu, is 16 m. N. of Kipini. The state was founded by Ahmed-bin-Fumo Luti, the last Nabhan sultan of Patta (an island off the coast), who was conquered by Seyyid Majid of Zanzibar. Ahmed, about 1860, took refuge in the forest district, and made himself an independent chief, acquiring the title of Simba or the Lion. In 1885 Ahmed was induced to place his country under German protection, and in 1887 the limits of Witu were fixed by international agreement. In 1890 Germany transferred her protectorate to Great Britain. In the September of that year a British naval force under Admiral Sir E. Fremantle was sent against the sultan Bakari, who had succeeded Ahmed in 1887 and by whose orders nine German traders and settlers had been murdered. Disorders continued until 1894, and in the following year Omar-bin-Hamed of the Nabhan dynasty—an ancient race of Asiatic origin—was recognized as sultan. The sultan is guided by a British resident, and the state since the accession of Sultan Omar has been both peaceful and prosperous. The population of the sultanate is over 15,000; of the town of Witu 6000, chiefly Swahilis. The port of Witu is Mkonumbi (pop. 1000).

WIVELISCOMBE (pronounced Wilscomb), a market town in the western parliamentary division of Somersetshire, England, 9½ m. W. of Taunton by the Great Western railway. Pop. (1901), 2246. It stands on a picturesque sloping site in a hilly district, and has some agricultural trade and a brewing industry, while in the neighbourhood are slate quarries.

Traces of a large Roman camp may still be seen to the south-east of Wiveliscombe (*Wellescombe, Wilscombe; Wiviscombe*), which is near the line of a Roman road, and hoards of Roman coins have been discovered in the neighbourhood. The town probably owed its origin to the suitability of its position for defence, and it was the site of a Danish fort, later replaced by a Saxon settlement. The overlords were the bishops of Bath and Wells, who had a palace and park here. They obtained a grant of freewarren in 1257. No charter granting self-government to Wiveliscombe has been found, and the only evidence for the traditional existence of a borough is that part of the town is called "the borough," and that until the middle of the 19th century a bailiff and a portreeve were annually chosen by the court leet. A weekly market on Tuesdays, granted to the bishop of Bath and Wells in 1284, is still held. During the 17th and 18th centuries the town was a centre of the woollen manufacture.

WLADISLAUS (WLADISLAW), the name of four kings of Poland and two Polish kings of Hungary.[1]

WLADISLAUS I. (1260–1333), king of Poland, called Lokietek, or "Span-long," from his diminutive stature, was the re-creator of the Polish realm, which in consequence of internal quarrels had at the end of the 13th century split up into fourteen independent principalities, and become an easy prey to her neighbours, Bohemia, Lithuania, and, most dangerous of all, the Teutonic Order. In 1296 the gentry of Great Poland elected Wladislaus, then prince of Cujavia, to reign over them; but distrusting the capacity of the taciturn little man, they changed their minds and placed themselves under the protection of the powerful Wenceslaus, king of Bohemia, who was crowned at Gnesen in 1300. Wladislaus thereupon went to Rome, where Pope Boniface VIII., jealous of the growing influence of Bohemia, adopted his cause; and on the death of Wenceslaus in 1305 Wladislaus succeeded in uniting beneath his sway the principalities of Little and Great Poland. From the first he was beset with great difficulties. The towns, mostly of German origin, and the prelates headed by Muskata, bishop of Cracow, were against him because he endeavoured to make use of their riches for the defence of the sorely pressed state. The rebellious magistrates of Cracow he succeeded in suppressing, but he had to invoke the aid of the Teutonic Order to save Danzig from the margraves of Brandenburg, thus saddling Poland with a far more dangerous enemy; for the Order not only proceeded to treat Danzig as a conquered city, but claimed possession of the whole of Pomerania. Wladislaus thereupon (1317) appealed to Pope John XXII., and a tribunal of local prelates appointed by the holy see ultimately (Feb. 9, 1321) pronounced judgment in favour of Wladislaus, and condemned the Order not only to restore Pomerania but also to pay heavy damages. But the knights appealed to Rome; the pope reversed the judgment of his own tribunal; and the only result of these negotiations was a long and bloody six years' war (1327–1333) between Poland and the Order, in which all the princes of Central Europe took part, Hungary and Lithuania siding with Wladislaus, and Bohemia, Masovia and Silesia with the Order. It was not till the last year but one of his life that Wladislaus succeeded with the aid of his Hungarian allies in inflicting upon the knights their first serious reverse at Plowce (27th of September 1332). In March 1333 he died. He had laid the foundations of a strong Polish monarchy, and with the consent of the pope revived the royal dignity, being solemnly crowned king of Poland at Cracow on the 20th of January 1320. His reign is remarkable for the development of the Polish constitution, the gentry and prelates being admitted to some share in the government of the country.

See Max Perlbach, *Preussisch-polnische Studien zur Geschichte des Mittelalters* (Halle, 1886); Julius A. G. von Pflugk-Harttung, *Der deutsche Orden im Kampfe Ludwigs des Bayern mit der Kurie* (Leipzig, 1900).

WLADISLAUS II., JAGIELLO (1350–1434), king of Poland, was one of the twelve sons of Olgierd, grand-duke of Lithuania, whom he succeeded in 1377. From the very beginning of his reign Jagiello was involved in disputes with the Teutonic Order, and with his uncle, the valiant Kiejstut, who ruled Samogitia independently. By the treaty of Dawidyszek (June 1, 1380) he contracted an alliance with the knights, and two years later, acting on the advice of his evil counsellor, Wojdyllo, enticed Kiejstut and his consort to Krewo and there treacherously murdered them (Aug. 15, 1382). This foul deed naturally drove Witowt (*q.v.*), the son of Kiejstut, into the arms of the Order; but both princes speedily recognized that the knights were the real enemies of Lithuania, and prudently composing their differences invaded Prussian territory. This was the beginning of the fifty years' struggle with the Teutonic Order which was to make the reign of Jagiello so memorable. He looked about him betimes for allies against the common enemy of the Slavonic races, and fortune singularly favoured him. The Poles had brought their young queen Jadwiga home from Hungary, and in 1384 Jagiello sent a magnificent embassy to Cracow offering her his hand on condition that they shared the Polish crown. Jadwiga had long been betrothed to William of Austria; but she sacrificed her predilections for her country's good. On the 15th of February 1386 Jagiello, who had previously been elected king of Poland under the title of Wladislaus II., accepted the Roman faith in the cathedral of Cracow, and on the 18th his espousals with Queen Jadwiga were solemnized.

Jagiello's first political act after his coronation was the conversion of Lithuania to the true religion. This solemn act was accomplished at Vilna, the Lithuanian capital, on the 17th of February 1387, when a stately concourse of nobles and prelates, headed by the king, proceeded to the grove of secular oaks beneath which stood the statue of Perkunos and other idols, and in the presence of an immense multitude hewed down the oaks, destroyed the idols, extinguished the sacred fire and elevated the cross on the desecrated heathen altars, 30,000 Lithuanians receiving Christian baptism. A Catholic hierarchy was immediately set up. A Polish Franciscan, Andrew Wassilo, was consecrated as the first Catholic bishop of Vilna, and Lithuania was divided ecclesiastically into seven dioceses. Mainly on the initiative of Queen Jadwiga, Red Russia with its capital the great trading city of Lemberg was persuaded to acknowledge the dominion of Poland; and there on the 27th of September 1387 the hospodars of Walachia and Moldavia for the first time voluntarily enrolled themselves among the vassals of Poland.

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[1] In Hungarian history the Polish Wladislaus (Mag. Ulászló) is distinguished from the Hungarian Ladislaus (Lászlo). They are reckoned separately for purposes of numbering. Besides the Wladislaus kings of Poland, there were three earlier dukes of this name: Wladislaus I. (d. 1102), Wladislaus II. (of Cracow, d. 1163) and Wladislaus III., duke of Great Poland and Cracow (d. 1231). By some historians these are included in the numbering of the Polish sovereigns, King Wladislaus I. being thus IV. and so on.

With savage Lithuania converted and in close alliance with Catholic Poland, the Teutonic Order was seriously threatened. The knights endeavoured to re-establish their position by sowing dissensions between Poland and Lithuania. In this for a time they succeeded (see Witowt); but in 1401 Jagiello recognized Witowt as independent grand-duke of Lithuania (union of Vilna, January 18, 1401), and their union was cemented in the battle of Grünewald, which shook the whole fabric of the Teutonic Order to its very foundations. Henceforth a remarkable change in the whole policy of the Order was apparent. The struggle was no longer for dominion but for existence. Fortunate for them, in Jagiello they possessed an equally cautious and pacific opponent. Wladislaus II., in sharp contrast to Witowt, was of anything but a martial temperament. He never swerved from his main object, to unite Poland and Lithuania against the dangerous denationalizing German influences which environed him. But he would take no risks and always preferred craft to violence. Hence his leaning upon the holy see in all his disputes with his neighbours. Hence, too, his moderation at the peace of Thorn (1st of February 1411), when the knights skilfully extricated themselves from their difficulties by renouncing their pretensions to Samogitia, restoring Dobrzyn and paying a war indemnity; Jagiello was content to discredit them rather than provoke them to a war *à outrance*. Equally skilful was Jagiello's long diplomatic duel with the emperor Sigismund, then the disturbing element of Central Europe, who aimed at the remodelling of the whole continent and was responsible for the first projected partition of Poland.

Jagiello was married four times. At the dying request of the childless Jadwiga he espoused a Styrian lady, Maria Cillei, who bore him a daughter, also called Jadwiga. His third wife, Elizabeth Grabowska, died without issue, and the question of the succession then became so serious that Jagiello's advisers counselled him to betroth his daughter to Frederick of Hohenzollern, who was to be educated in Poland as the heir to the throne. But in 1422 Jagiello himself solved the difficulty by wedding Sonia, princess of Vyazma, a Russian lady rechristened Sophia, who bore him two sons, Wladislaus and Casimir, both of whom ultimately succeeded him. Jagiello died at Grodko near Lemberg in 1434. During his reign of half a century Poland had risen to the rank of a great power, a position she was to retain for nearly two hundred years under the dynasty which Jagiello had founded.

See August Sokolowski, *History of Poland*, vol. i. (Pol.) (Vienna, 1903); Carl Edward Napierski, *Russo-Lithuanian Acts* (Rus.) (St Petersburg, 1868); *Monumenta Medii Aevi* (Cracow, 1882); Karol Szajnocha, *Jadwiga and Jagiello* (Pol.) (Lemberg, 1855–1856)

Wladislaus III. (1424–1444), king of Poland and Hungary, the eldest son of Wladislaus II. Jagiello, by his fourth wife, Sophia of Vyazma, was born at Cracow on the 31st of October 1424, succeeding to the throne in his tenth year. The domestic troubles which occurred during his minority had an important influence upon the development of the Polish constitution; but under the wise administration of Zbigniew Olesnicki Poland suffered far less from her rebels than might have been anticipated, and Wladislaus gave the first proof of his manhood by defeating the arch-traitor Spytek of Melztyn in his camp at Grotnik on the 4th of May 1439. On the sudden death of the emperor Albert, who was also king of Bohemia and Hungary, the Hungarians elected Wladislaus as their king, despite the opposition of the widowed empress Elizabeth, already big with the child who subsequently ascended the Hungarian throne as Wladislaus V. But Wladislaus III., who was solemnly crowned king of Hungary at Buda by the Magyar primate in July 1440, had to fight against the partisans of the empress for three years till Pope Eugenius IV. mediated between them so as to enable Wladislaus to lead a crusade against the Turks. War was proclaimed against Sultan Murad II. at the diet of Buda on Palm Sunday 1443, and with an army of 40,000 men, mostly Magyars, the young monarch, with Hunyadi commanding under him, crossed the Danube, took Nish and Sofia, and advancing to the slope of the Balkans, returned to Hungary covered with glory. Europe resounded with the praises of the youthful hero, and the Venetians, the Genoese, the duke of Burgundy and the pope encouraged Wladislaus to continue the war by offering him every assistance. But at this juncture the sultan offered terms to Wladislaus through George Brankovic, despot of Servia, and, by the peace of Szeged (July 1, 1444), Murad engaged to surrender Servia, Albania and whatever territory the Ottomans had ever conquered from Hungary, including 24 fortresses, besides paying an indemnity of 100,000 florins in gold. Unfortunately, Wladislaus listened to the representations of the papal legate, Cardinal Julian Cesarini, who urged him in the name of religion to break the peace of Szeged and resume the war. Despite the representations of the Poles and of the majority of the Magyars, the king, only two days after solemnly swearing to observe the terms of the treaty, crossed the Danube a second time to cooperate with a fleet from the West which was to join hands with the land army at Gallipoli, whither also the Greeks and the Balkan Slavs were to direct their auxiliaries. But the Walachians were the sole allies of Hungary who kept faith with her, and on the bloody field of Varna, November the 10th, 1444, Wladislaus lost his life and more than a fourth of his army.

See Julian Bartoszewicz, *View of the Relations of Poland with the Turks and Tatars* (Pol.) (Warsaw, 1860); August Sokolowski, *History of Poland*, vol. ii. (Pol.) (Vienna, 1904); Ignácz Acsady, *History of the Hungarian Realm*, vol. i. (Hung.) (Budapest, 1905).

Wladislaus IV. (1595–1648), king of Poland, son of Sigismund III., king of Poland, and Anne of Austria, succeeded his father on the throne in 1632. From his early youth he gave promise of great military talent, and served his apprenticeship in the science of war under Zolkiewski in the Muscovite campaigns of 1610–1612, and under Chodkiewicz in 1617–1618. Wladislaus's first official act was to march against the Muscovites, who had declared war against Poland immediately after the death of Sigismund, and were besieging Smolensk, the key of Poland's eastern frontier. After a series of bloody engagements (Aug. 7-22, 1632) Wladislaus compelled the tsar's general to abandon the siege, and eventually to surrender (March 1, 1634) with his whole army. Meanwhile the Turks were threatening in the south, and Wladislaus found it expedient to secure his Muscovite conquests. Peace was concluded at the river Polyankova on the 28th of May 1634, the Poles conceding the title of tsar to Michael Romanov, who renounced all his claims upon Livonia, Esthonia and Courland, besides paying a war indemnity of 200,000 rubles. These tidings profoundly impressed Sultan Murad, and when the victorious Wladislaus appeared at Lemberg, the usual starting-point for Turkish expeditions, the Porte offered terms which were accepted in October, each power engaging to keep their borderers, the Cossacks and Tatars, in order, and divide between them the suzerainty of Moldavia and Walachia, the sultan binding himself always to place philo-Polish hospodars on those slippery thrones. In the following year the long-pending differences with Sweden were settled, very much to the advantage of Poland, by the truce of Stumdorf, which was to last for twenty-six years from the 12th September 1635. Thus externally Poland was everywhere triumphant. Internally, however, things were in their usually deplorable state owing to the suspicion, jealousy and parsimony of the estates of the realm. They had double reason to be grateful to Wladislaus for defeating the enemies of the republic, for he had also paid for the expenses of his campaigns out of his own pocket, yet he could not obtain payment of the debt due to him from the state till 1643. He was bound by the *pacta conventa* which he signed on his accession to maintain a fleet on the Baltic. He proposed to do so by levying tolls on all imports and exports passing through the Prussian ports which had been regained by the truce of Stumdorf. Sweden during her temporary occupation of these ports had derived from them an annual income of 3,600,000 gulden. But when Wladislaus, their lawful possessor, imposed similar tolls in the interests of the republic, Danzig protested and appealed to the Scandinavian powers. Wladislaus's little fleet attempted to blockade the port of the rebellious city, whereupon a Danish admiral broke the blockade and practically destroyed the Polish flotilla. Yet the *sejm*, so sensitive to its own privileges, allowed the insult to the king and the injury to the state to pass unnoticed, conniving at the destruction of the national navy and the depletion of the treasury, " lest warships should make the crown too powerful." For some years after this humiliation, Wladislaus became indifferent to affairs and sank into a sort of apathy; but the birth of his son Sigismund (by his first wife, Cecilia Renata of Austria, in 1640) gave him fresh hopes, and he began with renewed energy to labour for the dynasty as well as for the nation. He saw that Poland, with her existing constitution, could not hope for a long future, and he determined to bring about a royalist reaction and a reform along with it by every means in his power. He began by founding the Order of the Immaculate Conception, consisting of 72 young noblemen who swore a special oath of allegiance to the crown, and were to form the nucleus of a patriotic movement antagonistic to the constant usurpations of the diet, but the *sejm* promptly intervened and quashed the attempt. Then he conceived the idea of using the Cossacks, who were deeply attached to him, as a means of chastising the *szlachta*, and at the same time forcing a war with Turkey, which would make his military genius indispensable to the republic, and enable him if successful to carry out domestic reforms by force of arms. His chief confidant in this still mysterious affair was the veteran grand hetman of the crown, Stanislaw Koniecpolski, who understood the Cossacks better than any man then living, but differed from the king in preferring the conquest of the Crimea to an open war with Turkey. Simultaneously Wladislaus contracted an offensive and defensive alliance with Venice against the Porte, a treaty directly contrary indeed to the *pacta conventa* he had sworn to observe, but excusable in the desperate circumstances. The whole enterprise fell through, owing partly to the death of Koniecpolski before it was matured, partly to the hastiness with which the king published his intentions, and partly to the careful avoidance by the Porte of the slightest occasion of a rupture. Frustrated in all his plans, broken-hearted by the death of his son (by his second wife, Marie Ludwika of Angoulême, Wladislaus had no issue), the king, worn out and disillusioned, died at Merecz on the 20th of May 1648, in his 52nd year. After his cousin Gustavus Adolphus, whom in many respects he strikingly resembled, he was indubitably the most amiable and brilliant of all the princes of the House of Vasa.

See Wiktor Czermak, *The Plans of the Turkish Wars of Wladislaus IV.* (Pol.) (Cracow, 1895); V. V. Volk-Karachevsky, *The Struggle of Poland with the Cossacks* (Rus.) (Kiev, 1899); *Letters and other Writings of Wladislaus IV.* (Pol.) (Cracow, 1845). (R. N. B.)

WOAD, a herbaceous plant, known botanically as *Isatis tinctoria* (natural order Cruciferae), which occurs sporadically in England in fields, on banks and chalk-pits. The erect branched stem, 1 to 3 ft. in height, bears sessile leaves and terminal clusters of small yellow flowers; the brown pendulous pods are ½ in. long. The ancient Britons stained themselves with this plant. It is still cultivated in Lincolnshire.

WOBURN, a market town in the northern parliamentary division of Bedfordshire, England, with a station (Woburn Sands), on a branch of the London & North-Western railway, 2 m. from the town and 51 m. N.W. by N. from London. Pop. (1901) 1129. It lies in a hollow of a northern spur of the Chiltern Hills, in a finely wooded locality. There is some agricultural trade, and a little straw-plaiting and lace-making are carried on. To the west of the town lies Woburn Park, the demesne of Woburn Abbey, the seat of the dukes of Bedford. The abbey was a Cistercian foundation of 1145, but only scanty remains of the buildings are seen in the mansion which rose on its site. This, with most of the abbey lands, was granted by Henry VIII. to John, Lord Russell, in 1547, who was created earl of Bedford in 1550 (the dukedom dating from 1694). The mansion was begun in 1744; it contains a magnificent collection of paintings and other objects of art.

WOBURN, a city of Middlesex county, Massachusetts, U.S.A., 10 m. W. by N.W. of Boston. Pop. (1890) 13,499; (1900) 14,254, of whom 3840 were foreign-born and 261 were negroes; (1910, U.S. census) 15,308. Area, 12·6 sq. m. Woburn is served by the southern division of the Boston & Maine railway, and is connected with Burlington, Lexington, Reading, Stoneham, Wilmington, Winchester, Arlington, Boston and Lowell by electric railways. In the city area are several villages, including Woburn proper, known as " the Centre," North Woburn, Woburn Highlands, Cummingsville (in the western part), Mishawum (in the north-east), Montvale (in the east) and Walnut Hill (also in the east). There are two ancient burying-grounds; the oldest, on Park Street, dates from about 1642 and contains the graves of ancestors of four presidents—Cleveland, Benjamin Harrison, Franklin Pierce and Garfield—and a granite obelisk to the memory of Loammi Baldwin (1744–1807). On Academy Hill is the Warren Academy building used by a Free Industrial School. Forest Park (53 acres) is a fine stretch of natural woods, and there are several small parks and squares; on Woburn Common is the Public Library, by H. H. Richardson, the gift of Charles Winn. The building houses an art gallery and historical museum, and a library of about 50,000 volumes especially rich in Americana. Among colonial houses still standing are the birthplace of Count Rumford (in North Woburn), built about 1714, and now preserved by the Rumford Historical Association as a depository for the Rumford Library and historical memorials, and the Baldwin mansion (built partly in 1661 and later enlarged), the home of Loammi Baldwin (1780–1838), known as " the father of civil engineering in America." Woburn's manufactories are concentrated within a small area. The city is the most important leather manufacturing centre of New England: in 1905 the value of the leather product was $2,851,554, being 61·3% of the value of all factory products ($4,654,067); other manufactures are chemicals, leather-working machinery, boots and shoes, glue and cotton goods. Market gardening is an important industry.

Woburn, first settled about 1638–1640, was incorporated as a township under its present name in 1642, and was the first township set off from Charlestown. It then included a large part of the present Winchester and the greater part of the present Wilmington and Burlington, separately organized in 1730 and 1799 respectively. It was named after Woburn in Bedfordshire by its chief founder, Edward Johnson (1599–1672), whose work, *The Wonder-Working Providence of Zion's Saviour* (1654; latest ed. 1910), was one of the earliest historical accounts of the Massachusetts Bay Colony. The leather industry was established by David Cummings at Cummingsville shortly before the War of Independence. Woburn's industrial growth dates from the construction through the township of the old Middlesex Canal. The city was chartered in 1888.

See P. L. Converse, *Legends of Woburn, 1642–1892* (2 vols., Woburn, 1892–1896); Samuel Sewall, *History of Woburn, 1640 to 1860* (Boston, 1868); F. E. Wetherell, *Two Hundred and Fiftieth Anniversary of Woburn* (Woburn, 1892); and G. M. Champney in S. A. Drake's *History of Middlesex County* (2 vols., Boston, 1880).

WOCHUA (ACHUA), a pygmy people of Africa, living in the forests of the Mabode district, south of the Welle. They were discovered (1880–1883) by Dr W. Junker, who described them as " well proportioned, though the oval-shaped head seemed somewhat too large for the size of the body." Some are of light complexion, like the Akka and Batwa, but as a general rule they belong to the darker, crisper-haired, more genuine negro stock.

WODEN, a deity of the Anglo-Saxons, the name being the Anglo-Saxon counterpart of the Scandinavian Odin (*q.v.*). In German the same god was called Wodan or Wuotan. Owing to the very small amount of information which has come down to us regarding the gods of ancient England and Germany, it cannot be determined how far the character and adventures attributed to Odin in Scandinavian mythology were known to other Teutonic peoples. It is clear, however, that the god was credited with special skill in magic, both in England and Germany, while the story of the Langobardic migration (see LOMBARDS) represents him as the dispenser of victory. From Woden also most of the anglo-Saxon royal families traced their descent. By the Romans he was identified at an early date with Mercurius, whence our name "Wednesday" (Woden's day) as a translation of *dies Mercurii.* Tacitus states that the ancient Germans worshipped Mercurius more than any other god, and that they offered him human sacrifices. Many scholars connect the origin of the deity with the popular German and Swedish belief in a raging host (in Germany called *das wütende Heer* or *Wutes Heer*, but in Sweden *Odens Jagt*), which passes through the forests on stormy nights. There is evidence, however, that deities similar to Woden were known to some of the ancient peoples of central Europe, *e.g.* the Gauls and Thracians. See TEUTONIC PEOPLES, *ad fin.* (H. M. C.)

WODROW, ROBERT (1679–1734), Scottish historian, was born at Glasgow, being a son of James Wodrow, professor of divinity. He was educated at the university and was librarian from 1697 to 1701. From 1703 till his death, on the 21st of March 1734, he was parish minister at Eastwood, near Glasgow. He had sixteen children, his son Patrick being the "auld Wodrow" of Burns's poem "Twa Herds." His great work, *The History of the Sufferings of the Church of Scotland from the Restoration to the Revolution,* was published in two volumes in 1721–1722 (new ed. with a life of Wodrow by Robert Burns, D.D., 1807–1808). Wodrow also wrote a *Life* (1828) of his father. He left two other works in MS.—*Memoirs of Reformers and Ministers of the Church of Scotland*, and *Analecta: or Materials for a History of Remarkable Providences, mostly relating to Scotch Ministers and Christians.* Of the former, two volumes were published by the Maitland Club in 1834–1845 and one volume by the New Spalding Club in 1890; the latter was published in four volumes by the Maitland Club in 1842–1843.

Wodrow left a great mass of correspondence, three volumes of which, edited by T. M'Crie, appeared in 1843–1844. The Wodrow Society, founded in Edinburgh to perpetuate his memory, was in existence from 1841 to 1847, several works being published under its auspices.

WOELFL, JOSEPH (1772–1812), Austrian pianist and composer, was born in 1772 at Salzburg, where he studied music under Leopold Mozart and Michael Haydn. After a short residence at Warsaw he produced his first opera, *Der Höllenberg*, with some success at Vienna, where it was soon followed by *Das schöne Milchmädchen* and some other dramatic pieces. His fame now rests upon his compositions for the pianoforte, and the skill with which he is said to have met their formidable demands upon his power as an executant. The perfection of his technique was immeasurably enhanced by the enormous stretch of his fingers (his hand could strike a thirteenth with ease); and to his wide grasp of the keyboard he owed a facility of execution which he turned to excellent account, especially in his extempore performances. His technique was superior even to that of the young Beethoven, who played in company with him at the house of Count Wetzlar, and in memory of this exhibition of good-humoured rivalry he dedicated to Beethoven his "Three Sonatas," *Op.* 6. Quitting Vienna in 1798, he exhibited his skill in most of the great European capitals, and, after spending some years in Paris, made his first appearance in London on the 27th of May 1805. Here he enjoyed a long term of popularity, crowned about 1808 by the publication of his sonata, *Op.* 41, containing some variations on "Life let us cherish." This, on account of its technical difficulty, he entitled *Non Plus Ultra*; and, in reply to the challenge, Dussek's London publishers reprinted a sonata by that composer, originally called *Le Retour à Paris*, with the title *Plus Ultra*, and an ironical dedication to *Non Plus Ultra.* Woelfl died in Great Marylebone Street, London, on the 21st of May 1812.

WOFFINGTON, MARGARET [PEG] (*c.* 1714–1760), English actress, was born at Dublin, of poor parents. As a child of ten she played Polly Peachum in a lilliputian presentation of *The Beggar's Opera*, and danced and acted at various Dublin theatres until 1740, when her success as Sir Harry Wildair in *The Constant Couple* secured her a London engagement. In this, and as Sylvia in *The Recruiting Officer*, she had a pronounced success; and at Drury Lane and Covent Garden, as well as in Dublin, she appeared in all the plays of the day to ever growing popularity. Among her best impersonations were the elegant women of fashion, like Lady Betty Modish and Lady Townley, and in "breeches parts" she was unapproachable. She lived openly with Garrick, and her other love affairs were numerous and notorious, but her generosity and kindness of heart were equally well known. She educated her sister Mary, and cared for and pensioned her mother. She built and endowed by will some almshouses at Teddington, where she lived quietly after her retirement in 1757.

See Austin Dobson's introduction to Charles Reade's novel *Peg Woffington* (London, 1899), and Augustin Daly's *Woffington: a Tribute to the Actress and the Woman* (1888).

WÖHLER, FRIEDRICH (1800–1882), German chemist, was born at Eschersheim, near Frankfort-on-the-Main, on the 31st of July 1800. In 1814 he began to attend the gymnasium at Frankfort, where he carried out experiments with his friend Dr J. J. C. Buch. In 1820 he entered Marburg University, and next year removed to Heidelberg, where he worked in Leopold Gmelin's laboratory. Intending to practise as a physician, he took his degree in medicine and surgery (1823), but was persuaded by Gmelin to devote himself to chemistry. He studied in Berzelius's laboratory at Stockholm, and there began a lifelong friendship with the Swedish chemist. On his return he had proposed to settle as a *Privatdozent* at Heidelberg, but accepted the post of teacher of chemistry in the newly established technical school (*Gewerbeschule*) in Berlin (1825), where he remained till 1831. Private affairs then called him to Cassel, where he soon became professor at the higher technical school. In 1836 he was appointed to the chair of chemistry in the medical faculty at Göttingen, holding also the office of inspector-general of pharmacies in the kingdom of Hanover. This professorship he held until his death on the 23rd of September 1882.

Wöhler had made the acquaintance of Liebig, his junior by three years, in 1825, and the two men remained close friends and allies for the rest of their lives. Together they carried out a number of joint researches. One of the earliest, if not the earliest, was the investigation, published in 1830, which proved the polymerism of cyanic and cyanuric acid, but the most famous were those on the oil of bitter almonds (benzaldehyde) and the radicle benzoyl (1832), and on uric acid (1837), which are of fundamental importance in the history of organic chemistry. But it was the achievement of Wöhler alone, in 1828, to break down the barrier held to exist between organic and inorganic chemistry by artificially preparing urea, one of those substances which up to that time it had been thought could only be produced through the agency of "vital force." Most of his work, however, lay in the domain of inorganic chemistry. The isolation of the elementary bodies and the investigation of their properties was one of his favourite pursuits. In 1827 he obtained metallic aluminium as a fine powder, and in 1845 improved methods enabled him to get it in fully metallic globules. Nine years afterwards H. E. Sainte-Claire Deville, ignorant of what he had done, adopted the same methods in his efforts to prepare the metal on an industrial scale; the result of Wöhler's claim of priority was that the two became good friends and joined in a research, published in 1856–1857, which yielded "adamantine boron." By the same method as had succeeded with aluminium (reduction of the chloride by potassium) Wöhler in 1828 obtained metallic beryllium and yttrium. Later, in 1849, titanium engaged his attention, and, proving that what had up to that time passed as the metal was really a cyanonitride, he showed how the true metal was to be obtained. He also worked at the nitrides, and in 1857 with H. Buff carried out an inquiry on the compounds of silicon in which they prepared the previously unknown gas, silicon hydride or siliciuretted hydrogen. A problem to which he returned repeatedly was that of separating nickel and cobalt from their ores and freeing them from arsenic; and in the course of his long laboratory practice he worked out numerous processes for the preparation of pure chemicals and methods of exact analysis.

The Royal Society's *Catalogue* enumerates 276 separate memoirs written by him, apart from 43 in which he collaborated with others.

In 1831 he published *Grundriss der anorganischen Chemie*, and in 1840 *Grundriss der organischen Chemie*, both of which went through many editions. Still more valuable for teaching purposes was his *Mineralanalyse in Beispielen* (1861), which first appeared in 1853 as *Praktische Übungen in der chemischen Analyse*. Chemists also had to thank him for translating three editions of the *Lehrbuch* of Berzelius and all the successive volumes of the *Jahresbericht* into German from the original Swedish. He assisted Liebig and Poggendorff in the *Handwörterbuch der reinen und angewandten Chemie*, and was joint-editor with Liebig of the *Annalen der Chemie und Pharmacie*.

A memoir by Hofmann appeared in the *Ber. deut. chem. Gesellsch.* (1882), reprinted in *Zur Erinnerung an vorangegangene Freunde* (1888).

WOHLGEMUTH, MICHAEL (1434–1519), German painter, was born at Nuremberg in 1434. Little is known of his private life beyond the fact that in 1472 he married the widow of the painter Hans Pleydenwurff, whose son Wilhelm worked as an assistant to his stepfather. The importance of Wohlgemuth as an artist rests, not only on his own individual paintings, but also on the fact that he was the head of a large workshop, in which many different branches of the fine arts were carried on by a great number of pupil-assistants, including Albert Dürer. In this *atelier* not only large altar-pieces and other sacred paintings were executed, but also elaborate retables in carved wood, consisting of crowded subjects in high relief, richly decorated with gold and colour, such as pleased the rather doubtful Teutonic taste of that time. Wood-engraving was also carried on in the same workshop, the blocks being cut from Wohlgemuth's designs, many of which are remarkable for their vigour and clever adaptation to the special necessities of the technique of woodcutting. Two large and copiously illustrated books have woodcuts supplied by Wohlgemuth and his stepson Wilhelm Pleydenwurff. The first is the *Schatzkammer der wahren Reichthümer des Heils*, printed by Koburger in 1491; the other is the *Historia mundi*, by Schedel, 1493–1494, usually known as the *Nuremberg Chronicle*, which is highly valued, not for the text, but for its remarkable collection of spirited engravings.

The earliest known work by Wohlgemuth is a retable consisting of four panels, dated 1465, now in the Munich gallery, a decorative work of much beauty. In 1479 he painted the retable of the high altar in the church of St Mary at Zwickau, which still exists, receiving for it the large sum of 1400 gulden. One of his finest and largest works is the great retable painted for the church of the Austin friars at Nuremberg, now moved into the museum; it consists of a great many panels, with figures of those saints whose worship was specially popular at Nuremberg. In 1501 Wohlgemuth was employed to decorate the town hall at Goslar with a large series of paintings; some on the ceiling are on panel, and others on the walls are painted thinly in tempera on canvas. As a portrait-painter he enjoyed much repute, and some of his works of this class are very admirable for their realistic vigour and minute finish. Outside Germany Wohlgemuth's paintings are scarce: the Royal Institution at Liverpool possesses two good examples—"Pilate washing his Hands," and "The Deposition from the Cross," parts probably of a large altar-piece. During the last ten years of his life Wohlgemuth appears to have produced little by his own hand. One of his latest paintings is the retable at Schwabach, executed in 1508, the contract for which still exists. He died at Nuremberg in 1519.

See the reproductions in *Die Gemälde von Dürer und Wohlgemuth*, by Riehl and Thode (Nuremberg, 1889–1895).

WOKING, a market town in the Chertsey parliamentary division of Surrey, England, 24 m. S.W. of London by the London and South-Western railway. Pop. of urban district (1891) 9786; (1901) 16,244. The river Wey and the Basingstoke canal pass through the parish. St Peter's church dates from the 13th century. Modern structures include a public hall, and an Oriental institute (in the building erected for the Royal Dramatic College, including a museum of Eastern antiquities, a mosque, and residences for Orientals). In the vicinity are the Surrey county asylum and a female convict prison. Near Woking is Brookwood cemetery, belonging to the London Necropolis Company, with a crematorium.

WOKINGHAM, a market town and municipal borough in the Wokingham parliamentary division of Berkshire, England, 36 m. W. by S. of London by the South-Western railway, served also by the South-Eastern and Chatham railway. Pop. (1901) 3551. It lies on a slight eminence above a valley tributary to that of the river Loddon, in a well-wooded district on the outskirts of the former royal forest of Windsor. The church of St Laurence is Perpendicular, greatly altered by restoration. Two miles west of the town is the village of Bearwood. The trade of Wokingham is principally agricultural. The borough is under a mayor, 4 aldermen and 12 councillors. Area, 557 acres.

Wokingham (*Wokyngham, Oakingham, Ockingham*), which was within the limits of Windsor Forest, was formerly situated partly in Berkshire and partly in a detached piece of Wiltshire, which is now annexed to Berkshire; the Berkshire portion of the town was in the manor of Sonning, which was held by the bishops of Salisbury from before the Conquest until the reign of Elizabeth. The earliest existing charter to Wokingham is that of Elizabeth (1583), which recites and confirms some ancient customary privileges respecting the election of an alderman and other corporate officers. The governing charter for more than 250 years was that of James I. (1612), incorporating it as a free town under the title of the "Alderman and Burgesses of the Town of Wokingham in the Counties of Berks and Wilts." Under the provisions of the Municipal Corporations Act of 1882 a new charter of incorporation was granted, instituting a municipal body to consist of a mayor, 4 aldermen and 12 councillors. Wokingham was assessed at £50 for ship-money, Reading being assessed at £220. It had at this time a manufacture of silk stockings, which flourished as early as 1625, and survived up to the 19th century. The town shared in the benefactions of Laud, whose father was born there. The Tuesday market, which is still held and which, during the first half of the 19th century, was famous for poultry, was granted to the bishop of Salisbury by Henry III. (1219), who also granted (1258) two annual fairs to be held on the vigil, day and morrow of St Barnabas and All Saints respectively; the latter is still kept up, the former appears in the list of fairs held in 1792.

WOLCOT, JOHN (1738–1819), English satirist and poet, known under the pseudonym of PETER PINDAR, was the son of Alexander Wolcot, surgeon at Dodbrooke, adjoining Kingsbridge, in Devonshire, and was baptized there on the 9th of May 1738. He was educated at Kingsbridge free school, at the Bodmin and Liskeard grammar schools, and in France. For seven years he was apprenticed to his uncle, John Wolcot, a surgeon at Fowey, and he took his degree of M.D. at Aberdeen in 1767. In 1769 he was ordained, and went to Jamaica with his uncle's patient, Sir William Trelawny, the new governor. In 1772 he became incumbent of Vere, Jamaica, but on the death of his patron (11th of December 1772) he returned to England, and settled as a physician at Truro. In 1781 Wolcot went to London, and took with him the young Cornish artist, John Opie, whose talents in painting he had been the first to recognize. Before they left Cornwall Opie apparently made a rash engagement to share his profits with Wolcot, but a breach between them occurred soon after they settled in London. Wolcot had already achieved some success in a *Supplicating Epistle to the Reviewers* (1778), and after his settlement in London he threw off with marvellous rapidity a succession of pungent satires. George III. was his favourite subject of ridicule, and his peculiarities were described or distorted in *The Lousiad* (1785), *Peeps at St James's* (1787) and *The Royal Visit to Exeter*. Two of Wolcot's happiest satires on the "farmer king" depicted the royal survey of Whitbread's brewery, and the king's naïve wonder how the apples got into the apple dumplings. In his *Expostulatory Odes* (1789) he eulogized the prince of Wales. Boswell's biography of Johnson was ridiculed in *An Epistle to James Boswell* (1786), and in the same year followed another piece, called *Bozzy and Piozzi*. Other subjects were found in *Sir Joseph Banks and the Emperor of Morocco* (1790), and a *Complimentary Epistle to James Bruce* (1790). Among his early satires were *Lyric Odes to the Academicians* (1782), and another series on the same subject, *Farewell Odes* (1786). He specially attacked Benjamin West, but expressed great admiration for the landscapes of Gainsborough and Richard Wilson. Wolcot was himself no mean artist, and in 1797 appeared *Six Picturesque Views from Paintings by Peter Pindar, engraved by Alken*. In 1795 he disposed of his works to the booksellers for an annuity of £250. His various pieces were published in 1796 in four octavo volumes and often reprinted. Wolcot cared little whether he hit above or below the belt, and the gross vituperation he indulged in spoils much of his work for present-day readers; but he had a broad sense of humour, a keen eye for the ridiculous, and great felicity of imagery and expression. Some of his serious pieces—his rendering of Thomas Warton's epigram on *Sleep* and his *Lord Gregory*, for example—reveal an unexpected fund of genuine tenderness. In William Gifford, who attacked him in the *Epistle to P. Pindar*, he for once met with more than his match. Wolcot made a personal assault on his enemy in Wright's shop in Piccadilly, but Gifford was too quick for him, and Wolcot was soundly thrashed. He died at Latham Place, Somers Town, London, on the 14th of January 1819, and seven days later was buried, as he had desired, near Samuel Butler, the author of *Hudibras*, in St Paul's, Covent Garden.

Polwhele, the Cornish historian, was well acquainted with Wolcot in his early life, and the best account of his residence in the west is found in vol. i. of Polwhele's *Traditions* and in Polwhele's *Biographical Sketches*, vol. ii. Cyrus Redding was a frequent visitor at the old man's house, and has described Wolcot's later days in his *Past Celebrities*, vol. i., and his *Fifty Years' Recollections*, vols. i. and ii.

WOLCOTT, ROGER (1679–1767), American administrator, was born in Windsor, Connecticut, on the 4th of January 1679, the son of Simon Wolcott (d. 1687). He was a grandson of Henry Wolcott (1578–1655) of Galdon Manor, Tolland, Somerset, who emigrated to New England in 1628, assisted John Mason and others to found Windsor, Conn., in 1635, and was a member of the first General Assembly of Connecticut in 1637 and of the House of Magistrates from 1643 to his death.[1] Roger Wolcott was early apprenticed to a weaver and throve at this trade; he was a member of the Connecticut General Assembly in 1709, one of the Bench of Justices in 1710, commissary of the Connecticut forces in the expedition of 1711 against Canada, a member of the Council in 1714, judge of the county court in 1721 and of the superior court in 1732, and deputy-governor and chief-justice of the superior court in 1741. He was second in command to Sir William Pepperrell, with rank of major-general in the expedition (1745) against Louisbourg, and was governor of Connecticut in 1751–1754. He died in what is now East Windsor, on the 17th of May 1767.

He wrote *Poetical Meditations* (1725), an epic on *The Agency of the Honourable John Winthrop in the Court of King Charles the Second* (printed in pp. 262-298 of vol. iv., series I, *Collections* of Massachusetts Historical Society), and a pamphlet to prove that "the New England Congregational churches are and always have been consociated churches." His *Journal at the Siege of Louisbourg* is printed in pp. 131-161 of vol. i. (1860) of the *Collections* of the Connecticut Historical Society.

His son, ERASTUS WOLCOTT (1722–1793) was a member of the Connecticut General Assembly and its speaker; he was a brigadier-general of Connecticut militia in the War of Independence, and afterwards a judge of the Superior Court of Connecticut.

Another son, OLIVER WOLCOTT (1726–1797), graduated at Yale in 1747 and studied medicine with his brother Alexander (1712–1795). In 1751 he was made sheriff of the newly established Litchfield county and settled in Litchfield, where he practised law. He was a member of the Council in 1774–1786 and of the Continental Congress in 1775–1776, 1778 and 1780–1784. Congress made him a commissioner of Indian affairs for the Northern Department in 1775, and during the early years of the War of Independence he was active in raising militia in Connecticut. He was one of the signers of the Declaration of Independence; commanded Connecticut militia that helped to defend New York City in August 1776; in 1777 organized more Connecticut volunteers and took part in the last few days of the campaign against General John Burgoyne; and in 1779 commanded the militia during the British invasion of Connecticut. In 1784, as one of the commissioners of Indian affairs for the Northern Department, he negotiated the treaty of Fort Stanwix (22nd Oct.) settling the boundaries of the Six Nations. In 1786–1796 he was lieutenant-governor of Connecticut, and in November 1787 was a member of the Connecticut Convention which ratified the Federal Constitution; he became governor in 1796 upon the death (15th Jan.) of Samuel Huntington, and served until his death on the 1st of December 1797.

See the sketch by his son Oliver in Sanderson's *Biography of the Signers of the Declaration of Independence* (Philadelphia, 1820–1827).

Oliver's son, OLIVER WOLCOTT, jun. (1760–1833), graduated at Yale in 1778, studied law in Litchfield under Judge Tapping Reeve, and was admitted to the bar in 1781. With Oliver Ellsworth he was appointed (May 1784) a commissioner to adjust the claims of Connecticut against the United States. In 1788 he was made comptroller of public accounts of Connecticut; in the next year was appointed auditor of the Federal Treasury; in June 1791 became comptroller of the Treasury, and in February 1795 succeeded Alexander Hamilton as Secretary of the Treasury. At the end of 1800 he resigned after a bitter attack by the Democratic-Republican press, against which he defended himself in an *Address to the People of the United States*. In 1801–1802 he was judge of the Circuit Court of the Second District (Connecticut, Vermont and New York), and then entered business in New York City, where he was president of the short-lived Merchants' Bank (1803) and president (1812–1814) of the Bank of North America. With a brother he then founded factories at Wolcottville (near Litchfield). He re-entered politics as a leader of the "Toleration Republicans," attempting to oust the Congregational clergy from power by adopting a more liberal constitution in place of the charter; he was defeated for governor in 1815, but in 1817 presided over the state convention which adopted a new constitution, and in the same year was elected governor, serving until 1827. He died in New York City on the 1st of June 1833.

His grandson, George Gibbs (1815–1873), in 1846 edited *Memoirs of the Administration of Washington and John Adams . . . from the Papers of Oliver Wolcott, Secretary of the Treasury.* Wolcott wrote *British Influence on the Affairs of the United States Proved and Explained* (1804).

A grandson of the second Oliver's brother Frederick was ROGER WOLCOTT (1847–1901), who graduated at Harvard in 1870, and was admitted to the Suffolk bar in 1874. He practised law in Boston, and served in the Massachusetts House of Representatives in 1882–1884 as a Republican. In 1892 he was elected lieutenant-governor (re-elected 1893 and 1895), and in 1896 became acting-governor upon the death (5th March) of Governor Frederick T Greenhalge. He was elected governor in 1896 and served until 1900. He died on the 21st of December 1901.

EDWARD OLIVER WOLCOTT (1848–1905), a member of the same family, went to Colorado, became interested in silver mining there, was a U.S. Senator in 1889–1901, and was a prominent Republican bimetallist.

See William Lawrence, *Roger Wolcott* [1847–1901] (Boston, 1902), and for all the family, Samuel Wolcott, *Memorial of Henry Wolcott, one of the first Settlers of Windsor, Connecticut, and of some of his Descendants* (New York, 1881).

WOLF, FRIEDRICH AUGUST (1759–1824), German philologist and critic, was born on the 15th of February 1759 at Hainrode, a little village not far from Nordhausen, in the province of Hanover. His father was the village schoolmaster and organist. In time the family removed to Nordhausen, and there young Wolf went to the grammar school, where he soon acquired all the Latin and Greek that the masters could teach him, besides learning French, Italian, Spanish and music. The precocity of his attainments was only equalled by the force of will and confidence in his own powers which characterized him throughout life. After two years of solitary study, at the age of eighteen, Wolf went (1777) to the university of Göttingen. His first act there was a prophecy—one of those prophecies which spring from the conscious power to bring about their fulfilment. He had to choose his "faculty," and chose one which then existed only in his own mind, the faculty of "philology." What is even more remarkable, the omen was accepted. He carried his point, and was enrolled as he desired. C. G. Heyne was then the chief ornament of Göttingen, and Wolf and he were not on good terms. Heyne excluded him from his lectures, and brusquely condemned

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[1] Henry Wolcott the younger (d. 1680) was one of the patentees of Connecticut under the charter of 1662.

Wolf's views on Homer. Wolf, however, pursued his studies in the university library, from which he borrowed with his old avidity. During 1779–1783 Wolf was a schoolmaster, first at Ilfeld, then at Osterode. His success as a teacher was striking, and he found time to publish an edition of the *Symposium* of Plato, which excited notice, and led to his promotion (1783) to a chair in the Prussian university of Halle. The moment was a critical one in the history of education. The literary impulse of the Renaissance was almost spent; scholarship had become dry and trivial. A new school, that of Locke and Rousseau, sought to make teaching more modern and more human, but at the sacrifice of mental discipline and scientific aim. Wolf was eager to throw himself into the contest on the side of antiquity. In Halle (1783–1807), by the force of his will and the enlightened aid of the ministers of Frederick the Great, he was able to carry out his long-cherished ideas and found the science of philology. Wolf defined philology broadly as "knowledge of human nature as exhibited in antiquity." The matter of such a science, he held, must be sought in the history and education of some highly cultivated nation, to be studied in written remains, works of art, and whatever else bears the stamp of national thought or skill. It has therefore to do with both history and language, but primarily as a science of *interpretation*, in which historical facts and linguistic facts take their place in an organic whole. Such was the ideal which Wolf had in his mind when he established the philological *seminarium* at Halle.

Wolf's writings make little show in a library, and were always subordinate to his teaching. During his time at Halle he published his commentary on the *Leptines* of Demosthenes (1789)—which suggested to his pupil, Aug. Boeckh, the *Public Economy of Athens*—and a little later the celebrated *Prolegomena* to Homer (1795). This book, the work with which his name is chiefly associated, was thrown off in comparative haste to meet an immediate need. It has all the merits of a great piece of oral teaching—command of method, suggestiveness, breadth of view. The reader does not feel that he has to do with a theory, but with great ideas, which are left to bear fruit in his mind (see HOMER). The publication led to an unpleasant polemic with Heyne, who absurdly accused him of reproducing what he had heard from him at Göttingen.

The Halle professorship ended tragically, and with it the happy and productive period of Wolf's life. He was swept away, and his university with him, by the deluge of the French invasion. A painful gloom oppressed his remaining years (1807–1824), which he spent at Berlin. He became so fractious and intolerant as to alienate some of his warmest friends. He gained a place in the department of education, through the exertions of W. von Humboldt. When this became unendurable, he once more took a professorship. But he no longer taught with his old success; and he wrote very little. His most finished work, the *Darstellung der Alterthumswissenschaft*, though published at Berlin (1807), belongs essentially to the Halle time. At length his health gave way. He was advised to try the south of France. He got as far as Marseilles, and, dying there on the 8th of August 1824, was laid in the classic soil of that ancient Hellenic city.

Mark Pattison wrote an admirable sketch of Wolf's life and work in the *North British Review* of June 1865, reproduced in his *Essays* (1889); see also J. E. Sandys, *Hist. of Class. Schol.* iii. (1908), pp. 51-60. Wolf's *Kleine Schriften* were edited by G. Bernhardy (Halle, 1869). Works not included are the *Prolegomena*, the *Letters to Heyne* (Berlin, 1797), the commentary on the *Leptines* (Halle, 1789) and a translation of the *Clouds* of Aristophanes (Berlin, 1811). To these must be added the *Vorlesungen* on *Iliad* i.-iv., taken from the notes of a pupil and edited by Usteri (Bern, 1830). (D. B. M.)

WOLF, HUGO (1860–1903), German composer, was born on the 13th of March 1860 at Windischgraz in Styria. His father, who was in the leather trade, was a keen musician. From him Hugo learned the rudiments of the piano and the violin. After an unhappy school life, in which he showed little aptitude for anything but music, he went in 1875 to the Conservatoire. He appears to have learned very little there, and was dismissed in 1877 because of a practical joke in the form of a threatening letter to the director, for which he was perhaps unjustly held responsible. From the age of seventeen he had to depend upon himself for his musical training. By giving lessons on the piano and with occasional small help from his father he managed to live for several years in Vienna, but it was a life of extreme hardship and privation, for which his delicate constitution and his proud, sensitive and nervous temperament were particularly ill-suited. In 1884 he became musical critic to the *Salonblatt*, a Viennese society paper, and contrived by his uncompromisingly trenchant and sarcastic style to win a notoriety which was not helpful to his future prospects. His ardent discipleship of Wagner was unfortunately linked with a bitter opposition to Brahms, for whose works he always retained an ineradicable dislike. The publication at the end of 1887 of twelve of his songs seems to have definitely decided the course of his genius, for about this time he retired from the *Salonblatt*, and resolved to devote his whole energies to song-composition. The nine years which followed practically represent his life as a composer. They were marked by periods of feverish creative activity, alternating with periods of mental and physical exhaustion, during which he was sometimes unable even to bear the sound of music. By the end of 1891 he had composed the bulk of his works, on which his fame chiefly rests, 43 Mörike Lieder, 20 Eichendorff Lieder, 51 Goethe Lieder, 44 Lieder from Geibel and Heyse's *Spanisches Liederspiel*, and 22 from Heyse's *Italienisches Liederbuch*, a second part consisting of 24 songs being added in 1896. Besides these were 13 settings of lyrics by different authors, incidental music to Ibsen's *Fest auf Solhaug*, a few choral and instrumental works, an opera in four acts, *Der Corregidor*, successfully produced at Mannheim in June 1896, and finally settings of three sonnets by Michelangelo in March 1897. In September of this year the malady which had long threatened descended upon him; he was placed in an asylum, released in the following January, only to be immured again some months later by his own wish, after an attempt to drown himself in the Traunsee. Four painful years elapsed before his death on the 22nd of February 1903. Apart from his works and the tragedy of his last years there is little in Wolf's life to distinguish it from that of other struggling and unsuccessful musicians. His touchy and difficult temperament perpetually stood in the way of worldly success. What little he obtained was due to the persevering efforts of a small band of friends, critics and singers, to make his songs known, to the support of the Vienna Wagner-Verein, and to the formation in 1895 of the Hugo-Wolf-Verein in Berlin. No doubt it was also a good thing for his reputation that the firm of Schott undertook in 1891 the publication of his songs, but the financial result after five years amounted to 85 marks 35 pfennigs (about £4, 10s.). He lived in cheap lodgings till in 1896 the generosity of his friends provided him with a house of his own, which he enjoyed for one year.

Among the song composers who have adopted the modern standpoint, according to which accepted canons of beauty and of form must yield if they interfere with a closer or more vivid realization of dramatic or emotional expression, Wolf holds a place in which he has no rival, not because of the daring originality of his methods and the remarkable idiosyncrasies of his style, but because these are the direct outcome of rare poetical insight and imaginative power. He has that gift of vision which makes the difference between genius and talent. His frequent adoption of a type of song built upon a single phrase or *leit-motiv* in the accompaniment has led to the misleading statement that his work represents merely the transference of Wagnerian principles to song. In reality the forms of Wolf's songs vary as widely as those of the poems which he set. No less remarkable is the immense range of style at his command. But with Wolf methods of form and style are so inseparably linked with the poetical conceptions which they embody, that they can hardly be considered apart. His place among the greatest song-writers is due to the essential truth and originality of his creations, and to the vivid intensity with which he has presented them. These results depend not merely on musical gifts that are exceptional, but also upon a critical grasp of poetry of the highest order.

No other composer has exhibited so scrupulous a reverence for the poems which he set. To displace an accent was for him as heinous an act of sacrilege as to misinterpret a conception or to ignore an essential suggestion. Fineness of declamation has never reached a higher point than in Wolf's songs. Emphasis should also be laid upon the objective and dramatic attitude of his mind. He preferred to make himself the mouthpiece of the poetry rather than to use his art for purposes of self-revelation, avoiding for his songs the works of those whom with healthy scorn he termed the Ich-Poeten. Hence the men and women characterized in his songs are living realities, forming a veritable portrait gallery, of which the figures, though unmistakably the work of a single hand, yet maintain their own separate identity. These statements can be verified as well by a reference to the simpler and more melodious of his songs, as to those which are of extreme elaboration and difficulty. Among the former may be named *Das verlassene Mägdlein in der Frühe* and *Der Gärtner* (Mörike), *Verschwiegene Liebe* and *Der Musikant* (Eichendorff), *Anakreons Grab* (Goethe), *Alle gingen, Herz, zur Ruh'* and *Herz, was fragst* (*Spanisches Liederspiel*), Nos. 1 and 4 of the *Italienisches Liederbuch*, and among the latter *Aeolsharfe* and *Der Feuerreiter* (Mörike), *Ganymed* and *Prometheus* (Goethe). (W. A. J. F.)

WOLF, JOSEPH (1820–1899), Anglo-German artist, the son of a German farmer, was born in 1820 at Münstermaifeld, on the river Moselle, in the Rhine Province. In his boyhood he was an assiduous student of bird and animal life, and showed a remarkable capacity as a draughtsman of natural history subjects. His powers were first recognized by Professor Schlegel of the Leiden museum, who gave him employment as an illustrator. In 1848 he settled in London, where he remained till his death on the 20th of April 1899. He made many drawings for the Zoological Society, and a very large number of illustrations for books on natural history and on travel in various countries; but he also won a considerable success as a painter.

See A. H. Palmer, *The Life of Joseph Wolf* (London, 1895).

WOLF (*Canis lupus*), the common English name for any wild member of the typical section of the genus *Canis* (see CARNIVORA). Excluding some varieties of domestic dogs, wolves are the largest members of the genus, and have a wide geographical range, extending over nearly the whole of Europe and Asia, and North America from Greenland to Mexico, but are not found in South America or Africa, where they are replaced by other members of the family. They present great diversities of size, length and thickness of fur, and coloration, although resembling each other in all important structural characters. These differences have given rise to a supposed multiplicity of species, expressed by the names *C. lycaon* (Central Europe), *C. laniger* and *C. niger* (Tibet), the *C. occidentalis*, *C. nubilus*, *C. mexicanus*, &c., of North America, and the great blackish-brown Alaskan *C. pambasileus*, the largest of them all. But it is doubtful whether these should be regarded as more than local varieties. In North America there is a second distinct smaller species, called the coyote or prairie-wolf (*Canis latrans*), and perhaps the Japanese wolf (*C. hodophylax*) may be distinct, although, except for its smaller size and shorter legs, it is scarcely distinguishable from the common species. The wolf enters the N.W. corner of India, but in the peninsula is replaced by the more jackal-like *C. pallipes*, which is probably a member of the jackal group, and not a wolf at all.

The ordinary colour of the wolf is yellowish or fulvous grey, but almost pure white and entirely black wolves are known. In northern countries the fur is longer and thicker, and the animal generally larger and more powerful than in the southern portion of its range. Its habits are similar everywhere and it is still, and has been from time immemorial, especially known to man in all the countries it inhabits as the devastator of sheep flocks. Wolves do not catch their prey by lying in ambush, or stealing up close and making a sudden spring, but by fairly running it down in open chase, which their speed and remarkable endurance enable them to do. Except during summer when the young families of cubs are being separately provided for by their parents, they assemble in troops or packs, often in relays, and by their combined and persevering efforts are able to overpower and kill deer, antelopes and wounded animals of all sizes. It is singular that such closely allied species as the domestic dog and the Arctic fox are among the favourite prey of wolves, and, as is well known, children and even full-grown people are not infrequently the objects of their attack when pressed by hunger. Notwithstanding the proverbial ferocity of the wolf in a wild state, many instances are recorded of animals taken when quite young becoming tame and attached to the person who has brought them up, when they exhibit many of the ways of a dog. They can, however, rarely be trusted by strangers.

The history of the wolf in the British Isles, and its gradual extirpation, has been thoroughly investigated by Mr J. E. Harting in his work on *Extinct British Animals*, from which the following account is abridged. To judge by the osteological remains which the researches of geologists have brought to light, there was perhaps scarcely a county in England or Wales in which, at one time or another, wolves did not abound, while in Scotland and Ireland they must have been still more numerous. The fossil remains which have been discovered in Britain are not larger than, nor in any way to be distinguished from, the corresponding bones and teeth of European wolves of the present day. Wolf-hunting was a favourite pursuit of the ancient Britons as well as of the Anglo-Saxons. In Athelstan's reign these animals abounded to such an extent in Yorkshire that a retreat was built by one Acehorn, at Flixton, near Filey, wherein travellers might seek refuge if attacked by them. As is well known, great efforts were made by King Edgar to reduce the number of wolves in the country, but, notwithstanding the annual tribute of 300 skins paid to him during several years by the king of Wales, he was not altogether so successful as has been commonly imagined. In the reign of Henry III. wolves were sufficiently numerous in some parts of the country to induce the king to make grants of land to various individuals upon the express condition of their taking measures to destroy these animals wherever they could be found. In Edward II.'s time, the king's forest of the Peak, in Derbyshire, is especially mentioned as infested with wolves, and it was not until the reign of Henry VII. (1485–1509) that wolves appear to have become finally extinct in England. This, however, is rather a matter of inference from the cessation of all mention of them in local records than from any definite evidence of their extirpation. Their last retreat was probably in the desolate wolds of Yorkshire. In Scotland, as might be supposed from the nature of the country, the wolf maintained its hold for a much longer period. There is a well-known story of the last of the race being killed by Sir Ewen Cameron of Lochiel in 1680, but there is evidence of wolves having survived in Sutherlandshire and other parts into the following century (perhaps as late as 1743), though the date of their final extinction cannot be accurately fixed. In Ireland, in Cromwell's time, wolves were particularly troublesome, and said to be increasing in numbers, so that special measures were taken for their destruction, such as the offering of large rewards for their heads, and the prohibition (in 1652) of the exportation of "wolf-dogs," the large dogs used for hunting the wolves. The active measures taken then and later reduced their numbers greatly, so that towards the end of the century they became scarce, but, as in the case of the sister island, the date of their final disappearance cannot now be ascertained. It has been placed, upon the evidence of somewhat doubtful traditions, as late as 1766.

It is owing to their position that the British Islands have been able to clear themselves of these formidable and destructive animals, for France, with no natural barriers to prevent their incursions from the continent to the east, is liable every winter to visits from numbers of these animals. (W. H. F.; R. L.*)

WOLFDIETRICH, German hero of romance. The tale of Wolfdietrich is connected with the Merovingian princes, Theodoric and Theodebert, son and grandson of Clovis; but in the Middle High German poems of *Ortnit* and *Wolfdietrich* in the *Heldenbuch* (*q.v.*) Wolfdietrich is the son of Hugdietrich, emperor of Constantinople. Repudiated and exposed by his father, the child was spared by the wolves of the forest, and was educated by the faithful Berchtung of Meran. The account of his parents and their wooing, however, differs in various texts. After the emperor's death Wolfdietrich was driven from his inheritance by his brothers at the instigation of the traitor Sabene. Berchtung and his sixteen sons stood by Wolfdietrich. Six of these were slain and the other ten imprisoned. It was only after long exile in Lombardy at the court of King Ortnit that the hero returned to deliver the captives and regain his kingdom. Wolfdietrich's exile and return suggested a parallel with the history of Dietrich of Bern, with whom he was often actually identified; and the Mentors of the two heroes, Hildebrand and Berchtung, are cast in the same mould. Presently features of the

Wolfdietrich legend were transferred to the Dietrich cycle, and in the *Anhang* to the *Heldenbuch* it is stated in despite of all historical considerations that Wolfdietrich was the grandfather of the Veronese hero. Among the exploits of Wolfdietrich was the slaughter of the dragon which had slain Ortnit (*q.v.*). He thus took the place of Hardheri, one of the mythical Hartung brothers, the original hero of this feat. The myth attached itself to the family of Clovis, around which epic tradition rapidly gathered. Hugdietrich is generally considered to be the epic counterpart of Theodoric (Dietrich), eldest son of Clovis. The prefix was the barbarian equivalent of Frank,[1] and was employed to distinguish him from Theodoric the Goth. After his father's death he divided the kingdom with his brothers. Wolfdietrich represents his son Theodebert (d. 548), whose succession was disputed by his uncles, but was secured by the loyalty of the Frankish nobles. But father and son are merged by a process of epic fusion in Wolfdietrich. The rape of Sydrat, daughter of the heathen Walgunt of Salnecke, by Hugdietrich disguised as a woman, is typical of the tales of the wooing of heathen princesses made fashionable by the Crusades, and was probably extraneous to the original legend. It may, however, also be put on a semi-historical basis by adopting the suggestion of C. Voretzsch (*Epische Studien I. Die Comp. des Huon von Bordeaux*, Halle 1900), that Wolfdietrich is far more closely connected with Theodoric than Theodebert, and that Hugdietrich, therefore, stands for Clovis, the hero, in the Merovingian historians, of a well-known Brautfahrtsaga.

Ortnit and *Wolfdietrich* have been edited by Dr J. L. Edlen von Lindhausen (Tübingen, 1906). G. Sarrazin, in *Zeitschr. für deutsche Phil.* (1896), compared the legend of Wolfdietrich with the history of Gundovald, as given by Gregory of Tours in books vi. and vii. of his *Hist. Francorum.*

WOLFE, CHARLES (1791–1823), Irish poet, son of Theobald Wolfe of Blackhall, Co. Kildare, was born on the 14th of December 1791. He was educated at English schools and at Trinity College, Dublin, where he matriculated in 1809 and graduated in 1814. He was ordained priest in 1817, and obtained the curacy of Ballyclog, Co. Tyrone, which he shortly exchanged for that of Donoughmore in the same county. He died at Cork on the 21st of February 1823 in his thirty-second year. Wolfe was well known as a poet in Trinity College circles. He is remembered, however, solely by his stirring stanzas on the "Burial of Sir John Moore," written in 1816 in the rooms of Samuel O'Sullivan, a college friend, and printed in the *Newry Telegraph.*

See John Russell, *Remains of the Rev. Charles Wolfe* (2 vols., 1825; 4th ed., 1829), and a correspondence in *Notes and Queries*, 8th series, vol. viii. pp. 145, 178, 235, 253, 331 and 418.

WOLFE, JAMES (1727–1759), British general, the hero of Quebec, was born at Westerham in Kent on the 2nd of January 1727. At an early age he accompanied his father, Colonel (afterwards Lieutenant-General) Edward Wolfe, one of Marlborough's veterans, to the Carthagena expedition, and in 1741 his ardent desire for a military career was gratified by his appointment to an ensigncy. At the age of fifteen he proceeded with the 12th Foot (now Suffolk Regiment) to the Rhine Campaign, and at Dettingen he distinguished himself so much as acting adjutant that he was made lieutenant. In 1744 he received a company in Barrel's regiment (now the 4th King's Own). In the Scottish rising of the "Forty-five" he was employed as a brigade-major. He was present at Hawley's defeat at Falkirk, and at Culloden. With his old regiment, the 12th, Wolfe served in the Flanders campaigns of the duke of Cumberland, and at Val (Lauffeld) won by his valour the commendation of the duke. Promotion followed in 1749 to a majority, and in 1750 to the lieutenant-colonelcy of the 20th, with which he served in Scotland. Some years later he spent six months in Paris. When war broke out afresh in 1757 he served as a staff officer in the unfortunate Rochefort expedition, but his prospects were not affected by the failure, for had his advice been taken the result might well have been different. Next year he was sent to N. America as a brigadier-general in the Louisburg expedition under Amherst and Boscawen. The landing was effected in the face of strenuous opposition, Wolfe leading the foremost troops. On the 27th of July the place surrendered after an obstinate defence; during the siege Wolfe had had charge of a most important section of the attack, and on his lines the fiercest fighting took place. Soon afterwards he returned to England to recruit his shattered health, but on learning that Pitt desired him to continue in America he at once offered to return. It was now that the famous expedition against Quebec was decided upon, Wolfe to be in command, with the local rank of major-general. In a brief holiday before his departure he met at Bath Miss Lowther, to whom he became engaged. Very shortly afterwards he sailed, and on the 1st of June 1759 the Quebec expedition sailed from Louisburg (see QUEBEC). After wearisome and disheartening failures, embittered by the pain of an internal disease, Wolfe crowned his work by the decisive victory on the Plains of Abraham (13th of September 1759) by which the French permanently lost Quebec. Twice wounded earlier in the fight, he had refused to leave the field, and a third bullet passing through his lungs inflicted a mortal injury. While he was lying in a swoon some one near him exclaimed, "They run; see how they run!" "Who run?" demanded Wolfe, as one roused from sleep. "The enemy," was the answer; "they give way everywhere." Wolfe rallied for a moment, gave a last order for cutting off the retreat, and murmuring, "Now God be praised, I will die in peace," breathed his last. On the battle-ground a tall column bears the words, "Here died Wolfe victorious on the 13th of September 1759." In the governor's garden, in Quebec, there is also a monument to the memory of Wolfe and his gallant opponent Montcalm, who survived him only a few hours, with the inscription "Wolfe and Montcalm. *Mortem virtus communem, famam historia, monumentum posteritas dedit.*" In Westminster Abbey a public memorial to Wolfe was unveiled on the 4th of October 1773.

See R. Wright, *Life of Major-General James Wolfe* (London, 1864); F. Parkman, *Montcalm and Wolfe* (London, 1884); *Twelve British Soldiers* (London, 1899); *General Wolfe's Instructions to Young Officers* (1768–1780); Beckles Willson, *The Life and Letters of James Wolfe* (1909); and A. G. Bradley, *Wolfe* (1895).

WOLFENBÜTTEL, a town of Germany, in the duchy of Brunswick, situated on both banks of the Oker, 7 m. S. of Brunswick on the railway to Harzburg. Pop. (1905) 19,083. Lessing was ducal librarian here, and the old library building, designed in 1723 in imitation of the Pantheon at Rome, contains a marble statue of him. The library, including 300,000 printed books and 10,000 MSS., was, however, transferred to a large and new Renaissance edifice in 1887. It is especially rich in Bibles, *incunabula* and books of the early Reformation period, and contains some fragments of the Gothic bible of Ulfilas. Opposite the old library is the palace, now occupied by a seminary. The ducal burial-vault is in the church of St Mary.

A castle is said to have been founded on the site of Wolfenbüttel by a margrave of Meissen about 1046. When this began in 1267 to be the residence of the early Brunswick or Wolfenbüttel line of counts, a town gradually grew up around it. In 1542 it was taken by the Saxons and Hessians, who, however, evacuated it five years later after the battle of Mühlberg. In the Thirty Years' War, in June 1641, the Swedes, under Wrangel and Königsmark, defeated the Austrians under the archduke Leopold at Wolfenbüttel. The town passed wholly into the possession of the Brunswick-Wolfenbüttel family in 1671, and for nearly one hundred years enjoyed the distinction of being the ducal capital. In 1754, however, Duke Charles transferred the ducal residence to Brunswick.

See Voges, *Erzählungen aus der Geschichte der Stadt Wolfenbüttel* (Wolfenbüttel, 1882); von Heinemann, *Die herzogliche Bibliothek zu Wolfenbüttel* (2nd ed., Wolfenbüttel, 1894). For the "Wolfenbüttel fragments" see LESSING and REIMARUS.

WOLFF, CASPAR FRIEDRICH (1733–1794), German anatomist and physiologist, justly reckoned the founder of modern embryology, was born in 1733 at Berlin, where he studied anatomy and physiology under the elder J. F. Meckel. He graduated in medicine at Halle in 1759, his thesis being his famous *Theoria generationis*. After serving as a surgeon in the Seven Years' War, he wished to lecture on anatomy and physiology in Berlin, but being refused permission he accepted a call from the empress Catharine to become professor of those subjects at the academy of St Petersburg, and acted in this capacity until his death there in 1794.

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[1] "Hugo Theodoricus iste dicitur, id est Francus, quia olim omnes Franci Hugones vocabantur . . .," *Annales Quedlinburg.* (Pertz *Script.* iii. 420.)

While the theory of "evolution" in the crude sense—*i.e.* a simple growth in size and unfolding of organs all previously existent in the germ—was in possession of the field, his researches on the development of the alimentary canal in the chick first clearly established the converse view, that of *epigenesis*, *i.e.* of progressive formation and differentiation of organs from a germ primitively homogeneous. He also largely anticipated the modern conception of embryonic layers, and is said even to have foreshadowed the cell theory.

WOLFF (less correctly WOLF), **CHRISTIAN** (1679–1754), German philosopher and mathematician, the son of a tanner, was born at Breslau on the 24th of January 1679. At the university of Jena he studied first mathematics and physics, to which he soon added philosophy. In 1703 he qualified as *Privatdozent* in the university of Leipzig, where he lectured till 1706, when he was called as professor of mathematics and natural philosophy to Halle. Before this time he had made the acquaintance of Leibnitz, of whose philosophy his own system is a modification. In Halle Wolff limited himself at first to mathematics, but on the departure of a colleague he added physics, and presently included all the main philosophical disciplines. But the claims which Wolff advanced on behalf of the philosophic reason (see RATIONALISM) appeared impious to his theological colleagues. Halle was the headquarters of Pietism, which, after a long struggle against Lutheran dogmatism, had itself assumed the characteristics of a new orthodoxy. Wolff's professed ideal was to base theological truths on evidence of mathematical certitude, and strife with the Pietists broke out openly in 1721, when Wolff, on the occasion of laying down the office of pro-rector, delivered an oration "On the Practical Philosophy of the Chinese" (Eng. tr. 1750), in which he praised the purity of the moral precepts of Confucius, pointing to them as an evidence of the power of human reason to attain by its own efforts to moral truth. For ten years Wolff was subjected to attack, until in a fit of exasperation he appealed to the court for protection. His enemies, however, gained the ear of the king Frederick William I. and represented to him that, if Wolff's determinism were recognized, no soldier who deserted could be punished, since he would only have acted as it was necessarily predetermined that he should. This so enraged the king that he at once deprived Wolff of his office, and commanded him to leave Prussian territory within forty-eight hours on pain of a halter. The same day Wolff passed into Saxony, and presently proceeded to Marburg, to which university he had received a call before this crisis. The landgrave of Hesse received him with every mark of distinction, and the circumstances of his expulsion drew universal attention to his philosophy. It was everywhere discussed, and over two hundred books and pamphlets appeared for or against it before 1737, not reckoning the systematic treatises of Wolff and his followers. In 1740 Frederick William, who had already made overtures to Wolff to return, died suddenly, and one of the first acts of his successor, Frederick the Great, was to recall him to Halle. His entry into the town on the 6th of December 1740 partook of the nature of a triumphal procession. In 1743 he became chancellor of the university, and in 1745 he received the title of *Freiherr* from the elector of Bavaria. But his matter was no longer fresh, he had outlived his power of attracting students, and his class-rooms remained empty. He died on the 9th of April 1754.

The Wolffian philosophy held almost undisputed sway in Germany till it was displaced by the Kantian revolution. It is essentially a common-sense adaptation or watering-down of the Leibnitzian system; or, as we can hardly speak of a system in connexion with Leibnitz, Wolff may be said to have methodized and reduced to dogmatic form the thoughts of his great predecessor, which often, however, lose the greater part of their suggestiveness in the process. Since his philosophy disappeared before the influx of new ideas and the appearance of more speculative minds, it has been customary to dwell almost exclusively on its defects—the want of depth or freshness of insight, and the aridity of its neo-scholastic formalism, which tends to relapse into verbose platitudes. But this is to do injustice to Wolff's real merits. These are mainly his comprehensive view of philosophy, as embracing in its survey the whole field of human knowledge, his insistence everywhere on clear and methodic exposition, and his confidence in the power of reason to reduce all subjects to this form. To these must be added that he was practically the first to "teach philosophy to speak German." The Wolffian system retains the determinism and optimism of Leibnitz, but the monadology recedes into the background, the monads falling asunder into souls or conscious beings on the one hand and mere atoms on the other. The doctrine of the pre-established harmony also loses its metaphysical significance, and the principle of sufficient reason introduced by Leibnitz is once more discarded in favour of the principle of contradiction which Wolff seeks to make the fundamental principle of philosophy. Philosophy is defined by him as the science of the possible, and divided, according to the two faculties of the human individual, into a theoretical and a practical part. Logic, sometimes called *philosophia rationalis*, forms the introduction or propaedeutic to both. Theoretical philosophy has for its parts ontology or *philosophia prima*, cosmology, rational psychology and natural theology; ontology treats of the existent in general, psychology of the soul as a simple non-extended substance, cosmology of the world as a whole, and rational theology of the existence and attributes of God. These are best known to philosophical students by Kant's treatment of them in the *Critique of Pure Reason*. Practical philosophy is subdivided into ethics, economics and politics. Wolff's moral principle is the realization of human perfection.

Wolff's most important works are as follows: *Anfangsgründe aller mathematischen Wissenschaften* (1710; in Latin, *Elementa matheseos universae*, 1713–1715); *Vernünftige Gedanken von den Kräften des menschlichen Verstandes* (1712; Eng. trans. 1770); *Vern. Ged. von Gott, der Welt und der Seele des Menschen* (1719); *Vern. Ged. von der Menschen Thun und Lassen* (1720); *Vern. Ged. von dem gesellschaftlichen Leben der Menschen* (1721); *Vern. Ged. von den Wirkungen der Natur* (1723); *Vern. Ged. von den Absichten der natürlichen Dinge* (1724); *Vern. Ged. von dem Gebrauche der Theile in Menschen, Thieren und Pflanzen* (1725); the last seven may briefly be described as treatises on logic, metaphysics, moral philosophy, political philosophy, theoretical physics, teleology, physiology: *Philosophia rationalis, sive logica* (1728); *Philosophia prima, sive Ontologia* (1729); *Cosmologia generalis* (1731); *Psychologia empirica* (1732); *Psychologia rationalis* (1734); *Theologia naturalis* (1736–1737); *Philosophia practica universalis* (1738–1739); *Jus naturae* and *Jus Gentium* (1740–1749); *Philosophia moralis* (1750–1753). His *Kleine philosophische Schriften* have been collected and edited by G. F. Hagen (1736–1740). In addition to Wolff's autobiography (*Eigene Lebensbeschreibung*, ed. H. Wuttke, 1841) and the usual histories of philosophy, see W. Schrader in *Allgemeine deutsche Biographie*, xliv.; C. G. Ludovici, *Ausführlicher Entwurf einer vollständigen Historie der Wolff'schen Philosophie* (1736–1738); J. Deschamps, *Cours abrégé de la philosophie wolffienne* (1743); F. W. Kluge, *Christian von Wolff der Philosoph* (1831); W. Arnsperger, *Christian Wolffs Verhältnis zu Leibniz* (1897). (A. S. P.-P.; X.)

WOLFF, JOSEPH (1795–1862), Jewish Christian missionary, was born at Weilersbach, near Bamberg, Germany, in 1795. His father became rabbi at Württemberg in 1806, and sent his son to the Protestant lyceum at Stuttgart. He was converted to Christianity through reading the books of Johann Michael von Sailer, bishop of Regensburg, and was baptized in 1812 by the Benedictine abbot of Emaus, near Prague. Wolff was a keen Oriental scholar and pursued his studies at Tübingen and at Rome, where he was expelled from the Collegio di Propaganda in 1818 for attacking the doctrine of infallibility and criticizing his tutors. After a short stay in the monastery of the Redemptorists at Val Sainte near Fribourg, he went to London, entered the Anglican Church, and resumed his Oriental and theological studies at Cambridge. In 1821 he began his missionary wanderings in the East by visiting Egypt, the Sinaitic peninsula, Jerusalem, Aleppo, Mesopotamia, Persia, Tiflis and the Crimea, returning to England in 1826, when Edward Irving introduced him to Lady Georgina Walpole, 6th daughter of Horatio Walpole, earl of Orford, whom he married in February 1827. In 1828 Wolff set out to search for the ten tribes, travelling through Anatolia, Armenia, Turkestan and Afghanistan to Simla and Calcutta, suffering many hardships but preaching with enthusiasm. He visited Madras, Pondicherry, Tinnevelly, Goa and Bombay, travelling home by Egypt and Malta. In 1836 he found Samuel Gobat in Abyssinia, took him to Jiddah, and himself visited Yemen and Bombay, going on to the United States, where he was ordained deacon in 1837, and priest in 1838

In the same year he was given the rectory of Linthwaite in Yorkshire. In 1843 he went to Bokhara to seek two British officers, Lieut.-Colonel C. Stoddart and Captain A. Conolly, and narrowly escaped the death that had overtaken them; his *Narrative* of this mission went through seven editions between 1845 and 1852. In 1845 he was presented to the vicarage of Ile Brewers, Somerset, and was planning another great missionary tour when he died on the 2nd of May 1862.

He published several *Journals* of his expeditions, especially *Travels and Adventures of Joseph Wolff* (2 vols., London, 1860).

His son, Sir Henry Drummond Wolff (1830–1908), was a well-known English diplomatist and Conservative politician, who started as a clerk in the foreign office and was created K.C.M.G. in 1862 for various services abroad. In 1874–1880 he sat in parliament for Christchurch, and in 1880–1885 for Portsmouth, being one of the group known as the "Fourth Party." In 1885 he went on a special mission to Constantinople in connexion with the Egyptian question, and as the result various awkward difficulties, hinging on the sultan's suzerainty, were got over. In 1888 he was sent as minister to Teheran, and from 1892 to 1900 was ambassador at Madrid. He died on the 11th of October 1908. Sir Henry was a notable *raconteur*, and he did good service to the Conservative party by helping to found the Primrose League. He was created G.C.M.G. in 1878 and G.C.B. in 1889.

WOLFRAMITE, or Wolfram, a mineral consisting of iron-manganese tungstate, $(Fe, Mn)WO_4$. The name is of doubtful origin, but it has been assumed that it is derived from the German *Wolf* and *Rahm* (froth), corresponding with the *spuma lupi* of old writers, a term hardly appropriate, however, to the mineral in question. Wolframite crystallizes in the monoclinic system, with approximation to an orthorhombic type; and the crystals offer perfect pinacoidal cleavage. The colour of wolframite is generally dark brownish-black, the lustre metallic or adamantine, the hardness 5 to 5·5, and the specific gravity 7·1 to 7·5. Wolframite may be regarded as an isomorphous mixture, in variable ratio, of iron and manganese tungstates, sometimes with a small proportion of niobic and tantalic acids. It was in wolframite that the metal tungsten was first recognized in 1785 by two brothers, J. J. and F. d'Elhuyar. At the present time the mineral is used in the manufacture of tungsten-steel and in the preparation of certain tungstates.

Wolframite is commonly associated with tin-ores, as in many parts of Cornwall, Saxony and Bohemia. In consequence of the two minerals, cassiterite and wolframite, having nearly the same density, their separation becomes difficult by the ordinary processes of ore-dressing, but may be effected by means of magnetic separators, the wolframite being attracted by powerful magnets. A process introduced many years ago by R. Oxland consisted in roasting the mixed ore with carbonate of soda, when the wolfram was converted into sodium tungstate, which was easily removed as a soluble salt. Wolframite occurs at many localities in the United States, notably at Trumbull, Conn., where it has been mined, and at Monroe, Conn., where it accompanies bismuth ores. Other localities are in Mecklenburg county, N.C., and in the Mammoth mining district, Nevada. Wolframite has in some cases resulted from the alteration of scheelite (*q.v.*), though on the contrary pseudomorphs are known in which scheelite has taken the form of wolframite. By oxidation wolframite may become encrusted with tungstic ochre, or tungstite, sometimes known as wolframine, a name to be carefully distinguished from wolframite.

As the relative proportions of iron and manganese vary in wolframite, the composition tends towards that of other minerals. Thus there is a manganous tungstate ($MnWO_4$) known as hübnerite, a name given by E. N. Riotte, in 1865, in compliment to Adolph Hübner, a Saxon mineralogist. There is also a mineral which contains little more than ferrous tungstate ($FeWO_4$), and is known as ferberite, having been named by A. Breithaupt in 1863 after Rudolph Ferber. The original hübnerite came from the Mammoth district, Nevada, and the ferberite from the Sierra Almagrera in Spain. It is possible that such minerals may represent the extreme terms in the series formed by the varieties of wolframite.

(F. W. R.*)

WOLFRAM VON ESCHENBACH, the most important and individual poet of medieval Germany, flourished during the end of the 12th and beginning of the 13th century. He was one of the brilliant group of Minnesingers whom the Landgrave Herrmann of Thuringia gathered round him at the historic castle of the Wartburg. We know by his own statement that he was a Bavarian, and came of a knightly race, counting his achievements with spear and shield far above his poetical gifts. The Eschenbach from which he derived his name was most probably Ober-Eschenbach, not far from Pleinfeld and Nuremberg; there is no doubt that this was the place of his burial, and so late as the 17th century his tomb was to be seen in the church of Ober-Eschenbach, which was then the burial place of the Teutonic knights. Wolfram probably belonged to the small nobility, for he alludes to men of importance, such as the counts of Abenberg, and of Wertheim, as if he had been in their service. Certainly he was a poor man, for he makes frequent and jesting allusions to his poverty. Bartsch concludes that he was a younger son, and that while the family seat was at Eschenbach, Wolfram's home was the insignificant estate of Wildenburg (to which he alludes), now the village of Wehlenberg. Wolfram seems to have disdained all literary accomplishments, and in fact insists on his unlettered condition both in *Parzival* and in *Willehalm*. But this is somewhat perplexing, for these poems are beyond all doubt renderings of French originals. Were the poems read to him, and did he dictate his translation to a scribe? The date of Wolfram's death is uncertain. We know that he was alive in 1216, as in *Willehalm* he laments the death of the Landgrave Herrmann, which took place in that year, but how long he survived his friend and patron we do not know.

Wolfram von Eschenbach lives in, and is revealed by, his work, which shows him to have been a man of remarkable force and personality. He has left two long epic poems, *Parzival* and *Willehalm* (the latter a translation of the French chanson de geste *Aliscans*), certain fragments, *Titurel* (apparently intended as an introduction to the *Parzival*), and a group of lyrical poems, *Wächter-Lieder*. These last derive their name from the fact that they record the feelings of lovers who, having passed the night in each other's company, are called to separate by the cry of the watchman, heralding the dawn. These *Tage Lieder*, or *Wächter Lieder*, are a feature of Old German folk-poetry, of which Wagner has preserved the tradition in the warning cry of Brangaene in the second act of *Tristan*. But the principal interest of Wolfram's work lies in his *Parzival*, immeasurably the finest and most spiritual rendering of the *Perceval-Grail* story.

The problem of the source of the *Parzival* is the crux of medieval literary criticism (see Perceval). These are the leading points. The poem is divided into sixteen books. From iii. to xii., inclusive, the story marches *pari passu* with the *Perceval* of Chrétien de Troyes, at one moment agreeing almost literally with the French text, at the next introducing details quite unknown to it. Books i. and ii., unrepresented in Chrétien, relate the fortunes of the hero's father, and connect the story closely with the house of Anjou; the four concluding books agree with the commencement, and further connect the Grail story with that of the Swan Knight, for the first time identifying that hero with Parzival's son, a version followed by the later German romance of *Lohengrin*. At the conclusion Wolfram definitely blames Chrétien for having mistold the tale, while a certain Kiot, the Provençal (whom he has before named as his source), had told it aright from beginning to end. Other peculiarities of this version are the representation of the Grail itself as a stone, and of the inhabitants of the castle as an ordered knighthood, *Templeisen*; the numerous allusions to, and evident familiarity with, Oriental learning in its various branches; and above all, the connecting thread of ethical interpretation which runs through the whole poem. The *Parzival* is a soul-drama; the conflict between light and darkness, faith and doubt, is its theme, and the evolution of the hero's character is steadily and consistently worked out. The teaching is of a character strongly at variance with the other romances of the cycle. Instead of an asceticism, based upon a fundamentally low and degrading view of women. Wolfram upholds a sane and healthy morality; chastity, rather than celibacy, is his ideal, and a loyal observance of the marriage bond is in his eyes the highest virtue. Not retirement *from* the world, but fulfilment of duty *in* the world, is the goal he marks out for attainment. Whether views so large, so sane and so wholesome, are to be placed to the credit of the German poet, or of his French source (and modern criticism is leaning more and more to a belief in the existence of Kiot), the *Parzival* is the work of a remarkable personality, and, given the age and the environment, a unique literary achievement.

Wolfram has moments of the highest poetical inspiration, but his meaning, even for his compatriots, is often obscure. He is in no sense a master of language, as was Gottfried von Strassbourg. This latter, in a very interesting passage of the *Tristan*, passes in review the poets of the day, awarding to the majority praise for the excellence of their style, but one he does not name, only blaming him as being so obscure and involved that none can tell what his meaning may be; this un-named poet has always been understood to be Wolfram von Eschenbach, and in a passage of *Willehalm* the author refers to the unfavourable criticisms passed on *Parzival*. Wolfram and Gottfried were both true poets, but of widely differing style. Wolfram was, above all, a man of deeply religious character (witness his introduction to *Willehalm*), and it seems to have been this which specially impressed the mind of his compatriots; in the 13th-century poem of *Der Wartburg-Krieg* it is Wolfram who is chosen as the representative of Christianity, to oppose the enchanter Klingsor von Ungerland. (J. L. W.)

WOLGAST, a seaport town of Germany, in the Prussian province of Pomerania, situated on the river Peene, which separates it from the island of Usedom, 30 m. by rail E. of Greifswald. Pop. (1905) 8346. There are various manufactures. Wolgast became a town in 1247, and after being the residence of the duke of Pomerania-Wolgast, it was ceded to Sweden in 1648. It was captured four times during the Thirty Years' War, and in 1675 by Frederick William, elector of Brandenburg. It was restored to Germany in 1815.

See B. Heberlein, *Beiträge zur Geschichte der Burg und Stadt Wolgast* (Wolgast, 1892).

WOLLASTON, WILLIAM (1659–1724), English philosophical writer, was born at Coton-Clanford in Staffordshire, on the 26th of March 1659. On leaving Sidney Sussex College, Cambridge, in 1681, he became an assistant master at the Birmingham grammar-school, and took holy orders. In 1688 an uncle left him a fortune. He then moved to London, married a lady of wealth, and devoted himself to learning and philosophy. He embodied his views in the one book by which he is remembered, *The Religion of Nature Delineated* (1st ed. 1722; 2nd ed. 1724). He died in October 1724.

Wollaston's *Religion of Nature*, which falls between Clarke's *Discourse of the Unchangeable Obligations of Natural Religion* and Butler's *Sermons*, was one of the popular philosophical books of its day. To the 8th edition (1750) was added a life of the author. The book was designed to be an answer to two questions: Is there such a thing as natural religion? and, If there is, what is it? Wollaston starts with the assumption that religion and morality are identical, and labours to show that religion is "the pursuit of happiness by the practice of truth and reason." He claims originality for his theory that the moral evil is the practical denial of a true proposition and moral good the affirmation of it (see ETHICS). Wollaston also published anonymously a small book, *On the Design of the Book of Ecclesiastes, or the Unreasonableness of Men's Restless Contention for the Present Enjoyments, represented in an English Poem* (London, 1691).

See John Clarke, *Examination of the Notion of Moral Good and Evil advanced in a late book entitled The Religion of Nature Delineated* (London, 1725); Drechsler, *Über Wollaston's Moral-Philosophie* (Erlangen, 1802); Sir Leslie Stephen's *History of English Thought in the Eighteenth Century* (London, 1876), ch. iii. and ch. ix.; H. Sidgwick's *History of Ethics* (1902), pp. 198 sq.

WOLLASTON, WILLIAM HYDE (1766–1828), English chemist and natural philosopher, was born at East Dereham, Norfolk, on the 6th of April 1766, the second of seventeen children. His father, the Rev. Francis Wollaston (1731–1815), rector of Chislehurst, grandson of the William Wollaston noticed above, was an enthusiastic astronomer. Wollaston was educated at Charterhouse, and afterwards at Caius College, Cambridge, of which he became a fellow. He took the degrees of M.B. (1787) and M.D. (1793), starting to practise medicine in 1789 at Bury St Edmunds, whence he soon removed to London. But he made little way, and failed to obtain a vacant physicianship at St George's hospital; the result was that he abandoned medicine and took to original research. He devoted much attention to the affairs of the Royal Society, of which he was elected a fellow in 1793 and made secretary in 1806. He was elected interim president in June 1820, on the death of Sir Joseph Banks; but he did not care to enter into competition with Sir Humphry Davy, and the latter was elected president at the anniversary meeting in November 1820. Wollaston became a member of the Geological Society of London in 1812, and served frequently on the Council and for some time as a vice-president. Beyond appearing at the meetings of learned societies he took little part in public affairs; he lived alone, conducting his investigations in a deliberate and exhaustive manner, but in the most rigid seclusion, no person being admitted to his laboratory on any pretext. Towards the close of 1828 he felt the approach of a fatal malady—a tumour in the brain—and devoted his last days to a careful revisal of his unpublished researches and industrial processes, dictating several papers on these subjects, which were afterwards published in the *Philosophical Transactions*. He died in London on the 22nd of December 1828.

Most of Wollaston's original work deals more or less directly with chemical subjects, but diverges on all sides into optics, acoustics, mineralogy, astronomy, physiology, botany and even art. In chemistry he made a speciality of the platinum metals. Platinum itself he discovered how to work on a practical scale, and he is said to have made a fortune from the secret, which, however, he disclosed in a posthumous paper (1829); and he was the first to detect the metals palladium (1804) and rhodium (1805) in crude platinum. In regard to palladium his conduct was open to criticism. He anonymously offered a quantity of the metal for sale at an instrument-maker's shop, issuing an advertisement in which some of its main properties were described. Richard Chevenix (1774–1830), a chemist, having bought some of the substance, decided after experiment that it was not a simple body as claimed, but an alloy of mercury with platinum, and in 1803 presented a paper to the Royal Society setting forth this view. As secretary, Wollaston saw this paper when it was sent in, and is said to have tried to persuade the author to withdraw it. But having failed, he allowed the paper, and also a second by Chevenix of the same tenor in 1805, to be read without avowing that it was he himself who had originally detected the metal, although he had an excellent opportunity of stating the fact in 1804 when he discussed the substance in the paper which announced the discovery of rhodium. In 1809 he proved the elementary character of columbium (niobium) and titanium. In optics he was the first, in 1802, to observe the dark lines in the solar spectrum. Of the seven lines he saw, he regarded the five most prominent as the natural boundaries or dividing lines of the pure simple colours of the prismatic spectrum, which he supposed to have four primary divisions. He described the reflecting goniometer in 1809 and the camera lucida in 1812, provided microscopists with the "Wollaston doublet," and applied concavo-convex lenses to the purposes of the oculist. His cryophorus was described in 1813, in a paper "On a method of freezing at a distance." In 1821, after H. C. Oersted (1777–1851) had shown that a magnetic needle is deflected by an electric current, he attempted, in the laboratory of the Royal Institution in the presence of Humphry Davy, to convert that deflection into a continuous rotation, and also to obtain the reciprocal effect of a current rotating round a magnet. He failed in both respects, and when Michael Faraday, who overheard a portion of his conversation with Davy on the subject, was subsequently more successful, he was inclined to assert the merit of priority, to which Faraday did not admit his claim. Among his other papers may be mentioned those dealing with the formation of fairy rings (1807), a synoptic scale of chemical equivalents (1814), sounds inaudible to ordinary ears (1820), the physiology of vision (1824), the apparent direction of the eyes in a portrait (1824) and the comparison of the light of the sun with that of the moon and fixed stars (1829).

In geological circles Wollaston is famous for the medal which bears his name, and which (together with a donation fund) is annually awarded by the council of the Geological Society of London, being the result of the interest on £1000 bequeathed by Wollaston for "promoting researches concerning the mineral structure of the earth." The first award was made in 1831. The medal is the highest honour bestowed by the society: it was originally made of palladium, but is now made of gold.

An appreciative essay on Wollaston will be found in George Wilson's *Religio Chemici* (1862).

WOLLASTONITE, a rock-forming mineral consisting of calcium metasilicate, $CaSiO_3$, crystallizing in the monoclinic system and belonging to the pyroxene (*q.v.*) group. It differs, however, from other members of this group in having cleavages, not parallel to the prism-faces, but in two directions perpendicular to the plane of symmetry. Crystals are usually elongated parallel to the axis of symmetry and flattened parallel to the ortho-pinacoid, hence the early name "tabular spar"; the name wollastonite is after W. H. Wollaston. The mineral usually occurs in white cleavage masses. The hardness is 5, and the specific gravity 2·85. It is a characteristic product of contact-metamorphism, occurring especially, with garnet, diopside, &c., in crystalline limestones. Crystals are found in the cavities of the ejected limestone blocks of Monte Somma, Vesuvius. At Santa Fé in the State of Chiapas, Mexico, a large rock-mass of wollastonite carries ores of gold and copper: here are found large pink crystals which are often partially or wholly altered to opal. (L. J. S.)

WOLLIN, an island of Germany, in the Prussian province of Pomerania, the more easterly of the islands at the mouth of the Oder which separate the Stettiner Haff from the Baltic Sea. It is divided from the mainland on the E. by the Dievenow Channel, and from Usedom on the W. by the Swine. It is roughly triangular in shape, and has an area of 95 sq. m. Heath and sand alternate with swamps, lakes and forest on its surface, which is flat, except towards the south-west, where the low hills of Lebbin rise. Cattle-rearing and fishing are the chief resources of the inhabitants, who number about 14,000. Misdroy, on the N.W. coast, is a favourite sea-bathing resort, and some of the other villages, as Ostswine, opposite Swinemünde, Pritter, famous for its eels, and Lebbin, are also visited in summer. Wollin, the only town, is situated on the Dievenow, and is connected with the mainland by three bridges. It carries on the industries of a small seaport and fishing-town. Pop. (1900) 4679.

Near the modern town once stood the ancient and opulent Wendish city of Wolin or Jumne, called Julin by the Danes, and Winetha or Vineta (*i.e.* Wendish town) by the Germans. In the 10th and 11th centuries it was the centre of an active and extensive trade. Adam of Bremen (d. 1076) extols its size and wealth, and mentions that Greeks and other foreigners frequented it, and that Saxons were permitted to settle there on equal terms with the Wends, so long as they did not obtrude the fact of their Christianity. The Northmen made a settlement here about 970, and built a fortress on the "silver hill," called Jomsburg, which is often mentioned in the sagas. Its foundation was attributed to a legendary Viking exiled from Denmark, called Palnotoke or Palnatoki. The stronghold of Jomsburg was destroyed in 1098 by King Magnus Barfod of Norway. This is probably the origin of the legend that Vineta was overthrown by a storm or earthquake and overwhelmed by the sea. Some submarine granite rocks near Damerow in Usedom are still popularly regarded as its ruins. The town of Wollin became in 1140 the seat of the Pomeranian bishopric, which was transferred to Kammin about 1170. Wollin was burnt by Canute VI. of Denmark in 1183, and was taken by the Swedes in 1630 and 1759 and by the Brandenburgers in 1659 and 1675.

See Khull, *Die Geschichte Palnatokis und der Jomsburger* (Graz, 1892); Koch, *Vineta in Prosa und Poesie* (Stettin, 1905); W. von Raumer, *Die Insel Wollin* (Berlin, 1851); Haas, *Sagen und Erzählungen von den Inseln Usedom und Wollin* (Stettin, 1904).

WOLLONGONG, a seaport of Camden county, New South Wales, Australia, 49 m. by rail S. of Sydney, the third port and chief harbour on the S. coast of the colony. Pop. (1901) 3545. Its harbour, known as Belmont Basin, is excavated out of the rock, having an area of 3 acres, and a depth of 18 ft. at low water. A breakwater protects its mouth; it has a lighthouse, and is defended by a fort on Signal Hill. It is the port for the Osborne-Wallsend and Mount Pleasant collieries, which are connected with it by rail. It lies at the foot of Mount Keira, amid fine mountain and coast scenery.

WOLOF (Woloff, Jolof), a Negroid people of Senegal, French West Africa. They occupy the seaboard between St Louis and Cape Verde and the south bank of the Senegal from its mouth to Dagana. Farther inland the districts of the Walo, Cayor Baol and Jolof (the last, the name of a chief division of the nation, being sometimes used as the national name) are almost exclusively peopled by Wolof. The cities of St Louis and Dakar are both in the Wolof country, and throughout the French Sudan no military station is without a Wolof colony, preserving national speech and usages. The name is variously explained as meaning "speaker" or "black." The Wolof justify both meanings, for they are at once far the blackest and among the most garrulous of all African peoples. They are a very tall race, with splendidly proportioned busts but weak and undeveloped legs and flat feet.

The Wolof language is spoken throughout Senegambia, and numerous grammars, dictionaries and vocabularies have appeared since 1825. There is, however, no written literature. The Wolof preserve their national songs, legends and proverbs by memory, but have little knowledge of letters beyond the Arabic characters on their paper spells and amulets. Wolof, a typical agglutinating language, differs from all other African forms of speech. The roots, almost all monosyllables ending in consonants, are determined by means of suffixes, and coalesce while remaining invariable in their various meanings. By these suffixes the meaning of the words is endlessly modified.

Most Wolof are nominally Mahommedans, and some near the Christian missions profess Christianity, but many pagan rites are still observed. Animal worship is prevalent. The capture of a shark is hailed with delight, and family genii have offerings made to them, the most popular of these household deities, the lizard, having in many houses a bowl of milk set aside for it daily. The Wolof have three hereditary castes, the nobles, the tradesmen and musicians (who are despised), and the slaves. These latter are kindly treated. Polygyny is customary.

The old kingdom of Cayor, the largest of Wolof states, has been preserved by the French. The king is elected, but always from the ruling family, and the electors, themselves unable to succeed, only number four. When elected the king receives a vase said to contain the seeds of all plants growing in Cayor, and he is thus made lord of the land. In earlier days there was the Bur or "Great Wolof," to whom all petty chiefs owed allegiance. The Wolof are very loyal to the French, and have constantly proved themselves courageous soldiers.

WOLOWSKI, LOUIS FRANÇOIS MICHEL RAYMOND (1810–1876), French economist and politician, was born in Warsaw and educated in Paris, but returned to Warsaw and took part in the revolution of 1830. Sent to Paris as secretary to the legation by the provisional government, he settled there on the suppression of the Polish rebellion and was naturalized in 1834. In 1833 he founded the *Revue de législation et de jurisprudence*, and wrote voluminously on economic and financial subjects. He established the first Crédit Foncier in France in 1852, and in 1864 became professor of political economy at the Conservatoire in succession to J. A. Blanqui. He was a member of the national assembly from 1848 to 1851, and again from 1871 till his election as a senator in 1876. He was a strong free-trader and an ardent bimetallist.

Of his works the following are the more important: *Mobilisation du crédit foncier* (1839); *De l'organisation industrielle de la France avant Colbert* (1842); *Les Finances de la Russie* (1864); *La Question des banques* (1864); *La Liberté commerciale* (1869); *L' Or et l'argent* (1870).

WOLSELEY, GARNET JOSEPH WOLSELEY, Viscount (1833–), British field marshal, eldest son of Major Garnet Joseph Wolseley of the King's Own Borderers (25th Foot), was born at Golden Bridge, Co. Dublin, on the 4th of June 1833. Educated at Dublin, he obtained a commission as ensign in the 12th Foot in March 1852, and was transferred to the 80th Foot, with which he served in the second Burmese War. He was severely wounded on the 19th of March 1853 in the attack of Donabyú, was mentioned in despatches, and received the war medal. Promoted to be lieutenant and invalided home, he exchanged into the 90th Light Infantry, then in Dublin. He accompanied the regiment to the Crimea, and landed at Balaklava in December 1854. He was selected to be an assistant engineer, and did duty with the Royal Engineers in the trenches before Sevastopol. He was promoted to be captain in January 1855, after less than three years' service, and served throughout the siege, was wounded at the Quarries on the 7th of June, and again in the trenches on the 30th of August. After the fall of Sevastopol Wolseley was employed on the quartermaster-general's staff, assisted in the embarkation of the troops and stores, and was one of the last to leave the Crimea in July 1856. For his services he was twice mentioned in despatches, was noted for a brevet majority, received the war medal with clasp, the 5th class of the French Legion of Honour, the 5th class of the Turkish Mejidie and the Turkish medal. After six months' duty with the 90th

Foot at Aldershot, he went with it again, in March 1857, to join the expedition to China under Major-General the Hon. T. Ashburnham. Wolseley embarked in command of three companies in the transport "Transit," which was wrecked in the Strait of Banka. The troops were all saved, but with only their arms and a few rounds of ammunition, and were taken to Singapore, whence, on account of the Indian Mutiny, they were despatched with all haste to Calcutta. Wolseley distinguished himself at the relief of Lucknow under Sir Colin Campbell in November, and in the defence of the Alambagh position under Outram, taking part in the actions of the 22nd of December 1857, the 12th and 16th of January 1858, and the repulse of the grand attack of the 21st of February. In March he served at the final siege and capture of Lucknow. He was then appointed deputy-assistant quartermaster-general on the staff of Sir Hope Grant's Oudh division, and was engaged in all the operations of the campaign, including the actions of Bari, Sarsi, Nawabganj, the capture of Faizabad, the passage of the Gumti and the action of Sultanpur. In the autumn and winter of 1858 he took part in the Baiswara, trans-Gogra and trans-Rapti campaigns, ending with the complete suppression of the rebellion. For his services he was frequently mentioned in despatches, and, having received his Crimean majority in March 1858, was in April 1859 promoted to be lieutenant-colonel, and received the Mutiny medal and clasp. Wolseley continued to serve on Sir Hope Grant's staff in Oudh, and when Grant was nominated to the command of the British troops in the Anglo-French expedition to China in 1860, accompanied him as deputy-assistant quartermaster-general. He was present at the action at Sin-ho, the capture of Tang-ku, the storming of the Taku Forts, the occupation of Tientsin, the battle of Pa-le-cheau and the entry into Peking. He assisted in the re-embarkation of the troops before the winter set in. He was mentioned in despatches, and for his services received the medal and two clasps. On his return home he published the *Narrative of the War with China in 1860*.

In November 1861 Wolseley was one of the special service officers sent to Canada to make arrangements for the reception of troops in case of war with the United States in connexion with the mail steamer "Trent" incident, and when the matter was amicably settled he remained on the headquarters staff in Canada as assistant quartermaster-general. In 1865 he became a brevet colonel, was actively employed the following year in connexion with the Fenian raids from the United States, and in 1867 was appointed deputy quartermaster-general in Canada. In 1869 his *Soldiers' Pocket Book for Field Service* was published, and has since run through many editions. In 1870 he successfully commanded the Red river expedition to put down a rising under Louis Riel at Fort Garry, now the city of Winnipeg, the capital of Manitoba, then an outpost in the Wilderness, which could only be reached through a network of rivers and lakes extending for 600 m. from Lake Superior, traversed only by Indians, and where no supplies were obtainable. The admirable arrangements made and the careful organization of the transport reflected great credit on the commander, who on his return home was made K.C.M.G. and C.B.

Appointed assistant adjutant-general at the war office in 1871 he worked hard in furthering the Cardwell schemes of army reform, was a member of the localization committee, and a keen advocate of short service, territorial regiments and linked battalions. From this time till he became commander-in-chief Wolseley was the prime mover and the deciding influence in practically all the steps taken at the war office for promoting the efficiency of the army under the altered conditions of the day. In 1873 he commanded the expedition to Ashanti, and, having made all his arrangements at the Gold Coast before the arrival of the white troops in January 1874, was able to complete the campaign in two months, and re-embark them for home before the unhealthy season began. This was the campaign which made his name a household word in England. He fought the battle of Amoaful on the 31st of January, and, after five days' fighting, ending with the battle of Ordahsu, entered Kumasi, which he burned. He received the thanks of both Houses of Parliament and a grant of £25,000, was promoted to be major-general for distinguished service in the field, received the medal and clasp and was made G.C.M.G. and K.C.B. The freedom of the city of London was conferred upon him with a sword of honour, and he was made honorary D.C.L. of Oxford and LL.D. of Cambridge universities. On his return home he was appointed inspector-general of auxiliary forces, but had not held the post for a year when, in consequence of the native unrest in Natal, he was sent to that colony as governor and general commanding. In November 1876 he accepted a seat on the council of India, from which in 1878, having been promoted lieutenant-general, he went as high-commissioner to the newly acquired possession of Cyprus, and in the following year to South Africa to supersede Lord Chelmsford in command of the forces in the Zulu War, and as governor of Natal and the Transvaal and high commissioner of South-East Africa. But on his arrival at Durban in July he found that the war in Zululand was practically over, and after effecting a temporary settlement he went to the Transvaal. Having reorganized the administration there and reduced the powerful chief Sikukuni to submission, he returned home in May 1880 and was appointed quartermaster-general to the forces. For his services in South Africa he received the Zulu medal with clasp, and was made G.C.B.

In 1882 he was appointed adjutant-general to the forces, and in August of that year was given the command of the British forces in Egypt to suppress the rebellion of Arabi Pasha (see EGYPT: *Military Operations*). Having seized the Suez Canal, he disembarked his troops at Ismailia, and after a very short and brilliant campaign completely defeated Arabi Pasha at Tel-el Kebir, and suppressed the rebellion. For his services he received the thanks of parliament, the medal with clasp, the bronze star, was promoted general for distinguished service in the field, raised to the peerage as Baron Wolseley of Cairo and Wolseley, and received from the Khedive the 1st class of the order of the Osmanieh. In 1884 he was again called away from his duties as adjutant-general to command the Nile expedition for the relief of General Gordon and the besieged garrison of Khartum. The expedition arrived too late: Khartum had fallen, and Gordon was dead; and in the spring of 1885 complications with Russia over the Penjdeh incident occurred, and the withdrawal of the expedition followed. For his services he received two clasps to his Egyptian medal, the thanks of parliament, and was created a viscount and a knight of St Patrick. He continued at the war office as adjutant-general to the forces until 1890, when he was given the command in Ireland. He was promoted to be field marshal in 1894, and was nominated colonel of the Royal Horse Guards in 1895, in which year he was appointed by the Unionist government to succeed the duke of Cambridge as commander-in-chief of the forces. This was the position to which his great experience in the field and his previous signal success at the war office itself had fully entitled him. His powers were, however, limited by a new order in council, and after holding the appointment for over five years, he handed over the command-in-chief to Earl Roberts at the commencement of 1901. The fact that the unexpectedly large force required for South Africa was mainly furnished by means of the system of reserves which Lord Wolseley had originated was in itself a high tribute to his foresight and sagacity; but the new conditions at the war office had never been to his liking, and on being released from responsibility he brought the whole subject before the House of Lords in a speech which resulted in some remarkable disclosures.

Lord Wolseley had been appointed colonel-in-chief of the Royal Irish Regiment in 1898, and in 1901 was made gold-stick in waiting. He married in 1867 Louisa, daughter of Mr A. Erskine, his only child, Frances, being heiress to the viscountcy under special remainder. A frequent contributor to periodicals, he also published *The Decline and Fall of Napoleon* (1895), *The Life of John Churchill, Duke of Marlborough, to the Accession of Queen Anne* (1894), and *The Story of a Soldier's Life* (1903), giving in the last-named work an account of his career down to the close of the Ashanti War.

WOLSEY, THOMAS (*c.* 1475–1530), English cardinal and statesman, born at Ipswich about 1475, was son of Robert Wolsey (or Wuley, as his name was always spelt) by his wife Joan. His father is generally described as a butcher, but he sold other things than meat; and although a man of some property and a churchwarden of St Nicholas, Ipswich, his character seems to have borne a striking resemblance to that of Thomas Cromwell's father. He was continually being fined for allowing his pigs to stray in the street, selling bad meat, letting his house to doubtful characters for illegal purposes, and generally infringing the by-laws respecting weights and measures (extracts from the Ipswich records, printed in the *Athenaeum*, 1900, i. 400). He died in September 1496, and his will, which has been preserved, was proved a few days later.

Thomas was educated at Magdalen College, Oxford; but the details of his university career are doubtful owing to the defectiveness of the university and college registers. He is said to have graduated B.A. at the age of fifteen (*i.e.* about 1490); but his earliest definite appearance in the records is as junior bursar of Magdalen College in 1498–1499, and senior bursar in 1499–1500, an office he was compelled to resign for applying funds to the completion of the great tower without sufficient authority (W. D. Macray, *Reg. of Magdalen College*, i. 29-30, 133-134). He must have been elected fellow of Magdalen some years before; and as master of Magdalen College school he had under his charge three sons of Thomas Grey, first marquess of Dorset. Dorset's beneficent intentions for his sons' pedagogue probably suggested Wolsey's ordination as priest at Marlborough on March 10, 1498, and on October 10, 1500, he was instituted, on Dorset's presentation, to the rectory of Limington in Somerset. His connexion with Magdalen had perhaps terminated with his resignation of the bursarship, though he supplicated for the degrees of B.D. and D.D. in 1510; and the college appears to have derived no advantage from Wolsey's subsequent greatness.

At Limington he came into conflict with law and order as represented by the sheriff, Sir Amias Paulet, who is said by Cavendish to have placed Wolsey in the stocks; Wolsey retaliated long afterwards by confining Paulet to his chambers in the Temple for five or six years. Dorset died in 1501, but Wolsey found other patrons in his pursuit of wealth and fame. Before the end of that year he obtained from the pope a dispensation to hold two livings in conjunction with Limington, and Archbishop Deane of Canterbury also appointed him his domestic chaplain. Deane, however, died in 1503, and Wolsey became chaplain to Sir Richard Nanfan, deputy of Calais, who apparently recommended him to Henry VII. Nanfan died in 1507, but the king made Wolsey his chaplain and employed him in diplomatic work. In 1508 he was sent to James IV. of Scotland, and in the same year he pleased Henry by the extraordinary expedition with which he crossed and recrossed the Channel on an errand connected with the king's proposal of marriage to Margaret of Savoy. His ecclesiastical preferments, of which he received several in 1506–1509, culminated in his appointment by Henry to the deanery of Lincoln on February 2, 1509.

Henry VIII. made Wolsey his almoner immediately on his accession, and the receipt of some half-dozen further ecclesiastical preferments in the first two years of the reign marks his growth in royal favour. But it was not till towards the end of 1511 that Wolsey became a privy councillor and secured a controlling voice in the government. His influence then made itself felt on English policy. The young king took little pains with the government, and the control of affairs was shared between the clerical and peace party led by Richard Fox (*q.v.*) and Archbishop Warham, and the secular and war party led by Surrey. Hitherto pacific counsels had on the whole prevailed; but Wolsey, who was nothing if not turbulent, turned the balance in favour of war, and his marvellous administrative energy first found full scope in the preparations for the English expedition to Biscay in 1512, and for the campaign in northern France in 1513. He brought about the peace with France and marriage between Mary Tudor and Louis XII. in 1514, and reaped his reward in the bishoprics of Lincoln and Tournai, the archbishopric of York, which was conferred on him by papal bull in September, and the cardinalate which he had sent Polydore Vergil to beg from Leo X. in May 1514, but did not receive till the following year. Nevertheless, when Francis I. in 1515 succeeded Louis XII. and won the battle of Marignano, Wolsey took the lead in assisting the emperor Maximilian to oppose him; and this revival of warlike designs was resented by Fox and Warham, who retired from the government, leaving Wolsey supreme. Maximilian proved a broken reed, and in 1518 Wolsey brought about a general pacification, securing at the same time his appointment as legate *à latere* in England. He thus superseded Warham, who was *legatus natus*, in ecclesiastical authority; and though legates *à latere* were supposed to exercise only special and temporary powers, Wolsey secured the practical permanence of his office.

The election of Charles V. as emperor in 1519 brought the rivalry between him and Francis I. to a head, and Wolsey was mainly responsible for the attitude adopted by the English government. Both monarchs were eager for England's alliance, and their suit enabled Wolsey to appear for the moment as the arbiter of Europe. England's commercial relations with Charles V.'s subjects in the Netherlands put war with the emperor almost out of the question; and cool observers thought that England's obvious policy was to stand by while the two rivals enfeebled each other, and then make her own profit out of their weakness. But, although a gorgeous show of friendship with France was kept up at the Field of Cloth of Gold in 1520, it had been determined before the conference of Calais in 1521, at which Wolsey pretended to adjudicate on the merits of the dispute, to side actively with Charles V. Wolsey had vested interests in such a policy. Parliament had in 1513–1515 showed signs of strong anti-clerical feeling; Wolsey had in the latter year urged its speedy dissolution, and had not called another; and he probably hoped to distract attention from the church by a spirited foreign policy, as Henry V. had done a century before. He had, moreover, received assurances from the emperor that he would further Wolsey's candidature for the papacy; and although he protested to Henry VIII. that he would rather continue in his service than be ten popes, that did not prevent him from secretly instructing his agents at Rome to press his claims to the utmost. Charles, however, paid Wolsey the sincere compliment of thinking that he would not be sufficiently subservient on the papal throne; while he wrote letters in Wolsey's favour, he took care that they should not reach their destination in time; and Wolsey failed to secure election both in 1521 and 1524. This ambition distinguishes his foreign policy from that of Henry VII., to which it has been likened. Henry VII. cared only for England; Wolsey's object was to play a great part on the European stage. The aim of the one was national, that of the other was oecumenical.

In any case the decision taken in 1521 was a blunder. Wolsey's assistance helped Charles V. to that position of predominance which was strikingly illustrated by the defeat and capture of Francis I. at Pavia in 1525; and the balance of power upon which England's influence rested was destroyed. Her efforts to restore it in 1526–1528 were ineffectual; her prestige had depended upon her reputation for wealth derived from the fact that she had acted in recent years as the paymaster of Europe. But Henry VII.'s accumulations had disappeared; parliament resisted in 1523 the imposition of new taxation; and the attempts to raise forced loans and benevolences in 1526–1528 created a storm of opposition. Still more unpopular was the brief war with Charles V. in which Wolsey involved England in 1528. The sack of Rome in 1527 and the defeat of the French before Naples in 1528 confirmed Charles V.'s supremacy. Peace was made in 1529 between the two rivals without England being consulted, and her influence at Wolsey's fall was less than it had been at his accession to power.

This failure reacted upon Wolsey's position at home. His domestic was sounder than his foreign policy: by his development of the star chamber, by his firm administration of justice and maintenance of order, and by his repression of feudal jurisdiction, he rendered great services to the monarchy. But the inevitable opposition of the nobility to this policy was not mitigated by the fact that it was carried out by a churchman; the result was to embitter the antagonism of the secular party to the church and to concentrate it upon Wolsey's head. The control of the papacy by Charles V., moreover, made it impossible for Wolsey to succeed in his efforts to obtain from Clement VII. the divorce which Henry VIII. was seeking from Charles V.'s aunt, Catherine of Aragon. An inscription on a contemporary portrait of Wolsey at Arras calls him the author of the divorce, and Roman Catholic historians from Sanders downwards have generally adopted the view that Wolsey advocated this measure merely as a means to break England's alliance with Spain and confirm its alliance with France. This view is unhistorical, and it ignores the various personal and national motives which lay behind that movement. There is no evidence that Wolsey first suggested the divorce, though when he found that Henry was bent upon it, he pressed for two points: (i.) that an application should be made to Rome, instead of deciding the matter in England, and (ii.) that Henry, when divorced, should marry a French princess.

The appeal to Rome was a natural course to be advocated by Wolsey, whose despotism over the English church depended upon an authority derived from Rome; but it was probably a mistake. It ran counter to the ideas suggested in 1527 on the captivity of Clement VII., that England and France should set up independent patriarchates; and its success depended upon the problematical destruction of Charles V.'s power in Italy. At first this seemed not improbable; French armies marched south on Naples, and the pope sent Campeggio with full powers to pronounce the divorce in England. But he had hardly started when the French were defeated in 1528; their ruin was completed in 1529, and Clement VII. was obliged to come to terms with Charles V., which included Campeggio's recall in August 1529.

Wolsey clearly foresaw his own fall, the consequent attack on the church and the triumph of the secular party. Parliament, which he had kept at arm's length, was hostile; he was hated by the nobility, and his general unpopularity is reflected in Skelton's satires and in Hall's *Chronicle*. Even churchmen had been alienated by his suppression of monasteries and by his monopoly of ecclesiastical power; and his only support was the king, who had now developed a determination to rule himself. He surrendered all his offices and all his preferments except the archbishopric of York, receiving in return a pension of 1000 marks (equal to six or seven thousand pounds a year in modern currency) from the bishopric of Winchester, and retired to his see, which he had never before visited. A bill of attainder, passed by the Lords, was rejected at Cromwell's instigation and probably with Henry's goodwill by the Commons. The last few months of his life were spent in the exemplary discharge of his archiepiscopal duties; but a not altogether unfounded suspicion that he had invoked the assistance of Francis I., if not of Charles V. and the pope, to prevent his fall involved him in a charge of treason. He was summoned to London, but died on his way at Leicester abbey on November 30, and was buried there on the following day.

The completeness of Wolsey's fall enhanced his former appearance of greatness, and, indeed, he is one of the outstanding figures in English history. His qualities and his defects were alike exhibited on a generous scale; and if his greed and arrogance were colossal, so were his administrative capacity and his appetite for work. "He is," wrote the Venetian ambassador Giustiniani, "very handsome, learned, extremely eloquent, of vast ability and indefatigable. He alone transacts the business which occupies all the magistrates and councils of Venice, both civil and criminal; and all state affairs are managed by him, let their nature be what it may. He is grave, and has the reputation of being extremely just; he favours the people exceedingly, and especially the poor, hearing their suits and seeking to despatch them instantly." As a diplomatist he has had few rivals and perhaps no superiors. But his pride was equal to his abilities. The familiar charge, repeated in Shakespeare, of having written *Ego et meus rex*, while true in fact, is false in intention, because no Latin scholar could put the words in any other order; but it reflects faithfully enough Wolsey's mental attitude. Giustiniani explains that he had to make proposals to the cardinal before he broached them to Henry, lest Wolsey "should resent the precedence conceded to the king." "He is," wrote another diplomatist, "the proudest prelate that ever breathed." He arrogated to himself the privileges of royalty, made servants attend him upon their knees, compelled bishops to tie his shoe-latchets and dukes to hold the basin while he washed his hands, and considered it condescension when he allowed ambassadors to kiss his fingers; he paid little heed to their sacrosanct character, and himself laid violent hands on a papal nuncio. His egotism equalled Henry VIII.'s; his jealousy and ill-treatment of Richard Pace, dean of St Paul's, referred to by Shakespeare but vehemently denied by Dr Brewer, has been proved by the publication of the Spanish state papers; and Polydore Vergil, the historian, and Sir R. Sheffield, speaker of the House of Commons, were both sent to the Tower for complaining of his conduct. His morals were of the laxest description, and he had as many illegitimate children as Henry VIII. himself. For his son, before he was eighteen years old, he procured a deanery, four archdeaconries, five prebends and a chancellorship, and he sought to thrust him into the bishopric of Durham. For himself he obtained, in addition to his archbishopric and lord chancellorship, the abbey of St Albans, reputed to be the richest in England, and the bishopric first of Bath and Wells, then of Durham, and finally that of Winchester. He also used his power to extort enormous pensions from Charles V. and Francis I. and lavish gifts from English suitors. His New Year's presents were reckoned by Giustiniani at 15,000 ducats, and the emperor paid —or owed—him 18,000 livres a year. His palaces outshone those of his king, and few monarchs could afford such a display of plate as commonly graced the cardinal's table. His foundations at Oxford and Ipswich were, nevertheless, not made out of his superabundant revenues, but out of the proceeds of the dissolution of monasteries, not all of which were devoted to those laudable objects.

That such a man would ever have used the unparalleled powers of ecclesiastical jurisdiction with which he had been entrusted for a genuine reformation of the church is only a pious opinion cherished by those who regret that the Reformation was left for the secular arm to achieve; and it is useless to plead lack of opportunity on behalf of a man who for sixteen years had enjoyed an authority never before or since wielded by an English subject. Wolsey must be judged by his deeds and not by doubtful intentions. During the first half of his government he materially strengthened the Tudor monarchy by the vigorous administration of justice at home and by the brilliance of his foreign policy abroad. But the prestige he secured by 1521 was delusive; its decline was as rapid as its growth, and the expense of the policy involved taxation which seriously weakened the loyalty of the people. The concentration of civil and ecclesiastical power by Wolsey in the hands of a churchman provided a precedent for its concentration by Henry VIII. in the hands of the crown; and the personal example of lavish ostentation and loose morals which the cardinal-archbishop exhibited cannot have been without influence on the king, who grew to maturity under Wolsey's guidance.

The *Letters and Papers of Henry VIII.*, vols. i.-iv., supplemented by the *Spanish and Venetian Calendars*, contain almost all that is known of Wolsey's public career, though additional light on the divorce has been thrown by Stephen Ehses' *Römische Dokumente* (1893). Cavendish's brief *Life*, which is almost contemporary, has been often edited. Fiddes's huge tome (1724) is fairly exhaustive. Brewer, in his elaborate prefaces to the *Letters and Papers* (reissued as his *History of the Reign of Henry VIII.*), originated modern admiration for Wolsey; and his views are reflected in Creighton's *Wolsey* in the "Twelve English Statesmen" series, and in Dr Gairdner's careful articles in the *Dict. Nat. Biog.* and *Cambridge Modern History*. A less enthusiastic view is adopted in H. A. L. Fisher's volume (v.) in Longmans' *Political History* (1906) and in A. F. Pollard's *Henry VIII.* (1902 and 1905). (A. F. P.)

WOLTER, CHARLOTTE (1834–1897), Austrian actress, was born at Cologne on the 1st of March 1834, and began her artistic career at Budapest in 1857. She played minor parts at the Karl theatre in Vienna, and soon obtained an engagement at the Victoria theatre in Berlin, where she remained until 1861. Her performance of Hermione in the *Winter's Tale* took the playgoing world by storm, and she was given in 1862 an appointment at the Vienna Hofburg theatre, to which she remained faithful until her death on the 14th of June 1897. According to her wish, she was buried in the costume of Iphigenia, in which rôle she had achieved her most brilliant success. Charlotte Wolter was one of the great tragic actresses of modern times. Her repertory included Medea, Sappho, Lady Macbeth, Mary Stuart, Preciosa, Phèdre, Adrienne Lecouvreur, Jane Eyre and Messalina, in which character she was immortalized by the painter Hans Makart. She was also an inimitable exponent of the heroïnes in plays by Grillparzer, Hebbel, Dumas and Sardou.

See Ehrenfeld, *Charlotte Wolter* (Vienna, 1887); Hirschfeld, *Charlotte Wolter, ein Erinnerungsblatt* (1897).

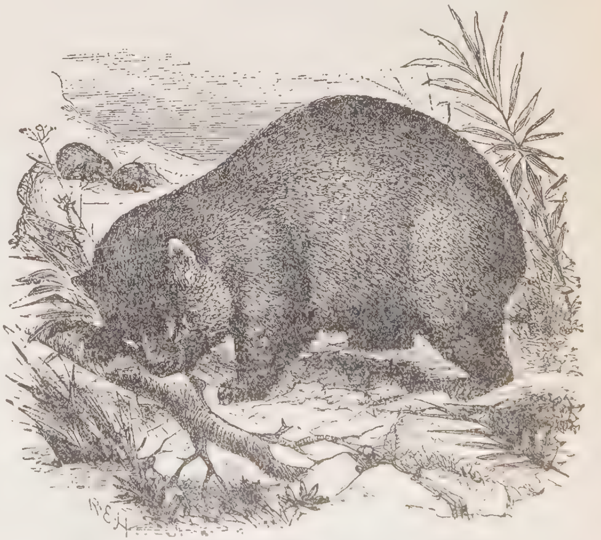
WOLVERHAMPTON, HENRY HARTLEY FOWLER, Viscount (1830–), English statesman, was born at Durham on the 16th of May 1830. He became a prosperous solicitor in Wolverhampton, and coming of a Liberal nonconformist family took a prominent part in politics. In 1880 he was elected Liberal member of parliament for Wolverhampton, and was re-elected for the east division at successive contests. In 1884–1885 he was under-secretary for the Home Office, and in 1886 financial secretary to the treasury. In Mr Gladstone's 1892–1894 ministry he was president of the local government board, and in Lord Rosebery's cabinet, 1894–1895, secretary of state for India. In these and the succeeding years of opposition he was recognized as a sound economist and a sober administrator, as well as a universally respected representative of nonconformist views. In Sir Henry Campbell-Bannerman's cabinet, 1905–1908, he was chancellor of the duchy of Lancaster, and he retained this office in Mr Asquith's ministry, but was transferred to the House of Lords with a viscountcy (April 1908). He retired in 1910. His daughter, Ellen Thorneycroft Fowler, who married Mr A. L. Felkin in 1903, became well known as a novelist with her *Concerning Isabel Carnaby* (1898) and other books.

WOLVERHAMPTON, a market town, and municipal, county and parliamentary borough of Staffordshire, England, 125 m. N.W. from London by the London & North-Western railway, served also by the northern line of the Great Western and by a branch of the Midland railway. Pop. (1891) 82,622; (1901) 94,187. It lies at the north-western edge of the group of great manufacturing towns extending S.E. to Birmingham, but there are pleasant residential suburbs to the west, where the country is rich and well wooded. The situation is elevated and healthy. The church of St Peter is a fine cruciform building, with S. porch and central tower. The lower part of the tower and the S. transept date from the 13th century; the nave, clerestory, upper part of the tower and N. transept from the 15th; the chancel was rebuilt in the restoration, completed in 1865, with an apsidal termination. The chief public buildings are the town hall (1871), exchange, agricultural hall, free library and theatres. A large free grammar school, founded in 1515 by Sir Stephen Jermyns, a native of the town and alderman of London, occupies modern buildings (1876). There are a Blue Coat school (1710) and a school of art. The benevolent institutions include a general hospital, the eye infirmary, orphan asylum, nursing institution and institute of the society for outdoor blind. In Queen Square is an equestrian statue of Albert, Prince Consort, unveiled by Queen Victoria in 1866, and on Snow Hill a statue (1879) of Charles Pelham Villiers. There are parks on the east and west of the town, and a new racecourse (1887) replaces that formerly on the site of the west park. In the district S. and E. of Wolverhampton (the Black Country) coal and ironstone are mined. Ironmongery and steel goods of all kinds, especially locks, machinery, tools and cycles, are produced; there are also tin and zinc works. Large agricultural markets are supplied from the districts W. and N. of the town. An annual fair is held at Whitsuntide. In 1902 an industrial and art exhibition was held. The parliamentary borough of Wolverhampton has three divisions, each returning one member. The town is governed by a mayor, 12 aldermen and 36 councillors. Area, 3525 acres. Wednesfield (pop. 4883), Heath Town or Wednesfield Heath (9441) and Willenhall (18,515) are neighbouring urban districts, with populations employed in the manufacture of locks, keys and small iron goods, in iron and brass foundries, varnish works, &c.

The town of Wolverhampton (*Handone, Wolvernehamptone, Wollernehampton*) seems to have grown up round the church of St Mary, afterwards the royal free chapel of Wolverhampton, probably founded in 996 by Wulfruna, widow of the earl of Northampton, who in that year endowed it with extensive lands. The estates of the clerks of Handone are enumerated in Domesday. In 1204 John granted the manor of Wolverhampton to the church, and at the Reformation it was held by the dean of the collegiate body; in 1553 Edward VI. granted the college and manor to Dudley, duke of Northumberland, but Mary, at the beginning of her reign, refounded the college and restored to it its property, and this arrangement was confirmed by Elizabeth. Henry III. (1258) granted the Wednesday market, which is still held, and a fair for eight days, beginning on the eve of the feast of SS. Peter and Paul (June 29). During the Great Rebellion the sympathies of Wolverhampton were royalist. In 1645 it was for a time the headquarters of Prince Rupert, while Charles I. lay at Bushbury to the north. At the end of the 17th century the market was esteemed the second market in the county. An account of Wolverhampton published in 1751 stated that the chief manufacture was locks, "here being the most ingenious locksmiths in England," and attributed the slow growth of the town to the fact that most of the land was church property. Wolverhampton was incorporated in 1848 as a municipal borough. It was not represented in parliament until after the passing of the Reform Bill (1832), under which it returned two members until in 1885 the representation was increased to three. The county borough dates from 1888.

WOLVERTON, a town in the Buckingham parliamentary division of Buckinghamshire, England, near the river Ouse, 52½ m. N.W. by N. of London by the London & North-Western railway. Pop. (1901) 5323. Its modern growth and importance are the result of the establishment of carriage works by the railway company. There are also printing works. A steam tramway connects the town with the old market town of Stony Stratford on the Ouse, 2 m. W.

WOMBAT, the title of the typical representatives of the marsupial family *Phascolomyidae* (see Marsupialia). They have the dental formula: $i. \frac{1}{1}, c. \frac{0}{0}, p. \frac{2}{2}, m. \frac{3}{3}; = 24$. All the teeth are of continuous growth, having persistent pulps. The incisors are large and chisel-like, much as in rodents. The body is broad and depressed, the neck short, the head large and flat, the eyes small and the tail rudimentary and hidden in the fur. The



Tasmanian Wombat (*Phascolomys ursinus*) limbs are equal, stout and short. The feet have broad, naked, tuberculated soles; the forefeet with five distinct toes, each furnished with a long, strong and slightly curved nail, the first and fifth considerably shorter than the other three. The hind-feet have a very short nailless first toe; the second, third and fourth toes partially united by integument, of nearly equal length; the fifth distinct and rather shorter; these four are provided with long and curved nails. In the typical group of the genus *Phascolomys* we find the following characters:—Fur rough and coarse; ears short and rounded; muzzle naked; postorbital process of the frontal bone obsolete; ribs fifteen pairs. Vertebrae: C. 7, D. 15, L. 4, S. 4, Ca. 10-12. The wombat of Tasmania and the islands of Bass's Straits (*P. ursinus*), and the closely similar but larger *P. platyrhinus* of the southern portion of the mainland of Australia, belong to this group. On the other hand, in the hairy-nosed wombat (*P. latifrons*) of Southern Australia, the fur is smooth and silky; the ears are large and more pointed; the muzzle is hairy; the frontal region of the skull is broader than in the other section, with well-marked postorbital processes; and there are thirteen ribs. Vertebrae: C. 7, D. 13, L. 6, S. 4, Ca. 15-16.

In general form and action wombats resemble small bears, having a somewhat similar shuffling manner of walking, but they are still shorter in the legs, and have a broader and flatter back. They live entirely on the ground, or in burrows or holes among rocks, and feed on grass, roots and other vegetable substances. They sleep during the day, but wander forth at night in search of food, and are shy and gentle, though they can bite strongly when provoked. The only noise the Tasmanian wombat makes is a low hissing, but the hairy-nosed wombat is said to emit a short quick grunt when annoyed. The prevailing colour of the last-named species, as well as *P. ursinus* of Tasmania, is brownish grey. The large wombat of the mainland is variable in colour, some individuals being pale yellowish brown, others dark grey and some black. The length of the head and body is about 3 ft. Fossil remains of wombats, some of larger size than any now existing, have been found in caves and Pleistocene deposits in Australia. (R. L.*)

WOMBWELL, an urban district in the Barnsley parliamentary division of the West Riding of Yorkshire, England, 4 m. S.E. of Barnsley, on the Great Central and Midland railways. The inhabitants are chiefly employed in the extensive collieries. Pop. (1901) 13,252.

WOMEN. The very word "woman" (O. Eng. *wifmann*), etymologically meaning a wife (or the wife division of the human race, the female of the species *Homo*), sums up a long history of dependence and subordination, from which the women of to-day have only gradually emancipated themselves in such parts of the world as come under "Western civilization." Though married life and its duties necessarily form a predominant element in the woman's sphere, they are not necessarily the whole of it; and the "woman's movement" is essentially a struggle for the recognition of equality of opportunity with men, and for equal rights irrespective of sex, even if special relations and conditions are willingly incurred under the form of partnership involved in marriage. The difficulties of obtaining this recognition are obviously due to historical causes combined with the habits and customs which history has produced.

Early law.

The dependent position of women in early law is proved by the evidence of most ancient systems which have in whole or in part descended to us.[1] In the Mosaic law divorce was a privilege of the husband only,[2] the vow of a woman might be disallowed by her father or husband,[3] and daughters could inherit only in the absence of sons, and then they must marry in their tribe.[4] The guilt or innocence of a wife accused of adultery might be tried by the ordeal of the bitter water.[5] Besides these instances, which illustrate the subordination of women, there was much legislation dealing with, *inter alia*, offences against chastity, and marriage of a man with a captive heathen woman or with a purchased slave. So far from second marriages being restrained, as they were by Christian legislation, it was the duty of a childless widow to marry her deceased husband's brother. In India subjection was a cardinal principle. "Day and night must women be held by their protectors in a state of dependence," says Manu.[6] The rule of inheritance was agnatic, that is, descent traced through males to the exclusion of females.[7] The gradual growth of *stridhana*, or property of a woman given by the husband before or after marriage, or by the wife's family, may have led to the suttee, for both the family of the widow and the Brahmans had an interest in getting the life estate of a woman out of the way.[8] Women in Hindu law had only limited rights of inheritance, and were disqualified as witnesses.

In Roman law a woman was even in historic times completely dependent. If married she and her property passed into the power of her husband; if unmarried she was (unless a vestal virgin) under the perpetual tutelage of her father during his life, and after his death of her agnates, that is, those of her kinsmen by blood or adoption who would have been under the power of the common ancestor had he lived. Failing agnates, the tutelage probably passed to the *gens*. The wife was the purchased property of her husband, and, like a slave, acquired only for his benefit. A woman could not exercise any civil or public office. In the words of Ulpian, "feminae ab omnibus officiis civilibus vel publicis remotae sunt."[9] A woman could not continue a family, for she was "caput et finis familiae suae,"[10] could not be a witness, surety, tutor, or curator; she could not adopt or be adopted, or make a will or contract. She could not succeed *ab intestato* as an agnate, if further removed than a sister. A daughter might be disinherited by a general clause, a son only by name. On the other hand, a woman was privileged in some matters, but rather from a feeling of pity for her bodily weakness and presumed mental incapacity[11] than for any more worthy reason. Thus she could plead ignorance of law as a ground for dissolving an obligation, which a man could not as a rule do; she could accuse only in cases of treason and witchcraft; and she was in certain cases exempt from torture. In succession *ab intestato* to immovable property Roman law did not, as does English, recognize any privilege of males over females.

Legal disabilities were gradually mitigated by the influence of fictions, the praetorian equity and legislation. An example of the first was the mode by which a woman freed herself from the authority of her tutor by fictitious cession into the authority of a tutor nominated by herself, or by sale of herself into the power of a nominal husband on the understanding that he was at once to emancipate her to another person, who then manumitted her. The action of equity is illustrated by the recognition by the praetor of cognatic or natural as distinguished from agnatic or artificial relationship, and of a widow's claim to succeed on the death of her husband intestate and without relations. Legislation, beginning as early as the Twelve Tables, which forbade excessive mourning for the dead by female mourners, did not progress uniformly towards enfranchisement of women. For instance, the Lex Voconia (about 169 B.C.), called by St Augustine the most unjust of all laws, provided that a woman could not be instituted heir to a man who was registered as owner of a fortune of 100,000 asses.[12] A constitution of Valentinian I. forbade bequests by women to ecclesiastics. But the tendency of legislation was undoubtedly in the direction indicated. Adoption of women was allowed by Diocletian and Maximian in 291. The tutelage of women of full age was removed by Claudius, and, though afterwards in part revived, has disappeared by the time of Justinian. This implied full testamentary and contractual liberty. In regard to the separate property of the married woman, the period of *dos* had by the time of Justinian long superseded the period of *manus*. The result was that, in spite of a few remaining disabilities, such as the general incapacity to be surety or witness to a will or contract, of a wife to make a gift to her husband, of a widow to marry within a year of her husband's death, the position of women had become, in the words of Sir H. Maine, "one of great personal and proprietary independence."[1] For this improvement in their position they were largely indebted to the legislation of the Christian emperors, especially of Justinian, who prided himself on being a protector of women.

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[1] But in the earliest extant code, however, that of Khammurabi, the position of women was free and dignified. See BABYLONIAN LAW.

[2] Deut. xxiv. 1.

[3] Numb. xxx. 3.

[4] Numb. xxvii., xxxvi.

[5] Numb. v. 11.

[6] Ch. ix. § 2 (Sir W. Jones's translation).

[7] Whether this was the oldest rule of inheritance has been much debated. That birth of a child gave the mother certain legal rights in a primitive stage of society is the view of many writers. See especially *Das Mutterrecht* of J. J. Bachofen (Stuttgart, 1861).

[8] Maine, *Early History of Institutions*, lect. xi.

[9] *Dig.* i. 16, 195.

[10] *Ibid.*

[11] *Imbecillitas* is the term used more than once in the texts of Roman law.

[12] The way in which this law was evaded was by non-enrolment of the testator in the census (see Montesquieu, *Esprit des lois*, bk. xxvii.). Another way was by leaving her the inheritance by *fideicommissum* (see TRUST).

The following are a few of the matters in which Christianity appears to have made alterations, generally but perhaps not always improvements, in the law. As a rule the influence of the church was exercised in favour of the abolition of the disabilities imposed by the older law upon celibacy and childlessness, of increased facilities for entering a professed religious life,[2] and of due provision for the wife. The church also supported the political power of those who were her best friends. The government of Pulcheria or Irene would hardly have been endured in the days of the pagan empire. Other cases in which Christianity probably exercised influence may be briefly stated. (1) All differences in the law of succession *ab intestato* of males and females were abolished by Justinian. (2) The appointment of mothers and grandmothers as tutors was sanctioned by the same emperor. (3) He extended to all cases the principle established by the Senatus Consultum Tertullianum (158), enabling the mother of three (if a freed woman four) children to succeed to the property of her children who died intestate, and gave increased rights of succession to a widow. (4) The restrictions on the marriage of senators and other men of high rank with women of low rank were extended by Constantine, but almost entirely removed by Justinian. (5) Second marriages were discouraged (especially by making it legal to impose a condition that a widow's right to property should cease on re-marriage), and the Leonine Constitutions at the end of the 9th century made third marriages punishable. (6) The same constitutions made the benediction of a priest a necessary part of the ceremony of marriage.[3] The criminal law in its relation to women presents some points of interest. Adultery was punished with death by Constantine, but the penalty was reduced by Justinian to relegation to a convent. A woman condemned for adultery could not re-marry. A marriage between a Christian and a Jew rendered the parties guilty of adultery. Severe laws were enacted against offences of unchastity, especially procurement and incest. It was a capital crime to carry off or offer violence to a nun. A wife could not commit *furtum* of her husband's goods, but he had a special action *rerum amotarum* against her. By several sumptuary constitutions, contained in the *Code*, bk. xi., women as well as men were subject to penalties for wearing dress or ornaments (except rings) imitating those reserved for the emperor and his family. Actresses and women of bad fame were not to wear the dress of virgins dedicated to Heaven. If a consul had a wife or mother living with him, he was allowed to incur greater expense than if he lived alone. The interests of working women were protected by enactments for the regulation of the *gynoecia*, or workshops for spinning, dyeing, &c.

The canon law, looking with disfavour on the female independence prevailing in the later Roman law, tended rather in the opposite direction. The *Decretum* specially inculcated subjection of the wife to the husband, and obedience to his will in all things.[4] The chief differences between canon and Roman law were in the law of marriage, especially in the introduction of publicity and of the formalities of the ring and the kiss. The benediction of a priest was made a necessary part of the ceremony, as indeed it had been made by the civil power, as has been already stated, in the post-Justinian period of Roman law. But in practice this rule appears to have fallen into disuse until it was again revived by the council of Trent. It was, however, the rule of the English common law after the Reformation. The ceremony was not to be performed during Lent. The woman was to be veiled during the ceremony. A promise of marriage was so sacred that it made a subsequent marriage with another person void. Spiritual cognation was a bar to marriage. The sentence of the church was made necessary for divorce. As to women in general the law does not say very much. Women, even relatives, were not to live with priests unless in case of necessity. They were not to approach the altar or fill any public office of the church; nor might they lend money on usury. Baptism might be valid although administered by a woman. Women who had professed religion could not be forced to give evidence as witnesses. In some cases the evidence of women was not receivable.[5]

The early law of the northern parts of Europe is interesting from the different ways in which it treated women. In the words of Sir H. Maine[6]—"The position of women in these barbarous systems of inheritance varies very greatly. Sometimes they inherit, either as individuals or as classes, only when males of the same generation have failed. Sometimes they do not inherit, but transmit a right of inheritance to their male issue. Sometimes they succeed to one kind of property, for the most part movable property, which they probably took a great share in producing by their household labour; for example, in the real Salic law (not in the imaginary code) there is a set of rules of succession which, in my opinion, clearly admit women and their descendants to a share in the inheritance of movable property, but confine land exclusively to males and the descendants of males. . . . The idea is that the proper mode of providing for a woman is by giving her a marriage portion; but, when she is once married into a separate community consisting of strangers in blood, neither she nor her children are deemed to have any further claim on the parent group." Among the Scandinavian races women were under perpetual tutelage, whether married or unmarried. The first to obtain freedom were the widows.[7] As late as the code of Christian V., at the end of the 17th century, it was enacted that if a woman married without the consent of her tutor he might have, if he wished, administration and usufruct of her goods during her life.[8] The provision made by the Scandinavian laws under the name of morning-gift was perhaps the parent of the modern settled property.[9] The Brehon law of Ireland excepted women from the ordinary course of the law. They could distrain or contract only in certain named cases, and distress upon their property was regulated by special rules. In the pre-Conquest codes in England severe laws were denounced against unchastity, and by a law of Canute a woman was to lose nose and ears for adultery. The laws of Athelstan contained the peculiarly brutal provision for the punishment of a female slave convicted of theft by her being burned alive by eighty other female slaves. Other laws were directed against the practice of witchcraft (*q.v.*) by women. Monogamy was enforced both by the civil and ecclesiastical law; and second and third marriages involved penance. A glimpse of cruelty in the household is afforded by the provision, occurring no less than three times in the ecclesiastical legislation, that if a woman scourged her female slave to death she must do penance. Traces of wife-purchase are seen in the law of Ethelbert, enacting that if a man carry off a freeman's wife he must at his own expense procure the husband another wife. The codes contain few provisions as to the property of married women, but those few appear to prove that she was in a better position than at a later period. The laws of Ine gave her a third of her husband's property; the laws of Edmund as to betrothal allowed this to be increased to half by antenuptial contract, to the whole if she had children and did not re-marry after her husband's death. No doubt the dower *ad ostium ecclesiae* favoured by the church generally superseded the legal rights where the property was large (in fact this is specially provided by Magna Carta, c. 7). "Provisio hominis tollit provisionem legis." The legal rights of a married woman apart from contract were gradually limited, until by the time of Glanvill her person and property had become during her husband's lifetime entirely at his disposal, and after his death limited to her dower and her *pars rationabilis*.

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[1] *Ancient Law*, ch. v. Hence the necessity of such laws as the Lex Oppia (see SUMPTUARY LAWS).

[2] A remarkable example of this tendency was the provision that an actress might leave the stage and break her contract of service with impunity in order to become a nun. Even under the pagan emperors a constitution of Diocletian and Maximian in 285 had enacted that no one was to be compelled to marry (*Cod.* v. 4, 14).

[3] See R. T. Troplong, *De l'influence du christianisme sur le droit civil*.

[4] Pt. ii. caus. xxxiii. qu. v. ch. 16.

[5] On this branch of the subject see Manssen's *Het Christendom en de Vrouw* (Leiden, 1877).

[6] *Early Law and Custom*, ch. v.

[7] See Stiernhöök, *De jure Sveonum* (Stockholm, 1672), bk. ii. ch. i.; Messenius, *Leges Svecorum* (Stockholm, 1714).

[8] Bk. iii. ch. xvi. §§ 1, 2.

[9] The development of the bride-price no doubt was in the same direction. Its original meaning was, however, different. It was the sum paid by the husband to the wife's family for the purchase of part of the family property, while the morning-gift was paid as *pretium virginitatis* to the bride herself. In its English form morning-gift occurs in the laws of Canute; in its Latinized form of *morgangiva* it occurs in the *Leges Henrici Primi*.

A few of the more interesting matters in which the old common and statute law of England placed women in a special position may be noticed. A woman was exempt from legal duties more particularly attaching to men and not performable by deputy. She could apparently originally not hold a proper feud, *i.e.* one of which the tenure was by military service.[1] The same principle appears in the rule that she could not be endowed of a castle maintained for the defence of the realm and not for the private use of the owner. She could receive homage, but not render it in the form used by men, and she was privileged from suit and service at the sheriff's tourn. She was not sworn to the law by the oath of allegiance in the leet or tourn, and so could not be outlawed, but was said to be waived. She could be constable, either of a castle or a vill, but not sheriff, unless in the one case of Westmorland, an hereditary office, exercised in person in the 17th century by the famous Anne, countess of Dorset, Pembroke and Montgomery. In certain cases a woman could transmit rights which she could not enjoy. On such a power of transmission, as Sir H. Maine shows,[2] rested the claim of Edward III. to the crown of France. The claim *through* a woman was not a breach of the French constitutional law, which rejected the claim *of* a woman. The jealousy of a woman's political influence is strikingly shown by the case of Alice Perrers, the mistress of Edward III. She was accused of breaking an ordinance by which women had been forbidden to do business for hire and by way of maintenance in the king's court.[3]

By Magna Carta a woman could not accuse a man of murder except of that of her husband. This disability no doubt arose from the fact that in trial by battle she naturally did not appear in person but by a champion. She was not admitted as a witness to prove the status of a man on the question arising whether he were free or a villein. She could not appoint a testamentary guardian, and could only be a guardian even of her own children to a limited extent. Her will was revoked by marriage, that of a man only by marriage and the subsequent birth of a child. By 31 Hen. VI. c. 9 the king's writ out of chancery was granted to a woman alleging that she had become bound by an obligation through force or fraud. By 39 Hen. VI. c. 2 a woman might have livery of land as heiress at fourteen. Benefit of clergy was first allowed to women partially by 21 Jac. I. c. 6, fully by 3 Will. & M. c 9 and 4 and 5 Will. & M. c. 24. Public whipping was not abolished until 57 Geo. III. c. 75, whipping in all cases until 1 Geo. IV. c. 57. Burning was the punishment specially appropriated to women convicted of treason or witchcraft A case of sentence to execution by burning for petit treason occurred as lately as 1784. In some old statutes very curious sumptuary regulations as to women's dress occur. By the sumptuary laws of Edward III. in 1363 (37 Edw. III cc. 8-14) women were in general to be dressed according to the position of their fathers or husbands. Wives and daughters of servants were not to wear veils above twelvepence in value. Handicraftsmen's and yeomen's wives were not to wear silk veils. The use of fur was confined to the ladies of knights with a rental above 200 marks a year. Careful observance of difference of rank in the dress was also inculcated by 3 Edw IV. c. 5. The wife or daughter of a knight was not to wear cloth of gold or sable fur, of a knight-bachelor not velvet, of an esquire or gentleman not velvet, satin or ermine, of a labourer not clothes beyond a certain price or a girdle garnished with silver. By 22 Edw. IV. c. 1, cloth of gold and purple silk were confined to women of the royal family. It is worthy of notice that at the times of passing these sumptuary laws the trade interests of women were protected by the legislature. By 37 Edw. III. c. 6, handicraftsmen were to use only one mystery, but women might work as they had been accustomed 3 Edw. IV. c. 3 forbade importation of silk and lace by Lombards and other alien strangers, imagining to destroy the craft of the silk spinsters and all such virtuous occupations for women. In some cases the wives and daughters of tradesmen were allowed to assist in the trades of their husbands and fathers; see, for instance, the act concerning tanners, 1 Jac. I. c. 22. Some trading corporations, such as the East India Company, recognized no distinction of sex in their members. The disabilities imposed on women by substantive law are sometimes traceable in the early law of procedure. For instance, by the Statute of Essoins (12 Edw. II. st. 2), essoin *de servitio regis* did not lie where the party was a woman; that is, a woman (with a few exceptions) could not excuse her absence from court by alleging that she was on public duty. The influence of the church is very clearly traceable in some of the earlier criminal legislation. Thus by 13 Edw. I. st. 1, c. 34, it was punishable with three years' imprisonment to carry away a nun, even with her consent. The Six Articles, 31 Hen. VIII. c. 14, forbade marriage and concubinage of priests and sanctioned vows of chastity by women.

In Scotland, as early as *Regiam Majestatem* (12th century) women were the object of special legal regulation. In that work the *mercheta mulieris* (probably a tax paid to the lord on the marriage of his tenant's daughter) was fixed at a sum differing according to the rank of the woman. Numerous ancient laws dealt with trade and sumptuary matters. By the *Leges Quatuor Burgorum* female brewsters making bad ale were to forfeit eightpence and be put on the cucking-stool, and were to set an ale-wand outside their houses under a penalty of fourpence. The same laws also provided that a married woman committing a trespass without her husband's knowledge might be chastised like a child under age. The *Statuta Gilde* of the 13th century enacted that a married woman might not buy wool in the streets or buy more than a limited amount of oats. The same code also ensured a provision for the daughter of one of the gild-brethren unable to provide for herself through poverty, either by marrying her or putting her in a convent. By the act 1429, c. 9, wives were to be arrayed after the estate of their husbands. By 1457, c. 13, no woman was to go to church with her face covered so that she could not be known. 1581, c. 18, was conceived in a more liberal spirit, and allowed women to wear any head-dress to which they had been accustomed. 1621, c. 25, permitted servants to wear their mistress's cast-off clothes. 1681, c. 80, contained the remarkable provision that not more than two changes of raiment were to be made by a bride at her wedding. In its more modern aspect the law is in most respects similar to that of England. (J. W.)

Modern English law specially affecting women.

In separate legal articles attention is drawn, on various subjects, to any special provisions or disabilities affecting women; see, for instance, EVIDENCE, DIVORCE, MARRIAGE, CHILDREN (*Law relating to*), INFANT, HUSBAND AND WIFE. The movement for removing the older disabilities has progressed at such different rates in various countries that it is impossible to do more than note here the chief distinctions remaining under English law in 1910.

Civil Rights.—The age at which a girl can contract a valid marriage, in English law, is, following the Roman law, twelve; she is thus two years in advance of a boy, who must be fourteen. Under the Infants Settlement Act 1855, a valid settlement could be made by a woman at seventeen with the approval of the court, the age for a man being twenty; by the Married Women's Property Act 1907 any settlement by a husband of his wife's property is not valid unless executed by her if she is of full age, or confirmed by her after she attains full age. An unmarried woman is liable for the support of illegitimate children till they attain the age of sixteen. She is generally assisted, in the absence of agreement, by an affiliation order granted by magistrates. A married woman having separate property is, under the Married Women's Property Acts 1882 and 1908, liable for the support of her parents, husband, children and grandchildren becoming chargeable to any union or parish. At common law the father was entitled as against the mother to the custody of a legitimate child up to the age of sixteen, and could only forfeit such right by misconduct. But the Court of Chancery, wherever there was trust property and the infant could be made a ward of court, took a less rigid view of the paternal rights and looked more to the interest of the child, and consequently in some cases to the extension of the mother's rights at common law. Legislation has tended in the same direction. By the Infants' Custody Act 1873, the Court of Chancery was empowered to enforce a provision in a separation deed, giving up the custody or control of a child to the mother. The Judicature Act 1873, § 25 (10), enacted that in questions relating to the custody and education of infants the rules of equity should prevail. The Guardianship of Infants Act 1886 largely extended the mother's powers of appointing and acting as a guardian, and gave the court a discretion to regard the mother's wishes as to the custody of the children. The Summary Jurisdiction (Married Women) Act 1895 enabled a court of summary jurisdiction, to whom a married woman has made application, to commit to the applicant the custody of any children of the marriage between the applicant and her husband, while under the age of sixteen years.

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[1] It is remarkable that the great fiefs of France, except the Isle of France, the special apanage of the crown, all became in time female fiefs. This is shown by the table at the end of Laboulaye's *Recherches*.

[2] *Early Law and Custom*, ch. v

[3] *Rot. Parl.*, vol. iii. p. 12

The most remarkable disabilities under which women were still placed in 1910 were (1) the exclusion of female heirs from intestate succession to real estate, unless in the absence of a male heir (see INHERITANCE; SUCCESSION); and (2) the fact that a husband could obtain a divorce for the adultery of his wife, while a wife could only obtain it for her husband's adultery if coupled with some other cause, such as cruelty or desertion.

Suits in which either necessarily or practically only women are plaintiffs are: breach of promise, affiliation (*q.v.*) and (though not nominally) seduction (*q.v.*).

The action for breach of promise[1] may indeed be brought by a man, but this is very rare, and its only real interest is as a protection for women. It may be brought by but not against an infant, and not against an adult if he or she has merely ratified a promise made during infancy; it may be brought against but not by a married man or woman (in spite of the inherent incapacity of such a person to have married the plaintiff), and neither by nor against the personal representatives of a deceased party to the promise (unless where special damage has accrued to the personal estate of the deceased). The promise need not be in writing. The parties to an action are by 32 and 33 Vict. c. 68 competent witnesses; the plaintiff cannot, however, recover a verdict without his or her testimony being corroborated by other material evidence. The measure of damages is to a greater extent than in most actions at the discretion of the jury; they may take into consideration the injury to the plaintiff's feelings, especially if the breach of promise be aggravated by seduction. Either party has a right to trial by jury under the rules of the Supreme Court, 1883. The action cannot be tried in a county court, unless by consent, or unless remitted for trial there by the High Court. Unchastity of the plaintiff unknown to the defendant when the promise was made and dissolution of the contract by mutual consent are the principal defences which are usually raised to the action. Bodily infirmity of the defendant is no defence to the action, though it may justify the other party in refusing to marry the person thus affected. Where the betrothed are within prohibited degrees of consanguinity or affinity, there can be no valid promise at all, and so no action for its breach.

Criminal Law.—There are some offences which can be committed only by women, others which can be committed only against them. Among the former are concealment of birth (in ninety-nine cases out of a hundred), the now obsolete offence of being a common scold, and prostitution (*q.v.*) and kindred offences. Where a married woman commits a crime in company with her husband, she is generally presumed to have acted by his coercion, and so to be entitled to acquittal. This presumption, however, was never made in witchcraft cases, and is not now made in cases of treason, murder and other grave crimes, or in crimes in which the principal part is most usually taken by the wife, such as keeping a brothel. In fact, the exceptions to the old presumption are now perhaps more numerous than those falling within it. The doctrine of coercion and the practice of separate acknowledgment of deeds by married women (necessary before the Married Women's Property Act) seem to be vestiges of the period when women, besides being chattels, were treated as chattels. Formerly a wife could not steal her husband's property, but since the Married Women's Property Act this has become possible. Adultery is no crime, England being almost the only country where such is the case. It was punished by fine in the ecclesiastical courts up to the 17th century, and was made criminal for a short time by an ordinance of the Long Parliament. The offences which can be committed only against women are chiefly those against decency, such as rape, procurement and similar crimes, in which a considerable change in the law in the direction of increased protection to women was made by the Criminal Law Amendment Act 1885. In regard to the protection given to a wife against her husband modern legislation has considerably strengthened the wife's position by means of judicial separation and maintenance in case of desertion (see DIVORCE). The whipping of female offenders was abolished in 1820. Chastisement of a wife by a husband, possibly at one time lawful to a reasonable extent, would now certainly constitute an assault. The husband's rights are limited to restraining the wife's liberty in case of her misconduct.

In Scotland the criminal law differs slightly from that of England. At one time drowning was a punishment specially reserved for women. Incest (*q.v.*), or an attempt to commit incest, has always been punishable as a crime. Adultery and fornication are still nominally crimes, but criminal proceedings in these cases have fallen into desuetude. The age of testamentary capacity is still twelve, not twenty-one, as in England.

Higher education and its results.

The whole idea of women's position in social life, and their ability to take their place, independently of any question of sex, in the work of the world, was radically changed in the English-speaking countries, and also in the more progressive nations beyond their bounds, during the 19th century. This is due primarily to the movement for women's higher education and its results. To deal in detail with this movement in various countries would here be too intricate a matter; but in the English-speaking countries at all events the change is so complete that the only curious thing now is, not what spheres women may not enter, more or less equally with men, but the few from which they are still excluded.

Before the accession of Queen Victoria, there was no systematic education for English women, but as the first half of the 19th century drew to a close, broader views began to be held on the subject, while the humanitarian movement, as well as the rapidly increasing number of women, helped to put their education on a sounder basis. It became more thorough; its methods were better calculated to stimulate intellectual power; and the conviction that it was neither good, nor politic, for women to remain intellectually in their former state of ignorance, was gradually accepted by every one. The movement owed much to Frederick Denison Maurice. He was its pioneer; and Queen's College (1848), which he founded, was the first to give a wider scope to the training of its scholars. Out of its teaching, and that of its professors (including Charles Kingsley), grew nearly all the educational advantages which women enjoy to-day; and to the women who were trained at Queen's College we owe some of the best teaching in England. Bedford College, Cheltenham College, the North London Collegiate School for Girls, the Girls' Public Day School Company's schools, are some of those which sprang into life in different parts of England, and were filled, as rapidly as they were opened, by the girls of the middle and professional classes. From their teaching came the final stage which gave women the same academic advantages as men. Somerville College and Lady Margaret Hall at Oxford, Girton and Newnham Colleges at Cambridge, Westfield College in London, St Hilda's College, St Hugh's Hall, Holloway College, Owens College, the Manchester and Birmingham and Victoria Universities, and other colleges for women in all parts of the United Kingdom, are some of the later but equally successful results of the movement. The necessity for testing the quality of the education of women, however, soon began to be felt. The University of Cambridge was the first to institute a special examination for women over eighteen, and its example was followed by Oxford; but while London, Dublin (Trinity College), Belfast (Queen's), Victoria, Edinburgh, Glasgow, and St Andrews universities now grant degrees, Oxford and Cambridge still denied them in 1910. In the act of 1908 establishing the new Roman

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[1] The action for breach of promise of marriage is in some of its incidents peculiar to English law. In Roman law, betrothal (*sponsalia*) imposed a duty on the betrothed to become husband and wife within a reasonable time, subject to the termination of the obligation by death, repudiation by the words *conditione tua non utor*, or lapse of time, the time fixed being two years. No action lay for breach of promise to marry unless *arrhae sponsalitiae* had been given, *i.e.* earnest of the bargain, to be forfeited by the party refusing to carry it out. The *arrha* might also be given by a parent, and was equally liable to forfeiture. A provincial governor, or one of his relations or household, could not recover any *arrha* that might have been given, it being supposed that he was in a position of authority and able to exercise influence in forcing consent to a betrothal. In the canon law breach of the promise made by the *sponsalia*, whether *de praesenti* or *de futuro*, a division unknown to Roman law, does not without more appear to have sufficed to found an action for its breach, except so far as it fell under ecclesiastical cognizance as *laesio fidei*, but it had the more serious legal effect of avoiding as a canonical disability the subsequent marriage, while the original *sponsalia* continued, of a betrothed person to any other than the one to whom he or she was originally betrothed. The *sponsalia* became inoperative, either by mutual consent or by certain supervening impediments, such as ordination or a vow of chastity. The canonical disability of pre-contract was removed in England by 32 Hen. VIII. c. 38, re-established in the reign of Edward VI., and finally abolished in 1753. In England the duty of the parties is the same as in Roman law, viz. to carry out the contract within a reasonable time, if no time be specially fixed. Formerly a contract to marry could be specifically enforced by the ecclesiastical court compelling a celebration of the marriage *in facie ecclesiae*. The last instance of a suit for this purpose was in 1752, and the right to bring it was abolished in 1753 by Lord Hardwicke's Act (26 Geo. II. c. 33). In Scotland a promise in the nature of *sponsalia de futuro* not followed by consummation may be resiled from, subject to the liability of the party in fault to an action for the breach, which by 6 Geo. IV. c. 120, s. 28, is a proper cause for trial by jury. If, however, the *sponsalia* be *de praesenti*, and, according to the more probable opinion, if they be *de futuro* followed by consummation, a pre-contract is constituted, giving a right to a decree of declarator of marriage and equivalent to marriage, unless declared void during the lifetime of the parties.

Catholic university in Ireland, it was provided that two members of the senate should be women; and Queen's University, Belfast, had three women in 1910 in its senate. Women may point with justifiable pride to the fact that within a very few years of their admission to university examinations, they provided at Cambridge both a senior classic and a senior wrangler. In America (see CO-EDUCATION) the movement has gone much farther than in Great Britain.

The temperate, calm, earnest demeanour of women, both in the schools and in university life, awakened admiration and respect from all; and the movement brought into existence a vast number of women, as well-educated as men, hard-working, persevering and capable, who invaded many professions, and could hold their ground where a sound education was the foundation of success. The pioneers of female education spent their energies in developing their higher and more intellectual ideals, but later years opened up other positions which better education has enabled women to fill. In the literary field they soon invaded journalism (see NEWSPAPERS), and took an important place on the staffs of libraries and museums. They form an important (and in America, the predominating) section of the teaching profession in the state schools, and in all research work play an increasingly valuable part. It is not possible for every woman to be a scholar, a doctor (see below), a lawyer,[1] or possibly to attain the highest position in professions where competition with men is keen, but the development of women's work has opened many other outlets for their energies. As members of school boards, factory inspectors, poor law guardians, sanitary inspectors, they have had ample scope for gratifying their ambition and energy. The progress made in philanthropy and religious activity[2] is largely due to their devotion, under the auspices of countless new societies. And increasing provision has been made, in the arts and crafts, for the furtherance of their careers. There are successful women architects now working in England, and in 1905 a woman won the silver medal of the Royal Society of British Architects; a large number of women travel for business firms; in decorative work, as silversmiths, dentists, law copyists, proof-readers, and in plan tracing women work with success; wood-carving has become almost as recognized a career for them as that of typewriting and shorthand, in which an increasing number are finding employment. Agriculture and gardening have opened up a new field of work, and, with it, kindred occupations.

Medicine.

Women have always found a peculiarly fitting sphere as nurses, though it is only in recent years that nursing (*q.v.*) has been professionalized by means of proper education. But their admission to the medical profession itself was one of the earliest triumphs of the 19th-century movement. It began in America, but was quickly followed up in England. After having been refused admission to instruction by numerous American medical schools, Miss Elizabeth Blackwell was allowed to enter as a student by the Geneva Medical College, N.Y., in 1847, from which she graduated in 1849. Hers was the first woman's name to be placed on the Medical Register of the United Kingdom (1859). In Great Britain the struggle to obtain admission to the teaching schools and to the examinations for medical degrees and diplomas was long and bitter. Though the Society of the Apothecaries admitted Mrs Garrett Anderson (*q.v.*) to their diploma in 1865, it was only after a series of rebuffs and failures that women were admitted to the degree examinations of the various universities. In August 1876 an "enabling" act was passed, empowering the nineteen British medical examining bodies to confer their degrees or diplomas without distinction of sex. In 1908 the Royal College of Physicians and Surgeons decided to admit women to their diplomas and fellowships. In the meantime women doctors had become a common phenomenon.

Political position.

Women in England may fill some of the highest positions in the state. A woman may be a queen, or a regent, and as queen regnant has, by 1 Mary, sess. 3, c. 1, as full rights as a king. Among the public offices a woman may hold are those of county, borough, parish and rural or urban district councillor, overseer, guardian of the poor, churchwarden and sexton. In 1908 Mrs Garrett Anderson was elected mayor of Aldeburgh, the first case of a woman holding that position. Women have also been nominated as members of Royal Commissions (*e.g.* those on the Poor Law and Divorce). A woman cannot serve on a jury, but may, if married, be one of a "jury of matrons" empanelled to determine the condition of a female prisoner on a writ *de ventre inspiciendo*. She can vote (if unmarried or a widow) in county council, municipal, poor law and other local elections. The granting of the parliamentary franchise to women was, however, still withheld in 1910. The history of the movement for women's suffrage is told below. It may be remarked that, with or without the possession of a vote on their own account, politics in England have in modern times been very considerably influenced by the work of women as speakers, canvassers and organizers. The great Conservative auxiliary political organization, the Primrose League, owes its main success to women, and the Women's Liberal Federation, on the opposite side, has done much for the Liberal party. The Women's Liberal Unionist Association, which came into being in 1886 at the time of the Irish Home Rule Bill, also played an active part in defence of the Unionist cause.

Women's suffrage.

The movement for the abolition of the sex distinction in respect of the right conferred upon certain citizens to share in the election of parliamentary representatives dates for practical purposes from the middle of the 19th century. The governmental systems of the ancient world were based without exception on the view that women could take no part in state politics, except in oriental countries as monarchs. Exceptional women such as Cleopatra, Semiramis, Arsinoe, might in the absence of men of the royal house, and by reason of royal descent or personal prestige, occupy the throne, and an Aspasia might be recognized as the able head of a political salon, but women in general derived thence no political status. Though Christianity and a broadening of men's theories of life tended to raise the moral and social status of women, yet Paul definitely assigns subservience as the proper function of women, and many of the fathers looked upon them mainly as inheriting the temptress function of Eve. This view generally obtained throughout the middle ages, though here and there glimmerings of a new idea are seen; many of the great English abbesses discharged their territorial duties as landowners, and women as custodians of castles voted for knights of the shire. In the 17th and 18th centuries in England and America, under the influence of advancing political theory, and in France in the 18th century, this idea began to take shape. In England the writings of Mary Astell (*Serious Proposal to Ladies*, 1697) and others led to the gradual revision of the inherited idea of the education and the true sphere of women, while in 1790 Mary Wollstonecraft published her *Vindication of the Rights of Women.* In America the dawning of political consciousness is evidenced by the claim made in 1647 by Margaret Brent to sit in the Assembly of Maryland as the executor of Lord Baltimore, and by the requests made by Abigail Adams (wife of John Adams), Mercy Otis Warren and Hannah Lee Corbin, that women taxpayers should enjoy direct representation. In France the movement towards democracy did not in the hands of Rousseau include the enfranchisement of women, and Comte taught that women were politically inferior to men; Condorcet, however, demanded equal rights for both sexes. Although, through an oversight, women could vote under the first constitution of New Jersey from 1776 to 1807, there is no doubt that women's suffrage had made practically no progress in any country till comparatively late in the 19th century. There has been considerable discussion as to whether women had constitutionally a right to vote in England prior to the Reform Act of 1832 (see Mrs C. C. Stopes, *British Freewoman*). The discussion, however, is one of purely antiquarian interest, and the Reform Act made quite clear what had certainly been the recognized custom before, by introducing specifically the word "male" in the new franchise law (2 and 3 Will. IV., cap. 45, sections 19 and 20).

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[1] Women have long practised law in the United States, and in 1896 the benchers of the Ontario Law Society decided to admit them to the bar. In France in December 1900 an act was passed enabling women to practise as barristers, and Madame Petit was sworn in Paris, while a woman was briefed for the defence in a murder case in Toulouse in 1903, this being the first case of a woman pleading in a European criminal court. In Finland and Norway women have long practised as barristers, and in Denmark since 1908 they have been admitted as assistants to lawyers. By the law of the Netherlands they are admitted as notaries. In England a special tribunal of the House of Lords presided over by the Lord Chancellor decided in 1903 not to admit women to the English bar, on the grounds that there was no precedent and that they were not desirous of creating one; but numbers of women take degrees in law in British universities, and several have become solicitors.

[2] In the olden times before the Reformation in England various religious communities absorbed a large number of the surplus female population, and in High Church and Roman Catholic circles many ladies still enter various sisterhoods and devote their lives to teaching the young, visiting the poor and nursing the sick. In the Church of England the only office which remained open to women was the modest one of churchwarden, and this office is not infrequently filled by women. The Convocation of Canterbury in 1908 refused by a majority of two to admit women to parochial church councils, though qualified persons of the female sex may vote for parochial lay representatives on the church council. In the Independent Churches there are fewer restrictions. Among the Congregationalists women have equal votes on all questions and may become deacons or even ministers; Miss Jane Brown has been recognized as pastor of Brotherton Congregational Church, Yorkshire, and Miss L. Smith as pastor of that in Cardiff, and in the Methodist Church women frequently act as local preachers. The same equality and share in religious work is accorded to women by the Baptists, the Society of Friends and the Salvation Army, the success of which is largely due to them. In Unitarian congregations in the United States and Australia many women have been appointed ministers, and in England the Rev. Gertrude von Petzold held in 1910 the post of minister of the Narborough Road Free Christian Church, Leicester.

The earliest known handbill representing the modern "women's suffrage" movement in England dates from about 1847, and in 1857 the first society was formed in Sheffield, the "Sheffield Female Political Association," due largely to the work of a Quaker lady, Anne Kent of Chelmsford. In July of the same year Mrs John Stuart Mill published an article in the *Westminster Review.*[1] The earliest outstanding figure, however, is Lydia Ernestine Becker (1827–1890), descended on the mother's side from an old Lancashire family, her father being the son of a German who settled in England in early youth. She became a well-known botanist, and an intimate friend of Charles Darwin. In 1858 the *Englishwoman's Journal* was started, and by this time there was a vigorous agitation for the alteration of the law relating to the property and earnings of married women. Among the leaders of that movement were Barbara Leigh Smith (Mrs Bodichon) and Bessie Rayner Parkes (Madame Belloc). At the same time a famous group of women, Emily Davies, Miss Beale and Miss Buss (founders respectively of the Cheltenham Ladies' College and the North London Collegiate School) and Miss Garrett (Dr Garrett Anderson), Miss Helen Taylor (John Stuart Mill's stepdaughter) and Miss Wolstenholme (afterwards Mrs Elmy), discussed women's suffrage at the "Kensington Society."

A new era began with the election in 1865, as member for Westminster, of John Stuart Mill, who placed women's suffrage in his election address. From that time the subject became more or less prominent in each successive parliament. Mill presented the first petition in May 1867. In 1868 the case of Chorlton *v.* Lings was decided against women applicants for the vote by the Court of Common Pleas, and a similar decision was given by the Supreme Court of Appeal in Scotland. From this time the efforts of the various local committees (in London, Manchester, Bristol, Edinburgh and Birmingham) were directed to promoting a bill in parliament, and to forwarding petitions (an average of 200,000 signatures a year was maintained from 1870 to 1880). The *Women's Suffrage Journal* was founded in 1870, and in the same year Jacob Bright moved the second reading of the Women's Disabilities Bill which was carried by a majority of 33 votes. Mr Gladstone then threw his opposition into the scale, and the bill was rejected in committee by 220 to 94. In 1871 the same bill was again lost by 220 to 151, in spite of a memorial headed by Florence Nightingale, Mary Carpenter, Augusta Webster, Harriet Martineau, Frances Power Cobbe and Anna Louisa Chisholm (Mrs H. W. Chisholm). G. O. Trevelyan's Household Franchise Bill in 1873 raised the hopes of the women's suffragist, and Mr Joseph Chamberlain at a great Liberal meeting in Birmingham carried a resolution in favour of the proposed change. From 1874 to 1876 the bill was in charge of a conservative, Mr Forsyth, and, despite the opposition of John Bright and the efforts of a parliamentary committee for "maintaining the integrity of the franchise," the number of supporters was well maintained. The work proceeded uneventfully from 1876 to 1884, huge meetings being held in all the chief towns. In 1880 the franchise was conferred upon women owners in the Isle of Man, subsequently upon women occupiers also. In 1883 a great Liberal conference at Leeds voted in favour of women's suffrage under the leadership of Dr Crosskey and Walter S. B. M‘Laren. The next notable event in the movement was the defeat of W. Woodall's amendment to the Reform Bill (1884), providing that words importing the masculine gender should include women, by 271 votes to 135, Mr Gladstone again making a powerful appeal to his party to withdraw the support which they had given in the past. 104 Liberal members crossed over in answer to this appeal. Numerous bills and resolutions followed year by year in the names of W. Woodall, L. H. Courtney (Lord Courtney, whose bill was read a second time without a division, 1886), W. S. B. M‘Laren, Baron Dimsdale, Caleb Wright, Sir Albert K. Rollit, F. Faithfull Begg (1897; second reading majority 71). Up to 1906 all those attempts had failed, in most cases owing to time being taken for government business.

The period 1906 to 1910 witnessed entirely new developments. The suffragists of the existing societies still carried on their constitutional propaganda, and various bills were introduced. In 1907 Mr W. H. Dickinson's bill was talked out, and in 1908 Mr H. Y. Stanger's bill was carried on its second reading by a majority of 179, but the government refused facilities for its progress. Prior to this, however, a number of suffragists had come to the conclusion that the failure of the various bills was due primarily to government hostility. Furthermore the advent of a Liberal government in 1906 had aroused hopes among them that the question would be officially taken up. Questions were therefore put by women to Liberal cabinet ministers at party meetings, and disturbances occurred, with the result that Miss Christabel Pankhurst and Miss Annie Kenney were fined in Manchester in 1906. A certain section of suffragists thereafter decided upon comprehensive opposition to the government of the day, until such time as one or other party should officially adopt a measure for the enfranchisement of women. This opposition took two forms, one that of conducting campaigns against government nominees (whether friendly or not) at bye-elections, and the other that of committing breaches of the law with a view to drawing the widest possible attention to their cause and so forcing the authorities to fine or imprison them. Large numbers of women assembled while parliament was sitting, in contravention of the regulations, and on several occasions many arrests were made. Fines were imposed, but practically all refused to pay them and suffered imprisonment. At a later stage some of the prisoners adopted the further course of refusing food and were forcibly fed in the gaols.

The failure of all the bills previously drafted on the basis of exact equality between the sexes, and the fact that both Unionists and Liberals refused to make the matter a party question, coupled with a general feeling of discomfort at the relations between the so-called "militant" suffragists and the authorities, led in the spring of 1910 to the formation of a committee (called the Conciliation Committee) of members of parliament under the presidency of the earl of Lytton. This committee, consisting of some 55 members belonging to all parties, succeeded in agreeing upon a new bill based upon the occupier franchise established by the Municipal Franchise Act of 1884. It was urged on behalf of this bill that it would establish the principle on a sufficiently representative basis without altering the numerical balance of parties in the country. It was calculated that slightly over 1,000,000 women would be enfranchised. After considerable pressure both inside the house and outside, Mr Asquith consented to give two days of government time for the debate, and the second reading, moved by the Labour member, Mr D. J. Shackleton, was carried by a majority of 110 votes. A further attempt to commit the bill to a Grand Committee failed by 175 votes; the bill was therefore sent to a committee of the whole house, and Mr Asquith announced that he would not give further facilities. It was noteworthy that, though the bill was opposed as undemocratic by Mr Lloyd-George and other Liberals, it was supported by 32 out of 40 of the Labour members, and evidence was given that a large proportion of the new voters would have been working women.

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[1] This article was written in reference to the Women's Rights Convention held in Worcester, Mass., U.S.A., in October 1850.

The leading women's suffrage societies may here be mentioned. All these societies have advocated precisely the same view, namely that women should have the same electoral privileges as men, whatever franchise system be adopted.

1. *The National Union of Women's Suffrage Societies* is the oldest organization. It began about 1867 as a number of separate local committees, and after various reorganizations a great amalgamation of all local societies was framed in 1896 under the present title. This union had 200 branches in 1910. All the early suffragists belonged to this body, and in latter years the chief name is that of Mrs Henry Fawcett. The union pursued continuously the "constitutional" policy and stood apart altogether from the "militant" societies. Its official organ, *The Common Cause*, was founded in 1908.

2. *The National Women's Social and Political Union*, associated chiefly with the name of Mrs Emmeline Pankhurst and Miss Christabel Pankhurst, formed in 1906, originated the more "militant" policy. Its income in 1909–1910 reached the figure of £60,000, and up to September 1910 some 500 of its members had undergone imprisonment. It undertook a widespread campaign of meetings, and though at first its speakers were subjected to an opposition of a violent character, there was no doubt that the movement received from its activities a wholly new stimulus. Its official organ, *Votes for Women*, obtained a large circulation.

Societies of various kinds multiplied. In 1907 were formed (3) the *Women's Freedom League* (chiefly associated with the name of Mrs C. Despard, a prominent supporter of the Labour party), whose members objected to the internal administration of the Social and Political Union, but agreed in adopting its policy in a modified form; and (4) the *Men's League for Women's Suffrage*, a society which included men of all parties, and in September 1910 adopted the anti-government election policy. Numerous other party[1] and non-party societies were formed, and resolutions supporting the principle, either in the abstract or as a part of adult suffrage, were passed by various Conservative, Liberal and Labour conferences and associations.

The remarkable prominence of the movement and the fact that successive parliaments contained a majority of pledged suffragists led to the formation of opposition societies. In 1908 was formed the *Women's National Anti-Suffrage League*, of men and women, which drew into its ranks prominent persons such as Lord Cromer, Lord Curzon, Lady Jersey and Mrs Humphry Ward; and about the same time the *Men's League for Opposing Women's Suffrage* came into existence. These two leagues amalgamated in December 1910, as the *National League for Opposing Women's Suffrage*, with Lord Cromer as president. The *Anti-Suffrage Review* was founded in 1909.

In New Zealand a measure for the enfranchisement of women, introduced by Richard Seddon, was carried in September 1893 (in the upper house by a majority of 2). In Australia the vote has been extended to all adult women both in the states (the first being South Australia, 1894, the last Victoria, 1908) and for the Commonwealth parliament. They have, moreover, the right to sit in the representative assemblies.

The movement assumed an organized form in the United States somewhat earlier than in the United Kingdom. It arose out of the interest taken by women in the temperance and anti-slavery agitations, and was fostered by the discussion on women's property rights. In 1840 the question was raised in a more acute form by the exclusion of women delegates from the World's Convention, and in 1848 the first women's suffrage convention was held at Seneca Falls, the leading spirits being Mrs Elizabeth Cady Stanton, Martha C. Wright and Lucretia Mott. Later conventions at Salem and Worcester, Massachusetts, in 1850, were the predecessors of annual meetings, but the extravagant dress adopted by some of the women brought ridicule upon the movement, which was further thrown into the background by the Civil War. In 1869 were formed: (1) in New York, the *National Women's Suffrage Association*, and (2) in Cleveland, the *American Woman's Suffrage Association*. In 1890 these two societies amalgamated as the *National American Woman's Suffrage Association*, of which in 1900 Mrs Carrie Chapman Catt became president. The question was considered by a select committee in the 48th Congress, and 200 petitions, representing millions of individuals, were presented in 1900. The Labour and Socialist parties in general supported the women's claim, but there was considerable opposition in other parties. In 5 states (Wyoming since 1869; Colorado, 1893; Utah, 1896; Idaho, 1896; and Washington, 1910) women are electors, and in 25 states they have exercised the school suffrage. In Louisiana they obtained the suffrage in connexion with tax levies in 1898. Anti-suffrage societies have also been formed in Brooklyn (1894), Massachusetts (1895), Illinois (1897), Oregon (1899).

In Finland all adult men and women over the age of 24, excluding paupers, received the right to vote for members of the Diet in 1906, in which year nineteen women became members of the Diet. In Norway, where there is male suffrage for men over 25 years of age, women were entitled to vote by a law of 1907, provided they or, if married, their husbands (*i.e.* where property is jointly owned) had paid income tax on an annual income of 400 kroner (£22) in the towns, or 300 kroner (£16, 10s.) in country districts. In Sweden a suffrage bill was carried in the lower but rejected in the upper house in 1909. In all the chief countries there are suffrage societies of greater or less strength. In Russia the question was placed in the forefront of the demands made by the Duma in 1906, and in 1907 propertied women received the right to confer votes on their sons who would otherwise be unenfranchised. In France a feminist congress met at Lyons in 1909.

The *International Woman Suffrage Alliance* originated in the United States in 1888. Its membership increased steadily, and at the Convention held in London in 1909 delegates were present from twenty-two countries. In the United Kingdom this Alliance is represented by the *National Union of Women's Suffrage Societies*. A social and propagandist club was founded in London in 1909 with an international membership. An international journal under the title *Jus Suffragii* (Brussels) was founded in 1907.

AUTHORITIES.—It is impossible to do more than mention a few works out of many dealing with various phases of the modern "women's movement." See Alice Zimmern's *Renaissance of Girls' Education in England* (1898); A. R. Cleveland, *Women under English Law* (1896); J. L. de Lanessan, *L'Éducation de la femme moderne* (1908); M. Ostrogorski, *Femme au point de vue du droit public* (1892); Mrs C. P. Gilman, *Women and Economics* (1899); Miss C. E. Collet, *Report on Changes in the Employment of Women* (1898; Parl. papers, C. 8794); B. and M. Van Vorst, *Woman in industry* (1908); A. Loria, *Le Féminisme au point de vue sociologique* (1907); Helen Blackburn, *Record of Women's Suffrage*, in the United Kingdom (1902); Susan B. Anthony, *History of Woman's Suffrage*, in the United States (4 vols., 1881–1902); C. C. Stopes, *British Free Women* (1894); W. Lyon Blease, *The Emancipation of Women* (1910). The classical exposition of the arguments on behalf of women's suffrage is J. S. Mill's *Subjection of Women*; the most important statement in opposition is perhaps that of Professor A. V. Dicey in the *Quarterly Review* (Oct. 1908). (X.)

WOOD, ANTHONY À[2] (1632–1695), English antiquary, was the fourth son of Thomas Wood (1580–1643), B.C.L. of Oxford, where Anthony was born on the 17th of December 1632. He was sent to New College school in 1641, and at the age of twelve was removed to the free grammar school at Thame, where his studies were interrupted by civil war skirmishes. He was then placed under the tuition of his brother Edward (1627–1655), of Trinity College; and, as he tells us, "while he continued in this condition his mother would alwaies be soliciting him to be an apprentice which he could never endure to heare of." He was entered at Merton College in 1647, and made postmaster. In 1652 he amused himself with ploughing and bell-ringing, and "having had from his most tender years an extraordinary ravishing delight in music," began to teach himself the violin, and was examined for the degree of B.A. He engaged a music-master, and obtained permission to use the Bodleian, "which he took to be the happiness of his life." He was admitted M.A. in 1655, and in the following year published a volume of sermons by his late brother Edward. He began systematically to copy monumental inscriptions and to search for antiquities in the city and neighbourhood. He went through the Christ Church registers, "at this time being resolved to set himself to the study of antiquities." Dr John Wallis, the keeper, allowed him free access to the university registers in 1660; "here he layd the foundation of that book which was fourteen years afterwards published, viz. *Hist. et Antiq. Univ. Oxon.*" He also came to know the Oxford collections of Brian Twyne to which he was greatly indebted. He steadily investigated the muniments of all the colleges, and in 1667 made his first journey to London, where he visited Dugdale, who introduced him into the Cottonian library, and Prynne showed him the same civility for the Tower records. On October 22, 1669, he was sent for by the delegates of the press, "that whereas he had taken a great deal of paines in writing the *Hist. and Antiq. of the Universitie of Oxon*, they would for his paines give him an 100 *li.* for his copie, conditionally, that he would suffer the book to be translated into Latine." He accepted the offer and set to work to prepare his English MS. for the translators, Richard Peers and Richard Reeve, both appointed by Dr Fell, dean of Christ Church, who undertook the expense of printing. In 1674 appeared *Historia et antiquitates Universitatis Oxoniensis*, handsomely reprinted "e Theatro Sheldoniano," in two folio volumes, the first devoted to the university in general and the second to the colleges. Copies were widely distributed, and university and author received much praise. On the other hand, Bishop Barlow told a correspondent that "not only the Latine but the history itself is in many things ridiculously false" (*Genuine Remains*, 1693, p.183). In 1678 the university registers which had been in his custody for eighteen years were removed, as it was feared that he would be implicated in the Popish plot. To relieve himself from suspicion he took the oaths of supremacy and allegiance. During this time he had been gradually completing his great work, which was produced by a London publisher in 1691–1692, 2 vols. folio, *Athenae Oxonienses: an Exact History of all the Writers and Bishops who have had their Education in the University of Oxford from 1500 to 1690, to which are added the Fasti, or Annals for the said time.* On the 29th of July 1693 he was condemned in the vice-chancellor's court for certain libels against the late earl of Clarendon, fined, banished from the university until he recanted, and the offending pages burnt. The proceedings were printed in a volume of *Miscellanies* published by Curll in 1714. Wood was attacked by Bishop Burnet in a *Letter to the Bishop of Lichfield and Coventry* (1693, 4to), and defended by his nephew Dr Thomas Wood, in a *Vindication of the Historiographer, to which is added the Historiographer's Answer* (1693), 4to, reproduced in the subsequent editions of the *Athenae*. The nephew also defended his uncle in *An Appendix to the Life of Bishop Seth Ward*, 1697, 8vo. After a short illness he died on the 28th of November 1695, and was buried in the outer chapel of St John Baptist (Merton College), in Oxford, where he superintended the digging of his own grave but a few days before.

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[1] *E.g.* the *Conservative and Unionist Women's Franchise Association*, of which the countess of Selborne became president in 1910.

[2] In the *Life* he speaks of himself and his family as Wood or à Wood, the last form being a pedantic return to old usage adopted by himself. A pedigree is given in Clark's edition.

He is described as "a very strong lusty man," of uncouth manners and appearance, not so deaf as he pretended, of reserved and temperate habits, not avaricious and a despiser of honours. He received neither office nor reward from the university which owed so much to his labours. He never married, and led a life of self-denial, entirely devoted to antiquarian research. Bell-ringing and music were his chief relaxations. His literary style is poor, and his taste and judgment are frequently warped by prejudice, but his two great works and unpublished collections form a priceless source of information on Oxford and her worthies. He was always suspected of being a Roman Catholic, and invariably treated Jacobites and Papists better than Dissenters in the *Athenae*, but he died in communion with the Church of England.

Wood's original manuscript (purchased by the Bodleian in 1846) was first published by John Gutch as *The History and Antiquities of the Colleges and Halls in the University of Oxford, with a continuation* (1786–1790, 2 vols. 4to), and *The History and Antiquities of the University of Oxford* (1792–1796, 3 vols. 4to), with portrait of Wood. To these should be added *The Antient and Present State of the City of Oxford, chiefly collected by A. à Wood, with additions by the Rev. Sir J. Peshall* (1773, 4to; the text is garbled and the editing very imperfect). An admirable edition of the *Survey of the Antiquities of the City of Oxford, composed in 1661–66 by Anthony Wood*, edited by Andrew Clark, was issued by the Oxford Historical Society (1889–1899, 3 vols. 8vo). *Modius Salium, a Collection of Pieces of Humour*, chiefly ill-natured personal stories, was published at Oxford in 1751, 12mo. Some letters between Aubrey and Wood were given in the *Gentleman's Magazine* (3rd ser., ix. x. xi.). Wood consulted Dr Hudson about getting a third volume of the *Athenae* printed in Holland, saying, "When this volume comes out I'll make you laugh again" (*Reliq. Hearnianae*, i. 59). This was included in a second edition of the *Athenae* published by R. Knaplock and J. Tonson in 1721 (2 vols. folio), "very much corrected and enlarged, with the addition of above 500 new lives." The third appeared as "a new edition, with additions, and a continuation by Philip Bliss" (1813–1820, 4 vols. 4to). The Ecclesiastical History Society proposed to bring out a fourth edition, which stopped at the *Life*, ed. by Bliss (1848, 8vo; see *Gent. Mag.*, N.S., xxix. 135, 268). Dr Bliss's interleaved copy is in the Bodleian, and Dr Griffiths announced in 1859 that a new edition was contemplated by the Press, and asked for additional matter (see *Notes and Queries*, 2nd ser., vii. 514, and 6th ser., vi. 5, 51). Wood bequeathed his library (127 MSS. and 970 printed books) to the Ashmolean Museum, and the keeper, William Huddesford, printed a catalogue of the MSS. in 1761. In 1858 the whole collection was transferred to the Bodleian, where 25 volumes of Wood's MSS. had been since 1690. Many of the original papers from which the *Athenae* was written, as well as several large volumes of Wood's correspondence and all his diaries, are in the Bodleian.

We are intimately acquainted with the most minute particulars of Wood's life from his *Diaries* (1657–1695) and autobiography; all earlier editions are now superseded by the elaborate work of Andrew Clark, *The Life and Times of Anthony Wood, Antiquary, of Oxford, 1632–1695, described by himself* (Oxford Historical Society, 1891–1900, 5 vols. 8vo). See also *Reliquiae Hearnianae*, ed. Bliss (2nd ed., 1869, 3 vols. 12mo); Hearne's *Remarks and Collections* (Oxford Historical Society, 1885–1907), vols. i.-viii.; Macray's *Annals of the Bodleian Library* (2nd ed., 1890); Nichols's *Literary Anecdotes*, i. iv. v. viii.; Noble's *Biogr. History of England*, i. (H. R. T.)

WOOD, MRS HENRY [Ellen] (1814–1887), English novelist, was born at Worcester on the 17th of January 1814. Her maiden name was Price; her father was a glove manufacturer in Worcester. She married Henry Wood in 1836, and after her marriage lived for the most part in France, her husband, who died in 1866, being at the head of a large shipping and banking firm. In 1860 she wrote a temperance tale, *Danesbury House*, which gained a prize of £100 offered by the Scottish Temperance League; but before this she had regularly contributed anonymous stories to periodicals. Her first great success was made with *East Lynne* (1861), which obtained enormous popularity. It was translated into several languages, and a number of dramatic versions were made. *The Channings* and *Mrs Halliburton's Troubles* followed in 1862; *Verner's Pride* and *The Shadow of Ashlydyat* in 1863; *Lord Oakburn's Daughters*, *Oswald Cray* and *Trevlyn Hold* in 1864. She became proprietor and editor of the *Argosy* magazine in 1867, and the *Johnny Ludlow* tales, published anonymously there, are the most artistic of her works. Among the thirty-five novels Mrs Henry Wood produced, the best of those not hitherto mentioned were *Roland Yorke* (1869); *Within the Maze* (1872) and *Edina* (1876). She continued to edit the *Argosy*, with the assistance of her son, Mr C. W. Wood, till her death, which occurred on the 10th of February 1887.

Memorials of Mrs Henry Wood, by her son, were published in 1894.

WOOD, SIR HENRY EVELYN (1838–), British field marshal, was born at Braintree, Essex, on the 9th of February 1838, the youngest son of Sir John Page Wood, Bart. Educated at Marlborough, he entered the Royal Navy in 1852, and served as a midshipman in the Russian war, being employed on shore with the naval brigade in the siege operations before Sevastopol, mentioned in despatches, and severely wounded at the assault on the Redan on June 18, 1855. Immediately afterwards he left the navy for the army, becoming a cornet in the 13th Light Dragoons. Promoted lieutenant in 1856, he exchanged into the 17th Lancers in 1857, and served in the Indian Mutiny with distinction as brigade-major of a flying column, winning the

Victoria Cross. In 1861 he became captain, in 1862 brevet-major, exchanging about the same time into the 73rd Highlanders (Black Watch), but returned to the cavalry three years later. Having meantime served as an aide-de-camp at Dublin, he was next employed on the staff at Aldershot until 1871, when he was appointed to the 90th (now 2nd Scottish Rifles) as a regimental major. In 1867 he had married the Hon. Mary Pauline Southwell, sister of the 4th Lord Southwell. In 1873 he was promoted brevet lieutenant-colonel, and in 1874 served in the Ashanti War (brevet-colonel); in 1874–1878 he was again on the staff at Aldershot, and in November 1878 he became regimental lieutenant-colonel, the 90th being at that time in South Africa engaged in the Kaffir War. In January 1879 he was in command of the left column of the army that crossed the Zulu frontier, and shortly afterwards he received the local rank of brigadier-general. Under him served Colonel Redvers Buller and also the Boer leader, Piet Uys, who fell at Inhlobana, but the repulse at that place was more than counterbalanced by the successful battle of Kambula. At the close of the war Sir Evelyn Wood, who received the K.C.B. for his services, was appointed to command the Chatham district. But in January 1881 he was again in South Africa with the local rank of major-general, and after Sir G. P. Colley's death at Majuba it fell to his lot to negotiate the armistice with General Joubert. Remaining in Natal until February 1882, he then returned to the Chatham command, having meantime been promoted substantive major-general. In 1882 he was made a G.C.M.G. and commanded a brigade in the Egyptian expedition. He remained in Egypt for six years. From 1883 to 1885 he was Sirdar of the Egyptian army, which he reorganized and in fact created. During the Nile operations of 1884–85 he commanded the forces on the line of communication of Lord Wolseley's army. In 1886 he returned to an English command, and two years later (January 1889), with the local rank of lieutenant-general, he was appointed to the Aldershot command. He became lieutenant-general in 1891, and was given the G.C.B. at the close of his tenure of the command, when he went to the War Office as quartermaster-general. Four years afterwards he became adjutant-general. He was promoted full general in 1895. He commanded the II. Army Corps and Southern Command from 1901 to 1904, being promoted field marshal on the 8th of April 1903. In 1907 he became colonel of the Royal Horse Guards. After retiring from active service he took a leading part, as chairman of the Association for the City of London, in the organization of the Territorial Force. Sir Evelyn Wood published several works, perhaps the best known of which to the soldier are *Achievements of Cavalry* (1897) and *Cavalry in the Waterloo Campaign* (1896). He also wrote *The Crimea in 1854 and in 1894*; an autobiography, *From Midshipman to Field Marshal*; and *The Revolt in Hindostan.*

WOOD, JOHN GEORGE (1827–1889), English writer and lecturer on natural history, was born in London on the 21st of July 1827. He was educated at Ashbourne grammar school and at Merton College, Oxford; and after he had taken his degree in 1848 he worked for two years in the anatomical museum at Christ Church under Sir Henry Acland. In 1852 he was ordained a deacon of the Church of England, became curate of the parish of St Thomas the Martyr, Oxford, and also took up the post of chaplain to the Boatmen's Floating Chapel at Oxford. He was ordained priest in 1854, and in that year gave up his curacy to devote himself for a time to literary work. In 1858 he accepted a readership at Christ Church, Newgate Street, and he was assistant-chaplain to St Bartholomew's Hospital, London, from 1856 until 1862. Between 1868 and 1876 he held the office of precentor to the Canterbury Diocesan Choral Union. After 1876 he devoted himself to the production of books and to delivering in all parts of the country lectures on zoology, which he illustrated by drawing on a black-board or on large sheets of white paper with coloured crayons. These "sketch lectures," as he called them, were very popular, and made his name widely known both in Great Britain and in the United States. In 1883–1884 he delivered the Lowell lectures at Boston. Wood was for a time editor of the *Boy's Own Magazine.* His most important work was a *Natural History* in three volumes, but he was better known by the series of books which began with *Common Objects of the Sea-Shore,* and which included popular monographs on shells, moths, beetles, the microscope and *Common Objects of the Country.* *Our Garden Friends and Foes* was another book which found hosts of appreciative readers. He died at Coventry on the 3rd of March 1889.

WOOD, SEARLES VALENTINE (1798–1880), English palaeontologist, was born on the 14th of February 1798. He went to sea in 1811 as a midshipman in the East India Company's service, which he left, however, in 1826. He then settled at Hasketon near Woodbridge, Suffolk. He devoted himself to a study of the mollusca of the Newer Tertiary (Crag) of Suffolk and Norfolk, and the Older Tertiary (Eocene) of the Hampshire basin. On the latter subject he published *A Monograph of the Eocene Bivalves of England* (1861–1871), issued by the Palaeontographical Society. His chief work was *A Monograph of the Crag Mollusca* (1848–1856), published by the same society, for which he was awarded the Wollaston medal in 1860 by the Geological Society of London; a supplement was issued by him in 1872–1874, a second in 1879, and a third (edited by his son) in 1882. He died at Martlesham, near Woodbridge, on the 26th of October 1880. His son, Searles Valentine Wood (1830–1884), was for some years a solicitor at Woodbridge, but gave up the profession and devoted his energies to geology, studying especially the structure of the deposits of the Crag and glacial drifts.

WOODBRIDGE, a market town in the Woodbridge parliamentary division of Suffolk, England; 79 m. N.E. by E. from London by the Great Eastern railway. Pop. of urban district (1901) 4640. It is prettily situated near the head of the Deben estuary, which enters the North Sea 10 m. S. by E. The church of St Mary the Virgin is a beautiful Perpendicular structure, with a massive and lofty tower of flint work. The large estate left by Thomas Seekford of Sekforde (1578) endows the grammar school and hospital. Woodbridge Abbey, built by Seekford, occupies the site of an Augustinian foundation of the 12th century. There is a large agricultural trade, and general fairs and horse fairs are held.

WOODBURY, CHARLES HERBERT (1864–), American marine painter, was born at Lynn, Massachusetts, on the 14th of July 1864. He graduated at the Massachusetts Institute of Technology, Boston, in 1886, was a pupil of the Académie Julien, Paris. He was president of the Boston Water Color Club, and became associate of the National Academy of Design, New York. His wife, Marcia Oakes Woodbury, born in 1865 at South Berwick, also became known as a painter.

WOODBURY, LEVI (1789–1851), American political leader, was born at Francestown, New Hampshire, on the 22nd of December 1789. He graduated from Dartmouth College in 1809, was admitted to the bar in 1812, and was a judge of the superior court from 1816 to 1823. In 1823–1824 he was governor of the state, in 1825 was a member and speaker of the state House of Representatives, and in 1825–1831 and again in 1841–1845 was a member of the U.S. Senate. He was secretary of the navy in 1831–1834, secretary of the treasury in 1834–1841, and associate justice of the U.S. Supreme Court from 1846 until his death, at Portsmouth, New Hampshire, on the 4th of September 1851. From about 1825 to 1845 Woodbury was the undisputed leader of the Jacksonian Democracy in New England.

See his *Writings, Political, Judicial and Literary* (3 vols., Boston, 1852), edited by Nahum Capen; and an article in the *New England Magazine,* new series, xxxvii. p. 658 (February 1908).

WOODBURY, a city and the county-seat of Gloucester county, New Jersey, U.S.A., in the western part of the state, 9 m. S. of Philadelphia. Pop. (1900) 4087, including 246 foreign-born and 517 negroes; (1910) 4642. It is served by the West Jersey & Seashore Railroad. Among its public institutions is the Deptford Institute Free Library. There are various manufactures. Woodbury is said to have been settled about 1684; it became the county-seat in 1787. It was chartered as a borough in 1854 and as a city in 1870.

WOOD-CARVING, the process whereby wood is ornamented with design by means of sharp cutting tools held in the hand. The term includes anything within the limit of sculpture in the round up to hand-worked mouldings such as help to compose the tracery of screens, &c.

Material.—The texture of wood limits the scope of the carver in that the substance consists of bundles of fibres (called grain) growing in a vertical direction without much lateral cohesive strength. It is therefore essential to arrange the more delicate parts of a design "with the grain" instead of across it, and the more slender stalks or leaf-points should not be too much separated from their adjacent surroundings. The failure to appreciate these primary rules may constantly be seen in damaged work, when it will be noticed that, whereas tendrils, tips of birds' beaks, &c., arranged across the grain have been broken away, similar details designed more in harmony with the growth of the wood and not too deeply undercut remain intact. Oak is the most suitable wood for carving, on account of its durability and toughness without being too hard. Chestnut (very like oak), American walnut, mahogany and teak are also very good woods; while for fine work Italian walnut, lime, sycamore, apple, pear or plum, are generally chosen. Decoration that is to be painted and of not too delicate a nature is as a rule carved in pine.

Tools.—The carver requires but few kinds of tools:—(1) the gouge—a tool with a curved cutting edge—used in a variety of forms and sizes for carving hollows, rounds and sweeping curves; (2) the chisel, large and small, whose straight cutting edge is used for lines and cleaning up flat surfaces; (3) the "V" tool used for veining, and in certain classes of flat work for emphasizing lines. A special screw for fixing work to the bench, and a mallet, complete the carver's kit, though other tools, more or less legitimate, are often used, such as a router for bringing grounds to a uniform level, bent gouges and bent chisels for cutting hollows too deep for the ordinary tool.

Method.—The process for relief carving is usually as follows. The carver first fixes the wood to his bench by means of the screw already referred to. He then (*a*) sketches on the main lines of his idea, indicating the flowers, foliage, &c.; or (*b*) should the design be very intricate or of a geometrical character, he traces the whole design from a pattern first prepared on paper; or (*c*) he may combine the first two methods. Next he grounds out the spaces between the lines with a gouge to a more or less uniform depth. Then he "bosts" the upstanding pattern that remains, *i.e.* he models and shapes the details of his design, carefully balancing the lights and shadows; and finally, after having obtained the result he desires, he cleans up the whole. The quicker he works, the fewer times he goes over the same part, the more sketchy the subsidiary portions, the less high finish he puts into the detail, the better the result. Incised work, chip-carving, &c., are generally finished at once and not in stages. Much carved work, that of savage nations for instance, is of course carved without the assistance of a bench. Many small articles, too, are carved in the hand. Little models of antelopes or bears, so familiar in Switzerland, are carved in this way with a tool somewhat like a half-open knife but with the blade fixed.

Style.—From the remotest ages the decoration of wood has been a foremost art. The tendency of human nature has always been to ornament every article in use. Just as a child of to-day instinctively cuts patterns on the bark of his switch freshly taken from the hedgerow, so the primitive man, to say nothing of his more civilized successor, has from the earliest times cut designs on every wooden article he is accustomed to handle. The North American Indian carves his wooden fish-hook or his pipe stem just as the Polynesian works patterns on his paddle. The native of British Guiana decorates his cavassa grater with a well-conceived scheme of incised scrolls, while the savage of Loango Bay distorts his spoon with a hopelessly unsuitable design of perhaps figures standing up in full relief carrying a hammock.

Figure work.

Figure-work seems to have been universal. The craving to represent one's god in a tangible form finds expression in numberless ways. The early carver, and, for that matter, the native of the present day, has always found a difficulty in giving expression to the eye, and at all times has evaded it by inlaying this feature with coloured material. Obsidian, for example, is used by the modern Easter Islander in common with the Egyptian craftsman of the earlier dynasties. To carve a figure in wood is not only more difficult but is less satisfactory than marble (for which see SCULPTURE), owing to the tendency of wood to crack, to be injured by insects, or to suffer from changes in the atmosphere. The texture of the material, too, often proves fatal to the expression of the features, especially in the classic type of youthful face. On the other hand, magnificent examples exist of the more rugged features of age: the beetling brows, the furrows and lines neutralizing the defects of the grain of the wood. However, in ancient work the surface was not of such consequence, for figures as a rule were painted.

Colour.

It is not always realized at the present day to what extent colour has even from the most ancient times been used to enhance the effect of wood-carving and sculpture. The modern prejudice against gold and other tints is perhaps due to the fact that painted work has been vulgarized. One associates coloured carvings too readily with theatre galleries and the triumphal car of the circus procession. The "restored" work too of some church screens does anything but encourage the revival of this time-honoured custom. The arrangement of a proper and harmonious scheme of colour is not the work of the house-painter, but of the specially trained artist. Witness the old coloured screens of Norfolk, the harmonious greens and reds, the proper proportion of gold, the panels adorned with saints on backgrounds of delicate diaper work, and compare these triumphs of decoration with the rougher blues and reds of the average restored screen, and one ceases to wonder why we now prefer the wood plain.

Of late years carving has gone out of fashion; a change has come about. The work is necessarily slow, thus causing charges to appear high. Other and cheaper methods of decoration have driven carving from its former place. Machine work has much to answer for, and the endeavour to popularize the craft by means of the village class has not always achieved its own end. The gradual disappearance of the individual artist, elbowed out as he has been by the contractor, is fatal to the continuance of an art which can never flourish when done at so much a yard. So long as the carver is expected to work to some one else's pattern—so long as he is, in detail at least, not his own designer—this art, which attained its zenith in the glories of the 15th-century cathedral and in the continental domestic work of the hundred years to follow, can never hope to live again.

Egypt.

Ancient Work before the Christian Era.—The extreme dryness of the climate of Egypt accounts for the existence of a number of wood-carvings from this remote period (see EGYPT: *Art and Archaeology*). Some wood panels from the tomb of Hosuî at Sakkarah are of the III. dynasty (over 4000 B.C.). The carving consists of hieroglyphs and figures in low relief, and the style is extremely delicate and fine. A stool shown on one of the panels has the legs shaped like the fore and hind limbs of an animal, a form common in Egypt for thousands of years.

Figure work.

In the Cairo museum may be seen the statue of a man of 50 years of age, of the period of the great pyramid, possibly 4000 B.C. The expression of the face and the realism of the carriage have never been surpassed by any Egyptian sculptor of this or any other period. The figure is carved out of a solid block of sycamore, and in accordance with the Egyptian custom the arms are joined on. The eyes are inlaid with pieces of opaque white quartz, with a line of bronze surrounding to imitate the lid; a small disk of transparent rock crystal forms the iris, while a tiny bit of polished ebony fixed behind the crystal imparts to it a lifelike sparkle. "The IV., V. and VI. dynasties cover the finest period of Egyptian sculpture. The statues found in the tombs show a freedom of treatment which was never reached in later times. They are all portraits, which the artist strove his utmost to render exactly like his model. For these are not, like more modern statues, simply works of art, but had primarily a religious signification" (Maspero). As the spirits of the deceased might inhabit these "Ka" statues, the features and proportions were closely copied.

There are to be found in the principal museums of Europe many Egyptian examples of the utmost interest—mummy cases of human

Mummy cases.

beings with the face alone carved, animal mummy cases, sometimes boxes, with the figure of a lizard, perhaps, carved in full relief standing on the lid. Sometimes the animal, a cat, sitting on its haunches, for example, or a jackal, crouching on all fours, would be carved in the round and its hollowed body used as the case itself.

Furniture.

Of furniture, folding seats like the modern campstool, and chairs with legs terminating in the heads of beasts or the feet of animals, still exist. Beds supported by lions' paws (XI. and XII. dynasties, from Gebeleîn, now in the Cairo Museum), head-rests, 6 or 8 in. high, shaped like a crutch on a foot, very like those used by the native of New Guinea to-day, are carved with scenes, &c., in outline. In the British Museum may be seen a tiny little coffer, 4 in. by $2\frac{1}{2}$ in., with very delicate figures carved in low relief. This little box stands on cabriole legs $\frac{5}{8}$ of an inch long with claw feet, quite Louis Quinze in character. There are incense ladles, the handle representing a bouquet of lotus flowers, the bowl formed like the leaf of an aquatic plant with serrated edges (from Gurnah, XVIII. dynasty); mirror handles, representing a little pillar, or a lotus stalk, sometimes surmounted by a head of Hathor (the Egyptian Venus) or of Bêsu (god of the toilet); pin-cushions, in the shape of a small round tortoise with holes in the back for toilet pins, which were also of wood with dog-head ends (XI. dynasty, Cairo Museum); and perfume boxes such as a fish, the two halves forming the bottom and top—the perfume or pomatum was removed by little wooden spoons, one shaped in the form of a cartouche emerging from a full-blown lotus, another shaped like the neck of a goose, a third consisting of a dog running with a fish in its mouth, the fish forming the bowl. The list might be prolonged, but enough has been said to show to what a pitch of refinement the art of wood-carving had reached thousands of years before the birth of Christ.

Assyria, Greece and Rome.

Of the work of Assyria, Greece and Rome, little is actually known except from history or inference. It may be safely assumed that the craft kept pace with the varying taste and refinement of all the older civilizations. Important pieces of wood sculpture which once existed in Greece and other ancient countries are only known to us from the descriptions of Pausanias and other classic writers. Many examples of the wooden images of the gods (ξόανα) were preserved down to late historic times. The Palladium, or sacred figure of Pallas, which was guarded by the Vestal Virgins in Rome and was fabled to have been brought by Aeneas from the burning Troy, was one of these wooden ξόανα.

First Eleven Centuries after Christ.—Wood-carving examples of this period are extremely rare. The carved panels of the main doors of St Sabina on the Aventine Hill, Rome, are very interesting specimens of early Christian relief sculpture in wood, dating, as the dresses show, from the 5th century. The doors are made up of a large number of small square panels, each minutely carved with a scene from the Old or New Testament. The whole feeling of these reliefs is thoroughly classic, though of course in a very debased form. A very fine fragment of Byzantine art (11th–12th centuries) is preserved in a monastery at Mount Athos in Macedonia. It consists of two panels (one above the other) of relief sculpture, surmounted by a semicircular arch of conventional foliage springing from columns ornamented with animals in foliage of spiral form. The capitals and bases are square, each face being carved with a figure. It is a wonderfully fine piece of work, conceived in the best decorative spirit.

Scandinavian work.

In Scandinavian countries we find some very early work of excellent design. In the Christiania Museum there are some fine chairs of the 9th or 10th centuries carved with that particular flat and broad treatment of scroll and strapwork so eminently suited to soft wood. In the Copenhagen Museum there are panels from Iceland in the same style. The celebrated wooden doorways of Aal (A.D. 1200) (Plate II. fig. 3), Sauland, Flaa, Solöer and other Norwegian churches (Christiania Museum) are only an elaboration of the same treatment of dragons and intricate scroll work, a style which we still see carried on in the door-posts of the 15th century in the Nordiska Museum, Stockholm, and in the Icelandic work of quite modern times. In these early days the leaf was not much developed in design. The carver depended almost entirely on the stalk, a style of work which has its counterpart in Burmese work of the 17th century.

Gothic Period (12th–15th Centuries).—It was towards the end of this epoch that wood-carving reached its culminating point. The choir stalls, rood-screens, roofs, retables, of England, France and the Teutonic countries of Europe, have in execution, balance and proportion, never at any time been approached. In small designs, in detail, in minuteness, in mechanical accuracy, the carver of this time has had his rivals, but for greatness of architectural conception, for a just appreciation of decorative treatment, the designer of the 15th century stands alone.

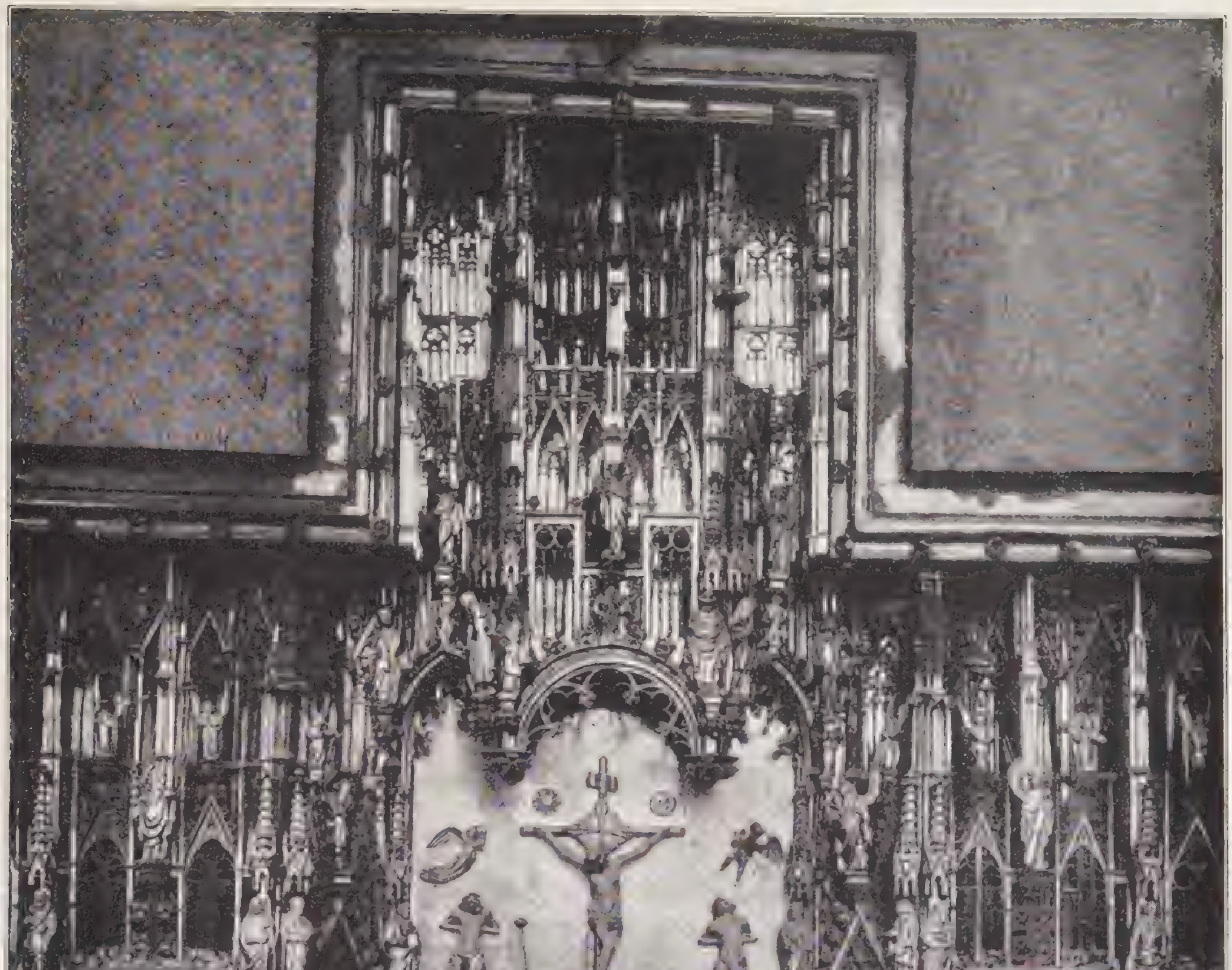
It should always be borne in mind that colour was the keynote of this scheme. The custom was practically universal, and enough traces remain to show how splendid was the effect of these old Gothic churches and cathedrals in their perfection. The priests in their gorgeous vestments, the lights, the crucifix, the banners and incense, the frescoed or diapered walls, and that crowning glory of Gothic art, the stained glass, were all in harmony with these beautiful schemes of coloured carved work. Red, blue, green, white and gilding were the tints as a rule used. Not only were the screens painted in colours, but the parts painted white were often further decorated with delicate lines and sprigs of foliage in conventional pattern. The plain surfaces of the panels were also adorned with saints, often on a background of delicate gesso diaper, coloured or gilded (Southwold). Nothing could exceed the beauty of the triptychs or retables of Germany, Flanders (Plate I. fig. 1) or France; carved with scenes from the New Testament in high relief arranged under a delicate lacework of canopies and clustered pinnacles glistening with gold and brilliant colours. In Germany the effect was further enhanced by emphasizing parts of the gilding by means of a transparent varnish tinted with red or green, thus giving a special tone to the metallic lustre.

The style of design used during this great period owes much of its interest to the now obsolete custom of employing direct the craftsman and his men, instead of the present-day habit of giving the work to a contractor. It is easy to trace how those bands of carvers travelled about from church to church. In one district the designer would employ a particular form and arrangement of vine leaf, while in another adjoining quite a different style repeatedly appears. Judging by results, this system produced the best class of work both in design and execution. The general scheme was of course planned by one master mind, but the carrying out of each section, each part, each detail, was left to the individual workman. Hence that variety of treatment, that endless diversity, which gives a charm and interest to Gothic art, unknown in more symmetrical epochs. The Gothic craftsman appreciated the cardinal fact that in design beautiful detail does not necessarily insure a beautiful composition, and subordinated the individual part to the general effect. He also often carved *in situ*, a practice seldom if ever followed in the present day. Here and there one comes across the work of long years ago still unfinished. A half-completed bench-end, a fragment of screen left plain, clearly show that sometimes at least the church was the workshop.

Gothic and Renaissance: a Comparison.—Gothic design roughly divides itself into two classes: (1) the geometrical, *i.e.* tracery and diaper patterns, and (2) the foliage designs, where the mechanical scroll of the Renaissance is as a rule absent. The lines of foliage treatment, so common in the bands of the 15th-century rood-screens and the panel work especially of Germany, serve to illustrate the widely different motives of the craftsmen of these two great epochs. Again, while the Renaissance designer as a rule made the two sides of the panel alike, the Gothic carver seldom repeated a single detail. While his main lines and grouping corresponded, his detail differed. Of numberless examples a 15th-century chest (Plate III. fig. 6) in the Kunstgewerbe Museum, Berlin, may be referred to. The arrangements of foliage, &c., on top, back and front, are typical of Gothic at its best.

End of the 12th century-1300.—As this section treats of wood-carving in Europe generally, and not of any one country alone, the dates just named must be of necessity only approximate. The 13th century was marked not only by great skill both in design and treatment, but also much devotional feeling. The craftsman seems to have not merely carved, but to have carved to the glory of God. At no time was work more delicately conceived or more beautifully cut. This early Gothic style certainly lent itself to fine finish, and in this respect was more suited to stone treatment than to wood. But the loving care bestowed on each detail seems to point to a religious devotion which is sometimes absent from later work. Very good examples of capitals (now, alas, divided down the centre) are to be seen in Peterborough cathedral. Scrolls and foliage spring from groups of columns of four. Some Italian columns of the same date (Victoria and Albert Museum) should be compared, much to the advantage of the former. Exeter cathedral boasts misereres unsurpassed for skilful workmanship; mermaids, dragons, elephants, masks, knights and other subjects introduced into foliage, form the designs. Salisbury cathedral is noted for its stall elbows, and the reredos in the south transept of Addisham, Kent, is another fine example testifying to the great skill of the 13th-century wood-carvers. A very interesting set of stalls, the early history of which is unknown, was placed in Barming church, Kent, about the year 1868. The book rest ends are carved with two scrolls and an animal standing between, and the ends of the stalls with figure sculpture: Christ rescuing souls from Hell, Samson slaying the lion, St George and the dragon, &c. The work of these stalls is that of an artist who knew what effect he wanted to produce and got it. There is in the Berlin Museum a very fine example of a 13th-century prayer desk from Johanniskirche in Herford. The front is carved in three panels under arches, two with vine leaves and grapes and the other with an oak tree conventionally treated. Along the arches is carved in Latin "this three-divisioned desk has John with the help of Thomas carved. Who will not praise this work may he then be removed," a somewhat drastic method of obtaining favourable criticism.

1300–1380.—During this period foliage forms, though still conventional, more closely followed nature. The canopy work of the choir of Winchester contains exquisite carvings of oak and other leaves. The choir stalls of Ely and Chichester and the tomb of Edward III. in Westminster Abbey are all fine examples of this period. Exeter boasts a throne—that of Bishop Stapledon (A.D. 1308–1326) standing 57 ft. high—which remains unequalled for perfection of proportion and delicacy of detail (Plate IV. fig. 8). In France the stalls



Photo, F. A. Crallan.

Fig. 1.—CENTRE PANEL OF RETABLE IN DIJON MUSEUM. FLEMISH, 1391 A.D.

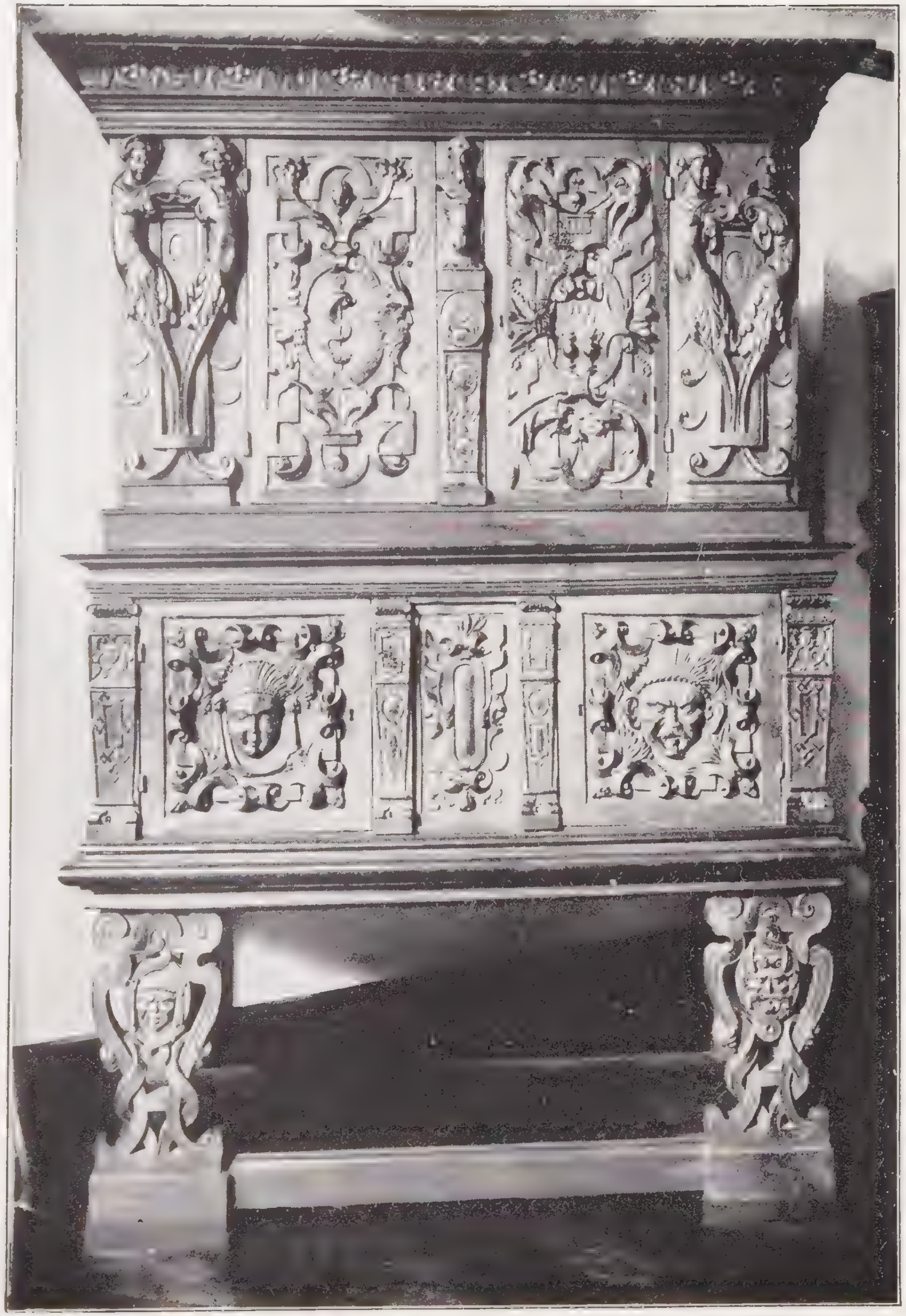


FIG. 2.—FRENCH CABINET. RENAISSANCE, 1577.

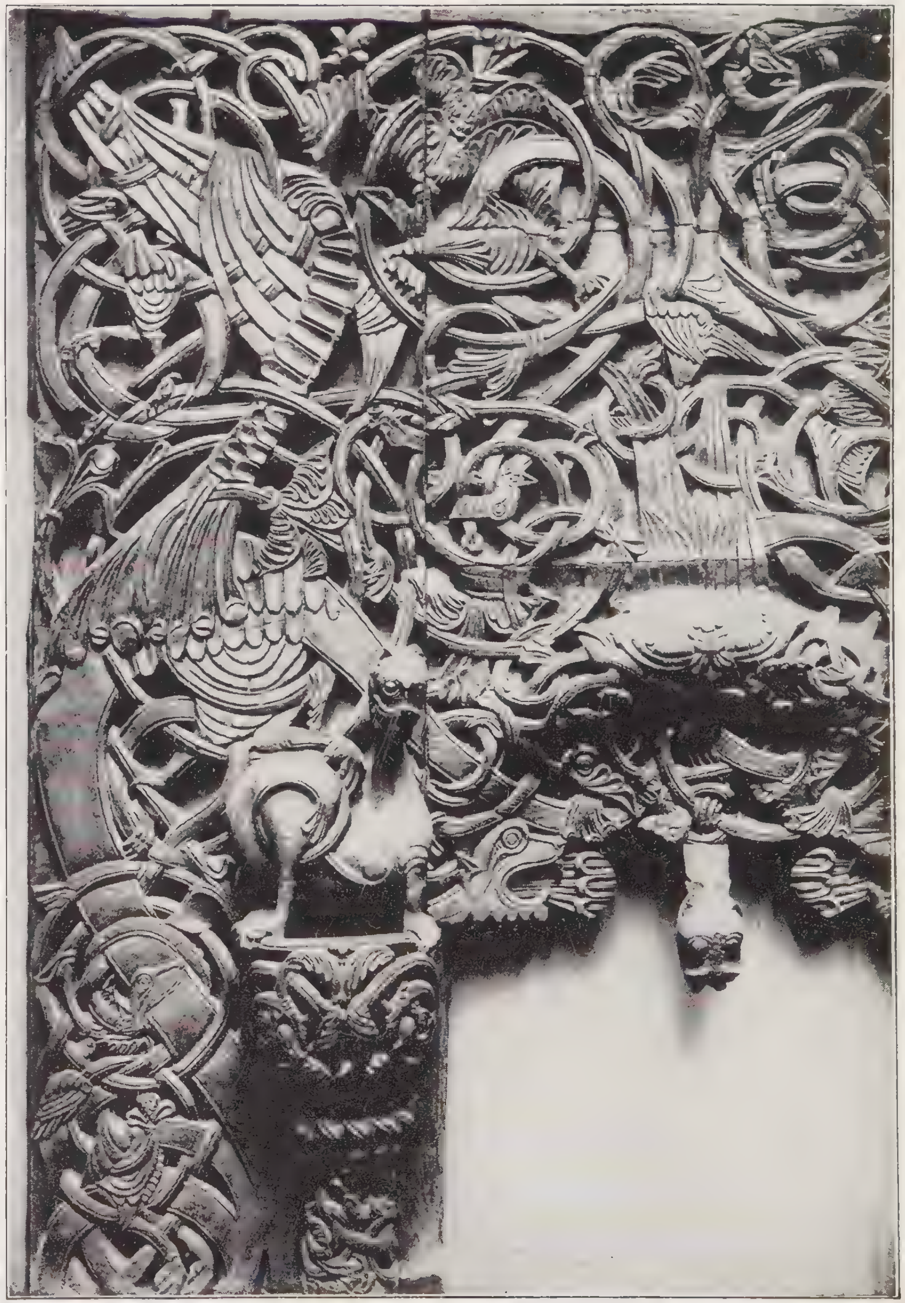


FIG. 3.—DETAIL OF DOORWAY FROM AAL, NORWAY.
SCANDINAVIAN, about 1200 A. D.

of St Benoit-sur-Loire, Lisieux, and Evreux are good 14th-century examples. But little Gothic work is now to be seen in the churches of this country. It is to the museums we have to look for traces of the old Gothic carvers. The two retables in Dijon Museum, the work of Jacques de Baerze (1301), a sculptor of Flanders, who carved for Philippe le Hardi, duke of Burgundy, are masterpieces of design and workmanship. The tracery is of the very finest, chiefly gilt on backgrounds of diapered gesso (Plate I. fig. 1).

1380–1520.—Towards the end of the 14th century carvers gave up natural foliage treatment to a great extent, and took to more conventional forms (Plate III. fig. 4). The oak and the maple no longer inspired the designer, but the vine was constantly employed. A very large amount of 15th-century work remains to us, but the briefest reference only can be made to some of the more beautiful examples that help to make this period so great.

The rood screen.

The rood screen, that wonderful feature of the medieval church, was now universal. It consisted of a tall screen of usually about 11 ft. high, on the top of which rested a loft, *i.e.* a platform about 6 ft. in width guarded on either side by a gallery and either on the top or in front of that, facing the nave, was placed the rood, *i.e.* a large crucifix with figures of St Mary and St John on either side. This rood screen sometimes spanned the church in one continuous length (Leeds, Kent), but often filled in the aisle and chancel arches in three separate divisions (Church Handborough, Oxon.). The loft was as a rule approached by a winding stair built in the thickness of the aisle wall. The lower part of the screen itself was solid panelled to a height of about 3 ft. 6 in. and the upper part of this panelling was filled in with tracery (Carbrook, Norfolk), while the remaining flat surfaces of the panels were often pictured with saints on a background of delicate gesso diaper (Southwold, Suffolk). Towards the end of this period the employment of figures became less common as a means of decoration, and the panels were sometimes filled entirely with carved foliage (Swimbridge, Devon). The upper part of the rood screen consisted of open arches with the heads filled in with pierced tracery, often enriched with crockets (Scarning, Norfolk), embattled transoms (Castle Hedingham, Essex), or floriated cusps (Eye, Suffolk). The mullions were constantly carved with foliage (Cheddar, Somerset), pinnacles (Causton, Norfolk), angels (Pilton, Devon), or decorated with canopy work in gesso (Southwold). But the feature of these beautiful screens was the loft with its gallery and vaulting. The loft floor rested on the top of the rood screen and was usually balanced and kept in position by means of a groined vaulting (Harberton, Devon) or a cove (Eddington, Somerset). The finest examples of vaulting are to be seen in Devon (Plate IV. fig. 10). The bosses at the intersections of the ribs and the carved tracery of the screen at Honiton stand unrivalled. Many screens still possess the beam which formed the edge of the loft floor and on which the gallery rested. It was here that the medieval rood-screen carver gave most play to his fancy, and carved the finest designs in foliage to be seen throughout the whole Gothic period. Although these massed moulds, crests and bands have the appearance of being carved out of one log, they were in practice invariably built up in parts, much of the foliage, &c., being pierced and placed in hollow moulds in order to increase the shadow. As a rule the arrangement consisted of a crest running along the top, with a smaller one depending from the lower edge, and three bands of foliage and vine between them (Feniton, Devon). The designs of vine leaves at Kenton (Plate IV. fig. 10), Bow and Dartmouth, all in Devon, illustrate three very beautiful treatments of this plant. At Swimbridge, Devon, there is a very elaborate combination; the usual plain beads which separate the bands are carved with twisted foliage also. At Abbots Kerswell and other places in the district round Totnes the carvers introduced birds in the foliage with the best effect. The variety of cresting used is very great. That at Winchcomb, Gloucester, consists of dragons combined with vine leaves and foliage. It illustrates how Gothic carvers sometimes repeated their patterns in as mechanical a way as the worst workmen of the present time. Little can be said of the galleries, so few remain to us. They were nearly all pulled down when the order to destroy the roods was issued in 1548. That they were decorated with carved saints under niches (Llananno, Wales), or painted figures (Strencham, Worcester), is certain from the examples that have survived the Reformation. At Atherington, Devon, the gallery front is decorated with the royal coat of arms, other heraldic devices, and with prayers. The Breton screen at St Fiacre-le-Faouet is a wonderful example of French work of this time, but does not compare with the best English examples. Its flamboyant lines and its small tracery never obtained any foothold in England, though screens carved in this way (Colebrook, Devon) are sometimes to be found.

The rood was sometimes of such dimensions as to require some support in addition to the gallery on which it rested. A carved beam was used from which a chain connected the rood itself. At Cullompton, Devon, such a beam still exists, and is carved with foliage; an open cresting ornaments the under side and two angels support the ends. This particular rood stood on a base of rocks, skulls and bones, carved out of two solid logs averaging 18 in. wide and 21 in. high, and together measuring 15 ft. 6 in. long; there are round holes along the top which were probably used for lights.

Roofs.

No country in Europe possesses roofs to equal those of England in the 15th century. The great roof of Westminster Hall (see ROOF) remains to the present day without an equal. In Norfolk and Suffolk roofs abound of the hammer-beam class; that at Woolpit, Suffolk, is of the first rank. Each bracket is carved with strongly designed foliage, the end of every beam terminates in an angel carrying a shield, and the purlins are crested, while each truss is supported by a canopied niche (containing a figure) resting on an angel corbel. Here, too, as at Ipswich and many other churches, there is a row of angels with outspread wings under the wall-plate. This idea of angels in the roof is a very beautiful one, and the effect was of course much enhanced by the colouring. The roof at St Nicholas, King's Lynn, is a magnificent example of tie-beam construction. The trusses are filled in with tracery at the sides and the centres more or less open, and the beams, which are crested and embattled, contain a row of angels on either side. In Devon, Cullompton possesses a very fine semicircular ceiling supported at intervals by ribs pierced with carving. Each compartment is divided up into small square panels, crossed by diagonal ribs of cresting, while every joint is ornamented with a boss carved in the decorative way peculiar to the Gothic craftsman. The nave roof of Manchester cathedral is nearly flat, and is also divided up into small compartments and bossed; the beams are supported by carved brackets resting on corbels with angels at each base.

Choir stalls.

In the 15th century, choir stalls with their canopies continued to increase in magnificence. Manchester cathedral (middle of 15th century) and Henry VII.'s chapel in Westminster Abbey (early 16th) are good examples of the fashion of massing pinnacles and canopies; a custom which hardly compares with the more simple beauty of the 14th-century work of Ely cathedral. The stalls of Amiens cathedral were perhaps the finest in the world at the beginning of the 16th century. The cresting employed, though common on the Continent, is of a kind hardly known in England, consisting as it does of arches springing from arches, and decorated with crockets and finials. The tabernacle work over the end seats, with its pinnacles and flying buttresses, stretches up towards the roof in tapering lines of the utmost delicacy. The choir stalls (the work of Jorg Syrlin, 1468) in Ulm cathedral are among the finest produced by the German carver (Plate III. fig. 4). The front panels are carved with foliage of splendid decorative boldness, strength and character; the stall ends were carved with foliage and sculpture along the top edge, as was sometimes the case in Bavaria and France as well as Germany.

Bench ends.

In early times the choir alone possessed seats, the nave being left bare. Gradually benches were introduced, and during the 15th century became universal. The "poppy-head" form of ornament now reached perfection and was constantly used for seats other than those of the choir. The name refers to the carved finial which is so often used to complete the top of the bench end and is peculiarly English in character. In Devon and Cornwall it is rarely met with (Ilsington, Devon). In Somerset it is more common, while in the eastern counties thousands of examples remain. The quite simple fleur-de-lys form of poppy-head, suitable for the village, is seen in perfection at Trunch, Norfolk, and the very elaborate form when the poppy-head springs from a crocketed circle filled in with sculpture, at St Nicholas, King's Lynn. Often the foliage contained a face (Cley, Norfolk), or the poppy-head consisted of figures or birds only (Thurston, Suffolk) or a figure standing on a dragon (Great Brincton, Northampton); occasionally the traditional form was departed from and the finial carved like a lemon in outline (Bury St Edmunds) or a diamond (Tirley, Glos.). In Denmark an ornament in the form of a large circle sometimes takes the place of the English poppy-head. In the Copenhagen Museum there is a set of bench ends of the 15th century with such a decoration carved with coats of arms, interlacing strap-work, &c. But the old 15th-century bench end did not depend entirely on the poppy-head for its embellishment. The side was constantly enriched with elaborate tracery (Dennington, Norfolk) or with tracery and domestic scenes (North Cadbury, Somerset), or would consist of a mass of sculpture in perspective, with canopy work, buttresses and sculptured niches, while the top of the bench end would be crowned with figures carved in the round, of the finest craftsmanship. Such work at Amiens cathedral is a marvel alike of conception, design and execution. In the Kunstgewerbe Museum, Berlin, some beautiful stall ends are to be seen. Out of a dragon's mouth grows a conventional tree arranged and balanced in excellent proportion. On another stall end a tree is carved growing out of the mouth of a fool. This custom of making foliage grow out of the mouth or eyes is hardly defensible, and was by no means confined to any country or time. We have plenty of Renaissance examples of the same treatment.

Pulpits.

Before the 15th century preaching had not become a regular institution in England, and pulpits were not so common. However, the value of the sermon began to be appreciated from the use to which the Lollards and other sects put this method of teaching doctrine, and pulpits became a necessity. A very beautiful one exists at Kenton, Devon. It is, as is generally the case, octagonal, and stands on a foot. Each angle is carved with an upright column of foliage between pinnacles, and the panels, which are painted with saints, are enriched with carved canopies and foliage; it is, however, much restored. The pulpit at Trull, Somerset, is noted for its fine figure carving. A large figure standing under a canopy fills each of the panelled sides, while many other smaller figures help to enrich the general effect. Examples of Gothic sounding boards are very rare; that, together with the pulpit, in the choir of Winchester is of the time of Prior Silkstede (1520), and is carved with his rebus, a skein of twisted silk.

Font covers.

The usual form of font cover during the hundred years before the Reformation was pyramidal, the ribs of the salient angles being straight and cusped (Frindsbury, Kent) or of curved outline and cusped (St Mildred, Canterbury). There is a very charming one of this form at Colebrook, Devon. It is quite plain but for a little angel kneeling on the top, with its hands clasped in prayer. But the most beautiful form is the massed collection of pinnacles and canopy work, of which there is such a fine example at Sudbury, Suffolk. It was not uncommon to carve a dove on the topmost pinnacle (Castleacre, Norfolk), in allusion to the descent of the Holy Spirit. The finest font in England is undoubtedly that of Ufford, Suffolk. It rises some 20 ft. in height, and when the panels were painted with saints and the exquisite tabernacle work coloured and gilded, must have been a masterpiece of Gothic craftsmanship. A cord connecting the tops of these covers with the roof or with a carved beam standing out from the wall, something like a crane (Salle, Norfolk), was used to remove the cover on the occasion of baptism.

Lecterns.

Many lecterns of the Gothic period do not exist to-day. They usually had a double sloping desk which revolved round a central moulded post. The lectern at Swanscombe, Kent, has a circle of good foliage ornamenting each face of the book rest, and some tracery work at either end. The box form is more common in France than in England, the pedestal of such a lectern being surrounded by a casing of three or more sides. A good example with six sides is in the church of Vance (France), and one of triangular form in the Musée of Bourges, while a four-sided box lectern is still in use in the church of Lenham, Kent. The Gothic prayer desk, used for private devotional purposes, is hardly known in England, but is not uncommon on the Continent. There is a beautiful specimen in the Musée, Bourges; the front and sides of the part for kneeling are carved with that small tracery of flowing character so common in France and Belgium during the latter part of the 15th century, and the back, which rises to a height of 6 ft., contains a little crucifix with traceried decoration above and below.

Ciboria.

A word should be said about the ciboria, so often found on the continent of Europe. In tapering arrangement of tabernacle work they rival the English font covers in delicacy of outline (Musée, Rouen).

Doors.

Numbers of doors are to be met with not only in churches but also in private houses. Lavenham, Suffolk, is rich in work of this latter class. In England the general custom was to carve the head of the door only with tracery (East Brent, Somerset), but in the Tudor period doors were sometimes covered entirely with "linenfold" panelling (St Albans Abbey). This form of decoration was exceedingly common on the Continent as well as in England. In France the doors towards the latter part of the 15th century were often square-headed, or perhaps had the corners rounded. These doors were usually divided into some six or eight oblong panels of more or less equal size. One of the doors of Bourges Cathedral is treated thus, the panels being filled in with very good tracery enriched with crockets and coats of arms. But a more restrained form of treatment is constantly employed, as at the church of St Godard, Rouen, where the upper panels only are carved with tracery and coats of arms and the lower adorned with simple linenfold design.

Altar-pieces.

To Spain and the Teutonic countries of Europe we look for the most important object of church decoration, the retable; the Reformation accounting for the absence in England of any work of this kind. The magnificent altar-piece in Schleswig cathedral was carved by Hans Bruggerman, and consists, like many others, of a number of panels filled with figures standing some four or five deep. The figures in the foremost rows are carved entirely separate, and stand out by themselves, while the background is composed of figure work and architecture, &c., in diminishing perspective. The panels are grouped together under canopy work forming one harmonious whole. The genius of this great carver shows itself in the large variety of the facial expression of those wonderful figures all instinct with life and movement. In France few retables exist outside the museums. In the little church of Marissel, not far from Beauvais, there is a retable consisting of eleven panels, the crucifixion being, of course, the principal subject. And there is a beautiful example from Antwerp in the Musée Cluny, Paris; the pierced tracery work which decorates the upper part being a good example of the style composed of interlacing segments of circles so common on the Continent during late Gothic times and but seldom practised in England. In Spain the cathedral of Valladolid was famous for its retable, and Alonso Cano and other sculptors frequently used wood for large statuary, which was painted in a very realistic way with the most startlingly lifelike effect. Denmark also possessed a school of able wood-carvers who imitated the great altar-pieces of Germany. A very large and well-carved example still exists in the cathedral of Roskilde. But besides these great altar-pieces tiny little models were carved on a scale the minuteness of which staggers the beholder. Triptychs and shrines, &c., measuring but a few inches were filled in with tracery and figures that excite the utmost wonder. In the British Museum there is such a triptych (Flemish, 1511); the centre panel, measuring an inch or two square, is crowded with figures in full relief and in diminishing perspective, after the custom of this period. This rests on a semicircular base which is carved with the Lord's Supper, and is further ornamented with figures and animals. The whole thing inclusive measures about 9 in. high, and, with the triptych wings open, 5 in. wide. The extraordinary delicacy and minuteness of detail of this microscopic work baffle description. There is another such a piece, also Flemish, in the Wallace collection, which rivals that just referred to in misapplied talent. For, marvellous as these works of art are, they fail to satisfy. They make one's eyes ache, they worry one as to how the result could ever have been obtained, and after the first astonishment one must ever feel that the same work of art on a scale large enough for a cathedral could have been carved with half the labour.

Panelling.

With regard to panelling generally, there were, during the last fifty years of the period now under review, three styles of design followed by most European carvers, each of which attained great notoriety. Firstly, a developed form of small tracery which was very common in France and the Netherlands. A square-headed panel would be filled in with small detail of flamboyant character, the perpendicular line or mullion being always subordinate, as in the German chasse (Musée Cluny), and in some cases absent, as the screen work of Evreux cathedral shows us. Secondly, the "linenfold" design. The great majority of examples are of a very conventional form, but at Bere Regis, Dorsetshire, the designs with tassels, and at St Sauvéur, Caen, those with fringe work, readily justify the universal title applied to this very decorative treatment of large surfaces. At the beginning of the 16th century yet another pattern became the fashion. The main lines of the design consisted of flat hollow mouldings sometimes in the form of interlacing circles (Gatton, Surrey), at other times chiefly straight (Rochester cathedral), and the intervening spaces would be filled in with cusps or sprigs of foliage. It marks the last struggle of this great school of design to withstand the oncoming flood of the new art—the great Renaissance. From this time onward Gothic work, in spite of various attempts, has never again taken a place in domestic decoration. The lines of the tracery style, the pinnacle, and the crocket—unequalled as they have always been in devotional expression—are universally considered unsuited for decoration in the ordinary dwelling-house.

Domestic work.

But little reference can be made to the domestic side of the period which ended with the dawn of the 16th century, because so few remains exist. On the Continent we have a certain proportion of timbered houses, the feature of which is the sculpture. At Bayeux, Bourges, Reims and pre-eminently Rouen, we see by the figures of saints, bishops or virgins, how much the religious feeling of the middle ages entered into the domestic life. In England the carved corner post (which generally carried a bracket at the top to support the overhanging storey) calls for comment. In Ipswich there are several such posts. On one house near the river, that celebrated subject, the fox preaching to geese, is carved in graphic allusion to the dissemination of false doctrine.

Of mantelpieces there is a good example in the Rouen Museum. The overhanging corners are supported by dragons and the plain mouldings have little bunches of foliage carved at either end, a custom as common in France during the 15th century as it was in England a century earlier; the screen beam at Eastbourne parish church, for example.

As a rule, cabinets of the 15th century were rectangular in plan. In Germany and Austria the lower part was often enclosed, as well as the upper; the top, middle and lower rails being carved with geometrical design or with bands of foliage (Museum, Vienna). But it was also the custom to make these cupboards with the corners cut off, thus giving five sides to the piece of furniture. A very pretty instance, which is greatly enhanced by the metal work of the lock plates and hinges, is in the Musée Cluny, and there are other good specimens with the lower part open in the Victoria and Albert Museum, South Kensington.

The chest was a very important piece of furniture, and is often to be met with covered with the most elaborate carving (Orleans Museum). There is a splendid chest (14th century) in the Cluny Museum; the front is carved with twelve knights in armour standing under as many arches, and the spandrels are filled in with faces, dragons and so on. But it is to the 15th century that we look for the best work of this class; there is no finer example than that in the Kunstgewerbe Museum, Berlin (Plate III. fig. 6). The front is a very animated hunting scene most decoratively arranged in a scheme of foliage, and the top bears two coats of arms with helms, crests and mantling. But the more general custom in chest decoration was to employ tracery with or without figure work; Avignon Museum contains some typical examples of the latter class.

A certain number of seats used for domestic purposes are of great interest. A good example of the long bench placed against the wall, with lofty panelled back and canopy over, is in the Musée Cluny, Paris. In the Museum at Rouen is a long seat of a movable kind with a low panelled back of pierced tracery, and in the Dijon Museum there is a good example of the typical chair of the period, with arms and high panelled and traceried back. There was a style of design admirably suited to the decoration of furniture when made of soft wood such as pine. It somewhat resembled the excellent Scandinavian

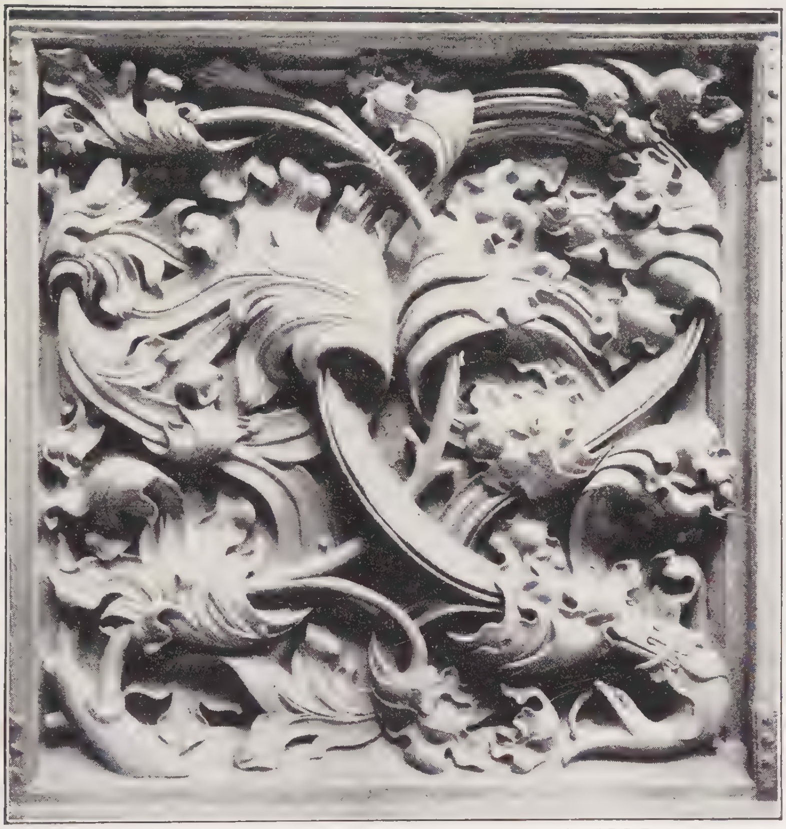


FIG. 4.—PANEL FROM FRONT OF STALLS, ULM CATHEDRAL. 1468-1474.

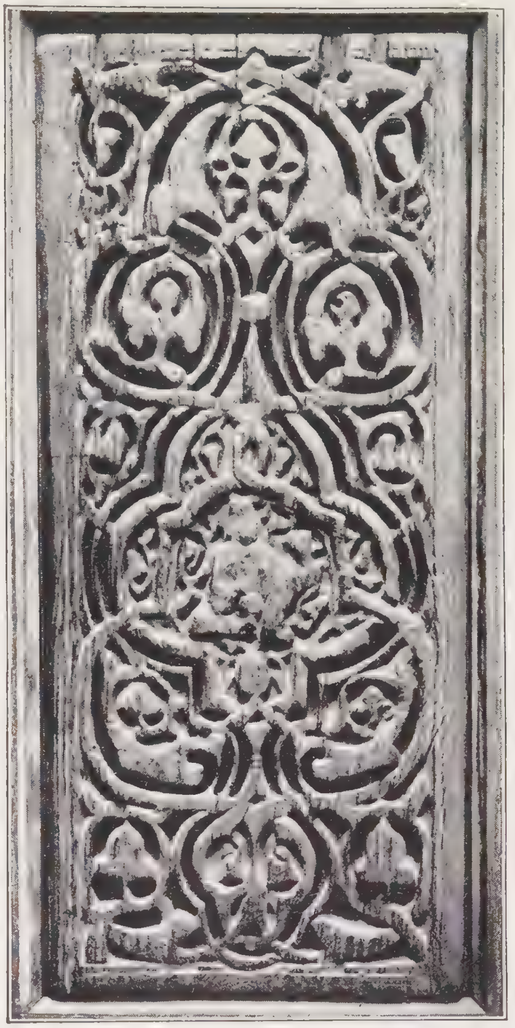
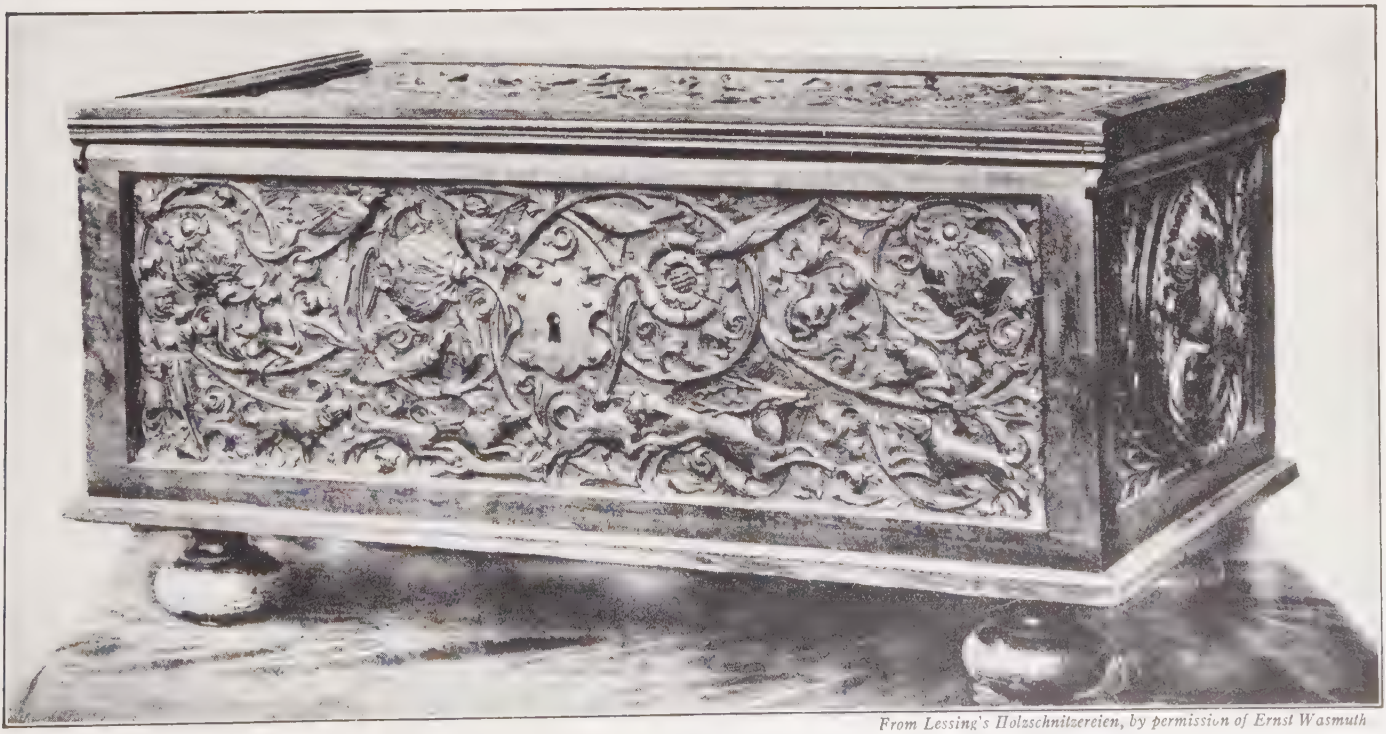


FIG. 5.—ARABIAN PANEL. 13th century.



From Lessing's Holzschnitzereien, by permission of Ernst Wasmuth

FIG. 6.—GERMAN CHEST. Late 15th century.

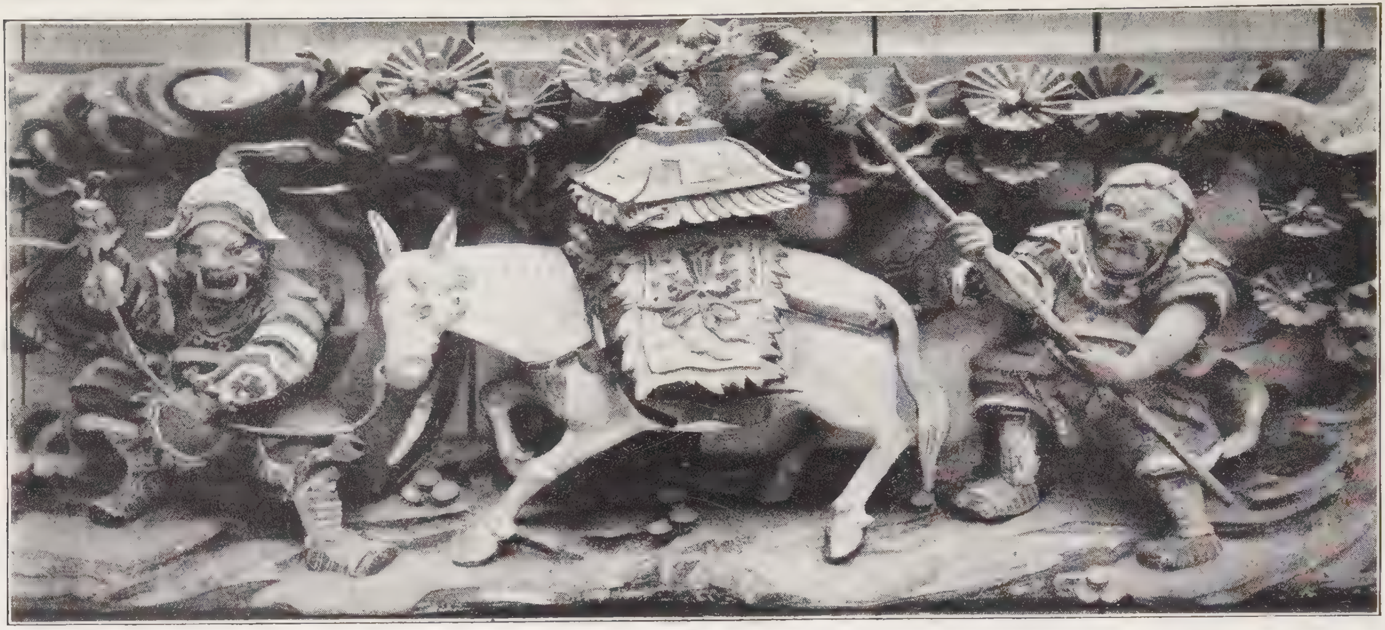
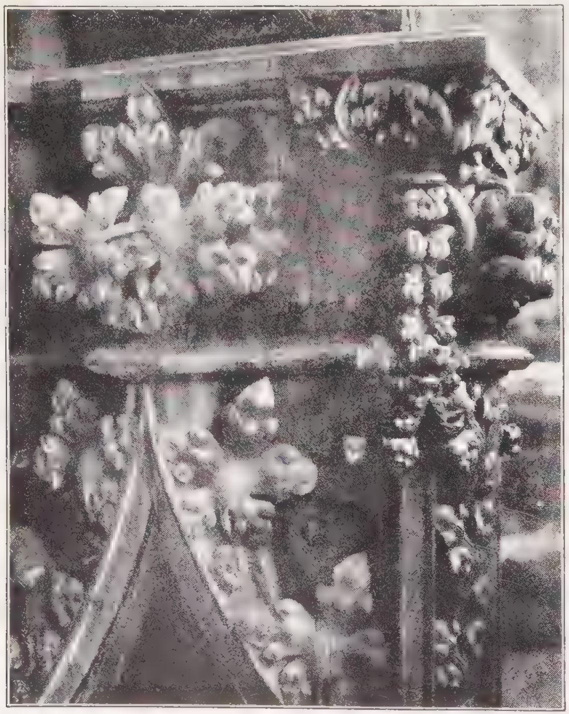


FIG. 7.—JAPANESE PANEL.



Photo, F. A. Crallan.

FIG. 8.—DETAIL OF BISHOP STAPLEDON'S THRONE, 1308-1326 A.D. EXETER CATHEDRAL.

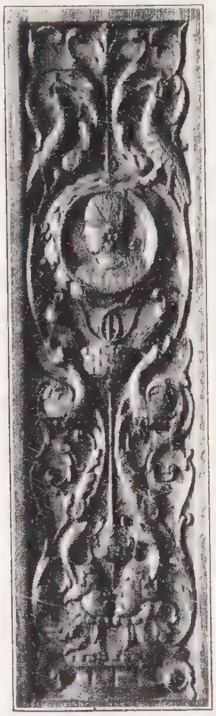
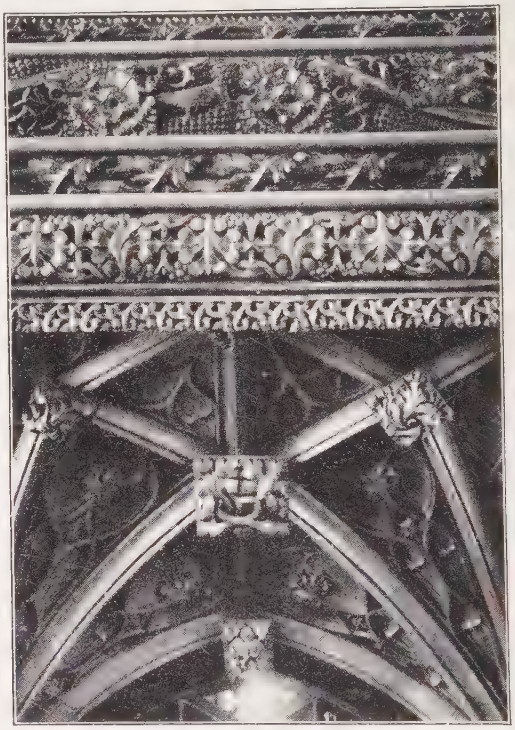


FIG. 9.—FLEMISH PANEL. RENAISSANCE, 16th century.



Photo, F. A. Crallan.

FIG. 10.—DETAIL OF ROOD-SCREEN VAULTING. Late 15th century. KENTON, DEVON.

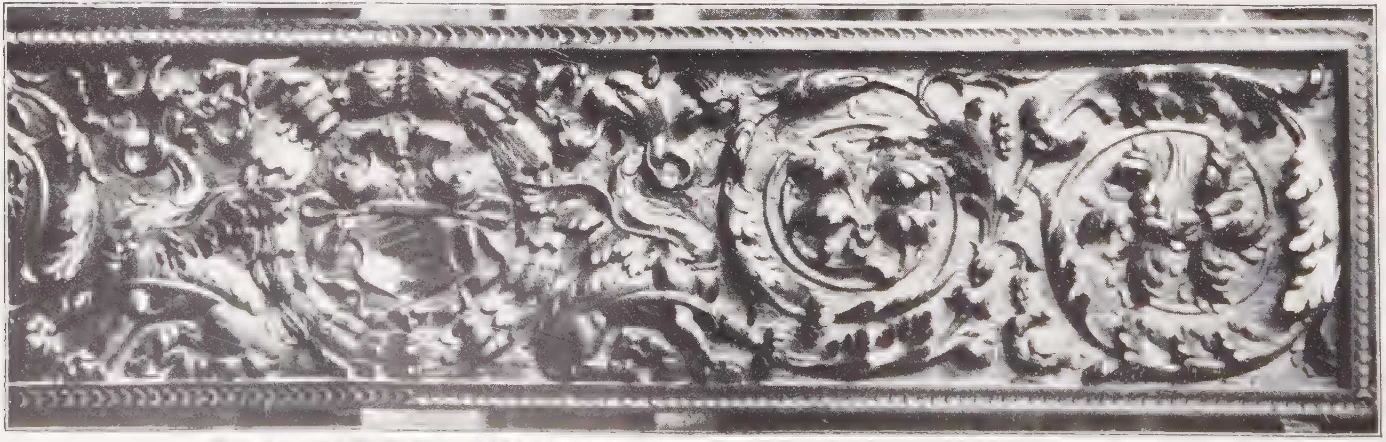


FIG. 11.—FRONT OF WALNUT COFFER, 16th century. RENAISSANCE. ITALIAN.

treatment of the 10th–12th centuries already referred to. A pattern of Gothic foliage, often of beautiful outline, would be simply grounded out to a shallow depth. The shadows, curves and twists only being emphasized by a few well-disposed cuts with a "V" tool; and of course the whole effect greatly improved by colour. A Swiss door of the 15th century in the Berlin Museum, and some German, Swiss and Tirolese work in the Victoria and Albert Museum, offer patterns that might well be imitated to-day by those who require simple decoration while avoiding the hackneyed Elizabethan forms.

Figure work.

It is hard to compare the figure work of England with that on the Continent owing to the disastrous effect of the Reformation. But when we examine the roofs of the Eastern counties, the bench ends of Somerset, or the misereres in many parts of the country, we can appreciate how largely wood sculpture was used for purposes of decoration. If as a rule the figure work was not of a very high order, we have conspicuous exceptions in the stall elbows of Sherborne, and the pulpit of Trull, Somerset. Perhaps the oldest instance is the much-mutilated and much-restored effigy of Robert, duke of Normandy, in Gloucester Cathedral (12th century), and carved, as was generally the case in England, in oak. At Clifton Reynes, Buckingham, there are two figures of the 13th century. They are both hollowed out from the back in order to facilitate seasoning the wood and to prevent cracking. During the 13th, 14th and 15th centuries there are numberless instances of figure carving of the most graphic description afforded in the misereres in many of our churches and cathedrals. But of figures carved in the round apart from their surroundings hardly an instance remains. At the little chapel of Cartmel Fell, in the wilds of Westmorland, there is a figure of Our Lord from a crucifix, some 2 ft. 6 in. in length. The cross is gone, the arms are broken away, and the feet have been burned off. A second figure of Our Lord (originally in the church of Keynes Inferior) is in the museum of Caerleon, and a third, from a church in Lincolnshire, is now in a private collection. On the continent some of the finest figure work is to be found in the retables, some of which are in the Victoria and Albert Museum. A Tirolese panel of the 15th century carved in high relief, representing St John seated with his back to the onlooker, is a masterpiece of perspective and foreshortening, and the drapery folds are perfect. The same may be said of a small statue of the Virigin, carved in lime by a Swiss hand, and some work of the great Tylman Reimenschneider of Wurzburg (1468–1531) shows that stone sculptors of medieval times were not ashamed of wood.

Renaissance Period (16th–17th Centuries).—With the beginning of the 16th century the great Renaissance began to elbow its way in to the exclusion of Gothic design. But the process was not sudden, and much transition work has great merit. The rood screen at Hurst, Berkshire, the stall work of Cartmel Priory, Westmorland, and the bench ends of many of the churches in Somerset, give good illustrations. But the new style was unequal to the old in devotional feeling, except in classic buildings like St Paul's cathedral, where the stalls of Grinling Gibbons better suit their own surroundings. The rest of this article will therefore be devoted in the main to domestic work, and the exact location of examples can only be given when not the property of private owners or where the public have access.

During the 16th century the best work is undoubtedly to be found on the Continent, France, Germany and the Netherlands producing numberless examples not only of house decoration but of furniture as well. The wealth of the newly discovered American continent was only one factor which assisted in the civilizing influence of this time, and hand in hand with the spread of commerce came the desire for refinement. The custom of building houses chiefly in wood wherever timber was plentiful continued. Pilasters took the place of pinnacles, and vases or dolphins assisted the acanthus leaf to oust the older forms of design. House fronts of wood gave ample scope to the carver. That of Sir Paul Pinder (1600), formerly in Bishopsgate, but now preserved in the Victoria and Albert Museum, is a good example of decorative treatment without overloading. The brackets carved in the shape of monsters which support the projecting upper storey are typical of hundreds of dwellings, as for instance St Peter's Hospital, Bristol. The panels, too, of Sir Paul Pinder's house should be noted as good examples of that Jacobean form of medallion surrounded by scroll work which is at once as decorative as it is simple.

In England that familiar style known as Elizabethan and Jacobean prevailed throughout the 16th and 17th centuries. At the present time hardly a home in the land has not its old oak chest carved with the familiar half circle or scroll border along the top rail, or the arch pattern on the panels. The court cupboards, with their solid or open under parts and upper cornice supported by turned balusters of extravagant thickness, are to be seen wherever one goes. And chairs, real as well as spurious, with solid backs carved in the usual flat relief, are bought up with an avidity inseparable from fashion. Four-post bedsteads are harder to come by. The back is usually broken up into small panels and carved, the best effect being seen in those examples where the panelling or the framework only is decorated. The dining-hall tables often had six legs of great substance, which were turned somewhat after the shape of a covered cup, and were carved with foliage bearing a distant resemblance to the acanthus. Rooms were generally panelled with oak, sometimes divided at intervals by flat pilasters and the upper frieze carved with scroll work or dolphins. But the feature which distinguished the period was the fire mantel. It always must be the principal object in a room, and the Elizabethan carver fully appreciated this fact. By carving the chimney breast as a rule to the ceiling and covering the surrounding walls with more or less plain panelling, the designer, by thus concentrating the attention on one point, often produced results of a high order. Caryatid figures, pilasters and friezes were among the customary details employed to produce good effects. No finer example exists than that lately removed from the old palace at Bromley-by-Bow to the Victoria and Albert Museum. The mantelshelf is 6 ft. from the ground and consists of a deep quadrant mould decorated with flat scroll work of good design. The supporting pilasters on either side are shaped and moulded in the customary Jacobean manner and are crowned by busts with Ionic capitals on the heads. Above the shelf the large centre panel is deeply carved with the royal coat of arms with supporters and mantling, and on either side a semicircular arched niche contains a figure in classic dress. The Elizabethan carver often produced splendid staircases, sometimes carving the newel posts with heraldic figures bearing coats of arms, &c. The newels of a staircase at Highgate support different types of Cromwellian soldiers, carved with great vivacity and life. But in spite of excellent work, as for example the beautiful gallery at Hatfield, the carving of this period did not, so far as England was concerned, compare with other epochs, or with contemporary work in other parts of Europe. Much of the work is badly drawn and badly executed. It is true that good decorative effects were constantly obtained at the very minimum of cost, but it is difficult to discover much merit in work which really looks best when badly cut.

In France this flat and simple treatment was to a certain extent used. Doors were most suitably adorned in this way, and the split baluster so characteristic of Jacobean work is often to be met with. There are some very good cabinets in the museum at Lyngby, Denmark, illustrating these two methods of treatment in combination. But the Swiss and Austrians elaborated this style, greatly improving the effect by the addition of colour. However, the best Continental designs adopted the typical acanthus foliage of Italy, while still retaining a certain amount of Gothic feeling in the strength of the lines and the "cut" of the detail (Plate IV. fig. 9). Panelling—often long and narrow—was commonly used for all sorts of domestic purposes, a feature being a medallion in the centre with a simple arrangement of vase, dolphins, dragons, or birds and foliage filling in the spaces above and below.

The cabinets of Holland and Belgium are excellent models of design. These pieces of furniture were usually arranged in two storeys with a fine moulded and carved cornice, mid division and plinth. The pilasters at the sides, and small raised panels carved only on the projecting part, would compose a very harmonious whole. A proportion of the French cabinets are decorated with caryatids not carved in the best taste, and, like other French woodwork of this period, are sometimes overloaded with sculpture. The doors of St Maclou, Rouen, fine as they are, would hardly to-day be held up as models for imitation. A noteworthy set of doors belong to the Hôtel de Ville, Oudenarde. The central door contains twelve and that on either side eight panels, each of which is carved with Renaissance foliage surrounding an unobtrusive figure. In the Palais de Justice we see that great scheme of decoration which takes up the whole of the fireplace end of the hall. Five large figures carved in the round are surrounded by small ones and with foliage and coats of arms.

In Italy, the birthplace of the Renaissance, there is much fine work of the 16th century. A very important school of design was promoted by Raphael, whose patterns were used or adapted by a large number of craftsmen. The shutters of "Raphael's Stanze" in the Vatican, and the choir stalls in the church of St Pietro de' Cassinesi at Perugia, are among the most beautiful examples of this style of carving. The work is in slight relief, and carved in walnut with those graceful patterns which Raphael developed out of the newly discovered remains of ancient Roman wall painting from the palace of Nero and other places. In the Victoria and Albert Museum are many examples of Italian work (Plate IV. fig. 11): the door from a convent near Parma, with its three prominent masks and heavy gadroon moulds; a picture frame with a charming acanthus border and egg and tongue moulds on either side; and various marriage chests in walnut covered with very elaborate schemes of carving. It is sometimes difficult to distinguish Spanish, or for that matter South of France work, from Italian, so much alike is the character. The Spaniards yield to none in good workmanship. Some Spanish panels of typical Italian design are in the Victoria and Albert Museum as well as cabinets of the purest Renaissance order. There is a wonderful Portuguese coffer (17th century) in this section. The top is deeply carved in little compartments with scenes from the life of Our Lord.

17th–18th Centuries.—In England the great school of Grinling Gibbons arose. Although he carved many beautiful mouldings of conventional form (Hampton Court Palace, Chatsworth, &c.), his name is usually associated with a very heavy form of decoration which was copied direct from nature. Great swags of drapery and foliage with fruit and dead birds, &c., would be carved in lime a foot thick. For technical skill these examples are unsurpassed; each grape would be undercut, the finer stalks and birds' legs stand out quite separate, and as a consequence soon succumb to the energy of the housemaid's broom. Good work of this class is to be found at Petworth; Trinity College, Oxford; Trinity College, Cambridge; St Paul's cathedral; St James', Piccadilly; and many other London churches.

During the reigns of Louis XIV. and XV. the principal merit of carved design, *i.e.* its appropriateness and suitability, gradually disappeared. Furniture was often carved in a way hardly legitimate. The legs, the rails of tables and chairs, the frames of cabinets, of looking-glasses, instead of being first made for construction and strength. and then decorated, were first designed to carry cherubs' heads and "rococo" (*i.e.* rock and shell ornament), quite regardless of utility or convenience. A wealth of such mistaken design was also applied to state carriages, to say nothing of bedsteads and other furniture. However, the wall panelling of the mansions of the rich, and sometimes the panelling of furniture, was decorated with rococo design in its least illegitimate form. The main part of the wood surface would be left plain, while the centre would be carved with a medallion surrounded by foliage, vases or trophies of torches and musical instruments, &c., or perhaps the upper part of the panel would be thus treated. France led the fashion, which was more or less followed all over Europe. In England gilt chairs in the style of Louis XV. were made in some quantities. But Thomas Chippendale, Ince and Mayhew, Sheraton, Johnson, Heppelwhite and other cabinet-makers did not as a rule use much carving in their designs. Scrolls, shells, ribbon, ears of corn, &c., in very fine relief, were, however, used in the embellishment of chairs, &c., and the claw and ball foot was employed as a termination to the cabriole legs of cabinets and other furniture.

The mantelpieces of the 18th century were as a rule carved in pine and painted white. Usually the shelves were narrow and supported by pilasters often of flat elliptic plan, sometimes by caryatids, and the frieze would consist of a raised centre panel carved with a classic scene in relief, or with a mask alone, and on either side a swag of flowers, fruit and foliage.

Interior doorways were often decorated with a broken pediment more or less ornate, and a swag of foliage commonly depended from either side over a background of scroll work. The outside porches so often seen in Queen Anne houses were of a character peculiar to the 18th century. A small platform or curved roof was supported by two large and heavy brackets carved with acanthus scroll work. The staircases were as a rule exceedingly good. Carved and pierced brackets were fixed to the "open strings" (*i.e.* the sides of the steps), giving a very pretty effect to the graceful balustrade of turned and twisted columns.

Renaissance figure work calls for little comment. During the 16th century many good examples were produced—those priestly statues in the museum of Sens for example. But the figure work used in the decoration of cabinets, &c., seldom rose above the ordinary level. In the 18th century cherubs' heads were fashionable and statuettes were sometimes carved in boxwood as ornaments, but as a means of decorating houses wood sculpture ceased to be. The Swiss, however, have kept up their reputation for animal sculpture to the present day, and still turn out cleverly carved chamois and bears, &c.; as a rule the more sketchily cut the better the merit. Their more ambitious works, their groups of cows, &c., sometimes reach a high level of excellence.

Of the work of the 19th century little can be said in praise. Outside and beyond the present-day fashion for collecting old oak there seems to be no demand for carved decoration. In church work a certain number of carvers find occupation, as also for repairs or the production of imitations. But the carving one is accustomed to see in hotels or on board the modern ocean palace is in the main the work of the machine. There is no objection to the machine in itself, as it only grounds out and roughly models the design which is finished by hand. Its fatal drawback is that it is of commercial value only when a large number of panels of the same pattern are turned out at the same time. It is this repetition which takes away the life of good work, which places that gulf between the contract job and the individual effort of the artist. The price of all labour has so greatly increased, to build a house is so much more expensive than it was before the days of the trades union that none but the very rich can afford to beautify their home in the way to which our forefathers were accustomed.

Coptic.—In the early medieval period, screens and other fittings were produced for the Coptic churches of Egypt by native Christian workmen. In the British Museum there is a set of ten small cedar panels from the church door of Sitt Miriam, Cairo (13th century). The six sculptured figure panels are carved in very low relief and the four foliage panels are quite Oriental in character, intricate and fine both in detail and finish. In the Cairo Museum there is much work treated after the familiar Arab style, while other designs are quite Byzantine in character. The figure work is not of a very high order.

Mohammedan Work.—Nothing can exceed the skill with which the Moslem wood-carvers of Persia, Syria, Egypt and Spain designed and executed the richest panelling and other decorations for wall linings, ceilings, pulpits and all kinds of fittings and furniture. The mosques and private houses of Cairo, Damascus and other Oriental cities are full of the most elaborate and minutely delicate woodwork. A favourite style of ornament was to cover the surface with very intricate interlacing patterns, formed by finely moulded ribs; the various geometrical spaces between the ribs were then filled in with small pieces of wood carved with foliage in slight relief. The use of different woods such as ebony or box, inlaid so as to emphasize the design, combined with the ingenious richness of the patterns, give this class of woodwork an almost unrivalled splendour of effect. Carved ivory is also often used for the filling in of the spaces. The Arabs are past masters in the art of carving flat surfaces in this way. A gate in the mosque of the sultan Bargoug (Cairo, 14th century) well illustrates this appreciation of lines and surfaces. The pulpit or mimbar (15th century) from a Cairo mosque, now in the Victoria and Albert Museum, is also a good example in the same style, the small spaces in this case being filled in with ivory carved in flat relief.

Screens made up of labyrinths of complicated joinery, consisting of multitudes of tiny balusters connecting hexagons, squares or other forms, with the flat surfaces constantly enriched with small carvings, are familiar to every one. In Cairo we also have examples in the mosque of Qous (12th century) of that finely arranged geometrical interlacing of curves with foliage terminations which distinguishes the Saracenic designer. Six panels in the Victoria and Albert Museum (13th century; Plate II. fig. 5), and work on the tomb of the sultan El Ghoury (16th century), show how deeply this form of decoration was ingrained in the Arab nature. Figure work and animals were sometimes introduced, in medieval fashion, as in the six panels just referred to, and at the hôpital du Moristan (13th century) and the mosque of El Nesfy Qeyçoun (14th century). There is a magnificent panel on the door of Beyt-el-Emyr. This exquisite design is composed of vine leaves and grapes of conventional treatment in low relief. The Arab designer was fond of breaking up his panelling in a way reminding one of a similar Jacobean custom. The main panel would be divided into a number of hexagonal, triangular or other shapes, and each small space filled in with conventional scroll work. Much of this simple flat design reminds one of that Byzantine method from which the Elizabethan carvers were inspired.

Persia.—The Persian carvers closely followed Arab design. A pair of doors of the 14th century from Samarkand (Victoria and Albert Museum) are typical. Boxes, spoons and other small articles were often fretted with interlacing lines of Saracenic character, the delicacy and minuteness of the work requiring the utmost patience and skill. Many of the patterns remind one of the sandalwood work of Madras, with the difference that the Persians were satisfied with a much lower relief. Sometimes a very beautiful result was obtained by the sparing use of fretted lattice pattern among foliage. A fine panel of the 14th century in the Victoria and Albert Museum shows how active was Arab influence even as far as Bokhara.

India and Burma.—Throughout the great Indian peninsula wood-carving of the most luxurious kind has been continuously produced for many centuries. The ancient Hindu temples were decorated with doors, ceilings and various fittings carved in teak and other woods with patterns of extreme richness and minute elaboration. We have architectural remains from Kashmir Smats (Punjab) dating from the 3rd or 4th century, the patterns employed being of a bold and decorative character strongly resembling the best Elizabethan design. The doors of the temple of Somnath, on the north-west coast, were famed for their magnificence and were highly valued as sacred relics. In 1024 they were carried off to Ghazni by the Moslem conqueror, Sultan Mahmud, and are now lying at the fort at Agra. The gates which now exist are very fine specimens of ancient wood-carving, but are probably only copies of the original very early doors. The Asiatic carver, like certain of his European brethren, is apt to be carried away by his own enthusiasm and to overcrowd his surfaces. Many a door, column, gallery or even a whole house-front is covered with the most intricate design bewildering to behold (Bhera, Shahpur). But this is not always the case, and the Oriental is at times more restrained in his methods. Architectural detail is to be seen with only a simple enrichment carved round the framing, producing the happiest result. The Hindu treatment of the circle is often exceedingly good, and might perhaps less rarely inspire western design. Sometimes native work strongly resembles Scandinavian of the 12th century. The scrolls are designed on the same lines, and foliage and flowers (beyond elementary buds) are not employed (Burma, 17th century, Victoria and Albert Museum). The pierced work of Bombay calls for note. Foliage, fruit and flowers are constantly adapted to a scheme of fret-cut decoration for doors or windows as well as the frames of chairs and the edges of tables. A reference should also be made to those wonderful sandalwood tables, cabinets and boxes to be seen in Southern India, always covered with design, often with scores of figures and monsters with every space filled in with the minutest decoration. Many of the gong stands of Burma show the highest skill; the arrangement of two figures bearing a pole from which a gong hangs is familiar. The Burmese are sculptors of proved merit.

China and Japan.—In these countries the carver is unrivalled for deftness of hand. Grotesque and imitative work of the utmost perfection is produced, and many of the carvings of these countries, Japan in particular, are beautiful works of art, especially when the carver copies the lotus, lily or other aquatic plant. A favourite form of decoration consists of breaking up the architectural surfaces, such as ceilings, friezes, &c., into framed squares and filling up each panel with a circle, or diamond of conventional treatment with a spandrel in each corner (door of T'ai-hê Hall, Pekin). A very Chinese feature is the finial of the newel post, so constantly left more or less straight in profile and deeply carved with monsters and scrolls. A heavily enriched moulding bearing a strong resemblance to the gadroon pattern is commonly used to give emphasis to edges, and the dragon arranged in curves imitative of nature is frequently employed over a closely designed and subordinated background. The general rule that in every country designers use much the same means whereby a pattern is obtained holds good in China. There are forms of band decoration here which closely resemble those of Gothic Europe, and a chair from Turkestan (3rd century) might almost be Elizabethan, so like are the details. Screens of grill form, so familiar in Mahommedan countries, are common, and the deeply grounded, closely arranged patterns of Bombay also have their counterparts. The imperial dais in the Ch'ien-Ch'ing Hall, Pekin, is a masterpiece of intricate design. The back consists of one central panel of considerable height, with two of lesser degree on either side luxuriously carved. The whole is crowned with a very heavy crest of dragons and scroll work; the throne also is a wonderful example of carved treatment, and the doors of a cabinet in the same building show how rich an effect of foliage can be produced without the employment of stalk or scroll. The Chinaman, who is unequalled as a microscopic worker, does not limit himself to ivory or metal. One might almost say, he wastes his talent on such an ungrateful material as wood. In this material fans and other trifles are carved with a delicacy that courts disaster.

In Japan much of the Chinese type is apparent. The native carver is fond of massing foliage without the stalk to lead him. He appears to put in his foliage, fruit and flowers first and then to indicate a stalk here and there, thus reversing the order of the Western method. Such a treatment, especially when birds and beasts are introduced, has the highest decorative effect. But, as such close treatment is bound to do, it depends for success to some extent upon its scheme of colour. A long panel in the Victoria and Albert Museum, depicting merchants with their packhorse (Plate IV. fig. 7), strongly resembles in its grouping and treatment Gothic work of the 15th century, as for example the panel of St Hubert in the museum at Châlons. The strength and character of Japanese figure work is quite equal to the best Gothic sculpture of the 15th century.

Savage Races.—There is a general similarity running through the carved design of most races of primitive culture, the "chip" form of ornament being almost universally employed. Decorated surfaces depending almost entirely upon the incised line also obtain all over the uncivilized world, and may no doubt be accounted for by the extensive use of stonecutting tools. The savage carver shows the same tendency to over-exalt his art by crowding on too much design as the more civilized craftsman of other lands, while he also on occasion exercises a good deal of restraint by a harmonious balance of decoration and plain space. So far as his chip designs and those patterns more or less depending on the line are concerned, his work as a rule is good and suitable, but when he takes to figure work his attempts do not usually meet with success. Primitive carving, generally, shows that very similar stages of artistic development are passed through by men of every age and race.

A very favourite style of "chip" pattern is that formed by small triangles and squares entirely covering a surface (Hervey Islanders), the monotony being sometimes varied by a band of different arrangement in the middle of the article or at the top or bottom. This form of art is hardly of a kind calculated to enlarge the imagination, though so far as the cultivation of patience and accuracy is concerned, has no equal. But many natives, as for example the Fiji Islanders, employ chip designs rivalling those of Europe in variety. Upon occasion the savage appreciates the way in which plain surfaces contrast and emphasize decorated parts, and judiciously restricts his skill to bands of decoration or to special points (Marquesa Islands). The Ijos of the lower Niger design their paddles in a masterly way, and show a fine sense of proportion between the plain and the decorated surface. Their designs, though slightly in relief, are of the chip nature. The method of decorating a subject with groups of incised lines, straight or curved, though often very effective and in every way suitable, is not a very advanced form of art and has decided limits. The native of the Congo does good work of this kind.

Carving in relief is common enough, idols being produced in many forms, but savage relief work seldom calls for praise. The Kafir carves the handle of his spoon perhaps in the form of a giraffe, and in the round, with each leg cut separately and the four hoofs meeting at the bowl, hardly a comfortable form of handle to hold. The North American Indian shows a wider invention than some nations, the twist in various shapes being a favourite treatment say of pipe stems. The Papuan has quite a style of his own; he uses a scroll of the form familiar in Indian shawls, and in some cases the scroll entwines in a way which faintly suggests the guilloche. The native of New Guinea also employs the scroll for a motive, the flat treatment of which reminds one of a similar method in use in Scandinavian countries. The work of the New Zealander is greatly in advance of the average primitive type; he uses a very good scheme of scroll work for decorative purposes, the lines of the scrolls often being enriched with a small pattern in a way reminding one of the familiar Norman treatment, as for example the prows of his canoes. The Maori sometimes carves not only the "bargeboards" of his house but the gables also, snakes and grotesque figures being as a rule introduced; the main posts and rafters, too, of the inside receive attention. Unlike the Hindu he has a good idea of decorative proportion, and does not plan his scheme of design on too small a scale.

AUTHORITIES.—Marshall, *Specimens of Antique Carved Furniture and Woodwork* (1888); Franklyn Crallan, *Details of Gothic Woodcarving* (1896); *Spring Gardens Sketch-book*; Sanders, *Examples of Carved Oak Woodwork of the 16th and 17th Centuries* (1883); Colling, *Medieval Foliage and Decoration* (1874); Bond, *Screens and Galleries* (1908); Paukert, *Die Zimmergothick* (1904); J. Lessing, *Holzschnitzereien* (Berlin, 1882); Rouyer, *La Renaissance*; Rowe, *Practical Wood-carving* (1907). (F. A. C.)

WOODCHUCK, the vernacular name of the common North American representative of the marmots (see MARMOT), scientifically known as *Arctomys monax.* The typical race of this species ranges from New York to Georgia and westward to the Dakotas, but it is represented by a second and darker race in Labrador, and by a third in Canada; while several other North American species have been named. The ordinary woodchuck measures about 18 in. in length, of which the tail forms a third. In colour it is usually brownish black above, with the nose, chin, cheeks and throat tending to whitish, and the under parts brownish chestnut; while the feet and tail are black and blackish. Like other marmots it is a burrower.

WOODCOCK (O. Eng. *wude-cocc*, *wudu-coc*, and *wudu-snite*), the *Scolopax rusticula*[1] of ornithology, a game-bird which is prized both by the sportsman and for its excellence for the table. It has a long bill, short legs and large eyes—suggestive of its nocturnal or crepuscular habits—with mottled plumage of black, chestnut- and umber-brown, ashy-grey, buff and shining white—the last being confined to the tip of the lower side of the tail-quills, but the rest intermixed for the most part in beautiful combination. Setting aside the many extreme aberrations from the normal colouring which examples of this species occasionally present (and some of them are extremely curious, not to say beautiful), there is much variation to be almost constantly observed in the plumage of individuals, in some of which the richer tints prevail while others exhibit a greyer coloration. This variation is often, but not always, accompanied by a variation in size or at least in weight.[2] The paler birds are generally the larger, but the difference, whether in bulk or tint, cannot be attributed to age, sex, season or, so far as can be ascertained, to locality. It is, notwithstanding, a very common belief among sportsmen that there are two "species" of woodcock, and many persons of experience will have it that, beside the differences just named, the "little red woodcock" invariably flies more sharply than the other. However, a sluggish behaviour is not really associated with colour, though it may possibly be correlated with weight—for it is quite conceivable that a fat bird will rise more slowly, when flushed, than one which is in poor condition. Ornithologists are practically unanimous in declaring against the existence of two "species" or even "races," and, moreover, in agreeing that the sex of the bird cannot be determined from its plumage, though there are a few who believe that the young of the year can be discriminated from the adults by having the outer web of the first quill-feather in the wing marked with angular notches of a light colour, while the old birds have no trace of this "vandyke" ornament. Careful dissections, weighings and measurings seem to show that the male varies most in size; on an average he is slightly heavier than the female, yet some of the lightest birds have proved to be cocks.[3]

Though there are probably few if any counties in the United Kingdom in which the woodcock does not almost yearly breed, especially since a "close time" has been afforded by the legislature for the protection of the species, there can be no doubt that by far the greater number of those shot in the British Islands have come from abroad,—mostly, it is presumed, from Scandinavia. These arrive on the east coast in autumn—generally about the middle of October—often in an exhausted and impoverished state. If unmolested, they are soon rested, pass inland, and, as would appear, in a marvellously short time recover their condition. Their future destination seems to be greatly influenced by the state of the weather. If cold or frost stop their supply of food on the eastern side of Great Britain they press onward and, letting alone Ireland, into which the immigrant stream is pretty constant, often crowd into the extreme south-west, as Devonshire and Cornwall, and to the Isles of Scilly, while not a few betake themselves to the unknown ocean, finding there doubtless a watery grave, though instances are on record of examples having successfully crossed the Atlantic and reaching Newfoundland, New Jersey and Virginia.

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[1] By Linnaeus, and many others after him, misspelt *rusticola.* The correct form of Pliny and the older writers seems to have been first restored in 1816 by Oken (*Zoologie*, ii. p. 589).

[2] The difference in weight is very great, though this seems to have been exaggerated by some writers. A friend who has had much experience tells us that the heaviest bird he ever knew weighed 16¼ oz., and the lightest 9 oz. and a fraction.

[3] Cf. Dr Hoffmann's monograph *Die Waldschnepfe*, ed. 2, p. 35 published at Stuttgart in 1887.

With regard to the woodcock which breed in Britain, pairing takes place very early in February and the eggs are laid often before the middle of March. These are four in number, of a yellowish cream-colour blotched and spotted with reddish brown, and seldom take the pyriform shape so common among those of Limicoline birds. The nest—always made on the ground amid trees or underwood, and usually near water or at least in a damp locality—is at first little more than a slight hollow in the soil, but as incubation proceeds dead leaves are collected around its margin until a considerable mass is accumulated. During this season the male woodcock performs at twilight flights of a remarkable kind, repeating evening after evening (and it is believed at dawn also) precisely the same course, which generally describes a triangle, the sides of which may be a quarter of a mile or more long. On these occasions the bird's appearance on the wing is quite unlike that which it presents when hurriedly flying after being flushed, and though its speed is great the beats of the wings are steady and slow. At intervals an extraordinary sound is produced, whether from the throat of the bird, as is commonly averred, or from the plumage is uncertain. This characteristic flight is in some parts of England called "roading," and the track taken by the bird a "cock-road."[1] In England in former times advantage was taken of this habit to catch the simple performer in nets called "cock-shutts," which were hung between trees across the open glades or rides of a wood. A still more interesting matter in relation to the breeding of woodcocks is the fact, finally established on good evidence, that the old birds transport their newly hatched offspring, presumably to places where food is more accessible. The young are clasped between the thighs of the parent, whose legs hang down during the operation, while the bill is to some extent, possible only at starting, brought into operation to assist in adjusting the load if not in bearing it through the air.[2]

Woodcock inhabit suitable localities across the northern part of the Old World, from Ireland to Japan, migrating southward towards autumn. As a species they are said to be resident in the Azores and other Atlantic Islands; but they are not known to penetrate very far into Africa during the winter, though in many parts of India they are abundant during the cold weather, and reach even Ceylon and Tenasserim. The popular belief that woodcock live "by suction" is perhaps hardly yet exploded; but those who have observed them in confinement know that they have an almost insatiable appetite for earthworms, which the birds seek by probing soft ground with their highly sensitive and flexible bill.[3] This fact seems to have been first placed on record by Bowles,[4] who noticed it in the royal aviary at San Ildefonso in Spain, and it has been corroborated by other observers, and especially by Montagu, who discovered that bread and milk made an excellent substitute for their ordinary food. They also do well on chopped raw meat.

The eastern part of North America possesses a woodcock, much smaller than, though generally (and especially in habits) similar to, that of the Old continent. It is the *Scolopax minor* of most authors; but, chiefly on account of its having the outer three primaries remarkably attenuated, it has been placed in a separate genus, *Philohela*. In Java is found a distinct and curiously coloured species, described and figured by Horsfield (*Trans. Linn. Society*, xiii. p. 191, and *Zoolog. Researches*, pl.) as *S. saturata*. To this H. Seebohm (*Geographical Distribution of the Family Charadriidae*, p. 506) referred the *S. rosenbergi* of Schlegel (*Nederl. Tijds. v. d. Dierkunde*, iv. p. 54) from New Guinea. Another species is *S. rochusseni* from the Moluccas; this has, like the snipe, the lower part of the tibia bare of feathers. (A. N.)

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[1] The etymology and consequently the correct spelling of these expressions seem to be very uncertain. Some would derive the word from the French *rôder*, to rove or wander, but others connect it with the Scandinavian *rode*, an open space in a wood (see *Notes and Queries*, ser. 5, ix. p. 214, and ser. 6, viii. pp. 523, 524). Looking to the regular routine followed by the bird, the natural supposition would be that it is simply an application of the English word *road*.

[2] Cf. J. E. Harting, *Zoologist* (1879), pp. 433-440, and Mr Wolf's excellent illustration. Sir R. Payne-Gallwey, in the "Badminton Library" (*Shooting*, ii. p. 118, note), states that he himself has witnessed the performance.

[3] The pair of muscles said by Loche (*Expl. Scient. de l'Algérie*, ii. p. 293) to exist in the maxilla, and presumably to direct the movement of the bill, do not seem to have been precisely described.

[4] *Introduccion a la historia natural y a la geografia fiscia de España*, pp. 454, 455 (Madrid, 1775).

WOOD ENGRAVING, the art of engraving (*q.v.*) on wood, by lines so cut that the design stands in relief. This method of engraving was historically the earliest, done for the purpose of taking impressions upon paper or other material. It is natural that wood engraving should have occurred first to the primitive mind, because the manner in which woodcuts are printed is the most obvious of all the kinds of printing. If a block of wood is inked with a greasy ink and then pressed on a piece of paper, the ink from the block will be transferred at once to the paper, on which we shall have a black patch exactly the size and shape of the inked surface. Now, suppose that the simple Chinese who first discovered this was ingenious enough to go a step further, it would evidently occur to him that if one of the elaborate signs, each of which in his own language stood for a word, were drawn upon the block of wood, in reverse, and then the whole of the white wood sufficiently cut away to leave the sign in relief, an image of it might be taken on the paper much more quickly than the sign could be copied with a camel-hair brush and Indian ink. No sooner had this experiment been tried and found to answer than block-printing was discovered, and from the printing of signs to the printing of rude images of things, exactly in the same manner, the step was so easy that it must have been made insensibly. Wood engraving, then, is really nothing but that primitive block-cutting which prepared for the printer the letters in relief now replaced by movable types, and the only difference between a delicate modern woodcut and the rude letters in the first printed books is a difference of artistic skill and knowledge. In Chinese and Japanese woodcuts we can still recognize traditions of treatment which come from the designing of their written characters. The main elements of a Chinese or a Japanese woodcut, uninfluenced by European example, are dashing or delicate outlines and markings of various thickness, exactly such as a clever writer with the brush would make with his Indian ink or vermilion. Often we get a perfectly black blot, exquisitely shaped and full of careful purpose, and these broad vigorous blacks are quite in harmony with the kind of printing for which wood engraving is intended.

It has not hitherto been satisfactorily ascertained whether wood engraving came to Europe from the East or was rediscovered by some European artificer. The precise date of the first European woodcut is also a matter of doubt, but here we have certain data which at least set limits to the possibility of error. European wood engraving dates certainly from the first quarter of the 15th century. It used to be believed that a cut of St Christopher (now in the Rylands library, Manchester), rudely executed and dated 1423, was the Adam of all our woodcuts, but since 1844 investigations have somewhat shaken this theory. There is a cut in the Brussels library, of the "Virgin and Child" surrounded by four saints, which is dated 1418, but the composition is so elegant and the drawing so refined and beautiful, that one has a difficulty in accepting the date, though it is received by many as authentic, while it is repudiated by others in the belief that the letters have been tampered with. The "Virgin and Child" of the Paris library is without date, but is supposed, apparently with reason, to be earlier than either of the two mentioned; and Delaborde proved that two cuts were printed in 1406. The "Virgin and Child" at Paris may be taken as a good representative specimen of very early European wood engraving. It is simple art, but not bad art. The forms are drawn in bold thick lines, and the black blot is used with much effect in the hollows and recesses of the design. Beyond this there is no shading. Rude as the work is, the artist has expressed exquisite maternal tenderness in the chief details of the design. The Virgin is crowned, and stands against a niche-like decoration with pinnacles as often seen in illuminated manuscripts. In the woodcut this architectural decoration is boldly but effectively drawn. Here, then, we have real art already, art in which appeared both vigour of style and tenderness of feeling.

The earliest wood engraving consisted of outlines and white spaces with smaller black spaces, cut with a knife, not with a graver, and shading lines are rare or absent. Before passing to shaded woodcuts we may mention a kind of wood engraving practised in the middle of the 15th century by a French engraver (often called Bernard Milnet, though his name is a matter of doubt) and by other engravers nearer the beginning of that century. This method is called the *criblé*, a word for which there is no convenient translation in English, unless we call it *drilled*. It means riddled with small holes, as a target may be riddled with small shot. The effect of light and dark is produced in this kind of engraving by sinking a great number of round holes of different diameters in the substance of the wood, which, of course, all come white in the printing; it is, in effect, a sort of stippling in white. When a more advanced kind of wood engraving had become prevalent the *criblé* was no longer used for general purposes, but it was retained for the grounds of decorative wood engraving, being used occasionally in borders for pages, in printers' marks and other designs, which were survivals in black and white of the ancient art of illuminating. Curiously enough, this kind of wood engraving, though long disused for purposes of art, was in recent times revived with excellent effect for scientific purposes, mainly as a method of illustration for astronomical books. The black given by the untouched wooden block represents the night sky, and the holes, smaller or larger, represent in white the stars and planets of lesser or greater magnitude. The process was perfectly adapted to this purpose, being cheap, rapid and simple. It has also been used in a spasmodic and experimental manner by one or two modern engravers.

The earlier workmen turned their attention to woodcut in simple black lines, including outline and shading. In early work the outline is firm and very distinct, being thicker in line than the shading, and in the shading the lines are simple, without cross-hatchings, as the workmen found it easier and more natural to take out a white line-like space between two parallel or nearly parallel black lines than to cut out the twenty or thirty small white lozenges into which the same space would have been divided by cross-hatchings. The early work would also sometimes retain the simple black patch which we find in Japanese woodcuts, for example, in the "Christmas Dancers," of Wohlgemuth, all the shoes are black patches, though there is no discrimination of local colour in anything else. A precise parallel to this treatment is to be found in a Japanese woodcut of the "Wild Boar and Hare," given by Aimé Humbert in his book on Japan, in which the boar has a cap which is a perfectly black patch though all other local colour is omitted. The similarity of method between Wohlgemuth and the Japanese artist is close: they both take pleasure in drawing thin black lines at a little distance from the patch and following its shape like a border. In course of time, as wood engravers became more expert, they were not so careful to spare themselves trouble and pains, and then cross-hatchings were introduced, but at first more as a variety to relieve the eye than as a common method of shading. In the 16th century a simple kind of wood engraving reached such a high degree of perfection that the best work of that time has never been surpassed in its own way.

Wood engraving in the 16th century was much more conventional than it became in more recent times, and this very conventionalism enabled it to express what it had to express with greater decision and power. The wood engraver in those days was free from many difficult conditions which hampered his modern successor. He did not care in the least about aerial perspective, and nobody expected him to care about it; he did not trouble his mind about local colour, but generally omitted it, sometimes, however, giving it here and there, but only when it suited his fancy. As for light-and-shade, he shaded only when he wanted to give relief, but never worked out anything like a studied and balanced effect of light-and-shade, nor did he feel any responsibility about the matter. What he really cared for, and generally attained, was a firm, clear, simple kind of drawing, conventional in its indifference to the mystery of nature and to the poetic sentiment which comes to us from that mystery, but by no means indifferent to fact of a decided and tangible kind. The wood engraving of the 16th century was a singularly positive art, as positive as carving; indeed, most of the famous woodcuts of that time might be translated into carved panels without much loss of character. Their complete independence of pictorial conditions might be illustrated by many examples. In Dürer's "Salutation" the dark blue of the sky above the Alpine mountains is translated by dark shading, but so far is this piece of local colour from being carried out in the rest of the composition that the important foreground figures, with their draperies, are shaded as if they were white statues. Again, the sky itself is false in its shading, for it is without gradation, but the shading upon it has a purpose, which is to prevent the upper part of the composition from looking too empty, and the conventionalism of wood engraving was so accepted in those days that the artist could have recourse to this expedient in defiance alike of pictorial harmony and of natural truth. In Holbein's admirable series of small well-filled compositions, the "Dance of Death," the firm and matter-of-fact drawing is accompanied by a sort of light-and-shade adopted simply for convenience, with as little reference to natural truth as might be expected in a stained-glass window. There is a most interesting series of little woodcuts drawn and engraved in the 16th century by J. Amman as illustrations of the different handicrafts and trades, and entitled "The Baker," "The Miller," "The Butcher," and so on. Nothing is more striking in this valuable series than the remarkable closeness with which the artist observed everything in the nature of a hard fact, such as the shape of a hatchet or a spade; but he sees no mystery anywhere—he can draw leaves but not foliage, feathers but not plumage, locks but not hair, a hill but not a landscape. In the "Witches' Kitchen," a woodcut by Hans Baldung (Grün) of Strassburg, dated 1510, the steam rising from the pot is so hard that it has the appearance of two trunks of trees denuded of their bark, and makes a pendant in the composition to a real tree on the opposite side which does not look more substantial. Nor was this a personal deficiency in Grün. It was Dürer's own way of engraving clouds and vapour, and all the engravers of that time followed it. Their conceptions were much more those of a carver than those of a painter. Dürer actually did carve in high relief, and Grün's "Witches' Kitchen" might be carved in the same manner without loss. When the engravers were rather draughtsmen than carvers, their drawing was of a decorative character. For example, in the magnificent portrait of Christian III. of Denmark by Jacob Binck, one of the very finest examples of old wood engraving, the face and beard are drawn with few lines and very powerfully, but the costume is treated strictly as decoration, the lines of the patterns being all given, with as little shading as possible, and what shading there is is simple, without cross-hatching.

The perfection of simple wood engraving having been attained so early as the 16th century by the use of the graver, the art became extremely productive. During the 17th and 18th centuries it still remained a comparatively severe and conventional form of art, because the workmen shaded as much as possible either with straight lines or simple curves, so that there was never much appearance of freedom. Modern wood engraving is quite a distinct art, being based on different principles, but between the two stands the work of an original genius, Thomas Bewick (1753–1828). Although apprenticed to an engraver in 1767, he was never taught to draw, and got into ways and habits of his own which add to the originality of his work, though his defective training is always evident. His work is the more genuine from his frequent habit of engraving his own designs, which left him perfect freedom of interpretation; but the genuineness of it is not only of the kind which comes from independence of spirit, it is due also to his fidelity to the technical nature of the process, a fidelity very rare in the art.

The reader will remember that in wood engraving every cutting prints white, and every space left untouched prints black. Simple black lines are obtained by cutting out white lines or spaces between them, and crossed black lines have to be obtained by laboriously cutting out all the white lozenges between them. In Bewick's cuts white lines, which had appeared before him in the *Fables* of 1772, are abundant and are often crossed, but black lines are never crossed; he is also quite willing to utilize the black space, as the Japanese wood-engravers and Dürer's master Wohlgemuth used to do. The side of the frying-pan in the vignette of "The Cat and the Mouse" is treated precisely on their principles, so precisely indeed that we have the line at the edge for a border. In the vignette of "The Fisherman," at the end of the twentieth chapter of the *Memoir*, the space of dark shade under the bushes is left quite black, whilst the leaves and twigs, and the rod and line too, are all drawn in pure white lines. Bewick, indeed, was more careful in his adherence to the technical conditions of the art than any of the primitive woodcutters except those who worked in *criblé* and who used white lines as well as their dots. Such a thing as a fishing-net is an excellent test of this disposition. In the interesting series by J. Amman already mentioned there is a cut of a man fishing in a river, from a small punt, with a net. The net comes dark against the light surface of the river, and Amman took the trouble to cut a white lozenge for every mesh. Bewick, in one of his vignettes, represents a fisherman mending his nets by the side of a stream. A long net is hung to dry on four upright sticks, but to avoid the trouble of cutting out the lozenges Bewick artfully contrives his arrangement of light and shade so that the net shall be in light against a space of black shade under some bushes. This permits him to cut every string of the net by a simple white line, according to his practice of using the white line whenever he could. He used it with great ability in the scales of his fish, but this was simply from a regard to technical convenience, for when he engraved on metal he marked the scales of his fish by black lines. These may seem very trifling considerations to persons unacquainted with the fine arts, who may think that it can matter little whether a fishing-net is drawn in black lines or in white, but the fact is that the entire destiny of wood engraving depended on preserving or rejecting the white line. Had it been generally accepted as it was by Bewick, original artists might have followed his example in engraving their own inventions, because then wood engraving would have been a natural and comparatively rapid art; but when the black line was preferred the art became a handicraft, because original artists have not time to cut out thousands of little white spaces. The reader may at once realize for himself the tediousness of the process by comparing the ease with which one writes a page of manuscript with the labour which would be involved in cutting away, with perfect accuracy, every space, however minute, which the pen had not blackened with ink.

Wood engraving in the first three quarters of the 19th century had no special character of its own, nothing like Bewick's work, which had a character derived from the nature of the process; but on the other hand, the modern art is set to imitate every kind of engraving and every kind of drawing. Thus we have woodcuts that imitate line engraving, others that copy etching and even mezzotint, whilst others try to imitate the crumbling touch of charcoal or of chalk, or the wash of water-colour, the greyness of pencil, or even the wash and the pen-line together. The art has been put to all sorts of purposes; and though it is not and cannot be free, it is made to pretend to a freedom which the old masters would have rejected as an affectation. Rapid sketches are made on the block with the pen, and the modern wood-engraver set himself patiently to cut out all the spaces of white, in which case the engraver is in reality less free than his predecessor in the 16th century, though the result has a false appearance of liberty. The woodcut is like a polyglot who has learned to speak many other languages at the risk of forgetting his own. And, wonderful as may be its powers of imitation, it can only approximate to the arts which it imitates; it can never rival each of them on its own ground. It can convey the idea of etching or water-colour, but not their quality; it can imitate the manner of a line engraver on steel, but it cannot give the delicacy of his lines. In its most modern development it has practically succeeded in imitating the grey tonalities of the photograph. Whatever be the art which the wood engraver imitates, a practised eye sees at the first glance that the result is nothing but a woodcut. Therefore, although we may admire the suppleness of an art which can assume so many transformations, it is certain that these transformations give little satisfaction to severe judges. At the same time, as the ultimate object was not only reproduction, but reduplication by the printing-press, the drawbacks mentioned are far outweighed by the practical advantages. In manual skill and in variety of resource modern wood engravers far excel their predecessors. A Belgian wood engraver, Stéphane Pannemaker, exhibited at the Salon of 1876 a woodcut entitled "La Baigneuse," which astonished the art-world by the amazing perfection of its method, all the delicate modelling of a nude figure being rendered by simple modulations of unbroken line. Both English and French publications have abounded in striking proofs of skill. The modern art, as exhibited in these publications, may be broadly divided into two sections, one depending upon line, in which case the black line of a pen or pencil sketch is carefully preserved, and the other depending upon tone, when the tones of a sketch with the brush are translated by the wood engraver into shades obtained in his own way by the burin. The first of these methods requires extreme care, skill and patience, but makes little demand upon the intelligence of the artist; the second leaves him more free to interpret, but he cannot do this rightly without understanding both tone and texture.

The woodcuts in Doré's *Don Quixote* are done by each method alternately, many of the designs having been sketched with a pen upon the block, whilst others are shaded with a brush in Indian ink and white, the latter being engraved by interpreting the shades of the brush. In the pen drawings the lines are Doré's, in the brush drawings the lines are the engraver's. In the night scenes Pisan usually adopted Bewick's system of white lines, the block being left untouched in its blackness wherever the effect permitted. English wood engraving showed to great advantage in such newspapers as the *Illustrated London News* and the *Graphic* of that day, and also in vignettes for book illustration. A certain standard of vignette engraving was reached by Edmund Evans in Birket Foster's edition of Cowper's *Task*, not likely to be surpassed in its own way, either for delicacy of tone or for careful preservation of the drawing.

An important extension of wood engraving was due to the invention of compound blocks by Charles Wells about the year 1860. Formerly a woodcut was limited in size to the dimensions of a block of boxwood cut across the grain, except in the primitive condition of the art, when commoner woods were used in the direction of the grain; but by this invention many small blocks were fitted together so as to form a single large one, sometimes of great size. They could be separated or joined together again at will, and it was this facility which rendered possible the rapid production of large cuts for the newspapers, many cutters working on the same subject at once, each taking his own section.

The process employed for wood engraving may be briefly described as follows. The surface of the block is lightly whitened with Chinese white so as to produce a light yellowish-grey tint, and on this the artist draws, either with a pen if the work is intended to be in line, or with a hard-pointed pencil and a brush if it is intended to be in shade. If it is to be a line woodcut the cutter simply digs out the whites with a sharp graver or scalpel (he has these tools of various shapes and sizes), and that is all he has to do; but if the drawing on the wood is shaded with a brush, then the cutter has to work upon the tones in such a manner that they will come relatively true in the printing. This is by no means easy, and the result is often a disappointment, besides which the artist's drawing is destroyed in the process. It therefore became customary to have the block photographed before the engraver touches it, when the drawing is specially worth preserving. This was done for Leighton's illustrations to *Romola*. By a later development the drawing, made upon paper, was by photography printed on the block, and the drawing remained untouched as a witness for or against the engraver.

In recent years the position of wood engraving in Great Britain has wholly changed. Up to 1880 and for a little while longer it was the chief means of book and newspaper illustration, and a frequent method of fine-art reproduction; but by the beginning of the 20th century it had been all but driven out of the field by "process" work of various kinds. It still flourishes in its commoner style for commercial and mechanical work; it is still occasionally maintained in its finest form by a sympathetic publisher here and there, who deplores and would arrest its decay. But the photograph and its facsimile reproduction have captivated the public, who want "illustration" and who do not want "art." The great body of the wood engravers have therefore found their occupation entirely gone, while the minority have found themselves forced to devote their skill to "re-touching" the process-block—sometimes carrying their work so far that the print from the finished block is a close imitation of a wood engraving. This system has been carried farthest in America; it is rarely seen elsewhere.

It is not only to considerations of economy that is due the supersession of engraving by "process." The apparent superiority of truthfulness claimed by the photograph over the artist's drawing is a factor in the case—the public forgetting that a photographic print shows us what a thing or a scene looks like to the undiscriminating lens, rather than what it looks like to the two eyes of the spectator, who unconsciously selects that part of the scene which he specially wishes to see. The rank and file of the engravers—even those who can "engrave" after a picture as well as "cut" a "special artist's" sketch—succumbed not only to the public, but to the artists themselves, who frequently insisted upon the process-block for the translation of their work. They preferred the greater truth of outline (though not necessarily of tone) which is yielded by "process," to all the inherent charm of the beautiful (and expensive) art of xylography.

In Great Britain a few engravers of high rank and ability still followed the art which was raised to so high a pitch by W. J. Linton (d. 1898). Such were Mr Charles Roberts, Mr Biscombe Gardner, Mr Comfort, Mr Ulrich and a few more—the first two the better engravers for being also practising artists. But there is every reason to fear that if wood engraving as a craft, for ordinary purposes, ceases to exist, wood engraving as a fine art must disappear as well—as there would be nothing to support the young craftsman during the years of apprenticeship and practice required to make an "artist" of him, and nothing to compensate him if he fail to attain at once the highest accomplishment.

Another circumstance which has contributed to the overthrow of wood engraving in England is the rapture begotten of the extraordinary executive perfection to which the art had been brought in America. These engravings, published in magazines and books having wide circulation in England, awakened not an intelligent but a foolish appreciation among the public. Just as the over-refinement of engraving on steel of Finden and his school killed his art by stripping it of all interest, so the unsurpassable perfection of the American wood engraver, by the law of paradox, effectually stifled xylography in England, as it has since done to an almost equal degree in America. The reason is simple. With the object of "dis-individualizing" himself, as he called it, the engraver sought to suppress his own recognizable manner of craftsmanship when translating the work of the artist for the public; and the more he succeeded in effacing himself, and the more he refined and elaborated his technique and imitated textures, and the more he developed extreme minuteness and excessive dexterity (so as to secure faithfulness and smoothness), the more closely did the result approximate to a photograph and nothing more. The result, in fact, became the *reductio ad absurdum* of the passion for the minute and the perfection of mere technique. The result was amazing in its completeness, but curiously grey and monotonous; and matter-of-fact publishers and public alike preferred the photograph, which in their eyes did not differ so very much (except in being a little greyer and more monotonous) reproduced by the half-tone block, while the cost of the latter was but a fraction of that of the former. The extreme elaboration, satisfying a craving of an acrobatic kind, defeated its own end. The public were pleased for a time, and the result has been disastrous for the art.

In England, in spite of the International Society of Wood Engravers, of which little is now heard, there are no signs of a general revival, and it seems as if the art must be born again, so long as the public interest in photographs continues. Charles Ricketts and Miss Housman have gone back to a Düreresque, or Florentine, manner of the Early Renaissance woodcut, while others are striving to begin engraving where Bewick began it. If the true art is ever restored, the revival will rather be based on a revolt against the greyness of the process-block, and the offensively shiny surface of the chalk-coated paper on which it is printed, than on any aesthetic delight in intelligent wood engraving, its expressive line, its delicate, pearly tones, and its rich, fat blacks.

In America, where the power of resuscitation is great, the miraculous technical perfection brought about by Timothy Cole and Frederick Juengling, as leaders of the school, has promptly given way to a greater feeling for art and a lesser worship of mechanical achievement, and, within strict limits, wood engraving is saved. Curiously enough, Cole (an Englishman by birth) was equally a leader in recognizing the danger which his own brilliant proficiency had helped to bring about. The "decadent" *de luxe* who had overwhelmed his art in the refinements which threatened to destroy it, and who had been seconded by the splendid printing-presses of America (which might without exaggeration be called instruments of precision), gave up what may be termed hyper-engraving, and, surrendering his wonderful power of imitating surfaces and textures, changed his manner. He became broader in handling; his example was followed by others, and wood engraving in a very few hands still prospers in the United States.

In France, where the art has reached the highest perfection and the most consummate and logical development, it flourishes up to a certain point on the true artistic instinct of the engraver, on the taste of an intelligent and appreciative public, and on official recognition and encouragement. Nevertheless, it was found necessary to establish a "Society of Wood Engravers" (with a magazine of its own) to protect it against the inroad of the process-block. The art doubtless produces more engravers of skill than it can provide work for; but that is evidence rather of vitality than of decay. Lepère, Baude, Jonnard and Florian have been among the leaders who, in different styles of wood engraving, have sustained the extraordinarily high level which has been attained in France, and which is fairly well maintained by virtue of the encouragement on which it has thriven heretofore. Florian, who died in 1900, was a man who successfully sought to obtain effects of tone rather than line, leaving masses of unengraved surface to enhance the delicate beauty of his pearly greys. But in rebelling against the mechanical style formerly so much in vogue in Germany, of indicating roundness of form by curved lines carried as far as possible at right angles to the convexity, and in substituting more or less longitudinal lines of shading, he sacrificed a good deal of the logic of form-rendering, and started a method that has not been entirely successful.

In Germany the artistic standard is lower than in France. It is true that few outside Germany could model a head as finely as M. Klinkicht in his own style of a judicious mingling of the black line and the white line; but, as a rule, German engraving is far more precise, more mechanical, more according to formula, and heavier and more old-fashioned than that of either France or America. The art has been injured by the great "studios" or factories designed to flourish on strictly business principles, workshops which, in the education of the craftsman, to some extent annihilated the artist. A few there are, however, of great ability and taste. The attempt to print wood engravings in colours has done little to improve the status of the art. In other countries, however, "original" work helped to raise the standard. Thus the work of Elbridge Kingsley, who would sit down in the woods and engrave the scene before him directly on to the block, exercised no little influence in America. The similar ability of Lepère to engrave directly from nature, whether from the trees of Fontainebleau Forest or the palace of Westminster, has in its time been much appreciated in his own country and in England. The efforts at block-printing by Charpentier and others, not only with colour, but by reinforcing it with blocks that print neither lines nor colour but "blind" pattern, raised or depressed upon the paper, are evidence of the movement by which new methods have been sought to interest the public. The immediate results have not been very serious, yet the fact shows the existence of a vitality that gives some hope for the future. But while the practice of dry-printing upon "surface paper" is maintained, it is hopeless to expect in the immediate future, in Great Britain at least, any permanently good results from orthodox wood engraving.

See the works cited under ENGRAVING; and also J. Jackson, *Treatise on Wood-Engraving* (1839); Didot's *Essai sur l'histoire de la gravure sur bois* (1863); W. S. Baker, *American Engravers and their Work* (Philadelphia, 1875); J. Jackson and W. A. Chatto, *Treatise on Wood-Engraving* (Chatto, 1881); P. G. Hamerton, *The Graphic Arts* (Seeley, 1882); W. J. Linton, *History of Wood-Engraving in America* (Chatto, 1882); G. E. Woodberry, *History of Wood-Engraving* (S. Low, 1883); Sir W. M. Conway, *The Wood-cutters of the Netherlands in the 15th century* (Cambridge Press, 1884); W. J. Linton, *Wood-Engraving* (G. Bell & Sons, London, 1884); Dr F. Lippmann, *Wood-Engraving in Italy in the 15th century* (Quaritch, 1888); John Ruskin, *Ariadne Florentina* (Allen, 1890); W. J. Linton, *The Masters of Wood-Engraving*: folio, issued to subscribers only (London, Stevens, Charing Cross, 1889 and 1892); P. G. Hamerton, *Drawing and Engraving* (A. & C. Black, 1892), an extended reprint of the article on "Engraving" in the 9th edition of the *Encyclopaedia Britannica*; Louis Fagan, *History of Engraving in England* (text and three portfolios of plates) (Low, 1893–1894); George and Edward Dalziel, *The Dalziel Brothers: a record of 50 years' work, 1848–1899* (Methuen, 1901). (P. G. H.; M. H. S.)

WOODFALL, HENRY SAMPSON (1739–1805), English printer and journalist, was born in London on the 21st of June 1739. His father, Henry Woodfall, was the printer of the newspaper the *Public Advertiser*, and the author of the ballad *Darby and Joan*, for which his son's employer, John Darby, and his wife, were the originals. H. S. Woodfall was apprenticed to his father, and at the age of nineteen took over the control of the *Public Advertiser*. In it appeared the famous letters of "Junius." Woodfall sold his interest in the *Public Advertiser* in 1793. He died on the 12th of December 1805. His younger brother, William Woodfall (1746–1803), also a journalist, established in 1789 a daily paper called the *Diary*, in which, for the first time, reports of the parliamentary debates were published on the morning after they had taken place.

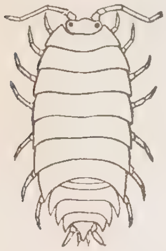
WOODFORD, an urban district in the Walthamstow (S.W.) parliamentary division of Essex, England, 9 m. N.E. from Liverpool Street station, London, by a branch of the Great Eastern railway. Pop. (1901) 13,798. Its proximity to the southern outskirts of Epping Forest has brought it into favour both with residents and with holiday visitors from London. A converted mansion, Woodford Hall, forms a convalescent home. On high ground to the N. is the ecclesiastical parish (one of three) of Woodford Wells, where there is a mineral spring.

WOOD GREEN, an urban district in the Tottenham parliamentary division of Middlesex, England, suburban to London, 7 m. N. of St Paul's Cathedral, on the Great Northern railway. Pop. (1891) 25,831, (1901) 34,233. The name covers a populous residential district lying north of Hornsey and west of Tottenham. To the west lies Muswell Hill, with the grounds and building of the Alexandra Palace, an establishment somewhat similar to the Crystal Palace. It was opened in 1873, destroyed by fire almost immediately, and reopened in 1875. Muswell Hill took name from a holy well, of high repute for curative powers, over which an oratory was erected early in the 12th century, attached to the priory of St John of Jerusalem in Clerkenwell.

WOOD-LOUSE, a name commonly applied to certain terrestrial Crustacea of the order Isopoda (see MALACOSTRACA), which are found in damp places, under stones or dead leaves, or among decaying wood. They form the tribe Oniscoidea and are distinguished from all other Isopoda by their habit of living on land and breathing air, and by a number of structural characters, such as the small size of the antennules and the absence of the mandibular pulp. As in most Isopods, the body is flattened, and consists of a head, seven thoracic segments which are always free, and six abdominal segments which may be free or fused. The "telson" is not separated from the last abdominal segment. The head bears a pair of sessile compound eyes as well as the minute antennules and the longer antennae. Each of the seven thoracic segments carries a pair of walking legs. The appendages of the abdomen (with the exception of the last pair) are flat membranous plates and serve as organs of respiration. In many cases their outer branches have small cavities opening to the outside by slit-like apertures, and giving rise internally to a system of ramifying tubules filled with air. From their similarity to the air tubes or tracheae of insects and other air-breathing Arthropods these tubules are known as "pseudo-tracheae."

The female wood-louse carries her eggs, after they are extruded from the body, in a pouch or "marsupium" which covers the under surface of the thorax and is formed by overlapping plates attached to the bases of the first five pairs of legs. The young, on leaving this pouch, are like miniature adults except that they are without the last pair of legs. Like all Arthropoda, they cast their skin frequently during growth. As a rule the skin of the hinder half of the body is moulted some days before that of the front half, so that individuals in process of moulting have a very peculiar appearance.

Some twenty-four species of wood-lice occur in the British Islands. Some, like the very common slaty-blue *Porcellio scaber*, are practically cosmopolitan in their distribution, having been transported, probably by the unconscious agency of man, to nearly all parts of the globe. Equally common is the brown, yellow-spotted *Oniscus asellus*. *Armadillidium vulgare* belongs to a group which have the power of rolling themselves up into a ball when touched and resembles the millipede *Glomeris*. It was formerly employed in popular medicine as a ready-made pill. The largest British species is *Ligia oceanica*, which frequents the sea-shore, just above high-water mark. In many points of structure, for instance in the long, many-jointed antennae, it is intermediate, as it is in habits, between the truly terrestrial forms and their marine allies. Finally, one of the most interesting species is the little, blind, and colourless *Platyarthrus hoffmannseggi*, which lives as a guest or commensal in the nests of ants. (W. T. CA.)



Common Wood-louse, *Oniscus asellus.*

WOODPECKER, a bird that pecks or picks holes in wood, and from this habit is commonly reputed to have its name; but it is in some parts of England also known as "Woodspeight" (erroneously written "Woodspite")—the latter syllable being cognate with Ger. *Specht* and Fr. *Épeiche*, possibly with Lat. *Picus*.[1] More than 300 species have been described, and they have been very variously grouped by systematists; but all admit that they form a very natural family *Picidae* of Coraciiform birds, their nearest allies being the toucans. They are generally of bright particoloured plumage, in which black, white, brown olive, green, yellow, orange or scarlet—the last commonly visible on some part of the head—mingled in varying proportions, and most often strongly contrasted with one another, appear; while the less conspicuous markings take the form of bars, spangles, tear-drops, arrow-heads or scales. Woodpeckers inhabit most parts of the world, with the exception of Madagascar and the Australian Region, save Celebes and Flores; but it may be worth stating that no member of the group is known to have occurred in Egypt.

Of the three British species, the green woodpecker, *Gecinus* or *Picus viridis*, though almost unknown in Scotland or Ireland, is the commonest, frequenting wooded districts, and more often heard than seen, its laughing cry (whence the name "Yaffil" or "Yaffle," by which it is in many parts known), and undulating flight afford equally good means of recognition, even when it is not near enough for its colours to be discerned. About the size of a jay, its scarlet crown and bright yellow rump, added to its prevailing grass-green plumage, make it a sightly bird, and hence it often suffers at the hands of those who wish to keep its stuffed skin as an ornament. Besides the scarlet crown, the cock bird has a patch of the same colour running backward from the base of the lower mandible, a patch that in the hen is black.[2] Woodpeckers in general are very shy birds, and to observe the habits of the species is not easy. Its ways, however, are well worth watching, since the ease with which it mounts, almost always spirally, the vertical trunks and oblique arms of trees as it searches the interstices of the bark for its food, flying off when it reaches the smaller or upper branches—either to return to the base of the same tree and renew its course on a fresh line, or to begin upon another tree near by—and the care it shows in its close examination, will repay a patient observer. The nest almost always consists of a hole chiselled by the bird's strong beak, impelled by very powerful muscles, in the upright trunk or arm of a tree, the opening being quite circular, and continued as a horizontal passage that reaches to the core, whence it is pierced downward for nearly a foot. There a chamber is hollowed out in which the eggs, often to the number of six, white, translucent and glossy, are laid with no bedding but a few chips that may have not been thrown out.[3] The young are not only hatched entirely naked, but seem to become fledged without any of the downy growth common to most birds. Their first plumage is dull in colour, and much marked beneath with bars, crescents and arrowheads.

Of generally similar habits are the two other woodpeckers which inhabit Britain—the pied or greater spotted and the barred or lesser spotted woodpecker—*Dendrocopus major* and *D. minor*—each of great beauty, from the contrasted white, blue-black and scarlet that enter into its plumage. Both of these birds have an extraordinary habit of causing by quickly-repeated blows of their beak on a branch, or even on a small bough, a vibrating noise, louder than that of a watchman's rattle, and enough to excite the attention of the most incurious. Though the pied woodpecker is a resident in Britain, its numbers receive a considerable accession nearly every autumn.

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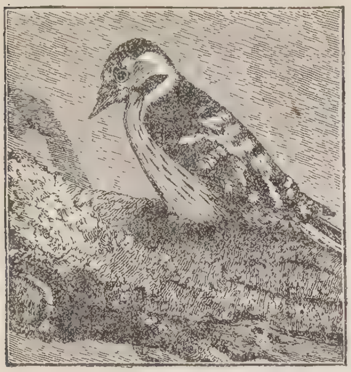
[1] The number of English names, ancient and modern, by which these birds are known is very great, and even a bare list of them could not be here given. The Anglo-Saxon was *higora* or *higere*, and to this may plausibly be traced "hickwall," nowadays used in some parts of the country, and the older "hickway," corrupted first into "highhaw," and, after its original meaning was lost, into "hewhole," which in North America has been still further corrupted into "high-hole" and more recently into "high-holder." Another set of names includes "whetile" and "woodwale," which, different as they look, have a common derivation perceptible in the intermediate form "witwale." The Mid. Eng. *wodehake* (=woodhack) is another name apparently identical in meaning with that commonly applied to woodpecker.

[2] A patch of conspicuous colour, generally red, on this part is characteristic of very many woodpeckers, and careless writers often call it "mystacial," or some more barbarously "moustachial." Considering that moustaches spring from above the mouth, and have nothing to do with the mandible or lower jaw, no term could be more misleading.

[3] It often happens that, just as the woodpecker's labours are over, a pair of starlings will take possession of the newly-bored hole, and, by conveying into it some nesting furniture, render it unfit for the rightful tenants, who thereby suffer ejectment, and have to begin all their trouble again. It has been stated of this and other woodpeckers that the chips made in cutting the hole are carefully removed by the birds to guard against their leading to the discovery of the nest. The present writer, however, had ample opportunity of observing the contrary as regards this species and, to some extent, the pied woodpecker next to be mentioned. Indeed there is no surer way of finding the nest of the green woodpecker than by scanning the ground in the presumed locality, for the tree which holds the nest is always recognizable by the chips scattered at its foot.

The three species just mentioned are the only woodpeckers that inhabit Britain, though several others are mistakenly recorded as occurring in the country—and especially the great black woodpecker, the *Picus martius* of Linnaeus, which must be regarded as the type of that genus.[1] This fine species considerably exceeds the green woodpecker in size, and except for its red cap is wholly black. It is chiefly an inhabitant of the fir forests of the Old World, from Lapland to Galicia and across Siberia to Japan. In North America this species is replaced by *Picus pileatus*, there generally known as the logcock, an equally fine species, but variegated with white; and farther to the southward occur two that are finer still, *P. principalis*, the ivory-billed woodpecker and *P. imperialis*. The *Picinae* indeed flourish in the New World, nearly one-half of the described species being American, but of the large number that inhabit Canada and the United States we can mention only a few.



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Lesser Spotted Woodpecker.

First of these is the Californian woodpecker, *Melanerpes formicivorus*, which has been said to display an amount of providence beyond almost any other bird in the number of acorns it fixes tightly in holes which it makes in the bark of trees, and thus "a large pine forty or fifty feet high will present the appearance of being closely studded with brass nails, the heads only being visible." This is not done to furnish food in winter, for the species migrates, and only returns in spring to the forests where its supplies are laid up. It has been asserted that the acorns thus stored are always those which contain a maggot, and, being fitted into the sockets prepared for them cup-end foremost, the enclosed insects are unable to escape, as they otherwise would, and are thus ready for consumption by the birds on their return from the south. But this statement has again been contradicted, and, moreover, it is alleged that these woodpeckers follow their instinct so blindly that "they do not distinguish between an acorn and a pebble," so that they "fill up the holes they have drilled with so much labor, not only with acorns but occasionally with stones" (cf. Baird, Brewer and Ridgway, *North American Birds*, ii. pp. 569-571).

The next North-American form deserving notice is the genus *Colaptes*, represented in the north and east by *C. auratus*, the golden-winged woodpecker or flicker, in most parts of the country a familiar bird, but in the south and west replaced by the allied *C. mexicanus*, easily distinguishable among other characteristics by having the shafts of its quills red instead of yellow. It is curious, however, that, in the valleys of the upper Missouri and Yellowstone rivers, where the range of the two kinds overlaps, birds are found presenting an extraordinary mixture of the otherwise distinctive features of each.

Other North American forms are the downy and hairy woodpeckers, small birds with spotted black and white plumage, which are very valuable as destroyers of harmful grubs and borers; the red-headed woodpecker, a very handsome form with strongly contrasted red, black and white plumage, common west of the Alleghany Mountains; and the yellow-bellied woodpecker ("sapsucker").

Some other woodpeckers deserve especial notice—the *Colaptes* or *Soroplex campestris*, which inhabits the treeless plains of Paraguay and La Plata; also the South-African woodpecker *Geocolaptes olivaceus*, which lives almost entirely on the ground or rocks, and picks a hole for its nest in the bank of a stream (*Zoologist*, 1882, p. 208).

The woodpeckers, together with the wrynecks (*q.v.*), form a very natural division of scansorial birds with zygodactylous feet, and were regarded by T. H. Huxley as forming a distinct division of birds to which he gave the name *Celeomorphae*, whilst W. K. Parker separated them from all other birds as *Saurognathae*. (A. N.)

WOODS, SIR ALBERT (1816–1904), English herald, son of Sir William Woods, Garter king-of-arms from 1838 to his death in 1842, was born on the 16th of April 1816. In 1838 he became a member of the chapter of the Heralds' College, of which he was appointed registrar in 1866. In 1869 he was knighted and became Garter king-of-arms. In this capacity he was entrusted with many missions to convey the order to foreign sovereigns; he was also registrar from 1878 of the orders of the Star of India and of the Indian Empire; and from 1869 was king-of-arms of the order of St Michael and St George. He officiated at the coronations both of Queen Victoria and of King Edward VII., and his authority on questions of precedence was unique. His later distinctions were K.C.B. (1897), K.C.M.G. (1899) and G.C.V.O. (1903). He died on the 7th of January 1904.

WOODS, LEONARD (1774–1854), American theologian, was born at Princeton, Massachusetts, on the 19th of June 1774. He graduated at Harvard in 1796, and in 1798 was ordained pastor of the Congregational Church at West Newbury. He was prominent among the founders of Andover Theological Seminary, and was its first professor, occupying the chair of Christian theology from 1808 to 1846, and being professor emeritus until his death in Andover on the 24th of August 1854. He helped to establish the American Tract Society, the American Education Society, the Temperance Society and the American Board of Commissioners for Foreign Missions. He was an orthodox Calvinist and an able dialectician. His principal works (5 vols., Andover, 1849–50) were *Lectures on the Inspiration of the Scriptures* (1829), *Memoirs of American Missionaries* (1833), *Examination of the Doctrine of Perfection* (1841), *Lectures on Church Government* (1843), and *Lectures on Swedenborgianism* (1846); he also wrote a *History of Andover Seminary* (1848), completed by his son.

His son, LEONARD WOODS (1807–1878), was born in West Newbury, Mass., on the 24th of November 1807, and graduated at Union College in 1827 and at Andover Theological Seminary in 1830. His translation of Georg Christian Knapp's *Christian Theology* (1831–1833) was long used as a text-book in American theological seminaries. He was assistant Hebrew instructor (1832–1833) at Andover, and having been licensed to preach by the Londonderry Presbytery in 1830 was ordained as an evangelist by the Third Presbytery of New York in 1833. In 1834–1837 he edited the newly-established *Literary and Theological Review*, in which he opposed the "New Haven" theology. After being professor of sacred literature in the Bangor Theological Seminary for three years, he was president of Bowdoin College from 1839 to 1866, and introduced there many important reforms. From June 1867 to September 1868 Dr Woods worked in London and Paris for the Maine Historical Society, collecting materials for the early history of Maine; he induced J. G. Kohl of Bremen to prepare the first volume (1868) of the Historical Society's *Documentary History*, and he discovered a MS. of Hakluyt's *Discourse on Western Planting*, which was edited, partly with Woods's notes, by Charles Dean in 1877. He died in Boston on the 24th of December 1878. He was a remarkable linguist, conversationalist and orator, notable for his uncompromising independence, his opinion that the German reformation was a misfortune and that the reformation should have been within the church.

See E. A. Park, *Life and Character of Leonard Woods, Jr.* (Andover, 1880).

ALVA WOODS (1794–1887), a nephew of the elder Leonard and the son of Abel Woods (1765–1850), a Baptist preacher, graduated at Harvard in 1817 and at Andover Theological Seminary in 1821, and was ordained as a Baptist minister. In 1824–1828 he was professor of mathematics and natural philosophy at Brown University, acting as president in 1826–1827; in 1828–1831 was president of Transylvania University, Lexington, Kentucky; and in 1831–1837 was president of the University of Alabama at Tuscaloosa, where he organized the Alabama Female Athenaeum. After 1839 he lived in Providence, R.I.

WOODSTOCK, a town and port of entry of Oxford county, Ontario, Canada, 80 m. S.W. of Toronto by rail, on Cedar creek, the Thames river and the Grand Trunk and Canadian Pacific railways. Pop. (1901) 8833. It is in one of the best agricultural sections of the province, and has a large export trade in cheese, butter and farm produce. Organs, pianos and agricultural implements are manufactured. It contains a residential school, under the control of the Baptist church, affiliated with McMaster University, Toronto.

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[1] The expression *Picus martius* was by old writers used in a very general sense for all birds that climbed trees, not only woodpeckers, but for the nuthatch and tree-creeper (*qq.v.*) as well. The adjective *martius* loses all its significance if it be removed from *Picus*, as some even respectable authorities have separated it.

WOODSTOCK, a market town and municipal borough in the Woodstock parliamentary division of Oxfordshire, England, 72$\frac{3}{4}$m. W.N.W. of London, the terminus (Blenheim and Woodstock) of a branch of the Great Western railway. Pop. (1901) 1684. The little river Glyme, in a steep and picturesque valley, divides the town into New and Old Woodstock. The church of St Mary Magdalene, in New Woodstock, is of Norman date, but has additions in the later styles, and a west tower built in 1785. The town-hall was erected in 1766 after the designs of Sir William Chambers. The picturesque almshouses were erected in 1798 by Caroline, duchess of Marlborough. The town is dependent chiefly on agriculture, but a manufacture of leather gloves (dating from the 16th century) is carried on. Woodstock is governed by a mayor, 4 aldermen, and 12 councillors. Area, 156 acres.

After the battle of Blenheim the manor of Woodstock was by Act 3 and 4 of Queen Anne, chap. 4, bestowed in perpetuity on John, duke of Marlborough. In 1723 it was destroyed, being already ruinous, and the site levelled after the erection of Blenheim House, a princely mansion erected by Parliament for the duke of Marlborough in consideration of his military services, and especially his decisive victory at Blenheim. The sum of £500,000 was voted for the purchase of the manor and the erection of the building, a huge pile built by Sir John Vanbrugh (*q.v.*), in a heavy Italo-Corinthian style. The greater part of the art treasures and curios were sold in 1886, and the great library collected by Charles Spencer, earl of Sunderland, the son-in-law of the first duke of Marlborough, in 1881. The magnificent park contains Fair Rosamund's well, near which stood her bower. On the summit of a hill stands a column commemorating the duke. Blenheim Park forms a separate parish.

Domesday describes Woodstock (*Wodestock*, *Wodestok'*, *Wodestok*) as a royal forest; it was a royal seat from early times and Æthelred is said to have held a council there, and Henry I. to have kept a menagerie in the park. Woodstock was the scene of Henry II.'s courtship of Rosamund Clifford ("Fair Rosamund"). It was a favourite royal residence until the Civil War, when the manor house was "almost totally destroyed."

In the Hundred Rolls of 1279 Woodstock is described as a vill, but a burgess is alluded to in the same document, and it returned two members to parliament as a borough in 1302 and 1305. A mayor of Woodstock was witness to a deed in 1398, but the earliest known charter of incorporation was that from Henry VI. in 1453, establishing the vill of New Woodstock a free borough, with a merchant gild and the same liberties and customs as New Windsor; and incorporating the burgesses under the title of the "Mayor and Commonalty of the Vill of New Woodstock." The mayor and a serjeant-at-mace were to be elected by the commonalty, and an independent borough court was established for the trial of all civil actions and criminal offences. The borough was also exempted from the burden of sending representatives to parliament, but it again returned two members in 1553 and then regularly from 1570 until 1881, when the representation was reduced to one member. In 1885 the borough was disfranchised. The charter of Henry VI. was confirmed by Henry VII., Edward VI. and Elizabeth, but before 1580, when an ordinance was drawn up for the government of the borough, the corporation had considerably developed, including a high steward, recorder, mayor, 6 aldermen, 20 common councillors, a town clerk and a crier of the court; and the new charter granted by Charles II. in 1665 did little more than confirm this corporation. The hamlet of Old Woodstock is said to have been founded by Henry I., and was never included within the borough. The existing Tuesday market is stated in the Hundred Rolls of 1279 to have been granted by Henry II. and the St Matthew's fair by John. The latter was confirmed in 1453, with the addition of a fair at the feast of St Mary Magdalen. Queen Elizabeth in 1565 granted to the mayor and commonalty a market on Friday, and two fairs of four days each at the feast of St Nicholas and Lady Day.

See Rev. E. Marshall, *Early History of Woodstock Manor* (Oxford, 1873); Adolphus Ballard, *Chronicles of Royal Borough of Woodstock*; *Victoria County History, Oxfordshire.*

WOODWARD, JOHN (1665–1728), English naturalist and geologist, was born in Derbyshire on the 1st of May 1665. At the age of sixteen he went to London, where he studied with Dr Peter Barwick, physician to Charles II. In 1692 he was appointed professor of physic in Gresham college. In 1693 he was elected F.R.S., in 1695 was made M.D. by Archbishop Tenison and also by Cambridge, and in 1702 became F.R.C.P. While still a student he became interested in botany and natural history, and during visits to Gloucestershire his attention was attracted by the fossils that are abundant in many parts of that county; and he began to form the great collection with which his name is associated. His views were set forth in *An Essay toward a Natural History of the Earth and Terrestrial Bodies, especially Minerals, &c.* (1695; 2nd ed. 1702, 3rd ed. 1723). This was followed by *Brief Instructions for making Observations in all Parts of the World* (1696). He was author also of *An Attempt towards a Natural History of the Fossils of England* (2 vols., 1728 and 1729). In these works he showed that the stony surface of the earth was divided into strata, and that the enclosed shells were originally generated at sea; but his views of the method of formation of the rocks were entirely erroneous. In his elaborate *Catalogue* he described his rocks, minerals and fossils in a manner far in advance of the age. He died on the 25th of April 1728, and was buried in Westminster Abbey.

By his will he directed that his personal estate and effects were to be sold, and that land of the yearly value of one hundred and fifty pounds was to be puchased and conveyed to the University of Cambridge. A lecturer was to be chosen, and paid £100 a year to read at least four lectures every year, on some one or other of the subjects treated of in his *Natural History of the Earth.* Hence arose the Woodwardian professorship of geology. To the same university he bequeathed his collection of English fossils, to be under the care of the lecturer, and these formed the nucleus of the Woodwardian museum at Cambridge. The specimens have since been removed to the new Sedgwick museum.

A full account of Woodward's life and views and a portrait of him are given in the *Life and Letters of the Rev. Adam Sedgwick*, by J. W. Clark and T. McK. Hughes, where it is mentioned that his paper, read before the Royal Society in 1699, entitled *Some Thoughts and Experiments concerning Vegetation*, "shows that the author should be ranked as a founder of experimental plant-physiology, for he was one of the first to employ the method of water-culture, and to make refined experiments for the investigation of plant-life."

See also *The Lives of the Professors of Gresham College*, by John Ward (1740).

WOODWARD, SAMUEL (1790–1838), English geologist and antiquary, was born at Norwich on the 3rd of October 1790. He was for the most part self-educated. Apprenticed in 1804 to a manufacturer of camlets and bombazines, a taste for serious study was stimulated by his master, Alderman John Herring and by Joseph John Gurney. Becoming interested in geology and archaeology, he began to form the collection which after his death was purchased for the Norwich museum. In 1820 he obtained a clerkship in Gurney's (afterwards Barclay's) bank at Norwich, and Hudson Gurney and Dawson Turner (of Yarmouth), both fellows of the Royal Society, encouraged his scientific work. He communicated to the *Archaeologia* articles on the round church towers of Norfolk, the Roman remains of the country, &c., and other papers on natural history and geology to the *Mag. Nat. Hist.* and *Phil. Mag.* He died at Norwich on the 14th of January 1838. He was author of *A Synoptical Table of British Organic Remains* (1830), the first work of its kind in Britain; *An Outline of the Geology of Norfolk* (1833); and of two works issued posthumously, *The Norfolk Topographer's Manual* (1842) and *The History and Antiquities of Norwich Castle* (1847).

His eldest son, Bernard Bolingbroke Woodward (1816–1869), was librarian and keeper of the prints and drawings at Windsor Castle from 1860 until his death. The second son, Samuel Pickworth Woodward (1821–1865), became in 1845 professor of geology and natural history in the Royal Agricultural College, Cirencester, and in 1848 was appointed assistant in the department of geology and mineralogy in the British Museum. He was author of *A Manual of the Mollusca* (in three parts, 1851, 1853 and 1856).

S. P. Woodward's son, Horace Bolingbroke Woodward (b. 1848), became in 1863 an assistant in the library of the Geological Society, and joined the Geological Survey in 1867, rising to be assistant-director. In 1893–1894 he was president of the Geologists' Association, and he published many important works on geology. Samuel Woodward's youngest son, Henry Woodward

(b. 1832) became assistant in the geological department of the British Museum in 1858, and in 1880 keeper of that department. He became F.R.S. in 1873, LL.D. (St Andrews) in 1878, president of the Geological Society of London (1894–1896), and was awarded the Wollaston medal of that society in 1906. He published a *Monograph of the British Fossil Crustacea, Order Merostomata* (Palaeontograph. Soc. 1866–1878); *A Monograph of Carboniferous Trilobites* (Pal. Soc. 1883–1884), and many articles in scientific journals. He was editor of the *Geological Magazine* from its commencement in 1864.

See Memoir of S. Woodward (with bibliography) in *Trans. Norfolk Nat. Soc.* (1879), and of S. P. Woodward (with portrait and bibliography), Ibid. (1882), by H. B. Woodward.

WOOL, WORSTED AND WOOLLEN MANUFACTURES. Wool is a modified form of hair, distinguished by its slender, soft and wavy or curly structure, and, as seen under the microscope, by its highly imbricated or serrated surface. At what point an animal fibre ceases to be hair and becomes wool it is impossible to determine, because the one by imperceptible gradations merges into the other, so that a continuous chain can be formed from the finest and softest merino to the rigid bristles of the wild boar. Thus the fine soft wool of the Australian merino merges into the cross-bred of New Zealand; the cross-bred of New Zealand merges into the long English and lustre wool, which in turn merges into alpaca and mohair-materials with clearly marked but undeveloped scale structure. Again, such animals as the camel and the Cashmere goat yield fibres, which it would perhaps be difficult to class rigidly as either wool or hair.

Wool in Britain.

Wool is one of the most important of the textile fibres. Owing to the ease with which it may be spun into thread, and the comfort derived from clothing made of wool, it would naturally be one of the first textiles used by mankind for clothing. Ancient records prove the high antiquity of wool textures and the early importance of the sheep. The different kinds of wool and the cloth made from them in antiquity are described by Pliny and referred to by other writers, and among the arts which the British Isles owe to the Romans not the least important is the spinning and weaving of wool. The sheep certainly was a domestic animal in Britain long before the period of the Roman occupation; and it is probable that some use was made of sheep skins and of wool. But the Romans established a wool factory whence the occupying army was supplied with clothing, and the value of the manufacture was soon recognized by the Britons, of whom Tacitus remarks, "Inde etiam habitus nostri honor et frequens toga" (*Agric.* c. 21). The product of the Winchester looms soon established a reputation abroad, it being remarked that "the wool of Britain is often spun so fine that it is in a manner comparable to the spider's thread." This reputation was maintained throughout the middle ages, and the fibre was in great demand in the Low Countries and other continental centres. There are many allusions to woollen manufactures in England in early times; but the native industry could not rival the products of the continent, although the troubles in various industrial centres, from time to time, caused skilled workers in wool to seek an asylum in England. In the time of William the Conqueror Flemish weavers settled under the protection of the queen at Carlisle, but subsequently they were removed to Pembrokeshire. At various subsequent periods there were further immigrations of skilled Flemish weavers, who were planted at different places throughout the country. The cloth fair in the church yard of the priory of St Bartholomew was instituted by Henry II.; gilds of weavers were established; and the exclusive privilege of exporting woollen cloth was granted to the city of London. Edward III. made special efforts to encourage wool industries. He brought weavers, dyers and fullers from Flanders; he himself wore British cloth; but to stimulate native industry he prohibited, under pain of life and limb, the exportation of English wool. Previous to this time English wool had been in large demand on the continent, where it had a reputation exceeded only by the wool of Spain. The customs duties levied on the export of wool were an important source of the royal revenue. Edward III.'s prohibitory law was, however, found to be unworkable, and the utmost that both he and his successors were able to effect was to hamper the export trade by vexatious restrictions and to encourage much smuggling of wool. Thus while Edward III. limited the right of exporting to merchant strangers, Edward IV. decreed that no alien should export wool and that denizens should export it only to Calais. Legislation of this kind prevailed till the reign of Elizabeth, when the free exportation of English wool was permitted; and Smith, in his *Memoirs of Wool*, points out that it was during this reign that the manufacture made the most rapid progress. In 1660 the absolute prohibition of the export of wool was again decreed, and it was not till 1825 that this law was finally repealed. The results of the prohibitory law were exceedingly detrimental; the production of wool far exceeded the consumption; the price of the raw material fell; wool-"running" or smuggling became an organized traffic; and the whole industry became disorganized. Extraordinary expedients were resorted to for stimulating the demand for woollen manufactures, among which was an act passed in the reign of Charles II. decreeing that all dead bodies should be buried in woollen shrouds—an enactment which remained in the Statute Book, if not in force, for a period of 120 years. On the opening up of the colonies, every effort was made to encourage the use of English cloth, and the manufacture was discouraged and even prohibited in Ireland.

It was not without reason that the attention of monarchs and legislators was so frequently directed to the wool industries. Wool was indeed "the flower and strength and revenue and blood of England," and till the development of the cotton trade, towards the end of the 18th century, the wool industries were, beyond comparison, the most important sources of wealth in the country. Towards the close of the 17th century the wool produced in England was estimated to be worth £2,000,000 yearly, furnishing £8,000,000 worth of manufactured goods, of which there was exported about £2,000,000 in value. In 1700 the official value of woollen goods exported was about £3,000,000, and in the third quarter of the century the exports had increased in value by about £500,000 only. In 1774 Dr Campbell (*Political Survey of Great Britain*) estimated the number of sheep in England at 10,000,000 or 12,000,000, the value of the wool produced yearly at £3,000,000, the manufactured products at £12,000,000, and the exports at £3,000,000 to £4,000,000. He also reckoned that the industry then gave employment to 1,000,000 persons. These figures, in the light of the dimensions of present-day industries, may appear small, but they bore a predominant relationship to the other great sources of employment and trade of the period. In 1800 the native crop of wool was estimated to amount to 96,000,000 ℔; and, import duty not being imposed till 1802, the quantity brought from abroad was 8,600,000 ℔, 6,000,000 ℔ of which came from Spain. In 1825 the importation of colonial wool became free, the duty leviable having been for several previous years as high as 6d. per ℔, and in 1844 the duty was finally remitted on foreign wool also.

Wool in America.

Sheep were introduced at Jamestown in Virginia in 1609, and in 1633 the animals were first brought to Boston. Ten years later a fulling mill was erected at Rowley, Mass., "by Mr Rowley's people, who were the first that set upon making cloth in this western world." The factory woollen industry was, however, not established till the close of the 18th century, and it is recorded that the first carding machine put in operation in the United States was constructed in 1794 under the supervision of John and Arthur Schofield.

Merino wool.

For centuries the finer wools used for cloth-making throughout Europe had been obtained from Spain—the home of the famous merino breed developed from races of sheep originally introduced into the Peninsula by the Moors. Till early in the 19th century the superiority of Spanish merinos remained unchallenged, but the Peninsular War and its attendant evils produced a depreciation of quality concurrently with the introduction of Saxon and Silesian wools, which suddenly supplanted the product of Spain. The Spanish merino sheep had been introduced into Saxony by the elector in 1765, and by judicious crossing with the best native race developed the famous electoral breed. Merinos were carried to Hungary in 1775, and to France in 1776, and in 1786 Daubenton brought them to Rambouillet, whence a famous race developed. In 1802 the first merinos known to have left pure descendants were taken to the United States, and in 1809–1810 an importation (4000) of merino sheep was made.

Wool in Australasia.

Wool in Australia.

The introduction of the merino sheep into the United States was an important move, but its results are not to be compared with the results of the introduction of the merino sheep into Australasia about the end of the 18th century and into South America a little later. It is probable that the marked improvement in the appearance of the first sheep taken out by the early colonists suggested the possibilities of Australia as a wool-growing country. As has been noted above, marked endeavours were being made at this time to extend the merino breed of sheep, so that it was but natural that this breed should be given the first chance. That marked success did not attend the first endeavours is shown by the fact that the London Colonial Wool Sales originated in the necessity of selling Australian wools just for what they would bring under the hammer, as distinct from the private treaty method of selling and buying the more highly priced continental merinos. It should here be noted that the Australian fine wools were first shipped from Botany Bay, hence the now universal term "botany" for fine wools. The colonists were not to be repressed however, and eventually, through the endeavours of Captain MacArthur, Sir J. Banks, the Rev. Samuel Marsden and others, the merino breed became established on a firm basis, and in a comparatively short time Australian wools were no longer a drug on the market. The evolution was not to stop, however, with the development of merino flocks and the exporting of merino wool. No doubt early in the 19th century the possibilities of raising larger sheep on the better coastal pasturage was naturally suggested. Until about 1885 this tendency was largely repressed owing to the demand for merino as distinct from cross-bred wool. In other words wool was the dominating factor. But with the possibilities and the development of the frozen meat trade from 1880 to 1890 this condition was changed, and the tendency to breed a large sheep with a valuable carcass and mediocre wool grew apace. New Zealand was specially adapted for this development; thus New Zealand frozen mutton completely dominated New Zealand wool. In this manner it came about that cross-bred wool supplanted merino wool to a very considerable extent throughout Australasia. This change would have been serious for the wool comber and spinner had not the Bradford combers, spinners and manufacturers put their shoulder to the wheel and developed a world-wide renown for their cross-bred tops, yarns and fabrics. Again the change was not altogether for the bad so far as the Australian sheep was concerned. Sheep-breeding developed into a real science, and remarkable results were obtained with such crosses as Merino-Lincoln, Merino-Leicester, Merino-Shropshire; all probably originating in the first place in the desire to produce a large-bodied early-fattening sheep, but later developing into a strenuous endeavour to develop more useful types of wools. Thus the wool produced from the first cross Merino-Lincoln might be very defective judged from a pure merino standpoint, but by breeding back to the merino practically none of the useful merino characteristics were sacrificed, while length of staple was added and the weight of the fleece perhaps doubled.

A somewhat different evolution has taken place in later years with reference to the interior sheep stations. The merino sheep will thrive where a larger sheep would starve, hence its value for the stations where salt-bush dominates all vegetation. But the merino sheep is a "wool" sheep, not a "frozen mutton" sheep, hence all crossing here was carried out with the idea of simply developing the weight of fleece and if possible retaining the merino wool characteristics. The most marked development in this direction was effected by the introduction of the United States merino or Vermont breed. Opinions differ as to the wisdom of this introduction. The weight of fleece carried per sheep has been remarkably increased, and the fact that up to the present weight multiplied by price per ℔ paid in London or elsewhere has been entirely in favour of first and second cross Vermonts, has undoubtedly influenced breeders in its favour Against this must be placed the fact that the Australian-Vermont merino cross produces a sheep of unstable physique, naturally unable to withstand drought, and—worst of all so far as London is concerned—producing a fleece very difficult to judge for yield of pure scoured wool. Again, the Australian-Vermont first cross is very liable to produce a very strong botany wool, while what is required is a long but fine wool technically termed a long and shafty 60's to 64's quality.

Wool in South America.

Hardly second in importance to Australia as a wool-growing country comes South America, or more correctly Argentina along with Patagonia, Punta Arenas and the Falkland Islands. In most years Australia has produced the greater bulk, but just occasionally S. America has come out top and is likely to do so more frequently in the future owing to the remarkable developments there taking place. The history of the introduction of the merino sheep into S. America may be briefly summed up as follows. In 1842 Henri Solanet, a Frenchman, began to shear the comparatively few sheep round Buenos Aires. His example was soon followed by Edouardo Olivera and José Planer. The idea almost at once came to these pioneers of importing well-bred rams, and as S. America is essentially a Latin country it was but natural that the French flocks of Rambouillet should be first drawn upon. With the development of the meat trade—just as in the case of Australia and New Zealand—a larger carcass was then sought after. This led to the introduction of the Lincoln ram and the development of cross-bred flocks about the year 1885. Perhaps this cross was favoured owing to the skill of the Bradford spinners, who made excellent use of the cross-bred wool produced Flocks of sheep were first introduced into the Falkland Islands in 1867. The pasturage here being limited, the flocks have probably attained their limit, but from the Falkland Islands flocks have been passed on to Punta Arenas, where there is practically unlimited pasturage. The chief centres from which wool from S. America comes to Europe are Buenos Aires, which exports chiefly long and cross-bred wools, Montevideo, which exports chiefly merino wools, and the Falkland Islands and Punta Arenas, which export mostly wools of the finer type. The industry is largely in the hands of Englishmen. Unfortunately, however, the British manufacturer early took a dislike to the Buenos Aires, &c., wools, and consequently these wools go largely to the continent of Europe. To-day they by no means merit their previous bad name, and the Bradford comber and spinner are endeavouring to make up for lost opportunities.

Wool in South Africa.

Prior to the introduction of the merino sheep into Australia it had been introduced into S. Africa by the Dutch. There the climate was not so helpful as was that of Australia. The newly acclimatized sheep appears to have cast its wool at about the fifth generation and to have generally deteriorated, necessitating the reintroduction of fresh blood form Europe. In this manner have been developed the Cape flocks and the considerable Cape wool trade—largely centred at Port Elizabeth, East London, Cape Town, Mossel Bay and Port Natal. The country is evidently specially adapted for the rearing of the merino type of sheep, as cross-bred Cape wool is practically unknown. The term snow-white Cape wool, on the other hand, betokens a quality of whiteness no doubt due to the atmospheric and pasturage conditions. Cape wools are also known as non-felting wools, and consequently are largely employed in the manufacture of flannels. In 1907 most marked endeavours were being made to develop the Cape flocks by the introduction of some thousands of Australian merino sheep. The opinion of wool experts was that the Cape had a great future before it as a wool-producing country.

Wool in other countries.

Large quantities of wool also come from the East and from Russia, while even Iceland contributes its quota. It is interesting to note that, notwithstanding all the developments instanced, Europe still maintains its supremacy as the chief wool-producing continent, though, as the wool is largely manufactured locally, one hears little of European wools.

The following statistics give an idea of the development of the colonial and foreign wool trade as gauged by the London wool sales:

	Bales.		Bales.
1814	165	1870 . . .	673,314
1824	1,620	1890 . . .	1,509,666
1834	16,926	1901 . . .	1,602,726
1840	44,502	1903 . . .	1,319,365
1850	158,558		

It must not be forgotten, however, that a large quantity of S. American, W. Indian, Russian, &c., wools, along with mohair and alpaca, come through Liverpool, and consequently are not taken into account here.

British wools.

With reference to wools grown in the United Kingdom the truth seems to be that a fine short wool has never been produced. English wool is known the world over as being of a long and lustrous type, which was doubtless that so much in demand in the middle ages. That it was as long and lustrous as the typical Leicester or Lincoln of to-day is doubtful, as the new Leicester breed of sheep was only fully developed by Mr Bakewell after the year 1747, and the latter day Lincoln was even a later development of a similar character. What the exact type of English wool or wools was prior to the 18th century will probably never be decided, but from the closing years of that century there is no difficulty in being fairly precise. As already remarked, the long and lustrous wools are the typical English, being grown in Lincolnshire, Yorkshire, Nottinghamshire, Devonshire, &c., in fact in all those districts where the pasturage is rich and specially fitted for carrying a heavy sheep. It is claimed that the lustre upon the wool is a direct result of the environment, and that to take a Lincoln sheep into Norfolk means the loss of the lustre. This is partially true, but it is perhaps better to take a larger view and remember that the two influencing factors are race and environment: which is the more potent it is impossible to say. Attempts were made in the 18th century to develop a fine wool breed in England, George IV. importing a number of merino sheep from Spain. The discovery was soon made that it was impossible to maintain a breed of pure merinos in Great Britain, but the final outcome was by no means unsatisfactory. By crossing with the indigenous sheep a race of fairly fine woolled sheep was developed, of which the present day representative is the Southdown—a sheep which feeds naturally on the Downs of Sussex, &c., forming a marked contrast to the artificially turnip-fed Lincoln, Leicester, &c., sheep. Following the short, curly Southdown, but rather longer, come such as the Sussex, Oxford and Hampshire Down sheep; these are followed by such as the Shropshires and Shropshire crosses, Kent and Romney Marsh, until at last the chain from the Southdown to the Lincoln is completed. Of course there are several British wools not included in this chain. Scotch or black-face wool is long and rough, but well adapted for being spun into carpet yarns. Welsh wool has the peculiarity of early attaining its limit of shrinkage when washed, and hence is specially chosen for flannels. Shetland wool is of a soft nature specially suited for knitting yarns, while Cheviot wool—said to be a cross between merino sheep saved from the wreck of the Great Armada and the native Cheviot sheep—has made the reputation of the Scottish manufacturers for tweeds. North wool—wool from an animal of the Border Leicester and Cheviot breed—Ripon, Wensleydale and Teasdale wools are also specially noted as lustre wools, Ripon and Wensleydale wools being, by many judges, considered superior so far as lustre is concerned to Lincoln and Leicester.

Such remarkable advances have been made in the weights of fleeces carried by sheep of particular breeds that it is difficult to say if finality has been reached. The following list gives average weights:

Breed.	Weight of Average Fleece.	Breed.	Weight of Average Fleece.
Merino (Australian)	6 ℔	Southdown . .	6 ℔
Merino (South American) . .	6½ ℔	Lincoln . . .	12 ℔
Merino-Lincoln .	8-10 ℔	Shetland . .	4 ℔
		Cashmere . .	4 oz.

In 1885 the average weight of wool per sheep per year was about 5 ℔, while 7 to 8 ℔ is now the average weight. Roughly speaking the weights of Australian fleeces are to-day about double as compared with 1885.

Physical characteristics of wool.

The prevailing colour of sheep's wool is white, but there are races with black, brown, fawn, yellow and grey shades of wool. For manufacturing purposes generally white wool is, of course, most valuable, but for the homespuns, which in earlier times absorbed the bulk of wool, natural colours were in many cases used with good effect. In domestic spinning, knitting, and weaving, natural colours are still largely taken advantage of, as in the cases of rough yarns, Shetland knitted shawls, Highland tweeds, &c.

As has already been indicated, the distinction between wool and hair lies chiefly in the great fineness, softness, and waved delicacy of woollen fibre, combined with a highly serrated surface. These peculiarities are precisely the characters which give wool its distinctive value as a textile fibre, the most distinctive characteristic of all being the serrated structure which specially belongs to wool and markedly aids the important property of felting, upon which many of its applications depend. The serrations of wool and the wavy structure it assumes are closely connected, those wools which have the greatest number of serrations being usually most finely waved in structure. The appearance presented by wool under the microscope is shown in figs. 1–6 (Plate). Under the influence of moisture and pressure, aided by alkalis or acids, masses of wool thoroughly mat together, by the mutual interlocking of the fibres. It is thus that the shrinking and thickening of woollen textures under washing is accounted for, the capacity of wool cloth for felting or fulling being due to this condition of the fibre, possibly along with a certain shrinkage of the true fibre mass. The serrations are most numerous, acute, pointed and distinct in fine merino wools, as many as 2800 per in. being counted in specimens of the finest Saxony wools. In the Leicester wool of England, on the other hand, which is a long bright staple, the serratures are not only much fewer in number, counting about 1800, but they are also less pronounced in character, so that the fibre presents a smoother, less waved character. In some inferior wools the serrations are not so many as 500 per in. A similar difference may be noted in the fineness of the fibres. The finest wool has a diameter of from $\frac{1}{2000}$ to $\frac{1}{3000}$ in., whilst coarse Algerian wools may rise to a maximum diameter of about $\frac{1}{275}$ in.

Other distinguishing qualities of good wool consist in uniformity and strength of fibre with freedom from tender or weak portions in its length, a condition which not unfrequently arises from ill health in the sheep, or is due to violent climatic changes. In ill-bred wool there may also be found intermingled " kemps " or dead hairs—straight, coarse, dull fibres which show conspicuously among the wool, and become even more prominent in the manufactured and dyed goods, as they will not take dye. Wool also possesses a softness of touch and an elasticity both in the raw and manufactured condition which distinguish it from all other fibres. In length of staple it varies very much, attaining in combing wools to a length of as much as 15 to 20 in.

Chemical characteristics of wool.

In dealing with wool from a practical point of view it must be recognized that it is by no means a simple body, but has a somewhat complex physical structure. Its composition in the raw state may be said to be threefold. Thus there is the wool-yolk—what may be termed a natural impurity; the wool-fat, which is not only present in the yolk but also permeates the fibre and seems to give it its plastic and soft handle; and the cell structure proper of the fibre. The natural impurity or wool-yolk is truly a skin product and is a protector of the wool-fibre rather than part of the true fibre substance. The wool-fat also may be regarded as independent of the true fibrous substance, but it is well to recognize that if the wool-fibre be entirely freed from the wool-fat it loses its plastic and elastic nature and is considerably damaged. In cleansing wool the true fibre mass may be disturbed and partially destroyed not only by dry but also by "wet" heat, and may be entirely disintegrated by means of alkalies, &c., with heat. The wool-fibre will almost free itself from the natural impurities—the yolk—in the presence of tepid water. This is taken advantage of in the various steeping machines placed on the market, which partially scour the wool by means of its own yolk—principally through the potash salts present.

According to Hummel the composition of the average wool-yolk is as follows:—

Moisture]	4 to 24 %	Dirt	3 to 24 %
Yolk	12 ,, 47 %	Wool-fibre	15 ,, 72 %

The potash salts are usually recovered from the wash-water products and a marked economy thereby effected.

The natural wool-fat—popularly known as "lanoline"—may be partially got rid of in the steeping process, but it is almost invariably necessary to free the wool still further from it by actually scouring the wool on either the "emulsion" or "solvent" method, in either case the action being largely physical. As previously pointed out, however, all the wool-fat must not be taken away from the fibre, or the fibre will lose its "nature." According to Dr Bowman, the chemical composition of the cell structure of the average wool-fibre is:—

Carbon	50·8
Hydrogen	7·2
Nitrogen	18·5
Oxygen	21·2
Sulphur	2·3
	100·0

It is said to be a most complex body of which the probable formula is $C_{42}H_{157}N_5SO_{15}$.

If wool is burnt, it largely resolves itself into ammonia gas—whence it derives its characteristic odour—and carbon "beads" or "remains," which serve to distinguish wool from cotton, which, upon being burnt, does not smoulder but burns with a flash and leaves no beads. For further particulars on the organic nature of the wool-fibre see FIBRES.

Lamb, Hogg and Wether wool.

The bulk of the wool of commerce comes into the market in the form of fleece wool, the product of a single year's growth, cut from the body of the living animal. The first and finest clip, called lambs' wool, may be taken from the young sheep at about the age of eight months. When the animal is not shorn till it attains the age of twelve or fourteen months the wool is known as hogg or hogget, and, like lambs' wool, is fine and tapers to a point. All subsequently cut fleeces are known as wether wool, and possess relatively somewhat less value than the first clip. Fleece wool as it comes into the market is "in the grease," that is, unwashed, and with all the dirt which gathers to the surface of the greasy wool present; or it is received as "washed" wool, the washing being done as a preliminary to the sheep-shearing, or, in some few cases, it is scoured and is consequently stated as "scoured." Skin wool is that which is obtained from sheep which either die or are killed. Typical skin wool is that which has been removed by a sweating process. The worst type of skin wool—technically known as "slipe"—is removed from the skins by lime, which naturally affects the handle of the wool and renders it difficult to bring into a workable condition later. Mazamet in France is the great continental centre for skin wools.

Sheep washing.

Where there is abundance of water and other conveniences it is the practice to wash or half-wash sheep previous to shearing, and such wool comes into the market as washed or half-washed fleece. The surface of a fleece has usually a thick coating of dirt, and in the case of merino breeds the fleece surface is firmly caked together into solid masses, from the adhesion of dirt to the wool constantly moist with the exudation from the skin of the greasy yolk or "suint," so that in an unwashed very greasy fleece 30 % of weight may represent dirt, and about 40 % the greasy suint which lubricates the wool, while the pure wool is not more than one-third part of the whole. Where running streams exist, the sheep are penned by the side of the water, and taken one by one and held in the stream while they are washed, one man holding and the other washing. The operation is objectionable in many ways, as it pollutes the stream, and it dissipates no mean amount of potash salts, valuable for manure or for other chemical purposes. Sheep washing appliances are now largely employed, the arrangement consisting of a pen into which the sheep are driven and subjected to a strong spray of water either hot or cold, which soaks the fleece and softens the dirt. This done, they are caused to swim along a tank which narrows towards the exit, and just as they pass out of the pen they are caught and subjected to a strong douche of pure water. They should then be kept on grass land free from straw, sand, &c., so that the wool may be sheared free from vegetable matter, &c. After a few days the wool of a washed sheep is sufficiently dry for shearing or clipping.

The relative advantages of shipping wool in the greasy or washed state have been fiercely debated. Although there are naturally exceptions, the superiority of greasy wool is now generally recognized. This is not only because the wool more fully retains its nature, but because it is more readily judged for "yield" and its spinning qualities are, perhaps, more readily estimated.

The following list gives an idea of the yield in clean wool of the chief commercial varieties, from which it will be noted that roughly merino greasy wool yields about 50 % clean wool and English about 75 % clean wool.

Type of Wool.	Yield per cent of Clean Wool.
Australian Merino	50 %
Cape ,,	48 %
South American Merino	45 %
New Zealand Cross-bred	75 %
South American Cross-bred	75 %
English Southdown	80 %
,, Shropshire	80 %
,, Lincoln	75 %
Mohair	85 %
Alpaca	85 %

Sheep shearing.

A skilful shearer will clip the fleece from a sheep in one unbroken continuous sheet, retaining the form and relative positions of the mass almost as if the creature had been skinned. In this unbroken condition each fleece is rolled up by itself and tied with its own wool, which greatly facilitates the sorting or stapling which all wool undergoes for the separation of the several qualities which make up the fleece. Mechanical shears have almost revolutionized the shearing industry, a good shearer shearing from 100 to 200 sheep per day.

Wool classing.

On the great Australian sheep stations wool classing is one of the most important operations, largely taking the place of sorting in the English wool trade. This is no doubt due to the wonderful success which has attended the efforts of the Australian sheep breeders to breed a sheep of uniform staple throughout. Thus the fleeces as taken from the sheep are skirted and trimmed on one table and then passed on to the classer, who places them in the 56's, 60's, 64's, 70's, 80's or 90's class according to their fineness, these numbers approximately indicating the worsted counts to which it is supposed they will spin. The shorter Australian wools not coming under any of these heads are classed as super-clothing, ordinary clothing, &c., being more suitable for the woollen industry.

The art of sheep shearing, skirting, classing, packing and transporting has been brought up to a wonderful state of perfection in Australia, and the "get up" of the wool is usually much superior to the "get up" of the "home-clip." Of late there has been an outcry against the prevalence of vegetable matter in colonial wools, but it seems probable that with the adoption of a suitable woolpack, and the exercising of a little more care in sorting at the home end, this difficulty will be satisfactorily surmounted.

Wool sorting.

Sorting or stapling was formerly a distinct industry, and to some extent it is so still, though frequently the work is done on the premises of the comber or spinner. Carding wools are separated and classed differently from combing wools, and in dealing with fleeces from different breeds, the classification of the sorter varies. In the woollen trade short-staple wool is separated into qualities, known, in descending series from the finest to the most worthless, as picklock, prime, choice, super, head, seconds, abb and breech, and the proportions in which the higher and lower qualities are present are determined by the "class" of the fleece. In the worsted trade the classification goes, also in descending series, from fine, blue, neat, brown, breech, downright, seconds, to abb for English wools. The last three are short and not commonly used in the worsted trade. The greater proportion of good English long wool will be classified as blue, neat and brown; it is only in exceptional cases that more than from 5 to 8 % is "fine" on the one hand, or of lower quality than breech on the other. Generally speaking, the best portion of a fleece is from the shoulders and side of the animal. The quality decreases towards the tail end of the sheep, the "britch" being frequently long, strong and irregular. The belly wool is short, worn and dirty, as is also the front of the throat, while on the head and shins the product is short, stiff and straight, more like hair than wool and is liable to contain grey hairs. The colonial wools come "classed," and consequently are only as a rule sorted into three or four qualities. Thus a 60's fleece may be sorted into 56's, ordinary 60's, super 60's and skirtings.

The sorter works at a table or frame covered with wire netting through which dust and dirt fall as he handles the wool. Fleeces which have been hard packed in bales, especially if unwashed, go into dense hard masses, which may be heated till the softening of the yolk and the swelling of the fibres make them pliable and easily opened up. When the fleece is spread out the stapler first divides it into two equal sides; then he picks away all straws, large burrs, and tarry fragments which are visible; and then with marvellous precision and certainty he picks out his separate qualities, throwing each lot into

WOOL, WORSTED, AND WOOLLENS

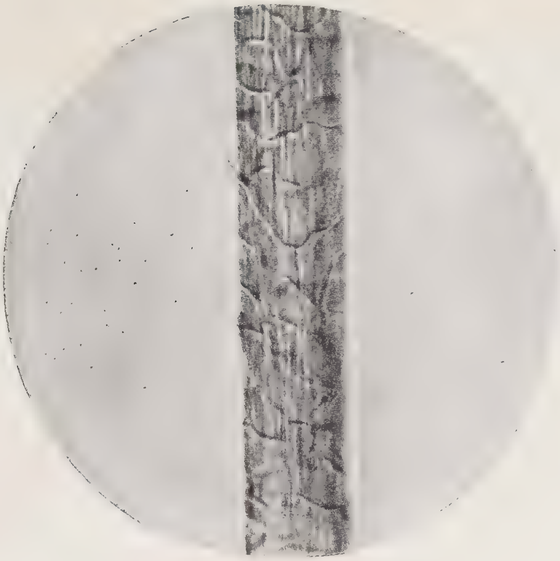


FIG. 1.—MOHAIR (×320).

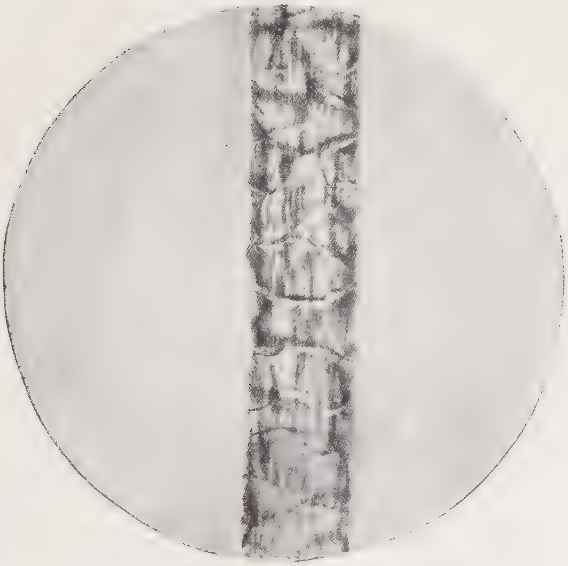


FIG. 2. LEICESTER WOOL (×320).

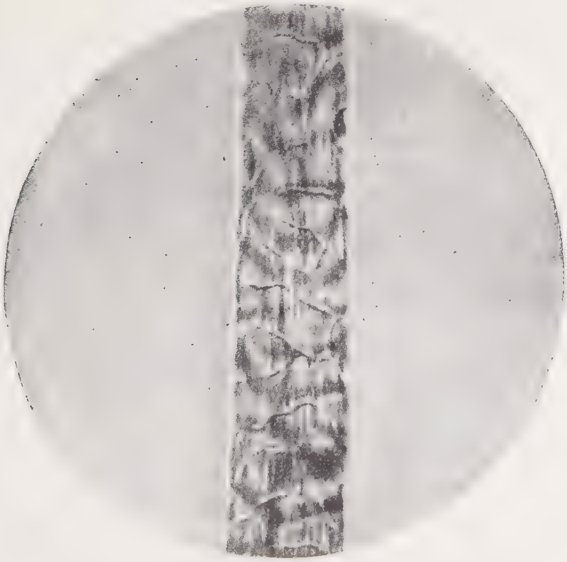


FIG. 3.—NEW ZEALAND CROSS-BRED WOOL (×320).

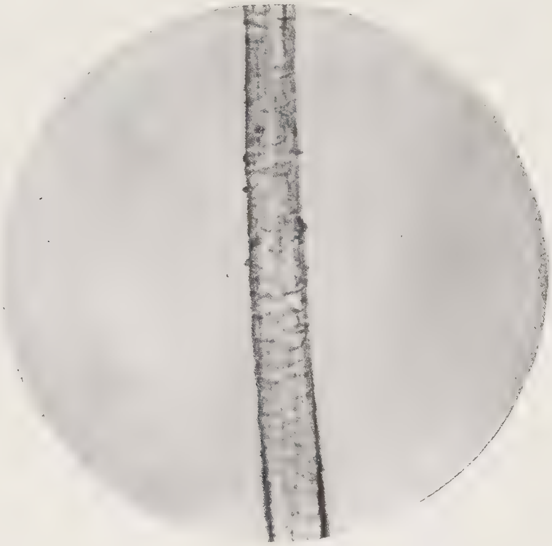


FIG. 4.—ALPACA WOOL HAIR (×320).

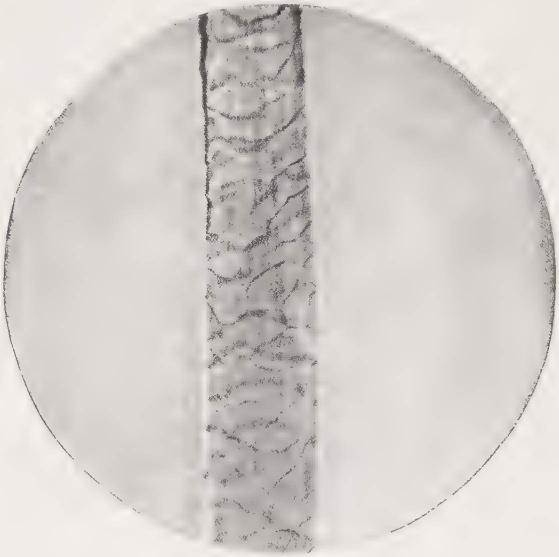


FIG. 5.—DOWN WOOL (×320).

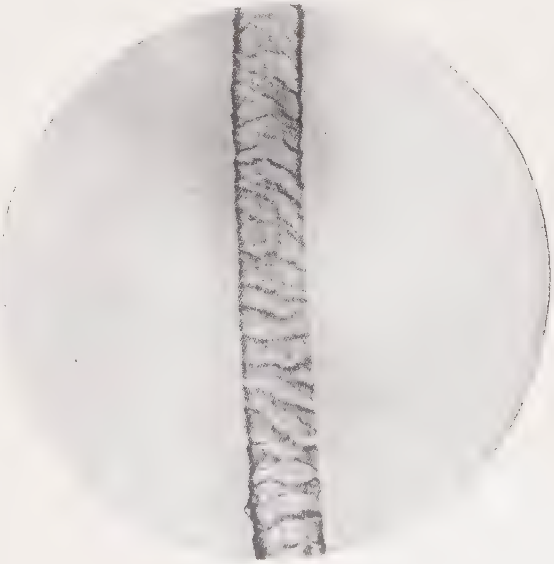


FIG. 6.—AUSTRALIAN MERINO WOOL (×320).

Photomicrographs of the most representative hairs and wools used in the textile industries.

s allotted receptacle. Sorting is very far removed from being a mere echanical process of selecting and separating the wool from certain arts of the fleece, because in each individual fleece qualities and roportions differ, and it is only by long experience that a stapler is nabled, almost as it were by instinct, rightly to divide up his lots, as to produce even qualities of raw material. Cleanliness is most ssential if the wool sorter is to keep his health and not succumb to he dread disease known as “ anthrax ” or “ wool-sorters' disease.” ertain wools such as Persian, Van mohair, &c., are known to be very able to carry the anthrax bacilli, and must be sorted under the con-itions imposed by government for “ dangerous wools.” Ordinary or on-dangerous wools are perfectly harmless from this point of view.

couring.

The washing which a fleece may have received on the live sheep not sufficient for the ordinary purposes of the manufacturer. On the careful and complete manner in which scouring is effected much depends. The qualities of the fibre may be seriously injured by injudicious treatment, while, if the ool is imperfectly cleansed, it will dye unevenly, and the manufactur-ng operations will be more or less unsatisfactory. The water used r scouring should be soft and pure, both to save soap and still more because the insoluble lime soap formed in dissolving soap in hard water is deposited on the wool fibres and becomes so fixed that its removal is a matter of extreme difficulty. In former times stale urine was a favourite medium in which to scour wool; but that is now a thing of the past, and a specially prepared potash soap is the detergent principally relied on. Excess of alkali has to be guarded against, since uncombined caustic acts energetically on the wool fibre—especially in the presence of heat—and is indeed a solvent of it. A soap solution of too great strength leaves the wool harsh and brittle, and the same detrimental result arises when the soapy solution is applied too hot.

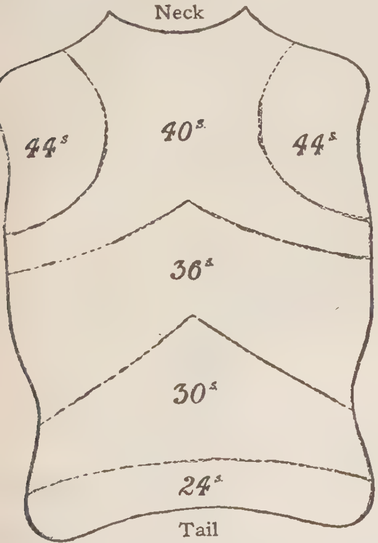


FIG. 7.—Qualities of Wool in a Lincoln Fleece.

The numbers indicate the quality of wool taken from the respective sections of the fleece. Thus the finest quality—44's—is found on the shoulders, while the coarsest “ britch ” is found on the hind-quarters of the sheep.

In former days, when the method of hand-scouring prevailed, the wool to be washed was placed with hot soap-sud in a large scouring “ bowl ” or vat, and two men with long poles kept stirring it gently about till the detergent loosened and separated the dirt and dissociated the grease. The wool was then lifted out and drained, after which it was rinsed in a current of clean water to remove the “ scour ” and then dried. These operations are now performed in scouring machines. Many firms now steep the wool previous to the true scouring operation, the object being to scour the wool with its own potash salts, to obtain wash-waters so fully charged with the potash salts that these salts, &c., may be readily extracted and put to some good use, and lastly to save the artificial scouring agent employed in the true scouring operation. The scouring of wool has passed through many vicissitudes during the past fifty years, but to-day the principle upon which all scouring machines are based is that wool naturally opens out in water. The mechanical arrangements of the machines are such as to ensure the passage of the wool without undue lifting and “ stringing,” to obviate the mixing of wool grease, sand, dirt, &c., once taken out of the wool with that wool again, to give time for the thorough action of the scouring agents, so that neither too strong solution nor too great a heat be employed, and to allow of the ready cleansing of the machines so that there is no unnecessary waste of time. In England the recognized type of merino wool-washing machine is the fork-frame bowl. Three to five of these machines are employed. The “ scour ” is strongest and hottest in the first bowl (unless this is used as a “ steeper ”) as the wool at first is protected from the caustic by the wool-fat, &c., present. The last bowl is simply a rinsing bowl. With modern “ nip rollers ” botany wool is sufficiently dry to be passed on directly—say by pneumatic conveyers—to the carding. This the worsted spinner does, thereby saving time and money. The woollen spinner, however, may require the wool for blending, and so may require it dry and in a fit state for oiling. He, therefore, will employ one or other of the drying processes to be immediately described. For English and cross-bred wools more agitation in the scouring bath may be desirable. If so, the eccentric fork action machine is employed, in which the agitation of the bath is satisfactorily controlled by the setting of the forks which propel the wool forward. An average wool will be in the scouring liquor about eight minutes, the temperature will vary from 120° F. to 110° F., and the length of bath through which it will have passed will be from 48 to 60 ft.

It is interesting to note that the “ emulsion ” method of wool scouring as described above is practically universal in England. In the United States of America the “ solvent ” method is largely in use, for the two points aimed at are quantity of production and cheapness. Quality is sacrificed to quantity and cheapness results from the ease with which the agent employed—say carbon disulphide—is recovered by volatilizing and condensing, thus being used over and over again.

Botany wools should leave the wool-washing machine in a fit condition to be fed immediately on to the carder, provided that the first cylinders are clothed with galvanized wire. Cross-bred and English wool, however, require artificially drying.

Wool drying.

The more gently and uniformly the drying can be effected the better is the result attained; over-drying of wool has to be specially guarded against. By some manufacturers the wool from the squeezing rollers is whizzed in a hydro-extractor, which drives out so much of the moisture that the further drying is easily effected. The commonest way, however, of drying is to spread the wool as uniformly as possible over a framework of wire netting, under or over which is a range of steam-heated pipes. A fan blast blows air over these hot pipes, and the heated air passes up and is forced upwards through the layer of wool which rests on the netting or downwards, as the case may be. In this case, unless the wool is spread with great evenness, it gets unequally dried, and at points where the hot air escapes freely it may be much over-dried. A more rapid and uniform result may be obtained by the use of the mechanical wool drier, a close chamber divided into horizontal compartments, the floors of which have alternate fixed and movable bars. Under the chamber is a tubular heating apparatus, and a fan by which a powerful current of heated air is blown up the side of the chamber, and through all the shelves or compartments successively, either following or opposing the wool in its passage through the machine. The wool is introduced by a continuous feed at one side of the chamber; the strength of the blast carries it up and deposits it on the upper shelf, and by the action of the movable bars, which are worked by cranks, it is carried forward to the opposite end, whence it drops to the next lower shelf, and so on it travels till at the extremity of the lower shelf it passes out by the delivery lattice well and equally dried. Another drying machine in extensive use is what is known as the “ Jumbo Dryer.” This consists of a large revolving cylinder or churn which turns over the wool—as a churn turns butter—and owing to its inclination passes it from one end to the other. A hot air blast follows the wool through the machine. In this and in all drying machines it is more important to get the moisture laden air away from the wool than to develop a great heat.

Teasing.

The dried wool may be in a partially matted condition. If so, it must be opened out and the whole material brought into a uniformly free and loose condition. This is effected in the Willey, which consists of a large drum and three small cylinders mounted in an enclosed frame. The drum is armed with ranges of powerful hooked teeth or spikes, and is geared to rotate with great rapidity, making about 500 revolutions per minute. The smaller cylinders, called workers, are also provided with strong spikes; they are mounted over the drum and revolve more slowly in a direction contrary to the drum, the spikes of which just clear those of the workers. The wool is fed into the drum, which carries it round with great velocity; but, as it passes on, the locks are caught by the spikes of the workers, and in the contest for possessing the wool the matted locks are torn asunder till the whole wool is delivered in a light, free and disentangled condition. It is a debatable point as to whether willowing should precede scouring. Some scourers always willow prior to scouring, while others never subject the wool to this operation, which is advantageous in some cases and not in others.

Burring.

For certain classes of wool, notably Buenos Aires, still another preparing operation is essential at this stage—that is, the removal of burrs or small persistently adherent seeds and other fragments of vegetable matter which remain in the wool. Two methods of effecting this—one chemical, the other mechanical—may be pursued. The chemical treatment consists in steeping the wool in a dilute solution of sulphuric acid (or other carbonizing agent), draining off the dilute acid by means of the hydro extractor, and then heat-drying in a temperature of about 250° F. The acid leaves the wool practically uninjured, but is concentrated on the more absorbent vegetable matter, and the high heat causes it to act so that the vegetable matter becomes completely carbonized. The burrs are then crushed and the wool washed in water rendered sufficiently alkaline to neutralize any free acid which may remain, and dried. The same burr-removing effect is obtained by the use of a solution of chloride of aluminium, a method said to be safer for the wool and less hurtful to the attendant workmen than is the sulphuric acid process. For mechanical removing of burrs, a machine something like the Willey in appearance is employed. The main feature of this apparatus is a large drum or swift armed with fine short spikes curved slightly in the direction in which it rotates. By a series of beaters and circular brushes the wool is carried to and fed on these short spikes, and in its rotation the burrs, owing to their weight, hang out from the swift. The swift as it travels round is met by a series of three burring rollers rotating in an opposite direction, the projecting rails of which knock the burrs off the wool. The burrs fall on a grating and are ejected, with a certain amount of wool adhering to them, by another rotating cylinder. With wools not too burry the worsted spinner largely depends upon burring rollers placed upon the first cylinder of the "carder," and possibly to one or other of the patent pulverizing processes applied further on in the card. In the latter process a complete pulverizing of the burrs is aimed at, this being effected by the introduction of specially constructed pulverizing rollers between the first doffer and the last swift of the carding engine.

Woollens and worsteds.

The processes hitherto described are common to merino, cross-bred or botany wools be they intended for woollen or worsted yarns From this point, however, differentiation starts. Wool may now be manipulated with the idea of converting it into felt (*q.v.*), woollen or worsted fabrics. In a general way it may be said that woollen yarns are those made from short wools possessed of high felting qualities, which are prepared by the process of carding; whereby the fibres are as far as possible crossed and interlaced with each other, and that the carded-slivers, though perhaps hard spun on the mule frame, form a light fluffy yarn, which suits the conditions when woven into cloth for being brought into the semi-felted condition by milling which is the distinguishing characteristic of woollen cloth. On the other hand, worsted yarns are generally made from the long lustrous varieties of wool; the fibres are so combed as to bring them as far as possible parallel to each other; the spinning is usually effected on the frame, and the yarn is spun into a compact, smooth and level thread, which, when woven into cloth, is not necessarily milled or felted. At all points, however, woollen and worsted yarns as thus defined overlap each other, some woollens being made from longer wool than certain worsteds, and some worsteds made from short staple wool, carded as well as combed. Worsted yarn is now largely spun on the mule frame, while milling or felting is a process done in all degrees—woollen being sometimes not at all milled, while to some worsteds a certain milled finish is given. The fundamental distinction between the two rests in the crossing and interlacing of the fibres in preparing woollen yarn—an operation confined to this alone among all textiles, while for worsted yarn the fibres are treated, as in the case of all other textile materials, by processes designed to bring them into a smooth parallel relationship to each other.

Woollen yarn manufacture.

To obtain a sliver which can be satisfactorily spun into a typical woollen thread the following operations are necessary: willowing, oiling and blending, teasing, carding (two or three operations), condensing and roving. Spinning upon the woollen mule completes the series of operations all of which are designed to lead up to the desired result. Of the foregoing operations the carding is perhaps the most important as it is certainly one of the most interesting. At the same time it must be fully realized that deficiencies in any one of these operations will result in bad work at every subsequent process. For example, let an unsatisfactory combination of materials be blended together and there will be trouble in both carding and spinning. The roving operation included above is not always necessary. In the old days, if a really fine thread were required, roving was absolutely necessary, as the carder could not turn off a sliver fine enough to be spun at one operation. To-day, however, with the "tape" condensers, such fine slivers can be turned off the condenser that there is no difficulty in spinning directly to the required count. In some few cases, however, it may be cheaper to rove than to condense fine; again, certain physical characteristics appertain to the roved thread, as distinct from the condensed thread, which may occasionally be of use to the cloth constructor.

Blending and oiling.

At the beginning of the 19th century woollen cloths were made of wool—some of them of the very finest wool obtainable. To-day woollen cloths are made from any and every kind of material, of which the following are the most important: noils (botany, cross-bred, English, alpaca and mohair), mungo, shoddy, extract, flocks, fud (short mill waste), cotton sweeping, silk waste, &c., &c.; in fact it is said that anything which has two ends to it can be incorporated into a woollen thread and cloth. It does not follow, however, that all woollen cloth is cheap and nasty. On the contrary the west of England still produces the finest woollen fabrics of really marvellous texture and beauty, and Batley, Dewsbury, &c., produce many fabrics which are certainly cheap and yet anything but nasty. The first essential for blending is that the materials to be blended should be fairly finely divided. This is effected by passing each material, if necessary, through the willow or through the "fearnaught"—a machine coming between the willow and card—prior to beginning the "blend-stack." Sometimes it may be that a blending of different colours of wools to obtain a definite "colour mixture" is necessary, more often it will be a blending of various materials, such as noils, mungo, cotton, &c., to obtain a cheap blend which may be spun into a satisfactory warp or weft yarn. The blender proceeds as follows: first a layer of No. 1 material—say wool—is spread over the required area on the floor; it is then lightly oiled. A layer of No. 2 material—say noils—is now added to the first layer; then another layer of wool with rather more oiling; then No. 2, then No. 1 with still more oil until all the material is built up into layers in the stack. The stack is now beaten down sideways with sticks, and then the more or less mixed mass is passed through the willow and fearnaught still further to mix it prior to carding, where the true and really fine mixing takes place. After passing through the fearnaught the material is sheeted and left to "mellow," this no doubt consisting in the oil applied distributing itself throughout the material. If wool and cotton are blended together the wool must be oiled first, or the blend will not work to the greatest advantage. The oil may be best Gallipoli olive oil—which should not turn rancid—but there are many good oils—and unfortunately many bad oils—placed on the market at a reasonable rate which the really skilled judge may use to advantage. The percentage of oil varies from 2 % to 10 %—this remark applies both to the woollen and worsted trades—and there is no guide as to the amount required, saving and excepting experience, observation and common sense. Automatic oiling arrangements have been applied in the woollen trade with only a moderate amount of success, the sprinkling of the oil by means of a watering-can on the stack, made as described above, still being most in favour. The oil serves to lubricate the fibres, and to render them more plastic and consequently more workable, and to bind the fibrous mass together and thus prevent "fly" during the passage through the cards.

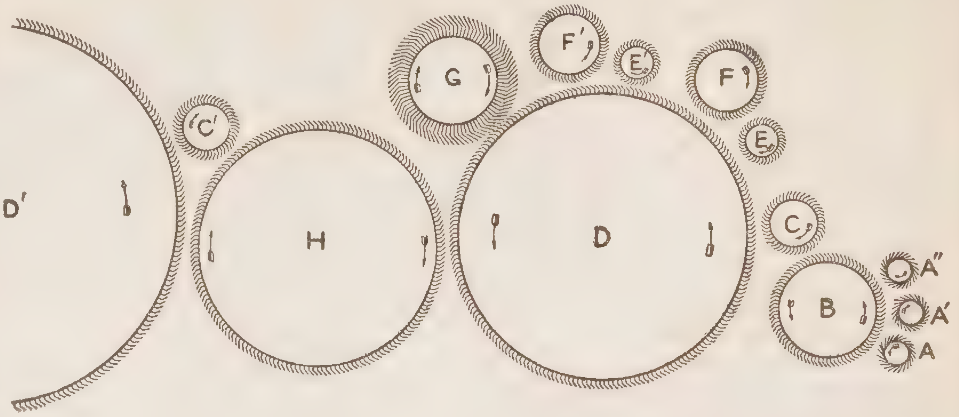


FIG. 8.—Sectional View of Carder; illustrating the principles of carding.

Carding.

Carding was originally effected by hand, two flat boards with convenient handles, covered with teeth or card clothing, serving as a means of teasing out lock by lock, fibre by fibre, reversing root to tip and tip to root, so that a perfect mixing of the fibres resulted. It was but natural that, when an attempt was made to render the carding operation more mechanical, the operation should be converted into a continuous one through the adoption of rollers in place of flats. Flats combined with rollers still maintain their position in cotton carding, but in wool carding the pure roller card is employed. The factors of carding are size of rollers, speeds of rollers, inclination of teeth and density of card clothing. Probably no operation in the textile industries is so little understood as carding. Thus the long wool carder would think a man an idiot who suggested the running of the teeth of the various cylinders actually into one another, while the short mungo carder regularly carries out this idea, and so on. The underlying principle of carding, however, is shown in fig. 8, in which a sectional drawing of part of a card is given. The wool is carried into the machine on a travelling lattice and delivered to the feed rollers A, A′, A″ of which A and A″ in turn are stripped by the licker-in B working at a greater speed point to smooth side. This in turn is stripped by the angle stripper C again working at a greater speed point to smooth side, which in its turn is stripped by the swift D—the "carrying-forward" and swiftest carding cylinder in the machine. The swift carries the wool forward past the stripper E—which as a matter of fact is stripped by the swift still working point to smooth side—into the slowly retreating teeth of the first worker F, which, being set a fair distance from the swift, just allows well laid-down wool to pass, but catches any projecting and uncarded staples. The worker in its turn is stripped by the stripper E′, which in turn is stripped by the swift as already described. The passage of the wool forward through the machine depends upon its being carried past each worker in turn. Thus from beginning to end of a machine the workers are set closer and closer to the swift, so that the last worker only allows completely carded wool to pass it. Immediately on passing the last worker F′ the wool is brushed up on the surface of the swift by the "fancy" G—as a rule the only cylinder whose teeth actually work into the teeth of the swift and the only cylinder with a greater surface speed than the swift. The swift then throws its brushed-up coating of wool into the slowly retreating teeth of the doffer H, which carries it forward until angle stripper C′ strips the doffer, to be in its turn stripped by swift D′ and so on. The speeds of the cylinders are in the first place obviously dependent upon the principle of carding adopted, the greater speed always stripping (save in the case of the fancy). As to whether the speed shall be obtained by actual revolutions or by a larger diameter of cylinder depends upon the nature of the wool to be carded (long or short), the part which each cylinder has to play in the card, and upon the question of wear of clothing and power consumed. As a rule the strippers are all driven from a smaller circumference of the swift to obtain conveniently the necessary reduction in speed, and the slowly revolving workers are chain driven from the doffer, which indirectly receives its motion from the swift. The principles involved in the relative inclinations of teeth are very apparent, but the principles involved in the relative densities of teeth on the respective cylinders are again much involved and little understood.

A complete scribbler or first card engine consists of a breast, or small swift, and two swifts with the accompanying workers, strippers, fancies, doffers, &c. The wool is stripped from this card as a thin film by means of the doffing comb. This is usually weighed on to the next machine—whether intermediate or condenser—a given weight giving a definite count of condensed sliver. Should an intermediate be employed, there must be an automatic feed, taking the wool, as stripped from the last doffer of the intermediate, and feeding it perfectly evenly on to the feed sheet of the condenser. The condenser is usually a one-swifted card, the only difference in principle being that, whereas the sliver comes out of the scribbler or intermediate in one broad film, it is broken up into a number of small continuous slivers or films, each one of which will ultimately be drafted or drawn out and twisted into a more or less perfect thread. These slivers—which are delicate and pith-like in substance—are wound on to light bobbins, and these bobbins are placed on the mule for the final roving and spinning operations. There are many forms of condensing mechanisms such as the single-doffer, the double-doffer and the tape-condensers, but their construction is too complex to be described here. Whatever the type may be, the result is that noted above, but it should be noted that the tape enables a much finer sliver to be taken from the card than is possible with either the single- or double-doffer condenser.

Mule spinning.

The principles involved in mule spinning are comparatively simple, but the necessary machinery is very complex; indeed it is questionable if a more ingenious machine than the mule exists. The pith-like slivers received from the card-loom must be attenuated until the correct count of yarn is obtained; they must be twisted while this attenuation or drafting is in process, otherwise they would at once break; and after being attenuated to the required fineness the requisite number of turns must be inserted. Great stress must be laid on the effects of what is termed the "drafting-twist" noted above; it is probably this simultaneous drafting and twisting which develops the most pronounced characteristics of the woollen yarn and cloth, and differentiates it entirely from the worsted yarn and cloth. The mule (see fig. 9) consists of the delivery cylinders A, upon which the sliver bobbins B from the condenser are placed, which deliver the slivers as required to the front delivery rollers C (these rollers controlling perfectly the delivery of sliver for each stretch of the carriage), and the carriage EE carrying the spindles which may be run close up to the front delivery rollers and about two yards away from them to effect the "spin," which is of an intermittent character. The spindles D are turned by bands passing round a tin drum K in the carriage, but this motion, and every other motion in the mule, is controlled perfectly from the headstock. In brief, the operation of spinning is as follows: as the carriage begins to recede from the delivery rollers these rollers deliver condensed sliver at about the same rate as the carriage moves out, the spindles putting in a little twist. When the carriage has perhaps completed half its traverse (say 36″) away from the front rollers these suddenly stop delivering the condensed sliver, the carriage goes more and more slowly outwards until it completes its traverse, drafting the sliver out to perhaps double the length. This drafting could not be effected but for the "drafting-twist," which, running into the thin parts of the yarn during drafting, strengthens them and thus from beginning to end equalizes the thread. Upon the completion of drafting the spindles are thrown on to "double speed" to complete the twisting of the 72″ of yarn just spun as rapidly as possible, the carriage being allowed to run inwards for a few inches, to allow for the take-up due to twisting. The mule now stops dead, backs-off the turns of yarn from the bottom of the spindle to the top, the faller H wire falls into position to guide the thread on to the spindle to form the required cop G, and the counter-faller I wire rises to maintain a nice tension on the yarn. The carriage now runs in, the spindles being revolved to wind up the yarn, and, in conjunction with the guiding on of the faller wire, builds up a firm cop or spool, as the case may be.

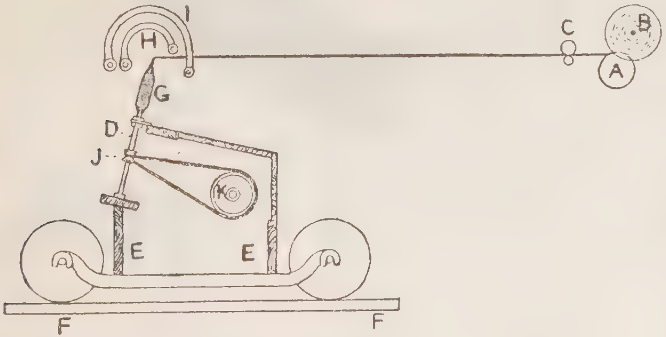


Fig. 9.—Sectional View of the Woollen Mule.

Woollen mules are made with several hundred spindles and of varying pitch to suit particular requirements. Thus if the mules are to follow a set of say three carders with a tape condenser, and are required to spin fine counts, the pitch of the spindles may be much finer than ordinary, but a greater number will be required to work up the sliver delivered by the set of machines. There are many other details which require careful consideration; the inclination of the spindles, for example, must be suited to the material to be spun. And when all the mechanical arrangements are perfect there is still the necessity of correct judgment as to the qualities of the blend in hand, for in this case perhaps more than in any other the machine must be adjusted to the material and not the material to the machine.

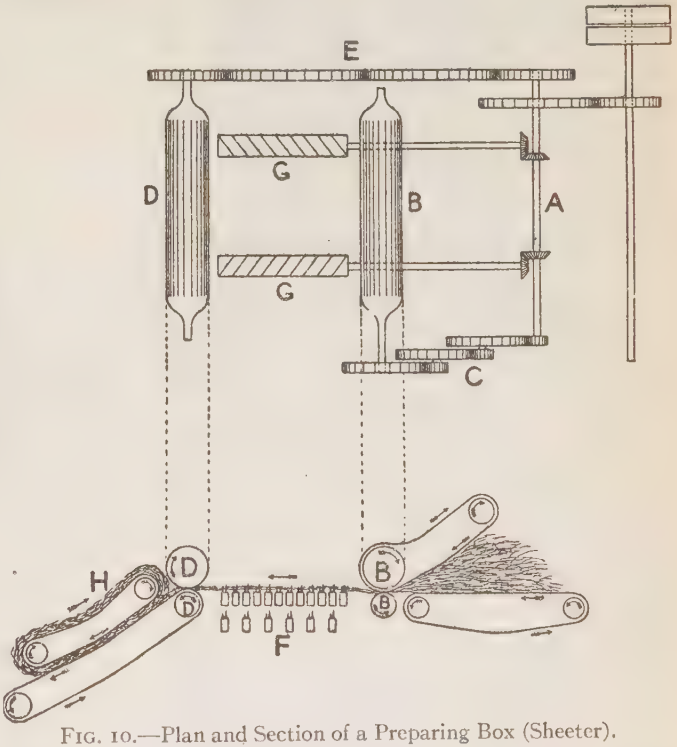


Fig. 10.—Plan and Section of a Preparing Box (Sheeter).

A is the back-shaft receiving its motion from the driving shaft upon which are the pulleys. This back-shaft A drives the back-rollers B at a slow speed by the reducing train of wheels C; also the front rollers D at a much quicker speed through the train of wheels E, and the fallers F at an intermediary speed by means of the levels and screws G. G. The wool is "made up" on the feed sheet and on emerging from the front rollers is built up layer by layer into the lap H, which is finally broken across and feeds up at the next machine.

The yarn as delivered by the mule is "single" and will serve as warp or weft for the great bulk of woollen cloths, warp being as a rule twisted harder than weft. Sometimes for strength, sometimes for colour, however, it will be necessary to twist two or more of these single strands together. This is best effected on a twisting frame of the ring type, which consists of delivery rollers, to deliver a specified length of yarn in relationship to the turns of the spindles, and the spindles, which serve to put in twist and to wind the yarn upon the bobbin or tube, which they carry by reason of the retarding action of the traveller. Fancy twists such as knops, loops, slubs, &c., may also be produced if the frame is fitted up with two pairs of delivery rollers and two or three special but simple appliances.

Worsted yarn manufacture.

The essential feature of a worsted yarn is straightness of fibre. Prior to the introduction of automatic machinery there was little difficulty in attaining this characteristic, as long wool was invariably employed and the sliver was made up by hand and then twisted. With the introduction of Arkwright's "water frame" or "throstle" the necessity for prepared slivers became apparent, and with the later introduction of cap and mule spinning the necessity for perfectly prepared slivers has been so accentuated that the preparatory machinery has quite exceeded the actual spinning machine in extent and complexity. To-day there are three distinct methods of producing worsted yarn.

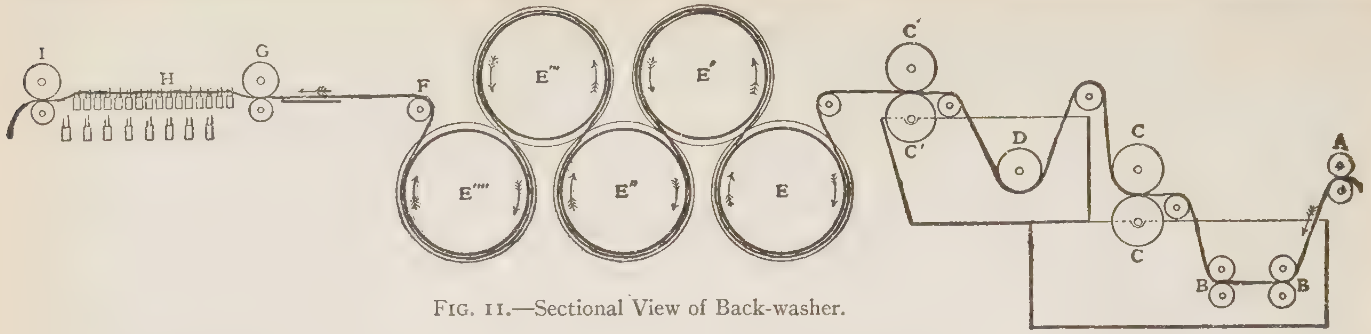


FIG. 11.—Sectional View of Back-washer.

A are the delivering rollers, B, B are the immersing rollers in the first tank, C, C are the press rollers to squeeze out superfluous liquors, D is the immersing roller in the second tank, and C′, C′ are the press rollers for the second tank. Drying cylinders E to E″″ may be arranged as "live-heat" cylinders, as secondary heated cylinders or as air drying cylinders. The roller F directs the slivers into the back rollers G of the gill-box, which in turn delivers up the slivers to the fallers H, which in turn delivers the wool to the front rollers I.

Firstly, there is the preparing and spinning of the true worsted thread, this being made from long English and colonial wool. In this class should also be included mohair and alpaca. Secondly, there is the preparing and spinning of what are known as cross-bred and botany yarns, these being made from cross-bred and botany wools. Thirdly, there is the preparing and spinning of short botany wools on the French system. There is a fourth class of worsted yarns, principally carpet and knitting yarns, which are treated in a much readier manner than any of the foregoing, but as the treatment is analogous—with the elimination of certain processes—to the second of the foregoing, it is not necessary to refer specially to it.

To obtain a sliver or "roving" which can be satisfactorily spun into a typical worsted thread the following operations are necessary:—preparing (five or six operations), back-washing, straightening, combing, straightening and drawing (say six operations), and finally spinning on the flyer frame.

Preparing.

After long wool has been scoured and dried it is necessarily considerably entangled, and if it were to be combed straight away a large proportion of the long fibres would be broken and combed out as "noil" or short fibre. To obviate this the wool is fed as straight as possible into a sheeter gill-box; after this it passes through other two sheeter gill-boxes, then through say three can gill-boxes. As shown in fig. 10 the main features of a preparing or gill-box are the following: the feed sheet upon which the wool is "made up," the back rollers B which take hold of the wool and deliver it to the fallers F which, working away from the back rollers more quickly than the wool is delivered, comb it out. The fallers in turn deliver the wool to the front rollers D, which, taking in the wool more quickly than the fallers delivering it, again draft and comb it, but with a reversing of the former combing operation. The wool emerges from the front rollers as thin attenuated continuous fibre about 12 in. wide, which is wound upon an endless leather sheet H from which the box takes its name. When a sliver of sufficient thickness has been wound upon the sheet, it is broken across and fed up at the next gill-box. The fourth gill-box delivers into cans instead of on to a sheet. A number of cans are then placed behind the fifth box and the slivers from these fed up into the back rollers, and similarly with the sixth. The primary object of "preparing" or gilling is to straighten and parallelize the fibres in the sliver. This is effected by means of the combining or doubling and drafting to which the slivers are subjected. In addition to this, however, a level sliver suitable for combing is formed by the combined action of the drafting and doubling which has taken place at each box.

Back-washing

Oil will have been added to the wool at the first preparing-box to cause the fibres to work well. Were this all, there would perhaps not be the necessity for back washing. But the slivers during their passage through the preparing-boxes become sullied naturally, and in addition, owing to the opening out of the locks of wool, dirt which was not "got at" in the scouring now works out and further sullies the slivers. It is consequently necessary to scour the slivers again, this being effected in what is termed a back-washing machine. This machine as shown in fig. 11 usually consists of two scouring tanks with immersing rollers, drying cylinders, a gill-box and oiling motion. The slivers on emerging from this machine should be clean, fairly straight and in good condition for combing. Their condition may be further improved by passing them through

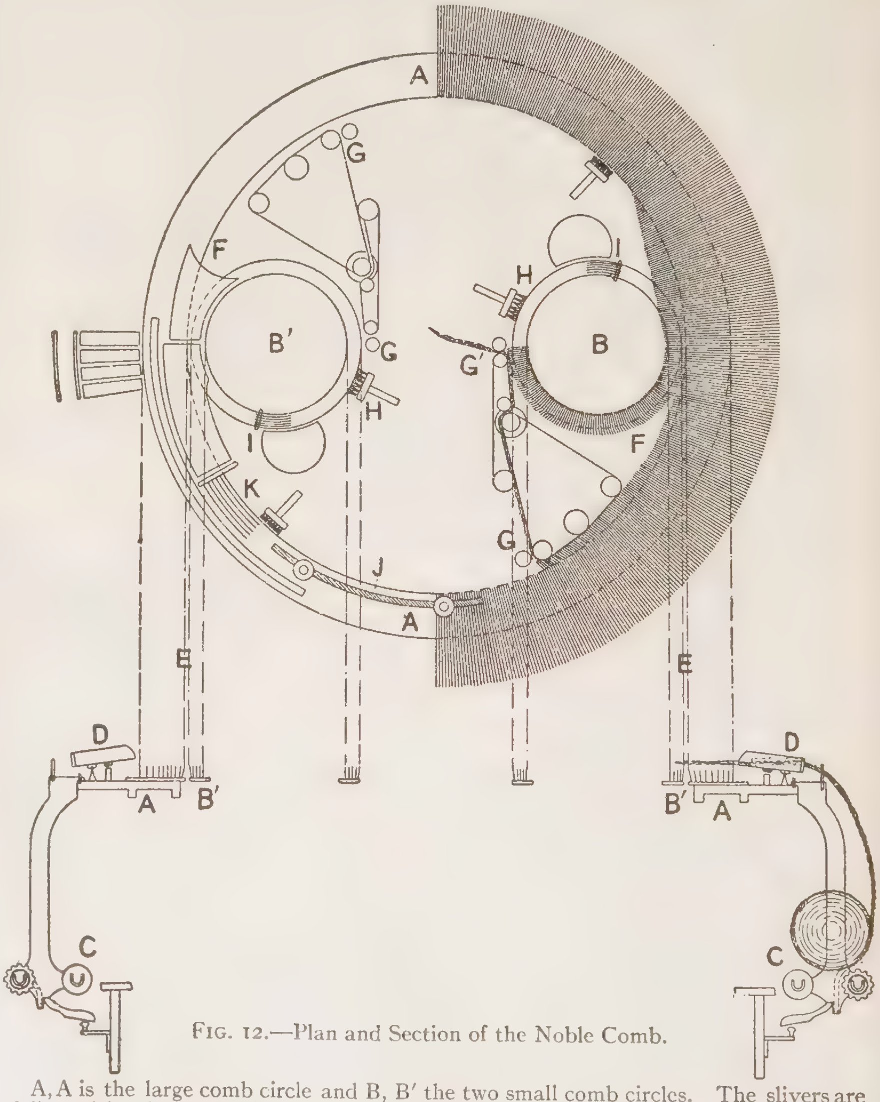


FIG. 12.—Plan and Section of the Noble Comb.

A, A is the large comb circle and B, B′ the two small comb circles. The slivers are delivered by the mechanism C to the feed boxes D, being thrown across the pins of the large and small circles at position E. A stroke at F suitably directs the fringes of fibre as the circles separate and the combed fibres are taken hold of by drawing-off rollers G and G′ and combined to form the "top." The brushes H, H and the noil knives I clear the small circles of the "noil." The feed knife J in conjunction with the inclined planes at K are instrumental in feeding a previously directed length of sliver over the two circles as they practically touch one another at the point E, and so the process is continued.

one or two more gill-boxes, prior to combing, to ensure straightness of fibre and even distribution of the lubricant.

Combing.

Prior to the mechanical era wool was combed immediately after scouring; there was no preparatory process. As a matter of fact the first combing process took the place of the processes just described and was termed "straightening," the "combing proper" following. Prior to the invention of a really satisfactory mechanical comb, between 1850 and 1860, the combing operation was the limitation of the worsted trade. English wools could be satisfactorily combed by hand, and perhaps the results of combing botany or fine wools by hand were satisfactory so far as quality of result was concerned, but the cost was largely prohibitive. The history of the colonial wool trade is inextricably bound up with the combing industry. How eventually botany wools were combed by machinery and how the wool industry was thereby revolutionized can only be briefly referred to here. About 1779 Dr Edmund Cartwright invented two distinct types of combs, the vertical and the horizontal circular. The former type was developed on the continent by Heilmann and others, and has only within the last five years taken its rightful place as a successful short wool comb in this country. The latter type was worked upon by Donisthorpe, Noble, Lister, the Holdens and others, and largely through the "driving" force of Lister (later Lord Masham) was made a truly practical success about the year 1850. Latter-day combs of this type may be readily grouped under three heads. The Lister or "nip" comb is specially suitable for long wools and mohair and alpaca. The Holden or square-motion comb is specially suited for short and very good quality wools. The last type, the Noble, is the most popular of all and, by a change of large and small circles, may be adapted to the combing of long, medium or short wools. As the great bulk of crossbred and a considerable proportion of botany wool is combed upon the Noble comb a brief description is here called for. The object of all wool combing is to straighten the long fibres and to comb out from the slivers treated all the fibres under a certain length, leaving the long fibres or "top" to form the sliver which is eventually spun into the worsted yarn. The Noble comb, which so effectually accomplishes this, consists in the main of a large revolving circle A inside which revolve two smaller circles B, B′ as shown in fig. 12, each of which touches the larger comb circle at one point only. At this point the slivers of wool to be carded are firmly dabbed into the pins of both the large and small circles. As the circles continue to revolve they naturally begin to separate, combing the wool fibres between them, the short fibres or "noil" being retained in the teeth of both small and large circles, the long fibres hanging on the inside of the large circle and on the outside of the small circle. A stroker or air blast at F now directs these long fibres into the vertical rollers, G and G′, shown here in plan, which draw them out, thus separating them from the short fibres. There are at least four pairs of drawing-off rollers in a comb, and the fibres drawn off by each—be it noted continuously—are united to form a sliver which is passed through a revolving funnel into a can. The short fibres, or "noil," are lifted out of the pins of the small circle by "noil knives." The continuous slivers, the ends of which remain in the pins of the large circle after the drawing-off rollers have been passed, are now lifted up until these ends are above the pins, at the same time an additional length of sliver being drawn into the comb, so that, as they reach the second small circle, they are ready to be again dabbed into the pins of both circles and the combing operation repeated. Thus the combing on a Noble comb is absolutely continuous. All the movements of this machine—with the exception of the dabbing-brush motion—are circular, so that mechanically it is an almost perfect machine. As illustrating the extent of the combing industry, it is interesting to note that even the making of dabbing-brushes is a separate and by no means unimportant trade.

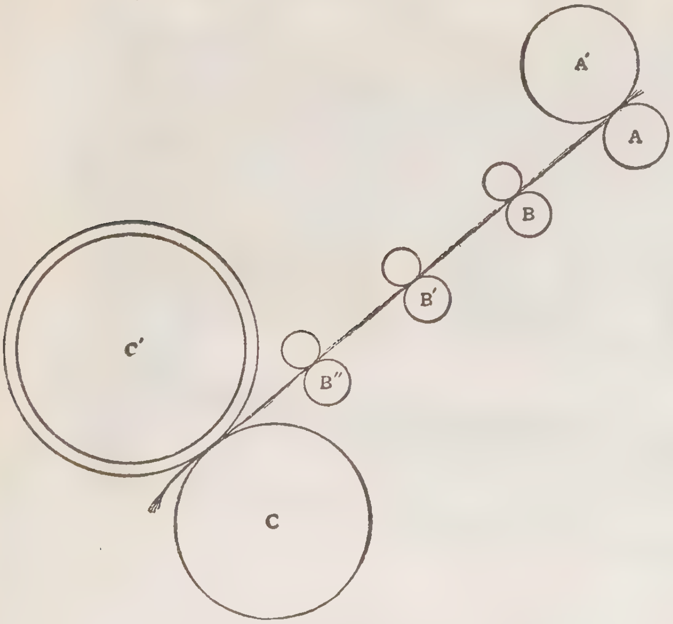


FIG. 13.—Section of Wool Drawing Rollers.

A, A′ are the back-rollers in a drawing box of which A is positively driven and A′ driven by friction which may be varied at will. Carriers B, B′, B″ simply control the fibres of which the sliver is composed during drafting. The front rollers C, C′—of which C is positively driven and C′ driven by friction—running at a greater speed than A, A′ draft or elongate the slivers as required. The carriers B, B′, B″ should be speeded to run at a suitable rate to assist the drafting operation, more by support than by direct aid. Rollers A, A′ must hold the sliver, hence they are fluted. Rollers C, C′ must pull the sliver somewhat severely, hence roller C′ is covered with leather. The yarn delivered by the front rollers is slightly twisted and wound into a double-headed bobbin of convenient size on the "flyer-system."

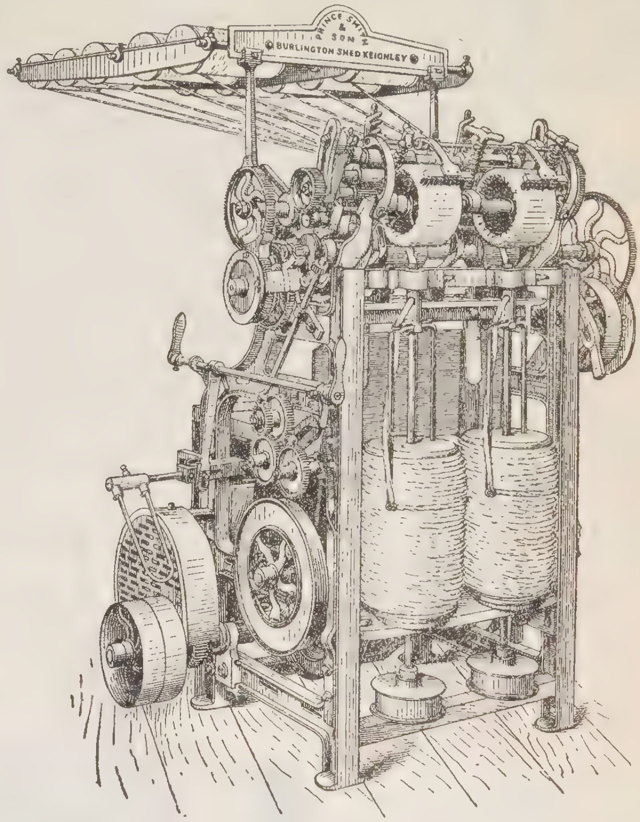


FIG. 14.—Two-Spindle Drawing-Box.

After combing it is usual to pass the "top" through two gill-boxes termed "finishers." The last of these boxes, and often the first, delivers the "top" in the form of a ball, thus it is often spoken of as a "balling gill-box." This stage marks one of the great divisions of the worsted trade, the comber taking the wool up to this point, but now handing it forward in the shape of top to the "worsted spinner," who draws and spins the slivers into the most desirable worsted yarns.

Drawing.

English tops are usually prepared for spinning by seven or eight operations. Three of these operations are effected in gill-boxes of a somewhat similar type to the preparing-box, only lighter in build. The remaining four are drawing-boxes, *i.e.* as shown in figs. 13 and 14, they consist of back and front rollers with small carrying-rollers—not gills—to support the wool in between. Thus an English set of drawing usually consists of a single-can gill-box, a double-can gill-box, a two-spindle gill-box, a four-spindle drawing-box, a four-spindle weigh-box, a six-spindle drawing-box, two six-spindle finishers and three thirty-spindle rovers. About fifteen flyer frames of 160 spindles each will be required to follow this set, although the balance varies partly in accordance with the counts spun to, in this case 1/32's English being the standard.

The object of drawing is to obtain firstly a level sliver from which an even thread may be spun, and secondly to reduce the comparatively thick top down to a relatively thin roving from which the required count of yarn may be spun. Of course parallelism of fibres must be retained throughout, so far as possible. To accomplish these objects doubling and drafting is resorted to. Thus the ends put up at the back of the above boxes will be 6, 6, 4, 4, 3, 3, 2 respectively, while the drafts may be 5, 6, 8, 8, 6, 9, 9 approximately.

As the drafts markedly preponderate over the doublings, so in exactly this proportion will the sliver be reduced in thickness.

Spinning.

The flyer spinning frame is very similar to the drawing frame, consisting of back rollers, carriers and front rollers, with the necessary spindle and flyer to put twist into the yarn and to wind it upon the bobbin. From the two-spindle gill-box to the spinning frame the spindle, bobbin and flyer combination is employed with the object just mentioned. From fig. 15 the action of this combination will be clearly understood. Drafting takes place as usual between the back and front rollers, the carriers controlling the yarn between the two. On emerging from the front rollers the yarn usually passes through an eyelet, to centre it over the centre of the spindle; it then takes a turn or two round the flyer leg, through the twizzle or eyelet on the flyer and on to the bobbin F. The flyer may be freely rotated by means of the wharl J and through the spindle G upon the top of which it is screwed. The bobbin fits loosely over the spindle and rests upon the lifter plate I; this latter, being controlled by the lifter mechanism, slowly raises and lowers the bobbin during the "spin" past the fixed plane of delivery of the yarn, *i.e.* the eyelet of the revolving flyer. Now, if for one moment it be considered that the bobbin may not revolve on the spindle but may be slid up and down by the lifter motion, then, if the front rollers deliver the necessary yarn, the flyer will wrap it in successive layers upon the bobbin—but no twist will be inserted. On the other hand, if the bobbin is perfectly free upon the spindle and the front rollers cease delivering yarn, then the flyer, by means of the yarn, will pull the bobbin round at the same speed as it goes itself, and the yarn will be twisted but not wound upon the bobbin. By obtaining an action in between these two extremes both twisting and winding on to the bobbin is effected. The speed of the bobbin is suitably retarded by washers placed between it and the lifter plate, so that it just drags sufficiently to wind up the yarn "paid out" by the front rollers. The turns per inch are in proportion to the yarn delivered and the revolutions of the flyer. Thus if, while 1 in. of yarn is delivered, the flyer revolves twelve times the turns per inch will be approximately twelve. This in brief is the theory of the spindle, flyer and bobbin action.

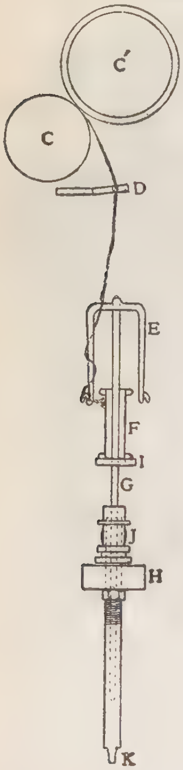


Fig. 15.—Section of Flyer Spindle.

C, C′ are the front rollers of a drawing or spinning frame, delivering the sliver to a centring board D, containing an eye for each sliver, from which the sliver passes to the flyer E and finally to the bobbin F, which rests on the lifter-plate I and is traversed up and down by this plate according to the length of bobbin employed. The flyer E is screwed on to the spindle G which is suitably held by the sheath, bolster, &c., shown at H, and in the footstep at K. The spindle is turned by a tape passing round the wharl J and thence to an ordinary tin-drum.

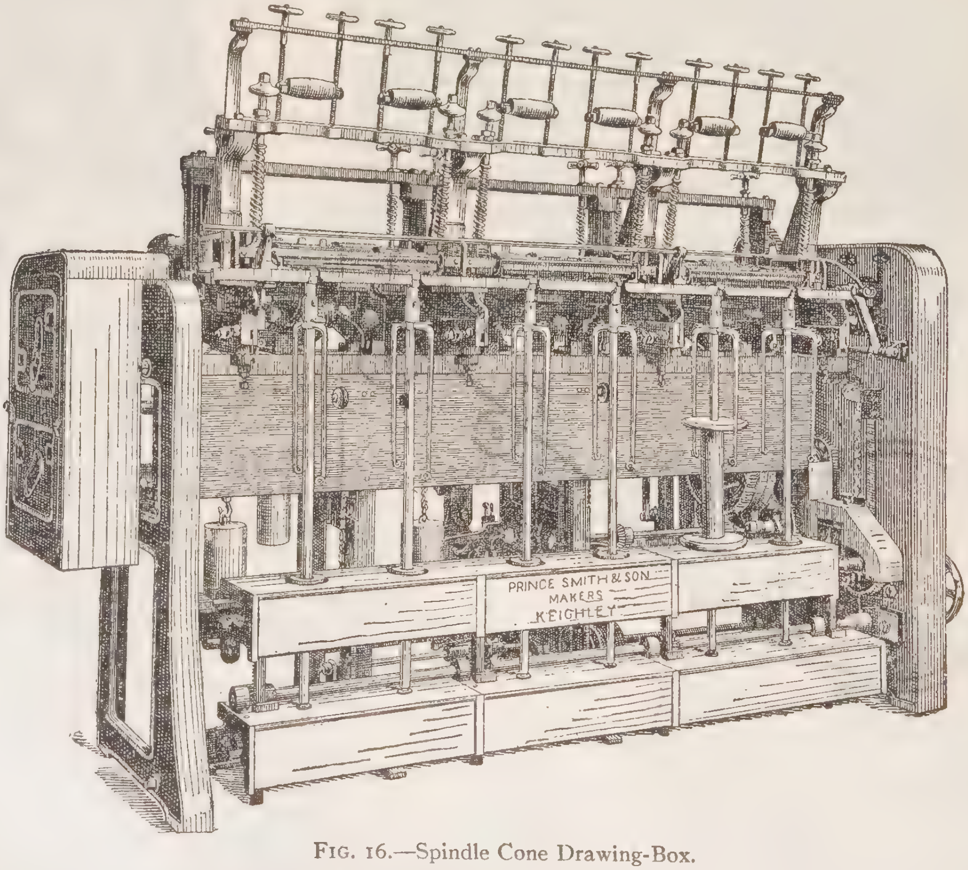


Fig. 16.—Spindle Cone Drawing-Box.

Carding of medium and short wools for worsted yarns.

Wools not more than 7 in. long are usually prepared for combing by the operation of carding. On first thought it might be imagined that carding would result in broken fibres and a poor yield of top. That this is not so is evident from the fact that there is a tendency to card wools from 7 to 10 in. long, this tendency being due to the relative cheapness of carding as compared with preparing. If long wools were fed directly on to a swift, no doubt serious breakage of fibre would occur, but it is customary to place before the first swift of a worsted card a series of four opening rollers and dividers—with their accompanying "burring rollers"—to open out the wool gradually, so that when it eventually reaches the first swift it is so opened out that further opening out instead of breakage occurs. Some carders use a breast or small swift in place of those opening rollers—mostly on account of economy. The swift is usually surmounted with four workers and strippers and is very similar to the woollen carder, save that the workers and doffer are larger, thereby effecting more of a combing action and working economically by reason of the greater wearing surface brought into play. As botany wool is usually brought directly from the wash bowl to the feed sheet of the card, it is usual to clothe the first cylinders with galvanized wire clothing.

Combing medium and fine wools.

After the carding the wool is back-washed and gilled—on similar lines to English wool—and then is ready for combing. The largest combers of botany wools, Messrs Isaac Holden & Co., employ the square-motion comb, in fact this comb is known in the trade as the Holden comb. Other combers, however, almost without exception employ the Noble comb with a fine "set over," *i.e.* fine spinning of the comb circles. After combing, the tops are "finished" by being passed through two finisher-boxes, the last of which "balls" the tops ready for marketing.

Drawing and spinning.

Short wools are drawn and spun on very similar lines to the longer wools, save that the boxes are more in number and are in some cases lighter in build. The boxes usually employed in a botany set are as follows: two double-head can gill-boxes, two two-spindle gill-boxes, a four-spindle drawing-box, a six-spindle weigh-box, an eight-spindle drawing-box, two eight-spindle finishing-boxes, two twenty-four-spindle second finishers, three thirty-two-spindle dandy reducers, ten thirty-two-spindle dandy rovers, with ten two-hundred-spindle cap spinners to follow.

The doublings as a rule are about 7, 6, 6, 6, 5, 5, 5, 4, 4, 2 and the drafts 5, 6, 6, 7, 7, 7, 8, 8, 8 at the respective boxes, an endeavour as a rule being made to obtain a roving of which 40 yds. = 2 drams, as this is the most convenient size for being spun into fine botany count of yarn.

Following the lead of the cotton trade endeavours have been made to positively control the driving and speed of both flyer and bobbin in all the drawing frames of such sets as that described above. Such control is usually effected by a pair of cones, from which this system has taken its name, viz. “ cone ” drawing. In fig. 16 a usual type of cone drawing-box is illustrated. The chief advantages of this system seem to be the possibilities of employing larger bobbins, and thus obtaining greater production, the consumption of relatively less power, and more particularly the production of a softer sliver with less twist, partaking more of the character of a French roving.

Spinning is usually effected upon the cap frame (see fig. 17)—a frame in which the bobbin, resting upon a fixed spindle, is itself driven at say 5000 revolutions per minute to put in the twist, while the friction of the yarn on the cap which covers the bobbin enables the bobbin to wind up upon itself the yarn as delivered by the front rollers. The weakness and the strength of the cap frame is that to make reasonably hard bobbins the bobbins must be driven at a high speed.

French drawing and spinning.

The French are noted for a special system of worsted spinning, which, producing soft botany yarns of a marked type, is worthy of more than passing comment. The preparation is very similar to the preparation of botany yarns for the English system save that as a rule the order of the operations are carding, gilling, combing, back-washing and finishing. The characteristic features of the method lie in the subsequent drawing and spinning. The drawing-box as shown in fig. 18 consists of back rollers, porcupine or revolving gill, front rollers, rubbers and winding-up arrangement. Thus there is no twist inserted, the slivers being treated softly and openly right away through the processes. A set of this type usually consists of two gill-boxes preparing for combing, comb, back-washing machine and two finishing gill-boxes, first drawing frame, second drawing frame, the slubbing frame, the roving frame and the self-acting mule. After leaving the last box as a fine soft pith-like sliver, spinning is effected upon the worsted mule. The main differences between the worsted and the woollen mule are firstly, the worsted mule is fitted with preliminary drafting rollers, and secondly, there is little or no spindle draft. As the mule is an intermittent worker it is natural to contrast it with the cap frame, which runs continuously. What the real advantage is it is difficult to say, but the mule-spun worsted yarn trade is becoming yearly of more importance, and it is pleasing to note that English spinners are at last doing a fair share of this business.

Doubling, twisting, etc.

Upon whichever system the yarns have been spun it will frequently be necessary to twofold them and sometimes to three- and fourfold them. Again the fashion sometimes runs upon fancy twists, and then it is necessary to be able to produce the various styles of cloud, loop, curl, knop, &c., yarns. Twofolding is done upon the flyer, cap and ring frames. The main difference between the cap and the ring frame is that in the latter a small bent piece of wire, termed a traveller, revolved round a ring by the pull of the spindle through the yarn, serves as the retarder to enable the bobbin to wind the yarn, delivered by the front rollers on to itself (see fig. 19). Fancy twisters are almost universally on the ring system.

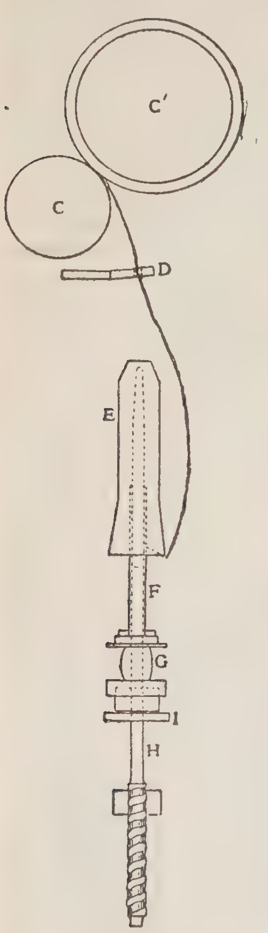


FIG. 17.—Section of Cap Spindle.

C, C′ are the front rollers of a cap spinning frame delivering the yarn through the centring board D under the edge of the cap E to the bobbin F, which rests upon the tube and wharlG, which in turn rest upon the lifter-rail I, which effects the necessary traversing. The spindle H is simply screwed into the framework, and does not revolve, but simply acts as a support for the cap and as a centre of motion for the tube and bobbin.

Yarns.

Yarns are placed on the market in eight forms, viz. in hank, on spools, on paper tubes, on bobbins, on cops, in cheeses, in the warp ball form and dressed upon the loom beam. Thus the manufacturer can order the yarn which he requires in the form best suited to his purpose.

Weaving.

Although in some few cases special means must be employed for the weaving of woollens, worsteds and stuff goods, still the main principles are the same for all classes of goods (see WEAVING). Attention may here be concentrated on the characteristic principles of woollen and worsted manufacture.

Finishing processes.

The characteristic feature of wool and of wool yarns and cloths is the quality of “ felting.” This quality has always been made use of in woollen cloths, but in worsted cloths, until comparatively recently, it has been largely ignored. To-day, however, cloths are made, ranging from the truest woollen to the typical worsted, of which it would be impossible to indicate the type of yarn employed without very careful analysis. As it is obviously impossible to give here every variety of finish employed, the two typical styles for woollen and worsted cloths are dealt with in detail, and further to elucidate the matter the finishing of a Bradford “ stuff ” or “ lustre ” piece is also given in outline.

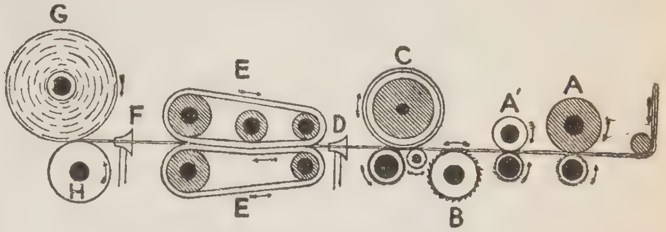


FIG. 18.—Section of French Drawing-Box.

A, A′, delivery rollers which control the slivers during the drafting operation. B is the porcupine (or circular gill) and C are the front drafting rollers. D is the funnel through which the slivers pass to the consolidating rubbers E, E, F is a second funnel and G is the condensed sliver wound up at a uniform rate on the roller H.

Woollen cloth finishing.

The fabric on leaving the loom is first mended and then scoured. The operation of scouring is effected in a “ dolly,” and must thoroughly clear the piece so that it is free to take the desired finish. The piece is now soaped and “ milled,” *i.e.* felted. Milling may be effected either in the stocks or in the milling machine. The stocks, the main features of which are huge hammers which are caused to fall or are driven positively into the cloth, exert a bursting action eliminating the thread structure. The milling machine acts more by compression, arrangements being made to compress the cloth in length or breadth at will. After milling scouring follows to clear the cloth thoroughly of the milling agents previous to the finishing proper. The cloth is now taken in a damp state to the tentering machine and, being hooked upon a frame running into a heated chamber, is stretched in width and dried in this condition. Raising follows, this being effected by subjecting the surface of the fabric to the action of “ teazles ” fixed on a large revolving cylinder, the whole machine being termed a “ gig.” After raising the fabric is “ cropped ” by being passed over a blade near which revolving knives work, on the principle of a lawn-mower, shearing and levelling the piece. Sometimes fabrics are raised wet, especially if a velvet finish is required. Brushing follows to clear the piece of all stray fibres. The fabric is now ready for “ crabbing,” which consists in winding it tightly on to a perforated roller through which steam may be blown or upon which the piece may be boiled. The pieces are then rewound and the operation repeated at least once, to obtain even distribution of finish. Being now ready for pressing, the fabric is cuttled, usually with press papers between each cuttle, and placed in the hydraulic

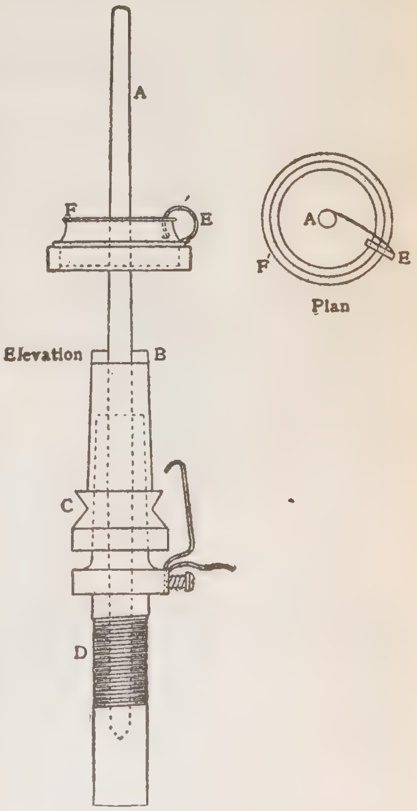


FIG. 19.—Section of Ring Spindle.

A is the spindle suitably shaped to receive the bobbin at B, with a wharl for turning at C, running in the specially designed receptacle D, which may be screwed firmly into the spindle rail. The traveller E is drawn round the ring F by the spindle acting through the yarn as shown in the plan. The spindle is a fixture and the ring-rail is traversed to distribute the yarn on the bobbin.

press either hot or cold. After pressing dry steaming is frequently necessary to take away cakiness and a certain false lustre which sometimes develops. Final cuttling completes the finishing operations.

Worsted cloth finishing.

Worsted cloth finishing is very similar to woollen cloth finishing save that some of the operations are less severe. Mending, scouring, milling and tentering are similar. The raising as a rule is effected by brushing, although it is by no means uncommon to raise worsteds on the gig. Cropping, crabbing, pressing and steaming are the same as for woollen fabrics. Of course the real difference between the woollen and the worsted cloth is due to the selection of the right material, to correct roving, spinning and fabric structure: finishing simply comes as a "developer" in the case of the woollen fabric, while in the case of the typical worsted fabric it simply serves as a "clearer," the cloth really being made in the loom. A woollen cloth as it leaves the loom is unsightly and in a sense may be said to be made in the finishing, although it is truer to say "developed" in the finishing: in the case of the worsted cloth it is altogether otherwise.

Lustre finishing.

A cotton warp, lustre weft style, is treated altogether differently from either of the foregoing. It is first crabbed, then steamed, then scoured and dried, then singed by being passed over a red-hot copper plate or through gas jets, then scoured again, and if necessary dyed. It is then washed, dried, then tentered and finally pressed. Of course these operations are applied with discrimination to the varied styles of goods made in the Bradford district. Thus, for instance, the finishing of an "Italian" may be considerably varied from the foregoing, being more complex, while other styles, such as plain all-wool goods, are treated very simply.

Varieties of woollens and worsteds.

It will be gathered from the foregoing remarks that the varieties of wool textures are many and very different in character. This is perhaps realized best by contrasting a heavy melton cloth weighing say 24–30 oz. per yard with a fine mohair texture weighing say 2–3 oz. per yard. None the less remarkable is the difference in appearance of varieties of wool textures. A rough Harris tweed, for example, contrasts strangely with a smooth fine wool Italian. Of course these differences are not created in any one process or merely by the selection of the raw material or yarn. Every process of manufacture must be directed to attain the desired end, and it is well to realize that huge businesses have been built up upon what, by the outsider, would only be regarded as unimportant details.

The principal styles of woollen cloth are tweeds, meltons, Venetians, beavers, doeskins, buckskins, cassimeres and diagonals. The largest class is the tweed, as this ranges from very expensive coatings and trouserings to the cheap styles made of the re-manufactured materials. Tweeds for ladies' wear also form a large class.

The principal styles of worsted cloths are coatings and trouserings, delaines, voiles, merinos, cashmeres, lastings, crêpe-de-chines, amazons, Orleans, lustres of various types (plain and figured), alpacas, Italians, moreens, &c., &c. Many of these are made entirely of worsted yarns, but others are compound so far as material or yarn is concerned. Thus amazons are made from mule-spun worsted warp and a woollen weft. Lustres are made from fine hard spun cotton warp and English or mohair weft, and so on. Perhaps the most interesting point to note is the skill developed by English designers during recent years. Fifty years ago the continental designer ruled the market. To-day the English designer can at least claim an equality with and in some respects is already considered as superior to his continental rival.

Wool tops, yarns and fabrics.

Prior to the development of native ingenuity and skill England was remarkable as a wool-growing country, most of the wool being shipped to the continent, so that it may be said that the wool of England met the skill of southern Europe in Flanders, which thus became the great textile centre so far as wool was concerned. With the development of native skill under the fostering care of several of the English monarchs—notably Edward III. and James I.—it was but natural to expect that endeavours would be made to manufacture English wool at home and export the woven cloth. With the remarkable colonial developments of the 17th, 18th and 19th centuries, in conjunction with the invention of the spinning frame and power-loom, this expectation was most fully realized, at least so far as ordinary wearing fabrics were concerned. Latterly, however, with the development of skill in newly developed countries, the tendency has been to partially revert to the old conditions. Thus in 1850 Bradford's chief export was cloth, in 1875 the yarn trade had markedly developed, in 1900 the top trade was well established, and to-day Bradford has a large wool export trade. Fabrics are made for the home and general export trade; yarns are exported mostly to the continent; tops and wool mostly to the United States of America.

Statistics.

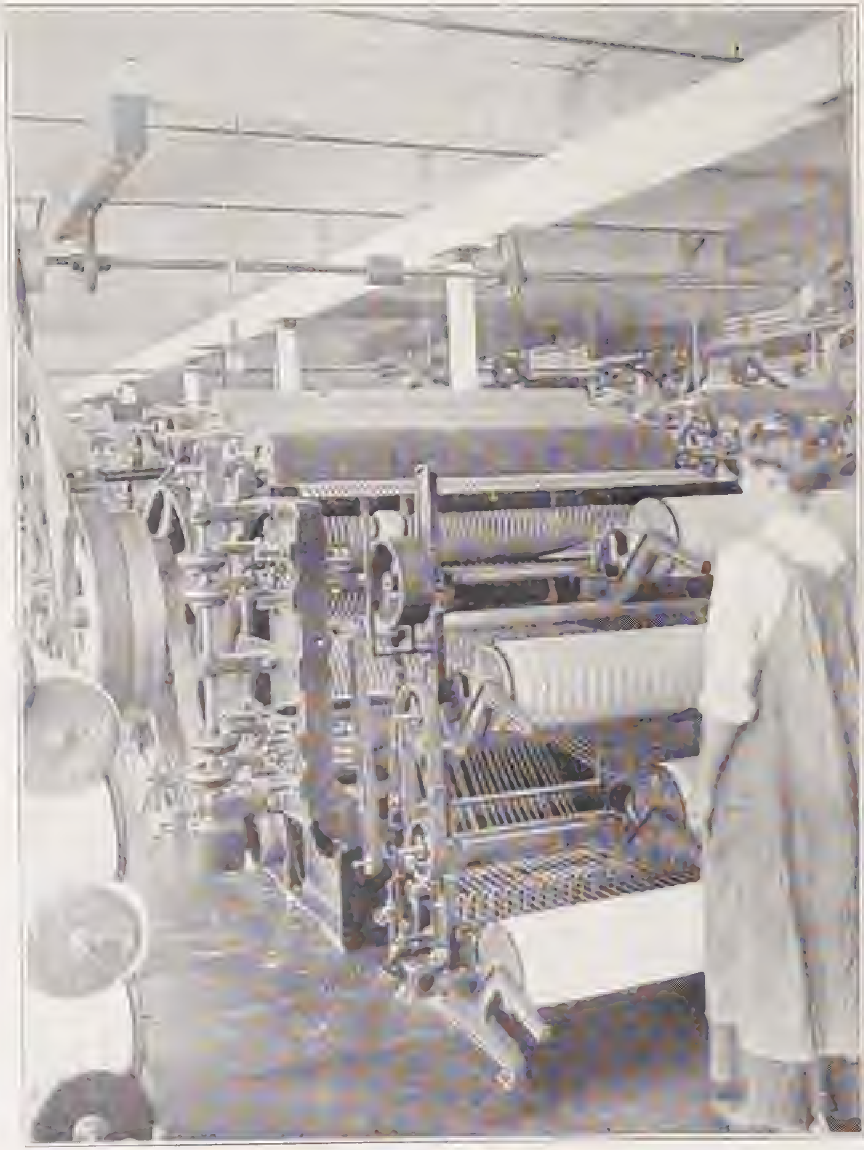
The following tables give a useful idea of (*a*) the sources of supply of the raw material, wool, also of the changes which have taken place in the trade since 1800; (*b*) the changes in monetary value of the chief sorts of wool during recent years; (*c*) the number of factories and of persons employed in the textile industries during the past half-century; (*d*) growth of the export trade in woollens and worsteds of the United Kingdom during the past century. For further details see Hooper's admirable tables now issued by the Bradford Chamber of Commerce.

Centres of industry.

Prior to the development of the factory system and the remarkable development in textile appliances at the end of the 18th and beginning of the 19th centuries, the textile industries were scattered all over the country, only in some few cases more or less accidental centralizing occurring. To-day it may be said that the wool industry is centralized where the coal supply of south Yorkshire meets the wool supply of north Yorkshire, *i.e.* in the Bradford and Leeds districts, though much of the wool dealt with in this district is imported and consequently can only be said to follow the trend already established. Of course there are wool manufacturing districts other than those mentioned. Scotland is noted for its Scotch tweeds manufactured in the Hawick and Galashiels district, the West of England still makes some magnificent all-wool cloths; Norwich guards a remnant of its once flourishing worsted industry and Leicester has developed a remarkable hosiery trade. Again, firms whose existence is due to individual enterprise are still studded up and down the country, and manage to compete fairly well with the main manufacturing districts. Since about 1856, however, there can be no doubt that the English wool trade has been centring more and more round Bradford, while the remanufactured materials and the blanket trade is centred round Batley and Dewsbury. Wales retains only a fragment of its once large flannel trade, this trade now being located in Yorkshire, with the exception of one or two individual firms elsewhere. The carpet trade is centred in Halifax, Kidderminster and Glasgow. Whether further centralization may be looked for is questionable. Specialization undoubtedly favours Bradford, as there the wool, top, yarn and fabric branches of the industry are individually developed to great advantage; but the development of means of communication and some such factor as electric or water power may radically disturb the present balance of the industry. (A. F. B.)

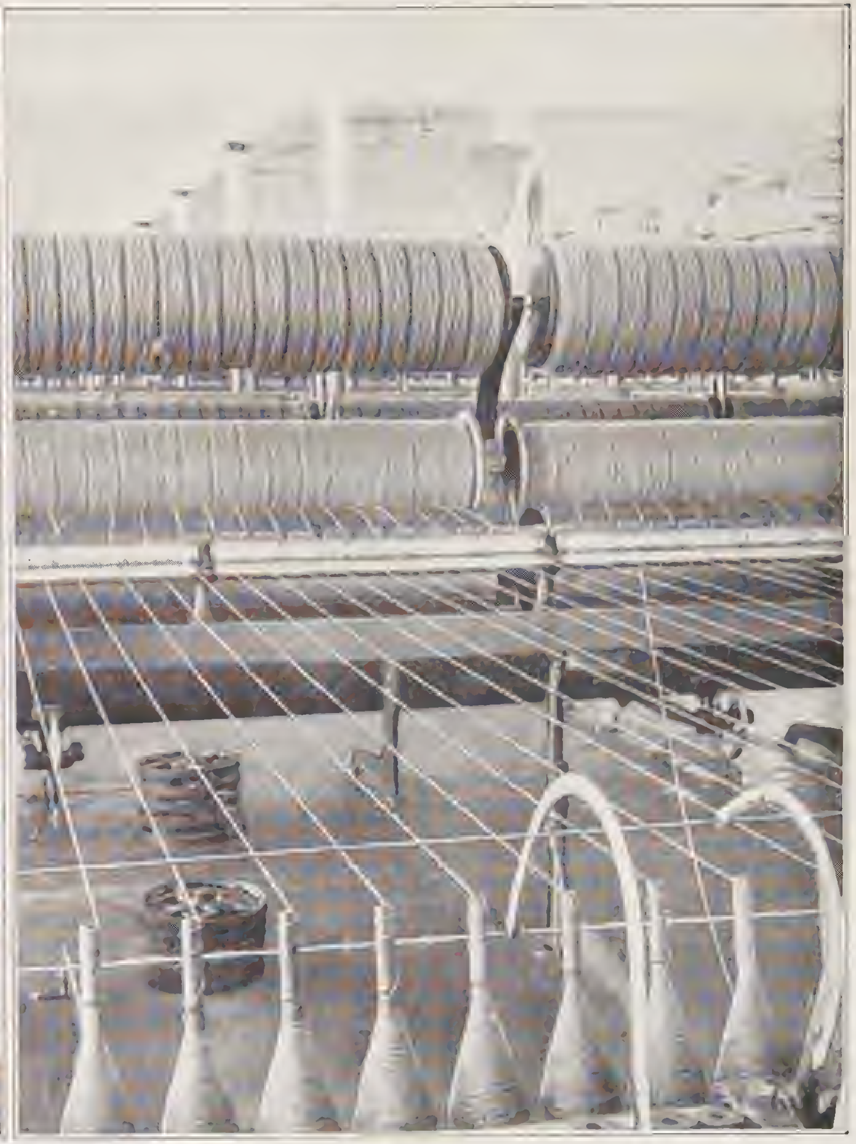
Imports of Wool into the United Kingdom from the Principal Countries, Foreign and Colonial.

Country.		1800.	1820.	1840.	1860.	1880.	1900.	1905.	1907.
New South Wales }	Bales	..	..	..	..	..	248,408	240,922	308,628
Queensland }		658	213	25,820	46,092	224,777	124,401	148,059	130,128
Victorian		..	..	..	78,186	306,817	255,131	261,724	330,326
Tasmanian		..	180	11,721	16,731	23,653	18,225	13,770	22,147
South Australian		..	..	3,484	23,554	109,917	50,720	76,469	89,637
West Australian		..	..	..	1,992	9,211	26,317	44,623	41,467
New Zealand		..	..	..	17,870	189,441	395,693	394,390	442,973
Cape and Natal		..	29	3,477	55,711	190,614	102,268	192,210	259,691
Total Colonial	Bales	658	422	44,502	240,136	1,054,430	1,221,163	1,327,167	1,624,997
East Indian and Persian		..	..	7,611	62,226	112,716	142,518	153,841	159,818
Chinese		..	..	..	119	1,672	4,151	7,284	15,060
German		1,170	14,609	63,278	19,681	28,119	9,126	6,636	11,533
Spanish		30,318	17,681	5,273	4,199	14,603	896	1,732	4,077
Portuguese		9,622	475	1,569	24,503	14,356	5,242	11,018	10,214
Russian		25	150	11,776	22,150	45,417	28,018	7,404	15,889
Turkish, Egyptian and North African		76	380	5,492	17,545	49,853	39,108	43,104	51,725
Peruvian and Chilean		..	25	40,004	69,068	52,876	70,423	55,163	53,493
Buenos Aires and Montevidean		..	..	..	5,058	9,852	22,077	52,839	70,348
Falkland Islands and Punta Arenas		..	..	..	..	4,700	28,784	34,903	53,249
Italian and Trieste		84	334	4,055	719	2,565	2,768	3,889	2,761
Sundry		487	1,479	2,519	15,172	35,973	37,150	46,485	43,176
Goat's Wool		..	..	..	11,915	57,449	69,445	101,712	109,077
Total Bales		42,440	35,555	186,079	492,491	1,484,581	1,680,869	1,853,177	2,225,417



(Underwood.)

CARDING MACHINE



(Underwood.)

CLOSE VIEW OF SPINNING MULE

Automatic carding and spinning machines, turning out daily almost incredible quantities of carded and spun wool, at a low cost of human effort, are among the striking features of industrialism to-day. The latest information on this subject will be found in the article on TEXTILE MACHINERY (Vol. 31).

Prices per ℔ in each Year of some Colonial, Foreign and English Wools, also of Alpaca and Mohair.

Material.	1874.[1]	1880.	1885.	1890.	1895.	1900.	1901.[2]	1902.[2]	1905.
	d.	d.	d.	d.	d.	d.	d.	d.	d.
Port Philip—Greasy	$14\frac{5}{8}$	$13\frac{1}{2}$	10	$10\frac{3}{4}$	$8\frac{3}{8}$	$11\frac{1}{2}$	$9\frac{1}{2}$	13	$13\frac{1}{2}$
Adelaide—Greasy	$11\frac{1}{2}$	$10\frac{5}{8}$	$6\frac{3}{4}$	$7\frac{1}{2}$	$5\frac{5}{8}$	$7\frac{7}{8}$	$6\frac{3}{8}$	$8\frac{1}{2}$	9
Cape—Greasy	$16\frac{1}{8}$	$12\frac{5}{8}$	9	$9\frac{1}{2}$	7	$9\frac{3}{4}$	7	$9\frac{1}{4}$	$10\frac{1}{4}$
Buenos Aires—Greasy	$7\frac{1}{2}$	$7\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{3}{4}$	$4\frac{3}{8}$	$4\frac{1}{4}$	$4\frac{5}{8}$	$5\frac{3}{4}$	$6\frac{3}{8}$
British Wool	22	$16\frac{1}{2}$	$9\frac{1}{2}$	10	$9\frac{1}{2}$	$7\frac{1}{2}$	$6\frac{1}{10}$	6	$11\frac{4}{5}$
Alpaca	33-35	$13-15\frac{1}{2}$	$12\frac{1}{2}-14\frac{1}{2}$	$22-14\frac{1}{2}$	$14\frac{1}{2}-27$	16-13	$12\frac{1}{2}-16$	$15\frac{1}{2}-19\frac{1}{2}$	$15\frac{1}{2}-17\frac{3}{4}$
Mohair	35-45	27-35-21	14-19	$18-13\frac{1}{2}$	14-30	$20\frac{1}{2}-17$	19-17	15	$13\frac{1}{2}-16$

[1] Year of the highest values of wools ever reached within recent times.
[2] Years of the lowest values of wools ever reached within recent times.

Summary of Woollen and Worsted Factories and of Persons employed in the same in the United Kingdom.

	1867.	1874.	1885.	1889.	1901.	1904.
Factories	2,649	2,617	2,751	2,517	..	2,382
Rag grinding machines	..	..	..	..	..	900
Woollen carding sets	..	..	..	..	..	6,700
Worsted combing machines	1,038	1,276	..	..	..	2,924
Spinning spindles	6,455,879	5,449,495	5,375,102	5,604,535	..	5,625,477
Doubling spindles	519,629	558,914	769,492	969,812	..	1,059,049
Power looms	118,875	140,274	139,902	131,506	..	104,514
Children (half timers)	33,054	38,416	24,636	22,940	7,475	..
Persons working full time—						
Males	94,838	106,005	112,935	120,441	102,876	..
Females	134,368	135,712	145,684	158,175	149,558	..

Summary of Exports of Wool, Wool Waste, Noils, Tops, Yarns and Fabrics from the United Kingdom.

	1840.	1882.	1890.	1900.	1907.
	℔	℔	℔	℔	℔
British Wool	5,000,000	13,800,000	19,500,000	24,900,000	34,500,000
Foreign and Colonial	2,000,000	264,100,000	342,200,000	197,500,000	314,200,000
Waste	..	..	2,397,600	1,593,100	8,937,100
Noils	..	..	10,234,700	7,897,400	12,689,700
Tops	..	..	9,016,000	28,031,200	35,580,000
Worsted Yarn	..	29,840,300	39,510,100	56,075,900	55,521,700
Mohair, &c., Yarn	..	8,752,200	12,959,600	10,397,700	17,782,800
Woollen Yarn	..	1,992,400	1,572,700	1,088,300	2,576,100
Cloths	..	£18,768,634	£20,418,482	£15,682,154	£22,153,680
Apparel	..	£1,380,000	£1,700,000	£1,700,000	£2,550,546

WOOLLETT, WILLIAM (1735–1785), English engraver, was born at Maidstone, of a family which came originally from Holland, on the 15th of August 1735. He was apprenticed to John Tinney, an engraver in Fleet Street, London, and studied in the St Martin's Lane academy. His first important plate was from the "Niobe" of Richard Wilson, published by Boydell in 1761, which was followed in 1763 by a companion engraving from the "Phaethon" of the same painter. After West he engraved his fine plate of the "Battle of La Hogue" (1781), and the "Death of General Wolfe" (1776), which is usually considered Woollett's masterpiece. In 1775 he was appointed engraver-in-ordinary to George III.; and he was a member of the Incorporated Society of Artists, of which for several years he acted as secretary. He died in London on the 23rd of May 1785.

In his plates, which unite work with the etching-needle, the dry-point and the graver, Woollett shows the greatest richness and variety of execution. In his landscapes the rendering of water is particularly excellent. In his portraits and historical subjects the rendering of flesh is characterized by great softness and delicacy. His works rank among the great productions of the English school of engraving. Louis Fagan, in his *Catalogue Raisonné of the Engraved Works of William Woollett* (1885), has enumerated 123 plates by this engraver.

WOOLMAN, JOHN (1720–1772), American Quaker preacher, was born in Northampton, Burlington county, New Jersey, in August 1720. When he was twenty-one he went to Mount Holly, where he was a clerk in a store, opened a school for poor children and became a tailor. After 1743 he spent most of his time as an itinerant preacher, visiting meetings of the Friends in various parts of the colonies. In 1772 he sailed for London to visit Friends in the north of England, especially Yorkshire, and died in York of smallpox on the 7th of October. He spoke and wrote against slavery, refused to draw up wills transferring slaves, induced many of the Friends to set their negroes free, and in 1760 at Newport, Rhode Island, memorialized the Legislature to forbid the slave trade. In 1763 at Wehaloosing (now Wyalusing), on the Susquehanna, he preached to the Indians; and he always urged the whites to pay the Indians for their lands and to forbid the sale of liquor to them.

Woolman wrote *Some Considerations on the Keeping of Negroes* (1754; part ii., 1762); *Considerations on Pure Wisdom and Human Policy, on Labor, on Schools, and on the Right Use of the Lord's Outward Gifts* (1768); *Considerations on the True Harmony of Mankind, and How it is to be Maintained* (1770); and *A Word of Remembrance and Caution to the Rich* (1793); and the most important of his writings, *The Journal of John Woolman's Life and Travels in the Service of the Gospel* (1775), which was begun in his thirty-sixth year and was continued until the year of his death. The best-known edition is that prepared, with an introduction, by John G. Whittier in 1871. *The Works of John Woolman* appeared in two parts at Philadelphia, in 1774–1775, and have often been republished; a German version was printed in 1852.

WOOLNER, THOMAS (1825–1892), British sculptor and poet, was born at Hadleigh, Suffolk, on the 17th of December 1825. When a boy he showed talent for modelling, and when barely thirteen years old was taken as an assistant into the studio of William Behnes, and trained during four years. In December 1842 Woolner was admitted a student in the Royal Academy, and in 1843 exhibited his "Eleanor sucking Poison from the Wound of Prince Edward." In 1844, among the competitive works for decorating the Houses of Parliament was his life-size group of "The Death of Boadicea." In 1846 he had at the Royal Academy a graceful bas-relief of Shelley's "Alastor." Then came (1847) "Feeding the Hungry," a bas-relief, at the Academy; and at the British Institution a brilliant statuette of "Puck" perched upon a toadstool and with his toe rousing a frog. "Eros and Euphrosyne" and "The Rainbow" were seen at the Academy in 1848.

Woolner became, in the autumn of 1848, one of the seven Pre-Raphaelite Brethren, and took a leading part in *The Germ* (1850), the opening poem in which, called "My Beautiful Lady," was written by him. He had already modelled and exhibited portraits of Carlyle, Browning and Tennyson. Unable to make his way in art as he wished, Woolner in 1852 tried his luck as a gold-digger in Australia. Failing in this, he returned to England in 1857, where during his absence his reputation had been increased by means of a statue of "Love" as a damsel lost in a day-dream. Then came his second portraits of Carlyle, Tennyson and Browning, the figures of Moses, David, St John the Baptist and St Paul for the pulpit of Llandaff cathedral, the medallion portrait of Wordsworth in Grasmere church, the likenesses of Sir Thomas Fairbairn, Rajah Brooke of Sarawak, Mrs Tennyson, Sir W. Hooker and Sir F. Palgrave. The fine statue of Bacon in the New Museum at Oxford was succeeded by full-size statues of Prince Albert for Oxford, Macaulay for Cambridge, William III. for the Houses of Parliament, London, and Sir Bartle Frere for Bombay; busts of Tennyson, for Trinity College, Cambridge, Dr Whewell, and Archdeacon Hare; statues of Lord Lawrence for Calcutta, Queen Victoria for Birmingham, Field for the Law Courts, London, Palmerston for Palace Yard, the noble colossal standing figure of Captain Cook that overlooks the harbour of Sydney, New South Wales, which is Woolner's masterpiece in that class; the recumbent effigy of Lord F. Cavendish (murdered in Dublin) in Cartmel church, the seated Lord Chief Justice Whiteside for the Four Courts, Dublin, and John Stuart Mill for the Thames Embankment, London; Landseer, and Bishop Jackson for St Paul's, Bishop Fraser for Manchester, and Sir Stamford Raffles for Singapore. Among Woolner's busts are those of Newman, Darwin, Sedgwick, Huxley, Cobden, Professor Lushington, Dickens, Kingsley, and Sir William Gull, besides the repetition, with variations, of Gladstone for the Bodleian, Oxford, and Mansion House, London, and Tennyson. The last was acquired for Adelaide, South Australia. Woolner's poetic and imaginative sculptures include "Elaine with the Shield of Lancelot," three fine panels for the pedestal of the Gladstone bust at Cambridge, the noble and original "Moses" which was commissioned in 1861 and is on the apex of the gable of the Manchester Assize Courts, and two other works in the same building; "Ophelia," a statue (1869); "In Memoriam"; "Virgilia sees in a vision Coriolanus routing the Volsces"; "Guinevere"; "Mercury teaching a shepherd to sing," for the Royal College of Music; "Ophelia," a bust (1878); "Godiva," and "The Water Lily."

In 1864 he married Alice Gertrude Waugh, by whom he had two sons and four daughters. He was elected an associate of the Royal Academy in 1871, and a full member in 1874. Woolner wrote and published two amended versions of "My Beautiful Lady" from *The Germ*, as well as "Pygmalion" (1881), "Silenus" (1884), "Tiresias" (1886), and "Poems" (1887) comprising "Nelly Dale" (1886) and "Children." Having been elected professor of sculpture in the Royal Academy, Woolner began to prepare lectures, but they were never delivered, for he resigned the office in 1879. He died suddenly on the 7th of October 1892, and was buried in the churchyard of St Mary's, Hendon.

WOOLSACK, *i.e.* a sack or cushion stuffed with wool, a name more particularly given to the seat of the lord chancellor in the House of Lords. It is a large square cushion of wool, without back or arms, covered with red cloth. It is stated to have been placed in the House of Lords in the reign of Edward III. to remind the peers of the importance of the wool trade of England. The earliest legislative mention, however, is in an act of Henry VIII. (c. 10 s. 8): "The lord chancellor, lord treasurer and all other officers who shall be under the degree of a baron of a parliament shall sit and be placed at the uppermost part of the sacks in the midst of the said parliament chamber, either there to sit upon one form or upon the uppermost sack." The woolsack is technically outside the precincts of the house, and the lord chancellor, wishing to speak in a debate, has to advance to his place as a peer.

WOOLSEY, THEODORE DWIGHT (1801–1889), American educationalist, was born in New York City on the 31st of October 1801. He was the son of a New York merchant, a nephew of Timothy Dwight, president of Yale, and a descendant of Jonathan Edwards. He graduated at Yale in 1820; was a tutor at Yale in 1823–1825; studied Greek at Leipzig, Berlin and Bonn in 1827–1830; became professor of Greek language and literature at Yale in 1831; and was elected president of the college and entered the Congregational ministry in 1846. He resigned the presidency in 1871, and died on the 1st of July 1889 in New Haven. During his administration the college grew rapidly, the scientific school and the school of fine arts were established, and the scholarly tone of the college was greatly improved. Much of his attention in his last years was devoted to the American commission for the revision of the authorized version of the New Testament, of which he was chairman (1871–1881). He prepared excellent editions of *Alcestis* (1834), *Antigone* (1835), *Prometheus* (1837) and *Gorgias* (1843). He published several volumes of sermons and wrote for the *New Englander*, of which he was a founder, for the *North American Review*, for the *Princeton Review* and for the *Century*, and his *Introduction to the Study of International Law, designed as an Aid in Teaching and in Historical Studies* (1860) and his *Divorce and Divorce Legislation* (1882) went through many editions. He also wrote *Political Science, or the State Theoretically and Practically Considered* (1877), and *Communism and Socialism, in their History and Theory* (1880). His son, THEODORE SALISBURY WOOLSEY (b. 1852), became professor of international law at Yale in 1878. He was one of the founders of the *Yale Review* (1892, a continuation of the *New Englander*), and is the author of *America's Foreign Policy* (1892).

WOOLSTON, THOMAS (1669–1731), English deist, born at Northampton in 1669, the son of a "reputable tradesman," entered Sidney College, Cambridge, in 1685, studied theology, took orders and was made a fellow of his college. After a time, by the study of Origen, he became possessed with the notion of the importance of an allegorical interpretation of Scripture, and advocated its use in the defence of Christianity both in his sermons and in his first book, *The Old Apology for the Truth of the Christian Religion against the Jews and Gentiles Revived* (1705). For many years he published nothing, but in 1720–1721 the publication of letters and pamphlets in advocacy of his notions, with open challenges to the clergy to refute them, brought him into trouble. It was reported that his mind was disordered, and he lost his fellowship. From 1721 he lived for the most part in London, on an allowance of £30 a year from his brother and other presents. His influence on the course of the deistical controversy began with his book, *The Moderator between an Infidel and an Apostate* (1725, 3rd ed. 1729). The "infidel" intended was Anthony Collins (*q.v.*), who had maintained in his book alluded to that the New Testament is based on the Old, and that not the literal but only the allegorical sense of the prophecies can be quoted in proof of the Messiahship of Jesus; the "apostate" was the clergy who had forsaken the allegorical method of the fathers. Woolston denied absolutely the proof from miracles, called in question the fact of the resurrection of Christ and other miracles of the New Testament, and maintained that they must be interpreted allegorically, or as types of spiritual things. Two years later he began a series of *Discourses* on the same subject, in which he applied the principles of his *Moderator* to the miracles of the Gospels in detail. The *Discourses*, 30,000 copies of which were said to have been sold, were six in number, the first appearing in 1727, the next five 1728–1729, with two *Defences* in 1729–1730. For these publications he was tried before Chief Justice Raymond in 1729 and sentenced (November 28) to pay a fine of £25 for each of the first four *Discourses*, with imprisonment till paid, and also to a year's imprisonment and to give security for his good behaviour during life. He failed to find this security, and remained in confinement until his death on the 21st of January 1731.

Upwards of sixty more or less weighty pamphlets appeared in reply to his *Moderator* and *Discourses*. Amongst the abler and most popular of them may be mentioned Z. Pearce's *The Miracles of Jesus Vindicated* (1729); T. Sherlock's *The Tryal of the Witnesses of the Resurrection of Jesus* (1729, 13th ed. 1755); and N. Lardner's *Vindication of Three of Our Saviour's Miracles* (1729), Lardner being one of those who did not approve of the prosecution of Woolston (see Lardner's Life by Kippis, in Lardner's *Works*, vol. i.).

See *Life* of Woolston prefixed to his *Works* in five volumes (London, 1733); *Memoirs of Life and Writings of William Whiston* (London, 1749, pp. 231-235); Appendix to *A Vindication of the Miracles of our Saviour, &c.*, by J. Ray (2nd ed., 1731); J. Cairns, *Unbelief in the Eighteenth Century* (1880); Sayous, *Les Déistes anglais* (1882); and the article Deism, with its bibliography.

WOOLWICH, a S.E. metropolitan borough of London, England, bounded W. by Greenwich and Lewisham, and extending N., E. and S., to the boundary of the county of London. Pop. (1901) 117,178. Area, 8276·6 acres. Its N. boundary is in part the river Thames, but it includes two separate small areas on the N. bank, embracing a portion of the district called N. Woolwich. The area is second to that of Wandsworth among the metropolitan boroughs, but is not wholly built over. The most populous part is that lying between Shooter's Hill Road (the Roman Watling Street) and the river, the site falling from an elevation of 418 ft. at Shooter's Hill to the river level. To the E. lies Plumstead, with the Plumstead marshes bordering the river to the N., and in the S. of the borough is Eltham. A large working population is employed in the Royal Arsenal, which occupies a large area on the river-bank, and includes the Royal Gun Factory, Royal Carriage Department, Royal Laboratory and Building Works Department. The former Royal Dockyard was made over to the War Office in 1872 and converted into stores, wharves for the loading of troopships, &c. The Royal Artillery Barracks, facing Woolwich Common, originally erected in 1775, has been greatly extended at different times, and consists of six ranges of brick building, including a church in the Italian Gothic style erected in 1863, a theatre, and a library in connexion with the officers' mess-room. Opposite the barracks is the memorial to the officers and men of the Royal Artillery who fell in the Crimean War, a bronze figure of Victory cast out of cannon captured in the Crimea. Near the barracks is the Royal Artillery Institution, with a fine museum and a lecture hall. On the W. of the barrack field is the Royal Military Repository, within the enclosure of which is the Rotunda, originally erected in St James's Park for the reception of the allied sovereigns in 1814, and shortly afterwards transferred to its present site. It contains models of the principal dockyards and fortifications of the British empire, naval models of all dates, and numerous specimens of weapons of war from the remotest times to the present day. On the Common is the Royal Military Academy, a castellated building erected from the design of Sir J. Wyatville in 1801, where cadets are trained for the artillery and engineer services. There are a number of other barracks. At the S.E. extremity of the Common is the Herbert Military Hospital. Among several military memorials, one in the Academy grounds was erected to the Prince Imperial of France, for two years a student in the Academy. Other institutions include the Woolwich polytechnic and the Brook fever hospital, Shooter's Hill. The parish church of St Mary Magdalene was rebuilt, in 1726–1729, near the site of the old one dating from before the 12th century. Woolwich Common (142 acres) is partly within this borough, but mainly in Greenwich. South of it is Eltham Common (37 acres), and in the E. of the borough are Plumstead Common (103 acres) and Bostall Heath (134 acres). Behind the Royal Military Academy is a mineral well, the "Shooter's Hill waters" mentioned by Evelyn. Near Woolwich Common there are brick and tile kilns and sand and chalk pits, and there are extensive market-gardens in the locality. The parliamentary borough of Woolwich returns one member. The borough council consists of a mayor, 6 aldermen, and 60 councillors. It was only by the London Government Act 1899 that Woolwich was brought into line with other London districts, for in 1855, as it had previously become a local government district under a local board, it was left untouched by the Metropolis Management Act.

Woolwich (Wulewich) is mentioned in a grant of land by King Edward in 964 to the abbey of St Peter at Ghent. In Domesday the manor is mentioned as consisting of 63 acres of land. The Roman Watling Street crossed Shooter's Hill, and a Roman cemetery is supposed to have occupied the site of the Royal Arsenal, numerous Roman urns and fragments of Roman pottery having been dug up in the neighbourhood. Woolwich seems to have been a small fishing village until in the beginning of the 16th century it rose into prominence as a dockyard and naval station. There is evidence that ships were built at Woolwich in the reign of Henry VII., but it was with the purchase by Henry VIII. of two parcels of land in the manor of Woolwich, called Boughton's Docks, that the foundation of the town's prosperity was laid, the launching of the "Harry Grâce de Dieu," of 1000 tons burden, making an epoch in its history. Woolwich remained the chief dockyard of the English navy until the introduction of iron ship building, but the dockyard was closed in 1869. The town became the headquarters of the Royal Artillery on the establishment of a separate branch of this service in the reign of George I. Land was probably acquired for a military post and store depôt at Woolwich in 1667, in order to erect batteries against the invading Dutch fleet, although in 1664 mention is made of storehouses and sheds for repairing ship carriages. In 1668 guns, carriages and stores were concentrated at Woolwich, and in 1695 the laboratory was moved hither from Greenwich. Before 1716 ordnance was obtained from private manufacturers and proved by the Board of Ordnance. In 1716 an explosion took place at the Moorfields Foundry, and it was decided to build a royal brass foundry at the "Tower Place," as the establishment at Woolwich was called until 1805. Founders were advertised for, and records show that Andrew Schalch of Douai was selected. In 1741 a school of instruction for the military branch of the ordnance was established here. It was not until 1805, however, that the collection of establishments at Woolwich became the Royal Arsenal.

See C. H. Grinling, T. A. Ingram and B. C. Polkinghorne, *Survey and Record of Woolwich and West Kent* (Woolwich, 1909).

WOOLWICH-AND-READING BEDS, in geology, a series of argillaceous and sandy deposits of lower Eocene age found in the London and Hampshire basins. By the earlier geologists this formation was known as the "Plastic Clay" so called by T. Webster in 1816 after the *Argile plastique* of G. C. F. D. Cuvier and A. Brongniart. It was called the "Mottled Clay" by J. Prestwich in 1846, but in 1853 he proposed the name "Woolwich-and-Reading Beds" because the other terms were not applicable to the different local aspects of the series.

Three distinct types of this formation are recognized: (1) The Reading type, a series of lenticular mottled clays and sands, here and there with pebbly beds and masses of fine sand converted into quartzite. These beds are generally unfossiliferous. They are found in the N. and W. portions of the London Basin and in the Hampshire Basin. (2) The Woolwich type, grey clays and pale sands, often full of estuarine shells and in places with a well-marked oyster bed. At the base of the shell-bearing clays in S.E. London there are pebble beds and lignitic layers. The Woolwich beds occur in W. Kent, the E. borders of Surrey, the borders of E. Kent, in S. Essex and at Newhaven in Sussex. (3) A third type consisting of light-coloured false-bedded sands with marine fossils occurs in E. Kent. Where it rests on the Thanet beds it is an argillaceous greensand with rounded flint pebbles; where it rests on the Chalk it is more clayey and the flints are less rounded and are green-coated. Except in the Hampshire basin the Woolwich-and-Reading beds usually rest on the Thanet beds, but they are found on the Chalk near Bromley, Charlton, Hungerford, Hertford, Reading, &c. In Dorsetshire the Reading beds appear on the coast at Studland Bay and at other points inland. The "Hertfordshire Pudding Stone" is a well-known rock from near the base of the formation; it is a flint pebble conglomerate in a siliceous matrix. The fossils, estuarine, freshwater and marine, include *Corbicula cuneiformis*, *C. tellinella*, *Ostrea bellovacina*, *Vivaparus lentus*, *Planorbis hemistoma*, *Melania* (*Melanatria*) *inquinata*, *Neritina globulus*, and the remains of turtles, crocodiles, sharks, birds (*Gastornis*) and the mammal *Coryphodon*. Bricks, tiles and coarse pottery and occasionally firebricks have been made from the clay beds in this formation.

See Eocene; also J. Prestwich, *Q.J.G.S.* (1854), x.; W. Whitaker, "Geology of London," *Mem. Geol. Survey*, i. and ii. (1889) and *Sheet Memoir*, No. 268.

WOONSOCKET, a city of Providence county, Rhode Island, U.S.A., on both banks of the Blackstone river, about 16 m. N. by W. of Providence. Pop. (1900) 28,204; (1905, state census) 32,196 (13,734 foreign-born, including 8939 French Canadians and 1369 Irish); (1910) 38,125. Woonsocket is served by the New York, New Haven & Hartford railway and by an interurban electric line. Among its institutions are the Sacred Heart College and the Harris Institute Public Library, founded (1863) by Edward Harris, a local manufacturer. Woonsocket has ample water power from the Blackstone river and its tributaries, the Mill and the Peters rivers. The value of its factory products in 1905 was $19,260,537. Worsted and woollen yarns are manufactured in Woonsocket by the French and Belgian processes. Other manufactures are cotton goods and yarns, rubber goods, clothes wringers, silks, bobbins and shuttles, and foundry products.

The first settlement in the vicinity was made apparently about 1666 by Richard Arnold, who at about that time built a saw-mill on the bank of the Blackstone river. Woonsocket was set off from Cumberland and was incorporated as a township in 1867; was enlarged by the addition of a part of Smithfield in 1871, and was chartered as a city in 1888.

WOOSTER, a city and the county-seat of Wayne county, Ohio, U.S.A., on Killbuck Creek, about 50 m. S. by W. of Cleveland. Pop. (1900) 6063 (407 foreign-born); (1910) 6136. Wooster is served by the Baltimore & Ohio and the Pennsylvania railways. It is the seat of the university of Wooster (co-educational; Presbyterian; founded in 1866 and opened in 1870), which in 1909 had 37 instructors and 1547 students. The Ohio Agricultural Experiment Station is in the city, which also has various manufactures. Wooster was laid out in 1808, was incorporated as a town in 1817, and became a city of the second class in 1869. It was named in honour of General David Wooster (1710–1777), who was killed in the War of Independence.

WOOTTON BASSETT, a market town in the N. parliamentary division of Wiltshire, England, 83 m. W. of London by the Great Western railway. Pop. (1901) 2200. It is the junction of the direct railway (1903) between London and the Severn tunnel with the main line of the Great Western system. The town has large cattle markets and an agricultural trade.

Wootton Bassett (*Wodeton, Wotton*) was held in the reign of Edward the Confessor by one Levenod, and after the Norman Conquest was included in the fief of Miles Crispin. About a century later the manor was acquired by the Basset family. The town received its first charter from Henry VI., and returned members to parliament from 1446–1447 until the passing of the Reform Act of 1832. In 1571 Elizabeth granted to the town a market on Tuesday and two fairs each to last two days, at the feasts of St George the Martyr and the Conception of the Virgin. In 1679 the town received a charter from Charles II., and the corporation consisted of a mayor, two aldermen and 12 capital burgesses, until abolished by the Municipal Corporations Act of 1886, under which the property is now vested in seven trustees, one of whom is appointed by the lord of the manor, and there are also two aldermen and four elected members. In 1836 fairs were instituted on the Tuesday before the 6th of April and on the Tuesday before the 11th of October, which are still maintained, and a large cattle market is held on the first Wednesday of every month. The manufacture of broadcloth was formerly carried on, but is now entirely decayed.

WORCESTER, EARLS AND MARQUESSES OF. Urso de Abitot, constable of Worcester castle and sheriff of Worcestershire, is erroneously said to have been created earl of Worcester in 1076. Waleran de Beaumont (1104–1166), count of Meulan in France, a partisan of King Stephen in his war with the empress Matilda, was probably earl of Worcester from 1136 to 1145. He was deprived of his earldom, became a crusader and died a monk. From 1397 to 1403 the earldom was held by Sir Thomas Percy (*c.* 1343–1403), a brother of Henry Percy, 1st earl of Northumberland. Percy served with distinction in France during the reign of Edward III.; he also held an official position on the Scottish borders, and under Richard II. he was the admiral of a fleet. He deserted Richard II. in 1399, and was employed and trusted by Henry IV., but in 1403 he joined the other Percies in their revolt; he was taken prisoner at Shrewsbury, and subsequently beheaded, the earldom becoming extinct. The title of earl of Worcester was revived in 1421 in favour of Richard Beauchamp, Lord Abergavenny, but lapsed on his death in 1422. The next earl was John Tiptoft, or Tibetot, a noted Yorkist leader during the wars of the Roses, who was executed in 1470 (see below). On the death of his son, Edward, in 1485 the earldom reverted to the crown.

In February 1514 the earldom was bestowed by Henry VIII. on Charles Somerset (*c.* 1460–1526), a bastard son of Henry Beaufort, duke of Somerset. Having married Elizabeth, daughter of William Herbert, earl of Huntingdon, he was styled Baron Herbert in right of his wife, and in 1506 he was created Baron Herbert of Ragland, Chepstow and Gower. He was chamberlain of the household to Henry VIII. His son Henry, 2nd earl (*c.* 1495–1548), obtained Tintern Abbey after the dissolution of the monasteries. The title descended in direct line to Henry, the 5th earl (1577–1646), who advanced large sums of money to Charles I. at the outbreak of the Great Rebellion, and was created marquess of Worcester in 1643.

Edward Somerset, 2nd marquess of Worcester (1601–1667), is better known by the title of earl of Glamorgan, this earldom having been conferred upon him, although somewhat irregularly, by Charles I. in 1644. He became very prominent in 1644 and 1645 in connexion with Charles's scheme for obtaining military help from Ireland and abroad, and in 1645 he signed at Kilkenny, on behalf of Charles, a treaty with the Irish Roman Catholics; but the king was obliged by the opposition of Ormonde and the Irish loyalists to repudiate his action. Under the Commonwealth he was formally banished from England and his estates were seized. At the Restoration his estates were restored, and he claimed the dukedom of Somerset promised to him by Charles I., but he did not obtain this, nor was his earldom of Glamorgan recognized. He was greatly interested in mechanical experiments, and his name is intimately connected with the early history of the steam-engine (*q.v.*). His *Century of the Names and Scantlings of such Inventions as at present I can call to mind to have tried and perfected* (1663) has often been reprinted. He died on the 3rd of April 1667.

See Henry Dircks, *Life, Times and Scientific Labours of the 2nd Marquess of Worcester* (1865); Sir J. T. Gilbert, *History of the Irish Confederation and the War in Ireland* (Dublin, 1882–1891).

His only son Henry (1629–1700), the 3rd marquess, abandoned the Roman Catholic religion and was a member of one of Cromwell's parliaments. But he was quietly loyal to Charles II., who in 1682 created him duke of Beaufort. As the defender of Bristol, the duke took a considerable part in checking the progress of the duke of Monmouth in 1685, but in 1688 he surrendered the city to William of Orange. He inherited Badminton, still the residence of the dukes of Beaufort, and died there on the 21st of January 1700. The Worcester title was henceforth merged in that of Beaufort (*q.v.*). Henry, the 7th duke (1792–1853), was one of the greatest sportsmen of his day, and the Badminton hunt owed much to him and his successors, the 8th duke (1824–1899) and 9th duke (b. 1847).

WORCESTER, JOHN TIPTOFT, Earl of (1427–1470), was son of John Tiptoft (1375–1443), who was Speaker of the House of Commons in 1406, much employed in diplomacy by Henry V., a member of the council during the minority of Henry VI., and created Baron Tiptoft in 1426. The younger Tiptoft was educated at Oxford, where John Rous says that he was one of his fellow-students; he is stated to have been a member of Balliol College. He married Cicely, daughter of Richard Neville, earl of Salisbury, and widow of Henry Beauchamp (d. 1445), duke of Warwick. In 1449 he was created earl of Worcester. His wife died in 1450, but he continued the association with the Yorkist party. During York's protectorate he was treasurer of the exchequer, and in 1456–1457 deputy of Ireland. In 1457 and again in 1459 he was sent on embassies to the pope. He was abroad three years, during which he made a pilgrimage to Jerusalem; the rest of the time he spent in Italy, at Padua, where he studied law and Latin; at Ferrara, where he made the acquaintance of Guarino of Verona; and at Florence, where he heard the lectures of John Argyropoulos, the teacher of Greek. He returned to England early in the reign of Edward IV., and on the 7th of February 1462 was made constable of England. In this office he had at once to try the earl of Oxford, and judged him by "lawe padoue" (*sc.* of Padua; Warkworth, 5). In 1463 he commanded at sea, without success. In the following year as constable he tried and condemned Sir Ralph Grey and other Lancastrians. In 1467 he was again appointed deputy of Ireland.

During a year's office there he had the earl of Desmond attainted, and cruelly put to death the earl's two infant sons. In 1470, as constable, he condemned twenty of Warwick's adherents, and had them impaled, "for which ever afterwards the earl was greatly hated among the people, for their disordinate death that he used contrary to the law of the land" (Warkworth, 9). On the Lancastrian restoration Worcester fled into hiding, but was discovered and tried before the earl of Oxford, son of the man whom he had condemned in 1462. He was executed on Tower Hill on the 18th of October 1470.

Worcester was detested for his brutality and abuse of the law, and was called "the butcher of England" (Fabyan, 659). More than any of his contemporaries in this country he represents the combination of culture and cruelty that was distinctive of the Italians of the Renaissance. Apart from his moral character he was an accomplished scholar, and a great purchaser of books in Italy, many of which he presented to the university of Oxford. He translated Cicero's *De amicitia* and Buonaccorso's *Declaration of Nobleness*, which were printed by Caxton in 1481. Caxton in his epilogue eulogized Worcester as superior to all the temporal lords of the kingdom in moral virtue as well as in science. Worcester is also credited with a translation of Caesar's *Commentaries* printed in 1530. His "ordinances for justes and triumphes," made as constable in 1466, are printed in Harrington's *Nugae antiquae*. Worcester was a patron of the early English humanist John Free, and his Italian friends included, besides those already mentioned, Lodovico Carbo of Ferrara, and the famous Florentine bookseller Vespasiano da Bisticci.

AUTHORITIES.—For Worcester's English career see especially the contemporary accounts in *Three Fifteenth Century Chronicles*, *Collections of a London Citizen* (Gregory's *Chronicle*), and Warkworth's *Chronicle*—all three published by the Camden Society. Vespasiano da Bisticci gave an account of him in his *Vite di uomini illustri*, i. 322-326, ap. *Opere inedite o rare nella provincia dell' Emilia*. See also Blades' *Life of Caxton*, i. 79, ii. 73. (C. L. K.)

WORCESTER, WILLIAM (*c.* 1415–*c.* 1482), English chronicler, was a son of William of Worcester, a Bristol citizen, and is sometimes called William Botoner, his mother being a daughter of Thomas Botoner. He was educated at Oxford and became secretary to Sir John Fastolf. When the knight died in 1459, Worcester, although one of his executors, found that nothing had been bequeathed to him, and with one of his colleagues, Sir William Yelverton, he disputed the validity of the will. However, an amicable arrangement was made and Worcester obtained some lands near Norwich and in Southwark. He died about 1482. Worcester made several journeys through England, and his *Itinerarium* contains much information. The survey of Bristol is of the highest value to antiquaries. Portions of the work were printed by James Nasmith in 1778, and the part relating to Bristol is in James Dallaway's *Antiquities of Bristowe* (Bristol, 1834).

Worcester also wrote *Annales rerum Anglicarum*, a work of some value for the history of England under Henry VI. This was published by T. Hearne in 1728, and by Joseph Stevenson for the "Rolls" series with his *Letters and Papers illustrative of the Wars of the English in France during the Reign of Henry VI.* (1864). Stevenson also printed here collections of papers made by Worcester respecting the wars of the English in France and Normandy. Worcester's other writings include the last *Acta domini Johannis Fastolf*. See the *Paston Letters* edited by J. Gairdner (1904); and F. A. Gasquet, *An Old English Bible and other Essays* (1897).

WORCESTER, a town of the Cape province, S. Africa, 109 m. by rail (58 in a direct line) N.E. of Cape Town, and the starting point of the railway to Mossel Bay and Port Elizabeth. Pop. (1904) 7885. It lies in the Little Karroo, about 800 ft. above the sea at the foot of the Hex River mountains. Tanning and wagon-building are among the industries, but the surrounding country is one of the largest wine and brandy producing districts in the province. At Brandvlei, 9 m. S., near the Breede river are thermal springs with a temperature of 145° F.

WORCESTER, an episcopal city and county of a city, municipal, parliamentary, and county borough, and county town of Worcestershire, England, on the river Severn, 120½ m. W.N.W. of London. Pop. (1901) 46,624. It is served by the Great Western railway and by the Bristol-Birmingham line of the Midland railway. Branches of the Great Western diverge to Malvern and Hereford, and to Leominster. Worcester lies mainly upon the left (E.) bank of the Severn, which is here a broad and placid river, the main part of the city lying on a ridge parallel with its banks. The city is governed by a mayor, 12 aldermen and 36 councillors. Area 3242 acres.

The cathedral church of Our Lord and the Blessed Virgin Mary is beautifully placed close to the river. The see was founded by the advice of Archbishop Theodore of Canterbury about 679 or 680, though, owing to the opposition of the bishop of Lichfield it was not finally established till 780. In its formation the tribal division was followed, and it contained the people of the Hwiccas. The bishop's church of St Peter's, with its secular canons, was absorbed by Bishop Oswald into the monastery of St Mary. The canons became monks, and in 983 Oswald finished the building of a new monastic cathedral. After the Norman Conquest the saintly bishop of Worcester, Wulfstan, was the only English prelate who was left in possession of his see, and it was he who first undertook the building of a great church of stone according to the Norman pattern. Of the work of Wulfstan, the outer walls of the nave, aisles, a part of the walls of the transepts, some shafts and the crypt remain. The crypt (1084) is one of the four apsidal crypts in England, the others being those in Winchester, Gloucester and Canterbury cathedrals. Wulfstan's building seems to have extended no farther than the transepts, but the nave was continued, though much of it was destroyed by the fall of the central tower in 1175. The two W. bays of the nave date from about 1160. In 1203 Wulfstan, who had died in 1095, was canonized, and on the completion and dedication of the cathedral in 1218, his body was placed in a shrine, which became a place of pilgrimage, and thereby brought wealth to the monks. They devoted this to the building of a lady chapel at the E. end, extending the building by 50 ft.; and in 1224 was begun the rebuilding of the choir, in its present splendid Early English style. The nave was remodelled in the 14th century, and, excepting the W. bays, shows partly Decorated but principally early Perpendicular work. The building is cruciform, and is without aisles in the transepts, but has secondary choir-transepts. A Jesus chapel (an uncommon feature) opens from the N. nave aisle, from which it is separated by a very beautiful modern screen of stone, in the Perpendicular style. Without, the cathedral is severely plain, with the exception of the ornate tower, which dates from 1374, and is 196 ft. in height. The principal dimensions of the cathedral are—extreme length 425 ft. (nave 170 ft., choir 180 ft.), extreme width 145 ft. (choir 78 ft.), height of nave 68 ft. The monastic remains lie to the S. The cloisters are of Perpendicular work engrafted upon Norman walls, being entered from the S. through a fine Norman doorway. In them the effect of the warm red sandstone is particularly beautiful. An interesting Norman chapter house adjoins them on the E., its Perpendicular roof supported on a central column, while on the S. lies the Refectory, a fine Decorated room (1372) now devoted to the uses of the Cathedral School. There are also picturesque ruins of the Guesten Hall (1320). A very extensive restoration was begun in 1857, upwards of £100,000 being spent. Among the monuments in the cathedral, that of King John, in the choir, is the earliest sepulchral effigy of an English king in the country. There is an altar tomb, in a very fine late Perpendicular chantry chapel, of Arthur, Prince of Wales, son of Henry VII., who died in 1502. There are also monuments of John Gauden, the bishop who wrote *Icon basilike*, often attributed to Charles I., of Bishop Hough by Roubillac, and of Mrs Digby by Chantrey.

Of the eleven parish churches, St Alban's has considerable Norman remains, St Peter's contains portions of all Gothic styles, St Helen's, with a fine peal of bells commemorating the victories of Marlborough, has also Gothic portions, but the majority were either rebuilt in the 18th century, or are modern. St Andrews has a beautiful spire, erected in 1751, 155 ft. 6 in. in height. Holy Trinity preserves the ancient roof of the Guesten Hall. St John's in Bedwardine was made a parish church in 1371.

There are no remains of the old castle of Worcester; it adjoined the monastery so closely that King John gave its yard to the monks, and after that time it ceased to be a stronghold. The Commandery, founded by St Wulfstan in 1085, was a hospital, and its name appears to lack authority. It was rebuilt in Tudor times, and there remains a beautiful hall, with music gallery, canopied dais, and a fine bay window, together with other parts. The wood-carving is exquisite. There are many old half-timbered houses. The guild-hall (1723) is an admirable building in the Italian style; it contains a portrait of George III., by Sir Joshua Reynolds, presented by the king to commemorate his visit to the city at the triennial musical festival in 1788. This, the Festival of the Three Choirs, is maintained here alternately with Gloucester and Hereford. The corporation possesses some interesting old charters and manuscripts, and good municipal regalia. Public buildings include the shire-hall (1835), Corn Exchange and market-house. Fairs are held thrice annually. The Victoria Institute includes a library, museum and art gallery. The cathedral school was founded by Henry VIII. in 1541, Queen Elizabeth's, in a modern building, in 1563; there are also a choir school, and municipal art, science and technical schools. In the vicinity of the city there is a large Benedictine convent, at Stanbrook Hall, with a beautiful modern chapel. The Clothiers' Company possesses a charter granted by Queen Elizabeth; but the great industries are now the manufacture of gloves and of porcelain. A company of glovers was incorporated in 1661. The manufacture of porcelain is famous. The materials employed are china clay and china stone from Cornwall, felspar from Sweden, fire-clay from Stourbridge and Broseley, marl, flint and calcined bones. The Royal Porcelain works cover 5 acres. Among Worcester's other trades are those of iron, iron goods and engineering works, carriage making, rope spinning, boat building, tanning and the production of chemical manures and of cider and perry. There is a considerable carrying trade on the Severn.

The charities are numerous, and include St Oswald's hospital, Nash's almshouses, Wyatt's almshouses, the Berkeley hospital, Goulding hospital, Shewring's hospital, Inglethorpe's almshouses, Waldgrave's almshouses, Moore's blue-coat school, Queen Elizabeth's charity, and others.

Traces of British and Roman occupation have been discovered at Worcester (*Wigeran Ceaster, Wigornia*), but its history begins with the foundation of the episcopal see. Being the chief city on the borders of Wales, Worcester was frequently visited by the kings of England. In 1139 it was taken by the Empress Maud and retaken and burnt by Stephen in 1149. It surrendered to Simon de Montfort in 1263. In 1642, during the Great Rebellion, a handful of cavaliers was besieged here, and in spite of an attempted relief by Prince Rupert, the city was pillaged, as it was again in 1646. In 1651 Charles II. with the Scottish army marched into Worcester, where he was welcomed by the citizens. Cromwell took up his position on the Red Hill just outside the city gates. Lambert succeeded in passing the Severn at Upton, and drove back the Royalist troops towards Worcester. Charles, seeking an advantage of this division of the enemy on opposite sides of the river, attacked Cromwell's camp. At first he was successful, but Cromwell was reinforced by Lambert's troops in time to drive back Charles's foot, who were not supported by the Scottish horse, and the rout of the King's force was complete.

In the reign of King Alfred, Æthelred and Æthelflead, ealdorman and lady of the Mercians, at the request of the bishop "built a burgh at Worcester" and granted to him half of their rights and privileges there "both in market and street within the borough and without." Richard I. in 1189 granted the town to the burgesses at a fee-farm of £24, and Henry III. in 1227 granted a gild merchant and exemption from toll, and raised the farm to £30. The first incorporation charter was granted by Philip and Mary in 1554 under the title of bailiffs, aldermen, chamberlains and citizens, but James I. in 1622 made the city a separate county and granted a corporation of a mayor, 6 aldermen, and a common council consisting of one body of 24 citizens, including the mayor and aldermen, and another body of 48, who elected the mayor from among the 24. By the Municipal Reform Act of 1835 the government was again altered. The burgesses returned two members to parliament from 1295 to 1885, when the number was reduced to one. As early as 1203 the men of the town paid 100s. for licence to buy and sell cloth as they had done in the time of Henry III., and in 1590 the weavers, walkers and clothiers received an incorporation charter, but the trade had already begun to decline and by 1789 had ceased to exist. Its place was taken by the manufacture of porcelain, introduced in 1751 by Dr Wall, and by the increasing manufacture of gloves, a trade in which is known to have been carried on in the 15th century.

See *Victoria County History, Worcester*; John Noake, *Worcester in Olden Times* (1849); Valentine Green, *The History and Antiquities of the City and Suburbs of Worcester* (1796).

WORCESTER, a city and the county-seat of Worcester county, Massachusetts, U.S.A., about 44 m. W. of Boston on the Blackstone river, a branch of the Providence river. Pop. (1900) 118,421 (37,652 foreign-born); (1905, state census) 128,135; (1910) 145,986. Area, 39 sq. m. Worcester is served by the Boston & Albany, the New York, New Haven & Hartford and the Boston & Maine railways, and is connected with Springfield and Boston by interurban electric lines. The park system of the city comprises about twenty tracts with a total area of more than 1100 acres; among them are Elm Park (88 acres) in the W. including Newton Hill (670 ft. above sea-level), and Green Hill Park (500 acres) in the N.E. Other parks are Institute Park (18 acres) and Boynton Park (113 acres) in the N.W. on Salisbury Pond, given to the city by Stephen Salisbury; Dodge Park (13 acres, N.); Burncoat Park (42 acres, N.E.); Chandler Hill Park (80 acres, E.); Hadwen (50 acres), University (14 acres) and Crompton Park (15·25 acres) in the S.W. and S.; and Greenwood (12·65 acres), Beaver Brook (15·5 acres), Tatnuck (2·94 acres), Kendrick (14·87 acres) and Vernon Hill (16·4 acres). Two miles N.E. of the centre of the city lies lake Quinsigamond, 4 m. long, from which flows the river of the same name, a branch of the Blackstone. On its shores is Lake Park (110 acres). Fronting the Common, a wooded square in the centre of the city, is the City Hall, near which is a bronze statue, by D. C. French, of G. F. Hoar. On the Common there is a monument, designed by Randolph Rogers, to the soldiers and sailors of the Civil War, and one to Colonel Timothy Bigelow (1739–1790), one of Worcester's soldiers of the War of Independence. The E. side of the Common was the site of an old burying ground, and the W. side of the First Church, built in 1663. About ½ m. N. of the Common is Lincoln Square, adjacent to which is the granite Court House; in front of it is a statue of General Charles Devens (1820–1891) by French. The old Salisbury mansion, dating back to Colonial days, stands in this square. At Salisbury Street and Park Avenue are the library and museum (1910) of the American Antiquarian Society, established in 1812 by Isaiah Thomas, with a collection of interesting portraits, a library of 99,000 vols. and many thousands of pamphlets, particularly rich in *Americana*. The Art Museum was erected and endowed (1899–1903) by Stephen Salisbury, and contains a fine collection of casts, many valuable paintings, and the Bancroft Collection of Japanese art. The city has many fine churches.

Worcester is an important educational centre. Clark University was established here in 1889 by Jonas Gilman Clark as a purely graduate institution. In 1902 Clark College was opened for undergraduate work under the presidency of Carroll D. Wright, with a separate endowment of $1,300,000. In 1910 it had 30 teachers and 177 students. The university in 1910 had 15 instructors, 103 students and a library of 50,000 volumes. Under G. Stanley Hall, who was made president in 1888, the university became well known for its work in child-psychology. Worcester Polytechnic Institute (founded in 1865 by John Boynton of Templeton, Massachusetts; opened in 1868) is one of the best-equipped technical schools of college rank in the country; in 1910 it had 49 instructors, 515 students and a library of 12,700 vols.; the buildings are near Institute Park.

On Packachoag Hill or Mt. St James (690 ft.) is the Jesuit college of the Holy Cross, with a preparatory school, founded in 1843 by Benedict J. Fenwick, bishop of Boston, and chartered in 1865; in 1910 it had 30 instructors and 450 students. There is a State Normal School (1874), and connected with it a kindergarten training school (1910).

The city library (175,000 vols.), founded in 1859, was one of the first in the country to be open on Sunday. There are four daily newspapers, one printed in French. From 1775 to 1848 was published here the weekly edition of the *Worcester Spy*, established by Isaiah Thomas in 1770 in Boston as the *Massachusetts Spy* and removed by him to Worcester at the outbreak of the War of Independence; a daily edition was published from 1845 to 1904. Early in the 19th century the city was an important publishing centre.

Worcester is one of the most important manufacturing centres in New England: in 1905 the value of the factory product was $52,144,965, ranking the city third among the cities of the state. Manufacturers of hardware and tools at an early date laid the foundation for the present steel and other metal industries, in which 42·8% of all the workers were employed in 1905. A large proportion are employed in the wire and wire-working industries, one plant, that of the American Steel and Wire Company, employing about 5000 hands; in 1905 the total value of wire-work was $1,726,088, and of foundry and machine shop products $7,327,095.

The first grant of land in this part of the Blackstone Valley was made in 1657, and the town, Quansigamond (or Quinsigamond) Plantation, was laid out in October 1668. In 1675, on the outbreak of King Philip's War, it was temporarily abandoned. In 1684 it was settled again and its name was changed to Worcester because several leaders in the settlement were natives of Worcester, England. In 1713 the vicinity was opened up to settlement, a tavern and a mill were constructed, and a turnpike road was built to Boston. Worcester was incorporated as a town in 1722. In 1755 a small colony of the exiled Acadians settled here. At the outbreak of the War of Independence Worcester was little more than a country market town. During Shays's Rebellion it was taken by the rebels and the courts were closed. The first real impetus to its growth came in 1835 with the construction of the Boston & Worcester railway, and it received a city charter in 1848. The strong anti-slavery sentiment of the city led in 1854 to a serious riot, owing to an apparent attempt to enforce the Fugitive Slave Law. In Worcester, or within a radius of a dozen miles of it, were the homes of Elias Howe, inventor of the sewing machine; Eli Whitney, inventor of the cotton gin; Erastus Bigelow (1814–1879), inventor of the carpet weaving machine; Dr Russell L. Hawes, inventor of an envelope machine; Thomas Blanchard (1788–1864), inventor of the machine for turning irregular forms; Samuel Crompton (1753–1827) and Lucius James Knowles (1819–1884), the perfectors of the modern loom; and Draper Ruggles, Joel Nourse and J. C. Mason, perfectors of the modern plough and originators of many inventions in agricultural machinery.

See F. E. Blake, *Incidents of the First and Second Settlements of Worcester* (Worcester, 1884); Wm. Lincoln, *History of Worcester to 1836* (Worcester, 1837); also same extended to 1862 by Charles Hersey (Worcester, 1862); D. H. Hurd, *History of Worcester County* (Worcester, 2 vols., 1889); I. N. Metcalf, *Illustrated Business Guide to City of Worcester* (Worcester, 1880); C. F. Jewett, *History of Worcester County* (2 vols., Worcester, 1879); the *Collections and Proceedings* (1881 sqq.) of the Worcester Society of Antiquity (instituted in 1877).

WORCESTERSHIRE, a midland county of England, bounded N. by Staffordshire, E. by Warwickshire, S. by Gloucestershire, W. by Herefordshire, and N.W. by Shropshire. The area is 751 sq. m. It covers a portion of the rich valleys of the Severn and Avon, with their tributary valleys and the hills separating them. The Severn runs through the county from N. at Bewdley to S. near Tewkesbury, traversing the Vale of Worcester. Following this direction it receives from the E. the Stour at Stourport, the Salwarpe above Worcester, and the Avon, whose point of junction is just outside the county. The Avon valley is known in this county as the Vale of Evesham, and is devoted to orchards and market gardening. The Cotteswold Hills rise sharply from it on the S.E., of which Bredon Hill, within this county, is a conspicuous spur. The Avon forms the county boundary with Gloucestershire for a short distance above its mouth. The Teme joins the Severn from the W. below Worcester, and forms short stretches of the W. boundary. Salmon and lampreys are taken in the Severn; trout and grayling abound in the Teme and its feeders. Besides the Cotteswolds, the most important hills are the Malvern and the Lickey or Hagley ranges. The Malverns rise abruptly from the flat Vale of Worcester on the W. boundary, being partly in Herefordshire, and reach a height of 1395 ft. in the Worcester Beacon, and 1114 in the Hereford Beacon. They are divided by the Teme from a lower N. continuation, the Abberley Hills. The Lickey Hills cross the N.E. corner of the county, rarely exceeding 1000 ft. Their N. part is called the Clent Hills. Partly within the county are the sites of two ancient forests. That of Wyre, bordering the Severn on the W. in the N. of Worcestershire and in Shropshire, retains to some extent its ancient character; but Malvern Chase, which clothed the slopes of the Malvern Hills, is hardly recognizable.

Geology.—Archean gneisses and schists (Malvernian) and volcanic rocks (Uriconian) form the core of the Malvern Hills; being the most durable rocks in the district, they form the highest ground. Similarly tuffs and volcanic grits (Barnt Green rocks) crop out in the Lickey Hills near Bromsgrove. They are succeeded by the Cambrian rocks (Hollybush Sandstone and Malvern Shales), which are well developed at the S. end of the Malvern Hills, where in places the Archean rocks have been thrust over them. The Lickey Quartzite, probably of the same age as the Hollybush Sandstone, is extensively quarried for roadstone. Strata of Ordovician age being absent in Worcestershire, the Silurian rocks rest unconformably on the earlier formations; they include the Upper Llandovery, Wenlock and Ludlow series. These dip steeply W. from the Malvern and Abberley axis and plunge under the Old Red Sandstone; some of the lower beds are represented at the Lickey, while the Wenlock Limestone forms some sharp anticlines at Dudley. The Silurian strata are rich in marine fossils, and the included limestones (Woolhope, Wenlock and Aymestry) are all represented in the Malvern district. The Old Red Sandstone succeeds the Silurian on the W. borders of the county. The Carboniferous Limestone and Millstone Grit were not deposited, so that the Coal Measures rest unconformably on the older rocks. These are represented in the Wyre Forest coalfield near Bewdley and in the S. end of the S. Staffordshire coalfield near Halesowen; they contain rich seams of coal and ironstone and several intrusions of basalt (dhustone, Rowley-rag). The so-called Permian red rocks are now grouped with the Coal Measures; some intercalated breccias cap the Clent Hills (1036 ft.). The Triassic red rocks—unconformable to all below—cover the centre of the county, and on the W. are faulted against the older rocks of the Malverns; they include the Bunter sandstones and pebble-beds, and the Keuper sandstones and marls, the beds of rock-salt in the latter yielding brine-springs (Droitwich, Stoke Prior). A narrow and seldom-exposed outcrop of Rhaetic beds introduces the marine Liassic formation which occupies most of the S.E. of the county; the Lower Lias consists of blue clays and limestones; the latter are burnt for lime and yield abundant ammonites. The sands and limestones of the Middle Lias and the clays of the Upper Lias are present in the lower slopes of Bredon Hill and of the Cotteswolds, and are succeeded by the sands and oolitic limestones of the Inferior Oolite. Glacial deposits—boulder-clay, isolated boulders, sand and gravel—are met with in many parts of the county, while later valley-gravels have yielded remains of mammoth, rhinoceros, &c. Coal, ironstone, salt, limestone and roadstone are the chief mineral products.

Climate and Agriculture.—The climate is generally equable and healthy, and is very favourable to the cultivation of fruit, vegetables and hops, for which Worcestershire has long held a high reputation, the red marls and the rich loams being good both for market gardens and tillage. About five-sixths of the area of the county is under cultivation, and of this about five-eighths is in permanent pasture. Orchards are extensive, and there are large tracts of woodland. Wheat and oats are the principal grain crops. Turnips are grown on about one-third of the green crop acreage, and potatoes on about one-fourth. There is a considerable acreage under beans. In the neighbourhood of Worcester there are large nurseries.

Industries.—In the N. Worcester includes a portion of the Black Country, one of the most active industrial districts in England. Dudley, Netherton and Brierley Hill, Stourbridge, Halesowen, Oldbury and the S. and W. suburbs of Birmingham, have a vast population engaged in iron-working in all its branches, from engineering works to nail-making, in the founding and conversion, galvanizing, finishing and extracting of metals, in chemical and glass works. Worcester is famous for porcelain, Kidderminster for carpets and

Redditch for needles, fish-hooks, &c. Salt is produced from brine at Droitwich and Stoke. The fire-clays and limestone of the N. unite with the coal measures to form a basis of the industries in the Black Country. Furniture, clothing and paper-making and leather-working are also important.

Communications.—The Great Western railway serves Evesham, Worcester, Droitwich and Kidderminster, with branches from Worcester to Malvern and into Herefordshire, from Kidderminster to Tenbury and the W., and from the same junction to Dudley and Birmingham. The London & North-Western system touches Dudley. The Midland company's line between Derby, Birmingham and Bristol runs from N. to S. through the county, with a branch diverging through Droitwich and Worcester, another serving Malvern from Ashchurch, and an alternative route from Birmingham to Ashchurch by Redditch and Evesham. The Severn is an important highway; the Avon, though locked up to Evesham, is little used save by pleasure-boats. Canals follow the courses of the Stour and the Salwarpe, and serve the towns of the Black Country.

Administration and Population.—The area of the ancient county is 480,560 acres, with a population in 1901 of 488,338. The area of the administrative county is 480,059 acres. The county is of very irregular shape, and has detached portions enclaved in Herefordshire, Staffordshire, Warwickshire and Gloucestershire. It comprises five hundreds. The municipal boroughs are Bewdley (2866), Droitwich (4201), Dudley (48,733), Evesham (7101), Kidderminster (24,681) and Worcester (46,624). Dudley and the city and county town of Worcester are county boroughs. The urban districts are Bromsgrove (8418), King's Norton and Northfield (57,122; forming a S. suburb of Birmingham), Lye and Wollescote (10,976; adjacent to Stourbridge), Malvern (16,449), North Bromsgrove (5688), Oldbury (25,191), Redditch (13,493), Stourbridge (16,302) and Stourport (4529). Halesowen (4057), Pershore (3348), Tenbury (2080) and Upton-upon-Severn (2225) may be mentioned among other towns. The county is in the Oxford circuit, and assizes are held at Worcester. It has one court of quarter-sessions, and is divided into 17 petty sessional divisions. Worcester and Dudley have separate courts of quarter-sessions, and all the boroughs have commissions of the peace. The total number of civil parishes is 239. The ancient county, which is mostly in the diocese of Worcester, with a few parishes in that of Hereford, contains 231 ecclesiastical parishes or districts wholly or in part. The county contains five parliamentary divisions—West or Bewdley, East, South or Evesham, Mid or Droitwich, and North or Oldbury. The parliamentary boroughs of Kidderminster and Worcester return one member each, and parts of the boroughs of Dudley and Birmingham are included in the county.

History.—The earliest English settlers in the district now known as Worcestershire were a tribe of the Hwiccas of Gloucestershire, who spread along the Severn and Avon valleys in the 6th century. By 679 the Hwiccan kingdom was formed into a separate diocese with its see at Worcester, and the Hwiccas had made themselves masters of the modern county, with the exception of the N.W. corner beyond the Abberley Hills. From this date the town of Worcester became not only the religious centre of the district, but the chief point of trading and military communication between England and Wales. A charter of the reign of Alfred alludes to the erection of a "burh" at Worcester by Edward and Æthelflead, and it was after the recovery of Mercia from the Danes by Edward that the shire originated as an administrative area. The first political event recorded by the *Saxon Chronicle* in Worcestershire is the destruction of Worcester by Hardicanute in 1041 in revenge for the murder of two of his tax-gatherers by the citizens.

In no county has the monastic movement played a more important part than in Worcestershire. Foundations existed at Worcester, Evesham, Pershore and Fladbury in the 8th century; at Great Malvern in the 11th century, and in the 12th and 13th centuries at Little Malvern, Westwood, Bordesley, Whistones, Cookhill, Dudley, Halesowen and Astley. At the time of the Domesday Survey more than half Worcestershire was in the hands of the church. The church of Worcester held the triple hundred of Oswaldslow, with such privileges as to exclude the sheriff's jurisdiction entirely, the profits of all the local courts accruing to the bishop, whose bailiffs in 1276 claimed to hold his hundred outside Worcester, at Dryhurst, and at Wimborntree. The two hundreds owned by the church of Westminster, and that owned by Pershore, had in the 13th century been combined to form the hundred of Pershore, while the hundred of Evesham owned by Evesham Abbey had been converted into Blakenhurst hundred; and the irregular boundaries and outlying portions of these hundreds are explained by their having been formed out of the scattered endowments of their ecclesiastical owners. Of the remaining Domesday hundreds, Came, Clent, Cresselaw and Esch had been combined to form the hundred of Halfshire by the 13th century, while Doddingtree remained unchanged. The shire-court was held at Worcester.

The vast possessions of the church prevented the growth of a great territorial aristocracy in Worcestershire, and Dudley Castle, which passed from William Fitz-Ansculf to the families of Paynel and Someri, was the sole residence of a feudal baron. The Domesday fief of Urse d'Abitot the sheriff, founder of Worcester Castle, and of his brother Robert le Despenser passed in the 12th century to the Beauchamps, who owned Elmley and Hanley Castles. The possessions of William Fitz Osbern in Doddingtree hundred and the Teme valley fell to the crown after his rebellion in 1074 and passed to the Mortimers. Hanley Castle and Malvern Chase were granted by Henry III. to Gilbert de Clare, with exemption from the sheriff's jurisdiction.

The early political history of Worcestershire centres round the city of Worcester. In the Civil War of the 17th century Worcestershire was conspicuously loyal. On the retreat of Essex from Worcester in 1642 the city was occupied by Sir William Russell for the king, and only surrendered in 1646. In 1642 Prince Rupert defeated the parliamentary troops near Powick. Sudeley Castle surrendered in 1644, and Dudley and Hartlebury by command of the king in 1646.

The Droitwich salt-industry was very important at the time of the Domesday Survey, Bromsgrove alone sending 300 cartloads of wood yearly to the salt-works. In the 13th and 14th centuries Bordesley monastery and the abbeys of Evesham and Pershore exported wool to the Florentine and Flemish markets, and in the 16th century the Worcestershire clothing industry gave employment to 8000 people; fruit-culture with the manufacture of cider and perry, nail-making and glass-making also flourished at this period. The clothing industry declined in the 17th century, but the silk-manufacture replaced it at Kidderminster and Blockley. Coal and iron were mined at Dudley in the 13th century.

As early as 1295 Worcestershire was represented by sixteen members in parliament, returning two knights for the shire and two burgesses each for the city of Worcester and the boroughs of Bromsgrove, Droitwich, Dudley, Evesham, Kidderminster and Pershore. With the exception of Droitwich, however, which was represented until 1311 and again recovered representation in 1554, the boroughs ceased to make returns. Evesham was re-enfranchised in 1604, and in 1606 Bewdley returned one member. Under the Reform Act of 1832 the county returned four members in two divisions; Droitwich lost one member; Dudley and Kidderminster were re-enfranchised, returning one member each. In 1867 Evesham lost one member.

Antiquities.—Remains of early camps are scarce, but there are examples at Berrow Hill near the Teme, W. of Worcester, at Round Hill by Spetchley, 3 m. E. of Worcester, and on the Herefordshire Beacon. Roman remains have been discovered on a few sites, as at Kempsey on the Severn, S. of Worcester, at Ripple, in the S. near Upton, and at Droitwich. There are remains of the great abbeys at Evesham and Pershore, and the fine priory church at Malvern, besides the cathedral at Worcester. There are further monastic remains at Halesowen and at Bordesley near Redditch, and there was a Benedictine priory at Astley, 3 m. S.W. of Stourport. There are fine churches in several of the larger towns, as Bromsgrove. The village churches are generally of mixed styles. Good Norman work remains in those of Martley, 8 m. N.W. of Worcester, Astley, Rous Lench in the Evesham district, Bredon near Pershore, and Bockleton in the N.W. of the county; while the Early English churches of Kempsey and Ripple are noteworthy. In domestic architecture, the half-timbered style adds to the picturesqueness of many streets in the towns and villages; and among country houses this style is well exemplified in Birts Morton Court and Eastington Hall, in the district S. of Malvern, in Elmley Lovett Manor between Droitwich and Kidderminster, and in Pirton Court near

Kempsey. Westwood Park is a mansion of the 16th and 17th centuries, with a picturesque gatehouse of brick; the site was formerly occupied by a Benedictine nunnery. Madresfield Court, between Worcester and Malvern, embodies remains of a fine Elizabethan moated mansion.

See *Victoria County History, Worcestershire*; T. R. Nash, *Collections for the History of Worcestershire* (2 vols., London, 1781–1799); Sir Charles Hastings, *Illustrations of the Natural History of Worcestershire* (London, 1834); W. D. Curzon, *Manufacturing Industries of Worcestershire* (Birmingham, 1883); W. S. Brassington, *Historic Worcestershire* (Birmingham, 1893). See also publications of the Worcester Historical Society.

WORDSWORTH, CHARLES (1806–1892), Scottish bishop, son of Christopher Wordsworth, Master of Trinity, was born in London on the 22nd of August 1806, and educated at Harrow and Christ Church, Oxford. He was a brilliant classical scholar, and a famous cricketer and athlete; he was in the Harrow cricket eleven in the first regular matches with Eton (1822) and Winchester (1825), and is credited with bringing about the first Oxford and Cambridge match in 1827, and the first university boat-race in 1828, in both of which he took part. He won the Chancellor's Latin verse at Oxford in 1827, and the Latin essay in 1831, and took a first-class in classics. From 1830 to 1833 he had as pupils a number of men (including W. E. Gladstone and H. E. Manning) who afterwards became famous. He then travelled abroad during 1833–1834, and after a year's work as tutor at Christ Church (1834–1835) was appointed second master at Winchester. He had previously taken holy orders, though he only became priest in 1840, and he had a strong religious influence with the boys. In 1839 he brought out his *Greek Grammar*, which had a great success. In 1846, however, he resigned; and then accepted the wardenship of Trinity College, Glenalmond, the new Scottish Episcopal public school and divinity college, where he remained from 1847 to 1854, having great educational success in all respects; though his views on Scottish Church questions brought him into opposition at some important points to W. E. Gladstone. In 1852 he was elected bishop of St Andrews, Dunkeld and Dunblane, and was consecrated in Aberdeen early next year. He was a strong supporter of the establishment, but conciliatory towards the Free churches, and this brought him into a good deal of controversy. He was a voluminous writer, and one of the company of revisers of the New Testament (1870–1881), among whom he displayed a conservative tendency. He died at St Andrews on the 5th of December 1892. He was twice married, first in 1835 to Charlotte Day (d. 1839), and secondly in 1846 to Katherine Mary Barter (d. 1897). He had thirteen children altogether.

See his *Annals of my Early Life* (1891), and *Annals of My Life*, edited by W. Earl Hodgson (1893); also *The Episcopate of Charles Wordsworth*, by his nephew John, bishop of Salisbury (1899).

WORDSWORTH, CHRISTOPHER (1774–1846), English divine and scholar, youngest brother of the poet William Wordsworth, was born on the 9th of June 1774, and was educated at Trinity College, Cambridge, where he became a fellow in 1798. Twelve years later he received the degree of D.D. He took holy orders, and obtained successive preferments through the patronage of Manners Sutton, bishop of Norwich, afterwards (1805) archbishop of Canterbury, to whose son Charles (afterwards Speaker of the House of Commons, and viscount Canterbury) he had been tutor. He had in 1802 attracted attention by his defence of Granville Sharp's then novel canon "on the uses of the definitive article" in New Testament textual criticism. In 1810 he published an *Ecclesiastical Biography* in 6 volumes. On the death of Bishop Mansel, in 1820, he was elected Master of Trinity, and retained that position till 1841, when he resigned. He is regarded as the father of the modern "classical tripos," since he had, as vice-chancellor, originated in 1821 a proposal for a public examination in classics and divinity, which, though then rejected, bore fruit in 1822. Otherwise his mastership was undistinguished, and he was not a popular head with the college. He died on the 2nd of February 1846, at Buxted. In his *Who wrote Ikon Basilike?* (1824), and in other writings, he advocated the claims of Charles I. to its authorship; and in 1836 he published, in 4 volumes, a work of *Christian Institutes*, selected from English divines. He married in 1804 Miss Priscilla Lloyd (d. 1815), a sister of Charles Lamb's friend Charles Lloyd; and he had three sons, John W. (1805–1839), Charles (*q.v.*), and Christopher (*q.v.*); the two latter both became bishops, and John, who became a fellow and classical lecturer at Trinity College, Cambridge, was an industrious and erudite scholar.

WORDSWORTH, CHRISTOPHER (1807–1885), English bishop and man of letters, youngest son of Christopher Wordsworth, Master of Trinity, was born in London on the 30th of October 1807, and was educated at Winchester and Trinity, Cambridge. He, like his brother Charles, was distinguished as an athlete as well as for scholarship. He became senior classic, and was elected a fellow and tutor of Trinity in 1830; shortly afterwards he took holy orders. He went for a tour in Greece in 1832–1833, and published various works on its topography and archaeology, the most famous of which is "Wordsworth's" *Greece* (1839). In 1836 he became Public Orator at Cambridge, and in the same year was appointed headmaster of Harrow, a post he resigned in 1844. He then became a canon of Westminster, and from 1850 to 1870 he held a country living in Berkshire. In 1865 he was made archdeacon of Westminster, and in 1869 bishop of Lincoln. He died on the 20th of March 1885. He was a man of fine character, with a high ideal of ecclesiastical duty, and he spent his money generously on church objects. As a scholar he is best known for his edition of the Greek New Testament (1856–1860), and the *Old Testament* (1864–1870), with commentaries; but his writings were many in number, and included a volume of devotional verse, *The Holy Year* (1862), *Church History up to A.D. 451* (1881–1883), and *Memoirs* of his uncle the poet (1851), to whom he was literary executor. His *Inscriptiones Pompeianae* (1837) was an important contribution to epigraphy. He married in 1838 Susanna Hartley Frere (d. 1884), and had a family of seven; the eldest son was John (b. 1843), bishop of Salisbury (1885), and author of *Fragments of Early Latin* (1874); the eldest daughter, Elizabeth (b. 1840), was the first principal (1879) of Lady Margaret Hall, Oxford.

His *Life*, by J. H. Overton and Elizabeth Wordsworth, was published in 1888.

WORDSWORTH, DOROTHY (1771–1855), English writer and diarist, was the third child and only daughter of John Wordsworth of Cockermouth and his wife, Anne Cookson-Crackanthorpe. The poet William Wordsworth was her brother and a year her senior. On the death of her father in 1783, Dorothy found a home at Penrith, in the house of her maternal grandfather, and afterwards for a time with a maiden lady at Halifax. In 1787, on the death of the elder William Cookson, she was adopted by her uncle, and lived in his Norfolk parish of Forncett. She and her brother William, who dedicated to his sister the *Evening Walk* of 1792, were early drawn to one another, and in 1794 they visited the Lakes together. They determined that it would be best to combine their small capitals, and that Dorothy should keep house for the poet. From this time forth her life ran on lines closely parallel to those of her great brother, whose companion she continued to be till his death. It is thought that they made the acquaintance of Coleridge in 1797.

From the autumn of 1795 to July 1797 William and Dorothy Wordsworth took up their abode at Racedown, in Dorsetshire. At the latter date they moved to a large manor-house, Alfoxden, in the N. slope of the Quantock hills, in W. Somerset, S. T. Coleridge about the same time settling near by in the town of Nether Stowey. On the 20th of January 1798 Dorothy Wordsworth began her invaluable *Journal*, used by successive biographers of her brother, but first printed in its quasi-entirety by Professor W. Knight in 1897. The Wordsworths, Coleridge, and Chester left England for Germany on the 14th of September 1798; and of this journey also Dorothy Wordsworth preserved an account, portions of which were published in 1897. On the 14th of May 1800 she started another *Journal* at Grasmere, which she kept very fully until the 31st of December of the same year. She resumed it on the 1st of January 1802 for another twelve months, closing on the 11th of January 1803. These were printed first in 1889. She composed *Recollections of a Tour in Scotland*, in 1803, with her brother and Coleridge; this was first published in 1874. Her next contribution to the family history was her *Journal of a Mountain Ramble*, in November 1805, an account of a walking tour in the Lake district with her brother. In July 1820 the Wordsworths made a tour on the continent of Europe, of which Dorothy preserved a very careful record, portions of which were given to the world in 1884, the writer having refused to publish it in 1824 on the ground that her "object was not to make a book, but to leave to her niece a neatly-penned memorial of those few interesting months of our lives." Meanwhile, without her brother, but in the company of Joanna Hutchinson, Dorothy Wordsworth had travelled over Scotland in 1822, and had composed a *Journal* of that tour. Other MSS. exist and have been examined carefully by the editors and biographers of the poets, but the records which we have mentioned and her letters form the principal literary relics of Dorothy Wordsworth. In 1829 she was attacked by very serious illness, and was never again in good health. After 1836 she could not be considered to be in possession of her mental faculties, and became a pathetic member of the interesting household at Grasmere. She outlived the poet, however, by several years, dying at Grasmere on the 25th of January 1855.

It would be difficult to exaggerate the importance of Dorothy Wordsworth's companionship to her illustrious brother. He has left numerous tributes to it, and to the sympathetic originality of her perceptions. "She," he said,

"gave me eyes, she gave me ears;
And humble cares, and delicate fears;
A heart the fountain of sweet tears;
And love, and thought, and joy."

The value of the records preserved by Dorothy Wordsworth, especially in earlier years, is hardly to be over-estimated by those who desire to form an exact impression of the revival of English poetry. When Wordsworth and Coleridge refashioned imaginative literature at the close of the 18th century, they were daily and hourly accompanied by a feminine presence exquisitely attuned to sympathize with their efforts, and by an intelligence which was able and anxious to move in step with theirs. "S. T. C. and my beloved sister," William Wordsworth wrote in 1832, "are the two beings to whom my intellect is most indebted." In her pages we can put our finger on the very pulse of the machine; we are present while the New Poetry is evolved, and the sensitive descriptions in her prose lack nothing but the accomplishment of verse. Moreover, it is certain that the sharpness and fineness of Dorothy's observation, "the shooting lights of her wild eyes," actually afforded material to the poets. Coleridge, for instance, when he wrote his famous lines about "The one red leaf, the last of its clan," used almost the very words in which, on the 7th of March 1798, Dorothy Wordsworth had recorded "One only leaf upon the top of a tree . . . danced round and round like a rag blown by the wind."

It is not merely by the biographical value of her notes that Dorothy Wordsworth lives. She claims an independent place in the history of English prose as one of the very earliest writers who noted, in language delicately chosen, and with no other object than to preserve their fugitive beauty, the little picturesque phenomena of homely country life. When we speak with very high praise of her art in this direction, it is only fair to add that it is called forth almost entirely by what she wrote between 1798 and 1803, for a decline similar to that which fell upon her brother's poetry early invaded her prose; and her later journals, like her *Letters*, are less interesting because less inspired. A *Life* by E. Lee was published in 1886; but it is only since 1897, when Professor Knight collected and edited her scattered MSS., that Dorothy Wordsworth has taken her independent place in literary history. (E. G.)

WORDSWORTH, WILLIAM (1770–1850), English poet, was born at Cockermouth, on the Derwent, in Cumberland, on the 7th of April 1770. He was the son of John Wordsworth (1741–1783), an attorney, law agent to the first earl of Lonsdale, a prosperous man in his profession, descended from an old Yorkshire family of landed gentry. On the mother's side also Wordsworth was connected with the middle territorial class: his mother, Anne Cookson, was the daughter of a well-to-do mercer in Penrith, but her mother was Dorothy Crackanthorpe, whose ancestors had been lords of the manor of Newbiggin, near Penrith, from the time of Edward III. He thus came of "gentle" kin, and was proud of it. The country squires and farmers whose blood flowed in Wordsworth's veins were not far enough above local life to be out of sympathy with it, and the poet's interest in the common scenes and common folk of the North country hills and dales had a traceable hereditary bias. William Wordsworth was one of a family of five, the others being Richard (1768–1816), Dorothy (*q.v.*), John (1772–1805), and Christopher (*q.v.*).

Though his parents were of sturdy stock, both died prematurely, his mother when he was eight years old, his father when he was thirteen. At the age of eight Wordsworth was sent to school at Hawkshead, in the Esthwaite valley in Lancashire. His father died while he was there, and at the age of seventeen he was sent to St John's College, Cambridge. He did not distinguish himself in the studies of the university, and for some time after taking his degree of B.A., in January 1791, he showed what seemed to his relatives a most perverse reluctance to adopt any regular profession. His mother had noted his "stiff, moody and violent temper" in childhood, and it seemed as if this family judgment was to be confirmed in his manhood. After taking his degree, he was pressed to take holy orders, but would not; he had no taste for the law; he idled a few months aimlessly in London, a few months more with a Welsh college friend, with whom he had made a pedestrian tour in France and Switzerland during his last Cambridge vacation; then in the November of 1791 he crossed to France, ostensibly to learn the language, made the acquaintance of revolutionaries, sympathized with them vehemently, and was within an ace of throwing in his lot with the Girondins. When it came to this, his relatives cut off his supplies, and he was obliged to return to London towards the close of 1792. But still he resisted all pressure to enter any of the regular professions, published his poems *An Evening Walk* and *Descriptive Sketches* in 1793, and in 1794, still moving about to all appearance in stubborn aimlessness among his friends and relatives, had no more rational purpose of livelihood than drawing up the prospectus of a periodical of strictly republican principles to be called "The Philanthropist."

But all the time from his boyhood upwards a great purpose had been growing and maturing in his mind. *The Prelude* expounds in lofty impassioned strain how his sensibility for nature was "augmented and sustained," and how it never, except for a brief interval, ceased to be "creative" in the special sense of his subsequent theory. But it is with his feelings towards nature that *The Prelude* mainly deals; it says little regarding the history of his ambition to express those feelings in verse. It is the autobiography, not of the poet of nature, but of the worshipper and priest. The salient incidents in the history of the poet he communicated in prose notes and in familiar discourses. Commenting on the couplet in the *Evening Walk*—

"And, fronting the bright west, yon oak entwines
Its darkening boughs and leaves in stronger lines—"

he said:

> "This is feebly and imperfectly exprest; but I recollect distinctly the very spot where this first struck me. It was on the way between Hawkshead and Ambleside, and gave me extreme pleasure. The moment was important in my poetical history; for I date from it my consciousness of the infinite variety of natural appearances which had been unnoticed by the poets of any age or country, so far as I was acquainted with them; *and I made a resolution to supply in some degree the deficiency.* I could not at that time have been above fourteen years of age."

About the same time he wrote, as a school task at Hawkshead, verses that show considerable acquaintance with the poets of his own country at least, as well as some previous practice in the art of verse-making.[1] The fragment that stands at the beginning of his collected works, recording a resolution to end his life among his native hills, was the conclusion of a long poem written while he was still at school. And, undistinguished as he was at Cambridge in the contest for academic honours, the *Evening Walk*, his first publication, was written during his vacations.[1] He published it in 1793, to show, as he said, that he could do something, although he had not distinguished himself in university work. There are touches here and there of the bent of imagination that became dominant in him soon afterwards, notably in the moral aspiration that accompanies his *Remembrance of Collins* on the Thames:—

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[1] *Memoirs of William Wordsworth*, by Canon Wordsworth, vol. i. pp. 10, 11. According to his own statement in the memoranda dictated to his biographer, it was the success of this exercise that "put it into his head to compose verses from the impulse of his own

> "O glide, fair stream! for ever so
> Thy quiet soul on all bestowing,
> Till all our minds for ever flow
> As thy deep waters now are flowing."

But in the main this first publication represents the poet in the stage described in the twelfth book of *The Prelude*:—

> "Bent overmuch on superficial things,
> Pampering myself with meagre novelties
> Of colour and proportion; to the moods
> Of time and season, to the moral power,
> The affections, and the spirit of the place
> Insensible."

But, though he had not yet found his distinctive aim as a poet, he was inwardly bent upon poetry as "his office upon earth."

In this determination he was strengthened by his sister Dorothy (*q.v.*), who with rare devotion consecrated her life henceforward to his service. A timely legacy enabled them to carry their purpose into effect. A friend of his, whom he had nursed in a last illness, Raisley Calvert, son of the steward of the duke of Norfolk, who had large estates in Cumberland, died early in 1795, leaving him a legacy of £900. It may be well to notice how opportunely, as De Quincey half-ruefully remarked, money always fell in to Wordsworth, enabling him to pursue his poetic career without distraction. Calvert's bequest came to him when he was on the point of concluding an engagement as a journalist in London. On it and other small resources he and his sister, thanks to her frugal management, contrived to live for nearly eight years. By the end of that time Lord Lonsdale, who owed Wordsworth's father a large sum for professional services, and had steadily refused to pay it, died, and his successor paid the debt with interest. His wife, Mary Hutchinson, whom he married on the 4th of October 1802, brought him some fortune; and in 1813, when in spite of his plain living his family began to press upon his income, he was appointed stamp-distributor for Westmorland, with an income of £500, afterwards nearly doubled by the increase of his district. In 1842, when he resigned his stamp-distributorship, Sir Robert Peel gave him a Civil List pension of £300.

To return, however, to the course of his life from the time when he resolved to labour with all his powers in the office of poet. The first two years, during which he lived with his self-sacrificing sister at Racedown, in Dorset, were spent in half-hearted and very imperfectly successful experiments, satires in imitation of Juvenal, the tragedy of *The Borderers*,[2] and a poem in the Spenserian stanza, now entitled *Guilt and Sorrow*. How much longer this time of self-distrustful endeavour might have continued is a subject for curious speculation; an end was put to it by a fortunate incident, a visit from Coleridge, who had read his first publication, and seen in it, what none of the public critics had discerned, the advent of "an original poetic genius." Stubborn and independent as Wordsworth was, he needed some friendly voice from the outer world to give him confidence in himself. Coleridge rendered him this indispensable service. He had begun to seek his themes in

> "Sorrow, that is not sorrow, but delight;
> And miserable love, that is not pain
> To hear of, for the glory that redounds
> Therefrom to human kind, and what we are."

He read to his visitor one of these experiments, the story of the ruined cottage, afterwards introduced into the first book of *The Excursion*.[3] Coleridge, who had already seen original poetic genius in the poems published before, was enthusiastic in his praise of them as having "a character, by books not hitherto reflected."

June 1797 was the date of this memorable visit. So pleasant was the companionship on both sides that, when Coleridge returned to Nether Stowey, in Somerset, Wordsworth at his instance changed his quarters to Alfoxden, within a mile and a half of Coleridge's temporary residence, and the two poets lived in almost daily intercourse for the next twelve months. During that period Wordsworth's powers rapidly expanded and matured; ideas that had been gathering in his mind for years, and lying there in dim confusion, felt the stir of a new life, and ranged themselves in clearer shapes under the fresh quickening breath of Coleridge's swift and discursive dialectic.

The *Lyrical Ballads* were the poetic fruits of their companionship. Out of their frequent discussions of the relative value of common life and supernatural incidents as themes for imaginative treatment grew the idea of writing a volume together, composed of poems of the two kinds. Coleridge was to take the supernatural; and, as his industry was not equal to his friend's, this kind was represented by the *Ancient Mariner* alone. Among Wordsworth's contributions were *The Female Vagrant*, *We are Seven*, *Complaint of a Forsaken Indian Woman*, *The Last of the Flock*, *The Idiot Boy*, *The Mad Mother* ("Her eyes are wild"), *The Thorn*, *Goody Blake and Harry Gill*, *The Reverie of Poor Susan*, *Simon Lee*, *Expostulation and Reply*, *The Tables Turned*, *Lines left upon a Yew-tree Seat*, *An Old Man Travelling* ("Animal Tranquillity and Decay"), *Lines above Tintern Abbey*. The volume was published by Cottle of Bristol in September 1798.

It is necessary to enumerate the contents of this volume in fairness to the contemporaries of Wordsworth, for their cold or scoffing reception of his first distinctive work. Those Wordsworthians who give up *The Idiot Boy*,[4] *Goody Blake* and *The Thorn* as mistaken experiments have no right to triumph over the first derisive critics of the *Lyrical Ballads*, or to wonder at the dullness that failed to see at once in this humble issue from an obscure provincial press the advent of a great master in literature. It is true that *Tintern Abbey* was in the volume, and that all the highest qualities of Wordsworth's imagination and of his verse could be illustrated from the lyrical ballads proper in this first publication; but clear vision is easier for us than it was when the revelation was fragmentary and incomplete.

Although Wordsworth was not received at first with the respect to which he was entitled, his power was not entirely without recognition. There is a curious commercial evidence of this, which ought to be noted, because a perversion of the fact is sometimes used to exaggerate the supposed neglect of Wordsworth at the outset of his career. When the Longmans

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mind." The resolution to supply the deficiencies of poetry in the exact description of natural appearances was probably formed while he was in this state of boyish ecstasy at the accidental revelation of his own powers. The date of his beginnings as a poet is confirmed by the lines in *The Idiot Boy*, written in 1798—

> "I to the Muses have been bound
> *These fourteen years* by strong indentures."

[1] In *The Prelude*, book iv., he speaks of himself during his first vacation as "harassed with the toil of verse, much pains and little progress."

[2] Not published till 1842. For the history of this tragedy see *Memoirs*, vol. i. p. 113; for a sound, if severe, criticism of it, A. C. Swinburne's *Miscellanies*, p. 118. And yet it was of the blank verse of *The Borderers* that Coleridge spoke when he wrote to Cottle that "he felt a little man by the side of his friend."

[3] The version read to Coleridge, however, must have been in Spenserian stanzas, if Coleridge was right in his recollection that it was in the same metre with *The Female Vagrant*, the original title of *Guilt and Sorrow*.

[4] The defect of *The Idiot Boy* is really rhetorical, rather than poetic. Wordsworth himself said that "he never wrote anything with so much glee," and, once the source of his glee is felt in the nobly affectionate relations between the two half-witted irrational old women and the glorious imbecile, the work is seen to be executed with a harmony that should satisfy the most exacting criticism. Poetically, therefore, the poem is a success. But rhetorically this particular attempt to "breathe grandeur upon the very humblest face of human life" must be pronounced a failure, inasmuch as the writer did not use sufficiently forcible means to disabuse his readers of vulgar prepossessions.

took over Cottle's publishing business in 1799, the value of the copyright of the *Lyrical Ballads*, for which Cottle had paid thirty guineas, was assessed at *nil*. Cottle therefore begged that it might be excluded altogether from the bargain, and presented it to the authors. But in 1800, when the first edition was exhausted, the Longmans offered Wordsworth £100 for two issues of a new edition with an additional volume and an explanatory preface. The sum was small compared with what Scott and Byron soon afterwards received, but it shows that the public neglect was not quite so complete as is sometimes represented. Another edition was called for in 1802, and a fourth in 1805. The new volume in the 1800 edition was made up of poems composed during his residence at Goslar in Germany (where he went with Coleridge) in the winter of 1798–1799, and after his settlement at Grasmere in December 1799. It contained a large portion of poems now universally accepted:—*Ruth*, *Nutting*, *Three Years She Grew*, *A Poet's Epitaph*, *Hartleap Well*, *Lucy Gray*, *The Brothers*, *Michael*, *The Old Cumberland Beggar*, *Poems on the Naming of Places*. But it contained also the famous Preface, in which he infuriated critics by presuming to defend his eccentricities in an elaborate theory of poetry and poetic diction.

This document (and let it be noted that *all* Wordsworth's *Prefaces* are of the utmost interest in historical literary criticism) is constantly referred to as a sort of revolutionary proclamation against the established taste of the 18th century. For one who has read Wordsworth's original, hundreds have read Coleridge's brilliant criticism, and the fixed conception of the doctrines put forth by Wordsworth is taken from that.[1] It is desirable, therefore, considering the celebrity of the affair, that Wordsworth's own position should be made clear. Coleridge's criticism of his friend's theory proceeded avowedly "on the assumption that his words had been rightly interpreted, as purporting that the proper diction for poetry in general consists altogether in a language taken, with due exceptions, from the mouths of men in real life, a language which actually constitutes the natural conversation of men under the influence of natural feelings." Coleridge assumed further that, when Wordsworth spoke of there being "no essential difference between the language of prose and metrical composition," he meant by language not the mere words but the style, the structure and the order of the sentences; on this assumption he argued as if Wordsworth had held that the metrical order should always be the same as the prose order. Given these assumptions, which formed the popular interpretation of the theory by its opponents, it was easy to demonstrate its absurdity, and Coleridge is very generally supposed to have given Wordsworth's theory in its bare and naked extravagance the *coup de grâce*. But the truth is that neither of the two assumptions is warranted; both were expressly disclaimed by Wordsworth in the Preface itself. There is not a single qualification introduced by Coleridge that was not made by Wordsworth himself in the original statement.[2] In the first place, it was not put forward as a theory of poetry in general, though from the vigour with which he carried the war into the enemy's country it was naturally enough for polemic purposes taken as such; it was a statement and defence of the principles on which his own poems of humbler life were composed. Wordsworth also assailed the public taste as "depraved," first and mainly in so far as it was adverse to simple incidents simply treated, being accustomed to "gross and violent stimulants," "craving after extraordinary incident," possessed with a "degrading thirst after outrageous stimulation," "frantic novels, sickly and stupid German tragedies, and deluges of idle and extravagant stories in verse." This, and not adherence to the classical rule of Pope, which had really suffered deposition a good half century before, was the first count in Wordsworth's defensive indictment of the taste of his age. As regards the "poetic diction," the liking for which was the second count in his indictment of the public taste, it is most explicitly clear that, when he said that there was no essential difference between the language of poetry and the language of prose, he meant words, plain and figurative, and not structure and order, or, as Coleridge otherwise puts it, the "ordonnance" of composition. Coleridge says that if he meant this he was only uttering a truism, which nobody who knew Wordsworth would suspect him of doing; but, strange to say, it is as a truism, nominally acknowledged by everybody, that Wordsworth does advance his doctrine on this point. Only he adds—"if in what I am about to say it shall appear to some that my labour is unnecessary, and that I am like a man fighting a battle without enemies, such persons may be reminded that, whatever be the language outwardly holden by men, a practical faith in the opinions which I am wishing to establish is almost unknown."

What he wished to establish was the simple truth that what is false, unreal, affected, bombastic or nonsensical in prose is not less so in verse. The form in which he expresses the theory was conditioned by the circumstances of the polemic, and readers were put on a false scent by his purely incidental and collateral and very much overstrained defence of the language of rustics, as being less conventional and more permanent, and therefore better fitted to afford materials for the poet's selection. But this was a side issue, a paradoxical retort on his critics, seized upon by them in turn and made prominent as a matter for easy ridicule; all that he says on this head might be cut out of the Preface without affecting in the least his main thesis. The drift of this is fairly apparent all through, but stands out in unmistakable clearness in his criticism of the passages from Johnson and Cowper:—

> "But the sound of the church-going bell
> These valleys and rocks never heard,
> Ne'er sighed at the sound of a knell
> Or smiled when a Sabbath appeared."

The epithet "church-going" offends him as a puritan in grammar; whether his objection is well founded or ill founded, it applies equally to prose and verse. To represent the valleys and rocks as sighing and smiling in the circumstances would appear feeble and absurd in prose composition, and is not less so in metrical composition; "the occasion does not justify such violent expressions." These are examples of all that Wordsworth meant by saying that "there is no essential difference between the language of prose and metrical composition." So far is Wordsworth from contending that the metrical order should always be the same as the prose order, that part of the Preface is devoted to a subtle analysis of the peculiar effect of metrical arrangement. What he objects to is not departure from the structure of prose, but the assumption, which seemed to him to underlie the criticisms of his ballads, that a writer of verse is not a poet unless he uses artificially ornamental language, not justified by the strength of the emotion expressed. The furthest that he went in defence of prose structure in poetry was to maintain that, if the words in a verse happened to be in the order of prose, it did not follow that they were prosaic in the sense of being unpoetic—a side-stroke at critics who complained of his prosaisms for no better reason than that the words stood in the order of prose composition. Wordsworth was far from repudiating elevation of style in poetry. "If," he said, "the poet's subject be judiciously chosen, it will naturally, and upon fit occasion, lead him to passions the language of which, if selected truly and judiciously, must necessarily be dignified and variegated, and alive with metaphors and figures."

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[1] Sir Henry Taylor, one of the most acute and judicious of Wordsworth's champions, came to this conclusion in 1834.

[2] Although Coleridge makes the qualifications more prominent than they were in the original statement, the two theories are at bottom so closely the same that one is sometimes inclined to suspect that parts, at least, of the original emanated from the fertile mind of Coleridge himself. The two poets certainly discussed the subject together in Somerset when the first ballads were written, and Coleridge was at Grasmere when the Preface was prepared in 1800. The diction of the Preface is curiously Hartleian, and, when they first met, Coleridge was a devoted disciple of Hartley, naming his first son after the philosopher, while Wordsworth detested analytic psychology. If Coleridge did contribute to the original theory in 1798 or 1800, he was likely enough to have forgotten the fact by 1814. At any rate, he evidently wrote his criticism without making a close study of the Preface, and what he did in effect was to restate the original theory against popular misconceptions of it.

Such was Wordsworth's theory of poetic diction. Nothing could be more grossly mistaken than the notion that the greater part of Wordsworth's poetry was composed in defiance of his own theory, and that he succeeded best when he set his own theory most at defiance. The misconception is traceable to the authority of Coleridge. His just, sympathetic and penetrating criticism on Wordsworth's work as a poet did immense service in securing for him a wider recognition; but his proved friendship and brilliant style have done sad injustice to the poet as a theorist. It was natural to assume that Coleridge, if anybody, must have known what his friend's theory was; and it was natural also that readers under the charm of his lucid and melodious prose should gladly grant themselves a dispensation from the trouble of verifying his facts in the harsh and cumbrous exposition of the theorist himself.[1]

The question of diction made most noise, but it was far from being the most important point of poetic doctrine set forth in the Preface. If in this he merely enunciated a truism, generally admitted in words but too generally ignored in practice, there was real novelty in his plea for humble subjects, and in his theory of poetic composition. Wordsworth's remarks on poetry in general, on the supreme function of the imagination in dignifying humble and commonplace incidents, and on the need of active exercise of imagination in the reader as well as in the poet, are immeasurably more important than his theory of poetic diction. Such sayings as that poetry "takes its origin from emotion recollected in tranquillity," or that it is the business of a poet to trace "how men associate ideas in a state of excitement," are significant of Wordsworth's endeavour to lay the foundations of his art in an independent study of the feelings and faculties of men in real life, unbiased as far as possible by poetic custom and convention. This does not mean that the new poet was to turn his back on his predecessors and never look behind him to what they had done. Wordsworth was guilty of no such extravagance. He was from boyhood upwards a diligent student of poetry, and was not insensible to his obligations to the past. His purpose was only to use real life as a touchstone of poetic substance. The poet, in Wordsworth's conception, is distinctively a man in whom the beneficent energy of imagination, operative as a blind instinct more or less in all men, is stronger than in others, and is voluntarily and rationally exercised for the benefit of all in its proper work of increase and consolation. Not every image that the excited mind conjures up in real life is necessarily poetical. It is the business of the poet to select and modify for his special purpose of producing immediate pleasure.

There were several respects in which the formal recognition of such elementary principles of poetic evolution powerfully affected Wordsworth's practice. One of these may be indicated by saying that he endeavoured always to work out an emotional motive from within. Instead of choosing a striking theme and working at it like a decorative painter, embellishing, enriching, dressing to advantage, standing back from it and studying effects, his plan was to take incidents that had set his own imagination spontaneously to work, and to study and reproduce with artistic judgment the modification of the initial feeling, the emotional motive, within himself. To this method he owed much of his strength and also much of his unpopularity. By keeping his eye on the object, as spontaneously modified by his own imaginative energy, he was able to give full and undistracted scope to all his powers in poetic coinage of the wealth that his imagination brought. On the other hand, readers whose nature or education was different from his own, were repelled or left cold and indifferent, or obliged to make the sympathetic effort to see with his eyes, which he refused to make in order that he might see with theirs.

"He is retired as noontide dew
Or fountain in a noon-day grove,
And you must love him ere to you
He will seem worthy of your love."

From this habit of taking the processes of his own mind as the standard of the way in which "men associate ideas in a state of excitement," and language familiar to himself as the standard of the language of "real men," arises a superficial anomaly in Wordsworth's poetry, an apparent contradiction between his practice and his theory. His own imagination, judged by ordinary standards, was easily excited by emotional motives that have little force with ordinary men. Most of his poems start from humbler, slighter, less generally striking themes than those of any other poet of high rank. But his poetry is not correspondingly simple. On the contrary, much of it, much of the best of it—for example, the *Ode to Duty*, and that on the *Intimations of Immortality*—is intricate, elaborate and abstruse. The emotional motive is simple; the passion has almost always a simple origin, and often is of no great intensity; but the imaginative structure is generally elaborate, and, when the poet is at his best, supremely splendid and gorgeous. No poet has built such magnificent palaces of rare material for the ordinary everyday homely human affections. It is because he has invested our ordinary everyday principles of conduct, which are so apt to become threadbare, with such imperishable robes of finest texture and richest design that Wordsworth holds so high a place among the great moralists in verse.

His practice was influenced also, and not always for good, by his theory that poetry "takes its origin from emotion recollected in tranquillity." This was a somewhat doubtful corollary from his general theory of poetic evolution. A poem is complete in itself; there must be no sting in it to disturb the reader's content with the whole; through whatever agitations it progresses, to whatever elevations it soars, to this end it must come, otherwise it is imperfect as a poem. Now the imagination in ordinary men, though the process is not expressed in verse, and the poet's special art has thus no share in producing the effect, reaches the poetic end when it has so transfigured a disturbing experience, whether of joy or grief, that this rests tranquilly in the memory, can be recalled without disquietude, and dwelt upon with some mode and degree of pleasure, more or less keen, more or less pure or mixed with pain. True to his idea of imitating real life, Wordsworth made it a rule for himself not to write on any theme till his imagination had operated upon it for some time involuntarily; it was not in his view ripe for poetic treatment till this transforming agency had subdued the original emotion to a state of tranquillity.[2] Out of this tranquillity arises the favourable moment for poetic composition, some day when, as he contemplates the subject, the tranquillity disappears, an emotion kindred to the original emotion is reinstated, and the poet retraces and supplements with all his art the previous involuntary and perhaps unconscious imaginative chemistry.

When we study the moments that Wordsworth found favourable for successful composition, a very curious law reveals itself, somewhat at variance with the common conception of him as a poet who derived all his strength from solitary communion with nature. We find that the recluse's best poems were written under the excitement of some break in the monotony of his quiet life—change of scene, change of companionship, change of occupation. The law holds from the beginning to the end of his poetic career. An immense stimulus was given to his powers by his first contact with Coleridge after two years of solitary and abortive effort. *Above Tintern Abbey* was composed during a four days' ramble with his sister; he began it on leaving Tintern, and concluded it as he was entering Bristol. His residence amidst strange scenes and "unknown men" at Goslar was particularly fruitful: *She Dwelt among the Untrodden Ways*, *Ruth*, *Nutting*, *There was a Boy*, *Wisdom and Spirit of the Universe*, all belong to those few months of unfamiliar environment. The breeze that met him as he issued from the city gates on his homeward journey brought him the first thought of *The Prelude*.

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[1] Wordsworth was not an adroit expositor in prose, and he did not make his qualifications sufficiently prominent, but his theory of diction taken with those qualifications left him free without inconsistency to use any language that was not contrary to "true taste and feeling." He acknowledged that he might occasionally have substituted "particular for general associations," and that thus language charged with poetic feeling to himself might appear trivial and ridiculous to others, as in *The Idiot Boy* and *Goody Blake*; he even went so far as to withdraw *Alice Fell*, first published in 1807, from several subsequent editions; but he argued that it was dangerous for a poet to make alterations on the simple authority of a few individuals or even classes of men, because if he did not follow his own judgment and feelings his mind would infallibly be debilitated.

[2] *The Prelude* contains a record of his practice, after the opening lines of the first book—

"Thus far, O friend! did I, not used to make
A present joy the matter of a song,
Pour forth," &c.

At the end of 1799 he was settled at Grasmere, in the Lake District, and seeing much of Coleridge. The second year of his residence at Grasmere was unproductive; he was "hard at work" then on *The Excursion*; but the excitement of a tour on the Continent in the autumn of 1802, combined perhaps with a happy change in his pecuniary circumstances and the near prospect of marriage, roused him to one of his happiest fits of activity. His first great sonnet, the *Lines on Westminster Bridge*, was composed on the roof of the Dover coach; the first of the splendid series "dedicated to national independence and liberty," the most generally impressive and universally intelligible of his poems, *Fair Star of Evening*, *Once did She hold the Gorgeous East in Fee*, *Toussaint*; *Milton, thou shouldst be Living at this Hour*; *It is not to be Thought of that the Flood*, *When I have Borne in Memory what has Tamed*, were all written in the course of the tour, or in London in the month after his return. A tour in Scotland in the following year, 1803, yielded the *Highland Girl* and *The Solitary Reaper*. Soon after his return he resumed *The Prelude*; and *The Affliction of Margaret* and the *Ode to Duty*, his greatest poems in two different veins, were coincident with the exaltation of spirit due to the triumphant and successful prosecution of the long-delayed work. The *Character of the Happy Warrior*, which he described to Harriet Martineau as "a chain of extremely *valooable* thoughts," though it did not fulfil "poetic conditions,"[1] was the product of a calmer period. The excitement of preparing for publication always had a rousing effect upon him; the preparation for the edition of 1807 resulted in the completion of the ode on the *Intimations of Immortality*, the sonnets *The World is too much with us*, *Methought I saw the Footsteps of a Throne*, *Two Voices are there*, and *Lady, the Songs of Spring were in the Grove*, and the *Song at the Feast of Brougham Castle*. After 1807 there is a marked falling off in the quality, though not in the quantity, of Wordsworth's poetic work. It is significant of the comparatively sober and laborious spirit in which he wrote *The Excursion* that its progress was accompanied by none of those casual sallies of exulting and exuberant power that mark the period of the happier *Prelude*. The completion of *The Excursion* was signalized by the production of *Laodamia*. The chorus of adverse criticism with which it was received inspired him in the noble sonnet to Haydon—*High is our Calling, Friend*. He rarely or never again touched the same lofty height.

It is interesting to compare with what he actually accomplished the plan of life-work with which Wordsworth settled at Grasmere in the last month of 1799.[2] The plan was definitely conceived as he left the German town of Goslar in the spring of 1799. Tired of the wandering unsettled life that he had led hitherto, dissatisfied also with the fragmentary occasional and disconnected character of his lyrical poems, he longed for a permanent home among his native hills, where he might, as one called and consecrated to the task, devote his powers continuously to the composition of a great philosophical poem on "Man, Nature and Society." The poem was to be called *The Recluse*, "as having for its principal subject the sensations and opinions of a poet living in retirement." He communicated the design to Coleridge, who gave him enthusiastic encouragement to proceed. But, though he had still before him fifty years of peaceful life amidst his beloved scenery, the work in the projected form at least was destined to remain incomplete. Doubts and misgivings soon arose, and favourable moments of felt inspiration delayed their coming. To sustain him in his resolution he thought of writing as an introduction, or, as he put it, an antechapel to the church which he proposed to build, a history of his own mind up to the time when he recognized the great mission of his life. One of the many laughs at his expense by unsympathetic critics has been directed against his saying that he wrote this *Prelude* of fourteen books about himself out of diffidence. But in truth the original motive was distrust of his own powers. He turned aside to prepare the second volume of the *Lyrical Ballads* and write the explanatory Preface, which as a statement of his aims in poetry had partly the same purpose of strengthening his self-confidence. From his sister's *Journal* we learn that in the winter of 1801–1802 he was "hard at work on *The Pedlar*"—the original title of *The Excursion*. But this experiment on the larger work was also soon abandoned. It appears from a letter to his friend Sir George Beaumont that his health was far from robust, and in particular that he could not write without intolerable physical uneasiness. His next start with *The Prelude*, in the spring of 1804, was more prosperous; he dropped it for several months, but, resuming again in the spring of 1805, he completed it in the summer of that year. In 1807 appeared two volumes of collected poems. It was not till 1814 that the second of the three divisions of *The Recluse*, ultimately named *The Excursion*, was ready for publication; and he went no further in the execution of his great design.

The derisive fury with which *The Excursion* was assailed upon its first appearance has long been a stock example of critical blindness, yet the error of the first critics is seen to lie not in their indictment of faults, but in the prominence they gave to the faults and their generally disrespectful tone towards a poet of Wordsworth's greatness. Jeffrey's petulant "This will never do," uttered, professedly at least, more in sorrow than in anger, because the poet would persist in spite of all friendly counsel in misapplying his powers, has become a byword of critical cocksureness. But *The Excursion* has not "done," and even Wordsworthians who laugh at Jeffrey are in the habit of repeating the substance of his criticism.

Jeffrey, it will be seen, was not blind to the occasional felicities and unforgetable lines celebrated by Coleridge, and his general judgment on *The Excursion* has been abundantly ratified.[3] It is not upon *The Excursion* that Wordsworth's reputation as a poet can ever rest. The two "books" entitled *The Churchyard among the Mountains* are the only parts of the poem that derive much force from the scenic setting; if they had been published separately, they would probably have obtained at once a reception very different from that given to *The Excursion* as a whole. The dramatic setting is merely dead weight, not because the chief speaker is a pedlar—Wordsworth fairly justifies this selection—but because the pedlar, as a personality to be known, and loved, and respected, and listened to with interest, is not completely created.

There can be little doubt that adverse criticism had a depressing influence on Wordsworth's poetical powers, notwithstanding his nobly expressed defiance of it and his determination to hold on in his own path undisturbed. Its effect in retarding the sale of his poems was a favourite topic with him in his later years;[4] but the absence of general appreciation, and the ridicule of what he considered his best and most distinctive work, contributed in all probability to a still more unfortunate result—the premature depression and deadening of his powers.

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[1] This casual estimate of his own work is not merely amusing but also instructive, as showing—what is sometimes denied—that Wordsworth himself knew well enough the difference between "poetry" and such "valuable thoughts" as he propounded in *The Excursion*.

[2] Wordsworth's residences in the Lake District were at Dove Cottage, Townend, Grasmere, from December 1799 till the spring of 1808; Allan Bank, from 1808 to 1811; the parsonage at Grasmere, from 1811 to 1813; Rydal Mount, for the rest of his life. Dove Cottage was bought in 1891 as a public memorial, and is held by trustees.

[3] Ward's *English Poets*, iv. 13.

[4] Matthew Arnold heard him say that "for he knew not how many years his poetry had never brought him in enough to buy his shoe-strings" (preface to *Selection*, p. v.). The literal facts are that he received £100 from the Longmans in 1800, and nothing more till he was sixty-five, when Moxon bought the copyright of his writings for £1000 (*Prose Works*, iii. 437).

For five years after the condemnation of *The Excursion* Wordsworth published almost nothing that had not been composed before. The chief exception is the *Thanksgiving Ode* of 1816. In 1815 he published a new edition of his poems, in the arrangement according to faculties and feelings in which they have since stood; and he sought to explain his purposes more completely than before in an essay on "Poetry as a Study." In the same year he was persuaded to publish *The White Doe of Rylstone*, written mainly eight years before. In purely poetic charm *The White Doe* ought to be ranked among the most perfect of Wordsworth's poems. But Jeffrey, who was too busy to enter into a vein of poetry so remote from common romantic sentiment, would have none of *The White Doe*: he pronounced it "the very worst poem ever written," and the public too readily endorsed his judgment. Two other poems, with which Wordsworth made another appeal, were not more successful. *Peter Bell*, written in 1798, was published in 1819; and at the instigation of Charles Lamb it was followed by *The Waggoner*, written in 1805. Both were mercilessly ridiculed and parodied. These tales from humble life are written in Wordsworth's most unconventional style, and with them emphatically "not to sympathize is not to understand."

Meantime, the great design of *The Recluse* languished. The neglect of what Wordsworth himself conceived to be his best and most characteristic work was not encouraging; and there was another reason why the philosophical poem on man, nature, and society did not make progress. Again and again in his poetry Wordsworth celebrates the value of constraint, and the disadvantage of "too much liberty," of "unchartered freedom."[1] The formlessness of the scheme prevented his working at it continuously. Hence his "philosophy" was expressed in casual disconnected sonnets, or in sonnets and other short poems connected by the simplest of all links, sequence in time or place. He stumbled upon three or four such serial ideas in the latter part of his life, and thus found beginning and end for chains of considerable length, which may be regarded as fragments of the project which he had not sufficient energy of constructive power to execute. The *Sonnets on the River Duddon*, written in 1820, follow the river from its source to the sea, and form a partial embodiment of his philosophy of nature. The *Ecclesiastical Sonnets*, written in 1820–1821, trace the history of the church from the Druids onwards, following one of the great streams of human affairs, and exhibit part of his philosophy of society. A tour on the continent in 1820, a tour in Scotland in 1831, a tour on the west coast in 1833, a tour in Italy in 1837, furnished him with other serial forms, serving to connect miscellaneous reflections on man, nature and society; and his views on the punishment of death were strung together in still another series in 1840.

It was Coleridge's criticism in the *Biographia Literaria* (1817), together with the enthusiastic and unreserved championship of Wilson in *Blackwood's Magazine* in a series of articles between 1819 and 1822 (*Recreations of Christopher North*), that formed the turning-point in Wordsworth's reputation. From 1820 to 1830 De Quincey says it was militant, from 1830 to 1840 triumphant. On the death of Southey in 1843 he was made poet laureate. He bargained with Sir Robert Peel, before accepting, that no official verse should be required of him; and his only official composition, an ode on the installation of the Prince Consort as chancellor of Cambridge university in 1847, is believed to have really been written either by his son-in-law Edward Quillinan or by his nephew Christopher (afterwards bishop of Lincoln). He died at Rydal Mount, after a short illness, on the 23rd of April 1850, and was buried in Grasmere churchyard. His wife survived him till 1859, when she died in her 90th year. They had five children, two of whom had died in 1812; the two surviving sons, John (d. 1875) and William (d. 1883), had families; the other child, a daughter, Dora, Wordsworth's favourite, married Edward Quillinan in 1841 and died in 1847.

Professor Knight brought out in 1882–1886 an eight-volume edition of the *Poetical Works*, and in 1889 a *Life* in three volumes. The *Memoirs* of the poet were published (1851) by his nephew, Bishop Christopher Wordsworth. The "standard text" of the works is the edition of 1849–1850. The "Aldine" edition (1892) is edited by Edward Dowden. The one-volume "Oxford" edition (1895), edited by Thomas Hutchinson, contains every piece of verse known to have been published or authorized by Wordsworth, his *Prefaces*, &c., and a useful chronology and notes. Among critics of Wordsworth especially interesting for various reasons we may mention De Quincey (*Works*, vols. ii. and v.), Sir Henry Taylor (*Works*, vol. v.), Matthew Arnold (preface to *Selection*), Swinburne (*Miscellanies*), F. W. H. Myers ("Men of Letters" series), Leslie Stephen (*Hours in a Library*, 3rd series, "Wordsworth's Ethics"), Walter Pater (*Appreciations*), Walter Raleigh (*Wordsworth*, 1903). Wordsworth's writings in prose were collected by Dr Grosart (London, 1876). This collection contained the previously unpublished *Apology for a French Revolution*, written in 1793, besides the scarce tract on the *Convention of Cintra* (1809) and the political addresses *To the Freeholders of Westmoreland* (1818). Wordsworth's *Guide to the Lakes* originally appeared in 1810 as an introduction to Wilkinson's *Select Views*, and was first published separately in 1822. (W. M.; H. Ch.)

WORKINGTON, a municipal borough, seaport and market town in the Cockermouth parliamentary division of Cumberland, England, 34 m. S.W. of Carlisle, served by the Cockermouth, Keswick & Penrith, the London & North-Western and the Cleator & Workington Junction railways. Pop. (1901) 26,143. It lies on the S. bank of the river Derwent, at its outflow into the Irish Sea. The harbour is safe, being protected by a stony beach and by a breakwater. The Lonsdale dock is 4½ acres in extent. The port was made subordinate to that of Maryport in 1892. There are large collieries in the neighbourhood of the town, the workings in some cases extending beneath the sea, and blast-furnaces, engineering works, cycle and motor works, shipbuilding yards and paper mills. The borough is under a mayor, 7 aldermen and 21 councillors. Area, 2245 acres. Near the town is Workington Hall, a castellated structure retaining some of the ancient rooms, including that in which Mary, queen of Scots, is said to have slept when she escaped to England after the battle of Langside in May 1568.

WORKS AND PUBLIC BUILDINGS, BOARD OF, an administrative department in England. In 1832 the public works and buildings of Great Britain were for the first time placed under the control of a responsible minister of the crown, and were assigned to the commissioners of woods and forests. In 1851 the department of public works was erected into a board under the name of Office of Works and Public Buildings. The first commissioner of works is the head of the board, and has the custody of the royal palaces and parks and of all public buildings not specially assigned to other departments; he is a member of the government and frequently has a seat in the cabinet.

WORKSOP, a market town in the Bassetlaw parliamentary division of Nottinghamshire, England, on the Great Central and the Midland railways, and on the Chesterfield Canal, 15½ m. E.S.E. of Sheffield. Pop. of urban district (1901) 16,112. To the S. lies that portion of Sherwood Forest popularly known as the dukeries. The church of St Mary and St Cuthbert is an old priory church, once divided internally into two parts, the E. dedicated to St Mary being for the use of the canons, and the W. dedicated to St Cuthbert for the parishioners. At the Reformation only the W. portion of the church was spared, and for many years it was in a dilapidated condition until it was restored with Perpendicular additions. Behind it are the ruins of the lady chapel, containing some fine Early English work. The priory gatehouse, chiefly in the Decorated style, now forms the entrance to the precincts of the church. It is supposed to have been built early in the 14th century by the 3rd Lord Furnival, when the market was established. Of the priory itself the only remains are a wall at the N.W. corner of the church which includes the cloister gateway. There was formerly a Norman keep on the castle hill. The manor-house, built by John Talbot, 1st earl of Shrewsbury, and occasionally occupied by Mary, queen of Scots, during her captivity under the 6th earl, was in great part destroyed by fire in 1761, and when the estate came into the possession of the duke of Newcastle in 1840 the ruined portion was removed and a smaller mansion built.

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[1] See the Sonnet, *Nuns fret not*, &c., *The Pass of Kirkstone* and the *Ode to Duty*.

The town hall and free library are the principal public buildings of Worksop. Malting is the principal industry. A large corn market and a cattle and horse fair are held. The town also possesses brass and iron foundries, agricultural implement works, saw-mills and chemical works; and there is a considerable trade in Windsor chairs and wood for packing-cases for Sheffield cutlery. There are collieries at Shireoaks, 3 m. W.

WORLD, a word which has developed a wide variety of meanings from its original etymological sense of the "age of man," "course of man's life." In O. Eng. it appears under its true form *weoruld*, being a compound of *wer*, man (cf. Lat. *vir*), and *yldo*, age, from *eald*, *eld*, old. Of the various meanings the principal are the earth (*q.v.*), as a planet, or a large division of the earth, such as the "old world," the eastern, the "new world," the western hemisphere; the whole of created things upon the earth, particularly its human inhabitants, mankind, the human race, or a great division of mankind united by a common racial origin, language, religion or civilization, &c. A derived meaning is that of social life, society, as distinct from a religious life.

WORM,[1] a term used popularly to denote almost any kind of elongated, apparently limbless creature, from a lizard, like the blindworm, to the grub of an insect or an earthworm. Linnaeus applied the Latin term *Vermes* to the modern zoological divisions *Mollusca*, *Coelentera*, *Protozoa*, *Tunicata*, *Echinoderma* (*qq.v.*), as well as to those forms which more modern zoologists have recognized as worms. As a matter of convenience the term *Vermes* or *Vermidea* is still employed, for instance in the *International Catalogue of Zoological Literature* and the *Zoological Record*, to cover a number of wormlike animals. In systematic zoology, however, the use of a division *Vermes* has been abandoned, as it is now recognized that many of the animals that even a zoologist would describe as worms belong to different divisions of the animal kingdom. The so-called flatworms (Platyelmia, *q.v.*), including the Planarians (*q.v.*), Flukes (see TREMATODES), Cestodes (see TAPEWORM) and the curious Mesozoa (*q.v.*), are no doubt related. The marine Nemertine worms (see NEMERTINA) are isolated. The thick-skinned round worms, such as the common horse-worm and the threadworms (see NEMATODA), together with the Nematomorpha (*q.v.*), *Chaetosomatida* (*q.v.*), Desmoscolecida (*q.v.*) and Acanthocephala (*q.v.*), form a fairly natural group. The Rotifera (*q.v.*), with probably the Kinorhyncha (*q.v.*) and Gastrotricha (*q.v.*), are again isolated. The remaining worms are probably all coelomate animals. There is a definite Annelid group (see ANNELIDA), including the Archiannelida, the bristleworms (see CHAETOPODA), of which the earthworm (*q.v.*) is the most familiar type, the Myzostomida (*q.v.*), Hirudinea (see LEECH) and the armed Gephyreans (see ECHIUROIDEA). The unarmed Gephyreans (see GEPHYREA) are now separated from their former associates and divided into two groups of little affinity, the *Sipunculoidea* and the *Priapuloidea* (*qq.v.*). The *Phoronidea* (*q.v.*) are now associated with Hemichordata (*q.v.*) in the line of vertebrate ancestry, whilst the *Chaetognatha* (*q.v.*) remain in solitary isolation.

Mention is made under TAPEWORM of the worms of that species inhabiting the human body as parasites, and it will be convenient here to mention other parasitic varieties. The most common human parasite is the *Ascaris lumbricoides* or round worm, found chiefly in children and occupying the upper portion of the intestine. They are usually few in number, but occasionally occur in such large numbers that they cause intestinal obstruction. Unlike the tapeworm no intermediate host is required for the development of this worm. It develops from direct ingestion of the larvae. Various symptoms, such as diarrhoea, anaemia, intermittent fever, restlessness, irritability and convulsions are attributed to these worms. The treatment is the administration of santonin, followed by a purgative. The threadworm or *Oxyuris vermicularis* is a common parasite infecting the rectum. The larvae of this worm are also directly swallowed, and infection probably takes place through water, or possibly through lettuces and watercress. The symptoms caused by threadworms are loss of appetite, anaemia and intense irritation and itching. The treatment consists in the use of enemata containing quassia, carbolic acid, vinegar or turpentine or even common salt. In addition mild purgatives should be given.

WORMS, a city of Germany, in the grand-duchy of Hesse-Darmstadt, situated in a fertile plain called the Wonnegau, on the left bank of the Rhine, 25 m. S. of Mainz, 20 m. N.W. of Heidelberg, and 9 m. by rail N.W. of Mannheim. Pop. (1895) 28,636; (1905) 43,841, about a third of whom are Roman Catholics. The town is irregularly built, and some of the old walls and towers still remain, but its general aspect is modern. The principal church and chief building is the spacious cathedral of SS. Peter and Paul, which ranks beside those of Spires and Mainz among the noblest Romanesque churches of the Rhine (see ARCHITECTURE: *Romanesque and Gothic in Germany*). This magnificent basilica, with four round towers, two large domes, and a choir at each end, has a specially imposing exterior, though the impression produced by the interior is also one of great dignity and simplicity, heightened by the natural colour of the red sandstone of which it is built. Only the ground plan and the lower part of the western towers belong to the original building consecrated in 1110; the remainder was mostly finished by 1181, but the west choir and the vaulting were built in the 13th century, the elaborate south portal was added in the 14th century, and the central dome has been rebuilt. The ornamentation of the older parts is simple to the verge of rudeness; and even the more elaborate later forms show no high development of workmanship. The baptistery contains five remarkable stone reliefs of the late 15th century. The cathedral is 358 ft. long, and 89 ft. wide, or including the transepts, which are near the west end, 118 ft. (inside measurements). It belongs to the Roman Catholic community, who possess also the church of St Martin and the church of Our Lady (*Liebfrauenkirche*), a handsome Gothic edifice outside the town, finished in 1467. The principal Protestant place of worship is the Trinity church, built in 1726. Second in interest to the cathedral is the church of St Paul, also in the Romanesque style, and dating from 1102–1116, with a choir of the early 13th century, cloisters and other monastic buildings. This church has been converted into an interesting museum of national antiquities. The late Romanesque church of St Andrew is not used. The old synagogue, an unassuming building erected in the 11th century and restored in the 13th, is completely modernized. The Jewish community of Worms (about 1300 in number) claims to be the most ancient in Germany and to have existed continuously since the Christian era, though the earliest authentic mention of it occurs in 588. A curious tradition, illustrating the efforts of the dispersed people to conciliate their oppressors, asserts that the Jews of Worms gave their voice against the crucifixion, but that their messenger did not arrive at Jerusalem until after the event.

The town hall was rebuilt in 1884. The Bischofshof, in which the most famous diet of Worms (1521) was held, is now replaced by a handsome modern residence. The Luginsland is an old watch-tower of the 13th century. In the Lutherplatz rises the imposing Luther monument (unveiled in 1868), on a platform 48 ft. sq. In the centre the colossal statue of Luther rises, on a pedestal at the base of which are sitting figures of Peter Waldo, Wycliffe, Hus and Savonarola, the heralds of the Reformation; at the corners of the platform, on lower pedestals, are statues of Luther's contemporaries, Melanchthon, Reuchlin, Philip of Hesse, and Frederick the Wise of Saxony, between which are allegorical figures of Magdeburg (mourning), Spires (protesting) and Augsburg (confessing). The greater part of the work, which took nine years to execute, was designed by Rietschel, and carried out after his death in 1861 by Gustav Kietz (1826–1908), Adolf von Donndorf (b. 1835) and Johannes Schilling (b. 1828). The "Rosengarten" on the opposite bank of the Rhine, associated with the stories of the wooing of Kriemhild (see *infra*), has been laid out in keeping with the old traditions and was opened with great festivities in 1906. Extensive burial-grounds, ranging in date from neolithic to Merovingian times, have recently been discovered near the city.

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[1] The O. Eng. *wyrm* represents a word common to Teutonic languages for a snake or worm, cf. Ger. *Wurm*, Dan. and Swed. *orm*, Du. *Worm*. The Lat. *vermis* must be connected. The Sanskrit word is *krimi*, which has given kermes, the cochineal insect, whence "crimson." Skeat takes the ultimate root to be *kar*, to move, especially in a circular motion, seen in "curve," "circle," &c. The word "worm" is applied to many objects resembling the animals in having a spiral shape or motion, as the spiral thread of a screw, or the spiral pipe through which vapour is passed in distillation (*q.v.*). As a term of disparagement and contempt the word is also used of persons, from the idea of wriggling or creeping on the ground, partly, too, perhaps, with a reminiscence of Genesis iii. 14.

The trade and industry of Worms are important, and not the least resource of the inhabitants is vine-growing, the most famous vintage being known as Liebfraumilch, grown on vineyards near the Liebfrauenkirche. The manufacture of patent leather employs about 5000 hands. Machinery, wool, cloth, chicory, slates, &c., are also produced. Worms possesses a good river harbour, and carries on a considerable trade by water.

Worms was known in Roman times as Borbetomagus, which in the Merovingian age became Wormatia, afterwards by popular etymology connected with *Wurm*, a dragon. The name Borbetomagus indicates a Celtic origin for the town, which had, however, before Caesar's time become the capital of a German tribe, the Vangiones. Drusus is said to have erected a fort here in 14 B.C. In 413 the emperor Jovinus permitted the Burgundians under their king Guntar or Guntiar to settle on the left bank of the Rhine between the Lauter and the Nahe. Here they founded a kingdom with Worms as its capital. Adopting Arianism they came into conflict with the Romans, and under their king Gundahar or Gundicar (the Gunther of the *Nibelungenlied*) rose in 435 against the Roman governor Aetius, who called in the Huns against them. The destruction of Worms and the Burgundian kingdom by the Huns in 436 was the subject of heroic legends afterwards incorporated in the *Nibelungenlied* (*q.v.*) and the *Rosengarten* (an epic probably of the late 13th century). In the *Nibelungenlied* King Gunther and Queen Brunhild hold their court at Worms, and Siegfried comes hither to woo Kriemhild.

Worms was rebuilt by the Merovingians, and became an episcopal see, first mentioned in 614, although a bishop of the Vangiones had attended a council at Cologne as early as 347. There was a royal palace from the 8th century, in which the Frankish kings, including Charlemagne, occasionally resided. The scene of the graceful though unhistorical romance of Einhard and Emma, the daughter of Charlemagne, is laid here.

Under the German kings the power of the bishops of Worms gradually increased, although they never attained the importance of the other Rhenish bishops. Otto I. granted extensive lands to the bishop, and in 979 Bishop Hildbold acquired comital rights in his city. Burchard I. (bishop from 1000 to 1025) destroyed the castle of the Franconian house at Worms, built the cathedral and laid the foundations of the subsequent territorial power of the see. There were frequent struggles between the bishops and the citizens, who espoused the cause of the emperors against them, and were rewarded by privileges which fostered trade. Herny IV. granted a charter to Worms in 1074, and held a synod there in 1076, by which Pope Gregory VII. was declared deposed. Henry V. acquired Worms in 1121 by the treaty of Würzburg, built a castle and granted privileges to the city, which retained its freedom until 1801, in spite of the bishops, who ruled a small territory south of the city, on both sides of the Rhine, and resided at Ladenburg near Mannheim till 1622.

The city of Worms was frequently visited by the imperial court, and won the title of "Mother of Diets." The concordat of Worms closed the investiture controversy in 1122. The "perpetual peace" (*ewiger Landfriede*) was proclaimed by the emperor Maximilian I. at the diet of 1495, and Luther appeared before the famous diet of 1521 to defend his doctrines in the presence of Charles V. Four years later, Worms formally embraced Protestantism, and religious conferences were held there in 1540 and 1557. It suffered severely during the Thirty Years' War. After being sacked in turn by Mansfeld, Tilly and the Spaniards, it was taken by Oxenstierna in 1632, who held a convention here with his German allies. The imperialists again took Worms in 1635, and it admitted the French under Turenne in 1644. The French under Mélac burnt the city almost entirely in 1689, and it has only fully recovered from this blow in recent years. Thus the population, which in its prosperous days is said to have exceeded 50,000, had sunk in 1815 to 6250.

By the treaty of Worms in 1743 an offensive alliance was formed between Great Britain, Austria and Sardinia. The French under Custine took the city by surprise in 1792 and it was annexed by the peace of Lunéville in 1801 to France, together with the bishop's territories on the left bank of the Rhine. The remaining episcopal dominions were secularized in 1803 and given to Hesse-Darmstadt, which acquired the whole by the Vienna Congress in 1815. In 1849 the Baden revolutionaries seized Worms, but were overthrown by the Mecklenburgers and Prussians in May of that year.

See Zorn, *Wormser Chronik* (Stuttgart, 1857); Fuchs, *Geschichte der Stadt Worms* (Worms, 1868); F. Soldan, *Der Reichstag zu Worms, 1521* (Worms, 1883); *Beiträge zur Geschichte der Stadt Worms* (Worms, 1896); G. Wolf, *Zur Geschichte der Juden in Worms* (Breslau, 1862); Nover, *Das alte und neue Worms* (Worms, 1895).

WORMWOOD, the popular name for an aromatic herb known botanically as *Artemisia Absinthium*, a member of the family Compositae. It grows from 1 to 3 ft. high and is silkily hairy; the leaves are small and much cut, and the flowers are small yellow hemispherical heads among the leaves at the end of the branches. It grows in waste places. It is a tonic and vermifuge and used to flavour drinks. A closely allied species is *A. vulgaris*, mugwort, also an aromatic herb, with larger and broader leaves, which are white woolly beneath, and erect woolly heads of reddish-yellow flowers.

WORSBOROUGH, an urban district in the Holmfirth parliamentary division of the W. Riding of Yorkshire, England, 3 m. S. of Barnsley, near the Sheffield & Barnsley branch of the Great Central railway, and on a branch of the Dearne & Dove canal. Pop. (1901) 10,336. The church of St Mary is an interesting structure with remains of Norman work, but chiefly of Early English date. There are extensive collieries and gunpowder mills near, and in the town iron and steel works and corn mills.

WORSHIP (*i.e.* "worth-ship," O. Eng. *weorðscipe*), honour, dignity, reverence, respect. The word is used in a special sense of the service, reverence and honour paid, by means of devotional words or acts, to God, to the gods, or to hallowed persons, such as the Virgin Mary or the saints, and hallowed objects, such as holy images or relics. In this sense, however, it must be borne in mind that the Roman Catholic Church distinguishes three kinds of worship: (1) *latria*, the worship due to God alone (from Gr. λατρεία, service, esp. the service of the gods, worship), and (2) *hyperdulia*, the worship or adoration due to the Virgin Mary as the Mother of God (from Gr. ὑπέρ, above, and δουλεία, service), and (3) *dulia*, that due to the saints. (See also ADORATION.) The public service of God in church is known as "divine worship" or "divine service" (see LITURGY). In the sense of "revere" or "respect," the verb "to worship" occurs in the English Prayer-book, in the phrase "with my body I thee worship" in the Marriage Service. In this sense the term "worship" is also used as a title of honour in speaking of or addressing other persons of position. Thus a mayor is spoken of as "his worship the mayor," or "the worshipful the mayor." Magistrates are addressed as "your worship."

WORSLEY, PHILIP STANHOPE (1835–1866), English poet, son of the Rev. Charles Worsley, was born on the 12th of August 1835, and was educated at Highgate grammar school and Corpus Christi College, Oxford, where he won the Newdigate prize in 1857 with a poem on "The Temple of Janus." In 1861 he published a translation of the *Odyssey*, followed in 1865 by a translation of the first twelve books of the *Iliad*, in both of which he employed the Spenserian stanza with success. In 1863 appeared a volume of *Poems and Translations*. Worsley died on the 8th of May 1866. His translation of the *Iliad* was completed after his death by John Conington.

WORSLEY, an urban district in the Eccles parliamentary division of Lancashire, England, 6 m. W.N.W. of Manchester by the London & North-Western railway. Pop. (1901) 12,462. Its growth is a result of the development of the cotton manufacture and of the neighbouring collieries.

WORTH, CHARLES FREDERICK (1825–1895), the famous dressmaker, was born at Bourne, Lincolnshire, in 1825. His father, a country solicitor, having lost his money in speculation, Charles was sent to London as an apprentice to Swan & Edgar, drapers. Thence, in 1846, he went to Paris, without capital or friends, and after twelve years in a wholesale silk house he began business as a dressmaker in partnership with a Swede named Dobergh. His originality and skill in design won the patronage of the empress Eugénie, and, through her, of fashionable Paris. After the Franco-German War, during which he turned his house into a military hospital, his partner retired, and Worth continued the business, which employed 1200 hands, with his two sons John and Gaston—both naturalized Frenchmen. For more than thirty years he set the taste and ordained the fashions of Paris, and extended his sway over all the civilized and much of the uncivilized world. He died on the 10th of March 1895.

WÖRTH, a village of Alsace, on the Sauer, 6 m. N. of Hagenau, which gives its name to the battle of the 6th of August 1870, fought between the Germans under the crown prince of Prussia and the French under Marshal MacMahon. The battle is also called Reichshoffen and Fröschweiler.

The events which led up to the engagement, and the general situation on the 6th are dealt with under FRANCO-GERMAN WAR. During the 5th of August the French concentrated in a selected position running nearly N. and S. along the Sauer Bach on the left front of the German III. army which was moving S. to seek them. The position is marked from right to left by Morsbronn, the Niederwald, the heights W. of Wörth and the woods N.E. of Fröschweiler. E. of the Sauer the German III. army was moving S. towards Hagenau, when their cavalry found the French position about noon. Thereafter the German vedettes held the French under close observation, while the latter moved about within their lines and as far as the village of Wörth as if in peace quarters, and this notwithstanding the defeat of a portion of the army at Weissenburg on the previous day. The remnant of the force which had been engaged, with many of its wounded still in the ranks, marched in about noon with so soldierly a bearing that, so far from their depressing the *morale* of the rest, their appearance actually raised it.

About 5 P.M. some horses were watered at the Sauer, as in peace, without escort, though hostile scouts were in sight. A sudden swoop of the enemy's hussars drove the party back to camp. The alarm was sounded, tents were struck and the troops fell in all along the line and remained under arms until the confusion died down, when orders were sent to fall out, but not to pitch the tents. The army therefore bivouacked, and but for this incident the battle of the next day would probably not have been fought. A sudden and violent storm broke over the bivouacs, and when it was over, the men, wet and restless, began to move about, light fires, &c. Many of them broke out of camp and went into Wörth, which was unoccupied, though Prussians were only 300 yds. from the sentries. These fired, and the officer commanding the Prussian outposts, hearing the confused murmur of voices, ordered up a battery, and as soon as there was light enough dropped a few shells into Wörth. The stragglers rushed back, the French lines were again alarmed, and several batteries on their side took up the challenge.

The Prussian guns, as strict orders had been given to avoid all engagement that day, soon withdrew and were about to return to camp, when renewed artillery fire was heard from the S. and presently also from the N. In the latter direction, the II. Bavarian corps had bivouacked along the Mattstall-Langensulzbach road with orders to continue the march if artillery were heard to the S. This order was contrary to the spirit of the III. army orders, and moreover the V. Prussian corps to the S. was in ignorance of its having been given.

The outpost battery near Wörth was heard, and the Bavarians at once moved forward. Soon the leading troops were on the crest of the ridge between the Sauer and the Sulzbach, and the divisional commander, anxious to prove his loyalty to his new allies—his enemies in 1866—ordered his troops to attack, giving the spire of Fröschweiler, which was visible over the woods, as the point of direction. The French, however, were quite ready and a furious fusillade broke out, which was multiplied by the echoes of the forest-clad hills out of all proportion to the numbers engaged. The Prussian officers of the V. corps near Dieffenbach, knowing nothing of the orders the Bavarians had received, were amazed; but at length when about 10.30 a.m. their comrades were seen retiring, in some cases in great disorder, the corps commander, General von Kirchbach, decided that an effort must at once be made to relieve the Bavarians. His chief of staff had already ordered up the divisional and corps artillery (84 guns in all), and he himself communicated his intention of attacking to the XI. corps (General von Bose) on his left and asked for all available assistance. A report was also despatched to the crown prince at Sulz, 5 m. away.

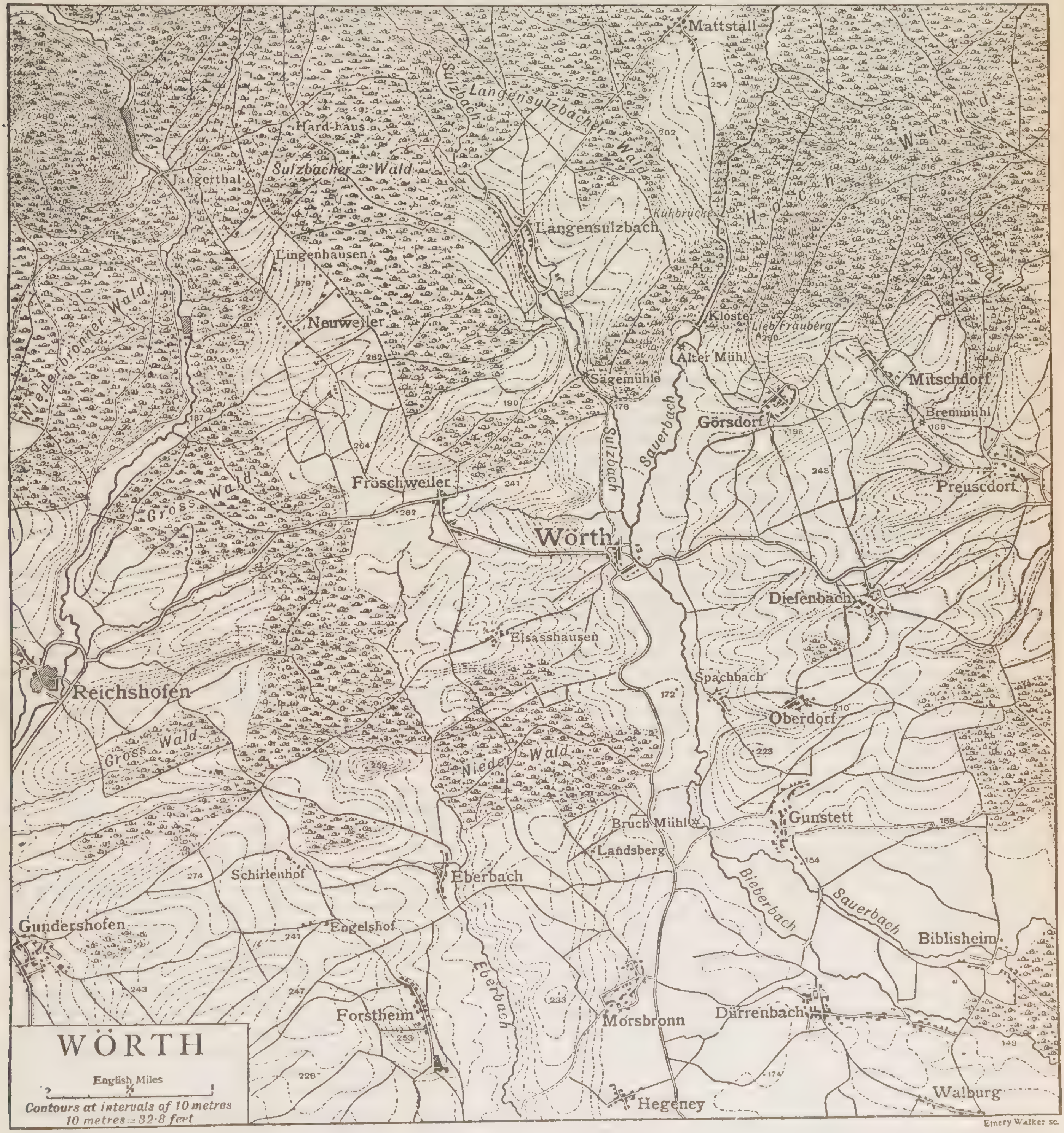
Meanwhile the XI. corps had become involved in an engagement. The left of the V. corps' outposts had over night occupied Gunstett and the bank of the Sauer, and the French shortly after daylight on the 6th sent down an unarmed party to fetch water. As this appeared through the mist, the Prussians naturally fired upon it, and the French General Lartigue (to whose division the party belonged), puzzled to account for the firing, brought up some batteries in readiness to repel an attack. These fired a few rounds only, but remained in position as a precaution.

Hearing the firing, the XI. corps' advanced guard, which had marched up behind in accordance with the general movement of the corps in changing front to the west, and had halted on reaching the Kreuzhecke Wood, promptly came up to Spachbach and Gunstett. In this movement across country to Spachbach some bodies appear to have exposed themselves, for French artillery at Elsasshausen suddenly opened fire, and the shrapnel bursting high, sent showers of bullets on to the house roofs of Spachbach, in which village a battalion had just halted. As the falling tiles made the position undesirable, the major in command ordered the march to be resumed, and as he gave the order, his horse ran away with him towards the Sauer. The leading company, seeing the battalion commander gallop, moved off at the double, and the others of course followed. Coming within sight of the enemy, they drew a heavy shell fire, and, still under the impression that they were intended to attack, deployed into line of columns and doubled down to the river, which they crossed. One or two companies in the neighbourhood had already begun to do so, and the stream being too wide for the mounted officers to jump, presently eight or ten companies were across the river and out of superior control. By this time the French outposts (some 1500 rifles), lining the edge of the Niederwald, were firing heavily. The line of smoke was naturally accepted by all as the objective, and the German companies with a wild rush reached the edge of the wood.

The same thing had happened at Gunstett. A most obstinate struggle ensued and both sides brought up reinforcements. The Prussians, with all their attention concentrated on the wood in their front, and having as yet no superior commanders, soon exhibited signs of confusion, and thereupon General Lartigue ordered a counter attack towards the heights of Gunstett, when all the Prussians between the Niederwald and the Sauer gave way. The French followed with a rush, and, fording the Sauer opposite Gunstett, for a moment placed the long line of German guns upon the heights in considerable danger. At this crisis a fresh battalion of the XI. corps arrived by the road from Surburg to Gunstett, and attacked the French on one flank whilst the guns swept the other. The momentum of the charge died out, and the French drifted backwards after an effort which compelled the admiration of both sides.

In the centre the fight had been going badly for the V. corps. As soon as the 84 guns between Dieffenbach and Spachbach opened fire the French disappeared from sight. There was no longer a target, and, perhaps to compel his adversary to show himself, von Kirchbach ordered four battalions to cross the river. These battalions, however, were widely separated, and coming under fire as soon as they appeared, they attacked in two groups, one from Wörth towards Fröschweiler, the other from near Spachbach towards the Calvary spur, E. of

Elsasshausen. Both were overpowered by infantry fire. A fraction of the S. party maintained itself all day in the elbow of the Hagenau chaussee, which formed a starting-point for subsequent attacks. But the rest were driven back in great confusion. Once more the dashing counter-attack of the French was thrown into confusion by the Prussian shell fire, and as the French fell back the Prussian infantry, now reinforced, followed them up (about 1 p.m.). The commander-in-chief of the German III. army (the crown prince Frederick) now appeared on the field and ordered Kirchbach to stand fast until the pressure of the XI. corps and Württemberg division could take effect against the French right wing. The majority of these troops had not yet reached the field. Von Bose, however, seeing the retreat of the troops of the V. corps, had independently determined to renew the attack against the Niederwald with such of his forces as had arrived, and had ordered General von Schkopp's brigade, which was then approaching, to join the troops collecting to the east of Gunstett. Schkopp, however, seeing that his present line of advance led him direct on to the French right about Morsbronn and kept him clear of the confusion to be seen around Gunstett, disregarded the order and continued to advance on Morsbronn. This deliberate acceptance of responsibility really decided the battle, for his brigade quietly deployed as a unit and compelled the French right wing to fall back.


Mattstall
Langensulzbacher Wald
Sulzbach
Hard-haus
Sulzbacher Wald
Jaegerthal
480
254
202
516
509
Hoch Wald
Kuhbrücke
Langensulzbach
Lingenhausen
279
183
Niederbronner Wald
Neuweiler
Kloster
Lieb Frauberg
Alter Mühl
Sägemühle
Mitschdorf
Bremmühl
186
262
190
176
Sauerbach
Sulzbach
Görsdorf
198
248
187
204
Fröschweiler
241
262
Gross Wald
Preuscdorf
Wörth
Diefenbach
Elsasshausen
Spachbach
172
210
Reichshofen
Oberdorf
223
Gross Wald
Nieder Wald
259
Gunstett
Bruch Mühl
168
Landsberg
164
Biebersbach
Sauerbach
274
Schirlenhof
Eberbach
Gundershofen
Engelshof
241
Biblisheim
Eberbach
243
247
233
Forstheim
Morsbronn
Dürrenbach
253
228
174
148
Hegeney
Walburg
WÖRTH
English Miles
½
Contours at intervals of 10 metres
10 metres = 32·8 feet

Emery Walker sc.

To cover the French retreat Michel's brigade of cavalry was ordered to charge. The order was somewhat vague, and in his position under cover near Eberbach, General Michel had no knowledge of the actual situation. Thus it came about that, without reconnoitring or manœuvring for position, the French cavalry rode straight at the first objective which offered itself, and struck the victorious Prussians as they were crossing the hills between the Albrechtshaüserhof and Morsbronn. Hence the charge was costly and only partly successful. However, the Prussians were ridden over here and there, and their attention was sufficiently absorbed while the French infantry rallied for a fresh counter-stroke. This was made about 1.20 P.M. with the utmost gallantry, and the Prussians were driven off the hillsides between the Albrechtshaüserhof and Morsbronn which they had already won. But the counter-attack soon came under the fire of the great artillery mass above Gunstett, and, von Bose having at length concentrated the main body of the XI. corps in the meadows between the Niederwald and the Sauer, the French had to withdraw. Their withdrawal involved the retreat of the troops who had fought all day in defence of the Niederwald.

By 3 P.M. the Prussians were masters of the Niederwald and the ground S. of it on which the French right wing had originally stood, but they were in indescribable confusion after the prolonged fighting in the dense undergrowth. Before order could be restored came another fierce counter-stroke. As the Prussians emerged from the N. edge of the wood, the French reserves suddenly came out from behind the Elsasshausen heights, and striking due S. drove the Prussians back. It was a grave crisis, but at this moment von Schkopp, who throughout all this had kept two of his battalions intact, came round the N.W. corner of the Wald, and these fresh battalions again brought the French to a standstill. Meanwhile von Kirchbach, seeing the progress of the XI. corps, had ordered the whole of his command forward to assault the French centre, and away to the right the two Bavarian corps moved against the French left, which still maintained its original position in the woods N.E. of Fröschweiler.

MacMahon, however, was not beaten yet. Ordering Bonnemains' cavalry division to charge, by squadrons to gain time, he brought up his reserve artillery, and sent it forward to case-shot range to cover a final counter-stroke by his last intact battalions. But from his position near Fröschweiler he could not see into the hollow between Elsasshausen and the Niederwald. The order was too late, and the artillery unlimbered just as the counter attack on the Niederwald alluded to above gave way before von Schkopp's reserve. The guns were submerged in a flood of fugitives and pursuers. Elsasshausen passed into the hands of the Germans. To rescue the guns the nearest French infantry attacked in a succession of groups, charging home the bayonet with the utmost determination. Before each attack the Prussians immediately in front gave way, but those on the flanks swung inwards and under this converging fire each French attempt died out, the Prussians following up their retreat. In this manner, step by step, in confusion which almost defies analysis, the Prussians conquered the whole of the ground to the S. of the Fröschweiler-Wörth road, but the French still held on in the village of Fröschweiler itself and in the woods to the N. of the road, where throughout the day they had held the two Bavarian corps in check with little difficulty. To break down this last stronghold, the guns of the V. and XI. corps, which had now come forward to the captured ridge of Elsasshausen, took the village as their target; and the great crowd of infantry, now flushed with victory but in the direst confusion, encouraged by the example of two horse artillery batteries which galloped boldly forward to case-shot range, delivered one final rush which swept all resistance before it.

The battle was won and cavalry only were needed to reap its consequences, but the Prussian cavalry division had been left behind without orders and did not reach the battlefield till late at night. The divisional cavalry squadrons did their best, but each pursued on its own account, and the results in prisoners and guns fell far short of what the opportunity offered. Under cover of darkness the French escaped, and on the following day the cavalry division was quite unable to discover the direction of the retreat.

MacMahon received no support from the neighbouring French troops (see FRANCO-GERMAN WAR). The battle was won by overpowering weight of numbers. The Prussian general staff were able to direct upon the field no fewer than 75,000 infantry, 6000 cavalry, and 300 guns, of which 71,000 rifles, 4250 sabres and 234 guns came into action, against 32,000 rifles, 4850 sabres and 101 guns on the French side. The superiority of the French chassepot to the needle guns may reasonably be set against the superior number of rifles on the German side, for though the Germans were generally, thanks to their numbers, able to bring a converging fire upon the French, the latter made nearly double the number of hits for about the same weight of ammunition fired, but the French had nothing to oppose to the superior German artillery, and in almost every instance it was the terrible shell fire which broke up the French counter attack. All of these attacks were in the highest degree honourable to the French army, and many came nearer to imperilling the ultimate success of the Germans than is generally supposed. One other point deserves special attention. As soon as the fighting became general, all order in the skirmisher lines disappeared on both sides, and invariably, except where the Prussian artillery fire intervened, it was the appearance of closed bodies of troops in rear of the fighting line which determined the retreat of their opponents. Even in the confused fighting in the Niederwald, the mere sound of the Prussian drums or the French bugles induced the adversary to give way even though drums and bugles frequently appealed to non-existent troops.

The losses of the Germans were 9270 killed and wounded and 1370 missing, or 13%; those of the French were about 8000 killed and wounded, and perhaps 12,000 missing, and prisoners, representing a total loss of about 41%. Some French regiments retained a semblance of discipline after suffering enormous losses. The 2nd Turcos lost 93%, 13th hussars 87%, and thirteen regiments in all lost over 50% of their strength.

See the French and German official histories of the war; H. Bonnal, *Fröschwiller* (1899); H. Kunz, *Schlacht von Wörth* (1891) and *Kriegsgesch. Beispiele*, Nos. 13-18; R. Tournès, *De Gunstett au Niederwald* and *Le Calvaire*; and Commandant Grange, "Les Réalités du champ de bataille," *Revue d'infanterie* (1908–1910). (F. N. M.)

WORTHING, a municipal borough and seaside resort in the Lewes parliamentary division of Sussex, England, 61 m. S. by W. from London by the London, Brighton & South Coast railway. Pop. (1901) 20,015. It has a fine marine parade, and a promenade pier, and there is a long range of firm sands. A public park, 21 acres in extent, was opened in 1881. The principal buildings are several modern churches, the town hall (1834), municipal buildings, free library, literary institute, infirmary and convalescent homes. The mother parish of Worthing is Broadwater, the church of which, 1 m. north of Worthing, is a cruciform building, and a fine example of transitional Norman work. A Roman villa, evidence of the existence of pottery works, and a so-called mile-stone, have been discovered at Worthing. The town was incorporated in 1890, and is under a mayor, 8 aldermen and 24 councillors. Area, 1439 acres.

WOTTON, SIR HENRY (1568–1639), English author and diplomatist, son of Thomas Wotton (1521–1587) and grand-nephew of the diplomatist Nicholas Wotton (*q.v.*), was born at Bocton Hall in the parish of Bocton or Boughton Malherbe, Kent.[1] He was educated at Winchester School and at New College, Oxford, where he matriculated on the 5th of June 1584. Two years later he removed to Queen's College, graduating B.A. in 1588. At Oxford he was the friend of Albericus Gentilis, then professor of Civil Law, and of John Donne. During his residence at Queen's he wrote a play, *Tancredo*, which has not survived, but his chief interests appear to have been scientific. In qualifying for his M.A. degree he read three lectures *De oculo*, and to the end of his life he continued to interest himself in physical experiments. His father, Thomas Wotton, died in 1587, leaving to his son the very inadequate maintenance of a hundred marks a year. About 1589 Wotton went abroad, with a view probably to preparation for a diplomatic career, and his travels appear to have lasted for about six years. At Altdorf he met Edward, Lord Zouch, to whom he later addressed a series of letters (1590–1593) which contain much political and other news. These (*Reliquiae Wottonianae*, pp. 585 et seq. 1685) provide a record of the journey. He travelled by way of Vienna and Venice to Rome, and in 1593 spent some time at Geneva in the house of Isaac Casaubon, to whom he contracted a considerable debt. He returned to England in 1594, and in the next year was admitted to the Middle Temple. While abroad he had from time to time provided Robert Devereux, second earl of Essex, with information, and he now definitely entered his service as one of his agents or secretaries. It was his duty to supply intelligence of affairs in Transylvania, Poland, Italy and Germany. Wotton was not, like his unfortunate fellow-secretary, Henry Cuffe, who was hanged at Tyburn in 1601, actually involved in Essex's downfall, but he thought it prudent to leave England, and within sixteen hours of his patron's apprehension he was safe in France, whence he travelled to Venice and Rome. In 1602 he was resident at Florence, and a plot to murder James VI. of Scotland having come to the ears of the grand-duke of Tuscany, Wotton was entrusted with letters to warn him of the danger, and with Italian antidotes against poison. As "Ottavio Baldi" he travelled to Scotland by way of Norway. He was well received by James, and remained three months at the Scottish court, retaining his Italian incognito. He then returned to Florence, but on receiving the news of James's accession hurried to England. James knighted him, and offered him the embassy at Madrid or Paris; but Wotton, knowing that both these offices involved ruinous expense, desired rather to represent James at Venice. He left London in 1604 accompanied by Sir Albertus Morton, his half-nephew, as secretary, and William Bedell, the author of an Irish translation of the Bible, as chaplain. Wotton spent most of the next twenty years, with two breaks (1612–1616 and 1619–1621), at Venice. He helped the Doge in his resistance to ecclesiastical aggression, and was closely associated with Paolo Sarpi, whose history of the Council of Trent was sent to King James as fast as it was written. Wotton had offended the scholar Caspar Schoppe, who had been a fellow student at Altdorf. In 1611 Schoppe wrote a scurrilous book against James entitled *Ecclesiasticus*, in which he fastened on Wotton a saying which he had incautiously written in a friend's album years before. It was the famous definition of an ambassador as an "honest man sent to lie abroad for the good of his country." It should be noticed that the original Latin form of the epigram did not admit of the double meaning. This was adduced as an example of the morals of James and his servants, and brought Wotton into temporary disgrace. Wotton was at the time on leave in England, and made two formal defences of himself, one a personal attack on his accuser addressed to Marcus Welser of Strassburg, and the other privately to the king. He failed to secure further diplomatic employment for some time, and seems to have finally won back the royal favour by obsequious support in parliament of James's claim to impose arbitrary taxes on merchandise. In 1614 he was sent to the Hague and in 1616 he returned to Venice. In 1620 he was sent on a special embassy to Ferdinand II. at Vienna, to do what he could on behalf of James's daughter Elizabeth, queen of Bohemia. Wotton's devotion to this princess, expressed in his exquisite verses beginning "You meaner beauties of the night," was sincere and unchanging. At his departure the emperor presented him with a jewel of great value, which Wotton received with due respect, but before leaving the city he gave it to his hostess, because, he said, he would accept no gifts from the enemy of the Bohemian queen. After a third term of service in Venice he returned to London early in 1624 and in July he was installed as provost of Eton College. This office did not relieve him from his pecuniary embarrassments, and he was even on one occasion arrested for debt, but he received in 1627 a pension of £200, and in 1630 this was raised to £500 on the understanding that he should write a history of England. He did not neglect the duties of his provostship, and was happy in being able to entertain his friends lavishly. His most constant associates were Izaak Walton and John Hales. A bend in the Thames below the Playing Fields, known as "Black Potts," is still pointed out as the spot where Wotton and Izaak Walton fished in company. He died at the beginning of December 1639 and was buried in the chapel of Eton College.

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[1] His elder half-brother, Edward Wotton (1548–1626), entered the service of Sir Francis Walsingham, and in 1585 was sent on an important errand to James VI. of Scotland. In 1602 he was made comptroller of the royal household, and in 1603 he was created Baron Wotton of Marley. The peerage became extinct on the death of his son Thomas, the 2nd baron (1588–1630).

Sir Henry Wotton was not an industrious author, and his writings are very small in bulk. Of the twenty-five poems printed in *Reliquiae Wottonianae* only fifteen are Wotton's. But of those fifteen two have obtained a place among the best known poems in the language, the lines already mentioned "On his Mistris, the Queen of Bohemia," and "The Character of a Happy Life."

During his lifetime he published only *The Elements of Architecture* (1624), which is a paraphrase from Marcus Vitruvius Pollio, and a Latin prose address to the king on his return from Scotland (1633). In 1651 appeared the *Reliquiae Wottonianiae*, with Izaak Walton's *Life*. An admirable *Life and Letters*, representing much new material, by Logan Pearsall Smith, was published in 1907. See also A. W. Ward, *Sir Henry Wotton, a Biographical Sketch* (1898).

WOTTON, NICHOLAS (*c.* 1497–1567), English diplomatist, was a son of Sir Robert Wotton of Boughton Malherbe, Kent, and a descendant of Nicholas Wotton, lord mayor of London in 1415 and 1430, and member of parliament for the city from 1406 to 1429. He early became vicar of Boughton Malherbe and of Sutton Valence, and later of Ivychurch, Kent; but, desiring a more worldly career, he entered the service of Cuthbert Tunstall, bishop of London. Having helped to draw up the *Institution of a Christian Man*, Wotton in 1539 went to arrange the marriage between Henry VIII. and Anne of Cleves and the union of Protestant princes which was to be the complement of this union. He crossed over to England with the royal bride, but, unlike Thomas Cromwell, he did not lose the royal favour when the king repudiated Anne, and in 1541, having already refused the bishopric of Hereford, he became dean of Canterbury and in 1544 dean of York. In 1543 he went on diplomatic business to the Netherlands, and for the next year or two he had much intercourse with the emperor Charles V. He helped to conclude the treaty of peace between England and France in 1546, and was resident ambassador in France from 1546 to 1549. Henry VIII. made Wotton an executor of his will and left him £300, and in 1549, under Edward VI., he became a secretary of state, but he only held this post for about a year. In 1550 he was again sent as envoy to Charles V., and he was ambassador to France during the reign of Mary, doing valuable work in that capacity. He left France in 1557, but in 1558 he was again in that country, helping to arrange the preliminaries of the treaty of Cateau Cambrésis. In 1560 he signed the treaty of Edinburgh on behalf of Elizabeth, and he had again visited the Netherlands before his death in London on the 26th of January 1567.

His brother, Sir Edward Wotton (1489–1551), was made treasurer of Calais in 1540, and was one of those who took part in the overthrow of the protector Somerset. His son, Thomas Wotton (1521–1587) was the father of Sir Henry Wotton (*q.v.*).

WOTTON, WILLIAM (1666–1727), English scholar, son of the Rev. Henry Wotton, was born in his father's parish of Wrentham, Suffolk, on the 13th of August 1666. He was not yet ten years old when he was sent to Catherine Hall, Cambridge, having by this time a good knowledge of Latin, Greek and Hebrew. He obtained a fellowship at St John's College, and was elected an F.R.S. in 1687. Wotton is chiefly remembered for his share in the controversy about the respective merits of ancient and modern learning. In his *Reflections upon Ancient and Modern Learning* (1694, and again 1697) he took the part of the moderns, although in a fair and judicial spirit, and was attacked by Swift in the *Battle of the Books*. During some of his later years Wotton resided in Wales and gave himself to the study of Celtic, making a translation of the laws of Howel Dda, which was published after his death (1730). Having taken holy orders, he was a prebend of Salisbury from 1705 until his death at Buxted, Essex, on the 13th of February 1727.

Wotton wrote a *History of Rome* (1701) and *Miscellaneous Discoveries relating to the Traditions and Usages of the Scribes and Pharisees* (1718).

WOUND (O. Eng. *wund*, connected with a Teutonic verb, meaning to strive, fight, suffer, seen in O. Eng. *winnan*, whence Eng. "win"), a solution in the continuity of the soft parts of the body. Contused wounds, or bruises, are injuries to the cellular tissues in which the skin is not broken. In parts where the tissues are lax the signs of swelling and discoloration are more noticeable than in the tenser tissues. The discoloration is caused by haemorrhage into the tissues (*ecchymosis*), and passes from dark purple through green to yellow before it disappears. If a considerable amount of blood is poured forth into the injured tissues it is termed a *haematoma*. The treatment of a bruise consists in the application of cold lotion, preferably an evaporating spirit-lotion, to limit the subcutaneous bleeding. The haemorrhage usually becomes absorbed of its own accord even in haematomata, but should suppuration threaten an incision must be made and the cavity aseptically evacuated.

Open wounds are divided into incised, lacerated, punctured and gunshot wounds. *Incised* wounds are made by any sharp instrument and have their edges evenly cut. In these wounds there is usually free haemorrhage, as the vessels are cleanly divided. *Lacerated* wounds are those in which the edges of the wound are torn irregularly. Such injuries occur frequently from accidents with machinery or blunt instruments, or from bites by animals. The haemorrhage is less than from incised wounds, and the edges may be bruised. *Punctured* wounds are those in which the depth is greater than the external opening. They are generally produced by sharp-pointed instruments. The chief danger arises from puncture of large blood-vessels, or injury to important structures such as occur in the thorax and abdomen. It is also difficult to keep such wounds surgically clean and to obtain apposition of their deeper parts, and septic germs are often carried in with the instrument.

The treatment of incised wounds is to arrest the bleeding (see HAEMORRHAGE), cleanse the wound and its surroundings, removing all foreign bodies (splinters, glass, &c.), and obtain apposition of the cut surfaces. This is usually done by means of sutures or stitches of silk, catgut, silkwormgut or silver wire. If the wound can be rendered aseptic, incised wounds usually heal by first intention. In lacerated wounds there is danger of suppuration, sloughing, erysipelas or tetanus. These wounds do not heal by first intention, and there is consequently considerable scarring. The exact amount of time occupied in the repair depends upon the presence or not of septic material, as lacerated wounds are very difficult to cleanse properly. Carbolic acid lotion should be used for cleansing, while torn or ragged portions should be cut away and provision made for free drainage. It is not always possible to apply sutures at first, but the wound may be packed with iodoform gauze, and later, when a clean granulating surface has been obtained, skin-grafting may be required. In extensive lacerated wounds, where the flesh has been stripped from the bones, where there is spreading gangrene, or in such wounds in conjunction with comminuted fractures or with severe sepsis supervening, amputation of a limb may be called for. Punctured wounds should be syringed with carbolic lotion, and all splinters and foreign bodies removed. The location of needles is rendered comparatively easy by the use of the Röntgen rays; the wound can then be packed with gauze and drained. If a large vessel should have been injured, the wound may have to be laid open and the bleeding vessel secured. Should paralysis indicate that a large nerve has been divided, the wound must also be laid open in order to suture the injured structure.

It is only possible here to mention some of the special characteristics of *gunshot* wounds. In the modern small-bore rifle (Lee-Metford, Mauser) the aperture of entry is small and the aperture of exit larger and more slit-like. There is usually but little haemorrhage. Should no large vessel be torn, and should no portion of septic clothing be carried in, the wound may heal by first intention. Such bullets may be said to disable without killing. They may drill a clean hole in a bone without a fracture, but sometimes there is much splintering. Abdominal wounds may be so small that the intestine may be penetrated and adhesions of neighbouring coils of intestine cover the aperture. Martini-Henry bullets make larger apertures, while soft-nosed or "dum-dum" bullets spread out as soon as the bullet strikes, causing great mutilation and destruction of the tissues. Shell wounds cause extensive lacerations. Small shot may inflict serious injury should one of the pellets enter the eye. In gunshot wounds at short distance the skin may be blackened owing to the particles of carbon lodging in it. The chief dangers of gunshot wounds are haemorrhage, shock and the carrying in of septic material or clothing into the wound.

WOUWERMAN, PHILIP (1619–1668), Dutch painter of battle and hunting scenes, was born at Haarlem in May 1619. He learned the elements of his art from his father, Paul Joosten Wouwerman, an historical painter of moderate ability, and he then studied with the landscape painter, Jan Wynants (1620–1679). Returning to Haarlem, he became a member of its gild of painters in 1642, and there he died in May 1668. About 800 pictures were enumerated in John Smith's *Catalogue raisonné* (1840) as the work of Philip Wouwerman, and in C. Hofstede de Groot's enlarged *Catalogue*, vol. ii. (1909), the number exceeds 1200; but probably many of these are the productions of his brothers Peter (1623–1682) and Jan (1629–1666), and of his many other imitators. His authentic works are distinguished by great spirit and are infinitely varied, though dealing recurrently with cavalry battle-pieces, military encampments, cavalcades, and hunting or hawking parties. He is equally excellent in his vivacious treatment of figures, in his skilful animal painting, and in his admirable and appropriate landscape backgrounds. Three different styles have been observed as characteristic of the various periods of his art. His earlier works are marked by the prevalence of a foxy-brown colouring, and by a tendency to angularity in draughtsmanship; the productions of his middle period have greater purity and brilliancy; and his latest and greatest pictures possess more of force and breadth, and are full of a delicate silvery-grey tone.

See the *Catalogue raisonné of the works of the most eminent Dutch and Flemish Painters of the 17th Century*, by De Groot, vol. ii. (1909), referred to above.

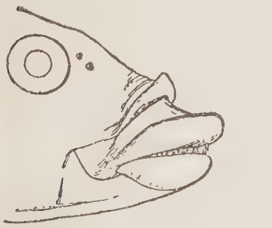
WRAITH, a general term in popular parlance for the appearance of the spirit of a living person. (See "Phantasms of the Living," under PSYCHICAL RESEARCH.)

WRANGEL, FRIEDRICH HEINRICH ERNST, COUNT VON (1784–1877), Prussian general field marshal, was born at Stettin, on the 13th of April 1784. He entered a dragoon regiment in 1796, became cornet in 1797, and second lieutenant in 1798. He fought as a subaltern against Napoleon, especially distinguishing himself as Heilsberg in 1807, and receiving the order *pour le mérite*. In the reorganization of the army, Wrangel became successively first lieutenant and captain, and won distinction and promotion to lieutenant-colonel in the War of Liberation in 1813, won the Iron Cross at Wachau near Leipzig, and became colonel in 1815. He commanded a cavalry brigade in 1821, and two years later was promoted major-general. He commanded the 13th Division, with headquarters at Münster, in Westphalia, in 1834, when riots occurred owing to differences between the archbishop of Cologne and the crown, and the determination and resolution with which he treated the clerical party prevented serious trouble. He was promoted lieutenant-general, received many honours from the court, enjoyed the confidence of the Junker party, and commanded successively at Königsberg and Stettin. In 1848 he commanded the II. Corps of the German Federal army in the Schleswig-Holstein campaign, was promoted general of cavalry, and won several actions. In the autumn he was summoned to Berlin to suppress the riots there. As governor of Berlin and commander-in-chief of the Mark of Brandenburg (appointments which he held till his death) he proclaimed a state of siege, and ejected the Liberal president and members of the Chamber. Thus on two occasions in the troubled history of Prussian revival Wrangel's uncompromising sternness achieved its object without bloodshed. From this time onwards he was most prominent in connexion with the revival of the Prussian cavalry from the neglect and inefficiency into which it had fallen during the years of peace and poverty after 1815. In 1856, having then seen sixty years' service, he was made a field marshal. At the age of eighty he commanded the Austro-Prussian army in the war with Denmark in 1864 and though he was too old for active work, and often issued vague or impracticable orders (he himself had always desired that the young and brilliant "Red Prince," Frederick Charles, should have the command), the prestige of his name, and the actual good work of Frederick Charles, Moltke and Vogel von Falckenstein among the Prussian, and of Gablenz among the Austrian generals, made the campaign a brilliant success. After the capture of Düppel he resigned the command, was created a count, and received other honours. In 1866 "Papa" Wrangel assisted in the Bohemian campaign, but without a command on account of his great age. He took a keen interest in the second reorganization of the cavalry arm 1866–1870, and in the war with France in 1870–71. He died at Berlin on the 2nd of November 1877. On the seventieth anniversary of his entering the army his regiment, the 3rd Cuirassiers, was given the title "Graf Wrangel."

See supplement to *Militär. Wochenblatt* (1877), and lives by von Köppen and von Maltitz (Berlin, 1884).

WRANGEL, KARL GUSTAV VON (1613–1676), Swedish soldier, was descended from a family of Esthonian origin, branches of which settled in Sweden, Russia and Germany. His father, Hermann von Wrangel (1587–1643), was a Swedish field marshal in Gustavus Adolphus's wars. Karl Gustav was born near Upsala on the 23rd of December 1613, and at the age of twenty distinguished himself as a cavalry captain in the war against the Army of the League. Three years later he was colonel, and in 1638 major-general, still serving in Germany. In 1644 he commanded a fleet at sea, which defeated the Danes at Fehmarn on the 23rd of October. In 1646 he returned to Germany as a field marshal and succeeded Torstensson as commander-in-chief of the Swedish army in Germany, which post he held during the last three campaigns of the Thirty Years' War. Under Wrangel and Turenne the allied Swedish and French armies marched and fought in Bavaria and Württemberg. At the outbreak of a fresh Polish war in 1655 Wrangel commanded a fleet, but in 1656 he was serving on land again and commanding, along with the Great Elector of Brandenburg, in the three days' battle of Warsaw. In 1657 he invaded Jutland and in 1658 passed over the ice into the islands and took Kronborg. In 1657 he was appointed admiral and in 1664 general of the realm, and as such he was a member of the regency during the minority of Charles XI. But his last campaign was unfortunate. Commanding, ineffectively owing to his broken health, in the war against Brandenburg, he was recalled after his stepbrother Waldemar, Freiherr von Wrangel (1647–1676), had been defeated at Fehrbellin. He died at Rügen shortly afterwards, on the 5th of July 1676.

WRASSE, a name given to the fishes of the family Labridae generally, and more especially to certain members of the family. They are very abundant in the tropical zone, less so in the temperate, and disappear altogether in the Arctic and Antarctic Circles. Their body is generally compressed, like that of a carp, covered with smooth (cycloid) scales; they possess one dorsal fin only, the anterior portion of which consists of numerous spines. Many wrasses are readily recognized by their thick lips, the inside of which is sometimes curiously folded, a peculiarity which has given to them the German name of "lip-fishes." The dentition of their jaws consists of strong conical teeth, of which some in front, and often one at the hinder end of the upper jaw, are larger than the others. But the principal organs with which they crush shell-fish, crustaceans and other hard substances are the solid and strongly-toothed pharyngeal bones, of which the lower are coalesced into a single flat triangular plate. All wrasses are surface fishes, and rocky parts of the coast overgrown with seaweed are their favourite haunts in the temperate, and coral-reefs in the tropical seas. Some 450 species of wrasses (including parrot-wrasses) are known, chiefly from the tropics.


Lips of *Labrus festivus*.

Of the British wrasses the ballan wrasse (*Labrus maculatus*) and the striped or red or cook wrasse (*Labrus mixtus*) are the most common. Both belong to the genus *Labrus*, in which the teeth stand in a single series, and which has a smooth edge of the praeoperculum and only three spines in the anal fin. The ballan wrasse is the larger, attaining to a length of 18 in., and, it is said, to a weight of 8 lb; its colours are singularly variegated, green or brownish, with red and blue lines and spots; the dorsal spines are twenty in number. The cook wrasse offers an instance of well-marked secondary sexual difference—the male being ornamented with blue streaks or a blackish band along the side of the body, whilst the female has two or three large black spots across the back of the tail. This species possesses only from sixteen to eighteen spines in the dorsal fin. The goldsinny or corkwing (*Crenilabrus melops*) is much more frequent on the S. coasts of England and Ireland than farther N., and rarely exceeds a length of 10 in. As in other wrasses, its colours are beautiful, but variable; but it may be readily distinguished from the two preceding species by the toothed edge of the praeoperculum. The three other British wrasses are much scarcer and more local, viz. Jago's goldsinny (*Ctenolabrus rupestris*), with a large black spot on the anterior dorsal spines and another on the base of the upper caudal rays; *Acantholabrus palloni*, which is so rarely captured that it lacks a vernacular name, but may be easily recognized by its five anal spines and by the teeth in the jaws forming a band; and the rock-cook (*Centrolabrus exoletus*), which also has five anal spines, but has the jaws armed with a single series of teeth.

On the Atlantic coasts of the N. states of the United States the wrasses are represented by the genus *Tautoga*. The only species of this genus, known by the names of tautog or blackfish, is much esteemed as food. It is caught in great numbers, and generally sold of a weight of about 2 lb.

WRAXALL, SIR NATHANIEL WILLIAM (1751–1831), English author, was born in Queen's Square, Bristol, on the 8th of April 1751. He was the son of a Bristol merchant, Nathaniel Wraxall, and his wife Anne, great niece of Sir James Thornhill the painter. He entered the employment of the East India Company in 1769, and served as judge-advocate and paymaster during the expeditions against Guzerat and Baroche in 1771. In the following year he left the service of the company and returned to Europe. He visited Portugal and was presented to the court, of which he gives a curious account in his *Historical Memoirs*; and in the N. of Europe he made the acquaintance of several Danish nobles who had been exiled for their support of the deposed Queen Caroline Matilda, sister of George III. Wraxall at their suggestion undertook to endeavour to persuade the king to act on her behalf. He was able to secure an interview with her at Zell in September 1774. His exertions are told in his *Posthumous Memoirs*. As the queen died on the 11th of May 1775, his schemes came to nothing and he complained that he was out of pocket, but George III. took no notice of him for some time. In 1775 he published his first book, *Cursory Remarks made in a Tour through some of the Northern Parts of Europe*, which reached its fourth edition by 1807, when it was renamed *A Tour Round the Baltic*. In 1777 he travelled again in Germany and Italy. As he had by this time secured the patronage of important people, he obtained a complimentary lieutenant's commission from the king on the application of Lord Robert Manners, which gave him the right to wear uniform though he never performed any military service. In this year he published his *Memoirs of the Kings of France of the Race of Valois*, to which he appended an account of his tour in the Western, Southern and Interior Provinces of France. In 1778 he went again on his travels to Germany and Italy, and accumulated materials for his *Memoirs of the Courts of Berlin, Dresden, Warsaw and Vienna* (1799). In 1780 he entered parliament and sat till 1794 for Hinton in Wiltshire, Ludgershall and Wallingford, in succession. He published in 1795 the beginning of a *History of France from the Accession of Henry III. to the Death of Louis XIV.*, which was never completed. Little is known of his later years except that he was made a baronet by the prince regent in 1813. His *Historical Memoirs* appeared in 1815. Both they and the *Posthumous Memoirs* (1836) are very readable and have real historical value. Wraxall married Miss Jane Lascelles in 1789, and died suddenly at Dover on the 7th of November 1831. His grandson, Sir F. C. Lascelles Wraxall (1828–1865), was a miscellaneous writer of some note.

See preface to *The Historical and Posthumous Memoirs of Sir N. W. Wraxall*, by H. B. Wheatley (London, 1884).

WREATH (O. Eng. *wrǣð*, from *wrīðan*, to twist), a band of leaves, flowers or metal, twisted into a circular form, and used either as a chaplet or diadem for the head or as an ornament to be hung upon or round an object. For the ancient usages of crowning victors in the games with wreaths, and the bestowal of them as marks of honour see CROWN and CORONET.

WRECK, a term which in its widest sense means anything without an apparent owner that is afloat upon, sunk in, or cast ashore by the sea; in legal phraseology, as appears below, it has a narrower meaning. Old Norman forms of the word, *varec* and *veresc*, are to be found in charters of 1181 and later date; and the former is still in use in Normandy. Latinized it becomes *wreccum*, *wreckum* or *warectum*; and such phrases as *maris ejectum*, *jactura maris*, *adventura maris*, *shipbryche*, are all used as descriptions of wreck. In Anglo-Saxon charters *sǽ-úpwyrþ*, and in the charters of the Cinque Ports *inventiones*, a translation of "findalls," probably a local word, are synonymous with wreck. Formerly an appreciable source of revenue to the crown, afterwards a valuable addition to the income of a landowner on the sea coast, wreck has almost within modern times ceased to be a perquisite of either, or to enrich the casual finder at the expense of its rightful owner. The history of the law as sketched below will indicate how this has come about.

History.—Of old it seems to have been the general rule in the civilized maritime countries of Europe that the right to wreck belonged to the sovereign, and formed part of the royal revenue. This was so under the Roman, French and feudal law; and in England the common law set out in the statute *De praerogativa regis* (17 Edw. II., 1324), provided that the king has wreck of the sea, whales and sturgeons taken in the sea and elsewhere within the kingdom, except in certain places privileged by the king. This right, which it is said had for its object the prevention of the practice of destroying the property of the shipwrecked, was, however, gradually relaxed; and the owner of wreck was allowed to recover it if he made claim to it, and gave proof of his ownership within a certain time—fixed at a year or a year and a day alike by a decree of Antonine the Great, the feudal law, the general maritime law, the law of France and English law. Richard I. released his prerogative right to wreck to the extent of allowing children, or if there were none, brothers and sisters of a perishing owner, to have his goods; and Henry III., by a charter of 1236, allowed the owner of wrecked goods to have his property again if he claimed within three months, provided that any man or beast escaped from the ship. The statute of Westminster the First (1276, 3 Edw. I.) provided that where a man, a dog or a cat escape alive out of the ship, such ship or barge or anything in it shall not be adjudged wreck, but the goods shall be saved and kept by view of the sheriff, coroner or the king's bailiff, and delivered into the hands of such as are of the town where the goods were found, so that if any one sue for those goods and prove that they were his, or perished within his keeping, within a year and a day, they shall be restored to him without delay, and if not they shall remain to the king or to such others to whom the wreck belonged. In 1277 the statute *De officio coronatoris* made provision for the safe custody of wreck, but coroners were relieved of their duties in respect of wreck by the Coroners Act 1887. An act of 1353 provided for the delivery to the merchants of goods coming to land which may not be said to be wreck, on payment of salvage. In Scotland, a statute of Alexander II., similar to that of Westminster, declared that where any creature escapes alive from a wrecked vessel, the goods cast away are not accounted wreck, but are to be preserved by the sheriff for those who within a year shall prove their property therein; otherwise they shall escheat to the crown. For a long time the view of English law was that the right to recover wrecked property depended on the fact of a live creature escaping, though in Hale's words, " because it was *lex odiosa* to add affliction to the afflicted, it was bound up with as many limits and circumstances, and restricted to as narrow a compass as might be "; and the admiralty records illustrate the statement. Thus in 1382 the prior of Wymondham claimed as wreck a ship which came ashore with no one on board, the men having left her for fear of their lives because of an enemy ship which was about to capture her; but the king's council, before whom it came, by certiorari from the admiral of the north, decided against the claim. In 1543, ships grounded on the Goodwins were held to be waif and wreck, although their crews to save their lives made their way to shore; and in 1637 a ship in the Cinque Ports was proceeded against in admiralty and condemned, " no man or dog being on board, but only a dead man with his head shot off. " Upon the institution of the office of lord high admiral early in the 15th or at the close of the 14th century, it became usual for the crown to grant to the lord admiral by his patent of appointment, amongst other *proficua et commoditates* appertaining to his office, wreck of the sea; and when, early in the reign of Henry VIII., vice-admirals of the coast were created, the lord admiral by patent under his own hand delegated to them his rights and duties in the several counties, including those in connexion with wreck. He did not, however, part with the whole of his emoluments; his vice-admirals were required to render an account of the proceeds of wreck, and to hand over to him a part, usually one-half, of their gains. This system, depending not upon any statute, but apparently upon an arrangement between the lord-admiral and his vice-admirals, continued until the year 1846. In that year an act (9 & 10 Vict. c. 99) was passed forbidding the vice-admirals to intermeddle with wreck, and it required the receivers of droits of admiralty to receive all wreck from the finders and to detain it for twelve calendar months; at the end of that period it was to be sold and the proceeds carried to the credit of the consolidated fund. The transfer to this fund of the hereditary casual revenues of the crown had previously been effected by legislation in the first years of the reigns of William IV. and Victoria, by which the civil list was instituted. The last lord-admiral, however, who beneficially enjoyed the proceeds of wreck was the duke of Buckingham in the reign of Charles I. Prince George of Denmark, Queen Anne's husband and lord-admiral, took wreck by his patent, but by a collateral instrument he surrendered the greater part of the revenues of his office to the crown. Notwithstanding this arrangement, the vice-admirals of counties, who, in the absence of a lord high admiral, received their appointments sometimes from the crown and sometimes from the commissioners of the admiralty, appear to have taken the whole or part of the proceeds of wreck until the passing of the act of 1846. The ancient law by which the unfortunate owner was deprived of his property, if no living thing escaped from the wreck, had during the 16th and 17th centuries been gradually but tacitly relaxed; it required, however, a decision of Lord Mansfield and the king's bench in 1771 (*Hamilton* v. *Davis*, 5 Burr. 2732) to settle the law definitely that, whether or no any living creature escaped, the property in a wreck remains in the owner. In Scotland it seems that the same law had been laid down in 1725, and there are indications that upon the continent of Europe there had before this date been a relaxation of the old law in the same direction. As early as 1269 a treaty with Norway provides that owners of ships wrecked upon the coasts of England or Norway should not be deprived of their goods (Rym. Foed. 1450). The system under which the lord-admiral and the vice-admirals of counties had for more than three centuries taken charge of wreck never worked well. Their interest was directly opposed to their duty; for it was to the interest of every one concerned, except the owners and crews of ships in distress, that nothing should land alive. Apart from this, the system discouraged legitimate salvors. The admirals and vice-admirals had by degrees assumed that all salvage operations were exclusively their business; they took possession of wreck brought or cast ashore, whether it was legal wreck or not, and this often gave rise to conflicts with outside working salvors. It was not until the 17th century that working salvors established the right, which they now have, to a lien upon property saved as a security for adequate remuneration of their exertions in saving it; and if the vice-admirals restored to its owners wreck that had come to their hands, they did so only upon payment of extravagant demands for salvage, storage and often legal expenses. A curious side light is thrown upon their practices by the case of an English ship that went ashore on the coast of Prussia in 1743. Frederick the Great restored her to her owners, but before doing so he exacted from them a bond for the full value of ship and cargo, and the condition of the bond was that the owners would within six months produce a certificate under seal of the English admiralty that by the law of England no " salvage " was payable to the crown or to the admiral of England in the like case of a Prussian ship going ashore upon an English coast. The records of the admiralty court show that Frederick's action in this case was intended as a protest, not against the payment of a fair reward to salvors of Prussian ships, but against exactions by English vice-admirals and their officers. Stories of wilful wrecking of ships and of even more evil deeds are probably exaggerations, but modern research has authenticated sufficient abuses to show that further legislation was necessary to regulate the taking possession of wreck and ships in distress by " sea-coasters. " Previously to the passing of the act of 1846 the only substantial protection against plunder which owners of a wrecked ship could get was to apply to the admiralty judge for a commission enabling them or their agents to take possession of what came ashore, but to obtain such a commission took time and cost money, and before the commissioners arrived at the scene of the wreck a valuable cargo would have disappeared and been dispersed through the country. Plunder of wrecks was common, and the crowds that collected for the purpose set law at defiance. The vice-admirals, even if they had been able, did little to protect the ship wrecked. Complaints from the lord-admiral that they neglected to render accounts of their profits were constant; and although the crown and the lord-admiral profited little by wreck, there is reason to think that the gains of vice-admirals and their officers, and also of landowners and dwellers on the coast, were more considerable. Many of the vice-admirals' accounts of the 17th and following centuries are extant. Most of them are for trifling sums, but occasionally the amounts are considerable. A vice-admiral for Cornwall charges himself in his account for the years 1628–1634 with a sum of £29,253, and in 1624 the duke of Buckingham found it worth his while to buy out the rights of the warden of the Cinque Ports over wreck within his jurisdiction for £1000 in addition to an annuity of £500 for the warden's life. At the close of the 17th century the vice-admirals were required to make affidavits as to the amount of their gains; in 1709 twenty of them swore that their office was worth less than £50 in the year.

The right of the warden of the Cinque Ports to wreck, above alluded to, was derived from charters granted to the ports by Edward I. and his successors; many other seaports enjoyed a similar right under early charters. It would seem that these rights were of some value, for in 1829 the little towns of Dunwich and Southwold litigated at a cost of £1000 the question whether a tub of whisky picked up at sea belonged to the admiralty jurisdiction of the one town or the other; and the town of Yarmouth is said to have spent no less than £7000 upon a similar question. It was partly in order to put an end to all dealings with wreck by local admiralty courts that the Municipal Corporations Act of 1835 was passed, abolishing all of them, except that of the Cinque Ports.

Grants of wreck to individuals are earlier than those to towns. Even before the conquest it seems to have been not unusual for grantees from the crown of lands adjoining the sea to get the franchise of wreck included in their grants. A charter purporting to be of the year 1023 contains a grant by King Canute to the abbot of Canterbury of wreck found at sea below low-water mark as far as a man could by wading touch it with a sprit (Kemble, Cod. Dipl., No. 737). There is reason to think that before the end of the reign of Henry II. the crown had granted away its right to wreck round a great part of the coast of England. Although a landowner of the present day, who under such a grant is entitled to wreck, will, in respect of wreck itself, derive no substantial benefit, nevertheless the grant may be of great value as evidence of his right to the foreshore; and even where no grant of wreck can be produced, if he can show that he and his predecessors have been accustomed to take possession of wreck on the foreshore, it is strong evidence as against the crown of his right to the foreshore, and a lost grant may be presumed. As to these grants of wreck Hale says that "though wreck of the sea doth *de jure communi* belong to the king, yet it may belong to a subject by charter or by prescription.... Sometime wreck hath belonged to an honour by prescription, as in the honour of Arundel, sometimes to the owner of a county. The lords of all counties palatine regularly had *wreccum maris* within their counties palatine as part of their *jura regalia*, but yet inferior lords might prescribe for wreck belonging to their several manors within a county palatine. The earl of Cornwall had *wreccum maris per totum comitatum Cornubiae*; for though Cornwall was not a county palatine, it had many royalties belonging to it, viz. as against the king, though particular lords might prescribe for wreck against the earl" (*De jure maris*, i. vii.; Hargrave, 41). In the Isle of Man unreclaimed wreck, whether cast on shore or found in the sea, within the headlands of Man, belongs to the lord, now the crown by purchase from the duke of Athol; in the Channel Islands all wreck cast on shore or within reach of a person standing on shore, except certain valuables which go to the crown, belongs to the lord of the manor if not reclaimed within a year and a day; while in Wales the old law made everything thrown on shore belong to the king, for "the sea is a packhorse of the king" (*A. G.* v. *Jones*, 2 H. & C. 347). In Scotland, as in England, unclaimed wreck belonged to the crown and was often granted to subjects, generally under the style of "wrak, waith and ware," the last two words signifying derelict and seaweed. It was so granted to the earl of Orkney in 1581. It was occasionally dealt with by the Scottish parliament. Thus by an act of 1426, ships wrecked on the coast of Scotland were to be escheat to the king if they belonged to a country observing a similar law, otherwise to have the favour shown to ships of Scotland. In France under the name of *droit de bris* or *droit d'épave* similar grants were made to feudal seigneurs.

From early times a distinction was made in English law between wreck cast ashore and wreck that is floating or sunken below low-water mark. Wreck proper, or common law wreck, *ejectum maris*, is what is cast by the sea upon the shore; for "nothing shall be said to be *wreccum maris*, but such goods as are cast or left upon the land" (*Sir H. Constable's Case*, 1599, 5 Rep. 106), and this belonged to the king *jure coronae*, and was dealt with by the common law. Floating and sunken wreck belonged to the crown as *inter regalia*, but was granted to the lord-admiral *jure regis*. Even when the office of lord high admiral is in abeyance, and the duties performed by commissioners, as now, these rights are distinguished from the other royal revenues as belonging to the crown in its office of admiralty, or, as they are commonly known, droits of the admiralty. From early times the lord-admiral tried to usurp, and there are several instances of his actually usurping jurisdiction over wreck proper; and in the reign of Richard II. special statutes (which were only declaratory of the common law) were passed for the purpose of confining his jurisdiction to its proper limits. One of these (15 Ric. II.) declared that "of all manner of contracts, pleas and quereles, and all other things arising within the bodies of the counties as well by land as by water and also of wreck of the sea, the admiral's court shall have no manner of cognizance, power nor jurisdiction, but all such manner of contracts, pleas and quereles, and all other things rising within the bodies of counties as well by land as by water as afore, and also wreck of the sea, shall be tried by the laws of the land and not before nor by the admiral nor his lieutenant in any wise."

In spite of this statute, instances still occurred of the admiralty court exercising this jurisdiction, until by frequent prohibition by the common law courts, especially in the 17th century, and by the admission of the admiralty judges themselves, it was recognized as beyond the scope of their authority. These admiralty droits are classified as flotsam, jetsam, lagan and derelict. In Lord Coke's words, flotsam is "when a ship sinks or otherwise perishes, and the goods float on the sea"; jetsam is "when goods are cast out of a ship to lighten her when in danger of sinking, and afterwards the ship perishes"; and ligan, or lagan, is "when heavy goods are, to lighten the ship, cast out and sunk in the sea tied to a buoy or cork, or something that will not sink, in order that they may be found again and recovered." Derelict is a ship or cargo, or part of it, abandoned by its master and crew *sine spe recuperandi et sine animo revertendi*. "None of these goods," adds Coke, "which are so called, are called wreck so long as they remain in or upon the sea; but if any of them by the sea be put upon the land then they shall be said to be wreck" (*Sir H. Constable's Case*, 1599, 5 Rep. 106; and 2 Inst. 167). Hale says "they are not wreck of the sea but of another nature, neither do they pass by *wreccum maris* as is recorded in Sir Henry Constable's case and the case of the 3 Edw. II., where they are styled *adventurae maris*. And as they are of another cognizance or jurisdiction, viz. the admiral jurisdiction. Flotsam, jetsam and lagan, and other sea estrays, if they are taken up in the wide ocean, belong to the taker of them if the owner cannot be known. But if they be taken up within the narrow seas that do belong to the king, or in any haven, port or creek or arm of the sea, they do prima facie and of common right belong to the king, in case where the ship perisheth or the owner cannot be known.... But if the owner can be known he ought to have his goods again, for the casting them overboard is not a loss of his property. Although the right of these adventures of the sea within the king's seas belongs to him where the owner cannot be known, yet the king hath little advantage of it, for by the custom of the English seas the one moiety of what is gained belongs to him that saves it [this is not the present rule].... A subject may be entitled to these as he may be entitled to wreck—(1) by charter; (2) by prescription" (*De jure maris*; Hargrave, 41, 42). The difference between these two kinds of wreck is clearly brought out in *R.* v. *49 Casks of Brandy* (1836, 3 Hagg. Ad. 257; and *R.* v. *2 Casks of Tallow*, *ibid.* 294)—a dispute between the crown and a grantee of wreck, where it was decided that objects picked up below low-water mark, and within 3 m. of it, as also objects afloat between high- and low-water marks, never having touched the ground, are droits of the crown, whereas objects picked up aground between high- and low-water marks, or though aground, yet covered by the waves, are wreck.

The distinction that Hale draws in the above passage between sea waifs or estrays taken on the high seas, and those taken in the seas of the realm, seems to be founded on the *occupatio* of the civil law; but although favoured by the similar rule existing in the case of royal fish, it has not been recognized by the courts, which have always held that in both cases they are droits of the crown in its office of admiralty, and, subject to the right of the salvor to reward and the right of the owner to reclaim them in a year and a day, go to the royal revenue (Lord Stowell, *The Aquila*, 1798, 1 C. Rob. 37). Lord Stowell bases this prerogative right "on the general rule of civilized countries that what is found derelict on the seas is acquired beneficially for the sovereign, if no owner shall appear." It seems that this was also Coke's view (2 Inst. 168).

The provisions of the Merchant Shipping Act 1894, mentioned below, upon the subject of droits of admiralty are not clear. In practice the only droits of the admiralty that are commonly dealt with are anchors that have been slipped or parted from in heavy weather. In the Downs and other roadsteads these are "swept" for by creepers towed over the sea bottom, and in former days sweeping for anchors was a common industry. In the Downs large sums have been made after gales in this way. In the 17th century it became customary to obtain from the crown grants of the right to fish for sunken wreck and treasure not only upon English coasts but all over the world.

Although a ship on board which, or by means of which a man was killed, might be a deodand (*q.v.*), yet *qua* wreck she was not subject to forfeiture as deodand.

Present British Law.—From the above sketch of the development of the law of wreck it will be seen that it owes little to the legislature. After the act of 1353 no statute dealt with the subject until 1712. In that year a salvage act was passed, but it made no material alteration in the law; and although during the 18th and early 19th centuries several acts were passed dealing fragmentarily with wreck and salvage, the act of 1846, above mentioned, is the only one that calls for notice. That act was embodied in and added to by the Merchant Shipping Act 1854, which again was repealed, re-enacted and added to by the Merchant Shipping Act 1894. The last mentioned act contains the whole of the existing statute law upon the subject of wreck within the territorial waters of the United Kingdom. For its purposes wreck includes jetsam, flotsam, lagan and derelict, found in or on the shores of the sea or any tidal water. The term does not extend to a barge adrift in the Thames, nor a raft of timber adrift; it must be the hull, cargo or appurtenances of a vessel. Under the Sea Fisheries Act 1883, passed to give effect to the North Sea Fisheries Convention, the provisions of the Merchant Shipping Act as to wreck apply to fishing boats with their rigging and gear.

The provisions of the Merchant Shipping Act dealing with wreck (ninth part) may be summarized as follows: The Board of Trade (as the receiver-general of droits of admiralty) has the general superintendence of wreck in the United Kingdom, and appoints receivers of wreck for the whole coast, who are paid by fees. Where a British or foreign vessel is wrecked, stranded or in distress, at any place on or near the coasts or any tidal water within the limits of the kingdom, it is the duty of the receiver for the district to proceed there and give directions for preserving the ship, the lives on board her and her cargo and apparel. He can require the assistance of any person, especially the master of any vessel, or the use of any waggons, carts or horses, near at hand; and for this purpose any person may, unless there is a public road equally convenient, pass and repass with or without horses or carriages over any adjoining lands without the owner's or occupier's consent, doing as little damage as possible, and may also deposit there any things recovered from the ship; any damage so done is a charge on the ship, cargo or articles, and is recoverable like salvage (*q.v.*). Penalties are imposed on any owner or occupier hindering the operations. The receiver has power to suppress any plundering or disorder, or any hindering of the preservation of the ship, persons, cargo or apparel. Where any vessel, wrecked or in distress as above, is plundered, damaged or destroyed, by any riotous or tumultuous assembly ashore or afloat, compensation must be made to her owner in England and Scotland by the same authority which would be liable to pay compensation in cases of riot (*q.v.*), and in Ireland in cases of malicious injuries to property. In the absence of the receiver, his powers may be exercised by the following officers or persons in successive order, viz. a chief officer of customs, principal officer of coast-guard, inland revenue officer, sheriff, justice of the peace, and naval or military officer on full pay. These persons act as the receiver's agent and put the salvage in his custody, but they are not entitled to any fees nor are they deprived of any right to salvage by so doing. An examination is also directed to be held, in cases of ships in distress on the coasts of the kingdom, by a wreck receiver, wreck commissioner or his deputy, at the request of the Board of Trade or a justice of the peace, by evidence on oath as to the name and description of ship, name of master, shipowner and owner of cargo, ports to and from which the ship was bound, the occasion of the ship's distress, the services rendered and the like. The act provides as follows for dealing with wreck: Any one finding wreck, if he is the owner of it, must give notice of his having done so to the receiver of the district, and if he is not the owner he must deliver it to that officer as soon as possible, except for reasonable cause, *e.g.* if, as a salvor, he retains it with the knowledge of the receiver. No articles belonging to a wrecked ship found at the time of the casualty must be taken or kept by any person, whether their owner or not, but must be handed over to the receiver. The receiver taking possession of any wreck must give notice of it, with a description, at the nearest custom-house; and if the wreck is in his opinion worth more than £20, also to Lloyd's. The owner of any wreck in the hands of a receiver must establish his claim to it within a year, and on so doing, and paying all expenses, is entitled to have it restored to him. Where a foreign ship has been wrecked on or near the coast, and any articles forming part of her cargo are found on or near the coast, or are brought into any port, the consular officer of the foreign country to which the ship or cargo belongs is deemed to be the agent for the owner so far as the custody and disposal of the articles is concerned. The receiver may in certain cases, *e.g.* where the value is small, sell the wreck and hold the proceeds till claimed. The right to unclaimed wreck belongs to the crown, except in places where the crown has granted that right to others. Persons so entitled, such as admirals—vice-admirals are mentioned in the act (*sed quaere*)—lords of manors and the like, are entitled, after giving the receiver notice and particulars of their title, to receive notice from the receiver of any wreck there found. Where wreck is not claimed by an owner within a year after it was found, and has been in the hands of a receiver, it can be claimed by the person entitled to wreck in the place where it was found, and he is entitled to have it after paying expenses and salvage connected with it; if no such person claims it, it is sold by the receiver, and the net proceeds are applied for the benefit of the crown, either for the duchy of Lancaster or the duchy of Cornwall; or if these do not claim it, it goes to the crown. Where the title to unclaimed wreck is disputed, the dispute may be settled summarily as in cases of salvage; either party, if dissatisfied, may within three months after a year since the wreck came into the hands of the receiver proceed in any competent court to establish his title. Delivery of unclaimed wreck by the receiver discharges him from liability, but does not prejudice the title thereto. The Board of Trade has power to purchase rights of wreck. No person exercising admiralty jurisdiction as grantee of wreck may interfere with wreck otherwise than in accordance with the act. Duties are payable on wrecked goods coming into the United Kingdom or Isle of Man as if they had been imported thither; and goods wrecked on their homeward voyage may be forwarded to their original destination, or, if wrecked on their outward voyage, to their port of shipment, on due security being taken for the protection of the revenue. Wreck commissioners may be appointed by the lord chancellor to hold investigations into shipping casualties, to act as judges of courts of survey, and to take examinations in respect of ships in distress.

The owner of a wrecked ship, sunk by his negligence in a navigable highway, so as to be an obstruction to navigation, if he retains the ownership of her, is liable in damages to the owner of any other ship which without negligence runs into her. If, however, the owner has taken steps to indicate her position, or the harbour authority at his request has undertaken to do so, no action lies against him for negligence either *in rem* or *in personam*. He may, however (whether the sinking was due to his negligence or not), abandon the ship, and can thus free himself from any further liability in respect of her. If he abandons her to any other person—*e.g.* an underwriter—who pays for her as for a total loss, that person does not become liable for her unless he takes possession or control in any way. Harbour authorities generally have by local statute, as they have by the general Harbours, Docks and Piers Clauses Act 1847 (if incorporated in their own act), the power of removing the wreck in such a case, and recouping themselves for their expenses from its proceeds. The general act also gives a personal right of action against the owner for any balance of expense over the value of the wreck; but if the owner has abandoned it, and no one else has taken it, neither he nor any one else is liable. A particular or local act (as *e.g.* one of the State of Victoria) may, however, fasten this liability on the person who is owner at the time when the ship is wrecked, and then he cannot free himself of it. A harbour authority is not obliged to remove a wreck because it has power to do so, unless it takes dues from vessels using the harbour where the wreck lies, or in some way warrants that the harbour is safe for navigation, in which case it is under an obligation to do so. Further statutory provision is now made in this respect by the Merchant Shipping Act, which empowers harbour authorities to raise, remove or destroy (and meantime buoy or light), or to sell and reimburse themselves out of the proceeds of any vessel or part of a vessel, her tackle, cargo, equipment and stores, sunk, stranded or abandoned in any water under their control, or any approach thereto, which is an obstruction or danger to navigation or lifeboat service. They must first give due notice of such intention, and must allow the owner to have the wreck on his paying the fair market value. The act gives similar powers to lighthouse authorities, with a provision that any dispute between a harbour and lighthouse authority in this respect is to be determined finally by the Board of Trade. Provision is also made by statute for the burial of bodies cast on shore from the sea by wreck or otherwise within the limits of parishes, or, in extra-parochial places, by the parish officers or constables at the cost of the county; and lords of manors entitled to wreck may defray part of the cost of burial of bodies cast up within the manor, as evidence of their right of wreck.

The method of dealing with wreck outside territorial waters (which does not come within the scope of the act) is governed by the previous general law relating to droits of admiralty. The Board of Trade, as receiver-general, in its instructions to receivers, directs that wreck picked up at sea out of the limits of the United Kingdom, or brought to it by British ships, is to be taken possession of by the receiver and held by him on behalf of the owners, or, if the owners do not claim it, on behalf of the crown. Derelict ships picked up at sea outside territorial limits and brought into British ports must be delivered to the receiver and kept by him until the owner can be found (but not longer than a year and a day). Wreck picked up out of territorial limits by a foreign ship need not be interfered with by the receiver, unless upon application by a party interested. For the receiver's rights with respect to property in distress and its liability to salvage, see SALVAGE.

By an act of 1896 it is the duty of the master of a British ship to report to Lloyd's agent, or to the secretary of Lloyd's, any floating derelict ship which he may fall in with at sea. Under the Merchant Shipping Act, it is a felony to take wreck found in territorial limits to a foreign port, and it is punishable by fine to interfere with a wreck. The receiver has power, by means of a search warrant from a justice, to search for wreck which he has reason to believe is concealed. By the general criminal law in Scotland plundering wreck is punishable at common law; and in England and Ireland it is a felony to plunder or steal any wreck or part thereof, to destroy any wreck or part thereof, to prevent or impede any person on board a wreck from saving himself, and to exhibit any false signal with the intent of endangering any ship, or to do anything tending to the immediate loss or destruction of a ship for which no other punishment is provided.

AUTHORITIES.—Du Cange, *Glossarium*, tit. "Wreckum"; Chief-Justice Hale, *De jure maris*; Hargrave, *Tracts* (London, 1787); Palmer, *Law of Wreck*, Law Tracts (London, 1843); Marsden. *Select Pleas of Admiralty*, Selden Society (London, 1892 and 1897); *Records of the Admiralty and of the High Court of Admiralty*, Public Record Office (London); *Victoria County History, Cornwall*, and other seaboard counties; *Maritime History*, by M. Oppenheim (1906, &c.); *Board of Trade Instructions as to Wreck and Salvage* (London).

(R. G. M.; G. G. P.*)

WREDE, KARL PHILIPP, PRINCE VON (1767–1838), Bavarian field-marshal, was born at Heidelberg on the 29th of April 1767, and educated for the career of a civil official under the Palatinate government, but on the outbreak of the campaign of 1799 he raised a volunteer corps in the Palatinate and was made its colonel. This corps excited the mirth of the well-drilled Austrians with whom it served, but its colonel soon brought it into a good condition, and it distinguished itself during Kray's retreat on Ulm. At Hohenlinden Wrede commanded one of the Palatinate infantry brigades with credit, and after the peace of Lunéville he was made lieutenant-general in the Bavarian army, which was entering upon a period of reforms. Wrede soon made himself very popular, and distinguished himself in opposing the Austrian invasion of 1805. The Bavarians were for several years the active allies of Napoleon, and Wrede was engaged in the campaign against Prussia, winning especial distinction at Pultusk. But the contemptuous attitude of the French towards the Bavarian troops, and accusations of looting against himself, exasperated the general's fiery temper, and both in 1807 and in 1809 even outward harmony was only maintained by the tact of the king of Bavaria. In the latter year, under Lefebvre, Wrede conducted the rearguard operations on the Isar and the Abens, commanded the Bavarians in the bitter Tirolese war, was wounded in the decisive attack at Wagram, and returned to Tirol in November to complete the subjection of the mountaineers. Napoleon made him a count of the Empire in this year. But after a visit to France, recognizing that Napoleon would not respect the independence of the Rhine states, and that the empire would collapse under the emperor's ambitions, he gradually went over to the anti-French party in Bavaria, and though he displayed his usual vigour in the Russian campaign, the retreat convinced him that Napoleon's was a losing cause and he left the army. At first his resignation was not accepted, but early in 1813 he was allowed to return to Bavaria to reorganize the Bavarian army. But he had no intention of using that army on Napoleon's side, and when the king of Bavaria resolved at last to join Napoleon's enemies, Wrede's army was ready to take the field. In concert with Schwarzenberg Wrede threw himself across Napoleon's line of retreat from Germany at Hanau, but on the 30th of October he was driven off the road with heavy losses. Next year, after recovering from a dangerous wound, he led a corps in the invasion of France, and supported Blücher's vigorous policy. In 1815 the Bavarians took the field but were not actively engaged. After Waterloo, Wrede, who had been made a prince in 1814, played a conspicuous part in Bavarian politics as the opponent of Montgelas, whom he succeeded in power in 1817, and in 1835 he was made head of the council of regency during the king's absence. He died on the 12th of December 1838.

See lives by Riedel (1844) and Heilmann (1881).

WREN, SIR CHRISTOPHER (1632–1723), English architect, the son of a clergyman, was born at East Knoyle, Wiltshire, on the 20th of October 1632; he entered at Wadham College, Oxford, in 1646, took his degree in 1650, and in 1653 was made a fellow of All Souls. While at Oxford Wren distinguished himself in geometry and applied mathematics, and Newton, in his *Principiâ*, p. 19 (ed. of 1713), speaks very highly of his work as a geometrician. In 1657 he became professor of astronomy at Gresham College, and in 1660 was elected Savilian professor of astronomy at Oxford. It is, however, as an architect that Wren is best known, and the great fire of London, by its destruction of the cathedral and nearly all the city churches, gave Wren a unique opportunity. Just before the fire Wren was asked by Charles II. to prepare a scheme for the restoration of the old St Paul's. In May 1666 Wren submitted his report and designs (in the All Souls collection), for this work; the old cathedral was in a very ruinous state, and Wren proposed to remodel the greater part, as he said, "after a good Roman manner," and not, "to follow the Gothick Rudeness of the old Design." According to this scheme only the old choir was left; the nave and transepts were to be rebuilt after the classical style, with a lofty dome at the crossing—not unlike the plan eventually carried out.

In September of the same year (1666) the fire occurred, and the old St Paul's was completely gutted. From 1668 to 1670 attempts were being made by the chapter to restore the ruined building; but Dean Sancroft was anxious to have it wholly rebuilt, and in 1668 he had asked Wren to prepare a design for a wholly new church. This first design, the model for which is preserved in the South Kensington Museum, is very inferior to what Wren afterwards devised. In plan it is an immense rotunda surrounded by a wide aisle, and approached by a double portico; the rotunda is covered with a dome taken from that of the Pantheon in Rome; on this a second dome stands, set on a lofty drum, and this second dome is crowned by a tall spire. But the dean and chapter objected to the absence of a structural choir, nave and aisles, and wished to follow the medieval cathedral arrangement. Thus, in spite of its having been approved by the king, this design was happily abandoned—much to Wren's disgust; and he prepared another scheme with a similar treatment of a dome crowned by a spire, which in 1675 was ordered to be carried out. Wren apparently did not himself approve of this second design, for he got the king to give him permission to alter it as much as he liked, without showing models or drawings to any one, and the actual building bears little resemblance to the approved design, to which it is very superior in almost every possible point. Wren's earlier designs have the exterior of the church arranged with one order of columns; the division of the whole height into two orders was an immense gain in increasing the apparent scale of the whole, and makes the exterior of St Paul's very superior to that of St Peter's in Rome, which is utterly dwarfed by the colossal size of the columns and pilasters of its single order. The present dome and the drum on which it stands, masterpieces of graceful line and harmonious proportion, were very important alterations from the earlier scheme. As a scientific engineer and practical architect Wren was perhaps more remarkable than as an artistic designer. The construction of the wooden external dome, and the support of the stone lantern by an inner cone of brickwork, quite independent of either the external or internal dome, are wonderful examples of his constructive ingenuity. The first stone of the new St Paul's was laid on the 21st of June 1675; the choir was opened for use on the 2nd of December 1697; and the last stone of the cathedral was set in 1710.

Wren also designed a colonnade to enclose a large piazza forming a clear space round the church, somewhat after the fashion of Bernini's colonnade in front of St Peter's, but space in the city was too valuable to admit of this. Wren was an enthusiastic admirer of Bernini's designs, and visited Paris in 1665 in order to see him and his proposed scheme for the rebuilding of the Louvre. Bernini showed his design to Wren, but would not let him copy it, though, as he said, he "would have given his skin" to be allowed to do so.

After the destruction of the city of London Wren was employed to make designs for rebuilding its fifty burnt churches, and he also prepared a scheme for laying out the whole city on a new plan, with a series of wide streets radiating from a central space. Difficulties arising from the various ownerships of the ground prevented the accomplishment of this scheme.

Among Wren's city churches the most noteworthy are St Michael's, Cornhill; St Bride's, Fleet Street, and St Mary-le-Bow, Cheapside, the latter remarkable for its graceful spire; and St Stephen's, Walbrook, with a plain exterior, but very elaborate and graceful interior. In the design of spires Wren showed much taste and wonderful power of invention. He was also very judicious in the way in which he expended the limited money at his command; he did not fritter it away in an attempt to make the whole of a building remarkable, but devoted it chiefly to one part or feature, such as a spire or a rich scheme of internal decoration. Thus he was in some cases, as in that of St James's, Piccadilly, content to make the exterior of an almost barnlike plainness.

The other buildings designed by Wren were very numerous. Only a few of the principal ones can be mentioned:—the Custom House, the Royal Exchange, Marlborough House, Buckingham House, and the Hall of the College of Physicians—now destroyed; others which exist are—at Oxford, the Sheldonian theatre, the Ashmolean museum, the Tom Tower of Christ Church, and Queen's College chapel; at Cambridge, the library of Trinity College and the chapel of Pembroke, the latter at the cost of Bishop Matthew Wren, his uncle. The western towers of Westminster Abbey are usually attributed to Wren, but they were not carried out till 1735–1745, many years after Wren's death, and there is no reason to think that his design was used. Wren (D.C.L. from 1660) was knighted in 1673, and was elected president of the Royal Society in 1681. He was in parliament for many years, representing Plympton from 1685, Windsor from 1689, and Weymouth from 1700. He occupied the post of surveyor of the royal works for fifty years, but by a shameful cabal was dismissed from this office a few years before his death

He died in 1723, and is buried under the choir of St Paul's; on a tablet over the inner north doorway is the well-known epitaph—*Si monumentum requiris, circumspice.*

For further information the reader should consult the *Parentalia*, published by Wren's grandson in 1750, an account of the Wren family and especially of Sir Christopher and his works; also the two biographies of Wren by Elmes and Miss Phillimore; Milman, *Annals of St Paul's* (1868); and Longman, *Three Cathedrals dedicated to St Paul in London* (1873), pp. 77 seq. See also Clayton, *Churches of Sir C. Wren* (1848–1849); Taylor, *Towers and Steeples of Wren* (London, 1881); Niven, *City Churches* (London, 1887), illustrated with fine etchings; A. H. Mackmurdo, *Wren's City Churches* (1883); A. Stratton, *The Life, Work and Influence of Sir Christopher Wren* (1897); Lena Milman, *Sir Christopher Wren* (1908). In the library of All Souls at Oxford are preserved a large number of drawings by Wren, including the designs for almost all his chief works, and a fine series showing his various schemes for St Paul's Cathedral. (J. H. M.)

WREN (O. Eng. *wrǽnna*, Mid. Eng. *wrenne*; Icel. *rindill*), the popular name for birds of the Passerine family Troglodytidae, of which the best known example is *Troglodytes parvulus*, the little brown bird—with its short tail, cocked on high—inquisitive and familiar, that braves the winter of the British Islands, and even that of the European continent. Great interest is taken in this bird throughout all European countries, and, though in Britain comparatively few vernacular names have been applied to it, two of them—"jenny" or "kitty-wren"—are terms of endearment. M. Rolland records no fewer than 139 local names for it in France; and Italy, Germany and other lands are only less prolific. Many of these carry on the old belief that the wren was the king of birds, a belief connected with the fable that once the fowls of the air resolved to choose for their leader that one of them which should mount highest. This the eagle seemed to do, and all were ready to accept his rule, when a loud burst of song was heard, and perched upon him was seen the wren, which unseen had been borne aloft by the giant. The curious association of this bird with the Feast of the Three Kings, on which day in S. Wales, or, in Ireland and in the S. of France, on or about Christmas Day, men and boys used to "hunt the wren," addressing it in a song as "the king of birds," is remarkable.

The better known forms in the United States are the house-wren, common in the eastern states; the winter-wren, remarkable for its resonant and brilliant song; the Carolina-wren, also a fine singer, and the marsh-wren, besides the cactus wrens and the cañon-wrens of the western states.

Wrens have the bill slender and somewhat arched: their food consists of insects, larvae and spiders, but they will also take any small creatures, such as worms and snails, and occasionally eat seeds. The note is shrill. The nest is usually a domed structure of ferns, grass, moss and leaves, lined with hair or feathers, and from three to nine eggs are produced, in most of the species white.

The headquarters of the wrens are in tropical America, but they reach Greenland in the N. and the Falkland Islands in the S. Some genera are confined to the hills of tropical Asia, but *Troglodytes*, the best known, ranges over N. and S. America, Asia and Europe.

The Troglodytidae by no means contain all the birds to which the name "wren" is applied. Several of the *Sylviinae* (cf. Warbler) bear it, especially the beautiful little golden-crested wren (cf. Kinglet) and the group commonly known in Britain as "willow-wrens"—forming the genus *Phylloscopus*. Three of these are habitual summer-visitants. The largest, usually called the wood-wren, *P. sibilatrix*, is more abundant in the N. than in the S. of England, and chiefly frequents woods of oak or beech. It has a loud and peculiar song, like the word *twēē*, sounded very long, and repeated at first slowly, but afterwards more quickly, while at uncertain intervals comes another note, which has been syllabled as *chea*, uttered about three times in succession. The willow-wren proper, *P. trochilus*, is in many parts of Great Britain the commonest summer-bird, and is the most generally dispersed. The third species, *P. collybita* or *minor* (frequently but most wrongly called *Sylvia rufa* or *P. rufus*), commonly known as the chiffchaff, from the peculiarity of its constantly repeated two-noted cry, is very numerous in the S. and W. of England, but seems to be scarcer N. These three species make their nest upon or very close to the ground, and the building is always domed. Hence they are commonly called "oven-birds," and occasionally, from the grass used in their structure, "hay-jacks," a name common to the white-throat (*q.v.*) and its allies. (A. N.)

WRESTLING (O. Eng. *wrǽstlian*), a sport in which two persons strive to throw each other to the ground. It is one of the most primitive and universal of sports. Upon the walls of the temple-tombs of Beni Hasan, near the Nile, are sculptured many hundred scenes from wrestling matches, depicting practically all the holds and falls known at the present day, thus proving that wrestling was a highly developed sport at least 3000 years before the Christian era. As the description of the bout between Odysseus and Ajax in the 23rd book of the *Iliad*, and the evolutions of the classic Greek wrestlers, tally with the sculptures of Beni Hasan and Nineveh, the sport may have been introduced into Greece from Egypt or Asia. In Homer's celebrated description of the match between Ajax and Odysseus the two champions wore only a girdle, which was, however, not used in the classic Greek games. Neither Homer nor Eustathius, who also minutely depicted the battle between Ajax and Odysseus, mentions the use of oil, which, however, was invariable at the Olympic games, where wrestling was introduced during the 18th Olympiad. The Greek wrestlers were, after the application of the oil, rubbed with fine sand, to afford a better hold.

Wrestling was a very important branch of athletics in the Greek games, since it formed the chief event of the *pentathlon*, or quintuple games (see GAMES, CLASSICAL). All holds were allowed, even strangling, butting and kicking. Crushing the fingers was used especially in the *pancration*, a combination of wrestling and boxing. Wrestlers were taught to be graceful in all their movements, in accordance with the Greek ideas of aesthetics. There were two varieties of Greek wrestling, the πάλη ὄρθη, or upright wrestling, which was that generally practised, and the ἀλίνδησις (κύλισις, *lucta volutatoria*) or squirming contest after the contestants had fallen, which continued until one acknowledged defeat. It was this variety that was employed in the *pancration.* The upright wrestling was very similar to the modern catch-as-catch-can style. In this three falls out of five decided a match. A variation of this style was that in which one of the contestants stood within a small ring and resisted the efforts of his adversary to pull him out of it. Other local varieties existed in the different provinces. The most celebrated wrestler of ancient times was Milo of Crotona (*c.* 520 B.C.), who scored thirty-two victories in the different national games, six of them at Olympia. Greek athletic sports were introduced into Rome in the last quarter of the 2nd century B.C., but it never attained to the popularity that it enjoyed in Greece.

Among the Teutonic peoples wrestling, at least as a method of fighting, was of course always known; how popular it had become as a sport during the middle ages is proved by the voluminous literature which appeared on the subject after the invention of printing, the most celebrated work being the *Ringer-Kunst* of Fabian von Auerswald (1539). Albrecht Dürer made 119 drawings illustrating the different holds and falls in vogue in the 15th and 16th centuries. These singularly resembled those used in the Greek games, even to certain brutal tricks, which, however, were considered by the German masters as not *geselliglich* (friendly) and were not commonly used. Wrestling was adopted by the German *Turnvereine* as one of their exercises, but with the elimination of tripping and all holds below the hips. At present the most popular style in Europe is the so-called Graeco-Roman.

In Switzerland and some of the Tirolese valleys a kind of wrestling flourishes under the name of *Schwingen* (swinging). The wrestlers wear *schwinghosen* or wrestling-breeches, with stout belts, on which the holds are taken. The first man down loses the bout. In Styria, wrestlers stand firmly on both feet with right hands clasped. When the word is given each tries to push or pull the other from his stance, the slightest movement of a foot sufficing to lose.

The popularity of wrestling has survived in many Asiatic countries, particularly in Japan, where the first match recorded took place in 23 B.C., the victor being Sukune, who has ever since been regarded as the tutelary deity of wrestlers. In the 8th century the emperor Shômu made wrestling one of the features of the annual harvest "Festival of the Five Grains," the victor being appointed official referee and presented with a fan bearing the legend, "Prince of Lions." In 858 the throne of Japan was wrestled for by the two sons of the emperor Buntoku, and the victor, Koreshito, succeeded his father under the name of Seiwa. Imperial patronage of wrestling ceased in 1175, after the war which resulted in the establishment of the Shogunate, but continued to be a part of the training of the *samurai* or military caste. About 1600, professional wrestling again rose to importance, the best men being in the employ of the great *daimios* or feudal nobles. It was, nevertheless, still kept up by the *samurai*, and eventually developed into the peculiar combination of wrestling and system of doing bodily injury called *ju-jutsu* (*q.v.*), which survives with wrestling as a separate though allied art. The national championships were re-established in 1624, when the celebrated Shiganosuke won the honour, and have continued to the present day. The Japanese wrestlers, like those of India, lay much stress upon weight and are generally men of great bulk, although surprisingly light on their feet. They form a gild which is divided into several ranks, the highest being composed of the *joshiyori*, or elders, in whose hands the superintendence of the wrestling schools and tournaments lies, and who in feudal times used to rank next to the *samurai*. The badges of the three highest ranks are damask aprons richly embroidered. Every public wrestler must have passed through a thorough course of instruction under one of the *joshiyori* and have undergone numerous practical tests. The wrestling takes place in a ring 12 ft. in diameter, the wrestlers being naked but for a loin-cloth. At the command of the referee the two adversaries crouch with their hands on the ground and watch for an opening. The method is very similar to that of the ancient Greeks and the modern catch-as-catch-can style, except that a wrestler who touches the ground with any part of his person except the feet, after the first hold has been taken, loses the bout.

Indian wrestling resembles that of Japan in the great size of its exponents or *Pulwans*, and the number and subtlety of its attacks, called *penches*. It is of the "loose" order, the men facing each other nude, except for a loin-cloth, and manœuvring warily for a hold. Both shoulders placed on the ground simultaneously constitute a fall.

In Great Britain wrestling was cultivated at a very early age, both Saxons and Celts having always been addicted to it, and English literature is full of references to the sport. On St James's and St Bartholomew's days special matches took place throughout England, those in London being held in St Giles's Field, whence they were afterwards transferred to Clerkenwell. The lord mayor and his sheriffs were often present on these occasions, but the frequent brawls among the spectators eventually brought public matches into disrepute. English monarchs have not disdained to patronize the sport, and Henry VIII. is known to have been a powerful wrestler.

It was inevitable, in a country where the sport was so ancient and so universal, that different methods of wrestling should grow up. It is likely that the "loose" style, in which the contestants took any hold they could obtain, generally prevailed throughout Great Britain until the close of the 18th century, when the several local fashions became gradually coherent; but it was not until well into the 19th that their several rules were codified. Of these the "Cumberland and Westmorland" style, which prevails principally in the N. of England (except Lancashire) and the S. of Scotland, is the most important. In this the wrestlers stand chest to chest, each grasping the other with locked hands round the body with his chin on the other's right shoulder. The right arm is below and the left above the adversary's. When this hold has been firmly taken the umpire gives the word and the bout proceeds until one man touches the ground with any part of his person except his feet, or he fails to retain his hold, in either of which cases he loses. When both fall together the one who is underneath, or first touches the ground, loses. If both fall simultaneously side by side, it is a "dog-fall," and the bout begins anew. The different manœuvres used in British wrestling to throw the adversary are called "chips," those most important in the "Cumberland and Westmorland" or "North Country" style being the "back-heel," in which a wrestler gets a leg behind his opponent's heel on the outside; the "outside stroke," in which after a sudden twist of his body to the left the opponent is struck with the left foot on the outside of his ankle; the "hank," or lifting the opponent off the ground after a sudden turn, so that both fall together, but with the opponent underneath; the "inside click," a hank applied after jerking the opponent forward, the pressure then being straight back; the "outside click," a back-heel applied by a wrestler as he is on the point of being lifted from the ground—it prevents this and often results in oversetting the opponent; the "cross-buttock," executed by getting one's hip underneath the opponent's, throwing one's leg across both his, lifting and throwing him; the "buttock," in which one's hip is worked still further under that of the opponent, who is then thrown right over one's back; the "hipe" or "hype," executed by lifting the opponent, and, while swinging him to the right, placing the left knee under his right leg and carrying it as high as possible before the throw; the "swinging hipe," in which the opponent is swung nearly or quite round before the hipe is applied; and the "breast-stroke," which is a sudden double twist, first to one side and then to the other, followed by a throw.

In the "Cornwall and Devon" or "West Country" style the men wrestle in stout, loosely cut linen jackets, the hold being anywhere above the waist or on any part of the jacket. A bout is won by throwing the opponent on his back so that two shoulders and a hip, or two hips and a shoulder (three points), shall touch the ground simultaneously. This is a difficult matter, since ground wrestling is forbidden, and a man, when he feels himself falling, will usually turn and land on his side or face. Many of the "chips" common to other styles are used here, the most celebrated being the "flying mare," in which the opponent's left wrist is seized with one's right, one's back turned on him, his left elbow grasped with the left hand and he is then thrown over one's back, as in the buttock. Until comparatively recently there was a difference between the styles of Cornwall and Devon, the wrestlers of the latter county having worn heavily-soled shoes, with which it was legitimate to belabour the adversary's shins. In 1826 a memorable match took place between Polkinhorne, the Cornish champion, and the best wrestler of Devon, Abraham Cann, who wore "kicking-boots of an appalling pattern." Polkinhorne, however, encased his shins in leather, and the match was eventually drawn.

The "Lancashire" style, more generally known as "catch-as-catch-can," is practised not only in Lancashire and the adjacent districts, but throughout America, Australia, Turkey and other countries. It is the legitimate descendant and representative of the ancient Greek sport and of the wrestling of the middle ages. A bout is won when both shoulders of one wrestler touch the floor together. No kicking, striking or other foul practices are allowed, but theoretically every hold is legitimate. Exceptions are, however, made of the so-called strangle-holds, which are sufficiently described by their designation, and any hold resulting in a dislocation or a fracture. This style contains practically all the manœuvres known to other methods, and in its freedom and opportunity for a display of strategy, strength and skill, is the most preferable. A fall, though invariably begun standing, is nearly always completed on the ground (mat). The holds and "chips" are so numerous and complicated as to make anything but an elaborate description inadequate. The best book on the subject is the *Handbook of Wrestling* by Hugh F. Leonard (1897).

In Scotland a combination of the Cumberland and catch-as-catch-can styles has attained some popularity, in which the wrestlers begin with the North Country hold, but continue the bout on the ground should the fall not be a clean one with two shoulders down.

In Ireland the national style is called "collar and elbow" (in America, "back-wrestling"), from the holds taken by the two hands. The man loses, any part of whose person, except the feet, touches the ground.

The style mostly affected by the professional wrestlers of Europe at the present day is the Graeco-Roman (falsely so called, since it bears almost no resemblance to classic wrestling), which arose about 1860 and is a product of the French wrestling schools. It is a very restricted style, as no tripping is allowed, nor any hold below the hips, the result being that the bouts, which are contested almost entirely prone on the mat, are usually tediously long. British and American wrestlers, being accustomed to their own styles, are naturally at a disadvantage when wrestling under Graeco-Roman rules.

WREXHAM (Welsh *Gwrecsam*, in the Anglo-Saxon Chronicle *Wrightesham*), a market town and parliamentary and municipal borough of Denbighshire, N. Wales, 11 m. S.S.W. of Chester, with stations on the Great Western railway, and on the Great Central railway, 202 m. from London. Pop. (1901) 14,966. "One of the seven wonders of Wales" is St Giles's church, of the 14th, 15th and 16th centuries, with a panelled tower of several stages erected between 1506 and 1520, and containing ten famous bells cast (1726) by Rudhall; the interior is Decorated, and has two monuments by Roubilliac to the Myddletons. Wrexham is the seat of the Roman Catholic bishop of Menevia, whose diocese includes all Wales except Glamorganshire. The endowed free school was established in 1603. The markets and fairs are good, and the ales, mills (corn and paper) and tanneries locally famous. Brymbo Hall, in the neighbourhood, is said to have been built from a design by Inigo Jones, as were probably Gwydyr chapel (1633) and the Conwy bridge (1636), both at Llanrwst. Erddig Hall was noted for its Welsh MSS. Near Wrexham, but in a detached portion of Flintshire, to the S.E., is Bangor-is-coed (Bangor yn Maelor), the site of the most ancient monastery in the kingdom, founded before 180; some 1200 monks were slain here by Æthelfrith of Northumbria, who also spoiled the monastery. Bangor-is-coed was probably Antoninus's *Bovium*, and the *Banchorium* of Richard of Cirencester. Wrightesham was of Saxon origin, and lying E. of Offa's Dyke, was yet reckoned in Mercia. It was given (with Bromfield and Yale, or *Iâl*) by Edward I. to Earl Warenne.

WRIGHT, CARROLL DAVIDSON (1840–1909), American statistician, was born at Dunbarton, New Hampshire, on the 25th of July 1840. He began to study law in 1860, but in 1862 enlisted as a private in a New Hampshire volunteer regiment. He became colonel in 1864, and served as assistant-adjutant-general of a brigade in the Shenandoah Valley campaign. He was admitted to the New Hampshire bar after the war, and in 1867 became a member of the Massachusetts and United States bars. From 1872 to 1873 he served in the Senate of Massachusetts, and from 1873 to 1878 he was chief of the Massachusetts Bureau of Statistics of Labor. He was U.S. commissioner of labour from 1885 to 1905, and in 1893 was placed in charge of the Eleventh Census. In 1894 he was chairman of the commission which investigated the great railway strike of Chicago, and in 1902 was a member of the Anthracite Strike Commission. He was honorary professor of social economics in the Catholic university of America from 1895 to 1904; in 1900 became professor of statistics and social economics in Columbian (now George Washington) University, from 1900 to 1901 was university lecturer on wage statistics at Harvard, and in 1903 was a member of the special committee appointed to revise the labour laws of Massachusetts. In 1902 he was chosen president of Clark College, Worcester, Mass., where he was also professor of statistics and social economics from 1904 until his death. Dr Wright was president of the American Association for the Advancement of Science in 1903, and in 1907 received the Cross of the Legion of Honour for his work in improving industrial conditions, a similar honour having been conferred upon him in 1906 by the Italian government. He died on the 20th of February 1909.

His publications include *The Factory System of the United States* (1880); *Relation of Political Economy to the Labor Question* (1882); *History of Wages and Prices in Massachusetts, 1752–1883* (1885); *The Industrial Evolution of the United States* (1887); *Outline of Practical Sociology* (1899); *Battles of Labor* (1906); and numerous pamphlets and monographs on social and economic topics.

WRIGHT, CHAUNCEY (1830–1875), American philosopher and mathematician, was born at Northampton, Mass., on the 20th of September 1830, and died at Cambridge, Mass., on the 12th of September 1875. In 1852 he graduated at Harvard, and became computer to the *American Ephemeris* and *Nautical Almanac*. He made his name by contributions on mathematical and physical subjects in the *Mathematical Monthly*. He soon, however, turned his attention to metaphysics and psychology, and for the *North American Review* and later for the *National* he wrote philosophical essays on the lines of Mill, Darwin and Spencer. In 1870–71 he lectured on psychology at Harvard. Although, in general, he adhered to the evolution theory, he was a free lance in thought. Among his essays may be mentioned *The Evolution of Self-Consciousness* and two articles published in 1871 on the *Genesis of Species*. Of these, the former endeavours to explain the most elaborate psychical activities of men as developments of elementary forms of conscious processes in the animal kingdom as a whole; the latter is a defence of the theory of natural selection against the attacks of St George Mivart, and appeared in an English edition on the suggestion of Darwin. From 1863 to 1870 he was secretary and recorder to the American Academy of Arts and Sciences, and in the last year of his life he lectured on mathematical physics at Harvard.

His essays were collected and published by C. E. Norton in 1877, and his *Letters* were edited and privately printed at Cambridge, Mass., in 1878 by James Bradley Thayer.

WRIGHT, JOSEPH (1734–1797), styled Wright of Derby, English subject, landscape and portrait painter, was born at Derby on the 3rd of September 1734, the son of an attorney, who was afterwards town-clerk. Deciding to become a painter, he went to London in 1751 and for two years studied under Thomas Hudson, the master of Reynolds. After painting portraits for a while at Derby, he again placed himself for fifteen months under his former master. He then settled in Derby, and varied his work in portraiture by the production of the subjects seen under artificial light with which his name is chiefly associated, and by landscape painting. He married in 1773, and in the end of that year he visited Italy, where he remained till 1775. While at Naples he witnessed an eruption of Vesuvius, which formed the subject of many of his subsequent pictures. On his return from Italy he established himself at Bath as a portrait-painter; but meeting with little encouragement he returned to Derby, where he spent the rest of his life. He was a frequent contributor to the exhibitions of the Society of Artists, and to those of the Royal Academy, of which he was elected an associate in 1781 and a full member in 1784. He, however, declined the latter honour on account of a slight which he believed that he had received, and severed his official connexion with the Academy, though he continued to contribute to the exhibitions from 1783 till 1794. He died at Derby on the 29th of August 1797. Wright's portraits are frequently defective in drawing, and without quality or variety of handling, while their flesh tints are often hard. He is seen at his best in his subjects of artificial light, of which the "Orrery" (1766), the property of the corporation of Derby, and the "Air-pump" (1768), in the National Gallery, are excellent examples. His "Old Man and Death" (1774) is also a striking and individual production. An exhibition of Wright's works was brought together at Derby in 1883, and twelve of his pictures were shown in the winter exhibition of the Royal Academy in 1886.

His biography, by William Bemrose, was published in 1885.

WRIGHT, SILAS (1795–1847), American political leader, was born at Amherst, Mass., on the 24th of May 1795. He graduated at Middlebury College, Vermont, in 1815, was admitted to the bar in 1819, and began practice at Canton, in northern New York. He was appointed surrogate of St Lawrence county in 1820, and was successively a member of the state Senate in 1824–1826, a member of the national House of Representatives in 1827–1829, comptroller of the state in 1829–1833, U.S. senator in 1833–1844, and governor of New York in 1844–1846. During his public life he had become a leader of the Democratic party in New York, Martin Van Buren being his closest associate. He was an influential member of the so-called "Albany Regency," a group of Democrats in New York, including such men as J. A. Dix and W. L. Marcy, who for many years virtually controlled their party within the state. Wright's integrity in office was illustrated in 1845, when the "anti-rent troubles" (see NEW YORK) broke out and it seemed probable that the votes of the disaffected would decide the coming election. The governor asked and obtained from the legislature the power to suppress the disturbance by armed force, and put an end to what was really an insurrection. When the national Democratic party in 1844 nominated and elected James K. Polk to the presidency, instead of Martin Van Buren, Wright and the state organization took an attitude of armed neutrality towards the new administration. Renominated for governor in 1846, Wright was defeated, and the result was by many ascribed in part to the alleged hostility of the Polk administration. He died at Canton on the 27th of August 1847.

The best biography is that by J. D. Hammond, *Life and Times of Silas Wright* (Syracuse, N.Y., 1848), which was republished as vol. iii. of that author's *Political History of New York*.

WRIGHT, THOMAS (1809–1884), British palaeontologist, was born at Paisley in Renfrewshire on the 9th of November 1809. He studied at the Royal College of Surgeons in Dublin, and qualified as a doctor in 1832. Soon afterwards he settled at Cheltenham, and graduated M.D. at St Andrews in 1846. He devoted his leisure to geological pursuits, became an active member of the Cotteswold Naturalists' Club (founded in 1846), and gathered a fine collection of Jurassic ammonites and echinoderms. He contributed to the Palaeontographical Society monographs on the British fossil Echinodermata from the Oolitic and Cretaceous formations (1855–1882); he also began (1878) a monograph on the Lias ammonites of the British Islands, of which the last part was issued in 1885, after his death. He wrote many papers in the *Ann. and Mag. Nat. Hist.* and *Proc. Cotteswold Club*. The Wollaston medal was awarded to him by the Geological Society of London in 1878, and he was elected F.R.S. in 1879. He died at Cheltenham on the 17th of November 1884.

WRIGHT, THOMAS (1810–1877), English antiquary, was born near Ludlow, in Shropshire, on the 21st of April 1810. He was descended from a Quaker family formerly living at Bradford, Yorkshire. He was educated at the old grammar school, Ludlow, and at Trinity College, Cambridge, where he graduated in 1834. While at Cambridge he contributed to the *Gentleman's Magazine* and other periodicals, and in 1835 he came to London to devote himself to a literary career. His first separate work was *Early English Poetry in Black Letter, with Prefaces and Notes* (1836, 4 vols. 12mo), which was followed during the next forty years by a very extensive series of publications, many of lasting value. He helped to found the British Archaeological Association and the Percy, Camden and Shakespeare societies. In 1842 he was elected corresponding member of the Académie des Inscriptions et Belles Lettres of Paris, and was a fellow of the Society of Antiquaries as well as member of many other learned British and foreign bodies. In 1859 he superintended the excavations of the Roman city of Uriconium, near Shrewsbury, of which he issued a description. He died at Chelsea on the 23rd of December 1877, in his sixty-seventh year. A portrait of him is in the *Drawing Room Portrait Gallery* for October 1st, 1859. He was a great scholar, but will be chiefly remembered as an industrious antiquary and the editor of many relics of the middle ages.

His chief publications are—*Queen Elizabeth and her Times, a Series of Original Letters* (1838, 2 vols.); *Reliquiae antiquae* (1839–1843, again 1845, 2 vols.), edited with Mr J. O. Halliwell-Phillipps; W. Mapes's *Latin Poems* (1841, 4to, Camden Society); *Political Ballads* and *Carols*, published by the Percy Society (1841); *Popular Treatises on Science* (1841); *History of Ludlow* (1841, &c.; again 1852); *Collection of Latin Stories* (1842, Percy Society); *The Vision and Creed of Piers Ploughman* (1842, 2 vols.; 2nd ed., 1855); *Biographia literaria*, vol. i. Anglo-Saxon Period (1842), vol. ii. Anglo-Norman Period (1846); *The Chester Plays* (1843–1847, 2 vols., Shakespeare Society); *St Patrick's Purgatory* (1844); *Anecdota literaria* (1844); *Archaeological Album* (1845, 4to); *Essays connected with England in the Middle Ages* (1846, 2 vols.); Chaucer's *Canterbury Tales* (1847–1851, Percy Society), a new text with notes, reprinted in 1 vol. (1853 and 1867); *Early Travels in Palestine* (1848, Bohn's Antiq. Lib.); *England under the House of Hanover* (1848, 2 vols., several editions, reproduced in 1868 as *Caricature History of the Georges*); Mapes, *De nugis curialium* (1850, 4to, Camden Society); Geoffrey Gaimar's *Metrical Chronicle* (1850, Caxton Society); *Narratives of Sorcery and Magic* (1851, 2 vols.); *The Celt, the Roman and the Saxon* (1852; 4th ed., 1885); *History of Fulke Fitz Warine* (1855); Jo. de Garlandia, *De triumphis ecclesiae* (1856, 4to, Roxburghe Club); *Dictionary of Obsolete and Provincial English* (1857); *A Volume of Vocabularies* (1857; 2nd ed., by R. P. Wülcker, 1884, 2 vols.); *Les Cent Nouvelles nouvelles* (Paris, 1858, 2 vols.); Malory's *History of King Arthur* (1858, 2 vols., revised 1865); *Political Poems and Songs from Edward III. to Richard III.* (1859–1861, 2 vols., "Rolls" series); *Songs and Ballads of the Reign of Philip and Mary* (1860, 4to, Roxburghe Club); *Essays on Archaeological Subjects* (1861, 2 vols.); *Domestic Manners and Sentiments in England in the Middle Ages* (1862, 4to, reproduced in 1871 as *The Homes of other Days*); *Roll of Arms of Edward I.* (1864, 4to); *Autobiography of Thomas Wright* (1736–1797), his grandfather (1864); *History of Caricature* (1865, 4to); *Womankind in Western Europe* (1869, 4to); *Anglo-Latin Satirical Poets of 12th Century* (1872, 2 vols., "Rolls" series).

WRIGHT, WILLIAM ALDIS (1836–   ), English man of letters, was educated at Trinity College, Cambridge, and in 1888 became vice-master of the college. He was one of the editors of the *Journal of Philology* from its foundation in 1868, and was secretary to the Old Testament revision company from 1870 to 1885. He edited the plays of Shakespeare published in the "Clarendon Press" series (1868–1897), also with W. G. Clark the "Cambridge" Shakespeare (1863–1866; 2nd ed. 1891–1893) and the "Globe" edition (1864). He published (1899) a facsimile of the Milton MS. in the Trinity College library, and edited Milton's poems with critical notes (1903). He was the intimate friend and literary executor of Edward FitzGerald, whose *Letters and Literary Remains* he edited in 1889. This was followed by the *Letters of Edward FitzGerald to Fanny Kemble* (1895), his *Miscellanies* (1900), *More Letters of Edward FitzGerald* (1901), *The Works of Edward FitzGerald* (7 vols., 1903). He edited the metrical chronicle of Robert of Gloucester (1887), *Generydes* (1878) for the Early English Text Society, and other texts.

WRIST, in anatomy, the carpus or carpal articulation in man, the joint by which the hand is articulated with the fore-arm (see ANATOMY: *Superficial and Artistic*; and SKELETON: *Appendicular*). The word means by origin "that which turns," and is formed from the O. Eng. *wrīðan*, to twist.

WRIT (O. Eng. *gewrit*, *writ*, from *writan*, to write), in law, a formal order from the crown or a delegated executive officer to an inferior executive officer or to a private person, enjoining some act or omission.[1] The word represents the Latin *brevis* or *breve* (sometimes Englished into "brief" in the older authorities), so called, according to Bracton and *Fleta*, from its "shortly" expressing the intention of the framer (*quia breviter et paucis verbis intentionem proferentis exponit*).[2]

The *breve* can be traced back as far as Paulus (about A.D. 220), who wrote a work *Ad edictum de brevibus*, cited in the Vatican Fragment, § 310. In the *Corpus juris* the word generally means a summary or report. In *Cod.* vii. 44, *breviculum* means a summary of the grounds of a judgment. The *interdictum* of Roman law sometimes represents the writ of English law; *e.g.* there is considerable likeness between the Roman *interdictum de libero homine exhibendo* and the English writs of *habeas corpus* and *de homine replegiando*. From Roman law the *breve* passed into the *Liber feudorum* and the canon law, in both in a sense differing from that at present borne by the writ of English law. The *breve testatum* of the *Liber feudorum* was an instrument in writing made on the land at the time of giving seisin by the lord to the tenant, and attested by the seals of the lord and the *pares curiae* or other witnesses. In England such witnesses were part of the inquest, and joined in the verdict in case of disputed right until 12 Edw. II. st. 1, c. 2. The *breve testatum* in England developed into the feoffment, later into the deed of grant; in Scotland into the charter, and later into the disposition. In canon law *breve* or *brevilegium* denoted a letter from the pope, sealed with the seal of the fisherman and less formal than a bull. In old English ecclesiastical law a brief—still named in one of the rubrics of the Book of Common Prayer—meant letters patent to churchwardens or other officers for the collection of money for church or charitable purposes.[1] (For counsel's brief see under Brief.)

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[1] There seems to be no authentic definition of writ. That of Reeves is "a settled form of precept applicable to the purpose of compelling defendants to answer the charge alleged by plaintiffs" (1 *Hist. of the Eng. Law*, 415).

[2] It is perhaps doubtful whether *intentio* is here used in its ordinary sense or in the technical signification which it bore as a part of the Roman *formula*.

The writ in English law still occupies a very important position, which can scarcely be understood without a sketch of its history.

History.

The whole theory of pleading depends in the last resort upon the writ, the plaintiff's claim simply expanding its terms.

Writ or *breve* was at first used in a less technical sense than that which it afterwards assumed: thus in the *Leges Henrici Primi* it simply means a letter from the king, and in the Assize of Clarendon (1166) *imbreviari* means to be registered. It became formalized by the reign of Henry II., and precedents are given by Glanvill. The writ process was at that date the foundation of all civil justice in the king's court, and of much in the lower courts, and was a profitable source of revenue to the exchequer. Writs were not framed on any scientific scheme, but as occasion arose, and were frequently the result of compromise in the struggle between the king's and the lords' courts. Every writ had to be purchased (*breve perquirere* was the technical term). This purchase developed in later times into the payment of a fine to the king where the damages were laid above £40. The usual scale was 6s. 8d. for every 100 marks claimed. In suing out a writ of covenant, the basis of the proceedings in levying a fine, the king was entitled to his *primer fine*, *i.e.* one-tenth of the annual value of the land concerned. The sale of writs was forbidden by Magna Carta and other statutes in certain cases, especially that of the writ *de odio et atia* in favour of the liberty of the subject. A solicitor was so called because his original duty was to solicit or sue out a writ and take the due proceedings by paying the proper fine. The costs of a writ purchased were first allowed to a successful demandant by the Statute of Gloucester, 1278. The counterpart of the writ (*contrabreve*) was usually filed in court with the *custos brevium*. Through the Norman period the prerogative of issuing writs seems to have been undisputed. Glanvill's precedents did not exhaust all possible forms, for in the time of Bracton, in the 13th century, it was still possible to frame new writs at the pleasure of the crown. The Provisions of Oxford in 1258 put an end to this by enacting that the chancellor should not seal anything out of course (*i.e.* any writ for which there was no precedent) by the will of the king, but that he should do it by the council. In 1285 the Statute of Westminster the Second re-established the power of the crown within certain limits, that is, in causes of action in a similar case falling under the same law (*in consimili casu cadente sub eodem jure*) as those for which precedents of writs already existed in the chancery. These precedents were recorded about 1227 in the *Registrum brevium*, called by Sir Edward Coke the oldest book in the common law.[2] Apart from the powers given by the statute, new writs could only be issued by the authority of parliament, and writs are sometimes found set out in statutes, especially in the *Statutum Walliae*, 1284, where precedents of the most usual writs will be found. The Statute of Westminster the Second itself contained precedents of the writ of formedon and of many others. The original flexibility of the writ was thus limited within comparatively narrow bounds. The right to the issue of the writ determined the right of action. If the writ was not sufficient to found an action, the writ was said to fail (*cadere*). So essential was the writ that it was a legal axiom in Bracton that no one could sue at law without a writ, and it was called by Coke, in his introduction to Littleton, "the heartstrings of the common law." As such it occupied an important place in some of the leading statutes dealing with constitutional rights. The Statute of Marlbridge, 1267, forbade a lord to distrain his freeholders to answer for their freeholds, or for anything touching their freeholds, without the king's writ. By 25 Edw. III. st. 5, c. 4 (1342), it was accorded, asserted and stablished that none should be taken by petition or suggestion made to the king or his council unless by indictment or presentment in due manner or by process made by writ original at the common law. 42 Edw. III. c. 3 (1359) provided that no man should be put to answer without presentment before justices, or matter of record, or by due process and writ original according to the old law of the land. Both these statutes were recited and the general principle confirmed by 16 Car. I. c. 10 (1641). Uniformity of procedure was secured by 27 Hen. VIII. c. 24 (1536), by which all writs were to be in the king's name in a county palatine or liberty, but tested by those who had the county palatine or liberty. It was not until 1731 that, by virtue of 4 Geo. II. c. 26, writs were framed in the English language. They had previously been in Latin; this accounts for the Latin names by which a large number are still known.

The writ was issued from the common law side of the chancery, and was in the special charge of the hanaper and petty bag offices.[3] Though issuing from the king's chancery, it did not necessarily direct the trial of the question in the king's court. In whatever court it was returnable, it called in the aid of the sheriff as executive officer. It was either addressed to him or, if addressed to the party alleged to be in default, it concluded with a threat of constraint by the sheriff in the event of disobedience, generally in those terms, *et, nisi feceris, vicecomes de N. faciat ne amplius clamorem audiam pro defectu justitiae.* If the writ was returnable in the county court or the lord's court, the sheriff or the lord sat as the deputy of the king, not by virtue of his inherent jurisdiction. The writ was not necessary for the initiation of proceedings in these courts or before the justices in eyre, but a custom seems to have grown up of suing out a writ from the king where the claim was above 40s. Cases were transferred from the lord's court to the county court by writ of *tolt* (so called because it removed, *tollit*, the case), from the latter to the king's court by writ of *pone* (so called from its first word). By Magna Carta the power of bringing a suit in the king's court in the first instance by writ of *praecipe* was taken away, and the writ was thenceforth only returnable in the king's court where the tenant held of the king *in capite*, or where the lord had no court or abandoned his right. Hence it became a common form in the writ of right to allege that the lord had renounced his court (*dominus remisit curiam*) so as to secure trial in the king's court.

Besides being used for the trial of disputes, writs addressed to sheriffs, mayors, commissioners or others were in constant use for financial and political purposes, *e.g.* for the collection of fifteenths, scutage, tallage, &c., for summons to the council and later to parliament, and for dissolving a parliament, the last by means of the rarely occurring writ *de revocatione parliamenti.*

There were several divisions of writs (excluding those purely financial and political), the most important being that into original and judicial, the former (tested in the name of the king) issued to bring a suit before the proper court, the latter (tested in the name of a judge) issued during the progress of a suit or to enforce judgment. Original were either optional, *i.e.* giving an option of doing a certain act or of showing cause why it was not done, beginning with the words *praecipe quod reddat*, the principal example being the writ on which proceedings in a common recovery (see Fine) were based, or peremptory, *i.e.* calling on a person to do a certain act, beginning with the words *si A. fecerit te securum.* Original were also either *de cursu* (also called by Bracton *formata*) or *magistralia*, the former those fixed in form and depending on precedent, the latter those framed by the masters in chancery under the powers of the Statute of Westminster the Second. They were also either general or special, the latter setting forth the grounds of the demand with greater particularity than the former. In regard to real estate they might be possessory or ancestral. By 5 Geo. II. c. 27 (1732) special writs were confined to causes of action amounting to £10 or upwards. There was also a division of writs into writs of right (*ex debito justitiae*), such as *habeas corpus*, and prerogative writs (*ex gratia*), such as mandamus and prohibition. Coke and other authorities mention numerous other divisions, but those which have been named appear to be the principal.

The most interesting form of writ from the historical point of view was the writ of right (*breve de recto*), called by Blackstone "the highest writ in the law," used at first for debt and other personal claims, afterwards confined to the recovery of real estate as the writ of right *par excellence.* It was so called from the words *plenum rectum* contained in it, and was the remedy for obtaining justice for ouster from or privation of the freehold. By it property as well as possession could be recovered. It generally lay in the king's court, as has been said, by virtue of a fictitious allegation. In that case it was addressed to the sheriff and was called a writ of right close. When addressed to the lord and tried in his court, it was generally a writ of right patent. After the appearance of the tenant the demandant in a writ of right counted, that is, claimed against the tenant according to the writ, but in more precise terms, the writ being as it were the embryo of the future count. The trial was originally by battle (see Trial), but in the reign of Henry II. an alternative and optional procedure was introduced, interesting as the earliest example of the substitution of something like the jury (*q.v.*) for the judicial combat. A writ *de magna assisa eligenda* was directed to the sheriff commanding him to return four knights of the county and vicinage to the court, there to return twelve other knights of the vicinage to try upon oath the question contained in the writ of right (technically called the *mise*). This mode of trial was known as trial by the grand assize. Generally the whole of the sixteen knights were sworn, though twelve was a sufficient number. The last occasion of trial by the grand assize was in 1835. But long before that date possessory had from their greater convenience tended to supersede proprietary remedies, and in most cases the title was sufficiently determined by the assizes of other kinds, especially that of novel disseisin and later by proceedings in ejectment. The oath of the champion on proceedings in a writ of right where the alternative of the judicial combat was accepted was regulated by statute, 3 Edw. I. c. 41 (1275). The writ of right is also interesting as being the basis of the law of limitation. By the Statute of Merton (1226) no seisin could be alleged by the demandant but from the time of Henry II. By 3 Edw. I. c. 39 the time was fixed at the reign of Richard I., by 32 Hen. VIII. c. 2 (1541) at sixty years at the most. There were other writs of right with special names, *e.g.* the writ of right by the custom of London for land in London, the writ of right by advowson, brought by the patron to recover his right of presentation to a benefice, and the writs of right of dower, *ne injuste vexes* and *de rationabili parte*, the latter brought by coparceners or brothers in gavelkind. Coheirs and coparceners also had the *nuper obiit* for disseisin by one of themselves. There were also writs in the nature of a writ of right, *e.g.* formedon, brought by a reversioner on discontinuance by a tenant in tail and given by the statute *De Donis Conditionalibus*; escheat, brought by the lord where the tenant died without an heir; *ne injuste vexes*, to prohibit the lord from exacting services or rents beyond his due; *de nativo habendo*, to recover the inheritance in a villein; and the little writ of right close according to the custom of the manor, to try in the lord's court the right of the king's tenants in antient demesne. They had also the writ of *monstraverunt*.

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[1] See W. A. Bewes, *Church Briefs* (1896). The lines in Cowper's "Charity" allude to such a brief:

"The brief proclaimed it visits every pew,
But first the squire's—a compliment but due."

[2] See article by F. W. Maitland in 3 *Harvard Law Rev.* 177.

[3] The place where writs were deposited was called *breviarium* or *breviorium.* This use of the word must be distinguished from legal compendia, such as the *Breviarium Alarici* or *Breviarium extravagantium.*

Up to 1832 an action was (except as against certain privileged persons, such as attorneys) begun at law by original writ, and writ practically became the equivalent of action, and is so used in old books of practice. The law was gradually altered by legislation and still more by the introduction of fictitious proceedings in the common law courts, by which the issue of the original writ was suspended, except in real actions, which were of comparatively rare occurrence. The original writ is no longer in use in civil procedure, an action being now in all cases commenced by the writ of summons, a judicial writ, a procedure first introduced in 1832 by 2 Will. IV. c. 39. In the following year an immense number of the old writs was abolished by the Real Property Limitation Act 1833. An exception was made in favour of the writ of right of dower, writ of dower *unde nihil habet*, *quare impedit* and ejectment, and of the plaints for freebench and dower in the nature of writs of right. Ejectment was remodelled by the Common Law Procedure Act 1852; the other writs and plaints remained up to the Common Law Procedure Act 1860, by which they were abolished. Other writs which have been superseded by simpler proceedings, generally by ordinary actions, are those of the four assizes of novel disseisin, *juris utrum*, *mort d'auncester* and *darrein presentment*, conspiracy, estrepement and waste, false judgment, *monstrans de droit*, nuisance, partition, *praemunire*, *quo warranto*, *scire facias*, *subpoena* and *warrantia chartae*.

Obsolete writs.

The number of writs, especially those connected with ecclesiastical procedure, was so large that any exhaustive list of them is almost impossible, but a few of those of more special interest which have become obsolete may be shortly mentioned. *Admensuratio* lay against persons usurping more than their share of property. It was either *dotis* or *pasturae*, the latter, like the Scottish "souming and rouming," being the remedy for surcharge of common, for which also *quod permittas* lay. *Alias* and *pluries* writs were issued when a previous writ had been disobeyed. *Apostata capiendo* was the mode of apprehension of a monk who had broken from his cloister. *Assistance* went to the sheriff to assist the party or an officer of chancery to gain possession of land. *Attaint* lay to inquire by a jury of twenty-four whether a jury of twelve had given a false verdict. *Decies tantum* also lay against a juror who had accepted a bribe, so called because he had to refund ten times the sum received. *Audita querela* was a means of relieving a defendant by a matter of discharge occurring after judgment. After having been long practically superseded by stay of execution it was finally abolished by the rules made under the Judicature Act 1875. *Beaupleader* lay to prohibit the taking of a fine *de pulcre placitando*, forbidden by the Statute of Marlbridge (1268).[1] *Capias*, *latitat* and *quominus* are interesting as showing the extraordinary mass of fictitious allegation in the old procedure of the common law courts before 1832. By *capias ad respondendum* followed by *alias* and *pluries* the court of common pleas was enabled to take cognizance of an action without the actual issue of an original writ. The *capias* was a judicial writ issued to follow an original writ of trespass *quia clausum fregit*. The issue of the original writ and after a time the issue of the *capias* became mere fictions, and proceedings commenced with the issue of another writ called *capias testatum*. On return of the writ the plaintiff elected to proceed with a cause of action other than trespass, and the real merits of the case were eventually reached in this tortuous manner. After being served with the *capias* the defendant was bound to put in common or special bail, the former being sufficient in all but exceptional cases. Here again there was a fiction, for his common bail were John Doe and Richard Roe. The same fictitious pair also appeared on the side of the plaintiff as his pledges for the due prosecution of his action. By *latitat* and *quominus* the courts of king's bench and exchequer respectively assumed jurisdiction by a further series of fictions over ordinary civil actions. The writ of *latitat*, following the bill of Middlesex, itself in later times generally a fiction, alledged that the defendant was in hiding out of Middlesex, after committing a trespass *quia clausum fregit*, for which he was in the custody of the king's marshal in the Marshalsea prison. The real cause of action was then stated in what was called the *ac etiam* clause. The writ of *quominus* alleged that the plaintiff was the king's debtor, and that through the defendant's default he was unable to discharge the debt. *De cautione admittenda* was a curiosity. It enjoined a bishop to admit an excommunicated person to absolution on condition of his giving security to obey the commands of the church. *Deceit* or *disceit* lay for the redress of anything done deceitfully in the name of another, but was especially used to reverse a judgment in a real action obtained by collusion. *Distraint of knighthood* was a mode of obtaining money for the crown by the exercise of the prerogative of forcing every one who held a knight's fee under the crown to be knighted or to pay a fine. The earliest extant writ was issued in 1278. It was abolished in 1641 by 16 Car. I. c. 20. *Entry* was a possessory remedy against one alleged to hold land unlawfully. It was divided into a large number of kinds, and was the subject of much of the old real property learning. The ones most commonly occurring were the writs of entry in the *per* and in the *post*, the former alleging, the latter not, the title of the heir from the original disseisor. When writ had come to be equivalent in meaning to action, one of the divisions of possessory actions was into writs of entry and writs of assize. A special writ of entry for dower was given by 6 Edw. I. c. 7. *Excommunicato capiendo* was the authority for arresting an excommunicated person and detaining him until he was reconciled to the church, when he was liberated by the writ *de excommunicato liberando*. These proceedings were abolished and the writ *de contumace capiendo* substituted in 1817. *Faux judgment* was for revising the decision of an inferior court. *Haeretico comburendo* was issued on certificate of conviction for heresy by the ecclesiastical court. A case of burning two Arians under this writ occurred as lately as the reign of James I. It was abolished by 29 Car. II. c. 9. *Homine replegiando*, *mainprize* and *odio et atia* (or *bono et malo*) were all ancient means of securing the liberty of the subject, long superseded by the more effective procedure of *habeas corpus*. The last of the three enjoined the sheriff to inquire whether a committal on suspicion of murder was on just cause or from malice and ill-will. It was regulated by Magna Carta and the Statute of Westminster the Second, but, having been abused to the advantage of sheriffs, it was abolished in 1355 by 28 Edw. III. c. 9. It was possibly among the means—like the writ of right—by which the trial by battle and the appeal of felony tended to become obsolete. *Leproso amovendo* explains itself. *Moderata misericordia* was the means of reviewing an excessive amercement of an inferior court, especially after an amercement had tended to become a fixed sum of twelve pence. *Nisi prius* was given by the Statute of Westminster the Second, 13 Edw. I. c. 30. Its place is now taken by the commission of *nisi prius*. *Orando pro rege et regno*, before the present Book of Common Prayer, enjoined public prayers for the high court of parliament. *Protection* was given for enabling a man to be quit of suits brought against him while absent beyond seas. It was dealt with by a large number of old statutes, but none has been issued since 1692. *Quare ejecit infra terminum* was the old remedy of the lessee for eviction by the lessor. *Rebellion* was a means of enforcing obedience to the process of the court of chancery. In modern procedure attachment takes its place. *Rege inconsulto* commanded judges of a court not to proceed in a case which might prejudice the king until his pleasure should be known. *Replevin* was a survival of the most archaic law. The procedure consisted of writ on writ to an almost unlimited extent. It originally began by the issue of a writ of replevin or *replegiari facias*. The case might be removed from the county court to a superior court by writ of *recordari facias loquelam*. If the distrainor claimed a property in the goods distrained, the question of property or no property was determined by a writ *de proprietate probanda*, and, if decided in favour of the distrainor, the distress was to be returned to him by writ *de retorno habendo*. If the goods were removed or concealed, a writ of *rescous* or *capias in withernam* enabled the sheriff, after due issue of *alias* and *pluries* writs, to take a second distress in place of the one removed. It is said that the question whether goods taken in *withernam* could be replevied was the only one which the Admirable Crichton found himself unable to answer. *Restitutione extracti ab ecclesia* lay for restoring a man to a sanctuary from which he had been wrongfully taken. *Secta* lay for enforcing the duties of tenants to their lord's court, *e.g.* *secta ad molendinum*, where the tenants were bound to have their corn ground at the lord's mill. *Seisina habenda* allowed delivery of lands of a felon to the lord after the king had had his year, day and waste. *Vi laica removenda* is curiously illustrative of ancient manners. It lay where two parsons contended for a church, and one of them entered with a great number of laymen and kept out the other by force. As lately as 1867 an application for the issue of the writ was made to the chancery court of the Bermuda Islands, but refused on the ground that the writ was obsolete, and that the same relief could be obtained by injunction. On appeal this refusal was sustained by the privy council.

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[1] Relief from "miskenning" or "mescheninga," or fine for beaupleader, was often granted in charters to towns, as by that of Henry I. to London.

Writs now in use. Of writs now in use, other than those for elections, all are judicial, or part of the process[1] of the court, except perhaps the writ of error in criminal cases. They are to be hereafter issued out of the central office of the supreme court, or the office of the clerk of the crown in chancery. By the Crown Office Act 1877 the wafer great seal or the wafer privy seal may be attached to writs instead of the impression of the great or privy seal. The judicial writs issue chiefly, if not entirely, from the central office, with which the old crown office was incorporated by the Judicature (Officers) Act 1879. The crown office had charge of writs occurring in crown practice, such as *quo warranto* and *certiorari*.

In local civil courts, other than county courts, writs are usually issued out of the office of the registrar, or an officer of similar jurisdiction. By the Borough and Local Courts of Record Act 1872, writs of execution from such courts for sums under £20 may be stamped or sealed as of course by the registrar of a county court, and executed as if they had issued from the county court. In county court practice the warrant corresponds generally to the writ of the supreme court. Most of the present law on the subject of writs is contained in the Rules of the Supreme Court, 1883, Ord. xlii.-xliv., and in the Crown Office Rules 1906. Both sets of rules contain numerous precedents in their schedules. By Ord. ii. r. 8 of the rules of 1883 all writs (with certain exceptions) are to be tested in the name of the lord chancellor, or, if that office be vacant, in the name of the lord chief justice. The main exceptions are those which occur in crown practice, which are tested by the lord chief justice. The writ of error bears the *teste* of the king "witness ourselves." Before the issue of most writs a *praecipe*, or authority to the proper officer to issue the writ, is necessary. This is of course not to be confounded with the old original writ of *praecipe*. Writs affecting land must generally be registered in order to bind the land (see LAND REGISTRATION). A writ cannot as a rule be served on Sunday. Some of the more important modern writs (other than those of an extrajudicial nature) may be shortly noticed. *Habeas corpus, mandamus, prohibition, scire facias* and others are treated separately. Writs are generally, unless where the contrary is stated, addressed to the sheriff. *Abatement* or *nocumento amovendo* enjoins the removal of a nuisance in pursuance of a judgment to that effect. *Ad quod damnum* is for the purpose of inquiring whether a proposed crown grant will be to the damage of the crown or others. If the inquiry be determined in favour of the subject, a reasonable fine is payable to the exchequer by 27 Edw. I. st. 2 (1299). Attachment is issued as a means of supporting the dignity of the court by punishment for contempt of its orders (see CONTEMPT OF COURT). Since the Judicature Acts a uniform practice has been followed in all the branches of the high court, and a writ of attachment can now only be issued by leave of the court or a judge after notice to the party against whom it is to be issued. *Capias:* the old writs of *capias ad satisfaciendum* and *capias utligatum* may still be used, but their importance has been much diminished since the alterations made in the law by the Debtors Act 1869 and the abolition of civil outlawry (see OUTLAWRY). *Certiorari* is a writ in very frequent use, by which the proceedings of an inferior court are brought up for review by the high court. In general it lies for excess of jurisdiction as *mandamus* does for defect. The Summary Jurisdiction Act 1879 makes the writ no longer necessary where a special case has been stated by a court of quarter sessions. Delivery enforces a judgment for the delivery of property without giving the defendant (unless at the option of the plaintiff) power to retain it on payment of the assessed value. *Distringas* lay to distrain a person for a crown debt or for his appearance on a certain day. Its operation has been much curtailed by the substitution of other proceedings by the Crown Suits Act 1865 and the rules of the supreme court. It now seems to lie only against inhabitants for non-repair of a highway. *Distringas nuper vicecomitem* is a writ calling on an ex-sheriff to account for the proceeds of goods taken in execution. *Elegit* is founded on the Statute of Westminster the Second, 1285, and is so named from the words of the writ, that the plaintiff has chosen (*elegit*) this particular mode of satisfaction. It originally ordered the sheriff to seize a moiety of the debtor's land and all his goods, save his oxen and beasts of the plough. By the Judgments Act 1838, the *elegit* was extended to include the whole of the lands, and copyholds as well as freeholds. By the Bankruptcy Act 1883, an *elegit* no longer applies to goods. *Error*, the last remaining example of an original writ was at one time largely used in both civil and criminal proceedings. It was abolished in civil procedure by the rules made under the Judicature Act 1875, and in criminal cases by the Criminal Appeal Act 1907. *Exigent* (with *proclamation*) forms part of the process of outlawry now existing only against a criminal. It depends on several statutes, commencing in 1344, and is specially mentioned in the Statute of Provisors of Edward III., 25 Edw. III. st. 6. *Extent* is the writ of execution issued by the crown for a crown debt of record. The sale of chattels seized under an extent takes place under a writ of *venditioni exponas*. A crown debtor is entitled to an *extent in aid* against a person indebted to him. Where a crown debtor has died a writ reciting his death, and so called *diem clausit extremum*, issues against his property. *Fieri facias* is the ordinary writ of execution on a judgment commanding the sheriff to levy the sum, interest and costs on the personal property of the party. Where the sheriff has not sold the goods, *venditioni exponas* issues to compel him to do so. Where the party is a beneficed clergyman, the writ is one of *fieri facias de bonis ecclesiasticis* or of *sequestrari facias* (addressed to the bishop). The latter writ also issues in other cases of an exceptional nature, as against a corporation and to seize a pension. It is addressed to commissioners, not to the sheriff. *Habere facias possessionem* is given to the owner of a tithe or rent charge, enabling him to have possession of the lands chargeable therewith until arrears due to him are paid. *Indicavit* is still nominally grantable under the statute *De Conjunctim Feoffatis* of 1306, and is a particular kind of prohibition granted to the patron of an advowson. *Inquiry* issues for the assessment of damages by the sheriff or his deputy. It represents to some extent the old writ of *justicies*, and the later writ of trial allowed by 3 & 4 Will. IV. c. 42, but is narrower in its operation, for under the last-named writs the whole case or issues under it could be tried. Before an inquiry the liability has been already established. *Levari facias* is the means of levying execution for forfeited recognizances. The Bankruptcy Act 1883 abolished it in civil proceedings. *Ne exeat regno* was at one time issued by virtue of the prerogative to prevent any person from leaving the realm, a form of restraint of liberty recognized by parliament in 5 Ric. II. c. 2. It has now become a means of preventing one who owes an equitable debt of £50 or more from quitting the kingdom, and so withdrawing himself from the jurisdiction of the court without giving security for the debt. It is usually issued on an *ex parte* motion in the chancery division, but is rare in practice, having been superseded by proceedings under the Debtors Act 1869. *Non omittas* is for executing process by the sheriff in a liberty or franchise, where the proper officer has neglected to do so. It rested originally chiefly upon the Statute of Westminster the Second, c. 39, and is now regulated by the Sheriffs Act 1887, which repeals the previous enactment. *Possession* enjoins the sheriff to give possession of land to the party entitled thereto under a judgment for such possession. It fills the place of the old writ of assistance. In admiralty, where the judgment is for possession of a ship, the writ is addressed to the marshal. *Procedendo* is the converse of prohibition. It directs the lower court to proceed with the case. It also lies to restore the authority of commissioners suspended by *supersedeas*. *Restitution* restores property, either real or personal, after the right to it has been judicially declared. Thus it lies on behalf of the owner of real property under the statutes of forcible entry and of the owner of personal property under the Larceny Act 1861. *Significavit*, once a writ, appears since 57 Geo. III. c. 127 to be merely a notice. It is a part of the process against a person disobeying the order of an ecclesiastical court, and consists in a notification to the crown in chancery of the disobedience. Thereupon a writ *de contumace capiendo* issues for his arrest. On his subsequent obedience or satisfaction, a writ of *deliverance* is granted. Precedents of these writs are given in the act named. *Subpoena* is the ordinary means of securing the presence of a witness in court, and is addressed to the person whose attendance is required. It is so called from its containing the words "and this you are not to omit under the penalty of £100," &c. The *subpoena* may be either *ad testificandum*, to give evidence, or *duces tecum*, to produce documents, &c., or both combined. By special order of a judge a *subpoena* may be issued from any court in England, Scotland or Ireland to compel the attendance of a witness out of the jurisdiction. *Summons* is the universal means of commencing an action in the high court. It is addressed to the defendant, and may be either generally or specially indorsed with a statement of the nature of the claim made. The latter form of indorsement is allowed in certain cases of debt or liquidated demand, and gives the plaintiff the great advantage of entitling him to final judgment in default of appearance by the defendant, and even in spite of appearance unless the defendant can satisfy a judge that he ought to be allowed to defend. No statement of claim is necessary in case of a specially indorsed writ, the indorsement being deemed to be the statement. The writ may be issued out of the central office or out of a district registry, and the plaintiff may name on his writ the division of the high court in which he proposes to have the case tried. There are special rules governing the issue of writs in probate and admiralty actions. The writ remains in force for twelve months, but may be renewed for good cause after the expiration of that time. Service must be personal, unless where substituted service is allowed, and in special cases, such as actions to recover land and admiralty actions. Service out of the jurisdiction of a writ or notice of a writ is allowed only by leave of the court or a judge. Notice of the issue of a writ, and not the writ itself, is served on a defendant who is neither a British subject nor in British dominions. The law is contained in the Rules of the Supreme Court, especially orders ii.-xi. and xiv. *Supersedeas* commands the stay of proceedings on another writ. It is often combined with *procedendo*, where on a *certiorari* or prohibition the high court has decided in favour of the jurisdiction of the inferior court. It is also used for removing from the commission of the peace, and for putting an end to the authority of any persons acting under commission from the crown. *Venire facias* is the first proceeding in outlawry, calling upon the party to appear. Under the old practice a *venire facias de novo* was the means of obtaining a new trial. *Ventre inspiciendo* appears still to be competent, and is a curious relic of antiquity. It issues on the application of an heir presumptive in order to determine by a jury of matrons whether the widow of a deceased owner of lands be with child or not. Almost exactly the same proceeding was known in Roman law.

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[1] It may be noticed that by the interpretation clause of the Sheriffs Act 1887 the expression "writ" includes any process.

The principal writs of a non-judicial nature relate to parliament or some of its constituent elements. Parliament is summoned by the king's writ issued out of chancery by advice of the privy council. The period of forty days once necessary between the writ and the assembling is now by an act of 1852 reduced to thirty-five days. Writs of summons are issued to the lords spiritual and temporal before every new parliament. Those to Irish representative peers are regulated by the Act of Union, those to archbishops and bishops by the Ecclesiastical Commissioners Act 1847. New peerages are no longer created by writ, but the eldest son of a peer is occasionally summoned to the House of Lords in the name of a barony of his father's. With respect to election of members of the House of Commons, the procedure differs as the election takes place after a dissolution or on a casual vacancy. After a dissolution the writ is issued, as already stated, by order of the crown in council. For a single election the warrant for a new writ is issued during the session by the speaker after an order of the house made upon motion; during the recess by the speaker's authority alone. The warrant is addressed to the clerk of the crown in chancery for Great Britain, to the clerk of the crown and hanaper of Ireland. A *supersedeas* to a writ has sometimes been ordered where the writ was improvidently issued. The time allowed to elapse between the receipt of the writ and the election is fixed by the Ballot Act 1872, sched. 1, at nine days for a county or a district borough, four days for any other borough. The writ is to be returned by the returning officer to the clerk of the crown with the name of the member elected endorsed on the writ. Sched. 2 gives a form of the writ, which is tested, like the writ of error, by the king himself. The returning officer is the sheriff in counties and counties of cities, generally the mayor in cities and boroughs, and the vice-chancellor in universities. Other writs for election are those for convocation, which is by 25 Hen. VIII. c. 19 summoned by the archbishop of the province on receipt of the king's writ, and for election of coroners, verderers of royal forests, and some other officers whose office is of great antiquity. The writ *de coronatore eligendo*, addressed to the sheriff, is specially preserved by the Coroners Act 1887.

Offences relating to writs are dealt with by the Criminal Law Consolidation Acts of 1861 and other statutes. The maximum penalty is seven years' penal servitude.

Scotland.—"Writ" is a more extensive term than in England. Writs are either judicial or extrajudicial, the latter including deeds and other instruments—as, for instance, in the Lord Clerk Register Act 1879, and in the common use of the phrase "oath or writ" as a means of proof. In the narrower English sense both "writ" and "brieve" are used. The brieve was as indispensable a part of the old procedure as it was in England, and many forms are given in *Regiam Majestatem* and *Quoniam Attachiamenta*. It was a command issued in the king's name, addressed to a judge, and ordering trial of a question stated therein. It was drawn by the writers to the signet, originally clerks in the office of the secretary of state. Its conclusion was the will of the summons. In some cases proceedings which were by writ in England took another form in Scotland. For instance, the writ of attaint was not known in Scotland, but a similar end was reached by trial of the jury for wilful error.[1] The English writ of *ne exeat regno* is represented by the *meditatio fugae* warrant. Most proceedings by brieve, being addressed to the sheriff, became obsolete after the institution of the court of session, when the sheriffs lost much of that judicial power which they had enjoyed to a greater extent than the English sheriff (see SHERIFF).[2] An English writ of execution is represented in Scotland by diligence, chiefly by means of warrants to messengers-at-arms under the authority of signet letters in the name of the king. See the Writs Execution Act 1868. The brieve, however, has not wholly disappeared. Brieves of tutory, terce and division among heir-portioners are still competent but not in use. Other kinds of brieve have been superseded by simpler procedure, *e.g.* the brieve of service of heirs, representing the older *breve de morte antecessoris*, by a petition to the sheriff under the Titles to Land Consolidation Act 1868 and the brieve of perambulation by a declaratory action. The brieve of cognition of insane persons is now one of the few of practical importance. The old brieves of furiosity and idiotcy were abolished, and this new form was introduced by the act last named. Writs *eo nomine* have been the subject of much modern legislation. The writs of *capias*, *habeas*, *certiorari* and extent were replaced by other proceedings by the Exchequer Court Act 1856. The writs of *clare constat*, resignation and confirmation (whether granted by the crown or a subject superior) were regulated by the act of 1868. By the same act crown writs are to be in the English language and registered in the register of crown writs. Writs need not be sealed unless at the instance of the party against whom they are issued. Writs of progress (except crown writs, writs of *clare constat* and writs of acknowledgment) were abolished by the Conveyancing Act 1874. The *clare constat* writ is one granted by the crown or a subject superior for the purpose of completing title of a vassal's heirs to lands held by the deceased vassal. Where the lands are leasehold the writ of acknowledgment under the Registration of Leases Act 1857 is used for the same purpose. By the Writs Execution Act 1877 the form of warrant of execution on certain extracts of registered writs is amended. Extracts of registered writs are to be equivalent to the registered writs themselves. Writs registered in the register of sasines for preservation only may afterwards be registered for preservation and execution. By 22 Geo. II. c. 48, passed for the purpose of assimilating the practice of outlawry for treason in Scotland to that in use in England, the court before which an indictment for treason or misprision of treason is found, is entitled on proper cause to issue writs of *capias*, proclamation and *exigent*. In some respects the proceedings in parliamentary elections differ from those in use in England. Thus the writ in university elections is directed to the vice-chancellors of Edinburgh and Glasgow respectively, but not to those of St Andrews and Aberdeen, and there is an extension of the time for the return in elections for Orkney and Shetland, and for the Wick burghs. Representative peers of Scotland were by the Act of Union to be elected after writ issued to the privy council of Scotland. On the abolition of the privy council a proclamation under the great seal was substituted by 6 Anne, c. 23.

United States.—Writs in United States courts are by Act of Congress to be tested in the name of the chief justice of the United States. By state laws writs are generally bound to be in the name of the people of the state, in the English language, and tested in the name of a judge. Writs of error have been the subject of much legislation by the United States and by the states. In New York writs of error and of *ne exeat* have been abolished. Writs as parts of real actions have been generally superseded, but in Massachusetts a writ of entry on disseisin is still a mode of trying title. Writs of dower and of estrepement are still in use in some states. By the law of some states, *e.g.* New Jersey, writs of election are issued to supply casually occurring vacancies in the legislature. The writ of assistance, already named, has its interest in constitutional history. Before the War of Independence it was issued to revenue officers to search premises for smuggled goods. It was on this writ that it was first contended in 1761 that a colonial court had jurisdiction to examine the constitutionality of a legislative act authorizing the issue of the writ. See Quincy's *Massachusetts Rep.* App., I. 520.

AUTHORITIES.—The importance of the writ in procedure led to the compilation of a great body of law and precedent at an early date. In addition to the *Registrum brevium* there were, among other old works, the *Natura brevium*, first published in 1525; Theloall, *Le Digest des briefes originales* (1579); Fitzherbert, *Le Nouvel Natura brevium* (1588); Hughes, *Original Writs* (1655); *Thesaurus brevium* (1661); Brownlow, *Brevia judicialia* (1662); *Officina brevium* (1679). See too Coke upon Littleton, 158, 159, 2 Coke's *Inst.* 39; and Du Cange.[3] Many precedents will be found in the collection of parliamentary writs and in Stubbs's *Select Charters*. The Crown Office Rules, 1906, contain many precedents of the modern writs used in crown practice. Old books of practice, such as Tidd's *Practice*, Corner's *Crown Practice* and Booth's *Real Actions*, contain much law on the subject. For the history, Spence's *Equitable Jurisdiction*, vol. i. bk. ii. ch. viii.; Forsyth's *Hist. of Trial by Jury*, Stephen; *On Pleading*, Bigelow's *Hist. of Procedure*, ch. iv.; Pollock and Maitland, *Hist. of Eng. Law*; and W. S. M'Kechnie, *Magna Carta* may be consulted. There appears to be no book dealing with the writ in modern practice, but sufficient information is contained in the ordinary treatises on procedure. (J. W.)

WRITERS TO THE SIGNET, in Scotland, a society of law agents corresponding to solicitors in England. They were originally clerks in the secretary of state's office and prepared the different writings passing the signet; every summons is still signed on its last page by a writer to the signet. By the Titles to Land Consolidation (Scotland) Act 1868, they have the exclusive privilege of preparing all crown writs, charters, precepts, &c., from the sovereign or the prince of Scotland. They have no charter but are usually considered a corporation by long custom; they have office-bearers and are members of the College of Justice. On the Act of Union there was much debate as to whether writers to the signet should be eligible to the Scottish bench. It was finally decided that they should be eligible aften ten years' practice. But, with the exception of Hamilton of Pencaitland in 1712, no writer to the signet has ever had a seat on the bench.

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[1] An example occurring in the reign of James VI. will be found in Pitcairn, *Criminal Trials*, i. 216.

[2] Explanations of many of the older writs will be found in Lord Clerk Register Skene's *De verborum significatione* (1641), and styles in Spotiswood, *Stile of Writs* (1715).

[3] A reference to Du Cange will show the great variety of the non-legal uses of *brevis* or *breve*. It may mean, *inter alia*, an annual rent, an amulet, a notice of the death of a monk. *Brevetum* signified what are now known as ship's papers.

WRITING (the verbal noun of "to write," O. Eng. *writan*, to inscribe), the use of letters, symbols or other conventional characters, for the recording by visible means of significant sounds; more specifically, the art of tracing by hand these symbols on paper or other material, by pen and ink, pencil, stylus or other such means, as opposed to mechanical methods such as printing. The principal features in the development of writing in its primary sense are dealt with in separate articles (see Alphabet, Palaeography, Inscriptions, Book, Manuscript, Shorthand, &c.). Here it is only necessary briefly to refer to the origins of a system which has eventually followed the history of the various languages and has been stereotyped by the progress of typography (*q.v.*). Very early in the history of mankind three needs become pressing. These are (*a*) to recall at a particular time something that has to be done; (*b*) to communicate with some other person who is not present, nor for the moment easily accessible; (*c*) to assert rights over tools, cattle, &c., by a distinctive mark, or by a similar mark to distinguish one's own production (*e.g.* a special make of pottery) from that of others. The last-named use, out of which in time develops every kind of trade-mark, is itself a development of the earlier property mark. The right to property must be established before traffic, whether by way of barter or of sale, is possible.

Knot signs.

Every one is familiar with devices to achieve the first of these aims; one of the commonest is to tie a knot in a handkerchief. It is obvious that by multiplying the number of knots a number of points equal to the number of knots might in this way be referred to, though it is probable that the untrained memory would fail to recall the meaning attached to more than a very limited number of knots. The simplest application of these knots is in keeping a record of a number of days, as in the story related by Herodotus (iv. 98), to the effect that Darius, on crossing the Ister in his Scythian expedition, left with the Greeks appointed to guard the bridge a thong with a number of knots equal to the number of days that their watch over the bridge was to be continued. One knot was to be undone each day, and if the king had not returned by the time that all the knots were undone, the Greeks were to break down the bridge and go away. A development of this is found in the Peruvian *quipus*, which consists of a number of thongs or cords hanging from a top-band or cross-bar. In its simplified form, knots are merely tied upon the individual cords. In its more elaborate forms the cords are of different colours, and are knotted together so as to form open loops of various shapes. In the *Antiguedades Peruanas*,[1] we are told that the knots of the *quipus* in all probability indicated only numbers originally, but that as time went on the skill of the makers became so great that historical events, laws and edicts could thus be communicated. In every place of any importance there was an official whose business it was to interpret *quipus* received from a distance, and to make *quipus* himself. If, however, the *quipus* which was received came from a distant province, it was not intelligible without an oral explanation. Unfortunately, the art of interpretation of *quipus* is lost, so that it is impossible to ascertain how far the knots were merely a mnemonic for the messenger, and how far they were intelligible without explanation to a stranger. Similar mnemonics are said to have been used in the remotest antiquity amongst the Chinese, the Tibetans, and other peoples of the Old World.[2]

Message-sticks.

Similar in character to the *quipus* is the message-stick, which is still in use amongst the natives of Australia. A branch of a tree is taken and notches made upon it. These are now cut with a knife; in earlier times they were made with the edge of a mussel shell. The notches are made in the presence of the messenger, who receives his instructions while they are being made. The notches are thus merely aids to memory, and not self-explanatory, though if messages frequently passed between two persons, practice would in time help the person to whom the message was sent to guess at the meaning, even without a verbal explanation. The following was the method of the Wotjoballuk of the Wimmera river in Victoria.[3] "The messenger carried the message-stick in a net bag, and on arriving at the camp to which he was sent, he handed it to the headman at some place apart from the others, saying to him, 'So-and-so sent you this,' and he then gives his message, referring as he does so to the notches on the message-stick; and if his message requires it, also enumerates the days or stages, as the case may be," by a method of counting on different parts of the body.

Marked pebbles.

For the purposes of communication with absent persons, however, another method commended itself, which in time was adopted also for mnemonic purposes. This method was the beginning whence some forms at least of later writing have been derived. From the very earliest times to which the energy of man can be traced, date two kinds of writing: (*a*) engraving of a visible object on some hard substance, such as the flat surface of a bone; (*b*) drawing, painting or engraving marks which could again be identified. Of the first kind are the engravings of reindeer, buffaloes and other animals by the cave men of prehistoric times; of the second are a large number of pebbles discovered by M. Ed. Piette at Mas d'Azil, on the left bank of the Arize, an account of which was published by the discoverer in *L'Anthropologie* (1896), vii. 384 sqq. This layer of coloured pebbles is intercalated between the last layer of the Reindeer Age and the first of the Neolithic period. The layer is over 2 ft. thick, of a reddish-black colour, and along with the pebbles are found cinders, peroxide of iron, teeth of deer perforated, probably in order to be strung like beads, harpoons of various kinds, and the bones of a large number of animals, some wheat, and, in the upper part of the layer, nuts, cherry-stones and plums. The stones were coloured with peroxide of iron. The characters are of two kinds: (*a*) a series of strokes which possibly indicate numbers, (*b*) graphic symbols. The stones were scattered about without connexion or relation one with another. Whatever the meaning may be, it is clear that the markings are not accidental. It is noticeable, however, that none of them definitely represent any animal, though some of them bear a certain resemblance to caterpillars or serpents. Others look like rough attempts to represent trees and river plants. A great number closely resemble symbols of the alphabet. Piette himself was inclined to see in the symbols the forerunners of the later syllabaries and alphabets of the East, nine of them agreeing with forms in the Cypriot syllabary (see below) and eleven with those of the Phoenician alphabet. A certain amount of likeness, however, could not well be avoided, for as soon as the artist advances beyond the single perpendicular or horizontal line he must, by crossing two lines, get forms which resemble alphabetical symbols. It might be therefore a safer conclusion to suppose that if they passed beyond magic symbols, to be buried like the Australian *churinga*, they were conventional marks understood by the members of the clan or tribe which frequented the caves of Mas d'Azil. It has been suggested that, like similar things among the American Indians, they may have been used in playing games or gambling.

American picture-writing, &c.

A very large number of conventional marks, however, are demonstrably reductions from still older forms, conventional marks often developing out of pictographs. Pictography has, in fact, left its traces in all parts of the world. It has, however, been most widely developed in the New World as a system lasting down to modern times. The American Indians, besides picture-writing, used also (1) the simple mnemonic of a notched stick to record various incidents, such as the number of days spent on an expedition, the number of enemies slain and the like; (2) wampum belts, consisting of strung beads, which could be utilized as a mnemonic, exactly like a rosary. Wampum belts, however, were employed in more intricate forms; white beads indicated peace, purple or violet meant war. Sometimes a pattern was made in the belt with beads of a different colour, as in the belt presented to

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[1] Quoted by Middendorf, *Das Runa Simi oder die Keshua Sprache* (Leipzig, 1890), p. 8.

[2] Cf. Andree, *Ethnologische Parallelen und Vergleiche*, i. p. 184 sqq.

[3] A. W. Howitt in *Journal of the Anthropological Institute*, xviii. (1889), p. 318 sqq.

William Penn on the making of a treaty with the Leni-Lenape chiefs in 1682. Here, in the centre of the belt, two figures, intended to represent Penn and an Indian, join hands, thus clearly indicating a treaty. Very simple pictures are drawn upon birch bark, indicating by their order the subjects in a series of song-chants with sufficient precision to enable the singer to recall the theme of each in his recitation. An account can be kept of sales or purchases by representing in perpendicular strokes the number of items, and adding at the end of each series a picture of the animal or object to which the particular series refers. Thus three strokes followed by the picture of a deer indicate that the hunter has brought three deer for sale. A conventional symbol (a circle with a line across it) is used to indicate a dollar, a cross represents ten cents, and an upright stroke one cent, so that the price can be quite clearly set forth. This practice is followed in many other parts of the world. In clay tablets discovered by Dr Arthur Evans during his exploration of the great palace at Knossos, in Crete, a somewhat similar method of enumeration is followed; while at Athens conventional symbols were used to distinguish drachmae and obols upon the revenue records, of which considerable fragments are still preserved.

In comparatively recent times, according to Colonel Mallery (*10th Annual Report of American Bureau of Ethnology*), the Dakota Indians invented a chronological table, or winter count, wherein each year is recorded by a picture of some important event which befell during that year. In these pictures a considerable amount of symbolism was necessary. A black upright stroke indicates that a Dakota Indian was killed, a rough outline of the head and body spotted with blotches indicates that in the year thus indicated the tribe suffered from smallpox. Sometimes, in referring to persons, the symbol is of the nature of a rebus. Thus, Red Coat, an Indian chief, was killed in the winter of 1807–1808; this fact is recorded by a picture of a red coat with two arrows piercing it and blood dripping. There is, however, nothing of the nature of a play upon words intended, and even when General Manyadier is represented as a figure in European dress, with the heads of two deer behind his head and connected with his mouth, no rebus was intended (many a deer), but the Indians supposed that his name really meant this, like their own names Big Crow, Little Beaver, and so forth. Here the Mexicans proceeded a stage further, as in the often quoted case of the name of Itz-coatl, literally knife-snake, which is ordinarily represented by a reptile (*coatl*) with a number of knives (*itz*) projecting from its back. It is, however, also found divided into three words, itz-co-atl—knife-pot-water—and represented by a different picture accordingly. The Mexicans, moreover, to indicate that the picture was a proper name, drew the upper part of the human figure below the symbol, and joined them by a line, a practice adopted also amongst their northern neighbours when, as in names like Little-Ring, the representation would hardly be sufficiently definite. Simple abstract notions could also be expressed in this picture-writing. Starvation or famine was graphically represented by a human figure with the ribs showing prominently. A noose amongst the Mexicans was the symbol for robbery, though more logically belonging to its punishment. In a Californian rock-painting reproduced by Mallery (p. 638), sorrow is represented by a figure from whose eyes drop tears. This could be abbreviated to an eye with tears falling from it, a form recorded by Schoolcraft as existing amongst the Ojibwa Indians. The symbol is so obvious that it is found with the same value among Egyptian hieroglyphics.

The civilization of the American Indians was nowhere very high, and for their simple needs this system, without further development, sufficed. It was different in the more elaborate civilizations which prevailed among the ancient peoples of the Old World, to whom with certainty the development of writing from pictography can be ascribed—the Assyrians (see CUNEIFORM), Egyptians (see EGYPT) and Chinese (see CHINA). Here more complex notions had to be expressed. The development of the system can be traced through many centuries, and, as might be expected, this development shows a tendency to conventionalize the pictorial symbols employed. Out of conventionalized forms develop (*a*) syllabaries, (*b*) alphabets. As regards the latter the historical evolution is traced in the article ALPHABET. The account given under CHINA (*language*) gives a good idea of the development of a syllabary from pictographic writing.

Egyptian.

The Egyptian system of writing is perhaps the oldest of known scripts, and was carried on till the Ptolemaic period, when the more convenient Greek alphabet led to its gradual disuse. But, as in Chinese, the fact that it was so long in use led to the conventionalizing of the pictures, and in many cases to a complete divorcement between the symbol and the sound represented, the original word having often become obsolete. In this case it is no longer possible to trace it. Attempts have been made to connect the three great pictographic systems of the Old World, some authorities holding that the Chinese migrated eastwards from Babylonia, while others contend that the civilization of Egypt sprang originally from the valley of the Euphrates, and that the ancient Egyptians were of the same stock as the Somali and were overlaid and permeated by a Semitic conquest and civilization. But there is no clear evidence that the Egyptian system of writing was not a development in the Nile Valley itself, or that it was either the descendant or the parent of the pictographic system which developed into the cuneiform of Assyria and neighbouring lands.

Egyptian started from the same point as every other pictographic system—the representation of the object or the concrete expression of the idea. But, like the Chinese, it took the further step, short of which the American Indian pictographs stopped; it converted its pictures into a syllabary from which there was an imperfect development towards an alphabet. Egyptian, however, never became alphabetic in the sense in which the western languages of modern Europe are alphabetic. This is attributed to the natural conservatism of the people, and the influence of the artist scribes, who, as Mr F. Ll. Griffith has pointed out, "fully appreciated the effect of decorative writing; to have limited their choice of signs by alphabetic signs would have constituted a serious loss to that highly important body." The effect of this love for decoration, combined with a desire for precision, is shown by the repetition several times over in the symbols of the sounds contained in a word. The development of Egyptian was exactly parallel to Chinese. A combination of sounds, which was originally the name of an object, was represented by the picture of that object. This picture again, like Chinese, and like the Indian name "Little-Ring," required at the end a determinative—a picture of the kind of object intended—in order to avoid ambiguity. As the alphabet represented only consonants and semi-consonants, and the Egyptian roots consisted mostly of only three letters, the parallelism with Chinese is remarkably close.

Hittite.

The cuneiform script spread to other people who spoke tongues in no way akin to those of either its inventors, the Sumerians, or their conquerors, the Semitic Babylonians. A widespread series of inscriptions, found in many parts of Asia and even in the Aegean, which are generally described as Hittite (*q.v.*) are written in a script of pictographic origin, though probably independent of Babylonian in its development.

Cyprian.

It is noteworthy that at a very early period a colony of Greeks from the Peloponnese, speaking a dialect closely akin to the Arcadian dialect (which is known to us only from a much later period), had settled in the island of Cyprus. Alone among the Greeks this colony did not write in an alphabet, but under some Asiatic influence adopted a syllabary. Even when the island came again closely in touch with their Greek kinsfolk, after the Persian wars, the Greek inhabitants continued to write in their syllabary. In the recent excavations made by the authorities of the British Museum an inscription of the 4th century B.C. was discovered, whereon a dedication to Demeter and Persephone was given first in Greek letters and repeated below in the syllabary, the Greek (as universally at so late a period) reading from left to right, the syllabary from right to left. This syllabary has five vowel symbols, but it could not distinguish between long and short vowels. In its consonant system it is unable to distinguish between breathed, voiced and aspirated stops, thus having but one symbol to represent τε, δε and θε. It is, of course, unable to represent a final consonant, but this is achieved by using the symbol for a syllable ending in *e* conventionally for the final consonant. Thus *ka-se* stands for κάς, the Cyprian equivalent of καί, "and." There are symbols for *ta*, for *te*, for *ti*, for *to*, for *tu*, though none for *t*, and similarly for most of the other consonants. There is, however, no symbol for *wu* (*F*υ); *ya*, *ye*, *yi* occur, but no *yo* or *yu*. Δημήτρι is expressed by *ta-ma-ti-ri*, where *ti* stands for *t* alone; *sa-ta-sa-to-ro* stands or Στασάνδρω (genitive). Here it is to be observed (1) that ν preceding another consonant is omitted altogether, the vowel being probably nasalized as in French; (2) that, as in the previous word, there is a sort of vowel euphony whereby the unnecessary vowel accompanying *t* takes the colour of the succeeding vowel. In other cases, however, it follows the preceding vowel, as in *a-ri-si-to-pa-to-o-a-ri-si-ta-go-ra-u* = Ἀριστόφαντο(s) ὁ Ἀρισταγόρου.

For literature on the history of writing, see the bibliographies to the articles ALPHABET, &c., and under the headings of the various languages and peoples.

WROTHAM, an urban district in the Medway parliamentary division of Kent, England, 10 m. W. by N. of Maidstone, on the South-Eastern & Chatham railway. Pop. (1901) 3571. The church of St George, Early English and later, contains numerous brasses; and near it is the site of a palace of the archbishops of Canterbury, maintained until the time of Archbishop Simon Islip (*c.* 1350). S.W. of Wrotham is the village of Ightham, in which is a fine quadrangular moated manor-house, the Mote, in part of the 14th century, but with portions of Tudor dates.

WRYNECK (Ger. *Wendehals*, Dutch *draaihalzen*, Fr. *torcol*), a bird so called from its way of writhing its head and neck, especially when captured on its nest in a hollow tree. The *Iynx*[1] *torquilla* is a regular summer visitant to most parts of Europe, generally arriving a few days before the cuckoo, and is known in England as "cuckoo's leader" and "cuckoo's mate," but occasionally is called "snake-bird," not only from the undulatory motions just mentioned, but from the violent hissing with which it seeks to repel an intruder from its hole.[2]

The unmistakable note of the wryneck is merely a repetition of what may be syllabled *que*, *que*, *que*, many times in succession, rapidly uttered at first, but gradually slowing and in a continually falling key. This is only heard during a few weeks, and for the rest of the bird's stay in Europe it seems to be mute. It feeds almost exclusively on insects, especially on ants. It is larger than a sparrow, but its plumage is not easily described, being beautifully variegated with black, brown, buff and grey—the last produced by minute specks of blackish-brown on a light ground—the darker markings disposed in patches, vermiculated bars, freckles, streaks or arrow-heads—and the whole blended most harmoniously, so as to recall the coloration of a goatsucker (*q.v.*) or of a woodcock (*q.v.*). The wryneck commonly lays its translucent white eggs on the bare wood of a hole in a tree, and it is one of the few wild birds that can be induced to go on laying by abstracting its eggs day after day, and thus upwards of forty have been taken from a single hole—but the proper complement is from six to ten. As regards Britain, the bird is most common in the S.E., its numbers decreasing rapidly towards the W. and N., so that in Cornwall and Wales and beyond Cheshire and Yorkshire its occurrence is but rare, while it appears only by accident in Scotland and Ireland.

Some writers have been inclined to recognize five other species of the genus *Iynx*; but the so-called *I. japonica* is specifically indistinguishable from *I. torquilla*; while that designated, through a mistake in the locality assigned to it, *I. indica*, has been found to be identical with the *I. pectoralis* of S. Africa. Near to this is *I. pulchricollis*, discovered by Emin Pasha in the E. of the Bar-el-Djebel (*Ibis*, 1884, p. 28, pl. iii.). Another distinct African species is the *I. aequatorialis*, originally described from Abyssinia. The wrynecks (see WOODPECKER) form a subfamily *Iynginae* of the *Picidae*, from the more normal groups of which they differ but little in internal structure, but much in coloration and in having the tail-quills flexible, or at least not stiffened to serve as props as in the climbing *Picinae*. (A. N.)

WRY-NECK (Lat. *Torticollis*), a congenital or acquired deformity, characterized by the affected side of the head being drawn downwards towards the shoulder together with deviation of the face towards the sound side. There are various forms. (1) The congenital, due to a lesion of the sterno-mastoid muscle, either the result of a malposition in utero or due to the rupture of the muscle in the delivery of the aftercoming head in the birth of the breech presentation. (2) The rheumatic, due to exposure to a draught or cold. This is commonly known as "stiff-neck." (3) The nervous or spasmodic, the result of (*a*) direct irritation of the spinal accessory nerve or its roots, or (*b*) the result of cerebral irritation. In this form there is generally a family history of nervous diseases, notably epilepsy. This spasm is one of a group of nervous spasms known as "tics," a variety of habit spasm. The character of the movements varies with the muscles involved, the most usual muscle being the sterno-mastoid. The spasm ceases during sleep. Many cases are also due to hysteria and some to spinal caries. When wry-neck is congenital, massage and manipulation may be tried and some form of apparatus. Failing this, division of the muscle surgically may be practised. In the spasmodic forms, anti-neurotic treatment is recommended, the use of the bromides, valerianates and belladonna, and hydrobromide of hyoscine injected into the muscles has been found of value. T. Grainger Stewart recommends in persistent tic the trial of continuous and regular movements in the affected group of muscles with a view to replacing the abnormal movements by normal ones. In severe cases it may be necessary to cut down on and stretch or excise the spinal accessory nerve. In rheumatic torticollis the spasm is usually overcome by the application of hot compresses and appropriate anti-rheumatic treatment.

WUCHANG, the capital of the combined provinces of Hup-eh and Hu-nan, China. It is one of the three cities, Wuchang, Hanyang and Hankow, which stand together at the mouth of the Han river, and is situated on the right bank of the river Yangtsze, almost directly opposite the foreign settlement of Hankow. It is the seat of the provincial government of the two Hu or Hu-kwang, as these provinces are collectively termed, at the head of which is a viceroy. Next to Nanking and Canton, it is one of the most important vice-royalties in the empire. It possesses an arsenal and a mint. The provincial government has established ironworks for the manufacture of rails and other railway material. As the works did not pay under official management, they were transferred to the director-general of railways. Wuchang is not open to foreign trade and residence, but a considerable number of missionaries, both Roman Catholic and Protestant, live within the walls. The native population is estimated at 800,000, including cities on both banks. Wuchang is an important junction on the trunk railway from Peking to Canton; and is on the route of the Sze-ch'uen railway.

WUCHOW, a treaty port in the province of Kwang-si, China, opened to foreign trade in 1897, and situated on the left bank of the Si-kiang (West river) at its junction with the Fu or Kwei-Kiang (Cassia) river. It is 220 m. above Canton, with which it is in navigable connexion for vessels drawing up to 8 ft. of water. In 1908 the value of the trade passing through the maritime customs amounted to £1,566,000, representing, however, only a portion of the trade. Of this total, two-thirds were for imports, consisting principally of cotton and cotton goods, kerosene oil, woollens, &c. Sugar, various oils, hides and aniseed were the chief exports. The native population is estimated at 65,000. At Shuihing the river flows for 5 m. through a deep gorge bordered by limestone cliffs 2000 ft. in height. Farther up the river threads its way through a series of rocky defiles, forming at intervals what seems an inland lake with no apparent outlet. During summer floods the water thus pent up by the gorges rises at Wuchow 50 or 60 ft. In consequence of the variation of river level, the principal offices and shops are built upon pontoons which are moored alongside the river-bank. The situation of Wuchow makes it the natural distributing centre between Kwei-chow, Kwang-si and Canton. Great things were therefore expected of it as a treaty port, but disorders in Kwang-si delayed the fulfilment of the hopes. Trade, however, has improved, and a large native passenger traffic has sprung up between it and Canton. It is connected with Hong Kong and Shanghai by telegraph.

WUHU, a district city in the province of Ngan-hui, China, about 1 m. from the S. bank of the Yangtsze-kiang, with which it is connected by a straggling suburb. It is about 50 m. above Nanking, and in 1858 it was marked out as a treaty port, but was not opened to trade until 1877. It is connected by canals with the important cities of Ning-Kwo Fu, T'ai-p'ing Hien, Nan-ling Hien and Ching Hien, the silk districts in the neighbourhood of the two last cities being within 50 m. of Wuhu. Coal to a considerable extent exists in the country round. At first its commercial progress was very slow, the older ports of Kiu-kiang and Chin-kiang militating against its success; but of late there has been a distinct improvement in the trade of the port, the net value of which was about £3,000,000 in 1906. The principal exports are rice, cotton, wheat, tea, furs and feathers. For the production of feathers large quantities of ducks are reared in the surrounding districts. Of imports, opium formed the most considerable item; other imports being matches, needles, sandalwood and window glass. The city, which is one of the largest of its rank in China, was laid desolate during the T‘ai-p‘ing rebellion, but has been repeopled, the population being estimated (1906) at 137,000. The streets are comparatively broad and are well paved. The land set apart for the British settlement, advantageously situated, was little built upon. A new general foreign settlement was opened in 1905.

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[1] Frequently misspelt, as by Linnaeus in his later years, *Yunx*.

[2] The peculiarity was known to Aristotle, and possibly led to the cruel use of the bird as a love-charm, to which several classical writers refer, as Pindar (*Pyth.* iv. 214; *Nem.* iv. 35), Theocritus (iv. 17. 30) and Xenophon (*Memorabilia*, iii. 11. 17, 18). In one part at least of China a name, *Shay ling*, signifying "Snake's neck," is given to it (*Ibis*, 1875, p. 125).

WULFENITE, a mineral consisting of lead molybdate, $PbMoO_4$, crystallizing in the hemimorphic-tetartohedral class of the tetragonal system. Crystals usually have the form of thin square plates bevelled at the edges by pyramidal planes. They have a brilliant resinous to adamantine lustre, and vary in colour from greyish to bright yellow or red: the hardness is 3, and the specific gravity 6·7. Small amounts of calcium are sometimes present isomorphously replacing lead. The mineral occurs in veins of lead ore, and was first found in the 18th century in the lead mines at Bleiberg in Carinthia. Bright yellow crystals are found in New Mexico and Utah, and brilliant red crystals in Arizona.

WULFHERE (d. 675), king of the Mercians, was a younger son of King Penda, and was kept in concealment for some time after his father's defeat and death in 655. In 658 or 659, however, the Mercians threw off the supremacy of Oswio, king of Northumbria, and Wulfhere became their king. He took energetic measures to spread Christianity, and was greatly helped by his bishop, Jaruman, and afterwards by St Chad. Outside Mercia he did something to induce the East and the South Saxons to accept Christianity, and is said to have founded one or two monasteries. He gained Lindsey from Northumbria in 657, and was successful against Wessex. He extended his borders in all directions, and was the founder of the passing greatness of Mercia, although he lost Lindsey just before his death. Wulfhere's wife was Eormenhild, a daughter of Erconberht, king of Kent, and he was succeeded by his brother Aethelred. His only son Coenred became king in 704 in succession to Aethelred. His only daughter was St Werburga or Werburh, abbess of Ely.

See Bede, *Historia ecclesiastica*, ed. C. Plummer (Oxford, 1896); and J. R. Green, *The Making of England* (1897–1899).

WULFSTAN, archbishop of York from 1003 until his death in May 1023, and also bishop of Worcester from 1003 to 1016, is generally held to be the author of a remarkable homily in alliterative English prose. Its title, taken from a manuscript, is *Lupi sermo ad Anglos, quando Dani maxime prosecuti sunt eos, quod fuit anno 1014*. It is an appeal to all classes to repent in the prospect of the imminent day of judgment, and gives a vivid picture of the desperate condition of England in the year of King Aethelred II.'s flight (1014). Of the many other homilies ascribed to Wulfstan very few are authentic. Subsequent legislation, especially that of Canute, bears clear traces of his influence.

See the edition of his homilies by A. Napier (Berlin, 1883); also the same writer's *Über die Werke des altenglischen Erzbischofs Wulfstan* (Göttingen dissertation, 1882), and his paper in *An English Miscellany* (Oxford, 1901, pp. 355 f.); also A. Brandl in H. Paul's *Grundriss der germanischen Philologie* (2nd ed., 1901–1909), ii. pp. 1110-1112.

WULFSTAN, ST (*c.* 1012–1095), bishop of Worcester, was born at Little Itchington near Warwick and was educated in the monastic schools of Evesham and Peterborough. He became a monk at Worcester, and schoolmaster and prior in the cathedral monastery there. In 1062 he was chosen bishop of Worcester, and the choice was approved by the witan; with some reluctance Wulfstan accepted, and was consecrated at York in September. The see of Worcester and the archbishopric of York had been held together before 1062 by Archbishop Aldred, who, when he was compelled to resign Worcester, retained twelve manors belonging to the see, which Wulfstan did not recover for some years. About 1070, however, it was decided that Worcester was in the province of Canterbury. Although he had been on friendly terms with Harold, the bishop submitted to William at Berkhampstead, and he was very useful in checking the rebellious barons during the revolt of 1075. He was equally loyal to William II. in his struggle with the Welsh. Wulfstan's relations with his ecclesiastical superiors were not so harmonious, and at one time both Lanfranc of Canterbury and Thomas of York unsuccessfully demanded his removal. He was the only survivor of the Anglo-Saxon bishops when he died on the 18th of January 1095. In 1203 he was canonized by Pope Innocent III. By his preaching at Bristol Wulfstan is said to have put an end to the kidnapping of English men and women and selling them as slaves. He rebuilt the cathedral church of Worcester, and some parts of his building still remain.

Lives of St Wulfstan by Hemming and Florence of Worcester are in H. Wharton's *Anglia sacra* (1691). See also E. A. Freeman, *Norman Conquest* (1867–1879).

WULLENWEBER, JÜRGEN (*c.* 1492–1537), burgomaster of Lübeck, was born probably at Hamburg. Settling in Lübeck as a merchant he took some part in the risings of the inhabitants in 1530 and 1531, being strongly in sympathy with the democratic ideas in religion and politics which inspired them. Having joined the governing council of the city and become leader of the democratic party, he was appointed burgomaster early in 1533 and threw himself into the movement for restoring Lübeck to her former position of influence. Preparations were made to attack the Dutch towns, the principal trading rivals of Lübeck, when the death of Frederick I., king of Denmark, in April 1533 changed the position of affairs. The Lübeckers objected to the bestowal of the Danish crown upon any prince favourable to the Empire or the Roman religion, and Wullenweber went to Copenhagen to discuss the matter. At length an alliance was concluded with Henry VIII. of England; considerable support was obtained in N. Germany; and in 1534 an attack was made on Christian, duke of Holstein, afterwards King Christian III., who claimed the throne. At first the Lübeckers gained several successes, but Christian of Holstein appeared before Lübeck; the efforts of Wullenweber to secure allies failed; and the citizens were compelled to make peace. The imperial court of justice at Spires restored the old constitution, and in August 1535 the aristocratic party returned to power. Soon afterwards Wullenweber was seized by Christopher, archbishop of Bremen, and handed over to his brother Henry II., duke of Brunswick-Wolfenbüttel. Having been tortured and sentenced to death as a traitor and an Anabaptist, he was beheaded at Wolfenbüttel on the 29th of September 1537. Wullenweber, who was long regarded as a popular hero in Lübeck, inspired tragedies by Heinrich Kruse and Karl Ferdinand Gutzkow, and a novel by Ludwig Köhler.

See G. Waitz, *Lübeck unter Jürgen Wullenweber und die europäische Politik* (Berlin, 1855–1856).

WUNDT, WILHELM MAX (1832–   ), German physiologist and philosopher, was born on the 16th of August 1832 at Neckarau, in Baden. He studied medicine at Tübingen, Heidelberg and Berlin, and in 1857 began to lecture at Heidelberg. In 1864 he became assistant professor there, and in 1866 was chosen to represent Heidelberg in the Baden Chamber, but soon resigned. In 1874 he was elected regular professor of philosophy at Zürich, and in the following year was called to the corresponding chair at Leipzig, where he founded an Institute for Experimental Psychology, the precursor of many similar institutes. The list of Wundt's works is long and comprehensive, including physiology, psychology, logic and ethics. His earlier works deal chiefly with physiology, though often in close connexion with psychology, as in the *Vorlesungen über die Menschen- und Tierseele* (1863; 4th ed., 1906; trans. Creighton and Titchener, 1896), *Lehrbuch der Physiologie des Menschen* (1865; 4th ed., 1878), and *Grundzüge der physiologischen Psychologie* (1874; 6th ed., 3 vols., 1908). He published an important work on *Logik* (1880–1883; 3rd ed., 1906–1907), and this was followed in 1886 by his *Ethik* (3rd ed., 1903). According to Wundt, the straight road to ethics lies through ethnic psychology, whose especial business it is to consider the history of custom and of ethical ideas from the psychological standpoint. We must look for ethics to supply the corner-stone of metaphysics, and psychology is a necessary propaedeutic. The *System der Philosophie* (1889; 3rd ed., 1907) contained the results of Wundt's work up to that date, both in the domain of science and in the more strictly philosophic field. The metaphysical or ontological part of psychology is in Wundt's view the actual part, and with this the science of nature and the science of mind are to be brought into relation, and thus constituted as far as possible philosophical sciences. In 1892 Wundt published *Hypnotismus und Suggestion.* Subsequent important works are the *Grundriss der Psychologie* (1896; 8th ed., 1907; trans. Judd, 3rd ed., 1907); *Völkerpsychologie* (1900–1906); *Einleitung in die Philos.* (1901; 4th ed., 1906). Two other works, containing accounts of the work of himself and his pupils, are *Philosophische Studien* (1883–1902) and *Psychologische Studien* (1905 foll.).

WUNTHO, a native state of Upper Burma annexed by the British and incorporated in the district of Katha in 1892. Wuntho was classed by the Burmese as a Shan state, but was never on the same footing as the true Shan states, and only escaped becoming an integral part of the Burmese empire through Burmese want of system. The Shan name is Wying Hsö, "the city of the high." It had an area of about 2400 sq. m. with 150,000 inhabitants, and lay midway between the Irrawaddy and Chindwin rivers. When the British annexed Upper Burma in 1885 the state became a refuge for rebels and dacoit leaders. Finally in 1891 the state broke out into open rebellion, the sawbwa was deposed, and a force of 1800 troops under General Sir George Wolseley occupied the town of Wuntho and reduced the state to order.

WUPPER, a river of Germany, a right-bank tributary of the Rhine, rising in the Sauerland near Meinerzhagen. The most remarkable part of its course is that in the so-called Wuppertal. In this section, 30 m. in length, it passes through the populous towns of Barmen and Elberfeld and supplies water-power to about five hundred mills and factories. Leaving the hills above Opladen, it debouches on to the plain and enters the Rhine at Rheindorf between Cologne and Düsseldorf, after a course of 63 m.

See A. Schmidt, *Die Wupper* (Lennep, 1902).

WÜRTTEMBERG, a kingdom of Germany, forming a tolerably compact mass in the S.W. angle of the empire. In the south it is cleft by the long narrow territory of Hohenzollern, belonging to Prussia; and it encloses six small enclaves of Baden and Hohenzollern, while it owns nine small exclaves within the limits of these two states. It lies between 47° 34′ 48″ and 49° 35′ 17″ N., and between 8° 15′ and 10° 30′ E. Its greatest length from N. to S. is 140 m.; its greatest breadth is 100 m.; its boundaries, almost entirely arbitrary, have a circuit of 1116 m.; and its total area is 7534 sq. m., or about $\frac{1}{28}$th of the entire empire. It is bounded on the E. by Bavaria, and on the other three sides by Baden, with the exception of a short distance on the S., where it touches Hohenzollern and the lake of Constance.

Physical Features.—Württemberg forms part of the South-German tableland, and is hilly rather than mountainous. In fact the undulating fertile terraces of Upper and Lower Swabia may be taken as the characteristic parts of this agricultural country. The usual estimates return one-fourth of the entire surface as "plain," less than one-third as "mountainous," and nearly one-half as "hilly." The average elevation above the sea-level is 1640 ft.; the lowest point is at Böttingen (410 ft.), where the Neckar quits the country; the highest is the Katzenkopf (3775 ft.), on the Hornisgrinde, on the western border.

The chief mountains are the Black Forest (*q.v.*) on the west, the Swabian Jura or Rauhe Alb stretching across the middle of the country from south-west to north-east, and the Adelegg Mountains in the extreme south-east, adjoining the Algau Alps in Bavaria. The Rauhe Alb or Alp slopes gradually down into the plateau on its south side, but on the north it is sometimes rugged and steep, and has its line broken by isolated projecting hills. The highest summits are in the south-west, viz. the Lemberg (3326 ft.), Ober-Hohenberg (3312 ft.) and Plettenberg (3293 ft.). To the south of the Rauhe Alb the plateau of Upper Swabia stretches to the lake of Constance and eastwards across the Iller into Bavaria. Between the Alb and the Black Forest in the north-west are the fertile terraces of Lower Swabia, continued on the north-east by those of Franconia

About 70% of Württemberg belongs to the basin of the Rhine, and about 30% to that of the Danube. The principal river is the Neckar, which flows northward for 186 m. through the country to join the Rhine, and with its tributaries the Rems, Kocher, Jagst, Ens, &c., drains 57% of the kingdom. The Danube flows from east to west across the south half of Württemberg, a distance of 65 m., a small section of which is in Hohenzollern. Just above Ulm it is joined by the Iller, which forms the boundary between Bavaria and Württemberg for about 35 m. The Tauber in the north-east joins the Main; the Argen and Schussen in the south enter the lake of Constance. The lakes of Württemberg, with the exception of those in the Black Forest, all lie south of the Danube. The largest is the Federsee (1 sq. m.), near Buchau. About one-fifth of the lake of Constance is reckoned to belong to Württemberg. Mineral springs are abundant; the most famous spa is Wildbad, in the Black Forest.

The climate is temperate, and colder among the mountains in the south than in the north. The mean temperature varies at different points from 43° to 50° F. The abundant forests induce much rain, most of which falls in the summer. The soil is on the whole fertile and well cultivated, and agriculture is the main occupation of the inhabitants.

Population.—The population of the four departments (*Kreise*) into which the kingdom is divided is shown below:—

District (*Kreis*).	Area in sq. m.	Pop. 1900.	Pop. 1905.	Density 1905.
Neckar.	1286	745,669	811,478	631
Black Forest (Schwarzwald)	1844	509,258	541,662	293
Jagst	1985	400,126	407,059	205
Danube (Donau) . .	2419	514,427	541,980	223
Total . .	7534	2,169,480	2,302,179	306

The population is particularly dense in the Neckar valley from Esslingen northward. The mean annual increase from 1900 to 1905 amounted to 1·22%. 8·5% of the births are illegitimate. Classified according to religion, about 69% are Protestants, 30% Roman Catholics, and Jews amount to about $\frac{1}{2}$%. Protestants largely preponderate in the Neckar district, Roman Catholics in that of the Danube. The people of the north-west belong to the Alamannic stock, those of the north-east to the Franconian, and those of the centre and south to the Swabian. According to the latest occupation census, nearly half of the entire population is supported by agriculture, and a third by industrial pursuits, mining and commerce. In 1910, 506,061 persons were engaged in agriculture and kindred occupations, 432,114 in industrial occupations, and 100,109 in trade and commerce.

The largest towns in the kingdom are Stuttgart (with Cannstadt), Ulm, Heilbronn, Esslingen, Reutlingen, Ludwigsburg, Göppingen, Gmünd, Tübingen, Tuttlingen and Ravensburg.

Agriculture.—Württemberg is essentially an agricultural state, and of its 4,821,760 acres, 44·9 % are agricultural land and gardens, 1·1 % vineyards, 17·9 % meadows and pastures, and 30·8 % forest. It possesses rich meadowlands, cornfields, orchards, gardens, and hills covered with vines. The chief agricultural products are oats, spelt, rye, wheat, barley, hops. To these must be added wine (mostly of excellent quality) of an annual value of about one million sterling, peas and beans, maize, fruit, chiefly cherries and apples, beets and tobacco, and garden and dairy produce. Of live stock, cattle, sheep and pigs are reared in considerable numbers, and great attention is paid to the breeding of horses.

Mining.—Salt and iron are the only minerals of great industrial importance found in Württemberg. The salt industry only began to be of importance at the beginning of the 19th century. The iron industry, on the other hand, is of great antiquity, but it is hampered by the entire absence of coal mines in the country. Other minerals produced are granite, limestone, ironstone and fireclay.

Manufactures.—The old-established manufactures embrace linen, woollen and cotton fabrics, particularly at Esslingen and Göppingen, and paper-making, especially at Ravensburg, Heilbronn and other places in Lower Swabia. The manufacturing industries assisted by the government developed rapidly during the later years of the 19th century, notably metal-working, especially such branches of it as require exact and delicate workmanship. Of particular importance are iron and steel goods, locomotives (for which Esslingen enjoys a great reputation), machinery, motor-cars, bicycles, small arms (in the Mauser factory at Oberndorf), all kinds of scientific and artistic appliances, pianos (at Stuttgart), organs and other musical instruments, photographic apparatus, clocks (in the Black Forest), electrical apparatus, and gold and silver goods. There are also extensive chemical works, potteries, cabinet-making workshops, sugar factories, breweries and distilleries. Water-power and petrol largely compensate for the lack of coal. Among other interesting developments is the manufacture of liquid carbonic acid gas procured from natural gas springs beside the Eyach, a tributary of the Neckar.

Commerce.—The principal exports are cattle, cereals, wood, pianos, salt, oil, leather, cotton and linen fabrics, beer, wine and spirits. The chief commercial cities are Stuttgart, Ulm, Heilbronn and Friedrichshafen. The book trade of Stuttgart, called the Leipzig of South Germany, is very extensive.

Communications.—In 1907 there were 1219 m. of railways, of which all except 159 m. belonged to the state. The Neckar, the Schussen and the lake of Constance are all navigable for boats; the Danube begins to be navigable at Ulm. The roads of Württemberg are fairly good; the oldest of them are Roman. Württemberg, like Bavaria, retained the control of its own postal and telegraph service on the foundation of the new German empire.

Constitution.—Württemberg is a constitutional monarchy and a member of the German empire, with four votes in the federal council (Bundesrat), and seventeen in the imperial diet. The constitution rests on a law of 1819, amended in 1868, in 1874, and again in 1906. The crown is hereditary, and conveys the simple title of king of Württemberg. The king receives a civil list of £103,227. The legislature is bi-cameral. The upper chamber (*Standesherren*) is composed of adult princes of the blood, heads of noble families from the rank of count (*Graf*) upwards, representatives of territories (*Standesherrschaften*), which possessed votes in the old German imperial diet or in the local diet; it has also members (not more than 6) nominated by the king, 8 members of knightly rank, 6 ecclesiastical dignitaries, a representative of the university of Tübingen, and 1 of the technical high school of Stuttgart, 2 representatives of commerce and industry, 2 of agriculture, and 1 of handicrafts. The lower house (*Abgeordnetenhaus*) has 92 members, viz. a representative from each of the administrative divisions (*Oberamtsbezirke*), 63 in all without Stuttgart, which has 6 representatives; also 1 from each of the six chief provincial towns, and 17 members elected by the two electoral divisions (*Landeswahlkreise*) into which the kingdom is divided. The latter class of members as well as those for Stuttgart are elected on the principle of proportional representation. The king appoints the president of the upper chamber; since 1874 the lower chamber has elected its own chairman. Members of both houses must be over twenty-five years of age, and parliaments are elected for six years; the suffrage is enjoyed by all male citizens over twenty-five years of age, and voting is by ballot.

The highest executive is in the hands of a ministry of state (*Staatsministerium*), consisting of six ministers respectively of justice, foreign affairs (with the royal household, railways, posts and telegraphs), the interior, public worship and education, war and finance. There is also a privy council, consisting of the ministers and some nominated councillors (*wirkliche Staatsräte*), who advise the sovereign at his command. The judges of a special supreme court of justice, called the *Staatsgerichtshof* (which is the guardian of the constitution), are partly elected by the chambers and partly appointed by the king. Each of the chambers has the right to impeach the ministers. The country is divided into four governmental departments (*Kreise*) and subdivided into sixty-four divisions (*Oberamtsbezirke*), each of which is under a headman (*Oberamtmann*) assisted by a local council (*Amtsversammlung*). At the head of each of the four departments is a government (*Regierung*).

Religion.—The right of direction over the churches resides in the king, who has also, so long as he belongs to the Protestant Church, the guardianship of the spiritual rights of that Church. The Protestant Church is controlled (under the minister of religion and education) by a consistory and a synod—the former consisting of a president, 9 councillors and 6 general superintendents or "prelates" from six principal towns, and the latter of a representative council, including both lay and clerical members. The Roman Catholic Church is subject to the bishop of Rottenburg, in the archdiocese of Freiburg. Politically it is under a Roman Catholic council, appointed by government. The Jews also, since 1828, have been subject to a state-appointed council (*Oberkirchenbehörde*).

Education.—According to official returns there is not an individual in the kingdom above the age of ten years who cannot both read and write. The higher branches of learning are provided in the university of Tübingen, in the technical high school (with academic rank) of Stuttgart, the veterinary high school at Stuttgart, the commercial college at Stuttgart, and the agricultural college of Hohenheim. There are gymnasia and other schools in all the larger towns, while every commune has a school. There are numerous schools and colleges for women. There is also a school of viticulture at Weinsberg.

Army.—By terms of the convention of 1871 the troops of Württemberg form the XIII. army corps of the imperial German army.

Finances.—The state revenue for 1909–1910 was estimated at £4,840,520, which is nearly balanced by the expenditure. About one-third of the revenue is derived from railways, forests and mines; about £1,400,000 from direct taxation; and the remainder from indirect taxes, the post-office and sundry items. In 1909 the public debt amounted to £29,285,335, of which more than £27,000,000 was incurred for railway construction. Of the expenditure over £900,000 is spent upon public worship and education, and over £1,200,000 goes in interest and repayment of the national debt. To the treasury of the German empire the kingdom contributed £660,000.

AUTHORITIES.—See *Württembergische Jahrbücher für Statistik und Landeskunde*; *Das Königreich Württemberg, eine Beschreibung nach Kreisen, Oberämtern und Gemeinden* (Stuttgart, 1904); *Statistisches Handbuch für das Königreich Württemberg* (Stuttgart, 1885 fol.); *Das Königreich Württemberg, eine Beschreibung von Land, Volk und Staat* (1893); the *Jahresberichte der Handels- und Gewerbekammern in Württemberg*; Lang, *Die Entwickelung der Bevölkerung Württembergs im Laufe des 19ten Jahrhunderts* (Tübingen, 1903); Engel and Schulze, *Geognosticher Wegweiser durch Württemberg* (Stuttgart, 1908); Göz, *Staatsrecht des Königreichs Württemberg* (Tübingen, 1908); and F. Bitzer, *Regierung und Stände in Württemberg* (Stuttgart, 1882).

History.—The origin of the name Württemberg is uncertain, but the once popular derivation from Wirth am Berg is now universally rejected. Some authorities derive it from a proper name, Wiruto or Wirtino; others from a Celtic place-name, Virolunum or Verdunum. At all events from being the name of a castle near the village of Rothenberg, not far from Stuttgart, it was extended over the surrounding country, and as the lords of this district increased their possessions so the name covered an ever-widening area, until it reached its present denotation. Early forms of it are Wirtenberg, Wirtembenc and Wirtenberc. Wirtemberg was long current, and in the latter part of the 16th century Würtemberg and Württemberg appeared. In 1806 Württemberg was adopted as the official spelling, though Würtemberg is also common and occurs sometimes in official documents and even on coins issued after that date.

As far as we know, the first inhabitants of the country were the Celts, and then the Suebi. In the 1st century A.D. the Romans conquered the land and defended their position there by a rampart (*limes*). Early in the 3rd century the Alamanni drove the Romans beyond the Rhine and the Danube, but in their turn they were conquered by the Franks under Clovis, the decisive battle being fought in 496. For about four hundred years the district was part of the Frankish empire, being administered by counts, but in the 9th century it was incorporated with the German duchy of Swabia. The duchy of Swabia was ruled by the Hohenstaufen family until the death of Conradin in 1268, when a considerable part of it fell to the count of Württemberg, the representative of a family first mentioned about 1080, a certain Conrad von Beutelsbach, having called himself after his ancestral castle of Württemberg. The earliest count about whom anything is known is one Ulrich, who ruled from 1241 to 1265. He was marshal of Swabia and advocate of the town of Ulm, and had large possessions in the valleys of the Neckar and the Rems. Under his sons, Ulrich II. and Eberhard I., and their successors the power of the family grew steadily. Eberhard (d. 1325) was the opponent, and not always the unsuccessful one, of three German kings; he doubled the area of his county and transferred his residence from Württemberg to Stuttgart. His successors were not perhaps equally important, but all added something to the area of Württemberg. The lands of the family were several times divided, but in 1482 they were declared indivisible and were united under Count Eberhard V., called im Bart. This arrangement was confirmed by the German king, Maximilian I., and the imperial diet in 1495.

Eberhard was one of the most energetic rulers that Württemberg ever had, and in 1495 his county was raised to the rank of duchy. Dying in 1496, he was succeeded by his cousin, Duke Eberhard II., who, however, was deposed after a short reign of two years. The long reign (1498–1550) of Ulrich I., who succeeded to the duchy while still a child, was a most eventful period for the country, and many traditions cluster round the name of this gifted, unscrupulous and ambitious man. The extortions by which he sought to raise money for his extravagant pleasures excited a rising known as that of the *arme Konrad* (poor Conrad), not unlike the rebellion in England led by Wat Tyler; order was soon restored, and in 1514 by the treaty of Tübingen the people undertook to pay the duke's debts in return for various political privileges, which in effect laid the foundation of the constitutional liberties of the country. A few years later Ulrich quarrelled with the Swabian League, and its forces, helped by William IV., duke of Bavaria, who was angered by the treatment meted out by Ulrich to his wife Sabina, a Bavarian princess, invaded Württemberg, expelled the duke and sold his duchy to the emperor Charles V. for 220,000 gulden. Charles handed over Württemberg to his brother, the German king, Ferdinand I., who was its nominal ruler for a few years. Soon, however, the discontent caused by the oppressive Austrian rule, the disturbances in Germany leading to the Peasants' War and the commotions aroused by the Reformation gave Ulrich an opportunity to recover it. Aided by Philip, landgrave of Hesse, and other Protestant princes, he fought a victorious battle against Ferdinand's troops at Lauffen in May 1534, and then by the treaty of Cadan he was again recognized as duke, but was forced to accept his duchy as an Austrian fief. He now introduced the reformed doctrines and proceeded to endow Protestant churches and schools throughout his land. Ulrich's connexion with the league of Schmalkalden led to another expulsion, but in 1547 he was reinstated by Charles V., although on somewhat onerous terms.

Ulrich's son and successor, Christopher (1515–1568), completed the work of converting his subjects to the reformed faith. He introduced a system of church government, the *Grosse Kirchenordnung*, which has endured in part to the present day. In this reign a standing commission was established to superintend the finances, and the members of this body, all of whom belonged to the upper classes, gained considerable power in the state, mainly at the expense of the towns. Christopher's son Louis, the founder of the *Collegium illustre*, died childless in 1593 and was succeeded by a kinsman, Frederick I. (1557–1608). This energetic prince, who disregarded the limits placed to his authority by the rudimentary constitution, by paying a large sum of money, induced the emperor Rudolph II. in 1599 to free the duchy from the suzerainty of Austria. Thus once again Württemberg became a direct fief of the Empire. Unlike his predecessor, the next duke, John Frederick (1582–1628), was not allowed to become an absolute ruler, but was forced to recognize the checks on his power. During this reign, which ended in July 1628, Württemberg suffered severely from the Thirty Years' War, although the duke himself took no part in it. His son and successor Eberhard III. (1614–1674), however, plunged into it as an ally of France and Sweden as soon as he came of age in 1633, but after the battle of Nördlingen in 1634 the duchy was occupied by the imperialists and he himself was for some years an exile. He was restored by the peace of Westphalia, but it was to a depopulated and impoverished country, and he spent his remaining years in efforts to repair the disasters of the great war. During the reign of Eberhard IV. (1676–1733), who was only one year old when his father Duke William Louis died in 1677, Württemberg made the acquaintance of another destructive enemy. In 1688, 1703 and 1707 the French entered the duchy and inflicted brutalities and sufferings upon the inhabitants. The sparsely populated country afforded a welcome to the fugitive Waldenses, who did something to restore it to prosperity, but this benefit was partly neutralized by the extravagance of the duke, anxious to provide for the expensive tastes of his mistress, Christiana Wilhelmina von Grävenitz. Charles Alexander, who became duke in 1733, had embraced the Roman Catholic faith while an officer in the Austrian service. His favourite adviser was the Jew Suss Oppenheimer, and it was thought that master and servant were aiming at the suppression of the diet and the introduction of the Roman Catholic religion. However, the sudden death of Charles Alexander in March 1737 put an abrupt end to these plans, and the regent, Charles Rudolph of Württemberg-Neuenstadt, had Oppenheimer hanged.

Charles Eugene (1728–1793), who came of age in 1744, was gifted, but vicious and extravagant, and he soon fell into the hands of unworthy favourites. He spent a great deal of money in building palaces at Stuttgart and elsewhere, and took the course, unpopular to his Protestant subjects, of fighting against Prussia during the Seven Years' War. His whole reign was disturbed by dissensions between the ruler and the ruled, the duke's irregular and arbitrary methods of raising money arousing great discontent. The intervention of the emperor and even of foreign powers was invoked, and in 1770 a formal arrangement removed some of the grievances of the people. But Charles Eugene did not keep his promises, although in his old age he made a few further concessions. He died childless, and was succeeded by one brother, Louis Eugene (d. 1795), and then by another, Frederick Eugene (d. 1797). This latter prince, who had served in the army of Frederick the Great, to whom he was related by marriage, educated his children in the Protestant faith. Thus, when his son Frederick II. became duke in 1797, the ruler of Württemberg was again a Protestant, and the royal house has adhered to this faith since that date. During Frederick Eugene's short reign the French invaded Württemberg, compelled the duke to withdraw his troops from the imperial army and to pay a sum of money.

Frederick II. (1754–1816), a prince whose model was Frederick the Great, took part in the war against France in defiance of the wishes of his people, and when the French again invaded and devastated the country he retired to Erlangen, where he remained until after the conclusion of the peace of Lunéville in 1801. By a private treaty with France, signed in March 1802, he ceded his possessions on the left bank of the Rhine, receiving in return nine imperial towns, among them Reutlingen and Heilbronn, and some other territories, amounting altogether to about 850 sq. m. and containing about 124,000 inhabitants. He also accepted from Napoleon the title of elector. These new districts were not incorporated with the duchy, but remained separate; they were known as New Württemberg and were ruled without a diet. In 1805 Württemberg took up arms on the side of France, and by the peace of Pressburg in December 1805 the elector was rewarded with various Austrian possessions in Swabia and with other lands in the neighbourhood. On the 1st of January 1806 Frederick assumed the title of king, abrogated the constitution and united old and new Württemberg. Subsequently he placed the property of the church under the control of the state. In 1806 he joined the Confederation of the Rhine and received further additions of territory containing 160,000 inhabitants; a little later, by the peace of Vienna in October 1809, about 110,000 more persons were placed under his rule. In return for these favours Frederick joined Napoleon in his campaigns against Prussia, Austria and Russia, and of 16,000 of his subjects who marched to Moscow only a few hundreds returned. Then after the battle of Leipzig he deserted the waning fortunes of the French emperor, and by a treaty made with Metternich at Fulda in November 1813 he secured the confirmation of his royal title and of his recent acquisitions of territory, while his troops marched with those of the allies into France. In 1815 the king joined the Germanic Confederation, but the congress of Vienna made no change in the extent of his lands. In the same year he laid before the representatives of his people the sketch of a new constitution, but this was rejected, and in the midst of the commotion Frederick died on the 30th of October 1816.

At once the new king, William I., took up the consideration of this question and after much discussion a new constitution was granted in September 1819. This is the constitution which, with subsequent modifications, is still in force, and it is described in an earlier section of this article. A period of quietness now set in, and the condition of the kingdom, its education, its agriculture and its trade and manufactures, began to receive earnest attention, while by frugality, both in public and in private matters, King William helped to repair the shattered finances of the country. But the desire for greater political freedom had not been entirely satisfied by the constitution of 1819, and after 1830 there was a certain amount of unrest. This, however.

soon passed away, while trade was fostered by the inclusion of Württemberg in the German Zollverein and by the construction of railways. The revolutionary movement of 1848 did not leave Württemberg untouched, although no actual violence took place within the kingdom. The king was compelled to dismiss Johannes Schlayer (1792–1860) and his other ministers, and to call to power men with more liberal ideas, the exponents of the idea of a united Germany. A democratic constitution was proclaimed, but as soon as the movement had spent its force the liberal ministers were dismissed, and in October 1849 Schlayer and his associates were again in power. By interfering with popular electoral rights the king and his ministers succeeded in assembling a servile diet in 1851, and this surrendered all the privileges gained since 1848. In this way the constitution of 1819 was restored, and power passed into the hands of a bureaucracy. Almost the last act of William's long reign was to conclude a concordat with the Papacy, but this was repudiated by the diet, which preferred to regulate the relations between church and state in its own way.

In July 1864 Charles I. (1823–1891) succeeded his father William as king and had almost at once to face considerable difficulties. In the duel between Austria and Prussia for supremacy in Germany, William I. had consistently taken the part of the former power, and this policy was equally acceptable to the new king and his advisers. In 1866 Württemberg took up arms on behalf of Austria, but three weeks after the battle of Königgrätz her troops were decisively beaten at Tauberbischofsheim, and the country was at the mercy of Prussia. The Prussians occupied the northern part of Württemberg and peace was made in August 1866; by this Württemberg paid an indemnity of 8,000,000 gulden, but at once concluded a secret offensive and defensive treaty with her conqueror.

The end of the struggle was followed by a renewal of the democratic agitation in Württemberg, but this had achieved no tangible results when the great war between France and Prussia broke out in 1870. Although the policy of Württemberg had continued antagonistic to Prussia, the country shared in the national enthusiasm which swept over Germany, and its troops took a creditable part in the battle of Wörth and in other operations of the war. In 1871 Württemberg became a member of the new German empire, but retained control of her own post office, telegraphs and railways. She had also certain special privileges with regard to taxation and the army, and for the next ten years the policy of Württemberg was one of enthusiastic loyalty to the new order. Many important reforms, especially in the realm of finance, were introduced, but a proposal for a union of the railway system with that of the rest of Germany was rejected. Certain reductions in taxation having been made in 1889, the reform of the constitution became the question of the hour. The king and his ministers wished to strengthen the conservative element in the chambers, but only slight reforms were effected by the laws of 1874, 1876 and 1879, a more thorough settlement being postponed. On the 6th of October 1891 King Charles died suddenly, and was succeeded by his cousin William II. (b. 1848), who continued the policy of his predecessor. The reform of the constitution continued to be discussed, and the election of 1895 was memorable because of the return of a powerful party of democrats. King William had no sons, nor had his only Protestant kinsman, Duke Nicholas (1833–1903); consequently the succession would ultimately pass to a Roman Catholic branch of the family, and this prospect raised up certain difficulties about the relations between church and state. The heir to the throne in 1910 was the Roman Catholic Duke Albert (b. 1865).

Between 1900 and 1910 the political history of Württemberg centred round the settlement of the constitutional and the educational questions. The constitution was revised in 1906 on the lines already indicated, and a settlement of the education difficulty was brought about in 1909. In 1904 the railway system was united with that of the rest of Germany.

For the history of Württemberg see the *Wirttembergisches Urkundenbuch* (Stuttgart, 1849–1907); and the *Darstellungen aus der württembergischen Geschichte* (Stuttgart, 1904 fol.). Histories are those of P. F. Stälin, *Geschichte Württembergs* (Gotha, 1882–1887); E. Schneider, *Württembergische Geschichte* (Stuttgart, 1896); Belschner, *Geschichte von Württemberg in Wort und Bild* (Stuttgart, 1902); Weller, *Württemberg in der deutschen Geschichte* (Stuttgart, 1900); K. V. Fricker and Th. von Gessler, *Geschichte der Verfassung Württembergs* (Stuttgart, 1869); Hieber, *Die württembergische Verfassungsreform von 1906* (Stuttgart, 1906); and R. Schmid, *Reformationsgeschichte Württembergs* (Heilbronn, 1904). See also Golther, *Der Staat und die katholische Kirche im Königreich Württemberg* (Stuttgart, 1874); B. Kaisser, *Geschichte des Volksschulwesens in Württemberg* (Stuttgart, 1895–1897); Bartens, *Die wirtschaftliche Entwickelung des Königreichs Württemberg* (Frankfort, 1901); W. von Heyd, *Bibliographie der württembergischen Geschichte* (1895–1896), Band iii. by Th. Schön (1907); D. Schäfer, *Württembergische Geschichtsquellen* (Stuttgart, 1894 fol.); and A. Pfister, *König Friedrich von Württemberg und seine Zeit* (Stuttgart, 1888).

WURTZ, CHARLES ADOLPHE (1817–1884), French chemist, was born on the 26th of November 1817 at Wolfisheim, near Strassburg, where his father was Lutheran pastor. When he left the Protestant gymnasium at Strassburg in 1834, his father allowed him to study medicine as next best to theology. He devoted himself specially to the chemical side of his profession with such success that in 1839 he was appointed "Chef des travaux chimiques" at the Strassburg faculty of medicine. After graduating there as M.D. in 1843, with a thesis on albumin and fibrin, he studied for a year under J. von Liebig at Giessen, and then went to Paris, where he worked in J. B. A. Dumas's private laboratory. In 1845 he became assistant to Dumas at the École de Médecine, and four years later began to give lectures on organic chemistry in his place. His laboratory at the École de Médecine was very poor, and to supplement it he opened a private one in 1850 in the Rue Garencière; but soon afterwards the house was sold, and the laboratory had to be abandoned. In 1850 he received the professorship of chemistry at the new Institut Agronomique at Versailles, but the Institut was abolished in 1852. In the following year the chair of organic chemistry at the faculty of medicine became vacant by the resignation of Dumas and the chair of mineral chemistry and toxicology by the death of M. J. B. Orfila. The two were united, and Wurtz appointed to the new post. In 1866 he undertook the duties of dean of the faculty of medicine. In this position he exerted himself to secure the rearrangement and reconstruction of the buildings devoted to scientific instruction, urging that in the provision of properly equipped teaching laboratories France was much behind Germany (see his report *Les Hautes Études pratiques dans les universités allemandes*, 1870). In 1875, resigning the office of dean but retaining the title of honorary dean, he became the first occupant of the chair of organic chemistry, which he induced the government to establish at the Sorbonne; but he had great difficulty in obtaining an adequate laboratory, and the building ultimately provided was not opened until after his death, which happened at Paris on the 10th of May 1884. Wurtz was an honorary member of almost every scientific society in Europe. He was one of the founders of the Paris Chemical Society (1858), was its first secretary and thrice served as its president. In 1880 he was vice-president and in 1881 president of the Academy, which he entered in 1867 in succession to T. J. Pelouze. He was made a senator in 1881.

Wurtz's first published paper was on hypophosphorous acid (1842), and the continuation of his work on the acids of phosphorus (1845) resulted in the discovery of sulphophosphoric acid and phosphorus oxychloride, as well as of copper hydride. But his original work was mainly in the domain of organic chemistry. Investigation of the cyanic ethers (1848) yielded a class of substances which opened out a new field in organic chemistry, for, by treating those ethers with caustic potash, he obtained methylamine, the simplest organic derivative of ammonia (1849), and later (1851) the compound ureas. In 1855, reviewing the various substances that had been obtained from glycerin, he reached the conclusion that glycerin is a body of alcoholic nature formed on the type of three molecules of water, as common alcohol is on that of one, and was thus led (1856) to the discovery of the glycols or diatomic alcohols, bodies similarly related to the double water type. This discovery he worked out very thoroughly in investigations of ethylene oxide and the polyethylene alcohols. The oxidation of the glycols led him to homologues of lactic acid, and a controversy about the constitution of the latter with H. Kolbe resulted in the discovery of many new facts and in a better understanding of the relations between the oxy- and the amido-acids. In 1867 Wurtz prepared neurine synthetically by the action of trimethylamine on glycol-chlorhydrin, and in 1872 he discovered aldol, pointing out its double character as at once an alcohol and an aldehyde. In addition to this list of some of the new substances he prepared, reference may be made to his work on abnormal vapour densities. While working on the olefines he noticed that a change takes place in the density of the vapour of amylene hydrochloride, hydrobromide, &c., as the temperature is increased, and in the gradual passage from a gas of approximately normal density to one of half-normal density he saw a powerful argument in favour of the view that abnormal vapour densities, such as are exhibited by sal-ammoniac or phosphorus pentachloride, are to be explained by dissociation. From 1865 onwards he treated this question in several papers, and in particular maintained the dissociation of vapour of chloral hydrate, in opposition to H. Sainte-Claire Deville and M. Berthelot.

For twenty-one years (1852–1872) Wurtz published in the *Annales de chimie et de physique* abstracts of chemical work done out of France. The publication of his great *Dictionnaire de chimie pure et appliquée*, in which he was assisted by many other French chemists, was begun in 1869 and finished in 1878; two supplementary volumes were issued 1880–1886, and in 1892 the publication of a second supplement was begun. Among his books are *Chimie médicale* (1864), *Leçons élémentaires de chimie moderne* (1867), *Théorie des atomes dans la conception du monde* (1874), *La Théorie atomique* (1878), *Progrès de l'industrie des matières colorantes artificielles* (1876) and *Traité de chimie biologique* (1880–1885). His *Histoire des doctrines chimiques*, the introductory discourse to his *Dictionnaire*, but published separately in 1868, opens with the well-known dictum, "La chimie est une science française."

For his life and work, with a list of his publications, see Charles Friedel's memoir in the *Bulletin de la Société Chimique* (1885); also A. W. von Hofmann in the *Ber. deut. chem. Gesellsch.* (1887), reprinted in vol. iii. of his *Zur Erinnerung an vorangegangene Freunde* (1888).

WÜRZBURG, a university town and episcopal see of Bavaria, Germany, capital of the province of Lower Franconia, situated on the Main, 60 m. by rail S.E. from Frankfort and at the junction of main lines to Bamberg and Nuremberg. Pop. (1905) 80,220. An ancient stone bridge (1474–1607), 650 ft. long and adorned with statues of saints, and two modern bridges, the Luitpold (1887) and the Ludwig (1894), connect the two parts of the town on each side of the river. On the lofty Leistenberg stands the fortress of Marienberg, which from 1261 to 1720 was the residence of the bishops. The main part of the town, on the right bank, is surrounded by shady promenades, the Ringstrasse and the quay.

Würzburg is quaintly and irregularly built; many of the houses are interesting specimens of medieval architecture; and the numerous old churches recall the fact that it was long the capital of an ecclesiastical principality. The principal church is the imposing Romanesque cathedral, a basilica with transepts, begun in 1042 and consecrated in 1189. The four towers, however, date from 1240, the (rococo) façade from 1711–1719, and the dome from 1731. The spacious transepts terminate in apses. The exterior was restored in 1882–1883. The beautiful Marienkapelle, a Gothic edifice of 1377–1441, was restored in 1856; it is embellished with twenty statues by Tilman Riemenschneider (d. 1531). The Haugerstifts church, with two towers and a lofty dome, was built in the Italian Renaissance style in 1670–1691. The bones of St Kilian, the patron saint of Würzburg, are preserved in the Neumünster church, which dates from the 11th century; Walther von der Vogelweide is buried in the adjoining cloisters. The church of St Burkhard is externally one of the best-preserved architectural monuments in the city. It was built in 1033–1042, in the Romanesque style, and was restored in 1168. The Late Gothic choir dates from 1494–1497. The Neubaukirche, or university church, curiously unites a Gothic exterior with a Classical interior. The Protestant church of St Stephen (1782–1789) originally belonged to a Benedictine abbey. Of the secular buildings in Würzburg the most conspicuous is the palace, a huge and magnificent edifice built in 1720–1744 in imitation of Versailles, and formerly the residence of the bishops and grand-dukes of Würzburg. The Julius hospital, a large and richly endowed institution affording food and lodging to 600 persons daily, was founded in 1576 by Bishop Julius Echter von Mespelbrunn (1545–1619). In 1906 it was arranged to convert this into a residential college for students, the hospital being removed to a site outside the town. The quaint town hall dates in part from 1456. Among the other chief buildings are the government offices, the law courts, the theatre, the Maxschule, the observatory and the various university buildings.

A university was founded at Würzburg in 1403, but it only existed for a few years. The present university was founded by Bishop Julius in 1582. The medical faculty speedily became famous, and has remained the most important faculty in Würzburg ever since. Here W. K. Röntgen discovered the "Röntgen rays" in 1896. Würzburg was long the stronghold of Jesuitism in Germany, and the Roman Catholic theological faculty still attracts a large number of students. The university has a library containing 300,000 volumes, and is attended by about 1400 students. In no other university city of Germany has so much of the medieval academic life been preserved.

Würzburg is surrounded by vineyards, which yield some of the best wine in Germany. Its principal industries are the manufacture of tobacco, furniture, machinery, scientific instruments and railway carriages. It has also breweries, and produces bricks, vinegar, malt and chocolate.

The site of the Leistenberg was occupied by a Roman fort, and was probably fortified early in the 13th century. *Wircebirgum* is the old Latin form of the name of the town; *Herbipolis* (herb town) first appears in the 12th century. The bishopric was probably founded in 741, but the town appears to have existed in the previous century. The first bishop was St Burkhard, and his successors soon acquired much temporal power; about the 12th century they had ducal authority in Eastern Franconia. It is not surprising that quarrels broke out between the bishops and the citizens, and the latter espoused the cause of the emperor Henry IV., while the former joined the emperor's foes. The struggle continued intermittently until 1400, when the citizens were decisively defeated and submitted. Several imperial diets were held in Würzburg, chief among these being the one of 1180 when Henry the Lion, duke of Saxony, was placed under the ban.

By the peace of Lunéville the bishopric was secularized, and in 1803 Würzburg passed to Bavaria. The peace of Pressburg in 1805 transferred it, under the name of an electorate, to Ferdinand, formerly grand-duke of Tuscany, who joined the confederation of the Rhine and took the title of grand-duke of Würzburg. In 1815 the congress of Vienna restored Würzburg to Bavaria. The Würzburg Conference is the name given to the meeting of representatives of the smaller German states in 1859 to devise some means of mutual support. The conference, however, had no result. Würzburg was bombarded and taken by the Prussians in 1866, in which year it ceased to be a fortress. The bishopric of Würzburg at one time embraced an area of about 1900 sq. m. and had about 250,000 inhabitants. A new bishopric of Würzburg was created in 1817.

For the town see S. Göbl, *Würzburg, Ein kulturhistorisches Städtebild* (Würzburg, 1896); J. Gramich, *Verfassung und Verwaltung der Stadt Würzburg* (Würzburg, 1882); M. Cronthal, *Die Stadt Würzburg im Bauernkriege* (Würzburg, 1887); Heffner, *Würzburg und seine Umgebungen* (Würzburg, 1871); Beckmann, *Führer durch Würzburg* (1906); and Holländer and Hessler, *Malerisches aus Alt-Würzburg* (Würzburg, 1898). For the university see F. X. von Wegele, *Geschichte der Universität Würzburg* (Würzburg, 1882). For the bishopric see J. Hofmann, *Die Heiligen und Seligen des Bistums Würzburg* (Würzburg, 1889); F. J. B. Stamminger and A. Amrhein, *Franconia sacra. Geschichte des Bistums Würzburg* (Würzburg, 1889–1901); and T. Henner, *Die herzogliche Gewalt der Bischöfe von Würzburg* (Würzburg, 1874).

WURZEN, a town of Germany in the kingdom of Saxony, on the Mulde, here crossed by two bridges, $15\frac{1}{2}$ m. by rail N.E. of Leipzig on the main line (via Riesa) to Dresden. Pop. (1905) 17,212. It has a cathedral dating from the 12th century, a castle, at one time a residence of the bishops of Meissen and now utilized as law courts, several schools and an agricultural college. The industries comprise iron-founding, weaving and brewing, and the making of machinery, carpets, cigars, furniture, leather and paper.

Wurzen was founded by the Sorbs, and was a town early in the 12th century, when Herwig, bishop of Meissen, founded a monastery here. In 1581 it passed to the elector of Saxony, and in the Thirty Years' War was sacked by the Swedes.

WUTTKE, KARL FRIEDRICH ADOLF (1819–1870), German Protestant theologian, was born at Breslau on the 10th of November 1819. He studied theology at Breslau, Berlin and Halle, where he eventually became professor ordinarius; and is known as the author of a treatise on Christian ethics (*Handbuch der christlichen Sittenlehre*, 1860–1863, 3rd ed. 1874–1875; Eng. trans., New York, 1873) and works on heathen religion (*Die Geschichte des Heidentums*, 1851–1853) and superstition (*Der deutsche Volksaberglaube der Gegenwart*, 1865, 2nd ed. 1869). He died on the 12th of April 1870.

WYANDOT, or HURON (*q.v.*), a tribe of N. American Indians of Iroquoian stock. When first met by the French early in the 17th century, the Wyandots lived between Georgian Bay and Lake Simcoe, Ontario. They were then estimated at about 10,000, scattered over twenty villages. They were continually the victims of raids on the part of their neighbours the Iroquoian league of six nations and the Sioux, being driven from place to place, and a dispersal in 1650 resulted in one section settling in Quebec, while others found their way to Ohio, where they fought for the English in the Wars of Independence and 1812. By a treaty made in 1817 the latter section was granted territory in Ohio and Michigan, but the larger part of this was sold in 1819. In 1842 they migrated to Kansas. In 1855 many became citizens, the remainder being in 1867 removed to a reservation (now N.E. Oklahoma), numbering about 400 in 1905. The Hurons at Lorette, in Quebec, also number about 400.

See *Handbook of American Indians*, ed. F. W. Hodge (Washington, 1907), s.v. "Huron."

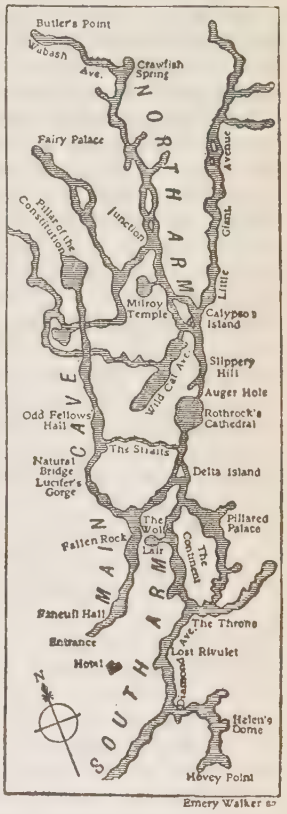
WYANDOTTE, a city of Wayne county, Michigan, U.S.A., on the Detroit river, about 6 m. S. by W. of Detroit. Pop. (1900) 5183, of whom 1267 were foreign-born; (1904) 5425; (1910) 8287. It is served by the Michigan Central, the Lake Shore & Michigan Southern, the Detroit, Toledo & Ironton, and (for freight only) the Detroit & Toledo Shore Line railways, and by two interurban electric lines. Salt and limestone are found here and the city has various manufactures. Wyandotte was first settled about 1820, was laid out as a town in 1854, and chartered as a city in 1867.

WYANDOTTE CAVE, a cave in Jennings township, Crawford county, Indiana, U.S.A., 5 m. N.E. of Leavenworth, on the Ohio river, and 12 m. from Corydon, the early territorial capital. The nearest railway station is Milltown, 9 m. distant. The cave is in a rugged region of high limestone hills, in one of which its main entrance is found, 220 ft. above the level of the Blue river, whose original name, the Wyandotte, was transferred to the cave by Governor David Wallace; it having previously been styled the Mammoth Cave of Indiana, the Epsom Salts Cave, and the Indiana Saltpetre Cave. The exact date of discovery is not known; but early records show it to have been pre-empted by a Dr Adams in 1812 for the manufacture of saltpetre, and his vats and hoppers are still to be seen. After the War of 1812 he relinquished his claim; and in 1819 the ground was bought from the United States government by Henry P. Rothrock, whose heirs are its owners. The earliest account is in Flint's *Geography* (1831); the first official report of it was by Dr R. T. Brown (1831); and it was first mapped by the writer (1855), whose map was revised by John Collett, state geologist (1878). No instrumental survey has been made, nor have all its intricate windings been explored. Its known passages aggregate more than 23 m. in length, and 144 places are named as noteworthy. The "Old Cave" contains the saltpetre works, and ends in a remarkable chamber exactly 144 ft. long and 56 ft. wide, in which stands the Pillar of the Constitution, a stalagmitic column perfectly cylindrical and 71 ft. in circumference, entirely composed of crystalline carbonate of lime (satin-spar), fluted and snow-white. A cavity in the column was first claimed by H. C. Hovey as a prehistoric quarry, proved to be such by the stag horns and boulder pounders found in its vicinity. His careful estimate of the rate of stalagmitic growth showed that 1000 years would have been needed to form the lip now covering the incision.

In the N. arm of the newer part of the cave, opened in 1850, is an immense room, styled Rothrock's Cathedral, 1000 ft. in circumference and 200 ft. high, with a rugged central hill 135 ft. high, surmounted by statuesque stalagmites, near which is another quarry of satin-spar with similar fragments, pounders and aboriginal relics. When Mr Hovey visited this cave in 1855 he found many extinct torches, charcoal embers, poles and pounders, as well as numerous footprints, in the soft nitreous earth of certain avenues, which were left by exploring parties previous to the coming of the white man.

In the Pillared Palace a number of large alabaster shafts had been thrown down and fragments carried away. Near by were so-called "bear-wallows," which proved to be the remains of an aboriginal workshop, where masses of flint were broken into rectangular blocks; and spalls and flint-chips encumber the floor and choke the passage-way. Milroy's Temple is a magnificent room, 100 by 150 ft. in its dimensions. It contains many remarkable formations; and its display of helictites, or twisted stalactites, is unsurpassed.

As Wyandotte Cave has no large streams and few pools or springs, its fauna and flora are not extensive. Formerly bears, wolves and other wild animals took refuge in its fastnesses; and bats, rats, mice and salamanders are frequent visitors. Blind crawfish (*Cambarus pellucidus*) inhabit the Crawfish Spring. Cave crickets (*Hadenoecus subterraneus*) abound. A dozen kinds of insects, with a few varieties of spiders, flies and worms, complete the meagre list. The flora include mainly forms brought in from the outside.



Emery Walker sc.

For more full descriptions of Wyandotte Cave and its contents, see Hovey's *Celebrated American Caverns*, pp. 123-153; Indiana State Geological Reports, by R. T Brown, E. T. Cox, John Collett and W. S. Blatchley; and concerning cave fauna reports and papers by C. H. Eigenmann, professor of zoology, Indiana State University. (H. C. H.)

WYANT, ALEXANDER H. (1836–1892), American artist, was born at Port Washington, Ohio, on the 11th of January 1836. He was a pupil of Hans Gude in Carlsruhe, Germany. A trip with a government exploring expedition in the west of America undermined his health, and he painted mainly in the high altitudes of the Adirondack Mountains. He was elected a full member of the National Academy of Design, New York, in 1869, and died in New York City on the 29th of November 1892. He was only moderately appreciated during his lifetime, though after his death his works were eagerly sought for.

WYAT, SIR THOMAS (1503–1542), English poet and statesman, elder son of Henry Wyat, or Wiat, afterwards knighted, and his wife Anne, daughter of John Skinner of Reigate, Surrey, was born at Allington Castle, near Maidstone, Kent, in 1503. His father (1460–1537) belonged to a Yorkshire family, but bought Allington about 1493. He was an adherent of the Lancastrian party, and was imprisoned and put to the torture by Richard III. The family records (in the possession of the earl of Romney) relate that during his imprisonment he was saved from starvation by a cat that brought him pigeons. At the accession of Henry VII. he became knight of the Bath (1509), knight banneret (1513) and held various offices at court. His son, Thomas Wyat, was admitted at St John's College, Cambridge, when about twelve years of age, took his B.A. degree in 1518, and proceeded M.A. in 1522. The vague statement of Anthony à Wood (*Athen. Oxon.* i. 124), that he was transferred to Oxford to attend Wolsey's new college there, has no foundation in fact. He married very early Elizabeth Brooke, daughter of the 3rd

Lord Cobham. The marriage was an unhappy one, for a letter (29th March 1537) from the lady's brother to Thomas Cromwell complains that Wyat had gone abroad and made no provision for his wife, and a letter from the Spanish ambassador Chapuys to Charles V. (9th Feb. 1542) speaks of her having been repudiated by her husband. As early as 1516 Wyat was server extraordinary to the king, and in 1524 he was at court as keeper of the king's jewels. He was one of the champions in the Christmas tournament of 1525. His father had been associated with Sir Thomas Boleyn as constable of Norwich Castle, and he had thus been early acquainted with Anne Boleyn. He appears to have been generally regarded as her lover, but it is possible that the relations between them were merely of the fashionable poetic sort. In 1526 he was sent with Sir Thomas Cheney to congratulate Francis I. on his safe return from Spain; in 1527 he accompanied Sir John Russell, afterwards 1st earl of Bedford, on an embassy to the papal court. He was sent by Russell, who was incapacitated by a broken leg, to negotiate with the Venetian republic. On his return journey to Rome he was taken prisoner by the Spanish troops, who demanded 3000 ducats for his ransom, but he contrived to escape. In 1528 he was acting as high marshal at Calais with a salary of two shillings per day, and was only superseded in November 1530. During the following years he was constantly employed in Henry's service, and was apparently high in his favour. He was, however, sent to the Tower in 1536, perhaps because it was desired that he should incriminate the queen. His father's correspondence with Cromwell does not suggest that his arrest had anything to do with the proceedings against Anne Boleyn, but the connexion is assumed (*Letters and Papers of Henry VIII.* vol. x. No. 919) in the letters of John Hussey to Lord Lisle, deputy of Calais. The Roman Catholic writer, Nicholas Harpsfield, makes a circumstantial statement (*Pretended Divorce . . .* Camden Soc. p. 253) that Wyat had confessed his intimacy with Anne to Henry VIII. and warned him against marrying her; but this, in view of his continued favour, seems highly improbable. He was released after a month's imprisonment, and in the autumn of that year took part in the suppression of the Lincolnshire rising. In March 1537 he was knighted, and a month later was sent abroad as ambassador to Charles V., whose ill-will had been revived by the declaration of the illegitimacy of the princess Mary. In 1538 he was joined by Edmund Bonner, then a simple priest, and one Simon Haynes, and seems to have been ashamed of their bad manners, and to have offended them in various ways. Bonner had evidently been desired by Thomas Cromwell to send his own account of the negotiations. He wrote to Cromwell (2nd Sept. 1538) a long letter (Petyt MS. 47, Middle Temple; first printed in the *Gentleman's Magazine*, June 1850) in which he accused Wyat of disloyalty to the king's interests, and of many personal slights to himself. Wyat was unsuccessful in the difficult affairs entrusted to him, but so long as Cromwell ruled he had a firm friend at court, and no notice was taken of Bonner's allegations. Cromwell even seems to have taken some care of his private affairs, which were left in considerable disorder. He was recalled in April 1539, but later in the same year he was employed on another embassy to the emperor, who was on his way to the Low Countries. After Cromwell's death Wyat's enemies renewed their attacks, and he was imprisoned (17th Jan. 1541) in the Tower on the old charges, with the additional accusation of treasonable correspondence with Cardinal Reginald Pole. Being privately informed of the nature of the charges, he prepared an eloquent and manly defence of his conduct in two documents addressed to the Privy Council and to his judges, in which he cleared himself effectually and exposed his accusers' motives. He was released at the intercession of the queen, Catherine Howard, on condition that he confessed his guilt and took back his wife, from whom he had been separated for fifteen years, on pain of death if he were thenceforth untrue to her (see Chapuys to Charles V., March 1541). He received a formal pardon on the 21st of March, and received during the year substantial marks of the king's favour. In the summer of the next year he was sent to Falmouth to meet the ambassadors of the emperor. The heat brought on a fever to which he succumbed at Sherborne, Dorset, on the 11th of October. A Latin elegy on his death was written by his friend John Leland, "Naenia in mortem Thomae Viati equitis incomparabilis"; and Henry Howard, earl of Surrey, celebrated his memory in some well-known lines beginning "Wyat resteth here, that quick could never rest," and in two sonnets.

Wyat's work falls readily into two divisions: the sonnets, rondeaus, and lyric poems dealing with love; and the satires and the version of the penitential psalms. The love poems probably date from before his first imprisonment. A large number were published in 1557 in *Songes and Sonettes* (*Tottel's Miscellany*). Wyat's contributions number 96 out of a total of 310. These have been supplemented from MSS. He was the pioneer of the sonnet in England, and the acknowledged leader of the "company of courtly makers who . . . having travailed in Italie and there tasted the sweet and stately measures and stile of the Italian Poesie, as novices newly crept out of the schooles of Dante, Arioste and Petrarche, greatly pollished our rude and homely maner of vulgar Poesie, from that it had been before" (Puttenham's *Art of English Poesie*, 1589).[1] Wyat wrote in all thirty-one sonnets, ten of which are direct translations of Petrarch. The sentiment is strained and artificial. Wyat shows to greater advantage in his lyrical metres, in his epigrams and songs, especially in those written for music,[2] where he is less hampered by the conventions of the Petrarcan tradition, to which his singularly robust and frank nature was ill-fitted. His thought is generally far in advance of his technical skill, and his disciple Surrey has been far more widely recognized, chiefly because of the superior smoothness of his versification. His works are preserved in a MS. in possession of the Harrington family, which originally belonged to Wyat himself, and in another belonging to the duke of Devonshire in which are inscribed the names of Wyat's sister, Margaret Lee, and of the duchess of Richmond, Surrey's sister. The text differs considerably from Tottel's, which has been generally adopted. Wyat wrote three excellent satires—"On the mean and sure estate," dedicated to John Poins, "Of the Courtier's Life," to the same, and "How to use the court and himself." They are written in *terza rima* and in form and matter owe much to Luigi Alamanni. In the "Penitential Psalms" each is preceded by a prologue describing the circumstances under which the psalmist wrote, and the psalms themselves are very freely paraphrased, with much original matter from the author. They were published in 1549 by Thomas Raynald and John Harrington as *Certayne Psalmes . . . drawen into English meter by Sir Thomas Wyat Knyght.*

None of Wyat's other poems were printed until fifteen years after his death, in *Songes and Sonettes*. The standard edition of his works is that by Dr G. F. Nott, forming the second volume (1816) of *The Works of Henry Howard, Earl of Surrey, and of Sir Thomas Wyat the Elder*, with an exhaustive memoir. Some family papers, now in the possession of the earl of Romney, were collected by Richard Wyat in 1727. Some use of these is made in *The History of Botley Parish* (1892), by J. Cave Browne. See also Brewer and Gairdner, *Letters and Papers of Henry VIII.* (especially from 1536 to 1542); *The Poetical Works of Sir Thomas Wyatt* (1866), with a memoir in the *Aldine Edition of the British Poets*; Professor E. Arber's introductory matter to the edition of *Songes and Sonnettes* (1870) in his *English Reprints*; R. Alscher, "Sir Thomas Wyatt . . ." (1886), in *Wiener Beiträge zur deutschen u. engl. Philologie*, giving a full account of Wyat's metrical practice; W. E. Simonds, *Sir Thomas Wyatt* (Boston, 1889); W. J. Courthope, *Hist. of Eng. Poetry*, vol. ii. (1897), the second chapter of which is devoted to a critical study of Wyat; E. Flügel, "Die handschriftliche Überlieferung der Gedichte von Sir Thomas Wyat," in *Anglia*, vol. xviii.; F. M. Padelford, *Early Sixteenth Century Lyrics* (1907).

WYAT, SIR THOMAS (d. 1554), English conspirator, son of the preceding, was over twenty-one in 1543, but the date of his birth is uncertain. He is said to have accompanied his father on his mission to Spain, and to have been turned into an enemy of the

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[1] Ed. J. Haslewood, *Ancient Critical Essays*, i. 48 (1811).

[2] One of the most musical of the pieces printed in his works, however, "The Lover complayneth the unkindnes of his Love," beginning "My lute, awake," is sometimes attributed to George Boleyn, Lord Rochford (see E. Bapst, *Deux Gentilshommes poètes de la cour de Henri VIII*, p. 142).

Spaniards by the menaces of the Inquisition. In 1537 he married Jane, daughter of Sir William Hawte of Bishopsbourne in Kent, by whom he had ten children. Wyat was noted in his youth as dissipated, and even as disorderly. He is known to have had a natural son, whose mother Elizabeth was a daughter of Sir Edward Darrell of Littlecote. In 1542 he inherited the family property of Allington Castle and Boxley Abbey on the death of his father. From 1543 to 1550 he saw service abroad as a soldier. In 1554 he joined with the conspirators who combined to prevent the marriage of Queen Mary with Philip the prince of Spain, afterwards King Philip II. A general movement was planned; but his fellow-conspirators were timid and inept, the rising was serious only in Kent, and Wyat became a formidable rebel mostly by accident. On the 22nd of January 1554 he summoned a meeting of his friends at his castle of Allington, and the 25th was fixed for the rising. On the 26th Wyat occupied Rochester, and issued a proclamation to the county. The country people and local gentry collected, but at first the queen's supporters, led by Lord Abergavenny and Sir Robert Southwell, the sheriff, appeared to be able to suppress the rising with ease, gaining some successes against isolated bands of the insurgents. But the Spanish marriage was unpopular, and Kent was more affected by the preaching of the reformers than most of the country districts of England. Abergavenny and Southwell were deserted by their men, who either disbanded or went over to Wyat. A detachment of the London train-bands sent against him by Queen Mary, under the command of the duke of Norfolk, followed their example. The rising now seemed so formidable that a deputation was sent to Wyat by the queen and council to ask for his terms. He insisted that the Tower should be surrendered to him, and the queen put under his charge. The insolence of these demands caused a reaction in London, where the reformers were strong and were at first in sympathy with him. When he reached Southwark on the 3rd of February he found London Bridge occupied in force, and was unable to penetrate into the city. He was driven from Southwark by the threats of Sir John Brydges (or Bruges), afterwards Lord Chandos, who was prepared to fire on the suburb with the guns of the Tower. Wyat now marched up the river to Kingston, where he crossed the Thames, and made his way to Ludgate with a part of his following. Some of his men were cut off. Others lost heart and deserted. His only hope was that a rising would take place, but the loyal forces kept order, and after a futile attempt to force the gate Wyat surrendered. He was brought to trial on the 15th of March, and could make no defence. Execution was for a time delayed, no doubt in the hope that in order to save his life he would say enough to compromise the queen's sister Elizabeth, afterwards Queen Elizabeth, in whose interests the rising was supposed to have been made. But he would not confess enough to render her liable to a trial for treason. He was executed on the 11th of April, and on the scaffold expressly cleared the princess of all complicity in the rising. His estates were afterwards partly restored to his son George, the father of the Sir Francis Wyat (d. 1644) who was governor of Virginia in 1621–26 and 1639–1642. A fragment of the castle of Allington is still inhabited as a farm-house, near Maidstone, on the bank of the Medway.

See G. F. Nott, *Works of Surrey and of Sir Thomas Wyat* (1815); and Froude, *History of England.*

WYATT, JAMES (1746–1813), English architect, was born at Burton Constable in Staffordshire on the 3rd of August 1746. He was the sixth son of Benjamin Wyatt, a farmer, timber merchant and builder. At the age of fourteen his taste for drawing attracted the attention of Lord Bagot, newly appointed ambassador to the pope, who took him with him to Rome, where he spent five or six years in studying architecture. He returned to England in 1766, and gained his first great success by the adaptation for dramatic purposes of the Pantheon in Oxford Street, London (1772), a work which was destroyed by fire twenty years later. In 1776 he was made surveyor of Westminster Abbey, and in 1778 and the following years executed many important commissions at Oxford.

During this earlier period Wyatt shared the prevailing contempt for Gothic architecture; thus the New Buildings at Magdalen College, Oxford, designed by him, formed part of a scheme, the plans for which are extant, which involved the demolition of the famous medieval quadrangle and cloisters. He built many country houses in the classic style, of which he proved himself a master. Gradually, however, he turned his attention to Gothic, the spirit of which, in spite of his diligent study of medieval models, he never understood. The result is still visible in such "Gothic" freaks as that at Ashridge Park, Hertfordshire, built for Lord Bridgewater to replace the ancient priory, and in the lamentable "restorations," *e.g.* in Salisbury and Lichfield cathedrals, which earned for him even among contemporary archaeologists the title of "the Destroyer." Of these Gothic experiments the most celebrated was Fonthill Abbey, built for Beckford (the eccentric author of *Vathek*), the great tower of which speedily collapsed, while much of the rest has been pulled down. None the less, Wyatt must be regarded as the pioneer of the "Gothic revival," while his general influence may be gauged by the fact that nearly every county and large town in England possesses or possessed buildings by him.

On the death of Sir William Chambers in 1796, he was appointed surveyor-general to the Board of Works. In 1785 he became a member of the Royal Academy, and during a misunderstanding between Benjamin West and the Academy, in 1805, he filled the presidential office at the wish of King George III. He was killed by a fall from his carriage on the 4th of September 1813, and was buried in Westminster Abbey. His son, Benjamin Dean Wyatt (1775–1850?), who succeeded him as surveyor of Westminster Abbey, was also an architect of some distinction.

WYCHERLEY, WILLIAM (*c.* 1640–1716), English dramatist, was born about 1640 at Clive, near Shrewsbury, where for several generations his family had been settled on a moderate estate of about £600 a year. Like Vanbrugh, Wycherley spent his early years in France, whither, at the age of fifteen, he was sent to be educated in the very heart of the "precious" circle on the banks of the Charente. Wycherley's friend, Major Pack, tells us that his hero "improved, with the greatest refinements," the "extraordinary talents" for which he was "obliged to nature." Although the harmless affectations of the circle of Madame de Montausier, formerly Madame de Rambouillet, are certainly not chargeable with the "refinements" of Wycherley's comedies—comedies which caused even his great admirer Voltaire to say afterwards of them, "Il semble que les Anglais prennent trop de liberté et que les Françaises n'en prennent pas assez"—these same affectations seem to have been much more potent in regard to the "refinements" of Wycherley's religion.

Wycherley, though a man of far more intellectual power than is generally supposed, was a fine gentleman first, a responsible being afterwards. Hence under the manipulations of the heroine of the "Garland" he turned from the Protestantism of his fathers to Romanism—turned at once, and with the same easy alacrity as afterwards, at Oxford, he turned back to Protestantism under the manipulations of such an accomplished master in the art of turning as Bishop Barlow. And if, as Macaulay hints, Wycherley's turning back to Romanism once more had something to do with the patronage and unwonted liberality of James II., this merely proves that the deity he worshipped was the deity of the "polite world" of his time—gentility. Moreover, as a professional fine gentleman, at a period when, as the genial Major Pack says, "the amours of Britain would furnish as diverting memoirs, if well related, as those of France published by Rabutin, or those of Nero's court writ by Petronius," Wycherley was obliged to be a loose liver. But, for all that, Wycherley's sobriquet of "Manly Wycherley" seems to have been fairly earned by him, earned by that frank and straightforward way of confronting life which, according to Pope and Swift, characterized also his brilliant successor Vanbrugh.

That effort of Wycherley's to bring to Buckingham's notice the case of Samuel Butler (so shamefully neglected by the court Butler had served) shows that the writer of even such heartless plays as *The Country Wife* may be familiar with generous impulses, while his uncompromising lines in defence of Buckingham, when the duke in his turn fell into trouble, show that the inventor of so shameless a fraud as that which forms the pivot of *The Plain Dealer* may in actual life possess that passion for fairplay which is believed to be a specially English quality. But among the "ninety-nine" religions with which Voltaire accredited England there is one whose permanency has never been shaken—the worship of gentility. To this Wycherley remained as faithful to the day of his death as Congreve himself. And, if his relations to that "other world beyond this," which the Puritans had adopted, were liable to change with his environments, it was because that "other world" was really out of fashion altogether.

Wycherley's university career seems also to have been influenced by the same causes. Although Puritanism had certainly not contaminated the universities, yet English "quality and politeness" (to use Major Pack's words) have always, since the great rebellion, been rather ashamed of possessing too much learning. As a fellow-commoner of Queen's College, Oxford, Wycherley only lived (according to Wood) in the provost's lodgings, being entered in the public library under the title of "Philosophiae Studiosus" in July 1660. And he does not seem to have matriculated or to have taken a degree.

Nor when, on quitting Oxford, he took up his residence in the Inner Temple, where he had been entered in 1659, did he give any more attention to the dry study of the law than was proper to one so warmly caressed "by the persons most eminent for their quality or politeness." Pleasure and the stage were alone open to him, and probably early in 1671 was produced, at the Theatre Royal, *Love in a Wood*. It was published the next year. With regard to this comedy Wycherley told Pope—told him "over and over" till Pope believed him—believed him, at least, until they quarrelled about Wycherley's verses—that he wrote it the year before he went to Oxford. But we need not believe him: the worst witness against a man is mostly himself. To pose as the wicked boy of genius has been the foolish ambition of many writers, but on inquiry it will generally be found that these inkhorn Lotharios are not nearly so wicked as they would have us believe. When Wycherley charges himself with having written, as a boy of nineteen, scenes so callous and so depraved that even Barbara Palmer's appetite for profligacy was, if not satisfied, appeased, there is, we repeat, no need to believe him. Indeed, there is every reason to disbelieve him,—not for the reasons advanced by Macaulay, however, who in challenging Wycherley's date does not go nearly deep enough. Macaulay points to the allusions in the play to gentlemen's periwigs, to guineas, to the vests which Charles ordered to be worn at court, to the great fire, &c., as showing that the comedy could not have been written the year before the author went to Oxford. We must remember, however, that even if the play had been written in that year, and delayed in its production till 1672, it is exactly this kind of allusion to recent events which any dramatist with an eye to freshness of colour would be certain to weave into his dialogue. It is not that "the whole air and spirit of the piece belong to a period subsequent to that mentioned by Wycherley," but that "the whole air and spirit of the piece" belong to a man—an experienced and hardened young man of the world—and not to a boy who would fain pose as an experienced and hardened young man of the world. The real defence of Wycherley against his foolish impeachment of himself is this, that *Love in a Wood*, howsoever inferior in structure and in all the artistic economies to *The Country Wife* and *The Plain Dealer*, contains scenes which no inexperienced boy could have written—scenes which, not for moral hardness merely, but often for real dramatic ripeness, are almost the strongest to be found amongst his four plays. With regard to dramatic ripeness, indeed, if we were asked to indicate the finest touch in all Wycherley, we should very likely select a speech in the third scene of the third act of this very play, where the vain, foolish and boastful rake Dapperwit, having taken his friend to see his mistress for the express purpose of advertising his lordship over her, is coolly denied by her and insolently repulsed. "I think," says Dapperwit, "women take inconstancy from me worse than from any man breathing."

Now, does the subsequent development of Wycherley's dramatic genius lead us to believe that, at nineteen, he could have given this touch, worthy of the hand that drew Malvolio? Is there anything in his two masterpieces—*The Country Wife* or *The Plain Dealer*—that makes it credible that Wycherley, the boy, could have thus delineated by a single quiet touch vanity as a chain-armour which no shaft can pierce—vanity, that is to say, in its perfect development? However, Macaulay (forgetting that, among the myriad vanities of the writing fraternity, this of pretending to an early development of intellectual powers that ought not to be, even if they could be, developed early is at once the most comic and the most common) is rather too severe upon Wycherley's disingenuousness in regard to the dates of his plays. That the writer of a play far more daring than Etheredge's *She Would if She Could*—and far more brilliant too—should at once become the talk of Charles's court was inevitable; equally inevitable was it that the author of the song at the end of the first act, in praise of harlots and their offspring, should touch to its depths the soul of the duchess of Cleveland. Possibly Wycherley intended this famous song as a glorification of Her Grace and her profession, for he seems to have been more delighted than surprised when, as he passed in his coach through Pall Mall, he heard the duchess address him from her coach window as a "rascal," a "villain," and as a son of the very kind of lady his song had lauded. For his answer was perfect in its readiness: "Madam, you have been pleased to bestow a title on me which belongs only to the fortunate." Perceiving that Her Grace received the compliment in the spirit in which it was meant, he lost no time in calling upon her, and was from that moment the recipient of those "favours" to which he alludes with pride in the dedication of the play to her. Voltaire's story (in his *Letters on the English Nation*) that Her Grace used to go to Wycherley's chambers in the Temple disguised as a country wench, in a straw hat, with pattens on and a basket in her hand, may be apocryphal—very likely it is—for disguise was quite superfluous in the case of the mistress of Charles II. and Jacob Hall, but it at least shows how general was the opinion that, under such patronage as this, Wycherley's fortune as poet and dramatist, "eminent for his quality and politeness," was now made.

Charles, who had determined to bring up his son, the duke of Richmond, like a prince, was desirous of securing for tutor a man so entirely qualified as was Wycherley to impart what was then recognized as the princely education, and it seems pretty clear that, but for the accident, to which we shall have to recur, of his meeting the countess of Drogheda at Bath and secretly marrying her, the education of the young man would actually have been entrusted by his father to Wycherley as a reward for the dramatist's having written *Love in a Wood*.

Whether Wycherley's experiences as a naval officer, which he alludes to in his lines "On a Sea Fight which the Author was in betwixt the English and the Dutch," occurred before or after the production of *Love in a Wood* is a point upon which opinions differ, but on the whole we are inclined to agree with Macaulay, against Leigh Hunt, that these experiences took place not only after the production of *Love in a Wood* but after the production of *The Gentleman Dancing Master*, in 1673. We also think, with Macaulay, that he went to sea simply because it was the "polite" thing to do so—simply because, as he himself in the epilogue to *The Gentleman Dancing Master* says, "all gentlemen must pack to sea."

This second comedy was published in 1673, but was probably acted late in 1671. It is inferior to *Love in a Wood*. In *The Relapse* the artistic mistake of blending comedy and farce damages a splendid play, but leaves it a splendid play still. In *The Gentleman Dancing Master* this mingling of discordant elements destroys a play that would never in any circumstances have been strong—a play nevertheless which abounds in animal spirits, and is luminous here and there with true dramatic points.

It is, however, on his two last comedies—*The Country Wife* and *The Plain Dealer*—that must rest Wycherley's fame as a master of that comedy of repartee which, inaugurated by Etheredge, and afterwards brought to perfection by Congreve and Vanbrugh, supplanted the humoristic comedy of the Elizabethans. *The Country Wife*, produced in 1672 or 1673 and published in 1675, is so full of wit, ingenuity, animal spirits and conventional humour that, had it not been for its motive—a motive which in any healthy state of society must always be as repulsive to the most lax as to the most moral reader—it would probably have survived as long as the acted drama remained a literary form in England. So strong, indeed, is the hand that could draw such a character as Majory Pinchwife (the undoubted original not only of Congreve's Miss Prue but of Vanbrugh's Hoyden), such a character as Sparkish (the undoubted original of Congreve's Tattle), such a character as Horner (the undoubted original of all those cool impudent rakes with whom our stage has since been familiar), that Wycherley is certainly entitled to a place alongside Congreve and Vanbrugh. And, indeed, if priority of date is to have its fair and full weight, it seems difficult to challenge Professor Spalding's dictum that Wycherley is “the most vigorous of the set.”

In order to do justice to the life and brilliance of *The Country Wife* we have only to compare it with *The Country Girl*, afterwards made famous by the acting of Mrs Jordan, that Bowdlerized form of *The Country Wife* in which Garrick, with an object more praiseworthy than his success, endeavoured to free it of its load of unparalleled licentiousness by disturbing and sweetening the motive—even as Voltaire afterwards (with an object also more praiseworthy than his success) endeavoured to disturb and sweeten the motive of *The Plain Dealer* in *La Prude*. While the two Bowdlerized forms of Garrick and Voltaire are as dull as the *Æsop* of Boursault, the texture of Wycherley's scandalous dialogue would seem to scintillate with the changing hues of shot silk or of the neck of a pigeon or of a shaken prism, were it not that the many-coloured lights rather suggest the miasmatic radiance of a foul ditch shimmering in the sun. It is easy to share Macaulay's indignation at Wycherley's satyr-like defilement of art, and yet, at the same time, to protest against that disparagement of their literary riches which nullifies the value of Macaulay's criticism. And scarcely inferior to *The Country Wife* is *The Plain Dealer*, produced probably early in 1674 and published three years later,—a play of which Voltaire said, “Je ne connais point de comédie chez les anciens ni chez les moderns où il y ait autant d'esprit.” This comedy had an immense influence, as regards manipulation of dialogue, upon all subsequent English comedies of repartee, and he who wants to trace the ancestry of Tony Lumpkin and Mrs Hardcastle has only to turn to Jerry Blackacre and his mother, while Manly (for whom Wycherley's early patron, the duke of Montausier, sat), though he is perhaps overdone, has dominated this kind of stage character ever since. If but few readers know how constantly the blunt sententious utterances of this character are reappearing, not on the stage alone, but in the novel and even in poetry, it is because a play whose motive is monstrous and intolerable can only live in a monstrous and intolerable state of society; it is because Wycherley's genius was followed by Nemesis, who always dogs the footsteps of the defiler of literary art. When Burns said—

> “The rank is but the guinea stamp,
> The man's the gowd for a' that”;

when Sterne, in *Tristram Shandy*, said, “Honours, like impressions upon coin, may give an ideal and local value to a bit of base metal, but gold and silver will pass all the world over without any other recommendation than their own weight,” what did these writers do but adopt—adopt without improving—Manly's fine saying to Freeman, in the first act:—“I weigh the man, not his title; 'tis not the king's stamp can make the metal better or heavier”? And yet it is in the fourth and fifth acts that the coruscations of Wycherley's comic genius are the most dazzling; also, it is there that the licentiousness is the most astonishing. Not that the worst scenes in this play are really more wicked than the worst scenes in Vanbrugh's *Relapse*, but they are more seriously imagined. Being less humorous than Vanbrugh's scenes, they are more terribly and earnestly realistic; therefore they seem more wicked. They form indeed a striking instance of the folly of the artist who selects a story which cannot be actualized without hurting the finer instincts of human nature. When Menander declared that, having selected his plot, he looked upon his comedy as three parts finished, he touched upon a subject which all workers in drama—all workers in imaginative literature of every kind—would do well to consider. In all literatures—ancient and modern—an infinite wealth of material has been wasted upon subjects that are unworthy, or else incapable, of artistic realization; and yet Wycherley's case is, in our literature at least, without a parallel. No doubt it may be right to say, with Aristotle, that comedy is an imitation of bad characters, but this does not mean that in comedy art may imitate bad characters as earnestly as she may imitate good ones,—a fact which Thackeray forgot when he made Becky Sharp a murderess, thereby destroying at once what would otherwise have been the finest specimen of the comedy of convention in the world. And perhaps it was because Vanbrugh was conscious of this law of art that he blended comedy with farce. Perhaps he felt that the colossal depravity of intrigue in which the English comedians indulged needs to be not only warmed by a superabundance of humour but softened by the playful mockery of farce before a dramatic circle such as that of the Restoration drama can be really brought within human sympathy. Plutarch's impeachment of Aristophanes, which affirms that the master of the old comedy wrote less for honest men than for men sunk in baseness and debauchery, was no doubt unjust to the Greek poet, one side of whose humour, and one alone, could thus be impeached. But does it not touch all sides of a comedy like Wycherley's—a comedy which strikes at the very root of the social compact upon which civilization is built? As to comparing such a comedy as that of the Restoration with the comedy of the Elizabethans, Jeremy Collier did but a poor service to the cause he undertook to advocate when he set the occasional coarseness of Shakespeare alongside the wickedness of Congreve and Vanbrugh. And yet, ever since Macaulay's essay, it has been the fashion to speak of Collier's attack as being levelled against the immorality of the “Restoration dramatists.” It is nothing of the kind. It is (as was pointed out so long ago as 1699 by Dr Drake in his little-known vigorous reply to Collier) an attack upon the English drama generally, with a special reference to the case of Shakespeare. While dwelling upon that noxious and highly immoral play *Hamlet*, Collier actually leaves unscathed the author of *The Country Wife*, but fastens on Congreve and Vanbrugh, whose plays—profligate enough in all conscience—seem almost decent beside a comedy whose incredible *vis motrix* is “the modish distemper.”

That a stage, indeed, upon which was given with applause *A Woman Killed with Kindness* (where a wife dies of a broken heart for doing what any one of Wycherley's married women would have gloried in doing) should, in seventy years, have given with applause *The Country Wife* shows that in historic and social evolution, as in the evolution of organisms, “change” and “progress” are very far from being convertible terms. For the barbarism of the society depicted in these plays was, in the true sense of the word, far deeper and more brutal than any barbarism that has ever existed in these islands within the historic period. If civilization has any meaning at all for the soul of man, the Englishmen of Chaucer's time, the Anglo-Saxons of the Heptarchy, nay, those half-naked heroes, who in the dawn of English history clustered along the southern coast to defend it from the invasion of Caesar, were far more civilized than that “race gangrenée”—the treacherous rakes, mercenary slaves and brazen strumpets of the court of Charles II., who did their best to substitute for the human passion of love (a passion which was known perhaps even to palaeolithic man) the promiscuous intercourse of the beasts of the field. Yet Collier leaves Wycherley unassailed, and classes Vanbrugh and Congreve with Shakespeare!

It was after the success of *The Plain Dealer* that the turning-point came in Wycherley's career. The great dream of all the men about town in Charles's time, as Wycherley's plays all show, was to marry a widow, young and handsome, a peer's daughter if possible—but in any event rich, and spend her money upon wine and women. While talking to a friend in a bookseller's shop at Tunbridge, Wycherley heard *The Plain Dealer* asked for by a lady who, in the person of the countess of Drogheda, answered all the requirements. An introduction ensued, then love-making, then marriage—a secret marriage, probably in 1680, for, fearing to lose the king's patronage and the income therefrom, Wycherley still thought it politic to pass as a bachelor. He had not seen enough of life to learn that in the long run nothing is politic but "straightforwardness." Whether because his countenance wore a pensive and subdued expression, suggestive of a poet who had married a dowager countess and awakened to the situation, or whether because treacherous confidants divulged his secret, does not appear, but the news of his marriage oozed out—it reached the royal ears, and deeply wounded the father anxious about the education of his son. Wycherley lost the appointment that was so nearly within his grasp—lost indeed the royal favour for ever. He never had an opportunity of regaining it, for the countess seems to have really loved him, and *Love in a Wood* had proclaimed the writer to be the kind of husband whose virtue prospers best when closely guarded at the domestic hearth. Wherever he went the countess followed him, and when she did allow him to meet his boon companions it was in a tavern in Bow Street opposite to his own house, and even there under certain protective conditions. In summer or in winter he was obliged to sit with the window open and the blinds up, so that his wife might see that the party included no member of a sex for which her husband's plays had advertised his partiality. She died, however, in the year after her marriage and left him the whole of her fortune. But the title to the property was disputed; the costs of the litigation were heavy—so heavy that his father was unable (or else he was unwilling) to come to his aid; and the result of his marrying the rich, beautiful and titled widow was that the poet was thrown into the Fleet prison. There he remained for seven years, being finally released by the liberality of James II.—a liberality which, incredible as it seems, is too well authenticated to be challenged. James had been so much gratified by seeing *The Plain Dealer* acted that, finding a parallel between Manly's "manliness" and his own, such as no spectator had before discovered, he paid off Wycherley's execution creditor and settled on him a pension of £200 a year. Other debts still troubled Wycherley, however, and he never was released from his embarrassments, not even after succeeding to a life estate in the family property. In coming to Wycherley's death, we come to the worst allegation that has ever been made against him as a man and as a gentleman. At the age of seventy-five he married a young girl, and is said to have done so in order to spite his nephew, the next in succession, knowing that he himself must shortly die and that the jointure would impoverish the estate.

Wycherley wrote verses, and, when quite an old man, prepared them for the press by the aid of Alexander Pope, then not much more than a boy. But, notwithstanding all Pope's tinkering, they remain contemptible. Pope's published correspondence with the dramatist was probably edited by him with a view to giving an impression of his own precocity. The friendship between the two cooled, according to Pope's account, because Wycherley took offence at the numerous corrections on his verses. It seems more likely that Wycherley discovered that Pope, while still professing friendship and admiration, satirized his friend in the *Essay on Criticism*. Wycherley died on the 1st of January 1716, and was buried in the vault of the church in Covent Garden. (T. W.-D.)

WYCLIFFE[1] (or WYCLIF), **JOHN** (*c.* 1320–1384), English reformer, was born, according to John Leland,[2] our single authority on the point, at Ipreswel (evidently Hipswell), 1 m. from Richmond in Yorkshire. The date may have been somewhere about 1320. Leland elsewhere mentions that he "drew his origin" from Wycliffe-on-Tees (*Collectanea*, ii. 329), so that his lineage was of the ancient family which is celebrated by Scott in *Marmion*. The Wycliffes had a natural connexion with the college at Oxford which had been founded in the latter part of the previous century by their neighbours, the Balliols of Barnard Castle; and to Balliol College, then distinctively an "arts" college,[3] John Wycliffe in due time proceeded. It has been generally believed, and was in fact believed not many years after his death, that he was a fellow of Merton College in 1356; but this identification probably rests on a confusion with a contemporary. That the future reformer was a fellow of Balliol is implied in the fact that some time after 1356, but before the summer of 1360, he was elected master. This office he held but a short time. So soon as 1361 he accepted a college living, that of Fillingham in Lincolnshire, and probably left Oxford for some time. In the same year the name of a certain "John de Wyclif of the diocese of York, M.A." appears as a suppliant to the Roman Curia for a provision to a prebend, canonry and dignity at York (*Cal. of Entries in the Papal Registries*, ed. Bliss, Petitions, i. 390). This was not granted, but Wycliffe received instead the prebend of Aust in the collegiate church of Westbury-on-Trym. In 1365 one "John de Wyclif" was appointed by Simon Islip, archbishop of Canterbury, to the wardenship of Canterbury Hall, a house which the archbishop founded for a mixed body of monks and secular clergy, and then—as a result of the inevitable quarrels—filled exclusively with the latter. Two years later, however, Islip's successor, the monk Simon Langham, reversed the process, replacing the intruded seculars by monks. The dispossessed warden and fellows appealed to Rome, and in 1371 judgment was given against them. The question of the identity of the warden of Canterbury Hall with the reformer is still a matter of dispute. It has been understood as referred to by Wycliffe himself (*De ecclesia*, cap. xvi. pp. 370 sq.), and was assumed by the contemporary monk of St Albans (*Chron. Angl.* "Rolls" ser. p. 115) and by Wycliffe's opponent William Woodford (*Fasc. Zizan.* p. 517), who found in Wycliffe's resentment at this treatment the motive for his attacks on the religious orders; it has likewise been assumed by a series of modern scholars, including Loserth (*Realencyklopädie*, 1908 ed., vol. xxi. p. 228, § 35), who only denies the deductions that Woodford drew from it. Dr Rashdall, on the other hand, following Shirley, brings evidence to show that the Wycliffe of Canterbury Hall could not have been the reformer, but was the same person as the fellow of Merton, this being the strongest argument against the identification of the latter with the reformer. The confusion is increased by the appearance of yet another "John Wyclif" or "Wiclif" on the books of Queen's College, as paying rent for rooms as a "pensioner" or "commoner" for the years 1371–1372, 1374–1375 and 1380–1381. It has thus been commonly assumed (*e.g.* by Loserth) that the reformer was at one time in residence at Queen's, the date being given as 1363. It is probable, however, that the John Wiclif of the Queen's College accounts is the same as the John Wyclif who appears in the College *computus* for 1371–1372 as one of the "almonry boys" of the College, and, therefore, certainly not the reformer.[1]

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[1] A note is necessary as to the spelling of Wycliffe's name. Out of thirteen contemporary entries in *documents*, twelve give "y" in the first syllable. In not one of these is there a "ck" (though once a "kc") (see F. D. Matthew in the *Academy*, June 7, 1884). The chroniclers, &c., offer every imaginable variety of spelling, and it is possible that one favourite form in more recent times, "Wickliffe," derived its popularity from the old play on the name, "nequam vita," which we find in Gascoigne. The spelling adopted in the present article is that of the village from which Wycliffe derived his name; it is also preferred by the editors of the Wycliffe Bible, by Milman and by Stubbs. "Wyclif" has the support of Shirley, of T. Arnold and of the Wyclif Society; while "Wiclif" is the popular form in Germany.

[2] *Itinerary*, Stow's transcript, Bodleian Library, Tanner MS. 464, f. 45 (Leland's original being mutilated at this place). Hearne misprinted the name "Spreswel" and thus set all Wycliffe's biographers on a search after a *vox nihili*. The identification of Spreswell with the site of a vanished hamlet near Wycliffe on the Tees, about 1 m. from that of a supposed "Old Richmond," accepted by Loserth on the authority of Lechler, is unsupported by any trustworthy evidence.

[3] See a document of 1325 printed in the appendix to the *Fourth Report* of the Historical Manuscripts Commission, pp. 442 sq. Provision for theological study was made by the benefaction of Sir Philip Somerville in 1340 (Lyte, *Hist. of the Univ. of Oxford*, p. 154, 1886).

These questions, even that of the wardenship of Canterbury, are, however, essentially unimportant, unless we are prepared with Woodford to impute mean motives to a great man. What is certain is that long before Wycliffe had become a power outside Oxford his fame was established in the university. He was acknowledged supreme in the philosophical disputations of the schools, and his lectures were crowded. His influence was, however, purely academic, nor does it seem to have been inspired at the outset by any conscious opposition to the established order in the church; and, as Loserth points out, it was not until he was drawn into the arena of the politico-ecclesiastical conflicts of the day that Wycliffe became of world-importance. It has been generally assumed that this happened first in 1366, and that Wycliffe published his *Determinatio quaedam de dominio* in support of the action of parliament in refusing the tribute demanded by Pope Urban V.; but Loserth has shown that this work, which contains the first trace of that doctrine of *dominium* or lordship which Wycliffe afterwards developed in a sense hostile to the whole papal system, must be assigned to a date some eight years later. Wycliffe, in fact, for some years to come had the reputation of a good "curialist." Had it been otherwise, the pope would scarcely have granted him (January 1373) a licence to keep his Westbury prebend even after he should have obtained one at Lincoln (*Cal. Papal Letters*, ed. Bliss and Twemlow, iv. 193). Moreover, it is uniformly asserted that Wycliffe fell into heresy after his admission to the degree of doctor (*Fasc. Ziz.* p. 2), and the papal document above quoted shows that he had only just become a doctor of theology, that is in 1372.

This, of course, does not mean that Wycliffe's tendencies may not already have been sufficiently pronounced to call attention to him in high places as a possibly useful instrument for the anti-papal policy of John of Gaunt and his party. Evidence of royal favour was soon not wanting. On the 7th of April 1374, he was presented by the crown to the rectory of Lutterworth in Leicestershire, which he held until his death; and on the 26th of July he was nominated one of the royal envoys to proceed to Bruges to confer with the papal representatives on the long vexed question of "provisions" (*q.v.*). It is probable that he was attached to this mission as theologian, and that this was so is sufficient proof that he was not yet considered a *persona ingrata* at the Curia. The rank he took is shown by the fact that his name stands second, next after that of the bishop of Bangor, on the commission, and that he received pay at the princely rate of twenty shillings a day. The commission itself was appointed in consequence of urgent and repeated complaints on the part of the Commons; but the king was himself interested in keeping up the papal system of provisions and reservations, and the negotiations were practically fruitless.

After his return to England Wycliffe lived chiefly at Lutterworth and Oxford, making frequent and prolonged visits to London, where his fame as a popular preacher was rapidly established. It is from this period, indeed, that dates the development of the trenchant criticisms of the folly and corruption of the clergy, which had gained him a ready hearing, into a systematic attack on the whole established order in the church. It was not at the outset the dogmatic, but the political elements in the papal system that provoked his censure. The negotiations at Bruges had doubtless strengthened the sympathy which he already felt for the anti-curial tendencies in English politics from Edward I.'s time onwards, and a final impulse was given by the attitude of the "Good Parliament" in 1376; in the autumn of that year he was reading his treatise on civil lordship (*De civili dominio*) to his students at Oxford. Of its propositions some, according to Loserth, were taken bodily from the 140 titles of the bill dealing with ecclesiastical abuses introduced in the parliament; but it may perhaps be questioned whether Wycliffe did not rather inspire the bill than the bill Wycliffe. However this may be, the reformer now for the first time publicly proclaimed the revolutionary doctrine that righteousness is the sole indefeasible title to dominion and to property, that an unrighteous clergy has no such title, and that the decision as to whether or no the property of ecclesiastics should be taken away rests with the civil power—"politicorum qui intendunt praxi et statui regnorum" (*De civ. dom.* i. 37, p. 269). It was unlikely that a doctrine so convenient to the secular authorities should long have remained a mere subject of obscure debate in the schools; as it was, it was advertised abroad by the indiscreet zeal of its orthodox opponents, and Wycliffe could declare that it was not his fault if it had been brought down into the streets and "every sparrow twittered about it."

If the position at which Wycliffe had now arrived was originally inspired, as Loserth asserts, by his intimate knowledge of and sympathy with the legislation of Edward I., *i.e.* by political rather than theological considerations, the necessity for giving to it a philosophical and religious basis led inevitably to its development into a criticism not only of the political claims but of the doctrinal standpoint of the church. As a philosopher, indeed, Wycliffe was no more than the last of the conspicuous Oxford scholastics, and his philosophy is of importance mainly in so far as it determined his doctrine of *dominium*, and so set the direction in which his political and religious views were to develop. In the great controversy between Realism and Nominalism he stood on the side of the former, though his doctrine of universals showed the influence of the criticisms of Ockham and the nominalists. He is Platonic in his conception of God as the *forma rerum* in whom the *rationes exemplares* exist eternally, being in fact his Word, who is *omnia in omnibus* (1 Cor. xv. 28); every creature in respect of its *esse intelligibile* is God, since every creature is in essence the same as the idea, and all *rationes ideales* are essentially the same as the Word of God (*De dominio divino*, pp. 42, 43). There is one *ens*, the *ens analogum*, which includes in itself and comprehends all other *entia*—all universals and all the individual parts of the universe (*De dom. div.* pp. 58 sq.). The process by which the primary *ens* is specificated, or by which a higher and more general class passes into sensible existence, is that it receives the addition of substantial form whereby it is rendered capable of acquiring qualities and other accidents (*ibid.* pp. 48 sq.). To Wycliffe the doctrine of arbitrary divine decrees was anathema. The will of God is his essential and eternal nature, by which all his acts are determined; it was thus with the creation, since God created all things in their primordial causes, as genera and species, or else in their material essences, *secundum rationes absconditas seminales* (*ibid.* p. 66). God's creation is conditioned by his own eternal nature; the world is therefore not merely one among an infinity of alternatives, an arbitrary selection, so to speak, but is the only possible world; it is, moreover, not in the nature of an eternal emanation from God, but was created at a given moment of time—to think otherwise would be to admit its absolute necessity, which would destroy free-will and merit. Since, however, all things came into being in this way, it follows that the creature can produce nothing save what God has already created.[2] So then all human lordship is derived from the supreme overlordship of God and is inseparable from it, since whatever God gives to his servants is part of himself, from the first gift, which is the *esse intelligibile*, *i.e.* really the divine essence, down to those special gifts which flow from the communication of his Holy Spirit; so that in him we live and move and have our being. But, in giving, God does not part with the lordship of the thing given; his gifts are of the nature of fiefs, and whatever lordship the creature may possess is held subject to due service to the supreme overlord. Thus, as in feudalism, lordship is distinguished from possession. Lordship is not properly proprietary, and property is the result of sin; Christ and his apostles had none.[1] The service, however, by which lordship is held of God is righteousness and its works; it follows that the unrighteous forfeit their right to exercise it, and may be deprived of their possessions by competent authority.

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[1] See H. T. Riley's remarks in the *Second Report* of the Historical Manuscripts Commission, appendix, pp. 141 sq. The appearance of a John Wyclif on the books of Queen's led to the common mistake, repeated in Milman's *Hist. of Latin Christianity* (bk. xiii. ch. vi)., that Wycliffe began his university career at Queen's College. The whole question is argued at length by Dr Rashdall in the *Dict. Nat. Biog.*

[2] This leads to the question of predestination and free-will, in which Wycliffe takes a middle position with the aid of the Aristotelian distinction between that which is necessary absolutely and that which is necessary on a given supposition. God does not will sin, for he only wills that which has being, and sin is the negation of being; he necessitates men to perform actions which are in themselves neither right nor wrong; they become right or wrong through man's free agency.

The question, of course, follows as to what this authority is, and this Wycliffe sets out to answer in the *Determinatio quaedam de dominio* and, more elaborately, in the *De civili dominio*. Briefly, his argument is that the church has no concern with temporal matters at all, that for the clergy to hold property is sinful, and that it is lawful for statesmen (*politici*)—who are God's stewards in temporals—to take away the goods of such of the clergy as, by reason of their unrighteousness, no longer render the service by which they hold them. That the church was actually in a condition to deserve spoliation he refused, indeed—though only under pressure—to affirm; but his theories fitted in too well with the notorious aims of the duke of Lancaster not to rouse the bitter hostility of the endowed clergy. With the mendicant orders he continued for a while to be on good terms.

Hitherto Wycliffe had made no open attack on the doctrinal system of the church, and for some time he had been allowed to spread his doctrines without hindrance. Early in 1377, however, Archbishop Sudbury summoned him to appear before the bishop of London, and answer certain charges laid against him. The nature of these accusations is not stated, but their purport can hardly be doubtful. On the 19th of February 1377, Wycliffe made his appearance at St Paul's. He was accompanied by the duke of Lancaster, by Lord Percy, marshal of England, and by four doctors of the four mendicant orders. The trial, however, came to nothing; before Wycliffe could open his mouth, the court was broken up by a rude brawl between his protectors and Bishop Courtenay, ending in a general riot of the citizens of London, who were so much enraged by the insult to their bishop in his own cathedral church—coming as this did at the same time as a serious attempt at an invasion by the duke in parliament of their civic liberties (*Chron. Angl.* p. 120)—that they would have sacked his palace of the Savoy had not Courtenay himself intervened.

Wycliffe had escaped for the time, but his enemies did not rely solely on their own weapons. Probably before this they had set their case before the pope; and on the 22nd of May five bulls were issued by Gregory XI., who had just returned to Rome from Avignon, condemning eighteen (or in other copies nineteen) "conclusions" drawn from Wycliffe's writings. All the articles but one are taken from his *De civili dominio*. The bulls truly stated Wycliffe's intellectual lineage; he was following in the error of Marsilius of Padua; and the articles laid against him are concerned entirely with questions agitated between church and state—how far ecclesiastical censures could lawfully affect a man's civil position, and whether the church had a right to receive and hold temporal endowments. The bulls were addressed to the archbishop of Canterbury and the bishop of London, the university of Oxford, and the king. The university was to take Wycliffe and send him to the prelates; the latter were then to examine the truth of the charges and to report to the pope, Wycliffe being meanwhile kept in confinement. The execution of the papal bulls was impeded by three separate causes—the king's death on the 21st of June; the tardy action of the bishops, who enjoined the university to make a report, instead of simply sending Wycliffe to them; and the unwillingness of the university to admit external authority, and, above all, the pope's right to order the imprisonment of any man in England. The convocation of the university, indeed, as the St Albans chronicler[2] states with lamentation, made serious objections to receiving the bull at all; and in the end it merely directed Wycliffe to keep within his lodgings at Black Hall for a time.

If the university was disposed to favour the reformer, the government was not less so. John of Gaunt was for the moment in retirement; but the mother of the young king appears to have adopted his policy in church affairs, and she naturally occupied a chief position in the new council. As soon as parliament met in the autumn of 1377, Wycliffe was consulted by it as to the lawfulness of prohibiting that treasure should pass out of the country in obedience to the pope's demand. Wycliffe's affirmative judgment is contained in a state paper still extant; and its tone is plain proof enough of his confidence that his views on the main question of church and state had the support of the nation.[3] Indeed he had laid before this same parliament his answer to the pope's bulls, with a defence of the soundness of his opinions. His university, moreover, confirmed his argument; his tenets, it said, were true (*i.e.* orthodox), though their expression was such as to admit of an incorrect interpretation. But Wycliffe was still bound to clear himself before the prelates who had summoned him, and early in 1378 he appeared for this purpose in the chapel of Lambeth Palace. His written defence, expressed in some respects in more cautious language than he had previously used, was laid before the council; but its session was rudely interrupted, not only by an inroad of the London citizens with a crowd of the rabble, but also by a messenger from the princess of Wales enjoining them not to pass judgment against Wycliffe; and thus a second time he escaped, either without sentence, or at most with a gentle *request* that he would avoid discussing the matters in question. Meanwhile his "protestatio" was sent on to Rome. Before, however, any further step could be taken at Rome, Gregory XI. died.

In the autumn of this year Wycliffe was once more called upon to prove his loyalty to John of Gaunt. The duke had violated the sanctuary of Westminster by sending a band of armed men to seize two squires who had taken refuge there. One of them was taken by a stratagem, the other murdered, together with the servant of the church who attempted to resist his arrest. After a while the bishop of London excommunicated all concerned in the crime (except only the king, his mother and his uncle), and preached against the culprits at Paul's Cross. At the parliament held at Gloucester in October, in the presence of the legates of Pope Urban VI., Wycliffe read an apology for the duke's action at Westminster, pleading that the men were killed in resisting legal arrest. The paper, which forms part of the *De ecclesia*, lays down the permissible limits of the right of asylum, and maintains the right of the civil power to invade the sanctuary in order to bring escaped prisoners to justice.

The schism in the papacy, owing to the election of Clement VII. in opposition to Urban VI., accentuated Wycliffe's hostility to the Holy See and its claims. His attitude was not, indeed, as yet fully developed. He did not object to a visible head of the church so long as this head possessed the essential qualification of righteousness, as a member of the elect. It was only later, with the development of the scandals of the schism, that Wycliffe definitely branded the pope, *qua* pope, as Antichrist;[4] the sin of Silvester I. in accepting the donation of Constantine had made all his successors apostates (*Sermones*, ii. 37). The year 1378, indeed, saw the beginning of an agressive propaganda which was bound sooner or later to issue in a position wholly revolutionary. Wycliffe's criticism of the established order and of the accepted doctrines had hitherto been mainly confined to the schools; he now determined to carry it down into the streets. For this purpose he chose two means, both based on the thesis which he had long maintained as to the supreme authority of Holy Scripture, as the great charter of the Christian religion. The first means was his institution of the "poor" or "simple" priests to preach his doctrines throughout the country; the second was the translation of the Vulgate into English, which he accomplished with the aid of his friends Nicholas Hereford and John Purvey (see BIBLE, ENGLISH). This version of the Bible, and still more his numerous sermons and tracts, established Wycliffe's now undisputed position as the founder of English prose writing.

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[1] See R. L. Poole's preface to his edition of the *De dominio divino*, where Wycliffe's indebtedness to Richard Fitz Ralph, archbishop of Armagh, for his views on lordship and property is shown at some length (pp. xxxiv sq.). Fitz Ralph had been a fellow of Balliol, and was vice-chancellor of the university in or about 1333 (A. à Wood, *Fasti Oxon* p. 21, ed. Gutch, 1790). The first four books of his *De pauperie Salvatoris* were edited by R. L. Poole for the Wycliffe Society, and published in 1890 in an appendix to the edition of the *De dominio divino*. Fitz Ralph also taught that lordship was conditioned by grace, and that property had come into the world with sin. Fitz Ralph's work was, however, directed to the settlement of the controversy raised by the mendicant orders as to "possession" and "use"; Wycliffe extended the scope of the doctrine so as to include all civil and ecclesiastical society.

[2] When he says that the bull was only received at Oxford shortly before Christmas, he is apparently confounding it with the prelates' mandate, which is dated December 18 (Lewis, appendix xvii.).—*Chron. Angl.* p. 173.

[3] In one text of this document a note is appended, to the effect that the council enjoined silence on the writer as touching the matter therein contained (*Fasciculi Zizaniorum*, p. 271). This, if true, was apparently a measure of precaution.

[4] So he describes the popes in the first sermon in vol. ii. of the *Sermones*. This may very probably refer to the two rival popes (cf. Buddensieg, *Polemical Works*, intr. p. xxi). Book iii. of his *Opus evangelicum* is also significantly entitled *De Antichristo*.

The choice of secular priests to be his itinerant preachers was significant of another change of attitude on Wycliffe's part. Hitherto he had been on good terms with the friars, whose ideal of poverty appealed to him; as already mentioned, four doctors of the mendicant orders had appeared with him at his trial in 1377. But he had come to recognize that all organized societies within the church, "sects" as he called them, were liable to the same corruption, while he objected fundamentally to the principle which had established a special standard of morality for the "religious." On the other hand, Wycliffe's itinerant preachers were not necessarily intended to work as rivals to the beneficed clergy. The idea that underlay their mission was rather analogous to that which animated Wesley four centuries later. Wycliffe aimed at supplementing the services of the church by regular religious instruction in the vernacular; and his organization included a good number of men who held or had held respectable positions in their colleges at Oxford. The influence of their teaching was soon felt throughout the country. The common people were rejoiced by the plain and homely doctrine which dwelt chiefly on the simple "law" of the gospel, while they no doubt relished the denunciation of existing evils in the church which formed, as it were, the burthen of such discourses. The feeling of disaffection against the rich and careless clergy, monks and friars was widespread but undefined. Wycliffe turned it into a definite channel.

Meanwhile, in addition to his popular propaganda and his interventions in politics, Wycliffe was appealing to the world of learning in a series of Latin treatises, which followed each other in rapid succession, and collectively form his *summa theologiae*.[1] During the years 1378 and 1379 he produced his works on the truth of Holy Scripture, on the church, on the office of king, on the papal power.

Of all these, except the third, the general character has already been indicated. The *De officio regis* is practically a declaration of war against the papal monarchy, an anticipation of the theocratic conception of national kingship as established later by the Reformation. The king is God's vicar, to be regarded with a spiritual fear second only to that due to God, and resistance to him for personal wrong suffered is wicked. His jurisdiction extends over all causes. The bishops—who are to the king as Christ's Humanity is to his Divinity—derive their jurisdiction from him, and whatever they do is done by his authority.[2] Thus in his palpable dignity, towards the world, the king is superior to the priest; it is only in his impalpable dignity, towards God, that the priest is superior to the king. Wycliffe thus passed from an assailant of the papal to an assailant of the sacerdotal power; and in this way he was ultimately led to examine and to reject the distinctive symbol of that power, the doctrine of transubstantiation.[3]

Wycliffe himself had for some time, both in speech and writing, indicated the main characteristics of his teaching on the Eucharist. It was not, however, till 1379 or 1380[4] that began a formal public attack on what he calls the "new" doctrine in a set of theses propounded at Oxford. These were followed by sermons, tracts, and, in 1381, by his great treatise *De eucharistia*. Finally, at the close of his life, he summed up his doctrine in this as in other matters in the *Trialogus*.

The language in which he denounced transubstantiation anticipated that of the Protestant reformers: it is a "blasphemous folly," a "deceit," which "despoils the people and leads them to commit idolatry";[5] philosophically it is nonsense, since it presupposes the possibility of an accident existing without its substance; it overthrows the very nature of a sacrament. Yet the consecrated bread and wine are the body and blood of Christ, for Christ himself says so (*Fasc. Zizan.* p. 115); we do not, however, corporeally touch and break the Lord's body, which is present only *sacramentaliter*, *spiritualiter et virtualiter*—as the soul is present in the body. The real presence is not denied; what Wycliffe "dares not affirm" is that the bread is after consecration "essentially, substantially, corporeally and identically" the body of Christ (*ib.*). His doctrine, which was by no means always consistent or clear, would thus seem to approximate closely to the Lutheran doctrine of consubstantiation, as distinguished from the Zwinglian teaching accepted in the xxviii. Article of Religion of the Church of England, that "the means whereby the body of Christ is received and eaten in the Supper is Faith."[6]

A public attack by a theologian of Wycliffe's influence on the doctrine on which the whole system of the medieval church was based could not be passed over as of mere academic interest. The theologians of the university were at once aroused. The chancellor, William Barton, sat with twelve doctors (six of whom were friars), and solemnly condemned the theses. Wycliffe appealed, in accordance with his principles, not to the pope, but to the king. But the lay magnates, who were perfectly ready to help the church to attain to the ideal of apostolic poverty, shrank from the responsibility of lending their support to obscure propositions of the schools, which, for no practical end, involved undoubted heresy and therefore the pains of hell. John of Gaunt, accordingly, hastily sent down a messenger enjoining the reformer to keep silence on the subject. The rift thus created between Wycliffe and his patrons in high places was, moreover, almost immediately widened by the outbreak of the great Peasants' Revolt of 1381, the result of which was to draw the conservative elements in church and state together, in defence of their common interests.

With the Peasants' Revolt it has been supposed that Wycliffe had something to do. The only positive fact implicating him is the confession of one of its leaders, John Ball, that he learned his subversive doctrines from Wycliffe. But the confession of a condemned man can seldom be accepted without reserve; and we have not only the precise and repeated testimony of Knyghton that he was a "precursor" of Wycliffe, but also documentary evidence that he was excommunicated as early as 1366, long before Wycliffe exposed himself to ecclesiastical censure. Wycliffe in truth was always careful to state his communistic views in a theoretical way; they are confined to his Latin scholastic writings, and thus could not reach the people from him directly. At the same time it is very possible that his less scrupulous followers translated them in their popular discourses, and thus fed the flame that burst forth in the rebellion. Perhaps it was a consciousness of a share of responsibility for it that led them to cast the blame on the friars. In any case Wycliffe's advocates must regret that in all his known works there is only one trace of any reprobation of the excesses that accompanied the outbreak.

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[1] J. Loserth, in his paper "Die Genesis von Wiclifs Summa Theologiae" (*Sitzungsber. der k. Akad. der Wissensch.*, Vienna, 1908, vol. 156) gives proofs that the *Summa* was not produced on a previously thought out plan, but that even the larger works forming part of it "were the outcome of those conflicts which were fought out inside and outside the Good Parliament," *i.e.* they were primarily intended as weapons in the ecclesiastico-political controversies of the time.

[2] *Episcopi, sui officiales et curati sui, tenentur in qualicunque tali causa spiritualiter cognoscere auctoritate regis; ergo rex per illos. Sunt enim tales legii homines regis.* See *De officio regis* (ed. A. W. Pollard and Charles Sayle, from Vienna MSS. 4514, 3933, Wyclif Soc. 1887), cap. vi. p. 119.

[3] Sporadic attacks had been made on this before, though it had not been formally challenged in the schools. See the interesting case of the heretic priest Ralph of Tremur in the *Register of John de Grandison, Bishop of Exeter*, edited by F. C. Hingeston-Randolph (London and Exeter, 1894), pp. 1147 and 1179.

[4] 1381 (corrected by the editor from 1380) is the date given in Shirley's edition of the *Fasciculi Zizaniorum*. F. D. Matthew, in the *Eng. Hist. Rev.* for April 1890 (v. 328), proves that the date must have been 1379 or 1380.

[5] *Trialogus*, lib. iv., cap. 22; *De Euch.* p. 249.

[6] The difference is summed up by Melanchthon, in his rejection of Bucer's eirenicon, thus:—*Fucum faciunt hominibus per hoc quod dicunt vere adesse corpus, et tamen postea addunt contemplatione fidei, i.e. imaginatione. Sic iterum negant praesentiam realem. Nos docemus, quod corpus Christi vere et realiter adest cum pane vel in pane* (*Corpus Reformatorum*, ii. 222 sq.).

In the spring following the Revolt his old enemy, William Courtenay, who had succeeded the murdered archbishop Sudbury as archbishop of Canterbury, resolved to take measures for stamping out Wycliffe's crowning heresy. He called a court of bishops, theologians and canonists at the Blackfriars' convent in London, which assembled on the 17th to 21st of May and sat with intervals until July. This proceeding was met by a hardly expected manifestation of university feeling on Wycliffe's side. The chancellor, Robert Rygge, though he had joined in the condemnation of the theses, stood by him, as did also both the proctors. On Ascension Day (the 15th of May) his most prominent disciple, Nicholas Hereford, was allowed to preach a violent sermon against the regulars in the churchyard of St Frideswyde. The archbishop protested through his commissary, the Carmelite Dr Peter Stokes, who was charged with the execution of the archbishop's mandate (on the 28th of May) for the publication in the university of the decision of the Blackfriars' council, by which 24 articles extracted from Wycliffe's works were condemned, ten as heretical and fourteen as erroneous. The reply of the chancellor was to deny the archbishop's jurisdiction within the university, and to allow Philip Repington, another of Wycliffe's disciples, to preach on Corpus Christi day before the university. Chancellor and preacher were guarded by armed men, and Stokes wrote that his life was not safe at Oxford. The chancellor and proctors were now summoned to Lambeth, and directed to appear before the Blackfriars' court on the 12th of June. The result was that the university officers were soon brought to submission. Though they were, with the majority of regent masters at Oxford, on the side of Wycliffe, the main question at issue was for them one of philosophy rather than faith, and they were quite prepared to make formal submission to the authority of the Church. For the rest, a few of the reformer's more prominent adherents were arrested, and imprisoned until they recanted.

Wycliffe himself remained at large and unmolested. It is said indeed by Knyghton that at a council held by Courtenay at Oxford in the following November Wycliffe was brought forward and made a recantation; but our authority fortunately gives the text of the recantation, which proves to be nothing more nor less than a plain English statement of the condemned doctrine. It is therefore lawful to doubt whether Wycliffe appeared before the council at all, and even whether he was ever summoned before it. Probably after the overthrow of his party at Oxford by the action of the Blackfriars' council Wycliffe found it advisable to withdraw permanently to Lutterworth. That his strength among the laity was undiminished is shown by the fact that an ordinance passed by the House of Lords alone, in May 1382, against the itinerant preachers was annulled on the petition of the Commons in the following autumn. In London, Leicester and elsewhere there is abundant evidence of his popularity. The reformer, however, was growing old. There was work, he probably felt, for him to do, more lasting than personal controversy. So in his retirement he occupied himself, with restless activity, in writing numerous tracts, Latin and English. To this period, too, belong two of his most important works:—the *Trialogus* and the unfinished *Opus evangelicum*.

The *Trialogus* is as it were his *summa summarum theologiae*, a summing up of his arguments and conclusions on philosophy and doctrine, cast in the form of a discussion between three persons, Alithia, representing "solid theology," Phronesis, representing "subtle and mature theology," and Pseustis, representing "captious infidelity" whose function is to bring out the truth by arguing and demonstrating against it. The *Trialogus* was the best known and most influential of all Wycliffe's works, and was the first to be printed (1525), a fact which gave it a still greater vogue. It is also significant that all the only four known complete MSS. of the work, preserved in the Imperial Library at Vienna, are of Hussite origin. The note of both the *Trialogus* and of the *Opus evangelicum*, Wycliffe's last work, is their insistence on the "sufficiency of Holy Scripture."

In 1382, or early in 1383, Wycliffe was seized with a paralytic stroke, in spite of which he continued his labours. In 1384 it is stated that he was cited by Pope Urban VI. to appear before him at Rome; but to Rome he never went. On the 28th of December of this year, while he was hearing mass in his own church, he received a final stroke, from the effects of which he died on the New Year's eve. He was buried at Lutterworth; but by a decree of the council of Constance, May 4, 1415, his remains were ordered to be dug up and burned, an order which was carried out, at the command of Pope Martin V., by Bishop Fleming in 1428.

A sober study of Wycliffe's life and works justifies a conviction of his complete sincerity and earnest striving after what he believed to be right. If he cannot be credited (as he has been by most of his biographers) with all the Protestant virtues, he may at least claim to have discovered the secret of the immediate dependence of the individual Christian upon God, a relation which needs no mediation of any priest, and to which the very sacraments of the Church, however desirable, are not essentially necessary. When he divorces the idea of the Church from any connexion with its official or formal constitution, and conceives it as consisting exclusively of the righteous, he may seem to have gone the whole length of the most radical reformers of the 16th century. And yet, powerful as was his influence in England, his doctrines in his own country were doomed to perish, or at best to become for a century and a half the creed of obscure and persecuted sectaries (see LOLLARDS). It was otherwise in Bohemia, whither his works had been carried by the scholars who came to England in the train of Richard II.'s queen, Anne of Bohemia. Here his writings were eagerly read and multiplied, and here his disciple, John Huss (*q.v.*), with less originality but greater simplicity of character and greater moral force, raised Wycliffe's doctrine to the dignity of a national religion. Extracts from the *De ecclesia* and the *De potestate Papae* of the English reformer made up the greater part of the *De ecclesia* of Huss, a work for centuries ascribed solely to the Bohemian divine, and for which he was condemned and burnt. It was Wycliffe's *De sufficientia legis Christi* that Huss carried with him to convert the council of Constance; of the fiery discourses now included in the published edition of Wycliffe's *Sermones* many were likewise long attributed to Huss. Finally, it was from the *De eucharistia* that the Taborites derived their doctrine of the Lord's Supper, with the exception of the granting of the chalice to the laity. To Huss, again, Luther and other continental reformers owed much, and thus the spirit of the English reformer had its influence on the reformed churches of Europe.

BIBLIOGRAPHY.—The documentary materials for Wycliffe's biography are to be found in John Lewis's *Life and Sufferings of J. Wiclif* (new ed., Oxford, 1820), which contains a valuable appendix of illustrative papers and records; Foxe's *Acts and Monuments*, vol. iii., ed. 1855, with app.; Forshall and Madden's preface to the Wycliffe Bible, p. vii. note, Oxford, 1851; W. W. Shirley's edition of the *Fasciculi Zizaniorum*, a collection of contemporary documents bearing on the history of Wycliffe and the Lollards, with interspersed narrative and comments (probably the work of Thomas Netter of Walden) (1858); and H. T. Riley's notices in the appendices to the *Second* and *Fourth Reports* of the Historical Manuscripts Commission. Among contemporary records the narrative of a monk of St Albans—a bitter opponent of John of Gaunt—is of conspicuous value; it was published under the title of *Chronicon Angliae*, by Sir E. Maunde Thompson (1874). Of this the account in Walsingham's *Historia Anglicana* (ed. H. T. Riley, 1863, 1864) is mainly a modified version. Knyghton, who wrote *De eventibus Angliae* at Leicester in the heart of what may be called the Wycliffe country, is very well informed as to certain passages in the reformer's history, though his chronology is extremely faulty (ed. J. R. Lumby, 1889–1895). There are valuable notices also in the continuation of the *Eulogium historiarum* (vol. iii., ed. F. S. Haydon, 1863), in the *Chronicle* of Adam of Usk (ed. E. M. Thompson, 1876), and in more than one of the continuations of Higden. For the study of Wycliffe's theology the controversial works of Wodeford and Walden are important, but must necessarily be used with caution.

Of modern biographies that by G. V. Lechler (*Johann von Wiclif und die Vorgeschichte der Reformation*, 2 vols., Leipzig, 1873; partial Eng. trans., by P. Lorimer, 1878, 1881 and 1884) is by far the most comprehensive; it includes a detailed exposition of the reformer's system, based to a considerable extent on works which were then unpublished. Shirley's masterly introduction to the *Fasciculi Zizaniorum*, and F. D. Matthew's to his edition of *English Works of Wyclif hitherto unprinted* (1880), as well as Creighton's *History of the Papacy*, vol. i., 1882, and Sir H. C. Maxwell Lyte's account in his *History of the University of Oxford* (1886), add to or correct our stock of biographical materials, and contain much valuable criticism.

Wycliffe's political doctrine is discussed by Mr R. L. Poole (*Illustrations of the History of Medieval Thought*, 1884); and his relation to Huss is elaborately demonstrated by Dr J. Loserth (*Hus und Wiclif*, Prague, 1884; also Eng. trans.).

See also G. M. Trevelyan, *England in the Age of Wycliffe* (London, 1899); Oman, *History of England 1377–1485* (London, 1906), pp. 511 ff. for authorities; W. W. Capes, "History of the English Church in the 14th and 15th Centuries," in *Hist. of the Eng. Church*, ed. Stephen and Hunt (London, 1900). Many references to more recent monographs on particular points will be found in J. Loserth's article "Wiclif," in Herzog-Hauck, *Realencyklopädie* (3rd ed., 1908), xxi. pp. 225-227.

Wycliffe's works are enumerated in a *Catalogue* by Shirley (Oxford, 1865). Of his Latin works only two had been published previously to 1880, the *De officio pastorali*, ed. G. V. Lechler (Leipzig, 1863) and the *Trialogus*, ed. Lechler (Oxford, 1869). The pious hope expressed by the learned editor of the *Trialogus* in his preface, that English scholars might be moved to publish all Wycliffe's Latin works, began to be realized in 1882 with the foundation at Oxford of the Wyclif Society, under the auspices of which the following have been published:—*Polemical Tracts*, ed. R. Buddensieg, (2 vols., 1883); *De civili dominio*, vol. i. ed. R. L. Poole, vols. ii.-iv., ed. J. Loserth (1885–1905); *De composicione hominis*, ed. R. Beer (1884); *De Ecclesia*, ed. Loserth (1886); *Dialogus sive speculum ecclesiae militantis*, ed. A. W. Pollard (1886); *Sermones*, ed. Loserth, vols. i.-iv. (1887–1890); *De officio regis*, ed. A. W. Pollard and C. Sayle (1887); *De apostasia*, ed. M. Dziewicki (1889); *De dominio divino*, ed. R. L. Poole (1890); *Quaestiones. De ente praedicamentali*, ed. R. Beer (1891); *De eucharistia tractatus major*, ed. Loserth (1893); *De blasphemia*, ed. Dziewicki (1894); *Logica* (3 vols., ed. Dziewicki, 1895–1899); *Opus evangelicum*, ed. Loserth (4 vols., 1898), parts iii. and iv. also bear the title *De Antichristo*; *De Simonia*, ed. Herzberg-Fränkel and Dziewicki (1898); *De veritatae sacrae scripturae*, ed. R. Buddensieg (3 vols., 1905); *Miscellanea philosophica*, ed. Dziewicki (2 vols., 1905) (vol. i. has an introduction on Wycliffe's philosophy); *De potestate papae*, ed. Loserth (1907).

For Wycliffe's English works see *Select English Works*, ed. T. Arnold (3 vols., 1869–1871), and *English Works hitherto unprinted*, ed. F. D. Matthew (1880), chiefly sermons and short tracts, of many of which the authenticity is uncertain. *The Wicket* (Nuremberg, 1546; reprinted at Oxford, 1828) is not included in either of these collections. (R. L. P.; W. A. P.)

WYCOMBE (officially Chepping Wycombe, also Chipping or High Wycombe), a market town and municipal borough in the Wycombe parliamentary division of Buckinghamshire, England, 34 m. W. by N. of London by the Great Western railway. Pop. (1901) 15,542. The church of All Saints, originally of Norman foundation, was rebuilt in 1273 by the abbess and nuns of Godstow near Oxford, and was largely reconstructed early in the 15th century. For the grammar school, founded *c.* 1550 by the mayor and burgesses, a new building was erected in 1883. There are remains of a Norman hospital of St John the Baptist, consisting of arches of the chapel. The market-house and guildhall was erected in 1757. The family of Petty, with whom the town has long been connected, occupied the mansion called Wycombe Abbey. Lord Beaconsfield's mansion of Hughenden is 1½ m. N. of the town. Among a number of almshouses are some bearing the name of Queen Elizabeth, endowed in 1562 out of the revenues of a dissolved fraternity of St Mary. The principal industry is chair-making, and there are also flour and paper mills. The borough is under a mayor, 8 aldermen and 24 councillors. Area, 1734 acres. The burgesses of Wycombe have ancient rights of common pasturage on the neighbouring Rye Mead.

There are various British remains in the neighbourhood of Chipping Wycombe (*Wicumbe, Wycumbee, Cheping Wycombe, Cheping Wichham*), but the traces of a Roman settlement are more important. In Domesday Book the manor only is mentioned, but in 1199 the men of Wycombe paid tallage to the king. In 1225–1226 Alan Basset granted to the burgesses the whole town as a free borough. This grant was confirmed by Henry III., Edward I., Henry IV. and Mary. In 1558, however, a new charter of incorporation was granted in reward for the loyalty shown to Queen Mary. It was confirmed by Elizabeth in 1598 and by James I. in 1609 with certain additions. Cromwell granted another charter, but it was burnt after the Restoration, and the last charter was granted by Charles II. in 1663. The corporation was remodelled under the Municipal Corporations Act of 1835, and now consists of a mayor, 6 aldermen and 18 councillors. Wycombe returned two burgesses to parliament in 1300 and continued to send members until 1885. The franchise was enlarged after 1832, and in 1867 the borough was deprived of one of its members. A market was granted by Basset to the burgesses in 1226, and at the present day it is held every Friday, the day fixed by the chart[illegible]y. Two statutory fairs were held under the charter of 1558, but in 1792 only one fair was held on the Monday before Michaelmas for hiring, but there is now a pleasure fair on the same day.

See John Parker, *History and Antiquities of Wycombe* (1878).

WYE, a river of England, famous for its beautiful scenery. It rises in Montgomeryshire on the E. slope of Plinlimmon, close to the source of the Severn, the estuary of which it joins after a widely divergent course. Its length is 130 m.; its drainage area (which is included in the basin of the Severn), 1609 sq. m. Running at first S.E. it crosses the W. of Radnorshire, passing Rhayader, and receiving the Elan, in the basin of which are the Birmingham reservoirs. It then divides Radnorshire from Brecknockshire, receives the Ithon on the left, passes Builth, and presently turns N.E. to Hay, separating Radnorshire from Herefordshire, and thus forming a short stretch of the Welsh boundary. The river, which rose at an elevation exceeding 2000 ft., has now reached a level of 250 ft., 55 m. from its source. As it enters Herefordshire it bends E. by S. to reach the city of Hereford. It soon receives the Lugg, which, augmented by the Arrow and the Frome, joins from the N. The course of the Wye now becomes extremely sinuous; and the valley narrows nearly to Chepstow. For a short distance the Wye divides Herefordshire from Gloucestershire, and for the rest of its course Gloucestershire and Monmouthshire. It passes Monmouth, where it receives the Monnow on the right, and finally Chepstow, 2 m. above its junction with the Severn estuary. The river is navigable for small vessels for 15 m. up from the mouth on high tides, but there is not much traffic above Chepstow. The average spring rise of the tide is 38 ft. at Chepstow, while 50 ft. is sometimes exceeded; the average neap rise is 28½ ft. The scenery is finest between Rhayader and Hay in the upper part, and from Goodrich, below Ross, to Chepstow in the lower, the second being the portion which gives the Wye its fame.

The name of Wye belongs also to two smaller English rivers—(1) a right-bank tributary of the Derbyshire Derwent, rising in the uplands near Buxton, and having part of its early course through one of the caverns characteristic of the district; (2) a left-bank tributary of the Thames, watering the valley of the Chilterns in which lies Wycombe and joining the main river near Bourne End.

WYKES, THOMAS, English chronicler, was a canon regular of Oseney Abbey, near Oxford. He was the author of a chronicle extending from 1066 to 1289, which is printed among the monastic annals edited by H. R. Luard for the "Rolls" Series. He gives an account of the barons' war from a royalist standpoint, and is a severe critic of Montfort's policy. He is of some value for the reign of Edward I. His work is closely connected with the Oseney Annals, which are printed parallel with his work by Luard, but from 1258 to 1278 Wykes is an independent authority.

See H. R. Luard's *Annales monastici*, vol. iv. (1869); and earlier edition in Gale's *Scriptores quinque*, pp. 21-128.

WYLIE, ALEXANDER (1815–1887), British missionary, was born in London on the 6th of April 1815, and went to school at Drumlithie, Kincardineshire, and at Chelsea. While apprenticed to a cabinet-maker he picked up a Chinese grammar written in Latin, and after mastering the latter tongue made such good progress with the former, that in 1846 James Legge engaged him to superintend the London Missionary Society's press at Shanghai. In this position he acquired a wide knowledge of Chinese religion and civilization, and especially of their mathematics, so that he was able to show that Sir George Horner's method (1819) of solving equations of all orders had been known to the Chinese mathematicians of the 14th century. He made several journeys into the interior, notably in 1858 with Lord Elgin up the Yang-tsze and in 1868 with Griffith John to the capital of Sze-ch'uen and the source of the Han. From 1863 he was an agent of the British and Foreign Bible Society. He settled in London in 1877, and died on the 10th of February 1887.

In Chinese he published books on arithmetic, geometry, algebra (De Morgan's), mechanics, astronomy (Herschel's), and *The Marine Steam Engine* (T. J. Main and T. Brown), as well as translations of the first two gospels. In English his chief works were *Notes on Chinese Literature* (Shanghai, 1867), and scattered articles collected under the title *Chinese Researches by Alexander Wylie* (Shanghai, 1897).

See H. Cordier, *Life and Labours of A. Wylie* (1887).

WYLIE, ROBERT (1839–1877), American artist, was born in the Isle of Man in 1839. He was taken to the United States when a child, and studied in the schools of the Pennsylvania Academy of the Fine Arts, Philadelphia, the directors of which sent him to France in 1863 to study. He won a medal of the second class at the Paris Salon of 1872. He went to Pont Aven, Brittany, in the early sixties, where he remained until his death on the 4th of February 1877. He painted Breton peasants and scenes in the history of Brittany; among his important works was a large canvas, "The Death of a Vendean Chief," now at the Metropolitan Museum of Art, New York.

WYMONDHAM (pronounced *Windham*), a market town in the mid-parliamentary division of Norfolk, England, 10 m. S.W. of Norwich by the Great Eastern railway. Pop. (1901) 4764. The church of St Mary the Virgin rises on an eminence on the outskirts of the town. It was attached to a Benedictine priory, founded about the beginning of the 12th century as a cell of St Albans abbey by William de Albini. In 1448 this foundation became an abbey. The nave is of ornate Norman work, with a massive triforium, surmounted by a Perpendicular clerestory and a beautiful wooden roof. The broad N. aisle is Perpendicular, and has also a very fine rood screen. At the W. end there is a lofty and graceful Perpendicular tower. The choir, which was used as the conventual church, has left only slight traces, and one arch is standing of a large chapel which adjoined it on the S. In the centre of the town is a picturesque half-timbered market cross (1616), with an octagonal upper chamber raised on massive pillars of wood. A chapel, dedicated to St Thomas of Canterbury, is used as a grammar school. At Wymondham on the 7th of July a festival was formerly held in honour of the saint. It was at this festival in 1549 that the rebellion of Robert Ket or Kett came to a head.

WYNAAD, or WAINAD, a highland tract in S. India, forming part of Malabar district, Madras. It consists of a table-land amid the W. Ghats, 60 m. long by 30 m. broad, with an average elevation of 3000 ft.; pop. (1901) 75,149. It is best known as the district where a large amount of British capital was sunk during the decade 1876–1886 in gold mines. It had yet earlier been a coffee-planting district, but this industry has recently declined. Tea, pepper and cardamoms are produced in increasing quantities. There are also valuable forest reserves.

WYNDHAM, SIR CHARLES (1837–), English actor, was born in Liverpool on the 23rd of March 1837, the son of a doctor. He was educated abroad, at King's College, London and at the College of Surgeons and the Peter Street Anatomical School, Dublin, but his taste for the stage was too strong for him to take up either the clerical or the medical career, suggested for him, and early in 1862 he made a first appearance in London as an actor. Later in the year, being in America, he volunteered during the Civil War, and became brigade surgeon in the Federal army, resigning in 1864 to appear on the stage in New York with John Wilkes Booth. Returning to England, he played at Manchester and Dublin in *Her Ladyship's Guardian*, his own adaptation of Edward B. Hamley's novel *Lady Lee's Widowhood*. He reappeared in London in 1866 as Sir Arthur Lascelles in Morton's *All that Glitters is not Gold*, but his great success at that time was in F. C. Burnand's burlesque of *Black-eyed Susan*, as Hatchett, "with dance." This brought him to the St James's theatre, where he played with Henry Irving in *Idalia*; then with Ellen Terry in Charles Reade's *Double Marriage*, and Tom Taylor's *Still Waters Run Deep*. As Charles Surface, his best part for many years, and in a breezy three-act farce, *Pink Dominoes*, by James Albery, and in *Brighton*, an anglicized version of *Saratoga* by Bronson Howard (1842–1908), who married his sister, he added greatly to his popularity both at home and abroad. In 1876 he took control of the Criterion theatre. Here he produced a long succession of plays, in which he took the leading part, notably a number of old English comedies, and in such modern plays as *The Liars*, *The Case of Rebellious Susan* and others by Henry Arthur Jones; and he became famous for his acting in *David Garrick*. In 1899 he opened his new theatre, called Wyndham's. In 1902 he was knighted. From 1885 onwards his leading actress was Miss Mary Moore (Mrs Albery), who became his partner in the proprietorship of the Criterion and Wyndham's theatres, and of his New Theatre, opened in 1903; and her delightful acting in comedy made their long association memorable on the London stage.

WYNDHAM, SIR WILLIAM, BART. (1687–1740), English politician, was the only son of Sir Edward Wyndham, Bart., and a grandson of William Wyndham (d. 1683) of Orchard Wyndham, Somerset, who was created a baronet in 1661. Educated at Eton and at Christ Church, Oxford, he entered parliament in 1710 and became secretary-at-war in the Tory ministry in 1712 and chancellor of the exchequer in 1713. He was closely associated with Lord Bolingbroke, and he was privy to the attempts made to bring about a Jacobite restoration on the death of Queen Anne; when these failed he was dismissed from office. In 1715 the failure of a Jacobite movement led to his imprisonment, but he was soon set at liberty. Under George I. Wyndham was the leader of the opposition in the House of Commons, fighting for his High Church and Tory principles against Sir Robert Walpole. He was in constant communication with the exiled Bolingbroke, and after 1723 the two were actively associated in abortive plans for the overthrow of Walpole. He died at Wells on the 17th of June 1740. Wyndham's first wife was Catherine, daughter of Charles Seymour, 6th duke of Somerset. By her he had two sons, Charles, who became 2nd earl of Egremont in 1750, and Percy, who took the name of O'Brien and was created earl of Thomond in 1756.

The Wyndham Family. Sir John Wyndham, a Norfolk man, was knighted after the battle of Stoke in 1487 and beheaded for high treason on the 2nd of May 1502. He married Margaret, daughter of John Howard, duke of Norfolk, and his son Sir Thomas Wyndham (d. 1521), of Felbrigg, Norfolk, was vice-admiral of England under Henry VIII. By his first wife Sir Thomas was the father of Sir John Wyndham, who married Elizabeth, daughter of John Sydenham of Orchard, Somerset, and founded the Somerset branch of the family, and also of Sir Edmund Wyndham of Felbrigg, who was sheriff of Norfolk at the time of Robert Ket's rebellion. By his second wife Sir Thomas was the father of the seaman Thomas Wyndham (*c.* 1510–1553), an account of whose voyage to Morocco in 1552 is printed in Hakluyt's *Voyages*.

From Sir John Wyndham of Orchard Wyndham was descended Thomas Wyndham (1681–1745), lord chancellor of Ireland from 1726 to 1739, who in 1731 was created Baron Wyndham of Finglass, a title which became extinct on his death. His nephew, Henry Penruddocke Wyndham (1736–1819), the topographer, wrote *A Gentleman's Tour through Monmouthshire and Wales in June and July 1774* (1775); and *Wiltshire from Domesday Book, with a Translation of the Original Latin into English* (Salisbury, 1788).

Sir John Wyndham of Orchard Wyndham was also the ancestor of the Windhams of Felbrigg, who adopted this form of spelling the family name, the most noteworthy members of which were the statesman William Windham (*q.v.*), and Sir Charles Ash Windham (1810–1870), a soldier who commanded in the Crimea and in the Indian Mutiny.

The Wyndhams are also connected through a female line with the family of Wyndham-Quin, which holds the earldom of Dunraven. Valentine Richard Quin (1752–1824), of Adare, county Limerick, was created Baron Adare on the union with England in 1800, and earl of Dunraven and Mount-Earl in 1822. His son, the 2nd earl (1782–1850), married Caroline (d. 1870), daughter and heiress of Thomas Wyndham of Dunraven Castle, Glamorganshire, and took the name of Wyndham-Quin. Their son, the 3rd earl (1812–1871), who was created a peer of the United Kingdom as Baron Kenry in 1866, was a well-known man of science, especially interested in archaeology. His son, Windham Thomas Wyndham-Quin (b. 1841), the 4th earl, was under-secretary for the colonies in 1885–1887, and became later a prominent figure in Irish politics, as [illegible] of the Irish Land Conference and president [illegible]ociation;

he was also prominent as a yachtsman, competing for the America cup (see YACHTING) in 1893 and 1895.

WYNN, SIR JOHN (1553–1627), Welsh antiquary, was the son of Morris Wynn and descended from the princes of Wales. He was educated at Oxford, succeeded to his father's estate of Gwydir in Carnarvonshire in 1580, and was member of parliament for this county in 1586. In 1606 he was made a knight and in 1611 a baronet. He was interested in several mining ventures and also found time for antiquarian studies. He died on the 1st of March 1627. At Llanrwst Wynn founded an hospital and endowed a school. His *History of the Gwydir Family*, which had a great reputation in North Wales, was first published by Daines Barrington in 1770, and in 1878 an edition was published at Oswestry. It is valuable as the only work which describes the state of society in North Wales in the 15th and the earlier part of the 16th century. His son Richard (d. 1649) was in attendance on Prince Charles, afterwards Charles I., when he visited Spain in 1623, and was afterwards treasurer to Queen Henrietta Maria; he wrote an account of the journey to Spain, published by T. Hearne in 1729 with the *Historia vitae et regni Ricardi II*. He built the bridge over the Conway at Llanrwst. The baronetcy became extinct in 1719, when Wynnstay, near Ruabon, passed to Sir Watkin Williams, who took the name of Williams-Wynn and founded the family of that name.

Sir John Wynn's estate of Gwydir came to the 1st duke of Ancaster in the 17th century by his marriage with the heiress of the Wynns. On the death of the last duke in 1779, Gwydir was inherited by his sister Priscilla, Lady Willoughby de Eresby in her own right, whose husband was created Baron Gwydir. On the death of Alberic, Lord Willoughby de Eresby (1870), this title (now merged in that of earl of Ancaster) fell into abeyance between his two daughters, while that of Baron Gwydir passed to his cousin and heir male Gwydir itself was sold by the earl of Ancaster in 1895, the house and part of the estate being bought by Earl Carrington, who also claimed descent from Sir John Wynn.

WYNTOUN, ANDREW OF (?1350–?1420), author of a long metrical history of Scotland, called the *Orygynale Cronykil of Scotland*, was a canon regular of St Andrews, and prior of St Serf's in Lochleven. He wrote the *Chronicle* at the request of his patron, Sir John of Wemyss, whose representative, Mr Erskine Wemyss of Wemyss Castle, Fifeshire, possesses the oldest extant MS. of the work. The subject is the history of Scotland from the mythical period (hence the epithet "original") down to the accession of James I. in 1406. The earlier books are of no historical value, but the later have in all outstanding matters stood the test of comparison with contemporary records. The philological interest is great, for few works of this date, and no other of like magnitude, are extant in the vernacular.

The text is preserved in eight MSS., of which three are in the British Museum, the Royal (17 D xx.), the Cottonian (Nero D. xi.) and the Lansdowne (197); two in the Advocates' library, Edinburgh (19, 2, 3 and 19, 2, 4), one at Wemyss Castle (*u.s.*); one in the university library at St Andrews, and one, formerly in the possession of the Boswells of Auchinleck, now the property of Mr John Ferguson, Duns, Berwickshire. The first edition of the *Chronicle* (based on the Royal MS.) was published by David Macpherson in 1795; the second by David Laing, in the series of "Scottish Historians" (Edin., 1872). Both are superseded by the elaborate edition by Mr Amours for the Scottish Text Society (1906).

WYOMING, one of the Central Western states of the United States of America, situated between the parallels of latitude 41° and 45° N., and the meridians of longitude 27° and 34° W. of Washington. It is bounded on the N. by Montana, on the E. by S. Dakota and Nebraska, on the S. by Colorado and Utah, and on the W. by Utah, Idaho, and a small southward projection of Montana. The state has a length of about 375 m. E. and W. along its southern border and a breadth of 276 m. N. and S. It has an area of 97,914 sq. m., of which 320 sq. m. are water surface

Physical Features.—The greater portion of the state belongs to the Great Plains Province, which extends from N. to S. across the United States between the 100th meridian and the Rocky Mountains. Within this province are found the Black Hills of S. Dakota, and their W. slopes extend across the boundary into N.E. Wyoming. The N.W. portion of the state is occupied by the S. end of the Northern Rocky Mountain Province; and the N. end of the Southern Rockies extends across the Colorado line into southern Wyoming. The Great Plains in Wyoming have an elevation of from 5000 to 7000 ft. over much of the state, and consist of flat or gently rolling country, barren of tree growth, but often covered with nutritious grasses, and affording pasturage for vast numbers of live stock. Erosion buttes and mesas occasionally rise as picturesque monuments above the general level of the plains, and in the vicinity of the mountains the plains strata, elsewhere nearly horizontal, are bent sharply upward and carved by erosion into "hogback" ridges. These features are well developed about the Bighorn Mountains, an outlying member of the Rockies which boldly interrupts the continuity of the plains in north-central Wyoming. The plains sediments contain important coal beds, which are worked in nearly every county in the state. In the region between the Northern and Southern Rockies, the plains are interrupted by minor Mountain groups, volcanic buttes and lava flows, among which the Leucite Hills and Pilot Butte are prominent examples.

Notwithstanding these elevations, this portion of the state makes a distinct break in the continuity of the Northern and Southern Rockies, giving a broad, relatively low pass utilized by the Oregon Trail in early days, and by the Union Pacific railway at a later period. The Black Hills District in the N.E. contains the Little Missouri Buttes and the Mato Tepee (or Devil's Tower), prominent erosion remnants of volcanic intrusions. Local glaciation has modified the higher levels of the Bighorn Mountains, giving glacial cirques, alpine peaks and many mountain lakes and waterfalls. Several small glaciers still remain about the base of Cloud Peak, the highest summit in the range (13,165 ft.). The Southern Rockies end in broken ranges with elevations of 9000 ft. and over. That portion of the Northern Rockies extending into the N.W. of the state affords the most magnificent scenery. Here is the Yellowstone National Park (*q.v.*). Just S. of the Park the Teton Mountains, rising abruptly from the low basin of Jackson's Hole to elevations of 10,000 and 11,000 ft., form a striking feature. In the Wind River Range, farther S.E., are Gannett Peak (13,775 ft.), the highest point in the state, and Fremont Peak (13,720 ft.). In addition to the hot springs of the Yellowstone region, mention should be made of large hot springs at Thermopolis and Saratoga, where the water has a temperature of about 135° F.

Much of the state is drained by branches of the Missouri river, the most important being the Yellowstone, Bighorn and Powder rivers flowing N., and the Cheyenne and North Platte flowing E. The Green river, a branch of the Colorado, flows S. from the S.W. of the state, while the Snake river rises farther N. and flows W. to the Pacific drainage. S.W. of the centre of the state is an area with no outward drainage, the streams emptying into desert lakes.

Fauna.—Great herds of bison formerly ranged the plains and a few are still preserved in the National Park. The white-tailed Virginia deer inhabits the bottom lands and the mule deer the more open country. Lewis's prairie dog, the cottontail rabbit, the coyote, the grey wolf and the kit fox are all animals of the plains. In the mountains are elk, puma, lynx, the varying hare and snowshoe rabbit, the yellow-haired porcupine, Fremont's and Bailey's squirrels, the mountain sheep, the four-striped chipmunk, Townsend's spermophile, the prong-horned antelope, the cinnamon pack-rat, grizzly, brown, silvertip and black bears and the wolverine. Other animals, more or less common, are the black-tailed deer, the jackrabbit, the badger, the skunk, the beaver, the moose and the weasel. The prairie rattlesnake is common in the dry plains country.

The streams are well stocked with rainbow and brook trout. The former fish were introduced from California in 1885. They thrive in the Wyoming streams and rivers and are superior game fish. Specimens of eight and ten pounds weight have been taken by rod and fly fishermen from the Big Laramie river. Other fish native to the waters of the state are the sturgeon, catfish, perch (locally called pike), buffalo fish, flathead and sucker.

There is a great variety of birds. Eared grebes and ring-billed gulls breed on the sloughs of the plains, and rarely the white pelican nests about the lake shores. Here, too, breed many species of ducks, the mallard, gadwall, baldpate, three species of teal, shoveler, pintail, hooded mergansers, and Canada geese; other ducks and geese are migrants only. Formerly the trumpeter swan nested here. On the plains a few waders breed, as the avocet, western willet and long-billed curlew; but most are birds of passage. At high altitudes the mountain plover is found; the dusky grouse haunts the forests above 8000 ft.; the white-tailed ptarmigan is resident in the alpine regions; and on the plains are found the prairie sharp-tailed grouse and the sage-hen. The turkey-buzzard is found mainly in the plains country. Various hawks and owls are common; the golden eagle nests on the mountain crags and the burrowing owl on the plains. The red-naped sapsucker and Lewis's woodpecker are conspicuous in wooded lands; Nuttall's poor-will, Say's phoebe, the desert horned lark, Bullock's oriole, the yellow-headed blackbird and McCown's longspur are characteristic of the open lowlands.

Flora.—Forest growth in Wyoming is limited to the highest mountain ranges, the most important forests being in the Black Hills region in the N.E., on the lower slopes of the Bighorn Mountains, and in the Rocky Mountain ranges of the N.W. of the state, including Yellowstone National Park. The yellow pine is the most important tree in the Bighorns, and small lodge-pole pine makes up the greater part of the N.W. forests. White fir is found above the foothill zone, and heavy growths of cottonwood along the streams in the Bighorn region. The Douglas spruce and Rocky Mountain white pine are common in the forests of the Medicine Bow Mountains, from which much of the native lumber used in the S. of the state is secured. Other trees are the juniper, willow, green ash, box elder, scrub oak, wild plum and wild cherry. Occasional cottonwoods along streams are the only trees on the plains. The common sage brush, artemisia, is the characteristic shrub of the plains where the soil is comparatively free from alkali, and is abundant in the valleys of the arid foothills. Where alkali is present, the plains may be nearly barren, or covered with grease wood and species of atriplex, including the so-called white sage. Grease wood is likewise abundant in the foothills wherever the soil contains alkali. Various species of nutritious grasses cover much of the plains and foothills, and even clothe the apparently barren mountain peaks.

Climate.—In the lower Bighorn Valley, summer temperatures rise to 95° or 100°, but at heights of 6000 to 7000 ft. on neighbouring ranges, summer temperatures seldom rise above 90°, and frosts may occur at any time. Elevations under 6000 ft. have a mean annual temperature of from 40° to 47°, but high mountain areas and cold valleys may have mean temperatures as low as 34°. The air is clear and dry, and although temperatures of 100° are recorded, sunstrokes are practically unknown. Winter temperatures as low as −51° have been recorded, but these very low temperatures occur in the valleys rather than on the higher elevations. The cold is sharp and bracing rather than disagreeable, on account of the dryness of the air; and the periods of cold weather are generally of short duration. The winter climate is remarkably pleasant as a rule, and outdoor work may usually be carried on without discomfort.

The following figures give some idea of the climatic variations. At Basin, in the Bighorn Valley, the mean winter temperature is 16°, the summer mean 72°. Thayne, on the mountainous W. border of the state, has a winter mean of 19°, and a summer mean of but 59°; Cheyenne in the S.E., has a winter mean of 27°, and a summer mean of 65°. The percentage of sunshine in the state is high. Precipitation varies in different areas from 8 to 20 in., the average for the state being 12·5 in. Wyoming thus belongs with the arid states, and irrigation is necessary for agriculture. A greater precipitation doubtless prevails on the higher mountains, but trustworthy records are not available. Spring is the wettest season. The prevailing winds are W. and reach a high velocity on the level plains.

Soil.—While some of the more arid districts have soils so strongly alkaline as to be practically unreclaimable, there are extensive areas of fertile lands which only require irrigation to make them highly productive. Alluvial deposits brought down by mountain streams, and strips of floodplain along larger streams on the plains are very fertile and well repay irrigation. Lack of water rather than poverty of soil renders most of the plains region fit for grazing only. In the mountains, ruggedness combines with thin and scattered soil to make these districts of small agricultural value.

Agriculture.—The total area in farms in 1880 was 124,433 acres, of which 83,122 acres (66·8 %) were improved; in 1900 it was 8,124,536 acres, of which 792,332 acres (9·8 %) were improved. The large increase in unimproved acreage in farms was principally due to the increased importance in sheep-raising. In 1909 Wyoming ranked first among the states in the number of sheep and the production of wool. The number of sheep in 1909 was 7,316,000, valued at $32,190,000, being more than one-eighth in numbers and nearly one-seventh in value of all sheep in the United States. The production of wool in 1909 was 38,400,000 ℔ of washed and unwashed wool and 12,288,000 ℔ of scoured wool. The average weight per fleece was 8 ℔. The Bureau of Animal Industry of the U.S. Department of Agriculture has made experiments in breeding range sheep in Wyoming. The total number of neat cattle on farms and ranges in 1910 was 986,000 (including 27,000 milch cows) valued at $26,277,000; horses, 148,000, valued at $12,284,000;[1] mules, 2000, valued at $212,000; and swine, 21,000, valued at $178,000.

In 1909 the hay crop (alfalfa, native hay, timothy hay, &c.) was 665,000 tons, valued at $5,918,000 and raised on 277,000 acres. The cereal crops increased enormously in the decade 1899–1909. The principal cereal crop in 1909 was oats, the product of which was 3,500,000 bushels, grown on 100,000 acres and valued at $1,750,000. The wheat crop increased from 4674 bushels in 1879 to 2,297,000 bushels in 1909, grown on 80,000 acres and valued at $2,274,000. The product of Indian corn in 1909 was 140,000 bushels, grown on 5000 acres and valued at $109,000.

Mining.—The development of Wyoming's naturally rich mineral resources has been retarded by inadequate transport and by insufficient capital. The value of the state's mineral product was $5,684,286 in 1902 and $9,453,341 in 1908. In 1908 Wyoming ranked twelfth among the states of the Union in the value of its output of bituminous coal. Other mineral products of the state are copper, gold, iron, petroleum, asbestos, soda, silver and lead, gypsum, stone and clay products. The original coal supply of the present state has been estimated (by the United States Geological Survey) at 424,085,000,000 short tons of the bituminous or sub-bituminous variety, this amount being second only to that for North Dakota, 500,000,000,000 short tons, which, however, is entirely lignite. Coal was first mined in what is now Wyoming in 1865, probably in connexion with the building of the Union Pacific railway, and the product in that year was 800 short tons. Thereafter the industry developed steadily and the product in 1908 was 5,489,902 tons, valued at $8,868,157. In 1908 (and for several years before) the largest product of coal (2,180,933 tons) came from Sweetwater county, in the S.W. of the state, and Uinta county (adjoining Sweetwater county on the W.) had the next largest product, 1,380,488 tons. Sheridan county, in the north-central part of the state, Carbon county, in the south-central part and Weston county in the N.E. were the next largest producers. The product of coal to the end of 1908 was 125,000,000 short tons, or 0·029 % of the estimated supply.

The mining product next in value to coal in 1908 was copper, taken chiefly in Carbon county in a zone of brecciated quartzite underlying schist, the original ore being chalcopyrite, with possibly some pyrite, a secondary enrichment, which has produced important bodies of chalcocite in the upper workings, but these are replaced by chalcopyrite at greater depth. The production in 1908 was 2,416,197 ℔, valued at $318,938. The gypsum product (from the Laramie plains) in 1908 was 31,188 tons, valued at $94,935.

There are extensive deposits of petroleum and natural gas, which have become of commercial importance. Oil has been found in eighteen different districts, the fields being known as follows:—The Carter, Hilliard, Spring Valley and Twin Creek in Uinta county; the Popo Agie, Lander, Shoshone, Beaver and a part of Dutton in Fremont county; the Rattlesnake, Arrago, Oil Mountain and a part of Dutton, Powder river and Salt Creek in Natrona county; part of Powder river and Salt Creek in Johnson county; Newcastle in Weston county; Belle Fourche in Crook county; Douglas in Converse county and Bonanza in Bighorn county. The Popo Agie and Lander fields produce the largest quantities of oil, the wells being partly gushers from which a heavy fuel oil is obtained. This is now being used by the Chicago & North Western Railroad Company on its locomotives, and it is also used in Omaha (Nebraska) by manufacturing establishments. There is a great variety in the grades of oils produced in the state, ranging from the heavy asphaltic oils of the Popo Agie and Lander fields to the high-grade lubricants and superior light products obtained from the wells in the Douglas, Salt Creek and Uinta county fields. Natural gas in quantity has been found in the Douglas field and in Bighorn county.

The iron deposits are very extensive, and the ores consist of red haematites, magnetites, titanic, chrome and manganese irons. In nearly every county there are veins of iron ore of varying extent and quality, the most important being at Hartville, Laramie county, Iron Mountain, Albany county, the Seminole and Rawlins in Carbon county. The Hartville ores are remarkable for their high grade and purity, running from 60 to 70 % metallic iron, with 2½ to 5 % silica, and only traces of sulphur and phosphorus. The ore is a red haematite occurring in slate. The iron ore from this district obtained the grand prize at the World's Fair held in Chicago in 1893, in competition with iron ores from all parts of the world. The Hartville iron deposits are worked by the Colorado Fuel & Iron Company, which ships large quantities of ore to its furnaces at Pueblo, Colorado. The discovery of natural gas in the Douglas oil field has opened up the possibility of working a smelting plant at the mines by means of this cheap and convenient fuel. The distance to be covered by a pipe line is not prohibitive, and the matter has been under consideration by the owners and lessees of the iron mines.

There are sandstone deposits in Carbon county, which supplied the stone for the Capitol at Cheyenne and the state penitentiary; and from the Iron mountain quarries in Laramie county was taken the white variety used in building the Carnegie library and the Federal building in Cheyenne. Sandstones and quartzites were also quarried in 1902 in Albany, Crook and Uinta counties. Limestone occurs in thick formations near Lava Creek, and in the valley of the East Fork of the Yellowstone river; also near the summit of the Owl Creek range, and in the Wind River range. Gold was discovered on the Sweetwater river in 1867, and placer and quartz deposits have been found in almost every county in the state. Sulphur has been found near Cody and Thermopolis.

Irrigation.—The irrigable area of Wyoming is estimated at about 6,200,000 acres, lying chiefly in Bighorn, Sheridan and Johnson counties in the N.W. of the state, and in Laramie, Albany and Carbon counties in the S.E., though there are large tracts around the headwaters of the Bighorn river, in Fremont county in the west-central part, along the North Platte river and its tributaries in Converse county in the central part, and along the Green river and its tributaries in Sweetwater and Uinta counties in the S.W. Under the Carey Act and its amendments Congress had in 1909 given to the state about 2,000,000 acres of desert land on condition that it should be reclaimed, and in that year about 800,000 acres were in process of reclamation, mostly by private companies. Settlers intending to occupy such lands must satisfy the state that they have entered into contracts with the irrigating company for a sufficient water-right

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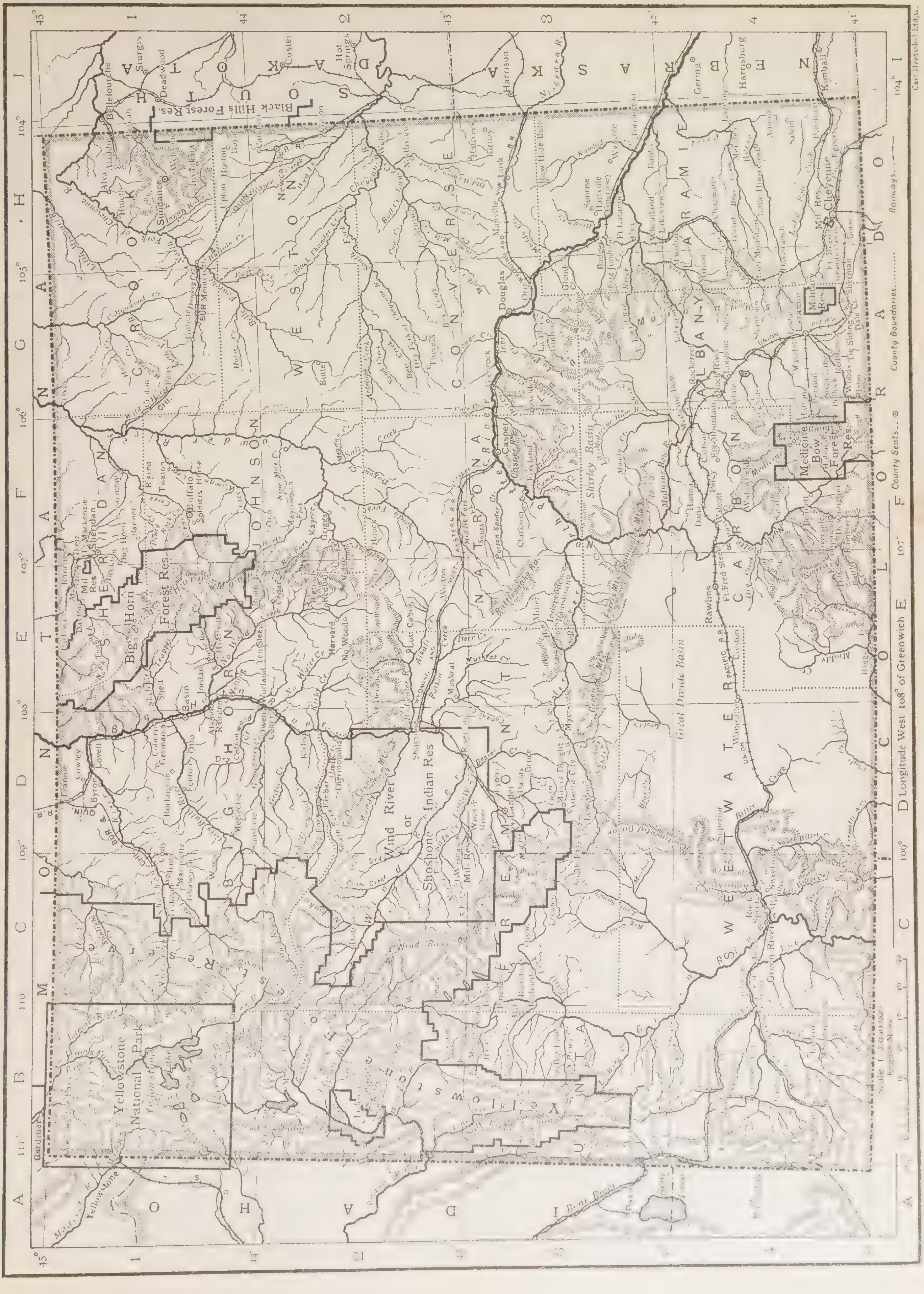
[1] The breed of horses in Wyoming has improved rapidly; in 1904, when the U.S. Department of Agriculture purchased eighteen mares and a stallion in hope of improving the American carriage horse, six of the mares were from Wyoming and were principally of Morgan stocks.

WYOMING



M O N T A N A
S O U T H D A K O T A
N E B R A S K A
C O L O R A D O
U T A H
I D A H O
Black Hills Forest Res.
Belle Fourche
Sturgis
Deadwood
Custer
Hot Springs
Harrison
Gering
Harrisburg
Kimball
Gardiner
Yellowstone
Yellowstone National Park
C R O O K
Sundance
W E S T O N
Newcastle
Upton
C O N V E R S E
Douglas
Lusk
Manville
N I O B R A R A
L A R A M I E
Cheyenne
Wheatland
Guernsey
Hartville
Sunrise
Mil. Res.
Ft. Russell
A L B A N Y
Laramie
Rock River
Medicine Bow Forest Res.
Military Res.
C A R B O N
Rawlins
Walcott
Ft. Fred Steele
Hanna
Shirley Basin
Medicine Bow R.
N A T R O N A
Casper
Independence Rock
Rattlesnake Ra.
Powder River
C A M P B E L L
Gillette
J O H N S O N
Buffalo
Kaycee
S H E R I D A N
Sheridan
Big Horn Forest Res.
Big Horn Mts.
B I G H O R N
Basin
Greybull
Lovell
Cowley
Byron
Worland
Ten Sleep
Thermopolis
H O T S P R I N G S
Lost Cabin
P A R K
Cody
Meeteetse
F R E M O N T
Lander
Shoshoni
Wind River or Shoshone Indian Res.
Wind River Ra.
South Pass City
Atlantic City
Great Divide Basin
S W E E T W A T E R
Rock Springs
Green River
Wamsutter
Creston
U I N T A
Evanston
L I N C O L N
Kemmerer
Bitter Cr.
Green R.
North Platte R.
Cheyenne R.
County Seats ⊙
County Boundaries ....
Railways
Longitude West 108° of Greenwich
45°
44°
43°
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41°
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and a perpetual interest in the irrigation works. The principal undertaking of the Federal government is the Shoshone project in Bighorn county. This provides for a storage reservoir, controlled by Shoshone dam on Shoshone river, about 8 m. above Cody; a canal diverting water from Shoshone reservoir round the N. of Shoshone dam and covering lands in the vicinity of Cody, Corbett, Eagle Nest and Ralston; a dam at Corbett about 16 m. below the reservoir diverting water to Ralston reservoir and thence to lands in the vicinity of Ralston, Powell, Garland, Mantua and Frannie, and a dam on the Shoshone river near Eagle Nest diverting water into a canal covering the lands of the Shoshone River Valley. This project was authorized in 1904; it will affect, when completed, 131,900 acres, of which in 1909 about 10,000 acres were actually under irrigation. Near Douglas, in Converse county, there is a reinforced concrete dam, impounding the waters of Laprele Creek, to furnish water for over 30,000 acres, and power for transmitting electricity. There are large irrigated areas in Johnson and Sheridan counties.

Forests.—The woodland area of Wyoming in 1900 was estimated at 12,500 sq. m. (13 % of the area of the state), of which the United States had reserved about 3500 sq. m. in the Yellowstone National Park and 5207 sq. m., chiefly in the Bighorn Mountains in the N., and the Medicine Bow Mountains in the S.E. of the state. The saleable timber consists almost entirely of yellow pine, though there is a relatively small growth of other conifers and of hard-wood trees.

Manufactures.—Wyoming's manufacturing industries are relatively unimportant. In the period 1900–1905 the value of factory products increased from $3,268,555 to $3,523,260; the amount of capital invested, from $2,047,883 to $2,695,889, and the number of establishments from 139 to 169; the average number of employees decreased from 2060 to 1834. In the same period (1900–1905), the value of the products of urban[1] establishments decreased from $1,332,288 to $1,244,223, and the amount of capital invested increased from $871,531 to $988,615; but the value of the products of rural establishments increased from $1,936,267 to $2,279,037, and the capital invested from $1,176,352 to $1,707,274. The values of the products of the principal industries of the state in 1905 were: car and general shop construction and repairs by steam railway companies, $1,640,361; lumber and timber products, $426,433; flour and grist mill products, $283,653; butter, $114,354. Among other manufactures were gypsum wall-plaster, saddlery and harness, malt liquors and tobacco, cigars and cigarettes.

Transport.—There has been relatively little development of transport facilities in Wyoming. The railway mileage, which was only 459 m. in 1870, increased to 1002 m. in 1890, 1280 m. in 1905, and 1623 m. on the 1st of January 1909. The Union Pacific railway crosses the S. of the state, connects with the Oregon Short Line at Green river and extends both E. and S. from Cheyenne. The Colorado & Southern (controlled by the Chicago, Burlington & Quincy Railroad Company) extends N. from Cheyenne to Orin Junction, where it connects with the Chicago & North Western, which runs across the south-central part of the state as far as Lander (under the name of the Wyoming & North Western railroad). Four branches of the Chicago, Burlington & Quincy system enter or cross the state. One extends from Cheyenne S.E. to Holdredge, Nebraska; the main line crosses the N.E. of the state to Billings, Montana, whence it extends S. to Cody and Kirby in the Bighorn basin, Wyoming; while another branch from Alliance, Nebraska, extends to the iron mines at Guernsey. The Chicago, Burlington & Quincy was building in 1910 a new line from the N.W. to connect with the Colorado & Southern line at Orin Junction, passing through Douglas. When completed to Orin Junction this will be a main through route from the Mexican Gulf to the N.W. Pacific coast. There are also several shorter railways in the state, and various stage lines reach the more inaccessible regions.

Population.—The population in 1870 was 9118; in 1880, 20,789; in 1890, 60,705; in 1900, 92,531; in 1910, 145,965. The density of the population was 0·6 per sq. m. in 1890 and 1·5 per sq. m. in 1910, there being in this year only one state with a smaller average number of inhabitants to the sq. m., namely Nevada, with 0·7. Of the total population in 1900, 88,051, or 96·2 %, were whites; 1686 were Indians; 940 were negroes; 461 were Chinese and 393 were Japanese. The Indians are all taxed. They belong to the Arapaho and Shoshoni tribes.[2] The Wind River Reservation, under the Shoshoni School, is in the central part of the state. There were 17,415 foreign-born in the state in 1900, of whom 2596 were English, 2146 Germans, 1727 Swedes, 1591 Irish, 1253 Scotch and 1220 Finns. Of the 41,993 persons of foreign parentage (*i.e.* having either or both parents of foreign birth) in that year 4973 were of English, 4571 of German, and 4482 of Irish parentage, *i.e.* on both the father's and the mother's side. Of the 75,116 born in the United States, 19,507 were natives of Wyoming, 6112 were born in Iowa, 5009 in Nebraska, 4923 in Illinois, 4412 in Missouri and 3750 in Utah. Among the numbers of religious denominations in 1906 the Roman Catholics, with 10,264 communicants, had the largest membership, followed by the Latter-day Saints, or Mormons, with 5211 communicants (21·8 % of the total church membership for the state), the Protestant Episcopalians with 1741, the Methodists with 1612 and the Presbyterians with 984. The urban population (*i.e.* the population of places having 4000 inhabitants or more) increased from 18,078 in 1890 to 26,657 in 1900 or 47·5 %, the urban being 28·8 % of the total population in 1900. The semi-urban population (*i.e.* population of incorporated places, or the approximate equivalent, having fewer than 4000 inhabitants) decreased in the same period from 14,910 to 12,725, and the rural population (*i.e.* the population outside of incorporated places) increased from 29,567 to 53,149, which was 78·7 % of the total increase. The principal cities of the state (with population) in 1900 were: Cheyenne, 14,087; Laramie, 8207; Rock Springs, 4363; Rawlins, 2317, and Evanston, 2110. After 1900 the population of the centre and N. of the state increased in proportion faster than the older settled portions in the S. In 1910 Sheridan (8408) in Sheridan county, Douglas in Converse county and Lander in Fremont county were as important as some of the older towns of the southern part of the state.

Government.—Wyoming is governed under its first constitution, which was adopted in November 1889. An amendment may be proposed by either branch of the legislature. If it is approved by two-thirds of the members of each branch, it must be submitted to the people at the next general election and, if approved by a majority of the electors, it then becomes a part of the constitution. Whenever two-thirds of the members elected to each branch of the legislature vote for a convention to revise or amend the constitution and a majority of the people voting at the next general election favour it, the legislature must provide for calling a convention. Suffrage is conferred upon both men and women, and the right to vote at a general election is given to all citizens of the United States who have attained the age of twenty-one years, are able to read the constitution, and have resided in the state one year and in the county sixty days immediately preceding, with the exception of idiots, insane persons, and persons convicted of an infamous crime; at a school election the voter must also own property on which taxes are paid. General elections are held biennially, in even-numbered years, the first Tuesday after the first Monday in November, and each new administration begins the first Monday in the following January.

Executive.—The governor is elected for a term of four years. He must be at least thirty years of age, and have resided in the state for five years next preceding his election. If the office becomes vacant the secretary of state becomes acting governor; there is no lieutenant-governor. The governor, with the concurrence of the Senate, appoints the attorney-general, the state engineer and the members of several boards and commissions. He has the power to veto bills, to pardon, to grant reprieves and commutations, and to remit fines and forfeitures, but the Board of Charities and Reform constitutes a Board of Pardons for investigating all applications for executive clemency and advising the governor with respect to them. The secretary of state, auditor, treasurer and superintendent of public instruction are elected for the same term as the governor.

Legislature.—The legislature consists of a Senate and a House of Representatives. The number of representatives must be not less than twice nor more than three times the number of senators. One-half the senators and all the representatives are elected every two years. Both senators and representatives are apportioned among the several counties according to their population; each county, however, is entitled to at least one senator and one representative. The legislature meets biennially, in odd-numbered years, on the second Tuesday in January, and the length of its sessions is limited to forty days. All bills for raising a revenue must originate in the House of Representatives, but the Senate may propose amendments. The governor has three days (Sundays excepted) in which to veto any bill or any item in an appropriation bill, and a two-thirds vote of the members elected to each house is required to override his veto.

Judiciary.—The administration of justice is vested principally in a supreme court, district courts, justices of the peace and municipal courts. The supreme court consists of three justices who are elected by the state at large for a term of eight years, and the one having the shortest term to serve is chief justice. The court has original jurisdiction in *quo warranto* and *mandamus* proceedings against state officers and in *habeas corpus* cases, general appellate jurisdiction, and a superintending control over the inferior courts. It holds two terms annually, at the capital, one beginning the first Monday in April and one beginning the first Monday in October. The state is divided into four judicial districts, and in each of these a district judge is elected for a term of eight years. The district courts have original jurisdiction in all actions and matters not expressly vested in some other court and appellate jurisdiction in cases arising in the lower courts. Justices of the peace, one of whom is elected biennially in each precinct, have jurisdiction in civil actions in which the amount in controversy does not exceed $200 and the title to or boundary of real estate is not involved, and in criminal actions less than a felony and in which the punishment prescribed by law does not exceed a fine of $100 and imprisonment for six months. Each incorporated city or town has a municipal court for the trial of offences arising under its ordinances.

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[1] That is, those in the two municipalities (Cheyenne and Laramie) having a population in 1900 of more than 8000.

[2] The *Report* of the Commissioner of Indian Affairs for 1909 gives 854 Arapaho and 816 Shoshoni under the Shoshoni School.

Local Government.—A board of three commissioners is elected in each county, one for four years and one for two years at each biennial election. It has the care of the county property, manages the county business, builds and repairs the county buildings, apportions and orders the levying of taxes, and establishes the election precincts. The other county officers are a treasurer, a clerk, an attorney, a surveyor, a sheriff, a coroner and a superintendent of schools, each elected for a term of two years. A justice of the peace and a constable are elected for and by each precinct. Cities and towns are incorporated under general laws.

Miscellaneous Laws.—A married woman may hold, acquire, manage and convey property and carry on business independently of her husband. When a husband or a wife dies intestate one-half of the property of the deceased goes to the survivor; if there are no children or descendants of any child three-fourths of it goes to the survivor; if there are no children or descendants of any child and the estate does not exceed $10,000 the whole of it goes to the survivor. The causes for a divorce are adultery, incompetency, conviction of a felony and sentence to imprisonment therefor after marriage, conviction of a felony or infamous crime before marriage provided it was unknown to the other party, habitual drunkenness, extreme cruelty, intolerable indignities, neglect of the husband to provide the common necessaries of life, vagrancy of the husband and pregnancy of the wife before marriage by another man than her husband and without his knowledge. The plaintiff must reside in the state for one year immediately preceding his or her application for a divorce unless the parties were married in the state and the applicant has resided there since the marriage. Neither party is permitted to marry a third party until one year after the divorce has been granted. The desertion of a wife or of children under fifteen years of age is a felony punishable with imprisonment for not more than three years nor less than one year. The homestead of a householder who is the head of a family or of any resident of the state who has attained the age of sixty years is exempt, to the value of $1500, or 160 acres of land, from execution and attachment arising from any debt, contract or civil obligation other than taxes, purchase money or improvements, so long as it is occupied by the owner or his or her family, and the exemption inures for the benefit of a widow, widower or minor children. If the owner is married the homestead can be alienated only with the consent of both husband and wife. The family Bible, school books, a lot in a burying-ground and $500 worth of personal property are likewise exempt to any person who is entitled to a homestead exemption. A day's labour in mines and in works for the reduction of ores is limited to eight hours except in cases of emergency where life or property is in imminent danger. The sale of intoxicating liquors is licensed only in incorporated cities and towns.

Charities and Corrections.—The state charitable and penal institutions consist of the Wyoming General Hospital at Rock Springs, with one branch at Sheridan and another branch at Casper; the Big Horn Hot Springs at Thermopolis, the Wyoming State Hospital for the Insane at Evanston, the Wyoming Home for the Feeble-Minded and Epileptic at Lander, the Wyoming Soldiers' and Sailors' Home near Buffalo, and the State Penitentiary at Rawlins. The general supervision and control of all these institutions is vested in the Board of Charities and Reform, consisting of the governor, the secretary of state, the treasurer, the auditor, and the superintendent of public instruction; the same officers also constitute the Board of Pardons. Convicts other than those for life are sentenced to the penitentiary for a maximum and a minimum term, and when one has served his minimum term the governor, under rules prescribed by the Board of Pardons, may release him on parole, but he may be returned to prison at any time upon the request of the Board of Pardons.

Education.—The administration of the common school system is vested in the state superintendent of public instruction, county superintendents and district boards. Whenever 100 freeholders request it, the county commissioners must submit to the voters of a proposed high school district the question of establishing a high school district, and each precinct giving a majority vote for it constitutes a part of such a district for establishing and maintaining a high school. All children between seven and fourteen years of age must attend a public, private or parochial school during the entire time that the public school of their district is in session unless excused by the district board. The common schools are maintained with the proceeds of school taxes and an annual income from school funds which are derived principally from lands. At the head of the educational system is the University of Wyoming (1886), at Laramie (*q.v.*); it is governed by a board of trustees consisting of its president, the superintendent of public instruction, and nine other members appointed by the governor with the concurrence of the Senate for a term of six years. It is maintained with the proceeds from funds derived principally from lands and with a university tax amounting in 1909 to one-half mill on a dollar.

Finance.—The principal sources of revenue are a general property tax, a tax on the gross receipts of express companies, a tax on the gross products of mines, an inheritance tax, a poll tax and the sale of liquor licences. Railways, telegraph lines and mines are assessed by the state board of equalization, which consists of the secretary of state, the treasurer and the auditor. Other property is assessed by the county assessors. The county commissioners constitute the county board of equalization. A commissioner of taxation who is appointed by the governor with the concurrence of the Senate for a term of four years exercises a general supervision over all tax officers and the boards of equalization. By a law enacted in 1909 county commissioners are forbidden to levy a tax which will yield more than 10% in excess of that raised the preceding year. The constitution limits the state tax for other than the support of educational and charitable institutions and the payment of the state debt and the interest thereon to four mills on the dollar; the county tax for other than the payment of the county debt and the interest thereon to twelve mills on the dollar; the tax of an incorporated city or town for other than the payment of its debt and the interest thereon to eight mills on the dollar. The constitution also forbids the creation of a state debt in excess of 1% of the assessed value of the taxable property in the state; of a county debt in excess of 2% of the assessed value of the taxable property in the county; or of a municipal debt for any other purpose than obtaining a water supply in excess of 2%, unless for building sewerage, when a debt of 4% may be authorized. Wyoming entered the Union with a bonded indebtedness of $320,000. This has been reduced as rapidly as the bonds permit, and on the 30th of June 1910 the debt was only $140,000.

History.—Spanish historians have claimed that adventurers from the Spanish settlements in the S. penetrated almost to the Missouri river during the first half of the 17th century and even formed settlements within the present limits of Wyoming, but these stories are more than doubtful. The first white men certainly known to have traversed the region were Sieur de la Verendrye and his sons, who working down from Canada spent a part of the year 1743–1744 examining the possibilities of the fur trade. Apparently no further French explorations were made from that direction, and the transfer of Canada from France to Great Britain (1763) was followed by lessened interest in exploration. The expedition of Meriwether Lewis and William Clark in 1804–1806 did not touch the region, but a discharged member of the party, John Colter, in 1807 discovered the Yellowstone Park region and then crossed the Rocky Mountains to the head of Green river. Trappers began to cover the N. portion about the same time, and in 1811 the overland party of the Pacific Fur Company crossed the country on their way to Astoria. In 1824 William H. Ashley with a considerable party explored and trapped in the Sweetwater and Green river valleys, and in 1826 wagons were driven from St Louis to Wind river for the Rocky Mountain Fur Company. Captain B. L. E. Bonneville was the first to cross the Rockies with wagons (1832),[1] and two years later Fort Laramie, near the mouth of the Laramie river, was established to control the fur trade of the Arapahoes, Cheyennes and Sioux.

The United States exploring expedition, commanded by John Charles Frémont, explored the Wind River Mountains and the South Pass in 1842, under the guidance of Kit Carson. From this time the favourite route to the Pacific led through Wyoming;[2] but of all the thousands who passed few or none settled permanently within the present limits of the state, partly because of the aridity of the land and partly because of the pronounced hostility of the Indians. For the latter reason the National Congress on the 19th of May 1846 authorized the construction at intervals along the trail of military stations for the protection of the emigrant trains, and Fort Kearny was built (1848) and Fort Laramie was purchased (1849). The great

[1] See Washington Irving, *Adventures of Captain Bonneville* (New York, 1860).

[2] See Francis Parkman, *The Oregon Trail* (Boston, 1849).

Mormon migration passed along the trail in 1847–1849, and in 1853 fifty-five Mormons settled on Green river at the trading post of James Bridger, which they purchased and named Fort Supply. This S.W. corner of the present state was at that time a part of Utah. With the approach of United States troops under Albert Sidney Johnston in 1857, Fort Supply was abandoned, and in the next year the Mormon settlers retired to Salt Lake City, again leaving the region almost without permanent inhabitants.

The Indians saw with alarm the movement of so many whites through their hunting grounds and became increasingly unfriendly. By a treaty negotiated at Fort Laramie in 1851, the Arapahoes, Sioux, Cheyennes and others agreed to confine themselves within the territory bounded by 100° and 107° W. longitude and 39° and 44° N. latitude; but, besides minor conflicts, a considerable portion of the garrison of Fort Laramie was killed in 1854 and there was trouble for more than twenty years. During the Civil War (1861–1865) the Indians were especially bold as they realized that the Federal troops were needed elsewhere. Meanwhile, there began a considerable migration to Montana, and the protection of the N. of the trail demanded the construction of posts, of which the most important were Fort Reno, on the Powder river, and Fort Phil Kearny in the Bighorn Mountains. In spite of the treaty allowing the opening of the road, during a period of six months fifty-one hostile demonstrations were made, and on the 21st of December 1866 Captain W. J. Fetterman and seventy-eight men from Fort Phil Kearny were ambushed and slain. Hostilities continued in 1867, but the troops were hampered on account of the scarcity of cavalry. Congress in 1867 appointed a commission to arrange a peace, but not until 1868 (29th April, at Fort Laramie) were any terms agreed upon. The posts on the Montana trail were abandoned, and the Indians agreed to remove farther E. and to cease attacking trains, not to oppose railway construction, &c. The territory N. of the Platte river and E. of the Bighorn Mountains was to be reserved as an Indian hunting ground and no white men were to settle on it without the consent of the Indians. Gold was discovered on the Sweetwater river in 1867, and a large inrush of population followed. This unorganized territory E. of the Rocky Mountains was a part of Dakota, and in January 1868 Carter (later Sweetwater) county was erected. Farther E. Cheyenne was laid out by the Union Pacific Railroad (July 1867), a city government was established in August, newspapers began publication, and Laramie county was organized before the arrival of the first railway train on the 13th of November 1867. About six thousand persons spent the winter in Cheyenne, and disorder was checked only by the organization of a vigilance committee. Almost the same scenes followed the laying off of Laramie in April 1868, when 400 lots were sold during the first week and 500 habitations were erected within a fortnight. Albany and Carbon counties were organized farther W. in the same year.

A bill to organize the Territory of Wyoming had been introduced into Congress in 1865, and in 1867 the voters of Laramie county had chosen a delegate to Congress. He was not permitted to take a seat, but his presence in Washington hastened action, and on the 25th of July 1868 the act of Congress establishing a Territory with the present boundaries was approved by President Andrew Johnson. The portion of the Territory E. of the Rocky Mountains was taken from Dakota and that W. from Utah and Idaho, and included parts of the three great additions to the original territory of the United States. That portion E. of the mountains was a part of the Louisiana Purchase (1803), the W. portion above 42° was a part of the Oregon country, and that S. of that parallel came by the Mexican cession of 1848. The first governor, John A. Campbell, was appointed in April 1869, and the organization of the Territory was completed in May of the same year. At the first election, on the 2nd of September 1869, 5266 votes were cast. The legislature established the seat of government at Cheyenne, and granted full suffrage and the right of holding office to women. The first great inrush of population, following the discovery of gold and the opening of the railway, brought many desperate characters, who were held in check only by the stern, swift measures of frontier justice. After the organization of the Territory, except for the appearance of organized bands of highwaymen in 1877–1879, there was little turbulence, in marked contrast with conditions in some of the neighbouring Territories. Agriculture began in the narrow but fertile river valleys, and stock-raising became an important industry, as the native grasses are especially nutritious. The history of the Territory was marked by few striking events other than Indian troubles. The N.E. of the Territory, as has been already said, had been set apart (1868) as a hunting ground for the Sioux Indians, but the rumour of the discovery of gold in the Black Hills and the Bighorn Mountains in 1874–1875 caused a rush to the region which the military seemed powerless to prevent. The resentful Indians resorted to war. After a long and arduous contest in Wyoming, Montana and Dakota, which lasted from 1874 to 1879, and during which General George A. Custer (*q.v.*) and his command were killed in 1876 on the Little Bighorn in Montana, the Indians were thoroughly subdued and confined to reservations. The settlers in Wyoming shared the general antipathy to the Chinese, common to the western country. On the 2nd of September 1885 the miners at Rock Springs attacked about 400 Chinamen who had been brought by the railway to work in the mines, killing about fifty of them and driving the remainder from the district. Governor Warren summoned Federal troops and prevented further destruction of life and property.

The Territory increased in population and more rapidly in wealth, owing chiefly to the large profits in cattle raising, though this prosperity suffered a check during the severe winter of 1886–1887, when nearly three-fourths of the range cattle died of exposure. Agitation for statehood increased, and on the 30th of September 1889 a constitution was formed which was adopted by the people in November of the same year. The Constitution, which continued the Territorial provision of full suffrage for women, met the approval of Congress, and on the 10th of July 1890 Wyoming was formally admitted as a state. Since admission the progress of the state has been steady. Extensive irrigation projects have made available many thousand acres of fertile land, and much more will be subjected to cultivation in the future as the large ranges are broken up into smaller tracts. In some sections a system of dry-farming, by which the scanty rainfall is protected from evaporation by deep ploughing and mulching the soil, has proved profitable.

The transition of the principal stock-raising industry from large herds of cattle to small, and the utilization of the ranges for sheep grazing almost exclusively covered a period of over twenty years preceding 1910, during which time many conflicts occurred between range cattle-owners and sheep flockmasters over the use of the grazing grounds. The settler also, who selected his homestead covering watering places to which the range cattle formerly had free access, came into conflict with the cattlemen. Some of these small settlers owned no cattle, and subsisted by stealing calves and unbranded cattle (mavericks) belonging to the range cattlemen. In parts of the state it became impossible to get a jury composed of these small squatters to convict anybody for stealing or killing cattle, and so bad did this become that, in 1892, certain cattlemen formed a small army of mounted men and invaded the central part of the state with the avowed intention of killing all the men generally considered to be stock thieves, an episode known as the Johnson County Raid. This armed body, consisting of over fifty men, surrounded a log cabin and shot down two of the supposed cattle "rustlers," the latter defending themselves bravely. The country round was roused and large numbers of settlers and others turned out and besieged the cattlemen, who had taken refuge in some ranch buildings. Their case was becoming desperate when a troop of Federal cavalry arrived, raised the siege, and took the cattlemen back to Cheyenne as prisoners. They were subsequently held for murder, but were finally released without trial. Since that time experience has proved that the grazing ranges of the state are better suited to sheep than cattle, the former being much more profitable and better able to stand the cold on the open range.

While many cattlemen have been driven out of business by the encroachments of sheep, the majority of the present flockmasters were range cattle owners in the past and have changed to the more profitable occupation. At the present time serious collisions between sheep and cattle owners are rare. There are still many cattle in the state, but they are divided up into small herds, no longer depending upon the open range for a precarious subsistence during the winter, but are sheltered and fed during winter storms on the hay ranches. The breeds of cattle are far superior now to the old range stock, so that it pays to take care of them; many thousands are fed during the winter on alfalfa hay.

Governors of Wyoming

Territorial.		
John A. Campbell		1869–1875
John M. Thayer		1875–1878
John W. Hoyt		1878–1882
William Hale		1882–1885
Francis E. Warren		1885–1886
George W. Baxter (acting)		1886–1887
Thomas Moonlight		1887–1889
Francis E. Warren		1889–1890
State.		
Francis E. Warren	Republican	1890
Amos W. Barber (acting)	,,	1890–1892
J. E. Osborne	Dem.-Populist	1892–1895
W. A. Richards	Republican	1895–1899
De Forest Richards	,,	1899–1903
Fenimore Chatterton[1] (acting)	,,	1903–1905
Bryant B. Brooks	,,	1905–1911
J. M. Carey	Democrat	1911–

Bibliography.—H. C. Beeler, *Report to the Governor of Wyoming by the State Geologist* (Cheyenne, 1904), and "Geology and Mineral Resources of Wyoming," pp. 113-118 of *Rept. of Proc. Am. Mining Cong.*, 7th Ann. Sess. (1905), a general account of the geology and mineral resources of Wyoming; C. A. White, "Geology and Physiography of a portion of North-western Colorado and adjacent parts of Utah and Wyoming," pp. 677-712 of 9th *Ann. Rept.* U.S. Geol. Survey, 1887–1888 (Washington, 1889); F. E. Mathes, "Glacial Sculpture of Bighorn Mountains, Wyoming," pp. 167-190 of Pt. ii. of 21st *Ann. Rept.* U.S. Geol. Survey, 1899–1900 (Washington, 1900); N. H. Darton, "Preliminary Description of the Geology and Water Resources of the Southern Half of the Black Hills and adjoining regions in South Dakota and Wyoming," pp. 489-599 of Pt. iv. of 21st *Ann. Rept.* U.S. Geol. Survey, 1899–1900 (Washington, 1901); A. C. Spencer, "Mineral Resources of the Encampment Copper Region, Wyoming," pp. 163-169, U.S. Geol. Survey *Bull.* No. 213 (Washington, 1903); *Mineral Resources of the United States* published annually by the U.S. Geological Survey; and material indexed in the various bibliographies (*e.g. Bulls.* 301, 372 and 409) of the U.S. Geological Survey; Aven Nelson, *Report on the Flora of Wyoming*, Wyoming Experiment Station, *Bull.* 28 (1896); A. J. Henry, *Climatology of the United States*, U.S. Weather Bureau *Bull.* Q (Washington, 1906); for industries, population, &c., the Reports of the U.S. Census generally; Department of Immigration of the state, *Some Views of Wyoming* (1908); *The State of Wyoming*, published by authority of the state legislature (1908); F. Chatterton, secretary of state, *The State of Wyoming* (1904); and reports of the various state officers mentioned in the text; *Revised Statutes of Wyoming* (Laramie, 1899); *Wyoming Irrigation Laws* (1908); G. R. Hebard, *Government of Wyoming* (San Francisco, 1904); H. H. Bancroft, *Nevada, Colorado and Wyoming* (San Francisco, 1890), and *Utah* (San Francisco, 1889); E. R. Talbot, *My People of the Plains* (New York, 1906); W. M. Raine, *Wyoming, a Story of the Outdoor West* (New York, 1909). An interesting picture of former conditions in Wyoming is given in Owen Wister's novel, *The Virginian* (1902).

WYOMING VALLEY, a valley on the N. branch of the Susquehanna river, in Luzerne county, Pennsylvania, U.S.A. Its name is a corruption of a Delaware Indian word meaning "large plains." The valley, properly speaking, is about 3½ m. wide and about 25 m. long, but the term is sometimes used historically in a broader sense to include all of the territory in the N.E. of the state once in dispute between Pennsylvania and Connecticut. In Connecticut the Susquehanna Land Company was formed in 1753 to colonize the valley, and the Delaware Land Company was formed in 1754 for the region immediately W. of the Delaware river. The rights of the Six Nations to all this territory were purchased at Albany, New York, by the Susquehanna Company in 1754, but the work of colonization was delayed for a time by the Seven Years' War. A few colonists sent out by the Susquehanna Company settled at Mill Creek near the present site of Wilkes-Barré in 1763, but were (October 15th) attacked and driven away by the Indians. In December 1768 the company divided a part of the valley into five townships of 5 sq. m. each, granting to forty proprietors the choice of one of these on condition that they should take possession of it by the 1st of February 1769, and the other four townships to 200 settlers on condition that they should follow by the 1st of May. The first group arrived on the 8th of February, the first division of the larger body on the 12th of May, and the five original towns of Wilkes-Barré (*q.v.*), Kingston (*q.v.*), Hanover,[2] Plymouth and Pittston were soon founded.

In the meantime the Six Nations (in 1768) had repudiated their sale of the region to the Susquehanna Company and had sold it to the Penns; the Penns had erected here the manors of Stoke and Sunbury, the government of Pennsylvania had commissioned Charles Stewart, Amos Ogden and others to lay out these manors, and they had arrived and taken possession of the block-house and huts at Mill Creek in January 1769. The conflict which followed between the Pennsylvania and the Connecticut settlers is known as the first Pennamite-Yankee War. Although defeated in the early stages of the conflict, the Yankees or Connecticut settlers finally rallied in August 1771 and compelled the Pennsylvanians to retreat, and the war terminated with the defeat of Colonel William Plunket (1720–1791) and about 700 Pennsylvanians by a force of 300 Yankees under Colonel Zebulon Butler (1731–1795) in the battle of "Rampart Rocks" on the 25th of December 1775. The General Assembly of Connecticut, in January 1774, erected the valley into the township of Westmoreland and attached it to Litchfield county, and in October 1776 the same body erected it into Westmoreland county. On the 3rd of July 1778, while a considerable number of the able-bodied men were absent in the Connecticut service, a motley force of about 400 men and boys under Colonel Zebulon Butler were attacked and defeated near Kingston in the "battle of Wyoming" by about 1100 British, Provincial (Tory) and Indian troops under Major John Butler, and nearly three-fourths were killed or taken prisoners and subsequently massacred. Thomas Campbell's poem, *Gertrude of Wyoming* (1809), is based on this episode, various liberties being taken with the facts. As the War of Independence came to a close the old trouble with Pennsylvania was revived. A court of arbitration appointed by the Continental Congress met at Trenton, New Jersey, in 1782, and on December 30th gave a unanimous decision in favour of Pennsylvania. The refusal of the Pennsylvania government to confirm the private land titles of the settlers, and the arbitrary conduct of a certain Alexander Patterson whom they sent up to take charge of affairs, resulted in 1784 in the outbreak of the second Pennamite-Yankee War. The Yankees were dispossessed, but they took up arms and the government of Pennsylvania despatched General John Armstrong with a force of 400 men to aid Patterson. Armstrong induced both parties to give up their arms with a promise of impartial justice and protection, and as soon as the Yankees were defenceless he made them prisoners. This treachery and the harsh treatment by Patterson created a strong public opinion in favour of the Yankees, and the government was compelled to adopt a milder policy. Patterson was withdrawn, the disputed territory was erected into the new county of Luzerne (1786), the land titles were confirmed (1787), and Colonel Timothy Pickering (*q.v.*) was commissioned to organize the new county and to effect a reconciliation. But a few of the settlers under the lead of Colonel John Franklin (1749–1831) attempted to form a separate state government. Franklin was seized and imprisoned, under a warrant from the State Supreme Court. As Pickering was held responsible for Franklin's imprisonment, some of Franklin's followers in retaliation kidnapped Pickering and carrying him into the woods, tried in vain for nearly three weeks to get from him a promise to intercede for Franklin's pardon. The trouble was again revived by the repeal in 1790 of the confirming act of 1787 and by a subsequent decision of the United States Circuit Court, unfavourable to the Yankees, in the case of *Van Horn* versus *Dorrance*. All of the claims were finally confirmed, by a series of statutes passed in 1799, 1802 and 1807. Since 1808, mainly through the development of its coal mines (see PITTSTON, PA.), the valley has made remarkable progress both in wealth and in population.

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[1] In place of De Forest Richards, deceased.

[2] Several Scotch-Irish families from Lancaster county, Pennsylvania, accepted Connecticut titles and settled at Hanover under Captain Lazarus Stewart.

For a thorough study of the early history of Wyoming Valley see O. J. Harvey, *A History of Wilkes-Barré* (3 vols., Wilkes-Barré, 1909–1910); see also H. M. Hoyt, *Brief of a Title in the Seventeen Townships in the County of Luzerne* (Harrisburg, 1879).

WYON, THOMAS (1792–1817), English medallist, was born at Birmingham. He was apprenticed to his father, the chief engraver of the king's seals, and studied in the schools of the Royal Academy, London, where he gained silver medals in both the antique and the life class; he also obtained a gold medal from the Society of Arts. He was appointed probationary engraver to the mint in 1811, and soon after engraved his medal commemorative of the peace, and his Manchester Pitt medal. In 1815 he was appointed chief engraver to the mint. His younger brother, Benjamin Wyon (1802–1858), his nephews, Joseph Shepherd Wyon (1836–1873) and Alfred Benjamin Wyon (1837–1884), and his cousin, William Wyon (1795–1851), were also distinguished medallists.

WYSE, SIR THOMAS (1791–1862), Irish politician, belonged to a family claiming descent from a Devon man, Andrew Wyse, who is said to have crossed over to Ireland during the reign of Henry II. and obtained lands near Waterford, of which city thirty-three members of the family are said to have been mayors or other municipal officers. From the Reformation the family had been consistently attached to the Roman Catholic Church. Thomas Wyse was educated at Stonyhurst College and at Trinity College, Dublin, where he distinguished himself as a scholar. After 1815 he passed some years in travel, visiting Italy, Greece, Egypt and Palestine. In 1821 he married Laetitia (d. 1872), daughter of Lucien Buonaparte, and after residing for a time at Viterbo he returned to Ireland in 1825, having by this time inherited the family estates. He now devoted his great oratorical and other talents to forwarding the cause of Roman Catholic emancipation, and his influence was specially marked in his own county of Waterford, while his standing among his associates was shown by his being chosen to write the address to the people of England. In 1830, after the passing of the Roman Catholic Relief Act, he was returned to parliament for county Tipperary, and he attached himself to the Liberal party and voted for the great measures of the reform era. But he was specially anxious to secure some improvement in the education of the Irish people, and some of his proposals were accepted by Mr E. G. Stanley, afterwards 14th earl of Derby, and the government. He was chairman of a committee which inquired into the condition of education in Ireland, and it was partly owing to his efforts that provincial colleges were established at Cork, Galway and Belfast. His work as an educational pioneer also bore fruit in England, where the principles of state control and inspection, for which he had fought, were adopted, and where a training college for teachers at Battersea was established on lines suggested by him. From 1835 to 1847 he was M.P. for the city of Waterford and from 1839 to 1841 he was a lord of the treasury; from 1846 to 1849 he was secretary to the board of control, and in 1849 he was sent as British minister to Greece. He was very successful in his diplomacy, and he showed a great interest in the educational and other internal affairs of Greece. In 1857 he was made a K.C.B., and he died at Athens on the 16th of April 1862. Wyse wrote *Historical Sketch of the late Catholic Association of Ireland* (1829); *An Excursion in the Peloponnesus* (1858, new ed. 1865); and *Impressions of Greece* (1871). His two sons shared his literary tastes. They were Napoleon Alfred Bonaparte Wyse (1822–1895); and William Charles Bonaparte Wyse (1826–1892), a student of the dialect of Provence.

WYTTENBACH, DANIEL ALBERT (1746–1820), German-Swiss classical scholar, was born at Bern, of a family whose nobility and distinction he loved to recall. In particular, he was proud of his descent from Thomas Wyttenbach, professor of theology in Basel at the end of the 15th and beginning of the 16th century, who numbered the Reformer Zwingli and other distinguished men among his pupils. Wyttenbach's own father was also a theological professor of considerable note, first at Bern, and then at Marburg. His removal to Marburg, which took place in 1756, was partly due to old associations, for he had studied there under the famous Christian Wolff, and embodied the philosophical principles of his master in his own theological teaching. Young Wyttenbach entered at the age of fourteen the university of Marburg, and passed through a four years' course there. His parents intended that he should become a Lutheran pastor. The first two years were given up to general education, principally to mathematics, "philology," philosophy and history. The professor of mathematics, Spangenberg, acquired great influence over young Wyttenbach. He is said to have taught his subject with great clearness, and with equal seriousness and piety, often referring to God as the supreme mathematician, who had constructed all things by number, measure and weight. "Philology" in the German universities of that age meant Hebrew and Greek. These two languages were generally handled by the same professor, and were taught almost solely to theological students. Wyttenbach's university course at Marburg was troubled about the middle of the time by mental unrest, due to the fascination exercised over him by Bunyan's *Pilgrim's Progress*. The disorder was cured by Spangenberg. The principal study of the third year was metaphysics, which took Wyttenbach entirely captive. The fourth and last year was to be devoted to theology and Christian dogma. Wyttenbach had hitherto submitted passively to his father's wishes concerning his career, in the hope that some unexpected occurrence might set him free. But he now turned away from theological lectures, and privately devoted his time to the task of deepening and extending his knowledge of Greek literature. He possessed at the time, as he tells us, no more acquaintance with Greek than his own pupils at a later time could acquire from him during four months' study. He was almost entirely without equipment beyond the bare texts of the authors. But Wyttenbach was undaunted, and four years' persistent study gave him a knowledge of Greek such as few Germans of that time possessed. His love for philosophy carried him towards the Greek philosophers, especially Plato. During this period Ruhnken's notes on the Platonic lexicon of *Timaeus* fell into his hands. Ruhnken was for him almost a superhuman being, whom he worshipped day and night, and with whom he imagined himself as holding converse in the spirit. When Wyttenbach was twenty-two he determined to seek elsewhere the aids to study which Marburg could not afford. His father, fully realizing the strength of his son's pure passion for scholarship, permitted and even advised him to seek Heyne at Göttingen. From this teacher he received the utmost kindness and encouragement, and he was urged by him to dedicate to Ruhnken the first-fruits of his scholarships. Wyttenbach therefore set to work on some notes to Julian, Eunapius and Aristaenetus, and Heyne wrote to Ruhnken to bespeak his favourable consideration for the work. Before it reached him Ruhnken wrote a kind letter to Wyttenbach, which the recipient "read, re-read and kissed," and another on receipt of the tract, in which the great scholar declared that he had not looked to find in Germany such knowledge of Greek, such power of criticism, and such mature judgment, especially in one so young. By Heyne's advice, he worked hard at Latin, which he knew far less thoroughly than Greek, and we soon find Heyne praising his progress in Latin style to both Ruhnken and Valckenaer. He now wrote to ask their advice about his scheme of coming to the Netherlands to follow the profession of a scholar. Ruhnken strongly exhorted Wyttenbach to follow his own example, for he too had been designed by his parents for the Christian ministry in Germany, but had settled at Leiden on the invitation of Hemsterhuis. Valckenaer's answer was to the same effect, but he added that Wyttenbach's letter would have been pleasanter to him had it been free from excessive compliments. These letters were forwarded to the elder Wyttenbach, with a strong recommendation from Heyne. The old man had been himself in Leiden in his youth, and entertained an admiration for the scholarship of the Netherlands; so his consent was easily won. Young Wyttenbach reached Leiden in 1770. A year was spent with great contentment, in learning the language of the people, in attending the lectures of the great "duumviri" of Leiden, and in collating MSS. of Plutarch. At the end of 1771 a professor was wanted at Amsterdam for the College of the Remonstrants. By the recommendation of Ruhnken, Wyttenbach obtained the chair, which he filled with great success for eight years. His lectures took a wide range. Those on Greek were repeated also to the students of the university of Amsterdam (the "Athenaeum"). In 1775 a visit was made to Paris, which was fruitful both of new friendships and of progress in study. About this time, on the advice of Ruhnken, Wyttenbach began the issue of his *Bibliotheca critica*, which appeared at intervals for the next thirty years. The methods of criticism employed were in the main those established by Hemsterhuis, and carried on by Valckenaer and Ruhnken, and the publication met with acceptance from the learned all over Europe. In 1777 the younger Burmann ("Burmannus Secundus") retired from his professorship at the Athenaeum, and Wyttenbach hoped to succeed him. When another received the appointment, he was sorely discouraged. Only his regard for Ruhnken and for Dutch freedom (in his own words "Ruhnkeni et Batavae libertatis cogitatio") kept him in Holland. For fear of losing him, the authorities at Amsterdam nominated him in 1779 professor of philosophy. In 1785 Toll, Burmann's successor, resigned, and Wyttenbach was at once appointed to succeed him. His full title was "professor of history and eloquence and Greek and Latin literature." He had hardly got to work in his new office when Valckenaer died, and he received a call to Leiden. Greatly to Ruhnken's disappointment, he declined to abandon the duties he had so recently undertaken. In 1787 began the internal commotions in Holland, afterwards to be aggravated by foreign interference. Scarcely during the remaining thirty-three years of Wyttenbach's life was there a moment of peace in the land. About this time two requests were made to him for an edition of the *Moralia* of Plutarch, for which a recension of the tract *De sera numinis vindicta* had marked him out in the eyes of scholars. One request came from the famous "Societas Bipontina," the other from the delegates of the Clarendon Press at Oxford. Wyttenbach, influenced at once by the reputation of the university, and by the liberality of the Oxonians in tendering him assistance of different kinds, declined the offer of the Bipontine Society,—very fortunately, since their press was soon destroyed by the French. The fortunes of Wyttenbach's edition curiously illustrate the text "habent sua fata libelli." The first portion was safely conveyed to Oxford in 1794. Then war broke out between Holland and Great Britain. Randolph, Wyttenbach's Oxford correspondent, advised that the next portion should be sent through the British ambassador at Hamburg, and the MS. was duly consigned to him "in a little chest well protected by pitch." After sending Randolph a number of letters without getting any answer, Wyttenbach in disgust put all thought of the edition from him, but at last the missing box was discovered in a forgotten corner at Hamburg, where it had lain for two years and a half. The work was finally completed in 1805. Meanwhile Wyttenbach received invitations from his native city Bern, and from Leiden, where vacancies had been created by the refusal of professors to swear allegiance to the new Dutch republic set up in 1795, to which Wyttenbach had made submission. But he only left Amsterdam in 1799, when on Ruhnken's death he succeeded him at Leiden. Even then his chief object in removing was to facilitate an arrangement by which the necessities of his old master's family might be relieved. His removal came too late in life, and he was never so happy at Leiden as he had been at Amsterdam. Before long appeared the ever-delightful *Life of David Ruhnken.* Though written in Latin, this biography deserves to rank high in the modern literature of its class. Of Wyttenbach's life at Leiden there is little to tell. The continual changes in state affairs greatly disorganized the universities of Holland, and Wyttenbach had to work in face of much detraction; still, his success as a teacher was very great. In 1805 he narrowly escaped with his life from the great gunpowder explosion, which killed 150 people, among them the Greek scholar Luzac, Wyttenbach's colleague in the university. One of Wyttenbach's letters gives a vivid account of the disaster. During the last years of his life he suffered severely from illness and became nearly blind. After the conclusion of his edition of Plutarch's *Moralia* in 1805, the only important work he was able to publish was his well-known edition of Plato's *Phaedo.* Many honours were conferred upon him both at home and abroad, and in particular he was made a member of the French Institute. Shortly before his death, he obtained the licence of the king of Holland to marry his sister's daughter, Johanna Gallien, who had for twenty years devoted herself to him as housekeeper, secretary and aider in his studies. The sole object of the marriage was to secure for her a better provision after her husband's death, because as the widow of a professor she would be entitled to a pension. Johanna Gallien was a woman of remarkable culture and ability, and wrote works held in great repute at that time. On the festival of the tercentenary of the foundation of the university of Marburg, celebrated in 1827, the degree of doctor was conferred upon her. Wyttenbach died of apoplexy in 1820, and he was buried in the garden of his country house near Amsterdam, which stood, as he noted, within sight of the dwellings of Descartes and Boerhaave.

Although his work can hardly be set on the same level as that of Hemsterhuis, Valckenaer and Ruhnken, yet he was a very eminent exponent of the sound methods of criticism which they established. These four men, more than any others after Bentley, laid the foundations of modern Greek scholarship. The precise study of grammar, syntax and style, and the careful criticism of texts by the light of the best manuscript evidence, were upheld by these scholars in the Netherlands when they were almost entirely neglected elsewhere on the Continent, and were only pursued with partial success in England. Wyttenbach may fairly be regarded as closing a great period in the history of scholarship. He lived indeed to see the new birth of German classical learning, but his work was done, and he was unaffected by it. Wyttenbach's criticism was less rigorous, precise and masterly, but perhaps more sensitive and sympathetic, than that of his great predecessors in the Netherlands. In actual acquaintance with the philosophical writings of the ancients, he has probably never been surpassed. In character he was upright and simple-minded, but shy and retiring, and often failed to make himself appreciated. His life was not passed without strife, but his few friends were warmly attached to him, and his many pupils were for the most part his enthusiastic admirers. Wyttenbach's biography was written in a somewhat dry and lifeless manner by Mahne, one of his pupils, who also published some of his letters. His *Opuscula*, other than those published in the *Bibliotheca critica*, were collected in two volumes (Leiden, 1823). (J. S. R.)

WYVERN, or WIVERN, the name of an heraldic monster, with the forepart of a winged dragon and the hind part of a serpent or lizard (see HERALDRY). The earlier spelling of the word was *wiver* or *wivere*; O. Eng. *wyvre*; O. Fr. *wivre*, mod. *givre*. It is a doublet of "viper," with an excrescent *n*, as in "bittern," M. Eng. *bitore.*

X the twenty-fourth letter of the English alphabet. Its position and form are derived from the Latin alphabet, which received them from the Western Greek alphabet. The alphabet of the Western Greeks differed from the Ionic, which is the Greek alphabet now in general use, by the shape and position of X and of some other consonants. The Ionic alphabet placed *x* (ξ) immediately after N and, in the oldest records, in the form 丰, from which the ordinary Greek capital Ξ was developed. The position and shape of this symbol show clearly that it was taken from the Semitic Samekh, which on the Moabite stone appears as 丰. Why the Greeks attached this value to the symbol is not clear; in Semitic the symbol indicates the ordinary *s*. Still less clear is the origin of the form X, which in the Ionic alphabet stands for χ (*k* followed by a breath). In a very ancient alphabet on a small vase found in 1882 at Formello near the ancient Veii in Etruria, a symbol appears after N consisting of three horizontal and three vertical lines, ⊞. From this it has been suggested that both forms of the Greek *x* are derived, Ξ by removing the vertical lines, X in its earliest form + by removing the four marginal lines. The Ionic symbol, however, corresponds closely to the earliest Phoenician, so that this theory is not very plausible for Ξ, and there are various other possibilities for the development of X (see Alphabet). This symbol appears in the very early Latin inscriptions found in the Roman Forum in 1899 as 𐌗. In its usual value as *ks* it is superfluous. In the Ionic alphabet it was useful, because there it represented a single sound, which before the invention of the symbol had to be represented by *kh*. In the alphabet in use officially at Athens before 403 B.C. *x* was written by χσ (*khs*). In English there is an interesting variation of pronunciation in many words according to the position of the accent: if the accent precedes, *x* is pronounced *ks*; if it follows, *x* is pronounced *gz*: compare *éxit* (*eksit*) with *exáct* (*egzact*).

The symbol X was used both by the Romans and the Etruscans for the numeral 10. Which borrowed from the other is uncertain, but the Etruscans did not use X as part of their alphabet. X with a horizontal line over it was used for 10,000, and when a line on each side was added, |X|, for a million. (P. Gi.)

XANTHI (Turkish *Eskije*), a town of European Turkey in the vilayet of Adrianople; situated on the right bank of the river Eskije and at the S. foot of the Rhodope Mountains, 29 m. W. of Gumuljina by the Constantinople-Salonica railway. Pop. (1905) about 14,000, of whom the bulk are Turks and Greeks in about equal proportions, and the remainder (about 4000) Armenians, Roman Catholics or Jews. There are remains of a medieval citadel, and on the plain to the S. the ruins of an ancient Greek town. Xanthi is built in the form of an amphitheatre and possesses several mosques, churches and monasteries, a theatre with a public garden, and a municipal garden. A preparatory school for boys and girls was founded and endowed by Mazzini. The town is chiefly notable for the famous Yénidjé tobacco.

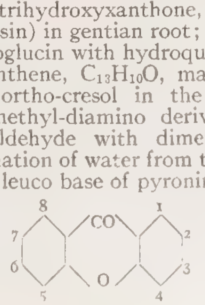
XANTHIC ACID (xanthogenic acid), $C_2H_5O\cdot CS\cdot SH$, an organic acid named from the Greek ξανθός, yellow, in allusion to the bright yellow colour of its copper salt. The salts of this acid are formed by the action of carbon bisulphide on the alcoholates, or on alcoholic solutions of the caustic alkalis. They react with the alkyl iodides to form dialkyl esters of the dithio-carbonic acid, which readily decompose into mercaptans and thiocarbamic esters on treatment with ammonia: $C_2H_5O\cdot CS\cdot SR_1+NH_3=C_2H_5O\cdot CS\cdot NH_2+R_1\cdot SH$; with the alkali alcoholates they give salts of the alkyl thiocarbonic acids: $C_2H_5O\cdot CS\cdot SR+CH_3OK+H_2O=CH_3O\cdot CO\cdot SK+C_2H_5OH+R\cdot SH$. Ethyl xanthic acid, $C_2H_5O\cdot CS\cdot SH$, is obtained by the action of dilute sulphuric acid on the potassium salt at 0° C. (Zeise, *Berz. Jahresb.*, 3, p. 83). It is a colourless oil which is very unstable, decomposing at 25° C. into carbon bisulphide and alcohol. The potassium salt crystallizes in colourless needles and is formed by shaking carbon bisulphide with a solution of caustic potash in absolute alcohol. On the addition of cupric sulphate to its aqueous solution it yields a yellow precipitate of cupric xanthate. Potassium xanthate is used in indigo printing and also as an antidote for phylloxera. Tschugaeff (*Ber.*, 1899, 32, p. 3332) has used the xanthic ester formation for the preparation of various terpenes, the methyl ester when distilled under slightly diminished pressure decomposing, in the sense of the equation, $C_nH_{2n-1}\cdot O.CS\cdot SCH_3=C_nH_{2n-2}+COS+CH_3SH$. According to the author molecular change in the hydrocarbon is prevented, since no acid agent is used.

XANTHIPPE, the wife of Socrates (*q.v.*). Her name has become proverbial in the sense of a nagging, quarrelsome woman. Attempts have been made to show that she has been maligned, notably by E. Zeller ("Zur Ehrenrettung der Xanthippe," in his *Vorträge und Abhandlungen*, i., 1875).

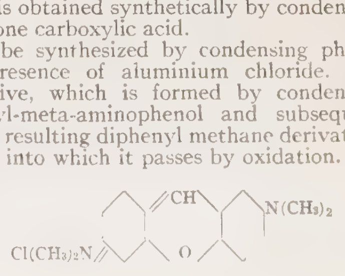
XANTHONE (dibenzo-γ-pyrone, or diphenylene ketone oxide), $C_{13}H_8O_2$, in organic chemistry, a heterocyclic compound containing the ring system shown below. It is obtained by the oxidation of xanthene (methylene diphenylene oxide) with chromic acid; by the action of phosphorus oxychloride on disodium salicylate; by heating 2·2′-dioxybenzophenone with concentrated sulphuric acid; by distilling fluoran with lime; by the oxidation of xanthydrol (R. Meyer, *Ber.*, 1893, 26, p. 1277); by boiling diazotized 2·2′-diaminobenzophenone with water (Heyl., *Ber.*, 1898, 31, p. 3034); by heating salol with concentrated sulphuric acid (C. Graebe, *Ann.*, 1889, 254, p. 280), and by heating potassium-ortho-chlorobenzoate with sodium phenolate and a small quantity of copper powder to 180–190° C. (F. Ullmann, *Ber.*, 1905, 38, pp. 729, 2120, 2211). It crystallizes in needles which melt at 173–174° and boil at 349–350° C., and are volatile in steam. Its solution in concentrated sulphuric acid is of a yellow colour and shows a marked blue fluorescence. The carbonyl group is not ketonic in character since it yields neither an oxime nor hydrazone. When fused with caustic potash it yields phenol and salicylic acid. Mild reducing agents convert it into xanthydrol, the group $>CO$ becoming $>CH\cdot OH$, whilst a strong reducing agent like hydriodic acid converts it into xanthene, the group $>CO$ becoming $>CH_2$. Phosphorus pentasulphide at 140–150° C. converts it into xanthion by transformation of $>CO$ to $>CS$ (R. Meyer, *Ber.*, 1900, 33, p. 2580), and this latter compound condenses with hydroxylamine to form xanthone oxime.

All four mono-hydroxyxanthones are known, and are prepared by heating salicylic acid with either resorcin, pyrocatechin or hydroquinone; they are yellow crystalline solids, which act as dyestuffs. The 1·7-dihydroxyxanthone, known as euxanthone, is prepared by heating euxanthic acid with hydrochloric acid or by heating hydroquinone carboxylic acid with β-resorcylic acid and acetic anhydride (S. Kostanecki, *Ber.*, 1891, 24, p. 3983; C. Graebe, *Ann.*, 1889, 254, p. 298). It is also obtained from Indian yellow (Graebe, ibid.), formed in the urine of cows fed on mango leaves. It crystallizes in yellow needles which sublime readily. On fusion with caustic potash it decomposes with formation of tetrahydroxy-benzophenone, which then breaks up into resorcin and hydroquinone. The isomeric 1·6-dihydroxyxanthone, isoeuxanthone, is formed when β-resorcylic acid is heated with acetic anhydride. Gentisein, or 1·3·7-trihydroxyxanthone, is found in the form of its methyl ether (gentisin) in gentian root; it is obtained synthetically by condensing phloroglucin with hydroquinone carboxylic acid.

Xanthene, $C_{13}H_{10}O$, may be synthesized by condensing phenol with ortho-cresol in the presence of aluminium chloride. Its tetramethyl-diamino derivative, which is formed by condensing formaldehyde with dimethyl-meta-aminophenol and subsequent elimination of water from the resulting diphenyl methane derivative, is the leuco base of pyronine, into which it passes by oxidation.



Xanthone.



Pyronine.

XANTHUS (mod. *Gunük*), an ancient city of Lycia, on the river Xanthus (*Eshen Chai*) about 8 m. above its mouth. It was besieged by the Persian general Harpagus (546 B.C.), when the acropolis was burned and all the inhabitants perished (Herod. i. 176). The city was afterwards rebuilt; and in 42 B.C. it was besieged by the Romans under M. Junius Brutus. It was taken by storm and set on fire, and the inhabitants perished in the flames. The ruins lie on a plateau, high above the left bank of the river. The nearest port is Kalamaki, whence a tedious ride of three to four hours round the edge of the great marsh of the Eshen Chai brings the traveller to Xanthus. The whole plan of the city with its walls and gates can be discerned. The well-preserved theatre is remarkable for a break in the curve of its *auditorium*, which has been constructed so as not to interfere with a sarcophagus on a pedestal and with the "Harpy Monument" which still stands to its full height, robbed of the reliefs of its parapet (now in the British Museum). In front of the theatre stands the famous *stele* of Xanthus inscribed on all four sides in Lycian and Greek. Behind the theatre is a terrace on which probably the temple of either the Xanthian Apollo or Sarpedon stood. The best of the tombs—the "Payava Tomb," the "Nereid Monument," the "Ionic Monument" and the "Lion Tomb"—are in the British Museum, as the result of Sir Chas. Fellows's expedition; only their bases can be seen on the site. A fine triple gateway, much polygonal masonry, and the walls of the acropolis are the other objects of most interest.

See O. Benndorf and G. Niemann, *Reisen in Lykien und Karien* (1884). (D. G. H.)

XAVIER, FRANCISCO DE (1506–1552), Jesuit missionary and saint, commonly known in English as St Francis Xavier and also called the "Apostle of the Indies." He was the youngest son of Juan de Jasso, privy councillor to Jean d'Albret, king of Navarre, and his wife, Maria de Azpilcueta y Xavier, sole heiress of two noble Navarrese families. He was born at his mother's castle of Xavier or Xavero, at the foot of the Pyrenees and close to the little town of Sanguesa, on the 7th of April 1506, according to a family register, though his earlier biographers fix his birth in 1497. Following a Spanish custom of the time, which left the surname of either parent optional with children, he was called after his mother; the best authorities write "Francisco de Xavier" (Lat. *Xaverius*) rather than "Francisco Xavier," as Xavier is originally a place-name. In 1524 he went to the university of Paris, where he entered the College of St Barbara, then the headquarters of the Spanish and Portuguese students, and in 1528 was appointed lecturer in Aristotelian philosophy at the Collége de Beauvais. In 1530 he took his degree as master of arts. He and the Savoyard Pierre Lefèvre, who shared his lodging, had already, in 1529, made the acquaintance of Ignatius of Loyola—like Xavier a native of the Spanish Basque country. Ignatius succeeded, though in Xavier's case after some opposition, in gaining their sympathy for his missionary schemes (see Loyola, Ignatius of); and they were among the company of seven persons, including Loyola himself, who took the original Jesuit vows on the 15th of August 1534. They continued in Paris for two years longer; but on November 15th, 1536, they started for Italy, to concert with Ignatius plans for converting the Moslems of Palestine. In January 1537 they arrived in Venice. As some months must elapse before they could sail for Palestine, Ignatius determined that the time should be spent partly in hospital work at Venice and later in the journey to Rome. Accordingly, Xavier devoted himself for nine weeks to the hospital for incurables, and then set out with eight companions for Rome, where Pope Paul III. sanctioned their enterprise. Returning to Venice, Xavier was ordained priest on Midsummer Day 1537; but the outbreak of war between Venice and Turkey put an end to the Palestine expedition, and the companions dispersed for a twelvemonth's home mission work in the Italian cities. Nicolas Bobadilla and Xavier betook themselves first to Monselice and thence to Bologna, where they remained till summoned to Rome by Ignatius at the close of 1538.

Ignatius retained Xavier at Rome until 1541 as secretary to the Society of Jesus (see Jesuits for the events of the period 1538–41). Meanwhile John III., king of Portugal, had resolved on sending a mission to his Indian dominions, and had applied through his envoy Pedro Mascarenhas to the pope for six Jesuits. Ignatius could spare but two, and chose Bobadilla and a Portuguese named Simão Rodrigues for the purpose. Rodrigues set out at once for Lisbon to confer with the king, who ultimately decided to retain him in Portugal. Bobadilla, sent for to Rome, arrived there just before Mascarenhas was about to depart, but fell too ill to respond to the call made on him.

Hereupon Ignatius, on March 15th, 1540, told Xavier to leave Rome the next day with Mascarenhas, in order to join Rodrigues in the Indian mission. Xavier complied, merely waiting long enough to obtain the pope's benediction, and set out for Lisbon, where he was presented to the king, and soon won his entire confidence, attested notably by procuring for him from the pope four briefs, one of them appointing him papal nuncio in the Indies. On April 7th, 1541, he sailed from Lisbon with Martim Alfonso de Sousa, governor designate of India, and lived amongst the common sailors, ministering to their religious and temporal needs, especially during an outbreak of scurvy. After five months' voyage the ship reached Mozambique, where the captain resolved to winter, and Xavier was prostrated with a severe attack of fever. When the voyage was resumed, the ship touched at Malindi and Sokotra, and reached Goa on May 6th, 1542. Exhibiting his brief to D. João d'Albuquerque, bishop of Goa, he asked his permission to officiate in the diocese, and at once began walking through the streets ringing a small bell, and telling all to come, and send their children and servants, to the "Christian doctrine" or catechetical instruction in the principal church. He spent five months in Goa, and then turned his attention to the "Fishery Coast," where he had heard that the Paravas, a tribe engaged in the pearl fishery, had relapsed into heathenism after having professed Christianity. He laboured assiduously amongst them for fifteen months, and at the end of 1543 returned to Goa.

At Travancore he is said to have founded no fewer than forty-five Christian settlements. It is to be noted that his own letters contain, both at this time and later on, express disproof of that miraculous gift of tongues with which he was credited even in his lifetime, and which is attributed to him in the *Breviary* office for his festival. Not only was he obliged to employ interpreters, but he relates that in their absence he was compelled to use signs only.

He sent a missionary to the isle of Manaar, and himself visited Ceylon and Mailapur (Meliapur), the traditional tomb of St Thomas the apostle, which he reached in April 1544, remaining there four months. At Malacca, where he arrived on September 25th, 1545, he remained another four months, but had comparatively little success. While in Malacca he urged King John III. of Portugal to set up the Inquisition in Goa to repress Judaism, but the tribunal was not set up until 1560. After visiting Amboyna, the Moluccas and other isles of the Malay archipelago, he returned to Malacca in July 1547, and found three Jesuit recruits from Europe awaiting him. About this time an attack upon the city was made by the Achinese fleet, under the raja of Pedir in Sumatra; and Xavier's early biographers relate a dramatic story of how he roused the governor to action. This story is open to grave suspicion, as, apart from the miracles recorded, there are wide discrepancies between the secular Portuguese histories and the narratives written or inspired by Jesuit chroniclers of the 17th century.

While in Malacca Xavier met one Yajiro, a Japanese exile (known to the biographies as Anger, Angero or Anjiro), who fired him with zeal for the conversion of Japan. But he first revisited India and then, returning to Malacca, took ship for Japan, accompanied by Yajiro, now known as Paul of the Holy Faith. They reached Kagoshima on the 15th of August 1549, and remained in Japan until the 20th of November 1551. (See Japan, § viii.) On board the "Santa Cruz," the vessel in which he returned from Japan to Malacca, Xavier discussed with Diogo Pereira, the captain, a project for a missionary journey to China. He devised the plan of persuading the viceroy of Portuguese India to despatch an embassy to China, in whose train he might enter, despite the law which then excluded foreigners from that empire. He reached Goa in February 1552, and obtained from the viceroy consent to the plan of a Chinese embassy and to the nomination of Pereira as envoy. Xavier left India on the 25th of April 1552 for Malacca, intending there to meet Pereira and to re-embark on the "Santa Cruz."

The story of his detention by the governor (officially styled captain) of Malacca—a son of Vasco da Gama named Alvaro de Ataide or Athayde—is told with many picturesque details by F. M. Pinto and some of the Jesuit biographers, who have pilloried Ataide as actuated solely by malice and self-interest. Ataide appears to have objected not so much to the mission as to the rank assigned to Pereira, whom he regarded as unfit for the office of envoy. The right to send a ship to trade with China was one for which large sums were paid, and Pereira, as commander of the expedition, would enjoy commercial privileges which Ataide had, *ex officio*, the power to grant or withhold. It seems doubtful if the governor exceeded his legal right in refusing to allow Pereira to proceed;[1] in this attitude he remained firm even when Xavier, if the Jesuit biographers may be trusted, exhibited the brief by which he held the rank of papal nuncio, and threatened Ataide with excommunication. On Xavier's personal liberty no restraint was placed. He embarked without Pereira on July 16th, 1552. After a short stay at Singapore, whence he despatched several letters to India and Europe, the ship at the end of August 1552 reached Changchuen-shan (St John Island) off the coast of Kwang-tung, which served as port and rendezvous for Europeans, not then admitted to visit the Chinese mainland.

Xavier was seized with fever soon after his arrival, and was delayed by the failure of the interpreter he had engaged, as well as by the reluctance of the Portuguese to attempt the voyage to Canton for the purpose of landing him. He had arranged for his passage in a Chinese junk, when he was again attacked by fever, and died on December 2nd, or, according to some authorities, November 27th, 1552. He was buried close to the cabin in which he had died, but his body was later transferred to Malacca, and thence to Goa, where it still lies in a magnificent shrine (see J. N. da Fonseca, *An Historical and Archaeological Sketch of Goa*, Bombay, 1878). He was beatified by Paul V. in 1619 and canonized by Gregory XV. in 1621.

In appearance Xavier was neither Spanish nor Basque. He had blue or grey eyes, and fair hair and beard, which turned white through the hardships he endured in Japan. That he was of short stature is proved by the length of the coffin in which his body is still preserved, less than 5 ft. 1 in. (Fonseca, *op. cit.* p. 296). Many miracles have been ascribed to him; an official list of these, said to have been attested by eyewitnesses, was drawn up by the auditors of the Rota when the processes for his canonization were formed, and is preserved in manuscript in the Vatican library. The contention that Xavier should be regarded as the greatest of Christian missionaries since the first century A.D. rests upon more tangible evidence. His Jesuit biographers attribute to him the conversion of more than 700,000 persons in less than ten years; and though these figures are absurd, the work which Xavier accomplished was enormous. He inaugurated new missionary enterprises from Hormuz to Japan and the Malay Archipelago, leaving an organized Christian community wherever he preached; he directed by correspondence the ecclesiastical policy of John III. and his viceroy in India; he established and controlled the Society of Jesus in the East. Himself an ascetic and a mystic, to whom things spiritual were more real than the visible world, he had the strong common sense which distinguished the other Spanish mystics, St Theresa, Luis de Leon or Raimon Lull. This quality is nowhere better exemplified than in his letters to Gaspar Baertz (Barzaeus), the Flemish Jesuit whom he sent to Hormuz, or in his suggestions for the establishment of a Portuguese staple in Japan. Supreme as an organizer, he seems also to have had a singularly attractive personality, which won him the friendship even of the pirates and bravos with whom he was forced to consort on his voyages. Modern critics of his work note that he made no attempt to understand the oriental religions which he attacked, and censure him for invoking the aid of the Inquisition and sanctioning persecution of the Nestorians in Malabar. He strove, with a success disastrous to the Portuguese empire, to convert the government in Goa into a proselytizing agency. Throughout his life he remained in close touch with Ignatius of Loyola, who is said to have selected Xavier as his own successor at the head of the Society of Jesus. Within a few weeks of Xavier's death, indeed, Ignatius sent letters recalling him to Europe with that end in view.

BIBLIOGRAPHY.—Many of the authorities on which the biographies of Xavier have been based are untrustworthy, notably the *Peregrinaçam* of F. M. Pinto (*q.v.*), which minutely describes certain incidents of his life in the Far East (especially in Japan and Malacca). Xavier's extant letters, supplemented by a few other 16th-century documents, outweigh all other evidence. It is perhaps noteworthy that Xavier himself never mentions Pinto; but the omission may be explained by the numerous gaps in his correspondence. A critical text of the letters, with notes, bibliography and a life in Spanish, will be found in *Monumenta Xaveriana ex Autographis vel ex Antiquioribus Exemplis collecta*, vol. i. (Madrid, 1899–1900), included in *Monumenta historica Societatis Jesu*. For translations, *The Life and Letters of St Francis Xavier*, by H. Coleridge, S.J. (2 vols., London, 1872), is useful, though the historical commentary has little value. There are numerous older and uncritical biographies by members of the Society; best and earliest are *De vita Francisca Xaverii . . . libri sex*, by O. Torsellino (Tursellinus) (Antwerp, 1596; English by T. F., *The Admirable Life of St Francis Xavier*, Paris, 1632); and *Historia da Vida do Padre Francisco de Xavier*, &c., by João Lucena (Lisbon, 1600). Later works by the Jesuits Bartoli, Maffei, de Sousa, Poussines, Menchacha, Léon Pagès and others owe much to Torsellino and Lucena, but also incorporate many traditions which can no longer be verified. *St François de Xavier, sa vie et ses lettres*, by J. M. Cros, S.J. (2 vols., Toulouse, 1900), embodies the results of long research. *The Missionary Life of St Francis Xavier*, by the Rev. H. Venn, prebendary of St Paul's cathedral, London (London, 1862), is polemical, but contains an interesting map of Xavier's journeys. For a non-partisan account of Xavier's work in the East, see K. G. Jayne, *Vasco da Gama and his Successors*, chapters 25–32 (London, 1910); and Otis Cary, *A History of Christianity in Japan* (2 vols., London, 1909). (K. G. J.)

XENIA, a city and the county-seat of Greene county, Ohio, U.S.A., in the township of Xenia, about 3 m. E. of the Little Miami river, and about 55 m. S.W. of Columbus and about 65 m. N.E. of Cincinnati. Pop. (1900) 8696, of whom 410 were foreign-born; (1910 census) 8706. Xenia is served by the Cincinnati, Hamilton & Dayton, and the Pittsburg, Cincinnati, Chicago & St Louis (Pennsylvania System) railways, and by interurban electric lines to Springfield and Dayton. It is the seat of the Ohio Soldiers' and Sailors' Orphans' Home and of the Xenia Theological Seminary (United Presbyterian; founded in 1794 at Service, Pa., and united in 1874 with the Theological Seminary of the North-West, founded in 1839 at Oxford, Ohio). About 3 m. N.E., at Wilberforce, is Wilberforce University (co-educational; opened in 1856 and reorganized in 1863), conducted by the African Methodist Episcopal Church. The public buildings of Xenia include a public library, the county court-house and the municipal building. Xenia is situated in a fine farming and stock-raising region, and among its manufactures are cordage and twine, boots and shoes, carriages and machinery. The township was first settled about 1797. Xenia was laid out as a village in 1803, was incorporated as a town in 1808 and was chartered as a city in 1870.

XENOCRATES, of Chalcedon, Greek philosopher, scholarch or rector of the Academy from 339 to 314 B.C., was born in 396. Removing to Athens in early youth, he became the pupil of the Socratic Aeschines, but presently joined himself to Plato, whom he attended to Sicily in 361. Upon his master's death

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[1] See R. S. Whiteway, *Rise of the Portuguese Power in India* (London, 1898), appendix A. The question is complicated by the fact that the *Sixth Decade* of Diogo do Couto, the best contemporary historian of these events, was suppressed by the censor in its original form, and the extant version was revised by an ecclesiastical editor.

(347 B.C.), in company with Aristotle he paid a visit to Hermias at Atarneus. In 339, Aristotle being then in Macedonia, Xenocrates succeeded Speusippus in the presidency of the school, defeating his competitors Menedemus and Heracleides by a few votes. On three occasions he was member of an Athenian legation, once to Philip, twice to Antipater. Soon after the death of Demosthenes in 322, resenting the Macedonian influence then dominant at Athens, Xenocrates declined the citizenship offered to him at the instance of Phocion, and, being unable to pay the tax levied upon resident aliens, was, it is said, sold, or on the point of being sold, into slavery. He died in 314, and was succeeded as scholarch by Polemon, whom he had reclaimed from a life of profligacy. Besides Polemon, the statesman Phocion, Chaeron, tyrant of Pellene, the Academic Crantor, the Stoic Zeno and Epicurus are alleged to have frequented his lectures.

Xenocrates's earnestness and strength of character won for him universal respect, and stories were remembered in proof of his purity, integrity and benevolence. Wanting in quickness of apprehension and in native grace, he made up for these deficiencies by a conscientious love of truth and an untiring industry. Less original than Speusippus, he adhered more closely to the letter of Platonic doctrine, and is accounted the typical representative of the Old Academy. In his writings, which were numerous, he seems to have covered nearly the whole of the Academic programme; but metaphysics and ethics were the subjects which principally engaged his thoughts. He is said to have invented, or at least to have emphasized, the tripartition of philosophy under the heads of physic, dialectic and ethic.

In his ontology Xenocrates built upon Plato's foundations: that is to say, with Plato he postulated ideas or numbers to be the causes of nature's organic products, and derived these ideas or numbers from unity (which is active) and plurality (which is passive). But he put upon this fundamental dogma a new interpretation. According to Plato, existence is mind pluralized: mind as a unity, *i.e.* universal mind, apprehends its own plurality as eternal, immutable, intelligible ideas; and mind as a plurality, *i.e.* particular mind, perceives its own plurality as transitory, mutable, sensible things. The idea, inasmuch as it is a law of universal mind, which in particular minds produces aggregates of sensations called things, is a "determinant" (πέρας ἔχον), and as such is styled "quantity" (ποσόν) and perhaps "number" (ἀριθμός); but the ideal numbers are distinct from arithmetical numbers. Xenocrates, however, failing, as it would seem, to grasp the idealism which was the metaphysical foundation of Plato's theory of natural kinds, took for his principles arithmetical unity and plurality, and accordingly identified ideal numbers with arithmetical numbers. In thus reverting to the crudities of certain Pythagoreans, he laid himself open to the criticisms of Aristotle, who, in his *Metaphysics*, recognizing amongst contemporary Platonists three principal groups—(1) those who, like Plato, distinguished mathematical and ideal numbers; (2) those who, like Xenocrates, identified them; and (3) those who, like Speusippus, postulated mathematical numbers only—has much to say against the Xenocratean interpretation of the theory, and in particular points out that, if the ideas are numbers made up of arithmetical units, they not only cease to be principles, but also become subject to arithmetical operations. Xenocrates's theory of inorganic nature was substantially identical with the theory of the elements which is propounded in the *Timaeus*, 53 C seq. Nevertheless, holding that every dimension has a principle of its own, he rejected the derivation of the elemental solids—pyramid, octahedron, icosahedron and cube—from triangular surfaces, and in so far approximated to atomism. Moreover, to the tetrad of simple elements—viz. fire, air, water, earth—he added the πέμπτη οὐσία, ether.

His cosmology, which is drawn almost entirely from the *Timaeus*, and, as he intimated, is not to be regarded as a cosmogony, should be studied in connexion with his psychology. Soul is a self-moving number, derived from the two fundamental principles, unity (ἕν) and plurality (δυὰς ἀόριστος), whence it obtains its powers of rest and motion. It is incorporeal, and may exist apart from body. The irrational soul, as well as the rational soul, is immortal. The universe, the heavenly bodies, man, animals, and presumably plants, are each of them endowed with a soul, which is more or less perfect according to the position which it occupies in the descending scale of creation. With this Platonic philosopheme Xenocrates combines the current theology, identifying the universe and the heavenly bodies with the greater gods, and reserving a place between them and mortals for the lesser divinities.

If the extant authorities are to be trusted, Xenocrates recognized three grades of cognition, each appropriated to a region of its own—viz. knowledge, opinion and sensation, having for their respective objects supra-celestials or ideas, celestials or stars, and infra-celestials or things. Even here the mythological tendency displays itself—νοητά, δοξαστά and αἰσθητά being severally committed to Atropos, Lachesis and Clotho. Of Xenocrates's logic we know only that with Plato he distinguished τὸ καθ' αὑτό and τὸ πρός τι, rejecting the Aristotelian list of ten categories as a superfluity.

Valuing philosophy chiefly for its influence upon conduct, Xenocrates bestowed especial attention upon ethics. The catalogue of his works shows that he had written largely upon this subject; but the indications of doctrine which have survived are scanty, and may be summed up in a few sentences. Things are goods, ills or neutrals. Goods are of three sorts—mental, bodily, external; but of all goods virtue is incomparably the greatest. Happiness consists in the possession of virtue, and consequently is independent of personal and extraneous advantages. The virtuous man is pure, not in act only, but also in heart. To the attainment of virtue the best help is philosophy; for the philosopher does of his own accord what others do under the compulsion of law. Speculative wisdom and practical wisdom are to be distinguished. Meagre as these statements are, they suffice to show that in ethics, as elsewhere, Xenocrates worked upon Platonic lines.

Xenocrates was not in any sense a great thinker. His metaphysic was a travesty rather than a reproduction of that of his master. His ethic had little which was distinctive. But his austere life and commanding personality made him an effective teacher, and his influence, kept alive by his pupils Polemon and Crates, ceased only when Arcesilaus, the founder of the so-called Second Academy, gave a new direction to the studies of the school.

See D. Van de Wynpersse, *De Xenocrate Chalcedonio* (Leiden, 1822); C. A. Brandis, *Gesch. d. griechisch-römischen Philosophie* (Berlin, 1853), ii. 2, 1; E. Zeller, *Philosophie d. Griechen* (Leipzig, 1875), ii. 1; F. W. A. Mullach, *Fragmenta Philosophorum Graecorum* (Paris, 1881), iii. (H. Ja.)

XENOPHANES of Colophon, the reputed founder of the Eleatic school of philosophy, is supposed to have been born in the third or fourth decade of the 6th century B.C. An exile from his Ionian home, he resided for a time in Sicily, at Zancle and at Catana, and afterwards established himself in southern Italy, at Elea, a Phocaean colony founded in the sixty-first Olympiad (536–533). In one of the extant fragments he speaks of himself as having begun his wanderings sixty-seven years before, when he was twenty-five years of age, so that he was not less than ninety-two when he died. His teaching found expression in poems, which he recited rhapsodically in the course of his travels. In the more considerable of the elegiac fragments which have survived, he ridicules the doctrine of the migration of souls (xviii.), asserts the claims of wisdom against the prevalent athleticism, which seemed to him to conduce neither to the good government of states nor to their material prosperity (xix), reprobates the introduction of Lydian luxury into Colophon (xx.), and recommends the reasonable enjoyment of social pleasures (xxi.). Of the epic fragments, the more important are those in which he attacks the "anthropomorphic and anthropopathic polytheism" of his contemporaries. According to Aristotle, "the first of Eleatic unitarians was not careful to say whether the unity which he postulated was finite or infinite, but, contemplating the whole firmament, declared that the One is God." Whether Xenophanes was a monotheist, whose assertion of the unity of God *suggested* to Parmenides the doctrine of the unity of Being, or a pantheist, whose assertion of the unity of God was also a declaration of the unity of Being, so that he *anticipated* Parmenides—in other words, whether Xenophanes's teaching was purely theological or had also a philosophical significance—is a question about which authorities have differed and will probably continue to differ. The silence of the extant fragments, which have not one word about the unity of Being, favours the one view; the voice of antiquity, which proclaims Xenophanes the founder of Eleaticism, has been thought to favour the other.

Of Xenophanes's utterances about (1) God, (2) the world, (3) knowledge, the following survive: (1) "There is one God, greatest among gods and men, neither in shape nor in thought like unto mortals. . . . He is all sight, all mind, all ear (*i.e.* not a composite organism). . . . Without an effort ruleth he all things by thought. . . . He abideth ever in the same place motionless, and it befitteth him not to wander hither and thither. . . . Yet men imagine gods to be born, and to have raiment and voice and body, like themselves. . . . Even so the gods of the Ethiopians are swarthy and flat-nosed, the gods of the Thracians are fair-haired and blue-eyed. . . . Even so Homer and Hesiod attributed to the gods all that is a shame and a reproach among men—theft, adultery, deceit and other lawless acts. . . . Even so oxen, lions and horses, if they had hands wherewith to grave images, would fashion gods after their own shapes and make them bodies like to their own. (2) From earth all things are and to earth all things return. . . . From earth and water come all of us. . . . The sea is the well whence water springeth. . . . Here at our feet is the end of the earth where it reacheth unto air, but, below, its foundations are without end. . . . The rainbow, which men call Iris, is a cloud that is purple and red and yellow. (3) No man hath certainly known, nor shall certainly know, that which he saith about the gods and about all things; for, be that which he saith ever so perfect, yet doth he not know it; all things are matters of opinion. . . . That which I say is opinion like unto truth. . . . The gods did not reveal all things to mortals in the beginning; long is the search ere man findeth that which is better."

There is very little secondary evidence to record. "The Eleatic school," says the Stranger in Plato's *Sophist*, 242 D, "beginning with Xenophanes, and even earlier, starts from the principle of the unity of all things." Aristotle, in a passage already cited, *Metaphysics*, A5, speaks of Xenophanes as the first of the Eleatic unitarians, adding that his monotheism was reached through the contemplation of the οὐρανός. Theophrastus (in Simplicius's *Ad Physica*, 5) sums up Xenophanes's teaching in the propositions, "The All is One and the One is God." Timon (in Sext. Empir. *Pyrrh.* i. 224), ignoring Xenophanes's theology, makes him resolve all things into one and the same unity. The demonstrations of the unity and the attributes of God, with which the treatise *De Melisso, Xenophane et Gorgia* (now no longer ascribed to Aristotle or Theophrastus) accredits Xenophanes, are plainly framed on the model of Eleatic proofs of the unity and the attributes of the Ent, and must therefore be set aside. The epitomators of a later time add nothing to the testimonies already enumerated.

Thus, whereas in his writings, so far as they are known to us, Xenophanes appears as a theologian protesting against an anthropomorphic polytheism, the ancients seem to have regarded him as a philosopher asserting the unity of Being. How are we to understand these conflicting, though not irreconcilable, testimonies? According to Zeller, the discrepancy is only apparent. The Greek gods being the powers of nature personified, pantheism lay nearer to hand than monotheism. Xenophanes was, then, a pantheist. Accordingly his assertion of the unity of God was at the same time a declaration of the unity of Being, and in virtue of this declaration he is entitled to rank as the founder of Eleaticism, inasmuch as the philosophy of Parmenides was his forerunner's pantheism divested of its theistic element. This reconciliation of the internal and the external evidence, countenanced as it is by Theophrastus, one of the best informed of the ancient historians, and approved by Zeller, one of the most learned of the modern critics, is more than plausible; but there is something to be said on the contrary part. In the first place, it may be doubted whether to a Greek of the 6th century pantheism was nearer than monotheism. Secondly, the external evidence does not bear examination. The Platonic testimony, if it proved anything, would prove too much, namely, that the doctrine of the unity of Being originated, not with Xenophanes, but before him; and, in fact, the passage from the *Sophist* no more proves that Plato attributed to Xenophanes the philosophy of Parmenides than *Theaetetus*, 16c D, proves that Plato attributed to Homer the philosophy of Heraclitus. Again, Aristotle's description of Xenophanes as the first of the Eleatic unitarians does not necessarily imply that the unity asserted by Xenophanes was the unity asserted by Parmenides; the phrase, "contemplating the firmament, he declared that the One is God," leaves it doubtful whether Aristotle attributed to Xenophanes any philosophical theory whatever; and the epithet ἀγροικότερος discourages the belief that Aristotle regarded Xenophanes as the author of a new and important departure. Thirdly, when Xenophanes himself says that theories about gods and about things are not knowledge, that his own utterances are not verities but verisimilitudes, and that, so far from learning things by revelation, man must laboriously seek a better opinion, he plainly renounces the "disinterested pursuit of truth." If then he was indifferent to the problem, he can hardly be credited with the Eleatic solution. In the judgment of the present writer, Xenophanes was neither a philosopher nor a sceptic. He was not a philosopher, for he despaired of knowledge. He was not a sceptic, if by "sceptic" is meant the misologist whose despair of knowledge is the consequence of disappointed endeavour, for he had never hoped. Rather he was a theologian who arrived at his theory of the unity of the Supreme Being by criticism of the contemporary mythology. But, while he thus stood aloof from philosophy, Xenophanes influenced its development in two ways: first, his theological henism led the way to the philosophical henism of Parmenides and Zeno; secondly, his assertion that so-called knowledge was in reality no more than opinion taught his successors to distinguish knowledge and opinion, and to assign to each a separate province.

Apart from the old controversy about Xenophanes's relations to philosophy, doubts have recently arisen about his theological position. In fragments i., xiv., xvi., xxi., &c., he recognizes, thinks Freudenthal, a plurality of deities; whence it is inferred that, besides the One God, most high, perfect, eternal, who, as immanent intelligent cause, unifies the plurality of things, there were also lesser divinities, who govern portions of the universe, being themselves eternal parts of the one all-embracing Godhead. Whilst it can hardly be allowed that Xenophanes, so far from denying, actually affirms a plurality of gods, it must be conceded to Freudenthal that Xenophanes's polemic was directed against the anthropomorphic tendencies and the mythological details of the contemporary polytheism rather than against the polytheistic principle, and that, apart from the treatise *De Melisso Xenophane et Gorgia*, now generally discredited, there is no direct evidence to prove him a consistent monotheist. The wisdom of Xenophanes, like the wisdom of the Hebrew Preacher, showed itself, not in a theory of the universe, but in a sorrowful recognition of the nothingness of things and the futility of endeavour. His theism was a declaration not so much of the greatness of God as rather of the littleness of man. His cosmology was an assertion not so much of the immutability of the One as rather of the mutability of the Many. Like Socrates, he was not a philosopher, and did not pretend to be one; but, as the reasoned scepticism of Socrates cleared the way for the philosophy of Plato, so did Xenophanes's "abnormis sapientia" for the philosophy of Parmenides.

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(H. JA.)

XENOPHON, Greek historian and philosophical essayist, the son of Gryllus, was born at Athens about 430 B.C.[1] He belonged to an equestrian family of the deme of Erchia. It may be inferred from passages in the *Hellenica* that he fought at Arginusae (406), and that he was present at the return of Alcibiades (408), the trial of the Generals and the overthrow of the Thirty. Early in life he came under the influence of Socrates, but an active life had more attraction for him. In 401, being invited by his friend Proxenus to join the expedition of the younger Cyrus against his brother, Artaxerxes II. of Persia, he at once accepted the offer. It held out the prospect of riches and honour, while he was little likely to find favour in democratic Athens, where the knights were regarded with suspicion as having supported the Thirty. At the suggestion of Socrates, Xenophon went to Delphi to consult the oracle; but his mind was already made up, and he at once proceeded to Sardis, the place of rendezvous. Of the expedition itself he has given a full and detailed account in his *Anabasis*, or the "Up-Country March." After the battle of Cunaxa (401), in which Cyrus lost his life, the officers in command of the Greeks were treacherously murdered by the Persian satrap Tissaphernes, with whom they were negotiating an armistice with a view to a safe return. The army was now in the heart of an unknown country, more than a thousand miles from home and in the presence of a troublesome enemy. It was decided to march northwards up the Tigris valley and make for the shores of the Euxine, on which there were several Greek colonies. Xenophon became the leading spirit of the army; he was elected an officer, and he it was who mainly directed the retreat. Part of the way lay through the wilds of Kurdistan, where they had to encounter the harassing guerrilla attacks of savage mountain tribes, and part through the highlands of Armenia and Georgia. After a five months' march they reached Trapezus [Trebizond] on the Euxine (February 400), where a tendency to demoralization began to show itself, and even Xenophon almost lost his control over the soldiery. At Cotyora he aspired to found a new colony; but the idea, not being unanimously accepted, was abandoned, and ultimately Xenophon with his Greeks arrived at Chrysopolis [Scutari] on the Bosporus, opposite Byzantium. After a brief period of service under a Thracian chief, Seuthes, they were finally incorporated in a Lacedaemonian army which had crossed over into Asia to wage war against the Persian satraps Tissaphernes and Pharnabazus. Xenophon, who accompanied them, captured a wealthy Persian nobleman, with his family, near Pergamum, and the ransom paid for his recovery secured Xenophon a competency for life.

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[1] As the description of the Ionian campaign of Thrasyllus in 410 (*Hellenica*, i. 2) is clearly derived from Xenophon's own reminiscences, he must have taken part in this campaign, and cannot therefore have been less than twenty years of age at the time.

On his return to Greece Xenophon served under Agesilaus, king of Sparta, at that time the chief power in the Greek world. With his native Athens and its general policy and institutions he was not in sympathy. At Coroneia (394) he fought with the Spartans against the Athenians and Thebans, for which his fellow-citizens decreed his banishment. The Spartans provided a home for him at Scillus in Elis, about two miles from Olympia; there he settled down to indulge his tastes for sport and literature. After Sparta's crushing defeat at Leuctra (371), Xenophon was driven from his home by the people of Elis. Meantime Sparta and Athens had become allies, and the Athenians repealed the decree which had condemned him to exile. There is, however, no evidence that he ever returned to his native city. According to Diogenes Laërtius, he made his home at Corinth. The year of his death is not known; all that can be said is that it was later than 355, the date of his work on the *Revenues of Athens*.

The *Anabasis* (composed at Scillus between 379 and 371) is a work of singular interest, and is brightly and pleasantly written. Xenophon, like Caesar, tells the story in the third person, and there is a straightforward manliness about the style, with a distinct flavour of a cheerful lightheartedness, which at once enlists our sympathies. His description of places and of relative distances is very minute and painstaking. The researches of modern travellers attest his general accuracy. It is expressly stated by Plutarch and Diogenes Laërtius that the *Anabasis* was the work of Xenophon, and the evidence from style is conclusive. The allusion (*Hellenica*, iii. 1, 2) to Themistogenes of Syracuse as the author shows that Xenophon published it under an assumed name.

The *Cyropaedia*, a political and philosophical romance, which describes the boyhood and training of Cyrus, hardly answers to its name, being for the most part an account of the beginnings of the Persian empire and of the victorious career of Cyrus its founder. The *Cyropaedia* contains in fact the author's own ideas of training and education, as derived conjointly from the teachings of Socrates and his favourite Spartan institutions. It was said to have been written in opposition to the *Republic* of Plato. A distinct moral purpose, to which literal truth is sacrificed, runs through the work. For instance, Cyrus is represented as dying peacefully in his bed, whereas, according to Herodotus, he fell in a campaign against the Massagetae.

The *Hellenica* written at Corinth, after 362, is the only contemporary account of the period covered by it (411–362) that has come down to us. It consists of two distinct parts; books i. and ii., which are intended to form a continuation of the work of Thucydides, and bring the history down to the fall of the Thirty, and books iii.–vii., the *Hellenica* proper, which deal with the period from 401 to 362, and give the history of the Spartan and Theban hegemonies, down to the death of Epaminondas. There is, however, no ground for the view that these two parts were written and published as separate works. There is probably no justification for the charge of deliberate falsification. It must be admitted, however, that he had strong political prejudices, and that these prejudices have influenced his narrative. He was a partisan of the reactionary movement which triumphed after the fall of Athens; Sparta is his ideal, and Agesilaus his hero. At the same time, he was a believer in a divine overruling providence. He is compelled, therefore, to see in the fall of Sparta the punishment inflicted by heaven on the treacherous policy which had prompted the seizure of the Cadmea and the raid of Sphodrias. Hardly less serious defects than his political bias are his omissions, his want of the sense of proportion and his failure to grasp the meaning of historical criticism. The most that can be said in his favour is that as a witness he is at once honest and well-informed. For this period of Greek history he is, at any rate, an indispensable witness.

The *Memorabilia*, or "Recollections of Socrates," in four books, was written to defend Socrates against the charges of impiety and corrupting the youth, repeated after his death by the sophist Polycrates. The work is not a literary masterpiece; it lacks coherence and unity, and the picture it gives of Socrates fails to do him justice. Still, as far as it goes, it no doubt faithfully describes the philosopher's manner of life and style of conversation. It was the moral and practical side of Socrates's teaching which most interested Xenophon; into his abstruse metaphysical speculations he seems to have made no attempt to enter: for these indeed he had neither taste nor genius. Moving within a limited range of ideas, he doubtless gives us "considerably less than the real Socrates, while Plato gives us something more." It is probable that the work in its present form is an abridgment.

Xenophon has left several minor works, some of which are very interesting and give an insight into the home life of the Greeks.

The *Oeconomics* (to some extent a continuation of the *Memorabilia*, and sometimes regarded as the fifth book of the same) deals with the management of the house and of the farm, and presents a pleasant and amusing picture of the Greek wife and of her home duties. There are some good practical remarks on matrimony and on the respective duties of husband and wife. The treatise, which is in the form of a dialogue between Socrates and a certain Ischomachus, was translated into Latin by Cicero.

In the essays on horsemanship (*Hippikē*) and hunting (*Cynegeticus*), Xenophon deals with matters of which he had a thorough practical knowledge. In the first he gives rules how to choose a horse, and then tells how it is to be groomed and ridden and generally managed. The *Cynegeticus* deals chiefly with the hare, though the author speaks also of boar-hunting and describes the hounds, tells how they are to be bred and trained, and gives specimens of suitable names for them. On all this he writes with the zest of an enthusiastic sportsman, and he observes that those nations whose upper classes have a taste for field-sports will be most likely to be successful in war. Both treatises may still be read with interest by the modern reader.

The *Hipparchicus* explains the duties of a cavalry officer; it is not, according to our ideas, a very scientific treatise, showing that the art of war was but very imperfectly developed and that the military operations of the Greeks were on a somewhat petty scale. He dwells at some length on the moral qualities which go to the making of a good cavalry officer, and hints very plainly that there must be strict attention to religious duties.

The *Agesilaus* is a eulogy of the Spartan king, who had two special merits in Xenophon's eyes: he was a rigid disciplinarian, and he was particularly attentive to all religious observances. We have a summary of his virtues rather than a good and striking picture of the man himself.

The *Hiero* works out the line of thought indicated in the story of the Sword of Damocles. It is a protest against the notion that the "tyrant" is a man to be envied, as having more abundant means of happiness than a private person. This is one of the most pleasing of his minor works; it is cast into the form of a dialogue between Hiero, tyrant of Syracuse, and the lyric poet Simonides.

The *Symposium*, or "Banquet," to some extent the complement of the *Memorabilia*, is a brilliant little dialogue in which Socrates is the prominent figure. He is represented as "improving the occasion," which is that of a lively Athenian supper-party, at which there is much drinking, with flute-playing, and a dancing-girl from Syracuse, who amuses the guests with the feats of a professional conjuror. Socrates's table-talk runs through a variety of topics, and winds up with a philosophical disquisition on the superiority of true heavenly love to its earthly or sensual counterfeit, and with an earnest exhortation to one of the party, who had just won a victory in the public games, to lead a noble life and do his duty to his country.

There are also two short essays, attributed to him, on the political constitution of Sparta and Athens, written with a decided bias in favour of the former, which he praises without attempting to criticize. Sparta seems to have presented to Xenophon the best conceivable mixture of monarchy and aristocracy. The second is certainly not by Xenophon, but was probably written by a member of the oligarchical party shortly after the beginning of the Peloponnesian War.

In the essay on the *Revenues of Athens* (written in 355) he offers suggestions for making Athens less dependent on tribute received from its allies. Above all, he would have Athens use its influence for the maintenance of peace in the Greek world and for the settlement of questions by diplomacy, the temple at Delphi being for this purpose an independent centre and supplying a divine sanction.

The *Apology*, Socrates's defence before his judges, is rather a feeble production, and in the general opinion of modern critics is not a genuine work of Xenophon, but belongs to a much later period.

Xenophon was a man of great personal beauty and considerable intellectual gifts; but he was of too practical a nature to take an interest in abstruse philosophical speculation. His dislike of the democracy of Athens induced such lack of patriotism that he even fought on the side of Sparta against his own country. In religious matters he was narrow minded, a believer in the efficacy of sacrifice and in the prophetic art. His plain and simple style, which at times becomes wearisome, was greatly admired and procured him many imitators.

The editions of Xenophon's works, both complete and of separate portions, are very numerous, especially of the *Anabasis*; only a selection can be given here. Editio princeps (1516, incomplete); J. G. Schneider (1790–1849); G. Sauppe (1865–66); L. Dindorf (1875); E. C. Marchant (1900–   , in the Clarendon Press *Scriptorum Classicorum Bibliotheca*). ANABASIS: R. Kühner (1852); J. F. Macmichael (1883); F. Vollbrecht (1887); A. Pretor (1888); C. W. Krüger and W. Pökel (1888); W. W. Goodwin and J. W. White (i.–iv., 1894). CYROPAEDIA: G. M. Gorham (1870); L. Breitenbach (1875); A. Goodwin (vi.–viii., 1880); F. Hertlein and W. Nitsche (1886); H. A. Holden (1887–90). HELLENICA: L. Breitenbach (1874–84); R. Büchsenschütz (1880–91); J. I. Manatt (i.–iv., 1888); L. D. Dowdall (i., ii., 1890). Memorabilia: P. Frost (1867); A. R. Cluer (1880); R. Kühner (1882); L. Breitenbach (1889); J. Marshall (1890). Oeconomicus: H. A. Holden (1895); C. Graux and A. Jacob (1886). Hiero: H. A. Holden (1888). Agesilaus: R. W. Taylor (1880); O. Güthling (1888). Resp. Lacedaem.: G. Pierleoni (1905). Resp. Atheniensium: A. Kirchhoff (1874); E. Belot (1880); H. Müller and Strübing (1880). Cynegeticus: G. Pierleoni (1902). Hippikē: Tommasini (1902). Reditus Athen.: A. Zurborg (1876). Scripta Minora: L. Dindorf (1888). There is a good English translation of the complete works by H. G. Dakyns (1890–94), and of the *Art of Horsemanship* by M. H. Morgan (U.S.A., 1890). Of general works bearing on the subject may be mentioned: G. Sauppe, *Lexilogus Xenophonteus* (1869); A. Croiset, *X., son caractère et son talent* (1873); Roquette, *De Xenophontis Vita* (1884); I. Hartmann, *Analecta Xenophontea* (1887) and *Analecta Xenophontea Nova* (1889); C. Joël, *Der echte und der Xenophonteische Socrates* (1892); Lange, *X., sein Leben, seine Geistesart und seine Werke* (1900). See also Greece: *Ancient History*, § "Authorities," and works quoted; J. B. Bury, *Ancient Greek Historians* (1909); Mure's *History of Greek Literature* and Grant's monograph in *Blackwood's Ancient Classics for English Readers* may be read with advantage. Bibliographies in Engelmann-Preuss, *Bibliotheca Scriptorum Classicorum* (i., 1880) and in C. Bursian's *Jahresbericht* (c., 1900) by E. Richter. (E. M. W.; J. H. F.)

XERXES (the Greek form of the Pers. *Khshayārshā*; Old Testament *Ahasverus, Akhashverosh—i.e.* Ahasuerus (*q.v.*)—with wrong vocalization and substitution of *y* for *v*, instead of *Akhshavarsh*; in Aramaic inscriptions and papyri from Egypt the name is written *Khshai'arsh*), the name of two Persian kings of the Achaemenid dynasty.

1. Xerxes I., son of Darius I. and Atossa, the daughter of Cyrus the Great, and therefore appointed successor to his father in preference to his eldest half-brothers, who were born before Darius had become king (Herod. vii. 2 f.). After his accession in October 485 B.C. he suppressed the revolt in Egypt which had broken out in 486, appointed his brother Achaemenes as satrap and "brought Egypt under a much heavier yoke than it had been before" (Herod. vii. 7). His predecessors, especially Darius, had not been successful in their attempts to conciliate the ancient civilizations. This probably was the reason why Xerxes in 484 abolished the "kingdom of Babel" and took away the golden statue of Bel (Marduk, Merodach), the hands of which the legitimate king of Babel had to seize on the first day of each year, and killed the priest who tried to hinder him.[1] Therefore Xerxes does not bear the title of "King of Babel" in the Babylonian documents dated from his reign, but "King of Persia and Media," or simply "King of countries" (*i.e.* of the world). This proceeding led to two rebellions, probably in 484 and 479; in the Babylonian documents occur the names of two ephemeral kings, Shamash-irbā and Tarziya, who belong to this time. One of these rebellions was suppressed by Megabyzus, son of Zopyrus, the satrap whom the Babylonians had slain.[2]

Darius had left to his son the task of punishing the Greeks for their interference in the Ionian rebellion and the victory of Marathon. From 483 Xerxes prepared his expedition with great care: a channel was dug through the isthmus of the peninsula of Mount Athos; provisions were stored in the stations on the road through Thrace; two bridges were thrown across the Hellespont. Xerxes concluded an alliance with Carthage, and thus deprived Greece of the support of the powerful monarchs of Syracuse and Agrigentum. Many smaller Greek states, moreover, took the side of the Persians ("Medized"), especially Thessaly, Thebes and Argos. A large fleet and a numerous army were gathered. In the spring of 480 Xerxes set out from Sardis. At first Xerxes was victorious everywhere. The Greek fleet was beaten at Artemisium, Thermopylae stormed, Athens conquered, the Greeks driven back to their last line of defence at the Isthmus of Corinth and in the Bay of Salamis. But Xerxes was induced by the astute message of Themistocles (against the advice of Artemisia of Halicarnassus) to attack the Greek fleet under unfavourable conditions, instead of sending a part of his ships to the Peloponnesus and awaiting the dissolution of the Greek armament.[3] The battle of Salamis (28th of September 480) decided the war (see Salamis). Having lost his communication by sea with Asia, Xerxes was forced to retire to Sardis; the army which he left in Greece under Mardonius was in 479 beaten at Plataea (*q.v.*). The defeat of the Persians at Mycale roused the Greek cities of Asia.

Of the later years of Xerxes little is known. He sent out Sataspes to attempt the circumnavigation of Africa (Herod. iv. 143), but the victory of the Greeks threw the empire into a state of languid torpor, from which it could not rise again. The king himself became involved in intrigues of the harem (cf. Herod. ix. 108 ff.—compare the late Jewish novel of *Esther*, in which a remembrance of the true character of the king is retained) and was much dependent upon courtiers and eunuchs. He left inscriptions at Persepolis, where he added a new palace to that of Darius, at Van in Armenia, and on Mount Elvend near Ecbatana; in these texts he merely copies the words of his father. In 465 he was murdered by his vizier Artabanus (*q.v.*), who raised Artaxerxes I. to the throne.

2. Xerxes II., son and successor of Artaxerxes I., was assassinated in 424 after a reign of forty-five days by his brother Secydianus or Sogdianus, who in his turn was murdered by Darius II. (*q.v.*).

See Ctesias, *Pers.* 44; Diod. xii., 64, 71, and the chronographers; neither of the two ephemeral kings is mentioned in the canon of Ptolemy nor in the dates of Babylonian contracts of this time.

The name Xerxes was also borne by a king of Armenia, killed about 212 B.C. by Antiochus the Great (Polyb. viii. 25; Johannes Antiochenus, p. 53; his name occurs on copper coins); and by a son of Mithradates the Great of Pontus (Appian, *Mithr.* 108, 117). (Ed. M.)

XIPHILINUS, JOANNES, epitomator of Dio Cassius, lived at Constantinople during the latter half of the 11th century A.D. He was a monk and the nephew of the patriarch of Constantinople of the same name, a well-known preacher (Migne, *Patrologia Graeca*, cxx.). The epitome (ἐκλογαί) of Dio was prepared by order of Michael Parapinaces (1071–1078), but is unfortunately incomplete. It comprises books 36–80, the period included being from the times of Pompey and Caesar down to Alexander Severus. In book 70 the reign of Antoninus Pius and the early years of Marcus Aurelius appear to have been missing in his copy, while in books 78 and 79 a mutilated original must have been used. Xiphilinus divided the work into sections, each containing the life of an emperor. He omitted the name of the consuls and sometimes altered or emended the original. The epitome is valuable as preserving the chief incidents of the period for which the authority of Dio is wanting.

See H. Reimar's edition of Dio Cassius, ii.; J. Melber's Dio in Teubner series; C. Wachsmuth, *Einleitung in das Studium der alten Geschichte* (1895); W. Christ, *Geschichte der griechischen Litteratur* (1898).

X-RAY TREATMENT. The X rays (see Röntgen Rays) are now used extensively in medical work for purposes of treatment. They have been found to be valuable in many forms of skin disease, more particularly in those of a chronic character. They have a favourable influence upon glandular tumours, as for example in enlargements of the lymphatic glands, of the spleen and of the thyroid gland. They give useful palliative effects in certain forms of malignant disease, although it is not yet certain that any permanent cures of cancerous conditions have been obtained by their use. In the disease known as rodent ulcer, which is a process of destructive ulceration, and to that extent presents features allied to cancer, there is no doubt of the efficacy of X-ray treatment for bringing about a complete cure in the majority of cases, provided that the disease has not advanced too deeply into the tissues.

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[1] Herod. i. 183, by Ctesias changed into a plundering of the tomb of Belitanas or Belus: cf. Aelian, *Var. Hist.* 13, 3; Aristobulus *ap.* Arrian vii. 17, 2, and Strabo xvi. p. 738.

[2] Ctesias, *Pers.* 22; his legendary history is transferred by Herodotus, iii. 150 ff., to the former rebellion against Darius.

[3] See G. B. Grundy, *Great Persian War* (1901), and in criticism W. W. Tarn, "The Fleet of Xerxes," in *Journal of Hellenic Studies* (1908), 202–34; also Macan's notes on Herod. iv.–vi. (1895), and authorities for Plataea, Salamis.

The idea of using X rays in the treatment of disease arose from the recognition of the injurious effects which followed the prolonged application of the rays for diagnostic purposes. It fell to the lot of many early workers with X rays to notice the production of an inflammation of the skin, or a falling out of the hair over parts which had been subjected to X rays, and Leopold Freund, of Vienna, has stated that his first attempts to utilize X rays in treatment were made in 1896 to cure a hairy mole and were prompted by what he had read of such occurrences. A definite action of the rays upon the skin having been observed, their employment in the treatment of skin diseases followed as a natural corollary. Amongst the earliest investigators of the possible therapeutic effects of X rays the names of Schiff, Freund, Kienböck, Holtzknecht, Sjögren and Stenbeck may be mentioned. In Great Britain Sir Malcolm Morris, E. Dore and J. H. Sequeira were amongst the earliest investigators.

For operating successfully with an agent capable of producing decidedly harmful effects when given in large doses it is necessary to have some method of measurement, and the need for this quickly became apparent when X rays were used for treatment. The results of X-ray photography had already shown that the tubes employed were capable of emitting radiations of very varying powers of penetration, and that the tubes were by no means constant in this respect; and the question whether highly penetrating rays or rays of feeble penetration were to be preferred for therapeutic use became the subject of much discussion. It is now recognized that the rays which act upon the tissues are those which are absorbed by the tissues, and consequently the softer or less penetrating rays are now regarded as those to be used in treatment. So too the problem of measuring the quantity of rays emitted by a tube during a given time began to call for a solution, if that were in any way possible. In 1901 Benoist designed an apparatus by which the quality of the rays emitted by a tube at any moment could be accurately determined, and in 1902 Holtzknecht brought out the first quantitative device. It was called a chromoradiometer, and it enabled the dose administered to a patient to be observed, and recorded for future guidance. Holtzknecht also drew up a scale of units by means of which the indications of his apparatus could be interpreted. The units of Holtzknecht are still used to express the dosage of X rays, though his apparatus has been superseded. Holtzknecht's method of measurement consisted in observing the change of colour in certain pastilles when exposed to X rays, and his apparatus consisted of a scale of tints, and a number of pastilles of a yellow tint which acquired a green colour during exposure. The composition of these was kept a secret, but analysis revealed in them the presence of potassium sulphate combined with celluloid or gelatine. The pastilles were laid upon the surface under treatment, and their change of colour was compared at intervals with the scale of standard tints.

It was next thought that under suitable conditions the measurement of the current passing through the X-ray tube might serve as a guide to the quantity of X rays emitted by the tube, but, although this is the case to a certain extent, the method of quantity measurement which is now employed almost universally in X-ray treatment is that devised by Sabouraud and Noiré, and used with signal success by them in an enormous number of cases of ringworm, in which disease measurement of dose is of the most critical importance, for the following reason. The cure of ringworm by X rays requires that all the hair of the affected region shall be caused to fall out, but, nevertheless, it is necessary for obvious reasons that the hair should grow again after the disease has disappeared. Now if the dose of X rays be insufficient the hair does not come out and no cure results, while if the dose be too great the hair comes out but does not grow again; and the margin of safety is quite a narrow one. The method of Sabouraud and Noiré which has proved itself reliable for such critical measurements of dosage as are required for ringworm treatment, has to-day the universal acceptance of all X-ray workers for other forms of X-ray treatment, although the use of their pastilles has certain disadvantages.

Sabouraud's pastilles consist of small disks of platinocyanide of barium. This chemical compound has a bright yellow-green colour when freshly prepared, and changes through gradations of yellow to a brown colour when exposed to X rays. The pastilles are supplied in a book with which a permanent tint of colour is supplied, to indicate the colour change in the pastille which corresponds with a quantity of X rays equal to the maximum dose which the healthy skin will stand without inflammatory consequences. This is often spoken of as a "pastille dose." As the amount of irradiation needed to produce the change of colour is considerable, the salt is fixed, during the treatment, at a point half-way between the source of the rays and the skin surface under treatment. During an exposure the chemical salt, in the form of a small disk of the material on cardboard, is adjusted in the required position by means of a pastille holder, and it is examined at intervals during the course of the exposure, until it has reached the required tint. When in the holder the pastille must be protected from light, and should have a piece of metal as a backing, if its indications are to be accurate.

In X-ray treatment some protection of the surrounding healthy parts is usually necessary. With this object various methods of shielding have been devised, either by coverings of the patient by impermeable materials, or by enclosing the tube in an impermeable box. Both methods are used, but tube-boxes are the most convenient, and most instrument makers now supply these boxes with suitable windows or openings of different sizes for the passage of the pencil of rays which is to fall upon the part under treatment.

The effect of the rays on healthy tissues is in the main a destructive one, but some of the cells of the tissues are more sensitive to the rays than are others; and this permits of a selective effect being obtained, with the destruction of some cells and not of the whole tissue. Young cells, and actively growing cells, are the most susceptible, and for this reason it is possible to influence the glands of the skin and the papillae of the hairs with a dose which will not destroy the skin itself. The art of successful working with X rays is based upon a careful adjustment of the dose so as to secure a selective destruction of the morbid elements, and to avoid wholesale damage to the part treated. The effects of excessive doses of X rays is to produce an inflammation which may result in painful sores which obstinately refuse to heal for many weeks or months. A quantity up to double that of the usual maximum or pastille dose may be employed in urgent cases without risk of any serious inflammation, but anything over this is to be avoided most carefully. In the treatment of ringworm the exact pastille dose must not be exceeded, for after a dose of about one and a half pastilles the fall of the hair is likely to be followed by permanent baldness.

In X-ray treatment it is customary to make use of moderate currents, and to bring the X-ray tube in its tube-holder and box into position so that the pencil of rays may fall upon the part to be treated. The distance of the skin surface from the centre of the tube must be known, and the pastille arranged in place accordingly. Fifteen centimetres is a usual distance, and at this distance a tube working with a current of a milliampere should give the full therapeutic dose or "pastille dose" in about 15 minutes. In general X-ray treatment it is quite usual at the present time to proceed by the method of full doses at rather long intervals. From the experience obtained by Sabouraud in numerous cases of ringworm it has been found that a full dose must not be repeated until a month has elapsed. So too in the treatment of rodent ulcer full doses at long intervals are now thought better than smaller doses repeated more often, and such doses are more easily measured by the Sabouraud pastille, which records large doses more simply than small ones, in which the slighter changes of tint are not easy to distinguish.

A great amount of work has been done with X rays for the treatment of cancer, but it is now recognized that the X rays do not cure a cancer, although they are of value for the relief of pain and for the healing of cancerous ulcers. Diminution of size in cancerous growths has frequently been observed, and in some instances sarcomatous tumours have completely disappeared under X-ray treatment. Sooner or later, however, the cancer or sarcoma returns either in the original site or elsewhere, and the patient dies of the disease. It is probable that X-ray treatment is able to prolong life in a fair number of cases, and by its agency in causing a healing of ulceration in cancer cases it is able to give valuable relief both to the body and mind of the patient, and this relief may last for a year or more.

In rodent ulcer X rays are usually sufficient to provide a lasting cure, but there are some exceptions, as for instance when the rodent ulcer has been long neglected, and has spread deeply so as to invade bony structures. An important factor in the successful treatment of rodent ulcer by X rays is to continue the applications at intervals for several months after apparent cure. If this precaution is omitted there is a very great likelihood of relapse taking place later on.

In the treatment of skin diseases by X rays the method finds a very suitable field. Almost all chronic skin affections yield to X-ray treatment fairly quickly, and maximal doses are not usually necessary.

In ringworm X rays have achieved wonderful results. The rays act upon the hair papillae, and not upon the ringworm fungus. They cause a shedding of the hair fifteen days after exposure and the fungus then dies out from the hair follicles, so that when in due course the hair begins to grow again after a period of two months it grows healthily and without disease. The X-ray treatment of ringworm has been a real advance, and Sabouraud has told us of the enormous pecuniary saving which has been effected in Paris by the shortening of the stay of the ringworm cases in the special schools maintained there for the affected children.

In lupus X rays are valuable, but not fully satisfactory. The treatment by the rays will often succeed in bringing about a healing of the ulceration of lupus, but relapses are frequent, because foci of infection are apt to remain in the healed scar tissue and after a period of quiescence these may gradually provoke fresh mischief.

X-ray treatment is of service for the treatment of enlarged "strumous" glands in the neck. When these glands are in the early stages, and there has not been any softening or breaking down of the gland tissue, the application of X rays, a few times repeated in moderate doses, will determine the subsidence of the enlargement and may effect a complete cure.

In the massive glandular enlargements of lymphadenoma a great reduction of the tumours can be brought about by heavy doses of X rays, but the results are to give a symptomatic rather than a real cure, for fresh glandular growths take place internally, and the usual course of the disease is not fundamentally modified.

So too in leukemia, the symptom of excessive abundance of white cells in the circulating blood can be surprisingly altered for the better by X rays, but generally without real cure of the underlying condition. The effect appears to be due to a direct destructive action upon the leucocytes or white corpuscles of the blood.

Quite recently the use of X rays in fibroid tumours of the uterus has been advocated, particularly by Courmelles in France and Albert-Schonberg in Germany. The action of the rays seems to be in part due to their influence upon the activity of the ovaries and in part to a direct effect upon the growing fibroids themselves, causing decrease of activity, relief of symptoms and reduction of the tumours. (H. L. J.)

XYLANDER, GUILIELMUS (Wilhelm Holtzman, according to his own spelling) (1532–1576), German classical scholar, was born at Augsburg on the 26th of December 1532. He studied at Tübingen, and in 1558, when in a state of abject poverty (caused, according to some, by his intemperate habits), he was appointed to succeed Micyllus (Molshem, Molseym or Molsheym) in the professorship of Greek at Heidelberg, which he exchanged for that of logic (publicus organi Aristotelii interpres) in 1562. He died at Heidelberg on the 10th of February 1576. Xylander was the author of a number of important works, among which his Latin translations of Dio Cassius (1558), Plutarch (1560–1570) and Strabo (1571) deserve special mention. He also edited (1568) the geographical lexicon of Stephanus of Byzantium; the travels of Pausanias (completed after his death by F. Sylburg, 1583); the *Meditations of Marcus Aurelius* (1558, the editio princeps based upon a Heidelberg MS. now lost; a second edition in 1568 with the addition of Antoninus Liberalis, Phlegon of Tralles, an unknown Apollonius, and Antigonus of Carystus—all paradoxographers); and the chronicle of George Cedrenus (1566). He translated the first six books of Euclid into German with notes, the *Arithmetica* of Diophantus, and the *De quattuor mathematicis scientiis* of Michael Psellus into Latin.

XYLENE, or Dimethyl Benzene, $C_6H_4(CH_3)_2$. Three isomeric hydrocarbons of this formula exist; they occur in the light oil fraction of the coal tar distillate, but they cannot be separated by fractional distillation owing to the closeness of their boiling points. The mixture can be separated by shaking with sulphuric acid, whereupon the ortho and meta forms are converted into soluble sulphonic acids, the para form being soluble only in concentrated acid; the ortho and meta acids may be separated by crystallization of their salts or sulphonamides. Ortho-xylene is obtained from ortho-bromtoluene, methyl iodide and sodium as a colourless mobile liquid boiling at 142°, melting at −28°, and having a specific gravity of 0·8932 at 0°. Oxidation by potassium permanganate gives phthalic acid; whilst chromic acid gives carbon dioxide and water. Meta- or iso-xylene, the most important isomer, may be prepared by nucleus-synthetic reactions, or by distilling mesitylenic acid, $C_6H_3(CH_3)_2CO_2H$, an oxidation product of mesitylene, $C_6H_3(CH_3)_3$, which is produced on the condensation of acetone, with lime; this reaction is very important, for it orientates meta-compounds. It boils at 139°, melts at −54°, and has a specific gravity of 0·8812. Para-xylene is obtained when camphor is distilled with zinc chloride, but it is best prepared from para-brom-toluene or dibrombenzene, methyl iodide and sodium. Dilute nitric acid oxidizes it first to para-toluic acid and then to terephthalic acid. It boils at 138°, melts at 15°, and has a specific gravity of 0·8801 at 0°.

XYLOPHONE (Fr. *xylophone*; Ger. *Xylophon*, *Strohfiedel* or *Holzharmonika*; Ital. *armonica de legno*), a small instrument of percussion, of definite sonorousness, used in the orchestra to mark the rhythm. The xylophone consists of a series of little wooden staves in the form of a half cylinder and graduated in size. The staves, each of which represents a semitone, rest on two, three or four wooden bars, covered with straw and converging to form an acute angle. They are so arranged that each stave is isolated. In some models the staves are grouped in two rows, comprising the naturals and the accidentals. The xylophone is played with two little wooden hammers, and has a compass of two or three octaves. The quality of tone is inferior to that of the steel harmonica or glockenspiel. (K. S.)

XYSTUS, the Greek architectural term for the covered portico of the gymnasium, in which the exercises took place during the winter or in rainy weather; this was known as the *ξυστὸς δρόμος*, from its polished floor (*ξύειν*, to polish). The Romans applied the term to the garden walk in front of the porticoes, which was divided into flower beds with borders of box, and to a promenade between rows of large trees.

Y the twenty-fifth letter of the English alphabet, one of four variants (*u*, *v*, *w*, *y*) which have been developed out of one Greek symbol. It was taken into the Roman alphabet as a form distinct from V in the 1st century B.C., when it was desired to represent the sound of the Greek υ more accurately than could be done by the ordinary Roman alphabet. Many Greek words had been borrowed from Greek long before this and pronounced like genuine Latin words. Thus the proper name Πύρρος was borrowed as *Burrus*, Φρύγες as *Bruges*. But with the growth of literary knowledge this was felt to be a very inexact representation of the Greek sounds, and the words were respelt as *Pyrrhus* and *Phryges*. The philosopher Pythagoras is said to have regarded this letter as a symbol of human life (Servius, on Virgil, *Aeneid* vi. 136). To this there are various references in the Roman poets. Two lines of Persius (iii. 56–57) seem to throw some light upon the particular form of Y intended:

> "Et tibi quae Samios diduxit littera ramos
> surgentem dextro monstravit limite callem."

These lines appear to imply that the letter took the form γ, which can only be one of the oldest forms (Ⴤ) written from right to left. The straight road is the difficult, the deviating line is the easier path of vice. Anglo-Saxon took over the Roman Y with its Roman value of the "modified *u*" (*ü*), and employed it accordingly for the sound which arose from a *u* sound under the influence of an *i* in the following syllable: *fyllan*, "fill," cp. Gothic *fulljan*; mūs, "mouse," plural *mūs*, from an earlier lost *mūsis*. The *y* sounds were often confused with *i*, whence, in modern English, *mice*.

The vowel use was the only use of the old symbol. The consonant Y is of a different origin. The early English *g* (always hard as in *gig*) was palatalized before *e* and *i* sounds into a consonant *į* (*i*) or *y*, which was written in Middle English with the symbol ȝ. With this letter also was written the original consonant *i* (*į*), which appears in Latin as *i* (*j*) in *iugum*, *iuvencus*. This Latin sound seems, at least initially, to have represented two originally separate sounds, for Greek represents the first sound of *iugum* by ζ (ζυγόν), while in other words it represents a *į* (*y*) of other languages by the "rough breathing" (*h* or ʽ): ἁγνός, "holy," is the same word as the Sanskrit *yajnas*. The English words that correspond etymologically to *iugum* and *iuvencus* are "yoke" and "young." In Northern English the symbol ȝ survived longer than in the southern part of the island, and in Scottish documents of the 16th century was confused with *z*. From this cause various Scottish names that were never pronounced with *z* are so spelt, as Menzies (Mengies), Dalziel, Cadzow. In others like Mackenzie, *z* is now universally pronounced, though as late as the middle of the 18th century Lord Kames declared that to hear Mackenzie pronounced with a *z* turned his stomach. (P. Gi.)

YABLONOI, or YABLONOVOI ("Apple Mountains," known to the Mongols as *Dynze-daban*), a range of E. Siberia, stretching N.E. from near the sources of the river Kerulen (N.E. of Urga in N. Mongolia) to the bend of the river Olekma in 56° N., and forming the S.E. border ridge of the upper terrace of the great plateau of Central and E. Asia. Its summits reach altitudes of 5000–6000 ft., culminating in Mount Sokhondo (8040 ft.) near the Transbaikal-Mongolia frontier. The range serves as the water-parting between the streams which flow to the Pacific and those which flow to the Arctic Ocean, and is a dividing line between the Siberian and the Daurian flora. The passes have altitudes of 2000–3500 ft. The range is a continuation of the Kentei Mountains of Mongolia, but is not orographically connected with the Stanovoi Mountains, farther to the N.E., though the names Yablonoi and Stanovoi are commonly used alternatively. The latter are the S.E. border-range of the lower terrace and are connected with the Great Khingan Mountains.

YACHOW-FU, a prefectural city in the province of Szech'uen, China, in 30° N., 103° E.; pop. about 40,000. It is situated in a valley on the banks of the river Ya, where tea is grown. The town owes its importance to the fact that it stands at the parting of the tea and tobacco trade route to Tibet via Tachienlu and the cotton trade route to west Yun-nan via Ningyuen-Fu. The city wall measures 2 m. in circumference, and is pierced by four gates. Yachow-Fu is first mentioned during the Chow dynasty (1122–255 B.C.).

YACHTING, the sport of racing in yachts[1] and boats with sails, and also the pastime of cruising for pleasure in sailing steam or motor vessels. Yacht racing dates from the beginning of the 19th century; for, although there were sailing yachts long before, they were but few, and belonged exclusively to princes and other illustrious personages. For instance, in the Anglo-Saxon period Athelstan had presented to him by the king of Norway a magnificent royal vessel, the sails of which were purple and the head and deck wrought with gold, apparently a kind of state barge. Elizabeth had one, and so has every English sovereign since. During her reign a pleasure ship was built (1588) at Cowes (Isle of Wight), so that the association of that place with the sport goes back a very long time. In 1660 Charles II. was presented by the Dutch with a yacht named the "Mary," until which time the word "yacht" was unknown in England. The Merrie Monarch was fond of sailing, for he designed a yacht of 25 tons called the "Jamie," built at Lambeth in 1662, as well as several others later on. In that year the "Jamie" was matched for £100 against a small Dutch yacht, under the duke of York, from Greenwich to Gravesend and back, and beat her, the king steering part of the time—apparently the first record of a yacht match and of an amateur helmsman. Mr Arthur H. Clark, in his *History of Yachting* (1904), traces the history of pleasure craft from 1600 to 1815, and gives an interesting illustrated account of the yachts belonging to Charles II.

The first authentic record of a sailing club is in 1720, when the Cork Harbour Water Club, now known as the Royal Cork Yacht Club, was established in Ireland, but the yachts were small. Maitland, in his *History of London* (1739) mentions sailing and rowing on the Thames as among the amusements then indulged in; and Strutt, in his *Sports and Pastimes* (1801), says that the Cumberland Society, consisting of gentlemen partial to this pastime, gave yearly a silver cup to be sailed for in the vicinity of London. The boats usually started from Blackfriars Bridge, went up the Thames to Putney, and returned to Vauxhall, being, no doubt, mere sailing boats and not yachts or decked vessels. From the middle to the end of the 18th century yachting developed very slowly: although matches were sailed at Cowes as far back as 1780, very few yachts of any size, say 35 tons, existed in 1800 there or elsewhere. In 1812 the Royal Yacht Squadron was established by fifty yacht-owners at Cowes and was called the Yacht Club, altered to the Royal Yacht Club in 1820; but no regular regatta was held there until some years later. The yachts of the time were built of heavy materials, like the revenue cutters, full in the fore body and fine aft; but it was soon discovered that their timbers and scantlings were unnecessarily strong, and they were made much lighter. It was also found that the single-masted cutter was more weatherly than the brigs and schooners of the time, and the former rig was adopted for racing, and, as there was no time allowance for difference of size, they were all built of considerable dimensions.

Early English Yachts.—Among the earliest of which there is any record were the "Pearl," 95 tons, built by Sainty at Wyvenhoe near Colchester in 1820, for the marquess of Anglesey, and the "Arrow," 84 tons, originally 61 ft. 9½ in. long and 18 ft. 5¼ in. beam, built by Joseph Weld in 1822, which for many years remained extant as a racing yacht, having been rebuilt and altered several times, and again entirely rebuilt in 1887–88. The Thames soon followed the example of the Solent and established the Royal Thames Yacht Club in 1823, the Clyde founding the Royal Northern Yacht Club in 1824, and Plymouth the Royal Western in 1827. In this year the Royal Yacht Squadron passed a resolution disqualifying any member who should apply steam to his yacht—the enactment being aimed at T. Assheton Smith, an enthusiastic yachtsman and fox-hunter, who was having a paddle-wheel steam yacht called the "Menai" built on the Clyde. In 1830 one of the largest cutters ever constructed was launched, viz. the "Alarm," built by Inman at Lymington for Joseph Weld of Lulworth Castle, from the lines of a famous smuggler captured off the Isle of Wight. She was 82 ft. on the load-line by 24 ft. beam, and was reckoned of 193 tons, old measurement, in which length, breadth and half-breadth (supposed to represent depth) were the factors for computation. Some yachtsmen at this time preferred still larger vessels and owned square-topsail schooners and brigs like the man-o'-war brigs of the day, such as the "Waterwitch," 381 tons, built by White of Cowes, in 1832, for Lord Belfast, and the "Brilliant," barque, 493 tons, belonging to J. Holland Ackers, who invented a scale of time allowance for competitive sailing. In 1834 the first royal cup was given by William IV. to the Royal Yacht Squadron. In 1836 the Royal Eastern Yacht Club was founded at Granton near Edinburgh; in 1838 the Royal St George's at Kingstown and the Royal London; in 1843 the Royal Southern at Southampton and the Royal Harwich; in 1844 the Royal Mersey at Liverpool and the Royal Victoria at Ryde. The number of vessels kept pace with the clubs—the fifty yachts of 1812 increasing nearly tenfold before the middle of the century.

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[1] The English word "yacht" is the Dutch *jacht*, *jagt*, from *jachten*, "to hurry," "to hunt." See also SHIP and SHIPBUILDING.

First Alteration in Type.—In 1848, after J. Scott Russell had repeatedly drawn attention to the unwisdom of constructing sailing vessels on the "cod's head and mackerel tail" plan, and had enunciated his wave-line theory, Mare built at Blackwall an entirely new type of vessel, with a long hollow bow and a short after-body of considerable fulness. This was the iron cutter "Mosquito," of 59 ft. 2 in. water-line, 15 ft. 3 in. beam, and measuring 50 tons. Prejudice against the new type of yacht being as strong as against the introduction of steam, there were no vessels built like the "Mosquito," with the exception of the "Volante," 59 tons, by Harvey of Wyvenhoe, until the eyes of English yachtsmen were opened by the Americans three years later. About this period yacht racing had been gradually coming into favour in the United States, the first yacht club being founded at New York in 1844 by nine yacht-owners; and in 1846 the first match between yachts in the States was sailed, 25 m. to windward and back from Sandy Hook lightship, between J. C. Stevens's new centre-board sloop "Maria," 170 tons, 100 ft. water-line and 26 ft. 8 in. beam, with a draught of 5 ft. 3 in. of water, and the "Coquette," schooner, 74 tons, belonging to J. H. Perkins, the latter winning; but the appearance of the "Maria," which had a clipper or schooner bow, something like that of the racing cutters of 1887–88, did much for yachting in America. Stevens then commissioned George Steers of New York, builder of the crack pilot schooners, to construct a racing schooner to visit England in the year of the great exhibition, and the result was the "America" of 170 tons. She crossed the Atlantic in the summer of 1851, but failed to compete for the Queen's cup at Cowes in August, although the club for that occasion threw the prize open to all the world, as her owner declined to concede the usual time allowance for difference of size. The members of the Yacht Squadron, not wishing to risk the reproach of denying the visitor a fair race, decided that their match for a cup given by the club, to be sailed round the Isle of Wight later in the same month, should be without any time allowance. The "America," thus exceptionally treated, entered and competed against fifteen other vessels. The three most dangerous competitors being put out through accidents, the "America" passed the winning-post 18 minutes ahead of the 47-ton cutter "Aurora," and won the cup; but, even if the time allowance had not been waived, the American schooner yacht would still have won by fully a couple of minutes. The prize was given to the New York Yacht Club and constituted a challenge cup, called "the America's cup," for the yachts of all nations, by the deed of gift of the owners of the winner. (See below for a complete account of these races.)

Not only was the "America" as great a departure from the conventional British type of yacht as the "Mosquito," but the set of her sails was a decided novelty. In England it had been the practice to make them baggy, whereas those of the "America" were flat, which told materially in working to windward. The revolution in yacht designing and canvasing was complete, and the bows of existing cutters were lengthened, that of the "Arrow" among others. The "Alarm" was also lengthened and turned into a schooner of 248 tons, and the "Wildfire," cutter, 59 tons, was likewise converted. Indeed there was a complete craze for schooners, the "Flying Cloud," "Gloriana," "Lalla Rookh," "Albertine," "Aline," "Egeria," "Pantomime" and others being built between 1852 and 1865, during which period the centre-board, or sliding keel, was applied to schooners as well as sloops in America. The national or cutter rig was nevertheless not neglected in England, for Hatcher of Southampton built the 35-ton cutter "Glance"—the pioneer of the subsequent 40-tonners—in 1855, and the "Vampire"—the pioneer of the 20-tonners—in 1857, in which year Weld also had the "Lulworth," an 82-ton cutter of comparatively shallow draught, constructed at Lymington. At this time too there came into existence a group of cutters, called "flying fifties" from their tonnage, taking after the "Mosquito" as their pioneer; such were the "Extravaganza," "Audax" and "Vanguard." In 1866 a large cutter was constructed on the Clyde called the "Condor," 135 tons, followed by the still larger "Oimara," 163 tons, in 1867. In 1868 the "Cambria" schooner was built by Ratsey at Cowes for Ashbury of Brighton, and, having proved a successful match-sailer, was taken to the United States in 1870 to compete for the America's cup, but was badly beaten, as also was the "Livonia" in 1871.

The First Great Era of Yacht Racing.—The decade between 1870 and 1880 may be termed the first Golden Age of yachting, inasmuch as the racing fleet had some very notable additions made to it, of which it will suffice to mention the schooners "Gwendolin," "Cetonia," "Corinne," "Miranda" and "Waterwitch"; the large cutters "Kriemhilda," "Vol au Vent," "Formosa," "Samœna" and "Vanduara," a cutter built of steel; the 40-tonners "Foxhound," "Bloodhound," "Myosotis" and "Norman"; the 20-tonners "Vanessa" (Hatcher's masterpiece), "Quickstep," "Enriqueta," "Louise" and "Freda"; and the yawls "Florinda," "Corisande," "Jullanar" and "Latona." The "Jullanar" may be noted as a specially clever design. Built in 1874 from the ideas of Bentall, an agricultural implement maker of Maldon, Essex, she had no dead wood forward or aft, and possessed many improvements in design which were embodied and developed by the more scientific naval architects, G. L. Watson, William Fife, jun., and others in later years. Lead, the use of which commenced in 1846, was entirely used for ballast after 1870 and placed on the keel outside.

Of races there was a plethora; indeed no fewer than 400 matches took place in 1876, as against 63 matches in 1856, with classes for schooners and yawls, for large cutters, for 40-tonners, 20-tonners and 10-tonners. The sport, too, was better regulated, and was conducted on a uniform system: the Yacht-Racing Association, established in 1875, drew up a simple code of laws for the regulation of yacht races, which was accepted by the yacht clubs generally, though a previous attempt to introduce uniformity, made by the Royal Victoria Yacht Club in 1868, had failed. The Association adopted the rule for ascertaining the size or tonnage of yachts which had been for many years in force, known as the Thames rule; but in 1879 they altered the plan of reckoning length from that taken on deck to that taken at the load water-line, and two years later they adopted an entirely new system of calculation.

The Plank-on-edge.—These changes led to a decline in yacht-racing, the new measurement exercising a prejudicial effect on the sport, as it enabled vessels of extreme length, depth and narrowness, kept upright by enormous masses of lead on the outside of the keel, to compete on equal terms with vessels of greater width and less depth, in other words, smaller yachts carrying an inferior area of sail. The new type was known as the "lead mine" or plank-on-edge type. Of this type were the yawls "Lorna" and "Wendur," the cutters "May," "Annasona," "Sleuth-hound," "Tara," "Marjorie" and "Margarite"—the most extreme of all being perhaps the 40-tonner "Tara," six times as long as she was broad, and unusually deep, with a displacement of 75 tons, 38 tons of lead on her keel, and the sail-spread of a 60-tonner like "Neva."

In 1884 two large 80-ton cutters of the above type were built for racing, the "Genesta" on the Clyde and the "Irex" at Southampton. Having been successful in her first season, the former went to the United States in 1885 in quest of the America's cup; but she was beaten by the "Puritan," which had a moderate draught of 8 ft. 3 in. of water, considerable beam and a deep centre-board. The defeat of the "Genesta" was not surprising; she drew 13 ft. of water, had a displacement or weight of 141 as against the "Puritan's" 106 tons, and a sail area of 7887 sq. ft. to the American's 7982—a greater mass with less driving power. Still, she did not leave the States empty-handed, as she won and brought back the Cape May and Brenton Reef challenge cups, though they were wrested from her by the "Irex" in the following year. The same thing happened to the "Galatea," which was beaten by the "Mayflower" in 1886. In all classes in British waters the narrow type was not carried to excess; indeed, as the narrowness of the new yachts increased annually, so did the popularity of racing decrease.

Plank-on-edge Type abandoned.—Prior to 1886 it had been the custom in Great Britain for several reasons to build the yachts deep, narrow, wall-sided, with very heavy lead keels and heavy displacement. The system of measurement had been a tonnage measurement, and under this system designers found, from the knowledge they had then attained from racing trials, that a narrow heavy vessel would beat a wider and lighter craft when both were measured by the tonnage rules. In America this was not the case. There a much lighter and wider form of yacht had been in vogue, having shallower draught and relying upon a centre-board for weatherliness instead of a deep lead keel. Hence in the International contests from 1884 to 1886 for the America's cup and other events the trials were between deep and narrow British yachts and shallow and broad American yachts. Even in 1887, when G. L. Watson built the "Thistle," much broader than "Genesta" and "Galatea," this vessel was met and defeated by a far wider and shallower American sloop, namely, the "Volunteer" above referred to. British yachtsmen claimed that their narrow deep-keeled vessels were more weatherly and better sea-boats than the light American sloops, but racing honours rested with the Americans.

In 1887 the plank-on-edge type was completely abandoned in the United Kingdom. Thenceforward, therefore, the old spirited contests between deep British yachts and shallow American sloops ceased. Whilst Britain abandoned her narrow deep type, America soon also began to modify the old shallow centre-board sloop type, and so between 1887 and 1893 the rival types began to converge very rapidly, until the old idea of a race for the America's cup being a test of a British type against an American type completely died out. Races sailed for that trophy, after 1887, were less and less trials of opposing national types, but merely contests between British and American designed yachts built upon the same general principle of similar type.

Dixon Kemp in 1887 induced British yachtsmen to abandon the system of measuring yachts by tonnage and to adopt a new system of rating them by water-line length and sail area. The new system contained no taxes or penalties upon beam or depth nor upon "over all" length. The only factors measured were the water-line and the area of the sails. All the old tonnage rules taxed the length and the breadth. The effect of this change of the system measurement was electrical. It crushed the plank-on-edge type completely. There was not another boat of the kind built.

Revival of Yacht-Racing under Length and Sail Area Rule.—Yachtsmen were greatly pleased with the broader and lighter types of yachts that designers began to turn out under the length and sail area rule. They were more comfortable and drier in a seaway than the old vessels. The first large cutters built with considerable beam were "Yarana" and "Petronilla" in 1888, and in 1889 the first of Lord Dunraven's Valkyries was a vessel that was much admired. Then in 1890 "Iverna," a handsome clipper-bowed cutter owned by Mr Jameson, came out and raced against "Thistle." Meanwhile, up to 1892 a host of splendid 40-raters had been built; "Mohawk," "Deerhound," "Castanet," "Reverie," "Creole," "Thalia," "Corsair," "White Slave," "Queen Mab" and "Varuna" formed a class the like of which had never been surpassed in British waters. Watson, Fife and Payne were the most successful designers.

While a revival of yachting in the larger classes was notable under the rule Dixon Kemp had originated, the sudden popularity attained in the small classes in the Solent was even more remarkable. Under the tonnage rules deep narrow 3-tonners, 5-tonners and 10-tonners had raced about the coast, but the Solent did not seem to attract a greater number of yachtsmen as small boat sailors than the Thames, Mersey or Irish ports. Moreover, the Clyde really remained the most advanced centre of small yacht sailing. At Southampton, prior to Dixon Kemp's rule being adopted by the Yacht-Racing Association in 1887, there were some sporting classes of so-called Itchen Ferry boats which raced on a rating consisting of length on the water-line only. As there was no tax upon their sail, they were built (according to the ideas of designers in 1885 or 1886, who had not by that time absorbed the knowledge of the value of bulb-keels) with great beam, immense displacement and very thick heavy lead keels and huge sail-spread. A sail area of 2200 sq. ft. was crowded on to a 30-foot yacht, and one 30-footer even carried a jointed spinnaker boom 56 ft. in length. It was not surprising that such a type never became popular; indeed the Southampton length classes in the 'eighties were no better than the extremely narrow 5-tonners and 3-tonners. The 5-tonner "Doris," built by Watson in 1885, was 33 ft. 8 in. L.W.L., 5 ft. 7 in. beam, 7 ft. draught; displacement of 12·55 tons; 1681 sq. ft. of sail. The "Yvonne," built by Fife in 1889, was 34·1 ft. L.W.L., 9 ft. beam, 8·1 ft. draught, with a displacement of 12·9 tons and a sail area of 1726 sq. ft. The difference in dimensions between "Doris" and "Yvonne" shows how the beam and sail-carrying power was increased in the new type, for "Yvonne" could beat the "Doris" with the greatest ease. With the advent of the length and sail area rule the Solent at once became the fashionable rendezvous for small racing yachts, and the craft known as the Solent classes, 5-raters, 2½-raters, 1-raters and ½-raters, flourished greatly.

The Second Great Era in Yachting.—As the years 1870 to 1880 will always be remembered for the great schooners and the glorious fleet of old-fashioned cutters and yawls, which showed such fine sport before they were outbuilt by the planks-on-edge, so will the seasons following 1892 be identified with the big cutter racing. In that year it was commonly said that yachtsmen would build no more very large cutters. The revival under the length and sail area rule had so far extended to "Iverna," "Tarana," "Petronilla," and "Valkyrie I." being built in the first class, but then there had been a pause of some years during which large numbers of 40-raters, 20-raters and the Solent classes had been built. Just when the critics were declaring that in the future no yachtsmen would build a class racer larger than a 40-rater (60 ft. L.W.L. with 4000 sq. ft. of sail), the prince of Wales (afterwards Edward VII.) gave an order for the cutter "Britannia," while Lord Dunraven built "Valkyrie II.," Mr A. D. Clarke "Satanita" and Mr Peter Donaldson "Calluna"; and in this same season (1893), an American yachtsman took the Herreshoff yacht "Navahoe" over the Atlantic. The new vessels averaged 87 ft. L.W.L. and carried about 10,300 sq. ft. of canvas, their beam being as much as 23 ft. They were an entirely different type from "Iverna" or

"Thistle," being developed from the form of the 40-raters "Varuna" and "Queen Mab." The main differences between the "Britannia" and other yachts of her year and the older vessels was that the new yachts had an overhanging shallow-sectioned mussel or pram bow instead of a fiddle or clipper bow with a wedge-shaped transverse section; the outline of the under-water profile was hollow, sloping in a concave curve from the deep part of the keel under the mast to the forward end of the water-line; the keel was deep, practically developing into a fin. The new vessels skimmed over the waves instead of cutting and plunging through them. The seaworthiness, speed, weatherliness and general handiness for racing purposes of the cutters of 1893 far exceeded all previous results. Yacht designing and building now became a science demanding the highest tax upon the skill and ingenuity of the naval architect. The cutter "Valkyrie II." visited the United States in 1893, but Lord Dunraven's vessel was beaten by the "Vigilant." Curiously enough, when the crack Herreshoff cutters "Navahoe" and "Vigilant" visited the British Isles they were severely beaten by the British yachts. In 1893 the "Navahoe" started 13 times and only won two first prizes. In 1894 "Vigilant" did a little better, but she only won six races in 19 starts. During the years that followed the "Britannia" held a wonderful record:—

	Starts.	First Prizes.	Other Prizes.	Total.	Prizes Value.
1893 . . .	43	24	9	33	£1572
1894 . . .	48	36	2	38	2799
1895 . . .	50	38	2	40	3040
1896 . . .	58	14	10	24	1562
1897 . . .	20	10	2	12	1000
	219	122	25	147	£9973

Some other famous racing yachts which were built under the length and sail area rule were "Ailsa" (1895), a first-class cutter designed by Fife, "Isolde," a very beautiful 40-rater for Mr Donaldson by the same designer, "Caress," a 40-rater by Watson, and the 20-raters "Audrey," from Lord Dunraven's own model, "Niagara" by Herreshoff, and the "Sibbick"-designed 5-rater "Norman," owned by Captain Orr-Ewing. Since the introduction of Dixon Kemp's rule the smaller classes from 20-rating right down to ½-rating had been built in great numbers, but whilst these classes had flourished exceedingly, the type of boat built had developed a very peculiar form. Each succeeding craft was made lighter and lighter in weight and more extreme in the overhang at the bow and stern. The stability was now attained by means of a cigar-shaped piece of lead placed at the bottom of a steel plate or fin, the hull of the boat being nothing more than the bowl of a dessert spoon resting upon the water.

Fin and Bulb Keels. Downfall of Length and Sail Area Rule.—It was apparent in 1895 that if plate and bulb skimming-dishes could win all the prizes in the 20-rating and smaller classes, it would be easy to design a modified form of fin and bulb yacht to beat "Isolde," "Britannia" and "Ailsa" in the larger classes. It was equally obvious that a skimming-dish of "Britannia's" or "Isolde's" rating would be an utterly useless machine with no cabin accommodation or head room, and that the evolution of such type would be as bad for the sport as the development of the old plank-on-edge had been in 1885. It seemed strange that whilst the old tonnage rule had evolved the plank-on-edge ten years previously, the sail area measurement now evolved a plank-on-side, balanced by a fin. The fact was that designers had solved the problem. The rule measured only the length and the area of canvas. Taking the length of the vessel on the water-line as constant, then the vessel with the smallest possible weight could be driven with less sail at the same speed as vessels with greater weight and greater sail. This solution of the problem was not apparent to designers from 1880 to 1885, because of the difficulty of obtaining stability. From 1880 to 1885 stability was obtained by means of very heavy keels. In 1895 the stability was obtained by means of a light piece of lead placed at the bottom of a deep steel fin. "Niagara," "Audrey" (20-raters) and "Norman" (5-rater) were thus built. They were wonderful sailing machines in heavy weather,—fast, powerful, handy and efficient in all weathers. But if head room and cabin accommodation are considered essential parts of a yacht these fliers, as "yachts," were entirely inefficient.

The First Linear Rating Rule.—To endeavour to check the tendency to build skimming-dishes the Yacht-Racing Association introduced in 1896 a new system of measurement which was proposed by Mr R. E. Froude. The novelty of the system consisted of a tax upon the skin girth of the yacht, whereby a vessel with hollow midship section was penalized by her girth being measured round the skin surface. Froude's first system of rating began on the 1st of January 1896 and ended at the close of the year 1900. It therefore had a career of five seasons. The measurement of the yacht was obtained by the following formula:—

$$\frac{\text{Length L.W.L.} + \text{beam} + \tfrac{3}{4}\,\text{skin girth} + \tfrac{1}{2}\sqrt{\text{sail area}}}{2} = \text{linear rating.}$$

This rule partially failed in its object. It was hoped that the skin-surface measurement would prevent the fin-bulb type being successful, but Froude and his colleagues had under-estimated the possible developments of exaggerated pram bows, immense scow-shaped shoulders and stern-lines, all of which could be introduced into the skimming-dish type with great success. So, notwithstanding the small premium on displacement this rule contained, the dishes could still beat the full-bodied yachts.

Yachts built in the small classes were very shallow bodied, and in the 20-rating and 40-rating, now called the 52 ft. and 65 ft. classes respectively, were uncomfortably shallow. The best vessels in the large classes were undoubtedly well formed and useful yachts; indeed in the larger classes the rule seems to have checked excesses. Under this rule in 1896 the German Emperor ordered a huge first-class cutter, the "Meteor II.," from Watson. By sheer size and power this vessel outsailed "Britannia." She carried a main boom of 96 ft. long against the "Britannia's" boom of 91 ft. In 1900 Watson designed another great cutter called the "Distant Shore," the same size as "Britannia," but she was not launched until 1901. In 1900 also Watson crowned all his previous successes by turning out the yawl "Sybarita," the same size as "Meteor." "Senta Tutty," "Eelin" and "Astrild," and finally "Khama," were amongst the 65-footers, and "Penitent," "The Saint," "Morning Star" and "Senga" about the best 52-footers. Probably the yacht which emphasized the possibilities of the rule more than any of her contemporaries was Captain Orr-Ewing's 36-footer "Sakuntala," built by Sibbick. She was a complete scow-shaped skimming-dish. The 30-footers "Marjory" and "Flatfish" were similar craft, and they outsailed everything in their respective classes in the Solent. Although many fine vessels, including the schooner "Rainbow" and others, were built under this rule, it was obviously insufficient to check the hollow-sectioned type.

The Second Linear Rating Rule.—This rule, also suggested by Froude, was introduced on the 1st of January 1901. The confidence of yachtsmen had been decidedly shaken by the previous rule, and the Y.R.A. agreed to fix this rule for a period of seven years. The object of the rule was to ensure a big-bodied vessel. The formula was:—

$$\frac{\text{Length} + \text{breadth} + \tfrac{3}{4}\text{girth} + 4\bar{d} + \tfrac{1}{2}\sqrt{\text{sail area}}}{2\cdot 1} = \text{linear rating.}$$

Now the novelty of this rule was the new tax $\bar{d}$. This $\bar{d}$ represents the difference in feet between the measurement of the girth of the yacht's hull taken round the skin surface and the girth at the same place measured with a string pulled taut. This measurement is taken $\frac{6}{10}$ths of the distance from the fore end of the water-line. It is easy to see that in a full-bodied yacht $\bar{d}$ = a small unit, whilst in a hollow-bodied yacht $\bar{d}$ = a larger unit. Four times $\bar{d}$ being taken, it followed that hollow-bodied yachts were heavily penalized. This ingenious $\bar{d}$ measurement was evolved by Alfred Benzon, a Danish scientist and yachtsman. The rule, so far as the development of a full-bodied cabin yacht went, proved very successful. It had certain marked faults: the measurement of the girth at a fixed station caused a shallowness of keel at that particular spot, and there was no check upon the full pram bows, which when introduced into vessels of heavy displacement strained the ships terribly as they smashed into a heavy seaway. The new racing yachts generally, however, from 1896 onwards, proved worthy and fast vessels.

As an instance of what could be done with them, in 1901 a memorable match was sailed on the Clyde between the Watson cutter

"Kariad" (originally the "Distant Shore," previously mentioned) and the same designer's 90-foot yawl "Sybarita." It was blowing a gale of wind, and the yachts raced from Rothesay round Ailsa Craig and back, a distance of 75 m., averaging 12·3 knots, with closed reefed sails, housed topmasts and in a mountainous sea. Several steam yachts attempted to accompany them, but all put back owing to the roaring sea that was running near the Craig. The yawl had the advantage of being the larger vessel, and "Sybarita" on this occasion won one of the greatest races ever recorded in Scottish waters.

Class Racing, Handicapping and Cruiser Racing.—Yacht racing may be subdivided under these three heads. Yacht racing by rating measurement or tonnage, when either the first yacht to finish is the winner, or the yacht saving her time by a fixed scale of time allowance in proportion to the rating of the vessel and the length of the course, is called class racing, and it obviously tends to encourage the fastest possible vessel under the current rating rule to be produced. It has always been regarded as the highest form of the sport. It is naturally, however, the most expensive form, because only the most up-to-date and perfectly equipped vessels can keep in the first flight.

From time to time, chiefly from about the years 1884 and 1885 onwards, handicaps framed according to merits have been fashionable amongst yachtsmen. They were originally devised to afford amusement and sport to out-classed racers and cruisers, but they obviously did nothing to encourage owners to build very fast vessels, nor to stimulate improvement in design. When a handicap is allotted to each vessel according to her assumed speed, the slowest and most ill-designed craft should have an equal chance with the best. Nevertheless, owing to the expense of class racing, handicap racing thrived greatly during the period of the first and second Girth Rules. During these periods, too, the third style of yacht racing came into vogue, namely cruiser racing; either very fast cruisers were built specially for the purpose of handicap racing, or a number of yachts of exactly similar design were built specially to the owner's orders for the purpose of racing in a class together. The fast handicap cruisers had the great advantage over class racers from 1896 up to 1906, inasmuch as they were much more strongly built. "Valdora" (107 tons), "Brynhild" (160 tons), "Leander," "Namara," "Rosamond," "Merrymaid" and many others were yachts of the former type. In form they did not differ vastly from the racers of their period, but in scantling of hull, fittings, bulwarks and rig they were more comfortable and better vessels than their class-racing sisters. It was obvious in the larger classes that many yacht-owners were not prepared to put up with the discomfort of the thin-skinned racers. During the whole period of the Girth Rules (1896 to 1906), while the class racers developed a good enough form of body—they were latterly yachts with plenty of cabin room—they were necessarily built in the lightest possible manner, the lightest steel frames being covered with the thinnest planking and decks for the sake of saving weight. The light scantling began to tell severely upon large yacht racing. Meanwhile, in the small classes, the Solent one-design class, South Coast one-design class, numerous Belfast one-design classes, Redwings, Whitewings and a host of others, show how an inexpensive form of cruiser racing had usurped the place of class racing and competitive designing. Many yachtsmen felt that if handicap racing and one-design racing were to usurp the place of the higher form of class racing the whole sport of yachting must soon deteriorate. It was obvious that had handicap racing and the one-design principle been seriously introduced in 1880 or 1886 and obtained a strong hold on yachtsmen such improved types as the modern cruisers of 1906 would never have been evolved. For all the best cruisers, even the "Valdora" and the ketches "Cariad I." and "Cariad II.," are but modified types evolved from the crack racers. Hence yachtsmen began to give careful attention—during the early period of the Second Linear Rating rule—to suggestions that in the future every class-racing yacht should be built according to a fixed table of scantlings, so that her hull should be as strong as a *bona fide* cruiser.

Yachts Built under the Second Linear Rating Rule.—Few large vessels were built expressly for racing under this rule; indeed the Fife 65-footer "Zinita" (1904) was the only light-scantling yacht of any importance. However, two very handsome first-class vessels were constructed to the rule: "White Heather I." by Fife in 1904, and "Nyria" by Nicholson in 1906; they were some 12 ft. shorter than the great cutters of "Britannia's" year and altogether smaller, having less beam and draught and some 1700 sq. ft. less sail area. The growing dissatisfaction of yacht-owners at the extreme light scantling of modern racing yachts was strongly demonstrated by the fact that both "White Heather I." and "Nyria" were specially ordered to be of heavy scantling, and they were classed A1 at Lloyd's. They were therefore of the semi-cruiser type. "Nyria," however, was the extreme type of a yacht of her period in shape, although heavy in construction. The only conspicuous fault to be found with the form of the racing yachts under the rule was a skimping of the mean draught and an exaggeration of the full pram-shaped overhanging bow.

The 52-footers were a very popular class. Fife made a great advance in yacht architecture with a 52-foot cutter called the "Magdalen" (1901). All the other successful vessels under the rule—"Camellia" (Payne), "Lucida" and "Maymon" (Fife), "Moyana" and "Britomart" (Mylne), and the first-class cutter "Nyria"—followed her closely in type. An interesting trial took place in 1906, when the first-class cutter "Kariad" (1900) was brought out to compete with "Nyria" and "White Heather I.," and decidedly out-sailed,—showing that yacht architecture had steadily improved in the past six seasons.

International Rules Introduced.—In April 1904 Mr Heckstall Smith drew the attention of German, French and British yachtsmen to the fact that the yacht measurement rules (then different in the various countries) were generally due to terminate about the end of 1907, and suggested that many advantages would accrue if an international rule could be agreed upon. The Yacht-Racing Association agreed to take the matter up, and at two International Conferences, held in London in January and June 1906, an international rule of yacht measurement and rating was unanimously agreed to by all the nations of Europe. America alone refused to attend the Conference. Mr R. E. Froude struck the keynote of the object of the Conference by a statement that the ideal yacht should be a vessel combining "habitability with speed." The truth of this axiom was generally accepted. Old plank-on-edge types under the tonnage rules were habitable but slow. Skimming-dishes attained the maximum speed, but were uninhabitable. Neither therefore attained the ideal type. A good form was attained in 1901 with "Magdalen," but since that year the bane of light construction had become harmful to yachting. Hence the conference aimed at a rule which would produce a yacht combining habitability with speed. They adopted a form of linear rating comprising certain penalties upon hollow midship section (*i.e.* Benzon's $\bar{d}$ tax) and also upon full pram bows. The following was adopted as the rule by which all racing yachts in Europe are rated:—

$$\frac{L+B+\frac{1}{2}G+3\bar{d}+\frac{1}{3}\sqrt{\bar{S}}-F}{2}=\text{Rating in linear units, i.e. either ft. or metres.}$$

Where L = Length in linear units.
,, B = Extreme beam in linear units.
,, G = Girth in linear units.
,, $\bar{d}$ = Girth difference in linear units.
,, S = Sail area in square units.
,, F = Freeboard in linear units.

The length L for the formula is the length on the water-line, with the addition (1) of the difference between the girth, covering-board to covering-board, at the bow water-line ending, and twice the freeboard at that point, and (2) one-fifth of the difference between the girth, covering-board to covering-board, at the stern water-line ending, and twice the freeboard at that point. The additions (1) and (2) penalize the full overhangs and the bow overhang in particular. The girth, G, is the chain girth measured at that part of the yacht at which the measurement is greatest, less twice the freeboard at the same station, but there are certain provisions allowing the measurement of girth generally to be taken 0·55 from the bow end of the water-line. The girth difference, $\bar{d}$ in the formula, is the difference between the chain girth, measured as above described, from covering-board to covering-board, and the skin girth between the same points, measured along the actual outline of the cross-section.

For racing the yachts are divided into eleven classes. Class A is for schooners and yawls only, above 23 metres (75·4 ft.) of rating, with a time allowance of four seconds per metre per mile. All the yachts in this class must be classed A1. In racing, yawls sail at their actual rating and schooners at 12% less than their actual rating. The other classes are the ten separate cutter classes, in which there is no time allowance whatever:—

International Classes approximating to L.W.L. of Yacht.	Corresponding Classes in English Feet.	Limit to Number of Persons allowed on Board during a Race.
23 metres rating. .	75·4	No limit
19 ,, ,, . .	62·3	20
15 ,, ,, . .	49·2	14
12 ,, ,, . .	39·4	10
10 ,, ,, . .	32·8	8
9 ,, ,, . .	29·5	6
8 ,, ,, . .	26·2	5
7 ,, ,, . .	23·0	4
6 ,, ,, . .	19·7	3
5 ,, ,, . .	16·4	2

Under the international rule the old trouble of ultra-light scantling in racing yachts has been completely abolished, for all yachts must be built under the survey and classed with one of the three classification societies—Lloyd's Register of British and Foreign Shipping, Germanischer Lloyd, or Bureau Veritas; and yachts of the international cutter classes enumerated above so built will be classed R., denoting that their scantlings are as required for their respective rating classes. This rule was introduced on the 1st of January 1908; England, Germany, France, Norway, Sweden, Denmark, Austria-Hungary, Belgium, Holland, Italy, Spain, Finland, Russia and the Argentine Republic agreed to adopt it until December 31st, 1917. England adopted the new system a year before it formally became international, on the 1st of January 1907.

Racing Yachts Built under the International Rules.—The new rule produced the type of yacht desired—a vessel combining habitability with speed. Amongst the handsomest examples were the German Emperor's schooner "Meteor" (1909), and the schooner "Germania" (1908), 400 tons or 31½ metres measurement, Class A, both built by Krupp's at Kiel. German designed, German built, and German rigged and manned, they demonstrated the wonderful strides made by Germany in yachting. A few years before there were not a dozen smart yachts in Germany, and indeed the Kaiserlicher Yacht Club at Kiel was only founded in 1887. The "Germania" holds the record over the old "Queen's course" at Cowes, having in 1908 sailed it a quarter of an hour faster than any other vessel. Her time over the distance of about 47 to 48 nautical m. was 3 hours 35 min. 11 secs., or at the rate of 13·1 knots. In 1910 Herreshoff built a wonderful racing schooner of A class for the international rules called the "Westward," and in the races this Yankee clipper sailed at Cowes she proved the most weatherly schooner ever built.

It is interesting to recall some old records of speed over courses inside the Isle of Wight.

Date.	Yacht.	Distance.	Time.	Remarks.
1858	The Arrow	45 miles	4 h. 19 m.	Cutter } Same
1872	The Arrow	50 ,,	4 h. 40 m.	Cutter } vessel.
1872	Kriemhilda	50 ,,	4 h. 37 m.	Cutter.
1883	Marjorie	50 ,,	4 h. 26 m.	Cutter.
1883	Samoena	50 ,,	4 h. 15 m.	Cutter.
1885	Lorna	50 ,,	4 h. 14 m.	Yawl.
1885	Irex	50 ,,	4 h. 7 m.	Cutter.
1870	Egeria	50 ,,	4 h. 27 m.	Schooner.
1875	Olga	50 ,,	4 h. 25 m.	Schooner.
1879	Enchantress	50 ,,	4 h. 18 m.	American schooner.
1908	Cicely	46 ,,	3 h. 43 m.	British sch.
1902	Meteor	47 ,,	3 h. 50 m.	American sch.
1908	Shamrock	47 ,,	4 h. 0 m.	British cutter, only 75 feet L.W.L.
1908	Germania	47 ,,	3 h. 35 m.	German sch.

In 1907, 1908, 1909 and 1910, 389 yachts were built under the international rules:—A class, 3; 23 metres class, 3; 15 metres class, 15; 12 metres, 21; 10 metres, 33; 9 metres, 17; 8 metres, 88; 7 metres, 46; 6 metres, 144; and 5 metres, 22. The 23-metre cutters "Shamrock," designed by Fife (1908), belonging to Sir Thomas Lipton, "White Heather II." (Fife; 1907), owned by Mr Kennedy, and "Brynhild" (Nicholson; 1907), owned by Sir James Pender; and also "Ostara," 15 metres (Mylne; 1909), owned by Mr W. P. Burton; "Hispania," 15 metres (Fife; 1909), owned by the king of Spain; "Alachie and Cintra" (Fife) in the 12-metre class, have been amongst the best yachts built for the international rules. During the seasons of 1908, 1909 and 1910 there was splendid sport in England, Germany, France, Belgium, Norway and Sweden, and indeed all over the continent; the yachts were very closely matched, the 15-metres (49·2 ft.), 8-metres (26·2 ft.) and 6-metres (19·7 ft.) proving perhaps the most popular. The national authorities of the countries which adopted the international rules in 1906 have now formed an International Yacht-Racing Union, under the chairmanship of the British Yacht-Racing Association.

YACHT-BUILDING STATISTICS.

The number and tonnage of yachts shown on Lloyd's Register (1909) as built in the several countries are as follows:—

	COUNTRIES.																		TOTAL.	
	United Kingdom.		British Colonies.		Belgium and Holland.		Denmark.		France.		Germany and Austria.		Italy.		Norway and Sweden.		Other Countries.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Steam and Motor Yachts:— Total .	1,443	190,160	137	3,775	76	2,454	27	5,498	182	6,745	86	6,602	20	427	37	1,648	286	66,107	2,294	283,418
Sailing Yachts:— Total .	3,151	57,510	271	3,231	129	2,643	106	1,911	347	4,062	647	6,884	49	571	305	3,899	269	13,298	5,274	94,009
Grand Total .	4,594	247,670	408	7,006	205	5,097	133	7,409	529	10,807	733	13,488	69	998	342	5,547	555	79,405	7,568	377,427

American yachts of 75 gross registered tons and upwards are included under "Other Countries"; the number of these yachts built in America is 248 of 67,119 tons.

In 1909, in the United Kingdom, from January to May, the time of the year when yachts are generally constructed, there were building, or built, 27 steam yachts of 3471 tons, and 28 sailing yachts of 963 tons; this includes only yachts of 10 tons and upwards. Excluding the small craft built in America, particulars of which are difficult to obtain, there were on the register 7568 yachts with a tonnage of 377,427. In 1887 there was a total of about 3000 yachts on the register with a tonnage of 132,718. Since that date, therefore, in round figures, 1500 had been added to the number and more than 100,000 tons to the tonnage. This fact seems to show clearly the extension of the pastime of yachting.

The America's Cup.

This international trophy was originally a cup given by the Royal Yacht Squadron at Cowes, Isle of Wight, on the 22nd of August 1851, for a race open to all yachts, with no time allowance of any kind, the course being "round the Isle of Wight, inside the No Man's buoy and Sand Head buoy and outside the Nab." Fifteen vessels took up their stations off Cowes and started from moorings. In the table on the following page are the names of the competitors.

The fleet started at 10 o'clock. At the No Man's buoy the yachts were in a cluster, "Volante" leading, then "Freak" "Aurora," "Gipsy Queen," "America," "Beatrice," "Alarm," "Arrow" and "Bacchante" in the order named. The other six brought up the rear, and the "Wyvern" returned to Cowes. Passing out to the

Yacht.	Rig.	Tons.	Owner.
Beatrice	Schooner	161	Sir W. P. Carew.
Volante	Cutter	48	Mr J. L. Craigie.
Arrow	Cutter	81	Mr T. Chamberlayne.
Wyvern	Schooner	205	The duke of Marlborough.
Ione	Schooner	75	Mr A. Hill.
Constance	Schooner	218	The marquis of Conyngham.
Gipsy Queen	Schooner	160	Sir H. B. Hoghton.
Alarm	Cutter	193	Mr J. Weld.
Mona	Cutter	82	Lord Alfred Paget.
America	Schooner	170	Messrs Stevens.
Brilliant	3-masted schooner	392	Mr G. H. Ackers.
Bacchante	Cutter	80	Mr B. H. Jones.
Freak	Cutter	60	Mr W. Curling.
Eclipse	Cutter	50	Mr H. S. Fearon.
Aurora	Cutter	84	Mr T. Le Marchant.

eastward the "America" went inside the Nab, a course which was contrary to the printed programme, but an objection afterwards made on this score against her was not persisted in. Off Sandown Bay the "America" obtained a long lead and in a freshening wind carried away her jibboom. Here the "Aurora" was second boat. The "Volante" sprung her bowsprit and gave up. The "Arrow" ran ashore and the "Alarm" went to her assistance, so both were out of the race. Abreast of Ventnor the American schooner was a mile ahead of "Aurora," which was the last British craft to keep her in sight in a thick haze that blew up from the S.W. late in the afternoon. At the Needles the wind dropped until it was very light, and the "America" was then some 6 m. ahead of "Aurora," the time being about 6 p.m. The finish was:—

America (winner)	8.37 p.m.	Aug. 22.
Aurora	8.58 p.m.	Aug. 22.
Bacchante	9.30 p.m.	Aug. 22.
Eclipse	9.45 p.m.	Aug. 22.
Brilliant	1.20 a.m.	Aug. 23.

The "America" was built at New York by the firm of George & James R. Steers for the special purpose of competing with British yachts at Cowes. George Steers, who was born in New York, designed her, the designer being a son of Henry Steers, a shipwright at Dartmouth. The registered owners of the vessel were Mr J. C. Stevens, the commodore of the New York Yacht Club, Mr C. A. Stevens, Mr H. Wilkes and Mr J. B. Finlay. Her crew consisted of thirteen all told, seven seamen before the mast, two mates, cook, steward, boy and master. The cost of building was set down at £24 per ton, and her builder was to receive one-third more should she succeed "in out-sailing any competitors of the same tonnage in England." The vessel had a long lean hollow entrance and rather short but fine run, but her lines were graceful and clean and the transverse sections amidships very gentle and shapely. She had a clipper bow and elliptical stern. Her sails particularly were superior in cut to those of the English vessels. Her masts raked, and she carried a mainsail laced to the boom, which in those days was almost unknown in England, a foresail, and a jib, also set on a boom and on an immensely heavy forestay which was the chief support of the foremast. She carried a small main topsail with a short yard and small jackyard. Occasionally she set also a flying jib on a jibboom, but this was not regarded as of much account. The principal dimensions of the "America" were: tonnage 171; length over all 94 ft.; on the keel 82 ft.; beam 22 ft. 6 in.; foremast 79 ft. 6 in.; mainmast 81 ft. (with a rake of 2⅞ in. to the foot in each mast); hollow bowsprit 17 ft. out board only; foregaff 24 ft.; maingaff 28 ft.; mainboom 56 ft. She was ballasted with pig-iron; 21 tons of the iron were permanently built into the vessel and the rest stowed inside. Below deck she was comfortably fitted for the living accommodation of the owner, guests and crew, and a cockpit on deck was a feature that few English yachts of the period possessed.

The cup won at Cowes by the "America," although not originally intended as a challenge cup, was afterwards given to the New York Yacht Club by the owner of the "America" as a challenge trophy and named the "America's cup." In 1887 the sole surviving owner of the cup, George L. S. Schuyler, attached to the trophy a deed of gift which sets forth the conditions under which all races for the cup must take place. In brief the conditions are: (1) That the races must be between one yacht built in the country of the challenging club and one yacht built in the country of the club holding the cup. (2) That the size of the yachts, if of one mast, must be not less than 65 ft. L.W.L. and not more than 90 ft. L.W.L. If of two-masted rig not less than 80 ft. L.W.L. and not more than 115 ft. L.W.L. (3) The challenging club must give ten months' notice of the race, and accompanying the challenge must be sent the name, rig and the following dimensions: length L.W.L.; beam and draught of water of the challenging vessel (which dimensions shall not be exceeded), and as soon as possible a custom-house registry of the vessel. (4) The vessel must proceed under sail on her own bottom to the place where the contest is to take place.

The deed of gift, however, is an elastic document, for it contains the following clause which is known as the *Mutual Agreement Clause*: "The club challenging for the cup and the club holding the same may by mutual consent make any arrangement satisfactory to both as to the dates, courses, number of trials, rules and sailing regulations, and any and all other conditions of the match, in which case also the ten months' notice may be waived."

In 1870 Mr James Ashbury of Brighton challenged with the schooner "Cambria," and in 1871 with another schooner the "Livonia." In both cases the event was a test of rival types, "Cambria" and "Livonia" being old-fashioned British schooners while the vessels they met were the pick of the American broader and shallower types. "Cambria" had to meet fourteen opponents, but in 1871 the "Livonia" raced against one opponent only. The Americans, however, although they agreed to race one vessel only against the "Livonia," brought several yachts up to the line and only selected their defender at the last moment. The first defender which "Livonia" had to meet was the "Columbia," which won the first and second events. In the third meeting, however, in a very strong wind the British schooner hammered the "Columbia" severely, and eventually the American yacht, having carried away some gear, was beaten by a quarter of an hour. In the two remaining races of the series the Americans were represented by the "Sappho," which easily defeated the "Livonia."

The next challenges came from Canada in 1876 and 1881, but neither the schooner "Countess of Dufferin" nor the sloop "Atalanta" met with any success.

The races of 1885 and 1886, when Sir Richard Sutton challenged with "Genesta" and Lieutenant Henn, R.N., with "Galatea," were interesting chiefly because they were of the nature of trials between the heavy plank-on-edge type of cutter and the prevailing American type of broad light-draught sloop. The contests proved the superiority of the American sloops.

In 1886 the plank-on-edge type was abandoned in England, and when the Scottish yacht "Thistle" was built in 1887 to challenge for the cup it was hoped that she would meet with success. "Thistle," however, although of greater beam and proportionately lighter displacement than such vessels as "Genesta" and "Galatea," was quite easily defeated by the centre-board sloop "Volunteer." Thus once again did the lighter American type prevail even against the modified form of the "Thistle."

The race between the "Thistle" and "Volunteer" of 1887 may be said to have been the last race for the cup wherein there was any marked difference between the type of the boats contesting. In all subsequent races the form of the challenger and defender became approximately similar, but while the types were gradually converging the American yachts were still usually somewhat lighter in displacement than the challengers. The "Thistle" was the first vessel built in Great Britain expressly for the match, and after her race in 1887 the types in fashion on both sides of the Atlantic rapidly converged, and deep-draught fin-keeled vessels with deep fins and light shallow hulls took the place of the former types of the shallow American sloops and deep-keeled wall-sided British cutters. In 1892 some splendid semi-fin-keeled cutters of the new pattern were built in the 40-rating class for the ordinary English coast regattas, and in 1893 the fin-keel type in England was even more successful. The first class cutters "Britannia," "Valkyrie II.," "Satanita" and "Calluna," built in 1893, handsomely defeated a Herreshoff yacht, the "Navahoe," which went over from America to race against them. On the strength of the victories of "Valkyrie II." and "Britannia" many British yachtsmen anticipated success for Lord Dunraven when he raced for the America's cup with his cutter "Valkyrie II." in the autumn of 1893. The Americans, however, had built a fine fleet of defenders, "Colonia," "Pilgrim," "Jubilee" and "Vigilant," and the latter beat "Valkyrie II." In the following season the "Vigilant" crossed the Atlantic and raced in British waters in 1894 against the "Britannia," and was frequently beaten. G. L. Watson, who had designed "Thistle" and "Valkyrie II." as well as "Britannia," was commissioned by Lord Dunraven to design "Valkyrie III." specially for an "America's cup" race in 1895. "Valkyrie III." was a very extreme fin-keeled boat, and for the first time the challenger appeared to have outbuilt the defending designer. "Valkyrie III." carried 13,027 sq. ft. of sail to the American "Defender's" 12,602. It was said that the Watson boat actually had less displacement. Both were 90 ft. L.W.L., "Valkyrie III." being 129 ft. over all against "Defender's" 123, and "Valkyrie III." 26·2 ft. beam against "Defender's" 23·03 ft. The races were unsatisfactory. In the first race Lord Dunraven claimed that "Valkyrie III." was hampered by the wash of steamers following the race, and his yacht was 8 m. 49 sec. astern. In the second race "Valkyrie" beat "Defender" by 49 seconds on the corrected time and actually by 1 m. 14 sec., but there was a foul at the start in which "Defender" was partially disabled. On protest the English yacht was disqualified, so that both events counted to "Defender." In the third race Lord Dunraven objected that ballast had been added to the American yacht since measurement, and the "Valkyrie III." merely crossed the line and retired, giving the "Defender" the match.

In 1899, 1901 and 1903 Sir Thomas Lipton tried to win the cup with three very costly and extreme vessels, "Shamrock I," "Shamrock II." and "Shamrock III." No. I. and No. III. were designed by W. Fife, and No. II. by G. L. Watson. In 1899 "Shamrock I." was rather easily defeated by "Columbia." In 1901 the Americans were not especially successful in building the vessel which they had prepared to defend the cup, and in the trial races the old 1899 yacht "Columbia," sailed by Captain Charles Barr—a half-brother of the skipper of the Scottish yacht "Thistle"—defeated the new vessel "Constitution," which had been built for the defence of the trophy for 1901; consequently the New York Yacht Club again selected the "Columbia" to defend the cup against "Shamrock II." After very close racing the "Columbia"—which was the better handled boat—retained the prize.

The next contest for the cup was in 1903. On this occasion Herreshoff turned out in "Reliance" a wonderful example of a large fin-keeled boat with full pram-bow and light skimming-dish hull. She was of the lightest possible construction (bronze with steel web frames), 90 ft. length L.W.L., 144 ft. length over all, with 16,160 sq. ft. of sail area, 25 ft. 10 in. beam, and a draught of 19 ft. 9 in. "Reliance" was a far more extreme vessel than "Shamrock III." The latter had a deeper body and a less prammed overhang forward. With the same water-line as "Reliance," the English yacht had rather over a foot less beam. The chief difference in dimensions, however, was in the sail area; "Shamrock III." carried 14,337 sq. ft., or 1823 sq. ft. less than "Reliance." The result was a very easy victory for the "Reliance."

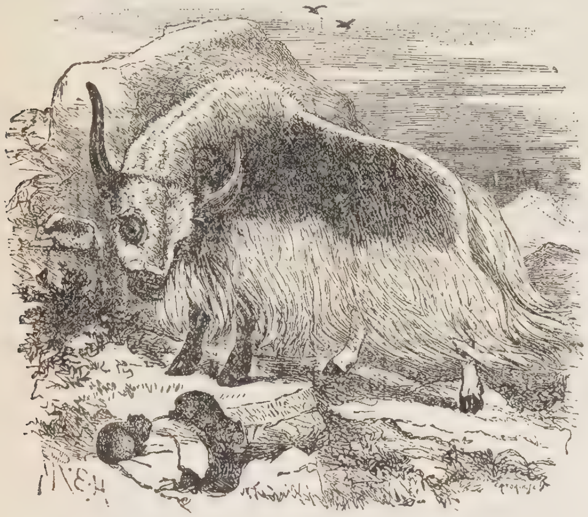
RACES FOR THE AMERICA'S CUP

Date.	Name.	Tonnage.	Course.	Allows	Elapsed Time.	Corrected Time.	Wins by
				M. S.	H. M. S.	H. M. S.	M. S.
Aug. 22, 1851	America	170	From Cowes around Isle of Wight (Aurora second).	. .	10 37 0	10 37 0	18 0
	Aurora	47		. .	10 55 0	10 55 0	
Aug. 8, 1870	Magic	97·2	N.Y.Y.C. Course (Cambria tenth).	. .	4 7 54	3 58 26	39 12·7
	Cambria	227·6		. .	4 34 57	4 37 38	
Oct. 16, 1871	Columbia	220	N.Y.Y.C. Course.	. .	6 17 42	6 19 41	27 4
	Livonia	280		. .	6 43 0	6 46 45	
Oct. 18, 1871	Columbia	220	20 miles to windward off Sandy Hook Lightship and return.	. .	3 1 33½	3 7 41¾	10 33¾
	Livonia	280		. .	3 6 49½	3 18 15½	
Oct. 19, 1871	Livonia	280	N.Y.Y.C. Course (Columbia disabled).	. .	3 53 5	4 2 25	15 10
	Columbia	220		. .	4 12 38	4 17 35	
Oct. 21, 1871	Sappho	310	20 miles to windward off Sandy Hook Lightship and return.	. .	5 33 24	5 36 2	33 21
	Livonia	280		. .	6 4 38	6 9 23	
Oct. 23, 1871	Sappho	310	N.Y.Y.C. Course.	. .	4 38 5	4 46 17	25 27
	Livonia	280		. .	5 4 41	5 11 44	
Aug. 11, 1876	Madeleine	151·49	N.Y.Y.C. Course.	. .	5 24 55	5 23 54	10 59
	C'tess.of Dufferin	138·20		. .	5 34 53	5 34 53	
Aug. 12, 1876	Madeleine	151·49	20 miles to windward off Sandy Hook Lightship and return.	. .	7 19 47	7 18 46	27 14
	C'tess.of Dufferin	138·20		. .	7 46 0	7 46 0	
Nov. 9, 1881	Mischief	79·27	N.Y.Y.C. Course.	. .	4 17 9	4 17 9	28 20¼
	Atlanta	84		. .	4 48 24½	4 45 29¼	
Nov. 10, 1881	Mischief	79·27	16 miles to leeward from Buoy 5 off Sandy Hook and return.	. .	4 54 53	4 54 53	38 54
	Atlanta	84		. .	5 36 52	5 33 47	
Sept. 14, 1885	Puritan	140	N.Y.Y.C. Course.	. .	6 6 5	6 6 5	16 19
	Genesta	80		0 28	6 22 52	6 22 24	
Sept. 16, 1885	Puritan	140	20 miles to leeward off Sandy Hook Lightship and return.	. .	5 3 14	5 3 14	1 38
	Genesta	80		0 38	5 5 20	5 4 52	
Sept. 9, 1886	Mayflower	171·74	N.Y.Y.C. Course.	. .	5 26 41	5 26 41	12 2
	Galatea	171·14		0 38	5 39 21	5 38 43	
Sept. 11, 1886	Mayflower	171·74	20 miles to leeward off Sandy Hook Lightship and return.	. .	6 49 0	6 49 0	29 9
	Galatea	171·14		0 39	7 18 48	7 18 9	
Sept. 27, 1887	Volunteer	209·08	N.Y.Y.C. Course.	. .	4 53 18	4 53 18	19 23¾
	Thistle	253·94		0 5	5 12 46¾	5 12 41¾	
Sept. 30, 1887	Volunteer	209·08	20 miles to windward off Scotland Lightship and return.	. .	5 42 56¼	5 42 56¼	11 48¾
	Thistle	253·94		0 6	5 54 51	5 54 45	
		Sailing Length.					
				M. S.	H. M. S.	H. M. S.	M. S.
Oct. 7, 1893	Vigilant	96·78	15 miles to windward off Scotland Lightship and return.	. .	4 5 47	4 5 47	5 48
	Valkyrie II.	93·11		1 48	4 13 23	4 11 35	
Oct. 9, 1893	Vigilant	96·78	Course—equilateral triangle—30 miles.	. .	3 25 1	3 25 1	10 35
	Valkyrie II.	93·11		1 48	3 37 24	3 35 36	
Oct. 13, 1893	Vigilant	96·78	15 miles to windward off Scotland Lightship and return.	. .	3 24 39	3 24 39	0 40
	Valkyrie II.	93·57*		1 33	3 26 52	3 25 19	
Sept. 7, 1895	Defender	100·36	15 miles to windward off Scotland Lightship and return.	0 29	5 0 24	4 59 55	8 49
	Valkyrie III.	101·49		. .	5 8 44	5 8 44	
Sept. 10, 1895	Defender	100·36	Course—equilateral triangle—30 miles.	0 29	3 56 25	3 55 56	0 47
	Valkyrie III.	101·49		. .	3 55 9†	3 55 9	
Sept. 12, 1895	Defender	100·36	15 miles to windward and return from Sandy Hook Lightship.	0 29	4 44 12	4 43 43	. .
	Valkyrie III.	101·49		. .	‡		
Oct. 16, 1899	Columbia	102·135	15 miles E.S.E. from Sandy Hook Lightship and return—30 miles.	. .	4 53 53	4 53 53	10 8
	Shamrock	101·092		0 6	5 4 7	5 4 1	
Oct. 17, 1899	Columbia	102·135	10 miles triangular from Sandy Hook Lightship—30 miles.	. .	3 37 0	. .	. .
	Shamrock	101·092		0 6	§		
Oct. 20, 1899	Columbia	102·135	15 miles S. by W. from Sandy Hook Lightship and return—30 miles.	0 16	3 38 25	3 38 9	6 34
	Shamrock	102·565		. .	3 44 43	3 44 43	
Sept. 28, 1901	Columbia	102·355	15 miles E. by S. from Sandy Hook Lightship and return—30 miles.	0 43	4 31 7	4 30 24	1 20
	Shamrock II.	103·79		. .	4 31 44	4 31 44	
Oct. 3, 1901	Columbia	102·355	Course—equilateral triangle—30 miles.	0 43	3 13 18	3 12 35	3 35
	Shamrock II.	103·79		. .	3 16 10	3 16 10	
Oct. 4, 1901	Columbia	102·355	15 miles S.S.E. from Sandy Hook Lightship and return—30 miles.	0 43	4 33 40	4 32 57	0 41
	Shamrock II.	103·79		. .	4 33 38	4 33 38	
Aug. 22, 1903	Reliance	108·41	15 miles to windward and return—30 miles.	. .	3 32 17	3 32 17	7 3
	Shamrock III.	104·37		1 57	3 41 17	3 39 20	
Aug. 25, 1903	Reliance	108·41	Course—equilateral triangle—30 miles.	. .	3 14 54	3 14 54	1 19
	Shamrock III.	104·37		1 57	3 18 10	3 16 12	
Sept. 3, 1903	Reliance	108·39	15 miles to windward and return—30 miles.	. .	4 28 0	4 28 0	. .
	Shamrock III.	104·37		1 57	Did not finish.		

* Remeasured. † Disqualified for fouling "Defender." ‡ Withdrew on crossing the line. § Carried away topmast and withdrew.

(B. H. S.)

YAK, the wild (and domesticated) ox of the Tibetan plateau; a species nearly allied to the bison group. The yak, *Bos* (*Pöephagus*) *grunniens,* is one of the finest and largest of the wild oxen, characterized by the growth of long shaggy hair on the flanks and under parts of the body and the well-known bushy tail. In Europe a false impression of the yak is prevalent, owing to the fact that all the specimens imported have belonged either to a small domesticated breed from Darjiling, or to half-breeds; the latter being generally black and white, instead of the uniform black of the pure-bred and wild animal. None of such half-breeds can compare with the magnificent half-tamed animals kept by the natives of the elevated Rupsu plateau, S. of the Indus, where they afford the only means of transport by this route between Ladak and India. But even these are inferior to the wild yak, which stands nearly 6 ft. at the shoulder, and is absolutely confined to the arid central plateau of Tibet. Yak have the great disadvantage that they will not eat corn, and the large pure-bred animals will not live at low elevations. The tails are used in India as fly-whisks, under the name of chowris. The title of "grunting ox" properly belongs only to the domesticated breed.



Domesticated Yak, *Bos* (*Pöephagus*) *grunniens.*

YAKUB KHAN (1849–   ), ex-amir of Afghanistan, son of the amir Shere Ali, was born in 1849. He showed great ability at an early age, and was made governor of Herat by his father, but broke into open rebellion against him in 1870, and was imprisoned in 1874 in Kabul. However, when Shere Ali in 1878 fled before the British, he handed over the government to Yakub, who, on his father's death in the following February, was proclaimed amir, and signed a treaty of peace with the British at Gandamak. He agreed to receive a British resident, and was in turn to receive a subsidy and support against foreign attack. But in September of the same year his revolted troops attacked the British residency, and the resident, Sir Louis Cavagnari, and his staff and suite were cut to pieces. This outrage was instantly avenged, for in October Earl (then Sir Frederick) Roberts with a large force defeated the Afghans on the 6th and took possession of Kabul on the 12th. Yakub Khan thereupon abdicated, took refuge in the British camp, and was sent to India on the 13th of December.

YAKU-SHIMA, an island belonging to Japan, lying S. of Kiushiu, in 30° 30′ N. and 130° 30′ E. It is an irregular pentagon, 14 m. in width and the same in length. It is separated from Tanega-shima by the Vincennes Strait (Yaku-kaikyô), 12¼ m. wide, and its surface is broken by lofty mountains, of which Yae-dake rises to a height of 6515 ft., and Eboshi-dake to a height of 4840 ft. It is covered with dense forest, in which are some of the finest cryptomeria in Japan, known as *Yaku-sugi.*

YAKUTSK, a province of E. Siberia, including nearly the whole of the basin of the Lena, and covering an area of 1,530,253 sq. m. It has the Arctic Ocean on the N., the governments of Yeniseisk and Irkutsk on the W., and Irkutsk and Amur on the S., and is separated from the Pacific (Sea of Okhotsk) by the narrow Maritime Province. The Vitim plateau, 2500 to 3500 ft. in altitude, bordered on the S.E. by the Stanovoi Mountains, occupies the S.E. portion of the province. Its moist, elevated valleys, intersected by ranges of flat, dome-shaped hills, which rise nearly 1000 ft. above the plateau, form an immense desert of forest and marsh, visited only by Tungus hunters, save in the S.W., where there are a few gold-mining settlements. The high border-ridge of the plateau (see SIBERIA) stretches from the South Muya Mountains towards the N.E., thus compelling the river Aldan to make a great bend in that direction. An alpine country skirts the plateau all along its N.W. margin, and contains productive gold-mines in the spurs between the Vitim and the Lena. The latter stream drains the outer base of this alpine region. It is a wild land, traversed by several chains of mountains, all having a N.E. strike, and intersected by deep, narrow valleys, down which the mountain-streams tumble uncontrolled. The whole is clothed with dense forests, through which none but the Tunguses can find their way. The summits of the mountains, 4000 to 6000 ft., mostly rise above the limits of tree vegetation, but in no case pass the snow-line. The summits and slopes alike are strewn with *dêbris* of crystalline rock, mostly hidden under thick incrustations of lichens, amid which the larch alone is able to find sustenance. Birch and aspen grow on the lower slopes; and in the narrow valley bottoms thickets of poplar and willow or patches of grass spring up on the scanty alluvium. All the necessaries of life for the gold-diggings have to be shipped from Irkutsk down the Lena, and deposited at entrepôts, whence they are transported in winter by means of reindeer to their destination. A line drawn from the mouth of the Vitim N.E. towards that of the Aldan separates the mountain regions from the elevated plains (1500 to 2000 ft.) which fringe the highlands all the way from the upper Lena to Verkhne-Kolymsk, and probably to the mouth of the Kolyma. Vast meadows, sometimes marshy, extend over these plains in the S.W.; farther N. mosses and lichens are the predominant vegetation. The surface is much furrowed by rivers and diversified by mountain-chains (Verkhoyansk, Kolymsk and Alazeya) about the real character of which little is known. Beyond the elevated plains vast tundras, carpeted with mosses and lichens, stretch to the shores of the ice-bound ocean.

The Arctic coast is indented by several bays—Borkhaya and Yana E. of the Lena delta, and Omulakh, Kolyma and Chaun still farther E. The islands fall into three groups—the Lyakhov, the Anjou or New Siberian and the De Long Islands. The Medvyezhie (Bear) Islands off the Kolyma and the two Ayun Islands in Chaun Bay are merely littoral. Wrangel Land seems to be the outer island of a great and as yet unknown archipelago. Every year a narrow passage close to the coast is left almost free of ice, enabling a ship or two sometimes to reach the estuary of the Yenisei, or even the delta of the Lena.

The great artery of Yakutsk, the Lena, rises on the W. slope of the Baikal Mountains, close to Lake Baikal. About 60° N. it receives from the right its first great tributary, the Vitim (1250 m. in length), which is navigable by steamers in its lower course. The Olekma (700 m.) is navigable only in the very lowest part of its course, and the Aldan (1155 m.) is navigated from Ust-Maysk. On the left is the Vilyui (1300 m.), which has an immense drainage area on the lower plains, and has been navigated since 1887. The lower course of the Lena is subject to terrible inundations when the ice breaks up on its upper reaches. The Olenek (1200 m.), which enters the Arctic Ocean to the W. of the Lena, is also a considerable river; the Yana (750 m.), Indigirka (950) and Kolyma (1100) all rise in the mountain region between 61° and 62° N., and flow N. and N.E. into the Arctic Ocean.

The granites, granitic syenites and gneisses of the high plateau are wrapped about by a variety of crystalline slates, Huronian and Laurentian; and Silurian and Devonian limestones and sandstones extend over vast areas. Farther N. the Carboniferous, Cretaceous and Jurassic formations are spread over a wide region, and the whole is covered with Glacial deposits in the highlands and with post-Glacial elsewhere. The mineral wealth of Yakutsk is very great; but gold and salt (obtained from springs) only are worked. Coal has been discovered on the Vilyui and on the lower Lena.

Yakutsk has unparalleled extremes of cold and heat. At

Verkhoyansk on the Yana (67° 34′ N. and 134° 20′ E.), frosts of −79·5° F. have been observed, and the average temperature of the three winter months is −53·1°; even that of March only is little above the freezing-point of mercury (−37·9°). Neither Ust-Yansk (70° 55′ N., but close to the sea coast) nor Yakutsk, nor even the polar station of Sagastyr at the mouth of the Lena (73° 23′ N.), has a winter so cold and so protracted. And yet at Sagastyr temperatures of −63·6° have been observed, and the average temperature of February is only −43·6°. At Yakutsk the average temperature of the winter is −40·2°, and the soil is frozen to a depth of 600 ft. (Middendorff). The Lena, both at Kirensk and at Yakutsk, is free from ice for only 161 days in the year, the Yana at Ust-Yansk for 105. At Yakutsk only 145 days and at Verkhoyansk only 73 have no snow; the interval between the latest frosts of one season and the earliest frosts of the next is barely 37 days.

The bulk of the inhabitants are Yakuts; there are some 20,000 Russians, many of them exiles, and a certain number of Tunguses, Tatars, Lamuts and Chukchis. The estimated pop. in 1906 was 300,600. The Yakuts belong to the Turkish stock, and speak a dialect of Turkish, with an admixture of Mongolian words. They call themselves Sokha or Sakhov (pl. Sokhalar or Sakhalov), their present name having been borrowed by the Russians from the Tunguses, who call them Yeko or Yekot. Most probably they once inhabited S. Siberia, especially the upper Yenisei, where a Tatar tribe calling itself Sakha still survives in Minusinsk. They are middle-sized, have dark and rather narrow eyes, a broad flat nose, thick black hair and little beard. They are very laborious and enterprising, and display in schools much more intelligence than the Tunguses or Buryats. Their implements show a great degree of skill and some artistic taste. They live in log *yurtas* or huts, with small windows, into which plates of ice or pieces of skin are inserted instead of glass. During summer they abandon their wooden dwellings and encamp in conical tents of birch bark. Their food is chiefly flesh, and they drink kumiss, or mares' milk. Though nearly all are nominally Christians, they retain much of their original Shamanism. Their settlements are now steadily advancing S. into the hunting domains of the Tunguses, who give way before their superior civilization.

The province is divided into five districts, the chief towns of which are Yakutsk, Olekminsk, Sredne-Kolymsk, Verkhoyansk and Viluisk. Though the production of gold from gold washings has been on the decrease, over 15,000 workers are employed in the Olekma and Vitim gold-mines. Only 43,000 acres are under crops, chiefly barley. Most of the inhabitants are engaged in live-stock breeding, and keep reindeer and sledge-dogs. Fish is an important article of food, especially in the Kolyma region. In the N. hunting is important, the skins taken being principally those of squirrels, ermines, hares, foxes, Arctic foxes, and a few sables, beavers and bears.

The principal channel of communication is the Lena. As soon as the spring arrives, scores of boats are built at Kachungsk, Verkholensk and Ust-Ilginsk, and the goods brought on sledges in winter from the capital of Siberia, including considerable amounts of corn and salt meat, are shipped down the river. A few steamers descend to the delta of the Lena, and return with cargoes of fish and furs. Cattle are brought from Transbaikalia. Two routes, mere horse-tracks, radiate from Yakutsk to Ayan and to Okhotsk. Manufactured goods and groceries are imported to Yakutsk by the former.

See F. Thiess, *Das Gouvernement Jakutsk in Ostsibirien*, in *Petermann's Mitteilungen* (1897), and Maydell, *Reisen und Forschungen im Jakutskischen Gebiet in Ostsibirien* (St Petersburg, 2 vols., 1895–1896). (P. A. K.; J. T. Be.)

YAKUTSK, a town of Asiatic Russia, capital of the province of the same name, in 62° 2′ N. and 129° 44′ E., 1165 m. N.E. of Irkutsk, on a branch of the Lena. Pop. about 7000. The old fort is destroyed, except its five wooden towers. The wooden houses are built upon high basements to protect them from the floods. Yakutsk possesses a theological seminary and a cathedral. Its merchants carry on trade in furs, mammoth ivory and reindeer hides. The town was founded in 1632.

YALE UNIVERSITY, the third oldest university in the United States, at New Haven, Connecticut.

The founders of the New Haven colony, like those of Massachusetts Bay, cherished the establishment of a college as an essential part of their ideal of a Christian state, of which education and religion should be the basis and the chief fruits. New Haven since 1644 had contributed annually to the support of Harvard College, but the distance of the Cambridge school from southern New England seemed in those days considerable; and a separate educational establishment was also called for by a divergent development in politics and theology. Yale was founded by ministers selected by the churches of the colony, as President Thomas Clap said, to the end that they might "educate ministers in our own way." Though "College land" was set apart in 1647,[1] Yale College had its actual beginning in 1700 when a few clergymen met in the New Haven with the purpose "to stand as trustees or undertakers to found, erect and govern the College" for which at various times donations of books and money had been made. The formal establishment was in 1701. The Connecticut legislature in October granted a charter which seems to have been partly drafted by Judge Samuel Sewall of Boston; the Mather family also were among those in Boston who welcomed and laboured for the establishment of a seminary of a stricter theology than Harvard, and the ten[2] clergymen who were the founders and first trustees of the College were graduates of Harvard.

The legislature, fearful of provoking in England attention either to the new school or to the powers used in chartering it, assumed merely to license a "collegiate school," and made its powers of conferring degrees as unobtrusive as possible. In 1702 the teaching of Yale began. In the early years the upper students studied where the rector lived, and considerable groups of the lower students were drawn off by their tutors to different towns. In 1716 the trustees purchased a lot in New Haven, and in the next year the College was established there by the legislature. Commencement was held at New Haven in the same year, but the last of the several student bodies did not disband until 1719. The school did not gain a name until the completion of the first building in 1718. This had been made possible by a gift from Elihu Yale (1649–1721), a native of Boston and son of one of the original settlers of New Haven; he had amassed great wealth in India, where he was governor of the East India Company's settlement at Madras. The trustees accordingly named it Yale College in his honour.

The charter of 1701 stated that the end of the school was the instruction of youth "in the arts and sciences," that they might be fitted "for public employment, both in church and civil state." To the clergy, however, who controlled the College, theology was the basis, security and test of "arts and sciences." In 1722 the rector, Timothy Cutler, was dismissed because of a leaning toward Episcopacy. Various special tests were employed to preserve the doctrinal purity of Calvinism among the instructors; that of the students was carefully looked after. In 1753 a stringent test was fixed by the Corporation to ensure the orthodoxy of the teachers. This was abolished in 1778. From 1808 to 1818 the President and tutors were obliged to signify assent to a general formulation of orthodox belief. When George Whitefield, in 1740, initiated by his preaching the "Great Awakening," a local schism resulted in Connecticut between "Old Lights" and "New Lights." When the College set up an independent church the Old Lights made the contention that the College did not owe its foundation to the original trustees, but to the first charter granted by the legislature, which might therefore control the College. This claim President Clap triumphantly controverted (1763), but Yale fell in consequence under popular distrust, and her growth was delayed by the shutting off of financial aid from the legislature.

By the first charter (1701) the trustees of the College were required to be ministers (for a long time, practically,

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[1] In 1668 the Hopkins Grammar School, next after the Boston Latin School the oldest educational institution of this grade in the United States, was established in New Haven.

[2] This number was increased to eleven, the full number allowed by the charter, within a month after it was granted.

Congregationalists) residing in the colony. By a supplementary act of 1723 the rector was made ex-officio a trustee. By a second charter (1745) ample powers were conferred upon the president (rector) and fellows, constituting together a governing board or Corporation. This charter is still in force. In 1792 the governor and lieutenant-governor of the state, and six state senators, were made ex-officio members of the Corporation. In 1872 the six senators were replaced by six graduates, chosen by the alumni body. The clerical element still constitutes one half of the Corporation. In the first half of the 19th century, under the lead of Nathaniel W. Taylor (*q.v.*), the Divinity School of Yale became nationally prominent for "Taylorism" or "New Haven Theology." Daily attendance at prayers is still required of all college students.

The first college professorship established was that of divinity (1755), which, in a sense, was the beginning of extra-college or university work. The theological department was not organized as a distinct school until 1822. In 1770 a second professorship was established, of mathematics and natural philosophy. Timothy Dwight (president, 1795–1817) planned the establishment of professional schools; his term saw the foundation of the Medical School (1813) besides the Divinity School. In 1803 a chair was created for Benjamin Silliman, Sr. (1779–1864) in chemistry and natural history; English grammar and geography did not disappear from the curriculum until 1826, nor arithmetic until 1830; political economy was introduced in 1825, and modern languages (French) in the same year. Not until 1847 did modern history receive separate recognition. The Library had been given the status of an independent department in 1843. Compulsory commons were abolished in 1842, thus removing one feature of a private boarding school. Corporal punishment ("cuffing" of the offender's ears by the President) had disappeared before the War of Independence; and so also had the custom of printing the students' names according to their social rank, and using a "degradation" in precedence as punishment; while Dwight abolished the ancient custom of fagging, and the undemocratic system of fines that enabled a rich student to live as he pleased at the expense only of his pocket. The School of Law was established in 1843. Instruction to graduates in non-professional courses seems to have been begun in 1826. The appointment of Edward E. Salisbury to the chair of Arabic and Sanskrit (1841) was the first provision at Yale for the instruction of graduates by professors independent of the College. About the same time graduate instruction in chemistry became important. (In 1846 also a chair of agricultural chemistry was established—the first in the country.) In 1846 an extra-College department of Philosophy and Arts was created, conferring degrees since 1852; and from this were separated in 1854 the sciences, which were entrusted to a separate Scientific School, the original promoter of agricultural experiment stations in the United States. Since that time this school and the College have developed much as complementary and co-ordinate schools of undergraduates, Yale affording in this respect a very marked contrast with Harvard. Graduate instruction was concentrated in 1871 into a distinct Graduate School. This with the three traditional professional schools—the Art School, established in 1866 (instruction since 1869), and the first university art school of the country, the Music School, established in 1894 (instruction since 1890), and the Forest School, established in 1900—make up the University, around the College. For the founding of the Peabody Museum of Natural History, George Peabody, of London, contributed $150,000 in 1866. The Observatory, devoted exclusively to research, was established in 1871. In 1887 the name Yale "University" was adopted. The organic unity of the whole was then recognized by throwing open to students of any department the advantages of all. In 1886, for the first time, a president was chosen who was not of the College faculty, but from the University faculty.

Great as were the changes in the metamorphosis of old Yale, none had more influence upon its real and inner life than the gradual extension of the freedom accorded the students in the selection of their studies. In 1854 there was no election permissible until late in the Junior year. In 1876, 1884 and 1893 such freedom was greatly extended. In 1892 the work of the Graduate School was formally opened to women (some professors having admitted them for years past by special consent). Yale was the first college in New England to take this step.

The buildings number sixty-four in all. Connecticut Hall (1750–52), long known as South Middle College, a plain brick building, is the only remainder of the colonial style (restored, 1905). Around it are fourteen buildings forming a quadrangle on the College campus on the W. side of the New Haven Green, between Elm and Chapel Streets. The oldest are the Old Library (1842) and Alumni Hall (1853). Others are the Art School (1864), Farnam Hall (1869), Durfee Hall (1870), Lawrance Hall (1886), Battell Chapel (1876), Osborn Hall (1889), Vanderbilt Hall (1894), Chittenden Hall (1888) and Linsly Hall (1908). Dwight Hall, erected in 1886 for the Yale University Christian Association, Welch Hall (1892) and Phelps Hall complete the quadrangle. Across from the W. side of the quadrangle is the Peabody Museum (1876). On the N. side of Elm Street is a row of buildings, including the Gymnasium (1892), the Divinity School (1870) and the Law School (1897). University Avenue leads N. from the College campus to the University court or campus, on which are the Bicentennial Buildings (1901–2). E. and N.E. of the University court are the buildings of the Sheffield Scientific School. Farther N.E. are the Observatory, Hammond Metallurgical Laboratory, Forestry Building and Infirmary, and to the S.W. of the College campus are the Medical School and University Clinic.

The University is organized in four departments—Philosophy and the Arts, Theology, Medicine, and Law—each with a distinct faculty. The first embraces the Academical Department (College), the Sheffield Scientific School,—named in honour of Joseph Earle Sheffield (1793–1882), a generous benefactor,—the School of the Fine Arts, the Department of Music, the Graduate School and the Forest School, founded in 1900 by a gift of $150,000 from J. W. Pinchot and his wife. Other institutions organized independently of any one department are: the Library, the Peabody Museum of Natural History, the Astronomical Observatory and the Botanical Garden, established in 1900 on the estate of Professor O. C. Marsh. The special treasures of the Library include the classical library of Ernst Curtius; the collection of Oriental books and manuscripts made by Edward E. Salisbury (1814–1901); the Chinese library of Samuel Wells Williams (1812–1884); a Japanese collection of above 3000 volumes; the Scandinavian library of Count Riant; the collection of Arabic manuscripts made by Count Landberg; the political science collection of Robert von Mohl; a copy of Newton's *Principia* presented to the College by the author; manuscripts of Jonathan Edwards; and large parts of a gift of nearly a thousand volumes given to Yale in 1733 by Bishop George Berkeley, who also gave to the College his American farm, as a basis of a scholarship, the first established in America. The Library is especially strong in the departments of American history, medieval history and English dramatic literature. Its total number of volumes in 1910 was nearly 600,000, exclusive of many thousand pamphlets. The Peabody Museum contains an unrivalled collection of Silurian trilobites; a fine collection of pseudomorphs; a beautiful collection of Chinese artistic work in stone made by Samuel Wells Williams; a notable mineralogical collection; a fine collection of meteorites made by Professor Hubert Anson Newton (1830–1896); and the magnificent palaeontological collection of Professor O. C. Marsh. The School of the Fine Arts possesses the Jarves gallery of Italian art, a remarkable collection of Italian "primitives" dating from the 11th to the 17th century; the Alden collection of Belgian wood-carvings, of the 17th century; and a large collection of modern paintings among which are fifty-four pictures by John Trumbull. The organization of the Trumbull collection in 1831 was the first step taken in the United States toward the introduction of the fine arts into a university. The equipment of the Observatory consists principally of a six-inch heliometer by Repsold, an eight-inch equatorial by Grubb, and two sets of equatorially mounted cameras for photographing meteors.

In the College and the Medical School four years are required to complete the course of instruction; in the Divinity School and the Law School, three years; in the Forest School, two years; and in the Scientific School there are both three-year and five-year courses, five years being required for all engineering degrees. Admission to the College is gained only by passing an examination in Latin, Greek or substitutes for Greek, French or German, English, mathematics and ancient history. Admission to the Scientific School is also only by examination. Substantially the equivalent of a college degree is required for admission to the Divinity School, but the Medical School and the Law School require only two years of college work, and a student may obtain a degree from Yale College and a degree in divinity, medicine or law in six years. The Forest School, with an extensive equipment at New Haven and a Forest Experiment Station comprising about

200 acres of forest and open land at Milford, Pike county, Pennsylvania—the estate of J. W. Pinchot—is open only to such graduates of colleges and scientific schools as have had a suitable scientific training, especially in advanced botany. It confers the degree of Master of Forestry.

In the College the individual courses are arranged in twenty-six groups within three divisions, and each student must complete before graduation both a major and a minor in some one of the three divisions and one minor in each of the other two divisions. In the Freshman and Sophomore years the student's freedom of election is further restricted. In the Scientific School there is a somewhat different system of groups. The College confers only the degree of Bachelor of Arts, but the Scientific School confers the degrees of Bachelor of Philosophy, Master of Science (requiring at least one year of resident graduate study), and the engineering degrees. In the Divinity School the student has the choice of three courses—the historical, the philosophical and the practical—or, by the use of electives, he may combine the three; the study of Hebrew is required only in the historical course. In the Law School there is one course for candidates for the degree of Bachelor of Laws and another for candidates for the degree of Bachelor of Civil Law, the latter requiring the study of Roman law and allowing the substitution of certain studies in political science for some of the law subjects. The Graduate School confers the degrees of Master of Arts and Doctor of Philosophy; the School of Music, the degree of Bachelor of Music; and the School of Fine Arts, which is open to both sexes, the degree of Bachelor of the Fine Arts.

In 1910 the body of officers and instructors in all departments numbered 496, and the students 3312.

In addition to the regular work of the departments there are several lecture courses open to all students of the University. Among them are: the Dodge Lectures on the Responsibilities of Citizenship (1900); the Bromley Lectures on Journalism, Literature and Public Affairs (1900); the Lyman Beecher Lectures on Preaching (1871); the Silliman Memorial Lectures (1884) on subjects connected with "the natural and moral world"; the Stanley Woodward Lectures (1907) by distinguished foreigners; the Harvard Lectures (1905) by members of the faculty of Harvard University; the Sheffield Lectures on scientific subjects; and the Medical Alumni Lectures.

The principal publications with which the University is more or less closely associated are: *The Yale Review, a Quarterly Journal for the Scientific Discussion of Economic, Political and Social Questions*, edited by Professors in Political Science and History; the *Yale Law Journal*, edited by a board of students; the *Yale Medical Journal*, edited by members of the Medical Faculty with the assistance of a board of students; the *Yale Alumni Weekly*; and the *Yale News*, a daily paper managed by the students. The Yale Bicentennial Publications contain reprints of *Research Papers from the Kent Chemical Laboratory, Studies in Physiological Chemistry* and *Contributions to Mineralogy and Petrography*. Numerous other publications of the Yale University Press are issued only with the approval of the University.

In addition to several million dollars invested in lands and buildings the University possessed at the end of 1909 productive funds amounting to $10,561,830 (in 1886, $2,111,000). The income from all sources for the year 1908–9, exclusive of benefactions ($1,469,515), was $1,240,208. Up to 1908 more than three-fourths of all the University buildings had been erected as private gifts; the rest were built with College funds, or from legislative grants.

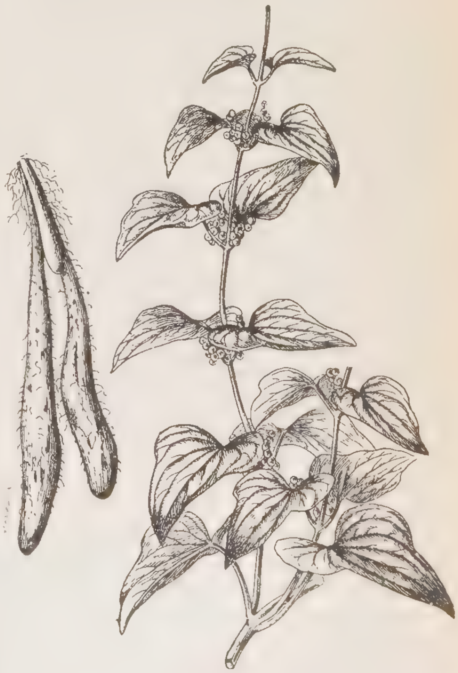
Yale shares with its fellow colleges founded in colonial days the advantages of old traditions and social prestige. In particular it shared these with Harvard so long as New England retained its literary and intellectual dominance over the rest of the country. But the spirit of the two institutions has always been very different. Harvard has on the whole been radical and progressive; Yale conservative. Yale could not draw, like Harvard, on the leaders of the New England schools of letters and philosophy to fill her professorial chairs. Her "comparative poverty, the strength of college feelings and traditions" (President Hadley) united with the lesser stimulus of her intellectual environment to delay her development. Harvard's transformation into a modern university was more spontaneous and rapid; Yale remained much longer under the dominance of collegiate traditions. But, according to Dr Charles F. Thwing (*The American College in American Life*, New York, 1897), of the men filling "the highest political and judicial offices," and coming from American colleges founded before 1770, Yale had helped (up to 1897) to train the largest number. On the roll of her alumni are such names as Philip Livingston, Eli Whitney, John C. Calhoun, James Kent, Samuel F. B. Morse, Chief-Justice Morrison R. Waite and President Taft.

The Presidents have been as follows: in 1701–1707, Abraham Pierson (1645–1707); *pro tem.* 1707–1719, Samuel Andrew (1656–1737); in 1719–1722, Timothy Cutler (1684–1765); in 1722–1726, office filled by the College trustees in rotation; in 1726–1739, Elisha Williams (1694–1755); in 1739–1766, Thomas Clap (1703–1767); *pro tem.* 1766–1777, Naphtali Daggett (1727–1780); in 1777–1795, Ezra Stiles (1727–1795); in 1795–1817, Timothy Dwight (1752–1817); in 1817–1846, Jeremiah Day (1773–1867); in 1846–1871, Theodore Dwight Woolsey (1801–1889); in 1871–1886, Noah Porter (1811–1892); in 1886–1899, Timothy Dwight (b. 1828); and Arthur Twining Hadley (b. 1856).

See *Universities and their Sons* (Boston, 5 vols., 1898–1900); Charles E. Norton, Arthur T. Hadley *et al.*, *Four American Universities* (New York, 1895); Timothy Dwight, *Memories of Yale Life and Men, 1845–1899* (New York, 1903); Franklin Bowditch Dexter, *Sketch of the History of Yale University* (New York, 1887), and *Biographical Sketches of Yale College with Annals of the College History, 1701–1792* (New York, 4 vols., 1885–1907); B. C. Steiner, *The History of Education in Connecticut*, Circular of Information No. 2 of the United States Bureau of Education (Washington, 1893); L. S. Welch and Walter Camp, *Yale, Her Campus, Class Room and Athletics* (Boston, 1899); Charles Franklin Thwing, *A History of Higher Education in America* (New York, 1906).

YALTA, a seaport of Russia, in the government of Taurida, on the S. coast of the Crimea, at the foot of the Yaila Mountains, 32 m. S. of Simferopol. Pop. 13,269. It is the *Galita* or *Jalita* of the Arab geographers. Its roadstead is open, and the annual mean temperature is 56·5° F. The town is a fashionable summer resort.

YAM, a term usually applied to the tubers of various species of *Dioscorea*. These are plants with thick tubers (generally a development of the base of the stem), from which protrude long, slender, annual climbing stems, bearing alternate or opposite, entire or lobed leaves and unisexual flowers in long clusters. The flowers are generally small and individually inconspicuous, though collectively showy. Each consists of a greenish bell-shaped or flat perianth of six pieces, enclosing six or fewer stamens in the male flowers, and surmounting a three-celled, three-winged ovary in the female flowers. The ovary ripens into a membranous capsule, bursting by three valves to liberate numerous flattish or globose seeds. The species are natives of the warmer regions of both hemispheres. According to Professor Church's analysis of the Chinese yam, it contains more nitrogenous matter, but less starch, than potatoes: in 100 parts there are of water 82·6, starch 13·1, albumen 2·4, fat 0·2, woody fibre 0·4 and mineral matter 1·3 parts.



Yam (*Dioscorea Batatas*). Branch about ½ nat. size. Root much reduced.

D. sativa and *D. alata* are the species most widely diffused in tropical and subtropical countries. *D. aculeata*, grown in India, Cochin China and the South Sea Islands, is one of the best varieties. *D. Batatas*, the Chinese yam, is hardy in Great Britain, but the great depth to which its enormous tubers descend renders its cultivation unprofitable. It has deeply penetrating, thick, club-shaped, fleshy roots, full of starch, which when cooked acquire a mild taste like that of a potato; they grow 3 ft. or upwards in length, and sometimes weigh more than 1½ lb. The plant grows freely in deep sandy soil, moderately enriched. The sets, consisting of pieces of the roots, may be planted in March or April, and require no other culture than the staking of the climbing stems. They should not be dug up before November, the chief increase in their size taking place in autumn. They sometimes strike downwards 2 or 3 ft. into the soil, and must be carefully dug out, the upper slender part being reserved for propagation, and the lower fleshy portion eaten after having been allowed a few days to dry. The tubers of *D. alata* sometimes weigh 100 lb. Most of the yams contain an acrid principle, which is dissipated in cooking.

The only European *Dioscorea* is that known as *D. pyrenaica*, a native of the Pyrenees, a remarkable instance of a species growing at a long distance from all its congeners. True yams must not be confounded with the sweet potato, *Ipomoea Batatas*, as they sometimes are in London markets. The common black bryony (*Tamus communis*) of hedges in England is closely allied to the yams of the tropics, and has a similar root-stock, which is reputed to be poisonous.

For the history of the yam, and its cultivation and uses in India, see G. Watt, *Dictionary of the Economic Products of India*, iii. (1890).

YAMA (Sanskrit "twin," in allusion to his being twin with his sister Yami, traditionally the first human pair), in Hindu mythology, judge of men and king of the unseen world. He was the first mortal to die, and having discovered the way to the other world is the guide of the dead. Three hymns in the Rig Veda are addressed to him.

YAMAGATA, ARITOMO, PRINCE (1838–), Japanese field-marshal, was born in Choshu. He began life as an ordinary *samurai* and rose steadily in reputation and rank, being created a count in 1884, a marquess in 1895 (after the war with China) and a prince in 1907 (after the war with Russia). He twice held the post of premier, and was the leader of Japanese conservatism, being a staunch opponent of party cabinets.

YAMBOLI, a town of Bulgaria, on the river Tunja, 49 m. W. of Burgas by rail. Pop. (1906) 15,708. It has a large agricultural trade, being situated in the centre of one of the chief corn districts. In the town are the remains of old fortifications, and the ruins of a fine mosque. The *bezetlan*, or old market-house, is entire, but is now used as a military magazine. An ancient Macedonian town lay some 4 m. N., but Yamboli is first mentioned in the 11th century, when it was known by the Byzantines as Dampolis or Hyampolis.

YAMÈTHIN, a town and district in the Meiktila division of Upper Burma. The town has a station on the railway 275 m. N. of Rangoon. Pop. (1901) 8680. It is an important centre of trade with the Shan States. The district lies between the Shan States and the Meiktila, Magwe and Toungoo districts; area, 4258 sq. m.; pop. (1901) 243,197, showing an increase of 18% in the decade. The staple crop is rice, which is irrigated from tanks and canals. Millets and oil-seeds are grown in the N., where drought has more than once caused distress. There are special industries of inlaid metal-work and ornamental pottery. Besides the chief town, Pyinmana and Pyawbwè, both also on the railway, carry on an active trade with the Shan States.

YANAON, or YANAM, a French settlement in India, near the mouth of the river Godavari, within the Godavari district of Madras. It is situated in 16° 44′ N. and 82° 13′ E.; area, 5 sq. m.; pop. (1901) 5005. Yanaon was founded about 1750, and followed the vicissitudes of French history in S. India. It was finally restored to the French by the treaty of 1815.

YANCEY, WILLIAM LOWNDES (1814–1863), American political leader, son of Benjamin Cudworth Yancey, an able lawyer of South Carolina, of Welsh descent, was born near the Falls of the Ogeechee, Warren county, Georgia, on the 10th of August 1814. After his father's death in 1817, his mother remarried and removed to Troy, New York. Yancey attended Williams College for one year, studied law at Greenville, South Carolina, and was admitted to the bar. As editor of the Greenville (South Carolina) *Mountaineer* (1834–35), he ardently opposed nullification. In 1835 he married a wealthy woman, and in the winter of 1836–1837 removed to her plantation in Alabama, near Cahaba (Dallas county), and edited weekly papers there and in Wetumpka (Elmore county), his summer home. The accidental poisoning of his slaves in 1839 forced him to devote himself entirely to law and journalism; he was now an impassioned advocate of State's Rights and supported Van Buren in the presidential campaign of 1840. He was elected in 1841 to the state House of Representatives, in which he served for one year; became state senator in 1843, and in 1844 was elected to the national House of Representatives to fill a vacancy, being re-elected in 1845. In Congress his ability and his unusual oratorical gifts at once gained recognition. In 1846, however, he resigned his seat, partly on account of poverty, and partly because of his disgust with the Northern Democrats, whom he accused of sacrificing their principles to their economic interests. His entire energy was now devoted to the task of exciting resistance to anti-slavery aggression. In 1848 he secured the adoption by the state Democratic convention of the so-called "Alabama Platform," which was endorsed by the legislatures of Alabama and Georgia and by Democratic state conventions in Florida and Virginia, declaring that it was the duty of Congress not only to allow slavery in all the territories but to protect it, that a territorial legislature could not exclude it, and that the Democratic party should not support for president or vice-president a candidate "not . . . openly and unequivocally opposed to either of the forms of excluding slavery from the territories of the United States mentioned in these resolutions." When the conservative majority in the national Democratic convention in Baltimore refused to incorporate his ideas into the platform, Yancey with one colleague left the convention and wrote an *Address to the People of Alabama*, defending his course and denouncing the cowardice of his associates. Naturally, he opposed the Compromise of 1850, and went so far as openly to advocate secession; but the conservative element was in control of the state. Disappointment of the South with the results of "Squatter Sovereignty" caused a reaction in his favour, and in 1858 he wrote a letter advocating the appointment of committees of safety, the formation of a League of United Southerners, and the repeal of the laws making the African slave-trade piracy. After twelve years' absence from the national conventions of the Democratic party, he attended the Charleston convention in April 1860, and again demanded the adoption of his ideas. Defeated by a small majority, he again left the hall,[1] followed this time by the delegates of Alabama, Mississippi, Louisiana, South Carolina, Florida, Texas, and two of the three delegates from Delaware. On the next day the Georgia delegation and a majority of the Arkansas delegation withdrew. In the Baltimore convention of the seceders he advocated the nomination of John C. Breckinridge, and he made a tour of the country on his behalf. In Alabama he was the guiding spirit in the secession convention and delivered the address of welcome to Jefferson Davis on his arrival at Montgomery. He refused a place in President Davis's cabinet. On the 31st of March 1861 he sailed for Europe as the head of a commission sent to secure recognition of the Confederate government, but returned in 1862 to take a seat in the Confederate Senate, in which he advocated a more vigorous prosecution of the war. On account of his failing health, he left Richmond early in 1863, and on the 27th of July died at his home near Montgomery.

See J. W. Du Bose, *Life and Times of W. L. Yancey* (Birmingham, Ala., 1892); W. G. Brown, *The Lower South in American History* (New York, 1902); and Joseph Hodgson, *The Cradle of the Confederacy* (Mobile, Ala., 1876).

YANG-CHOW FU, a prefectural city in the province of Kiang-su, China, forming the two distinct cities of Kiang-tu and Kan-ch'üan, on the Grand Canal, in 32° 21′ N., 119° 15′ E. Pop. about 100,000. The walls are between three and four miles in circumference. The streets are well supplied with shops, and there are handsome temples, colleges, and other public buildings. There was a serious religious outbreak in 1868, when Hudson Taylor, the founder of the China Inland Mission, opened a station here; but Yang-chow is now one of the centres of the Protestant missionaries in the province. Yang-chow Fu possesses an early historical connexion with foreigners, for Marco Polo ruled over it for three years by appointment from Kublai Khan (?1282–85).

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[1] It is probable that Yancey was approached with the offer of the vice-presidential nomination on the Douglas ticket by George N. Sanders. There was a movement to nominate him on the ticket with Breckinridge also.

YANGTSZE-KIANG, a great river of China, and the principal commercial watercourse of the country. It is formed by the junction of a series of small streams draining the E. slopes of the Tibetan plateau, and for the first third of its course flows almost parallel with the Mekong and the Salween, each, however, separated from the other by intervening ridges of great height. The total length of the Yangtsze is calculated to be not less than 3000 m. Although the term Yangtsze is applied by Europeans to the whole course of the river, in China it indicates only the last three or four hundred miles, where it flows through a division of the empire which in ancient time was known as "Yang," a name which also survives in the city of Yang-Chow in the province of Kiang-su. The ordinary official name for the whole river is Ch'ang Kiang (pronounced in the north, Chiang) or Ta Chiang, meaning the "long river" or the "great river." Popularly in the upper reaches every section has its local name. As it emerges from Tibet into China it is known as the Kinsha Kiang or river of Golden Sand, and farther down as the Pai-shui Kiang. In Sze-ch'uen, after its junction with the large tributary known as the Min, it is for some distance called the Min-kiang, the people being of opinion that the Min branch is in fact the main river. The fall in the upper reaches is very rapid. At the junction of the two main affluents in Upper Tibet, where the river is already a formidable torrent barely fordable at low water, the altitude is estimated at 13,000 ft. From Patang (8540 ft.) to Wa-Wu in Sze-ch'uen (1900 ft.) the fall is about 8 ft. per mile, thence to Hwang-kwo-shu (1200 ft.) about 6 ft. per mile, and farther down to Pingshan (1039 ft.) the fall is about 3 ft. per mile. At Pingshan, in the province of Sze-ch'uen, the river first becomes navigable, and the fall decreases to about 6 in. per mile down to Chungk'ing (630 ft.). From Chungk'ing through the gorges to Ich'ang (130 ft.), a distance of nearly 400 m., the fall again increases to about 14 in. per mile; but from Ich'ang down to the sea, a distance of 1000 m., the fall is exceedingly small, being as far as Hankow at the rate of 2½ in., and from Hankow to the mouth at the rate of little more than 1 in. per mile. The last 200 m. are practically a dead level, for at low-water season there is a rise of tide enough to swing ships as far up as Wuhu, 200 m. from the mouth.

The principal tributaries, counting from the sea upwards, are: (1) the outlet from Poyang lake, draining the province of Kiang-si; (2) the Han river, entering on the left bank at Hankow; (3) the outlet from Tungt'ing lake on the right bank, draining the province of Hu'nan; (4) the three great rivers of Sze-ch'uen, the Kialing, the To Kiang and the Min, all entering on the left bank; and (5) the Yaiung, draining a vast area on the borderland between Sze-ch'uen and Tibet. The whole drainage area is about 650,000 sq. m., of which more than four-fifths lie above Hankow. The period of low water is from December to March. The melting of the snows on the Tibetan highlands combined with the summer rainfall causes an annual rise in the river of from 70 to 90 ft. at Chungk'ing and from 40 to 50 at Hankow and Kiukiang. The mean volume of water discharged into the sea is estimated at 770,000 cub. ft. per second. The quantity of sediment carried in solution and deposited at the mouth is similarly estimated at 6428 million cub. ft. per annum, representing a subaërial denudation of the whole drainage area at the rate of one foot in 3707 years. (See *Journal* of the China Branch of the Royal Asiatic Society, vol. xvi., Dr Guppy.)

The Yangtsze-kiang forms a highway of first-class importance. As the rise in the river is only about 130 ft. for the first 1000 m., it resembles a huge canal expressly formed for steam navigation. Except at winter low water, steamers of 5000 or 6000 tons can reach Hankow with ease. Between Hankow and Ich'ang, especially above the outlet from Tungt'ing lake, the volume of water diminishes very much, and as the channel is continually shifting with the shifting sand-banks, navigation is more difficult. Above Ich'ang, where the river flows between rocky gorges, and where a series of rapids are encountered, navigation is still more difficult. But taking the Yangtsze as a whole, with its numerous subsidiary streams, canals and lakes, it forms a highway of communication unrivalled in any other country in the world. About half the sea-borne commerce of all China is further distributed by means of the Yangtsze and its connexions, not to mention the interchange of native produce between the provinces, which is carried by native sailing craft numbered by thousands.

The Yangtsze valley as a political term indicates the sphere of influence or development which by international agreement was assigned to Great Britain. This was first acquired in a somewhat negative manner by the Chinese government giving an undertaking, which they did in 1898, not to alienate any part of the Yangtsze valley to any other power. A more formal recognition of the British claim was embodied in the agreement between the British and Russian governments in 1899 for the delimitation of their respective railway interests in China, Russia agreeing not to interfere with British projects in the basin of the Yangtsze, and Great Britain agreeing not to interfere with Russian projects north of the Great Wall (Manchuria). The basin or valley of the Yangtsze was defined to comprise all the provinces bordering on the Yangtsze river, together with the provinces of Ho-nan and Chehekiang. This agreement was communicated to the Chinese government, and has been generally acknowledged. The object of the negotiations was to guard against conflict of railway interests; in all other respects the policy known as that of the "open door" was advocated by Great Britain and the chief commercial states. This policy was more fully declared by mutual engagements entered into in 1900 by the Great Powers on the initiative of the United States, whereby each undertook to guarantee equality of treatment to the commerce of all nations within its own sphere. As to railway enterprise, an agreement of 1910 admitted French, German and American financial interests equally with those of great Britain in the projected line from Hankow to Sze-ch'uen. (G. J.)

YANKEE, the slang or colloquial name given to a citizen of the New England states in America, and less correctly applied, in familiar European usage, to any citizen of the United States. It was used by the British soldiers of their opponents during the War of Independence, and during the Civil War by the Confederates of the Federal troops and by the South of the North generally. The origin of the name has given rise to much speculation. In Dr William Gordon's *History of the American War* (ed. 1789, i. 324) it is said to have been a cant word at Cambridge, Mass., as early as 1713, where it was used to express excellency, and he quotes such expressions as "a Yankee good horse." Webster gives the earliest recorded use of its accepted meaning, from *Oppression, a Poem by an American* (Boston, 1765), "From meanness first this Portsmouth Yankee rose," and states that it is considered to represent the Indian pronunciation of "English" or *Anglais*, and was applied by the Massachusetts Indians to the English colonists. On the other hand, the Scots "yankie," sharp or clever, would seem more probable as the origin of the sense represented in the Cambridge expression. Other suggestions give a Dutch origin to the name. Thus it may be a corruption of "Jankin," diminutive of "Jan," John, and applied as a nickname to the English of Connecticut by the Dutch of New York. Skeat (*Etym. Dict.*, 1910) quotes a Dutch captain's name, Yanky, from Dampier's *Voyages* (ed. 1699, i. 38), and accepts the theory that "Yankee" was formed from *Jan*, John, and *Kees*, a familiar diminutive of Cornelius (H. Logeman, *Notes and Queries*, 10th series, iv. 509, v. 15).

YANKTON, a city and the county-seat of Yankton county, South Dakota, U.S.A., on the left bank of the Missouri river, about 60 m. N.W. of Sioux City, Iowa. Pop. (1900) 4125 (850 foreign-born); (1910) 3787. It is served by the Chicago, Milwaukee & St Paul, the Great Northern, and the Chicago & North-Western railways. The Missouri is navigable at this point, and the city has a considerable river traffic. Yankton is the seat of Yankton College (founded by Congregationalists in 1881, opened in 1882; now non-sectarian). The city is built on a nearly level plateau, averaging about 1200 ft. above the sea-level. It is in a rich grain-growing and stock-raising district, has grain-elevators, and manufactures flour, beer and cement. The water supply is obtained from artesian wells. The first permanent settlement, a trading post, was made here in 1858, when a treaty was concluded with the Yankton Indians. This was the first settlement made in the Missouri Valley in Dakota. Yankton was laid out in 1859, first chartered as a city in 1869, rechartered in 1873, and in 1910 adopted a commission form of government. In 1861–82 Yankton was the capital of the Territory of Dakota. The name is a corruption of the Sioux name *Ihanktonwan*, meaning "end village."

YAOS, or AJAWA, a Bantu-Negroid people of east-central Africa, whose home is the country around the upper reaches of the Rovuma river, and the north of Portuguese East Africa. They are an enterprising and intelligent race, and have spread into British territory south of Lake Nyasa and throughout the Shiré districts. They are the tallest and strongest of the natives in the Mozambique country, have negroid features and faces which are noticeable for their roundness, and, for Africans, have light skins. They have long been popular among Europeans as carriers and servants. They earned, however, a bad name as slave-traders, and gave much trouble to the British authorities in Nyasaland until 1896, when they were reduced to submission. They do not tattoo except for tribal marks on their foreheads. The women wear disks of ivory or burnished lead in the sides of their nostrils, and some, probably of Anyanja origin, disfigure the lip with the *pelele* or lip-ring. The Yaos have elaborate ceremonies of initiation for the youth of both sexes. They bury their dead in a contracted position, the grave being roofed with logs and earth sprinkled over; in the case of a rich man, some of his property is buried with him and the rest is inherited by his eldest sister's son.

See Miss A. Werner, *The Natives of British Central Africa* (1906); Sir H. H. Johnston, *British Central Africa* (1897); H. L. Duff, *Nyasaland under the Foreign Office* (1903). For the Yao language see BANTU LANGUAGES.

YAʻQŪBĪ [Aḥmad ibn abī Yaʻqūb ibn Jaʻfar ibn Wahb ibn Wāḍiḥ] (9th century), Arab historian and geographer, was a great-grandson of Wāḍiḥ, the freedman of the caliph Manṣūr. Until 873 he lived in Armenia and Khorasan; then he travelled in India, Egypt and the Maghrib, where he died in 891. His history is divided into two parts. In the first he gives a comprehensive account of the pre-Mahommedan and non-Mahommedan peoples, especially of their religion and literature. For the time of the patriarchs his source is now seen to be the Syriac work published by C. Bezold as *Die Schatzhöhle*. In his account of India he is the first to give an account of the stories of Kalila and Dimna, and of Sindibad (Sinbad). When treating of Greece he gives many extracts from the philosophers (cf. M. Klamroth in the *Zeitschrift der deutschen morgenländischen Gesellschaft*, vols. xl. and xli.). The second part contains Mahommedan history up to 872, and is neither extreme nor unfair, although he inherited Shiʻite leanings from his great-grandfather. The work is characterized by its detailed account of some provinces, such as Armenia and Khorasan, by its astronomical details and its quotations from religious authorities rather than poets.

Edition by T. Houtsma (2 vols., Leiden, 1883). Yaʻqūbī's geography, the *Kitāb ul-Buldān*, contains a description of the Maghrib, with a full account of the larger cities and much topographical and political information (ed. M. de Goeje, Leiden, 1892). (G. W. T.)

YĀQŪT, or YAKUT (Yāqūt ibn ʻAbdallah ur-Rūmī) (1179–1229), Arab geographer and biographer, was born in Greece of Greek parentage, but in his boyhood became the slave of a merchant of Hamah (Hamath), who trained him for commercial travelling and sent him two or three times to Kish in the Persian Gulf (on his journeys, cf. F. Wüstenfeld, "Jacut's Reisen" in the *Zeitschr. d. deutsch. morg. Gesellschaft*, vol. xviii. pp. 397–493). In 1194 he quarrelled with his master and had to support himself by copying; he took advantage of the opportunity of studying under the grammarian al-ʻUkbarī. After five years he returned to his old master and again travelled for him to Kish, but on his return found his master dead, and set up for himself as a bookseller and began to write. During the next ten years he travelled in Persia, Syria, Egypt and visited Merv, Balkh, Mosul and Aleppo. About 1222 he settled in Mosul and worked on his geography, the first draft of which was ready in 1224. After a journey to Alexandria in 1227 he went to Aleppo, where he died in 1229. In his large geography, the *Muʻjam ul-Buldān* (ed. F. Wüstenfeld, 6 vols., Leipzig, 1866–73), the places mentioned in the literature or the stories of the Arabs are given in alphabetical order, with the correct vocalization of the names, an indication whether they are Arabic or foreign and their locality. Their history is often sketched with a special account of their conquest by the Moslems and the name of the governor at the time is recorded. Attention is also given to the monuments they contain and the celebrities who were born in them or had lived there. In this way a quantity of old literature, both prose and poetry, is preserved by Yāqūt.

The parts of this work relating to Persia have been extracted and translated by Barbier de Meynard under the title *Dictionnaire géographique, historique et littéraire de la Perse* (Paris, 1871). Some account of its sources is given in F. J. Heer's *Die historischen und geographischen Quellen in Jacut's geographischem Wörterbuch* (Strassburg, 1898), and the material relating to the Crusades is treated by H. Derenbourg, "Les Croisades d'après le dictionnaire géographique de Jacout" in the volume of the *Centenaire de l'école des langues orientales vivantes*, 71–92. A digest of the whole work was made by Ibn ʻAbdulhaqq (d. 1338) under the title *Marāṣid ul-Ittilā* (ed. T. G. J. Juynboll, Leiden, 1850–1864). Yāqūt also wrote a dictionary of geographical homonyms, the *Mushtarik* (ed. F. Wüstenfeld, Göttingen, 1846). Besides all this activity in geography Yāqūt gave his attention to biography, and wrote an important dictionary of learned men, the *Muʻjam ul-Udabāʻ*. Parts of this work exist in MS. in different libraries; vol. i. has been edited by D. S. Margoliouth, *Irshād al-Arib Il ā Māʻrifat al Adīb* (London, 1908). (G. W. T.)

YARKAND (Chinese name Sochē Fu), the chief town of the principal oasis of Chinese Turkestan, on the Yarkand-Darya, in 38° 25′ N., 77° 16′ E., and 3900 ft. above sea-level. The settlements of the Yarkand oasis occupy the S.W. corner of E. Turkestan, and are scattered along the numerous rivers which issue from the steep slopes of the Pamir in the W., and the Karakoram and Kuen-Lun Mountains in the S. The oasis of Kashgar limits it in the N., and a tract of desert separates it from the oasis of Khotan in the S.E. The Yarkand-Darya and its numerous tributaries, which are fed by the glaciers of the mountain regions, as also many rivers which are now lost in the steppe or amidst the irrigated fields, bring abundance of water to the desert; one of them is called Zarafshan ("gold-strewing"), as much on account of the fertility it brings as of its auriferous sands. Numberless irrigation canals carry the water to the fields, which occupy a broad zone of loess skirting the base of the mountains. In the spurs of the mountains there are rich pasturages, where goats, yaks, camels, sheep and cattle are reared. The oasis of Yarkand is regarded as the richest of E. Turkestan, and its population probably numbers about 200,000 inhabitants. Wheat, barley, rice, beans and various oil-yielding plants are grown, and melons, grapes, apples and other fruits. The cotton tree and the mulberry are cultivated in the warmer parts of the oasis. Gold, lead and precious stones are found in the mountains, though only the first-named is worked. Yarkand is renowned for its leather-ware and saddlery. Carpets and silk fabrics, cotton and woollen goods are manufactured. The population consists of Persians, who now speak Turkish, and of Turkish Sarts.

The town of Yarkand, which has a population of about 100,000 (5000 houses in the city, and as many in Yanghishar and the suburbs), is situated on the river of the same name, five days' journey S.E. from Kashgar. It is surrounded by a thick earthen wall, nearly 4 m. long, with towers in the Chinese style of architecture, and is well watered by canals. The square fortress of Yanghishar, which was built by the Chinese, stands within 400 yds. of the walls of the town. This is one of the three strong places in Chinese Turkestan. The ten mosques and madrasas of Yarkand, although poorer than those of Bokhara or Samarkand, enjoy wide renown in the Moslem world. There is a brisk trade, especially in horses, cotton, leather-ware and all kinds of imported manufactured goods.

Yarkand is surrounded by a number of smaller towns, the chief of which are—Yanghi-hissar, which has about 600 houses, Tashkurgan on the Pamirs, Posgam (1600 houses), Kargałyk, at the junction of the routes leading to Ladakh and Khotan (2000 houses), Sanju (2000), Tagarchi, Kartchum, Besh-taryk (1800) and Guma (3000).

Yarkand was very imperfectly known until the second half of the 19th century. Marco Polo visited it between 1271 and 1275, and Goes in 1603; but the continuous wars (see TURKESTAN) prevented Europeans from frequenting it, so that until 1863 the information borrowed from medieval travellers and from Chinese sources, with that supplied by the pundit Mir Isset Ullah in 1812, was all that was known about the Yarkand region. The first European who reached it in the 19th century was Adolph Schlagintweit, who passed by Yarkand in August 1857, but was killed a few days later at Kashgar. The pundit Mohammed Hamid visited it in 1863 and determined its geographical position and altitude. Later information is due to Robert Shaw and G. W. Hayward, who stayed at Yarkand in 1869, and to Sir Douglas Forsyth, who first visited it in 1870. Three years later he visited it again with an expedition which had Gordon, Bellew, Chapman, Trotter, Biddulph and Stoliczka as members, and afterwards published a detailed report upon the scientific results of the mission. In 1886, after a remarkable journey through E. Turkestan, A. D. Carey reached Yarkand and spent the winter there. It was again visited by Dr Lansdell in 1888, and by Dr Aurel Stein in 1906. The Swedish Protestant missionaries whose headquarters are at Kashgar maintain a medical mission at Yarkand.

YARMOUTH, a seaport town and port of entry, Yarmouth county, Nova Scotia, Canada, on the Dominion & Atlantic railway, 218 m. from Halifax. Pop. (1901) 6430. Steamers run daily to Boston (Mass.), and weekly to St John (N.B.) and Halifax. It contains the county buildings, and has good schools and small local manufactories. Fish and lumber are exported in large quantities.

YARMOUTH (GREAT YARMOUTH), a municipal, county and parliamentary borough, watering-place, and seaport of Norfolk, England (with a small portion in Suffolk), 121 m. N.E. from London by the Great Eastern railway, served also by the Midland & Great Northern joint line. Pop. (1901) 51,316. It lies on a long and narrow peninsula of sand, between the North Sea and the Breydon Water (formed by the rivers Yare and Waveney) and the river Bure. The neighbouring country is very flat, but the Bure affords access to the Norfolk Broads, which give the district its well-known individuality. The old town of Great Yarmouth was built chiefly along the E. bank of the Yare, but the modern town has extended beyond its ancient walls, of which some remains exist, to the seashore, where there are a marine drive and three piers. On the landward or Suffolk side of the estuary is the suburb of Southtown, and farther S. that of Gorleston. The principal features of Yarmouth are the N. and S. quays, and the straight narrow lanes called "rows," 145 in number, running at right angles to them. These rows were at one time inhabited by the wealthy burgesses, and many of the houses, now tenanted by the poorer classes, have panelled rooms with richly decorated ceilings. The old town is connected with Little Yarmouth by a bridge across the Yare of stone and iron, erected in 1854. The Bure is crossed by a suspension bridge. The church of St Nicholas, founded in 1101 by Herbert Losinga, the first bishop of Norwich, and consecrated in 1119, is one of the largest parish churches in England. It is cruciform, with a central tower, which perhaps preserves a part of the original structure, but by successive alterations the form of the church has been completely changed. The Transitional clerestoried nave, with columns alternately octagonal and circular, was rebuilt in the reign of King John. A portion of the chancel is of the same date. About fifty years later the aisles were widened, so that the nave is now the narrowest part of the building. A grand W. front with towers and pinnacles was constructed in 1330–1338, but the building was interrupted by a visitation of the plague. In the 16th century the monumental brasses were cast into weights and the gravestones cut into grindstones. Within the church there were at one time eighteen chapels, maintained by gilds or private families, but these were demolished by the Reformers, who sold the valuable utensils of the building and applied the money to the widening of the channel of the harbour. During the Commonwealth the Independents appropriated the chancel, the Presbyterians the N. aisle and the Churchmen were allowed the remainder of the building. The brick walls erected at this time to separate the different portions of the building remained till 1847. In 1864 the tower was restored, and the E. end of the chancel rebuilt; in 1869–1870 the S. aisle was rebuilt; and in 1884 the S. transept, the W. end of the nave and the N. aisle underwent restoration. The width of the nave is 26 ft., and the total length of the church is 236 ft. St John's is a noteworthy modern church, and the Roman Catholic church is a handsome Gothic building erected in 1850. A grammar-school was founded in 1551, when the great hall of the old hospital, founded in the reign of Edward I. by Thomas Fastolfe, was appropriated to its use. It was closed from 1757 to 1860, was re-established by the charity trustees, and settled in new buildings in 1872. Among the principal public buildings are the town hall and public offices (1883); a picturesque toll-house of the 14th century, carefully preserved and serving as a free library; assembly rooms, museum, drill hall, custom house, barracks at Southtown and theatres. Among charitable and benevolent institutions are a royal naval lunatic asylum, three hospitals, and fishermen's hospital, the North Sea Church Mission and various homes and minor charities. To the S. of the town, on the part of the peninsula known as the South Denes, are a race-course and a Doric column erected in 1817 to commemorate Lord Nelson. To the N. (on the North Denes) are golf links. Winter gardens were opened in 1904. The municipal and parliamentary borough became coextensive by the inclusion in the former of Gorleston in 1890. The parliamentary borough, returning one member, falls between the E. division of Norfolk and the Lowestoft division of Suffolk. Yarmouth is governed by a mayor, 12 aldermen and 36 councillors. Area, 3568 acres.

Yarmouth Roads, off the coast, afford excellent anchorage except in E. or N.E. winds. The channel to the quays was made by Joost Jansen, a Dutch engineer, in 1567, and affords a depth at the bar of 12 ft. at low water. The herring and mackerel fisheries are most important, and fish-curing is an extensive industry, Yarmouth bloaters being widely famous. The fishing fleet numbers some 500 vessels of 20,000 tons, and employs about 3000 hands. The principal imports are coal, timber and seeds, and exports are grain and fish. Other industries are ship and boat building, rope, twine and trawl-net manufactories, silk-crape works and maltings.

Yarmouth (Gernemwa, Yernemuth), which lies near the site of the Roman camp of Gariannonum, is believed to have been the landing-place of Cerdic in the 5th century. Not long afterwards, the convenience of its situation having attracted many fishermen from the Cinque Ports, a permanent settlement was made, and the town numbered seventy burgesses before the Conquest. Henry I. placed it under the rule of a reeve. The charter of King John (1208), which gave his burgesses of Yarmouth general liberties according to the customs of Oxford, a gild merchant and weekly hustings, was amplified by several later charters asserting the rights of the borough against Little Yarmouth and Gorleston. In 1552 Elizabeth granted a charter of admiralty jurisdiction, afterwards confirmed and extended by James I. In 1668 Charles II. incorporated Little Yarmouth in the borough by a charter which with one brief exception remained in force till 1703, when Anne replaced the two bailiffs by a mayor, reducing the aldermen and common councilmen to eighteen and thirty-six. By the Boundary and Municipal Corporation Acts of 1832 and 1855, Gorleston was annexed to the borough, which became a county borough in 1888. Yarmouth returned two members to parliament from 1300 to 1868, when it was disfranchised until 1885. From the 11th to the 18th century the herring trade, which has always been the main industry of Yarmouth, was carried on at an annual fair between Michaelmas and Martinmas. This was regulated by the barons of the Cinque Ports, and many quarrels arose through their jurisdiction and privileges. Yarmouth has had a weekly market at least from the 13th century.

See *Victoria County History, Norfolk*; H. Swinden, *History of Great Yarmouth* (1772); C. J. Palmer, *History of Great Yarmouth* (1854).

YARMOUTH, a small port at the western extremity of the Isle of Wight, England, on the shore of the Solent, where the estuary of the Yar debouches. Pop. (1901) 903. Steamers connect it with the London & South-Western railway at Lymington on the mainland, and it is also served by the Isle of Wight Central line. The church contains a fine monument to Admiral Sir Robert Holmes, who took New Amsterdam, afterwards New York, from the Dutch.

The place appears in the Domesday Survey of 1086 under the name of Ermud; it was then assessed at 1 hide 2½ virgates, and held in parage by Aluric and Wislac, two of the king's thegns who had also held it under Edward the Confessor. The first charter was granted by Baldwin de Redvers in 1135, and was confirmed by Edward I., Henry VI., Edward IV. and Elizabeth, but the earliest charter of incorporation was from James I., instituting a governing body of a mayor and twelve chief burgesses, with power to choose a steward, town clerk and serjeant-at-mace. Under the Municipal Corporations Act of 1883 the corporation was abolished and the administration vested in a town trust of eleven members. Yarmouth and Newport returned members to parliament as one borough in 1295, but no further returns were made until 1584, from which date Yarmouth continued to send representatives until disfranchised by the Reform Act of 1832. The charter from James I. instituted a Wednesday market and a fair at the feast of St James, which were maintained until within recent years. In the 18th century Yarmouth was a notorious smuggling centre. In 1206 John embarked from Yarmouth for the expedition to La Rochelle. The town was burnt by the French in 1337 and in 1544. In the 16th century, at the time of the expectation of the Spanish invasion, a small fort was built called Carey's Sconce, the remains of which are to be seen at the W. of the town. In 1648 Charles I. was brought to Yarmouth on his way from Carisbrooke to Hurst Castle; and in 1671 Charles II. and his court were entertained at Yarmouth by Admiral Sir Robert Holmes, governor of the island.

YARN,[1] the name given to any textile fibre when prepared by the process of spinning for being woven into cloth. It is only in a few minor and exceptional cases, such as the weaving of haircloth or wire, that there is any making of fabrics without the previous spinning of yarn. But yarn is of the most diverse description, and its value varies in proportion to its lustre, its bleaching and dyeing properties, its fineness, strength, elasticity, uniformity of diameter, smoothness, suppleness and colour in its natural condition. Yarn is single, folded and fancy, and if twisted to the right it is called twist way, and if to the left, weft way, but those terms do not necessarily imply that the yarn is for either warp or weft.

Single Yarn consists of fibrous matter as twisted together during the process of spinning. If it is intended for warp it should be strong, elastic and smooth; if for weft it has less twist and is spongy. The raw material from which yarn is made has much to do with its appearance and value. Thus *Cotton Yarn*, although it varies from a soft spongy thread to a closely compacted one, is generally dull in appearance, soft, pliable and of but moderate strength and elasticity. Dulness in this material is not, however, a constant feature; when combed and gassed it is brighter than when simply carded, and when mercerized it assumes a high lustre. *Cotton-waste Yarn* is of two classes, both of low counts, and is made from the cotton wasted in the preparing, spinning and weaving operations: one from soft material that had not previously been spun; the other from hard threads which are broken up into separate filaments. The best grades of cotton have been spun into commercial threads, 588,000 yds. of which weigh 1 ℔, but for experimental purposes much finer threads have been spun. For yarn in more general use the range is up to 250,000 yds. per ℔. When spun from soft waste it is up to 13,400 yds. per ℔, and from hard waste it is up to 2520 yds. per ℔. *Linen Yarn* is of two kinds, namely, Line and Tow. In their natural conditions both are stiff, inelastic and somewhat rough, but the method of spinning has much to do with their appearance. If spun wet they are more compact, smoother and brighter than when spun dry; yet line yarn is always stronger and better in these respects than tow, which is by comparison soft, full and hairy. Both bleach to a pure white, become lustrous and moderately soft. Exceptionally fine linen yarn contains 180,000 yds. per ℔, but the range of line yarn in general use is up to 60,000 yds. per ℔, and that of tow 10,000 yds. per ℔. *Woollen Yarn* is soft, spongy, hairy, elastic, moderately strong and possesses felting properties in a high degree; it bleaches indifferently but dyes readily. It is spun into threads that range up to 15,000 yds. per ℔. Several kinds of waste yarn are spun from wool, such as Shoddy, Mungo and Extract, most of which are irregular, lustreless and only suitable for coarse counts, but they dye well. *Shoddy* is made from the liberated fibres of soft spun woollen threads and cloths that have not been felted. *Mungo* is made from the liberated fibres of hard spun woollen yarn, and felted cloths, while *Extract* is made from the woollen material contained in mixed goods, the vegetable fibrous matters from which have been destroyed by acids and heat. *Worsted Yarn* is made from combed wool, and is, as a consequence, uniform in diameter, lustrous, smooth, very elastic and strong. It is spun into threads that range up to 56,000 yds. per ℔. *Silk* is made into Net, Spun and Noil yarns, all of which are readily dyed. *Net Silk* yields Organzine and Tram; both are, in proportion to diameter, the strongest and most elastic of textile threads, and are highly lustrous and smooth; but organzine is hard twisted and used for warp, while tram is slightly twisted and used for weft. They give a range up to 450,000 yds. per ℔. *Spun Silk* is made by combing and spinning the material wasted during the conversion of cocoons into fabrics; it is less lustrous and elastic than net silk, also weaker. *Silk Noil* is made from the fibres rejected by the comber during the making of spun silk, and is inferior in all respects to spun silk. *Mixed Yarn* is obtained by mixing and spinning different fibrous materials together; as cotton and wool, silk and ramie, and the proportions in which they are mixed vary from 10% to 80% of the most expensive fibre. The counts of single yarns made from different fibres are differently expressed, as are occasionally those spun in different districts from similar fibres. Cotton yarns are based upon the number of hanks, of 840 yds., contained in 1 ℔; linen, upon the number of leas, of 300 yds., in 1 ℔; worsted, upon the number of hanks, of 560 yds., in 1 ℔. Wool is expressed in the West of England by the number of hanks, of 320 yds., in 1 ℔.; in parts of Yorkshire by the number of skeins, of 1520 yds., in 6 ℔; in some parts of the United States by the number of runs, of 1600 yds., in 1 ℔. Silk is expressed by the weight of 1000 yds. in drams; also by the weight, in deniers, of 476 meters, the denier being an Italian weight equal to $\frac{1}{8533}$ part of 1 ℔; spun silk, by the number of hanks, of 840 yds., in 1 ℔.

Folded Yarn.—Yarn is folded to impart increased strength, elasticity and smoothness, and is used, both glazed and unglazed, for warp and weft in ordinary fabrics. It is also made for such special purposes as sewing, lace-making, crocheting and hosiery. The counts of these yarns are expressed according to the number of threads twisted together, as $2/50^s$, $3/60^s$; the former indicating that two threads of 50^s, and the latter three threads of 60^s, were twisted together to yield yarn of 25 hanks and 20 hanks per ℔ respectively; the count of the single yarn being invariably named in the cotton, linen, woollen and worsted trades. With spun silk the practice adopted is to name the count of the folded yarn; thus, 70/2 and 40/3 imply that two threads of 140^s and three threads of 120^s were respectively folded together. *Sewing Cotton* should be smooth and strong, and much of it is from two to six cord. When two or three cord, the doubling twist is in the opposite direction to that of the singles. When more than three cord, it usually undergoes two twistings, the first in the same direction as the single threads, the second is in the opposite direction to, and more closely twisted than the first. Thus:—A six-cord thread is first folded and twisted two into one, then three strands of two fold are twisted into one; after which it is sized and polished. *Lace Yarn* should be strong, elastic, smooth and spun twist way in the singles, but doubled weft way. *Crochet Yarn* is bulky, elastic and has a corded appearance. It is twice doubled: the first time it is twisted in the opposite direction to the singles, the second time in the same direction as the singles. *Hosiery Yarn* is often a soft, bulky, single thread, but it is also folded, sometimes without being twisted, at other times it is slightly twisted. There are two types, namely, wool and silk, neither of which need be made from the fibres named. For the former a hairy surface is not objectionable, but the latter should be smooth, and may be gassed. *Polished Yarn* may be either single or folded, but it should be fully twisted and level. It is bleached or dyed in hanks, immersed in size and polished with brushes while the size is moist.

Fancy Yarn is made by twisting together threads of different counts, colours, materials or twistings, at regular or irregular tensions, and in the same or opposite directions. The effects thus produced are known in commerce under a great variety of names, of which the following are a few. *Grandrelle* is probably the one in greatest demand; it has a mottled effect which is due to uniformly twisting together two threads of different colours, but of approximately equal counts. In some cases the folding twist is slight, in others it is considerable. *Mock Grandrelle* presents a similar appearance to true grandrelle, but is made at the spinning machine by twisting together two rovings that are dyed in different colours. *Flaked Yarn* has a cloudy appearance imparted to it, (*a*) by twisting a hard spun thread with a roving, which, at regular or irregular intervals is made thick and thin by drawing rollers; (*b*) by supplying, intermittently, during carding or spinning, tufts of extra fibre to a thread; or (*c*) as in *Knickerbocker Yarn*, by dropping small quantities of dyed fibres into two, similar or dissimilar, rovings at the spinning machine, or into two, similar or dissimilar, threads at the doubler. *Corkscrewed Yarn* has a spiral surface effect which may be produced in different ways, such as twisting threads together that differ in tension, in count and in the quantity or direction of the twist in the single threads. If a fine, hard spun, single or folded thread be twisted with a coarse, soft spun single, the coarse thread will wrap itself about the fine one and give a corrugated surface. *Chain*, and other effects may be given by two foldings and twistings, if for the first doubling a coarse soft thread is twisted with a finer one having medium twist, and for the second a still finer thread is twisted with the twofold one, but in the opposite direction and with a different number of twists per inch. *Gimp Yarn* is spiral in structure and requires two doublings, the first to form a twofold spiral, then, at the second doubling, a fine tight thread is added. *Knopped Yarn* is formed by twisting together several strands, one of which is at intervals delivered in greater lengths than the others, in order to allow a loop to be made; the direction of twist in one single may differ from that in another. *Curled Yarn* is produced by twisting two supple threads round a longer and stiffer one, after which a fourth thread is added.

(T. W. F.)

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[1] The etymology is uncertain, but apparently the word is cognate with "cord." The meaning "tale" comes from something spun out.

YAROSLAVL, or YAROSLAV, a government of central Russia, separated from the government of Moscow by the governments of Vladimir and Tver on the S., and having Tver and Novgorod on the W., Volgoda on the N. and Kostroma on the E. It is one of the smallest, but most populous and busiest, governments of Great Russia; area, 13,747 sq. m. It consists of a broad and shallow depression, elongated from W. to E., where the Volga flows at a level of 260 to 230 ft. above the sea, while the surrounding hills rise to 700 or 800 ft. In the W., especially between the Mologa and the Sheksna, the country contains very many marshes and ponds, and there are low and marshy tracts in the S. about Rostov.

Jurassic clays, sandstones and sands cover nearly the whole of Yaroslavl, but they are concealed almost everywhere under thick deposits of Glacial boulder clay, which is regarded by Russian geologists as the bottom moraine of the great ice-cap of the Glacial period. Triassic "variegated marls," widely disseminated throughout the whole of the middle Volga region. undoubtedly underlie nearly all the Jurassic deposits of the government, but only a few patches emerge at the surface; many salt springs exist in these deposits. The Upper Carboniferous limestones crop out only in the N.W. and towards the E. The chief mineral products are bog-iron ores, sulphate of copper and pottery clay. Peat occurs in thick beds. There are several mineral springs. The soil is mostly a kind of loess of moderate fertility; sandy tracts are not uncommon.

The principal river is the Volga, which traverses the government for 180 m., making a great bend to the N. The chief towns—Rybinsk, Yaroslavl, Mologa, Romanovo-Borisoglyebsk, Uglich and Myshkin—are situated on its banks, and a brisk traffic is carried on, both by the river itself and by two canals, Mariinsk and Tikhvinsk, which connect it with the Neva through its tributaries the Sheksna and the Mologa. Another tributary of the Volga is the Kotorost, which has many factories on its banks and is navigated, especially in spring. The Kostroma flows along the E. border and is a channel for the export of timber and fuel.

The forests, chiefly fir and Scotch pine, cover one-third of the area; but they are being rapidly destroyed. The flora bears a northern stamp, owing to the presence of the dwarf birch, of the Arctic raspberry (*Rubus arcticus*), and of *Linnaea borealis*.

The average temperature at the city of Yaroslavl is 40° F. (January, 6·5°; July, 61·5°); the prevailing S.W. and W. winds render it moister than in central Russia. The rivers remain frozen 118 to 183 days every year.

The population, which is thoroughly Russian, numbered 1,175,900 in 1906. The government is divided into ten districts, the chief towns of which are Yaroslavl, Danilov, Lyubim, Mologa, Myshkin, Poshekhon, Romanovo-Borisoglyebsk, Rostov, Rybinsk and Uglich. Yaroslavl belongs to the manufacturing region of central Russia, but the domestic character of many industries permits the inhabitants to cultivate their fields and also to work in small factories. The peasants and peasant communities own over 5,000,000 acres, or about 57% of the total area, of which they have acquired nearly 1,000,000 acres by purchase since their emancipation in 1861; 30% is held by private persons, and 7% by the crown. There were in 1900 1,169,000 acres (13·3 % of the total area) under cereals, the principal crops being rye, wheat, oats, barley and potatoes. Flax is widely cultivated both for linseed and fibre, and both fresh and dried vegetables are exported; Rostov enjoys a great reputation as the centre of this industry. Live-stock breeding is of only less importance than agriculture, and poultry is exported. Large numbers find employment in the making of hardware, locks, felt boots, gloves, wooden wares, pottery and metallic wares. Factories have considerably developed; the principal are cotton, flax and woollen mills, flour-mills, tobacco factories, distilleries, breweries, chicory works, tanneries, candle works, petroleum refineries, machinery, chemical and match works. Rybinsk and Yaroslavl are the chief commercial centres, but Rostov, Mologa, Romanovo and Poshekhon carry on an active trade in corn, timber and manufactured wares. Many of the male population annually leave their homes to work all over Russia as locksmiths, masons, plasterers, waiters in restaurants, greengrocers, tailors, gardeners, carpenters, joiners, pilots, boatmen.

As early as the 9th century the Slavs had become masters of the Yaroslavl territory, which was formerly occupied by the Finnish tribes of Vess and Merya, as also by Mordvinians, Muroms and Cheremisses in the S. Rostov was already in existence; but Yaroslavl, Rybinsk and Uglich begin to be mentioned in the annals only in the 11th and 12th centuries. The independent principality of Rostov was divided in the 13th century into three parts, but these were soon afterwards successively annexed to Moscow.

YAROSLAVL, a town of Russia, capital of the government of the same name, on the right bank of the Volga, at its confluence with the Kotorost, 174 m. by rail N.E. of Moscow. Pop. about 70,000. Yaroslavl is an archiepiscopal see. The Uspenskiy cathedral was begun in 1215 and rebuilt in 1646–48; the churches of the Preobrazhenskiy monastery, St John's and Voskreseniye date from the 15th and 17th centuries. Yaroslavl has a lyceum, founded (1803) by a wealthy member of the Demidov family. The manufactories include cotton-mills, flour-mills, tobacco and linen factories. The town was founded in 1026–36. It became the chief town of a principality in 1218 and remained so until 1471, when it fell under the dominion of Moscow.

YARRELL, WILLIAM (1784–1856), British naturalist, was born in London on the 3rd of June 1784. His father was a newspaper agent, and he succeeded to the business, and prosecuted it till within a few years of his death. He acquired the reputation of being the best shot and the first angler in the metropolis, and soon also became an expert naturalist. In 1825 he was elected a fellow of the Linnean Society, of which he subsequently became treasurer, and was a diligent contributor to their *Transactions*; and he was one of the original members of the Zoological Society. The greater part of his leisure towards the end of his life was devoted to his two great works, *The History of British Fishes* (2 vols., 1836) and *The History of British Birds* (2 vols., 1843). These works from the first took rank as standard authorities. He died at Yarmouth on the 1st of September 1856.

YARROW, a river and parish of Selkirkshire, Scotland. The river, issuing from St Mary's Loch, flows for 14 m. E. by N. to the Tweed, which it joins about 3 m. below the county town. The stream and vale are famous in poetry. Only a fragment remains of Dryhope Tower, on Dryhope Burn, the home of Mary Scott, "the flower of Yarrow," whom Walter Scott of Harden married about 1576. On Douglas Burn, a left-hand tributary, are the ruins of the keep of "the good" Sir James Douglas, the friend of Robert Bruce; and Blackhouse, Mount Benger and the farm of Altrive are all connected with James Hogg. Near Broadmeadows Sir William Douglas, the knight of Liddesdale, was murdered by his kinsman (1353) in revenge for the death of Sir Alexander Ramsay of Dalhousie at Hermitage Castle. The body lay for a night in Lindean church, now in ruins, near Selkirk, before its burial in Melrose Abbey. On the right bank are the ruins of Newark Castle, built by James III. in 1466 as a hunting seat, afterwards the property of the Scotts of Buccleuch. It was burned by the English in 1548, but the tower was restored. On the right side of the Yarrow is Bowhill, a seat of the duke of Buccleuch.

YATAGHAN (from Turk. *yātāghān*; sometimes spelled in English "attaghan" and "ataghan"), the name of a type of sword common to Mahommedan peoples. It has no guard or quillons, but a large and often decorated pommel; its blade has a double curve on the cutting edge, first concave and then convex; the back is usually straight (see SWORD).

YATES, EDMUND HODGSON (1831–1894), English journalist and author, son of Frederick Henry Yates (1797–1842), was born at Edinburgh on the 3rd of July 1831. His father and mother (*née* Brunton; 1799–1860) were both prominent figures on the London stage from about 1817 onwards. Edmund Yates was educated at Highgate School and at Düsseldorf. In 1847 he obtained a clerkship in the General Post Office, with which he continued to be connected up to 1872, becoming in 1862 head of the missing letter department. He married in 1853, and soon began to write for the press. Charles Dickens made him dramatic critic to the *Daily News*, and he was a contributor to *Household Words*. He wrote several farces which were acted between 1857 and 1860. In 1855 he had begun writing a column for the *Illustrated Times* (under Henry Vizetelly), headed "The Lounger at the Clubs": this was the first attempt at combining "smart" personal paragraphs with the better class of journalism, and in 1858 Yates was made editor of a new paper called *Town Talk*, which carried the innovation a step forward. His first number contained a laudatory article on Dickens, and the second a disparaging one on Thackeray, containing various personal references to private matters. Thackeray, regarding this as a serious affront, brought the article before the committee of the Garrick Club, of which he contended that Yates had made improper use, and the result was that Yates was expelled. Besides editing *Temple Bar* and *Tinsley's Magazine*, Yates during the 'sixties took to lecturing on social topics, and published several books, including his best novel, *Black Sheep* (1867); and under the heading of "Le Flâneur" he continued in the *Morning Star* the sort of "personal column" which he had inaugurated in the *Illustrated Times*. On his retirement from the Post Office in 1872 he went to America on a lecturing tour, and afterwards, as a special correspondent for the *New York Herald*, travelled through Europe. But in 1874, with the help of E. C. Grenville Murray, he established a new London weekly, *The World*, "a journal for men and women," which he edited himself. The paper at once became a success, and Yates bought out Grenville Murray and became sole proprietor. *The World* was the first of the new type of "society papers," abounding in personal criticism and gossip: one of its features was the employment of the first person singular in its columns, a device by which the personal element in this form of journalism was emphasized. After *Truth* was started in 1877 by Mr Henry Labouchere (who was one of Yates's earliest contributors), the rivalry between the two weeklies was amusingly pointed by references in *The World* to what "Henry" said, and in *Truth* to the mistakes made by "Edmund." In 1885 Yates was convicted of a libel in 1884 on Lord Lonsdale, and was imprisoned in Holloway gaol for seven weeks. In the same year he published his *Recollections and Experiences* in two volumes. He died on the 20th of May 1894. He had been the typical *flâneur* in the literary world of the period, an entertaining writer and talker, with a talent for publicity of the modern type —developed, no doubt, from his theatrical parentage—which, through his imitators, was destined to have considerable influence on journalism.

YATES, MARY ANN (1728–1787), English actress, was the daughter of William Graham, a ship's steward. In 1753 she appeared at Drury Lane as Marcia in Samuel Crisp's (d. 1783) *Virginia*, Garrick being the Virginius. She was gradually entrusted with all the leading parts. Mrs Yates, whose husband, Richard Yates (*c.* 1706–1796), was a well-known comedian, succeeded Mrs Cibber as the leading tragedian of the English stage, and was in turn succeeded—and eclipsed—by Mrs Siddons.

YATES, RICHARD (1818–1873), American political leader, was born at Warsaw, Kentucky, on the 18th of January 1818. He graduated at the Illinois College at Jacksonville in 1838, was admitted to the bar, and entered politics as a Whig. From 1842 to 1845 and again in 1849 he served in the state House of Representatives. He was a representative in Congress in 1851–1855, but having become a Republican, was defeated for a third term. From 1861 to 1865 he was governor of Illinois, and was successful in enlisting troops and in checking the strong pro-Southern sentiment in the state. He was a member of the United States Senate in 1865–71, and was prominent in Reconstruction legislation. He died at St Louis, Missouri, on the 27th of November 1873. His son Richard (b. 1860) was governor of Illinois from 1901 to 1905.

YATSAUK, called by the Shans LAWKSAWK, a state in the central division of the southern Shan States of Burma. Area, 2197 sq. m. Pop. (1901), 24,839, of whom less than one-half are Shans; revenue, £2000. The crops grown are rice, segamum, cotton, ground-nuts and oranges. As a whole the state is mountainous, with ranges running N. and S. The main range has a general height of 5000 ft., with peaks, such as Loi Sampa, rising to 7846 ft. The middle and S., however, consist of open rolling country, with an average height of 3500 ft. To the N. the country falls away to the Nam Tu (Myitngè), where there are fine teak forests, as well as along the Nam Lang and Nam Et, which with the Zawgyi form the chief rivers of the state. Most of them disappear underground at intervals, which makes the extraction of timber impossible except for local use. Lawksawk, the capital, stands on the N. bank of the Zawgyi, near a small weedy lake. The old brick walls and the moat are falling into decay. The chief at the time of annexation had been at war with the Burmese, but refused to submit to the British, and fled to Kēng Hūng, where he died some years afterwards. The sawbwa chosen in 1887 belonged to another Shan ruling house. He died in 1900, and was succeeded by his son.

YATUNG, a trade-market of Tibet, situated in the mouth of the Chumbi valley near the Indian frontier. According to the Convention of 1890–93, the market at Yatung was opened to India, and the conduct of the Tibetans in building a wall across the road between Yatung and Tibet was one of the incidents that led up to the British mission of 1904. According to the treaty of that year, a British trade-agent was to be maintained at Yatung.

YAUCO, a city of the department of Ponce, Porto Rico, 20 m. W. by N. of the city of Ponce. Pop. (1899) 6108. Yauco is served by the American Railroad of Porto Rico. The city is situated about 150 ft. above the sea, and has a delightful climate. It is connected by a wagon road with its port, Guanica (pop. about 1000), which has an excellent harbour. Coffee and tobacco are the chief industries. Yauco was first settled in 1756.

YAVORSKY, STEPHEN (*c.* 1658–1722), Russian archbishop and statesman, one of the ablest coadjutors of Peter the Great, was educated at the Kiev Academy and various Polish schools. Becoming a monk, he settled at the Kiev Academy as a preacher and professor, being appointed prefect of the institution and prior of the monastery of St Nicholas. He attracted the attention of Peter by his funeral oration over the boyar Shein, and was made archbishop of Ryazan in 1700. In 1702, on the death of the last patriarch of Moscow, Yavorsky was appointed custodian of the spiritualities of the patriarchal see. Notwithstanding frequent collisions with Peter, and his partiality for the unfortunate tsarevich Alexius, Yavorsky was too valuable a man to be discarded. In 1721 he was made first president of the newly erected Holy Synod, but died in the following year.

Yavorsky's chief works are his *Rock of the Faith of the Orthodox-Catholic Eastern Church* and *Dogmatic, Moral and Panegyrical Sermons*. See Y. T. Samarin, *Stephen Yavorsky* (Rus.) (Moscow, 1844); I. Morev, "*The Rock of the Faith*" *of the Metropolitan Stephen Yavorsky* (Rus.) (Petersburg, 1904).

YAWL, the name of a special rig of small sailing vessels or yachts, with two masts, the mainmast cutter-rigged, and a small mizzen stepped far aft with a spanker or driving sail. The name has also been applied to a small ship's boat rowed with four or more oars. The word is apparently an adaptation of the Dutch *jol*, skiff.

The English "jolly-boat," a small bluff-bowed, wide-transomed ship's boat, swung at the stern of a vessel for ready use, is probably a corruption of the Danish form of the word *jolle*. Other authorities take it to be a corruption of a late 15th-century *jolywat*, a small ship's boat, which is supposed to represent *galiote*, galliot (see GALLEY). A galliot, however, was never a small boat, but an independent vessel propelled by oars or sails.

YAWS, the name in use in the British West Indies for a contagious inoculable tropical disease, running a chronic course and characterized by a peculiar eruption, together with more or less constitutional disturbance. It is known by various local names in different parts. In the French Antilles it is called *pian*; in Brazil, *boba*; on the west coast of Africa, *gattu*, *dubé* and *taranga*; in Fiji, *coko*; in the Malay Peninsula, *purru*; in the Moluccas, *bouton d'Amboine*; in Samoa, *tonga* or *tono*; in Basutoland, *makaola*; and in Ceylon it is spoken of under the name of *parangi.* The name *framboesia* was first given to the disease by Sauvages in 1759 from the likeness of the typical excrescences to a raspberry. For many years yaws was thought to be peculiar to the African negro, either in his home (both west and east coasts) or in the West Indies and Brazil. But a disease the same in every respect has long been known in the East Indies (first mentioned by Bontius early in the 17th century), affecting the Malays rather than the negroes, its chief seats being Amboyna, Ternate, Timor, Celebes, Java and Sumatra. It has been identified by De Rochas and other observers in New Caledonia and Fiji.

The general course of the disease is as follows. Previous to the eruption there may or may not be any disorder of health: in children (who form a large part of the subjects of yaws) there will probably be rheumatic pains in the limbs and joints, with languor, debility and upset of the digestion; in adults of ordinary vigour the eruption is often the first sign, and it is attended with few or no constitutional troubles. The eruption begins as small pimples like a pin's head, smooth and nearly level with the surface; they have a little whitish speck on their tops, grow rapidly and reach the size of a sixpence or a shilling. The pustules then break and a thick viscid ichor exudes and dries upon them as a whitish slough and around their base as a yellowish-brown crust. Beneath the whitish slough is the raspberry excrescence or yaw proper, a reddish fungous growth with a nodular surface. The favourite seats of the eruption are the forehead, face, neck, arm-pits, groin, genitals, perinaeum and buttocks. Hairs at the seat of a yaw turn white. In young children or infants the corners of the mouth ulcerate, as in syphilis, and the perineal excrescences resemble condylomata. The pustules and excrescences do not all arise in one crop: some are found mature while others are only starting. If the patient be of sound constitution and good reaction, the yaws may reach the full size of a mulberry in a month, in which case they will probably be few; but in persons of poor health they may take three months to attain the size of a wood-strawberry, in which case they will be numerous inversely to their size. Often there is one yaw much larger than the rest, and longer in falling; it is called the "master yaw" "or mother yaw." On the soles of the feet (less often on the palms of the hands) the bursting yaws are as if imprisoned beneath the horny cuticle; they cause swelling and tenderness of the foot, until set free by paring the callous skin down to the quick; these yaws are called "crab yaws" or *tubbas*. Usually a yaw is painless unless when rubbed or irritated. The absence of pain is used as a diagnostic sign if there be any doubt as to the nature of the attack: a pustule is opened and a little of the juice of capsicum dropped into it; if it be a yaw, no smarting will be felt. In some cases a few yaws will show themselves long after the primary attack is over; these are called "memba yaws" (from "remember"), the term being sometimes applied also to protracted cases with successive crops of eruption. Six weeks is the average time in a good case, from the first of the eruption to the fall of the excrescences; in such regular cases a scar remains, it may be for many months, darker than the rest of the (negro) skin. But the disease is often a much more tedious affair, the more protracted type having become common in the West Indies of recent years. In such cases the eruption comes out by degrees and as if with difficulty, crop after crop; foul, excavating and corroding ulcers may remain, or a limb may be in part seamed and mutilated by the scars of old ulceration. The scars after ulceration are not so dark as the skin around.

Aetiology.—Yaws is a highly contagious disease. It is neither hereditary nor congenital. The disease spreads by contact with previously infected cases, though it has been stated that infection also arises from inhabiting dirty houses, the floors and walls of which are contaminated with yawey matter from former yaw cases; and it is also believed, and has been proved by experiment, that infection may be conveyed by flies, which act as go-betweens, carrying infective material from a yaws sore to an ordinary ulcer. The virus must be introduced directly through a breach of the skin or mucous membrane; an attack in childhood gives a large degree of immunity for the rest of life. A micrococcus was found by Pierez and Nicholls in the tubercles of yaws, but a pure culture of this micro-organism failed to give rise to yaws in animals into whom it was injected experimentally, and in no instance was it present in the blood. In 1905 Aldo Castellani demonstrated in yaws the presence of a slender spirillum, which he named the *Spirochaeta pertenuis* or *Spirochaeta pallidula.* It was also experimentally proved by him (1) that the material taken from persons suffering from yaws and containing the *Spirochaeta pertenuis* is infective to monkeys; (2) that when the *Spirochaeta pertenuis* is removed by filtration the material becomes inert; (3) that the injection of blood from the general circulation of a yaws patient gave positive results in monkeys; (4) by means of the Bordet-Gengou reaction it is possible to detect specific yaws anti-bodies and antigen.

The prophylaxis consists in the segregation of the patients suffering from the disease, the antiseptic dressing of the eruption, the application of a covering to protect it from flies, and the thorough cleansing and disinfection of infected houses and clothing, even the demolition of houses in endemic centres, and finally the compulsory notification of cases of yaws to the local sanitary authority.

As regards treatment, the malady in a person of good constitution runs its course and gets well in a few weeks. Whatever tends to check the eruption, such as exposure to chill, is to be avoided. A week's course of cream of tartar and sulphur (confection of sulphur) at the beginning of the illness is often resorted to, so as to bring the eruption well out. The patient should remain indoors, in a well-aired room, and take daily warm baths and diluent drinks. If the excrescences are flabby and unhealthy, it is an indication for generous diet. When the eruption is declared, iodide of potassium and arsenic are very beneficial. As external applications, weak lotions of zinc or carbolic acid may be used, and, if the excrescences are irritable, a watery solution of opium. Tedious and unhealthy yaws should be dressed with a wash of sulphate of zinc or of copper; the same may be applied to a yaw ulcer. The crab yaws of the horny soles or palms, after they are let through by paring the cuticle, may be dusted with alum powder.

On the whole, the mortality is small. In 7157 West Indian cases treated in various hospitals there were only 185 deaths, a mortality of 25·8 per thousand (Nicholls).

YAZDEGERD ("made by God," *Izdegerdes*), the name of three Sassanid kings of Persia. (1) Yazdegerd I., son of Shapur III., 399–420, called "the sinner" by the Persians, was a highly intelligent ruler, who tried to emancipate himself from the dominion of the magnates and the Magian priests. He punished the nobles severely when they attempted oppression; he stopped the persecution of the Christians and granted them their own organization. With the Roman Empire he lived in peace and friendship, and is therefore as much praised by the Byzantine authors (Procop. *Pers.* i. 2; Agath. iv. 26) as he is blamed by the Persians. After a reign of twenty years he appears to have been murdered in Khorasan. (2) Yazdegerd II., was the son of Bahram V. Gor, 438–457. He persecuted the Christians and Jews, and had a short war with Rome in 441. He tried to extend his kingdom in the East and fought against the Kushans and Kidarites (or Huns). (3) Yazdegerd III., a grandson of Chosroes II., who had been murdered by his son Kavadh II. in 628, was raised to the throne in 632 after a series of internal conflicts. He was a mere child and never really ruled; in his first year the Arabic invasion began, and in 637 the battle of Kadisiya decided the fate of the empire. Ctesiphon was occupied by the Arabs, and the king fled into Media. Yazdegerd fled from one district to another, till at last he was murdered at Merv in 651 (see Caliphate, sect. A. 1). The Parsees, who use the old Persian calendar, continue to count the years from his accession (era of Yazdegerd, beginning June 16th, A.D. 632). (Ed. M.)

YEAST (O.E. *giest* or *gyst*; the root *yes-*, to boil, ferment, is seen in Sansk. *nir-yāsa*, exudations from trees, and Gr. *ζέειν*, to boil), a cellular organism produced in the alcoholic fermentation of saccharine liquids (see Fungi, Fermentation, Brewing).

YEATS, WILLIAM BUTLER (1865–), Irish author, son of J. B. Yeats (b. 1839), a distinguished Irish artist and member of the Royal Hibernian Academy, was born at Sandymount, Dublin, on the 13th of June 1865. At nine years old he went to live with his parents in London, and was sent to the Godolphin School, Hammersmith. At fifteen he went to the Erasmus Smith School in Dublin. Later he studied painting for a short time at the Royal Dublin Society, but soon turned to literature, contributing poems and articles to the *Dublin University Review* and other Irish periodicals. In 1888 he was encouraged by Oscar Wilde to try his fortune in London, where he published in 1889 his first volume of verse, *The Wanderings of Oisin*; its original and romantic touch impressed discerning critics, and started a new interest in the "Celtic" movement. The same year and the next he contributed to Mr Walter Scott's "Camelot Series," edited by Ernest Rhys, *Fairy and Folk Tales*, a collection of Irish folklore, and *Tales from Carleton*, with original introductions. In 1891 he wrote anonymously two Irish stories, *John Sherman* and *Dhoya*, for Mr Fisher Unwin's "Pseudonym Library." In 1892 he published another volume of verse, including *The Countess Kathleen* (a romantic drama), which gave the book its title, and in 1893 *The Celtic Twilight*, a volume of essays and sketches in prose. He now submitted his earlier poetical work to careful revision, and it was in the revised versions of *The Wanderings of Usheen* and *The Countess Kathleen*, and the lyrics given in his collected *Poems* of 1895 that his authentic poetical note found adequate expression and was recognized as marking the rise of a new Irish school. In the meantime he had followed *The Countess Kathleen* with another poetical drama, *The Land of Heart's Desire*, acted at the Avenue Theatre for six weeks in the spring of 1894, published in May of that year. He contributed to various periodicals, notably to the *National Observer* and the *Bookman*, and also to the *Book of the Rhymers' Club*—the English *Parnasse Contemporain* of the early 'nineties. With Edwin J. Ellis he edited the *Works of William Blake* (1893), and also edited *A Book of Irish Verse* (1895). In 1897 appeared *The Secret Rose*, a collection of Irish legends and tales in prose, with poetry interspersed, containing the stories of Hanrahan the Red. The same year he printed privately *The Tables of the Law* and the *Adoration of the Magi*, afterwards published in a volume of Mr Elkin Mathews's "Vigo Street Cabinet" in 1904. In 1889 he published *The Wind among the Reeds*, containing some of his best lyrics, and in 1900 another poetical drama, *The Shadowy Waters*. He now became specially interested in the establishment of an Irish literary theatre; and he founded and conducted an occasional periodical (appearing fitfully at irregular intervals), called first *Beltain* and later *Samhain*, to expound its aims and preach his own views, the first number appearing in May 1899. In the autumn of 1901 Mr F. R. Benson's company produced in London the play *Diarmuid and Grania*, written in collaboration by him and George Moore. In 1902 he published his own first original play in prose, *Cathleen ni Houlihan*, which was printed in *Samhain* in October that year. In 1903 he collected and published a volume of literary and critical essays, to which he gave the title, *Ideas of Good and Evil*. In the same and the following years he published a collected edition of his *Plays for an Irish Theatre*, comprising *Where There is Nothing*, *The Hour-Glass*, *Cathleen ni Houlihan*, *The Pot of Broth*, *The King's Threshold* and *On Baile's Strand*. In 1904 he also edited two volumes of *Irish Representative Tales*. Whether or not "Celtic" is the right word for it, Mr Yeats's art was quickly identified by enthusiasts with the literary side of the new Irish national movement. His inspiration may be traced in some measure to the Pre-Raphaelites and also to Blake, Shelley and Maeterlinck; but he found in his native Irish legend and life matter apt for his romantic and often elfin music, with its artful simplicities and unhackneyed cadences, and its elusive, inconclusive charm.

See the section on W. B. Yeats in *Poets of the Younger Generation* by William Archer (1902), and for bibliography up to June 1903, *English Illustrated Magazine*, vol. xxix. (N.S.) p. 288. A library edition of his collected works in prose and verse was issued by Mr Bullen from the Shakespeare Head Works, Stratford-on-Avon, in 8 vols., 1908.

YECLA, a town of E. Spain, in the extreme N. of the province of Murcia, on the Yecla-Villena railway; it is situated on the W. slope of Monte Castillo, which rises above the left bank of the Arroyo del Jua. Pop. (1900) 18,743. The chief buildings are a half-ruined citadel, a modern parish church with a pillared Corinthian façade, and a town hall standing in a fine arcaded square. Yecla has a thriving trade in the grain, wine, oil, fruit and esparto grass produced in the surrounding country.

YEISK, a town of Russia, in the province of Kuban (Caucasus), founded in 1848 on a sandbank which separates the shallow Bay of Yeisk from the Sea of Azov, 76 m. S.W. of Rostov-on-the-Don. Pop. 35,446. Notwithstanding its shallow roadstead, Yeisk has grown with great rapidity, and exports corn, linseed and wool. There are wool-cleansing factories, oil-works and tanneries.

YELLOW FEVER, a specific infective tropical fever, the germ of which is transmitted by the *Stegomyia fasciata* or domestic mosquito, occurring endemically in certain limited areas. The area of distribution includes the West Indies, Mexico, part of Central America, the W. coast of Africa and Brazil.

The first authentic account of yellow fever comes from Bridgetown, Barbados, in 1647, where it was recognized as a "nova pestis" that was unaccountable in its origin, except that Ligon, the historian of the colony, who was then on the spot, connected it with the arrival of ships. It was the same new pestilence that Dutertre, writing in 1667, described as having occurred in the French colony of Guadeloupe in 1635 and 1640; it recurred at Guadeloupe in 1648, and broke out in a peculiarly disastrous form at St Kitts the same year, and again in 1652; in 1655 it was at Port Royal, Jamaica; and from those years onwards it became familiar at many harbours in the West Indies and Spanish Main. It appeared at the Brazilian ports in 1849. In 1853 it appeared in Peru and in 1820 on the W. coast of Africa. In Georgetown (British Guiana) 69% of the garrison died in 1840.

During the great period of yellow fever (1793–1805), and for some years afterwards, the disease found its way time after time to various ports of Spain. Cadiz suffered five epidemics in the 18th century, Malaga one and Lisbon one; but from 1800 down to 1821 the disease assumed much more alarming proportions, Cadiz being still its chief seat, while Seville, Malaga, Cartagena, Barcelona, Palma, Gibraltar and other shipping places suffered severely, as well as some of the country districts nearest to the ports. In the severe epidemic at Barcelona in the summer of 1821, 5000 persons died. At Lisbon in 1857 upwards of 6000 died in a few weeks. In New Orleans 7970 people died in 1853, 3093 in 1867, and 4056 in 1878. In Rio 4160 died in 1850, 1943 in 1852, and 1397 in 1886.

Certain distinct conditions have seemed to be necessary for an outbreak. Foremost we may notice a high atmospheric temperature, one of 75° F. or over. As the thermometer sinks, the disease ceases to spread. Moisture favours the spread of yellow fever, and epidemics in the tropics have usually occurred about the rainy season. Seaport towns are most affected. In many instances the elevated airy and hygienic quarters of a town may escape, while the shore districts are decimated. Usually the disease does not spread to villages or sparsely populated districts. Certain houses become hotbeds of the disease, case after case occurring in them; and it is usually in houses that the disease is contracted. A house may be said to be infected when it contains infected mosquitoes, whether there be a yellow-fever patient there or not. Ships become infected in the same way, the old wooden trading ships affording an ideal hiding-place to the *Stegomyia* in a way that the modern and airy steamship does not.

The incubation period of yellow fever is generally four or five days, but it may be as short as twenty-four hours. There are usually three marked stages: (1) the febrile period, (2) the period of remission or lull, (3) in severe cases, the period of reaction. The illness usually starts with languor, chilliness, headache, and muscular pains, which might be the precursors of any febrile attack. These are followed by a peculiar look of the eyes and face, which is characteristic: the face is flushed, and the eyes suffused at first and then congested or ferrety, the nostrils and lips red, and the tongue scarlet—these being the most obvious signs of universal congestion of the skin, mucous membranes and organs. Meanwhile the temperature has risen to fever heat, and may reach a very high figure (maximum of 110° Fahr., it is said); the pulse is quick, strong and full, but may not keep up in these characters with the high temperature throughout. There are all the usual accompaniments of high fever, including hot skin, failure of appetite, thirst, nausea, restlessness and delirium (which may or may not be violent); albumen will nearly always be found in the urine. The fever is continued; but the febrile excitement comes to an end after two or three days. In a certain class of ambulatory or masked cases the febrile reaction may never come out, and the shock of the infection after a brief interval may lead unexpectedly and directly to prostration and death. The cessation of the paroxysm makes the *stadium*, or lull, characteristic of yellow fever. The hitherto militant or violent symptoms cease, and prostration or collapse ensues. The internal heat falls below the normal; the action of the heart (pulse) becomes slow and feeble, the skin cold and of a lemon-yellow tint, the act of vomiting effortless, like that of an infant, the first vomit being clear fluid, but afterwards black from an admixture of blood. It is at this period that the prospect of recovery or of a fatal issue declares itself. The prostration following the paroxysm of fever may be no more than the weakness of commencing recovery, with copious flow of urine, which even then is very dark-coloured from the presence of blood. The prostration will be all the more profound according to the height reached by the temperature during the acute paroxysm. Much blood in the vomit and in the stools, together with all other haemorrhagic signs, is of evil omen. Death may also be ushered in by suppression of urine, coma and convulsions, or by fainting from failure of the heart. In severe types of the disease an apoplectic, an algid and a choleraic form have been described.

The case mortality averages from 12 to 80%. In Rio in 1898 it reached the appalling height of 94·5%. In cities where it is endemic the case mortality is usually lower. In 269 cases observed by Sternberg, the mean mortality was 27·7%. In 158 cases of yellow fever in Vera Cruz in 1905 there were 91 deaths. The death-rate, however, tends to vary in different epidemics. In the epidemic occurring in Zacapa, Mexico, in 1905 in a population of 6000 there were 700 cases, and the mortality among the infected was 40%.

Treatment.—The patient should be removed from the focus of infection and nursed in a well-ventilated room, screened from mosquitoes. The further treatment is symtomatic. A purgative, followed by hot baths, is useful in the early stages to relieve congestion, high temperature may be controlled by sponging; vomiting, by ice; or, if haemorrhagic, by ergot, perchloride of iron or other styptics; and pilocarpine may be given if the urine be scanty. Sternberg has introduced a system of treatment by alkalis to counteract the hyperacidity of the intestinal contents and increase the flow of urine. Of 301 whites treated by this method only 7·3% died, and of 72 blacks all recovered.

Causation.—The pathology of the disease is discussed in the article Parasitic Diseases. In 1881 Dr Charles Finlay, of Havana, propounded the theory that mosquitoes were the carriers of the infection. Numerous theories had previously been brought forward, notably that of the *Bacillus icteroides*, described by Sanarelli; but it is now certain that this organism is not the cause. Other authorities held that the disease was spread by contagion, by miasmata, or some other of the vague agencies which have always been put forward in the absence of exact knowledge. Finlay's mosquito theory remained in abeyance until attention was again drawn to it by the demonstration in recent years of the part played by these insects in the causation of other tropical diseases. The mosquito selected by Finlay was the *Stegomyia fasciata*, a black insect with silvery markings on the thorax, which is exceedingly common in the endemic area. It frequents towns, and breeds in any stagnant water about houses. Specimens were caught, fed upon yellow-fever patients, kept for a fortnight, and then allowed to bite susceptible persons established in a special camp with other susceptible persons as a control. Those bitten developed the fever, the others did not. An American commission was appointed in 1900, consisting of Walter Reed, James Carroll, A. Agramonte and Lazear, and its conclusions were: that the *Stegomyia fasciata* is the agent of infection, that the virus of yellow fever is present in the blood during the first three days of the fever, and is generally absent on the fourth; that the germ is so small that it can pass through a Chamberland porcelain filter; that the bite of all infected *Stegomyia* does not produce yellow fever (about 35% of the experiments proving negative); that mosquitoes fed on yellow-fever blood were not capable of giving rise to infection until after a lapse of twelve or fourteen days, but the insects retained their infective power for at least fifty-seven days. It can therefore be concluded that the virus of yellow fever is a parasite, requiring as in malaria an alternate passage through a vertebrate and an insect host, the analogy to malaria being very complete. E. Marchoux and P. L. Simond, of the French Yellow Fever Commission to Rio de Janeiro, 1906, have observed an interesting fact in connexion with the *S. fasciata.* In order to lay her eggs she must first have a feed of blood, three days after which she lays them. Before she lays her eggs she strikes both day and night, after that period at night only. Persons bitten in the day-time, therefore, do not develop yellow fever, while those bitten at night do. This may explain the impunity with which Europeans may visit an infected district in the day-time provided that they are careful not to sleep there at night. It was stated by Marchoux and Simond that an infected mosquito transmits the parasite to her eggs, the progeny proving infective.

Prophylaxis.—Following on the publication of these experiments there was instituted a vigorous campaign against mosquitoes in Havana in 1901, based on the methods applied to the suppression of malaria, and carried out under the direction of Major W. C. Gorgas of the United States army, chief sanitary officer of Havana. The work was begun on the 27th of February 1901. An order was issued that all receptacles containing water were to be kept mosquito-proof; sanitary inspectors were told off for each district to maintain a constant house-to-house inspection, and to treat all puddles, &c., with oil; receptacles found to contain larvae were destroyed and their owners fined; breeding-grounds near the town were treated by draining and oil; hospitals and houses containing yellow-fever patients were screened; infected and adjacent buildings were fumigated with pyrethrum powder. The results exceeded all expectation, and after January 1902 the disease entirely ceased to originate in Havana. Cases occasionally now come into Havana from Mexican ports, but are treated under screens with impunity in ordinary city hospitals and never at any time infect the city. Thus in 1907 there was one death from yellow fever, and the general death-rate of Havana from all diseases was 17 per thousand. In the *Bulletin of Public Health and Charities of Cuba* it is stated there only occurred between 1905–9 a total of 345 cases of yellow fever in all Cuba, where formerly they numbered many thousands, and in April 1910 the republic was declared to be entirely free from the disease.

Among other modern outbreaks in which sanitary measures have triumphed in the suppression of yellow fever were the outbreak in New Orleans in 1905, in which a medical staff of 50 with subordinates to the number of 1203 started immediately on the outbreak to clean up the city; the outbreak in Belize, British Honduras, in 1905; the anti-yellow-fever campaign undertaken in the British W. Indies in 1906–9. As soon as the Isthmian Canal commissioners took over the administration of the Panama Canal Zone they undertook a vigorous campaign against the mosquito, as the result of which yellow fever was successfully banished. Colonel Gorgas in his 1908 report wrote: "It is now three years since a case of yellow fever has developed in the Isthmus, the last being in November 1905."

Rio de Janeiro, which had lost 28,078 inhabitants in 13 years by yellow fever, and Santo, have also waged war against the disease; as a result of the anti-*Stegomyia* policy the deaths from yellow fever in Rio fell to 42 in 1906, 39 in 1907, 4 in 1908, and 0 in 1909.

See Sir P. Manson, *Tropical Diseases* (1907); article "Yellow Fever" in Allbutt and Rolleston's *System of Medicine*; Sir R. Boyce, *Report on Yellow Fever in Honduras* (1906), and *Health and Administration in the West Indies* (1910); *Bulletins of the U.S. Yellow Fever Institute*; *Annales de l'Institut Pasteur* (January 1906).

YELLOWSTONE NATIONAL PARK, an American national reservation, situated mainly in N.W. Wyoming, U.S.A., dedicated by the United States government as "a public park or pleasure ground for the benefit and enjoyment of the people." It is nearly a rectangle in shape, with a length, from N. to S., of 62 m., a width of 54 m. and an area of approximately 3350 sq. m. It extends into Montana, on the N., about $2\frac{1}{4}$ m. and into Montana and Idaho, on the W., 2 m. Except at its main entrance, through the valley of the Yellowstone on the N., the park is entirely surrounded by national forests: the Gallatin and Absaroka national forests, on the N.; the Shoshone and the Beartooth, on the E.; the Teton, on the S.; and the Targhee, the Madison and the Gallatin, on the W.

The central portion, comprising an area of about 2000 sq. m., is an undulating volcanic plateau with a mean elevation above the sea of about 8000 ft. Along the entire E. border stretches the Absaroka range, with peaks exceeding 11,000 ft. (Index Peak, 11,740 ft.) in height. On the N. is the Snowy range with its snow-capped peaks. W. of the Snowy the Gallatin range extends S. for 20 m. along the W. border. Electric Peak, in the N.W. corner of the park, rises to a height of 11,155 ft. Near the S. end of the park are the Red Mountains, which culminate in Mt. Sheridan (10,385 ft.) and afford a magnificent view of the whole region; and farther S. the N. spur of the lofty Tetons juts across the S. border.

In the production of these mountains and plateau there was first, at the close of the Cretaceous period, an upheaval of the earth's substance to form a mountain rim and a depressed basin. Subsequently, in the Tertiary period, there were two enormous outpourings of volcanic material—first andesitic lava, and later, after a long interval of quiet, rhyolitic—which nearly half filled the basin, converted it into a plateau and broke up the mountain rim. Two centres of volcanic activity were Mt. Sheridan, in the S., and Mt. Washburn, in the N. The volcanoes have long been extinct, but the diminished energy now causes hot springs and geysers in all parts of the plateau, about 100 in number. More than half, including the largest and finest, are in the upper and the lower Geyser basins, near the head of the Madison, here known as the Firehole, river. Several others are farther N. in the Norris basin upon Gibbon river, a branch of the Madison, and others are farther S. in the Shoshone basin.

Excelsior, the largest geyser, with a crater about 300 ft. long and 200 ft. wide, has not been active since 1890, but for several years after its discovery it threw up at intervals a huge mass of water to a height of 200–250 ft. Old Faithful, at regular intervals of 65–70 minutes, throws up a column of hot water 2 ft. in diameter to a height of 125–150 ft., and the eruption lasts 4–$4\frac{1}{2}$ minutes. The Giant, at intervals of 2 to 4 days or more, throws up a column to a height of 250 ft. for 90 minutes. The Beehive (so called from the shape of its cone), the Grand and the Lone Star throw up columns to a height of 200 ft. but at irregular intervals. In the Norris basin are the Black Growler and the Hurricane, which consist of small apertures through which steam rushes with such tremendous force that it may be heard for miles. The hot springs are widely distributed over the plateau and number from 3000 to 4000. The water of most of the springs and geysers holds silica in solution in considerable quantities, so that as it cools and evaporates it deposits a dazzling white sinter which has covered many square miles of the valleys and contrasts strongly with the dark green of the surrounding forests. The springs, geysers and steam vents are scattered over it in the most irregular fashion. The silicious matter has also built up around the springs and geysers cones or mounds of considerable size and great beauty of form. The water of many of the springs contains sulphur, iron, alum and other materials in solution, which in places stain the pure white sinter with bright bands of colour. The tints and hues of some of the pools are of matchless beauty. Near the N. boundary of the park there is a group of about 70 active springs, known as the Mammoth Hot Springs, which hold carbonate of lime in solution. Their deposits have built across a small valley or ravine a series of broad, flat, concentric terraces beautiful in form and 300 ft. in height. The water which trickles over the rims of the pools and basins on the upper terraces is a transparent blue, while the formation itself contains a network of fibrous algae which gives it a wonderful variety of colours. In the lower Geyser basin are the Mammoth Paint Pots, a group of mud springs with colours varying according to the mineral ingredients in the steam, which not only colours the mud but also forms it into imitative figures. Near the centre of the park is Mud Caldron, a circular crater about 40 ft. deep with the boiling mud at the bottom. Although there have been some changes in the thermal energy in the park since 1871, there has been no appreciable diminution. Certain springs and geysers lose some of their energy at intervals, while others gain; certain geysers have become quiescent, but some new ones have been formed.

The Continental Divide crosses the park in a S.E. direction from the meeting-point of the states of Wyoming, Idaho and Montana. The small section S. of the Divide is drained by the Snake river into the Columbia river and the Pacific Ocean; the large section N. of the Divide is drained by the Yellowstone and Madison rivers into the Missouri, the Mississippi and the Gulf of Mexico. The Lewis river, a fork of the Snake, has its origin in the beautiful Shoshone Lake, and the Heart river, another fork of the Snake, rises in Heart Lake, under Mt. Sheridan.

The Yellowstone drains the entire E. section. Rising just beyond its S. limits, it flows into and through Yellowstone Lake, a magnificent sheet of water, very irregular in shape, dotted with forested islands, having an area of about 140 sq. m., lying 7741 ft. above the sea and nearly surrounded by lofty mountains. A few miles below the lake, the river, after a succession of rapids, leaps over a cliff, making the Upper Fall, 109 ft. in height. Half a mile lower down it rolls over the Lower Fall, which has a clear descent of 308 ft. The river at this point carries, at the average stage of water, about 1200 cub. ft. per second. With this fall the river enters the "Grand Canyon," which in many scenic effects is unequalled. Its depth is not great, at least as compared with the canyons upon the Colorado river system; it ranges from 600 ft. at its head to 1200 near the middle, where it passes the Washburn Mountains. Its length to the mouth of Lamar river is 24 m. It is cut in the volcanic plateau, and its ragged broken walls, which are inclined at very steep angles, are of a richness of colouring that almost defies description, a colouring that is produced by the action of the thermal springs, at the base of the canyon, upon the mineral pigments in the lava. Bright orange, yellow, red and purple hues predominate and are set off very effectively against the dark green pines with which the margins of the canyon are fringed, and the white foam of the river at the bottom of the chasm. Near the foot of the Grand Canyon, Tower creek, which drains the concavity of the horseshoe formed by the Washburn Mountains, enters the Yellowstone. Just above its mouth this stream makes a beautiful fall of 132 ft. into the gorge in which it joins the river. A few miles farther down, the Yellowstone is joined by an E. branch, Lamar river, which drains a large part of the Absaroka Range. Then it enters the Third Canyon, from which it emerges at the mouth of Gardiner river. The latter stream drains an area of elevated land by means of its three forks, and upon each of them occurs a fine fall in its descent toward the Yellowstone. The Madison rises in the W. of the park and flows in a generally N. and then W. course out of the park. Its waters are mainly collected from the rainfall upon the plateaux, and from the hot springs and geysers, most of which are within its drainage area. Upon this river and its affluents are several fine falls. Indeed, all the streams in this region show evidence, in the character of their courses, of a recent change of level in the surface of the country.

The climate, influenced by the high elevation, is characterized by long and severe winters and short summers with great diurnal extremes of temperature. But the low temperature causes the moisture-laden winds to deposit here greater quantities of rain and snow than in the semi-arid regions below, which not only promote the growth of vegetation, but cause the activity of the springs, geysers and waterfalls. The mean annual temperature at the station of the United States Weather Bureau, near the N. boundary, is 39° F. The summer (June, July and August) mean is 59°; the winter (December, January and February) mean, 20°.

Extremes have ranged from 96° in July to −35° in February. The temperature has fallen to 30° in July, and a warm summer day may at any time be followed by frost at night. The mean annual precipitation is 19·6 in. Much of this is in the form of snow, and nearly half of it is during the four months from December to March; in the four dryest months, from July to October, it is only 4·4 in. Some snow falls in every month except July and August, and the average annual snowfall amounts to 94·7 in. The prevailing winds are S.

About four-fifths of the park is covered with dense forests of black pine (*Pinus Murrayana*), balsam, fir, spruce, cedar and poplar. These trees do not attain a large size. A low blueberry (*Vaccinium myrtilis*) forms a thick underbrush in much of the forest. Choke-cherries, gooseberries, buffalo-berries, red currants and black currants grow along the streams and in moist places of the lower altitudes. In the glades are bunch-grass and a variety of flowering plants; buttercups, daisies, forget-me-nots and other wild flowers may be found near melting snow-banks in August. In the hot-spring districts are plants with peculiarities both of those common to the desert and those common to the seashore. In the N.E. corner of the park fossil forests rise one above the other. After the destruction of one forest by volcanic eruptions another grew over it; it, too, was buried under volcanic material, and the process was repeated several times.

The native fauna is abundant and varied. The policy of the government which protects game, both in the park and in the surrounding national forests, has induced elk, deer, antelope, mountain-sheep, bears, porcupines, coyotes, squirrels, gophers and woodchucks to take shelter here. There are also a few moose and some beavers. Black, brown and grizzly bears may be seen at almost any time during the summer season feeding on the garbage from the hotels. A few wild bison still remain at large, and besides these there is a herd of about 100 confined within a pasture in the Lamar Valley. The lakes and rivers are well stocked with trout and other fish, and visitors have the privilege of catching a limited number with rod and line. Robins, bluebirds, warblers, chickadees, finches, vireos, wrens, yellow-headed blackbirds, nutcrackers, nuthatches, meadow-larks, sparrows, woodpeckers, swifts, kingbirds and several other species of small birds are found in the park, but the number of each is not great. Among birds of prey are the golden eagle, bald eagle, hawks and owls. Geese, ducks, cranes, pelicans and gulls are very numerous in the autumn months.

The park is under the supervision of a superintendent who is appointed and instructed by the Secretary of the Interior. It is policed, however, by troops of United States cavalry with headquarters at Fort Yellowstone, near the Mammoth Hot Springs, and the building of roads and other improvements is under the direction of the Secretary of War. The only railway approaches to the park are a branch of the Northern Pacific railway up the valley of the Yellowstone to the main gate at Gardiner, Montana, and a branch of the Oregon Short Line up the valley of the North Fork of the Snake to Yellowstone, Montana. Automobiles are not allowed within the park, and the principal means of conveyance is by stage coaches and by a steamboat on Yellowstone Lake. There are hotels at the Mammoth Hot Springs, at the principal geyser basins and at Yellowstone Lake. The hotels and stage lines open for the tourist season early in June and close in the middle of September.

The strange phenomena of this region were known to some of the Indians; they were discovered by John Colter, a member of the Lewis and Clark expedition, in 1807; the region was visited by James Bridger before 1840; an account of the geysers was published at Nauvoo, Illinois, in *The Wasp*, a Mormon paper, in 1842; Captain W. F. Raynolds, of the United States Corps of Topographical Engineers, with full knowledge of Bridger's accounts, was ordered to explore the region in 1859, and yet, chiefly because of the persistent incredulity with which the accounts of the phenomena were received, the region remained practically unknown until 1870. From 1863 to 1866 gold seekers repeatedly confirmed the early reports, and the publication of their accounts in Western papers gradually aroused interest. In 1869 a private exploring party, consisting of David E. Folsom, C. W. Cook and William Peterson, set out from the gold-fields of Montana with the express purpose of verifying or refuting the rumours, and they returned full of enthusiasm. In 1870 a semi-official expedition, led by Henry D. Washburn, the surveyor-general of Montana, and Lieutenant Gustavus C. Doane of the Second United States Cavalry, made the "Yellowstone Wonderland" widely known. A year later an expedition under Dr Ferdinand V. Hayden (1829–1887) made a large collection of specimens and photographs, and with these data, together with the reports of this and the Washburn-Doane expedition, Congress was induced to reserve the area from settlement, which was done by an act approved the 1st of March 1872. In that year further explorations were made, and in subsequent years army expeditions continued the work of exploration. In 1878 a map of the park based upon triangulation was drawn up by the Hayden survey, and in 1883–85 a more detailed map was made by the United States Geological Survey, and a systematic study of its geological phenomena was instituted.

See Arnold Hague, *Geology of the Yellowstone National Park* (Washington, 1899), "Geological History of the Yellowstone National Park," in the *Annual Reports* of the Smithsonian Institution (ibid., 1893), and "The Yellowstone National Park," in *Scribner's Magazine* (May, 1904); W. H. Weed, "Formation of Travertine and Siliceous Sinter by the Vegetation of Hot Springs," in the 9th *Annual Report* of the Director of the United States Geological Survey (Washington, 1889); descriptions in the 5th, 6th and 12th *Reports* of the Hayden Geological and Geographical Survey of the Territories (ibid., 1871, 1872 and 1878); J. H. Raftery, *Historical and Descriptive Sketch of the Yellowstone National Park*, Senate Document No. 752, 2nd Session of the 60th Congress (ibid., 1909); H. M. Chittenden, *Yellowstone National Park, Historical and Descriptive* (Cincinnati, 1895); and *Annual Reports* of the Superintendent of the Park (Washington, 1880 sqq.).

YEMEN (*Yaman*), a province of Arabia, forming the S.W. corner of the peninsula, between 12° 35′ and 18° N., and 42° and 47° E., bounded on the N. by Asir and on the E. by the Dahna desert and Hadramut. Ptolemy and the ancient geographers in general include the whole peninsula under the name of Arabia Felix (εὐδαίμων), in which sense they translate the Arabic *Yemen*, literally "right hand," for all Arabia S. of the Gulf of Akaba was to the right from their standpoint of Alexandria; the Mahommedan geographers, however, viewing it from Mecca, confine the term to the provinces S. of Hejaz, including Asir, Hadramut, Oman and part of southern Nejd. The Turkish vilayet of Yemen includes Asir, and extends along the Red Sea coast from El Laith in the N. to Shekh Said at the straits of Bab-el-Mandeb; its land boundary on the E. is undefined, except in the S.E., where the boundary between Turkish territory and that of the independent tribes under British protection was defined by an agreement between Great Britain and Turkey in 1904, by a line running approximately N.E. from Shekh Said to the Dahna desert. The main physical characteristics of the province are described in the article ARABIA. A lowland strip 20 to 30 m. wide extends along its western and southern coasts, skirting the great mountain range which runs along the whole western side of the Arabian peninsula, and attains its greatest height in the Jibal, or highlands of Yemen; beyond this mountain zone the interior plateau falls gradually towards the N.E. to the Dahna desert.

The lowland, or Tehama, is hot and generally sterile; it contains oases, however, near the foot of the mountains, fertilized and irrigated by hill streams and supporting many large villages and towns. The most important of these are Abu Arish, Bet el Fakih and Zubed in the western Tehama, the latter a thriving town of 20,000 inhabitants and the residence of a Turkish kaimakām; and Abyan and Lahej, the chief place of the independent Abdali tribe, in the southern Tehama. Hodeda and Aden are the only ports of commercial importance, Lohaia and Ghalefika have sunk to insignificant fishing villages, and Mokha, the old centre of the coffee trade, is now almost deserted. The Jibal forms a mountainous zone some 50 m. in width rising steeply from the foothills of the Tehama to an average height of 9000 ft.; many summits exceed 10,000 ft.—the highest fixed by actual survey is Jebel Manar, 10,565 ft., about 10 m. E. of the town of Ibb. With its temperate climate and regular rainfall, due to the influence of the S.W. monsoon, the Jibal must be considered the most favoured district of Arabia. The villages are substantially built of stone, often picturesquely situated on the spurs and crests of the hills, the houses clustering round the *dars* or towers which dominate the cultivated slopes and valleys. The principal crops are wheat, barley, millet and coffee, the last-named more particularly on the western slopes of the range within reach of the moist sea-breezes. In many places the hillsides, otherwise too steep for cultivation, are cut into terraced fields supported by stone walls; the name given by the Greek geographers to the range of S. Arabia was no doubt intended to describe the step-like appearance of the hills due to this method of cultivation. A special characteristic of the Yemen highlands is that fields and inhabited sites are found at the highest elevations, the mountain-tops forming extensive plateaux, often scarped on every side and only accessible by difficult paths cut in the cliffs which encircle them like the escarpments of a natural fortress; a remarkable example of this is Jebel Jihaf on the Aden border, 8000 ft.

above sea-level and 4000 ft. above the Kataba valley, an isolated plateau some 6 m. long, containing thirty or forty villages.

The principal town of the Jibal is Ta'iz, the seat of a Turkish mutassarif; its present population does not exceed 4000, but it was formerly a large city, and from its position in the centre of a comparatively fertile district at the junction of several trade routes it must always be important. It contains five mosques and the Turkish government offices and barracks, and in the business quarter several cafés and shops kept by Greeks. The climate is unhealthy, perhaps owing to its position in a low valley, 4400 ft. above sea-level, at the foot of the lofty Jebel Sabur (9900 ft.), and even in Niebuhr's time many of the houses in the city were in ruins. Thirty miles further N. are the small towns of Ibb (6700 ft.) and Jibla, about 5 m. apart, typical hill towns with their high stone-built houses and paved streets. To the E. on the main road to the coast via Zubed is Udēn, the centre of a coffee-growing district; 80 m. to the N. is Manākha, a Turkish post on the main road from Hodeda to the capital, and the chief place of Jebel Harāz, which produces the best coffee in Yemen. Another group of hill towns lies still further N. in the mountain mass between the Wadi Maur and Wadi La'a, where the strongholds of Dhāfir, Afār, Haja and Kaurkabān held out for long against the Turkish advance; the last-named town, now almost deserted, was once a city of 20,000 inhabitants, and the capital of a small principality which preserved its independence during the earlier Turkish occupation between 1536 and 1630.

The inner or plateau zone of Yemen stretches along the whole length of the province, with an average width of 120 m.; it lies entirely to the E. of the high range, and has therefore a smaller rainfall than the Jibal; its general character is that of a steppe increasing in aridity towards the E. where it merges in the desert, but broken in places by rocky ranges, some of which rise 2000 ft. above the general level, and which in the Hamdan district N. of Sana show evidence of volcanic action. It is intersected by several *wadi* systems, of which the principal are those in the N. uniting to form the Wadi Nejrān, in the centre the Wadi Khārid and Shibwān running to the Jauf, and in the S. the Wadi Bana and its affluents draining to the Gulf of Aden. The plateau has a gradual fall from the watershed near Yarim, 8500 ft. above sea-level, to less than 4000 ft. at the edge of the desert.

The northern part nearly down to the latitude of Sana, is the territory of the warlike Hāshid and Bakīl tribes, which have never submitted to the Turks, and in 1892 and again in 1904–5 drove the Turkish troops from almost every garrison in the province, and for a time held the capital Sana itself for the Imām Muhammad Yahiya, the representative of the old dynasty that ruled in Yemen from the expulsion of the Turks in 1630 till its reconquest in 1871. The principal places are Sa'da, the residence of the Imām, an important town on the old pilgrim road 120 m. N. of Sana, Khaiwān and Khamr. In the N.E., bordering on the desert, is the district of Nejrān, a mountainous country with several fertile valleys including the Wadi Nejrān, Bedr and Habuna, all probably draining N.E. to the Wadi Dāwasir. Further S. is the oasis of Jauf, a hollow or depression, as its name signifies, containing many villages, and of great antiquarian interest as the central point of the old Minaean and Sabaean kingdoms, known to the ancients from the earliest historical times through their control of the frankincense trade of S. Arabia. Ma'in, identified by Halévy as the seat of the former, is on a hilltop surrounded by walls still well preserved. Numerous other ruins were found by him in the neighbourhood, together with inscriptions supporting the identification. Mārib, the Sabaean capital, was celebrated for its great dam, built according to tradition by the Queen of Sheba, and the bursting of which in A.D. 120 is said to have led to the abandonment of the city. This was, however, more probably due to the deterioration of the country through desiccation, which has forced the settled population farther westward, where Sana became the centre of the later Himyaritic kingdom. The Arhab district drained by the Wadi Khārid and Shibwān between Sana and the Jauf is covered with Himyaritic ruins, showing that the land formerly supported a large settled population where owing to the want of water cultivation is now impossible.

South of this independent tribal territory the principal places are Amran and Shibām on the road leading N. from the capital Sana; Dhamar (a town of 4000 inhabitants, the residence of a kaimakām, and the seat of an ancient university) and Yarim are on the road leading S. to Aden; and two days' journey to the E. is Rada in the extreme S.E. of Turkish Yemen, formerly a large town, but now much decayed. From near Rada the boundary runs S.W. to the small town of Ka'taba through which the direct road passes from Aden to Sana. The territory to the S. and E. is occupied by independent tribes under British protection, of which the principal are the Yafa', the Haushabi and the Abdali.

The inhabitants of Yemen are settled, and for the most part occupied in agriculture and trade, the conditions which favour the pastoral or Bedouin type found in Hejaz and Nejd hardly existing. As in the adjoining province of Hadramut, with which Yemen has always been closely related, the people are divided into four classes: (1) The Seyyids or Ashrāf, descendants of the prophet, forming a religious aristocracy; (2) the Kabail, or tribesmen, belonging to the Kahtanic or original S. Arabian stock, who form the bulk of the population, and are the only class habitually carrying arms; (3) the trading class; (4) the servile class, mostly of mixed African descent, and including a number of Jews. These latter wear a distinctive garb and occupy separate villages, or quarters in the towns. Owing to the hardships to which they have been exposed through the disturbed state of the country, many are emigrating to Jerusalem.

See C. Niebuhr, *Travels and Description of Arabia* (Amsterdam, 1774); D. G. Hogarth, *Penetration of Arabia* (London, 1904); E. Glaser, *Geschichte und Geographie Arabiens* (Berlin, 1890), and in *Petermann's Mitt.* (1886); R. Manzoni, *Il Yemen* (Rome, 1884); A. Deflers, *Voyage en Yemen* (Paris, 1889); S. M. Zwemer, *Arabia* (Edinburgh, 1900); W. B. Harris, *A Journey through Yemen* (London, 1893); H. Burchardt, *Z. d. Ges. für Erdkunde* (Berlin, 1902), No. 7. (R. A. W.)

YENISEI, a river of Asia, which rises in two principal headstreams, the Bei-kem and the Khua-kem, on the plateau of N.W. Mongolia—the former on the S. flank of the Sayan Mountains in 97° 30′ E. and 52° 20′ N., and the latter in marshes a few miles W. of Lake Kosso-gol. They have a westerly course, but after uniting they turn N., through the Sayan Mountains in the wild gorge of Kemchik, in 92° E. Thence the river makes its way across the Alpine region that borders the Sayan Mountains on the N. until it emerges upon the steppes at Sayansk (53° 10′ N.). Augmented by the Abakan on the left and the Tuba on the right, it traverses the mining region of Minusinsk, approaches within 6 m. of the Chulym, a tributary of the Ob, intersects the Siberian railway at Krasnoyarsk, and is joined first by the Kan and then by the Upper (Verkhnyaya), the Stony (Podkamennaya), and the Lower (Nizhnyaya) Tunguzka, all from the right. The Upper Tunguzka, known also as the Angara, drains Lake Baikal, and is navigable from Irkutsk. The Yenisei continues N. to the Arctic Ocean, joined on the left by the Zym, Turukhan and Ingarevka, and on the right by the Kureika and Daneshkina. After the confluence of the Angara, the stream continues to widen out to 30 m., its bed being littered with islands until it breaks into its delta (240 m. long). The length of the river is nearly 3000 m., and the area of its drainage basin 970,000 sq. m. It is navigable as far up as Minusinsk, a distance of 1840 m., and is free from ice on the average for 155 days at Turukhansk and for 196 days at Krasnoyarsk. A canal connects the Great Kaz, a tributary of the Yenisei, with the Ket, an affluent of the Ob.

YENISEISK, a government of E. Siberia, extending from the Chinese frontier to the shores of the Arctic Ocean, with an area of 986,908 sq. m. It has the governments of Tobolsk and Tomsk on the W., Yakutsk and Irkutsk on the E., N.W. Mongolia on the S. and the Arctic Ocean on the N. Its southern extremity being in 51° 45′ N. and its northern (Cape Chelyuskin) in 77° 38′, it combines a great variety of orographical types, from the Sayan alpine regions in the S. to the tundras of the Arctic littoral.

The border-ridge of the high plateau of N.W. Mongolia, which is known under the general name of the Western Sayans, and reaches altitudes of 7000 to 8000 ft., limits it on the S. This is flanked on the north-western slope by a zone, nearly 100 m. wide, characterized by narrow valleys separating parallel chains of mountains, which are built up of crystalline slates, 6000 to 7000 ft. high. Here in the impenetrable forests a few Tungus families live by hunting. Towards the S., in the basins of the Tuba, Sisim, Yus, Kan, Agul and Biryusa, the valleys of the alpine tracts contain rich auriferous deposits, and numerous gold-washings have been established along the *taiga*. A flattened range of mountains, hardly attaining more than 3000 to 3500 ft., shoots N.E. from the Kuznetskiy Ala-tau, and separates the dry steppes of Minusinsk and Abakan from the next terrace of plains, 1200 to 1700 ft. in altitude, which also stretch N.E. from Barnaul in the government of Tomsk to Krasnoyarsk, and into the upper basin of the Vilui. Another system of mountains, known as the Yeniseisk Taiga, rises on the outer border of this terrace, in the space between the upper Tunguzka, or Angara, and the Podkamennaya Tunguzka. This system consists of several parallel chains running S.W. to N.E., and reaching 2500 to 3500 ft. in altitude, though they are much lower on the left bank of the Yenisei. For many years past the Yeniseisk Taiga has been one of the most productive auriferous regions of Siberia, on account not so much of the percentage of gold in its alluvial deposits (which are poor in comparison with those of Olekminsk) as of the facilities for supplying the gold-fields with food produced in the steppes of Minusinsk.

Beyond the Yeniseisk Taiga begin the lowlands, which at no point rise more than a few hundred feet above the sea. They slope gently towards the Arctic Ocean and are covered with lakes, scanty forests and marshes; and, as they approach the ocean, they assume more and more the character of barren tundras. Beyond 70° N. trees occur only along the courses of the rivers. Two ranges, however, break the monotony of the lowlands—the Tungusk, which stretches N.E., between the Khatanga and Anabar rivers, and the Byrranga mountains, which skirt the N.W. shore of the Taimyr peninsula. The shores of the Arctic Ocean are indented by deep estuaries, that of the Taz penetrating 600 m. into the interior of the continent, and that of the Yenisei 300 m. Taymyr, Thaddeus and Khatanga Bays are wide and deep indentations, ice-bound almost all the year round. Taymyr peninsula, between the Yenisei and the Khatanga, is a stony tundra.

The government is drained by the Yenisei and its affluents. In 55° N. this river approaches the Chulym, a tributary of the Ob, from which it is separated by an isthmus only 6 m. in width. The possibility of connecting the two great river systems of Siberia at this point has often been discussed; the difficulty is that the Chulym valley is 440 ft. higher than the other.

Yeniseisk is rich in all kinds of metals and minerals. Gold dust appears in the N. Yeniseisk Taiga, in the region of the Kuznetskiy Ala-tau and its spurs, with the basins of the Tuba, Sisim and Black and White Yus, and in the upper parts of the tributaries of the Kan and Agul. Silver ore is found in the basin of the Abakan, but the mines have been abandoned. Iron ore occurs almost everywhere in S. Yeniseisk, but there is only one iron-work on the Abakan. Salt lakes are common.

The climate, though very severe throughout, offers great varieties. The Minusinsk steppes have a dry and relatively mild climate. At Krasnoyarsk (55° 1′ N.) the climate is more severe, and the winds are disagreeable. The yearly fall of snow is so small that the winds blow it away in the neighbourhood of the town. The town of Yeniseisk (58° 27′ N.) has an average temperature below freezing-point, and at Turukhansk the coldest month (February) averages −24° F. On the Taymyr peninsula the average summer temperature hardly reaches 45°.

The highlands of Sayan and Ala-tau are thickly clothed with forests of cedar, pitch-pine, larch, elder and birch, with rhododendrons, *Berberis* and *Ribes*; the Scotch fir appears only in the lower and drier parts of the valleys. The summits and slopes of the mountains are strewn with débris and boulders, and thickly carpeted with lichens and mosses; but there are patches of meadow-land brightened with flowers, most of which are known in Europe. Still, the flora is poor as a rule, and Dr Martianov, after several years' labour, succeeded in collecting only 104 species of phanerogams.[1] On the other hand, the Minusinsk plains and the steppes of the Abakan are bright with flowers scattered amid the common *Gramineae*, and in June and July with the *Polygala*, *Dianthus*, *Medicago*, *Lathyrus*, yellow sweet-scented lily, and scores of other flowers, mostly familiar in Europe, but attaining in Yeniseisk a larger size and greater brilliancy of colour. The rich carpet of grass and flowers is overtopped by the tall white blossoms of *Archangelica* and *Spiraea Ulmaria*, and by the blue masses of *Veronica longifolia*. The meadows of the moister localities, surrounded by thickets of willow, poplar, wild cherry and hawthorn, are still more attractive, on account of their wealth in anemones, violets, gentians and so on, and the numerous creepers which festoon the trees and shrubs. Dr Martianov's lists enumerate a total of 760 flowering and 760 cryptogamic plants. Of the lower Fungi and parasitical Myxomycetes 1300 species were noted, and out of the 823 species hitherto described by specialists no fewer than 124 have proved to be new. Farther N. the flora is similar in character to that of the Siberian lowlands (see SIBERIA). In the Taimyr peninsula it is represented by only 124 species of flowering plants.

The steppes of the upper Yenisei have been inhabited from a very remote antiquity, and numberless *kurgans*, or burial-mounds, graves, rock inscriptions and smelting furnaces of the successive inhabitants are scattered all over the prairies of Abakan and Minusinsk.[2] The present population exhibit traces of all their predecessors. Numerous survivals of Turkish and Samoyedic tribes are found in the steppes and in the Sayans; but some of them are greatly reduced in numbers. The estimated population in 1906 was 657,900. It is almost entirely Russian, the rest (about 10%) consisting of Samoyedes, Tatars, Tunguses, Yakuts, Mongols and Ostyaks. The government is divided into five districts, the chief towns of which are Krasnoyarsk, Achinsk, Kansk, Minusinsk and Yeniseisk.

Some 1,117,000 acres (0·2%) are under crops, the principal being rye, wheat, oats, barley and potatoes. Live-stock, including reindeer, breeding is very extensively carried on. Fishing, especially on the lower Yenisei, is of great importance. Sables are not now to be found, and the hunters obtain chiefly squirrels, foxes, Arctic foxes and bears. In the middle of the 19th century 350,000 to 525,000 oz. of gold were obtained annually in N. and S. Yeniseisk, but by the end of the century the output had dropped to less than 100,000 oz. Salt is extracted as well as Epsom salts. Coal has been found on the Lower Tunguzka, near the mouth of the Yenisei, and in many places in the S. of the government. Silver, copper, lead, brown coal or lignite, rock-salt, graphite and mica all exist in large quantities, but are not regularly mined. There are several distilleries. The trade is in furs (exported), and in groceries and manufactured goods (imported). The gold-fields of the Yeniseisk Taiga are supplied with grain and cattle by river from the Minusinsk region, and with salt, spirits and iron by the Angara. The government is traversed from W. to E. by the Siberian railway, and considerable efforts have been made to establish regular steamer communication between the mouth of the Yenisei and W. Europe. For some years before the close of the 19th century steamers (*e.g.* that of the English Captain Wiggins) reached the mouth of the Yenisei, importing provisions and machinery for the gold mines. Efforts have been made to clear the rapids of the Angara, so as to bring Lake Baikal into steamer communication with the Yenisei. Owing to the shallowness, however, of the small tributaries of the Yenisei, the canal connecting the Yenisei with the Ob has not proved as serviceable as was expected. (P. A. K.; J. T. BE.)

YENISEISK, a town of Asiatic Russia, capital of the government of the same name, on the right bank of the Yenisei, 170 m. N.N.W. of Krasnoyarsk, with which it has regular communication by steamer. Pop. 12,000. It is the centre of a gold-mining region, and has a public library and a natural history and archaeological museum. The town was founded in 1618.

YEOLA, a town of British India, in the Nasik district of Bombay, on the chord line of the Great Indian Peninsula railway, 18 m. from Manmad junction. Pop. (1901) 16,559. There are important manufactures of cotton and silk cloth and thread, and also of gold and silver wire. At the time of its foundation Yeola was under the emperor of Delhi; it subsequently passed into the hands of the rajas of Satara and then the Peshwas. Finally it was given in grant to Vithal, the ancestor of the present chief of Vinchur.

YEOMAN, a term of which the various meanings fall into two main divisions, first that of a class of holders of land, and secondly that of a retainer, guard, attendant or subordinate officer or official. The word appears in M.E. as *ʒeman*, *ʒoman* and *yeman*; it does not appear in O.E. Various explanations of the first part have been suggested, such as *jung-mann*, young man, and *yeme-man*, attendant, from *yeme*, care; but it is generally accepted that the first part is the same word as the Ger. *Gau*, district, province, and probably occurs in O.E. as *gêa* in *Súðri-gêa*, Surrey, *i.e.* southern district, and other place-names. Thus in O. Frisian is found *gāman*, a villager; Bavarian, *gäumann*, peasant. "Yeoman" thus meant a countryman, a man of the district, and it is this sense which has survived in the special use of the word for a class of landholders, treated below. For the transition in meaning to a guard of the sovereign's body and to officials of a royal household see YEOMEN OF THE GUARD and VALET. In the British royal household there are, besides the Yeomen of the Guard, a yeoman of the wine and beer cellar, a yeoman of the silver pantry and yeoman state porters. The term also occurs in the title of the first assistant to the Usher of the Black Rod, the Yeoman Usher of the Black Rod. In the British navy there are petty officers in charge of the signalling styled "Yeomen of Signals." For the history and present organization of the "yeomanry cavalry" see YEOMANRY and UNITED KINGDOM (§ *Army*).

The extent of the class covered by the word "yeoman" in England has never been very exactly defined. Not only has the meaning of the word varied from century to century, but men writing about it at the same time have given to it different interpretations. One of the earliest pictures of a yeoman is that given by Chaucer in the Prologue to the *Canterbury Tales*. Here, represented as a forester, he follows the esquire as a retainer or dependant. The yeomen of the ages succeeding Chaucer are, however, practically all occupied in cultivating the land, although, doubtless from its younger sons, the class furnished retainers for the great lords, men-at-arms and archers for the wars, and also tradesmen for the towns. Stubbs (*Const. Hist.* vol. iii.) refers to them as "a body which in antiquity of possession and purity of extraction was probably superior to the classes that looked down upon it as ignoble," and Medley (*Eng. Const. Hist.*) describes the yeomen as in the 15th century representing on the whole "the small freeholders of the feudal manor." Holinshed, in his *Chronicle*, following Sir T. Smyth (*De republica Anglorum*), and W. Harrison (*Description of England*), describes them as having free land worth £6 annually, and in times past 40s., and as not entitled to bear arms, being for the most part farmers to gentlemen, and this description may be accepted as the popular idea of the yeoman in the 16th century. He formed the intermediate class between the gentry and the labourers and artisans, the line of demarcation, however, being not drawn very distinctly.

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[1] N. Martianov, "Materials for a Flora of the Minusinsk Region," in *Trudy* of the Kazan Society of Naturalists (xi. 3, 1882).

[2] See W. Radlov, *Aus Sibirien* (2 vols., Leipzig, 1880), and N. Savenkov, in *Izvestia* of the East Siberian Geographical Society (xvii., 1887).

The yeomen were the smaller landholders, and in the 15th century were practically identical with the forty-shilling freeholders who exercised the franchise under the act of 1430. Occasionally they found their way into parliament, for in 1446 the sheriffs were forbidden to return *valletti* (*i.e.* yeomen) as members, but this prohibition had very little result. Soon, however, the name appears to have included tenant farmers as well as small freeholders. Thus Latimer, in his famous sermon before Edward VI., says: "My father was a yeoman, but had no land of his own"; the bishop represents the yeoman as an exceedingly prosperous person, and the same opinion had been expressed about a century before by Sir John Fortescue in his *Governance of England*. The decay of the class began with the formation of large sheep farms in the 16th century, but its decline was very slow, and the yeomen furnished many sturdy recruits to the parliamentary party during the Civil War. Their decay was accelerated during the 18th century, when many of them were bought out by the large landowners, while they received another blow when the factory system destroyed the country's domestic industries. Many writers lament the decay of the yeoman in the 18th and 19th centuries, but this is partly accounted for by the fact that they exclude all tenant farmers from the class, which they confine to men cultivating their own land. Thus the wheel has come full circle and the word means to-day much the same as it meant in the early part of the 15th century.

YEOMANRY, the name given to the volunteer mounted troops of the home defence army of Great Britain, ever since their original formation; it indicated that recruiting, organization and command were upon a county basis, the county gentlemen officering the force, the farmers and yeomen serving in its ranks, and all alike providing their own horses. Although the yeomanry was created in 1761, it was not organized until 1794. Under the stimulus of the French War recruiting was easy, and 5000 men were quickly enrolled. A little later, when more cavalry was needed, the Provisional Cavalry Act was passed, whereby a sort of revived knight-service was established, every owner of ten horses having to find and equip a horseman, and all who owned fewer than ten, grouped by tens of horses, similarly finding one. But an amending act was soon passed, by which yeomanry cavalry could be substituted for provisional cavalry in the county quota. This gave a great stimulus to yeomanry recruiting, as similar enactments had done in the case of the infantry volunteers. But even so the provisional cavalry, which was embodied only in counties that did not supply the quota in yeomanry, was stronger than the yeomanry at the peace of Amiens. At that peace, partly with a view to preserving internal order, partly because of the probable renewal of the war, the yeomanry was retained, although the provisional cavalry was disbanded. There was thus a nucleus for expansion when Napoleon's threatened invasion (1803–5) called out the defensive powers of the country, and as early as December 1803 there were in England, Scotland and Ireland 44,000 yeomen. At the same time the limitations as to place of service (some undertaking to serve in any part of Great Britain, some within a specified military district, most only in their own county) were abolished. The unit of organization was the troop of 80–100, but most of the force was grouped in regiments of five or more troops, or in "corps" of three or four troops. Permanent paid adjutants and staff sergeants were allowed to corps and regiments, but no assistance was given in the shape of officers on the active list and serving non-commissioned officers of the army and militia. Equipment, supply and mobilization arrangements were purely regimental, and through all the war years most of the troops and squadrons were ready to take the field, with equipment, food and forage, complete at a day's notice. They were trained as light cavalry, and armed with sabre and pistol. But a few town corps had mounted riflemen, and several corps, both in town and country, had one or more dismounted troops, who were carried on vehicles similar to the "Expedition or Military Fly" pictured by Rowlandson.

From the extinction of Chartism to the South African War the history of the yeomanry is uneventful. The strength of the force gradually sank to 10,000. But when it became apparent that mounted troops would play a decisive part in the war against the Boers, the yeomanry again came to the front. Of its 10,000 serving officers and men, 3000 went to South Africa in newly formed battalions of "Imperial Yeomanry," armed and organized purely as mounted rifles, and to these were added over 32,000 fresh men, for whom the yeomanry organization at home and at the seat of war provided the cadres and training, while the home yeomanry not only filled up its gaps but expanded. In 1901 the yeomanry, now all styled "Imperial," was remodelled; and the strength of regiments was equalized on a four-squadron basis. In the prevailing conditions practically all regiments were able to recruit up to the increased establishment, and the strength of the force was more than trebled. Fresh regiments were formed, some in the towns, others on the nucleus of special corps disbanded at the close of the South African War. In 1907 the yeomanry became part of the new Territorial Force (see UNITED KINGDOM, § *Army*).

YEOMEN OF THE GUARD, originally "Yeomen of the Guard of (the body of) our Lord the King," or in the 15th-century Latin, "Valecti garde (corporis) domini Regis," the title (maintained with but a slight variation since their institution in 1485, the official wording under Edward VII. being "The King's Body Guard of the Yeomen of the Guard") of a permanent military corps in attendance on the sovereign of England, as part of the royal household, whose duties, now purely ceremonial, were originally that of the sovereign's personal bodyguard. They are the oldest existing body of the kind, having an unbroken record from 1485, as well as the oldest military body in England. Before that time there had been forms of royal guard, but no permanent institution. Under Edward I. we find in England the "crossbowmen of the household," and under Edward II. an "Archer guard of the King's body"; but the "Archers of the King," "of the crown" or "of the household," who appear in the records up to 1454, seem to have had no continuous establishments. Apparently each sovereign, on coming to the throne, established a new Guard of his own particular followers. It was not till Henry VII. created the "Yeomen of the Guard" that the royal bodyguard came into regular existence. The first warrants to individual "Yeomen of the Guard" date from September 16, 1485, and it is a fair inference that the Guard was created by the king on the battlefield of Bosworth (August 22, 1485), its first members being men who had shared Henry's exile in Brittany, followed him on his return, and fought as his private Guard in that action. The warrant of September 18, 1485, now in the Record Office, "to William Brown, Yeoman of the King's Guard," corroborates this view—"in consideration of the good service that oure humble and faithful subject William Browne Yeoman of oure Garde hath heretofore doon unto us as well beyonde the see as at our victorieux journeye." It is argued by Sir Reginald Hennell that the title of "Yeomen of the Guard" signified Henry VII.'s intention to choose the special protectors of his person not from the ranks of the nobility, but from the class just below them (see YEOMAN), who had proved in war the backbone of the national strength. The term *valecti*, or "valets" (see Valet), was already in use, as signifying personal attendants, with none of the modern menial sense of the word.

The first official recorded appearance of the king's bodyguard of the Yeomen of the Guard was at the coronation of its founder Henry VII. at Westminster Abbey on the 31st of October 1485, when it numbered 50 members. This number was rapidly increased, for there is an authentic roll of 126 attending the king's funeral in 1509. Henry VIII. raised the strength of the Guard to 600 when he took it to visit Francis I. of France at the Field of the Cloth of Gold. In Queen Elizabeth's reign it numbered 200. The corps was originally officered by a captain (a post long associated with that of vice-chamberlain), an ensign (or standard-bearer), a clerk of the cheque (or chequer roll, his duty being to keep the roll of every one connected with the household), besides petty officers, captains, sergeants or ushers. In 1669 Charles II. reorganized the Guard and gave it a fixed establishment of 100 yeomen, officered by a captain, a lieutenant, an ensign, a clerk of the cheque and four corporals, which is the present organization and strength. The only variation is that the captaincy is now a ministerial appointment filled by a nobleman of distinction under the lord chamberlain, and that the old rank of "corporals" has been changed to "exon," a title derived from "exempt," *i.e.* exempted from regular regimental duty for employment on the staff. Formerly officers on the active list were given these appointments in addition to their own.

The original duties of the Guard were of the most comprehensive nature. They were the king's personal attendants day and night at home and abroad. They were responsible for his safety not only on journeys and on the battlefield, but also within the precincts of the palace itself. The regulations for making of the king's bed in Tudor times were of the most elaborate formality. No one but the Yeomen of the Guard under an officer might touch it. Each portion was separately examined. Each sheet or coverlet was laid with the greatest ceremony, and the sovereign could not retire to rest until the work was reported as well and truly done. The existence of the custom is verified at the present day by the designations Y.B.H. ("Yeomen Bed-Hangers") and Y.B.G. ("Yeomen Bed-Goers"), which are still affixed against the names of certain yeomen on the roll of the Guard. Another of their duties outside the palace is retained, viz. the searching of the vaults of the houses of parliament at the opening of each session, dating from the "Gunpowder Plot" in 1605, when the Yeomen of the Guard seized Guy Fawkes and his fellow-traitors and conveyed them to the Tower. Owing to the destruction by fire of most of the records of the Guard in St James's Palace in 1809, the precise history of the search is a matter of controversy. It is recorded in the papers of the House of Lords that the Guard conducted it in 1690 and that it has been continuous since 1760, but Sir Reginald Hennell's contention is that it dated from 1605 and has since been regularly observed.

Though the corps from the earliest day was composed of foot-soldiers, during royal progresses and journeys a portion of the Guard formed a mounted escort to the sovereign until the end of the Georgian period.

The dress worn by the Yeomen of the Guard is in its most striking characteristics the same as it was in Tudor times. It has consisted from the first of a royal red tunic with purple facings and stripes and gold lace ornaments. Sometimes the sleeves have been fuller and the skirts longer. Red knee-breeches and red stockings (white in Georgian period only), flat hat, and black shoes with red, white and blue rosettes are worn. Queen Elizabeth added the ruff. The Stuarts replaced the ruff and round hats with fancy lace and plumed hats. Queen Anne discarded both the ruff and the lace. The Georges reintroduced the ruff, and it has ever since been part of the permanent dress. But the most interesting point connected with the dress is that the gold-embroidered emblems on the back and front of the coats tell the history of the consolidation of the kingdoms of Great Britain and Ireland. From 1485, when the Guard was created, till 1603, the emblems were the Tudor crown with the Lancastrian rose, and the initials of the reigning sovereign. When the Stuarts succeeded the Tudors in 1603, they substituted the St Edward's crown for the Tudor, and added under it and the initials the motto "Dieu et mon Droit," which is still worn. When William and Mary came to the throne in 1689, their initials were entwined, W.M.R.R. (William, Mary, Rex, Regina), the only instance of the queen and king's initials being so placed. Anne restored the Tudor crown, and added the thistle to the rose on the official union with Scotland in 1709. The Georges reverted to the St Edward's crown, and on the union with Ireland in 1801 George III. added the shamrock to the rose and thistle. No change was made during Queen Victoria's reign. But Edward VII. ordered the Tudor crown to be substituted for the St Edward's, and now the coats of the Guard are as they were in 1485, with the additions of the motto "Dieu et mon Droit" and the shamrock and the thistle.

Up to 1830 the officers of the Guard wore the same Tudor dress as the non-commissioned officers and men, but when William IV. ordered that in future no civilian should be appointed, and that the purchase and sale of officers' commissions should cease, the old Tudor dress was discontinued, and the officers were given the dress of a field officer of the Peninsular period.

There has also been little or no change in the arms of the Guard. No doubt they retained during Henry VII.'s reign (1485–1509) the pikes with which they had helped to win the battle of Bosworth Field. Under Henry VIII. archery became a national pastime, and the long-bow and arrow were issued to at least one-half of his Guard. When firearms came into use, a certain portion were armed with the harquebus, the Guard being given buff cross belts to support the weight on service. When on duty in the palace gold-embroidered cross belts took the place of the service buff, and are worn now as part of the state dress. The present weapons of the Guard are a steel gilt halberd with a tassel of red and gold, and an ornamental sword.

The real fighting days of this Guard ended with the Tudor period, but it was only at the end of the reign of George II. that the Guard's function of attending a sovereign on the battlefield ceased. Their last duty in this nature was at the battle of Dettingen (1743), when they accompanied the king as personal attendants. For a brief period during the Georgian era the Guard lost to a certain extent its distinctive military character, and a custom crept in of filling vacancies with civilians, who bought their places for considerable sums, the appointments of the yeomen proper and the officers being of great value. But William IV. put a stop to the practice. The last civilian retired in 1848, and the Guard regained its original military character. Every officer (except the captain), non-commissioned officer and yeoman must have served in the Home or Indian army or Royal Marines. They are selected for distinguished conduct in the field, and their pay is looked upon as a pension for the same. The officers must be of the rank of captain and over, and the yeomen of that of sergeant or warrant officer.

The Guard has a permanent orderly room in St James's Palace, where the routine of duty is carried on by the adjutant and "clerk of the cheque," the latter old true designation being retained after the former modern title. Under the orderly room is a guard room lined with lockers in which the uniforms are stored. They are in charge of a resident wardrobe-keeper. Here the division for duty musters once a week in the season and once a fortnight at other times, and here the yeomen dress for state functions. These now are confined to receptions of foreign potentates, levees, courts and state banquets, the Guard still taking part in the searching of the houses of parliament, the ceremony of the distribution of Maundy money in Westminster Abbey and in the Epiphany offerings of gold, frankincense and myrrh in the Chapel Royal, St James's Palace. The yeomen live in their own homes.

The nickname "Beef-eaters," which is sometimes associated with the Yeomen of the Guard, had its origin in 1669, when Count Cosimo, grand duke of Tuscany, was in England, and, writing of the size and stature of this magnificent Guard, said, "They are great eaters of beef, of which a very large ration is given them daily at the court, and they might be called Beef-eaters." The supposed derivation from "Buffetier" (*i.e.* one who attends at the sideboard) has no authority.

A singular misapprehension exists as regards the Tower warders. Wearing as they do the same uniform, except the cross belt which used to hold the harquebus, and being so much more before the public in their daily duty as warders of the Tower, they are often thought erroneously to be Yeomen of the Guard. They had their origin in 1509–10 in the twelve Yeoman of the Guard whom young King Henry VIII. left, when he gave up the Tower of London as a permanent residence, to show that it was still a royal palace. When the Tower was finally given up as a royal residence they became warders and were deprived of the dress, but were given it back in Edward VI.'s reign, on a petition from the lord protector, who had been confined there and to whom the warders had been most considerate. They are now a distinct body, but in an honorary sense still termed "Extraordinary of the Guard." But they perform no state functions, being solely yeomen warders under the orders of the constable of the Tower. They are all old soldiers.

A brief notice of the other royal guard will be appropriate. In 1509, Henry VIII., envying the magnificence of the bodyguard of Francis I. of France, decided to have a noble guard of his own, which he accordingly instituted and called "The Gentlemen Speers." It was composed of young nobles gorgeously attired. In 1539 this guard was reorganized and called "Gentleman Pensioners." This title it retained till William IV.'s reign, when the corps regained its military character, the king on their petition giving them their present designation, "The Honourable Corps of Gentlemen-at-Arms."

See *The History of the King's Body Guard of the Yeomen of the Guard*, by Colonel Sir Reginald Hennell, D.S.O., Lieutenant of the Yeomen of the Guard (1904). (R. He.)

YEOTMAL, a town and district of India, in Berar. The town stands at an elevation of 1476 ft. Pop. (1901) 10,545. It was formerly the headquarters of Wun district, but in 1905 a new district of Yeotmal was established, covering the former Wun district, with additions from the district of Basim. Cotton-ginning and pressing are carried on. The town is also the chief trading centre in the district, and is connected by road with Dhamangaon station, 29 m. distant.

The District of Yeotmal has an area of 5183 sq. m. It is a wild hilly country, intersected by offshoots from the Ajanta mountains. The hills are bare, or clothed only with dwarf teak or small jungle; but on the heights near Wun town the bamboo grows abundantly, and small bamboos are found in the ravines. The Wardha and Penganga, which bound the district on the E. and S., unite at its S.E. corner. The Penganga drains the greater part of the district. The tiger, leopard and hyena abound; bears, wolves and jackals are also numerous; while small game is plentiful. The climate is enervating and unhealthy; the annual rainfall averages about 41 in. Pop. (1901) 575,957. The principal crops are millets, cotton, pulses, oil-seeds and wheat. Coal has been found, and iron ore abounds.

See *Yeotmal District Gazetteer* (Calcutta, 1908).

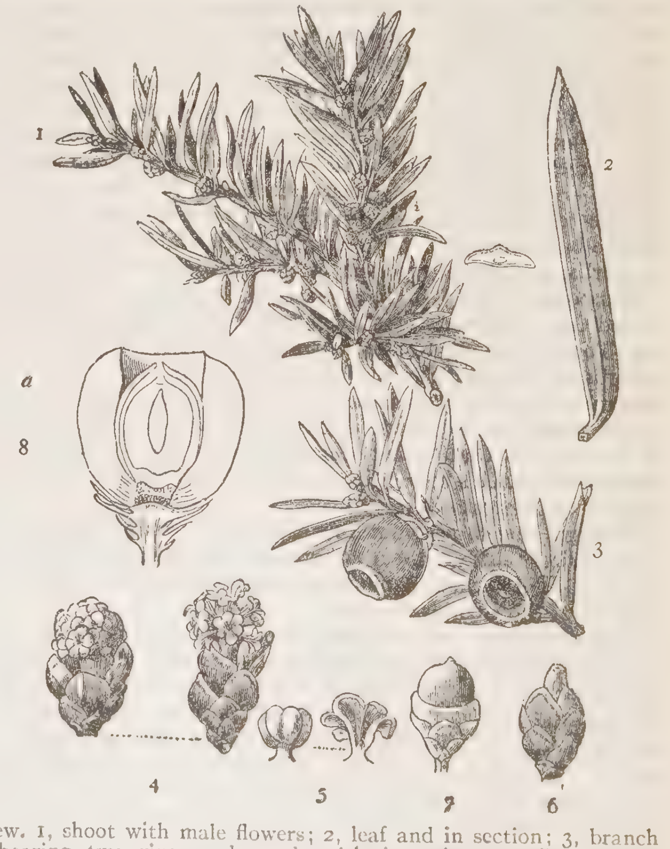
YEOVIL, a market town and municipal borough in the S. parliamentary division of Somersetshire, England, on the Great Western and South-Western railways, 127 m. W. by S. of London. Pop. (1901) 9861. The town lies on the river Yeo, and is a thriving place, with a few old houses. The church of St John the Baptist is a perpendicular cruciform structure, consisting of chancel, nave of seven bays, aisles, transepts and lofty western tower. There are some 15th- and 16th-century brasses, a dark cradle roof, and an early 13th-century crypt under the chancel. The town is famous for its manufacture of gloves (dating from 1565). Its agricultural trade is considerable. The town is governed by a mayor, 4 aldermen and 12 councillors. Area, 654 acres. Yeovil (Gyoele, Evill, Ivle, Yeoele) before the Conquest was part of the private domains of the Anglo-Saxon kings. The town owed its origin to trade, and became of some size in the 13th century. In 14th-century documents it is described as a town or borough governed by a portreeve, who frequently came into conflict with the parson of St John's church, who had become lord of the manor of Yeovil during the reign of Henry III. The corporation in the 18th century consisted of a portreeve and eleven burgesses, and was abolished when the town was reincorporated in 1853.

Fairs on the 17th of July and the 6th of November were held under grant of Henry VII., and were important for the sale of leather and of woollen cloth, both made in the town. The Friday market dates from 1215. There is a great market every other Friday and a monthly horse sale.

YERKES, CHARLES TYSON (1837–1905), American capitalist, was born of Quaker parentage, in Philadelphia, Pennsylvania, on the 25th of June 1837. He was a clerk in a grain-commission house, an exchange broker (1858–61) and a banker (1861–86). When he failed in 1871 he refused to give any preference to the city of Philadelphia for bonds sold on its account, and was convicted of "misappropriating city funds," and sentenced to two years and nine months in the penitentiary. After serving seven months of this sentence he was pardoned, and the City Council afterward passed an ordinance cancelling the municipality's claim against him. He established a banking business in Chicago in 1881; in 1886 got control of the Chicago City Railway Company; and within the next twelve years organized a virtual monopoly of the surface and elevated railway service of Chicago. He disposed of his street railway interests in Chicago, and removed to London (1900). There he acquired in 1901 a controlling interest in the Metropolitan District railway, and by organizing the finances of the Underground Electric Railways Company he took an important initiative in extending the system of London electric railways. Yerkes gave to the university of Chicago the great telescope installed in the Yerkes Observatory at Lake Geneva, Wisconsin, and gathered in his New York residence a remarkable collection of paintings, tapestries and rugs, which were sold at auction in April 1910 for $2,034,450. He died in New York on the 29th of December 1905.

YETHOLM, a village of Roxburghshire, Scotland. Pop. (1901) 571. It is situated on Bowmont Water, 7½ m. S.E. of Kelso, and 5 m. S.S.W. of Mindrum in Northumberland, the nearest railway station. It is divided into two quarters, Kirk Yetholm on the right and Town Yetholm on the left of the stream. The name is said to be the O.E. *yet*, "gate," and *holm* (here the same as *ham*), "hamlet," meaning "the hamlet at the gate" of Scotland, the border being only 1½ m. distant. Since about the middle of the 17th century the district has been the headquarters of a tribe of gipsies.

YEW (*Taxus baccata*), a tree which belongs to a genus of Coniferae (see Gymnosperms), in which the ordinarily woody cone is represented by a single seed surrounded by a fleshy cup. Usually it forms a low-growing evergreen tree of very



Yew. 1, shoot with male flowers; 2, leaf and in section; 3, branch bearing two ripe seeds each with its crimson aril; 4, male flowers; 5, stamens; 6, 7, female flower in different stages; 8, section of ripe seed and aril, *a*. 1, slightly reduced; 2, and 4 to 8, enlarged.

diverse habit, but generally with dense spreading branches, thickly covered with very dark green linear leaves, which are given off from all sides of the branch, but which, owing to a twist in the base of the leaf, become arranged in a single series on each side of it. The trees are usually dioecious, the male flowers being borne on one individual and the female on another, although instances occur in which flowers of both sexes are formed on the same tree. The male flowers are more or less globular and occur in the axils of the leaves. They consist of a number of overlapping brownish scales, gradually increasing in size from below upwards and surrounding a naked stalk that bears at its summit a head of four to eight stamens. Each stamen has a flat five-lobed top, something like a shield; from its under surface, five, six or more pollen cases hang down, and these open lengthwise to liberate the globose pollen-grains. The female flowers are also placed each separately in the axil of a leaf, and consist of a number of overlapping scales, as in the male. These scales surround a cup which is at first shallow, green and thin (the so-called aril), but which subsequently becomes fleshy and red, while it increases so much in length as almost entirely to conceal the single straight seed. It is clear that the structure of the female flower differs from that of most conifers, from which it is now often separated in a distinct order, Taxaceae.

The poisonous properties, referred to by classical writers such as Caesar, Virgil and Livy, reside chiefly if not entirely in the foliage. This, if eaten by horses or cattle, especially when it has been cut and thrown in heaps so as to undergo a process of fermentation, is very injurious. The leaves have also been used for various medicinal purposes, but are not employed now. An alkaloid *taxine*, said to depress the circulation, is extracted. It forms white crystals soluble in alcohol and ether. As a timber tree the yew is used for cabinet-work, axle-trees, bows and the like, where strength and durability are required.

The yew occurs wild over a large area of the northern hemisphere. In N.E. America and in Japan trees are found of a character so similar that by some botanists they are all ranged under one species. Generally, however, the European yew, *T. baccata*, is regarded as native of Europe, N. Africa, and Asia as far as the Himalayas and the Amur region, while the American and Japanese forms are considered to represent distinct species. The yew is wild in Great Britain, forming a characteristic feature of the chalk downs of the southern counties and of the vegetation of parts of the Lake District and elsewhere. The evidence of fossil remains, antiquities and place-names indicates that it was formerly more widely spread in Europe than at the present day. The varieties grown in the United Kingdom are numerous, one of the most striking being that known as the Irish yew—a shrub with the pyramidal or columnar habit of a cypress, in which the leaves spread from all sides of the branches, not being twisted, as they usually are, out of their original position. In the ordinary yew the main branches spread more or less horizontally, and the leaves are so arranged as to be conveniently exposed to the influence of the light; but in the variety in question the branches are mostly vertical, and the leaves assume a direction in accordance with the ascending direction of the branches. The plants have all sprung from one of two trees found growing wild more than a hundred years ago on the mountains of Co. Fermanagh in Ireland, and afterwards planted in the garden of Florence Court, a seat of the earl of Enniskillen.

The yew is a favourite evergreen tree, either for planting separately or for hedges, for which its dense foliage renders it well suited. Its dense growth when pruned has led to its extensive use in topiary work, which was introduced by John Evelyn and became very prevalent at the close of the 17th and the beginning of the 18th centuries. The wood is very hard, close-grained and of a deep red-brown colour internally. The planting of the yew in churchyards was at one time supposed to have been done with a view to the supply of yew staves. But, while importation from abroad was fostered, there seems to have been no statute enforcing the cultivation of the yew in Great Britain; a statute, however, of Edward I. (cited in *The Gardeners' Chronicle*, 6th March 1880, p. 306) states that the trees were often planted in churchyards to defend the church from high winds. The Crowhurst yew, mentioned by Evelyn as 30 ft. in circumference, still exists. The large yew at Ankerwyke, near Staines, with a trunk $30\frac{3}{4}$ ft. in circumference, in sight of which Magna Carta was signed (1215), probably exceeds a thousand years of age. The fine yew in Buckland churchyard, near Dover, was removed in 1880 to a distance of 60 yds. The trunk had been split so that it had a direction nearly parallel with the soil. This huge tree was moved with a ball of soil round its roots, 16 ft. 5 in. by 15 ft. 8 in., by 3 ft. $6\frac{1}{2}$ in. in depth, the weight of the entire mass being estimated at 56 tons. The dimensions of the tree in 1880 were as follows: "circumference of the main trunk, 22 ft.; of the upright portion of the trunk, 6 ft. 10 in.; second horizontal trunk, 10 ft. 10 in.; do., south limb forking off at 9 ft. from the main trunk, 7 ft. 10 in.; do., west limb forking off at 9 ft. from the main trunk, 8 ft. 8 in.; extent of branches from centre of main trunk southwards, 30 ft. 10 in., and from north to south, 48 ft.; they extend from the main trunk westward 33 ft." The tree was replanted so that the horizontal portions were replaced in their original erect position and the natural symmetry restored.

For further details see Veitch, *Manual of Coniferae* (1900); Elwes and Henry, *Trees of Great Britain and Ireland* (1906).

YEZD, or YAZD, a province of Persia, bounded S. by Kerman, W. by Fars and Isfahan, and N. and E. by the central Persian deserts. It contains an area of about 20,000 sq. m., but its population barely exceeds 100,000, of whom about half inhabit the capital of the province. Its subdivisions are: (1) the city of Yezd and immediate environs; (2) Ardakan; (3) Bafk; (4) Taft; (5) Kuhistan (Pish Kuh, Mian Kuh, Pusht Kuh, on the slopes and in the valleys of the Shir Kuh, a part of the great Central Range of Persia W. of the city of Yezd, and rising to an elevation of 11,000 ft.); and (6) Shahr i Babek. The last is situated far S. near Kerman, and sometimes is regarded as part of that province. The revenues slightly exceed £60,000 a year. Much silk is grown in the district, but is not sufficient for the silk stuffs which Yezd manufactures with its 1000 looms, and raw silk (about 75,000 lb yearly) has to be obtained from Khorasan and Gilan. Great quantities of felts (*nimads*), white and yellow cotton stuffs, the latter a kind of nankeen made of *Gossypium herbaceum*, are also manufactured and exported. Other exports are opium, madder and almonds. The grain produced suffices for only two or three months' consumption, and supplies have to be brought from Khorasan, so that wheat and barley are dearer than at other places in Persia. The part of the district situated in the plain is much exposed to moving sands, which render cultivation difficult and at times impossible.

YEZD, the capital of the province of the same name in Persia, situated 192 m. N.W. of Kerman, 162 m. S.E. of Isfahan, in 31° 54′ N. and 54° 22′ E., at an elevation of 4240 ft. Its population, 100,000 in 1810, is now estimated at 50,000, including 2000 Jews and 1300 Zoroastrians.[1] The city is divided into the Shahr i nau (new town) and Shahr i kohneh (old town), separated by a wall with two gates. The ark, or citadel, in the E. of the town, is fortified with walls, bastions and dry ditch, and contains the governor's residence. The bazaar is in good repair and well stocked; other parts of the town are irregularly planned, with dark, narrow streets. There are eighteen mosques, one, the Masjed i Jama, also called Masjed i Mir Chakhmak, is an old and decayed structure originally built in 1119, with a lofty and imposing frontage dating from 1472. There are seven colleges. The caravanserais number thirty-three. There are telegraph (English staff since 1903) and post offices. The Englishman in charge of the telegraph office acts as British vice-consul.

YEZIDIS, a sect of devil-worshippers, calling themselves Dasni, who are found in Kurdistan, Armenia and the Caucasus. Their religion has points of connexion with old Iranian and Assyrian beliefs and traces of Manichaeism and Nestorianism. Thus they regard the devil as the creative agent of the Supreme God, a reinstated fallen angel who is the author of evil. They avoid mentioning his name and represent him by the peacock. They regard Christ as an angel in human form and recognize

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[1] In 1879 the Zoroastrian community of Yezd numbered 6483, 1242 residing in the city, 5241 in the villages; in 1892 the community numbered 6908, and as many have emigrated, it is computed that it now numbers not more than 7000.

Mahomet as a prophet with Abraham and the patriarchs. They believe in a future life and practise both circumcision and baptism. The name is probably derived from the Kurdish and Persian *Yazdān*, God; though some have connected it with the city of Yezd, or with Yezid, the second Omayyad caliph (720–24). Their sacred book is called *Al-Yalvah*, and its chief exponent was Shaikh Adi (*c.* 1200).

See Layard, *Ninevah and its Remains* (London, 1850); Menant, *Les Yézidis* (Paris, 1892).

YEZO, or Ezo, the most northerly of the five principal islands forming the Japanese empire, the five being Yezo, Nippon, Shikoku, Kiushiu and Formosa. It is situated between 45° 30′ and 41° 21′ N. and between 146° 7′ and 139° 11′ E.; its coast-line measures 1423·32 m., and it has an area of 30,148·41 sq. m. On the N. it is separated from Sakhalin by Soya Strait (La Pérouse) and on the S. from Nippon by Tsugaru Strait. Its northern shores are washed by the Sea of Okhotsk, its southern and eastern by the Pacific Ocean, and its western by the Sea of Japan.

Orography.—The highest mountain in the island is Ishikaridake (6955 ft.) and the next in importance is Tokachi-dake (6541 ft.). Yubari-take in Ishikari has a height of 6508 ft., and in the province of Kushiro are O-akan-dake (4470 ft.) and Meakan-take (4500 ft.). Dr Rein's investigations led him to state that Tokachi-dake forms a species of central elevation whence most of the principal rivers flow towards the sea, and that the mountain system is a continuation, on the W., of the Sakhalin range, and on the E. of the Kuriles range; the former consisting of granite and old schists, the latter chiefly of volcanic formations. Near Hakodate are two conspicuous volcanic peaks, Komaga-take (3822 ft.) and Tokatsu-dake (3800 ft.); and 24 m. from Kushiro (by rail) is a volcano called Atosa-nobori, or Iwo-zan (sulphur mountain), whence great quantities of first-rate sulphur are exported to the United States. Mention must also be made of Rishiri, an islet on the extreme N.W. of Yezo, which has a peak of the same name rising to a height of nearly 6000 ft.

Rivers.—Yezo boasts the largest river in the Japanese empire, the Ishikari-gawa, which is estimated to measure 275 m. Its other large rivers are the Teshio-gawa (192 m.), the Tokachi-gawa (120 m.), the Shiribeshi-gawa (88 m.), the Kushiro-gawa (81 m.), the Toshibetsu-gawa (64 m.), and the Yubetsu-gawa (64 m.). The valley of the Ishikari is believed to be the most fertile part of the island; the Tokachi is navigable to a point 56 m. from its mouth, but the Teshio has a bar which renders its approach extremely difficult. A peculiarity of several of the rivers is that, on approaching the seashore, they run parallel to it for some distance before finding an exit. Those flowing to the S. coast take a W. direction, those flowing to the E. coast a N. direction. This is attributed to the fact that the prevailing winds set up the sand so as to deflect the rivers from their straight course. Nearly all these rivers abound with salmon, the most remarkable in that respect being the Nishibetsu-gawa, which yields an average of over 2000 tons of fish annually.

Lakes.—There are no large lakes, the most extensive—Toyako, Shikotsuko and Kushiroko—not having a circumference of more than 25 m. Lagoons, however, are not uncommon. The largest of these—Saruma-ko in Kitami—is some 17 m. long by 7 wide. It abounds with oysters nearly as large as those for which the much smaller lagoon at Akkeshi is famous, the molluscs measuring about 18 in. in length.

Climate.—The climate differs markedly from that of the main island of Japan, resembling rather the climate of the British Isles, though the winter is longer and more severe, and the atmosphere in the warm season contains a greater quantity of moisture. During five months the country is under snow, its depth averaging about 2 ft. in the regions along the southern coast and more than 6 ft. in the northern and western regions. An ice-drift, setting from the north and working southwards as far as Nemuro, stops all sea trade on the E. coast during January, February and March, though the W. coast is protected by the warm current of the Kuro-shiwo. Fogs prevail along the E. coast during the summer months, and it is not uncommon to find a damp, chilly atmosphere near the sea in July, whereas, a mile inland, the thermometer stands at 80° or 90° F. in the shade, and magnolia trees are in full blossom.

Zoology.—Tsugaru Strait has been shown by Captain T. W. Blakiston, R.A., to form a line of zoological division. Pheasants and monkeys are not found on the Yezo side of this line, though they abound on Nippon, and, on the other hand, Yezo has grouse and solitary snipe which do not exist in Nippon. The Yezo bear, too, is of a distinct species, and the island has an abundance of singing birds which are absent S. of the strait. There are also notable differences in the flora, the trees and flowers of Yezo resembling those of the British Isles rather than those of Japan.

Population.—The island seems to have been originally peopled by a semi-barbarous race of pit-dwellers, whose modern representatives are to be found in the Kuriles or their neighbours of Kamchatka and Sakhalin. These autochthons were driven out by the Ainu, and the latter, in their turn, succumbed to the Japanese. The population of Yezo is 605,742, of whom 17,573 are Ainu. There is a steadily growing but not large emigration from Japan proper to Yezo. Yezo is divided into ten provinces, the names of which, beginning from the S., are Oshima, Shiribeshi, Ishikari, Teshio, Kitami, Iburi, Hidaka, Tokachi, Kushiro and Nemuro. Of these, Oshima, Shiribeshi and Ishikari are by far the most important. There are only three towns having a population of over 20,000, viz. Hakodate (50,314), Sapporo (46,147) and Otaru (34,586). Other towns of importance are Fukuyama (formerly called Matsumae), the seat of government in feudal days, Esashi, Mombetsu, Oiwake, Tomakomai, Piratori (the chief Ainu settlement), Mororan, Kushiro, Akkeshi, Nemuro, Horobetsu, Yunokawa, Abashiri and Mashike. Yunokawa, 4½ m. from Hakodate, is much frequented for its hot springs; Oiwake is the junction of the main line of railway with the branch to the Yubari collieries; Kushiro exports coal and sulphur; Akkeshi is celebrated for its oysters.

Industries and Products.—Marine products constitute the principal wealth of Yezo. Great quantities of salmon, sardines and codfish are taken. The salmon are salted for export to Nippon and other parts of Japan; the sardines are used as an agricultural fertilizer, their value varying from £2 to £5 per ton; and the codfish serve for the manufacture of oil. An immense crop of edible seaweed is also gathered and sent to Chinese markets as well as to Japanese. This *kombu*, as it is called, sometimes reaches a length of 90 ft. and a width of 6 in. The herring fishery, too, is a source of wealth, and the canning of Akkeshi oysters as well as of salmon gives employment to many hands. Vast tracts are covered with a luxuriant growth of ash, oak, elm, birch, chestnut and pine, but, owing to difficulties of carriage, this supply of timber has not yet been much utilized. One of the earliest acts of the *Meiji* government was to develop the resources of Yezo and encourage Japanese to emigrate thither. Free grants of agricultural land were made, roads were constructed, model farms established, beet-sugar factories and sawmills opened, horse-breeding undertaken, foreign fruit trees planted and railways laid. The outlays incurred did not immediately bear fruit, but they attracted large numbers of settlers. During recent years attention has been attracted to the mineral resources of Yezo. Coal of fair quality is abundant, and a railway has been built for its carriage; an apparently inexhaustible supply of sulphur is obtained from a mountain near Kushiro lake; petroleum seems likely to pay exploiters, and in 1899 gold was discovered at Usotannai, Pankanai and other places along the Poropetsu river, near Esashi in Kitami province.

Communications.—The roads are few and in bad order, but there is a railway which, setting out from Hakodate in the extreme S., runs, via Sapporo and Iwamizawa, to the extreme N., with branches from Iwamizawa, S. to Mororan and E. to Poronai, and from Oiwake N.E to the Yubari coal-mines. There is also a line W. along the S. coast from Nemuro. In districts beyond the railway, travelling is done on horseback, there being an abundant supply of ponies. There is good coastwise communication by steamer.

History.—Yezo was not brought under Japan's effective control until medieval times. In 1604 the island was granted in fief to Matsumae Yoshihiro, whose ancestor had overrun it, and from the close of the 18th century the E. was governed by officials sent by the shôgun, whose attention had been attracted to it by Russian trespassers. In 1871 the task of developing its resources and administering its affairs was entrusted to a special bureau, which employed American agriculturists to assist the work and American engineers to construct roads and railways; but in 1881 this bureau was abolished, and the government abandoned to private hands the various enterprises it had inaugurated.

YGGDRASIL, in Scandinavian mythology, the mystical ash tree which symbolizes existence, and binds together earth, heaven and hell. It is the tree of life, of knowledge, of fate, of time and of space. Its three roots go down into the three great realms—(1) of death, where, in the well Hvergelmer, the dragon Nidhug (Niðhöggr) and his brood are ever gnawing it; (2) of the giants, where, in the fountain of Mimer, is the source of wisdom; (3) of the gods, Asgard, where, at the sacred fountain of Urd, is the divine tribunal, and the dwelling of the Fates. The stem of Yggdrasil upholds the earth, while its branches overshadow the world and reach up beyond the heavens. On its topmost bough sits an eagle, between whom and Nidhug the squirrel Ratatöskr runs to and fro trying to provoke strife. Honey-dew falls from the tree, and on it Odin hung nine nights, offering himself to himself. G. Vigfusson and York Powell (*Corpus Poeticum Boreale*, Oxford, 1883) see in Yggdrasil not a primitive Norse idea, but one due to early contact with Christianity, and a fanciful adaptation of the cross.

YO-CHOW FU, a prefectural city in the Chinese province of Hu-nan, standing on high ground E. of the outlet of Tung-tʽing Lake, in 29° 18′ N., 113° 2′ E. Pop. about 20,000. It was opened to foreign trade in 1899. The actual settlement is at Chinling-ki, a village 5½ m. below Yo-chow and half a mile from the Yangtsze. From Yo-chow the cities of Chang sha and Chang tê are accessible for steam vessels drawing 4 to 5 ft. of water by means of the Tung-tʽing Lake and its affluents, the Siang and Yuen rivers. The district in which Yo-chow Fu stands is the ancient habitat of the aboriginal San Miao tribes, who were deported into S.W. China, and who, judging from some non-Chinese festival customs of the people, would appear to have left traditions behind them. The present city, which was built in 1371, is about 3 m. in circumference and is entered by four gates. The walls are high and well built, but failed to keep out the Tʽaipʽing rebels in 1853. Situated between Tung-tʽing Lake and the Yangtsze-kiang, Yo-chow Fu forms a depot for native products destined for export, and for foreign goods on their way inland. The net value of the total trade of the port in 1906 was 747,000 taels.

YOGI, a Hindu religious ascetic. The word *yoga* means union, and first occurs in the later *Upanishads*; and *yogi* means one who practises *yoga*, with the object of uniting his soul with the divine spirit. This union, when accomplished by the individual soul, must enhance its susceptibilities and powers, and so the *yogis* claim a far-reaching knowledge of the secrets of nature and extensive sway over men and natural phenomena. The most usual manifestation of this power is a state of ecstasy, of the nature of self-hypnotism.

YOKOHAMA, a seaport of Japan on the W. shore of Tokyo Bay, 18 m. S. of Tokyo by rail. It stands on a plain shut in by hills, one of which, towards the S.E., terminates in a promontory called Honmoku-misaki or Treaty Point. The temperature ranges from 95° to 43° F., and the mean temperature is 57·7°. The cold in winter is severe, owing to N. winds, while the heat is great in summer, though tempered by S.W. sea breezes. The rainfall is about 70 in. annually. In 1859, when the neighbouring town of Kanagawa was opened to foreigners under the treaty with the United States, Yokohama was an insignificant fishing village; and notwithstanding the protests of the foreign representatives the Japanese government shortly afterwards chose the latter place as the settlement instead of Kanagawa. The town grew rapidly—in 1886 the population was 111,179 (3904 foreigners, including 2573 Chinese, 625 British and 256 Americans, while in 1903 there were 314,333 Japanese and 2447 foreigners (1089 British, 527 Americans, 270 Germans, 155 French) besides about 3800 Chinese. The Japanese government constructed public works, and excellent water was supplied from the Sagamigawa. The foreign settlement has well-constructed streets, but the wealthier foreigners reside S. of the town, on the Bluff. The land occupied by foreigners was leased to them by the Japanese government, 20% of the annual rent being set aside for municipal expenses. The harbour, which is a part of Tokyo Bay, is good and commodious, somewhat exposed, but enclosed by two breakwaters. There is a pier 2000 ft. long, and two docks were opened in 1897 and 1898, with lengths of 351 ft. and 478 ft. 10 in., and depths of 26 ft. 2 in. and 28 ft. on the blocks at ordinary spring tides. The average depth in the harbour at high water is about 46 ft., with a fall of tide of about 8 ft., the entrance being marked by a lightship and two buoys. The railway connecting Yokohama with Tokyo was the first in Japan, and was constructed in 1872. The value of exports and imports, which in 1880 was £3,792,991 and £5,378,385, and in the ensuing five years averaged £4,638,635 and £4,366,507, had increased in 1905 to £14,861,823 and £19,068,221. Metals and metal goods, rice, wool and woollen goods, and cotton and cotton goods are the chief imports; and silk, silk goods and tea are the chief exports.

YOKOSUKA, a seaport and naval station of Japan, on the W. shore of Tokyo Bay, 12 m. S. of Yokohama. The town is connected by a branch line with the main railway from Tokyo. The port is sheltered by hills and affords good anchorage. The site was occupied by a small fishing village until 1865, when the shogun's government established a shipyard here. In 1868 the Japanese government converted the shipyard into a naval dockyard, and subsequently carried out many improvements. In 1884 the port became a first-class naval station; and naval barracks, warehouses, offices, hospitals, &c., were established here. The dockyard was first constructed by French engineers; but after 1875 the work passed entirely into the hands of Japanese engineers.

YOLA, once a native state of West Africa, forming part of the Fula emirate of Adamawa, now a province in the British protectorate of Nigeria. The province, which has an area of 16,000 sq. m., occupies the S.E. of the protectorate and both banks of the upper Benue. It is bounded S. and E. by the German colony of Cameroon, N. by the British province of Bornu, and W. by the British provinces of Bauchi and Muri. It has an estimated population of 300,000. The capital is Yola, a town founded by the Fula conqueror Adama about the middle of the 19th century. It was the capital of the emirate of Adamawa, the greater part of which is now a German protectorate. The town is situated in 9° 12′ N., 12° 40′ E. and is built on the left or S. bank of the Benue, 480 m. by river from Lokoja. It can be reached by shallow draught steamers when the river is in flood. The Niger Company had trading relations with Yola before the establishment of British administration in Northern Nigeria. In 1901 the reigning emir, a son of Adama, forced them to evacuate their station, and, all attempts to establish friendly relations proving unavailing, the British government despatched an expedition from Lokoja in August 1901. The emir was deposed and a new emir installed in his place. The hostility of certain pagan tribes had to be overcome by British expeditions in January and April of 1902. By 1903 the province was brought fairly under administrative control, and divided into three administrative divisions—the N.W. with a station at Gazi, the N.E. and the S. with Yola for its station. The new emir proved friendly and loyal, but though appointed in 1901 was not formally installed till October 1904, when he took the customary oath of allegiance to the British crown and accepted all the conditions with regard to the suppression of slavery, &c. The slave markets were immediately closed as a result of British occupation, and any slave-trading which is still done is smuggled. In 1903 an exploring expedition was sent up the Gongola, one of the principal rivers of the Yola province, and as a result the navigability of the river for steam launches as far as Gombe at high water was demonstrated. An important means of communication with the province of Bornu was thus established, and a rich agricultural district opened to development. The Gongola valley was in ancient times extensively cultivated, and the population are readily returning to the land. Cotton, rice and tobacco are among the heavy crops (see Nigeria, Adamawa).

YOLANDE [or Isabella] **OF BRIENNE** (1212–1228), the daughter of John of Brienne, who had married Mary, daughter of Conrad of Montferrat, heiress on the death of Amalric II. of the kingdom of Jerusalem. Yolande inherited the throne on her mother's death in 1212, but her father ruled as her guardian. In 1225 she married the emperor Frederick II., the pope hoping by this bond to attach the emperor firmly to the crusade. Immediately upon his marriage Frederick demanded all the rights of sovereignty in the kingdom of Jerusalem, which he claimed to exercise in his wife's name. His action led to difficulties with John, who did not relish the loss of his position. Yolande died in 1228 after the birth of a son, Conrad, and her husband then continued to rule, though not without opposition.

YONGE, CHARLOTTE MARY (1823–1901), English novelist and writer on religious and educational subjects, daughter of William

Crawley Yonge, 52nd Regiment, and Frances Mary Bargus, was born on the 11th of August 1823 at Otterbourne, Hants. She was educated by her parents, and from them inherited much of the religious feeling and High Church sympathy which coloured her work. She resided at Otterbourne all her life, and was one of the most prolific writers of the Victorian era. In 1841 she published five works of fiction, including *The Clever Woman of the Family*, *Dynevor Terrace* and *The Trial*; and after that she was the author of about 120 volumes, including novels, tales, school manuals and biographies. Her first conspicuous success was attained with *The Heir of Redclyffe* (1853), which enjoyed an enormous vogue. *The Daisy Chain* (1856) continued the success; and among her other popular books may be mentioned *Heartsease* (1854), *The Young Stepmother* (1861) and *The Dove in the Eagle's Nest* (1866). In more serious fields of literature she published *Landmarks of History* (three series, 1852–57), *History of Christian Names* (1863), *Cameos of English History* (1868), *Life of Bishop Patteson* (1874), *English Church History for Use in Schools* (1883) and many others. She also edited various educational works, and was for more than thirty years editor of the *Monthly Packet*. She died at Otterbourne on 23rd March 1901. Her books err on the side of didacticism, but exercised a wide and wholesome influence. The money realized by the early sales of *The Daisy Chain* was given to the building of a missionary college at Auckland, N.Z., while a large portion of the proceeds of *The Heir of Redclyffe* was devoted to the missionary schooner "The Southern Cross."

See *Charlotte Mary Yonge: an Appreciation*, by Ethel Romanes (1908).

YONGE, JOHN (1467–1516), English ecclesiastic and diplomatist, was born at Heyford, Oxfordshire, and educated at Winchester and New College, Oxford, where he became a fellow in 1485. He was ordained in 1500 and held several livings before receiving his first diplomatic mission to arrange a commercial treaty with the archduke of Austria in 1504, and in the Low Countries in 1506 in connexion with the projected marriage between Henry VII. and Margaret of Savoy. In 1507 he was made Master of the Rolls, and in the following year was employed in various diplomatic missions. He was one of the ambassadors who arranged the Holy League in 1513, and accompanied Henry VIII. during the ensuing campaign. In 1514 he was made dean of York in succession to Wolsey, and in 1515 he was one of the commissioners for renewing the peace with Francis I. He died in London on the 25th of April 1516. Yonge was on terms of intimate friendship with Dean Colet, and was a correspondent of Erasmus.

YONGE, SIR WILLIAM, Bart. (*c.* 1693–1755), English politician, was the son of Sir Walter Yonge of Colyton, Devonshire, and great-great-grandson of Walter Yonge of Colyton (?1581–1649), whose diaries (1604–45), more especially four volumes now in the British Museum (Add. MSS. 18777–18780), are valuable material for history. In 1722 he was elected to parliament as member for Honiton; and he succeeded his father, the third baronet, in 1731. In the House of Commons he attached himself to the Whigs, and making himself useful to Sir Robert Walpole, was rewarded with a commissionership of the treasury in 1724. George II., who conceived a strong antipathy to Sir William, spoke of him as "Stinking Yonge"; but Yonge conducted himself so obsequiously that he obtained a commissionership of the admiralty in 1728, was restored to the treasury in 1730, and in 1735 became secretary of state for war. He especially distinguished himself in his defence of the government against a hostile motion by Pulteney in 1742. Making friends with the Pelhams, he was appointed vice-treasurer of Ireland in 1746; and, acting on the committee of management for the impeachment of Lord Lovat in 1747, he won the applause of Horace Walpole by moving that prisoners impeached for high treason should be allowed the assistance of counsel. In 1748 he was elected F.R.S. He died at Escott, near Honiton, on the 10th of August 1755. By his second wife, Anne, daughter and coheiress of Thomas, Lord Howard of Effingham, he had two sons and six daughters. He enjoyed some reputation as a versifier, some of his lines being even mistaken for the work of Pope, greatly to the disgust of the latter; and he wrote the lyrics incorporated in a comic opera, adapted from Richard Brome's *The Jovial Crew*, which was produced at Drury Lane in 1730 and had a considerable vogue.

His eldest son, Sir George Yonge (1731–1812), was member of parliament for Honiton continuously from 1754 to 1794, and held a number of different government appointments, becoming a lord of the admiralty (1766–70), vice-treasurer for Ireland (1782), secretary of state for war (1782–94, with an interval from April to December 1783), master of the mint (1794–99). In 1799 he was appointed governor of the Cape of Good Hope. Serious charges being brought against his administration, which was marked by great lack of judgment, he was recalled in 1801. He died on the 25th of September 1812. The baronetcy became extinct at his death.

YONKERS, a city of Westchester county, New York, U.S.A., on the E. bank of the Hudson river, immediately adjoining New York City on the N. Pop. (1900) 47,931, of whom 14,634 were foreign-born and 1005 were negroes; (1910, U.S. census) 79,803. Yonkers is served by three divisions of the New York Central & Hudson River railway, and is connected with New York City and other places E. and N. by interurban electric lines. It has also during most of the year steamboat service on the Hudson. There are two principal residential districts: one in the N., including Amackassin Heights and (about 1 m. W.) Glenwood, where are the old Colgate Mansion and "Greystone," the former home of Samuel J. Tilden; the other in the S., including Ludlow, Van Cortlandt Terrace and Park Hill (adjoining Riverdale in the borough of the Bronx), a park-like reserve with winding streets and drives. The business and manufacturing districts occupy the low lands along the river. Among the public buildings are the City Hall, the High School and a Manual Training School, and Yonkers is the seat of St Joseph's Theological Seminary (Roman Catholic; 1896), the Halsted School (founded 1874) for girls, and a business college. It has a good public library (established 1893; 25,000 vols. in 1910), and the Woman's Institute (1880) and the Hollywood Inn Club (1897; for working-men) have small libraries. Philipse Manor Hall, built originally about 1682 as the mansion of the son of Frederick Philipse (1626–1702), the lord of Philipsburgh, and enlarged to its present dimensions in 1745, is of some historic interest. It was confiscated by act of the legislature in 1779 because its owner, Frederick Philipse (1746–1785), was suspected of Toryism, and was sold in 1789. In 1867 it passed into the possession of Yonkers, and from 1872 to 1908 was used as the city hall. In 1908 it was bought by the state, and is now maintained as a museum for colonial and revolutionary relics. It is one of the best examples of colonial architecture in America. In the square before it stands a monument to the soldiers and sailors of the Civil War. Yonkers is an important manufacturing city, and in 1905 the value of its factory products was $33,548,688.

On the site of Yonkers stood an Indian village known as Nappeckamack, or town of the rapid water, at the time of the settlement of the Dutch in New Amsterdam; and a great rock, near the mouth of the Nepperhan Creek, was long a place of Indian worship. The territory was part of the "Keskeskick purchase," acquired from the Indians by the Dutch W. India Company in 1639. In 1646 the tract was included in the grant to Adrian van der Donck, the first lawyer and historian of New Netherland, author of *A Description of New Netherland* (1656), in Dutch. His grant, known as "Colen Donck" (Donck's Colony), embraced all the country from Spuyten Duyvil Creek, N. along the Hudson to the Amackassin Creek, and E. to the Bronx river. Some squatters settled here before 1646. Van der Donck encouraged others to remove to his lands along the Hudson river, and in 1649 he built a saw-mill near the mouth of the Nepperhan Creek, which for many years was called "Saw-Mill river." The whole settlement soon came to be called "De Jonkheer's Land" or "De Jonkheers"—meaning the estate of the young lord, as Van der Donck was called by his tenants—and afterwards Yonkers. Subsequently the tract passed largely into the hands of Frederick Philipse and became part of the manor of Philipsburgh. Early in the War of Independence Yonkers was occupied for a time by part of Washington's army, and was the scene of several skirmishes. The town of Yonkers was incorporated in 1788 and the village in 1855. In 1872 Yonkers became a city; at the same time the southern part was separately incorporated as Kingsbridge, which in 1874 was annexed to New York.

See Frederic Shonnard and W. W. Spooner, *History of Westchester County* (New York, 1900); J. T. Scharf, *History of Westchester County* (New York, 1886); and Allison, *History of Yonkers* (New York, 1896).

YONNE, a department of central France, formed partly from the province of Champagne proper (with its dependencies, Sénonais and Tonnerrois), partly from Burgundy proper (with its dependencies, the county of Auxerre and Avallonnais) and partly from Gâtinais (Orléanais and Île-de-France). It is bounded by Aube on the N.E., Côte-d'Or on the S.E., Nièvre on the S., Loiret on the W. and Seine-et-Marne on the N.W. Pop. (1906) 315,199. Area, 2880 sq. m. The highest elevation (2000 ft.) is in the granitic highlands of Morvan, in the S.E., where other peaks range from 1300 to 1600 ft. The department belongs to the basin of the Seine, except a small district in the S.W. (Puisaye), which belongs to that of the Loire. The river Yonne flows through it from S. to N.N.W., receiving on the right bank the Cure, the Serein and the Armançon, which water the S.E. of the department. Farther N. it is joined by the Vanne, between which and the Armançon lies the forest-clad plateau of the Pays d'Othe. To the W. of the Yonne, in the Puisaye, are the sources of the Loing, another tributary of the Seine, and of its affluents, the Ouanne and the Lunain. The Yonne is navigable throughout the department, and is connected with the Loire by the canal of Nivernais, which in turn is connected with that of Briare, which connects the Seine and the Loire. The climate is temperate, except in the Morvan, where the extremes of heat and cold are greater, and where the rainfall is most abundant. The prevailing winds are S.W. and W.

The department is essentially agricultural. Wheat and oats are the chief cereals; potatoes, sugar-beet, lucerne, mangold-wurzel and other forage plants are also cultivated, and there is much good pasture.

The vineyards of the Tonnerrois and Auxerrois produce the finest red wines of lower Burgundy, and those of Chablis the finest white. The wine of the Côte St Jacques (Joigny) is also highly esteemed. Cider-apples are the chief fruit. Charny is a centre for the rearing of horses. Forests cover considerable areas of the department and consist chiefly of oak, beech, hornbeam, elm, ash, birch and pine. Quarry products include building-stone, ochre and cement. Among the industrial establishments are tanneries, tile-works, saw-mills and breweries, but there is little manufacturing activity. Cereals, wines, firewood, charcoal, ochre and bark are exported.

The department is served chiefly by the Paris-Lyon railway. The canal of Burgundy, which follows the valley of the Armançon, has a length of 57 m. in the department, that of Nivernais, following the valley of the Yonne, a length of 33 m. The department constitutes the archiepiscopal diocese of Sens, has its court of appeal in Paris, its educational centre at Dijon, and belongs to the district of the V. army corps. It is divided into five arrondissements (37 cantons, 486 communes), of which the capitals are Auxerre, also capital of the department, Avallon, Sens, Joigny and Tonnerre, which with those of Chablis, St Florentin and Vézelay are its most noteworthy towns and are treated separately. Yonne is rich in objects of antiquarian and architectural interest. At Pontigny there is a Cistercian abbey, where Thomas Becket spent two years of his exile. Its church is an excellent type of the Cistercian architecture of the 12th century. The fine 12th-century château of Druyes, which stands on a hill overlooking the village, once belonged to the counts of Auxerre and Nevers. Villeneuve-sur-Yonne has a medieval keep and gateways and a church of the 13th and 16th centuries. The Renaissance châteaux of Fleurigny, Ancy-le-France and Tanlay, the last-named for some time the property of the Coligny family, and the château of St Fargeau, of the 13th century, rebuilt by Mademoiselle de Montpensier under Louis XIV., are all architecturally remarkable. At St Moré there are remains of the Roman road from Lyons to Gallia Belgica and of a Roman fortified post.

YORCK VON WARTENBURG, HANS DAVID LUDWIG, COUNT (1759–1830), Prussian general field-marshal, was of English ancestry. He entered the Prussian army in 1772, but after seven years' service was cashiered for disobedience. Entering the Dutch service three years later he took part in the operations of 1783–84 in the East Indies as captain. Returning to Prussia in 1785 he was, on the death of Frederick the Great, reinstated in his old service, and in 1794 took part in the operations in Poland, distinguishing himself especially at Szekoczyn. Five years afterwards Yorck began to make a name for himself as commander of a light infantry regiment, being one of the first to give prominence to the training of skirmishers. In 1805 he was appointed to the command of an infantry brigade, and in the disastrous Jena campaign he played a conspicuous and successful part as a rearguard commander, especially at Altenzaun. He was taken prisoner, severely wounded, in the last stand of Blücher's corps at Lübeck. In the reorganization of the Prussian army which followed the peace of Tilsit, Yorck was one of the leading figures. At first major-general commanding the West Prussian brigade, afterwards inspector-general of light infantry, he was finally appointed second in command to General Grawert, the leader of the auxiliary corps which Prussia was compelled to send to the Russian War of 1812. The two generals did not agree, Grawert being an open partisan of the French alliance, and Yorck an ardent patriot; but before long Grawert retired, and Yorck assumed the command. Opposed in his advance on Riga by the Russian General Steingell, he displayed great skill in a series of combats which ended in the retirement of the enemy to Riga. Throughout the campaign he had been the object of many overtures from the enemy's generals, and though he had hitherto rejected them, it was soon borne in upon him that the Grand Army was doomed. Marshal Macdonald, his immediate French superior, retreated before the corps of Diebitsch, and Yorck found himself isolated. As a soldier his duty was to break through, but as a Prussian patriot his position was more difficult. He had to judge whether the moment was favourable for the war of liberation; and, whatever might be the enthusiasm of his junior staff-officers, Yorck had no illusions as to the safety of his own head. On December 30th the general made up his mind. The Convention of Tauroggen "neutralized" the Prussian corps. The news was received with the wildest enthusiasm, but the Prussian Court dared not yet throw off the mask, and an order was despatched suspending Yorck from his command pending a court-martial. Diebitsch refused to let the bearer pass through his lines, and the general was finally absolved when the treaty of Kalisch definitely ranged Prussia on the side of the Allies. Yorck's act was nothing less than the turning-point of Prussian history. His veterans formed the nucleus of the forces of East Prussia, and Yorck himself in public took the final step by declaring war as the commander of those forces. On March 17th, 1813, he made his entry into Berlin in the midst of the wildest exuberance of patriotic joy. On the same day the king declared war. During 1813–14 Yorck led his veterans with conspicuous success. He covered Blücher's retreat after Bautzen and took a decisive part in the battles on the Katzbach. In the advance on Leipzig his corps won the action of Wartenburg (October 4) and took part in the crowning victory of October 18th. In the campaign in France Yorck drew off the shattered remnants of Sacken's corps at Montmirail, and decided the day at Laon. The storm of Paris was his last fight. In the campaign of 1815 none of the older men were employed in Blücher's army, in order that Gneisenau (the ablest of the Prussian generals) might be free to assume command in case of the old prince's death. Yorck was appointed to a reserve corps in Prussia, and, feeling that his services were no longer required, he retired from the army. His master would not accept his resignation for a considerable time, and in 1821 made him general field-marshal. He had been made Count Yorck von Wartenburg in 1814. The remainder of his life was spent on his estate of Klein-Öls, the gift of the king. He died there on the 4th of

October 1830. A statue (by Rauch) was erected to him in Berlin in 1855.

See Seydlitz, *Tagebuch des Preussischen Armee Korps 1812* (Berlin, 1823); Droysen, *Leben des G. F. M. Grafen Yorck von Wartenburg* (Berlin, 1851).

YOREDALE SERIES, in geology, a local phase of the lower Carboniferous rocks of the N. of England. The name was introduced by J. Phillips on account of the typical development of the phase in Yoredale (Wensleydale), Yorkshire. In the Yorkshire dales the Carboniferous rocks assume an aspect very different from that which obtains in the S. Beds of detrital sediment, sandstones, shales and occasional ironstones and thin coals separate the limestones into well-defined beds. These limestone beds have received various names of local significance (Hardraw Scar, Simonstone, Middle, Underset, Main and many others), and owing to the country being little disturbed by faulting and being much cut up by the streams, they stand out as escarpments on either side of the valleys. The first indication of the intercalation of thick detrital deposits within the massive limestone is seen in Ingleborough and Penyghent; but as the rocks are traced N. the detrital matter increases in quantity and the limestones diminish, till in Northumberland the whole Carboniferous series assumes the Yoredale phase, and consists of alternations of detrital and calcareous beds, no massive limestone being seen.

The Yoredale limestones are characterized by the presence of *Productus giganteus* and the brachiopod fauna usually associated with it. The main limestone of Weardale is full of corals, including *Lonsdaleia floriformis*, *Dibunophyllum* sp., *Cyclophyllum pachyendothecum*, &c., and has a typical Viséan fauna; it would therefore correspond, palaeontologically, with the upper part of the Carboniferous Limestone of Derbyshire. On Ingleborough the limestones are not very fossiliferous, but the Main Limestone contains small corals of a zaphrentoid type and an upper Viséan fauna. *Posidonomya Becheri* occurs fairly low down in the series in the Shale above the Hardraw Scar and Gayls limestones, but it is not accompanied by any of the goniatites or other cephalopods and lamellibranchs which characterize the *Posidonomya Becheri* beds of the Pendleside Series, the faunas of the Yoredale and Pendleside phases being very distinct. The Red Bed Limestone of Leyburn, the uppermost limestone of the series, is very rich in fish remains, which are identical in many cases with those found in the topmost beds of the massive Carboniferous Limestone at Bolt Edge quarry in Derbyshire. The shales between the limestones are rich in fossils and contain abundant single corals referable to *Zaphrentis enniskilleni*, *Cyclophyllum pachyendothecum* and others; these, though high-zonal forms, occur low down in the Yoredale strata, even in the shale above the Hardraw Scar limestone. In the Derbyshire area and farther N. these corals would indicate the uppermost beds of the limestone series of those districts, and their early appearance in the Yoredale area is probably entirely due to conditions of environment. Attempts have been made to correlate rocks in a number of widely separated areas with the Yoredale strata, but on wholly insufficient grounds. It is clear that the exact relationship which the Yoredale series of the type area bears as a whole to the lower Carboniferous rocks of the Midlands, N. and S. Wales, &c., on the one hand, and to the Pendleside series on the other, has yet to be established on a firm palaeontological basis.

See *Mem. Geol. Survey*, "Geology of Mallerstang"; W. Hind, *Proc. Yorks. Geol. and Poly. Soc.* (1902), xiv. part iii.; and *Rep. Brit. Ass.*, "Life Zones Brit. Carb. Rocks" (1901).

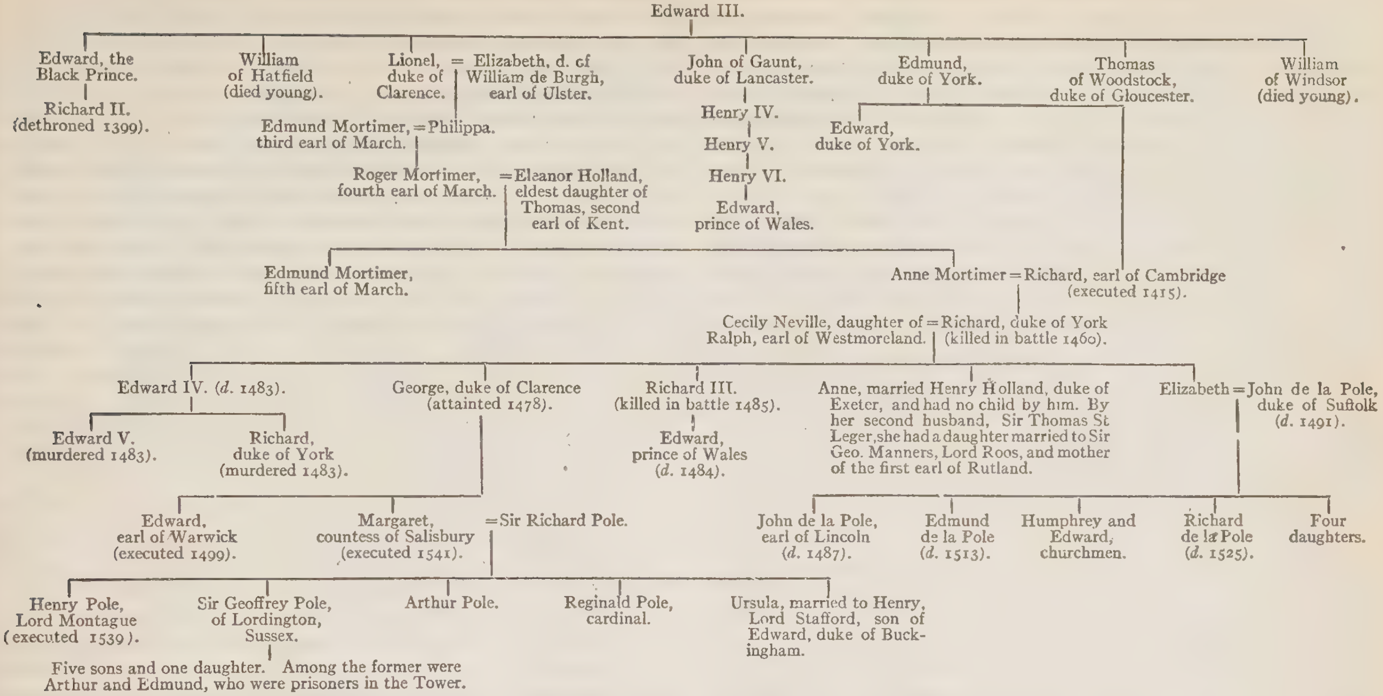
YORK (HOUSE OF), a royal line in England, founded by Richard, duke of York (*q.v.*), who claimed the crown in opposition to Henry VI. It may be said that his claim, at the time it was advanced, was rightly barred by prescription, the house of Lancaster having then occupied the throne for three generations, and that it was really owing to the misgovernment of Margaret of Anjou, and her favourites that it was advanced at all. Yet it was founded upon strict principles of lineal descent. For the duke was descended from Lionel, duke of Clarence, the third son of Edward III., while the house of Lancaster came of John of Gaunt, a younger brother of Lionel. One thing which might possibly have been considered an element of weakness in his claim was that it was derived (see the Table) through females—an objection actually brought against it by Chief-Justice Fortescue. But a succession through females could not reasonably have been objected to after Edward III.'s claim to the crown of France; and, apart from strict legality, the duke's claim was probably supported in the popular estimation by the fact that he was descended from Edward III. through his father no less than through his mother. For his father, Richard, earl of Cambridge, was the son of Edmund, duke of York, fifth son of Edward III.; and he himself was the direct lineal heir of this Edmund, just as much as he was of Lionel, duke of Clarence. His claim was also favoured by the accumulation of hereditary titles and estates. The earldom of Ulster, the old inheritance of the De Burghs, had descended to him from Lionel, duke of Clarence; the earldom of March came from the Mortimers, and the dukedom of York and the earldom of Cambridge from his paternal ancestry. Moreover, his own marriage with Cecily Neville, though she was but the youngest daughter of Ralph, 1st earl of Westmorland, allied him to a powerful family in the north of England, to whose support both he and his son were greatly indebted.

The reasons why the claims of the line of Clarence had been so long forborne are not difficult to explain. Roger Mortimer, 4th earl of March, was designated by Richard II. as his successor; but he died the year before Richard was dethroned, and his son Edmund, the 5th earl, was a child at Henry IV.'s usurpation. Henry took care to secure his person; but the claims of the family troubled the whole of his own and the beginning of his son's reign. It was an uncle of this Edmund who took part with Owen Glendower and the Percies; and for advocating the cause of Edmund Archbishop Scrope was put to death. And it was to put the crown on Edmund's head that his brother-in-law Richard, earl of Cambridge, conspired against Henry V. soon after his accession. The plot was detected, being revealed, it is said, by the earl of March himself, who does not appear to have given it any encouragement; the earl of Cambridge was beheaded. The popularity gained by Henry V. in his French campaigns secured the weak title of the house of Lancaster against further attack for forty years.

Richard, duke of York, seems to have taken warning by his father's fate; but, after seeking for many years to correct by other means the weakness of Henry VI.'s government, he first took up arms against the ill advisers who were his own personal enemies, and at length claimed the crown in parliament as his right. The Lords, or such of them as did not purposely stay away from the House, admitted that his claim was unimpeachable, but suggested as a compromise that Henry should retain the crown for life, and the duke and his heirs succeed after his death. This was accepted by the duke, and an act to that effect received Henry's own assent. But the act was repudiated by Margaret of Anjou and her followers, and the duke was slain at Wakefield fighting against them. In little more than two months, however, his son was proclaimed king at London by the title of Edward IV., and the bloody victory of Towton immediately after drove his enemies into exile and paved the way for his coronation. After his recovery of the throne in 1471 he had little more to fear from the rivalry of the house of Lancaster. But the seeds of distrust had already been sown among the members of his own family, and in 1478 his brother Clarence was put to death—secretly, indeed, within the Tower, but still by his authority and that of parliament—as a traitor. In 1483 Edward himself died; and his eldest son, Edward V., after a nominal reign of two months and a half, was put aside by his uncle, the duke of Gloucester, who became Richard III., and then caused him and his brother Richard, duke of York, to be murdered. But in little more than two years Richard was slain at Bosworth by the earl of Richmond, who, being proclaimed king as Henry VII., shortly afterwards fulfilled his pledge to marry the eldest daughter of Edward IV. and so unite the houses of York and Lancaster.

Here the dynastic history of the house of York ends, for its claims were henceforth merged in those of the house of Tudor. But, although the union of the Roses ought to have extinguished controversy, a host of debatable questions and plausible pretexts for rebellion remained. The legitimacy of Edward IV.'s children had been denied by Richard III. and his parliament, and, though the act was denounced as scandalous, the slander might still be reasserted. The duke of Clarence had left two

Genealogical Table of the House of York


Edward III.
Edward, the Black Prince.
Richard II. (dethroned 1399).
William of Hatfield (died young).
Lionel, duke of Clarence. = Elizabeth, d. of William de Burgh, earl of Ulster.
Edmund Mortimer, third earl of March. = Philippa.
Roger Mortimer, fourth earl of March. = Eleanor Holland, eldest daughter of Thomas, second earl of Kent.
Edmund Mortimer, fifth earl of March.
John of Gaunt, duke of Lancaster.
Henry IV.
Henry V.
Henry VI.
Edward, prince of Wales.
Edmund, duke of York.
Edward, duke of York.
Thomas of Woodstock, duke of Gloucester.
William of Windsor (died young).
Anne Mortimer = Richard, earl of Cambridge (executed 1415).
Cecily Neville, daughter of Ralph, earl of Westmoreland. = Richard, duke of York (killed in battle 1460).
Edward IV. (d. 1483).
Edward V. (murdered 1483).
Richard, duke of York (murdered 1483).
George, duke of Clarence (attainted 1478).
Edward, earl of Warwick (executed 1499).
Margaret, countess of Salisbury (executed 1541). = Sir Richard Pole.
Henry Pole, Lord Montague (executed 1539).
Sir Geoffrey Pole, of Lordington, Sussex.
Five sons and one daughter. Among the former were Arthur and Edmund, who were prisoners in the Tower.
Arthur Pole.
Reginald Pole, cardinal.
Ursula, married to Henry, Lord Stafford, son of Edward, duke of Buckingham.
Richard III. (killed in battle 1485).
Edward, prince of Wales (d. 1484).
Anne, married Henry Holland, duke of Exeter, and had no child by him. By her second husband, Sir Thomas St Leger, she had a daughter married to Sir Geo. Manners, Lord Roos, and mother of the first earl of Rutland.
Elizabeth = John de la Pole, duke of Suffolk (d. 1491).
John de la Pole, earl of Lincoln (d. 1487).
Edmund de la Pole (d. 1513).
Humphrey and Edward, churchmen.
Richard de la Pole (d. 1525).
Four daughters.

children, a son and a daughter, and the attainder of their father could not be a greater bar to the crown than the attainder of Henry VII. himself. Seeing this, Henry had, immediately after his victory at Bosworth, secured the person of the son, Edward, earl of Warwick, and kept him a prisoner in the Tower of London. Yet a formidable rebellion was raised in his behalf by means of Lambert Simnel, who was defeated and taken prisoner at the battle of Stoke in 1487. The earl of Warwick lived for twelve years later in unjust confinement, and was ultimately put to death in 1499 because he had consented to a plot for his own liberation. As to his sister Margaret, she was married to one of Henry VII.'s Welsh followers, Sir Richard Pole (or Poole), and could give no trouble, so that, when Henry VIII. came to the throne, he thought it politic to treat her with kindness. He made her countess of Salisbury, reversed her brother's attainder, created her eldest son, Henry, Lord Montague, and caused one of her younger sons, Reginald, who displayed much taste for learning, to be carefully educated. This, however, was the very thing which involved the whole family in ruin. For Henry looked to the learning and abilities of Reginald Pole to vindicate before Europe the justice of his divorce from Catherine of Aragon; and, when Pole was conscientiously compelled to declare the very opposite, the king's indignation knew no bounds. Pole himself was safe, having secured some time before a retreat in Italy. He was even made a cardinal by the pope. But this only made matters worse for his family at home: his brother, Lord Montague, and even his mother, the aged countess of Salisbury, were beheaded as traitors because they had continued to correspond with him. Cardinal Pole, however, came back to his own country with great honour in the reign of Queen Mary, and was made archbishop of Canterbury on the deprivation of Cranmer.

Early in the reign of Queen Elizabeth, two nephews of the cardinal, Arthur and Edmund Pole, being ardent young men, conspired to go over to the duke of Guise in France, hoping to return with an army into Wales and so promote the claims of Mary Queen of Scots to the crown of England, for which service the elder, Arthur, expected to be restored to the dukedom of Clarence. The result was that they were condemned to death, but were only imprisoned for the rest of their days in the Tower, where they both carved inscriptions on the walls of their dungeon, which are still visible in the Beauchamp tower.

Another branch of the house of York might have given trouble to the Tudors if they had not been narrowly watched and ultimately extinguished. Of the sisters of Edward IV., the eldest, Anne, who married the duke of Exeter, left only one daughter by her second husband, Sir Thomas St Leger; but the second, Elizabeth, married John de la Pole, duke of Suffolk, and had several children. Their eldest son was created earl of Lincoln during his father's life, and Richard III., after the death of his own son, had designated him as his successor. Disappointed of a kingdom by the success of Henry VII., he joined in Simnel's rebellion and was killed at the battle of Stoke. His brother Edmund thus became heir to his father; but in the reduced circumstances of the family he agreed to forbear the title of duke and take that of earl of Suffolk. He continued for some years in favour with the king, who made him a knight of the Garter; but, having killed a man in a passion, he fled abroad and was entertained at the court of the emperor Maximilian, and afterwards at that of Philip, king of Castile, when resident in the Low Countries before his departure for Spain. Philip, having been driven on the English coast when going to take possession of his Spanish kingdom, was entertained at Windsor by Henry VII., to whom he promised to deliver up the fugitive on condition that his life should be spared. Edmund de la Pole accordingly was brought back to England and lodged in the Tower. Though the promise to spare his life was kept by the king who gave it, his son Henry VIII. caused him to be executed in 1513, when war broke out with France, apparently for treasonable correspondence with his brother Richard, then in the French service. After his death Richard de la Pole, remaining in exile, called himself earl of Suffolk, and was flattered occasionally by Francis I. with faint hopes of the crown of England. He was killed at the battle of Pavia in 1525. There were no more De la Poles who could advance even the most shadowy pretensions to disturb the Tudor dynasty. (J. Ga.)

YORK, EDMUND OF LANGLEY, Duke of (1341–1402), fifth son of Edward III., was born at King's Langley in Hertfordshire on the 5th of June 1341. He accompanied his father on a campaign in France in 1359, was created earl of Cambridge in 1362, and took part in expeditions to France and Spain, being present at the sack of Limoges in 1370. After marrying Isabella (d. 1393), daughter of Peter the Cruel, king of Castile, he was appointed one of the English lieutenants in Brittany, whither he led an army in 1375. A second campaign in Brittany was followed in 1381 by an expedition under the earl's leadership to aid Ferdinand, king of Portugal, in his struggle with John I., king of Castile; but after a period of inaction Edmund was compelled to return to England as Ferdinand had concluded an independent peace with Castile. Accompanying Richard II. on his march into Scotland, he was created duke of York in August 1385, and subsequently on three occasions he acted as regent of England. In this capacity he held a parliament in 1395, and he was again serving as regent when Henry of Lancaster, afterwards Henry IV., landed in England in July 1399. After a feeble attempt to defend the interests of the absent king, York joined the victorious invader; but soon retired from public life, and, in the words of Froissart as translated by Lord Berners, "laye styll in his castell, and medled with nothynge of the busynesse of Englande." He died at King's Langley on the 1st of August 1402. York was a man who preferred pleasure to business, and during the critical events of his nephew's reign he was content to be guided by his more ambitious brothers, the dukes of Lancaster and Gloucester. His second wife was Joan, or Johanna (d. 1434), daughter of Thomas Holland, earl of Kent, but his only children were two sons and a daughter, Constance (d. 1416), by his first wife.

YORK, EDWARD, Duke of (*c.* 1373–1415), elder son of the preceding, was created earl of Rutland in 1390. Being an intimate friend of his cousin, Richard II., he received several important appointments, including those of admiral of the fleet, constable of the tower of London and warden of the Cinque Ports. He accompanied the king to Ireland in 1394 and was made earl of Cork; arranged Richard's marriage with Isabella, daughter of Charles VI. of France; and was one of the king's most active helpers in the proceedings against the "lords appellant" in 1397. As a reward he secured the office of constable of England and the lands in Holderness which had previously belonged to his murdered uncle, Thomas of Woodstock, duke of Gloucester, together with other estates and the title of duke of Aumerle or Albemarle. He appears to have deserted Richard in 1399, but only at the last moment; and in Henry IV.'s first parliament he was vigorously denounced as the murderer of Gloucester. After declaring that his part in the proceedings of 1397 had been performed under constraint, his life was spared, but he was reduced to his former rank as earl of Rutland, and deprived of his recent acquisitions of land. It is uncertain what share Rutland had in the conspiracy against Henry IV. in January 1400, but his complete acquittal by parliament in 1401, and the confidence subsequently reposed in him by the king, point to the conclusion that he was not seriously involved. Serving as the royal lieutenant in Aquitaine and in Wales, Rutland, who became duke of York on his father's death in 1402, was, like all Henry's servants, hampered by want of money, and perhaps began to feel some irritation against the king. At all events he was concerned in the scheme, concocted in 1405 by his sister, Constance, widow of Thomas le Despencer, earl of Gloucester, for seizing the young earl of March, and his brother Roger Mortimer, and carrying them into Wales. On her trial Constance asserted that her brother had instigated the plot, which also included the murder of the king, and York was imprisoned in Pevensey castle. Released a few months later, he was restored to the privy council and regained his estates, after which he again served Henry in Wales and in France. York led one division of the English army at Agincourt, where, on the 25th of October 1415, he was killed by "much hete and thronggid." He was buried in Fotheringhay church. The duke left no children and was succeeded as duke of York by his nephew, Richard.

York compiled the *Maystre of the Game*, a treatise on hunting which is largely a translation of the *Livre de Chasse* of Gaston Phochus, count of Foix. This has been edited by W. A. and F. Baillie-Grohman (1904).

YORK, FREDERICK AUGUSTUS, Duke of (1763–1827), second son of George III., was born at St James's Palace on the 16th of August 1763. At the age of six months his father secured his election to the rich bishopric of Osnabrück. He was invested a knight of the Bath in 1767, a K.G. in 1771, and was gazetted colonel in 1780. From 1781 to 1787 he lived in Germany, where he attended the manœuvres of the Austrian and Prussian armies. He was appointed colonel of the 2nd horse grenadier guards (now 2nd Life Guards) in 1782, and promoted major-general and appointed colonel of the Coldstream Guards in 1784. He was created duke of York and Albany and earl of Ulster in 1784, but retained the bishopric of Osnabrück until 1803. On his return to England he took his seat in the House of Lords, where, on December 15, 1788, he opposed Pitt's Regency Bill in a speech which was supposed to have been inspired by the prince of Wales. A duel fought on Wimbledon Common with Colonel Lennox, afterwards duke of Richmond, served to increase the duke of York's popularity, his acceptance of the challenge itself and his perfect coolness appealing strongly to the public taste. In 1791 he married Princess Frederica Charlotte Ulrica Catherina (b. 1767), daughter of Frederick William II. of Prussia. The princess was enthusiastically received in London, but the marriage was not happy, and a separation soon took place. The princess retired to Oatlands Park, Weybridge, where she died on the 6th of August 1820.

In 1793 the duke of York was sent to Flanders in command of the English contingent of Coburg's army destined for the invasion of France (see French Revolutionary Wars). On his return in 1795 the king promoted him field-marshal, and on April 3rd, 1798, appointed him commander-in-chief. His second command was with the army sent to invade Holland in conjunction with a Russian *corps d'armée* in 1799. Sir Ralph Abercromby and Admiral Sir Charles Mitchell in charge of the vanguard had succeeded in capturing the Dutch ships in the Helder, but from time of the duke's arrival with the main body of the army disaster followed disaster until, on the 17th of October, the duke signed the convention of Alkmaar, by which the allied expedition withdrew after giving up its prisoners. Although thus unsuccessful as commander of a field army the duke was well fitted to carry out reforms in the army at home, and to this task he devoted himself with the greatest vigour and success until his enforced retirement from the office of commander-in-chief on the 18th of March 1809, in consequence of his relations with Mary Ann Clarke (1776–1852), who was convicted of profiting by her intimacy with the duke to extract money from officers by promising to recommend them for promotion. A select committee was appointed by the House of Commons to inquire into the matter, and the duke was acquitted of having received bribes himself by 278 votes to 196. Two years later, in May 1811, he was again placed at the head of the army by the prince regent, and rendered valuable services in this position. He died on the 5th of January 1827 and was buried at St George's Chapel, Windsor.

A firm friendship seems to have existed between the duke and his elder brother, afterwards George IV., and he is also said to have been his father's favourite son. He was very popular, thanks to his amiable disposition and a keen love of sport, but it is as the organizing and administrative head of the army that he has left his mark. He was untiring in his efforts to raise the tone of the army, restore discipline, weed out the undesirables, and suppress bribery and favouritism. He founded the Duke of York's School for the sons of soldiers at Chelsea, and his name is also commemorated by the Duke of York's column in Waterloo Place.

YORK, RICHARD, Duke of (1411–1460), was born on the 21st of September 1411, the son of Richard, earl of Cambridge, second son of Edmund of Langley, duke of York. By the death of his uncle Edward at Agincourt he became duke of York, and on the death of Edmund Mortimer in 1425 he succeeded to his claims as representing in the female line the elder branch of the royal family. He had been kindly treated by Henry V., and his name appears at the head of the knights made by the little Henry VI. at Leicester on the 19th of May 1426. York's first service was in France during 1430 and 1431. In 1432 he obtained livery of his lands and afterwards went over to Ireland to take possession of his estates there. In January 1436 he was appointed lieutenant-general of France and Normandy, but did not enter on his command till June. He showed vigour and capacity, and recovered Fécamp and some other places in

Normandy. Probably he was not supported cordially by the home government, and in 1437 applied to be recalled. One authority alleges that his council thwarted him in his desire to relieve Montereau, because he had been discharged from his office (*Chronicles of London*, 143). York returned to England in the autumn of 1437. From this time at all events he attached himself to the war-party of which Humphrey of Gloucester was head, in opposition to the government under Cardinal Beaufort. By his marriage in 1438 to Cicely, sister of the earl of Salisbury, he allied himself to the rising family of the Nevilles. On the 2nd of July 1440 York was again appointed to the French command. His previous experience made him stipulate for full powers and a sufficient revenue. He did not, however, go to Rouen till June 1441. During his second governorship York maintained, if he could not improve, the English position in Normandy. He was again hampered by his political opponents at home, and at the end of 1446 was recalled, on the pretext that his term of office had expired. The death of Humphrey of Gloucester in February 1447 made York the first prince of the blood. Suffolk, now Henry's chief minister, found a convenient banishment for a dangerous rival by appointing York to be lieutenant of Ireland for ten years (9th of December 1447). York, however, contrived to put off his departure for eighteen months. During his absence in Ireland English discontent came to a crisis in Jack Cade's rebellion. The use made of the names of Mortimer and York, however unauthorized, shows the trend of popular opinion. In September 1450 York landed in Wales. His opponents endeavoured to waylay him, but he came to London with an armed retinue and forced himself into the king's presence. Nevertheless he declared his loyalty and that he desired only justice and good government. He took part in the punishment of Cade's supporters, and discountenanced a proposal in parliament that he should be declared heir to the crown. In March 1452 he came once more in arms to London, and endeavoured to obtain Somerset's dismissal. On a promise that his rival should be held in custody he disbanded his men, and thus outwitted found himself virtually a prisoner. However, a nominal agreement was concluded, and York accepted the king's pardon. The situation was changed by the birth of a prince of Wales and the king's illness in October 1453. After a struggle with the queen and Somerset, York secured his recognition as protector on the 27th of March 1454. He declared that he accepted the post only as a duty, and, though he put his own friends in power, exercised his authority with moderation and on the side of good order. But at the end of the year the king's sudden recovery brought York's protectorate to an end. When it was clear that the queen and Somerset would proceed to extremities, York and his friends took up arms in self-defence. Even when the two armies met at St Albans, York endeavoured to treat for settlement. The issue was decided by the defeat and death of Somerset on the 22nd of May 1455. York used his success with moderation. He became constable of England, and his friends obtained office. This was no more than a change of ministers. But a return of the king's illness in October 1455 made York again for a brief space protector. Henry recovered in February 1456, and Margaret, his queen, began to assert herself. Finally, at Coventry, in October, the Yorkist officials were displaced. Still there was no open breach, and in March 1458 there was even a ceremonial reconciliation of all parties at St Paul's in London. York would not again accept honourable banishment to Ireland, but made no move till the queen's preparations forced him to act. In September 1459 both parties were once more in arms. York protested that he acted only in self-defence, but the desertion of his best soldiers at Ludlow on the 12th of October left him helpless. With a few followers he escaped to Ireland, where his position as lord-lieutenant was confirmed by an Irish parliament, and he ruled in full defiance of the English government. In March 1460 the earl of Warwick came from Calais to concert plans with his leader. York himself only landed in England on the 8th of September, two months after Warwick's victory at Northampton. All pretence of moderation was put aside, and he marched on London, using the full arms of England, and with his sword borne upright before him. On reaching Westminster, York took up his residence in the royal palace, and formally asserted his claim to the throne in parliament. In the end a compromise was arranged, under which Henry was to retain the crown for life, but Richard was to succeed him. On the 8th of November he was accordingly proclaimed heir-apparent and protector. Meantime the queen was gathering her friends, and early in December, Richard went north with a small force. He kept Christmas at Sandal Castle near Wakefield. There, on the 30th of December, he was hemmed in by a superior force of Lancastrians. Declaring that he had never kept castle in the face of the enemy, Richard rashly offered battle, and was defeated and slain. His enemies had his head cut off, and set it up on the walls of York adorned with a paper crown.

Richard of York was not a great statesman, but he had qualities of restraint and moderation, and might have made a good king. He had four daughters and four sons. Edmund, earl of Rutland, his second son, was killed at Wakefield. The other three were Edward IV., George, duke of Clarence, and Richard III.

See *The Paston Letters* with Dr Gairdner's Introduction; *Three Fifteenth Century Chronicles*, and *Collections of a London Citizen* (published by the Camden Society); *Chronicles of London* (ed. C. L. Kingsford, 1905); J. S. Stevenson's *Wars of the English in France* (Rolls Series). The French chronicles of Matthieu d'Escouchy, T. Basin and Jehan Waurin should also be consulted (these three are published by the *Société de l'Histoire de France*). For modern accounts see especially Sir James Ramsay's *Lancaster and York*, and *The Political History of England*, vol. iv., by Professor C. Oman.
(C. L. K.)

YORK, a city, municipal, county and parliamentary borough, the seat of an archbishop, and the county town of Yorkshire, England, 188 m. N. by W. from London by the Great Northern railway. It is an important junction of the North-Eastern railway. Pop. (1901) 77,914. It lies in a plain watered by the river Ouse, at the junction of the Foss stream with the main river. It has narrow picturesque streets, ancient walls, and, besides the cathedral, many churches and buildings of architectural interest.

York was a Roman station (see below), and large collections of Roman remains are preserved in the hospitium of St Mary's Abbey. Of these a great proportion came from the cemetery and from the foundations of the railway station. A noteworthy relic of the Roman occupation, however, appears in its original place. This is the so-called multangular tower, on the N.W. of the city walls. Its base is Roman, of mingled stone and brick work. The city walls date in part from Norman times, but are in the main of the 14th century. Their circuit is a little over 2½ m., and the area enclosed is divided by the river Ouse, the larger part lying on the left bank. The walls have been carefully preserved and are remarkably perfect. On the E. for a short distance the river Foss took the place of a wall. Of the gates, called Bars, the best specimen is Micklegate Bar on the S.W., where the heads of traitors were formerly exposed. It is a square tower built over a circular, probably Norman, arch, and has embattled corner turrets. Others are Bootham Bar, the main entrance from the N., also having a Norman arch; Monk Bar (N.E.), formerly called Goodramgate, but renamed in honour of General Monk, and Walmgate Bar, of the time of Edward I., retaining the barbican repaired in 1648. The castle stands in the angle between the Ouse and the Foss immediately above their junction. Of the fortress built by William the Conqueror in 1068 some portions were probably incorporated in Clifford's tower, the shell of which, showing an unusual ground plan of four intersecting circles, rises from an artificial mound. The castle serves as the prison and county courts.

The cathedral of St Peter, commonly known as the minster, has no superior in general dignity of form among English cathedrals. It is in the form of a Latin cross, consisting of nave with aisles, transepts, choir with aisles, a central tower, and two W. towers. The palace of the archbishops is at Bishopthorpe, 2½ m. S. of York. It is of various dates, and includes slight remains of the Early English palace of Archbishop Grey. The diocese includes over half the parishes in Yorkshire, and also covers very small portions of Durham, Nottinghamshire and Lincolnshire.

The extreme external length of the cathedral is 524 ft. 6 in., the breadth across the transepts 250 ft., the height of the central tower 213 ft., and the height of the western towers 202 ft. The material is magnesian limestone. The cathedral occupies the site of the wooden church in which King Edwin was baptized by Paulinus (*q.v.*) on Easter Day 627. After his baptism Edwin, according to Bede, began to construct "a large and more noble basilica of stone," but it was partly destroyed during the troubles which followed his death, and was repaired by Archbishop Wilfrid. The building suffered from fire in 741, and, after it had been repaired by Archbishop Albert, was described by Alcuin as "a most magnificent basilica." At the time of the Norman invasion the Saxon cathedral, with the library of Archbishop Egbert, perished in the fire by which the greater part of the city was destroyed, the only relic remaining being the central wall of the crypt. It was reconstructed by Archbishop Thomas of Bayeux (1070–1100); but of this building few portions remain. The apsidal choir and crypt were reconstructed by Archbishop Roger (1154–81), the S. transept by Archbishop Walter de Grey (1216–1255), and the N. transept and central tower by John Romanus, treasurer of the cathedral (1228–56). With the exception of the crypt, the transepts are the oldest portions of the building now remaining. They represent the Early English style at its best, and the view across the great transept is unsurpassed for architectural effect. The S. transept is the richest and most elaborate in its details, one of its principal features being the magnificent rose window; and the N. transept contains a series of beautiful lancet windows called the Five Sisters. The foundation of the new nave was laid by Archbishop Romanus (1286–96), son of the treasurer, the building of it being completed by Archbishop William de Melton about 1340. The chapter-house, a magnificent ornate building, was built during the same period. The W. front, consisting of a centre and two divisions corresponding with the nave and aisles, has been described as "more architecturally perfect as a composition and in its details than that of any other English cathedral," the great window above the door being considered by some superior to the famous E. window at Carlisle.

In 1361 Archbishop Thoresby (1352–73) began the lady chapel and presbytery, both in the Early Perpendicular style. The rebuilding of the choir, begun about the same period, was not completed till about 1400. It is Late Perpendicular, the great E. window being one of the finest in the world. With the rebuilding of the choir the whole of the ancient Norman edifice was removed, the only Norman architecture now remaining being the E. portion of the crypt of the second period, built by Archbishop Roger (1154–1191). To correspond with later alterations, the central tower was recased and changed into a Perpendicular lantern tower, the work being completed in 1444. The S.W. tower was begun in 1432 during the treasurership of John de Bermingham, and the N.W. tower in 1470. With the erection of this tower the church was completed as it now stands, and on the 3rd of February 1472 it was reconsecrated by Archbishop Neville. On the 2nd of February 1829 the woodwork of the choir was set on fire by Jonathan Martin, a madman. On the 2nd of May 1840 a fire broke out in the S.W. tower, reducing it to a mere shell. The stained glass both in the cathedral and in other churches of the city is particularly noteworthy; its survival may be traced to the stipulation made by the citizens when surrendering to parliament in the civil wars that it should not be damaged.

The following is a list of the archbishops of York:—

1. Paulinus, 627–633.
*2. Chad, 664–669.
*3. Wilfrid, 669–678. (He again held the see in 686—for how long is not certain—Bosa retiring in his favour.)
*4. Bosa, 678–*c.* 705.
*5. John of Beverley, 705–718.
*6. Wilfrid II., 718–732.
7. Egbert, 732–766.
8. Albert, 766–782.
9. Eanbald I., 782–796.
10. Eanbald II., 796–812.
11. Wulfsi, 812–831.
12. Wigmund, 837–854.
13. Wulfhere, 854–890.
14. Ethelbald, 890–895.
15. Redewald, 895–928.
16. Wulfstan, 928–956.
17. Oskytel, 956–972.
18. Ethelwold, 972.
19. Oswald, 972–992.
20. Adulf, 992–1002.
21. Wulfstan, 1002–1023.
22. Alfric Puttoc, 1023–1050.
23. Kinsi, 1050–1060.
24. Ealdred, 1060–1067.
25. Thomas of Bayeux, 1070–1100.
26. Gerard, 1101–1108.
27. Thomas, 1108–1114.
28. Thurstan, 1114–1140.
29. William Fitzherbert, 1143–1147. (His election was disputed, and he was deprived by the pope.)
30. Henry Mordac, 1147–1153.
William Fitzherbert, reinstated, 1153 to 1154.
31. Roger of Pont l'Evêque, 1154–1181.
(The see was now vacant for ten years.)
32. Geoffrey, 1191–1207.
(The see was vacant for nine years.)
33. Walter de Grey, 1216–1255.
34. Sewal de Bovil, 1256–1258.
35. Geoffrey of Ludham, 1258–1265.
36. Walter Giffard, 1266–1279.
37. William of Wickwaine, 1279–1286.
38. John Romanus, 1286–1296.
39. Henry of Newark, 1298–1299.
40. Thomas of Corbridge, 1300–1304.
41. William Greenfield, 1306–1315.
42. William de Melton, 1317–1340.
43. William la Zouche, 1342–1352.
44. John Thoresby, 1352–1373.
45. Alexander Neville, 1374–1388.
46. Thomas Fitzalan, 1388–1396.
47. Robert Waldby, 1397–1398.
48. Richard Scrope, 1398–1405.
49. Henry Bowet, 1407–1423.
50. John Kemp, 1426–1452.
51. William Booth, 1452–1464.
52. George Neville, 1464–1476.
53. Laurence Booth, 1476–1480.
54. Thomas Scott, 1480–1500.
55. Thomas Savage, 1501–1507.
56. Christopher Bainbridge, 1508–1514.
57. Thomas Wolsey, 1514–1530.
58. Edward Lee, 1531–1544.
59. Robert Holgate, 1545–1554.
60. Nicholas Heath, 1555–1559.
61. Thomas Young, 1561–1568.
62. Edward Grindal, 1570–1576.
63. Edwin Sandys, 1577–1588.
64. John Piers, 1588–1594.
65. Matthew Hutton, 1595–1606.
66. Tobias Matthew, 1606–1628.
67. George Monteign, 1628.
68. Samuel Harsnett, 1628–1631.
69. Richard Neile, 1632–1640.
70. John Williams, 1641–1650.
71. Accepted Frewen, 1660–1664.
72. Richard Sterne, 1664–1683.
73. John Dolben, 1683–1686.
74. Thomas Lamplugh, 1688–1691.
75. John Sharp, 1691–1714.
76. William Dawes, 1713–1724.
77. Lancelot Blackburne, 1724–1743.
78. Thomas Herring, 1743–1747.
79. Matthew Hutton, 1747–1757.
80. John Gilbert, 1757–1761.
81. Robert Hay Drummond, 1761–1776.
82. William Markham, 1777–1807.
83. Edward Vernon Harcourt, 1808–1847.
84. Thomas Musgrave, 1847–1860.
85. Charles Thomas Longley, 1860–1862.
86. William Thomson, 1863–1891.
87. William Connor Magee, 1891.
88. William Dalrymple Maclagan, 1891–1908.
89. Cosmo Gordon Lang, 1908–

Next to the cathedral, the most interesting building in York is St Mary's Abbey, situated in Museum Gardens, founded for Benedictines by Alan, lord of Richmond, in 1078, its head having the rank of a mitred abbot with a seat in parliament. The principal remains of the abbey (see ABBEY) are the N. wall and the ruins of the church, in the Early English and Decorated styles, and the principal gateway with a Norman arch. They lie near the cathedral, outside the walls. The hospitium, of which the upper part is of wood, contains a collection of Roman antiquities; the building is of the 14th and 15th centuries. A considerable portion of the abbey was employed for the erection of the king's manor, a palace for the lord president of the north, now occupied as a school for the blind. In the gardens is also the ambulatory of St Leonard's hospital, founded by King Aethelstan and rebuilt by Stephen. St William's College, near the minster, was founded in 1453 as a college for priests holding chantries in the minster; its restoration as a church house and meeting-place for convocation was undertaken in 1906. York also possesses a large number of churches of special architectural interest, including All Saints, North Street, Early English, Decorated and Perpendicular, with a spire 120 ft. in height; Christ Church, with S. door in the Decorated style, supposed to occupy the site of the old Roman palace; Holy Trinity, in Goodramgate, Decorated and Perpendicular, with Perpendicular tower; Holy Trinity, Micklegate, formerly a priory church, now restored, showing Roman masonry in its walls; St Denis, Walmgate, with rich Norman doorway and Norman tower arches; St Helen's, St Helen's Square, chiefly Decorated; St John's, North Street, chiefly Perpendicular; St Margaret's, Walmgate, celebrated for its curiously sculptured Norman porch and doorway; St Mary the Elder, Bishophill, Early English and Decorated, with brick tower, rebuilt in 1659; St Mary the Younger, Bishophill, with a square tower in the Saxon style, rebuilt probably in the 13th century; St Mary, Castlegate, with Perpendicular tower and spire 154 ft. in height, the body of the church dating back to transitional Norman times; St Michael-le-Belfry, founded in 1066, but rebuilt in 1538 in Late Perpendicular style; St Martin's-le-Grand, fine Perpendicular; and St Martin's cum Gregory, Early English and Perpendicular. Among modern churches is the Roman Catholic pro-cathedral, standing near the cathedral.

The guild-hall, with a fine old room in Perpendicular style erected in 1446, contains a number of stained-glass windows. Adjoining it are handsome municipal buildings (1891), and near it is the mansion house, built in 1725 from designs by the earl of Burlington. The courts of justice were opened in 1892. Assembly rooms, a corn exchange, barracks and a theatre are the other chief buildings.

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* These bishops did not receive the pall as metropolitans.

The public institutions include the Yorkshire Philosophical Society, whose museum, in the Grecian style, was opened in 1830, and the free library in the building of the York Institute of Science and Art. The principal schools are St Peter's cathedral grammar-school (originally endowed in 1557), Archbishop Holgate's grammar-school, the York and diocesan grammar-school, and the bluecoat school for boys (founded in 1705), with the associated greycoat school for girls. There are numerous charities.

The chief industrial establishments are iron foundries, railway and motor engineering works, breweries, flour-mills, tanneries and manufactories of confectionery, artificial manure, &c. There is water communication by the Ouse with the Humber, and by the Foss Navigation to the N.E. This is under the control of the corporation. The parliamentary borough returns 2 members. The county borough was created in 1888. The municipal borough is under a lord mayor, 12 aldermen and 36 councillors. The city within the municipal limits constitutes a separate division of the county. The municipal city and the Ainsty (a district on the S.W. included in the city bounds in 1449) are for parliamentary purposes included in the N. Riding, for registration purposes in the E. Riding, and for all other purposes in the W. Riding. The parliamentary borough extends into the E. Riding. Area, 3730 acres.

History.—York is known to have been occupied by the Britons, and was chosen by the Romans as their most important centre in north Britain and named *Eborācum* or *Eburacum.* The fortress of Legio VI. Victrix was situated near the site of the cathedral, and a municipality (*colonia*) grew up, near where the railway station now is, on the opposite side of the Ouse. Many inscriptions and a great quantity of minor objects have been found. The emperor Hadrian visited York in A.D. 120, and, according to tradition, the body of the emperor Severus who died there in A.D. 211 was burnt on Severus Hill, near the city. After the death of Constantine Chlorus, which also took place in York, his son Constantine the Great, who, according to an ancient but incorrect tradition, was born there, was also inaugurated emperor there. A bishop of York is mentioned, along with, and with precedence of, bishops of London and Lincoln (the last name is uncertain) as present at the council of Arles in 314. Nothing is known of the history of the city from the time the Romans withdrew from Britain in 410 until 627, when King Edwin was baptized there, and where shortly afterwards Paulinus, the first archbishop, was consecrated. In the time of Archbishop Egbert (732–766) and of Alcuin, at first a scholar and afterwards master of the cloister school, York became one of the most celebrated places of education in Europe. It was also one of the chief Danish boroughs, and Earl Siward is said to have died there in 1055. In 1066 it was taken by Harold Hardrada, and in 1068 the men of the north of England, rising under Edgar Aetheling and Earl Waltheof, stormed the castles which William I. had raised, putting to death the whole of the Norman garrison. The Conqueror in revenge burnt the town and laid waste the country between the Humber and Tees. York was frequently visited by the kings of England on the way to Scotland, and several important parliaments were held there, the first being that of 1175, when Malcolm, king of Scotland, did homage to Henry II. In the reign of Richard I., the citizens rose against the Jews, who fled to the castle. Here, however, they were obliged to surrender, many killing themselves after putting to death their wives and children, the rest being massacred by the citizens. The council of the North was established in York in 1537 after the suppression of the Pilgrimage of Grace. In 1642 York was garrisoned by Royalists and besieged by the parliament. It was relieved by Prince Rupert, but surrendered after the battle of Marston Moor. Being under the rule of the earls of Northumbria, York is not mentioned in the Domesday Survey. In the first charter (which is undated) Henry II. granted the citizens a merchant gild and all the free customs which they had in the time of Henry I. Richard I. in 1194 granted exemption from toll, &c., throughout the kingdom, and King John in 1200 confirmed the preceding charters, and in 1212 granted the city to the citizens at a fee-farm of £160 a year. These charters were confirmed by most of the early kings. Richard II. conferred the title of lord mayor, and a second charter, given in 1392, shows that the government then consisted of a lord mayor and aldermen, while a third in 1396 made the city a county of itself and gave the burgesses power to elect two sheriffs. Edward IV. in 1464 incorporated the town under the title of "Lord Mayor and Aldermen," and in 1473 directed that all the citizens should choose the mayor from among the aldermen. As this led to constant disputes, Henry VII. arranged that a common council, consisting of two men from each of the more important gilds and one from each of the less important ones, should elect the mayor. The city is now governed under a charter of Charles II., confirming that of 1464, the governing body consisting of a lord mayor, 12 aldermen and 36 councillors. The city has returned two members to parliament since 1295. During the 14th century there were constant quarrels between the citizens and the abbey of St Mary's about the suburb of Bootham, which the citizens claimed as within the jurisdiction of the city, and the abbey as a separate borough. In 1353 the king took the borough of York into his own hands, "to avoid any risk of disturbance and possible great bloodshed such as has arisen before these times," and finally in the same year an agreement was brought about by Archbishop Thoresby that the whole of Bootham should be considered a suburb of York except the street called St Marygate, which should be in the jurisdiction of the abbey.

From the time of the conquest York was important as a trading and commercial centre. There were numerous trade gilds, one of the chief being that of the weavers, which received a charter from Henry II. During the 17th and 18th centuries the trade declined, partly owing to the distance of the city from the sea, and partly owing to the regulations of the trade gilds.

See Francis Drake, *Eboracum: or the History and Antiquities of the City of York, from its original to the present time* (1736); *Extracts from the Municipal Records of the City of York during the Reigns of Edward IV., Edward V. and Richard III.* (1843); *Victoria County History, Yorkshire*; J. Raine, *York* (1893); A. P. Purey-Cust, *York Minster* (1897), *Heraldry of York Minster* (Leeds, 1890); B. S. Rowntree, *Poverty: a Study of Town Life* (1901).

YORK, a township of York county, Maine, U.S.A., on the Atlantic coast about 45 m. S.W. of Portland, and 9 m. by rail N.E. of Portsmouth, New Hampshire. Pop. (1910) 2802. Area, 64 sq. m. York is at the terminus of the York Harbor and Beach division of the Boston & Maine railway. In York village is the county gaol (1653–54), preserved by the Old York Historical and Improvement Society as a museum of local antiquities. Two colonial taverns also remain. York Harbor, York Beach, York Cliffs and Long Beach are attractive summer villages. The first settlement was made about 1624. In April 1641 Sir Ferdinando Gorges, proprietor of the province of Maine, erected this into the Borough of Agamenticus, and on the 1st of March 1642 he chartered it as a city under the name of Gorgeana. In 1652, when Massachusetts extended her jurisdiction over Maine, the city of Gorgeana became the town of York. In 1692 most of the houses were burned by the Indians and the inhabitants killed or taken captive. York was the shire town of Yorkshire from 1716 to 1735, the shire town with Portland (then Falmouth) of the district of Maine from 1735 to 1760, and a county-seat of York county from 1760 to 1832. During the middle of the 18th century York had considerable trade with the West Indies and along the coast, and as late as the middle of the 19th century it had important fishing interests. Its development as a summer resort was begun about 1873, but until 1887, when the railway reached it, its chief means of access was by stage from Portsmouth.

See J. P. Baxter, *Agamenticus, Bristol, Gorgeana, York* (Portland, 1904); G. A. Emery, *Ancient City of Gorgeana and Modern Town of York* (Boston, 1873); and Pauline C. Bouvé, "Old York, a Forgotten Seaport," in the *New England Magazine* (July 1902).

YORK, a city and the county-seat of York county, Nebraska, U.S.A., about 46 m. W. by N. of Lincoln. Pop. (1900) 5132; (1910) 6235. It is served by the Chicago, Burlington & Quincy and Chicago & North-Western railways. It is the seat of the School of the Holy Family and of York College (founded in 1890, co-educational). The city is situated in a farming and stock-raising region, and among its manufactures are foundry products, bricks and flour. York was settled in 1864, was laid out in 1869, was incorporated as a town in 1875 and was chartered as a city in 1877.

YORK, a city and the county seat of York county, Pennsylvania, U.S.A., about 100 m. W. of Philadelphia and about 28 m. S.E. of Harrisburg. Pop. (1900) 33,708—1304 being foreign-born and 776 negroes; (1910) 44,750. York is served by the Maryland & Pennsylvania, the Northern Central (Pennsylvania) and the Western Maryland railways. Among the public buildings are the County Court House (1899) and a large Federal Building (1910). York is the seat of the York Collegiate Institute (1873), founded by Samuel Small (d. 1885) and of the York County Academy (1785). The Historical Society of York (1895) has a valuable collection of documents relating to local history. York is the commercial centre for a rich agricultural region, and has manufactures of foundry and machine-shop products, silk goods, &c. The total factory product in 1905 was valued at $14,258,696.

York, the first permanent settlement in the state W. of the Susquehanna, was laid out in 1741 in what was then the Manor of Springettsbury (named in honour of Springett Penn, a grandson of William Penn) by Thomas Cookson, a surveyor for Richard and Thomas Penn, then the proprietors of the colony, and was named after York, England. The first settlers were chiefly Germans from the Rhenish Palatinate, who were Lutherans, Reformed, Mennonites and Moravians. English Quakers and Scotch-Irish settled here also. The settlement lay on the Monocacy road, the main line of travel to the S. and S.W., and it grew rapidly, especially between 1748 and 1751. In 1749 the county of York was erected (from Lancaster county) and York was made the county-seat. In 1754 York had 210 houses and 1000 inhabitants. Troops from York took part in the Seven Years' War and the War of American Independence. In the old county court-house (built in 1754–56, pulled down in 1841) the Continental Congress sat from the 30th of September 1777 to the 27th of June 1778, having left Philadelphia on the approach of the British, and having held a day's session at Lancaster. At York the Congress passed the Articles of Confederation (15th of November 1777) and received news of the American victory at Saratoga and of the signing of treaties between the United States and France. The Conway cabal came to an end here, and the arrival here of Baron Steuben and of Lafayette in 1777 helped the American cause. In September 1778, $1,500,000 in silver lent by France to the United States was brought to York; and Benjamin Franklin's press, removed from Philadelphia, issued $10,000,000 of Continental money. Thomas Paine here wrote part of his *Fifth Crisis*. Philip Livingston, a signer of the Declaration of Independence, is buried here. In the Civil War, Confederate troops under General John B. Gordon entered York on the 28th of June 1863, and a small Federal force retreated before them; and the battle of Gettysburg was fought about 28 m. E. York was incorporated as a borough in 1787 and was chartered as a city in 1887.

See G. R. Prowell, *The City of York, Past and Present* (York, 1904), and C. A. Hawkins and H. E. Landis, *York and York County* (ibid. 1901).

YORKE, CHARLES (1722–1770), English lord chancellor, second son of Philip Yorke, 1st earl of Hardwicke, was born in London on the 30th of December 1722, and was educated at Corpus Christi College, Cambridge. His literary abilities were shown at an early age by his collaboration with his brother Philip in the *Athenian Letters*. In 1745 he published an able treatise on the law of forfeiture for high treason, in defence of his father's treatment of the Scottish Jacobite peers; and in the following year he was called to the bar. His father being at this time lord chancellor, Yorke obtained a sinecure appointment in the Court of Chancery in 1747, and entered parliament as member for Reigate, a seat which he afterwards exchanged for that for the university of Cambridge. He quickly made his mark in the House of Commons, one of his earliest speeches being in favour of his father's reform of the marriage law. In 1751 he became counsel to the East India Company, and in 1756 he was appointed solicitor-general, a place which he retained in the administration of the elder Pitt, of whose foreign policy he was a powerful defender. He resigned with Pitt in 1761, but in 1762 became attorney-general under Lord Bute. He continued to hold this office when George Grenville became prime minister (April 1763), and advised the government on the question raised by Wilkes's *North Briton*. Yorke refused to describe the libel as treasonable, while pronouncing it a high misdemeanour. In the following November he resigned office. Resisting Pitt's attempt to draw him into alliance against the ministry he had quitted, Yorke maintained, in a speech that extorted the highest eulogy from Walpole, that parliamentary privilege did not extend to cases of libel; though he agreed with Pitt in condemning the principle of general warrants. Yorke, henceforward a member of the Rockingham party, was elected recorder of Dover in 1764, and in 1765 he again became attorney-general in the Rockingham administration, whose policy he did much to shape. He supported the repeal of the Stamp Act, while urging the simultaneous passing of the Declaratory Act. His most important measure was the constitution which he drew up for the province of Quebec, and which after his resignation of office became the Quebec Act of 1774. On the accession to power of Chatham and Grafton in 1767, Yorke resigned office, and took little part in the debates in parliament during the next four years. In 1770 he was invited by the duke of Grafton, when Camden was dismissed from the chancellorship, to take his seat on the woolsack. He had, however, explicitly pledged himself to Rockingham and his party not to take office with Grafton. The king exerted all his personal influence to overcome Yorke's scruples, warning him finally that the great seal if now refused would never again be within his grasp. Yorke yielded to the king's entreaty, went to his brother's house, where he met the leaders of the Opposition, and feeling at once overwhelmed with shame, fled to his own house, where in three days he was a dead man (January 20, 1770). The patent raising him to the peerage as Baron Morden had been made out, but his last act was to refuse his sanction to the sealing of the document.

Charles Yorke was twice married. His son by his first marriage became earl of Hardwicke; his eldest son by his second marriage, Charles Philip Yorke (1764–1834), member of parliament for Cambridgeshire and afterwards for Liskeard, was secretary of state for war in Addington's ministry in 1801, and was a strong opponent of concession to the Roman Catholics. He made himself exceedingly unpopular in 1810 by bringing about the exclusion of strangers, including reporters for the press, from the House of Commons under the standing order, which led to the imprisonment of Sir Francis Burdett in the Tower and to riots in London. In the same year Yorke joined Spencer Perceval's government as first lord of the admiralty; he retired from public life in 1818, and died in 1834. Charles Yorke's second son by his second marriage was Sir Joseph Sydney Yorke (1768–1831), an admiral in the navy, whose son succeeded to the earldom of Hardwicke.

See under HARDWICKE, PHILIP YORKE, 1st Earl of.

YORKSHIRE, a north-eastern county of England, bounded N. by Durham, E. by the North Sea, S.E. by the Humber estuary (separating it from Lincolnshire), S. by Nottinghamshire and Derbyshire, S.W. for a short distance by Cheshire, W. by Lancashire and N.W. by Westmorland. It is the largest county in England, having an area of 6066·1 sq. m., and being more than double the size of Lincolnshire, which ranks next to it. In a description of the county it is constantly necessary to refer to its three great divisions, the North Riding, East Riding and West Riding (see RIDING, and map of ENGLAND, Sections I., II.).

The centre of the county is a plain, which in the S., about the head of the Humber, resembles the Fens in character. The hills W. of the central plain, covering nearly the whole of the W. Riding and the N.W. of the N. Riding, are part of the great Pennine Chain (*q.v.*). These hills consist of high-lying moorland, and are not generally remarkable for great beauty of outline. The higher parts are bleak and wild, and the slope towards the central plain is gradual. The chief beauty of the district is to be found in the numerous deeply scored valleys or dales, such as Teesdale, Swaledale, Wensleydale (*q.v.*), Nidderdale, Wharfedale and Airedale, in which the course of the streams is often broken by waterfalls, such as High Force in Teesdale and Aysgarth Force in Wensleydale.

The hills E. of the central plain cannot be similarly considered as a unit. In the N., wholly within the N. Riding, a line of heights known as the Cleveland Hills, forming a spur of the N. Yorkshire Moors, ranges from 1000 to nearly 1500 ft., and overlooks rather abruptly the lowest part of the Tees valley. The line of greatest elevation approaches the central plain, and swings sharply S. in the Hambleton Hills to overlook it, while to the S. of the line long deep dales carry tributary streams S. to the river Derwent, thus draining to the Ouse. Eastward the N. Yorkshire moors give immediately upon the coast. Their higher parts consist of open moorland. The remarkable upper valley of the Derwent (*q.v.*) marks off the N. Yorkshire moors from the Yorkshire wolds of the E. Riding, the river forming the boundary between the N. and E. Ridings. The wolds superficially resemble the moors, inasmuch as they abut directly on the coast E., run thence W., and swing S. to overlook the central plain. At the S. extremity they sink to the shore of the Humber. Their greatest elevation is found near the W. angle (Howardian Hills), but hardly reaches 800 ft. Eastward they encircle a low-lying fertile tract bounded S. by the Humber and E. by the North Sea. The name of Holderness is broadly applied to this low tract, though the wapentake of that name includes properly only the E. of it.

The diverse character of the coast may be inferred from the foregoing description. In the north, S. of Teesmouth, it is low for a short distance; then the E. abutments of the Cleveland Hills form fine cliffs, reaching at Boulby the highest elevation of sea-cliffs in England (666 ft.). Picturesque valleys bearing short streams break the line, notably that of the Esk, reaching the sea at Whitby. The trend of the coast is at first S.E. and then S. South of Scarborough it sinks with the near approach of the Derwent valley, begins to rise again round the shallow sweep of Filey Bay, and then springs seaward in the fine promontory of Flamborough Head (see Bridlington). South of this, after the sharp incurve of Bridlington Bay, the low coast-line of Holderness succeeds, long and unbroken, as far as Spurn Point, which encloses the mouth of the Humber. Encroachments of the sea are frequent, but much land has been reclaimed.

There are several watering-places on the coast in high favour with visitors from the manufacturing districts. The principal, from N. to S. are Redcar, Saltburn-by-the-Sea, Whitby, Robin Hood's Bay, Scarborough (the largest of all), Filey, Bridlington and Hornsea. There are numerous mineral springs in Yorkshire, the principal being those at Harrogate. There is also a spa at Scarborough, and others are Askern near Doncaster, Boston Spa near Harrogate, Croft on the Tees near Darlington, Hovingham, near Malton, Guisbrough in Cleveland and Slaithwaite near Huddersfield. The springs are chiefly sulphurous and chalybeate.

By far the greater part of Yorkshire is within the drainage basin of the Ouse, which with the Trent makes the estuary of the Humber (*q.v.*). It is formed in the central plain by the junction of the Ure and Swale, both rising in the Pennine hills; but whereas the Swale drains the N. of the plain, the Ure, traversing Wensleydale, is enclosed by the hills over the greater part of its course. The Ouse also receives from the Pennine district the Nidd, traversing Nidderdale, the Wharfe, the Aire, with its tributary the Calder, and the Don. The Aire rises in the fine gorge of Malham Cove, from the subterranean waterways in the limestone. None of these tributaries is naturally navigable, but the Aire, Calder and Don are in part canalized. From the E. the principal tributary is the Derwent, which on entering the central plain follows a course roughly parallel to that of the Ouse, and joins it in its lower part, between Selby and Howden. The Foss joins the Ouse at York. In the W. the county contains the headwaters of several streams of the W. slope of the Pennines, draining to the Irish Sea; of these the principal is the Ribble. In the N. the Tees forms most of the boundary with the county of Durham, but receives no large tributary from Yorkshire. In the S. of the W. Riding a few streams drain to the Trent. In Holderness, debarred by the wolds from the general drainage system of the county, the chief stream is the Hull. The only sheets of water of any size are Semmer Water, in a branch of Wensleydale; Malham Tarn, near the head of Airedale, the effluent of which quickly disappears into an underground channel; and Hornsea Mere, near the flat seacoast at Hornsea.

Geology.—The great variety in the scenery of Yorkshire is but a reflection of the marked differences in the geological substructure. The stratification is for the most part regular, but owing to a great line of dislocation nearly coincident with the W. boundary of the county the rocks dip towards the E., while the strike of the strata is from N. to S. The bold and picturesque scenery of the western hills and dales is due to the effects of denudation among the harder rocks, which here come to the surface. The strata in the Pennines consist of (1) older Palaeozoic rocks, viz. a faulted inlier of Silurian and Ordovician at Horton in Ribblesdale, and a small patch of Silurian at Sedbergh with inliers of Coniston limestone; (2) the Carboniferous or Mountain Limestone, which has been subjected to great dislocations, the more important of which are known as the N. and S. Craven faults; (3) the Yoredale series, consisting of shales, flagstones, limestones and thin seams of coal; and (4) the Millstone Grit, forming part of the hilly moorlands, and capping many of the loftier eminences. In the W. Riding the Pennine range forms part of the elevated country of Craven and Dent. The scenery in the W. of the N. Riding is somewhat similar to that in Craven, except that the lower hills are of sharper outline owing to the perpendicular limestone scars. To the intermingling of the limestone with the softer rocks are due the numerous "forces" or waterfalls, which are one of the special features of the scenery of this district. The action of water on the limestone rocks assisted by joints and faults has given rise to extensive caverns, of which the best examples are those of Clapham and Ingleton in the W. Riding, as well as to subterranean watercourses. At Brimham, Plumpton and elsewhere there are fantastic masses of rocks due to irregular weathering of the Millstone Grit. The Pennine region is bounded on the S.E. by the Coal Measures, forming the N. of the Derbyshire, Nottingham and Yorkshire coal-field, which in Yorkshire extends from Sheffield N. to Leeds. The noted fireclays of the Leeds district are obtained from this formation. To the E. the Coal Measures dip beneath the unconformable Permian beds, with magnesian limestone and marl slate, of which a narrow band crops up from Masham southwards. The Permian strata are overlain to the E. by the Trias or New Red Sandstone, scarcely ever exposed, but having been partly worn away is covered with Glacial deposits of clay and gravel, forming the low-lying Vale of York, extending from the Tees S. to Tadcaster and E. beyond York to Market Weighton. Near Middlesbrough red rock with gypsum and rock-salt (100 ft.) have been proved. Farther E. the Triassic beds are overlain by Lias and Oolite; Rhaetic beds have been recorded from near Northallerton. The Lias crops to the surface in a curve extending from Redcar to the Humber. In the Middle Lias there is a seam of valuable iron ore, the source of the prosperity of the Cleveland region. The moorlands extending from Scarborough and Whitby are formed of Liassic strata, topped with the estuarine beds of Lower Oolite, rising gradually to the N.E. and attaining at Burton Head a height of 1489 ft., the greatest elevation of the Oolite formation in England. In the Oolitic "Dogger" series the magnetic iron ore of Rosedale is worked. Corallian rocks form the scarp of the Hambleton hills and extend E. on the N. of the Vale of Pickering through Hackness to the coast, and S.W. of the vale to the neighbourhood of Malton. The Vale of Pickering is underlaid by faulted Kimeridge Clay. Lias and Oolites fringe the E. of the Vale of York to Ferriby on the Humber. In the S.E. of the county, Cretaceous rocks cover up the older strata, N. to the Vale of Pickering and W. to the Vale of York. The Chalk forms the Yorkshire wolds and the country S. through Driffield, Beverley and Holderness.

The Yorkshire coast between Redcar and Flamborough presents a continuous series of magnificent exposures of the strata from the Lower Lias to the Chalk. The Upper Lias fossils and jet of Whitby and alum shale of Saltwick are well known. At Scarborough the Corallian, Oxford Clay, Kellaways Rock, Cornbrash and Upper Estuarine beds are well exposed in the cliffs. In Filey Bay the Kimeridge Clay appears on the coast, but it is covered farther S. by the historic beds of Speeton, representing the marine equivalents of Portland, Purbeck, Wealden, and Lower Greensand of S. England. Over the Speeton beds lies the Red Chalk, the Yorkshire equivalent of the Upper Greensand and Gault. The evidences of glacial action are of unusual interest and variety; the great thickness of boulder clay on the coast is familiar to all, but inland also great deposits of glacial clay, sand and gravel obscure the older geology. The Vale of Pickering and many of the smaller northern valleys were at one period the sites of Glacial lakes, and the "warp" which covers much of the Vale of York is a fluvio-glacial deposit. The Cleveland Dike is an intrusive igneous dike of augite-andesite of Tertiary age which can be traced across the country in a N.W. direction from the neighbourhood of Fylingdales Moor.

Minerals.—The coal-field in the W. Riding is one of the chief sources of mineral wealth in Yorkshire, the most valuable seams being the Silkstone, which is bituminous and of the highest reputation as a house coal, and the Barnsley Thick Coal, the great seam of the Yorkshire coal-field, which is of special value, on account of its semi-anthracitic quality, for use in iron-smelting and in engine furnaces. Associated with the Upper Coal Measures there is a valuable iron ore, occurring in the form of nodules. Large quantities of fireclay are also raised, as well as of gannister and oil-shale. Middlesbrough is the most important centre of pig-iron manufacture in the kingdom. Lead ore is obtained in the Yoredale beds of the Pennine range in Wharfedale, Airedale, Nidderdale, Swaledale, Arkendale and Wensleydale. Slates and flagstones are quarried in the Yoredale rocks. In the Millstone Grit there are several beds of good building stone, but that most largely quarried is the magnesian limestone of the Permian series, which, however, is of somewhat variable quality.

Agriculture.—Nearly nine-tenths of the E. Riding is under cultivation, but of the N. and W. Ridings only from three-fifths to seven-tenths—proportions explained by the different physical conditions. The till or boulder clay of Holderness is the richest soil in Yorkshire, and the chalk wolds, by careful cultivation, form one of the best soils for grain crops. The central plain bears all kinds of crops excellently. Wheat is grown in the E. and W. Ridings, but oats are the principal grain crop in these ridings, and barley exceeds wheat in all three. The bulk of the acreage under green crops is devoted to turnips and swedes. A little flax is grown, and liquorice is cultivated near Pontefract. The proportion of hill pasture is greatest in the N. Riding and least in the E., and the N. and W. Ridings are among the principal sheep-farming districts in England. Cattle, for the rearing of which the W. Riding is most noted, do not receive great attention. The Teeswater breed, however, is increasing in Yorkshire, and in Holderness there is a short-horned breed, chiefly valuable for its milking qualities. Cheese-making is largely carried on in some districts. Of sheep perhaps the most common breeds are the Leicester, Lincoln and South Down, and crosses between the Cheviot and the Leicester. Large numbers of pigs are kept at the dairy farms and fed mainly on whey. The small breed is that chiefly in favour. Yorkshire bacon is famous. Draught horses are generally of a somewhat mixed breed, but the county is famed for its hunters and carriage and saddle horses. The breed of Cleveland bays is much used for carriages.

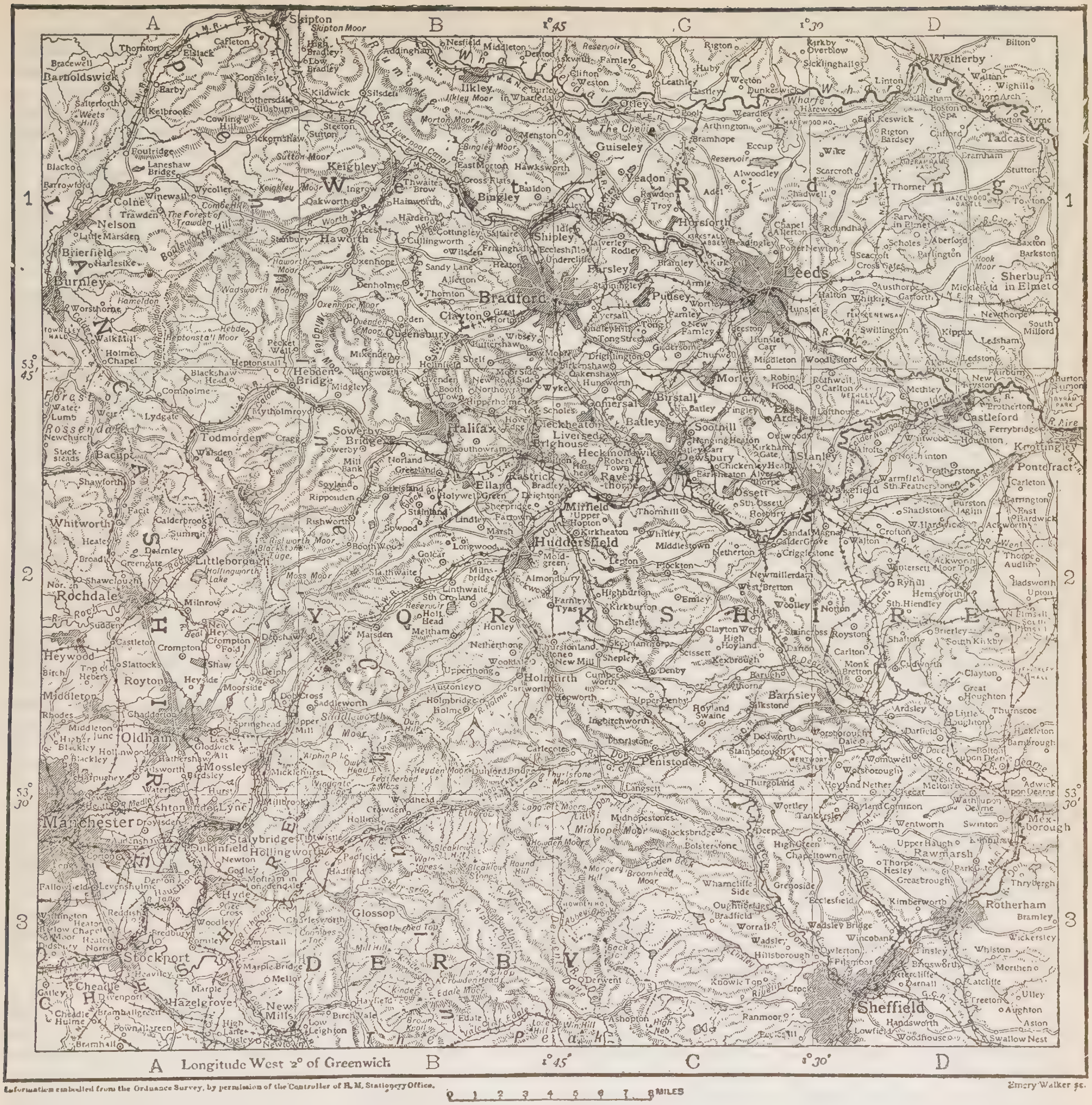
Manufactures.—The industrial district of south Yorkshire occupies the S. of the W. Riding, and may be taken as marked off approximately by the watershed from the similar district in S. Lancashire. The W. Riding is now the chief seat of the woollen manufacture of the United Kingdom, and has almost a monopoly in the production of worsted cloths. The early development of the industry was in part due to the abundance of water-power, while later the presence of coal helped to maintain it on the introduction of steam-power. In this industry nearly all the most important towns are engaged, while the names of several of the largest are connected with various specialities. Thus, while almost every variety of woollen and worsted cloth is produced at Leeds, Bradford is especially concerned with yarns and mixed worsted goods, Dewsbury and Batley with shoddy, Huddersfield with fancy goods and Halifax with carpets. The cotton industry of Lancashire has also penetrated to the neighbourhood of Halifax. Among the characteristics of the industrial population, the love of music should be mentioned. Choral societies are numerous, and the work of some of those in the larger towns, such as Sheffield, Leeds and Bradford, has attracted wide notice. Next to the woollen industry comes the manufacture of iron and steel machinery and implements of every variety, which is common to most of the larger centres in the district. Sheffield is especially famous for iron-work, fine metal-work and cutlery. The development of the iron ore deposits of Cleveland dates only from the middle of the 19th century. About two and a half million tons of pig-iron are produced in this district annually, and there are considerable attendant industries, such as the production of steel, and shipbuilding. The chemical manufacture is important both here and in the W. Riding, where also a great variety of minor industries have sprung up. Such are leather working (at Leeds), the manufacture of clothing, printing and bleaching, and paper-making. Besides coal and iron ore, great quantities of clay, limestone and sandstone are raised. Excellent building-stone is obtained at several places in the W. Riding. The sea-fisheries are of some importance, chiefly at Hull, Scarborough, Whitby and Filey.

Communications.—N. and E. of Leeds communications are provided almost wholly by the North-Eastern railway, the main line of which runs from Leeds and from Doncaster N. by York, Thirsk and Northallerton. The main junction with the Great Northern line is effected immediately N. of Doncaster, at which town are the Great Northern works. This company serves the chief centres of the W. Riding, as do also the Midland, Great Central, London & North-Western, Lancashire & Yorkshire, and North-Eastern companies, the trains working over a close network of lines, while the system of running-powers held by one or more companies over the lines of another assists intercommunication. The Midland main line to Carlisle runs by Leeds, Skipton and Settle through the hilly country of the W. The Hull & Barnsley line runs from Hull to Barnsley. A complete system of canals links the centres of the southern W. Riding with the sea both E. and W., the Aire & Calder Navigation communicating with the Ouse at Goole; the Huddersfield canal runs S.W. into Lancashire, crossing the watershed by the long Stanedge tunnel, and other canals are the Leeds & Liverpool, Calder & Nebble Navigation, and the Sheffield & South Yorkshire Navigation, which gives access from Sheffield to the Trent. The Aire & Calder Navigation, the most important of these canals, which has branches from Castleford to Leeds and Wakefield, and other branches to Barnsley, Bradford and Selby, has a total length of 85 m., and has been much improved since its construction. It was projected by John Rennie and opened in 1826, with a depth of 7 ft. and locks measuring 72 by 18 ft. Its depth now varies from 8 ft. 6 in. to 10 ft., and over a distance of 28 m., between Goole and the collieries, the locks have been enlarged to 460 by 25 ft., and the width of the canal to 90 ft. The chief ports are Middlesbrough on the Tees, Hull on the Humber, and Goole on the Ouse.

Population and Administration.—The area of the ancient county is 3,882,328 acres. Its population in 1891 was 3,208,521, and in 1901, 3,584,762. The population increased over fivefold between 1801 and 1901; the increase in the W. Riding exceeding sevenfold. The manner in which the population is distributed may be inferred from the following statement of the parliamentary divisions, parliamentary, county and municipal boroughs, and urban districts in the three ridings. It should be premised that each of the three ridings is a distinct administrative county; though there is one high sheriff for the whole county. The city of York (pop. 77,914) is situated partly in each of the three ridings.

The West Riding has an area of 1,771,562 acres, with a population in 1891 of 2,445,033, and in 1901 of 2,750,493. Of this area the S. industrial district, considered in the broadest application of the term as extending between Sheffield and Skipton, Sheffield and Doncaster, and Leeds and the county boundary, covers rather less than one-half. The area thus defined includes the parliamentary divisions of Barnsley, Colne Valley, Elland, Hallamshire, Holmfirth, Keighley, Morley, Normanton, Pudsey, Rotherham, Shipley, Sowerby, Spen Valley. It also includes parts of the divisions of Barkston Ash, Doncaster, Osgoldcross, Otley and Skipton (a small part). The remaining parts of these last divisions, with that of Ripon, cover the rest of the riding. Each division returns one member. The following are parliamentary boroughs: Bradford, returning 3 members, Dewsbury 1, Halifax 1, Huddersfield 1, Leeds 5, Pontefract 1, Sheffield 5, Wakefield 1. All these are within the industrial district. Within this district are the following municipal boroughs (pops. in 1901): Barnsley (41,086), Batley (30,321), Bradford, city and county borough (279,767), Brighouse (21,735), Dewsbury (28,060), Doncaster (28,932), Halifax, county borough (104,936), Huddersfield, county borough (95,047), Keighley (41,564), Leeds, city and county borough (428,968), Morley (23,636), Ossett (12,903), Pontefract (13,427), Pudsey (14,907), Rotherham (54,349), Sheffield, city and county borough (409,070), Todmorden (partly in Lancashire, 25,418), Wakefield, city (41,413). The only municipal boroughs elsewhere in the riding are Harrogate (28,423) and Ripon (cathedral city, 8230). Within the industrial region there are 113 other urban districts, those with populations exceeding 10,000 being Bingley (18,449), Castleford (17,386), Cleckheaton (12,524), Elland (10,412), Featherstone (12,093), Handsworth (13,404), Hoyland Nether (12,464), Liversedge (13,980), Mexborough (10,430), Mirfield (11,341), Normanton (12,352), Rawmarsh (14,587), Rothwell (11,702), Saddleworth (12,320), Shipley (25,573), Skipton (11,986), Sowerby Bridge (11,477), Stanley (12,290), Swinton (12,127), Thornhill (10,290), Wombwell (13,252), Worsborough (10,336). The only urban districts in the West Riding not falling within the industrial region are—Goole (16,576), Ilkley (7455), Knaresborough (4979) and Selby (7786).

The North Riding has an area of 1,362,378 acres, with a population in 1891 of 359,547 and in 1901 of 377,338. It comprises the parliamentary divisions of Richmond, Cleveland, Whitby, and Thirsk and Malton, each returning one member; and the parliamentary boroughs of Middlesbrough (one member), Scarborough (one member), and parts of Stockton-on-Tees and York. The municipal boroughs are Middlesbrough, county borough (91,302), Richmond (3837), Scarborough (38,161) and Thornaby-on-Tees (16,054). The urban districts are Eston (11,199), Guisborough (5645), Hinderwell (1937), Kirklington-cum-Upsland (255), Loftus (6508), Malton (4758), Masham (1955), Northallerton (4009), Ormesby (9482), Pickering (3491), Redcar (7695), Saltburn-by-the-Sea (2578), Scalby (1350), Skelton and Brotton (13,240), South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Leeds
Bradford
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Haworth
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Nelson
Burnley
Todmorden
Halifax
Brighouse
Heckmondwike
Dewsbury
Batley
Morley
Castleford
Pontefract
Wakefield
Huddersfield
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Information embodied from the Ordnance Survey, by permission of the Controller of H. M. Stationery Office.

Bank in Normanby (9645), Whitby (11,755). Of these, all except Kirklington, Malton, Masham, Northallerton, Pickering and Whitby are in the populous Cleveland district. Besides Pickering, there lie at the S. of the Cleveland hills the small towns of Kirkby Moorside (1550) and Helmsley (1363). South of the last-named is the village of Ampleforth, with its large Roman Catholic college, founded in 1802, and accommodating, in fine modern buildings, about 120 students.

The East Riding has an area of 750,039 acres, with a population in 1891 of 341,560 and in 1901 of 385,007. It comprises the parliamentary divisions of Buckrose, Howdenshire and Holderness, each returning one member; and contains the parliamentary borough of Hull, returning three members, and part of that of York. The municipal boroughs are Beverley (13,183), Bridlington (12,482), Hedon (1010), and Hull, or Kingston-upon-Hull, a city and county of a city and county borough (240,259). The urban districts are Cottingham, near Hull (3751), Filey (3003), Driffield (5766), Hessle, near Hull (3754), Hornsea (2381), Norton, near Malton (3842), Pocklington (2463) and Withernsea (1426).

The West Riding comprises 9 wapentakes and the liberty of Ripon. It has one court of quarter sessions and is divided into 26 petty sessional divisions. The boroughs of Bradford, Doncaster, Leeds, Pontefract, Rotherham and Sheffield, and the liberty of Ripon, have separate courts of quarter sessions and commissions of the peace; and Barnsley, Batley, Brighouse, Dewsbury, Halifax, Harrogate, Huddersfield, Keighley, Morley, Ossett and Wakefield have commissions of the peace. The liberty and borough of Ripon are rated separately from the West Riding for the purposes of the county rate.

The North Riding comprises 11 wapentakes, and the liberties of E. and W. Langbaurgh and of Whitby Strand. It has one court of quarter sessions and is divided into 19 petty sessional divisions. The boroughs of Richmond and Scarborough have separate courts of quarter sessions and commissions of the peace, and the borough of Middlesbrough has a commission of the peace. The East Riding comprises 6 wapentakes and has one court of quarter sessions, and is divided into 12 petty sessional divisions, while Hull has a separate court of quarter sessions and commission of the peace, and Beverley has a separate commission of the peace. The city of York has a separate court of quarter sessions and commission of the peace. Yorkshire is in the N.E. circuit. The total number of civil parishes is 1586. The county contains

1178 ecclesiastical parishes and districts wholly or in part. It is divided between the dioceses of York, Ripon and Wakefield, with small parts in those of Manchester, Southwell, Durham and Lincoln. York is the seat of the northern archdiocese.

History.—The kingdom of Deira (*q.v.*), which was afterwards to include the whole of the modern Yorkshire, is first known to us in the 6th century, an Anglian tribe having seized the promontory at the mouth of the Humber, named by the invaders Holderness, followed by the gradual subjugation of the whole district now known as the East Riding. The wolds between Weighton and Flamborough Head were then mere sheep-walks, and the earliest settlements were chiefly confined to the rich valley of the lower Derwent, but the district around Weighton became the Deiran sacred ground, and Goodmanham is said to mark the site of a temple. The area computed in the modern West Riding constituted the British kingdom of Elmet, and at this date presented a desolate and unbroken tract of moorland in the N.; in the central parts about Leeds stretched a forest region where the last wolf seen in Yorkshire is said to have been slain by John of Gaunt; while in the S. the forest and fen of Hatfield Chase presented a barrier to invasion broken only by the line of Watling Street, which crossed the Don at Doncaster, the Aire at Castleford and the Wharfe at Tadcaster. The N. continuation of the road from York through Catterick to the Tees opened the way to the fertile plain in the heart of the modern North Riding, the S.E. of which offered an unbroken forest area, later known as the forest of Galtres, which in the middle ages stretched from York N. to Easingwold and Craike and E. to Castle Howard, and as late as the 16th century lay a waste and unfrequented region abounding only in deer. Ella, the first king of Deira, extended his territory N. to the Wear, and his son Edwin completed the conquest of the district which was to become Yorkshire by the subjugation of Elmet, prompted thereto by vengeance on its king, Cerdic, for the murder of his uncle Hereric. Traces of the "burhs" by which Edwin secured his conquests are perhaps visible in the group of earthworks at Barwick and on the site of Cambodunum, but the district long remained scantily populated, and as late as the 17th century deer were said to be as plentiful in Hatfield Chase as "sheep upon a hill," for Prince Henry in 1609 was asserted to have killed 500 in one day's hunting. The defeat of Edwin at Hatfield in 633 was followed by a succession of struggles between Mercia and Northumbria for the supremacy over Deira, during which the boundaries underwent constant changes. After the Danish conquest of Deira, Guthrum in 875 portioned the district among his followers, under whose lordship the English population were for the most part allowed to retain their lands. Cleveland came under Scandinavian influence, and the division into tithings probably originated about this date, the boundaries being arranged to meet at York, which, as the administrative and commercial centre of the district, rapidly increased in importance, and it has been estimated that in A.D. 1000 it had a population of over 30,000. At the battle of Stamford Bridge in 1066 Harold Hardrada, who had seized York, and Earl Tosti were both defeated and slain by Harold of England. The merciless harrying with which the Conqueror punished resistance to his claims is proved by the reiterated entries of waste land in the Domesday Survey, and for many years all the towns between York and Durham lay uninhabited. In 1138 the forces of David of Scotland were defeated near Northallerton in the Battle of the Standard. In the barons' wars of the reign of Henry II. Thirsk and Malgeard Castles, which had been garrisoned against the king by Roger de Mowbray, were captured and demolished. In the harrying of the northern counties by the forces of Robert Bruce in 1318, Northallerton, Boroughbridge, Scarborough and Skipton were reduced to ashes. In 1322, at the battle of Boroughbridge, the rebel barons were defeated by the forces of Edward II. In 1399 Richard II. was murdered in Pontefract Castle. In 1405 Archbishop Scrope and Thomas Mowbray joined in the insurrection against Henry IV., and led the citizens of York to Skipton Moor, where, after a defeat by the earl of Westmorland, the leaders were beheaded under the walls of York. In 1408 the rebel forces of the earl of Northumberland were defeated by Sir Thomas Rokesby, high sheriff of Yorkshire, at Bramham Moor near Tadcaster. In 1453 a skirmish between the Percies and the Nevilles at Stamford Bridge was the opening event in the struggle between the houses of York and Lancaster; in 1460 the duke of York was defeated and slain at Wakefield; in 1461 the Lancastrians were defeated at Towton. The suppression of the monasteries roused deep resentment in Yorkshire, and the inhabitants flocked to join the Pilgrimage of Grace, Skipton Castle being the only place immediately N. of the Humber which remained loyal to the king. On the outbreak of the Civil War of the 17th century, opinion was divided in Yorkshire, the chief parliamentary families being the Fairfaxes and the Hothams, while the Puritan clothing-towns of the West Riding also sided with the parliament. Sir William Savile captured Leeds and Wakefield for the king in 1642, and in 1643 Newcastle, having defeated the Fairfaxes at Adwalton Moor, held all Yorkshire except Hull, which the Hothams, moved by jealousy of the Fairfaxes, had already designed to give up. In 1644, however, the Fairfaxes secured the East and West Ridings, while Cromwell's victory at Marston Moor was followed by the capture of York, and in the next year of Pontefract and Scarborough.

On the redistribution of estates after the Norman Conquest, Alan of Brittany, founder of Richmond Castle, received a vast fief which became the honour of Richmond; Ilbert de Laci was rewarded with lands which afterwards constituted the honour of Pontefract. Earl Harold's estate at Coningsburgh passed to William de Warenne, earl of Surrey, together with Sandal Castle, which on the expiration of the Warenne line in the 14th century was bestowed on Edmund Langley, duke of York. Other great Domesday landholders were William de Percy, founder of the abbey of Whitby; Robert de Bruce, ancestor of the royal line of Scotland, the head of whose fief in Cleveland was transferred in the 12th century from Danby Castle to Skelton; Roger de Busli owned a large tract in S. Yorkshire, of which Tickhill was the head; the archbishop of York enjoyed the great lordship of Sherburn, and Howdenshire was a liberty of the bishop of Durham. Among the great lordships of the middle ages for which Yorkshire was distinguished were: Topcliffe, the honour of the Percies; Thirsk, of the Mowbrays; Tanfield, of the Marmions; Skipton, of the Cliffords; Middleham, of the Fitz-Hughes and Nevilles; Helmsley, of the de Roos; Masham and Bolton, of the Scropes; Sheffield, of the Furnivalls and Talbots; Wakefield, of the duke of York. The Fairfaxes were settled in Yorkshire in the 13th century, and in the 16th century Denton became their chief seat.

The shire court for Yorkshire was held at York, but extensive privileges were enjoyed by the great landholders. In the 13th century Henry de Lacy, earl of Lincoln, claimed to hold the sheriff's tourn at Bradford and Leeds; his bailiff administered the wapentake of Stainclif in his court at Bacskalf and Slaidburn; and his steward judged cases of felony in his court at Almondbury. The archbishop of York held the sheriff's tourn at Otley, and had his own coroners at York, Hull, Beverley and Ripon. Eudo la Zouche held the sheriff's tourn at Bingley, and Thomas de Furnivall in Hallamshire. The bailiffs of Tickhill Castle also held tourns in place of the sheriff. The bishop of Durham had a court at Hoveden, and the king's bailiffs were excluded from executing their office in his estates of Howdenshire and Allertonshire. The abbot of St Mary's York had his own coroners in the wapentake of Ryedale, and the abbot of Bella Landa in Sutton. The prior of Bradenstoke held a court in his manor of Wales. The archbishop of York, Robert de Ros, and the abbot of St Mary's York judged felonies at their courts in Holderness. The liberty of Ripon (*q.v.*), city of Ripon, still constitutes a franchise of the archbishops of York.

In the 13th century the diocese of York included in this county the archdeaconry of York, comprising the deaneries of York, Pontefract, Doncaster and Craven; the archdeaconry of Cleveland, comprising the deaneries of Bulmer, Cleveland

and Ryedale; the archdeaconry of East Riding, comprising the deaneries of Harthill (Hull), Buckrose, Dickering and Holderness; and the archdeaconry of Richmond, comprising the deaneries of Richmond, Catterick, Boroughbridge and Lonsdale. In 1541 the deaneries of Richmond were transferred to Henry VIII.'s new diocese of Chester. Ripon was created an episcopal see by act of parliament in 1836, and the deaneries of Craven and Pontefract were formed into the archdeaconry of Craven within its jurisdiction, together with the archdeaconry of Richmond. The archdeaconry of Sheffield was created in 1884 to include the deaneries of Sheffield, Rotherham, Ecclesfield and Wath. In 1888 the area of the diocese of Ripon was reduced by the creation of the see of Wakefield, including the archdeaconry of Halifax with the deaneries of Birstall, Dewsbury, Halifax, Silkstone and Wakefield, and the archdeaconry and deanery of Huddersfield. The diocese of Ripon now includes in this county the archdeaconries of Craven with three deaneries, Richmond with three deaneries and Ripon with seven deaneries. The diocese of York includes the archdeaconries of York with six deaneries, Sheffield with four deaneries, East Riding with thirteen deaneries and Cleveland with nine deaneries.

The great woollen industry of Yorkshire originated soon after the Conquest, and the further development of this and other characteristic industries may be traced in the articles on the various industrial centres. The time of the American War marked the gradual absorption by Yorkshire of the clothing trade from the E. counties. Coal appears to have been used in Yorkshire by the Romans, and was dug at Leeds in the 13th century. The early fame of Sheffield as the centre of the cutlery and iron trade is demonstrated by the line in Chaucer, "a Sheffield whitel bore he in his hose." In the 13th century a forge is mentioned at Rosedale, and the canons of Gisburn had four "fabricae" in blast in Glaisdale in Cleveland. In the 16th century limestone was dug in many parts of Elmet, and Huddlestone, Hesselwood and Tadcaster had famous quarries; Pontefract was famous for its liquorice, Aberford for its pins, Whitby for its jet. Alum was dug at Guisborough, Sandsend, Dunsley and Whitby in the 17th century, and a statute of 1659 forbade the importation of alum from abroad, in order to encourage its cultivation in this country. Bolton market was an important distributive centre for cotton materials in the 17th century, and in 1787 there were eleven cotton mills in the county.

Parliamentary Representation.—The county of York was represented by two knights in the parliament of 1295, and the boroughs of Beverley, Hedon, Malton, Pickering, Pontefract, Ripon, Scarborough, Thirsk, Tickhill, Yarm and York each by two burgesses. Northallerton acquired representation in 1298, Boroughbridge in 1300, Kingston-on-Hull and Ravensburgh in 1304. In most of the boroughs the privilege of representation was allowed to lapse, and from 1328 until 1547 only York, Scarborough and Kingston-on-Hull returned members. Hedon, Thirsk, Ripon and Beverley regained the franchise in the 16th century, and Boroughbridge, Knaresborough, Aldborough and Richmond also returned members. Pontefract was represented in 1623, New Malton and Northallerton in 1640. In 1826 two additional knights were returned for the shire of York, and 14 boroughs were represented. Under the Reform Act of 1832 the county returned 6 members in 3 divisions—2 for each riding; Aldborough, Boroughbridge and Hedon were disfranchised; Northallerton and Thirsk lost 1 member each; Bradford, Halifax, Leeds and Sheffield acquired representation by 2 members each, and Wakefield and Whitby by 1 member each. Under the act of 1868 the representation of the West Riding division was increased to 6 members in 3 divisions; Dewsbury and Middlesbrough were enfranchised, returning 1 member each; Leeds now returned 3 members; Knaresborough, Malton, Richmond and Ripon lost 1 member each. Beverley was disfranchised in 1870. (For arrangements under the act of 1885 see § *Administration.*)

Antiquities.—Of ancient castles Yorkshire retains many interesting examples. The fine ruins at Knaresborough, Pickering, Pontefract, Richmond, Scarborough and Skipton are described under their respective headings. Barden Tower, picturesquely situated in upper Wharfedale, was built by Henry de Clifford (d. 1523), called the "shepherd lord" from the story that he was brought up as a shepherd. He was a student of astronomy and astrology. Bolton Castle, which rises majestically above Wensleydale, was pronounced by Leland "the fairest in Richmondshire." It is a square building with towers at the corners, erected in the reign of Richard II. by Richard Scrope, chancellor of England. It was occupied by Queen Mary while under the charge of Lord Scrope, was besieged during the civil wars, and rendered untenable in 1647. Of Bowes Castle, in the North Riding near Barnard Castle, there remains only the square keep, supposed to have been built by Alan Niger, 1st earl of Richmond, in the 12th century, but the site was occupied by the Romans. Cawood Castle, on the Ouse near Selby, retains its gateway tower erected in the reign of Henry VI. The castle, said to have been founded by Æthelstan in 620, was the palace of the archbishops of York, and Wolsey resided in it. Conisborough Castle stands by the Don between Rotherham and Doncaster. Its origin is uncertain, but dates probably from Saxon times. The keep and portions of the walls remain; and the ruin possesses additional interest from its treatment in Scott's *Ivanhoe*. The ruins of Danby Castle, which is supposed to have been built shortly after the Conquest by Robert de Bruce or Brus, are of various dates. Harewood Castle in lower Wharfedale was founded soon after the Conquest, but contains no portions earlier than the reign of Edward III. The keep of Helmsley Castle was built late in the 12th century probably by Robert de Ros, surnamed Fursan; the earthworks are apparently of much earlier date. There are picturesque remains of the quadrangular fortress of Middleham in Wensleydale, built in the 12th century by Robert FitzRanulph, afterwards possessed by the Nevilles, and rendered untenable by order of parliament in 1647. Mulgrave Castle, near the modern residence of the same name in the Whitby district, is said to have been founded two centuries before the Conquest by a Saxon giant named Wade or Wadda. Parts are clearly Norman, but some of the masonry suggests an earlier date. The castle was dismantled after the civil wars. There are slight remain, of the 15th century, of Ravensworth Castle, near Richmond. This was probably an early foundation of the family of Fitz Hugh. Sheriff Hutton Castle, between York and Malton, was the foundation of Bertram de Bulmer in the reign of Stephen; the remains are of the early part of the 15th century, when the property passed to the Nevilles. Spofforth Castle, near Harrogate, was erected by Henry de Percy in 1309. Its ruins range from the period of foundation to the 15th century. Of Tickhill Castle, near Doncaster, built or enlarged by Roger de Busli in the 11th century, there are foundations of the keep and fragments of the walls. Of Whorlton Castle in Cleveland, the Perpendicular gatehouse is very fine. One side remains of the great quadrangular fortress of Wressell, E. of Selby, built by Thomas Percy, earl of Worcester, in the reign of Richard II. Some of the mansions in the county incorporate remains of ancient strongholds, such as those at Gilling, under the Hambleton Hills in the North Riding, Ripley near Harrogate, and Skelton in Cleveland. Medieval mansions are numerous, a noteworthy example being the Elizabethan hall of Burton Agnes, in the N. of Holderness.

In ecclesiastical architecture Yorkshire is extraordinarily rich. At the time of the Dissolution there were 28 abbeys, 26 priories, 23 nunneries, 30 friaries, 13 cells, 4 commanderies of Knights Hospitallers and 4 preceptories of Knights Templars. The principal monastic ruins are described under separate headings and elsewhere. These are Bolton Abbey (properly Priory), a foundation of Augustinian canons; Fountains Abbey, a Cistercian foundation, the finest and most complete of the ruined abbeys in England; the Cistercian abbey of Kirkstall near Leeds (*q.v.*); the Cistercian abbey of Rievaulx, and the Benedictine abbey of St Mary, at York. For the plans and buildings of Fountains, Kirkstall and St Mary's, York, see ABBEY. Separate reference is also made to the ruins of Jervaulx (Cistercian) and Coverham (Premonstratensian) in Wensleydale, and to the remains at Bridlington, Guisborough, Malton, Whitby, Easby near Richmond, Kirkham near Malton, Monk Bretton near Barnsley, and Mount Grace near Northallerton. There are fine though scanty remains of Byland Abbey, of Early English date, between Thirsk and Malton; the abbey was founded for Cistercian monks in the 12th century, and was previously established at Old Byland near Rievaulx. There was a house of Premonstratensians at Egglestone above the Tees near Barnard Castle. Other ruins are the Cistercian foundations of the 12th century at Meaux in Holderness, Roche, E. of Rotherham, and Sawley in Ribblesdale; the Benedictine nunneries of Marrick in upper Swaledale, and Rosedale under the high moors of the N.E.; and the Gilbertine house of Watton in Holderness, of the 12th century, converted into a dwelling.

Descriptions are given in the articles on the respective cities and towns of the cathedral or minster at York, and of the numerous churches in that city; of the cathedral churches at Ripon and Wakefield; of the minster and the church of St Mary at Beverley; and of the fine parish churches at Bradford, Bridlington (the old priory church), Hedon, Hull, Rotherham, Selby (abbey church), Sheffield and Thirsk. In Holderness are the splendid churches of Howden and Patrington, both in the main Decorated; and the fine late Norman building at Kirkburn. A very perfect though small example of a Norman church is seen at Birkin on the Aire below Pontefract. At Nun Monkton near York is a beautiful Early English church, formerly belonging to a Benedictine nunnery. Goodmanham in the S. Wolds is the scene, in all probability, of the conversion by Paulinus of Edwin of Northumbria in 625, who was afterwards baptized at York. At Kirkdale near Kirkby Moorside in the N. Riding is a singular example of an inscribed sundial of pre-Conquest date. At Lastingham in the same district is a very fine and early Norman crypt.

See *Victoria County History, Yorkshire*: T. Allen, *History of the County of York* (3 vols., London, 1828–31); T. Baines, *Yorkshire Past and Present*, including an account of the woollen trade of Yorkshire by E. Baines (2 vols., London, 1871–77); John Burton, *Monasticon Eboracense* (London, 1758–59); W. Smith, *Old Yorkshire* (London, 1881); G. Frank, *Ryedale and North Yorkshire Antiquities* (York, 1888); G. R. Park, *Parliamentary Representation of Yorkshire* (Hull, 1886); A. D. H. Leadman, *Proelia Eboracensia, Battles fought in Yorkshire* (London, 1891); T. D. Whitaker, *History of Richmondshire* (London, 1823), *History of Craven* (London, 1878), *History of Leeds and Elmet* (2 vols., Leeds, 1816); J. Wainwright, *Yorkshire; Wapentake of Strafford and Tickhill*, vol. i. (Sheffield, 1826); W. Grainge, *Castles and Abbeys of Yorkshire* (York, 1855); J. Hunter, *South Yorkshire* (2 vols., London, 1828–31); J. J. Sheahan and T. Whellan, *History of the City of York, the Ainsty Wapentake, and the East Riding of Yorkshire* (3 vols., Beverley, 1855–57); T. Langdale, *Topographical Dictionary of Yorkshire* (Northallerton, 1809); G. H. de S. N. Plantagenet Harrison, *History of Yorkshire* (London, 1879, &c.); see also publications of the Yorkshire Archaeological and Topographical Society.

YORKTOWN, a town and the county-seat of York county, Virginia, U.S.A., on the York river 10 m. from its mouth, and about 60 m. E.S.E. of Richmond. Pop. (1910) 136. It is served by the Baltimore, Chesapeake & Richmond steamship line, and about 6½ m. distant is Lee Hall, a station on the Chesapeake & Ohio railway. Large deposits of marl near the town are used for the manufacture of cement. In the main street is the oldest custom-house in the United States, and the house of Thomas Nelson (1738–1789), a signer of the Declaration of Independence. In commemoration of the surrender of Lord Cornwallis in October 1781, there is a monument of Maine granite (100 ft. 6 in. high) designed by R. M. Hunt and J. Q. A. Ward; its corner-stone was laid in 1881 during the centennial celebration of the surrender, and it was completed in 1883. Yorktown was founded in 1691, as a port of entry for York county. It became the county-seat in 1696, and although it never had more than about 200 houses its trade was considerable until it was ruined by the War of Independence. In that war the final victory of the Americans and their French allies took place at Yorktown.

Baffled by General Nathanael Greene in his campaign in the Carolinas, his diminished force (fewer than 1400) sadly in need of reinforcement, and persuaded that the more southern colonies could not be held until Virginia had been reduced, Lord Cornwallis marched out of Wilmington, N. Carolina, April 25th, 1781, arrived at Petersburg, Virginia, on May 20th, and there with the troops which had been under William Phillips and Benedict Arnold and with further reinforcements from New York raised his army to more than 7000 men. Facing him in Richmond was Lafayette, whom Washington had sent earlier in the year with a small force of light infantry to check Arnold, and who had now been placed in command of all the American troops in Virginia. Cornwallis's first attempt was to prevent the union of Lafayette and General Anthony Wayne. Failing in this, he retired down the James in the hope, it is thought, of receiving further reinforcements from General Henry Clinton. Clinton, who had not approved Cornwallis's plan against Virginia, at first ordered him to send a portion of his troops to aid in the defence of New York; but as other reinforcements came to New York, and as the home government approved Cornwallis's plan, Clinton resolved to establish a permanent base in the Chesapeake and directed Cornwallis to fortify a post for the protection of the British navy. Cornwallis seized Yorktown and Gloucester early in August and immediately began to fortify them. While Cornwallis was marching from N. Carolina to Virginia, Washington learned that a large French fleet under Count de Grasse was to come up from the West Indies in the summer and for a brief period co-operate with the American and French armies. At a conference (May 21st) at Wethersfield, Connecticut, with the French commanders, Washington favoured a plan for a joint attack on New York when De Grasse should arrive. An attack on the British in Virginia was, however, considered, and the minutes of the conference with some suggestions from Rochambeau having been sent to De Grasse, he announced in a letter received the 14th of August that he should sail for the Chesapeake for united action against Cornwallis. About the same time Washington learned from Lafayette that Cornwallis was fortifying Yorktown. Sir Samuel Hood with 14 ships-of-the-line arrived at the Chesapeake from the West Indies three days ahead of De Grasse, and proceeding to New York warned Admiral Thomas Graves of the danger. Graves took command of the combined fleet, 19 ships-of-the-line, and on the 31st of August sailed for the Chesapeake in the hope of preventing the union of the French fleet from Newport, under Count de Barras, with that under De Grasse. He arrived at the Chesapeake ahead of De Barras, but after an encounter with De Grasse alone (September 5th), who had 24 ships-of-the-line, he was obliged to return to New York to refit, and the French were left in control of the coast. Leaving only about 4000 men to guard the forts on the Hudson, Washington set out for Virginia with the remainder of his army immediately after learning of De Grasse's plan, and the French land forces followed. The French fleet transported the allied army from the head of the Chesapeake to the vicinity of Williamsburg, and on the 28th of September it marched to Yorktown. Receiving, on the same day, a despatch from Clinton promising relief, and fearing the enemy might outflank him, Cornwallis abandoned his outposts during the following night and withdrew to his inner defences, consisting of seven redoubts and six batteries connected by intrenchments, besides batteries along the river bank. The allies, 16,000 strong, took possession of the abandoned posts and closed in on the town in a semicircle extending from Wormley Creek below it to about a mile above it, the Americans holding the right and the French the left. On the night of October 5th–6th the allies opened the first parallel about 600 yds. from the British works, and extending from a deep ravine on the N.W. to the river bank on the S.E., a distance of nearly 2 m. Six days later the second parallel was begun within 300 yds. of the British lines, and it was practically completed on the night of the 14th and 15th, when two British redoubts were carried by assault, one by the Americans led by Alexander Hamilton and one by the French led by Lieut.-Colonel G. de Deux-Ponts. In the morning of the 16th Cornwallis ordered Lieut.-Colonel Abercrombie to make an assault on two French batteries. He carried them and spiked eleven guns, but they were recovered and the guns were ready for service again twelve hours later. On the night of the 16th and 17th Cornwallis attempted to escape with his army to Gloucester on the opposite side of the river, but a storm ruined what little chance of success there was in this venture. In grave danger of an assault from the allies, Cornwallis offered to surrender on the 17th; two days later his whole army, consisting of 7073 officers and men, was surrendered, and American Independence was practically assured. The British loss during the siege was about 156 killed and 326 wounded; the American and French losses were 85 killed and 199 wounded.

Yorktown campaign, 1781.

In 1862 the Confederate defences about Yorktown were besieged for a month (April 4–May 3) by the Army of the Potomac under General M'Clellan. There was no intention on the part of the Confederate commander-in-chief, Joseph Johnston, to do more than gain time by holding Yorktown and the line of the Warwick river as long as possible without serious fighting, and without imperilling the line of retreat on Richmond; and when after many delays M'Clellan was in a position to assault with full assistance from his heavy siege guns, the Confederates fell back on Williamsburg.

See T. N. Page, "Old Yorktown," in *Scribner's Magazine* (October, 1881); H. P. Johnston, *The Yorktown Campaign and the Surrender of Cornwallis* (New York, 1881); A. S. Webb, *The Peninsular Campaign* (New York, 1882); and J. C. Ropes, *Story of the Civil War*, vol. ii.

YORUBAS; YORUBALAND. The Yoruba, a group of Negro tribes, have given their name to an extensive area in West Africa, in the hinterland of Lagos. The Yoruba are of true Negro stock, in many respects typical of the race, but among them are found persons with lighter skins and features recalling the Hamitic or Semitic peoples. This arises, in all probability, from an infiltration of Berber and Arab blood through the Fula (*q.v.*). The Yoruba themselves have traditions of an Oriental origin. They are divided into many tribes, among the best known being the Oyo = Yoruba proper, the Egba, Jebu, Ife and Ibadan. They are sometimes called by the French Nago, and are known to the Sierra Leonis, many of whom are of Yoruba descent, as Aku. A considerable proportion of the American negroes are also said to be of Yoruba origin. For a long period the Yoruba were raided by the Dahomeyans and other coast tribes, to sell as slaves to the white traders. They are both an urban and agricultural people. Pottery, weaving, tanning, dyeing, and forging are among their industries. The houses of chiefs, often containing fifty rooms, are well built, and decorated with carvings representing symbolic devices, fabulous animals and scenes of war or the chase.

The Yoruba have considerable administrative ability. Their system of government places the power in a council of elders presided over by a chief who owes his position to a combination of the principles of heredity and election.[1] The ruling chief must always be taken from the members of one of two families, the succession in many cases passing from one to the other family alternately. Primogeniture is not necessarily considered.

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[1] R. E. Dennett states that the government is based on the rule of four great chiefs who respectively represent the phases of family life, namely, (1) the deified head of the family. called Orisha; (2) the

Before the introduction of letters the Yoruba are said to have employed knotted strings for recording events. Their language, which has been reduced to writing and carefully studied, has penetrated as far E. as Kano in the Hausa country. The best known dialectic varieties are those of Egba, Jebu, Ondo, Ife, Illorin and Oyo (Yoruba proper, called also Nago); but the discrepancies are slight. The most marked feature, a strong tendency towards monosyllabism—produced by phonetic decay—has given rise to the principle of intonation, required to distinguish words originally different but reduced by corruption to the condition of homophones. Besides the tones, of which there are three,—high, low and middle,—Yoruba has also developed a degree of vocalic harmony, in which the vowels of the affixes are assimilated to that of the root. Inflexion, as in Bantu, is effected chiefly by prefixes; and there is a remarkable power of word-formation by the fusion of several relational elements in a single compound term. The Bible and several other books have been translated into Yoruba, which as a medium of general intercourse in West Africa ranks in importance next to Hausa and Mandingan. The Yoruba religion is that usually known as fetishism.

The Yoruba country extends from Benin on the E. to Dahomey on the W. (where it somewhat overlaps the French frontier), being bounded N. by Borgu and S. by the coastlands of Lagos. It covers about 25,000 sq. m. Most of it is included in the British protectorate of Southern Nigeria. The land is moderately elevated and a large part of it is densely forested. It is well watered; the rivers belong mainly to the coast systems, though some drain to the Niger. The history of Yorubaland, as known to Europeans, does not go back beyond the close of the 17th century. At that time it was a powerful empire, and had indirectly come—through its connexion with Benin and Dahomey—to some extent under European influence. There was also a much slighter Moslem influence. One tradition brought the founder of the nation from Bornu. The Yoruba appear to have inhabited their present country at least as early as A.D. 1000. In the 18th century the Yoruba were constantly engaged in warfare with their Dahomeyan neighbours, and in 1738 they captured Kana, the sacred city of the kings of Dahomey. From 1747 to the time of King Gezo (1818) the Dahomeyans paid tribute to Yoruba. It was not until the early years of the 19th century that the Yoruba came as far S. as the sea, when they founded a colony at Lagos. About 1825 the province of Illorin, already permeated by Moslem influences from the north, declared itself independent of the Yoruba, and shortly afterwards Yorubaland was overrun by Fula invaders. From this time (1830–35) the Yoruba empire—there had been six confederate kingdoms—was broken up into a number of comparatively weak states, who warred with one another, with the Dahomeyans and with their Moslem neighbours. The advent of the British at first led to further complications and fighting, but gradually the various tribes gained confidence in the colonial government and sought its services as peacemaker. A treaty placing their country under British protection was signed by the Egba in January 1893, and the subsequent extension of British control over the other portions of Yorubaland met with no opposition.

Though divided into semi-independent states, the Yoruba retain a feeble sense of common nationality. The direct representative of the old Yoruba power is the *alafin* or king of Oyo occupying the N. and central parts of the whole region. Round this central state, which has lost much of its importance, are grouped the kingdoms of Illorin, Ijesa, Ife and Ondo in the E., Mahin and Jebu in the S. and Egba in the W. The ruler of each of these states has a title characteristic of his office. Thus the chief of Ife bears the title of *oni* (a term indicating spiritual supremacy). To the oni of Ife or the alafin of Oyo all the other great chiefs announce their succession. The oni, says Sir William MacGregor, is regarded as the fountain of honour, and without his consent no chief can assume the privilege of wearing a crown. The most important of the Yoruba states is Egba, the ruling chief of which is the *alake* of Abeokuta (see Abeokuta).

Yorubaland is a country of comparatively large cities. The alafin resides at Oyo, on a headstream of the Oshun, a place which has succeeded the older capitals, Bohu and Katunga, lying farther N. and destroyed during the wars with the Fula. Oyo is exceeded in size by several other places in Yorubaland, where the inhabitants have grouped themselves together for mutual protection in walled towns. Thus have sprung up the important towns of Abeokuta on the Ogun, due N. of Lagos; Ibadan on a branch of the Omi, 30 m. S. of Oyo; and Illorin, capital of the Illorin state, besides several other towns with a population of some 40,000.

See A. Dalzell, *The History of Dahomey* (London, 1793); A. B Ellis, *The Yoruba-speaking Peoples of the Slave Coast of West Africa* (London, 1894); R. E. Dennett, *Nigerian Studies, or the Religions and Political System of the Yoruba* (London, 1910); C. F. Harford-Battersby, *Niger and Yoruba Routes* (London, 1895–96); and Lagos and Nigeria.

YŌSAI [Kikuchi] (1781–1878), Japanese painter, was the son of a *samurai* named Kawara, of Yedo. He was adopted by the Kikuchi family, who were old hereditary retainers of the Tokugawa clan. When eighteen, he became a pupil of Takata Enjō; but, after studying the principles of the Kanō, Shijō, and Maruyama schools—in the latter, perhaps, under Ōzui, a son of Ōkyo—he developed an independent style, having some affinities with that of Tani Bunchō. He was one of the last of the great painters of Japan; and his illustrated history of Japanese heroes, the *Zenken Kojitsu*, is a remarkable specimen of his power as a draughtsman in black and white.

YOSEMITE, a famous valley on the W. slope of the Sierra Nevada of California, about 150 m. E. of San Francisco and 4000 ft. above the sea. It is 7 m. long, half a mile to a mile wide, and nearly a mile deep, eroded out of hard massive granite by glacial action. Its precipitous walls present a great variety of forms, and the bottom, a filled-up lake basin, is level and park-like. The most notable of the wall rocks are: El Capitan, 3300 ft. high, a sheer, plain mass of granite; the Three Brothers, North Dome, Glacier Point, the Sentinel, Cathedral, Sentinel Dome and Cloud's Rest, from 2800 to nearly 6000 ft. high; and Half Dome, the noblest of all, which rises at the head of the valley to the height of 4740 ft. These rocks illustrate on a grand scale the action of ice in mountain sculpture. For here five large glaciers united to form the grand trunk glacier that eroded the valley and occupied it as its channel. Its moraines, though mostly obscured by vegetation and weathering, may still be traced; while on the snowy peaks at the headwaters of the Merced a considerable number of small glaciers, once tributary to the main Yosemite glacier, still exist. The Bridal Veil Fall, 900 ft. high, is one of the most interesting features of the lower end of the valley. Towards the upper end the great Yosemite Fall pours from a height of 2600 ft. The valley divides at the head into three branches, the Tenaya, Merced and South Fork canyons. In the main (Merced) branch are the Vernal and Nevada Falls, 400 and 600 ft. high. The Nevada is usually ranked next to the Yosemite among the five main falls of the valley, and is the whitest of all the falls. The Vernal, about half a mile below the Nevada, is famous for its afternoon rainbows. At flood-time it is a nearly regular sheet about 80 ft. wide, changing as it descends from green to purplish-grey and white. In the S. branch, a mile from the head of the main valley, is the Illilouette Fall, 600 ft. high, one of the most beautiful of the Yosemite choir.

Considering the great height of the snowy mountains about the valley, the climate of the Yosemite is remarkably mild. The vegetation is rich and luxuriant. The tallest pines are over 200 ft. high; the trunks of some of the oaks are from 6 to 8 ft. in diameter; violets, lilies, golden-rods, ceanothus, manzanita, wild rose and azalea make broad beds and banks of bloom in the spring; and on the warmest parts of the walls flowers blossom in every month of the year.

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fatherhood; (3) motherhood; (4) sonship. The chief representing motherhood is brother to the mother, and in the developed state has become the Balogun or war lord.

The valley was discovered in 1851 by a military company in pursuit of marauding Indians; regular tourist travel began in 1856. The first permanent settler in the valley was Mr J. C. Lamon, who built a cabin in the upper end of it in 1860 and planted gardens and orchards. In 1864 the valley was granted to the state of California by act of Congress on condition that it should be held as a place of public use, resort and recreation inalienable for all time, was re-ceded to the United States by California on the 3rd of March 1905, and is now included in the Yosemite National Park.

In the number and height of its vertical falls and in the massive grandeur of El Capitan and Half Dome rocks Yosemite is unrivalled. But there are many other valleys of the same kind. The most noted of those in the Sierra, visited every summer by tourists, hunters and mountaineers, are the Hetch Hetchy Valley, a wonderful counterpart of Yosemite in the Tuolumne canyon; Tehipitee Valley, in the Middle Fork canyon of King's river; and the King's river Yosemite in the South Fork canyon, the latter being larger and deeper than the Merced Yosemite. All are similar in their trends, forms, sculpture and vegetation, and are plainly and harmoniously related to the ancient glaciers. The Romsdal and Naerödal of Norway and Lauterbrunnen of the Alps are well characterized glacial valleys of the Yosemite type, and in S.E. Alaska many may be observed in process of formation.

See the *Annual Reports* (Washington, 1891 sqq.) of the Superintendent of the Park; the *Guide to the Yosemite* published by the California Geological Survey; John Muir, *Our National Parks* (Boston, 1901); and Bunnell's *Discovery of the Yosemite* (New York, 1893). (J. Mu.*)

YOUGHAL (pronounced *Yawl*), a seaport, market town and watering-place of county Cork, Ireland, on the W. side of the Blackwater estuary, and on the Cork & Youghal branch of the Great Southern & Western railway, 26¾ m. E. of Cork. Pop. (1901) 5393. The collegiate church of St Mary, in the later Decorated style, was erected in the 11th century, but rebuilt in the 13th, and since that time frequently restored. It contains a beautiful monument to the 1st earl of Cork. The college was founded by an earl of Desmond in 1464. There are still a few fragments of the Dominican friary founded in 1269. The Clock Gate (1771) is noticeable, and portions of the old walls are to be seen. Myrtle Grove was formerly the residence of Sir Walter Raleigh. He was mayor of Youghal in 1588–89, and is said to have first cultivated the potato here. The harbour is safe and commodious, but has a bar at the mouth. At the N. extremity of the harbour the river is crossed by a bridge on wooden piles. The principal exports are corn and other agricultural produce; the imports are coal, culm, timber and slate. Coarse earthenware and bricks are manufactured. Fine point-lace commanding high prices is made by the Presentation Sisters. The Blackwater is famous for salmon, and sea-fishing is important. The Strand, the modern portion of the town, has all the attributes of a seaside resort.

Youghal (*Eschaill*, "the Yew wood") was made a settlement of the Northmen in the 9th century, and was incorporated by King John in 1209. The Franciscan monastery, founded at Youghal by FitzGerald in 1224, was the earliest house of that order in Ireland. Sir Roger Mortimer landed at Youghal in 1317. The town was plundered by the earl of Desmond in 1579. In 1641 it was garrisoned and defended by the earl of Cork. In 1649 it declared for the parliament, and was occupied as his headquarters by Cromwell. It sent two members to parliament from 1374 till the Union, after that only one down to 1885.

YOUNG, ARTHUR (1741–1820), English writer on agriculture and social economy, second son of the Rev. Arthur Young, rector of Bradfield, in Suffolk, chaplain to Speaker Onslow, was born on the 11th of September 1741. After being at a school at Lavenham, he was in 1758 placed in a mercantile house at Lynn, but showed no taste for commercial pursuits. He published, when only seventeen, a pamphlet *On the War in North America*, and in 1761 went to London and started a periodical work, entitled *The Universal Museum*, which was dropped by the advice of Samuel Johnson. He also wrote four novels, and *Reflections on the Present State of Affairs at Home and Abroad* in 1759. After his father's death in 1759, his mother had given him the direction of the family estate at Bradfield Hall; but the property was small and encumbered with debt. From 1763 to 1766 he devoted himself to farming on his mother's property. In 1765 he married a Miss Allen; but the union is said not to have been happy, though he was of domestic habits and an affectionate father. In 1767 he undertook on his own account the management of a farm in Essex. He engaged in various experiments, and embodied the results of them in *A Course of Experimental Agriculture* (1770). Though Young's experiments were, in general, unsuccessful, he thus acquired a solid knowledge of agriculture. He had already begun a series of journeys through England and Wales, and gave an account of his observations in books which appeared from 1768 to 1770—*A Six Weeks' Tour through the Southern Counties of England and Wales*, *A Six Months' Tour through the North of England* and the *Farmer's Tour through the East of England*. He says that these books contained the only extant information relative to the rental, produce and stock of England that was founded on actual examination. They were very favourably received, being translated into most European languages by 1792.

In 1768 he published the *Farmer's Letters to the People of England*, in 1771 the *Farmer's Calendar*, which went through a great number of editions, and in 1774 his *Political Arithmetic*, which was widely translated. About this time Young acted as parliamentary reporter for the *Morning Post*. He made a tour in Ireland in 1776, publishing his *Tour in Ireland* in 1780. In 1784 he began the publication of the *Annals of Agriculture*, which was continued for 45 volumes: this work had many contributors, among whom was George III., writing under the *nom de plume* of "Ralph Robinson." Young's first visit to France was made in 1787. Traversing that country in every direction just before and during the first movements of the Revolution, he has given valuable notices of the condition of the people and the conduct of public affairs at that critical juncture. The *Travels in France* appeared in 2 vols. in 1792. On his return home he was appointed secretary of the Board of Agriculture, then (1793) just formed under the presidency of Sir John Sinclair. In this capacity he gave most valuable assistance in the collection and preparation of agricultural surveys of the English counties. His sight, however, failed, and in 1811 he had an operation for cataract, which proved unsuccessful. He suffered also in his last years from stone. He died on the 20th of April 1820. He left an autobiography in MS., which was edited (1898) by Miss M. Betham-Edwards, and is the main authority for his life; and also the materials for a great work on the "Elements and practice of agriculture."

Arthur Young was the greatest of all English writers on agriculture; but it is as a social and political observer that he is best known, and his *Tour in Ireland* and *Travels in France* are still full of interest and instruction. He saw clearly and exposed unsparingly the causes which retarded the progress of Ireland. He strongly urged the repeal of the penal laws which pressed upon the Catholics; he condemned the restrictions imposed by Great Britain on the commerce of Ireland, and also the perpetual interference of the Irish parliament with industry by prohibitions and bounties. He favoured a legislative union of Ireland with Great Britain, though he did not regard such a measure as absolutely necessary, many of its advantages being otherwise attainable.

The soil of France he found in general superior to that of England, and its produce less. Agriculture was neither as well understood nor as much esteemed as in England. He severely censured the higher classes for their neglect of it. "Banishment (from court) alone will force the French nobility to execute what the English do for pleasure—reside upon and adorn their estates." Young saw the commencement of violence in the rural districts, and his sympathies began to take the side of the classes suffering from the excesses of the Revolution. This change of attitude was shown by his publication in 1793 of a tract entitled *The Example of France a Warning to England*. Of the profounder significance of the French outbreak he seems to have had little idea, and thought the crisis would be met by a constitutional adjustment in accordance with the English type. He strongly condemned the *métayer* system, then widely prevalent in France, as "perpetuating poverty and excluding instruction"—as, in fact, the ruin of the country. Some of his phrases have been often quoted by the advocates of peasant proprietorship as favouring their view. "The magic of property turns sand to gold." "Give a man the secure possession of a bleak rock, and he will turn it into a garden; give him a nine years' lease of a garden, and he will convert it into a desert." But these sentences, in which the epigrammatic form exaggerates a truth, and which might seem to represent the possession of capital as of no importance in agriculture, must not be taken as conveying his approbation of the system of small properties in general. He approved it only when the subdivision was strictly limited, and even then with great reserves; and he remained to the end what J. S. Mill calls him, "the apostle of *la grande culture*."

The Directory in 1801 ordered his writings on the art to be translated and published at Paris in 20 volumes under the title of *Le Cultivateur anglais*. His *Travels in France* were translated in 1793–94 by Soulès; a new version by M. Lesage, with an introduction by M. de Lavergne, appeared in 1856. An interesting review of the latter publication, under the title of *Arthur Young et la France de 1789*, will be found in M. Baudrillart's *Publicistes modernes* (2nd ed., 1873).

YOUNG, BRIGHAM (1801–1877), second president of the Church of Jesus Christ of Latter-Day Saints, was born in Whittingham, Vermont, on the 1st of June 1801. He died in Salt Lake City, Utah, on the 29th of August 1877. (See MORMONS.)

YOUNG, CHARLES MAYNE (1777–1856), English actor, was the son of a surgeon. His first stage appearance was in Liverpool in 1798 as Douglas, in Home's tragedy. His first London appearance was in 1807 as Hamlet. With the decline of John Philip Kemble, and until the coming of Kean and Macready, he was the leading English tragedian. He retired in 1832.

YOUNG, EDWARD (1683–1765), English poet, author of *Night Thoughts*, son of Edward Young, afterwards dean of Salisbury, was born at his father's rectory at Upham, near Winchester, and was baptized on the 3rd of July 1683. He was educated on the foundation at Winchester College, and matriculated in 1702 at New College, Oxford. He soon removed to Corpus Christi, and in 1708 was nominated by Archbishop Tenison to a law fellowship at All Souls', for the sake of Dean Young, who died in 1705. He took his degree of D.C.L. in 1719. His first publication was an *Epistle to . . . . Lord Lansdoune* (1713). It was followed by a *Poem on the Last Day* (1713), dedicated to Queen Anne; *The Force of Religion: or Vanquish'd Love* (1714), a poem on the execution of Lady Jane Grey and her husband, dedicated to the countess of Salisbury; and an epistle to Addison, *On the late Queen's Death and His Majesty's Accession to the Throne* (1714), in which he made indecent haste to praise the new king. The fulsome style of these dedications ill accords with the pious tone of the poems, and they are omitted in the edition of his works drawn up by himself. About this time began his connexion with Philip, duke of Wharton, whom he accompanied to Dublin in 1717. In 1719 his play of *Busiris* was produced at Drury Lane, and in 1721 his *Revenge*. The latter play was dedicated to Wharton, to whom it owed, said Young, its "most beautiful incident." Wharton promised him two annuities of £100 each and a sum of £600 in consideration of his expenses as a candidate for parliamentary election at Cirencester. In view of these promises Young said that he had refused two livings in the gift of All Souls' College, Oxford, and had also sacrificed a life annuity offered by the marquess of Exeter if he would act as tutor to his son. Wharton failed to discharge his obligations, and Young, who pleaded his case before Lord Chancellor Hardwicke in 1740, gained the annuity but not the £600. Between 1725 and 1728 Young published a series of seven satires on *The Universal Passion*. They were dedicated to the duke of Dorset, Bubb Dodington (afterwards Lord Melcombe), Sir Spencer Compton, Lady Elizabeth Germain and Sir Robert Walpole, and were collected in 1728 as *Love of Fame, the Universal Passion*. This is qualified by Samuel Johnson as a "very great performance," and abounds in striking and pithy couplets. Herbert Croft asserted that Young made £3000 by his satires, which compensated losses he had suffered in the South Sea Bubble. In 1726 he received, through Walpole, a pension of £200 a year. To the end of his life he continued to urge on the government his claims to preferment, but the king and his advisers persisted in regarding this sum as an adequate settlement.

Young was nearly fifty when he decided to take holy orders. It was reported that the author of *Night Thoughts* was not, in his earlier days, "the ornament to religion and morality which he afterwards became," and his intimacy with the duke of Wharton and with Lord Melcombe did not improve his reputation. A statement attributed to Pope probably gives the correct view: "He had much of a sublime genius, though without common sense; so that his genius, having no guide, was perpetually liable to degenerate into bombast. This made him pass a foolish youth, the sport of peers and poets; but his having a very good heart enabled him to support the clerical character when he assumed it, first with decency and afterwards with honour" (O. Ruffhead, *Life of A. Pope*, p. 291). In 1728 he was made one of the royal chaplains, and in 1730 was presented to the college living of Welwyn, Hertfordshire. He married in 1731 Lady Elizabeth Lee, daughter of the 1st earl of Lichfield. Her daughter, by a former marriage with her cousin Francis Lee, married Henry Temple, son of the 1st viscount Palmerston. Mrs Temple died at Lyons in 1736 on her way to Nice. Her husband and Lady Elizabeth Young died in 1740. These successive deaths are supposed to be the events referred to in the *Night Thoughts* as taking place "ere thrice yon moon had filled her horn" (Night i.). In the preface to the poem Young states that the occasion of the poem was real, and Philander and Narcissa have been rather rashly identified with Mr and Mrs Temple. M. Thomas suggests that Philander represents Thomas Tickell, who was an old friend of Young's, and died three months after Lady Elizabeth Young. It was further supposed that the infidel Lorenzo was a sketch of Young's own son, a statement disproved by the fact that he was a child of eight years old at the time of publication. *The Complaint*, or *Night Thoughts on Life, Death and Immortality*, was published in 1742, and was followed by other "Nights," the eighth and ninth appearing in 1745. In 1753 his tragedy of *The Brothers*, written many years before, but suppressed because he was about to enter the Church, was produced at Drury Lane. *Night Thoughts* had made him famous, but he lived in almost uninterrupted retirement, although he continued vainly to solicit preferment. He was, however, made clerk of the closet to the princess dowager in 1761. He was never cheerful, it was said, after his wife's death. He disagreed with his son, who had remonstrated, apparently, on the excessive influence exerted by his housekeeper Miss (known as Mrs) Hallows. The old man refused to see his son before he died, but is said to have forgiven him, and left him his money. A description of him is to be found in the letters of his curate, John Jones, to Dr Samuel Birch. He died at Welwyn on the 5th of April 1765.

Young is said to have been a brilliant talker. He had an extraordinary knack of epigram, and though the *Night Thoughts* is long and disconnected it abounds in brilliant isolated passages. Its success was enormous. It was translated into French, German, Italian, Spanish, Portuguese, Swedish and Magyar. In France it became one of the classics of the romantic school. The suspicion of insincerity that damped the enthusiasm of English readers acquainted with the facts of his career did not exist for French readers. If he did not invent "melancholy and moonlight" in literature, he did much to spread the fashionable taste for them. Madame Klopstock thought the king ought to make him archbishop of Canterbury, and some German critics preferred him to Milton. Young wrote good blank verse, and Samuel Johnson pronounced *Night Thoughts* to be one of "the few poems" in which blank verse could not be changed for rhyme but with disadvantage.

Other works by Young are: *The Instalment* (to Sir R. Walpole, 1726); *Cynthio* (1727); *A Vindication of Providence . . .* (1728), a sermon; *An Apology for Punch* (1729), a sermon; *Imperium Pelagi, a Naval Lyrick . . .* (1730); *Two Epistles to Mr Pope concerning the Authors of the Age* (1730); *A Sea-Piece . . .* (1733); *The Foreign Address, or The Best Argument for Peace* (1734); *The Centaur not Fabulous; in Five Letters to a Friend* (1755); *An Argument . . . for the Truth of His* [Christ's] *Religion* (1758), a sermon preached before the king; *Conjectures on Original Composition . . .* (1759), addressed to Samuel Richardson; and *Resignation . . .* (1762), a poem.

Night Thoughts was illustrated by William Blake in 1797, and by Thomas Stothard in 1799. *The Poetical Works of the Rev. Edward Young . . .* were revised by himself for publication, and a completed edition appeared in 1778. *The Complete Works, Poetry and Prose, of the Rev. Edward Young . . .*, with a life by John Doran, appeared in 1854. His *Poetical Works* are included in the *Aldine Edition of the British Poets*, with a life by J. Mitford (1830–1836, 1857 and 1866). Sir Herbert Croft wrote the life included in Johnson's *Lives of the Poets*, but the critical remarks are by Johnson. For Young's influence on foreign literature see Joseph Texte, *Jean Jacques Rousseau, A Study of the Literary Relations between France and England during the Eighteenth Century* (Eng. trans., 1889), pp. 304–14; and J. Barnstoff, *Young's Nachtgedanken und ihr Einfluss auf die deutsche Litteratur* (1895). See also W. Thomas, *Le Poète Edward Young* (Paris, 1901), who gives an exhaustive study of Young's life and work.

YOUNG, JAMES (1811–1883), Scottish industrial chemist, was born in Glasgow on the 13th of July 1811. During his apprenticeship to his father, a carpenter, he attended evening classes at Anderson's College, where he had Lyon Playfair and David Livingstone for fellow-pupils; and the ability he showed was such that Thomas Graham, the professor of chemistry, chose him as lecture assistant in 1832. About 1839, on the recommendation of Graham, whom in 1837 he had accompanied to University College, London, he was appointed chemist at James Muspratt's alkali works in Lancashire; in connexion with alkali he showed that cast-iron vessels could be satisfactorily substituted for silver in the manufacture of caustic soda, and worked out improvements in the production of chlorate of potash. But his name is best known in connexion with the establishment of the Scottish mineral-oil industry. In 1847 Lyon Playfair informed him of a spring of petroleum which had made its appearance at Ridding's Colliery at Alfreton in Derbyshire, and in the following year he began to utilize it for making both burning and lubricating oils. This spring was practically exhausted by 1851. It had served to draw Young's attention to the question of oil-production, and in 1850 he took out his fundamental patent for the distillation of bituminous substances. This was soon put into operation in Scotland, first with the Boghead coal or Torbanehill mineral, and later with bituminous shales, and though he had to face much litigation Young successfully employed it in the manufacture of naphtha and lubricating oils, and subsequently of illuminating oils and paraffin wax, until in 1866, after the patent had expired, he transferred his works to a limited company. In 1872 he suggested the use of caustic lime to prevent the corrosion of iron ships by the bilge water, which he noticed was acid, and in 1878 he began a determination of the velocity of white and coloured light by a modification of H. L. Fizeau's method, in collaboration with Professor George Forbes (b. 1849), at Pitlochry. The final results were obtained in 1880–81 across the Firth of Clyde from Kelly, his house at Wemyss Bay, and a hill above Inellan, and gave values rather higher than those obtained by M. A. Cornu and A. A. Michelson. Young was a liberal supporter of David Livingstone, and also gave £10,500 to endow a chair of technical chemistry at Anderson's College. He died at Wemyss Bay on the 14th of May 1883.

YOUNG, THOMAS (1773–1829), English man of science, belonged to a Quaker family of Milverton, Somerset, where he was born on the 13th of June 1773, the youngest of ten children. At the age of fourteen he was acquainted with Latin, Greek, French, Italian, Hebrew, Persian and Arabic. Beginning to study medicine in London in 1792, he removed to Edinburgh in 1794, and a year later went to Göttingen, where he obtained the degree of doctor of physic in 1796. In 1797 he entered Emmanuel College, Cambridge. In the same year the death of his grand-uncle, Richard Brocklesby, made him financially independent, and in 1799 he established himself as a physician in Welbeck Street, London. Appointed in 1801 professor of physics at the Royal Institution, in two years he delivered ninety-one lectures. These lectures, printed in 1807 (*Course of Lectures on Natural Philosophy*), contain a remarkable number of anticipations of later theories. He resigned his professorship in 1803, fearing that its duties would interfere with his medical practice. In the previous year he was appointed foreign secretary of the Royal Society, of which he had been elected a fellow in 1794. In 1811 he became physician to St George's Hospital, and in 1814 he served on a committee appointed to consider the dangers involved by the general introduction of gas into London. In 1816 he was secretary of a commission charged with ascertaining the length of the seconds pendulum, and in 1818 he became secretary to the Board of Longitude and superintendent of the *Nautical Almanac*. A few years before his death he became interested in life assurance, and in 1827 he was chosen one of the eight foreign associates of the French Academy of Sciences. He died in London on the 10th of May 1829.

Young is perhaps best known for his work in physical optics, as the author of a remarkable series of researches which did much to establish the undulatory theory of light, and as the discoverer of the interference of light (see INTERFERENCE). He has also been called the founder of physiological optics. In 1793 he explained the mode in which the eye accommodates itself to vision at different distances as depending on change of the curvature of the crystalline lens; in 1801 he described the defect known as astigmatism; and in his *Lectures* he put forward the hypothesis, afterwards developed by H. von Helmholtz, that colour perception depends on the presence in the retina of three kinds of nerve fibres which respond respectively to red, green and violet light. In physiology he made an important contribution to haemadynamics in the Croonian lecture for 1808 on the "Functions of the Heart and Arteries," and his medical writings included *An Introduction to Medical Literature, including a System of Practical Nosology* (1813) and *A Practical and Historical Treatise on Consumptive Diseases* (1815).

In another field of research, he was one of the first successful workers at the decipherment of Egyptian hieroglyphic inscriptions; by 1814 he had completely translated the enchorial (demotic) text of the Rosetta stone, and a few years later had made considerable progress towards an understanding of the hieroglyphic alphabet (see EGYPT, § *Language and Writing*). In 1823 he published an *Account of the Recent Discoveries in Hieroglyphic Literature and Egyptian Antiquities*. Some of his conclusions appeared in the famous article of Egypt which in 1818 he wrote for the *Encyclopædia Britannica*.

His works were collected, with a *Life* by G. Peacock, in 1855.

YOUNG MEN'S CHRISTIAN ASSOCIATION,[1] an organization for social and religious work among young men, founded in England by Sir George Williams (1821–1905), a merchant of London. Williams's organization grew out of meetings he held for prayer and Bible-reading among his fellow-workers in a dry goods business in the city of London, and was founded in 1844; on the occasion of its jubilee its originator was knighted. Similar associations, indeed, had been in existence in Scotland at a much earlier date. In 1824 David Naismith, who also founded city missions in London and Glasgow, started the Glasgow Young Men's Society for Religious Improvement, a movement which spread to various parts of the United Kingdom, France and America: later the name was changed to the Glasgow Young Men's Christian Association. The object of such associations is to provide in large towns a rendezvous for young men who are compelled to live in lodgings or in the apartments provided by the great business houses. An associate of the Y.M.C.A. must not only be of good moral character, but must also express his adherence to the objects and principles of the association. To be a member means a definite acceptance of the doctrines of the Evangelical Christian faith. In 1910 there were about 400 associations in England, Ireland and Wales, and 226 in Scotland—besides various soldiers' and other auxiliaries. The total membership was about 146,000. Some of the buildings, notably in the Midlands and the north of England, are very fine. The London Association, which from 1880 until shortly before its demolition in 1908 used Exeter Hall, Strand, has erected a handsome block of buildings in Tottenham Court Road, designed to provide, in addition to the usual features, bedrooms at a reasonable rent.

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[1] Commonly abbreviated Y.M.C.A.

The Young Men's Christian Association is seen at its best in the United States. It is true that Germany has more associations than any other country, but of its 2129 branches only 142 have their own buildings, and the total membership is only 125,000. In America, however, the associations have been built on a broad basis and worked with enterprise and business skill. Thus they have been able to secure the generous support of many of the leaders of commerce. America has over 1900 associations, and the total membership is 456,000. In Greater Britain the associations are numerous and flourishing, and Canada has 35,000 members. There are many active associations in Switzerland, Norway, Denmark and the Netherlands, and indeed the Y.M.C.A. is now well known all over the world. Even in Japan, China and Korea there are 150 branches with a membership of nearly 12,000. The value of association buildings all over the world is £11,940,000 (America, £8,900,000; Greater Britain, £1,912,000; United Kingdom, £1,128,000).

The *Young Women's Christian Association* was founded in 1855, by two ladies simultaneously. In the south of England Miss Robarts started a Prayer Union with a purely spiritual aim; in London Lady Kinnaird commenced the practical work of opening homes and institutes for young women in business. In 1877 the two branches united in the Young Women's Christian Association, which seeks to promote the all-round welfare of young women by means of residential and holiday homes, club rooms, restaurants, noon rest rooms, classes and lectures, and other useful departments. The Young Women's Christian Association has spread all over the world, and the total membership is about half a million.

YOUNGSTOWN, a city and the county-seat of Mahoning county, Ohio, U.S.A., on the Mahoning river, about 60 m. S.E. of Cleveland. Pop. (1900) 44,885 (12,207 being foreign-born especially English, Irish and German); (1910 census) 79,066. It is served by the Baltimore & Ohio, the Erie, the Lake Shore & Michigan Southern, the Pennsylvania, and the Pittsburg & Lake Erie railways, and by interurban electric lines. The Rayen High School (incorporated 1856) was endowed under the will of Judge William Rayen (1776–1854). The Reuben McMillan Public Library (about 25,000 volumes in 1910) is housed in a building finished in 1910 and is named in honour of Reuben McMillan (1820–1898), formerly superintendent of schools. Among other public buildings are the post office and Federal court house, the county court house, the city and the Mahoning Valley hospitals, and the Y.M.C.A. building. The business district lies in the valley on the N. of the river; the residential districts are chiefly on the neighbouring hills. Youngstown has four parks, including Mill Creek (483 acres), East End (60 acres) and Wick (48 acres), presented to the city by the Wick family, descendants of the merchant Henry Wick (1771–1845). The value of its factory products increased from $33,908,459 in 1900 to $48,126,885 in 1905. The most important establishments are blast-furnaces, iron and steel works (of the U.S. Steel Corporation) and rolling mills.

Youngstown was named in honour of John Young (1763–1825), a native of Petersborough, New Hampshire, who in 1796 bought from the Connecticut Land Company a tract of land upon which the city now stands, and lived there from 1799 until 1803. The first permanent settlement was made probably in 1796 by William Hillman. The tract was set off as a township in 1800, and the first township government was organized in 1802; the town was incorporated in 1848, and was chartered as a city of the second class in 1867. The county-seat of Mahoning county was removed from Canfield to Youngstown in 1876, and after much litigation the legality of this removal was confirmed by the United States Supreme Court in 1879. The first iron-mining in the region was done in 1803 by Daniel Eaton, who in 1804 built the first blast-furnace W. of Pennsylvania and N. of the Ohio river. Eaton also built in 1826 the first blast-furnace within the present limits of Youngstown.

YPRES (Flemish *Yperen*), a town of Belgium, in the province of West Flanders, of which it was formerly considered the capital. Pop. (1904) 17,073. It is situated 35 m. S. of Ostend and 12 m. W. of Courtrai, on the Yperlée, a small river flowing into the Yser, both of which have been canalized. In the 14th century it ranked with Bruges and Ghent, and its population in its prime reached 200,000. It is remarkable chiefly for its fine Halles or cloth market, with a façade of over 150 yds. in length. The main building was begun in 1201 and completed in 1304. The cathedral of St Martin dates from the 13th century, with a tower of the 15th century. Jansen, bishop of Ypres and the founder of the Jansenist school, is buried in the cathedral. The Butchers' Hall is also of interest and dates from the 15th century. Although Ypres is unlikely to regain the importance it possessed when its "red-coated" contingent turned the day in the great battle of Courtrai (1302), it has an important linen and lace trade and a great butter market. The Belgian cavalry training-school is established at Ypres.

YPSILANTI, or HYPSILANTI, the name of a family of Phanariot Greeks claiming descent from the Comneni. ALEXANDER YPSILANTI (1725–1805) was dragoman of the Porte, and from 1774 to 1782 hospodar of Wallachia, during which period he drew up a code for the principality. He was again appointed hospodar just before the outbreak of the war with Austria and Russia in 1790. He allowed himself to be taken prisoner by the Austrians, and was interned at Brünn till 1792. Returning to Constantinople, he fell under the suspicion of the sultan and was executed in 1805. His son CONSTANTINE (d. 1816), who had joined in a conspiracy to liberate Greece and, on its discovery, fled to Vienna, had been pardoned by the sultan and in 1799 appointed by him hospodar of Moldavia. Deposed in 1805, he escaped to St Petersburg, and in 1806, at the head of some 20,000 Russians, returned to Bucharest, where he set to work on a fresh attempt to liberate Greece. His plans were ruined by the peace of Tilsit; he retired to Russia, and died at Kiev. He left five sons, of whom two played a conspicuous part in the Greek war of independence.

ALEXANDER YPSILANTI (1792–1828), eldest son of Constantine Ypsilanti, accompanied his father in 1805 to St Petersburg, and in 1809 received a commission in the cavalry of the Imperial Guard. He fought with distinction in 1812 and 1813, losing an arm at the battle of Dresden, and in 1814 was promoted colonel and appointed one of the emperor's adjutants. In this capacity he attended Alexander I. at the congress of Vienna, where he was a popular figure in society (see La Garde-Chambonas, *Souvenirs*). In 1817 he became major-general and commander of the brigade of hussars. In 1820, on the refusal of Count Capo d'Istria to accept the post of president of the Greek *Hetairia Philike*, Ypsilanti was elected, and in 1821 he placed himself at the head of the insurrection against the Turks in the Danubian principalities. Accompanied by several other Greek officers in the Russian service he crossed the Pruth on the 6th of March, announcing that he had the support of a "great power." Had he advanced on Ibraila he might have prevented the Turks entering the principalities and so forced Russia to accept the *fait accompli*. Instead, he remained at Jassy, disgracing his cause by condoning the massacres of Turkish merchants and others. At Bucharest, whither he advanced after some weeks' delay, it became plain that he could not rely on the Vlach peasantry to rise on behalf of the Greeks; even the disconcerting expedient of his Vlach ally Theodore Vladimiresco, who called on the peasants to present a petition to the sultan against Phanariot misrule, failed to stir the people from their apathy. Then, wholly unexpectedly, came a letter from Capo d'Istria upbraiding Ypsilanti for misusing the tsar's name, announcing that his name had been struck off the army list, and commanding him to lay down his arms. Ypsilanti's decision to explain away the tsar's letter could only have been justified by the success of a cause which was now hopeless. There followed a series of humiliating defeats, culminating in that of Dragashan on the 19th of June

Alexander, accompanied by his brother Nicholas and a remnant of his followers, retreated to Rimnik, where he spent some days in negotiating with the Austrian authorities for permission to cross the frontier. Fearing that his followers might surrender him to the Turks, he gave out that Austria had declared war on Turkey, caused a *Te Deum* to be sung in the church of Kosia, and, on pretext of arranging measures with the Austrian commander-in-chief, crossed the frontier. But the Austria of Francis I. and Metternich was no asylum for leaders of revolts in neighbouring countries. Ypsilanti was kept in close confinement for seven years, and when released at the instance of the emperor Nicholas I. of Russia, retired to Vienna, where he died in extreme poverty and misery on the 31st of January 1828.

Demetrios Ypsilanti (1793–1832), second son of Prince Constantine, distinguished himself as a Russian officer in the campaign of 1814, and in the spring of 1821 went to the Morea, where the war of Greek independence had just broken out. He was one of the most conspicuous of the Phanariot leaders during the earlier stages of the revolt, though he was much hampered by the local chiefs and by the civilian element headed by Mavrocordato. In January 1822 he was elected president of the legislative assembly; but the ill-success of his campaign in central Greece, and his failure to obtain a commanding position in the national convention of Astros, led to his retirement early in 1823. In 1828 he was appointed by Capo d'Istria commander of the troops in East Hellas. He succeeded, on the 25th of September 1829, in forcing the Turkish commander Aslan Bey to sign a capitulation at the Pass of Petra, which ended the active operations of the war. He died at Vienna on the 3rd of January 1832.

Gregory Ypsilanti (d. 1835), third son of Prince Constantine, founded a princely family still settled near Brünn. Nicholas Ypsilanti wrote *Mêmoires* valuable as giving material for the antecedents of the insurrection of 1820 and the part taken in them by Alexander I. of Russia. They were published at Athens in 1901.

See the works cited in the bibliography of the article Greek Independence, War of, especially the *Δοκίμιον ἱστορικὸν* of J. Philemon.

YPSILANTI, a city of Washtenaw county, Michigan, U.S.A., on the Huron river, 30 m. W. by S. of Detroit. Pop. (1900) 7378; (1904) 7587; (1910) 6230. It is served by the Michigan Central and the Lake Shore & Michigan Southern railways, and is the seat of the Michigan State Normal College (1849). There are various manufactures. Ypsilanti was laid out and named in honour of Demetrius Ypsilanti, the Greek patriot, in 1825; it was incorporated as a village in 1832, and chartered as a city in 1858.

YSAŸE, EUGÈNE (1858–), Belgian violinist, was born at Liége, where he studied with his father and under R. Massart, at the Conservatoire, until he was fifteen; he had some lessons from Wieniawski, and later from Vieuxtemps. In 1879 Ysaÿe played in Germany, and next year acted as leader of Bilse's orchestra in Berlin; he appeared in Paris in 1883, and for the first time in London at a Philharmonic concert in 1889. He was violin professor at the Brussels Conservatoire from 1886 to 1898, and instituted the celebrated orchestral concerts of which he was manager and conductor. Ysaÿe first appeared as conductor before a London audience in 1900, and in 1907 conducted *Fidelio* at Covent Garden. The sonata concerts in which he played with Raoul Pugno (b. 1852), the French pianist, became very popular in Paris and Brussels, and were notable features of several London concert seasons. As a violinist he ranks with the finest masters of the instrument, with extraordinary temperamental power as an interpreter. His compositions include a Programme Symphony (played in London, 1905), a Piano Concerto, and a "Suite Wallonne."

YSTAD, a seaport of Sweden on the S. Baltic coast, in the district (*län*) of Malmöhus, 39 m. E.S.E. of Malmö by rail. Pop. (1900) 9862. Two of its churches date from the 13th century. Its artificial harbour, which admits vessels drawing 19 ft., is freer from ice in winter than any other Swedish Baltic port. Apart from a growing import trade in coal and machinery, its commerce has declined; but it is among the first twelve manufacturing places in Sweden, having large mechanical workshops.

YTTERBIUM (Neo-Ytterbium) [symbol, Yb; atomic weight, 172·0 (O=16)], a metallic chemical element belonging to the rare earth group. Mixed with scandium it was discovered by Marignac in gadolinite in 1878 (see Rare Earths). The oxide, Yb_2O_3, is white and forms colourless salts; the crystallized chloride, $YbCl_3 \cdot 6H_2O$, forms colourless, deliquescent crystals; the anhydrous chloride sublimes on heating (C. Matignon, *Ann. chim. phys.*, 1906 (8), 8, p. 440). In 1907 G. Urbain separated ytterbium into two new elements, neo-ytterbium and lutecium (atomic weight, 174·0); and in 1908 C. A. von Welsbach published the same result, naming his elements aldebaranium and cassiopeium (on the question of priority see F. Wenzel, *Zeit. anorg. Chem.*, 1909, 64, p. 119).

YTTRIUM [symbol, Y; atomic weight, 89·0 (O=16)], a metallic chemical element. In its character yttrium is closely allied to, and in nature is always associated with, cerium, lanthanum, didymium and erbium (see Rare Earths). For the preparation of yttrium compounds the best raw material is gadolinite, which, according to König, consists of 22·61% of silica, 34·64 of yttria, Y_2O_3, and 42·75 of the oxides of erbium, cerium, didymium, lanthanum, iron, beryllium, calcium, magnesium and sodium. The extraction (as is the case with all the rare earths) is a matter of great difficulty. Metallic yttrium is obtainable as a dark grey powder by reducing the chloride with potassium, or by electrolysing the double chloride of yttrium and sodium. It decomposes water slowly in the cold, and more rapidly on heating. Yttria, Y_2O_3, is a yellowish white powder, which at high temperatures radiates out a most brilliant white light. It is soluble, slowly but completely, in mineral acids. It is recognized by its very characteristic spark spectrum. Solutions of yttria salts in their behaviour to reagents are not unlike those of zirconia. The atomic weight was determined by Cleve.

YUCATAN, a peninsula of Central America forming the S.E. extremity of the republic of Mexico and including the states of Campeche and Yucatan and the territory of Quintana Roo. Small parts of British Honduras and Guatemala are also included in it. The natural boundary of the peninsula on the S. is formed in part by the ridges extending across N. Guatemala, the line terminating E. at the lower part of Chetumal Bay, and W. at Laguna de Terminos. From this base the land extends N. between the Gulf of Mexico and Caribbean Sea in nearly rectangular form for about 280 m., with about the same extreme width in longitude. It has a mean breadth of about 200 m., a coast-line of 700 m. and an area of about 55,400 sq.m.

The coast on the N. and W. is low, sandy and semi-barren, and is made dangerous by the Campeche banks, a northward extension of the peninsula, covered with shifting sands. The outer shore-line on the N. for nearly 200 m. consists of a narrow strip of low sand dunes, within which is a broad channel terminating to the E. in a large lagoon. There are a number of openings through the outer bank and several small towns or ports have been built upon it. The E. coast consists of bluffs, indented with bays and bordered by several islands, the larger ones being Cozumel (where Cortés first landed), Cancum, Mujeres and Contoy. There is more vegetation on this coast, and the bays of Chetumal, Espiritu Santo, Ascencion and San Miguel (on Cozumel Island) afford good protection for shipping. It is, however, sparsely settled and has little commerce.

The peninsula is almost wholly composed of a bed of coralline and porous limestone rocks, forming a low tableland, which rises gradually toward the S. until it is merged in the great Central American plateau. It is covered with a layer of thin, dry soil, through the slow weathering of the coral rocks. The surface is not so level and monotonous as it appears on many maps; for, although there are scarcely any running streams, it is diversified by a few lakes, of which Bacalar and Chichankanab are the largest, as well as by low isolated hills and ridges in the W., and in the E. by the Sierra Alta, a range of moderate elevation traversing the whole peninsula from Catoche Point S. to the neighbourhood of Lake Peteu in Guatemala. The culminating points of the W. ridges do not exceed 900 ft., and some authorities estimate it at 500 ft.

The climate of Yucatan is hot and dry; the Gulf Stream, which sweeps by its N. shores, adds to its naturally high temperature, and the absence of high mountainous ridges to intercept the moisture-bearing clouds from the Atlantic gives it a limited rainfall. The temperature ranges from 75° to 98° F. in the shade, but the heat is modified by cool sea winds which prevail day and night throughout the greater part of the year. The atmosphere is also purified by the fierce *temporales*, or "northers," which occasionally sweep down over the Gulf and across this open region. The dry season lasts from October to May, the hottest months appear to be in March and April, when the heat is increased by the burning of the corn and henequén fields. The rains are quickly absorbed by the light porous soil and leave only temporary effects on the surface, where arboreal growth is stunted and grasses are commonly thin and harsh. For the most part the climate of Yucatan is healthy, though enervating. There are undrained, swampy districts in Campeche, in the vicinity of the Terminos Lagoon, where malarial diseases are prevalent, and the same conditions prevail along the coast where mangrove swamps are found. Yellow fever epidemics are common on the Campeche coast, and sometimes appear at Progreso and Mérida. The sites of some of the old Maya cities are also considered dangerous at certain seasons.

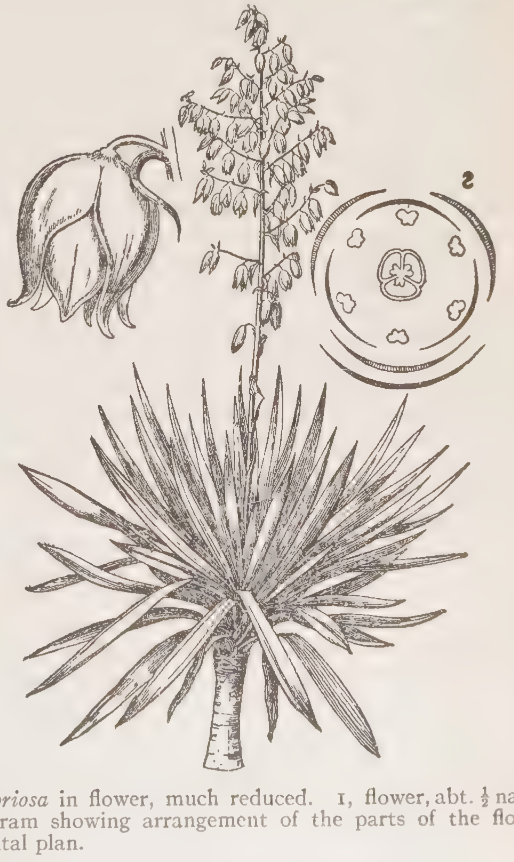
All the N. districts, as well as the greater part of the Sierra Alta, are destitute of large trees; but the coast-lands on both sides towards Tabasco and British Honduras enjoy a sufficient rainfall to support forests containing the mahogany tree, several valuable cabinet woods, vanilla, logwood and other dye-woods. Logwood forests fringe all the lagoons and many parts of the seaboard, which are flooded during the rainy season. The chief cultivated plants are maize, the sugar-cane, tobacco, cotton, coffee and especially henequén, the so-called "Sisal hemp," which is a strong, coarse fibre obtained from the leaves of the *Agave rigida*, var. *elongata*. It requires very little moisture, grows luxuriantly on the thin calcareous soil of Yucatan and is cultivated almost exclusively by the large landowners. It is used chiefly in the manufacture of coarse sack-cloth, cordage and hammocks, and is exported in large quantities. The labour needed in this industry is supplied by Indian *peons*, who live in a state of semi-servitude and are paid barely enough to sustain life.

History and Antiquities.—The modern history of Yucatan begins with the expedition of Francisco Hernandez de Cordova, a Spanish adventurer settled in Cuba, who discovered the E. coast of Yucatan in February 1517, when on a slave-hunting expedition. He followed the coast round to Campeche, but was unable to penetrate the interior. In 1518 Juan de Grijalva followed the same coast, but added nothing to the information sought by the governor of Cuba. In 1519 a third expedition, under Hernando Cortés, the conqueror of Mexico, came into collision with the natives of the island of Cozumel. In 1525 the inland part of the peninsula was traversed by Cortés during an expedition to Honduras. The conquest of the peninsula was undertaken in 1527 by Francisco de Montejo, who encountered a more vigorous opposition than Cortés had on the high plateau of Anáhuac. In 1549 Montejo had succeeded in establishing Spanish rule over barely one-half of the peninsula, and it was never extended further. The Spaniards found here the remains of a high aboriginal civilization which had already entered upon decline. There were deserted cities falling into ruins, and others, like Chichen-itza, Uxmal and Tuloom, which were still inhabited by remnants of their former Maya populations. The Mayas have left no record of their institutions or of the causes of their decline, beyond what may be deduced from their ruined structures. The number and extent of these ruins (temples, palaces, ball courts, market-places, &c.) indicate large towns in the midst of thickly settled, productive districts, for there were then, so far as can be determined, no means of supporting large urban populations through commercial exchanges. The exhaustion of the soil in the vicinity of towns, or epidemics brought on by insanitary habits, might easily cause depopulation in so hot a climate. Other remains which bear witness to the civilization of the Mayas are the paved highways and the artificial reservoirs (*aguadas*) designed for the preservation of water for towns through the long dry season. These *aguadas* were huge basins, paved and cemented, with underground cisterns, also lined with stone and cement, which may have been used for the protection of water against heat when the principal supply had become exhausted. The great problem in all the Maya settlements of Yucatan was that of securing and preserving a water supply for the dry season. Some of their towns were built near large underground reservoirs, called *cenotes*, that afforded a perennial supply. Since the Spanish conquest, the Mayas have clung to the semi-barren, open plains of the peninsula, and have more than once revolted. They seceded in 1839 and maintained their independence until 1843. In 1847 another revolt followed, and the Indians were practically independent throughout the greater part of the peninsula until near the beginning of the Diaz administration. In 1910 there was another revolt with some initial successes, such as the capture of Valladolid, but then the Indians withdrew to the unknown fastnesses of Quintana Roo.

The Mexican STATE OF YUCATAN is bounded N. by the Gulf of Mexico, E. and S. by the territory of Quintana Roo, S. and W. by the state of Campeche. Pop. (1900) about 306,000. The railways include the three lines of the United Railways of Yucatan (373 m.), and a line from Mérida to Peto (145 m.). The capital is Mérida, and its principal towns, inhabited almost exclusively by Indians and *mestizos*, are Valladolid, Acanceh, Tekax, Motul, Temax, Espita, Maxcanú, Hunucmá, Tixkokob, Peto and Progreso, the port of Mérida.

Quintana Roo was separated from the state of Yucatan in 1902 and received a territorial government under the immediate supervision of the national executive. It comprises the sparsely settled districts along the E. coast of the peninsula, and the wooded sections of the S., which have not been thoroughly explored. Its population is estimated at 3000, but as its inhabitants never submitted to Spanish and Mexican rule, and have maintained their independence against overwhelming odds for almost four centuries, this estimate should be accepted as a conjecture. Little is known of the wild tribes of the territory.

YUCCA,[1] a genus of the order Liliaceae (*q.v.*), containing about thirty species. They occur in greatest frequency in Mexico and the S.W. United States, extending also into Central America, and occurring in such numbers in some places as to form straggling



Yucca gloriosa in flower, much reduced. 1, flower, abt. ½ nat. size; 2, diagram showing arrangement of the parts of the flower in horizontal plan.

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[1] A Spanish word meaning "bayonet," recalling the form and character of the leaves.

forests. They have a woody or fibrous stem, sometimes short, and in other cases attaining a height of 15 to 20 ft., and branching at the top into a series of forks. The leaves are crowded in tufts at the ends of the stem or branches, and are generally stiff and sword-shaped, with a sharp point, sometimes flaccid and in other cases fibrous at the edges. The numerous flowers are usually white, bell-shaped and pendulous, and are borne in much-branched terminal panicles. Each flower has a perianth of six regular pieces, and has as many hypogynous stamens, with dilated filaments, bearing relatively small anthers. The three-celled ovary is surmounted by a short thick style, dividing above into three stigmas, and ripens into a succulent berry in some of the species, and into a dry three-valved capsule in others. The flowers are fertilized by the agency of moths.

A coarse fibre is obtained by the Mexicans from the stem and foliage, which they utilize for cordage, and in the S.E. United States the leaves of some species, under the name "bear-grass," are used for seating chairs, &c. The fruits, which resemble small bananas, are cooked as an article of diet; and the roots contain a saponaceous matter used in place of soap.

Many of the species are hardy in Great Britain, and their striking appearance renders them attractive in gardens even when not in flower. They thrive in a rich, light soil, and are propagated by divisions planted in the open ground, or by pieces of the thick, fleshy roots in sandy soil under heat. Their rigid foliage, invested by thick epidermis, enables them to resist the noxious air of towns better than most plants. A popular name for the plant is "Adam's needle." The species which split up at the margins of their leaves into filaments are called "Eve's thread."

YUE-CHI (or YUEH-CHIH), the Chinese name of a central Asiatic tribe who ruled in Bactria and India, are also known as Kushans (from one of their subdivisions) and Indo-Scythians. They appear to have been a nomad tribe, inhabiting part of the present Chinese province of Kan-suh, and to have been driven W. by Hiung-nu tribes of the same stock. They conquered a tribe called the Wusun, who lived in the basin of the Ili river, and settled for some time in their territory. The date of these events is placed between 175 and 140 B.C. They then attacked another tribe known as Sakas, and drove them to Persia and India. For about twenty years it would seem that the Yue-Chi were settled in the country between the rivers Chu and Syr-Darya, but here they were attacked again by the Hiung-nu, their old enemies, with whom was the son of the defeated Wusun chieftain. The Yue-Chi then occupied Bactria, and little is heard of them for a hundred years. During this period they became a united people, having previously been a confederacy of five tribes, the principal of which, the Kushans (or Kwei-Shwang), supplied the new national name. They also to some extent gave up their nomadic life and became civilized. Bactria about this time was said to contain a thousand cities, and though this may be an exaggeration it was probably a meeting-place of Persian and Hellenic culture: its kings Demetrius and Eucratides had invaded India. It is therefore not surprising to find the warlike and mobile Yue-Chi following the same road and taking fragments of Persian and Greek civilization with them.

The chronology of this invasion and of the history of the Kushans in India must be regarded as uncertain, though we know the names of the kings. Indian literature supplies few data for the period, and the available information has been collected chiefly from notices in Chinese annals, from inscriptions found in India, and above all from coins. From this evidence it has been deduced that a king called Kozulokadphises, Kujulakasa or Kieu-tsieu-k'io (? A.D. 45–85) united the five tribes, conquered the Kabul valley and annihilated the remnants of Greek dominion. He was succeeded, possibly after an interval, by Ooemokadphises (Himakapisa or Yen-kao-tsin-tai), who completed the annexation of N. India. Then followed Kanishka (? *c.* A.D. 123–53), who is celebrated throughout eastern Asia as a patron of the Buddhist church and convener of the third Buddhist council. He is also said to have conquered Kashgar, Yarkand and Khotan. His successors were Huvishka and then Vasudeva, who may have died *c.* A.D. 225. After Vasudeva's reign the power of the Kushans gradually decayed, and they were driven back into the valley of the Indus and N.E. Afghanistan. Here, according to Chinese authorities, their royal family was supplanted by a dynasty called Ki-to-lo (Kidara), who were also of Yue-Chi stock, but belonged to one of the tribes who had remained in Bactria when the Kushans marched to India. The subsequent migration of the Kitolo S. of the Hindu Kush was due to the movements of the Jwen-Jwen, who advanced W. from the Chinese frontier. Under this dynasty a state known as the Little Kushan kingdom flourished in Gandhâra (E. Afghanistan) about A.D. 430, but was broken up by the attacks of the Hûnas.

Some authorities do not accept the list of Kushan kings as given above, and think that Kanishka must be placed before Christ and perhaps as early as 58 B.C.: also that there was another king with a name something like Vasushka before or after Huvishka. In any case the invasion of the Yue-Chi cannot have been very long before or very long after the Christian era, and had an important influence on Indian civilization. Their coins show a remarkable union of characteristics, derived from many nations. The general shape and style are Roman: the inscriptions are in Greek or in a Persian language written in Greek letters, or in Kharoshthi: the reverse often bears the figure of a deity, either Greek (Herakles, Helios, Selene) or Zoroastrian (Mithra, Vata, Verethraghna) or Indian (generally Siva or a war god). One figure called Sarapo appears to be the Egyptian Serapis, and others are perhaps Babylonian deities. On the obverse is generally the king, who, in the earlier coins at any rate, wears a long open coat, knee boots and a tall cap—clearly the costume of a nomad from the north. The Gandhâra school of sculpture, of which the best specimens come from the neighbourhood of Kanishka's capital, Purushpura (the modern Peshawar), is a branch of Graeco-Roman art adapted to Oriental religious subjects. The Yue-Chi were probably the principal means of disseminating it in India, though all movements which kept open the communications between Bactria and Persia and India must have contributed, and the first introduction was due to the short-lived Graeco-Bactrian conquest (180–130 B.C.). The importance of the Gandhâran influence on the art of India and all Buddhist Asia is now recognized. Further, it is probably in the mixture of Greek, Persian and Indian deities which characterizes the pantheon of the Kushan kings that are to be sought many of the features found in Mahâyânist Buddhism and Hinduism (as distinguished from the earlier Brahmanism). Kanishka and other monarchs were zealous but probably by no means exclusive Buddhists, and the conquest of Khotan and Kashgar must have facilitated the spread of Buddhist ideas to China. It is also probable that the Yue-Chi not only acted as intermediaries for the introduction of Greek and Persian ideas into India, and of Indian ideas into China, but left behind them an important element in the population of N. India.

It is hard to say whether the Yue-Chi should be included in any of the recognized divisions of Turanian tribes such as Turks or Huns. Nothing whatever is known of their original language. Such of the inscriptions on their coins as are not in Greek or an Indian language are in a form of Persian written in Greek uncials. In this alphabet the Greek letter ρ̇ (or rather a very similar letter with the loop a little lower down) is used to represent *sh*, and there are some peculiarities in the use of *o* apparently connected with the expression of the sounds *h* and *w*. Thus PAONANO PAO KANHPKI KOPANO is to be read as something like *Shâhanân Shâh Kanishki Koshan*: Kanishka the Kushan, king of kings. This Persian title became in later times the special designation of the Kushan kings and is curiously parallel to the use of Arabic and Persian titles (padishah, sultan, &c.) by the Ottoman Turks. The physical type represented on these coins has a strong prominent nose, large eyes, a moderately abundant beard and somewhat thick or projecting lips. Hence, as far as any physical characters can be formulated for the various tribes (and their validity is very doubtful) the Yue-Chi type is Turkish rather than Mongol or Ugro-Finnic. In such points of temperament as military ability and power of assimilating Indian and Persian civilization, the Yue-Chi also resemble the Turks, and some authorities think that the name Turushka or Turukha sometimes applied to them by Indian writers is another evidence of the connexion. But the national existence and name of the Turks (*q.v.*) seem to date from the 5th century A.D., so that it is an anachronism to speak of the Yue-Chi as a division of them. The Yue-Chi and Turks, however, may both represent parallel developments of similar or even originally identical tribes. The Mahommedan writer Alberuni states that in former times the kings of the Hindus (among whom he mentions Kanik or Kanishka) were Turks by race, and this may represent a native tradition as to the affinities of the Yue-Chi. Some authors consider that the Yue-Chi are the same as the Getae and that the original form of the name was Yüt or Get, which is also supposed to appear in the Indian Jât.

See Vincent Smith, *Early History of India* (1908); Hoernle and Stark, *History of India* (1905); Rapson, *Indian Coins* (1898); Gardner, *Coins of Greek and Scythian Kings in India* (1886); Franke, *Beiträge aus Chinesischen Quellen zur Kenntnis der Türkvölker und*

Skythen (1904), and numerous articles by Cunningham, Fleet, A. Stein, Vincent Smith, Sylvian Levi, E. H. Parker and others in the *Journal of the Royal Asiatic Society, Journal asiatique, Asiatic Quarterly*, &c. Owing to the new evidence which is continually being brought forward, the most recent writings on this subject are generally to be preferred. (C. El.)

YUKON, the largest river in Alaska, and the fifth largest in N. America. With its longest tributaries not in Alaska, the Lewes and the Teslin (or Hootalinqua), its length is about 2300 m., in the form of a great arc, beginning in the Yukon District of British Columbia, near the Pacific Ocean, and ending at the Bering Sea coast. Its catchment area is about 330,000 sq. m., more than one-half of which lies in Canada. The Lewes river rises in Lake Bennet (Yukon District) on the N. slope of the Coast Range, about 25 m. inland from the Lynn Canal (at the head of Chatham Strait), and flows N. through a chain of lakes, its confluence with the Pelly river, at Selkirk, Yukon District, about 120 m. due E. of the Alaskan-Canadian boundary, forming the headwaters of the Yukon. Flowing thence N.W., the Yukon turns abruptly to the S.W. near Fort Yukon, Alaska, on the Arctic Circle, and continues nearly at right angles to its former course to a point S. of the head of Norton Sound, where it turns again and flows in a N.W. direction, emptying into the Sound from its S. shore. The length of the river, from its headwaters to its mouth, is about 1500 m.

The Yukon Valley comprises four sub-provinces, or physiographic divisions; in their order from the headwaters of the river these divisions have been called the "Upper Yukon," "Yukon Flats," "Rampart Region" and "Lower Yukon." The "Upper Yukon" Valley is about 450 m. long and from 1 to 3 m. broad, and is flanked by walls rising to the plateau level from 1500 to 3000 ft. above the stream. In this part of its course the Yukon receives from the S. the Selwyn river (about 40 m. below the junction of the Lewes and Pelly rivers); from the W. the White river (about 60 m. below the Selwyn); from the N. the Stewart river (about 10 m. below the White), one of the largest tributaries of the Yukon; from the E. the Klondike river (near 64° N.); from the W. Fortymile Creek (about 40 m. above the Alaskan-Canadian boundary line), and many other smaller streams. The "Yukon Flats" flank the river for about 200 m. and are from 40 to 100 m. wide. Here the stream varies in width from 10 to nearly 20 m., and involves a confused network of constantly changing channels. Here, too, the river makes its great bend to the S.W., and its channels are constantly changing. The "Flats" are monotonous areas of sand bars and low islands, thickly wooded with spruce. The principal tributaries here are the Porcupine river (an important affluent, which enters the main stream at the great bend about 3 m. N. of the Arctic Circle); the Chandlar river, also confluent at the great bend, from the N., and, near the W. edge of the Flats, the Dall river, also from the N. The "Rampart Region" begins near 66° N., where the "Flats" end abruptly, and includes about 110 m. of the valley, from 1 to 3 m. wide, and extending to the mouth of the Tanana. No large tributaries are received in this part of the river. The Lower Yukon includes that portion between the Ramparts and the sea, a stretch of about 800 m. At the mouth of the Tanana (which enters the main stream from the S.) the gorge opens into a lowland from 15 to 20 m. wide. Along the N.W. boundary of the valley are low mountains whose base the Yukon skirts, and it continues to press upon its N. bank until the delta is reached. The valley is never less than 2 or 3 m., and the river has many channels and numerous islands; it has walls nearly to the head of the delta, though about 100 m. above the delta the S. wall merges into the lowland coastal plain; the relief is about 1000 ft.

At the W. edge of the Ramparts the Yukon receives the Tanana river, its longest tributary lying wholly within Alaska. The Tanana Valley is about 400 m. long, nearly parallel to the Yukon from about due W. of its headwaters to the great bend, and drains about 25,000 sq. m. Its sources are chiefly glaciers in the Alaskan Range, and it receives many tributaries. The Yukon delta begins near 63° N. Here the main stream branches into several channels which follow N. or N.W. courses to Norton Sound. The northernmost of these channels is the Apoon Pass, and the most southerly is Kwikluak Pass; their outlets are about 75 m. apart on the coast, and from 40 to 50 m. from the head of the delta. Between them is a labyrinth of waterways, most of the intervening land being not more than 10 ft. above low tide. The stream is mud-laden throughout its course, and though the sediment is heavier above the "Flats" than below them (where the slower current permits the settling of much of the silt), so much of it is carried to the river's mouth that the delta is being steadily extended. Immediately S. of the Yukon delta proper is that of the Kushkowim, into which undoubtedly the Yukon's waters once found their way.

The Yukon is navigable from May till September, and steamers ply on several of its larger tributaries, making the aggregate navigable waters about 3500 m., about three-fourths of which are in Alaska. The nearest harbour for ocean-going vessels is a poor one at St Michael's Island, about 60 m. N.E. of the delta; here freight and passengers are transferred to flat-bottomed river steamers. These enter the delta and the river by the Apoon Pass, which is about 4 ft. deep at mean low water, the current varying from 1½ to 4 m. an hour. The Lewes (about 400 m. long) is navigable (with some difficulty, during low water, at Lake Lebarge) as far as White Horse Rapids, which, with Miles Canyon, obstruct the river for a few miles; above them the stream is again navigable to its source, about 100 m. beyond. The Pacific & Arctic railway from Skagway to White Horse (111 m.) overcomes these obstructions, however, for traffic and travel; and even the dangerous White Horse Rapids may be run by a skilful pilot in a small boat, as was done repeatedly by the gold-seekers in 1896–97. The Stewart river, seldom less than 150 yds. wide, is navigable by light-draught steamers to Frazer Falls, a distance of nearly 200 m. The Porcupine is navigable, in high water, to about the Alaska-Yukon boundary line (*c.* 90 m.); the Chandlar for a few miles; the Tanana (which is about 500 m. long) for about 225 m. to the Chena river (which is navigable for about 100 m.); and the Tolovana, another affluent of the Tanana, is also navigable for about 100 m.

In 1842–43 the Yukon was explored by the Russian Lieutenant Zagoskin, who built a trading post at Nulato, ascended the river (which he called the Kwikpak) as far as the Tanana, made a track survey of the stream to that point and reported that it was not navigable beyond there. In 1861 Robert Kennicott made his way overland by the Hudson Bay route from the Mackenzie river down the Yukon to Fort Yukon, and in 1865 he and Captain Charles S. Bulkley led the expedition sent out by the Western Union Telegraph Company to survey a route for a land telegraph line to Europe by way of Alaska and Siberia. Kennicott died at Nulato in 1866, and the expedition was abandoned in that year, but explorations were continued by other members, notably Dr William H. Dall,[1] with the result that valuable surveys were made and the Yukon identified as the Kwikpak of the earlier Russian surveys. Captain C. W. Raymond made a reconnoissance of the Yukon in 1869; the Indian route by the Lewes to the headwaters of the Yukon was used by gold prospectors as early as 1881, while in 1883 Lieutenant Frederick Schwatka (1849–1892) crossed the Chilkoot Pass (which he called "Perrier Pass"), descended the Lewes to Fort Selkirk, and down the river to the sea. Charles W. Homan, who accompanied Schwatka, made the first sketch survey of the great system; since then it has been frequently explored, but much of the region has not been mapped.

See Alfred H. Brooks, *The Geography and Geology of Alaska*. U.S. Geol. Survey, Document No. 201 (Washington, 1906); also G. M. Dawson, *Yukon District and British Columbia*, Annual *Report* of the Geol. and Natural History Survey of Canada, vol. 3, pt. 1 (1889); William Ogilvie, *The Klondike Official Guide* (Buffalo, N.Y., 1898); C. W. Haynes, "An Expedition through the Yukon District," *Nat. Geog. Mag.* vol. 4 (1892); R. G. McConnell, *Salmon River Gold Fields*, Summary of *Report* of Geol. Survey of Canada (1901); idem, *The Macmillan River, Yukon District*, Summary of *Report* of the Geological Survey of Canada for 1902; A. H. Brooks, *A Reconnaissance in the Tanana and White River Basins in 1898*, Twentieth Annual *Report*, U.S. Geol. Survey (Washington, 1900); and *A Reconnaissance from Pyramid Harbor to Eagle City, Alaska*, Twenty-first Annual *Report*, ibid. (Washington, 1900), and other sources cited by Brooks in the first-named work.

YUKON TERRITORY, the most westerly of the northern territories of Canada, bounded S. by British Columbia, W. by Alaska, N. by the Arctic Ocean and E. by the watershed of Mackenzie river. It has an area of 207,076 sq. m. The territory is chiefly drained by the Yukon river and its tributaries, though at the S.E. corner the headwaters of the Liard river, flowing into the Mackenzie, occupy a part of its area. The margins of the territory are mountainous, including part of the St Elias range with the highest mountains in Canada at the S.W. corner (Mount Logan and Mount St Elias), and the N. extension of the Rocky Mountains along the S. and N.E. sides; here, however, not very lofty. The interior of the territory is high toward the S.E. and sinks toward the N.W., and may be described as a much-dissected peneplain with low mountains to the S. The most important feature of the hydrography is the Yukon (*q.v.*) and the rivers which flow into it. The Klondike gold mines are reached by river boats, either coming up from St Michael at its mouth, or down 460 m. from White Horse. The White Horse route is now used almost entirely, since the White Pass railway, 111 m. long, was constructed from Skagway, on Lynn Canal, an inlet of the Pacific. As the voyage up the Pacific coast from Vancouver or Victoria is almost entirely through sheltered waters, the journey to the Klondike is very attractive in summer. Comparatively little snow is seen in crossing White Pass during summer, though there are patches on the low mountains on each side. The Rocky Mountains, N.E. of the interior plateau, are somewhat snowy, but apparently with no large glaciers; but the St Elias range to the S.W. is buried under immense snowfields, from which great glaciers project into the valleys. The rocks are largely ancient schists and eruptives, Palaeozoic or Archean, but considerable areas are covered with Mesozoic and Tertiary rocks, some of which include important seams of lignite or coal, the latter especially in the neighbourhood of White Horse. There have been comparatively recent volcanic eruptions in the region, as shown by a layer of white ash just beneath the soil for many miles along the river, and by a quite perfect cone with a crater and lava stream; but there are no records of volcanic outbreaks within the short modern history of the territory.

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[1] William Healey Dall (1845–), American naturalist, was born in Boston, Massachusetts, served with the United States Coast Survey of Alaska from 1871 to 1884, became honorary curator of the United States National Museum in 1880, and in 1893 was appointed professor of invertebrate palaeontology at the Wagner Institute of Science, Philadelphia. He was palaeontologist to the United States Geological Survey in 1884–1909. The white mountain sheep, or Dall's sheep (*Ovis dalli*), discovered in 1884, was named in his honour.

Before the discovery of gold on the Forty Mile and other rivers flowing into the Yukon the region was inhabited only by a few Indians, but the sensational finds of rich placers in the Klondike (*q.v.*) in 1896 brought in a vigorous population centred in the mines and at Dawson City, which was made the capital of the newly constituted Yukon Territory. When the White Pass railway was built, White Horse at its N. terminus became of importance, and since then a fluctuating body of prospectors and miners has been at work, not only in the Klondike but at various points along the other rivers. The territory is ruled by a governor and council, partly elective, seated at Dawson, and has a representative in the parliament of the Dominion. Almost the only economic product of the territory was at first gold, but copper and other ores later began to attract attention in the S. near White Horse. Though so near the Pacific the Yukon territory has a rigorous continental climate with very cold winters seven months long, and delightful sunny summers. Owing to the lofty mountains to the W. the amount of rain and snow is rather small, and the line of perpetual snow is more than 4000 ft. above sea-level, so that glaciers are found only on the higher mountains; but the moss-covered ground is often perpetually frozen to a depth of 100 or 200 ft. Vegetation is luxuriant along the river valleys, where fine forests of spruce and poplar are found, and the hardier grains and vegetables are cultivated with success. (A. P. C.)

YULE, SIR HENRY (1820–1889), British Orientalist, was born on the 1st of May 1820, at Inveresk, near Edinburgh, the son of Major William Yule (1764–1839), translator of the *Apothegms* of Ali. He was educated at Edinburgh, Addiscombe and Chatham, and joined the Bengal Engineers in 1840. He served in both the Sikh wars, was secretary to Colonel (afterwards Sir) Arthur Phayre's mission to Ava (1855), and wrote his *Narrative of the Mission to the Court of Ava* (1858). He retired in 1862 with the rank of colonel, and devoted his leisure to the medieval history and geography of Central Asia. He published *Cathay and the Way Thither* (1866), the *Book of Ser Marco Polo* 1871–75), for which he received the gold medal of the Royal Geographical Society, and brought out with Dr Arthur C. Burnell *Hobson-Jobson* (1886), a dictionary of Anglo-Indian colloquial phrases. For the Hakluyt Society, of which he was for some time president, he edited (1863) the *Mirabilia descripta* of Jordanus and *The Diary of William Hedges* (1887–89). The latter contains a biography of Governor Pitt, grandfather of Chatham. From 1875 to 1889 Yule was a member of the Council of India, being appointed K.C.S.I. on his retirement. He died on the 30th of December 1889.

See Memoir by his daughter, prefixed to the posthumous third edition of *Marco Polo* (1903).

YULE, the season of Christmas (*q.v.*). This word is chiefly used alone as an archaism or in poetry or poetical language, but is more common in combination, as in "yule-tide," "yule-log," &c. The Old English word appears in various forms, *e.g. geóla, iula, geol, gehhol, gehhel*; cognate forms are Icel, *jól*; Dan. *juul*; Swed. *jul*. It was the name of two months of the year, December and January, the one the "former yule" (*se aérra geóla*), the other the "after yule" (*se aeftera geóla*), as coming before and after the winter solstice (*Cotton MS.* Tib. B. i.; and Bede, *De Temporum Ratione*, 13, quoted in Skeat, *Etym. Dict.*, 1898). According to A. Fick (*Vergleichendes Wörterbuch der Indogermanischen Sprachen*, vol. iii. 245, 1874) in proper meaning is noise, clamour, the season being one of rejoicing at the turning of the year among Scandinavian peoples before Christian times.

YUN-NAN (*i.e.* Cloudy South), a S.W. province of China, bounded N. by Sze-ch'uen, E. by Kwei-chow and Kwang-si, S. by Burma and the Lao tribes and W. by Burma and Tibet; area estimated at from 122,000 to 146,000 sq. m. Though the second largest province of the empire, its population is estimated at only 12,000,000. The inhabitants include many races besides Chinese, such as Shans, Lolos and Maotsze. The Musus, in N.W. Yun-nan, once formed an independent kingdom which extended into E. Tibet. Many of the inhabitants are nominally Moslems. The greater part of the province may be said to consist of an extensive plateau, generally from 5000 to 7000 ft. in altitude, containing numerous valley plains, which is divided in the N. by mountain ranges that enter at the N.W. corner and separate the waters of the Yangtsze-kiang, the Mekong and the Salween. The mountains attain heights of 16,000 ft. The climate is generally healthy and equable; on the plateau the summer heat seldom exceeds 86°, and in winter there is little snow. The principal rivers are the Yangtsze-kiang (locally known as the Kinsha-kiang = Golden Sand river), which enters Yun-nan at its N.W. corner, flows first S.E. and then N.E., forming for a considerable distance the N. boundary of the province; the Mekong, which traverses the province from N. to S. on its way to the sea through Annam; the Salween, which runs a parallel course through its W. portion; and the headwaters of the Songkoi, which rises in the S.E. of the province. This last-named river is navigable from the Gulf of Tongking to Man-hao, a town ten days' journey from Yun-nan Fu. There are two large lakes—one in the neighbourhood of Ta-li Fu, which is 24 m. long by 6 m. broad, and the other near Yun-nan Fu, which measures from 70 to 80 m. in circumference.

Besides Yun-nan Fu, the capital, the province contains thirteen prefectural cities, several of which—Teng-ch'uen Fu, Ta-li Fu, Yung-ch'ang Fu, Ch'u-siung Fu and Lin-gan Fu, for example—are situated in the valley plains. Mengtsze, Szemao and Momein (or Têng-yueh) are open to foreign trade. Yun-nan Fu is connected by railway (1910) with Tongking. The line which starts from Haiphong runs, in Yun-nan, via Mengtsze hsien (a great commercial centre), to the capital. Several important roads intersect the province; among them are—1. The road from Yun-nan Fu to Bhamo in Burma via Ta-li Fu (12 days), Têng-yueh Chow or Momein (8 days) and Manwyne—beyond Ta-li Fu it is a difficult mountain route. 2. The road from Ta-li Fu N. to Patang via Li-kiang Fu, which thus connects W. Yun-nan with Tibet. 3. The ancient trade road to Canton, which connects Yun-nan Fu with Pai-sê Fu, in Kwang-si, on the Canton West River, a land journey which occupies about twenty days. From this point the river is navigable to Canton.

Agricultural products include rice and maize (the principal crops), wheat, barley and oats. The poppy was formerly extensively cultivated, but after the anti-opium edict of 1906 vigorous measures were taken to stamp out the cultivation of the plant. In certain localities the sugar-cane is grown. Tea from Pu-êrh Fu in S. Yun-nan is appreciated throughout the empire. Fruits and vegetables are plentiful, and there are large herds of buffaloes, goats and sheep. Silkworms are reared. The chief wealth of Yun-nan consists, however, in its minerals. Copper is the most important of the minerals worked. Silver and gold are produced, but they are not known to exist in any large quantities. Lead is of frequent occurrence, and indeed the area through which copper, silver, lead, tin and zinc are distributed in sufficient quantities to make mining answer, comprises at least 80,000 sq. m. Coal is also found and several salt mines are worked. The ores are generally of good quality, and are easy of extraction. Cotton yarn and cloth, petroleum, timber and furs are among the chief imports; copper, tin, hides and tea are important exports; medicines in the shape not only of herbs and roots, but also of fossils, shells, bones, teeth and various products of the animal kingdom; and precious stones, principally jade and rubies. are among the other exports.

Yun-nan, long independent, was subdued by Kublai Khan, but was not finally incorporated in the empire until the 17th century. It was the principal centre of the great Mahommedan rebellion, which lasted sixteen years and was suppressed in 1872. Even in 1910 the province had not wholly recovered from the effects of that struggle and the barbarity with which it was stamped out. The opening of Christian (Protestant) mission work in Yun-nan began in 1877, and was one result of the murder of Mr Margary (see CHINA, *History*, § *D*).

See H. R. Davies, *Yun-nan, the Link between India and the Yangtze* (Cambridge, 1909); A. Little, *Across Yunnan* (London, 1910); Rev. J. M'Carthy, "The Province of Yunnan," in *The Chinese Empire* (London, 1907); L. Richard, *Comprehensive Geography of the Chinese Empire* (Shanghai, 1908).

YUN-NAN FU, the capital of the province of Yun-nan, China, in 25° 6′ N., 102° 52′ E. It is about 500 m. by rail N.N.W. of the port of Haiphong, Tongking. The population was returned in 1907 at 45,000. Originally the surrounding district was known as the "land of the southern barbarians." The city is situated on a plain, and is surrounded by fortified walls, 6½ m. in circuit. For many years Mahommedans have been numerous in the city and neighbourhood; and in 1855 a Mahommedan rising occurred. Before the rebellion Yun-nan Fu had a prosperous aspect; the shops were large and well supplied with native silken goods, saddlery, &c., while English cotton, Russian cloths and raw cotton from Burma constituted the main foreign merchandise. Employment for large numbers of work-people was found in the copper factories. A mint at Yun-nan Fu issued annually 101,000,000 cash. Nearly ruined by the rebellion, the city took many years to recover its prosperity. A fresh impetus to commerce was given by the opening in 1910 of the railway from Tongking, a line built by French engineers and with French capital. The construction of a British railway to connect Burma with Yun-nan Fu and onwards to the Yangtsze-kiang has been in contemplation.

YURIEV (formerly DORPAT, also *Dörpt*; Russian, *Derpt*; Esthonian, *Tarto* and *Tartolin*; in Lettish, *Tehrbata*), a town of W. Russia, in the government of Livonia, situated on the Embach, 158 m. by rail N.E. of Riga, in 58° 23′ N. and 26° 23′ E. Pop. 42,421. The principal part of the town lies S. of the river, and the more important buildings are clustered round the two eminences known as the Domberg (cathedral hill) and the Schlossberg (castle hill), which in the middle ages were occupied by the citadel, the cathedral and the episcopal palace. Owing to a great fire in 1777, the town is almost entirely modern; and its fortifications have been transformed into promenades. Besides a good picture gallery in the Ratshof, and the 13th-century church of St John, Yuriev possesses a university, with an observatory, an art museum, a botanical garden and a library of 250,000 volumes, which are housed in a restored portion of the cathedral, burned down in 1624. The university was founded by Gustavus Adolphus of Sweden in 1632; but in 1699 teachers and students removed to Pernau on the advance of the Russians, and on the occupation of the country by Peter the Great again took flight to Sweden. In spite of the treaty of 1710 and the efforts of the Livonian nobles, it was not till 1802 that its restoration was effected under the patronage of Alexander I. Down to 1895, in which year it was thoroughly Russified, the university was German in spirit and in sentiment. It is now attended by some 1700 students annually. The astronomical department is famous, owing partly to the labours of F. G. W. von Struve (1820–39), and partly to Fraunhofer's great refracting telescope, presented by the emperor Alexander I. There are monuments to the naturalist K. E. von Baer (1886) and Marshal Barclay de Tolly (1849), and the town is the headquarters of the XVIII. army corps.

The foundation of Dorpat is ascribed to Yaroslav, prince of Kiev, and is dated 1030. In 1224 the town was seized by the Teutonic Knights, and in the following year Bishop Hermann erected a cathedral on the Domberg. From that date till about 1558 the town enjoyed great prosperity, and the population reached 50,000. In 1558 it was captured by the Russians, but in 1582 was yielded to Stephen Bathori, king of Poland. In 1600 it fell into the hands of the Swedes, in 1603 reverted to the Poles, and in 1625 was seized by Gustavus Adolphus of Sweden. The Russians again obtained temporary possession in 1666, but did not effect a permanent occupation till 1704. In 1708 the bulk of the population were removed to the interior of Russia.

YUSAFZAI, a large group of Pathan tribes, originally immigrants from the neighbourhood of Kandahar, which includes those of the Black Mountain, the Bunerwals, the Swatis, the people of Dir and the Panjkora valley, and also the inhabitants of the Yusafzai plain in Peshawar district of the North-West Frontier Province of India. Three sections of the tribe, the Hassanzais, Akazais and Chagarzais, inhabit the W. slopes of the Black Mountain, and the Yusafzai country stretches thence to the Utman Khel territory. The trans-border Yusafzais are estimated at 65,000 fighting men, giving a total population of about 250,000. The Yusafzais are said to be descended from one Mandai, who had two sons, Umar and Yusaf. Umar died, leaving one son, Mandan; from Mandan and Yusaf come the two primary divisions of the Yusafzais, which are split into numerous subdivisions, including the Isazais, Malizais, Akazais, Ranizais and Utmanzais.

YUZGAT, the chief town of a sanjak of the same name in the Angora vilayet of Asia Minor, altitude 4380 ft., situated 105 m. E. of Angora, near the head of a narrow valley through which the Angora-Sivas road runs. The town was built largely out of the ruins of Nefez Keui (anc. *Tavium*), by Chapan Oghlu, the founder of a powerful Dere Bey family. There is a trade in yellow berries and mohair. The sanjak is very fertile, and contains good breeding-grounds, upon which horses, camels and cattle are reared. The population, about 15,000, includes a large Armenian community.

YVETOT, a town of N. France, capital of an arrondissement in the department of Seine-Inférieure, 24 m. N.W. of Rouen on the railway to Havre. Pop. (1906) 6214. Cotton goods of various kinds and hats are made here, and trade is carried on in agricultural products. The church (18th century) contains a marble altar from the Carthusian monastery at Rouen, fine woodwork of the 17th century from the abbey of St Wandrille, and a handsome pulpit. The town is the seat of a sub-prefect and has tribunals of first instance and of commerce, and a chamber of arts and manufactures. The lords of Yvetot bore the title of king from the 15th till the middle of the 16th century, their petty monarchy being popularized in one of Béranger's songs. In 1592 Henry IV. here defeated the troops of the League.

Z the twenty-sixth letter of the English alphabet and the last, although till recent times the alphabets used by children terminated not with *z* but with &, or *&*. For & the English name is *ampersand, i.e.* "and *per se* and," though the Scottish name *epershand, i.e.* "*Et, per se* and," is more logical and also more clearly shows its origin to be the Latin *et*, of which it is but the manuscript form. To the following of *z* by & George Eliot refers when she makes Jacob Storey say, "He thought it (*z*) had only been put to finish off th' alphabet like, though *ampusand* would ha' done as well, for what he could see." *Z* is put at the end of the alphabet because it occupied that position in the Latin alphabet. In early Latin the sound represented by *z* passed into *r*, and consequently the symbol became useless. It was therefore removed from the alphabet and *G* (*q.v.*) put in its place. In the 1st century B.C. it was, like *y*, introduced again at the end, in order to represent more precisely than was before possible the value of the Greek *Z*, which had been previously spelt with *s* at the beginning and *ss* in the middle of words: *sona* = ζώνη, "belt"; *tarpessita* = τραπεζίτης, "banker." The Greek form was a close copy of the Phoenician symbol 𐤆, and the Greek inscriptional form remained in this shape throughout. The name of the Semitic symbol was *Zayin*, but this name, for some unknown reason, was not adopted by the Greeks, who called it *Zeta*. Whether, as seems most likely, Zeta was the name of one of the other Semitic sibilants Ẓade (Tzaddi) transferred to this by mistake, or whether the name is a new one, made in imitation of Eta (η) and Theta (θ), is disputed. The pronunciation of the Semitic letter was the voiced *s*, like the ordinary use of *z* in English, as in *zodiac, raze*. It is probable that in Greek there was a considerable variety of pronunciation from dialect to dialect. In the earlier Greek of Athens, North-west Greece and Lesbos the pronunciation seems to have been *zd*, in Attic from the 4th century B.C. onwards it seems to have been only a voiced *s*, and this also was probably the pronunciation of the dialect from which Latin borrowed its Greek words. In other dialects, as Elean and Cretan, the symbol was apparently used for sounds resembling the English voiced and unvoiced *th* (ð, þ). In the common dialect (κοινή) which succeeded the older dialects, ζ became a voiced *s*, as it remains in modern Greek. In Vulgar Latin the Greek *Z* seems to have been pronounced as *dy* and later *y; di* being found for *z* in words like *baptidiare* for *baptizare*, "baptize," while conversely *z* appears for *di* in forms like *zaconus, zabulus*, for *diaconus*, "deacon," *diabulus*, "devil." *Z* also is often written for the consonantal I (J) as in *zunior* for *iunior*, "younger" (see Grandgent, *Introduction to Vulgar Latin*, §§ 272, 339). Besides this, however, there was a more cultured pronunciation of *z* as *dz*, which passed through French into Middle English. Early English had used *s* alone for both the unvoiced and the voiced sibilant; the Latin sound imported through French was new and was not written with *z* but with *g* or *i*. The successive changes can be well seen in the double forms from the same original, *jealous* and *zealous*. Both of these come from a late Latin *zelosus*, derived from the imported Greek ζῆλος. Much the earlier form is *jealous*; its initial sound is the *dz* which in later French is changed to *z* (voiced *s*). It is written *gelows* or *ielous* by Wycliffe and his contemporaries, the form with *i* is the ancestor of the modern form. The later word *zealous* was borrowed after the French *dz* had become *z*. At the end of words this *z* was pronounced *ts* as in the English *assets*, which comes from a late Latin *ad satis* through an early French *asez*, "enough." With *z* also is frequently written *zh*, the voiced form of *sh*, in *azure, seizure*. But it appears even more frequently as *s* before *u*, and as *si* or *ti* before other vowels in *measure, decision, transition*, &c., or in foreign words as *g*, as in *rouge*. For the ȝ representing *g* and *y* in Scottish proper names see under *Y*. (P. Gi.)

ZAANDAM (incorrectly SAARDAM), a town of Holland, in the province of North Holland, on the river Zaan, 6½ m. N.W. of Amsterdam, with which it is connected by railway and steamer. Pop. (1905) 23,773. It is of typically Dutch appearance, with low, brightly coloured houses. It has an important trade in timber, and numerous windmills in the vicinity provide power for oil, cement and paper works, timber-sawing and corn-grinding. At Zaandam is preserved the wooden hut which Peter the Great occupied for a week in 1697 while studying shipbuilding and paper-making.

ZABERN (French, *Saverne*), a town of Germany, in the imperial province of Alsace-Lorraine, district of Lower Alsace, situated on the Rhine-Marne canal at the foot of a pass over the Vosges, and 27 m. N.W. of Strassburg by the railway to Deutsch Avricourt. Pop. (1900) 8499. Its principal building, the former episcopal residence, rebuilt by Cardinal de Rohan in 1779, is now used as barracks. There are also a 15th century church and an antiquarian museum. In the vicinity are the ruined castles of Hoch-barr, Grossgeroldseck, Ochsenstein and Greifenstein. Hence a beautiful road, immortalized by Goethe in *Dichtung und Wahrheit*, leads across the Vosges to Pfalzburg.

Zabern (*Tres Tabernae*) was an important place in the times of the Romans, and, after being destroyed by the Alamanni, was rebuilt by the emperor Julian. During the Peasants' War the town was occupied, in 1525, by the insurgents, who were driven out in their turn by Duke Anton of Lorraine. It suffered much from the ravages of the Thirty Years' War, but the episcopal castle, then destroyed, was subsequently rebuilt, and in 1852 was converted by Louis Napoleon into a place of residence for widows of knights of the Legion of Honour.

See Fischer, *Geschichte der Stadt Zabern* (Zabern, 1824).

ZABRZE, a town of Germany, in the extreme S.E. of Prussian Silesia, on the railway between Gleiwitz and Königshütte. Pop. (1905) 55,634. Like other towns in this populous region, it is an important manufacturing centre, having coal-mines, iron, wire, glass, chemical and oil works, breweries, &c.

ZACATECAS, a state of Mexico, bounded N. by Durango and Coahuila, E. by San Luis Potosí, S. by Aguascalientes and Jalisco, and W. by Jalisco and Durango. Area, 24,757 sq. m. Pop. (1900) 462,190. It belongs wholly to the great central plateau of Mexico, with an average elevation of about 7700 ft. The state is somewhat mountainous, being traversed in the W. by lateral ranges of the Sierra Madre Occidental, and by numerous isolated ranges in other parts—Mazapil, Norillos, Guadalupe and others. There are no large rivers, only the small head-streams of the Aguanaval in the N., and of the Guazamota, Bolanos and Juchipila in the W., the last three being tributaries of the Rio Grande de Santiago. As the rainfall is light this lack of streams suitable for irrigation is a drawback to agriculture. The climate is dry and generally healthy, being warm in the valleys and temperate in the mountains. The agricultural products are cereals, sugar and maguey, the first being dependent on the rainfall, often failing altogether, the second on irrigation in the lower valleys, and the latter doing best in a dry climate on a calcareous soil with water not far beneath the surface. There is also a considerable production of peaches, apricots and grapes, the last being made into wine. A few cattle are raised, and considerable attention is given to the rearing of sheep, goats and swine. A natural product is *guayule*, a shrub from which rubber is extracted. The chief industry of Zacatecas, however, is mining for silver, gold, mercury, copper, iron, zinc, lead, bismuth, antimony and salt. Its mineral wealth was discovered soon after the conquest, and some of its mines are among the most famous of Mexico, dating from 1546. One of the most productive of its silver mines, the Alvarado, has records which show a production of nearly $800,000,000 in silver between 1548 and 1867. The state is traversed by the Mexican Central and the Mexican National railways. Its manufactures are limited chiefly to the reduction of mineral ores, the extraction of rubber from *guayule*, the making of sugar, rum, mescal, pulque, woollen and cotton fabrics, and some minor industries of the capital. The capital is Zacatecas, and the other principal towns are Sombrerete (pop. 10,000), an important silver-mining town 70 m. N.W. of the capital (elevation 8430 ft.); Ciudad Garcia (about 9500); Guadalupe (9000); Pinos (8000), a mining town; San Juan de Mezquital (7000); and Fresnillo (6300), an important silver- and copper-mining centre.

ZACATECAS, a city of Mexico, capital of the state of Zacatecas, 442 m. by the Mexican Central railway N.W. of Mexico city. Pop. (1900) 39,912. It is built in a deep, narrow ravine, 8050 ft. above sea-level, with narrow, crooked streets climbing the steep hillsides, and white, flat-roofed houses of four and five storeys overtopping each other. Its streets are well paved, and are lighted with electricity. The city is well drained and has a fine aqueduct for its water supply. The cathedral is an elaborately carved red-stone structure with unfinished towers and richly decorated interior. Several domed churches occupy prominent sites. The National College and the Colegio de Nuesta Señora de Guadalupe with its fine library may be noticed. Overlooking the city from an elevation of 500 ft. is the Bufa Hill, which is crowned by a chapel and is a popular pilgrimage resort. The Guadalupe chapel near the city has elaborate decorations, including frescoes, onyx steps, silver rails and paintings, and a curious tiled dome. The industries comprise carriage building, weaving and the manufacture of coarse pottery. The town is an important commercial centre.

Zacatecas was founded in 1546 and was built over a rich vein of silver discovered by Juan de Tolosa in the same year. This and other mines in the vicinity attracted a large population, and it soon became one of the chief mining centres of Mexico. It was made a city in 1585 by Philip II.

ZACH, FRANZ XAVER, Baron von (1754–1832), German astronomer, was born at Pesth on the 4th of June 1754. He served for some time in the Austrian army, and afterwards lived in London from 1783 to 1786 as tutor in the house of the Saxon minister, Count Brühl. In 1786 he was appointed by Ernest II. of Saxe-Coburg-Gotha director of the new observatory on the Seeberg at Gotha, which was finished in 1791. From 1806 Zach accompanied the duke's widow on her travels in the south of Europe. He died in Paris on the 2nd of September 1832.

Zach published *Tables of the Sun* (Gotha, 1792; new and improved edition, *ibid.*, 1804), and numerous papers on geographical subjects, particularly on the geographical positions of many towns and places, which he determined on his travels with a sextant. His principal importance was, however, as editor of three scientific journals of great value: *Allgemeine Geographische Ephemeriden* (4 vols., Gotha, 1798–99), *Monatliche Correspondenz zur Beförderung der Erd- und Himmels-Kunde* (28 vols., Gotha, 1800–13, from 1807 edited by B. von Lindenau), and *Correspondance astronomique, géographique, hydrographique, et statistique* (Genoa, 1818–26, 14 vols., and one number of the 15th suppressed at the instigation of the Jesuits).

ZACHARIAE VON LINGENTHAL, KARL SALOMO (1769–1843), German jurist, was born on the 14th of September 1769 at Meissen in Saxony, the son of a lawyer, and received his early education at the famous public school of St Afra in that town. He afterwards studied philosophy, history, mathematics and law at the university of Leipzig. In 1792 he went to Wittenberg University as tutor to one of the counts of Lippe, and continued his legal studies. In 1794 he became *privatdozent*, lecturing on canon law, in 1798 extraordinary professor, and 1802 ordinary professor of *feudal law*. From that time to his death in 1843, with the exception of a short period in which public affairs occupied him, he poured out a succession of works covering the whole field of jurisprudence, and was a copious contributor to periodicals. In 1807 he received a call to Heidelberg, then beginning its period of splendour as a school of law. There, resisting many calls to Göttingen, Berlin and other universities, he remained until his death. In 1820 he took his seat, as representative of his university, in the upper house of the newly constituted parliament of Baden. Though he himself prepared many reforms—notably in the harsh criminal code—he was, by instinct and conviction, conservative and totally opposed to the violent democratic spirit which dominated the second chamber, and brought it into conflict with the grand-duke and the German federal government. After the remodelling of the constitution in a "reactionary" sense, he was returned, in 1825, by the district of Heidelberg to the second chamber, of which he became the first vice-president, and in which he proved himself more "loyal" than the government itself. With the growth of parliamentary Liberalism, however, he grew disgusted with politics, from which he retired altogether in 1829. He now devoted himself wholly to juridical work and to the last days of his life toiled with the ardour of a young student. His fame extended beyond Germany. The German universities then enjoyed, in regard to legal questions of international importance, a jurisdiction dating from the middle ages; and Zachariae was often consulted as to questions arising in Germany, France and England. Elaborate "opinions," some of them forming veritable treatises —*e.g.* on Sir Augustus d'Este's claim to the dukedom of Sussex, Baron de Bode's claim as an English subject to a share in the French indemnity, the dispute as to the debts due to the elector of Hesse-Cassel, confiscated by Napoleon, and the constitutional position of the Mecklenburg landowners—were composed by Zachariae. Large fees which he received for these opinions and the great popularity of his lectures made him rich, and he was able to buy several estates; from one of which, Lingenthal, he took his title when, in 1842, he was ennobled by the grand-duke. He died on the 27th of March 1843. He had married in 1811, but his wife died four years later, leaving him a son, Karl Eduard.

Zachariae's true history is in his writings, which are extremely numerous and multifarious. They deal with almost every branch of jurisprudence; they are philosophical, historical and practical, and relate to Roman, Canon, German, French and English law. The first book of much consequence which he published was *Die Einheit des Staats und der Kirche mit Rücksicht auf die Deutsche Reichsverfassung* (1797), a work on the relations of church and state, with special reference to the constitution of the empire, which displayed the writer's power of analysis and his skill in making a complicated set of facts appear to be deductions from a few principles. In 1805 appeared *Versuch einer allgemeinen Hermeneutik des Rechts;* and in 1806 *Die Wissenschaft der Gesetzgebung*, an attempt to find a new theoretical basis for society in place of the opportunist politics which had led to the cataclysm of the French Revolution. This basis he seemed to discover in something resembling Bentham's utilitarianism. Zachariae's last work of importance was *Vierzig Bücher vom Staate* (1839–42), to which his admirers point as his enduring monument. It has been compared to Montesquieu's *L'Esprit des lois*, and covers no small part of the field of Buckle's first volume of the *History of Civilization*. But though it contains proof of vast erudition and many original ideas as to the future of the state and of law, it lacks logical sequence, and is, consequently, full of contradictions. Its fundamental theory is, that the state had its origin, not in a contract (Rousseau-Kant), but in the consciousness of a legal duty. What Machiavelli was to the Italians and Montesquieu to the French, Zachariae aspired to become to the Germans; but he lacked their patriotic inspiration, and so failed to exercise any permanent influence on the constitutional law of his country. Among other important works of Zachariae are his *Staatsrecht*, and his treatise on the *Code Napoléon*, of which several French editions were published, and which was translated into Italian. Zachariae edited with Karl Joseph Mittermaier the *Kritische Zeitschrift für Rechtswissenschaft und Gesetzgebung des Auslandes*, and the introduction which he wrote illustrates his wide reading and his constant desire for new light upon old problems. Though Zachariae's works have been superseded, they were in their day epoch-making, and they have been superseded by books which, without them, could not have been written.

For an account of Zachariae and his works, see Robert von Mohl, *Geschichte u. Literatur der Staatswissenschaften* (1855–58), and Charles Brocher, *K. S. Zachariae, sa vie et ses œuvres* (1870); cf. also his biography in *Allgem. Deutsche Biographie* (vol. 44) by Wilhelm Fischer, and Holtzendorff, *Rechts-Lexicon, Zachariae von Lingenthal.*

His son, Karl Eduard Zachariae (1812–1894), also an eminent jurist, was born on the 24th of December 1812, and studied philosophy, history, mathematics and languages, as well as jurisprudence, at Leipzig, Berlin and Heidelberg. Having made Roman and Byzantine law his special study, he visited Paris in 1832 to examine Byzantine MSS., went in 1834 to St Petersburg and Copenhagen for the same purpose, and in 1835 worked in the libraries of Brussels, London, Oxford, Dublin, Edinburgh and Cambridge. After a few months as a practising lawyer and *privatdozent* at Heidelberg, he went in 1837, in search of materials, to Italy and the East, visiting Athens, Constantinople and the monasteries of Mount Athos. Having a taste for a country life, and none for teaching, he gave up his position as extraordinary professor at Heidelberg, and in 1845 bought an estate in the Prussian province of Saxony. Here he lived, engaged in scientific agriculture and interested in Prussian politics, until his death on the 3rd of June 1894.

He produced an enormous mass of works of great importance for students of Byzantine law. The task to which he devoted his life was, to discover and classify the sources of Byzantine law hidden away in the libraries of the East and West; to re-edit, in the light of modern criticism, those sources which had already been published; to write the history of Byzantine law on the basis of this hitherto undiscovered material; and finally, to apply the results to the scientific elucidation of the Justinian law. His *Jus Graeco-Romanum*, of which the first part was published in 1856, the last in 1891, is the best and most complete collection of the sources of Byzantine law and of the *Novels* from the time of Justin II. to 1453. On the general history of the subject he wrote two epoch-making works, the *Historiae Graeco-Romani juris delineatio, cum appendice ineditorum* (Heidelberg, 1839), and *Innere Geschichte des grieschisch-römischen Rechts. I. Personalrecht; II. Erbrecht; III. Die Geschichte des Sachenrechts und Obligationsrecht* (Leipzig, 1856), the third edition of which appeared under the title *Geschichte des griechisch-römischen Rechts* (1892). In this last work, which covered ground hitherto unexplored, Byzantine is treated as a development of Justinian law, and incidentally many obscure points in the economic and agrarian conditions of the Eastern empire are elucidated. For a list of Zachariae's other works, see *Allgem. Deutsche Biogr.*, art. by Wilhelm Fischer.

ZACHARIAS, ST, pope from 741 to 752, was a Greek by birth, and appears to have been on intimate terms with Gregory III., whom he succeeded (November 741). Contemporary history dwells chiefly on his great personal influence with the Lombard king Luitprand, and with his successor Rachis; it was largely through his tact in dealing with these princes in a variety of emergencies that the exarchate of Ravenna was rescued from becoming part of the Lombard kingdom. A correspondence, of considerable extent and of great interest, between Zacharias and St Boniface, the apostle of Germany, is still extant, and shows how great was the influence of this pope on events then passing in France and Germany: he encouraged the deposition of Childeric, and it was with his sanction that Boniface crowned Pippin as king of the Franks at Soissons in 752. Zacharias is stated to have remonstrated with the emperor Constantine Copronymus on the part he had taken in the iconoclastic controversy. He died on the 14th of March 752, and was succeeded by Stephen II.

The letters and decrees of Zacharias are published in Migne, *Patrolog. lat.* lxxxix. p. 917–960.

ZAGAZIG (Zaḳāzīk), a town of Lower Egypt, capital of the province of Sharkia. Pop. (1907) 34,999, including 2617 Copts and 1355 Greeks. It is built on a branch of the Fresh Water or Ismailia canal, and on the Al-Mo'izz canal (the ancient Tanitic channel of the Nile), and is 47 m. by rail N.N.E. of Cairo. Situated on the Delta in the midst of a fertile district, Zagazig is a great centre of the cotton and grain trade of Egypt. It has large cotton factories and the offices of numerous European merchants. About a mile south of the town are the ruins of Bubastis (*q.v.*).

ZÄHRINGEN, the name of an old and influential German family, taken from the castle and village of that name near Freiburg-im-Breisgau. The earliest known member of the family was probably one Bezelin, a count in the Breisgau, who was living early in the 11th century. Bezelin's son Bertold I. (d. 1078) was count of Zähringen and was related to the Hohenstaufen family. He received a promise of the duchy of Swabia, which, however, was not fulfilled, but in 1061 he was made duke of Carinthia. Although this dignity was a titular one only Bertold lost it when he joined a rising against the emperor Henry IV. in 1073. His son Bertold II. (d. 1111), who like his father fought against Henry IV., inherited the land of the counts of Rheinfelden in 1090 and took the title of duke of Zähringen; he was succeeded in turn by his sons, Bertold III. (d. 1122) and Conrad (d. 1152). In 1127 Conrad inherited some land in Burgundy and about this date he was appointed by the German king, Lothair the Saxon, rector of the kingdom of Burgundy or Arles. This office was held by the Zähringens until 1218 and hence they are sometimes called dukes of Burgundy. Bertold IV. (d. 1186), who followed his father Conrad, spent much of his time in Italy in the train of the emperor Frederick I.; his son and successor, Bertold V., showed his prowess by reducing the Burgundian nobles to order. This latter duke was the founder of the town of Bern, and when he died in February 1218 the main line of the Zähringen family became extinct. By extensive acquisitions of land the Zähringens had become very powerful in the districts now known as Switzerland and Baden, and when their territories were divided in 1218 part of them passed to the counts of Kyburg and thence to the house of Habsburg. The family now ruling in Baden is descended from Hermann, margrave of Verona (d. 1074), a son of duke Bertold I., and the grand-duke is thus the present representative of the Zähringens.

See E. J. Leichtlen, *Die Zähringer* (Freiburg, 1831); and E. Heyck, *Geschichte der Herzoge von Zähringen* (Freiburg, 1891), and *Urkunden, Siegel und Wappen der Herzoge von Zähringen* (Freiburg, 1892).

ZÄHRINGEN, a village of Germany, in the grand duchy of Baden, situated under the western slope of the Black Forest, 2 m. from Freiburg-im-Breisgau, and on the railway from Heidelberg to Basel. Pop. (1900) 1200. Above the village on a spur of the mountains, 1500 ft. above the sea, lie the ruins of the castle of Zähringen, formerly the stronghold of the ducal line of that name (see above).

See Schöpflin, *Historia Zaringo-Badensis* (Karlsruhe, 1763–66, 7 vols.).

ZAILA, or ZEILA; a town on the African coast of the Gulf of Aden, 124 m. S.W. of Aden and 200 m. N.N.E. of Harrar. Zaila is the most western of the ports of the British Somaliland protectorate, being 170 m. N.W. of Berbera by the coast caravan track. The town is surrounded on three sides by the sea; landward the country is unbroken desert for some fifty miles. The principal buildings, which date from the days of Egyptian occupation (1875–1884) are of white (coral) stone; the Somali dwellings are made of grass. Zaila has a good sheltered anchorage much frequented by Arab sailing craft, but heavy draught steamers are obliged to anchor a mile and a half from the shore. Small coasting boats lie off the pier and there is no difficulty in loading or discharging cargo. The water supply of the town is drawn from the wells of Takosha, about three miles distant; every morning camels, in charge of old Somali women and bearing goatskins filled with water, come into the town in picturesque procession. The population varies from 3000 to 7000, the natives, who come in the cool season to barter their goods, retiring to the highlands in hot weather. The chief traders are Indians, the smaller dealers Arabs, Greeks and Jews. The imports, which reach Zaila chiefly via Aden, are mainly cotton goods, rice, jowaree, dates and silk; the exports —of which 90 per cent. are from Abyssinia—are principally coffee, skins, ivory, cattle, ghee and mother-of-pearl.

Zaila owed its importance to its proximity to Harrar, the great entrepôt for the trade of southern Abyssinia. The trade of the port received, however, a severe check on the opening (1901–2) of the railway to Harrar from the French port of Jibuti, which is 35 m. N.W. of Zaila. A steamer from Aden to Zaila takes fifteen hours to accomplish the journey; caravans proceeding from Zaila to Harrar occupy from ten days to three weeks on the road.

For history and trade statistics, see SOMALILAND, BRITISH.

ZAIMUKHT, the name of a small Pathan tribe on the Kohat border of the North-West Frontier Province of India. The Zaimukhts inhabit the hills to the south of the Orakzais between the Miranzai and Kurram valleys. Their country may be described as a triangle, with the range of hills known as the Samana as its base, and the village of Thal in the Kurram valley as its apex. This includes a tract on its western side occupied by an Orakzai clan. The total area is about 400 sq. m., of which the Orakzais occupy a fourth. The Zaimukhts are a fine-looking powerful race, with a fighting strength of some 3000 men.

ZAIRE, a name by which the river Congo was formerly known. Zaire is a Portuguese variant of a Bantu word (*nzari*) meaning river. In the 16th and 17th centuries the powerful native kingdom of Congo possessed both banks of the lower river, and the name of the country was in time given to the river also. Until, however, the last quarter of the 19th century "Zaire" was frequently used to designate the stream. It is so called by Camoens in the *Lusiads*. Since H. M. Stanley's discoveries "Congo" has become the general name for the river from its mouth to Stanley Falls, despite an effort on the part of Stanley to have the stream re-named Livingstone. (See Congo, river.)

ZAISAN, or Zaisansk, a town of Russian Central Asia, in the province of Semipalatinsk, near the Chinese frontier, at an altitude of 2200 ft. and near the S.E. corner of Lake Zaisan. Pop. (1897) 4471. Lake Zaisan, situated in an open valley between the Altai range on the north-east and the Tarbagatai on the south, lies at an altitude of 1355 ft. It has a length of 65 m., a width of 14 to 30 m., an area of 707 sq. m., and a maximum depth of 50 ft. Its water is fresh, as it receives the Black Irtysh and the Kendyrlyk from the east, and several small streams from the west, all of which leave the lake at its north-west extremity by the White Irtysh. The fisheries, which yield abundantly, are in the hands of the Siberian Cossacks. The lake is generally frozen from the beginning of November to the end of April.

ZALEUCUS, of Locri Epizephyrii in Magna Graecia, Greek lawgiver, is supposed to have flourished about 660 B.C. The statement that he was a pupil of Pythagoras is an anachronism. Little is known of him, and Timaeus even doubted his existence, but it is now generally agreed that this is an error. He is said to have been the author of the first written code of laws amongst the Greeks. According to the common story, the Locrians consulted the Delphic oracle as to a remedy for the disorder and lawlessness that were rife amongst them. Having been ordered to make laws for themselves, they commissioned one Zaleucus, a shepherd and slave (in later tradition, a man of distinguished family) to draw up a code. The laws of Zaleucus, which he declared had been communicated to him in a dream by Athena, the patron goddess of the city, were few and simple, but so severe that, like those of Draco, they became proverbial. They remained essentially unchanged for centuries, and the Locrians subsequently enjoyed a high reputation as upholders of the law. One of the most important provisions was that the punishment for different offences was definitely fixed, instead of being left to the discretion of the judge before whom a case was tried. The penalty for adultery was the loss of the eyes, and in general the application of the *lex talionis* was enjoined as the punishment for personal injuries. Special enactments concerning the rights of property, the alienation of land, settlement in foreign countries, and various sumptuary laws (*e.g.* the drinking of pure wine, except when ordered medicinally, was forbidden) are attributed to him. After the code was firmly established, the Locrians introduced a regulation that, if a citizen interpreted a law differently from the cosmopolis (the chief magistrate), each had to appear before the council of One Thousand with a rope round his neck, and the one against whom the council decided was immediately strangled. Any one who proposed a new law or the alteration of one already existing was subjected to the same test, which continued in force till the 4th century and even later. Zaleucus is often confused with Charondas, and the same story is told of their death. It is said that one of Zaleucus's laws forbade a citizen, under penalty of death, to enter the senate-house bearing a weapon. During the stress of war, Zaleucus violated this law; and, on its being pointed out to him, he committed suicide by throwing himself upon the point of his sword, declaring that the law must be vindicated.

See Bentley, *Dissertation on the Epistles of Phalaris*; F. D. Gerlach, *Zaleukos, Charondas, Pythagoras* (1858); G. Busolt, *Griechische Geschichte*, i.; Schol. on Pindar, *Ol.* x. 17; Strabo vi. p. 259; Diod. Sic. xii. 20, 21; Demosthenes, *In Timocratem*, p. 744; Stobaeus, *Florilegium*, xliv. 20, 21, where the supposed preface of Zaleucus and the collection of laws as a whole is spurious; Suïdas, s.v., who makes him a native of Thurii; Cicero, *De Legibus*, ii. 6. See also article Greek Law.

ZALMOXIS, or Zamolxis, a semi-mythical social and religious reformer, regarded as the only true God by the Thracian Getae. According to Herodotus (iv. 94), the Getae, who believed in the immortality of the soul, looked upon death merely as going to Zalmoxis. Every five years they selected by lot one of the tribesmen as a messenger to the god. The man was thrown into the air and caught upon the points of spears. If he did not die, he was considered unfit to undertake the mission and another was chosen. By the euhemeristic Hellespontine Greeks Herodotus was told that Zalmoxis was really a man, formerly a slave of Pythagoras at Samos, who, having obtained his freedom and amassed great wealth, returned to Thrace, and instructed his fellow-tribesmen in the doctrines of Pythagoras and the arts of civilization. He taught them that they would pass at death to a certain place, where they would enjoy all possible blessings for all eternity, and to convince them of this he had a subterranean chamber constructed, to which he withdrew for three years. Herodotus, who declines to commit himself as to the existence of Zalmoxis, expresses the opinion that in any case he must have lived long before the time of Pythagoras. It is probable that Zalmoxis is Sabazius, the Thracian Dionysus or Zeus; Mnaseas of Patrae identified him with Cronus. In Plato (*Charmides*, 158 B) he is mentioned with Abaris as skilled in the arts of incantation. No satisfactory etymology of the name has been suggested.

ZAMAKHSHARĪ [Abū-l Qāsim Maḥmūd ibn ʽUmar uz-Zamakhsharī] (1074–1143), Arabian theologian and grammarian, was born at Zamakhshar, a village of Khwarizm, studied at Bokhara and Samarkand, and enjoyed the fellowship of the jurists of Bagdad. For many years he stayed at Mecca, from which circumstance he was known as *Jār-ullāh* ("God's client"). Later he returned to Khwarizm, where he died at the capital Jurjānīyya. In theology he was a pronounced Moʽtazilite (see Mahommedan Religion: section *Sects*). Although he used Persian for some of his works he was a strong supporter of the superiority of the Arabic language and an opponent of the Shuʽūbite movement. Zamakhsharī's fame as a commentator rests upon his commentary on the Koran, called *al-Kashshāf* ("the Revealer"). In spite of its Moʽtazilite theology it was famous among scholars and was the basis of the widely-read commentary of Baidhāwī (*q.v.*). It has been edited by W. Nassau Lees (Calcutta, 1856), and has been printed at Cairo (1890). Various glosses on it have been written by different authors. His chief grammatical work is the *Kitāb ul-mufaṣṣal*, written about 1120 and edited by J. P. Broch (2nd ed., Christiania, 1879). Many commentaries have been written on this work, the fullest being that of Ibn Yaʽīsh (d. 1245), edited by G. Jahn (2 vols., Leipzig, 1876–86).

Of his lexicographical works the *Kitāb Muqaddimat ul-Adab* was edited as *Samachscharii Lexicon Arab. Pers.* (ed. J. G. Wetzstein, 2 vols., Leipzig, 1844), and the *Asās ul-balāgha*, a lexicon of choice words and phrases, was printed at Bulāq, 1882. Of his *adab* works the *Nawābigh ul-kalim*, an anthology, was edited by H. A. Schultens (Leiden, 1772), by B. de Meynard in the *Journal asiatique*, ser. 7, vol. vi., pp. 313 ff. (cf. M. de Goeje in *Zeitschr. d. deutsch. morg. Gesellschaft*, vol. xxx. pp. 569 ff.). The *Atwāq udh-Dhahab* was edited by J. von Hammer-Purgstall (Vienna, 1835); by H. L. Fleischer (Leipzig, 1835); by G. Weil (Stuttgart, 1863); and by B. de Meynard (Paris, 1876; cf. de Goeje as above). (G. W. T.)

ZAMBEZI, the fourth in size of the rivers of Africa, and the largest of those flowing eastwards to the Indian Ocean. Its length (taking all curves into consideration) is about 2200 m. The area of its basin, according to Dr Bludau, is 513,500 sq. m., or rather less than half that of the Nile. The main channel is clearly marked from beginning to end. The river takes its rise in 11° 21′ 3″ S., 24° 22′ E. The source lies in British territory in a depression of an undulating country 5000 ft. above the sea, covered with bracken and open forest. The water, like that of all the rivers of the neighbourhood, issues from a black marshy bog, and quickly collects into a well-defined stream. In the first hundred miles of its course the river is known as the Yambeshe—in sound almost identical with its name in its lower course, though intervening sections are known as Liambeshe, Liambai, &c. Eastward of the source the water-parting between the Congo and Zambezi basins is a well-marked belt of high ground, falling abruptly north and south, and running nearly east and west between 11° and 12° S. This distinctly cuts off the basin of the Luapula (the main branch of the upper Congo) from that of the Zambezi. In the neighbourhood of the source, however, the water-parting is not so clear, but the two river systems do not connect.

The Upper River.—The infant Zambezi, after pursuing a south-westerly course for about 150 m., turns more directly south and, soon after the 12° S. is crossed, is joined by a stream (coming from the north-west) whose source is near a marshy lake called Dilolo, 4600 ft. above sea-level in 11° 50′ S., 22° 10′ E. Lake Dilolo was at one time believed to communicate with the Kasai river, one of the great affluents of the Congo flowing north-west, but this is not the case. Dilolo belongs to the Zambezi system only, sending water to that river after heavy rain. The Zambezi as it flows southward receives on either side numerous small tributaries. A few miles above Kakengi (in 12° 24′ S.), the Zambezi, narrow, picturesque and tortuous, suddenly widens from 100 to 350 yds. Below Kakengi are a number of rapids ending (13° 7′ S.) in the Sapuma cataracts. At this point the river flows tumultuously through a rocky fissure.

The first of its large tributaries to enter the Zambezi is the Kabompo, a left-hand affluent. It joins the main stream in 14° 26′ S. A little lower down (in 14° 18′ S.) the Zambezi receives from the west the waters of a much larger stream than the Kabompo, namely, the Lungwebungu. (For details concerning these and the other chief tributaries of the Zambezi, see below.) The savannah forest, which has hitherto characterized the country, now gives place to a more open bush valley, studded with Borassus palms. Dense vegetation is confined to narrow strips of matted forest which skirt the first few hundred yards of the sources of the Zambezi and its tributaries during the first 100 m. or so. The land, from 5000 ft. at the source, falls gradually to 3600 ft. at Kakengi—a distance of 220 m. From this point until the Victoria Falls are reached—500 m.—the level of the Zambezi basin is very uniform, the fall being in this distance 600 ft. only. Twenty miles below the confluence of the Lungwebungu the country becomes flat, and in the rainy seasons is largely covered by floods. Some 50 m. farther down, the Luanginga, which with its tributaries drains a large area to the westward, joins the Zambezi. A few miles higher up on the east the main stream is reinforced by the waters of the Luena. On the same (eastern) side a little below the junction of the Luanginga and the Zambezi stands Lialui, the capital of the Barotse (*q.v.*). The river, which for some distance has had a slight western as well as southern trend, now turns distinctly south-east. From the east the Zambezi continues to receive numerous small streams, but on the west is without tributaries for 150 m., when the great river formerly misnamed the Chobe, but known to the natives as Kwando or Linyante, joins it (in 17° 47′ S.). Before this junction is effected, the Gonye Falls, the work of erosion (16° 40′ S.), offer an interruption to navigation, whilst below the falls are numerous rapids. The western bank of the Zambezi, which in this part of its course is very tortuous, is German territory from the most southern of these rapids—Katima Molilo (17° 28′ S.)—to the confluence of the Kwando, including the right or northern bank of the lower course of the last-named river; this narrow strip of land projecting from the main portion of German South-West Africa expressly to allow Germany access to the Zambezi

Below the junction of the Kwando and the Zambezi the river bends almost due east. The stream has hitherto flowed, in the main, in a gentle steady current, the depth of water, owing to the breadth of the channel, not being great. But its character is about to change. As it flows eastward towards the border of the great central plateau of Africa it reaches a tremendous chasm in the floor of the earth, and thus the Victoria Falls (*q.v.*), the largest waterfalls in the world, are formed.

The Middle Zambezi.—The Victoria Falls are reached some 60 m. after the Kwando confluence is passed, and below them the river continues to flow due east for about 120 m. It then cuts its way through perpendicular walls of basalt from 60 to 100 ft. apart. This dismal canyon, named by Major St Hill Gibbons "The Devil's Gorge," is 8 m. long. Towering over the rocks which form the banks of the river are precipitous hills, 700 to 800 ft. high. The river flows swiftly through the gorge, the current being continually interrupted by reefs. Beyond the gorge are a succession of rapids, ending with those called Molele, which is 146 m. below the Victoria Falls. In this distance the fall of the river is 800 ft. From the Devil's Gorge the Zambezi takes a decided trend north whilst still pursuing its general easterly course. For the next 700 m. until the Kebrabasa Rapids are reached, the river flows through well-defined and occasionally rocky banks. Besides the rapids already mentioned there are several others in the middle stretch of the river, forming impediments to navigation at low water. One of the most difficult passages is that of a grand gorge a little above the mouth of the Loangwa, in about 30° E., named by Major Gibbons Livingstone's Kariba, in distinction from a second Kariba (= "gorge") a little beyond the Kafukwe confluence. Between the two gorges the river is generally unobstructed, but at the western end of the second Kariba navigation is dangerous at low water. Exclusive of the Shiré (*q.v.*) the Loangwa and the Kafukwe (also called Kafue) just mentioned are the two largest left-hand tributaries of the Zambezi. The Kafukwe joins the main river in 15° 57′ S. in a quiet deep stream about 200 yds. wide. From this point the northward bend of the Zambezi is checked and the stream continues due east. At the confluence of the Loangwa (15° 37′ S.) it enters Portuguese territory, and from this point to the sea both banks of the river belong to that kingdom. At the Kebrabasa Rapids—800 m. below the Victoria Falls—the Zambezi is sharply deflected to the south, the river at this point breaking through the continental escarpment to reach the sea. The Kebrabasa Rapids, which extend about 45 m.—the road taking a détour of 70 m.—are absolutely unnavigable, and with them the middle stretch of the Zambezi as definitely ends as does the upper river at the Victoria Falls.

The Lower River.—The lower Zambezi—400 m. from Kebrabasa Rapids to the sea—presents no obstacles to navigation save the shallowness of the stream in many places in the dry season. This shallowness arises from the different character of the river basin. Instead of, as in the case of the middle Zambezi, flowing mainly through hilly country with well-defined banks, the river traverses a broad valley and spreads out over a large area. Only at one point, the Lupata Gorge, 200 m. from its mouth, is the river confined between high hills. Here it is scarcely 200 yds. wide. Elsewhere it is from 3 to 5 m. wide, flowing gently in many streams. The river-bed is sandy, the banks are low and reed-fringed. At places, however, and especially in the rainy season, the streams unite into one broad swift-flowing river. About 100 m. from the sea the Zambezi receives the drainage of Lake Nyasa through the river Shiré. On approaching the ocean, which it reaches in 18° 50′ S. the Zambezi splits up into a number of branches and forms a wide delta. Each of the four principal mouths—Milambe, Kongone, Luabo and Timbwe—is obstructed by a sand-bar. A more northerly branch, called the Chinde mouth, has a minimum depth at low water of 7 ft. at the entrance, and of 12 ft. farther in, and is the branch used for navigation. Sixty miles farther north is a river called the Qua-Qua or Quilimane, from the town founded by the Portuguese at its mouth. This stream, which is silting up, receives in the rainy season the overflow of the Zambezi.

The region drained by the Zambezi may be represented as a vast broken-edged plateau 3000 or 4000 ft. high, composed in the remote interior of metamorphic beds and fringed with the igneous rocks of the Victoria Falls. At Shupanga, on the lower Zambezi, thin strata of grey and yellow sandstones, with an occasional band of limestone, crop out on the bed of the river in the dry season, and these persist beyond Tete, where they are associated with extensive seams of coal. Coal is also found in the district just below the Victoria Falls. Gold-bearing rocks occur in several places.

Four Thousand Miles of Navigable Water.—As a highway into the interior of the continent the Zambezi, like all other large African rivers, in greater or less degree, suffers on account of the bar at its mouth, the shallowness of its stream, and the rapids and cataracts which interrupt its course. Nevertheless its importance to commerce is great, as the following recapitulation of its navigable stretches will show. (1) From the sea to the Kebrabasa Rapids, 400 m. (2) From Chikoa (above Kebrabasa) to within 140 m. of the Victoria Falls, 700 m. (3) From the rapids above the Victoria Falls to the Katima Molilo Rapids, 100 m. (4) Above the Gonye Falls to the Supuma cataract, 300 m. (5) Above the Supuma cataract, 120 m. Thus for 1620 m. of its course the Zambezi is navigable for steamers with a draught of from 18 to 28 in. Were the obstruction caused by the Kebrabasa Rapids removed, there would be a clear passage from the sea almost to the foot of the cataracts below the Victoria Falls. The difficulty at Kebrabasa might be removed either by the cutting of a side channel or the building of a dam to convert the gorge into a lake, to be connected with the river below by a lock and weir.

Several of the Zambezi affluents are also navigable for many miles. The Lungwebungu, which enters the upper river, is navigable for a long distance, thus supplying communication with the extreme north-west corner of the Zambezi basin. Parts at least of the Luena, Kafukwe, Loangwa and the Kwando tributaries are also capable of being navigated. The possibility of connecting the

Kwando with the navigable waters of the Okavango, at the point where the overflow mentioned below takes place, has likewise been suggested. The Shiré is also navigable for a considerable distance. The sum of such navigable reaches within the Zambezi basin as exceed 100 m. is nearly 4000 m.

Tributaries.—The tributaries of the Zambezi are very numerous. The course of the more important streams is as follows: The Kabompo, which flows in from the east in about 14° 8′ S., rises not far from 11° 34′ S., 25° 17′ E. in the high land which forms the eastern watershed between the Zambezi and Congo systems. In 13½° S. it receives on the right bank a tributary, the Lunga, said to be more important than the upper Kabompo itself, and rising somewhat farther north. The Lungwebungu, which enters the Zambezi from the west in 14° 35′ S., is a strong, deep stream 200 yds. wide in its upper course, flowing in a valley bordered by undulations of white sand covered by thin forest, its floor forming at times an inundated plain 2 to 3 m. wide.

The Kwando, largest of the western affluents of the Zambezi, formerly known as the Chobe and frequently spoken of as the Linyante from the ruined capital of the Makololo, situated on its lower course, rises in about 12° 40′ S., 18° 50′ E., and flows in a generally straight course south-east to 17° 30′ S., at which point it makes a sudden bend to the south before flowing east to the Zambezi. In this eastward stretch the Kwando for some 70 m. flows through a vast reedy swamp or lake studded with alluvial islands. Apart from its head-streams, it receives most of its tributaries from the west, and at its most southern bend is joined by the Magwe'-kwana, which in time of flood receives some of the surplus water of the Okavango (see NGAMI). This surplus water, received after most of the flood water of the Kwando has passed, raises the level of the lake and holds up the waters of the Kwando for some miles above it.

Of the streams which enter the upper Zambezi from the east, the largest, after the Kabompo, is the Luena, which rises in 16° S., 26° E., and flows first north-west, afterwards west-south-west, joining the main river a little north of 15° S. Others are the Njoko joining in 17° 8′ S., the Machili, which enters in about 25° E., the Lumbi, 16° 45′ S., and the Umgwezi, 17° 37′ S. The largest tributary of the middle Zambezi—the Kafukwe—rises in about 11° 35′ S. at an elevation of 4400 ft. in thick forest country. The main head-stream, which flows first south-east, afterwards south-west, is joined in 14° 35′ S. by the Lunga or Luanga, an important right-bank tributary, the united stream then flowing first south, afterwards due east. The lower Kafukwe is a large navigable river until about 40 m. from its mouth, but it then descends from the plateau by a series of falls and cataracts, the drop being over 1000 ft. in 15 m., one very high fall occurring in a stupendous chasm. The next great tributary to the east is the Loangwa (also called Luangwa) which in its upper course runs parallel to the western shores of Lake Nyasa, having its source not far from the north-west corner of the lake. The main stream flows in a generally level valley, bounded by steep plateau escarpments, and is for the most part shallow and rapid, though fairly wide. In 14° 30′ S., however, it passes through narrow gorges with a speed of 8 or 9 m. an hour. In 15° 5′ S. it is joined by the Lunsefwa, which, with its tributary, the Lukosasi, drains a large extent of the western plateau, its basin being separated by the Mchinga mountains from that of the Loangwa. The Loangwa joins the Zambezi a little above the town of Zumbo. For some distance its lower course forms the frontier between Portuguese and British territory. From the south the middle Zambezi receives various rivers which water northern Matabele and Mashona lands—namely, the Shangani, Sanyati, and Hanyani, besides minor streams. The Mazoe, which also rises in Mashonaland, joins the Zambezi below the Kebrabasa Rapids.

Exploration of the River.—The Zambezi region was known to the medieval geographers as the empire of Monomotapa and the course of the river, as well as the position of Lakes Ngami and Nyasa, was filled in with a rude approximation to accuracy in the earlier maps. These were probably constructed from Arab information. The first European to visit the upper Zambezi was David Livingstone in his exploration from Bechuanaland between 1851 and 1853. Two or three years later he descended the Zambezi to its mouth and in the course of this journey discovered the Victoria Falls. During 1858–60, accompanied by Dr (afterwards Sir) John Kirk, Livingstone ascended the river by the Kongone mouth as far as the Falls, besides tracing the course of its tributary the Shiré and discovering Lake Nyasa. For the next thirty-five years practically no additions were made to our knowledge of the river system. In 1889 the entrance of vessels from the sea was much facilitated by the discovery by Mr D. J. Rankin of the Chinde channel north of the main mouths of the river. Major A. St Hill Gibbons and his assistants, during two expeditions, in 1895–96 and 1898–1900, ably continued the work of exploration begun by Livingstone in the upper basin and central course of the river. Of non-British travellers Major Serpa Pinto examined some of the western tributaries of the river and made measurements of the Victoria Falls (1878). Steamers had been used on the lower river—the "Ma-Robert" and the "Pioneer"—by the Livingstone expedition of 1858–61, but the utilization of the Zambezi as a commercial highway was inconsiderable until after the discovery of the Chinde mouth. The first steamer placed on the river above the Kebrabasa Rapids was the "Constance" launched by the Gibbons expedition at Chikoa in September 1898. She steamed to beyond the Guay confluence, and being ultimately sold to a commercial company, was used to carry goods on the middle Zambezi. The first steamer placed on the river above the Victoria Falls was the "Livingstone," launched in August 1902.

See David and Charles Livingstone, *Narrative of an Expedition to the Zambesi and its Tributaries* (1865); A. de Serpa Pinto, *How I Crossed Africa* (1881); D. J. Rankin in *Proc. R. G. S.* (March, 1890); A. Sharpe, *ibid.* (December, 1890); H. S. Bivar, "Curso medio do Zambeze," *B. S. G. Lisboa*, vol. xxiv. (1906); G. W. Lamplugh in *Geo. Jnl.*, vol. xxxi. (1908); F. Coillard, *On the Threshold of Central Africa* (London, 1897), and A. St H. Gibbons. *Africa from South to North through Marotseland* (2 vols., London, 1904), which gives the results of a detailed examination of the upper Zambezi valley (with map). The last-named author has kindly revised the account given above. (F. R. C.)

ZAMBOANGA, the capital of the Moro Province, and of the District (or Comandancia) of Zamboanga, and a port of entry, on the island of Mindanao, Philippine Islands, at the S. extremity of the western peninsula. Pop. (1903) 3281; of the comandancia, 20,692. Zamboanga has one of the most healthful sites in the islands, its climate being decidedly cooler than that of Manila. Since the American occupation the trade has greatly increased and various improvements have been planned or are under way, including a new custom-house, better facilities for docking, pavements, bridges, and public parks. The Provincial Capitol, one of the finest government buildings in the Philippines, was completed in 1908. There is considerable valuable timber in the vicinity, live-stock is extensively raised, and rice, copra, hemp, sugar-cane, tobacco, and sweet potatoes are other important products. Zamboanga was one of the oldest Spanish settlements in the islands, it having been taken and fortified as a base against the Moros, and it still contains an old stone fort. Many of the inhabitants are descendants of slaves who escaped from the Moros and sought Spanish protection. A Spanish patois, called "Zamboangueno," is spoken by most of the native inhabitants.

ZAMINDAR, or ZEMINDAR (from Persian *zamin* = "land"), an Indian landholder. In official usage the term is applied to any person, whether owner of a large estate or cultivating member of a village community, who is recognized as possessing some property in the soil, as opposed to the ryot (*q.v.*), who is regarded as having only a right of occupancy, subject in both cases to payment of the land revenue assessed on his holding. The *zamindari* system obtains throughout northern and central India, and also in the permanently settled estates of Madras.

The raja of Benares had certain special rights as *zamindar*, and in 1910 it was arranged to make part of his "family domain" a new native state with an area of 887 sq. m. (pop. 362,000).

ZAMINDAWAR, a district of Afghanistan, situated on the right bank of the Helmund river to the N.W. of Kandahar, bordering the road which leads from Kandahar to Herat via Farah. Zamindawar is a district of hills, and of wide, well populated, and fertile valleys watered by important affluents of the Helmund. The principal town is Musa Kala, which stands on the banks of a river of the same name, about 60 m. N. of Girishk. The whole of this region is a well-known hotbed of fanaticism, the headquarters of the Achakzais, the most aggressive of all Durani tribes. It was from Zamindawar that much of the strength of the force which besieged Kandahar under Ayub Khan in 1880 was derived; and it was the Zamindawar contingent of tribesmen who so nearly defeated Sir Donald Stewart's force at Ahmad Khel previously. The control of Zamindawar may be regarded as the key to the position for safeguarding the route between Herat and Kandahar.

ZAMORA, an inland province of north-western Spain, one of the three into which the former province of Leon has since 1833 been divided; bounded on the W. by Portugal and Orense, N. by Leon, E. by Valladolid, and S. by Salamanca. Pop. (1900) 275,545; area, 4097 sq. m. Zamora is traversed from east to west by the river Duero or Douro (*q.v.*), which receives within the province the Valderaduey and the Esla on the right and the Guareña on the left; the Tormes also skirts the south-western boundary for some 25 m. Except in the north-west, where it is entered by two outlying ridges of the Cantabrian Mountains, the Sierra de la Culebra and Sierra de Peña Negra, the surface consists of a level or slightly undulating plateau; its lowest point is 1070 ft. above sea-level. Its plains, especially the valley of the Esla, yield large quantities of grain and pulse; wine and flax are also produced; and on the higher grounds large numbers of merino sheep and goats are reared, chiefly for export to Portugal. The manufactures of Zamora are unimportant. Three lines of railway, from Astorga on the N., Salamanca on the S., and Medina del Campo on the E., traverse the province and meet at the city of Zamora; there is a lack of good roads, and it is largely for this reason that the mines and extensive forests are neglected. The only towns with more than 5000 inhabitants are Zamora (pop., 1900, 16,287) and Toro (8379), which are described in separate articles. The people of the province are very poor, badly educated, and lacking in enterprise. (See also LEON.)

ZAMORA, an episcopal city, and the capital of the Spanish province of Zamora; on the right bank of the river Duero (Douro), and at the junction of railways from Salamanca, Medina del Campo and Astorga. Pop. (1900) 16,283. Zamora occupies a rocky height overlooking the Duero, a little below its confluence with the Valderaduey. The river is crossed by a fine 14th-century bridge of sixteen pointed arches. The citadel of Zamora dates from the 8th century. The small but beautiful cathedral, one of four 12th-century churches in the city, is a Romanesque building, with a square tower, a dome above the crossing, and an elaborately-decorated interior. It was completed about 1175, and contains some interesting medieval tombs, and paintings by Fernando Gallegos (1475–1550). The other principal buildings are the 17th-century town-hall, the palace of the provincial assembly, a hospital with curious Gothic windows, an ecclesiastical seminary, and a school of engineering. The trade is chiefly agricultural, but linen and woollen goods, pottery, hats, leather, and spirits are manufactured in small quantities.

In the early period of the Christian re-conquest Zamora, from its position on the north bank of the Duero, was a place of considerable strategic importance. It was taken from the Moors by Alphonso I. of Leon in 748, but was again held by them for short periods in 813, 939, 963, 984 and 986. It was entirely repaired by Ferdinand I. of Castile and Leon, who in 1061 gave it to his daughter Doña Urraca. After his death in 1065 his son Sancho II. disputed possession with Urraca and laid siege to the city, but without success, although the famous Ruy Diaz de Bivar was among his warriors, and indeed at this time received his title of "The Cid." Zamora became subject to Alphonso VI. in 1073.

ZAMOYSKI, JAN (1541–1605), Polish statesman, was the son of Stanislaw, Castellan of Chelm, and Anna Herburtowna, who belonged to one of the most ancient and illustrious families in Poland. After completing his education at Paris, Strassburg, and at Padua, where as rector of the academy he composed his celebrated work *De senatu romano* (Venice, 1563), he returned home in 1565, one of the most consummate scholars and jurists in Europe. His essentially bold and practical genius sought at once the stormy political arena. He was mainly instrumental, after the death of Sigismund II., in remodelling the Polish constitution and procuring the election of Henry of Valois. After the flight of that prince Zamoyski seems to have aimed at the throne himself, but quickly changed his mind and threw all his abilities into the scale in favour of Stephen Báthory and against the Austrian influence. By his advice, at the beginning of January 1576 a diet was summoned to Jedrzejow to confirm the election of Báthory, and from the time of that monarch's arrival in Poland till his death ten years later Zamoyski was his foremost counsellor. Immediately after the coronation, on the 1st of May 1576, Zamoyski was appointed chancellor, and in 1580 *wielki hetman*, or commander-in-chief, so that he was now the second highest dignitary in the kingdom. He strenuously supported Stephen during his long struggle with Ivan the Terrible, despite the obstruction and parsimony of the diet. He also enabled the king in 1585 to bring the traitorous Samuel Zborowski to the scaffold in the face of a determined resistance from the nobility. On the death of Stephen, the Zborowski recovered their influence and did their utmost to keep Zamoyski in the background. Their violence prevented "the pasha," as they called him, from attending the convention summoned to Warsaw on the death of Báthory; but at the subsequent election diet, which met at Warsaw on the 9th of July 1587, he appeared at the head of 6000 veterans and intrenched himself with his partisans in what was called "the Black Camp" in contradistinction to "the General Camp" of the Zborowski. Zamoyski was at first in favour of a member of the Báthory family, with which he was united by ties of amity and mutual interest; but on becoming convinced of the impossibility of any such candidature, he pronounced for a native Pole, or for whichever foreign prince might be found most profitable to Poland. The Habsburgs, already sure of the Zborowski, bid very high for the support of Zamoyski. But though he was offered the title of prince, with the Golden Fleece and 200,000 ducats, he steadily opposed the Austrian faction, even at the imminent risk of a civil war; and on the 19th of August procured the election of Sigismund of Sweden, whose mother was Catherine Jagiellonica. The opposite party immediately elected the Austrian Archduke Maximilian, who thereupon made an attempt upon Cracow. But Zamoyski traversed all the plans of the Austrian faction by routing the archduke at the battle of Byczyna (January 24, 1588) and taking him prisoner. From the first there was a certain coldness between the new king and the chancellor. Each had his own plan for coping with the difficulties of the situation; but while Zamoyski regarded the Habsburgs with suspicion, Sigismund III. was disposed to act in concert with them as being the natural and strongest possible allies for a Catholic power like Poland. Zamoyski feared their influence upon Poland, which he would have made the head of the Slavonic powers by its own endeavours. Zamoyski was undoubtedly most jealous of his dignity; his patriotism was seldom proof against private pique; and he was not always particular in his choice of means. Thus at the diet of 1589 he prevailed over the king by threatening to leave the country defenceless against the Turks, if the Austrians were not excluded from the succession. In general, however, his Turkish policy was sound, as he consistently adopted the Jagiellonic policy of being friendly with so dangerous a neighbour as the Porte. His views on this head are set out with great force in his pamphlet, *La deffaicte des Tartares et Turcs* (Lyons, 1590). The ill-will between the king and the chancellor reached an acute stage when Sigismund appointed an opponent of Zamoyski vice-chancellor, and made other ministerial changes which limited his authority; though ultimately, with the aid of his partisans and the adoption of such desperate expedients as the summoning of a confederation to annul the royal decrees in 1592, Zamoyski recovered his full authority. In 1595 Zamoyski, in his capacity of commander-in-chief, at the head of 8000 veterans dethroned the anti-Polish hospodar of Moldavia and installed in his stead a Catholic convert, George Mohila. On his return he successfully sustained in his camp at Cecora a siege by the Tatar khan. Five years later (October 20, 1600) he won his greatest victory at Tergoviste, when with a small well-disciplined army he routed

Michael the Brave, hospodar of Walachia and Moldavia. But beyond securing the Polish frontier Zamoyski would never go. He refused to wage war with Turkey even under the most favourable circumstances, nor could he be drawn into the Holy League against the Ottomans in 1600. When pressed by the papal legate and the Austrian envoys to co-operate at the head of all the forces of the league, he first demanded that in case of success Moldavia, Walachia and Bessarabia should fall to Poland, and that she should in the meantime hold Olmutz and Breslau as guarantees. The refusal of the Austrians to accept these reasonable terms justified Zamoyski's suspicion that the league would use Poland as a cat's-paw, and the negotiations came to nothing. Statesman though he was, Zamoyski cannot, however, be called a true patriot. Polish historians, dazzled by his genius and valour, are apt to overlook his quasi-treasonable conduct and blame Sigismund III. for every misadventure; but there can be no doubt that the king took a far broader view of the whole situation when he attempted to reform the Polish constitution in 1605 by strengthening the royal power and deciding all measures in future by a majority of the diet. These reforms Zamoyski strenuously opposed. The last speech he delivered was in favour of the anarchic principle of free election. He died suddenly at Zamosc on the 3rd of June 1605.

See *Vincent Laureo*, 1574–78, *et ses dépêches inédites* (Ital.) (Warsaw, 1877); Augustin Theiner, *Vetera monumenta Poloniae et Lituaniae* vol. ii. (Rome, 1862); Adam Tytus Dzialynski, *Collectanea vitam resque gestas J. Zamoyocii illustrantia* (Posen, 1881). (R. N. B.)

ZANARDELLI, GIUSEPPE (1826–1903), Italian jurisconsult and statesman, was born at Brescia on the 29th of October 1826. A combatant in the volunteer corps during the war of 1848, he returned to Brescia after the defeat of Novara, and for a time earned a livelihood by teaching law, but was molested by the Austrian police and forbidden to teach in consequence of his refusal to contribute pro-Austrian articles to the press. Elected deputy in 1859, he received various administrative appointments, but only attained a political office in 1876 when the Left, of which he had been a prominent and influential member, came into power. Minister of public works in the first Depretis cabinet of 1876, and minister of the interior in the Cairoli cabinet of 1878, he in the latter capacity drafted the franchise reform, but created dissatisfaction by the indecision of his administrative acts, particularly in regard to the Irredentist agitation, and by his theory of repressing and not in any way preventing crime, which led for a time to a perfect epidemic of murders. Overthrown with Cairoli in December 1878, he returned to power as minister of justice in the Depretis cabinet of 1881, and succeeded in completing the commercial code. Abandoned by Depretis in 1883, he remained in opposition until 1887, when he again joined Depretis as minister of justice, retaining his portfolio throughout the ensuing Crispi ministry until the 31st of January 1891. During this period he promulgated the Criminal Code, and began the reform of the magistracy. After the fall of the Giolitti cabinet in 1893, Zanardelli made a strenuous but unsuccessful attempt to form an administration. Elected president of the chamber in 1894 and 1896, he exercised that office with ability until, in December 1897, he accepted the portfolio of justice in the Rudini cabinet, only to resign in the following spring on account of dissensions with his colleague, Visconti-Venosta, over the measures necessary to prevent a recurrence of the tumults of May 1898. Returning to the presidency of the chamber, he again abandoned his post in order to associate himself with the obstructionist campaign against the Public Safety Bill (1899–1900), and was rewarded by being enabled to form an administration with the support of the Extreme Left upon the fall of the Saracco cabinet in February 1901. He was unable to achieve much during his last term of office, as his health was greatly impaired; his Divorce Bill, although voted in the chamber, had to be withdrawn on account of the strong opposition of the country. He retired from the administration on the 2nd of November 1903, and died on the 21st of December following.

ZANELLA, GIACOMO (1820–1888), Italian poet, was born at Chiampo, near Vicenza, on the 9th of September 1820, and was educated for the priesthood. After his ordination he became professor at the lyceum of his native place, but his patriotic sympathies excited the jealousy of the Austrian authorities, and although protected by his diocesan, he was compelled to resign in 1853. After the liberation of Venetia, the Italian government conferred upon him a professorship at Padua, and he achieved distinction as a poet on the publication of his first volume of poems in 1868. In 1872 grief for the death of his mother occasioned a mental malady, which led to the resignation of his professorship. After his complete and permanent recovery he built himself a villa on the bank of his native river, the Astichello, and lived there in tranquillity until his death on the 17th of May 1888. His last published volume contains a series of sonnets of singular beauty, addressed to the river, resembling Wordsworth's "Sonnets to the Duddon," but more perfect in form; and a blank verse idyll, "Il Pettirosso" ("The Redbreast"), bearing an equally strong, though equally accidental, resemblance to the similar compositions of Coleridge. His ode to Dante, and that on the opening of the Suez Canal, are distinguished by great dignity. Of his other compositions, the most individual are those in which, deeply impressed by the problems of his day, he has sought to reconcile science and religion, especially the fine dialogue between Milton and Galileo, where the former, impressed by Galileo's predictions of the intellectual consequences of scientific progress, resolves "to justify the ways of God to man." Zanella was a broad-minded and patriotic ecclesiastic, and his character is justly held in equal honour with his poetry, which, if hardly to be termed powerful, wears a stamp of peculiar elegance and finish, and asserts a place of its own in modern Italian literature.

ZANESVILLE, a city and the county-seat of Muskingum county, Ohio, U.S.A., on the Muskingum river, at the mouth of the Licking river, about 60 m. E. of Columbus. Pop. (1890) 21,009; (1900) 23,538, of whom 1435 were foreign-born; (1910, census) 28,026. Zanesville is served by the Baltimore & Ohio, the Pennsylvania, the Cleveland, Akron & Columbus, the Ohio River & Western, the Wheeling & Lake Erie, the Zanesville & Western, and the Ohio & Little Kanawha (B. and O. system) railways, by a belt line around the city, and by the Ohio Electric and the South-Eastern Ohio electric interurban lines. By a series of locks and dams the Muskingum river has been made navigable for small vessels to the Ohio and above Zanesville to Dresden, where connexion is made with the Ohio Canal extending north to Cleveland. Within the city limits the Muskingum is crossed by seven bridges (including a notable concrete Y bridge) and the Licking by two. The business districts of the city lie on both sides of the two rivers; the residential districts being chiefly on the hills to the north and west. Among the principal buildings are the Federal building, the county court-house, the Soldiers and Sailors' Monumental Building, containing a large auditorium, the Masonic and Oddfellows' temples, the Market building, containing city offices, a National Guard armoury, the John McIntire public library, the John McIntire Children's Home (1880), the Helen Purcell home for women, the county infirmary, the Bethesda Hospital (1890), and the Good Samaritan hospital (1902; under the Franciscan Sisters). The John McIntire public library (about 20,000 volumes) is a consolidation of the Zanesville Athenaeum (1827) and the Eunice Buckingham library of the former Putnam Female Seminary (1835) here; Andrew Carnegie contributed $50,000 for the erection of the building. John McIntire (1759–1815), one of the early settlers, provided by will for the maintenance of a school for poor children, and such a school was maintained from 1836 to 1856, when it was transferred to the city school system, annual contributions being made from the fund for poor children; later the McIntire Home was founded, and in 1902 donations to the city school system were discontinued and the entire revenues of the estate devoted to the maintenance of the Home, which is a model of its kind. Zanesville is an important centre for the manufacture of art and domestic pottery, plain and ornamental tile, building and paving bricks, and other clay products. In 1905 it ranked sixth among the cities of the country in the amount of pottery produced, and third in the degree of the specialization of that industry. In 1905 the value of all factory products was $7,047,637, of which $1,144,384 (16·2 per cent.) represented pottery, terra-cotta, and fireclay products.

Zanesville was first platted in 1800 by Ebenezer Zane (1747–1811) of Wheeling, Virginia (now West Virginia), his brother Jonathan, and John McIntire, his son-in-law, of Alexandria, Va., who under an act of Congress of 1796 surveyed a road from Wheeling to what is now Maysville, Kentucky, and received for this service three sections of land. Jonathan Zane and McIntire selected the land at the point where the new road crossed the Muskingum river. The settlement was first called Westbourne and later was named Zanesville; a post office was established in 1802. Zanesville became the county-seat upon the creation of Muskingum county in 1804, was the capital of the state from 1810 to 1812, was incorporated as a town in 1814, and was chartered as a city in 1850.

ZANGWILL, ISRAEL (1864–   ), Jewish man of letters, was born in London on the 14th of February 1864. His early childhood was spent in Plymouth and at Bristol, where he received his first schooling. He was in his ninth year when his parents settled in Spitalfields, and he entered the Jews' Free School, where eventually he became a teacher. Concurrently with his teaching work he took his degree with honours at London University. He had already written a fantastic tale entitled *The Premier and the Painter* in collaboration with Louis Cowen, when he resigned his position as a teacher owing to differences with the school managers and ventured into journalism. He founded and edited *Ariel*, *The London Puck*, and did much miscellaneous work on the London press. He made his literary reputation with a novel, *The Children of the Ghetto* (1892), which was followed by *Ghetto Tragedies* (1893); *The Master* (1895); *Dreamers of the Ghetto* (1898); *The Mantle of Elijah* (1901); and other tales and novels of great interest dealing with Jewish life. *Children of the Ghetto* was produced in a play in New York with success in 1899, and has since been extensively played both in English and Yiddish. Others of his plays are: *Merely Mary Ann*, played at the Duke of York's theatre, and *The Serio-Comic Governess; Nurse Marjorie;* and *The Melting Pot*, all produced in New York. Mr Zangwill was the founder of the International Jewish Territorial Organization (see ZIONISM).

ZANTE (anc. *Zacynthus*), an island of Greece, one of the Ionian group, in the Ionian Sea, in 37° 40′ N. lat. and 21° E. long., is 25 m. long, about 12 broad, and 64 m. round, with an area of 277 sq. m., and a population in 1907 of 42,502. Zante lies 8 m. S. of Cephalonia, forming with it, Leucas and Ithaca a crescent-shaped insular group, which represents the crests of a submerged limestone ridge facing the Gulf of Patras. Zante is of somewhat irregular oval shape, with its main axis disposed in the direction from north-west to south-east, and indented by a deep inlet at its southern extremity. The surface is mainly occupied by an extensive and highly productive central plain, skirted on the west side by a range of bare limestone hills from 1000 to 1200 ft. high, which fall gently landwards, but present bold steep cliffs towards the sea, and which culminate northwards in Mount Skopos, the ancient *Elatos* (1600 ft.), the highest point in the island. On the east side the plain is also limited by a low ridge, which still justifies the epithet of *nemorosa*, or the "wooded," applied by Virgil to Zacynthus. These hills are densely clothed to their summits with an exuberant growth of olives, figs, myrtles, laurels, oranges, aloes, vines and other sub-tropical plants. The central plain is highly cultivated, forming an almost continuous stretch of gardens and vineyards, varied here and there with a few patches of cornfields and pasture lands. Here is grown a peculiar dwarf vine, whose fruit, the "currant" (from "Corinth") of commerce, forms the chief resource and staple export of Zante, as well as of the neighbouring mainland. The vine, which grows to a height of 3 ft., begins to yield in seven years and lasts for over a century. From the grape, which has a pleasant bitter-sweet taste, a wine is also extracted, which is said to excel all others in flavour, fire and strength. Besides this species, there are nearly forty different kinds of vine and ten of the olive, including the *karudolia*, which yields the best edible olive berry. For size, vigorous growth and productiveness the olive tree of Zante is rivalled only by that of Corfu.

The island enjoys a healthy climate; and, although there are no perennial streams, an abundant supply of good water is obtained from the numerous springs, occurring especially in the eastern and central districts. But earthquakes are frequent and at times disastrous. During recent times the most destructive were those of 1811, 1820, 1840 and 1893; and, although the prevailing geological formations are sedimentary, chiefly calcareous, there seems no doubt that these disturbances are of igneous origin. Other indications of volcanic agency are the oil springs occurring on the coast, and even in the bed of the sea near Cape Skinari on the north side, and especially the famous pitch or bituminous wells already mentioned by Herodotus (*Hist.*, bk. iv.). These have been productive throughout the historic period and still yield a considerable supply of pitch. They are situated in a swamp near the coast village of Chieri, and comprise two basins, with alternate layers of water and bitumen, the lower sheet of water apparently communicating with the sea.

Zante, capital of the island, is a considerable seaport on the east side, with a population in 1907 of 13,501. It occupies the site of the ancient city of Zacynthus, said to have been founded by Zacynthus, son of a legendary Arcadian chief, Dardanus, to whom was also attributed the neighbouring citadel of Psophis. But of this, as well as of the temple of Artemis that formerly crowned Mount Skopos, no vestiges can now be discovered.

Traditionally the island formed part of the territory of Ulysses, king of Ithaca. It was peopled in ancient times by settlers variously represented as coming from Achaea or Arcadia. It figures occasionally in history as a base for belligerents in the Ionian Sea. Thus during the Peloponnesian War it served as a naval station for the Athenians, who again in 374 B.C. endeavoured to acquire it for a similar purpose; in 357 it became the headquarters of Dion on his expedition against Syracuse. In 217 it was seized by Philip V. of Macedon. The Romans captured it in 211, but restored it temporarily to Philip; in 191, wishing to keep it out of the hands of ambitious Greek powers, they definitely annexed it. In 86 it was raided by Mithradates' admiral Archelaus during a short foray into Ionian waters. Under the Roman Empire Zante was included in the province of Epirus. In the 11th century it passed to the Norman kings of Sicily; after the Fourth Crusade it belonged at various times to the despots of Epirus, the emperors of Constantinople, and the Orsini counts of Cephalonia. After remaining from 1357 to 1482 in the hands of the Tocco family it became a Venetian possession. In 1797 it was ceded to France, and after a short occupation by the Russians was brought under British protection; in 1864 it was ceded with the other Ionian islands to the Greek kingdom.

The long Venetian occupation is reflected in the appearance, character, and to some extent even the language and religion of the Zantiots. Nearly all the aristocracy claim Venetian descent; most of the upper classes are bilingual, speaking both Greek and Italian; and a considerable section of the population are Roman Catholics of the Latin rite. Even the bulk of the people, although mainly of Greek stock, form in their social usages a connecting link between the Hellenes, whose language they speak, and the Western nations by whom they were so long ruled.

See B. Schmidt, *Die Insel Zakynthos* (Freiburg, 1899); B. V. Head, *Historia Numorum* (Oxford, 1887), pp. 359–60.

ZANY, a fool or silly person. The word came into English in the 16th century from Ital. *Zane*, mod. *Zanni*, an abbreviation of the name Giovanni (John). This familiar form of the name was given by Italians to a special type of clown or buffoon who acted as an attendant or follower of the regular professional clown on the stage and made clumsy and ludicrous attempts to mimic his performance.

ZANZIBAR, a sultanate and British protectorate of East Africa. The sultanate, formerly of much larger extent (see below, *History*), was reduced in 1890 to the islands of Zanzibar and Pemba, some adjacent islets, the nominal sovereignty of the coast line—for ten miles inland—of the protectorate of British East Africa (*q.v.*), and the possession, also nominal, of five ports on the Benadir coast, leased to Italy. (In 1905 the sultan of Zanzibar sold his sovereign rights to these ports to Italy. See Somaliland: § *Italian.*) The islands of Pemba and Zanzibar have a collective area of 1020 sq. m. and an estimated population (1909) of 250,000.

Topography, &c.—The political and commercial, as well as the geographical, centre of the state is the fertile and densely peopled island of Zanzibar, which lies at a mean distance of 20 m. from the mainland, between 5° 40′ and 6° 30′ S. Pemba (*q.v.*) to the north and the more distant Mafia (to the south) form with Zanzibar an independent geological system, resting on a foundation of coralline reefs, and constituting a sort of outer coast-line, which almost everywhere presents a rocky barrier to the Indian Ocean. All three are disposed parallel to the mainland, from which they are separated by shallow waters, mostly under thirty fathoms, strewn with numerous reefs dangerous to navigation, especially in the Mafia channel opposite the Rufiji delta. (For Mafia, see German East Africa.) Some 6 m. N. of Zanzibar and forming part of the coral reef is the small, densely wooded island of Tumbatu. Its inhabitants are excellent sailors.

Zanzibar island is 47 m. long and 20 broad at its greatest breadth. It has an area of 640 sq. m. The island, called Unguja in Swahili, is not exclusively of coralline formation, several heights of a reddish ferruginous clay rising in gentle slopes 400 to 450 ft. in the centre and double that in the north. There are several tolerable natural harbours, used only by Arab dhows, the port of Zanzibar sufficing for the general trade. The forests which formerly covered the island have largely disappeared; the eastern half is now mostly covered with low scrub. The western part is noted for the luxuriance and variety of its flora, notwithstanding the absence of timber trees. Among fruit-trees the coco-nut palm is conspicuous. Each tree yields 100 to 120 nuts a year. In places there are extensive groves of these trees, elsewhere the palms grow indiscriminately among other trees, which include the mangrove (in swampy districts), lemons, sweet and sour limes, the bread fruit, papaw, pomegranate, tamarind, the orange and mango trees. The two last-named and plantains and bananas are abundant. The mango trees attain a great size. Many of the fruit-trees and plants have been introduced from India and Malaysia, such as the mangosteen, guava, durian, cinnamon, nutmeg and cloves, all of which thrive well. The soil seems specially suited for the clove, which, although nearly destroyed by a terrible cyclone in 1872, completely recovered from that disaster.

Although the fauna is almost exclusively continental, Zanzibar till recently possessed a distinct variety of monkey (*Colobus kirkii*), which appears to be now extinct. Other varieties of monkeys are fairly numerous. Hippopotami have occasionally swum to the island. Wild boars and servals are common, pythons are found in the swamps. Camels and bullocks are used as draught animals.

Climate.—The great heat and the excessive moisture of the atmosphere render the climate very trying, especially to Europeans. The year is divided into two seasons, according to the direction of the monsoons. The north-east monsoon sets in about the end of November, the south-west monsoon in April. The "hot season" corresponds with the north-east monsoon, when the minimum readings of the thermometer often exceed 80° F. In June to September the minimum readings drop to 72°, the mean annual temperature being about 80°. Rain falls in every month of the year. December, April and May are the rainiest months, August to October the driest. The average annual rainfall (18 years' observations) is 65 in. (In 1859 as much as 170 in. were registered.)

Inhabitants.—On the east side of the island the inhabitants, a Bantu-speaking race of low development, probably represent the aboriginal stock. They are known as Wahadimu and are noted as good fishermen, cattle raisers, and skilled artisans. In the west, and especially in the capital (for which, see below), the population is of an extremely heterogeneous character, including full-blood and half-caste Arabs, Goanese, Parsis, Hindus, Comoro Islanders, Swahili (*q.v.*) of every shade, and representatives of tribes from all parts of East Africa. The Arabs number about 7000; Asiatics (mostly British Indians), 20,000; whites (chiefly British), 250. Besides the port of Zanzibar there are no large towns. Chuaka is a pleasant health resort on the eastern shore facing the Indian Ocean.

Production.—Cloves and copra are the chief products of the island. There are also extensive chilli and rubber plantations. The muhogo (cassava), the tobacco plant and vanilla are cultivated on a smaller scale; experiments in cotton-growing proved unsuccessful. The shambas (plantations) are mostly the property of Arabs. The labourers are chiefly Swahilis, and were formerly slaves. The labour available at harvest time is often inadequate, and year after year a large proportion of the clove crop has remained unpicked. As its prosperity depended much more on its transit trade (Zanzibar being the entrepôt for all the East African ports as far south as the Zambezi) than on agriculture the resources of the island were somewhat neglected; but when in the early years of the 20th century the competition of Mombasa and Dar-es-Salaam was felt, efforts were made to increase the number and productiveness of the crops and also to decrease costs by providing better means of transport. Good roads were made by the government, and an American company built a 3-ft. gauge railway from Zanzibar town to the north of the island, where are the chief plantations. Rice is imported in large quantities from Rangoon and Bombay. Besides rice, cassava, grown on the island, and fish (which is abundant) are the chief foods of the natives. The pigeon pea (*cajanus Indicus*) is commonly grown, and the Wahadimu and Watumbata cultivate the betel-nut creeper.

Revenue and Currency.—Custom duties are the chief source of revenue. Other sources are registration and market fees, hut tax (one dollar per hut) on government ground, post office receipts, &c., and the produce of crown shambas. A sum of £17,000 a year is paid to the government by the British East Africa Protectorate for the right to administer the mainland portion of the sultanate; the Zanzibar government also receives some £10,000 a year interest on the purchase money paid by Germany and Italy for the part of Zanzibar territory acquired by those Powers. In 1900 the revenue was £123,000 and the expenditure £131,000. In 1902 the sultan, on the advice of the British government, appointed a financial adviser, under whose care the finances steadily improved. In 1906 the revenue was £191,000, the expenditure £156,000. In the last-named year there was a public debt of £88,000. The principal items of expenditure come under the heads of administration, public works, civil list and military police.

The coinage system is somewhat complicated. The Maria Theresa dollar (equalling approximately 3s. 9d.) is used as a standard of value in price quotations, but the coin is not in circulation. The Indian rupee is in universal currency and the British sovereign is legal tender at the fixed rate of 15 rupees to £1. The division of the rupee into annas and pice was abolished in 1908 and the rupee divided into 100 cents. In the same year the government issued notes of 5, 10, 20, 50 and 100 rupees. British weights and measures are used in wholesale transactions, with the exception of the *frasila*, which equals 35 ℔ avoir.

Religion, Education and Justice.—Mahommedanism is the dominant religion. Most of the inhabitants are Sunnis of the Shafi school, but the sultan and his relatives are schismatics of the Ibadhi sect. There are several Protestant and Roman Catholic missions with branches on the mainland. These missions maintain schools. The government supports kuttabs in which elementary education is given in Arabic and the vernacular, and more advanced schools in which English, geography and arithmetic are taught. In December 1892 the sultan delegated to the British agent and consul-general his right to try all cases in which a British subject is plaintiff or accuser, and the defendant or accused is a Zanzibar subject. The British court also tries all cases in which other Europeans (and Americans) are concerned, the consular jurisdiction exercised by other Powers having been finally abolished in 1907. Cases between natives are tried by Moslem tribunals. There is a military police force under a British officer.

History.—From the earliest times of which there is any record the African seaboard from the Red Sea to an unknown distance southwards was subject to Arabian influence and dominion. Egyptians, Chinese and Malays also appear to have visited the coast. At a later period the coast towns were founded or conquered by Persian and Arab Mahommedans who, for the most part, fled to East Africa between the 8th and 11th centuries on account of the religious differences of the times, the refugees being schismatics. Various small states thus grew up along the coast, Mombasa seeming to be the most important. These states are sometimes spoken of as the Zenj empire, though they were never, probably, united under one ruler. Kilwa (*q.v.*) was regarded as the capital of the "empire." The seaboard itself took the name of *Zanquebar* (corrupted to Zanzibar by the Banyan traders), the Balid ez-Zenj, or "Land of the Zenj" of the Arabs, a term which corresponds to the Hindu-bar, or "land of the Hindu," formerly applied to the west coast of India. By Ibn Batuta, who visited the coast in 1328, and other Arab writers the Zenj people are referred to in a general way as Mahommedan negroes; and they are no doubt still represented by the semi-civilized Mahommedan Bantus now collectively known as the Swahili or "coast people," and in whose veins is a large admixture of Asiatic blood. The Zenj "empire" began to decline soon after the appearance of the Portuguese in East African waters at the close of the 15th century. To them fell in rapid succession the great cities of Kilwa with its 300 mosques (1505), Mombasa the "Magnificent" (1505), and soon after Malindi and Mukdishu the "Immense" (Ibn Batuta). The Portuguese rule was troubled by many revolts, and towards the end of the 16th century the chief cities were ravaged by the Turks, who came by sea, and by the Zimbas, a fierce negro tribe, who came overland from south of the Zambezi. On the ruins of the Portuguese power in the 17th century was built up that of the Imams of Muscat. Over their African dominions the Imams placed *valis* or viceroys, who in time became independent of their overlord. In Mombasa power passed into the hands of the Mazrui family. The island of Zanzibar, conquered by the Portuguese in 1503–8, was occupied by the Arabs in 1730, and in 1832 the town of Zanzibar, then a place of no note, was made the capital of his dominions by the Sayyid Said of Muscat, who reconquered all the towns formerly owning allegiance to the Imams, Mombasa being taken by treachery in 1837. On the death of Said in 1856 his dominions were divided between his two sons, the African section falling to Majid, who was succeeded in 1870 by his younger brother Bargash ibn Said, commonly known as sultan of Zanzibar. Bargash witnessed the dismemberment of his dominions by Great Britain, Germany and Italy (see AFRICA, § 5), and in March 1888 left to his successor, Sayyid Khalifa, a mere fragment of the territories over which he had once ruled. The Sayyids Majid and Bargash acted largely under the influence of Sir John Kirk (*q.v.*), who from 1866 to 1887 was consular representative of Great Britain at Zanzibar. By Sir John's efforts a treaty for the suppression of the slave trade throughout the sultanate had been concluded in 1873.

In the negotiations between the Powers for the partition of Africa the supremacy of British interests in the island was acknowledged by Germany and France, thus rendering a treaty made in 1862 between France and Great Britain recognizing the "independence" of Zanzibar of no effect. On the 4th of November 1890 the sultanate was proclaimed a British protectorate, in conformity with conventions by which Great Britain on her part ceded Heligoland to Germany and renounced all claims to Madagascar in favour of France.[1] Sultan (Sayyid) Ali, who had succeeded his brother Sayyid Khalifa in February 1890, in August following issued a decree which resulted in the liberation of large numbers of slaves. Sayyid Ali was succeeded in March 1893 by Hamed bin Thwain, on whose death in August 1896 his cousin, Sayyid Khalid, proclaimed himself sultan, and seized the palace. The British government disapproved, and to compel Khalid's submission the palace was bombarded by warships. Khalid fled to the German consulate, whence he was removed to the mainland, and Hamed bin Mahommed, brother of Hamed bin Thwain, was installed sultan by the British representative (27th of August 1896). The government was reconstituted under British auspices in October 1891, when Sir Lloyd Mathews[2] was appointed prime minister, and the sultan made virtually a crown pensioner, with a civil list of 120,000 rupees. In 1897 the legal status of slavery was abolished, compensation being given to slave owners. In July 1902 Hamed bin Mahommed died, and was succeeded by his son Ali bin Hamud, born in 1885. The British government is represented by an agent and consul-general, without whose sanction no important steps can be undertaken. This officer also administered the East Africa Protectorate, but the dual appointment was found to hamper the progress of both protectorates, and in 1904 when Mr Basil S. Cave was given charge of the Zanzibar protectorate another officer was appointed for the mainland. In 1906 the British agent assumed more direct control over the protectorate and again reorganized the administration, Capt. (locally general) A. E. H. Raikes being appointed prime minister. These changes, together with the abolition of foreign consular jurisdiction, led to many reforms in the government and the increased prosperity of the Zanzibari.

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ZANZIBAR, an East African seaport, capital of the island and sultanate of the same name, in 6° 9′ S., 39° 15′ E. The town is situated on the western side of the island, 26 m. N.E. of the mainland port of Bagamoyo, which is visible from Zanzibar in very clear weather. Zanzibar is built on a triangular-shaped peninsula about a mile and a half long which runs from east to west, forming a safe and spacious roadstead or bay with a minimum depth of water exceeding five fathoms. Ocean steamers anchor in the roadstead and are loaded and discharged by lighters. The harbour, frequented by British, German and French steamers, warships and Arab dhows, affords a constant scene of animation. Viewed from the sea, the town presents a pleasant prospect with its mosques, white flat-topped houses, barracks, forts, and round towers. The most prominent buildings are the Sultan's palace and the Government offices (formerly the British consulate), the last-named situated at the Point, the south-west horn of the bay. To the left of the palace—viewed from the sea—is the "stone ship," a series of water tanks (now disused) the front of which is cleverly carved to resemble a ship. The town consists of two quarters—Shangani, the centre of trade and residence of the sultan, and the eastern suburb, formerly separated from the rest of the town by the Malagash lagoon, an inlet of the sea, now drained. For the most part Zanzibar consists of a labyrinth of narrow and dirty streets, in which live the Banyans, Singalese, the negro porters, fishermen and half-castes. There are numerous markets. In Shangani are the houses of the European merchants and the chief Arabs, and the headquarters of various Protestant and Roman Catholic missions. Characteristic of the streets are the carved and massive wooden doors, whose blackness contrasts with the white stone of the houses, and the bright red of the acacias in the garden enclosures. Ndia Kun or Main Road extends from the Sultan's palace to the (new) British Agency at Mnazi Moja, a castellated building situated in beautiful grounds. Along this thoroughfare are the custom house, the post office buildings (an imposing edifice) and several consulates. In a turning off Main Street is the residence of Tippoo Tib (now an hotel). Next to this house is the English Club, and in the same street are the law courts (built 1909–10). The Anglican cathedral (built 1873–79) a semi-Gothic coral building, occupies the site of the old slave market. The Roman Catholic cathedral—in the Renaissance style—is one of the finest buildings in East Africa. On the outskirts of the town at Mnazi Moja is a public park, a golf course and cricket ground. Zanzibar is well supplied with pure water brought from the neighbouring hills.

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[1] By the Zanzibar Order in Council, 1906, the protectorate of Zanzibar was limited to the islands of Zanzibar and Pemba, including the territorial waters thereof and any islets within those waters.

[2] Sir Lloyd Mathews (1850–1901) was a British naval officer. He served in Ashanti 1873–74 and went to Zanzibar in 1875 as lieutenant on a ship engaged in the suppression of the slave trade. In 1877 he was selected to command the military force being raised by Sayyid Bargash and thereafter devoted his services entirely to the Zanzibar government. He was made a K.C.M.G. in 1894.

Submarine cables connect Zanzibar with all parts of the world; whilst lines of steamships from Europe and India make it a regular port of call. It was not, however, until 1910 that direct steamship communication with London was established. The average annual value of the external trade for the five years 1902–6 was: imports, £1,075,580; exports, £1,084,224. In 1907 the imports were valued at £1,232,957, the exports at £1,070,067. The figures for 1908 were: imports, £969,841; exports, £977,628. Many of the imports brought from the neighbouring mainland also figure as exports. Of these the most important are ivory, and rhinoceros horn, gum copal, hides and skins. Cloves, clove stems and copra are the chief exports, the production of the island. The bulk of the articles named, with the exception of copra, are sent to the United Kingdom; India, however, has a larger trade with Zanzibar than any other country. From it are imported food stuffs (rice, grain, flour, ghee, groceries) and piece goods. The copra is sent almost exclusively to Marseilles. The most valuable articles of import are piece goods and rice. The piece goods come chiefly from the United Kingdom, India, America and the Netherlands, the rice entirely from India. Other imports of value are building material, coal, petroleum and sugar.

The motley population of Zanzibar is indicative of the commercial importance of the city. Its geographical position has made it the key of East Africa from Cape Guardafui to Delagoa Bay. "When you play on the flute at Zanzibar" (says an Arab proverb) "all Africa as far as the lakes dances." From the time (1832) when Seyyid Said of Muscat fixed on the town as the capital of his empire, Zanzibar became the centre of the trade between the African continent, India, Arabia and the Persian Gulf, as well as Madagascar and the Mauritius. It also speedily obtained a large trade with Europe and America. The Americans were the first among white merchants to realize the possibilities of the port, and a United States consulate was established as early as 1836. The name Merikani, applied to cotton goods and blankets on the east coast, is a testimony to the enterprise of the American trader. Zanzibar is to a greater degree than any other city the capital of negro Africa; made so, however, not by the negroes but by Arab conquerors and traders. The aspect of the city has changed since the establishment of the British protectorate, the suppression of the slave market and of slavery itself, and the enforcement of sanitation; but Professor Henry Drummond in *Tropical Africa* (1888) aptly sketched the characteristics of Zanzibar in pre-protectorate days when he wrote of it as a "cesspool of wickedness Oriental in its appearance, Mahommedan in its religion, Arabian in its morals . . . a fit capital for the Dark Continent." Nevertheless Zanzibar in those days was the focus of all exploring and missionary work for the interior, the portal through which civilizing influences penetrated into the eastern section of equatorial Africa. The growth of the British and German protectorates on the neighbouring shores led in the early years of the 20th century to considerable trade which had hitherto gone through Zanzibar being diverted to Mombasa and Dar-es-Salaam, but Zanzibar maintains its supremacy as the great distributing centre for the eastern seaboard.

ZAPAROS, a tribe or group of tribes of South American Indians of the river Napo. They occupy some 12,000 sq. m. between the Napo and the Pastaza. Their only industries are hammock plaiting and fishing-net weaving. Polygamy is general. They wear a long skirt of bark fibre.

ZARA (Serbo-Croatian *Zadar*), the capital of Dalmatia, Austria. Pop. (1900), of town and commune, 32,506; including a garrison of 1330. Zara is situated on the Adriatic Sea, 52 m. S.E. of Trieste, and opposite the islands of Ugliano and Pasman, from which it is separated by the narrow Channel of Zara. It is the meeting-place of the provincial diet, and the seat of a Roman Catholic archbishop and an Orthodox bishop. The promontory on which it stands is separated from the mainland by a deep moat, practically making an island of the city. In 1873 the ramparts of Zara were converted into elevated promenades commanding extensive views to seaward and to landward. Of its four old gates one, the Porta Marina, incorporates the relics of a Roman arch, and another, the Porta di Terraferma, was designed in the 16th century by the Veronese artist Sanmichele. The chief interest of Zara lies in its churches, the most remarkable of which is the cathedral of St Anastasia, a fine Romanesque basilica, built between 1202 and 1205. The churches of St Chrysogonus and St Simeon are also in the Romanesque style, and St Mary's retains a fine Romanesque campanile of 1105. The round church of St Donatus, traditionally but erroneously said to have been erected in the 9th century on the site of a temple of Juno, is used for secular purposes. The church treasuries contain some of the finest Dalmatian metal-work; notably the silver ark or reliquary of St Simeon (1380), and the pastoral staff of Bishop Valaresso (1460). Most of the Roman remains were used in the construction of the fortifications. But two squares are embellished with lofty marble columns; a Roman tower stands on the east side of the town; and some remains of a Roman aqueduct may be seen outside the ramparts. Among the other chief buildings are the Loggia del Comune, rebuilt in 1565, and containing a public library; the old palace of the priors, now the governor's residence; and the episcopal palaces. The harbour, to the north-east of the town, is safe and spacious, and it is annually entered by about 2500 small vessels, mainly engaged in the coasting trade. Large quantities of maraschino are distilled in Zara; and the local industries include fishing, glass-blowing, and the preparation of oil, flour and wax.

In the early days of the Roman empire Zara was a flourishing Roman colony under the name of *Jadera*, subsequently changed to *Diadora*. It remained united with the eastern empire down to 998, when it sought Venetian protection. For the next four centuries it was always under Venetian or Hungarian rule, changing hands repeatedly. It was occupied by the Hungarians at the end of the 12th century, but was recaptured by the Venetians in 1202, with the aid of French crusaders on their way to Palestine. In 1409 it was finally purchased from Hungary by Venice for 100,000 ducats. In 1792 it passed into the possession of Austria. From 1809 to 1813 it belonged to France.

About 15 m. S.E. is Zara Vecchia, or Old Zara, an insignificant village on the site of Biograd, the former residence of the Croatian kings, which was destroyed during the wars between Venice and Hungary.

See Angelo Nani, *Zara, e suoi Dintorni* (Zara, 1878), and *Notizie Storiche della Città di Zara*, (Zara, 1883).

ZARCILLO Y ALCARAZ, FRANCISCO (1707–1781), Spanish sculptor, was born in Murcia on the 12th of May 1707. At the age of twenty he completed the statue of St Ines of Montepulciano, which had been begun for the Dominicans at Murcia by his father. On the death of the latter the care of the family fell upon Francisco, who with the help of his brothers and sisters organized a workshop. In 1765 he also founded a small academy, which, however, was speedily dissolved owing to disunion among the members. In the Ermita de Jesús in Murcia may be seen Zarcillo's scenes from the Passion of Our Lord, a vast work in which all the sculptor's qualities and defects are revealed. In the church of St Miguel are an Immaculate Conception and a St Francis. Mention should also be made of the Christ at the Well in the church of Santa Maria dellas Gracias in Murcia, and of the sculptures in San Pedro and in the Capucine monastery in Murcia. Zarcillo worked in wood, which was coloured. The ascription of the stone sculptures on the façade of the St Nicolas Church in Murcia to him rests on conjecture. He died at Murcia in 1781.

See B. Haendcke, *Studien zur Geschichte der spanischen Plastik* (Strassburg, 1900).

ZARHÓN, a mountain in Morocco, 9½ m. N. of Mequinez, on whose hillside is the town Mulai Idris Zarhón, so called after Mulai Idrís I., the founder of the Moorish empire, who was buried there in A.D. 791. The whole town is considered as a sanctuary, pays no taxes, provides no soldiers and is never visited save by Mahommedans. Near the town are the ruins of Volubilis—Kasar Fara'on or Pharaoh's Castle, once the Roman capital, and the first home of Idris.

ZARIA, a province of the British protectorate of Northern Nigeria. It lies approximately between 5° 50′ and 8° 30′ E. and 9° 20′ and 11° 30′ N. It has an area of 22,000 sq. m. and an estimated population of about 250,000. The province, of which a great portion consists of open rolling plains, is watered by the Kaduna affluent of the Niger and its many tributaries, and is generally healthy and suitable for cultivation. The chief towns are Zaria, the capital of the emirate, 87 m. S.W. of Kano, and Zungeru, the headquarters of the British administration for the whole of Northern Nigeria. The British station at Zaria town, with an elevation of 2150 ft., has so far proved the healthiest and most agreeable point of occupation in the protectorate. The climate here for a great portion of the year is bracing, and in the cold season there is frost at night.

The British capital at Zungeru, in the south-western corner of the province, less fortunate than Zaria, has only an elevation of about 450 ft. above the sea. The climate, though better than that of Lokoja, is still relaxing and trying for Europeans. The site of Zungeru, 6° 9′ 40″ E. 9° 48′ 32″ N., was selected in 1901. By the summer of 1902 brick houses for the public departments, a residency, a hospital, barracks and a certain number of houses for the civilian staff had been erected, and the town is now a flourishing settlement, having all the appearance of an English suburban town with shaded avenues and public gardens clustering on either side of the river Dago, over which several bridges have been thrown.

Zaria is not a great grain-producing province. Its principal crop is cotton, of which the surplus is available for purposes of trade, and among the Mahommedan population there is a growing demand for cloth, agricultural and culinary implements, Birmingham goods, soap, oil, sugar and European provisions. The construction of roads, telegraphs and other public works consequent upon the British occupation of the province makes somewhat heavy calls upon the local labour supply and accentuates to some of the large landowners the inconvenience resulting from the abolition of the slave trade, but the practice of owning domestic slaves is not forbidden, and it is the policy of the administration to render the transition from slave labour to free labour as gradual as possible.

The ancient state of Zaria, also called Zeg-Zeg by the geographers and historians of the middle ages, was one of the original seven Hausa states. It suffered all the fluctuations of Hausa history, and in the 13th and early 14th centuries seems to have been the dominating state of Hausaland. At later periods it underwent many conquests and submitted in turn to Kano, Songhoi and Bornu. At the end of the 18th century it was an independent state living under its own Mahommedan rulers; but, like the rest of northern Hausaland, it was conquered in the opening years of the 19th century by the emissaries of the Fula Dan Fodio. It remained a Fulani emirate paying allegiance to Sokoto up to the period of the British occupation of Nigeria, January 1900. Early in 1900 a British garrison was placed at Wushishi, a town in the south-western corner of the emirate which marks the limit of navigation of the Kaduna river. The emir of Zaria professed friendliness to the British, and at his own request British troops were quartered at his capital, in order to protect him from the threatened attacks of Kontagora. In March 1902 the province was taken under British administrative control. Throughout that year it was found that, notwithstanding his friendly professions, the emir of Zaria was intriguing with Kano and Sokoto, then openly hostile to Great Britain, while at the same time he continued, contrary to his undertaking in return for British protection, to raid for slaves and to perpetrate acts of brutal tyranny and oppression. He was deposed in the autumn of 1902, and after the Sokoto-Kano campaign of 1903, which assured the supremacy of Great Britain in the protectorate, another emir was appointed to Zaria. The new emir, Dan Sidi, took the oath of allegiance to the British crown and accepted his appointment on the conditions required of all the Nigerian native rulers. He afterwards continued to act in loyal co-operation with the British administration.

The province has been organized for administration on the same system as the rest of the protectorate. It has been divided into four administrative districts, each under a British assistant resident. A good cart road suitable for wheeled traffic has been constructed between Zungeru and Zaria, and the Kaduna has been handsomely bridged at a point near Wushishi, which is the meeting-point of main caravan roads, and whence there is at certain seasons of the year uninterrupted water carriage to the mouth of the Niger. The development of trade was further facilitated in the early days of the British occupation by the building of a light railway from Barijuko, a point on the Kaduna river below Wushishi, to Zungeru. This line was superseded by the construction, in 1907–1909, of a 3 ft. 6 in. railway from Baro, a port on the lower Niger, to Zungeru, whence the line was continued to Zaria.

The taxation scheme introduced by the British administration works satisfactorily, and the revenue shows a regular surplus. Courts of justice have been established in the administrative districts. In 1904 Zaria suffered from the misfortune of a famine, but excellent harvests restored prosperity in the following year, and the province shows every sign of contentment under existing rule. The main artery of commerce which runs from Zaria to Wushishi has been rendered not only safe and peaceful, but has been made so much more commodious by the construction of a good road and by the bridging of the river that the north and south trade is steadily increasing. The local movements of trade throughout the province are also greater.

A large portion of the province is occupied by pagan tribes, especially in the south and the south-west. These districts require more direct British supervision than the Fula districts, in which the native administration, under British control, is fairly efficient. The creation of an administrative division at Kachia with a British station and garrison at Kachia town had an excellent effect, and the resident was able to report in 1905 that "the inhabitants of the once dangerous pagan districts now buy cloth, kolas and salt from the traders in exchange for mats, rubber, palm oil and corn, instead of seizing these articles as they formerly did." (F. L. L.)

ZARLINO, GIOSEFFO (1517–1590), Italian musical theorist, surnamed from his birthplace ZARLINUS CLODIENSIS, was born at Chioggia, Venetia, in 1517 (not 1540, as Burney and Hawkins say). Studying in his youth for the Church, he was admitted to the minor orders in 1539 and ordained deacon in 1541 at Venice; but he soon devoted himself entirely to the study of music under the guidance of Adrian Willaert, then choirmaster at St Mark's. Willaert, dying in 1562, was succeeded by Cipriano di Rore, on whose removal to Parma in 1565 Zarlino was elected choirmaster. Though now remembered chiefly for invaluable contributions to the theory of music, it is evident that he must have been famous both as a practical musician and as a composer; for, notwithstanding the limited number of his printed works, consisting of a volume entitled *Modulationes Sex Vocum* (Venice, 1566), and a few motets and madrigals scattered through the collections of Scotto and other contemporary publishers, he both produced and superintended the public performance of some important pieces in the service of the republic. First among these was the music written to celebrate the battle of Lepanto (on the 7th of October 1571). Again, when Henry III. of France passed through Venice on his return from Poland in 1574, Zarlino directed on board the "Bucentaur" the performance of an ode for which he himself had composed the music, to verses supplied by Rocco Benedetti and Cornelio Frangipani. The ode was followed by a solemn service in St Mark's, in which Zarlino's music formed a prominent feature, and the festival concluded with the representation of a dramatic piece entitled *Orfeo* composed by Zarlino. When the church of S. Maria della Salute was founded in 1577 to commemorate the plague, he composed a solemn mass for the occasion. No one of these works is now known to be in existence; the only example we possess of Zarlino's compositions on a grand scale is a MS. mass for four voices, in the library of the Philharmonic Lyceum at Bologna. He died at Venice on the 14th, or according to some the 4th, of February 1590.

Zarlino's first theoretical work was the *Istitutioni Armoniche* (Venice, 1558; reprinted 1562 and 1573). This was followed by the *Dimostrationi Armoniche* (Venice, 1571; reprinted 1573) and by the *Sopplimenti Musicali* (Venice, 1588). Finally, in a complete edition of his works published shortly before his death Zarlino reprinted these three treatises, accompanied by a *Tract on Patience*, a *Discourse on the True date of the Crucifixion of Our Lord*, an essay on *The Origin of the Capuchins*, and the *Resolution of Some Doubts Concerning the Correction of the Julian Calendar* (Venice, 1589).[1]

The *Istitutioni* and *Dimostrationi Armoniche* deal, like most other theoretical works of the period, with the whole science of music as it was understood in the 16th century. The earlier chapters, treating chiefly of the arithmetical foundations of the science, differ but little in their line of argument from the principles laid down by Pietro Aron, Zacconi, and other early writers of the Boeotian school; but in bk. ii. of the *Institutioni* Zarlino boldly attacks the false system of tonality to which the proportions of the Pythagorean tetrachord, if strictly carried out in practice, must inevitably lead. The fact that, so far as can now be ascertained, they never were strictly carried out in the Italian medieval schools, at least after the invention of counterpoint, in no wise diminishes the force of the reformer's argument. The point at issue was, that neither in the polyphonic school, in which Zarlino was educated, nor in the later monodic school, of which his recalcitrant pupil, Vincenzo Galilei, was the most redoubtable champion, could those proportions be tolerated in practice, however attractive they might be to the theorist in their mathematical aspect. So persistently does the human ear rebel against the division of the tetrachord into two greater tones and a leimma or hemitone, as represented by the fractions $\frac{8}{9}$, $\frac{8}{9}$, $\frac{243}{256}$, that, centuries before the possibility of reconciling the demands of the ear with those of exact science was satisfactorily demonstrated, the Aristoxenian school advocated the use of an empirical scale, sounding pleasant to the sense, in preference to an unpleasing tonality founded upon immutable proportions. Didymus, writing in the year 60, made the first step towards establishing this pleasant-sounding scale upon a mathematical basis, by the discovery of the lesser tone; but unhappily he placed it in a false position below the greater tone. Claudius Ptolemy (130) rectified this error, and in the so-called syntonous or intense diatonic scale reduced the proportions of his tetrachord to $\frac{8}{9}$, $\frac{9}{10}$, $\frac{15}{16}$,—*i.e.* the greater tone, lesser tone, and diatonic semitone of modern music.[2] Ptolemy set forth this system as one of eight possible forms of the diatonic scale. But Zarlino uncompromisingly declared that the syntonous or intense diatonic scale was the only form that could reasonably be sung; and in proof of its perfection he exhibited the exact arrangement of its various diatonic intervals, to the fifth inclusive, in every part of the diapason or octave. The proportions are precisely those now universally accepted in the system called "just intonation." But this system is practicable only by the voice and instruments of the violin class. For keyed or fretted instruments a compromise is indispensable. To meet this exigency, Zarlino proposed that for the lute the octave should be divided into twelve equal semitones; and after centuries of discussion this system of "equal temperament" has, within the last thirty-five years, been universally adopted as the best attainable for keyed instruments of every description.[3]

Again, Zarlino was in advance of his age in his classification of the ecclesiastical modes. These scales were not, as is vulgarly supposed, wholly abolished in favour of our modern tonality in the 17th century. Eight of them, it is true, fell into disuse; but the medieval Ionian and Hypo-ionian modes are absolutely identical with the modern natural scale of C; and the Aeolian and Hypo-aeolian modes differ from our minor scale, not in constitution, but in treatment only. Medieval composers, however, regarded the Ionian mode as the least perfect of the series and placed it last in order. Zarlino thought differently and made it the first mode, changing all the others to accord with it. His numerical table, therefore, differs from all others made before or since, prophetically assigning the place of honour to the one ancient scale now recognized as the foundation of the modern tonal system.

These innovations were violently opposed by the apostles of the monodic school. Vincenzo Galilei led the attack in a tract entitled *Discorso Intorno alle Opere di Messer Gioseffe Zarlino*, and followed it up in his famous *Dialogo*, defending the Pythagorean system in very unmeasured language. It was in answer to these strictures that Zarlino published his *Sopplementi*.

ZARNCKE, FRIEDRICH KARL THEODOR (1825–1891), German philologist, was born on the 7th of July 1825 at Zahrenstorf, near Brüel, in Mecklenburg, the son of a country pastor. He was educated at the Rostock gymnasium, and studied (1844–1847) at the universities of Rostock, Leipzig and Berlin. In 1848 he was employed in arranging the valuable library of Old German literature of Freiherr Karl Hartwig von Meusebach (1781–1847), and superintending its removal from Baumgartenbrück, near Potsdam, to the Royal Library at Berlin. In 1850 he founded at Leipzig the *Literarisches Centralblatt für Deutschland*. In 1852 he established himself as *Privatdozent* at the university of Leipzig, and published an excellent edition of Sebastian Brant's *Narrenschiff* (1854), a treatise *Zur Nibelungenfrage* (1854), followed by an edition of the *Nibelungenlied* (1856, 12th ed. 1887), and *Beiträge zur Erläuterung und Geschichte des Nibelungenliedes* (1857). In 1858 he was appointed full professor, and commenced a series of noteworthy studies on medieval literature, most of which were published in the reports (*Berichte*) of the Saxon Society of Sciences. Among them were that on the old High German poem *Muspilli* (1866); *Gesang vom heiligen Georg* (1874); the legend of the *Priester Johannes* (1874); *Der Graltempel* (1876), and the *Annolied* (1887). He also wrote a valuable treatise on Christian Reuter (1884), on the portraits of Goethe (1884), and published the history of Leipzig university, *Die urkundlichen Quellen zur Geschichte der Universität Leipzig* (1857) and *Die deutschen Universitäten im Mittelalter* (1857). Two volumes of his *Kleine Schriften* appeared in 1897.

See *Zur Erinnerung an den Heimgang von Dr Friedrich Zarncke* (1891); Franz Vogt in *Zeitschrift für deutsche Philologie*; Eduard Zarncke in *Biographisches Jahrbuch für Altertumswissenschaft* (1895); and E. Sievers in *Allgemeine deutsche Biographie*.

ZEALAND (also Sealand or Seeland; Danish *Sjaelland*), the largest island of the kingdom of Denmark. It is bounded N. by the Cattegat, E. by the Sound, separating it from Sweden, and the Baltic Sea, S. by narrow straits separating it from Falster, Möen, and smaller islands, and W. by the Great Belt, separating it from Fünen. Its nearer point to Sweden is 3 m., to Fünen 11. Its greatest extent from N. to S. is 82 m., from E. to W. 68 m., but the outline is very irregular. The area is 2636 sq. m. The surface is for the most part undulating, but on the whole little above sea-level; the highest elevations are in the south-east, where Cretaceous hills (the oldest geological formation on the island) reach heights of upwards of 350 ft. The coast is indented by numerous deep bays and fjords; the Ise Fjord in the north, with its branches the Roskilde Fjord on the east and the Lamme Fjord on the west, penetrates inland for about 25 m. There are no rivers of importance; but several large lakes, the most considerable being Arre and Esrom, occur in the north-east. The soil is fertile and produces grain, especially rye and barley, in great abundance, as well as potatoes and other vegetables, and fruit. The scenery, especially in the neighbourhood of the fjords, is pleasant, lacking the barrenness of some portions of the kingdom.

Zealand is divided into five *amter* (counties). (1) Frederiksborg, in the north, named from the palace of Frederiksborg. In the north-east, where the coast approaches most nearly to Sweden, is Helsingör or Elsinore. (2) Kjöbenhavn, south of Frederiksborg. The capital is that of the kingdom, Copenhagen (Kjöbenhavn). The only other town of importance is the old cathedral city of Roskilde on the fjord of that name. Off the little port of Kjöge in the south the Danes under Nils Juel defeated the Swedes in 1677, and in another engagement in 1710 the famous Danish commander Hvitfeldt sank with his ship. (3) Holbaek, west of Kjöbenhavn. The chief town, Holbaek, lies on an arm of the Ise Fjord. In the west is the port of Kallundberg, with regular communication by steamer with Aarhus in Jutland. It has a singular Romanesque church of the 12th century. The district is diversified with small lakes, as the Tüs Sö. (4) Sorö, occupying the south-western part of the island. The chief town, Sorö, lies among woods on the small Sorö lake. It was formerly the seat of a university, and remains an important educational centre. Its church, of the

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[1] Ambros mentions an edition of the *Istitutioni* dated 1557, and one of the *Dimostrationi* dated 1562. The present writer has never met with either.

[2] We have given the fractions in the order in which they occur in the modern system. Ptolemy, following the invariable Greek method, placed them thus—$\frac{15}{16}$, $\frac{8}{9}$, $\frac{9}{10}$. This, however, made no difference in the actual proportions.

[3] It was first used in France, for the organ, in 1835; in England, for the pianoforte in 1846 and for the organ in 1854. Bach had advocated it in Germany a century earlier; but it was not generally adopted.

12th century, contains the tombs of the poet Holberg (d. 1754) and of some of the Danish kings. Slagelse in the west, an agricultural centre, is an ancient town dating back to the 12th century. Here Hans Christian Andersen, the poet, received part of his education. Korsör is an important seaport. (5) Praestö, the most southerly county. The capital, Praestö, is a small port on the inner lagoon of a bay of this name, on the east coast. In the west is the ancient town of Naestved; in the south, Vordingborg, with a ruined castle and a small harbour. The railway here crosses a great bridge on to the small Masnedö, whence there is a ferry to Orehöved on Falster island, a link in the direct route between Copenhagen and Berlin.

ZEBRA, the name used for all the striped members of the horse-tribe, although properly applicable only to the true or mountain zebra. The latter species (*Equus zebra*) inhabits the mountainous regions of the Cape Colony, where, owing to the advances of civilized man into its restricted range it has become very scarce, and is even threatened with extermination, but it exists in the form of a local race in Angola. The second species, Burchell's zebra (*Equus burchelli*), is represented by a large number of local races, ranging from the plains north of the Orange river to north-east Africa.

Equus zebra is the smaller of the two (about 4 ft. high at the shoulders), and has longer ears, a tail more scantily clothed with hair, and a shorter mane. The general ground colour is white, and the stripes are black; the lower part of the face is bright brown. With the exception of the abdomen and the inside of the thighs, the whole of the surface is covered with stripes, the legs having narrow transverse bars reaching quite to the hoofs, and the base of the tail being also barred. The outsides of the ears have a white tip and a broad black mark occupying the greater part of the surface, but are white at the base. Perhaps the most constant and obvious distinction between this species and the next is the arrangement of the stripes on the hinder part of the back, where there are a number of short transverse bands reaching to the median longitudinal dorsal stripe, and unconnected with the uppermost of the broad stripes which pass obliquely across the haunch from the flanks towards the root of the tail. There is often a median longitudinal stripe under the chest.

Typically, Burchell's zebra, or the bonte-quagga (*Equus burchelli*), is a rather larger and more robust animal, with smaller ears, a longer mane, and fuller tail. The general ground-colour of the body is pale yellowish brown, the limbs nearly white, the stripes dark brown or black. In the typical form the stripes do not extend on to the limbs or tail; but there is a great variation in this respect, and as we proceed north the striping increases, till in the north-eastern *E. burchelli granti* the legs are striped to the hoofs. There is a strongly marked median longitudinal ventral black stripe, to which the lower ends of the transverse side stripes are usually united, but the dorsal stripe (also strongly marked) is completely isolated in its posterior half, and the uppermost of the broad haunch stripes runs nearly parallel to it. A much larger proportion of the ears is white than in the other species. In the middle of the wide intervals between the broad black stripes of the flanks and haunches fainter stripes are generally seen. It is closely allied to the quagga, but the typical form, in which the resemblance is closest, is extinct. The Abyssinian and Somali Grévy's zebra (*E. grevyi*) is markedly distinguished by its enormous ears and more numerous and narrower black stripes. The flesh of Burchell's zebra (or quagga, as it is often called) is relished by the natives as food, and its hide is very valuable for leather. Although the many attempts that have been made to break in and train zebras for riding and driving have sometimes been rewarded with partial success, the animal has never been domesticated in the true sense of the word (see Horse).
(W. H. F.; R. L.*)

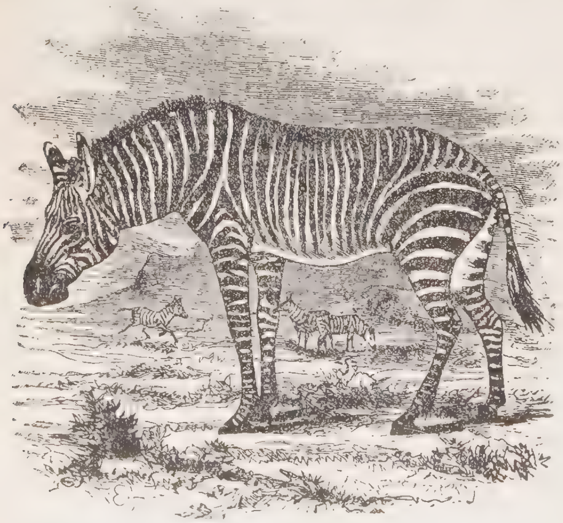

Fig. 1.—The True or Mountain Zebra (*Equus zebra*).

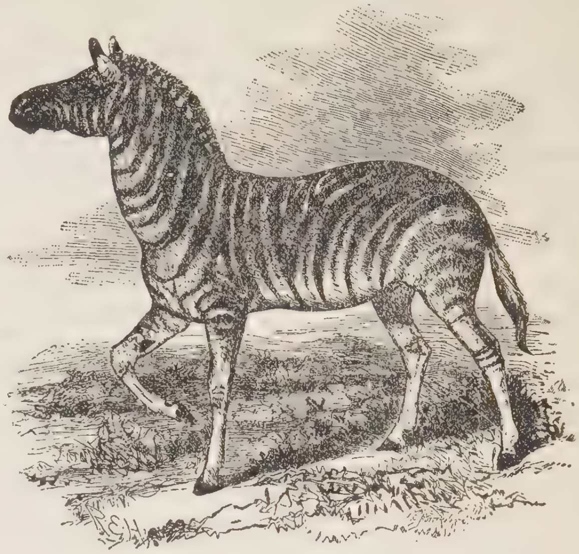

Fig. 2.—Burchell's Zebra (*E. burchelli*).

ZEBULUN, a tribe of Israel, named after Jacob's sixth "son" by Leah. The narrator of Gen. xxx. 20 offers two etymologies of the name, from the roots *z–b–d*, "give," and *z–b–l*, "exalt (?)."[1] The country of Zebulun lay in the fertile hilly country to the north of the plain of Jezreel, which forms the first step towards the mountains of Asher and Naphtali, and included the goodly upland plain of el-Baṭṭōf. The description of its boundaries is obscure, owing in some measure to its position between Issachar and Naphtali, with one or the other of which it is frequently combined. At one period Zebulun, like Dan and Asher (Judges v. 17), would seem to have reached the sea and bordered on Phoenician territory (Gen. xlix. 13, Deut. xxxiii. 18 seq.). In the latter passage allusion is made to a feast upon a sacred mountain held by Zebulun and Issachar in common, and to the wealth these tribes derived from commerce by sea. Zebulun had a chief part in the war with Sisera (Judges iv. 6, v. 18; see Deborah); it is said to have furnished at least one of the "judges," Elon the Zebulonite (Judges xii. 11 seq.); and the prophet Jonah, who foretold the victories of Jeroboam II., came from the border town of Gath-hepher (probably the modern el-Meshhed) (2 Kings xiv. 25). The deportation of the northern tribes under Tiglath Pileser IV. (2 Kings xv. 29) appears to have included Zebulun (Isa. ix. 1). Nazareth lay within the territory of Zebulun but is not mentioned in the Old Testament. (S. A. C.)

ZECHARIAH, son of Berechiah, son of Iddo (or by contraction, son of Iddo), a prophet of the Old Testament. He appeared in Jerusalem along with Haggai (*q.v.*), in the second year of Darius Hystaspis (520 B.C.), to warn and encourage the

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[1] A connexion with a divine name (cf. Baal-Zebul) is not improbable; see H. W. Hogg, *Ency. Bib.*, art. "Zebulun."

Jews to address themselves at length to the restoration of the Temple.[1] Supported by the prophets, Zerubbabel and Joshua set about the work, and the elders of Judah built and the work went forward (Ezra v. 1 seq., vi. 14). The first eight chapters of the book of Zechariah exactly fit into this historical setting. They are divided by precise chronological headings into three sections—(*a*) chap. i. 1–6, in the eighth month of the second year of Darius; (*b*) chap. i. 7–vi. 15, on the twenty-fourth day of the eleventh month of the same year; (*c*) chap. vii.–viii., on the fourth day of the ninth month of the fourth year of Darius. The first section is a preface containing exhortation in general terms. The main section is the second, containing a series of night visions, the significant features of which are pointed out by an angel who stands by the prophet and answers his questions.

i. 7–17. The divine chariots and horses that make the round of the world by Yahweh's orders return to the heavenly palace and report that there is still no movement among the nations, no sign of the Messianic crisis. Seventy years have passed, and Zion and the cities of Judah still mourn. Sad news! but Yahweh gives a comfortable assurance of His gracious return to Jerusalem and the rebuilding of His temple.

i. 18–21 (Heb. ii. 1–4). Four horns, representing the hostile world-power that oppresses Israel and Jerusalem, are cast down by four smiths.

ii. 1–13 (Heb. ii. 5–17). The new Jerusalem is laid out with the measuring line. It is to have no walls, that its population may not be limited, and it needs none, for Yahweh is its protection. The catastrophe of "the land of the north" is near to come; then the exiles of Zion shall stream back from all quarters, the converted heathen shall join them, Yahweh Himself will dwell in the midst of them, and even now He stirs Himself from His holy habitation.

iii. 1–10. The high priest Joshua is accused before Yahweh by Satan, but is acquitted and given rule in Yahweh's house and courts, with the right of access to Yahweh in priestly intercession. The restoration of the temple and its service is a pledge of still higher things. The promised "branch" (or "shoot," *ṣĕmaḥ*), the Messiah, will come; the national kingdom is restored in its old splendour; and a time of general felicity dawns, when every man shall sit happy under his vine and under his fig tree. As by rights the Messianic kingdom should follow immediately on the exile, it is probable that the prophet designs to hint in a guarded way that Zerubbabel, who in all other places is mentioned along with Joshua, is on the point of ascending the throne of his ancestor David. The jewel with seven facets is already there, the inscription only has still to be engraved on it (iii. 9). The charges brought against the high priest consist simply in the obstacles that have hitherto impeded the restoration of the temple and its service; and in like manner the guilt of the land (iii. 9) is simply the still continuing domination of foreigners.

iv. 1–14. Beside a lighted golden candlestick of seven branches stand two olive trees—Zerubbabel and Joshua, the two anointed ones—specially watched over by Him whose seven eyes run through the whole earth. This explanation of the vision is separated from the description by an animated dialogue, not quite clear in its expression, in which it is said that the mountain of obstacles shall disappear before Zerubbabel, and that, having begun the building of the temple, he shall also bring it to an end in spite of those who now mock at the day of small beginnings.

v. 1–4. A written roll flies over the Holy Land; this is a concrete representation of the curse which in future will fall of itself on all crime, so that, *e.g.*, no man who has suffered theft will have occasion himself to pronounce a curse against the thief (cf. Judges xvii. 2).

v. 5–11. Guilt, personified as a woman, is cast into an ephah-measure with a heavy lid and carried from Judah to Chaldaea, where it is to have its home for the future.

vi. 1–8. The divine teams, four in number, again traverse the world toward the four winds, to execute Yahweh's commands. That which goes northward is charged to wreak His anger on the north country. The series of visions has now reached its close, returning to its starting-point in i. 7 sqq.

An appendix follows (vi. 9–15). Jews from Babylon have brought gold and silver to Jerusalem; of these the prophet must make a crown designed for the "branch" who is to build Yahweh's house and sit king on the throne, but retain a good understanding with the high priest. Zerubbabel is certainly meant here, and, if the received text names Joshua instead of him (vi. 11), this is only a correction, made for reasons easy to understand, which breaks the context and destroys the sense and the reference of "them both" in verse 13.

The third section (chaps. vii.–viii.), dated from the fourth year of Darius, contains an inquiry whether the fast days that arose in the captivity are still to be observed, with a comforting and encouraging reply of the prophet.

Thus throughout the first eight chapters the scene is Jerusalem in the early part of the reign of Darius.[2] Zerubbabel and Joshua, the prince and the priest, are the leaders of the community. The great concern of the time and the chief practical theme of these chapters is the building of the temple; but its restoration is only the earnest of greater things to follow, viz., the glorious restoration of David's kingdom. The horizon of these prophecies is everywhere limited by the narrow conditions of the time, and their aim is clearly seen. The visions hardly veil the thought, and the mode of expression is usually simple, except in the Messianic passages, where the tortuousness and obscurity are perhaps intentional. Noteworthy is the affinity between some notions evidently not first framed by the prophet himself and the prologue to Job—the heavenly hosts that wander through the earth and bring back their report to Yahweh's throne, the figure of Satan, the idea that suffering and calamity are evidences of guilt and of accusations presented before God.

Passing from chaps. i.–viii. to chaps. ix. seq., we at once feel ourselves transported into a different world.

(1) Yahweh's word is accomplished on Syria-Phoenicia and Philistia; and then the Messianic kingdom begins in Zion, and the Israelites detained among the heathen, Judah and Ephraim combined, receive a part in it. The might of the sons of Javan is broken in battle against this kingdom (ch. ix.). After an intermezzo of three verses (x. 1–3: "Ask rain of Yahweh, not of the diviners") a second and quite analogous Messianic prophecy follows. The foreign tyrants fall; the lordship of Assyria and Egypt has an end; the autonomy and martial power of the nation are restored. The scattered exiles return as citizens of the new theocracy, all obstacles in their way parting asunder as when the waves of the Red Sea gave passage to Israel at the founding of the old theocracy (x. 3–12). Again there is an interlude of three verses (xi. 1–3): fire seizes the cedars of Lebanon and the oaks of Bashan.[3]

(2) The difficult passage about the shepherds follows. The shepherds (rulers) of the nation make their flock an article of trade and treat the sheep as sheep for the shambles. Therefore the inhabited world shall fall a sacrifice to the tyranny of its kings, while Israel is delivered to a shepherd who feeds the sheep for those who make a trade of the flock (כנעניי הצאן, xi. 7, 11 = "they that sell them," ver. 5) and enters on his office with two staves, "Favour" and "Union." He destroys "the three shepherds" in one month, but is soon weary of his flock and the flock of him. He breaks the staff "Favour," *i.e.* the covenant of peace with the nations, and asks the traders for his hire. Receiving thirty pieces of silver, he casts it into the temple treasury and breaks the staff "Union," *i.e.* the brotherhood between Judah and Israel. He is succeeded by a foolish shepherd, who neglects his flock and lets it go to ruin. At length Yahweh intervenes; the foolish shepherd falls by the sword; two-thirds of the people perish with him in the Messianic crisis, but the remnant of one-third forms the seed of the new theocracy (xi. 4–17 taken with xiii. 7–9, according to the necessary transposition proposed by Ewald). All this must be an allegory of past events, the time present to the author and his hopes for the future beginning only at xi. 17, xiii. 7–9.

(3) Chap. xii. presents a third variation on the Messianic promise. All heathendom is gathered together against Jerusalem and perishes there. Yahweh first gives victory to the countryfolk of Judah and then they rescue the capital. After this triumph the noblest houses of Jerusalem hold, each by itself, a great lamentation over a martyr "whom they have pierced" (or "whom men have

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[1] The alleged foundation of the second temple in 536 (Ezra iii. 8–13; cf. iv. 1–5, 24) is open to doubt, because (*a*) the statements of the compiler of Ezra are not contemporary evidence, (*b*) the contemporary Haggai and Zechariah seem to imply that this work first began in 520 (Hag. ii. 18; Zech. viii. 9; cf. Ezra v. 2). If, on the ground of Ezra v. 16, we accept the truth of an original foundation in 536 (so Driver, *Minor Prophets*, p. 148), that event was admittedly formal only and without success, so that the real beginning was made in 520. Wellhausen (*Isr. und Jüd. Gesch.*, 3rd ed., p. 160) rejects the earlier foundation; on the other hand, he insists, with the majority of scholars and against Kosters, on the actual return of exiles in 537 to form the nucleus of the post-exilic community (*loc. cit.*, p. 157 *n.*).

[2] The historical occasion of the emergence of Haggai and Zechariah was supplied by the series of revolts following the succession of Darius in 522 (cf. Driver, *op. cit.*, p. 150). His reconquest of Babylon in 520 may, in particular, have seemed the prelude to the Messianic age (Wellhausen, *Gesch.*, p. 161 *n.*).

[3] "The cedars of Lebanon, the oaks of Bashan, the forest of Jordan represent the national might of the heathen kingdoms" (Wellh., *Die Kl. Proph.*, 3rd ed., p. 192).

pierced"). It is taken for granted that the readers will know who the martyr is, and the exegesis of the Church applies the passage to our Lord. Chap. xiii. 1–6 is a continuation of chap. xii.; the dawn of the day of salvation is accompanied by a general purging away of idolatry and the enthusiasm of false prophets.

(4) Yet a fourth variation of the picture of the incoming of the Messianic deliverance is given in chap. xiv. The heathen gather against Jerusalem and take the city, but do not utterly destroy the inhabitants. The Yahweh, at a time known only to Himself, shall appear with all His saints on Mount Olivet and destroy the heathen in battle, while the men of Jerusalem take refuge in their terror in the great cleft, that opens where Yahweh sets His foot. Now the new era begins, and even the heathen do homage to Yahweh by bringing due tribute to the annual feast of tabernacles. All in Jerusalem is holy down to the bells on the horses and the cooking-pots.

There is a striking contrast between chaps. i.–viii. and chaps. ix.–xiv. The former prophecy is closely linked to the situation and wants of the community of Jerusalem in the second year of Darius I., and relates to the restoration of the temple and, perhaps, the elevation of Zerubbabel to the throne of David. In chaps. ix.–xiv., however, "there is nothing about the restoration of the temple, or about Joshua and Zerubbabel; but we read of the evil rulers, foreign and native alike, who maltreat their subjects, and enrich themselves at their expense.[1] There are corresponding differences in style and speech, and it is particularly to be noted that, while the superscriptions in the first part name the author and give the date of each oracle with precision, those in the second part (ix. i., xii. 1) are without name or date. That both parts do not belong to the same author is now generally admitted, as is also the fact that chaps. ix.–xiv. are of much later date.[2] The predictions of these chapters have no affinity either with the prophecy of Amos, Hosea and Isaiah, or with that of Jeremiah. The kind of eschatology which we find in Zech. ix.–xiv. was first introduced by Ezekiel, who in particular is the author of the conception that the time of deliverance is to be preceded by a joint attack of all nations on Jerusalem, in which they come to final overthrow (Ezek. xxxviii. seq.; Isa. lxvi. 18–24; Joel). The importance attached to the temple service, even in Messianic times (Zech. xiv.), implies an author who lived in the ideas of the religious commonwealth of post-exile times. A future king is hoped for; but in the present there is no Davidic king, only a Davidic family standing on the same level with other noble families in Jerusalem (xii. 7, 12). The "bastard" (mixed race) of Ashdod reminds us of Neh. xiii. 23 sqq.; and the words of ix. 12 ("to-day, also, do I declare that I will render double unto thee") have no sense unless they refer back to the deliverance from Babylonian exile. But the decisive argument is that in ix. 13 the sons of Javan, *i.e.* the Greeks, appear as the representatives of the heathen world-power. This part of the prophecy, therefore, is later than Alexander, who overthrew the Persian empire in 333. Egypt and Assyria (x. 10, 11) must be taken to represent the Ptolemaic and Seleucid kingdoms, which together made up for the Jews the empire of the sons of Javan.[3]

The whole prophecy, however, is not a unity. By reference to the analysis given above, it will be seen that there are four sections in Zech. ix.–xiv., viz. (1) ix., x. (xi. 1–3); (2) xi. 4–17, xiii. 7–9; (3) xii., xiii. 1–6; (4) xiv., which are more or less independent of each other. Of these (3) and (4) are of marked eschatological character, and show little contact with definite historical events (except xii. 7, which suggests the Maccabean age). On the other hand (1) implies a period when the Jews were governed by the Seleucids, since it is against these that the anger of Yahweh is first directed (ix. 1, 2).[4] This section, therefore, belongs to the first third of the 2nd century B.C., when the Jews were first held in the power of the Seleucids.[5] The same date may be assigned to (2), where the traffickers in the sheep may be regarded as the Seleucid rulers, and the shepherds as the Jewish high priests and ethnarchs; the prelude to the Maccabean revolt largely consisted of the rapid and violent changes here figured. In particular, the evil shepherd of xi. 15 f. may be Menelaus; whilst the disinterested speaker may be Hyrcanus ben Tobias (cf. xi. 13 and II. Macc. iii. 11).

Recent criticism (for further details see G. A. Smith, *The Book of the Twelve Prophets*, ii. pp. 450 f., and Driver, *Minor Prophets*, pp. 232–234) shows some difference of opinion as to the question of unity, and also of actual date within the Greek period. Whilst G. A. Smith (following Stade) and Marti find no adequate ground for the further division of Zech. ix.–xiv., Driver (following Nowack) accepts the fourfold division indicated above ("Four anonymous Prophecies, perhaps the work of four distinct Prophets," *op. cit.*, p. 235). In regard to date, G. A. Smith (here also following Stade) accepts the earlier part of the Greek period (306–278). With this Driver provisionally agrees, whilst Nowack thinks no more can be said than that (1) belongs to the Greek and (2)–(4) to the post-exilic period in general. On the other hand, Marti assigns the whole to 160 B.C. (Maccabean period; a little later than Wellhausen) and sees a number of references to historical personages of that age. The chief arguments to be urged against this late date are the character of the Hebrew style (Driver, *op. cit.*, p. 233) and the alleged close of the prophetic canon by 200; but perhaps neither of these can be regarded as very convincing.

RECENT LITERATURE.—Nowack, *Die Kleinen Propheten* (1897; ed. 2, 1903); Wellhausen, *Die Kleinen Propheten*,[3] (1898); G. A. Smith, *The Book of the Twelve Prophets* (in *The Expositor's Bible*), vol. ii. (pp. 253–328, 447–490) (1898); Marti, *Dodekapropheton*, ii. (1904); Driver, *Minor Prophets*, ii. (in *The Century Bible*, 1906; the most useful for the general reader). The article in Hastings's *Dictionary of the Bible* (vol. iv., pp. 967–970) (1902), by Nowack, is a reproduction from his work cited above; the article in the *Ency. Bibl.* by Wellhausen is a revision of his article in the 9th edition of the *Ency. Brit.*, and the present independent revision is in some points indebted to it. (J. WE.; H. W. R.*)

ZEDEKIAH (Hebrew for "righteousness of Yah[weh]"), son of Josiah, and the last king of Judah (2 Kings xxiv. 17 sqq.; 2 Chron. xxxvi. 10 seq.). Previously known as Mattaniah ("gift of Yah[weh]"), he was appointed king by Nebuchadrezzar after the capture of Jerusalem (597 B.C.) and his name changed to Zedekiah. He held his position under an oath of allegiance, but after three years (cf. Jehoiakim, 2 Kings xxiv. 1) began an intrigue with Moab, Edom, Ammon, Tyre and Sidon, which the prophet Jeremiah vigorously denounced (Jer. xxvii. seq.; cf. also Ezek. xvii. 11–21). It is possible that he was summoned to Babylon to explain his conduct (Jer. li. 59; the Septuagint reads "*from* Zedekiah"; see also xxix. 3). Nevertheless, relations were maintained with Egypt and steps were taken to revolt. The Babylonian army began to lay siege to Jerusalem in the ninth year of his reign, and a vain attempt was made by Pharaoh Hophra to cause a diversion. The headings to the prophecies in Ezek. xxix. sqq. suggest that fuller details of the events were once preserved, and the narratives in Jer. xxxii.–xxxiv., xxxvii. give some account of the internal position in Jerusalem at the time. After six months a breach was made in the city, Zedekiah's flight was cut off in the Jordan Valley and he was taken to Nebuchadrezzar at Riblah. His sons were killed, and he was blinded and carried to Babylon in chains (cf. Ezek. xii. 10–14). Vengeance was taken upon Jerusalem, and, on the seventh day of the fifth month, 586 B.C., Nebuzaradan sacked the temple, destroyed the walls and houses, and deported the citizens, only the poorest peasantry of the land being left behind. See JEWS (HISTORY), § 17 seq. (S. A. C.)

ZEEHAN, a town of Montagu county, Tasmania, 225 m. direct N.W. of Hobart, on the Little Henty river. Pop. (1901) 5014. It is an important railway centre, and from it radiate lines to Strahan, its port on the Macquarie Harbour, to Dundas, to Williamsford, and to Burnie, where connexion is made to

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[1] Driver, *op. cit.*, p. 229, who also refers to the differences of Messianic outlook, and the substitution of an atmosphere of war for one of peace.

[2] Earlier critics made the second part the older. Chaps. ix.–xi. were ascribed to a contemporary of Amos and Hosea, about the middle of the 8th century B.C., because Ephraim is mentioned as well as Judah, and Assyria along with Egypt (x. 10), while the neighbours of Israel appear in ix. 1 sq. in the same way as in Amos i.–ii. That chaps. xii.–xiv. also were pre-exilic was held to appear especially in the attack on idolatry and lying prophecy (xiii. 1–6); but, as this prophecy speaks only of Judah and Jerusalem, it was dated after the fall of Samaria, and assigned to the last days of the Judaean kingdom on the strength of xii. 11, where an allusion is seen by some to the mourning for King Josiah, slain in battle at Megiddo.

[3] What follows is summarized from Wellhausen, *Die Kleinen Propheten*, pp. 190, 192, 195–197.

[4] Hadrach, *i.e* the Assyrian Hatarika, apparently denotes a district S. of Hamath (between Palmyra and the Mediterranean).

[5] Wellhausen, *Sketch of the History of Israel and Judah*, pp. 137, 139.

Launceston and Hobart. The town is lighted by electricity and has an academy of music and a state-aided school of mines. It is the principal centre of the silver-lead mining district, and has large smelting works.

ZEELAND (or Zealand), a province of Holland, bounded S.E. and S. by Belgium, W. by the North Sea, N. by South Holland, and E. by North Brabant. It has an area of 690 sq. m. and a population (1905) of 227,292. Zeeland consists of the delta islands formed about the estuaries of the Maas and Scheldt with its two arms, the Honte or Western Scheldt, and the Ooster Scheldt, together with a strip of mainland called Zeeland-Flanders. The names of the islands are Schouwen and Duiveland, St Filipsland, Tolen, North Beveland, South Beveland and Walcheren. The history of these islands is in every case one of varying loss and gain in the struggle with the sea. They were built up by the gradual accumulation of mud deposits in a shallow bay, separated by dunes from the North Sea. As late as the 12th and 13th centuries each of these islands consisted of several smaller islands, many of whose names are still preserved in the fertile *polders* which have taken their place. Lying for the most part below sea-level, the islands are protected by a continuous line of artificial dikes, which hide them from view on the seaward side, whence only an occasional church steeple is seen. The islands of Schouwen and Duiveland are united owing to the damming of the Dykwater; St Filipsland, or Philipsland, and South Beveland are connected with the mainland of North Brabant by naturally formed mud banks.

The soil of Zeeland consists of a fertile sea clay which especially favours the production of wheat; rye, barley (for malting), beans and peas, and flax are also cultivated. Cattle and swine are reared, and dairy produce is largely exported; but the sheep of the province are small and their wool indifferent. The industries (linen, yarn-spinning, distilling, brewing, salt-refining, shipbuilding) are comparatively unimportant. The inhabitants, who retain many quaint and archaic peculiarities of manner and dress, speak the variety of Dutch known as Low Frankish.

The chief towns on the island of Schouwen are the ports of Zieriksee and Brouwershaven. On the well-wooded fringe of the dunes on the west side of the island are the two villages of Renesse and Haamstede, the seats in former days of the two powerful lordships of the same name. St Maartensdyk on the adjoining island of Tolen was formerly the seat of a lordship which belonged successively to the families of Van Borssele, Burren and Orange-Nassau. There is a monument of the Van Borsseles in the Reformed church. The castle built here in the first half of the 14th century was demolished in 1819. The island of South Beveland frequently suffered from inundations and experienced a particularly disastrous one in 1530. In the same century the flourishing walled town of Reimenswaal and the island of Borsele or Borssele disappeared beneath the waves; but the last-named was gradually recovered during the 17th century. This island gave its name to the powerful lordship of the same name. Goes is the chief town on South Beveland. Oyster-breeding is practised on the north coast of the island, especially at Wemeldinge and Ierseke or Yerseke. Ierseke was once a town of importance and the seat of a lordship, while at Wemeldinge there was formerly an establishment of the Templars. In 1866 South Beveland and Walcheren were joined by a heavy railway dam, a canal being cut through the middle of the former island to restore the connexion between the East and West Scheldt. South Beveland is sometimes called the "granary" and Walcheren the "garden" of Zeeland. The principal towns in Walcheren are Middelburg, the chief town of the province, Flushing and Veere; all three connected by a canal (1867–72) which divides the island in two. The fishing village of Arnemuiden flourished as a harbour in the 16th century, but decayed owing to the silting up of the sand. Domburg is pleasantly situated at the foot of the dunes on the west side of the island, and in modern times has become a popular but primitive watering-place. It is a very old town, having received civic rights in the 13th century, and from time to time Roman remains and other antiquities have been dug out of the sands. Between Domburg and the village of Westkapelle there stretches the famous Westkapelle sea-dike. The mainland of Zeeland-Flanders was formerly also composed of numerous islands which were gradually united by the accumulation of mud and sand, and in this way many once flourishing commercial towns, such as Sluis and Aardenburg, were reduced in importance. The famous castle of Sluis, built in 1385, was partly blown up by the French in 1794, and totally demolished in 1818. Yzendyke represents a Hanse town which flourished in the 13th century and was gradually engulfed by the sea. Similarly the original port of Breskens was destroyed by inundations in the 15th and 16th centuries. The modern town rose into importance in the 19th century on account of its good harbour. The old towns of Axel and Halst were formerly important fortresses, and as such were frequently besieged in the 16th, 17th and 18th centuries. Ter Neuzen was strongly fortified in 1833–39, and has a flourishing transit trade, as the port of Ghent, by the canal constructed in 1825–27.

ZEERUST, a town of the Transvaal, 149 m. by rail, via Krugersdorp, N.N.W. of Pretoria and 33 m. N.E. of Mafeking. Pop. (1904) 1945. It was founded in 1868 and is the chief town of the Marico district, one of the most fertile regions of South Africa. In the neighbourhood are lead, zinc and silver mines, and some 20 m. S. are the Malmani goldfields. The Marico Valley was occupied early in the 19th century by Matabele, who had come from Zululand. They were driven out by Boer trekkers in 1837. To Boer cultivation the valley of the Marico river owes its fertility. Wheat and oats are largely cultivated and almost all sub-tropical fruits flourish. Following the relief of Mafeking, 17th of May 1900, Zeerust was occupied by the British under General R. S. S. Baden-Powell. Railway connexion with Pretoria was established in 1907.

ZEISSBERG, HEINRICH, Ritter von (1839–1899), Austrian historian, was born in Vienna on the 8th of July 1839, and in 1865 became professor of history at the university of Lemberg. In 1871 he removed to Innsbruck; in 1873 he was appointed professor at the university of Vienna, and here he was historical tutor to the crown prince Rudolph. In 1891 he was made director of the Vienna institute for historical research, and in 1896 director of the imperial court library at Vienna. He resigned his professorial chair in 1897 and died on the 27th of May 1899.

Zeissberg's writings deal mainly with the history of Austria and of Poland, and among them the following may be mentioned:—*Die polnische Geschichtsschreibung des Mittelalters* (Leipzig, 1873); *Arno, erster Erzbischof von Salzburg* (Vienna, 1863); *Die Kriege Kaiser Heinrichs II. mit Herzog Boleslaw I. von Polen* (Vienna, 1868); *Rudolf von Habsburg und der österreichische Staatsgedanke* (Vienna, 1882); *Über das Rechtsverfahren Rudolfs von Habsburg gegen Ottokar von Böhmen* (Vienna, 1887); and *Der österreichische Erbfolgestreit nach dem Tode des Königs Ladislaus Posthumus*, 1457–58 (Vienna, 1879). Dealing with more recent times he wrote:—*Zur deutschen Kaiserpolitik Oesterreichs: ein Beitrag zur Geschichte des Revolutionsjahres 1795* (Vienna, 1899); *Zwei Jahre belgischer Geschichte 1791–92* (Vienna, 1891); *Belgien unter der Generalstatthalterschaft Erzherzog Karls 1793–94* (Vienna, 1893–94); *Erzherzog Karl von Oesterreich. Lebensbild* (Vienna, 1895); and *Franz Josef I.* (Vienna, 1888). He edited three volumes of the *Quellen zur Geschichte der Deutschen Kaiserpolitik Oesterreichs während der französischen Revolutionskriege 1790–1801* (Vienna, 1882–1885, 1890).

ZEITUN (="olive"), the name of several places in Turkey and Egypt, but principally an Armenian town in the Aleppo vilayet, altitude about 4000 ft., situated in the heart of Mt. Taurus, about 20 m. N.N.W. of Marash. The inhabitants, about 10,000, all Christians, are of a singularly fine physical type, though too much inbred, and are interesting from their character and historical position as a remnant of the kingdom of Lesser Armenia. The importance of Zeitun dates from the capture of Leo VI. by the Egyptians in 1375, and it probably became then a refuge for the more active and irreconcilable Armenians; but nothing certain is known of the place till 300 years later. It long maintained practical independence as a nest of freebooters, and it was only in 1878 that the Turks, after a long conflict, were enabled to station troops in a fort above the town. In 1890 there was a serious revolt, from the worst consequences of which the town was saved by the intercession of the British consul at Aleppo warned in time by the devoted energy of T. Christie, American missionary at Marash; and in 1895, after the Armenian massacres had commenced elsewhere, the people again rose, seized the fort, and, after holding out for more than three months against a large Turkish force, secured honourable terms of peace on the mediation of the consuls of the Powers at Aleppo. The inhabitants seem to be abandoning their robber customs and devoting themselves to oil and silk culture. In consequence transit trade through the passes of eastern Taurus (see MARASH), long almost annihilated by fear of the Zeitunli marauders, revived considerably. The governor must be a Christian, and certain other privileges are secured to the Zeitunlis during their good behaviour.

(D. G. H.)

ZEITZ, a town of Germany, in the extreme south of the Prussian province of Saxony, pleasantly situated on a hill on the Weisse (White) Elster, 28 m. by rail S.S.W. of Leipzig on the line to Gera, and with branches to Altenburg and Weissenfels. Pop. (1885) 19,797; (1900) 27,391. The river is here crossed by two iron bridges, and one stone and one timber bridge, and the upper and lower towns are connected by a funicular railway. The Gothic abbey church dates from the 15th century, but its Romanesque crypt from the 12th. The old Franciscan monastery, now occupied by a seminary, contains a library of 20,000 volumes. Just outside the town rises the Moritzburg, built in 1564 by the dukes of Saxe-Zeitz, on the site of the bishop's palace; it is now a reformatory and poorhouse. Zeitz has manufactures of cloth, cottons and other textiles, machinery, wax-cloth, musical instruments, vinegar, cigars, &c.; and wood-carving, dyeing and calico-printing are carried on. In the neighbourhood there are considerable deposits of lignite, and mineral-oil works.

Zeitz is an ancient place of Slavonic origin. From 968 till 1028 it was the seat of a bishopric, afterwards removed to Naumburg, 15½ m. to the N.W., and styled Naumburg-Zeitz. In 1564 the last Roman Catholic bishop died, and his dominions were thenceforward administered by princes of Saxony. From 1653 till 1718 Zeitz was the capital of the dukes of Saxe-Zeitz or Sachsen-Zeitz. It thereafter remained in the possession of the electors of Saxony until 1815, when it passed to Prussia.

See Rothe, *Aus der Geschichte der Stadt Zeitz* (Zeitz, 1876); and Lange, *Chronik des Bisthums Naumburg* (Naumburg, 1891).

ZELLER, EDUARD (1814–1908), German philosopher, was born at Kleinbottwar in Württemberg on the 22nd of January 1814, and educated at the university of Tübingen and under the influence of Hegel. In 1840 he was *Privatdozent* of theology at Tübingen, in 1847 professor of theology at Bern, in 1849 professor of theology at Marburg, migrating soon afterwards to the faculty of philosophy as the result of disputes with the Clerical party. He became professor of philosophy at Heidelberg in 1862, removed to Berlin in 1872, and retired in 1895. His great work is his *Philosophie der Griechen* (1844–52). This book he continued to amplify and improve in the light of further research; the last edition appeared in 1902. It has been translated into most of the European languages and became the recognized text-book of Greek philosophy. He wrote also on theology, and published three volumes of philosophical essays. He was also one of the founders of the *Theologische Jahrbücher*, a periodical which acquired great importance as the exponent of the historical method of David Strauss and Christian Baur. Like most of his contemporaries he began with Hegelianism, but subsequently he developed a system on his own lines. He saw the necessity of going back to Kant in the sense of demanding a critical reconsideration of the epistemological problems which Kant had made but a partially successful attempt to solve. None the less his merits as an original thinker are far outshone by his splendid services to the history of philosophy. It is true that his view of Greek thought is somewhat warped by Hegelian formalism. He is not alive enough to the very intimate relation which thought holds to national life and to the idiosyncrasy of the thinker. He lays too much stress upon the "concept," and explains too much by the Hegelian antithesis of subjective and objective. Nevertheless his history of Greek philosophy remains a noble monument of solid learning informed with natural sagacity. He received the highest recognition, not only from philosophers and learned societies all over the world, but also from the emperor and the German people. In 1894 the Emperor William II. made him a "Wirklicher Geheimrat" with the title of "Excellenz," and his bust, with that of Helmholtz, was set up at the Brandenburg Gate near the statues erected to the Emperor and Empress Frederick. He died on the 19th of March 1908.

The *Philosophie der Griechen* has been translated into English by S. F. Alleyne (2 vols., 1881) in sections: S. F. Alleyne, *Hist. of Gk. Phil. to the time of Socrates* (1881); O. J. Reichel, *Socrates and the Socratic Schools* (1868; 2nd ed. 1877); S. F. Alleyne and A. Goodwin, *Plato and the Older Academy* (1876); Costelloe and Muirhead, *Aristotle and the Earlier Peripatetics* (1897); O. J. Reichel, *Stoics, Epicureans and Sceptics* (1870 and 1880); S. F. Alleyne, *Hist. of Eclecticism in Gk. Phil.* (1883). The *Philosophie* appeared in an abbreviated form as *Grundriss d. Gesch. d. Griech. Philos.* (1883; 5th ed. 1898); Eng. trans. by Alleyne and Evelyn Abbott (1866), under the title, *Outlines of the Hist. of Gk. Philos.* Among his other works are:—*Platonische Studien* (1839); *Die Apostelgeschichte krit. untersucht* (1854; Eng. trans. J. Dare, 1875–76); *Entwickelung d. Monotheismus bei d. Griech.* (1862); *Gesch. d. christlich. Kirche* (1898); *Gesch. d. deutsch. Philos. seit Leibniz* (1873, ed. 1875); *Staat und Kirche* (1873); *Strauss in seinen Leben und Schriften* (1874; Eng. trans. 1874); *Über Bedeutung und Aufgabe d. Erkenntniss-Theorie* (1862); *Über teleolog. und mechan. Naturerklärung* (1876); *Vorträge und Abhandlungen* (1865–84); *Religion und Philosophie bei den Römern* (1866, ed. 1871); *Philosoph. Aufsätze* (1887).

ZEMARCHUS (fl. 568), Byzantine general and traveller. The Turks, by their conquest of Sogdiana in the middle of the 6th century, gained control of the silk trade which then passed through Central Asia into Persia. But the Persian king, Chosroes Nushirvan, dreading the intrusion of Turkish influence, refused to allow the old commerce to continue, and the Turks after many rebuffs consented to a suggestion made by their mercantile subjects of the Soghd, and in 568 sent an embassy to Constantinople to form an alliance with the Byzantines and "transfer the sale of silk to them." The offer was accepted by Justin II., and in August 568, Zemarchus the Cilician, "General of the cities of the East," left Byzantium for Sogdiana. The embassy was under the guidance of Maniakh, "chief of the people of Sogdiana," who had first, according to Menander Protector, suggested to Dizabul (*Dizaboulos*, the *Bu Min khan* of the Turks, the *Mokan* of the Chinese), the great khan of the Turks, this "Roman" alliance, and had himself come to Byzantium to negotiate the same. On reaching the Sogdian territories the travellers were offered iron for sale, and solemnly exorcised; Zemarchus was made to "pass through the fire" (*i.e.* between two fires), and strange ceremonies were performed over the baggage of the expedition, a bell being rung and a drum beaten over it, while flaming incense-leaves were carried round it, and incantations muttered in "Scythian." After these precautions the envoys proceeded to the camp of Dizabul (or rather of Dizabul's successor, Bu Min khan having just died) "in a hollow encompassed by the Golden Mountain," apparently in some locality of the Altai. They found the khan surrounded by astonishing barbaric pomp—gilded thrones, golden peacocks, gold and silver plate and silver animals, hangings and clothing of figured silk. They accompanied him some way on his march against Persia, passing through Talas or Turkestan in the Syr Daria valley, where Hsüan Tsang, on his way from China to India sixty years later, met with another of Dizabul's successors. Zemarchus was present at a banquet in Talas where the Turkish kagan and the Persian envoy exchanged abuse; but the Byzantine does not seem to have witnessed actual fighting. Near the river Oēkh (Syr Daria?) he was sent back to Constantinople with a Turkish embassy and with envoys from various tribes subject to the Turks. Halting by the "vast, wide lagoon" (of the Aral Sea?), Zemarchus sent off an express messenger, one George, to announce his return to the emperor. George hurried on by the shortest route, "desert and waterless," apparently the steppes north of the Black Sea: while his superior, moving more slowly, marched twelve days by the sandy shores of "the lagoon"; crossed the Emba, Ural, Volga, and Kuban (where 4000 Persians vainly lay in ambush to stop him); and passing round the western end of the Caucasus, arrived safely at Trebizond and Constantinople. For several years this Turkish alliance subsisted, while close intercourse was maintained between Central Asia and Byzantium; when another Roman envoy, one Valentinos (Οὐαλεντῖνος), goes on his embassy in 575 he takes back with him 106 Turks who had been visiting Byzantine lands; but from 579 this friendship rapidly began to cool. It is curious that all this travel between the Bosporus and Transoxiana seems not to have done anything to correct, at least in literature, the widespread misapprehension of the Caspian as a gulf of the Arctic Ocean.

See Menander Protector, *Περὶ Πρεσβέων Ῥωμαίων πρὸς Ἔθνη* (*De Legationibus Romanorum ad Gentes*), pp. 295–302, 380–85, 397–404, Bonn edition (xix.), 1828 (=pp. 806–11, 883–87, 899–907, in Migne, *Patrolog. Graec.*, vol. cxiii., Paris, 1864); H. Yule, *Cathay*, clx.–clxvi. (London, Hakluyt Society, 1866); L. Cahun, *Introduction à l'histoire de l'Asie*, pp. 108–18 (Paris, 1896); C. R. Beazley, *Dawn of Modern Geography*, i. 186–89 (London, 1897). (C. R. B.)

ZENÁGA (Sanhájà, Senajeh), a Berber tribe of southern Morocco who gave their name to Senegal, once their tribal home. They formed one of the tribes which, uniting under the leadership of Yusef bin Tashfin, crossed the Sahara and gave a dynasty to Morocco and Spain, namely, that of the Almoravides (*q.v.*). The Zeirid dynasty which supplanted the Fatimites in the Maghrib and founded the city of Algiers was also of Zenága origin. The Zenága dialect of Berber is spoken in southern Morocco and on the banks of the lower Senegal, largely by the negro population.

ZENANA (Persian *zanana*), the apartments of an Eastern house in which the women of the family are secluded (see Harem). This is a Mahommedan custom, which has been introduced into India and has spread amongst the Hindus. The zenana missions are missions to Indian women in their own homes.

ZENATA, or Zanátà, a Berber tribe of Morocco in the district of the central Atlas. Their tribal home seems to have been south of Oran in Algeria, and they seem to have early claimed an Arab origin, though it was alleged by the Arabs that they were descendants of Goliath, *i.e.* Philistines or Phoenicians (Ibn Khaldun, vol. iii. p. 184 and vol. iv. p. 597). They were formerly a large and powerful confederation, and took a prominent part in the history of the Berber race. The Beni-Marin and Wattasi dynasties which reigned in Morocco from 1213 to 1548 were of Zenata origin.

ZEND-AVESTA, the original document of the religion of Zoroaster (*q.v.*), still used by the Parsees as their bible and prayer-book. The name "Zend-Avesta" has been current in Europe since the time of Anquetil Duperron (*c.* 1771), but the Parsees themselves call it simply *Avesta*, *Zend* (*i.e.* "interpretation") being specially employed to denote the translation and exposition of a great part of the Avesta which exists in Pahlavi. Text and translation are often spoken of together in Pahlavi books as *Avistāk va Zand* ("Avesta and Zend"), whence—through a misunderstanding—our word Zend-Avesta. The origin and meaning of the word "Avesta" (or in its older form, *Avistāk*) are alike obscure; it cannot be traced further back than the Sasanian period. The language of the Avesta is still frequently called Zend; but, as already implied, this is a mistake. We possess no other document written in it, and on this account modern Parsee scholars, as well as the older Pahlavi books, speak of the language and writing indifferently as Avesta. As the original home of the language can only be very doubtfully conjectured, we shall do well to follow the usage sanctioned by old custom and apply the word to both. Although the Avesta is a work of but moderate compass (comparable, say, to the *Iliad* and *Odyssey* taken together), there nevertheless exists no single MS. which gives it in entirety. This circumstance alone is enough to reveal the true nature of the book: it is a composite whole, a collection of writings, as the Old Testament is. It consists, as we shall afterwards see, of the last remains of the extensive sacred literature in which the Zoroastrian faith was formerly set forth.

Contents.—As we now have it, the Avesta consists of five parts—the Yasna, the Vispered, the Vendidad, the Yashts, and the Khordah Avesta.

1. The *Yasna*, the principal liturgical book of the Parsees, in 72 chapters (*hāiti*, *hā*), contains the texts that are read by the priests at the solemn yasna (Izeshne) ceremony, or the general sacrifice in honour of *all* the deities. The arrangement of the chapters is purely liturgical, although their matter in part has nothing to do with the liturgical action. The kernel of the whole book, around which the remaining portions are grouped, consists of the Gāthās or "hymns" of Zoroaster (*q.v.*), the oldest and most sacred portion of the entire canon. The Yasna accordingly falls into three sections of about equal length:—(*a*) The introduction (chaps. 1–27) is, for the most part, made up of long-winded, monotonous, reiterated invocations. Yet even this section includes some interesting texts, *e.g.* the *Haoma* (*Hom*) Yasht (9, 11) and the ancient confession of faith (12), which is of value as a document for the history of civilization. (*b*) The Gāthās (chaps. 28–54) contain the discourses, exhortations and revelations of the prophet, written in a metrical style and an archaic language, different in many respects from that ordinarily used in the Avesta. As to the authenticity of these hymns, see Zoroaster. The Gāthās proper, arranged according to the metres in which they are written, fall into five subdivisions (28–34, 43–46, 47–50, 51, 53). Between chap. 37 and chap. 43 is inserted the so-called Seven-Chapter Yasna (*haptanghāiti*), a number of small prose pieces not far behind the Gāthās in antiquity. (*c*) The so-called Later Yasna (*Aparō Yasnō*) (chaps. 54–72) has contents of considerable variety, but consists mainly of invocations. Special mention ought to be made of the *Sraosha* (*Srōsh*) Yasht (57), the prayer to fire (62), and the great liturgy for the sacrifice to divinities of the water (63–69).

2. The *Vispered*, a minor liturgical work in 24 chapters (*karde*), is alike in form and substance completely dependent on the Yasna, to which it is a liturgical appendix. Its separate chapters are interpolated in the Yasna in order to produce a modified—or expanded—Yasna ceremony. The name Vispered, meaning "all the chiefs" (*vispē ratavō*), has reference to the spiritual heads of the religion of Ormuzd, invocations to whom form the contents of the first chapter of the book.

3. The *Vendidad*, the priestly code of the Parsees, contains in 22 chapters (*fargard*) a kind of dualistic account of the creation (chap. 1), the legend of Yima and the golden age (chap. 2), and in the bulk of the remaining chapters the precepts of religion with regard to the cultivation of the earth, the care of useful animals, the protection of the sacred elements, such as earth, fire and water, the keeping of a man's body from defilement, together with the requisite measures of precaution, elaborate ceremonies of purification, atonements, ecclesiastical expiations and so forth. These prescriptions are marked by a conscientious classification based on considerations of material, size and number; but they lose themselves in an exaggerated casuistry. Still the whole of Zoroastrian legislation is subordinate to one great point of view: the war—preached without intermission—against Satan and his noxious creatures, from which the whole book derives its name; for "Vendīdād" is a modern corruption for *vī-daēvō-dātem*—"the anti-demonic Law." Fargard 18 treats of the true and false priest, of the value of the house-cock, of the four paramours of the she-devil, and of unlawful lust. Fargard 19 is a fragment of the Zoroaster legend: Ahriman tempts Zoroaster; Zoroaster applies to Ormuzd for the revelation of the law, Ahriman and the devils despair, and flee down into hell. The three concluding chapters are devoted to sacerdotal medicine.

The Yasna, Vispered and Vendidad together constitute the Avesta in the stricter sense of the word, and the reading of them appertains to the priest alone. For liturgical purposes the separate chapters of the Vendidad are sometimes inserted among those of the Yasna and Vispered. The reading of the Vendidad in this case may, when viewed according to the original intention, be taken as corresponding in some sense to the sermon, while that of the Yasna and Vispered may be said to answer to the hymns and prayers of Christian worship.

4. The *Yashts*, *i.e.* "songs of praise," in so far as they have not been received already into the Yasna, form a collection by themselves. They contain invocations of *separate* Izads, or angels, number 21 in all, and are of widely divergent extent and antiquity. The great Yashts—some nine or ten—are impressed with a higher stamp: they are cast almost throughout in a poetical mould, and represent the religious poetry of the ancient Iranians. So far they

may be compared to the Indian Rig-Veda. Several of them may have been cemented together from a number of lesser poems or songs. They are a rich source of mythology and legendary history. Side by side with full, vividly coloured descriptions of the Zoroastrian deities, they frequently interweave, as episodes, stories from the old heroic fables. The most important of all, the 19th Yasht, gives a consecutive account of the Iranian heroic saga in great broad lines, together with a prophetic presentment of the end of this world.

5. The *Khordah Avesta, i.e.* the Little Avesta, comprises a collection of shorter prayers designed for all believers—the laity included—and adapted for the various occurrences of ordinary life. In part, these brief petitions serve as convenient substitutes for the more lengthy Yashts—especially the so-called *Nyāishes.*

Over and above the five books just enumerated, there are a considerable number of fragments from other books, *e.g.* the *Nīrangistān,* as well as quotations, glosses and glossaries.

The Larger Avesta and the Twenty-one Nasks.—In its present form, however, the Avesta is only a fragmentary remnant of the old priestly literature of Zoroastrianism, a fact confessed by the learned tradition of the Parsees themselves, according to which the number of Yashts was originally thirty. The truth is that we possess but a trifling portion of a very much larger Avesta, if we are to believe native tradition, carrying us back to the Sassanian period, which tells of a larger Avesta in twenty-one books called *nasks* or *nosks,* as to the names of which we have several more or less detailed accounts, particularly in the Pahlavi Dīnkard (9th century A.D.) and in the Rivayats. From the same sources we learn that this *larger* Avesta was only a part of a yet more extensive *original* Avesta, which is said to have existed before Alexander. We are told that of a number of nasks only a small portion was found to be extant "after Alexander." For example, of the seventh nask, which "before Alexander" had as many as fifty chapters, there then remained only thirteen; and similar allegations are made with regard to the eighth, ninth, tenth and other nasks. The Rivayats state that, when after the calamity of Alexander they sought for the books again, they found a portion of each nask, but found no nask in completeness except the Vendidad. But even of the remains of the Avesta, as these lay before the author of the 9th century, only a small residue has survived to our time. Of all the nasks one only, the nineteenth, has come down on us intact—the Vendidad. All else, considered as wholes, have vanished in the course of the centuries.

It would be rash summarily to dismiss this old tradition of the twenty-one nasks as pure invention. The number twenty-one points, indeed, to an artificial arrangement of the material; for twenty-one is a sacred number, and the most sacred prayer of the Parsees, the so-called Ahunō Vairyō (Honovar) contains twenty-one words; and it is also true that in the enumeration of the nasks we miss the names of the books we know, like the Yasna and the Yashts. But we must assume that these were included in such or such a nask, as the Yashts in the seventeenth or *Bakān* Yasht; or, it may be that other books, especially the Yasna, are a compilation extracted for liturgical purposes from various nasks. Further, the statements of the Dīnkard leave on us a very distinct impression that the author actually had before him the text of the nasks, or at all events of a large part of them: for he expressly states that the eleventh nask was entirely lost, so that he is unable to give the slightest account of its contents. And, besides, in other directions there are numerous indications that such books once really existed. In the Khordah Avesta, as we now have it, we find two Srōsh Yashts; with regard to the first, it is expressly stated in old MSS. that it was taken from the *Hādōkht* nask (the twentieth, according to the Dīnkard). From the same nask also a considerable fragment (*Yts.* 21 and 22 in Westergaard) has been taken. So, also, the *Nīrangistān* is a portion of the seventeenth (or *Hūspāram*) nask. Lastly, the numerous other fragments, the quotations in the Pahlavi translation, the many references in the *Bundahish* to passages of this Avesta not now known to us, all presuppose the existence in the Sassanian period of a much more extensive Avesta literature than the mere prayer-book now in our hands. The existence of a larger Avesta, even as late as the 9th century A.D., is far from being a mere myth. But, even granting that a certain obscurity still hangs undispelled over the problem of the old Avesta, with its twenty-one nasks, we may well believe the Parsees themselves, when they affirm that their sacred literature has passed through successive stages of decay, the last of which is represented by the present Avesta. In fact we can clearly trace this gradual process of decay in certain portions of the Avesta during the last few centuries. The great Yashts are not of very frequent occurrence in the manuscripts: some of them, indeed, are already met with but seldom, and MSS. containing all the Yashts are of extreme rarity. Of the fifteenth, seventeenth and nineteenth Yashts the few useful copies that we possess are derived from a single MS. of the year 1591 A.D.

Origin and History.—While all that Herodotus (i. 132) has to say is that the Magi sang "the theogony" at their sacrifices, Pausanias is able to add (v. 27. 3) that they read from a book. Hermippus, in the 3rd century B.C., affirmed that Zoroaster, the founder of the doctrine of the Magi, was the author of twenty books, each containing 100,000 verses. According to the Arab historian, Ṭabari, these were written on 12,000 cowhides, a statement confirmed by Masudi, who writes: "Zartusht gave to the Persians the book called Avesta. It consisted of twenty-one parts, each containing 200 leaves. This book, in the writing which Zartusht invented and which the Magi called the writing of religion, was written on 12,000 cowhides, bound together by golden bands. Its language was the Old Persian, which now no one understands." These assertions sufficiently establish the existence and great bulk of the sacred writings. Parsee tradition adds a number of interesting statements as to their history. According to the *Arda-Viraf-Nāma* the religion revealed through Zoroaster has subsisted in its purity for 300 years, when Iskander Rumi (Alexander the Great) invaded and devastated Iran, and burned the Avesta which, written on cowhides with golden ink, was preserved in the archives at Persepolis. According to the Dīnkard, there were two copies, of which one was burned, while the second came into the hands of the Greeks. One of the Rivāyato relates further: "After the villainy of Alexander, an assemblage of several high-priests brought together the Avesta from various places, and made a collection which included the sacred Yasna, Vispered, Vendidad and other scraps of the Avesta." As to this re-collection and redaction of the Avesta the Dīnkard gives various details. One of the Arsacid kings, Vologeses (I. or III.?), ordered the scattered remnants of the Avesta to be carefully preserved and recorded. The first of the Sassanian kings, Ardashīr Bābagān (226–240), caused his high-priest, Tanvasar, to bring together the dispersed portions of the holy book, and to compile from these a new Avesta, which, as far as possible, should be a faithful reproduction of the original. King Shāpūr I. (241–272) enlarged this re-edited Avesta by collecting and incorporating with it the non-religious tractates on medicine, astronomy, geography and philosophy. Under Shāpūr II. (309–380) the nasks were brought into complete order, and the new redaction of the Avesta reached its definitive conclusion.

Historical criticism may regard this tradition, in many of its features, as mere fiction, or as a perversion of facts made for the purpose of transferring the blame for the loss of a sacred literature to other persons than those actually responsible for it. We may, if we choose, absolve Alexander from the charge of vandalism of which he is accused, but the fact nevertheless remains, that he ordered the palace at Persepolis to be burned (Diod., xvii. 72; Curt., v. 7). Even the statement as to the one or two complete copies of the Avesta may be given up as the invention of a later day. Nevertheless the essential elements of the tradition remain unshaken, viz. that the original Avesta, or old sacred literature, divided on account of its great bulk and heterogeneous contents into many portions and a variety of separate works, had an actual existence in numerous copies and also in the memories of priests, that, although gradually diminishing in bulk, it remained extant during the period of foreign domination and ecclesiastical decay after the time of Alexander, and that it served as a basis for the redaction subsequently made. The kernel of this native tradition—the fact of a late collection of older fragments—appears indisputable. The character of the book is entirely that of a compilation.

In its outward form the Avesta, as we now have it, belongs to the Sassanian period—the last survival of the compilers' work already alluded to. But this Sassanian origin of the Avesta must not be misunderstood: from the remnants and heterogeneous fragments at their disposal, the diasceuast or diasceuasts composed a new canon—erected a new edifice from the materials of the old. In point of detail, it is now impossible to draw a sharp distinction between that which they found surviving ready to their hand and that which they themselves added, or to define how far they reproduced the traditional fragments with verbal fidelity or indulged in revision and remoulding. It may reasonably be supposed, not only that they constructed the external framework of many chapters, and also made some additions of their own—a necessary process in order to weld their motley collection of fragments into a new and coherent book—but also that they fabricated anew many formulae and imitative passages on the model of the materials at their disposal. In this consisted the "completion" of Tanvasar, expressly mentioned in the account of the Dīnkard. All those texts in which the grammar is handled, now with laxness and want of skill, and again with absolute barbarism, may probably be placed to the account of the Sassanian redactors. All the grammatically correct texts, together with those portions of the Avesta which have intrinsic worth, especially the metrical passages, are indubitably authentic and taken *ad verbum* from the original Avesta. To this class, above all, belong the Gāthās and the nucleus of the greater Yashts. Opinions differ greatly as to the precise age of the original texts brought together by subsequent redactors: according to some, they are pre-Achaemenian; according to Darmesteter's former opinion, they were written in Media under the Achaemenian dynasty; according to some, their source must be sought in the east, according to others, in the west of Iran. But to search for a precise time or an exact locality is to deal with the question too narrowly; it is more correct to say that the Avesta was worked at from the time of Zoroaster down to the Sassanian period. Its oldest portions, the Gāthās, proceed from the prophet himself. This conclusion is inevitable for every one to whom Zoroaster is an historical personality, and who does not shun the labour of an unprejudiced research into the meaning of those difficult texts (cf. Zoroaster). The rest of the Avesta, in spite of the opposite opinion of orthodox Parsees, does not even claim to come from Zoroaster. As the Gāthās now constitute the kernel of the most sacred prayer-book, viz. the Yasna, so they ultimately proved to be the first nucleus of a religious literature in general. The language in which Zoroaster taught, especially a later development of it, remained as the standard with his followers, and became the sacred language of the priesthood of that faith which he had founded; as such it became, so to speak, absolved from the ordinary conditions of time and space. Taught and acquired as an ecclesiastical language, it was enabled to live an artificial life long after it had become extinct as a vernacular—in this respect comparable to the Latin of the middle ages or the Hebrew of the rabbinical schools. The priests, who were the composers and repositories of these texts, succeeded in giving them a perfectly general form. They refrained from practically every allusion to ephemeral or local circumstances. Thus we search vainly in the Avesta itself for any precise data to determine the period of its composition or the place where it arose. The original country of the religion, and the seat of the Avesta language, ought perhaps to be sought rather in the east of Iran (Seistān and the neighbouring districts). But neither the spiritual literature nor the sacred tongue remained limited to the east. The geography of the Avesta points both to the east and the west, particularly the north-west of Iran, but with a decided tendency to gravitate towards the east. The vivid description of the basin of the Hilment (*Yasht* 19, 65–69) is peculiarly instructive. The language of the Avesta travelled with the Zoroastrian religion and with the main body of the priesthood, in all probability, that is to say, from east to west; within the limits of Iran it became international.

As has been already stated, the Avesta now in our hands is but a small portion of the book as restored and edited under the Sassanians. The larger part perished under the Mahommedan rule and under the more barbarous tyranny of the Tatars, when through conversion and extermination the Zoroastrians became a mere remnant that concealed its religion and neglected the necessary copying of manuscripts. A most meagre proportion only of the real religious and ritual writings, the sacerdotal law and the liturgy, has been preserved to our time. The great bulk—over three-fourths of the Sassanian contents—especially the more secular literature collected, has fallen a prey to oblivion. The understanding of the older Avesta texts began to die away at an early period. The need for a translation and interpretation became evident; and under the Later Sassanians the majority of the books, if not the whole of them, were rendered into the current Pahlavi. A thorough use of this translation will not be possible until we have it in good critical editions, and acquaintance with its language ceases to be the monopoly of a few privileged individuals. For the interpretation of the older texts it is of great value where they are concerned with the fixed, formal statutes of the church. But when they pass beyond this narrow sphere, as particularly in the Gāthās, the Pahlavi translator becomes a defective and unreliable interpreter. The Parsee priest, Neryosangh, subsequently translated a portion of the Pahlavi version into Sanskrit.

The MSS. of the Avesta are, comparatively speaking, of recent date. The oldest is the Pahlavi Vispered in Copenhagen, dated 1258. Next come the four MSS. of the Herbad Mihirāpān Kaī Khusro at Cambay (1323 and 1324), two Vendidads with Pahlavi in London and Copenhagen, and two Yasnas with Pahlavi in Copenhagen and formerly in Bombay (now Oxford). Generally speaking, the MSS. fall off in quality and carefulness in proportion to their lateness; though an honourable exception must be made in favour of those proceeding from Kirman and Yazd in Persia, mostly dating from the 17th and 18th centuries.

The first European scholar to direct attention to the Avesta was Hyde of Oxford, in his *Historia Religionis Veterum Persarum eoramque Magorum* (1700), which, however, failed to awake any lasting interest in the sacred writings of the Parsees. The merit of achieving this belongs to the enthusiastic orientalist Anquetil Duperron, the fruit of whose prolonged stay in India (1755–1761) and his acquaintance with the Parsee priests was a translation (certainly very defective) of the Zend-Avesta. The foundation of a scientific exegesis was laid by Burnouf. The interpretation of the Avesta is one of the most difficult problems of oriental philology. To this very day no kind of agreement has been reached by conflicting schools, even upon some of the most important points. The value of the Pahlavi interpretation was overrated by Spiegel, Darmesteter, but wholly denied by Roth. The truth lies between these two extremes. Opinion is divided also as to the significance of the Avesta in the literature of the world. The exaggerated enthusiasm of Anquetil Duperron has been followed, especially since Spiegel's translation, by an excessive reaction. Upon the whole, the Avesta is a monotonous book. The Yasna and many Yashts in great part consist of formulae of prayer which are as poor in contents as they are rich in verbiage. The book of laws (*Vendidad*) is characterized by an arid didactic tone; only here and there the legislator clothes his dicta in the guise of graceful dialogues and tales, or of poetic descriptions and similitudes; and then the book of laws is transformed into a didactic poem. Nor can we deny to the Yashts, in their depiction of the Zoroastrian angels and their presentment of the old sagas, a certain poetic feeling, at times, and a pleasant diction. The Gāthās are quite unique in their kind. As a whole, the Avesta, for profundity of thought and beauty, stands on a lower level than the Old Testament. But as a religious book—the most important document of the Zoroastrian faith, and the sole literary monument of ancient Iran—the Avesta occupies a prominent position in the literature of the world. At the present day its significance is decidedly underrated. The future will doubtless be more just with regard to the importance of the book for the history of religion in general and even of Christianity.

Editions.—*Zend-Avesta*, ed. by N. L. Westergaard (Copenhagen 1852–54), complete; F. Spiegel, *Avesta* (Vienna, 1853–58), only Vendidad, Vispered and Yasna, but with the Pahlavi translation, K. Geldner (Stuttgart, 1886–96). *Translations.*—Anquetil Duperron, *Zend-Avesta, Ouvrage de Zoroastre* (Paris, 1771); Fr. Spiegel, 3 vols. (Leipzig, 1852–63), both completely antiquated. *Avesta traduit* par C. de Harlez, ed. 2 (Paris, 1881); *The Zend-Avesta, Part I. Vendidad, Part II. Sīrōzahs, Yashts and Nyāyish*, tr. by J. Darmesteter, *Part III. Yasna, Visparad, &c.*, by L. H. Mills (Oxford, 1880–87), in the *Sacred Books of the East; Le Zend-Avesta, traduction nouvelle* par J. Darmesteter, 3 vols. (Paris, 1892–93) (*Annales du Musée Guimet*)—a most important work.

Literature.—Anquetil Duperron (see above); Haug, *Essays on the Sacred Language, &c., of the Parsis*, especially in the new edition by E. W. West (London, 1878); De Harlez, *Introduction à l'étude de l'Avesta* (Paris, 1881); Max Duncker, *Geschichte des Altertums*, vol. iv.; Eduard Meyer, *Geschichte des Altertums*, vol. i. (Stuttgart, 1884); J. Darmesteter, in the *Introduction* to his translation (see above); K. Geldner, *Avesta-Litteratur* in the *Grundriss der iranischen Philologie*, by Geiger and Kuhn (Strassburg, 1896), vol. 2, 1 f.; E. W. West, *Contents of the Nasks*, S. B. E. 37 (Oxford, 1892). (K. G.)

ZENGG (Hungarian, *Zeng*; Croatian, *Senj*; Italian, *Segna*), a royal free town of Hungary, in the county of Lika-Krbava, Croatia-Slavonia, 34 m. S.E. of Fiume, on the Adriatic Sea. Pop. (1900) 3182. Zengg lies at the entrance to a long cleft among the Velebit Mountains, down which the *bora*, or N.N.E. wind, sweeps with such violence as often to render the harbour unsafe, although the Austrian Lloyd steamers call regularly. Apart from the cathedral of its Roman Catholic bishop, a *gymnasium*, and some ancient fortifications, the town contains little of interest. It carries on a small trade in tobacco, fish and salt. The island of Veglia faces the town and the port of San Giorgio lies 5 m. S.

The captaincy of Zengg was established, in the 15th century, by King Matthias Corvinus of Hungary, as a check upon the Turks; and subsequently, until 1617, the town became famous as the stronghold of the Uskoks.

ZENITH (from the Arabic), the point directly overhead; its direction is defined by that of the plumb-line.

ZENJÁN, or ZANJAN, a town of Persia, capital of the Khamseh province, about 205 m. N.W. of Teheran, on the high road thence to Tabriz, at an elevation of 5180 ft. It has a population of about 25,000 and post and telegraph offices, and was one of the original strongholds of the Bábí sectarians, who held it against a large Persian force from May 1850 to the end of the year, when most of them were massacred. It has extensive gardens, well watered by the Zanjaneh river, which flows south of it. The well-stocked bazaar supplies the neighbouring districts.

ZENO, East Roman emperor from 474 to 491, was an Isaurian of noble birth, and originally bore the name of Trascalissaeus, which he exchanged for that of Zeno on his marriage with Ariadne, daughter of Leo I., in 468. Of his early life nothing is known; after his marriage (which was designed by Leo to secure the Isaurian support against his ambitious minister Aspar) he became patrician and commander of the imperial guard and of the armies in the East. While on a campaign in Thrace he narrowly escaped assassination; on his return to the capital he avenged himself by compassing the murder of Aspar, who had instigated the attempt. In 474 Leo I. died after appointing as his successor Leo the son of Zeno and Ariadne; Zeno, however, with the help of his mother-in-law Verina, succeeded in getting himself crowned also, and on the death of his son before the end of the year became sole emperor. In the following year, in consequence of a revolt fomented by Verina in favour of her brother Basiliscus, and the antipathy to his Isaurian soldiers and administrators, he was compelled to take refuge in Isauria, where, after sustaining a defeat, he was compelled to shut himself up in a fortress. The growing misgovernment and unpopularity of Basiliscus ultimately enabled Zeno to re-enter Constantinople unopposed (476); his rival was banished to Phrygia, where he soon afterwards died. The remainder of Zeno's reign was disturbed by numerous other less formidable revolts. Since 472 the aggressions of the two Ostrogoth leaders Theodoric had been a constant source of danger. Though Zeno at times contrived to play them off against each other, they in turn were able to profit by his dynastic rivalries, and it was only by offering them pay and high command that he kept them from attacking Constantinople itself. In 487 he induced Theodoric, son of Theodemir, to invade Italy and establish his new kingdom. Zeno is described as a lax and indolent ruler, but he seems to have husbanded the resources of the empire so as to leave it appreciably stronger at his death. In ecclesiastical history the name of Zeno is associated with the *Henoticon* or instrument of union, promulgated by him and signed by all the Eastern bishops, with the design of terminating the Monophysite controversy.

See J. B. Bury, *The Later Roman Empire* (London, 1889), i. pp. 250–274; E. W. Brooks in the *English Historical Review* (1893), pp. 209–238; W. Barth, *Der Kaiser Zeno* (Basel, 1894).

ZENO OF ELEA, son of Teleutagoras, is supposed to have been born towards the beginning of the 5th century B.C. The pupil and the friend of Parmenides, he sought to recommend his master's doctrine of the existence of the One by controverting the popular belief in the existence of the Many. In virtue of this method of indirect argumentation he is regarded as the inventor of "dialectic," that is to say, disputation having for its end not victory but the discovery or the transmission of truth. He is said to have been concerned in a plot against a tyrant, and on its detection to have borne with exemplary constancy the tortures to which he was subjected; but authorities differ both as to the name and the residence of the tyrant and as to the circumstances and the issue of the enterprise.

In Plato's *Parmenides*, Socrates, "then very young," meets Parmenides, "an old man some sixty-five years of age," and Zeno, "a man of about forty, tall and personable," and engages them in philosophical discussion. But it may be doubted whether such a meeting was chronologically possible. Plato's account of Zeno's teaching (*Parmenides*, 128 seq.) is, however, presumably as accurate as it is precise. In reply to those who thought that Parmenides's theory of the existence of the One involved inconsistencies and absurdities, Zeno tried to show that the assumption of the existence of the Many, that is to say, a plurality of things in time and space, carried with it inconsistencies and absurdities grosser and more numerous. In early youth he collected his arguments in a book, which, according to Plato, was put into circulation without his knowledge.

Of the paradoxes used by Zeno to discredit the belief in plurality and motion, eight survive in the writings of Aristotle and Simplicius. They are commonly stated as follows.[1] (1) If the Existent is Many, it must be at once infinitely small and infinitely great—infinitely small, because the parts of which it consists must be indivisible and therefore without magnitude; infinitely great, because, that any part having magnitude may be separate from any other part, the intervention of a third part having magnitude is necessary, and that this third part may be separate from the other two the intervention of other parts having magnitude is necessary, and so on *ad infinitum*. (2) In like manner the Many must be numerically both finite and infinite—numerically finite, because there are as many things as there are, neither more nor less; numerically infinite, because, that any two things may be separate, the intervention of a third thing is necessary, and so on *ad infinitum*. (3) If all that is is in space, space itself must be in space, and so on *ad infinitum*. (4) If a bushel of corn turned out upon the floor makes a noise, each grain and each part of each grain must make a noise likewise; but, in fact, it is not so. (5) Before a body in motion can reach a given point, it must first traverse the half of the distance; before it can traverse the half of the distance, it must first traverse the quarter; and so on *ad infinitum*. Hence, that a body may pass from one point to another, it must traverse an infinite number of divisions. But an infinite distance (which Zeno fails to distinguish from a finite distance infinitely divided) cannot be traversed in a finite time. Consequently, the goal can never be reached. (6) If the tortoise has the start of Achilles, Achilles can never come up with the tortoise; for, while Achilles traverses the distance from his starting-point to the starting-point of the tortoise, the tortoise advances a certain distance, and while Achilles traverses this distance, the tortoise makes a further advance, and so on *ad infinitum*. Consequently, Achilles may run *ad infinitum* without overtaking the tortoise. [This paradox is virtually identical with (5), the only difference being that, whereas in (5) there is one body, in (6) there are two bodies, moving towards a limit. The "infinity" of the premise is an infinity of subdivisions of a distance which is finite; the "infinity" of the conclusion is an infinity of distance. Thus Zeno again confounds a finite distance infinitely divided with an infinite distance. If the tortoise has a start of 1000 ft. Achilles, on the supposition that his speed is ten times that of the tortoise, must traverse an infinite number of spaces—1000 ft., 100 ft., 10 ft., &c.—and the tortoise must traverse an infinite number of spaces—100 ft., 10 ft., 1 ft., &c.—before they reach the point, distant from their starting-points $1111\frac{1}{9}$ ft. and $111\frac{1}{9}$ ft. respectively, at which the tortoise is overtaken. In a word, 1000+100+10 &c., in (6) and $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}$ &c., in (5) are convergent series, and $1111\frac{1}{9}$ and 1 are the limits to which they respectively approximate.] (7) So long as anything is in one and the same space, it is at rest. Hence an arrow is at rest at every moment of its flight, and therefore also during the whole of its flight. (8) Two bodies moving with equal speed traverse equal spaces in equal time. But, when two bodies move with equal speed in opposite directions, the one passes the other in half the time in which it passes it when at rest. These propositions appeared to Zeno to be irreconcilable. In short, the ordinary belief in plurality and motion seemed to him to involve fatal inconsistencies, whence he inferred that Parmenides was justified in distinguishing the mutable movable Many from the immutable immovable One, which alone is really existent. In other words, Zeno re-affirmed the dogma, "The Ent is, the Non-ent is not."

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[1] See Zeller, *Die Philosophie d. Griechen*, i. 591 seq.; *Grundriss*, 54.

If tradition has not misrepresented these paradoxes of time, space and motion, there is in Zeno's reasoning an element of fallacy. It is indeed difficult to understand how so acute a thinker should confound that which is infinitely divisible with that which is infinitely great, as in (1), (2), (5), and (6); that he should identify space and magnitude, as in (3); that he should neglect the imperfection of the organs of sense, as in (4); that he should deny the reality of motion, as in (7); and that he should ignore the relativity of speed, as in (8): and of late years it has been thought that the conventional statements of the paradoxes, and in particular of those which are more definitely mathematical, namely (5), (6), (7), (8), do less than justice to Zeno's acumen. Thus, several French writers—notably, Tannery and Noël—regard them as dilemmas advanced, with some measure of success, in refutation of specific doctrines attributed to the Pythagoreans. "One of the most notable victims of posterity's lack of judgment," says Bertrand Russell, "is the Eleatic Zeno. Having invented four arguments all immeasurably subtle and profound, the grossness of subsequent philosophers pronounced him to be a mere ingenious juggler, and his arguments to be one and all sophisms. After two thousand years of continual refutation, these sophisms were reinstated, and made the foundation of a mathematical renaissance, by a German professor, who probably never dreamed of any connexion between himself and Zeno. Weierstrass, by strictly banishing all infinitesimals, has at last shown that we live in an unchanging world, and that the arrow at every moment of its flight is truly at rest." "The interpretation of Zeno's last four paradoxes given by Messrs. Noël and Russell," says G. H. Hardy, "may be briefly stated as follows: The notion of time, which seems at first sight to enter into (5) and (6), should be eliminated. The former should be regarded as asserting that the whole is, not temporally, but logically, subsequent to the part, and that therefore there is an infinite regress in the notion of a whole which is infinitely divisible—a view which at any rate demands a serious refutation. The kernel of the latter lies in the perfectly valid proof which it affords that the tortoise passes through as many positions as Achilles—a view which embodies an accepted doctrine of modern mathematics. The paradox of the arrow (7), says Mr Russell, is a plain statement of a very elementary fact: the arrow is at rest at very moment of its flight: Zeno's only mistake was in inferring (if he did infer) that it was therefore at the same point at one moment as at another. Finally, the last paradox may be interpreted as a valid refutation of the doctrine that space and time are not infinitely divisible. How far this interpretation of Zeno is historically justifiable, may be doubtful. But one may well believe that there was in his mind at any rate a foreshadowing of some of the ideas by which modern mathematicians have finally laid to rest the traditional difficulties connected with infinity and continuity."

Great as was the importance of these paradoxes of plurality and motion in stimulating speculation about space and time, their direct influence upon Greek thought was less considerable than that of another paradox—strangely neglected by historians of philosophy—the paradox of predication. We learn from Plato (*Parmenides*, 127 D) that "the first hypothesis of the first argument" of Zeno's book above mentioned ran as follows: "If existences are many, they must be both like and unlike [unlike, inasmuch as they are not one and the same, and like, inasmuch as they agree in not being one and the same, Proclus, *On the Parmenides*, ii. 143]. But this is impossible; for unlike things cannot be like, nor like things unlike. Therefore existences are not many." That is to say, not perceiving that the same thing may be at once like and unlike in different relations, Zeno regarded the attribution to the same thing of likeness and unlikeness as a violation of what was afterwards known as the principle of contradiction; and, finding that plurality entailed these attributions, he inferred its unreality. Now, when without qualification he affirmed that the unlike thing cannot be like, nor the like thing unlike, he was on the high road to the doctrine maintained three-quarters of a century later by the Cynics, that no predication which is not identical is legitimate. He was not indeed aware how deeply he had committed himself; otherwise he would have observed that his argument, if valid against the Many of the vulgar, was valid also against the One of Parmenides, with its plurality of attributes, as well as that, in the absence of a theory of predication, it was useless to speculate about knowledge and being. But others were not slow to draw the obvious conclusions; and it may be conjectured that Gorgias's sceptical development of the Zenonian logic contributed, not less than Protagoras's sceptical development of the Ionian physics, to the diversion of the intellectual energies of Greece from the pursuit of truth to the pursuit of culture.

For three-quarters of a century, then, philosophy was at a standstill; and, when in the second decade of the 4th century the pursuit of truth was resumed, it was plain that Zeno's paradox of predication must be disposed of before the problems which had occupied the earlier thinkers—the problem of knowledge and the problem of being—could be so much as attempted. Accordingly, in the seventh book of the *Republic*, where Plato propounds his scheme of Academic education, he directs the attention of studious youth primarily, if not exclusively, to the concurrence of inconsistent attributes; and in the *Phaedo*, 102 B–103 A, taking as an instance the tallness and the shortness simultaneously discoverable in Simmias, he offers his own theory of the immanent idea as the solution of the paradox. Simmias, he says, has in him the ideas of tall and short. Again, when it presently appeared that the theory of the immanent idea was inconsistent with itself, and moreover inapplicable to explain predication except where the subject was a sensible thing, so that reconstruction became necessary, the Zenonian difficulty continued to demand and to receive Plato's best attention. Thus, in the *Parmenides*, with the paradox of likeness and unlikeness for his text, he inquires how far the current theories of being (his own included) are capable of providing, not only for knowledge, but also for predication, and in the concluding sentence he suggests that, as likeness and unlikeness, greatness and smallness, &c., are relations, the initial paradox is no longer paradoxical; while in the *Sophist*, Zeno's doctrine having been shown to be fatal to reason, thought, speech and utterance, the mutual *κοινωνία* of *εἴδη* which are not *αὐτὰ καθ' αὑτά* is elaborately demonstrated. It would seem then that, not to Antisthenes only, but to Plato also, Zeno's paradox of predication was a substantial difficulty; and we shall be disposed to give Zeno credit accordingly for his perception of its importance.

In all probability Zeno did not observe that in his controversial defence of Eleaticism he was interpreting Parmenides's teaching anew. But so it was. For, while Parmenides had recognized, together with the One, which is, and is the object of knowledge, a Many, which is not, and therefore is not known, but nevertheless becomes, and is the object of opinion, Zeno plainly affirmed that plurality, becoming and opinion are one and all inconceivable. In a word, the fundamental dogma, "The Ent is, the Non-ent is not," which with Parmenides had been an assertion of the necessity of distinguishing between the Ent, which is, and the Non-ent, which is not, but becomes, was with Zeno a declaration of the Non-ent's absolute nullity. Thus, just as Empedocles developed Parmenides's theory of the Many to the neglect of his theory of the One, so Zeno developed the theory of the One to the neglect of the theory of the Many. With the severance of its two members Eleaticism proper, the Eleaticism of Parmenides, ceased to exist.

The first effect of Zeno's teaching was to complete the discomfiture of philosophy. For the paradox of predication, which he had used to disprove the existence of plurality, was virtually a denial of all speech and all thought, and thus led to a more comprehensive scepticism than that which sprang from the contemporary theories of sensation. Nevertheless, he left an enduring mark upon Greek speculation, inasmuch as he not only recognized the need of a logic, and grappled, however unsuccessfully, with one of the most obvious of logical problems, but also by the invention of dialectic provided a new and powerful instrument against the time when the One and the Many should be reunited in the philosophy of Plato.

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Russell, *Principles of Mathematics* (Cambridge, 1903), pp. 346–354. For histories of philosophy and other works upon Eleaticism see Parmenides. (H. Ja.)

ZENO OF SIDON, Epicurean philosopher of the first century B.C., and contemporary of Cicero. In the *De Natura Deorum* (i. 34), Cicero states that he was contemptuous of other philosophers and even called Socrates "the Attic Buffoon." Diogenes Laërtius and Cicero both speak of him with respect and describe him as an accurate and polished thinker. He held that happiness includes not merely present enjoyment and prosperity, but also a reasonable expectation of their continuance. His views were made the subject of a special treatise by Posidonius.

ZENO OF TARSUS, Stoic philosopher and pupil of Chrysippus, belonged to the period of the Middle Stoa. He appears to have accepted all the Stoic doctrines except that he denied the final conflagration of the universe (see Stoics).

ZENOBIA (Gr. *Ζηνοβία*), queen of Palmyra, one of the heroines of antiquity. Her native name was Septimia Bathzabbai, a name also borne by one of her generals, Septimius Zabbai.[1] This remarkable woman, famed for her beauty, her masculine energy and unusual powers of mind, was well fitted to be the consort of Odainatti (see Odaenathus) in his proud position as Dux Orientis; during his lifetime she actively seconded his policy, and after his death in A.D. 266–7 she not only succeeded to his position but determined to surpass it and make Palmyra mistress of the Roman Empire in the East. Wahab-allath or Athenodōrus (as the name was Graecized), her son by Odainath, being still a boy, she took the reins of government into her own hands. Under her general-in-chief Zabdā, the Palmyrenes occupied Egypt in A.D. 270, not without a struggle, under the pretext of restoring it to Rome; and Wahab-allath governed Egypt in the reign of Claudius as joint ruler with the title of *βασιλεύς* (king), while Zenobia herself was styled *βασιλίσσαη* (queen). In Asia Minor Palmyrene garrisons were established as far west as Ancyra in Galatia and Chalcedon opposite Byzantium, and Zenobia still professed to be acting in the interests of the Roman rule. In his coins struck at Alexandria in A.D. 270 Wahab-allath is named along with Aurelian, but the title of Augustus is given only to the latter; a Greek inscription from Byblos, however, mentions Aurelian (or his predecessor Claudius) and Zenobia together as *Σεβαστός* and *Σεβαστή* (*i.e.* Augustus and Augusta, *C.I.G.* 4503 b). When Aurelian became emperor in 270 he quickly realized that the policy of the Palmyrene queen was endangering the unity of the empire. It was not long before all disguises were thrown off; in Egypt Wahab-allath began to issue coins without the head of Aurelian and bearing the imperial title, and Zenobia's coins bear the same. The assumption marked the rejection of all allegiance to Rome. Aurelian instantly took measures; Egypt was recovered for the Empire by Probus (close of 270), and the emperor himself prepared a great expedition into Asia Minor and Syria. Towards the end of 271 he marched through Asia Minor and, overthrowing the Palmyrene garrisons in Chalcedon, Ancyra and Tyana, he reached Antioch, where the main Palmyrene army under Zabdā and Zabbai, with Zenobia herself, attempted to oppose his way. The attempt, however, proved unsuccessful, and after suffering considerable losses the Palmyrenes retired in the direction of Emesa (now Höms), whence the road lay open to their native city. The queen refused to yield to Aurelian's demand for surrender, and drew up her army at Emesa for the battle which was to decide her fate. In the end she was defeated, and there was nothing for it but to fall back upon Palmyra across the desert. Thither Aurelian followed her in spite of the difficulties of transport, and laid siege to the well-fortified and provisioned city. At the critical moment the queen's courage seems to have failed her; she and her son fled from the city to seek help from the Persian king;[2] they were captured on the bank of the Euphrates, and the Palmyrenes, losing heart at this disaster, capitulated (A.D. 272). Aurelian seized the wealth of the city but spared the inhabitants; to Zenobia he granted life; while her officers and advisers, among whom was the celebrated scholar Longinus, were put to death. Zenobia figured in the conqueror's splendid triumph at Rome, and by the most probable account accepted her fall with dignity and closed her days at Tibur, where she lived with her sons the life of a Roman matron. A few months after the fall of Zenobia, Palmyra revolted again; Aurelian unexpectedly returned, destroyed the city, and this time showed no mercy to the population (spring, 273).

Among the traditions relating to Zenobia may be mentioned that of her discussions with the Archbishop Paul of Samosata on matters of religion. It is probable that she treated the Jews in Palmyra with favour; she is referred to in the Talmud, as protecting Jewish rabbis (Talm. Jer. *Ter.* viii. 46 b).

The well-known account of Zenobia by Gibbon (*Decline and Fall*, i. pp. 302–312 Bury's edition) is based upon the imperial biographers (*Historia Augusta*) and cannot be regarded as strictly historical in detail. An obscure and distorted tradition of Zenobia as an Arab queen survived in the Arabian story of Zabbā, daughter of ʻAmr b. Ẓarib, whose name is associated with Tadmor and with a town on the right bank of the Euphrates, which is no doubt the Zenobia of which Procopius speaks as founded by the famous queen. See C. de Perceval, *Essai sur l'hist. des Arabes*, ii. 28 f., 197 f.; Ṭabari, i. 757 f. See further Palmyra. (G. A. C.*)

ZENOBIUS, a Greek sophist, who taught rhetoric at Rome during the reign of Hadrian (A.D. 117–138). He was the author of a collection of proverbs in three books, still extant in an abridged form, compiled, according to Suïdas, from Didymus of Alexandria and "The Tarrhaean" (Lucillus of Tarrha in Crete). Zenobius is also said to have been the author of a Greek translation of Sallust and of a birthday poem (*γενεθλιακόν*) on Hadrian.

Editions by T. Gaisford (1836) and E. L. Leutsch-F. W. Schneidewin (1839), and in B. E. Miller, *Mélanges de littérature grecque* (1868); see also W. Christ, *Griechische Litteraturgeschichte* (1898).

ZENODOCHIUM (Gr. *ξενοδοχεῖον*, *ξένος*, stranger, guest, *δέχεσθαι*, to receive), the name given by the Greeks to a building erected for the reception of strangers.

ZENODOTUS, Greek grammarian and critic, pupil of Philetas (*q.v.*) of Cos, was a native of Ephesus. He lived during the reigns of the first two Ptolemies, and was at the height of his reputation about 280 B.C. He was the first superintendent of the library at Alexandria and the first critical editor (*διορθώτης*) of Homer. His colleagues in the librarianship were Alexander of Aetolia and Lycophron of Chalcis, to whom were allotted the tragic and comic writers respectively, Homer and other epic poets being assigned to Zenodotus. Although he has been reproached with arbitrariness and an insufficient knowledge of Greek, in his recension he undoubtedly laid a sound foundation for future criticism. Having collated the different MSS. in the library, he expunged or obelized doubtful verses, transposed or altered lines, and introduced new readings. He divided the Homeric poems into books (with capitals for the *Iliad*, and small letters for the *Odyssey*), and possibly was the author of the calculation of the days of the *Iliad* in the Tabula Iliaca. He does not appear to have written any regular commentary on Homer, but his Homeric *γλῶσσαι* (lists of unusual words) probably formed the source of the explanations of Homer attributed by the grammarians to Zenodotus. He also lectured upon Hesiod, Anacreon and Pindar, if he did not publish editions of them. He is further called an epic poet by Suïdas, and three epigrams in the Greek Anthology are assigned to him.

There appear to have been at least two other grammarians of the same name: (1) Zenodotus of Alexandria, surnamed ὁ ἐν ἄστει; (2) Zenodotus of Mallus, the disciple of Crates, who like his master attacked Aristarchus.

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[1] See the Palmyrene inscriptions given in Vogüé, *Syrie centrale*, Nos. 28, 29 = Cooke, *North-Semitic Inscriptions*, Nos. 130, 131. Zabbai, an abbreviation of some such form as Zabd-ilā = *dowry of God*, was a common Palmyrene name; it occurs in the Old Testament, Ezr. x. 28; Neh. iii. 20.

[2] Whether Shāpūr or his son Hormuzdi is not certain; Shāpūr's death is variously placed in 269 and 272.

See F. A. Wolf, *Prolegomena ad Homerum*, section 43 (1859 edition); H. Düntzer, *De Zenodoti studiis Homericis* (1848); A. Römer, *Über die Homerrecension des Zenodotus* (Munich, 1885); F. Susemihl, *Geschichte der griechischen Litteratur in der Alexandrinerzeit*, i. p. 330, ii. p. 14; J. E. Sandys, *Hist. of Class. Schol.* (1906), ed. 2, vol. i. pp. 119–121.

ZENTA, a market town of Hungary, in the county of Bács-Bodrog, 133 m. S.E. of Budapest by rail. Pop. (1900) 28,582. It is situated on the right bank of the river Theiss, and is historically known for the decisive victory won in its vicinity by Prince Eugene of Savoy over the Turks on the 11th of September 1697.

ZEOLITES, a family of minerals consisting of hydrated silicates of alumina with alkalis or alkaline earths or both. The water they contain is readily lost, and before the blowpipe it is expelled with intumescence; hence the name zeolite, from the Greek ζεῖν (to boil) and λίθος (a stone), given by A. Cronstedt in 1758. In some other characters, as well as in their origin and mode of occurrence, they have points in common. Several species have been distinguished, of which the following are the more important. Apophyllite (*q.v.*) and pectolite (see Pyroxene) are also sometimes included.

Heulandite Group.	Heulandite . . .	$H_4CaAl_2(SiO_3)_6+3H_2O$.
	Brewsterite . . .	$H_4(Sr, Ba, Ca)Al_2(SiO_3)_6+3H_2O$.
	Epistilbite . . .	$H_4CaAl_2(SiO_3)_6+3H_2O$.
Stilbite Group.	Wellsite	$(Ba, Ca, K_2)Al_2Si_3O_{10}+3H_2O$.
	Phillipsite . . .	$(K_2, Ca)Al_2(SiO_3)_4+4H_2O$.
	Harmotome . . .	$H_2(K_2, Ba)Al_2(SiO_3)_5+5H_2O$.
	Stilbite	$CaAl_2(SiO_3)_6+6H_2O$.
	Gismondite . . .	$CaAl_2(SiO_3)_4+4H_2O$.
	Laumontite . . .	$H_4CaAl_2Si_4O_{14}+2H_2O$.
Chabazite Group.	Chabazite . . .	$(Ca, Na_2)Al_2(SiO_4)_2+4H_2O$, &c.
	Gmelinite . . .	$(Na_2, Ca)Al_2(SiO_3)_4+6H_2O$.
	Levynite . . .	$CaAl_2Si_3O_{10}+5H_2O$.
	Analcite	$NaAl(SiO_3)_2+H_2O$.
Natrolite Group.	Natrolite. . . .	$Na_2Al_2Si_3O_{10}+2H_2O$.
	Mesolite	$(Ca, Na_2)Al_2Si_3O_{10}+2H_2O$.
	Scolecite	$CaAl_2Si_3O_{10}+3H_2O$.
	Edingtonite . . .	$BaAl_2Si_3O_{10}+3H_2O$.
	Thomsonite . . .	$(Na_2, Ca)Al_2(SiO_4)_2+2\frac{1}{2}H_2O$.

Some of the chemical formulae given above are only approximate, since in some species the composition varies between certain limits and can be best expressed by the isomorphous mixing of different molecules (see, for example, Chabazite). They are all readily decomposed by hydrochloric acid, usually with the separation of gelatinous silica. By the action of various reagents several substitution products have been prepared artificially: thus, crystallized products, in which the alkalis or alkaline earths are replaced by ammonium or silver, &c., have been obtained.

The zeolites are often beautifully crystallized, and belong to several crystal-systems. The crystals usually show evidences of twinning, and when examined in polarized light they frequently exhibit optical anomalies and a complex structure. The hardness ($H.=3\frac{1}{2}-5\frac{1}{2}$) and specific gravity (2·0–2·4) are comparatively low, and so are the indices of refraction and the double refraction.

The water of zeolites presents many points of interest. Laumontite loses water on exposure to air, and the crystals soon crumble to powder unless they are kept in a moist atmosphere. All the zeolites lose a portion of their "water of crystallization" in dry air (over sulphuric acid), and a considerable portion at a temperature of 100° C., increasing in amount to 200° or 300°; the actual amount lost depending not only on the temperature, but also on the tension of aqueous vapour in the surrounding atmosphere. In some species the remaining water is expelled only at a red heat, and is therefore to be regarded as "water of constitution." With the progressive loss of water there is a progressive change in the optical characters of the crystals. When a partially dehydrated and opaque crystal is exposed to moist air the water is reabsorbed, the crystal becoming again transparent and regaining its original optical characters. Not only may water be reabsorbed, but such substances as ammonia, hydrogen sulphide and alcohol may be absorbed in definite amounts and with an evolution of heat. The water of zeolites may therefore be partly driven off and reabsorbed or replaced by other substances without destroying the crystalline structure of the material, and it would thus seem to differ from the water of crystallization of most other hydrated salts.

Zeolites are minerals of secondary origin and in most cases have resulted by the decomposition of the felspars of basic igneous rocks: in fact their chemical composition is somewhat analogous to that of the felspars with the addition of water. Nepheline and sodalite are often altered to zeolites. They usually occur as crystals lining the amygdaloidal and other cavities of basalt, melaphyre, &c. Usually two or more species are associated together, and often with agate, calcite and some other minerals. Less frequently they occur in cavities in granite and gneiss, and in metalliferous veins (*e.g.* harmotome); while only exceptionally are they primary constituents (*e.g.* analcite) of igneous rocks. Several species have been observed in the Roman masonry at the hot springs of Bourbonne-les-Bains in France: and phillipsite has been dredged from the floor of the deep sea.

See Analcite, Chabazite, Harmotome, Heulandite, Natrolite, Phillipsite, Scolecite, Stilbite. (L. J. S.)

ZEPHANIAH, the ninth of the minor prophets in the Bible. The name (*Yah*[*weh*] "hides" or "treasures"; there is a similar Phoenician compound of Baal) is borne by various individuals, in Jer. xxix. 25 (cf. lii. 24); Zech. vi. 10, 14; 1 Chron. vi. 36, and among the Jews of Elephantine in Egypt (5th century B.C.). The prophet's ancestry is traced through Cushi (cf. Jer. xxxvi. 14) to his great-grandfather Hezekiah, who may, in spite of 2 Kings xx. 18, xxi. 1, be the well-known king of Judah (*c.* 720–690). This would agree fairly with the title (i. 1) which makes the prophet a contemporary of King Josiah (*c.* 637), and this in turn appears to agree (*a*) with the internal conditions (i. 4–6, cf. 2 Kings xxiii. 4, 5, 12) which, it is held, are evidently earlier than Josiah's reforms (620); (*b*) with the denunciation of the royal household, but not of the (young) king himself (i. 8, iii. 3); (*c*) with the apparent allusion in ch. i. to the invasion of the Scythians (perhaps *c.* 626), and (*d*) with the anticipated downfall of Assyria and Nineveh (ii. 13, 607 B.C.). Zephaniah's prophecies are characterized by the denunciation of Judah and Jerusalem and the promise of a peaceful future, and these are interwoven with the idea of a world-wide judgment resulting in the sovereignty of a universally recognized Yahweh. The theme in its main outlines is a popular one in biblical prophecy, but when these 53 verses are carefully examined and compared with prophetical thought elsewhere, several difficult problems arise, an adequate solution of which cannot as yet be offered.

After the title (i. 1) and the announcement of the entire destruction of every living thing (2–3), the fate of Judah and Jerusalem is heralded (4–6). The *name* of Baal (so LXX.; *remnant* implies a date after Josiah's reforms) and of the idolatrous priests will be cut off, together with them that worship the "host of heaven" (condemned later than 620 in Jer. xix. 13, cf. xliv. 15–19) and swear by the Ammonite god *Milcom* (or perhaps by their Moloch; for the persistence of his grim cult, see Moloch). Silence is enjoined at the presence of Yahweh (*v.* 7, cf. Zech. ii. 13) and there follows a fine description of "the Day of Yahweh" (*vv.* 7–18).[1] The inveterate popular belief in the manifestation of the warring deity on behalf of his people (*e.g.* Isa. xxxiv. 8, lxiii. 4; Jer. xlvi. 10; Obad. 15; Ezek. xxx. 3) is treated (*a*) ethically, as a day of judgment upon sin and pride (Amos v. 18; Isa. ii. 12–21) and (*b*) apocalyptically, is bound up with ideas of a universal doom. Punishment will fall upon an oppressive court, upon those who wear foreign apparel, and who "leap over the threshold" (*v.* 9, cf. 1 Sam. v. 5, a Philistine custom)—a protest against heathen intercourse, for which cf. Isa. ii. 6, and Costume, *Oriental*. The blow falls upon the north side of Jerusalem (*v.* 10 seq., the merchant quarter (?), cf. Zech. xiv. 21); the city will be ransacked and the indifferent or apathetic, who thought that Yahweh could do neither good nor evil (so, of the idols, Isa. xli. 23; Jer. x. 5) will be ruined. With *v.* 13 contrast the promises Isa. lxv. 21. "That day is a day of wrath" (*v.* 15)[2] with celestial signs (cf. Amos v. 18, 20, viii. 9; Isa. xiii. 10; Joel ii. 2, iii. 15), war and distress, when wealth shall not avail (*v.* 18, cf. Isa. xiii. 17, of the Medes against Babylon, and more generally Ezek. vii. 19). Thus Yahweh's jealousy fired by the dishonour shown towards him *in Judah* will make an end of *all them that dwell in the earth* (*v.* 18, cf. *v.* 2 seq., and see Isa. x. 23, where a remnant is promised).

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[1] For "day" (*i.e.* of battle) cf. the Arab usage, W. R. Smith, *Proph. of Israel*, p. 398. The victorious and divine kings of Egypt in the XIXth and XXth Dynasties are likened to Baal in his "hour" (J. H. Breasted, *Hist. Doc. Eg.*, iii. §§ 312, 326, iv. § 106).

[2] The Vulgate *Dies irae dies illa*, whence the striking hymn by Thomas of Celano (*c.* 1250).

Chap. ii. opens probably " Get you shame, and be ye ashamed, O nation unabashed, before ye become as chaff that passeth away " (the last two clauses of *v.* 2 are doublets). With this very general call to repentance (cf. Amos v. 6, 15; Jer. iv. 14, &c.) is joined a particular appeal to " the humble ones of the earth " (*v.* 3, cf. iii. 12; Isa. xi. 4; Ps. lxxvi. 9) to seek righteousness and humility, *peradventure* (but LXX. *so that*) they may be hid in the day of Yahweh's wrath (cf. Isa. xxvi. 20). " For " the cities of the Philistines shall be destroyed (*v.* 4, cf. on i. 9 above), and an oracle of woe is uttered against their land (*v.* 5 seq.). With a sudden transition the " remnant of the house of Judah " is promised the maritime coast (*v.* 7, read *by the sea* for *thereupon*), and this is enhanced by the tidings of the return of the captivity. This thought is developed further. Yahweh has " heard " (cf. Isa. xvi. 6, 13 seq.; Jer. xlviii. 29 sqq.; Ezek. xxxv., 12) " the reproach of Moab and the revilings of the Ammonites," and the Lord of Hosts, the God of Israel, swears by his life that both shall be destroyed for their hostility towards his people, and the remnant of his nation shall possess their territory (*vv.* 8–10). After turning aside to Yahweh's supremacy (*v.* 11, iii. 9 seq.) the chapter continues with a short and vague doom " also " upon Cush (Ethiopia) " slain by my sword " (cf. Isa. lxvi. 16), and a more detailed prophecy upon Assyria and Nineveh. The exulting and boastful city (cf. Babylon, Isa. xlvii. 8, 10, with xlv. 5 seq.) shall be a haunt of wild animals (cf. Babylon, Isa. xiii. 20 sqq., and more especially Edom *ibid.* xxxiv. 11–13) and is pictured as shortly to be made desolate (*v.* 15, with the last words cf. Jerusalem, Jer. xix. 8, Edom, xlix. 17).

In chap. iii. there are again changing situations. The defiant, polluted and oppressive city is condemned for failing to regard the warnings. Her secular and religious leaders are denounced, and stress is laid, not upon foreign cults, but upon the rampant treachery and profanation (cf. Mal. ii. 11; Isa. lvi. 10–12, and especially Ezek. xxii. 25–28). Yahweh in the midst of her is " righteous " (cf. Neh. ix. 33, and especially the " Deutero-Isaiah," xl. sqq.),[1] but although the nations round about have been cut off and destroyed, Jerusalem, instead of taking warning in order to escape destruction, has been persistently corrupt (*vv.* 1–7; *v.* 2, cf. Jer. ii. 30 and often). " Therefore, wait ye for me, saith Yahweh, for the day when I arise *as a witness* " (so read in *v.* 8, cf. Mic. i. 2; Mal. iii. 5). But there is another sudden transition—in that day Yahweh shall assemble all nations and kingdoms to pour out upon them his anger (*v.* 8). This judgment upon the world will be followed by a universal conversion (*v.* 9, cf. ii. 11) and " from beyond the rivers of Cush " (cf. ii. 12) tribute will be brought to Yahweh (cf. Isa. xlv. 14, and especially xviii. 1, 7; some reference to a return of dispersed Jews may be suspected in the now corrupt text). " In that day " (*i.e.* after the judgment, implied by *v.* 7 seq.) there will be a purified Judah (cf. often in Isaiah, i. 24 sqq., iv. 2–6) and, with the removal of the proud, there will be left an afflicted, poor and trusting people (*v.* 12). " The remnant of Israel," also, shall dwell in peace and piety (*v.* 13; cf. the corrupt people who are to be " refined," Jer. ix. 3–9). Next, a noteworthy jubilant note is struck when " the daughter of Zion " is bidden to exult (*v.* 14, cf. Zech. ii. 10, ix. 9), for the " judgments " are removed, the " enemy " is cleared away. Yahweh, the mighty deliverer, is in her midst as " king of Israel " (Isa. xxiv. 23, xliv. 6), he will take joy in her (cf. Isa. lxii. 5, lxv. 19), and she shall no more see evil. In conclusion (*vv.* 18–20), he will gather them that are in exile away from the sacred festivals, who were a cause of " reproach " (cf. Ezek. xxxvi. 15; Isa. liv. 4; Neh. i. 3); he will " deal with " all oppressors and restore the outcast and the lame (cf. Mic. iv. 6 seq.; Ezek. xxxiv. 16). She shall become a praise and a name (cf. Jer. xxxiii. 9) when Yahweh brings back the captivity " before your eyes " (*i.e.* in your generation).

It is a natural assumption that prophecies have a practical end and refer to existing or impending conditions.[2] But although one single leading motive runs through the book of Zephaniah there are abrupt transitions which do not concern mere subjective considerations of logical or smooth thought, but material and organic changes representing different groups of ideas. The instruments of Yahweh's anger (ch. i.) are not so real or prominent on the political horizon as, for example, in Isaiah, Jeremiah or Habakkuk. The true date of the Scythian inroad and its results for Judah and Philistia are less important when it is observed that the doom upon Philistia, the vengeance upon Moab and Ammon and the promises for Judah (ch. ii.) belong to a large group of prophecies against certain historic enemies (Edom included) who are denounced for their contempt, hostility and intrusion. These prophecies are in large measure associated traditionally with the fall of Jerusalem, and to such a calamity, and not to the inroad of the Scythians, the references to the " remnant " and the " captivity " can only refer.[3] The anticipation of future events is of course conceivable in itself, but the promises (in ch. ii.) *presuppose* events other and later than those with which the Scythians were connected. On the other hand, it is entirely intelligible that a prophecy relating to Scythians should have been re-shaped to apply to later conditions, and on this view it is explicable why the indefinite political convulsions should be adjusted to the exile and why the gloom should be relieved by the promise of a territory extending from the Mediterranean to the Syrian desert (ii. 7, 9). After a period of punishment (cf. Lamentations) Yahweh's jealousy *against* the semi-heathen Judah has become a jealousy *for* his people, and we appear to move in the thought of Haggai and Zechariah, where the remnant are comforted by Yahweh's return and the dispersed exiles are to be brought back (cf. Zech. i. 14–17, viii. 2–17). But in ch. iii. other circles of thought are manifest. Israel's enemies have been destroyed, her own God Yahweh has proved *his* loyalty and has fulfilled *his* promises, but the city remains polluted (*vv.* 1–7, cf. Isa. lviii. seq.; Malachi). Once more doom is threatened, and once more we pass over into a later stage where Yahweh has vindicated *his* supremacy and Zion is glorified. Instead of the realities of history we have the apocalyptical feature of the gathering of the nations (*v.* 8); the thought may be illustrated from Zech. xii. 1.–xiii. 6, where Jerusalem is attacked, purged and delivered, and from Zech. xiv. where the city is actually captured and half the people are removed into captivity (cf. Zeph. iii. 11 purging, 15 removal of the enemy, 18–20 return of the captivity). The goal is the vindication of Israel and of Israel's God, and the establishment of universal monotheism (ii. 11, iii. 9 seq.). The foe which threatened Judah has become the chastiser of Ethiopia and Assyria (ii.) and the prelude to the golden age (iii., cf. Ezek. xxxviii. seq.). No longer does Yahweh contend for recognition with Baal and the " host of heaven " (i. 4–6); the convulsions of history are Yahweh's work for the instruction and amendment of Israel (iii. 6 seq.); the heathen gods prove helpless (ii. 11), but in what manner the conviction of Yahweh's greatness is brought home is not stated.[4]

If Jer. iv. 5–vi. 30 originally referred to the Scythians, it has been revised to refer to the Chaldeans; also in Ezek. xxxviii. seq. the northern foe has been associated with the great world-judgment. The replacing of the sequel of Amos (*q.v.*) by one which presupposes a later historical background, the addendum to the prophecy against Moab (Isa. xvi. 13 seq.), the pessimistic glosses in Isa. xlviii., the variations in the Hebrew and Greek text of Jeremiah, and the general treatment of prophecies of judgment and promise, exemplify certain *literary* processes which illustrate the present form of Zephaniah. In Isaiah and Zechariah, notably, older and later *groups* of prophecies are preserved, whereas here the new preludes and new sequels suggest that the original nucleus has passed through the hands of writers in touch with those vicissitudes of thought which can be studied more completely elsewhere. It is not to be supposed that the elimination of all later passages and traces of revision will give us Zephaniah's prophecies in their original extent. In fact the internal religious and social conditions in i. 4–6 or iii. 1–4 do not compel a date before Josiah's reforms. The doom of Cush is still in the future in Ezek. xxx. 4; and if the impending fall of Nineveh (ii. 13) implies an early date, yet it is found in writings which have later additions (Nahum), or which are essentially later (Jonah, cf. Tobit xiv. 4 [LXX], 8, 10, 15); cf. also the use of Assyria for Babylon (Ezra vi. 22) or Syria (Zech. x. 10). Historical references in prophecies are not always decisive (Ezek. xxxii., for example, looks upon Edom and Sidon as dead), and while the continued revision of the book allows the presumption that the tradition ascribing its inception to the time of Josiah may be authentic, it is doubtful how much of the original nucleus can be safely recognized. These are problems which concern not only the criticism of biblical prophetical writings as a whole, but also the historical vicissitudes of the period over which they extend (see JEWS; PALESTINE; *History*).

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[1] The idea of " righteousness " (*ṣ-d-ḳ*), or loyalty, appears to have implied the mutual bonds uniting the community and its deity, see *Journ. Theol. Stud.*, 1908, p. 632 *n.* 1; *Expositor*, Aug. 1910, p. 120.

[2] Material familiar to contemporary thought is naturally used (see especially H. Gressmann, *Ursprung d. israel-jüd. Eschatologie;* J. M. P. Smith, *Biblical World*, 1910, pp. 223 sqq.).

[3] The " humble " (ii. 3) can scarcely be identified with the " remnant " and, as in iii. 12, are viewed as a small pious community such as we find in the Psalms (see Nowack's *Comm.*).

[4] See further W. R. Smith, art. " Zephaniah," *Ency. Brit.* 9th ed., who points out that " in the scheme of Isaiah it is made clear that the fall of the power that shatters the nations cannot fail to be recognized as Yahweh's work."

According to late tradition Zephaniah, like Habakkuk, was of the tribe of Simeon (cf. Micah of Mareshah and Obadiah of Beth-haccerem, see Cheyne, *Ency. Bib.*, col. 3455). The apocryphal prophecy of Zeph. (Clement of Alex., *Strom.*, v. 11, 77; see Schürer, *Gesch. Volk. Isr.*, iii. 271 seq.) merely illustrates the tendency to utilize older traditions. See further on textual, metrical and literary details, W. R. Smith (note 4, previous page), reprinted in *Ency. Bib.*, with additions by S. R. Driver, J. A. Selbie in Hastings's *Dict. Bib.*, J. Lippl in *Bibl. Studien* (1910), and the commentaries on (all or portions of) the Minor Prophets by A. B. Davidson (*Camb. Bible*, 1896); G. A. Smith (1898); W. Nowack (1903); K. Marti (1904; especially valuable); Driver (*Cent. Bib.*, 1906); Von Hoonacker (1908). (S. A. C.)

ZEPHYRINUS, ST, bishop of Rome from about 198 to 217, succeeded Victor I. He is described as a man of little intelligence or strength of character, and the somewhat important controversies on doctrine and discipline that marked his pontificate are more appropriately associated with the names of Hippolytus and of Calixtus, his principal adviser and afterwards his successor.

ZEPHYRUS, in Greek mythology, the west wind (whence the English "zephyr," a light breeze), brother of Boreas, the north wind, and son of the Titan Astraeus and Eos, the dawn. He was the husband of Chloris, the goddess of flowers, by whom he had a son, Carpus, the god of fruit (Ovid, *Fasti*, v. 197); by the harpy Podargē he was also the father of Xanthus and Balius, the horses of Achilles. Being spurned by Hyacinthus (*q.v.*), he caused his death by accident at the hands of Apollo. He was identified by the Romans with Favonius, and Chloris with Flora.

ZERBST, a town of Germany, in the duchy of Anhalt, situated on the Nuthe, 11 m. N.W. of Dessau and 27 m. S.E. of Magdeburg by the railway Dessau-Leipzig. Pop. (1900) 17,095. It is still surrounded in part by old walls and bastions, while other portions of the whilom fortifications have been converted into pleasant promenades. It contains five churches, one of which (St Nicholas), built in 1446–88, is a good example of the late Gothic style as developed in Saxony, with its spacious proportions, groined vaulting, and bare simple pillars. The town hall dates from about 1480, but it was disfigured by additions in the beginning of the 17th century. It contains the municipal museum, among the chief treasures of which is a Luther Bible illustrated by Lucas Cranach the younger. The palace (1681–1750) has been used as a depository of archives since 1872. There are several quaint old houses, with high gables, in the market-place, in the middle of which stand a Roland column, of about 1445, and a bronze figure known as the *Butterjungfer* (butter-girl), of uncertain origin and meaning, but now regarded as the palladium of the town. The old Franciscan monastery, with fine cloisters, founded in 1250, contains the gymnasium; a Cistercian nunnery of 1214 has been converted into barracks; and the Augustinian monastery of 1390 has been a hospital since 1525. Gold and silver articles, silk, plush, cloth, leather, soap, starch, chemicals and carriages are among the chief manufactures. Iron-founding is carried on; and several breweries are engaged in the preparation of Zerbster bitter beer, which enjoys considerable repute.

Zerbst is an ancient town, mentioned in 949. In 1307 it came into the possession of the Anhalt family, and from 1603 till 1793 was the capital of the collateral branch of Anhalt-Zerbst. In 1793 it passed to Anhalt-Dessau.

ZERMATT, a mountain village at the head of the Visp valley and at the foot of the Matterhorn, in the canton of the Valais, Switzerland. It is 22¼ m. by rail from Visp in the Rhône valley, and there is also a railway from Zermatt past the Riffel inns to the very top of the Gornergrat (10,289 ft.). The village is 5315 ft. above the sea, and in 1900 had 741 permanent inhabitants (all Romanists save 9, and all but 12 German-speaking), resident in 73 houses. Formerly Zermatt was called "Praborgne," and this name is mentioned in the Swiss census of 1888. Its originally Romance population seems to have been Teutonised in the course of the 15th century, the name "Matt" (now written "Zermatt," *i.e.* the village on the meadows) first occurring at the very end of that century. Zermatt was long known to botanists and geologists only, and has an interesting though very local history. De Saussure in 1789 was one of the first tourists to visit it. But it was not till the arrival of M. Alexandre Seiler in 1854 that its fame as one of the chief tourist resorts in the Alps was laid, for tourists abound only where there are good inns. When M. Seiler died in 1891 he was proprietor of most of the great hotels in and around Zermatt. The Matterhorn, which frowns over the village from which it takes its name, was not conquered till 1865, Mr E. Whymper and two guides then alone surviving the terrible accident in which their four comrades perished. The easy glacier pass of the St Théodule (10,899 ft.) leads S. in six hours from the village to the Val Tournanche, a tributary glen of the valley of Aosta.

ZERO, the figure 0 in the Arabic notation for numbers, nought, cipher. The Arabic name for the figure was *sifr*, which meant literally an empty thing. The old Latin writers on arithmetic translated or transliterated the Arabic word as *zephyrum*; this in Ital. became *zefiro*, contracted to *zero*, borrowed by F. *zéro*, whence it came late into English. The Spanish form *cifra*, more closely resembling the original Arabic, gave O. Fr. *cifre*, mod. *chiffre*, also used in the sense of monogram, and English "cipher" which is thus a doublet. In physics, the term is applied to a point with which phenomena are quantitatively compared, especially to a point of a graduated instrument between a positive and negative or ascending and descending scale, as in the scales of temperature.

ZEULENRODA, a town of Germany, in the principality of Reuss-the-Elder, situated on a high plateau in a well-wooded and hilly country, 35 m. N. from Hof by the railway to Werdau. Pop. (1900) 9419. The town contains a handsome town hall, several churches and schools, and carries on an active industry in cotton and woollen stocking manufacture. Zeulenroda is mentioned as a village as early as 1399, and it obtained municipal rights in 1438. Since 1500 it has belonged to the Greiz branch of the Reuss line of princes.

ZEUS, the Greek counterpart of the Roman god, Jupiter (*q.v.*). In the recorded periods of Hellenic history, Zeus was accepted as the chief god of the pantheon of the Greeks; and the religious progress of the people from lower to higher ideas can be well illustrated by the study of his ritual and personality. His name is formed from a root *div*, meaning "bright," which appears in other Aryan languages as a formative part of divine names, such as the Sanskrit *Dyâus*, "sky"; Latin *Diovis*, *Jovis*, *Diespiter*, *divus*; Old English *Tiw*; Norse *Tyr*. The conclusion that has been frequently drawn from these facts, that all the Indo-Germanic stocks before their dispersal worshipped a personal High God, the Sky-Father, has been now seen to be hazardous.[1] Nevertheless, it remains probable that Zeus had already been conceived as a personal and pre-eminent god by the ancestors of the leading Hellenic tribes before they entered the peninsula which became their historic home. In the first place, his pre-eminence is obviously pre-Homeric; for Homer was no preacher or innovator in religion, but gives us some at least of the primary facts of the contemporary religious beliefs prevailing about 1000 B.C.: and he attests for us the supremacy of Zeus as a belief which was unquestioned by the average Hellene of the time; and appreciating how slow was the process of religious change in the earlier period, we shall believe that the god had won this position long before the Homeric age. In the next place, we cannot trace the origin of his worship back to any special stock or particular locality; we cannot find a single community that did not possess his worship or that preserved any legend that suggests a late date for its introduction. Doubtless, it has very ancient and close associations with Thessaly; for most of the leading tribes must have entered Hellas by this route, and remembered the mountain Olympus that dominates this region as the earliest home of his cult, and took with them to their most distant settlements the cult-title Ὀλύμπιος. Also, some of the prehistoric stocks in Thessaly, like the Achaean Aeacidae, may have regarded him as specially their ancestor. But to maintain therefore that he originated in Thessaly as the special deity of a single tribe, who were able to impose him upon the whole of Hellas, is against the analogies offered by the study of the special cults of Greek polytheism. But if we assume that he was the aboriginal Hellenic High God, we must be quite ready to admit that the separate communities were always liable to cherish other divinities with a more ardent and closer devotion, whether divinities that they brought with them or divinities that they found powerfully established in the conquered lands, Athena or Hera, for instance, in Attica or Argolis, or Poseidon in the Minyan settlements. This in fact is a frequent fate of a "High God" in polytheistic systems; he is vaguely praised and reverenced, but lower divine powers are nearer to the people's love or fear.

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[1] See, however, Schrader, *Prehistoric Antiquities of the Aryan Peoples* (trans. Jevons), 416–419.

The Cretan legend of his birth and origin, which gave rise to the Cretan cult of Zeus Κρηταγενής,[1] "Zeus born in Crete," may appear evidence against the theory just set forth. But it is not likely that any birth-legend belongs to the earliest stratum of the Zeus-religion. The Aryan Hellenes found in many of the conquered lands the predominant cult of a mother-goddess, to whom they gradually had to affiliate their own High God: and in Crete they found her cult associated with the figure of a male divinity who was believed to be born and to die at certain periods; probably he was an early form of Dionysus, but owing to his prominence in the island the Hellenic settlers may have called him Zeus; and this would explain the markedly Dionysiac character of the later Zeus-religion in Crete.

We can now consider the question how the god was imagined in the popular belief of the earliest and later periods. Homer is our earliest literary witness; and the portrait that he presents of Zeus is too well known to need minute description. To appreciate it, we must distinguish the lower mythologic aspect of him, in which he appears as an amorous and capricious deity lacking often in dignity and real power, and the higher religious aspect, in which he is conceived as the All-Father, the Father of Gods and men in a spiritual or moral sense, as a God omnipotent in heaven and earth, the sea and the realms below, as a God of righteousness and justice and mercy, who regards the sanctity of the oath and hears the voice of the suppliant and sinner, and in whom the pious and the lowly trust. In fact the later Greek religion did not advance much above the high-water mark of the Homeric, although the poets and philosophers deepened certain of its nobler traits. But Homer we now know to be a relatively late witness in this matter. How much of his sketch is really primitive, and what can we learn or guess concerning the millennium that preceded him? His God is pronouncedly individual and personal, and probably Zeus had reached this stage of character at the dawn of Hellenic history. Yet traces of a pre-deistic and animistic period survived here and there; for instance, in Arcadia we find the thunder itself called Zeus (Ζεὺς Κεραυνός) in a Mantinean inscription,[2] and the stone near Gythium in Laconia on which Orestes sat and was cured of his madness, evidently a thunder-stone, was named itself Ζεὺς Καππώτας, which must be interpreted as "Zeus that fell from heaven";[3] we here observe that the personal God does not yet seem to have emerged from the divine thing or divine phenomenon. Yet the Arcadians, like the other Greeks, had probably long before Homer risen above this stage of thought; for Greek religion was so strongly conservative that it preserved side by side the deposits of different ages of thought sundered perhaps by thousands of years.

Again the Homeric Zeus is fully anthropomorphic; but in many domains of Greek religion we discover the traces of theriomorphism, when the deity was regarded as often incarnate in the form of an animal or the animal might itself be worshipped in its own right. We seem to find it latent in the Arcadian worship of Zeus Λυκαῖος and the legend of King Lycaon. The latter offers a cannibal-meal to the disguised God, who turns him into a wolf for his sins; and the later Arcadian ritual in honour of this God betrays a hint of lycanthropy; some one who partook of the sacrifice or who swam across a certain lake was supposed to be transformed into a wolf for a certain time.[4] Robertson Smith[5] was the first to propose that we have here the traces of an ancient totemistic sacrifice of a wolf-clan, who offered the "theanthropic" animal "the man-wolf" to the wolf-God. The totemistic theory in its application to Greek religion cannot be here discussed; but we may note that there is no hint in the story that the wolf was offered to Zeus and that the name Λυκαῖος could not originally have designated the "wolf"-God: for from the stem λυκο- we should get the adjective λυκειος, not λυκαιος; the latter is better derived from a word such as λυκη = "light," and may allude to the God of the clear sky; in fact the wolf, which was a necessary animal in the ritual and legend of Apollo Λύκειος, may have strayed casually into association with Zeus Λυκαῖος, attracted by a false etymology. Another ritual, fascinating for the glimpse it affords of very old-world thought, is that of the Diipolia, the yearly sacrifice to Zeus Polieus on the Acropolis at Athens.[6] In this an ox was slaughtered with ceremonies unique in Greece; the priest who slew him fled and remained in exile for a period, and the axe that was used was tried, condemned and flung into the sea; the hide of the slain ox was stuffed with hay, and this effigy of the ox was yoked to the plough and feigned to be alive. Again Robertson Smith saw here the "theanthropic" animal, the Ox-God-man, eaten sacramentally by an ox-tribe, and so sacred that his death is a murder that must be atoned for in other ways and by a feigned resurrection. We recognize indeed the sacramental meal and the sanctity of the ox; but the animal may have acquired this sanctity temporarily through contact with the altar; we need not suppose an ox-clan—the priest was merely βούτης "the herdsman"—nor assume the permanent sanctity of the ox, nor the belief that the deity was permanently incarnate in the ox: the main parts of the ceremony can be explained as cattle-magic intended to appease the rest of the oxen or to prevent them suffering sympathetically through the death of one. We may indeed with Mr Andrew Lang explain the many myths of the bestial transformations of Zeus on the theory that the God was the tribal ancestor and assumed the shape of the animal-totem in order to engender the tribal patriarch;[7] but on the actual cults of Zeus theriomorphism has left less trace than on those of many other Hellenic deities. The animal offered to him may become temporarily sacred; and its skin would have magic properties: this explains his use of the *aegis*, the goat-skin, as a battle-charm; but of a Goat-Zeus, a Ram-Zeus, or a Wolf-Zeus, there is no real trace.

The peculiar characteristic of his earliest ritual was the human sacrifice; besides the legend of King Lycaon, we find it in the story of the house of Athamas and in the worship of Zeus Λαφύστιος of Thessaly,[8] and other examples are recorded. The cruel rite had ceased in the Arcadian worship before Pliny wrote, but seems to have continued in Cyprus till the reign of Hadrian. It was found in the worship of many other divinities of Hellas in early times, and no single explanation can be given that would apply to them all. A hypothesis favoured by Dr Frazer, that the victim is usually a divine man, a priest-king incarnating the God, may be well applied to the Athamantid sacrifice and to that of King Lycaon; for he derives his name from the divinity himself, and according to one version[1] he offers his own child; and the Lycaonid legend presents one almost unique feature, which is only found elsewhere in legendary Dionysiac sacrifice, the human flesh is eaten, and the sacrifice is a cannibalistic-sacrament, of which the old Mexican religion offers conspicuous example. Yet it is in this religion of Zeus that we see most clearly the achievement of progressive morality; Zeus himself punishes and abolishes the savage practice; the story related by Plutarch,[2] how a kid was substituted miraculously for Helen when she was led to the altar to be offered, is a remarkably close parallel to the biblical legend of Abraham's sacrifice of Isaac.

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[1] *Corp. Inscr. Graec.* 2554.

[2] *Bull. Corr. Hell.*, 1878, p. 515.

[3] Pausan. iii. 22. 1.

[4] Pliny, *Nat. Hist.* viii. 82; Pausan. viii. 2, § 3 and § 6.

[5] Article on "Sacrifice" in *Ency. Brit.*, 9th ed.

[6] Cf. Porphyry, ii. 29, 30 (from Theophrastus) and Pausan. i. 24. 4.

[7] *Myth, Ritual and Religion*, ii. 176.

[8] Herod. vii. 197.

We can now consider the special attributes of the anthropomorphic God. His character and power as a deity of the sky, who ruled the phenomena of the air, so clearly expressed in Homer, explains the greater part of his cult and cult-titles. More personal than Ouranos and Helios—with whom he has only slight associations—he was worshipped and invoked as the deity of the bright day (Ἀμάριος, Λευκαῖος, Λυκαῖος), who sends the rain, the wind and dew (Ὄμβριος, Νάϊος, Ὑέτιος, Οὔριος, Εὐάνεμος, Ἰκμαῖος), and such a primitive adjective as διϊπετής, applied to things "that fall from heaven," attests the primeval significance of the name of Zeus. But the thunder was his most striking manifestation, and no doubt he was primevally a thunder-God, Κεραύνιος, Κεραυνοβόλος, Ἀστραπαῖος. These cult-titles had originally the force of magic invocation, and much of his ritual was weather-magic: the priest of Zeus Λυκαῖος, in time of drought, was wont to ascend Mount Lycaeum and dip an oak-bough in a sacred fountain, and by this sympathetic means produce mist.[3] A god of this character would naturally be worshipped on the mountain-tops, and that these were very frequently consecrated to him is shown by the large number of appellatives derived from the names of mountains.[4] But probably in his earliest Hellenic period the power of Zeus in the natural world was not limited to the sky. A deity who sent the fertilizing rains would come to be regarded as a god of vegetation, who descended into the earth and whose power worked in the life that wells forth from the earth in plant and tree. Also the close special association of the European Thunder-God and the oak-tree has recently been exposed.[5] Homer calls the God of the lower world Ζεὺς Καταχθόνιος,[6] and the title of Zeus Χθόνιος which was known to Hesiod, occurred in the worship of Corinth;[7] and there is reason to believe that Eubouleus of Eleusis and Trophonius of Lebadeia are faded forms of the nether Zeus; in the Phrygian religion of Zeus, which no doubt contains primitive Aryan elements, we find the Thunder-God associated also with the nether powers.[8]

A glimpse into a very old stratum of Hellenic religion is afforded us by the records of Dodona. A Dodonean liturgy has been preserved which, though framed in the form of an invocation and a dogma, has the force of a spell-prayer—"Zeus was and is and will be, oh great Zeus: earth gives forth fruits, therefore call on Mother Earth."[9] Zeus the Sky-God is seen here allied to the Earth-Goddess, of whom his feminine counterpart, Dione, may have been the personal form. And it is at Dodona that his association with the oak is of the closest. His prophet-priests the Selloi "with unwashed feet, couching on the ground,"[10] lived about the sacred oak, which may be regarded[11] as the primeval shrine of the Aryan God, and interpreted its oracular voice, which spoke in the rustling of its leaves or the cooing of its doves. Achilles hails the Dodonean God as Πελασγικέ, either in the sense of "Thessalian," or "primitive";[12] and Zeus, we may believe, long remained at Dodona such as he was when the Hellenic tribes first brought him down from the Balkans, a high God supreme in heaven and in earth.

We may also believe that in the earliest stages of worship he had already acquired a moral and a social character. The Homeric view of him as the All-Father is a high spiritual concept, but one of which many savage religions of our own time are capable. The family, the tribe, the city, the simpler and more complex organisms of the Hellenic polity, were specially under his care and direction. In spite of the popular stories of his amours and infidelities, he is the patron-God of the monogamic marriage, and his union with Hera remained the divine type of human wedlock. "Reverence Zeus, the Father-God": "all fathers are sacred to Zeus, the Father-God, and all brothers to Zeus the God of the family": these phrases of Aristophanes and Epictetus[13] express the ideas that engendered his titles Πατρῷος, Γαμήλιος, Τελεῖος, Ὁμόγνιος. In the *Eumenides* of Aeschylus[14] the Erinyes are reproached in that by aiding Clytemnestra, who slew her husband, "they are dishonouring and bringing to naught the pledges of Zeus and Hera, the marriage-goddess"; and these were the divinities to whom sacrifice was offered before the wedding,[15] and it may be that some kind of mimetic representation of the "Holy Marriage," the Ἱερὸς γάμος, of Zeus and Hera formed a part of the Attic nuptial ceremonies.[16] The "Holy Marriage" was celebrated in many parts of Greece, and certain details of the ritual suggest that it was of great antiquity: here and there it may have had the significance of vegetation-magic,[17] like the marriage of the Lord and Lady of May; but generally it seems to have been only regarded as a divine counterpart to the human ceremony. Society may have at one time been matrilinear in the communities that become the historic Hellenes; but of this there is no trace in the worship of Zeus and Hera.[18]

In fact, the whole of the family morality in Hellas centred in Zeus, whose altar in the courtyard was the bond of the kinsmen; and sins against the family, such as unnatural vice and the exposure of children, are sometimes spoken of as offences against the High God.[19]

He was also the tutelary deity of the larger organization of the phratria; and the altar of Zeus Φράτριος was the meeting-point of the *phrateres*, when they were assembled to consider the legitimacy of the new applicants for admission into their circle.[20]

His religion also came to assist the development of certain legal ideas, for instance, the rights of private or family property in land; he guarded the allotments as Ζεὺς Κλάριος,[21] and the Greek commandment "thou shalt not remove thy neighbour's landmark" was maintained by Zeus Ὅριος, the god of boundaries, a more personal power than the Latin Jupiter Terminus.[22]

His highest political functions were summed up in the title Πολιεύς, a cult-name of legendary antiquity in Athens, and frequent in the Hellenic world.[23]

His consort in his political life was not Hera, but his daughter Athena Polias. He sat in her judgment court ἐπὶ Παλλαδίῳ where cases of involuntary homicide were tried.[24] With her he shared the chapel in the Council-Hall of Athens dedicated to them under the titles of Βουλαῖος and Βουλαία, "the inspirers of counsel," by which they were worshipped in many parts of

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[1] Clemens, *Protrept.* p. 31 P.

[2] *Parallela*, 35.

[3] Pausan. viii. 38, 3.

[4] Farnell, *Cults of the Greek States*, i. 154; ref. 66–89.

[5] See Chadwick in *Anthropological Journ.*, 1900, on "The Oak and the Thunder-God."

[6] *Il.* ix. 457.

[7] *Works and Days*, 456; Pausan. ii. 2, 8.

[8] *Journ. Hellen. Stud.* iii. 124; v. 257.

[9] Pausan. x. 12, 10.

[10] Hom. *Il.* xvi. 233.

[11] Chadwick, *op. cit.*

[12] *Il.* xvi. 233.

[13] Arist. *Nub.* 1468; Epict. *Diatrib.* iii. ch. 11.

[14] 213–214.

[15] Schol. Aristoph. *Thesm.* 973.

[16] Photius, s.v. Ἱερὸς γάμος.

[17] See Frazer's *Golden Bough*, 2nd ed. i. 226–227.

[18] The attempts to discover the traces of matrilinear society in Greek religion may be regarded as mainly unsuccessful: *vide* A. B. Cook, *Class. Rev.* 1906 (October, November), "Who was the wife of Zeus?"

[19] Dio. Chrys. *Or.* 7 (Dind. i. 139).

[20] Demosth. *Contra Macartatum*, 1078, i.

[21] Pausan. viii. 53, 9.

[22] Plato's *Laws*, 842 E.

[23] Vide Farnell, *op. cit.* i. 159; ref. 107–109.

[24] *Corp. Inscr. Attic.* iii. 71 and 273.

Greece.[1] The political assembly and the law-court were consecrated to Ζεὺς Ἀγοραῖος,[2] and being the eternal source of justice he might be invoked as Δικαιόσυνος "The Just."[3] As the god who brought the people under one government he might be worshipped as Πάνδημος;[4] as the deity of the whole of Hellas, Ἑλλάνιος,[5] a title that belonged originally to Aegina and to the prehistoric tribe of the Aeacidae, and had once the narrower application to the "Thessalian Hellenes," but acquired the Pan-Hellenic sense, in fact expanded into the form Πανελλήνιος, perhaps about the time of the Persian wars, when thanksgiving for the victory took the form of dedications and sacrifice to "Zeus the Liberator"—Ἐλευθέριος.[6] Finally, in the formulae adopted for the public oath, where many deities were invoked, the name of Zeus was the masterword.

There is reason for thinking that this political character of Zeus belongs to the earliest period of his religion, and it remained as long as that religion lasted. Yet in one respect Apollo was more dominant in the political life; for Apollo possessed the more powerful oracle of Delphi. Zeus spoke directly to his people at Dodona only,[7] and with authority only in ancient times; for owing to historical circumstances and the disadvantage of its position, Dodona paled before Delphi.

It remains to consider briefly certain moral aspects of his cult. The morality attaching to the oath, so deeply rooted in the conscience of primitive peoples, was expressed in the cult of Zeus Ὅρκιος, the God who punished perjury.[8] The whole history of Greek legal and moral conceptions attaching to the guilt of homicide can be studied in relation to the cult-appellatives of Zeus. The Greek consciousness of the sin of murder, only dimly awakened in the Homeric period, and only sensitive at first when a kinsman or a suppliant was slain, gradually expands till the sanctity of all human life becomes recognized by the higher morality of the people: and the names of Ζεὺς Μειλίχιος, the dread deity of the ghost-world whom the sinner must make "placable," of Ζεὺς Ἱκέσιος and Προστροπαῖος, to whom the conscience-striken outcast may turn for mercy and pardon, play a guiding-part in this momentous evolution.[9]

Even this summary reveals the deep indebtedness of early Greek civilization to this cult, which engendered ideas of importance for the higher religious thought of the race, and which might have developed into a monotheistic religion, had a prophet-philosopher arisen powerful enough to combat the polytheistic proclivities of Hellas. Yet the figure of Zeus had almost faded from the religious world of Hellas some time before the end of paganism; and Lucian makes him complain that even the Egyptian Anubis is more popular than he, and that men think they have done the outworn God sufficient honour if they sacrifice to him once in five years at Olympia. The history of religions supplies us with many examples of the High God losing his hold on the people's consciousness and love. In the case of this cult the cause may well have been a certain coldness, a lack of enthusiasm and mystic ardour, in the service. These stimulants were offered rather by Demeter and Dionysus, later by Cybele, Isis and Mithras.

BIBLIOGRAPHY.—For older authorities see Preller-Robert, *Griechische Mythologie*, i. pp. 115–159; Welcker's *Griechische Götterlehre*, ii. pp. 178–216; among recent works, Gruppe's *Griechische Mythologie*, ii. pp. 1100–1121; Farnell's *Cults of the Greek States*, vol. i. pp. 35–178; Daremberg and Saglio, *Dictionnaire des antiquités grecques et romaines*, s.v., "Jupiter"; A. B. Cook's articles in *Classical Review*, 1903–1904, "Zeus, Jupiter, and the Oak": for cult-monuments and art-representations, Overbeck, *Kunst-Mythologie*, vol. i. (L. R. F.)

ZEUXIS, a Greek painter, who flourished about 420–390 B.C., and described himself as a native of Heraclea, meaning probably the town on the Black Sea. He was, according to one account, a pupil of Damophilus of Himera in Sicily, the other statement being that he was a pupil of Neseus of Thasos. Afterwards he appears to have resided in Ephesus. His known works are—

1. Zeus surrounded by Deities.
2. Eros crowned with Roses.
3. Marsyas bound.
4. Pan.
5. Centaur family.
6. Boreas or Triton.
7. Infant Heracles strangling the serpents in presence of his parents, Alcmena and Amphitryon.
8. Alcmena, possibly another name for 7.
9. Helena at Croton.
10. Penelope.
11. Menelaus.
12. Athlete.
13. An old Woman.
14. Boy with grapes.
15. Grapes.
16. Monochromes.
17. Plastic works in clay.

In ancient records we are told that Zeuxis, following the initiative of Apollodorus, had introduced into the art of painting a method of representing his figures in light and shadow, as opposed to the older method of outline, with large flat masses of colour for draperies, and other details, such as had been practised by Polygnotus and others of the great fresco painters. The new method led to smaller compositions, and often to pictures consisting of only a single figure, on which it was more easy for the painter to demonstrate the combined effect of the various means by which he obtained perfect roundness of form. The effect would appear strongly realistic, as compared with the older method, and to this was probably due the origin of such stories as the contest in which Zeuxis painted a bunch of grapes so like reality that birds flew towards it, while Parrhasius painted a curtain which even Zeuxis mistook for real. It is perhaps a variation of this story when we are told (Pliny) that Zeuxis also painted a boy holding grapes towards which birds flew, the artist remarking that if the boy had been as well painted as the grapes the birds would have kept at a distance. But, if the method of Zeuxis led him to real roundness of form, to natural colouring, and to pictures consisting of single figures or nearly so, it was likely to lead him also to search for striking attitudes or motives, which by the obviousness of their meaning should emulate the plain intelligibility of the larger compositions of older times. Lucian, in his *Zeuxis*, speaks of him as carrying this search to a novel and strange degree, as illustrated in the group of a female Centaur with her young. When the picture was exhibited, the spectators admired its novelty and overlooked the skill of the painter, to the vexation of Zeuxis. The pictures of Heracles strangling the serpents to the astonishment of his father and mother (7), Penelope (10), and Menelaus Weeping (11) are quoted as instances in which strong motives naturally presented themselves to him. But, in spite of the tendency towards realism inherent in the new method of Zeuxis, he is said to have retained the ideality which had characterized his predecessors. Of all his known works it would be expected that this quality would have appeared best in his famous picture of Helena, for this reason, that we cannot conceive any striking or effective incident for him in her career. In addition to this, however, Quintilian states (*Inst. Orat.* xii. 10, 4) that in respect of robustness of types Zeuxis had followed Homer, while there is the fact that he had inscribed two verses of the *Iliad* (iii 156 seq.) under his figure of Helena. As models for the picture he was allowed the presence of five of the most beautiful maidens of Croton at his own request, in order that he might be able to "transfer the truth of life to a mute image." Cicero (*De Invent.* ii. 1, 1) assumed that Zeuxis had found distributed among these five the various elements that went to make up a figure of ideal beauty. It should not, however, be understood that the painter had made up his figure by the process of combining the good points of various models, but rather that he found among those models the points that answered to the ideal Helena in his own mind, and that he merely required the models to guide and correct himself by during the process of transferring his ideal to form and colour. This picture also is said to have been exhibited publicly, with the result that Zeuxis made much profit out of it. By this and other means, we are told, he became so rich as rather to give away his pictures than to sell them. He presented his Alcmena to the Agrigentines, his Pan to King Archelaus of Macedonia, whose palace he is also said to have decorated with paintings. According to Pliny (*N.H.* xxxv. 62), he made an ostentatious display of his wealth at Olympia in having his name woven in letters of gold on his dress. Under his picture of an athlete (12) he wrote that "It is easier to revile than to rival" (*μωμήσεταί τις μᾶλλον ἢ μιμήσεται*). A contemporary, Isocrates (*De Permut.* 2), remarks that no one would say that Zeuxis and Parrhasius had the same profession as those persons who paint *pinakia*, or tablets of terra-cotta. We possess many examples of the vase-painting of the period *circa* 400 B.C., and it is noticeable on them that there is great freedom and facility in drawing the human form, besides great carelessness. In the absence of fresco paintings of that date we have only these vases to fall back upon. Yet, with their limited resources of colour and perspective, they in a measure show the influence of Zeuxis, while, as would be expected, they retain perhaps more of the simplicity of older times.

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[1] Antiphon vi. p. 789; Pausan. i. 3, 5: cf. *Corp. Inscr. Attic.* iii. 683.
[2] Farnell, *op. cit.* vol. i. p. 162.
[3] *Amer. Journ. Archaeol.*, 1905, p. 302.
[4] *C. I. A.* 3, 7. Head, *Hist. Num.* p. 569.
[5] Herod. ix. 7, 4; Pind. *Nem.* v. 15 (Schol.).
[6] Simonides, *Frag.* 140 (Bergk), Strab. 412.
[7] There was a minor oracle of Zeus at Olympia. See ORACLE.
[8] Pausan. v. 24, 9.
[9] Farnell, *op. cit.* vol. i. pp. 64–69.

ZHELESNOVODSK, a health resort of Russian Caucasia, in the province of Terek, lying at an altitude of 1885 ft. on the S. slope of the Zhelesnaya Gora (2805 ft.), 11 m. by rail N.N.W. from Pyatigorsk. It possesses chalybeate springs of temperature 56½–96° Fahr.; the buildings over the springs were erected in 1893. The season lasts from early in June to the middle of September.

ZHITOMIR, or Jitomir, a town of western Russia, capital of the government of Volhynia, on the Teterev river, 83 m. W.S.W. of Kiev. Pop. (1900) 80,787, more than one-third Jews. It is the see of an archbishop of the Orthodox Greek Church and of a Roman Catholic bishop. Two printing offices in Zhitomir issue nearly one-half of all the Hebrew books printed in Russia. The Jewish merchants carry on a considerable export trade in agricultural produce, and in timber and wooden wares from the forests to the north. Kid gloves, tobacco, dyes and spirits are manufactured.

Zhitomir is a very old city, tradition tracing its foundation as far back as the times of the Scandinavian adventurers, Askold and Dir (9th century). The annals, however, mention it chiefly in connexion with the invasions of the Tatars, who plundered it in the 13th, 14th and 17th centuries (1606), or in connexion with destructive conflagrations. It fell under Lithuanian rule in 1320, and during the 15th century was one of the chief cities of the kingdom. Later it became part of Poland, and when the Cossacks rose under their chieftain, Bogdan Chmielnicki (1648), they sacked the town. It was annexed to Russia along with the rest of the Ukraine in 1778.

ZHOB, a valley and river in the N.E. of Baluchistan. The Zhob is a large valley running from the hills near Ziarat first eastward and then northward parallel to the Indus frontier, till it meets the Gomal river at Khajuri Kach. It thus becomes a strategic line of great importance, as being the shortest route between the North-West Frontier Province and Quetta, and dominates all the Pathan tribes of Baluchistan by cutting between them and Afghanistan. Up to the year 1884 it was practically unknown to Europeans, but the Zhob Valley Expedition of that year opened it up, and in 1889 the Zhob Valley and Gomal Pass were taken under the control of the British Government. The Zhob Valley was the scene of punitive British expeditions in 1884 and 1890. In 1890 Zhob was formed into a district or political agency, with its headquarters at Fort Sandeman: pop. (1901) 3552. As reconstituted in 1903, the district has an area of 9626 sq. m.; pop. (1901) 69,718, mostly Pathans of the Kakar tribe.

See Sir T. H. Holdich's *Indian Borderland* (1901); Bruce's *Forward Policy* (1900); McFall's *With the Zhob Field Force* (1895); and *Zhob District Gazetteer* (Bombay, 1907).

ZIARAT ("a Mahommedan shrine"), the summer residence of the chief commissioner of Baluchistan, and sanatorium for the European troops at Quetta: 8850 ft. above the sea and 33 m. by cart-road from the railway. There is a good water-supply, and the hills around are well-wooded and picturesque.

ZICHY (of Zich and Vásonykeö), the name of a noble Magyar family, conspicuous in Hungarian history from the latter part of the 13th century onwards. Its first authentic ancestor bore the name of Zayk, and this was the surname of the family until it came into possession of Zich in the 15th century. It first came into great prominence in the 16th century, being given countly rank in 1679 in the person of the imperial general Stefan Zichy (d. 1693). His descendants divided, first into two branches: those of Zichy-Palota and Zichy-Karlburg. The Palota line, divided again into three: that of Nagy-Láng, that of Adony and Szent-Miklós, and that of Palota, which died out in the male line in 1874. The line of Zichy-Karlburg (since 1811 Zichy-Ferraris) split into four branches: that of Vedröd, that of Vézsony, and those of Daruvár and Csicsó, now extinct.

Count Károly Zichy (1753–1826) was Austrian war minister in 1809 and minister of the interior in 1813–1814; his son, Count Ferdinánd (1783–1862) was the Austrian field-marshal condemned to ten years' imprisonment for surrendering Venice to the insurgents in 1848 (he was pardoned in 1851). Count Ödön [Edmund] Zichy (1809–1848), administrator of the county of Veszprém, was hanged on the 30th of September 1848 by order of a Hungarian court-martial, presided over by Görgei, for acting as Jellachich's emissary to the imperial general Roth. Count Ferenc Zichy (1811–1900) was secretary of state for commerce in the Széchényi ministry of 1848, but retired on the outbreak of the revolution, joined the imperial side, and acted as imperial commissary; from 1874 to 1880 he was Austrian ambassador at Constantinople. Count Ödön Zichy (1811–1894) was remarkable for his great activity in promoting art and industry in Austria-Hungary; he founded the Oriental Museum in Vienna. His son, Count Eugen Zichy (b. 1837), inherited his father's notable collections, and followed him in his economic activities; he three times visited the Caucasus and Central Asia to investigate the original seat of the Magyars, publishing as the result *Voyages au Caucase* (2 vols., Budapest, 1897) and *Dritte asiatische Forschungsreise* (6 vols., in Magyar and German; Budapest and Leipzig, 1900–1905). Count Ferdinánd Zichy (b. 1829), vice-president of the Hungarian stadtholdership under the Mailáth régime, was condemned in 1863 under the press laws to the loss of his titles and to imprisonment. In 1867 he was elected to the Hungarian parliament, at first joining the party of Deák, and subsequently becoming one of the founders and leaders of the Catholic People's Party (see Hungary, *History*). His second son, Count Aladár Zichy (b. 1864), also a member of the Catholic People's Party, was made minister of the royal household in the Wekerle cabinet of 1906. Count János Zichy (b. 1868), also from 1896 to 1906 a member of the Catholic People's Party in the Lower House, and after 1906 attached to Andrássy's Constitutional Party, was of importance as the confidant of the heir to the throne, the Archduke Francis Ferdinand. Count Géza Zichy (b. 1849), nephew of the Count Ferenc mentioned above, studied under Liszt and became a professional pianist; in 1891 he became intendant of the Hungarian national opera-house, a member of the Hungarian Upper House and head of the Conservatoire at Budapest. Count Mihály Zichy (b. 1829), one of the most conspicuous Hungarian painters, was appointed court painter at St Petersburg in 1847 and accompanied the Russian emperors on their various journeys. The National Gallery at Budapest possesses some of his paintings, notably that of "Queen Elizabeth before the coffin of Francis Deák"; but he is best known for his illustrations of the works of the great Magyar writers (Petöfy, Arany, &c.).

ZIEM, FÉLIX FRANÇOIS GEORGE PHILIBERT (1821–   ), French painter, was born at Beaune (Côte d'Or) in 1821. Having studied at the art school of Dijon, where he carried off the *grand prix* for architecture, he went to Rome in 1839 and there continued his studies. The years from 1845 to 1848 were spent in travel in the south of France, Italy and the East, where he found the glowing sunlight and the rich colour peculiarly suited to his temperament. His reputation is, however, not based so much on his orientalist canvases as on his pictures of Venice, which are generally characterized by the intensity of the sunny glow on the red sails and golden-yellow buildings under a deep blue sky. Many of his Venetian pictures are purely imaginative, and their appeal is entirely due to their qualities of colour, his architectural drawing being frequently faulty and careless. After "Sunrise at Stamboul," which Théodore Gautier called "the finest picture of modern times," he received the Legion of Honour in 1857, and was made an officer in 1878. The majority of his paintings have gone to American private collections, but two of his finest pictures, "The Doge's Palace in Venice" (1852), and a marine-painting, are at the Luxembourg Museum, and a "View of Quai St Jean, Marseilles" at the Marseilles Gallery, whilst many others are to be found in the leading private collections of modern pictures in France, England and Germany. In collaboration with Luc de Vos he illustrated *The Death of Paganini*.

See *Félix Ziem*, by L. Roger-Milès (*Librairie de l'art*, Paris).

ZIERIKSEE, a town in the province of Zeeland, Holland, on the south side of the island of Schouwen. Pop. 6800. It is a very old town, and formerly flourished exceedingly on account of its trade and fishing, and important salt-making industry, and now is the chief market centre and port in the island. Among the principal buildings are the town-hall (15th century); the Great Church, which was rebuilt after a fire in 1832, but retains the lofty tower (1454) belonging to the earlier building; the Little Church, the prison and the exchange. The chief public square occupies the site of a residence of the counts of Zeeland dating from 1048.

ZIETEN, HANS JOACHIM VON (1699–1786), Prussian general-field-marshal, began his military career as a volunteer in an infantry regiment. He retired after ten years' service, but soon afterwards became a lieutenant of dragoons. Being involved in some trade transactions of his squadron-commander, he was cashiered, but by some means managed to obtain reinstatement, and was posted to a hussar corps, then a new arm. At that time light cavalry work was well known only to the Austrians, and in 1735 Rittmeister von Zieten made the Rhine campaign under the Austrian general Baronay. In 1741, when just promoted lieutenant-colonel, Zieten met his old teacher in battle and defeated him at the action of Rothschloss. The chivalrous Austrian sent him a complimentary letter a few days later, and Winterfeld (who was in command at Rothschloss) reported upon his conduct so favourably that Zieten was at once marked out by Frederick the Great for high command. Within the year he was colonel of the newly formed Hussar regiment, and henceforward his promotion was rapid. In the "Moravian Foray" of the following year Zieten and his hussars penetrated almost to Vienna, and in the retreat to Silesia he was constantly employed with the rearguard. Still more distinguished was his part in the Second Silesian War. In the short peace, the hussars, like the rest of the Prussian cavalry, had undergone a complete reformation; to iron discipline they had added the dash and skirmishing qualities of the best irregulars, and the hussars were considered the best of their arm in Europe. Zieten fought the brilliant action of Moldau Tein almost on the day he received his commission as major-general. In the next campaign he led the famous *Zietenritt* round the enemy's lines with the object of delivering the king's order to a distant detachment. At Hohenfriedberg-Striegau and at Katholisch-Hennersdorf the hussars covered themselves with glory. Hennersdorf and Kesselsdorf ended the second war, but the Prussian army did not rest on its laurels, and their training during the ten years' peace was careful and unceasing. When the Seven Years' War broke out in 1756 Zieten had just been made lieutenant-general. At Reichenberg and at Prag he held important commands, and at the disastrous battle of Kolin (18th June 1757) his left wing of cavalry was the only victorious corps of troops. At Leuthen, the most brilliant battle of the 18th century, Zieten's cavalry began the fighting and completed the rout of the Austrians. He continued, during the whole of the war, to be one of Frederick's most trusted generals. Almost the only error in his career of battles was his misdirection of the frontal attack at Torgau, but he redeemed the mistake by his desperate assault on the Siptitz heights, which eventually decided the day. At the peace, General Zieten went into retirement, the hero alike of the army and the people. He died in 1786. Six years later Frederick's successor erected a column to his memory on the Wilhelmsplatz in Berlin.

See the Lives by his daughter, Frau von Blumenthal (Berlin, 1800), by Hahn (5th ed., Berlin, 1878), by Lippe-Weissenfeld (2nd ed., Berlin, 1878), and by Winter (Leipzig, 1886).

ZIMBABWE, a Bantu name, probably derived from the two words *zimba* ("houses") and *mabgi* ("stones"), given to certain ruins in South-East Africa. Its use is not confined to Southern Rhodesia and should not properly be restricted to any one particular site. For, as the medieval Portuguese stated, it is merely a generic term for the capital of any considerable chief, and it has been applied even by them to several distinct places. From about 1550 onwards the Zimbabwe generally referred to by Portuguese writers was at a spot a little north of the Afur district, not far from the Zambezi. There is some reason, however, to suppose that before this the capital of the Monomotapa was situated much farther south, and it may plausibly be identified with the most extensive ruins as yet known, viz. those near Victoria (Mashonaland) to which popular usage has now attached *par excellence* the name of Zimbabwe.

These ruins were discovered by Adam Renders in 1868 and explored by Karl Mauch in 1871. They became well known to English readers from J. T. Bent's account of the *Ruined Cities of Mashonaland*, but the popularity of that work disseminated a romance concerning their age and origin which was only dispelled when scientific investigations undertaken in 1905 showed it to be wholly without historical warrant. Even before this it had been clear to archaeologists and ethnologists that there was no evidence to support the popular theory that Zimbabwe had been built in very ancient days by some Oriental people. Swan's measurements, which had misled Bent into accepting a chronology based on a supposed orientation of the "temple," had been shown to be inexact. There was no authentic instance of any inscription having been found there or elsewhere in Rhodesia. Numerous objects had been discovered in the course of excavations, but not one of them could be recognized as more than a few centuries old, while those that were not demonstrably foreign imports were of African type.

The explorations conducted in 1905 added positive evidence. For it was proved that the medieval objects were found in such positions as to be necessarily contemporaneous with the foundation of the buildings, and that there was no superposition of periods of any date whatsoever. Finally from a comparative study of several ruins it was established that the plan and construction of Zimbabwe are by no means unique, and that this site only differs from others in Rhodesia in respect of the great dimensions and the massiveness of its individual buildings. It may confidently be dated to a period not earlier than the 14th or 15th century A.D., and attributed to the same Bantu people the remains of whose stone-fenced *kraals* are found at so many places between the Limpopo and the Zambezi.

There are three distinct though connected groups of ruins at Zimbabwe, which are commonly known as the "Elliptical Temple," the "Acropolis" and the "Valley Ruins." The most famous is the first, which is doubly misnamed, since it is not a temple and its contour is too unsymmetrical to be described properly as elliptical. It is an irregular enclosure over 800 ft. in circumference, with a maximum length of 292 ft. and a maximum breadth of 220 ft., surrounded by a dry-built wall of extraordinary massiveness. This wall is in places over 30 ft. high and 14 ft. wide, but is very erratic in outline and variable in thickness. The most carefully executed part is on the south and south-east, where the wall is decorated by a row of granite monoliths beneath which runs a double line of chevron ornament. The interior has been much destroyed by the ravages of gold-seekers and amateur excavators. Enough, however, remains to show that the scheme was a combination of such a stone *kraal* as that at Nanatali with the plan of a fort like those found about Inyanga. The only unique feature is the occurrence of a large and a small conical tower at the southern end, which Bent and others considered to be representatives of the human phallus. Their form, however, is not sufficiently characteristic to warrant this identification, though it may be noted that the nearest approximation to phallic worship is found amongst the most typical of African peoples, viz. the Ewe-speaking natives of the West Coast. The floor of the enclosure is constituted as in the other Zimbabwe buildings by a thick bed of cement which extends even outside the main wall. This cement mass is heightened at many places so as to make platforms and supports for huts. Groups of these dwellings are enclosed by subsidiary stone walls so as to form distinct units within the larger precinct.

The "Acropolis" is in some ways more remarkable than the great *kraal* which has just been described. It is a hill rising 200 to 300 ft. above the valley, fortified with the minutest care and with extraordinary ingenuity. The principles of construction, the use of stone and cement are the same as in the "elliptical" *kraal*; there is no definite plan, the shape and arrangement of the enclosures being determined solely by the natural features of the ground. Between this and the "elliptical" *kraal* are the "Valley Ruins," consisting of smaller buildings which may have been the dwellings of those traders who bartered the gold brought in from distant mines. Zimbabwe was probably the distributing centre for the gold traffic carried on in the middle ages between subjects of the Monomotapa and the Mahommedans of the coast.

Compare also the articles RHODESIA: *Archaeology*, and MONOMOTAPA.

See D. Randall-MacIver, *Mediaeval Rhodesia* (London, 1906); *Journal of Anthrop. Inst.*, vol. xxxv.; *Geog. Journal* (1906); Mauch's report in *Ausland* (1872) is now only of bibliographical interest, while Bent's *Ruined Cities of Mashonaland* (1892) and R. N. Hall's *Great Zimbabwe* (1905) are chiefly valuable for their illustrations.[1] (D. R.-M.)

ZIMMERMANN, JOHANN GEORG, RITTER VON (1728–1705), Swiss philosophical writer and physician, was born at Brugg, in the canton of Aargau, on the 8th of December 1728. He studied at Göttingen, where he took the degree of doctor of medicine; and he established his reputation by the dissertation, *De irritabilitate* (1751). After travelling in Holland and France, he practised as a physician in his native place, and here he wrote *Über die Einsamkeit* (1756, emended and enlarged, 1784–85) and *Vom Nationalstolz* (1758). These books made a great impression in Germany, and were translated into almost every European language. They are now only of historical interest. In Zimmermann's character there was a strange combination of sentimentalism, melancholy and enthusiasm; and it was by the free and eccentric expression of these qualities that he excited the interest of his contemporaries. Another book by him, written at Brugg, *Von der Erfahrung in der Arzneiwissenschaft* (1764), also attracted much attention. In 1768 he settled at Hanover as private physician of George III. with the title of Hofrat. Catherine II. invited him to the court of St Petersburg, but this invitation he declined. He attended Frederick the Great during that monarch's last illness, and afterwards issued various books about him, of which the chief were *Über Friederich den Grossen und meine Unterredung mit ihm kurz vor seinem Tode* (1788) and *Fragmente über Friedrich den Grossen* (1790). These writings display extraordinary personal vanity, and convey a wholly false impression of Frederick's character. Zimmermann died at Hanover on the 7th of October 1795.

See A. Rengger, *Zimmermann's Briefe an einige seiner Freunde in der Schweiz* (1830); E. Bodemann, *Johann Georg Zimmermann, sein Leben und bisher ungedruckte Briefe an ihn* (Hann., 1878); and R. Ischer, *Johann Georg Zimmermann's Leben und Werke* (Berne, 1893).

ZINC, a metallic chemical element; its symbol is Zn, and atomic weight 65·37 (O = 16). Zinc as a component of brass (χαλκός, ὀρεί-χαλκος) had currency in metallurgy long before it became known as an individual metal. Aristotle refers to brass as the "metal of the Mosynoeci,"[2] which is produced as a bright and light-coloured χαλκός, not by addition of tin, but by fusing up with an earth. Pliny explicitly speaks of a mineral καδμεία or *cadmia* as serving for the conversion of copper into *aurichalcum*, and says further that the deposit (of zinc oxide) formed in the brass furnaces could be used instead of the mineral. The same process was used for centuries after Pliny, but its rationale was not understood. Stahl, as late as 1702, quoted the formation of brass as a case of the union of a metal with an earth into a metallic compound; but he subsequently adopted the view propounded by Kunckel in 1677, that "cadmia" is a metallic calx, and that it dyes the copper yellow by giving its metal up to it.

The word zinc (in the form *zinken*) was first used by Paracelsus, who regarded it as a bastard or semi-metal; but the word was subsequently used for both the metal and its ores. Moreover, zinc and bismuth were confused, and the word *spiauter* (the modern spelter) was indiscriminately given to both these metals. In 1597 Libavius described a "peculiar kind of tin" which was prepared in India, and of which a friend had given him a quantity. From his account it is quite clear that that metal was zinc, but he did not recognize it as the metal of calamine. It is not known to whom the discovery of isolated zinc is due; but we do know that the art of zinc-smelting was practised in England from about 1730. The first continental zinc-works were erected at Liége in 1807.

Occurrence.—Zinc does not occur free in nature, but in combination it is widely diffused. The chief ore is zinc blende, or sphalerite (see BLENDE), which generally contains, in addition to zinc sulphide, small amounts of the sulphides of iron, silver and cadmium. It may also be accompanied by pyrites, galena, arsenides and antimonides, quartz, calcite, dolomite, &c. It is widely distributed, and is particularly abundant in Germany (the Harz, Silesia), Austro-Hungary, Belgium, the United States and in England (Cumberland, Derbyshire, Cornwall, North Wales). Second in importance is the carbonate, calamine (*q.v.*) or zinc spar, which at one time was the principal ore; it almost invariably contains the carbonates of cadmium, iron, manganese, magnesium and calcium, and may be contaminated with clay, oxides of iron, galena and calcite; "white calamine" owes its colour to much clay; "red calamine" to admixed iron and manganese oxides. Calamine chiefly occurs in Spain, Silesia and in the United States. Of less importance is the silicate, $Zn_2SiO_4 \cdot H_2O$, named electric calamine or hemimorphite; this occurs in quantity in Altenburg near Aix-la-Chapelle, Sardinia, Spain and the United States (New Jersey, Pennsylvania, Missouri, Wisconsin). Other zinc minerals are willemite (*q.v.*), Zn_2SiO_4, hydrozincite or zinc bloom, $ZnCO_3 \cdot 2Zn(OH)_2$, zincite (*q.v.*) or red zinc ore, ZnO, and franklinite, $3(Fe,Zn)O \cdot (Fe,Mn)_2O_3$.

Production.—Until about 1833 the supply of zinc was almost entirely obtained from Germany, but in this year Russia began to contribute about 2000 tons annually to the 6000 to 7000 derived from Germany. Belgium entered in 1837 with an output of about 2000 tons; England in 1855 with 3000; and the United States in 1873 with 6000 tons. The productions of Germany, Belgium and the United States have enormously and fairly regularly increased; the rise has been most rapid in the United

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[1] [In 1909 Hall published another volume, *Prehistoric Rhodesia*, in which he maintained, in emphatic opposition to Dr MacIver's conclusions, that the ruins were of ancient date and not the unaided work of Bantu negroes. See the review by Sir Harry Johnston in the *Geog. Jnl.*, Nov. 1900. ED.]

[2] From the name of this tribe the German word *Messing*, brass, is undoubtedly derived (see K. B. Hoffmann, *Zeit. f. Berg. und Hüttenwesen*, vol. 41).

States. England, France, Spain and Austria have been fairly constant producers. Germany produced 155,799 tons in 1900, and 198,208 in 1905; Belgium, 120,000 in 1900 and 143,165 in 1905; the United States, 111,000 in 1900 and 183,014 in 1905. The world's supply was 445,438 tons in 1900, and 654,367 in 1905.

METALLURGY

The principles underlying the extraction of zinc may be summarized as: (1) the ore is first converted into zinc oxide; (2) the oxide is distilled with carbon and the distillate of metallic zinc condensed. Oxide of zinc, like most heavy metallic oxides, is easily reduced to the metallic state by heating it to redness with charcoal; pure red zinc ore may be treated directly; and the same might be done with pure calamine of any kind, because the carbon dioxide of the zinc carbonate goes off below redness and the silica of zinc silicate only retards, but does not prevent, the reducing action of the charcoal. Zinc blende, however, being zinc sulphide, is not directly reducible by charcoal; but it is easy to convert it into oxide by roasting: the sulphur goes off as sulphur dioxide whilst the zinc remains in the (infusible) form of oxide, ZnO. In practice, however, we never have to deal with pure zinc minerals, but with complex mixtures, which must first of all be subjected to mechanical operations, to remove at least part of the gangue, and if possible also of the heavy metallic impurities (see ORE-DRESSING).

As ores of zinc are usually shipped before smelting from widely separated places—Sweden, Spain, Algiers, Italy, Greece, Australia and the Rocky Mountains region of North America—it is important that they be separated from their mixtures at the mines. The difficulty in separating zinc blende from iron pyrites is well known, and probably the most elaborate ore-dressing works ever built have been designed with this end in view. The Wetherill system of magnetic concentration has been remarkably successful in separating the minerals contained in the well-known deposit in Sussex county, N.J. Here very clean non-magnetic concentrate of willemite, which is an anhydrous zinc silicate and a very high-grade zinc ore, is separated from an intimate mixture of willemite, zincite and franklinites, with calcite and some manganese silicates. The magnetic concentrates contain enough zinc to be well adapted to the manufacture of zinc oxide. Magnetic concentration is also applied in the removal of an excess of iron from partially roasted blende. Neither mechanical nor magnetic concentration can effect much in the way of separation when, as in many complex ores, carbonates of iron, calcium and magnesium replace the isomorphous zinc carbonate, when some iron sulphide containing less sulphur than pyrites replaces zinc sulphide, and when gold and silver are contained in the zinc ore itself. Hence only in exceptional circumstances is it possible to utilize a large class of widely distributed ores, carrying from 10 to 35 per cent. of zinc, in which the zinc alone, estimated at 2d. a pound, is worth from about £2 to £7 per ton of ore. The ores of the Joplin district, in the Ozark uplift in the Mississippi Valley, are remarkable in that they are specially adapted to mechanical concentration. The material as mined will probably not average over 10 per cent. of zinc, but the dressed zinc ore as sold ranges from 45 to 62 per cent. of zinc. This region now furnishes the bulk of the ore required by the smelters of Illinois, Missouri and Kansas.

The ore, even if it is not blende, must be roasted or calcined in order to remove all volatile components as completely as possible, because these, if allowed to remain, would carry away a large proportion of the zinc vapour during the distillation. If the zinc is present as blende, this operation offers considerable difficulties, because in the roasting process the zinc sulphide passes in the first instance into sulphate, which demands a high temperature for its conversion into oxide. Another point to be considered in this connexion is that the masses of sulphur dioxide evolved, being destructive of vegetable life, are an intolerable nuisance to the neighbourhood in which the operations take place. For the desulphurization of zinc blende where it is not intended to collect and save the sulphur there are many mechanical kilns, generally classified as straight-line, horse-shoe, turret and shaft kilns; all of these may be made to do good work on moderately clean ores which do not melt at the temperature of desulphurization. But the problem of saving the sulphur is yearly becoming more important. In roasting a ton of rich blende containing 60 per cent. of zinc enough sulphur is liberated to produce one ton of strong sulphuric acid, and unless this is collected not only are poisonous gases discharged, but the waste is considerable. When sulphuric or sulphurous acid is to be collected, it is important to keep the fuel gas from admixture with the sulphur gases, and kilns for this purpose require some modification. If hot air is introduced into the kiln, the additional heat developed by the oxidation of the zinc and the sulphur is sufficient to keep up a part of the reaction; but for the complete expulsion of the sulphur an externally-fired muffle through which the ore is passed is found to be essential.

Distillation of the Oxide with Charcoal.—The distillation process in former times, especially in England, used to be carried out "per descensum." The bottom of a crucible is perforated by a pipe which projects into the crucible to about two-thirds of its height. The mixture of ore and charcoal is put into the crucible around the pipe, the crucible closed by a luted-on lid, and placed in a furnace constructed so as to permit of the lower end of the pipe projecting into the ash-pit. The zinc vapour produced descends through the pipe and condenses into liquid zinc, which is collected in a ladle held under the outlet end of the pipe. For manufacturing purposes a furnace similar to that used for the making of glass was employed to heat a circular row of crucibles standing on a shelf along the wall of the furnace. This system, however, has long been abandoned.

The modern processes may be primarily divided into two groups according to the nature of the vessel in which the operation is effected. These distilling vessels are called retorts if they are supported only at the ends, and the furnace using them is termed a Belgian furnace. If they are supported at intervals along a flat side, they are called muffles, and the furnace is known as a Silesian furnace. Various combinations and modifications of these two types of furnace have given rise to distinctive names, and as each system has its advantages and disadvantages local conditions determine which is the better.

In the *Belgian process* the reduction and distillation are carried out in cylindrical or elliptical retorts of fire-clay, from 3 ft. 3 in. to 4 ft. 9 in. long and 6 to 10 in. internal diameter. Some forty-six or more retorts, arranged in parallel horizontal rows, are heated in one furnace. The furnaces are square and open in front, to allow the outlet ends of the retorts to project: they are grouped together by fours; and their several chimneys are within the same enclosure. Each retort is provided with two adapters, namely, a conical pipe of fire-clay, about 15 in. long, which fits into the retort end, and a conical tube of sheet iron, which fits over the end of the fire-clay pipe, and which at its outlet end is only about an inch wide. To start a new furnace, the front side is closed provisionally by a brick wall, a fire lighted inside, and the temperature raised very gradually to a white heat. After four days' heating the provisional front wall is removed piecemeal, and the retorts, after having been heated to redness, are inserted in corresponding sets. The charge of the retorts consists of a mixture of 1100 lb of roasted calamine and 550 lb of dry powdered coal per furnace. A newly started furnace, however, is used for a time with smaller charges. Supposing the last of these preliminary distillations to have been completed, the residues left in the retorts are removed, and the retorts, as they lie in the hot furnace, are charged by means of semi-cylindrical shovels, and their adapters put on. The charging operation being completed, the temperature is raised, and as a consequence an evolution of carbon monoxide soon begins, and becomes visible by the gas bursting out into the characteristic blue flame. After a time the flame becomes dazzling white, showing that zinc vapour is beginning to escape. The iron adapters are now slipped on, and left on for two hours, when, as a matter of experience, a considerable amount of zinc has gone out of the retort, the greater part into the fire-clay adapter, the rest into the iron cone. The former contains a mixture of semi-solid and molten metal, which is raked out into iron ladles and cast into plates of 66 to 77 lb weight, to be sold as "spelter." The contents of the iron recipient consist of a powdery mixture of oxide and metal, which is added to the next charge, except what is put aside to be sold as "zinc dust." This dust may amount to 10 per cent. of the total production. As soon as the adapters have been cleared of their contents, they are replaced, and again left to themselves for two hours, to be once more emptied and replaced, &c. The complete exhaustion of the charge of a furnace takes about eleven hours.

In the *Silesian process* the distillation is conducted in specially constructed muffles of a prismatic shape arched above, which are arranged in two parallel rows within a low-vaulted furnace, similar to the pots in a glass furnace. As a rule every furnace accommodates ten muffles. Through an orifice in the outlet pipe (which is closed during the distillation by a loose plug) a hot iron rod can be introduced from time to time to clear away any solid zinc that may threaten to obstruct it. As soon as the outlet pipe has become sufficiently hot the zinc flows through it and collects in conveniently placed receptacles. About six or eight hours after starting the distillation is in full swing, and in twenty-four hours it is completed. A fresh charge is then put in at once, the muffles being cleared only after three successive distillations. The distillate consists of a conglomerate of drops ("drop zinc"). It is fused up in iron basins lined with clay, and cast out into the customary form of cakes.

The chief improvements in the plant of these processes are concerned with the manufacture of the retorts or muffles, and especially with the introduction of gas-firing. Even a machine of simple type, like the ordinary drain-pipe machine, in which the retorts are made by forcing the plastic clay mixture through a die, may result in greater economy and uniformity than is possible when retorts are made by hand. When hydraulic pressure to the amount of 2000 to 3000 lb per square inch is applied, the saving is unquestioned, since less time is required to dry the pressed retort, its life in the furnaces is longer, its absorption of zinc is less, and the loss of zinc by passage through its walls in the form of vapour is reduced.

Three modes of gas-firing are to be noticed, each of which is adapted to special local conditions. (*a*) The gas is made from the fuel in a detached fireplace and conducted while hot into the combustion chamber of the furnace, and the air for complete combustion is heated by the products of combustion on their way to the chimney. (*b*) Both the producer gas and the air are heated before they enter the combustion chamber, as in the Siemens system of regenerative firing. (*c*) Natural gas is piped to the furnace, where it meets air heated by the chimney gases. The primary advantages of gas-firing are that less fuel is required, that there is better control of the heat in the furnace, and that larger and more accessible furnaces can be built. In Silesia the introduction of gas-firing has led to the use of furnaces containing eighty muffles. In the United States, Belgian furnaces of type (*a*) are built to contain 864 retorts; of type (*b*), to contain 300 to 400 retorts; and of type (*c*), preferably about 600 retorts. The use of gas-fired furnaces greatly simplifies manual labour. On a direct-fired furnace at least one man, the brigadier, must be an expert in all the operations involved; but with a gas furnace a division of labour is possible. One man who understands the use of gaseous fuel can regulate the heat of a thousand or more retorts. The men who charge and empty the retorts, those who draw and cast the metal, and those who keep the furnace in repair, need not know anything about the making or using of gas, and the men who make the gas need not know anything about a zinc furnace. Again, in direct-fired furnaces there are commonly seven or eight rows of retorts, one above another, so that to serve the upper rows the workman must stand upon a table, where he is exposed to the full heat of the furnace and requires a helper to wait upon him. With gas-firing the retorts can be arranged in four horizontal rows, all within reach of a man on the furnace-room floor. Furthermore, with the large furnaces which gas-firing makes possible mechanical appliances may be substituted for manual labour in many operations, such as removing and replacing broken retorts, mixing and conveying the charge, drawing and casting the metal, charging and emptying the retorts, and removing the residues and products.

Refining.—The specific effects of different impurities on the physical properties of zinc have only been imperfectly studied. Fortunately, however, the small amounts of any of them that are likely to be found in commercial zinc are not for most purposes very deleterious. It is generally recognized that the purest ores produce the purest metal. Grades of commercial zinc are usually based on selected ores, and brands, when they mean anything, usually mean that the metal is made from certain ores. Chemical control of the metal purchased is not nearly as common as it should be, and the refining of zinc is at best an imperfect operation. To obtain the metal chemically pure a specially prepared pure oxide or salt of zinc is distilled. A redistilled zinc, from an ordinarily pure commercial zinc, is often called chemically pure, but redistillation is seldom practised except for the recovery of zinc from galvanizer's dross and from the skimmings and bottoms of the melting furnaces of zinc rolling mills. The only other method of refining is by oxidizing and settling. A bath, even of very impure zinc, is allowed to stand at about the temperature of the melting-point of the metal for forty-eight or more hours, whereupon the more easily oxidizable impurities can be largely removed in the dross at the top, the heavier metals such as lead and iron settling towards the bottom. This method is rarely practised except by the rollers of zinc. A certain amount of refined zinc can be dipped from the furnace; a further amount, nearly free from iron, can be liquated out of the ingots cast from the bottom of the bath in a subsequent slow remelting, and it is sometimes possible to eliminate a zinciferous lead which collects in the sump of the furnace. Owing to the fact that at temperatures between its melting and boiling point zinc has a strong affinity for iron, it is often contaminated by the scraper while being drawn from the condenser, as is shown by the fact that the scraper wears away rapidly. As each retort in a furnace is in all essentials a separate crucible, and as the metal from only a few of them goes into a single ingot, there can be no uniformity either in the ingots made from the same furnace during a day's run or in those made from several furnaces treating the same ore. Some brassfounders break from a single ingot the quantity of zinc required to produce the amount of brass they wish to compound in one crucible, but when perfect uniformity is desired the importance of remelting the zinc on a large scale cannot be too strongly emphasized.

Electrolytic Separation of Zinc.—The deposition of pure zinc is beset with many difficulties. Zinc being more electro-positive even than nickel, all the heavy metals must be removed before its deposition is attempted. Moreover, unless the conditions are closely watched, it is liable to be thrown down in a spongy form. M. Kiliani found that the sponge was produced chiefly when a weak solution, or a low current-density, was used, and that hydrogen was usually evolved simultaneously; sound deposits resulted from the use of a current-density of 200 amperes, or more, per sq. ft., and strong solutions. The cause of the spongy deposit is variously explained, some (Siemens and Halske) ascribing it to the existence of a compound of zinc and hydrogen, and others, among whom are G. Nahnsen, F. Mylius and A. Fromm, F. Foerster and W. Borchers, trace it to the presence of oxide, produced, for example, either by the use of a solution containing a trace of basic salt of zinc (to prevent which the bath should be kept just—almost imperceptibly—acid), or by the presence of a more electro-negative metal, which, being co-deposited, sets up local action at the expense of the zinc. Many processes have been patented, the ore being acted upon by acid, and the resulting solution treated, by either chemical or electrolytic means, for the successive removal of the other heavy metals. The pure solution of zinc is then electrolysed. E. A. Ashcroft patented a process of dealing with complex ores of the well-known Broken Hill type, containing sulphides of silver, lead and zinc, but the system was abandoned after a long trial on a practical scale. A full account of the process (*Trans. Inst. Min. and Met.*, 1898, vol. vi. p. 282) has been published by the inventor, describing the practical trial at the Cockle Creek Works. The ore was crushed roasted, and leached with sulphuric acid (with or without ferric sulphate); the solution was purified and then electrolysed for zinc with lead anodes and with a current-density of 5 amperes per sq. ft. at 2·75 volts when diaphragms were used, or 2·5 volts when they were dispensed with, or with 10 amperes per sq. ft. at 3 or 2·5 volts respectively, the electrolyte containing 1·2 ℔ of zinc in the form of sulphate, and ½ to ¾ oz. of sulphuric acid, per gallon. The current efficiency was about 83 per cent. Canvas diaphragms were used to prevent the acid formed by electrolysis at the anode from mixing with the cathode liquor, and so hindering deposition. C. Hoepfner has patented several processes, in one of which (No. 13,336 of 1894) a rapidly rotating cathode is used in a chloride solution, a porous partition separating the tank into anode and cathode compartments, and the chlorine generated by electrolysis at the anode being recovered. Hoepfner's processes have been employed both in England and in Germany. Nahnsen's process, with an electrolyte containing alkali-metal sulphate and zinc sulphate, has been used in Germany, and a process invented by Dieffenbach has also been tried in that country. Siemens and Halske have proposed the addition of oxidizing agents such as free halogens, to prevent the formation of zinc hydride, to which they attribute the formation of zinc-sponge. Borchers and others deposit zinc from the fused chloride. In Borchers' process the chloride is heated partly by external firing, partly by the heat generated owing to the use of a current-density of 90 to 100 amperes per sq. ft.

Properties

Zinc is a bluish-white metal, showing a high lustre when freshly fractured. It fuses at 415° C. and under ordinary atmospheric pressure boils at 1040° C. Its vapour density shows that it is monatomic. The molten metal on cooling deposits crystals belonging to the hexagonal system, and freezes into a compact crystalline solid, which may be brittle or ductile according to circumstances. If zinc be cast into a mould at a red heat, the ingot produced is laminar and brittle; if cast at just the fusing-point, it is granular and sufficiently ductile to be rolled into sheet at the ordinary temperature. According to some authorities, pure zinc always yields ductile ingots. Commercial "spelter" always breaks under the hammer; but at 100° to 150° C. it is susceptible of being rolled out into even a very thin sheet. Such a sheet, if once produced, remains flexible when cold. At about 200° C., the metal becomes so brittle that it can be pounded in a mortar. The specific gravity of zinc cannot be expected to be perfectly constant; according to Karsten, that of pure ingot is 6·915, and rises to 7·191 after rolling. The coefficient of linear expansion is 0·002,905 for 100° from 0° upwards (Fizeau). The specific heat is 0·09555 (Regnault). Compact zinc is bluish white; it does not tarnish much in the air. It is fairly soft, and clogs the file. If zinc be heated to near its boiling-point, it catches fire and burns with a brilliant light into its powdery white oxide, which forms a reek in the air (*lana philosophica*, "philosopher's wool"). Boiling water attacks it appreciably, but slightly, with evolution of hydrogen and formation of the hydroxide, $Zn(OH)_2$. A rod of perfectly pure zinc, when immersed in dilute sulphuric acid, is so very slowly attacked that there is no visible evolution of gas; but, if a piece of platinum, copper or other more electro-positive metal be brought into contact with the zinc, it dissolves readily, with evolution of hydrogen and formation of the sulphate. The ordinary impure metal dissolves at once, the more readily the less pure it is. Cold dilute nitric acid dissolves zinc as nitrate, with evolution of nitrous oxide. At higher temperatures, or with stronger acid, nitric oxide, NO, is produced besides or instead of nitrous. Zinc is also soluble in soda and potash solutions, but not in ammonia.

Applications.—Zinc is largely used for "galvanizing" iron, sheets of clean iron being immersed in a bath of the molten metal and then removed, so that a coat of zinc remains on the iron, which is thereby protected from atmospheric corrosion. It is also a constituent of many valuable alloys; brass, Muntz-metal, pinchbeck, tombac, are examples. In technological chemistry it finds application as a reducing agent, *e.g.* in the production of aniline from nitrobenzene, but the use of iron is generally preferable in view of the cheapness of this metal.

Compounds

Zinc forms only one oxide, ZnO, from which is derived a well-characterized series of salts. It is chemically related to cadmium and mercury, the resemblance to cadmium being especially well marked; one distinction is that zinc is less basigenic. Zinc is capable of isomorphously replacing many of the bivalent metals—magnesium, manganese, iron, nickel, cobalt and cadmium.

Zinc oxide, ZnO, is maufactured for paint by two processes—directly from the ore mixed with coal by volatilization on a grate, as in the Wetherill oxide process, and by oxidizing the vapour given off by a boiling bath of zinc metal. The oxide made by the latter method has generally a better colour, a finer texture, and a greater covering power. It is also manufactured by the latter process from the metallic zinc liquated out of galvanizer's dross. It is an infusible solid, which is intensely yellow at a red heat, but on cooling becomes white. This at least is true of the oxide produced from the metal by combustion; that produced from the carbonate, if once made yellow at a red heat, retains a yellow shade permanently. By heating the nitrate it is obtained as hemimorphous pyramids belonging to the hexagonal system; and by heating the chloride in a current of steam as hexagonal prisms. It is insoluble in water; it dissolves readily in all aqueous acids, with formation of salts. It also dissolves in aqueous caustic alkalis, including ammonia, forming "zincates" [*e.g.* $Zn(OK)_2$]. Zinc oxide is used in the arts as a white pigment (zinc white); it has not by any means the covering power of white lead, but offers the advantages of being non-poisonous and of not becoming discoloured in sulphuretted hydrogen. It is used also in medicine.

Zinc hydroxide, $Zn(OH)_2$, is prepared as a gelatinous precipitate by adding a solution of any zinc salt to caustic potash. The alkali must be free from carbonate and an excess of it must be avoided, otherwise the hydrate redissolves. It is a white powder, and is insoluble in water. To acids and to alkalis it behaves like the oxide, but dissolves more readily.

Zinc chloride, $ZnCl_2$, is produced by heating the metal in dry chlorine gas, when it distils over as a white translucent mass, fusing at 250° and boiling at about 400°. Its vapour-density at 900° C. corresponds to $ZnCl_2$. It is extremely hygroscopic and is used in synthetical organic chemistry as a condensing agent. It dissolves in a fraction of its weight of even cold water, forming a syrupy solution. A solution of zinc chloride is easily produced from the metal and hydrochloric acid; it cannot be evaporated to dryness without considerable decomposition of the hydrated salt into oxychloride and hydrochloric acid, but it may be crystallized as $ZnCl_2 \cdot H_2O$. A concentrated solution of zinc chloride converts starch, cellulose and a great many other organic bodies into soluble compounds; hence the application of the fused salt as a caustic in surgery and the impossibility of filtering a strong $ZnCl_2$ solution through paper (see CELLULOSE). At a boiling heat, zinc chloride dissolves in any proportion of water, and highly concentrated solutions, of course, boil at high temperatures; hence they afford a convenient medium for the maintenance of high temperatures.

Zinc chloride solution readily dissolves the oxide with the formation of oxychlorides, some of which are used as pigments, cements and for filling teeth in dentistry. A solution of the oxide in the chloride has the property of dissolving silk, and hence is employed for removing this fibre from wool.

Zinc bromide, $ZnBr_2$, and *Zinc iodide*, ZnI_2, are deliquescent solids formed by the direct union of their elements. With ammonia and alkaline bromides and iodides double salts are formed.

Zinc sulphide, ZnS, occurs in nature as blende (*q.v.*), and is artificially obtained as a white precipitate by passing sulphuretted hydrogen into a neutral solution of a zinc salt. It dissolves in mineral acids, but is insoluble in acetic acid.

Zinc sulphate, $ZnSO_4+7H_2O$, or white vitriol, is prepared by dissolving the metal in dilute sulphuric acid. If care be taken to keep the zinc in excess, the solution will be free from all foreign metals except iron and perhaps manganese. Both are easily removed by passing chlorine through the cold solution, to produce ferric and manganic salt, and then digesting the liquid with a washed precipitate of basic carbonate, produced from a small portion of the solution by means of sodium carbonate. The iron and manganese are precipitated as hydroxides, and are filtered off. The filtrate is acidified with a little sulphuric acid and evaporated to crystallization. The salt crystallizes out on cooling with 7 molecules of water, forming colourless orthorhombic prisms, usually small and needle-shaped. They are permanent in the air. According to Poggiale, 100 parts of water dissolve respectively of ($7H_2O$) salt, 115·2 parts at 0°, and 653·6 parts at 100°. At 100° C. the crystals lose 6 of their molecules of water; the remaining molecule goes off at 250°, a temperature which lies close to that at which the salt begins to decompose. The anhydrous salt, when exposed to a red heat, breaks up into oxide, sulphur dioxide and oxygen. An impure form of the salt is prepared by roasting blende at a low temperature. In the arts it is employed in the preparation of varnishes, and as a mordant for the production of colours on calico. A green pigment known as *Rinmann's green* is prepared by mixing 100 parts of zinc vitriol with 2·5 parts of cobalt nitrate and heating the mixture to redness, to produce a compound of the two oxides. Zinc sulphate, like magnesium sulphate, unites with the sulphates of the potassium metals and of ammonium into crystalline double salts, $ZnSO_4 \cdot R_2SO_4+6H_2O$, isomorphous with one another and the magnesium salts.

Zinc carbonate, $ZnCO_3$, occurs in nature as the mineral calamine (*q.v.*), but has never been prepared artificially, *basic carbonates*, $ZnCO_3.xZn(OH)_2$, where x is variable, being obtained by precipitating a solution of the sulphate or chloride with sodium carbonate. To obtain a product free of Cl or SO_4, there must be an excess of alkali and the zinc salt must be poured into the hot solution of the carbonate. The precipitate, even after exhaustive washing with hot water, still contains a trace of alkali; but from the oxide, prepared from it by ignition, the alkali can be washed away. The basic carbonate is used as a pigment.

Of zinc phosphates we notice the minerals hopeite, $Zn_3(PO_4)_2.4H_2O$, and tarbuttite, $Zn_3(PO_4)_2.Zn(OH)_2$, both found in Rhodesia.

Analysis.—From neutral solutions of its salts zinc is precipitated by sulphuretted hydrogen as sulphide, ZnS—a white precipitate, soluble, but by no means readily, in dilute mineral acids, but insoluble in acetic acid. In the case of acetate the precipitation is quite complete; from a sulphate or chloride solution the greater part of the metal goes into the precipitate; in the presence of a sufficiency of free HCl the metal remains dissolved; sulphide of ammonium precipitates the metal completely, even in the presence of ammonium salts and free ammonia. The precipitate, when heated, passes into oxide, which is yellow in the heat and white after cooling; and, if it be moistened with cobalt nitrate solution and re-heated, it exhibits a green colour after cooling.

Zinc may be quantitatively estimated by precipitating as basic carbonate, which is dried and ignited to zinc oxide. It may also be precipitated as zinc ammonium phosphate, NH_4ZnPO_4, which is weighed on a filter tared at 100°. Volumetric methods have also been devised.

Pharmacology and Therapeutics of Zinc Compounds

Zinc chloride is a powerful caustic, and is prepared with plaster of Paris in the form of sticks for destroying warts, &c. Its use for this purpose at the present day is, however, very rare, the knife or galvanocautery being preferred in most cases. The salt is a corrosive irritant poison when taken internally. The treatment is to wash out the stomach or give such an emetic as apomorphine, and, when the stomach has been emptied, to administer demulcents such as white of egg or mucilage. Numerous other salts of zinc, used in medicine, are of value as containing this metal. Certain others are referred to in relation with the important radicle contained in the salt. Those treated here are the sulphate, oxide, carbonate, oleate and acetate. All these salts are mild astringents when applied externally, as they coagulate the albumen of the tissues and of any discharge which may be present. In virtue of this property they are also mild haemostatics, tending to coagulate the albumens of the blood and thereby to arrest haemorrhage. *Lotio Rubra*, the familiar "Red Lotion," a solution of zinc sulphate, is widely used in many catarrhal inflammations, as of the ear, urethra, conjunctiva, &c. There are also innumerable ointments.

These salts have been extensively employed internally, and indeed they are still largely employed in the treatment of the more severe and difficult cases of nervous disease. The sulphate is an excellent emetic in cases of poisoning, acting rapidly and without much nausea or depression. For these reasons it may also be given with advantage to children suffering from acute bronchitis or acute laryngitis.

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ZINCITE, a mineral consisting of zinc oxide (ZnO), crystallizing in the hemimorphic-hemihedral class of the rhombohedral system. Distinct crystals are of rare occurrence; they have the form of a hexagonal pyramid terminated at one end only by a basal plane. There is a perfect cleavage parallel to the basal plane, and usually the mineral is found as platy foliated masses. The blood-red colour and the orange-yellow streak are characteristic features. The hardness is 4½, and the specific gravity is 5·6. Some manganese is usually present replacing zinc. It is found in the zinc mines at Sterling Hill and Franklin Furnace in Sussex county, New Jersey, where it is associated with franklinite and willemite in crystalline limestone, and is mined as an ore of zinc. Artificial crystals of a white or yellowish colour are not infrequently formed by sublimation in zinc furnaces.

ZINDER, a town on the northern margin of the central Sudan. Zinder is a great emporium of the trade across the Sahara between the Hausa states of the south and the Tuareg countries and Tripoli in the north. Its ruler was formerly subordinate to Bornu, but with the decline of that kingdom shook off the yoke of the sultan, and on the conquest of that country by Rabah (*q.v.*) seems to have maintained his independence. The country of which Zinder is the capital is known as Damerghu. It is semi-fertile, and supports considerable numbers of horses and sheep, besides troops of camels. By the Anglo-French agreement of June 1898 it was included in the French sphere, having already been the object of French political action. The explorer Cazemajou was assassinated there in 1897, but the town was occupied in July 1899, after a slight resistance, by Lieutenant Pallier of the reconstructed Voulet-Chanoine mission (see Senegal, country). A French post (named Fort Cazemajou) was built outside the town on a mound of huge granite blocks. Zinder was the first point in the Sudan reached by F. Foureau after his great journey across the Sahara *via* Air in 1899. Subsequently Commandant Gadel, from his headquarters at Zinder, mapped and pacified the surrounding region, and sent out columns of *meharistes* (camel-corps) which occupied the oasis of Air and Bilma in 1906. Zinder is a large and fine town surrounded with high earthen walls, very thick at the base and pierced with seven gates. Its houses, in part built of clay, in part of straw, are interspersed with trees. There is an important colony of Tuareg merchants, who occupy the suburb of Zengu, and who deal in a variety of wares, from cotton, silks, spices, ostrich feathers, &c., to French scent bottles. Salt is a great article of merchandise. A busy market is held outside one of the gates. Administratively Damerghu is dependent on the French colony of Upper Senegal and Niger.

See Cazemajou, in *Bul. Com. de l'Afrique Française* (1900); F. Foureau, in *La Géographie* (December 1900), *D'Alger au Congo par le Tchad* (Paris, 1902); Joalland, in *La Géographie*, vol. iii. (1901); E. Arnaud and M. Cortier, *Nos Confins Sahariens* (Paris, 1908); C. Jean, *Les Touarag du Sud-Est* (Paris, 1909).

ZINGERLE, IGNAZ VICENZ (1825–1892), Austrian poet and scholar, was born, the son of the Roman Catholic theologian and orientalist, Pius Zingerle (1801–1881), at Meran on the 6th of June 1825. He began his studies at Trient, and entered for a while the Benedictine monastery at Marienberg. Abandoning the clerical profession, he returned to Innsbruck, where, in 1848, he became teacher in the gymnasium, and in 1859 professor of German language and literature at the university. He died at Innsbruck on the 17th of September 1892.

Zingerle is known as an author by his *Zeitgedichte* (Innsbruck, 1848); *Von den Alpen* (1850); *Die Müllerin*, a village tale (1853); *Der Bauer von Longvall* (1874); and *Erzählungen aus dem Burggrafenamte* (1884). His ethnographical writings and literary studies, dealing especially with the Tirol, have, however, rendered him more famous. Among them may be mentioned his editions of *König Laurin* (1850), of the legend, *Von den heyligen drei Künigen* (1855); *Sagen aus Tirol* (1850, 2nd ed. 1891); *Tirol. Natur, Geschichte und Sage im Spiegel deutscher Dichtung* (1851); *Die Personen- und Taufnamen Tirols* (1855); *Sitten, Bräuche und Meinungen des Tiroler-Volkes* (2nd ed. 1871); *Das deutsche Kinderspiel im Mittelalter* (2nd ed. 1873); *Schildereien aus Tirol* (1877, new series, 1888). With E. Inama-Sternegg, he edited *Tirolische Weistümer* (5 vols., 1875–1891).

ZINNIA, in botany, a genus of the natural order Compositae, containing about a dozen species of half-hardy annual or perennial herbs or undershrubs, natives of the southern United States and Mexico. The numerous single and double garden forms are mostly derived from *Zinnia elegans*, and grow about 2 ft. high, producing flowers of various colours, the double ones being about the size of asters, and very handsome. The colours include white, yellow, orange, scarlet, crimson and purple. Zinnias do best in a rich deep loamy soil, in a sunny position. They should be sown on a gentle hotbed at the end of March or in April and planted out early in June.

ZINZENDORF, NICOLAUS LUDWIG, Count of Zinzendorf and Pottendorf (1700–1760), German religious and social reformer, was born on the 26th of May 1700 at Dresden. His ancestors belonged to Lower Austria, but had taken the Protestant side in the Reformation struggle, and settled near Nuremberg. Both his parents belonged to the Pietist circle and the lad had Philipp Jakob Spener for his godfather. His father died six weeks after he was born. His mother married again when he was four years old, and he was educated under the charge of his pious and gifted grandmother,[1] Catherine von Gersdorf, who did much to shape his character. His school days were spent at Halle amidst Pietist surroundings, and in 1716 he went to the university of Wittenberg, to study law and fit himself for a diplomatic career. Three years later he was sent to travel in Holland, in France, and in various parts of Germany, where he made the personal acquaintance of men distinguished for practical goodness and belonging to a variety of churches. On his return he visited the branches of his family settled at Oberbirg and at Castell. During a lengthened visit at Castell he fell in love with his cousin Theodora; but the widowed countess, her mother, objected to the marriage, and the lady afterwards became the wife of Count Henry of Reuss. Zinzendorf seems to have considered this disappointment to be a call to betake himself to some special work for God. He had previously, in deference to his family, who wished him to become a diplomatist, rejected the invitation of August Francke to take Baron von Canstein's place in the Halle orphanage; and he now resolved to settle down as a Christian landowner, spending his life on behalf of his tenantry. He bought Berthelsdorf from his grandmother, and selected John Andrew Rothe for pastor and John George Heiz for factor; he married Erdmute Dorothea, sister of Count Henry of Reuss, and began living on his estate. His intention was to carry out into practice the Pietist ideas of Spener. He did not mean to found a new church or religious organization distinct from the Lutheranism of the land, but to create a Christian association the members of which by preaching, by tract and book distribution and by practical benevolence might awaken the somewhat torpid religion of the Lutheran Church. The "band of four brothers" (Rothe, pastor at Berthelsdorf; Melchior Schäffer, pastor at Görlitz; Francis von Wattewille, a friend from boyhood; and himself) set themselves by sermons, books, journeys and correspondence to create a revival of religion, and by frequent meetings for prayer to preserve in their own hearts the warmth of personal trust in Christ. From the printing-house at Ebersdorf large quantities of books and tracts, catechisms, collections of hymns and cheap Bibles were issued; and a translation of Johann Arndt's *True Christianity* was published for circulation in France. A dislike of the high and dry Lutheran orthodoxy of the period gave Zinzendorf some sympathy with that side of the growing rationalism which was attacking dogma, while at the same time he felt its lack of earnestness, and of a true and deep understanding of religion and of Christianity, and endeavoured to counteract these defects by pointing men to the historical Christ, the revelation of the Father. He seems also to have doubted the wisdom of Spener's plan of not separating from the Lutheran Church, and began to think that true Christianity could be best promoted by free associations of Christians, which in course of time might grow into churches with no state connexion. These thoughts took a practical turn from his connexion with the Bohemian or Moravian Brethren. Zinzendorf offered an asylum to a number of persecuted wanderers from Moravia (see Moravian Brethren), and built for them the village of Herrnhut on a corner of his estate of Berthelsdorf. The refugees who came to this asylum (between 1722 and 1732—the first detachment under Christian David) from various regions where persecution raged, belonged to more than one Protestant organization. Persecution had made them cling pertinaciously to small peculiarities of creed, organization and worship, and they could scarcely be persuaded to live in peace with each other. Zinzendorf devoted himself to them. He, with his wife and children, lived in Herrnhut and brought Rothe with him. He had hard work to bring order out of the confusion. He had to satisfy the authorities that his religious community could be brought under the conditions of the peace of Augsburg; he had to quiet the suspicions of the Lutheran clergy; and, hardest of all, he had to rule in some fashion men made fanatical by persecution, who, in spite of his unwearied labours for them, on more than one occasion, it is said, combined in his own house to denounce him as the Beast of the Apocalypse, with Rothe as the False Prophet. Patience had at last its perfect work, and gradually Zinzendorf was able to organize his refugees into something like a *militia Christi*, based not on monastic but on family life. He was able to establish a common order of worship in 1727, and soon afterwards a common organization, which has been described in the article MORAVIAN BRETHREN. Zinzendorf took the deepest interest in the wonderful missionary enterprises of the Brethren, and saw with delight the spread of this Protestant family order in Germany, Denmark, Russia and England. He travelled widely in its interests, visiting America in 1741–42 and spending a long time in London in 1750. Missionary colonies had by this time been settled in the West Indies (1732), in Greenland (1733), amongst the North American Indians (1735); and before Zinzendorf's death the Brethren had sent from Herrnhut missionary colonies to Livonia and the northern shores of the Baltic, to the slaves of North Carolina, to Surinam, to the Negro slaves in several parts of South America, to Travancore in the East Indies, to the Copts in Egypt and to the west coast of South Africa. The community in Herrnhut, from which almost all these colonies had been sent out, had no money of its own, and its expenses had been almost exclusively furnished by Zinzendorf. His frequent journeyings from home made it almost impossible for him to look after his private affairs; he was compelled from time to time to raise money by loans, and about 1750 was almost reduced to bankruptcy. This led to the establishment of a financial board among the Brethren, on a plan furnished by a lawyer, John Frederick Köber, which worked well. In 1752 Zinzendorf lost his only son, Christian Renatus, whom he had hoped to make his successor; and four years later he lost his wife Erdmute, who had been his counsellor and confidante in all his work. Zinzendorf remained a widower for one year, and then (June 1757) contracted a second marriage with Anna Nitschmann, on the ground that a man in his official position ought to be married. Three years later, overcome with his labours, he fell ill and died (on the 9th of May 1760), leaving John de Wattewille, who had married his eldest daughter Benigna, to take his place at the head of the community.

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[1] A volume of *Spiritual Songs*, written by Zinzendorf's grandmother Catherine, was published in 1729 by Paul Anton.

Zinzendorf had a naturally alert and active mind, and an enthusiastic temperament that made his life one of ceaseless planning and executing. Like Luther, he was often carried away by strong and vehement feelings, and he was easily upset both by sorrow and joy. He was an eager seeker after truth, and could not understand men who at all costs kept to the opinions they had once formed; yet he had an exceptional talent for talking on religious subjects even with those who differed from him. Few men have been more solicitous for the happiness and comfort of others, even in little things. His activity and varied gifts sometimes landed him in oddities and contradictions that not infrequently looked like equivocation and dissimulation, and the courtly training of his youth made him susceptible about his authority even when no one disputed it. He was a natural orator, and though his dress was simple his personal appearance gave an impression of distinction and force. His projects were often misunderstood, and in 1736 he was even banished from Saxony, but in 1749 the government rescinded the decree and begged him to establish within its jurisdiction more settlements like that at Herrnhut.

He wrote a large number of hymns, of which the best known are "Jesus, Thy blood and righteousness," and "Jesus, still lead on." A selection of his *Sermons* was published by G. Clemens in 10 vols., his *Diary* (1716–1719) by G. Reichel and J. Th. Müller (Herrnhut, 1907), and his *Hymns*, &c., by H. Bauer and G. Burkhardt (Leipzig, 1900).

See A. G. Spangenberg, *Leben des Grafen von Zinzendorf* (Barby, 1772–1775); L. von Schrautenbach, *Der Graf v. Zinzendorf* (Gnadau, 1871; written in 1782, and interesting because it gives Zinzendorf's relations to such Pietist rationalists as J. K. Dippel); F. Bovet, *Le Comte de Zinzendorf* (Paris, 1860; Eng. tr. *A Pioneer of Social Christianity*, by T. A. Seed, London, 1896); B. Becker, *Zinzendorf im Verhältniss z. Philosophie u. Kirchenthum seiner Zeit* (Leipzig, 1886); H. Römer, *Zinzendorf's Leben und Werken* (Gnaudau, 1900), and other literature mentioned under MORAVIAN BRETHREN and in the article "Zinzendorf" by J. Th. Müller in Hauck-Herzog's *Realencyk. für prot. Theologie u. Kirche.*

ZION, or SION (Heb. צִיּוֹן, perhaps from צחה "to be dry," צוה "to set up," or צין "to protect"; Arabic analogies favour the meaning "hump," "summit of a ridge," and so "citadel"), the name of the Jebusite stronghold at Jerusalem captured by David (2 Sam. v.). Zion (which is synonymous with the Ophel) is properly the southern part of the eastern hill[1] on the top of which was built the temple, so that the name came to be given to the whole hill (2 Kings xix. 31, Isaiah xxiv. 23 and throughout 1 Maccabees), to all Jerusalem (Isaiah i. 27, cf. iv. 3), and even to the nation or its spiritual nucleus. Thus the people of Jerusalem are spoken of as "the daughter of Zion" (Isaiah i. 8), the name being often personified and idealized, especially in Isaiah ii., and in the Psalter, *e.g.* Ps. lxxxvii. 5, "Every one calls Zion his mother."

See G. A. Smith, *Jerusalem* (London, 1908).

ZIONISM. One of the most interesting results of the anti-Semitic agitation (see ANTI-SEMITISM) has been a strong revival of the national spirit among the Jews in a political form. To this movement the name Zionism has been given. In the same way that anti-Semitism differs from the Jew-hatred of the early and middle ages, Zionism differs from previous manifestations of the Jewish national spirit. It was originally advocated as an expedient without Messianic impulses, and its methods and proposals have remained almost harshly modern. None the less it is the lineal heir of the attachment to Zion which led the Babylonian exiles under Zerubbabel to rebuild the Temple, and which flamed up in the heroic struggle of the Maccabees against Antiochus Epiphanes. Without this national spirit it could, indeed, never have assumed its present formidable proportions. The idea that it is a set-back of Jewish history, in the sense that it is an unnatural galvanization of hopes long since abandoned for a spiritual and cosmopolitan conception of the mission of Israel, is a controversial fiction. The consciousness of a spiritual mission exists side by side with the national idea. The great bulk of the Jewish people have throughout their history remained faithful to the dream of a restoration of their national life in Judea. Its manifestations have suffered temporary modifications under the influence of changing political conditions, and the intensity with which it has been held by individual Jews has varied according to their social circumstances, but in the main the idea has been passionately clung to.

The contention of some modern rabbis that the national idea is Messianic, and hence that its realization should be left to the Divine initiative (*e.g.* Chief Rabbi Adler, *Jewish Chronicle*, 25th November 1898), is based on a false analogy between the politics of the Jews and those of other oppressed nationalities. As all Hebrew politics were theocratic, the national hope was necessarily Messianic. It was not on that account less practical or less disposed to express itself in an active political form. The Messianic dreams of the Prophets, which form the framework of the Jewish liturgy to this day, were essentially politico-national. They contemplated the redemption of Israel, the gathering of the people in Palestine, the restoration of the Jewish state, the rebuilding of the Temple, and the re-establishment of the Davidic throne in Jerusalem with a prince of the House of David. How little the dispersed Jews regarded this essentially political programme as a mere religious ideal is shown by their attitude towards the pseudo-Messiahs who endeavoured to fulfil it. Bar Cochba (A.D. 117–138) lived at a period when a Jewish national uprising might well have been exclusively political, for the dissolution of the kingdom was scarcely half a century old, and Palestine still had a large Jewish population. None the less Bar Cochba based his right to lead the Jewish revolt on Messianic claims, and throughout the Roman Empire the Jews responded with enthusiasm to his call. Three centuries later Moses of Crete attempted to repeat Bar Cochba's experiment, with the same results. In the 8th century, when the Jews of the West were sufficiently remote from the days of their political independence to have developed an exclusively spiritual conception of their national identity, the Messianic claims of a Syrian Jew named Serene shook the whole of Jewry, and even among the Jews of Spain there was no hestitation as to whether they had a right to force the hands of Providence. It was the same with another pseudo-Messiah named Abu-Isa Obadia, who unfurled the national banner in Persia some thirty years later.

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[1] Christians of the 4th century removed the name to the S.W. hill, and this tradition has persisted until modern times, when archaeological and topographical evidence has re-identified Sion with the E. hill.

During the middle ages, though the racial character of the Jews was being transformed by their Ghetto seclusion, the national yearning suffered no relaxation. If it expressed itself exclusively in literature, it was not on that account undergoing a process of idealization. (Cf. Abrahams's *Jewish Life in the Middle Ages*, pp. 24–25.) The truth is that it could not have expressed itself differently. There could have been no abandonment of national hopes in a practical sense, unless the prospect of entering the national life of the peoples among whom they dwelt had presented itself as an alternative. Of this there was not the remotest sign. The absence of militant Zionism during this period is to be accounted for partly by the want of conspicuous pseudo-Messiahs, and partly by the terror of persecution. Unlike the modern Greeks, the medieval Jews could expect no sympathy from their neighbours in an agitation for the recovery of their country. One may imagine what the Crusaders would have thought of an international Jewish conspiracy to recapture Jerusalem. In the 15th century the aversion from political action, even had it been possible, must have been strengthened by the fact that the Grand Signor was the only friend the Jews had in the world. The nationalist spirit of the medieval Jews is sufficiently reflected in their liturgy, and especially in the works of the poet, Jehuda Halevi. It is impossible to read his beautiful *Zionide* without feeling that had he lived another twenty years he would have gladly played towards the pseudo-Messiah David Alroy (*circa* 1160) the part that Akiba played towards Bar Cochba.

The strength of the nationalist feeling was practically tested in the 16th century, when a Jewish impostor, David Reubeni (*circa* 1530), and his disciple, Solomon Molcho (1501–1532), came forward as would-be liberators of their people. Throughout Spain, Italy and Turkey they were received with enthusiasm by the bulk of their brethren. In the following century the influence of the Christian Millenarians gave a fresh impulse to the national idea. Owing to the frenzy of persecution and the apocalyptic teachings of the Chiliasts, it now appeared in a more mystical form, but a practical bias was not wanting. Menasseh ben Israel (1604–1657) co-operated with English Millenarians to procure the resettlement of the Jews in England as a preliminary to their national return to Palestine, and he regarded his marriage with a scion of the Davidic family of Abarbanel as justifying the hope that the new Messiah might be found among his offspring. The increasing dispersion of the Marranos or crypto-Jews of Spain and Portugal through the Inquisition, and the persecution of the Jews in Poland, deepened the Jewish sense of homelessness the while the Millenarians encouraged their Zionist dreams. The Hebraic and Judeophil tendencies of the Puritan revolution in England still further stirred the prevailing unrest, and some Jewish rabbis are said to have visited England in order to ascertain by genealogical investigations whether a Davidic descent could be ascribed to Oliver Cromwell. It only wanted a leader to produce a national movement on a formidable scale. In 1666 this leader presented himself at Smyrna, in the person of a Jew named Sabbatai Zevi (1626–1676), who proclaimed himself the Messiah. The news spread like wildfire, and despite the opposition of some of the leading rabbis, the Jews everywhere prepared for the journey to Palestine. Not alone was this the case with the poor Jews of Lithuania and Germany, but also with well-to-do communities like those of Venice, Leghorn and Avignon, and with the great Jewish merchants and bankers of Hamburg, Amsterdam and London. Throughout Europe the nationalist excitement was intense. Even the downfall and apostasy of Sabbatai were powerless to stop it. Among the wealthier Jews it partially subsided, but the great bulk of the people refused for a whole century to be disillusionized. A Messianic frenzy seized upon them. Encouraged on the one hand by Christian Millenarians like Pierre Jurien, Oligér Pauli, and Johannes Speeth, pandered to by Sabbataic impostors like Cardoso, Bonafoux, Mordecai of Eisenstadt, Jacob Querido, Judah Chassid, Nehemiah Chayon and Jacob Franks, and maddened by fresh oppressions, they became fanaticized to the verge of demoralization.

The reaction arrived in 1778 in the shape of the Mendelssohnian movement. The growth of religious toleration, the attempted emancipation of the English Jews in 1753, and the sane Judeophilism of men like Lessing and Dohm, showed that at length the dawn of the only possible alternative to nationalism was at hand. Moses Mendelssohn (1729–1786) sought to prepare his brethren for their new life as citizens of the lands in which they dwelt, by emphasizing the spiritual side of Judaism and the necessity of Occidental culture. His efforts were successful. The narrow nationalist spirit everywhere yielded before the hope or the progress of local political emancipation. In 1806 the Jewish Sanhedrin convened by Napoleon virtually repudiated the nationalist tradition. The new Judaism, however, had not entirely destroyed it. It had only reconstructed it on a wider and more sober foundation. Mendelssohnian culture, by promoting the study of Jewish history, gave a fresh impulse to the racial consciousness of the Jews. The older nationalism had been founded on traditions so remote as to be almost mythical; the new race consciousness was fed by a glorious martyr history, which ran side by side with the histories of the newly adopted nationalities of the Jews, and was not unworthy of the companionship. From this race consciousness came a fresh interest in the Holy Land. It was an ideal rather than a politico-nationalist interest—a desire to preserve and cherish the great monument of the departed national glories. It took the practical form of projects for improving the circumstances of the local Jews by means of schools, and for reviving something of the old social condition of Judea by the establishment of agricultural colonies. In this work Sir Moses Montefiore, the Rothschild family, and the Aliiance Israélite Universelle were conspicuous. More or less passively, however, the older nationalism still lived on—especially in lands where Jews were persecuted—and it became strengthened by the revived race consciousness and the new interest in the Holy Land. Christian Millenarians also helped to keep it alive. Lord Ashley, afterwards Lord Shaftesbury, Colonel Gawler, Mr Walter Cresson, the United States consul at Jerusalem, Mr James Finn, the British consul, Mr Laurence Oliphant and many others organized and supported schemes for the benefit of the Jews of the Holy Land on avowedly Restoration grounds. Another vivifying element was the reopening of the Eastern Question and the championship of oppressed nationalities in the East by the Western Powers. In England political writers were found to urge the re-establishment of a Jewish state under British protection as a means of assuring the overland route to India (Hollingsworth, *Jews in Palestine*, 1852). Lord Palmerston was not unaffected by this idea (Finn, *Stirring Times*, vol. i. pp. 106–112), and both Lord Beaconsfield and Lord Salisbury supported Mr Laurence Oliphant in his negotiations with the Porte for a concession which was to pave the way to an autonomous Jewish state in the Holy Land. In 1854 a London Jew attempted to float a company "for the purpose of enabling the descendants of Israel to obtain and cultivate the Land of Promise" (*Hebrew Observer*, 12th April). In 1876 the publication of George Eliot's *Daniel Deronda* gave to the Jewish nationalist spirit the strongest stimulus it had experienced since the appearance of Sabbatai Zevi.

It was not, however, until the spread of anti-Semitic doctrines through Europe made men doubt whether the Mendelssohnian denationalization of Judaism possessed the elements of permanency that the Jewish nationalist spirit reasserted itself in a practical form. As long as the anti-Semites were merely polemical, the nationalists were mute, but when in Russia their agitation took the form of massacres and spoliation, followed by legislation of medieval harshness, the nationalist remedy offered itself. In 1882 several pamphlets were published by Jews in Russia, advocating the restoration of the Jewish state. They found a powerful echo in the United States, where a young Jewish poetess, Miss Emma Lazarus, passionately championed the Zionist cause in verse not unworthy of Jehuda Halevi. But the movement did not limit itself to literature. A society, "Chovevi Zion," was formed with the object of so extending and methodizing the establishment of agricultural colonies in Palestine as to make the eventual acquisition of the country by the Jews possible. From the beginning it was a great success, and branches, or "tents" as they were called, were established all over the world. At the same time two other great schemes for rescuing the Jewish people from oppression were brought before the public. Neither was Zionist, but both served to encourage the Zionist cause. One was due to the initiative of Mr Cazalet, a financier who was interested in the Euphrates Valley Railway project. With the assistance of Mr Laurence Oliphant he proposed that the concession from the Porte should include a band of territory two miles wide on each side of the railway, on which Jewish refugees from Russia should be settled. Unfortunately the scheme failed. The other was Baron de Hirsch's colossal colonization association (see HIRSCH, MAURICE DE). This was neither political nor Zionist, but it was supported by a good many members of the "Chovevi Zion," among them Colonel Goldsmid, on the ground that it might result in the training of a large class of Jewish yeomen who would be invaluable in the ultimate settlement of Palestine. (Interview in *Daily Graphic*, 10th March 1892.)

None of these projects, however, proved sufficiently inspiring to attract the great mass of Jewish nationalists. The Chovevi Zion was too timid and prosaic; the Hirsch scheme did not directly appeal to their strongest sympathies. In 1897 a striking change manifested itself. A new Zionist leader arose in the person of a Viennese journalist and playwright, Dr Theodore Herzl (1860–1904). The electoral successes of the anti-Semites in Vienna and Lower Austria in 1895 had impressed him with the belief that the Jews were unassimilable in Europe, and that the time was not far distant when they would be once more submitted to civil and political disabilities. The Hirsch scheme did not, in his view, provide a remedy, as it only transplanted the Jews from one uncongenial environment to another. He came to the conclusion that the only solution of the problem was the segregation of the Jews under autonomous political conditions. His first scheme was not essentially Zionist. He merely called for a new exodus, and was ready to accept any grant of land in any part of the world that would secure to the Jews some form of self-government. The idea was not new. In 1566 Don Joseph Nasi had proposed an autonomous settlement of Jews at Tiberias, and had obtained a grant of the city from the Sultan for the purpose. In 1652 the Dutch West India Company in Curaçao, in 1654 Oliver Cromwell in Surinam, and in 1659 the French West India Company at Cayenne had attempted similar experiments. Marshal de Saxe in 1749 had projected the establishment of a Jewish kingdom in South America, of which he should be sovereign; and in 1825 Major M. M. Noah purchased Grand Island, in the river Niagara, with a view to founding upon it a Jewish state. All these projects were failures. Dr Herzl was not slow to perceive that without an impulse of real enthusiasm his scheme would share the fate of these predecessors. He accordingly resolved to identify it with the nationalist idea. His plan was set forth in a pamphlet, entitled *The Jewish State*, which was published in German, French and English in the spring of 1896. It explained in detail how the new exodus was to be organized and how the state was to be managed. It was to be a tribute-paying state under the suzerainty of the Sultan. It was to be settled by a chartered company and governed by an aristocratic republic, tolerant of all religious differences. The Holy Places were to be exterritorialized. The pamphlet produced a profound sensation. Dr Herzl was joined by a number of distinguished Jewish literary men, among whom were Dr Max Nordau and Mr Israel Zangwill, and promises of support and sympathy reached him from all parts of the world. The *haute finance* and the higher rabbinate, however, stood aloof.

The most encouraging feature in Dr Herzl's scheme was that the Sultan of Turkey appeared favourable to it. The motive of his sympathy has not hitherto been made known. The Armenian massacres had inflamed the whole of Europe against him, and for a time the Ottoman Empire was in very serious peril. Dr Herzl's scheme provided him, as he imagined, with a means of securing powerful friends. Through a secret emissary, the Chevalier de Newlinsky, whom he sent to London in May 1896, he offered to present the Jews a charter in Palestine provided they used their influence in the press and otherwise to solve the Armenian question on lines which he laid down. The English Jews declined these proposals, and refused to treat in any way with the persecutor of the Armenians. When, in the following July, Dr Herzl himself came to London, the Maccabaean Society, though ignorant of the negotiations with the Sultan, declined to support the scheme. None the less, it secured a large amount of popular support throughout Europe, and in 1910 Zionism had a following of over 300,000 Jews, divided into a thousand electoral districts. The English membership is about 15,000.

Between 1897 and 1910 the Zionist organization held nine international Congresses. At the first, which met at Basel, a political programme was adopted on the following terms:—

> "Zionism aims at establishing for the Jewish people a publicly and legally assured home in Palestine. For the attainment of this purpose the Congress considers the following means serviceable: (1) The promotion of the settlement of Jewish agriculturists, artisans and tradesmen in Palestine. (2) The federation of all Jews into local or general groups, according to the laws of the various countries. (3) The strengthening of the Jewish feeling and consciousness. (4) Preparatory steps for the attainment of those governmental grants which are necessary to the achievement of the Zionist purpose."

Subsequent congresses founded various institutions for the promotion of this programme, notably a People's Bank known as the Colonial Trust, which is the financial instrument of political Zionism, a National Fund for the purchase of land in Palestine and a Palestine Commission with subsidiary societies for the study and improvement of the social and economic condition of the Jews in the Holy Land. For the purposes of these bodies about £400,000 was collected in small sums and invested. Very little practical work of any abiding value, however, was accomplished, and on the political side the career of Zionism had up to the end of 1910 proved a failure.

In May 1901 and August 1902 Dr Herzl had audiences of the Sultan Abdul Hamid, and was received with great distinction, but the negotiations led to nothing. Despairing of obtaining an immediate charter for Palestine, he turned to the British government with a view to securing a grant of territory on an autonomous basis in the vicinity of the Holy Land, which would provisionally afford a refuge and a political training-ground for persecuted Jews. His overtures met with a sympathetic reception, especially from Mr Chamberlain, then Colonial Secretary, and Earl Percy, who was Under-Secretary for Foreign Affairs (October 1902). At first a site for the proposed settlement was suggested in the Sinai peninsula, but owing to the waterless character of the country the project had to be abandoned. Then Mr Chamberlain, who in the interval had paid a visit to Africa, suggested the salubrious and uninhabited highlands of the East Africa Protectorate, and in 1903 the British government formally offered Dr Herzl the Nasin Gishiu plateau, 6000 sq. m. in area. No such opportunity for creating a Jewish self-governing community had presented itself since the Dispersion, and for a moment it seemed as if Zionism were really entering the field of practical politics. Unhappily it only led to bitter controversies, which nearly wrecked the whole movement. The British offer was submitted to the Sixth Congress, which assembled at Basel in August 1903. It was received with consternation and an explosion of wrath by the ultra-nationalist elements, who interpreted it as an abandonment of the Palestine idea. By his personal influence Dr Herzl succeeded in obtaining the appointment of a commission to examine the proposed territory, but its composition was largely nationalist, and in the following year the Congress gladly availed itself of certain critical passages in the report to reject the whole scheme.

Meanwhile Zionism had suffered an irreparable blow by the death of Dr Herzl (1904). He was succeeded by Mr David Wolffsohn, a banker of Cologne, but there was in truth nobody who in ability and personal dignity and magnetism could take his place. The movement was further shaken by the dissensions which followed the rejection of the East African project. Mr Israel Zangwill led an influential minority which combined with certain non-Zionist elements to found a rival organization under the name of the ITO (Jewish Territorial Organization) with a view to taking over the East African offer or to establish an autonomous place of refuge elsewhere. Thus freed from all moderating elements the Zionists hardened into an exclusively Palestinian body, and under the auspices of Mr Wolffsohn fresh negotiations were opened with the Porte. These, however, were rendered finally hopeless by the Turkish revolution, which postulated a united Ottoman nationality, and resolutely set its face against any extension of the racial and religious autonomies under which the integrity of the Empire had already severely suffered.

During 1905–1910 the Jewish national idea, for all practical purposes, was in a state of suspended animation. The recovery of the Holy Land appeared more distant than ever, while even the establishment of an independent or autonomous Jewish state elsewhere, for which the ITO was labouring, had encountered unexpected difficulties. On the rejection of the British offer by the Zionists Mr Zangwill approached the Colonial Office, but he was too late, as the reserve on the Nasin Gishiu plateau had already been officially withdrawn. The ITO then turned its attention to Cyrenaica, and an expedition to examine the country was sent out (1908), but it was not found suitable. A project for combining all the Jewish organizations in an effort to secure an adequate foothold in Mesopotamia in connexion with the scheme for the irrigation of that region was subsequently proposed by Mr Zangwill, but up to January 1911 it had not been found practicable. The ITO, however, did valuable work by organizing an Emigration Regulation Department for deflecting the stream of Jewish emigration from the overcrowded Jewry of New York to the Southern states of the American Union, where there is greater scope for employment under wholesome conditions. For this purpose a fund was formed, to which Mr Jacob Schiff contributed £100,000 and Messrs Rothschild £20,000.

Although the Zionist organization was numerically strong—indeed, the strongest popular movement Jewish history had ever known—its experience from 1897 to 1910 rendered it very doubtful whether its nationalist aspirations could, humanly speaking, ever be fulfilled. From Turkey, either absolutist or democratic, it appeared hopeless to expect any willing relaxation of the Ottoman hold on Palestine, while in the event of a dissolution of the Empire it was questionable whether Christendom—and especially the Roman and Greek Churches—would permit the Holy Land to pass to the Jews, even though the Holy Places were exterritorialized. Should these obstacles be overcome, still more formidable difficulties would await the Jewish state. The chief of these is the religious question. The state would have to be orthodox or secular. If it were orthodox it would desire to revive the whole Levitical polity, and in these circumstances it would either pass away through internal chaos or would so offend the modern political spirit that it would be soon extinguished from outside. If it were secular it would not be a Jewish state. The great bulk of its supporters would refuse to live in it, and it would ultimately be abandoned to an outlander population consisting of Hebrew Christians and Christian Millenarians.

Modern Zionism is vitiated by its erroneous premises. It is based on the idea that anti-Semitism is unconquerable, and thus the whole movement is artificial. Under the influence of religious toleration and the naturalization laws, nationalities are daily losing more of their racial character. The coming nationality will be essentially a matter of education and economics, and this will not exclude the Jews as such. With the passing away of anti-Semitism, Jewish nationalism will disappear. If the Jewish people disappear with it, it will only be because either their religious mission in the world has been accomplished or they have proved themselves unworthy of it.

Literature.—A Zionist bibliography has been published by the Federation of American Zionists. Besides the works already cited in the body of this article, see on the early nationalist movement Graetz, *Geschichte der Juden*, under the heads of the various pseudo-Messiahs and their adherents. Jewish agricultural colonies will be found discussed very fully in *The Jewish Encyclopedia*, vol. i. pp. 249–262. For early Zionist projects see *Publications of the American Jewish Historical Society*, No. 8, pp. 75–118; Laurence Oliphant, *Land of Gilead*; Mrs Oliphant, *Life of Laurence Oliphant*, pp. 168 et seq. The Zionist movement since 1895 is fully recorded in its official organ, *Die Welt* (Vienna). For proceedings of the Congresses see the *Official Protocols* published for each year by the society "Erez Israel" of Vienna; also Herzl, *Der Baseler Congress* (Vienna, 1897). On the movement generally, see Herzl's *Zionistische Schriften*, edited by Dr Leon Kellner; *Ten Years of Zionism* (Cologne, 1907); Nordau, *Zionism, its History and its Aims* (London, 1905); J. de Haas, *Zionism, Jewish Needs and Jewish Ideals*; also articles by I. Zangwill in *Cosmopolis* (October 1897), *Contemporary Review* (October 1899) and *Fortnightly Review* (April 1910); Dr Gaster in *Asiatic Quarterly Review* (October 1897); H. Bentwitch in *Nineteenth Century* (October 1897), and *Fortnightly Review* (December 1898); Reich in *Nineteenth Century* (August 1897); Lucien Wolf in *Jewish Quarterly Review* (October 1904: "The Zionist Peril"). On the ITO see pamphlets and leaflets published by the Jewish Territorial Organization; also the *Report of the Commission on Cyrenaica* (London, 1909). (L. W.)

ZIRCON, a mineral composed of zirconium silicate, sometimes used as a gem-stone. It is believed that the name comes from the Arabic *zargun*, and is essentially the same as "jargoon," the name given to certain varieties of zircon. The mineral crystallizes in the tetragonal system, generally in combinations of square prisms and square pyramids, as in figs. 1 and 2. Zircon is isomorphous with cassiterite and rutile, and like them may occur in geniculated twins. There is no distinct cleavage, and the mineral breaks with a conchoidal fracture. The hardness is about 7·5. It is notable that the specific gravity has a very wide range, extending from a little below 4 to rather more than 4·7, and being thus greater than that of any other gem-stone. Rarely colourless, zircon is usually brown or red, sometimes orange, yellow or green, and occasionally parti-coloured or zoned. Whilst common zircon is opaque, the gem-varieties are transparent. The dichroism of coloured zircons is always feeble; the double refraction usually strong and of positive sign; and the optical properties of some zircons suggest a biaxial mineral. It was pointed out long ago by Sir A. H. Church that many transparent zircons afford a spectrum

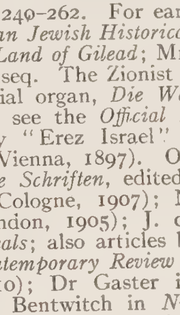


Fig. 1.

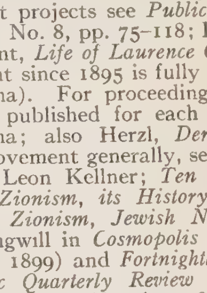


Fig. 2.

marked by certain absorption-bands, a property perhaps due to the presence of uranium.

The effect of heat on zircon is remarkable. Most coloured zircons, exposed to a high temperature, either change or lose their colour, but this loss is attended by a gain in brilliancy. The "Matura diamonds" of Ceylon are zircons which have been thus artificially decolorized. Certain zircons when heated in a Bunsen-flame glow with an orange incandescence, whilst others may emit an orange glow when ground on a copper-wheel fed with diamond-dust. Even exposure to sunlight will sometimes modify the colour and lustre of a zircon. Some zircons suffer contraction when heated, so that the specific gravity becomes raised; but the behaviour of zircons in this respect shows such anomalies that S. Stevanović has been led to suggest the existence of three classes of zircon. One group has a specific gravity of 4·0 and another of 4·7, both remaining unchanged in density when heated. L. J. Spencer, who has studied some remarkable crystals from Ceylon, calls the former α-zircon, and the latter β-zircon. A third class has specific gravity between 4·0 and 4·7, and increases in density on heating. These stones consist, according to Spencer, of an intergrowth of α-zircon or β-zircon, with a third unstable modification which he distinguishes as γ-zircon.

Whilst zircon is usually regarded as a zirconium silicate ($ZrSiO_4$) it is sometimes placed with the oxides as consisting of $ZrO_2 \cdot SiO_2$. A small proportion of ferric oxide seems to be always present, and to this the colour of zircon, according to G. Spezia, may be ascribed. Traces of so many elements have been recorded in certain zircons that it was at one time proposed to call the species polycrasilite from the Greek πολύς (many) and κρᾶσις (mixture). Zircon is used as a source of zirconia in various preparations, for incandescent gas-mantles, &c. It was in this mineral that zirconia was originally discovered by M. H. Klaproth in 1789.

Zircon fit for use as a gem-stone is often known as "noble" or "precious zircon." The red and orange stones are termed hyacinth (*q.v.*) and jacinth, whilst those of other colours, as also the colourless transparent zircons, are called jargoon (*q.v.*). The *lyncurium* of the ancients, described as an amber-coloured stone used for signets, is supposed by some authorities to have been zircon and by others amber. The gem varieties of zircon are found in detrital deposits, especially in Ceylon and in New South Wales, where they accompany sapphire, &c. They occur also in the Anakie sapphire district, near Emerald, in Queensland. A. K. Coomáraswámy has pointed out that most of the stones in the gem-gravels of Ceylon, known locally as *toramalli*, are zircons rather than tourmalines.

Zircon is an accessory constituent of many rocks, especially granite, where it appears to have crystallized at an early stage of consolidation. In microscopic sections, viewed by transmitted light, the zircon by virtue of its high refractive power appears to stand out in relief. It forms an important constituent of the zircon-syenite of Norway. Zircon occurs also in many basic eruptive rocks, notably the basalts of the Rhine and Central France. Being but little subject to alteration, it is common in secondary deposits, as in auriferous and other sands, occurring usually in small characteristic crystals, with rounded angles. Fine crystals of zircon are found in the Ilmen Mountains in Russia, and in Renfrew co., Ontario, where it occurs in crystalline limestone. Many localities in the United States yield zircon, especially in New York state and in North Carolina: it has been largely worked in Henderson co., N.C. Zircon occurs also in Tasmania. Certain varieties of zircon have received distinctive names, such as the azorite, which occurs in sanidine-trachyte in the Azores. Several other minerals seem to be altered zircon, generally hydrated, such as malacon, cyrtolite and oerstedite, the last being a Norwegian mineral containing titanium and magnesium. Auerbachite is a Russian mineral closely related to zircon. (F. W. R.*)

ZIRCONIUM [symbol Zr, atomic weight 90·6 (O=16)], a metallic chemical element. Klaproth in 1789 analysed the mineral zircon or hyacinth and found it to contain a new earth, which he called "zirconia." The metal was obtained by Berzelius as an iron-grey powder by heating potassium zirconofluoride with metallic potassium. The amorphous metal also results when the chloride is heated with sodium; the oxide reduced with magnesium; or when fused potassium zirconofluoride is electrolysed (Wedekind, *Zeit. Elektrochem.*, 1904, 10, p. 331). Troost produced crystallized zirconium by fusing the double fluoride with aluminium in a graphite crucible at the temperature of melting iron, and extracting the aluminium from the melt with hydrochloric acid. It is more conveniently prepared by heating the oxide with carbon in the electric furnace. The crystals look like antimony, and are brittle, and so hard as to scratch glass and rubies; their specific gravity is 4·25. The powdery metal burns readily in air; the crystalline metal requires to be heated in an oxyhydrogen flame before it catches fire. Mineral acids generally attack the crystallized metal very little even in the heat; aqua regia, however, dissolves it readily, and so does hydrofluoric acid. In its chemical affinities zirconium resembles titanium, cerium and thorium; it occurs in company with these elements, and is tetravalent in its more important salts.

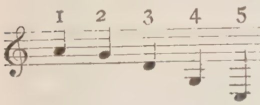
Zirconium oxide or *zirconia*, ZrO_2, has become important since its application to the manufacture of mantles for incandescent gas-lighting. For its extraction from zircon the mineral is heated and quenched in water to render it brittle, and then reduced to a fine powder, which is fused with three to four parts of acid potassium fluoride in a platinum crucible. When the mass is quietly fusing, the crucible is heated for two hours in a wind-furnace. The porcelain-like melt is powdered, boiled with water, and acidified with hydrofluoric acid, and the residual potassium fluosilicate is filtered off. The filtrate on cooling deposits crystals of potassium zirconofluoride, K_2ZrF_6, which are purified by crystallization from hot water. The double fluoride is decomposed with hot concentrated sulphuric acid; the mixed sulphate is dissolved in water; and the zirconia is precipitated with ammonia in the cold. The precipitate, being difficult to wash, is (after a preliminary washing) re-dissolved in hydrochloric acid and re-precipitated with ammonia. Zirconium hydroxide, $Zr(OH)_4$, as thus obtained, is quite appreciably soluble in water and easily in mineral acids, with formation of zirconium salts, *e.g.* $ZrCl_4$. But, if the hydroxide is precipitated in the heat, it demands concentrated acids for its solution. The hydroxide readily loses its water at a dull red heat and passes into anhydride with vivid incandescence. Zirconia can be obtained crystalline, in a form isomorphous with cassiterite and rutile, by fusing the amorphous modification with borax, and dissolving out with sulphuric acid. The anhydrous oxide is with difficulty soluble even in hydrofluoric acid; but a mixture of two parts of concentrated sulphuric acid and one of water dissolves it on continued heating as the sulphate, $Zr(SO_4)_2$. Zirconia, when heated to whiteness, remains unfused, and radiates a fine white light, which suggested its utilization for making incandescent gas mantles; and, in the form of disks, as a substitute for the lime-cylinders ordinarily employed in "limelight." Zirconia, like stannic and titanic oxides, unites not only with acids but also with basic oxides. For instance, if it be fused with sodium carbonate, sodium zirconate, Na_2ZrO_3, is formed. If the carbonate be in excess, the salt Na_4ZrO_4 results, which when treated with water gives $Na_2Zr_8O_{17} \cdot 12H_2O$, which crystallizes in hexagonal plates. When heated in a loosely covered crucible with magnesium the nitride Zr_2N_3 is formed (Wedekind, *Zeit. anorg. Chem.*, 1905, 45, p. 385).

Zirconium hydride, ZrH_2, is supposed to be formed when zirconia is heated with magnesium in an atmosphere of hydrogen. *Zirconium fluoride*, ZrF_4, is obtained as glittering monoclinic tables (with $3H_2O$) by heating zirconia with acid ammonium fluoride. It forms double salts, named zircono-fluorides, which are isomorphous with the stanni- and titani-fluorides. *Zirconium chloride*, $ZrCl_4$, is prepared as a white sublimate by igniting a mixture of zirconia and charcoal in a current of chlorine. It has the exact vapour-density corresponding to the formula. It dissolves in water with evolution of heat; on evaporation a basic salt, $ZrOCl_2 \cdot 8H_2O$, separates out in star-shaped acicular aggregates. *Zirconium bromide*, $ZrBr_4$, is formed similarly to the chloride. Water gives the oxybromide $ZrOBr_2$. *Zirconium iodide*, ZrI_4, was obtained as a yellow, microcrystalline solid by acting with hydriodic acid on heated zirconium (Wedekind, *Ber.*, 1904, 37, p. 1135). It fumes in air; with water it gives $ZrOI_2 \cdot 8H_2O$; and with alcohol ethyl iodide and zirconium hydroxide are formed. The iodide combines with liquid ammonia to form $ZrI_4 \cdot 8NH_3$; and with ether to give $ZrI_4 \cdot 4(C_2H_5)_2O$. Zirconium combines with sulphur to form a sulphide, and with carbon to form several carbides. The sulphate, $Zr(SO_4)_2$, is a white mass obtained by dissolving the oxide or hydroxide in sulphuric acid, evaporating and heating the mass to nearly a red heat. Since it forms a series of double sulphates, Ruer (*Zeit. anorg. Chem.*, 1904, 42, p. 87) regards it as a dibasic acid, $ZrOSC_4 \cdot SO_4H_2$, and that the crystalline sulphate is $ZrOSO_4 \cdot SO_4H_2 \cdot 3H_2O$ (not $Zr(SO_4)_2 \cdot 4H_2O$). Zirconium also forms double sulphates of the type $Zr_2O_3(SO_4M)_2 \cdot nH_2O$, where M=K, Rb, Cs, and $n=8$ for K, 15 for Rb, 11 for Cs (Rosenheim and Frank, *Ber.*, 1905, 38, p. 812). The atomic weight was determined by Marignac to be 90·03; Bailey (*Proc. Roy. Soc.*, 1890, 46, p. 74) deduced the value 89·95.

ZIRKEL, FERDINAND (1838–   ), German geologist and petrographer, was born at Bonn on the 20th of May 1838. He was educated in his native town, and graduated Ph.D. at the university in 1861. In early years he was engaged in teaching geology and mineralogy in Vienna. He became professor of geology in 1863 in the university of Lemberg, in 1868 at Kiel, and in 1870 professor of mineralogy and geology in the university of Leipzig.

His numerous papers and essays include *Geologische Skizze von der Westküste Schottlands* (1871); *Die Struktur der Variolite* (1875); *Microscopical Petrography* (in Report of U.S. Geol. Exploration of 40th Par., vol. vi., 1876); *Limurit aus der Vallée de Lesponne* (1879); *Über den Zirkon* (1880). His separate works include *Lehrbuch der Petrographie* (1866; 2nd ed. 1893, 1894); *Die mikroskopische Beschaffenheit der Mineralien und Gesteine* (1873).

ZITHER (Ger. *Zither*, *Schlagzither*, *Streichzither;* Ital. *cithara*), a name applied in modern Germany to the ancient cithara (*q.v.*), to the cittern (*q.v.*), and to an instrument which is a kind of psaltery, consisting of a shallow sound-chest with ribs having the outline of a flattened jug (termed in German *Flaschenform*, bottle-shape). In the centre of the sound-board is a rose sound-hole, and the finger-board with frets lies along the straight side of the zither in front of the performer. The number of the strings varies, but 36, 38 and 42 are the most usual. Over the finger-board are four or five strings known as *violin*, on which the melody is played. These five melody strings are stopped with the thumb and fingers of the left hand and plucked with the thumb of the right hand, which usually has a thumb ring with plectrum. Nos. 1 and 2 are steel strings; No. 3 of brass, and 4 and 5 of spun wire; the bass is played with the fingers of the right hand, and in order to facilitate the fingering the strings are tuned in fourths and fifths. Most of the other strings from the 6th are of gut. All the strings lie horizontally across the sound-board, being fastened in the usual manner to hitch and wrest pins. The zither is placed on the table in front of the performer, who holds his right arm so that the wrist rests on the side of the zither parallel with the hitch pins, the thumb being over the finger-board.



No. 1 is only used for passages in double notes and for chords.

The foregoing remarks apply to the *discant* and *concert* zither; the *elegiac* or *bass zither* is of similar construction but larger, and is a transposing instrument, having the same notation as the former, the real sounds being a fourth lower. These zithers are the favourite instruments of the peasants in the Swiss and Bavarian highlands, and are sometimes seen in the concert halls of north and western Germany. The *Streichzither*, or bowed zither, has a body of heart- or pear-shape similar to that of the cittern, but without the long neck of the latter. The finger-board covers the whole of the sound-board with the exception of a few inches at the tapering end, which is finished off with a raised nut or bridge, the bow being applied in the centre of this gap. The bowed zither has little feet and is placed on a table when being played. There are four strings corresponding to those of the violin or viola, but the tone is nasal and glassy.

The spelling of the word with a "Z" had already become usual in the early 17th century, for, although the instrument described above did not then exist, *Cither* was the name by which the cittern was known in Germany, and Michael Praetorius, writing in 1618, spells it with both "C" and "Z."

ZITTAU, a town of Germany, in the kingdom of Saxony, on the left bank of the Mandau, near its confluence with the Neisse, close to the Bohemian and Silesian frontier, 25 m. by rail S.E. of Bautzen, 48 E.S.E. of Dresden and at the junction of lines to Reichenberg (in Bohemia), Eibau and Hermsdorf. Pop. (1905) 34,706. The town hall dates from 1844, and contains a beautiful hall with rich stained glass windows. Among the six Evangelical churches, the following are noticeable: that of St John, rebuilt in 1834–37, with twin spires, and the church of St Peter and St Paul, with its elegant tower, which formerly belonged to an old Franciscan monastery. The latter was restored in 1882 and part of it fitted up as an historical museum. Another wing of this building contains the municipal library of 40,000 volumes and valuable manuscripts. Zittau is well equipped with schools, including a gymnasium and a commercial school, which are both accommodated in the Johanneum, and several technical institutions. There are also a theatre, well-equipped public baths and a richly endowed hospital. Zittau is one of the chief manufacturing towns of Saxony. The leading branch of industry is linen and damask weaving; but woollen stuffs, trimmings, &c., are also produced in the factories of the town, and in the surrounding weaving villages, sixty-six of which, with 113,455 (1900) inhabitants, are included in the municipal jurisdiction. The corporation owns valuable forests on the mountains of Upper Lusatia and other estates, the annual income of which is about £15,000. There are various steam-mills, iron-foundries, brick-fields and potteries near the town, and extensive deposits of lignite.

Zittau is of Wendish origin (Chytawa is its Wendish name), and was made a town by Ottocar II. of Bohemia. It was one of the six towns of the Lusatian League (1346), at which period it belonged to Bohemia. It suffered severely in the Hussite wars and in the Thirty Years' War, and was bombarded and burnt by the Austrians in 1757 during the Seven Years' War. The musical composer Marschner (1795–1861) was born at Zittau.

See Carpzov, *Analecta fastorum Zittaviensium* (Leipzig, 1716); *Moschkau, Zittau und seine Umgebung* (5th ed., Zittau, 1893); and Lamprecht, *Wegweiser durch Zittau und das Zittauer Gebirge* (Zittau, 1901).

ZITTEL, KARL ALFRED VON (1839–1904), German palaeontologist, was born at Bahlingen in Baden on the 25th of September 1839. He was educated at Heidelberg, Paris and Vienna. For a short period he served on the Geological Survey of Austria, and as assistant in the mineralogical museum at Vienna. In 1863 he became teacher of geology and mineralogy in the polytechnic at Carlsruhe, and three years later he succeeded Oppel as professor of palaeontology in the university of Munich, with the charge of the state collection of fossils. In 1880 he was appointed to the geological professorship, and eventually to the directorship of the natural history museum of Munich. His earlier work comprised a monograph on the Cretaceous bivalve mollusca of Gosau (1863–66); and an essay on the Tithonian stage (1870), regarded as equivalent to the Purbeck and Wealden formations. In 1873–74 he accompanied the Rohlfs expedition to the Libyan desert, the primary results of which were published in *Über den geologischen Bau der libyschen Wüste* (1880), and further details in the *Palaeontographica* (1883). Dr Zittel was distinguished for his palaeontological researches. From 1869 until the close of his life he was chief editor of the *Palaeontographica* (founded in 1846 by W. Dunker and H. von Meyer). In 1876 he commenced the publication of his great work, *Handbuch der Palaeontologie*, which was completed in 1893 in five volumes, the fifth volume on palaeobotany being prepared by W. P. Schimper and A. Schenk. To make his work as trustworthy as possible Dr Zittel made special studies of each great group, commencing with the fossil sponges, on which he published a monograph (1877–79). In 1895 he issued a summary of his larger work entitled *Grundzüge der Palaeontologie* (ed. 2, part 1, *Invertebrata*, revised by Dr Zittel in 1903; the American edition of 1900 by C. R. Eastman is so revised, sometimes in opposition to Zittel's views, as to be practically an independent work). He was author of *Aus der Urzeit* (1873, ed. 2, 1875); and *Die Sahara* (1883). In 1899 he published *Geschichte der Geologie und Palaeontologie bis Ende des 19 Jahrhunderts*, a monumental history of the progress of geological science (Eng. trans., Mrs Maria M. Ogilvie-Gordon, 1901). Dr Zittel was from 1899 president of the Royal Bavarian Academy of Sciences, and in 1894 he was awarded the Wollaston medal by the Geological Society of London. He died on the 5th of January 1904.

Obituary with portrait and bibliography, by Dr F. L. Kitchin, *Geol. Mag.* (February 1904).

ŽIŽKA, JOHN (*c.* 1376–1424), Bohemian general and Hussite leader, was born at Trocnov in Bohemia, of a family which belonged to the gentry. He took part in the civil wars in Bohemia in the reign of Wenceslaus IV., during which he lost one eye in a skirmish. He was from his youth connected with the court, and held the office of chamberlain to Queen Sophia. Žižka's name first became prominent when the Hussite movement began. When in 1419 a Hussite procession was stoned at Prague from the town hall, Žižka headed those who threw the town councillors from its windows. When a temporary armistice was concluded between the partisans of King Sigismund and the citizens of Prague, Žižka marched to Plzeň (Pilsen) with his followers, but soon left that city, and, after defeating at Sudomer the partisans of Sigismund, arrived at Tabor, the newly founded stronghold of the advanced Hussites. Žižka took a large part in the organization of the new military community and became one of the four captains of the people (*hejtmane*) who were at its head. Meanwhile Sigismund, king of the Germans and king of Hungary, invaded Bohemia, claiming the crown as the heir of his brother Wenceslaus. Menaced by Sigismund, the citizens of Prague entreated the Taborites for assistance. Led by Žižka and their other captains, the Taborites set out to take part in the defence of the capital. At Prague Žižka and his men took up a strong position on the hill then known as the Vitkov, on the spot where Žižkoz, a suburb of Prague, now stands. At the end of June (1420) the siege of the city began, and on the 14th of July the armies of Sigismund made a general attack. A strong German force assaulted the position on the Vitkov which secured the Hussite communications with the open country. Mainly through the heroism of Žižka, the attack was repulsed, and the forces of Sigismund abandoned the siege. Shortly afterwards (August 22, 1420) the Taborites left Prague and returned to Tabor. Žižka was now engaged in constant warfare with the partisans of Sigismund, particularly with the powerful Romanist, Ulrich of Rosenberg. By this struggle, in which Žižka was invariably successful, the Hussites obtained possession of the greatest part of Bohemia, which Sigismund now left for a time. It was proposed to elect a Polish prince to the throne; but meanwhile the estates of Bohemia and Moravia, who met at Časlav on the 1st of June 1421, decided to appoint a provisional government, consisting of twenty members chosen from all the political and religious parties of the country, Žižka, who took part in the deliberations at Časlav, being elected as one of the two representatives of Tabor. He summarily suppressed some disturbances on the part of a fanatical sect called the Adamites. He continued his campaigns against the Romanists and adherents of Sigismund; and having captured a small castle near Litoměřice (Leitmeritz) he retained possession of it—the only reward for his great services that he ever received or claimed. According to the Hussite custom he gave the biblical name of "Chalice" to this new possession, and henceforth adopted the signature of "Žižka of the Chalice." Later, in 1421, he was severely wounded while besieging the castle of Rábi, and lost the use of his remaining eye. Though now totally blind, he continued to command the armies of Tabor. At the end of 1421 Sigismund, again attempting to subdue Bohemia, obtained possession of the important town of Kutna Hora (Kuttenberg). Žižka, who was at the head of the united armies of Tabor and Prague, at first retreated to Kolin; but after having received reinforcements he attacked and defeated Sigismund's army at the village of Nebovid between Kolin and Kutna Hora (January 6, 1422). Sigismund lost 12,000 men and only escaped himself by rapid flight. Sigismund's forces made a last stand at Německy Brod (Deutschbrod) on the 10th of January, but the city was stormed by the Bohemians, and, contrary to Žižka's orders, its defenders were put to the sword. Early in 1423 internal dissensions among the Hussites led to civil war. Žižka, as leader of the Taborites, defeated the men of Prague and the Utraquist nobles at Hŏric on the 27th of April; but shortly afterwards the news that a new crusade against Bohemia was being prepared, induced the Hussites to conclude an armistice at Konopist on the 24th of June 1423. As soon, however, as the so-called crusaders had dispersed without even attempting to enter Bohemia, the internal dissensions broke out afresh. During his temporary rule over Bohemia Prince Sigismund Korybutovič of Poland had appointed as governor of the city of Králové Hradec (Königgrätz) Borek, lord of Miletinek, who belonged to the moderate Hussite, the so-called Utraquist, party. After the departure of the Polish prince the city of Králové Hradec, in which the democratic party now obtained the upper hand, refused to recognize Borek as its ruler, and called Žižka to its aid. He acceded to the demand and defeated the Utraquists under Borek at the farm of Strachov, near the city of Králové Hradec (August 4, 1423). Žižka now attempted to invade Hungary, which was under the rule of his old enemy King Sigismund. Though this Hungarian campaign was unsuccessful owing to the great superiority of the Hungarians, it ranks among the greatest military exploits of Žižka, on account of the skill he displayed in retreat. In 1424, civil war having again broken out in Bohemia, Žižka decisively defeated the Praguers and Utraquist nobles at Skalic on the 6th of January, and at Malesov on the 7th of June. In September he marched on Prague, but on the 14th of that month peace was concluded between the Hussite parties through the influence of John of Rokycan, afterwards Utraquist archbishop of Prague. It was agreed that the now reunited Hussites should attack Moravia, part of which country was still held by Sigismund's partisans, and that Žižka should be the leader in this campaign. But he died of the plague at Pribyslav (October 11, 1424) before reaching the Moravian frontier.

See Count Lützow, *Bohemia: an Historical Sketch* (London, 1896); Louis Léger, *Jean Žižka* in "*Nouvelles études Slaves*," *deuxième série* (Paris, 1886), the best account of Žižka's career for those unacquainted with the Bohemian language; Tomek, *Jan Žižka*, and *Dějepis Mesta Prahy;* Palacky, *History of Bohemia.* Žižka is the hero of a novel by George Sand, of a German epic by Meissner, and of a Bohemian tragedy by Alois Jirasek. (L.)

ZLATOUST, a town of Russia, in the government of Ufa, close to the river Ufa, in a picturesque valley of the middle Urals, 1925 ft. above sea level, 199 m. by rail E.N.E. of the town of Ufa. Pop. 20,973. The town has a first-class meteorological and magnetical observatory, a cathedral and a museum; it is the seat of the mining administration for the Zlatoust district, and has a brisk trade in agricultural produce and manufactured wares.

ZNAIM (Czech *Znojmo*), a town of Austria, in Moravia, 50 m. S.W. of Brünn by rail. Pop. (1900) 16,261, mostly German. It is picturesquely situated on the left bank of the Thaya. The site of the former fortifications is occupied by a promenade. The Räuberturm is a relic of the old castle of the margraves of Moravia; the round castle-chapel, known as the heathen temple (Heiden-Tempel), in the Romanesque style of the 12th century, was at one time considered the most ancient building in Moravia. The Gothic church of St Nicholas was built about 1348 by the emperor Charles IV.; the town house, with a Gothic tower, 250 ft. high, dates from about 1446. The ancient and once powerful Premonstratensian abbey of Bruck, east of the town, is now occupied as barracks.

The present town of Znaim was founded in 1226 by Ottacar I. of Bohemia on the site of Znojmo, the ancient capital of the tributary margraves of Moravia, which had been destroyed in 1145. Znaim is best known to history for the armistice concluded here in 1809 after the battle of Wagram between Napoleon I. and the archduke Charles. In 1866 the Prussians occupied the town from July 13th till September 3rd. The novelist Karl Postl (1793–1864), who wrote under the pseudonym of Charles Sealsfield, was born at Poppitz, 2½ m. S.W.

ZOBEIR RAHAMA (1830–), Egyptian pasha and Sudanese governor, came of the Gemaab section of the Jaalin, and was a member of a family which claims descent from the Koreish tribe through Abbas, uncle of Mahomet. He became prominent as the most energetic and intelligent of the Arab ivory and slave traders who about 1860 established themselves on the White Nile and in the Bahr-el-Ghazal. Nominally a subject of Egypt, he raised an army of several thousand well-armed blacks and became a dangerous rival to the Egyptian authorities. At the height of his power Zobeir was visited (1871) by Georg Schweinfurth, who found him "surrounded with a court which was little less than princely in its details" (*Heart of Africa*, vol. ii., chap. xv.). In 1869 an expedition sent from Khartum into the Bahr-el-Ghazal was attacked by Zobeir and completely defeated, its commander being slain. Zobeir represented that he was blameless in this matter, received a "pardon," and was himself appointed governor of the Bahr-el-Ghazal, where he was practically independent. In 1873 he attacked the sultan of Darfur, and the khedive Ismail gave him the rank of bey and sent troops to co-operate. After he had conquered Darfur (1874), Zobeir was made a pasha, but he claimed the more substantial reward of being made governor-general of the new province, and went to Cairo in the spring of 1876 to press his title. He was now in the power of the Egyptian authorities, who prevented his return, though he was allowed to go to Constantinople at the outbreak of the Russo-Turkish War. In 1878, however, his son Suleiman, having got possession of the Bahr-el-Ghazal, and acting on instructions from his father, defied the authority of General Gordon, the new governor-general of the Sudan. Gordon sent Romolo Gessi against Suleiman, who was subdued after an arduous campaign and executed. During the campaign Zobeir offered, if he were allowed to return to the Sudan, to restore order and to pay a revenue of £25,000 a year to the khedive. Gordon declined this help, and subsequently, for his instigation of the revolt, Zobeir was condemned to death, but the trial was a farce, the sentence was remitted, and he remained at Cairo, now in high favour with the khedival court. In March 1884, Gordon, who had been sent to Khartum to effect, if possible, the relief of the Egyptian garrisons in the Sudan, astonished Europe by requesting that Zobeir, whose son he had overthrown and whose trade he had ruined, should be sent to Khartum as his successor.[1] Zobeir, described by Sir Reginald Wingate, who knew him well, as "a quiet, far-seeing, thoughtful man of iron will—a born ruler of men" (*Mahdiism and the Egyptian Sudan*, book v.), might have been able to stem the mahdist movement. But to reinstate the notorious slave-dealer was regarded in London as too perilous an expedient, even in the extreme circumstances then existing, although Colonel Stewart (Gordon's companion in Khartum), Sir Evelyn Baring and Nubar Pasha in Cairo, and Queen Victoria and Mr Gladstone, all favoured such a course. In March 1885 Zobeir was arrested in Cairo by order of the British government for treasonable correspondence with the mahdi and other enemies of Egypt, and was interned at Gibraltar. In August 1887 he was allowed to return to Cairo, and after the reconquest of the Sudan was permitted (1899) to settle in his native country. He established himself on his estates at Geili, some 30 m. N. of Khartum.

See GORDON, CHARLES GEORGE, and the authorities there cited.

ZODIAC (ὁ ζωδιακὸς κύκλος, from ζώδιον, "a little animal"), in astronomy and astrology, an imaginary zone of the heavens within which lie the paths of the sun, moon and principal planets. It is bounded by two circles equidistant from the ecliptic, about eighteen degrees apart; and it is divided into twelve signs, and marked by twelve constellations. These twelve constellations, with the symbols of the signs which correspond to them, are as follows:—

Aries, the Ram	♈	Libra, the Balance	♎
Taurus, the Bull	♉	Scorpio, the Scorpion	♏
Gemini, the Twins	♊	Sagittarius, the Archer	♐
Cancer, the Crab	♋	Capricornus, the Goat	♑
Leo, the Lion	♌	Aquarius, the Water-carrier	♒
Virgo, the Virgin	♍	Pisces, the Fishes	♓

The signs—the Greek δωδεκατημόρια—are geometrical divisions thirty degrees in extent, counted from the spring equinox in the direction of the sun's progress through them. The whole series accordingly shifts westward through the effect of precession by about one degree in seventy-two years. At the moment of crossing the equator towards the north the sun is said to be at the first point of Aries; some thirty days later it enters Taurus, and so on through Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius and Pisces. The constellations bearing the same names coincided approximately in position, when Hipparchus observed them at Rhodes, with the divisions they designate. The discrepancy now, however, amounts to the entire breadth of a sign, the sun's path in Aries lying among the stars of Pisces, in Taurus among those of Aries, &c.

Assyria and Babylonia.—The twelvefold division of the zodiac was evidently suggested by the occurrence of twelve full moons in successive parts of it in the course of each year. This approximate relation was first systematically developed by the early inhabitants of Mesopotamia, and formed the starting-point for all their divisions of time. As the year separated, as it were of itself, into twelve months, so the day was divided into twelve "double hours," and the great cosmical period of 43,200 years into twelve "sars." Each sar, month and hour was represented at once visibly and symbolically by a twelfth part of the "furrow" drawn by the solar Bull across the heavens. The idea of tracing the sun's path among the stars was, when it occurred to Chaldaean astronomers, an original and, relatively to their means, a recondite one. We owe to its realization by them the constitution and nomenclature of the twelve signs of the zodiac. Assyrian cylinders and inscriptions indicate for the familiar series of our text-books an antiquity of some four thousand years. Ages before Assur-bani-pal reigned at Nineveh the eighth month (Marchesvan) was known as "the month of the star of the Scorpion," the tenth (Tebet) belonged to the "star of the Goat," the twelfth (Adar) to the "star of the Fish of Ea."[2] The motive underlying the choice of symbols is in a few cases obvious, but in most remains conjectural. The attributes of the deities appointed to preside over the months and signs were to some extent influential. Two of them, indeed, took direct possession of their respective portions of the sky. The zodiacal Virgo is held to represent the Assyrian Venus, Ishtar, the ruling divinity of the sixth month, and Sagittarius the archer-god Nergal, to whom the ninth month was dedicated. But no uniform system of selection was pursued; or rather perhaps the results of several systems, adopted at various epochs, and under the influence of varying currents of ideas, became amalgamated in the final series.

Aries.

This, there is reason to believe, was the upshot of a prehistoric reform. So far as positive records go, Aries was always the first sign. But the arrangement is, on the face of it, a comparatively modern one. None of the brighter stars of the constellation could be said even roughly to mark the equinox much before 1800 B.C.; during a long stretch of previous time the leading position belonged to the stars of Taurus.[3] Numerous indications accordingly point to a corresponding primitive zodiac. Setting aside as doubtful evidence derived from interpretations of cuneiform inscriptions, we meet, in connexion with Mithraic and Mylittic legends, reminiscences of a zodiac and religious calendar in which the Bull led the way.[4] Virgil's

> Candidus auratis aperit cum cornibus annum
> Taurus

perpetuates the tradition. And the Pleiades continued, within historical memory, to be the first asterism of the *lunar* zodiac.

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[1] Gordon and Zobeir met in Cairo on the 25th and 26th of January (see *Egypt No.* 12 of 1884) and Gordon from that time onward asked for Zobeir's help. It was not, however, until the 10th of March that his wish was made public, in a telegram from Khartum published in *The Times*.

[2] Lenormant, *Origines de l'Histoire*, i. 236.

[3] The possibility should not, however, be overlooked that the "stars of the months" were determined by their heliacal risings (see Bosanquet and Sayce on Babylonian astronomy, in *Monthly Notices Roy. Astr. Soc.* xl. 117). This would give a further extension backwards of over 1000 years, during which the equinox might have occurred in the month of the Ram.

[4] J. B. F. Lajard, *Recherches sur le Culte de Mithra*, p. 605.

In the Chaldaean signs fragments of several distinct strata of thought appear to be embedded. From one point of view they shadow out the great epic of the destinies of the human race; again, the universal solar myth claims a share in them; hoary traditions were brought into *ex post facto* connexion with them; or they served to commemorate simple meteorological and astronomical facts.

The first Babylonian month Nisan, dedicated to Anu and Bel, was that of "sacrifice"; and its association with the Ram as the chief primitive object of sacrifice is thus intelligible.[1] According to an alternative explanation, the heavenly Ram, placed as leader in front of the flock of the stars, merely embodied a spontaneous figure of the popular imagination. An antique persuasion, that the grand cycle of creation opened under the first sign, has been transmitted to modern cognizance by Dante (*Inf.* i. 38). **Taurus.** The human race, on the other hand, was supposed to have come into being under Taurus. The solar interpretation of the sign goes back to the far-off time when the year began with Taurus, and the sun was conceived of as a bull entering upon the great furrow of heaven as he ploughed his way among the stars. **Gemini.** In the third month and sign the building of the first city and the fratricidal brothers—the Romulus and Remus of Roman legend—were brought to mind. The appropriate symbol was at first indifferently a pile of bricks or two male children, always on early monuments placed feet to feet. **Cancer.** The retrograde movement of a crab typified, by an easy association of ideas, the retreat of the sun from his farthest northern excursion, and Cancer was constituted the sign of the summer solstice. **Leo.** The Lion, as the symbol of fire, represented the culmination of the solar heat. **Virgo.** In the sixth month, the descent of Ishtar to Hades in search of her lost husband Tammuz was celebrated, and the sign of the Virgin had thus a purely mythological signification.

The history of the seventh sign is somewhat complicated. The earlier Greek writers—Eudoxus, Eratosthenes, Hipparchus—knew of only eleven zodiacal symbols, but made one do double duty, extending the Scorpion across the seventh and eighth divisions. **Libra and Scorpio.** The Balance, obviously indicating the equality of day and night, is first mentioned as the sign of the autumnal equinox by Geminus and Varro, and obtained, through Sosigenes of Alexandria, official recognition in the Julian calendar. Nevertheless, Virgil (*Georg.* i. 32) regarded the space it presided over as so much waste land, provisionally occupied by the "Claws" of the Scorpion, but readily available for the apotheosis of Augustus. Libra was not of Greek invention. Ptolemy, who himself chiefly used the "Claws" (Χηλαί), speaks of it as a distinctively Chaldaean sign;[2] and it occurs as an extra-zodiacal asterism in the Chinese sphere. An ancient Chinese law, moreover, prescribed the regularization of weights and measures at the *spring* equinox.[3] No representation of the seventh sign has yet been discovered on any Euphratean monument; but it is noticeable that the eighth is frequently doubled,[4] and it is difficult to avoid seeing in the pair of zodiacal scorpions carved on Assyrian cylinders the prototype of the Greek scorpion and claws. Both Libra and the sign it eventually superseded thus owned a Chaldaean birthplace. The struggle of rival systems of nomenclature, from which our zodiacal series resulted, is plainly visible in their alternations; and the claims of the competing signs were long sought to be conciliated by representing the Balance as held between the claws of the Scorpion.

The definitive decline of the sun's power after the autumnal equinox was typified by placing a Scorpion as the symbol of darkness in the eighth sign. **Sagittarius.** Sagittarius, figured later as a Centaur, stood for the Babylonian Mars. **Capricornus.** Capricornus the sign of the winter solstice, is plausibly connected with the caprine nurse of the young solar god in Oriental legends, of which that of Zeus and Amalthia is a variant.[5] The fish-tailed Goat of the zodiac presents a close analogy with the Mexican calendar sign Cipactli, a kind of marine monster resembling a narwhal.[6] **Aquarius.** Aquarius is a still more exclusively meteorological sign than Leo. The eleventh month was known in Euphratean regions as that of "want and rain." The deluge was traditionally associated with it. It was represented in zodiacal symbolism by the god Ramman, crowned with a tiara and pouring water from a vase, or more generally by the vase and water without the god. **Pisces.** The resumption of agricultural labours after the deluge was commemorated in the twelfth month, and a mystical association of the fishes, which were its sign, with the life after death is evident in a monument of Assyrian origin described by Clermont-Ganneau, showing a corpse guarded by a pair of fish-gods.[7] The doubling of the sign of Pisces still recalls, according to Sayce,[8] the arrangement of the Babylonian calendar, in which a year of 360 days was supplemented once in six years by a thirteenth month, a second Adar. To the double month corresponded the double sign of the "Fishes of Hea."[9]

Cyclical Meaning of the Succession of Signs.—The cyclical meaning of the succession of zodiacal signs, though now obscured by interpolations and substitutions, was probably once clear and entire. It is curiously reflected in the adventures of the Babylonian Hercules, the solar hero Gilgamesh (see GILGAMESH, EPIC OF). They were recorded in the comparatively late surviving version of the 7th century B.C., on twelve tablets, with an obvious design of correlation with the twelve divisions of the sun's annual course. Gilgamesh's conquest of the divine bull was placed under Taurus; his slaying of the tyrant Khumbaba (the prototype of Geryon) in the fifth month typified the victory of light over darkness, represented in plastic art by the group of a lion killing a bull, which is the form ordinarily given to the sign Leo on Ninevite cylinders.[10] The wooing of Ishtar by the hero of the epic falls under Virgo, and his encounter with two scorpion men, guardians of the rising and the setting sun, under Scorpio. The eleventh tablet narrates the deluge; the twelfth associates the apotheosis of Eabani with the zodiacal emblems of the resurrection.

In the formation of the constellations of the zodiac little regard was paid to stellar configurations. The Chaldaeans chose three stars in each sign to be the "councillor gods" of the planets.[11] These were called by the Greeks "decans," because ten degrees of the ecliptic and ten days of the year were presided over by each. The college of the decans was conceived as moving, by their annual risings and settings, in an "eternal circuit" between the infernal and supernal regions. Modern asterisms first appear in the *Phaenomena* of Eudoxus about 370 B.C. But Eudoxus, there is reason to believe, consulted, not the heavens, but a celestial globe of an anterior epoch, on which the stars and the signs were forced into unnatural agreement. The representation thus handed down (in the verses of Aratus) has been thought to tally best with the state of the sky about 2000 B.C.;[12] and the mention of a pole-star, for which Eudoxus was rebuked by Hipparchus, seems, as W. T. Lynn pointed out,[13] to refer to the time when α Draconis stood near the pole. The data afforded by Eudoxus, however, are far too vague to serve as the basis of any chronological conclusion.

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[1] Sayce, *Transactions of the Society of Biblical Archaeology*, iii. 162.

[2] In citing a Chaldaean observation of Mercury dating from 235 B.C. (*Almagest*, ii. 170, ed. Halma).

[3] See *Uranographie Chinoise*, by Gustav Schlegel, who, however, claims an extravagant antiquity for the Chinese constellational system.

[4] Lenormant, *Origines*, i. 267.

[5] Lenormant, *Origines*, i. 267.

[6] Humboldt, *Vues des Cordillères* (1810), p. 157.

[7] *Rev. Archéol.* (1879), p. 344.

[8] *Trans. Soc. Bibl. Archaeol.*, iii. 166.

[9] The god Ea or Hea, the Oannes of Berossus, equivalent to the fish-god Dagon, came to the rescue of the protagonist in the Chaldaean drama of the deluge.

[10] Lenormant, *Origines*, i. 240.

[11] Diod. Sic., *Hist.*, ii. 30, where, however, by an obvious mistake the number of "councillor gods" is stated at only thirty.

[12] R. Brown, *Babylonian Record*, No. 3, p. 34.

[13] *Babylonian Record*, No. 5, p. 79.

Egyptian Zodiacal Signs.—The Egyptians adopted from the Greeks, with considerable modifications of its attendant symbolism, the twelve-fold division of the zodiac. Aries became the Fleece; two Sprouting Plants, typifying equality or resemblance, stood for Gemini; Cancer was re-named Scarabaeus; Leo was converted, from the axe-like configuration of its chief stars, into the Knife: Libra into the Mountain of the Sun, a reminiscence, apparently, of the Euphratean association of the seventh month with a "holy mound," designating the biblical tower of Babel. A Serpent was the Egyptian equivalent of Scorpio; the Arrow only of Sagittarius was retained; Capricornus became "Life," or a Mirror as an image of life; Aquarius survived as Water; Taurus, Virgo and Pisces remained unchanged.[1] The motive of some of the substitutions was to avoid the confusion which must have ensued from the duplication of previously existing native asterisms; thus, the Egyptian and Greek Lions were composed of totally different stars. Abstractions in other cases replaced concrete objects, with the general result of effacing the distinctive character of the Greek zodiac as a "circle of living things."

Spread of Greek System.—Early Zoroastrian writings, though impregnated with star-worship, show no traces of an attempt to organize the heavenly array. In the *Bundahish*, however (9th century), the twelve "Akhtārs," designated by the same names as our signs, lead the army of Ormāzd, while the seven "Awakhtārs" or planets (including a meteor and a comet) fight for Ahriman. The knowledge of the solar zodiac thus turned to account for dualistic purposes was undoubtedly derived from the Greeks. By them, too, it was introduced into Hindustan. Āryabhaṭa, about the beginning of the Christian era, reckoned by the same signs as Hipparchus. They were transmitted from India by Buddhist missionaries to China, but remained in abeyance until the Jesuit reform of Chinese astronomy in the 17th century.

Chinese Zodiacal Signs.—The native Chinese zodiacal system was of unexampled complexity. Besides divisions into twenty-eight and twenty-four parts, it included two distinct duodenary series. The *tse* or "stations" were referred by E. C. Biot to the date 1111 B.C. Measured from the winter solstice of that epoch, they corresponded, in conformity with the Chinese method of observation by intervals of what we now call right ascension, to equal portions of the celestial equator.[2] Projected upon the ecliptic, these were considerably unequal, and the *tse* accordingly differed essentially from the Chaldaean and Greek signs. Their use was chiefly astrological, and their highly figurative names—"Great Splendour," "Immense Void," "Fire of the Phoenix," &c.—had reference to no particular stars. They became virtually merged in the European series, stamped with official recognition over two centuries ago. The twenty-four *tsieki* or demi-*tse* were probably invented to mark the course of weather changes throughout the year. Their appellations are purely meteorological.

The characteristic Chinese mode of dividing the "yellow road" of the sun was, however, by the twelve "cyclical animals"—Rat, Ox, Tiger, Hare, Dragon or Crocodile, Serpent, Horse, Sheep, Monkey, Hen, Dog, Pig. The opening sign corresponds to our Aquarius, and it is remarkable that the rat is, in the far East, frequently used as an ideograph for "water." But here the agreement ceases. For the Chinese series has the strange peculiarity of proceeding in a retrograde direction or *against* the course of the sun. Thus, the second sign (of the Ox) occupies the position of Capricorn, the third that of Sagittarius, and so on. The explanation of this seeming anomaly is to be found in the primitive destination of the "animals" to the purposes of an "horary zodiac." Their succession, established to mark the hours of day and night, was not unnaturally associated with the diurnal revolution of the sphere from east to west.[3] They are unquestionably of native origin. Tradition ascribes their invention to Tajao, minister of the emperor Hwang-ti, who reigned *c.* 2697 B.C., and it can scarcely be placed later than the 7th century B.C.[4]

The Chinese circle of the "animals" obtained early a wide diffusion. It was adopted by Tatars, Turks and Mongols, in Tibet and Tong-king, Japan and Korea. It is denominated by Humboldt[5] the "zodiac of hunters and shepherds," and he adds that the presence in it of a tiger gives it an exclusively Asiatic character. It appears never to have been designed for astronomical employment. From the first it served to characterize the divisions of time. The nomenclature not only of the hours of the day and of their minutest intervals was supplied by it, but of the months of the year, of the years in the Oriental sixty-year cycle, and of the days in the "little cycle" of twelve days. Nor has it yet fallen into desuetude. Years "of the Rat," "of the Tiger," "of the Pig," still figure in the almanacs of Central Asia, Cochin China and Japan.

Aztec Zodiacal Signs.—A large detachment of the "cyclical animals" even found its way to the New World. Seven of the twenty days constituting the Aztec month bore names evidently borrowed from those of the Chinese horary signs. The Hare (or Rabbit), Monkey, Dog and Serpent reappeared without change; for the Tiger, Crocodile and Hen, unknown in America, the Ocelot, Lizard and Eagle were substituted as analogous.[6] The Aztec calendar dated from the 7th century; but the zodiacal tradition embodied by it was doubtless much more ancient. Of the zodiac in its true sense of a partitioned belt of the sphere there was no aboriginal knowledge on the American continent. Mexican acquaintance with the signs related only to their secondary function as dies (so to speak) with which to stamp recurring intervals of time.

Lunar Zodiac.—The *synodical* revolution of the moon laid down the lines of the solar, its *sidereal* revolution those of the lunar zodiac. The first was a circlet of "full moons"; the second marked the diurnal stages of the lunar progress round the sky, from and back again to any selected star. The moon was the earliest "measurer" both of time and space; but its services can scarcely have been rendered available until stellar "milestones" were established at suitable points along its path. Such were the Hindu *nakshatras*, a word originally signifying stars in general, but appropriated to designate certain small stellar groups marking the divisions of the lunar track. They exhibit in an exaggerated form the irregularities of distribution visible in our zodiacal constellations, and present the further anomaly of being frequently reckoned as twenty-eight in number, while the ecliptical arcs they characterize are invariably twenty-seven. Now, since the moon revolves round the earth in $27\frac{1}{3}$ days, hesitation between the two full numbers might easily arise; yet the real explanation of the difficulty appears to be different. The superfluous asterism, named *Abhijit*, included the bright star α Lyrae, under whose influence the gods had vanquished the Asuras. Its invocation with the other *nakshatras*, remoteness from the ecliptic notwithstanding, was thus due (according to Max Müller's plausible conjecture)[7] to its being regarded as of especially good omen. Acquaintance with foreign systems of twenty-eight lunar divisions tended doubtless to fix its position, which remained, nevertheless, always equivocal.[8] Alternately admitted into or rejected from the series, it was finally, some six or seven centuries ago, eliminated by the effects of precession in reversing the order of culmination of its limiting stars.

The notion of a twenty-seven-fold division of the zodiac was deeply rooted in Hindu tradition. The number and the name were in early times almost synonymous. Thus a *nakshatra-mālā* denoted a necklace of twenty-seven pearls;[1] and the fundamental equality of the parts was figured in an ancient legend, by the compulsion laid upon King Soma (the Moon) to share his time impartially between all his wives, the twenty-seven daughters of Prajápati. Everything points to a native origin for the system of *nakshatras*. Some were named after exclusively Vedic deities; they formed the basis of the sacrificial calendar of the Brahmins; the old Indian names of the months were derived from them; their existence was pre-supposed in the entire structure of Hindu ritual and science.[2] They do not, however, obtain full recognition in Sanskrit literature until the Brāhmana period (7th or 8th century B.C.). The *Rig-Veda* contains only one allusion to them, where it is said that "Soma is placed in the lap of the *nakshatras*"; and this is in a part including later interpolations.

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[1] Brugsch, *Z. D. M. G.*, ix. 513.

[2] Biot, *Journ. des Savans*, 1839, p. 729, and 1840, p. 151; Gaubil, *Hist. de l'Astr. Chinoise*, p. 9.

[3] Humboldt, *Vues des Cordillères*, p. 168.

[4] G. Schlegel, *Ur. Chin.*, pp. 37, 561.

[5] *Op. cit.*, p. 219.

[6] *Ibid.*, p. 152; Prescott, *Conquest of Mexico*, iii. 321 (ed 1860).

[7] *Rig-Veda Samhita*, vol. iv. (1862), Preface, p. lxii.

[8] Whitney, *Journ. Am. Orient. Soc.*, viii. 394.

Positive proof of the high antiquity of the Hindu lunar zodiac is nevertheless afforded by the undoubted fact that the primitive series opened with Krittikā (the Pleiades) as the sign of the vernal equinox. The arrangement would have been correct about 2300 B.C.; it would scarcely have been possible after 1800 B.C.[3] We find nowhere else a well-authenticated zodiacal sequence corresponding to so early a date. The reform by which Krittikā, now relegated to the third place, was superseded as the head of the series by "Açvini"[4] was accomplished under Greek influence somewhere near the beginning of the Christian era. For purposes of ritual, however, the Pleiades, with Agni or "Fire" as their presiding deity, continued to be the first sign. Hindu astronomy received its first definite organization in the 6th century, with results embodied in the *Sūrya-Siddhānta*. Here the "signs" and the "constellations" of the lunar zodiac form two essentially distinct systems. The ecliptic is divided into twenty-seven equal parts, called *bhogas* or arcs, of 800′ each. But the *nakshatras* are twenty-eight, and are represented by as many "junction stars" (*yogātāra*), carefully determined by their spherical co-ordinates. The successive entries of the moon and planets into the *nakshatras* (the ascertainment of which was of great astrological importance) were fixed by means of their conjunctions with the *yogātāras*. These, however, soon ceased to be observed, and already in the 11th century, al-Bīrūnī could meet with no Hindu astronomer capable of pointing out to him the complete series. Their successful identification by Colebrooke[5] in 1807 had a purely archaeological interest. The modern *nakshatras* are twenty-seven equal ecliptical divisions, the origin of which shifts, like that of the solar signs, with the vernal equinox. They are, in fact, the *bhogas* of the *Sūrya-Siddhānta*. The mean place of the moon in them, published in all Hindu almanacs, is found to serve unexceptionally the ends of astral vaticination.[6]

The system upon which it is founded is of great antiquity. Belief in the power of the *nakshatras* evidently inspired the invocations of them in the *Atharva-Veda*. In the Brāhmana period they were distinguished as "deva" and "yama," the fourteen lucky asterisms being probably associated with the waxing, the fourteen unlucky with the waning moon.[7] A special *nakshatra* was appropriated to every occurrence of life. One was propitious to marriage, another to entrance upon school-life, a third to the first ploughing, a fourth to laying the foundation of a house. Festivals for the dead were appointed to be held under those that included but one star. Propitiatory abstinences were recommended when the natal asterism was menaced by unfavourable planetary conjunctions. The various members of the body were parcelled out among the *nakshatras*, and a rotation of food was prescribed as a wholesome accompaniment of the moon's revolution among them.[8]

The nomenclature of the Hindu signs of the zodiac, save as regards a few standard asterisms, such as Açvini and Krittikā, was far from uniform. Considerable discrepancies occur in the lists given by different authorities.[9] Hence it is not surprising to meet in them evidence of foreign communications. Reminiscences of the Greek signs of Gemini, Leo, Libra, Sagittarius, Capricornus and Pisces are obvious severally in the Hindu Two Faces, Lion's Tail, Beam of a Balance, Arrow, Gazelle's Head (figured as a marine nondescript) and Fish. The correspondence does not, however, extend to the stars; and some coincidences adverted to by Humboldt between the *nakshatras* and the zodiacal animals of Central Asia are of the same nominal character.[10] Mexican loans are more remarkable. They were apparently direct as well as indirect. The Aztec calendar includes *nakshatra* titles borrowed, not only through the medium of the Tatar zodiac, but likewise straight from the Indian scheme, apart from any known intervention. The "three footprints of Vishnu," for example, unmistakably gave its name to the Mexican day Ollin, signifying the "track of the sun"; and both series further contain a "flint weapon," a "stick," and a "house."[11] Several houses and couches were ranged along the Hindu zodiac with the naive idea of providing resting-places for the wandering moon.

Relative Antiquity of Hindu, Chinese and Arabian Systems.—Relationship of a more intimate kind connects the Hindu lunar mansions with those of the Arabs and Chinese. The resemblance between the three systems is indeed so close that it has been assumed, almost as axiomatic, that they must have been framed from a single model. It appears nevertheless to have become tolerably clear that the *nakshatras* were both native to India, and the *sieu* to China, but that the *manāzil* were mainly of Indian derivation. The assertion, paradoxical at first sight, that the twenty-eight "hostelries" of the Chinese sphere had nothing to do with the moon's daily motion, seems to convey the actual fact. Their number, as a multiple of four, was prescribed by the quaternary partition of the heavens, fundamental in Chinese astronomy. It was considered by Biot to have been originally twenty-four, but to have been enlarged to twenty-eight about 1100 B.C., by the addition of determinants for the solstices and equinoxes of that period.[12] The essential difference, however, between the *nakshatras* and the *sieu* is that the latter were equatorial, not ecliptical, divisions. They were measured by the meridian-passages of the limiting stars, and varied in amplitude from 2° 42′ to 30° 24′.[13] The use of the specially observed stars constituting or representing the *sieu* was as points of reference for the movements of sun, moon and planets. They served, in fact, and still serve (though with astrological ends in view), the precise purpose of "fundamental stars" in European astronomy. All that is certainly known about the antiquity of the *sieu* is that they were well established in the 3rd century B.C. Their initial point at the autumnal equinox marked by Kio (Spica Virginis) suits a still later date; and there is no valid evidence that the modern series resulted from the rectification of an older superannuated arrangement, analogous to the Krittikā sequence of *nakshatras*. The Hindu zodiacal constellations belong then to an earlier epoch than the Chinese "stations," such as they have been transmitted to our acquaintance. Yet not only were the latter an independent invention, but it is almost demonstrable that the *nakshatras*, in their more recent organization, were, as far as possible, assimilated to them. The whole system of junction stars was doubtless an imitation of the *sieu*; the choice of them by the Hindu astronomers of the 6th century A.D. was plainly instigated by a consideration of the Chinese list, compiled with a widely different intent. Where they varied from it, some intelligible reason can generally be assigned for the change. Eight junction stars lie quite close to, seven others are actually identical with, Chinese determinants;[14] and many of these coincidences are between insignificant and, for the purposes of ecliptical division, inconveniently situated objects.

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[1] Max Müller, *op. cit.*, p. lxiv.

[2] *Ibid.*, p. 42.

[3] A. Weber, *Indische Studien*, x. 241.

[4] Named from the Açvins, the Hindu Castor and Pollux. It is composed of the stars in the head of Aries, and is figured by a horse's head.

[5] *As. Res.*, ix. 330.

[6] J. B. Biot, *Études sur l'Astronomie Indienne*, p. 225.

[7] A. Weber, "Die Vedischen Nachrichten von den Naxatra," in *Berliner Abhandlungen* (1861), p. 309.

[8] *Ibid.*, p. 322; H. Kern, *Die Yogatara des Varamihira*; Weber's *Ind. Stud.*, xv. 174–181.

[9] Sir William Jones, *As. Res.*, ii. 294–95.

[10] Humboldt, *Vues des Cordillères*, p. 154.

[11] *Ibid.*, p. 152.

[12] Biot, *Journ. des Savans* (1845), p. 40.

[13] G. Schlegel, *Ur. Chin.*, p. 77.

[14] Biot, *Études*, p. 136.

Arabian Mansions of the Moon.—The small stellar groups characterizing the Arab "mansions of the moon" (*manāzil al-ḳamār*) were more equably distributed than either the Hindu or Chinese series. They presented, nevertheless, striking resemblances to both. Twenty-four out of twenty-eight were formed, at least in part, of *nakshatra* or *sieu* stars.[1] That the Arab was essentially a copy of the Hindu lunar zodiac can scarcely admit of doubt. They were divided on the same principle; each opened at the spring equinox; the first Arab sign Sharaṭān was strictly equivalent to the Hindu Açvini; and eighteen constellations in each were virtually coincident. The model of the *sieu* was, however, also regarded. Eighteen Chinese determinants were included in the Arab asterisms, and of these five or six were not *nakshatra* stars; consequently, they must have been taken directly from the Chinese series. Nor were the Greek signs without effect in determining the names of the *manāzil*,[2] the late appearance of which, in a complete form, removes all difficulty in accounting for the various foreign influences brought to bear upon them. They were first enumerated by Alfarghāni early in the 9th century, when the Arabs were in astronomy the avowed disciples of the Hindus. But, although they then received perhaps their earliest quasi-scientific organization, the mansions of the moon had for ages previously figured in the popular lore of the Bedouin. A set of twenty-eight rhymes associated their heliacal risings with the changes of season and the vicissitudes of nomad life; their settings were of meteorological and astrological import;[3] in the Koran (x. 5) they are regarded as indispensable for the reckoning of time. Yet even this intimate penetration into the modes of thought of the desert may be explained by prehistoric Indian communication. The alternative view, advocated by Weber, that the lunar zodiac was primitively Chaldaean, rests on a very shadowy foundation. It is true that a word radically identical with *manāzil* occurs twice in the Bible, under the forms *mazzaloth* and *mazzaroth* (2 Kings xxiii. 5; Job xxxviii. 32); but the heavenly halting-places which it seems to designate may be solar rather than lunar. Euphratean exploration has so far brought to light no traces of ecliptical partition by the moon's diurnal motion, unless, indeed, zodiacal associations be claimed for a set of twenty-eight deprecatory formulae against evil spirits inscribed on a Ninevite tablet.[4]

The safest general conclusions regarding this disputed subject appear to be that the *sieu*, distinctively and unvaryingly Chinese, cannot properly be described as divisions of a lunar zodiac, that the *nakshatras*, though of purely Indian origin, became modified by the successive adoption of Greek and Chinese rectifications and supposed improvements; while the *manāzil* constituted a frankly eclectic system, in which elements from all quarters were combined. It was adopted by Turks, Tatars and Persians, and forms part of the astronomical paraphernalia of the *Bundahish*. The *sieu*, on the other hand, were early naturalized in Japan.

Astrological Systems.—The refined system of astrological prediction based upon the solar zodiac was invented in Chaldaea, obtained a second home and added elaborations in Egypt, and spread irresistibly westward about the beginning of the Christian era. For genethliacal purposes the signs were divided into six solar and six lunar, the former counted onward from Leo, the "house" of the sun, the latter backward from the moon's domicile in Cancer. Each planet had two houses—a solar and a lunar—distributed according to the order of their revolutions. Thus Mercury, as the planet nearest the sun, obtained Virgo, the sign adjacent to Leo, with the corresponding lunar house in Gemini; Venus had Libra (solar) and Taurus (lunar); and so for the rest. A ram frequently stamped on coins of Antiochus, with head reversed towards the moon and a star (the planet Mars), signified Aries to be the lunar house of Mars. With the respective and relative positions in the zodiac of the sun, moon and planets, the character of their action on human destiny varied indefinitely. The influence of the signs, though secondary, was hence overmastering: Julian called them *θεῶν δυνάμεις*,[5] and they were the objects of a corresponding veneration. Cities and kingdoms were allotted to their several patronage on a system fully expounded by Manilius:—

> Hos erit in fines orbis pontusque notandus,
> Quem Deus in partes per singula dividit astra,
> Ac sua cuique dedit tutelae regna per orbem,
> Et proprias gentes atque urbes addidit altas,
> In quibus exercent praestantia sidera vires.[6]

Syria was assigned to Aries, and Syrian coins frequently bear the effigy of a ram; Scythia and Arabia fell to Taurus, India to Gemini. Palmyra, judging from numismatic evidence, claimed the favour of Libra, Zeugma that of Capricorn; Leo protected Miletus, Sagittarius Singara.[7] The "power of the signs" was similarly distributed among the parts of the human body:—

> Et quanquam communis eat tutela per omne
> Corpus, et in proprium divisis artubus exit:
> Namque aries capiti, taurus cervicibus haeret;
> Brachia sub geminis censentur, pectora cancro.[8]

Warnings were uttered against surgical treatment of a member through whose sign the moon happened to be passing;[9] and zodiacal anatomy was an indispensable branch of the healing art in the Middle Ages. Some curious memorials of the superstition have survived in rings and amulets, engraven with the various signs, and worn as a kind of astral defensive armour. Many such, of the 14th and 15th centuries, have been recovered from the Thames.[10] Individuals, too, adopted zodiacal emblems. Capricornus was impressed upon the coins of Augustus, Libra on those of Pythodoris, queen of Pontus; a sultan of Iconium displayed Leo as his "horoscope" and mark of sovereignty; Stephen of England chose the protection of Sagittarius.

Egyptian Astrology.—In Egypt celestial influences were considered as emanating mainly from the thirty-six "decans" of the signs. They were called the "media of the whole circle of the zodiac";[11] each ten-day period of the Egyptian year was consecrated to the decanal god whose section of the ecliptic rose at its commencement; the body was correspondingly apportioned, and disease was cured by invoking the zodiacal regent of the part affected.[12] As early as the 14th century B.C. a complete list of the decans was placed among the hieroglyphs adorning the tomb of Seti I.; they figured again in the temple of Rameses II.,[13] and characterize every Egyptian astrological monument. Both the famous zodiacs of Dendera display their symbols, unmistakably identified by Lepsius. The late origin of these representations was established by the detection upon them of the cartouches of Tiberius and Nero. As the date of inception of the circular zodiac now at Paris the year 46 B.C. has, however, been suggested with high probability, from (among other indications) the position among the signs of the emblem of the planet Jupiter.[14] Its design was most likely to serve as a sort of *thema coeli* at the time of the birth of Caesarion. The companion rectangular zodiac still *in situ* on the portico of the temple of Isis at Dendera suits, as to constellational arrangements, the date 29 A.D. It set forth, there is reason to believe, the natal scheme, not of the emperor Tiberius, as had been conjectured by Lauth,[15] but of the building it served to decorate. The Greek signs of the zodiac, including Libra, are obvious upon both these monuments, which have thrown useful light upon the calendar system and method of stellar grouping of the ancient Egyptians.[16]

Planispheres.—An Egypto-Greek planisphere, first described by Bianchini,[17] resembles in its general plan the circular zodiac of Dendera. The decans are ranged on the outermost of its five concentric zones; the planets and the Greek zodiac in duplicate occupy the next three; while the inner circle is unaccountably reserved for the Chinese cyclical animals. The relic was dug up on the Aventine in 1705, and is now in the Louvre. It dates from the 2nd or 3rd century A.D. The Tatar zodiac is not unfrequently found engraven on Chinese mirrors in polished bronze or steel of the 7th century, and figured on the "plateau of the twelve hours" in the treasury of the emperors of the Tang dynasty.[1] Probably the most ancient zodiacal representation in existence is a fragment of a Chaldaean planisphere in the British Museum, once inscribed with the names of the twelve months and their governing signs. Two only now remain.[2]

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[1] Whitney, Notes to *Sūrya-Siddhānta*, p. 200.

[2] *Ibid.*, p. 206.

[3] A. Sprenger, *Z. D. M. G.*, xiii. 161; Bīrūnī, *Chronology*, trans. by Sachau (London, 1879), p. 336 seq.

[4] Lenormant, *Chaldean Magic*, p. 1.

[5] "Orat. in Solem," *Op.*, i. 148 (ed. 1696).

[6] *Astr.*, bk. iv. ver. 696 seq.

[7] Eckhel, *Descriptio Nummorum Antiochiae Syriae*, pp. 18, 25.

[8] Manilius, *Astr.*, bk. iv. ver. 702–5.

[9] A. J. Peirce, *Science of the Stars*, p. 84.

[10] *Journ. Arch. Soc.* xiii. 254, 310, and xx. 80.

[11] In a fragment of *Hermes* translated by Th. Taylor at p. 362 of his version of Iamblichus.

[12] Pettigrew, *Superstitions Connected with Hist. of Medicine*, p. 30.

[13] Lepsius, *Chronologie der Aegypter*, part i. p. 68.

[14] *Ibid.*, p. 102.

[15] *Les Zodiaques de Denderah*, p. 78.

[16] See Riel's *Das feste Jahr von Denderah* (1878).

[17] *Mém. de l' Acad.*, Paris, 1708, Hist., p. 110; see also Humboldt, *Vues des Cordillères*, p. 170; Lepsius, *op. cit.*, p. 83; Fröhner, *Sculpture du Louvre*, p. 17.

A zodiac on the "astrological altar of Gabies" in the Louvre illustrates the apportionment of the signs among the inmates of the Roman Pantheon;[3] and they occur as a classical reminiscence in the mosaic pavements of San Miniato and the baptistery at Florence, the cathedral of Lyons, and the crypt of San Savino at Piacenza.[4] Zodiacal symbolism became conspicuous in medieval art. Nearly all the French cathedrals of the 12th and 13th centuries exhibit on their portals a species of rural calendar, in which each month and sign has its corresponding labour. The zodiac of Notre Dame of Paris, opening with Aquarius, is a noted instance.[5] A similar series, in which sculptured figures of Christ and the Apostles are associated with the signs, is to be seen in perfect preservation on the chief doorway of the abbey church at Vézelay. The cathedrals of Amiens, Sens and Rheims are decorated in the same way. In Italy the signs and works survive fragmentarily in the baptistery at Parma, completely on the porch of the cathedral of Cremona and on the west doorway of St Mark's at Venice. They are less common in England; but St Margaret's, York, and the church of Iffley in Oxfordshire offer good specimens. In the zodiac of Merton College, Oxford, Libra is represented by a judge in his robes and Pisces by the dolphin of Fitzjames, warden of the college, 1482–1507.[6] The great rose-windows of the Early Gothic period were frequently painted with zodiacal emblems; and some frescoes in the cathedral of Cologne contain the signs, each with an attendant angel, just as they were depicted on the vault of the church at Mount Athos. Giotto's zodiac at Padua was remarkable (in its undisturbed condition) for the arrangement of the signs so as to be struck in turns, during the corresponding months, by the sun's rays.[7] The "zodiac of labours" was replaced in French castles and hôtels by a "zodiac of pleasures," in which hunting, hawking, fishing and dancing were substituted for hoeing, planting, reaping and ploughing.[8]

It is curious to find the same sequence of symbols employed for the same decorative purposes in India as in Europe. A perfect set of signs was copied in 1764 from a pagoda at Verdapettah near Cape Comorin, and one equally complete existed at the same period on the ceiling of a temple near Mindurah.[9]

The hieroglyphs representing the signs of the zodiac in astronomical works are found in manuscripts of about the 10th century, but in carvings not until the 15th or 16th.[10] Their origin is unknown; but some, if not all of them, have antique associations. The hieroglyph of Leo, for instance, occurs among the symbols of the Mithraic worship.[11]

See also the article ASTROLOGY, and the separate articles on the constellations. The whole subject of the history of the zodiac is very obscure. See generally Franz Boll, *Sphaera* (Leipzig, 1903); also the bibliographies to ASTROLOGY and BABYLONIAN AND ASSYRIAN RELIGION. (A. M. C.)

ZODIACAL LIGHT, a faint illumination of the sky, surrounding the sun and elongated in the direction of the ecliptic on each side of the sun. It is lenticular in form, brightest near the sun, and shades off by imperceptible gradations, generally becoming invisible at a distance of 90° from the sun. Until a recent time it was never observed except in or near the zodiac; hence its designation. Its breadth varies with the time and place of observation, depending upon the position of the ecliptic with respect to the horizon. In the tropics, where the ecliptic is nearly perpendicular to the horizon, it may be seen after the end of twilight on every clear evening, and before twilight on every clear morning, unless blotted out by moonlight. It then presents a nearly vertical wedge-shaped form, the base of which extends 15° or 20° on each side of the point at which the ecliptic intersects the horizon. The point of the wedge is quite indefinite, the extremely diffuse light gradually fading into invisibility at a height which may range from 50° to 70° or even more, according to the keenness of the observer's vision. The boundary everywhere is ill defined so that no exact statement of the extent of the light can be made. The brightness is at its maximum along its central line, called the axis of the light. Along this axis the brightness continually increases as the sun is approached. Owing to the softness of the outline, it is not possible to fix the position of the axis with precision; but, so far as observations have been made, it is found that it lies near the ecliptic, though deviating from it by a quite sensible amount.

Having this position, the conditions of visibility will be best when the ecliptic, and therefore the axis of the light, are nearly perpendicular to the horizon, and, as the angle between the ecliptic and horizon becomes acute, will deteriorate, slowly at first, more and more rapidly afterwards, owing to the increasing effect of atmospheric absorption. This effect is enhanced by the light being brighter as we approach the sun. More and more of the brighter regions of the light will then be near the horizon the more acute the angle. The result is that the light can be only indistinctly seen when the angle with the horizon is less than 45°, unless in a region where the atmosphere is unusually clear. From this statement of the conditions it will be seen that the tropical zone is the most favourable for observation, and that the most favourable hour of the day at which the light can be seen must always be the earliest after sunset and the last before sunrise. Practically this is when twilight is first ended in the evening, and about to begin in the morning. At these hours the angle of the ecliptic with the horizon varies with the season. At the close of evening twilight the angle is greatest about three weeks before the vernal equinox. The months of February and March are therefore best for the evening observations in the northern hemisphere, but the light can generally be seen from January until April. Similar favourable conditions prevail in the morning from September to November.

It is clear that the light proceeds from a region surrounding the sun, and lenticular in form, the axis of the lens being nearly perpendicular to the ecliptic, while the circumference extends at least to the orbit of the earth. If it did not extend so far as this it could not be seen as frequently as it is at a distance of 90° from the sun. The accompanying figure shows the form of the outline, as it would appear to an observer on an outer planet were the light of the sun cut off. The hypothesis which best explains all the phenomena is that the light is that of the sun reflected from an extremely tenuous cloud of particles having the form and extent described, and becoming more and more tenuous as the earth's orbit is approached until, immediately outside the orbit, it fades into complete invisibility. The fact that the light widens out toward the sun leads to the inference that it entirely surrounds the sun. It is therefore of interest to test this inference by observations at midnight in such a latitude that the distance of the sun below the horizon is no more than necessary to preclude the possibility of twilight. Such an opportunity is offered when the sun is near the summer solstice, in latitudes not differing much from 50° north. A transparent atmosphere and clear horizon are necessary, conditions which can best be secured on a mountain top. The visibility of a light corresponding to the inference was shown by Simon Newcomb, by observations at the top of the Brienzer Rothorn, in 1905. Previously to this, E. E. Barnard had observed the same phenomenon at Chicago. The only source of doubt as to the validity of the conclusion that this is really the zodiacal light arises from the possibility that, after the close of the ordinarily recognized twilight, there may be a faint illumination arising from the reflection of light by the very rare upper atmosphere, shown by the phenomena of meteors to extend some hundred miles or more above the earth's surface. The problem of separating a possible effect produced in this way from the zodiacal light proper may seem to offer some difficulty. But the few observations made show that, after ordinary twilight has ended in the evening, the northern base of the zodiacal light extends more and more toward the north as the hours pass until, towards midnight, it merges into the light of the sky described by the two observers mentioned. Yet more conclusive are the observations of Maxwell Hall at Jamaica, who reached conclusions identical with those of Barnard and Newcomb, from observations of the base of the light at the close of twilight, which he estimated at 60° in the line through the sun.

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[1] Schlegel, *Ur. Chin.*, p. 561; Pettigrew, *Journ. Arch. Soc.*, viii. 21.

[2] Fox Talbot, *Trans. Soc. Bibl. Archaeol.* iv. 260.

[3] Ménard, *La Mythologie dans l'Art*, p. 388.

[4] Fowler, *Archaeologia*, xliv. 172.

[5] Viollet-le-Duc, *Dict. de l'Arch. Française*, ix. 551; Le Gentil, *Mém. de l'Acad.*, Paris, 1785, p. 20.

[6] Fowler, *Archaeologia*, xliv. 150.

[7] *Ibid.*, p. 175.

[8] Viollet-le-Duc, *Dict. de l'Arch.*, ix. 551.

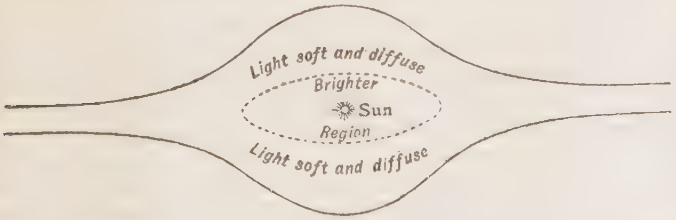
[9] John Call, *Phil. Trans.* lxii. 353. Cf. Houzeau, *Bibliographie Astronomique*, vol. i. pt. i. p. 136, where a useful sketch of the general results of zodiacal research will be found.

[10] R. Brown, *Archaeologia*, xlvii. 341; Sayce, in *Nature*, xxv. 525.

[11] See Lajard, *Culte de Mithra*, pl. xxvii. fig. 5, &c. The actual symbol ♉ can be carried back to about 250 B.C. (see *Journal of the Asiatic Society of Bengal*, vol. 50 (1881), 171, No. 20, and plate 17, No. 6); it occurs there with an Assyrian winged bull. But there is nothing to prove that it there, or elsewhere, means Taurus; it is found, in the same early period, with a lion as well as with a bull—on coins, seals, &c.

These observations show that the outline on that portion of the light commonly seen in the morning or evening is concave instead of convex, as it would be were the cloud strictly lenticular. The actual outline of the cloud is that of which a section through the sun is shown in the figure. Since the tenuous edge of the lens extends beyond the earth's orbit it follows that there must be some zodiacal light, whether it can be seen or not, passing entirely across the sky, along or near the ecliptic. Observations of this zodiacal band are therefore of great interest. It has been seen to stretch across the sky at midnight by several observers, especially Barnard, to whom it appears 3° to 4° wide. He found it to be best seen during the months of October, November and May.

Intimately connected with this band and with the zodiacal light is the *Gegenschein*, or counter-glow, a faint illumination of the sky in the region opposite the sun, which may generally be seen by a trained eye when all the conditions are favourable. Unfavourable conditions are moonlight, nearness to the Milky Way, and elevation of the light above the horizon (and therefore a depression of the sun below the horizon) of less than 20°, and the presence in the region of any bright planet. The Milky Way renders the object invisible during the months of June, July, December and January. Its light is so faint and diffuse that it is impossible to assign dimensions to it, except to say it covers a region of several degrees in extent. Barnard, the most successful observer, assigns diameters of 5° or even 10° or more. From what has been said of its position it is evident that the zodiacal band, when seen across the sky, must include it. It may therefore be regarded as an intensification of this band, possibly produced by the increased intensity of the light when reflected nearly back toward the sun, and therefore toward the earth. From the description given of the zodiacal band and the *Gegenschein*, it is clear that these objects should be best seen at the highest elevation, especially within the tropics. But the only well-authenticated observations we have of this kind show anomalies which have never been cleared up. This is especially the case with those of Chaplain George Jones, who spent eight months at Quito, Peru, at an elevation of more than 9000 ft., for the express purpose of observing the phenomenon in question. He saw the zodiacal band at midnight as a complete arch spanning the sky, agreeing in this point with the observations of Barnard. One anomaly of his observations is his description of the arch as sometimes so bright as to resemble the Milky Way, a condition which would make it easily visible at ordinary altitudes. Another anomaly is that he never saw the *Gegenschein*, but describes the band as equally bright in all its parts, except near the horizon. We are therefore forced to the conclusion that either he must have been a quite untrustworthy observer, or that there are anomalies in the phenomena which are yet to be explained.



The latter possibility is also suggested by the curious fact that the visibility of the light does not seem to be proportional to the transparency of the atmosphere. Barnard reports it as sometimes best seen when the sky is slightly milky, while during the observations already mentioned from the Rothorn the *Gegenschein* was scarcely, if at all, visible, though the conditions were exceptionally favourable. It has even been said that observers at great elevations have failed to see the zodiacal light; but it is scarcely credible that this failure could arise from any other cause than not knowing what it was or where to look for it. Moreover, it has been well seen by Hansky from the observatory on the summit of Mont Blanc.

In studying the causes of the phenomenon we must clearly distinguish between the apparent form as seen from the earth, and the real form of the lenticular-shaped cloud. The former refers to the earth, which is continually changing the point of view of the observer as he is carried around the sun, while the latter relates to the invariable position of the matter which reflects the light. First in importance is the question of the position of the principal plane, passing through the sun, and containing the circumferential regions of the cloud. This plane must be near, but not coincident with, that of the ecliptic. It has therefore a node and a certain inclination to the ecliptic. The determination of these elements requires that, at some point within the tropics where the atmosphere is clear, observations of the position of the axis of the light among the stars should be made from time to time through an entire year. In view of the simplicity of the necessary appliances, and of the small amount of labour that would be required, we find a singular paucity of such observations. The most elaborate attempt in the required direction was made by the American chaplain, George Jones, during a voyage of the "Mississippi" in the Pacific Ocean, in 1852–54. Owing to the varying latitude of the ship, and the fact that the observer attempted to draw curves of equal brilliancy instead of the central line, the required conclusions cannot be drawn with certainty from these observations. More recently Maxwell Hall in Jamaica made a satisfactory determination during the months from January to March, July and October, and carefully discussed his results. But the observations do not extend continuously throughout the year, and do not include a sufficient length of the central line on each evening to enable us to distinguish certainly the heliocentric latitude of the central line, as distinct from its apparent geocentric position. Yet his observations are of the first importance as showing the smallness of the deviation of the central line from the ecliptic. When smoothed out, the maximum latitude is less than 3°, which seems to preclude the coincidence of the central plane of the light with that of the sun's equator. Hall also reaches the interesting conclusion that the plane in question seems to lie near the invariable plane of the solar system, a result which might be expected if the light proceeded from a swarm of independent meteoric particles moving around the sun. Chaplain Jones concluded, from his observations at Quito, that the central line of the arch made an angle of 3° 20′ with the ecliptic, the ascending node being in Taurus, near longitude 62°. This is about 40° from the ascending node of the invariable plane, so that there is a well-marked deviation of his results from those of Hall.

Yet more divergent are the conclusions of Francis J. Bayldon, R.N.R., who made many observations while on voyages through the Pacific Ocean between Australia and the west coast of North America. He places the ascending node at the vernal equinox, and assigns an inclination of 4°. He found that as the observer moved to the north or south the axis of the light appeared to be displaced in the direction of the motion, which is the opposite of the effect due to parallax, but in the same sense as the effect of the greater atmospheric absorption of the light on the side nearest the horizon. He also describes the moon as adding to the zodiacal light during her first and last quarters, a result so difficult to explain that it needs confirmation. It is noteworthy that he could see the zodiacal band across the entire sky during the whole of every very clear moonless night in tropical regions.

If we accept the general conclusion already drawn as to the form and boundary of the region from which the light emanates, the next question is that of the matter sending it forth. The most plausible view is that we have to do with sunlight reflected from meteoric particles moving round the sun within the region of the lens. The polariscope and the spectroscope are the only instruments by the aid of which the nature of the matter can be inferred. The evidence afforded by these instruments is not, however, altogether accordant. In 1867, Ångström, observing at Upsala in March, obtained the bright auroral line (W.L. 5567), and concluded that in the zodiacal light there was the same material as is found in the aurora and in the solar corona, and probably through all space. Upsala, however, is a place where the auroral spectrum can often be observed in the sky, even when no aurora is visible, and it has generally been believed that what Ångström really saw was an auroral and not a zodiacal spectrum.

Professor A. W. Wright, of New Haven, also made careful observations leading to the conclusion that the spectrum differs from sunlight only in intensity. Some evidence has also been found by the same observer of polarization, showing that a considerable portion of the light must be reflected sunlight. The observations of Maxwell Hall also embraced some made with the spectroscope. He was unable to see any marked deviation of the spectrum from that of the sun; but it does not appear that either he or any other of the observers distinctly saw the dark lines of the solar spectrum. Direct proof that we have to do with reflected sunlight is therefore still incomplete.

The question whether the *Gegenschein* can be accounted for by the reflection of light from the same matter as the zodiacal band is still unsettled. Taking the general consensus of the observations it would seem that its light must be so much brighter than that of the band as to imply the action of some different cause. In this connexion may be mentioned the ingenious suggestion of S. Arrhenius, that the phenomenon is due to corpuscles sent off by the earth and repelled by the sun in the same way that they are sent off from a comet and form its tail. In other words, the light may be an exceedingly tenuous cometary tail to the earth, visible only because seen through its very great length. The view that no cause intervenes additional to that producing the zodiacal band is strengthened, though not proved, by a theorem due to F. R. Moulton of Chicago. He shows that, supposing the cloud of particles to move around the sun in nearly circular orbits immediately outside the earth, the perturbations by the earth in the motion of the particles will result in their retardation in that part of the orbit nearest the earth, and therefore in their always being more numerous in a given space in this part of the orbit than in any other. This view certainly accounts for some intensification of the light, to which may be added the intensification produced by the vertical reflection of the sunlight.

A new interest was given to the subject by the investigations of H. H. Seeliger, published in 1906, who showed that the observed excess of motion of the perihelion of Mercury may be accounted for by the action of that portion of the matter reflecting the zodiacal light which lies nearest to the sun. Plausible though his result is, the subject still requires investigation. It seems not unlikely that the final conclusion will be that instead of the reflecting matter being composed of solid particles it is an exceedingly tenuous gaseous envelope surrounding the sun and revolving on an axis the mean position of which is between that of the sun's equator and that of the invariable plane of the solar system.

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(S. N.)

ZOFFANY, JOHANN (1733–1810), British painter, whose father was architect to the prince of Thurn and Taxis, was born in Frankfort-on-Main. He ran away from home at the age of thirteen and went to Rome, where he studied art for nearly twelve years. In 1758 he left for England, and after undergoing some hardships was brought into fashion by royal patronage, and in 1769 was included among the foundation members of the Royal Academy. He went to Florence in 1772 with an introduction from George III. to the grand duke of Tuscany, and did not return until 1779. During this second stay in Italy he met with much success, and was commanded by the empress Maria Theresa to paint a picture of the royal family of Tuscany; this work he executed so much to the satisfaction of the empress that in 1778 he was created a baron of the Austrian empire. He went next to India, where he lived from 1783 to 1790, to which period belong some of his best-known paintings; but the last twenty years of his life were spent in England. He died in 1810 and was buried in Kew churchyard. His portrait groups of dramatic celebrities are, perhaps, the most highly esteemed of his many productions; they have considerable technical merit and show much shrewd insight into character. Several of the best are in the Garrick Club, London.

ZOÏLUS (*c.* 400–320 B.C.), Greek grammarian of Amphipolis in Macedonia. According to Vitruvius (vii., preface) he lived during the age of Ptolemy Philadelphus (285–247 B.C.), by whom he was crucified as the punishment of his criticisms on the king. This account, however, should probably be rejected. Zoïlus appears to have been at one time a follower of Isocrates, but subsequently a pupil of Polycrates, whom he heard at Athens, where he was a teacher of rhetoric. Zoïlus was chiefly known for the acerbity of his attacks on Homer (which gained him the name of Homeromastix, "scourge of Homer"), chiefly directed against the fabulous element in the Homeric poems. Zoïlus also wrote against Isocrates and Plato, who had attacked the style of Lysias of which he approved. The name Zoïlus came to be generally used of a spiteful and malignant critic.

See U. Friedländer, *De Zoilo aliisque Homeri Obtrectatoribus* (Königsberg, 1895); J. E. Sandys, *History of Classical Scholarship* (2nd ed. 1906).

ZOISITE, a rock-forming mineral, consisting of basic calcium and aluminium silicate, $Ca_2(AlOH)Al_2(SiO_4)_3$, crystallizing in the orthorhombic system. It is closely related to epidote (*q.v.*) both in the angles of the crystals and in chemical composition: a zoisite containing some iron replacing aluminium may be identical in composition with an epidote ("clinozoisite") poor in iron. The crystals are prismatic in habit and are deeply furrowed parallel to their length; terminal planes are rare; there is a perfect cleavage parallel to the brachy-pinacoid. Columnar and compact masses are more common. The hardness is $6\frac{1}{2}$ and the specific gravity 3·25–3·37. The colour is often grey; a rose-red variety, known as "thulite," occurs with sky-blue vesuvianite at Telemarken in Norway, and has been used to a limited extent as an ornamental stone. According to differences in the optical characters, two kinds of zoisite have been distinguished. Zoisite is a product of dynamo-metamorphism, and occurs as a constituent of some crystalline schists, such as amphibolite and eclogite. It was first observed by Baron Zois (after whom it was named) in the eclogite of Sau-Alpe in Carinthia; other localities are the Ducktown copper mines in Tennessee, where it occurs embedded in chalcopyrite; Loch Garve in Ross-shire, &c. The "saussurite" of the Alps and elsewhere, which has resulted from the alteration of the plagioclase felspar of gabbro, consists largely of zoisite with epidote. (L. J. S.)

ZOLA, ÉMILE ÉDOUARD CHARLES ANTOINE (1840–1902), French novelist, was born in Paris on the 2nd of April 1840, his father being an engineer, part Italian and part Greek, and his mother a Frenchwoman. The father seems to have been an energetic, visionary man, who, dying while his only son was a little lad, left to his family no better provision than a lawsuit against the municipality of the town of Aix It was at Aix, which figures as Plassans in so many of his novels, that the boy received the first part of his education. Thence he proceeded, in 1858, to Paris, where, as later at Marseilles, he failed to obtain his bachelor's degree. Then came a few years of terrible poverty; but at the beginning of 1862 he obtained a clerkship, at the modest salary of a pound a week, in the house of Hachette the publisher. Meanwhile he was writing apace, but nothing of particular merit. His first book, *Contes à Ninon*, appeared on the 24th of October 1864, and attracted some attention, and in January 1866 he determined to abandon clerking and take to literature. Vigorous and aggressive as a critic, his articles on literature and art in Villemessant's paper *L'Événement* created a good deal of interest. So did the gruesome but powerful novel, *Thérèse Raquin* (1867). Meanwhile, with characteristic energy, Zola was projecting something more important: the creation of a world of his own, like that of Balzac's *Comédie Humaine*—the history of a family in its various ramifications during the Second Empire. The history of this family, the Rougon-Macquart, was to be told in a series of novels containing a scientific study of heredity—science was always Zola's *ignis fatuus*—and a picture of French life and society. The first novel of the series, *La Fortune des Rougon*, appeared in book form at the end of 1871. It was followed by *La Curée* (1874), *Le Ventre de Paris* (1874), *La Conquête de Plassans* (1875), *La Faute de l'Abbé Mouret* (1875), *Son Excellence Eugène Rougon* (1876)—all books unquestionably of immense ability, and in a measure successful, but not great popular successes. Then came *L'Assommoir* (1878?), the epic of drink, and the author's fortune was made. Edition followed edition. He became the most discussed, the most read, the most bought novelist in France—the sale of *L'Assommoir* being even exceeded by that of *Nana* (1880) and *La Débâcle* (1892). From the *Fortune des Rougon* to the *Docteur Pascal* (1893) there are some twenty novels in the *Rougon-Macquart* series, the second half of which includes the powerful novels *Germinal* (1885) and *La Terre* (1888). In 1888 Zola departed from his usual vein in the idyllic story of *Le Rêve*. Zola also wrote a series of three romances on cities, *Lourdes*, *Rome*, *Paris* (1894–98), novels on the "gospels" of population (*Fécondité*) and work (*Travail*), a volume of plays, and several volumes of criticism, and other things. These books are based on study and observation; the novels are crowded with characters. The whole is a gigantic opus, the fruit of immense labour, of an admirable tenacity—so many pages written, morning after morning, without intermission, during some thirty years. He prided himself on his motto, *Nulla dies sine linea*.

Zola was the apostle of the "realistic" or "naturalistic" school; but he was in truth not a "naturalist" at all, in so far as "naturalism" is to be regarded as a record of fact. He was an idealist, but while other idealists idealize the nobler elements in human nature, so has he, for the most part—the later books, however, show improvement—idealized the elements that are bestial. He saw man's lust, greed, gluttony, as in a vision, magnified, overwhelming, portentous. And what he saw he presented with tremendous power. His style may lack the classic qualities of French prose—lightness, delicacy, sparkle; it certainly has not Daudet's colour and felicity of touch. The first impression it produces may be one of heaviness, and the later "gospels" on population and work are distinctly ponderous. But for rendering the gloomy horror of the subjects in which he most delights—detail on detail being accumulated till the result is overwhelming—Zola has no superior. Some of his descriptions of crowds in movement have never been surpassed.

Zola played a very important part in the Dreyfus affair, which convulsed French politics and social life at the end of the 19th century. At an early stage he came to the conclusion that Dreyfus was the innocent victim of a nefarious conspiracy, and on the 13th of January 1898, with his usual intrepidity, he published in the *Aurore* newspaper, in the form of a letter beginning with the words *J'accuse*, a terrible denunciation of all those who had had a hand in hounding down that unfortunate officer. Zola's object was a prosecution for libel, and a judicial inquiry into the whole *affaire*, and at the trial, which took place in Paris in February, a fierce flood of light was thrown on the case. The chiefs of the army put forth all their power, and Zola was condemned. He appealed. On the 2nd of April the Cour de Cassation quashed the proceedings. A second trial took place at Versailles, on the 18th of July, and without waiting the result Zola, by the advice of his counsel and friends, and for reasons of legal strategy, abruptly left France and took refuge in England. Here he remained in hiding, writing *Fécondité*, till the 4th of June 1899, when, immediately on hearing that there was to be a revision of the first Dreyfus trial, he returned to Paris. Whatever may be thought of the *affaire* itself, there can be no question of Zola's superb courage and disinterestedness.

On the morning of the 29th of September 1902 Zola was found dead in the bedroom of his Paris house, having been accidentally asphyxiated by the fumes from a defective flue. He received a public funeral, at which Captain Dreyfus was present. Anatole France delivered an impassioned oration at the grave. At the time of his death Zola had just completed a novel, *Vérité*, dealing with the incidents of the Dreyfus trial. A sequel, *Justice*, had been planned, but not executed. After a life of constant struggle and an obloquy which never relaxed, the sensational close of Zola's career was the signal for an extraordinary burst of eulogy. The verdict of posterity will probably be kinder than the first, and less unmeasured than the second. Zola's literary position would have more than qualified him for the French Academy. He was several times a candidate in vain. (F. T. M.)

See *Émile Zola, Novelist and Reformer* (1904), giving a full account of his life and work, by E. A. Vizetelly, who translated and edited many of his works in English; also P. Alexis, *Émile Zola, Notes d'un ami;* F. Brunetière, *Le Roman Naturaliste* (1883); vols. iii., v. and vi. of the *Journal des Goncourt* (1888–92); E. Hennequin, *Quelques Écrivains français* (1890); R. H. Sherard, *Émile Zola: a biographical and critical study* (1903); A. Laporte, *Émile Zola, l'homme et l'œuvre* (1894) with a bibliography. A complete report of the proceedings against Zola is printed in *Le Procès Zola* (2 vols. 1898, Eng. trans. 1898).

ZOLKIEWSKI, STANISLAUS (1547–1619), the most illustrious member of an ancient Ruthenian family which emigrated to Galicia in the 15th century. During the interregnum in Poland after the death of Henry of Valois, Zolkiewski was an ardent partisan of the chancellor Zamoyski, and supported the candidature of Stephen Báthory, under whose banner he learned the art of war in the Muscovite campaigns. On the death of Stephen, Zolkiewski vigorously supported the policy of Zamoyski, and took an active part in the battle of Byczyna, when the Austrian archduke Maximilian was defeated by the Polish chancellor. Shortly afterwards Zolkiewski was made castellan of Lemberg and acting commander-in-chief. On the accession of Sigismund III. he retired from court and divided his time between improving his estates, where he built towns and fortresses, and disciplining the Cossacks, with whom he enjoyed great influence. In 1601–2 he served with distinction in the Livonian war against the Swedes, whom he defeated at Reval. During the insurrection of Nicholas Zebrzydowski he led the army which routed the rebels at Guzow in 1607, though protesting against the necessity of shedding "his brothers' blood." For his services he received the palatinate of Kiev. He was opposed to the expedition sent to place the false Demetrius on the throne of Muscovy; but nevertheless accompanied the king to Smolensk and was sent thence with a handful of men against Moscow. On his way thither he defeated and captured Tsar Vasily Shuiski at the battle of Klushino (July 14, 1610), and two months later entered the Russian capital in triumph. His tactful and conciliatory diplomacy speedily won over the boyars, whom he persuaded to offer the Muscovite crown to the Polish crown prince, Wladislaus. For a moment it seemed possible that the Vasa family might occupy the throne of Ivan the Terrible; but Sigismund III. would not consent to the reception of his son into the Greek Church, and refused to ratify the terms made with the boyars. Zolkiewski then returned to the Polish camp and assisted in the reduction of Smolensk, but Moscow in the meantime drove out the Polish garrison and proclaimed a native dynasty under Michael Romanov. When Zolkiewski presented his captives, Tsar Vasily and his family, to the Polish diet, he received an ovation and was rewarded with the dignity of *hetman wielki* (commander-in-chief). For the next few years he defended the Ukraine against the Tatars and Cossacks, and in 1617 was involved in a war with the Porte owing to the unauthorized interference of the Polish nobles in the affairs of Wallachia and Moldavia. Unable to defeat the vastly superior forces of the Turkish commander Skinder, he concluded with him an advantageous truce at Jaruda (27th of August 1618), by the terms of which he pledged himself to curb the Cossacks and at the same time renounced all the claims of Poland to the Danubian principalities. Thus he saved the one army of Poland to guard her southern frontier from apparently inevitable destruction. On his return he was fiercely assailed by the diet for not risking everything in a pitched battle, but Zolkiewski defended himself with an eloquence which silenced his most venomous opponents. The peace of Jaruda was then confirmed, and the king conferred upon Zolkiewski the grand-chancellorship, an honour he had neither desired nor expected. Fresh attacks were presently made against him for failing, it was alleged, to prevent the Tatar incursions. So deeply wounded was the hero by these calumnies that when in 1619 he was sent against the Turks he publicly declared that he would never return alive unless victorious. He was as good as his word. Surrounded near the Dniester by countless hosts of Turks, Tatars and Janissaries, he retreated through the Steppes, fighting night and day without food or water, towards Cecora. By the time he reached it, he saw clearly that success was impossible, and deliberately determined to die where he stood. Disguising himself so that his dead body might not be recognized, he turned upon the pursuers and was slain after a desperate resistance (6th of October 1620). His head was cut off, exhibited in the Turkish camp and then sent to Constantinople as a present to the sultan, from whom it was subsequently ransomed at a great price. Zolkiewski is one of the most heroic figures in Polish history. An accomplished general, a skilful diplomatist, and a patriot who not only loved his country above all things, but never feared to tell his countrymen the truth, he excelled in all private and public virtues. As a writer he made a name by an important history of his Muscovite campaigns.

See Stanislaw Gabryel Kozlowski, *Life of Stanislaus Zolkiewski* (Pol.) (Cracow, 1904). (R. N. B.)

ZÖLLNER, JOHANN KARL FRIEDRICH (1834–1882), German astronomer and physicist, was born at Berlin on the 8th of November 1834. From 1872 he held the chair of astrophysics at Leipzig University. He wrote numerous papers on photometry and spectrum analysis in Poggendorff's *Annalen* and *Berichte der k. sächsischen Gesellschaft der Wissenschaften*, two works on celestial photometry (*Grundzüge einer allgemeinen Photometrie des Himmels*, Berlin, 1861, 4to, and *Photometrische Untersuchungen*, Leipzig, 1865, 8vo), and a curious book, *Ueber die Natur der Cometen* (Leipzig, 1872, 3rd ed. 1883). He died at Leipzig on the 25th of April 1882.

ZOLLVEREIN (Ger. *Zoll*, toll, customs, and *Verein*, union), a term used generally for a certain form of Customs Union, but specially for the system among the German states which was in force between 1819 and 1871 (see TARIFF, and GERMANY: *History*).

ZOMBOR, a town of Hungary, capital of the county of Bács Bodrog, 146 m. S. of Budapest by rail. Pop. (1900) 29,036, two-thirds Servians. It is situated in a fertile plain near the Franz Josef canal, which connects the Danube and the Theiss, and is the centre of the corn and cattle trade of an extensive area.

ZONARAS, JOANNES (JOHN), Byzantine chronicler and theologian, flourished at Constantinople in the 12th century. Under Alexius I. Comnenus he held the offices of commander of the bodyguard and private secretary to the emperor, but in the succeeding reign he retired to Hagia Glykeria (one of the Princes' Islands), where he spent the rest of his life in writing books. His most important work, *Ἐπιτομὴ Ἱστοριῶν* (compendium of history), in eighteen books, extends from the creation of the world to the death of Alexius (1118). The earlier part is largely drawn from Josephus; for Roman history he chiefly followed Dio Cassius, whose first twenty books are not otherwise known to us. His history was continued by Nicetas Acominatus. Various ecclesiastical works have been attributed to Zonaras—commentaries on the Fathers and the poems of Gregory of Nazianzus; lives of Saints; and a treatise on the Apostolical Canons—and there is no reason to doubt their genuineness. The lexicon, however, which has been handed down under his name (ed. J. A. H. Tittmann 1808) is probably the work of a certain Antonius Monachus (Stein's *Herodotus*, ii. 479 f.).

Complete edition in Migne, *Patrologia Graeca*, cxxxiv. cxxxv. cxxxvii.; the *Chronicon* by M. Pinder and T. Büttner-Wobst in the Bonn *Corpus Scriptorum Hist. Byz.* (1841–97) and by L. Dindorf in the Teubner series (1868–76); see bibliography in C. Krumbacher, *Geschichte der byzantinischen Litteratur* (2nd ed. 1897).

ZONE (Gr. *ζώνη*, a girdle, from *ζωννύναι*, to gird), a term for a belt or girdle, now used chiefly in the transferred sense of a demarcated area. Thus the earth's surface is divided, for classification of climates, into five climatic zones: the two temperate and the two frigid zones and the tropical or torrid zone. (See CLIMATE AND CLIMATOLOGY.)

ZOOLOGICAL DISTRIBUTION (also known as Zoogeography), the science dealing, in the first place, with the distribution of living animals on the surface of the globe (both land and water), and secondly with that of their forerunners (both in time and in space). The science is thus a side-branch of zoology,[1] intimately connected on the one hand with geography and on the other with geology. It is a comparatively modern science, which dates, at all events in its present form, from the second half of the 19th century.

Different parts of the land-surface of the globe are inhabited by different kinds of animals, or, in other words, by different faunas. These differences, in many cases at any rate, are not due to differences of temperature or of climate; and they do not depend on the distance of one place from another. The warm-blooded land-animals of Japan are, for example, very much more closely related to those of the British Isles than is the corresponding fauna of Africa to that of Madagascar. Again, on the hypothesis of the evolution of one species from another, in the case of land-animals unprovided with the means of flight such resemblances and differences between the faunas of different parts of the world depend in a great degree on the presence or absence of facilities for free communication by land between the areas in question. Prima facie, therefore, it is natural to suppose that the fauna of an island will differ more from that of the adjacent continent than will those of different parts of that continent from one another.

To a great extent this is the case; and if the present continents and islands had always been *in statu quo*, the proposition would, for the most part at any rate, be universally true. Geology has, however, taught us that many parts of what are now continents formed at earlier periods of the earth's history portions of the ocean-bed, while what are now islands have in some instances been connected with the adjacent mainlands, or even with land-masses the sites of which are now occupied by the open sea.

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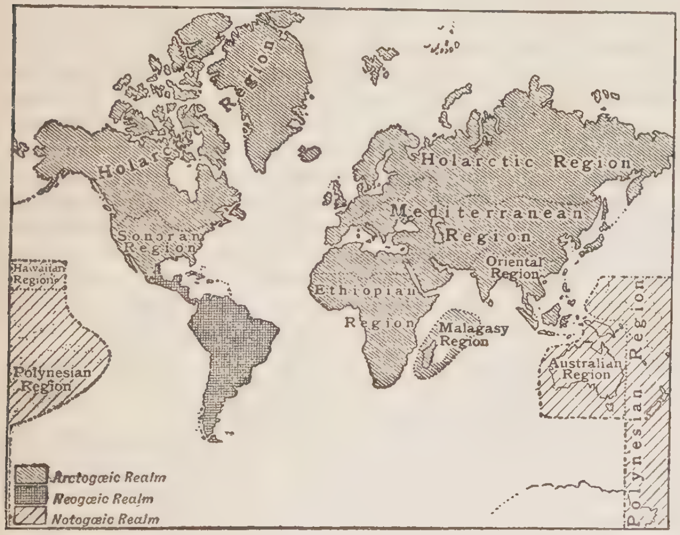
[1] For the distribution of plants, see PLANTS: *Distribution*.

We can hope, therefore, to understand and explain the present distribution of terrestrial animal life only by taking into account what geology teaches us as to past changes in the configuration of the land-masses of the globe, accompanied by investigations into the past history of animals themselves, as revealed by their fossil remains.

Although to understand the reason of many facts in the present distribution of animals—as, for example, why tapirs are confined to the Malay countries and South America—it is essential to study fossil faunas, yet it has been found possible from the consideration of existing faunas alone to map out the land-surface of the globe into a number of zoological "regions," or provinces, more or less independent of the ordinary geographical boundaries, and severally characterized by a greater or smaller degree of distinctness in the matter of their faunas. One of the pioneers in this line of research was Dr P. L. Sclater, who in a paper on the geographical distribution of birds, published in the *Journal* of the Linnean Society of London for 1858, was enabled to define and name six of such zoological regions; these being mainly based on the distribution of the perching or passerine birds. Two years later Dr A. Russel Wallace, in the same journal, discussed in some detail the problems presented by the distribution of animals in the Malay Archipelago and Australasia. This preliminary essay was followed in 1876 by the appearance of the latter author's *Geographical Distribution of Animals*, an epoch-making work, which may be said to have first put the study of the distribution of animals generally on a thoroughly firm and scientific basis. With some slight modifications, the names proposed for the six zoological regions by Dr Sclater were adopted by Dr Wallace. Certain changes in regard to the limits and number of the zoological regions adopted by Sclater and Wallace have been proposed; but the original scheme forms the basis of all the later modifications, and these eminent naturalists are entitled to be regarded as the fathers of the study of distributional zoology. T. H. Huxley was also one of those who did much to advance the science in its early days, while among those who have proposed more or less important modifications of the original scheme special mention may be made of Dr W. T. Blanford, Dr A. Heilprin, Prof. P. Matschie and Prof. Max Weber.



The zoological regions proposed by Dr Sclater were based mainly on the distribution of the perching birds; but in the writings of Dr Wallace and of later authors mammals were very largely taken into consideration, and in later schemes there has been a similarly extensive use of the evidence afforded by mammalian distribution. That different groups of animals do not agree with another in the matter of geographical distribution will be evident when we reflect that in many instances there are very great differences in the relative ages of such groups, or, at all events, in the dates of their dispersal, or "radiation," over the surface of the earth. The radiation and dominance of reptiles, for example, greatly antedated that of either birds or mammals. Consequently, the zoological regions indicated by the present geographical distribution of the former group are very different from those suggested by the distribution of the two latter. If zoological regions are based on the evidence of the existing distribution of animals, groups with a relatively late radiation are clearly to be preferred to those the dispersal of which was earlier. Mammals and birds, therefore, are of greater value from this point of view than reptiles; while the absence of the power of flight in the great bulk of the class renders the evidence afforded by mammals superior to that derived from birds. The marked general agreement between the geographical distribution of birds on the one hand and of mammals on the other is, however, a fact of the greatest importance in regard to the value of the zoological regions established on their evidence. Further testimony in the same direction is afforded by the distribution of certain other groups, more especially spiders (Arachnida); and it is also noteworthy that the distribution of the three main divisions of the human race accords to a certain extent with the boundaries of some of the zoological regions based on the distribution of the lower animals.

With regard to the theory of the polar origin of life and the gradual dispersal of animals from the arctic regions, it may be briefly stated that the presumed series of radiations of life southward from the northern pole can have nothing to do with the present geographical distribution of animals, since we have abundant evidence that mammals have been spread over the whole of the warmer parts of the globe since, at any rate, the commencement of the Tertiary period, while the radiation of reptiles commenced at a much earlier epoch.

As regards barriers to the free dispersal of nonvolant terrestrial animals these may be grouped under two main heads, namely, climatic and geographical, of which the second is by far the more important. At the present day a certain number of animals are fitted to live respectively only in hot and in cold climates. The man-like apes and elephants among mammals, and trogons and parrots among birds, are, for example, now exclusively dwellers in tropical or subtropical climates; whereas the polar bear, the musk-ox and ptarmigan are equally characteristic of the arctic zone. To a great extent this must be regarded as a comparatively modern adaptive feature, since many of these arctic and tropical animals belong to groups the distribution of which, either in the past or the present, is more or less independent of climate. Elephants, for instance, formerly inhabited Siberia at a time when the climate, although probably less cold than at present, was certainly not tropical; while the polar bear is a specialized member of a group some of the representatives of which are denizens of the tropics.

It is true, indeed, that within the limits of the different zoological regions temperature-control has had an important influence on the distribution of animals, and has resulted in certain cases in the formation of life-zones, as in North America. As remarked, however, by H. A. Pilsbry and J. H. Ferriss[1] in connexion with the distribution of land-molluscs, "the life-zones of the United States as mapped by Dr C. H. Merriam emphasize the secondary and not the primary facts of distribution. The laws of temperature-control do not define trans-continental zones of primary import zoologically. These zones are secondary divisions of vertical life-areas of which the molluscan faunas were evolved in large part independently." And what is true of molluscs will hold good in the case of several other groups.

[1] *Proc. Academy of Philadelphia*, 1906, p. 123.

There is also the phenomenon of vertical temperature-control. On this subject Dr A. R. Wallace has written (*Ency. Brit.*, 9th ed., art. “Distribution”): “As we ascend lofty mountains, the forms of life change in a manner somewhat analogous to the changes observed in passing from a warm to a cold country. This change is, however, far less observable in animals than in plants; and it is so unequal in its action, and can so frequently be traced to mere change of climate and deficiency of food, that it must rank as a phenomenon of secondary importance. Vertical distribution among animals will be found in most cases to affect species rather than generic or family groups, and to involve in each case a mass of local details. . . . The same remarks apply to the bathymetrical zones of marine life. Many groups are confined to tidal, or shallow, or deeper waters; but these differences of habit are hardly geographical, but involve details, suited rather to the special study of individual groups.” Temperature-control is therefore mainly a factor which has acted independently in the different zoological regions of the globe, and as such demands little or no further mention in a general sketch of the present nature.

The same remark will apply in the case of the influence of humidity on distribution, and also as regards “station.” To illustrate the latter we may take the instances of the European squirrel and the chamois, the former of which is found only in wooded districts and is entirely absent from the open plains, while the latter occurs only in the isolated mountain ranges of the Pyrenees, the Alps, the Apennines and the Caucasus. The distributional area of both may, however, be regarded as including Europe generally, so that these local restrictions of range have nothing to do with the wider problems of distribution.

Very different is the case with regard to geographical barriers to the free dispersal of terrestrial animals. It should be observed, however, that even these act with different degrees of intensity in the case of different groups. From the fact that the great majority of them are oviparous, reptiles, whose powers of dispersal in the adult state are generally as restricted as those of mammals, have an advantage over the latter in that their eggs may be carried long distances on floating timber down rivers and thence across the ocean, or may even be occasionally transported by birds. The eggs of batrachians, like those of fresh-water fishes, will in some cases at any rate withstand being frozen, and hence conceivably may be transported by floating ice. Adult insects may be carried in the same manner as the eggs of reptiles. After all, however, such unusual means of transport are probably of no great importance; and it seems most likely that the varying features in the geographical distribution of different groups of animals are due much more to differences in the dates of radiation, or dispersal of those groups, than to varying degrees of facility for overcoming natural geographical barriers to dispersal.

The greatest barriers of all are formed by the ocean and the larger rivers; and from the former factor it follows that zoological regions coincide to a considerable extent—although by no means altogether—with the main geographical (as distinct from political) divisions of the earth’s surface. In the main, mammals and other nonvolant terrestrial animals are debarred from crossing anything more than comparatively narrow channels of the sea, while even these and the larger rivers form a more or less effectual barrier to the dispersal of the great majority of the species. Hence it results that oceanic islands are usually devoid of such forms of life; while it may be laid down, as a general rule, that the existence of nearly allied types of terrestrial animals in countries now separated by stretches of sea implies a former land-connexion between them. There are, however, in many cases great difficulties in determining the nature of such connexions, largely owing to the fact that we are still in the dark as to whether the dispersal of many groups of animals has taken place down the lines of the present continents from north to south or equatorially by means of belts of land long since swallowed up by the ocean. In this connexion it may be remarked, as tending against the old idea of the radiation of all the modern groups of terrestrial animals from the north towards the south, that there is decisive evidence to prove the existence during the Tertiary period (so far at least as mammals are concerned) of certain great centres of development, and in some instances, at all events, also of radiation, in the southern hemisphere; one of these developmental centres being in Africa a second in South America, and a third in Australia.

To the general law that straits and arms of the sea form an effectual barrier to the dispersal of the larger land-animals, and more especially mammals, certain exceptions may be pleaded. Jaguars have, for instance, been known to cross the Rio de la Plata, while tigers constantly swim from island to island in the delta of the Ganges and probably also in the Malay Archipelago, and a polar bear has been observed swimming twenty miles away from land in Bering Sea. Deer, certain antelopes, pigs and elephants are also good swimmers; while hippopotamuses and crocodiles—especially the latter—can cross channels of considerable width. The great tropical and subtropical rivers also carry down masses of floating soil or large trees upon which mammals and reptiles are borne, and although in many or most instances such are swept out to sea and their occupants drowned, in other instances they may be stranded upon the opposite bank or shore where their living freight can effect a landing. Such instances, however, cannot be very frequent, and they cannot affect widely sundered countries, owing to the lack of food supplies. Moreover, supposing a mammal to have reached a new land, unless it happened to be a pregnant female, or unless another individual of the opposite sex be similarly stranded, it would eventually die without progeny. Even in the case of a pregnant female, there is no certainty that the offspring, if but one, would be a male; and even supposing this to be the case, the progeny might perish from the attacks of other animals or from inbreeding. On the whole, it may be said, that instances of such methods of dispersal must be relatively few and can affect only countries not very widely sundered. The most important case that can be cited is the occurrence of a pig and an extinct hippopotamus in Madagascar, which probably reached that island by swimming from Africa. As a rule, a strait like that separating Ceylon from India may be considered an effectual barrier to the dispersal of large land-animals.

Although the Rio de la Plata has effectually prevented the amphibious carpincho from reaching Argentina, deserts form even more impassable barriers than large rivers, the Sahara having prevented the North African fauna from reaching the heart of that continent. High and continuous mountain-ranges are likewise most effective in restricting the range of animals; this being more especially the case when, like the Himalaya, their trend is equatorial instead of, as in the case of the Rocky Mountains and the Andes, from north to south in the direction of the main continental extension. Forests also present great obstacles to animal migration, although this is to a great extent of a local nature and comes, in fact, under the category of “station.” Indeed, there appears to be no instance of the separation of one zoological region from another by forest alone.

Lastly it should be mentioned that ice may serve as a factor in the dispersal of animals by acting as a bridge between different land-areas; and at some period this means of communication may have aided in the great migrations of animals that have taken place between the Old and the New World by way of what is now Bering Sea.

I. TERRESTRIAL DISTRIBUTION

Zoological Regions.

The zoological regions recognized by Dr A. R. Wallace in 1876, which are in the main identical with those proposed by Dr P. L. Sclater in 1858, and are chiefly based on the distribution of birds and mammals, are as follows:—

1. *Palaearctic*, which includes Europe to the Azores and Iceland, temperate Asia from the high Himalaya and west of the Indus, with Japan, and China from Ningpo and to the north of the watershed

of the Yang-tse-kiang; also North Africa and Arabia, to about the line of the tropic of Cancer.

2. *Ethiopian*, including Africa south of the tropic of Cancer, as well as the southern part of Arabia, with Madagascar and the adjacent islands.

3. *Oriental*, or Indo-Malay, comprising India and Ceylon, the Indo-Chinese countries and southern China, and the Malay Archipelago as far as the Philippines, Borneo and Java.

4. *Australian*, composed of the remainder of the Malay Archipelago, Australia, New Zealand and all the tropical islands of the Pacific, as far east as the Marquesas and the Low Archipelago.

5. *Neotropical*, which comprises South America and the adjacent islands, the West Indies or Antilles, and Central America and Mexico.

6. *Nearctic*, consisting of temperate and arctic North America, with Greenland.

"These six regions," remarks Dr Wallace, "although all of primary importance from their extent, and well marked by their total assemblage of animal forms, vary greatly in their zoological richness, their degree of isolation and their relationship to each other. The Australian region is the most peculiar and the most isolated, but it is comparatively small and poor in the higher animals. The Neotropical region comes next in peculiarity and isolation, but it is extensive and excessively rich in all forms of life. The Ethiopian and Oriental regions are also very rich, but they have much in common. The Palaearctic and Nearctic regions being wholly temperate are less rich, and they too have many resemblances to each other; but while the Nearctic region has many groups in common with the Neotropical, the Palaearctic is closely connected with the Oriental and Ethiopian regions."

In Dr Sclater's original scheme the first four of the above regions were bracketed together under the designation of *Palaeogaea*, and the fifth and sixth, or those belonging to the New World, as *Neogaea*. T. H. Huxley, in a paper on the distribution of game-birds, published in the *Proceedings of the Zoological Society of London for* 1868, instead of dividing the world into an eastern and a western division, adopted a northern and a southern division, calling the former *Arctogaea*, and the latter (which included Australasia and the Neotropical region of Messrs Sclater and Wallace, but not the Ethiopian region) *Notogaea*.

In 1874 Dr Sclater,[1] taking mammals as well as birds into consideration, adopted Huxley's Arctogaea as the major northern division to include the Nearctic, Palaearctic, Oriental and Ethiopian regions; and instead of Huxley's Notogaea recognized three primary divisions, namely, *Dendrogaea* for the Neotropical region, *Antarctogaea* for the Australian region (in a somewhat restricted sense), and *Ornithogaea* for New Zealand and Polynesia.

The tendency of these amendments on the original scheme of a simple division into six regions was to recognize three primary divisions of higher rank than such "regions." This view was adopted in 1890 by Dr W. T. Blanford,[2] who proposed to designate these three major divisions of the earth's land surface respectively the Australian, the South American and the Arctogaean regions. A weak point in this scheme is that since the term "region" is likewise applied to the subdivisions of Arctogaea, there is a danger of confusion between the primary and secondary divisions. An amendment proposed anonymously[3] in 1893 was to substitute the names Notogaea, Neogaea and Arctogaea for the three primary divisions of Dr Blanford. Yet another emendation, suggested by R. Lydekker[4] and subsequently adopted by Prof. H. F. Osborn,[5] was to designate these three primary divisions as "realms," and to reserve the name "region" for their subdivisions.

Emendations on the original scheme also included modifications in the limits of the regions themselves. In 1878, for instance, Dr A. Heilprin[6] (in accordance with a suggestion of Prof. A. Newton) proposed to nuite the Nearctic with the Palaearctic region under the name of Holarctic; separating at the same time from the former a "transitional" Sonoran, and from the latter a similar Mediterranean, or Tyrrhenian, region, while he also recognized a distinct Polynesian region, distinguished in the main by negative characters. The Sonoran region was subsequently adopted by Dr C. H. Merriam[7] in 1892, and later on by Dr Blanford in the address already cited, the title being, however, changed to Medic-Columbian. A most important proposal was also embodied in Dr Blanford's scheme, namely, the separation from the Ethiopian region of Madagascar and the Comoro islands to form a separate Malagasy region. Another modification of the original scheme was to transfer the island of Celebes, together with Lombok, Flores and Timor, from the Australian to the Oriental region, or to regard them as representing a transitional region between the two.[8] The effect of this change was practically to abolish "Wallace's line" (the deep channel between the islands of Bali and Lombok and thence northward through the Macassar Strait), the deepest channel being really situated to the eastward of Timor.

The later evolution of the scheme, as presented by Dr Max Weber,[9] may be tabularized, with some slight alteration, as follows, the "realms" being printed in capitals, the regions and sub-regions in ordinary type, and the transitional regions in italics:—

I. ARCTOGAEA

1. Holarctic. 2. Ethiopian. 3. Malagasy. 4. Oriental.

Nearctic Palaearctic
Sonoran *Mediterranean* *Austro-Malayan*

II. NEOGAEA
5. Neotropical.

III. NOTOGAEA.
6. Australian
(?) 7. Polynesian
(?) 8. Hawaiian.

In the accompanying map the Sonoran and Mediterranean transitional regions are represented as equivalent in value to the main regions, and the Austro-Malayan transitional region is not indicated. The recognition of a Polynesian and still more of a Hawaiian region, is provisional.

Notogaea. The most distinct of the three primary realms is undoubtedly Notogaea, the Australian section of which is the sole habitat of egg-laying mammals (Monotremata) and of a great variety of marsupials, inclusive of the whole of the diprotodonts, with the exception of the few (cuscuses) found in the Austro-Malayan transitional region. Apart from monotremes and marsupials, the only indigenous mammals found in Notogaea are rodents and bats, with perhaps a pig in New Guinea; although it is most probable that the latter is introduced, as is almost certainly the dingo, or native dog, in Australia. The rodents are all referable to the family Muridae, and are mostly of peculiar types, such as the golden water-rat (*Hydromys*) and the jerboa-rats (*Conilurus*, *Notomys*, &c.); they are, however, in many instances more or less nearly related to species found in Celebes, the mountains of the Philippines and Borneo, and apparently represent an ancient fauna. The mammalian fauna of Notogaea is practically limited to the Australian region, its indigenous representatives in New Zealand being only a couple of bats. The monotremes are in all probability the survivors of a group which was widely spread in Jurassic times; while marsupials, as represented by the American opossums (Didelphyidae), had a very wide range even as late as the Oligocene division of the Tertiary period. The diprotodont marsupials may not improbably have originated within the Australian region, or this region conjointly with the Austro-Malayan transitional region.

Notogaea is likewise the home of a number of peculiar types of birds, some of which range, however, into the Austro-Malayan area, that is to say, Celebes and Ceram. In the Australian region the peculiar avian families include the birds-of-paradise (Paradiseidae), the honeysuckers (Meliphagidae), and the lyre-birds (Menuridae) among the perching group, the cockatoos (Cacatuidae) and lories (Loriidae) among the parrots, the mound-builders, or brush-turkeys (Megapodiidae) among the game-birds, and the cassowaries and emeus (Casuariidae and Dromaeidae) in the ostrich group. The peculiarity of the region is also marked by the absence of certain widely spread family groups, such as the barbets (Megalaemidae), the otherwise cosmopolitan woodpeckers (Picidae), the trogons (Trogonidae), and the pheasant and partridge tribe (Phasianidae).

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[1] *Manchester Science Lectures*, ser. 5 and 6, p. 202 seq.

[2] *Proc. Geol. Soc.* (London, 1890), p. 76.

[3] *Natural Science*, iii. 289.

[4] *Geographical Distribution of Mammals* (London, 1896), p. 27.

[5] "Correlation between Tertiary Mammal Horizons of Europe and America," *Annals New York Academy*, xiii. 48 (1900).

[6] *The Geographical and Geological Distribution of Animals* (London, 1878).

[7] "The Geographical Distribution of Life in North America with special reference to the Mammalia," *Proc. Biol. Soc., Washington*, vol. vii. pp. 1–64 (1892).

[8] See W. L. Sclater, "The Geography of Mammals," part v., *Geographical Journal*, 1896; M. Weber, "On the Origin of the Fauna of Celebes," *Ann. Mag. Nat. Hist.*, ser. 7, vol. iii. pp. 121–136 (1899), and *Der Indo-australische Archipel und die Geschichte seiner Tierwelt* (Jena, 1902); Lydekker, "Celebes: a Problem in Distribution," *Knowledge*, vol. xxi. pp. 175–177 (1898); see also *Deer of All Lands*, p. 168 (1898).

[9] *Die Säugetiere* (Jena, 1904), p. 308.

The reptiles, owing probably to their earlier radiation, are much less peculiar, such widely spread types as the monitors (Varanidae) and skinks, (Scincidae) being abundant, as are also crocodiles (Crocodilidae). The tortoises belong, however, exclusively to the side-necked group (Pleurodira), now restricted to the southern hemisphere; among these the most noteworthy being the giant horned tortoise (*Miolania*) from the Pleistocene of Queensland, which belongs to a genus elsewhere known only from the South American Tertiary. The Australian lung-fish (*Ceratodus*, or *Neoceratodus*) is the sole survivor of a widely spread Triassic and Jurassic type. The salmon tribe (Salmonidae), however, is notable for its absence, although one peculiar form occurs in New Zealand; and the Cyprinidae, or carps, are wanting throughout the realm, this absence extending to Celebes, although in Borneo the group is abundantly represented.

New Zealand, here provisionally included in a separate Polynesian region, is characterized by the absence of all indigenous mammals except two bats, each representing a peculiar genus. Among birds, the Neogaeic family Meliphagidae includes several peculiar genera, as does also the widely spread starling group (Sturnidae); while the parrots of the genera *Stringops* and *Nestor* are likewise peculiar. Still more noteworthy is the abundance of the ostrich group, represented by the living kiwis (*Apteryx*), and the moas (Dinornithidae) which have been exterminated within comparatively recent times. Reptiles are scarce, but among them the tuatera lizard (*Sphenodon*) is especially noteworthy on account of being the sole survivor of an ordinal group (Rhynchocephalia) widely spread during Triassic and Jurassic times.

Of the Hawaiian area (whether or no rightly regarded as a distinct region), it must suffice to state that it is the sole habitat of the gorgeously coloured birds known as mamos, or sickle-bills (Drepanididae).

With regard to the origin of the modern fauna of Notogaea, and more especially the Australian region, as here restricted, we enter extremely debatable ground. Dr Wallace, who refused to admit the existence of any great inter-continental connexions in the past, was of opinion that Australia received the ancestors of its marsupials and monotremes from Asia by way of the Austro-Malayan area (as it certainly has its rodents) "far back in the Secondary period." This view has been endorsed by the present writer[1] who suggested the early Eocene as the most probable date of immigration; and it has also received the assent of Dr Max Weber,[2] who is of opinion that in pre-Tertiary—very likely Cretaceous—times Australia was united by land with Asia. A Euro-Asiatic fauna inhabited this land, from which during the Eocene a southern portion was cut off by partial submergence, this southern portion being the modern Australia and New Guinea, the home of monotremes, marsupials and ancient forms of other groups, such as cassowaries and birds-of-paradise, while widely distributed specialized types are wanting. Northwards extended a coral-sea, in the islands of which dwelt primitive rodents, insectivores and other ancient groups, with perhaps cuscuses. During the Miocene, great changes of level took place in the archipelago, which attained its present form in the Pleistocene. Celebes was insulated early, Java later. Intermittent land-connexions took place, which allowed of periodical immigrations of Asiatic forms from one side and of Australian types from the other. The question is left undecided whether the cuscuses of the Austro-Malayan islands are remnants of the primitive Euro-Asiatic fauna or later immigrants from Australia. The suggestion is also made that the Australian and Philippine rodents are survivors of the original pre-Tertiary fauna, although it is admitted that the specialization of *Hydromys* is against this. The author fails to see any evidence in favour of a former connexion of Australasia with either South America or a former large antarctic continent (Antarctica).

While admitting that this may be the true explanation, Mr B. A. Bensley[3] considers it possible that opossums (Didelphyidae), which he regards as the ancestral stock of the marsupials, may have effected an entrance into Neogaea by way of Antarctica. In either event, he would place the date of entry as post-Eocene; but against this view is the occurrence of remains of a diprotodont marsupial (*Wynyardia*) in Tasmanian strata believed to be of Eocene age. Prof. Baldwin Spencer[4] is also of opinion that the Australian marsupials and monotremes reached their present habitat by means of a land-connexion in the south subsequent to the insulation of New Zealand. This, of course, implies the existence of an extinct southern marsupial fauna of which we have no knowledge except in the case of the Epanorthidae of Patagonia.

That Australia formed part of a great equatorial land-belt connecting the southern continents in Jurassic times appears to be demonstrated by the evidence of the "Gondwana flora." The question is whether such a connexion—either by way of Antarctica or not—persisted in the case of Neogaea long enough to admit of the ancestors of the modern fauna (supposing it all to have come by a southern route) having effected an entrance. The existence of such a land-bridge was suggested by Sir Joseph Hooker in 1847; and the idea of a late connexion between Neogaea and Notogaea has been adopted by L. Rütimeyer (1867), Captain F. W. Hutton (1873), Prof. H. O. Forbes (1893), Mr C. Hedley (1895), Dr H. von Ihering (1891 and 1900), Prof. H. F. Osborn, who takes an intermediate view of the extent of the part played by Antarctica (1900), and by Dr A. F. Ortmann (1902). On the other hand, Dr T. Gill (1875) believed in the existence of an "Eogaea" connecting the three great continents exclusive of Antarctica; and in 1884 Capt. Hutton, abandoning his former view, suggested the connexion of Australia and South America by means of a mid-Pacific continent. A summary of these views, with references, is given by Dr Ortmann in vol. xxxv. pp. 139–142 of the *American Naturalist* (1901).

So far as mammals are concerned, the evidence in favour of a comparatively late land-connexion is weakened by the recent view that certain supposed Patagonian Tertiary marsupials, such as *Prothylacinus*, are really creodont Carnivora. On the other hand (putting aside these carnivores), Mr W. J. Sinclair[5] is of opinion that the living South American marsupial *Caenolestes* and its extinct relatives are annectant forms between diprotodonts and polyprotodonts, and not far removed from the ancestral stock which gave rise to the Australian phalangers. The occurrence in the Tertiary of Patagonia of primitive opossums, which cannot be regarded as ancestral to the modern South American forms, is also an important determination. From this, coupled with the testimony afforded by the invertebrate faunas, he considers himself justified in stating that "considerable evidence is now available to show that a land-connexion between Patagonia and the Australian region existed not later than the close of the Cretaceous or the beginning of the Tertiary, and it is possible that at this time the interchange of marsupials between the two continents was effected. Whether the marsupials originated in South America and migrated thence to Australia, or the reverse, cannot at present be determined." The above-mentioned tortoises of the genus *Miolania* also appear to afford strong evidence of the persistence of the Jurassic connexion between Notogaea and Neogaea to a comparatively late epoch.

Again, Prof. W. B. Benham,[6] from the evidence of earthworms, is strongly disposed to believe in a late connexion between the areas in question. From their invariable association with angiospermous plants, this author is of opinion that earthworms are a comparatively modern group, which did not attain any important development before the Cretaceous. The ancestral type would appear to have been more or less nearly related to the existing *Notiodrilus*, of which the headquarters, if not the birthplace, was the "Melanesian plateau." New Zealand and the neighbouring islands, which possess the most ancient worm-fauna, were separated at an early date from this plateau. From this area the primitive worms travelled in one direction into the Austro-Malayan countries, while in another, by way of Antarctica, they reached South America and Africa. With this brief summary of the chief views, this part of the subject must be dismissed without the writer being committed to any definite conclusion.

Neogaea.

Next to Notogaea the most distinct faunistic continental area, so far at any rate as its present and later Tertiary mammals are concerned, is Neogaea, containing, as we have seen, only the Neotropical region. It is remarkable as being, with the exception of Notogaea, the only land-area which contains at the present day more than one living genus of marsupials, and also a large middle Tertiary marsupial fauna. The living marsupials include a large number of true opossums, constituting the family Didelphyidae and *Caenolestes* the surviving representative of the Epanorthidae of the Patagonian Tertiaries. The opossums are represented by the genera *Chironectes* and *Didelphys;* the latter divisible into a number of sub-genera of which the typical group alone ranged into North America. Whether the modern opossums belong to the endemic Neogaeic fauna, or whether they are late immigrants from the north (where they were represented in the Oligocene of both hemispheres), is a question in regard to which a definite answer can scarcely at present be given. It appears, however, that *Microbiotherium* and certain allied forms from the middle Tertiary of Patagonia are endemic representatives of the Didelphyidae which did not give rise to the modern types. The Epanorthidae, in the opinion of Prof. Max Weber, indicate a sub-ordinal group by themselves; and if this be correct their evidence in favour of a land-connexion between Neogaea and Notogaea cannot have the weight attributed to it by Mr W. J. Sinclair.

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[1] Lydekker, *Geographical Distribution of Mammals* (1896).

[2] *Der Indo-Australische Archipel, &c.* (Jena, 1902).

[3] *American Naturalist*, xxv. 260 and 261 (1902).

[4] *Report of Horn Expedition to Central Australia*, pp. 187 and 188 (1896).

[5] *Proc. Amer. Phil. Soc.*, xlix. 73 (1905).

[6] *Report, Australian Assoc.*, ix. 319 (1903).

The typical Edentata (sloths, anteaters and armadillos) are at the present day practically confined to Neogaea where they have existed from the date of the Santa Cruz beds of Patagonia (which are probably of Miocene age). A few armadillos, however, have penetrated into Texas; and in the Pleistocene epoch several representatives of the extinct ground-sloths (Megatheriidae) and a glyptodon, or giant armadillo, also ranged into North America. The group is, however, essentially Neogaeic. Among the monkeys the Cebidae, or American monkeys, and their relatives the Hapalidae, or marmosets, are likewise peculiar to Neogaea, where they date from the Santa Cruz epoch. The vampire-bats, or Phyllostomatidae, are likewise peculiar to this realm, and are doubtless also endemic. With the exception of a few shrew-mice, which have evidently entered from the north, continental Neogaea is at the present day devoid of Insectivora. It is, however, very noteworthy that one peculiar family (Solenodontidae) of the order, apparently nearly allied to the Malagasy Centetidae (tenrecs), occurs in the West Indies, while the extinct *Necrolestes*, believed to be near akin to the African golden moles (Chrysochloridae), is found in the Santa Cruz beds. Rodents of more or less peculiar types are highly characteristic of Neogaea and for the most part date from the Santa Cruz epoch. Among these the Caviidae, Chinchillidae and Octodontidae are peculiar to this realm, while the Capromyidae are common to the Ethiopian region of Arctogaea, but are unknown elsewhere.

Ungulates are in the main very poorly represented in Neogaea and include only the llama group (guanaco, &c.), tapirs, and certain small or medium-sized deer related to North American types. Palaeontological evidence tells us that these, like certain peculiar genera of horses now extinct (such as *Hippidium*) and mastodons, were comparatively recent intruders into the realm from the north. On the other hand, Neogaea at the date of the deposition of the Santa Cruz beds was the home of certain endemic groups of ungulates, such as the Toxodontia and Litopterna, some of the representatives of which (*Toxodon* and *Macrauchenia*) flourished during the Pleistocene Pampean epoch.

Of the Carnivora, the civet group (Viverridae) is absent, and the representatives of the dog tribe (Canidae), bears (Ursidae), of which there is only a single existing representative, cats (Felidae), and probably raccoons (Procyonidae), must be regarded as intruders from the north, although several genera of the last-named group are peculiar to the area. In the Santa Cruz epoch the place of these modern specialized Carnivora was taken by marsupial-like creodonts, such as *Prothylacinus*.

In birds Neogaea is especially rich and contains more than a score of family groups unknown elsewhere. Several of these, such as the tyrant-birds (Tyrannidae), manakins (Pipridae), chatterers (Cotingidae), ant-thrushes (Formicariidae), the oven-bird group (Dendrocolaptidae), plant-cutters (Phytotomidae), and wren-thrushes (Pteroptychidae), belong to a low and generalized type of the perching, or passerine, group. Among the so-called picarian birds, which are likewise a generalized type, the big-billed toucans (Rhamphasiidae), puff-birds (Bucconidae), jacamars (Galbulidae), motmots (Momotidae), and the vast assemblage of humming-birds (Trochilidae) are in the main peculiar to this realm, although some of the last-named family wander to the northward in summer. The condors (Cathartidae), form a highly characteristic Neogaeic family; while the hoatzin (*Opisthocomus*) represents another. Of the higher forms of perching-birds the quit-quits (Coerebidae), greenlets (Vireonidae), the hang-nests and many other representatives of the Icteridae, and the tanagers (Tanagridae) are exclusively Neogaeic; while crows, starlings, thrushes, warblers and flycatchers are either rare or wanting, although the finches are abundant. Parrots are numerous, and represented by peculiar forms such as the macaws (*Ara*) and conures or ordinary South American parrots (*Conurus*). Very characteristic of the realm, and unknown elsewhere are the curassows and guans (Cracidae) among the game-birds, the chajas, or screamers (Palamedeidae), the trumpeters (Psophiidae), sun-bitterns (Eurypygidae), and the seriema (Cariamidae). Allied apparently to the last is *Phororhachos*, a giant extinct bird from the Santa Cruz beds with a skull nearly as large as that of a pony. The tinamous (Tinamidae), possibly an annectant type between game-birds and the ostrich group, and the rheas or American ostriches (Rheidae) are likewise exclusively Neogaeic. It may be added that the distribution of all the members of the ostrich group affords a strong argument in favour of a former union of the southern continents, especially as their earliest known representative is African.

Among reptiles, the tortoises, with the exception of representatives of the terrestrial genus *Testudo*, all belong to the Pleurodira, and include several peculiar generic types such as *Chelys* (matamata) and one, *Podocnemis*, common to Madagascar. The occurrence in the Tertiary of Patagonia of a representative of *Miolania*, elsewhere known only from the Pleistocene of Queensland, has been already mentioned. A number of snakes of the boa group (Boinae) occur in the realm, to which the genus *Eunectes* (anacondas) is restricted; but *Boa* itself, like *Podocnemis* among the tortoises, is common to Neogaea and Madagascar. The blind burrowing-snakes of the family Glauconiidae occur throughout the warmer parts of the realm, and are also found in Africa and south-western Asia. The caimans or South American alligators (*Caiman*) are solely Neogaean; the iguanas (Iguanidae) are mainly peculiar to the realm, although a few inhabit North America, and there are two outlying genera in Madagascar and a third in Fiji. The tejus (Tejidae) are wholly Neogaean. The Xantusiidae are exclusively Central American and Antillean; while the Amphisbaenidae are practically restricted to Neogaea and Africa. On the other hand, Lacertidae, Varanidae and Agamidae are absent. Tailed amphibians are unknown south of Central America; but the region is the home of several peculiar types of toads, such as *Pipa* (Surinam toad) belonging to an otherwise Ethiopian section, and the majority of the family Cystignathidae, as exemplified by the horned toad and the escuerso (*Ceratophrys*), the remainder of the group being Australian.

Freshwater fishes are very abundant in Neogaea, where they are represented by a number of peculiar generic and certain family types; some of the members have developed the remarkable habit of feeding upon the floating fruits abundant in the rivers of the tropical forest-districts.

The electric eels (Gymnotidae) are peculiar to the waters of Neogaea, as are certain other groups, such as the armoured cat-fishes (Loricariidae), while true cat-fishes (Siluridae) are extremely abundant. Perhaps, however, the most remarkable feature of the fish-fauna of Neogaea is its affinity to that of the Ethiopian region. Among the lung-fishes the family Lepidosirenidae is, for example, restricted to the two areas, with one genus in each, as is also the family Characinidae. Much the same may be said of the Cichlidae, which have, however, representatives in the Malagasy and Oriental regions; and the Cyprinodontidae, which are extremely abundant in Neogaea (where certain of their representatives are separated by some naturalists as a distinct family, Poeciliidae) likewise present the same general type of distribution, although their area includes the southern fringe of the Palaearctic sub-region and a considerable portion of the Oriental region.

As regards the past history of Neogaea, Professor Carl Eigenmann, writing in the *Popular Science Monthly* for June 1906, observes that "in the earliest Tertiary tropical America consisted of two land-areas, Archiguiana and Archamazonia, separated by the lower valley of the Amazon, which was still submerged. There was a land-mass, Hellenis, between Africa and South America, possibly in contact with Guiana and some point in tropical Africa. This land-mass, which was inhabited, among other things, by fishes belonging to the families Lepidosirenida (lung-fishes), Poeciliidae, Characinidae, Cichlidae and Siluridae (cat-fishes), sank beneath the surface of the ocean, forcing the fauna in two directions, towards Africa and towards South America, exterminating all types not moved to the east or to the west. From these two rudiments have developed the present diverse faunas of Africa and South America, each reinforced by intrusions from the ocean and neighbouring land-areas, and by autochthonous development within its own border. . . . The connexion between Africa and South America existed before the origin of present genera, and even before the origin of some of the present families and sub-families, some time before the early Tertiary. There has never been any exchange between Africa and South America since that time."

This connexion between Neogaea and Africa was doubtless a continuation of the old Jurassic equatorial land-belt to which allusion has been already made; freshwater fishes being probably a group of earlier radiation than mammals. Perhaps the distribution of the reptilian genera common to Neogaea and Madagascar may be explained in the same manner, although tortoises apparently identical with *Podocnemis* occur in the Eocene of Europe (as well as in that of Africa and India), so that this group may have radiated from the north. Whether the evidence of the Cystignathidae among the amphibians and of the extinct *Miolania* among chelonians is also evidence of the persistence of the Jurassic connexion between Neogaea and Notogaea till a considerably later epoch must, for the present, be left an open question. The distribution of other families of lizards is, however, not in favour of such a connexion, the Lacertidae and Agamidae being confined to the Old World, inclusive of Australia but exclusive of Madagascar, while the cosmopolitan Scincidae, so abundant in Notogaea, are extremely scarce in Neogaea.

Reverting to the mammalian fauna, its evidence, combined with that of geology, indicates that during the greater portion of the Tertiary period South America was isolated from North America, and inhabited by its autochthonous fauna of monkeys, marmosets, sloths, ground-sloths, ant-eaters, armadillos, glyptodonts, toxodonts, macrauchenias (together with certain other peculiar ungulates), rodents, marsupials and creodonts, as well as by *Phororhachos*, rheas, tinamous and probably some of the other groups of birds now peculiar to the area. This state of things continued till the later Miocene or Pliocene epoch, during some portion of which a connexion was established with North America by way of the isthmus of Darien. By means of this new land-bridge a certain proportion of the autochthonous fauna of Neogaea was enabled to effect an entrance into North America, as is exemplified by the occurrence there of ground-sloths and glyptodonts. Simultaneously a large immigration of northern forms took place into Neogaea; these invaders from Arctogaea, including cats and sabre-toothed tigers, bears, fox-like dogs, raccoons, llamas, horses, tapirs, deer, mastodons and perhaps opossums. While representatives of most of these invaders have persisted to the present day, some groups, such as horses and mastodons, have entirely disappeared, as has also a large portion of the autochthonous fauna. Here it may be well to notice that the evidence for the insulation of Neogaea during a large portion of the Tertiary period does not by any means rest only on that supplied by mammals. C. H. Gilbert and E. C. Starks,[1] for instance, in a work on the fishes of the two sides of the isthmus of Darien, wrote as follows:—"The ichthyological evidence is overwhelmingly in favour of the existence of a former open communication between the two oceans, which must have become closed at a period sufficiently remote from the present to have permitted the specific differentiation of a very large majority of the forms involved. . . . All evidence concurs in fixing the date of that connexion at some time prior to the Pleistocene, probably in the early Miocene." This, it will be observed, agrees almost precisely with the conclusions drawn from the fossil mammalian faunas of North and South America, which indicate that land-communication between those two continents was interrupted during a considerable portion of the Tertiary epoch, and only re-established (or [?] established for the first time) either towards the close of the Miocene or the early part of the Pliocene epoch.

The South American mammalian fauna, as we now know it, is, then, a complex, consisting of an original autochthonous element and of a large foreign infusion from the north. As to the origin of the latter, there is no difficulty; but some degree of obscurity still prevails with regard to the source of the autochthonous fauna. According to Prof. Eigenmann's interpretation of the evidence of the fresh-water fishes the early Tertiary Atlantic "Hellenis" may have been in contact with Guiana on the one side and tropical Africa on the other. That such a connexion did really exist in Tertiary times is the conclusion reached by Dr C. W. Andrews,[2] as the result of his studies of the Tertiary vertebrate fauna of the Fayum district of Egypt, as expressed in the following passage:—"Speaking generally, it appears that (1) probably in Jurassic times Africa and South America formed a continuous land-mass; (2) in the Cretaceous period the sea encroached southwards over this land, forming what is now the South Atlantic. How far this depression had advanced southwards at the end of the Secondary period is not clear, but it appears certain that the final separation of the two continents did not take place till Eocene times, and that there may have been a chain of islands between the northern part of Africa and Brazil which persisted even till the Miocene."

By this route, as was suggested considerably earlier by Prof. W. B. Scott and subsequently by the present writer, Neogaea may have received a considerable portion of its autochthonous mammal-fauna. Further reference to this point is made later; but it may be added that the evidence of the land-faunas is supplemented by that of the shallow-water marine faunas on the two sides of the Atlantic, which present a striking similarity.

In an address to the British Association at the meeting in 1905 in South Africa Mr G. A. Boulenger expressed himself, however, as by no means satisfied with the evidence of a Tertiary connexion between Africa and South America. "It is undeniable," he observed, "that the hypothesis of a South Atlantic land-communication in the Eocene has much in its favour, and when this is really established, all difficulty in explaining the distribution of the Cichlidae will have disappeared. In the meanwhile . . . we must not construct bridges without being sure of our points of attachment." In this connexion it may be mentioned that those who explain the distribution of certain forms of life by the former existence of a land-connexion between the southern continents by way of "Antarctica," have attached some importance to the existence of fishes of the genus *Galaxias* in the freshwaters of New Zealand, Australia, South America and the Cape. This evidence has been shattered by Mr Boulenger's description (in a memoir of the fishes of the Congo) of a marine representative of the genus in question from the Southern Ocean.

For the zoological subregions of Neogaea the reader must refer, as in the case of most of the other regions, to special works on zoological distribution.

Arctogaea.

As Arctogaea includes the whole of the rest of the land-surface of the globe (with the exception of Antarctica) it is almost impossible to give any general diagnosis even of its mammalian fauna. It may be mentioned, however, that at the present day monotremes are wholly wanting, while marsupials are represented only by one or two species of opossums (*Didelphys*) in North America and by cuscuses (*Phalanger*) in the Austro-Malayan subregion. The true or typical Edentata are, if we except late wanderers from Neogaea into North America, absent from this realm at the present date and during the Pleistocene; the alleged occurrence of a ground-sloth in the Pleistocene of Madagascar being probably due to a misinterpretation. On the other hand, this region, and more especially its eastern half, is the great home of the ungulate mammals. Indeed rhinoceroses may be considered absolutely characteristic of Arctogaea, since at one time or another they have ranged over the whole area, except Madagascar, and are quite unknown elsewhere. The modern land Carnivora are likewise an essentially Arctogaeic group, which only found its way into Neogaea at a comparatively recent epoch; and the realm may be said to have been the birthplace of most of the higher groups of placental mammals. The tortoises of the family Trionychidae form an exclusively Arctogaean group, once ranging all over the realm, although long since extinct in Europe.

Ethiopian region.

If Madagascar be excepted, the Ethiopian region (or Ethiopia) is the most distinct of all the regions of Arctogaea. So distinct is it that, on the evidence of the distribution of moths, Dr H. S. Packard[3] has suggested that it should be separated from Arctogaea to form a realm by itself, under the name of Apogaea. The mammalian fauna, even exclusive of the Tertiary one of Egypt, does not, however, countenance such a separation. By Sclater and Wallace, Madagascar was included in the Ethiopian region, but that island was subsequently made a region by itself by Dr Blanford. This separation of Madagascar to form a Malagasy region has met with general acceptance; but in the opinion of Mr R. I. Pocock,[4] who bases his conclusion on the distribution of trapdoor-spiders (which in other respects accords curiously well with that of mammals), it is not justified. The mammalian evidence appears, however, to be overwhelmingly strong in its favour; and it also receives support from reptilian distribution. All are agreed that the Ethiopian region should exclude that part of Africa which lies, roughly speaking, northward of the tropic of Cancer. By Sclater and Wallace the region was taken to include that portion of Arabia lying to the south of the same tropic; but Mr Pocock[5] has pointed out that this separation of Arabia into two portions is not supported by the distribution of scorpions, and he would refer the whole of it to the Mediterranean transitional region. The occurrence of a tahr-goat (*Hemitragus*) in Oman lends some support to this proposal since that genus has no representative in Africa, and occurs elsewhere only in the Himalaya and the mountains of southern India. Other writers have not accepted Mr Pocock's emendation; and the reference of the northern half of Arabia to the Mediterranean and of the southern half to the Ethiopian region is usually followed. The area is admittedly a meeting-ground of at least two faunas.

Discoveries in the Fayum district of Egypt have conclusively proved that during the early (Eocene) part of the Tertiary period Ethiopia was a great centre of development, and subsequently of dispersal, instead of having received (as was formerly supposed) the whole of its higher modern mammalian fauna from the north. In this Ethiopian centre were developed the ancestors of the elephants (Proboscidea) and of the hyraxes (Hyracoidea); the latter group being represented by species of much larger size than the existing forms, some of the former of which ranged into southern Europe during the later Tertiary. It was also the home of a peculiar subordinal group of ungulates (Barypoda), typified by *Arsinöitherium*, and may likewise have been the birthplace of the swine (Suidae) as the earliest known representative of that group (*Geniohyus*) occurs in the Fayum Eocene. The hippopotamuses (Hippopotamidae), which appear to be descended from the Tertiary Anthracotheriidae, may likewise be of Ethiopian origin, and the same may turn out to be the case with the giraffe group (Giraffidae) although definite evidence with regard to the latter point is wanting.

The occurrence of an ostrich-like flightless bird in the Fayum Eocene—the oldest known representative of that group—is suggestive that the Ratitae originated in Ethiopia, which would accord well with their distribution both in the present and the past. A giant land-tortoise (*Testudo*) is likewise known from the Fayum beds, and as it is allied to the species recently or still inhabiting Madagascar and the Mascarene islands, there is a strong probability that Ethiopian Africa was likewise the centre of development and dispersal of that group.

Turning to its existing mammalian fauna, Ethiopia possesses a number of peculiar family or generic groups, and is also nearly equally well characterized by the absence of others. As remarked by Wallace, one of its characteristics is the great number of species of large size. Among the Primates, it is the home of the typical group of the Negroid branch of the human species, whose northern limits coincide approximately with the boundary of the region itself, being replaced in northern Africa by races of the Caucasian stock. Gorillas and chimpanzees (*Anthropopithecus*) are peculiar to the region, as are also baboons (*Papio* and *Theropithecus*), if southern Arabia be included. Monkeys abound, and although in most cases nearly allied to those of the Oriental region, are generically distinct. The Prosimiae, or lemuroids, include the galagos (*Galago*) and pottos (*Perodictycus*), of which the latter are akin to the Oriental lorises, while the former are quite distinct from the Malagasy lemurs. Among the Carnivora, the aard-wolf (*Proteles*), the hunting-dog (*Lycaon*) and the long-eared fox (*Otocyon*) are peculiar generic types, as are several forms of mungooses (Herpestinae); while the spotted hyaena forms a subgenus by itself. The bear-family (Ursidae), on the other hand, is totally absent. In the great ungulate order the African elephant is widely sundered from its Asiatic cousin, as are the two species of rhinoceros from their representatives in the Oriental region; indeed each group is subgenerically distinct. The hyraxes, forming the suborder Hyracoidea, are, with the exception of a single outlying Syrian species, confined to Ethiopia. Zebras and true wild asses are likewise peculiar to the region. More remarkable is the extraordinary number of peculiar genera of antelopes, a few of which range, however, into North Africa, Syria and Arabia; the African buffaloes are markedly different from those of Asia; and sheep and goats are absent from the region, with the exception of intruding into it to some extent in the mountains of the Sudan and Abyssinia. The giraffe-family (Giraffidae), as represented by giraffes (*Giraffa*) and the okapi (*Ocapia*), is absolutely confined to this region, from which the deer-tribe (Cervidae) is completely absent. Chevrotains, or mouse-deer, are represented by the peculiar genus *Dorcatherium* (or *Hyomoschus*); in the pigs the wart-hogs (*Phacochoerus*), forest-hogs (*Hylochoerus*), and the bush-pigs (subgenus *Potamochoerus*), with the exception of one Malagasy species, are now unknown elsewhere, as are also hippopotamuses. Rodents include a number of peculiar types, among which may be noticed the scaly-tailed squirrels (Anomaluridae), the jumping-hares (*Pedetes*), the strand-moles (Bathyergidae), the crested-rats (*Lophiomys*), and the cane-rats (*Thryonomys*, or *Aulacodus*); the last being nearly allied to South American forms. In the Insectivora, moles (Talpidae) are absent, the jumping-shrews (Macroscelididae) are solely African, although ranging north of the Sahara, while the golden moles (Chrysochloridae) and the Potamogalidae are exclusively Ethiopian. Lastly, the ant-bears, or aard-varks (Orycteropodidae), represent a suborder of the Edentata unknown elsewhere; while the African pangolins (Manidae) differ markedly from their Oriental kindred.

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[1] *Mem. Californian Academy*, vol. iv. (1904).

[2] *Catalogue of the Tertiary Vertebrata of the Fayum* (London, 1906).

[3] *Science*, ser. 2, vol. xix. p. 221 (1904). Dr Packard groups Notogaea and Neogaea in a single realm under the name Antarctogaea. Some other writers, such as Dr H. Gadow, take Notogaea to include all the three southern continents, and employ the term Arctogaea for the rest of the world.

[4] *Proc. Zool. Soc., London*, 1903, pp. 340–368.

[5] *Natural Science*, vol. iv., pp. 353–364 (1894).

The Ethiopian birds are less peculiar. The ostrich (*Struthio*) ranges, in suitable localities, all over the region, thus entering the Mediterranean transition-region in the north. The guinea-fowls (Numidinae) form a subfamily confined to Ethiopia and Madagascar, where true pheasants are unknown. Other peculiar types are plantain-eaters (Musophagidae), colies (Coliidae), wood-hoopoes (Irrisoridae), barbets (Megalaemidae), ground-hornbills (*Bucorvus*), secretary-birds (Serpentariidae), glossy starlings (*Lamprotornis*), ox-peckers (*Buphaga*), the genera *Laniarius* and *Telephorus*, as well as a number of others, all of which are unknown in Madagascar. In addition to true pheasants, wrens (Troglodytidae) and water-ousels (Cinclidae) are unknown in the Ethiopian region.

Apart from the widespread Trionychoidea (of which there are two genera peculiar to the region), the Ethiopian fresh-water tortoises belong to the section Pleurodira; the two genera *Pelomedusa* and *Sternothaerus* being common to Africa and Madagascar, and unknown elsewhere. The Amphisbaenidae are common to Neogaea and Ethiopia, to the exclusion of Madagascar; but the Gerrhosauridae and Zonuridae, on the other hand, are restricted to the present region and Madagascar, which also form the headquarters of chameleons. In contrast to the latter community is the absence in Madagascar of Agamidae and Varanidae, which are common in Ethiopia. The absence of slow-worms and their kindred (Anguidae) is a marked negative feature of the present region. As regards batrachians, the region has no salamanders or other tailed forms, but, in common with India, possesses caecilians (Apoda); while it shares the group of tongueless toads (Aglossa) with Neogaea, its peculiar family being the Xenopodidae, in contradistinction to the South American Pipidae. The Pelobatidae are absent, and true toads are few, but frogs are abundant.

Among fishes, Africa south of the Sahara possesses a number of peculiar types. With Neogaea it shares the possession of the typical lung-fishes (Lepidosirenidae), while it is the habitat of the species of bichir (*Polypterus*) and *Calamoichthys*, the sole survivors of the ancient group of fringe-finned ganoids (Crossopterygii). The other families peculiar to Ethiopia are the Mormyridae (proboscis-fishes), Pantodontidae, and Phractolaemidae; the two latter being represented only by a single species each. The Notopteridae, Ophiocephalidae, Anabantidae, Osphromenidae and Mastacembelidae are common to Ethiopia and the Oriental region. In addition to the Lepidosirenidae, the Characinidae are peculiar to this region and Neogaea. The Cichlidae occur in Madagascar, Ethiopia, the Oriental region and Neogaea; and the Osteoglossidae are common to the last three of these regions, as well as Australia, while the Nandidae are Ethiopian, Oriental and Neotropical. On the whole, the affinities of the fish-fauna of Ethiopia are nearest to that of the Oriental region, and, secondly, to that of South America.

Although invertebrates do not come within the scope of the present article, it may be mentioned that Ethiopia is remarkable for the total absence of fresh-water cray-fishes.

As regards its past history, Ethiopian Africa was in connexion with India during the Triassic and Jurassic periods, the two areas collectively forming "Gondwanaland," which doubtless constituted a portion of the equatorial land-belt referred to as existing during the epochs in question. Gondwanaland was the home of a large section of the anomodont reptiles from which mammals have sprung; and it is quite probable that the evolution of the latter group took place within the present area. Between the Trias and the Eocene little or nothing is known of the vertebrate palaeontology of Ethiopia;[1] and in Egypt there is also a long gap between the lower Miocene and certain Pliocene beds in the Wadi Natrun. The Tertiary deposits of southern Europe and northern India indicate, however, that Ethiopian Africa was in free communication with these countries during the upper Miocene and Pliocene epochs. There occur, for instance, either in south-eastern Asia or southern Europe, or both, during the latter period numerous genera of antelopes now restricted to Ethiopia, as well as giraffes, okapi-like ruminants (*Palaeotragus*), elephants and rhinoceroses of an African type, probably zebras, hippopotamuses, baboons, chimpanzees and ostriches. Owing to imperfect knowledge of Pliocene Africa, it is impossible to say whether these types were first developed in Ethiopia or to the north-east, and consequently whether or not Professor Huxley was right in his theory that the modern higher mammalian fauna of Ethiopia came from the north. It has, however, been suggested that while the Bovidae are an autochthonous Ethiopian group, the Cervidae originated in either the Holarctic or the Oriental region; a theory which if confirmed will materially aid in explaining the absence of the latter group from Ethiopia. It is supported to some extent by the fact that we are acquainted with primitive ancestral deer in the European Tertiary, while the ancestors of the Bovidae are at present unknown. Whatever be the truth on this point, it is manifest that whether the middle Tertiary Bovidae migrated from Ethiopia to Asia or in the opposite direction, there must have been some cause which barred the entrance by the same route into the latter area of all members of the deer-tribe (as well as bears). It should be added that although the ancestral Proboscidea were Ethiopian, the passage from the mastodons into the true elephants appears to have taken place in Asia; a circumstance which would imply the Asiatic origin of the African elephant.

The evidence in favour of the continuation of the Mesozoic land-bridge between Ethiopia and Neogaea has been discussed under the heading of the latter area. If the arguments in favour of such a connexion are valid, it is to the old mammal fauna of Ethiopia that we must probably look for the progenitors of the Santa Cruz fauna of Patagonia. Very noteworthy is the alleged occurrence of remains of primitive armadillos in the Oligocene beds of southern Europe in association with those of pangolins and aard-varks; since, if these fossils be rightly determined, there at once arises the probability of Africa having been the original home of the entire Edentate order.

Malagasy region.

In the case of an island lying so close to the African continent as does Madagascar the natural expectation would be that its fauna should be intimately related to that of the former. As a matter of fact—in the case of mammals and birds, at any rate—it is much more distinct from the Ethiopian fauna than is the latter from the fauna of either the Oriental or the Holarctic region. The evidence—from the above-mentioned groups—in favour of recognizing a distinct Malagasy region is in fact positively overwhelming, while it is also supported in some degree by the distribution of groups other than those named. In place of the Ethiopian assemblage of apes, monkeys, baboons, galagos and pottos, Madagascar (together with the Comoro islands) possesses an absolutely unique fauna of lemurs, constituting the family Lemuridae, which, as now understood, is confined to this island, where it is represented by the three subfamily-groups of sifakas (Indrisinae), true lemurs (Lemurinae), and aye-ayes (Chiromyinae). All these animals agree with one another in the characters of the tympanic region of the skull; thereby differing from the African and Oriental Prosimiae, but agreeing with the European Oligocene *Adapis*, which must apparently be regarded as the ancestral form. This is a striking confirmation of the theory advanced many years ago by Huxley that Madagascar received its lemuroid fauna from Europe at a very early date, since which time, at any rate, it has been isolated from Africa. Some of the Pleistocene Malagasy lemurs were much larger than any of the living forms, rivalling in this respect a chimpanzee. The Carnivora are represented only by a small number of species, mostly referable to peculiar genera, of Viverridae, among which the fossa (*Cryptoprocta*) is the largest. In the ungulates there are only two extinct species of hippopotamus and a living bush-pig, the ancestors of all three of which probably crossed the Mozambique channel by swimming; and Edentata are equally conspicuous by their absence. Insectivora, on the other hand, are represented by the tenrecs (Centetidae), with numerous generic types, whose nearest relatives appear to be the west Indian solenodons. The bats are likewise different from those of the mainland; a notable feature being the occurrence of flying-foxes of the Asiatic and Australian genus *Pteropus*. Of the countless rodents of Africa, all are wanting; while the only members of that group inhabiting the island are certain rat-like animals collectively constituting the family Nesomyidae.

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[1] The fossils of the Uitenhage beds, now generally classed as Jurassic, consist chiefly of invertebrates and plants.

The birds are scarcely less remarkable than the mammals, such common Ethiopian types as the ostrich, secretary-bird, honey-guides (*Indicator*), wood-hoopoes, ground-hornbills, ox-peckers, barbets and glossy starlings being entirely unknown. On the other hand, the Malagasy region, inclusive of the Mascarene islands, comprises quite a number of distinctive bird-genera, such as *Mesites*, *Tylas*, *Artamia*, *Calicalicus*, *Euryceros*, *Philepitta*, *Atelornis* and *Leptosomus*; the first of these representing a peculiar family of game-birds, while the last, including only the kirombo, forms a subfamily of rollers (Coraciidae). In the Pleistocene the ostrich group was represented by various species of *Aepyornis*, probably the original of the legendary roc; while within historic times Mauritius and Réunion were the respective homes of the two species of dodo (*Didus*), and Rodriguez was inhabited by the solitaire (*Pezophaps*), the three constituting the family Dididae. The guinea-fowls, on the contrary, form a group common to the Ethiopian and Malagasy regions and are unknown elsewhere.

Many of the features of the reptilian fauna are alluded to under the headings of Neogaea and the Ethiopian region. Among lizards, the absence of Agamidae, Veranidae, Lacertidae, Amphisbaenidae and Anguidae is very remarkable, since all these except the last are Ethiopian. In addition, Madagascar possesses, apart from the cosmopolitan skinks and geckos, only Gerrhosauridae, Zonuridae and chameleons (Chamaeleontidae), which are essentially African groups. Affinity with Neogaea is indicated by the presence of a few iguanas, of snakes of the boa group (especially the genus *Boa*), and of *Podocnemis* among the tortoises. The other pleurodiran tortoises are, however, of an Ethiopian type. The same may perhaps be said with regard to the giant land-tortoises of the genus *Testudo*, which in Pleistocene or modern times were spread over all the islands of the region, while they existed in Africa in the Eocene, as well as in India in the Pliocene. The spider-tortoise (*Pyxis*) is a peculiar cryptodiran Malagasy genus. In the matter of batrachians the Malagasy region lacks both coecilians (Apoda) and tongueless toads (Aglossa), while it has abundance of true frogs (Raninae), among them the Oriental genus *Rhacophorus*. Of fishes, the peculiar Ethiopian types are absent from the present region, although the community of the Cichlidae to Neogaea and the Ethiopian, Malagasy and Oriental regions is noteworthy. It may be added that Madagascar differs from Ethiopia in possessing one fresh-water cray-fish, the representative of a genus by itself.

The radical distinctness of the Malagasy fauna is thus demonstrated from all sides. That the island has been separated from Ethiopia during the greater portion of the Tertiary period is self-evident. The interpretation of its relationships with other regions is, however, exceedingly difficult. It is generally considered that the Comoro and Seychelle groups mark the line of a former connexion between Madagascar and India, and also with South Africa; but it is evident that this line must have been closed to the passage of mammals since a very remote date, as is exemplified by the fact that the lorises of Ceylon and southern India are quite distinct from the Malagasy lemurs, and much nearer to the African pottos. Whether the occurrence of South American types of reptiles (boas, *Podocnemis*, and iguanas) in Madagascar and not in Africa can be held to indicate a late connexion with Neogaea by way of the Pacific, cannot yet be decided. The occurrence of iguanas in Fiji is, however, as noteworthy as is the community of *Miolania* to Patagonia and Queensland. Moreover, Polynesia is evidently a subsiding area. In the opinion of Captain F. Hutton[1] the land-shells of the genus *Endodonta*, which range all through Polynesia, New Zealand, eastern Australia, New Guinea and the Philippines, with an outlier in Ceylon, afford the best evidence in favour of a Polynesian continent, the Singhalese outlier pointing to the conclusion that this group of molluscs originally came from the north. The molluscan evidence will not, however, explain the South American connexion.

Zoological evidence of the latter connexion, by way of Antarctica, is afforded by the earthworms of the family Acanthodrilidae, which are unknown north of the equator, although their occurrence in Madagascar may point to a northern origin. Additional evidence of a connexion with Patagonia is afforded by the occurrence in the Tertiary strata of South America and New Zealand of a number of shallow-water marine invertebrates. Further, the occurrence of these forms in older strata in South America than in New Zealand suggests that the migration took place from the former to the latter area.

Oriental region.

The relatively small and wholly tropical or subtropical Oriental region was originally taken to include the Punjab; but in a memoir, of which an abstract appeared in the *Proceedings* of the Royal Society of London for 1900 (vol. lxvii. p. 484), Dr Blanford came to the conclusion that the Punjab differs so remarkably in its fauna from the rest of India that it cannot be included in the Oriental region, and must be assigned to the Mediterranean transitional region. To the latter belongs also the Himalayan area above the forests, as does Tibet. India proper, together with Ceylon, is regarded as a single subdivision of the Oriental region, under the title of Cisgangetic, while the Himalaya and Burma form a second subregion, the Transgangetic, which also includes southern China, Tonquin, Siam and Cambodia. A third subregion, the Malayan, includes southern Tenasserim, the Malay Peninsula, and the Malay Archipelago exclusive of Celebes. In the map in the present article the last-named island is included in the present region, although, as stated, it is by preference referred to an Austro-Malay transitional region. Wallace drew the main line dividing the Oriental from the Australian region between the islands of Bali and Lombok, and between Borneo and Celebes: "The strait [between Bali and Lombok] is here fifteen miles wide, so that we may pass in two hours from one great division of the earth to another, differing as essentially in their animal life as Europe does from America. If we travel from Java or Borneo to Celebes or the Moluccas, the difference is still more striking." The hydrographic results obtained by the Dutch Siboga Expedition show, however, that although there exists a line of great depth separating the two areas, this line on no point corresponds to "Wallace's line." On the contrary, it passes east of Timor and through the Banda and Molucca seas, separating Sula from Buru, Obi and Halmaheira. For this line which replaces "Wallace's line," Dr A. Pelseneer has proposed the name of "Weber's line." It is this "Weber's line" which marks the real division between the Arctogaeic and the Notogaeic faunas, although it has been convenient to make Celebes the centre of an intermediate transitional region.

The Oriental region agrees with the Ethiopian in being inhabited by elephants, rhinoceroses, buffaloes, several large representatives of the Felidae (among which the lion, leopard and hunting-leopard are common to the two areas), and numerous civets and mungooses. The elephant and the three species of rhinoceros are, however, subgenerically distinct from their Ethiopian relatives, and the buffaloes are also widely different from those of Africa. Wild cattle (of the subgenus *Bibos*), as represented by the gaur and the bantin, are peculiar to this region; and, with the exception of gazelles, antelopes are poorly represented, although the three genera *Antilope* (blackbuck), *Tetraceros* (chousingha), and *Tragocamelus* (nilgai) are restricted to the area. Southern India has one tahr (*Hemitragus*) in its mountains, and this genus also occurs in the Himalaya, where serows (*Nemorhaedus*) and gorals (*Urotragus*)—goat-like antelopes ranging through the Malay countries—are likewise met with. Deer (Cervidae) are abundant, and include three peculiar subgenera of *Cervus*, namely *Rusa*, *Hyelaphus* and *Rucervus*, to the exclusion of the typical red deer group. The typical *Tragulus* represents the chevrotains; and the pigs, unlike those of Ethiopia, belong to the typical section of *Sus*. In addition to Neogaea, the Malay subregion is now the sole habitat of tapirs (Tapiridae). A notable distinction from Ethiopia is the presence of bears, which are, however, distinct from the typical *Ursus arctus* group of the north.[2] Borneo and Sumatra form the home of the orang-utan (*Simia*), the sole Oriental representative of the Simiidae, while the gibbons (Hylobatidae), which range as far west as the eastern Himalaya, are restricted to the region. The monkeys are all generically distinct from those of Ethiopia. The tarsier represents a family (Tarsiidae) by itself; and the lorises a subfamily (Nycticebinae) peculiar to the forest-tracts. Fruit-bats of the genera *Pteropus*, *Rousettus* and *Cynopterus* help to distinguish the region from Ethiopia; while among the Insectivora the tupais, or tree-shrews (Tupaiidae), with three genera, and the rat-shrews (Gymnurinae), also with three generic modifications, are likewise solely Oriental. The cobegos, or flying-lemurs (*Galeopithecus*), represent an ordinal group (Dermoptera) peculiar to this region; while there are several distinctive genera of rodents, especially in the mountains of the Philippines, where some approximate closely to the Australian type represented by *Hydromys*.

Pangolins, of a type different from those of Ethiopia, alone represent the Edentata. A striking feature of the mammalian fauna of the region is the presence of so many peculiar and probably archaic types in the Malay subregion, and the affinity of the fauna of this area to that of western Africa. Both districts may be said to be highly conservative in the matter of their faunas.

The birds are extremely abundant, and include a number of peculiar genera to which detailed reference is impossible. There is no representative of the ostrich group; and the place of guinea-fowls is taken by pea-fowl (*Pavo*) and argus-pheasants (*Argusiana*), while francolins (*Francolinus*) abound. Attention may be directed to the abundance of pheasants, pigeons, king-fishers, sunbirds, flycatchers and starlings. The babblers (Timeliidae) are especially numerous, the group allied to the hill-robin (*Liothrix*) being peculiar to the region, as are also the green bulbuls (*Chloropsis*). True bulbuls (Pycnonotidae) and king-crows (Dicruridae) are also more abundant than elsewhere; while the broad-bills (Eurylaemidae) are peculiar.

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[1] *Index Faunae Novae-Zealandiae* (London, 1904).

[2] One member of this group has recently been described from the Shan States.

Among reptiles, the long-snouted crocodiles of the genera *Gavialis* and *Tomistoma* are elsewhere unknown at the present day. The river-tortoises of the family Trionychidae have three peculiar genera; while the other fresh-water tortoises differ from those of Ethiopia in belonging to the section Cryptodira, of which there are a number of peculiar generic types. The family Platysternidae is solely represented by a tortoise confined to the Malay countries. In the lizards the family Anguidae is represented by one genus; Agamidae are very abundant; and include several types peculiar to the region, among which may be noticed the flying-dragons (*Draco*). Chameleons are rare. The burrowing-snakes of the genus *Typhlops* are exceedingly numerous; the allied Ilysiidae are common to India and Neogaea; while the Uropeltidae are restricted to India and Ceylon. In the presence of pythons the region agrees with Ethiopia, as it does in possessing cobras; but it divides with Neogaea the range of the Amblycephalidae, while it is also inhabited by pit-vipers (Crotalinae), which form an exclusively Asiatic and American group. Among the Amphibia, the region agrees with Ethiopia in possessing representatives of the limbless Apoda, but differs in the presence of frogs of the family Pelobatidae, while toads (Bufonidae) and true frogs (Raninae), especially those of the genus *Rhacophorus*, are abundant.

Of the fishes it must suffice to state that lung-fishes and ganoids are absent, as are also Mormyridae. But the families Ophiocephalidae (serpent-heads) and Rhynchobdellidae (or Mastacembelidae), which have a few African representatives, are abundant; while the Cobitidae are a group unknown in Ethiopia. Siluridae and Cyprinidae are common.

Allusion has been already made to the presence of African forms of mammals in the Tertiary deposits of northern India (some of which are, however, within the Mediterranean transition-region); and it may be added that remains of a baboon (*Papio*) and of a large pangolin allied to the west African species have been found in Madras.

Austro-Malayan transition-region.

Few words must suffice for the Malayan transitional area, which embraces Celebes, the Moluccas, &c.; and has a fauna showing a blending of that of the Oriental with that of the Australian region. While Celebes possesses a small buffalo allied to the Indian species, a monkey (*Cynopithecus*), and a peculiar type of pig (*Babirusa*), it has also cuscuses (*Phalanger*), while cassowaries, cockatoos and other Notogaeic types occur in the area. A notable feature is also the absence of Cyprinidae (carps) from Celebes, although they are abundant in Borneo.

Mediterranean transition-region.

The Mediterranean transition-region, the limitations of which are approximately shown on the map, must likewise be dismissed with brief notice; its fauna at the eastern end being intermediate between those of the Oriental and the Holarctic region, while in the west it serves as the No-man's-land between the Holarctic and the Ethiopian faunas. The most distinct portion of the Mediterranean fauna is undoubtedly that of Tibet, where are such peculiar types among mammals as the takin (*Budorcas*), the chiru antelope (*Pantholops*), the yak, representing a subgenus of *Bos*, snub-nosed monkeys (*Rhinopithecus*), the giant panda (*Aeluropus*), and certain peculiar shrews (*Nectogale*).

Farther west the great mole-rat (*Spalax*), the rabbit (subgenus *Oryctolagus*) and the two species of fallow-deer (subgenus *Dama*), are very characteristic of the Mediterranean zone, which is also the home of the addax antelope (*Addax*), the Barbary sheep (subgenus *Ammotragus*), and numerous true sheep, wild goats and gazelles. *Ctenodactylus*, the gundi, is a characteristic North African genus of rodents. It is also noteworthy that with the Mediterranean zone we enter the domain of typical deer of the red deer group (*Cervus*), and of bears of the brown bear group (*Ursus arctus*). The wolf and the fox are also animals whose territory we reach on entering the Mediterranean zone, although neither of these, or the brown bear, are confined to this tract, or even to the Palaearctic section of the Holarctic region.

Reference to many other animals of the Mediterranean tract will be found under the heading of the Palaearctic subregion.

Holarctic region.

The Holarctic region, which comprises the whole of the land lying northward of the Mediterranean transitional zone in the eastern, and north of the Sonoran zone in the western hemisphere, is the largest of all the zoological provinces of the globe. The whole territory is extra-tropical, and it is inhabited at the present day neither by monotremes, marsupials, edentates, lemurs nor monkeys, although representatives of the three latter occur in portions of the Mediterranean transitional region. The types common to the eastern and western halves of this region are to be met with on the two sides of the northern Pacific, and it is evident that the main communication took place by way of Bering Strait, although it has been suggested that there was also a land-bridge connecting the European continent with Iceland, and thus with Greenland.

Among characteristic groups of mammals common to the two halves of the Holarctic region (or in some instances of portions of the adjacent transitional zones to the southward) the following may be mentioned: elk (*Alces*), reindeer (*Rangifer*), wapiti (*Cervus canadensis* and its Asiatic representatives), bison (subgenus *Bison*), bighorn sheep (*Ovis canadensis* and its representatives in north-eastern Asia), musk-ox (*Ovibos*), now extinct in the eastern hemisphere, glutton or wolverine (*Gulo*), brown bear (*Ursus arctus* and its representatives in north-east Asia and America), lynx (*Felis lynx*), wolf (*Canis lupus*), fox (*C. vulpes*), pine-marten (*Mustela martes* and the allied American form), ermine and weasel (*Putorius*), variable hare (*Lepus timidus* and its relatives), picas (*Ochotona*, or *Lagomys*), beavers (*Castor*), marmots (*Arctomys*), chipmunks (*Tamias*), susliks (*Spermophilus*, or *Citillus*), jumping-mice (*Zapus*), field-mice, or voles (*Microtus*, or *Arvicola*), lemmings (*Lemmus* and *Dicrostonyx*), mole-shrews (*Urotrichus*),[1] and several genera of bats. To these may be added, as more exclusively arctic forms, the polar bear (*Ursus maritimus*), and the arctic fox (*Canis lagopus*). There are likewise many groups or species of birds common to the two divisions of the region. Among reptiles, the pond-tortoises of the genus *Emys*, if we include their Pleistocene range, are an essentially Holarctic (and Mediterranean-Sonoran) group. In regard to fishes, the whole area is characterized by the abundance of sturgeons (Acipenseridae), carps (Cyprinidae), pike (Esocidae), and the salmon-group (Salmonidae), coupled with the scarcity of cat-fishes (Siluridae).

Further testimony in favour of the unity of the Holarctic region is afforded by the presence on the two sides of the Pacific (and in most cases nowhere else) of true alligators (*Alligator*), giant salamanders (*Cryptobranchus* and *Megalobatrachus*, really scarcely worthy of separation), and shovel-beaked sturgeons (*Scaphirhynchus*). Again, it is highly probable that Père David's deer of Central Asia, alone representing the genus *Elaphurus*, is akin to the fork-antlered deer, *Mazama*, of North America; and many other analogous instances might be quoted. Finally, the distribution of earthworms affords the strongest confirmation of the view that the two halves of the Holarctic region form but a single zoological province, with the Mediterranean and Sonoran zones as transitional appendages.

Palaearctic subregion.

In briefly reviewing some of the chief faunistic areas of the Palaearctic, as distinct from the Nearctic, subregion, it will be convenient to include some of the groups and species inhabiting the transitional Mediterranean zone, much of which is in reality only a portion of the Palaearctic subregion. Distinctive of the area in this wider sense are a number of wild sheep, such as *Ovis musimon*, *gmelini*, *ammon*, *poli*, &c., which have no representatives on the other side of Bering Strait, as well as wild goats, like *Capra hircus aegagrus*, *C. ibex*, and *C. sibirica*, belonging to an exclusively Old World genus. The saiga antelope (*Saiga*) and the chamois (*Rupicapra*) may also be regarded as Palaearctic (in the sense of Old World) types; as are also wild horses (*Equus caballus przewalskii*), and the kiang (*E. hemionus*) and onager (*E. hemippus*), the two latter being commonly termed wild asses, although widely different from the African animals properly so-called. There are also many peculiar types of deer, inclusive of the red deer (*Cervus elaphus*), Père David's deer (*Elaphurus*), the roe-deer (*Capreolus*), and the musk-deer (*Moschus*); while the Chinese water-deer (*Hydrelaphus*) is one of the characteristic forms from the Mediterranean zone. Camels (*Camelus*) are a type quite unknown east of Bering Sea. Among the Carnivora, reference may be made to the raccoon-dog (*Nyctereutes*), the panda (*Aelurus*), now a Himalayan and Chinese type, but occurring in the later Tertiary of England and the continent, and the tiger (*Felis tigris*); the last being essentially a Siberian and Mongolian animal which only reached India at a comparatively recent date, and never penetrated to Ceylon. Badgers (*Meles*) are unknown in the Nearctic region. In the Insectivora the water-shrew (*Neomys* or *Crossopus*) is exclusively Palaearctic, as is the allied *Diplomesodon*, while the desmans (*Myogale*), although a Mediterranean type, are solely Old World. Among the rodents, reference may be made to the Old World family of the dormice (Gliridae or Myoxidae), of which the genera *Glis* and *Muscardinus* are restricted to the area; as are the hamsters (*Cricetus*) and zokors (*Ellobius* and *Siphneus*) in the Muridae, and *Euchoreutes*, *Alactaga*, and *Platycercomys* in the jerboa-group (Jaculidae, or Dipodidae). *Sminthus* is another characteristic Palaearctic (and Mediterranean) rodent. To continue the list would merely be wearisome, without any compensating advantage; but it may be added that there are a number of characteristic extinct forms, among the most notable of the latter of which are the aurochs or wild bull (*Bos taurus primigenius*) and the giant Irish deer (*Cervus* [*Megaceros*] *giganteus*).

Of the remaining groups of vertebrates characteristic of this subregion space admits of but scant mention. Among abundant and more or less characteristic birds, reference may be made to thrushes, warblers, jays, magpies, buntings, sparrows, and (in the eastern part of the Mediterranean zone) pheasants, pratincoles, coursers (Glareolidae), and bustards (Otididae), of which there are numerous genera confined to the area. The two families last named, together with that of the Panuridae (represented by the bearded tit), being solely Old World, are of themselves sufficient to distinguish the Palaearctic from the Nearctic fauna.

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[1] The American form is often separated as *Neurotrichus*, but this does not affect the relationship of the two areas.

Of reptiles there is not much to be said, the Palaearctic subregion, in its restricted sense, being characterized by the poverty of its fauna, several of the widely spread families of the Old World, such as the Varanidae and Agamidae, stopping short of its southern limits. Among batrachians, the tailed salamanders are common in this and the Mediterranean region (as in the northern hemisphere generally), the genera *Salamandra* and *Chioglossa*, as well as the frogs and toads of the genera *Alytes* and *Pelobates*, being unknown in the Nearctic subregion, while newts (*Molge*) abound in the Palaearctic and are rare in the Nearctic subregion. The olm (*Proteus*) is a native of the Mediterranean rather than the proper Palaearctic area.

As regards fishes, the subregion differs from the Nearctic province by the absence of bony-pike (Lepidosteidae), bow-fins (Amiidae), and the family Catostomatidae, as typified by the " suckers," " red horses " and " stone-rollers " of the genus *Catostomus*, and the presence of loaches (Cobitidae) and barbels (*Barbus*).

Nearctic subregion.

As compared with the Palaearctic (and Mediterranean) province of the Holarctic region the Nearctic subregion (together with the Sonoran transitional zone) is characterized by the extreme poverty of its fauna of hollow-horned ruminants. Of these the bison is generically (and subgenerically) identical with its European relative, while the musk-ox can scarcely be regarded as a distinctive Nearctic type, seeing that it is only since the Pleistocene epoch that it has ceased to be a denizen of northern Europe and Asia. The only other living members of the group are the bighorn sheep (*Ovis canadensis*), which has representatives in Kamchatka and north-eastern Siberia, and the white, or Rocky Mountain goat (*Oreamnus*, or *Haploceros*), which is a peculiar type. All must be regarded as originally immigrants from Europe; and it is noteworthy that in the Nearctic Pleistocene are several extinct types of musk-oxen, together with certain other genera which may possibly serve to connect the white goat and the musk-ox with the serow and the takin of the Old World. The deer (Cervidae), apart from the three Old World types alluded to under the heading of the Holarctic region, are altogether peculiar types referable to the genus *Mazama* (subgenus *Dorcelaphus*, *Cariacus* or *Odocoileus*), but they may be akin to the Asiatic *Elaphurus*, and the group is certainly of Old World origin. The same may be said of the bears (Ursidae), in which the black bear (*Ursus americanus*) is a peculiar species, although probably allied to the Himalayan *U. torquatus*. In the brown bear group (*U. arctus*) it is noteworthy that while the Alaskan forms are very close to those inhabiting Kamchatka and Amurland, the Rocky Mountain grizzly, which has penetrated farther into the continent, is more distinct. The grey-fox (subgenus *Urocyon*) is a characteristic Nearctic type. Among other groups of mammals, the following generic groups distinguish the Nearctic from the Palaearctic subregion, although some of them enter the Sonoran area. In the Insectivora we have *Blarina*, *Scalops* and *Scapanus*; in the Carnivora *Procyon* among the raccoons, *Mephitis* among the skunks, and *Taxidea* among the badgers. *Cynomys* (" prairie-dog ") is a characteristic rodent; and in the same order a very important feature is the replacement of all the true rats and mice (Murinae) of the Old World by the deer-mice and their allies belonging to the subfamily Cricetinae, which is but poorly represented in the Old World. *Peromyscus* is a very characteristic Nearctic genus, although it has an analogue in the Old World in the form of the single representative of the Persian *Calomyscus*. The wood-rats of the genus *Neotoma* and the musquash (*Fiber*) are characteristic Nearctic types of the vole-group. More important is the family Haplodontidae, represented only by the sewellels (*Haplodon*, or *Aplodon*), all the members of which are exclusively North American, although some are Sonoran. The pocket-gophers (Geomyidae) and kangaroo-rats (Heteromyidae) are also solely American, though more developed in the Sonoran than in the Nearctic area; *Geomys* and *Thomomys* in the former and *Perognathus* in the latter family are, however, found in the Nearctic area. Lastly, among the rodents, we have the Canadian porcupine (*Erithizon*), typifying the New World family Erithizontidae. Among bats it must suffice to state that the genus *Lasiurus* (*Atalapha*) is solely North American.

Reference to the Tertiary mammal-faunas of North America must be of the briefest. It may be mentioned that even in the Pleistocene these display a much greater development of large forms than occurs at the present day; while a notable feature at this epoch is the mingling of Arctogaeic and Neogaeic types, as exemplified by the occurrence of elephants and mastodons alongside of ground-sloths (*Megalonyx* and *Mylodon*). In the Pliocene and Miocene, the fauna was more of an Old World type, including a great development of camels (Tylopoda), horses (*Equidae*), rhinoceroses (Rhinocerotidae), mastodons, &c., but also a number of peculiar types, such as the ruminating oreodonts (Oreodontidae, or Merycodidae), the perissodactyle Titanotheriidae, and the more generalized Uintatheriidae, which typify a subordinal ungulate group by themselves. It has been suggested that some of the more widely spread of these groups, such as the camels and horses, may have originated in the New World, but there seems at least an equal probability that Central Asia—or a land-area common to Asia and America—may have been their birthplace.

The earliest Tertiary North American fauna is that of the lowest, or Puerco, Eocene, which includes a number of mammals of various types, some of the largest being of the approximate dimensions of a mastiff. Evidently the Puerco epoch was a period of great development and radiation on the part of mammals; its fauna including primitive creodont Carnivora, amblypodous and condylarthrous Ungulata, and a number of smaller types, some of which were probably related to the modern Rodentia, Insectivora and Primates. As only a foreshadowing of the Puerco mammals is found in the under upper Cretaceous Laramie beds, it has been suggested that the fauna was largely of northern origin.

By the middle of the Eocene period the more generalized types of the Puerco fauna had almost disappeared, although a few creodonts survived till the Oligocene. It is surmised that the low brain-capacity of the members of this fauna rendered them unfit to cope with the irruption of more highly organized mammals which suddenly appeared on the scene in the Lower Eocene; this new fauna, it is conjectured, may have developed from a side-line of the original Puerco stock which had remained in the old northern home at the time of the earlier radiation.

" Assuming that the Puerco mammals," observes Mr Madison Grant,[1] " were driven out of more northerly or boreal lands, where they had originally developed, by a declining temperature, it is conceivable that some animals remained behind and adjusted themselves to the changed conditions, until a still further increase of cold freed them also to follow the path of their predecessors, southward.

"Some of these Lower Eocene types of this second radiation, which are found in the Wasatch beds of Wyoming, have sent down lines of descendants, which have ultimately culminated in existing animals. At this time first appear the horses, tapirs, rhinoceroses, camels and dogs (or rather the ancestral stocks thereof). Some of these animals, such as the horses and rhinoceroses, are found contemporaneously in Europe, others, like the (ancestral) camels, are peculiar to America [some of the later types have recently been discovered in Asia].

" Being more highly organized and better adapted to their environment, these new types entirely supplanted the older fauna, and by the Oligocene this transformation was complete, and the older fauna had disappeared. This Wasatch fauna culminated, and then faded gradually away on this [American] continent, until in the Middle Pleistocene it was largely supplanted by arrivals from Asia."

The relationship of the fauna to that of South America, and the interchanges which took place between the two during the Pleistocene and Pliocene epochs, have been already sufficiently discussed when treating of Neogaea.

Of the birds of the Nearctic subregion and the adjacent Sonoran zone, there are a very large number of peculiar genera in the passerine order, a large proportion of which are referable to the finch-group (Fringillidae), and the American warblers (Mniotiltidae), the latter being solely a New World family; there are also a few stragglers from the Neogaeic family of tanagers (Tanagridae). Among game-birds the turkeys (*Meleagris*), the ruffed grouse (*Bonasa*), the prairie-grouse (*Tympanuchus*, or *Cupidonia*), the sage-cock (*Centrocercus*), the prairie-chicken (*Pedioecetes*), and several genera of the American partridges (Odontophorinae), such as *Lophortyx* and *Ortyx* (" bob-white "), may be cited as characteristic Nearctic groups, although some extend farther south. Turning to reptiles, the presence of rattlesnakes (*Crotalus*) is a feature broadly distinguishing the Nearctic subregion (together with America generally) from the Palaearctic; in the more southern territories we also enter the domain of iguanas; while among chelonians we have the family of snappers (Chelydridae), the " stink-pot terrapins " (Cinosternidae), and in the Testudinidae the box-tortoises (*Cistudo*), and the terrapins of the genera *Chrysemys* and *Malacoclemmys* are solely American, although some of them range far to the south, while during the Pliocene the snappers were represented in Europe. There are several more or less peculiar types of North American amphibians, but since these are for the most part Sonoran in range, they may be best noticed in a later paragraph.

From that of the Palaearctic (+Mediterranean) subregion the fish-fauna of the Nearctic subregion (together with that of at least much of the Sonoran area) is broadly distinguished by the presence of bony-pike (Lepidosteidae), bow-fins (Amiidae), and the members of the family Catostomatidae, for which there appears to be no collective English name, as well as by the absence of the loach family (Cobitidae), and barbels (*Barbus*) among the Cyprinidae.

The last of the zoological provinces into which the land-surface of the globe is divided on the evidence of the distribution of mammals and birds is the Sonoran, which, although often regarded as an

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[1] " The Origin and Relationship of the Large Mammals of North America," *Rep. New York Zool. Soc.* (1904), p. 7.

Sonoran transition-zone.

independent region, is best ranked (on Prof. Max Weber's scheme) as a transitional zone between the Nearctic subregion of the Holarctic region of Arctogaea, on the one hand, and Neogaea on the other. Its fauna is indeed essentially a mixture of Nearctic and Neotropical types (inclusive of those originally indigenous to Neogaea and such as are properly immigrants from the north) together with a few more or less wholly endemic forms. Marsupials are represented by opossums (*Didelphys*), and armadillos by *Tatusia*. Peccaries (*Dicotyles*, or "*Tagassu*") make their appearance, but the fork-antlered deer (*Mazama*) are mainly of the northern type. The pronghorn antelope, representing the family Antilocapridae, may be regarded as mainly a Sonoran type; and the same may be said with regard to the pocket-gophers (Geomyidae) and kangaroo-rats (Heteromyidae), some of the genera of which are peculiar to this area. Among cricetine rats, *Rhithrodontomys*, *Sigmodon* and *Neofiber* are characteristically Sonoran. In the Carnivora the three genera of skunks, *Mephitis*, *Conepatus* and *Spilogale* are represented, as are the three raccoon genera *Procyon*, *Nasua* and *Bassariscus*; the third in each case being mainly confined to this zone. *Scalops* and *Notiosorex* among the Insectivora are almost exclusively Sonoran, while *Blarina* and *Scapanus* here attain their maximum development.

Omitting all reference to birds, it may be mentioned that among reptiles the poisonous lizards (Helodermatidae) and the chelonian family Dermatemydidae, with two or three genera, are almost or quite exclusively Sonoran; while such southern types as iguanas become more numerous than in the north. The Mississippi alligator is also Sonoran, although with a congener in China. Among batrachians the salamanders of the genera *Cryptobranchus* (if distinct from the Old World *Megalobatrachus*), *Amphiuma*, *Typhlomolge*, *Necturus* and *Siren*, together with *Scaphiopus* and certain other genera of the frog and toad groups, are exclusively American and mainly Sonoran. The axolotls, or tiger-salamanders (*Amblystoma*), are also a group attaining a great development in this zone, although also ranging to the northward, and likewise recurring in south-eastern Asia.

Antarctica.

So far as birds and mammals are concerned, the Antarctic continent can scarcely represent a distinct zoological province; its fauna consisting mainly of certain peculiar generic groups of seals (which are at least as much inhabitants of the pack-ice as of the continent) together with a number of species of penguins—a group common to the extremities of the three great southern continents—and certain other birds.

Reptilian and Amphibian regions.

The zoological provinces already discussed are based on the present distribution of mammals and birds (see further MAMMALIA and BIRD). The distribution of reptiles and batrachians, like that of fresh-water fishes, by no means accords with that indicated by mammals and birds, probably owing to the earlier radiation, or rather radiations, of the former groups, and different zoological provinces have been proposed to indicate their distribution, as is more fully recorded in the articles BATRACHIA and REPTILES.

From the evidence of batrachian distribution Dr H. Gadow adopts the view that the world may be divided into a northern and a southern half, for the former of which the name Arctogaea is adopted, while Notogaea is used for the latter. It would, however, be much better if entirely new terms were proposed, since the use of the former in a sense different from that in which they are now employed in the case of mammals is liable to create confusion. Notogaea, which (in this sense) includes Australia, Polynesia and the Neotropical region, is characterized by the presence of that family of frogs known as the Cystignathidae, combined with the preponderance of the section Arcifera, the representatives of which form nearly 90 per cent. of the Anura (frogs and toads) inhabiting this half of the globe. Arctogaea, on the other hand, is characterized by the absence of Cystignathidae, and is divisible into two main provinces, or regions, respectively termed Periarctic and Palaeotropical. Of these latter, the Periarctic province is characterized by the presence of salamanders and their allies (Urodela), which are indeed almost peculiar to the area. It is divisible into the (1) Western Palaearctic, (2) Eastern Palaearctic and (3) Nearctic subregions, of which the first two approximately correspond to the Palaearctic subregion *plus* the Mediterranean transition-zone of the mammalian scheme, while the third represents the combined Nearctic and Sonoran areas. The Palaeotropical region has few salamanders or newts; but possesses caecilians (Apoda) which are wanting in the Periarctic; and includes the Ethiopian, Oriental, Malagasy and Austro-Malayan areas of the system based on mammalian distribution, together with Melanesia. Whether the region should be broken up into the four above-named divisions, or regarded as indivisible, may be a matter of opinion; but if such divisions be adopted, they have no approach to the corresponding mammalian areas, the Oriental tract not even possessing a peculiar subfamily. It is thus evident, as might have been expected, that the zoological provinces indicated by the distribution of batrachians are in no wise comparable to those based on mammalian evidence.

As regards reptiles, Dr H. Gadow has remarked that since the various orders have come into existence at very different geological periods, and have each followed their own line of dispersal, no scheme of zoological distribution can be formulated for the class as a whole. In the case of the crocodilian order little information of importance can be gathered from its present distribution, seeing that representatives of all the principal groups occur together in the older Tertiary deposits of Europe. It is, however, of some interest to note that caimans (*Caiman*) are restricted to Neogaea (in the mammalian sense); while the long-snouted *Gavialis* and *Tomistoma* are equally confined to the Oriental region. An important feature in the present distribution of chelonians is the restriction of the section Pleurodira to the southern hemisphere (inclusive of all the three southern continents, as well as Madagascar), and thus in no wise corresponding to the "batrachian Notogaea." The value of this feature in chelonian distribution is to some extent discounted by the occurrence of Pleurodira in the northern hemisphere during the Eocene period.

In regard to lizards (*Lacertilia*), Dr Gadow remarks that their distribution does not support the division of the land-areas of the globe into a northern and a southern half; the marked distinctness of the lacertian fauna of the New from that of the Old World pointing in the same direction. On the other hand, lizards countenance the view "that the Palaeotropical region is but the tropical and therefore richer continuation of the now impoverished Palaearctic subregion."

The present distribution of snakes, according to the same naturalist, indicates that the Ophidia are a group of late radiation, while it further suggests that some of the divisions adopted in classification are not natural ones. Perhaps the most important fact is that the two families, *Boidae* (boas and pythons) and *Typhlopidae* (blind burrowing-snakes), which alone retain vestiges of hind-limbs, occur all over the tropical zone, while certain allied families are found in portions of the same. The restriction of true vipers (Viperinae) to the Palaeotropical and Periarctic areas of the batrachian distributional scheme is a noteworthy fact. The pit-vipers (Crotalinae), however, may perhaps be presumed to have originated in the Palaearctic area, whence they reached and spread all over America, although they were unable to enter either Africa or Australia. The absence of all venomous snakes (which abound in Africa and India) from Madagascar, is a fact harmonizing with mammalian distribution, so far as the peculiarity of the fauna of that island is concerned.

Distribution of fresh-water fishes.

For a fuller account of the distribution of fishes, both fresh-water and marine, see ICHTHYOLOGY; here it will suffice to refer to a zöo-geographical scheme, based on the present distribution of the freshwater families, adopted by Dr A. C. L. G. Günther. According to this scheme, the land-surface of the earth is divided into three parallel zones, the Northern, the Equatorial and the Southern. The Northern zone is characterized by the presence of sturgeons (Acipenseridae), the paucity of cat-fishes (Siluridae), and the abundance of carps (Cyprinidae), the salmon-tribe (Salmonidae), and pike (Esocidae). This zone falls naturally into an eastern and a western section. In the first, forming the Palaearctic, or Europe-Asiatic region, bony-pikes (Lepidosteidae) are lacking, while loaches (Cobitidae) and barbels (*Barbus*) abound. In the second section, constituting the Nearctic or North American region, bony-pikes, bow-fins (*Amiidae*), and the family Catostomatidae, all of which are unknown in the Palaearctic area, are present, while loaches and barbels are lacking.

The Equatorial zone is divisible into two provinces: an Eastern, characterized by the presence of carps and of the family (Anabantidae) typified by the well-known "climbing-perch," and a Western province, in which these two groups are wanting. The Eastern province includes an Indian (Oriental) region, in which lung-fishes (Dipnoi) are absent, while serpent-heads (Ophiocephalidae), Mastacembelidae and loaches are numerous; and an African (Ethiopian) region, distinguished by the presence of lung-fishes, bichirs (Crossopterygii), and proboscis-fishes (Mormyridae), the abundance of chromids (Chromididae) and characinids (Characinidae), and the lack of loaches. The Western Equatorial province is likewise divisible into two regions, namely, a Tropical American (Neotropical), distinguished by the possession of lung-fishes and electric eels and the abundance of chromids and characinids, and a Tropical Pacific (Australian and Hawaiian) characterized by the presence of Dipnoi (widely different, however, from those of Africa and South America, which are nearly related), and the lack of chromids and characinids.

Lastly, the Southern zone is characterized by the absence of carps and the scarcity of cat-fishes, while the salmon tribe is replaced by the Haplochitonidae and pike by the Galaxiidae (since this classification was proposed a marine *Galaxias* has been discovered). This zone includes only a single (Antarctic) region, embracing Tasmania and the south-eastern point of Australia, New Zealand and Patagonia and Tierra del Fuego.

It will be seen that the present distribution of fishes, although showing certain features in common, by no means accords as a whole with that of mammals. Indeed, it is suggestive of the period of the earth's history when there was an extensive and more or less continuous belt of equatorial land

Distribution of spiders.

For the distribution of invertebrate animals generally, the reader may be referred to the articles dealing with the various groups of that assemblage. An exception must, however, be made with regard to that group of spiders known as the Mygalomorphae (which includes the trap-door spiders) on account of the remarkable general similarity presented by its distribution to that of mammals. According to Mr R. I. Pocock,[1] the distribution of this group justifies the mapping of the world into the following zoological regions:—(1) The Holarctic, including Europe north of the southern mountain-chains, North Asia, and North America north of about the 45th parallel of latitude. (2) The Mediterranean, including South Europe, Africa north of the Sahara and the desert-regions of south-western Asia. (3) The Sonoran, comprising the United States of America south of about the 45th parallel and the plateau of Mexico. (4) The Ethiopian, embracing Africa south of the Sahara, South Arabia and Madagascar. The last-mentioned island ranks merely as a subregion of the Ethiopian. (5) The Oriental, including India, Ceylon, Burma, Siam, and all the Indo- and Austro-Malayan Islands to Australia; "Wallace's line" being non-existent so far as spiders are concerned. (6) The Australian, containing Australia and New Zealand; the latter being worthy of recognition as a subregion. (7) The Neotropical, including Central America, apart from the Mexican plateau, the West Indies and South America.

These spiders furnish, moreover, strong evidence in favour of a former union between Africa and South America, and of a connexion between the Afro-Mascarene and Austro-Zealandian continents on the one hand and Austro-Zealandia and the southern extremity of South America on the other. As regards the "regions," apart from the greater divisions, or "realms," the distribution of these spiders accords with remarkable closeness to that of mammals, if we except the more intimate connexion indicated between the faunas of Ethiopian Africa and Madagascar.

The fact that the generally accepted scheme of division of the land-surface of the globe into zoological regions is based almost entirely upon the present distribution of mammals and birds has already been emphasized. It is perhaps only fair to quote the views of Dr A. E. Ortmann[2] (who has devoted much study to the distribution of animals), although they by no means wholly commend themselves to the present writer:—

> "(1) Any division of the earth's surface into zöo-geographical regions which starts exclusively from the present distribution of animals, without considering its origin, must be unsatisfactory, since always only certain cases can be taken in, while others remain outside of this scheme. (2) Considering the geological development of the distribution of animals, we must pronounce it impossible to create any scheme whatever that covers all cases. (3) Under these circumstances, it is incorrect to regard the creation of a scheme of animal distribution as an important feature or purpose of zöo-geographical research."

Dr Ortmann adds in a later paragraph, "the chief aim of zöo-geographical study consists—as in any other branch of biology—in the demonstration of its geological development."

II. Marine Distribution

That the fauna of the ocean, apart from the influence of temperature, would be much more uniform, and therefore less susceptible of being divided into zoological provinces, or regions, will be apparent from a glance at the map of the world on Mercator's projection, in which the fact that the three great oceans—the Pacific, the Atlantic and the Indian—are in free communication with one another in the southern hemisphere is clearly brought out. There is, however, more than this; for there is evidence that during the early part of the Tertiary period the Pacific and the Atlantic were not separated by the isthmus of Darien; while there is a probability that the Mediterranean was at one time in communication with the Red Sea, and that other connexions of a like nature have existed.

In addition to this general community of the marine fauna of the world, there is the further important fact that such faunas may be divided into three main, and for the most part perfectly distinct, groups: namely, the littoral, or shallow water, fauna, the abyssal, or deep-sea, fauna, and the pelagic, or surface, fauna. Of these three the first alone is really susceptible of division into more or less ill-defined zoological regions, the other two being practically uniform in character. Moreover, these three faunas are for the most part perfectly well defined; the pelagic being very sharply sundered from the abyssal, although there may in certain instances be a tendency for the littoral to merge locally into the abyssal. As regards the sharp demarcation between the pelagic and the abyssal faunas, an idea was formerly current that whales, which are essentially pelagic animals, when "sounding," descended to abyssal depths in the ocean. A moment's reflection will show the absurdity of such a supposition; for no surface-dwelling animal could possibly support the enormous pressure existing at great depths, which would crush in the body-cavities. Evidence of this is afforded by the fact that when fishes are brought to the surface from great depths their bodies are practically broken to pieces by the removal of the normal pressure, while their scales start from the skin and the eyes from their sockets. The absolute darkness prevailing at great depths would be another bar to pelagic animals descending to the ocean abysses. We may accordingly regard the pelagic and the abyssal faunas as perfectly distinct and widely sundered from one another; as widely sundered in the case of some species as are beings living in three-dimension space from these (if such there be) inhabiting space of four or more dimensions.

Deep-sea fauna.

Modern research shows that invertebrates, and probably also fishes, live at the greatest depths that have yet been reached by the dredge, and the inference from this is that they occur everywhere. The general results of these explorations is indeed to show that the fauna of the ocean depths is much the same all the world over, and that identical species occur at points sundered as widely as possible from one another. The ocean floor, as has been well remarked, with its uniformity in the matter of temperature, food, station and general conditions of life, contains, in fact, no effectual barriers to the almost indefinite dispersal of species.

The following general conclusions with regard to the deep-sea fauna were arrived at after working out the material and evidence obtained during the cruise of H.M.S. "Challenger":—(1) Animal-life is present at all depths on the ocean floor. (2) At extreme depths life is not nearly so abundant as at moderate depths; but since representatives of all classes of marine invertebrates are met with at all depths, this poverty probably depends more upon certain causes affecting the composition of the bottom deposits, and the degree to which the bottom-water is provided with chemical substances necessary for animals, rather than upon conditions immediately associated with depth. (3) There is reason to believe that the fauna of "blue water" is chiefly restricted to two belts; one at or near the surface, and the other near the bottom, the intervening zone being more or less completely devoid of inhabitants. From the surface-zone a continual rain of organic débris is falling to the bottom, which, however, in the case of the greatest depths may be completely dissolved *in descensu*. (4) Although all the chief groups of invertebrates are represented in the abyssal fauna, their relative proportions are unequal; molluscs, crabs and annelids being, as a rule, scarce, while echinoderms and sponges predominate. (5) Depths below 500 fathoms are inhabited by a practically uniform fauna, the genera being usually cosmopolitan, although the species may differ, and be represented by allied forms in widely sundered areas. (6) The abyssal fauna, so far as invertebrates are concerned, is of an archaic type as compared with shallow-water faunas. (7) The most characteristic and archaic abyssal types seen to be most abundant and to attain their maximum dimensions in the southern ocean. (8) In general character the abyssal fauna approximates to that of shallower water in polar latitudes, doubtless owing to the fact that the conditions of temperature, on which the distribution of marine animal life mainly depends, are nearly the same.

In reference to the abundance of sponges in the deep-sea fauna, it may be mentioned that the calcareous group is absent, and that among the siliceous section, the Hexactinellidae, of which the Venus flower-basket (*Euplectella*) and glass-rope sponge (*Hyalonema*) are familiar representatives, are exceedingly abundant; this group being likewise of great geological antiquity. Corals are sparse and belong for the most part to the Turbinolidae. Echinoderms are represented by all the existing ordinal groups; some of the crinoids, or stone-lilies, belong to the family Apiocrinidae, which attained its maximum development during the Jurassic epoch; and somewhat similar relationships are exhibited by certain of the brittle-stars (Ophiuroidea). Very noteworthy is the great development of the sea-cucumber group (Holothuroidea), and likewise the bizarre forms assumed by some of its abyssal representatives. Molluscs, however, are poorly represented, and it is not improbable that cephalopods (nautilus and cuttlefish group) are wanting. Bivalves of the genera *Leda* and *Arca* have, however, been obtained from a depth of 16,000 ft. Lamp-shells (Brachiopoda) are likewise scarce.

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[1] *Proc. Zool. Soc., London*, 1903, vol. i. p. 340.

[2] *Proc. Amer. Phil. Soc.*, xli. p. 267 (1902).

Considerable difficulty exists in determining from what depths fishes are dredged. Although many species display various structural peculiarities, such as a huge head, or an attenuated ribbon-like body, while special phosphorescent organs are very generally present, yet deep-sea fishes as a whole do not represent an ordinal or sectional group by themselves, but are drawn from a number of families, certain members of which have adapted themselves to an abyssal existence. A preponderance of representatives of the families Macruridae, Ophidiidae and Scorpelidae is, however, noticeable.

Whether light or temperature is the prepotent agency in regulating the limitations of the deep-sea fauna, has long been a debated question. It may be noted that reef-building corals, which require an average temperature of from 70° to 75° F. and one which never falls below 68°, are never found below a depth of 20 fathoms (120 ft.). Nevertheless, there are several areas where a temperature of from 70° to 77° obtains to depths of between 80 and 100 fathoms. It is further remarkable that well-characterized deep-sea faunas are locally met with in comparatively shallow waters, one such area occurring in the European Atlantic and a second in the Mediterranean, where they live within the 100-fathom zone. Light, which was formerly supposed not to penetrate to a greater depth than the 40 to 50 fathom-line, has also been regarded as the chief agent controlling vertical distribution. It appears, however, as Prof. Heilprin has remarked, "more than likely that not a single cause, but a combination of causes, is operative in bringing about the general results. That the deep-sea fauna is a fauna of darkness must be admitted; but this is so from the nature of the case rather than a matter of choice resting with the animals composing it."

After referring to the fact of the dissimilarity between the faunas of the two poles, Dr A. E. Ortmann, in a paper on the origin of the deep-sea fauna,[1] observes that we have reason to believe that each of these faunas had a separate origin, "the north-polar fauna being a derivate of the old Mesozoic Mediterranean, the south-polar fauna of the old Pacific fauna. The first developed along the shores of the northern continents, while the second had its original home on the shores of the Antarctic continent. We know that there is a strange element among the littoral fauna of the southern extremities of the continents, differing entirely from the arctic fauna, and we cannot but think that this is a remnant of the old Tertiary antarctic fauna. The above considerations give us a threefold origin of the present deep-sea fauna:—(1) An ancient Mesozoic (or pre-Tertiary) constituent, derived from a transformed part of the old warm-water fauna of the deep sea, adapted to the changed climatic conditions. It is clearly autochthonous. (2) A more modern, immigrant, Tertiary constituent, which came from the north-polar littoral waters, and immigrated into the deep sea together with the cool water (or after it had cooled). This element goes back to an old pre-Tertiary stock that lived in the warm littoral waters of the old Tethys (Mediterranean Sea), but as a cool-water fauna, it is not older than Tertiary. (3) Another Tertiary element, corresponding to the second one, but belonging to the south pole, which is finally to be traced back to the warm waters of the old Pacific Ocean of pre-Tertiary times."

The surface fauna.

The surface, or pelagic, fauna contains some of the smallest and actually the largest of all living animals, for among its members are included a host of so-called animalcules on the one hand and the whales on the other. The essential characteristic of pelagic animals is that they pass the whole of their existence swimming at or near the surface of the ocean, and only by accident touch the shores or the bottom. Much information with regard to the smaller pelagic creatures will be found in the article PLANKTON. Among the groups included in the pelagic fauna may be mentioned the radiolarian animalcules, together with certain representatives of the Foraminifera; the siphon-bearing jelly-fishes, such as *Physalia* (Portuguese man-of-war), *Velella*, *Porpita*, &c.; all the pteropod molluscs, such as *Clio*, *Clione* and *Cavolinia* (*Hyalaea*), together with less aberrant gastropods, like *Janthina* (violet-snail), *Atlanta* and *Glaucus;* a few cephalopodous molluscs, such as the paper-nautilus (*Argonauta*) and *Spirula;* and a number of social ascidians, like *Salpa* and *Pyrosoma*. Crustaceans belonging to the entomostracous (shelled) and schizopod divisions abound; and there is a group of insects (*Halobates*), belonging to the order Hemiptera, whose home is on the ocean-surface at, practically, any distance from land. Fishes form no inconsiderable portion of the pelagic fauna, among these being the true flying-fishes, or flying-herrings (*Exocoetus*), herrings, mackerel, tunny, flying-gurnards (*Dactyloptera*), sword-fishes (*Histiophorus*), sea-horses (*Hippocampus*), pipe-fishes (*Fistularia*) and many of the sharks. With the exception of the comparatively few fluviatile species, the whole of the cetacean mammals—that is to say, whales, grampuses, porpoises, dolphins, &c.—claim a place among the surface-fauna of the ocean. Whether the sea-cows (Sirenia) should likewise be included is doubtful, as they hold a somewhat intermediate position in regard to habits between cetaceans and seals. While they agree with the former in never (or very rarely) landing and in bringing forth their young at sea, they come inshore to feed. Turtles certainly cannot be considered truly pelagic, since they come ashore to lay their eggs.

A large proportion of the smaller pelagic animals are more or less completely transparent, while others, such as the violet-snail, have developed an azure tint which renders them as inconspicuous as possible in the waste of waters. In the case of the larger animals, like mackerel and the finner-whales, the same result is attained by the under surface of the body being silvery white (thus rendering them invisible when looked at from below against the sky), and the upper surface olive or blackish green, sometimes, as in the mackerel, mottled to harmonize with the ripple of the waves.

The distribution of whales and dolphins has been taken by P. L. and W. L. Sclater to some extent as a basis in dividing the ocean into zoological regions. Since, however, such regions were mainly defined on the distributional evidence afforded by seals and sea-cows, they are best considered in connexion with the shallow-water fauna.

The shallow-water fauna.

The shallow-water, or littoral, fauna includes all marine animals which belong neither to the deep-sea nor to the surface fauna, and is the most important of all three. In addition to the great bulk of marine invertebrates, the littoral fauna may be taken to include the reef-building corals (whose distributional limitations under the influence of temperature-control have been already mentioned) and likewise seals and sea-cows among mammals, and turtles among reptiles.

"The fauna of the coast," observes Prof. H. N. Moseley, "has not only given origin to the terrestrial and fresh-water faunas, it has through all time, since life originated, given additions to the pelagic fauna in return for having received from it its starting-point. It has also received some of these pelagic forms back again to assume a fresh littoral existence. The terrestrial fauna has returned some forms to the shores, such as certain shore-birds, seals and the polar bear; and some of these, such as the whales and a small oceanic insect (*Halobates*), have returned thence to pelagic life.

"The deep-sea fauna has probably been formed almost entirely from the littoral, not in most remote antiquity, but only after food, derived from the débris of the littoral and terrestrial faunas and floras, became abundant in deep water. It was in the littoral region that all the primary branches of the zoological family-tree were formed; all terrestrial and deep-sea forms have passed through a littoral phase, and amongst the representatives of the littoral fauna the recapitulative history, in the form of series of larval conditions, is most completely retained."

Marine Zoological regions.

From the distribution of certain groups of animals, it has been attempted (as stated) to divide the ocean into a number of zoological provinces, or regions. Among the more important of such schemes, the following may be mentioned.

Coral regions.

The reef-building corals, whose limitations are defined by conditions of temperature and depth, are necessarily restricted to certain seas and coasts within or near the tropics. "They abound," wrote Dr A. R. Wallace in the ninth edition of the present work, "in and near the West Indies, on the east coast of Africa, in the Indian Ocean, in the Malay and Pacific archipelagoes, and on the coast of Australia; while they are absent from the whole of the west coasts of South America and of Africa, from the Indian peninsula, and from much of the east coast of South America. The coral-reefs of the Bermudas, in 33° N. lat., are the farthest from the equator; in the Red Sea they reach 30° N., in the Pacific 27° N., while they nowhere extend to more than 29° S. of the equator. . . . The coral regions are therefore somewhat peculiar, and differ considerably from those which best exhibit the distribution of other marine animals. The regions adopted by Prof. J. D. Dana are three—the first comprising the Red Sea and Indian Ocean; the second, the whole of the Pacific islands and the adjacent coasts of Australia; and the third the West Indies. This last region is the most isolated in position; and it is not surprising that it should contain the largest proportion of peculiar forms. The corals of the Central Pacific are also very peculiar, as are those of the Red Sea and Indian Ocean."

Crustacean regions.

Prof. J. D. Dana[2] proposed to divide the oceans into three main areas according to the distribution of Crustacea. These areas are respectively termed the Occidental, the Africo-European and the Oriental. The first comprises both coasts of America; the second, the western shores of the Atlantic, both African and European; while the third comprehends the vast area from the east coast of Africa to the Central Pacific. Each of these regions is subdivided into climatal and local provinces, but the primary divisions can alone be mentioned here. The facts adduced in support of this scheme of distribution are interesting. At the date of Prof. Dana's memoir 47 genera were known to be exclusively American, 15 being common to both the east and west coasts; but as 26 genera were said to be confined to the west and 6 to the east coast, these two provinces are really distinct, even if they do not form primary regions. The Africo-European region had 19 peculiar genera, and only 8 in common with the

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[1] *Rep. Eighth International Geographic Congress*, p. 619.

[2] See *Amer. Journ. Science*, ser. 2, vol. xvi. p. 155 (1853).

American region; so that the eastern and western shores of the Atlantic appear decidedly more distinct than the eastern and western coasts of America. The extensive Oriental region is by far the richest.

From the distribution of the species (not genera) of barnacles, or cirrhipeds, which are an aberrant group of Crustacea, Darwin considered that the ocean might be divided into the following regions, viz.:—(1) The North Atlantic, comprising North America and Europe down to N. lat. 30°; (2) The West American, from Bering Strait to Tierra del Fuego; (3) The Malayan, from India to New Guinea, and (4) The Australian, comprising Australia and New Zealand: the Malayan and Australian regions being the richest in cirrhipeds.

Molluscan regions.

One of the earliest students of the geographical distribution of marine animals was Dr S. P. Woodward, who, in his *Manual of the Mollusca*, proposed a scheme of zöo-geographical regions. He adopted three main divisions for the warmer parts of the ocean, namely, the Atlantic, the Indo-Pacific and the West American; and these Wallace was inclined to regard as the only valid marine molluscan regions. The Indo-Pacific region extends from the Red Sea and the east coast of Africa to the eastern Pacific islands, and corresponds to Prof. Dana's Oriental region for Crustacea, many species ranging over nearly the whole area. The Atlantic region unites the fauna of the east coast of America with that of West Africa and South Europe, but has considerable affinity with that of West America, many genera being common to both areas. Several genera appear restricted to the north temperate zone, which in Wallace's opinion should perhaps form a distinct region. Numerous genera are confined to the Indo-Pacific region. The Atlantic coasts have few peculiar genera of importance, while the west coast of America has hardly any, the difference of its fauna from that of the Atlantic on the one side and the Pacific on the other being chiefly specific. It is stated that while there is not a single species common to the east and west coasts of tropical South America, the corresponding coasts of North America have a large number in common, while others are so closely representative as to be almost identical.

Inclusive of an Arctic province of somewhat doubtful value, Dr Woodward's three main regions were divided into 18 subregions; but, according to a somewhat modified later scheme, these may be arranged in four main groups, as follows:—

Regions.	Subregions.	Regions.	Subregions.
A. ATLANTIC and CIRCUMPOLAR	1. Arctic. 2. Boreal. 3. Celtic. 4. Lusitanian. 5. W. African. 6. S. African.	*C*. AUSTRALIAN	1. Australian. 2. Neozealanian.
B. INDO-PACIFIC .	1. Indo-Pacific. 2. Japanese.	*D*. AMERICAN .	1. Aleutian. 2. Californian. 3. Panamic. 4. Peruvian. 5. Magellanic. 6. Argentinian. 7. Caribbean. 8. Transatlantic.

Fish Regions.—From the distribution of shore-haunting fishes, Dr A. C. L. G. Günther[1] suggested the following marine zoological regions, the characteristic family and generic types of which we are prevented by limitations of space from discussing:—

- I. Arctic Ocean.
- II. Northern Temperate Zone.
  - *A*. Temperate N. Atlantic.
    - 1. British district.
    - 2. Mediterranean district.
    - 3. N. American district.
  - *B*. Temperate N. Pacific.
    - 1. Kamchatkan district.
    - 2. Japanese district.
    - 3. Californian district.
- III. Equatorial Zone.
  - *A*. Tropical Atlantic.
  - *B*. Tropical Indo-Pacific.
  - *C*. Pacific Coast of Tropical America.
    - 1. Central American district.
    - 2. Galapagos district.
    - 3. Peruvian district.
- IV. Southern Temperate Zone.
    - 1. Cape of Good Hope district.
    - 2. South Australian district.
    - 3. Chilean district.
    - 4. Patagonian district.
- V. Antarctic Ocean.

Mammalian Regions.—The last scheme of marine zoological regions necessary to mention is one proposed by P. L. and W. L. Sclater[2] on the distributional evidence afforded by seals, sea-cows and cetaceans. According to this, we have the following six regions, viz.:—

- (i) Arctatlantica (North Atlantic), characterized by the presence of seals of the subfamily *Phocinae*, with the genera *Halichoerus* peculiar to it, and *Phoca* common to it and No. iv.; the absence of sea-cows; and (it is stated) by the bottle-nosed whales (*Hyperöodon*) being peculiar to this area.
- (ii) Mesatlantica (Mid Atlantic), the sole habitat of the monk-seal (*Monachus*) and the manatis (*Manatus*).
- (iii) Philopelagica (Indian Ocean, &c.), characterized by the presence of dugongs and the absence of seals.
- (iv) Arctirenia (North Pacific), agreeing with No. i. in the possession of *Phoca* but distinguished by also having sea-bears and sea-lions (*Otariidae*); formerly the habitat of the northern sea-cow (*Rhytina*), and now of the grey whale (*Rhachianectes*).
- (v) Mesirenia (Mid Pacific), without *Phocinae* or sea-cows, but with the elephant-seal (*Macrorhinus*), from the south, and also *Otariidae*.
- (vi) Notopelagica (Southern Ocean), with four peculiar genera of seals (*Phocidae*), numerous sea-bears and sea-lions, and two peculiar genera of cetaceans, the pigmy-whale (*Neobalaena*) and Arnoux's beaked-whale (*Berardius*).

To explain the absence of sea-bears and sea-lions from the North Atlantic, and likewise the existence of manatis on both Atlantic coasts, the authors of this scheme call in the aid of a land-connexion between Africa and South America, which presented a barrier to the northward progress of the former, while its coasts afforded a means of dispersal to the latter. As the *Otariidae* are at present unknown previous to the Miocene, such an explanation, if valid, requires the persistence of the ancient land-bridge across the Atlantic to a much later date than is commonly supposed.

III. DISTRIBUTION IN TIME

The subject of the distribution of animals in time, *i.e.* the relative dates of their first appearance on the earth, and in the case of extinct forms the length of their sojourn there, can be treated but briefly; reference being restricted to the larger groups, and not even all of these being mentioned. The dates of appearance and disappearance of the various groups are only relative, for although many more or less vague attempts have been made to determine the age of the earth, there is no possibility of indicating in years the length of time occupied by the deposition of any one stratum or series of strata. All that can be attempted is to say that one stratum (and consequently the remains of animals that may be entombed in it) is older or younger, as the case may be, than another. For the sequence and names of the various strata, or time-periods of the geological record, see GEOLOGY. An important factor in regard to the past history of animals is the imperfection of the geological record. Recent discoveries have rendered this imperfection much less marked than was formerly the case. There are, however, still many very serious gaps; and we have, for instance, no definite information as to where and when the transformation from reptiles into mammals took place.

It may nevertheless be emphatically affirmed that the geological, or rather the palaeontological, record indicates a gradual progression in the status of animals from the lowest to the highest fossiliferous strata. That is to say, the earlier animals were creatures of comparatively low grade (although certain representatives of such groups may have attained a relatively high degree of specialization), and that as we ascend the geological ladder higher and higher types of animals make their appearance, till the series culminates in man himself—the crowning effort of creation, in the modern evolutionary signification of that term. It is not, indeed, to be supposed that the higher groups made their appearance exactly according to their relative grades (or what we regard as such); all that can be affirmed is that in the main the higher forms have made their appearance later than the lower. The record is thus almost exactly what it might be expected to be on the theory of evolution; while it also accords fairly well—if regarded with sufficient breadth of view—with the Biblical narrative of creation.

A brief survey of the time-distribution of the leading groups of animals may now be undertaken, commencing with the highest and concluding with the lowest groups.

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[1] See *Study of Fishes* (London, 1880).

[2] *The Geography of Mammals* (London, 1899).

Mammals.

As the highest of all vertebrates, it is natural to expect that mammals should be one of the latest groups of that assemblage to make their appearance; and this as a matter of fact they are, although it is by no means improbable that birds are the latest of all. Mammals are commonly stated to commence in the Trias, where they are presumed to be represented by *Microlestes* in Europe and by *Dromatherium* in North America. From the fact, however, that the approximately contemporary *Tritylodon*, which has cheek-teeth very like those of the former, appears to be in great degree intermediate between reptiles and mammals, it is by no means improbable that none of these Triassic creatures were true mammals. Undoubted mammals occur in the lower Jurassic Stonesfield Slate, in the upper Jurassic Permian beds, and, very sparingly, in the Wealden of England; while a large fauna has been discovered in the upper Cretaceous of North America. The mammals included among these Mesozoic forms appear, for the most part at any rate, to be referable to the Marsupialia, Insectivora, and, not improbably, the Monotremata (see MARSUPIALIA). After the lowest Eocene (when the Puerco fauna represented an inferior and apparently non-progressive type) mammals became abundant; and during that epoch most if not all of the existing orders made their appearance. The lower Eocene representatives of several of the orders, such as the Condylarthra among the Ungulata and the Creodonta among Carnivora, belonged, however, to low suborders which disappeared more or less completely by the Oligocene. Several subordinal groups of Ungulata developed and became extinct at later periods than the Eocene; but with the exception of the Ancylopoda and Tillodontia (whose right to ordinal distinction is by no means universally admitted), none of the Tertiary orders of mammals are extinct. At the present day—as during the greater part of the Tertiary epoch—mammals are the dominant terrestrial representatives of the Vertebrata. We have at present no evidence of the existence of Cretacea before the lower Eocene.

Birds.

Although some of the three-toed bipedal tracks in the Trias of the Connecticut valley were formerly supposed to have been made by birds, there is little doubt that they are really due to dinosaurian reptiles. The class Aves, so far as we know, is therefore first represented by the long-tailed *Archaeopteryx* of the upper Jurassic, which represents a subclass (or order) by itself. Toothed birds also existed in the upper Cretaceous of both Europe and North America, but all these appear referable to existing ordinal (or subordinal) groups. By the lower Eocene, when teeth appear to have been entirely lost, most or all of the existing ordinal groups were developed, since which date the majority at all events have steadily increased.

Reptiles.

In contradistinction to both the preceding classes, reptiles, which date from the Permian, are a waning group, at all events so far as both terrestrial and marine forms of large bodily size are concerned. The Permian reptiles were small or medium-sized creatures, few in number, and of generalized character. The one existing order dating from that epoch (when it was represented by *Protorosaurus*) is the Rhynchocephalia, of which the sole survivor is the New Zealand tuatara (*Sphenodon*). The Mesozoic period, from the Trias to the Chalk, is the true "age of reptiles," a number of orders being confined to that period. It is noteworthy, however, that the Triassic forms were in the case of the marine groups very generally of small size, and apparently amphibious, or perhaps freshwater. Of the various extinct Mesozoic orders, the Dinosauria, as demonstrated by their footprints in the sandstone of the Connecticut valley, were represented by species of huge size even in the Trias. The other extinct orders whose distribution was approximately coequal with the Mesozoic period were the ichthyosaurs (Ichthyopterygia), the plesiosaurs (Sauropterygia), and the pterodactyles (Ornithosauria). The Chelonia and Crocodilia (if we include the Phytosauria) date from the Trias, but are also dominant forms at the present day. But the mammal-like Anomodontia (Theromorpha), which ranged from South Africa to India and Russia, were solely Triassic. The Squamata, including lizards and snakes, together with the extinct Cretaceous Pythonomorpha (*Mosasaurus*, &c.), did not come into being till the upper Jurassic, or lower Cretaceous, and constitute the great bulk of the existing members of the class.

Amphibians.

Batrachia, as represented by the labyrinthodonts, or Stegocephalia, carry the origin of vertebrates one stage further back, namely, to the upper Carboniferous. The stegocephalians, which appear to have included the ancestors of the anomodont reptiles, died out at the close of the Triassic epoch. The existing representatives of the class date, so far as is known, only from the Tertiary, but it is not improbable that the limbless caecilians (Apoda) may really be much older, since they appear to be related to the Stegocephalia.

Fishes.

The class Pisces is the lowest and at the same time the oldest representative of the Vertebrata, dating from the lower Ludlow beds of the upper Silurian. The oldest group is that of the sharks and rays (Elasmobranchii), in which the orders Pleuropterygii, Ichthyotomi and Acanthodii are confined to the Palaeozoic. The lung-fishes (Dipnoi) are also an ancient group, although surviving in the form of three genera widely sundered in space; the order Arthrodira (as represented by *Coccosteus* of the Devonian) was solely Palaeozoic. Of the subclass Teleostomi, the fringe-finned group (Crossopterygii) attained its maximum in the Palaeozoic, although it survives in the shape of two African genera. In the case of the subclass Teleostomi the enamel-scaled, or ganoid, division was abundant during the Palaeozoic and early Mesozoic periods (and still survives in North America), but the modern soft-scaled bony fishes did not make their appearance till the Cretaceous, or thereabouts.

Lampreys.

Of the class Agnatha, as typified by the modern lampreys, the palaeontological record is very imperfect. There is, however, an armoured subclass, the Ostracodermi, represented by *Pterichthys*, *Cephalaspis*, &c., which was confined to the upper Silurian and Devonian; and *Palaeospondylus* of the Devonian has been regarded as an early lamprey (Cyclostomi). Whether the so-called conodonts, ranging from the upper Cambrian to the Carboniferous, are really teeth of lampreys, has not been definitely ascertained.

Brachiopods.

The lamp-shells, or Brachiopoda, form an exceedingly ancient group, dating from the lower Cambrian, and surviving at the present day, although in greatly diminished numbers compared to the Palaeozoic epoch, when they far surpassed the now dominant bivalve molluscs. The group attained its maximum in the Silurian, when, as in the Palaeozoic genera, nearly all the forms belonged to the hingeless section. With the beginning of the Mesozoic period the waning of the brachiopods, which had set in with the Devonian, became more pronounced, and was continued throughout the Mesozoic formations. A remarkable feature is the survival to the present day of the Cambrian genera *Lingula*, *Discina* and *Crania* (or closely allied types).

Polyzoans.

The Polyzoa, of which the sea-mats (*Flustra*) are well-known representatives, date from the Ordovician; the Palaeozoic forms belonging almost exclusively to the section Cyclostomata, which attained its maximum in the Jurassic; while the dominant modern Chilostomata came in with the Tertiary.

Molluscs.

The Mollusca, of which the great bulk are marine and the majority of the remainder freshwater, are perhaps the most important of all fossils from the chronological point of view. Since the three principal classes (Pelecypoda, Gastropoda and Cephalopoda) are represented in the upper Cambrian, it is evident that the origin of the group was much earlier. In the Palaeozoic the chambered cephalopods of the section Tetrabranchiata (now represented by the nautilus) were the dominant forms; the bivalves (Pelecypoda) and gastropods showing a relatively poor development. The tetrabranchiate cephalopods continued throughout the Mesozoic, when they were specially represented by the ammonites; but by the Tertiary they had become almost extinct. The section Dibranchiata (cuttle-fishes) commenced with the Mesozoic. The bivalves and gastropods have shown a steady increase to the present day, and are now the dominant forms.

Insects.

Insects date from the Ordovician graptolite-slates of Sweden, where they are represented by *Protocimex;* the next oldest being *Palaeoblattina* of the French upper Silurian. From the Devonian about a dozen forms are known, belonging to several groups; and from the Coal-measures extensive insect-faunas have been described. All the Palaeozoic forms lack most of the distinctive features by which the modern groups are characterized, the majority of them showing kinship to the cockroach group.

Myriapods.

The Myriapoda (centipedes and millipedes) are of comparatively little importance as fossils. The class dates from the Devonian, and is abundant in the Coal-measures; the Palaeozoic forms for the most representing two orders—Archipolypoda and Protosyngnatha—peculiar to that period, of which the second has only a single known species. The modern centipedes (Chilopoda) date mainly from the Tertiary, although several Carboniferous genera have been assigned to the group. Millipedes (Diplopoda), although known from the Cretaceous of Greenland, elsewhere date from the Tertiary.

Arachnids.

The class Arachnida, now taken to include trilobites and king-crabs, as well as scorpions and spiders, is ancient. Scorpions—not far removed from existing types—are known in the Silurian, while true spiders occur in the Coal-measures. The great majority of the more typical Palaeozoic arachnids are, however, referred to an order by themselves—the Anthracomarti. King-crabs (Xiphosura) date from the Silurian, the existing genus *Limulus* occurring in the Trias; but the gigantic eurypterids (Eurypterida) and the trilobites (Trilobita) are exclusively Palaeozoic, the former dating from the Ordovician, and the latter from the upper Cambrian.

Crustaceans.

Most of the existing ordinal groups of the class Crustacea appear to date from the Palaeozoic; the decapods (lobsters and crabs) which represent the highest development of the class, did not, however, attain a dominant position till well on in the Mesozoic, and are at their maximum in the present day; genuine crabs (Brachyura) apparently not having come into existence till the Cretaceous.

Among the Echinodermata, the classes Blastoidea and Cystoidea are exclusively Palaeozoic, while the stone-lilies (Crinoidea) form a group, dating from the same epoch, now on the verge of extinction.

Echinoderms.

The sea-urchins (Echinoidea), which date from the Ordovician but attain no great development till the Mesozoic, the starfishes (Asteroidea) and brittle-stars (Ophiuroidea), which also date from the Ordovician, and the sea-cucumbers (Holothuroidea), which appear to be represented in the Carboniferous, do not seem, however, to have attained their full development till the modern period.

Annelids.

That the Annelida are a very ancient group is indicated by the occurrence of remains of marine worms in the Ordovician; while "tracks" or "burrows" apparently point to the existence of the class in the lower Cambrian, if not indeed in the Laurentian.

Coelenterates.

The earliest-known representatives of the Coelenterata occur in the upper Cambrian, where we find primitive types of hydroid polyps, especially the graptolites, which lived only till the Silurian, and have no near relatives. The equally isolated stromatoporids, on the other hand, commenced in the Ordovician and survived till the Devonian. The corals (Actinozoa) were completely differentiated from the Hydrozoa in the Ordovician. Most of the Palaeozoic actinozoans belong to the Rugosa (inclusive of the four-rayed corals) which did not survive the Permian, but the Aporosa are also well represented. In the Mesozoic and Tertiary as well as at the present day the Aporosa and Porosa became, however, the dominant forms.

Sponges.

As might have been expected from their low grade of organization, the sponges (Porifera) were strongly represented in the early formations; the oldest known form occurring in the Welsh Cambrian. In the Silurian and Carboniferous silicious sponges were extraordinarily abundant, and are represented by several extinct groups.

Protozoa.

Foraminifera, extremely abundant in the Carboniferous, date at any rate from the Ordovician, where the existing genus *Saccammina* has been identified. The Chalk consists almost entirely of foraminifers. The Radiolaria, as represented by the Polycystina, are believed to date from the Silurian, or even the Cambrian, but did not attain their maximum till the Mesozoic or Tertiary. The so-called *Eozoon* of the Laurentian is not admitted to be of organic origin.

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ZOOLOGICAL GARDENS, sometimes called ZOOLOGICAL PARKS, institutions in which wild animals are kept in captivity. Their primary object is to gratify the pleasure most persons take in viewing at close range the curious and beautiful living products of nature, but they serve also as means of instruction in natural history, providing material for museums and for investigations in comparative anatomy and pathology, while they may have a commercial value as pleasure resorts, or as show grounds for the display of animals that have been imported or bred for sale.

According to Captain Stanley Flower, director of the Zoological Gardens at Giza, Cairo, Egypt, the ancient Egyptians kept various species of wild animals in captivity, but the first Zoological Garden of which there is definite knowledge was founded in China by the first emperor of the Chóu dynasty, who reigned about 1100 B.C. This was called the "Intelligence Park," and appears to have had a scientific and educational object. The ancient Greeks and Romans kept in captivity large numbers of such animals as leopards, lions, bears, elephants, antelopes, giraffes, camels, rhinoceroses and hippopotamuses, as well as ostriches and crocodiles, but these were destined for slaughter at the gladiatorial shows. In later times royal persons and great feudal magnates frequently kept menageries of wild animals, aviaries and aquaria, and it is from these that modern public Gardens have taken their origin. Henry I. (1100–1135) established a menagerie at Woodstock, Oxfordshire, England. This was transferred to the Tower of London, apparently in the reign of Henry III., and kept up there until at least 1828. Philip VI. had a menagerie in the Louvre at Paris in 1333, Charles V. maintained collections at Conflans, Tournelles and in Paris, and Louis XI. formed a menagerie at Plessis les Tours in Touraine, which after his death was re-established at the Louvre in Paris and enlarged by collections obtained in North Africa. It was destroyed by Henry III. Henry IV. had a small collection, which included an elephant. Louis XIII. kept some animals at Versailles, whilst his son Louis XIV. founded the famous "Menagerie du Parc" at Versailles, which received many animals from Cairo, was maintained for over a century, and furnished much valuable material to French naturalists and anatomists. It gradually decayed, however, and was almost extinguished by the mob in 1789. In 1793 the Paris Museum of Natural History was re-established by law, and Buffon's idea of attaching to it a menagerie was carried out; the latter, as the collection in the Jardin des Plantes, still survives.

In Germany the elector Augustus I. founded a menagerie at Dresden in 1554. In the New World, according to Prescott, King Nezahualcoyotl had zoological gardens at Tezcuco in Mexico in the middle of the 15th century, whilst in the next century Cortes found aviaries and fishponds at Iztapalapan and Montezuma II., emperor of Mexico in the beginning of the 16th century, maintained large collections of animals in the gardens of his capital.

Most of the modern zoological gardens date from comparatively recent years, and there are a larger number stocked with a finer collection of animals, more suitably housed, than at any past time in the history of the world. According to a reference list compiled by Captain Stanley Flower, there were 102 actually existing public gardens or parks containing collections of wild animals in 1910, while there are also a considerable number of private collections. It is possible to refer here only to the more important of these.

Africa.—The Zoological Gardens at Giza, Cairo, are a government institution administered by the Public Works Department. The grounds are beautifully laid out and the collection is particularly rich in African animals, to which the climate is well adapted. The Khartum Zoological Gardens are free to the public and are under the control of the municipality, but the collection of animals is under the Game Preservation Department. The Transvaal Zoological Gardens at Pretoria are a government institution, and are associated with the Museum.

America, North.—The Zoological Park at Bronx Borough, New York City, opened in 1899, is one of the largest in the world. It is controlled by the Zoological Society of New York, with representatives of the municipality of the City of New York, and is financed largely out of municipal funds, and is open free to the public five days a week. The Park occupies nearly 300 acres, of great natural beauty, which has been increased by the judicious arts of the landscape gardener. It contains many fine buildings, designed on the most modern lines, but its special feature is a series of spacious enlosures for large herds of bison and deer. In a sense it serves also as a national reserve, and has already been an important factor in the preservation of the American bison. The National Zoological Park at Washington, D.C., was founded by Congress in 1889–1890 "for the advancement of science and the instruction and recreation of the people." The site was purchased by the United States government, and all the expenses come from national funds, the management being vested in the Smithsonian Institution. The Park consists of about 265 acres of undulating land with natural woods and rocks, traversed by a gorge cut by Rock Creek, a tributary of the Potomac. The river and gorge extend into the country far beyond the Park, and in addition to the animals that have been introduced, there are many wild creatures living in their native freedom, such as musk rats in the creek, grey squirrels, crested cardinals and turkey buzzards. The varied natural conditions form an almost ideal site for a collection of animals; great care and skill have been expended on the designing and construction of the houses, the collection receives many accessions from various government departments, including the foreign consular service, and the whole institution is rapidly becoming a model of what is possible. The Zoological Gardens in Fairmount Park, Philadelphia, resemble the gardens of the Zoological Society of London, on which they were modelled. They are controlled by the Zoological Society of Philadelphia, founded in 1859, and are supported partly by subscriptions of members, partly by gate-money and partly by an allowance from the city of Philadelphia. They contain an admirable collection, well housed and carefully managed, a specially interesting feature being the careful quarantine system of new arrivals and the post-mortem examinations of animals that have died. There are many smaller collections in the United States and several in Canada, but none of these present features of special interest.

America, South.—The Zoological Gardens at Buenos Aires are supported by the municipality, and contain many interesting animals, well housed in beautiful surroundings. The director issues a popular illustrated guide and a valuable quarterly scientific journal. At Para, Brazil, is a good collection attached to the Museum Goeldi, and there are unimportant collections at Rio de Janeiro and Bahia.

Asia.—There are many small collections in different parts of Asia, but the only garden of great interest is at Alipore, Calcutta, supported chiefly by gate-money and a contribution from government, and managed by an honorary committee. It was established in 1875 by the government of Bengal, in co-operation with the public, and is 33 acres in area. An extremely interesting collection is maintained, the variety of bird life, both feral and in captivity, being notable.

Australia and New Zealand.—There are Zoological Gardens at Melbourne (founded in 1857), Adelaide, Sydney and Perth, and small gardens at Wellington, New Zealand, supported partly by private societies and partly by the municipalities. These collections are not specially rich in the very interesting and peculiar native fauna, but devote themselves preponderatingly to imported animals.

Europe.—There are a large number of zoological gardens in Europe, but those of real importance are not numerous. The Imperial Menagerie of the palace of Schönbrunn, Vienna, was founded about 1752. The public are admitted free to the greater part of the grounds, but the gardens and collection are the property of and are supported by the emperor of Austria. The collection is fine and well cared for in beautiful surroundings. The garden and large menagerie of the Royal Zoological Society of Antwerp were founded in 1843, and have been maintained at a very high level. The collection is not usually very rich in species, but there have been great and long-continued successes in the breeding of large animals such as hippopotamuses, lions and antelopes, and a very large business is done in domesticated birds, water-fowl and cage birds. The annual sales of wild animals, held in the Gardens, chiefly surplus stock from various European Gardens, are famous. The revenue is derived partly from subscriptions, partly from gate-money, from the fine concert-hall and refreshment pavilions, and from sales. The Gardens of the Zoological Society of London in Regent's Park, founded in 1828, extend to only about 35 acres, but the collection, if species and rare animals be considered rather than the number of individuals, has always been the finest in existence. The Society is not assisted by the state or the municipality, but derives its revenue from the subscriptions of Fellows, gate-money, Garden receipts and so forth. In addition to the menagerie, there is an infirmary and operating room, an anatomical and pathological laboratory, and the Society holds scientific meetings and publishes stately volumes containing the results of zoological research. Partly because of its long and successful existence, and partly because of the extensive possessions of Great Britain throughout the world, the Zoological Society of London has been able to exhibit for the first time in captivity a greater number of species of wild animals than probably the total of those shown by all other collections. The Royal Zoological Society of Ireland, founded in 1830, maintains a fine collection in the Phoenix Park at Dublin, and has been specially successful in the breeding of lions. The Bath, Clifton and West of England Zoological Society owns small but extremely well-managed Zoological Gardens, well situated on the edge of Clifton Downs. Messrs Jennison have maintained since 1831 a Zoological Collection in their pleasure Park at Belle Vue, Manchester. The animals exhibited are selected chiefly because of their popular interest, but the arrangements for housing are specially ingenious and successful, those for monkeys and snakes being notable. The Zoologisk Have at Copenhagen, founded in 1859, contains a good collection, with a specially well-designed monkey-house. At Lyons and at Marseilles in France there are beautifully situated Gardens with small collections, in each case owned and controlled by the municipalities. In Paris there are two well-known Gardens. That of the Jardin des Plantes was founded in 1793 and is under the control of the Museum authorities. It is open free to the public and generally contains a good collection of mammals. The larger and better known Jardin d'Acclimatation in the Bois de Boulogne is owned and conducted by a private company. It was founded in 1858 and is beautifully situated and well laid out. In addition to wild animals it usually contains many domesticated creatures of commercial value. In recent years it has been somewhat neglected and presents no features of special interest, but efforts are being made to revive its prosperity. Germany contained in 1910 nineteen Zoological Gardens in active existence whilst several others were in process of formation. In most cases they are associated with concert-halls and open-air restaurants, which account for much of their material prosperity, but the natural taste of the people for wild animals, and the increasing scientific and commercial enterprise of the nation have combined to make the collections rich and interesting. The great Gardens at Berlin were founded in 1844, and belong to a private company, but owe much to the interest and beneficence of the Royal House. The collection is extremely good, the houses are well constructed and sumptuously decorated, and the general management is conducted on the most adequate scientific lines. The Zoological Gardens at Breslau, founded in 1863 and owned by a private company, although not large, contain many fine buildings and are a notably well-managed institution. They possessed a fine gorilla, keeping it alive for a longer period than has been done in any other zoological collection. The beautiful Gardens at Cologne, founded in 1860, contain many interesting features and in particular one of the finest aviaries in Europe. The Gardens of the Zoological Society of Hamburg, founded in 1863, always contain a large and fine collection and display many ingenious devices for the housing of the animals. More recently C. Hagenbeck has constructed a remarkable zoological park at Stellingen, near Hamburg. The chief feature of this is a magnificent panorama, from the central point of which large collections of wild animals are visible without any intervening bars. The background consists of artificial rockwork, supported on huge wooden scaffoldings. The surface is formed of cement moulded over metal gimmel-work, and arranged to form ledges and boulders, peaks and escarpments, and faced with coloured sand and paint. It is made sufficiently strong to bear the weight of the animals, which are confined within their bounds by undercut overhanging ridges, and by deep and wide ditches, masked by rockwork. The arrangement is extremely successful from the spectacular point of view, and very suitable where most of the animals are young and in process of training. The chief gardens in Holland are at Amsterdam, owned by the society "Natura Artis Magistra." In addition to the menagerie, founded in 1838, and since then remaining one of the chief collections of the world, the Society owns a fine aquarium, and supports a museum and library. The garden at Rotterdam is also of high interest. The zoological collections of other European countries are of little importance.

Certain general remarks may be made on the efficient management of the zoological gardens.

Finance.—Disbursements for rent, rates and taxes naturally vary according to the special conditions; in a large number of cases public land is provided free of cost, and in a smaller number of cases the institutions, in view of their useful public functions, are relieved of the ordinary burden of taxation. In London, where rent, rates and taxes have all to be paid, precisely as if the gardens were a profit-distributing private institution, the annual expenditure under these headings amounts to about £2000. The staff, excluding purely scientific departments, costs about £6000 per annum; gardening department, about £1500 per annum; maintenance of buildings, enclosures, paths and so forth, about £4000 per annum; provisions for animals, about £5000 per annum; litter, water, heating and general menagerie expenses about £3000 per annum. These figures are based chiefly on the London expenditure and relate to a collection which is probably more varied than any other, but not specially large in numbers, containing on an average a little over 3000 individuals. The cost of maintaining the collection depends on the numbers received by purchase, in exchange, or presented, but for an average of about £2000 per annum a collection such as that in London can be adequately maintained. The cost of new buildings varies too much to make any individual figures useful.

Many of the zoological gardens are owned by private companies and derive their income entirely from gate-money, menagerie sales, rent of refreshment rooms, concert-halls and other auxiliary public attractions, any profits being distributed amongst the members of the company. In other cases the gardens are assisted by public authorities, in return for which a certain number of free days are given. In other cases again, as in the case of London, the income is derived partly from the subscriptions of members, who in return receive privileges as to admission, and partly from gate-money and menagerie receipts, all the income being expended on the maintenance of the institution and on scientific purposes.

Nature of Collection.—This depends to a certain extent on the object of the institution. The species and varieties of mammals and birds that have a commercial value as farmyard stock or as pets, are for the most part easy to keep, are attractive to the public and may be a source of profit. Some of the smaller gardens in Europe, and perhaps a majority of those in other parts of the world, pay much attention to this side, but the more important collections are as much as possible limited to natural species and wild animals. In theory every wild species has its place in a zoological collection, but the actual choice is limited by so many practical considerations that the better-known collections are remarkably alike. Birds and mammals take the first place; the leading collections devote a good deal of attention to reptiles and batrachians; fishes and aquatic invertebrata are most often to be found only when there are special aquaria, whilst non-aquatic invertebrates are seldom to be seen and at most consist of a few moths and butterflies, spiders, scorpions and centipedes, molluscs and crustaceans. Within these limits, the first choice falls on large and well-known creatures which every one can recognize and desires to see. The large Carnivora, lions, tigers, jaguars and leopards are the first favourites; then follow monkeys, then the large ungulates, elephants, rhinoceroses and hippopotamuses, camels and giraffes, deer and antelopes and equine animals, whilst birds are appreciated chiefly for plumage and song. Animals vary very greatly in viability (see LONGEVITY), and practical experience has shown that certain species bear captivity well, whilst others for reasons that appear to be psychological as well as physical quickly succumb. Many animals of great zoological interest, from their nocturnal habits, or natural disposition, display themselves so seldom that their possession is valueless from the point of view of the public, whilst closely allied species are not distinguished except by trained observers. If the object of a collection is simply to provide a hardy and popular exhibition, it is neither difficult nor very costly to get together and to maintain. But if the object be, as in the case of the greater zoological institutions, to get together as many species as possible, and to exhibit animals that have not been hitherto obtained, the possible range is enormous and the cost very great.

Sources of Animals.—A certain number of wild animals are born in captivity and from time to time the possession of a successful stock enables one collection to supply many others. At one time London was able to supply many Continental gardens with giraffes, and Dublin and Antwerp have had great successes with lions, whilst antelopes, sheep and cattle, deer and equine animals are always to be found breeding in one collection or another. Such stocks, however, usually fail in time, partly from too close interbreeding, partly from the ordinary chances of mortality, and partly from the cumulative effects of strange conditions. Fresh-caught wild animals have to be obtained to replenish the stock. In the majority of cases the conditions of success are that the wild creatures should be obtained as young as possible, kept in their native localities until they have become accustomed to man and to such food as they can be given at their ultimate destinations. The percentage of failure is greatest when fresh-caught adults are hurried to Europe or America. Individuals, moreover, vary greatly in their capacity to respond successfully to new conditions of life, and it is less costly and more practical if the selection be made in their natural homes. The most promising sources of new animals for collections are young creatures which have been partly tamed by hunters, traders or natives, and which have been acquired by travellers. Many of these find their way to the great shipping-ports, where there have grown up establishments that trade in wild animals. Occasionally special expeditions are arranged to procure numbers of particular birds or mammals, but these are extremely costly and the mortality is usually high.

Area and Site.—The areas occupied vary from about 300 acres (New York) to about 8 acres (Bristol, England). In the larger gardens, however, the greater part of the space is engaged by a few extensive enclosures for herds of herbivorous animals, and where no attempt is made to associate the function of a game reserve with that of a menagerie a smaller area is quite satisfactory. From the point of view of public convenience, too large a space is fatiguing and makes it more difficult to see the animals, whilst the expenses of maintenance, drainage and supervision increase out of proportion to the advantages. The older gardens have followed too closely the idea of small cages, designed to guard an animal securely rather than to display it in a fitting environment, but if exercise, light and air are provided, animals do better in a relatively small than in a relatively large enclosure. With regard to situation, the ideal would be to have the collection placed in the open country, far from centres of population. But as menageries are supported for the public and in most cases by the public, such a site is impractical, and if the soil, drainage and exposure are reasonably good, experience shows that a thriving collection may be maintained in the immediate vicinity of large towns.

Hygiene.—The first requisite is strict attention to cleanliness. A collection of animals must be compared with public institutions such as barracks, or infirmaries. There must be an abundant supply of fresh air and of water, and a drainage system as complete as possible. The soil of yards and the floors and walls of houses rapidly become contaminated, and the ideal condition would be to have an impermeable flooring covering the whole area, and supplied with suitable layers of sand, sawdust, peat-moss or other absorbent substances which can be changed at frequent intervals. The buildings should be constructed on the most modern hospital lines, with smooth walls and rounded corners, so that complete cleansing and disinfecting are possible. It has been shown abundantly, however, that even the best designed and best cared for buildings rapidly become contaminated, and it is probable that the costly and massive buildings of the more modern Gardens are erroneous in principle, and should be replaced by light and cheap structures not intended to last longer than a few years. In most temperate climates, artificial heating is necessary, at least occasionally, in many cases, but the tendency has been to be more sedulous of warmth than of ventilation. Cold-blooded animals, such as reptiles and batrachians, thrive best in an equable temperature, and, especially in the case of snakes, frequently can be induced to feed only when their temperature has been raised to a certain point. But the vast majority of birds and mammals not only can endure a large range of temperature, but thrive best when they are subjected to it. Protection from violent draught and shelter from extremes of heat and cold are necessary, but in most cases the choice is best left to the animals themselves, and the most successful arrangements consist of free exposure to the open air, with access to warmth and shelter. All collections of living beings are subject to epidemics, and in an ideal menagerie special precautions should be taken. New arrivals should be quarantined, until it is certain that they are in a satisfactory condition of health. Sickly animals should be at once isolated, and their cages and enclosures disinfected, whilst as a matter of routine the enclosure in which any animal has died should be cleansed, and according to the results of *post-mortem* examination, which should be made in every case, appropriate measures of disinfection employed.

Feeding.—The food must be as varied as possible, and special attention should be given to the frequency and quantity of the supply. It is important that no more should be supplied at a time than is necessary, as most animals rapidly foul their food, and except in a few special cases, wild animals are peculiarly liable to the evil results of stale or putrid substances. Quantities can be learned from experience, and from watching individual cases; frequency varies within very wide limits, from reptiles which at most may feed once a week and fast for long periods, to the smaller insectivorous birds which require to be fed every two or three hours, and which in the winter dark of northern latitudes must be lighted up once or twice in the night to have the opportunity of feeding. Knowledge of the habits of animals and experience are the best guides to the nature of food to be supplied, but the keepers should be required to observe the droppings of their charges and to judge from these of the extent to which any particular substances are being digested. The feeding of carnivores is on the whole the most easy; the chief pitfall being the extreme liability of all except the larger forms to fatal digestive disturbances from food that is not quite fresh. The more powerful creatures in a state of nature are accustomed to kill a prey too large to be devoured at once, and to return to it again and again, long after it has become putrid; the smaller forms, for the most part, devour nothing but small creatures immediately after they have been captured and killed, and consequently in an absolutely fresh condition. The chief danger with herbivorous and frugivorous creatures is that their constitutions are not adapted to the richness of cultivated fruits and cereals, and, in captivity, they may suffer mechanically from the want of bulk in their food supply, or if they eat a quantity sufficient in bulk, it contains an excess of nutritive material. A minor problem in menageries is injudicious feeding by visitors. Many authorities attempt to restrain visitors from feeding the animals in their charge, but such a restriction, even if practicable, is not all gain, for animals in captivity are less inclined to mope, and are more intelligent and tamer, if they become accustomed to regard visitors as pleasant sources of tit-bits.

LITERATURE.—S. S. Flower, *Notes on Zoological Collections visited in Europe in 1907* (Public Works Dept., Cairo); *Reference List of the Zoological Gardens of the World* (1910); C. V. A. Peel, *The Zoological Gardens of Europe* (London, 1903); "Bulletins of the Zoological Society of New York" (with many photographs and plans of buildings and enclosures); *Annual Reports of the Smithsonian Institution*, Washington; G. Loisel, *Rapport sur une mission scientifique dans les jardins et établissements zoologiques publics et privés du Royaume-Uni, de la Belgique et des Pays-Bas, et des États-Unis et du Canada, et conclusions générales* (Paris, Imprimerie Nationale, 1907, 1908; with many photographs and plans). (P. C. M.)

ZOOLOGICAL NOMENCLATURE, the system by which it is attempted to designate, exactly and conveniently, the animals which exist now or are known to have existed. It is, in fact, the grammar of classification, and has the advantage that it is international. The popular names of animals differ from country to country, but even amongst civilized peoples, and still more amongst uneducated persons and the lower races, the animals denoted by popular names are a very small part of existing forms, whilst the connotation of the names is vague and varying. Linnaeus was the first to adopt a precise system, which he explained and applied in 1751 in his *Philosophia botanica*, and later extended to animals in the tenth edition of his *Systema naturae* (1758). The foundation of the system was the application of a binomial nomenclature to species (see SPECIES). Each species was to be designated by two latinized names, the first being that of the genus to which it belonged, and the second the appellation peculiar to the species. There are many different cat-like animals, such as the common cat, lion, tiger and so forth, more obviously related to one another than they are to dog-like or hyaena-like carnivores. The assemblage of cats constitute the genus *Felis*, the wild cat being one species, *Felis catus*, the lion another, *Felis leo*, the tiger yet another, *Felis tigris*, and so forth. The various genera were grouped into families, the family taking its designation from the leading genus, as, for instance, the family Felidae for the cats. Families were associated in orders, as the Cats, Dogs, Bears, &c., in the order Carnivora, and the orders in Classes. There is still little uniformity in the designation of the assemblages higher than families, and less agreement as to the degree or measure of separation to be indicated by the use of the designations employed. For the system adopted in the present work, see ZOOLOGY.

Linnaeus named very many species and genera, but the number known continues to increase at a prodigious rate, while precision of description has far surpassed his conceptions, with the result that his rules have long ceased to meet the needs of modern science. In 1842 the English ornithologist, H. E. Strickland, assisted by a committee of which Charles Darwin was a member, elaborated rules which became known as the Strickland Code, and were adopted in 1845 by the American Society of Geologists and Naturalists, and in 1846 by the British Association for the Advancement of Science. In 1881. the International Congress of Geology, meeting at Bologna, constructed a code differing in many respects from that of Strickland and specially applicable to fossil forms. In 1881 the Zoological Society of France agreed on new rules, based on those of Strickland, but formulated by a committee of which Maurice Chaper and R. Blanchard were leading members. In 1885 the American Ornithologists' Union, urged by the needs of the great advance in ornithology in America, adopted rules which were still further modified from the Strickland Code. In 1894 the Zoological Society of Germany framed another set of rules drawn up by J. V. Carus, L. Doderlein and K. Möbius. In 1896 the English entomologist Lord Walsingham devised another modification of the Strickland Code, which became known as the Merton Rules, followed by many entomologists. The existence of so many conflicting authorities caused much confusion and an impractical condition of anarchy in which many distinguished and active systematists elaborated practices individual to themselves. When the International Congress of Zoology held its first meeting in Paris in 1889, one of the chief objects submitted to it was the necessity of framing rules which should be uniform in their application to the whole animal kingdom and which might receive international sanction. The discussion was carried over to the second meeting of the Congress, held at Moscow in 1892, when a code prepared by R. Blanchard was accepted. Further modifications were made, partly to reconcile it with the German Code, and a permanent commission was appointed to consider fresh points that might arise. In 1905 there was published, with the sanction of the Congress, in French, English and German (*International Rules of Zoological Nomenclature*, Paris, 1905, F. R. de Rudeval) a set of rules finally codified by MM. R. Blanchard, von Maehrenthal and C. W. Stiles, which appears to be a close approach to an international system applicable to every group in the animal kingdom. At subsequent meetings of the Congress minor alterations have been proposed and no doubt will continue to be proposed and occasionally adopted, but with one important exception, to be referred to later, fundamental lines of agreement appear to have been reached, and many of the most active workers have accepted the international code as binding. It is possible here to give only a short summary of the more important rules.

The goal to be reached is that the connotation and denotation of every zoological designation should be definite. One name is to be used for each sub-genus or higher group, two names for each species (following the invention of Linnaeus) and three names for each sub-species (a refinement not necessary in the time of Linnaeus). The scientific names must be Latin or Latinized forms. The name of a family is to be formed by adding the ending *idae*, the name of the sub-family by adding the ending *inae* to the root of the name of the genus from which it is derived, as Felidae and Felinae from *Felis*. When a generic name is changed there must be a corresponding change in the name of the family or sub-family derived from it. A generic name must consist of a single word, written with a capital initial letter, and treated as a substantive in the nominative singular. When a genus is divided into sub-genera the name of the typical sub-genus must be the same as the name of the genus, and when it is desired to cite the name of a sub-genus this name must be placed in parentheses between the generic and the specific names, as, for instance, *Vanessa* (*Vanessa*) *cardui* and *Vanessa* (*myrameis*) *cardui* respectively, for the typical sub-genus and another sub-genus of the genus *Vanessa*.

Specific names are adjectives, substantives in apposition with the generic name or substantives in the genitive; they are written with a small initial letter except when they are substantives derived from the name of a person, but even in the latter case it is permitted and is becoming usual to employ the small initial letter, as *Gazella cuvieri*. If it be desired to cite the sub-specific name, such name is written immediately following the specific name without the interposition of any mark of punctuation, as *Rana esculenta marmorata*. The author of a scientific name is that person who first publishes the name in association with a clear indication of what the name denotes, and if it be desired to cite the author's name, it should follow the specific name in a different type but without the interposition of any mark of punctuation, *e.g. Felis catus* Linnaeus. Names are merely designations, or recognition marks, and not descriptions, and hence a name is not to be rejected or changed if it is otherwise valid, because it gives a wrong description; there is no more reason why *Felis rufus* should be a ruddy cat than John Black a person of swarthy complexion; nor is a name to be rejected because of tautonomy, and thus *Apus apus apus* may be a valid designation of a sub-species if the names are otherwise valid.

It has happened frequently and continues to happen that a creature is discovered to have been given more than one name. Which of these is valid? The decision of this is one of the most difficult and controverted problems in nomenclature. In the hope of settling it by some system which should be as nearly as possible automatic and should leave the least possible to the inclination or choice of the individual worker, there was formulated what is called the rule of priority. The valid name of a genus or species is that name under which it was first designated, but with the conditions first that the name was published and accompanied by an indication, definition or description, and second that the author applied the principles of binary nomenclature. The tenth edition of Linnaeus' *Systema naturae* (1758) is the work that first consistently applied the binary system to zoology generally and is accepted as the starting-point of zoological nomenclature. Beginning from this the oldest available name is therefore to be retained. The application of the rule of priority is in many cases very difficult, but the labours of zoologists in many groups are rapidly succeeding in making the necessary direct and incidental changes in nomenclature, whilst, with regard to recent work, the rule is invaluable. A special difficulty has, however, arisen and is pressing so acutely that a most important modification is likely to be introduced. To systematists working with a large series of species in a museum or collection, one species is as important as another, and changes of names even of familiar animals are matters of little moment. But a comparatively small number of animals hold a prominent place in the attention of zoologists who are not specially systematists and of the public interested in natural history. It is complained that application of the rules of priority is changing the names of many familiar animals, designations that are sanctioned by long usage in museums and laboratories, in the famous treatises of comparative anatomy, of general biology, of travel, medicine, and the sciences and subjects closely related to zoology. There is being claimed, in fact, protection against the law of priority for a certain number of such familiar and customary appellations. The machinery for drafting such a list of exceptions exists in the permanent nomenclature commission of the International Congress of Zoology, and there is more than a hope that this change will come into operation.

To make the denotation of zoological names precise, exact workers are endeavouring to associate the conception of types with names, a process which can be made simple and definite with new work, but which presents great difficulties in the attempt to apply it to existing terms. Every family should have designated one of its genera as the type genus, every genus a type species and so forth. In the case of species or sub-species the type is a single specimen, either the only one before the author when writing his description, or one definitely selected by him, the others being paratypes. Such type specimens are the keynote of modern expert systematic work and their careful preservation and registration is of fundamental importance. A co-type is one of several specimens which have together formed the basis of a species, no one of them having been selected by the author as a type. A topotype is a specimen killed at the typical locality. (P. C. M.)

ZOOLOGY (from Gr. ζῷον, a living thing, and λόγος, theory), that portion of biology (*q.v.*) which relates to animals, as distinguished from that portion (Botany) which is concerned with plants.

HISTORY

There is something almost pathetic in the childish wonder and delight with which mankind in its earlier phases of civilization gathered up and treasured stories of strange animals from distant lands or deep seas, such as are recorded in the *Physiologus*, in Albertus Magnus, and even at the present day in the popular treatises of Japan and China. That omnivorous universally credulous stage, which may be called the "legendary," was succeeded by the age of collectors and travellers, when many of the strange stories believed in were actually demonstrated as true by the living or preserved trophies brought to Europe. The possibility of verification established verification as a habit; and the collecting of *things*, instead of the accumulating of *reports*, developed a new faculty of minute observation. The early collectors of natural curiosities were the founders of zoological science, and to this day the naturalist-traveller and his correlative, the museum curator and systematist, play a most important part in the progress of zoology. Indeed, the historical and present importance of this aspect or branch of zoological science is so great that the name "zoology" has until recently been associated entirely with it, to the exclusion of the study of minute anatomical structure and function which have been distinguished as anatomy and physiology. Anatomy and the study of animal mechanism, animal physics and animal chemistry, all of which form part of a true zoology, were excluded from the usual definition of the word by the mere accident that the zoologist had his museum but not his garden of living specimens as the botanist had;[1] and, whilst the zoologist was thus deprived of the means of anatomical and physiological study—only later supplied by the method of preserving animal bodies in alcohol—the demands of medicine for a knowledge of the structure of the human animal brought into existence a separate and special study of human anatomy and physiology.

Change in the character of the science.

From these special studies of human structure the knowledge of the anatomy of animals has proceeded, the same investigator who had made himself acquainted with the structure of the human body desiring to compare with the standard given by human anatomy the structures of other animals. Thus comparative anatomy came into existence as a branch of inquiry apart from zoology, and it was only in the latter part of the 19th century that the limitation of the word "zoology" to a knowledge of animals which expressly excludes the consideration of their internal structure was rejected by the general consent of those concerned in the progress of science. It is now generally recognized that it is mere tautology to speak of zoology *and* comparative anatomy, and that museum naturalists must give attention as well to the inside as to the outside of animals.

Scientific zoology really started in the 16th century with the awakening of the new spirit of observation and exploration, but for a long time ran a separate course uninfluenced by the progress of the medical studies of anatomy and physiology. The active search for knowledge by means of observation and experiment found its natural home in the universities. Owing to the connexion of medicine with these seats of learning, it was natural that the study of the structure and functions of the human body and of the animals nearest to man should take root there; the spirit of inquiry which now for the first time became general showed itself in the anatomical schools of the Italian universities of the 16th century, and spread fifty years later to Oxford.

In the 17th century the lovers of the new philosophy, the investigators of nature by means of observation and experiment, banded themselves into academies or societies for mutual support and intercourse. The first founded of surviving European academies, the Academia Naturae Curiosorum (1651),[2] especially confined itself to the description and illustration of the structure of plants and animals; eleven years later (1662) the Royal Society of London was incorporated by royal charter, having existed without a name or fixed organization for seventeen years previously (from 1645). A little later the Academy of Sciences of Paris was established by Louis XIV. The influence of these great academies of the 17th century on the progress of zoology was precisely to effect that bringing together of the museum-men and the physicians or anatomists which was needed for further development. Whilst the race of collectors and systematizers culminated in the latter part of the 18th century in Linnaeus, a new type of student made its appearance in such men as John Hunter and other anatomists, who, not satisfied with the superficial observations of the popular "zoologists," set themselves to work to examine anatomically the whole animal kingdom, and to classify its members by aid of the results of such profound study. Under the influence of the touchstone of strict inquiry set on foot by the Royal Society, the marvels of witchcraft, sympathetic powders and other relics of medieval superstition disappeared like a mist before the sun, whilst accurate observations and demonstrations of a host of new wonders accumulated, amongst which were numerous contributions to the anatomy of animals, and none perhaps more noteworthy than the observations, made by the aid of microscopes constructed by himself, of Leeuwenhoek, the Dutch naturalist (1683), some of whose instruments were presented by him to the society.

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[1] The medieval attitude towards both plants and animals had no relation to real knowledge, but was part of a peculiar and in itself highly interesting mysticism. A fantastic and elaborate doctrine of symbolism existed which comprised all nature; witchcraft, alchemy and medicine were its practical expressions. Animals as well as plants were regarded as "simples" and used in medicine, and a knowledge of them was valued from this point of view.

[2] The Academia Secretorum Naturae was founded at Naples in 1560, but was suppressed by the ecclesiastical authorities.

It was not until the 19th century that the microscope, thus early applied by Leeuwenhoek, Malpighi, Hook and Swammerdam to the study of animal structure, was perfected as an instrument, and accomplished for zoology its final and most important service. The perfecting of the microscope led to a full comprehension of the great doctrine of cell-structure and the establishment of the facts—(1) that all organisms are either single corpuscles (so-called cells) of living material (microscopic animalcules, &c.) or are built up of an immense number of such units; (2) that all organisms begin their individual existence as a single unit or corpuscle of living substance, which multiplies by binary fission, the products growing in size and multiplying similarly by binary fission; and (3) that the life of a multicellular organism is the sum of the activities of the corpuscular units of which it consists, and that the processes of life must be studied in and their explanation obtained from an understanding of the chemical and physical changes which go on in each individual corpuscle or unit of living material or protoplasm.

Ideas of development.

Meanwhile the astronomical theories of development of the solar system from a gaseous condition to its present form, put forward by Kant and by Laplace, had impressed men's minds with the conception of a general movement of spontaneous progress or development in all nature. The science of geology came into existence, and the whole panorama of successive stages of the earth's history, each with its distinct population of strange animals and plants, unlike those of the present day and simpler in proportion as they recede into the past, was revealed by Cuvier, Agassiz and others. The history of the crust of the earth was explained by Lyell as due to a process of slow development, in order to effect which he called in no cataclysmic agencies, no mysterious forces differing from those operating at the present day. Thus he carried on the narrative of orderly development from the point at which it was left by Kant and Laplace—explaining by reference to the ascertained laws of physics and chemistry the configuration of the earth, its mountains and seas, its igneous and its stratified rocks, just as the astronomers had explained by those same laws the evolution of the sun and planets from diffused gaseous matter of high temperature. The suggestion that living things must also be included in this great development was obvious.

The Natur-philosophen.

The delay in the establishment of the doctrine of organic evolution was due, not to the ignorant and unobservant, but to the leaders of zoological and botanical science. Knowing the almost endless complexity of organic structures, realizing that man himself with all the mystery of his life and consciousness must be included in any explanation of the origin of living things, they preferred to regard living things as something apart from the rest of nature, specially cared for, specially created by a Divine Being. Thus it was that the so-called "Natur-philosophen" of the last decade of the 18th century, and their successors in the first quarter of the 19th, found few adherents among the working zoologists and botanists. Lamarck, Treviranus, Erasmus Darwin, Goethe, and Saint-Hilaire preached to deaf ears, for they advanced the theory that living beings had developed by a slow process of transmutation in successive generations from simpler ancestors, and in the beginning from simplest formless matter, without being able to demonstrate any existing mechanical causes by which such development must necessarily be brought about. They were met by the criticism that possibly such a development had taken place; but, as no one could show as a simple fact of observation that it *had* taken place, nor as a result of legitimate inference that it *must* have taken place, it was quite as likely that the past and present species of animals and plants had been separately created or individually brought into existence by unknown and inscrutable causes, and (it was held) the truly scientific man would refuse to occupy himself with such fancies, whilst ever continuing to concern himself with the observation and record of indisputable facts. The critics did well; for the "Natur-philosophen," though right in their main conception, were premature.

Darwin's doctrine of organic evolution.

It was reserved for Charles Darwin, in the year 1859, to place the whole theory of organic evolution on a new footing, and by his discovery of a mechanical cause actually existing and demonstrable by which organic evolution must be brought about, entirely to change the attitude in regard to it of even the most rigid exponents of the scientific method. Darwin succeeded in establishing the doctrine of organic evolution by the introduction into the web of the zoological and botanical sciences of a new science. The subject-matter of this new science, or branch of biological science, had been neglected: it did not form part of the studies of the collector and systematist, nor was it a branch of anatomy, nor of the physiology pursued by medical men, nor again was it included in the field of microscopy and the cell-theory. The area of biological knowledge which Darwin was the first to subject to scientific method and to render, as it were, contributory to the great stream formed by the union of the various branches, is that which relates to the breeding of animals and plants, their congenital variations, and the transmission and perpetuation of those variations. This branch of biological science may be called thremmatology (θρέμμα, "a thing bred"). Outside the scientific world an immense mass of observation and experiment had grown up in relation to this subject. From the earliest times the shepherd, the farmer, the horticulturist, and the "fancier" had for practical purposes made themselves acquainted with a number of biological laws, and successfully applied them without exciting more than an occasional notice from the academic students of biology. It is one of Darwin's great merits to have made use of these observations and to have formulated their results to a large extent as the laws of variation and heredity. As the breeder selects a congenital variation which suits his requirements, and by breeding from the animals (or plants) exhibiting that variation obtains a new breed specially characterized by that variation, so in nature is there a selection amongst all the congenital variations of each generation of a species. This selection depends on the fact that more young are born than the natural provision of food will support. In consequence of this excess of births there is a struggle for existence and a survival of the fittest, and consequently an ever-present necessarily acting selection, which either maintains accurately the form of the species from generation to generation or leads to its modification in correspondence with changes in the surrounding circumstances which have relation to its fitness for success in the struggle for life.

Darwin's introduction of thremmatology into the domain of scientific biology was accompanied by a new and special development of a branch of study which had previously been known as teleology, the study of the adaptation of organi

New development of teleology.

structures to the service of the organisms in which they occur. It cannot be said that previously to Darwin there had been any very profound study of teleology, but it had been the delight of a certain type of mind—that of the lovers of nature or naturalists *par excellence*, as they were sometimes termed—to watch the habits of living animals and plants, and to point out the remarkable ways in which the structure of each variety of organic life was adapted to the special circumstances of life of the variety or species. The astonishing colours and grotesque forms of some animals and plants which the museum zoologists gravely described without comment were shown by these observers of living nature to have their significance in the economy of the organism possessing them; and a general doctrine was recognized, to the effect that no part or structure of an organism is without definite use and adaptation, being *designed* by the Creator for the benefit of the creature to which it belongs, or else for the benefit, amusement or instruction of his highest creature—man. Teleology in this form of the doctrine of design was never very deeply rooted amongst scientific anatomists and systematists. It was considered permissible to speculate somewhat vaguely on the subject of the utility of this or that startling variety of structure; but few attempts, though some of great importance, were made systematically to explain by observation and experiment the adaptation of organic structures to particular purposes in the case of the lower animals and plants. Teleology had, indeed, an important part in the development of physiology—the knowledge of the mechanism, the physical and chemical properties, of the parts of the body of man and the higher animals allied to him. But, as applied to lower and more obscure forms of life, teleology presented almost insurmountable difficulties; and consequently, in place of exact experiment and demonstration, the most reckless though ingenious assumptions were made as to the utility of the parts and organs of lower animals. Darwin's theory had as one of its results the reformation and rehabilitation of teleology. According to that theory, every organ, every part, colour and peculiarity of an organism, must either be of benefit to that organism itself or have been so to its ancestors:[1] no peculiarity of structure or general conformation, no habit or instinct in any organism, can be supposed to exist for the benefit or amusement of another organism, not even for the delectation of man himself. Necessarily, according to the theory of natural selection, structures either are present because they are selected as useful or because they are still inherited from ancestors to whom they were useful, though no longer useful to the existing representatives of those ancestors. Structures previously inexplicable were now explained as survivals from a past age, no longer useful though once of value. Every variety of form and colour was urgently and absolutely called upon to produce its title to existence either as an active useful agent or as a survival. Darwin himself spent a large part of the later years of his life in thus extending the new teleology.

The old doctrine of types, which was used by the philosophically minded zoologists (and botanists) of the first half of the 19th century as a ready means of explaining the failures and difficulties of the doctrine of design, fell into its proper place under the new dispensation. The adherence to type, the favourite conception of the transcendental morphologist, was seen to be nothing more than the expression of one of the laws of thremmatology, the persistence of hereditary transmission of ancestral characters, even when they have ceased to be significant or valuable in the struggle for existence, whilst the so-called evidences of design which was supposed to modify the limitations of types assigned to Himself by the Creator were seen to be adaptations due to the selection and intensification by selective breeding of fortuitous congenital variations, which happened to prove more useful than the many thousand other variations which did not survive in the struggle for existence.

Effects of Darwin's theory upon zoology.

Thus not only did Darwin's theory give a new basis to the study of organic structure, but, whilst rendering the general theory of organic evolution equally acceptable and necessary, it explained the existence of low and simple forms of life as survivals of the earliest ancestry of more highly complex forms, and revealed the classifications of the systematist as unconscious attempts to construct the genealogical tree or pedigree of plants and animals. Finally, it brought the simplest living matter or formless protoplasm before the mental vision as the starting-point whence, by the operation of necessary mechanical causes, the highest forms have been evolved, and it rendered unavoidable the conclusion that this earliest living material was itself evolved by gradual processes, the result also of the known and recognized laws of physics and chemistry, from material which we should call not living. It abolished the conception of life as an entity above and beyond the common properties of matter, and led to the conviction that the marvellous and exceptional qualities of that which we call "living" matter are nothing more nor less than an exceptionally complicated development of those chemical and physical properties which we recognize in a gradually ascending scale of evolution in the carbon compounds, containing nitrogen as well as oxygen, sulphur and hydrogen as constituent atoms of their enormous molecules. Thus mysticism was finally banished from the domain of biology, and zoology became one of the physical sciences—the science which seeks to arrange and discuss the phenomena of animal life and form, as the outcome of the operation of the laws of physics and chemistry.

Scope of zoology.

A subdivision of zoology which was at one time in favour is simply into morphology and physiology, the study of form and structure on the one hand, and the study of the activities and functions of the forms and structures on the other. But a logical division like this is not necessarily conducive to the ascertainment and remembrance of the historical progress and present significance of the science. No such distinction of mental activities as that involved in the division of the study of animal life into morphology and physiology has ever really existed: the investigator of animal forms has never entirely ignored the functions of the forms studied by him, and the experimental inquirer into the functions and properties of animal tissues and organs has always taken very careful account of the forms of those tissues and organs. A more instructive subdivision must be one which corresponds to the separate currents of thought and mental preoccupation which have been historically manifested in western Europe in the gradual evolution of what is to-day the great river of zoological doctrine to which they have all been rendered contributory.

It must recognize the following five branches of zoological study:—

1. *Morphography.*—The work of the collector and systematist: exemplified by Linnaeus and his predecessors, by Cuvier, Agassiz, Haeckel.
2. *Bionomics.*—The lore of the farmer, gardener, sportsman, fancier and field-naturalist, including thremmatology, or the science of breeding, and the allied teleology, or science of organic adaptations: exemplified by the patriarch Jacob, the poet Virgil, Sprengel, Kirby and Spence, Wallace and Darwin.

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[1] A very subtle and important qualification of this generalization has to be recognized (and was recognized by Darwin) in the fact that owing to the interdependence of the parts of the bodies of living things and their profound chemical interactions and peculiar structural balance (what is called organic polarity) the variation of one single part (a spot of colour, a tooth, a claw, a leaflet) may, and demonstrably does in many cases entail variation of other parts—what are called *correlated* variations. Hence many structures which are obvious to the eye, and serve as distinguishing marks of separate species, are really not themselves of value or use, but are the necessary concomitants of less obvious and even altogether obscure qualities, which are the real characters upon which selection is acting. Such "correlated variations" may attain to great size and complexity without being of use. But eventually they may in turn become, in changed conditions, of selective value. Thus in many cases the difficulty of supposing that selection has acted on minute and imperceptible initial variations, so small as to have no selective value, may be got rid of. A useless "correlated variation" may have attained great volume and quality before it is (as it were) seized upon and perfected by natural selection. All organisms are essentially and necessarily built up by such correlated variations.

3. *Zoo-Dynamics, Zoo-Physics, Zoo-Chemistry.*—The pursuit of the learned physician,—anatomy and physiology: exemplified by Harvey, Haller, Hunter, Johann Müller.
4. *Plasmology.*—The study of the ultimate corpuscles of living matter, their structure, development and properties, by the aid of the microscope; exemplified by Malpighi, Hook, Schwann, Kowalewsky.
5. *Philosophical Zoology.*—General conceptions with regard to the relations of living things (especially animals) to the universe, to man, and to the Creator, their origin and significance: exemplified in the writings of the philosophers of classical antiquity, and of Linnaeus, Goethe, Lamarck, Cuvier, Lyell, H. Spencer and Darwin.

It is unnecessary to follow in this article all these subjects, since they are for the most part treated under separate headings, not indeed under these names—which are too comprehensive for that purpose—but under those of the more specific questions which arise under each. Thus *Bionomics* is treated in such articles as EVOLUTION, HEREDITY, VARIATION, MENDELISM, REPRODUCTION, SEX, &c.; *Zoo-dynamics* under MEDICINE, SURGERY, PHYSIOLOGY, ANATOMY, EMBRYOLOGY, and allied articles; *Plasmology* under CYTOLOGY, PROTOPLASM, &c.; and *Philosophical Zoology* under numerous headings, EVOLUTION, BIOLOGY, &c. See also ZOOLOGICAL DISTRIBUTION, PALAEONTOLOGY, OCEANOGRAPHY, MICROTOMY, &c.

It will be more appropriate here, without giving what would be a needless repetition of considerations, both historical and theoretical, which appear in other articles, to confine ourselves to two general questions, (1) the history of the various schemes of classification, or *Morphography*, and (2) the consideration of the main tendencies in the study of zoology since Darwin.

SYSTEMS OF CLASSIFICATION

Morphography includes the systematic exploration and tabulation of the facts involved in the recognition of all the recent and extinct kinds of animals and their distribution in space and time. (1) The museum-makers of old days and their modern representatives the curators and describers of zoological collections, (2) early explorers and modern naturalist-travellers and writers on zoo-geography, and (3) collectors of fossils and palaeontologists are the chief varieties of zoological workers coming under this head. Gradually since the time of Hunter and Cuvier anatomical study has associated itself with the more superficial morphography until to-day no one considers a study of animal form of any value which does not include internal structure, histology and embryology in its scope.

Edward Wotton.

The real dawn of zoology after the legendary period of the middle ages is connected with the name of an Englishman, Edward Wotton, born at Oxford in 1492, who practised as a physician in London and died in 1555. He published a treatise *De differentiis animalium* at Paris in 1552. In many respects Wotton was simply an exponent of Aristotle, whose teaching, with various fanciful additions, constituted the real basis of zoological knowledge throughout the middle ages. It was Wotton's merit that he rejected the legendary and fantastic accretions, and returned to Aristotle and the observation of nature.

Aristotle's classification.

The most ready means of noting the progress of zoology during the 16th, 17th and 18th centuries is to compare the classificatory conceptions of successive naturalists with those which are to be found in the works of Aristotle himself. Aristotle did not definitely and in tabular form propound a classification of animals, but from a study of his treatises *Historia animalium*, *De generatione animalium*, and *De partibus animalium* the following classification can be arrived at:—

A. **Ἔναιμα**, blood-holding animals (=*Vertebrata*).
1. *Ζωοτοκοῦντα ἐν αὑτοῖς*, viviparous *Enaema* (=Mammals, including the Whale).
2. *Ὄρνιθες* (=Birds).
3. *Τετράποδα ἢ ἄποδα ᾠοτοκοῦντα*, four-footed or legless *Enaema* which lay eggs (=Reptiles and *Amphibia*).
4. *Ἰχθύες* (=Fishes).

B. **Ἄναιμα**, bloodless animals (=*Invertebrata*).
1. *Μαλάκια*, soft-bodied *Anaema* (=*Cephalopoda*).
2. *Μαλακόστρακα*, soft-shelled *Anaema* (=*Crustacea*).
3. *Ἔντομα*, insected *Anaema* or Insects (=*Arthropoda*, exclusive of *Crustacea*).
4. *Ὀστρακοδέρματα*, shell-bearing *Anaema* (=*Echini*, *Gastropoda* and *Lamellibranchia*).

Wotton's modifications.

Wotton follows Aristotle[1] in the division of animals into the *Enaema* and the *Anaema*, and in fact in the recognition of all the groups above given, adding only one large group to those recognized by Aristotle under the *Anaema*, namely, the group of *Zoophyta*, in which Wotton includes the *Holothuriae*, Star-Fishes, *Medusae*, Sea-Anemones and Sponges. Wotton divides the viviparous quadrupeds into the many-toed, double-hoofed and single-hoofed. By the introduction of a method of classification which was due to the superficial Pliny—depending, not on structure, but on the medium inhabited by an animal, whether earth, air or water—Wotton is led to associate Fishes and Whales as aquatic animals. But this is only a momentary lapse, for he broadly distinguishes the two kinds.

Gesner.

The Swiss professor, Konrad Gesner (1516–1565), is the most voluminous and instructive of these earliest writers on systematic zoology, and was so highly esteemed that his *Historia animalium* was republished a hundred years after his death. His great work appeared in successive parts—*e.g. Vivipara, ovipara, aves, pisces, serpentes et scorpio*—and contains descriptions and illustrations of a large number of animal forms with reference to the lands inhabited by them. Gesner's work, like that of John Johnstone (b. 1603), who was of Scottish descent and studied at St Andrews, and like that of Ulysses Aldrovandi of Bologna (b. 1522), was essentially a compilation, more or less critical, of all such records, pictures and relations concerning beasts, birds, reptiles, fishes and monsters as could be gathered together by one reading in the great libraries of Europe, travelling from city to city, and frequenting the company of those who either had themselves passed into distant lands or possessed the letters written and sometimes the specimens brought home by adventurous persons.

Medical anatomists and microscopists.

The exploration of parts of the New World next brought to hand descriptions and specimens of many novel forms of animal life, and in the latter part of the 16th century and the beginning of the 17th that careful study by "specialists" of the structure and life-history of particular groups of animals was commenced, which, directed at first to common and familiar kinds, was gradually extended until it formed a sufficient body of knowledge to serve as an anatomical basis for classification. This minuter study had two origins, one in the researches of the medical anatomists, such as Fabricius (1537–1619), Severinus (1580–1656), Harvey (1578–1657), and Tyson (1649–1708), the other in the careful work of the entomologists and first microscopists, such as Malpighi (1628–1694), Swammerdam (1637–1680), and Hook (1635–1702). The commencement of anatomical investigations deserves notice here as influencing the general accuracy and minuteness with which zoological work was prosecuted, but it was not until a late date that their full influence was brought to bear upon systematic zoology by Georges Cuvier (1769–1832).

John Ray.

The most prominent name between that of Gesner and Linnaeus in the history of systematic zoology is that of John Ray (1628–1705). A chief merit of Ray is to have limited the term "species" and to have assigned to it the significance which it bore till the Darwinian era, whereas previously it was loosely and vaguely applied. He also made considerable use of anatomical characters in his definitions of larger groups, and may thus be considered as the father of modern zoology. Associated with Ray in his work, and more especially occupied with the study of the Worms and *Mollusca*, was Martin Lister (1638–1712), celebrated also as the author of the first geological map.

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[1] If we remember that by "blood" Aristotle understood "red blood," and that he did not know of the existence of colourless blood, his primary division is not a bad one. One can imagine the interest and astonishment with which the great Greek would have been filled had some unduly precocious disciple shown to him the red-blood-system of the marine terrestrial Annelids; the red blood of *Planorbis*, of *Apus cancriformis*, and of the Mediterranean razor shell, *Solen legumen*.

From Ray to Linnaeus.

After Ray's death the progress of anatomical knowledge, and of the discovery and illustration of new forms of animal life from distant lands, continued with increasing vigour. We note the names of Vallisnieri (1661–1730) and Alexander Monro (1697–1767); the travellers Tournefort (1656–1708) and Shaw (1692–1751); the collectors Rumphius (1637–1706) and Hans Sloane (1660–1753); the entomologist Réaumur (1683–1757); Lhwyd (1703) and Linck (1674–1734), the students of Star-Fishes; Peyssonel (b. 1694), the investigator of Polyps and the opponent of Marsigli and Réaumur, who held them to be plants; Woodward, the palaeontologist (1665–1722)—not to speak of others of less importance.

Linnaeus.

Two years after Ray's death Carl Linnaeus (1707–1778) was born. Unlike Jacob Theodore Klein (1685–1759), whose careful treatises on various groups of plants and animals were published during the period between Ray and Linnaeus, the latter had his career marked out for him in a university, that of Upsala, where he was first professor of medicine and subsequently of natural history. His lectures formed a new departure in the academic treatment of zoology and botany, which, in direct continuity from the middle ages, had hitherto been subjected to the traditions of the medical profession and regarded as mere branches of "materia medica." Linnaeus taught zoology and botany as branches of knowledge to be studied for their own intrinsic interest. His great work, the *Systema naturae*, ran through twelve editions during his lifetime (1st ed. 1735, 12th 1768). Apart from his special discoveries in the anatomy of plants and animals, and his descriptions of new species, the great merit of Linnaeus was his introduction of a method of enumeration and classification which may be said to have created systematic zoology and botany in their present form, and establishes his name for ever as the great organizer, the man who recognized a great practical want in the use of language and supplied it. Linnaeus adopted Ray's conception of species, but he made species a practical reality by insisting that every species shall have a double Latin name—the first half to be the name of the genus common to several species, and the second half to be the specific name. Previously to Linnaeus long many-worded names had been used, sometimes with one additional adjective, sometimes with another, so that no true *names* were fixed and accepted. Linnaeus by his binomial system made it possible to write and speak with accuracy of any given species of plant or animal. He was, in fact, the Adam of zoological science. He proceeded further to introduce into his enumeration of animals and plants a series of groups, viz. genus, order, class, which he compared to the subdivisions of an army or the subdivisions of a territory, the greater containing several of the less, as follows:—

Class.	Order.	Genus.	Species.	Variety.
Genus summum.	Genus intermedium.	Genus proximum.	Species.	Individuum.
Provincia.	Territorium.	Paroecia.	Pagus.	Domicilium.
Legio.	Cohors.	Manipulus.	Contubernium.	Miles.

Linnaeus himself recognized the purely subjective character of his larger groups; for him species were, however, objective: "there are," he said, "just so many species as in the beginning the Infinite Being created." It was reserved for a philosophic zoologist of the 19th century (Agassiz, *Essay on Classification*, 1859) to maintain that genus, order and class were also objective facts capable of precise estimation and valuation. This climax was reached at the very moment when Darwin was publishing the *Origin of Species* (1859), by which universal opinion has been brought to the position that species, as well as genera, orders and classes, are the subjective expressions of a vast ramifying pedigree in which the only objective existences are individuals, the apparent species as well as higher groups being marked out, not by any distributive law, but by the interaction of living matter and its physical environment, causing the persistence of some forms and the destruction of vast series of ancestral intermediate kinds.

Classification of Linnaeus.

The classification of Linnaeus (from *Syst. Nat.*, 12th ed., 1766) should be compared with that of Aristotle. It is as follows—the complete list of Linnaean genera being here reproduced:—

Class I. MAMMALIA.
Order 1. *Primates.*
Genera: *Homo, Simia, Lemur, Vespertilio.*
„ 2. *Bruta.*
Genera: *Elephas, Trichecus, Bradypus, Myrmecophaga, Manis, Dasypus.*
„ 3. *Ferae.*
Genera: *Phoca, Canis, Felis, Viverra, Mustela, Ursus, Didelphys, Talpa, Sorex, Erinaceus.*
„ 4. *Glires.*
Genera: *Hystrix, Lepus, Castor, Mus, Sciurus, Noctilio.*
„ 5. *Pecora.*
Genera: *Camelus, Moschus, Cervus, Capra, Ovis, Bos.*
„ 6. *Belluae.*
Genera: *Equus, Hippopotamus, Sus, Rhinoceros.*
„ 7. *Cete.*
Genera: *Monodon, Balaena, Physeter, Delphinus.*

Class II. AVES.
Order 1. *Accipitres.*
Genera: *Vultur, Falco, Strix, Lanius.*
„ 2. *Picae.*
Genera: (*a*) *Trochilus, Certhia, Upupa, Buphaga, Sitta, Oriolus, Coracias, Gracula, Corvus, Paradisea;* (*b*) *Ramphastos, Trogon, Psittacus, Crotophaga, Picus, Yunx, Cuculus, Bucco;* (*c*) *Buceros, Alcedo, Merops, Todos.*
„ 3. *Anseres.*
Genera: (*a*) *Anas, Mergus, Phaethon, Plotus;* (*b*) *Rhyncops, Diomedea, Alca, Procellaria, Pelecanus, Larus, Sterna, Colymbus.*
„ 4. *Grallae.*
Genera: (*a*) *Phoenicopterus, Platalea, Palamedea, Mycteria, Tantalus, Ardea, Recurvirostra, Scolopax, Tringa, Fulica, Parra, Rallus, Psophia, Cancroma;* (*b*) *Hematopus, Charadrius, Otis, Struthio.*
„ 5. *Gallinae.*
Genera: *Didus, Pavo, Meleagris, Crax, Phasianus, Tetrao, Numida.*
„ 6. *Passeres.*
Genera. (*a*) *Loxia, Fringilla, Emberiza;* (*b*) *Caprimulgus, Hirundo, Pipra;* (*c*) *Turdus, Ampelis, Tanagra, Muscicapa;* (*d*) *Parus, Motacilla, Alauda, Sturnus, Columba.*

Class III. AMPHIBIA.
Order 1. *Reptilia.*
Genera: *Testudo, Draco, Lacerta, Rana.*
„ 2. *Serpentes.*
Genera: *Crotalus, Boa, Coluber, Anguis, Amphisbaena, Caecilia.*
„ 3. *Nantes.*
Genera: *Petromyzon, Raja, Squalus, Chimaera, Lophius, Acipenser, Cyclopterus, Balistes, Ostracion, Tetrodon, Diodon, Centriscus, Syngnathus, Pegasus.*

Class IV. PISCES.
Order 1. *Apodes.*
Genera: *Muraena, Gymnotus, Trichiurus, Anarrhichas, Ammodytes, Ophidium, Stromateus, Xiphias.*
„ 2. *Jugulares.*
Genera: *Callionymus, Uranoscopus, Trachinus, Gadus, Blennius.*
„ 3. *Thoracici.*
Genera: *Cepola, Echeneis, Coryphaena, Gobius, Cottus, Scorpaena, Zeus, Pleuronectes, Chaetodon, Sparus, Labrus, Sciaena, Perca, Gasterosteus, Scomber, Mullus, Trigla.*
„ 4. *Abdominales.*
Genera: *Cobitis, Amia, Silurus, Zeuthis, Loricaria, Salmo, Fistularia, Esox, Elops, Argentina, Atherina, Mugil, Mormyrus, Exocoetus, Polynemus, Clupea, Cyprinus.*

Class V. INSECTA.
- Order 1. *Coleoptera.*
  - Genera: (*a*) *Scarabaeus, Lucanus, Dermestes, Hister, Byrrhus, Gyrinus, Attelabus, Curculio, Silpha, Coccinella;* (*b*) *Bruchus, Cassida, Ptinus, Chrysomela, Hispa, Meloe, Tenebrio, Lampyris, Mordella, Staphylinus;* (*c*) *Cerambyx, Leptura, Cantharis, Elater, Cicindela, Buprestis, Dytiscus, Carabus, Necydalis, Forficula.*
- ,, 2. *Hemiptera.*
  - Genera: *Blatta, Mantis, Gryllus, Fulgora, Cicada, Notonecta, Nepa, Cimex, Aphis, Chermes, Coccus, Thrips.*
- ,, 3. *Lepidoptera.*
  - Genera: *Papilio, Sphinx, Phalaena.*
- ,, 4. *Neuroptera.*
  - Genera: *Libellula, Ephemera, Myrmeleon, Phryganea, Hemerobius, Panorpa, Raphidia.*
- ,, 5. *Hymenoptera.*
  - Genera: *Cynips, Tenthredo, Sirex, Ichneumon, Sphex, Chrysis, Vespa, Apis, Formica, Mutilla.*
- ,, 6. *Diptera.*
  - Genera: *Oestrus, Tipula, Musca, Tabanus, Culex, Empis, Conops, Asilus, Bombylius, Hippobosca.*
- ,, 7. *Aptera.*
  - Genera: (*a*) Pedibus sex; capite a thorace discreto: *Lepisma, Podura, Termes, Pediculus, Pulex.*
    - (*b*) Pedibus 8–14; capite thoraceque unitis: *Acarus, Phalangium, Aranea, Scorpio, Cancer, Monoculus, Oniscus.*
    - (*c*) Pedibus pluribus; capite a thorace discreto: *Scolopendra, Julus.*

Class VI. VERMES.
- Order 1. *Intestina.*
  - Genera: (*a*) Pertusa laterali poro: *Lumbricus, Sipunculus, Fasciola.*
    - (*b*) Imperforata poro laterali nullo: *Gordius, Ascaris, Hirudo, Myxine.*
- ,, 2. *Mollusca.*
  - Genera: (*a*) Ore supero; basi se affigens: *Actinia, Ascidia.*
    - (*b*) Ore antico; corpore pertuso laterali foraminulo: *Limax, Aplysia, Doris, Tethis.*
    - (*c*) Ore antico; corpore tentaculis antice cincto: *Holothuria, Terebella.*
    - (*d*) Ore antico; corpore brachiato: *Triton, Sepia, Clio, Lernaea, Scyllaea.*
    - (*e*) Ore antico; corpore pedato: *Aphrodita, Nereis.*
    - (*f*) Ore infero centrali: *Medusa, Asteria, Echinus.*
- ,, 3. *Testacea.*
  - Genera: (*a*) Multivalvia: *Chiton, Lepas, Pholas.*
    - (*b*) Bivalvia (=*Conchae*): *Mya, Solen, Tellina, Cardium, Mactra, Donax, Venus, Spondylus, Chama, Arca, Ostrea, Anomia, Mytilus, Pinna.*
    - (*c*) Univalvia spira regulari (=*Cochleae*): *Argonauta, Nautilus, Conus, Cypraea, Bulla, Voluta, Buccinum, Strombus, Murex, Trochus, Turbo, Helix, Nerita, Haliotis.*
    - (*d*) Univalvia absque spira regulari: *Patella, Dentalium, Serpula, Teredo, Sabella.*
- ,, 4. *Lithophyta.*
  - Genera: *Tubipora, Madrepora, Millepora, Cellepora.*
- ,, 5. *Zoophyta.*
  - Genera: (*a*) Fixata: *Isis, Gorgonia, Alcyonium, Spongia, Flustra, Tubularia, Corallina, Sertularia, Vorticella.*
    - (*b*) Locomotiva: *Hydra, Pennatula, Taenia, Volvox, Furia, Chaos.*

The characters of the six classes are thus given by Linnaeus:—

Cor biloculare, biauritum; Sanguine calido, rubro:	viviparis, *Mammalibus*; oviparis, *Avibus.*
Cor uniloculare, uniauritum;[1] Sanguine frigido, rubro:	pulmone arbitrario, *Amphibiis*; branchiis externis, *Piscibus.*
Cor uniloculare, inauritum; Sanie frigida, albida:	antennatis, *Insectis*; tentaculatis, *Vermibus.*

From Linnaeus to Cuvier.

Between Linnaeus and Cuvier there are no very great names; but under the stimulus given by the admirable method and system of Linnaeus observation and description of new forms from all parts of the world, both recent and fossil, accumulated. We can only cite the names of Charles Bonnet (1720–1793), the entomologist, who described the reproduction of *Aphis;* Banks and Solander, who accompanied Captain Cook on his first voyage (1768–1771); Thomas Pennant (1726–1798), the describer of the English fauna; Peter Simon Pallas (1741–1811), who specially extended the knowledge of the Linnaean *Vermes*, and under the patronage of the empress Catherine explored Russia and Siberia; De Geer (1720–1778), the entomologist; Lyonnet (1707–1789), the author of the monograph of the anatomy of the caterpillar of *Cossus ligniperdus;* Cavolini (1756–1810), the Neapolitan marine zoologist and forerunner of Della Chiaje (fl. 1828); O. F. Müller (1730–1784), the describer of fresh-water *Oligochaeta;* Abraham Trembley (1700–1784), the student of *Hydra;* and O. F. Ledermüller (1719–1769), the inventor of the term *Infusoria.* The effect of the Linnaean system upon the general conceptions of zoologists was no less marked than were its results in the way of stimulating the accumulation of accurately observed details. The notion of a *scala naturae*, which had since the days of classical antiquity been a part of the general philosophy of nature amongst those who occupied themselves with such conceptions, now took a more definite form in the minds of skilled zoologists. The species of Linnaeus were supposed to represent a series of steps in a scale of ascending complexity, and it was thought possible thus to arrange the animal kingdom in a single series—the orders within the classes succeeding one another in regular gradation, and the classes succeeding one another in a similar rectilinear progression.

Lamarck's classification.

J. B. P. de Lamarck (1744–1829) represents most completely, both by his development theory (to be further mentioned below) and by his scheme of classification, the high-water mark of the popular but fallacious conception of a *scala naturae.* His classification (1801–1812) is as follows:—

Invertebrata.
- 1. *Apathetic Animals.*
  - Class I. INFUSORIA.
    - Orders: *Nuda, Appendiculata.*
  - Class II. POLYPI.
    - Orders: *Ciliati* (*Rotifera*), *Denudati* (Hydroids), *Vaginati* (*Anthozoa* and *Polyzoa*), *Natantes* (Crinoids).
  - Class III. RADIARIA.
    - Orders: *Mollia* (*Acalephae*), *Echinoderma* (including *Actiniae*).
  - Class IV. TUNICATA.
    - Orders: *Bothryllaria, Ascidia.*
  - Class V. VERMES.
    - Orders: *Molles* (Tape-Worms and Flukes), *Rigiduli* (Nematoids), *Hispiduli* (*Nais*, &c.), *Epizoariae* (Lernaeans, &c.).
- 2. *Sensitive Animals.*
  - Class VI. INSECTA (*Hexapoda*).
    - Orders: *Aptera, Diptera, Hemiptera, Lepidoptera, Hymenoptera, Neuroptera, Orthoptera, Coleoptera.*
  - Class VII. ARACHNIDA.
    - Orders: *Antennato-Trachealia* (=*Thysanura* and *Myriapoda*), *Exantennato-Trachealia, Exantennato-Branchialia.*
  - Class VIII. CRUSTACEA.
    - Orders: *Heterobranchia* (*Branchiopoda, Isopoda, Amphipoda, Stomapoda*), *Homobranchia* (*Decapoda*).
  - Class IX. ANNELIDA.
    - Orders: *Apoda, Antennata, Sedentaria.*
  - Class X. CIRRIPEDIA.
    - Orders: *Sessilia, Pedunculata.*
  - Class XI. CONCHIFERA.
    - Orders: *Dimyaria, Monomyaria.*
  - Class XII. MOLLUSCA.
    - Orders: *Pteropoda, Gasteropoda, Trachelipoda, Cephalopoda, Heteropoda.*

Vertebrata.
- 3. *Intelligent Animals.*
  - Class XIII. FISHES.
  - ,, XIV. REPTILES.
  - Class XV. BIRDS.
  - ,, XVI. MAMMALS

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[1] The anatomical error in reference to the auricles of Reptiles and Batrachians on the part of Linnaeus is extremely interesting, since it shows to what an extent the most patent facts may escape the observation of even the greatest observers, and what an amount of repeated dissection and unprejudiced attention has been necessary before the structure of the commonest animals has become known.

The enumeration of orders above given will enable the reader to form some conception of the progress of knowledge relating to the lower forms of life during the fifty odd years which intervened between Linnaeus and Lamarck. The number of genera recognized by Lamarck is more than ten times as great as that recorded by Linnaeus.

We have mentioned Lamarck before his great contemporary Cuvier because, in spite of his valuable philosophical doctrine of development, he was, as compared with Cuvier and estimated as a systematic zoologist, a mere enlargement and logical outcome of Linnaeus.

Cuvier.

The distinctive merit of G. L. Cuvier (1769–1832) is that he started a new view as to the relationship of animals, which he may be said in a large measure to have demonstrated as true by his own anatomical researches. He opposed the *scala naturae* theory, and recognized four distinct and divergent branches or *embranchemens*, as he called them, in each of which he arranged a certain number of the Linnaean classes, or similar classes. The *embranchemens* were characterized each by a different type of anatomical structure. Cuvier thus laid the foundation of that branching tree-like arrangement of the classes and orders of animals now recognized as being the necessary result of attempts to represent what is practically a genealogical tree or pedigree. Apart from this, Cuvier was a keen-sighted and enthusiastic anatomist of great skill and industry. It is astonishing how many good observers it requires to dissect and draw and record over and over again the structure of an animal before an approximately correct account of it is obtained. Cuvier dissected many Molluscs and other animals which had not previously been anatomized; of others he gave more correct accounts than had been given by earlier writers. Another special distinction of Cuvier is his remarkable work in comparing extinct with recent organisms, his descriptions of the fossil *Mammalia* of the Paris basin, and his general application of the knowledge of recent animals to the reconstruction of extinct ones, as indicated by fragments only of their skeletons.

It was in 1812 that Cuvier communicated to the Academy of Sciences of Paris his views on the classification of animals. He says:—

> " Si l'on considère le règne animal d'après les principes que nous venons de poser, en se debarassant des préjugés établis sur les divisions anciennement admises, en n'ayant égard qu' à l'organisation et à la nature des animaux, et non pas à leur grandeur, à leur utilité, au plus ou moins de connaissance que nous en avons, ni à toutes les autres circonstances accessoires, on trouvera qu'il existe quatre formes principales, quatre plans généraux, si l'on peut s'exprimer ainsi, d'après lesquels tous les animaux semblent avoir été modelés et dont les divisions ultérieures, de quelque titre que les naturalistes les aient décorées, ne sont que des modifications assez légères, fondées sur le développement, ou l'addition de quelques parties qui ne changent rien à l'essence du plan."

Cuvier's classification.

His classification as finally elaborated in *Le Règne Animal* (Paris, 1829) is as follows:—

First Branch. **Animalia Vertebrata.**
- Class I. MAMMALIA.
  - Orders: *Bimana, Quadrumana, Carnivora, Marsupialia, Rodentia, Edentata, Pachydermata, Ruminantia, Cetacea.*
- Class II. BIRDS.
  - Orders: *Accipitres, Passeres, Scansores, Gallinae, Grallae, Palmipedes.*
- Class III. REPTILIA.
  - Orders: *Chelonia, Sauria, Ophidia, Batrachia.*
- Class IV. FISHES.
  - Orders: (*a*) *Acanthopterygii, Abdominales, Subbrachii, Apodes, Lophobranchii, Plectognathi;* (*b*) *Sturiones, Selachii, Cyclostomi.*

Second Branch. **Animalia Mollusca.**
- Class I. CEPHALOPODA.
- Class II. PTEROPODA.
- Class III. GASTROPODA.
  - Orders: *Pulmonata, Nudibranchia, Inferobranchia, Tectibranchia, Heteropoda, Pectinibranchia, Tubulibranchia, Scutibranchia, Cyclobranchia.*
- Class IV. ACEPHALA.
  - Orders: *Testacea, Tunicata.*
- Class V. BRACHIOPODA.
- Class VI. CIRRHOPODA.

Third Branch. **Animalia Articulata.**
- Class I. ANNELIDES.
  - Orders: *Tubicolae, Dorsibranchiae, Abranchiae.*
- Class II. CRUSTACEA.
  - Orders: (*a*) Malacostraca: *Decapoda, Stomapoda, Amphipoda, Laemodipoda, Isopoda;* (*b*) Entomostraca: *Branchiopoda, Poecilopoda, Trilobitae.*
- Class III. ARACHNIDES.
  - Orders: *Pulmonariae, Trachea riae.*
- Class IV. INSECTS.
  - Orders: *Myriapoda, Thysanura, Parasita, Suctoria, Coleoptera, Orthoptera, Hemiptera, Neuroptera, Hymenoptera, Lepidoptera, Rhipiptera, Diptera.*

Fourth Branch. **Animalia Radiata.**
- Class I. ECHINODERMS.
  - Orders: *Pedicellata, Apoda.*
- Class II. INTESTINAL WORMS.
  - Orders: *Nematoidea, Parenchymatosa.*
- Class III. ACALEPHAE.
  - Orders: *Simplices, Hydrostaticae.*
- Class IV. POLYPI (including the *Coelentera* of later authorities and the *Polyzoa*).
  - Orders: *Carnosi, Gelatinosi, Polypiarii.*
- Class V. INFUSORIA.
  - Orders: *Rotifera, Homogenea* (this includes the *Protozoa* of recent writers and some *Protophyta*).

Von Baer.

The leading idea of Cuvier, his four *embranchemens*, was confirmed by the Russo-German naturalist Von Baer (1792–1876), who adopted Cuvier's divisions, speaking of them as the peripheric, the longitudinal, the massive, and the vertebrate types of structure. Von Baer, however, has another place in the history of zoology, being the first and most striking figure in the introduction of embryology into the consideration of the relations of animals to one another.

The morphologists.

Cuvier may be regarded as *the* zoologist by whom anatomy was made the one important guide to the understanding of the relations of animals. But the belief, dating from Malpighi (1670), that there *is* a relationship to be discovered, and not merely a haphazard congregation of varieties of structure to be classified, had previously gained ground. Cuvier was familiar with the speculations of the " Natur-philosophen," and with the doctrine of transmutation and filiation by which they endeavoured to account for existing animal forms. The noble aim of F. W. J. Schelling, " das ganze System der Naturlehre von dem Gesetze der Schwere bis zu den Bildungstrieben der Organismus als ein organisches Ganze darzustellen," which has ultimately been realized through Darwin, was a general one among the scientific men of the year 1800. Lamarck accepted the development theory fully, and pushed his speculations far beyond the realm of fact. The more cautious Cuvier adopted a view of the relationships of animals which, whilst denying genetic connexion as the explanation, recognized an essential identity of structure throughout whole groups of animals. This identity was held to be due to an ultimate law of nature or the Creator's plan. The tracing out of this identity in diversity, whether regarded as evidence of blood-relationship or as a remarkable display of skill on the part of the Creator in varying the details whilst retaining the essential, became at this period a special pursuit, to which Goethe, the poet, who himself contributed importantly to it, gave the name " morphology." C. F. Wolff, Goethe and Oken share the credit of having initiated these views, in regard especially to the structure of flowering plants and the Vertebrate skull. Cuvier's doctrine of four plans of structure was essentially a morphological one, and so was the single-scale doctrine of Buffon and Lamarck, to which it was opposed. Cuvier's morphological doctrine received its fullest development in the principle of the " correlation of parts," which he applied to palaeontological investigation, namely, that every animal is a definite whole, and that no part can be varied without entailing correlated and law-abiding variations in other parts, so that from a fragment it should be possible, had we a full knowledge of the laws of animal structure or morphology, to reconstruct the whole. Here Cuvier was imperfectly formulating, without recognizing the real physical basis of the phenomena, the results of the laws of heredity, which were subsequently investigated and brought to bear on the problems of animal structure by Darwin.

Owen.

Sir Richard Owen (1804–1892) may be regarded as the foremost of Cuvier's disciples. Owen not only occupied himself with the dissection of rare animals, such as the Pearly Nautilus, *Lingula, Limulus, Protopterus, Apteryx*, &c., and with the description and reconstruction of extinct reptiles, birds and mammals—following the Cuvierian tradition—but gave precision and currency to the morphological doctrines which had taken their rise in the beginning of the century by the introduction of two terms, "homology" and "analogy," which were defined so as to express two different kinds of agreement in animal structures, which, owing to the want of such "counters of thought," had been hitherto continually confused.

Analogous structures in any two animals compared were by Owen defined as structures performing similar functions, but not necessarily derived from the modification of one and the same part in the "plan" or "archetype" according to which the two animals compared were supposed to be constructed. *Homologous* structures were such as, though greatly differing in appearance and detail from one another, and though performing widely different functions, yet were capable of being shown by adequate study of a series of intermediate forms to be derived from one and the same part or organ of the "plan-form" or "archetype." It is not easy to exaggerate the service rendered by Owen to the study of zoology by the introduction of this apparently small piece of verbal mechanism; it takes place with the classificatory terms of Linnaeus. And, though the conceptions of "archetypal morphology," to which it had reference, are now abandoned in favour of a genetic morphology, yet we should remember, in estimating the value of this and of other speculations which have given place to new views in the history of science, the words of the great reformer himself. "Erroneous observations are in the highest degree injurious to the progress of science, since they often persist for a long time. But erroneous theories, when they are supported by facts, do little harm, since every one takes a healthy pleasure in proving their falsity" (Darwin). Owen's definition of analogous structures holds good at the present day. His homologous structures are now spoken of as "homogenetic" structures, the idea of community of representation in an archetype giving place to community of derivation from a single representative structure present in a common ancestor. Darwinian morphology has further rendered necessary the introduction of the terms "homoplasy" and "homoplastic" (E. Ray Lankester, in *Ann. and Mag. Nat. Hist.* 1870) to express that close agreement in *form* which may be attained in the course of evolutionary changes by organs or parts in two animals which have been subjected to similar moulding conditions of the environment, but have not a close genetic community of origin, to account for their similarity in form and structure, although they have a certain identity in primitive quality which is accountable for the agreement of their response to similar moulding conditions.

Owen's classification.

The classification adopted by Owen in his lectures (1855) does not adequately illustrate the progress of zoological knowledge between Cuvier's death and that date, but, such as it is, it is worth citing here.

Province: **Vertebrata** (*Myelencephala*, Owen).
  Classes: MAMMALIA, AVES, REPTILIA, PISCES.
Province: **Articulata.**
  Classes: ARACHNIDA, INSECTA (including Sub-Classes *Myriapoda, Hexapoda*), CRUSTACEA (including Sub-Classes *Entomostraca, Malacostraca*), EPIZOA (Epizootic *Crustacea*), ANNELLATA (Chaetopods and Leeches), CIRRIPEDIA.
Province: **Mollusca.**
  Classes: CEPHALOPODA, GASTEROPODA, PTEROPODA, LAMELLIBRANCHIATA, BRACHIOPODA, TUNICATA.
Province: **Radiata.**
  Sub-Province: **Radiaria.**
    Classes: ECHINODERMATA, BRYOZOA, ANTHOZOA, ACALEPHAE, HYDROZOA.
  Sub-Province: **Entozoa.**
    Classes: COELELMINTHA, STERELMINTHA.
  Sub-Province: **Infusoria.**
    Classes: ROTIFERA, POLYGASTRIA (the *Protozoa* of recent authors).

The real centre of progress of systematic zoology was no longer in France nor with the disciples of Cuvier in England, but after his death moved to Germany. The wave of morphological speculation, with its outcome of new systems and new theories of classification (see Agassiz, *Essay on Classification*, 1859), which were as numerous as the professors of zoological science, was necessarily succeeded in the true progress of the science by a period of minuter study in which the microscope, the discovery of embryological histories, and the all-important cell-theory came to swell the stream of exact knowledge.

Müller.

The greatest of all investigators of animal structure in the 19th century was Johann Müller (1801–1858), the successor in Germany of the anatomists Rathke (1793–1860) and Meckel (1781–1833). His true greatness can only be estimated by a consideration of the fact that he was a great teacher not only of human and comparative anatomy and zoology but also of physiology, and that nearly all the most distinguished German zoologists and physiologists of the period 1850 to 1870 were his pupils and acknowledged his leadership. The most striking feature about Johann Müller's work, apart from the comprehensiveness of his point of view, in which he added to the anatomical and morphological ideas of Cuvier a consideration of physiology, embryology and microscopic structure, was the extraordinary accuracy, facility and completeness of his recorded observations. He could do more with a single specimen of a rare animal (*e.g.* in his memoir on *Amphioxus*, Berlin, 1844) in the way of making out its complete structure than the ablest of his contemporaries or successors could do with a plethora. His power of rapid and exhaustive observation and of accurate pictorial reproduction was phenomenal. His most important memoirs, besides that just mentioned, are those on the anatomy and classification of Fishes, on the Caecilians and on the developmental history of the Echinoderms.

J. V. Thompson.

A name which is apt to be forgotten in the period between Cuvier and Darwin, because its possessor occupied an isolated position in England and was not borne up by any great school or university, is that of John Vaughan Thompson (1779–1847), an army surgeon, who in 1816 became district medical inspector at Cork, and then took to the study of marine *Invertebrata* by the aid of the microscope. Thompson made three great discoveries, which seem to have fallen in his way in the most natural and simple manner, but must be regarded really as the outcome of extraordinary genius. He showed (1830) that the organisms like *Flustra* are not hydroid Polyps, but of a more complex structure resembling Molluscs, and he gave them the name *Polyzoa* He discovered (1823) the *Pentacrinus europaeus*, and showed that it was the larval form of the Feather-Star *Antedon* (*Comatula*). He upset (1830) Cuvier's retention of the Cirripedes among *Mollusca*, and his subsequent treatment of them as an isolated class, by showing that they begin life as free-swimming *Crustacea* identical with the young forms of other *Crustacea*. Vaughan Thompson is a type of the marine zoologists, such as Dalyell, Michael Sars, P. J. Van Beneden, Claparède, and Allman, who during the 19th century approached the study of the lower marine organisms in the same spirit as that in which Trembley and Schäffer in the 18th century, and Swammerdam in the 17th, gave themselves to the study of the minute fresh-water forms of animal life.

It is impossible to enumerate or to give due consideration to all the names in the army of anatomical and embryological students of the middle third of the 19th century whose labours bore fruit in the modification of zoological theories and in the building up of a true classification of animals. Their results are best summed up in the three schemes of classification which follow below—those of Rudolph Leuckart (1823–1896), Henri Milne-Edwards (1800–1884), and T. H. Huxley (1825–1895), all of whom individually contributed very greatly by their special discoveries and researches to the increase of exact knowledge.

Single-fact systems of classification.

Contemporaneous with these were various schemes of classification which were based, not on a consideration of the entire structure of each animal, but on the variations of a single organ, or on the really non-significant fact of the structure of the egg. All such single-fact systems have proved to be departures from the true line of growth of the zoological system which was shaping itself year by year—unknown to those who so shaped it—as a genealogical tree. They were attempts to arrive at a true knowledge of the relationships of animals by "royal roads"; their followers were landed in barren wastes.

Leuckart's classification.

R. Leuckart's classification (*Die Morphologie und die Verwandtschaftsverhältnisse der wirbellosen Thiere*, Brunswick, 1848) is as follows:—

Type I. **Coelenterata.**
  Class I. POLYPI.
    Orders: *Anthozoa* and *Cylicozoa*.
  " II. ACALEPHAE.
    Orders: *Discophorae* and *Ctenophorae*.

Type 2. **Echinodermata.**
Class I. Pelmatozoa.
Orders: *Cystidea* and *Crinoidea.*
„ II. Actinozoa.
Orders: *Echinida* and *Asterida.*
„ III. Scytodermata.
Orders: *Holothuriae* and *Sipunculida.*
Type 3. **Vermes.**
Class I. Anenteraeti.
Orders: *Cestodes* and *Acanthocephali.*
„ II. Apodes.
Orders: *Nemertini, Turbellarii, Trematodes* and *Hirudinei.*
„ III. Ciliati.
Orders: *Bryozoa* and *Rotifera.*
„ IV. Annelides.
Orders: *Nematodes Lumbricini* and *Branchiati.*
Type 4. **Arthropoda.**
Class I. Crustacea.
Orders: *Entomostraca* and *Malacostraca.*
„ II. Insecta.
Orders: *Myriapoda, Arachnida* (*Acera,* Latr.), and *Hexapoda.*
Type 5. **Mollusca.**
Class I. Tunicata.
Orders: *Ascidiae* and *Salpae.*
„ II. Acephala.
Orders: *Lamellibranchiata* and *Brachiopoda.*
„ III. Gasteropoda.
Orders: *Heterobranchia, Dermatobranchia, Heteropoda, Ctenobranchia, Pulmonata,* and *Cyclobranchia.*
„ IV. Cephalopoda.
Type 6. **Vertebrata.** (Not specially dealt with.)

Milne-Edwards's classification.

The classification given by Henri Milne-Edwards (*Cours Élémentaire d'Histoire Naturelle*, Paris, 1855) is as follows:—

Branch I. **Osteozoaria** or **Vertebrata.**
Sub-Branch 1. **Allantoidians.**
Class I. Mammalia.
Orders: (*a*) Monodelphia: *Bimana, Quadrumana, Cheiroptera, Insectivora, Rodentia, Edentata, Carnivora, Amphibia, Pachydermata, Ruminantia, Cetacea*; (*b*) Didelphia: *Marsupialia, Monotremata.*
„ II. Birds.
Orders: *Rapaces, Passeres, Scansores, Gallinae, Grallae, Palmipedes.*
„ III. Reptiles.
Orders: *Chelonia, Sauria, Ophidia.*
Sub-Branch 2. **Anallantoidians.**
Class I. Batrachians.
Orders: *Anura, Urodela, Perennibranchia, Caeciliae.*
„ II. Fishes.
Section 1. *Ossei.*
Orders: *Acanthopterygii, Abdominales, Subbrachii, Apodes, Lophobranchii, Plectognathi.*
Section 2. *Chondropterygii.*
Orders: *Sturiones, Selachii, Cyclostomi.*

Branch II. **Entomozoa** or **Annelata.**
Sub-Branch 1. **Arthropoda.**
Class I. Insecta.
Orders: *Coleoptera, Orthoptera, Neuroptera, Hymenoptera, Lepidoptera, Hemiptera, Diptera, Rhipiptera, Anopleura, Thysanura.*
„ II. Myriapoda.
Orders: *Chilognatha* and *Chilopoda.*
„ III. Arachnids.
Orders: *Pulmonaria* and *Trachearia.*
„ IV. Crustacea.
Section 1. *Podophthalmia.*
Orders: *Decapoda* and *Stomopoda.*
Section 2. *Edriophthalmi.*
Orders: *Amphipoda, Loemodipoda* and *Isopoda.*
Section 3. *Branchiopoda.*
Orders: *Ostracoda, Phyllopoda* and *Trilobitae.*
Section 4. *Entomostraca.*
Orders: *Copepoda, Cladocera, Siphonostoma, Lernaeida, Cirripedia.*
Section 5. *Xiphosura.*

(The orders of the classes which follow are not given in the work quoted.)

Sub-Branch 2. **Vermes.**
Class I. Annelids.
„ II. Helminths.
„ III. Turbellaria.
Class IV. Cestoidea.
„ V. Rotatoria.

Branch III. **Malacozoaria** or **Mollusca.**
Sub-Branch 1. **Mollusca** proper.
Class I. Cephalopoda.
„ II. Pteropoda.
Class III. Gasteropoda.
„ IV. Acephala.
Sub-Branch 2. **Molluscoidea.**
Class I. Tunicata.
Class II. Bryozoa.
Branch IV. **Zoophytes.**
Sub-Branch 1. **Radiaria.**
Class I. Echinoderms.
„ II. Acalephs.
Class III. Corallaria or Polypi.
Sub-Branch 2. **Sarcodaria.**
Class I. Infusoria.
Class II. Spongiaria.

Huxley's classification.

In England T. H. Huxley adopted in his lectures (1869) a classification which was in many respects similar to both of the foregoing, but embodied improvements of his own. It is as follows:—

Sub-Kingdom I. **Protozoa.**
Classes: Rhizopoda, Gregarinida, Radiolaria, Spongida.
Sub-Kingdom II. **Infusoria.**
Sub-Kingdom III. **Coelenterata.**
Classes: Hydrozoa, Actinozoa.
Sub-Kingdom IV. **Annuloida.**
Classes: Scolecida, Echinodermata.
Sub-Kingdom V. **Annulosa.**
Classes: Crustacea, Arachnida, Myriapoda, Insecta, Chaetognatha, Annelida.
Sub-Kingdom VI. **Molluscoida.**
Classes: Polyzoa, Brachiopoda, Tunicata.
Sub-Kingdom VII. **Mollusca.**
Classes: Lamellibranchiata, Branchiogastropoda, Pulmogastropoda, Pteropoda, Cephalopoda.
Sub-Kingdom VIII. **Vertebrata.**
Classes: Pisces, Amphibia, Reptilia, Aves, Mammalia.

We now arrive at the period when the doctrine of organic evolution was established by Darwin, and when naturalists, being convinced by him as they had not been by the transmutationists of fifty years' earlier date, were compelled to take an entirely new view of the significance of all attempts at framing a "natural" classification.

Classifications based on structure.

Agassiz.

Many zoologists—prominent among them in Great Britain being Huxley—had been repelled by the airy fancies and assumptions of the "philosophical" morphologists. The efforts of the best minds in zoology had been directed for thirty years or more to ascertaining with increased accuracy and minuteness the structure, microscopic and gross, of all possible forms of animals, and not only of the adult structure but of the steps of development of that structure in the growth of each kind of organism from the egg to maturity. Putting aside fantastic theories, these observers endeavoured to give in their classifications a strictly objective representation of the facts of animal structure and of the structural relationships of animals to one another capable of demonstration. The groups within groups adopted for this purpose were necessarily wanting in symmetry: the whole system presented a strangely irregular character. From time to time efforts were made by those who believed that the Creator must have followed a symmetrical system in his production of animals to force one or other artificial, neatly balanced scheme of classification upon the zoological world. The last of these was that of Louis Agassiz (1807–1873), who, whilst surveying all previous classifications, propounded a scheme of his own (*Essay on Classification*, 1859), in which, as well as in the criticisms he applies to other systems, the leading notion is that sub-kingdoms, classes, orders and families have a real existence, and that it is possible to ascertain and distinguish characters which are of class value, others which are only of ordinal value, and so on, so that the classes of one sub-kingdom should on paper, and in nature actually do, correspond in relative value to those of another sub-kingdom, and the orders of any one class similarly should be so taken as to be of equal value with those of another class, and have been actually so created.

Influence of Darwinian doctrine on taxonomy.

The whole position was changed by the acquiescence, which became universal, in the doctrine of Darwin. That doctrine took some few years to produce its effect, but it became evident at once to those who accepted Darwinism that *the* natural classification of animals, after which collectors and anatomists, morphologists, philosophers and embryologists had been so long striving, was nothing more nor less than a genealogical tree, with breaks and gaps of various extent in its record. The facts of the relationships of animals to one another, which had been treated as the outcome of an inscrutable law by most zoologists and glibly explained by the transcendental morphologists, were amongst the most powerful arguments in support of Darwin's theory, since they, together with all other vital phenomena, received a sufficient explanation through it. It is to be noted that, whilst the zoological system took the form of a genealogical tree, with main stem and numerous diverging branches, the actual form of that tree, its limitation to a certain number of branches corresponding to a limited number of divergences in structure, came to be regarded as the necessary consequence of the operation of the physico-chemical laws of the universe, and it was recognized that the ultimate explanation of that limitation is to be found only in the constitution of matter itself.

Haeckel.

The first naturalist to put into practical form the consequences of the new theory, in so far as it affected zoological classification, was Ernst Haeckel of Jena (b. 1834), who in 1866, seven years after the publication of Darwin's *Origin of Species*, published his suggestive *Generelle Morphologie.* Haeckel introduced into classification a number of terms intended to indicate the branchings of a genealogical tree. The whole "system" or scheme of classification was termed a genealogical tree (*Stammbaum*); the main branches were termed "phyla," their branchings "sub-phyla"; the great branches of the sub-phyla were termed "cladi," and the "cladi" divided into "classes," these into sub-classes, these into legions, legions into orders, orders into sub-orders, sub-orders into tribes, tribes into families, families into genera, genera into species. Additional branchings could be indicated by similar terms where necessary. There was no attempt in Haeckel's use of these terms to make them exactly or more than approximately equal in significance; such attempts were clearly futile and unimportant where the purpose was the exhibition of lines of descent, and where no natural equality of groups was to be expected *ex hypothesi.* Haeckel's classification of 1866 was only a first attempt. In the edition of the *Natürliche Schöpfungsgeschichte* published in 1868 he made a great advance in his genealogical classification, since he now introduced the results of the extraordinary activity in the study of embryology which followed on the publication of the *Origin of Species.*

The pre-Darwinian systematists since the time of Von Baer had attached very great importance to embryological facts, holding that the stages in an animal's development were often more significant of its true affinities than its adult structure. Von Baer had gained unanimous support for his dictum, "Die Entwickelungsgeschichte ist der wahre Lichtträger für Untersuchungen über organische Körper." Thus J. Müller's studies on the larval forms of Echinoderms and the discoveries of Vaughan Thompson were appreciated. But it was only after Darwin that the cell-theory of Schwann was extended to the embryology of the animal kingdom generally, and that the knowledge of the development of an animal became a knowledge of the way in which the millions of cells of which its body is composed take their origin by fission from a smaller number of cells, and these at last from the single egg-cell. Kölliker (*Development of Cephalopods*, 1844), Remak (*Development of the Frog*, 1850), and others had laid the foundations of this knowledge in isolated examples; but it was Kovalevsky, by his accounts of the development of Ascidians and of *Amphioxus* (1866), who really made zoologists see that a strict and complete cellular embryology of animals was as necessary and feasible a factor in the comprehension of their relationships as at the beginning of the century the coarse anatomy had been shown to be by Cuvier. Kovalevsky's work appeared between the dates of the *Generelle Morphologie* and the *Schöpfungsgeschichte.* Haeckel himself, with his pupil Miklucho-Maclay, had in the meantime made studies on the growth from the egg of Sponges—studies which resulted in the complete separation of the unicellular or equicellular *Protozoa* from the Sponges, hitherto confounded with them. It is this introduction of the consideration of cell-structure and cell-development which, subsequently to the establishment of Darwinism, has most profoundly modified the views of systematists, and led in conjunction with the genealogical doctrine to the greatest activity in research—an activity which culminated in the work (1873–1882) of F. M. Balfour, and produced the profoundest modifications in classification.

Haeckel's 1868 arrangement.

Haeckel's second pedigree is as follows:—

Phyla.	Clades.	Classes.
Protozoa.	Ovularia.	*Archezoa.*
		Gregarinae.
		Infusoria.
	Blastularia.	*Planaeada.*
		Gastraeada.
Zoophyta.	Spongiae.	*Porifera.*
	Acalephae.	*Coralla.*
		Hydromedusae.
		Ctenophora.
Vermes.	Acoelomi.	*Platyhelminthes.*
	Coelomati.	*Nemathelminthes.*
		Bryozoa.
		Tunicata.
		Rhynchocoela.
		Gephyraea.
		Rotatoria.
		Annelida.
Mollusca.	Acephala.	*Spirobranchia.*
		Lamellibranchia.
	Eucephala.	*Cochlides.*
		Cephalopoda.
Echinoderma.	Colobrachia	*Asterida.*
		Crinoida.
	Lipobrachia.	*Echinida.*
		Holothuriae.
Arthropoda.	Carides.	*Crustacea.*
	Tracheata.	*Arachnida.*
		Myriapoda.
		Insecta.
Vertebrata.	Acrania.	*Leptocardia.*
	Monorrhina.	*Cyclostoma.*
	Anamnia.	*Pisces.*
		Dipneusta.
		Halisauria.
		Amphibia.
	Amniota	*Reptilia.*
		Aves.
		Mammalia.

Dendriform distribution of animal kingdom.

In representing pictorially the groups of the animal kingdom as the branches of a tree, it becomes obvious that a distinction may be drawn, not merely between the individual main branches, but further as to the level at which they are given off from the main stem, so that one branch or set of branches may be marked off as belonging to an earlier or lower level than another set of branches; and the same plan may be adopted with regard to the clades, classes and smaller branches. The term "grade" was introduced by Ray Lankester ("Notes on Embryology and Classification," in *Quart. Journ. Micr. Sci.* 1877), to indicate this giving off of branches at a higher or lower, *i.e.* a later or earlier, level of a main stem.[1] The mechanism for the statement of the genealogical relationships of the groups of the animal kingdom was thus completed. Renewed study of every group was the result of the acceptance of the genealogical idea and of the recognition of the importance of cellular embryology. On the one hand, the true method of arriving at a knowledge of the genealogical tree was recognized as lying chiefly in attacking the problem of the genealogical relationships of the smallest twigs of the tree, and proceeding from them to the larger branches. Special studies of small families or orders of animals with this object in view were taken in hand by many zoologists. On the other hand, a survey of the facts of cellular embryology which were accumulated in regard to a variety of classes within a few years of Kovalevsky's work led to a generalization, independently arrived at by Haeckel and Lankester, to the effect that a lower grade of animals may be distinguished, the *Protozoa* or *Plastidozoa*, which consist either of single cells or colonies of equiformal cells, and a higher grade, the *Metazoa* or *Enterozoa*, in which the egg-cell by "cell division" gives rise to two layers of cells, the endoderm and the ectoderm, surrounding a primitive digestive chamber, the archenteron. Of these latter, two grades were further distinguished by Lankester—those which remain possessed of a single archenteric cavity and of two primary cell-layers (the *Coelentera* or *Diploblastica*), and those which by nipping off the archenteron give rise to two cavities, the coelom or body-cavity and the metenteron or gut (*Coelomata* or *Triploblastica*). To the primitive two-cell-layered form, the hypothetical ancestor of all *Metazoa* or *Enterozoa*, Haeckel gave the name *Gastraea*; the embryonic form which represents in the individual growth from the egg this ancestral condition he called a "gastrula." The term "diblastula" was subsequently adopted in England for the gastrula of Haeckel. The tracing of the exact mode of development, cell by cell, of the diblastula, the coelom, and the various tissues of examples of all classes of animals was in later years pursued with immense activity and increasing instrumental facilities.

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[1] Sir Edwin Ray Lankester (b. 1847) was the eldest son of Edwin Lankester (1814–1874), a physician and naturalist (F.R.S. 1845), who became well known as a scientific writer and lecturer, editor of the *Quarterly Journal of Microscopical Science* from 1853 to 1871, and from 1862, in succession to Thomas Wakley, coroner for Central Middlesex. Educated at St Paul's and both at Downing College, Cambridge, and Christ Church, Oxford, E. Ray Lankester obtained the Radcliffe Travelling Fellowship at Oxford in 1870, and became a fellow and lecturer at Exeter College in 1872. From 1874 to 1890 he was professor of zoology and comparative anatomy at University College, London; and from 1891 to 1898 Linacre professor of comparative anatomy at Oxford. From 1898 to 1907 he was director of the Natural History Department of the British Museum. He was made K.C.B. in 1907. [Ed. *E. B.*].

Two names in connexion with post-Darwinian taxonomy and the ideas connected with it require brief mention here.

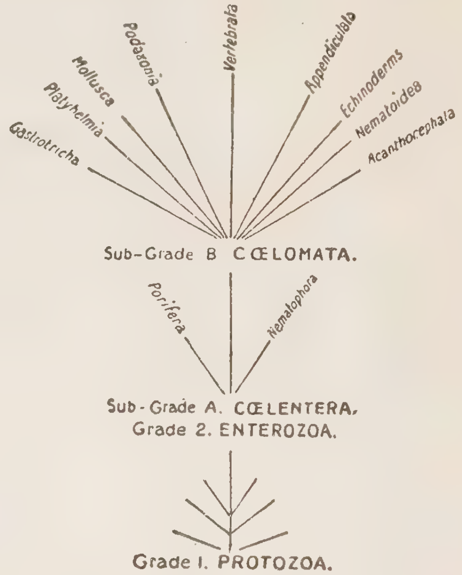
Fritz Müller's recapitulation.

Fritz Müller, by his studies on *Crustacea* (*Für Darwin*, 1864), showed the way in which genealogical theory may be applied to the minute study of a limited group. He is also responsible for the formulation of an important principle, called by Haeckel "the biogenetic fundamental law," viz. that an animal in its growth from the egg to the adult condition tends to pass through a series of stages which are recapitulative of the stages through which its ancestry has passed in the historical development of the species from a primitive form; or, more shortly, that the development of the individual (ontogeny) is an epitome of the development of the race (phylogeny). Pre-Darwinian zoologists had been aware of the class of facts thus interpreted by Fritz Müller, but the authoritative view on the subject had been that there is a parallelism between (*a*) the series of forms which occur in individual development, (*b*) the series of existing forms from lower to higher, and (*c*) the series of forms which succeed one another in the strata of the earth's crust, whilst an explanation of this parallelism was either not attempted, or was illusively offered in the shape of a doctrine of harmony of plan in creation. It was the application of Fritz Müller's law of recapitulation which gave the chief stimulus to embryological investigations between 1865 and 1890; and, though it is now recognized that "recapitulation" is vastly and bewilderingly modified by special adaptations in every case, yet the principle has served, and still serves, as a guide of great value.

Dohrn's doctrine of degeneration.

Another important factor in the present condition of zoological knowledge as represented by classification is the doctrine of degeneration propounded by Anton Dohrn. Lamarck believed in a single progressive series of forms, whilst Cuvier introduced the conception of branches. The first post-Darwinian systematists naturally and without reflexion accepted the idea that existing simpler forms represent stages in the gradual progress of development—are in fact survivors from past ages which have retained the exact grade of development which their ancestors had reached in past ages. The assumption made was that (with the rare exception of parasites) all the change of structure through which the successive generations of animals have passed has been one of progressive elaboration. It is Dohrn's merit to have pointed out[1] that this assumption is not warranted, and that degeneration or progressive simplification of structure may have, and in many lines certainly has, taken place, as well as progressive elaboration and in other cases continuous maintenance of the *status quo*. The introduction of this conception necessarily has had a most important effect in the attempt to unravel the genealogical affinities of animals. It renders the task a more complicated one; at the same time it removes some serious difficulties and throws a flood of light on every group of the animal kingdom.

One result of the introduction of the new conceptions dating from Darwin was a healthy reaction from that attitude of mind which led to the regarding of the classes and orders recognized by authoritative zoologists as sacred institutions which were beyond the criticism of ordinary men. That state of mind was due to the fact that the groupings so recognized did not profess to be simply the result of scientific reasoning, but were necessarily regarded as the expressions of the "insight" of some more or less gifted persons into a plan or system which had been arbitrarily chosen by the Creator. Consequently there was a tinge of theological dogmatism about the whole matter. To deny the Linnaean, or later the Cuvierian, classes was very much like denying the Mosaic cosmogony. But systematic zoology is now entirely free from any such prejudices, and the Linnaean taint which is apparent even in Haeckel and Gegenbaur may be considered as finally expunged.



A genealogical tree of animal kingdom (Lankester, 1884).

Lankester's system.

There are, and probably always will be, differences of opinion as to the exact way in which the various kinds of animals may be divided into groups and those groups arranged in such an order as will best exhibit their probable genetic relationships. The main divisions which, writing in 1910, the present writer prefers, are those adopted in his *Treatise on Zoology* (Part II. ch. ii.) except that Phylum 17, Diplochorda (a name doubtfully applicable to *Phoronis*) is replaced by Podaxonia, a term employed by Lankester in the 9th edition of this encyclopaedia and now used to include a number of groups of doubtful but possible affinity. The terms used for indicating groups are "Phylum" for the large diverging branches of the genealogical tree as introduced by Haeckel, each Phylum bears secondary branches which are termed "classes," classes again branch or divide into orders, orders into families, families into genera, genera into species. The general purpose is to give something like an equivalence of importance to divisions or branches indicated by the same term, but it is not intended to imply that every phylum has the same range and distinctive character as every other, nor to make such a proposition about classes, orders, families and genera. Where a further subdivision is desirable without descending to the next lower term of grouping, the prefix "sub" is made use of, so that a class *may* be divided first of all into sub-classes each of which is divided into orders, and an order into sub-orders each of which bears a group of families. The term "grade" is also made use of for the purpose of indicating the conclusion that certain branches on a larger or smaller stem of the genealogical tree have been given off at an earlier period in the history of the evolution of the stem in question than have others marked off as forming a higher grade. Thus, to begin with, the animal pedigree is divided into two very distinct grades, the Protozoa and the Metazoa. The Metazoa form two main branches; one, Parazoa, is but a small unproductive stock comprising only the Phylum Porifera or Sponges; the other, the great stem of the animal series Enterozoa, gives rise to a large number of diverging Phyla which it is necessary to assign to two levels or grades—a lower, Enterocoela (often called Coelentera), and a higher, Coelomocoela (often called Coelomata). These relations are exhibited by the two following diagrams.

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[1] *Ursprung der Wirbelthiere* (Leipzig, 1875); and Lankester, *Degeneration* (London, 1880).

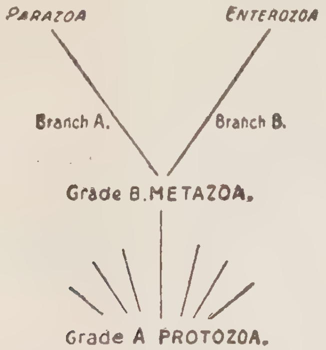

Diagram showing the primary grades and branches of the Animal Pedigree.

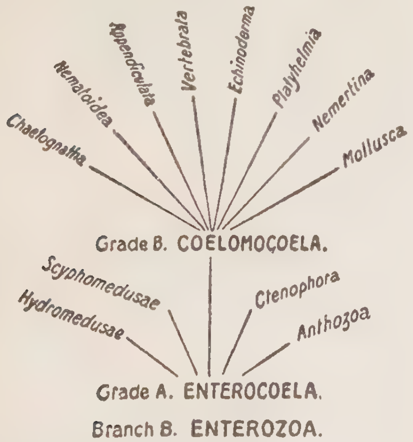

Diagram to show the division of the great branch Enterozoa into two grades and the Phyla given off therefrom.

The Phylum Vertebrata in the above scheme branches into the sub-phyla Hemichorda, Urochorda, Cephalochorda and Craniata. The Phylum Appendiculata similarly branches into sub-phyla, viz. the Rotifera, the Chaetopoda and the Arthropoda. Certain additional small groups should probably be recognized as independent lines of descent or phyla, but their relationships are obscure—they are the Mesozoa, the Polyzoa, the Acanthocephala and the Gastrotricha.

We may now enumerate these various large groups in tabular form.

BIONTA—PHYTA, ANIMALIA.
  GRADE A. **Protozoa** (various groups included).
  GRADE B. **Metazoa.**
    Branch *a*. **Parazoa.**
      Phylum 1. PORIFERA.
    Branch *b*. **Enterozoa.**
      Grade 1. ENTEROCOELA.
        Phylum 2. HYDROMEDUSAE.
          3. SCYPHOMEDUSAE.
          4. ANTHOZOA.
          5. CTENOPHORA.
      Grade 2. COELOMOCOELA.
        Phylum 6. PLATYELMIA.
          7. NEMATOIDEA.
          8. CHAETOGNATHA
          9. NEMERTINA.
          10. MOLLUSCA.
          11. APPENDICULATA.
            Sub-phyla: ROTIFERA, CHAETOPODA, ARTHROPODA.
          12. ECHINODERMA.
          13. VERTEBRATA.
            Sub-phyla: HEMICHORDA, UROCHORDA, CEPHALOCHORDA, CRANIATA.
          14. MESOZOA.
          15. POLYZOA.
          16. ACANTHOCEPHALA
          17. PODAXONIA.
          18. GASTROTRICHA.

Classification adopted in the present work.

A statement may now be given of the classes and orders in each group, as recognized by the writers of the various special zoological articles in the Eleventh Edition of the *Encyclopaedia Britannica*. These subdivisions of the larger groups are not necessarily those theoretically approved by the present writer, but they have the valuable sanction of the individual experts who have given special attention to different portions of the vast field represented by the animal kingdom.[1]

GRADE A. **Protozoa** (*q.v.*).
  Phylum 1. **Sarcodina** (*q.v.*).
    Class 1. PROTEOMYXA (*q.v.*)
    Class 2. RHIZOPODA (*q.v.*).
      Orders: *Lobosa, Filosa.*
    Class 3. HELIOZOA (*q.v.*).
    Class 4. FORAMINIFERA (*q.v.*).
      Orders: *Nuda, Allogromidiaceae, Astrorhizidiaceae, Lituolidaceae, Miliolidaceae, Textulidaridaceae, Cheilostomellaceae, Lagenidaceae, Globigerinidaceae, Rotalidaceae, Nummulidiaceae.*
      Insertae sedis. Xenophyophoridae (see FORAMINIFERA).
    Class 5. RADIOLARIA.
      Orders: *Spumellaria* (=*Peripylaea*), *Acantharia* (=*Actipylaea*), *Nasselaria* (=*Monopylaea*), *Phaeodaria* (=*Tripylaea*).
    Class 6. LABYRINTHULIDEA (*q.v.*).
      No Orders.
    Class 7. MYXOMYCETES.
      No Orders.
  Phylum 2. **Mastigophora** (*q.v.*).
    Class 1. FLAGELLATA (*q.v.*).
      Sub-class A. Rhizoflagellata.
        Orders: *Holomastigaceae, Rhizomastigaceae.*
      Sub-class B. Euflagellata.
        Orders: *Protomastigaceae, Chrysomonadaceae, Cryptomonadaceae, Chloromonadaceae, Euglenaceae, Volvocaceae.*
    Class 2. DINOFLAGELLATA.
      Orders: *Gymnodiniaceae, Prorocentraceae, Peridiniaceae.*
    Class 3. CYSTOFLAGELLATA.
      No Orders.
  Phylum 3. **Sporozoa** (*q.v.*).
    Class 1. ENDOSPORA (*q.v.*).
      Orders: *Myxosporidia, Actinomyxidia, Sarcosporidia, Haplosporidia.*
    Class 2. ECTOSPORA (*q.v*).
      Orders: *Gregarina* (see GREGARINES), *Coccidia* (*q.v.*), *Haemosporidia* (*q.v.*).
  Phylum 4. **Infusoria** (*q.v.*).
    Class 1. CILIATA.
      Orders: *Gymonostomaceae, Trichostomata, Aspirotrichaceae, Spirotricha, Heterotrichaceae, Oligotrichaceae, Hypotrichaceae, Peritrichaceae.*
    Class 2. SUCTORIA.
      No orders.

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[1] It is to be noted that the terms used for designating categories in the classification are not always identical in this summary and separate articles, as authors differ as to the use of these.

- GRADE B. **Metazoa.**
  - Branch *a*. **Parazoa.**
    - Phylum 1. **Porifera** (see SPONGES).
      - Sub-phylum 1. Calcarea.
        - Class. CALCAREA.
          - Orders: *Homocoela, Heterocoela.*
      - Sub-phylum 2. Non-Calcarea.
        - Class 1. MYXOSPONGIDA.
          - Order: *Myxospongida.*
        - Class 2. TRIAXONIDA (=HEXACTINELLIDA).
          - Orders: *Amphidiscophora, Hexasterophora.*
        - Class 3. TETRAXONIDA.
          - Sub-Class 1. Tetractinellida.
            - Orders: *Homosclerophora, Astrophora, Sigmatophora.*
          - Sub-class 2. Lithistida.
            - No Orders.
          - Sub-class 3. Monaxonellida.
            - Orders: *Astromonaxonellida, Sigmatomonaxonellida.*
        - Class 4. EUCERATOSA.
          - Order: *Euceratosa.*
  - Branch *b*. **Enterozoa.**
    - Grade 1. ENTEROCOELA (see COELENTERA).
      - Phylum 2. **Hydromedusae** or **Hydrozoa** (*q.v.*).
        - Class. HYDROMEDUSAE, (*q.v.*).
          - Orders: *Eleutheroblastea, Hydroidae* seu *Leptolinae* (Sub-orders: *Anthomedusae, Leptomedusae*), *Hydrocorallinae, Graptolitoidea Trachylinae* (Sub-orders: *Trachomedusae, Narcomedusae*), *Siphonophora.*
      - Phylum 3. **Scyphomedusae** (*q.v.*).
        - Class. SCYPHOMEDUSAE.
          - Orders: *Cubomedusae, Stauromedusae, Coronata, Discophora.*
      - Phylum 4. **Anthozoa** (*q.v.*).
        - Class. ANTHOZOA.
          - Sub-class 1. Alcyonaria.
            - Orders: *Stolonifera, Alcyonacea, Pseudaxonia, Axifera, Stelechotokea, Coenothecalia.*
          - Sub-class 2. Zoantharia.
            - Orders: *Zoanthidea, Cereanthidea, Antipathidea, Actiniidea* (Sub-orders: *Malacactiniae* and *Scleractiniae* or *Madreporia*).
      - Phylum 5. **Ctenophora.**
        - Class. CTENOPHORA.
          - Sub-class 1. Tentaculata.
            - Orders: *Cydippidea, Lobata, Cestoidea.*
          - Sub-class 2. Nuda.
            - No Orders.
    - Grade 2. COELOMOCOELA.
      - Phylum 6. **Platyelmia** (*q.v.*).
        - Class 1. PLANARIA (see PLANARIANS).
          - Order: *Turbellaria.*
        - Class 2. TEMNOCEPHALOIDEA (see appendix to PLANARIANS).
          - No Orders.
        - Class 3. TREMATODA (see TREMATODES).
          - Orders: *Heterocotylea, Aspidocotylea, Malacocotylea.*
        - Class 4. CESTODA (see TAPEWORMS).
          - Orders: *Monozoa, Merozoa.*
      - Phylum 7. **Nematoidea.**
        - Class 1. NEMATODA (see NEMATODE).
          - No Orders.
        - Class 2. CHAETOSOMIDAE (see CHAETOSOMATIDA).
          - No Orders.
        - Class 3. DESMOSCOLECIDA (*q.v.*).
          - No Orders.
        - Class 4. NEMATOMORPHA (*q.v.*).
          - No Orders.
      - Phylum 8. **Chaetognatha** (*q.v.*).
        - No Orders.
      - Phylum 9. **Nemertina.**
        - Class. NEMERTINA (*q.v.*).
          - Orders: *Protonemertini, Mesonemertini, Metanemertini, Heteronemertini.*
      - Phylum 10. **Mollusca** (*q.v.*).
        - Grade A. ISOPLEURA.
          - Class 1. AMPHINEURA (see CHITON).
            - Orders: *Polyplacophora, Aplacophora.*
        - Grade B. PRORHIPIDOGLOSSOMORPHA.
          - Class 2. GASTROPODA (*q.v.*).
            - Sub-class 1. Streptoneura.
              - Orders: *Aspidobranchia, Pectinibranchia.*
            - Sub-class 2. Euthyneura.
              - Orders: *Opisthobranchia, Pulmonata.*
          - Class 3. SCAPHOPODA (*q.v.*).
            - No Orders.
          - Class 4. LAMELLIBRANCHIA (*q.v.*).
            - Orders: *Protobranchia, Filibranchia, Eulamellibranchia, Septibranchia.*
        - Grade C. SIPHONOPODA.
          - Class 5. CEPHALOPODA (*q.v.*).
            - Orders: *Tetrabranchia, Dibranchia.*
      - Phylum 11. **Appendiculata.**
        - Sub-phylum 1. Rotifera (*q.v.*).
          - Class. ROTIFERA.
            - Orders: *Asplanchnaceae, Melicertaceae, Trochosphaeraceae, Ploimoidaceae, Bdelloidaceae, Flosculariaceae, Ploima, Seisonaceae.*
        - Sub-phylum 2. Chaetopoda (*q.v.*).
          - Class 1. POLYCHAETA.
            - Orders: *Nereidiformia, Cryptocephala, Capitelliformia, Terebelliformia, Spioniformia, Scoleciformia.*
          - Class 2. OLIGOCHAETA.
            - Orders: *Aphaneura, Limicolae, Moniligastres, Terricolae.*
          - Class 3. HIRUDINAE (see LEECH).
            - Orders: *Rhynchobdellidae, Gnathobdellidae, Acanthobdellidae.*
          - Class 4. MYZOSTOMIDA (*q.v.*).
            - No Orders.
          - Class 5. SACCOCIRRIDA.
            - No Orders.
          - Class 6. HAPLODRILI (*q.v.*).
            - No Orders.
          - Class 7. ECHIUROIDEA (*q.v.*).
            - No Orders.
        - Sub-phylum 3. Arthropoda (*q.v.*).
        - Grade 1. CERATOPHORA.
          - Class 1. PERIPATIDEA (see PERIPATUS).
            - No Orders.
          - Class 2. CHILOPODA (see CENTIPEDE).
            - Sub-class 1. Pleurostigma.
              - Orders: *Geophilomorpha, Scolopendromorpha, Craterostigmomorpha, Lithobiomorpha.*
            - Sub-class 2. Notostigma.
              - Order: *Scutigeromorpha.*
          - Class 3. DIPLOPODA (see MILLIPEDE).
            - Sub-class 1. Pselaphognatha.
              - Order: *Penicillata.*
            - Sub-class 2. Chilognatha.
              - Orders: *Oniscomorpha, Limacomorpha, Colobognatha, Ascospermophora, Proterospermophora, Merochaeta, Opisthospermophora.*
          - Class 3. PAUROPODA (see MILLIPEDE).
            - No Orders.
          - Class 4. SYMPHYLA (see MILLIPEDE).
            - No Orders.
          - Class 5. HEXAPODA (*q.v.*).
            - Sub-class 1. Apterygota.
              - Order: *Aptera.*
            - Sub-class 2. Exopterygota.
              - Orders: *Dermaptera, Orthoptera, Plecoptera, Isoptera, Corrodentia, Ephemoptera, Odonata, Thysanoptera, Hemiptera, Anoplura.*
            - Sub-class 3. Endopterygota.
              - Orders: *Neuroptera, Coleoptera, Mecaptera, Trichoptera, Lepidoptera, Diptera, Siphonaptera, Hymenoptera.*
        - Grade 2. ACERATA.
          - Class 1. CRUSTACEA (*q.v.*).
            - Sub-class 1. Entomostraca (*q.v.*).
              - Orders: *Branchiopoda* (Sub-orders: *Phyllopoda, Cladocera, Branchiura*), *Ostracoda, Copepoda.*
            - Sub-class 2. Thyrostraca (*q.v.*) = (Cirripedia).
              - No Orders.
            - Sub-class 3. Leptostraca.
              - No Orders.
            - Sub-class 4. Malacostraca (*q.v.*).
              - Orders: *Decapoda* (Sub-orders: *Brachyura, Macrura*), *Schizopoda* (including *Anaspides*), *Stomatopoda, Sympoda* (*Cumacea*), *Isopoda* (including *Tanaidacea*), *Amphipoda.*
          - Class 2. ARACHNIDA (*q.v.*).
            - Grade A. TRILOBITAE (see TRILOBITE).
              - (Orders not determined.)
            - Grade B. NOMOMERISTICA.
              - Sub-class 1. Pantopoda.
                - Orders: *Nymphonomorpha, Ascorhynchomorpha, Pycnogonomorpha.*
              - Sub-class 2. Eu-Arachna.
                - Grade *a*. Delobrancha (or Hydropneusta).
                  - Orders: *Xiphosura, Gigantostraca.*

- Grade *b*. Embolobranchia (or Aeropneusta).
  - Section. *Pectinifera.*
  - Order: *Scorpionidea.*
  - Section. *Epectinata.*
  - Orders: *Pedipalpi, Araneae, Palpigradi, Solifugae, Pseudoscorpiones, Podogona, Opiliones, Rhynchostomi* (*Acari*).
- Class 3. TARDIGRADA (*q.v.*).
  - No Orders.
- Class 4. LINGUATALINA (see PENTASTOMIDA).
  - No Orders.
- Phylum 12. **Echinoderma** (see ECHINODERMS).
  - Branch A. PELMATOZOA.
    - Class 1. CYSTIDEA.
      - Orders: *Amphoridea, Carpoidea, Rhombifera, Aporita, Diploporita.*
    - Class 2. BLASTOIDEA.
      - Divisions: Protoblastoidea, Eublastoidea.
      - No Orders.
    - Class 3. CRINOIDEA.
      - Orders: *Monocyclica Inadunata, Adunata, Monocyclica Camerata, Dicyclica Inadunata, Flexibilia, Dicyclica Camerata.*
    - Class 4. EDRIOASTEROIDEA.
      - No Orders.
  - Branch B. ELEUTHEROZOA.
    - Class 1. HOLOTHUROIDEA.
      - Orders: *Aspidochirota, Dendrochirota.*
    - Class 2. STELLIFORMIA.
      - Sub-class 1. Asterida.
        - Orders: *Phanerozonia, Cryptozonia.*
      - Sub-class 2. Ophiurida.
        - Orders: *Streptophiurae, Zygophiurae, Cladophiurae.*
    - Class 3. ECHINOIDEA.
      - Orders: *Bothriocidaroida, Melonitoida, Cystocidaroida, Cidaroida, Diademoida, Holectypoida, Spatangoida, Clypeastroida.*
- Phylum 13. **Vertebrata** (*q.v.*).
  - Sub-phylum *a*. Hemichorda (*q.v.*).
    - Class. ENTEROPNEUSTA (see BALANOGLOSSUS).
      - No Orders.
  - Sub-phylum *b*. Urochorda.
    - Class. TUNICATA (*q.v.*).
      - Orders: *Larvacea, Thaliacea* (Sub-orders: *Cyclomyaria, Hemimyaria*), Ascidiacea (Sub-orders: *Ascidiae Simplices, Ascidiae Compositae, Ascidiae Luciae*).
  - Sub-phylum *c*. Cephalochorda (see AMPHIOXUS).
    - Class. CEPHALOCHORDA.
      - No Orders.
  - Sub-phylum *d*. Craniata.[1]
    - Class 1. PISCES (see ICHTHYOLOGY).
      - Sub-class 1. Cyclostomata (*q.v.*).
        - Orders: *Myxinoides* (or *Hyperotreti*), *Petromyzontes* (or *Hyperoariii*).
      - Sub-class 2. Selachia or Elasmobranchii (see SELACHIANS).
        - Orders: *Pleuropterygii, Acanthodii, Ichthyotomi, Plagiostomi, Holocephali.*
      - Sub-class 3. Teleostoma.
        - Orders: *Ganoidea, Crossopterygii, Dipneusti, Teleostei.*
    - Class 2. BATRACHIA (*q.v.*).
      - Orders: *Stegocephalia, Apoda* (or *Peromela*), *Caudata* (or *Urodela*), *Ecaudata* (or *Anura*).
    - Class 3. REPTILIA (see REPTILES).
      - Orders: *Anomodontia, Chelonia, Samopterygia, Ichthyopterygia, Rhyncocephalia, Dinosauria, Crocodilia, Ornithosauria, Squamata.*
    - Class 4. AVES (see BIRD and ORNITHOLOGY).
      - Sub-class 1. Archaeornithes.
        - No Orders.
      - Sub-class 2. Neornithes.
        - Division 1. Ratitae.
          - Orders: *Struthiones, Rheae, Casuariae, Apteryges, Dinornithes, Aepyornithes.*
        - Division 2. Odontolcae.
          - No Orders.
        - Division 3. Carinatae.
          - Orders: *Ichthyornes, Colymbiformes, Sphenisciformes, Procellariiformes, Ciconiiformes,* (Sub-orders: *Steganopodes, Ardeae, Ciconiae, Phoenicopteri*). *Anseriformes* (Sub-orders: *Palamedeae, Anseres*), *Falconiformes* (Sub-orders: *Cathartae, Accipitres*), *Tinamiformes, Galliformes* (Sub orders: *Mesites, Turnices, Galli, Opisthocomi*), *Gruiformes, Charadriiformes* (Sub-orders: *Limicolae, Lari, Pterocles, Columbae*), *Cuculiformes* (Sub-orders: *Cuculi, Psittaci*), *Coraciiformes* (Sub-orders: *Coraciae, Striges, Caprimulgi, Cypseli, Colii, Trogones, Pici*), *Passeriformes* (Sub-orders: *Passeres Anisomyodae, Passeres Diacromyodae*).
    - Class 4. MAMMALIA (*q.v.*).
      - Sub-class 1. Monotremata (*q.v.*) (Prototheria).
        - No Orders.
      - Sub-class 2. Marsupialia (*q.v.*) (Metatheria).
        - One Order: *Marsupialia.*
          - Sub-orders: *Polyprotodonta, Paucituberculata, Diprotodonta.*
      - Sub-class 3. Placentalia (Monodelphia, *q.v.*; or Eutheria).
        - Orders: *Insectivora, Chiroptera, Dermoptera, Edentata* (Sub-orders: *Xenarthra, Pholidota, Tubulidentata*), *Rodentia* (Sub-orders: *Duplicidentata, Simplicidentata*), *Tillodontia, Carnivora* (Sub-orders: *Fissipedia, Pinnipedia, Creodonta*), *Cetacea* (Sub-orders: *Archaeoceti, Odontoceti, Mystacoceti*), *Sirenia, Ungulata* (Sub-orders: *Proboscidea, Hyracoidea, Barypoda, Toxodontia, Amblypoda, Litopterna, Ancylopoda, Condylarthra, Perissodactyla, Artiodactyla*), *Primates* (Sub-orders: *Prosimiae, Anthropoidea*).
- Phylum 14. **Mesozoa** (*q.v.*).
  - Class 1. RHOMBOZOA.
    - No Orders.
  - Class 2. ORTHONECTIDA.
    - No Orders.
- Phylum 15. **Polyzoa** (*q.v.*).
  - Class 1. ENTOPROCTA.
    - No Orders.
  - Class 2. ECTOPROCTA.
    - Orders: *Gymnolaemata* (Sub-orders: *Tripostomata, Cryptostomata, Cyclostomata, Ctenostomata, Cheilostomata*), *Phylactolaemata.*
- Phylum 16. **Acanthocephala** (*q.v.*).
  - Class. ACANTHOCEPHALA.
    - No Orders.
- Phylum 17. **Podaxonia.**
  - Class 1. SIPUNCULOIDEA (*q.v.*).
    - No Orders.
  - Class 2. PRIAPULOIDEA (*q.v.*).
    - No Orders.
  - Class 3. PHORONIDEA (*q.v.*).
    - No Orders.
  - Class 4. PTEROBRACHIA (*q.v.*).
    - No Orders.
  - Class 5. BRACHIOPODA (*q.v.*).
    - Sub-class 1. Ecardines (Inarticulata).
      - Orders: *Atremata, Neotremata.*
    - Sub-class 2. Testicardines (Articulata).
      - Orders: *Protremata, Telotremata.*
- Phylum 18. **Gastrotricha** (*q.v.*).
  - Class. GASTROTRICHA.
    - Sub-orders: *Ichthydina, Cepodina.* (Possibly *Kinorhyncha* (*q.v.*), with only *Echinoderes* is to be placed here).

General Tendencies since Darwin

Darwin may be said to have founded the science of bionomics, and at the same time to have given new stimulus and new direction to morphography, physiology, and plasmology, by uniting them as contributories to one common biological doctrine—the doctrine of organic evolution—itself but a part of the wider doctrine of universal evolution based on the laws of physics and chemistry. The immediate result was, as pointed out above, a reconstruction of the classification of animals upon a genealogical basis, and an investigation of the individual development of animals in relation to the steps of their gradual building up by cell-division, with a view to obtaining evidence of their genetic relationships. On the other hand, the studies which occupied Darwin himself so largely subsequently to the publication of the *Origin of Species*, viz. the explanation of animal (and vegetable) mechanism, colouring, habits, &c., as advantageous to the species or to its ancestors, are only gradually being carried further. The most important work in this direction has been done by Fritz Müller (*Für Darwin*), by Herman Müller (*Fertilization of Plants by Insects*), by August Weismann (memoirs translated by Meldola) by Edward B. Poulton (see his addresses and memoirs published in the *Transactions* of the Entomological Society and elsewhere), and by Abbot Thayer (*Concealing Coloration in the Animal Kingdom,* Macmillan & Co. 1910). In the branch of bionomics, however, concerned with the laws of variation and heredity (thremmatology), there has been considerable progress. In the first place, the continued study of human population has thrown additional light on some of the questions involved, whilst the progress of microscopical research has given us a clear foundation as to the structural facts connected with the origin of the egg-cell and sperm-cell and the process of fertilization.

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[1] Craniata may be usefully divided into 3 grades: (*a*) Branchiata Heterodactyla, which includes Pisces except Cyclostomes. (*b*) Branchiata Pentadactyla, which includes Batrachia. (*c*) Lipobranchia Pentadactyla, which includes Reptiles, Birds and Mammals.

Great attention has been given lately to the important experiments upon the results of hybridizing certain cultivated varieties of plants which were published so long ago as 1865, by the Abbé Mendel, but failed to attract notice until thirty-five years later, sixteen years after his death (see MENDELISM).

Mendelism.

Mendel's object was to gain further knowledge as to the result of mixing by cross-fertilization or interbreeding two strains exhibiting diverse characters or structural features. The whole question as to the mixture of characters in offspring thus produced was—and remains—very imperfectly observed. Mendel's observations constitute an ingenious attempt to throw light on the matter, and in the opinion of some biologists have led to the discovery of an important principle. Mendel made his chief experiments with cultivated varieties of the self-fertilizing edible pea. He selected a variety with some one marked structural feature and crossed it with another variety in which that feature was absent. Instances of his selected varieties are the tall variety which he hybridized with a dwarf variety, a yellow-seeded variety which he hybridized with a green-seeded variety, and again a smooth-seeded variety which he hybridized with a wrinkle-seeded variety. In each set of experiments he concentrated his attention on the one character selected for observation. Having obtained a first hybrid generation, he allowed the hybrids to self-fertilize, and recorded the result in a large number of instances (a thousand or more) as to the number of individuals in the first, second, third and fourth generations in which the character selected for experiment made its appearance. In the first hybrid generation formed by the union of the reproductive germs of the positive variety (that possessing the structural character selected for observation) with those of the negative variety, it is not surprising that all or nearly all the individuals were found to exhibit, as a result of the mixture, the positive character. In subsequent generations produced by self-fertilization of the hybrids it was found that the positive character was not present in all the individuals, but that a result was obtained showing that in the formation of the reproductive cells (ova and sperms) of the hybrid, half were endowed with the positive character and half with the negative. Consequently the result of the haphazard pairing of a large number of these two groups of reproductive cells was to yield, according to the regular law of chance combination, the proportion 1PP, 2PN, 1NN, where P stands for the positive character and N for its absence or negative character—the positive character being accordingly present in three-fourths of the offspring and absent from one-fourth. The fact that in the formation of the reproductive cells of the hybrid generation the material which carries the positive quality is not subdivided so as to give a half-quantity to each reproductive cell, but on the contrary is apparently distributed as an undivided whole to half only of the reproductive cells and not at all to the remainder, is the important inference from Mendel's experiments. Whether this inference is applicable to other classes of cases than those studied by Mendel and his followers is a question which is still under investigation. The failure of the material carrying a positive character to divide so as to distribute itself among all the reproductive cells of a hybrid individual, and the limitation of its distribution to half only of those cells, must prevent the "swamping" of a newly appearing character in the course of the inter-breeding of those individuals possessed of the character with those which do not possess it. The tendency of the proportions in the offspring of 1PP, 2PN, 1NN is to give in a series of generations a regular reversion from the hybrid form PN to the two pure races, viz. the race with the positive character simply and the race with the total absence of it. It has been maintained that this tendency to a severance of the hybrid stock into its components must favour the persistence of a new character of large volume suddenly appearing in a stock, and the observations of Mendel have been held to favour in this way the views of those who hold that the variations upon which natural selection has acted in the production of new species are not small variations but large and "discontinuous." It does not, however, appear that "large" variations would thus be favoured any more than small ones, nor that the eliminating action of natural selection upon an unfavourable variation could be checked.

A good deal of confusion has arisen in the discussions of this latter topic, owing to defective nomenclature. By some writers the word "mutation" is applied only to large and suddenly appearing variations which are found to be capable of hereditary transmission, whilst the term "fluctuation" is applied to small variations whether capable of transmission or not. By others the word "fluctuation" is apparently applied only to those small "acquired" variations due to the direct action of changes in food, moisture and other features of the environment. It is no discovery that this latter kind of variation is not hereditable, and it is not the fact that the small variations, to which Darwin attached great but not exclusive importance as the material upon which natural selection operates, are of this latter kind. The most instructive classification of the "variations" exhibited by fully formed organisms consists in the separation in the first place of those which arise from antecedent congenital, innate, constitutional or germinal variations from those which arise merely from the operation of variation of the environment or the food-supply upon normally constituted individuals. The former are "innate" variations, the latter are "superimposed" variations (so-called "acquired variations"). Both innate and superimposed variations are capable of division into those which are more and those which are less obvious to the human eye. Scarcely perceptible variations of the innate class are regularly and invariably present in every new generation of every species of living thing. Their greatness or smallness so far as human perception goes is not of much significance; their real importance in regard to the origin of new species depends on whether they are of value to the organism and therefore capable of selection in the struggle for existence. An absolutely imperceptible physiological difference arising as a variation may be of selective value, and it may carry with it correlated variations which appeal to the human eye but are of no selective value themselves. The present writer has, for many years, urged the importance of this consideration.

The views of de Vries and others as to the importance of "saltatory variation," the soundness of which was still by no means generally accepted in 1910, may be gathered from the articles MENDELISM and VARIATION. A due appreciation of the far-reaching results of "correlated variation" must, it appears, give a new and distinct explanation to the phenomena which are referred to as "large mutations," "discontinuous variation" and "saltatory evolution." Whatever value is to be attached to Mendel's observation of the breaking up of self-fertilized hybrids of cultivated varieties into the two original parent forms according to the formula "1PP, 2PN, 1NN," it cannot be considered as more than a contribution to the extensive investigation of heredity which still remains to be carried out. The analysis of the specific variations of organic form so as to determine what is really the nature and limitation of a single "character" or "individual variation," and whether two such true and strictly defined single variations of a single structural unit can actually "blend" when one is transmitted by the male parent and the other by the female parent, are matters which have yet to be determined. We do not yet know whether such absolute blending is possible or not, or whether all apparent blending is only a more or less minutely subdivided "mosaic" of non-combinable characters of the parents, in fact whether the combinations due to heredity in reproduction are ever analogous to chemical compounds or are always comparable to particulate mixtures. The attempt to connect Mendel's observation with the structure of the sperm-cells and egg-cells of plants and animals has already been made. The suggestion is obvious that the halving of the number of nuclear threads in the reproductive cells as compared with the number of those present in the ordinary cells of the tissues—a phenomenon which has now been demonstrated as universal—may be directly connected with the facts of segregation of hybrid characters observed by Mendel. The suggestion requires further experimental testing, for which the case of the parthenogenetic production of a portion of the offspring, in such insects as the bee, offers a valuable opportunity for research.

Variation.

Another important development of Darwin's conclusions deserves special notice here, as it is the most distinct advance in the department of bionomics since Darwin's own writings, and at the same time touches questions of fundamental interest. The matter strictly relates to the consideration of the "causes of variation," and is as follows. The fact of variation is a familiar one. No two animals, even of the same brood, are alike: whilst exhibiting a close similarity to their parents, they yet present differences, sometimes very marked differences, from their parents and from one another. Lamarck had put forward the hypothesis that structural alterations acquired by (that is to say, superimposed upon) a parent in the course of its life are transmitted to the offspring, and that, as these structural alterations are acquired by an animal or plant in consequence of the direct action of the environment, the offspring inheriting them would as a consequence not unfrequently start with a greater fitness for those conditions than its parents started with. In its turn, being operated upon by the conditions of life, it would acquire a greater development of the same modification, which it would in turn transmit to its offspring. In the course of several generations, Lamarck argued, a structural alteration amounting to such difference as we call "specific" might be thus acquired. The familiar illustration of Lamarck's hypothesis is that of the giraffe, whose long neck might, he suggested, have been acquired by the efforts of a primitively short-necked race of herbivores who stretched their necks to reach the foliage of trees in a land where grass was deficient, the effort producing a distinct elongation in the neck of each generation, which was then transmitted to the next. This process is known as "direct adaptation"; and there is no doubt that such structural adaptations are acquired by an animal in the course of its life, though such changes are strictly limited in degree and rare rather than frequent and obvious.

Causes of congenital variation.

Transmission of acquired and inherited characters.

Whether such acquired characters can be transmitted to the next generation is a separate question. It was not proved by Lamarck that they can be, and, indeed, never has been proved by actual observation. Nevertheless it has been assumed, and also indirectly argued, that such acquired characters *must* be transmitted. Darwin's great merit was that he excluded from his theory of development any *necessary* assumption of the transmission of acquired characters. He pointed to the admitted fact of congenital variation, and he showed that congenital variations are arbitrary and, so to speak, non-significant. Their causes are extremely difficult to trace in detail, but it appears that they are largely due to a "shaking up" of the living matter which constitutes the fertilized germ or embryo-cell, by the process of mixture in it of the substance of two cells—the germ-cell and the sperm-cell—derived from two different individuals. Other mechanical disturbances may assist in this production of congenital variation. Whatever its causes, Darwin showed that it is all-important. In some cases a pair of animals produce ten million offspring, and in such a number a large range of congenital variation is possible. Since on the average only two of the young survive in the struggle for existence to take the place of their two parents, there is a selection out of the ten million young, none of which are exactly alike, and the selection is determined in nature by the survival of the congenital variety which is fittest to the conditions of life. Hence there is no *necessity* for an assumption of the perpetuation of direct adaptations. The selection of the fortuitously (fortuitously, that is to say, so far as the conditions of survival are concerned) produced varieties is sufficient, since it is ascertained that they will tend to transmit those characters with which they themselves were born, although it is *not* ascertained that they could transmit characters *acquired* on the way through life. A simple illustration of the difference is this: a man born with four fingers only on his right hand is ascertained to be likely to transmit this peculiarity to some at least of his offspring; on the other hand, there is not the slightest ground for supposing that a man who has had one finger chopped off, or has even lost his arm at any period of his life, will produce offspring who are defective in the slightest degree in regard to fingers, hand or arm. Darwin himself, influenced by the consideration of certain classes of facts which seem to favour the Lamarckian hypothesis, was of the opinion that acquired characters are *in some cases* transmitted. It should be observed, however, that Darwin did not attribute an essential part to this Lamarckian hypothesis of the transmission of acquired characters, but expressly assigned to it an entirely subordinate importance.

The new attitude which has been taken since Darwin's writings on this question is to ask for evidence of the asserted transmission of acquired characters. It is held[1] that the Darwinian doctrine of selection of fortuitous congenital variations is sufficient to account for all cases, that the Lamarckian hypothesis of transmission of acquired characters is not supported by experimental evidence, and that the latter should therefore be dismissed. Weismann has also ingeniously argued from the structure of the egg-cell and sperm-cell, and from the way in which, and the period at which, they are derived in the course of the growth of the embryo from the egg—from the fertilized egg-cell—that it is impossible (it would be better to say highly improbable) that an alteration in parental structure *could* produce any exactly representative change in the substance of the germ or sperm-cells.

The one fact which the Lamarckians can produce in their favour is the account of experiments by Brown-Séquard, in which he produced epilepsy in guinea-pigs by section of the large nerves or spinal cord, and in the course of which he was led to believe that in a few rare instances the artificially produced epilepsy and mutilation of the nerves was transmitted. This instance does not stand the test of criticism. The record of Brown-Séquard's original experiment is not satisfactory, and the subsequent attempts to obtain similar results have not been attended with success. On the other hand, the vast number of experiments in the cropping of the tails and ears of domestic animals, as well as of similar operations on man, are attended with negative results. No case of the transmission of the results of an injury can be produced. Stories of tailless kittens, puppies and calves, born from parents one of whom had been thus injured, are abundant, but they have hitherto entirely failed to stand before examination.

Whilst simple evidence of the fact of the transmission of an acquired character is wanting, the *a priori* arguments in its favour break down one after another when discussed. The very cases which are advanced as only to be explained on the Lamarckian assumption are found on examination and experiment to be better explained, or only to be explained, by the Darwinian principle. Thus the occurrence of blind animals in caves and in the deep sea was a fact which Darwin himself regarded as best explained by the atrophy of the organ of vision in successive generations through the absence of light and consequent disuse, and the transmission (as Lamarck would have supposed) of a more and more weakened and structurally impaired eye to the offspring in successive generations, until the eye finally disappeared. But this instance is really fully explained (as the present writer has shown) by the theory of natural selection acting on congenital fortuitous variations. It is definitely ascertained that many animals are thus born with distorted or defective eyes whose parents have not had their eyes submitted to any peculiar conditions. Supposing a number of some species of arthropod or fish to be swept into a cavern or to be carried from less to greater depths in the sea, those individuals with perfect eyes would follow the glimmer of light and eventually escape to the outer air or the shallower depths, leaving behind those with imperfect eyes to breed in the dark place. A natural selection would thus be effected. In every succeeding generation this would be the case, and even those with weak but still seeing eyes would in the course of time escape, until only a pure race of eyeless or blind animals would be left in the cavern or deep sea.

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[1] Weismann, *Vererbung*, &c. (1886).

Educability.

It is a remarkable fact that it was overlooked alike by the supporters and opponents of Lamarck's views until pointed out by the present writer (*Nature*, 1894, p. 127), that the two statements called by Lamarck his first and second laws are contradictory one of the other. Lamarck's first law asserts that a past history of indefinite duration is powerless to create a bias by which the present can be controlled. He declares that in spite of long-established conditions and correspondingly evoked characters new conditions will cause new responsive characters. Yet in the second law he asserts that these new characters will resist the action of yet newer conditions or a reversion to the old conditions and be maintained by heredity. If the earlier characters were not maintained by heredity why should the later be? If a character of much longer standing (certain properties of height, length, breadth, colour, &c.) had not become fixed and congenital after many thousands of successive generations of individuals had developed it in response to environment, but gave place to a new character when new moulding conditions operated on an individual (Lamarck's first law), why should we suppose that the new character is likely to become fixed and transmitted by mere heredity after a much shorter time of existence in response to environmental stimulus? Why should we assume that it will be able to escape the moulding by environment (once its evoking cause is removed) to which, according to Lamarck's first law, all parts of organisms are subject? Clearly Lamarck gives us no reason for any such assumption, and his followers or latter-day adherents have not attempted to do so. His enunciation of his theory is itself destructive of that theory. Though an acquired or "superimposed" character is not transmitted to offspring as the consequence of the action of the external agencies which determine the "acquirement," yet the tendency to react to such agencies possessed by the parent *is* transmitted and may be increased and largely developed by survival, if the character developed by the reaction is valuable. This newly discovered inheritance of "variation in the tendency to react" has a wide application and has led the present writer to coin the word "educability." It has application to all kinds of organs and qualities, but is of especial significance in regard to the development of the brain and the mental qualities of animals and of man (see the jubilee volume of the Soc. de Biologie, 1899, and *Nature*, 1900, p. 624).

Theory of transmission of instincts.

It has been argued that the elaborate structural adaptations of the nervous system which are the corporeal correlatives of complicated instincts must have been slowly built up by the transmission to offspring of acquired experience, that is to say, of acquired brain structure. At first sight it appears difficult to understand how the complicated series of actions which are definitely exhibited as so-called "instincts" by a variety of animals can have been due to the selection of congenital variations, or can be otherwise explained than by the transmission of habits acquired by the parent as the result of experience, and continuously elaborated and added to in successive generations. It is, however, to be noted, in the first place, that the imitation of the parent by the young possibly accounts for some part of these complicated actions, and, secondly, that there are cases in which curiously elaborate actions are performed by animals as a characteristic of the species, and as subserving the general advantage of the race or species, which, nevertheless, can *not* be explained as resulting from the transmission of acquired experience, and must be supposed to be due to the natural selection of a fortuitously developed habit which, like fortuitous colour or form variation, happens to prove beneficial. Such cases are the habits of "shamming dead" and the combined posturing and colour peculiarities of certain caterpillars (Lepidopterous larvae) which cause them to resemble dead twigs or similar surrounding objects. The advantage to the animal of this imitation of surrounding objects is that it escapes the pursuit of (say) a bird which would, were it not deceived by the resemblance, attack and eat the caterpillar. Now it is clear that preceding generations of caterpillars cannot have acquired this habit of posturing by experience. Either the caterpillar postures and escapes, or it does not posture and is eaten; it is not half eaten and allowed to profit by experience. We seem to be justified in assuming that there are many movements of stretching and posturing possible to caterpillars, and that some caterpillars had a congenital fortuitous tendency to one position, some to another, and, finally that among all the variety of habitual movements thus exhibited one has been selected and perpetuated because it coincided with the necessary conditions of safety, since it happened to give the caterpillar an increased resemblance to a twig.

The view that instinct is the hereditarily fixed result of habit derived from experience long dominated all inquiry into the subject, but we may now expect to see a renewed and careful study of animal instincts carried out with the view of testing the applicability to each instance of the pure Darwinian theory without the aid of Lamarckism.

The Record of the Past.

Nothing can be further from the truth than the once favourite theory that instincts are the survivals of lapsed reasoning processes. Instincts, or the inherited structural mechanisms of the nervous centres, are in antagonism to the results of the reasoning process, which are not capable of hereditary transmission. Every higher vertebrate animal possesses the power of forming for itself a series of cerebral mechanisms or reasoned conclusions based on its individual experience, in proportion as it has a large cerebrum and has got rid of or has acquired the power of controlling its inherited instincts. Man, compared with other animals, has the fewest inherited mental mechanisms or instincts and at the same time the largest cerebrum in proportion to the size of his body. He builds up, from birth onwards, his own mental mechanisms, and forms more of them, that is to say, is more "educable," and takes longer in doing so, that is to say, in growing up and maturing his experience, than any other animal. The later stages of evolution leading from his ape-like ancestors to man have consisted definitely in the acquirement of a larger and therefore more educable brain by man and in the consequent education of that brain. A new and most important feature in organic development makes its appearance when we set out the facts of man's evolutional history. It amounts to a new and unprecedented factor in organic development, external to the organism and yet produced by the activity of the organism upon which it permanently reacts. This factor is the Record of the Past, which grows and develops by laws other than those affecting the perishable bodies of successive generations of mankind, and exerts an incomparable influence upon the educable brain, so that man, by the interaction of the Record and his educability, is removed to a large extent from the status of the organic world and placed in a new and unique position, subject to new laws and new methods of development unlike those by which the rest of the living world is governed. That which we term the Record of the Past comprises the "taboos," the customs, the traditions, the beliefs, the knowledge which are handed on by one generation to another independently of organic propagation. By it a new heredity, free from the limitations of protoplasmic continuity, is established. Its first beginnings are seen in the imitative tendencies of animals by which the young of one generation acquire some of the habits of their parents, and by which gregarious and social animals acquire a community of procedure ensuring the advantage of the group. "Taboo," the systematic imposition by the community of restrictions upon the conduct of the individual, is one of its earliest manifestations in primitive man and can be observed even in animal communities. But with the development of the power of inter-communication by the use of language, the Record rapidly acquired an increased development, which was enormously extended by the continuous growth in mankind of the faculty of memory. To the mere tradition preserved by memory and handed on by speech was then added the written record and its later multiplication by the mechanical arts of printing, by which it acquired permanence and universal distribution. The result is the creation of an almost inconceivably vast body of traditional custom, law and knowledge into which every human being is born, less in the more isolated and barbarous communities, but large everywhere. Education is not in its essential nature a training administered to the young by an older generation, but is the natural and unaided assimilation of the Record of the Past by the automatically educable brain—an assimilation which is always in all races very large but becomes far larger in civilized communities. It is among them so important whilst the Record in all its details is so far beyond the receptive capacity of the brain, that selection and guidance are employed by the elders in order to enable the younger generation to benefit to the utmost by the absorption (so to speak) in the limited span of a lifetime of the most valuable influences to be acquired from this prodigious envelope of Recorded Experience. The imperishable Record invests the human race like a protective atmosphere, a new and yet a natural dispensation, giving to man, as compared with his animal ancestry, a new heaven and a new earth!

A result of the very greatest importance arising from the application of the generalizations of Darwinism to human development and to the actual phase of existing human population is that education has no direct effect upon the mental or physical features of the race or stock: it can only affect those of the individual. Educability, defects or excellences, or peculiarities of mind or body, can be handed on from parent to offspring by protoplasmic continuity in reproduction. But the results of education cannot be so handed on. The educated man who has acquired new experiences, new knowledge, can place these on the great Record for the benefit of future generations of men, but he cannot bodily transmit his acquirements to his offspring. Were acquired (superimposed) characters really transmissible by breeding, then every child born would inherit, more or less completely, the knowledge acquired by both its parents. But we know this is not the case: the child has to begin with a clean slate and learn for itself. Aptitudes and want of aptitude, which are innate and constitutional, are transmitted to offspring, but not the results of experience, education and training. Blemishes in the stock, defects of mind or body, though they may be to some extent corrected in the individual by training, cannot be got rid of from the stock by any such process. A defective stock, if allowed to breed, will perpetuate its defects, in spite of the concealment of those defects in an individual by training or other treatment. Equally it must be concluded that the weakness and degradation produced by semi-starvation and insanitary conditions of life are only an effect on the individual and cannot affect the stock. The stock may be destroyed, killed out by adverse conditions, but its quality is not directly affected, and if removed to more favourable conditions it will show no hereditary results of the previous adversity; indeed it will probably have been strengthened in some ways by the destruction in severe conditions of its weaker members and the survival of the stronger individuals. Such considerations have the very greatest importance for the guidance of the action of civilized man in seeking the health and happiness of the community. But it must not be forgotten that the problems presented by human communities are extremely complex, and that the absence of any selection of healthy or desirable stock in the breeding of human communities leads to undesirable consequences. The most thrifty and capable sections of the people at the present day are not (it has been shown) in overcrowded areas, producing offspring at such a rate as to contribute to the increase of the population. That increase, it has been shown, is due to the early marriage and excessive reproduction of the reckless and hopeless, the poorest, least capable, least desirable members of the community. The questions raised by these considerations have attracted much public attention under the newly invented name of "eugenics," but they are of an exceedingly difficult and delicate nature.

(E. R. L.)

ZORILLA, MANUEL RUIZ, Don (1834–1895), Spanish politician, was born at Burgo de Osma in 1834. He began his education at Valladolid, and studied law afterwards at Madrid University, where he leaned towards Radicalism in politics. In 1856 he was elected deputy, and soon attracted notice among the most advanced Progressists and Democrats. He took part in the revolutionary propaganda that led to the military movement in Madrid on the 22nd of June 1866. He had to take refuge in France for two years, like his fellow-conspirators, and only returned to Spain when the revolution of 1868 took place. He was one of the members of the first cabinet after the revolution, and in 1869, under the regency of Marshal Serrano, he became minister of grace and justice. In 1870 he was elected president of the House of Deputies, and seconded Prim in offering the throne to Amadeus of Savoy. He went to Italy as president of the commission, carrying to the prince at Florence the official news of his election. On the arrival of Amadeus in Spain, Ruiz Zorilla became minister of public works for a short time, and resigned by way of protesting against Serrano and Topete entering the councils of the new king. Six months later, in 1871, he was invited by Amadeus to form a cabinet, and he continued to be the principal councillor of the king until February 1873, when the monarch abdicated in disgust at the resistance he met with in the army, and at the lack of sincerity on the part of the very politicians and generals who had asked him to ascend the throne. After the departure of Amadeus, Ruiz Zorilla advocated the establishment of a republic. Notwithstanding this, he was not called upon either by the Federal Republicans to help them during the year 1873, or by Marshal Serrano during 1874 to join Martos and Sagasta in his cabinet. Immediately after the restoration of Alphonso XII., early in 1875, Ruiz Zorilla went to France. He was for nearly eighteen years the soul of the republican conspiracies, the prompter of revolutionary propaganda, the chief inspirer of intrigues concerted by discontented military men of all ranks. He gave so much trouble to the Madrid governments that they organized a watch over him with the assistance of the French government and police, especially when it was discovered that the two military movements of August 1883 and September 1886 had been prepared and assisted by him. During the last two years of his life Ruiz Zorilla became less active; failing health and the loss of his wife had decreased his energies, and the Madrid government allowed him to return to Spain some months before he died at Burgos, on the 13th of June 1895, of heart disease.

ZORNDORF, a village of Prussia, in the Oder valley, north-east of Cüstrin. It is famous as the scene of a battle in which the Prussians under Frederick the Great defeated the Russians commanded by Fermor, on the 25th of August 1758 (see Seven Years' War).

ZOROASTER, one of the great teachers of the East, the founder of what was the national religion of the Perso-Iranian people from the time of the Achaemenidae to the close of the Sassanian period. The name (Ζωροάστρης) is the corrupt Greek form of the old Iranian *Zarathustra* (new Persian, *Zardusht*). Its signification is obscure; but it certainly contains the word *ushtra*, "camel."

Evidence for his life.

Zoroaster was already famous in classical antiquity as the founder of the widely renowned wisdom of the Magi. His name is not mentioned by Herodotus in his sketch of the Medo-Persian religion (i. 131 seq.). It occurs for the first time in a fragment of Xanthus (29), and in the *Alcibiades* of Plato (i. p. 122), who calls him the son of Oromazdes. For occidental writers, Zoroaster is always the *Magus*, or the founder of the whole Magian system (Plut. *de Is. et Osir.* 46; Plat. *loc. cit.*; Diog. Laërt. *prooem.* 2: other passages in Jackson's *Zoroaster*, 6 seq.). They sometimes call him a Bactrian, sometimes a Median or Persian (cf. Jackson, *op. cit.* 186). The ancients also recount a few points regarding the childhood of Zoroaster and his hermit-life. Thus, according to Pliny (*Nat. Hist.* vii. 15), he laughed on the very day of his birth—a statement found also in the *Zardusht-Nāma*—and lived in the wilderness upon cheese (xi. 97). Plutarch speaks of his intercourse with the deity, and compares him with Lycurgus and Numa (*Numa*, 4). Dio Chrysostom, Plutarch's contemporary, declares that neither Homer nor Hesiod sang of the chariot and horses of Zeus so worthily as Zoroaster, of whom the Persians tell that, out of love to wisdom and righteousness, he withdrew himself from men, and lived in solitude upon a mountain. The mountain was consumed by fire, but Zoroaster escaped uninjured and spoke to the multitude (vol. ii. p. 60). Plutarch, drawing partly on Theopompus, speaks of his religion in his *Isis and Osiris* (cc. 46–47). He gives a faithful sketch of the doctrines, mythology and dualistic system of the Magian Zoroaster.

As to the period in which he lived, most of the Greeks have already lost the true perspective. Hermodorus and Hermippus of Smyrna place him 5000 years before the Trojan war, Xanthus 6000 years before Xerxes, Eudoxus and Aristotle 6000 years before the death of Plato. Agathias remarks (ii. 24), with perfect truth, that it is no longer possible to determine with any certainty when he lived and legislated. "The Persians," he adds, "say that Zoroaster lived under Hystaspes, but do not make it clear whether by this name they mean the father of Darius or another Hystaspes. But, whatever may have been his date, he was their teacher and instructor in the Magian religion, modified their former religious customs, and introduced a variegated and composite belief."

He is nowhere mentioned in the cuneiform inscriptions of the Achaemenidae, although Darius and his successors were without doubt devoted adherents of Zoroastrianism. The Avesta is, indeed, our principal source for the doctrine of Zoroaster; on the subject of his person and his life it is comparatively reticent; with regard to his date it is, naturally enough, absolutely silent. The 13th section, or *Spend Nask*, which was mainly consecrated to the description of his life, has perished; while the biographies founded upon it in the 7th book of the *Dinkard* (9th century A.D.), the *Shāh-Nāma*, and the *Zardusht-Nāma* (13th century), are thoroughly legendary—full of wonders, fabulous histories and miraculous deliverances.

Under all circumstances we must imitate the ancient authors in holding fast to the historic personality of Zoroaster; though he—like many another name of the dim past—has failed to escape the fate of being regarded as a purely mythical creation (for instance, by Kern and by Darmesteter, in the *Sacred Books of the East*, vol. iv. 1880, introd. 76). According to Darmesteter, the Zarathustra of the Avesta is a mere myth, a divinity invested with human attributes, an incarnation of the storm-god, who with his divine word, the thunder, comes and smites the demons. Darmesteter has failed to realize sufficiently the distinction between the Zoroaster of the later Avesta and the Zoroaster of the Gāthās. It cannot be denied that in the later Avesta, and still more in writings of more recent date, he is presented in a legendary light and endowed with superhuman powers. At his appearing all nature rejoices (*Yasht*, 13, 93); he enters into conflict with the demons and rids the earth of their presence (*Yasht*, 17,19); Satan approaches him as tempter to make him renounce his faith (*Vendidad*, 19, 6).

The Gāthās alone within the Avesta make claim to be the *ipsissima verba* of the prophet; in the rest of that work they are put into Zoroaster's own mouth (*Yasna*, 9, 1) and are expressly called "the Gāthās of the holy Zoroaster" (*Yasna*, 57, 8). The litanies of the Yasna, and the Yashts, refer to him as a personage belonging to the past. The Vendidad also merely gives accounts of the dialogues between Ormazd and Zoroaster. The Gāthās alone claim to be authentic utterances of Zoroaster, his actual expressions in presence of the assembled congregation. They are the last genuine survivals of the doctrinal discourses with which—as the promulgator of a new religion—he appeared at the court of King Vīshtāspa

The person of the Zoroaster whom we meet with in these hymns differs *toto coelo* from the Zoroaster of the younger Avesta. He is the exact opposite of the miraculous personage of later legend—a mere man, standing always on the solid ground of reality, whose only arms are trust in his God and the protection of his powerful allies. At times his position is precarious enough. He whom we hear in the Gāthās has had to face, not merely all forms of outward opposition and the unbelief and lukewarmness of adherents, but also the inward misgivings of his own heart as to the truth and final victory of his cause. At one time hope, at another despondency, now assured confidence, now doubt and despair, here a firm faith in the speedy coming of the kingdom of heaven, there the thought of taking refuge by flight—such is the range of the emotions which find their immediate expression in these hymns. And the whole breathes such a genuine originality, all is psychologically so accurate and just, the earliest beginnings of the new religious movement, the childhood of a new community of faith, are reflected so naturally in them all, that it is impossible for a moment to think of a later period of composition by a priesthood whom we know to have been devoid of any historical sense, and incapable of reconstructing the spiritual conditions under which Zoroaster lived. So soon as the point of view is clear—that in the Gāthās we have firm historical ground on which Zoroaster and his surroundings may rest, that here we have the beginnings of the Zoroastrian religion—then it becomes impossible to answer otherwise than affirmatively every general question as to the historical character of Zoroaster. Yet we must not expect too much from the Gāthās in the way of definite detail. They give no historical account of the life and teaching of their prophet, but rather are, so to say, *versus memoriales*, which recapitulate the main points of interest, often again in brief outlines. They are more of general admonitions, asseverations, solemn prophecies, sometimes directed to the faithful flock or to the princes, but generally cast in the form of dialogues with God and the archangels, whom he repeatedly invokes as witnesses to his veracity. Moreover, they contain many allusions to personal events which later generations have forgotten. It must be remembered, too, that their extent is limited, and their meaning, moreover, frequently dubious or obscure.

The Person of the Prophet.—As to his birthplace the testimonies are conflicting. According to the Avesta (*Yasna*, 9, 17), Airyanem Vaējō, on the river Dāitya, the old sacred country of the gods, was the home of Zoroaster, and the scene of his first appearance. There, on the river Darejya, assuming that the passage (*Vend.*, 19, 4) is correctly interpreted, stood the house of his father; and the *Bundahish* (20, 32 and 24, 15) says expressly that the river Dāraja lay in Airan Vej, on its bank was the dwelling of his father, and that there Zoroaster was born. Now, according to the *Bundahish* (29, 12), Airan Vej was situated in the direction of Atropatene, and consequently Airyanem Vaējō is for the most part identified with the district of Arrān on the river Aras (Araxes), close by the north-western frontier of Media. Other traditions, however, make him a native of Rai (Ragha, Ῥάγαι). According to *Yasna*, 19, 18, the *zarathushtrōtema*, or supreme head of the Zoroastrian priesthood, had at a later (Sasanian) time, his residence in Ragha. The Arabic writer Shahrastānī endeavours to bridge the divergence between the two traditions by means of the following theory: his father was a man of Atropatēne, while the mother was from Rai. In his home tradition recounts he enjoyed the celestial visions and the conversations with the archangels and Ormazd which are mentioned already in the Gāthās. There, too, according to *Yasht*, 5, 105, he prayed that he might succeed in converting King Vīshtāspa. He then appears to have quitted his native district. On this point the Avesta is wholly silent: only one obscure passage (*Yasna*, 53, 9) seems to intimate that he found an ill reception in Rai. Finally, in the person of Vīshtāspa, who seems to have been a prince resident in east Iran, he gained the powerful protector and faithful disciple of the new religion whom he desired—though after almost superhuman dangers and difficulties, which the later books depict in lively colours. According to the epic legend, Vīshtāspa was king of Bactria. Already in the later Avesta he has become a half-mythical figure, the last in the series of heroes of east Iranian legend, in the arrangement of which series priestly influence is unmistakably evident. He stands at the meeting-point between the old world and the new era which begins with Zoroaster. In the Gāthās he appears as a quite historical personage; it is essentially to his power and good example that the prophet is indebted for his success. In *Yasna*, 53, 2, he is spoken of as a pioneer of the doctrine revealed by Ormazd. In the relation between Zoroaster and Vīshtāspa already lies the germ of the state church which afterwards became completely subservient to the interests of the dynasty and sought its protection from it.

Among the grandees of the court of Vīshtāspa mention is made of two brothers, Frashaoshtra and Jāmāspa; both were, according to the later legend, vizirs of Vīshtāspa. Zoroaster was nearly related to both: his wife, Hvōvi, was the daughter of Frashaoshtra, and the husband of his daughter, Pourucista, was Jāmāspa. The actual rôle of intermediary was played by the pious queen Hutaosa. Apart from this connexion, the new prophet relies especially upon his own kindred (*hvaētush*). His first disciple, Maidhyōimāongha, was his cousin: his father was, according to the later Avesta, Pourushaspa, his mother Dughdōvā, his great-grandfather Haēcataspa, and the ancestor of the whole family Spitama, for which reason Zarathushtra usually bears this surname. His sons and daughters are repeatedly spoken of. His death is, for reasons easily intelligible, nowhere mentioned in the Avesta; in the *Shāh-Nāma* he is said to have been murdered at the altar by the Turanians in the storming of Balkh.

We are quite ignorant as to the date of Zoroaster; King Vīshtāspa does not seem to have any place in any historical chronology, and the Gāthās give no hint on the subject. In former times the assertion often was, and even now is often put forward, that Vīshtāspa was one and the same person with the historical Hystaspes, father of Darius I. This identification can only be purchased at the cost of a complete renunciation of the Avestan genealogy. Hutaosa is the same name as Atossa: but in history Atossa was the wife of Cambyses and Darius. Otherwise, not *one* single name in the entourage of our Vīshtāspa can be brought into harmony with historical nomenclature. According to the Arda Vīrāf, 1, 2, Zoroaster taught, in round numbers, some 300 years before the invasion of Alexander. The testimony of Assyrian inscriptions relegates him to a far more ancient period. If these prove the name Mazdaka to have formed part of Median proper names in the year 715 B.C., Eduard Meyer (*v. Ancient Persia*) is justified in maintaining that the Zoroastrian religion must even then have been predominant in Media. Meyer, therefore, conjecturally puts the date of Zoroaster at 1000 B.C., as had already been done by Duncker (*Geschichte des Altertums*, 4^4, 78). This, in its turn, may be too high: but, in any case, Zoroaster belongs to a prehistoric era. Probably he emanated from the old school of Median Magi, and appeared first in Media as the prophet of a new faith, but met with sacerdotal opposition, and turned his steps eastward. In the east of Iran the novel creed first acquired a solid footing, and subsequently reacted with success upon the West.

Zoroastrianism.—Zoroaster taught a new religion; but this must not be taken as meaning that everything he taught came, so to say, out of his own head. His doctrine was rooted in the old Iranian—or Aryan—folk-religion, of which we can only form an approximate representation by comparison with the religion of the Veda. The newly discovered Hittite inscriptions have now thrown a welcome ray of light on the primitive Iranian creed (Ed. Meyer, *Sitzungsberichte der Preuss. Akademie*, 1908). In these inscriptions Mitra, Varuna, Indra and Nāsatya are mentioned as deities of the Iranian kings of Mitani at the beginning of the 14th century—all of them names with which we are familiar from the Indian pantheon. The Aryan folk-religion was polytheistic. Worship was paid to popular divinities, such as the war-god and dragon-slayer Indra, to natural forces and elements such as fire, but the Aryans also believed in the ruling of moral powers and of an eternal law in nature (*v.* Ed. Meyer in the article PERSIA: *History*, § *Ancient*). On solemn occasions the inspiring drink soma (*haoma*) ministered to the enjoyment of the devout. Numerous coincidences with the Indian religion survive in Zoroastrianism, side by side with astonishing diversities.

The most striking difference between Zoroaster's doctrine of God and the old religion of India lies in this, that while in the Avesta the evil spirits are called *daēva* (Modern Persian *dīv*), the Aryans of India, in common with the Italians, Celts and Letts, gave the name of *dēva* to their good spirits, the spirits of light. An alternative designation for deity in the *Rig-Veda* is *asura*. In the more recent hymns of the *Rig-Veda* and in later India, on the other hand, only *evil* spirits are understood by *asuras*, while in Iran the corresponding word *ahura* was, and ever has continued to be, the designation of God the Lord. Thus *ahura-daēva*, *dēva-asura* in Zoroastrian and in later Brahman theology are in their meanings diametrically opposed.

Asura-daiva represent originally two distinct races of gods (like the Northern Aser and Vaner)—two different aspects of the conception of deity, comparable to δαίμων and δεός. *Asura* indicates the more sublime and awful divine character, for which man entertains the greater reverence and fear: *daiva* denotes the kind gods of light, the vulgar—more sensuous and anthropomorphic—deities. This twofold development of the idea of God formed the point of leverage for Zoroaster's reformation. While in India the conception of the *asura* had veered more and more towards the dreadful and the dreaded, Zoroaster elevated it again—at the cost, indeed, of the daivas (*daēvas*), whom he degraded to the rank of malicious powers and devils. In one *Asura*, whose Aryan original was Varuna, he concentrated the whole of the divine character, and conferred upon it the epithet of "the wise" (*mazdāo*). This culminating stage in the *asura*-conception is the work of Zoroaster. The Wise Lord (*Ahurō Mazdāo*—later *Ormazd*) is the primeval spiritual being, the All-father, who was existent before ever the world arose. From him that world has emanated, and its course is governed by his foreseeing eye. His guiding spirit is the Holy Spirit, which wills the good: yet it is not free, but restricted, in this temporal epoch, by its antagonist and own twin-brother (*Yasna*, 30, 3), the Evil Spirit (*angrō mainyush*, *Ahriman*), who in the beginning was banished by the Good Spirit by means of the famous ban contained in *Yasna*, 45, 2, and since then drags out his existence in the darkness of Hell as the principle of ill—the arch-devil. In the Gāthās the Good Spirit of Mazda and the Evil Spirit are the two great opposing forces in the world, and Ormazd himself is to a certain extent placed above them both. Later the Holy Spirit is made directly equivalent to Ormazd; and then the great watchword is: "Here Ormazd, there Ahriman!" The very *daēvas* are only the inferior instruments, the corrupted children of Ahriman, from whom come all that is evil in the world. The *daēvas*, unmasked and attacked by Zoroaster as the true enemies of mankind, are still, in the Gāthās, without doubt the perfectly definite gods of old popular belief—the idols of the people. For Zoroaster they sink to the rank of spurious deities, and in his eyes their priests and votaries are idolaters and heretics. In the later, developed system the *daēvas* are the evil spirits in general, and their number has increased to millions. Some few of these have names; and among those names of the old Aryan divinities emerge here and there, *e.g.* Indra and Nāonhaitya. With some, of course—such as the god of fire—the connexion with the good deity was a priori indissoluble. Other powers of light, such as Mitra the god of day (Iranian *Mithra*), survived unforgotten in popular belief till the later system incorporated them in the angelic body. The authentic doctrine of the Gāthās had no room either for the cult of Mithra or for that of the Haoma. Beyond the Lord and his Fire, the Gāthās only recognize the archangels and certain ministers of Ormazd, who are, without exception, personifications of abstract ideas. This hypostasization and all-egotization is especially characteristic of the Zoroastrian religion. The essence of Ormazd is Truth and Law *asha* = Vedic *rta*): this quality he embodies, and its personification (though conceived as sexless) is always by his side, a constant companion and intimate. The essence of the wicked spirit is falsehood: and falsehood, as the embodiment of the evil principle, is much more frequently mentioned in the Gāthās than Ahriman himself.

Zoroaster says of himself that he had received from God a commission to purify religion (*Yasna*, 44, 9). He purified it from the grossly sensual elements of *daēva* worship, and uplifted the idea of religion to a higher and purer sphere. The motley body of Aryan folk-belief, when subjected to the unifying thought of a speculative brain, was transformed to a self-contained theory of the universe and a logical dualistic principle. But this dualism is a temporally limited dualism—no more than an episode in the world-whole—and is destined to terminate in monotheism. Later sects sought to rise from it to a higher unity in other ways. Thus the Zarvanites represented Ormazd and Ahriman as twin sons proceeding from the fundamental principle of all—*Zrvana Akarana*, or limitless time.

Ethically, too, the new doctrine stands on a higher plane, and represents, in its moral laws, a superior civilization. The devil-worshippers, at their sacrifices, slay the ox; and this the *daēvas* favour, for they are foes to the cattle and to cattle-breeding, and friends to those who work ill to the cow. In Zoroaster's eyes this is an abomination: for the cow is a gift of Ormazd to man, and the religion of Mazda protects the sacred animal. It is the religion of the settled grazier and the peasant, while the ruder *daēva*-cult holds its ground among the uncivilized nomadic tribes. In an old confession of faith, the convert is pledged to abjure the theft and robbery of cattle and the ravaging of villages inhabited by worshippers of Mazda (*Yasna*, 12, 2).

Zoroaster's teachings show him to have been a man of a highly speculative turn, faithful, however, with all his originality, to the Iranian national character. With zeal for the faith, and boldness and energy, he combined diplomatic skill in his dealings with his exalted protectors. His thinking is consecutive, self-restrained, practical, devoid of everything that might be called fantastic or excessive. His form of expression is tangible and concrete: his system is constructed on a clearly conceived plan and stands on a high moral level; for its time it was a great advance in civilization. *The doctrine of Zoroaster* and the Zoroastrian Church may be summarized somewhat as follows:—

At the beginning of things there existed the two spirits who represented good and evil (*Yasna*, 30, 3). The existence of evil in the world is thus presupposed from the beginning. Both spirits possess creative power, which manifests itself positively in the one and negatively in the other. Ormazd is light and life, and creates all that is pure and good—in the ethical world of law, order and truth. His antithesis is darkness, filth, death, and produces all that is evil in the world. Until then the two spirits had counterbalanced one another. The ultimate triumph of the good spirit is an ethical demand of the religious consciousness and the quintessence of Zoroaster's religion.

The evil spirit with his wicked hosts appears in the Gāthās much less endowed with the attributes of personality and individuality than does Ahura Mazda. Within the world of the good Ormazd is Lord and God alone. In this sense Zoroastrianism is often referred to as the faith of Ormazd or as Mazdaism. Ormazd in his exalted majesty is the ideal figure of an Oriental king. He is not alone in his doings and conflicts, but has in conjunction with himself a number of genii—for the most part personifications of ethical ideas. These are his creatures, his instruments, servants and assistants. They are comprehended under the general name of *ameshā spentā* ("immortal holy ones") and are the prototypes of the seven *amshaspands* of a later date. These are—(1) Vohu Manō (εὔνοια), good sense, *i.e.* the good principle, the idea of the good, the principle that works in man inclining him to what is good; (2) Ashem, afterwards Ashem Vahishtem (Plutarch's ἀλήθεια), the genius of truth and the embodiment of all that is true, good and right, upright law and rule—ideas practically identical for Zoroaster; (3) Khshathrem, afterwards Khshathrem Vairīm (εὐνομία), the power and kingdom of Ormazd, which have subsisted from the first but not in integral completeness, the evil having crept in like tares among the wheat: the time is yet to come when it shall be fully manifested in all its unclouded majesty; (4) Ārmaiti (σοφία), due reverence for the divine, *verecundia*, spoken of as daughter of Ormazd and regarded as having her abode upon the earth; (5) Haurvatāt (πλοῦτος), perfection; (6) Ameretāt, immortality. Other ministering angels are Gēush Urvan ("the genius and defender of animals"), and Sraosha, the genius of obedience and faithful hearing.

As soon as the two separate spirits (cf. *Bundahish*, 1, 4) encounter one another, their creative activity and at the same time their permanent conflict begin. The history of this conflict is the history of the world. A great cleft runs right through the world: all creation divides itself into that which is Ahura's and that which is Ahriman's. Not that the two spirits carry on the struggle in person; they leave it to be fought out by their respective creations and creatures which they sent into the field. The field of battle is the present world.

In the centre of battle is man: his soul is the object of the war. Man is a creation of Ormazd, who therefore has the right to call him to account. But Ormazd created him free in his determinations and in his actions, wherefore he is accessible to the influences of the evil powers. This freedom of the will is clearly expressed in *Yasna*, 31, 11: "Since thou, O Mazda, didst at the first create our being and our consciences in accordance with thy mind, and didst create our understanding and our life together with the body, and works and words in which man according to his own will can frame his confession, the liar and the truth-speaker alike lay hold of the word, the knowing and the ignorant each after his own heart and understanding. Ārmaiti searches, following thy spirit, where errors are found." Man takes part in this conflict by all his life and activity in the world. By a true confession of faith, by every good deed, word and thought, by continually keeping pure his body and his soul, he impairs the power of Satan and strengthens the might of goodness, and establishes a claim for reward upon Ormazd; by a false confession, by every evil deed, word and thought and defilement, he increases the evil and renders service to Satan.

The life of man falls into two parts—its earthly portion and that which is lived after death is past. The lot assigned to him after death is the result and consequence of his life upon earth. No religion has so clearly grasped the ideas of guilt and of merit. On the works of men here below a strict reckoning will be held in heaven (according to later representations, by Rashnu, the genius of justice, and Mithra). All the thoughts, words and deeds of each are entered in the book of life as separate items—all the evil works, &c., as debts. Wicked actions cannot be undone, but in the heavenly account can be counterbalanced by a surplus of good works. It is only in this sense that an evil deed can be atoned for by a good deed. Of a real remission of sins the old doctrine of Zoroaster knows nothing, whilst the later Zoroastrian Church admits repentance, expiation and remission. After death the soul arrives at the *cinvatō peretu*, or accountant's bridge, over which lies the way to heaven. Here the statement of his life account is made out. If he has a balance of good works in his favour, he passes forthwith into paradise (*Garō demāna*) and the blessed life. If his evil works outweigh his good, he falls finally under the power of Satan, and the pains of hell are his portion for ever. Should the evil and the good be equally balanced, the soul passes into an intermediary stage of existence (the *Hamēstakāns* of the Pahlavi books) and its final lot is not decided until the last judgment. This court of reckoning, the *judicium particulare*, is called *ākā*. The course of inexorable law cannot be turned aside by any sacrifice or offering, nor yet even by the free grace of God.

But man has been smitten with blindness and ignorance: he knows neither the eternal law nor the things which await him after death. He allows himself too easily to be ensnared by the craft of the evil powers who seek to ruin his future existence. He worships and serves false gods, being unable to distinguish between truth and lies. Therefore it is that Ormazd in his grace determined to open the eyes of mankind by sending a prophet to lead them by the right way, the way of salvation. According to later legend (*Vd.*, 2, 1), Ormazd at first wished to entrust this task to Yima (Jemshid), the ideal of an Iranian king. But Yima, the secular man, felt himself unfitted for it and declined it. He contented himself therefore with establishing in his paradise (*vara*) a heavenly kingdom in miniature, to serve at the same time as a pattern for the heavenly kingdom that was to come. Zoroaster at last, as being a spiritual man, was found fit for the mission. He experienced within himself the inward call to seek the amelioration of mankind and their deliverance from ruin, and regarded this inner impulse, intensified as it was by long, contemplative solitude and by visions, as being the call addressed to him by God Himself. Like Mahommed after him he often speaks of his conversations with God and the archangels. He calls himself most frequently *manthran* ("prophet"), *ratu* ("spiritual authority"), and *saoshyant* ("the coming helper"—that is to say, when men come to be judged according to their deeds).

The full contents of his dogmatic and ethical teaching we cannot gather from the Gāthās. He speaks for the most part only in general references of the divine commands and of good and evil works. Among the former those most inculcated are renunciation of Satan, adoration of Ormazd, purity of soul and body, and care of the cow. We learn little otherwise regarding the practices connected with his doctrines. A ceremonial worship is hardly mentioned. He speaks more in the character of prophet than in that of lawgiver. The contents of the Gāthās are essentially eschatological. Revelations concerning the last things and the future lot, whether bliss or woe, of human souls, promises for true believers, threatenings for misbelievers, his firm confidence as to the future triumph of the good—such are the themes continually dwelt on with endless variations.

It was not without special reason—so Zoroaster believed—that the calling of a prophet should have taken place precisely when it did. It was, he held, the final appeal of Ormazd to mankind at large. Like John the Baptist and the Apostles of Jesus, Zoroaster also believed that the fulness of time was near, that the kingdom of heaven was at hand. Through the whole of the Gāthās runs the pious hope that the end of the present world is not far distant. He himself hopes, with his followers, to live to see the decisive turn of things, the dawn of the new and better aeon. Ormazd will summon together all his powers for a final decisive struggle and break the power of evil for ever; by his help the faithful will achieve the victory over their detested enemies, the *daēva* worshippers, and render them impotent. Thereupon Ormazd will hold a *judicium universale*, in the form of a general ordeal, a great test of all mankind by fire and molten metal, and will judge strictly according to justice, punish the wicked, and assign to the good the hoped-for reward. Satan will be cast, along with all those who have been delivered over to him to suffer the pains of hell, into the abyss, where he will henceforward lie powerless. Forthwith begins the one undivided kingdom of God in heaven and on earth. This is called, sometimes the good kingdom, sometimes simply the kingdom. Here the sun will for ever shine, and all the pious and faithful will live a happy life, which no evil power can disturb, in the eternal fellowship of Ormazd and his angels. Every believer will receive as his guerdon the inexhaustible cow and the gracious gifts of the *Vohu manō*. The prophet and his princely patrons will be accorded special honour.

History and Later Development.—For the great mass of the people Zoroaster's doctrine was too abstract and spiritualistic. The vulgar fancy requires sensuous, plastic deities, which admit of visible representation; and so the old gods received honour again and new gods won acceptance. They are the angels (*yazata*) of New Zoroastrianism. Thus, in the later Avesta, we find not only Mithra but also purely popular divinities such as the angel of victory, Verethraghna, Anāhita (Anāïtis), the goddess of the water, Tishrya (Sirius), and other heavenly bodies, invoked with special preference. The Gāthās know nothing of a new belief which afterwards arose in the *Fravashi*, or guardian angels of the faithful. *Fravashi* properly means "confession of faith," and when personified comes to be regarded as a protecting spirit. Unbelievers have no *fravashi*.

On the basis of the new teaching arose a widely spread priesthood (*āthravanō*) who systematized its doctrines, organized and carried on its worship, and laid down the minutely elaborated laws for the purifying and keeping clean of soul and body, which are met with in the Vendidad. To these ecclesiastical precepts and expiations belong in particular the numerous ablutions, bodily chastisements, love of truth, beneficial works, support of comrades in the faith, alms, chastity, improvement of the land, arboriculture, breeding of cattle, agriculture, protection of useful animals, as the dog, the destruction of noxious animals, and the prohibition either to burn or to bury the dead. These are to be left on the appointed places (*dakhmas*) and exposed to the vultures and wild dogs. In the worship the drink prepared from the *haoma* (Indian *soma*) plant had a prominent place. Worship in the Zoroastrian Church was devoid of pomp; it was independent of temples. Its centre was the holy fire on the altar. The fire altars afterwards developed to fire temples. In the sanctuary of these temples the various sacrifices and high and low masses were celebrated. As offerings meat, milk, show-bread, fruits, flowers and consecrated water were used. The priests were the privileged keepers and teachers of religion. They only performed the sacrifices (Herodotus, i. 132), educated the young clergy, imposed the penances; they in person executed the circumstantial ceremonies of purification and exercised a spiritual guardianship and pastoral care of the laymen. Every young believer in Mazda, after having been received into the religious community by being girt with the holy lace, had to choose a confessor and a spiritual guide (*ratu*).

Also in eschatology, as may be expected, a change took place. The last things and the end of the world are relegated to the close of a long period of time (3000 years after Zoroaster), when a new Saoshyant is to be born of the seed of the prophet, the dead are to come to life, and a new incorruptible world to begin.

Zoroastrianism was the national religion of Iran, but it was not permanently restricted to the Iranians, being professed by Turanians as well. The worship of the Persian gods spread to Armenia and Cappadocia and over the whole of the Near East (Strabo, xv. 3, 14; xi. 8, 4; 14, 76). Of the Zoroastrian Church under the Achaemenides and Aeracides little is known. After the overthrow of the dynasty of the Achaemenides a period of decay seems to have set in. Yet the Aeracides and the Indo-Scythian kings as well as the Achaemenides were believers in Mazda. The national restoration of the Sasanides brought new life to the Zoroastrian religion and long-lasting sway to the Church. Protected by this dynasty, the priesthood developed into a completely organized state church, which was able to employ the power of the state in enforcing strict compliance with the religious law-book hitherto enjoined by their unaided efforts only. The head of the Church (Zara-Shushtrōtema) had his seat at Rai in Media and was the first person in the state next to the king. The formation of sects was at this period not infrequent (cf. MANICHAEISM). The Mohammedan invasion (636), with the terrible persecutions of the following centuries, was the death-blow of Zoroastrianism. In Persia itself only a few followers of Zoroaster are now found (in Kerman and Yezd). The PARSEES (*q.v.*) in and around Bombay hold by Zoroaster as their prophet and by the ancient religious usages, but their doctrine has reached the stage of a pure monotheism.

LITERATURE.—See under ZEND-AVESTA. Also Hyde, *Historia Religionis veterum Purarum* (Oxon, 1700); Windischmann, *Zoroastrische Studien* (Berlin, 1863); A. V. Williams Jackson, *Zoroaster, the Prophet of Ancient Iran* (New York, 1899); Jackson, in the *Grundriss der iranischen Philologie*, vol. ii. 612 sqq. (Strassburg, 1896–1904); Tiele, *Die Religion bei den iranischen Völkern* (Gotha, 1898); Tiele, *Kompendium der Religionsgeschichte*, German transl. by Sōderblom (Breslau, 1903); Rastamji Edulji Dastoor Peshotan Sanjana, *Zarathushtra and Zarathushtrianism in the Avesta* (Bombay, 1906); E. Lehmann, *Zarathushtra*, 2 vols. (Copenhagen, 1899–1902); E. W. West, "Marvels of Zoroastrianism" in the *Sacred Books of the East*, vol. xlvii.; Z. A. Ragozin, *The Story of Media, Babylon and Persia* (New York, 1888); Dosabhai Framji Karaka, *History of the Parsis* (2 vols., London, 1884). (K. G.)

ZORRILLA Y MORAL, JOSÉ (1817–1893), Spanish poet and dramatist, son of a magistrate in whom Ferdinand VII. placed special confidence, was born at Valladolid on the 21st of February 1817. He was educated by the Jesuits at the Real Seminario de Nobles in Madrid, wrote verses when he was twelve, became an enthusiastic admirer of Scott and Chateaubriand, and took part in the school performances of plays by Lope de Vega and Calderon. In 1833 he was sent to read law at the University of Toledo, but, after a year of idleness, he fled to Madrid, where he horrified the friends of his absolutist father by making violent speeches and by founding a newspaper which was promptly suppressed by the government. He narrowly escaped transportation to the Philippines, and passed the next few years in poverty. The death of the satirist Larra brought Zorrilla into notice. His elegiac poem, declaimed at Larra's funeral in February 1837, served as an introduction to the leading men of letters. In 1837 he published a book of verses, mostly imitations of Lamartine and Hugo, which was so favourably received that he printed six more volumes within three years. His subjects are treated with fluency and grace, but the carelessness which disfigures much of his work is prominent in these juvenile poems. After collaborating with García Gutiérrez, in a piece entitled *Juan Dándolo* (1839) Zorrilla began his individual career as a dramatist with *Cada cual con su razón* (1840), and during the following five years he wrote twenty-two plays, many of them extremely successful. His *Cantos del trovador* (1841), a collection of national legends versified with infinite spirit, showed a decided advance in skill, and secured for the author the place next to Espronceda in popular esteem. National legends also supply the themes of his dramas, though in this department Zorrilla somewhat compromised his reputation for originality by adapting older plays which had fallen out of fashion. For example, in *El Zapatero y el Rey* he recasts *El montañés Juan Pascual* by Juan de la Hoz y Mota; in *La mejor razón la espada* he borrows from Moreto's *Travesuras del estudiante Pantoja*; in *Don Juan Tenorio* he adapts from Tirso de Molina's *Burlador de Sevilla* and from the elder Dumas's *Don Juan de Marana* (which itself derives from *Les âmes du purgatoire* of Prosper Mérimée). But his rearrangements usually contain original elements, and in *Sancho García*, *El Rey loco*, and *El Alcalde Ronquillo* he apparently owes little to any predecessor. The last and (as he himself believed) the best of his plays is *Traidor, inconfeso y mártir* (1845). Upon the death of his mother in 1847 Zorrilla left Spain, resided for a while at Bordeaux, and settled in Paris, where his incomplete *Granada*, a striking poem of gorgeous local colour, was published in 1852. In a fit of depression, the causes of which are not known, he emigrated to America three years later, hoping, as he says, that yellow fever or smallpox would carry him off. During eleven years spent in Mexico he produced little, and that little was of no merit. He returned in 1866, to find himself a half-forgotten classic. His old fertility was gone, and new standards of taste were coming into fashion. A small post, obtained for him through the influence of Jovellar and Cánovas del Castillo, was abolished by the republican minister. He was always poor, and for some twelve years after 1871 he was in the direst straits. The law of copyright was not retrospective, and, though some of his plays made the fortunes of managers, they brought him nothing. In his untrustworthy autobiography, *Recuerdos del tiempo viejo* (1880), he complained of this. A pension of 30,000 reales secured him from want in his old age, and the reaction in his favour became an apotheosis. In 1885 the Spanish Academy, which had elected him a member many years before, presented him with a gold medal of honour, and in 1889 he was publicly crowned at Granada as the national laureate. He died at Madrid on the 23rd of January 1893.

Zorrilla is so intensely Spanish that it is difficult for foreign critics to do him justice. It is certain that the extraordinary rapidity of his methods seriously injured his work. He declares that he wrote *El Caballo del Rey Don Sancho* in three weeks, and that he put together *El Puñal del Godo* (which, like *La Calentura*, owes much to Southey) in two days; if so, his deficiencies need no other explanation. An improvisator with the characteristic faults of redundance and verbosity, he wrote far too much, and in most of his numbers there are numerous technical flaws. Yet the richness of his imagery, the movement, fire and variety of his versification, will preserve some few of his poems in the anthologies. His appeal to patriotic pride, his accurate dramatic instinct, together with the fact that he invariably gives at least one of his characters a most effective acting part, have enabled him to hold the stage. It is by *Don Juan Tenorio*, the play of which he thought so meanly, that Zorrilla will be best remembered. (J. F.-K.)

ZOSIMUS, bishop of Rome from the 18th of March 417 to the 26th of December 418, succeeded Innocent I. and was followed by Boniface I. For his attitude in the Pelagian controversy, see PELAGIUS. He took a decided part in the protracted dispute in Gaul as to the jurisdiction of the see of Arles over that of Vienne, giving energetic decisions in favour of the former, but without settling the controversy. His fractious temper coloured all the controversies in which he took part, in Gaul, Africa and Italy, including Rome, where at his death the clergy were very much divided.

ZOSIMUS, Greek historical writer, flourished at Constantinople during the second half of the 5th century A.D. According to Photius, he was a count, and held the office of "advocate" of the imperial treasury. His *New History*, mainly a compilation from previous authors (Dexippus, Eunapius, Olympiodorus), is in six books: the first sketches briefly the history of the early emperors from Augustus to Diocletian (305); the second, third and fourth deal more fully with the period from the accession of Constantius and Galerius to the death of Theodosius; the fifth and sixth cover the period between 395 and 410. The work, which is apparently unfinished, must have been written between 450–502. The style is characterized by Photius as concise, clear and pure. The historian's object was to account for the decline of the Roman empire from the pagan point of view, and in this undertaking he at various points treated the Christians with some unfairness.

The best edition is by Mendelssohn (1887), who fully discusses the question of the authorities used by Zosimus; there is an excellent appreciation of him in Ranke's *Weltgeschichte*, iv. French translation by Cousin (1678); English (anonymous), 1684, 1814.

ZOSTEROPS,[1] originally the scientific name of a genus of birds founded by N. A. Vigors and T. Horsfield (*Trans. Linn. Society*, xv. p. 235) on an Australian species called by them *Z. dorsalis*, but subsequently shown to be identical with the *Certhia caerulescens*, and also with the *Sylvia lateralis*, previously described by J. Latham. The name has been Anglicized in the same sense, and, whether as a scientific or a vernacular term, applied to a great number of species[2] of little birds which inhabit for the most part the tropical districts of the Old World, from Africa to most of the islands in the Indian and Pacific Oceans, and northwards in Asia through India and China to the Amur regions and Japan.

The birds of this group are mostly of unpretending appearance, the plumage above being generally either mouse-coloured or greenish olive; but some are varied by the white or bright yellow of their throat, breast or lower parts, and several have the flanks of a more or less lively bay. Several islands are inhabited by two perfectly distinct species, one belonging to the brown and the other to the green section, the former being wholly insular. The greater number of species seem to be confined to single islands, often of very small area, but others have a very wide distribution, and the type-species, *Z. caerulescens*, has largely extended its range. First described from New South Wales, where it is very plentiful, it had been long known to inhabit all the eastern part of Australia. In 1856 it was found in the South Island of New Zealand, when it became known to the Maories by a name signifying "Stranger," and to the British as the "Blight-bird,"[3] from its clearing the fruit-trees of a blight. It soon after appeared in the North Island, where it speedily became common, and thence not only spread to the Chatham Islands, but was met with in considerable numbers 300 miles from land, as though in search of new countries to colonize. In any case it is obvious that this *Zosterops* must be a comparatively modern settler in New Zealand.

All the species of *Zosterops* are sociable, consorting in large flocks, which only separate on the approach of the pairing season. They build nests—sometimes suspended from a horizontal fork and sometimes fixed in an upright crotch—and lay (so far as is known) pale blue, spotless eggs, thereby differing wholly from several of the groups of birds to which they have been thought allied. Though mainly insectivorous, they eat fruits of various kinds. The habits of *Z. caerulescens* have been well described by Sir W. Buller (*Birds of New Zealand*), and those of a species peculiar to Ceylon, *Z. ceylonensis*, by Col. Legge (*B. Ceylon*), while those of the widely ranging Indian *Z. palpebrosa* and of the South-African *Z. capensis* have been succinctly treated by Jerdon (*B. India*, ii.) and Layard (*B. South Africa*) respectively.

It is remarkable that the largest known species of the genus, *Z. albigularis*, measuring nearly 6 in. in length, is confined to so small a spot as Norfolk Island, where also another, *Z. tenuirostris*, not much less in size, occurs; while a third, of intermediate stature, *Z. strenua*, inhabits the still smaller Lord Howe's Island. A fourth, *Z. vatensis*, but little inferior in bulk, is found on one of the New Hebrides; the rest are from one-fifth to one-third less in length, and some of the smaller species hardly exceed 3½ in.

Placed by some writers, if not systematists, with the *Paridae* (see TITMOUSE), by others among the Meliphagidae (see HONEY-EATER), and again by others with the Nectariniidae (see SUNBIRD), the structure of the tongue, as shown by H. F. Gadow (*Proc. Zool. Society*, 1883, pp. 63, 68, pl. xvi. fig. 2), entirely removes it from the first and third, and from most of the forms generally included among the second. It seems safest to regard the genus, at least provisionally, as the type of a distinct family—Zosteropidae—as families go among Passerine birds. (A. N.)

ZOUAVE, the name given to certain infantry regiments in the French army. The corps was first raised in Algeria in 1831 with one and later two battalions, and recruited solely from the Zouaves, a tribe of Berbers, dwelling in the mountains of the Jurjura range (see KABYLES). In 1838 a third battalion was raised, and the regiment thus formed was commanded by Lamoricière. Shortly afterwards the formation of the *Tirailleurs algériens*, the Turcos, as the corps for natives, changed the enlistment for the Zouave battalions, and they became, as they now remain, a purely French body. Three regiments were formed in 1852, and a fourth, the Zouaves of the Imperial Guard, in 1854. The Crimean War was the first service which the regiments saw outside Algeria. There are now four regiments, of five battalions each, four of which are permanently in Africa, the fifth being stationed in France as a depôt regiment. For the peculiarly picturesque uniform of these regiments, see UNIFORM.

The Papal Zouaves were formed in defence of the Papal states by Lamoricière in 1860. After the occupation of Rome by Victor Emmanuel in 1870, the Papal Zouaves served the government of National Defence in France during the Franco-Prussian war, and were disbanded after the entrance of the German troops into Paris.

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[1] The derivation is ζωστήρ-ηρος and ὦψ, whence the word should be pronounced with all the vowels long. The allusion is to the ring of white feathers round the eyes, which is very conspicuous in many species.

[2] In 1883 R. B. Sharpe (*Cat. B. Brit. Museum*, ix. pp. 146–203) admitted 85 species, besides 3 more which he had not been able to examine.

[3] By most English-speaking people the prevalent species of *Zosterops* is commonly called "White-eye" or "Silver-eye."

ZOUCH, RICHARD (*c.* 1590–1661), English jurist, was born at Anstey, Wiltshire, and educated at Winchester and afterwards at Oxford, where he became a fellow of New College in 1609. He was admitted at Doctor's Commons in January 1618, and was appointed regius professor of law at Oxford in 1620. In 1625 he became principal of St Alban Hall and chancellor of the diocese of Oxford; in 1641 he was made judge of the High Court of Admiralty. Under the Commonwealth, having submitted to the parliamentary visitors, he retained his university appointments, though not his judgeship; this last he resumed at the Restoration, dying soon afterwards at his apartments in Doctor's Commons, London, on the 1st of March 1661.

He published *Elementa jurisprudentiae* (1629), *Descriptio juris et judicii feudalis, secundum consuetudines Mediolani et Normanniae, pro introductione ad jurisprudentiam Anglicanam* (1634), *Descriptio juris et judicii temporalis, secundum consuetudines feudales et Normannicas* (1636), *Descriptio juris et judicii ecclesiastici, secundum canones et consuetudines Anglicanas* (1636), *Descriptiones juris et judicii sacri, . . . militaris, . . . maritimi* (1640), *Juris et judicii fecialis sive juris inter gentes . . . explicatio* (1650), and *Solutio quaestionis de legati delinquentis judice competente* (1657). In virtue of the last two he has the distinction of being one of the earliest systematic writers on international law. He was also the author of a poem, *The Dove, or Passages of Cosmography* (1613).

ZOUCHE, or Zouch, the name of an English family descended from Alan la Zouche, a Breton, who is sometimes called Alan de Porrhoet. Having settled in England during the reign of Henry II., Alan obtained by marriage Ashby in Leicestershire (called after him Ashby de la Zouch) and other lands. His grandson, another Alan la Zouche, was justice of Chester and justice of Ireland under Henry III.; he was loyal to the king during the struggle with the barons, fought at Lewes and helped to arrange the peace of Kenilworth. As the result of a quarrel over some lands with John, Earl Warenne, he was seriously injured in Westminster Hall by the earl and his retainers, and died on the 10th of August 1270. Alan's elder son Roger (d. 1285) had a son Alan la Zouche, who was summoned to parliament as a baron about 1298. He died without sons, and this barony fell into abeyance between his daughters and has never been revived. The elder Alan's younger son, Eades or Ivo, had a son William (*c.* 1276–1352), who was summoned to parliament as a baron in 1308, and this barony, which is still in existence, is known as that of Zouche of Haryngworth.

John, 7th baron Zouche of Haryngworth (*c.* 1460–1526), was attainted in 1485 as a supporter of Richard III., but was restored to his honours in 1495. His descendant, Edward, the 11th baron (*c.* 1556–1625), was one of the peers who tried Mary, queen of Scots, and was sent by Elizabeth as ambassador to Scotland and to Denmark. He was president of Wales from 1602 to 1615 and lord warden of the Cinque Ports from 1615 to 1624. He was a member of the council of the Virginia Company and of the New England council. He had many literary friends, among them being Ben Jonson and Sir Henry Wotton. Zouche left no sons, and the barony remained in abeyance among the descendants of his two daughters until 1815, when the abeyance was terminated in favour of Sir Cecil Bisshopp, Bart. (1753–1828), who became the 12th baron. He died without sons, a second abeyance being terminated in 1829 in favour of his daughter Harriet Anne (1787–1870), wife of the Hon. Robert Curzon (1771–1863). In 1873 her grandson, Robert Nathaniel Curzon (b. 1851), became the 15th baron.

Two antiquaries, Henry Zouch (*c.* 1725–1795) and his brother Thomas Zouch (1737–1815), claimed descent from the family of Zouche. Both were voluminous writers, Thomas's works including a *Life of Izaak Walton* (1823) and *Memoirs of Sir Philip Sidney* (1808).

ZOUTPANSBERG, the north-eastern division of the Transvaal. This was the district to which Louis Trichard and Jan van Rensburg, the forerunners of the Great Trek, journeyed in 1835. In 1845 Hendrik Potgieter, a prominent leader of the Trek Boers, removed thither. The Zoutpansberg Boers formed a semi-independent community, and in 1857 Stephanus Schoeman, their commandant-general, sided against Marthinus Pretorius and Paul Kruger when they invaded the Orange Free State. It was not until 1864 that Zoutpansberg was definitely incorporated in the South African Republic. Trichard and his companions had been shown gold workings by the natives, and it was in this district in 1867–70, and in the neighbouring region of Lydenburg, that gold mines were first worked by Europeans south of the Limpopo. The white settlers in Zoutpansberg had for many years a reputation for lawlessness, and were later regarded as typical "back velt Boers." Zoutpansberg contains a larger native population than any other region of the Transvaal. It is highly mineralized, next to gold, copper, found near the Limpopo (where is the Messina mine) being the chief metal worked. The district long suffered from lack of railway communications, but in 1910 the completion of the Selati line giving it direct access to Delagoa Bay was begun. The chief towns are Pietersburg and Leydsdorp.

See S. Hofmeyr, *Twintig jaren in Zoutpansberg* (Cape Town, 1890); *Report on a Reconnaissance of the N.-W. Zoutpansberg District* (Pretoria, 1908).

ZRINYI, MIKLÓS, Count (1508–1566), Hungarian hero, was a son of Miklós Zrinyi and Ilóna Karlovics. He distinguished himself at the siege of Vienna in 1529, and in 1542 saved the imperial army from defeat before Pest by intervening with 400 Croats, for which service he was appointed ban of Croatia. In 1542 he routed the Turks at Somlyo. In 1543 he married Catherine Frangipán, who placed the whole of her vast estates at his disposal. The Emperor Ferdinand also gave him large possessions in Hungary, and henceforth the Zrinyis became as much Magyar as Croatian magnates. In 1556 Zrinyi won a series of victories over the Turks, culminating in the battle of Babócsa. The Croatians, however, overwhelmed their ban with reproaches for neglecting them to fight for the Magyars, and the emperor simultaneously deprived him of the captaincy of Upper Croatia and sent 10,000 men to aid the Croats, while the Magyars were left without any help, whereupon Zrinyi resigned the banship (1561). In 1563, on the coronation of the Emperor Maximilian as king of Hungary, Zrinyi attended the ceremony at the head of 3000 Croatian and Magyar mounted noblemen, in the vain hope of obtaining the dignity of palatine, vacant by the death of Thomas Nadasdy. Shortly after marrying (in 1564) his second wife, Eva Rosenberg, a great Bohemian heiress, he hastened southwards to defend the frontier, defeated the Turks at Segesd, and in 1566 from the 5th of August to the 7th of September heroically defended the little fortress of Szigetvár against the whole Turkish host, led by Suleiman the Magnificent in person, perishing with every member of the garrison in a last desperate sortie.

See F. Salamon, *Ungarn im Zeitalter der Türkenherrschaft* (Leipzig, 1887); J. Csuday, *The Zrinyis in Hungarian History* (Hung.), Szombathely, 1884, 8vo. (R. N. B.)

ZRINYI, MIKLÓS, Count (1620–1664), Hungarian warrior, statesman and poet, the son of George Zrinyi and Magdalena Széchy, was born at Csákvár. At the court of Péter Pásmány the youth conceived a burning enthusiasm for his native language and literature, although he always placed arms before arts. From 1635 to 1637 he accompanied Szenkveczy, one of the canons of Esztergom, on a long educative tour through Italy. During the next few years he learnt the art of war in defending the Croatian frontier against the Turks, and approved himself one of the first captains of the age. In 1645 he acted against the Swedes in Moravia, equipping an army corps at his own expense. At Szkalec he scattered a Swedish division and took 2000 prisoners. At Eger he saved the emperor, who had been surprised at night in his camp by Wrangel. Subsequently he routed the army of Rákóczy on the Upper Theiss. For his services the emperor appointed him captain of Croatia. On his return from the war he married the wealthy Eusebia Draskovics. In 1646 he distinguished himself in the Turkish war. At the coronation of Ferdinand IV. he carried the sword of state, and was made ban and captain-general of Croatia. In this double capacity he presided over many Croatian diets, always strenuously defending the political rights of the Croats and steadfastly maintaining that as regarded Hungary they were to be looked upon not as *partes annexae* but as a *regnum*. During 1652–53 he was continually fighting against the Turks, yet from his castle at Csáktornya he was in constant communication with the learned world; the Dutch scholar, Jacobus Tollius, even visited him, and has left in his *Epistolae itinerariae* a lively account of his experiences. Tollius was amazed at the linguistic resources of Zrinyi, who spoke German, Croatian, Hungarian, Turkish and Latin with equal facility. Zrinyi's Latin letters (from which we learn that he was married a second time, to Sophia Löbel) are fluent and agreeable, but largely interspersed with Croatian and Magyar expressions. The last year of his life was also its most glorious one. He set out to destroy the strongly fortified Turkish bridge at Esseg, and thus cut off the retreat of the Turkish army, re-capturing all the strong fortresses on his way. He destroyed the bridge, but the further pursuance of the campaign was frustrated by the refusal of the imperial generals to co-operate. Still the expedition had covered him with glory. All Europe rang with his praises. It was said that only the Zrinyis had the secret of conquering the Turks. The emperor offered him the title of prince. The pope struck a commemorative medal with the effigy of Zrinyi as a field-marshal. The Spanish king sent him the Golden Fleece. The French king created him a peer of France. The Turks, to wipe out the disgrace of the Esseg affair, now laid siege to Uj-Zerin, a fortress which Zrinyi had built, and the imperial troops under Montecuculi looked on while he hastened to relieve it, refusing all assistance, with the result that the fortress fell. It was also by the advice of Montecuculi that the disgraceful peace of Vásvár was concluded. Zrinyi hastened to Vienna to protest against it, but in vain. Zrinyi quitted Vienna in disgust, after assuring the Venetian minister, Sagridino, that he was willing at any moment to assist the Republic against the Turks with 6000 men. He then returned to Csáktornya, and there, on the 18th of November, was killed by a wild boar which he had twice wounded and recklessly pursued to its lair in the forest swamps, armed only with his hunting-knife.

His poetical works first appeared at Vienna in 1651, under the title of *The Siren of the Adriatic* (Hung.); but his principal work, *Obsidio Szigetiana*, the epopoeia of the glorious self-sacrifice of his heroic ancestor of the same name, only appeared in fragments in Magyar literature till Arany took it in hand. It was evidently written under the influence of both Virgil and Tasso, though the author had no time to polish and correct its rough and occasionally somewhat wooden versification. But the fundamental idea—the duty of Hungarian valour to shake off the Turkish yoke, with the help of God—is sublime, and the whole work is intense with martial and religious enthusiasm. It is no unworthy companion of the other epics of the Renaissance period, and had many imitators. Arany first, in 1848, began to recast the *Zrinyiad*, as he called it, on modern lines, and the work was completed by Antal Vékóny in 1892.

See J. Arany and Kazmir Greksa, *Zrinyi and Tasso* (Hung.), Eger, 1892; Karoly Széchy, *Life of Count Nicholas Zrinyi, the poet* (Hung.), Budapest, 1896; Sándor Körösi, *Zrinyi and Macchiavelli* (Hung.), Budapest, 1893. (R. N. B.)

ZSCHOKKE, JOHANN HEINRICH DANIEL (1771–1848), German author, was born at Magdeburg on the 22nd of March 1771. He was educated at the monasterial (*kloster*) school and at the Altstädter gymnasium of his native place. He spent some time as playwright with a company of strolling actors, but afterwards studied philosophy, theology and history at the university of Frankfort-on-the-Oder, where in 1792 he established himself as *Privatdozent*. He created much sensation by an extravagant novel, *Abällino, der grosse Bandit* (1793; subsequently also dramatized), modelled on Schiller's *Räuber*, and the melodramatic tragedy, *Julius von Sassen* (1796). The Prussian government having declined to make him a full professor, Zschokke in 1796 settled in Switzerland, where he conducted an educational institution in the castle of Reichenau. The authorities of the Grisons admitted him to the rights of a citizen, and in 1798 he published his *Geschichte des Freistaats der drei Bünde im hohen Rätien*. The political disturbances of this year compelled him to close his institution. He was, however, sent as a deputy to Aarau, where he was made president of the educational department, and afterwards as government commissioner to Unterwalden, his authority being ultimately extended over the cantons of Uri, Schwyz and Zug. Zschokke distinguished himself by the vigour of his administration and by the enthusiasm with which he devoted himself to the interests of the poorer classes of the community. In 1800 he reorganized the institutions of the Italian cantons and was appointed lieutenant-governor of the canton of Basel. Zschokke retired from public life when the central government at Bern proposed to re-establish the federal system, but after the changes effected by Bonaparte he entered the service of the canton of Aargau, with which he remained connected. In 1801 he attracted attention by his *Geschichte vom Kampfe und Untergange der schweizerischen Berg- und Wald-Kantone*. Through his *Schweizerbote*, the publication of which began in 1804, he exercised a wholesome influence on public affairs; and the like may be said of his *Miscellen für die neueste Weltkunde*, issued from 1807 to 1813. In 1811 he also started a monthly periodical, the *Erheiterungen*. He wrote various historical works, the most important of which is *Des Schweizerlandes Geschichte für das Schweizervolk* (1822, 8th ed. 1849). Zschokke's tales, on which his literary reputation rests, are collected in several series, *Bilder aus der Schweiz* (5 vols., 1824–25), *Ausgewählte Novellen und Dichtungen* (16 vols., 1838–39). The best known are: *Addrich im Moos* (1794); *Der Freihof von Aarau* (1794); *Alamontade* (1802); *Der Creole* (1830); *Das Goldmacherdorf* (1817); and *Meister Jordan* (1845). In *Stunden der Andacht* (1809–1816; 27 editions in Zschokke's lifetime), which was widely read, he expounded in a rationalistic spirit the fundamental principles of religion and morality. *Eine Selbstschau* (1842) is a kind of autobiography. Zschokke was not a great original writer, but he secured an eminent place in the literature of his time by his enthusiasm for modern ideas in politics and religion, by the sound, practical judgment displayed in his works, and by the energy and lucidity of his style. He died at his country house of Blumenhalde on the Aar on the 27th of June 1848.

An edition of Zschokke's selected works, in forty volumes, was issued in 1824–28. In 1851–54 an edition in thirty-five volumes was published. A new edition of the *Novellen* was published by A. Vögtlin in twelve volumes (1904). There are biographies of Zschokke by E. Münch (1831); Emil Zschokke (3rd ed. 1876); R. Sauerländer (Aarau, 1884); and R. Wernly (Aarau, 1894). See also M. Schneiderreit, *Zschokke, seine Weltanschauung und Lebensweisheit* (1904).

ZSCHOPAU, a town in the kingdom of Saxony, on the left bank of the Zschopau, 18 m. S.E. from Chemnitz by the railway to Annaberg. Pop. (1900) 6748. It contains a handsome parish church dedicated to St Martin, a town hall and a castle (Wildeck), built by the Emperor Henry I. in 932. The industries include ironfounding, cotton and thread-spinning, cloth-weaving and furniture making.

ZUCCARELLI, FRANCESCO (1702–1788), Italian painter, was born at Pitigliano in Tuscany, and studied in Rome under Onesi, Morandi, and Nelli. At Rome, and later in Venice, he became famous as one of the best landscape painters of the classicizing 18th century. Having visited England on a previous occasion, he was induced by some patrons to return thither in 1752, remaining until 1773, when he settled in Florence, dying there in 1788. Zuccarelli, who was one of the foundation members of the Royal Academy, enjoyed the patronage of royalty and of many wealthy English collectors, for whom he executed his principal works—generally landscapes with classic ruins and small figures. A large number of them are at Windsor Castle, and of the seven examples which formed part of the John Samuel collection two are now at the National Gallery. The royal palace in Venice contains as many as twenty-one, and the academy four. Others are at the Vienna Gallery and at the Louvre in Paris. His work was very unequal, but at his best he rivals the leading landscape painters of his time. His paintings often bear a mark representing a pumpkin, a pictorial representation of his name, which signifies "little pumpkin."

ZUCCARO, or ZUCCHERO,[1] the name of two Italian painters.

I. TADDEO ZUCCARO (1529–1566), one of the most popular painters of the so-called Roman mannerist school, was the son of Ottaviano Zuccaro, an almost unknown painter at St Angelo in Vado, where he was born in 1529. Taddeo found his way to Rome, and he succeeded at an early age in gaining a knowledge of painting and in finding patrons to employ him. When he was seventeen a pupil of Correggio, named Daniele da Parma, engaged him to assist in painting a series of frescoes in a chapel at Vitto near Sora, on the borders of the Abruzzi. Taddeo returned to Rome in 1548, and began his career as a fresco painter, by executing a series of scenes in monochrome from the life of Furius Camillus on the front of the palace of a wealthy Roman named Jacopo Mattei. From that time his success was assured, and he was largely employed by the popes Julius III. and Paul IV., by Della Rovere, duke of Urbino, and by other rich patrons. His best frescoes were a historical series painted on the walls of a new palace at Caprarola, built for Cardinal Alessandro Farnese, for which Taddeo also designed a great quantity of rich decorations in stucco relief after the style of Giulio Romano and other pupils of Raphael. Nearly all his paintings were in fresco, very large in scale, and often in *chiaroscuro* or monochrome; they were more remarkable for rapidity of execution and a certain boldness of style than for any higher qualities. His work is mannered in style, artificial and pompous in conception, and lacks any close or accurate knowledge of the human form and its movements. He died in Rome in 1566, and was buried in the Pantheon, not far from Raphael.

Taddeo's easel pictures are less common than his decorative frescoes. A small painting on copper of the Adoration of the Shepherds, formerly in the collection of James II., is now at Hampton Court; it is a work of very small merit. The Caprarola frescoes were engraved and published by Prenner, *Illustri Fatti Farnesiani Coloriti nel Real Palazzo di Caprarola* (Rome, 1748–50).

II. FEDERIGO ZUCCARO (1543–1609) was in 1550 placed under his brother Taddeo's charge in Rome, and worked as his assistant; he completed the Caprarola frescoes. Federigo attained an eminence far beyond his very limited merits as a painter, and was perhaps the most popular artist of his generation. Probably no other painter has ever produced so many enormous frescoes crowded with figures on the most colossal scale, all executed under the unfortunate delusion that grandeur of effect could be attained merely by great size combined with extravagance of attitude and exaggeration of every kind. Federigo's first work of this sort was the completion of the painting of the dome of the cathedral at Florence; the work had been begun by the art-historian Vasari, who wrote in the most generous language about his more successful rival. Regardless of the injury to the apparent scale of the interior of the church, Federigo painted about 300 figures, each nearly 50 ft. high, sprawling with violent contortions all over the surface. Happily age has so dimmed these pictures that their presence is now almost harmless. Federigo was recalled to Rome by Gregory XIII. to continue in the Pauline chapel of the Vatican the scheme of decoration begun by Michelangelo during his failing years, but a quarrel between the painter and members of the papal court led to his departure from Italy. He visited Brussels, and there made a series of cartoons for the tapestry-weavers. In 1574 he passed over to England, where he received commissions to paint the portraits of Queen Elizabeth, Mary, queen of Scots, Sir Nicholas Bacon, Sir Francis Walsingham, Lord High Admiral Howard, and others. A curious full-length portrait of Elizabeth in fancy dress, now at Hampton Court, is attributed to this painter, though very doubtfully. Another picture in the same collection appears to be a *replica* of his painting of the "Allegory of Calumny," as suggested by Lucian's description of a celebrated work by Apelles; the satire in the original painting, directed against some of his courtier enemies, was the immediate cause of Federigo's temporary exile from Rome. His success as a painter of portraits and other works in oil was more reasonable than the admiration expressed for his colossal frescoes. A portrait of a "Man with Two Dogs," in the Pitti Palace at Florence, is a work of some real merit, as is also the "Dead Christ and Angels" in the Borghese Gallery in Rome. Federigo was soon recalled to Rome to finish his work on the vault of the Pauline chapel. In 1585 he accepted an offer by Philip II. of Spain to decorate the new Escorial at a yearly salary of 2000 crowns, and worked at the Escorial from January 1586 to the end of 1588, when he returned to Rome. He there founded in 1595, under a charter confirmed by Sixtus V., the Academy of St Luke, of which he was the first president. Its organization suggested to Sir Joshua Reynolds his scheme for founding the English Royal Academy.

Like his contemporary Giorgio Vasari, Federigo aimed at being an art critic and historian, but with very different success. His chief book, *L'Idea de' Pittori, Scultori, ed Architetti* (Turin, 1607), is a senseless mass of the most turgid bombast. Little can be said in praise of his smaller works, consisting of two volumes printed at Bologna in 1608, describing his visit to Parma and a journey through central Italy. Federigo was raised to the rank of a *cavaliere* not long before his death, which took place at Ancona in 1609.

For both Taddeo and Federigo Zuccaro, see Vasari, pt. iii., and Lanzi, *Storia Pittorica*, Roman School, epoch iii. (J. H. M.)

ZUG (Fr. *Zoug*), a canton of central Switzerland. It is the smallest undivided canton, both as regards area and as regards population. Its total area is but 92·3 sq. m., of which, however, no fewer than 75·1 sq. m. are reckoned as "productive," forests covering 19·9 sq. m. Of the rest 10 sq. m. are occupied by the cantonal share of the lake of Zug (*q.v.*), and 2¾ sq. m. by the lake of Aegeri, which is wholly within the canton.

It includes the fertile strips on the eastern and western shores of the lower portion of the lake of Zug, together with the alluvial plain at its northern extremity. The lower range, culminating in the Zugerberg (3255 ft.), and the Wildspitz (5194 ft.), the highest summit of the Rossberg, that rises east of the lake of Zug, separates it from the basin and lake of Aegeri, as well as from the hilly district of Menzingen. The Lorze issues from the lake of Aegeri, forces its way through moraine deposits in a deep gorge with fine stalactite caverns and falls into the lake of Zug, issuing from it very soon to flow into the Reuss. The canton thus belongs to the hilly, not to the mountainous, Swiss cantons, but as it commands the entrance to the higher ground it has a certain strategical position. Railways connect it both with Lucerne and with Zürich, while lines running along either shore of the lake of Zug join at the Arth-Goldau station of the St Gotthard railway. On the eastern shore of the lake of Aegeri, and within the territory of the canton, is the true site of the famous battle of Morgarten (*q.v.*) won by the Swiss in 1315. Till 1814 Zug was in the diocese of Constance, but on the reconstruction of the diocese of Basel in 1828 it was assigned to it. In 1900 the population of the canton was 25,093, of whom 24,042 were German-speaking, 819 Italian-speaking, and 157 French-speaking, while 23,362 were Romanists, 1701 Protestants, and 19 Jews. Its capital is Zug, while the manufacturing village of Baar, 2 m. N., had 4484 inhabitants, and the village of Cham, 3 m. N.W., had 3025 inhabitants. In both cases the environs of the villages are included, and this is even more the case with the wide-spreading parishes of Unter Aegeri with 2593 inhabitants, of Menzingen with 2495 inhabitants, and the great school for girls and female teachers, founded in 1844 by Father Theodosius Florentini, and of Ober Aegeri with 1891 inhabitants.

In the higher regions of the canton the population is mainly engaged in pastoral pursuits and cattle-breeding. There are 61 "alps," or high pastures, in the canton. At Cham is a well-known factory of condensed milk, now united with that of Nestlé of Vevey. At Baar there are extensive cotton-spinning mills and other factories. Round the town of Zug there are great numbers of fruit trees, and "*Kirschwasser*" (cherry-water) and cider are largely manufactured. Apiculture too flourishes greatly. A number of factories have sprung up in the new quarter of the town, but the silk-weaving industry has all but disappeared. The canton forms a single administrative district, which comprises eleven communes. The legislature, or *Kantonsrat*, has one member to every 350 inhabitants, and the seven members of the executive, or *Regierungsrat*, are elected directly by popular vote, proportional representation obtaining in both cases if more than two members are to be elected in the same electoral district to posts in the same authority. The term of office in both cases is four years. Besides the "facultative Referendum" by which, in case of a demand by one-third of the members of the legislative assembly, or by 800 citizens, any law, and any resolution involving a capital expenditure of 40,000, or an annual one of 10,000 francs, must be submitted to a direct popular vote, and the "initiative" at the demand of 1000 citizens in case of amendments to the cantonal constitution; there is also an "initiative" in case of bills, to be exercised at the demand of 800 citizens. The two members of the Federal *Ständerat*, as well as the one member of the Federal *Nationalrat*, are also elected by a popular vote.

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[1] So spelt by Vasari.

The earlier history of the canton is practically identical with that of its capital Zug (see below). From 1728 to 1738 it was distracted by violent disputes about the distribution of the French pensions. In 1798 its inhabitants opposed the French, and the canton formed part of the Tellgau, and later of one of the districts of the huge canton of the Waldstätten in the Helvetic republic. In 1803 it regained its independence as a separate canton, and by the constitution of 1814 the "Landsgemeinde," or assembly of all the citizens, which had existed for both districts since 1376, became a body of electors to choose a cantonal council. The reform movement of 1850 did not affect the canton, which in 1845 was a member of the Sonderbund and shared in the war of 1847. In 1848 the remaining functions of the Landsgemeinde were abolished. Both in 1848 and in 1874 the canton voted against the acceptance of the federal constitutions. The constitution of 1873–76 was amended in 1881, and was replaced by a new one in 1894.

Authorities.—J. J. Blumer, *Staats- und Rechtsgeschichte der schweiz. Demokratien*, 3 vols. (St. Gall, 1850–9); *Geschichtsfreund*, from 1843; A. Lütolf, *Sagen, Bräuche, Legenden aus den fünf Orten* (Lucerne, 1862); Achille Renaud, *Staats- und Rechtsgeschichte d. Kant. Zug* (Pforzheim, 1847); H. Ryffel, *Die schweiz. Landsgemeinden* (Zürich, 1903); F. K. Stadlin, *Die Topographie d. Kant. Zug*, 4 parts (Lucerne, 1819–24); B. Staub, *Der Kant. Zug*, 2nd ed. (Zug, 1869); A. Strüby, *Die Alp- und Weidewirthschaft im Kant. Zug* (Soleure, 1901); and the *Zugerisches Neujahrsblatt* (Zug from 1882). (W. A. B. C.)

ZUG, capital of the Swiss canton of that name, a picturesque little town at the N.E. corner of the lake of Zug, and at the foot of the Zugerberg (3255 ft.), which rises gradually, its lower slopes thickly covered with fruit trees. Pop. (1900) 6508, mainly German-speaking and Romanists. The lake shore has been embanked and forms a promenade, whence glorious views of the snowy peaks of the Bernese Oberland, as well as of the Rigi and Pilatus, are gained. Towards its northerly end a monument marks the spot where a part of the shore slipped into the lake in 1887. The older part of the town is rather crowded together, though only four of the wall towers and a small part of the town walls still survive. The most striking old building in the town is the parish church of St Oswald (late 15th century), dedicated to St Oswald, king of Northumbria (d. 642), one of whose arms was brought to Zug in 1485. The town hall, also a 15th-century building, now houses the Historical and Antiquarian Museum. There are some quaint old painted houses close by. A little way higher up the hill-side is a Capuchin convent in a striking position, close to the town wall and leaning against it. Still higher, and outside the old town, is the fine new parish church of St Michael, consecrated in 1902. The business quarter is on the rising ground north of the old town, near the railway station. Several fine modern buildings rise on or close to the shore in the town and to its south, whilst to the south-west is a convent of Capuchin nuns, who manage a large girls' school, and several other educational establishments.

The town, first mentioned in 1240, is called an "*oppidum*" in 1242, and a "*castrum*" in 1255. In 1273 it was bought by Rudolph of Habsburg from Anna, the heiress of Kyburg and wife of Eberhard, head of the cadet line of Habsburg, and in 1278 part of its territory, the valley of Aegeri, was pledged by Rudolph as security for a portion of the marriage gift he promised to Joanna, daughter of Edward I. of England, who was betrothed to his son Hartmann, whose death in 1281 prevented the marriage from taking place. The town of Zug was governed by a bailiff, appointed by the Habsburgs, and a council, and was much favoured by that family. Several country districts (Baar, Menzingen, and Aegeri) had each its own "Landsgemeinde" but were governed by one bailiff, also appointed by the Habsburgs; these were known as the "Aeusser Amt," and were always favourably disposed to the Confederates. On the 27th of June 1352 both the town of Zug and the Aeusser Amt entered the Swiss Confederation, the latter being received on exactly the same terms as the town, and not, as was usual in the case of country districts, as a subject land; but in September 1352 Zug had to acknowledge its own lords again, and in 1355 to break off its connexion with the league. About 1364 the town and the Aeusser Amt were recovered for the league by the men of Schwyz, and from this time Zug took part as a full member in all the acts of the league. In 1379 the German king Wenceslaus exempted Zug from all external jurisdictions, and in 1389 the Habsburgs renounced their claims, reserving only an annual payment of twenty silver marks, and this came to an end in 1415. In 1400 Wenceslaus gave all criminal jurisdiction to the town only. The Aeusser Amt then, in 1404, claimed that the banner and seal of Zug should be kept in one of the country districts, and were supported in this claim by Schwyz. The matter was finally settled in 1414 by arbitration and the banner was to be kept in the town. Finally in 1415 the right of electing their "landammann" was given to Zug by the Confederates, and a share in the criminal jurisdiction was granted to the Aeusser Amt by the German king Sigismund. In 1385 Zug joined the league of the Swabian cities against Leopold of Habsburg and shared in the victory of Sempach, as well as in the various Argovian (1415) and Thurgovian (1460) conquests of the Confederates, and later in those in Italy (1512), having already taken part in the occupation of the Val d'Ossola. Between 1379 (Walchwil) and 1477 (Cham) Zug had acquired various districts in her own neighbourhood, principally to the north and the west, which were ruled till 1798 by the town alone as subject lands. At the time of the Reformation Zug clung to the old faith and was a member of the "Christliche Vereinigung" of 1529. In 1586 it became a member of the Golden League. (W. A. B. C.)

ZUG, LAKE OF, one of the minor Swiss lakes, on the outskirts of the Alps and N. of that of Lucerne. Probably at some former date it was connected by means of the Lake of Lowerz and the plain of Brunnen with the Lake of Lucerne. At present it is formed by the Aa, which descends from the Rigi and enters the southern extremity of the lake. The Lorze pours its waters into the lake at its northern extremity, but 1¼ m. further W. issues from the lake to pursue its course towards the Reuss. The Lake of Zug has an area of about 15 sq. m., is about 9 m. in length, 2½ m. in breadth, and has a maximum depth of 650 ft., while its surface is 1368 ft. above sea-level. For the most part the lake is in the Canton of Zug, but the southern end is, to the extent of 3¾ sq. m., in that of Schwyz, while the Canton of Lucerne claims about ¾ sq. m., to the N. of Immensee. Toward the S.W. extremity of the lake the Rigi descends rather steeply to the water's edge, while part of its east shore forms a narrow level band at the foot of the Rossberg (5194 ft.) and the Zugerberg. At its northern end the shores are nearly level, while on the west shore the wooded promontory of Buonas (with its castles, old and new) projects picturesquely into the waters. The principal place on the lake is the town of Zug, whence a railway (formerly part of the St Gotthard main route) runs along its eastern shore past Walchwil to Arth at its south end, which is connected by a steam tramway with the Arth-Goldau station of the St Gotthard line. This line runs from Arth along the western shore to Immensee, where it bears S.W. to Lucerne, while from Immensee another railway leads (at first some way from the shore) to Cham, 3 m. W. of Zug. The first steamer was placed on the lake in 1852. Many fish (including pike and carp of considerable weights) are taken in the lake, which is especially famous by reason of a peculiar kind of trout (*Salmo salvelinus*, locally called *Rötheli*). (W. A. B. C.)

ZUHAIR [Zuhair ibn Abī Sulmā Rabī’a ul-Muzanī] (6th century), one of the six great Arabian pre-Islamic poets. Of his life practically nothing is known save that he belonged to a family of poetic power; his stepfather, Aus ibn Hajar, his sister, Khansā, and his son, Ka'b ibn Zuhair, were all poets of eminence. He is said to have lived long, and at the age of one hundred to have met Mahomet. His home was in the land of the Banī Ghatafān. His poems are characterized by their peaceful nature and a sententious moralizing. One of them is contained in the *Moallakāt*.

As a whole his poems have been published by W. Ahlwardt in his *The Diwans of the six Ancient Arabic Poets* (London, 1870); and with the commentary of al-A'lam (died 1083) by Count Landberg in the second part of his *Primeurs arabes* (Leiden, 1889). Some supplementary poems are contained in K. Dyroff's *Zur Geschichte der Überlieferung des Zuhairdiwans* (Munich, 1892). (G. W. T.)

ZUIDER ZEE, or ZUYDER ZEE, a land-locked inlet on the coast of Holland, bounded N. by the chain of the Frisian Islands, and W., S., and E. by the provinces of North Holland, Utrecht, Gelderland, Overysel, and Friesland. It is about 85 m. long N. to S., and from 10 to 45 m. broad, with an area of 2027 sq. m., and contains the islands of Marken, Schokland, Urk, Wieringen, and Griend. In the early centuries of the Christian era the Zuider (*i.e.* Southern) Zee was a small inland lake situated in the southern part of the present gulf, and called *Flevo* by Tacitus, Pliny, and other early writers. It was separated from the sea by a belt of marsh and fen uniting Friesland and North Holland, the original coast-line being still indicated by the line of the Frisian Islands. Numerous streams, including the Vecht, Eem, and Ysel, discharged their waters into this lake and issued thence as the Vlie (Latin *Flevus*), which reached the North Sea by the Vliegat between the islands of Vlieland and Terschelling. In the *Lex Frisonum* the Vlie (Fli, or Flehi) is accepted as the boundary between the territory of the East and West Frisians. In time, however, and especially during the 12th century, high tides and north-west storms swept away the western banks of the Vlie and submerged great tracts of land. In 1170 the land between Stavoren, Texel, and Medemblik was washed away, and a century later the Zuider Zee was formed. The open waterway between Stavoren and Enkhuizen, however, as it now exists, dates from 1400. In the south and east the destruction was arrested by the high sandy shores of Gooi, Veluwe, Voorst, and Gasterland in the provinces of Utrecht, Gelderland, Overysel, and Friesland respectively.

The mean depth of the Zuider Zee is 11·48 ft.; depth in the southern basin of the former lake, 19 ft.; at Val van Urk (deep water to the west of the island of Urk), 14½ ft. If a line be drawn from the island of Urk to Marken, and thence westwards to Hoorn (North Holland) and N.N.E. to Lemmer (Friesland), these lines will connect parts of the Zuider Zee having a uniform depth of 8 ft. The other parts on the coast are only 3 ft. deep or less. This shallowness of its waters served to protect the Zuider Zee from the invasion of large ships of war. It also explains how many once flourishing commercial towns, such as Stavoren, Medemblik, Enkhuizen, Hoorn, Monnikendam, declined to the rank of provincial trading and fishing ports. The fisheries of the Zuider Zee are of considerable importance. Eighty per cent. of the bottom consists of sea clay and the more recent silt of the Ysel; 20 per cent. of sand, partly in the north about Urk and Enkhuizen, partly in the south along the high shores of Gooi, Veluwe, &c. The shallowness of the sea and the character of its bottom, promising fertile soil, occasioned various projects of drainage. The scheme recommended by the Zuider Zee Vereeniging (1886) formed the subject of a report in 1894 by a state commission. The principal feature in the scheme was the building of a dike from the island of Wieringen to the coast of Friesland. The area south of this would be divided into four polders, with reservation, however, of a lake, Yselmeer, in the centre, whence branches would run to Ysel and the Zwolsche Diep, to Amsterdam, and, by sluices near Wieringen, to the northern part of the sea. The four polders with their areas of fertile soil would be:—

(1) North-west polder, area 53,599 acres; fertile soil, 46,189 acres.
(2) South-west ,, ,, 77,854 ,, ,, ,, 68,715 ,,
(3) South-east ,, ,, 266,167 ,, ,, ,, 222,275 ,,
(4) North-east ,, ,, 125,599 ,, ,, ,, 120,783 ,,

The Lake Yselmeer would have an area of 560 sq. m. The gain would be the addition to the kingdom of a new and fertile province of the area of North Brabant, a saving of expenses on dikes, diminution of inundations, improvement of communication between the south and the north of the kingdom, protection of isles of the sea, &c. The costs were calculated as follows: (1) enclosing dike, sluices, and regulation of Zwolsche Diep, £1,760,000; (2) reclamation of four polders, £5,200,000; (3) defensive works, £400,000; (4) indemnity to fishermen, £180,000; total, £7,540,000.

In 1901 the government introduced a bill in the States General, based on the recommendations of the commission, providing for enclosing the Zuider Zee by building a dike from the North Holland coast, through the Amsteldiep to Wieringen and from that island to the Friesland coast at Piaam; and further providing for the draining of two portions of the enclosed area, namely the N.W. and the S.W. polders shown in the table. The entire work was to be completed in 18 years at an estimated cost of £7,916,000. The bill failed to become law and in consequence of financial difficulties the project had not, up to 1910, advanced beyond the stage of consideration.

With the exception of Griend and Schokland, the islands of the Zuider Zee are inhabited by small fishing communities, who retain some archaic customs and a picturesque dress. Urk is already mentioned as an island in 966. The inhabitants of Schokland were compelled to leave the island by order of the state in 1859, it being considered insecure from inundation. The island of Griend (or Grind) once boasted a walled town, which was destroyed by flood at the end of the 13th century. But the island continued for some centuries to serve as a pasturage for cattle, giving its name to a well-known description of cheese. Like some of the other islands, sheep are still brought to graze upon it in summer, and a large number of birds' eggs are collected upon it in spring. Several of the islands were once the property of religious houses on the mainland.

The British Foreign Office report, *Draining of the Zuiderzee* (1901), gives full particulars of the Dutch government's scheme and a retrospect of all former proposals. See also *De economische beteekens van de afsluiting en drooglegging der Zuiderzee vom Zuiderzee-Verein* (2nd ed., 1901), and D. Bellet, "Le dessèchement du Zuiderzee," *Rev. Geog.* (1902) and W. J. Tuyn, *Oude Hollandsche Dorpen aan de Zuiderzee* (Haarlem, 1900).

ZULA, a small town near the head of Annesley Bay on the African coast of the Red Sea. It derives its chief interest from ruins in its vicinity which are generally supposed to mark the site of the ancient emporium of Adulis ("Αδουλὶς, 'Αδουλεί), the port of Axum (*q.v.*) and chief outlet in the early centuries of the Christian era for the ivory, hides, slaves and other exports of the interior. Cosmas Indicopleustes saw here an inscription of Ptolemy Euergetes (247–222 B.C.); and hence, as the earliest mention of Adulis is found in the geographers of the first century A.D., it is conjectured that the town must have previously existed under another name and may have been the Berenice Panchrysus of the Ptolemies. Described by a Greek merchant of the time of Vespasian as "a well-arranged market," the place has been for centuries buried under sand. The ruins visible include a temple, obelisks and numerous fragments of columns.

In 1857 an agreement was entered into by Dejaj Negusye, a chief of Tigré, in revolt against the Negus Theodore of Abyssinia, to cede Zula to the French. Negusye was defeated by Theodore, and the commander of a French cruiser sent to Annesley Bay in 1859 found the country in a state of anarchy. No farther steps were taken by France to assert its sovereignty, and Zula with the neighbouring coast passed, nominally, to Egypt in 1866. Zula was the place where the British expedition of 1867–68 against Theodore disembarked, Annesley Bay affording safe and ample anchorage for the largest ocean-going vessels. The road made by the British from Zula to Senafé on the Abyssinian plateau is still in use. The authority of Egypt having lapsed, an Italian protectorate over the district of Zula was proclaimed in 1888, and in 1890 it was incorporated in the colony of Eritrea (*q.v.*).

See Eduard Rüppell, *Reise in Abyssinien*, i. 266 (1838); G. Rohlfs in *Zeitschr. d. Gesell. f. Erdkunde in Berlin*, iii. (1868), and, for further references, the editions of the *Periplus* by C. Müller (*Geog. Gr. Min.*, i. 259) and Fabricius (1883). Consult also ETHIOPIA: *The Axumite Kingdom.*

ZULOAGA, IGNACIO (1870–), Spanish painter, was born at Eibar, in the Basque country, the son of the metal-worker and damascener Placido Zuloaga, and grandson of the organizer and director of the royal armoury in Madrid. The career chosen for him by his father was that of an architect, and with this object in view he was sent to Rome, where he immediately followed the strong impulse that led him to painting. After only six months' work he completed his first picture, which was exhibited at the Paris Salon of 1890. Continuing his studies in Paris, he was strongly influenced by Gauguin and Toulouse Lautrec. Only on his return to his native soil he found his true style, which is based on the national Spanish tradition embodied in the work of Velazquez, Zurbaran, El Greco, and Goya. His own country was slow in acknowledging the young artist whose strong, decorative, rugged style was the very negation of the aims of such well-known modern Spanish artists as Fortuny, Madrazo, and Benlliure. It was first in Paris, and then in Brussels and other continental art centres, that Zuloaga was hailed by the reformers as the regenerator of Spanish national art and as the leader of a school. He is now represented in almost every great continental gallery. Two of his canvases are at the Luxembourg, one at the Brussels Museum ("Avant la Corrida"), and one ("The Poet Don Miguel") at the Vienna Gallery. The Pau Museum owns an interesting portrait of a lady, the Barcelona Municipal Museum the important group "Amies," the Venice Gallery, "Madame Louise"; the Berlin Gallery, "The Topers." Other examples are in the Budapest, Stuttgart, Ghent and Posen galleries and in many important private collections.

A fully illustrated account of the artist and his work, by M. Utrillo, was published in a special number of *Forma* (Barcelona, 1907).

ZULULAND, a country of south-east Africa, forming the N.E. part of the province of Natal in the Union of South Africa. The "Province of Zululand," as it was officially styled from 1898 to 1910, lies between 26° 50′ and 29° 15′ S. and 30° 40′ and 33° E., and has an area of 10,450 sq. m. It includes in the north the country of the Ama Tonga, Zaambanland, and other small territories not part of the former Zulu kingdom and stretches north from the lower Tugela to the southern frontier of Portuguese East Africa. Bounded S.E. by the Indian Ocean it has a coast line of 210 m. North and north-west it is bounded by the Utrecht and Vryheid districts of Natal and by Swaziland. Its greatest length in a direct line is 185 m., its greatest breadth 105 m. (For map see SOUTH AFRICA.)

Physical Features.—Zululand is part of the region of hills and plateaus which descend seaward from the Drakensberg—the great mountain chain which buttresses the vast tableland of inner South Africa. The coast, which curves to the N.E., is marked by a line of sandhills covered with thick bush and rising in places to a height of 500 ft. There are occasional outcrops of rock and low perpendicular cliffs. Behind the sandhills is a low-lying plain in which are a number of shallow lagoons. Of these St Lucia Lake and Kosi Lake are of considerable size and communicate with the sea by estuaries. St Lucia, the larger of the two, is some 35 m. long by 10 m. broad with a depth of 9 to 10 ft. It runs parallel to the ocean, from which it is separated by sandhills. The opening to the sea, St Lucia river, is at the south end. Kosi Lake lies further north, in Tongaland. It is not more than half the size of St Lucia and its opening to the sea is northward. Between Kosi and St Lucia lakes lies Lake Sibayi, close to the coast but not communicating with the sea. The coast plain extends inland from 5 to 30 m., increasing in width northward, the whole of Tongaland being low lying. The rest of the country is occupied by ranges of hills and plateaus 2000 to 4000 ft. above sea level. Behind Eshowe, in the south, are the Entumeni Hills (3000 ft.), beyond which stretch the Nkandhla uplands (rising to 4500 ft.) densely wooded in parts and abounding in flat-topped hills with precipitous sides. Westward of the uplands are the Kyudeni Hills (5000 ft.), also densely wooded, situated near the junction of the Buffalo and Tugela rivers. Further north, along the S.W. frontier, are Isandhlwana and the Nqutu hills. To the N.W. the Lebombo Mts. (1800 to 2000 ft.), which separate the coast plains from the interior, mark the frontier between Swaziland and Zululand. On their eastern (Zululand) side the slope of the Lebombo mountains is gentle, but on the west they fall abruptly to the plain.

The geological structure of the country is comparatively simple, consisting in the main of plateaus formed of sedimentary rocks, resting on a platform of granitic and metamorphic rocks (see NATAL: *Geology*).

The country is well watered. Rising in the high tablelands or on the slopes of the Drakensberg or Lebombo mountains the rivers in their upper courses have a great slope and a high velocity. In the coast plains they become deep and sluggish. Their mouths are blocked by sand bars, which in the dry season check their flow and produce the lagoons and marshes which characterize the coast. After the rains the rivers usually clear the bars for a time. The following are the chief rivers in part or in whole traversing the country:—The Pongola, in its lower course, flows through Tongaland, piercing the Lebombo Mts. through a deep, narrow gorge with precipitous sides. Its point of confluence with the Maputa (which empties into Delagoa Bay) marks the parallel along which the frontier between Zululand and Portuguese East Africa is drawn. The Umgavuma which rises in Swaziland and also pierces the Lebombo, joins the Pongola about ten miles above its confluence with the Maputa. The Umkuzi which rises in the Vryheid district of Natal forces its way through the Lebombo Mts. at their southern end and flows into the northern end of St Lucia Lake. The Umfolosi, with two main branches, the Black and White Umfolosi, drains the central part of the country and reaches the ocean at St Lucia Bay. In the bed of the White Umfolosi are dangerous quicksands. Farther south the Umhlatuzi empties into a lagoon which communicates with the ocean by Richards Bay. For a considerable part of their course the Blood, Buffalo and Tugela rivers form the S.W. frontier of Zululand (see TUGELA). There are numerous other rivers—every valley has its stream, for the most part unnavigable.

Climate.—The climate of the coast belt is semi-tropical and malaria is prevalent; that of the highlands temperate. The summer is the rainy season, but in the higher country snow and sleet are not uncommon in the winter months of May, June and July. On the coast about 40 in. of rain fall in the summer months and about 7 in. in the winter months. A fresh S.E. wind is fairly constant in the inland regions during the middle of the day. A hot wind from the N.W. is occasionally experienced in the highlands.

Flora and Fauna.—The coast plain (in large part), the river valleys, and the eastern sides of the lower hills are covered with mimosa and other thorn trees. This is generally known as thornbush and has little undergrowth. "Coast forests" grow in small patches along the lower courses of the rivers, at their mouths, and on the sandhills along the coast. They contain stunted timber trees, palms, mangroves and other tropical and sub-tropical plants and have an almost impenetrable undergrowth. The largest coast forest is that of Dukuduku, some 9 m. by 15 m. in extent, adjacent to St Lucia Bay. The upland regions are those of high timber forests, the trees including the yellow-wood and iron-wood. The most noteworthy timber forests are those of Nkandhla and Kyudeni and that near Eshowe. Large areas of the plateau are covered with grass and occasional thorn trees. Orchids are among the common flowers.

The fauna includes the lion and elephant, found in the neighbourhood of the Portuguese frontier (the lion was also found as late as 1895 in the Ndwandwe district), the white and the black rhinoceros, the leopard, panther, jackal, spotted hyena, aard-wolf, buffalo, zebra, gnu, impala, inyala, oribi, hartebeeste, kudu, springbok, waterbuck, eland, roan antelope, duiker, &c., hares and rabbits. Hippopotami are found on the coast, and alligators are common in the rivers and lagoons of the low country. Venomous snakes abound. The great kori bustard, the koorhan, turkey buzzards (known as *insingisi*), wild duck, and paauw are among the game birds. The ostrich and secretary-bird are also found. Of domestic animals the Zulus possess a dwarf breed of smooth-skinned humped cattle. Locusts are an occasional pest.

Inhabitants.—The population in 1904 was estimated at 230,000. Of these only 5635 lived outside the area devoted to native locations. The white population numbered 1693. The vast majority of the natives are Zulu (see KAFFIRS), but there is a settlement of some 2000 Basutos in the Nqutu district. After the establishment of the Zulu military ascendancy early in the 19th century various Zulu hordes successively invaded and overran a great part of east-central Africa, as far as and even beyond the Lake Nyasa district. Throughout these regions they are variously known as Ma-Zitu, Ma-Ravi, Wa-Ngoni (Angoni), Matabele (Ame-Ndebeli), Ma-Viti, and Aba-Zanzi. Such was the terror inspired by these fierce warriors that many of the tribes, such as the Wa-Nindi of Mozambique, adopted the name of their conquerors or oppressors. Hence the impression that the true Zulu are far more numerous north of the Limpopo than has ever been the case. In most places they have become extinct or absorbed in the surrounding populations owing to their habit of incorporating prisoners in the tribe. But they still hold their ground as the ruling element in the region between the Limpopo and the middle Zambezi, which from them takes the name of Matabeleland. The circumstances and history of the two chief migrations of Zulu peoples northward are well known; the Matabele were led by Mosilikatze (Umsiligazi), and the Angoni by Sungandaba, both chiefs of Chaka who revolted from him in the early 19th century.

The Zulu possess an elaborate system of laws regulating the inheritance of personal property (which consists chiefly of cattle), the complexity arising from the practice of polygamy and the exchange of cattle made upon marriage. The giving of cattle in the latter case is generally referred to as a barter and sale of the bride, from which indeed it is not easily distinguishable. But it is regarded in a different light by the natives. The kraal is under the immediate rule of its headman, who is a patriarch responsible for the good behaviour of all its members. Over the headman, whose authority may extend to more than one kraal, is the tribal chief, and above the tribal chief was the king, whose authority is now exercised by a British commissioner. By the custom of *hlonipa* a woman carefully avoids meeting her husband's parents or the utterance of any word which occurs in the names of the principal members of her husband's family: *e.g.* if she have a brother-in-law named U'Nkomo, she would not use the Zulu for "cow," *inkomo*, but would invent some other word for it. The husband observes the same custom with regard to his mother-in-law. The employment of "witch doctors" for "smelling out" criminals or *abatagati* (usually translated "wizards," but meaning evildoers of any kind, such as poisoners), once common in Zululand, as in neighbouring countries, was discouraged by Cetywayo, who established "kraals of refuge" for the reception of persons rescued by him from condemnation as *abatagati*. "Smelling out" was finally suppressed by the British in the early years of the 20th century. (For the Zulu speech, see BANTU LANGUAGES.)

Towns.—The Zulus live in kraals, circular enclosures with, generally, a ring fence inside forming a cattle pen. Between this fence and the outer fencing are the huts of the inhabitants. The royal kraal for a considerable period was at Ulundi, in the valley of the White Umfolosi. The last king to occupy it was Cetywayo; Dinizulu's kraal was farther north near the Ndwandwe magistracy. The chief white settlements are Eshowe and Melmoth. Eshowe (pop. 1904, 1855 of whom 570 were whites) is about 95 m. N.E. of Durban, lies 15 m. inland and some 1800 ft. above the sea. Eshowe is 2 m. W. of the mission station of the same name in which Col. Pearson was besieged by the Zulus in 1879, and was laid out in 1883. It is picturesquely situated on a well-wooded plateau and has a bracing climate. Two hundred acres of forest land in the centre of the town have been reserved as a natural park. Melmoth, 25 m. N.N.E. of Eshowe, lies in the centre of a district farmed by Boers. Somkele is the headquarters of the St Lucia coal-fields district. Nkandhla is a small settlement in the south-west of the country.

Communications.—Notwithstanding its 210 m. of coast-line Zululand possesses no harbours. Thirty-six miles N.E. of the mouth of the Tugela there is, however, fairly safe anchorage, except in S.S.W. or W. winds, about 1500 yds. from the shore. The landing-place is on the open sandy beach, where a small stream enters the sea. This landing-place is dignified with the name of Port Durnford. It was used to land stores in the war of 1879. Well-made roads connect all the magistracies. The Tugela is crossed by well-known drifts, to which roads from Natal and Zululand converge. Two, the Lower Tugela and Bond's Drift, are both near the mouth of the river. The Middle Drift is 36 m. in a direct line above the mouth of the Tugela. Rorke's Drift, 48 m., also in a direct line, above the Middle Drift, is a crossing of the Buffalo river a little above the Tugela confluence. A railway, completed in 1904, which begins at Durban and crosses into Zululand by a bridge over the Tugela near the Lower Drift, runs along the coast belt over nearly level country to the St Lucia coal-fields in Hlabisa magistracy—167 m. from Durban, of which 98 are in Zululand. There is telegraphic communication between the magistracies and townships and with Natal.

Industries.—The Zulu gives little attention to the cultivation of the soil. Their main wealth consists in their herds of cattle and flocks of sheep. They raise, however, crops of maize, millet, sweet potatoes and tobacco. Sugar, tea and coffee are grown in the coast belt by whites. Anthracite is mined in the St Lucia Bay district, and bituminous coal is found in the Nqutu and Kyudeni hills. Gold, iron, copper and other minerals have also been found, but the mineral wealth of the country is undeveloped. There is a considerable trade with the natives in cotton goods, &c., and numbers of Zulu seek service in Natal. (Trade statistics are included in those of Natal.)

Administration.—Zululand for provincial purposes is governed by the provincial council of Natal; otherwise it is subject to the Union parliament, to which it returns one member of the House of Assembly. It was formerly represented in the Natal legislature by three members, one member sitting in the Legislative Council, and two being elected to the Legislative Assembly, one each for the districts of Eshowe and Melmoth. Their selection and election were governed by the same laws as in Natal proper, and on the establishment of the Union the franchise qualifications—which practically exclude natives—remained unaltered. The parliamentary voters in 1910 numbered 1442. The executive power is in the hands of a civil commissioner whose residence is at Eshowe. Zululand is divided into eleven magistracies, and the district of Tongaland (also called Mputa or Amaputaland). In the magistracies the authority of the chiefs and *indumas* (headmen) is exercised under the control of resident magistrates. The Ama-Tonga enjoy a larger measure of home rule, but are under the general supervision of the civil commissioner. The Ingwavuma magistracy, like Tongaland, formed no part of the dominions of the Zulu kings, but was ruled by independent chiefs until its annexation by Great Britain in 1895.

With the exception of the townships and a district of Emtonjaneni magistracy known as "Proviso B,"[1] mainly occupied by Boer farmers, all the land was vested in the crown and very little has been parted with to Europeans. The crown lands are, in effect, native reserves. A hut tax of 14s. per annum is levied on all natives. The tax has to be paid for each wife a Zulu may possess, whether or not each wife has a separate hut. Since 1906 a poll tax of £1 a head is also levied on all males over eighteen, European or native.

History.—At what period the Zulu (one of a number of closely allied septs) first reached the country to which they have given their name is uncertain; they were probably settled in the valley of the White Umfolosi river at the beginning of the 17th century, and they take their name from a chief who flourished about that time. The earliest record of contact between Europeans and the Zulu race is believed to be the account of the wreck of the "Doddington" in 1756. The survivors met with hospitable treatment at the hands of the natives of Natal, and afterwards proceeded up the coast to St Lucia Bay. They describe the natives as "very proud and haughty, and not so accommodating as those lately left." They differed from the other natives in the superior neatness of their method of preparing their food, and were more cleanly in their persons, bathing every morning, apparently as an act of devotion. Their chief pride seemed to be to keep their hair in order. It is added that they watched strictly over their women.

Rise of the Zulu nation.

Chaka.

At the close of the 18th century the Zulu were an unimportant tribe numbering a few thousands only. At that time the most powerful of the neighbouring tribes was the Umtetwa (mTetwa or Aba-Tetwa) which dwelt in the country north-east of the Tugela. The ruler of the Umtetwa was a chief who had had in early life an adventurous career and was known as Dingiswayo (the Wanderer). He had lived in Cape Colony, and there, as is supposed, had observed the manner in which the whites formed their soldiers into disciplined regiments. He too divided the young men of his tribe into *impis* (regiments), and the Umtetwa became a formidable military power. Dingiswayo also encouraged trade and opened relations with the Portuguese at Delagoa Bay, bartering ivory and oxen for brass and beads. In 1805 he was joined by Chaka, otherwise Tshaka (born *c.* 1783), the son of the Zulu chief Senzangakona; on the latter's death in 1810 Chaka, through the influence of Dingiswayo, was chosen as ruler of the Ama-Zulu, though not the rightful heir. Chaka joined in his patron's raids, and in 1812 the Umtetwa and Zulu drove the Amangwana across the Buffalo river. About this time Dingiswayo was captured and put to death by Zwide, chief of the Undwandwe clan, with whom he had waged constant war. The Umtetwa army then placed themselves under Chaka, who not long afterwards conquered the Undwandwe. By the incorporation of these tribes Chaka made of the Zulu a powerful nation. He strengthened the regimental system adopted by Dingiswayo and perfected the discipline of his army. A new order of battle was adopted—the troops being massed in crescent formation, with a reserve in the shape of a parallelogram ready to strengthen the weakest point.[2] Probably Chaka's greatest innovation was the introduction of the stabbing assegai. The breaking short of the shaft of the assegai when the weapon was used at close quarters was already a common practice among the Ama-Zulu, but Chaka had the shaft of the assegais made short, and their blades longer and heavier, so that they could be used for cutting or piercing. At the same time the size of the shield was increased, the more completely to cover the body of the warrior. Military kraals were formed in which the warriors were kept apart. Members of a regiment were of much the same age, and the young warriors were forbidden to marry until they had distinguished themselves in battle.

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[1] The Boers obtained the right to settle in this district in virtue of Proviso B of an agreement made, on the 22nd of October 1886, between the settlers in the "New Republic" and Sir A. E. Havelock, governor of Natal.

[2] Dr G. McCall Theal states that the ancestors of the tribes living in what is now Natal and Zululand were acquainted with the regimental system and the method of attack in crescent shape formation in the 17th century. Memories of these customs lingered even if the practice had died out. Among the Ama-Xosa section of Kaffirs they appear to have been quite unknown.

Chaka had but two ways of dealing with the tribes with whom he came in contact; either they received permission to be incorporated in the Zulu nation or they were practically exterminated. In the latter case the only persons spared were young girls and growing lads who could serve as carriers for the army. No tribe against which he waged war was able successfully to oppose the Zulu arms. At first Chaka turned his attention northward. Those who could fled before him, the first of importance so to do being a chief named Swangendaba (Sungandaba), whose tribe, of the same stock as the Zulu, was known as Angoni. He was followed by another tribe, which under Manikusa for many years ravaged the district around and north of Delagoa Bay (see GAZALAND). Chaka next attacked the tribes on his southern border, and by 1820 had made himself master of Natal, which he swept almost clear of inhabitants. It was about 1820 that Mosilikatze (properly Umsilikazi), a general in the Zulu army, having incurred Chaka's wrath by keeping back part of the booty taken in an expedition, fled with a large following across the Drakensberg and began to lay waste a great part of the country between the Vaal and Limpopo rivers. Mosilikatze was not of the Zulu tribe proper, and he and his followers styled themselves Abaka-Zulu. Chaka's own dominions, despite his conquests, were not very extensive. He ruled from the Pongolo river on the north to the Umkomanzi river on the south, and inland his power extended to the foot of the Drakensberg; thus his territory coincided almost exactly with the limits of Zululand and Natal as constituted in 1903. His influence, however, extended from the Limpopo to the borders of Cape Colony, and through the ravages of Swangendaba and Mosilikatze the terror of the Zulu arms was carried far and wide into the interior of the continent.

Arrival of the British.

Chaka seems to have first come into contact with Europeans in 1824. In that year (see NATAL) he was visited by F. G. Farewell and a few companions, and to them he made a grant of the district of Port Natal. Farewell found the king at Umgungindhlovu, the royal kraal on the White Umfolosi, "surrounded by a large number of chiefs and about 8000 or 9000 armed men, observing a state and ceremony in our introduction little expected." At this time an attempt was made to murder Chaka; but the wound he received was cured by one of Farewell's companions, a circumstance which made the king very friendly to Europeans. Anxious to open a political connexion with the Cape and British governments, Chaka entrusted early in 1828 one of his principal chiefs, Sotobi, and a companion to the care of J. S. King, one of the Natal settlers, to be conducted on an embassage to Cape Town, Sotobi being commissioned to proceed to the king of England. But they were not allowed to proceed beyond Port Elizabeth, and three months later were sent back to Zululand. In July of the same year Chaka sent an army westward which laid waste the Pondo country. The Zulu force did not come into contact with the British troops guarding the Cape frontier, but much alarm was caused by the invasion. In November envoys from Chaka reached Cape Town, and it was determined to send a British officer to Zululand to confer with him. Before this embassy started, news came that Chaka had been murdered (23rd of September 1828) at a military kraal on the Umvote about fifty miles from Port Natal. Chaka was a victim to a conspiracy by his half brothers Dingaan and Umthlangana, while a short time afterwards Dingaan murdered Umthlangana, overcame the opposition of a third brother, and made himself king of the Zulu.

Dingaan.

Bloodstained as had been Chaka's rule, that of Dingaan appears to have exceeded it in wanton cruelty, as is attested by several trustworthy European travellers and merchants who now with some frequency visited Zululand. The British settlers at Port Natal were alternately terrorized and conciliated. In 1835 Dingaan gave permission to the British settlers at Port Natal to establish missionary stations in the country, in return for a promise made by the settlers not to harbour fugitives from his dominions. In 1836 American missionaries were also allowed to open stations; in 1837 he permitted the Rev. F. Owen, of the Church Missionary Society, to reside at his great kraal, and Owen was with the king when in November 1837 he received Pieter Retief, the leader of the first party of Boer immigrants to enter Natal.

Arrival of the Boers.

Coming over the Drakensberg in considerable numbers during 1837, the Boers found the land stretching south from the mountains almost deserted, and Retief went to Dingaan to obtain a formal cession of the country west of the Tugela, which river the Zulu recognized as the boundary of Zululand proper. After agreeing to Retief's request Dingaan caused the Boer leader and his companions to be murdered (6th of February 1838), following up his treachery by slaying as many as possible of the other Boers who had entered Natal. After two unsuccessful attempts to avenge their slain, in which the Boers were aided by the British settlers at Port Natal, Dingaan's army was totally defeated on the 16th of December 1838, by a Boer force under Andries Pretorius. Operating in open country, mounted on horseback, and with rifles in their hands, the Boer farmers were able to inflict fearful losses on their enemy, while their own casualties were few. On "Dingaan's day" the Boer force received the attack of the Zulu while in laager; the enemy charged in dense masses, being met both by cannon shot and rifle fire, and were presently attacked in the rear by mounted Boers. After the defeat Dingaan set fire to the royal kraal (Umgungindhlovu) and for a time took refuge in the bush; on the Boers recrossing the Tugela he established himself at Ulundi at a little distance from his former capital. His power was greatly weakened and a year later was overthrown, the Boers in Natal (January 1840) supporting his brother Mpande (usually called Panda) in rebellion against him. The movement was completely successful, several of Dingaan's regiments going over to Panda. Dingaan passed into Swaziland in advance of his retreating forces, and was there murdered, while Panda was crowned king of Zululand by the Boers.

Panda.

When in 1843 the British succeeded the Boers as masters of Natal they entered into a treaty with Panda, who gave up to the British the country between the upper Tugela and the Buffalo rivers, and also the district of St Lucia Bay. (The bay was not then occupied by the British, whose object in obtaining the cession was to prevent its acquisition by the Boers. Long afterwards the treaty with Panda was successfully invoked to prevent a German occupation of the bay.) No sooner had the British become possessed of Natal than there was a large immigration into it of Zulu fleeing from the misgovernment of Panda. That chief was not, however, as warlike as his brothers Chaka and Dingaan; and he remained throughout his reign at peace with the government of Natal.[1] With the Boers who had settled in the Transvaal, however, he was involved in various frontier disputes. He had wars with the Swazis, who in 1855 ceded to the Boers of Lydenburg a tract of land on the north side of the Pongolo in order to place Europeans between themselves and the Zulu. In 1856 a civil war broke out between two of Panda's sons, Cetywayo and Umbulazi, who were rival claimants for the succession. A battle was fought between them on the banks of the Tugela in December 1856, in which Umbulazi and many of his followers were slain. The Zulu country continued, however, excited and disturbed until the government of Natal in 1861 obtained the formal nomination of a successor to Panda; and Cetywayo was appointed. The agent chosen to preside at the nomination ceremony was Mr (afterwards Sir) Theophilus Shepstone, who was in charge of native affairs in Natal and had won in a remarkable degree the respect and liking of the Zulu. Panda died in October 1872, but practically the government of Zululand had been in Cetywayo's hands since the victory of 1856, owing both to political circumstances and the failing health of his father. In 1873 the Zulu nation appealed to the Natal government to preside over the installation of Cetywayo as king; and this request was acceded to, Shepstone being again chosen as British representative. During the whole of Panda's reign the condition of Zululand showed little improvement. Bishop Colenso visited him in 1857 and obtained a grant of land for a mission station, which was opened in 1860, by the Rev. R. Robertson, who laboured in the country for many years, gaining the confidence both of Panda and Cetywayo. German, Norwegian and other missions were also founded. The number of converts was few, but the missionaries exercised a very wholesome influence and to them in measure was due the comparative mildness of Panda's later years.

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[1] Bishop Schreuder, a Norwegian missionary long resident in Zululand, gave Sir Bartle Frere the following estimate of the three brothers who successively reigned over the Zulu:—"Chaka was a really great man, cruel and unscrupulous, but with many great qualities. Dingaan was simply a beast on two legs. Panda was a weaker and less able man, but kindly and really grateful, a very rare quality among Zulus. He used to kill sometimes, but never wantonly or continuously."

Disputes with the Transvaal.

The frontier disputes between the Zulu and the Transvaal Boers ultimately involved the British government and were one of the causes of the war which broke out in 1879. They concerned, chiefly, territory which in 1854 was proclaimed the republic of Utrecht, the Boers who had settled there having in that year obtained a deed of cession from Panda. In 1860 a Boer commission was appointed to beacon the boundary, and to obtain, if possible, from the Zulu a road to the sea at St Lucia Bay. The commission, however, effected nothing. In 1861 Umtonga, a brother of Cetywayo, fled to the Utrecht district, and Cetywayo assembled an army on that frontier. According to evidence brought forward later by the Boers, Cetywayo offered the farmers a strip of land along the border if they would surrender his brother. This they did on the condition that Umtonga's life was spared, and in 1861 Panda signed a deed making over the land to the Boers. The southern boundary of the strip added to Utrecht ran from Rorke's Drift on the Buffalo to a point on the Pongolo. The boundary was beaconed in 1864, but when in 1865 Umtonga fled from Zululand to Natal, Cetywayo, seeing that he had lost his part of the bargain (for he feared that Umtonga[1] might be used to supplant him as Panda had been used to supplant Dingaan), caused the beacon to be removed, the Zulu claiming also the land ceded by the Swazis to Lydenburg. The Zulu asserted that the Swazis were their vassals and denied their right to part with the territory. During the year a Boer commando under Paul Kruger and an army under Cetywayo were posted along the Utrecht border. Hostilities were avoided, but the Zulu occupied the land north of the Pongolo. Questions were also raised as to the validity of the documents signed by the Zulu concerning the Utrecht strip; in 1869 the services of the lieut.-governor of Natal were accepted by both parties as arbitrator, but the attempt then made to settle the difficulty proved unsuccessful.

Cetywayo king.

Such was the position when by his father's death Cetywayo (*q.v.*) became absolute ruler of the Zulu. As far as possible he revived the military methods of his uncle Chaka, and even succeeded in equipping his regiments with firearms. It is believed that he instigated the Kaffirs in the Transkei to revolt, and he aided Sikukuni in his struggle with the Transvaal. His rule over his own people was tyrannous. By Bishop Schreuder he was described as "an able man, but for cold, selfish pride, cruelty and untruthfulness worse than any of his predecessors." In September 1876 the massacre of a large number of girls (who had married men of their own age instead of the men of an older regiment, for whom Cetywayo had designed them) provoked a strong remonstrance from the government of Natal, inclined as that government was to look leniently on the doings of the Zulu. The tension between Cetywayo and the Transvaal over border disputes continued, and when in 1877 Britain annexed the Transvaal the dispute was transferred to the new owners of the country. A commission was appointed by the lieut.-governor of Natal in February 1878 to report on the boundary question. The commission reported in July, and found almost entirely in favour of the contention of the Zulu. Sir Bartle Frere, then High Commissioner, who thought the award "one-sided and unfair to the Boers" (Martineau, *Life of Frere*, ii. xix.), stipulated that, on the land being given to the Zulu, the Boers living on it should be compensated if they left, or protected if they remained. Cetywayo (who now found no defender in Natal save Bishop Colenso) was in a defiant humour, and permitted outrages by Zulu both on the Transvaal and Natal borders.

Frere's ultimatum. The war of 1879.

Frere was convinced that the peace of South Africa could be preserved only if the power of Cetywayo was curtailed. Therefore in forwarding his award on the boundary dispute the High Commissioner demanded that the military system should be remodelled. The youths were to be allowed to marry as they came to man's estate, and the regiments were not to be called up except with the consent of the council of the nation and also of the British government. Moreover, the missionaries were to be unmolested and a British resident was to be accepted. These demands were made to Zulu deputies on the 11th of December 1878, a definite reply being required by the 31st of that month.

Isandhlwana.

Rorke's Drift.

Cetywayo returned no answer, and in January 1879 a British force under General Thesiger (Lord Chelmsford) invaded Zululand. Lord Chelmsford had under him a force of 5000 Europeans and 8200 natives; 3000 of the latter were employed in guarding the frontier of Natal; another force of 1400 Europeans and 400 natives were stationed in the Utrecht district. Three columns were to invade Zululand, from the Lower Tugela, Rorke's Drift, and Utrecht respectively, their objective being Ulundi, the royal kraal. Cetywayo's army numbered fully 40,000 men. The entry of all three columns was unopposed. On the 22nd of January the centre column (1600 Europeans, 2500 natives), which had advanced from Rorke's Drift, was encamped near Isandhlwana; on the morning of that day Lord Chelmsford moved out with a small force to support a reconnoitring party. After he had left, the camp, in charge of Col. Durnford, was surprised by a Zulu army nearly 10,000 strong. The British were overwhelmed and almost every man killed, the casualties being 806 Europeans (more than half belonging to the 24th regiment) and 471 natives. All the transport was also lost. Lord Chelmsford and the reconnoitring party returned to find the camp deserted; next day they retreated to Rorke's Drift, which had been the scene of an heroic and successful defence. After the victory at Isandhlwana several impis of the Zulu army had moved to the Drift. The garrison stationed there, under Lieuts. Chard and Bromhead, numbered about 80 men of the 24th regiment, and they had in hospital between 30 and 40 men. Late in the afternoon they were attacked by about 4000 Zulu. On six occasions, the Zulu got within the entrenchments, to be driven back each time at the bayonet's point. At dawn the Zulu withdrew, leaving 350 dead. The British loss was 17 killed and 10 wounded.

In the meantime the right column under Colonel Pearson had reached Eshowe from the Tugela; on receipt of the news of Isandhlwana most of the mounted men and the native troops were sent back to the Natal, leaving at Eshowe a garrison of 1300 Europeans and 65 natives. This force was hemmed in by the enemy. The left column under Colonel (afterwards Sir) Evelyn Wood, which had done excellent work, found itself obliged to act on the defensive after the disaster to the centre column.[2] For a time an invasion of Natal was feared. The Zulu, however, made no attempt to enter Natal, while Lord Chelmsford awaited reinforcements before resuming his advance. During this time (March the 12th) an escort of stores marching to Luneberg, the headquarters of the Utrecht force, was attacked when encamped on both sides of the Intombe river. The camp was surprised, 62 out of 106 men were killed, and all the stores were lost. News of Isandhlwana reached England on the 11th of February, and on the same day about 10,000 men were ordered out to South Africa. The first troops arrived at Durban on the 17th of March. On the 29th a column, under Lord Chelmsford, consisting of 3400 Europeans and 2300 natives, marched to the relief of Eshowe, entrenched camps being formed each night. On the 2nd of April the camp was attacked at Ginginhlovo, the Zulu being repulsed. Their loss was estimated at 1200 while the British had only two killed and 52 wounded. The next day Eshowe was relieved. Wood, who had been given leave to make a diversion in northern Zululand, on the 28th of March occupied Hlcbane (Inhlobane) mountain. The force was, however, compelled to retreat owing to the unexpected appearance of the main Zulu army, which nearly outflanked the British. Besides the loss of the native contingent (those not killed deserted) there were 100 casualties among the 400 Europeans engaged.[1] At mid-day next day the Zulu army made a desperate attack, lasting over four hours, on Wood's camp at Kambula; the enemy—over 20,000 strong—was driven off, losing fully 1000 men, while the British casualties were 18 killed and 65 wounded.

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[1] Umtonga had been originally designated by Panda as his successor. He afterwards served in the Zulu war with Wood's column.

[2] With the column were 40 Boers, the Uys clan, under Piet Uys, whose father had been killed in 1838 in the wars with Dingaan.

Ulundi.

By the middle of April nearly all the reinforcements had reached Natal, and Lord Chelmsford reorganized his forces. The 1st division, under major-general Crealock, advanced along the coast belt and was destined to act as a support to the 2nd division, under major-general Newdigate, which with Wood's flying column, an independent unit, was to march on Ulundi from Rorke's Drift and Kambula. Owing to difficulties of transport it was the beginning of June before Newdigate was ready to advance. On the 1st of that month the prince imperial of France (Louis Napoleon), who had been allowed to accompany the British troops, was killed while out with a reconnoitring party. On the 1st of July Newdigate and Wood had reached the White Umfolosi, in the heart of the enemy's country. During their advance messengers were sent by Cetywayo to treat for peace, but he did not accept the terms offered. Meantime Sir Garnet (afterwards Lord) Wolseley had been sent out to supersede Lord Chelmsford, and on the 7th of July he reached Crealock's headquarters at Port Durnford. But by that time the campaign was practically over. The 2nd division (with which was Lord Chelmsford) and Wood's column crossed the White Umfolosi on the 4th of July—the force numbering 4200 Europeans and 1000 natives. Within a mile of Ulundi the British force, formed in a hollow square, was attacked by a Zulu army numbering 12,000 to 15,000. The battle ended in a decisive victory for the British, whose losses were about 100, while of the Zulu some 1500 men were killed (see ULUNDI).

Wolseley's settlement.

After this battle the Zulu army dispersed, most of the leading chiefs tendered their submission, and Cetywayo became a fugitive. On the 27th of August the king was captured and sent to Cape Town. His deposition was formally announced to the Zulu, and Wolseley drew up a new scheme for the government of the country. The Chaka dynasty was deposed, and the Zulu country portioned among eleven Zulu chiefs, John Dunn,[2] a white adventurer, and Hlubi, a Basuto chief who had done good service in the war. A Resident was appointed who was to be the channel of communication between the chiefs and the British government. This arrangement was productive of much bloodshed and disturbance, and in 1882 the British government determined to restore Cetywayo to power. In the meantime, however, blood feuds had been engendered between the chiefs Usibepu (Zibebu) and Hamu[3] on the one side and the tribes who supported the ex-king and his family on the other. Cetywayo's party (who now became known as Usutus) suffered severely at the hands of the two chiefs, who were aided by a band of white freebooters. When Cetywayo was restored Usibepu was left in possession of his territory, while Dunn's land and that of the Basuto chief (the country between the Tugela and the Umhlatuzi, *i.e.* adjoining Natal) was constituted a reserve, in which locations were to be provided for Zulu unwilling to serve the restored king. This new arrangement proved as futile as had Wolseley's. Usibepu, having created a formidable force of well-armed and trained warriors, and being left in independence on the borders of Cetywayo's territory, viewed with displeasure the re-installation of his former king, and Cetywayo was desirous of humbling his relative. A collision very soon took place; Usibepu's forces were victorious, and on the 22nd of July 1883, led by a troop of mounted whites, he made a sudden descent upon Cetywayo's kraal at Ulundi, which he destroyed, massacring such of the inmates of both sexes as could not save themselves by flight. The king escaped, though wounded, into the Reserve; there he died in February 1884.

Cetywayo left a son, Dinizulu, who sought the assistance of some of the Transvaal Boers against Usibepu, whom he defeated and drove into the Reserve. These Boers, led by Lukas Meyer (1846–1902), claimed as a stipulated reward for their services the cession of the greater and more valuable part of central Zululand. On the 21st of May the Boer adventurers had proclaimed Dinizulu king of Zululand; in August following they founded the "New Republic," carved out of Zululand, and sought its recognition by the British government. The Usutu party now repented of their bad bargain, for by the end of 1885 they found the Boers claiming some three-fourths of their country. The British government intervened, took formal possession of St Lucia Bay (to which Germany as well as the Transvaal advanced claims), caused the Boers to reduce their demands, and within boundaries agreed to recognize the New Republic—whose territory was in 1888 incorporated in the Transvaal and has since 1903 formed the Vryheid division of Natal.

The New Republic.

Zululand annexed by Great Britain.

Seeing that peace could be maintained between the Zulu chiefs only by the direct exercise of authority, the British government annexed Zululand (minus the New Republic) in 1887, and placed it under a commissioner responsible to the governor of Natal. In the following year Dinizulu, who continued his feud with Usibepu, rebelled against the British. After a sharp campaign (June to August 1888), the Usutu losing 300 killed in one encounter, Dinizulu fled into the Transvaal. He surrendered himself to the British in November; in April 1889 he and two of his uncles (under whose influence he chiefly acted) were found guilty of high treason and were exiled to St Helena.

Under the wise administration of Sir Melmoth Osborn, the commissioner, whose headquarters were at Eshowe, and the district magistrates, the Zulu became reconciled to British rule, especially as European settlers were excluded from the greater part of the country. Large numbers of natives sought employment in Natal and at the Rand gold mines, and Zululand enjoyed a period of prosperity hitherto unknown. Order was maintained by a mounted native police force.

The Boer road to the sea blocked.

At the end of 1888 and at the beginning of 1890 some small tracts of territory lying between Zululand and Tongaland, under the rule of petty semi-independent chiefs, were added to Zululand; and in 1895 the territories of the chiefs Zambaan (Sambana) and Umtegiza, 688 sq. m. in extent, lying between the Portuguese territories, Swaziland, Zululand and Tongaland, were also added. In the same year a British protectorate was declared over Tongaland. The coast-line was thus secured for Great Britain up to the boundary of the Portuguese territory at

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[1] For his action on this occasion Colonel (afterwards General Sir) Redvers Buller, who was Wood's principal assistant, received the V.C. Piet Uys was among the slain.

[2] Dunn was a son of one of the early settlers in Natal and had largely identified himself with the Zulu. In 1856 he fought for Umbulazi against Cetywayo, but was high in that monarch's favour at the time of his coronation in 1873. When Frere's ultimatum was delivered to Cetywayo, Dunn, with 2000 followers, crossed the Tugela into Natal (10th of January 1879). In 1888 he fought against Dinizulu.

[3] Both these chiefs were members of the royal family.

Delagoa Bay. At that time the Transvaal government—which had been the first to reap the benefit of Great Britain's defeat of the Zulu by acquiring the "New Republic"—was endeavouring to obtain the territories of Zambaan and Umtegiza, hoping also to secure a route through Tongaland to Kosi Bay. President Kruger protested in vain against this annexation, Great Britain being determined to prevent another Power establishing itself on the south-east African seaboard.

Zululand made part of Natal.

Boer raids.

In 1893 Sir M. Osborn was succeeded as resident commissioner by Sir Marshal Clarke,[1] who gained the confidence and good will of the Zulu. At the close of 1897 Zululand, in which Tongaland had been incorporated, was handed over by the imperial government to Natal, and Sir (then Mr) C. J. R. Saunders was appointed civil commissioner of the province, with whose government he had been associated since 1887. In 1898 Dinizulu was allowed to return and was made a "government induna." Officially one of several chiefs subject to the control of the resident magistrate, he was, in fact, regarded by most of the Zulu as the head of their nation. His influence appeared to be in the main exercised on the side of order. During the war of 1899–1902 there was some fighting between the Zulu and the Boers, provoked by the Boers entering Zulu territory. A Zulu kraal having been raided, the Zulu retaliated and, surrounding a small Boer commando, succeeded in killing every member of it. In September 1901 Louis Botha made an attempt to invade Natal by way of Zululand, but the stubborn defence made by the small posts at Itala and Prospect Hill, both within the Zulu border, caused him to give up the project. Throughout the war the Zulu showed marked partiality for the British side.

The Revolt of 1906: Dinizulu's trial.

At the close of the war the Natal government decided to allow white settlers in certain districts of Zululand, and a Lands Delimitation Commission was appointed. The commission, however, reported (1905) that four-fifths of Zululand was unfit for European habitation, and the remaining fifth already densely populated. The commissioners urged that the tribal system should be maintained. Meantime the coal mines near St Lucia Bay were opened up and connected with Durban by railway. At this time rumours were current of disaffection among the Zulu, but this was regarded as the effervescence natural after the war. In 1905 a poll tax of £1 on all adult males was imposed by the Natal legislature; this tax was the ostensible cause of a revolt in 1906 among the natives of Natal, who were largely of Zulu origin. Bambaata, the leader of the revolt, fled to Zululand. He took refuge in the dense bush in the Nkandhla highlands, where Cetywayo's grave became the rallying-point of the rebels, who in April were joined by an aged chief named Sigananda and his tribe. After an arduous campaign, the Natal force (about 5000 strong) being commanded by Col. Sir Duncan McKenzie, the rebellion was crushed by July 1906, without the aid of imperial troops. Bambaata was killed in battle (June 10th); his head was cut off for purposes of identification, but afterwards buried with the body. Sigananda surrendered. In all some 3500 Zulus were killed and about 3000 taken prisoners, the majority of the prisoners being released in 1907 (see further NATAL: *History*). Zululand remained, however, in a disturbed condition, and a number of white traders and officials were murdered. Dinizulu had been accused of harbouring Bambaata, and in December 1907 the Natal government felt justified in charging him with high treason, murder and other crimes. A military force entered Zululand, and Dinizulu surrendered without opposition. He was brought to trial in November 1908, and in March 1909 was found guilty of harbouring rebels. The more serious charges against him were not proved. He was sentenced to four years' imprisonment and deprived of his position as a government induna. Other Zulu chiefs were convicted of various offences and sentenced to imprisonment. At his trial Dinizulu was defended by W. P. Schreiner, ex-premier of Cape Colony, while Miss H. E. Colenso (a daughter of Bishop Colenso) constituted herself his champion in the press of Natal and Great Britain. On the day that the Union of South Africa was established (31st of May 1910), the Botha ministry released Dinizulu from prison. He was subsequently settled on a farm in the Transvaal and given a pension of £500 a year.

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ZUMALACÁRREGUI, THOMAS (1788–1835), Spanish Carlist general, was born at Ormaiztegui in Navarre on the 29th of December 1788. His father, Francisco Antonio Zumalacárregui, was a lawyer who possessed some property, and the son was articled to a solicitor. When the French invasion took place in 1808 he enlisted at Saragossa. He served in the first siege, at the battle of Tudela, and during the second siege until he was taken prisoner in a sortie. He succeeded in escaping and in reaching his family in Navarre. For a short time he served with Gaspar de Jauregui, known as "The Shepherd" (*El Pastor*), one of the minor guerrillero leaders. But Zumalacárregui, who was noted for his grave and silent disposition and his strong religious principles, disliked the disorderly life of the guerrillas, and when regular forces were organized in the north he entered the 1st battalion of Guipuzcoa as an officer. During the remainder of the war he served in the regular army. In 1812 he was sent with despatches to the Regency at Cadiz, and received his commission as captain. In that rank he was present at the battle of San Marciál (31st of August 1813). After the restoration of Ferdinand VII. he continued in the army, and is said to have made a careful study of the theory of war. Zumalacárregui had no sympathy with the liberal principles which were spreading in Spain, and became noted as what was called a *Servil* or strong Royalist. He attracted no attention at headquarters, and was still a captain when the revolution of 1820 broke out. His brother officers, whose leanings were liberal, denounced him to the revolutionary government, and asked that he might be removed. The recommendation was not acted on, but Zumalacárregui knew of it, and laid up the offence in his mind. Finding that he was suspected (probably with truth) of an intention to bring the soldiers over to the royalist side, he escaped to France. In 1823 he returned as an officer in one of the royalist regiments which had been organized on French soil by the consent of the government. He was now known as a thoroughly trustworthy servant of the despotic royalty, but he was too proud to be a courtier. For some years he was employed in bringing regiments which the government distrusted to order. He became lieutenant-colonel in 1825 and colonel in 1829. In 1832 he was named military governor of Ferrol. Before Ferdinand VII. died in 1833, Zumalacárregui was marked out as a natural supporter of the absolutist party which favoured the king's brother, Don Carlos. The proclamation of the king's daughter Isabella as heiress was almost the occasion of an armed conflict between him and the naval authorities at Ferrol, who were partisans of the constitutional cause. He was put on half pay by the new authorities and ordered to live under police observation at Pamplona. When the Carlist rising began on the death of Ferdinand he is said to have held back because he knew that the first leaders would be politicians and talkers. He did not take the field till the Carlist cause appeared to be at a very low ebb, and until he had received a commission from Don Carlos as commander-in-chief in Navarre. The whole force under his orders when he escaped from Pamplona on the night of the 29th of October 1833, and took the command next day in the Val de Araquil, was a few hundred ill-armed and dispirited guerrilleros. In a few months Zumalacárregui had organized the Carlist forces into a regular army. The difficulty he found in obtaining supplies was very great, for the coast towns—and notably Bilbao—were constitutional in politics. It was mainly by captures from the government troops that he equipped his forces. He gradually obtained full possession of Navarre and the Basque provinces, outside of the fortresses, which he had not the means to besiege. Whether as a guerrillero leader, or as a general conducting regular war in the mountains, he proved unconquerable. By July 1834 he had made it safe for Don Carlos to join his headquarters. The pretender was, however, a narrow-minded, bigoted man, who regarded Zumalacárregui with suspicion, and was afraid of his immense personal influence with the soldiers. Zumalacárregui had therefore to drag behind him the whole weight of the distrust and intrigues of the court. Yet by the beginning of June 1835 he had made the Carlist cause triumphant to the north of the Ebro, and had formed an army of more than 30,000 men, of much better quality than the constitutional forces. If Zumalacárregui had been allowed to follow his own plans, which were to concentrate his forces and march on Madrid, he might well have put Don Carlos in possession of the capital. But the court was eager to obtain command of a seaport, and Zumalacárregui was ordered to besiege Bilbao. He obeyed reluctantly, and on the 14th of June 1835 was wounded by a musket bullet in the calf of the leg. The wound was trifling and would probably have been cured with ease if he had been allowed to employ an English doctor whom he trusted. But Don Carlos insisted on sending his own physicians, and in their hands the general died on the 24th of June 1835—not without suspicion of poison. Zumalacárregui was a fine type of the old royalist and religious principles of his people. The ferocity with which he conducted the war was forced on him by the government generals, who refused quarter.

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[1] Lieut.-Col. Sir Marshal James Clarke, R.A. (1841–1909) was A.D.C. to Sir Theophilus Shepstone when the Transvaal was annexed in 1877. He served in the Boer war of 1880–81; was resident commissioner of Basutoland from 1884 to 1893, and after leaving Zululand became resident commissioner in Southern Rhodesia (1898). He was made a K.C.M.G. in 1886.

An engaging account of Zumalacárregui will be found in *The Most Striking Events of a Twelvemonth Campaign with Zumalacárregui in Navarre and the Basque Provinces*, by C. F. Henningsen (London, 1836). A chap-book called *Vida politica y militar de Don Tomas Zumalacárregui*, which gives the facts of his life with fair accuracy, is still very popular in Spain. (D. H.)

ZUMPT, the name of two German classical scholars. Karl Gottlob Zumpt (1792–1894), who was educated at Heidelberg and Berlin, was from 1812 to 1827 a schoolmaster in Berlin, and in 1827 became professor of Latin literature at the university. His chief work was his *Lateinische Grammatik* (1818), which stood as a standard work until superseded by Madvig's in 1844. He edited Quintilian's *Institutio oratoria* (1831), Cicero's *Verrines* and *De officiis* (1837), and Curtius. Otherwise he devoted himself mainly to Roman history, publishing *Annales veterum regnorum et populorum* (3rd ed. 1862), a work in chronology down to A.D. 476, and other antiquarian studies. His nephew, August Wilhelm Zumpt (1815–1877), studied in Berlin, and in 1851 became professor in the Friedrich Wilhelm Gymnasium. He is known chiefly in connexion with Latin epigraphy, his papers on which (collected in *Commentationes epigraphicae*, 2 vols., 1850–54) brought him into conflict with Mommsen in connexion with the preparation of the *Corpus inscriptionum Latinarum*, a scheme for which, drawn up by Mommsen, was approved in 1847. His works include *Monumentum Ancyranum* (with Franck, 1847) and *De monumento Ancyrano supplendo* (1869); *Studia Romana* (1859); *Das Kriminalrecht der röm. Republik* (1865–69); *Der Kriminalprozess der röm. Republik* (1871); editions of Namatianus (1840), Cicero's *Pro Murena* (1859) and *De lege agraria* (1861). Ihne incorporated materials left by him in the 7th and 8th vols. of his *Römische Geschichte* (1840).

ZUNZ, LEOPOLD (1794–1886), Jewish scholar, was born at Detmold in 1794, and died in Berlin in 1886. He was the founder of what has been termed the "science of Judaism," the critical investigation of Jewish literature, hymnology and ritual. Early in the 19th century he was associated with Gans Moser and Heine in an association which the last named called "Young Palestine." The ideals of this *Verein* were not destined to bear religious fruit, but the "science of Judaism" survived. Zunz took no large share in Jewish reform, but never lost faith in the regenerating power of "science" as applied to the traditions and literary legacies of the ages. He had thoughts of becoming a preacher, but found the career uncongenial. He influenced Judaism from the study rather than from the pulpit. In 1832 appeared what E. H. Hirsch rightly terms "the most important Jewish book published in the 19th century." This was Zunz's *Gottesdienstliche Vorträge der Juden*, *i.e.* a history of the Sermon. It lays down principles for the investigation of the Rabbinic exegesis (Midrash, *q.v.*) and of the prayer-book of the synagogue. This book raised Zunz to the supreme position among Jewish scholars. In 1840 he was appointed director of a Lehrerseminar, a post which relieved him from pecuniary troubles. In 1845 appeared his *Zur Geschichte und Literatur*, in which he threw light on the literary and social history of the Jews. Zunz was always interested in politics, and in 1848 addressed many public meetings. In 1850 he resigned his headship of the Teachers' Seminary, and was awarded a pension. He had visited the British Museum in 1846, and this confirmed him in his plan for his third book, *Synagogale Poesie des Mittelalters* (1855). It was from this book that George Eliot translated the following opening of a chapter of *Daniel Deronda:* "If there are ranks in suffering, Israel takes precedence of all the nations" . . . &c. After its publication Zunz again visited England, and in 1859 issued his *Ritus*. In this he gives a masterly survey of synagogal rites. His last great book was his *Literaturgeschichte der synagogalen Poesie* (1865). A supplement appeared in 1867. Besides these works, Zunz published a new translation of the Bible, and wrote many essays which were afterwards collected as *Gesammelte Schriften*. Throughout his early and married life he was the champion of Jewish rights, and he did not withdraw from public affairs until 1874, the year of the death of his wife Adelhei Beermann, whom he had married in 1822.

See Emil G. Hirsch, in *Jewish Encyclopedia*, xii. 699–704. (I. A.)

ZURBARAN, FRANCISCO (1598–1662), Spanish painter, was born at Fuente de Cantos in Estremadura on the 7th of November 1598. His father was Luis Zurbaran, a country labourer, his mother Isabel Marquet. In childhood he set about imitating objects with charcoal; and his father sent him, still young, to the school of Juan de Roélas in Seville. Francisco soon became the best pupil in the studio of Roélas, surpassing the master himself; and before leaving him he had achieved a solid reputation, full though Seville then was of able painters. He may have had here the opportunity of copying some of the paintings of Michelangelo da Caravaggio; at any rate he gained the name of "the Spanish Caravaggio," owing to the forcible realistic style in which he excelled. He constantly painted direct from nature, following but occasionally improving on his model; and he made great use of the lay-figure in the study of draperies, in which he was peculiarly proficient. He had a special gift for white draperies; and, as a consequence, Carthusian houses are abundant in his paintings. To these rigid methods Zurbaran is said to have adhered throughout his career, which was prosperous, wholly confined to Spain, and varied by few incidents beyond those of his daily labour. His subjects were mostly of a severe and ascetic kind—religious vigils, the flesh chastised into subjection to the spirit—the compositions seldom thronged, and often reduced to a single figure. The style is more reserved and chastened than Caravaggio's, the tone of colour often bluish to excess. Exceptional effects are attained by the precise finish of foregrounds, largely massed out in light and shade. Zurbaran married in Seville Leonor de Jordera, by whom he had several children. Towards 1630 he was appointed painter to Philip IV.; and there is a story that on one occasion the sovereign laid his hand on the artist's shoulder, saying, "Painter to the king, king of painters." It was only late in life that Zurbaran made a prolonged stay in Madrid, Seville being the chief scene of his operations. He died, probably in 1662, in Madrid.

In 1627 he painted the great altarpiece of St Thomas Aquinas, now in the Seville museum; it was executed for the church of the college of that saint there. This is Zurbaran's largest composition, containing figures of Christ and the Madonna, various saints, Charles V. with knights, and Archbishop Deza (founder of the college) with monks and servitors, all the principal personages being beyond the size of life. It had been preceded by the numerous pictures of the screen of St Peter Nolasco in the cathedral. In the church of Guadalupe he painted various large pictures, eight of which relate to the history of St Jerome, and in the church of St Paul, Seville, a famous figure of the Crucified Saviour, in grisaille, presenting an illusive effect of marble. In 1633 he finished the paintings of the high altar of the Carthusians in Jerez. In the palace of Buenretiro, Madrid, are four large canvases representing the Labours of Hercules, an unusual instance of non-Christian subjects from the hand of Zurbaran. A fine specimen is in the National Gallery, London, a whole-length, life-sized figure of a kneeling Franciscan holding a skull. It seems probable that another picture in the same gallery, the "Dead Roland," which used to be ascribed to Velasquez, is really by Zurbaran. His principal scholars, whose style has as much affinity to that of Ribera as to Caravaggio's, were Bernabe de Ayala and the brothers Polanco.

(W. M. R.)

ZÜRICH (Fr. *Zurich;* Ital. *Zurigo*), one of the cantons of north-eastern Switzerland, ranking officially as the first in the Confederation. Its total area is 665·7 sq. m., of which 625·2 sq. m. are reckoned as "productive" (forests covering 180·8 sq. m., and vineyards 16·9 sq. m., the most extensive Swiss wine district save in Vaud and in Ticino). Of the rest, 21 sq. m. are occupied by the cantonal share of the lake of Zürich, while wholly within the canton are the smaller lakes of Greifen ($3\frac{1}{4}$ sq. m.) and Pfäffikon ($1\frac{1}{3}$ sq. m.). The canton is of irregular shape, consisting simply of the acquisitions made in the course of years by the town. Of these the more important were the whole of the lower part of the lake (1362), Küssnacht (1384), Thalwil (1385), Erlenbach (1400), Greifensee (1402), Horgen (1406), Grüningen and Stäfa (1408), Bülach and Regensberg (1409), Wald (1425), Kyburg (1452), Winterthur (1467), Eglisau (1496), Konau (1512), and Wädenswil (1549)—Stein was held from 1484 to 1798, while in 1798 the lower part of the Stammheim glen, and finally in 1803 Rheinau, were added to the canton. In 1798 the town ruled nineteen "inner" bailiwicks and nine rural bailiwicks, besides the towns of Stein and of Winterthur. The canton at present extends from the left bank of the Rhine (including also Eglisau on the right bank) to the region west of the lake of Zürich. It is bounded on the E. and W. by low hills that divide it respectively from the valleys of the Thur, and from those of the Reuss and of the Aar. In itself the canton consists of four shallow river valleys, separated by low ranges, all running from S.E. to N.W. The most important of these is that of the Linth (*q.v.*), which forms the lake of Zürich. To the east are the valleys of the Glatt (forming lake Greifen) and of the Töss (forming lake Pfäffikon), both sending their streams direct to the Rhine. The highest point in the canton is the Albishorn (3012 ft.) in the Albis range, which limits the Sihl valley to the west. All the valleys named are traversed by railway lines, while many lines branch off in every direction from the town of Zürich. The first railway line opened (1847) in Switzerland was that from Zürich to Baden in Aargau (14 m.). From the town of Zürich mountain railways lead S.W. to near the summit of the Uetliberg (2864 ft.) and N.E. towards the Zürichberg (2284 ft.).

In 1900 the population was 431,036, of whom 413,141 were German-speaking, 11,192 Italian-speaking, 3894 French-speaking, and 610 Romonsch-speaking, while there were 345,446 Protestants, 80,752 Catholics (Roman or "Old"), and 2933 Jews. The capital of the canton is Zürich (*q.v.*), but Winterthur (*q.v.*) is the only other considerable town, Uster (7623 inhabitants), and Horgen (6883 inhabitants) being rather large manufacturing villages. The land in the canton is highly cultivated and much subdivided. But the canton is above all a great manufacturing district, especially of machinery and railway rolling-stock, while both silk weaving and cotton weaving are widely spread. It is divided into 11 administrative districts, which comprise 189 communes. In 1869 the cantonal constitution was revised in a democratic sense, and with the exception of a few changes made later, it is the existing constitution. There is an executive or *Regierungsrat* of seven members and a legislature or *Kantonsrat* (one member to every 1500 resident Swiss citizens or a fraction over 750), each holding office for three years and elected at the same time directly by the vote of the people. The referendum exists in both forms, compulsory and optional: all laws and all money grants of a total sum over 250,000 frcs. or an annual sum of 20,000 must be submitted to a popular vote, the people meeting for that purpose at least twice in each year, while the executive may submit to a popular vote any other matter, though it fall within its powers as defined by law. One-third of the members of the legislature or 5000 legally qualified voters can force the government to submit to the people any matter whatsoever (initiative). Both members of the Federal *Ständerat* and the 22 members of the Federal *Nationalrat* are elected simultaneously by a popular vote and hold office for three years. The constitution provides for the imposition of a graduated and progressive income tax. In 1885 the penalty of death was abolished in the canton.

(W. A. B. C.)

ZÜRICH (Fr. *Zurich;* Ital. *Zurigo*), the capital of the Swiss canton of the same name. It is the most populous, the most important, and on the whole the finest town in Switzerland, and till 1848 was practically the capital of the Swiss Confederation. It is built on both banks of the Limmat (higher up called Linth) as it issues from the lake of Zürich, and also of its tributary, the Sihl, that joins it just below the town. That portion of the town which lies on the right bank of the Limmat is called the "Grosse Stadt" and that on the left bank the "Kleine Stadt." Till 1893 the central portion of the town on either bank of the Limmat formed the "city" and ruled the outlying communes or townships that had sprung up around it. But at that time the eleven outer districts (including Aussersihl, the workmen's quarter on the left bank of the Sihl) or suburbs were incorporated with the town, which is now governed by a town council of 125 members (one to every 1200 inhabitants), and an executive of 9 members, both chosen direct by a popular vote. Much land has been rescued from the lake, and is the site of fine quays, stately public buildings, and splendid private villas. The older quarters are still crowded. But the newer quarters stretch up the slope of the Zürichberg (above the right bank of the Limmat) while the fine Bahnhofstrasse (extending from the railway station to the lake) has the best shops and is in the neighbourhood of the more important public buildings.

Zürich has always been wealthy and prosperous. It has increased enormously, as is shown by the following figures. Its population in 1900 (including the eleven suburbs above named) was 150,703, while (without these) in 1888 it was 94,129; in 1880, 78,345; in 1870, 58,657; in 1860, 44,978; and in 1850 only 35,483. Of the inhabitants in 1900 no fewer than 43,761 (as against 20,928 in 1888 and 3155 in 1850) were not Swiss citizens, Germans numbering 31,125, Italians 5350, Austrians 4210, Russians 683, French 652, British subjects 157, and citizens of the United States 232. In

1900 there were in the town 140,803 German-speaking persons, 5100 Italian-speaking, 2586 French-speaking, and 415 Romonsch-speaking. In 1888 the corresponding figures were 90,500, 1135, 1320, and 148. In 1900 the town numbered 102,794 Protestants, 43,655 "Catholics" (Roman or "Old") and 2713 Jews. In 1888 the religious figures were 70,970, 20,571 and 1221 respectively, while in 1850 the numbers were 32,763, 2664 and 56. The international character of the town has thus become much more marked. This is partly due to the immigration of many foreign workmen, and partly to the arrival of Russian and Polish exiles. Both have added a turbulent cosmopolitan element to the town, in which the Socialist party is strong, and is increasing in power and influence, even in matters concerned with civic government.

Of the old buildings the finest and most important is the Gross Münster (or Propstei), on the right bank of the Limmat. This was originally the church of the king's tenants, and in one of the chapels the bodies of Felix, Regula and Exuperantius, the patron saints of the city, were buried, the town treasury being formerly kept above this chapel. The present building was erected at two periods (*c.* 1090–1150 and *c.* 1225–1300), the high altar having been consecrated in 1278. The towers were first raised above the roof at the end of the 15th century and took their present form in 1779. The chapter consisted of twenty-four secular canons; it was reorganized at the Reformation (1526), and suppressed in 1832. On the site of the canons' houses stands a girls' school (opened 1853), but the fine Romanesque cloisters (12th and 13th centuries) still remain. There is a curious figure of Charlemagne in a niche on one of the towers; to him is attributed the founding or reform of the chapter. On the left bank of the Limmat stands the other great church of Zürich, the Frau Münster (or Abtei), founded for nuns in 853, by Louis the German. The high altar was consecrated in 1170; but the greater part of the buildings are of the 13th and 14th centuries. It was in this church that the relics of the three patron saints of the town were preserved till the Reformation, and it was here that the burgomaster Waldmann was buried in 1489. There were only twelve nuns of noble family, comparatively free from the severer monastic vows; the convent was suppressed in 1524. Of the other old churches may be mentioned St Peter's, the oldest parish church, though the present buildings date in part from the 13th century only (much altered in the early 18th century), and formerly the meeting-place of the citizens; the Dominican church (13th century), in the choir of which the cantonal library of 80,000 volumes has been stored since 1873; the church of the Austin friars (14th century), now used by the Old Catholics, and the Wasserkirche. The last-named church is on the site of a pagan holy place, where the patron saints of the city were martyred; since 1631 it has housed the Town Library, the largest in Switzerland, which contains 170,000 printed volumes and 4500 MSS. (among these being letters of Zwingli, Bullinger and Lady Jane Grey), as well as a splendid collection of objects from the lake dwellings of Switzerland. The building itself was erected from 1479 to 1484, and near it is a statue of Zwingli, erected in 1885. The existing town-hall dates from 1698, while the gild houses were mostly rebuilt in the 18th century. One of the most magnificent of the newer buildings is the Swiss National Museum, behind the railway station. This museum, which was opened in 1898, contains a wonderful collection of Swiss antiquities (especially medieval) and art treasures of all kinds, some of which are placed in rooms of the actual date, removed from various ancient buildings. There are some fine old fountains (the oldest dating back to 1568). There are several good bridges, Roman traces being seen in the case of the Niederbrücke (now called the Rathausbrücke). The mound of the Lindenhof was formerly crowned by the king's house, which disappeared in the 13th century, and the hillock was planted with limes as early as 1422.

The town is noted for its numerous clubs and societies, and is the intellectual capital of German-speaking Switzerland. Cotton-spinning and the manufacture of machinery are two leading industries, but by far the most important is the silk-weaving industry. This flourished in Zürich in the 12th and 13th centuries, but disappeared about 1420; it was revived by the Protestant exiles (such as the Muralti and Orelli families) from Locarno (1555) and by the Huguenot refugees from France (1682 and 1685). The value of the silk annually exported (mainly to France, the United States and England) is estimated at over three millions sterling. Zürich is the banking centre of Switzerland. Besides the excellent primary and secondary schools, there are the Cantonal School, including a gymnasium and a technical side (opened 1842), and a high school for girls (opened 1875). The Cantonal University and the Federal Polytechnic School are housed in the same building, but have no other connexion. The university was opened in 1833, no doubt as a successor to the ancient chapter school at the Gross Münster, said to date back to Charlemagne's time—hence its name the Carolinum—reorganized at the Reformation, and suppressed in 1832. The Polytechnic School, opened in 1855, includes seven main sections (industrial chemistry, industrial mechanics, engineering, training of scientific and mathematical teachers, architecture, forestry and agriculture, and the military sciences), besides a general philosophical and political science department. The Polytechnic School has good collections of botanical specimens and of engravings. Near it is the observatory (1542 ft.). There are also in Zürich many institutions for special branches of education—*e.g.* veterinary surgery, music, industrial art, silk-weaving, &c.

The earliest inhabitants of the future site of Zürich were the lake dwellers. The Celtic Helvetians had a settlement on the Lindenhof when they were succeeded by the Romans, who established a custom station here for goods going to and coming from Italy; during their rule Christianity was introduced early in the 3rd century by Felix and Regula, with whom Exuperantius was afterwards associated. The district was later occupied by the Alamanni, who were conquered by the Franks.

The name Zürich is possibly derived from the Celtic *dur* (water). It is first mentioned in 807 under the form "Turigus," then in 853 as "Turegus." The true Latinized form is *Turicum*, but the false form *Tigurum* was given currency by Glareanus and held its ground from 1512 to 1748. It is not till the 9th century that we find the beginnings of the Teutonic town of Zürich, which arose from the union of four elements: (1) the royal house and castle on the Lindenhof, with the king's tenants around, (2) the Gross Münster, (3) the Frau Münster, (4) the community of "free men" (of Alamannian origin) on the Zürichberg. Similarly we can distinguish four stages in the constitutional development of the town: (i.) the gradual replacing (*c.* 1250) of the power of the abbess by that (real, though not nominal) of the patricians, (ii.) the admittance of the craft gilds (1336) to a share with the patricians in the government of the town, (iii.) the granting of equal political rights (1831) to the country districts, hitherto ruled as subject lands by the burghers, and (iv.) the reception as burghers of the numerous immigrants who had settled in the town (town schools opened in 1860, full incorporation in 1893).

The Frankish kings had special rights over their tenants, were the protectors of the two churches, and had jurisdiction over the free community. In 870 the sovereign placed his powers over all four in the hands of a single official (the Reichsvogt), and the union was still further strengthened by the wall built round the four settlements in the 10th century as a safeguard against Saracen marauders and feudal barons. The "Reichsvogtei" passed to the counts of Lenzburg (1063–1173), and then to the dukes of Zähringen (extinct 1218). Meanwhile the abbess of the Benedictine Frau Münster had been acquiring extensive rights and privileges over all the inhabitants, though she never obtained the criminal jurisdiction. The town flourished greatly in the 12th and 13th centuries, the silk trade being introduced from Italy. In 1218 the "Reichsvogtei" passed back into the hands of the king, who appointed one of the burghers as his deputy, the town thus becoming a free imperial city under the nominal rule of a distant sovereign. The abbess in 1234 became a princess of the empire, but power rapidly passed from her to the council which she had originally named to look after police, &c., but which came to be elected by the burghers, though the abbess was still "the lady of Zürich." This council (all powerful since 1304) was made up of the representatives of certain knightly and rich mercantile families (the "patricians"), who excluded the craftsmen from all share in the government, though it was to these last that the town was largely indebted for its rising wealth and importance.

In October 1291 the town made an alliance with Uri and

Schwyz, and in 1292 failed in a desperate attempt to seize the Habsburg town of Winterthur. After that Zürich began to display strong Austrian leanings, which characterize much of its later history. In 1315 the men of Zürich fought against the Swiss Confederates at Morgarten. The year 1336 marks the admission of the craftsmen to a share in the town government, which was brought about by Rudolf Brun, a patrician. Under the new constitution (the main features of which lasted till 1798) the Little Council was made up of the burgomaster and thirteen members from the "*Constafel*" (which included the old patricians and the wealthiest burghers) and the thirteen masters of the craft gilds, each of the twenty-six holding office for six months. The Great Council of 200 (really 212) members consisted of the Little Council, plus 78 representatives each of the *Constafel* and of the gilds, besides 3 members named by the burgomaster. The office of burgomaster was created and given to Brun for life. Out of this change arose a quarrel with one of the branches of the Habsburg family, in consequence of which Brun was induced to throw in the lot of Zürich with the Swiss Confederation (1st May 1351). The double position of Zürich as a free imperial city and as a member of the Everlasting League was soon found to be embarrassing to both parties (see SWITZERLAND). In 1373 and again in 1393 the powers of the *Constafel* were limited and the majority in the executive secured to the craftsmen, who could then aspire to the burgomastership. Meanwhile the town had been extending its rule far beyond its walls—a process which began in the 14th, and attained its height in the 15th century (1362–1467). This thirst for territorial aggrandizement brought about the first civil war in the Confederation (the "Old Zürich War," 1436–50), in which, at the fight of St Jacob on the Sihl (1443), under the walls of Zürich, the men of Zürich were completely beaten and their burgomaster Stüssi slain. The purchase of the town of Winterthur from the Habsburgs (1467) marks the culmination of the territorial power of the city. It was to the men of Zürich and their leader Hans Waldmann that the victory of Morat (1476) was due in the Burgundian war; and Zürich took a leading part in the Italian campaign of 1512–15, the burgomaster Schmid naming the new duke of Milan (1512). No doubt her trade connexions with Italy led her to pursue a southern policy, traces of which are seen as early as 1331 in an attack on the Val Leventina and in 1478, when Zürich men were in the van at the fight of Giornico, won by a handful of Confederates over 12,000 Milanese troops.

In 1400 the town obtained from the Emperor Wenceslaus the Reichsvogtei, which carried with it complete immunity from the empire and the right of criminal jurisdiction. As early as 1393 the chief power had practically fallen into the hands of the Great Council, and in 1498 this change was formally recognized.

This transfer of all power to the gilds had been one of the aims of the burgomaster Hans Waldmann (1483–89), who wished to make Zürich a great commercial centre. He also introduced many financial and moral reforms, and subordinated the interests of the country districts to those of the town. He practically ruled the Confederation, and under him Zürich became the real capital of the League. But such great changes excited opposition, and he was overthrown and executed. His main ideas were embodied, however, in the constitution of 1498, by which the patricians became the first of the gilds, and which remained in force till 1798; some special rights were also given to the subjects in country districts. It was the prominent part taken by Zürich in adopting and propagating (against the strenuous opposition of the *Constafel*) the principles of the Reformation (the Frau Münster being suppressed in 1524) which finally secured for it the lead in the Confederation (see SWITZERLAND and ZWINGLI).

The environs of Zürich are famous in military history on account of the two battles of 1799. In the first battle (4th June) the French under Masséna, on the defensive, were attacked by the Austrians under the Archduke Charles, Masséna retiring behind the Limmat before the engagement had reached a decisive stage. The second and far more important battle took place on the 25th and 26th of September. Masséna, having forced the passage of the Limmat, attacked and totally defeated the Russians and their Austrian allies under Korsákov's command. (See FRENCH REVOLUTIONARY WARS.)

In the 17th and 18th centuries a distinct tendency becomes observable in the town government to limit power to the actual holders. Thus the country districts were consulted for the last time in 1620 and 1640; and a similar breach of the charters of 1489 and 1531 (by which the consent of these districts was required for the conclusion of important alliances, war and peace, and might be asked for as to other matters) occasioned disturbances in 1777. The council of 200 came to be largely chosen by a small committee of the members of the gilds actually sitting in the council—by the constitution of 1713 it consisted of 50 members of the Little Council (named for a fixed term by the Great Council), 18 members named by the *Constafel*, and 144 selected by the 12 gilds, these 162 (forming the majority) being co-opted for life by those members of the two councils who belonged to the gild to which the deceased member himself had belonged. Early in the 18th century a determined effort was made to crush by means of heavy duties the flourishing rival silk trade in Winterthur. It was reckoned that about 1650 the number of privileged burghers was 9000, while their rule extended over 170,000 persons. The first symptoms of active discontent appeared later among the dwellers by the lake, who founded in 1794 a club at Stäfa and claimed the restoration of the liberties of 1489 and 1531, a movement which was put down by force of arms in 1795. The old system of government perished in Zürich, as elsewhere in Switzerland, in February 1798, and under the Helvetic constitution the country districts obtained political liberty. The cantonal constitution was rather complicated, and under it the patrician party obtained a small working majority. That constitution was meant to favour the town as against the country districts. But under the cantonal constitution of 1814 matters were worse still, for the town (10,000 inhab.) had 130 representatives in the Great Council, while the country districts (200,000 inhab.) had only 82. A great meeting at Uster on the 22nd of November 1830 demanded that two-thirds of the members in the Great Council should be chosen by the country districts; and in 1831 a new constitution was drawn up on these lines, the town getting 71 representatives as against 141 allotted to the country districts, though it was not till 1837–38 that the town finally lost the last relics of the privileges which it had so long enjoyed as compared with the country districts. From 1803 to 1814 Zürich was one of the six "directorial cantons," its chief magistrate becoming for a year the chief magistrate of the Confederation, while in 1815 it was one of the three cantons, the government of which acted for two years as the Federal government when the diet was not sitting. In 1833 Zürich tried hard to secure a revision of the Federal constitution and a strong central government. The town was the Federal capital for 1839–40, and consequently the victory of the Conservative party there in 1839 (due to indignation at the nomination by the Radical government to a theological chair in the university of D. F. Strauss, the author of the famous *Life of Jesus*) caused a great stir throughout Switzerland. But when in 1845 the Radicals regained power at Zürich, which was again the Federal capital for 1845–46, that town took the lead in opposing the Sonderbund cantons. It of course voted in favour of the Federal constitutions of 1848 and of 1874, while the cantonal constitution of 1869 was remarkably advanced for the time. The enormous immigration from the country districts into the town from the "thirties" onwards created an industrial class which, though "settled" in the town, did not possess the privileges of burghership, and consequently had no share in the municipal government. First of all in 1860 the town schools, hitherto open to "settlers" only on paying high fees, were made accessible to all, next in 1875 ten years' residence *ipso facto* conferred the right of burghership, while in 1893 the eleven outlying districts (largely peopled by working folk) were incorporated with the town proper. The town and canton continued to be on the Liberal, or Radical, or even Socialistic side, while from 1848 to 1907 they claimed 7 of the 37 members of the Federal executive or *Bundesrat*, these 7 having filled the presidential chair of the Confederation in twelve years, no canton surpassing this record. From 1833 onwards the walls and fortifications of Zürich were little by little pulled down, thus affording scope for the extension and beautification of the town.

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(W. A. B. C.)

ZÜRICH, LAKE OF, a Swiss lake, extending S.E. of the town of Zürich. It is formed by the river Linth, which, rising in the glaciers of the Tödi range in Glarus, was diverted by the Escher canal (completed in 1811) into the Walensee, whence, by means of the Linth canal (completed in 1816), its waters are carried to the east end of the lake of Zürich. This river issues from the lake at its north-west end, passing through the town of Zürich, but is then called the Limmat. No streams of importance flow into the lake. Its area is about 34 sq. m., its extreme length 25 m., its greatest breadth 2½ m., and its greatest depth 469 ft., while its surface is 1342 ft. above sea-level. It is included, or the greater portion, in the Canton of Zürich, but at its east end 8¾ sq. m. towards the southern shore are in that of Schwyz, and 4 sq. m. towards the northern shore in that of St Gall. The great dam of masonry, carrying the railway line and carriage road from Rapperswil to Pfäffikon, which cuts off the extreme eastern part of the lake from the rest, is passed only by small boats; steamers (of which the first was placed on the lake in 1835) do not go beyond the dam, as the eastern portion of the lake is shallow and choked by weeds. West of this dam is the small island of Ufenau, where in 1523 Ulrich von Hutten took refuge and died. Both shores are well cultivated and fertile. There are many villas, particularly near Zürich, and elsewhere numerous factories in the various flourishing villages. Zürich, at the north end of the lake, is the principal place on it. On the west shore (which gradually becomes the south shore) are Thalwil, Horgen, Wädenswil, Richterswil, Pfäffikon, and Lachen. On the opposite shore are Meilen (near which the first lake dwellings were discovered in 1853–54), Stäfa, and the quaint town of Rapperswil, the castle of which shelters a Polish museum, wherein is the heart of Kosciuszko. Schmerikon is close to the east end of the lake, and a little beyond is the more important town of Uznach. (W. A. B. C.)

ZURITA Y CASTRO, JERÓNIMO (1512–1580), Spanish historian, was born at Saragossa, and studied at Alcalá de Henares under the celebrated Hellenist, Hernán Nuñez. Through the influence of his father, Miguel de Zurita, physician to Charles V., he entered the public service as magistrate at Barbastro, and in 1537 was appointed assistant-secretary of the Inquisition. In 1548 Zurita was nominated official chronicler of the kingdom of Aragon, and in 1566 Philip II. attached him as secretary to the council of the Inquisition, delegating to him the conduct of all matters sufficiently important to require the king's signature. Zurita resigned these posts on the 21st of January 1571, obtained a sinecure at Saragossa, and dedicated himself wholly to the composition of his *Anales de la corona de Aragón*, the first part of which had appeared in 1562; he lived to see the last volume printed at Saragossa on the 22nd of April 1580, and died on the 3rd of November following. Zurita's style is somewhat crabbed and dry, but his authority is unquestionable; he displayed a new conception of an historian's duties, and, not content with the ample materials stored in the archives of Aragon, continued his researches in the libraries of Rome, Naples and Sicily; he founded the school of historical scholarship in Spain.

ZUTPHEN, or ZUTFEN, a town in the province of Gelderland, Holland, on the right bank of the Ysel at the influx of the Berkel, and a junction station 18 m. by rail N.N.E. of Arnhem. Pop. 19,000. It is a picturesque old town with several brick houses of the 16th and 17th centuries. The most important building is the Groote Kerk, of St Walpurgis, which dates from the 12th century and contains monuments of the former counts of Zutphen, a 13th-century candelabrum, an elaborate copper font (1527), and a fine modern monument to the van Heeckeren family. The chapter-house contains a pre-Reformation library which includes some valuable MSS. and *incunabula*. There are some remains of the old town walls. The place has an active trade, especially in grain and in the timber floated down from the Black Forest by the Rhine and the Ysel; the industries include tanning, weaving, and oil and paper manufactures. Not far from Zutphen on the west at Monnikhuizen once stood the Carthusian convent founded by Reinald III., duke of Gelderland, in 1342 and dissolved in 1572. About 3 m. to the north of Zutphen is the agricultural colony of Nederlandsch-Mettray, founded by a private benefactor for the education of poor friendless boys in 1851, and since that date largely extended.

In the middle ages Zutphen was the seat of a line of counts, which became extinct in the 12th century. Having been fortified the town stood several sieges, specially during the wars of freedom waged by the Dutch, the most celebrated fight under its walls being the one in September 1586 when Sir Philip Sidney was mortally wounded. Taken by the Spaniards in 1587 Zutphen was recovered by Maurice, prince of Orange, in 1591, and except for two short periods, one in 1672 and the other during the French Revolutionary Wars, it has since then remained a part of the United Netherlands. Its fortifications were dismantled in 1874.

ZWEIBRÜCKEN, a town of Germany, in the Palatinate, on the Schwarzbach, and on the railway between Germersheim and Saarbrücken. Pop. (1905) 14,711. The town was the capital of the former duchy of Zweibrücken, and the Alexander-Kirche contains the tombs of the dukes. The ducal castle is now occupied by the chief court of the Palatinate. There is a fine Gothic Catholic church. Weaving and brewing and the manufacture of machinery, chicory, cigars, malt, boots, furniture and soap are the chief industries.

Zweibrücken ("two bridges") is the Latin *Bipontinum*; it appears in early documents also as *Geminus Pons*, and was called by the French *Deux-Ponts*. The independent territory was at first a countship, the counts being descended from Henry I., youngest son of Simon I., count of Saarbrücken (d. 1180). This line became extinct on the death of Count Eberhard (1393), who in 1385 had sold half his territory to the count palatine of the Rhine, and held the other half as his feudatory. Louis (d. 1489), son of Stephen, count palatine of Zimmern-Veldenz, founded the line of the dukes of Zweibrücken, which became extinct in 1731, when the duchy passed to the Birkenfeld branch, whence it came under the sway of Bavaria in 1799. At the peace of Lunéville Zweibrücken was ceded to France; on its reunion with Germany in 1814 the greater part of the territory was given to Bavaria, the remainder to Oldenburg and Prussia. At the ducal printing office at Zweibrücken the fine edition of the classics known as the Bipontine Editions was published (1799 sqq.).

See Lehmann, *Geschichte des Herzogtums Zweibrücken* (Munich, 1867).

ZWICKAU, a town of Germany, in the kingdom of Saxony, situated in a pleasant valley at the foot of the Erzgebirge, on the left bank of the Zwickauer Mulde, 41 m. S. of Leipzig and 20 m. S.W. of Chemnitz on the main line of railway Dresden-Hof and at the junction of several other lines. Pop. (1834) 6701; (1880) 35,005; (1890) 44,198; (1905) 68,502. Among the nine churches, the fine Gothic church of St Mary (1451–1536 and restored 1885–91), with a spire 285 ft. high and a bell weighing 5½ tons, is remarkable. The church contains an altar with wood-carving and eight pictures by Michael Wohlgemuth and a remarkable *Pietà* in carved and painted wood, probably by Veit Stoss. The late Gothic church of St Catharine (restored 1893–94) has an altarpiece ascribed to Lucas Cranach the Elder, and is memorable for the pastorate (1520–22) of Thomas Münzer. Of the secular buildings the most noteworthy are the town-hall of 1581, with the municipal archives, including documents dating back to the 13th century and an autograph MS. of the works of Hans Sachs, and the late Gothic *Gewandhaus* (cloth merchants' hall), built 1522–24 and now in part converted into a theatre. The manufactures of Zwickau include spinning and weaving, machinery, motor-cars, chemicals, porcelain, paper, glass, dyestuffs, wire goods, tinware, stockings, and curtains. There are also steam saw-mills, diamond and glass polishing works, iron-foundries, and breweries. Though no longer relatively so important as when it lay on the chief trade route from Saxony to Bohemia and the Danube, Zwickau carries on considerable commerce in grain, linen, and coal. The mainstay of the industrial prosperity of the town is the adjacent coalfield, which in 1908 employed 13,000 hands, and yields 2½ million tons of coal annually. The mines are mentioned as early as 1348; but they have only been actively worked since 1823, during which time the population has increased more than tenfold.

Zwickau is of Slavonic origin, and is mentioned in 1118 as a trading place. The name is fancifully derived from the Latin *cygnea*, from a tradition that placed a "swan lake" here which had the property of renewing the youth of those who bathed in it. Zwickau was an imperial possession, but was pledged to Henry the Illustrious, margrave of Meissen (d. 1288). The German king Charles VI. conferred it as a fief in 1348 on the margraves of Meissen, and it thus passed to their successors the electors of Saxony. The discovery of silver in the Schneeberg in 1470 brought it much wealth. The Anabaptist movement of 1525 began at Zwickau under the inspiration of the "Zwickau prophets." Robert Schumann (1810–1856), the musical composer, was born here in a house which still stands in the market-place.

See Herzog, *Chronik der Kreisstadt Zwickau* (2 vols., Zwickau, 1839–45), *Geschichte des Zwickauer Steinkohlenbaues* (Dresden, 1852); Hänsch, *Das Zwickau-Chemnitzer Kohlengebiet* (Meissen, 1908).

ZWIEDINECK VON SÜDENHORST, HANS (1845–1906), German historian, was born at Frankfort-on-the-Main on the 14th of April 1845. He studied at the university of Gratz, where he became a professor in 1885, and died at Gratz on the 22nd of November 1906.

Südenhorst's principal writings are *Dorfleben im 18 Jahrhundert* (Vienna, 1877); *Hans Ulrich, Fürst von Eggenberg* (Vienna, 1880); *Die Politik der Republic Venedig während des dreissigjährigen Krieges* (Stuttgart, 1882–85); *Venedig als Weltmacht und Weltstadt* (Bielefeld, 1899 and 1906); *Kriegsbilder aus der Zeit der Landsknechte* (Stuttgart, 1883); *Die öffentliche Meinung in Deutschland im Zeitalter Ludwigs XIV. 1650–1700* (Stuttgart, 1888); *Erzherzog Johann im Feldzuge von 1809* (Gratz, 1892); and *Maria Theresia* (Bielefeld, 1905). He edited the *Bibliothek deutscher Geschichte*, writing for this series, *Deutsche Geschichte im Zeitalter der Gründung des preussischen Königtums* (Stuttgart, 1887–94); and *Deutsche Geschichte von der Auflösung des alten bis zur Gründung des neuen Reiches* (Stuttgart, 1897–1905). He completed A. Wolf's *Oesterreich unter Maria Theresia, Josef II. und Leopold II.* (Berlin, 1882–84), and edited the *Zeitschrift für allgemeine Geschichte* (Stuttgart, 1884–88).

ZWINGLI, HULDREICH (1484–1531), Swiss reformer, was born on the 1st of January 1484, at Wildhaus in the Toggenburg valley, in the canton of St Gall, Switzerland. He came of a free peasant stock, his father being *amtmann* of the village; his mother, Margaret Meili, was the sister of the abbot of Fischingen in Thurgau. His uncle, Bartholomew Zwingli, afterwards *dekan* or *superintendent* of Wesen, had been elected parish priest of Wildhaus. As he was keen at his books and fond of music he was destined for the Church, and when eight years old was sent to school at Wesen, where he lived with his uncle, the dean. Two years later he was sent to a school in Basel, where he remained three years, passing thence to the high school at Bern, where his master, Heinrich Wölflin, inspired him with an enthusiasm for the classics. After some two years there the boy took up his abode in the Dominican monastery. But his father had no thoughts of letting him become a monk, and in 1500 he was sent to the university of Vienna, where he remained for another two years and "included in his studies all that philosophy embraces." He then returned to Basel, where he graduated in the university and became a teacher of the classics in the school of St Martin's church.

The circumstances and surroundings of Zwingli's early life were thus dissimilar from those of his contemporary, Martin Luther. Zwingli, moreover, never knew anything of those spiritual experiences which drove Luther into a cloister and goaded him to a feverish "searching of the Scriptures" in the hope of finding spiritual peace. Zwingli was a humanist, a type abhorred of Luther; and he was far more ready for the polite Erasmian society of Basel than for a monastery. Luther never quite shook off scholasticism, whereas Zwingli had early learnt from Dr Thomas Wyttenbach that the time was at hand when scholastic theology must give place to the purer and more rational theology of the early Fathers and to a fearless study of the New Testament. He heard from this same teacher bold criticisms of Romish teaching concerning the sacraments, monastic vows and papal indulgences, and unconsciously he was thus trained for the great remonstrance of his maturer life.

At the age of twenty-two Zwingli was ordained by the bishop of Constance (1506), preached his first sermon at Rapperswyl, and said his first mass among his own people at Wildhaus. In the same year he was elected parish priest of Glarus, in spite of the pope's nomination of Heinrich Goldli, an influential pluralist of Zürich, whom Zwingli found it necessary to buy off at an expense of more than a hundred gulden. The Holy See, much dependent at that time on its Swiss mercenaries in the pursuit of its secular ends, expressed no resentment on this occasion. Zwingli indeed seemed still to be devoted to the pope, whom he styled "beatissimus Christi vicarius," and he publicly proclaimed the mercenary aid given by the Swiss to the papal cause to be its dutiful support of the Holy See. The Curia, following its accustomed policy, rewarded his zeal with a pension of 50 gulden.

The ten years which Zwingli spent at Glarus laid the foundations of his work as a reformer. He there began th

Greek that he might "learn the teaching of Christ from the original sources," and gave some attention to Hebrew. He read also the older Church Fathers and soon won for himself fame as a student, whilst his skill in the classics led his friends to hail him as "the undoubted Cicero of our age." He had an unbounded admiration for Erasmus, with whom he entered into correspondence, and from whom he received a somewhat chilling patronage; whilst the brilliant humanist, Pico della Mirandola (1463–1494), taught him to criticize, in a rationalizing way, the medieval doctrines of Rome. His first publications, which appeared as rhymed allegories, were political rather than religious, being aimed at what he deemed the degrading Swiss practice of hiring out mercenaries in the European wars. His convictions on this matter were so much intensified by his later experiences as army chaplain that in 1521 he prevailed upon the authorities of the canton of Zürich to renounce the practice altogether. Especially did he oppose alliances with France; but the French party in Glarus was strong, and it retaliated so fiercely that in 1516 Zwingli was glad to accept the post of people's priest at Einsiedeln. He always in later days dated his arrival at evangelical truth from the three years (1516–19) which he spent in this place. There he studied the New Testament in the editions of Erasmus and began to found his preaching on "the Gospel," which he declared to be simple and easy to understand. He held that the Bible was the sufficient revelation of the will of God, and he threw away the philosophy and theology of the later Roman Church, whereas he declared that the early Church Fathers were helpful, though still fallible, interpreters of the Word. In his definite recognition of the theological place of Scripture he showed, says Dr T. M. Lindsay (*History of the Reformation*), clearer insight than the Lutherans, and Zwingli rather than Luther was in this matter Calvin's guide, and the guide of the reformed churches of Switzerland, France, England and the Netherlands. All these set forth in their symbolical books the supreme place of Scripture, accepting the position which Zwingli laid down in 1536 in *The First Helvetic Confession*, namely, that "Canonic Scripture, the Word of God, given by the Holy Spirit and set forth to the world by the Prophets and Apostles, the most perfect and ancient of all philosophies, alone contains perfectly all piety and the whole rule of life."

Zwingli began to preach "the Gospel" in 1516, but a contemporary says that he did it so cunningly (*listiglich*) that none could suspect his drift. He still, to use his own words, hung his new exposition on to "the old doctrines, however much they at times pained me, rather than on to the purer and clearer"; for he hoped that the reformation of the Church would proceed quietly and from within. The papal curia had no wish to bring things to a quarrel with him. The Swiss, who furnished them with troops, were to be treated with consideration; and the pope sought to silence the reformer by offers of promotion, which he refused. He held himself, as did the Swiss in general, very free of papal control. They had long been used, in their orderly democratic life, to manage their own ecclesiastical affairs. Church property paid its share of the communal taxes, and religious houses were subject to civil inspection. Zwingli looked rather to the City Fathers than to the pope, and as long as he had them with him he moved confidently and laboured for reforms which were as much political and moral in character as religious. He had none of Luther's distrust of "the common man" and fear of popular government, and this fact won for his teaching the favour of the towns of South Germany not less than of Switzerland.

As yet he had preached his Gospel without saying much about corruptions in the Roman Church, and it was his political denunciation of the fratricidal wars into which the pope, not less than others, was drawing his fellow-countrymen, that first led to rupture with the papal see. Three visits which he had paid to Italy in his capacity of army chaplain had done much to open his eyes to the worldly character of the papal rule, and it was not long before he began to attack at Einsiedeln the superstitions which attended the great pilgrimages made to that place. Zwingli denounced t publication of plenary indulgence to all visitors to the shre, and his sermons in the Swiss vernacular drew great crowds nd attracted the attention of Rome. His quarrel was turne more immediately against the pope himself when in August 518 the Franciscan monk Bernardin Samson, a pardon-selle like Johann Tetzel, made his appearance in Switzerland a the papally commissioned seller of indulgences. Zwingli pvailed on the council to forbid his entrance into Zürich and even then the pope argued that, so long as the pcher was still receiving a papal pension, he could not a formidable adversary, and he gave him a further sopn the form of an acolyte chaplaincy.

Zwingli had never meant to nain at Einsiedeln long, and he now threw himself into a comition for the place of people's priest at the Great Minster of rich, and obtained it (1518) after some opposition. He stipted that his liberty to preach the truth should be respected. In the beginning of 1519 he began a series of discourses on Matthew's Gospel, the Acts of the Apostles, and the Paue epistles; and with these it may be said that the Reforman was fairly begun in Zürich. He had made a copy of St Pa epistles and committed them to memory, and from this arsl of Scripture he attacked the unrighteousness of the state ness than the superstition of the Church. His correspondence this year shows him jealous of the growing influence of her. It was his claim that he had discovered the Gospel be ever Luther was heard of in Switzerland, and he was as aous as Erasmus to make it clear that he was not Luther's disci Towards the end of September he fell a victim to the plaguhich was ravaging the land, and his illness sobered his spirind brought into his message a deeper note than that merel oral and common-sense one with which, as a polite humanist had hitherto been content. He began to preach against fasg, saint worship and the celibacy of priests; and some of his arers began to put his teachings into practice. The monases raised an outcry when people were found eating flesh in nt, and the bishop of Constance accused them before the ccil of Zürich. Zwingli was heard in their defence and the asation was abandoned. His first Reformation tract, April 2, dealt with this subject: "*Von Erkiesen und Fryheit der sen.*" The matter of the celibacy of the clergy was more rious. Zwingli had joined in an address to the bishop of stance calling on him no longer to endure the scandal of hary, but to allow the priests to marry wives, or, at least, to at their marriages. He and his co-signatories confessed t they had lived unchastely, but argued that priests could t be expected to do otherwise, seeing that God had not seen o give the gift of continence. Pope Adrian VI. interfered asked the Zürichers to abandon Zwingli, but the refor persuaded the council to allow a public disputation (152 when he produced sixty-seven theses[1] and vindicated his pon so strongly that the council decided to uphold their pcher and to separate the canton from the bishopric of Conse. Thus legal sanction was given in Zürich to the Reforman. In 1522 Zwingli produced his first considerable writing, *rchiteles*, "the beginning and the end," in which he sot by a single blow to win his spiritual freedom from the con of he bishops, and in a sermon of that year he contended th only the Holy Spirit is requisite to make the Word intelligibl and hat there is no need of Church, council, or pope in t matter.

The progress of th Reformation attracted the attention of all Switzerland, but the was a trong opposition to it, especially in the five Forest Cants: Lucerne, Zug, Schwyz, Uri and Unterwalden; and the Zthers fet it necessary to form a league in its defence. They re especially anxious to gain Bern, and Zwingli challenged e Romanists to a public disputation in that city. No les han 350 ecclesiastics came to Bern from the various cant to hear the pleadings, which began on the 2nd of Janu 1523 and lasted nineteen days. Zwingli and his companions undertook to defend the following propositions:—

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[1] Cf. P. Schaff, *ceds of the Evangelical Protestant Churches*, p. 197.

(1) That the Holy Christian Church, of which Christ is the only Head, is born of the Word of God, abides therein, and does not listen to the voice of a stranger; (2) that this Church imposes no laws on the conscience of people without the sanction of the Word of God, and that the laws of the Church are binding only in so far as they agree with the Word; (3) that Christ alone is our righteousness and our salvation, and that to trust to any other merit or satisfaction is to deny Him; (4) that it cannot be proved from the Holy Scripture that the body and blood of Christ are corporeally present in the bread and in the wine of the Lord's Supper; (5) that the mass, in which Christ is offered to God the Father for the sins of the living and of the dead, is contrary to Scripture and a gross affront to the sacrifice and death of the Saviour; (6) that we should not pray to dead mediators and intercessors, but to Jesus Christ alone; (7) that there is no trace of purgatory in Scripture; (8) that to set up pictures and to adore them is also contrary to Scripture, and that images and pictures ought to be destroyed where there is danger of giving them adoration; (9) that marriage is lawful to all, to the clergy as well as to the laity; (10) that shameful living is more disgraceful among the clergy than among the laity.

The result of the discussion was that Bern was won over to the side of the Reformer, who apprehended the whole struggle of Protestantism as turning directly on the political decisions of the various cantons of the Confederation. He had enunciated in his theses the far-reaching new principle that the congregation, and not the hierarchy, was the representative of the Church; and he sought henceforward to reorganize the Swiss constitution on the principle of representative democracy so as to reduce the wholly disproportionate voting power which, till then, the Forest Cantons had exercised. He argued that the administration of the Church belongs, like all administration, to the state authorities, and that if these go wrong it then lies with Christian people to depose them.

On the 2nd April 1524 the marriage of Zwingli with Anna Reinhard was publicly celebrated in the cathedral, though for some two years already he had had her to wife. Many of his colleagues followed his example and openly made profession of marriage. In August of that year Zwingli printed a pamphlet in which he set forth his views of the Lord's Supper. They proved the occasion of a conflict with Luther which was never settled, but in the meantime more attention was attracted by Zwingli's denunciation of the worship of images and of the Roman doctrine of the mass. These points were discussed at a fresh congress where about 900 persons were present, and where Vadian (Joachim von Watt, the reformer of St Gall) presided. It was decided that images are forbidden by Scripture and that the mass is no sacrifice. Shortly afterwards the images were removed from the churches, and many ceremonies and festivals were abolished. When a solemn embassy of rebuke was sent to Zürich from a diet held at Lucerne, on the 26th of January 1524, the city replied that in matters relating to the Word of God and the salvation of souls she would brook no interference. When a new embassy threatened Zürich with exclusion from the union she began to make preparations for war.

It was at this moment that the controversy between Luther and Zwingli took on a deeper significance. In March 1525 the latter brought out his long *Commentary on the True and False Religion*, in which he goes over all the topics of practical theology. Like others of the Reformers he had been led independently to teach justification by faith and to declare that Jesus Christ is the one and only Mediator between sinful man and God; but his construction rested upon what he regarded as biblical conceptions of the nature of God and man rather than upon such private personal experiences as those which Luther had made basal. In this Commentary there appear the mature views of Zwingli on the subject of the Elements of the Lord's Supper. He is quite as clear as Luther in repudiating the medieval doctrine of transubstantiation, but he declined to accept Luther's teaching that Christ's words of institution required the belief that the real flesh and blood of Christ co-exist in and with the natural elements. He declared that Luther was in a fog and that Christ had warned His disciples against all such notions, and had proclaimed that by faith alone could His presence be received in a feast which He designed to be commemorative and symbolical. Efforts to reach agreement failed. The landgrave of Hesse brought the two Reformers together in vain at Marburg in October 1529, and the whole Protestant movement broke into two camps, with the result that the attempt made at Schmalkalden in 1530 to form a comprehensive league of defence against all foes of the Reformation was frustrated.

But the close of Zwingli's life was brought about by trouble nearer home. The long-felt strain between opposing cantons led at last to civil war. In February 1531 Zwingli himself urged the Evangelical Swiss to attack the Five Cantons, and on the 10th of October there was fought at Kappel a battle, disastrous to the Protestant cause and fatal to its leader. Zwingli, who as chaplain was carrying the banner, was struck to the ground, and was later despatched in cold blood. His corpse, after suffering every indignity, was quartered by the public hangman, and burnt with dung by the Romanist soldiers. A great boulder, roughly squared, standing a little way off the road, marks the place where Zwingli fell. It is inscribed, "'They may kill the body but not the soul': so spoke on this spot Ulrich Zwingli, who for truth and the freedom of the Christian Church died a hero's death, Oct. 11, 1531."

Zwingli's theological views are expressed succinctly in the sixty-seven theses published at Zürich in 1523, and at greater length in the *First Helvetic Confession*, compiled in 1536 by a number of his disciples.[1] They contain the elements of Reformed as distinguished from Lutheran doctrine. As opposed to Luther, Zwingli insisted more firmly on the supreme authority of Scripture, and broke more thoroughly and radically with the medieval Church. Luther was content with changes in one or two fundamental doctrines; Zwingli aimed at a reformation of government and discipline as well as of theology. Zwingli never faltered in his trust in the people, and was earnest to show that no class of men ought to be called *spiritual* simply because they were selected to perform certain functions. He thoroughly believed also that it was the duty of all in authority to rule in Christ's name and to obey His laws. He was led from these ideas to think that there should be no government in the Church separate from the civil government which ruled the commonwealth. All rules and regulations about the public worship, doctrines and discipline of the Church were made in Zwingli's time, and with his consent, by the council of Zürich, which was the supreme civil authority in the state. This was the ground of his quarrel with the Swiss Anabaptists, for the main idea in the minds of these greatly maligned men was the modern thought of a free Church in a free state. Like all the Reformers, he was strictly Augustinian in theology, but he dwelt chiefly on the positive side of predestination—the election to salvation—and he insisted upon the salvation of infants and of the pious heathen. His most distinctive doctrine is perhaps his theory of the sacrament, which involved him and his followers in a long and, on Luther's part, an acrimonious dispute with the German Protestants. His main idea was that the sacrament of the Lord's Supper was not the *repetition* of the sacrifice of Christ, but the faithful *remembrance* that that sacrifice had been made once for all; and his deeper idea of faith, which included in the act of faith a real union and communion of the faithful soul with Christ, really preserved what was also most valuable in the distinctively Lutheran doctrine. His peculiar theological opinions were set aside in Switzerland for the somewhat profounder views of Calvin. The publication of the Zürich Consensus (*Consensus Tigurinus*) in 1549 marks the adherence of the Swiss to Calvinist theology.

Zwingli's most important writings are—*Von Erkiesen und Fryheit der Spysen* (April 1522); *De Canone Missae Epichiresis* (September 1523); *Commentarius de Vera et Falsa Religione* (1525); *Vom Touf, vom Wiedertouf, und vom Kindertouf* (1525); *Ein klare Unterrichtung vom Nachtmal Christi* (1526); *De Providentia Dei* (1530); and *Christianae Fidei Expositio* (1531). For a full bibliography see G. Finsler, *Zwingli-Bibliographie* (Zürich, 1897).

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[1] P. Schaff, *Creeds of the Evangelical Protestant Churches*, p. 211.